SOCIALRES

Report on behavioural aspects of engagement with social innovation projects

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WIP Renewable Energies coordinates the SocialRES project.

The consortium involves 13 partners in 9 European Countries.The logos of the partners cooperating in this project are shown below and information about them is available in this report and at the website: www.socialres.eu

This report has been written by Sofía Mulero and Alejandro Hernández from CARTIF, and Ivan Petrov from TCD. The authors thankfully acknowledge the valuable contributions from all project partners.

Disclaimer

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List of Abbreviations

Acronym	Description
CG	Control Group
DCE	Discrete Choice Experiment
DH	District heating
ERSE	Entidade Reguladora dos Serviços Energéticos
EU	European Union
EV	Electric Vehicle
HVAC	Heating, Ventilation and Air Conditioning
ID	Identity Document
INE	National Statistics Institute
kVA	Kilovolt-Ampere
kW	Kilowatt
LED	Light Emitting Diode
PPs	Percentage Points
REE	Red Eléctrica de España
RES	Renewable Energy Sources
VDEW	The German Electricity Association
WTA	Willingness to Accept
ZINB	Zero-inflated negative binomial regression

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1. Introduction

Current environmental challenges have triggered a major transformation of energy markets in recent years. Current policies focus on energy efficiency and sustainability, and are committed to technological progress for the sustainable use of energy sources. As an essential part of this transition towards clean energy, the concept of energy democracy is gaining ground. In this scenario, social innovation projects in the renewable energy sector such as Cooperatives, Aggregators and Crowdfunding Platforms come into play, allowing the consumer to play a more active role.

SocialRES aims to close the non-technological research gaps that prevent the widespread adoption of social innovation business models and services in the European energy sector, by creating a better understanding of socio-economic, socio-cultural, socio-political and gender aspects related to energy. This document presents the main results of the analysis focused on the behavioral aspects of energy consumption, in order to better understand how social innovations favor more active consumption behaviors. The research identifies, on the one hand, behavior characteristics in consumers to show the differences between users belonging to social initiatives and ordinary users, the main behavior patterns and their relationship with the business model in which they are involved. On the other, it analyses how different groups of consumers make decisions to get involved in social initiatives, to better understand the social or cultural aspects that have a greater influence when deciding to get involved.

1.1 Structure of the document

The document is structured into 4 main sections:

- **Section 1. Introduction** introduces the document and explains the structure of the sections that comprise it.
- **Section 2. Behaviour analysis using quantitative data** collects the main results associated with the analysis of the behavior of users belonging to different social initiatives, based on electricity consumption data and a series of characteristics collected in a questionnaire.
- **Section 3. Behaviour analysis using surveys** analyses attitudes about commitment to social innovation in the energy sector, through a series of surveys answered by members of social initiatives and the general public.
- **Section 4. Behavioural aspects of engagement with social innovation projects** combines the information obtained in the two previous sections to draw the main conclusions of the study.

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2. Behaviour analysis using quantitative data

This section summarizes the main results obtained in the activities focused on the behaviour analysis using quantitative data. Its main goal is to find out the differences and similarities among energy use-related behaviour of users involved in different social initiatives, which correspond to Energy Cooperatives, Aggregators and Crowdfunding Platforms. This analysis has a quantitative component, which will be complemented by other qualitative information, coming from a set of questionnaires performed within the same activity, and the work developed in the set of activities related to the behaviour analysis using surveys (Section 3).
To this end, case study participants have provided electricity consumption data from the monitoring systems installed within the framework of the project, or already available.

A better understanding of consumer demand and use of electricity is needed to drive energy efficiency improvement measures and promote reduced electricity consumption. The analysis of different types of data, such as quantitative information from household-level monitoring systems, to households properties and occupants characteristic can help determine a set of common patterns and associated typical behavioural features, considering also the different business models in which they are involved: from energy cooperatives, to aggregators or crowdfunding platforms. This brings the opportunity to identify similarities and differences between engaged and ordinary users in the renewable energy sector.

2.1 Methodological approach

Electricity consumption data measured at the household level can provide relevant insights on the final use of energy. Users can be segmented into groups based on similarities in their electrical profiles. Nevertheless, combining this information with other characteristics may help to better explain this behaviour.

This section describes the proposed four-step methodology to obtain consumers segmentation. Through the combination of information monitored at the household level and a questionnaire created to collect significant characteristics of the environment and the behaviour of the occupants, an in-depth analysis is performed in order to identify a set of profiles that represent the possible ways in which participants use energy throughout the day.
The four steps are described below. The main aim of the quantitative data analysis is to discover knowledge from the household level consumption data.

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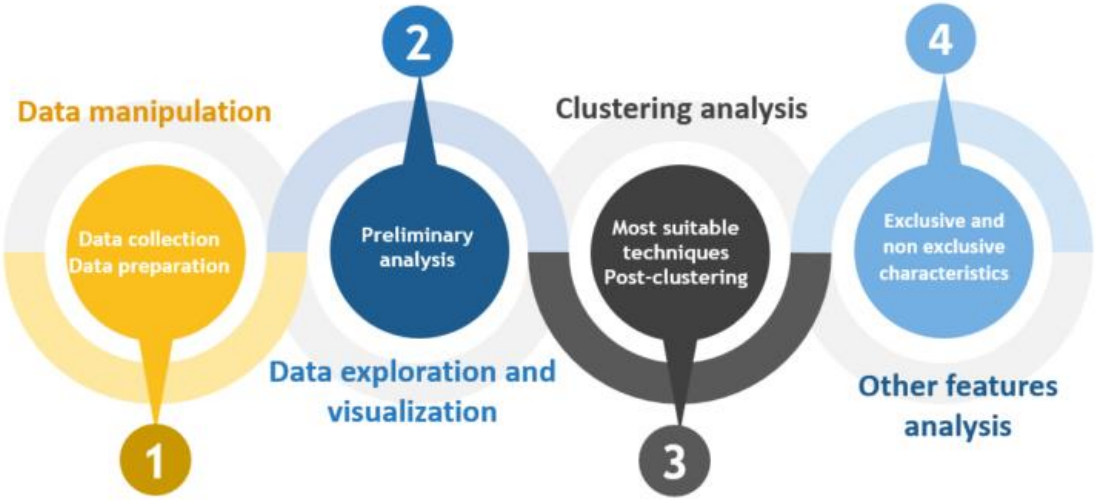

Figure 1: Methodology.

1. Data manipulation

First of all, the case studies that can provide data are identified. A collaborative approach is then followed to collect information not only on electricity consumption, but also to engage the participants through a questionnaire. Both data sources are linked by means of an identification, which makes it possible to work by anonymizing the information.

Once the information is collected, it is processed for further use. This step includes the detection and cleaning of erroneous values, the imputation of missing data to improve its reliability and quality, and the calculation of additional parameters. The degree on completeness of the monitored information differs in the monitored system used, being less if is necessary to install smart meters (some case study participants initially had no monitoring system at home).

2. Data exploration and visualisation

An exploratory data analysis was performed in the selected case studies to determine the strategy to follow, considering the way in which the consumption curves of the participants change over time. An average user profile per season is calculated, considering also the type of day (weekday or weekend). The study then focuses on the analysis of the continuity and evolution of working days profiles throughout the year, for the available periods. Other individual statistics of the participants are extracted to complete the picture. Similarly, the data from questionnaires are visualised to extract the most significant similarities and differences between the participants in the case studies.

3. Clustering analysis

Participants are grouped and classified to obtain representative curves per cluster. This analysis is performed on seasonal average profiles per household. Based on the information on electricity consumption by season and type of day, and using classification algorithms (K-means and hierarchical clustering mainly), users from case study providers have been grouped with those with similar characteristics, in terms of electricity consumption. The results obtained in relation with the number of groups and the appearance of the curves differ according to the period considered. Then, the previous segmentation by seasons has made it possible to detect a greater number of different profiles. Additionally, this seasonal division has allowed a greater use of the information collected: those participants who present a representative number of monitored days in the selected period have been

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considered in that time slot, and not directly discarded for not having completed the full monitoring period.

4. Other features analysis

The information from the questionnaires is combined with the corresponding consumption curves obtained, in order to better explain the characteristics associated to them. On the one hand, the common features of the group are considered. On the other, an attempt is made to find out which of all the characteristics are most representative, programming different algorithms. The results reveal that the characteristics that determine to a greater extent belonging to a group, considering the aspects collected in the questionnaire are not always the same. This common strategy is followed for the analysis of all the case studies that provide information from the questionnaires.

2.2 Case Studies participants

The most suitable case studies were selected for this analysis. The information required included the electricity consumption of the members of the different initiatives, with the aim of expanding it with their participation in the study by filling out a questionnaire that would help establish the contextual characteristics. Some of the case studies required installing smart meters to collect data for subsequent quantitative behavioural analysis (LCF, Coopernico and GoParity members). For this purpose, the same smart meter model was selected, considering as a necessary condition to be supported by a cloud-based platform where this information should be stored for a period. This installation was led by case studies, who were also responsible for obtaining explicit end-user consent for the study. The case studies followed this process and were in contact with members if problems were detected. Following the requirements included in the GDPR, once the information was collected, the duly anonymised data was provided. An ID was assigned to each study participant, which facilitated the relationship of the consumption profiles with the information collected in the questionnaire. This questionnaire was created to better contextualise the collected monitoring information, retrieving three types of information: available equipment, preliminary ideas about heating habits and behavioural change of the participants.

2.2.1 Data inputs

The electricity consumption datasets or profiles consist of daily records with 24 values each. A monitoring period was agreed for those case studies that should install smart meters (April 2020 to March 2021), considering it would be interesting to analyse a complete year or four season periods for the same period of time. Another consideration was that it would be desirable to have representation of the three social innovations studied in SocialRES (Cooperatives, Aggregator and Crowdfunding platforms), and also to be able to compare the results of the same type of initiative from different locations. The other case studies that provided information selected a different time period for different reasons: in the case of IEner, a problem was detected and information started being collected later than expected (only 6 months are available). For EnergÉtica and Tractebel different periods were selected, in order to have information before and after the pandemic situation.

The questionnaires were designed to better contextualise the members' behaviour in relation to electricity consumption. Case studies shared the questionnaire with members

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using Google Forms. The questions were designed by CARTIF, and shared with case studies responsible in English. These surveys were subsequently received by members in their native language. The participants were identified using the ID already assigned, and the results were mainly collected by case studies. The final responses were translated afterwards, and additional processing procedures were necessary as some nuances were detected in the implementation of the questionnaires, to make them more appropriate in the context of each case study.

Table 1 shows a summary of the number of valid responses (consumption curves in energy terms and associated questionnaire), for the main periods analysed in each case study.

Table 1: Summary participants by Case Study.

	Case Study	Country	Own meter	Monitoring period	Years	Number of participants				Questionnaire
						S1	S2	S3	S4	
Cooperative	LCF	DE	No	04/2020 - 03/2021	1	16	16	16	13	Yes
	Coopernico	PT	No	04/2020 - 03/2021	1	25	20	22	23	Yes
	EnergÉtica	ES	Yes	01/2019 - 06/2020	1.5	86	87	87	87	Yes
	IEner	FR	Yes	03/2021 - 09/2021	0.5	29	29			Yes
Aggregator	Tractebel s1	RO	Yes	01/2019 - 08/2019	0.5	137	139		135	No
	Tractebel s2		Yes	07/2019 - 06/2020	0.67	176	181	173	172	No
	Tractebel s3		Yes	01/2019 - 06/2020	1.5	31	36	34	33	No
Crowdfunding	GoParity	PT	No	04/2020 - 03/2021	1	43	36	39	35	Yes

S1, S2, S3, S4: Season 1, 2, 3, 4, respectively.

The structure of the questionnaire is as follows:

Equipment
Participants were asked to indicate the list of home appliances available in the home, the main energy systems used for heating and cooling (if any) and the amount of non-electric heating energy consumption spent per year. It should also be indicated if there is any type of storage system and some specific characteristics of their dwelling (type of household, year of construction, number of inhabitants and total floor area).

Heating habits
The main aim of this section is to collect common habits regarding the use of energy for heating. Then, a better idea of the level of comfort participants have at home could be created, and linked with specific actions in their daily routine.

Behavioural change
The third section was created to cover two types of information: first, specific details about their electricity contract (power supply capacity and contracted rate type); secondly, if they have ever worried about improving this contract and conditions in the

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home, by applying some measure of energy efficiency or adopting changes in their regular behaviour.

2.2.2 Control group definition

The general population has been characterised using data from relevant institutions, reports and national and European databases. The main aim is, on the one hand, to be able to create a set of representative consumption profiles to be compared with the monitored information coming from the smart meters installed in users homes, on the other, to have reference values for the other contextual aspects considered in the questionnaire, which may help to better describe the main behaviour characteristics behind each found profile.

This information is computed using the same methodological approach considered for the case studies information. In the following subsections, the main characteristics of the control groups created for the five affected countries are presented.

2.2.2.1 Electricity profiles

In the following subsections, a brief description in provided for the electrical profiles defined in each of the countries.

Germany

In the case of Germany, data coming from Stadtwerke Witzenhausen GmbH is used for the control group profile [1]. This organization is the regional provider in Werra-Meissner in Germany. They have published some standard load profiles for households, trade and agriculture according to the VDEW (the German Electricity Association). The VDEW represents more than 750 utilities in Germany, including most energy trading companies, and cover all levels of the value added chain. The dynamic standard load profile H0 of the VDEW is used for households and has been selected for the study (year 2018). In the case under analysis, all the customers from LCF have a single rate contracted.
The following figures show the profiles calculated for the different types of days and times of the year.

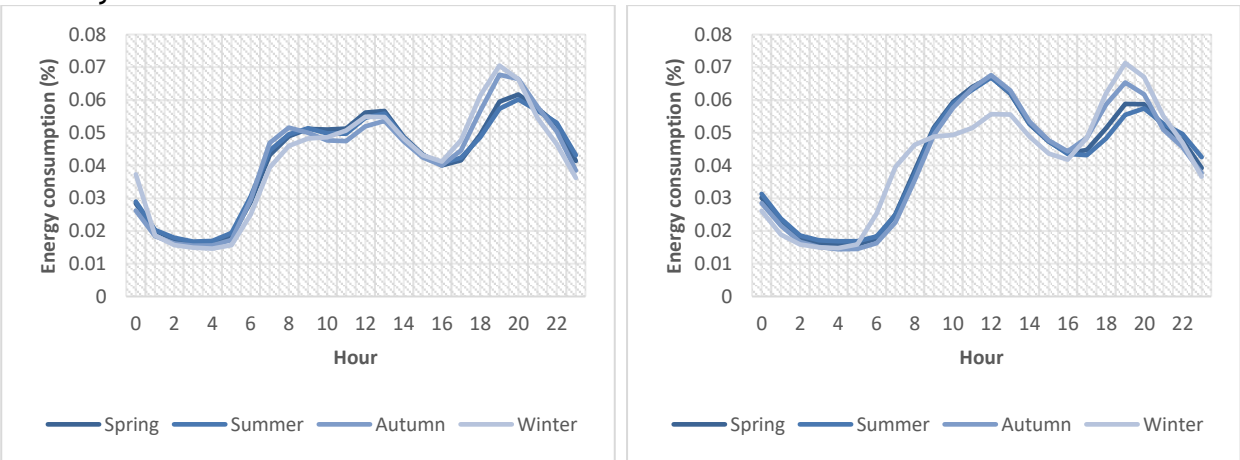

Figure 2: Average electricity consumption profiles calculated in the case of Germany for weekdays and weekends, respectively.

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Portugal

Control group in Portugal has been defined considering the information from the Entidade Reguladora dos Serviços Energéticos (ERSE) [2]. According to the acquisition of electrical energy in normal low tension (BTN) some profiles are found, which are class A, class B, class C, IP, MP and UPAC. However, since this project focuses on residential houses, the class C profile has been selected as the control group for Portugal. Users belonging to profile class C have the following characteristics: power less than or equal to 13.8 kVA; annual consumption less than or equal to 7,140 kWh. In 2017, the average annual consumption of the BTN class C profile was 1,681 kWh.
The following figures show the profiles calculated for the different types of days and times of the year.

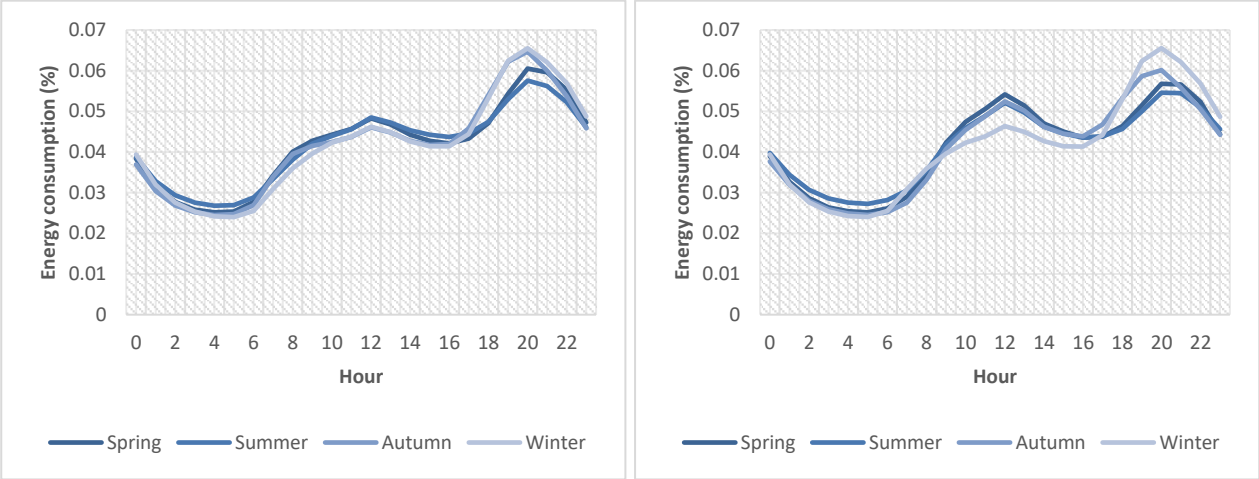

Figure 3: Average electricity consumption profiles calculated in the case of Portugal for weekdays and weekends, respectively.

Spain

According to the responses received by the questionnaires and the information facilitated by the case study provider in Spain (EnergÉtica), consumers from the Spanish case study (only residential participants) have contracted different rates: 2.A, 2.1A, 2.0DHA and 2.1 DHA access (only residential participants). These rates were available until 01/06/2021, as will be explained later.
The regulation until 01/06/2021 in Spain established 6 access rates for the range of domestic use: 2.0A, 2.0DHA, 2.0DHS, 2.1A, 2.1DHA ad 2.1DHS, where:

- 2.0A and 2.1 A, where associated to a single access toll throughout the day
- 2.0DHA and 2.1 DHA offered hourly discrimination in two periods, with two access tolls according to the consumption band
- 2.0DHS and 2.1 DHS rates were associated to hourly discrimination in three periods, with three access tolls.

Red Eléctrica de España (REE) [3] publishes average profiles every year depending on the expected behaviour, and these final coefficients are used in the study to select the curves of the control groups. These consumer categories can be associated with a different profile. Considering the previous explanation, the profiles of the control group selected for Spain are based on two of the groups found: Type A profiles (for 2.0A and 2.1A rates), and Type B profiles (with 2 schedules). The final coefficients published by REE are

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calculated for each dependent month on measured data, and represent the information to be used. These coefficients represent the percentage of the annual total consumed in each hour. To know the energy consumption in that hour, it would be necessary to multiply the value of the coefficient by the total annual consumption. As the analysis is carried out considering differences between seasons during the year, a profile has been calculated for spring, summer, autumn and winter, separately. In the following figures, the average electricity consumption profiles calculated in the case of Spain for weekdays and weekends are shown.

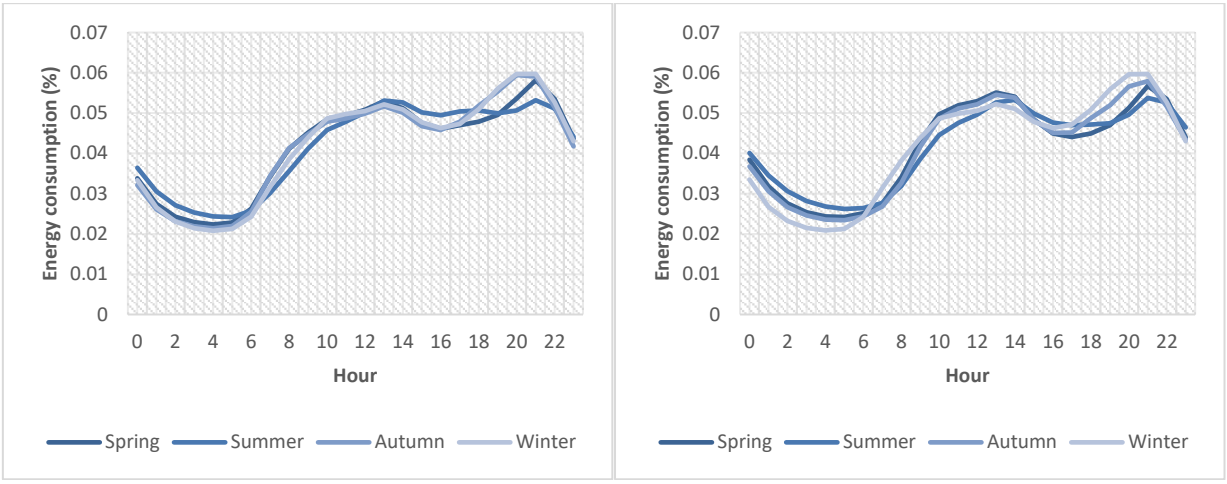

Figure 4: Average electricity consumption profiles calculated in the case of Spain for weekdays and weekends, respectively (type A profile).

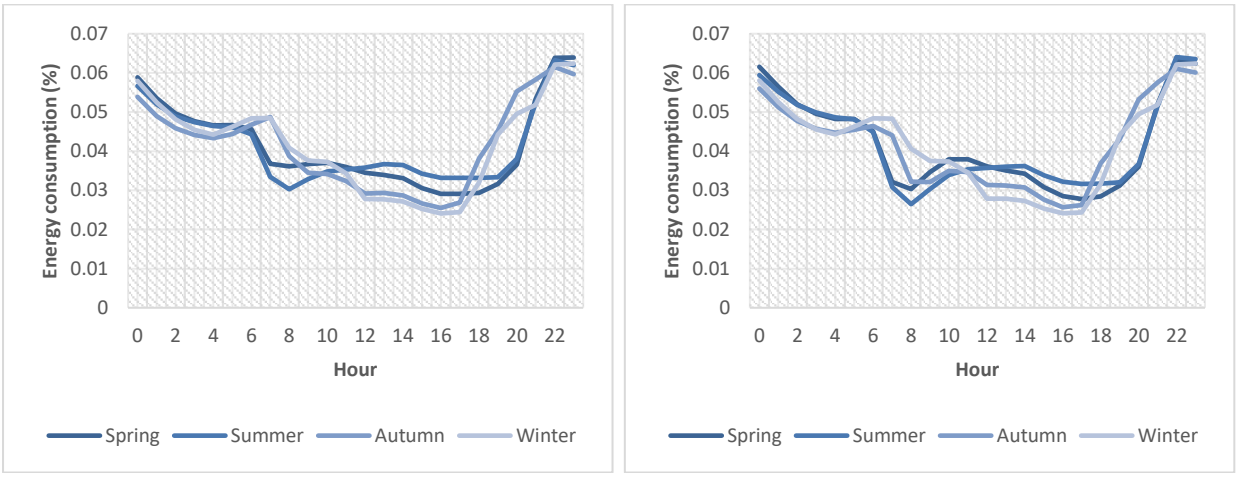

Figure 5: Average electricity consumption profiles calculated in the case of Spain for weekdays and weekends respectively (type B profile).

In June 2021, the 2.0A, 2.0DHA, 2.1A and 2.1DHA access tolls were unified into a single rate, 2.0 TD. This new tariff counts 3 terms of energy and 2 of power.
For domestic use, there are some main changes in access rates: access rates 2.0 and 2.1 become a single toll 2.0TD, and power can be contracted according to the time slot. The different types of hourly discrimination are reformed, giving way to a single hourly discrimination of Rate 2.0TD. The time bands of the new electricity tariff are divided into 3 periods. With access tolls 2.0 and 2.1 there was only one power term (the same for power throughout the day), but with the new 2.0TD electricity tariff we can choose two different powers, one for the off-peak period and the other for the peak.

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Romania

In the case of Romania, the profiles have been extracted from Distribuție Energie Electrică Romania [4], dedicated to the distribution of electricity in Romania. The profiles found are associated to two different locations, Transilvania Nord and Muntenia Nord. It may be noted that in this case, the information is provided considering two different periods of the year: the warm season (associated to months from April to September), and the cold season (months from October to March). Additionally, these data are divided considering rural and urban areas.

The following figures show the profiles calculated for the different types of days and times of the year.

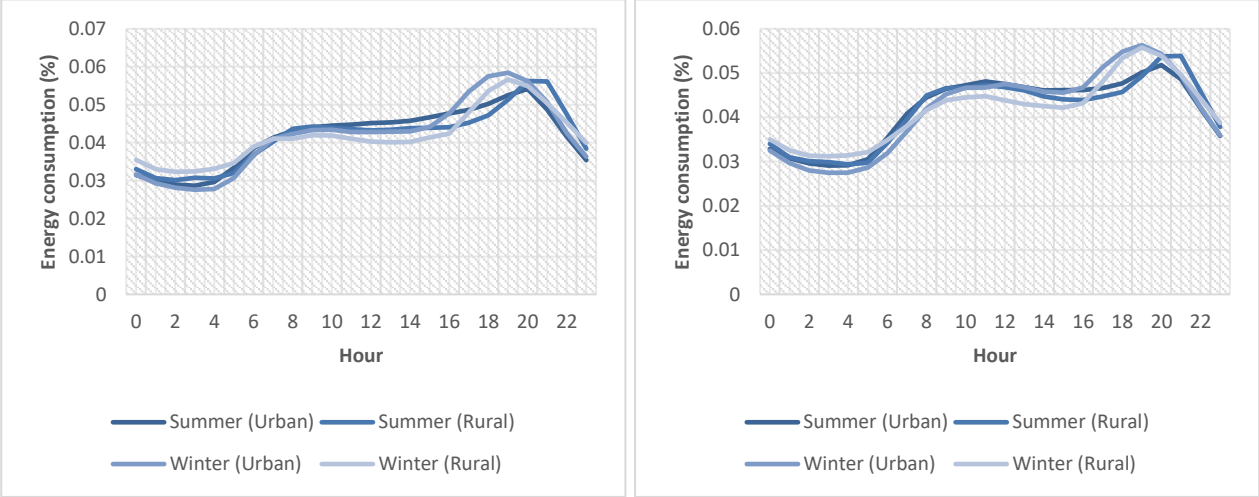

Figure 6: Average electricity consumption profiles calculated in the case of Romania for weekdays and weekends, respectively (Transilvania North zone).

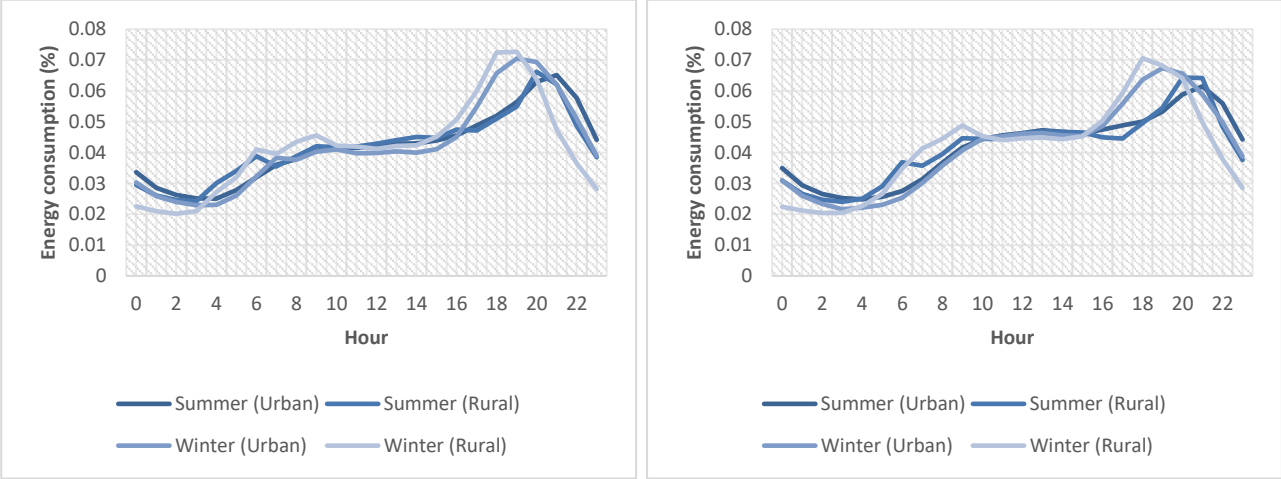

Figure 7: Average electricity consumption profiles calculated in the case of Romania for weekdays and weekends, respectively (Muntenia North zone).

France

The French control group has been defined considering information from Enedis Open Data [5]. The selected profiles was RES1.This Profile refers to residential sites delivered at low voltage, with a subscribed power less than or equal to 6 kVA. The following figures show the profiles calculated for the different types of days and times of the year.

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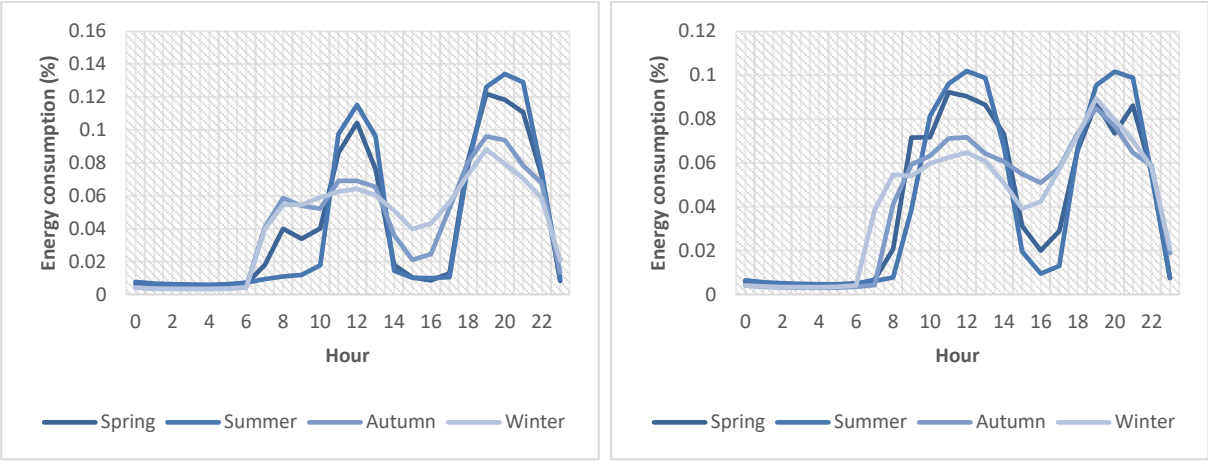

Figure 8: Average electricity consumption profiles calculated in the case of France for weekdays and weekends, respectively.

2.2.2.2 Questionnaire features

In this section, average characteristics of the case studies related to different aspects are defined, aligned with the values required in the questionnaire. Information comes mainly from European and National databases, in addition with European reports [6] [7] [8] [9]. Table 2 shows the obtained results.

Table 2: Summary statistics for CG by country.

	Average	DE	PT	ES	FR
Dwelling and equipment features					
Type (proportion)					
House	33.80			33.80	
Detached house	13.90			13.90	
Semi-detached house	19.90			19.90	
Flat	66.10			66.10	
Others	0.10			0.10	
Total floor area (m2)					
Multi-family	121.14	148.43	104	119.15	112.98
Single-family	90.44	83.41	104	112.3	62.05
Year of construction (proportion)					
< 1945	20.18	25.24	16.43	12.84	26.72
1945-1969	23.03	34.12	21.34	18.62	18.04
1970-1979	15.52	14.90	14.12	17.41	15.66
1980-1989	13.11	10.97	15.93	13.07	12.45
1990-1999	11.84	7.68	15.60	14.27	9.81
2000-2010	12.76	5.17	15.60	17.28	13.00
> 2010	5.62	1.92	0.97	6.51	4.33
Number of inhabitants (proportion)					
1 person	26.10			26.10	
2 people	30.30			30.30	
3 people	20.60			20.60	
4 people	16.60			16.60	
5 people	4.50			4.50%	
6 people or more	1.90			1.90	

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Home appliances (number)					
Refrigerators	1.02	1.12	0.96		0.99
Televisions	1.16	1.49		1.00	0.99
Washing machines	0.64	0.84	0.94		0.98
Computers	0.77	0.87	0.66	0.73	0.81
Dishwashers	0.54	0.67	0.41		0.54
Dryers	0.24	0.39	0.19		0.33
Freezers	0.43	0.69	0.48		0.60
Main heating and cooling systems (proportion)					
Electricity	23.38	3.00	28.34		38.80
Gas	49.52	69.80	32.15		46.60
Biomass	7.50	13.80	7.40	2.80	6.00
DH	5.70	9.80	0.00		7.30
Central fuel	7.00			7.00	
Central gas	6.60			6.60	
Individual fuel	4.80			4.80	
Electric accumulator	14.00			14.00	
Other	12.30	3.60	32.01		1.30
Behavioural change					
Annual major renovation rate (proportion)	0.83	1.49	0.00	0.08	1.75
Electricity consumption					
Yearly consumption (kWh)	4097	3695	3293	4046	5354

2.3 Main results

This section shows the main results obtained after the analysis. The objective of the first part is to offer details about the set of representative profiles found after the analysis of the data offered by the participating case studies. The second, focused on the comparison of consumption profiles of users involved in social initiatives and ordinary users, collects the list of the profiles with greater similarity with the control group established for the country, or in other words, the expected profile for an ordinary user.

2.3.1 Pattern discovery and user segmentation

The pattern discovery activity has as its main objective to find a small set of profiles that faithfully represent all the possible ways in which a participant uses energy throughout the day. Following the methodology already described, the consumption data has been clustered, allowing users to be segmented based on a series of established groups. In this way, users are grouped according to the profiles that best describe the way in which they demand electricity. The number of groups found for each case study is different, even by season. A detailed analysis of consumption profiles for the different seasons has been carried out, seeking continuity of profiles throughout the year. In some cases, differences have been detected in the amount of profiles obtained according to the season, some of them due to very different behaviour on the part of some users, others due to having consumption information for a very small number of days. Table 3 collects the final number of profiles obtained for each season of the year, by case study. Likewise, it is indicated if the profile of ordinary consumption or control group has been found in the results, so that there is at least one group of consumers who have a similar behaviour.

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Table 3: Summary of number of profiles per Case Study.

Case Study		Number of profiles							CG profile
		S1	S2	S3	S4	S5	S6	Final	
Cooperative	LCF	4	3	4	3			**3**	Yes
	Coopernico	5	5	5	5			**5**	Yes
	EnergÉtica	7	9	7	7	7	7	**7**	Yes
	IEner	3	3					**3**	Yes
Aggregator	Tractebel s1	6	5		5				Yes
	Tractebel s2	6	6	6	6			**6**	Yes
	Tractebel s3	3	3	3	4	4	4	**3**	Yes
Crowdfunding	GoParity	5	5	5	5			**5**	Yes

This activity of discovering patterns of electricity consumption is completed in the next stage with the analysis of other characteristics (questionnaire features). The complete sequence of the analysis is as follows:

1. Features analysis per cluster & season: this allows finding a series of exclusive and non-exclusive characteristics for each of the groups found for the different seasons of the year in each of the case studies.

2. Profile analysis through seasons: the continuity of the electrical profiles throughout the different seasons of the year is found, and subsequently the characteristics associated with said groups are analysed. It should be noted here that some specific details may be lost over the different periods of the year (unshared characteristics), and then this information must be carefully compared in order to extract elements in common.

3. Similar profiles features comparison (all case studies): those profiles with similar electrical behaviour in the different case studies are contrasted and compared, in order to discover similar and different characteristics related to the specific forms of use of energy.

Figure 9 reflects the details of these three steps followed in this last step of the analysis focused on the analysis of other characteristics, according to the electrical profiles.

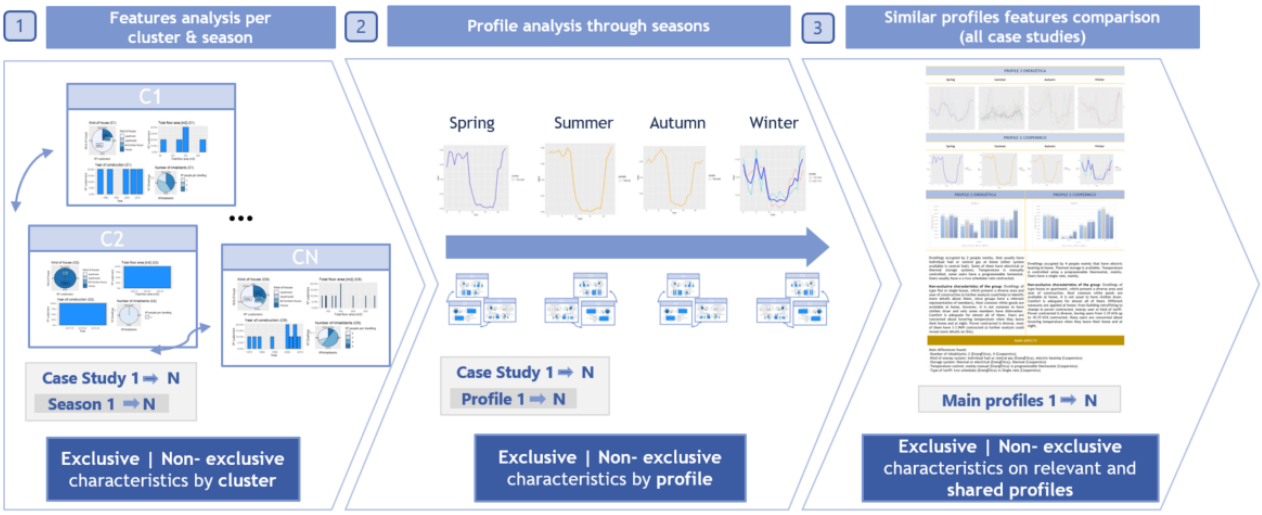

Figure 9: Features analysis main steps.

The following table shows the results obtained in the questionnaires for the complete groups of each case study (prior to their segmentation).

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Table 4: Summary statistics for case study.

	Average	Cooperative				Crowdfunding
		DE (LCF)	PT (Coopernico)	ES (EnergÉtica)	FR (lEner)	PT (GoParity)
Dwelling and equipment features						
Type (proportion)						
House	36.05	56.25	25.00	32.95	58.62	30.00
Flat	59.74	37.50	66.67	64.77	37.93	70.00
Others	6.01	6.25	8.33***	1.14	3.45***	8.33***
Total floor area (proportion)						
Multi-family >100 m^2	58.32	50.00	58.30		57.2	66.67
Single-family < 100 m^2	41.68	50.00	41.70		42.8	33.33
Year of construction (proportion)						
< 1945	6.30	6.25	16.67	2.27	29.20	0.00
1945-1969	14.63	18.75	25.00	14.77	18.60	0.00
1970-1979	16.39	12.50	8.30	14.77	17.52	30.00
1980-1989	11.68	12.50	8.30	15.90	10.45	10.00
1990-1999	19.22	37.50	16.67	22.72	8.85	0.00
2000-2010	27.69	12.50	16.67	21.59	12.90	60.00
> 2010	5.30	0.00	16.67	4.54	2.48	0.00
Number of inhabitants (proportion)						
1 person	12.77	18.75	13.00	19.31	20.00	0.00%
2 people	17.02	6.25	25.00	54.54	28.00	25.00
3 people	14.63	6.25	25.00	14.77	12.50	12.50
4 people	24.43	12.50	25.00	10.23	20.00	50.00
5 people	8.54		12.00	1.13	3.50	12.50
6 people or more	0.00			0.00		
Home appliances (proportion)						
Refrigerator	100.00	100.00	100.00%	100.00	97.00	100.00
Washing machine	71.55	100.00	100.00%	97.73	93.10	87.50
Dishwasher	67.26	100.00	87.00%	68.18	72.40	100.00
Dryer	18.30	25.00	48.00%	10.23	20.70	37.50
Oven	91.93	87.5		88.30	97.00	100.00
Kitchen hob	83.90	81.25		95.45	62.50	75.00
LED lighting	82.95			82.95		
At least one white good	100	100	100	100	100	100
Main heating and cooling systems (proportion)						
Electricity	25.42	6.25*	50.00*		13.70	20.00*
Gas	15.17	50.00	25.00		10.34	20.00
Biomass	9.22	6.25	15.00	6.82	6.80	15.00
DH	0.04	12.50%	0.00			0.00
Central fuel	10.23			10.23		
Central Gas	18.18%			18.18		
Individual Fuel	13.64			13.64		
Individual gas	51.14			51.14		
Electric accumulators	14			14.00		
Other	23.75	6.25**	35.00****			30.00****
Storage systems (proportion)						

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Thermal	14.76	25	8.34	5.68		20.00
Electrical	26.32	0	8.33	11.36		0.00
No storage	81.82%			81.82		
Heating habits						
Temperature control type (proportion)						
Manual	47.76	31.25	60.00	39.77	58.60	60.00
Programmable thermostat	26.33	68.75	22.00	4.55	44.80	10.00
Lowering temperature habit (proportion)						
At night	56.42	87.50	40.00	68.18	75.00	30.00
When away from home	48.65	15.50	60.00	59.09	65.00	60.00
Community handles it	2.27			2.27		
Never	12.50	37.50	0.00			0.00
Adequate comfort (proportion)	81.04	100.00	66.67	87.50	-	70.00
Behavioural change						
Type of contracted rate (proportion)						
Single rate	70.61	87.50	62.00	45.45	65.50	87.50
Two schedules	25			37.50	34.50	12.50
Three schedules	38		38.00			
N/A	14.78	12.50		17.05		
EEMs applied (proportion)						
Change electricity tariff	47.05	31.15	60.00		43.70	50.00
Change energy use times	4.17	12.50	0.00		31.25	0.00
Change HVAC system	27.50	12.50	50.00		6.25	20.00
Building retrofitting	30.00	12.50	30.00		18.75	30.00
Change LED lighting	6.25	6.25				
Lower supply power capacity	37.50		45.00		6.25	30.00
Solar-thermal panel	15.00		10.00			20.00
eV (proportion)						
Home charging	6.25	6.25				
No home charging	12.25	12.5				
Electricity consumption (number)						
Yearly consumption (kWh)	1590.68	1789.97	1365.57	1814.63	4019.65	1443.37

*Electricity used for cooling. ** Oil Heating. *** Office. ****Electric heating

To conclude this section, specific details of some of the main patterns discovered are provided below as an example. It should be noted that it has not been considered relevant to include all of them, but rather those that are most representative, either because of their similarity to the defined control groups, because they have very specific and marked characteristics, or because they are shared among several of the study cases located in different geographical locations.

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Table 5: Summary data for Pattern 2.

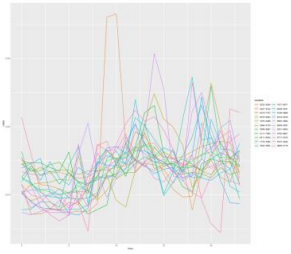
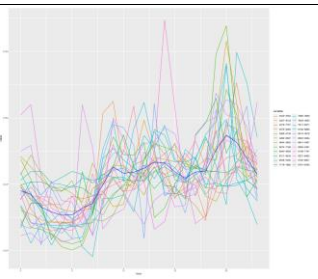
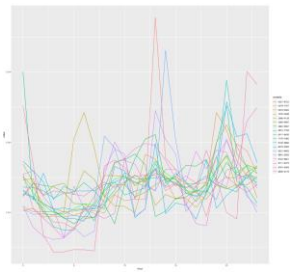
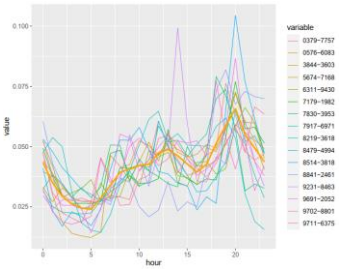
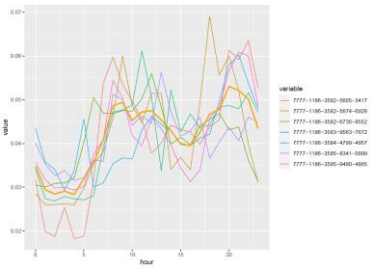
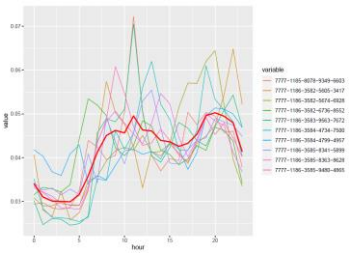
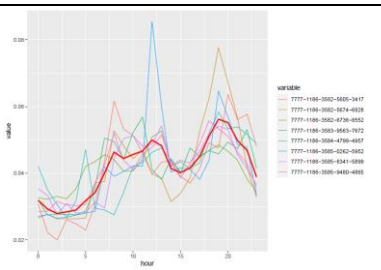
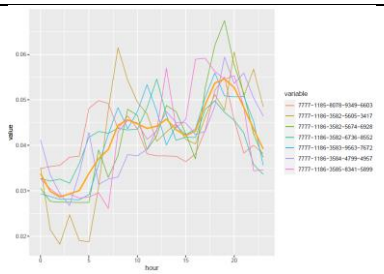
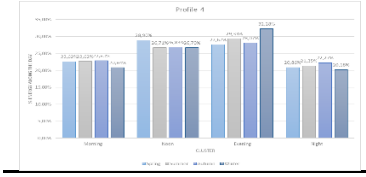
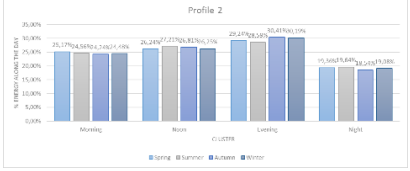
PATTERN 2		
Electricity behaviour		***Contextual features***
PROFILE 4 GOPARITY		
Spring	Summer	*Exclusive characteristics*
		Dwellings occupied by 2 or 3 people mainly (also some of them by 4), that have electric heating mainly as energy system or gas boiler (also many of them have electric air conditioning). Thermal and electrical storage is available for some of the members. Users have mainly a single rate contracted, but there are also some who have contracted a two schedule or a three schedule rate. Most of the users are concerned about lowering temperature when they leave their home and at night.
Autumn	Winter	*Non-exclusive characteristics*
		Dwellings of type house or apartment, which present a diverse area and year of construction. Most common white goods are available at home, it is not usual to have clothes dryer. Temperature is manually controlled mainly, some users have programmable thermostat. Comfort is adequate for almost all of them. Different measures are applied at home; from building retrofitting to change in power contracted, energy user or kind of tariff. Power contracted is diverse, having users from 3.35 kVA up to 10.35 kVA contracted.
PROFILE 2 LCF		
Spring	Summer	*Exclusive characteristics*
		Mainly homes occupied by two people, which have the most common appliances. The most common heating systems are oil heating or gas boiler, and some members have electric cooling. Thermal storage is used by some of the members. It is common for programmable thermostats to be available. Mostly, not eV available.
Autumn	Winter	*Non-exclusive characteristics*
		The homes are flat or single house type, with variable size and very different age of the building. Most of the participants have the habit of lowering the temperature of their home at night, and even when they leave the house. Comfort is considered adequate by all of them, and a simple electricity rate has been contracted.
Energy distribution along the day (%)		***Contextual features***
PROFILE 4 GOPARITY	***PROFILE 2 LCF***	*Main aspects*
		Main differences found: -Kind of energy system: electric heating or gas boiler (GoParity) vs oil heating or gas boiler, and electric cooling (LCF). Temperature control: mainly manual (GoParity) vs programmable thermostat (LCF).

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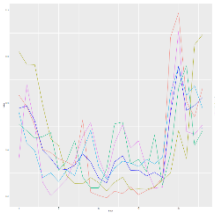
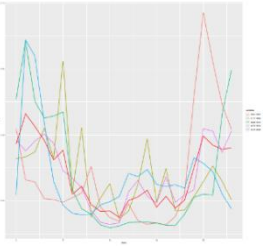
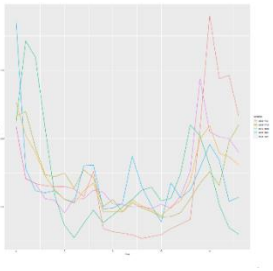
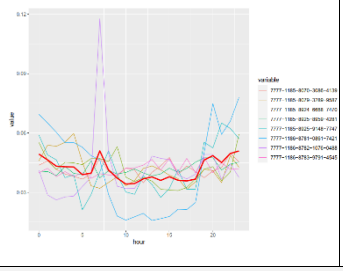
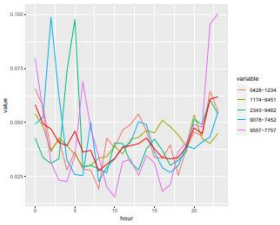
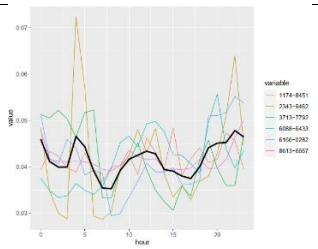
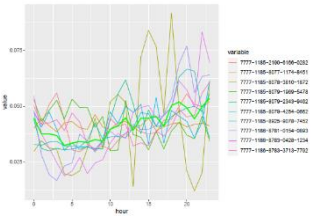
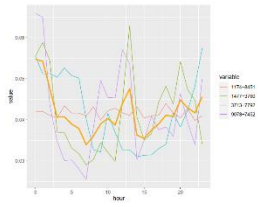
Table 6: Summary data for Pattern 13.

PATTERN 13		
Electricity behaviour		***Contextual features***
PROFILE 3 GOPARITY		
Spring	Summer	*Exclusive characteristics*
		Dwellings occupied by 2 or 3 people mainly, that have electric heating mainly as energy system (also some of them have electric air conditioning). No storage system is available mainly (some have thermal or electrical storage). Users have two schedule rates contracted mainly, but also users with single rate or three schedules are found. Many users are concerned about lowering temperature when they leave their home and at night.
Autumn	Winter	*Non-exclusive characteristics*
		Dwellings of type house or apartment, which present a diverse area and year of construction. Most common white goods are available at home, it is not usual to have clothes dryer. Temperature is manually controlled mainly, some users haver programmable thermostat. Comfort is adequate for almost all of them. Different measures are applied at home; from building retrofitting to change in power contracted, energy user or kind of tariff. Power contracted is diverse, having users from 3.35 kVA up to 10.35 kVA contracted.
PROFILE 1 COOPERNICO		
Spring	Summer	*Exclusive characteristics*
		Dwellings occupied by 2 or 3 people mainly, that usually have electric heating and air conditioning at home. Some of them have thermal or electrical storage systems. Temperature is manually controlled mainly, some users have a programmable thermostat. Most of the users have a single rate contracted, but there are some with two schedule rates.
Autumn	Winter	*Non-exclusive characteristics*
		Dwellings of type house or apartment, which present a diverse area and year of construction. Most common white goods are available at home, it is not usual to have clothes dryer. Comfort is adequate for almost all of them. Different measures are applied at home; from building retrofitting to change in power contracted, energy user or kind of tariff. Power contracted is diverse, having users from 3.35 kVA up to 10.35 kVA contracted. Many users are concerned about lowering temperature when they leave their home and at night.

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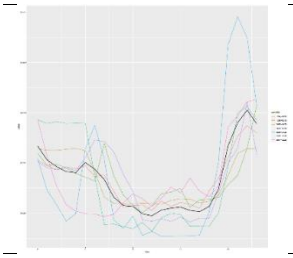
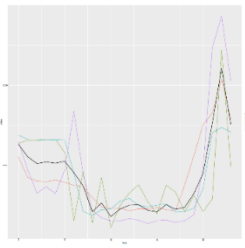
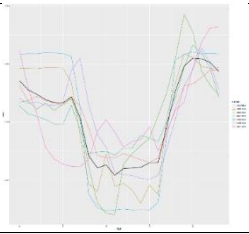
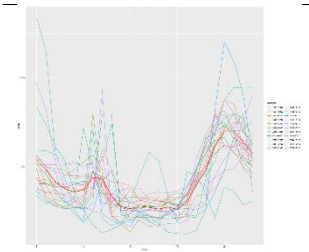
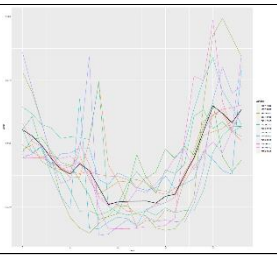
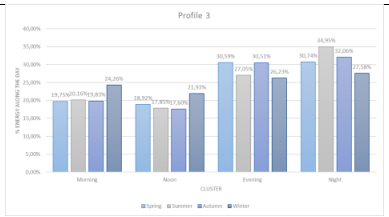
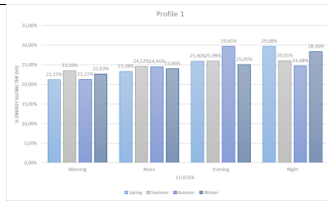
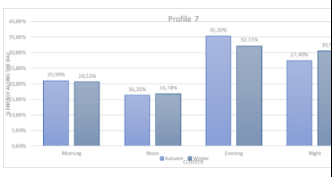
PROFILE 4 TRACTEBEL SET 1

Spring	Summer	*Exclusive characteristics*
		Information coming from rural/ urban residential dwellings, from Romania. Different periods have been considered within the analysis, but some kind of users could be expected. Questionnaire not available.
Autumn	**Winter**	
		

PROFILE 7 TRACTEBEL SET 2

Autumn	Winter	Non-exclusive characteristics
		Information coming from rural/ urban residential dwellings, from Romania. Different periods have been considered within the analysis, but some kind of users could be expected. Questionnaire not available.

Energy distribution along the day (%)		***Contextual features***
PROFILE 3 GOPARITY	***PROFILE 1 COOPERNICO***	***Main aspects***
		Main differences found: -Kind of tariff: single rate or three schedules (GoParity), single rate or two schedules (Coopernico)
PROFILE 4 TRACTEBEL SET 1	***PROFILE 7 TRACTEBEL SET 2***	
		

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 837758.

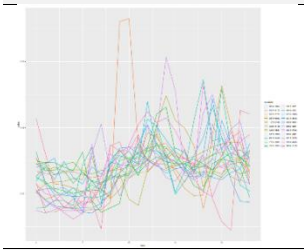
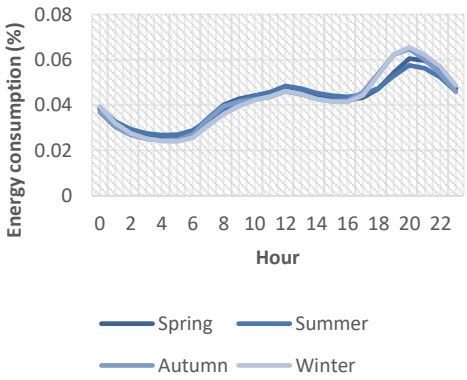
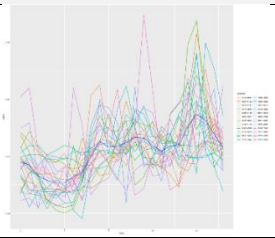
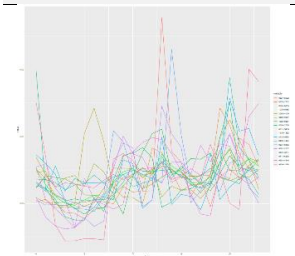
2.3.2 Behavioural differences between users in social initiatives and the general population

This section contains the main conclusions regarding the similarities and differences found between the behaviour of users involved in social innovations and the ordinary public.

2.3.2.1 Electricity consumption

In electrical terms, it has been considered interesting to highlight that there are some profiles having a greater similarity with the control groups defined for the country. In all the study cases, a group with a similar behaviour in terms of electricity consumption in relation to said control has been found. To determine such profile, we have proceeded in a similar way to what has been done to establish representative patterns, so that the control profile, previously treated in a similar way to the information from the members of the study cases, has been included in the clustering analysis, and segmented to be placed in the group of greatest similarity. Details about these profiles are included in the tables shown below. A global idea about the type of user that can be associated with the expected behaviour is given by delving into the exclusive and non-exclusive characteristics of the group. The preliminarily characterized control group for each country does not include details about heating habits or changes in behaviour. Therefore, some new feature about such previously unknown groups can be inferred. Below, an example of the most similar profile found for the case study participants located in Portugal can be found.

Table 7: Summary data for the profile most similar to that established for the control group in Portugal (GoParity case study).

<table>
<tr><td colspan="3">PORTUGAL (GoParity)</td></tr>
<tr><td colspan="2">Spring (C4)</td><td>CG Profile</td></tr>
<tr><td colspan="2"> 
-Local pronounced around 8h and a local high at 19h
-Maximum around 12h
-Lowest values between 1-5h
-Local minimum around 18h
-The current curve has not a great amplitude
-The curve has many drops and increases in consumption</td><td rowspan="2">  </td></tr>
<tr><td colspan="2">Summer (C2)</td></tr>
<tr><td colspan="2"> 
-Local high at 9h and 13h
-Maximum at 20h
-Lowest values between 2-6h
-Local minimum at 10h and 15h
-The curve shows a rise with two consumption peaks along the day</td></tr>
<tr><td colspan="2">Autumn (C4)</td><td>Exclusive characteristics</td></tr>
<tr><td colspan="2"> 
-Local high between 10h and 15h and at 20h
-Maximum value of the day recorded around 19h
-Lowest values between 1-6h
-Local minimum from 14h to 17h
-The curve does not show a greater variation in amplitude over time</td><td>Dwellings occupied by 2 or 3 people mainly (also some of them by 4), that have electric heating mainly as energy system or gas boiler (also many of them have electric air conditioning). Thermal and electrical storage is available for some of the members. Users have mainly a single rate contracted, but there are also some who have contracted a two schedule or a three schedule rate. Most of the users are concerned about lowering temperature when they leave their home and at night.</td></tr>
</table>

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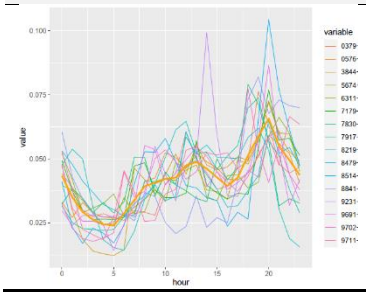
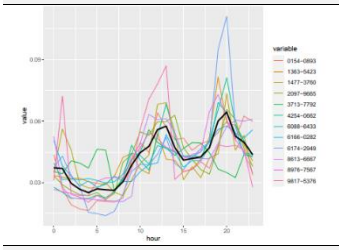
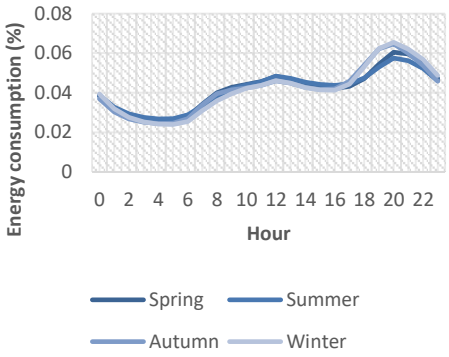
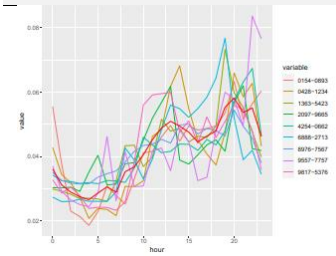
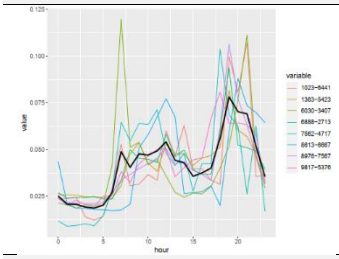
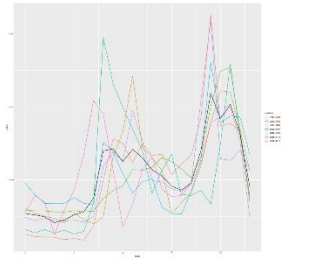
Winter (C3)	*Non-exclusive characteristics*
 -Local high around 11h -Maximum at 20h -Lowest values between 1-6h -Local minimum at 16h -The curve shows two consumptions peaks both at noon and at night -Increasing aspect from 17h	Dwellings of type house or apartment, which present a diverse area and year of construction. Most common white goods are available at home, it is not usual to have clothes dryer. Temperature is manually controlled mainly, some users haver programmable thermostat. Comfort is adequate for almost all of them. Different measures are applied at home; from building retrofitting to change in power contracted, energy user or kind of tariff. Power contracted is diverse, having users from 3.35 kVA up to 10.35 kVA contracted.

Table 8: Summary data for the profile most similar to that established for the control group in Portugal (Copernico case study).

PORTUGAL (Coopernico)	
Spring (C5)	*CG Profile*
 -Local high at 12h -Maximum at 20h -Lowest values recorded between 2h-6h -Local minimum at 15h -Remarkable U trend between 14h-19h -Increasing aspect from 6h	
Summer (C1)	
 -Local high at 13h, 6h and an increase from 7h -Maximum at 20h -Lowest values between 1-5h -Local minimum at 16h -U-shape between 14h and 17h -Increasing aspect from 6h	
Autumn (C5)	*Exclusive characteristics*
 -Local high at 7h and 12h -Maximum around 19h -Lowest values between 1-5h -Local minimum at 15h and 8h -Remarkable U-shape between 13-16h -Increasing aspect from 6h	Dwellings occupied by 2 or 4 people mainly, that usually have electric heating and air conditioning at home. Some of them have electrical or thermal storage systems at home. Temperature is manually controlled mainly, some users have a programmable thermostat. Most of the users have a single rate contracted, but there are some with two schedule rates.
Winter (C5)	*Non-exclusive characteristics*
 -Local high at 9h and 21h -Maximum at 19h -Lowest values between 1-5h -Local minimum between 14-17h -Increasing aspect from 6h	Dwellings of type house or apartment, which present a diverse area and year of construction. Most common white goods are available at home, it is not usual to have clothes dryer. Comfort is adequate for almost all of them. Different measures are applied at home; from building retrofitting to change in power contracted, energy user or kind of tariff. Power contracted is diverse, having users from 3.35 kVA up to 10.35 kVA contracted. Many users are concerned about lowering temperature when they leave their home and at night.

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2.3.2.2 Questionnaire features

Finally, this section includes the main differences with the control group found at the group level in reference to contextual characteristics.

The results have been divided into four sections, so that the first two tables identify characteristics at the level of the dwelling and its equipment, the third focuses on highlighting aspects discovered around heating habits, and the last on changes in the behaviour of the participants.

Table 9: Summary data on the characteristics of the dwellings of the participants of the different case studies compared to the corresponding control group.

Dwelling features					
		Type	Total area	Year of construction	Number of inhabitants
DE	LCF	Most usual kind of dwelling is represented by house, and flat in second place. There is no information for the CG.	Dwelling size is very diverse, and can not be easily compared with CG information	Most of the dwellings were constructed between 1990-1999, followed by between 1945-1969. There is no representation >2010. However, according to CG, most of the dwellings in Germany are from 1945-1969 and <1945. Very low number is found or dwellings from >2010.	Most of the dwellings are occupied by 2 people, and in the opposite extreme, very few by 3. There is no information for the CG.
PT	Coopernico	Most usual kind of dwelling is represented by flats, and house in second place. There is no information for the CG.	Dwelling size if very diverse, and can not be easily compared with CG information.	Most of the dwellings were constructed between 1945-1969. There is some representations >2010. According to CG, most of the dwellings in Portugal are from this same range, 1945-1969 and <1945. Very low number is found or dwellings from >2010 in the CG, however, this groups contains a higher representation here.	Most of the dwellings are occupied by 2, 3 and 4 people, and in the opposite extreme, very few by 5. There is no information for the CG.
ES	EnergÉtica	Most usual kind of dwelling is represented by flat, and house in second place. This is completely aligned with the information displayed by the CG	Dwelling size if very diverse, and can not be easily compared with CG information. Most of the dwellings are below 100 m2.	Most of the dwellings were constructed between 1990-1999, followed by between 2000-2009. Very low representation is found for dwellings >2010. This is completely aligned with the information displayed by the CG.	Most of the dwellings are occupied by 2 people, followed by the group with 1 inhabitant, and in the opposite extreme, very few by 5, and no one by 6 or more. This is completely aligned with the information displayed by the CG
PT	GoParity	Most usual kind of dwelling is represented by flats, and house in second place. There is no information for the CG.	Dwelling size if very diverse, and can not be easily compared with CG information.	Most of the dwellings were constructed between 1970-2009. There is some representations >2010. However, according to CG, most of the dwellings in Portugal are from 2000-2009 and 1970-1979. Very low number is found or dwellings between 1980-1989 and 1990-1999	Most of the dwellings are occupied by 4 people, and in the opposite extreme, very few by 3. There is no information for the CG
FR	IEner	Most usual kind of dwelling is represented by houses, and flats in second place. There is no information for the CG.	Dwelling size is very diverse, and can not be easily compared with the CG information.	Most of the dwellings were constructed before 1945.There is some representation >2010. However, according to CG, most of the dwellings in France are from 1945-1969 and 1970-1979. Very low number of dwellings is found between 1990-1999.	Most of the dwellings are occupied by 2 people, and in the opposite extreme, very few by 5. There is no information for the CG.

Table 10: Summary data on the characteristics of the equipment of the participants of the different case studies compared to the corresponding control group.

Equipment characteristics				
		White goods	Heating systems	Storage systems
DE	LCF	As expected according to the CG, there is a low presence of clothes dryer at home.	Most common heating systems in the group are gas and DH. CG indicates that the most common one in Germany is Gas, followed by Biomass, and in the other extreme, electricity. In this analysed case, electricity is used for cooling.	A 25% of the users have thermal storage, but no information is obtained for the CG
PT	Coopernico	As expected according to the CG, there is a low presence of clothes dryer at home. Dishwasher is the second least used white good at home, totally aligned with CG information.	Most common heating systems in the group are gas and electricity (for heating). CG indicates that the most common one in Portugal is gas followed by other main systems, and in the other extreme, biomass or DH.	There is a fairly similar proportion between thermal and electrical (around 8.33%), but no information is obtained for the CG.
ES	EnergÉtica	As expected and according to the CG, there is a low presence of clothes dryer at home. Similarly, dishwasher is the second least	Most common heating systems in the group are individual gas, central gas, individual fuel and central fuel. Similarly, CG indicates that the most common ones in Spain	A 25% of the users have thermal storage, but no information is obtained for the CG.

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		used white good at home. The obtained results follow the expected trend in Spain	are are individual gas, central fuel, central gas and individual fuel (some of them also have electric accumulators).	
PT	GoParity	As expected according to the CG, there is a low presence of clothes dryer at home.	Most common heating systems in the group are gas and electricity (for heating). CG indicates that the most common one in Portugal is gas followed by other main systems, and then electricity, and in the other extreme, biomass or DH.	The most used storage system is thermal (20%), but no information is obtained for the CG.
FR	IEner	There is a fairly high presence of dishwashers in the home (different from CG).	Most common heating systems in the group are gas and electricity. CG indicates that the most common one in France is gas followed by other main systems, and then electricity, and in the other extreme, biomass or DH.	No information about the most used storage system

Table 11: Summary data on the heating habits of the participants of the different case studies. No information is available for the control groups.

Heating habits		
DE	LCF	Most of the users have a programmable thermostat, and most of them are concerned about lowering the temperature of their heating system at night. A low number of them are concerned about lowering it when they leave their home.
PT	Coopernico	Most of the users have a manual thermostat, and most of them are concerned about lowering the temperature of their heating system where they are away from home. A low number of them are concerned about lowering at night.
ES	EnergÉtica	Most of the users manually control the temperature at home. A very low number of them use programmable thermostat or have central control at home. Most of them are concerned about lowering the temperature of their heating system at night. A significant number of them are concerned about lowering it when they leave their home. There is no information regarding these habits for the CG.
PT	GoParity	Most of the users have a manual thermostat, and most of them are concerned about lowering the temperature of their heating system where they are away from home. A low number of them are concerned about lowering at night
FR	IEner	Most of the users have a manual thermostat, and most of them are concerned about lowering the temperature of their heating system at night. A low number of them are concerned about lowering where they are away from home.

Table 12: Summary data on the behavioural change of the participants of the different case studies compared to the corresponding control group.

Behavioural change				
		Type of contracted rate	EEMs	eV
DE	LCF	Almost all the users have a single rate contracted.	Users have applied some EEMs at home. The ones used are the following: change in energy tariff, change in energy use, HVAC system or building retrofitting, change in LED lighting. Annual major renovation rate expected in Germany is about 1.49%.	About a 18.75% of users have eV at home. No information has been obtained for the CG.
PT	Coopernico	Most of the users have a single rate contracted. There are also two schedule rates in the group.	Users have applied some EEMs at home. The ones used are the following: Change electricity tariff, Lower contracted, Building retrofitting and Change HVAC system. However, annual major renovation rate expected in Portugal is around 0%.	
ES	EnergÉtica	Almost all the users have a single rate contracted, but users with a two schedule rate are also included in the group.	There is no information for EEMs applied at home, but the expected annual major renovation rate is rather low (0.08%).	
PT	GoParity	Most of the users have a single rate contracted, and there are also some who have contracted a two schedule rate.	Users have applied some EEMs at home. The ones used are the following: Change electricity tariff, Lower contracted, Building retrofitting and Change HVAC system. However, the annual major renovation rate expected in Portugal is around 0%.	
FR	IEner	Most of the users have variable rate contracted, and there are some that have a single rate.	Users have applied some EEMs at home. The ones used are the following: Change electricity tariff, Lower contracted, Building retrofitting and Change HVAC system. However, the change energy use in France is around 1.75%.	

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3. Behaviour analysis using surveys

This section summarizes the results of the analysis carried out using representative surveys of the general public. The goal of these surveys is to better understand citizens' and customers' attitudes towards engagement with different socially innovative business models in the energy sector, namely energy cooperatives, energy crowdfunding platforms and energy aggregators. To achieve this goal, we conducted large-scale surveys of the general public between June and October of 2020, which cover citizens of 10 EU countries (Croatia, France, Germany, Italy, Ireland, Poland, Portugal, Romania, Spain and Sweden) as well as the UK and US, with each having approximately 800 valid responses.

3.1 Methodological approach

3.1.1 Survey background and representativeness

Data collection for the survey was conducted with the assistance of a panel provider company, and respondents completed surveys on a leading online survey platform (Qualtrics). Surveys were translated to the languages of corresponding countries using a professional translation service, and each respondent from the targeted population received an anonymous link, through which he/she was directed to the survey in his/her language.

Quotas were set regarding respondents' age, gender and region before data collection to obtain a representative sample for the population of each country. The sample and targeted statistics of these variables are presented in Table 13. Expectedly, the results from Chi-squared tests indicate the representativeness of our collected samples for each variable where quotas were set (i.e., the null hypothesis of same distribution regarding age, gender and region between the collected sample and the general population cannot be rejected at 10% level).

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Table 13: Results of sample representativeness regarding age, gender and region.

	Germany (coop)		France		Spain		Sweden		Poland	
Variables	Sample	Target	Sample	Target	Sample	Target	Sample	Target	Sample	Target
Age										
18-24 years (%)	10.7	12	12.4	12	12.0	12	14.6	14	14.0	14
25-34 years (%)	18.2	18	18.1	20	23.9	24	20.6	20	24.0	24
35-44 years (%)	25.4	25	22.5	22	24.0	24	21.5	23	21.1	21
45-54 years (%)	20.3	20	21.5	21	19.0	19	20.6	21	19.7	20
>55 years (%)	25.5	25	25.5	25	21.0	21	22.6	22	21.2	21
Gender (male %)	48.7	50	48.0	50	48.9	49	50.9	51	49.8	50
Region (rep.)[c]	Yes		Yes		Yes		Yes		Yes	

	Portugal		UK		Ireland		Croatia		Italy	
Variables	Sample	Target	Sample	Target	Sample	Target	Sample	Target	Sample	Target
Age										
18-24 years (%)	11.9	12	12.1	12	13.1	11	14.1	16	10.9	11
25-34 years (%)	23.0	23	15.8	17	15.4	17	24.9	26	18.1	18
35-44 years (%)	23.1	23	18.2	18	19.7	21	27.5	26	24.1	24
45-54 years (%)	21.1	21	18.2	18	16.1	18	30.7	32	21.8	22
>55 years (%)	21.1	21	35.5	35	35.8	33	2.9	/	25.1	25
Gender (male %)	50.9	51	48.3	49	45.6	49	49.9	50	50	50
Region (rep.)[c]	Yes		Yes		Yes		Yes		Yes	

	Romania		US		Germany (p2p)	
Variables	Sample	Target	Sample	Target	Sample	Target
Age						
18-24 years (%)	14.3	14	12.6	13	7.0	12
25-34 years (%)	22.4	22	17.3	18	18.3	18
35-44 years (%)	25.4	25	18.2	18	28.6	25
45-54 years (%)	16.7	18	19.2	19	20.2	20
>55 years (%)	21.2	21	32.7	32	25.9	25
Gender (male %)	49.6	50	48.8	50	48.5	50
Region (rep.)[c]	Yes		Yes		Yes	

Note: The statistics of the targeted percentage is from Federal Statistical office (Germany), INSEE (France), Instituto nacional de Statistica (Spain), SCB (Sweden) and Główny Urząd Statystyczny (Poland), Instituto Nacional de Estatistica (Portugal), ONS (UK), Central Statistics Office (Ireland), Croatian Bureau of Statistics (Croatia), ISTAT (Italy), National Institute of Statistics (Romania) and US Census Bureau (US). (b) Chi-squared test is conducted to test representativeness; (c) As the names of the regions are different across countries, we do not present all regions in order to limit table size.

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The basic flow of the survey is as follows:

(1) Survey Introduction

The survey starts with an introduction, outlining the purpose of the survey, associated researchers, project and funders (Figure 10). Respondents were informed that the survey is only to be completed by individuals over 18 years of age and that their anonymity and confidentiality are guaranteed.

Figure 10: Survey Introduction Screen

(2) *Basic demographic questions*

Respondents were then presented with a number of basic demographic questions, e.g., age, gender and region, where quotas were set for each variable to collect nationally representative samples.

(3) *Energy behaviour*

Next, a number of questions related to consumers' energy behaviour were asked, e.g., source of fuel used for home heating, whether they have certain appliances such as airconditioners and approximate electricity bill amount. The idea here is to prime respondents for the discrete choice experiment to follow.

(4) *Discrete choice experiment*

Three discrete choice experiments were distributed as part of the survey, depending on the business model studied (cooperative, crowdfunder or peer-to-peer platform). These are discussed in greater detail in the subsequent section of this report.

(5) *Investment motivations and investment security*

In this section, respondents were asked a series of Likert scale questions about their attitudes towards the importance of the business models' wider impacts, e.g., impacts on the wider energy market, and investment security.

(6) *Environmental attitudes and concerns*

Respondents were asked their opinions on the role of government in the energy transition, their degree of concern about climate change and their most preferred renewable energy type.

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(7) *Demand-side management*

Participants were also asked to express their attitudes towards a number of energy-saving products and services, and whether these would change their patterns of energy consumption.

(8) *General risk attitude and socioeconomic status*

Lastly, respondents were asked a general risk attitude question, followed by a number of socioeconomic and social-political questions.

Ethical approval for the survey was obtained prior to distribution the survey from the Ethics Board of Trinity College Dublin in Ireland.

3.1.2 Discrete choice experiments

Each survey included a Discrete Choice Experiment (DCE) where we aim to capture respondents' preferences towards different attributes of energy cooperatives, crowdfunders and peer-to-peer trading platforms. The attributes studied differ between each of the business models considered.

Attributes selection is based on the descriptive results of previous studies related to characteristics of energy initiatives ([10]; [11]; [12]; [13]; [14]) and quantitative research on peoples attitudes towards different energy projects operated or crowdfunded by energy initiatives across countries ([15] [16]; [17]; [18]; [19]; [20]).

To define levels of these attributes, we collaborated with partners from the SocialRES project, who are experts in the energy sector and are experienced operators of energy cooperatives/crowdfunders/aggregators running a wide range of renewable projects in several european countries. Their guidance helped us to (a) add important attributes and eliminate less relevant attributes; (b) identify attributes that are strongly correlated; (c) define appropriate levels for each attribute for each specific business model in the EU.

(1) DCE Attributes for energy cooperatives and energy crowdfunding platforms

Annual return

As with any financial investment, investors are expected to receive economic return from the energy project they have invested in, once the project starts to operate. In our context, the rate of the return ranges from 0% to 7.5% to cover the return rate of energy projects in most cases in reality. Specifically, a 0% return is included in the design to reflect a situation where a project has not yet started to operate. To avoid ambiguity about the actual amount of return investors can get, we use an example in which respondents were shown how much money (in their own currency) they would receive if they invested €1,000 at a rate of 2.5% per annum.

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Type of renewable technology

In our context, the renewable projects can be either solar powered or wind powered, which are the most common technologies for co-owned or co-funded projects in the EU [21].

Carbon reduction and project size

Carbon reduction is a typical attribute of renewable projects which reflects investors' desire to contribute to climate change mitigation. Following official statistics and suggestions from our energy initiative partners, the volume of carbon reduction in our context ranges from 150 tonnes, which represents a micro-scale energy project such as rooftop solar panels on a school building, to 12,000 tonnes, which represents a large energy project. As the amount of carbon reduction depends on the size of the project, the information about the land area used for the project was also presented to respondents, and to facilitate understanding, we use number of football pitches to depict land size.

Location of the project

Following a number sources in the literature which suggest citizens' "patriotic" preferences for energy projects ([15]; [18]; [22]), the proximity of the renewable energy project was included as an attribute, ranging from projects within respondents local area to projects outside of the respondents' country of residence.

Minimum investment (energy cooperatives only)

Energy cooperatives often require a minimum amount of investment, which in our context, varies from €50 to €5,000.

Minimum duration (energy cooperatives only)

Minimum duration is a common feature of community energy projects [17], which refers to the time horizon after which an investor can withdraw their investment. Four levels were included in our DCE design: no minimum duration, a 1-year, 2-year and a 5-year minimum duration.

Participation (energy cooperatives only)

The level of participation is another distinctive feature of cooperatives ([15]; [20]). The rights to participate in cooperatives' decision making process are often reflected by the one-member-one-vote principle [21]. Respondents were informed that cooperative meetings allowed them to participate in the decision making of the cooperative, such as the allocation of the profit and whether to change investment conditions. They were offered three possible options: no meetings, annual meetings and quarterly meetings, with the level of "no meetings" serving as a reference level.

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Minimum investment (energy crowdfunders only)

Crowdfunded projects often require a minimum amount of investment, which in our context, varies from € 10 to € 1,000.

Investment duration (energy crowdfunders only)

Five levels of investment duration were included in the design: a 1-year, 5-year, 10-year, 20-year or 25-year contract.

Type of issuer (energy crowdfunders only)

Respondents are asked to buy climate bonds to support renewable projects in our context, and the issuers can be local councils, community organisations or private companies.

(2) DCE Attributes for energy peer-to-peer platforms

Monthly energy saved

Joining the peer-to-peer platform allows investors to buy cheap locally generated renewable energy. The expected amount of money saved ranges from €0 to €9 for Romanian survey. To account for differences in energy consumption, the range is rescaled by 2 for German survey, and by 7 for the US survey.

Carbon reduction and project size

Using renewable energy helps to reduce carbon emissions. The levels of this attribure are set to 100 kg, 200 kg and 300 kg for the peer-to-peer DCE sample.

Type of green electricity

The available renewable energy can either come from mostly solar or mostly wind generators.

Green notification

In our example, the peer-to-peer platform has a green alert system which can send investors notifications about predictions for renewable energy production in their local area. The frequency of notification can be one of the following: none, daily and weekly.

Platform goal

The online platform in our experiment can be automated to reduce a household's carbon footprint, electricity bill, or both electricity bill and carbon emissions simultaneously.

Contract length

The length of the contract can be 3, 6, 9 or 12 months.

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The final attributes and levels for each business model can be found in Table 14, Table 15 and Table 16.

Table 14: Attributes and levels for the energy cooperative model.

Attributes	Levels				
Annual return	0%	2.5%	5%	7.5%	
Type of project	Solar energy	Wind energy			
Carbon emissions reduction (and corresponding size of the project)	150 tonnes (1/4 football pitch)	600 tonnes (1 football pitch)	3,000 tonnes (5 football pitches)	6,000 tonnes (10 football pitches)	12,000 tonnes (20 football pitches)
Location of the project	Within your local area	Within your region	Within your country	Outside your country	
Minimum amount of investment	€50	€100	€500	€1,000	€5,000
Minimum duration of investment	No minimum duration	1 year	2 years	5 years	
Participation	None	Quarterly meetings	Annual meetings		

Table 15: Attributes and levels for the energy crowdfunder model

Attributes	Levels				
Annual return	0%	2.5%	5%	7.5%	
Type of the project	Solar energy	Wind energy			
Carbon emissions reduction (and corresponding size of the project)	150 tonnes (1/4football pitch)	600 tonnes (1 football pitch)	3,000 tonnes (5 football pitches)	6,000 tonnes (10 football pitches)	12,000 tonnes (20 football pitches)
Location of the project	Within your local area	Within your region	Within your country	Outside your country	
Minimum amount of investment	€10	€50	€100	€500	€1,000
Investment duration	1 year	5 year	10 years	20 years	25 years
Type of issuer	Local councils	Community organisations	Private companies		

Table 16: Attributes and levels for the energy peer-to-peer trading platform.

Attributes	Levels			
Energy saved	€0	€3	€6	€9
Carbon reduction	100kg reduced	200kg reduced	300kg reduced	
Type of green electricity	Mostly solar	Mostly wind		
Green notification	None	Daily	Weekly	
Platform goal	Reduce CO2	Reduce bill	Reduce both	
Investment duration	3 months	6 months	9 months	12 months

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For the discrete choice experiment part of the survey, participants were first given a scenario description on investing/participating in the renewable energy projects run by each business model. For the energy cooperative model, respondents were informed that there were a number of energy organisations raising money from the public to install renewable generation, such as solar panels or wind turbines, and selling the electricity in the local community and open market. Investors would receive a share of cooperative profits and could vote on major decisions. For the crowdfunding platform model, respondents were told that they were offered a chance to invest in a Climate Bond, which is a way for organisations (such as councils, private companies or community organisations) to raise funds for the installation of renewable generation. They would be paid a regular interest over the term of the project, and would receive their original investment amount back at the end of the term of the project. For the peer-to-peer platform model, respondents were told that many households in their area were generating electricity from solar panels and wind turbines, and a peer-to-peer electricity platform offered them a chance to buy renewable electricity directly at low prices when there is an excess in generation. The platform would search for the best options and tries to minimise their bills and/or carbon footprint.

After the scenario introduction, respondents were then given a description of the typical characteristics (i.e., attributes) associated with each business model. A warm-up DCE question was then given to respondents with the intent to familiarise them with the question format [23]. Next, they were presented with eight choice experiment tasks where they were asked to choose a preferred option from two energy projects (or energy contracts for the peer-to-peer model) run by each business model with varied features, and an opt-out option. After completing the choice tasks, respondents answered a number of post-experimental questions related to the tasks.

We constructed D-efficient fractional-factorial designs with four blocks of eight choice sets for the cooperative and crowdfunding platform models, and with two blocks of eight choice sets for the peer-to-peer platform model, using the routine *dcreate* in Stata 16.1 [24]. We randomised the presentation of choice cards to individuals to minimize order effects. Examples of choice cards for the energy cooperative, crowdfunder and peer-to-peer platform DCEs (respectively) can be found in Figure 11.

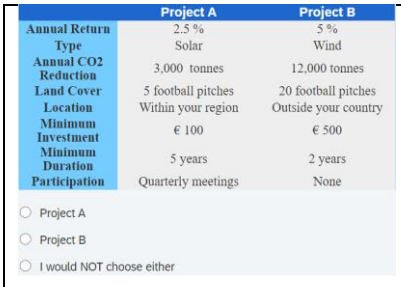

Figure 11a. An example of a choice cards for the energy cooperative model

Figure 11b. An example of choice cards for the energy crowdfunder model

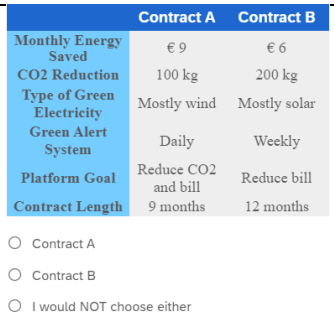

Figure 11c. An example of choice cards for the energy peer-to-peer platform

Figure 11: Example of the choice cards for the energy cooperative model

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3.2 Descriptive statistics

Respondents in each country received one of either the Cooperative, Crowdfunder or Peer-to-peer platform focused surveys, except in the case for the German population where both the cooperative and P2P versions were distributed. We selected major countries in several European regions (i.e., Western, Southern, Eastern and Northern Europe) to attempt to provide a balanced sample of EU citizens. A further reason for choosing this set of countries is to capture potentially contrasting energy profiles, such as energy behaviour, renewable energy development and popularity of energy initiatives, which are identified in several existing studies ([25]; [26]; [27]; [21]). In addition, we collaborated with experts in the energy sector (such as CEOs/owners/project managers) of energy initiatives in several of the above European countries, in order to improve our understating of the development of energy initiatives in each country prior to the distribution of the survey.

Table 17 presents mean values of responses to some of the additional sociodemographic, behaviour and attitude questions in the surveys, both for the entire sample and by country and business model. Significant differences in responses are exhibited across countries. For example, we see significant variation between countries in sociodemographic characteristics such as location (urban vs rural), tenure status, type of heating system, heating/cooling requirement, energy spend, and education. This illustrates that our sampling strategy has been successful in capturing a diverse set of respondents in different settings and with differing backgrounds and energy requirements.

We also observe significant variation in previous energy initiative experience, general investment experience, trust in energy saving claims made by organizations, and attitudes towards climate change. Other variables presented in Table 17 include interest in a phone app which informs participants about real time energy consumption; interest in demand side management such as a device which can automatically switch on/off electrical appliances; whether respondents currently have varying electricity rates; and how comfortable respondents are with sharing electricity use data.

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Table 17: Summary statistics additional variables

		Cooperative					Crowdfunder					Peer-to-peer		
	Full	DE	FR	ES	SE	PL	PT	UK	IE	HR	IT	RO	DE	US
Female (*proportion*)	0.51	0.51	0.52	0.51	0.49	0.50	0.49	0.51	0.54	0.50	0.50	0.50	0.51	0.50
Age (*years*)	43.11	44.18	44.05	41.62	42.21	41.13	41.69	46.53	45.83	38.11	43.24	40.79	44.66	46.59
Tertiary education (*proportion*)	0.56	0.48	0.62	0.73	0.63	0.57	0.57	0.51	0.53	0.56	0.45	0.69	0.50	0.44
Number of children (*number*)	0.88	0.90	0.86	0.85	0.83	0.97	0.88	0.65	0.82	0.87	1.11	1.03	0.92	0.75
Number of adults (*number*)	2.26	1.97	2.03	2.45	1.93	2.45	2.36	2.10	2.42	2.68	2.59	2.46	1.87	2.09
Location *(proportion)*														
Urban	0.51	0.45	0.51	0.74	0.44	0.76	0.56	0.28	0.30	0.56	0.56	0.77	0.46	0.27
Suburban	0.27	0.27	0.24	0.16	0.30	0.10	0.25	0.52	0.36	0.27	0.24	0.07	0.23	0.54
Rural	0.21	0.28	0.24	0.11	0.26	0.15	0.19	0.20	0.34	0.17	0.19	0.16	0.31	0.19
Tenure status *(proportion)*														
Owner with a mortgage	0.28	0.20	0.27	0.41	0.37	0.18	0.38	0.30	0.30	0.19	0.24	0.24	0.18	0.39
Owner without mortgage	0.39	0.23	0.32	0.35	0.14	0.64	0.34	0.40	0.33	0.54	0.56	0.61	0.26	0.35
Renter	0.29	0.57	0.39	0.21	0.46	0.15	0.22	0.27	0.34	0.15	0.16	0.10	0.55	0.24
Other	0.04	0.01	0.02	0.04	0.03	0.03	0.06	0.03	0.04	0.11	0.04	0.05	0.01	0.02
Type of heating *(proportion)*														
Electricity	0.32	0.20	0.44	0.45	0.63	0.19	0.60	0.21	0.22	0.23	0.18	0.17	0.17	0.43
Gas	0.42	0.45	0.40	0.46	0.03	0.33	0.17	0.72	0.34	0.39	0.69	0.59	0.50	0.44
Oil	0.09	0.20	0.07	0.07	0.03	0.04	0.03	0.04	0.32	0.03	0.02	0.04	0.18	0.06
Wood	0.09	0.05	0.08	0.02	0.07	0.11	0.19	0.01	0.05	0.32	0.08	0.17	0.04	0.02
Coal	0.02	0.01	0.00	0.00	0.01	0.21	0.00	0.01	0.06	0.00	0.00	0.01	0.00	0.00
I don't know	0.06	0.09	0.02	0.01	0.24	0.12	0.01	0.02	0.01	0.03	0.02	0.02	0.09	0.05
Upgraded heating system *(proportion)*	0.45	0.27	0.48	0.52	0.33	0.50	0.48	0.42	0.40	0.46	0.56	0.69	0.31	0.37
Air conditioning *(proportion)*	0.39	0.17	0.25	0.62	0.34	0.24	0.33	0.15	0.07	0.66	0.64	0.53	0.20	0.85
Electricity spend (*scale 1-10*)	3.66	4.02	3.81	3.57	4.04	2.37	3.12	3.36	4.24	3.09	3.66	2.95	3.99	5.38
Heating temperature required (*scale 1-10*)	5.99	5.89	5.25	6.28	5.60	6.70	5.93	4.91	5.14	7.32	5.68	7.16	5.68	6.13
Can afford to adequately heat *(proportion)*	0.83	0.92	0.73	0.80	0.89	0.88	0.68	0.84	0.81	0.83	0.82	0.88	0.91	0.87
Comfort with income (*scale 1-5*)	3.10	3.37	2.82	3.11	3.17	3.23	2.77	3.33	3.08	2.81	3.21	2.64	3.41	3.41
Previous involvement with an energy organization *(proportion)*	0.14	0.17	0.21	0.15	0.15	0.12	0.10	0.13	0.10	0.06	0.14	0.19	0.18	0.17
Previous general investment experience *(proportion)*	0.35	0.45	0.28	0.33	0.49	0.31	0.24	0.37	0.30	0.19	0.42	0.29	0.40	0.47
Risk averse *(proportion)*	0.67	0.71	0.60	0.64	0.59	0.68	0.64	0.75	0.70	0.64	0.69	0.72	0.72	0.70
Trust in energy saving claims (*scale 1-5*)	3.15	3.01	2.97	3.36	2.96	3.44	3.38	2.98	3.10	3.19	3.13	3.37	3.00	3.07
Climate change seriousness (*scale 1-5*)	4.06	3.83	4.04	4.22	3.72	4.11	4.55	3.82	4.04	4.26	4.22	4.24	3.96	3.68
EU/state responsibility to empower (*scale 1-5*)	2.15	2.13	2.20	1.84	2.47	2.22	2.03	2.12	2.36	1.82	2.19	2.14	2.11	2.36
Considerable interest phone app *(proportion)*	0.37	0.25	0.25	0.48	0.30	0.41	0.55	0.24	0.45	0.46	0.34	0.46	0.30	0.30
Considerable interest DSM device *(proportion)*	0.38	0.30	0.27	0.46	0.28	0.44	0.59	0.24	0.45	0.47	0.36	0.51	0.30	0.31
Considerable comfort data sharing *(proportion)*	0.31	0.32	0.23	0.24	0.28	0.25	0.43	0.26	0.35	0.29	0.31	0.38	0.34	0.32
Considerably varying electricity tariff *(proportion)*	0.24	0.15	0.36	0.28	0.15	0.17	0.24	0.17	0.19	0.48	0.35	0.16	0.17	0.25
Observations	10373	790	806	800	800	801	800	795	791	805	799	797	792	797

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3.3 Main results

3.3.1 Previous experience with an energy organisation

We begin by exploring differences between individuals who indicated that they have already participated in an energy organisation, and those that have not. These differences are presented across all variables used in the analysis in Table 18. We include a t-test for the equality of means for all variables.

When looking at mean values, we see significant differences between past participants and non-participants in energy organisations across almost all variables. Focusing on socio-demographic characteristics, we find a lower proportion of females among past participants. Previous participants are also on average younger and are more likely to have completed third-level education. They are more likely to live in an urban area, have more children and own their property with a mortgage or loan. Those with previous energy organisation experience are more likely to have electric heating, be aware of their heating type, have air conditioning, and to have upgraded their heating system in the last 10 years. Electricity spend is higher on average for previous energy organisation participants, however they tend to heat their property to a lower temperature. The majority of participants in our study indicate that they can afford to adequately heat their home (86%), however this share is slightly larger in those with previous energy organisation experience. Previous energy organization participants tend to have higher overall household incomes, however, interestingly, lower comfort/satisfaction with their income.

Looking at general investment behaviour, those with energy organisation experience are also much more likely to have other general investment experience, such as with stocks, bonds or investment funds. Interestingly, these individuals also appear to be slightly more risk averse, indicating that lack of previous participation may not be driven by risk aversion. Those with previous energy organisation experience are more likely to have higher trust in energy/carbon saving claims made by organisations, and to more strongly agree that it is the EU's responsibility to empower citizens to participate in the energy transition. In what appears to be somewhat of a contradiction, those with previous energy organisation experience seem to view climate change as a slightly less serious problem than those without previous energy experience. However, given agreement that climate change is a very serious problem is quite high for both groups, this may indicate that those with previous energy experience may simply take a slightly more moderate view on the issue.

Finally, individuals with previous energy organisation experience are also more likely to be considerably interested in electricity demand-side management, to have varying electricity tariffs and to be more comfortable in sharing electricity data with organisations.

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Table 18: Previous energy organisation experience

	Previous experience with an energy organization (2)		No previous experience with an energy organization (3)		Difference (3-2)	
	mean	sd	mean	sd	b	t
Female (*dummy*)	0.45	0.50	0.52	0.50	0.07***	(5.25)
Age (*years*)	36.89	13.23	44.16	14.89	7.26***	(19.22)
Tertiary education (*dummy*)	0.76	0.43	0.53	0.50	-0.23***	(-18.48)
Number of children (number)	1.28	1.29	0.81	1.12	-0.47***	(-13.13)
Number of adults (number)	2.31	1.07	2.25	1.00	-0.05	(-1.83)
Location						
Urban (dummy)	0.55	0.50	0.51	0.50	-0.04**	(-3.00)
Suburban (dummy)	0.26	0.44	0.27	0.45	0.01	(0.82)
Rural (dummy)	0.19	0.39	0.22	0.41	0.03**	(2.88)
Tenure status						
Owner with a mortgage (dummy)	0.35	0.48	0.27	0.44	-0.09***	(-6.43)
Owner without a mortgage (dummy)	0.36	0.48	0.40	0.49	0.04**	(2.71)
Renter (dummy)	0.27	0.44	0.30	0.46	0.03*	(2.54)
Other (dummy)	0.02	0.14	0.04	0.19	0.02***	(4.06)
Type of heating						
Electricity (dummy)	0.39	0.49	0.31	0.46	-0.08***	(-6.16)
Gas (dummy)	0.39	0.49	0.43	0.50	0.04**	(3.14)
Oil (dummy)	0.09	0.29	0.08	0.28	-0.01	(-0.81)
Wood (dummy)	0.08	0.27	0.09	0.29	0.02*	(1.97)
Coal (dummy)	0.02	0.15	0.02	0.16	0.00	(0.63)
I don't know (dummy)	0.03	0.17	0.06	0.24	0.03***	(5.68)
Upgraded heating system (dummy)	0.63	0.48	0.41	0.49	-0.22***	(-16.05)
Air conditioning (dummy)	0.56	0.50	0.36	0.48	-0.20***	(-14.35)
Electricity spend (scale 1-10)	4.12	2.29	3.58	2.25	-0.54***	(-8.35)
Heating temperature (scale 1-10)	5.85	2.15	6.01	2.01	0.16**	(2.61)
Can afford to adequately heat (dummy)	0.86	0.35	0.83	0.37	-0.03**	(-2.71)
Comfort with income (scale 1-5)	3.05	1.13	3.11	1.01	0.06*	(1.99)
Previous investment experience (dummy)	0.58	0.49	0.31	0.46	-0.26***	(-18.66)
Risk averse (dummy)	0.71	0.46	0.67	0.47	-0.04**	(-3.01)
Trust (scale 1-5)	3.32	1.02	3.12	0.95	-0.19***	(-6.81)
EU/state responsibility to empower (scale 1-5)	2.09	0.99	2.16	1.01	0.07**	(2.61)
Climate change seriousness (*scale 1-5*)	3.86	1.07	4.09	1.07	0.22***	(7.40)
Considerable interest phone app (dummy)	0.39	0.49	0.37	0.48	-0.02	(-1.39)
Considerable interest DSM device (dummy)	0.43	0.50	0.38	0.48	-0.06***	(-4.04)
Considerable comfort data sharing (dummy)	0.41	0.49	0.29	0.45	-0.12***	(-8.47)
Considerably varying electricity tariff (dummy)	0.36	0.48	0.22	0.42	-0.13***	(-9.91)
Observations	1491		8882			

Note: t-tests for equality of means assume unequal population variances. Those with previous experience in an energy organisation are identified from the question *"Have you ever been involved in an energy organisation (such as an energy cooperative, an energy peer-to-peer platform or a crowdfunded energy project?"*.

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3.3.2 Relative importance of energy organization attributes.

While the above results indicate correlations between previous organization experience and various sociodemographic characteristics, the survey also contained a discrete choice experiment which analysed a number of attributes associated with cooperatives, crowdfunders and peer-to-peer trading platforms in an experimental setting. The results of the discrete choice experiment are studied in detail in Wu, Carroll, & Denny, (2022) however we begin by presenting findings from the post-experimental survey questions where respondents self-reported the importance of individual attributes using a 5 Likert scale. These findings are presented in
Figure 12, Figure 13 and Figure 14 for the cooperative, crowdfunder and peer-to-peer platform surveys respectively.

All attributes studied were considered to be at least moderately important by the majority of respondents. Some differences in self-reported importance between attributes exist. Annual CO_2 reduction appears to be considered very important or extremely important by the largest share of survey participants, followed by minimum investment and annual return. This is consistent with the experimental findings from [28] where these attributes were all found to exhibit significant willingness to accept values. Landcover and participation in cooperative activities appear to be the least important attributes for respondents in the cooperatives sample.

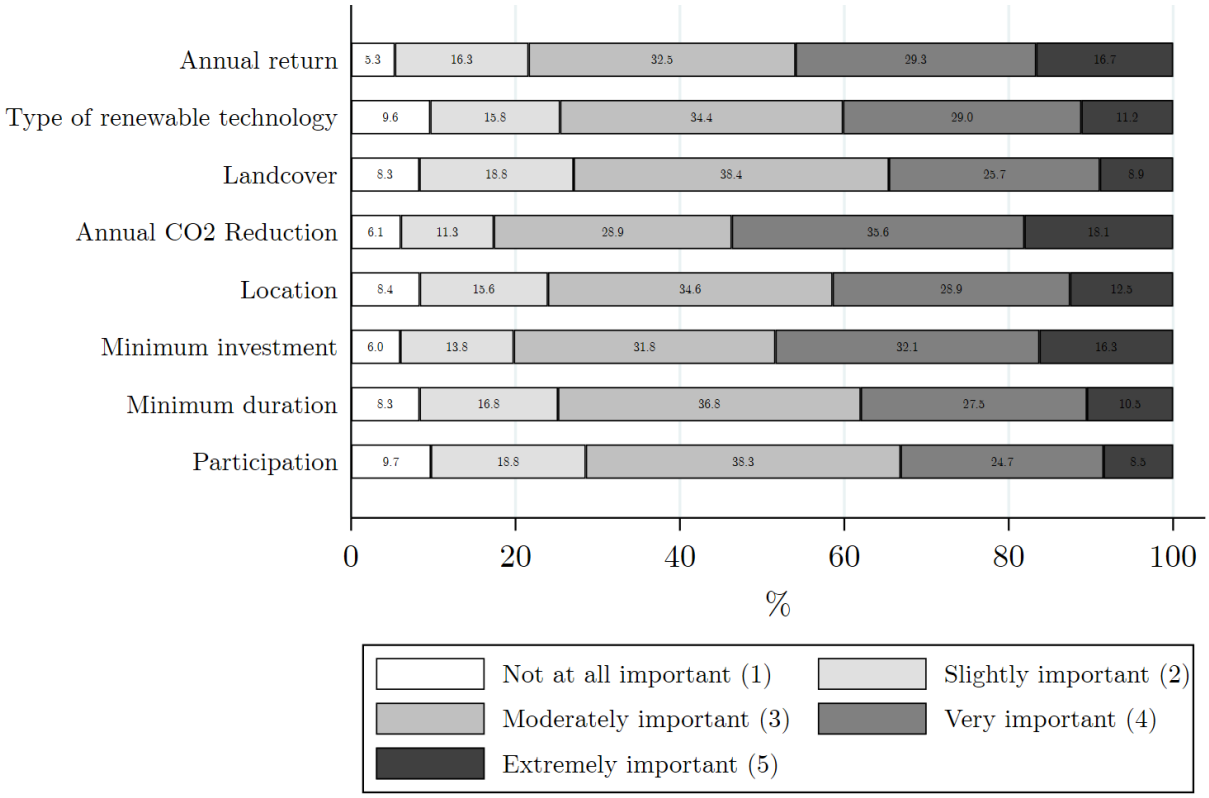

Figure 12: Relative importance of attributes for cooperative studies

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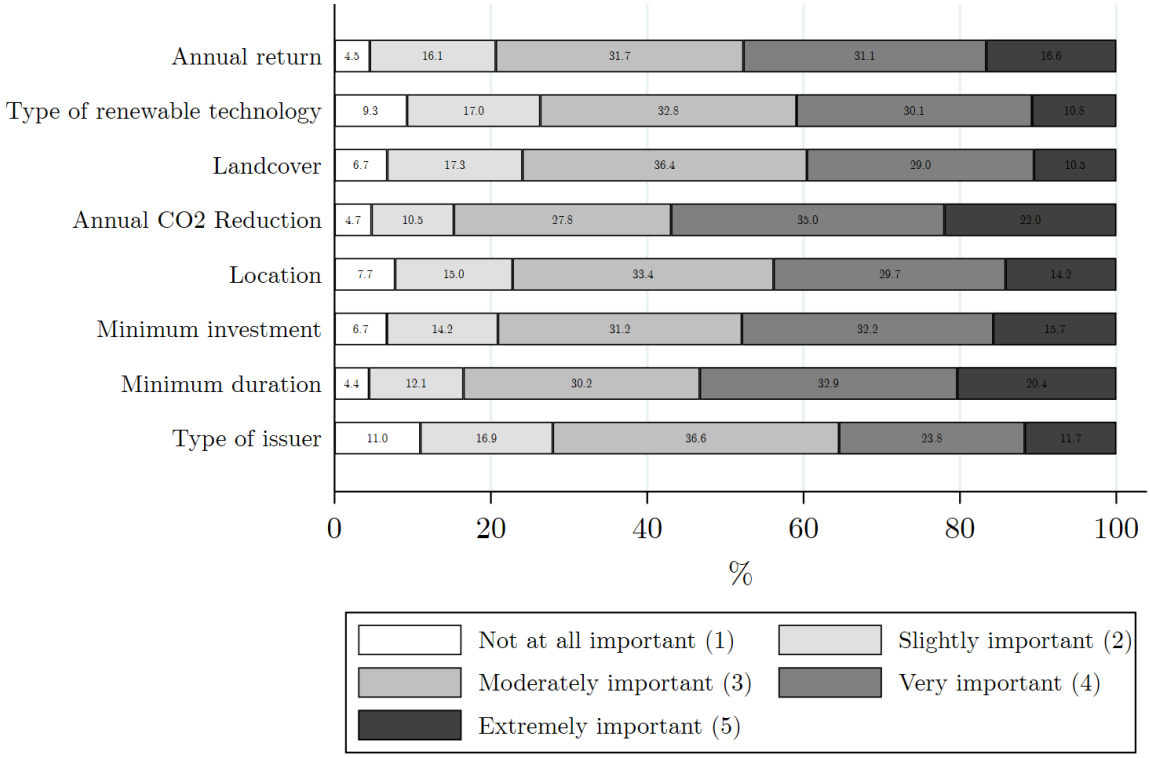

Figure 13: Relative importance of attributes for crowdfunder studies

The results from the crowdfunding surveys follow a similar pattern. In both cases annual CO_2 reduction appears to be the primary, self-reported attribute of importance. This result may be driven by social desirability bias. One interesting difference emerges however in the realm of minimum duration and investment. For the cooperative sample, minimum investment amount appears to be relatively more important. For respondents to the crowdfunding studies on the other hand, minimum duration of investment is given greater relative importance. This is intuitive, as investment duration is likely to be more important from a purely financial point of view for crowdfunding participants looking to make a return on their investment. In the case of energy cooperatives however, a minimum duration of investment or engagement may not be as critical, since participants might be less driven by financial considerations and be more driven by other social motives such as community engagement or energy independence. A high minimum investment requirement may therefore be seen as prohibitive for local motivated actors to engage in energy cooperatives.

The attributes examined in the energy aggregator samples are different to those explored in the cooperative and crowdfunding studies, with the exception of CO_2 reduction and the type of green electricity considered. These are presented in Figure 14. CO_2 reduction is again considered to be one of the most important characteristics associated peer-to-peer platform design, however the energy savings (and equivalent bill savings) associated with such platforms are given even greater weight by respondents. This suggest participants in the peer-to-peer platform DCEs were driven primarily by energy/bill savings. A "*green alert system*" which sends notifications about predictions for renewable energy

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production in the respondent's local area was given the lowest relative importance among the attributes considered. This might suggest that respondents are be inflexible to shifting their energy consumption based purely on a prompt system.

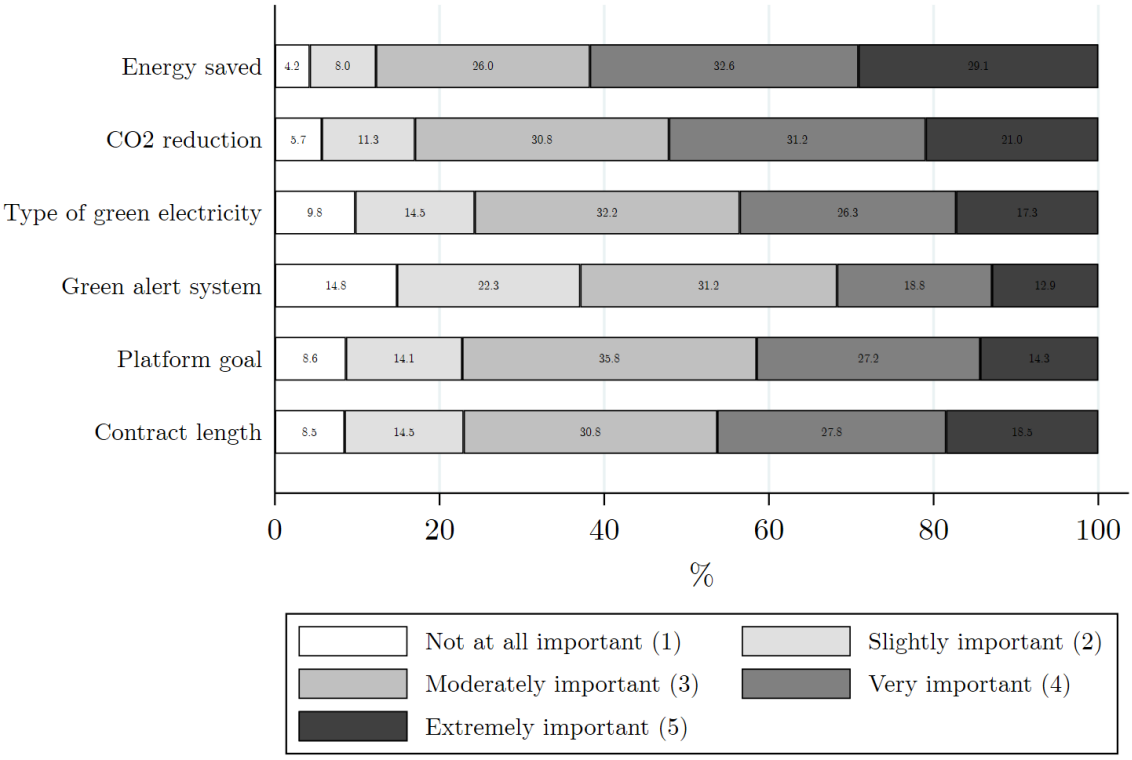

Figure 14: Relative importance of attributes for energy aggregator study

3.3.3 Additional aspects of social initiatives and their relative importance

Respondents in the surveys were also asked to express their view on the importance of various additional aspects of energy social initiative design, which were not included as attributes in the DCE. These questions were broadly consistent across business model types, with some variation depending on unique business model characteristics. For example, Questions 8, 9 and 10 in Figure 15 were specific to the cooperative sample, as they relate to active participation and decision rights of members. Respondents were asked to rank the importance of each attribute using a Likert scale ranging from 1 *"Not important at all"* to 5 *"Extremely important"*. The list of additional cooperative aspects investigated is presented in Figure 15.

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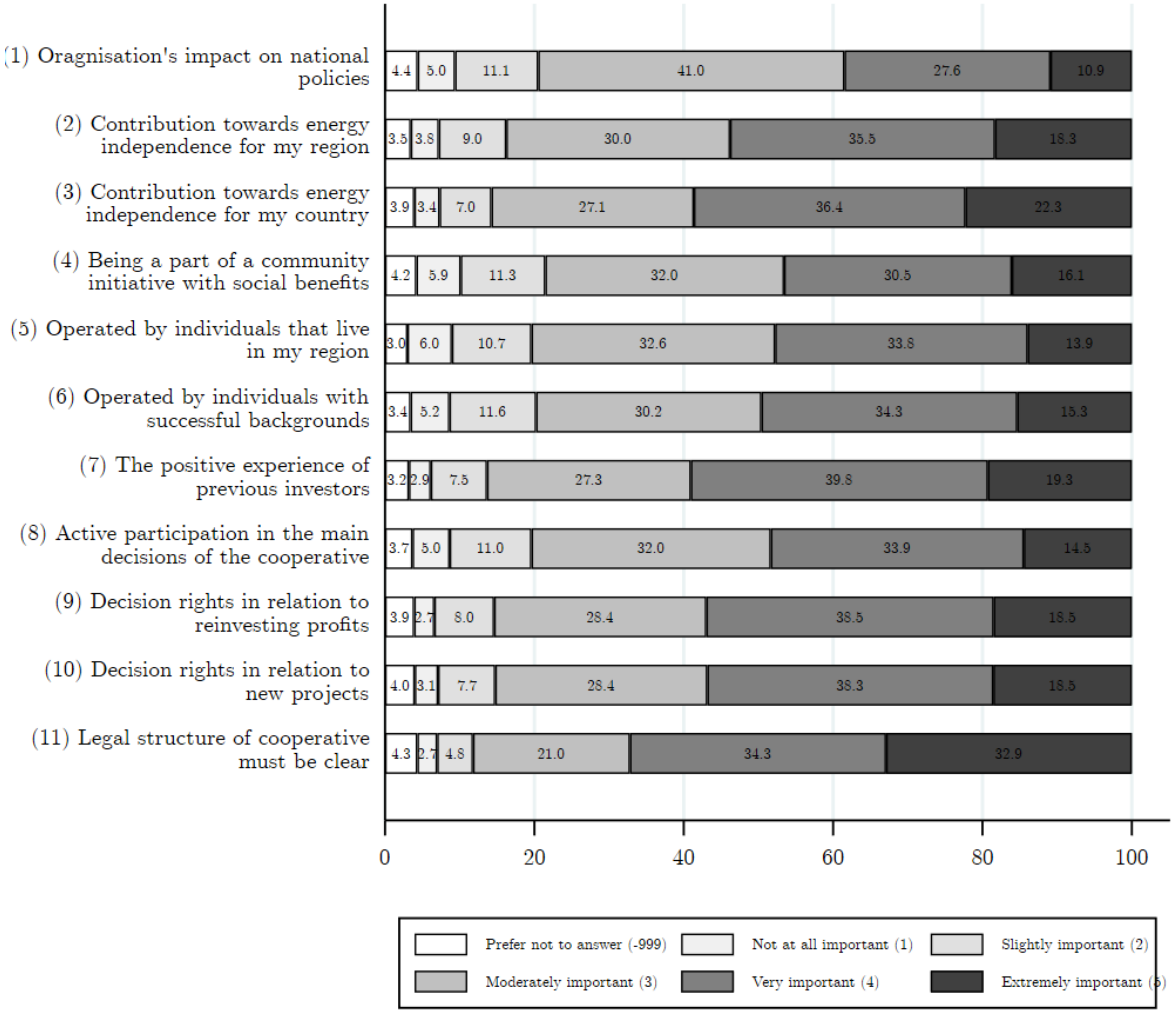

Figure 15: Aspects of cooperatives and their importance

The majority of respondents in the cooperative samples rated all of the above aspects as at least moderately important, however there is some variation in importance across the different characteristics presented. The most important aspect of cooperative design appears to be the clarity of the legal structure employed, followed by the positive experience of previous investors and national energy independence. Relatively speaking, the cooperative's impact on national level policies appears to the least important aspect from this list, with the highest share of responders indicating moderate importance. This may not be surprising, as energy cooperatives are typically small-scale organizations which may have limited influence on national level policies.[1] This may appear to also signal a preference for smaller-scale local energy co-operatives rather than large scale national entities. Interestingly however, national level energy independence appears to be slightly more important for respondents than regional level energy independence, suggesting that respondents may view cooperatives as a means to achieving national – rather than local level energy independence. As will be seen across the other business models examined, the positive experience of previous investors also appear to be highly valued by participants.

[1] In their analysis [33] find that energy cooperatives typically range from 5-200 participants.

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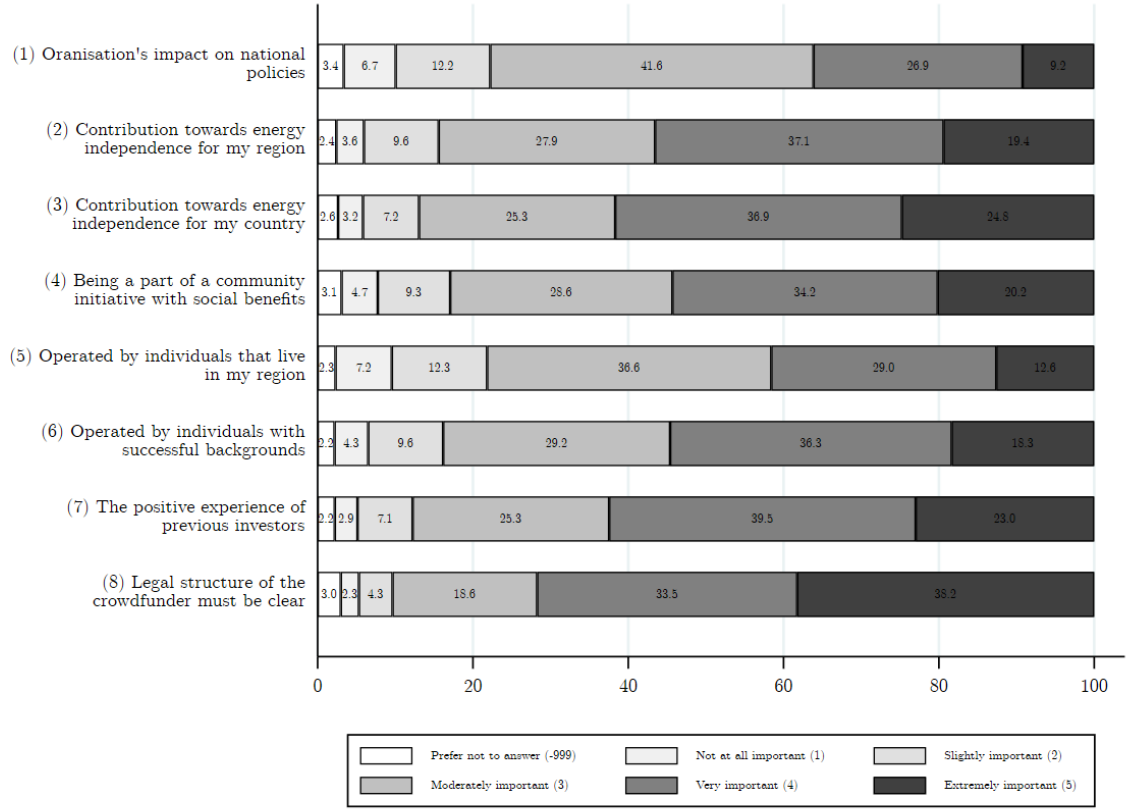

Figure 16: Aspects of crowdfunders and their importance

When looking at the importance of crowdfunder aspects a similar pattern emerges. Respondents appear to place the most weight on the legal structure of the crowdfunder, the previous experience of past investors and energy independence for their country. Again, even less importance appears to be given to the impact of crowdfunders on national policies and whether the crowdfunder is operated by individuals that live in the respondent's region. This pattern appears to be repeated for the responses to the peer-to-peer platform in Figure 17.

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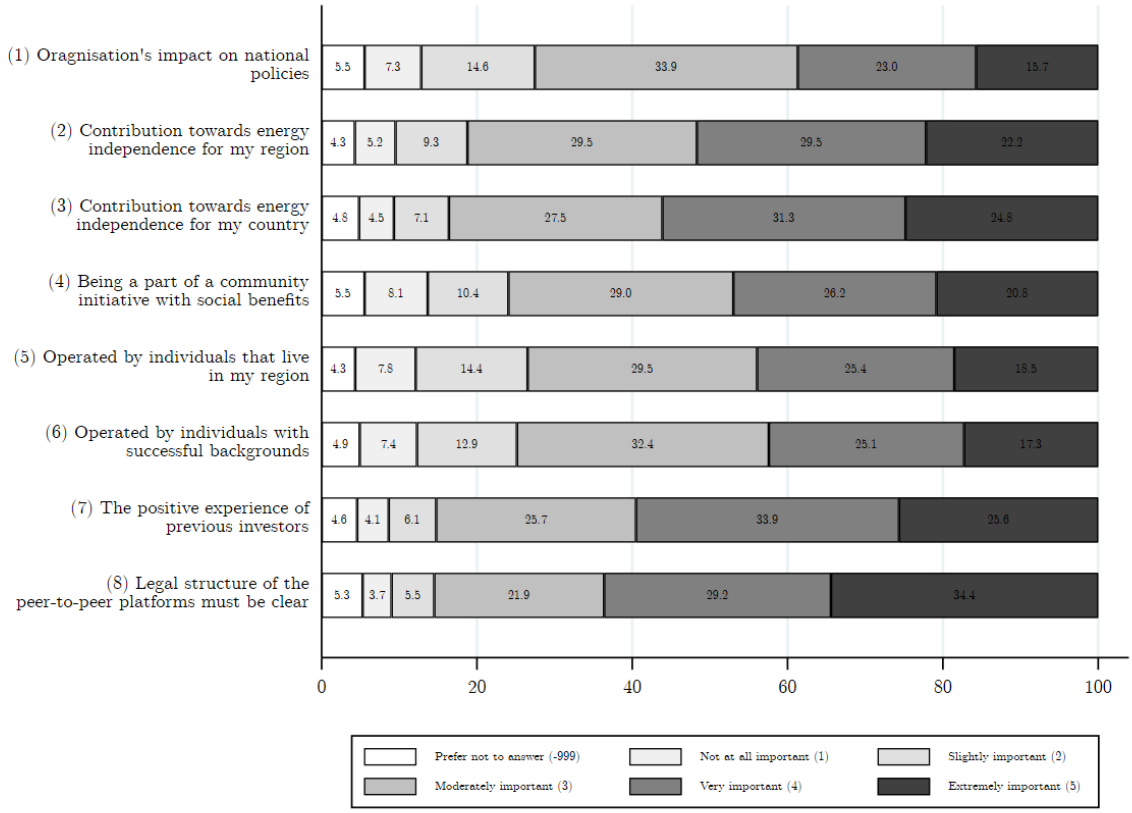

Figure 17: Aspects of peer-to-peer platforms and their importance

3.3.4 Cooperatives and Crowdfunders DCE results

We next present a brief summary of the expiremental DCE Results for the cooperative and crowdfunder platform samples. These findings, including the underlying methodology are discussed in much greater detail in Wu, Carroll, & Denny (2022). Table 19 presents the pooled results of the preference estimates from Wu, Carroll, & Denny (2022).

Generally speaking, the negative and significant alternative specific constant in both business models suggests that respondents are willing to participate in the coopertaive and crowdfunder models in our DCEs. When looking at specific attributes, we observe a highly significant effect for the annual return attribute for both business models in the expected direction, and the resulting mean estimates of this attribute suggest that respondents prefer higher financial return.

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Table 19: Result from the mixed logit model for the pooled sample for the Cooperative Model and Crowdfunder Model (Source: Wu, Carroll and Denny (2022))

	Cooperative		Crowdfunder	
Variables	Mean	SD	Mean	SD
Constant	-2.315***	***	-3.405	***
	(0.111)			
Annual return [a]	0.279***	***	0.200***	***
	(0.029)		(0.015)	
Wind project	-0.328***	***	-0.186***	***
	(0.048)		(0.044)	
600 t (1 pt)	0.247***		0.013	***
	(0.069)		(0.071)	
3,000 t (5 pt)	0.249***	***	0.222***	
	(0.074)		(0.064)	
6,000 t (10 pt)	0.321***	***	0.153*	
	(0.07)		(0.08)	
12,000 t (20 pt)	0.490***	***	0.402***	***
	(0.082)		(0.08)	
Within region	0.062		0.059	*
	(0.06)		(0.061)	
Within country	0.082		0.003	
	(0.062)		(0.057)	
Outside country	-0.447***	***	-0.394***	***
	(0.067)		(0.067)	
Additional Attributes for the Cooperative Model				
Minimum investment [c]	-0.202***			
	(0.019)			
Minimum term (1 year)	-0.018			
	(0.058)			
Minimum term (2 years)	0.082			
	(0.058)			
Minimum term (5 years)	-0.19***	*		
	(0.062)			
Quarterly meetings	0.036			
	(0.053)			
Annual meetings	0.027	***		
	(0.049)			
Additional Attributes for the Crowdfunder Model				
Minimum investment [b]			-0.479***	***
			(0.067)	
Minimum term (5 years)			0.063	***
			(0.065)	
Minimum term (10 years)			0.068	
			(0.069)	
Minimum term (20 years)			-0.285***	*
			(0.067)	
Minimum term (25 years)			-0.293***	***
			(0.073)	
Community organisation			-0.078	**
			(0.047)	
Private company			-0.186***	***
			(0.05)	

Note: Table taken from Wu, Carroll and Denny (2022)
a. Annual return is log-normally distributed.
b. "t" here means tonnes and "fp" means football pitch(es).
c. Minimum investment is treated as linear and rescaled by 0.001.
d. The model estimation excluded those who constantly chose "Project A" or "Project B" throughout the experiment.
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

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In terms of other attributes we study, we find that individuals prefer solar over wind technology for renewable projects in both the cooperative and crowdfunder DCEs. We also find that individuals in the cooperative sample prefer higher levels of carbon reduction (with larger land cover), yet the utility gain is not proportional with the amount of carbon reduction (the increase of land size) – i.e. diminishing marginal utility is observed when the level of carbon reduction (project size) increases. A similar pattern is observed in the crowdfunding sample [28].

In addition, we find that respondents do not show preferences for a within-region or within-country project compared to a local project, however they demonstrate a disutility towards participating in renewable projects outside their countries. This is true for both the crowdfunder and cooperative samples. These findings are consistent with [18] using a German sample, implying that citizens hold a "patriotic" attitude towards energy generation.

Respondents in both business model surveys dislike high minimum investment amounts. In the cooperative sample, respondents dislike a 5-year lock-in period but are indifferent to a short duration (1 or 2 years), compared with a no minimum duration requirement. A similar pattern is observed for the crowdfunder model where longer durations of investment were studied. We find that individuals are insensitive to a medium-term 5-year or 10-year contract compared with a short-term contract (1-year), however dislike very long-term contracts (20 or 25 years).

For the participation attribute, which features only in the cooperative sample, respondents do not obtain significant utility from the presence of meetings with opportunities to be involved in the decision making of cooperatives' important affairs. For the crowdfunder model, the results show that respondents do not demonstrate significant differential preferences between community organisations and local councils as issuers of climate bonds, but dislike lending to private companies.

In addition to the above, in Wu, Carroll, & Denny (2022) we also quantify to what extent individuals are willing to sacrifice financial returns for non-financial attribute improvements. These are known as Willingness to Accept (WTA) values and are presented in Figure 18. Again, the results suggest that respondents place a high value on CO2 reduction (land size), solar technology, and express a willingness to avoid projects being built outside their countries in the cooperative sample. For example, respondents would be willing to sacrifice 1.7 percentage points (PPs) of annual return for projects with carbon reductions of 12,000 tonnes relative to 500 tonnes. When looking at the type of renewable energy employed, individuals would need to be compensated 1.1 PPs in annual return for wind projects relative to solar projects.

In the crowdfunder sample, we observe similar patterns for the attributes that are common to both business models, except that minimum amount of investment is valued more (0.7 PPs vs 2.4 PPs). In terms of the term-money trade-off, individuals would sacrifice as much as 1.4 PPs in order to avoid a long-term contract (e.g., 20 years). Respondents are also willing to forgo 0.9 PPs in return for climate bonds issued by local councils instead of private companies.

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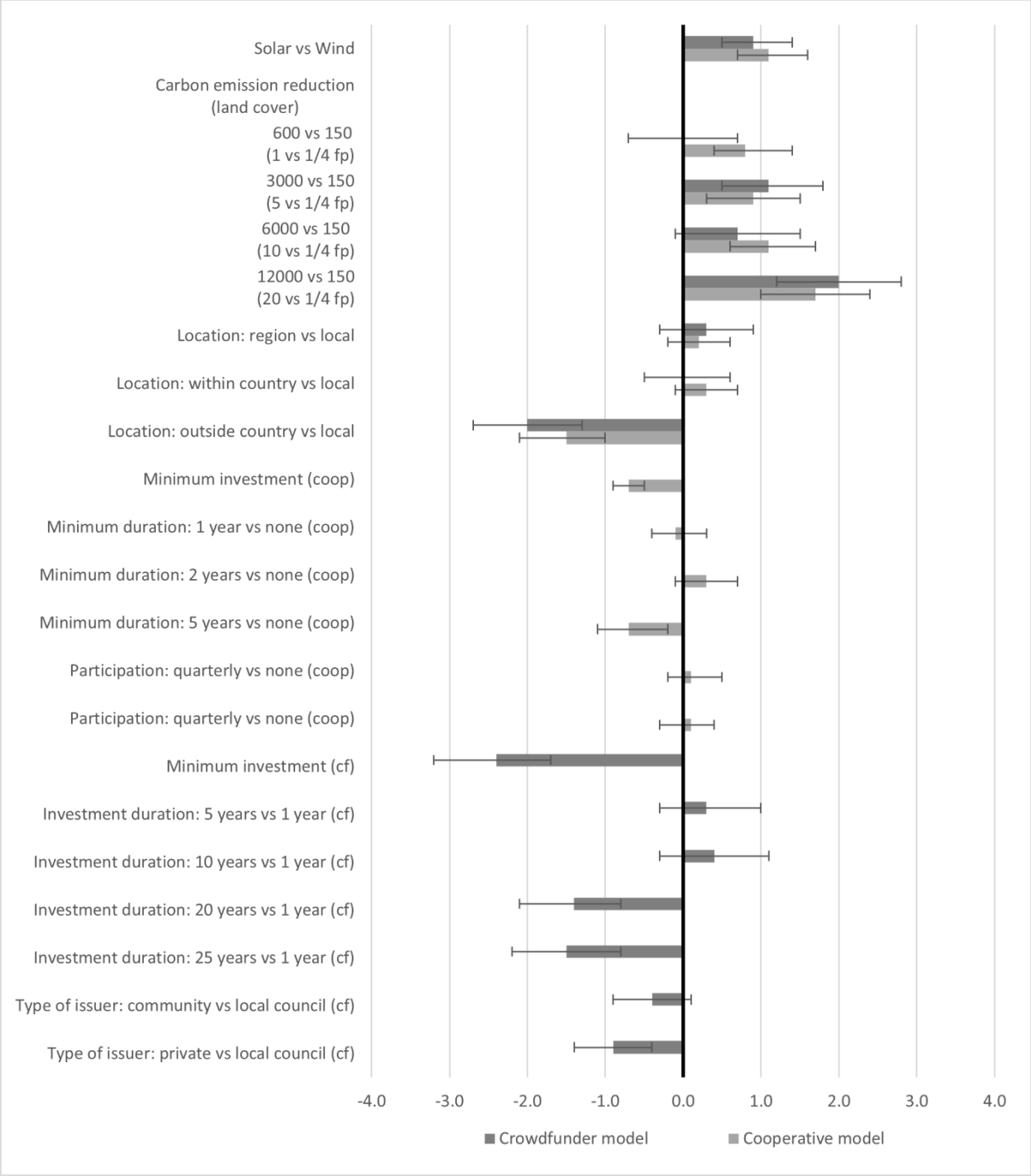

Figure 18: Mean WTA values for the Cooperative and Crowdfunder sample [28]

The panel on the left represents the characteristics of a typical energy cooperative or a crowdfunded project. The bar represents the extent to which a level is preferred over the reference level of the attribute. The larger the bars on the positive domain (on the negative domain), the more respondents value (dislike) the alternative level relative to the reference level.
Note:
"fp" refers to football pitch; "coop" refers to attributes for the Cooperative Model and "cf" refers to attributes for the Crowdfunder Model.
All the WTA estimates are presented in percentage of annual return.
95% confidence is calculated using [29]'s approach.

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3.3.5 Peer-to-peer platform DCE results

We next briefly discuss some preliminary findings from the peer-to-peer platform DCE samples. These are studied in more detail in a working paper by Carroll, Denny, Ferris, Petrov, & Wu (2022) [30].

We again find a significant and negative constant term, suggesting that respondents generally would like to join peer-to-peer platforms. When looking at attribute effects, we find that individuals from all surveyed countries prefer higher energy bill savings. Most respondents also express a preference towards higher carbon emission reductions. Romanian and US respondents prefer solar over wind energy, whilst German respondents are indifferent to the type of renewable energy consumed.

Amoung peer-to-peer service characteristics, Romanian respondents are interested in receiving a green energy notification, yet no difference in preference is observed between daily and weekly message frequency. German and US respondents appear to be less interested in this attribute. In our example, the online platform also allows users to customise a search algorithm, which will automatically search for contracts that maximise bill saving, carbon saving, or both. Preliminary results indicate that individuals are indifferent to optimising bill saving when compared with carbon savings, but significantly prefer the option that optimises both aspects simultaneously. Finally, whilst Romanian respondents seem to be indifferent towards contract length, German and US respondents tend to choose shorter contracts.

3.3.6 Individuals who choose the opt-out option

Since each respondent is presented with 8 choice cards in our DCE, we can count the number of times the opt-out option is chosen by an individual, and look for relationships with other sociodemographic and energy attitude characteristics. These relationships are explored in greater detail in Carroll, Denny, Ferris, Petrov, & Wu (2022) however we provide a brief summary of some preliminary results here.

When looking at socio-demographic characteristics, we find that females are significantly more likely to opt-out or abstain from choosing an energy initiative option in our DCE setting. Age appears to be even more strongly correlated with the number of opt-outs, with increases in age being associated with an increasing number of opt-outs for all age categories relative to our baseline category of 18-29 years. This effect is largest for age groups over 50 years old. For example, respondents in the 70+ age category choose the opt-out option 1.89 times as often as the 18-29 age group. Those with higher level education are also likely to opt-out fewer times than those without [31].

In terms of correlations with other energy behaviour variables, respondents that have upgraded their heating system in the last 10 years are significantly less likely to opt of energy initiative investment in our DCE relative to those that have not. Those with considerable interest in a phone app which monitors electricity consumption, and those that are comfortable with sharing energy data with organizations are also significantly less likely to choose the opt-out option.

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General previous investment experience appears to strongly negatively related with choosing the opt-out option. This is expected, as such individuals may be more likely to have higher investment appetites, and hence be less likely to abstain from energy initiative investment also. In a similar vein, risk averse individuals are found to be more likely to opt-out more often – likely due to their distaste for taking on investment risk of any kind. Importantly, individuals with high levels of trust in carbon saving claims made by organizations were found to be significantly less likely to opt out from the DCEs. Coupled with our findings from looking at stated previous energy organization experience (Table 18), this suggests that gaining the publics' trust regarding carbon saving claims will be imperative in encouraging participation across multiple energy business models.

Self-reported reasons for opting out.

Subsequent to the DCE, respondents were given the option to self-report one or more reasons for choosing the opt-out option from a pre-determined list as well as an open-ended "Other" category.

The most common reason given for opting out form the pre-determined list is that respondents could not afford to invest in energy projects, followed by deeming such investments as unrealistic/convincing. The least common selected reasons include *"I don't have time to go through the details*" and *"I don't think is the public's responsibility to reduce emissions"*. Some heterogeneity in opt-out reasons exists between countries and business models. For example, unaffordability and an unrealistic/unconvincing project description appear to be less common responses among the peer-to-peer study samples.

Among the open-ended *"Other reasons"* option some interesting patterns also emerge. A very common reason cited is the duration of investment (particularly in the crowdfunder study) and its relationship to respondent age. For example, a typical response observed was:

"My age. 10 years or more are not viable for me."

Or

"Most are too long term for someone at my time of life"

This is consistent with the pattern observed in the regression analysis of opt-outs, whereby older respondents are considerably more likely to opt-out of energy investment or participation, across all business models. In the UK, of the 120 or so respondents that chose to justify their abstinence, 46% explained it was due to the length of the project, generally linked to the age of the participant, i.e., too old to see the investment returned. The second most popular reason was the return level being seen as too low (12.5%), or too low for the timescale (different 11%).

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3.3.7 Surveys of existing customers

In addition to surveys of the general public, we also collected data from customers of SocialRES partners using customer version surveys. The number of responses for the general public samples and customer survey samples is shown in Table 20. We didn't collect customer data from our partner Tractebel in Romania, as their peer-to-peer platform is still at an infant stage. As our partners Power Parity and REGEA operate both energy cooperatives and crowdfunding platforms, we sent both versions of the surveys to their customers. The list of countries and associated project partners is as follows:

- Energy cooperatives: Germany (Lake Constance Foundation), France (I-ENER), Spain (EnergÉtica), Sweden, Poland
- Energy crowdfunding platforms: UK (Abundance), Portugal (Power Parity), Croatia (REGEA), Ireland, Italy
- Energy peer-to-peer platforms: Romania (Tractebel), Germany, US
-

Table 20: General public and customer samples

	Energy cooperatives					
	Germany	France	Spain	Sweden	Poland	Portugal
Sample size for the general public	790	805	799	800	801	/
Sample size for the customers	18	66	23	/	/	150

	Energy crowdfunding platforms				
	Portugal	UK	Croatia	Ireland	Italy
Sample size for the general public	799	794	804	790	798
Sample size for the customers	231	192	24	/	/

	Energy peer-to-peer platforms		
	Romania	US	Germany
Sample size for the general public	797	796	791
Sample size for the customers	/	/	/

The findings from the existing customer surveys are broadly speaking similar to the findings from the general public. A comparison of self-reported ranking of cooperative attributes in the general public and in the customer surveys is presented in Table 21. Overall, both samples consider carbon reduction as the most important aspect concerning investment in energy cooperatives, with 54% from the general public and 63% from the existing customers rating this feature as very or extremely important. On the other hand, only 33% individuals from the general public and 24% surveyed customers think that the chance of participation in an energy cooperative is very or extremely important, which is the lowest among all cooperative characteristics. Differences in the perception of energy cooperative features between the two samples are also observed: minimum investment is considered as the second most important feature for the general public, yet it only comes in fifth for the existing customers. Instead, project location is the second most important self-reported factor for current cooperative customers.

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Table 21 Ranking of the importance of key features of energy cooperatives

	General public		Existing customers	
	Ranking	% Importance [a]	Ranking	% Importance [a]
Carbon reduction	1	54%	1	63%
Minimum investment	2	48%	5	32%
Annual return	3	46%	3	41%
Location of the project	4	41%	2	53%
Project technology	5	40%	4	36%
Minimum duration	6	38%	8	16%
Land size	7	35%	6	30%
Participation	8	33%	7	24%

Note: (a) Percentage of those who chose "very important" or "extremely important" on the 5-point Likert scale question.

For the energy crowdfunding samples, the results comparing self-reported attribute importance between the general public and the customer surveys are presented in Table 22, which illustrate that carbon reduction (57%), investment duration (53%) and minimum investment (48%) are considered the top 3 factors in making investment decisions for the general public. However, annual return (65%) appears to be the most important element for the customer sample, followed by investment duration (55%) and carbon reduction (42%). On the other hand, land size and type of issuer are the least important for the general public sample, whilst project technology and land size are the least important for the customer sample.

Table 22 Ranking of the importance of key features of energy crowdfunders

	General public		Existing customers	
	Ranking	% Importance [a]	Ranking	% Importance [a]
Carbon reduction	1	57%	3	42%
Investment duration	2	53%	2	55%
Minimum investment	3	48%	4	27%
Annual return	4	48%	1	65%
Location of the project	5	44%	6	24%
Project technology	6	41%	7	18%
Land size	7	40%	8	15%
Type of issuer	8	35%	5	25%

Note: (a) Percentage of those who chose "very important" or "extremely important" on the 5-point Likert scale question.

We next turn out attention to the DCE results for the customer sample and their comparison to the general public. The experimental results for both groups are again broadly similar. We find that alternative specific constants for both the cooperative and crowdfunder customer samples are significant, indicating that in both samples individuals would like to participate in the presented DCE energy initiatives.

The findings from the DCE results on existing cooperative customers indicate that annual return, the level of carbon reduction and the location of the project are again considered as important attributes in participation, which is consistent with the findings from the general public. Respondents from both the general public sample and customer sample also prefer solar rather than wind projects. Individuals from both samples are indifferent to the location of the project within their countries, yet dislike projects built outside their countries.

Some differences between both cooperative samples are also present. Respondents from the customer sample are indifferent to all levels of minimum duration, but those from the

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general public sample show a distaste towards a 5-year minimum duration. This may suggest that individuals without previous experience in investing in cooperatives may be more unwilling to have their invested money tied up for a longer duration of time. It is also observed that individuals from the general public sample are indifferent to participating in meetings organised by energy cooperatives, whilst customers prefer to participate cooperatives' annual meetings.

When looking at the DCE preference estimates for the crowdfuder customer sample, we again find that respondents prefer projects with a bigger annual returns and higher levels of carbon reduction, which is consistent with the findings from the general public. Respondents from the general public sample showed a distaste towards a 20-year or a 25-year minimum investment duration, and this distaste is even stronger for those from the customer sample. Respondents from both samples also dislike private companies as the issuer of climate bonds. Individuals from the general public sample appear to be indifferent between local councils and community organisations as issuers, whilst customers prefer community organisations over local councils.

Some differences in preferences are also exhibited in the crowdfunder samples. Respondents from the general public prefer solar over wind projects, yet those from the customer sample are indifferent in preferences between the two types of renewable technology. Individuals from the customer sample also have a strong preference for localised projects (as well as within country projects), whilst those from the general public are indifferent to the location of the project within their country, and only exhibit a distaste to projects built outside of their country.

The above findings suggest that current customers and the general publics' importance of attributes is broadly similar, with some nuanced differences in preferences. These differences may be attributable to the fact that existing customers are early adopters and may not be representative of the general population. Conversely, the general publics' views may be naïve to the reality of participating in an energy organisation, given that a very small share from the general public sample have indicated that they have previously participated in an energy organisation. An additional caveat in comparing these results is that the samples of existing customers are much smaller, and hence the significance of preference may be harder to detect.

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4. Behavioural aspects of engagement with social innovation projects

The results obtained from the surveys suggest in a preliminary way that there may be differences in the consumption profiles of the participants, depending on the group in which they fall, and this aspect becomes the link between both studies detailed before. The groups considered in the study present notable differences: in the case of Section 2, behaviour analysis using quantitative data, the study participants belong to some social innovation in the energy sector such as a Cooperative, Aggregator or Crowdfunding platform, and have voluntarily shared their consumption data for analysis. On the other hand, in Section 3, focused on behaviour analysis using surveys, the answers are attributed, on the one hand, to the public, and on the other, and in a similar way, to members of the aforementioned social innovations, who have also decided to participate in the study voluntarily. However, there is no monitored information on electricity consumption for the latter, so the link is complex, and it is necessary to identify a series of common features between users that allow characterising groups, and extrapolating conclusions. Having introduced a questionnaire in the analysis carried out in Section 2 allows establishing this union in a simpler way, and with it, being able to associate consumption curves with qualitative characteristics of the participants.

There are a series of elements collected in the surveys of the general public and the questionnaire from Section 2 that, although not immediately in all cases, can be related. Some of the most relevant potential relationships have been analysed in greater detail:

- **Heating systems**: in both studies the user is asked to indicate what type of system they use in their home. In the case of the surveys of the general public, the possible answers include gas, oil, wood, coal or electricity, and in the case of the questionnaire, some additional ones are included such as biomass, or DH.
- **Air conditioning**: in both studies, information is collected on the availability or not of these systems.
- **Behavioural change**: in the case of the surveys, it is possible to know if users have changed their heating system, if they have previously participated or not in an energy organization and if they have modified their contracted rate. In the case of the questionnaires, information is collected on various energy efficiency measures applied in the home, from simple aspects such as the application of a rate change, in the hours of energy use, or reduction of the contracted power, to more complex measure which require a larger investment, such as changing the HVAC system, renovating the building, switching to LED lighting or installing solar thermal panels.
- **Habits and predisposition**: in the case of the surveys, information is collected on whether users would be interested in having an application that reports on their consumption or not, if they are interested in participating in DSM programs or would be willing to share their electricity consumption data. On the other hand, the questionnaire allows knowing how temperature control is carried out in the home, and if the user has behavioural habits focused on reducing consumption at specific times.

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- **Electricity consumption**: the surveys provide information on the amount of electricity consumed by users globally, and in the case linked to the questionnaires, information is available at a much higher level of precision.

Some possible links to findings from Section 3 include:

- Differences in load profiles based on heating type can be linked to differences in heating types between those that have participated in an energy organization and those who have not. Those with previous energy organization experience in the general public surveys seem to be more likely to have electric heating, and less likely to use oil, gas or coal as their main central heating fuel. This could be extended considering other heating systems included in the questionnaire.

- Differences in load profiles between those that have upgraded their heating system (or intend to) can be linked to the findings that those who have upgraded their heating systems are more likely to have participated in an energy organization and less likely to opt-out of participation in the DCE. Having upgraded one's heating system significantly increases the likelihood that they have participated in an energy organization previously, and at the same time also decreases the likelihood that these individuals will opt-out of participation in the DCE setting. This could suggest that these individuals may be more environmentally/energy conscious and upgrading one's heating system changes energy behaviours and attitudes significantly.

- Findings for air-conditioning. Respondents with air conditioning are more likely to indicate that they have participated in an energy organization.

- Those that have considerable interest in a DSM device, considerable comfort in sharing electricity consumption data and considerably varying electricity tariffs are more likely to have participated in an energy organization. This could be linked to control habits considered in the questionnaire in Section 2.

- Additionally, those that have considerable interest in a phone app showing real time electricity consumption, considerable interest in a DSM device, considerable comfort in sharing electricity consumption data or considerably varying electricity tariffs are all less likely to choose the opt-out option in the DCE. These could be linked to the findings on heating habits and behavioural change in Section 2.

Considering that the **survey of participants from the general public who have belonged to an energy organization** in the past may present similar behaviour to **members of social innovations analysed in Section 2** (as a consequence of their previous membership, acquired knowledge and interests), an analysis is performed in order to identify the profiles that may represent them.
Similarly, a study is conducted with the purpose of finding the profiles that may best represent participants from the **survey of general public who have not previously belonged to an energy organization**. In this case, the information from the control group

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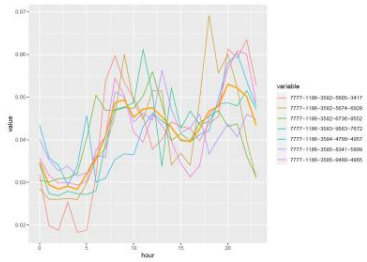
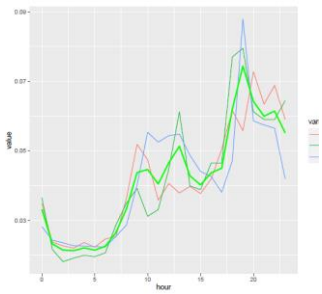
is not considered directly related, since the characterization of the average control group values may be associated with different types of users (current and former members of the social innovations, or the general public). Then, the profiles obtained from Section 2 are considered again, with the aim of identifying those most associated with the most representative features detected through the surveys for this group of participants. Extrapolating these results, we could infer that this behaviour would be similar to that of those participants in the survey of the general public who have not previously belonged to a social innovation, according to the results of the surveys on heating systems, or energy use and concerns.

The following tables show the main profiles classification obtained according to all these features for the case study participants in the quantitative analysis:

Table 23: Most representative profiles according to the characteristics of the survey and considering the obtained profiles for the LCF Case Study.

<table>
<tr><th colspan="6">PROFILES FROM LCF CASE STUDY (DE)</th></tr>
<tr><td colspan="6">INDIVIDUALS THAT HAVE PARTICIPATED IN AN ENERGY ORGANIZATION: POTENTIAL PROFILES</td></tr>
<tr><td>PROFILE 2</td><td colspan="3">MAIN FEATURES</td><td colspan="2">Exclusive characteristics</td></tr>
<tr><td rowspan="4">  </td><td rowspan="2">✓</td><td rowspan="2">Similar to households from the general public surveys who are more likely to have previously participated in an energy organization</td><td>✓</td><td>Electric heating</td><td rowspan="4">Mainly homes occupied by two people, which have the most common appliances. The most common heating systems are oil heating or gas boiler, and some members have electric cooling. Thermal storage is used by some of the members. It is common for programmable thermostats to be available. Mostly, not eV available.
Higher consumption levels</td></tr>
<tr><td>×</td><td>Air conditioning</td></tr>
<tr><td>✓</td><td>EEMs application</td></tr>
<tr><td>✓</td><td>May be less likely to choose the opt-out option</td><td>✓</td><td>EEMs application</td></tr>
<tr><td rowspan="2">✓</td><td rowspan="2">May have higher acceptability of demand side management</td><td>✓</td><td>Heating habits</td></tr>
<tr><td>✓</td><td>EEMs application</td></tr>
<tr><td colspan="6">INDIVIDUALS THAT HAVE NOT PARTICIPATED IN AN ENERGY ORGANIZATION: POTENTIAL PROFILES</td></tr>
<tr><td>PROFILE 3</td><td colspan="3">MAIN FEATURES</td><td colspan="2">Exclusive characteristics</td></tr>
<tr><td rowspan="2">  </td><td>×</td><td>Similar to households from the general public surveys who are more likely to have previously participated in an energy organization</td><td>×</td><td>Electric heating</td><td rowspan="2">Homes occupied by 4, 3/4, 1/3 or 2/3 people, depending on the case, which have most common appliances. Differences also in heating systems (gas boiler, oil heating, biomass boiler). Storage systems are not available. Temperature controlled manually and eV available for some members, charged at home or not, depending on the specific case.</td></tr>
<tr><td>✓</td><td>May be less likely to choose the opt-out option</td><td>✓</td><td>EEMs application</td></tr>
<tr><td colspan="6">Non-exclusive characteristics of the LCF case study participants</td></tr>
<tr><td colspan="6">The homes are flat or single house type, with variable size and very different age of the building. Most of the participants have the habit of lowering the temperature of their home at night, and even when they leave the house. Comfort is considered adequate by all of them, and a simple electricity rate has been contracted.</td></tr>
</table>

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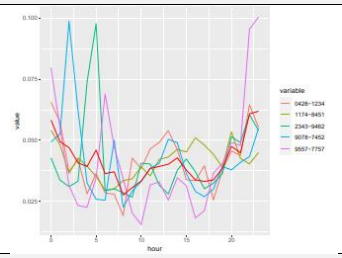
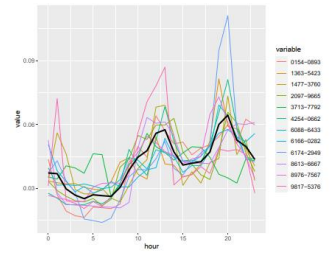
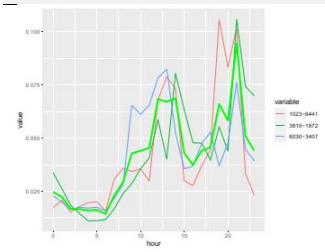
Main findings	
Previous participation in energy organization	Profile 2's characteristics may be similar to individuals who are more likely to have participated in an energy organization in the general public surveys. In this specific case, no user has air conditioning at home. In the other extreme, Profile 3 may be similar to individuals who are less likely to have participated: these users have non-electric systems at home, mainly. The profile aspect is different: the latter presents the lowest consumption values between 1-6h, a growing aspect from 6h, and large peaks at 12h and 22h, while peaks are less pronounced for the first one.
Opt-out option selection	Profiles 2 and 3 may be less likely to choose the opt-out option, since they belong to the group of participants who have applied the largest amount of EEMs at home. Profile 2 presents the highest levels of consumption for the LCF case study sample, but it may not be enough representative to determine this characteristic.
Acceptability of DSM	Profile 2 may present the most promising profile of participants who may accept DSM programs.

Table 24: Most representative profiles according to the characteristics of the survey and considering the obtained profiles for the Coopernico Case Study

PROFILES FROM COOPERNICO CASE STUDY (PT)				
INDIVIDUALS THAT HAVE PARTICIPATED IN AN ENERGY ORGANIZATION: POTENTIAL PROFILES				
PROFILE 1	*MAIN FEATURES*			*Exclusive characteristics*
	✓	*Similar to households from the general public surveys who are more likely to have previously participated in an energy organization*	✓ *Electric heating* ✓ *Air conditioning* ✓ *EEMs application*	Dwellings occupied by 2 or 3 people mainly, that usually have electric heating and air conditioning at home. Some of them have thermal or electrical storage systems. Temperature is manually controlled mainly, some users have a programmable thermostat. Variable tariff
	✓	*May be less likely to choose the opt-out option*	✓ *EEMs application*	
	✓	*May have higher acceptability of demand side management*	✓ *Heating habits* ✓ *EEMs application*	
PROFILE 3	*MAIN FEATURES*			*Exclusive characteristics*
	✓	*Similar to households from the general public surveys who are more likely to have previously participated in an energy organization*	✓ *Electric heating* ✓ *Air conditioning* ✓ *EEMs application*	Dwellings occupied by 2 or 4 people mainly, that usually have electric heating and air conditioning at home. Some of them have electrical or thermal storage systems at home. Temperature is manually controlled mainly, some users have a programmable thermostat. Most of the users have a single rate contracted, but there are some with a two schedule rate.
	✓	*May be less likely to choose the opt-out option*	✓ *EEMs application*	
	✓	*May have higher acceptability of demand side management*	✓ *Heating habits* ✓ *EEMs application*	
INDIVIDUALS THAT HAVE NOT PARTICIPATED IN AN ENERGY ORGANIZATION: POTENTIAL PROFILES				
PROFILE 5	*MAIN FEATURES*			*Exclusive characteristics*
	✗	*Similar to households from the general public surveys who are more likely to have previously participated in an energy organization*	✗ *Electric heating*	Dwellings occupied by 2, 4, 5 or 6 people mainly, that usually have electric heating or gas boiler at home. Some of them have electrical storage. Temperature is manually controlled. Most of the users have a single rate contracted, but there are some with a two schedule rate.
	✗	*May be less likely to choose the opt-out option*	✗ *EEMs application*	

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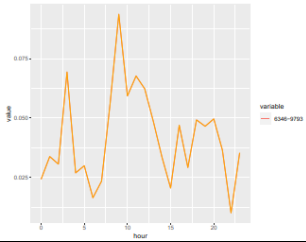
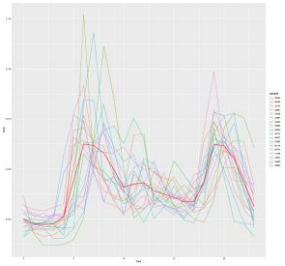
OTHER PROFILES					
PROFILE 4	*MAIN FEATURES*				*Exclusive characteristics*
	✖	*Similar to households from the general public surveys who are more likely to have previously participated in an energy organization*	✖	*Electric heating*	Dwellings occupied by 4 people that have no energy system at home. No storage system is available. Temperature is manually controlled, mainly. Users have a single rate contracted. *Higher consumption levels*
	✖	*May be less likely to choose the opt-out option*	✖	*EEMs application*	
Non-exclusive characteristics of the Coopernico case study participants					
Dwellings occupied by 2 or 3 people mainly, that usually have electric heating and air conditioning at home. Some of them have thermal or electrical storage systems. Temperature is manually controlled mainly, some users have a programmable thermostat. Most of the users have a single rate contracted, but there are some with a two schedule rate.					
Main findings					
Previous participation in energy organization	Profiles 1 and 3 may be similar to individuals who are more likely to have participated in an energy organization in the general public surveys, although they look very different (the second is the closest to the CG profile). At the other extreme, Profile 5 may be similar to the group of participants who are less likely to have participated in an energy organization. The profile aspect is different: the latter presents the lowest consumption values between 1-6h, a growing aspect from 6h, and large peaks at 14h and 22h.				
Opt-out option selection	Profiles 1 and 3 may be less likely to choose the opt-out option, since they belong to the group of participants who have applied the largest amount of EEMs at home. No other information can be added for the other profiles; Profile 4 presents the highest levels of consumption, but it may not be enough representative to determine this characteristic.				
Acceptability of DSM	Profiles 1 and 3 may present the most promising profiles of participants who may accept DSM programs.				

Table 25: Most representative profiles according to the characteristics of the survey and considering the obtained profiles for the EnergÉtica Case Study

PROFILES FROM ENERGETICA CASE STUDY (ES)					
INDIVIDUALS THAT HAVE NOT PARTICIPATED IN AN ENERGY ORGANIZATION: POTENTIAL PROFILES					
PROFILE 1	*MAIN FEATURES*				*Exclusive characteristics*
	✖	*Similar to households from the general public surveys who are more likely to have previously participated in an energy organization*	✖	*Electric heating*	Dwellings occupied by 2 people or 1 person mainly, that usually have central gas at home (other systems are central fuel or individual gas) Some of them have electrical or thermal storage systems. Temperature is mainly manually controlled, some users have central control. Most of the users have a two-schedules rate contracted, but there are some with single rate. Variable tariff
	✖	*May have higher acceptability of demand side management*	✖	*Heating habits*	

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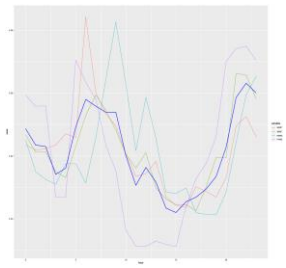
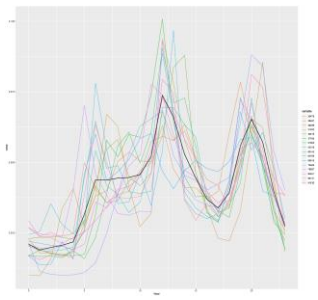
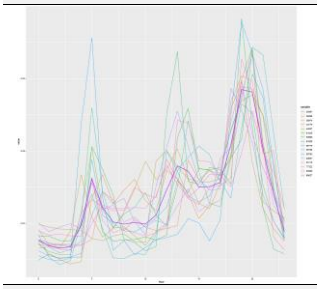
PROFILE 2	*MAIN FEATURES*				*Exclusive characteristics*
	✖	*Similar to households from the general public surveys who are more likely to have previously participated in an energy organization*	✖	*Electric heating*	Dwellings occupied by 2 people mainly, that usually have individual fuel or central gas at home (other system available is central fuel)..Some of them have electrical or thermal storage systems. Temperature is manually controlled, some users have a programmable termostat. Users usually have a two-schedules rate contracted.
	✖	*May be less likely to choose the opt-out option*	✖	*EEMs application*	*Higher consumption levels* | Variable tariff

OTHER PROFILES

PROFILE 5	*MAIN FEATURES*				*Exclusive characteristics*
	✖	*Similar to households from the general public surveys who are more likely to have previously participated in an energy organization*	✖	*Electric heating*	Dwellings occupied by 2 or 3 people mainly, that usually have individual gas (other available systems are central gas and individual fuel). Some of them have thermal or electrical storage systems. Temperature is mainly manually controlled, some users have a programmable thermostat. Most of the users have a single rate contracted, but there are some with a two schedule rate.
	✓	*May have higher acceptability of demand side management*	✓	*Heating habits*	*Higher consumption levels*

PROFILE 6	*MAIN FEATURES*				*Exclusive characteristics*
	✖	*Similar to households from the general public surveys who are more likely to have previously participated in an energy organization*	✖	*Electric heating*	Dwellings occupied by 2 people mainly, that usually have individual gas (other available systems are central gas or central fuel). Some members have electrical storage at home. Temperature is mainly manually controlled, some users have central control or a programmable thermostat. Most of the users have a single rate contracted, but there are some with a two schedule rate.
	✓	*May have higher acceptability of demand side management*	✓	*Heating habits*	

Non-exclusive characteristics of the EnergÉtica case study participants

Dwellings of type flat or single house, which present a diverse area and year of construction (a further analysis could help to identify more details about them, since groups have a relevant representation of members). Most common white goods are available at home, however, it is not common to have clothes dryer and only some members have dishwasher. Comfort is adequate for almost all of them. Users are concerned about lowering temperature when they leave their home and at night. Power contracted is diverse, most of them have 3-3.9kW contracted (a further analysis could reveal more details on this).

Main findings

Previous participation in energy organization	Profiles 1 and 2 may be similar to individuals who are less likely to have participated in an energy organization, although they look very different (the second is the closest to one of the Spanish CG profiles). No members have been labelled at the other extreme, since there is not enough information available.
Opt-out option selection	There is not enough information to create groups based on this characteristic. Profiles 2 and 5 present the highest levels of consumption, but this seems not be enough to determine this characteristic.
Acceptability of DSM	Profiles 5 and 6 may present the most promising profiles of participants who may accept DSM programs. On the other hand, members of Profiles 1 and 2 usually have a variable rate.

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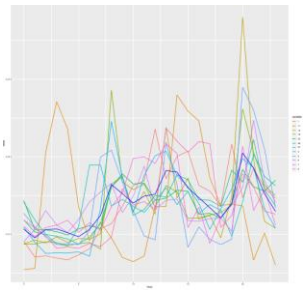
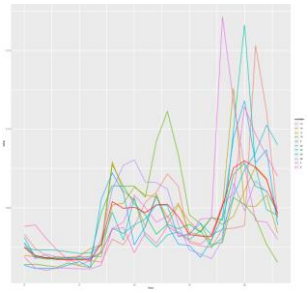
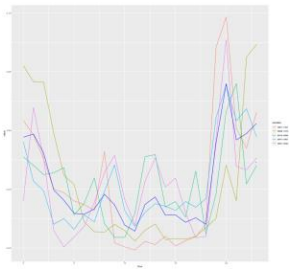
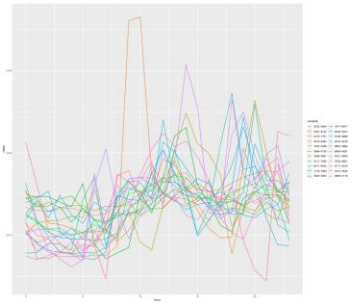
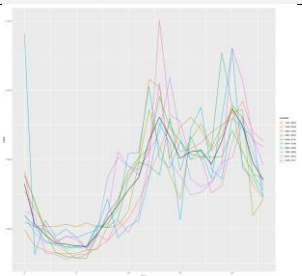
Table 26: Most representative profiles according to the characteristics of the survey and considering the obtained profiles for the IEner Case Study

<table>
<tr><th colspan="5">PROFILES FROM IENER CASE STUDY (FR)</th></tr>
<tr><td colspan="5">INDIVIDUALS THAT HAVE PARTICIPATED IN AN ENERGY ORGANIZATION: POTENTIAL PROFILES</td></tr>
<tr><td>PROFILE 2</td><td colspan="3">MAIN FEATURES</td><td>Exclusive characteristics</td></tr>
<tr><td rowspan="4">  </td><td rowspan="2">✓</td><td rowspan="2">Similar to households from the general public surveys who are more likely to have previously participated in an energy organization</td><td>✓ Electric heating</td><td rowspan="4">Dwellings of type apartment or house. Heat pumps represent the most common heating system, and some have gas boiler. Users perform a manual control or using programmable thermostat. Most of the users have single rate contracted, and it is common to have some behaviour habits focused on improving the energy efficiency of the home (change in energy use and building retrofitting, mainly).
Higher consumption levels</td></tr>
<tr><td>× Air conditioning</td></tr>
<tr><td>✓</td><td>May be less likely to choose the opt-out option</td><td>✓ EEMs application</td></tr>
<tr><td>✓</td><td>May have higher acceptability of demand side management</td><td>✓ Heating habits
✓ EEMs application</td></tr>
<tr><td colspan="5">INDIVIDUALS THAT HAVE NOT PARTICIPATED IN AN ENERGY ORGANIZATION: POTENTIAL PROFILES</td></tr>
<tr><td>PROFILE 1</td><td colspan="3">MAIN FEATURES</td><td>Exclusive characteristics</td></tr>
<tr><td rowspan="2">  </td><td>×</td><td>Similar to households from the general public surveys who are more likely to have previously participated in an energy organization</td><td>× Electric heating</td><td rowspan="2">Dwellings of type apartment or house. The most common heating system is electric heating, and some members have gas or biomass boiler. It is common for programmable thermostats to be available although many of them perform a manual temperature control. Users have two schedules mainly, there are some with a single rate contracted, and it is common to have some behaviour habits focused on improving the energy efficiency of the home (change in energy use, mainly).
Variable tariff</td></tr>
<tr><td>✓</td><td>May be less likely to choose the opt-out option</td><td>✓ EEMs application</td></tr>
<tr><td colspan="5">Non-exclusive characteristics of the IEner case study participants</td></tr>
<tr><td colspan="5">Dwellings presenting a diverse area and year of construction, occupied by diverse number of people (from 1 to 5). Most common white goods are available at home, it is not usual to have clothes dryer or storage systems at home. Users usually are concerned about lowering temperature at night or when they are away from home. Power contracted is diverse, having users from 3 kVA up to 9 kVA contracted.</td></tr>
<tr><td colspan="5">Main findings</td></tr>
<tr><td>Previous participation in energy organization</td><td colspan="4">Profile 2 may be similar to individuals who are more likely to have participated in an energy organization. In the other extreme, Profile 1 can be found. The profile aspect is different: the latter presents the lowest consumption values between 0-5h, and a u-shape between 13-20h (pronounced peak at 20h).</td></tr>
<tr><td>Opt-out option selection</td><td colspan="4">Profiles 1 and 2 may be less likely to choose the opt-out option, since members belong to the group of participants who have applied the largest amount of EEMs at home. Additionally, Profile 2 presents the highest levels of consumption, but this seems not be enough to determine this characteristic. No other information can be added for the other profile.</td></tr>
<tr><td>Acceptability of DSM</td><td colspan="4">Profile 2 may present the most promising profile of participants who may accept DSM programs. On the other hand, members of Profile 1 usually have a variable rate.</td></tr>
</table>

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 837758.

Table 27: Most representative profiles according to the characteristics of the survey and considering the obtained profiles for the GoParity Case Study

<table>
<tr><td colspan="6">PROFILES FROM GOPARITY CASE STUDY (PT)</td></tr>
<tr><td colspan="6">INDIVIDUALS THAT HAVE PARTICIPATED IN AN ENERGY ORGANIZATION: POTENTIAL PROFILES</td></tr>
<tr><td>PROFILE 3</td><td colspan="3">MAIN FEATURES</td><td colspan="2">Exclusive characteristics</td></tr>
<tr><td rowspan="5">  </td><td rowspan="3">✓</td><td rowspan="3">Similar to households from the general public surveys who are more likely to have previously participated in an energy organization</td><td>✓</td><td>Electric heating</td><td rowspan="5">Dwellings occupied by 2 or 3 people mainly, that have electric heating mainly as energy system (also some of them have electric air conditioning). No storage system is available mainly (some have thermal or electrical storage). Users have two schedules contracted mainly, but there are also users who have contracted a single rate or three schedules. Many users are concerned about lowering temperature when they leave their home and at night.
Variable tariff</td></tr>
<tr><td>✓</td><td>Air conditioning</td></tr>
<tr><td>✓</td><td>EEMs application</td></tr>
<tr><td>✓</td><td>May be less likely to choose the opt-out option</td><td>✓</td><td>EEMs application</td></tr>
<tr><td rowspan="2">✓</td><td rowspan="2">May have higher acceptability of demand side management</td><td>✓</td><td>Heating habits</td></tr>
<tr><td>✓</td><td>EEMs application</td></tr>
<tr><td>PROFILE 4</td><td colspan="3">MAIN FEATURES</td><td colspan="2">Exclusive characteristics</td></tr>
<tr><td rowspan="5">  </td><td rowspan="3">✓</td><td rowspan="3">Similar to households from the general public surveys who are more likely to have previously participated in an energy organization</td><td>✓</td><td>Electric heating</td><td rowspan="5">Dwellings occupied by 2 or 3 people mainly (also some of them by 4), that have electric heating mainly as energy system or gas boiler (also many of them have electric air conditioning). Thermal and electrical storage is available for some of the members. Users have mainly a single rate contracted, but there are also some who hav contracted two schedules or three schedules. Most of the users are concerned about lowering temperature when they leave their home and at night.
Higher consumption levels</td></tr>
<tr><td>✓</td><td>Air conditioning</td></tr>
<tr><td>✓</td><td>EEMs application</td></tr>
<tr><td>✓</td><td>May be less likely to choose the opt-out option</td><td>✓</td><td>EEMs application</td></tr>
<tr><td rowspan="2">✓</td><td rowspan="2">May have higher acceptability of demand side management</td><td>✓</td><td>Heating habits</td></tr>
<tr><td>✓</td><td>EEMs application</td></tr>
<tr><td colspan="6">INDIVIDUALS THAT HAVE NOT PARTICIPATED IN AN ENERGY ORGANIZATION: POTENTIAL PROFILES</td></tr>
<tr><td>PROFILE 5</td><td colspan="3">MAIN FEATURES</td><td colspan="2">Exclusive characteristics</td></tr>
<tr><td rowspan="2">  </td><td>×</td><td>Similar to households from the general public surveys who are more likely to have previously participated in an energy organization</td><td>×</td><td>Electric heating</td><td rowspan="2">Dwellings occupied by 4 people mainly (also 2 or 3), that have electric heating, gas boiler or no energy system at home. Some of them have electric air conditioning. Some of them have thermal storage. Users have a single rate contracted. Many users are concerned about lowering temperature when away from home, and some of them also do it at night</td></tr>
<tr><td>×</td><td>May be less likely to choose the opt-out option</td><td>×</td><td>EEMs application</td></tr>
<tr><td colspan="6">Non-exclusive characteristics of the GoParity case study participants</td></tr>
<tr><td colspan="6">Dwellings of type house or apartment, which present a diverse area and year of construction. Most common white goods are available at home, it is not usual to have clothes dryer. Temperature is manually controlled mainly, some users haver programmable thermostat. Comfort is adequate for almost all of them. Different measures are applied at home; from building retrofitting to change in power contracted, energy user or kind of tariff. Power contracted is diverse, having users from 3.35 kVA up to 10.35 kVA contracted.</td></tr>
<tr><td colspan="6">Main findings</td></tr>
<tr><td colspan="2">Previous participation in energy organization</td><td colspan="4">Profiles 3 and 4 may be similar to individuals who are more likely to have participated in an energy organization, although they look very different (the second is the closest to the CG profile). At the other extreme, Profile 5 may represent the group of participants less likely to have participated in an energy organization. The profile aspect is different: the latter presents the lowest consumption values between 1-6h, a growing aspect from 6h, and large peaks around 13h and 21h.</td></tr>
</table>

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 837758.

Opt-out option selection	Profiles 3 and 4 may be less likely to choose the opt-out option, since they belong to the group of participants who have applied the largest amount of EEMs at home. Additionally, Profile 4 presents the highest levels of consumption, but this seems not be enough to determine this characteristic. No other information can be added for the other profile.
Acceptability of DSM	Profiles 3 and 4 may present the most promising profiles of participants who may accept DSM programs.

In general, it can be seen that:

- There are significant differences between the profiles of households who are similar to those in the general public that are likely to indicate that they have participated in an energy organization, and those that have not, in terms of energy consumption. This might suggest that energy behaviours change significantly post heating system retrofit, or EEMs application.
- In addition, the profiles of those who belong to the group of participants most likely to have participated in an energy organization are also similar to individuals who are less likely to choose the opt-out option, except for the Spanish case, where there is not enough information available to determine all the household characteristics.
- The group of participants that shows the highest potential levels of acceptability of DSM always fulfills the two conditions explained above, except for the Spanish case, where there is not enough information available to determine all characteristics.
- Sometimes more than one profile is selected to represent the group of participants who are similar to previous energy participants in the general public. In those situations, both profiles look very different. The type of contracted rate associated with each profile (single rate or variable rate) may determine this.
- There are many similarities between the two types of profiles located in the previous group, even belonging to different countries and types of social innovation.
- More than one profile can be found in the group of participants least likely to have participated in an energy organization. The shape of these profiles may differ depending on the geographical location, but similarities can be found between some of them.
- Profiles representing the highest levels of consumption are often related to the group of profiles most likely to have participated in an energy organization, but no unequivocal association has been found.

In the case of Portugal, the common profiles found have been analysed in detail. The results are included in the following tables:

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Table 28: Comparison between main profiles found in the portuguese case studies: first common profile.

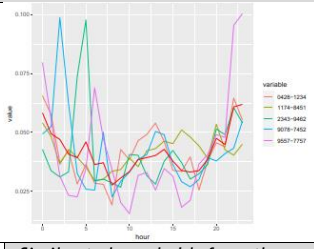
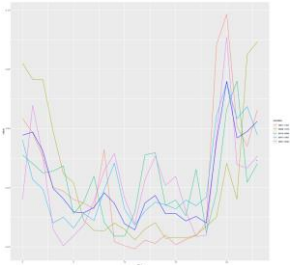
PROFILE 1 COOPERNICO CASE STUDY (PT)	
	*Exclusive characteristics*
	Dwellings occupied by 2 or 3 people mainly, that usually have electric heating and air conditioning at home. Some of them have thermal or electrical storage systems. Temperature is manually controlled mainly; some users have a programmable thermostat. Most of the users have a single rate contracted, but there are some with two schedule rates.-
	Non exclusive characteristics
✓ *Similar to households from the general public surveys who are more likely to have previously participated in an energy organization* ✓ *May be less likely to choose the opt-out option* ✓ *May have higher acceptability of demand side management* Variable tariff	Dwellings of type house or apartment, which present a diverse area and year of construction. Most common white goods are available at home, it is not usual to have a clothes dryer. Comfort is adequate for almost all of them. Different measures are applied at home; from building retrofitting to change in power contracted, energy user or kind of tariff. Power contracted is diverse, having users from 3.35 kVA up to 10.35 kVA contracted. Many users are concerned about lowering temperature when they leave their home and at night.
PROFILE 3 GOPARITY CASE STUDY (PT)	
	*Exclusive characteristics*
	Dwellings occupied by 2 or 3 people mainly, that have electric heating (also some of them have electric air conditioning). No storage system is available mainly (some have thermal or electrical storage). Users have a two schedule rate contracted mainly, but also users with single rate or three schedules are found. Many users are concerned about lowering temperature when they leave their home and at night.
	Non exclusive characteristics
✓ *Similar to households from the general public surveys who are more likely to have previously participated in an energy organization* ✓ *May be less likely to choose the opt-out option* ✓ *May have higher acceptability of demand side management* *Variable tariff*	Dwellings of type house or apartment, which present a diverse area and year of construction. Most common white goods are available at home, it is not usual to have a clothes dryer. Temperature is manually controlled mainly, some users have a programmable thermostat. Comfort is adequate for almost all of them. Different measures are applied at home; from building retrofitting to change in power contracted, energy user or kind of tariff. Power contracted is diverse, having users from 3.35 kVA up to 10.35 kVA contracted.
Main findings	
Main similarities:	
-Participants in both profiles may be more likely to have participated in an energy organization, less likely to choose the opt-out option of the surveys and may have higher acceptability on Demand Side Management.	
Main differences:	
-*Kind of storage*: some users have thermal or electrical storage (Coopernico), but this is not available in the other case (GoParity). -*Temperature is manually controlled mainly*: exclusive characteristic of the profile (Coopernico), non exclusive for the other case study (GoParity). -*Kind of tariff*: single rate mainly or two schedules (Coopernico), two schedules mainly, but also single rate or three schedules (GoParity).	

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Table 29: Comparison between main profiles found in the portuguese case studies: second common profile.

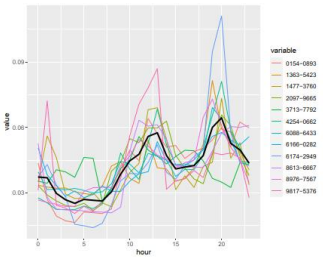
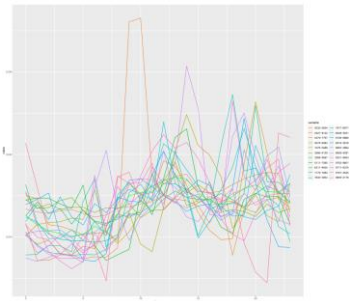
PROFILE 3 COOPERNICO CASE STUDY (PT)	
	*Exclusive characteristics*
	Dwellings occupied by 2 or 4 people mainly, that usually have electric heating and air conditioning at home. Some have electrical or thermal storage systems at home. Temperature is manually controlled mainly, some users have a programmable thermostat. Most users have a single rate contracted, but there are some with two schedule rates.
	Non exclusive characteristics
✓ *Similar to households from the general public surveys who are more likely to have previously participated in an energy organization* ✓ *May be less likely to choose the opt-out option* ✓ *May have higher acceptability of demand side management*	Dwellings of type house or apartment, which present a diverse area and year of construction. Most common white goods are available at home, it is not usual to have a clothes dryer. Comfort is adequate for almost all of them. Different measures are applied at home; from building retrofitting to change in power contracted, energy user or kind of tariff. Power contracted is diverse, having users from 3.35 kVA up to 10.35 kVA contracted. Many users are concerned about lowering temperature when they leave their home and at night.
PROFILE 4 GOPARITY CASE STUDY (PT)	
	*Exclusive characteristics*
	Dwellings occupied by 2 or 3 people mainly (also some of them by 4), that have electric heating mainly or a gas boiler (also many of them have electric air conditioning). Thermal and electrical storage is available for some of the members. Users have mainly a single rate contracted, but there are also some who have contracted a two schedule or a three schedule rate. Most of the users are concerned about lowering temperature when they leave their home and at night.
	Non exclusive characteristics
✓ *Similar to households from the general public surveys who are more likely to have previously participated in an energy organization* ✓ *May be less likely to choose the opt-out option* ✓ *May have higher acceptability of demand side management* *Higher consumption levels*	Dwellings of type house or apartment, which present a diverse area and year of construction. Most common white goods are available at home, it is not usual to have clothes dryer. Temperature is manually controlled mainly, some users have a programmable thermostat. Comfort is adequate for almost all of them. Different measures are applied at home; from building retrofitting to change in power contracted, energy user or kind of tariff. Power contracted is diverse, having users from 3.35 kVA up to 10.35 kVA contracted.
Main findings	
Main similarities:	
-Participants in both profiles may be more likely to have participated in an energy organization and less likely to choose the opt-out option of the surveys.	
Main differences:	
-*Number of occupants*: 2 or 4 people mainly (Coopernico), 2 or 3 people (GoParity). -*Kind of tariff*: single rate mainly, but some have two schedules (Coopernico); single rate mainly, but some have two or three schedules contracted (GoParity). -*Temperature control*: lowering the temperature at night and when leaving home represents a non exclusive characteristic of the first profile (Coopernico), and exclusive for the other case study (GoParity). -*Electricity consumption*: in the case of GoParity this profile is associated with the highest consumption levels.	

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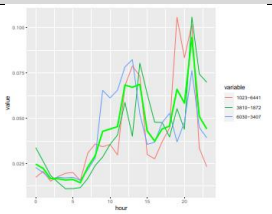
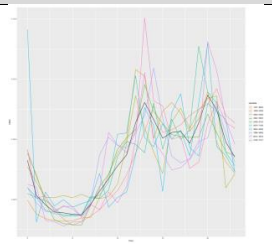
Table 30: Comparison between main profiles found in the portuguese case studies: third common profile.

PROFILE 5 COOPERNICO CASE STUDY (PT)	
	*Exclusive characteristics* Dwellings occupied by 2, 4, 5 or 6 people mainly, that usually have electric heating or a gas boiler at home. Some of them have electrical storage. Temperature is manually controlled. Most of the users have a single rate contracted, but there are some with two schedule rates. *Non exclusive characteristics* Dwellings of type house or apartment, which present a diverse area and year of construction. Most common white goods are available at home, it is not usual to have a clothes dryer. Comfort is adequate for almost all of them. Different measures are applied at home; from building retrofitting to change in power contracted, energy user or kind of tariff. Power contracted is diverse, having users from 3.35 kVA up to 10.35 kVA contracted. Many users are concerned about lowering temperature when they leave their home and at night.
x *Similar to households from the general public surveys who are more likely to have previously participated in an energy organization* x *May be less likely to choose the opt-out option* x *May have higher acceptability of demand side management*	
PROFILE 5 GOPARITY CASE STUDY (PT)	
	*Exclusive characteristics* Dwellings occupied by 4 people mainly (also 2 or 3), that have electric heating, gas boiler or no energy system at home. Some of them have electric air conditioning. Some of them have thermal storage. Users have a single rate contracted. Many users are concerned about lowering temperature when away from home, and some of them also do it at night. *Non exclusive characteristics* Dwellings of type house or apartment, which present a diverse area and year of construction. Most common white goods are available at home, it is not usual to have a clothes dryer. Temperature is manually controlled mainly, some users haver programmable thermostat. Comfort is adequate for almost all of them. Different measures are applied at home; from building retrofitting to change in power contracted, energy user or kind of tariff. Power contracted is diverse, having users from 3.35 kVA up to 10.35 kVA contracted.
x *Similar to households from the general public surveys who are more likely to have previously participated in an energy organization* x *May be less likely to choose the opt-out option* x *May have higher acceptability of demand side management*	
Main findings	
Main similarities:	
-Participants in both profiles may be less likely to have participated in an energy organization and less likely to choose the opt-out option of the surveys.	
Main differences:	
-*Number of occupants*: 2 people mainly (Coopernico), 4 people (GoParity). -*Storage systems*: electrical storage available (Coopernico), thermal storage available (GoParity). -*Temperature is manually controlled mainly*: exclusive characteristic (Coopernico), and non exclusive for the other case study (GoParity). -*Kind of tariff*: single rate mainly, but some have two schedules (Coopernico).	

- In the case of Portugal, there is a direct relationship between the most representative profiles, which are present regardless of the associated social initiative, and whose similarity may have a certain relation with geographical location. In addition, the number of profiles discovered in both cases is five.
- In general, the three paired profiles have a very important similarity to each other. The main differences found are not related to the characteristics of electricity consumption, but rather to the qualitative characteristics of the users belonging to each profile of each case study. These differences are found in specific features: type of storage, mode of temperature control at home (whether it is an exclusive feature at cluster level or not), and type of rate contracted, mainly.
- The relationship is not as exact between profiles from different countries, although many of them are coincidental. These differences may be linked to:

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- Geographical and qualitative characteristics of the participants (different heating systems, need for refrigeration, types of EEMs applied more frequently).
- The number of representative profiles discovered in each case study is not always the same, and the existence of a greater number of groups makes it more difficult to label unique profiles based on the characteristics analysed, since they often represent a lower number of users.
- The questionnaire has not been implemented in the same way in all countries, given its adaptation to the real context. This means that not all the answers based on which the classification has been made are available, and for some of them there may not be enough information.

Finally, when studying the general publics' attitude towards novel energy business models, the positive previous experience of investors/participants was found to be highly valued. As final remark, a possible way to engage/motivate households to join energy initiatives may be to illustrate the positive previous experience of households who have joined energy initiatives and have a similar electricity consumption profile. We must not forget that the energy transition has to be supported and driven by users.

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