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Further reflections on vulnerability and resistance in the United Kingdom's smart meter transition

Benjamin K. Sovacool^{*,1,2}, Paula Kivimaa^{1,3}, Sabine Hielscher,^{1,4} and Kirsten Jenkins⁴

^{*} Corresponding Author, Science Policy Research Unit (SPRU), University of Sussex
Jubilee Building, Room 367, Falmer, East Sussex, BN1 9SL
Phone: +44 1273 877128 Email: B.Sovacool@sussex.ac.uk

¹ Science Policy Research Unit (SPRU), School of Business, Management, and Economics,
University of Sussex, United Kingdom

² Center for Energy Technologies, Department of Business Development and Technology,
Aarhus University, Denmark

³ Finnish Environment Institute (SYKE), Finland

⁴ University of Brighton, Brighton

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Abstract

The Smart meter Implementation Programme (SMIP) in Great Britain is one of the largest and most complex smart meter programs in the world, and for this reason, it provides unique challenges that we must critically reflect upon. We thank Shipworth et al. (2018) for reading Sovacool et al. (2017) and engaging with some of its findings. Their analysis adds helpful depth and context. We both welcome critical discussion about the SMIP and appreciate the value of “rounding out” the discussion with additional contextual information and the identification of evolving challenges. In this Correspondence, we take the opportunity to reflect further on the SMIP and clarify elements of our research methodology and approach. We also identify additional emerging challenges beyond those elaborated by Shipworth et al. (2018).

Introduction

Joseph Joubert is said to have remarked that “it is better to debate a question without settling it than to settle a question without debating it.” That the Smart Meter Implementation Programme (SMIP) in Great Britain is worth debating is beyond reproach, and we thank Shipworth et al. (2018) for reading Sovacool et al. (2017) and engaging with some of its findings. In that light, we both welcome critical discussion about the SMIP and appreciate the value of “rounding out” the discussion with additional contextual information and evolving challenges.

In Sovacool et al. (2017), our main aim was to explore what almost a decade of peer-reviewed research in academic journals has said on the complex and evolving topic of smart meters in the United Kingdom (or more accurately England, Scotland, and Wales). We essentially sought to know: Over the past 9 years, what have the barriers been? And, how have they been discussed in the academic literature? This approach is very different from analyzing the status of the rollout currently, analyzing the grey literature, or presenting data about the state of the art. In this way, the analysis offered by Shipworth et al. (2018) adds depth and context that helps to provide a broader reflection on the SMIP’s challenges *and* opportunities.

In this Correspondence, we reflect further on the SMIP and clarify elements of our research methodology and approach. We also identify additional emerging challenges designed to stimulate on-going, fruitful discussion.

Research method

As a starting point, we would note that in the energy studies community (as well as the energy policy field), the nature of what is considered to be an “appropriate method” is divergent rather than convergent. Put another way, there are multiple ways to design—and execute—a literature review. These range from qualitative/narrative approaches to more

quantitative ones or even formal systematic reviews and meta-analysis (Sovacool et al. 2018a).

Upon reflection, we concede to not using a “pure” systematic review in the way that Shipworth et al. (and perhaps others) use the term. Instead, what we sought to convey was that we used a systematic search combined with qualitative review of the resultant sample contents – a process that may be more accurately termed as a “systematized review” or “content analysis”. Similar qualitative approaches are acknowledged by Petticrew and Roberts (2006) in their book on systematic reviews in the social sciences. This makes our approach “more than” a simple narrative literature review, albeit there are risks in summarizing uncontrolled studies. To reinforce the validity of this technique, we would also add that our type of systematized qualitative literature review has been used in many other academic articles and, moreover, that ours was subject to thorough editorial and peer review within *Energy Policy*.

Nonetheless, we agree in full that offering more information and context about our research method is warranted. In terms of the review itself, we did not strictly assess quality of evidence (or adjust or normalize results) from the body of literature we reviewed, which was published across five academic databases (Science Direct, Springer Link, Informaworld, Wiley Online Library, and Sage Journals) between March 2008 and March 2017. The foundation of our analysis is presented in Table A1, which offers a qualitative coding matrix showing how we categorized each of the 47 academic studies collected. We also appreciate the opportunity to share the full reference list for those studies.

As Table A1 reveals, almost two-thirds (59.6%) of the sample of academic articles raised criticisms about the SMIP or smart meters, and 63.8% discussed technical barriers or challenges to smart meters. Only 8.5% of the sample discussed issues of vulnerability. While 38.2% discussed issues related to social acceptance, behavior, or practices, issues

interconnected to resistance, only 4.2% actively discussed resistance or ambivalence on behalf of users. This led us to conclude that, generally speaking, the body of literature focused predominantly on technical issues, to the neglect of some of the social aspects identified in Sovacool et al. (2017). Resultantly, this identified the need for further analysis on these non-technical issues.

To the query about Table 2 listing “Sixty-seven anticipated short- and long-term benefits to smart meters in the United Kingdom,” this was derived from a review of policy documents. We searched for policy documents to record expectations in three sets of Command Papers, i.e., texts that set out and describe government initiatives: major policy proposals (such as White Papers), departmental reports and departmental reviews. These were identified by searching the Department of Energy and Climate Change and the National Archives databases for the phrase “meter” and “smart meter” from January 2000 to May 2016. Supplementary policy documents were added through a snowballing technique derived from reference lists of the initial pool of documents. Our search identified 49 documents, of which 38 mentioned smart meters and articulated surrounding expectations and were, thus, included in the analysis. Our search concentrated on “higher level” policy documents, rather than ones specifically produced in relation to the smart meter rollout (such as smart meter consultation documents), because we wanted to examine expectations associated with smart meters within the wider energy policy debate. The analysis behind this process features in another study, Hielscher and Kivimaa (2018).

In terms of the smart meter events attended, we are also happy to offer as much additional detail as we can. During the period September 2015 to November 2016, two of the authors participated in all of the smart meter events in the Greater London area that we could identify based on regular searches in the internet. Thus, the only sampling strategy was event availability (or in other terms, there was no sampling – all events we identified were

attended). We appreciate that due to minimal advertising, or a lack of advertising in the public sphere, some events may have been missed but see this as a reasonable limitation of our study. To analyze the events we used both our notes and public transcripts of the events, making sure that any references to the event data made in the article could be verified through the public transcripts (and indeed that as a matter of methodological replicability, it can also be done by others when reading the transcripts).

To the third point about our use of non-academic sources such as reports and media articles, as well as the importance of the grey literature, we admit to being less systematic. It is an accepted practice to use non-systematic searches of the popular literature to supplement systematic reviews of academic literature. This is in fact what many, if not most, academic studies do in the early parts of their articles in order to ground the debate. Further, we note that whilst it is easy to concur with Shipworth et al. (2018) that analysis of non-peer reviewed literature, i.e. grey literature, is also very valuable (particularly to assess the current state of the affairs), that this is not what our article sought to achieve. We were transparent in our desire to synthesize the academic literature from the viewpoint of barriers.

Thus, we acknowledge the utility of further research on the SMIP and welcome the finding that issues of vulnerability are being addressed through the use of a range of grey sources. We also acknowledge a number of very recent news stories or letters all critiquing various aspects of the smart meter program, underscoring the contested nature of the rollout (Homewood 2018; Tims 2018; Vaughan 2018) as well as the presence of highly critical storylines within the media (Hielscher & Sovacool 2018).¹

¹ It should be noted that Homewood only remarked on correspondence on a single day, June 28, 2018. However, the subject was treated again on June 29, 30, and July 3 and 5, in the same newspaper. These highlighted: consumers will eventually pay for these “free” meters; “your bills will rocket”; “claimed savings will not be achieved, except by suppliers”; and “half-hour metering will push household expenditure on electricity and gas sharply upwards”. Ofgem’s Rob Salter-Church wrote in that: “No-one will be forced into switching to a time-of-use tariff.” The Letters Editor of *The Daily Telegraph* then published, immediately below this, Geoff Riley’s letter: “Water companies got permission from relevant ministry to make meters compulsory.” On July 5, 2018, the UK Department of Business, Energy & Industrial Strategy announced the extension of the deadline for first-generation meter installation providers, reflecting the fact that of the 280,000 meters being installed only a few

Additional contextual information

We applaud the additional contextual information offered by Shipworth et al. (2018). The points about network coverage and the DCC, how many of the earlier technical barriers we identified are being overcome, and how numerous actors have begun to seriously address issues of vulnerability and justice are apt. We concur that the planners behind the rollout have begun to pay greater attention to the distributional impacts of the smart meter rollout as well as the impact on vulnerable groups, such as older people or those with long-term health conditions or disabilities. We even hope that our article played some role in identifying the need for this. The partnerships and activities mentioned by Shipworth et al. (2018), especially those via Smart Energy GB and Citizens Advice, are an extremely positive sign.

We would like to add one additional topic to any discussion about context or technical performance of the SMIP: the sheer complexity of current supplier and meter types (marques). There are currently more than 50 energy suppliers involved in the rollout (at this time), with a variety of different meter types. Many suppliers are currently still installing first generation (SMETS1) meters, using their own data and communications networks to provide smart services, rather than the national DCC network (BEIS 2018a). The problem with SMETS1 meters is, however, that they are not yet part of the national DCC network, and, moreover, they can lose functionality when homes switch suppliers, as roughly one million smart meter homes did over the past year (Meadows 2018). BEIS (2018a: 6) cautions that the “evidence suggests that less than half of SMETS1 consumers changing energy suppliers are able to maintain smart functionality on their SMETS1 meter, with the meter subsequently operating in traditional mode.”

hundred are second-generation. This exacerbates fears that if households switch suppliers then first-generation meters will continue to fail. Another letter raised ongoing concerns about cyber-security, despite claims that this is among the issues in hand, while a senior former Ofgem official questioned the whole concept of smart meters being the optimum route to raising energy efficiency when smart appliances are the answer.

BEIS (2018a: 3) has indicated they support plans to “introduce an obligation on energy suppliers to take all reasonable steps to enroll SMETS1 meters in the DCC, or to replace them with SMETS2 meters, within a specified timeframe,” but it remains unclear (at the time) whether and how that will unfold. Most recently, in July of 2018 the Department of Business, Energy & Industrial Strategy announced it was considering extending deadline for first-generation SMETS1 meter installation providers until December 2018 (Mason 2018). So, a new technical issue has arisen that may partially offset some of the technical improvements mentioned by Shipworth et al. (2018).

Emerging challenges

We laud Shipworth et al. (2018) for calling attention to issues of broader stakeholder involvement, data compliance, privacy, and consumer consent. (We also, as an aside, hope to use the Smart Meter Research Portal in our own work going forward).

In addition to the novel points they raise, three others are worth mentioning. First, the diffusion of smart meters in the UK has not been even. Electricity meters are notably outpacing those for gas. Figure 1 shows the most recent smart meters data from BEIS (2018b), indicating that 5.47 million electricity meters have been installed but only 4.1 million gas meters, a notable difference of almost 1.4 million meters.

Figure 1: Cumulative installation of electricity and gas smart meters in Great Britain, 2012-2017

Source: Department for Business, Energy & Industrial Strategy (2018b).

Second, and critically, there is very little available data about actual acceptance rates for smart meters. Every home and small business must be offered one by the end of 2020, but only the suppliers know the true extent of how many of those offers have been accepted. Admittedly, the acceptance rate is a difficult metric to define as there will often be several contacts with a customer before an acceptable installation date is found (along with other factors, such as households potentially waiting for SMETS2 meters) that might result in a low initial acceptance rate but a much higher ultimate acceptance rate. By no means academic or representative, *The Telegraph* ran an investigation where “less than half of households” contacted indicated they accepted a smart meter (Meadows 2017). *The Telegraph* also reported uptake rates for smart meters “as low as one in five” (Meadows 2017). Yet as we note in Sovacool et al. (2018b), in order to better understand the reasons for rejecting smart meters, and to maximize the number of smart meters delivered, greater monitoring and transparency is needed about the proportion of consumers who accept a smart meter when offered one. The collection and analysis of such data would also enable researchers and

planners to understand better the reasons for rejection, or which arguments have proved the most effective for acceptance.

Third, and finally, is the issue of waste. So far, 10.1 million SMETS1 meters have been installed, and another 2.5 million are waiting to be deployed by fourteen energy suppliers (BEIS 2018a). How many of these SMETS1 meters will need replacing? Relatedly, what is the lifespan of a SMETS1 meter, a SMETS2 meter, and current in-home displays (IHDs)? Who will be responsible for their replacement, recycling, and reuse? Furthermore, the SMIP will result in the removal of tens of millions of old (and soon to be obsolete) meters, but most of these end up in a landfill. About 1.4 million meters are replaced and removed each year in the UK, but anecdotal evidence suggests that only about a quarter were being recycled as of 2011 (Wills 2011). Greater consideration should be given to what will happen to meters (old and new) and IHDs at the end of their lifetimes so that as far as possible, they are repurposed and recycled, rather than disposed of. Although it appears that energy suppliers have responsibilities under the European Union's Waste Electrical and Electronic Equipment (WEEE) Directive, neither smart meters nor traditional meters are explicitly listed in the ten categories of regulations. Smart meters and traditional meters are also not mentioned as a type of waste in the annexes to the most recent Waste Framework Directive. Moreover, it is unclear how well both Directives are enforced (or will be enforced post-Brexit), and whether such guidelines apply to IHDs (with liquid crystal displays that may contain mercury).

Conclusion

In sum, smart meters have the potential to bring benefits to consumers in terms of reduced energy bills through a more efficient (and hence cheaper to run) energy system. We thank Shipworth et al. (2018) for facilitating a discussion that has enabled us to clarify important points of our research method and elaborate on context and emerging, or at least

remaining, challenges such as compatibility with the DCC and waste. We would add to this list issues about electricity smart meters outpacing those for gas, empirically grounded data about actual acceptance rates, and the need to manage waste streams better.

Our intended contribution in Sovacool et al. (2017) was to highlight that the comparatively overlooked non-technical—political, social, and environmental—factors will have a considerable impact on the success of the smart meter rollout. Our fruitful exchange with Shipworth et al. (2018) shows that such a discussion is well underway not only in the research community, but among civil society groups and the planners of the rollout. These attributes will only serve to benefit smart meters adopters as well as the UK energy system as a whole, and we are pleased to have played a part in this discussion.

Disclosure of interests

We know of no conflict of interest that would affect the impartiality or independence of our research.

Table A1: Qualitative coding matrix of academic smart meters research (n=47), March 2008 to March 2017

No.	Reference	Critical of the SMIP/smart meters*		Discusses technical issues	Discusses vulnerability (e.g. rural peripheralisation, poverty, equity, and/or externalities)	Discusses social acceptance (e.g., privacy, health, practices)	Discusses active consumer resistance or ambivalence	Notes
		Yes	No					
1	Kotter (2013)	0	1	1	0	0	0	High level summary of the UK smart meter vision and legal framework, as well as potential to integrate EVs
2	Chilvers and Longhurst (2016)	1	0	1	0	1	1	Mentions Visible Energy Trial, sees IHDs as a participatory technology and type of governmentality
3	Mmojieje (2015)	0	1	0	0	0	0	Focuses on benefits to smart meters, can enable improved data about consumption, and capture “active and reflective” learners
4	Davoudi et al. (2014)	0	1	0	0	1	0	Describes how smart meters can offer direct and indirect feedback to alter energy consumption patterns
5	Balta-Ozkan et al. (2014)	1	0	1	1	1	1	Comparative study of UK, Italy, and Germany, focuses on smart homes and issues such as reducing energy use, practices, tariffs, vulnerability, privacy and security
6	Bradley et al. (2016)	1	0	1	0	1	0	Investigates smart meters through the lens of organizations and social norms, especially social distance and social interaction

7	Darby (2010)	1	0	1	0	1	0	Examines smart metering technologies and narratives through concepts such as affordances, emphasizing programs in Europe but also interpretations and implementation in the UK
8	Hamilton et al. (2010)	0	1	0	0	0	0	Briefly mentions smart meter legal framework and issues opportunities connected to “big data”
9	Sunikka-Blank et al. (2012)	1	0	1	0	0	0	Examines energy efficiency retrofits in social housing estates, especially how smart meters may (or may not) facilitate energy savings
10	Giest (2017)	1	0	1	0	1	0	Emphasizes big data elements of smart meters as a challenge of governance and privacy, case studies of London and Oxford (as well as Vienna in Austria)
11	Viitanen et al. (2015)	1	0	1	0	1	0	Analyses two low-carbon communities in Sheffield and Leeds, critiques that smart meters do “not create user empowerment”
12	Murphy (2016)	1	0	0	0	1	0	Looks at privacy issues from smart meters and rule of law
13	Savirimuthu (2013)	1	0	1	0	1	0	Analyzes smart meter information and data through the notion of the Panopticon, raising issues of data protection, surveillance, privacy, and control
14	Bellantuono (2014)	1	0	1	0	0	0	Investigates policy and regulatory approaches (regulatory innovation) to smart meters in the USA and UK
15	Groves et al. (2016)	1	0	0	0	1	0	Assesses the psychosocial factors of smart meter (home) practices as well as consumer engagement, especially themes of convenience and ambivalence

16	Darby (2008)	1	0	1	0	0	0	Frames smart meters around the notion of “energy feedback to end-users,” raises some technical and policy issues
17	Lanzarone & Zanzi (2010)	0	1	1	0	0	0	Analyses gas (and water) smart meters only, identifies numerous supplier benefits but also technical challenges around ICT
18	Hess (2014)	1	0	0	0	1	0	Examines smart meter perceptions in Canada and the UK (with insight for policy around the world), focuses on privacy and health issues
19	Marantes & Openshaw (2012)	0	1	1	0	0	0	Case study of the “Large Scale Low Carbon Smart Grid Project” in London, assesses carbon reduction benefits as well as DNO benefits, notes emerging technical challenges as well
20	Thomas (2012)	1	0	1	1	0	0	A strong critique of the SMIP, challenging its cost benefit analysis as well as technical suitability, it raises issues of fuel poverty and affordability as well
21	Eadson (2016)	0	1	0	0	0	0	Analyses smart meters through the lens of “modes of enrolment” to emphasize power, policy, and politics
22	Bulkeley et al. (2016)	1	0	1	0	1	0	Looks at smart grids and smart cities through the approach of “urban material politics of actualizing smart electricity networks” as well as smart meter trials, proves “more complex” and more “social negotiation” than initially thought
23	Thomson et al. (2017)	0	1	0	0	0	0	Smart meters create the option to measure fuel poverty directly

24	Buck and While (2015)	1	0	1	0	0	0	Assesses smart meter proposals through the lens of “technological vision of smart urbanism” and the limits and “competing interests” to smart innovation
25	Marres (2012)	1	0	1	0	0	0	Examines smart meters for electricity and critiques them on the grounds that digital tools enable “tag clouding” and smart meters present “problematic devices”
26	Strengers (2011)	1	0	1	0	1	0	Although it focuses in Australia, it offers a survey of trials involving IHDs, smart meters, and time of use tariffs, reporting a reduction in consumption between 0 and 20%.
27	Muller (2012)	1	0	1	0	0	0	Compares various policy, design, and technical aspects of smart meters in Italy and the UK, argues that while most aspects of the SMIP are positive, regulatory technology preferences are a negative
28	Schächtele and Uhlenbrock (2012)	1	0	1	0	0	0	Studies smart electricity meters, examines costs and benefits of the SMIP, especially for residences and suppliers, but also installation and operation challenges
29	Wagner and Alexander (2014)	0	1	0	0	0	0	Only briefly mentions smart meters as a feature of energy markets in Europe/UK
30	Jennings (2013)	1	0	1	0	1	0	Argues that better alternatives to smart meters exist for automated meter reading (regulation) or demand management (complex tariffs), briefly mentions the debate over privacy
31	Bhatt et al. (2014)	1	0	1	0	1	0	A broad review of the smart meters literature, including different designs as

								well as barriers such as reliability, congestion, security, and efficiency (although no poverty or vulnerability issues are identified)
32	Gans et al. (2013)	0	1	0	0	0	0	Estimates the effect real-time information can reduce residential electricity consumption in Northern Ireland, and identifies savings in the range of 11 to 17%
33	Robinson et al. (2013)	0	1	0	0	0	0	Argues that smart meters can change charging patterns (for electric vehicles) to off-peak times
34	Kilpatrick et al. (2011)	0	1	0	0	0	0	Suggests that smart meters could give householders detailed information not only on the total energy used but also appliance usage and cost
35	Drysdale et al. (2015)	0	1	0	0	0	0	States that access to domestic loads will become more technically feasible following the roll out of smart meters to domestic properties and businesses
36	Poghosyan et al. (2015)	0	1	0	0	0	0	Uses smart meter data to understand electric vehicle behaviour among households
37	Al-Wakeel et al. (2016)	0	1	0	0	0	0	Utilized real smart meter data to better examine potential for distribution network monitoring and control.
38	Jennings and Shah (2014)	1	0	1	0	0	0	Notes the workforce impacts of smart meters on suppliers, also emphasizes costs for skills training, upskilling, and optimization
39	Chaney et al. (2016)	0	1	0	0	0	0	Suggests that smart meter data could be used to more accurately determine building occupancy rates

40	Vallés et al. (2016)	1	0	1	0	1	0	Argues that smart meters can challenge traditional business practices and present regulatory and market barriers, notes some concerns over data access, control, and privacy
41	Liu et al. (2015)	0	1	0	0	0	0	Looks at smart meter for the water sector, not electricity or gas
42	Jenkins et al. (2015)	1	0	1	0	0	0	Offers an overview of the SMIP, explaining the program to date as well as drivers, policies, incentives, and technical challenges
43	Liddell (2015)	0	1	1	0	1	0	Uses smart meter data in Northern Ireland to examine household patterns and practices, emphasizes the need for “vigilance” in achieving reductions in consumption
44	Barnicoat and Danson (2015)	1	0	1	1	0	0	Looks at household attitudes towards smart meters in Scotland, notes difficulties some vulnerable groups (the elderly) experienced
45	Spanyol (2012)	1	0	1	0	1	0	Emphasizes the benefits of smart meters for marketers, noting that “the data collected by smart meters have the capability to track consumer behaviour patterns and give anything from an approximate indication to detailed information as to which household appliances consumers are using and when,” which is also a privacy issue
46	Cook et al. (2012)	0	1	1	0	0	0	Uses UK smart meter data to draw implications for the United States, does talk about technical challenges and implement costs (which it argues are offset by benefits)

47	Zhang et al. (2011)	1	0	1	1	0	0	Modelled four different deployment options for the SMIP, two government led (competitive, monopoly), one led by suppliers, and one led by Distribution Network Operators (DNOs). Concluded that the government chose the least effective rollout option from the standpoint of both overall cost and maximum benefits for households
Total	N=47 (100%)	N=28 (59.6%)	N=19 (40.4%)	N=30 (63.8%)	N=4 (8.5%)	N=18 (38.2%)	N=2 (4.3%)	

Note: For coding purposes, a (1) signifies a “Yes” or “True” and a (0) signifies a “No” or “Not mentioned.” * By “critical” we mean it discussed some element of criticism, critique, barriers, obstacles, challenges, or impediments, not that it was definitively “against” the rollout or smart meters per se. IHD=in-home display. UK=United Kingdom. SMIP=Smart Meter Implementation Programme. EV=electric vehicle. ICT=information and communication technology.

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