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The project leading to this application has received funding from the European Union's Horizon 2020 research and Innovation Program under grant agreement No 749402





Research objectives

- The aim of this research is to **generate awareness towards renewable energies** and also to take a deeper look into **consumers behavior** towards them:
 - to get to know the **costumer journey** through all the stages of installing **domestic renewable** and **low-carbon energy technologies**.
 - To find what are the users' energy **behaviors' profiles**
 - To understand what are the **triggers, motivations** and **restrains** for changing behavior
 - To find what are the main triggers and motivations to adopt sustainable energy: **Photovoltaic systems, Pellet stoves** and **air conditioning systems** for heating and cooling.





Methodology and sample



- **Online Community** with a total of **40 participants** during **one week**, which targeted **household decision or co-decision makers** regarding **alternative sources of energy**. With the following distribution:

House type	Photovoltaic Solar Panels	Pellet Stoves	Air Conditioner	Other Energy sources
Apartment	6	6	6	6
Isolated house	2	2	2	2
Attached House	2	2	2	2
TOTAL	10	10	10	10





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1. Renewable Energy Sources **Current experience and perception**

Users profile towards RES (Renewable Energy Sources)



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To the participants of this community, sustainable energy means...

- A **clean energy source**, in the sense that it **doesn't pollute the environment** (vs. fossil energy sources) – it means **taking care of the planet**.
- Taking advantage of a **natural and endless energy source**, such as solar, wind and hydric power – as opposed to charcoal, oil and gas, which are resources that are on the verge of ending/with limited availability.
- An environmental-friendly way to achieve **savings on their energy and gas bill**



Despite being perceived as a **very positive and sometimes profitable source of energy**, some participants mention that there's **not enough information about the benefits** of using sustainable energies **and what can be done** in order to take advantage of those resources, and there is also the **perception that it may be expensive** to install.





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- **Preserving the environment seems to be a major concern for all the participants:** they see **climate changes** and the consequences happening, such as **extreme drought and high temperatures felt in Portugal** lately.



- In this sense, all participants **feel the need to do something about it**, in order to **help rebalancing the environment**, and being able to allow the future of civilization.
 - There is a common perception that Portuguese citizens are very active on taking actions towards climate change - some mention that Portugal is in a high position in what regards an international climate change performance rank.





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- Most participants are aware that nowadays **there's a lack of energy resources**: adopting a RES seems like the **only tangible solution** to help **preserve the remaining fossil energies** (non-renewable) as these energies are **“endless” and non-pollutant**.
- Apart from preserving the environment, the **possibility to reduce electricity/gas bills costs** is also a very commonly mentioned factor to adopt a RES solution.





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All participants **have an active role** in what concerns **energy and gas expenses:**

- They are **well aware of their energy consumptions** and their monthly bills and most of them **actively implemented solutions in order to enhance power** (ex. searching for other profitable sources) **and/or try to reduce bills** (ex. electricity, gas, water).
- They have a profile of heavy energy users : **with average energy expenses around 84€ monthly**



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“Energetic behavior”, to the majority of participants, is related to **actions/attitudes** they do/have done/could be done in order to **avoid wasting energy**, both on a...

- **“Consumer/private level”** :
 - Being **aware of one’s energy/gas consumption** patterns in order to **choose the most appropriate alternative** energy resources.
 - **Applying energy saving measures around the house**, in order to **optimize/reduce energy consumptions** and promote savings on the power/gas bill.
- And on a **“citizenship level”**:
 - A **sustainable/responsible usage of the available energy resources** – trying to avoid/reduce the usage of non renewable energies and implementing renewable sources
 - Making other citizens aware of alternative energy resources and the current situation of the world’s natural resources usage.





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In what regards actions that can or could be done to change behavior, participants mention...

As a **private consumer**:

- Adapt/learn what house features and behaviors can be altered in order to **avoid energy waste**, meaning: **getting environmental friendly appliances**, that have an **efficient energy certificate** and also raise awareness and **promote power saving routines** to all members of the household.
- Furthermore, some participants even suggest **adapting some structural parts of the house**, in order to enhance natural elements and less need for artificial power (eg: change windows) .





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And also, **governments should/could:**

- **Promote and create incentives towards exploring and installing sustainable energy appliances/devices**
 - Above all, it's crucial to **raise awareness** to the use of renewable energies and its role on **preserving the environment**, and at the same time to show the **damaging effects that abusing fossil energies** such as oil and gas, can play on future of the planet.
 - Promote **the use of sustainable sources of energy** and communicate its advantages for the adopters - although some participants are interested in adopting renewable energies, **the existing solutions are perceived as expensive.**



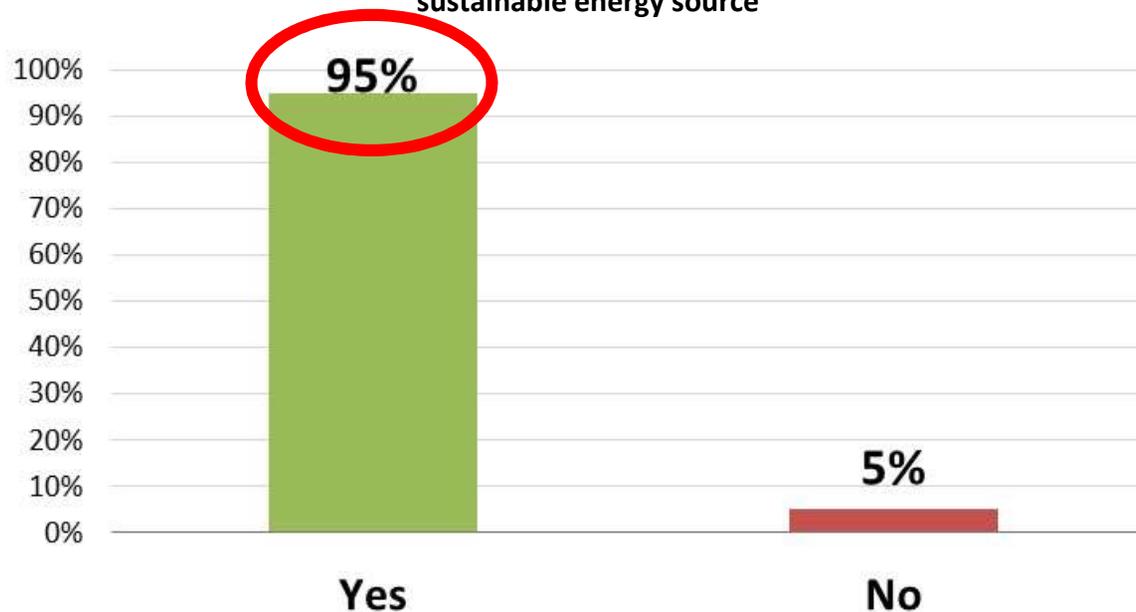


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In this on line community, there's a strong **will to change/adapt daily habits in order to take the most advantage out of a sustainable energy source, with 95% saying that they....**

Willingness to adapt/change your daily habits in order to take the most advantage out of a sustainable energy source



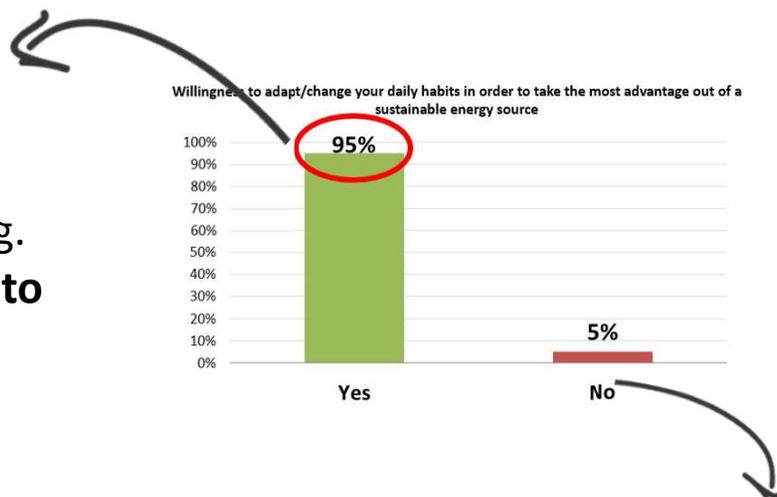


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- **In what way?**

- **With solar panels**, take advantage of solar power to use the appliances (e.g. using the washing machine) and also **to produce enough energy to be self sufficient** – no need for a power supplier.
- **Getting an electric/hybrid car** – it is environmental friendly and also avoids using Diesel
- **Using more public transports** – reduces CO2 releases



- **Why not?**

- Doesn't have **time to change/adapt to a different routine.**
- Perceived as being **too expensive** – unstable financial situation.





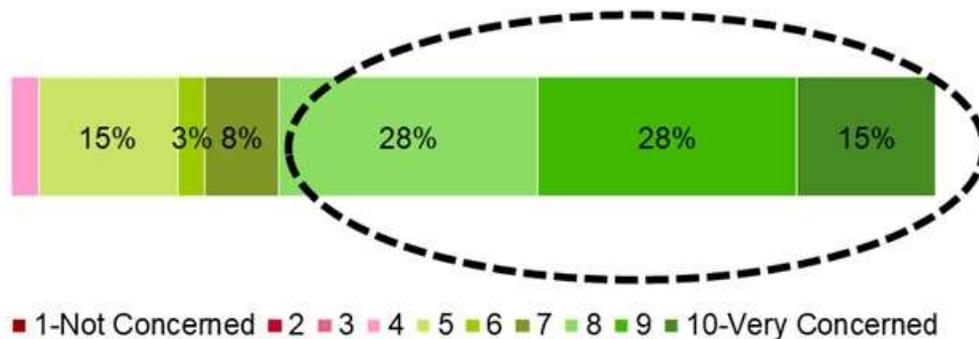
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In reality, the majority is concerned with, or has already adopted sustainable energy sources.

Behavior evaluation regarding sustainable energy

T3B: 71%



- About 71% are concerned/very concerned or have already taken action towards adopting alternative sustainable sources of energy.

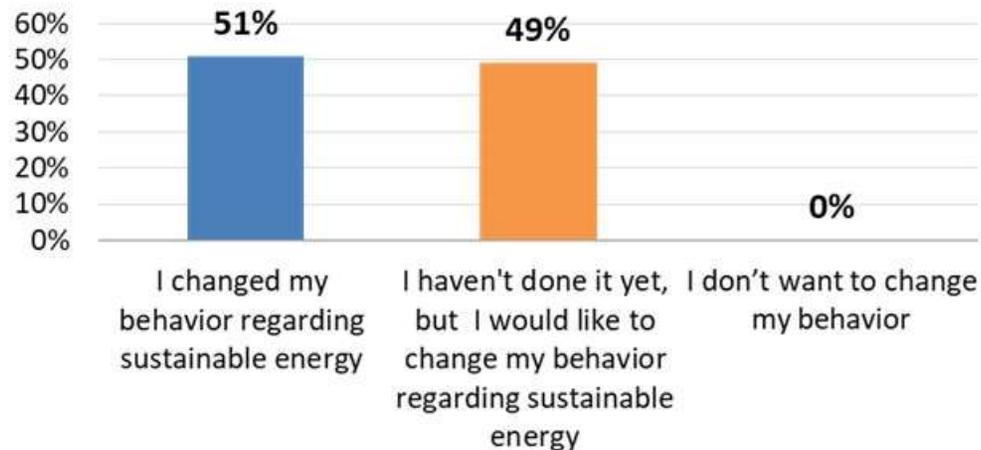




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In terms of taking matters into actions...



- All participants in this community show a **big involvement** with the subject **as well as a proactive concern** regarding sustainable energies: either they already changed their behavior or are willing to change their behavior.





For those who mention having **already changed something on their behavior...**

- **What triggered** most participants in search of a RES was the **actual news regarding climate change** – there's a major concern with the environment as some of them believe that it has reached a point that they believe something must be done in order to preserve the remaining natural non renewable resources.
- Other strong motive mentioned by the participants was the **idea of savings on the power/gas bill** – although it may seem expensive at first, on the long run they consider that it's an investment that will pay off eventually.





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In this sense, **participants who mentioned having already implemented changes in their lives**: either **applied/adapted to an alternative energy sources** on their house in order to take advantage of more natural resources, or **changed their habits**, namely...

Installing equipment
such as:

- **Solar panels** - perceived as a more clear and able to enhance energy efficiency.

Replacing appliances
such as:

- Replacing house lighting with LED bulbs
- Replacing appliances with those certified as more energy efficient
- **Installing/using smart plugs** – turns off appliances when they are not in use, can be programmed remotely.

Changing habits
such as:

- **Avoid using the “standby” mode** on appliances (i.e. router, box, TV) – disconnecting the power socket when they’re not in use.
- **Turning off lights** when exiting a room
- Taking **advantage of rain water to irrigate the yard**
- **Reduce number of cars per house hold** – use more public transports





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And also
**adjust the
house
structure:**

- **Check/adapt house insulation as well as caulking house/door frames**
– it prevents heat/energy loss, it helps to naturally acclimatize the house, with no need for any other sources.
- **Install skylights** - it provides more hours of natural light and less need for artificial lights.
- **Use natural materials to power central heating** - powered by pellets or other natural materials such as olive pits, nutshells..





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After applying changes, **most of the participants have perceived differences...**

- **Visible on their electricity/gas bills** – had less monthly expenses, specially those who installed panels and used alternate heating systems (powered by pellets).



- They felt more happy, as part of the solution: **the changes they did contributed to the future of society/energy management and helped preserve the environment.**





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For those participants who are **willing to change their behavior but haven't yet done it...**



They would like to...

- **Install solar panels** – both to power the heating system and to generate energy, being able to provide energy for self consumption.
- **Buy a eco friendly car** ex. Electrical or hybrid.
- Some of them still feel the need to **get more information before applying any permanent measure** – for instance, about the available resources, how to install, and what are the actual benefits both to the environment and also on their current expenses.





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Although they **haven't done it yet as...**

Their main restrains seems to be:



- **The installation expenses**– it is perceived as a very expensive measure both installing and adapting to their houses.
- Some participants, mainly those who live in an apartment **have building/construction restrictions and aren't able to adapt their houses** to a different kind of energy source.

It would help changing their minds, regarding a RES, if...

- There were **some sort of governmental incentives to support the initial expenses** to buy/install material, as well as the possibility to pay by installments.
- They also suggested **applying the previous VAT rate (13%) and free installation** (as seen on previous government initiatives)





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2. The triggers and motivations to adopt sustainable energy, costumer journey with:

Solar panels

Pellet stoves

Air conditioning



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For those who installed solar panels...



- Their main motivations were to **reduce costs on their power bill** and also **being able to get something in return for their investment**, the ability to **generate electricity and be self sustainable**.
- **Some of them were also moved by the belief in contributing to the perseverance of the environment.**
- Others were encouraged by **state incentives** that promoted acquiring equipment destined to use a RES with lower VAT rates.

When choosing the installer...

- The great majority of participants have chosen their brand/installer according to the **price** and the **possibility to pay by installments**.





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Customer experience installing solar panels

Before the installation:



- On most cases, the installer **monitored the costumers consumption profile through their electricity bill**, on a fewer cases, the installer made questions regarding **time/hours of the day** usually **spent at home**.
- **None of the participants had problems with the installation.**

After the installation:

- Only **one participant** mentioned having **issues with an electrical switch** on the panel – it eventually stopped working.
- After installing solar panels **the great majority of the participants felt a notable reduction on their electricity bill.**





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Participants who have already installed solar panels, **gave positive feedback and tried to encourage the remaining members** also to get it:

- Although it may it is **a strong investment at first** –i.e. it can ascend up to 2000€ - on the long run, they **guarantee that it will be profitable.**
 - Some of them even consider it the **right RES to adopt**, due to **Portugal's great sunlight exposure.**
 - The main setback to adopt/install a solar panel is **the initial investment and the lack of information about it return on investment.**





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For those that didn't install solar panels...

- Almost half of the total sample **considered installing solar panels but didn't do it, as it is very expensive** and they couldn't afford it and in some cases due to **construction restrictions** – namely when living on **apartments**.



Awareness of the license for small self production



- Overall, the majority of the participants **seem to be unaware of the necessity of a license** .
- A smaller percentage mentions that **there's no need for a license** while only a small minority disagrees, **mentioning that it is necessary a license** for small self consumption installations.





In the case of those who **installed pellet stoves...**

- Their main motivations seem to be related with both **the idea of savings on the electricity and/or gas bill and also on materials, such as wood.**
- Some participants mention that it is a **more eco-friendly solution** because it **doesn't pollute the atmosphere** as much as other heating sources, as **it only uses natural/biomass products to burn.**
- Other participants mention it is **safer and provides a cozier ambience around the house** than other heating systems.
 - It is also perceived by some as a more technologically advanced system (e.g. it is possible to activate remotely).

When choosing the installer:

Most of the participants, chose a pellet stove based on **family/friends recommendations** of a **brand**. About half also mentioned **price** as an important aspect in their decision.





Customer experience installing pellet stoves

Before the installation:



- On the majority of the cases, **the installer visited the house before recommending a product.**
- Only a small amount of participants mention that the installer **didn't visit the house**, but on most of the cases **inquired about the room/s dimension/s, window positioning** as well as **the house insulation.**

After the installation:

- **Only one participant mentioned having had an issue several years later with a pressure valve, that stopped working properly.**
- After installing the pellet stove **all of the participants perceived changes mainly on heating costs – they had a lower bill.**





Customer experience with pellet stoves

Regarding usage:

- The majority uses a pellet stove **for more than 4h per day**.
- A very small amount of participants mention **not using it on a daily basis it depends on the outside temperature**.

Besides the pellet stoves...



- A few participants **also use other heating sources**, such as: **oil heaters, central heating systems, electrical wall warmers, air conditioning...**

About maintenance contracts:

- Only a small amount of the participants mention **having a maintenance contract**. The **great majority doesn't have one**.





In terms of **biomass products usage...**

When **choosing Pellets...**

- Most of the participants choose a brand of pellets with which they had a **positive previous experience**.
- Another important aspect mentioned when choosing pellets is **the price**. A few participants mention other aspects such as **the energy efficiency of the material**.

About **certification** and **product origin**:

- The **vast majority** of participants **takes into account if the product is certified**.
- And also for a greater majority of participants the **wood origin**, (i.e. Made from recycled wood materials) and/or if it is **from sustainable forests** is an **important matter when choosing biomass products**.

In terms of **quantity**:

- The greater majority of participants **prefer to buy smaller quantities along the winter**





For those that didn't install pellet stoves...

- About half of the inquired participants **thought about installing** it but didn't do it, because **they had other heating sources already installed, and didn't feel the need to change yet.**
- **A few didn't think about installing as they have restrictions on construction and/or haven't quite explored the idea of a pellet stove yet.**





And finally, participants who mentioned installing **air conditioners...**



- Their main drivers were:
 - having a multi-functional appliance
 - efficient and easy to use
 - with lower energy consumption
 - and that it can be used both on hot or cold weather.
- For the majority of participants, the air conditioning **was their first choice of a heating/cooling technology.**
 - Only to one participant it was **chosen as an alternative to a pellet stove**
 - To other 2 participants the air conditioning was bought in order to **replace** the use of a **fireplace** and an **oil heater**.





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Customer experience installing air conditioning

When choosing the installer...

Most of the participants, **made their choice based on family/friends recommendations**. Price was also a very **important factor** to half of the participants.

Before the installation:



- On the majority of the cases, **the installer visited the house** before recommending a product.
- For those who didn't: the installer **made questions about the room/s dimension/s**. However, on most cases **he didn't ask about the window positioning** and the insulation used.
- **When choosing an air conditioner...** most of the participants took into account the **energy efficiency on the appliance**.





Customer experience installing air conditioning

After the installation:

- The great majority of participants **didn't have any problems** with the installation.
- After installing the AC, **only a few participants perceived changes on their electricity bill**. The majority didn't feel any change.

Regarding usage:



- The majority of participants uses the air conditioning **from 2h to 4h per day**
 - Some participants mention **they don't use it on a daily basis** – only when they feel the need for a hot/cold temperature.
- The most used **temperatures in the winter time are between 20 and 25 degrees**, and on the **summer it's around 19 and 25 degrees** – there doesn't seem to be any significant difference on the temperature levels used on the summer and winter time.





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Besides the air conditioning...

- The **majority of participants also use other heating systems**, such as: **wood furnaces, convectors, gas heating systems, oil heaters, a fireplace...**
- **None of the participants have an air conditioner maintenance contract.**





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For those that didn't install air conditioning...

- Overall, for those participants who **didn't even consider the option** of installing an air conditioning – **it's an idea that most of them haven't even explored or are not convinced to install.**
- For some it **seems like an expensive solution**, or they have already installed other systems and are satisfied with their current choice.





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3. Main findings & recommendations



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Main findings

- Overall, there's a **high sense of responsibility and relevance about environmental issues, and it can be strong enough to motivate and trigger changes in behavior.**
- The grand majority of the participants have started to **adapt their lives and routines/habits to a more energy efficient consumption:**
 - not only replacing appliances in the house but also changing their main energy source from a non renewable, perceived as pollutant and in the verge of ending (i.e. powered by oil, gas, carbon) to a renewable source of energy, perceived as a cleaner and more ecological source (i.e. solar, biomass materials, wind)
- Although all the participants are **well aware of the RES**, the main **restraints** to adopt one seems to be the **price**: perceived as very expensive and not always accessible to all budgets. Other restraint seems to be on a few cases the **lack of information**: they don't know how to get them, the practical advantages of getting it, and who to contact.





Recommendations

- To overcome these main barriers, it was suggested to...
 - **Create governmental initiatives to order to help consumers with the installation and maintenance costs** – specially when installing solar panels, by subsidizing/ giving a budget or percentage of the installation, maintenance, having lower vat rates...
 - **Create more affordable pricing packages to acquire/install the equipment or promoting the option to pay by installments**
 - **To develop campaigns about the benefits of adopting an RES, explaining in a simple way what can be done and how:** some participants feel that this information is not easily accessible and easy to understand, something that is far away from them.

