05-002

ANALYSIS THROUGH SMART METERS OF THE EFFECTS OF ENERGY POVERTY IN THE CONSUMPTION OF HOUSEHOLDS.

Canals Casals, Lluc (1); Bonet, Neus (1); Cantero, Toni (2); Jiménez, Mariana Catalina (2); Ortiz, Joana (2)
(1) UPC, (2) IREC

Spain is Pioneer in implementing Smart meters in Europe, having spread them in almost all territory. Presumably, this allows to increase the knowledge in the energy consumption of households, providing information to contract the most suitable power and tariff and to adjust consumption habits. Consequently, Smart meters are said to be useful to mitigate energy poverty. As a result of this presumption, Barcelona's pilot site in the H2020 EmpowerMed Project developed a tool for diagnosis and energy audits that, from data collected through Smart meters, provides recommendations and knowledge for future decisions. The study presents the common difficulties found to get access to remote data from commercial smart meters, focusing on the particularities that affect vulnerable collectives. Moreover, the study characterizes and compares the energy consumption of energy poverty affected and non-affected households to contrast the stereotypes this collective is subjected to and to put in evidence that their consumption is lesser and that they generally contract a power and tariff more suitable to their reality than those of non-affected households.

Keywords: Energy poverty; Smart meter; EmpowerMed.

ANÁLISIS DEL EFECTO DE LA POBREZA ENERGÉTICA EN EL CONSUMO DE LOS HOGARES A TRAVÉS DE LOS CONTADORES INTELIGENTES.

España es pionera en Europa en la implantación de contadores inteligentes en la casi totalidad del territorio. Supuestamente, esto permite un mayor conocimiento del consumo de energía en los hogares y facilita la elección del factor de potencia, la tarifa a contratar e incluso ajustar sus hábitos de consumo. Por ello, al uso de contadores inteligentes se le atribuye la capacidad de mitigar los efectos de la pobreza energética. En consecuencia, el piloto en Barcelona del proyecto H2020 EmpowerMed desarrolló una herramienta de diagnóstico y asesoría energética que, a partir de los datos accesibles mediante estos sistemas, proporciona recomendaciones y el conocimiento para tomar decisiones a futuro. Este estudio presenta las dificultades habituales que hay para para tener acceso a los datos recogidos por contadores inteligentes, con especial énfasis en las particularidades que mayormente afectan a los colectivos más vulnerables. Así mismo, el estudio caracteriza y compara los consumos energéticos de viviendas afectadas, o no, por pobreza energética para contrastar los estereotipos habituales a los que está sujeto el colectivo de personas vulnerables y evidencia como su consumo de energía es menor y cómo tienen mejor ajustada la potencia y tarifa a su realidad.

Palabras claves: Pobreza energética; smart meter; contador inteligente; EmpowerMed.

Correspondencia: Lluc Canals Casals lluc.canals@upc.edu"

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1. Introduction

Energy is essential for life (Niu et al., 2013) and, therefore, although not explicitly included in the declaration of human rights by the United Nations, it is reasonable to count on it because it is an implicit attribute of other stablished rights, such as the sustainable development right or the right for non-discrimination (Tully, 2006).

In 2015, the same United Nations targeted to "ensure access to affordable, reliable, sustainable and modern energy" by 2030 in its seventh sustainable development goal (Jensen, 2021), which reaffirms the idea that energy is, as a matter of fact, a human right.

This seventh goal raise the awareness that, effectively speaking, not everybody has access to energy and, as a consequence, these people might be in risk of poverty or social exclusion. To fight the effects of poverty in the field of energy, many countries have appropriated the concept of energy (or fuel) poverty (EP), which they mostly consider comes from low incomes, energy-inefficiency and high fuel prices (Galvin, 2019).

Nonetheless, H2020 EmpowerMed project (www.empowermed.eu/), which is the frame of this study, understands EP from a wider perspective and defines it following the idea that EP is "the situation in which a household lacks a socially and materially necessitated level of energy services in the home" (Bouzarovski, 2014). In fact, EmpowerMed empowers people (focus on women) to take action against energy poverty in six Mediterranean pilot sites (Albania, Barcelona, Croatia, Marseille, Padova and Slovenia) following different strategies:

- Household visits: Where a trained energy auditor visits a household to observe, analyse and suggest saving possibilities of different kinds.
- Collective assemblies: Where EP affected people comes to share their difficulties and particular cases to find support through collective knowledge that is gained in each session
- Do-it-yourself building capacity: To build self-developed solar panels, to understand and take maximum profit of the use of smart meters...
- Workshops: On possibilities of savings with small investment equipment or tips, on building renovation funds to follow-up the possible grants appearing in each site, help people to get them and to analyse whether these funds focus on more necessitated collectives or not.

However, energy, as a whole, covers several types of sources. In a residential framework it is generally linked to the general supplies that a household has, which are water, electricity and gas or petrol. Although, historically, gas and biomass have been mostly used for heating and cooking, electricity is becoming the one having more impact in households' day-to-day activities, as it is the only source capable of being used for lighting, heating, cooking and cleaning; reason why its coverage is close to 100% in contrast to other energy carriers in OECD countries (Canals Casals, Tirado-Herrero, Barbero, & Corchero, 2020). Consequently, it makes sense to question if the access to electricity can also be considered a human right and which are the considerations to achieve this goal (Löfquist, 2020).

Yet within electricity premises, EU directives ask for massive deployment of smart meters to state members (European Union, 2009), but, up-to-now, few countries have implemented them actively (Tractebel, 2019). Spain is one of these countries, with a 98% deployment, which allows the monitorization of practically all households (Comision Nacional de los Mercados y de la Competencia, 2019). This is very useful when deploying monitoring strategies in EP projects, as these devices are currently installed and storing the consumption data for the last years so there is no need to enter any house to install nothing, which facilitates the participation of people.

These are the principal reasons why the H2020 EmpowerMed project considered the use of smart meters to provide advice in electricity tariffs and consumption behaviour in the pilot in Barcelona, as well as other sites where this was possible (Marseille and Padova).

The pilot in the Metropolitan Area of Barcelona (AMB) took the leading role in the smart metering strategies by becoming the first one to work with them. This pilot site counts with the participation of three entities: Catalonia Institute for Energy Research (IREC), Universitat Autonoma de Barcelona (UAB) and Associació Catalana d'Enginyeria Sense Fronteres (ESF). However, it is important to note that the activities in this pilot site are done taking advantage of the ongoing activity of the Alliance against Energy Poverty in Catalonia (APE from its acronym in catalan), of whom ESF is member and spokeperson.

The AMB, a dense and unequal urban region, contains 36 municipalities (including the city of Barcelona) and more than 3.2 million inhabitants. It is the eighth largest metropolitan region in Europe containing some of the most densely populated urban districts of the whole EU. In the years 2016-2017, 24.7% of the metropolitan population was at risk of poverty or social exclusion and 5.3% suffered severe material deprivation. Data from the city of Barcelona indicate that poverty affects women disproportionately as they have lower salaries and pensions, more precarious jobs and lower levels of self-perceived health. Regarding EP, it has been estimated that, for the year 2016, 105,800 households declared inadequate temperatures at home during winter; 93,500 spent more than 10% of their income on domestic energy; and 47,300 spent more than 3% of their income on domestic water (Tirado-Herrero & González Pijuan, 2020).

This study presents the results of the first 4 months of Empowermed's monitoring campaign in the pilot site of the AMB, presenting the steps followed to collect data from smart meters and comparing the results from EP affected and non-affected people.

2. Methodology

This section briefly describes the electricity sector to present the main actors and the communications with the final user/consumer. Then, it describes the electricity bills structure and where to find saving possibilities.

Once done, it presents the process followed to collect data from smart meters. Note that data is classified into two groups of people, affected and non-affected by EP. It was possible to clearly identify EP affected volunteers because they come from the collective assemblies organized by the APE with the collaboration of the EmpowerMed project (APE, n.d.). Non-affected by EP volunteers were reached through general e-mailing and social media dissemination strategies.

Finally, an analysis of the data from the energy consumption and peak power demand grouped by these two categories is done through statistical means. Note that, although the steps defined in section 2.2 do count on individual reports, this study presents only aggregated data for the sake of individual data protection.

2.1 Spanish framework

In Spain, as in most markets, the activities in the electricity sector can be classified into four major groups:

- The generation is meant for companies that generate electricity for self-consumption or sell to the market or directly to other users. and it is liberalized, although its entrance is "not-so-easy";
- The transmission of electricity is regulated by the state and operated by Red Eléctrica Española (REE), a private company with public participation, as the country's Transmission System Operator (TSO). Under this role, REE oversees large scale / high voltage energy transmission and control of the grid stability;
- The distribution of electricity, understood as the local distribution of electricity (DSO from Distribution System Operator) from high voltage to household, is also regulated by the State but the operation is distributed regionally among private companies. So far, 5 DSO control 90% of the Spanish territory.
- The supply and commercialization billing the final consumer. Electricity commercialization is almost fully liberated, except for small-sized consumers who can opt for a service under regulated prices.

Domestic consumers in Spain can choose their electricity supplier (commercialization companies) since the market completed its liberalization process more than a decade ago. In non-regulated contracts, companies can offer all types of tariff structures and price ranges, limited only by the market dynamics. This study focuses on small-sized consumers with contracted power up to 10 kW and voltage levels under 1 kV. For them, the Spanish government, through the Real Decreto 216/2014, reserved the possibility to opt for regulated companies –*Comercializadoras de Referencia* – that must offer the service under government controlled prices (Gobierno de España. Ministerio de Industria Energía y Turismo, 2014). Most of these companies are subsidiaries from large utilities that also participate in the commercialization of electricity under non-regulated prices, which tends to be more lucrative: it is estimated that a customer under a regulated contract will spend 28.2% less than with non-regulated options for the same energy consumed (Gobierno de España. Comisión Nacional de Mercados y Competencia, 2020). Thus, there is little incentive to inform customers about the regulated option known as the Voluntary Price for Small Consumers or PVPC for its Spanish acronym.

The PVPC englobes three tariff options: 2.0 A, 2.0 DHA and 2.0 DHS. All of them are conformed by two cost components, energy and contracted power, plus the applicable taxes (added value tax and special tax on electricity). When applicable, a rental cost is also charged to those users that do not own their house energy meter (Real Decreto 216/2014). The differences among the three tariffs relies on the energy cost component (euros per kilowatt-hour, €/kWh) as depending on the tariff different pricing periods are considered throughout the day, summarized in the table 1.

Table 1. Defined pricing periods for the three PVPC tariffs

PVPC tariff	2.0 A	2.0DHA		2.0 DHS*		
Pricing period	Unique	Peak	Valley	Peak	Valley	Super-valley
Summer	All day	13h-23h	0h-13h 23h-24h	10h-14h 18h-22h	8h-10h 14h-18h 22h-24h	0h-8h
Winter	All day	12h-22h	0h-12h 22h-24h	10h-14h 18h-22h	8h-10h 14h-18h 22h-24h	0h-8h

*In weekends and holidays all hours are considered to be Valley.

In general terms, PVPC tariffs are considered to be the cheapest option for domestic consumers as all costs are regulated (Antepara Lopez de Maturana, 2020). Moreover, the Spanish legislation forbids companies to charge for extra services that are beyond those described in the previous paragraph. For households suffering from EP, these tariffs offer an extra advantage, as being under this scheme is a requirement to access the *Bono Social*, a social aid that reduces the consumer's energy bill in a percentage according to their vulnerability level. Consumers with highest vulnerability get a 40% discount over their electricity bill while the rest of vulnerable consumers have access to 25%. It is important to note that the vulnerability levels are defined by a series of requirements imposed by the Spanish government, including a threshold for the household's annual income (Gobierno de España. Ministerio para la Transición Ecológica y el Reto Demográfico, 2020).

However, having access to the *Bono Social* does not always mean that vulnerable households are able to cover their energy needs and face its costs without cutting expenses from other basic needs. This is why consumers suffering from EP with or without social aids are often motivated to reduce their energy costs, especially with strategies that require little or no investment. One of such strategies consists on selecting the tariff that is more adequate to their energy profile and adjusting its contracted power to their demand needs.

In the AMB (and in almost all Catalonia), consumers can access their data through the website of *e-distribución* (https://zonaprivada.edistribucion.com), the regional DSO. Among other information, it is possible to observe the user's maximum demanded power and to download the hourly-electricity consumption, which can be later used to calculate the more adequate tariff for each particular case as hourly electricity prices are publicly available through the market operator site (www.esios.ree.es).

By selecting Time-of-Use (ToU) tariffs – 2.0 DHA or 2.0 DHS - consumers also have the option to modify their habits and shift their consumption to low-priced periods further minimizing costs. In the near future, PVPC users would not have other choice than adapting to a three-period ToU tariff as a new Circular 3/2020 (Gobierno de España. Comision Nacional de los Mercados y de la Competencia, 2020) will rule out previous PVPC tariffs by mid-2021. This new tariff will also allow users to select two power values to be applied in two different periods. Nonetheless, this new format was not considered for this article as by the time of the study all described PVPC tariffs were still in place.

2.2 Data collection

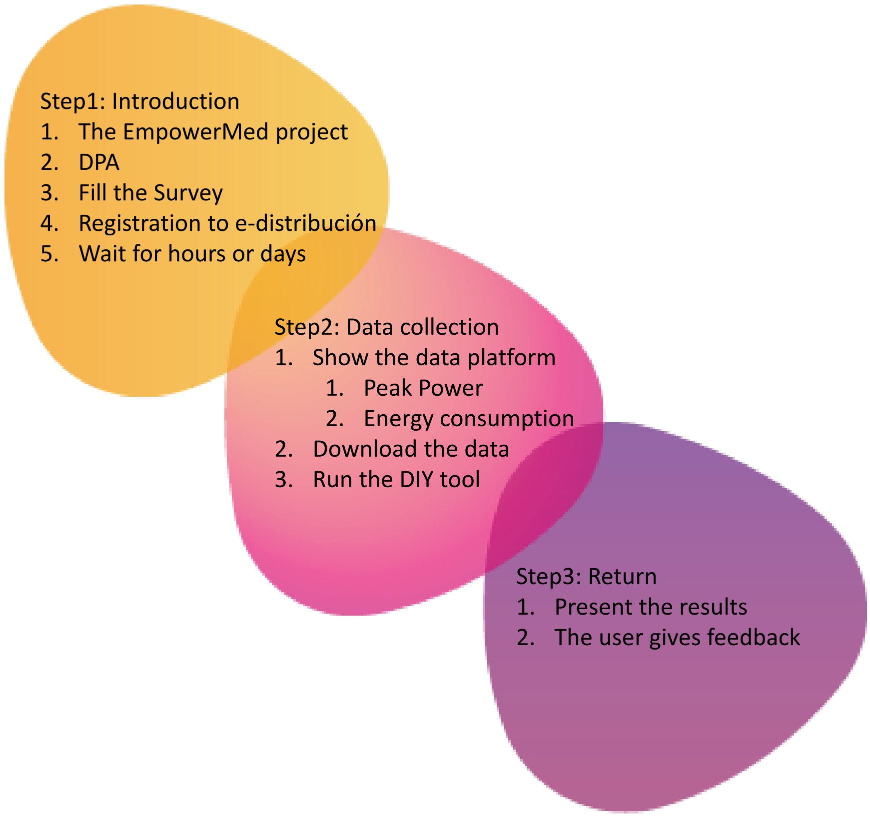
The process of collecting data consists of three main steps that can be divided in sub-steps, as shown in Figure 1. In this process there are some slight differences between affected and non-affected by EP volunteers because the first group participate in the collective assemblies while the latter does not:

Step 1. Introduction: It begins with an introduction to the project including an explanation of the amount of time and sessions required from volunteers until the process ends. All their questions and doubts are clarified in this stage. A data protection agreement (DPA) that indicates that all data collected in the process will be only used for the purpose of the EmpowerMed project and will be treated anonymously is presented for their signature. Then, volunteers must fill a survey asking for personal information plus details about their household, electricity tariff and knowledge on the electric sector. This process is done through an online questionnaire designed using Google forms for the purpose of this project (Canals Casals, Cantero, et al., 2020). Afterwards, volunteers must register to the *"e-distribución* platform, the online website for accessing smart meter data, as explained in section 2.1. Note that, in order to gain access to the data concerning energy usage and other relevant information from the smart meter, volunteers need to be the contract or be granted permission by the contract holder (a family member, the owner of the household, etc.) to access the platform using their credentials. Since the validation of the registry to *e-distribución* platform takes the DSO between hours and up to five days, it is agreed to meet with the participants some days after to ensure that the registration is completed and their data can be obtained.

Step 2. Data collection: It starts by showing volunteers all the information they can retrieve from the *e-distribución* platform whenever they need to, for instance, the maximum power demand per month (peak power), hourly energy usage or information of their electricity tariff. To do so, it is needed to log into the platform with their user and password and explain where and how to find the relevant information. Additionally, the hourly electricity consumption data is downloaded going back in time as much as possible (it is aimed for at least one year of data). Once their data is downloaded, it is analysed with a Do-it-yourself (DIY) software tool programmed in Python, which also uses information from the questionnaire. The tool generates a report indicating potential cost savings that can be achieved. It is considered a DIY action because participants can reach the aforementioned savings in case they follow the recommendations given in step 3.

Step 3. Return: This step relays on the return given to the participants. In the first place, members of the project go through the individual report with each participant explaining the results obtained by the DIY tool and the steps to follow in case they want to reach the projected cost savings. In the group affected by EP, volunteers are invited to share their feedback to the rest of participants in the collective assemblies with the purpose to engage new volunteers in the project. Non-affected participants do not take part of the collective assemblies, so they do not provide communal return and the process ends in step 3.1. Note that the project is still ongoing and results presented in section 3 count on few participants.

Figure 1: Steps used to collect data



2.3 Data analysis

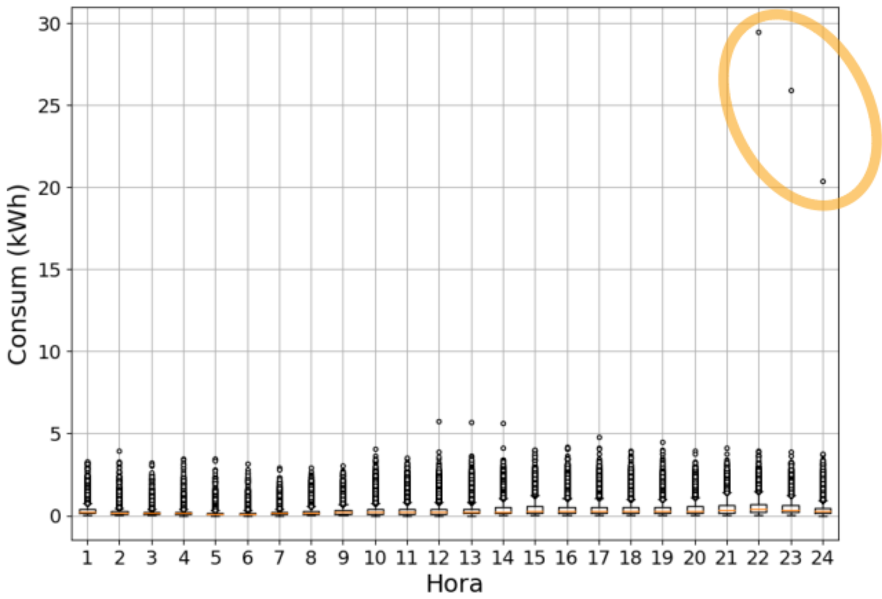
The analysis done in this study is based, mostly, in the results extracted from the monthly power demand and the consumption files downloaded in step 2 from the distribution company website.

This study counts on data from 6 volunteers affected by EP (3 women, 2 men, 1 not comfortable with woman/man definitions) and 51 volunteers non-affected by EP (36% woman, 60% man, 4% not-specified). However, it is important to note that, from these 51 non-affected volunteers, only 37 volunteers (72%) could provide energy consumption data because they were the contract holders. Almost a 30% were no contract holders and, thus, uncapable to access their consumption data. This undesirable situation is relatively common when people is renting or irregularly living in a flat (which is an unfortunate reality in many cases of EP vulnerable people) and the electricity contract is linked to the owner of the household.

The amount of *csv files downloaded per person depend on the process used for the download (either using the "massive download" option given by the platform or going month by month downloading the consumption files) and the length of the period analysed, as several users had recently moved in. For this reason, the number of files went from 6 to 24 *.csv files per person. These files indicate, day by day and for each hour, the amount of energy registered by the smart meter and if this data is real or estimated. Using Python programming, all days are grouped so the comparisons use the same year period of time. Then, some data cleaning is done for statistical purposes, as punctual values were clearly out of range (as it can be seen in figure 2). Note that all these discarded values were identified as "estimated" in the downloaded files.

Once data is reliable, the analysis continues with the study of the consumption through temporal series in weeks for the whole year separating affected and non-affected collectives to facilitate the comparison among them. Similarly, a comparison between affected and non-affected groups is done in the average consumption per day and, additionally, for the 24 hours of a day. This allows for a comparison of the "trends" in daily habits of energy consumption.

Figure 2: Boxplot of the consumption per hour of all household grouped showing out-of-range values to be discarded



The comparison continues analysing the concentration of consumption of households in peak or valley periods (Table 1) to preliminary evaluate the goodness of changing to hourly discriminated tariffs (DHA/DHS) in contrast to whole-day fixed price tariffs (A).

Similarly, the study analyses the differences in consumption for winter/summer seasons individually and for both collectives.

Finally, crossing the hourly consumption data per person with the reference cost of electricity from ESIOS, as described in section 2.2, it is possible to determine the economic savings expected by the change from fixed to discriminated in the tariffs contracted by consumers. Similarly, as Spanish legislation severely charges the power contracted, an economic analysis is done by adjusting the power contracted to the maximum demand per month during the period analysed.

3. Results section

This section will follow the organization presented in section 2.3 for data analysis.

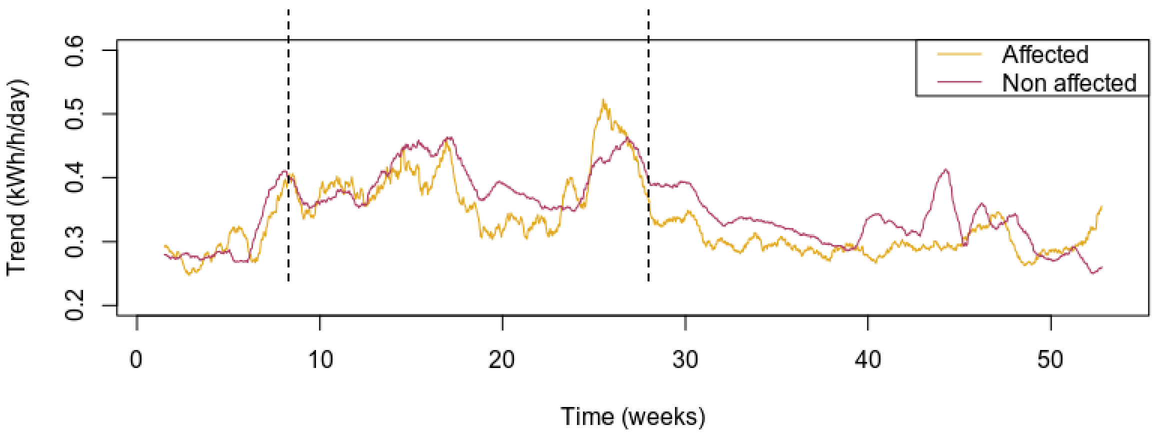
The analysis of the survey showed that the distribution of people living in EP affected houses is unevenly distributed, having 3 households occupied by a single person, 1 by a couple and 2 cases with 4 and 8 occupants. On the other hand, the distribution for non-affected results are more balanced with an average of 2.85 inhabitants per household. Moreover, it seems that EP is gender affected, as only 33% of cases had a man as contract holder and 66% were women or people non-comfortable with male/female definition while these numbers invert when dealing with non-affected volunteers

The average rating in a scale from 0 to 10 of the thermal comfort for EP affected volunteers is of 7 and 3,8 for summer and winter respectively, while for non-affected these ratings correspond to 6,8 and 7, which shows that EP affected tend to be cold in winter. In fact, only 16% of affected households have a gas heating system, while 66% use less efficient portable heaters (electric or butane) and the rest had no heating system at all. This numbers change dramatically when looking at non-affected households, where only an 11% of them use portable heaters while the rest have building heating installations (gas/air) and even centralized and programable systems.

In terms of building electric equipment, most representative differences between non-affected and affected households come from the electric cooking (32% versus none respectively), microwaves (94% vs 50%), dishwashing machine (76% vs 16%), (television (1,6 vs 2,2 items per household), personal computers or laptops (2.3 vs 1.3), and tablets (1 vs 0.3). For the rest of equipment, such as fridges, washing machines or mobile phones, numbers are similar in both groups.

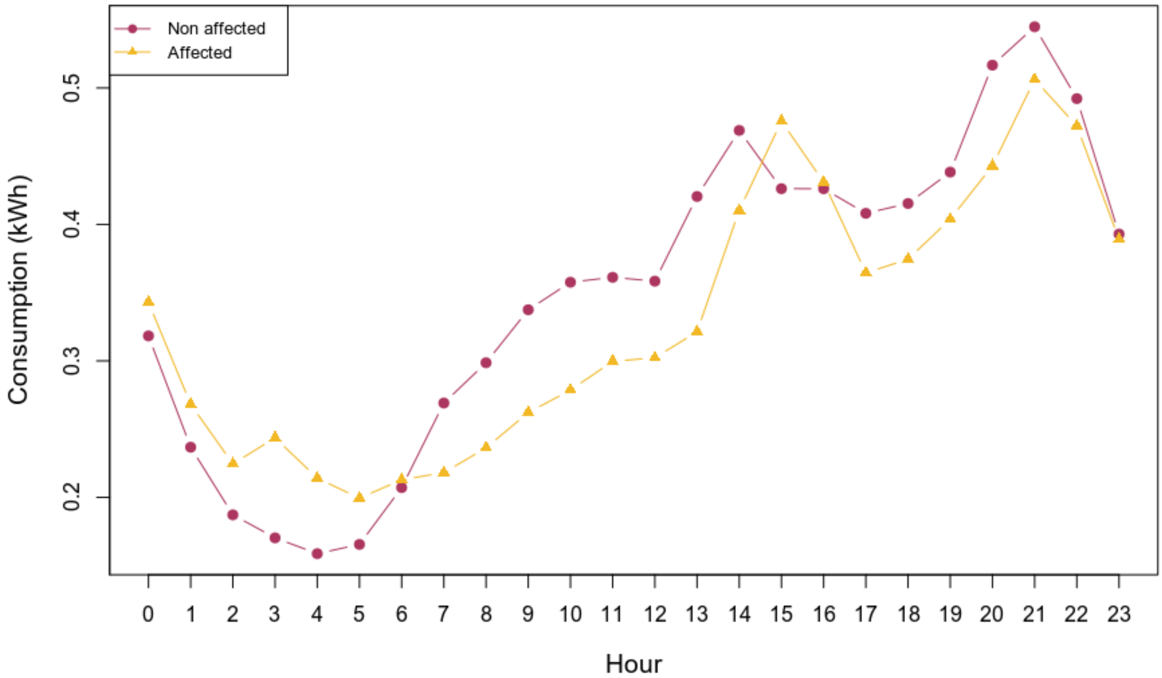
The temporal series (Figure 3) should be read as a continuous timeline that begins on September 2019 and ends on September 2020. Results indicate that, in general terms, both collectives behave similarly although vulnerable groups (affected collective) tend to consume slightly less energy. Note that the presented consumption is the average hourly consumption per day. That is, from week 8 to 28 the average consumption per day is around 0.4kWh per hour (coinciding with the winter/summer periods for the hourly discriminated tariffs marked with two vertical dashed lines in Figure 3) while since week 30 it decreases to 0.3 kWh per hour. However, there are two specific issues to remark. The first one is the peak of consumption in winter, which is higher for the collective affected by EP and might be attributed to heating. The second aspect to highlight is that the non-affected by EP group of people tends to present another peak during summer time (seeks 40 to 50).

Figure 3: Temporal series for the collectives affected (yellow) and non-affected (purple) by EP.



Results show that, generally speaking, most of the electricity consumption in households is concentrated in the afternoon and evening (since 13h to 23h). Figure 4 shows how during night/resting hours (0-6) the consumption is lower than during day/active hours (7-23). Moreover, Figure 4 shows that there is a peak between 14 and 15h (assumed to be the cooking/lunch period). Note that COVID might have some impact in these results as many people is currently at home when they would not be in other conditions.

Figure 4: Average hourly consumption from a typical day for affected and non-affected users



When separating the consumption in affected and non-affected by EP groups, Figure 4 shows that during night/resting hours, their consumption is relatively higher in comparison to the non-affected collective while during most of the day/active hours it is the other way around and the consumption stays generally below. As most of affected by EP volunteers specifically indicated in the questionnaire that they tend to consume as few electricity as possible this allows to extract two preliminary conclusions: To assume that the lower consumption during daily/active hours is due to lower use of electricity with the purpose to reduce the energy demand while the higher consumption during resting hours from affected by EP households could be attributed to the uninterruptable consumption of less efficient appliances (i.e. fridges), although this latter assumption should be validated with precise information from the households. This flatter demand curve for EP affected household is in line with what literature has reported so far (Gouveia & Seixas, 2016). Note that this flatter curve shows that the day-to-day efforts done by EP affected to consume less electricity during the day are more significant than they seem by just reading the numbers, as there is an inherent higher base consumption that they cannot avoid.

Converging the previous analysis, Figure 5 shows how, effectively, from a yearly perspective, EP affected households do tend to consume less than non-affected households (6%). Note that this difference is even higher when considering the surface of the household and the number of persons living in it, which is 8% lower. Separating the year in two seasons according to regulation and coinciding with the hour-adjustment days, summer goes from the last Sunday of March to last Sunday of October (7 months) and winter is considered the rest of the year (5 months). This situation is especially visible during summer with a 10% consumption decrease, while winter consumption is 2% higher for EP affected households coinciding with higher heating needs. Note also that, for affected households, the consumption during the 5 months of winter is similar to the consumption during the summer period (7 months), in line with what was appreciable in figure 3.

However, what is most significant is the hourly distribution of energy consumption. See (Figure 5) how non-affected users consume substantially more energy (7%) during peak hours than on valley hours than affected users (2%). Remember, from table 1, that valley hours go from 22h to noon, so more than twice the time defined as resting period in Figure 4, meaning that in only 6 hours (6h to 12h), affected households counteract the effect of the higher base consumption visible from 0h to 6h in the night.

Figure 5: Yearly consumption (right) and average consumption per year by persons and surface of the household ()

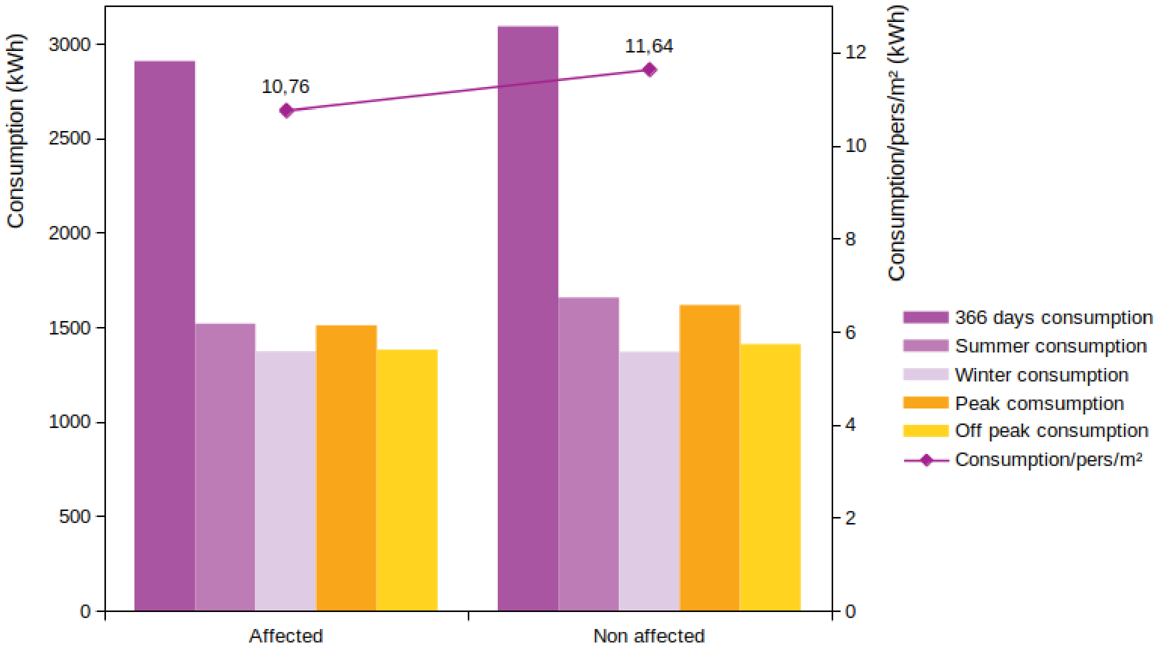
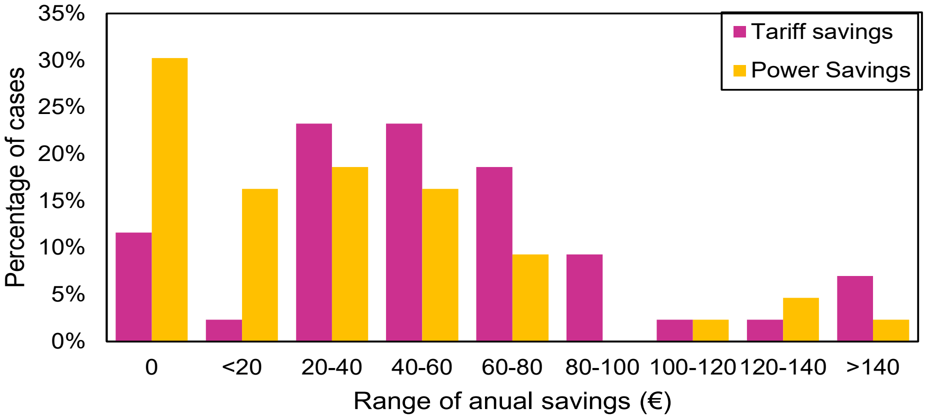


Figure 6. energy savings from tariff and power demand



In terms of economic savings, the results in Figure 6 indicates that all the households (except the cases already in DHA) benefit of having the DHA tariff (with hour discrimination) instead of using the A tariff (non-discriminated). The average savings for a tariff-change from non-discriminated to hourly discrimination is around 67€ per year in both groups. Note that, in the case of this study, 50% of the affected volunteers already had this tariff while only a 5% of the participants from the non-affected collective had it. These results indicate that seriously affected users that get involved in the APE do take actions and have higher knowledge of the energy reality, in contrast to what another study indicates for the region of Valencia (Spain) (Calero-pastor, Pellicer-sifres, Lillo-rodrigo, & Alfonso-solar, 2021).

When analysing the contracted versus demanded power, results highlight that economic savings do reach a value around 36€ per year (46€ per year only considering cases where there are savings) by just adjusting the current power contracted to their maximum ever reached in a month. This substantial saving is reached due to the high cost (4 €/kW per month) of the contracted power in Spain and to the fact that 31% of participants have a contracted power exceeding their maximum demand by more than 1 kW and 38% equal or less than 1 kW. Only 31% of volunteers have a contracted power adequate to their needs. Higher savings could be achieved with a more aggressive approach going below the maximum registered and incurring into punctual electricity cuts due to the thermomagnetic switch trip or changing the consumption habits to reduce the simultaneous use of appliances, avoiding to increase the maximum peak above the limit.

Finally, from all the participants, 56.6% of people had never consulted data from the smart meter, 50% did not knew the difference between energy commercialization and distribution companies and 45.6% of people did not even know what was a tariff counting on hour discrimination.

4. Conclusions

This study highlights that, effectively, people affected by EP (specially women) are more concerned on the household expenses in terms of electricity, maybe because of their implication with the APE, and gives much more importance to prevent using devices when not absolutely needed to pursuing a decrease in their energy consumption. However, the savings from reducing consumption are relatively low in contrast to the effort to do so because the weight of electricity demand in the electricity bill is about 1/3 of the total cost.

Positively, there are two effective and easy ways to achieve substantial cost reductions (11%) by adjusting the contracted power and changing to an hourly-discrimination tariff.

Nonetheless, in order to properly adjust the contracted power and to know the tariff that best fits individual consumption needs, it is important to have access to the data from the smart meter and only 27% of the participants were capable to do so because of their particular situation on the supply contract. This is a huge impediment when trying to use smart meters to fight energy poverty.

Another issue to improve would be the registration time required to access the data. This slow response, which might take one week or more, delays the process of analysis and the willingness to participate or to do this analysis on your own.

Additionally, as the smart meter reads information constantly from the household, it would be interesting for users to be able to read their maximum power demand more often than once per month, especially with the upcoming PVPC tariff scheme that will accept different power values depending on the period of consumption. Right now, having just one value per month, it is impossible to do such differentiation. However, this goes against the direct benefits of electricity companies. Recently, a new platform involving all DSO was implemented in Spain, helping to replicate this kind of studies for all the country.

Finally, this exercise proves that collective assemblies do empower people to act and save money.

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