CLEAR2.0

enabling Consumers to Learn about, Engage with and Adopt Renewable energy technologies

WP2 Monitoring Consumptions & Identifying Targeted Solutions

D2.1 Report on the relevant Energy Consumption Segments in the Residential Sector

Contents

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T2.1 Global assessment of Households profiles. You provided a diagram in Annex 2 of household profiles, but I was wondering you have a more comprehensive report

1. Introduction.

The main purpose of the T2.3 "Household monitoring of devices to optimize self-consumption" is to gather data regarding the consumption profiles of real families and follow the positive changes resulting from the optimized use of renewable energy equipment and energy efficiency measures. This will result in tailored advice that can fit the specific profiles that were studied. The advices can, then, be disseminated to the remaining population, using the most adequate advices to each profile, and maximizing the potential for energy savings in each profile.

To achieve this goal, the households that are monitored should already be chosen taking into account the most representative energy consumption profiles of each country. And, since the objective is to introduce counselling regarding optimization of energy using equipment, the energy consumption profiles need to take into account specific details, like the type of heating and hot water production systems that are more popular in the countries. Besides this, other elements such as geographic location, number of persons per household, type of energy source used, etc., need also to be taken in account. With this report, we explain in detail how each country found the data needed to build the energy consumption profiles.

Each country has carried out a deep research by contacting the main public administrations (for example, Energy Agencies, Energy Regulators, Statistic Data and State Institutions, etc.) to collect the most up to date information on the energy situation in the residential area.

Following this national data collection, the consortium has had several meetings to share the local situation with the other countries in order to see common points, differences, and to go deeper on the reason of the differences between countries, taking advantage of learning about what other countries are doing.

As we have said, this task represents the foundation for T2.3 "Household monitoring of devices to optimize self-consumption", helping on the definition of the KPIs and on the definition of the possible impacts, after the identification of the different household profiles (depending on the climate zone, the different types of buildings, construction types, consumption profiles, type of occupation and energy systems, etc.).

The study of the household profiles has allowed the consortium to match the behavior of the selected families with the societal typology, which is the main goal of the CLEAR 2.0 project. The intention is that the outcome of the activities in T2.3 can be spread to

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achieve as much people as possible, helping them to improve their energy consumption, saving energy, money and being closer to renewable energies.

Each country has adapted the development of the T2.3 monitoring process based on their own specific situation, to assure the success of the process, but still keeping in mind the global KPI's and minimum requirements defined by the consortium.

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2. Assessment of Households profiles per each country.

2.1. Belgium assessment.

In the Belgium assessment, the team started by collecting official government statistics regarding population, energy use, type of dwellings and some appliances ownership.

A lot of statistics were available, and besides the official information, we used different pilot project reports and scientific literature at national or European level, directly or partially related to energy use and behavioral change at domestic level and also some project focusing on feed-back monitoring project.

Reading these main references allowed us to learn about what is already available and well known and make sure that we are going to contribute as much as we can to new learnings.

You will discover into this Belgian section the way leading to a more specific scope for the monitoring project and a new definition of household profiles for which very few statistics are available at the moment.

2.1.1. Population[1].

Total Belgium

11.376.070 inhabitants composed as follows: 50,8% women and 49,2% man

Flanders (North Belgium)

6.552.967 inhabitants (57,5%) composed as follows: 50,5% women and 49,5% man

Wallonia (South Belgium)

3.624.377 inhabitants (32,0%) composed as follows: 51,1% women and 48,9% man

Brussels Capital Region

1.198.726 inhabitants (10,5%) composed as follows: 51,1% woman and 48,9% man

If we cross with age distribution we obtain the figure showed on the next page.

[1] Statistics from Federal Government Statistical Office (www.statbel.fgov.be). Figures here are including statistics until end 2017.

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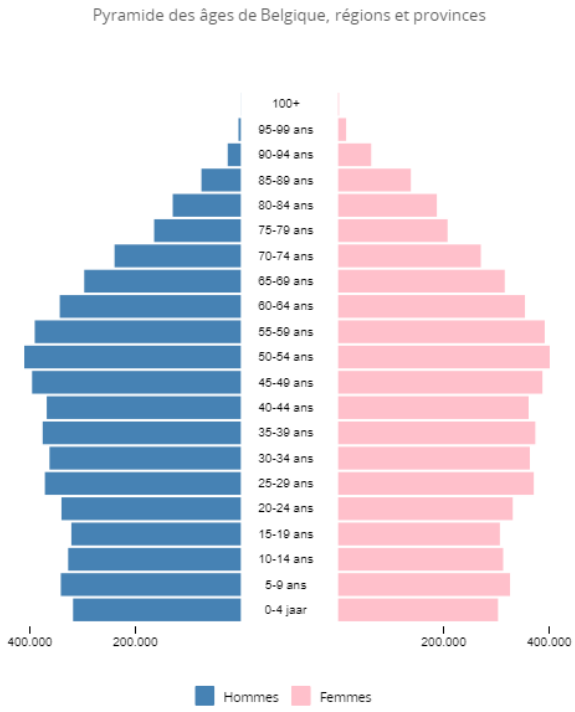

Globally, age distribution shows that majority of Belgian people are between 45 and 60 years old and the second big range is between 25 and 45 years old, regardless of gender.

2.1.2. Regions or climate zones[2].

Belgium is not big enough to establish real climatic zones. We can however distinguish some small differences between the sea side (north of the country), the center and the south with another topography (hills and very small mountains).

Average temperature on yearly basis is showing a relative higher temperature on the seaside compared to center end the same trend compared to south of the country due to the topography and the lower related sun irradiation.

[2] Graphs extracted from IRM website (Royal Meteorology Institute), www.meteo.be.

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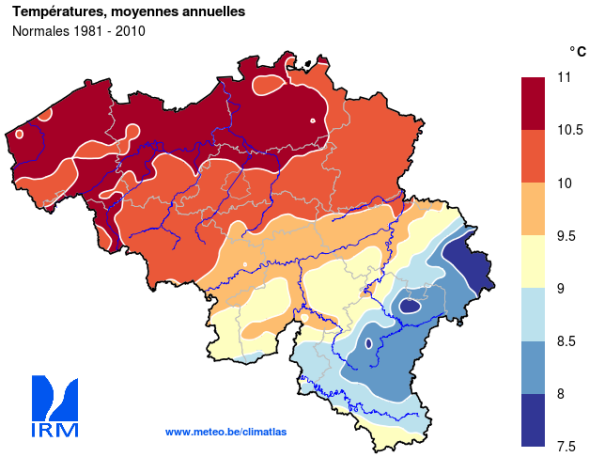
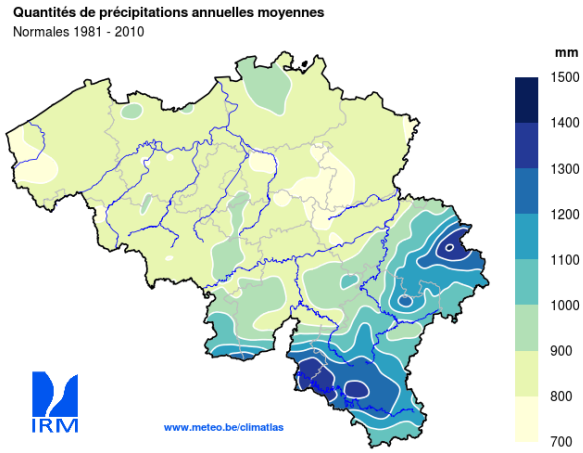
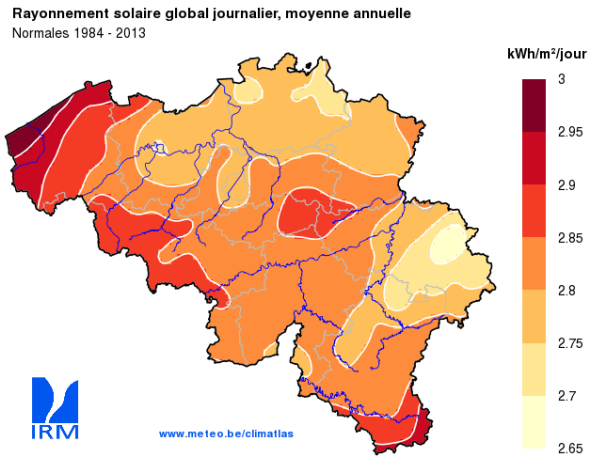


Heating needs are therefore higher on the South of the country but are also related to the building typology with a very high level of open houses (4 facades).



South of the country has more rain compared to center and North.



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Sun irradiation is on average similar in the country with a slightly higher power on the seaside.
Considering these results, we are not going to define specific climatic zones to select the families within the monitoring project, since climatic variations are not high enough to justify a segmentation. We find that typology of housing is more determinant at national level.

2.1.3. Buildings typology.

- Type of dwelling:

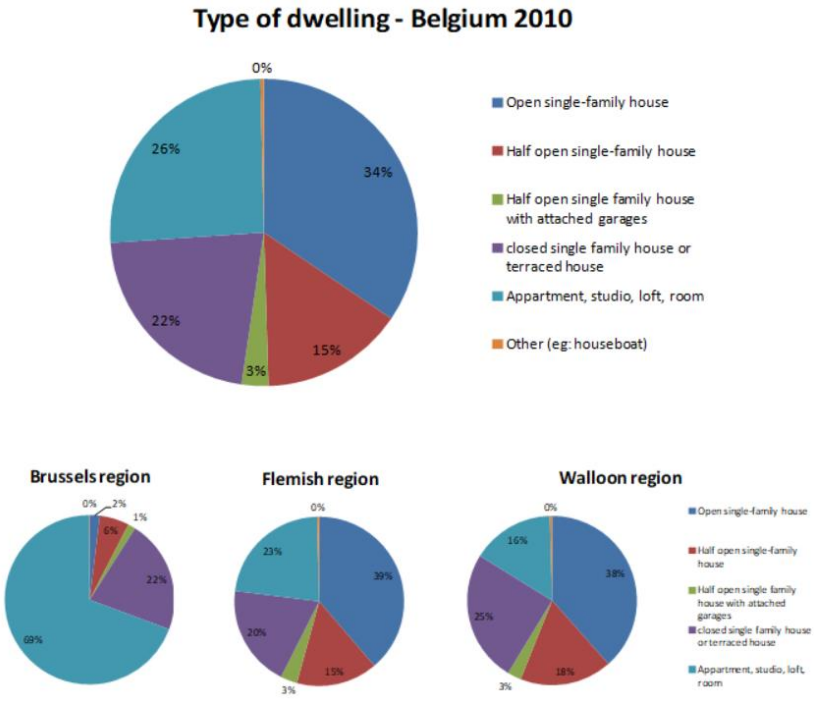

Figure 2: Type of dwelling in Belgium and in the regions (survey results)

Most of Belgian dwelling are open houses for single families (36%), while apartments, lofts and studios represent more than 26% and are increasing since 2001 (20%).

Half open family houses represent 15% and 22% of dwelling are closed single family house.

Closed single family houses are of course much more present in a city such as Brussels with 22% (knowing that there are 32% of single family houses in the city).

In the two other regions the countryside proportion has a majority of open single-family house (38 and 39%).

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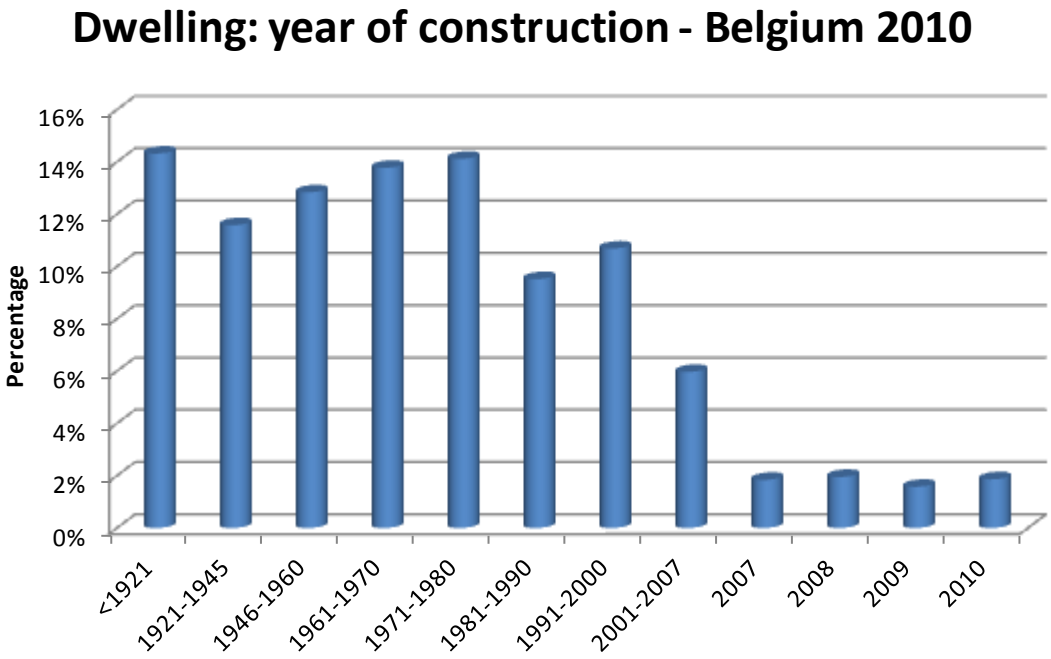
- Ownership and relative age of constructions

67% of Belgians are homeowners.



Region	Before 1918	1919-1945	1946-1961	1962-1970	1971-1981	After 1981
Brussels region	31%	20%	24%	17%	6%	2%
Flemish region	18%	7%	20%	20%	15%	20%
Walloon region	44%	12%	13%	11%	8%	12%
Belgium	29%	10%	17%	17%	12%	16%

More than 50% of the dwellings are older than 40-year-old and up to 100 years old in Belgium but the biggest proportion of dwellings have different ages in the 3 regions:

- 50th-60th in the Flemish region
- before 1918 until the 60th in the Capital
- before 1918 in the Walloon region

Insulation of dwellings:

Situation reported in 2010
>65% roof or attic insulation
76% no floor insulation
62% no wall insulation

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81% equipped with double glazing, 68% have high efficiency double glazing windows.

Intentions in insulation investments

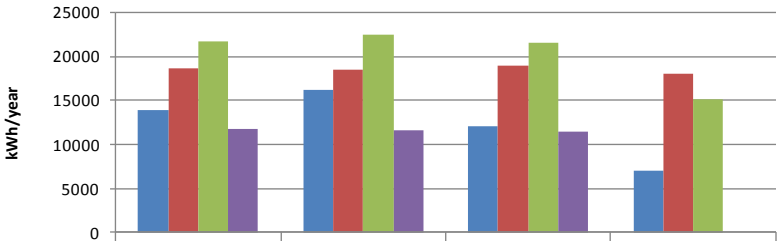
- Roof insulation 72%
- Wall insulation 78%
- Energy efficient glazing 74%
- Floor insulation 85%
- PV panels 75%

2.1.4. Energy consumption of households.

- Electricity consumption

The two-following graphics are very interesting because they give us more information on energy profile related to the main energy source (for heating purpose) and also for electricity consumption when not used for heating purposes.

Average energy consumption (kWh/year) of the principal source per region and Belgium, 2010



	Belgium	Flemish region	Walloon region	Brussels region
Electricity	13886	16121	12063	7044
Natural gas	18563	18540	19008	17995
Fuel oil	21676	22518	21524	15059
Wood	11703	11587	11480	

In this first figure we can notice that **natural gas for heating** is very constant with an **average consumption of 17000-18000 kWh/year**.

Fuel consumption average is around **22000 kWh/year, except in Brussels where it is around 15000 kWh/year**.

Electricity average use for heating purpose **is around 14000 kWh/year** which must be divided by 2,5 to estimate correctly the needs, 5600 kWh/year.

With this low heating demand for people using electricity, we can suspect that the main technology used could be heat pump.

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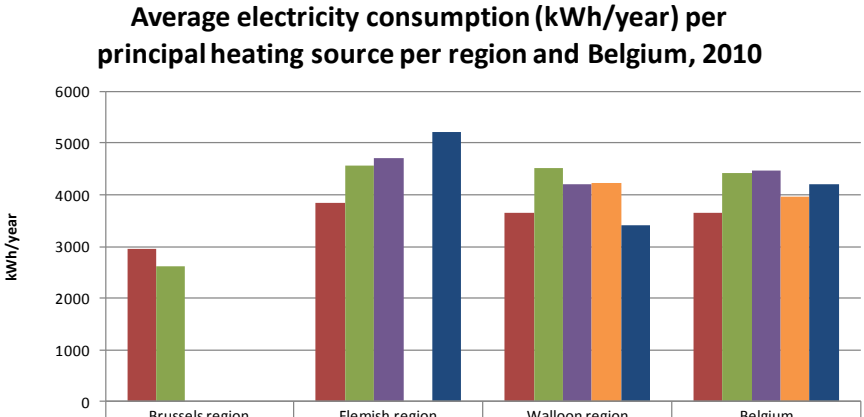
The second graphic shows the electricity average consumption for dwellings not using it as the main source.



	Brussels region	Flemish region	Walloon region	Belgium
natural gas	2957	3841	3650	3663
fuel oil	2620	4562	4509	4423
wood		4710	4219	4467
coal			4242	3961
Propane		5221	3403	4215

Average in Belgium is known to be around 3500 kWh/year, here we are around 4100 kWh/year starting at 3600 up to 4500 approximately.

- Electricity consumption profiles

Electricity households classification:

Da (Very small): annual consumption below 1 000 kWh
Db (Small): annual consumption between 1 000 and 2 500 kWh
Dc (Medium): annual consumption between 2 500 and 5 000 kWh
Dd (Large): annual consumption between 5 000 and 15 000 kWh
De (Very large): annual consumption above 15000 kWh

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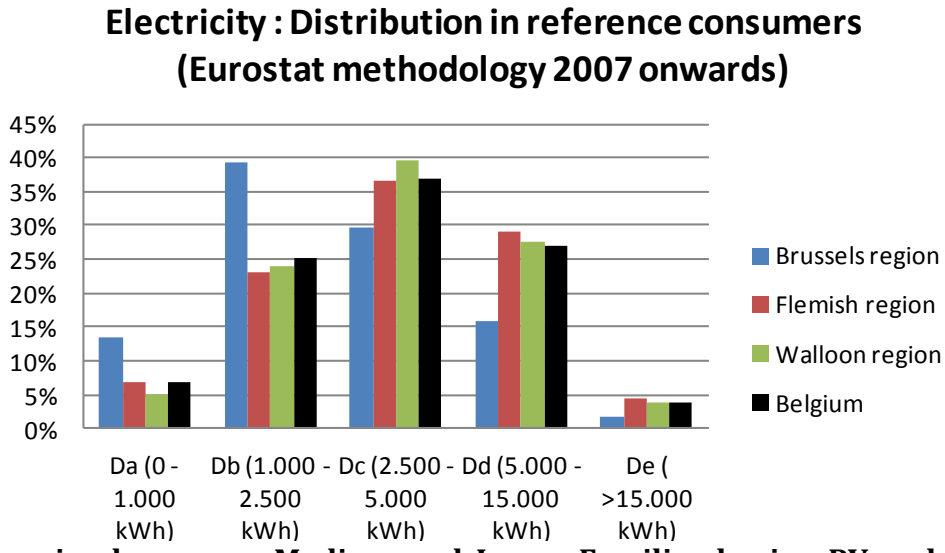
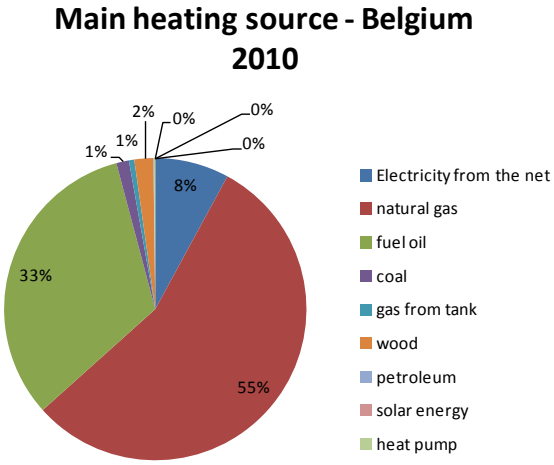


The two main classes are Medium and Large. Families having PV and or using heating system with electricity are more represented in the Large segment. We are going then to focus on these two categories with attention to large segment for the monitoring project:
Dc (Medium): annual consumption between 2 500 and 5 000 kWh
Dd (Large): annual consumption between 5 000 and 15 000 kWh

2.1.5. Energy uses. Appliances available on the households.

- Heating system and hot water system characteristics

Main energy source for heating purpose were in 2010 natural gas, fuel, and electricity (55%, 33%, 8%)



Trends in the energy sources use for heating purpose are:
- Increasing of natural gas, decrease of fuel

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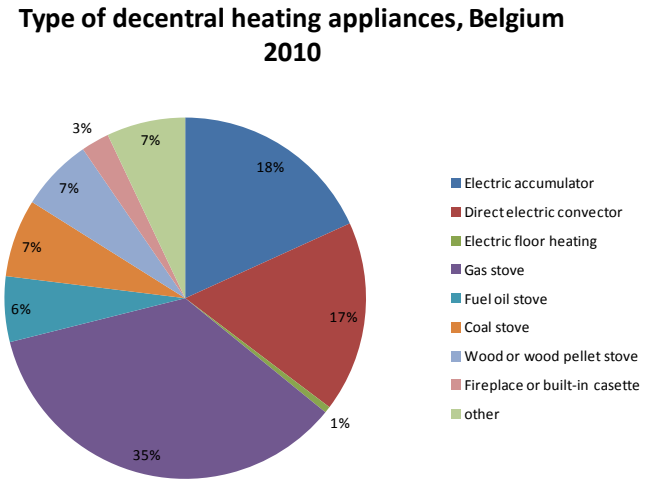
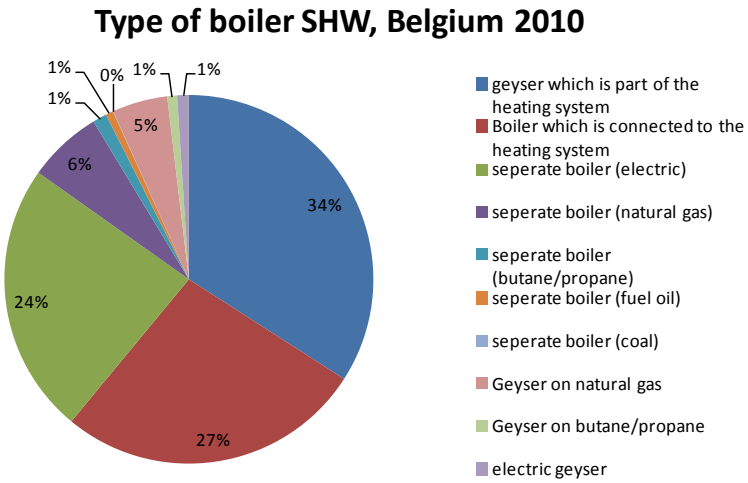
- Increase of wood but still relatively low in total percentage compared to the other energy sources.

Heating system are mainly individual central heating systems (71%), separate heaters (stove, electricity accumulators, -16%), common installation for central heating systems (13%).

In case the dwelling is using a decentralized heating system it is mainly with gas, electric convector, or accumulator.



Type of domestic hot water systems



Most of the systems are connected to the central heating system and directly followed by electrical boiler (24%).

- Domestic appliances and their consumption

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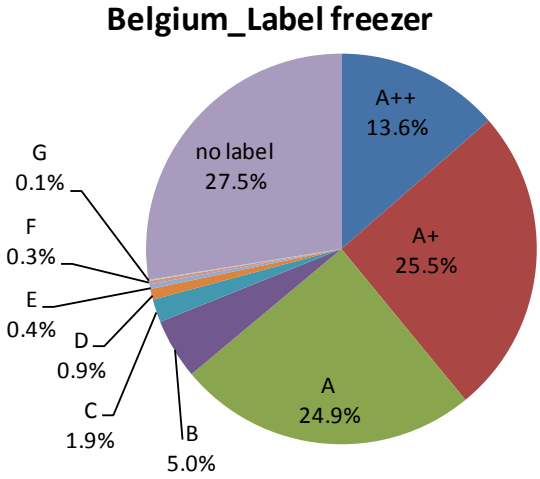
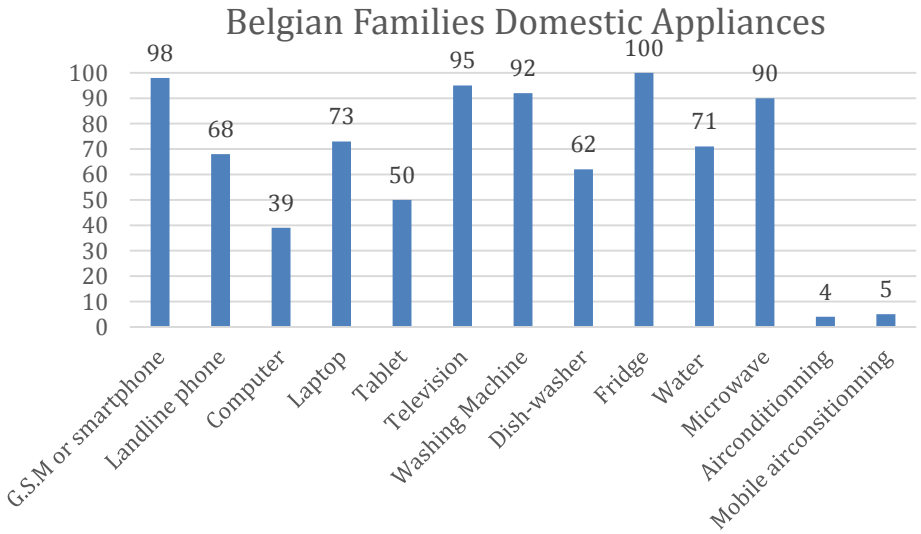
- Fridge and freezer

Fridges and freezers which are more than 15 years old could be replaced.



- Domestic appliances

Domestic appliances are an opportunity to save energy and to allow prosumer to increase their self-consumption rate.
Most common appliance in Belgian families is the fridge with 100% penetration rate and then washing machines (92%) and dish-washer (62%)



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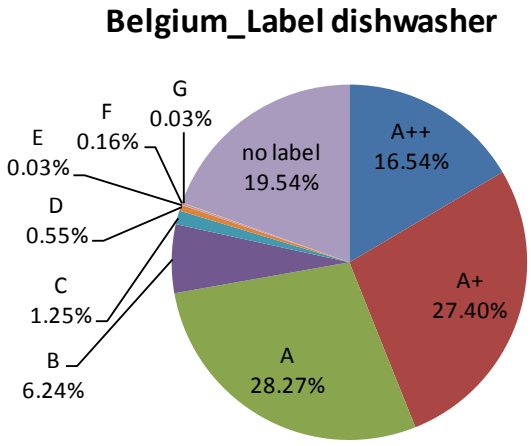
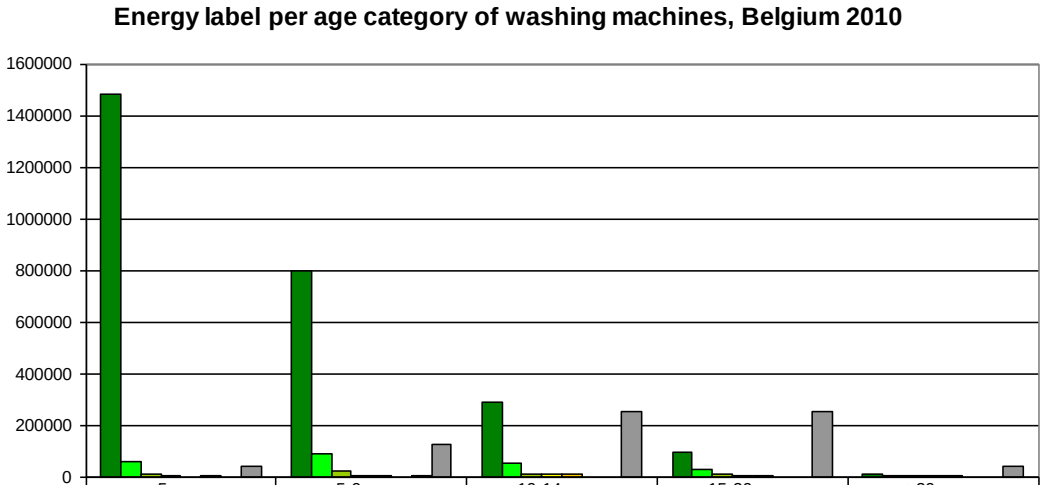
- Dish-washer

62% of Belgian dwellings have a dishwasher.



- Washing machines



	<5 years	5-9 years	10-14 years	15-20 years	>20 years
A, A+,A++	1481111	798487	285982	91369	11280
B	58176	87753	51148	27706	3118
C	6355	18397	10709	7664	2208
D	1598	2388	11410	3019	2471
E	0	1495	7273	2742	1030
F	2472	0	0	0	0
G	0	490	0	0	0
no label	40790	126661	251338	249434	38869

- Lights

We can see that at least 92 % of the Belgian dwelling has already purchased a led lamp but still more than 50% have more than 5 old lamps and-or low energy lamps. More

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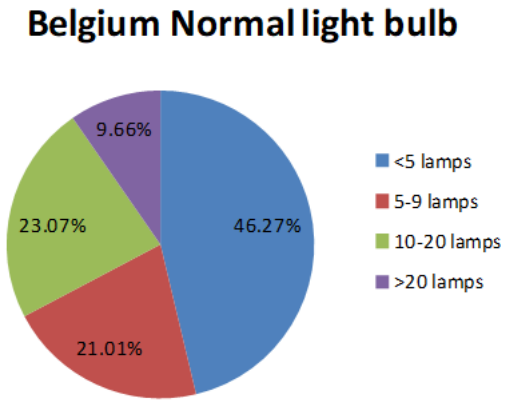
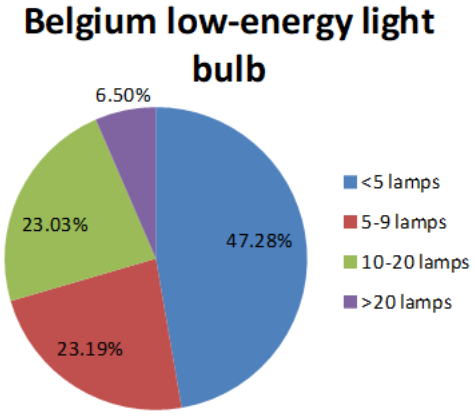
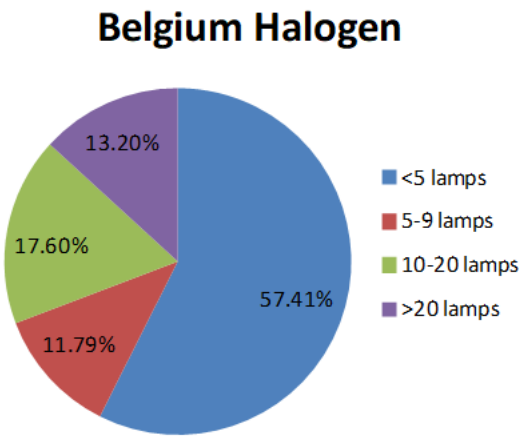
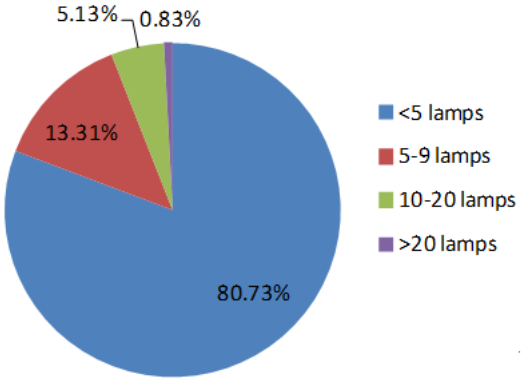
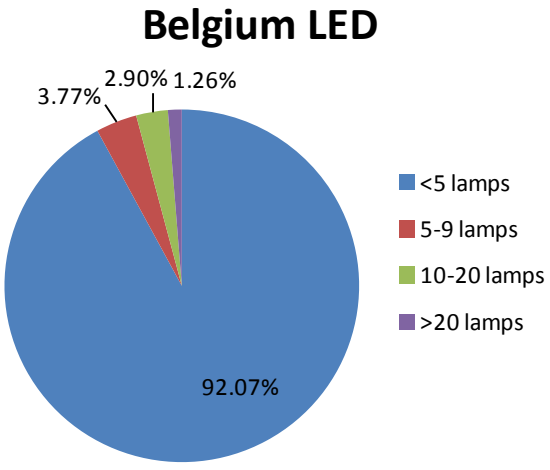
than 40% of the population has more than 5 halogen lamps. The perspective of energy savings on lighting replacement is therefore significant.











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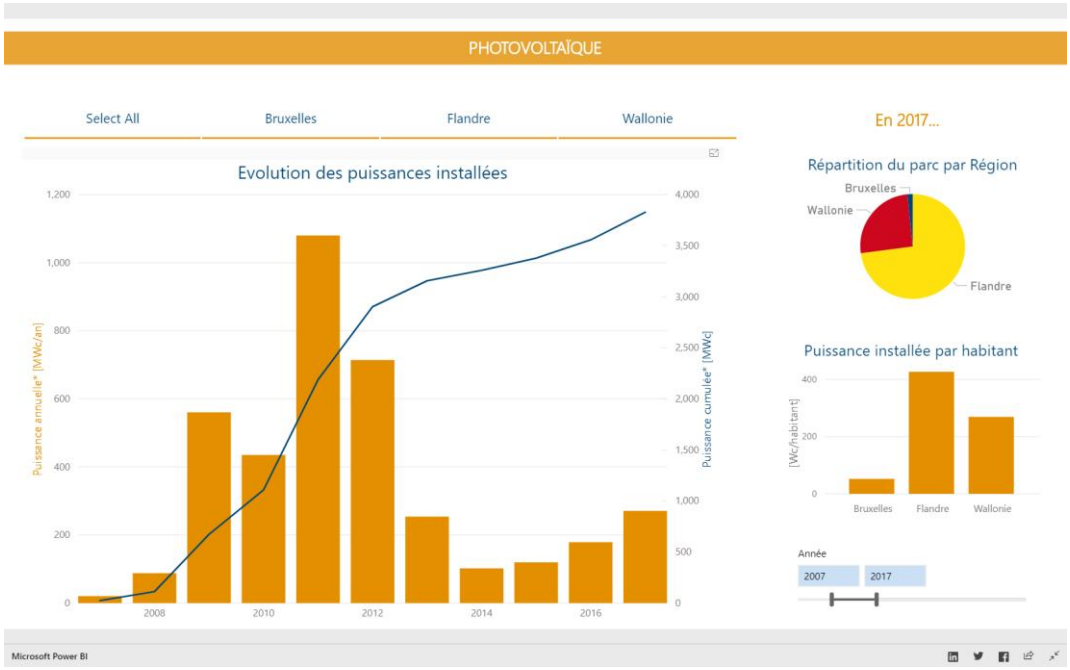
- Photovoltaic residential systems[3]

In the three different regions, PV systems are increasing and the total installed power is higher in the Flemish part (around 2800 MWc) compared to Wallonia (around 1000MWc) of the country and even more compared to the Capital (62MWc).



The power installed in Flanders is however more industrial and commercial.

Real residential installations are then around 1590 MWc for Flanders, 800 MWc for Wallonia and 10.5 MWc for Brussels

[3] www.apere.org

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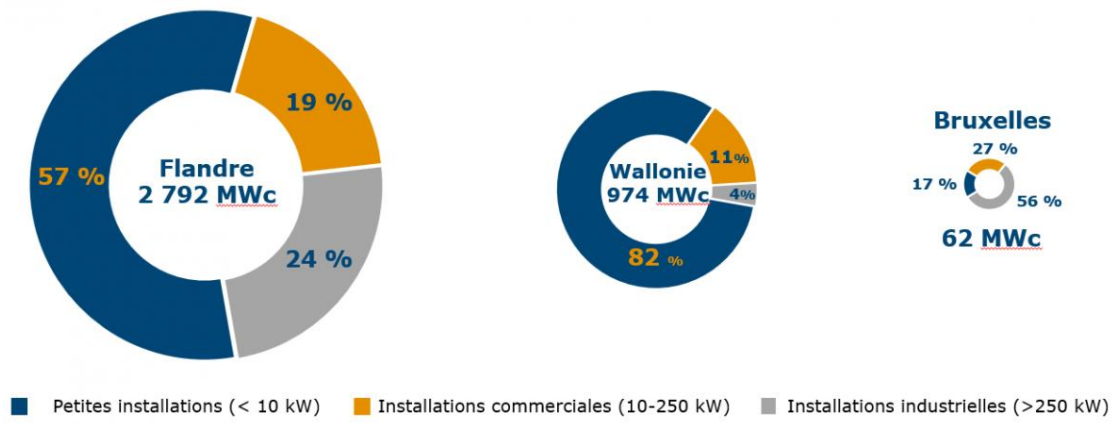

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Residential installations characteristics:

Region	Residential installation (number)	< 5kWc (%)	5 - 10kWc (%)
Brussels	2709	91.9%	7,9%
Flanders	275000*57% = 156750	ns	ns
Wallonia	141512	61.9%	38.1%

At residential level in Belgium, the majority of the PV capacity installations is under 5kWc and even lower in Brussels due to lower available roof surface.
In Wallonia, the majority of the residential installations has a power below 5kW.
In Flanders we have approximately the same number of installation, but the penetration rate is much lower compared to Wallonia because (Flanders represent 57% of the total population and Wallonia only 32%).

2.1.6. Profiles of domestic households.

Most Belgian dwellings are homeowners and live in openhouses or halfopen houses.

They use gas or fuel as main energy source for heating purpose.

Heating energy	% Belgian families	Average consumption (kWh/year)
Gas	55	17000-18000
Fuel	33	22000 - 15000[4]
Electricity	8	5600[5]

More than half of the housing has been insulated (mainly windows, then roof, walls, floors).
Most dwellings have intention to invest in energy performance (insulation) in their home.
Approximately 80% of the dwellings have a central heating system and have hot water system connected to this central heating system.
Belgian dwelling is replacing faster washing machine compare to freezers and fridges.
Main represented electricity consumption profiles are:
Electricity consumption profiles in Belgium is represented by two main segments:
Dc (Medium): annual consumption between 2 500 and 5 000 kWh
Dd (Large): annual consumption between 5 000 and 15 000 kWh[6]

[4] In Brussels
[5] Excluding other electricity uses

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Existing Monitoring project or Feed-back project with dwellings and main findings

Due to the smart meter debate ongoing for years in Belgium, we have collected studies related to the impact on energy savings at residential level using feed-back information to consumers. This feed-back was either direct or indirect using feed-back displays with immediate consumption information or billing and not instantaneous data.

These references are for us very indicative:

- PILOOTPROJECT EANDIS - UGENT Smart Metering & Energie-Efficiëntie ir.-arch. Eline Himpe (o.l.v. prof. Arnold Janssens, dr. ir.-arch. Marc Delghust, prof. Jelle Laverge)
- POC II Smart Metering Energie-Efficiëntie Resultaat verbruik, INFRAX-EANDIS (2012)
- Energy Feedback Systems: Evaluation of Meta-studies on energy savings through feedback. JRC-IET Renewables and Energy Efficiency Unit. Tiago Serrenho, Paolo Zangheri, Paolo Bertoldi (2015).
- The Effectiveness of feedback on energy consumption: a review for defra of the literature on metering, billing and direct displays, Environmental Change Institute, University of Oxford, Darby S. (pp24).
- Linear, demand respons for families published by the Linear consortium (Eandis, EDF Luminus, EnergyVille (KU Leuven, VITO & imec), fifthplay, iMinds, INFRAX, Laborelec, Miele Belgium, Proximus, Siemens, Telenet, Viessmann) 2014
- What's in it for the user? Effects and perceived user benefits of online interactive energy feedback. Anneli Selveforsa , I.C. MariAnne Karlssonb , Ulrike Rahec. Design & Human Factors, Product and Production Development, Chalmers University of Technology, SE-412 96 Gothenburg, Sweden
- Klopfert F. & Wallenborn G. (2011), "Les 'compteurs intelligents' sont-ils conçus pour économiser de l'énergie ?", Terminal 106- 107, 87-100.

Through these readings and mainly crossing these with Darby other publications and Wallenborn professor from the Brussels University, we came to the conclusion that:

- Energy savings using a feed-back system in household has been already well studied on Belgium specially to generate savings on heating needs and for a part regarding electricity consumptions.
- Other feed-back – response projects on energy savings or use of the smart metering have demonstrated that behavior is key, continuous communication as well and potential savings are related to the original level of consumption. The more you waste the more savings you can make. Surprisingly, high consumers

[6] Including high consuming appliances or Heating system based on electricity

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could sometimes not be the best "students" if they have been recruited with care and not trying to get only motivated people, which don't represent the general population. In some studies people wasting a lot of energy have been the least successful on generating savings because they were not interested (see Wallenborn references).

- Investment in insulation and heating system performances is much more effective on heating energy savings compared to the results estimated through feed-back on billing or using smart meters feed-back displays and then taking into account behavioral changes stable in a long-term perspective.
- Average electricity consumption is already low in Belgium for many families not using electricity for heating purpose or for mobility and not having any PV installation. It has been showed on the first segment of users (see 2.1.6) and the basic needs covered by this consumption will not be compressible for savings except if we consider investment in more efficient technology (hot water heat pump or A+++ white goods).
- The number of families we will be able to follow in the monitoring part of the Clear project needs to lead to a valuable result to feed:
    - The current knowledge in Belgium and the renewable challenges
    - A significant added value for Policy makers related to renewable energy discussions in the coming years.

For the mentioned above reasons and learnings we have decided to establish a more specific scope for the monitoring project in Belgium and:

- **Select only families having the most common renewable energy system in Belgium at residential level, this system is a PV installation**
- **Select the most present, affordable and reliable monitoring system for electrical consumption only**
- **Use the monitoring system results to give feed-back and advice in order to:**
    - **Increase awareness over different electrical consumption at home**
    - **Generate savings through behavioral changes and or investments**
    - **Increase awareness regarding direct use of PV production vs taking electricity from the grid**
    - **evaluate in which extend a better self-consumption rate of electricity generated by PV system at domestic level is possible with families showing different profiles.**

In this way we are very confident to get interesting results to feed Policy discussions at Belgian and EU level concerning self-consumption possibilities for residentials households.
There are currently discussions to change the net metering (bill compensation) conditions for prosumers in Belgium starting from January 2020.

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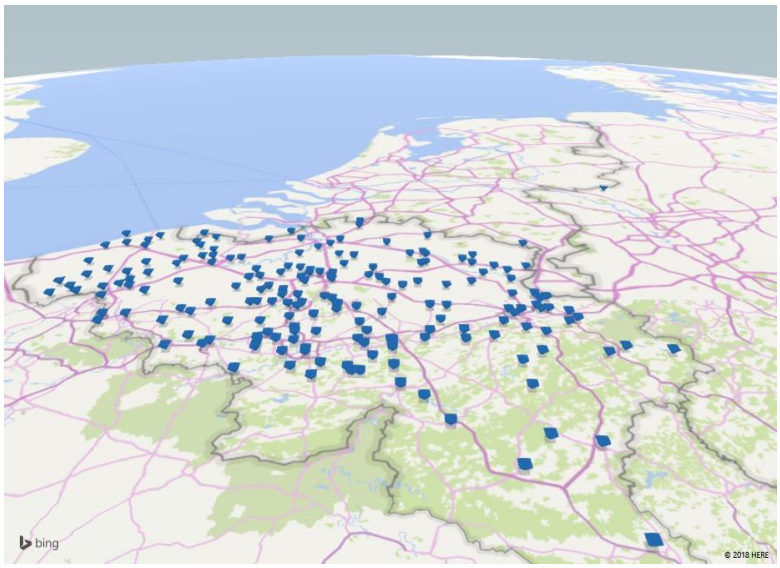
Therefore, we would like to select only families having PV systems in order to study in which extend they could increase significantly their level of self-consumption.
This study could allow us to learn:

- **The impact on a feed-back monitoring system and advice on the self-consumption**
- **The importance of existing appliances to help this change**
  - **Electrical boiler or another hot water electrical based appliance**
  - **Domestic appliances having or not a delay function**
  - **A hybrid or electric car**
  - **A energy storage system**

In the families we have already selected 34 families among 240 subscribers using a freeform questionnaire.
Families subscribing were well distributed over the country:



In the questionnaire we have asked people different questions related to family composition, PV installation, type of dwelling, energy consumption, white goods and their delay function, hot water system.

We have selected different profiles:

Family A:
Annual electricity consumption (around 3500 kWh/year)
PV installation
No system facilitating direct consumption of electricity (hot water boiler, whitegoods with delay function, hybrid or electrical car, heating system electrical based)

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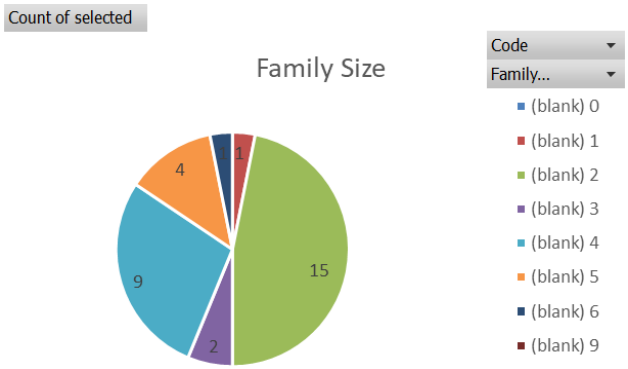
Family B:
PV installation
System facilitating direct consumption: whitegoods with delay OR Electrical Boiler Or Electrical Heating system

Family C:
PV installation
Multiple systems facilitating direct consumption: white goods and or electrical boiler and or hybrid or electrical car and or hot water system using electricity

Family D:
PV Installation
High level of consumption
Heating system using electricity

Here are the 32 families selected:

Family size the most present is 2 people followed by 4 and 5.
Minority of families composed with 1 or 6 people.



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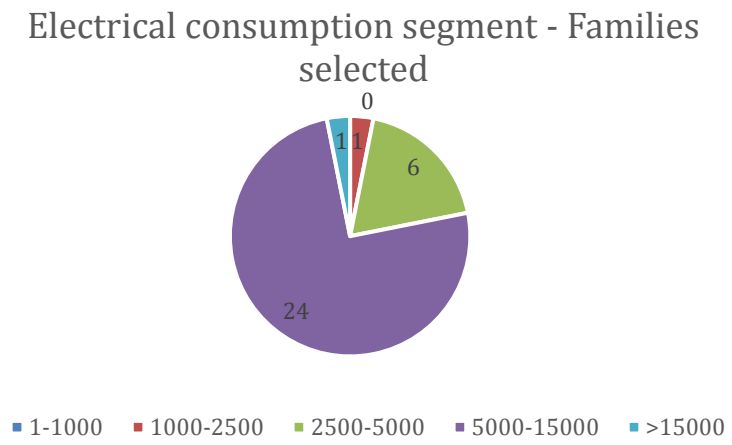
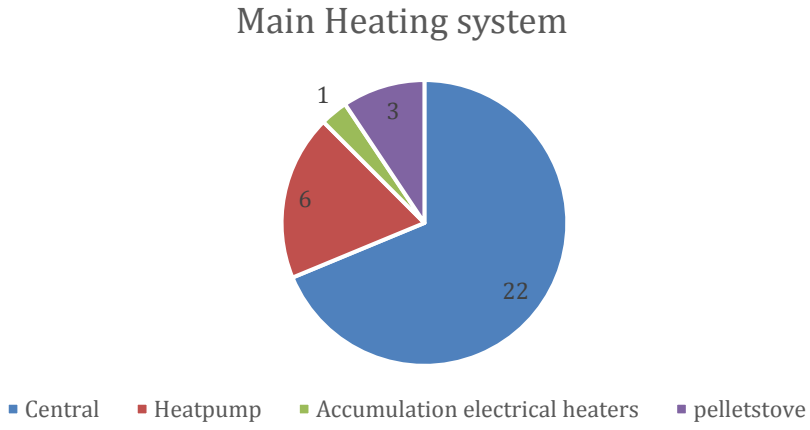


Segment of families selected (average and large). We have selected more large consumption families because we wanted to include families using heating system with electricity and families having electrical system for hot water.

Within the selected families we wanted to include some families using electricity-based systems and also renewable systems (most common in Belgium are woodstoves or pellet stove).
We have then the following distribution for the main heating systems with majority of families using central heating systems based either on fuel or gas



Delay function available on whitegoods.

Only 2 families didn't have any delay function on any domestic appliance.
For the rest the appliance most commonly equipped with a delay function is the dishwasher.

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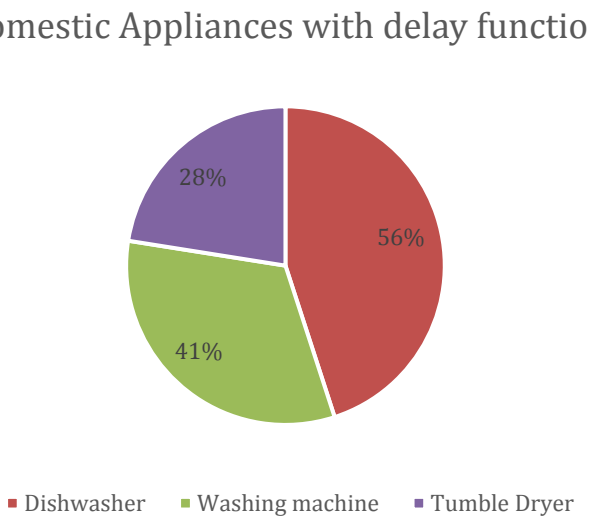
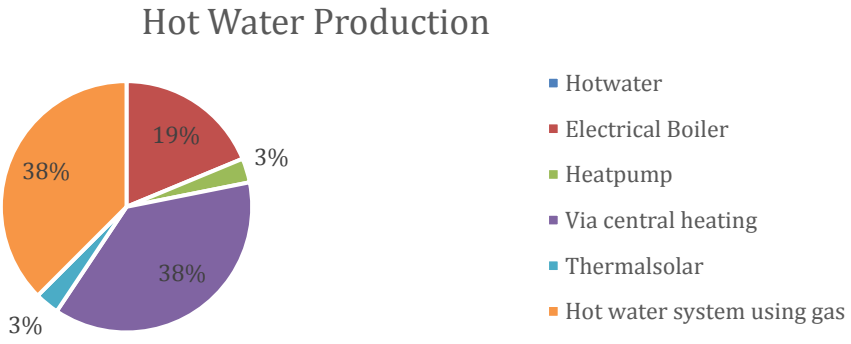


Hot water production within the selected families is showing a majority of 56% of systems connected to the central heating boiler or separate equipment but using the same resource (fuel or gas). 19% are using an electrical boiler or a domestic hot water heat pump which could be a big advantage to boost the self-consumption.



Regarding the last, but not least, energy storage facility which could be available for some families, we have had some families with either hybrid car or electrical car. However, the majority doesn't have any real electricity storage system.

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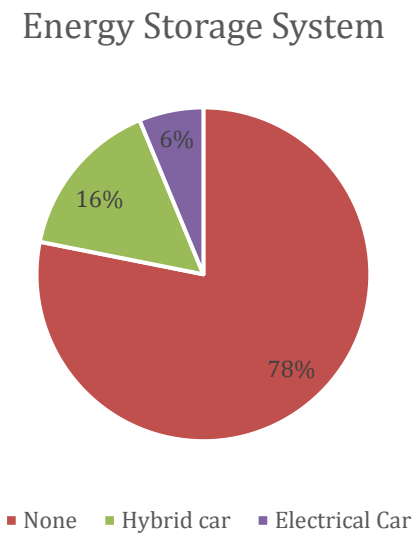

2.2. Czech Republic assessment.

In this part of the report summarizes the information about the energy use (electrical and thermic) from a residential consumers point of view.

Thanks to this information, we can evaluate the different profiles needed to be part of the monitoring process.

2.2.1. Population.

10 610 055 (Czech Statistical Office 03/2018).

2.2.2. Regions or climate zones.

According to Köppen climate classification, the whole Czech Republic falls under the Humid continental climate (Dfb subtype). Mild climate, typical continental European – warm summers, rainy springs and falls and cold freezing winters. Heavy snowfalls occur during the winters typically on mountains and occasionally in the lowlands and cities also.

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2.2.3. Buildings typology.

- Type of building:

People living in apartments 56%
People living in houses 44%

- Ownership and relative age of constructions

Owners 55,9 %
Owners of co-op share 9,4 %
Tenants 22,4 %
Others 12,3 %

Average age of apartment houses 52,4 years
Average age of houses 49,3 years

2.2.4. Energy consumption of households.

- Electricity consumption

Total 5 300 000 MWh

- Electricity consumption profiles

Average per apartment: 2140 kWh
Average per house: 4800 kWh
Average per person in apartment: 970 kWh
Average per person in house: 1700 kWh
Average per m2 apartment: 34 kWh
Average per m2 in house: 44 kWh

2.2.5. Energy uses. Appliances available on the households.

All data according to the Czech Statistical Office, 2015, unless stated otherwise.

- Heating system and hot water system characteristics

Heating:

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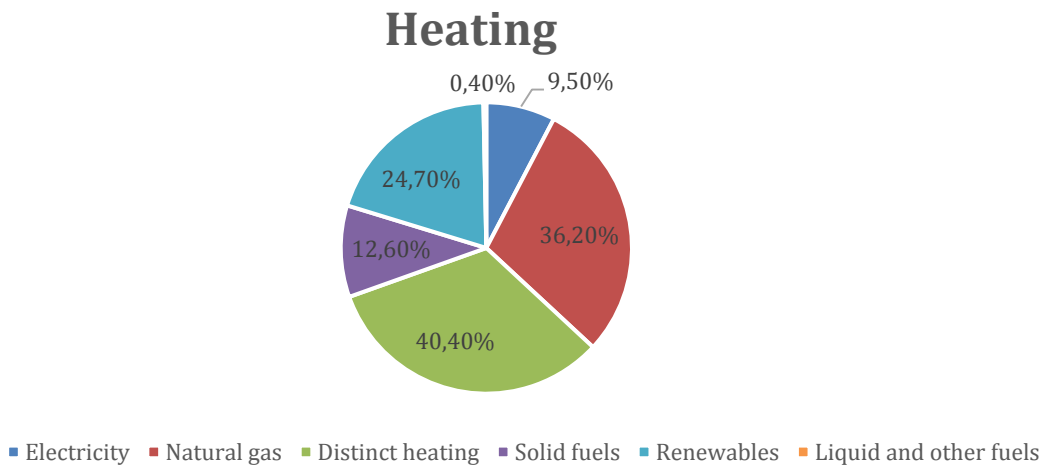
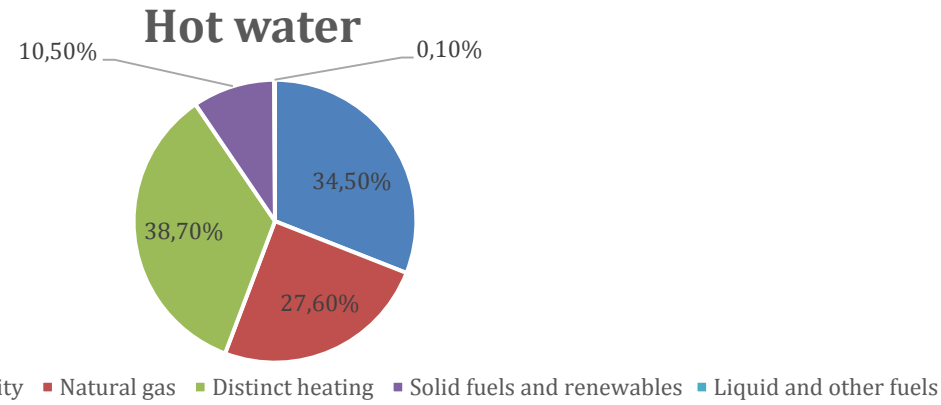
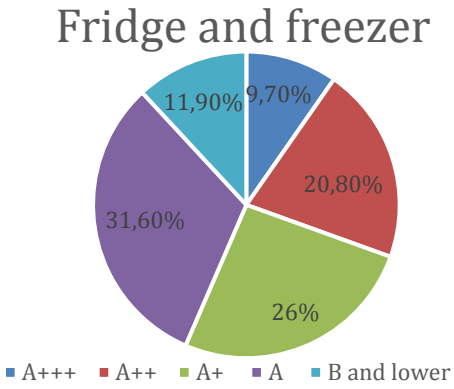


Hot water:



- Fridge and freezer



- Dish-washer

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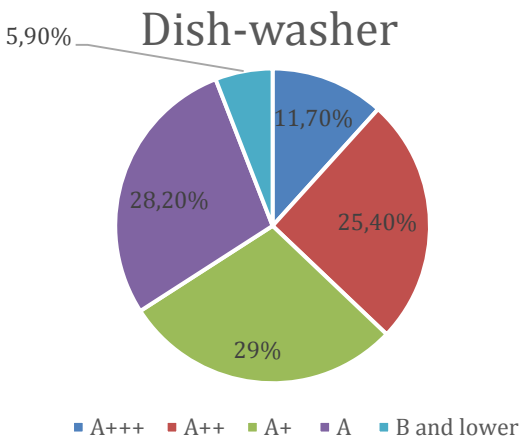
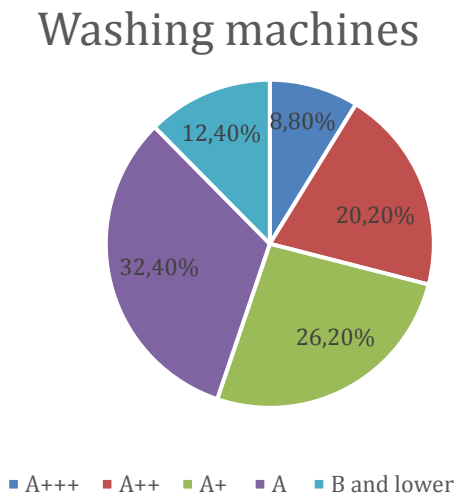


- Washing machines



- Lights

Average number of light sources in one household:
Wolfram 6,4 pcs
CFL 4,7 pcs
Halogen 1,7 pcs
LED 1,6 pcs
Linear lamp 0,8 pcs
Vacuum tube 0,1 pcs
Source: Ekolamp, 2018

- Photovoltaic residential systems

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Unfortunately, the statistics from the Energy Regulatory Czech Office only collects data for big players, not households.

2.2.6. Profiles of domestic households.

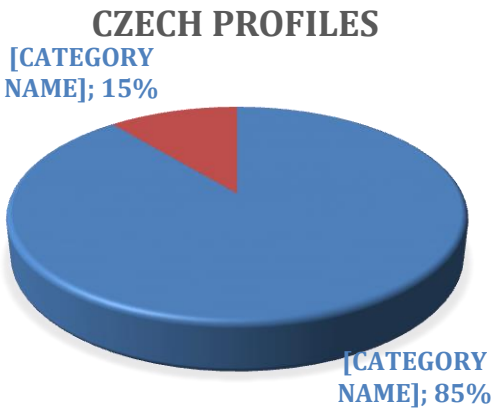
Most people know how much they pay for electricity, but they usually don‘t follow how much energy they actually use.

Respondents are usually trying to save intuitively (having LED bulbs, switching off the lights and heating at a time when they are not in the room / at night, using the washing machine at a time when energy is cheaper, replacing electrical appliances for energy saving kind...). This saving is also connected to finance.

When it comes to energy suppliers, most people consider the price. They don‘t have any problem to change the supplier if they offer a better and cheaper tariff than their existing supplier.

They usually have energy from the big energy suppliers - sometimes they change the supplier according to the prices.

It is quite common that the backups are set higher:
- for the certainty that they will not have arrears
- feeling good when their overpayments return.



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Profile A covers non-renewable energy users. Profile B represents the use of renewable energies such as photovoltaic systems in Czech Republic according to actual data. Since the C and D profiles which are used by some of our partners (use of electric vehicles or photovoltaic system with battery) are not very common we put them together with B profile (i.e. in 2017 there were 271 595 newly registered cars – of which are only 387 electric vehicles).

The monitoring will focus on households with 3-4 members. It will be divided between users of non-renewable energy sources and those who use of the common sources of renewables. Mainly it will be PV panels or PV panels combined with water heater. Regionally, it is planned to divide between the regions to cover all parts of Czech Republic since there are no significant differences in terms of climate in the north vs. south part of the country (unlike Portugal or Spain).

In profile A, we would also like to monitor families living in apartments and standalone houses. In profile B it is most common to install renewables on standalone house – it is still quite rare in apartment houses. Therefore, the profile B families will be chosen according to this phenomenon.

Also, according to the statistics, the chosen families will reside in houses they own. More than half of Czechs live in their own houses or apartments and a vast majority of those who choose to use renewables are owners.

As for the average monitored households' energy consumption, we will choose accordingly to the actual average consumption as stated by the state office. The chosen families should represent typical consumers in terms of amount of energy supplied to them.

2.3. Italy assessment.

This report will summarize most recent studies which have been conducted at Italian level to have a better understanding over the energy consumptions in the residential sector.

The purpose of this analysis is to determine the average situation for each energy source in this sector and also to determine common profile and particular profiles.

By reading these main references it will also allow us to learn over what is already available and well known and make sure that we are going to contribute as much as we can with new learnings.

2.3.1. Population.

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60.589.445
From ISTAT (Italian National Institute of Statistics)

2.3.2. Regions or climate zones.

The country, between the 47th and the 36th parallel north, is located almost in the middle of the temperate zone of the northern hemisphere. In the north of the peninsula, a type of constantly humid temperate climate prevails (Cfa / Cfb), while in the center-south the Mediterranean climate is frequent with dry summer periods (Csa).

The climatic classification of Italian municipalities was introduced by the Decree of the President of the Republic n. 412 of 26 August 1993 (table A and subsequent amendments and additions) setting bases for the Regulations laying down rules for the design, installation, operation and maintenance of the thermal systems of buildings with the purpose of containing energy consumption.

The municipalities were divided into six climatic zones, (stated in table A attached to the decree) with the indications on the sum, extended to every day of a conventional annual heating period, of the positive daily differences between the ambient temperature, conventionally set at 20 ° C, and the average daily outdoor temperature; the unit of measurement used is the degree-day (GG).

Climate Zone	Degree/Day	Cities	Cities %
A	< 600	6	0,1%
B	600 - 900	1046	13,2%
C	901 - 1.400	4209	52,9%
D	1.401 - 2.100	1551	19,5%
E	2.101 - 3.000	984	12,4%
F	> 3.000	158	2,0%

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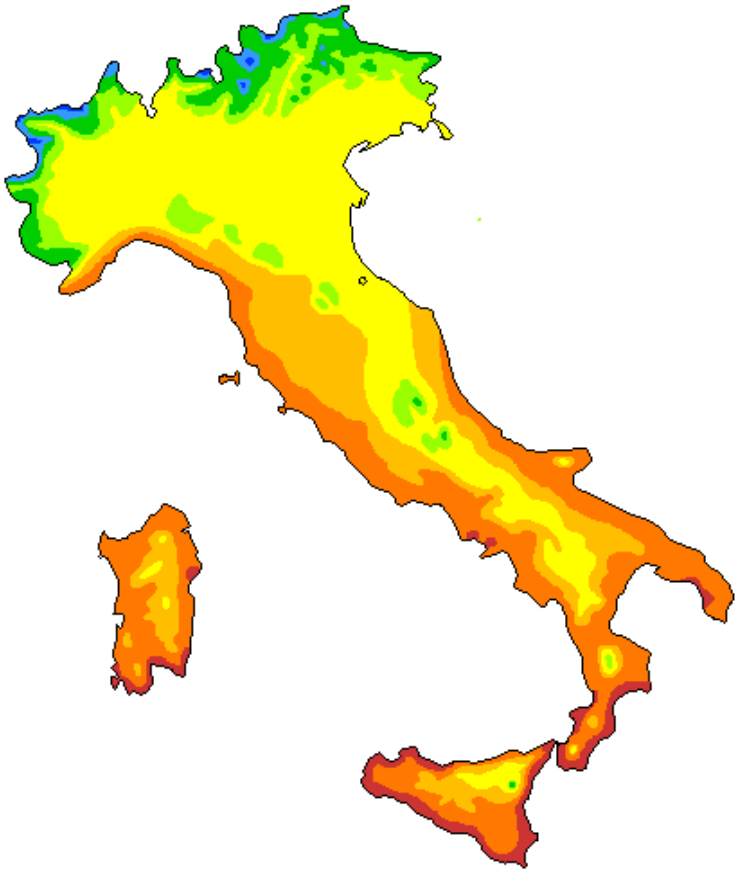

2.3.3. Buildings typology.

From ISTAT (Italian National Institute of Statistics) 2008

- Type of building:
  - People living in apartments 54,9%
  - People living in houses 38,1%
  - Others 7,0%

- Ownership and relative age of constructions
  - Owners 68,5 %
  - Tenants 18,9 %
  - Usufruct / Free use 12,6 %

- Age of constructions
  - 2008-1990 16,1 %
  - 1989-1950 59,4 %
  - Before 1950 17,2 %

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- Unknown 7,3 %

2.3.4. Energy consumption of households.

- Electricity consumption

From ISTAT (Italian National Institute of Statistics) 2012

- Electricity consumption for person 1885,9 kWh/year
- Electricity consumption for house 2298,9 kWh/year

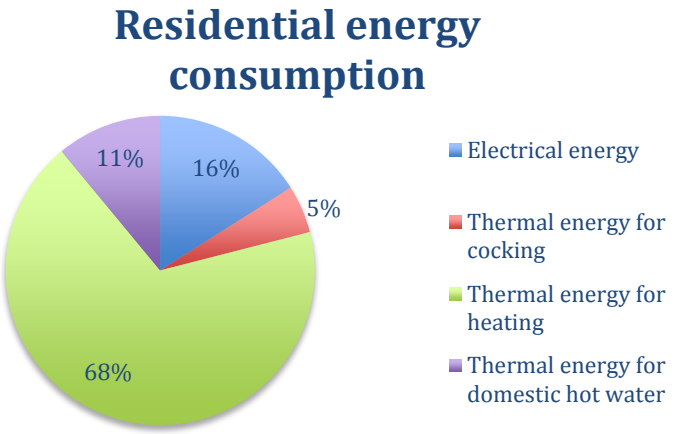
- Electricity consumption profiles

From ENEA Italian National Agency for New Technologies, Energy and Sustainable Economic Development. KiloWattene Program 2010

Consumption range	Averange kWh/year	% Families
0	900	13,10%
900	1800	25,90%
1800	2640	26,70%
2640	3540	19,70%
3540	4440	9,50%
4440	50000	5,10%
Total		100,00%

2.3.5. Energy uses. Appliances available on the households.

All data according to the Italian National Statistics Institute (ISTAT) 2013 and elaboration by ECCO, unless otherwise indicated.



- Heating system and hot water system characteristics

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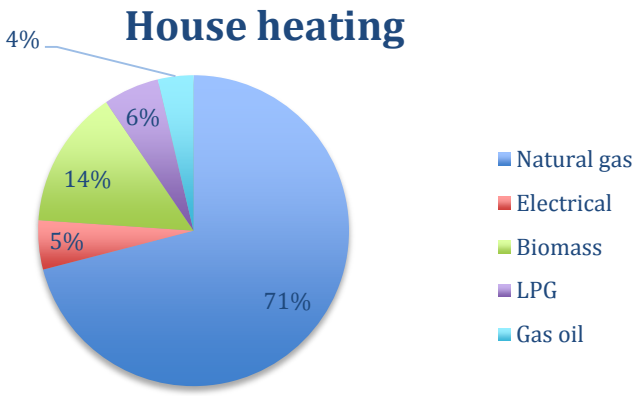

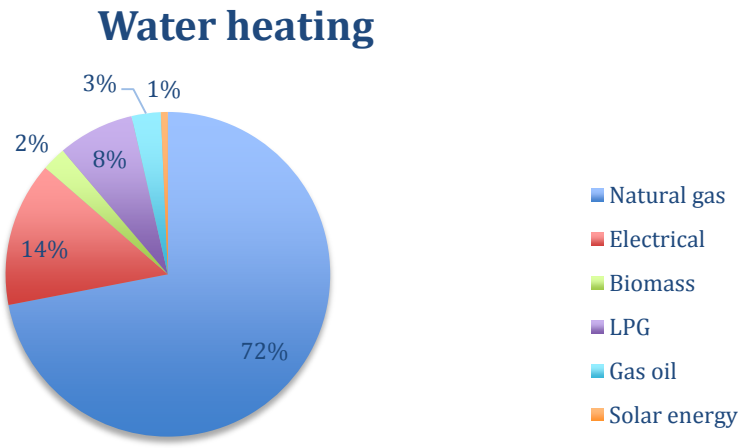

- Domestic appliances and their consumption

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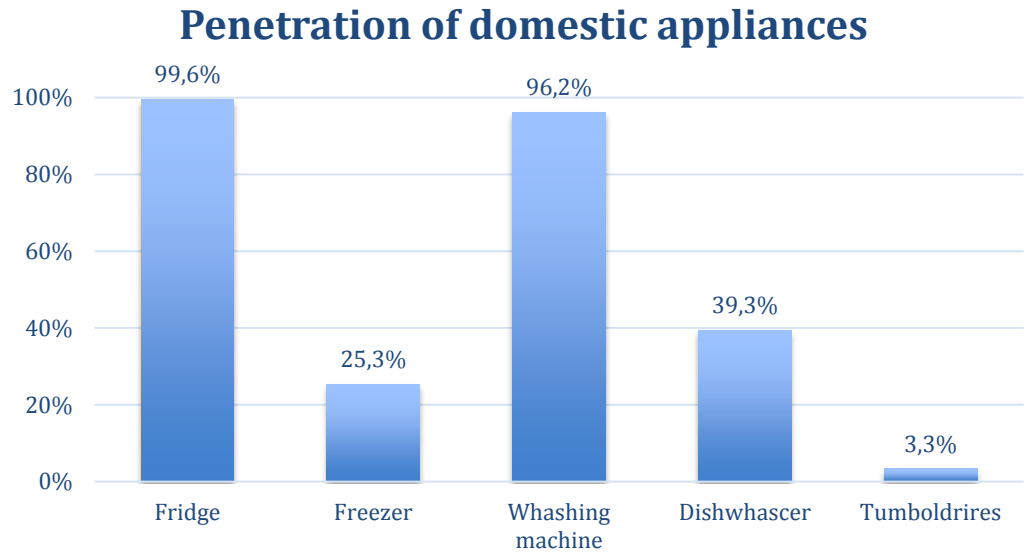
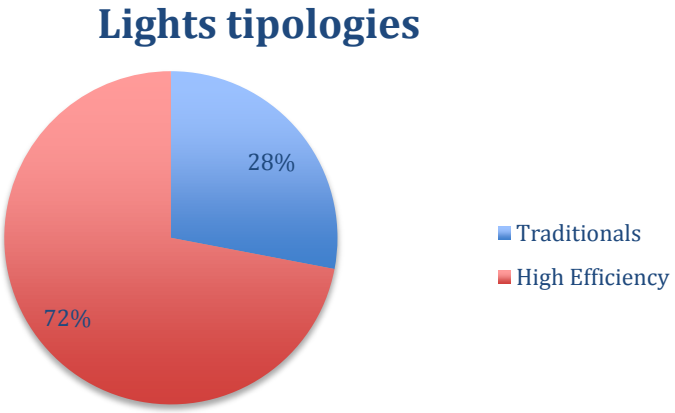


- Lights



- Photovoltaic residential systems

From GSE Gestore dei Servizi Energetici 2016

- Domestic Photovoltaic systems

➢ Number of domestic PV plants at 31/12/2016 *580.075*
➢ Power of domestic PV plants at 31/12/2016 *2793 MW*

- Global distribution and impact at regions

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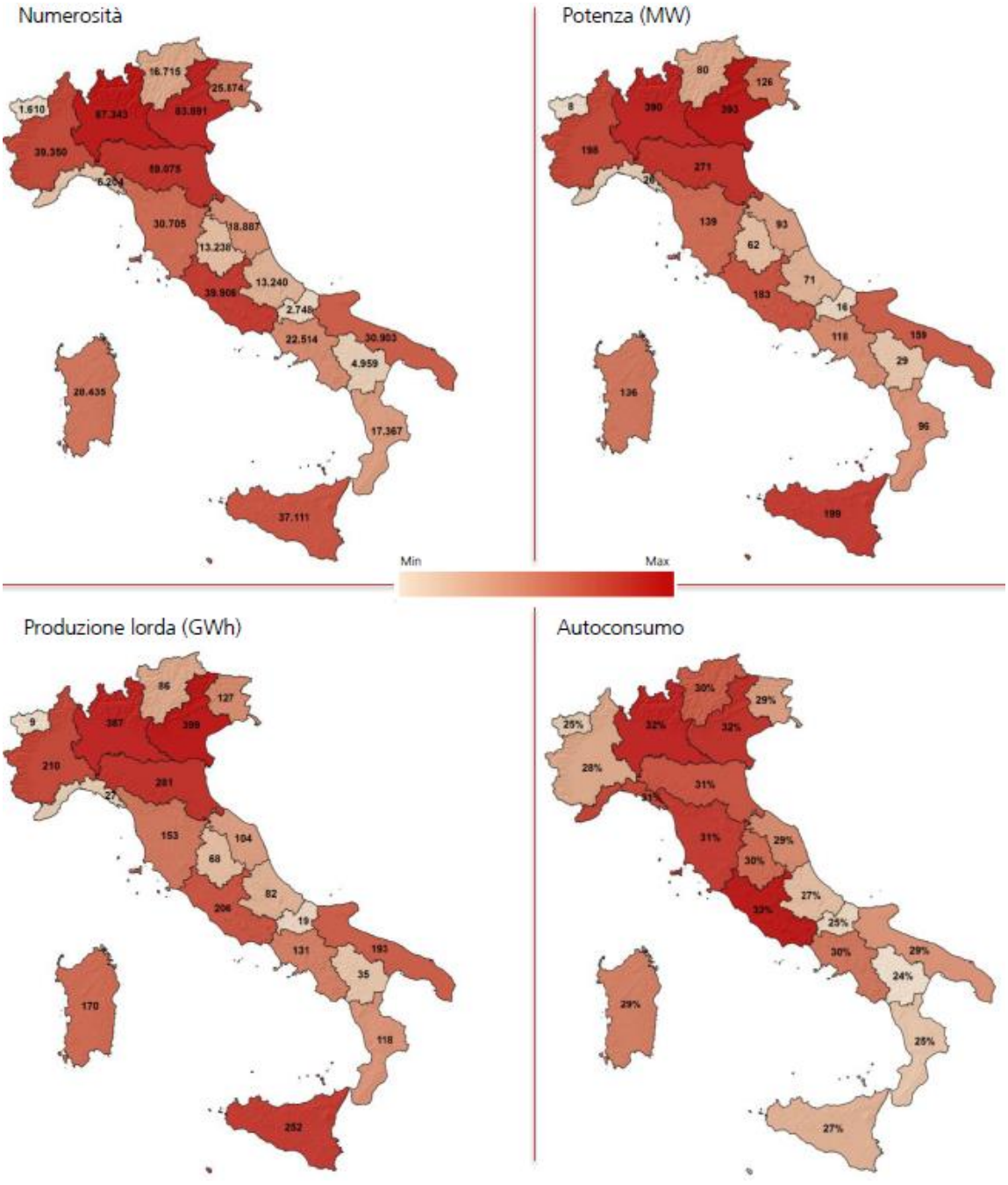

- Consumption, production and self-consumption

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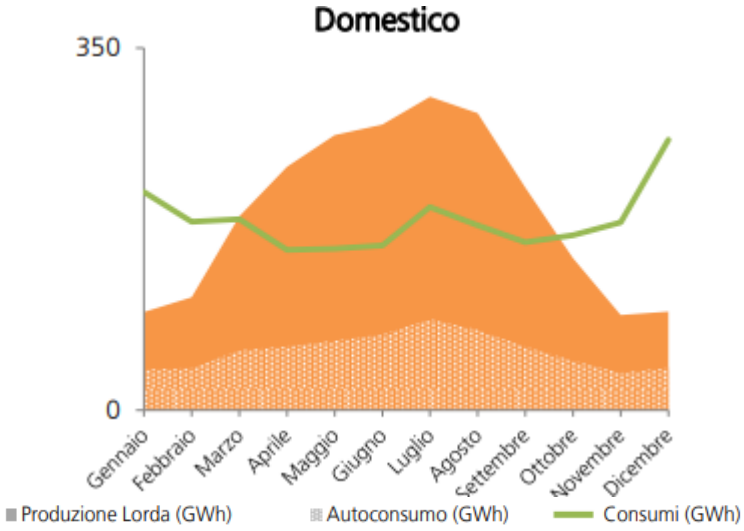
Power production averange kWP	Power consumption average kW	Self-consumption/Production %	Self-consumption/Consumption %
4,6	4,8	30%	31%



2.3.6. Profiles of domestic households.

Large part of population is aware of the impact of the global cost of energy of their house, but they don't know how much energy they consume.

A lot of them don't know what possibilities exist in the electric market for domestic users, and are not able to recognize a good offer from a bad offer. They don't understand correctly the energy (gas or electricity) bill.

Normally their interventions to reduce the consumption consist of choosing a new household appliance with a good energy label.

Most important are the incentives by government, direct or indirect, to support relevant interventions in the house, like photovoltaic system, solar thermal, condensation gas system or other energy efficiency interventions.

Most of them changed the old lighting system by fluorescent lights with higher efficiency and, most recently, by LED system.

According to the analysis, 4 segmented profiles were defined.

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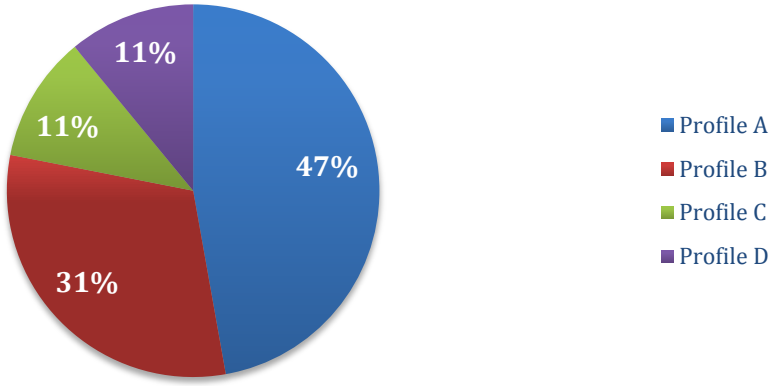
Global Assessment of Household Profiles



According to the study carried out and with the profiles identified for the study, it is proposed to investigate in particular for the Italian scenario the profile B, C and D, following this distribution: Profile A 47%, Profile B 31%, Profile C 11% and Profile D 11%.

Profile A, non-renewable energy use, Profile B, represents the use of renewable energies such as photovoltaic systems, Profile C, features an optimized system with photovoltaic and electric vehicle, and finally Profile D, that represents a family with optimized system with photovoltaic and / or solar thermal with accumulation of batteries.

All the profile are segmented for consider the large part of different geographic and sociological difference in Italy, with two large categories (North-Center, Center-South-Islands), to increase the global information acquired, especially for consumers without any efficiency on renewable technologies.
In plus, would be observed the different approach to the climatization need and the different habit of house appliances use (Profile A)
In plus, consider the important and relevant level of efficiency penetration in Italy, especially for the domestic photovoltaic plant, we would like to investigate how many energy saving with house equipment with efficiency house appliance and other efficiency technologies versus house with PV plant but without any smart approach to use the energy production. (Profile B)
On more, we would to know the possible next future scenario with the support of the batteries, and how energy saving with this technology and how level of auto consumption it's possible to get. (Profile D)

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Last analysis only to know the possible impact and sustainability of the electrical mobility in house without renewable energy, versus house whit high efficiency with PV production for some smart advanced consumers (profile C).

2.4. Portugal assessment.

This report intends to explain in a succinct way how we determined the profiles to be studied.

we started with the focus was to identify and differentiate the regions taking into account demographic and climatic differences. Subsequently, a study was carried out on the energy consumptions in the residential sector broken down by the regions.

The combination of consumption data and the existing penetration of household equipments was used to determine and segment the profiles.

We used a combination of statistical data taken from PORDATA / INE, DGEG, studies and dissertations of public and private entities that represent Portuguese universities, companies and associations

2.4.1. Population.

Through statistical data taken from PORDATA / INE, we started by identifying the number of dwellings that we can find in Portugal.

We have a total number of 5 932 697 dwellings, where 3 997 724 are primary use dwellings.

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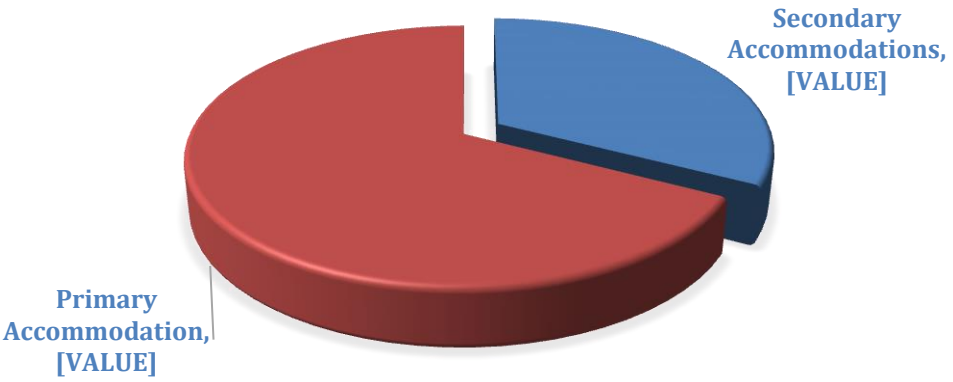
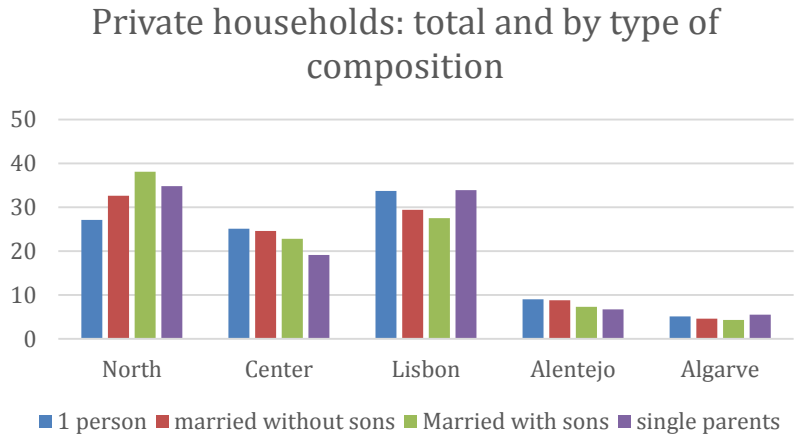
NUMBER OF ACCOMMODATIONS PER SEGMENT



Regarding to the composition of the household in the housing units, a greater weight of families with children is found in the north of the country and contrasts with what is happening in Lisbon, where houses with 1 person and single parent families are higher.



2.4.2. Regions or climate zones.

Continental Portugal is divided into 6 major regions, two of which are divided into two sub-regions, with different consumption profiles and climatic zones:

- North (subdivided in Minho and Trás-os-Montes)
- Porto urban region
- Center (subdivided in coastal and interior)
- Lisbon urban region

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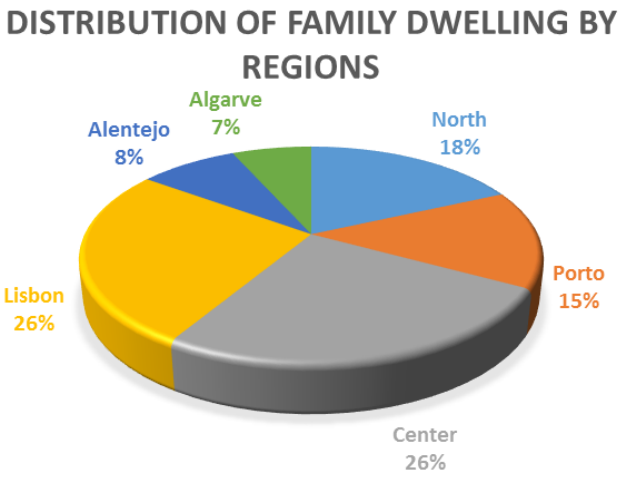
- Alentejo
- Algarve

The percentage of dwellings is higher in the Centre and Lisbon regions, corresponding to more than 50% of the total family households.



Data provided by National Buildings Regulation and the Environment Protection Agency, we can distinguish the climatic zones existing in Portugal.

The map on the left shows the global radiation by kcal / cm^2 that increases from North to South.

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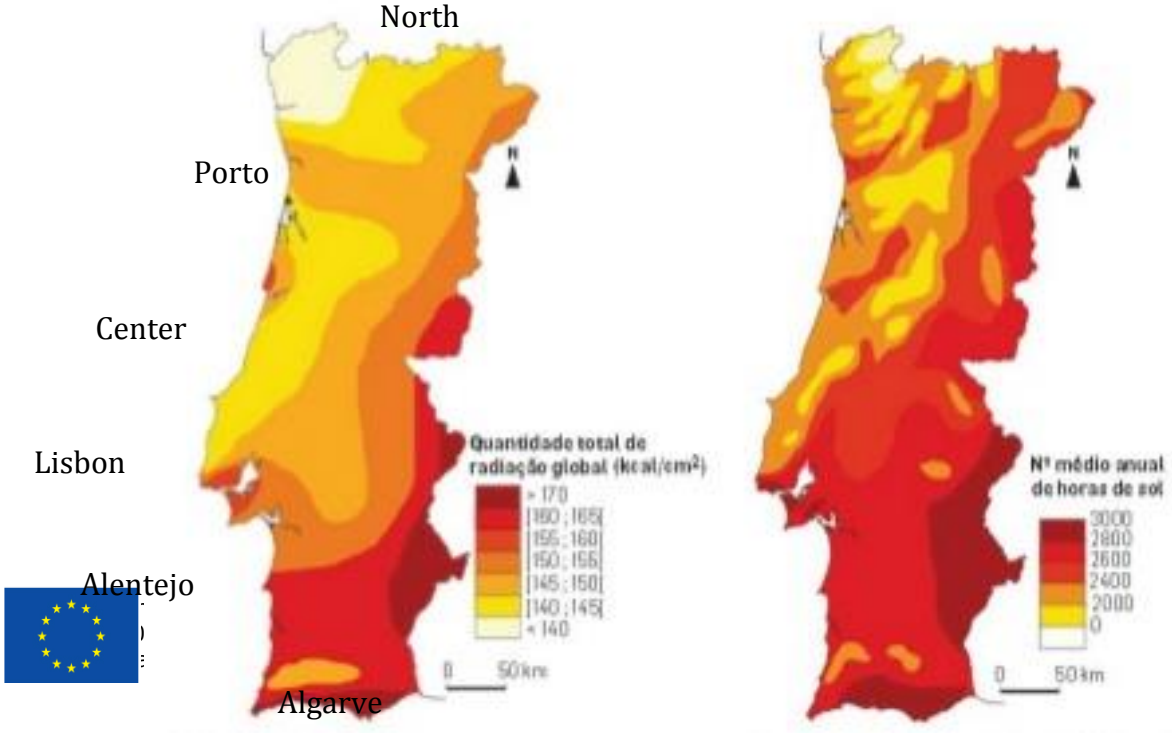
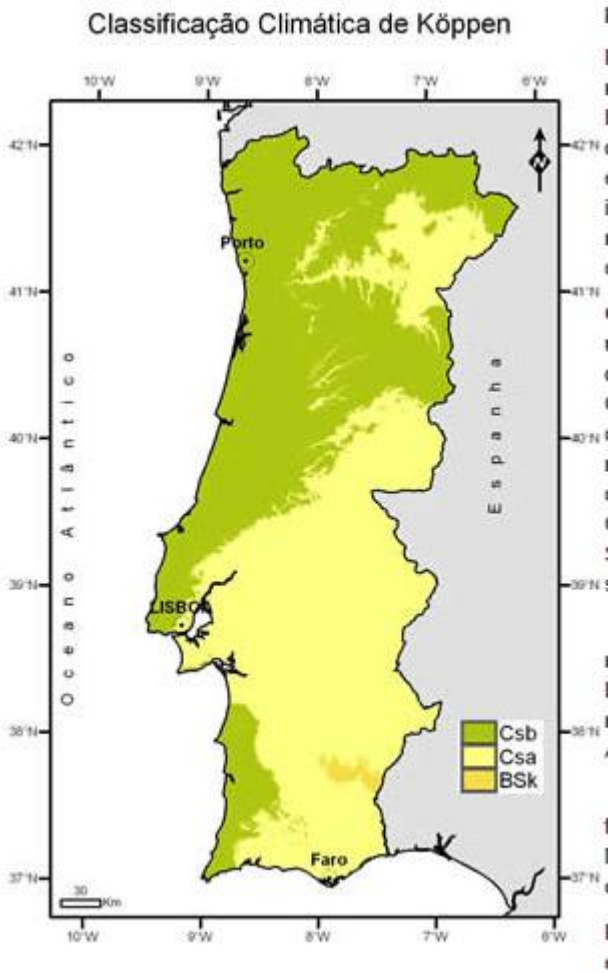


The data provided by the National Weather Institute (Instituto Português do Mar e da Atmosfera) shows the climatic differences between the coastal and interior area, which is more visible in the Center and the North:



Taking the monthly average temperatures in the Summer (July) and Winter (January) months, the differences of temperature between the coast (higher population) and the interior (lower population) are also visible:

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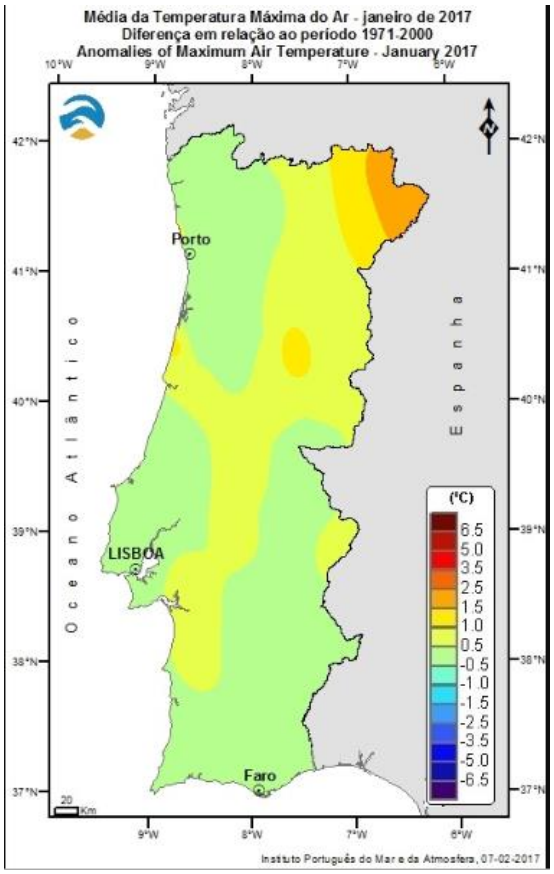

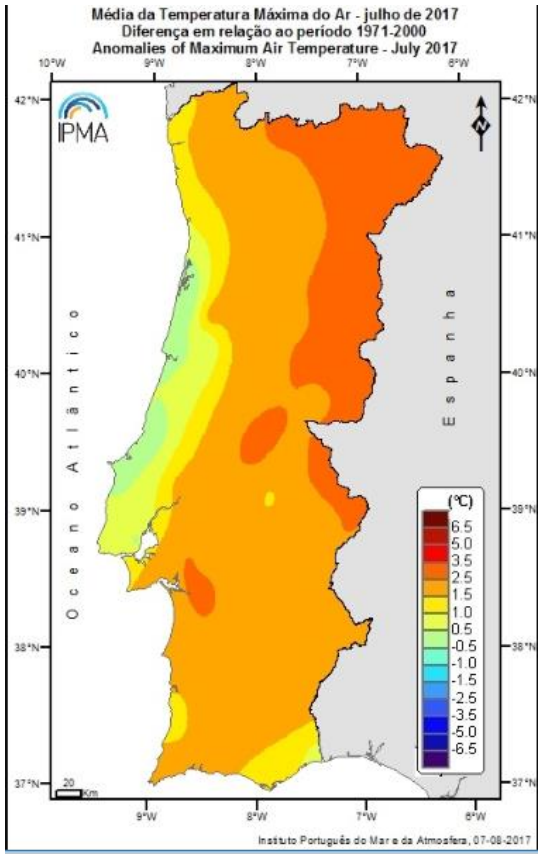

This is the reason why we chose to consider the difference between coastal region and interior region in the profiles.

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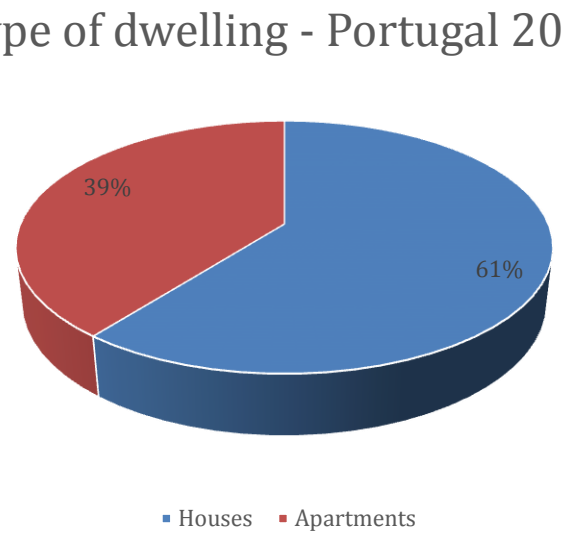
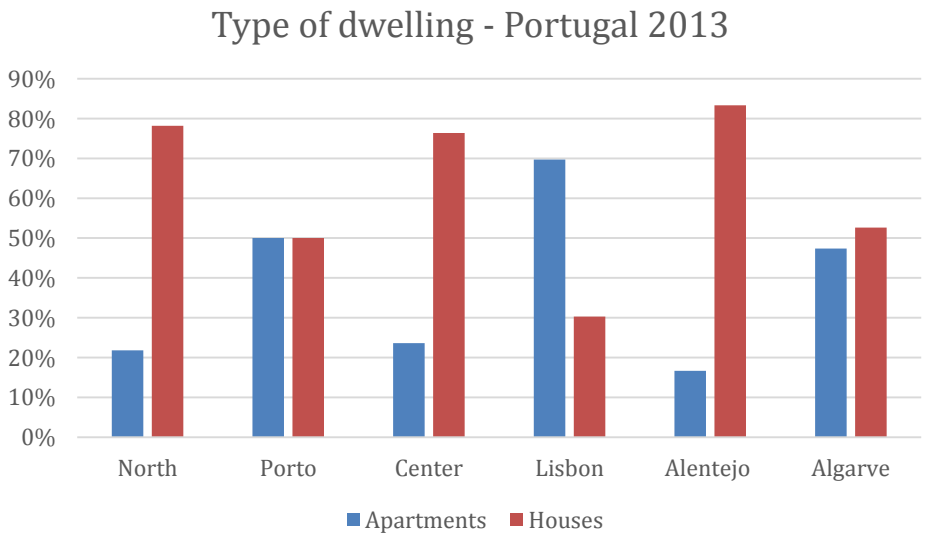
2.4.3. Buildings typology.

Most of Portuguese dwelling are single family houses (61%), while apartments represent around 39%.



Analyzing the distribution by regions, there is a great difference between the large urban centers (Lisbon and Porto) compared to the rest of the country. Lisbon households are mostly apartments (70%), while and in Porto we find an equivalent distribution between single family houses and apartments (50%/50%).



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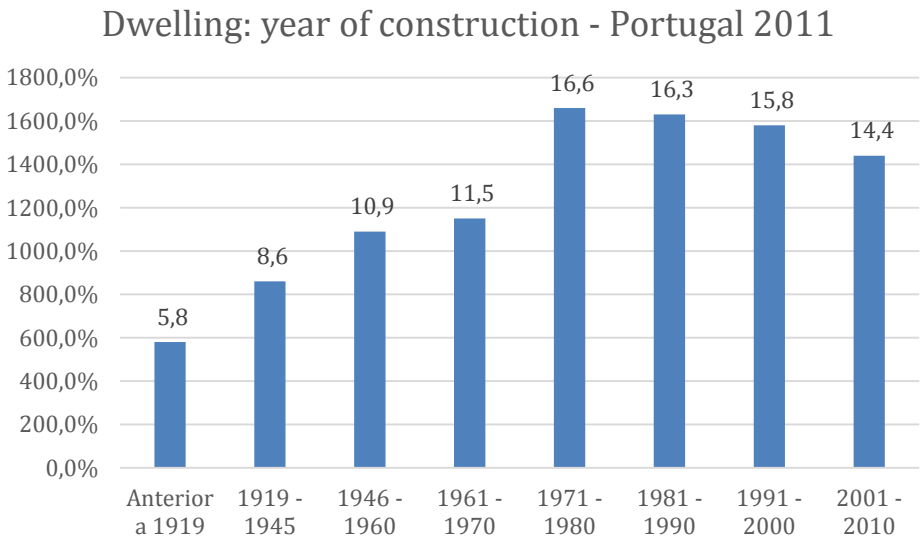
The majority of houses with more than 5 rooms are located in the North and Center.

geographical area	number of rooms in the house by %						
	Total	1	2	3	4	5	6+
Years	2011	2011	2011	2011	2011	2011	2011
North	34,6	27,6	31,7	31,5	30,6	35,9	38,6
Porto	16,9	16,6	19,1	19,9	17,7	16,0	16,1
Trás-os-Montes	1,2	0,9	0,9	0,7	0,7	1,3	1,9
Center	23,4	15,9	16,2	15,5	17,7	24,7	31,5
Lisboa	29,5	39,4	37,6	38,8	38,8	27,3	18,2
Alentejo	7,8	9,1	8,1	7,6	7,5	7,8	8,3
Algarve	4,7	7,9	6,4	6,6	5,4	4,3	3,5

The majority of existing dwellings in Portugal was built in the 70s (17%). Since then, new household construction has decreased every year. Only 14% of the houses were built in 2014.



geographical area	before a 1919	1919 - 1945	1946 - 1960	1961 - 1970	1971 - 1980	1981 - 1990	1991 - 2000	2001 - 2010
Years	2011	2011	2011	2011	2011	2011	2011	2011
North	37%	31%	31%	34%	37%	40%	39%	37%
Terras de Trás-os-Montes	2%	2%	2%	2%	3%	2%	2%	2%
Porto	14%	13%	13%	13%	12%	13%	12%	10%
Centro	29%	35%	36%	34%	34%	32%	32%	32%
Lisboa	11%	10%	15%	15%	15%	13%	13%	13%
Alentejo	17%	19%	14%	12%	9%	9%	10%	10%
Algarve	6%	6%	5%	5%	5%	6%	7%	8%
Área Metropolitana do Porto	14%	13%	13%	13%	12%	13%	12%	10%

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In summary, we found that 70% of the buildings go back to before 1991, buildings that have not incorporated the most modern techniques of efficient house construction. They are smaller houses located in the urban centers,.

Knowing the geographical and population distribution of the dwellings, we proceeded by incorporating the level of energy consumption in the previously defined regions.

2.4.4. Energy consumption of households.

The aim of this topic is to identify which energy sources are used, and the most typical levels of energy consumption for each one of them.

For electricity use, in Portugal, each household has a specific energy contract that established the maximum instant power that is available in this household. There are several levels of possible contract power that the consumer can choose (provided that the electric installation is also adapted, especially in the higher levels). In the low voltage use, these levels are ranging from 1.15 kVa up to 20.7 kVa.

When it comes to natural gas there are 4 contract levels depending on consumption. The first two levels are the ones that correspond to the consumption in the household sector. The first level is typically used by families that only use gas to produce domestic hot water (0 to 220 m^3) and the second level corresponds to families that use natural gas for ambient heating (221 to 500 m^3).

The analysis of the natural gas consumption was made based on the existing data from suppliers located in the different regions described; Sonorgás, Duriensegás, Portgás for the North and Porto; Lusitaniagás for the Coast Center, Beiragás in the Interior Center, Dianagás, Paxgás, Setgás and Tagusgás for Alentejo; Lisboagás in Lisbon and Medigás in the Algarve.
As piped natural gas does not reach all of the geographical Portugal, a large number of families have to use LPG in bottles. This type of energy source still has a majority penetration, with 2.5 million households depending on this use

- Electricity consumption

Through statistical data taken from ERSE (regulator of energy services), DGEG (General Direction of Energy and Geology) and EDP (Portuguese Energy supplier), the following graphics give us more information on energy profile related to the main contract power installed and the average electricity consumption by regions.

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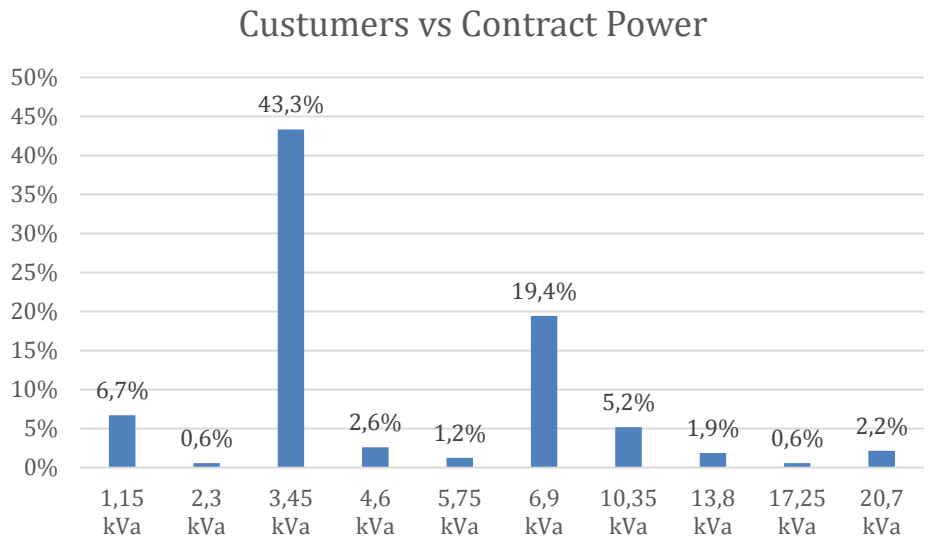

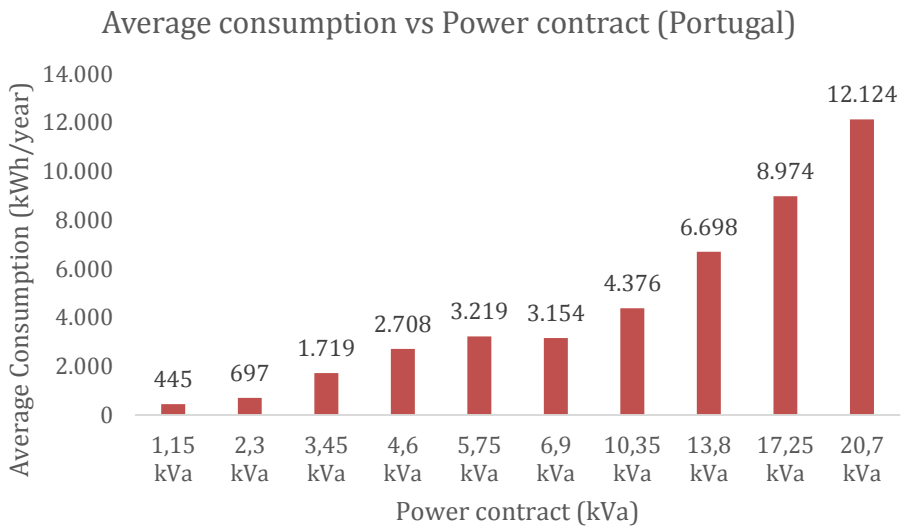

Geográfic Zone	Contract Power (kVa)												
	1,15	2,3	3,45	4,6	5,75	6,9	10,35	13,8	17,25	20,7	27,6	34,5	41,4
North	6,2%	0,9%	46,3%	6,3%	3,0%	24,5%	5,7%	2,5%	0,9%	2,6%	0,4%	0,3%	0,4%
Minho	4,3%	1,0%	44,8%	7,4%	3,3%	24,8%	6,6%	2,9%	1,0%	2,8%	0,4%	0,3%	0,4%
Trás-os-Montes	10,6%	0,9%	49,9%	3,9%	2,1%	23,8%	3,7%	1,6%	0,5%	2,2%	0,3%	0,2%	0,3%
Porto	3,3%	0,7%	29,2%	8,7%	4,1%	35,2%	9,9%	3,9%	1,3%	2,6%	0,4%	0,3%	0,5%
Center	6,1%	1,0%	45,4%	6,1%	2,8%	25,6%	6,3%	2,3%	0,7%	2,7%	0,3%	0,3%	0,4%
Center Litoral	5,0%	0,8%	43,0%	6,0%	2,9%	27,8%	7,2%	2,6%	0,8%	2,9%	0,3%	0,3%	0,4%
Center Interior	8,7%	1,3%	50,8%	6,4%	2,8%	20,5%	4,2%	1,6%	0,5%	2,4%	0,3%	0,2%	0,3%
Lisboa	5,8%	0,6%	49,7%	5,9%	2,9%	21,5%	6,1%	2,5%	0,9%	2,9%	0,4%	0,4%	0,3%
Alentejo	6,3%	0,8%	50,4%	5,3%	3,4%	21,9%	4,6%	2,3%	0,6%	3,1%	0,4%	0,3%	0,5%
Algarve	4,1%	0,6%	37,9%	4,7%	2,5%	30,7%	7,0%	4,0%	1,3%	5,7%	0,6%	0,4%	0,5%

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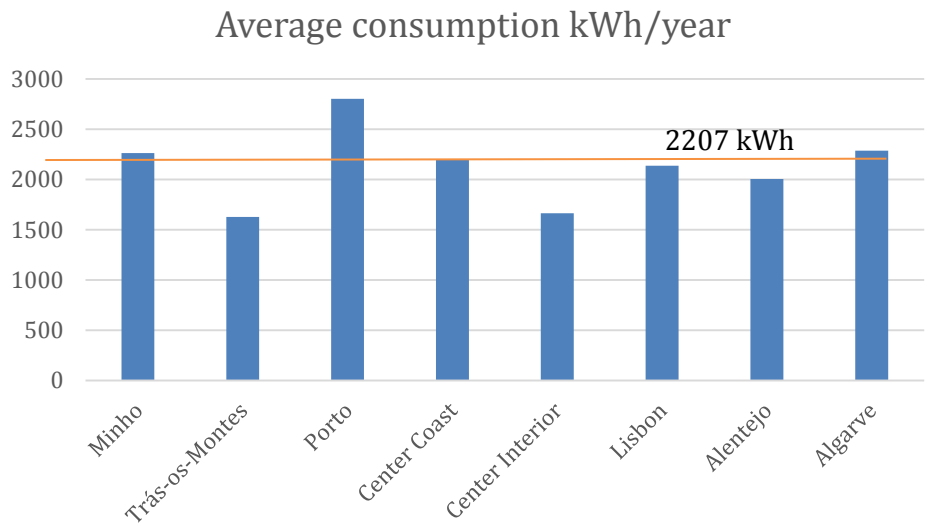
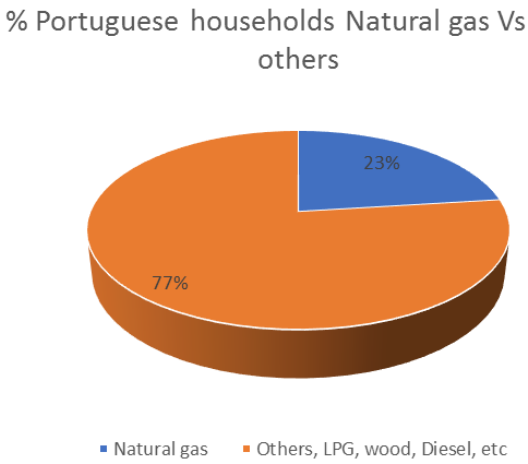
Average electricity consumption in Portugal is around 2200 kWh / year, with Porto, Minho and Algarve surpassing the national average (reaching 2700 kWh/year) contrasting with Trás-os-Montes, Center interior and Alentejo where electricity consumption is lower (around 1600 kWh/year).



- Natural gas consumption

Natural gas as an energy source still accounts for a minority (23%) compared to other existing gases such as butane, propane and others. In this study, only those clients with a 1st and 2nd level contract was compared. In Portugal there are 4 levels, the third and fourth for large consumers 8normally in large service buildings) .



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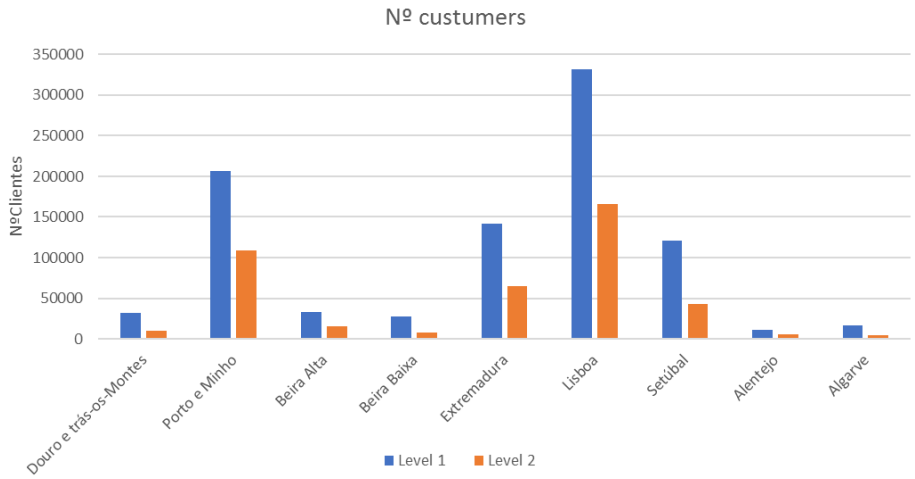
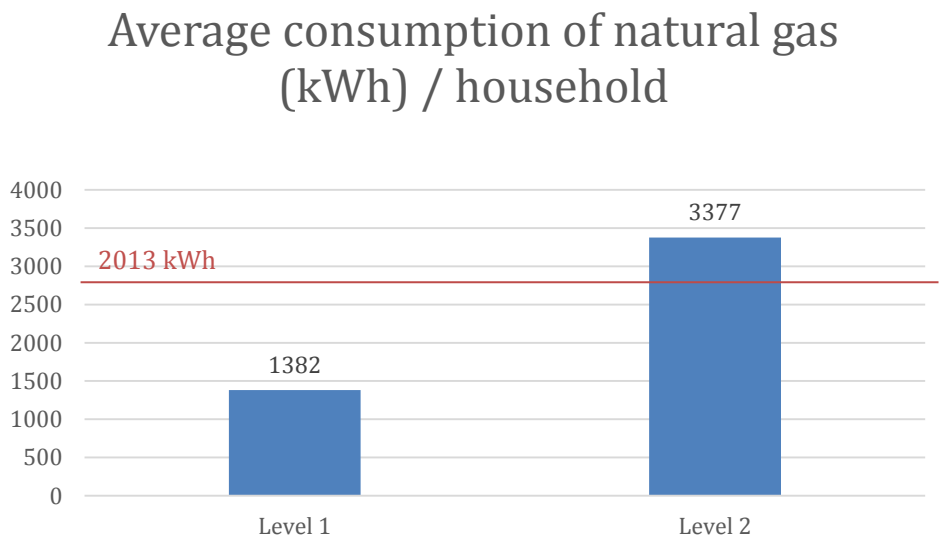
Of the total households with gas water boiler/heaters, 23% use natural gas, 10% use piped LPG and the remaining 58% use LPG Bottle.

Most of Natural gas exists in the major centers of Lisbon, Porto and Center Coast, and is not very representative in the other regions (since the gas network is not available).



The following graph shows the average consumption per household in each level. Not surprisingly, the highest level of consumption is found on Level 2 users.



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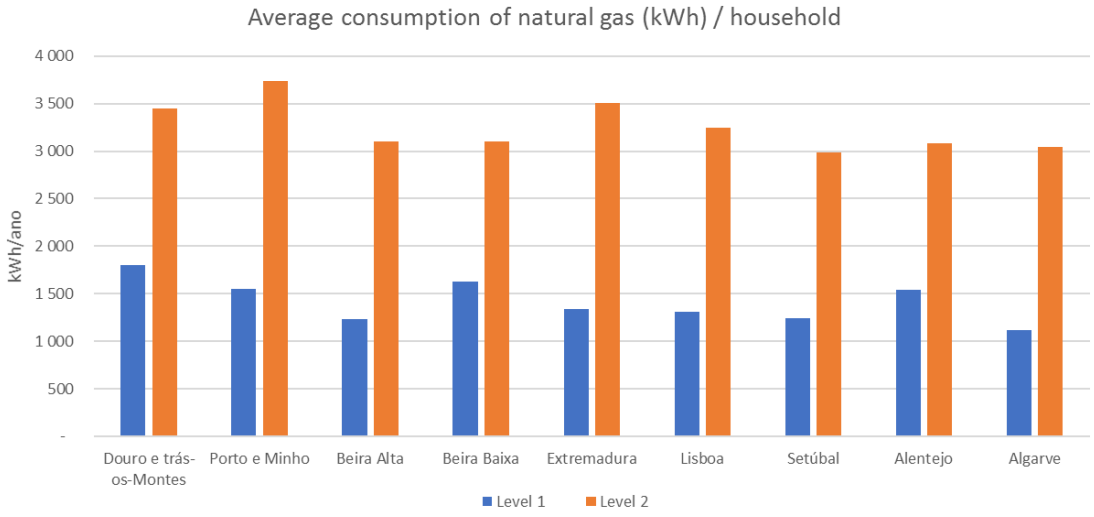
The use of natural gas does not depend on the region of the country in the same proportion as we find for electricity use.

Minho and Porto are the geographical areas with the highest average gas consumption.



2.4.5. Energy uses. Appliances available on the households.

Analyzing the distribution of the heating system of Portugal, we conclude that Portuguese households use mostly portable electrical equipment (41%) for home heating.

The difference of the heating source according with the typology of the households is significant. In single family households, there is a majority of wood, coal or other solid fuel (51%), opposed to the use of electricity (74%) in apartments, mostly located in the large urban centers of Lisbon and Porto.

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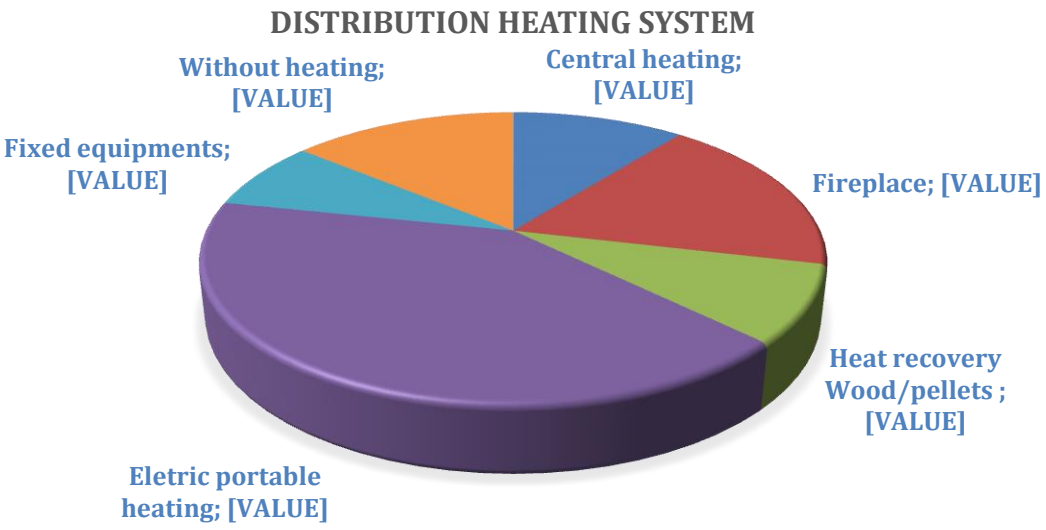

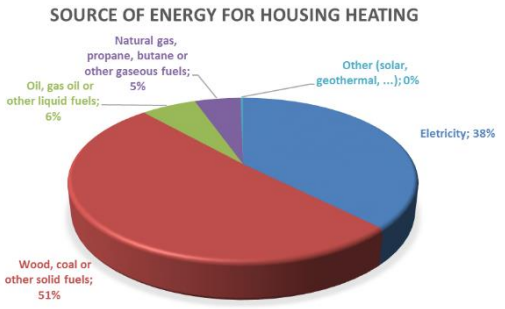

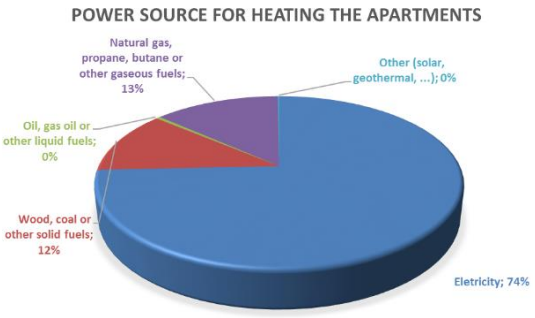

The following graph shows the representativeness of the equipment used as a heating system, discriminated by region.

Again, we find several regional differences. In regions such as Trás-os-Montes and Center, the use of fireplace and LPG is very representative. The opposite happens in Lisbon and Porto, where more than 50% of equipment corresponds to portable electrical heating.

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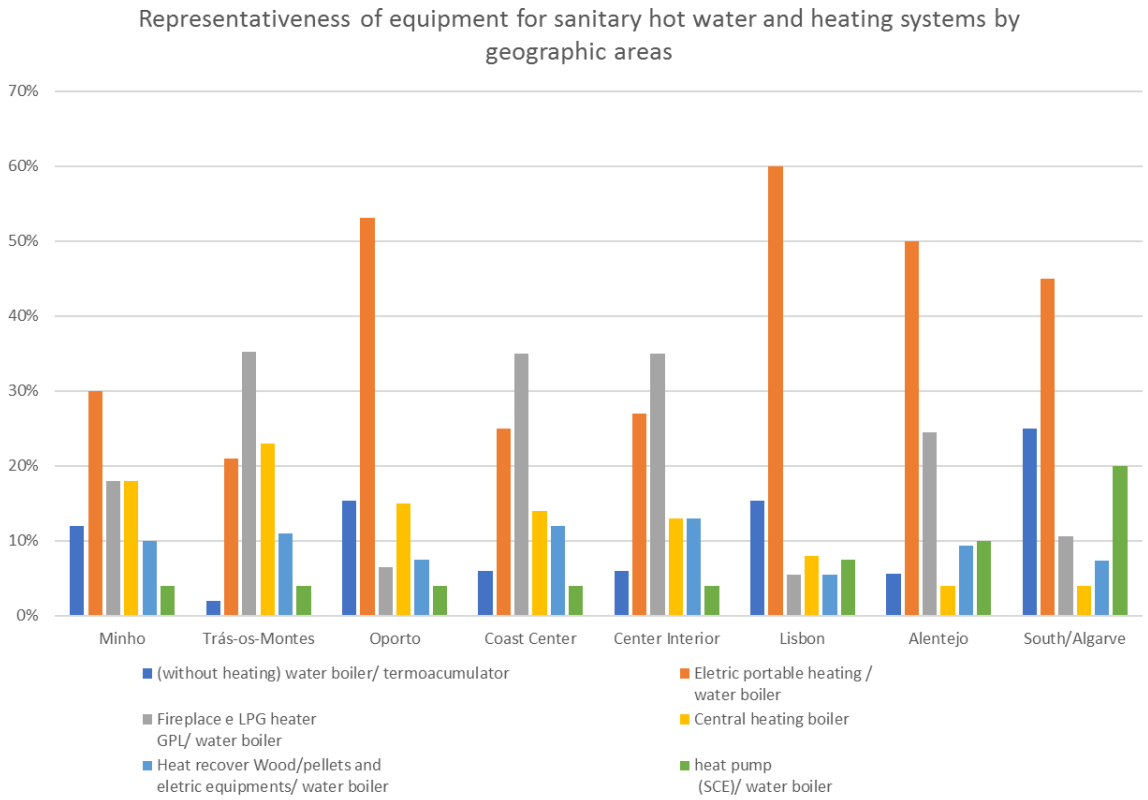

Algarve is the region where we find the highest percentage of heat pumps (20%).

- Domestic appliances and their consumption

Another interesting analysis can be done regarding penetration rate of several electrical appliances for which we could take profit of three pre-existing studies done at national level. All the houses have at least one equipment used for food conservation (refrigerators with or without freezer, combined fridge-freezers and freezers). The washing machine is also present in all the houses, while the dishwasher appears only in half of them. The penetration rate of the microwave is also quite significant. There are usually two televisions per dwelling.

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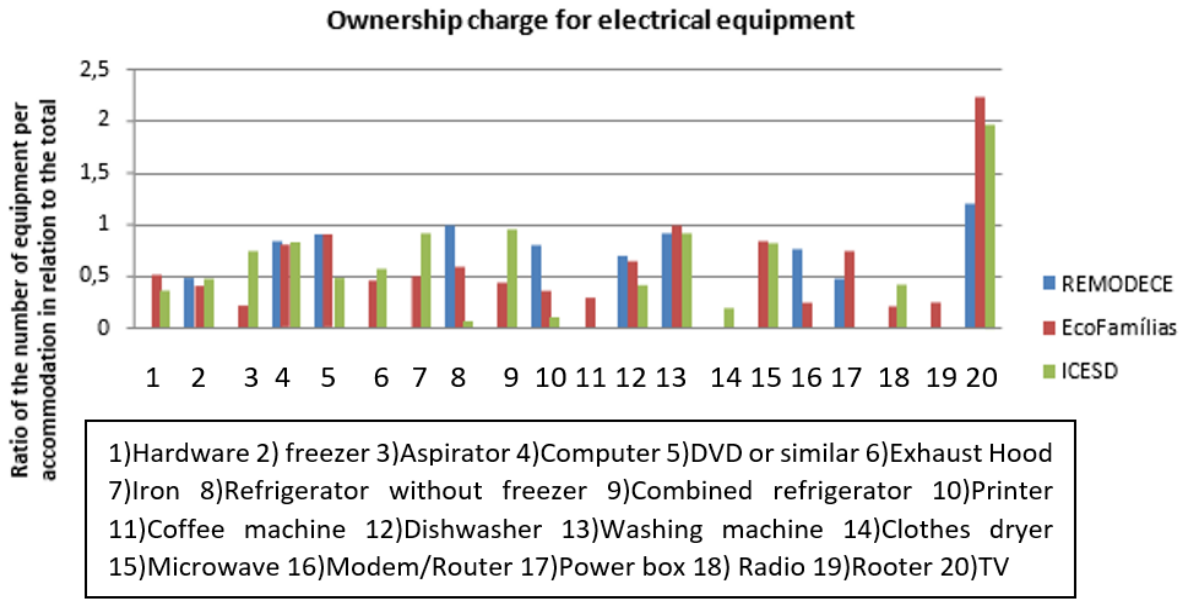
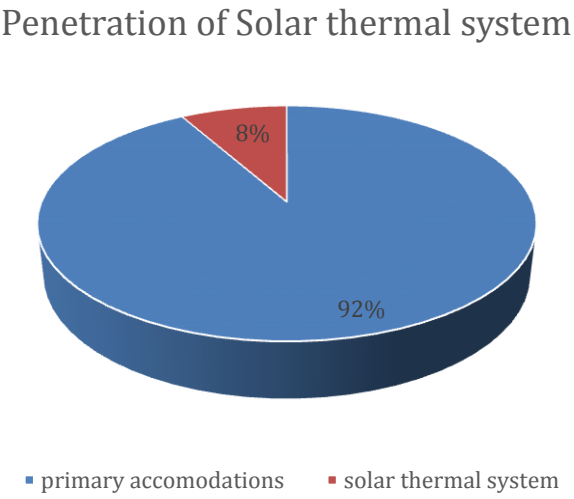


The information was collected from 3 different studies and the most recent is from ICESD.

- Solar thermal systems

The penetration of solar thermal systems corresponds to approximately 330 000 units which corresponds to 8% of the total existing primary accommodations



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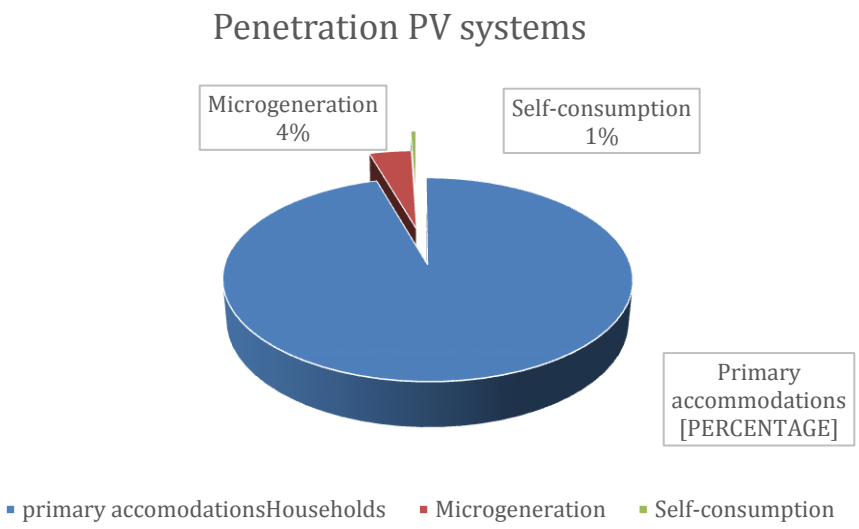
- Photovoltaic residential systems

The penetration of photovoltaic systems represents approximately 5% of the primary accommodations in Portugal.

Until 2015, the PV systems were seen as a financial investment (microgeneration) in which all production was sold to the grid. In this period, an individual consumer would install a system of a specific power, limited to 3.68 kWp. In 2014, the government eliminated the subsidized micro-generation tariffs and, according to the new Decree 153/2014, families were allowed to start self-consumption with installed power levels between 200W and 1500W.

- Number of domestic microgeneration PV plants before 2015: 166 577 units
- Number of domestic self-consumption PV plants after 2015: *15 560 units*



There is still a small penetration of the photovoltaic systems, especially of self-consumption, which represents approximately 0.5%. Because the possibility to use micro-generation does not exist anymore, to determinate the profiles we will choose only families that have self-consumption.

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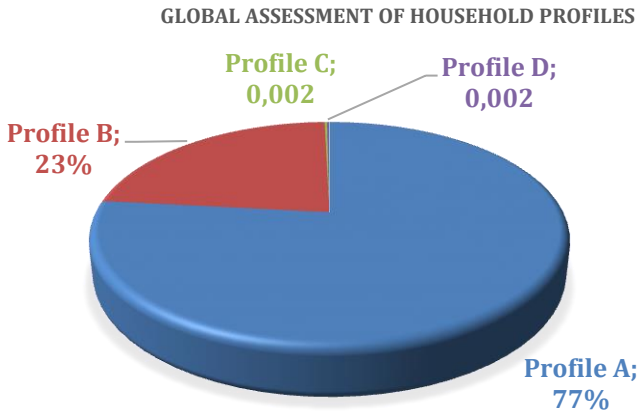
2.4.6. Profiles of domestic households.

According to the analysis, 4 segmented profiles were defined: Profile A, B, C & D, using the approach that was previously agreed between the consortium partners.
According to the national statistics, the representativeness of each global profile is distributed as follows: profile A, 77%, profile B, 23% and a residual value for profiles C and D.



Profile A corresponds to families that don't use any renewable energy use. In Portugal we decided to make a subdivision of profile A, due to the climatic and equipment prevalence differences of each regions. in which we make a distinction according with the types of heating system used with the penetration of the appliances, and the source of energy. In this way, we found that 4 sub profiles should be taken into consideration: A.1, A.2, A.3 and A.4.

In the following table we specify the penetration of the energy sources that are used in the dwellings, according to the previously identified regions. It is clear that in urban centers such as Porto and Lisbon there is a great percentage of unheated houses, and we will need to monitor some representative cases of this profile (A.1).

There was a high representation of highly inefficient electrical portable equipment in the Porto, Minho, Lisbon and Alentejo. These regions also need to be monitored, with representative families of this use profile (A.2).

Another representative profile (A.3) can be found in the Center, Trás-os-Montes and Alentejo, with a great penetration of LPG use and Fireplaces (Profile A.3).

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		Profile A									
Geografic Zones	Prim. Accom.	Without RES									
National	3 997 724	3 409 110				85%			77%*		
Minho	422 669	329 682				79%					
Trás-os-Montes	250 828	203 720				81%					
Oporto	647 363	584 987				87%					
Center Litoral	663 386	530 709				80%					
Center Interior	231 928	187 862				80%					
Lisbon	1 129 789	1 002 966				89%					
Alentejo	299 764	252 322				84%					
South/Algarve	179 304	151 584				85%					
Açores	80 527	75 467				94%					
Madeira	92 166	89 813				97%					
		Profile A.1		Profile A.2			Profile A.3			Profile A.4		
		(without heating) water boiler/ termoacumulator		(Eletric portable heating / water boiler)			(fireplace e LPG heater GPL/ water boiler)			(Central heating boiler)		
Nacional	3997724	562730	**14%**	1696361	**42%**	**38%***	680225	**17%**	**15%***	469794	**12%**	**11%***
Minho	422669	50720	**12%**	126 801	**30%**		76080	**18%**		76 080	**18%**	
Trás-os-Montes	250828	5017	**2%**	52 674	**21%**		88339	**35%**		57 690	**23%**	
Oporto	647363	99001	**15%**	343980	**53%**		41829	**6%**		100177	**15%**	
Center Litoral	663386	39803	**6%**	165 847	**25%**		232185	**35%**		92 874	**14%**	
Center Interior	231928	13916	**6%**	62 621	**27%**		81175	**35%**		30 151	**13%**	
Lisbon	1129789	172834	**15%**	677 873	**60%**		61875	**5%**		90 383	**8%**	
Alentejo	299764	16903	**6%**	149 882	**50%**		73546	**25%**		11 991	**4%**	
South/Algarve	179304	44686	**25%**	80658	**45%**		19068	**11%**		7 172	**4%**	
Açores	80527	47983	**60%**	21621	**27%**		4000	**5%**		1863	**2%**	
Madeira	92166	71867	**78%**	14405	**16%**		2128	**2%**		1413	**2%**	

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The same structure was used to characterize the B profiles, which are similar to A profiles, but already using renewable energy systems such as biomass stoves, heat pump (air-conditioning), photovoltaic and solar thermal systems.

Profile C, features an optimized system with photovoltaic (self-consumption) and electric vehicle. Due to the low percentage of population corresponding to this profile, we decided not to further segment it regionally.

Profile D, represents a family with optimized system with photovoltaic and / or solar thermal with accumulation of batteries. There is no data of existing PV installations with batteries, so it is not possible to see if it corresponds to a specific geographical or energy-use related profile.

		Profile B			Profile C		Profile D	
Geografic Zones	Prim. Accom.	With RES			With Eletric car**		With Batteries	
National	3 997 724	1035093	26%	23%*	7 817	0,2%	-	0.2%
Minho	422 669	88760	21%		-	<1%	-	<1%
Trás-os-Montes	250 828	47657	19%		-	<1%	-	<1%
Oporto	647 363	84157	13%		-	<1%	-	<1%
Center Litoral	663 386	132677	20%		-	<1%	-	<1%
Center Interior	231 928	46386	20%		-	<1%	-	<1%
Lisbon	1 129 789	127715	11%		-	<1%	-	<1%
Alentejo	299 764	58398	19%		-	<1%	-	<1%
South/Algarve	179 304	28889	16%		-	<1%	-	<1%
Açores	80 527	5060	6%		-	<1%	-	<1%
Madeira	92 166	2353	3%		-	<1%	-	<1%

		Profile B.1 (Heat recover Wood/pellets and eletric)			Profile B.2 (air conditioning (SCE)/ water boiler)			Profile B.3 PV e/ou Solar térmico			Profile C	Profile D
											** There is no differentiation of electric cars for business or home use or where they are loaded. Total: 7817 electric and hybrid cars	
Nacional	3997724	335207	**8%**	**8%***	199886	**5%**	**4%***	500 000	**13%**	**12%***	* 100% approximation due to data overlap	
Minho	422669	42 267	**10%**		33814	**8%**		**54 947**	**13%**	-		
Trás-os-Montes	250828	27 591	**11%**		20066	**8%**		**32 608**	**13%**	-		
Oporto	647363	48739	**8%**		51789	**8%**		**84 157**	**13%**	-		
Center Litoral	663386	79 606	**12%**		53071	**8%**		**86 240**	**13%**	-		
Center Interior	231928	30 151	**13%**		18554	**8%**		**30 151**	**13%**	-		
Lisbon	1129789	61504	**5%**		169468	**15%**		**146 873**	**13%**	-		
Alentejo	299764	28172	**9%**		59953	**20%**		**29 976**	**10%**	-		
South/Algarve	179304	13277	**7%**		71722	**40%**		**23 310**	**13%**	-		
Açores	80527	2766	**3%**		-	-		-	-	-		
Madeira	92166	1134	**1%**		-	-		-	-	-		

The sources of information to develop this analysis were the following:

- INE, National Statistics Institute: http://www.ine.pt/ for social information (populations, kind of buildings, etc.)
- PORDATA, Contemporary Portugal database: https://www.pordata.pt/ for social and average energy households consumption information
- ERSE, regulator of energy services: http://www.erse.pt/ for electricity and gas information

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- EDP, Energy of Portugal: https://www.edp.pt/ for tariffs and profiles, consumption for power contracted information
- DGEG, General Direction of Energy and Geology: http://www.dgeg.gov.pt/ for energy and appliances available (heating system, sanitary hot water and SERUP/PV) information.
- ADENE, agency for Portuguese energy: https://www.adene.pt/ information of profiles consumption energy
- IPES, Portuguese Institute of Solar Energy: http://www.ipes.pt/ipes/ for information of the penetration of Solar systems
- EEESE, Eficiência energética em equipamentos e sistemas eléctricos no sector residencial
- EF225, EcoFamílias225 studies
- EFII, EcoFamílias II
- ICESD, Inquérito ao Consumo de Energia no Sector Doméstico/INE

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2.5. Slovenia assessment.

In this report we summarize the information about the energy use in the residential sector to have a better understanding over the energy consumption distribution in our country.

Thanks to this information, we have a better overview on what is available in Slovene households and we can evaluate the different profiles needed in the monitoring process.

2.5.1. Population.

2.066.880 (Slovene Statistical Office 01/2018)

2.5.2. Regions or climate zones.

In Slovenia, there are three climate regions. In Central and Eastern Slovenia, there is a temperate continental climate. In the Alpine region a mountain climate and west of the Alpine-Dinar barrier is described as a sub-Mediterranean climate with higher precipitation and lower temperatures compared to the real Mediterranean climate.

Most of Slovenia is characterized by moderate continental climate. Average temperatures of the coldest month are lower than 0 ° C. In the eastern part, there is already a summer rainfall, which is typical for the climate of continental Europe. Winters are quite cold, the summers are quite hot.

The moderate Mediterranean climate is limited to the seashore to the high karst plateaus. It is the warmest and softer climate in Slovenia, since the effects of the sea mitigate winter cold and summer heat. Mild winters are typical and this region has also the highest number of sunny days in the country. It is distinguished from the real Mediterranean climate (proximity to the Alps, transitional position) by a greater amount of precipitation and lower temperatures.

The mountain climate is typical of Alpine highlands, the associated mountain valleys, and some high dinar plateau. It is the sharpest climate in the country. Temperatures are lower throughout the year than elsewhere. These are areas with abundant precipitation, which, in the cold half of the year, fall normally in the form of snow.

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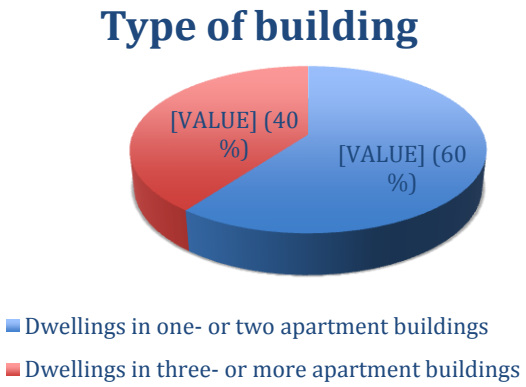
2.5.3. Buildings typology.

All data present in this report is for 2015, unless otherwise stated (Statistical Office of the Republic of Slovenia, 2015)

Number of dwellings: 845.415
Number of inhabited dwellings: 674.463
Average number of persons in dwelling: 3,0
Share of new dwellings built after 2005: 6,9 %

In 2015, the majority of dwellings in Slovenia were in one- or two-dwelling buildings (60 %), the rest were in three- or more dwelling buildings. There were 674.463 inhabited dwellings in almost 800.000 private households, and a total of 1.995.500 inhabitants (96,7 %). The remaining 3,3 % of the population lived in group and other forms of accommodation.
Seven inhabitants of Slovenia out of ten lived in single houses or two dwelling buildings, and three inhabitants out of ten lived in three- or more apartment buildings and other buildings. Owners of the majority of dwellings (91 %) were residents, 6 % of the dwellings were owned by the public sector, while the owners of 3 % of the dwellings were other legal entities. Only every 15th inhabitant of Slovenia lives in a rental dwelling.

- Type of building:



Number of dwellings in one-dwelling buildings: 365.370
Number of dwellings in two-apartment buildings: 40.588
Number of dwellings in three- or more apartment buildings: 250.106
Number of dwellings in non-residential buildings: 18.399

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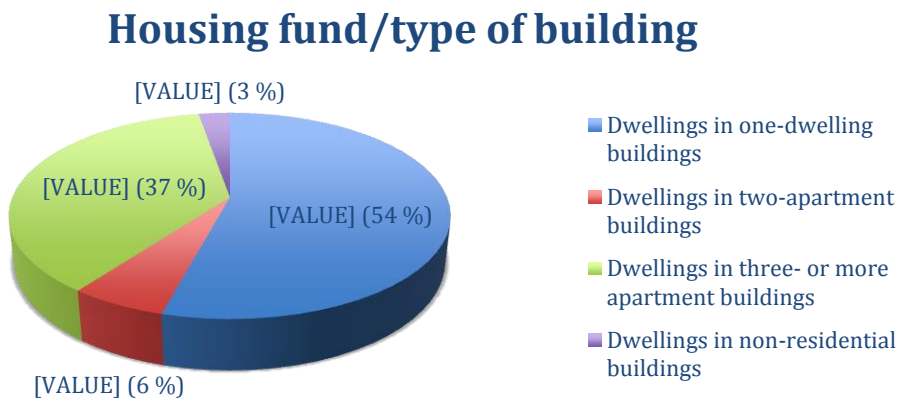
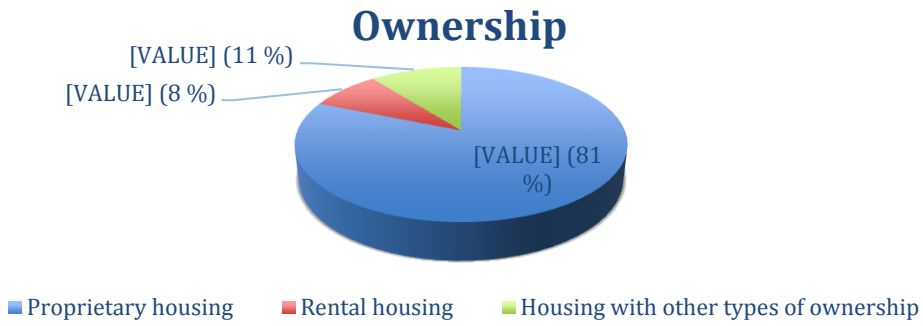


- Ownership



Proprietary housing: 547.799

- In residential buildings: 535.415
- In one-dwelling buildings: 335.243
- In two-dwelling buildings: 32.492
- In three- or more apartment buildings: 167.680
- In non-residential buildings: 12.384

Rental housing: 55.213

- In residential buildings: 51.804
- In one-dwelling buildings: 4486
- In two-dwelling buildings: 1343
- In three- or more apartment buildings: 45.975
- In non- residential buildings: 3409

Housing with other types of ownership: 71.451

- In residential buildings: 68.845
- In one-dwelling buildings: 25.641
- In two-dwelling buildings: 6753
- In three- or more apartment buildings: 36.451

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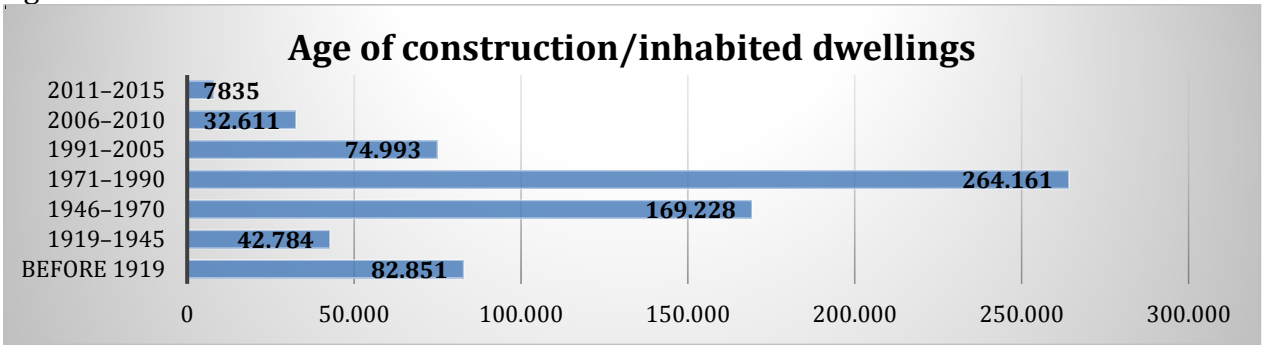
- In non-residential buildings: 2606

Age of construction:

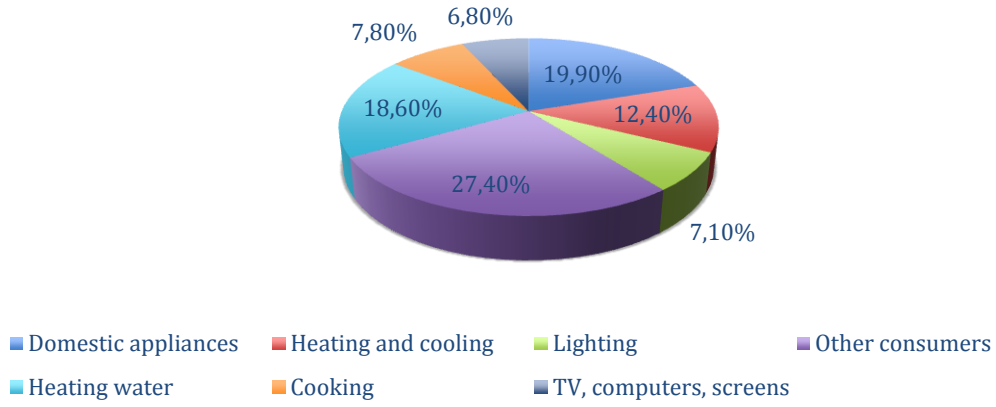


2.5.4. Energy consumption of households.

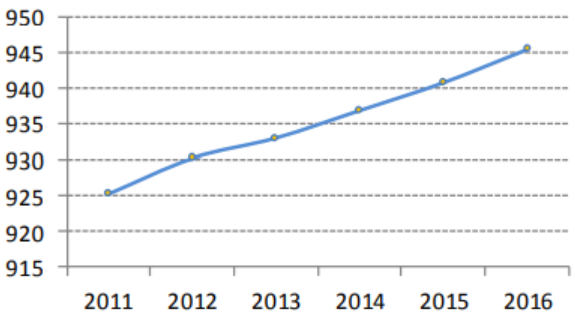
- Electricity consumption

Total electricity consumption in Slovene households in 2016: 3260 GWh

Electricity consumption in Slovene households in 2016:



Number of electricity consumers in 2016: 945.442 (in thousands)



Source: Energy Agency, 2016

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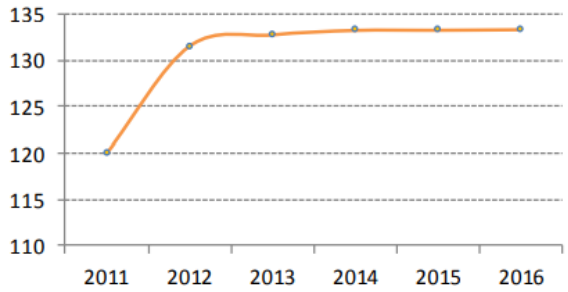
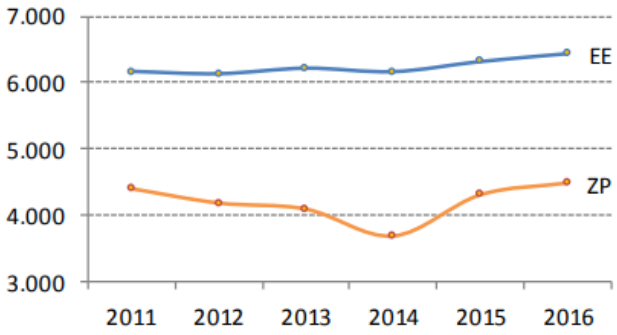
Number of gas consumers in 2016: 133.307 (in thousands)



Source: Energy Agency, 2016

Electricity in natural gas consumption per capita (in kWh):



Source: Energy Agency, 2016

2.5.5. Energy uses. Appliances available on the households.

- Heating system and hot water system characteristics

Sources for heating in households (TJ)

	Local heating	Central heating
Energy source – TOTAL	3322	27.861
Extra light fuel oil	-	4116
Natural gas	-	3674
Wood fuel	2686	15.134
Liquefied petroleum gas	-	593
Electricity	637	601
Coal	-	4
Remote heat	-	2876
Solar energy	-	11
Heat pumps	-	852

Source: Statistical Office of the Republic of Slovenia, calculation Jožef Stefan Institute - Center for Energy Efficiency (IJS-CEU), 2016

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A good fifth of Slovenian households are thinking about switching to a different way of heating or upgrading the existing way of heating the rooms, since heating is the biggest cost in the household. This is why Almost three-fifths of these households indicate a reduction in the cost of heating or a more economical way of heating as a reason to do this changes. More and more households are motivated by the reduction of environmental impacts caused by heating. Often the reason is also the finding that the lifetime of the existing heating mode is slowly running out. Households in single-family homes are more interested in changing or supplementing the method of heating than households in multi-dwelling buildings. (*Source: Energy Efficiency Survey of Slovenia - REUS 2017*)

Sources for heating water in households (TJ)

	Local heating	Central heating
Energy source – TOTAL	663	6871
Extra light fuel oil	-	556
Natural gas	18	887
Wood fuel	97	2097
Liquefied petroleum gas	-	139
Electricity	548	1636
Coal	-	2
Remote heat	-	559
Solar energy	-	447
Heat pumps	-	494

Source: Statistical Office of the Republic of Slovenia, calculation Jožef Stefan Institute - Center for Energy Efficiency (IJS-CEU), 2016

- Domestic appliances and their consumption

Domestic appliances and equipment with energy label (%) in households

	Washing machines	Refrigerator	Freezer	Dish-washer
% dwellings with electrical appliances	95,6	99,7	61,2	56,2
% devices with energy label	89,2	85,1	68,9	84,6
% appliances with energy class A+++	9,4	0,6	0,1	0,8
% appliances with energy class A ++	9,1	3,0	5,2	7,3
% appliances with energy class A+	38,1	34,6	45,0	16,5
% appliances with energy class A	37,5	49,6	27,7	72,1
% appliances with energy class B	3,0	11,8	17,4	2,3
% appliances with energy class C	2,7	0,3	2,7	0,9
% appliances with energy class D	0,1	0	1,1	0
% appliances with energy class E	-	-	0,5	-
% appliances with energy class F	-	-	0,3	-
% appliances with energy class G	-	0	0	-

Source: Statistical Office of the Republic of Slovenia, calculation Jožef Stefan Institute - Center for Energy Efficiency (IJS-CEU), 2014

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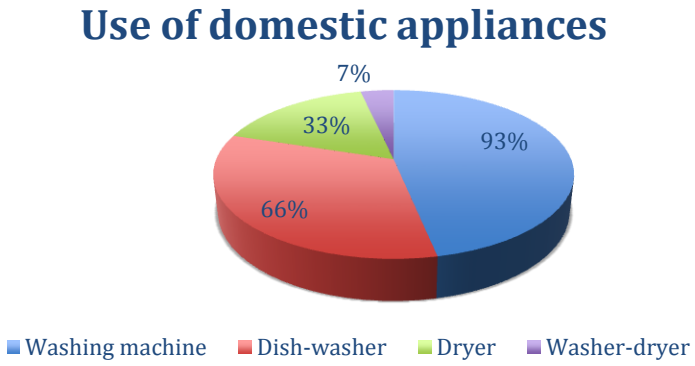
- Washing machines, dish-washers, dryers

The majority of Slovenian households has washing machine. The trend since 2010 shows that the number of energy-saving washing machines, dish-washers and above all dryers is constantly increasing. Almost half of Slovenian households use these appliances during a higher tariff, which means the potential for lowering costs.

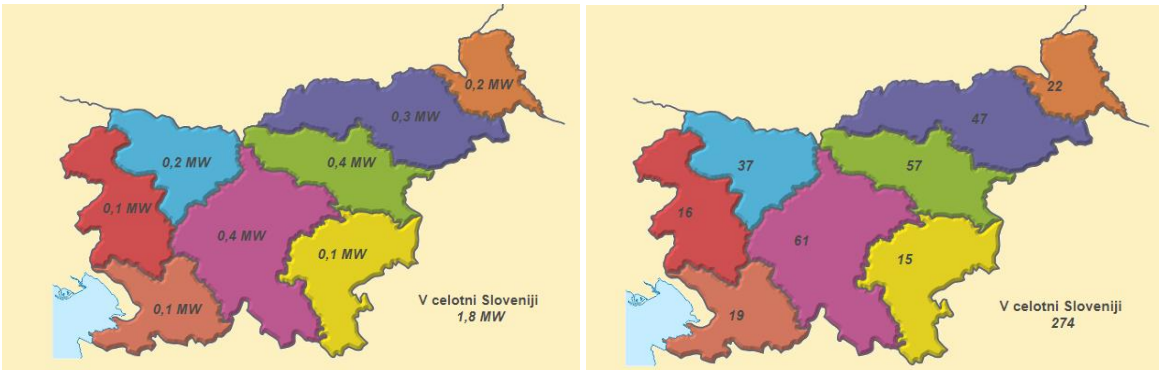


Source: Energy Efficiency Survey of Slovenia - REUS 2017

Energy Efficiency Survey of Slovenia - REUS 2017 (1015 surveyed Slovenian households) showed that 93% of households use washing machines, of which 46 % are washing machines with less than 5 years, 38 % are between 5 and 9 years. The dryer is present in 33 % of households, of which 48 % are dryers with less than 5 years (2015: 39 %), 33 % are between 5 and 9 years. The washing-drying machine is used by 7 % of households, of which 49 % are washing machines under 5 years, 35 % are aged 5 to 9 years. The dishwasher has 66 % of households, of which 38 % of dishwashers are up to 5 years and 37 % between 5 and 9 years.

- Photovoltaic residential systems

On 3 April 2018, 274 small solar power plants (up to 10 kW) were installed in Slovenia, with a total capacity of 1,8 MW.



Source: Slovenian portal for photovoltaics, 3. 4. 201

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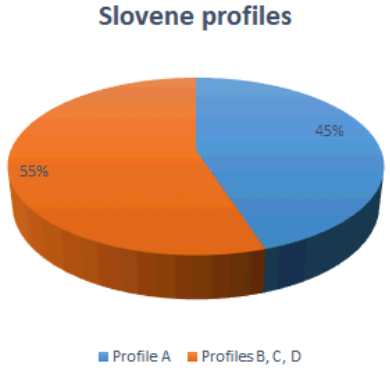
2.5.6. Profiles of domestic households.

A good fifth of Slovenian households are thinking about switching to a different way of heating or upgrading the existing way of heating the rooms, since heating is the biggest cost in the household. Almost three-fifths of these households, as a reason, indicate a reduction in the cost of heating or a more economical way of heating. More and more households are motivated by the reduction of environmental impacts caused by heating.

Often the reason is also the finding that the lifetime of the existing heating mode is slowly running out. Households in single-family homes are more interested in changing or supplementing the method of heating than households in multi-dwelling buildings.

We will focus on average Slovene families with 3-4 members from different climate zones. According to the first analyses less than half of them fall into profile A, the rest into profiles B, C and D.



It could be quite strange seeing that the % of profiles that already has a renewable system at home is higher that the profile that has not. The justification is given that renewable resources include heating on wood. The truth is that heating systems on wood are mostly old and energy-ineffective, but they are considered a renewable source. So, we will have a good point to improvement.

Sources for heating in households (TJ)

	Local heating	Central heating
Energy source – TOTAL	3322	27.861
Extra light fuel oil	-	4116
Natural gas	-	3674
Wood fuel	2686	15.134
Liquefied petroleum gas	-	593
Electricity	637	601
Coal	-	4
Remote heat	-	2876
Solar energy	-	11
Heat pumps	-	852

Source: Statistical Office of the Republic of Slovenia, calculation Jožef Stefan Institute - Center for Energy Efficiency (IJS-CEU), 2016

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2.6. Spain assessment.

The aim of this report is to have as much information as possible for having a global picture of the energy situation of the Spanish families, being able to select the different Spanish domestic profiles identified for the monitoring WP. So, we are going to summarize up the principal data, starting in a macro way (from demography and climatologic point of view), to a micro vision of the energy consumption and behaviors of the households. As we will see at throughout the text, the needs depend not only of the type of building, or the geographical location, but also on how old the building is, for example.

Nevertheless, even though we can detect different profiles, we can also find many similarities from a general point of view, distinguishing 3 principal zones on the country, and 2 main kind of family's profiles.

The micro study will give us the critical points to better focus our effort when it comes to finding the best ways for helping the families to save energy, trying to invest on the most suitable way, and doing it in a continuous and progressive way.

The sources of information to develop this analysis have been:

- INE, National Statistics Institute: http://www.ine.es/ for social information (populations, kind of buildings, etc.)
- IDAE, Institute for Energy Diversification and Saving: http://www.idae.es/, for energy information
- CNMC, National Commission of the Market and Competence: https://www.cnmc.es/ information of tariffs and profiles, consumption for power contracted.
- REE, Spanish Electric Grid, http://www.ree.es/es/ global information about the energy infrastructure, statics of the energy system.
- EUROSTAT, Statistical Office of the European Union http://ec.europa.eu/eurostat , for checking the global information and complete missing one.
- Transition Ecology Spanish Ministry (Energy Ministry): http://www.mincotur.gob.es/energia/es-ES/Paginas/index.aspx and Self consumption register https://sedeaplicaciones.minetur.gob.es/REA/Vista/RegistroPublico.aspx
- T2.2: Internal survey developed on the project.

2.6.1. Population.

The total population was 46.572.132 in 2017, practically divided on the same percentage of men and women: 22.832.861 of men, and 23.739.271 of women. The

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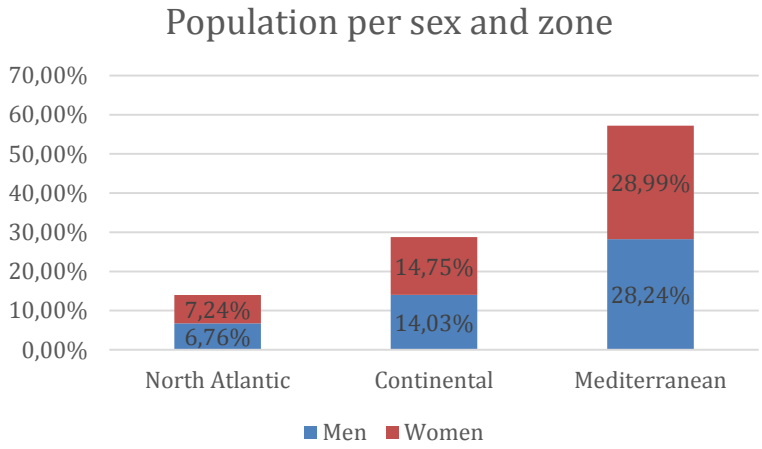
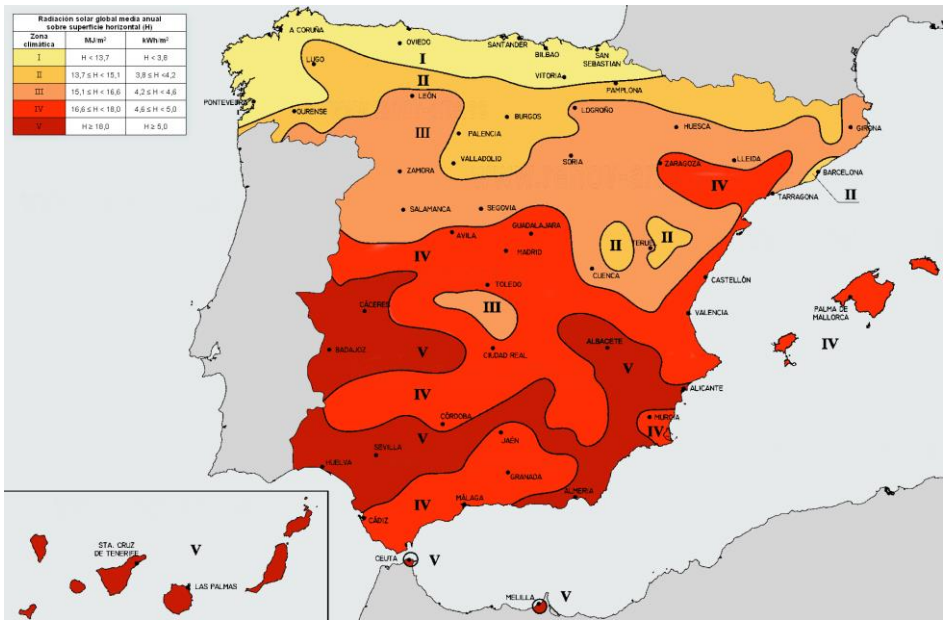
number of primary households, to which we will refer along the report is 18.083.692 (the global number of households is 25.208.623).

As it is shown on the graph below, more than half of the population is concentrated on the Mediterranean zone, mainly because of the weather that makes many retired European people move to live there.



2.6.2. Regions or climate zones.

There are different classifications of the climatologist zones in which Spain is divided, depending on which factors are taking in account. On one hand, there is the classification that has been stablished by the Technical Building Code (CTE), the regulatory framework for buildings requirements, based on the radiation source available. (DB-HE Energy saving).



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Climate Zone	Radiation (kWh/m2 and day)	Cities	Cities %
I	< 3.8	2.435	17%
II	Between 3.8 and 4.2	2.854	19%
III	Between 4.2 and 4.6	4.267	29%
IV	Between 4.6 and 5	3.518	24%
V	> 5.0	1.642	11%

So, of the whole number of cities in Spain (14.716), more than half have a radiation around 4.6 kWh/m^2 per day. As we are going to see later, this is the first indicator that we are not using the solar source as much as we must.

On the other hand, if we focus only on the weather factors, like temperature and humidity, we have 3 principal different zones, as Eurostat has distinguished on their reports:

- North- Atlantic: it includes all the north of the country, from the Pyrenees to Galicia.
- Continental: it includes all the center of the country.
- Mediterranean: it includes not only the part near to Mediterranean cost, also the south of the country (Andalucía and Extremadura) including also the north part of the Mediterranean cost, as Barcelona.

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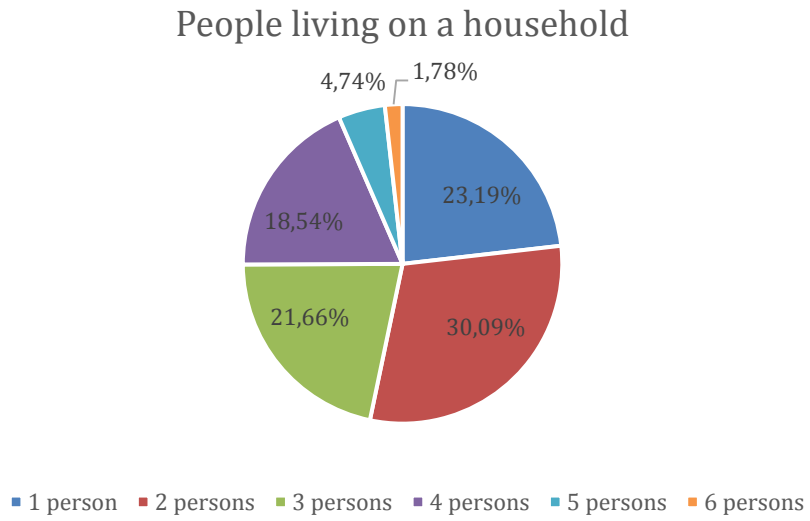
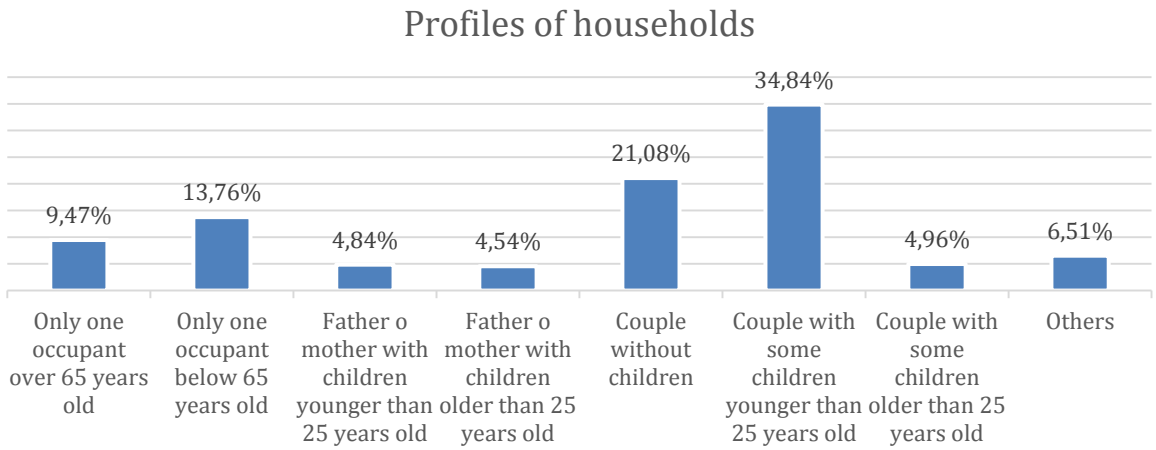
If we put one map over the other we can conclude that we have three different parts of the country, with different energy needs and energy sources:

- Zone 1: North- Atlantic and zones I and II of radiation
- Zone 2: Continental and zones III and IV of radiation.
- Zone 3: Mediterranean and zones IV and V of radiation.

2.6.3. Buildings typology.

- Type of building:
  - People living in apartments 66,00%
  - People living in houses 33,66%
  - Others 0,34%





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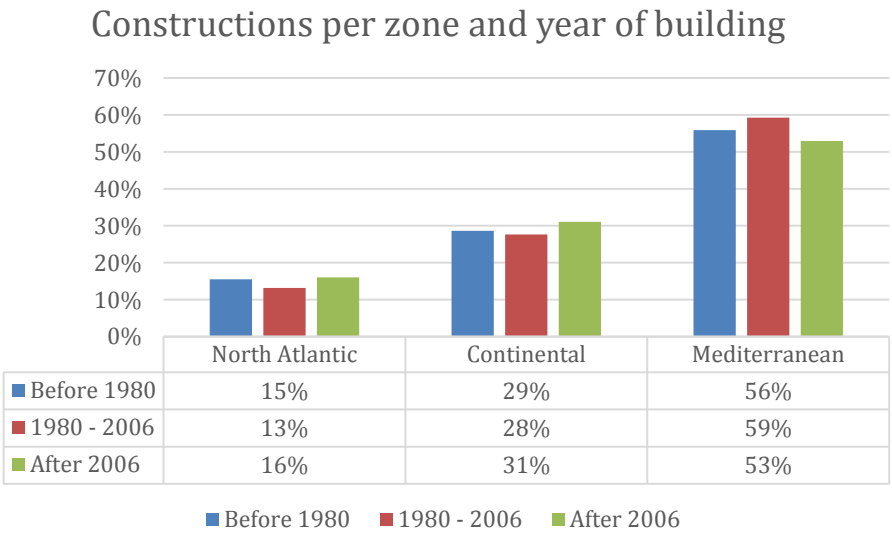
So, once again, if we do a mix of both graphs we can conclude that the most common "families" in Spain could be divided in:

- ❖ Family 1: A family of 3-4 members (40%)
- ❖ Family 2: A couple (20%)

- Ownership and relative age of constructions
  - ➢ Owners 80 %
  - ➢ Tenants 20 %

- Age of constructions: We distinct 3 different period based on the regulation framework. As a consequence, the level of insulation and the quality of the buildings are different, affecting the energy needs:



	North Atlantic	Continental	Mediterranean
Before 1980	15%	29%	56%
1980 - 2006	13%	28%	59%
After 2006	16%	31%	53%

	Apartment needs	Detached house needs
Before 1980	200 kWh/m2	300 kWh/m2
1980-2006	150 kWh/m2	200 kWh/m2
After 2006	100 kWh/m2	150 kWh/m2

These needs are an average estimation, as we have seen above, and we will also explain in the next points that it can be influenced by the location and the type of the building itself.

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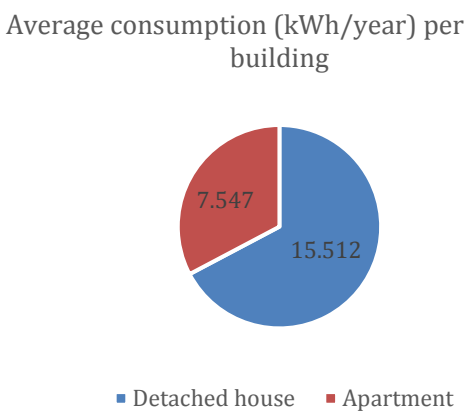
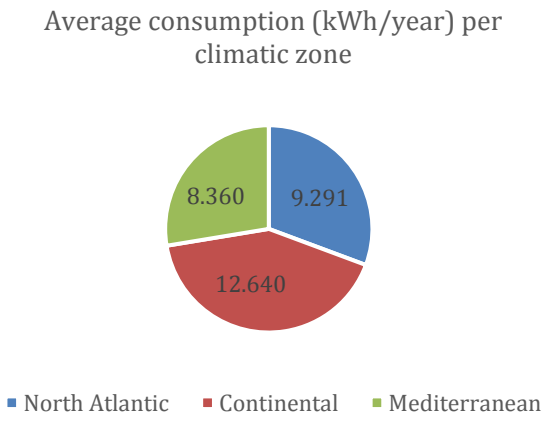
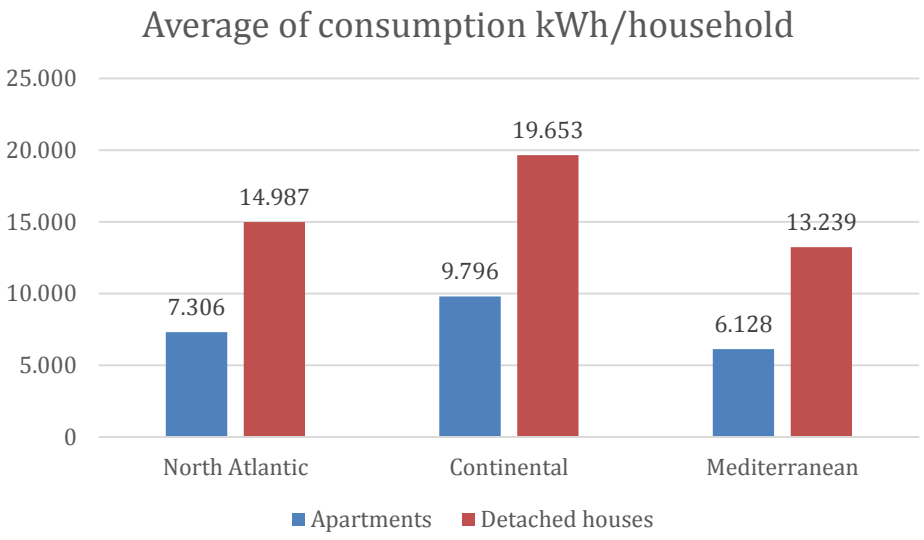




As we can see on the next graph, the most consuming buildings are the detached houses located on the continental zone, with values around 20.000 kWh/year, so we must focus on that profile to allow those families to improve the way that they use energy, saving money as well and reducing the level of emissions.

2.6.4. Energy consumption of households.



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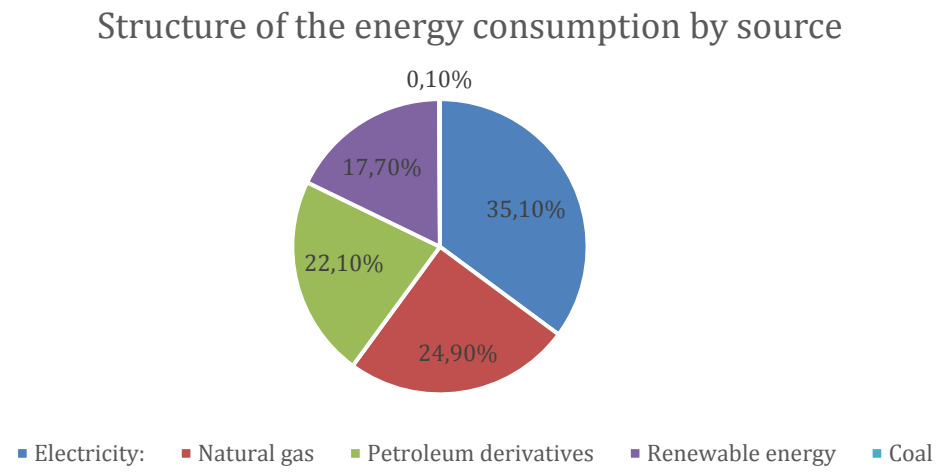
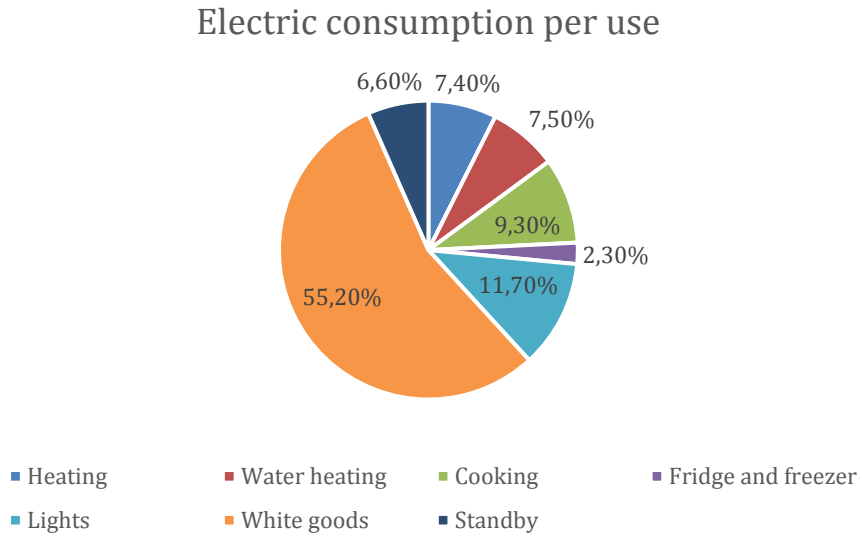


The percentage of renewable energy on the contribution to the global energy consumption structure is increasing during the last years, nevertheless it is still a minority source, below 1/5 of the global consumption, so we have a great opportunity to contribute to increase that number, trying to get at least to 1/4, thus reducing the percentage of electricity and petroleum derivatives (including natural gas).

- Electricity consumption



If we analyse where electricity is used on a household, we can see that most of them are using nearly ¾ of electricity on electric appliances and lighting. In this case, acting on lighting will be easier for the families because they can improve by gradually changing their traditional lights by LED. The inversion on the electric appliances, and the fact that

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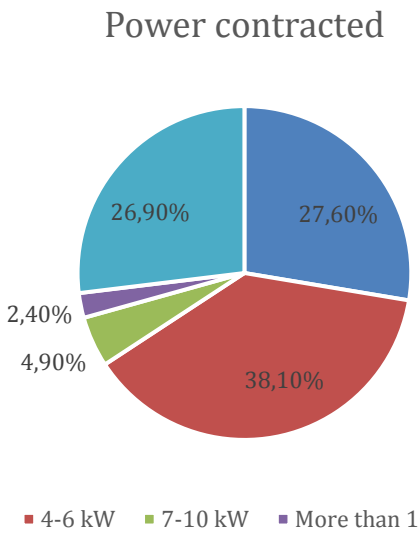
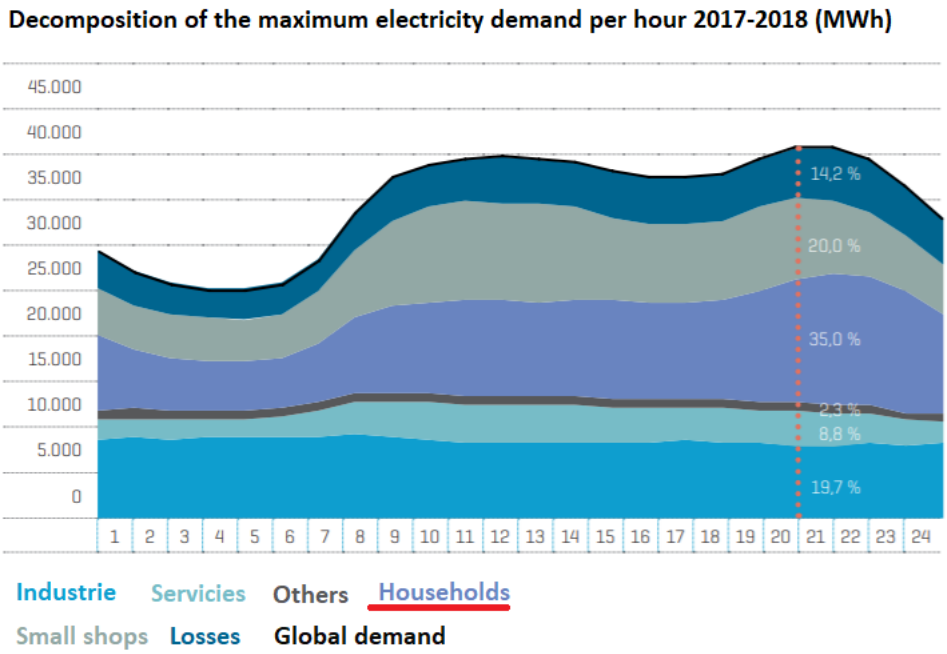
the reduction of the energy waste may not so significant will prove more difficult implement. On the other hand, the stand-by consumption is something that each family can cut directly, only with a change of behaviour, saving more than a 6% of their electric invoice, which in some cases could be more than 60 € per year. The percentage of savings is not so significant, but taking in account that there is not any investment needed, it is a very good point to start saving energy.

- Electricity consumption profiles





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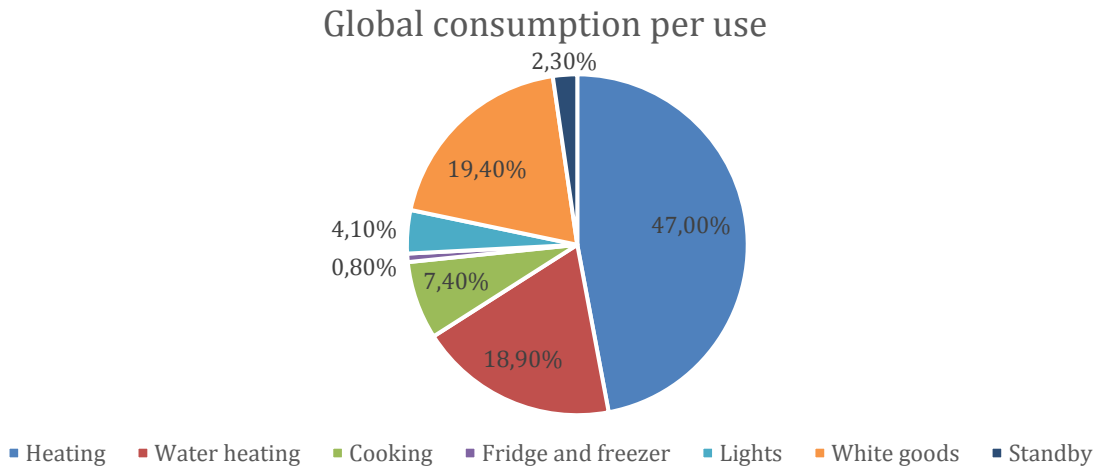
From the information of the graphs we can extract that the household's electric consumption is the biggest within the overall consumption of the country, which means that this should be a priority area of work by the government , if the goal is to reduce the electric structure, for example by betting to enforce self-consumption at residential level. That reasoning will be further explained in WP 5, because we will have more reliable evidence (through the monitoring) to create and support a change in the legal frame.

We can resume the energy domestic consumption profile as:

Average of total consumption per household	9.907	kWh
Electric power contracted	3-6	kW
Average of electricity consumption per Home	3.487	kWh
Average of annual expenditure per household	990	€

2.6.5. Energy uses. Appliances available on the households.



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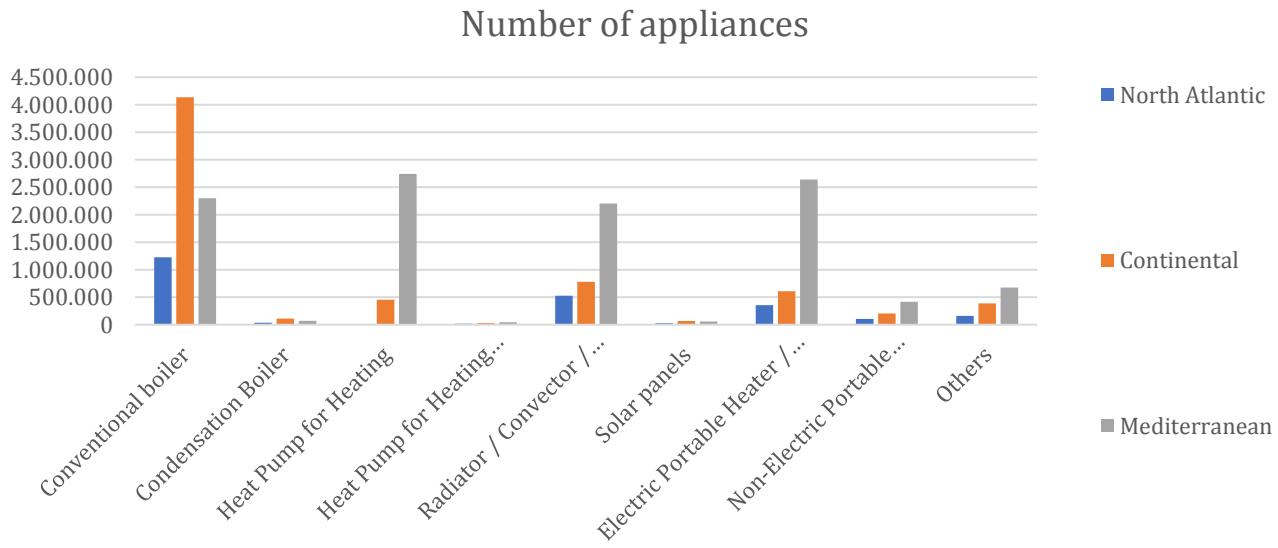
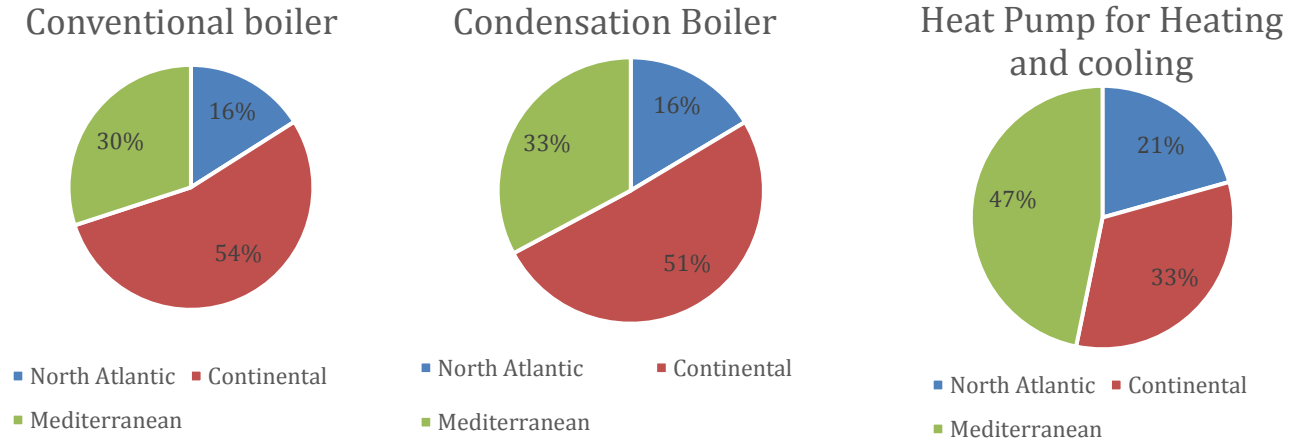
- Heating system and hot water system characteristics

The concentration of boilers on the Continental zone is justified by the cooler temperature in Winter, and because the population is higher than on the North Atlantic. So, even if in North Atlantic the heating needs are higher, there are less people in the dwellings and boilers are less installed. In the case of the heat pumps, the reason why they are more common on the Mediterranean zone is twofold: first, because it can be used for cooling for a significant part of the year. Second, because the weather near to the Mediterranean sea is mild, and the heating needs are very low. The many buildings in this region didn't include heating systems when they were built, so the easiest system to be installed by the users are the heat pumps for heating and cooling.



In heating, the mainly used energy sources are electricity (46%) and natural gas (32%). In the Mediterranean area electricity predominates, while in the Continental zone, the most used source is natural gas.



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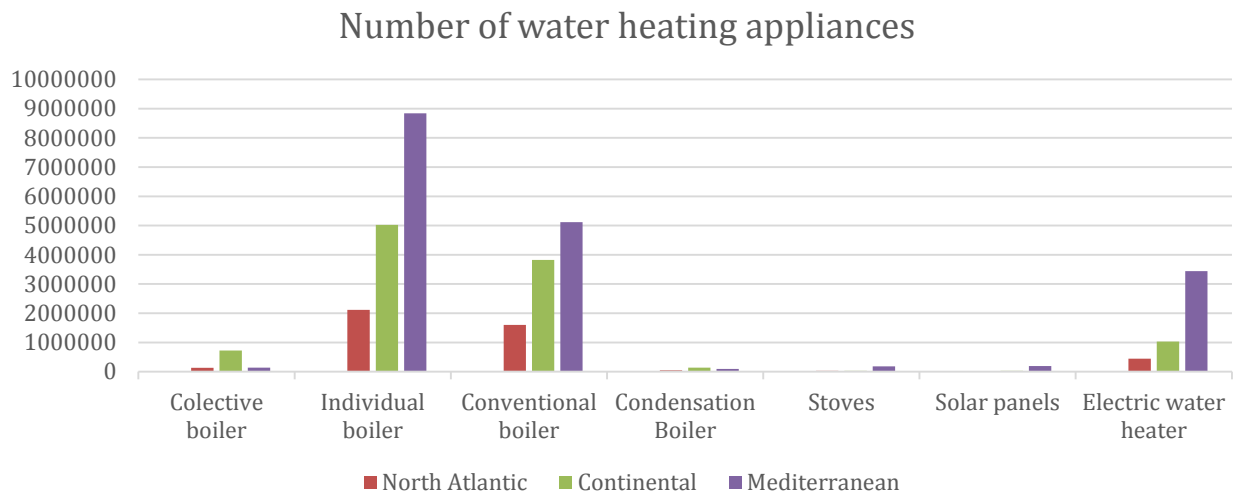
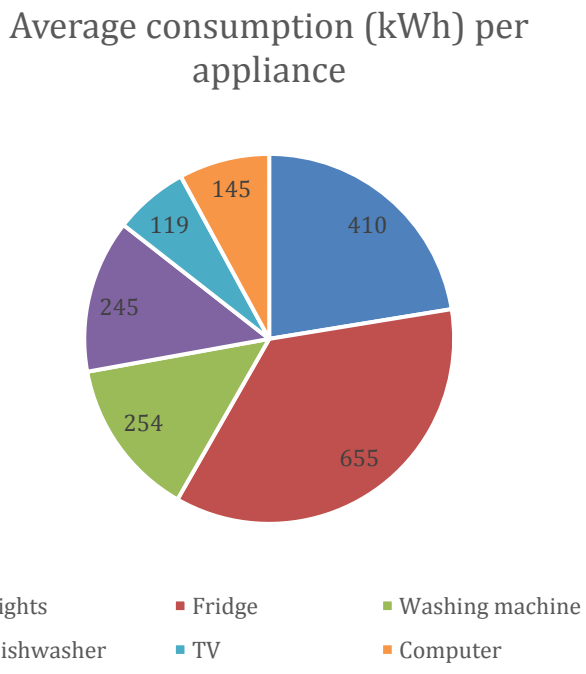
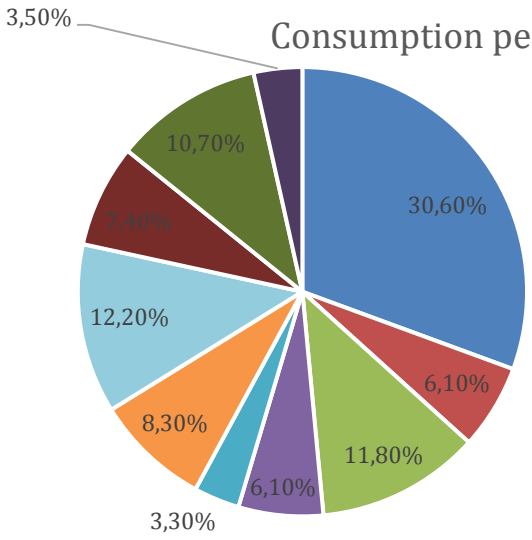


The most used energy sources are natural gas (40%), butane (26%) and electricity (22%), varying on importance according to the climate zone and the building construction.

- Domestic appliances and their consumption





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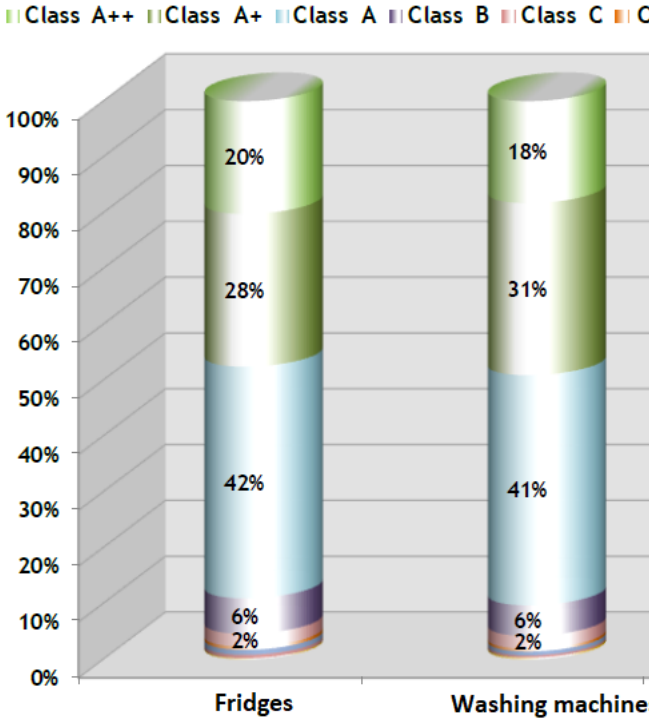
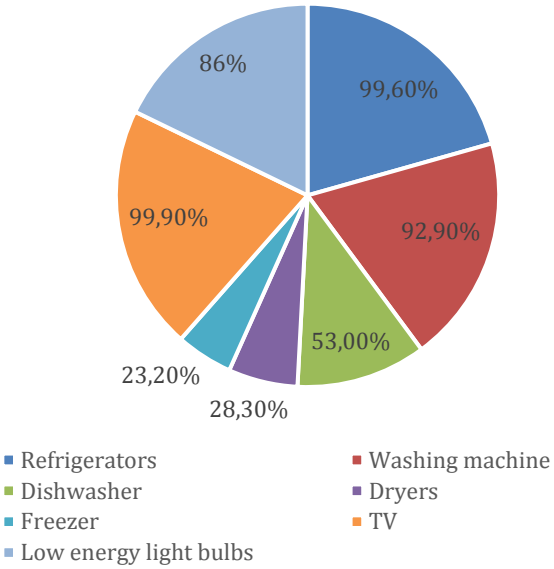
If we compare the consumption per appliance with the penetration rate of those appliance in the households, we can see that the top three consumers are fridge, washing machine and lights (of course are present in almost all the houses). That is point of attention because they will be a starting point for our recommendation, when it comes to changing the behaviour, as well as to highlight on our Community.

Penetration of energy label according to homes that know the label of their appliances:



Houses with this kind of appliances



Once again, if we link the previous conclusion to the graph above, we can see that most all the fridges and washing machines are still below A label (of the "old" label scale"), so they probably are consuming much energy not only due to their age but also because we can suspect that not all of them were kept under good maintenance.

- Lights

Following with the preceding trend, we can see below that the situation with the lighting

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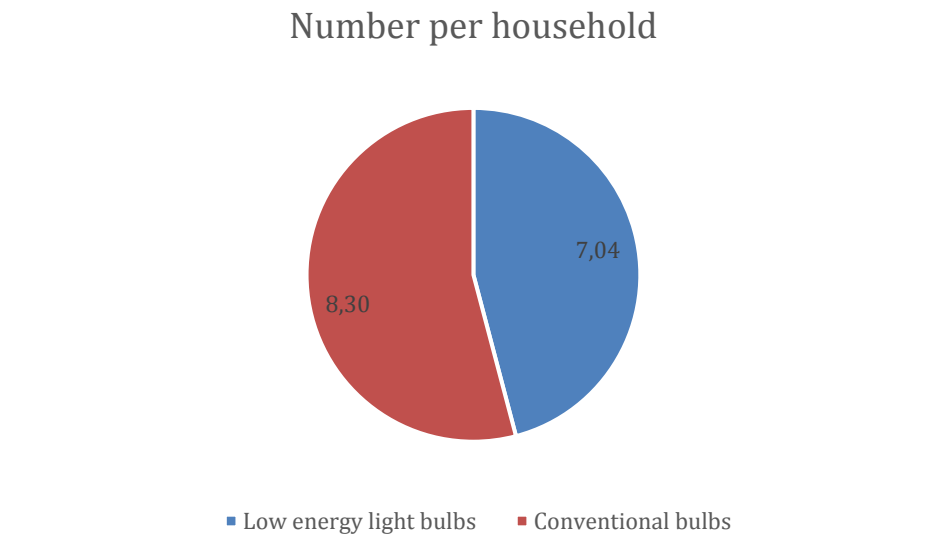
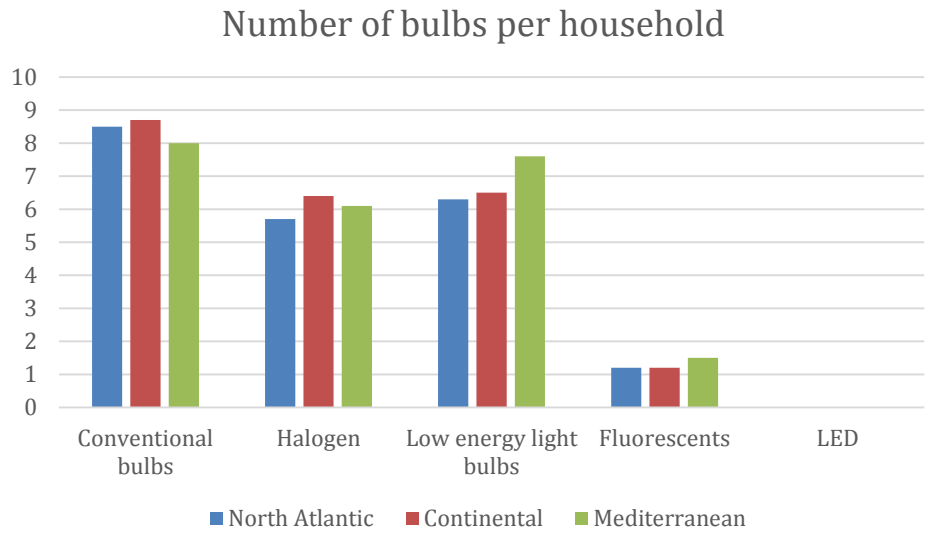
is aligned with the situation of the fridges and washing machines. Although the legislation is focus on removing the incandescent bulbs, they are still the most used equipment on the household, so we will need to do an extra effort in that sense.





- Renewable energies and Photovoltaic residential systems

Renewable energy at households	11,20%
Detached house	22%
Apartments	6%

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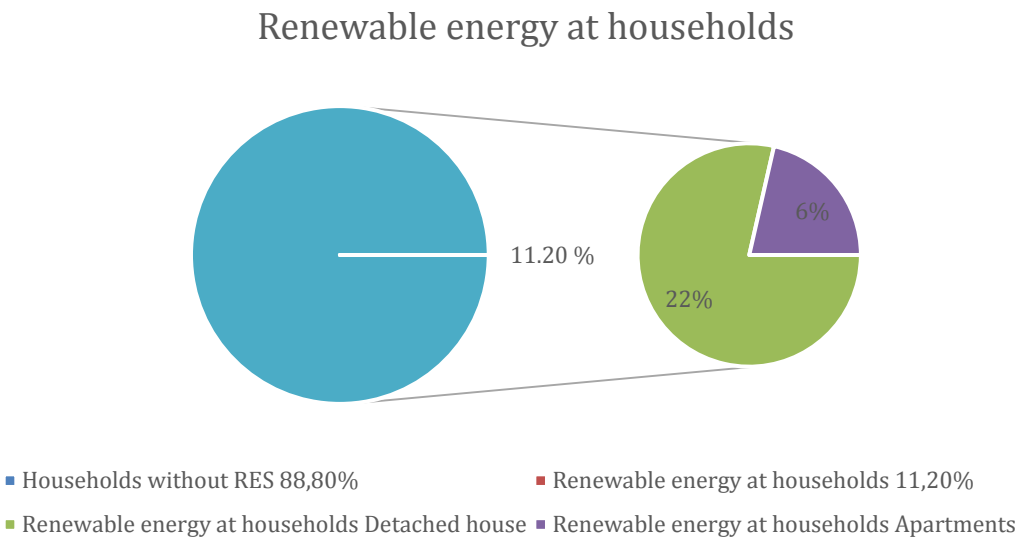
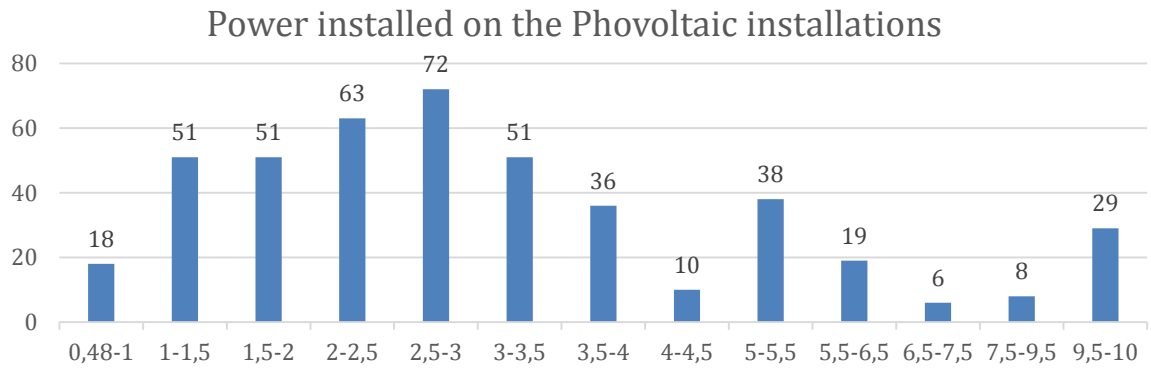


On the framework of renewable energies penetration in the in the domestic sector we also have a great margin for improvement, mostly on apartments, although the implementation on these kinds of buildings is more difficult, which will force us to explore collective solutions, that from an energy efficiency point of view are more interesting.

Self-consumption installations:

Tecnology	Number of installations	Total Power installed (kW)
Biogas	1	3,3
Gas cogeneration	1	5,5
Photovoltaic	452	1.627,54



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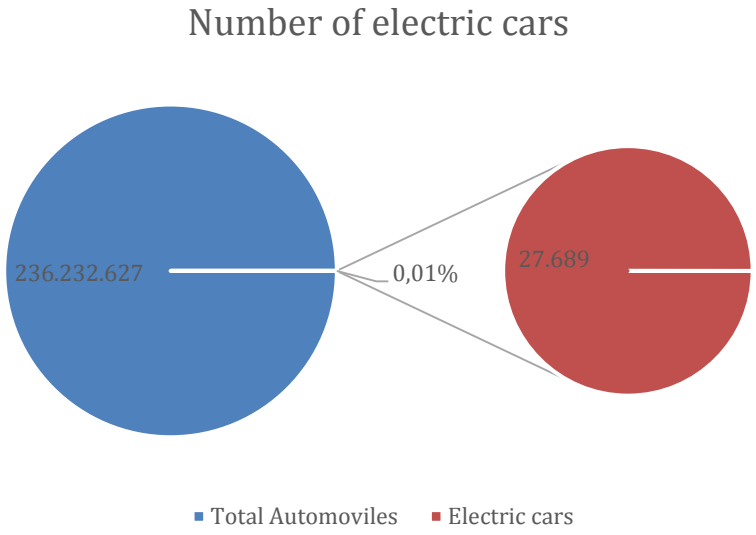
According with the official register of self-consumption installations, there are more than 450 installations below 10 kW. Taking in account that these installations are not going to sell energy (so they must to use all the energy that they produce), the type of installation that fits in a household consumption profile are the ones below 7 kW (as we have seen on the "Electricity consumption profile"), so the real number will be 410 installations (less than 0,0023%% of primary households).

But we also must consider that this kind of installation could be easier on a detached house than an apartment, so we can suspect that the 410 installations were probably done within the 6.148.455 detached house (corresponding to 0,01%).

Being positive, and taking into account information of the Group Purchases done in CLEAR project, our experience says that most of the photovoltaic installations are not included in this register because they are isolated installations with batteries, disconnected of the grid (around 67%, so we could be talking of a global amount of 1.022 photovoltaic installations).



We can say that to a certain extend the Spanish market is coherent with their electric solutions, as the % of the electric car implementation is exactly the same that the number of photovoltaic installations. Unfortunately, we don't have numbers that show a link between the two solution, i.e. if the people with a self-consumption installation have also an electric car.

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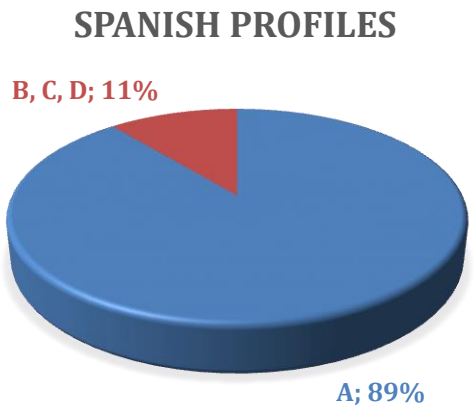
2.6.6. Profiles of domestic households.

As we have being concluding along this report, and considering the main goal of being able to reach all the relevant country profiles, at the beginning we will focus on:

3 different geographic zones, North-Atlantic, Continental, and Mediterranean, focused principally on families of 3-4 members, and starting (depending of course of the conclusion of the initial audit), on tasks for improve the performance of the fridge, washing machine and lighting.

In addition, and aligned with the analysis of all the partners, we have segmented the profiles in 4 different groups.

Profile A, non-renewable energy use, unfortunately still the most common profile in Spain, Profile B, in our case we have included any available renewable energy system in the households. If we only focus on photovoltaic systems, we will be talking about a 0,02 % on the best situation, so the inclusion of other renewable energy systems is inevitable. We have the same situation regarding the use of the electric car, the optimization of photovoltaic installations and the installation of batteries, (Profile C and Profile D respectively) so we have aggregated all on the global percentage. In consequence, we will have:



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3. General conclusions.

Even though each country of the consortium is singular, we can see some convergences as a European level in the participating countries, that will help us to compare the results of the monitoring part of the project. The consortium made an effort to find a common approach on the definition of the general profiles (A, B, C and D) in order to facilitate comparisons in the end of the monitoring.

Generally, in the consortium countries, most people live in apartments situated on big cities, but for the remaining population (except in the Spanish case where the difference is higher), more or less half of them are living on a detached house.

When it comes to the energy sources, natural gas and electricity are the most commonly used sources overall, and with the exception of Belgium and Italy, there is still a long way until renewable energies become the most used energy source for domestic applications.

If we talk about how much consumers pay for electricity, we realize that, in most cases, they are not aware of how much energy they are actually using. All the country reports have in common that, unfortunately, most people are not conscious about saving energy except for the benefit that comes from buying an efficient appliance when they need a new one. Even so, most of the electric appliances are still around “old label A”, so, also in many cases could be the right moment to be changed.

From a point of view of the buildings we can also conclude that, in general, the majority is quite old (over 40 years old), so probably many insulation related solutions could be carried out.

Taking all the information present in this report, each country will focus on the profiles that they considered most representative of the national situation and those that are more interesting for the project in the sense that they can either be used as examples or because there is the potential to reach more people. Still, the monitoring process will be a dynamic procedure, and changes during the process need to be taken into account as we go along. It is also possible that new families could start to participate in the project in a later stage.

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4. Global Aassessment of Households profiles for the consortium.

The selection of profiles and their representativeness in each country has been changing throughout the analysis, as it deepened by the input of official data, other studies and previous projects. Even the selection process of the families to participate in the monitoring has an influence (as is the case of Belgium).

So, after the whole studies done, each partner of the consortium has concluded to focus principally on:

Profile	A	B, C, D
BE	These specific statistics are not available in Belgium. The will focus on the profiles selection based on the subscribers (Family A, B, C and D) all of them with PV installation.	
IT	47%	53%
PT	77%	23%
CZ	85%	15%
SL	45%	55%
SP	89%	11%

5. Decisions made for the T2.3 household monitoring of devices to optimize self-consumption

In parallel with the work of the analysis of the profiles, the consortium had also focused on the monitoring process itself, because as important as a good selection of the families to be monitored is the system used to carry it out, and the process and methodology for doing it:

- Definition of the minimum requirements of the monitoring system per country and as a consortium

Funcionalities	
Interval of measurements recorded (each second, minute...)	mandatory seconds
Monitoring of global electrical household consumption	mandatory
Real-time or preprogrammed control of individual equipment.	optional
Appliance recognition	optional
Create consumption alerts and know, in real time, the value of your next invoice	mandatory
Analysis and management tools for consumption, with intuitive access through a tablet or smartphone	optional
Single phase	mandatory
Three-phase, displays individual readings for each phase	optional
telling you when you have improved your usage habits	optional
Detect standby power consumption	optional (specific report, game on the community)
See how much your heat pump consumes in real time	optional
Check the output of your solar panels PV	mandatory
% selfcomsuption and put back on the grid	mandatory
storage system (% of energy)	optional (maybe an aditional system)
web plattform	mandatory
Monitoring of global gas consumption	mandatory for Italy - Preferable
Data storage (comply legal issues) (access with double logging??)	mandatory

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As the table shows, we agreed that in order to correctly identify the improvement actions on each family, we need to be able to know the energy consumption in real time, and to store the data, because we need to follow the energy consumption evolution as well as the achievements when the counselling is made or when the optimization equipment is installed. As we are going to see bellow not all the countries will use the same monitoring system, so we need to be sure that the data and their quality will be the same, and with the highest level possible. Taking in consideration the selection process, we have:

- Identified the products available on each country looking for a global solution of system to be installed.

Monitoring Grid								
Cloogy	Go	139 €	PT	SP**				
	Home	199 €	PT	SP**				
	Renewable	100 €	PT	SP**				
OWL	Intuition-e	47 €	PT	SP				
	OWL + USB	65 €	PT	SP				
	Intuition-PV	90 €	PT	SP				
	Intuition-c/h	120 €	PT	SP				
Efergy Engage	HUB KIT	100 €	PT	SP				
	E2 + USB	85 €	PT					
Smappee	Energy	€ 229,00	PT	SP	IT	BE	SL	CZ
	Plus	€ 495,00	PT	SP	IT	BE	SL	CZ
Mirubee	Mono	€ 110,00	PT	SP				
	Moti-1	135 €	PT	SP				
IPDOMO	smart met	130 €	PT*	SP				
ENDESA	NEXO	120 + 5 euros/month		SP				
Wattio	marthome Energ	299 €		SP				
Wibeee	Circutor	130 €		SP				
Voltaide - SENTRY		160 €			IT		IT	
Wiser - Schneider Electric		500 €			IT		IT	
E-GOODLIFE ENEL Energia		430 €			IT		IT	
Edison		89 €			IT		IT	

- Tested several products in the laboratory to be reassured on the quality and reliability of the results. The consortium considered that the level of precision should be very high and we established a tolerance below 5%. After that, we also considered the way the information is displayed to consumer.

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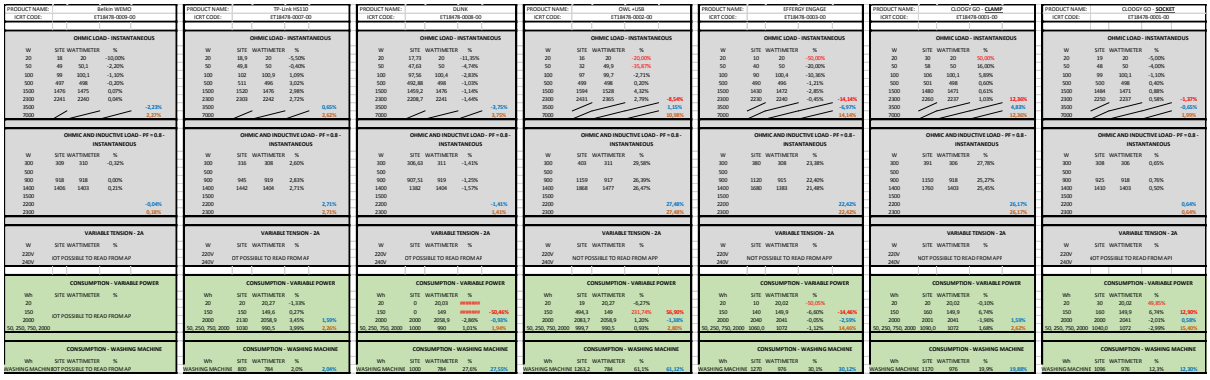
PRODUCT NAME:	Smappee Energy			
ICRT CODE:	ET18478-0014-00			
OHMIC LOAD - INSTANTANEOUS				
W	SITE	WATTIMETER	%	
20	20	20	0,00%	
50	49	50	-2,00%	
100	99	99	0,00%	
500	498	500	-0,40%	
1500	1501	1500	0,07%	
2300	2336	2330	0,26%	
3500	3505	3500	0,14%	-0,28%
7000				0,41%
OHMIC AND INDUCTIVE LOAD - PF = 0.8 - INSTANTANEOUS				
W	SITE	WATTIMETER	%	
300	311	313	-0,64%	
500	491	494	-0,61%	
900	904	908	-0,44%	
1400	1408	1407	0,07%	
1500	1498	1504	-0,40%	
2200	2207	2200	0,32%	-0,19%
2300	2315	2306	0,39%	0,41%
VARIABLE TENSION - 2A				
W	SITE	WATTIMETER	%	
220V	441	442	-0,23%	-0,30%
240V	523	525	-0,38%	0,30%
CONSUMPTION - VARIABLE POWER				
Wh	SITE	WATTIMETER	%	
20	20	20	0,00%	
150	150	149,6	0,27%	
2000	2002	1995	0,35%	0,41%
50, 250, 750, 2000	759	751,4	1,01%	0,41%
CONSUMPTION - WASHING MACHINE				
Wh	SITE	WATTIMETER	%	
WASHING MACHINE	860	845	1,8%	1,78%

PRODUCT NAME:	Smappee Solar			
ICRT CODE:	ET18478-0015-00			
OHMIC LOAD - INSTANTANEOUS				
W	SITE	WATTIMETER	%	
20	20	20	0,00%	
50	49	50	-2,00%	
100	99	99	0,00%	
500	501	500	0,20%	
1500	1512	1500	0,80%	
2300	2353	2330	0,99%	
3500	3538	3500	1,09%	0,15%
7000				0,72%
OHMIC AND INDUCTIVE LOAD - PF = 0.8 - INSTANTANEOUS				
W	SITE	WATTIMETER	%	
300	314	313	0,32%	
500	494	491	0,61%	
900	911	908	0,33%	
1400	1421	1407	1,00%	
1500	1517	1504	0,86%	
2200	2225	2200	1,14%	0,79%
2300	2335	2306	1,26%	0,55%
VARIABLE TENSION - 2A				
W	SITE	WATTIMETER	%	
220V	444	442	0,45%	0,42%
240V	527	525	0,38%	0,42%
CONSUMPTION - VARIABLE POWER				
Wh	SITE	WATTIMETER	%	
20	20	20,2	-0,99%	
150	150	149,6	0,27%	
2000	2022	1995	1,35%	0,44%
50, 250, 750, 2000	760	751,4	1,14%	0,94%
CONSUMPTION - WASHING MACHINE				
Wh	SITE	WATTIMETER	%	
WASHING MACHINE	860	845	1,8%	1,78%

PRODUCT NAME:	Mirubee MOTI-1			
ICRT CODE:	ET18478-0006-00			
OHMIC LOAD - INSTANTANEOUS				
W	SITE	WATTIMETER	%	
20	0	20,1	-100,00%	
50	0	50,3	-100,00%	
100	92,7	100,7	-7,94%	
500	482	500,6	-3,72%	
1500	1452	1500,8	-3,25%	
2300	2242	2306	-2,78%	-27,84%
3500	3416	3508	-2,62%	-3,79%
7000	6831	7000,7	-2,42%	27,84%
OHMIC AND INDUCTIVE LOAD - PF = 0.8 - INSTANTANEOUS				
W	SITE	WATTIMETER	%	
300	295	303	-2,64%	
500	485	497	-2,41%	
900	895	899	-0,44%	
1400	1399	1402	-0,21%	
1500	1492	1534	-2,74%	
2200	2202	2204	-0,09%	-1,53%
2300	2257	2307	-2,17%	1,10%
VARIABLE TENSION - 2A				
W	SITE	WATTIMETER	%	
220V	434	437	-0,69%	-1,28%
240V	470	479	-1,88%	1,28%
CONSUMPTION - VARIABLE POWER				
Wh	SITE	WATTIMETER	%	
20	0	20,1	-100,00%	
150	148	140	5,71%	-23,77%
2000	1910	1986,4	-3,85%	1,64%
50, 250, 750, 2000	790	766,5	3,07%	4,21%
CONSUMPTION - WASHING MACHINE				
Wh	SITE	WATTIMETER	%	
WASHING MACHINE	860	845	1,8%	1,78%



After the test, we have concluded that Smappee (present on all the markets) is a very good product with a high precision on the measurement to be installed for the monitoring process. Belgium, Slovenia, and Czech Republic will install different Smappee appliances (solar, energy and plugs). Italy, Portugal and Spain will use Smappee only as a backup, while preferably they will install Wibeee/Mirubeee solutions that have a similar value of precision but is more adapted to the type of electric installation in these countries.

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- Tested software for following families without monitoring system (energy audit) and integrating these results with the ones from the different monitoring systems. Indeed, trying to have a global solution we have launched a tender to different companies with similar solutions to get a whole management system. Unfortunately, the language issue would increase the cost more than we have expected. Besides this, there are other local specificities, such as the particularities of the local energy tariffs (for example) that overruled the possibility to use a global solution.

- To achieve global results that could be comparative all the consortium follow the same procedure. Also several questionnaires for the most relevant moments of the process (recruitment, first contact with the family, first and other reports...) have been developed in order that all the data will be treated in the same way.

- Definition of the relevant clauses to be included on the contracts that will be signed between each partner and the families, paying special attention on the flow of the data collected with the monitoring system (GDPR compliant).

The consortium has defined all the monitoring process in order to gather as much information as possible that could be used for changing the energy behavior in the monitoring families and, in a later stage applied for consumers with the same profile.

Although we are on delay compared to the original planning, thanks of the analysis that we are carrying out, the consortium will be able to extrapolate the information to more families than expected. This means that more people will be reached, more people will adopt our saving advises and will be involved in the project.

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6. Planning and next steps

Task 2.3 has followed closely the result of T2.1. After the identification of the global assessment of household profiles, the consortium was able to launch the recruitment of the families to be monitored covering those profiles identified:

6.1. Methodology to recruit adopters, subscribers analysis and criteria to select participants.

- **Belgium:** Belgium has launched a communication campaign to which more than 200 consumers have replied.

TEST ACHATS

NEWS

WANTED : familles équipées de panneaux photovoltaïques

09 avril 2018

09 avril 2018

Nous lançons une étude sur le profil de consommation électrique de différentes familles belges. Les familles participantes se verront outillées d'un système de monitoring et bénéficieront d'un suivi personnalisé par un expert de Test Achats. L'objectif est d'évaluer la situation avant, pendant et après notre intervention.

Dans le cadre du projet Clear 2.0 qui vise à favoriser l'utilisation d'énergies renouvelables en Europe et à réduire la consommation d'énergie, Test Achats s'engage et veut aider les consommateurs à réduire leurs dépenses énergétiques.

Mieux utiliser ma production d'énergie renouvelable

Cuisinière, frigo, lave-vaisselle, lave-linge, sèche-linge, télévision, ordinateur, ... nos maisons sont remplies d'appareils électriques qui consomment plus ou moins d'électricité. Pour diminuer votre facture, vous avez décidé d'investir dans des panneaux photovoltaïques, mais votre production est-elle utilisée de manière optimale ?

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The family selection was closed on the 14th of June, and various interesting profiles were found. Among 240 families, 34 have been selected and are included on the project.

- **Czech Republic:** is preparing to choose participants according to a web questionnaire where possible participants will provide general info about the size of their apartment, if they live in a flat or a house, if they use renewable energy sources or how many people does their household contain.

- **Italy:** has send out an email invitation to 20000 energy community members and done a specific questionnaire/survey to build energy profile of each member.

CasaRinnovabile.it

Powered by Altroconsumo

CasaRinnovabile ti aspetta sul sito di Altroconsumo

Caro Membro della Community,

CasaRinnovabile rinnova la sua casa: dagli inizi di giugno ci troverai direttamente sul sito di **Altroconsumo** dove ci sarà una nuova sezione totalmente dedicata all'energia rinnovabile.

Per questo ti invitiamo a partecipare a questo semplice e veloce questionario per fornirci preziose informazioni per migliorare il progetto.
Inoltre potrai riservarti la possibilità, totalmente libera e **GRATUITA** di partecipare attivamente alle selezione per alcune delle prossime attività di studio sul campo dell'efficienza energetica delle case italiane. Clicca QUI!

PARTECIPA ORA

Sul nuovo sito potrai continuare a usare la community esattamente come hai fatto fino ad ora, insieme a tutte le notizie, i consigli, i test e le iniziative per risparmiare con l'efficienza energetica e le fonti rinnovabili come impianti solari, climatizzatori e stufe a pellet.

Cosa potrai fare su www.altroconsumo.it/casarinnovabile?
Semplice. Tutto quello che hai fatto finora, e molto altro:

- **Continua a postare domande e chiedere consigli;**
- **Aiuta gli altri utenti condividendo le tue esperienze;**
- **Ricevi risposte di qualità perché gli esperti di Altroconsumo tengono monitorate tutte conversazioni;**
- **Consulta i test sui prodotti e i comparatori di tariffe (ad esempio quelli sulle tariffe di luce e gas);**
- **Tieniti informato, leggendo news, consigli, inchieste e guide all'acquisto sulle fonti rinnovabili.**

Manca pochissimo!
La nuova **CasaRinnovabile** ti aspetta per l'inaugurazione.

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- **Portugal:** has launched an invitation through the Portuguese community, (already started with the old website). In addition, DECO has also made a communication action via Facebook. The people who participated in the WP2 survey are now being contacted to see if they are interested. Finally, also an internal communication has been launch within DECO PROTESTE employees to see if their relatives/friends would like to join.

The questionnaire launched was planned to be done using freeware which was not possible in terms of compliance with GDPR. We used instead a VoxCo tool,

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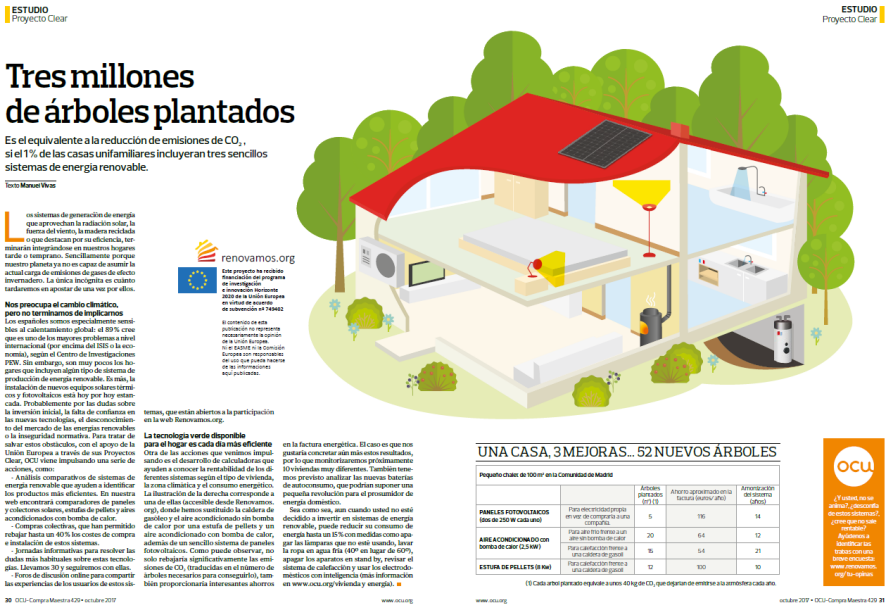
already existing in the company, with whom DECO already has a contract under GDPR.

- **Slovenia:** Slovenia is just about to select households for the monitoring in cooperation with an agency that has conducted for ZPS a survey on the attitude of Slovenes to renewable energy sources. We are waiting for the agency to send us the data. If necessary, we will also launch an invitation through ZPS web site and FB but most probably this will not be necessary.

- **Spain:** OCU sent an invitation to their members in the launching project article in order to include the ones that have expressed interest on the process. Also in T2.2 task, we asked people to show interest in participating in the monitoring process. These efforts were made in order to cover the most common profiles that reflect Spanish society (as it is needed on the monitoring project). With all that people who expressed a desire to be part of the project, we have divided them on the previously identified profiles to select at least one of each profile, as a first step of the project.



ESTUDIO
Proyecto Clear

Tres millones de árboles plantados

Es el equivalente a la reducción de emisiones de CO_2, si el 1% de las casas unifamiliares incluyeran tres sencillos sistemas de energía renovable.

Texto Manuel Vivas

Los sistemas de generación de energía que aprovechan la radiación solar, la fuerza del viento, la madera reciclada o que destacan por su eficiencia, terminarán integrándose en nuestros hogares tarde o temprano. Sencillamente porque nuestro planeta ya no es capaz de asumir la actual carga de emisiones de gases de efecto invernadero. La única incógnita es cuánto tardaremos en apostar de una vez por ellos.

Nos preocupa el cambio climático, pero no tarrinamos de implicarnos

Los españoles somos especialmente sensibles al calentamiento global: el 89% cree que es uno de los mayores problemas a nivel internacional (por encima del ISIS o la economía), según el Centro de Investigaciones PRW. Sin embargo, son muy pocos los hogares que incluyen algún tipo de sistema de producción de energía renovable. Es más, la instalación de nuevos equipos solares térmicos y fotovoltaicos está hoy por hoy estancada. Probablemente por las dudas sobre la inversión inicial, la falta de confianza en las nuevas tecnologías, el desconocimiento del mercado de las energías renovables o la inseguridad normativa. Para tratar de salvar estos obstáculos, con el apoyo de la Unión Europea a través de sus Proyectos Clear, OCU viene impulsando una serie de acciones, como:

- Análisis comparativos de sistemas de energía renovable que ayuden a identificar los productos más eficientes. En nuestra web encontrará comparadores de paneles y colectores solares, estufas de pellets y aires acondicionados con bomba de calor.
- Compras colectivas, que han permitido rebajar hasta un 40 % los costes de compra e instalación de estos sistemas.
- Jornadas informativas para resolver las dudas más habituales sobre estas tecnologías. Llevamos 30 y seguiremos con ellas.
- Foros de discusión online para compartir las experiencias de los usuarios de estos sistemas, que están abiertos a la participación en la web Renovamos.org.

renovamos.org

Este proyecto ha recibido financiación del programa de investigación e innovación Horizonte 2020 de la Unión Europea en virtud del acuerdo de subvención nº 749402

La tecnología verde disponible para el hogar es cada día más eficiente

Otra de las acciones que venimos impulsando es el desarrollo de calculadoras que ayuden a conocer la rentabilidad de los diferentes sistemas según el tipo de vivienda, la zona climática y el consumo energético. La ilustración de la derecha corresponde a una de ellas (accesible desde Renovamos.org), donde hemos sustituido la caldera de gasóleo y el aire acondicionado sin bomba de calor por una estufa de pellets y un aire acondicionado con bomba de calor, además de un sencillo sistema de paneles fotovoltaicos. Como puede observar, no solo rebajaría significativamente las emisiones de CO_2 (traducidas en el número de árboles necesarios para conseguirlo), también proporcionaría interesantes ahorros en la factura energética. El caso es que nos gustaría concretar aún más estos resultados, por lo que monitorizaremos próximamente 10 viviendas muy diferentes. También tenemos previsto analizar las nuevas baterías de autoconsumo, que podrían suponer una pequeña revolución para el prosumidor de energía doméstico.

Sea como sea, aun cuando usted no esté decidido a invertir en sistemas de energía renovable, puede reducir su consumo de energía hasta un 15 % con medidas como apagar las lámparas que no esté usando, lavar la ropa en agua fría (40º en lugar de 60º), apagar los aparatos en stand by, revisar el sistema de calefacción y usar los electrodomésticos con inteligencia (más información en www.ocu.org/vivienda y energía). ■

UNA CASA, 3 MEJORAS... 52 NUEVOS ÁRBOLES

Pequeño chalet de 100 m² en la Comunidad de Madrid

		Árboles plantados (nº) (1)	Ahorro aproximado en la factura (euros/ año)	Amortización del sistema (años)
PANELES FOTOVOLTAICOS (dos de 250 W cada uno)	Para electricidad propia en vez de comprarla a una compañía	5	195	14
AIRE ACONDICIONADO con bomba de calor (2,5 kW)	Para aire frío frente a un aire acondicionado de calor	20	64	12
	Para calefacción frente a una caldera de gasoil	15	54	21
ESTUFA DE PELLETS (8 kw)	Para calefacción frente a una caldera de gasoil	12	100	10

(1) Cada árbol plantado equivale a unos 40 kg de CO_2 que dejarían de emitirse a la atmósfera cada año.

OCU

¿Y usted, no se anima? ¿Descarta de estos sistemas? ¿Cree que no son rentables? Ayúdenos a identificar las trabas con una breve encuesta: www.renovamos.org/tu-opinas

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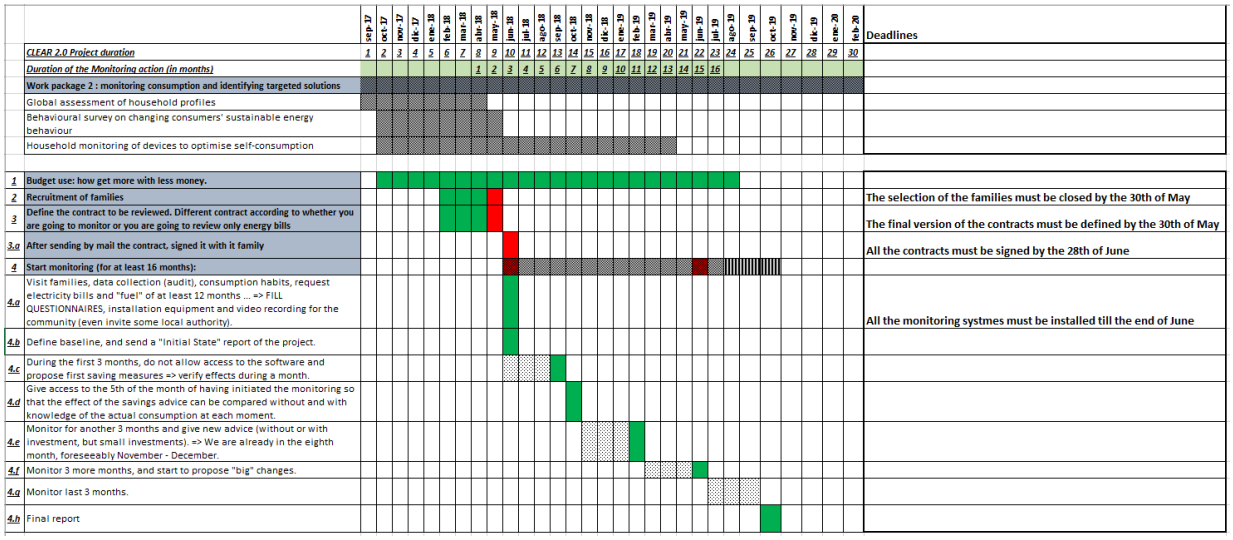
Pople at home	Type of household	District	Clinmate zone
4 piso		Albacete	H≥5.0
		Alicante	H≥5.0
		Almería	H≥5.0
		Alzira	H≥5.0
		Asturias	H≥5.0
		Ávila	4.6<H<5.0
		Badajoz	H≥5.0
		Badajoz	H≥5.0
		Badajoz	H≥5.0
		Baleares	H≥5.0
piso		Barcelona	3.8<H<4.2
		Barcelona	3.8<H<4.2
		Barcelona	3.8<H<4.2
		Cádiz	4.6<H<5.0
		Cádiz	4.6<H<5.0
		Castellón	4.6<H<5.0
		Elche	H<3.8
		Gijón	H<3.8
piso		Gijón	H<3.8
3 piso		Gipuzkoa	H<3.8
		Guadalajara	4.6<H<5.0
		Guadalajara	4.6<H<5.0
		Huesca	4.2<H<4.6
		La Coruña	4.6<H<5.0
		Lleida	3.8<H<4.2
		Madrid	4.6<H<5.0
		Madrid	4.6<H<5.0
		Madrid	4.6<H<5.0
		Madrid	4.6<H<5.0
		Madrid	4.6<H<5.0
1 piso		Madrid	4.6<H<5.0
		Madrid	4.6<H<5.0
		Madrid	4.6<H<5.0

The next steps of the project are summarized on the picture below:



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To reach as much people as possible, we will update continuously the information on each country community. We have also have planned several articles on Ocu magazines:

Jan-19	CLEAR 2.0 Presentation of the monitoring
feb-19	CLEAR 2.0 Pellets Stoves
may-19	CLEAR 2.0 Learning over stand-by
jun-19	CLEAR 2.0 Batteries solar panels safety (Test)
jul-19	CLEAR 2.0 Slot PV (link with group purchase in Belgium)
oct-19	CLEAR 2.0 Learning from the monitoring, preparing for the winter: savings
Dec-19/Jan-20	CLEAR 2.0 Overall learnings

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