EXTENDED USE OF SMART METERING IN COMPARATIVE PERSPECTIVE WITH EMPHASIS ON CONSUMER

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Abstract

The gradual introduction of smart meters is in coherence with new technologies that are generating energy efficiently. The paper takes advantage of the fact that Great Britain's statistics provide details on the implementation of smart meters. Therefore, it is possible to introduce and compare the factors that describe the extended use of smart metering. The paper aims to present the implementation process of smart meters in the UK and the public's perception of the introduction of smart meters. Factors observed in one country may serve as a lesson learned for other countries depending on the specific condition of the country in question. Statistics gathered led to confirmation of the assumed effects of smart metering. Effects are in optimal use of the capacity of electric connection, prevention of overloading or network failure, followed by significant advantage in the protection of both the producer and the consumer. Opinions of electricity consumers, who are already using smart meters with consumers that are not using them are compared within age strata and saving attitudes and others. The impact of the factors discussed relates to differences in countries` conditions for introducing smart meters.

Key words: energy, smart meter, consumption, efficiency, energy management

JEL Code: Q41, Q43, Q49

Introduction

Energy management systems are a means for advanced control techniques in electricity supply. The mismatch between supply and demand and the reliability of energy supplies are naming the solution for energy management bottlenecks. The installation of smart meters should help with this. (Al-Waisi and Agyeman, 2018; Barai et al., 2015; Rodriguez-Diaz et al., 2015). However, smart metering can be associated with certain complications, such as securing systems. These are mainly the issue of personal data disclosure, the legislative framework, and national security concerns due to systems being hacked (Asghar, 2017; Ur-Rehman et al., 2015).

The Department of Energy & Climate Change (one of the departments of the Government of the United Kingdom, specifically, it is part of the Department for Business, Energy & Industrial Strategy) is responsible for the legislative framework and promoting initiatives aimed at increasing energy efficiency. One of the initiatives is the Smart Metering Programme, which started in 2011, and its main part, which focuses on installing smart meters, was launched in 2016. The installation itself concerns households and small businesses. Introducing smart meters is a gradual transition to a clean energy system (Department for Energy Security and Net Zero, Ofgem, and Department for Business, Energy & Industrial Strategy, 2013).

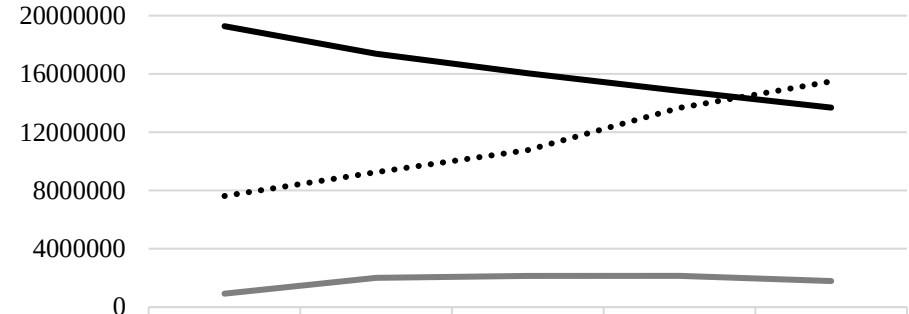
An advantage of implementing smart meters, which can be considered innovative products, is taking control of consumers over their consumption. Customers can monitor their real consumption. They find out more clearly when off-peak energy can be used and manage their energy costs. Benefits can also be seen on the side of energy suppliers. These advantages include a new approach to demand management that helps reduce emissions. Automatically reading and better managing demand allows you to provide better customer service. Due to this reasoning, The Department of Energy & Climate Change states that the energy system could become more transparent and reliable thanks to the gradual introduction of smart meters (Department for Business, Energy & Industrial Strategy, 2022). By smart meter implementation, it is possible to influence the behaviour of actors creating demand and supply in order to secure efficiency in using scarce energy sources. The implementation process of smart meters in the UK and the public's perception of the introduction of smart meters is the paper aims to present for the sake of lessons learned.

1 Implementation of smart meters in the UK

As it is evident from Fig. 1, there is a gradual increase in smart meters in smart mode introduced by large electricity providers in the monitored period 2018-2022. On the other hand, smart meters in traditional mode and non-smart meters are decreasing. A large electricity supplier is considered to be an entity that supplies electricity to at least 250,000 domestic or foreign metering points (the list of large electricity suppliers can be seen in Appendix 1). It is further clarified that a smart meter is a device that meets the Government's technical specifications and is operated in smart mode. Non-smart meters have no smart function. Smart meters in traditional mode must be able to store at least half an hour's worth of electricity data (the customer must have timely access, and the supplier must have remote

access). If we look at the proliferation of smart meters installed by major suppliers, there has been an increase to 15,486,981 in 2022. It represents an increase of 103% compared to 2018 (Department for Business, Energy & Industrial Strategy, 2022).

Fig. 1: Domestic and non-domestic electricity meters operated by large suppliers (in number at the end year)



	2018	2019	2020	2021	2022
Meters smart in smart mode	7626368	9254414	10764552	13682934	15486981
Meters smart in traditional mode	923234	2003982	2142346	2144601	1778962
Meters non-smart	19276248	17390791	16039552	14847330	13689549

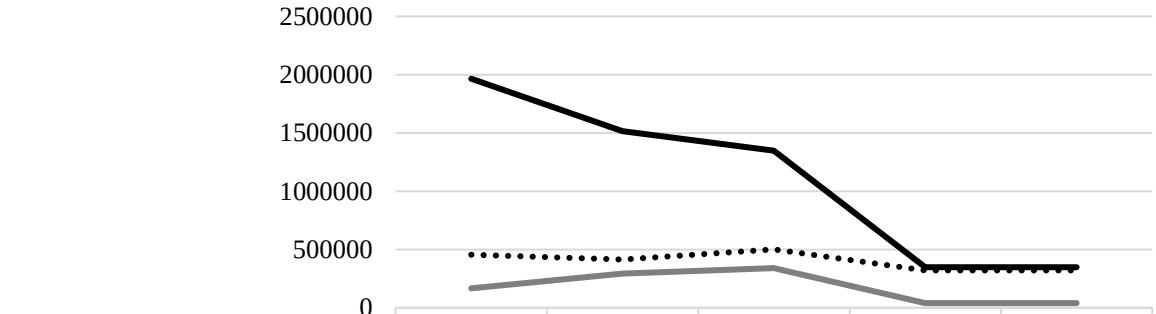
Source: Department for Business, Energy & Industrial Strategy. (2022, November 24). *Smart meter statistics*. GOV.UK. https://www.gov.uk/government/collections/smart-meters-statistics#2021-quarterly-updates, authors´ processing.

More pronounced fluctuations in the installation of smart meters are visible among smaller electricity providers, as Fig. 2 shows. Specifically, it decreased in 2019 (- 9%) and 2021 (-36%). In addition, we specify that small electricity suppliers are providers that supply energy to less than 250,000 domestic or non-domestic metering points (an overview of all small electricity suppliers is given in Appendix 1). If we focus on single periods, smart meter installation volumes differ between small and large suppliers (see Fig. 1 and 2) depending on their business strategies. In particular, the number of smart meters installed in smaller non-domestic sites is volatile. There are various reasons for this fact. For example, these are customer transitions within individual suppliers (some do not/have smart meters) (Department for Business, Energy & Industrial Strategy, 2022).

The implementation of smart meters of the second generation was reflected in the gradual installation in 2019. The companies took their employees out of the field for the necessary training. In 2020, the implementation of smart meters was accompanied by

additional security measures to ensure the safety of customers and employees due to the COVID-19 pandemic. In 2021, most smart meters were installed by large electricity suppliers. The installation was still in compliance with the COVID-19 measures. In addition, from January to April 2021, specific measures took effect in Scotland. It was only possible to intervene in emergencies. The gradual implementation of smart meters was suspended. As of 2022, the installation progress has started to return to pre-COVID-19 levels (Department for Business, Energy & Industrial Strategy, 2022).

Fig. 2: Domestic and non-domestic electricity meters operated by small suppliers (in number at end year)



	2018	2019	2020	2021	2022
Meters smart in smart mode	453884	413545	500712	320273	320273
Meters smart in traditional mode	166691	292356	340351	39552	39552
Meters non-smart	1965430	1514737	1346835	347873	347873

Source: Department for Business, Energy & Industrial Strategy. (2022, November 24). *Smart meter statistics*. GOV.UK. https://www.gov.uk/government/collections/smart-meters-statistics#2021-quarterly-updates, authors´ processing.

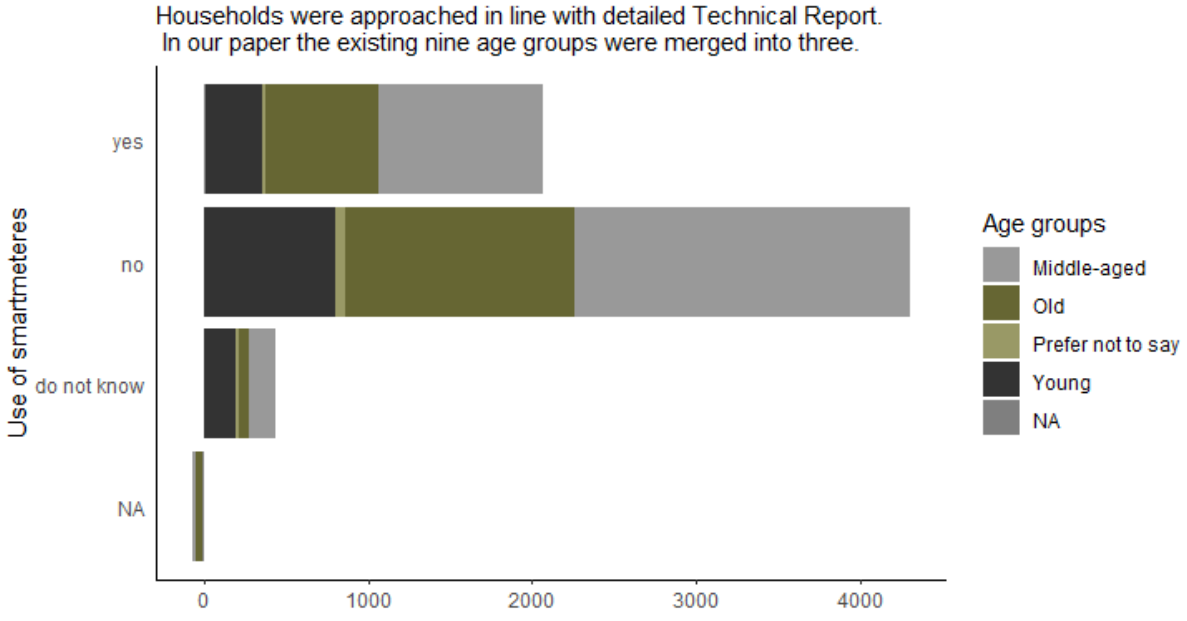
2 Public attitude to the implementation of smart meters in the UK

Along with the gradual introduction of smart meters, society's opinion on using newer technologies is also being formed. The new device sometimes creates both curiosities as a positive attitude and sometimes fear as a negative attitude. However, people, today discuss often environmental issues without any boundary among professions or age groups or other differences that might be an obstacle in defining the rightfulness of the opinion. Description of the situation on smart meter use in Great Britain was allowed thanks to data in The Attitudes tracker or National Archives (The National Archives, 2022).

Figure 3. shows that most consumers using smart meters were middle-aged (1001), i.e. 49% of the sample, followed by the old age group (687) that is 33% of the total, young (352

in percentage 17 as proportionate to the sample and category of using smart meters). In the category of not using smart meters are results similar with slight changes in percentages and values (48%, 32%, and 19%, respectively).

Fig. 3: Smart meter use in Great Britain (N=4381) as of 2022 survey



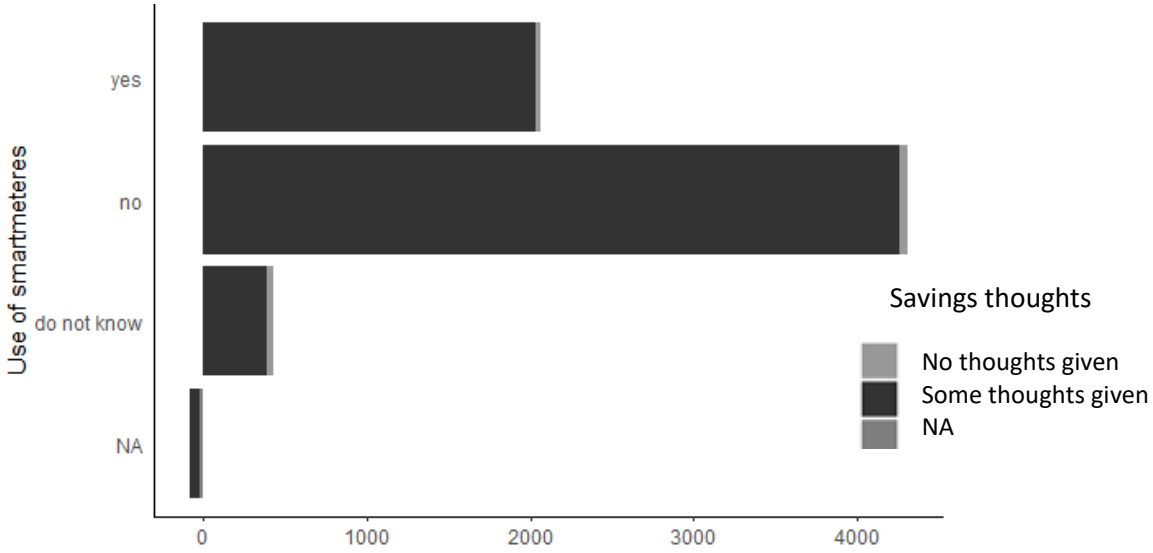
Source: prepared based on data from The National Archives, 2022

In addition to the age structure of smart meter users (in Fig. 3), the attitude towards energy savings as a result of the ongoing implementation of smart meters is reflected in Fig. 4. Prevailing number of respondents are thinking about saving (2026 of surveyed persons). Contrary to economise the energy in a household only approximately half of the respondents (2126) applied the smart meter yet. The numbers for the opposite attitude "No thought given" to energy saving were rather negligible (28, 25 for using and not using the smart meter). It should be noted that the UK is enhancing smart meters strongly. Other countries have a strategy that companies and consumers do not need support in implementation. On top of it, the energy crises had an influence over these attitudes and thus the results` interpretation is only emphasizing the fact that is in line with global sustainability approaches.

Despite the fact that some family members might have objected that the new technology can be difficult to operate or understand, consumers have allowed the change. Another concern that should be obvious, on the consumer side is that the cost of new technology will be included in the price of energy. (Darby et al., 2015) A noticeable fact was

that only 5% of respondents have actively contacted their supplier to install a smart meter. In most cases, it was the supplier who initiated the smart meter installation.

Fig. 4: Smart meter use with respect to saving thoughts in Great Britain (N=4381) as of the 2022 survey



Source: prepared based on data from The National Archives, 2022

The metering itself contributes to being thoughtful about energy use in households. Not only it is linked to thoughts of being wise in to use of energy, but it also changes behaviour itself. For instance, boiling the kettle with more water than needed or leaving the lights on when nobody is in the room.

3 Discussion on observation of smart meters implementation for country`s consumers

The survey showed that the implementation of smart meters prevails among the middle-aged and old-age groups. It could be attributed to the age groups' greater awareness of household costs and a greater tendency to save not only energy. One missing category is the income of the respondent/consumer. It is due to the fact that income price elasticity seems to be the key to demand reaction. Therefore it is suggested for implementing smart meters to try to gather data on clients' income groups as well. It can be said that consumers who use a smart meter and meter in traditional mode focus on energy-saving measures when purchasing electricity.

The introduction of smart meters can mean a better overview of possible savings for consumers. The reason is that on the bill occurs only energy used. Another advantage is better cost management (lower cost for not using metering in person, as well as invoicing, is easier) and lower emissions. Intelligent meters have a digital display for showing energy consumption in real-time that is linked with providing information on credit available. Credit can be increased remotely. Feedback on energy distribution is almost immediate (Department for Business, Energy & Industrial Strategy, 2022).

However, there are also benefits that are evident at the national level. Energy distributors are more flexible in obtaining data on the power outage and their possible reasons. This should result in faster and cheaper maintenance. Advantages are significant when it comes down to the use of electricity off-peak hours. One has to programme for off-peak hours use of appliances that are nowadays having such options in their control panels too. Some features are highly dependent on consumer preferences, such as the choice of which appliances will be plugged-in on intelligent metering (Department for Business, Energy & Industrial Strategy, 2022). Not forgetting the possible risks of introducing smart meters, which are visible from the point of view of data protection in the area of personal data disclosure and system security (see for example Asghar, 2017; Ur-Rehman et al., 2015). The security and protection of these areas are key to the functioning of the smart meter implementation concept. This concern could be the reason for the lack of interest in the introduction of smart meters.

Conclusion

The objective of the paper was to present the implementation process of smart meters in the UK and the public's perception of the introduction of smart meters. The survey showed that the motivation behind implementing smart meters in the UK is certain customer and supplier advantages. These are fundamental steps in transitioning to a greener, more reliable energy system. These advantages could motivate other states to move towards more efficient use of electricity (Department for Energy Security and Net Zero and Department for Business, Energy & Industrial Strategy, 2013).

When we focus on the enumeration of the main reasons for keeping statistics on the implementation of smart meters and the motivation for other countries, it includes in particular: (1) Internal analysis is used for political decisions. (2) Industry statistics and related trend monitoring. (3) Transparency of smart meter implementation. (4) Availability of

information to the public and stakeholders. (5) Unification of standards for data recording and the possibility of international comparison.

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Appendix

Appendix 1: Electricity suppliers included in the analysis of smart meters (at the end of 2021)

Large Energy Suppliers:

British Gas	EDF Energy	Scottish Power	Utilita
Bulb	Octopus Energy	Shell EnergyRetail	Utility Warehouse
E Energy	Opus Energy	So Energy (includes ESB)	
E.ON Next	OVO	SSE Energy Solutions	

Small Energy Suppliers:

Ampower	Dual Energy	Igloo Energy	So Energy
Avanti Gas	E	iSupply Energy	Solarplicity
Avid Energy	Ecotricity	Logicor	Squeaky Energy
Avro Energy	ElectroRoute	MA Energy	Symbio Energy
Axis	ENGIE	Marble Power	Together Energy
BES Utilities	Enstroga	MB Energy	Tonik Energy
Better Energy	Entice Energy	Nabuh Energy	Total Gas & Power
BPG Energy	ESB Energy	Opal Gas	Toto Energy
Breeze Energy	Eversmart Energy	Opus Energy	Tru Energy
Brilliant Energy Supply	Foxglove Energy	Orbit Energy	URE Energy
Bristol Energy	Gazprom Energy	Orsted	Utility Point
Brook Green Supply	GnERGY	People's Energy	Vayu (now Naturgy)

Continues on next page.

Small Energy Suppliers - continued:

Bryt Energy	Go Effortless Energy	PFP Energy	Verastar
CNG	Good Energy	Pure Planet	Xcel Energy
Corona Energy	Green Energy	Regent Gas	Yorkshire Gas and Power
Crown Gas and Power	Green Network Energy	Robin Hood Energy	Yu Energy
D-ENERGi	Gulf Gas and Power	Simplicity Energy	Zebra Power
Daisy Energy Supply	Haven Power	SmartestEnergy	Zog Energy

Source: Department for Business, Energy & Industrial Strategy. (2022, November 24). *Smart meter statistics*. GOV.UK. https://www.gov.uk/government/collections/smart-meters-statistics#2021-quarterly-updates, authors´ processing.

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