AESC Review Note 4

Smart Grids and Smart Meters

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Introduction:

Smart grids and smart meters have become increasingly engaged in our society. The literature discussed the main features, functions, benefits and risks of these intelligent network. Smart grids may improve energy efficiency, maximize network utility and diminish maintenance costs, but on the other hand, users may feel suspicious towards the perceived risks which are associated with issues such as data leakage, energy autonomy and mistrust of suppliers. Some key findings of the literature are highlighted in Table 1.

Table 1. Highlights of the Key Findings of the Literature on Smart Grids and Smart Meters.

Author	Title	Keywords	Main Findings
(Buchanan et al., 2016)	The British public's perception of the UK smart metering initiative: Threats and opportunities.	Smart meters, Smart meter enabled services, Building automation, Consumer acceptance, Consumer engagement	• This paper examines the consumer acceptance of smart metering initiatives using focus groups. • Consumers perceive both threats and opportunities in smart metering initiatives. • Threats include (1) autonomy issues, (2) privacy concerns and (3) mistrust of suppliers. • Opportunities include (1) accurate billing and (2) enablement of future ICT services.
(Chatzigeorgiou & Andreou, 2021)	A systematic review of feedback research for residential energy behaviour change through mobile and web interfaces.	Feedback, Systematic review, Energy efficiency, Energy conservation, Behaviour change, Household energy	• This paper extracts the important attributes of the feedback pilots from the literature review • Result shows that mobile phones, computers and tablets are a promising strategy for energy efficiency • However, no concrete conclusion can be extracted on the average expected effect size of this strategy
(Fang et al., 2012)	Smart grid — The new and improved power grid: A survey.	Smart grid, power grid, the survey, energy information, energy management	• This article interprets the previous literature on enabling smart grid technology • For the smart management system, researchers explore various methods to (1) enhance the energy efficiency, (2) maximize utility and (3) reduce cost • For the smart protection network, researchers interpret the (1) network security and (2) privacy issue

(Frederiks et al., 2015)	Household energy use: Applying behavioural economics to understand consumer decision-making and behaviour.	Behavioural economics, Psychology, energy consumption, household energy use, behaviour change	• This paper illustrates the (1) key cognitive biases and (2) motivation factors that may explain why energy-related behaviour often failed to align with the personal value of users • Results may help public makers design more cost-effective and mass scalable behaviour solutions to facilitate sustainable energy usage.
(Hafner et al., 2020)	Energy use in social housing residents in the UK and recommendations for developing energy behaviour change interventions.	Energy-saving, Behaviour change, Social housing, Decision-making, Sustainability	• This article presents the qualitative exploration of domestic energy consumption practices in the UK • The result shows that residents were highly engaged with the topic of energy conservation, but several psychological barriers prevent residents from changing their behaviour
(Lund et al., 2012)	From electricity smart grids to smart energy systems – A market operation based approach and understanding.	Smart grid, The smart energy system, Electricity market	• This paper illustrates why electricity smart grids should be seen as part of the overall smart energy systems • The result shows that the inclusion of Combined Heat and Power Production (CHP) is beneficial for electricity balancing and grid stabilisation
(Park et al., 2014)	A study of factors enhancing smart grid consumer engagement.	Smart grid, Consumer engagement, Technology acceptance model	• This article examines what factors influence electricity consumers' smart grid acceptance. • We test the smart grid technology acceptance model including the perceived risk as to the main factor. • The importance of consumer education and public relations of the smart grid has been confirmed.

(Pothitou et al., 2016)	A framework for targeting household energy savings through habitual behavioural change.	habitual energy behaviour, household energy savings, energy efficiency, energy conservation	• The proposed framework recommends that the individual energy perception gaps are affected by (1) psychological, (2) habitual, (3) structural and (4) cultural in various spectrum • Result finds that the combined intervention methods can shift the energy-consuming behaviour and implement the energy policy more successful
(Schultz et al., 2015)	Using in-home displays to provide smart meter feedback about household electricity consumption: A randomized control trial comparing kilowatts, cost, and social norms.	Smart meters, Feedback, In-home displays, Social norms,	• This study utilizes the custom-coded-in-home-displays (IHDs) to reduce household energy consumption • Result suggests that the in-home displays offer promise for encouraging energy-saving, but careful consideration should be given to the way that the feedback is framed
(Siano, 2014)	Demand response and smart grids—A survey.	Smart grids, Demand response, energy management system	• In this paper, the smart grid benefits and demand response (DR) potentials are investigated • The measures discover that the demand response system may (1) improve the power plant reliability, (2) reduces the overall investment costs and (3) postpones the need for network upgrades

Buchanan, K., Banks, N., Preston, I., & Russo, R. (2016). The British public's perception of the UK smart metering initiative: Threats and opportunities. *Energy Policy, 91,* 87-97. doi:10.1016/j.enpol.2016.01.003

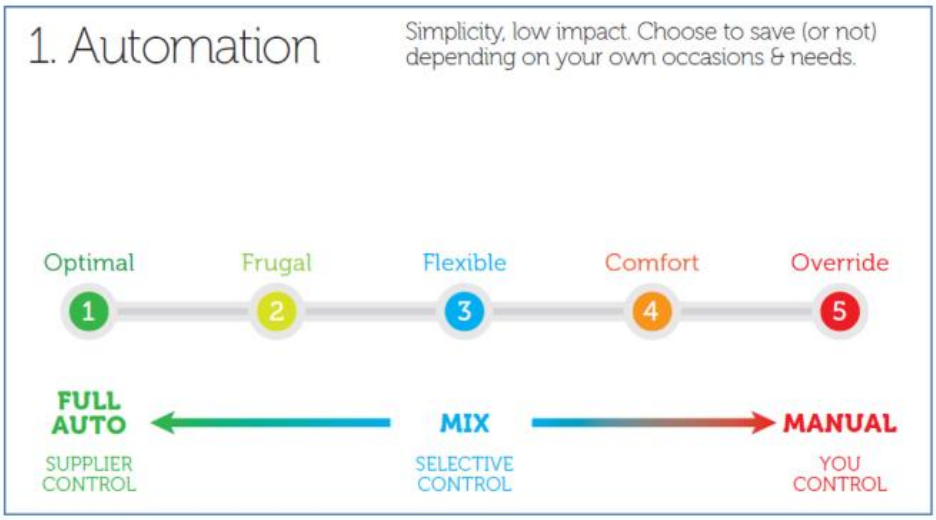

Fig. 1. The concept board shown to focus groups depicting the automation service.

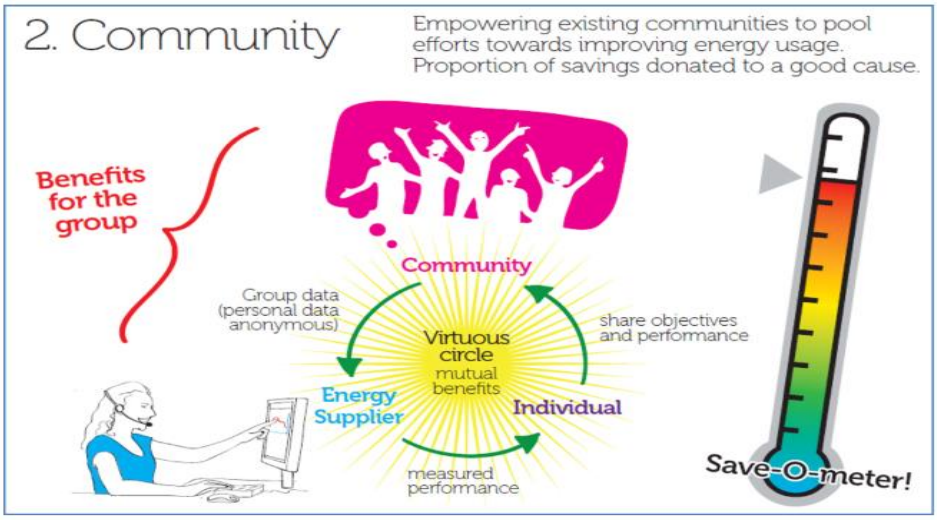

Fig. 2. The concept board shown to focus groups depicting the community rewards service.

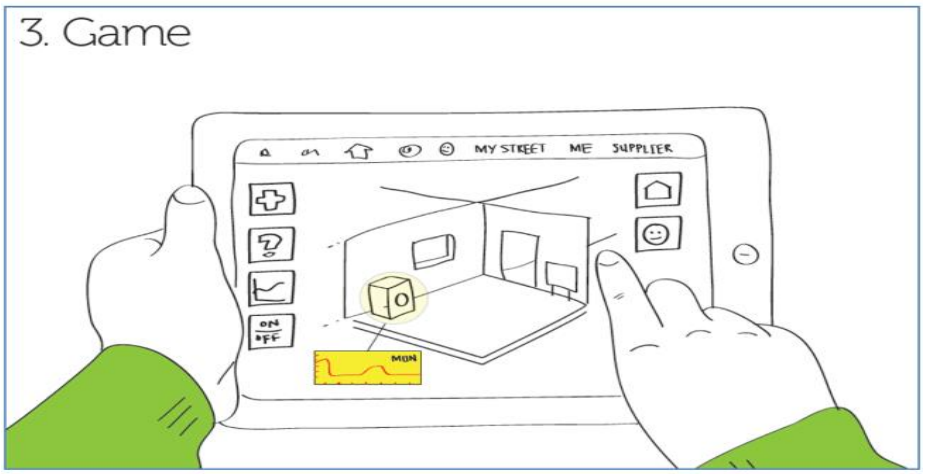

Fig. 3. The concept board shown to focus groups depicting the gamification service.

Table 2
The Links between each Service Design Concept and the New Economic Foundation's Five Ways to Well-Being.

Well-Being Aspects	Service Design Concept		
	Automation	Community	Gamification
Connect	Automation dial could be a talking point among friends/colleagues.	Be an active member of the community and make new friends.	Connect with others taking part in the game and gain a sense of community.
Be Active	N/A	You may be able to help with installing/fitting the community reward	–
Take Notice	Be aware of how reducing your energy use can have a positive impact on the environment	See what other communities are doing and what you can do to improve your own	Enjoy the gaming experience of reducing your energy.
Keep Learning	Learning how to reduce energy use	Learn how to reduce energy usage.	Learn how to reduce your energy usage & play a new game.
Give	Giving back to the system and reduce environmental impact	Give back to the community and to the system and reduce environmental impact.	Give back to the system and reduce environmental impact.

Hafner, R. J., Pahl, S., Jones, R. V., & Fuertes, A. (2020). Energy use in social housing residents in the UK and recommendations for developing energy behaviour change interventions. *Journal of Cleaner Production, 251*, 119643. doi:10.1016/j.jclepro.2019.119643

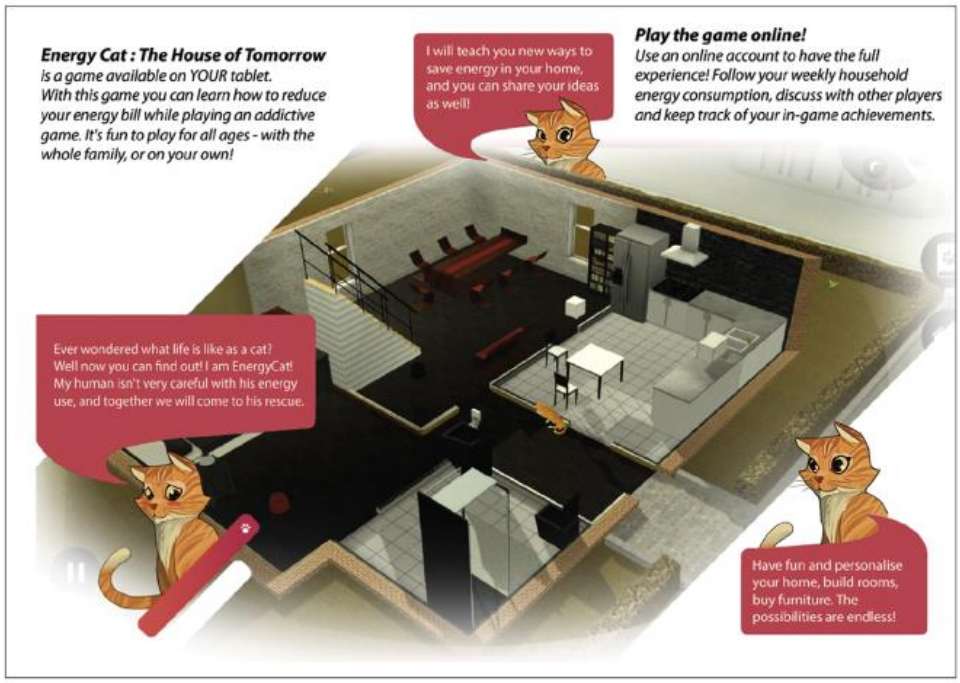

Fig. 1. Sample screenshot of EnergyCat game platform.

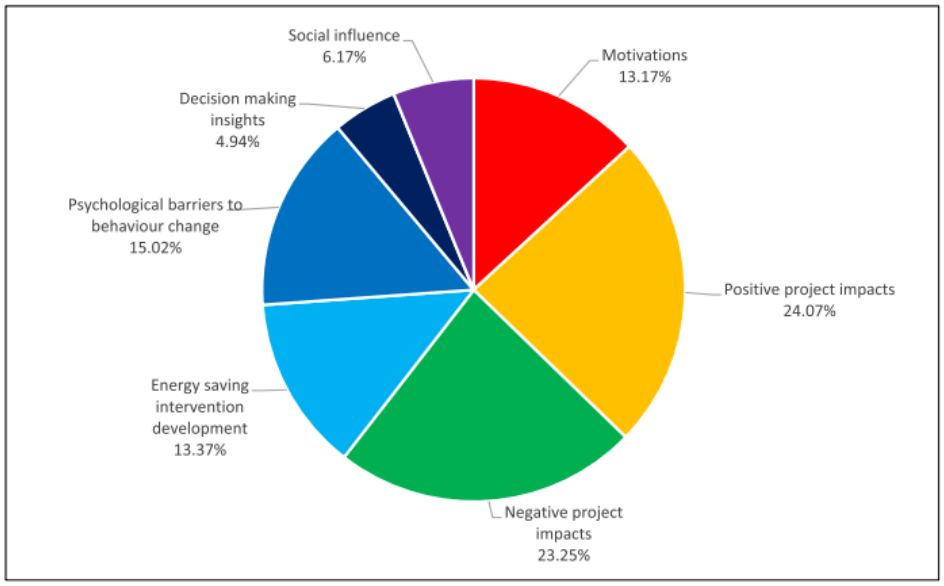

Fig. 2. Pie chart showing the frequency of different types of response generated in the 20 interview sessions (collapsed), displayed as a percentage of the total number comments ($N = 486$).

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