Smart Meter Awareness in Italy, Ancona

Vasileios Ntouros, Nikolaos Kampelis, Martina Senzacqua, Theoni Karlessi, Margarita-Niki Assimakopoulos, Dionysia Kolokotsa, and Cristina Cristalli

Abstract Smart meters, one of the crucial enablers of the smart-grid concept and cornerstones in smart planning for cities, offer the opportunity for consumers to address their energy consumption effectively through timely and accurate data on their energy usage. However, previous studies have shown that smart meters may not lead to the desired energy savings unless actively used by households. To this end, the research presented in this paper investigates the penetration of smart meters at community level and explores how such a metering system can help people to understand and manage their energy use better. It examines the awareness about smart meters, looks into their presence in current accommodation and focuses on the views people have about smart meters. For this purpose, a questionnaire was prepared and distributed to a group of individuals residing in the wide area of Ancona province in Italy. Although the deployment of modern second-generation smart meters started in 2017 replacing the outdated smart meters massively installed in the 2000s, the results show low-to-moderate levels of awareness of modern smart meters among the respondents and a low presence of second-generation metering devices in their current accommodation. However, the general view expressed by the participants about smart meters is positive. The findings demonstrate that respondents are in need not only of a gauge that measures energy consumption but also of a tool that assists them to manage effectively their energy use.

Keywords Smart meters · Residential sector · Energy consumption · Energy usage

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1 Introduction

The European residential sector is responsible for approximately one quarter of electricity use and more than one-third of gas consumption in the European Union (Eurostat 2020a). Because of these high shares of electricity and gas consumption in households, there is a significant socioeconomic and environmental interest in understanding and optimizing energy usage in the residential sector (Himpe 2017). By monitoring energy consumption at a fine granularity on the order of minutes, high-resolution data from smart meters can give valuable insights into domestic energy usage patterns (Wang et al. 2018). Understanding these insights and addressing any deficiencies is important for energy planning and management strategies, as well as for evaluating cost-effective optimizations and potential for energy efficiency amelioration. For this reason, alongside the development of smart grids, a 34% penetration of electricity smart meters across the EU was reached by 2018 while the EU Member States are expected to replace 92% of the traditional electricity meters by 2030 (TRACTEBEL–Engie 2019). With regard to the gas smart meters, there are no indications of the number to be replaced or a specific timeline. Smart metering and smart grids rollout can lead to reduced annual energy consumption by up to 9% within the European Union (EU) while some pilot projects suggest that actual energy savings for consumers can be even higher (European Commission 2011). By providing real-time feedback about energy usage, smart meters are supposed to help consumers reduce their electricity or gas bills. As indicated in a study conducted in 900 households in Linz, Austria, feedback on energy usage patterns was likely to have triggered investments in household appliances of higher energy efficiency, as well as to stable behavior changes with regard to energy saving (Schleich et al. 2017).

Initially, a goal of at least 80% of consumers to be equipped with intelligent metering systems by 2020 was set out in the Electricity Directive 2009/72/EC, while in 2012, the European Commission (EC) recommended a set of minimum functional requirements for the smart metering systems (European Commission 2012). As stipulated in the Third Energy Package, the deployment of smart metering systems is required in those EU Member States (MS) where smart meters' rollout is assessed positively through a cost-benefit analysis conducted in each MS. However, a massive smart meter rollout for electricity is underway only in Denmark, Estonia, Finland, Italy, Malta, Spain and Sweden. In most EU MS, at least 80% of the consumers will be equipped with a smart meter between 2020 and 2025, while, in about one-third of the countries, wide-scale installation will take place by 2030 or later (TRACTEBEL–Engie 2019). According to a 2014 report on progress in smart meter deployment, issued by the EC, it is expected that almost 72% of European consumers will have a smart meter for electricity by 2020 (European Commission 2014a). However, delays in starting the deployment, a lack of a legal framework, late approval of rollout plans and political and/or financial instability across Europe call into question the 72% expectation (Bularca et al. 2018).

According to Eurostat's 2018 data, across the EU-28 households, the total final-energy consumption was 283,301.425 thousand tonnes of oil equivalent (Eurostat 2020b). Of this amount, the share of electricity was 24.6% and gas 36.2%. Nevertheless, even if the rollout of smart meters had been completed, those intelligent metering systems alone would not have led to the desired energy savings, and the aforementioned levels of consumption will not be reduced significantly unless consumers are willing to actively use them and optimize their daily energy consumption patterns (Wallenborn et al. 2011).

In addition, previous studies have shown that direct feedback on energy consumption is of great importance because it enhances the saving efforts of households. However, the savings reported in individual studies differ due to various contexts, methods and the design features of feedback of the respective projects (Fischer 2008). Darby (2006) has shown that direct feedback on energy consumption may result to a reduction in the region of 5–15%. Grønhøj and Thøgersen (2011) reported a 8.1% reduction in electricity consumption in households that received feedback through displays, whereas Carroll et al. (2013) reported a 2.1% savings. Interestingly, in a report made on the impact of feedback on energy consumption, a mean saving for electricity of 5% and for gas 3% (Ea Energy Analyses 2015) was calculated. Various challenges are identified in the literature that pose a burden for consumers to fully familiarize themselves with intelligent metering systems and increase their energy savings (Mela et al. 2018). Consumers consider the information from smart meters as complicated and difficult to understand, while other reported barriers include lack of feedback on energy-saving assistance, residents' decreased level of interest toward smart meters after an initial period of use, technical problems and concerns about loss of privacy. Thus, providing households with meaningful feedback on their energy consumption accompanied with tailored tips on energy saving, while ensuring residents for their data safety, are critical factors for the next phase of the household energy sector.

Smart meters as one of the cornerstones of intelligent metering are among the crucial enablers of the smart-grid vision that increases the network's reliability. They are the next generation of electricity and gas meters capable of two-way communication since they enable the remote exchange of information about the amount of energy being used and/or produced between any node in the grid and energy suppliers or other denominated parties (Page et al. 2010). In addition, they provide information to consumers on their actual consumption, and the bills issued by the energy suppliers are based on actual consumption and not on estimations. Thus, smart metering offers the opportunity for consumers to address their energy consumption effectively through timely and accurate data on their energy usage. However, there are concerns that smart meters potentially come with some privacy and security risks (Depuru et al. 2011). Overall, for the successful development of smart grids in cities or nationwide, it is critical for consumers to raise their awareness of smart metering and become familiar with these intelligent systems (Park et al. 2017).

In Italy, the experience gained from Enel's "Telegestore" voluntary project when the Italian distribution company replaced 30 million of its conventional meters with digital meters during the period 2001–2006 paved the way for the realization of

smart metering in the country. The Italian government, recognizing the benefits of implementing smart meters, defined the legal framework for mandatory rollout to all metering points in the country in 2006, prior to 2009s EC communications, and by 2011, 95% of metering points were equipped with a smart metering device, achieving EU's 80% goal well ahead of 2020 (European Commission 2014b). This first generation of deployed smart meters is compliant with the requirements set by the EC in 2012, except for not providing updated readings at least every 15 min.

In 2016, the Italian Regulatory Authority issued a decision for the deployment of the next generation of smart meters and set the minimal functional requirements to further enhance the accuracy of the metering data and improve customers' experience with the services. Soon after, in 2017, Enel, now called e-distribuzione, being among the biggest Distribution System Operators (DSO) in Europe and in Italy in terms of connected customers (Prettico et al. 2019), operating with the oldest generation of smart meters by that time, started the rollout of the second generation of smart meters. The newly introduced metering system, contrary to its predecessor, is capable of delivering raw metering data directly to the costumer and to forward even more precise measurements to the DSO (Piti et al. 2017).

The aim of this survey is to investigate the views of people who have already utilized the first generation of digital electricity meters, as is the case in Italy, have on smart meters and explore how the metering system can help people to understand and manage their energy use better. It examines the awareness of smart meters and looks into the rate of penetration of the new smart meters within the community. Another aspect of this study is its focus on individuals holding tertiary qualifications. The literature suggests that education is expected to raise wages (Frini and Muller 2012) and consequently motivates consumption because income directly affects household energy consumption (Cayla et al. 2011). Therefore, investigating the opinions of a group likely to have a high-savings potential could add to the further improvement of smart metering systems.

The rest of this article is structured in three sections. The second section describes the specific elements of the methodological design employed in this study. The third explains the quantitative insights that emerge from the results and the fourth summarizes and concludes.

2 Methodology

For the scope of this study, a purposeful sampling technique was used for the identification and selection of information-rich cases for the most effective use of limited resources. This involved identifying and selecting individuals who have tertiary qualifications and are knowledgeable about automation and data-acquisition systems and who, at the same time, were available and willing to participate in this research. To find an appropriate sample of participants, a company from the technology sector was approached through a contact person because the profile of its employees suited the

purposes of this study. Finally, 70 individuals were approached, and a questionnaire was prepared and distributed through email to them.

From those 70 persons, only 47 fully completed the questionnaire and their answers were considered valid. All of them resided in the wide area of Ancona province, Italy. The survey was conducted in June 2018, one year after the deployment of the second generation of smart meters began in Italy. Due to the small sample size, the results should not be considered as representative of the entire energy consumers' universe but as indicative, and so they should be used with prudence.

An online version of the questionnaire survey was created on LimeSurvey in English. The questionnaire was disseminated to participants through their company's mailing list. The questionnaire includes multiple choice and dichotomous questions. In the first type of close-ended questions, participants were offered a set of answers they have to choose from, while in the second type, respondents can choose the "yes" or "no" option. Finally, the answers were collected online, and afterward they were coded, quantified and analyzed using the statistical computer-based programs Microsoft Excel and IBM SPSS. For the derivation of the results, a quantitative analysis that involves bar charts and percentages was used. The questionnaire is available in appendix.

Before participating in the actual survey, the participants were told the purpose of the survey and asked for their informed consent. After providing their consent to participate in the survey, the following short explanation of what smart meters are was also given:

> Smart meters are the next generation of electricity and gas meters capable of two-way communication. They remotely send and receive information about the amount of energy being used directly to energy suppliers and other nominated parties. They provide information to consumers on their actual consumption and bills issued by the energy suppliers are based on actual consumption and not on estimations.

3 Results

A large number of male, as compared to female, respondents participated in the survey as a result of the research conducted within a technology company: 85% of the respondents male versus 15% female. Only a small minority of the participants in the survey are between 18 and 25 years of age. The vast majority of the respondents (55.3%) were 26 to 34 years of age. Moreover, almost 32% percent (31.9%) of those surveyed were 35–45 years of age, while very few participants (6.4%) were between 46 to 57 years old. None of the participants were younger than 18 years old or older than 58.

Most of the participants (51.5%) pay their energy bills exclusively by themselves. This is an indication that, overall, they have an overview of their energy consumption. Approximately, 28% (27.7%) of the respondents do not contribute to paying the energy bills in their household. Almost one out of five respondents (21.3%) share the cost of their energy bills with others living in the same accommodation.

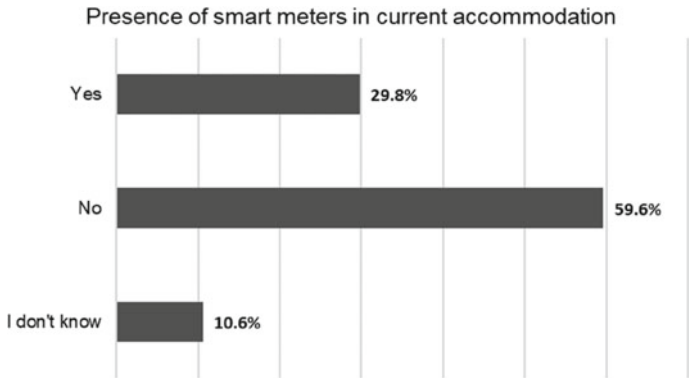

Fig. 1 Presence of smart meters in respondents' current accommodation (sample size $N = 47$)

3.1 Presence of Smart Meters in the Current Accommodation

Respondents were asked if there is a smart meter in their current accommodation. As depicted on Fig. 1, over half of those questioned (59.6%) reported that there is not a smart meter in their current accommodation, whereas less than thirty percent of the respondents answered positively (29.8%). Interestingly, 10.6% do not know if there is a smart meter installed in their homes.

3.2 Awareness of Smart Meters and Their Function

Respondents were asked if they were aware of a smart meter and its function. As depicted in Fig. 2, the most frequently occurring response was "I have a general idea" (38.3%). On the other hand, only a small percent (4.3%) of those interviewed reported that they have an excellent idea what a smart meter is. Interestingly, 12.8% of the respondents stated that they have no idea what a smart meter is. The findings have also revealed that 25.5% have a vague idea, whereas 19.1% have a good idea about smart meters and their function.

3.3 Sources of Information About Smart Meters

Respondents were asked to select from a list the sources from which they received information about smart meters. This question allowed for multiple answering choices, and thus respondents could select as many options as relevant. Therefore, the sum of the percentages reported per option is greater than 100%. The results are shown in Fig. 3.

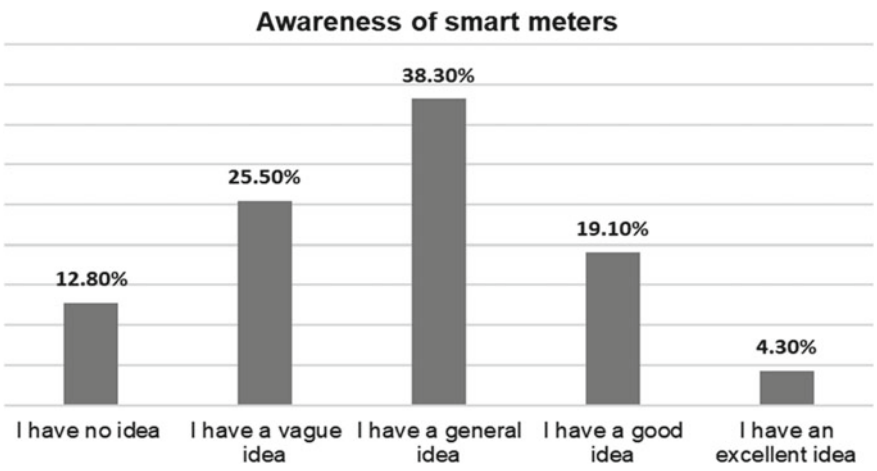

Fig. 2 Awareness of smart meters and their function (sample size $N = 47$)

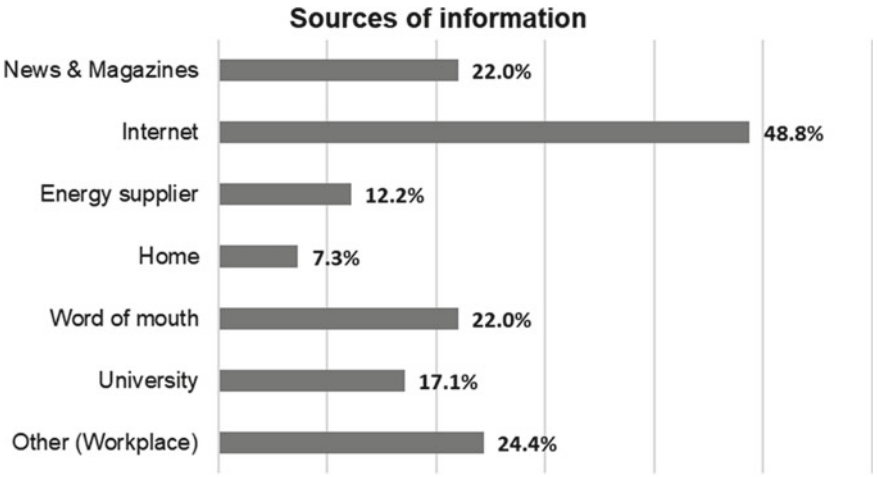

Fig. 3 Sources of information about smart meters (sample size $N = 41$)

The near majority of the respondents (48.8%) reported that they were informed about smart meters from the Internet. On the other hand, a 7.3% minority stated that they were informed from "home". Approximately, one out of four respondents (24.4%) added that they were informed about smart meters from their jobs, i.e., workplace. Twenty-two percent (22%) of the respondents selected "news and magazines" or the "word of mouth" option. About seventeen percent (17.1%) stated that they had heard about smart meters at their university, whereas 12.2% surveyed reported that their energy supplier provided them information about smart meters.

3.4 *Shared Opinions About Smart Meters—Benefits and Drawbacks*

Respondents were asked about the level of agreement, if at all, with given statements with respect to possible benefits of smart meters or the drawbacks they might pose. Results are on a 1 to 3 scale (1 = Disagree, 2 = Neither agree nor disagree, 3 = Agree). Mean values (M) over 2.5 indicate agreement with the statement. The results with regard to possible benefits are presented in Figs. 4 and 5, whereas the findings about the drawbacks are shown in Figs. 6 and 7.

The total sample of respondents agreed the most that smart meters "keep track of the energy consumption" ($M = 2.95$, St.Dev = 0.3), whereas they agreed the least with the statement that smart meters are likely to "increase energy efficiency" ($M = 2.5$, St.Dev = 0.73). The total sample of respondents agreed with all of the proposed possible benefits of smart metering.

In Fig. 5, a segmentation of the given answers per statement is shown. Most of the respondents (97.7%) agree that keeping track of energy consumption is an advantage of smart metering. Moreover, a 91.1% majority of those surveyed regard as a benefit that smart meters provide accurate bills instead of estimates. Although there is a high share of respondents (63.6%) who agree that smart meters help consumers to reduce their energy bills, 29.5% of those questioned neither agree nor disagree with that. However, a larger share of respondents, 73.3%, agrees that smart meters help consumers to reduce their energy consumption. Interestingly, an 86.6% majority

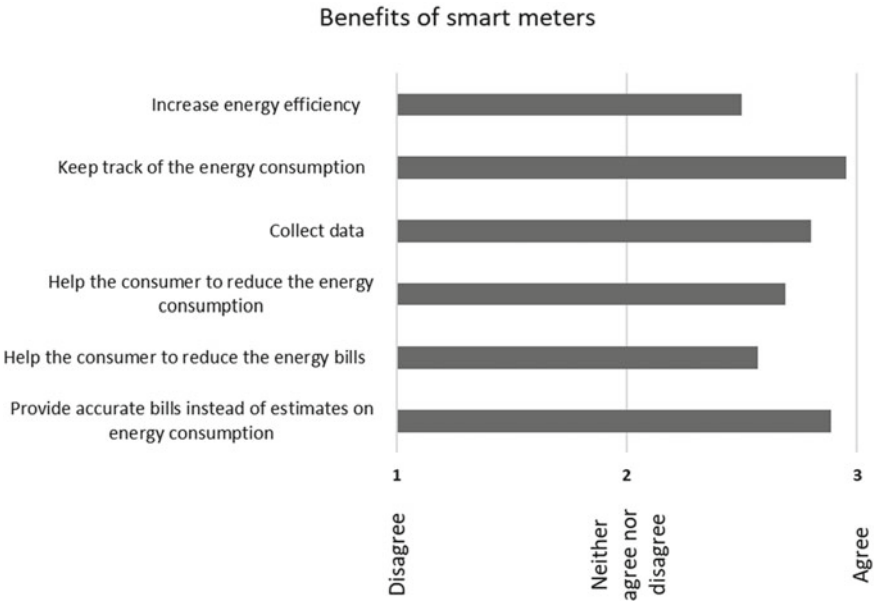

Fig. 4 Respondents' level of agreement on possible benefits of smart meters—total sample

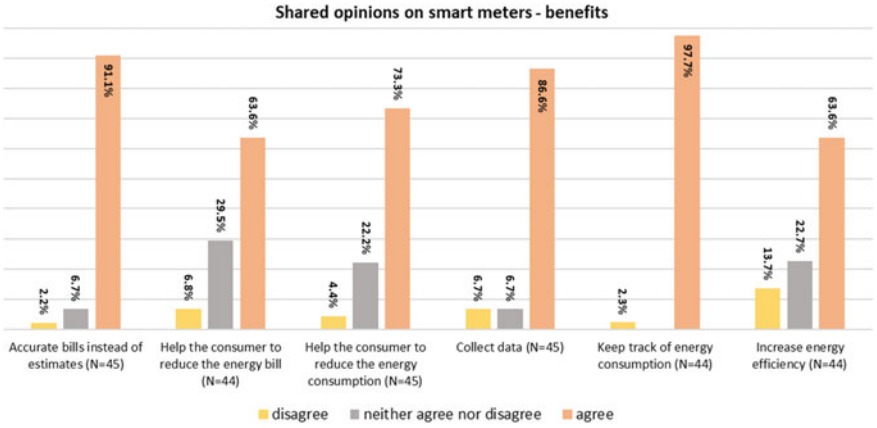

Fig. 5 Shared opinions about possible benefits of smart meters (sample size N indicated in parenthesis)

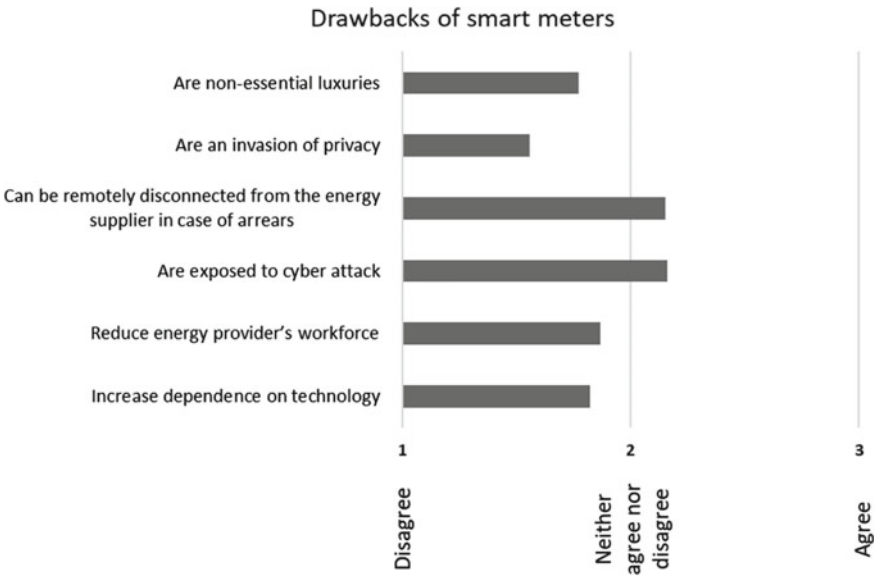

Fig. 6 Respondents' level of agreement on possible disadvantages of smart meters—total sample

regards collection of data as a benefit of smart metering. Finally, for 13.7% of respondents, it is questionable if smart meters are able to increase energy efficiency, and they stated that they disagree with this statement, whereas 63.6% of the respondents agree.

Interestingly, when it comes to possible disadvantages of smart meters, the total sample of those questioned is rather indifferent with any statement in particular (see

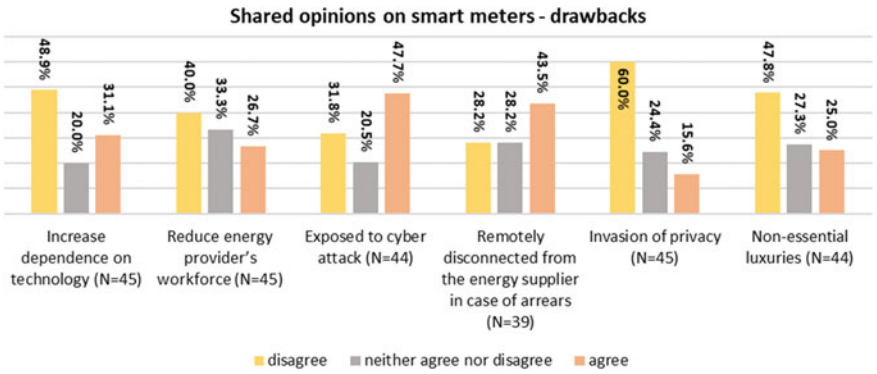

Fig. 7 Shared opinions about possible drawbacks of smart meters (sample size N indicated in parenthesis)

Fig. 6). They neither agreed nor disagreed that smart meters' possible disadvantages are that they "are exposed to cyberattack" ($M = 2.16$, St.Dev $= 0.89$) and "can be remotely disconnected from the energy supplier in case of arrears" ($M = 2.15$, St.Dev $= 0.84$). On the other hand, the total sample of participants disagreed the most with the statement that smart meters "are an invasion of privacy" ($M = 1.56$, St.Dev $= 0.76$).

When the responses are broken down (see Fig. 7), then the findings reveal that the vast majority of the respondents (60%) disagree that smart meters are an invasion of privacy. On the other hand, 47.7% of those surveyed agree that smart meters are vulnerable to cyberattacks.

Almost 47% (48.9%) of the participants disagree that smart meters increase customer's dependence on technology. Moreover, 40% of those questioned are in disagreement that smart meters reduce the number of the energy provider's personnel, whereas 33.3% stated that they neither agree nor disagree. A share of 43.5% interprets as a drawback the fact that smart meters can be remotely disconnected from the energy supplier in case of arrears. Finally, 47.8% of the respondents disagree that smart meters are non-essential luxuries.

3.5 Energy Control Readings

Respondents were asked what they would like to see on their smart meter's screen that would help them understand and better manage their energy use. A targeted list based on various information types provided to households equipped with a smart meter by different energy distributors across Europe was given, and the results are depicted on Fig. 8. The vast majority of the respondents (80.9%) would like to see any unusual energy consumption when they are away from home. On the other hand, only 25.5% would like to know the daily carbon footprint of their energy use.

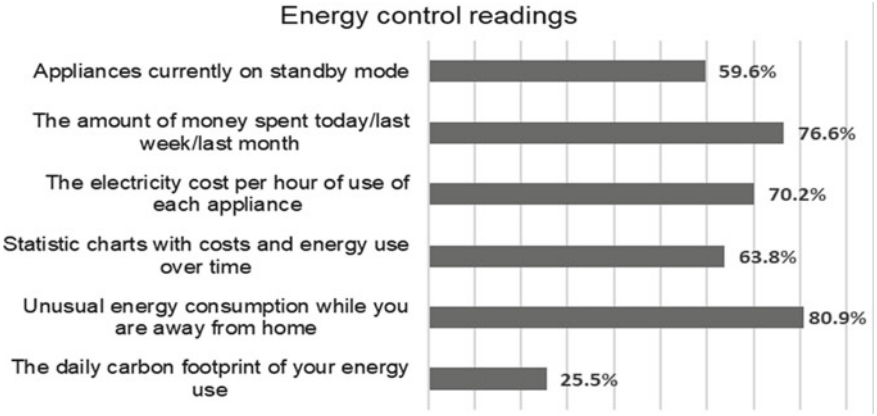

Fig. 8 Readings from smart meters that could help consumers to better understand and manage their energy use (sample size $N = 47$)

The findings have also revealed that more than three out of four respondents (76.6%) stated that seeing the amount of money spent for energy within the last period of time (today/last week/last month) would help them better understand and manage their energy use. On the other hand, less than three out of four respondents (70.2%) would like to see the electricity cost per hour-of-use of each appliance. Statistic charts displaying costs and energy use over time are preferred by 63.8% of the respondents, while almost 60% (59.6%) of those surveyed would like to see any appliances that are on standby mode.

3.6 Future Services

Respondents were asked which services, from a targeted list, they would like a smart meter to offer in the future. As depicted in Fig. 9, 78.7% of the respondents would like to have their smart meter connected with their smartphone or their personal computer. Following that, 63.8% of those surveyed would like their smart meter to show them notifications—credit alerts—in advance to help them keep track of their energy consumption. The findings have also indicated that 57.4% of the respondents would like to receive tailor-made suggestions from their energy provider on how to improve their energy behavior. Less than half of the respondents (48.9%) would like to receive information through their smart meters on market energy prices. Finally, 46.8% of those interviewed would like to be able to compare their energy consumption with that of a similar household in the neighborhood.

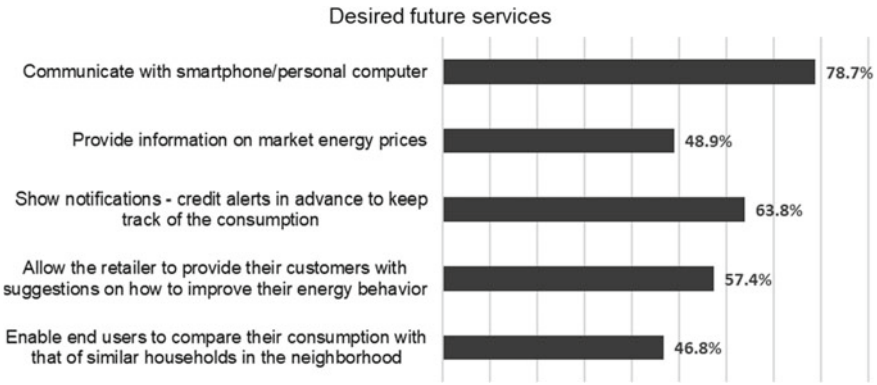

Fig. 9 Desired future services of smart meters (sample size $N = 47$)

3.7 Smart Metering Mobile Applications

Respondents were asked if they would like to have a mobile application connected with their smart meter with the aim of increasing energy awareness and savings in the house. The results are shown in Fig. 10.

The overall response to this question was quite positive, with 87.2% of the respondents to answer "Yes". Very few participants (8.5%) stated that they would not like to have a mobile application that is connected to their smart meter and aims to increase their energy awareness and help them to better control their energy use.

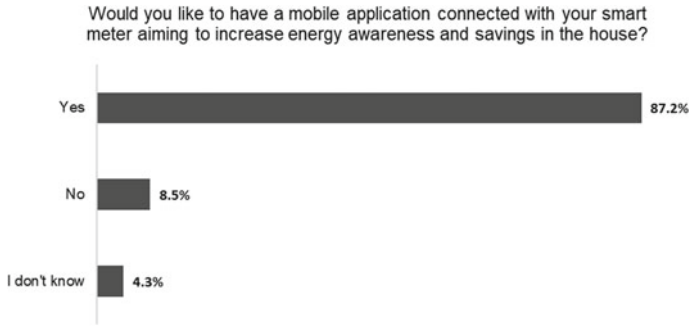

Fig. 10 Receptiveness to mobile applications connected to smart meters aiming to increase energy awareness and energy savings (sample size $N = 47$)

4 Conclusions

This survey investigated the penetration of modern smart meters in a small community of 47 well-educated employees from the automation and data-acquisition sector. All of them reside in the wider area of Ancona, Italy. It examined respondents' awareness of smart meters focused on the views they have on smart meters and explored how the metering system can help them to understand and manage their energy use better. Given the small sample size, it is unwise to rush to any hasty conclusions without further research in the form of a large-scale survey, however, some suggestive remarks could be made.

As depicted from the survey, the vast majority of the respondents have a low-to-moderate level of awareness of modern smart meters and their functions, while the presence of second-generation smart meters in their current accommodation is scarce. These could be partly attributed to the fact that the deployment of new smart meters in Italy, by the time this survey was conducted, was at an early stage. However, at the same time, it highlights the existing potential to improve the communication of smart metering and its functionalities. Wider installations of smart meters, as well as raising awareness of the benefits of smart metering, could help consumers make more informed decisions about energy efficiency and policy makers should be aware of this when creating their energy policy.

On the other hand, despite the low penetration of second-generation smart meters observed in this small community, the opinions respondents expressed about smart metering are positive. Respondents' being enthusiastic about technological advances possibly drives them toward a positive view on smart metering, but, at the same time, their knowledge of data-acquisition systems showcases the strong and weak points of this technology. According to those surveyed, the ability to track energy consumption and the resultant accurate bills instead of estimates are the most important features connected to smart meters. Moreover, neither the collection of data is seen as a drawback nor are smart meters perceived as an invasion of privacy by the vast majority of the respondents. However, almost 45% of the respondents agreed that smart meters' exposure to cyberattacks is a drawback. This latter aspect should be thoroughly investigated by the research community, authorities and relevant stakeholders to counteract threats by cyber adversaries and increase consumers' confidence in smart metering.

Smart meters can be a helpful tool for consumers to better understand their energy use. Any information about unusual energy consumption while they are away from home or energy costs displayed on a smart meter's screen are practical for consumers to regulate their energy use. Readings such as the electricity cost per hour-of-use of appliances or the total amount of money spent for certain periods of time are considered valuable. In addition, the respondents stated that in the future they would like to receive tailored tips on energy efficiency or credit alerts sent by their energy suppliers. Such information would assist them to save energy and keep their consumption between affordable limits. As the results revealed, feedback plays a key role by making energy usage visible and should not be seen only as stand-alone technological solution to provide energy use patterns. An all-inclusive approach to complementary

services is considered important in assisting energy consumer's decision making about energy efficiency.

Another important insight derived from this research is the fact that a large percentage of participants expressed their willingness to have their mobile phone or PC connected to their smart meters. This would give them the ability to check their energy consumption instantly even if they are away from their homes. In addition, respondents showed high receptiveness to mobile applications that use data collected from smart meters and aim to increase energy savings and energy awareness. This might be attributed to the age of respondents and again their enthusiasm toward technologically advanced solutions, however, society's fast pace toward digitalization supports the interconnection of appliances and paves the way for energy-efficient behaviors assisted by digital tools. Such applications could showcase the potential of smart meters to serve as an educational medium for young people, and increase their awareness of energy efficiency and reasonable energy use. Concluding, it must be noted that the successful introduction of smart meters in our communities will enhance the successful evolution of smart grids. This survey confirms that respondents are in need not only of a gauge that measures energy consumption but also of a tool that assists them to manage effectively their energy use. Designing an intelligent metering system that is attractive to consumers is key to new technological developments that change radically the way energy is managed. Ensuring the smooth transition to smart metering, governments, agencies, energy suppliers, stakeholders and other associated parties should work together to increase confidence in the benefits of smart meters and provide reassurance about areas of consumer concern. Looking to the future, technological advances and modern technologies combined with smart meters can reshape the way in which consumers will involve themselves in energy control. To this direction, smart metering should be seen as part of a greater integrated electric/communication infrastructure that is able to dynamically optimize grid operations, mobilize resources and incorporate demand response. Thus, for the vision of smart grids to be successfully realized in our communities and be fully beneficial for the consumer, smart meters should be massively deployed and, at the same time, provide feedback that facilitates consumers process of learning about energy efficiency.

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Appendix

Survey on Smart Meters

This survey investigates the penetration of smart meters at the community level. It examines the awareness on smart meters at the community level, focuses on the views people have on smart meters and explores how the metering system can help people to understand and manage their energy use better.

This project has received funding from the European Union's Horizon 2020 research and innovation program under the Marie Skłodowska-Curie grant agreement No 645677.

For more information please follow the link:
https://www.smartgems.tuc.gr

Informed Consent

Voluntary participation

- Your participation is completely **voluntary and anonymous**.

Confidentiality

- The survey is being conducted with multiple people.

Sharing of results

- The completely anonymized results can be used in scientific research.

Privacy and security of the data

- All data are stored on an **encrypted database** on a **secured server environment**.

I have read the informed consent and want to participate ☐
I do not want to participate ☐

Smart Meters

Smart meters are the next generation of electricity and gas meters capable of two-way communication. They remotely send and receive information about the amount of energy being used directly to energy suppliers and other nominated parties. They provide information to consumers on their actual consumption and bills issued by the energy suppliers are based on actual consumption and not on estimations.

Q1. What is your age?

Q1_1 under 18	☐
Q1_2 18–25	☐
Q1_3 26–34	☐
Q1_4 35–45	☐
Q1_5 46–57	☐
Q1_6 58–69	☐
Q1_7 69 and over	☐

Q2. What is your gender?

Q2_1 Female	☐
Q2_2 Male	☐
Q2_3 Prefer not to say	☐

Q3. In your current accommodation, energy bills are paid by

Q3_1 Myself exclusively	☐
Q3_2 Others exclusively	☐
Q3_3 Myself and others—shared	☐
Q3_4 Other (please specify):	

Q4. Are you aware of smart meters and their function?

Q4_1 I have no idea what they are	☐
Q4_2 I have a vague idea of what they are	☐
Q4_3 I have a general idea of what they are	☐
Q4_4 I have a good idea of what they are	☐
Q4_5 I have an excellent idea of what they are	☐

If Q4_1 applies, then move to Q6.

Q5. How do you know about smart meters? please select all that apply.

Q5_1 News and magazines	☐
Q5_2 Internet	☐
Q5_3 Energy supplier	☐
Q5_4 Home	☐
Q5_5 Word of mouth	☐
Q5_6 University	☐
Q5_6 Other (specify)	

Q6. Is there a smart meter installed in your current accommodation?

Q6_1 Yes	☐
Q6_2 No	☐
Q6_3 I don't know	☐

Q7. From your point of view, a drawback smart meters have is that they

	disagree	neither agree nor disagree	agree	[don't know]
Q7_1 Increase dependence on technology	☐	☐	☐	[☐]
Q7_2 Reduce energy provider's workforce	☐	☐	☐	[☐]
Q7_3 Are exposed to cyberattack	☐	☐	☐	[☐]
Q7_4 Can be remotely disconnected from the energy supplier in case of arrears	☐	☐	☐	[☐]
Q7_5 Are an invasion of privacy	☐	☐	☐	[☐]
Q7_6 Are non-essential luxuries	☐	☐	☐	[☐]

Q8. From your point of view, a benefit smart meters have is that they

	disagree	neither agree nor disagree	agree	[don't know]
Q8_1 Provide accurate bills instead of estimates on energy consumption	☐	☐	☐	[☐]
Q8_2 Help the consumer to reduce the energy bill	☐	☐	☐	[☐]
Q8_3 Help the consumer to reduce the energy consumption	☐	☐	☐	[☐]
Q8_4 Collect data	☐	☐	☐	[☐]
Q8_5 Keep track of the energy consumption	☐	☐	☐	[☐]
Q8_6 Increase energy efficiency	☐	☐	☐	[☐]

Q9. What would you like to see on your smart meter's screen that would help you understand and better manage your energy use? Please select all that apply.

Q9_1 Appliances currently on standby mode	☐
Q9_2 The amount of money spent today/last week/last month	☐
Q9_3 The electricity cost per hour-of-use of each appliance	☐
Q9_4 Statistic charts with costs and energy use over time	☐
Q9_5 Unusual energy consumption while you are away from home	☐
Q9_6 The daily carbon footprint of your energy use	☐
Q9_7 Other (please specify):	

Q10. What would you like a smart meter do in the future? Please select all that apply.

Q10_1 Enable end users to compare their consumption with that of similar households in the neighborhood	☐
Q10_2 Allow the retailer to provide their customers with suggestions on how to improve their energy behavior	☐
Q10_3 Show notifications–credit alerts in advance to keep track of the consumption	☐
Q10_4 Provide information on market energy prices	☐
Q10_5 Communicate with smartphone/personal computer	☐
Q10_6 Other (please specify):	

Q11. Would you like to have a mobile application connected with your smart meter aiming to increase energy awareness and savings in the house?

Q12_1 Yes	☐
Q12_2 No	☐
Q12_3 I don't know	☐

Thank you for your participation. Your input is invaluable for us.

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