EMPOWER DEMAND 2

Energy Efficiency through Information and Communication Technology
– Best Practice Examples and Guidance

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Executive Summary

The phrase, "it's not what you do but the way that you do it" could not be truer than in the case of smart meter enabled consumption feedback and demand response programmes. Such programmes typically lack the nuances required for success when it comes to understanding customers and how to optimise their behaviour – yet some have proven themselves to be outstanding in the results they deliver and the learnings they bring. From these programmes we can learn how to develop a new best practice for the industry, a new way forward, but only by combining elements from each of them. No single programme has all the best practice.

Over the past five years, VaasaETT has conducted the most extensive international studies of their kind, analysing Demand Response programmes across four continents. The most recent and comprehensive of these was the 2011-2012 Empower Demand - phase I project, known simply as ‘EMPOWER DEMAND 1’, funded by ESMIG.

Following on from this ground-breaking research, which quantitatively analyzed 100 demand response programmes around the world, Empower Demand - phase 2, known simply as ‘EMPOWER DEMAND 2’, investigates the qualitative issues concerning how best to empower consumers to reduce consumption through a more intelligent approach to the way the energy industry and its technologies interact with customers. The Empower Demand 2 research has identified new approaches to preparing the public for the smart future in ways that enable consumers to make more informed decisions and better use of smart energy demand infrastructure when it arrives.

Feedback and control, done well, will in the future lead to average energy consumption savings far above those typically experienced in pilots to-date, but only through the creation of intelligent customer ecosystems that combine an appropriate combination of communication and technology, as well as the collaboration of different technologies and players in the energy market. It will also require the support of committed governments and regulators in order to enable the demand balancing requirements inherent within the market, to flow through to customers and other players in the market in the form of incentives.

Pilot programmes to-date have experienced large variations in their levels of success, but while some have proved highly promising, and many have done some things well, the research indicates that the ingredients for true success have been spread among them. Through qualitatively investigating a selection of nine of the best programmes, from Australia, the USA and Europe, Empower II has found that success depends on a plethora of criteria.

Pre-Offering Education

The inter-play of outstanding pre-offering, pre-technology education, especially from independent sources is an extremely important way to prepare consumers for the programme to come. As a first step, a consumer must see the bigger picture, the reason why the utility is embarking on this action, why the customer should be interested and why the community should be working together. Only then should technology be introduced. It is after all, not the technology that is the objective; it is only a means to an end.

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1 This report is public and available at no cost at: http://www.esmig.eu/press/publications-new/empower-demand-report.pdf/view
In fact the main factor preventing the progress of Demand Response and indeed energy efficiency programmes is apparently the lack of appropriate and effective education, communication and feedback of information to consumers, in the face of negative consumer pre-dispositions towards energy utilities companies. Consumers have been confronted with discussions of Smart Meter (and smart grid) infrastructure technologies, the prospect of associated costs and a plethora of related utility promises thrown in their faces in recent years, without sufficient understanding of how that technology might assist them to reduce or improve the predictability of their household costs, contribute to improved environmental consciousness, enhance their way of life or re-balance the fairness of their relationship with the utilities industry.

**Step-by-Step Discovery, Experimentation and Enlightenment**

People like to explore, they like to discover, in general more than they like to study or be taught. If we are to obtain the interest and involvement of consumers and avoid the patronising feel that typically characterises utility-consumer relationships, then consumers must be able to learn at their own pace, in their own way, to their own desired extent. They should feel that they are enlightened by their own findings, not just by the rhetoric of those who think they know better.
Mixed Feedback

There is a lot of debate in the field of smart meter enabled energy efficiency and demand response about which forms of feedback work best, but what this research, and the research presented as part of Empower Demand 1 has shown, is that multiple feedback channels work best. While in home displays are typically the most effective form of feedback, leaflets done well can in some cases prove to be even more effective. Furthermore, different consumers will prefer different channels, be they paper based, electronically via a computer, phone or tablet, via a home display or some other means. Nor should it be forgotten that different feedback channels have different purposes.

Empower Demand 1 researched a wide variety of types of feedback channel and content, but typically, successful programmes put many of the above forms of feedback together in one programme, in one offering to the consumer. Comprehensive simplicity is the name of the game. This breadth of coverage additionally assists in making the overall offerings more appropriate to different segments of customers.

Feedback should furthermore be personalised (requiring substantial understanding of the customer), evolving in nature, supported by tips and advice (and wherever possible also solutions), not based on kWh, available in both ambient and more direct form, and available real-time, but ultimately delivered by request, both in its timing, content, quantity and style.

The research found evidence to indicate that feedback, done well, leads to year-on-year increases in savings and increased interest and participation in other programmes.

Appealing Feedback Devices

It would appear that energy efficiency and demand response trials can be effective largely regardless of the characteristics of the display, but based on research findings, including also those related to more recent displays, we estimate that those programmes researched for this report would have been more, or even more successful had they applied more aesthetic, ergonomic, simple, ambient, intuitive devices. The fact that even basic devices can be effective however, is an indication at least, that the cost of devices does not necessarily have to inhibit the opportunity for utilities to offer energy efficiency and demand response programmes.

Empathy & Trust

While customers generally appreciate financial gifts for participating in pilot programmes, they do not necessarily require them. Receiving education and support on how to reduce energy bills and keeping the technology afterwards can in some situations be just similarly motivating. This is not to say though, that customers do not respond better within programmes when they are provided with financial rewards for their positive behavioural response, for such incentives are highly effective.

The fact is though, that customers appreciate knowing, or even need to know, through the demonstration of the utility’s behaviour and or promises and guarantees, that the utility is trying to help the customer rather than just themselves, that their participation will not lead to them paying more, as they may have experienced with water meters, and that their participation will provide them opportunities to save money, or even earn money (though not a promise of saving or earning money), with minimal inconvenience. The environment comes in a cool, but important second, and even claims of helping the environment should be made in the knowledge that all claims need to have the confidence and trust of consumers.
A key objective of public engagement campaigns prior to programmes should therefore be to reassure consumers that guarantees and safeguards are in place to protect them from being duped, to protect them from higher costs, and to justify to consumers the logic and simplicity of their offering.

More specifically, if customers are to willingly involve themselves in a relationship step change, such as adopting dynamic tariffs, something that demands trust in the provider of those tariffs, it can be beneficial to provide promises and guarantees, at least initially, until the customer’s perception of risk of change is overcome or sufficiently reduced.

The need for empathy and trust also infers the need to demonstrate and instil a ‘mutual benefit’ into the communication, offering and ultimately the relationship. Punishment and control, commonly associated with for instance dynamic tariff or automation offerings by customers, can also be overcome through safeguard promises, guarantees or providing customers with the ability to override the control or exit the programme altogether, if they so wish. The importance of subtlety in communication as a means of achieving empathy and trust should not be over-estimated however.

**Motivation and Incentivisation**

Motivational messages and visualisations focused can take many forms but tend to focus on three issues: reasons to be positive about the new developments, reasons to get involved and the elimination of reasons not to get involved.

Invitation letters are an important part of the motivation process, but so are drip-feed communications (communicating to consumers in manageable bites) and communications, feedback and consumer experiences relating to: Insights into tangible Improvements; demonstrations of the value of smart meter data; and various other means such as goal-setting and competitions.

Ultimately it is however, the interplay of price and cost incentive with information (including education and feedback) that drives customer involvement and energy efficiency behaviour, and both sets of drivers are of equal importance and inter-dependent.

It is essential, however, that consumers have the ability to opt into and out of programmes. Consumers are more motivated when they are in a position they arrived in willingly and when they know they are not trapped there.

**The Inter-play of Automation, Self-Control and Experimentation**

The common argument over whether automation is preferable to self-control is rather inappropriate to the future development of energy efficiency and demand response. Ultimately, consumers do not seem to be opposed to automation per se. It is after all the most convenient, hassle free solution for the consumer. What consumers want however, is to not be: controlled without their permission; in a way that they do not approve of; or without their ability to opt-out, override or modify their involvement.

It is also important that consumers understand, through manual involvement, the relationship between their consumption behaviour and the consequences for themselves and the environment, before they are provided with automation. Otherwise, consumer’s achievements will in the future be limited entirely to the extent facilitated by automation and their understanding of the value of automation will be undermined.
Building Interaction With & Through Technologies

Feedback and control technologies are an essential element of the process of creating partnership between the utility and the consumer through energy efficiency and demand response. The main requirements to optimise customer interaction with technologies, whether they are feedback or control-related, concern the customer experience and supporting education.

In particular in-home displays are such an important part of the entire customer education process that they cannot be taken out of the equation. They form a germinating hub of intrigue, exploration and awareness for the customer. The importance of ambience, ease of use, real-time feedback and aesthetic appeal related to in-home displays cannot be underestimated however.

![Diagram](image)

**Figure 2: Best Practice Programmes Will Combine Elements**

Technology Trends

The latest technologies suggest some emerging trends. They are typically more user-friendly, inspiring, ambient, sometimes providing more impressionist and less numerical and graphical feedback. They are typically more aesthetic, ergonomic and intuitive (requiring less reliance on manuals and consumer technical-learning time). They are taking the technology from
something consumers might feel they need to facilitate a service or solution, towards objects that customers will desire, at least in combination with an energy efficiency or demand response service, but even because of the direct interaction experience it can provide or its aesthetic desirability.

Another trend would appear to be that feedback and control technologies are relying increasingly on smart meters, as more and more smart meters are rolled out, and as more and more roll-outs are being mandated or announced.

A Changing Landscape for Smart meter Enabled Energy Efficiency and Demand Response Services

All but three of the programmes researched for Empower Demand 2 utilised smart meters. By combining the learnings, technologies and solutions described in the report, with national and regulatory commitment to energy efficiency, massive achievements can be expected. The sooner that smart meters are rolled out, the sooner that market structures are designed to value savings equally along-side generation, the sooner that smart meter enabled energy efficiency and demand response potential can be fulfilled in Europe.

Suggestions for Further Research

Some elements were apparently missing from the programmes studied. For instance, no programmes recommended using in-home feedback to measure out-of-home appliances. While a relatively small and occasional consumer of electricity, a sizable number of homes, especially those with larger consumptions, do nevertheless use appliances such as electric garden equipment (e.g. mowers, cutters, pressure washers), outdoor lighting and, in the Nordic region even engine heaters. Residential consumers might be interested to also know how much energy these sorts of appliances use, how much they can save, and even how their costs compare to petrol driven or gas fuelled alternatives. In fact even appliances such as hoovers appear to be rather ignored from programmes, as is the role of feedback in helping consumers to consider the likely savings (if any) on their heating and even cooking related costs if they substituted gas for electricity, a major potential means of reducing a consumer’s CO2 footprint. It is questionable is these offerings would appeal to consumers, but such feedback might broaden the value of the feedback offering to consumers, potentially thereby increasing involvement and resulting in bigger savings for consumers and the environment.
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1. Background to the study

“Empower Demand 1” was an in-depth comparison of demand response pilot studies collected globally, to discern the most important success factors, as well as comparing overall results. It succeeded in adding substance to the claims made by the energy industry on Smart Meters – namely that they offer substantial, efficiency benefits over the long term for residential consumers. It focused both on the results that the technology can provide as well as what the real requirements are for success and added authority to these claims through comparing the results of over 100 pilots broken down into 460 pilot samples involving over 450,000 households, according to some 22 different potential success factors. Empower Demand Phase 1 achieved clear, reliable quantitative findings through the analysis of accumulated past experiences.

The findings of Empower Demand 1 demonstrate that technology provides an important but enabling function in creating a successful demand side program. It is one of five factors which decide success:

1. Socioeconomic factors
2. Participant consumption patterns
3. Program content/structure
4. Supportive technology
5. Household load sources.

In this, socioeconomic factors and consumption patterns can overcome supportive technology and program type. For example, a good informative billing pilot can lead to higher savings than an IHD pilot depending on surrounding circumstances despite the fact that on average an IHD is 50% more effective than an informative bill at reducing overall electricity consumption.

Therefore one of the main findings of Empower Demand 1 was that consumer engagement, through technology and through information is at the heart of a successful Smart Meter enabled program. A main conclusion of the work was that this factor should be explored in more depth.

Due to the fact that Empower Demand 1 was a comparative statistical study, it automatically looked back at pilots already completed which had been ongoing in some cases for one, two or three years, using technologies that are no longer considered state-of-the-art. These pilots did not necessarily take into account developing technologies and ongoing pilots. Due to its quantitative nature, Empower Demand 1 also did not look deeper into the details and dynamics of successful customer engagement through information and technology.

Empower Demand 2 therefore looks to the future of consumer engagement and energy efficiency, researching areas which have not been thoroughly understood through quantitatively studying past pilots, to ascertain and guide the direction of future developments in consumer feedback technologies. It also collects information on feedback and control technologies currently being offered and developed in order to provide an overview of the

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2 VaasaETT reviewed approximately 140-160 pilots, of which 100 were chosen for detailed analysis.

3 Consumption efficiency refers is defined here broadly, including both general energy savings and demand response (the timely reduction or shifting of consumption).
direction the market is taking and its future potential. It furthermore gathers knowledge on
issues that will be needed to support these future technologies.

Following this report, **Empower Demand 3** will be created through combining Phases 1 and 2
to form one large and significant report, the end product being an integration of the in-depth
findings of both phases of the Empower Demand research, and guideline criteria of what is
needed to achieve various levels of consumption reductions in differing market situations.
2. Research Structure and Methodology

The research for this project was conducted through a mixture of extensive desk research, in-depth interviews, existing in-house expertise and experience at VaasaETT, as well as data collected through VaasaETT’s extensive Global Energy Think Tank network of thousands of industry experts.

The research followed two distinct stages:

1) Consumer Engagement Analysis: This stage conducted in-depth research into the dynamics of energy efficiency through consumer engaging technology and communication. Nine smart meter-based energy efficiency related programmes were analyzed in detail with others additionally being considered in lesser detail. The nine programmes varied substantially in terms of the energy efficiency that they achieved and their overall level of success, but all displayed achievements in terms of consumer engagement through technology and or other communication.

<table>
<thead>
<tr>
<th>Pilot name</th>
<th>Country</th>
<th>Period of trial</th>
<th>Number of residential participants</th>
<th>Trial’s main focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perth Solar City</td>
<td>Australia</td>
<td>February and June 2011 (for the IHD trial)</td>
<td>813</td>
<td>IHD</td>
</tr>
<tr>
<td>Oklahoma Gas and Electric’s Smart Study Together</td>
<td>USA</td>
<td>Summer of 2010 and 2011</td>
<td>3,000 in 2010 and 6,000 in 2011</td>
<td>Dynamic tariffs, IHD, web portal</td>
</tr>
<tr>
<td>O’Power SMUD Pilot</td>
<td>USA</td>
<td>Running since April 2008</td>
<td>35,000</td>
<td>Consumption reports</td>
</tr>
<tr>
<td>The Meter Hunt by Utility SEAS-NVE</td>
<td>Denmark</td>
<td>Running since 2009</td>
<td>71,000</td>
<td>Feedback, tailored tips and advice on energy reduction</td>
</tr>
<tr>
<td>Electricity Smart Metering Customer Behaviour Trials</td>
<td>Republic of Ireland</td>
<td>January and December 2010.</td>
<td>3,296</td>
<td>Dynamic tariffs, IHD, informative bill</td>
</tr>
<tr>
<td>PowerCents DC</td>
<td>USA</td>
<td>July 2008 and October 2009</td>
<td>900</td>
<td>Dynamic tariffs, IHD</td>
</tr>
<tr>
<td>BeAware</td>
<td>Finland/Sweden/Italy</td>
<td>2010</td>
<td>1st trial: 8 trial: 12</td>
<td>Feedback, ambient, game-like application</td>
</tr>
<tr>
<td>Energy Demand Research Project</td>
<td>Great Britain</td>
<td>2007-2010</td>
<td>60,000</td>
<td>Dynamic pricing, IHD</td>
</tr>
<tr>
<td>Home Energy Management System trials</td>
<td>The Netherlands</td>
<td>2008-2009</td>
<td>304</td>
<td>IHD and web portal</td>
</tr>
</tbody>
</table>

Figure 3: Pilots Analysed For This Report
2) **The Next Best Practice:** This stage investigated the likely future direction of the market in terms of the technologies and practices that would be, and indeed need to be applied in future. In terms of the consideration of technologies, this included an overview of a wide range of latest feedback and control technologies, the new capabilities they are looking to enable and the requirements for supporting these capabilities.

The research conducted for this report, Empower Demand 2, is qualitative in nature, whereas the research conducted for Empower Demand Phase 1 was primarily quantitative in nature. Therefore, although various tables and charts are presented in this report are, to some extent at least, comparative, they in no way aim or claim to be statistically significant analyses.
3. Research Findings

3.1. Education, Communication and Feedback

Arguably the most significant factor preventing the progress of Demand Response and indeed energy efficiency programmes is the lack of appropriate and effective education, communication and feedback of information to consumers, in the face of negative consumer pre-dispositions towards energy utilities companies. In many markets, and for some time now, consumers have been confronted with discussions of Smart Meter (and smart grid) infrastructure technologies, the prospect of associated costs and a plethora of related utility promises thrown in their faces in recent years, without sufficient understanding of basic issues, how that technology might assist them to reduce or improve the predictability of their household costs, contribute to improved environmental consciousness, enhance their way of life or re-balance the fairness of their relationship with the utilities industry.

3.1.1. Stages of Evolution

Missing Basic Understanding

Before it is possible to attempt to provide behaviour changing education, communication or feedback to consumers, it is necessary to develop a basic understanding by customers of the most basic comprehension and appreciation of what it is that they are trying to change with their behaviour, and why. Customer knowledge of energy issues is in fact so low prior to energy efficiency or demand response programmes that the basic building blocks have to first be laid.

For instance, recent research by YouGov in Great Britain in 2011, found that 81 percent of UK adults did not understand their energy bills and were unaware of the real cost of energy. In Australia, a national survey conducted for Origin Energy found that Australians were confused about the impact they could have on their bills and the environment. 93 percent of respondents stated that they wanted to be more focused on implementing sustainable solutions in the home, and over half struggled to make the correlation between energy consumption, behavioural change and the resulting impact on the environment.

This typical absence of awareness has to first be addressed by energy efficiency or demand response programmes prior to taking any more advanced steps. For this reason the best pilots studied by this research followed a progressive approach to developing the customer knowledge.

Independence of Opinion

A key finding of the research is that expert public sources should initially communicate, and play a larger role in designing Demand Response programmes. Whether justified or not, a large proportion of utility consumers feel suspicious of utility companies when those companies promise to give the customer savings or benefits for free. Typically, though not always and not for all companies, consumers perceive that utility companies are more like tax collectors than charities. Their aim, in consumers' minds, is to provide a simple, monopolistic public commodity service and earn a good profit in doing so. The utility company makes money through the maximization of sales and price of that commodity. So when utility companies then
claim to consumers that they want to save energy and that they intend to help the consumer to save energy and money, it is quite understandable that consumers often think that they can smell a rat.

For this reason, the initial message proclaiming initiatives to save energy and money should come from communication sources for whom the consumer associates no negative vested interest; a source that they feel is independent, ideally on their side and/or the side of the environment, but at least not on the side of the utility companies.

**Behavioural Awareness Before Technological Awareness**

Vitally important engagement and education of consumers should to a large extent take place already prior to roll-out and even large-scale piloting, to a wide audience, ideally in a public campaign fashion, for the purpose of raising awareness regarding the benefits associated with smart meters and the forthcoming related offerings. This should not be some vague generic TV advertising, but rather a comprehensive and specific multi-channel approach that engenders understanding and trust. Done right, and followed eventually by targeted direct marketing and subsequent outbound calls, this systematic approach to engagement appears to achieve greatly enhanced customer adoption and usage of programmes, technologies and offerings. For instance Opower found that while dynamic rate plans can help consumers save money and reduce demand at peak times, they are often poorly understood, resulting in higher bills and customer complaints. Opower therefore engaged customers about dynamic rates before smart meters were installed, and afterwards. A detailed rate analysis tool recommended the least-expensive rate plan for them based on their past usage, and consumers also received tips on saving even more money through shaving peak energy usage.

Technology should be introduced to consumers gradually and the bulk of the technology should be promoted only after consumers are sufficiently educated and savvy about the relationship between their behaviour and the benefits of Demand Response and energy efficiency. More specifically Demand Response and energy efficiency should be introduced and developed in accordance with the following stages of evolution.

Typically technology, including Smart Meters and Demand Response, has been introduced following an inverted evolution whereby technology and utility based communication has been at the fore-front, with consumer education and feedback as well as public communication being introduced as a next-step or reaction to negative publicity. These findings do not mean however, that Smart Meter roll-out should be delayed, nor that consumers should be able to opt-in to Smart Meters. Whereas Demand Response has been shown to be more effective following opt-in, Smart Meters should be seen as a facilitating infrastructure.

For education, communication, feedback and control to achieve their consumption reduction potential in future, utilities and their partners will need to incorporate a more comprehensive and holistic set of education, communication and feedback measures.
Case: Perth Solar City:

Perth Solar City’s systematic approach to developing awareness and understanding is perhaps the most comprehensive larger scale example of an evolutionary process anywhere in the world to date. Firstly, the organisers launched a large scale awareness campaign concerning for instance energy consumption, tips to save energy and why it is important for the environment to reduce energy consumption. The objectives of the Perth Solar City marketing strategy was more specifically to:

- Create awareness of the Perth Solar City program
- Promote Solar Cities as an Australian Government initiative and provide due recognition for its leadership and funding of the program
- Showcase iconic and demonstration solar PV installations
- Build general knowledge of the products and services being offered under the program (without elevating one product/service or consortium member above another), and
- Create excitement and a sense of ‘collective impact’ about its benefits to households and the community to encourage participation.
Once smart meters were installed for the smart metering pilot, the opportunity was taken to get people interested in other trials such as remote control of AC (air conditioning) and the IHD (in-home display) trial.

Prior to the IHD programme, the organisers developed a unique brand – ‘MAXimise energy savings’ - and developed information-based marketing materials and campaigns. Following the campaign, two recruitment methods were used: one was to package the IHD and send it via mail to 1,544 smart meter households (including 345 households with a solarPV system). These households were pre-selected without the householder specifically opting into the trial. The remainder of the 397 MAX units deployed to date (as of the time of conducting this report), have been deployed to households that specifically opted-in to the trial.

The ‘Collective Impact’ cinema advertisement (cini-ad) encouraged residents to be part of the ‘collective impact’ and join Perth Solar City. This cini-ad features the voice of Perth’s own Melissa George (an award winning actress) and a typical home within a relevant suburb within Perth’s Eastern Region. Ads were also displayed in newspapers, put on billboards, bus stops, train stations, traffic lights. Cinema advertising, rather than television media was chosen as it enabled residents within the Region to be targeted without wasting resources engaging with wider Perth and therefore ineligible households.
Figure 6: Perth Solar City Collective Impact Campaign, Phase 2

Art installations were also erected within the region to further highlight the collective impact undertaken by the community, for instance ‘tree’ artwork attached to street lights in high pedestrian traffic areas, such as outside public libraries and recreational centres. An Art installation includes for instance a plaque stating:

“If your household took part in the Perth Solar City energy saving project and turned off your stand-by power, it would be the equivalent of planting 5 trees every year. So let’s all take action and make a collective impact”.

Direct mail shots were also sent. In addition for instance, the Eco House project competition launched in January 2011, encouraging residents to nominate their home to receive an AUD 50,000 home eco-makeover, and participate in a 12 month energy efficiency education program. In return the winning household would open their home four times over 12 months to educate the community about the practicalities of energy efficiency.

Case: OG&E

OG&E branded its customer partnership program, Positive Energy Together®, and educated its employees and customers through an extensive multi-channel marketing campaign that included an extensive TV and radio media campaign, a branded website, prints and community events. The reason for such a program, terminology such as ‘peak periods’ and ‘peak generation’, and other issues were all explained in support of the programme.
3.1.2. Dealing with Smart Meter Roll-Outs

If customers are to appreciate the benefits of smart meters, then they must first at least accept the smart meter roll-out. Often, however, customers around the world have been opposed to smart meters even before the roll-out, or as a result of it.

International experience tells us that consumer acceptance of smart metering is partly cultural and partially due to the actions of the utility and government. For the citizens of California, public protests are relatively common, while in Finland they are rare. Therefore it is to be expected that Californians are more likely to protest during a Smart Meter rollout than Finns. With that being said, PG&E experienced serious consumer backlash during smart meter rollout while its neighbor Southern California Edison, did not. In Australia, Origin had to halt Smart Meter rollout due to public backlash while Western Power in Perth has experienced a rise in popularity. This clearly demonstrates that though cultural norms and surrounding circumstances play a role, the choices made by the utility and regulators impacts consumer acceptance.

The following outlines simple lessons learned from the international experience on how to create a successful Smart Meter rollout:

1) Mandatory Smart Metering which ‘feels like a choice’: Mandatory Smart Meter rollouts are successful only when the DSO has been able to persuade consumers they want the meters anyway. Otherwise, having some form of opt-out option for consumers, for which they pay, makes the management of public relations for the DSO much easier. If consumers do make mandatory rollout into an issue (and they might not) the utility will be trapped into forcing an unwanted technology into people's homes. This causes strong anger and a high level of negative public reaction.

2) Quick response to consumer concerns: Successful Meter rollouts (especially when mandatory) react quickly to any signs of decent, worry or to any consumer questions. Well informed call center personnel are important here. They should be able to answer standard as well as strange questions, if they should come up – questions such as “will the meters damage my house”, “Will they cause health issues” etc.

3) Well-informed ground personnel: Perth Solar City noted that it is important Smart Meter installers think well of the technology. They had experience of negative installers causing confusion when they indicated to consumers that the new Meters were a waste of money. This can be especially damaging in a mandatory rollout where the installer may be dealing with a customer who is actively opposed to a smart meter installation. Successful Smart Meter rollouts have all dealt successfully with consumer concerns and questions.
   a. Questions are dealt with quickly, fully and by qualified personnel who approve of the technology themselves (this includes installers).
   b. If extra site visits are needed, these are made and consumers are not forced into accepting a technology before they are ready.

A ‘successful’ smart meter rollout in this context is defined as a rollout which is within budget, where media attention is neutral or positive, and where the impression among consumers post-rollout is neutral or one of improved service. At the end of a successful Smart Meter rollout the DSO should remain a trusted partner and in the best case, their reputation should have improved.
4) A clear simple information package: The consumer will not be choosing their Smart Meter, yet they need to have a basic understanding of what this new technology will provide for them. Successful utilities created consumer information packages, which connected to their consumer base and satisfied them that the meter exchange is necessary and beneficial. In this area simple message seemed to be most successful for large rollouts (while smaller utilities can create more complex packages).

Successful mandatory meter rollouts have marketed the new meters in two ways 1) as a needed technical upgrade within the larger distribution network, or 2) they have positioned the Smart Meter as a small part of a larger package of services. Both approaches can work well though both have their pitfalls. In Perth, Australia for instance, Smart Meters were a small part of a larger Green City program involving solar panels, feedback and potentially dynamic pricing. Others, including SEAS-NVE have used varieties of this model.

On site: Information about the meters should be available during the actual meter exchange as well. Though this may sound obvious, several utilities mentioned the difficulty of training installers to adequately answer consumers' questions and the need for dedicated training resources.

5) Technical Issues kept invisible to consumers: Most utilities experience technical issues during rollout. The successful utilities keep these issues from causing consumer's inconvenience (for instance through inaccurate bills) and they kept them from increasing the cost of the overall rollout budget. Large and robust pilots prior to rollout are helpful. However, even utilities that carry out large pilots experience technical issues and therefore it is better to budget for these to take place. It is also important again to ensure that telephone personnel will be available and prepared to support consumers through any issues, which might impact them directly. Technical issues also impact the timing of marketing. For examples if a rollout is delayed, a service which the consumer thought they would receive within months can take a year or more.

6) Keeping electricity costs consistent during rollout: Consumers are suspicious that the new meters will not measure electricity correctly. Unfortunately the more accurate readings from the Smart Meters mean that for some consumers their bills will increase. This can lead to accusations of inaccurate readings. It is therefore all the more important that all surrounding costs, which can be kept consistent are kept consistent. This includes taxes, fees, distribution tariffs and any other costs over which the regulator or DSO has control.

7) Consumer privacy and data protection: Consumer privacy is a genuine issue in Europe. Much has been written on this issue and the regulator will be primarily responsible. The issues should be respected by the DSO and should be seen to be respected by DSOs.

8) Consumer expectations are managed well: Successful utilities make promises which can be fulfilled in a timely manner and without extra expense on the part of the consumer. It is important for utilities NOT to advertise smart meters as providing direct feedback on energy consumption, since it can lead to customer backlash when they realize that they would have to pay extra for the IHD, and that in fact the costly meters would provide them no free feedback whatsoever.
While consumers must see some benefit from the Smart Meter rollouts directly, these expectations should not include promises of future programs but only explain benefits which will be available in a timely manner and for free. If the DSO wishes also to help advertising Supplier driven items for purchase, it must be made clear from the start that the extra items are extra and will cost and this activity should only be started post-rollout.

9) Governments are managed well: Interestingly, it can be governments causing the most trouble. Policy makers sometimes wish to justify the cost of the Smart Meter rollout by naming all the ‘wonderful services’ it can provide the community. If they wish to do so, they must understand and consider the fact that their own budgets do not include these services. The DSO is later blamed for failing to enable the service or for charging extra. This has occurred in France, California and Victoria, Australia and is perhaps in danger of occurring again now in Ireland. Successful rollouts are supported when the governments’ promises and the utilities’ delivery are aligned, for example in Western Australia.

10) An attractive interactive information package: The best meter rollouts, improving the utilities image and are most likely to lead to further consumer engagement, are attractive and encourage interaction. Good examples of this are Perth Solar City in Australia and SEAS-NVE in Denmark. In these examples the DSO has created a look for the rollout which is repeated within all marketing material. They have included explanatory videos, question and answer pages and photos of attractive products, which can be used with the Smart Meters if desired. Of course, in order to do this the DSO must be offering more than a simple meter reading. The most successful rollouts also therefore include a website where consumers will be able to download their consumption information either through their computer or on their Smart Phone, at no extra charge.

3.1.3. Step-by-Step Discovery, Experimentation and Enlightenment

People like to explore, they like to discover, in general more than they like to study or be taught. If we are to obtain the interest and involvement of consumers and avoid the patronising feel that typically characterises utility-consumer relationships, then consumers must be able to learn at their own pace, in their own way, to their own desired extent. They should feel that they are enlightened by their own findings, not just by the rhetoric of those who think they know better. In the following illustration from the BeAware project, it can be seen that consumers were able to check on the consumption of individual appliances presented as cards in a carousel by tapping on the card of their choice to reveal further details. The consumer was only presented with the amount of information they required, when they requested it, in a visual and non-graphical manner.

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5 In a deregulated context it may not be the DSO creating such pages, however in this case it may be worth investigating the possibility to cooperate with suppliers during rollout.
As supported additionally by the evidence presented in the Empower Demand 1 research project, the findings of this research strongly indicate that automation follows on from discovery, experimentation and enlightenment. The Be Aware project for instance found that consumers’ realisation of the value of control was typically achieved through them for example turning appliances on and off in order to see what effect it had on their consumption level. This kind of exploration is not only educational, but it is also fun and rewarding from the perspective of many consumers. Furthermore, customers are more likely to believe their own observations than those of a utility for instance. Such learning can therefore be a good way to overcome the trust barrier concerning the communication of the benefits of smart meter based information, as well as a good mechanism for avoiding the information overload phenomenon.

Of course all customers are different however, and some would rather be simply presented with the knowledge, but it would appear that the majority of customers prefer to learn at least partly by their own hand, in their own time and to decide themselves when they have received enough information. In line with this the SEAS-NVE programme for instance, followed the “The More You Co-operate – The More We Help You, but You Choose Your Speed” approach. Consumers were encouraged to provide more information about themselves and their consumption so that SEAS-NVE could provide them with more detailed and appropriate feedback, hints and tips. The more information the consumers provided the more assistance SEAS-NVE gave them. This is not only a means of supporting step by step learning, but it also supports customers’ sense of empowerment and acts as an incentive to take the relationship with the utility deeper and deeper, one safe step at a time.

As an extension to this logic, Opower identified a Halo effect, whereby consumer, according to their research, are 15-20% more likely to get involved in other offerings/programmes after being in one good programme.
3.1.4. Educational Material

As part of the education of customers, educational leaflets or brochures are an important tool as a generic pre-programme overview of the offering and the reasons behind it. Best practice leaflets or brochures, such as those from Ireland and PowerCents, are typically around just two pages in length, extremely clear and aesthetically pleasing.

The components contained within them are typically kept to the minimum, including especially most of the following elements: What is the programme or offering about?, Why is it being offered or done?, Has this been done somewhere else before and if so where (to ensure the consumer that they are not a total guinea pig)?, Who is taking part in it and why?, How does it work?, How can a consumer become involved in it?, Who is behind it?, Where to find more information?, Will the consumer pay more if they do not change their behaviour?, Is there a risk or likelihood that the customer will pay more in any case?, Can and if so how can the consumer save money through it? How can the consumer reduce their energy consumption? Is there a cost for the consumer, initial or ongoing if the consumer takes part in the programme or offering? When will it take place? If there are special tariff schemes involved in it, then what are they, how do they work and how can and should the consumer ensure that they maximize their benefit from them? How can the consumer keep track of the prices and costs that they are paying?, Explanation of the equipment that will be provided to the consumer (e.g. an In-home display), What will the equipment look like?, and What will be involved in the installation process?

![Figure 8: Educational Brochure by PowerCents DC, USA](image)
In terms of layout and style, it can be seen from the above examples that the layout is relatively consistent, with short, narrow sections and paragraphs and green and white colours being a popular choice, providing a simple, uncluttered, modern, aesthetic and environmental. This is not to say that this is the only layout and style choice that can be effective, nor is it the only
style used by effective programmes, but it reflects very well the essence of what customers are known to want from such programmes.

Whereas feedback, explored in the following section should be provided to customers on a regular basis, it is generally believed that this kind of brochure need only be provided to customers once, prior to the programme or offering commencement, although brochures providing additional tips and other information remain an option. This is in addition to manuals required to support the operation of technologies provided to the customer as part of the programme or offering.

3.1.5 Feedback

An Integrated Approach

There is a lot of debate in the field of smart meter enabled energy efficiency and demand response about which forms of feedback work best, but what this research, and the research presented as part of Empower Demand 1 has shown, is that multiple feedback channels work best. While in home displays are typically the most effective form of feedback, leaflets done well can in some cases prove to be even more effective. Furthermore, different consumers will prefer different channels, be they paper based, electronically via a computer, phone or tablet, via a home display or some other means. Nor should it be forgotten that different feedback channels have a different purpose:

- In home displays provide feedback to the entire family;
- Fully ambient displays provide less feedback information, but can be excellent ways of, for instance, gently informing (through push feedback) family members of critical peak pricing or high usage periods with minimal involvement required on the part of family members; they can also be seen as aesthetically desirable elements of a feedback and control environment;
- Communication to a phone provides the opportunity to deliver advice, support and warnings to customers at any time, regardless of where they are;
- Energy usage statements and smart bills can aggregate larger amounts of information to provide consumers with excellent explanations for their bills when they receive them, at the time they are most keen to receive such explanations. PowerCentsDC for instance, found that 42% of users in the post-pilot survey stated that they had changed their consumption significantly because of the usage reports.
- Online feedback via tablets or computers can provide a low cost alternative to in home displays for consumers wanting to know how much they are consuming and how much it is going to cost, while there is still time to do something about that cost before the next bill arrives;
- Fridge magnets can be an excellent, well uses and popular quick reference guide for consumers wishing for instance to know when the next higher price period will be as part of a time of use pricing scheme. For instance in the Irish trials, 75% of the respondent participants stated that fridge magnets were useful to them in practice.
As technological developments continue to deliver new feedback channels, the choice of channels will naturally change, but the principle of multi-channel feedback will remain.

<table>
<thead>
<tr>
<th>Pilot name</th>
<th>Country</th>
<th>Feedback Sample 1</th>
<th>Feedback Sample 2</th>
<th>Feedback Sample 3</th>
<th>Comments</th>
</tr>
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<tbody>
<tr>
<td>Perth Solar City</td>
<td>Australia</td>
<td>IHD</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Oklahoma Gas and Electric’s Smart Study Together</td>
<td>USA</td>
<td>IHD</td>
<td>Informative billing</td>
<td>Web Portal</td>
<td>N/A</td>
</tr>
<tr>
<td>O’Power SMUD Pilot</td>
<td>USA</td>
<td>Consumption Reports</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>The Meter Hunt by Utility SEAS-NVE</td>
<td>Denmark</td>
<td>Web Portal</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Electricity Smart Metering Customer Behaviour Trials</td>
<td>Republic of Ireland</td>
<td>IHD</td>
<td>Informative Billing</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>PowerCents DC</td>
<td>USA</td>
<td>Informative Billing*</td>
<td>Web Portal</td>
<td>Smart Thermostat **</td>
<td>*Included seasonal bill inserts **Showed hourly pricing; Only 35% of participants were given one</td>
</tr>
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<td>BeAware</td>
<td>Finland, Sweden/Italy</td>
<td>IHD</td>
<td>Smart phone application*</td>
<td>Ambient displays</td>
<td>*Smartphone presents visualized energy consumption data</td>
</tr>
<tr>
<td>Energy Demand Research Project</td>
<td>Great Britain</td>
<td>IHD</td>
<td>Informative Billing</td>
<td>Web portal*</td>
<td>*TV box to access web portal via television</td>
</tr>
<tr>
<td>Home Energy Management System trials</td>
<td>The Netherlands</td>
<td>IHD</td>
<td>Web portal</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

*Figure 12: Feedback Channels Used by Programmes*
Content

Whichever channels and layout are used for feedback, whichever layout is used, for there is no clear best-practice layout, a combined content should be achieved. Despite the wide array of feedback however, this selection of combined content remains remarkably simple. The following list has been ranked in terms importance, or rather perceived influence over behaviour, in accordance with the research conducted for this project, although in some cases the difference between items in the list is considered small and the list should only be considered as illustrative and not exhaustive:

1. Relativity to other comparable consumers or households (social comparison)
2. Energy consumption ratings
3. Relativity to other targets (e.g. own targets)
4. Hints and tips (energy efficiency, saving money)
5. Cost and consumption by appliance (including also according to different tariff options; time of use; critical peak versus off peak; etc.)
6. Bill Predictions (what will my bill be?)
7. Cost per hour (or some other period)
8. Competitions and energy challenges
9. Usage predictions
10. Unusual Usage Alerts: Alerts (SMS or Email) warning of a high electricity bill along with tips for how to avoid (e.g. as applied by Opower)
11. Historical consumption (across different periods of time), including also relativity to historical averages
12. Current usage rate (kWh)
13. Unit cost of electricity (including also time of use and critical peak where appropriate)
15. Total consumption to-date, today, etc.
16. Additional information (including also where the consumer can find more information through other channels)

These types of content can also be categorised in terms of their psychological significance:

Absolute Consumption

Knowing how much energy you have used to-date or today etc. a day is of interest to some consumers, but in general serves little purpose for the consumer. As such, it does not assist them to know if their consumption is excessive, nor the consequence of the consumption for their costs. Neither does it provide any guidance for the customer concerning how they can reduce their consumption or their costs. Even if customers understand the quantitative significance of kWhs, which very few do, knowing one’s absolute consumption is consequently a form of feedback of relatively minor importance.

Empowerment

Consumers like to be empowered to save money through their own decisions and actions and in their own ways, by their own will. This can be achieved through for instance hints and tips relating to energy efficiency or financial savings), or through consumers receiving feedback relating to the cost and consumption (ideally actual but at least typical) per appliance. Customers should also be aware of the way these costs differ according to different tariff options; time of use; critical peak versus off peak; etc.
Figure 13: Tips by PowerCents DC

As shown in the following example, tips and hints can be even more effective if they are timely, either through being provided at appropriate times, or though being suggested for different times of day.

Figure 14: Time of Use Tips by Oklahoma Gas & Electric
Figure 15: Usage Statement by ESB, Ireland
Environment

For those consumers who view the environment or more precisely the protection of the environment as paramount, feedback relating to the environmental impact of their consumption, such as the amount of CO2 they are creating, at any point in time and over a period of time is highly valuable. It is important to realise though, that few consumers, even the more environmentally conscious ones, can comprehend the relationship between CO2 values and environmental impact. As shown in several examples in this chapter from the programmes studied for this research, feedback should explicitly illustrate the link between consumption and impact, preferably real time, but even after the fact, rather than simply presenting CO2 values to customers. This was done well by the Perth programme.

External Relativity

There is no doubt that a large proportion of consumers revel in being able to compare their energy efficiency behaviour against those of others, such as their neighbours, other consumers in their area, region, country, or simply other customers that are in some way comparable to them. PowerCents, OG&E, SEAS–NVE and Opower all used social comparison within their programmes to positive effect.

Perhaps the most advanced programme in this respect however, was the Opower SMUD programme. Psychologically this stems from the fundamental fact that human beings have no way to judge how good they are except through relativity against other human beings.

An important element to remember concerning such comparison based feedback is that, like all the other types of feedback discussed in this report, there are many ways to present it. To keep consumer interest high in fact, and in order to provide the consumer with deeper insight into their relativity, it is considered effective to provide the consumer with many perspectives on the same comparability. For instance, as show in the following example, a consumer can be informed if they are Good or not, if their comparability is improving or not, and they can be informed about the impact (e.g. on their consumption, energy bills or the environment) of themselves compared to their better or efficient neighbours for instance.

Customers should not feel bad as a result of such comparisons however. Therefore best practice suggests that comparability should be used as a form of encouragement rather than as a form of self-shame.

Relativity can however, take a less personal form. As shown by the following example from the SEAS-NVE programme in Denmark, a customer’s consumption can for instance be depicted on a ratings table, similar to that used for rating the efficiency of electrical appliances such as light bulbs. In the case of SEAS-NVE, this form of relativity was popular with consumers.

It should be noted that the SEAS-NVE programme recorded one of the most successful energy consumption reduction campaigns ever seen, even among the one hundred analysed as part of the Empower Demand 1 project. The following figure describes that success.
Figure 16: Consumer Relativity by OPower

Figure 17: Consumer Relativity by OPower
Figure 18: Consumer Energy Consumption Rating by SEAS–NVE

Energy conservation: Meter Hunt compared to average impact

Figure 19: The Success of SEAS–NVE’s Feedback Programme
Internal Relativity

Targets can be set by anyone at any level, whatever the consumer wants to achieve or whatever the utility or other party deems to be an appropriate level. Targets that are more meaningful, logical and relevant to the consumer have more impact, but even less appropriate targets can drive consumers towards achieving them. The fact is that consumers are generally competitive and they like to achieve targets. Seeing a cross on an in-home display, for instance can, can make a customer want to use less energy in order to achieve a tick.

A common form of relativity is historical consumption (across different periods of time), including also relativity to historical averages. Despite the popularity of these historical benchmarks, they would appear to provide mixed value to customers. Many consumers like to see how their consumption has developed and changed over time, but this appears to be more out of interest than anything else. To know that one's consumption is higher than normal, while concerning to some customers, is in generally not particularly motivating because a consumer knows that this is an exception to the rule, and as such is not a reflection on their overall achievements. For a consumer to see that their consumption is falling over time, perhaps as a result of their positive consumption related decisions and actions, is motivating but can also be seen by some customers as a reason to ease off their efforts since they have already bettered themselves.

Figure 20: Prediction Feedback by Oklahoma Gas & Electric

Predictions

Predictability can be seen as both a fear and an opportunity for consumers. Consumers fear the knowledge that their bill will be high if they carry on consuming as they are, but the knowledge that they still have time to do something about it provides comfort and a sense of empowerment (as explained earlier in this chapter). Providing consumers with a knowledge of
‘what my bill will be’ or ‘how much energy I will have used’ acts as both carrot and stick to consumers.

Providing customers with predictions of bills and consumption levels seems to work best though, when combined with tips and suggestions for how the consumer can reduce the forecast costs and consumption though either changing their behaviour, or through adopting a different tariff or utility offering.

The following example by Opower illustrates how a consumer can be provided with scenario based predictions of their forthcoming bill, whereby the outcome of the consumers’ decision regarding choice of tariff is calculated for a selection of different tariffs. This kind of feedback to consumers can additionally support the empathy between consumer and utility (as discussed later in this chapter), as well as provide the customer to find the most appropriate tariff, as a potential alternative to the need to switch retailer. In fact, utilities offering advice and support to consumers who thereafter save energy and money, have found that customer loyalty and therefore customer switching levels and likelihood are lower among such customers.

Figure 21: Prediction Feedback by OPower

Rate of Usage

The concept of cost or usage per hour, per day or some other period is one which consumers seem to find easy to comprehend. However, since consumers generally do not understand kWh, and because cost is what ultimately matters to most customers, cost per time period is far more favourable to usage per time period. In fact this report would argue that it would be better if kWh were generally not used at all within feedback, although kWh readings should be
available for consumers who want to be able to reconcile their bills with their consumption. While kWh per hour is sometimes likened to Km per hour, consumers understand Km in a way that they will never understand kWh.

**Rewards**

Competitions and energy challenges have proven to be a highly successful way to engage consumers, at least at the outset of programmes. Such competitions have been used for instance by Perth Solar City and SEAS-NVE to good effect. In the case of SEAS-NVE, consumers’ meter reading values (direct from the meter – traditional meters prior to smart meter roll out - ) were entered into a prize draw if consumers sent in their meter readings to the utility. This competition was used to sign up people for an energy efficiency programme, whereby if consumers provided their data, SEAS-NVE would provide them with consumption analysis, comparison, advice and tips for energy consumption.

The purpose of competitions, as used in both Perth Solar City and SEAS-NVE, is however more than just to sign consumers up to programmes. Competitions, when done well, help to capture consumer awareness and provide an opportunity to bring their attention to the objectives and deliverables of the programmes. They also create a sense of fun, value and the behavioural benefits of competitiveness to such programmes. They are also a good way to bring child and youth consumers into the equation.

![Figure 22: SEAS-NVE Meter Hunt Competition](image)

**Miscellaneous**

There are various components within feedback that, whilst neither motivational nor engaging as such, are necessary in order to provide the consumer with all the information they need or want in order to make decisions or feel comfortable about their involvement in a programme. They include contact information and sources of further information; unit costs of electricity, explanations of key terms and pricing methodologies, etc. The key however is to ensure that a consumer has their questions answered without overloading them with clutter and detail. Miscellaneous information content should be researched as extensively as any other feedback.

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Empower Demand 2
and education information in order to ensure that the most efficient mix of information is included as possible. As a back-up it is important that consumers’ additional needs are met through access to knowledgeable call centre staff as much as Q&A sections on for instance a web site or in a brochure.

Heuristic tools can be an effective way to provide supporting information to customers. A good example is the fridge magnet time of use reference tool developed for the Electricity Smart Metering Customer Behaviour Trials in Ireland that was popular with users.

**Putting Different Feedback Together**

Typically programmes put many of the above forms of feedback together in one programme, in one offering to the consumer as shown in the following examples by Oklahoma Gas and Electric and PowerCents DC. Once again comprehensive simplicity is the name of the game.

This breadth of coverage additionally assists in making the overall offerings more appropriate to different segments of customers. Segmentation is explored further later in this report.

![Figure 23: Fridge Magnet showing time of use times and prices, developed for Electricity Smart Metering Customer Behaviour Trials, Ireland](image)

**Feedback by Request**

The research indicates that consumers should be able to decide the rate at which they are involved in and receive feedback. In the SEAS-NVE programme for instance the more information that consumers volunteered to give to SEAS-NVE about themselves, the more advice
that SEAS-NVE gave to them to assist them in reducing their energy consumption. The self-regulation of feedback by consumers not only relates to the consumers’ need and desire not to be overloaded with feedback, but it also relates to the customer’s desire for empathy and personalisation as explained later in this chapter.

**Figure 24: Overview of Oklahoma Gas and Electric Feedback Collection**

In general however, optimal feedback frequency depends on the channel concerned. For in-home displays for instance, while consumers decide when they access the feedback channel, feedback should be instant. As shown in for instance the BeAware trials, consumers learn more effectively about the impact of their behaviour through instantly observing changes in consumption or cost in response to changes in the way they use appliances in the home. If a consumer turns on a water kettle or a micro-wave oven, they want to know there and then how much that costs them. Instant feedback provides a fun and involving way of learning about the relationship between actions and consequences, appliance usage and the cost to the consumer.

In the case of informative and smart billing, it is typically sufficient if the frequency of the feedback is only as often as the bills are sent to consumers. Several times per year ranging up...
to once per month appears to be sufficient for this purpose, although once per year would not be sufficient in those countries where billing is annual.

**Figure 25: Overview of PowerCents DC Feedback Collection**

**Do Not Forget the Bill**

Ultimately, the proof of the pudding is in the eating. Regardless of all the feedback that a customer receives, if the bill that comes to them at the end of a billing period is higher than previously or higher than they expected, or even not noticeably lower than previously, then a customer will be discouraged or in the worst cases (in programmes that were not among those studied for this report but which were studied for the Empower Demand 1 report) even highly critical of the feedback programme.
A way to overcome this is to make billing as clear and informative as possible, arguably at least partially the case in the Irish trials or through feedback and other communication provided to the customer which ultimately allows the customer to differentiate between increases in bills that are attributable to price increases as opposed to increases in consumption. The OPower platform style of communication appears to provide the greatest ability to facilitate this differentiation, but it should be pointed out that utilities should be mindful of the dangers facing the introduction of energy efficiency and demand response programmes at times of increasing underlying price levels.

Interestingly, in the Irish trials for instance, 91% of the respondent participants thought their bi-monthly billing statements were easy to understand. This is quite an achievement.

Feedback Devices

Aesthetics, ergonomics, clarity, ambience, coolness, intuitiveness are all important characteristics of feedback devices such as in-home displays and ambient feedback displays. As illustrated later in this report, the feedback devices available of the market today, or being currently developed, incorporate many of these characteristics, yet most of the programmes conducted to date, including those researched in detail for this report, have arguably not incorporated what would be considered particularly appealing devices.

Some devices, such as the OG&E in home display shown below and that used in the Irish trials, are among the more aesthetic, but others such as that used in the Perth Solar City trials, as also illustrated below are more functional. Yet, the Perth Solar City trial can be seen as successful.

It would appear that energy efficiency and demand response trials can be effective largely regardless of the characteristics of the display, but based on research findings related to more recent displays, we estimate that those programmes researched for this report would have been more, or even more successful had they applied more aesthetic, ergonomic, simple, ambient, intuitive devices.

The fact that even basic devices can be so effective is also proof that the cost of devices does not necessarily have to inhibit the opportunity for utilities to offer energy efficiency and demand response programmes.

Figure 26: OG&E In–home Display
Feedback done well, leads to year-on-year increases in savings

In Massachusetts, programmes with National Grid and NSTAR in collaboration with Opower, which achieved savings from opt-out programs of between 1.25% to 3% per household across over 300,000 households, found that savings have persisted and grown by as much as 30% year-on-year. These programmes also led to significantly increased participation in the utility's other efficiency programs. Another programme in Illinois by ComEd in collaboration with OPower, found that annual savings increased from the first program year to the second by a statistically significant 38%.

Likewise, an ONZO deployment of IHDs to over 80,000 energy users (that resulted in an 8% reduction in overall energy use and a further 5% shift away from using energy at peak times) further found that these changes were sustained, self-motivated and did not even require financial incentives.

3.1.6. Empathy and Trust

While customers generally appreciate financial gifts for participating in pilot programmes, they do not necessarily require them. Receiving education and support on how to reduce energy bills and keeping the technology afterwards can in some situations be just as motivating. This is not to say though, that customers do not respond better within programmes when they are provided with financial rewards for their positive behavioural response, for such incentives are highly effective.

The fact is though, that customers appreciate knowing, or even need to know, through the demonstration of the utility’s behaviour and or promises and guarantees, that the utility is trying to help the customer rather than just themselves, that their participation will not lead to them paying more, as they may have experienced with water meters, and that their participation will provide them opportunities to save money, or even earn money (though not a promise of saving or earning money), with minimal inconvenience. The environment comes in a
cool, but important second, and even claims of helping the environment should be made in the knowledge that all claims need to have the confidence and trust of consumers.

A key objective of public engagement campaigns prior to programmes should therefore be to reassure consumers that guarantees and safeguards are in place to protect them from being duped, to protect them from higher costs, and to justify to consumers the logic and simplicity of their offering.

More specifically, if customers are to willingly involve themselves in a relationship step change, such as adopting dynamic tariffs, something that demands trust in the provider of those tariffs, it can be beneficial to provide promises and guarantees, at least initially, until the customer’s perception of risk of change is overcome or sufficiently reduced. In the Electricity Smart Metering Customer Behaviour Trials in the Republic of Ireland, for instance, the utility CER promised participants testing time-of-use tariffs that they would not pay more than the standard Electric Ireland tariff. Customers were promised that they would be recompensed if participants did end up paying more.

Similarly, at the end of the first year of the program, OG&E promised to credit participants account the full difference if they pay more for electricity used than they would have on the standard price plan—so they would stand to lose nothing at all. And customers aged 65 or over received an additional $5 monthly discount during the summer. Perhaps at least part in consequence of this, in a survey of customers in late 2010, 88% believed OGE was trying to help them use energy more efficiently.

Figure 28: OPower SMUD Pilot: Subtle Communication Plays a Major Role
The need for empathy and trust also infers the need to demonstrate and instil a ‘mutual benefit’ into the communication, offering and ultimately the relationship. Punishment and control, commonly associated with for instance dynamic tariff or automation offerings by customers, can also be overcome through safeguard promises, guarantees or providing customers with the ability to override the control or exit the programme altogether, if they so wish.

The importance of subtlety in communication as a means of achieving empathy and trust should not be estimated however. In the Opower SMUD pilot for instance, communication was viewed and developed in a holistic manner, with every communication following a very common theme, a common understanding of what is needed in order to build empathy and trust between the utility and the customers. In fact, as illustrated by Opower, arguably the best way for a utility to build empathy with customers is by not communicating with the customer at all, but rather by letting a specialist communicator do it for them, as an intermediate agency.

Elements of communications that can further inference of empathy and trust, as seen in the more successful programmes include for instance keeping the communication short, to the point, with transparent clear, simple and non-technical language, avoiding wording that sounds like the utility is trying to protect or cover itself, or hide its intentions or obligations in exceptions or complication. A clear, transparent, unambiguous message is a sign of a clear intent.

3.1.7 Motivation and Incentivisation

Motivational Messages and Visualizations

A wide selection of motivational messages to get consumers’ support and involvement were incorporated into the communications of the programmes researched for this report. Messages essentially fit into three categories, namely: messages justifying and trying to get consumers’ approval of the programme and the developments surrounding the programme as a whole; messages promoting the reasons to get involved; and messages eliminating the reasons not to get involved

Reasons to be positive about the new developments

1. Creating a better environment
2. The future possibilities (products, services) enabled by SM
3. Working to partner with you the consumer
4. Other benefits of the smart meter, such as more accurate consumption measurement

Reasons to get involved:

1. Help the utility to provide better services for you and everyone;
2. Individual actions, however small, are part of something greater (e.g. Perth Solar City);
3. The opportunity to benefit the environment
4. The opportunity (not promise) to save money
5. The opportunity to manage energy bills
6. Receipt of energy usage reports
7. Understanding your bill and energy costs, e.g. OG&E: "...helping you track and manage electricity more efficiently to lower your bills by letting you see the energy you’re using in incredible detail."
8. Financial reward for participation (e.g. USD 50-100, 25-50 before and 25-50 after)
9. Receipt of a free smart meter
10. Receipt of a free smart thermostat
11. Receipt of an in-home display (and the right to keep it after the trial)
12. Receipt of a fridge magnet to indicate time of use periods and costs
13. Receipt of education (including also tips) on how to reduce consumption and costs
14. Win money, e.g. SEAS-NVE
15. The opportunity to take part in quizzes – e.g. Be Aware
16. Added home comfort and convenience (home energy management system);
17. More convenient time-of-use tariffs (only appropriate for customers already on time-of-use tariffs), e.g. OG&E: "This intelligent thermostat gives you even more flexibility on the plan, allowing you to set preferences for your lifestyle, or control it manually and react to the current price of electricity. The choice on how you save is always yours.”

Figure 29: ESB Motivational Message
Elimination of Reasons not to get involved:

1. Ease of Use, e.g. plug and play or automation to make it simpler
2. Promises (and guarantees) that the utility is trying to help you the consumer
3. Promise of excellent customer support

1. The right for you the consumer to opt-in and leave the programme
2. Answers to you, the consumers' questions

Figure 30: A Message of Empowerment, Oklahoma Gas & Electric

Motivational Content of Invitation Letters

The first stage of motivating and incentivizing consumers in the research programmes took place with the letters of invitation to customers. Letters applied a wide variety of different messages elements, promises, and stated rewards. In summary the motivating communications of the more successful programmes include the following:

1. A statement, sometimes at the beginning and end of the letter, that the customer is among a select group of customers
2. A statement that the utility is very grateful to the customer if they participate
3. The motivational messages referred to in the previous section.

Examples of introduction and other letters sent to consumers as part of the researched programmes are shown in Section 6 of this report.
Communications to consumers by ESB as part of the Irish trials were an excellent example of how to provide consumers with substantial amounts of explanatory (technical, procedural and other) information in a way that was not daunting to customers, not off-putting and therefore...
not de-motivating to consumers. Successive letters provided to consumers who had agreed to participate gradually introduced customers to new elements and requirements of the programme: a letter relating to billing, a letter relating to in-home displays and so on. Each letter is a chance not only to provide the customer with more beneficial information, but also a chance to spread out the weight of information that the customer will need to effectively participate in the programme.

Above all however, the drip feed approach is a means by which the utility can have multiple opportunities to positively communicate to the consumer, to reaffirm their gratitude for the customer’s participation and to show the customer that they are trying to assist them. This regular positive personal can therefore be seen as an opportunity for the utility to strengthen their relationship with the consumer.

The Desire for Insights into Tangible Improvements

Concerning motivating programmes and feedback, consumers need to see and feel the difference, supported by insights, not raw data:

“The key is a visible, tangible improvement in the customer experience. Customers must enjoy in change in the level of service they receive—through the mail, online, over the phone—as a result of the Smart Grid, as that is what makes the Smart Grid “real” to them. Reaching out through “push” channels is also critical: since they are already disengaged, a majority of customers will not see improvements to “pull” or passive channels such as utility websites”: Opower, 2012

Demonstrating the Value of Smart Meter Data – Opower Findings

Demonstrating the value of smart meter data to utility consumers can come from various communications including:

1. High bill and unusual usage alerts – knowing how much you are going to consume and how much it is going to cost, while there is still time to do something about it.
2. Heating/cooling usage analysis and recommendations
3. Money-saving rate plan recommendations
4. Time-of-day usage analysis and recommendations
5. Advanced targeting allows improved marketing of offers and other Smart Grid programs
6. Consumption Disaggregation: Using sophisticated software tools to approximate a customer’s energy consumption through heating, cooling, and other uses. This proprietary process—which does not require or rely upon any devices installed in the home—helps customers understand how different appliances affect their home’s overall energy footprint, as well as where immediate energy savings can be found. Usage disaggregation algorithms based on a multiple linear regression strategy that utilize customer profiles, weather data, and energy consumption data to determine the likely distribution of energy use. Opower has validated and refined this algorithm through simulation studies and by comparing data from separately metered heat pump units.

Customer-Perceived Motivations – The Case of the Irish Pilot

Research conducted as part of the Irish Pilot found that in fact in consumers’ minds at least, numerous factors had motivated their energy efficiency behaviour. The main factors, stated by 91% to 83% respectively, were:

1. Different prices charged at different times of day;
2. The electricity monitor (IHD);
3. The overall cost of electricity charged as part of the trial;
4. Additional information that they received in their bill;
5. The need to reduce their bill due to the economic climate.

Given the relatively small difference in the incidence of these statements, it would seem fair to argue that all of these issues were of very high importance.

For consumers who had not participated, perceived incentives to participate included:

1. A €50-100 payment for participation (the variation in amount yielded only a small 5% difference in interest in participation)
2. An opportunity to reduce the bill by changing times when they use the most electricity
3. An opportunity to reduce the impact on the environment by reducing the overall amount of electricity used.
4. An opportunity to reduce the bill by moving the time when they use electricity away from peak hours
5. A cash back reward for reducing electricity usage overall by a specific amount over a number of months
6. More advice on how to reduce electricity usage
7. In home display
8. More information on the bill about the amount of electricity they use at different times of the day or week

Payments, cash-back and assistance to the environment were seen as the most important, but once again the importance of all the above variables was very similar.

The Essential Interplay of Financials and Information

Ultimately what this the two above sets of findings and other researched for this report clearly reaffirm is that it is the interplay of price and cost incentive with information (including education and feedback) that drives customer involvement and energy efficiency behaviour, and both sets of drivers are of equal importance and inter-dependent.

Disincentives

There are of course some disincentives that utilities should avoid when delivering energy efficiency and demand response offerings. These include the inconvenience of the meter installation, consumers’ expectation of not materialised benefits, consumers’ fear of paying more (as with the installation of water meters), consumer feelings of having received or fear of receiving too much information in the bill/interface; and unanswered customer questions. Unanswered questions lead to customer assumptions, often negative, or doubt.

The best ways to avoid these disincentives are: to provide promises (as explained earlier in this report in the section on Empathy and Trust); through the provision of clarifications in introductory letters; through the design of the programme. Honesty and transparency is also of paramount importance.

Goal Setting

Goal setting can be offered and achieved in many ways. There is no clear best practice concerning exactly how goal setting should take place, but what appears clear is that it cannot happen in isolation from knowledge acquisition, community comparison and tools. There is
simply no point in providing customers with targets unless they are also provided with the awareness of how to achieve those goals, the sense of achievement from knowing the relativity of those goals compared to other consumers, the regular status of where they are against those goals, and the means, in the form of home automation or simply devices and sufficient excess energy consumption that they can control. Goal setting should therefore incorporate all of these elements.

In the BeAware project for instance, goal setting was coordinated with knowledge acquisition in the form of tips, knowledge checks in the form of quizzes, and the influence of community comparability to maintain the pressure on the consumer's behaviour.

![Figure 32: BeAware Project Goal Setting](image)

**Goal Setting – The Case of Origin**

While not one of the programmes extensively researched for this report, the Australian utility Origin is another example of a utility that provides consumers with a program that includes customers setting goals for themselves and being able to track their progress against those goals, with the support of tips and hints from the online tracking system that consumers use. The system, which tracks consumption on an hourly and daily basis, also provides comparisons with other households in similar situations. Ultimately, the system aims to “provide customers with a supportive learning environment, which aims to enlist the persistent active participation of consumers in managing their home energy use.”

**Community and Society**

Communal involvement and a sense of communal involvement plays a major role in programme success, being a key element for instance within Perth Solar City, Be Aware and also the SEAS-NVE programmes. Through public awareness campaigns, competitions and games, communities, neighbours and families can be brought together to help each other, inspire each
other, and compete against each other. Good programmes also lead to extensive positive word of mouth communication. Opower found, for instance, found that approximately 60% of participants talked to their friends or neighbours.

Opt-in – Opt Out

Contrary to some policy suggestions, as in Great Britain for instance, the evidence indicates that customers are far more co-operative, motivated and effective when they do things willingly. Programmes appear to be more successful where customers opt-in. In the case of the Perth Solar City trials for instance, the pairing rate for IHDs that were not opt-in was significantly lower than for opt-in households. The pairing rate for IHDs by households that did not opt-in was lower (52% for first generation, 64% for second generation) than for opt-in households (75%). Approximately 100 customers (6.5%) returned the IHD to the retailer. This is not to say however, that smart meters should be ‘op-in’ however, since smart meters are an enabling technology and not the interface, feedback or control technology as such.

3.1.8. Automation and Control

Automation was only practiced in four of the programmes that were analysed for this report, namely the OG&E, Power Cents, BeAware and the Home Energy Management System Trials in The Netherlands.

What was controlled?

Within the programmes researched for this report, the following items in homes were controlled:

- Heating and Cooling
- Fridge; Washing Machine; Microwave; Tea Kettle; Coffee Machine; Dishwasher
- Base Station / Router
- Laptop Chargers
- Digibox
- TV
- Floor lamp
- Music player
- PC
- PC Printer

The inter-play of automation, self-control and experimentation

What is clear is that the common argument over whether automation is preferable to self-control is rather inappropriate to the future development of energy efficiency and demand response. Ultimately, consumers do not seem to be opposed to automation per se. It is after all the most convenient, hassle free solution for the consumer. What consumers want however, is to not be: controlled without their permission; in a way that they do not approve of; or without their ability to opt-out, override or modify their involvement.

Additionally, as discussed earlier in this report, and as evidenced statistically in the Empower Demand 1 report, it is important that customers understand, through manual involvement, the relationship between their consumption behaviour and the consequences for themselves and the environment, before they are provided with Automation. Otherwise consumers
achievements will in future be limited entirely to the extent facilitated by automation and their understanding of the value of automation will be undermined.

3.1.9. Security and Safety

Data protection, security and health risks are perceived by some customers, but seem to be a concern made primarily when it is made one by media. Nevertheless, these issues should be addressed by communications to consumers.

3.1.10. Segmentation

Opower have found that different people like different types of comparison. The question is, how can consumers be segmented in meaningful ways that will help to guide the way we interact with them for the purpose of feedback or control, for energy efficiency or demand response.

Once advanced segmentation classification has been carefully developed by SEAS-NVE that categorises customers according to their 'dream-reality' dynamics that illustrates the consumers' (emotional) involvement in terms of his/her relation to and expectations of the given utility. "Reality" represents the functional and practical needs. "Dream" represents the need for something more emotional that gives the consumer and experience. The consequence of this segmentation for customer's attitudes towards and expectations of smart metering include:

Dreamers (more likely to be women) are more likely to value the softer benefits of smart meters such as:

- Aesthetic and comfort elements of smart home
- The chance to show off their achievements
- The feeling of empowerment
- Environmental and nature benefits derived from smart meter-based consumption feedback.
- Helpful, friendly and fun advice about how to save energy

For Dreamers, more creative and aesthetic communications relating to the above types of benefits would be more effective.

Reality consumers (more likely to be men) are more likely to value the harder benefits of smart meters such as:

- Home automation (e.g. heating control)
- On-off (home away) buttons
- Home supervision and security
- Energy-cost savings

Unique consumers, as the definition suggests, are keen to do things differently and to let people know it. While smart meters are hardly a source of inspiration or identity for any consumer, such consumers are more likely to be open to the idea of taking on a new smart meter and especially the sorts of smart home services that are likely to follow on form that.
Standard consumers tend to do things the way they are normally done, by typical customers.

![Figure 33: SEAS-NVE Segmentation Matrix - Characterised](image)

From these two dimensions, four segments can therefore be identified, as shown above.

Unfortunately however, none of the above segments can be easily identified within a customer database; they do not have sufficient demographic labels. Similarly, Perth Solar City for instance identified a lack of demographic data: an inability to effectively target appropriate market segments with smart grid enabled products and services.

It is however, possible though to transform the SEAS-NVE segments into differentiated above-the-line marketing communications, as illustrated in the following diagram. In public communications, SEAS-NVE showed the smart meter in different ways, with different messages, to take account of the four consumer segments that they had identified through their research.

![Figure 34: SEAS-NVE - From Segmentation to Communication](image)

Segmentation or profiling can ultimately be used in so many ways. In the following example from Opower, customers are provided tips and suggestions based on their personal profile.
Present the right offers to the right customers at the right time—click here to find out more.

**Figure 35: OPower – Profile Based Tips and Suggestions**
3.2. Building Interaction With & Through Technologies

The research investigated for this report indicates that feedback and control technologies are an essential element of the process of creating partnership between the utility and the consumer through energy efficiency and demand response.

The main requirements to optimise customer interaction with technologies, whether feedback or control-related, concern the customer experience and supporting education.

Customers need to be taken through a journey that includes preparing them for interaction, helping them to benefit from the interaction, providing them with an experience positive enough make them responsive to future offerings and then continuously evolving and developing their enlightenment, exploration and benefits through new knowledge, experimentation and offerings & solutions.

In particular in-home displays are such an important part of the entire customer education process that they cannot be taken out of the equation. They form a germinating hub of intrigue, exploration and awareness for the customer. The importance of ambience, ease of use, real-time feedback and aesthetic appeal related to in-home displays cannot be underestimated however. In general, technologies used in programmes to-date have been too complex and uninspiring, numerical and graphical. They are typically neither aesthetic nor ergonomic and they are presented to customers ahead of the customer's comprehension of their true value.

Making the Experience Simpler – The Case of Perth Solar City

In the Perth Solar City in-home display (IHD) trial, leaflets were provided to customers to help them set up the IHD, but the process was made easier through a two button process – consumers just needed to press two buttons to pair it to the meter with the IHD, pre pairing was done in Western Power's labs. Western Power also provided on-going technical assistance to consumers in support of the IHD trial.

The following three cases, based on the research of two state-of-the art technology providers, expand on what was found in the main researched programmes in order to bring the technological experience right up-to-date.

3.2.1. CASE: GEO Technology-Relationship Research Findings

To explain the relationship – or perhaps the gap – between energy efficiency and customer engagement, we can turn to Green Energy Options (GEO). They have good reason to be viewed as industry experts. Over the past four years, GEO has spent over £2m on research and field trials. Their aim is to hone in on consumer behaviour and expectation, the role of energy monitoring for utilities and the apparent disconnect between interest in green energy and the uptake of knowledge – particularly that offered by energy companies. Their research yielded some surprising results.

The more data you provide, the more detail people want

In GEO’s visible energy trial, three groups of consumers were given a monitor. The first group were given the basic Solo, the second group the mid-range Duet and the third group the top-
end multi-functional Trio. GEO asked all participants to say whether they wanted more functionality. These figures show the number who said yes:

- Basic IHD user: 38%
- Mid-range: 47%
- Top-end: 71%

The results prove there is a thirst for knowledge that isn’t currently catered for with most smart metering programmes. Consumers are not getting real-time, accessible information in a format that they find engaging. It’s startling to note that the more real-time functionality given to consumers, the more they want to know, particularly when you consider the potential scope for change. Although consumer engagement with smart metering has a relatively high profile in the UK, Europe is a long way behind.

![Figure 36: More Functionality Means More Engagement](source)

**Figure 36: More Functionality Means More Engagement: % of customers of different GEO devices that would like more functionality**

*Source: Green Energy Options, 2012*

**Simplicity + visibility = ultimate customer engagement**

Fundamentally, what links positive customer experience and energy efficiency is the right information presented in the right way. And we’ve already established that the more education consumers receive the more interest they have in analysing their energy habits. Therefore GEO argue that true customer engagement, the kind that allows consumers to see their usage in a way that is most expedient to them, is part and parcel of any efficiency strategy. This in turn generates customer retention and brand loyalty. Overwhelmingly there is a feeling that energy information from smart metering simply isn’t being presented in a way that customers can identify with.

**Reduce, replace, renew**

Making energy visible is categorically not a death knell for utilities. It is far from it. By giving customers visibility and control of their consumption, they are more likely to spend money on efficient, modern appliances and the kit that allows them to keep a close eye on usage. This...
reflects GEO’s view of a customer’s energy efficiency journey: reduce, replace and renew. Consumers start by reducing their energy then look to replace their appliances (35% of trial participants did just that). Consumers who replace their appliances are then keen to look to renewables to complete their journey.

![The customer journey](image)

**Figure 37: The Customer Journey**

Source: Green Energy Options, 2012

**See, explore, analyse**

This is not to say that IHDs are the only way to present information and engage users. In fact GEO argue that the best results are when IHDs, mobiles and web platforms work in conjunction with each other. Consequently they are pioneering a new route to customer engagement with three simple steps:

- Users want to see information at-a-glance – data that is simple, meaningful and relevant to them.
- When they are alerted to something by the IHD, or by their mobile, they then use a mobile app to explore and understand what is happening.
- And when they want to analyse their historic usage or consider the next steps on their journey they use the utility’s web portal (where there will also be data and advice derived from their smart meters).

So using smart metering data to drive energy efficiency behaviour is best achieved by playing to the strengths of each medium and communication channel. Adopting a multichannel, customer-centric approach to information will turn engagement into efficiency and browsers into customers.
3.2.2. CASE: ONZO Technology-Relationship Research Findings

While the emphasis differs by region, around the globe utilities’ key business objectives are to attract and retain customers, change their behaviour, maximise revenue and margin from that customer base through new products and services, and serve them at the lowest possible cost while meeting obligations for energy efficiency and security of supply. Success across any of these objectives requires a transformation in the relationship between the utility and its customers, as has been achieved in other industries such as supermarket retailing, banking and telecoms. While smart metering is widely believed to be the key to this relationship transformation, the reality is that on its own smart metering delivers little more than an improved billing process and is actually having very limited impact on the utilities’ ability to achieve wider business benefits.

But transforming the relationship between an industry and its customers is an enormously difficult challenge, especially for a utility coming from a traditionally very low base of trust and engagement. Onzo’s strongly held belief, again as has been proven in other verticals, is that the winners will be those who most successfully can realise the value of data. Below we briefly discuss how data analytics plays a key role in customer engagement and behaviour change.

1. **Customer segmentation.** Residential customers are people – not “meter end-points” – with different behaviours and attitudes. In fact they are usually groups of people with complex internal consumer behaviour dynamics. Onzo’s extensive research in the UK identified a useful definition of eight consumer segments based on levels of motivation to engage with energy which has subsequently been used by a utility for targeted marketing. At a summary level this identifies that 43% of customers are actively engaged in energy (i.e. they will put in some level of effort to achieve a perceived benefit such as saving money or being green), 39% are passively engaged (i.e. they will not put in effort, but they will take notice if information or a stimulus is pushed toward them), and 18% are disengaged (i.e. no amount of engagement will budge them). Perhaps surprisingly, there is little correlation to socio-demographics. The path now is to increasingly refine the segmentation with behavioural data.

2. **Relevance.** An interaction between a utility and its customer will not enhance the relationship unless it is perceived as relevant to that customer. A simple example: a customer that is known to have a relatively poor performing fridge is likely to be receptive to targeted advice or even promotion of a new appliance. They may wish to know how much they could save, or the payback time. Relevant and fresh insight keeps sustained interest. All of this can be achieved through clever data analytics that can depict individual appliances from a whole-house dataset, and changes over time.

3. **Channel mix.** Many studies on the energy saving impact of energy monitoring products show the increased efficacy of delivering messages through multiple channels (e.g. IHD, web, paper). Different media are better for certain types of information. In home displays are excellent for stimulating an immediate action, such as turning off a high consuming appliance or in a smart-world environment deferring use of an appliance until a lower tariff kicks in. However, consumers tend to view the display for only a few seconds, therefore displays are of little use for detailed historical analysis. Paper reports tend to be good for influencing longer term behaviour, such as appliance choice. SMS is perfect for pushed alerts. Web is a ‘pull’ media for those interested in more detailed analysis and comparisons. Each channel needs to be fit-for-purpose, and used in a combination that makes sense for
each customer’s preference.

4. **Design for behaviour change.** Utilities have different motivations to change the behaviour of their customers. One example in the US is the goal to reduce consumption during peak periods – usually hot summer afternoons. Research shows there are about 12 identifiable mechanisms to encourage behaviour change, including target setting, comparisons with peer groups and rewards/incentives. OPOWER in the US has harnessed one of these levers well, that of peer group comparison. Onzo’s view however is that customers are nudged by different combinations of these triggers (and these differ over time too), so tools should be designed to use many factors.

Onzo has put much of this into practice with utility clients, with proven effects. Across many tens of thousands of customers, we have seen evidence of business objectives being met by rolling out in home display and web presentment following the four practices above. Headline impacts include:

- 8% reduction in overall energy consumption, which has been sustained
- A further 5% reduction in peak time usage, achieved with no financial incentive or time of use tariff
- Customer churn has reduced by 50%
- Customer ‘likes’ on Facebook is up to 100x higher than other brands

The final point worth noting is that utilities must find a positive business case for implementing these methods of customer engagement and behaviour change above and beyond smart metering. Hardware-centric solutions are difficult to make stack up, while solutions based on data analytics are lower cost and can drive a far wider range of benefits to utilities.

### 3.2.3. CASE: eMeter Technology-Engagement Approach

eMeter, a Siemens Business has extended worldwide experience around smart grid providing a smart network application platform, including direct implementation of consumer energy efficiency and demand response pilot programs. Deploying smart meters and communications that generate interval usage data provides the basic infrastructure. Turning that data into information and consumer empowerment has three key considerations.

1. **Data Standards and Infrastructure** – As of early 2012, nearly 200 million smart meters around the world are tracking energy data and communicating it back to utility data centres. But, getting that data out of the utility data centre and into places where it can be used in more ways by end customers requires data standardization. Industry interoperability standards enable vendors and application developers to receive the data and turn it into useful information for customers, whether delivered by the utility, the retailer, or a third party chosen and authorized by the customer.

2. **Customer Engagement and Motivation Programs** – Once data has been standardized, it may be leveraged in compelling ways that deliver real value to customers’ daily lives. By integrating data availability with consumer education and marketing, the programs show users how their energy is consumed and empower them to take specific actions to manage their energy consumption, including making it easy for them to sign up for programs that would further automate their activity. The result is benefits to both the customer and the grid.
3. Customer Empowerment – Going beyond motivating customers to get engaged, full consumer empowerment enables them to take full advantage of their energy management activities – with the ease of set-and-forget automation. Full empowerment involves the triad of information, pricing options, and automation. These elements reinforce one another to maximize energy efficiency, demand response, renewable integration – and consumer convenience.

In the PowerCentsDC program managed by eMeter Strategic Consulting, customers were offered smart meters, a smart thermostat and one of three price plans: critical peak prices, peak time rebates, or hourly prices. On average, customers reduced peak hour consumption on critical days by 13%. Over 90% of the participants saved money, and 91% preferred their new price option over their old pricing plan.

Figure 38: The PowerCents DC It Architecture by eMeter provided an integrated, multi-function solution.

3.2.4. Recent Automation Technologies

Technologies are now emerging in the European market, on a commercial basis, that enable the consumer to automate their heating and or hot water consumption schedule in co-ordination with both the weather and the price of energy in the wholesale market. The first such offering in Europe is one offered by the Finnish utility Fortum, using There Corporation technology. Their own research has indicated heating savings of up to 15%. The system requires installation by a professional, but the cost of that installation is paid by the utility. The consumer interface is simple and web-based, supported by extensive energy consumption visualization as well as tips and guidance for the consumer, to help them understand and maximize the benefits of the system.
Essentially, the system aims to use energy during the hours when transfer prices and the price of electricity on the Nordic wholesale market for electricity, Nord Pool Spot, are cheapest. The system knows the price on Nord Pool Spot by collecting daily spot prices per hour and through also acquiring local weather forecasts, applies control algorithms to calculate heating needs. Based on these calculations, the system schedules the sufficient amount of heating across the cheapest hours of the day. The system informs the consumer by email and to their mobile phone when the price of electricity is high, and while the consumer has the ability to override, the system automatically schedules heating.

Figure 39: Home Heating Automation Solution by Fortum and There Corporation

Figure 40: Home Heating Linked to Spot Prices and Weather by Fortum and There Corporation
This is an emerging system, and as such is intended for more than simply heating control, although at present the system is limited to heating until more controllable appliances are added to the capabilities of this service. Considering that a typical electrically heated household in Finland uses approximately 20,000kWh of electricity per year, the potential for customer savings through such systems is substantial, and likely to be highly motivating to customers.

3.2.5. Where Technologies Are Heading

The latest technologies, some of which are explained in Section 5 suggest some emerging trends. They are typically more user-friendly, inspiring, ambient, sometimes providing more impressionist and less numerical and graphical feedback. They are typically more aesthetic, ergonomic and intuitive (requiring less reliance on manuals and consumer technical learning time). They are taking the technology from something consumers might feel they need to facilitate a service or solution, towards objects that customers will desire, at least in combination with an energy efficiency or demand response service, but even because of the direct interaction experience it can provide or its aesthetic desirability.

Above all, technological solutions are finally emerging that are market ready - technologies that are suited to commercial roll-outs rather than simply proof-of-concept pilots. The AwareClock, shown below is just one relatively extreme example of this direction. Soon to be launched as a commercial stand-alone product in Sweden in Autumn 2012, it provides consumers with a truly fun and aesthetic real-time visualisation of their energy consumption.

Figure 41: The 'Aware Clock' developed by the Interactive Institute, Sweden and soon to be launched commercially by Pike Solution in 2012.

Source: www.awareclock.com
Another trend would appear to be that feedback and control technologies are relying increasingly on smart meters, as more and more smart meters are rolled out, and as more and more roll-outs are being mandated or announced.

A potential concern for the utilities industry is however, that some emerging solutions, and exciting ones at that, are being developed in ways that exclude the role of the utility. This is in part at least due to the commoditisation of energy efficiency solutions, but also apparently due to the slow speed at which the utilities industry is progressing with its commercial energy efficiency offerings.
Another trend is that technologies are converging, integrating more elements of feedback and control within one solution and overcoming more and more inter-connectivity issues, allowing an enhanced extended plug and play experience for the consumer, and an improved commercial business case for utilities or other parties offering the service which is based upon the technology.

3.2.6. A Changing Landscape for Smart meter Enabled Energy Efficiency and Demand Response Services

By combining the learnings, technologies and solutions described in this report, with national and regulatory commitment to energy efficiency, massive energy efficiency and demand response achievements can be expected. The sooner that smart meters are rolled out, the sooner that market structures are designed to value savings equally along-side generation, the sooner that smart meter enabled energy efficiency and demand response potential can be fulfilled.

Case: Nationwide rollout is king: Germany to launch smart metering for customers with more than 6,000 kWh

An article by: Gabriele Riedmann de Trinidad, Head of the Strategic Business Area Energy at Deutsche Telekom

The nationwide installation of electricity meters at the approx. 44.5 million German electricity customers is to be completed by 2022. As early as from January 1, the German Law on the Fuel and Electricity Industries [Energiewirtschaftsgesetz, EnWG] will obligate all companies consuming more than 6,000 kWh per annum – around 5 million in Germany – to use smart metering. This will support the ambitious targets for the extended use of renewable energies, among other things. Because, if you go by the target of the German government, the proportion of renewable energies in the area of power supply will be increasing to at least 35 percent by 2020.

The government has also discovered the topic of energy efficiency in private households and companies. It considers the more efficient use of energy to be key in the implementation of what is referred to as the energy turnaround. Practical experience shows, for example, that power consumption can be reduced by roughly 5 percent and heat consumption by approx. 25 percent when using smart energy meters. A key lever for this is the growing level of transparency on actual energy consumption which causes tenants or home owners to change their consumption behaviour.

However, despite all these benefits, the mass rollout of smart meters in Germany has only just begun. The ‘Mülheim zählt’ [Mülheim counts] project is the largest smart metering project in Germany to date. Here, Deutsche Telekom is currently installing 15,000 digital electricity meters – 200 a day – as well as the necessary communications boxes for remote access for RWE Deutschland in Mülheim an der Ruhr. The boxes collect metering data from the meters and transfer the values after encryption securely to RWE.
Based on experiences gained in Friedrichshafen and in other smart meter projects, the Fraunhofer Institute for Solar Energy Systems (ISE) has analysed various rollout scenarios for smart meters. A fast, nationwide rollout of intelligent measuring systems able to record electricity, water, heat as well as gas would have the highest economic benefit. With solutions that bundle the recording of electricity, gas, heat and water consumption, over EUR 1 billion processing costs could be saved in Germany according to the Fraunhofer Institute.

A solution is called for, because from next year onwards, all customers consuming more than 6,000 kWh of electricity are to be provided with more transparency. Telekom assists suppliers with a comprehensive service behind the meter. In addition to a communications box including software, installation and operation, this also comprises the connection to the communications network, reading the usage data, and data transmission. Telekom bears the cost of investment in the infrastructure and is responsible for its operation.

Telekom also uses its own communications infrastructure and know-how to prepare for the new challenges in the area of smart metering, for example the question of how the mass data can be managed. If several million smart meters record and forward usage data every 15 minutes, gigantic data volumes will be generated. Telekom has successfully simulated the processing of 50 million smart meter data every 15 minutes in its own data centre and thus passed one of the first stress tests without any problems.

Together with partners such as EnBW, EON, eQ-3, Miele or Samsung, Telekom goes one step further with the connected house. The alliance carrying the name of QIVICON not only aims to ensure energy efficiency at home but also the areas of security, convenience and health. This includes automatic heating management and control, the “All Power Off” function, which disconnects all consumers from the power supply at the press of a button, the remote control washing machine as well as energy-saving functions along with security solutions and applications from the health sector. All connected devices are easy to operate on a smartphone or tablet PC.
### 4. Programme Review Summaries

**Perth Solar City (Part of Solar Cities Australia)**

<table>
<thead>
<tr>
<th>Location</th>
<th>Western Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Description</strong></td>
<td>Project launched in November 2009 to test the installation and running of smart meters, giving feedback to participants through an IHD, the response of participants to TOU prices, the introduction of solar panels, remote control of AC, and the introduction of solar water heaters. It also featured an awareness campaign to reduce electricity usage. The IHD trials included 813 participants who were either assigned to the pilot or volunteered. The measurement period ran between February and June 2011.</td>
</tr>
</tbody>
</table>
| **Feedback channel and description** | Two generations of IHDs:  
- standard real-time energy consumption information – generation 1 and 2  
- micro-generation information – generation 2 only  
The standard first generation IHD, has three main functions:  
- show real time electrical energy consumption information in units and dollars  
- show historical electricity consumption based on a user defined date and time  
- coloured lights representing time-based tariff consumption blocks  
- show current tariff rate in dollars per unit  
- Receive messages from Synergy and Western Power  
The micro-generation capable, second generation IHD has additional functionality to show the household’s net generation, for example when a solar PV system is installed on the home. The IHDs have a LED light changing colour according to the price of electricity. |
| **Customer engagement and education** | Customer engagement is done through the awareness campaign not directly directed at IHD participants. "Collective Impact" (the name of the campaign), shows residents of Perth’s Eastern region that their individual actions, however small, are part of something greater and gives them tips and advice to reduce electricity usage. Use of local cinema, local newspaper, direct mail and outdoor communications channels. A website was launched in December 2009 to create a link between the Collective Impact campaign, and the Perth Solar City program. Then, as the smart meters were being installed for the smart metering pilot, the installers used the opportunity to get people interested in other trials such as remote control of AC and the IHD trial. The organiser’s main recruitment method was to package the IHD and send it via mail to smart meter households. 82% of IHDs were deployed to households who had not opted-in to the Trial while the remaining was deployed to households that specifically opted-in to the trial. The pairing rate for IHDs by households that did not opt-in was lower; hence the recruitment will be only opt-in for the second year of the pilot (52% - 64% for selected households vs. 75% for opt-in households). |
| **General Results** | IHD 6.82% (No results yet for participants on TOU tariffs with IHDs) |
Oklahoma Gas and Electric's Smart Study Together

<table>
<thead>
<tr>
<th>Location</th>
<th>USA</th>
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<tbody>
<tr>
<td>General Description</td>
<td>The first phase of the pilot took place in the summer of 2010 (June to September) with 3,000 volunteers. Customers were split across two dynamic rate options, CPP (with standard, medium or high price difference) or a Time-of-Use + CPP rate. OG&amp;E tested four technology options: a web portal, an in-home display (IHD), a programmable communicating thermostat (PCT), and a combination of all three. Phase II in summer 2011 included 6,000 customers. OG&amp;E marketed the offer without the IHD in 2012.</td>
</tr>
<tr>
<td>Technology Description</td>
<td>Smart thermostats are programmable to respond to price levels. OG&amp;E does not directly control participants’ load. The platform is built to be able to accommodate PV, EVs, and other HAN devices.</td>
</tr>
<tr>
<td>Feedback channel and description</td>
<td>The pilot tested two feedback channels, a web portal and an in-home display combined with dynamic prices.</td>
</tr>
<tr>
<td></td>
<td>1) Web portal (including a mobile version for smart phones and Tablets) showing:</td>
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<tr>
<td></td>
<td>• Personalised consumption report</td>
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<tr>
<td></td>
<td>• DR event alerts</td>
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<tr>
<td></td>
<td>• Current and day-ahead pricing information</td>
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<tr>
<td></td>
<td>• Most recent energy usage information from smart meter</td>
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<tr>
<td></td>
<td>• Historical usage</td>
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<td></td>
<td>• Projected bill</td>
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<tr>
<td></td>
<td>• Translate electricity use into savings</td>
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<tr>
<td></td>
<td>• Define the effects on the environment</td>
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<td></td>
<td>• Gives simple advice to reduce consumption</td>
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<td></td>
<td>• Peer comparison with neighbours</td>
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<td>Printed consumption reports and detailed billing were provided to customers without internet.</td>
</tr>
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<td></td>
<td>2) IHD:</td>
</tr>
<tr>
<td></td>
<td>• Most recent energy usage information from smart meter in unit and dollars</td>
</tr>
<tr>
<td></td>
<td>• Current and day-ahead pricing information</td>
</tr>
<tr>
<td></td>
<td>• Receive messages from OG&amp;E</td>
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<tr>
<td></td>
<td>• DR event alerts</td>
</tr>
<tr>
<td>Customer engagement and education</td>
<td>Multi-channel marketing campaign that included an extensive TV and radio media campaign, a branded website, prints and community events. Participants opted-in. Reasons for such a program, terminology such as peak periods, peak generation were also explained. On-going education takes place through the web portal and / or the IHD. IHGs act as a constant reminder. To respond to the fear of paying more with dynamic pricing, at the end of the first year on the program OG&amp;E promises to credit participants’ account the full difference if they pay more for electricity used than they would have on the standard price plan.</td>
</tr>
<tr>
<td>General Results</td>
<td>88% of customers believed OGE was trying to help them use energy more efficiently. 99% of residential customers saved compared to the standard rate plan - average savings of $157.38. Consumption reduction is visible in all income and age groups. Results from 2011 confirm 2010.</td>
</tr>
<tr>
<td>Sample 1: Web portal (including a mobile version for smart phones and Tablets)</td>
<td>2010 peak consumption reduction: TOU weekday: 11%, VPP standard (event):8%, VPP medium (event): 8%, VPP high (event):12%</td>
</tr>
<tr>
<td>Sample 2: IHD</td>
<td>2010 peak consumption reduction: TOU weekday: 16%, VPP standard (event):6%, VPP medium (event): 8%, VPP high (event):11%</td>
</tr>
<tr>
<td>Results for the samples with programmable smart thermostat are ignored for this analysis.</td>
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</table>
## O’Power SMUD Pilot

<table>
<thead>
<tr>
<th>Location</th>
<th>USA</th>
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<tbody>
<tr>
<td><strong>General Description</strong></td>
<td>O’Power’s energy reports provide customers with normative comparisons of their current energy use compared to their neighbours and suggest actions that they can take to reduce their electric use. 35,000 randomly assigned participants with option to opt-out are taking part in the SMUD pilot since April 2008.</td>
</tr>
</tbody>
</table>

| Feedback channel and description | Personalised consumption reports give customers three types of information: a) how their recent electricity use compares to their energy use in the past; b) tips on how to reduce electricity consumption, some of which are tailored to the customer’s circumstances (e.g. customers with electric heat receive information on how to reduce electricity consumption by electric heating systems); and c) information on how their electricity use compares to that of neighbours with similar homes. Consumption reports do not give negative feedbacks but only ways to improve if consumption is higher than peers. |

| Customer engagement and education | The introductory letter sent by the Utility explained to customers what the project was about and how they could benefit from it. Education is done through the consumption reports with tips and advice to reduce consumption depending on the participant’s profile. |

| **General Results** | Program savings reveal strong seasonal effects, with savings highest in the seasons of highest electricity use, summer and winter. All demographic segments reduce consumption. |

**Sample 1:** Large users with monthly reports

High consumption profiles saved 2.89% in year 2 compared to 2.37% in year one. Ramp-up period of about 10-12 months followed by fairly constant annual savings

**Sample 2:** Small users with monthly reports

Low consumption profiles: saved 1.7% in year 2 compared to 1.25% in year 1. Program savings continue to trend upward. |
**The Meter Hunt by Utility SEAS-NVE**

<table>
<thead>
<tr>
<th>Location</th>
<th>Denmark</th>
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<tbody>
<tr>
<td><strong>General Description</strong></td>
<td>By self-reading their electricity meter and inserting the numbers on a web portal, participants are able to take part in a lottery. They also may give SEAS-NVE various information about their household. Each meter reading and each batch of information became a lottery ticket. SEAS NVE is in return able to give participants personalised tips and advice about reducing energy consumption. The programme started in 2009 and there were 71,000 participants as of June 2012.</td>
</tr>
</tbody>
</table>

| Feedback channel and description | Web portal showing peer comparison, historical consumption information with data over past weeks/months/years, profiling (participants choose what, when and how much information to provide), tailored tips and advice on energy reduction. The more information that is given by the household, the more personalised and efficient the communication can be. Alarm pop-ups when energy consumption reaches a certain level predefined by the customer. Alarm can also be given as SMS when mobile phone number is registered. Possibility to sign up for email newsletter and other SMS services. Messages were designed to be simple and targeted to reach customers with different needs. |

| Customer engagement and education | Recruitment process started after the Utility identified 4 different profiles of customers depending on their relationship to the Utility. Different messages were sent targeting the different profiles to make them interested in the Meter Hunt. Each meter reading and each batch of information became a lottery ticket with a 50,000 DKK prize (later reduced to 25,000 DKK). After signing up to the programme, participants can provide information about its household. |

| General Results | 17% average overall consumption reduction  
- 84% signed up for newsletter  
- 45% signed up for SMS service |
Electricity Smart Metering Customer Behaviour Trials

<table>
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<tr>
<th>Location</th>
<th>Republic of Ireland</th>
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<tbody>
<tr>
<td><strong>General Description</strong></td>
<td>The pilot attempted to measure the potential of different dynamic tariffs and feedback channels to change consumer behaviour and identify a “Tipping Point” when electricity usage changes significantly due to prices. A group of 3,296 residential participants designed to be representative of the Irish population were assigned to one of four tariff groups (with increasing price differential) and broken down into 4 different feedback channels. A goal setting incentive was also used. The pilot ran between January and December 2010.</td>
</tr>
<tr>
<td><strong>Feedback channel and description</strong></td>
<td>Time of use tariffs were used in combination with different feedback channels:</td>
</tr>
<tr>
<td>1. Informative bill with energy usage statement. The bill was similar to the existing supplier’s bill (with additional lines for time of use tariffs). The energy usage statement provided additional detail on usage and tips on energy reduction. Some sample groups received them monthly while other received them bi-monthly (consistent with their normal bill frequency).</td>
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</tr>
<tr>
<td>2. In-house display to provide participants with information on how much electricity they are using and how much it is costing them. The electricity monitor also included a budget setting mechanism, where consumers could decide the maximum they wanted to spend on electricity per day. A usage gauge on the home screen showed consumers their usage against their daily budget.</td>
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<tr>
<td>3. Overall Load Reduction (OLR) Incentive involved the setting of a target reduction in electricity usage for the participant. This target was based on an analysis of the participant’s previous actual usage, less 10%. The target was an eight month target and rewarded participants with €20 (in addition to their energy savings) if they were successful. Participants were updated on their progress with each bill and energy statement.</td>
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<tr>
<td>Participants also received supporting information in the form of a fridge magnet and stickers which outlined the different time bands and cost per band, customized for each tariff group.</td>
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<tr>
<td><strong>Customer engagement and education</strong></td>
<td>Potential participants were sent a pre-trial survey to assess their interest in such a pilot. The interested participants were mailed an invitation letter along with a FAQ brochure. The language used in the invitation was made sure to be accessible to all social classes (highly educated vs. lower educated and richer vs. poorer) as well as addressing any concerns that may discourage from less wealthy and educated groups. Given the importance of the letter in securing opt-in from a nationally representative group, focus groups of consumers who had not been invited to participate in the Trial were conducted in order to obtain their comments and insights on the communication. Ongoing education is done through the energy statements. They provide participants with tips and advice to reduce consumption. IHDs act as a constant reminder. Participants in the pre- and post-trial surveys received a “thank-you” payment for their participation which was €25 pre and €25 post survey.</td>
</tr>
<tr>
<td><strong>General Results</strong></td>
<td>Sample 1: Monthly bill with energy usage statement: Overall consumption reduction: 2.7%, Peak consumption reduction: 8.4%</td>
</tr>
<tr>
<td>Sample 2: Bi-monthly bills with usage statement: Overall consumption reduction: 1.1%, Peak consumption reduction: 6.9%</td>
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<tr>
<td>Sample 3: Bi-monthly bills with usage statement and IHD: Overall consumption reduction: 3.2%, Peak consumption reduction: 11.3%</td>
<td></td>
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<tr>
<td>Sample 4: Overall load incentive with bi-monthly bill and usage statement: Overall consumption reduction: 2.9%, Peak consumption reduction: 8.3%</td>
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<td>Bi-monthly bills are seen as more cost effective.</td>
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# PowerCents DC

<table>
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<tr>
<th>Location</th>
<th>USA</th>
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## General Description
Between July 2008 and October 2009, the PowerCentsDC program tested the response of residential consumers to different pricing structures and multiple energy information feedback channels. Nearly 900 randomly selected residential customers began receiving electricity with one of three price plans for supply service: Critical Peak Pricing (CPP), Critical Peak Rebate (CPR), or Hourly Pricing (HP).

## Technology Description
Participants with a central air conditioner were offered a smart thermostat that automatically reduces air conditioning usage when power prices are high.

## Feedback channel and description
Participants received descriptive bills and monthly electric usage reports displaying daily usage by price and informational inserts highlighting specific savings opportunities related to the season. A website was launched for participants and others to obtain information about the program. Participants could log in and see historical consumption information, basic program information, energy savings tips, and hourly prices for HP participants.

## Customer engagement and education
“All-of-the-above” approach. Each participant received a recruitment package with a single offer to one of the three price options. As an incentive to enrol, CPP and HP participants received a “thank you payment” of $100. Prior to live billing, the organisers took the unusual step of in-person group meetings for the program participants. Three separated sessions were held; one for each of the price plan participants. At about the same time, participants received an education package including a pricing leaflet, conservation brochure, and refrigerator magnet displaying the critical peak hours and contact information. Upon commencement of the program, participants began to receive new bills, along with monthly electric usage reports.

## General Results
Average peak consumption reduction:

- CPP: 29% (22% for all electric participants)
- CPR: 11% (6% for all electric participants)
- HP: 10% for all electric participants

Results for the samples with programmable smart thermostat are ignored for this analysis.
## BeAware

### Location
Finland/Sweden/Italy

### General Description
BeAware is a collaborative research project co-funded by the European Union in the FP7/ICT programme and is spanning three years. BeAware has created EnergyLife - a solution to motivate and empower citizens to become active energy consumers. EnergyLife is an engaging informational game-like application that is designed to raise awareness on energy conservation and help users to embrace a sustainable energy conservation lifestyle. It makes the users aware of their energy consumption and gives information regarding the electricity consumed by the whole household and certain appliances at different times during the day. It also lets the users understand whether or not they are saving energy compared to their normal consumption and how much above or under it they are.

### Technology Description
3-phase Main Meter was used. A set of Plugwise Sensors were connected to the appliances, such as: Fridge, Washing machine, Microwave, Tea kettle, Base Station, Laptop chargers, TV, Coffee machine, CD player, Printer (different set of appliances in each country depending on the availability in the houses).

### Feedback channel and description
IHD displays have been installed. The system consists of a base station, sensors connected to appliances and main fuse box and a smartphone that present the application to the household members. The system also includes servers that process the measured data and delivers services to the phones in order to present and visualize the data. Users can track their consumption history and get an overview on what appliances are saving electricity and which ones are consuming.

BeAware have also developed a new ambient Interface called The Watt7Lite Twist, which resembles a large flashlight that the user can twist to the desired kilowatt7hours of consumption. During the measurement period, the flashlight projects consumption progress, starting at the left with a white circle (the target amount of kilowatt7hours) or, which disappears as energy is consumed, indicating consumption breakdown by device. When the target amount of kilowatt7hours has been consumed, the white circle disappears, leaving a darkened shadow of a circle instead.

### Customer engagement and education
Users receive advice on energy saving and every third day they are presented with a quiz where they can choose what would be the best way of conserving energy in different situations. The application behaves as a game where users can reach new levels by gaining enough points. Saving points are gathered by saving electricity and you can get awareness points by answering correct on quiz, reading advice and participating in the community. BeAware support 3 levels of advice:

- **Normal advice** is based on informing users of expected energy usage of appliances and how to lower it, and informing users of common bad and good habits. No measurement data is needed.

- **Smart advice** depends on minute level measurements and advises people on their normal usage patterns: how long a device was used per week, how long it was on standby, how much power it consumed, etc.

- **UltraGsmart advice** requires more frequent measurements (1 Hz range) and power quality information. The data is used to advise users on device specific issues such as suitable power levels, or on usage anomalies, e.g. an unclosed refrigerator door. This class of advice can also import other information, such as outside temperature and indoors humidity to enable the system to produce better information of HVAC and heating related systems.
## Home Energy Management System (HEMS) Trials

<table>
<thead>
<tr>
<th>Location</th>
<th>The Netherlands</th>
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<tbody>
<tr>
<td><strong>General Description</strong></td>
<td>Conducted in 2008 for a period of 15 months and with a total of 304 residential participants. The main aims of the pilot were:</td>
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<tr>
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<td>1) What are the medium- to long-term results of Home Energy Management Systems (HEMS) on energy savings?</td>
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<td>2) What is the influence of the design quality and usability of HEMS?</td>
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<td></td>
<td>3) Is there a relationship between the amount of HEMS usage and achieved energy savings, and what role does the development of habitual behaviour play?</td>
</tr>
<tr>
<td><strong>Technology Description</strong></td>
<td>Participants with a central air conditioner were offered a smart thermostat that automatically reduces air conditioning usage when power prices are high.</td>
</tr>
<tr>
<td><strong>Feedback channel and description</strong></td>
<td>IHD feedback (real-time updates), and feedback information consisted of current up-to-date consumption and savings compared to previous periods.</td>
</tr>
<tr>
<td><strong>Customer engagement and education</strong></td>
<td>Education and interviews before and during pilot,</td>
</tr>
<tr>
<td><strong>General Results</strong></td>
<td>Average consumption reduction: 7.8%</td>
</tr>
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</table>
### Energy Demand Research Project

<table>
<thead>
<tr>
<th>Location</th>
<th>Great Britain</th>
</tr>
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<tbody>
<tr>
<td><strong>General Description</strong></td>
<td>EDRP was a major project in Great Britain to test consumers’ responses to different forms of information about their energy use. Four energy suppliers each conducted trials of the impacts of various interventions (individually or in combination) between 2007 and 2010. The interventions used were primarily directed at reducing domestic energy consumption, with a minority focused on shifting energy use from periods of peak demand. The project involved over 60,000 households, including 18,000 with smart meters. Measures were generally applied at household level but one supplier also tested action at community level.</td>
</tr>
<tr>
<td><strong>Technology Description</strong></td>
<td>18,000 customers had SM installed. Real-time displays.</td>
</tr>
<tr>
<td><strong>Feedback channel and description</strong></td>
<td>EDRP used web-based services to provide advice, billing information and historic feedback (delayed by only a day but not real-time feedback) and real-time displays to provide live data on energy consumption (kW and cost) and usually other information such as CO2 emissions and energy consumption over specified periods.</td>
</tr>
<tr>
<td><strong>Customer engagement and education</strong></td>
<td>EDRP used generic written advice (not personalised to the customer) – mainly on paper but also via the web, a dedicated TV-based web page and RTDs. Advice was sent at varying frequencies and in varying amounts and styles. Historic feedback was principally a graphical comparison of consumption in the current bill/statement period and the same period the previous year.</td>
</tr>
<tr>
<td><strong>General Results</strong></td>
<td>With two exceptions, there was no significant reduction in energy consumption when the intervention did not include a smart meter. In the case of electricity consumption, providing an RTD is the more important factor: Savings were generally 2-4% higher than with a smart meter only. In the case of gas consumption, the smart meter itself appears to be a positive mechanism, resulting in savings of around 3%. The reduction in consumption with generic advice and historic feedback was up to 5%. EDRP found no reliable or persistent effect of either financial incentives to reduce energy consumption or general statements of commitment to reduce consumption. Feedback channels had no effect on consumption. Load shifting: estimates of the magnitude of shifting effect vary with trial but were up to 10%.</td>
</tr>
</tbody>
</table>
5. Examples of Communication Letters

Dear Neighbor,

In this time of increasing energy costs, a new program is available to help you better manage your electric bill and provide more information about your energy use.

You are among a select group of District of Columbia residents invited to participate in PowerCentsDC—a new electricity pricing program. The program will run for two years beginning this fall. PowerCentsDC is sponsored by a non-profit corporation, SMPP, comprised of Pepco, the DC Public Service Commission, the DC Office of the People’s Counsel, the DC Consumer Utility Board, and the International Brotherhood of Electrical Workers.

As a participant, your rate will be changed to a new Critical Peak Pricing (CPP) rate plan. Under this plan, up to 15 days each year will be designated as Critical Peak days. For four hours on only those days, your price will be higher than your current price. At all other times, your price will be lower. The new prices are based on hourly prices in the electric wholesale market. Reducing energy usage when prices are high gives you the power to manage your electric bill, save money, and help the environment.

Participants in the CPP rate plan will receive:

- A $100 incentive for participation - $50 upfront and $50 at the end of the program.
- A free smart thermostat, available on a first come, first served basis, for those with central air conditioning.
- Monthly billing reports with easy-to-read charts on your daily electricity usage and spending.
- Suggestions for ways to reduce or shift electricity use - and save money.
- Notification of when prices will be high the following day via text message, email, phone and/or phone message.
- A free smart meter that records when electricity is used.

To sign up, return the enclosed enrollment form, visit our website at www.PowerCentsDC.org, or call 1-888-232-5949. The number of participants is limited, so only the first to sign up will have the opportunity to participate.

Your participation will help determine what kind of pricing options will be offered to all customers in the District of Columbia in the future. Pepco continues to provide you with electric service during your participation. Thank you for your part in helping to manage electricity costs and improving the environment in DC.

Sincerely,

Rick Morgan
Chairman, SMPP

1 Smart Meter Pilot Program, Inc.
The National Smart Meter Plan. Make the smart move.

Dear Mr. Surname,

I would like to invite you to participate in the User Trials of the National Smart Meter Plan which are due to commence shortly.

What are the Smart Meter User Trials?

The purpose of the User Trials is to see how Smart Meters, combined with different forms of information and incentives, can help customers reduce the amount of electricity they use. Smart Meters are a new type of electricity meter which can:

- Help you to conserve energy and make savings on your bill
- Enable you to have more regular information on your electricity usage throughout the year
- Assist you in contributing to the environment by being more energy efficient
- Eliminate the need for estimated bills

Smart Meters are already in use in other countries, such as Italy, Canada and Sweden and following this trial, will ultimately be installed in every home in Ireland.

What happens if you choose to participate?

If you choose to participate ESB Customer Supply will provide you with all the necessary information at the start of the trial and at regular intervals throughout. In addition, your existing electricity meter will be replaced with a Smart Meter by ESB Networks. You will receive €50 credited to your ESB bill at the end of the trial as a “thank you” for completing a short 10-minute questionnaire at the start and end of the trial.

During the Trial a number of energy-efficiency initiatives enabled by smart metering will be trialed, including “Time of Use” tariffs. These tariffs and initiatives will offer you the opportunity to better manage and reduce your electricity bill.

How do you sign up to take part in the Smart Meter User Trials?

- Complete and return the tear-off slip at the bottom of this letter
- Or phone us on a Local number 1850 21 19 50
- Or email us at smartmeter@eb.ie quoting your ESB Customer Supply account number and your name and address.

As this User Trial is limited to 5,000 places nationally, we would ask you to let us know as soon as possible if you wish to participate.

Please note, throughout the trial, all information will remain confidential to you and to ESB Customer Supply.

Want to find out more?

Please read through the enclosed leaflet or, if you prefer, call us on 1850 21 16 50 or email smartmeter@eb.ie

Yours sincerely,

[Signature]

Pat Henderson
General Manager
ESB Customer Supply
18th December 2009

Dear

Your role in the User Trial of the National Smart Meter Plan is about to begin. From 1st January to 31st December 2010, as a participant in the User Trial your help will be invaluable to us in trialling the following:

**Time of Use Electricity Prices**
Your current electricity price is changing to “Time of Use” pricing. Time of Use pricing means electricity is charged based on the time of day when it is used – Peak, Day or Night. See enclosed guide for further details.

Peak rate, the highest rate, applies for only two hours per day – weekdays only excluding public holidays and weekends.

Day rate applies from 8am to 5pm and from 7pm to 11pm on weekdays and all day from 8am to 11pm on weekends and public holidays (no Peak at weekends or on public holidays).

Many households use around one quarter of their electricity between 11pm and 8am (Night rate). The table below shows how much electricity you have used on average during the different time bands since your smart meter was installed.

<table>
<thead>
<tr>
<th>Timeband</th>
<th>Day Rate</th>
<th>Peak Rate</th>
<th>Day Rate</th>
<th>Night Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>8am – 5pm</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>5pm – 7pm</td>
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<tr>
<td>7pm – 11pm</td>
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<td></td>
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<tr>
<td>11pm – 8am</td>
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<td></td>
</tr>
</tbody>
</table>

A fridge magnet and stickers which illustrate the ‘different times, different prices’ are included in your folder.

Over the period of the trial we will ensure you won’t pay any more for your electricity than you would if you had stayed on your normal electricity prices. To help you get started in using your new Time of Use prices we have credited € to your December bill. Once your participation in the trial ends in December 2010 you will receive a further credit of € in January 2011. This is in addition to the two €25 credits for completing the surveys.

**Detailed Bill**
As part of the trial, you will receive a more detailed bill than normal to help you reduce your electricity use and decide what you might use outside of the weekday Peak time. This bill will give you information on electricity used, tips on how to save money and how to move use from the Peak to Day or Night periods. The bill will also compare your usage to others in the User Trial.

**Electricity Monitor**
Delivered and installed in your home by ESB Networks, the Electricity Monitor will give you information on your electricity usage.
Joe Sample
Sample House no.
Sample Road
Dublin Sample
Ireland

18th December 2009

Dear XXXX,

As the start of your participation in the User Trial of the National Smart Meter Plan nears I am writing to inform you of changes to the timing of your electricity bill from 1st January 2010.

Why are these changes being made?

At the moment customers receive bills at different times in the month over any two month billing period. So, for example in the period January to February, some customers get their bill early in January, some at the end of January and some in February. We need everyone in the trial to get their bill at the same time so that we can clearly see what changes have occurred as a result of smart meters. This means changing the timing of your bill.

Changes to your Bill Timing

In summary the main changes are:

- From 1st January to 31st December 2010 you will receive an electricity bill once a month (you currently receive a bill every two months).
- Your bill will issue at the start of the month following each billing period.
- We will issue you with a bill up to end of December 2009, so that from 1st January 2010 we can start participants in the trial at the same billing date.
- If you pay by direct debit, your payment dates will change.

What happens at the end of the User Trial?

At the end of the User Trial (31st December 2010) your bill will return to its normal billing cycle. We will write to you again at this time.

Thank you for participating in the National Smart Meter Plan. The active phase of the User Trials will commence from 1st January 2010 and we will contact you shortly with further details.

Yours sincerely

Pat Fenlon
General Manager
ESB Customer Supply

The National Smart Meter Plan is managed by the Commission for Energy Regulation with the support of the Department of Communications, Energy & Natural Resources, Sustainable Energy Ireland, ESB Networks and the electricity and gas industry in Ireland.

This leaflet and letter are printed on environmentally friendly stock which is produced from sustainable forests, 50% mill broke and post consumer waste.

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Empower Demand 2
Dear Joe,

Thank you for agreeing to participate in the user trials for the National Smart Meter Plan. The trial will begin shortly and we would just like to give you some additional information on it. From 1st January to 31st December 2010 you will be helping us in testing:

An Electricity Monitor
Time of use electricity prices
A more detailed bill

We will tell you more about the time of use prices and the detailed bill in December, but for now we will just talk about your home Electricity Monitor.

Electricity Monitor
You are being given an Electricity Monitor for use during the user trial. It takes data from the Smart Meter and provides you with information on your electricity use and costs on a small screen.

For the purpose of this trial, it is important that all groups start their requested actions at the same time. Therefore, your Electricity Monitor will be delivered and installed in your home by ESB Networks between the 30th December 2009 and 4th January 2010. A representative will contact you in December to agree a suitable time.

Replacement of Communications Module
Before installing your Electricity Monitor, ESB Networks need to call and replace a communications module in your home Smart Meter to enable it to communicate with the Electricity Monitor. This will mean your electricity supply will need to be disconnected for a short period, less than 20 minutes. ESB Networks will contact you shortly to agree a convenient time for this replacement in the next few weeks.

Attached is a leaflet which provides more information on the Electricity Monitor. It also includes contact details should you require further information.

Thank you again for taking part in the user trials. We will write to you shortly with details of other aspects of the trial as detailed above.

Yours Sincerely,

Pat Farlon

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The National Smart Meter Plan is managed by the Commission for Energy Regulation with the support of the Department of Communications, Energy & Natural Resources, Sustainable Energy Ireland, ESB Networks and the electricity and gas industry in Ireland.

This leaflet and letter are printed on environmentally friendly stock which is produced from sustainable forests, some will break and post consumer waste.
Mr AB Sample  
123 Sample Road  
Sample Town  
Sample County  

17th November 2008  

The National Smart Meter Plan. Make the smart move.  

Dear Mr Sample,  

Thank you for agreeing to participate in the User Trials of the National Smart Meter Plan. We will be writing to you over the coming months to provide you with more details on the various initiatives involved in these Trials.  

In the meantime, however, we would like to arrange to have a Smart Meter installed at your home. ESB Networks has a programme of work in place to install Smart Meters nationally and they plan to have all installed by the end of April 2009. A local ESB Networks representative will contact you to arrange an appointment to install the smart meter in your home.  

There are a number of points we would like you to note:  

- The Smart Meter will be positioned in the same location as your existing electricity meter and this replacement will involve the minimum of disruption.  
- During installation you will be without power for 1 to 2 hours. This is necessary because the meter is being exchanged.  
- The Smart Meter, which will be used in the trial works on GPRS communications (i.e. similar to your mobile phone). If the GPRS signal at the meter location is not sufficiently strong, it will not be possible to install a Smart Meter. This will be checked by ESB Networks before installation and we will be in contact with you should such a situation occur.  

Once again, I would like to thank you for your participation. Your inputs and feedback from working with the various initiatives planned over the Trial, will provide us with valuable information for decisions around the national roll-out of these meters. We will provide you with further information on these shortly, but in the meantime if you have any queries, please contact us on 1850 21 16 50 or email us at smartmeter@esb.ie  

Yours sincerely,  

Pat Fenlon  
General Manager  
ESB Customer Supply  

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Empower Demand 2
6. References


Gary, Raw and David, Ross (June 2011). Energy Demand Research Project: Final Analysis Report - prepared by AECOM Limited for Ofgem on behalf of DECC.


Silver Spring Networks (2011). Case Study: Oklahoma Gas & Electric: Demand Response Program Background and Interim 2010 Results.


7. Annex 1: Glossary of Terms

**Ambient displays**: Differ from IHDs in that they do not provide specific consumption information but rather signal to the customer messages about their general level of consumption and/or a change in electricity prices. Many ambient displays have the attributes of being attractive and intuitive which adds to their customer acceptance potential.

**Bill reduction**: Extent to which experiments led to a reduction in customers energy bills (in %).

**Critical Peak Pricing (CPP)**: CPP pricing schemes involve substantially increased electricity prices during times of heightened wholesale prices caused by heightened consumption (for example on very hot days) or when the stability of the system is threatened and black-outs may occur. In exchange for a lower tariff during non-peak hours (compared to customers on say flat tariffs), participants agree to have substantially higher tariffs during critical peak hours. The number and length of critical peak periods which the utility is allowed to call is often agreed upon in advance in order to lower participant risk. The periods when critical peaks occur depend on conditions in the market and cannot be decided in advance. Residential customers are usually notified the day before that the next day will be a critical day.

**Critical Peak Rebate (CPR)**: CPR pricing schemes are inverse forms of Critical Peak Pricing tariffs. Participants are paid for the amounts that they reduce consumption below their predicted consumption levels during critical peak hours. The number and length of critical peak periods which the utility is allowed to call is often agreed upon in advance in order to lower participant risk. The periods when critical peaks occur depend on conditions in the market and cannot be decided in advance. Residential customers are usually notified the day before that the next day will be a critical day.

**Customer, consumer, participants**: Unless specified otherwise, these terms always refer to households.

**Demand response capability**: Sell back/shift energy source based on two-way communication with the smart meter.

**Disaggregation of consumption**: The household's electricity consumption is broken down as per household electrical appliances. The depth and degree of the breakdown can vary but in most cases the consumption of the oven, the fridge, the TV, and the lighting are measured. It helps participants see how much electricity individual appliances use and act upon it (and maybe buy more energy efficient ones).

**Energy conservation**: Extent to which the experiment led to a reduction in overall energy consumption (in %).

**Energy management**: Smart plugs (ZigBee SEP/M)

**Energy monitoring service**: Smart meters plugged into the company’s energy monitoring service take readings of energy usage typically every 15-30 minutes and provides a variety of ways for the end-user to drill down into that data.

**Environment (CO2 emissions)**: This shows the amount of CO2 the households emits due to electricity consumption. This presents the environmental costs or consequences of the households' energy consumption.

**Historical comparison**: Shows the household's current electricity consumption levels in comparison to pre-pilot consumption levels. Participants can know if they reduced or increased their consumption compared to the same period last year, for instance.
HAN refers to **Home Area Network**. HAN are typically wireless networks, in this case in the homes (or premises in the case of SME's) of customers, either dedicated to **Home Energy Management Systems (HEMS)** or for some other purpose such as smart home, entertainment or simply to connect appliances to the internet. HEMS typically communicate within the home or premise via the HAN. Smart meters must therefore be able wirelessly communicate with the HAN if they are to support HEMS and various kinds of in-home consumption feedback and communication to the customer. To this a smart meter must be equipped with the necessary wireless software and hardware, with the appropriate communication protocol, such as Zigbee or Zwave. Often or even typically, HEMS related HANs are controlled via a gateway in the home. This gateway is typically connected to the home's internet portal. The smart meter need typically, therefore, only communicate with the gateway, and not directly with all elements within the HAN. While this may change in future, it is expected that as long as the smart meter communicates to HAN with a common and effective protocol, and has upgradable firmware and software, this will be sufficient to future proof its communications functionality.

**Home Automation:** Traditionally, homes have been wired for four systems: electrical power, telephones, TV outlets (cable or antenna), and a doorbell. With the invention of the electronic micro and auto controller and the widespread uptake of digital communication technology, the cost of electronic control is falling rapidly and its uses are increasing. Through remote controllers in appliances, which can either communicate with each other and/or react to outside information, such as electricity pricing signals for example, the price responsiveness of a household will approximately double. This is called automation. In most pilots the automation are an AC or electric heating thermostat which is set to turn down or turn off during peak periods. However, automation systems can be more advanced and include lighting, appliances, and entertainment equipment. Residents can be informed when their equipment is malfunctioning or be able to turn it on and off remotely.

**Informative billing:** Example of indirect feedback. They therefore do not accurately reflect the actual usage for a given month. The difference between the estimated average consumption and the actual usage is made up at the end of the billing period or when a resident changes electricity supplier. Informative billing will invoice for the actual consumption and provides either historical information comparing what the customer used this month to last month or to last year during the same period. The bill may also provide information on how much the household consumed in comparison to other dwellings of the same description. Unlike standard billing in which households receive their bill 4-6 times per year, informative bills can be sent as frequently as once per month.

**In-house displays (IHD):** Displays which hang on the wall or sit on a counter and provide close to real time information about household electricity consumption. IHDS provide households with real-time and historical information on their electricity usage and costs. Additional feedback content that can be offered on the IHD are peer comparisons (showing the consumption rate of neighbours or consumers with similar conditions), and disaggregation of consumption (breaking down the energy usage of individual appliances in the home).

**Lighting control:** Switches, dimmers, thermostats, socket outlets

**Overall consumption reduction:** Extent to which the experiment led to a reduction in overall energy consumption.

**Peak clipping:** Extent to which the experiment led to a reduction in energy consumption during peak periods (in %).

**Peer comparison:** Consist of comparison of household energy consumption levels between participants and similar-sized households. This information may include neighbours within near vicinities or households of similar size. It enables participants to see if they use more or less electricity than their peers.

**Price of electricity:** Indicate the current price of electricity per kWh. This does not include the
up-to-date electricity bill, only the current price of electricity per kWh.

**Real-Time Consumption Data.** The term Real-Time Consumption Data refers to the frequency of a) meter reading and b) delivery of meter reading data to the utility or home/customer. Real-Time may range from ‘hourly’, down to minute-by-minute or even more frequently. Even if smart meters read the data real-time, they typically only deliver that meter reading data to the utility on an occasional (e.g. daily or less frequent) basis due to communications cost reasons.

**Real-Time Pricing (RTP):** The price paid by participants is tied to the price of electricity on the wholesale market. However they do not lead to consumption reductions without feedback. Even then customers will sometimes tire of checking a price that only changes slightly from day to day. In order to encourage reductions during high price periods and reduce risk of high bill, participants are warned when wholesale prices reach a certain threshold decided upon in advance.

**Retailer.** A retailer is taken to refer to any company that sells the electricity commodity to an end customer.

**Savings compared to previous periods:** Compares the energy savings of households to previous periods. Households would have a certain target for their energy consumptions which would be a percentage savings on previous energy consumptions.

**Security application:** Magnetic contacts, smoke detectors, electronic door locks, etc. based on gateway with battery back-up.

**Surveillance:** Camera (IP or analogue)

**Time-of-Use (TOU):** TOU tariffs induce people into using electricity during times when consumption is lower. Prices are therefore set higher during high consumption periods, typically during working hours, and lower during the rest of the day. TOU usually includes one long peak daily period or two shorter daily peak periods. TOU can have two level of prices (peak and off- peak prices) or three (peak, partial peak and off-peak prices) per day. The peak hours are known in advance by the customers. The prices may also vary according to the season.

**Up-to-date consumption level:** Presents the current up-to-date consumption level of the household in kWh. In itself, it does not include the cost of electricity, or the current level of the bill. However, if coupled with consumption goals or targets not to exceed, it can be a powerful incentive to reduce consumption.

**Up-to-date Cost (Bill):** Presents the up-to-date bill which enables households to gauge their current costs for their electricity and act upon it.

**Utility.** The term utility is taken to refer to incumbent electricity distribution companies.

**Websites:** Offer an alternative way to provide the consumer with information about their electricity consumption. Websites are chosen as a means of providing feedback because they are relatively cheap. They rely on smart meters to collect the necessary consumption data and therefore the granularity of data provided to consumers depends largely on how often the meters are read or how often the information is transferred from the meter to the utility (or retailer).

Source: Electricity Smart Metering Customer Behaviour Findings Report (CER 2011) and VaasaETT 2012
8. **About the VaasaETT Global Energy Think Tank**

VaasaETT is a Global Energy Think-Tank, one of the World’s top centres for expertise in Utility Customer Psychology, Customer Behaviour and Demand Response in energy markets. VaasaETT is also a leading international expert in related issues including Utilities Marketing and Competition, Smart Energy, Smart Home, Smart Grid and Market Structures. In particular, for instance VaasaETT is the World’s leading authority on utility customer switching trends and dynamics; Europe’s best source of retail energy price data; and a founding member of the Smart Energy Demand Coalition (SEDC).

VaasaETT comprises five inter-dependent business areas: 1) Data and Analysis, 2) Research and Consulting, 3) Events, 4) Associations, and 5) Networks and Partnerships. At the heart of VaasaETT’s differentiation is a network of thousands of experts and specialists in four continents, people who VaasaETT know personally and with whom we collaborate for all our business activities.

VaasaETT is a unique concept, bringing together Utilities, Vendors, Researchers, Consultants, Associations, NGOs and Policy Makers to collaborate and solve important issues facing the energy industry today and in the future. VaasaETT and its staff have worked for more than 500 utilities and other industry organizations around the world, experience that dates back as far as the opening of the world’s first competitive markets and covers almost every fully liberalised market in the world.

More information at: [www.vaasaett.com](http://www.vaasaett.com)
9. About ESMIG

The European Smart Metering Industry Group (ESMIG) is the European industry association that provides knowledge and expertise on Smart Metering and related communications at a European level. ESMIG’s members are the leading companies in the European Smart Metering Market: meter manufacturers, IT companies and system integrators. ESMIG covers all aspects of Smart Metering, including electricity, gas, water and heat measurement. Member companies cover the entire value chain from meter manufacturing, software, installation and consulting to communications and system integration. By giving support to European Union Institutions, Member States and Standardisation Organisations, the industry group aims to assist in the development of national and European-wide introduction, roll-out and management of Smart Metering solutions.

For further information contact:

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Email: secretariat@esmig.eu
European Smart Metering Industry Group
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www.esmig.eu
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About Dr. Philip E. Lewis

Dr. Lewis is a world leading specialist in energy and utility competition, marketing, customer behaviour and psychology as well as related issues including Demand Response/Eco-Home/Smart Grid/Energy Efficiency. During 16 years in the liberalised utilities industry Dr. Lewis has conducted research and strategic support in over 50 countries for nearly 400 organisations. He is perhaps the only specialist in the world to have followed every liberalised retail electricity and gas market since it opened to competition.

Founder and CEO of VaasaETT as well as a Director and Board Member of the Smart Energy Demand Coalition (SEDC), Dr. Lewis was formerly head of Marketing Research and Analysis for the UK based retailing subsidiary of Amoco and (now) Edf during the onset of full competition in the British retail energy market. Dr. Lewis was also founder and chief of the University of Vaasa Energy Markets Group (VaasaEMG); holds a PhD in Marketing (specialising in service marketing, customer psychology and behaviour issues) from the University of Edinburgh, Scotland; was formerly an Assistant Professor of Marketing at the University of Vaasa in Finland; has written in numerous academic publications and has been on the editorial board of the European ‘Energy Efficiency’ Journal published by Springer. Dr. Lewis developed his graduate marketing expertise in the banking sector with American Express Bank in Frankfurt and National Westminster Bank in London.