

Digital services and communication platforms for residential energy customer engagement

Part 1: International studies



Objectives of this rapid review

Rapid development of digital technologies – combined with advances in energy management, automation of devices and smart buildings – is presenting power utility companies with new opportunities for customer engagement.

The Internet and mobile phone apps, as well as other digital devices, such as in-home displays, can help improve customer education, provide new energy monitoring possibilities and offer greater options for customer control. Information flows can be two-way in nature, both to and from the consumer.



This rapid review, which is the first of two parts, summarises some of the findings from seven systematic reviews (including one meta-analysis) of academic literature on digital services and communication platforms that allow for residential customer engagement and interaction with the energy system. These results are mostly from international research. Part 2 will review Australian primary studies on this same topic.

This review is a scoping study of the relevant literature. It is not a meta-analysis, nor an attempt to systematically compare the effectiveness of different modes of engagement. However, the review does point towards findings and insights that may help to improve customer engagement in the energy domain.

Key findings of this rapid review

This rapid review of international literature identified six systematic reviews and one meta-analysis that fulfilled the inclusion criteria. The focus of these studies ranged from providing feedback on energy consumption through to defining features of smart homes and uses for gamification.

Overall, the evidence suggests that digital services and communication platforms that enable residential customer engagement are likely to play integral role in the future energy management systems. However, the potential for exploiting interactive communication platforms to build consumer engagement is still not fully utilised [1].

New solutions for energy customer issues

Online customer engagement can provide unique opportunities to address both ongoing and emerging challenges faced by energy utilities. These may include [1]:

- More effective and efficient ways of gathering and processing consumer data,
- Enabling greater responsiveness to customer concerns in order to reduce mistrust,

- Making information on energy products and services more accessible and transparent,
- Reaching a greater number of consumers by diversifying and tailoring presented information,
- Encouraging proactive consumer behaviour via interactive dissemination of information.

Digital services and online communication platforms that enable customer engagement are likely to play integral role in the future energy management systems.

Comparing the effectiveness of interventions

Studies comparing the outcomes of different energy-related interventions may provide important insights to inform the design and delivery of a utility's customer engagement strategy. However, often there are various design and methodological problems associated with such studies, which may lead to unreliable results.

Sources of bias may include using participant samples comprised of self-selected volunteers who are already motivated to curb their energy consumption, self-selection of the preferred interventions by participants, and participants withdrawing from the interventions over time.

One systematic review adjusted their impact estimates for the potential effects of biases by incorporating bias corrections obtained from the medical research. The study examined three types of interventions [2]:

- (i) Providing feedback on electricity consumption and prices via in-home displays,
- (ii) Varying the cost of electricity over time (dynamic pricing programs),
- (iii) Home automation, where programmable thermostats and other smart technologies can control electricity consumption following pre-set parameters.

Based on an analysis of 32 included studies, the authors concluded that in-home displays performed best to reduce overall energy consumption (3% after adjusting for risk-of-bias; 4% using reported data), whereas dynamic pricing allowed to curb peak demand (6% adjusted; 11% reported), and that dynamic pricing was even more effective when coupled with home automation (14% adjusted, 25% reported).

Methodologies for designing energy feedback programs

There are various approaches for developing energy feedback programs to make residential electricity usage more visible, interpretable and controllable for customers. The main methods include:

- surveys,
- energy use analysis (i.e. analytics),
- experiments,
- simulations.

All these approaches have their strengths and weaknesses. One of the systematic reviews revealed that there are current research gaps and future opportunities that may bring constructive insights on how to maximise the efficacy of research projects via combining and integrating some of these approaches [4]. For example, insights derived from the analysis of energy consumption (e.g., load patterns) could be more effectively combined with survey data (e.g., customer attitudes, motives, demographics, self-reported behaviour) to help design more targeted and tailored feedback programs.

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Gamification

Online platforms are also offering new ways to introduce games into the mix of tools to engage customers and influence energy consumption. 'Gamification' can be defined as the use of game-like elements in real-life contexts to improve user engagement and user experience [3].

Game elements that have commonly been employed to influence the behaviour of energy consumers include points, rewards, challenges, feedback, leader-boards and social sharing. Research suggests that games may be used to directly influence energy consumption behaviour, as well as being an active learning tool that may help educate users on environmental impacts and other issues associated with energy consumption [3, 6].



A systematic review of 25 studies reveals that games can influence energy consumers' awareness, motivation and energy-saving behaviours (e.g., reflected via reductions in energy consumption) [3].

However, there is still lack of studies examining the effectiveness of applied games over longer timeframes. There is also a need for more quantitative research to accurately measure the effectiveness of various gamification elements for influencing customer behaviour, and to compare this effectiveness against that of more traditional intervention techniques.

Design for visualising energy consumption

Visualising energy consumption for digital services and communication platforms proves to be a challenging task. In the absence of agreed upon standards for designing visualisations of residential electricity usage, systematic reviews can provide some guidance.

A review of 22 studies concluded that there are five criteria to guide an effective visualisation design strategy for energy consumption [5].

The criteria are grouped into two key areas: (1) functional criteria, i.e. actual data displayed in the visualisation, modes of visualisation, and visualisation techniques, and (2) non-functional criteria, i.e. hardware and software integrity, extensibility and portability [5].

At present, there is little rigorous empirical research that systematically compares the effectiveness of visual design elements. However, in addition to basic display information (such as kWh consumption, CO₂ emissions), some significant motivating factors in visualisation include: (a) allowing for social interaction (e.g., using social media for sharing energy-related posts), (b) setting and following personal milestones, and (c) creating communities (e.g., via competitions on social media) [5].

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