HARP

Heating Appliances Retrofit Planning

Deliverable 4.3:
Professional training toolbox
March 2021

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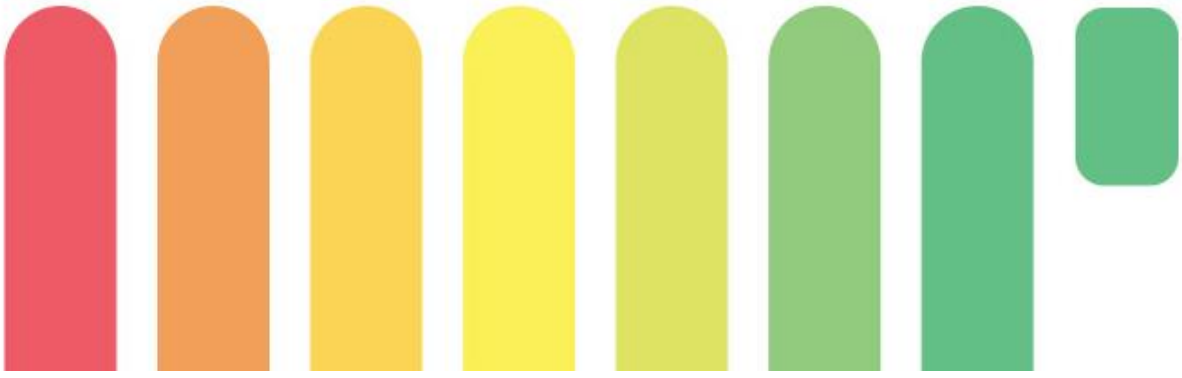

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ABBREVIATIONS AND DEFINITIONS

ABBREVIATION	DESCRIPTION
Abbreviation 1	Description of Abbreviation
Abbreviation 2	Description of Abbreviation

TABLE OF CONTENTS

1 PROJECT SUMMARY

The HARP (Heating Appliances Retrofit Planning) project aims at raising consumers' awareness to the underlying opportunities of the planned replacement of their old and inefficient heating appliance. This will be done by supporting the consumer in the identification of the energy (in)efficiency of their current heating equipment and the saving opportunities that derive from its replacement with a more energy efficient solution. The mission is to accelerate the European replacement rate for heating systems, actively contributing to the reduction of energy demand in buildings, in line with the energy efficiency targets set by the EU.

Now is the time to act and raise consumers' awareness about the opportunities of a planned replacement. Taking advantage of the energy label for space and water heating, we can mainstream the labelling concept to the installed heating stock, which makes it possible to use a well-known support decision tool to communicate and motivate the consumer to replace its heating system with a modern high-efficiency one, using renewable solutions. HARP accompanies the consumer's decision-making process, providing an impartial message, based on the energy label and presenting the market solutions that respond to the consumer's heating needs, providing a quantified approach for economic and non-economic benefits and bridging the gap with the market providers and available national incentives. HARP is promoted by key partners with expertise in the fields of consumer behaviour, energy efficiency, heating solutions and business models; working directly with the consumer, or indirectly via professionals who are critical multiplying agents. The project advocates for dynamic efficient heating communities, where all the agents – from the supply to the demand side – are committed to an efficient heating market, supporting the consumer to make smarter choices.

2 EXECUTIVE SUMMARY

This document describes the materials which have been developed for professionals as part of Task 4.3 "Commitment materials for professionals" with the aim of involving heating professionals into the consumer engagement strategy, since these actors play an important role in the consumer's decision process.

The practical toolbox for professionals was been designed with the aim of developing the following materials:

- 5 specialized articles for professional media "Heating energy label – how to use old and new installations";
- 1 brochure for professionals covering topics such as the heating label, the methodology to follow for installed appliances, HARP tools, and how to interact with the consumer;
- Professional's training material: 1 power point presentation and 1 power point script with examples on how to use the online tool, covering the whole journey;
- 1 tutorial for the professional version of the online use of the HARP app.

From this list of planned materials, some were developed for the first heating season and are presented in this paper.

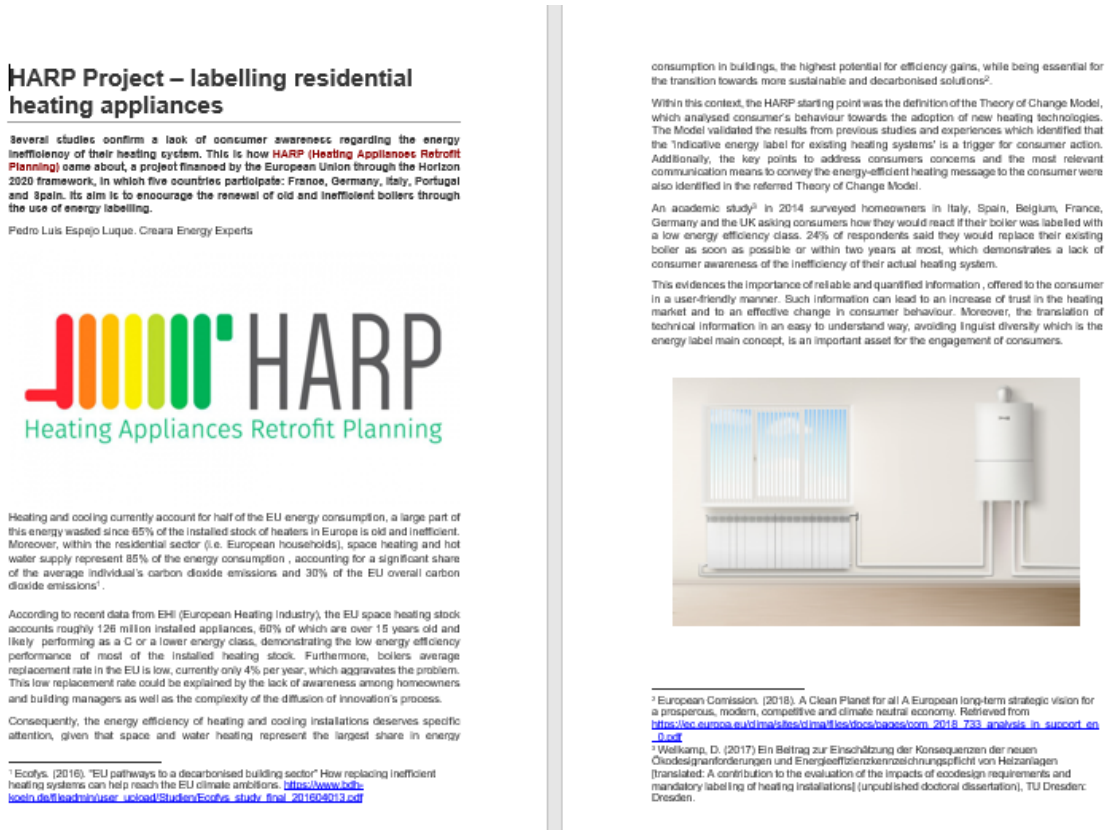
- Regarding the articles, it was decided that for the first heating season, three out of the five planned ones would be developed. The remaining two will be written for the second heating season;
- The brochure for professionals has already been prepared and described in this paper;
- Professional's training material: five PowerPoint presentations were designed as training modules instead of the two planned presentations;
- For the tutorial, a webinar will be prepared which has yet to be conducted.

3 ARTICLES

In this section the three articles that have already been written are presented. For all of the articles presented in this version, an initial version was made and subsequently sent to partners for them to review and provide feedback and impressions. Partner's comments were integrated and a final version of each of the articles is now available.

3.1 Article 1: Labelling residential heating appliances.

The first article presents the existing problem with current heating appliances and how the HARP project can help solve it.



HARP Project – labelling residential heating appliances

Several studies confirm a lack of consumer awareness regarding the energy inefficiency of their heating system. This is how HARP (Heating Appliances Retrofit Planning) came about, a project financed by the European Union through the Horizon 2020 framework, in which five countries participate: France, Germany, Italy, Portugal and Spain. Its aim is to encourage the renewal of old and inefficient boilers through the use of energy labelling.

Pedro Luis Espejo Luque. Creara Energy Experts

HARP
Heating Appliances Retrofit Planning

Heating and cooling currently account for half of the EU energy consumption, a large part of this energy wasted since 65% of the installed stock of heaters in Europe is old and inefficient. Moreover, within the residential sector (i.e. European households), space heating and hot water supply represent 85% of the energy consumption , accounting for a significant share of the average individual's carbon dioxide emissions and 30% of the EU overall carbon dioxide emissions[1].

According to recent data from EHI (European Heating Industry), the EU space heating stock accounts roughly 126 million installed appliances, 60% of which are over 15 years old and likely performing as a C or a lower energy class, demonstrating the low energy efficiency performance of most of the installed heating stock. Furthermore, boilers average replacement rate in the EU is low, currently only 4% per year, which aggravates the problem. This low replacement rate could be explained by the lack of awareness among homeowners and building managers as well as the complexity of the diffusion of innovation's process.

Consequently, the energy efficiency of heating and cooling installations deserves specific attention, given that space and water heating represent the largest share in energy

[1] Ecofys. (2016). "EU pathways to a decarbonised building sector" How replacing inefficient heating systems can help reach the EU climate ambitions. https://www.bdh-koeln.de/fileadmin/user_upload/Studien/Ecofys_study_final_20160401i3.pdf

consumption in buildings, the highest potential for efficiency gains, while being essential for the transition towards more sustainable and decarbonised solutions[2].

Within this context, the HARP starting point was the definition of the Theory of Change Model, which analysed consumer's behaviour towards the adoption of new heating technologies. The Model validated the results from previous studies and experiences which identified that the 'indicative energy label for existing heating systems' is a trigger for consumer action. Additionally, the key points to address consumers concerns and the most relevant communication means to convey the energy-efficient heating message to the consumer were also identified in the referred Theory of Change Model.

An academic study[3] in 2014 surveyed homeowners in Italy, Spain, Belgium, France, Germany and the UK asking consumers how they would react if their boiler was labelled with a low energy efficiency class. 24% of respondents said they would replace their existing boiler as soon as possible or within two years at most, which demonstrates a lack of consumer awareness of the inefficiency of their actual heating system.

This evidences the importance of reliable and quantified information , offered to the consumer in a user-friendly manner. Such information can lead to an increase of trust in the heating market and to an effective change in consumer behaviour. Moreover, the translation of technical information in an easy to understand way, avoiding linguist diversity which is the energy label main concept, is an important asset for the engagement of consumers.

[2] European Comission. (2018). A Clean Planet for all A European long-term strategic vision for a prosperous, modern, competitive and climate neutral economy. Retrieved from https://ec.europa.eu/clima/sites/clima/files/docs/pages/com_2018_733_analysis_in_support_en_0.pdf

[3] Wellkamp, D. (2017) Ein Beitrag zur Einschätzung der Konsequenzen der neuen Ökodesignanforderungen und Energieeffizienzkennzeichnungspflicht von Heizanlagen [translated: A contribution to the evaluation of the impacts of ecodesign requirements and mandatory labelling of heating installations] (unpublished doctoral dissertation), TU Dresden: Dresden.

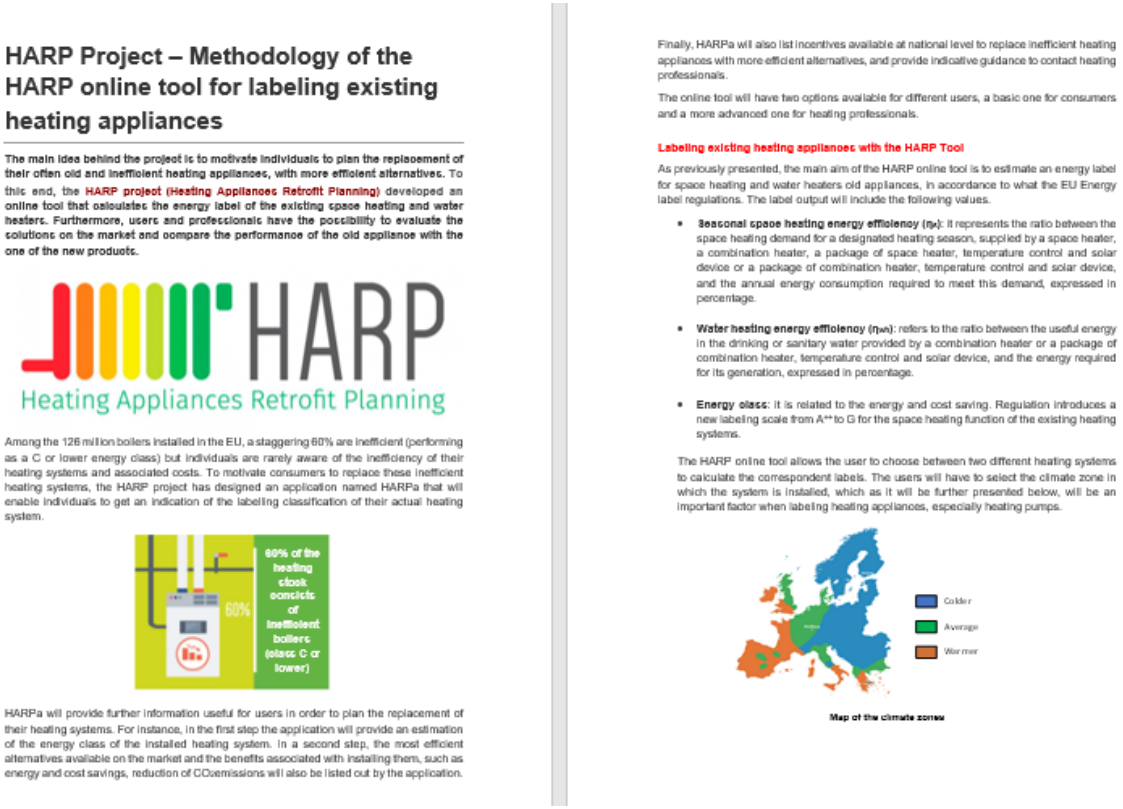
Figure 1 – First article: Labelling residential heating appliances.

The key topics covered by the first article are:

- Introduction to the current situation of the EU's heating stock and HARP's starting point;
- Methodology developed by HARP with the aim of encouraging the renovation of inefficient heating appliances;
- Brief introduction to the HARP online application;
- Presentation of the objectives and scope of the HARP project.

3.2 Article 2: Methodology of the online HARP tool for labelling heating appliances.

The second article intends to explain the methodology behind the online HARP tool.



HARP Project – Methodology of the HARP online tool for labeling existing heating appliances

The main idea behind the project is to motivate individuals to plan the replacement of their often old and inefficient heating appliances, with more efficient alternatives. To this end, the **HARP project (Heating Appliances Retrofit Planning)** developed an **online tool that calculates the energy label of the existing space heating and water heaters. Furthermore, users and professionals have the possibility to evaluate the solutions on the market and compare the performance of the old appliance with the one of the new products.**

HARP
Heating Appliances Retrofit Planning

Among the 126 million boilers installed in the EU, a staggering 60% are inefficient (performing as a C or lower energy class) but individuals are rarely aware of the inefficiency of their heating systems and associated costs. To motivate consumers to replace these inefficient heating systems, the HARP project has designed an application named HARPa that will enable individuals to get an indication of the labeling classification of their actual heating system.

HARPa will provide further information useful for users in order to plan the replacement of their heating systems. For instance, in the first step the application will provide an estimation of the energy class of the installed heating system. In a second step, the most efficient alternatives available on the market and the benefits associated with installing them, such as energy and cost savings, reduction of CO_2 emissions will also be listed out by the application.

Finally, HARPa will also list incentives available at national level to replace inefficient heating appliances with more efficient alternatives, and provide indicative guidance to contact heating professionals.

The online tool will have two options available for different users, a basic one for consumers and a more advanced one for heating professionals.

Labeling existing heating appliances with the HARP Tool

As previously presented, the main aim of the HARP online tool is to estimate an energy label for space heating and water heaters old appliances, in accordance to what the EU Energy label regulations. The label output will include the following values.

- **Seasonal space heating energy efficiency (η_s):** It represents the ratio between the space heating demand for a designated heating season, supplied by a space heater, a combination heater, a package of space heater, temperature control and solar device or a package of combination heater, temperature control and solar device, and the annual energy consumption required to meet this demand, expressed in percentage.
- **Water heating energy efficiency (η_{wh}):** refers to the ratio between the useful energy in the drinking or sanitary water provided by a combination heater or a package of combination heater, temperature control and solar device, and the energy required for its generation, expressed in percentage.
- **Energy class:** It is related to the energy and cost saving. Regulation introduces a new labeling scale from A** to G for the space heating function of the existing heating systems.

The HARP online tool allows the user to choose between two different heating systems to calculate the correspondent labels. The users will have to select the climate zone in which the system is installed, which as it will be further presented below, will be an important factor when labeling heating appliances, especially heating pumps.

Map of the climate zones

Figure 2 – Second article: Methodology of the HARP online tool for labelling heating appliances

This article covers the following points:

- Introduction to the technical methodology of the online HARP tool;
- Presentation and description of the label provided by the tool;
- Energy demand and energy consumption calculations;
- Presentation of the savings achieved through the installation of a new system.

3.3 Article 3: The heating professionals' role in the consumer's decision process to replace old and inefficient heating appliances.

The aim of the third article is to provide an overview of how the HARP online tool can be useful for heating professionals in their daily work.

HARP Project – The heating professionals' role in the consumer's decision process to replace old and inefficient heating appliances

Professionals play a key role in accelerating the modernization of EU's heating stock. Considering their relevance in the consumer's decision process to replace heating appliances, the HARP (Heating Appliances Retrofit Planning) project has developed an online application to support the comparison of heating systems through the energy label and plans to reach and train 1,000 professionals across France, Germany, Italy, Portugal and Spain.

Laura Pérez del Olmo. Creara Energy Experts

HARP
Heating Appliances Retrofit Planning

The residential sector is the main consumer of heating and cooling in Europe. The building sector is responsible for roughly half of the EU's energy consumption and 80% of that energy is used for space heating and domestic hot water production.

Despite its significance in terms of energy consumption, the heating system stock is very static. Installed boilers can last for over 15 years, which justifies the slow replacement rate in Europe, at about 4% per year. Additionally, consumers lack of awareness, information and advice on the technical possibilities and actual energy costs, results in 60% of the European heating stock being composed of old and inefficient boilers (performing as a C or lower energy class).

In this context, professionals play a key role in accelerating the modernisation of EU's heating stock and significantly contribute to the compliance of the energy efficiency targets set for the EU. Except for Germany where an energy label for installed heating appliances already exists, European consumers are not informed about the energy efficiency of their installed heating systems. This is particularly concerning when the systems are more than 10 years old and there is no information about how the system is performing. In fact, according to the European Commission[1], consumer choice is limited by a lack of information on actual energy consumption and costs, lack of awareness of the benefits of cost-efficient technologies, lack advice on the technical possibilities, split incentives (for instance in multi-apartment buildings) and lack of financial means to invest in the most efficient technology .

In addition, it is necessary to support professionals in improving their expertise and knowledge in new efficient and renewable heating technologies.

Considering the relevance of professional in the consumer's decision process to replace heating appliances, the HARP European funded project plans to reach and train 1,000 professionals among the partner countries (France, Germany, Italy, Portugal and Spain) and provide an online application to further support the consumer. Thanks to this online application, professionals will be able to accompany the consumer decision process, supporting in the identification of the consumer's actual heating system energy class and presenting technological solutions that respond to the consumer's heating needs. The online application also aims to provide a quantified approach for economic and non-economic benefits as well as information on the availability of national incentives for the replacement of old and inefficient heating systems.

The important role of intermediaries

The vast majority of heating systems currently installed in European homes is old and inefficient. Decisions on replacing old appliances are typically made under pressure when the heating system breaks down. Comparison of prices between solutions, as well as information on how their existing system performs, is not easily available for most consumers. Furthermore, it is difficult to compare technologies and solutions based on lifetime costs and benefits, quality and reliability.

Initial findings[2] highlighted that an important role in the consumers' decision to choose a heating system is played by intermediaries or key professionals (namely energy experts, installers, system designers, retailers), which interact directly with consumers. The acquisition process of heating systems by the consumer relies mostly on professionals when a maintenance relation is in place and sales agents when going for replacements or new acquisitions.

Moreover, professionals are found to be the preferred information channel for consumers regarding the replacement of their heating systems. For many consumers, their knowledge comes very often from professionals. Although they try to collect more information from other sources such as the national and local authorities, internet or friends, the installers' advice has often more impact on the customers' decision due to their professional knowledge. This advice is especially important when it is urgent for consumers to replace their heating system and they do not have any time to do further research on their own. In this case, the recommendation by professionals determines the choice.

[1] European Commission. (2016). An EU Strategy on Heating and Cooling https://ec.europa.eu/transparency/regdoc/rep/1/2016/EN/1-2016-51-EN-F1-1.PDF

[2] European Commission (2019). Final report on the analysis of the heating and cooling consumers and recommendations in terms of new business models and regulatory framework. Retrieved from https://www.rhc-platform.org/content/uploads/2019/12/Final-report-on-the-analysis-of-the-heating-and-cooling-consumers.pdf

Figure 3 -- Third article: The heating professional's role in the consumer's decision process to replace old and inefficient heating appliances

The third article covers the following points:

- Introduction to the important role of intermediaries, namely energy experts and installers that directly interact with consumers;
- Presentation of how the training program can be an opportunity for professionals;
- HARP methodology: how it can help professionals interact with consumers.

4 BROCHURE FOR PROFESSIONALS

The brochure briefly presents the opportunities that the HARP project offers to professionals, and how they can get involved to make the most of it.

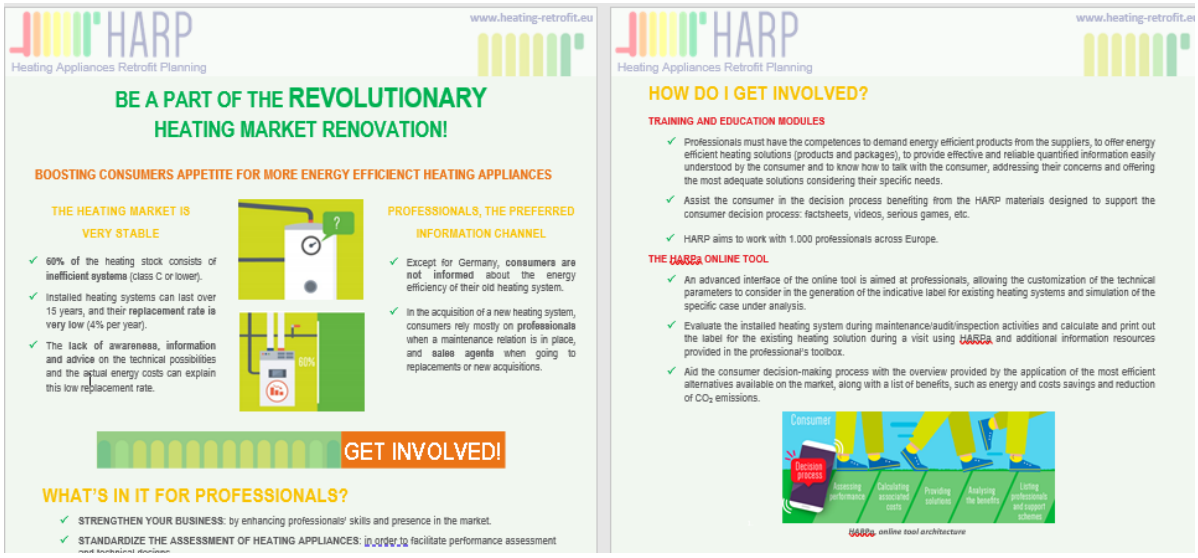


Figure 4 -- Brochure for professionals

After undergoing different changes and preliminary versions, the final version of the brochure is now available and all the comments from partners have been integrated.

5 TRAINING MODULES FOR PROFESSIONALS

The training modules have been developed to support professionals and provide them with a guidance on how to use the HARP online tool and how it can be useful for them and their work.

Different versions of all the training modules were sent to partners, the final version of each of them integrates all the comments received and are now available.

5.1 Training module 0: Introduction to the training programme

This is the first training module, and its main goal is to introduce the training program.

Figure 5 -- Training module 0

The module covers the following points:

- The HARP project: presentation of the main objectives, expected results and potential benefits of the project;
- Provides an introduction to the partners;
- Describes the reasons to get involved with the project.

5.2 Training module 1: Current situation of space heating appliances in Europe

This module was designed with the main objective of providing an overview of the current situation of space heating appliances in Europe.

Figure 6 -- Training module 1

This module covers the following points:

- Introduction to the current status of the heating appliances at EU level;
- Outline of the key EU objectives concerning energy efficiency, renewable energies and emissions;
- Review of the most commonly installed heating solutions;
- Presentation of the renovation potential.

5.3 Training module 2: The HARP tool

Module 2 introduces the user to the HARP online tool.

Figure 7 -- Training module 2

This module covers the following points:

- Introduction to the HARP tool: the labelling process of existing heating appliances;
- Description of the energy demand and consumption calculations;
- New system savings: review of the benefits the user would get from the substitution of their inefficient system by one of the replacement options given by the tool.

5.4 Training module 3: The HARP tool: Covering the whole journey.

The main aim of this module is to present the user with a guide of the HARP online tool covering all the steps.

Figure 8 -- Training module 3

The module covers the following key points:

- Provides a "how to" guide of the HARP tool for heating professionals;
- The whole journey of the user when using the online tool, from entering the data to understanding the gathered results and information.

5.5 Training module 4: Embedding HARP to your clients

The main aim of this module is to present how heating professionals can take advantage of the tool to guide their clients in the replacement of their heating appliances.

Figure 9 -- Training module 4

The module covers the following points:

- Review of consumer's concerns regarding heating;
- the role of professionals as the preferred information channel, who can play an important part in the substitution of the heating appliances;
- Guidance to heating professionals about customer service;
- Introduction to some initiatives that can motivate the clients to replace their heating appliances.

HARP Project – labelling residential heating appliances

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Pedro Luis Espejo Luque. Creara Energy Experts

Heating and cooling currently account for half of the energy consumption in the EU, of which a large part is wasted given that 65% of the installed stock of heaters in Europe is old and inefficient. Moreover, within the residential sector (i.e. European households), space heating and hot water supply represent 85% of the energy consumption , accounting for a significant share of the average individual's carbon dioxide emission footprint and 30% of the overall EU carbon dioxide emissions[1].

According to recent data from the EHI (European Heating Industry), the EU space heating stock is constituted by roughly 126 million installed appliances, 60% of which are over 15 years old and likely performing as a C or a lower energy class, demonstrating the low energy efficiency performance of most of the installed heating stock. Furthermore, boilers' average replacement rate in the EU is low, currently only 4% being replaced yearly, which aggravates the problem. This low replacement rate could be explained by the lack of awareness among homeowners and building managers, and the complexity of the dissemination of the innovation process.

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Consequently, the energy efficiency of heating and cooling installations deserves specific attention given that space and water heating represent the largest share of energy consumption in buildings, present the highest potential for energy efficiency gains, whilst being essential for the transition towards more sustainable and decarbonised solutions[2].

Within this context, the starting point for HARP was the definition of the Theory of Change Model, which analysed consumer's behaviour towards the adoption of new heating technologies. The Model validated the results from previous studies and experiences which identified that the 'indicative energy label for existing heating systems' is a trigger for consumer action. Additionally, the key points to address consumer concerns and the most relevant communication means to convey the energy-efficient heating message to the consumer were also identified in the referred Theory of Change Model.

An academic study[3] in 2014 surveyed homeowners in Italy, Spain, Belgium, France, Germany and the UK, asking them how they would react if their boiler was labelled with a low energy efficiency class. 24% of respondents said they would replace their existing boiler as soon as possible or within two years at most, which demonstrates a lack of consumer awareness of the inefficiency of their actual heating system.

This evidences the importance of providing the consumer with reliable and quantified information in a user-friendly manner, which can lead to an increased trust in the heating market and to an effective change in consumer behaviour. Moreover, the translation of technical information into an easy to understand terminology, looking for a common universal language, which is the energy label's main concept, is an important asset for the engagement of consumers.

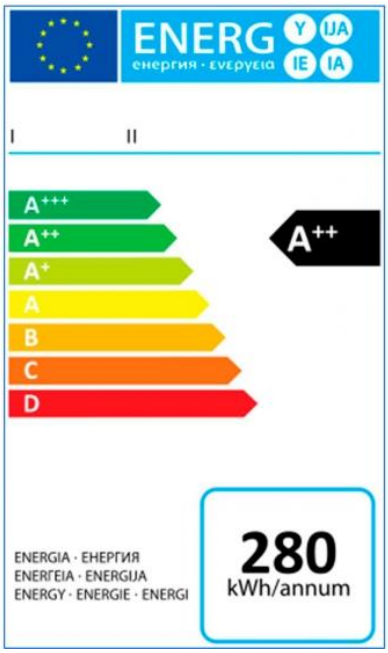
[2] European Comission. (2018). A Clean Planet for all A European long-term strategic vision for a prosperous, modern, competitive and climate neutral economy. Retrieved from https://ec.europa.eu/clima/sites/clima/files/docs/pages/com_2018_733_analysis_in_support_en_0.pdf

[3] Wellkamp, D. (2017) Ein Beitrag zur Einschätzung der Konsequenzen der neuen Ökodesignanforderungen und Energieeffizienzkennzeichnungspflicht von Heizanlagen [translated: A contribution to the evaluation of the impacts of ecodesign requirements and mandatory labelling of heating installations] (unpublished doctoral dissertation), TU Dresden: Dresden.

Methodology

Through the use of energy labelling, HARP has developed its own methodology with the aim of encouraging the renovation of old and inefficient boilers, which can be classified into 5 phases:

1. **Awareness**: this is the first and key stage of the process. There is a need to capture the attention of consumers and make them understand the opportunities that arise from a change in heating and domestic hot water equipment. The fundamental channels through which this can be done are direct contact through campaigns (educational material, videos, seminars, social networks), indirect contact through professionals (who will be given specific training), and via public policies.
2. **Quantification**: the labelling of the current heating system gives the consumer an understandable message on how inefficient the currently installed heating system is. It also allows consumers to easily compare the efficiency their existing boiler with newer options which are available on the market and quantify the potential savings once the old heating system is replaced with a more efficient solution.
3. **Market offer**: this phase shows consumers the heating technologies that are available on the market (both conventional and renewable), their main characteristics, and indicating the energy class of the new heating solution.
4. **Benefits**: consumers are presented with the potential for energy savings, reduced maintenance costs, avoided CO_2 emissions and other additional benefits (improved comfort, reduced noise, improved air quality, independence from energy prices, increased value of their house, etc.).
5. **Motivation**: the last step puts the consumer in direct contact with professionals that can further support the acquisition process of a new heating system, also making the consumer aware of other existing benefits such as public financing and incentive schemes that are available at national level, which can provide an extra incentive for the replacement of their current system.



Example of the heating energy label for new heating and domestic hot water appliances

Labelling available for everyone: an online application

To execute this methodology, HARP has developed an online app with two different versions. The first version, designed for individual consumers, allows users to easily get information and assess the energy class of their existing heating appliance from their homes. This can be done without any major inconvenience and without having to spend time or resources.

The second version, which is aimed at professionals, is more advanced as it offers more detailed and technical information which enables experts to explain all the relevant data to consumers during maintenance visits or in the event of possible breakdowns. The app allows to standardize the proposed methodology for any type of user, giving common, coherent and truthful information in the five countries where the project is carried out (France, Germany, Italy, Portugal and Spain).

Once the required data regarding the installed heating appliance has been inserted into the web application, it generates an energy efficiency label similar to the one already found on new appliances. In addition, the application proposes an optimal and more efficient heating system through the following indicators:

- The application indicates which **technology** among those currently available on the market might be the optimal one for the consumer's specific heating needs, taking into consideration the characteristics of their home and their needs and preferences in terms of additional benefits considered when replacing a heating appliance.
- The indicated **power** needed to use the new technology.
- The **energy efficiency class** achieved by the proposed new technology.
- The indicative **investment** required to change the heating system.
- The estimated **annual energy savings** as a result of the change of system.
- The estimated **annual economic savings** achieved from the use of a more efficient technology.
- Estimation of **annual CO_2 emissions savings** from the change of heating appliance.
- Estimated energy, economic and CO_2 emissions savings throughout the expected lifetime of the new heating appliance.
- **Payback period** or term in which the initial investment is recovered by the savings obtained.
- The **Net Present Value** of the investment

Objectives and scope

The HARP project aims at raising consumers' awareness to new heating solutions, accelerating the replacement rate of these types of equipment and significantly reducing energy consumption in existing buildings through the exploitation of the energy label as a privileged support decision tool for the consumer.

In this regard, since professionals are the preferred information channel for consumers which are considering the replacement of their heating system, the HARP project will target the development of their capabilities via training activities. In fact, 1000 professionals are expected to be trained across the participating countries: France, Germany, Italy, Portugal and Spain.

The range of options for the replacement of a system can be extense, with variations depending on the type of system (for instance hot water heating and/or space heating), the

demand profile of the consumer, or the geographical region. Under these contextual realities, the project will deliver a toolbox aimed at professionals (namely energy experts, installers, system designers, retailers), explicitly providing a training programme on how to interact with the consumer and promote efficient heating solutions in the consumer advisory process, using the HARP resources and online app. Moreover, experience and best-practices gathered from the roll-out of activities with professionals and consumers will be shared.

Professionals will be reached out through trade associations and impartial organizations as an essential element to bring dynamism into the heating market. Experts shall also be supported when reaching out to consumers, and consumers will be provided with the necessary tools to aid them in their decision-making process.

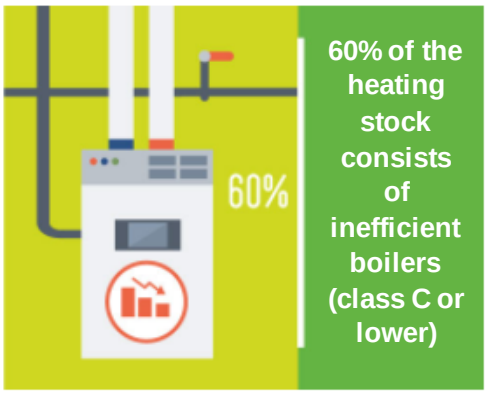
The HARP project started in May 2019 and gathers a consortium of 18 partners with long-standing expertise in relevant work areas, involving stakeholders from the heating industry sector such as EHI (European Heating Industry), Solar Heat Europe, Assotermica (Italian Heating Association) and Uniclima (French Heating Association); consumer organizations such as DECO (Portuguese Consumer Defense Association), OCU (Spanish Consumer Defense Association) and Energies 2050 (French ONG); energy consultant companies such as Creara (Spain), R2M (Spain), Trenkner (Belgium) and EURAC (Italy); universities such as Universidade Nova de Lisboa and Universidade do Minho; and national energy agencies such as DENA (German National Energy Agency), ENEA (Italian National Energy Agency) and the project leader, ADENE (Portuguese National Energy Agency).

For further information, visit the HARP website.

HARP Project – Methodology of the HARP online tool for labeling existing heating appliances

The main idea behind the project is to motivate individuals to plan the replacement of their often old and inefficient heating appliances with more efficient alternatives. To this end, the HARP project (Heating Appliances Retrofit Planning) has developed an online tool that calculates the energy label of existing space heating appliances and water heaters. Furthermore, users and professionals have the possibility to evaluate the solutions on the market and compare the performance of old appliances with newer products.

Among the 126 million boilers installed in the EU, a staggering 60% are inefficient (performing as a C or lower energy class). However, individuals are rarely aware of the inefficiency of their heating systems and the associated costs. To motivate consumers to replace these inefficient heating systems, the HARP project has designed an application named HARPa that enables individuals to get an indication of the labelling classification of their current heating system.



In addition, HARPa provides useful information allowing users to plan the replacement of their current heating systems. For instance, in the first step of the app, an estimation of the energy class of the installed heating system is provided. In a second step, the most efficient alternatives available on the market and the benefits associated with installing them (such as energy and cost savings, and reduction of CO_2 emissions) are listed out. Finally, HARPa

will also list incentives available at national level to replace inefficient heating appliances with more efficient alternatives, also providing indicative guidance for customers to contact heating professionals.

The online tool has two options available for different users, a basic one for consumers, and a more advanced one for heating professionals.

Labeling existing heating appliances with the HARP Tool

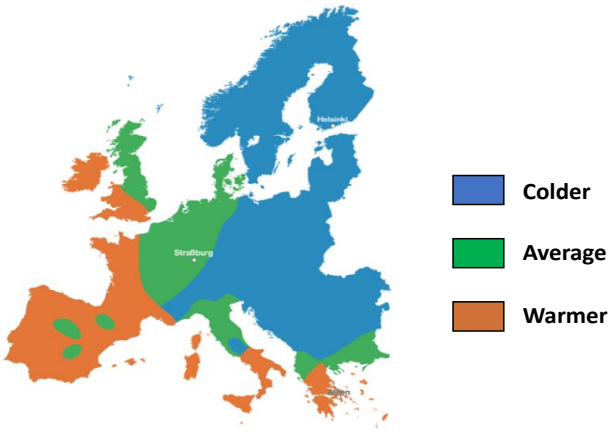
As previously presented, the main aim of the HARP online tool is to estimate an energy label for old space heating and water heating appliances, in accordance with the EU Energy label regulations. The label output will include the following values.

- **Seasonal space heating energy efficiency (η_s)**: it represents the ratio between the space heating demand for a designated heating season (supplied by either a space heater, a combination heater, a package of space heater, temperature control and solar device, or a package of combination heater, temperature control and solar device) and the annual energy consumption required to meet this demand, expressed as a percentage.

- **Water heating energy efficiency (η_{wh})**: refers to the ratio between the useful energy in drinking or sanitary water which is provided by a combination heater or a package of combination heater, temperature control and solar device, and the energy required for its generation, expressed as a percentage.

- **Energy class**: it is related to the energy and cost savings. Regulation introduces a new labeling scale from A^{++} to G for the space heating function of the existing heating systems.

The HARP online tool allows the user to choose between two different heating systems to calculate the corresponding labels. The users will have to select the climate zone in which the system is installed, which as presented further below, will be an important factor when labeling heating appliances, especially heating pumps.



Map of the climate zones in Europe

Boilers

The regulation defines them, for this purpose, as a space heater that generates heat by combusting fossil fuels and/or biomass fuels, and/or using the Joule effect in electric resistance heating elements.

Keeping this definition in mind, the equations necessary for the calculations performed by the tool are presented below.

$$\eta_s = \eta_{son} - \sum F_{(i)}$$

$$\eta_{son} = 0.85 \cdot \eta_1 + 0.15 \cdot \eta_4$$

Where:

- η_s refers to seasonal space heating energy efficiency (defined previously).
- η_{son} stands for the seasonal space heating energy efficiency in active mode and, according to the regulation, means:
    - For fuel boiler space heaters and fuel boiler combination heaters: a weighted average of the useful efficiency at rated heat output and the useful efficiency at 30 % of the rated heat output, expressed as a percentage.
    - For electric boiler space heaters and electric boiler combination heaters: the useful efficiency at rated heat output, expressed as a percentage.
    - For cogeneration space heaters not equipped with supplementary heaters: the useful efficiency at rated heat output, expressed as a percentage.
    - For cogeneration space heaters equipped with supplementary heaters: a weighted average of the useful efficiency at rated heat output with supplementary heater disabled, and the useful efficiency at rated heat output with supplementary heater enabled, expressed as a percentage.
- F can assume different values. Depending on the particular situation, a given formula will be applied to obtain the value for F, the possibilities are:
    - No temperature controls
    - Auxiliary electricity consumption
    - Standby heat losses
    - Ignition burner
- η_1 and η_4 are referring to the useful efficiency at different points:
    - η_1: at 30% of rated heat output and low-temperature regime.
    - η_4: at rated heat output and high-temperature regime.

Heat pumps

A heat pump space heater, in accordance to the regulation, referred to as a 'heat pump', means a space heater using ambient heat from an air source, water source or ground source, and/or waste heat for heat generation; a heat pump space heater may be equipped with one or more supplementary heaters using the Joule effect in electric resistance heating elements or the combustion of fossil and/or biomass fuels.

The efficiency depends on the climate and the type of heat pump. The tool calculates the label as a function of these two parameters.

Taking into account the previously presented calculations for each of the heating systems the HARPa provides the efficiency and the corresponding label. The tool will then return a label presenting the energy class of the heating appliance, within the ranges of efficiency values presented in the following figure.

Entering the data

As mentioned previously, the tool has two possible configurations, a basic one for consumers and an advanced one for professionals. Depending on the user's choice, HARPa will ask for more detailed data.

- Simplified version for consumers:
    - Boiler: the user will have to answer basic questions about their current system such as its power and location. The tool will gather information based on this data.
    - Heat pump: in this case the user will only have to choose the type of heat pump.
        - Air to air heat pump
        - Air to water heat pump
        - Air (from exhaust air) to water heat pump
        - Water to water heat pump

- A more detailed version for professionals' use:
    - Boiler: professional must enter technical characteristics of the boiler, such as the partial (30 %, η_{30}) and full load (100 %, η_{100}) efficiency and the standby heat loss (P_{stby}).
    - Heat pump: the tool will only ask for the heat pump type.

In general, although both versions follow the same procedure, different questions will be addressed to the user. These questions will be related to different aspects such as the location, the size of the heating area, and the fuel used, among others.

Energy demand and energy consumption calculation

Once the required inputs are introduced by the user, HARPa will present the following results:

- **Space heating energy demand *(MWh / year)*:**

The tool's first output is the space heating energy demand. To obtain this value (in MWh/year), the following equation is used:

Energy demand [kWh/m^2] × Heating space = Calculated Energy demand [MWh/year]

The space heating energy demand depends on both the country and the year of installation of the current heating system. The tool works with specific ranges based on the country and age of installation.

- **Domestic Hot Water (DHW) energy demand *(MWh/year)*:**

The DHW energy demand (not available in the current version of HARPa) will take into account the persons dailyfor hot water needs (60°C) by considering the average water temperature of a specific country.

- **Energy consumption *(MWh / year)*:**

For the calculation of the energy consumption, the equation is:

Calculated Energy demand × System efficiency = Energy consumption (MWh/year)

- **Energy cost (MWh/year):**

In the case of the energy cost, the equation is the following:

Energy consumption × Energy cost [€/kWh] = Calculated Energy cost [€/year]

The formula takes into account the average energy price.

New system savings

The HARPa tool will provide the expected energy cost and savings suggesting new heating appliances. Further questions related to the user's needs (storage space availability, electricity capacity, etc.) will be addressed.

For the calculation of the thermal power, the equation is the following:

$$Max\ Power\ [W/m^2] \times Heating\ space = Calculated\ Max\ Power\ [kW]$$

The tool will take into account an average space heating energy demand (in kWh/m^2) for a specific country and building age.

The tool will provide the following parameters:

1. Energy consumption = Energy demand
2. Energy cost = Energy consumption × Energy price (fuel)
3. CO_2 emissions = Energy consumption × unit emissions (fuel and market)
4. Average Investment. Considering location, system and power.
5. Energy savings (kWh/year)
6. Money savings (€/year)
7. CO_2 savings (tons of CO_2/year)

As the final step of the assessment, the tool provides suggestions for different technologies which are feasible for the user. Users can explore the characteristics of each of them and get an idea of the available possibilities on the market for the substitution of their old and inefficient heating appliances. HARPa also provides a list of financial incentives, and guidance for users on the easier path to contact heating professionals and installers.

This article presents the methodology and calculations behind the HARPa online tool, for further information about the HARP project or the HARPa tool, visit the HARP website.

HARP Project – The heating professionals' role in the consumer's decision process to replace old and inefficient heating appliances

Professionals play a key role in accelerating the modernization of the EU's heating stock. Considering their relevance in the consumer's decision-making process when considering replacing their heating appliances, the HARP (Heating Appliances Retrofit Planning) project has developed an online application to support the comparison of heating systems through the energy label and plans to reach and train 1,000 professionals across France, Germany, Italy, Portugal and Spain.

Laura Pérez del Olmo. Creara Energy Experts

The residential sector is the main consumer of energy in the heating and cooling sector in Europe. The building sector is responsible for roughly half of the EU's energy consumption and 80% of that energy is used for space heating and domestic hot water production.

Despite its significance in terms of energy consumption, the renovation rate of the heating system stock is fairly static. Installed boilers can last for over 15 years, which justifies the slow replacement rate in Europe, at about 4% per year. Additionally, consumers' lack of awareness, information and advice on the technical possibilities and actual energy costs, results in 60% of the European heating stock being composed of old and inefficient boilers (performing as a C or lower energy class).

In this context, professionals play a key role in accelerating the modernisation of the EU's heating stock and significantly contribute to the compliance of the energy efficiency targets set out by the EU. Except for Germany, where an energy label for installed heating appliances already exists, European consumers are not informed about the energy efficiency of their installed heating systems. This is particularly concerning when the systems are more than 10 years old and there is no information about how the system is performing. In fact, according to the European Commission[1], consumer choice is limited by a lack of information on actual energy consumption and costs, lack of awareness of the benefits of cost-efficient

[1] European Commission. (2016). An EU Strategy on Heating and Cooling.https://ec.europa.eu/transparency/regdoc/rep/1/2016/EN/1-2016-51-EN-F1-1.PDF

technologies, lack advice on the technical possibilities, split incentives (for instance in multi-apartment buildings) and lack of financial means to invest in the most efficient technology.

In addition, it is necessary to support professionals in improving their expertise and knowledge in new efficient and renewable heating technologies.

Considering the relevance of professionals in the consumer's decision process to replace heating appliances, the HARP European-funded project plans to reach and train 1,000 professionals among the partner countries (France, Germany, Italy, Portugal, and Spain) and provide an online application to further support the consumer. Thanks to this online application, professionals will be able to accompany the consumer decision process, supporting in the identification of the consumer's current heating system energy class and presenting technological solutions that respond to the consumer's heating needs. The online application also aims to provide a quantified approach for economic and non-economic benefits as well as information on the availability of national incentives for the replacement of old and inefficient heating systems.

The important role of intermediaries

The vast majority of heating systems currently installed in European homes is old and inefficient. Decisions on replacing old appliances are typically made under pressure when the heating system breaks down. Comparison of prices between solutions, as well as information on how their existing system performs, is not easily available for most consumers. Furthermore, it is difficult to compare technologies and solutions based on lifetime costs and benefits, quality and reliability.

Initial findings[2] highlighted that an important role in the consumers' decision to choose a heating system is played by intermediaries or key professionals (namely energy experts, installers, system designers, retailers), which interact directly with consumers. The acquisition process of heating systems by the consumer relies mostly on professionals when a maintenance relation is in place and sales agents when going for replacements or new acquisitions.

Moreover, professionals are found to be the preferred information channel for consumers regarding the replacement of their heating systems. For many consumers, their knowledge comes very often from professionals. Although they try to collect more information from other sources such as the national and local authorities, internet or friends, the installers' advice has often more impact on the customers' decision due to their professional knowledge. This advice is especially important when it is urgent for consumers to replace their heating system and they do not have any time to do further research on their own. In this case, the recommendation by professionals determines the choice.

[2] European Commission (2019). Final report on the analysis of the heating and cooling consumers and recommendations in terms of new business models and regulatory framework. Retrieved from https://www.rhc-platform.org/content/uploads/2019/12/Final-report-on-the-analysis-of-the-heating-and-cooling-consumers.pdf

Additionally, consumers are more likely to switch to a more efficient heating system[3] when they are aware of additional co-benefits and are willing to spend extra money to achieve them. These benefits go beyond cost savings: an energy efficient heating system offers improved air quality, noise reduction, higher market value of the building, etc.

Key professionals need therefore to stress the main benefits and additional co-benefits over an energy efficient heating appliance to foster the consumer's decision process.

An opportunity for professionals

Professionals have a high know-how and all the technical information necessary for the installation, maintenance or replacement of a heating system. However, many times they do not have simple, clear tools to facilitate the dialogue with consumers who lack technical background.

Additionally, installers have a good connection with the industry. Professionals are usually in an intermediate position between heating companies and consumers. Therefore, they are key to advice on the best possible solutions and on the latest market developments.

Under these circumstances, the professionals' that cooperate and receive training from the HARP project will be able to stand out from their competition since the training programme helps them to interact with the consumer and promote efficient heating solutions in the consumer advisory process. Additionally, the training programme allows them to be part of a list of HARP trained professionals accessible by potential clients.

On the other hand, in some countries like France and Germany, consumers word of mouth is the most trusted communication channel, which could result in a differential factor among the competence. Those consumers who replaced their heating systems with more efficient ones thanks to the advice of a professional who uses the HARP online application, will see their energy bill reduced. These consumers will share their positive experience with family, friends and co-workers among others, who will eventually contact the same professional to benefit from energy labelling and replace the heating system.

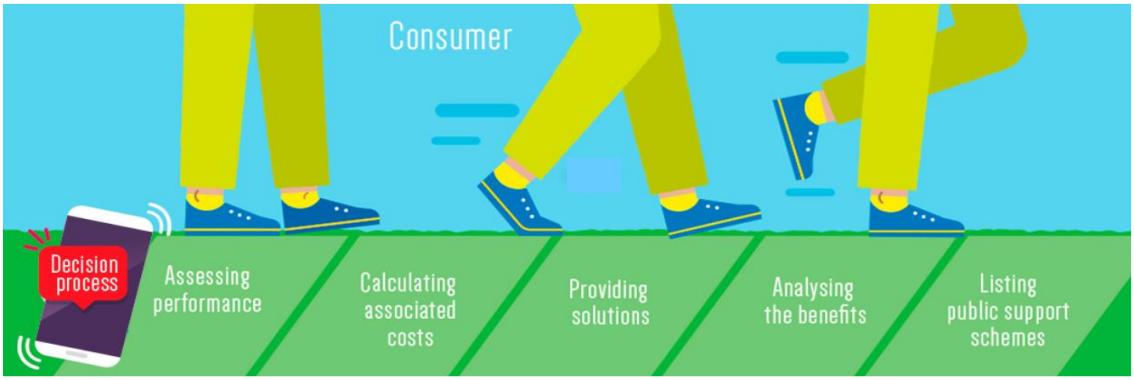
Mitigation measures: HARP methodology

Professionals are multiplying agents, as they have direct contact with multiple consumers. The development of a comprehensive customer-targeting toolbox is an asset professional's

[3] Oliveira, T., Neves, C., & Neves, J. (2020). Deliverable 2.1: Consumer behaviour change model regarding the adoption of efficient heating systems. https://heating-retrofit.eu/wp-content/uploads/2020/05/HARP-D2.1-Consumer-behaviour-change-model-EEHA-V1.1.pdf

can use in their interaction with consumers to explain and justify the importance of energy efficient heating. The HARP project delivers a **toolbox** providing a training programme on how to interact with the consumer and promote efficient heating solutions in the consumer advisory process, using the HARP resources and an online application.

The **online application** has two different versions (lighter version to be directly used by consumers and a detailed version to be used by the professionals supporting the consumer). The detailed version includes comprehensive and technical information, so experts can explain this type of data to consumers during maintenance visits or in the event of possible breakdowns. The application allows standardizing the proposed methodology for any type of user, giving a common, coherent and transparent information in the countries where the project is carried out.



In addition, the application indicates which technologies among those currently available on the market is more adequate to the consumer's specific heating needs, considering the dwelling characteristics and the consumer's preferences.

Trainings for professionals will be available, delivered by HARP partners and promoted via market associations and impartial organizations with the aim of bringing dynamics into the heating market and enhancing professionals' skills and presence in such market, strengthening their business.

Upon this, professionals' will be able to use the HARP resources and, during maintenance/audit/inspection activities, professionals will be able to evaluate the installed heating system, calculate the energy class and present the energy label for the existing heating solution, thus supporting the consumer in the evaluation of heating replacement opportunities by using the online application and additional information resources provided in the **professional's toolbox**.

For further information, visit [customize national HARP website]

HARP

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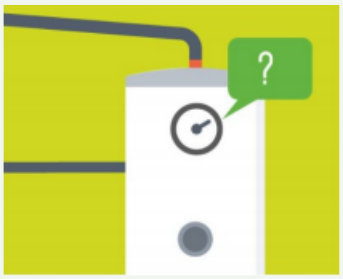
www.heating-retrofit.eu

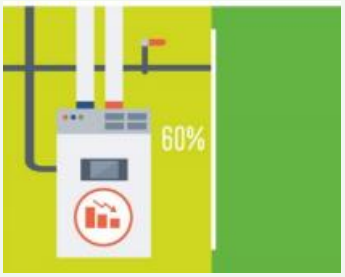
BE A PART OF THE REVOLUTIONARY HEATING MARKET RENOVATION!

BOOSTING CONSUMER'S APPETITE FOR MORE ENERGY EFFICIENT HEATING APPLIANCES

THE HEATING MARKET IS VERY STABLE

- ✓ **60% of** the heating stock consists of **inefficient systems** (class C or lower).
- ✓ Installed heating systems can last over 15 years, and their **replacement rate is very low** (4% per year).
- ✓ The **lack of awareness, information and advice** on the technical possibilities and the actual energy costs can explain this low replacement rate.





PROFESSIONALS, THE PREFERRED INFORMATION CHANNEL

- ✓ Except for Germany, **consumers are not informed** about the energy efficiency of their old heating system.
- ✓ When acquiring a new heating system, consumers mostly rely on **professionals** when a maintenance relationship already exists, and on **sales agents** when replacements or new acquisitions take place.

GET INVOLVED!

WHAT'S IN IT FOR PROFESSIONALS?

- ✓ **STRENGTHEN YOUR BUSINESS**: by enhancing your professional skills and market presence.
- ✓ **STANDARDIZE THE ASSESSMENT OF HEATING APPLIANCES**: to ease performance assessment and technical designs.
- ✓ **TAKE ADVANTAGE OF THE ENERGY LABEL**: using a successful tool that simplifies the customer's decision-making process when estimating and highlighting the energy savings that they can benefit from by replacing their old heating system.
- ✓ **STAND OUT AMONGST YOUR COMPETITORS**: you will get additional know-how in long-term cost savings potential and customer relations, improving your argumentation when proposing replacement opportunities.
- ✓ **WORD OF MOUTH**: in some countries such as France and Germany, word of mouth is the most trusted communication channel; this could become a differentiating factor among your competition.
- ✓ **IMPROVE YOUR KNOWLEDGE**: join HARP's training programme on how to use the voluntary labelling tool for existing heating solutions, interact with the consumer and promote efficient heating solutions when offering them advisory services.
- ✓ **BE PART OF THE EUROPEAN HEATING COMMUNITY**: be recognized as one of the key professionals in energy efficient heating. Consumers will have the opportunity to access and directly contact with the HARP trained professionals as the last step in the online support decision tool.
- ✓ **MAKE A CHANGE**: with your work, you can help contribute to climate change mitigation. Each one of us can make a difference; together, we can make a change!

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 847049.

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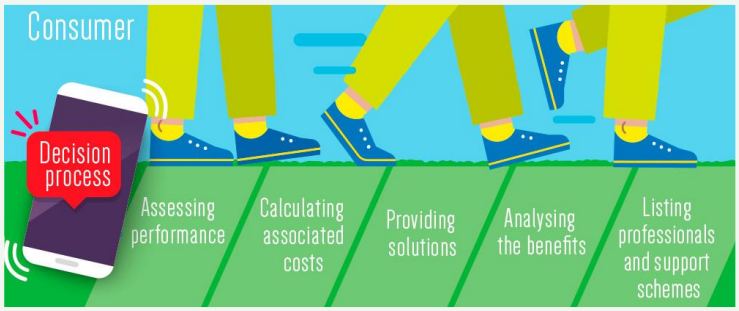
HOW DO I GET INVOLVED?

TRAINING AND EDUCATION MODULES

- ✓ Professionals must have the competences to demand energy efficient products from suppliers, offer energy efficient heating solutions (products and packages), correctly address customer needs and concerns, providing effective and reliable quantified information which can be easily understood by customers, and offering the most adequate solutions considering their specific needs.
- ✓ By assisting the consumer in their decision-making process, professionals can benefit from the HARP materials such as factsheets, videos, serious games, etc. designed to support consumers in their decision-making journey.
- ✓ HARP aims to work with 1,000 professionals across Europe.

THE HARPa ONLINE TOOL

- ✓ An advanced interface of the online tool is intended for professionals, allowing for the customization of the technical parameters to consider when generating an indicative energy class label for existing systems, and a simulation of the specific case being analysed.
- ✓ When evaluating installed heating systems during maintenance/audit/inspection activities, professionals may calculate and print out the label for the existing heating solution using HARPa, together with additional information resources provided in the professional's toolbox.
- ✓ Professionals can support the consumer's decision-making process with help of the overview provided by the app, which provides an overview of the most efficient alternatives available on the market, along with a list of benefits such as energy and cost savings, and reductions in CO_2 emissions.



HARPa, online tool architecture

HARP IN NUMBERS

HARP stands for Heating Appliances Retrofit Planning. It is a project funded by the European Union through the Horizon 2020 framework, focusing on 5 EU Member States: France, Germany, Italy, Portugal, and Spain.

18 PARTNERS	3 YEARS	1,5 MILLION CONSUMERS expected to be reached	10 000 CONSUMERS could be motivated to change heating systems

PROJECT CONSORTIUM

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MATERIALS FOR PROFESSIONAL TRAININGS

MODULE 0 - Introduction to the training programme

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SUMMARY

- Training programme
- The HARP project
- Why get involved?

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Training programme

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Structure

- **Module 0 – Introduction to the training programme**
- Module 1 - Current situation of space heating appliances in Europe
- Module 2 - Labelling existing heating appliances with the HARP Tool
- Module 3 - The HARP Tool. Covering the whole journey
- Module 4 - Embedding HARP to your clients

The HARP project

HARP

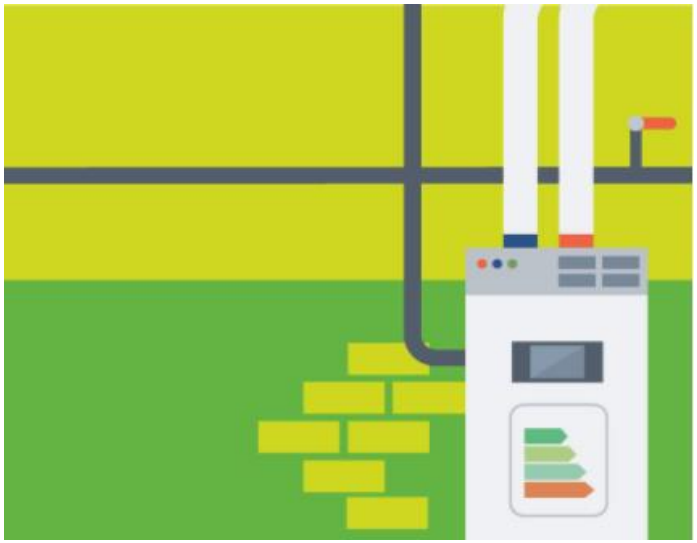
Objective

The main idea behind the project is to **motivate individuals** to plan the **replacement** of their often outdated and inefficient **heating appliances** with more **efficient** alternatives.

Expected results

- **Increase the replacement rate of old and inefficient heating appliances,** and significantly reduce the energy consumption and emissions from residential buildings

- **Draw lessons from the implementation of a labelling scheme** and potential development of financing schemes building upon the experience drawn from HARP



Potential benefits of the project

- **Enable individuals to get an indication of the labelling classification of their heating system;** except for Germany, consumers are not informed about the efficiency of their installed heating systems
- **Provide an overview of the most efficient alternatives available on the market**, along with a list of their benefits, such as energy and costs savings
- **Decrease in the energy consumption and use of fossil fuels;** heating and hot water represents 80% of the energy demand of EU households and 84% of it is generated from fossil fuels

HARP partners

France	Germany	Italy	Portugal	Spain	Europe
ENERGIES 2050	dena German Energy Agency	Assotermica	adene Agência para a Energia	creara ENERGY EXPERTS	ehi association of the European Heating Industry
énergies et avenir ASSOCIATION DES PROFESSIONNELS POUR LE CHAUFFAGE DURABLE		ENEA Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile	Universidade do Minho	R2M RESEARCH TO MARKET SOLUTION	Solar Heat Europe ESTIF
Uniclima Syndicat des industries thermiques, aérauliques et frigorifiques		eurac research	DECO	ocu	trenkner consulting
			NOVA IMS Information Management School		ECOS

Why get involved?

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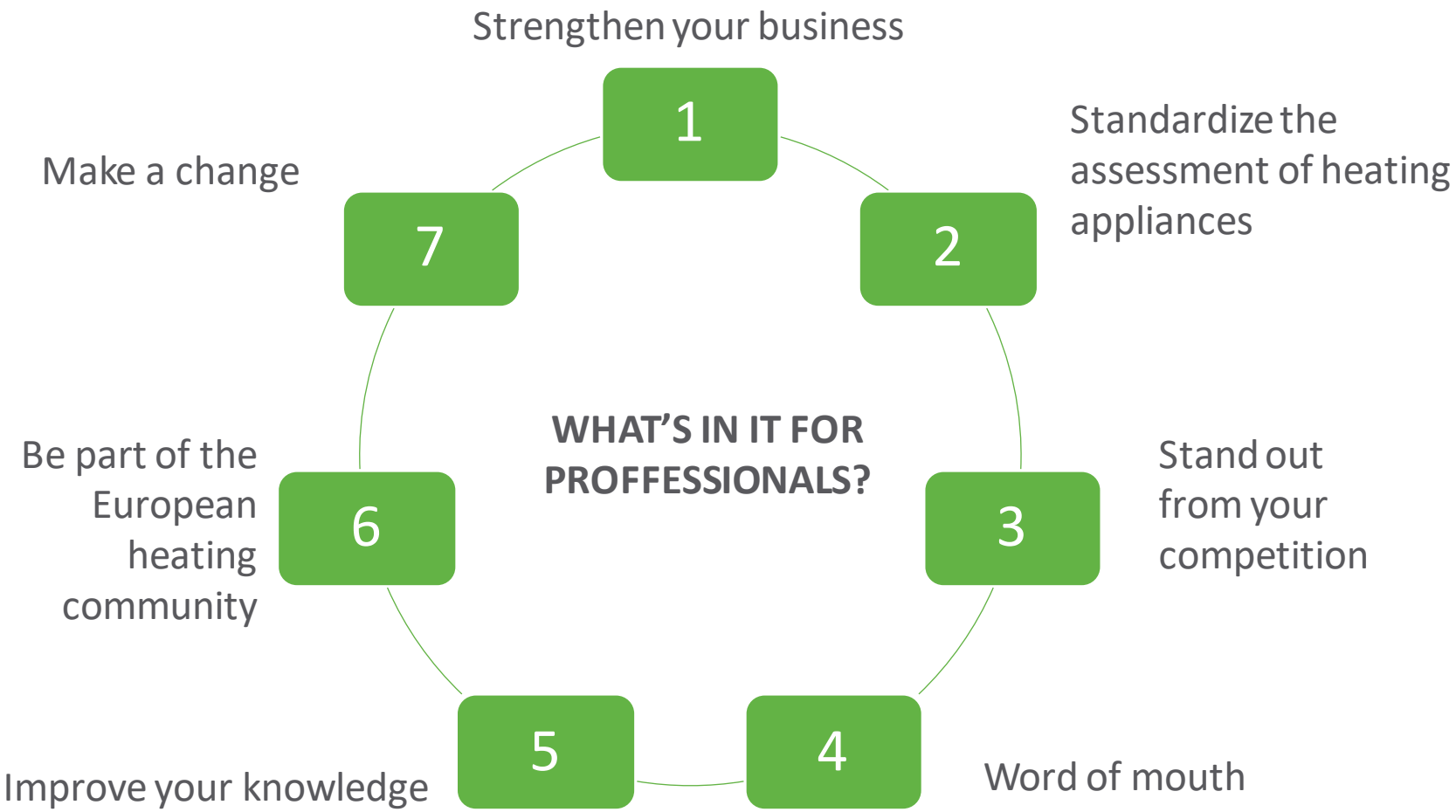
Why get involved?



Thank you for your attention!

Follow us!

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@HarpProject

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MATERIALS FOR PROFESSIONAL TRAININGS

MODULE 1 - Current situation of space heating appliances in Europe

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Structure

- Module 0 – Introduction to the training programme
- **Module 1 - Current situation of space heating appliances in Europe**
- Module 2 - Labelling existing heating appliances with the HARP Tool
- Module 3 - The HARP Tool. Covering the whole journey
- Module 4 - Embedding HARP to your clients

SUMMARY

- Current status of heating appliances at EU level
- Key EU objectives
- Most common heating solutions installed
- Renovation potential

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Current status of heating appliances at EU level

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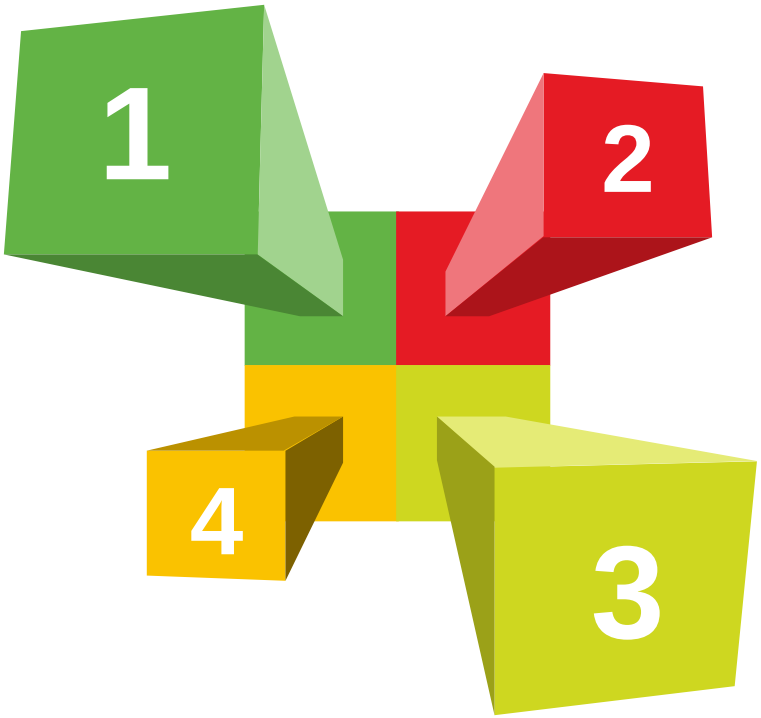
Current status



40%

Buildings are the single largest energy consumer in Europe (40% of EU energy consumption)

9%

Only **9% of European dwellings** are heated with **renewable source heating**

60%

Among the 126 million boilers installed in the EU, **60% of the heating stock consists of inefficient heating appliances (class C or lower)**

4%

The average replacement rate of the EU heating appliances is only 4% per year, covering essentially break-down situations.

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Key EU objectives

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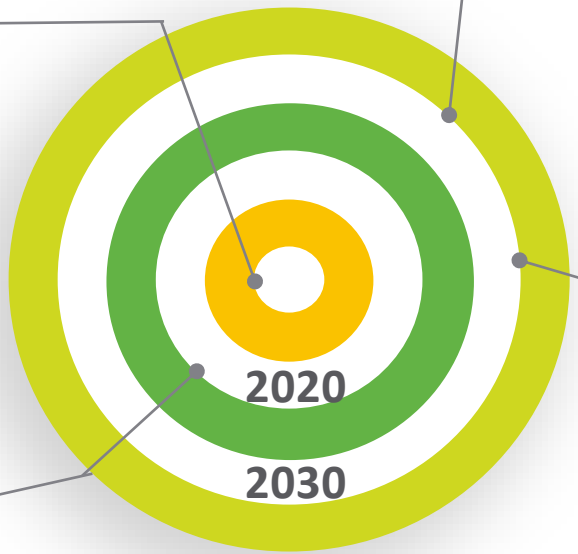
Key EU targets



20%

EU's **20% energy efficiency and renewable energy** target **by 2020**

32,5%

EU's **32,5% energy efficiency** target **by 2030**

32%

EU's **32% renewable energy** target **by 2030**

NZEB

From 2021, all new buildings must be nearly zero-energy buildings (NZEB)

It's imperative to tackle the most energy demanding need, heating.

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European approach

By using **more efficient heating appliances** and thereby consuming less, Europeans can:

- ✓ lower their energy bills
- ✓ help protect the environment
- ✓ mitigate climate change
- ✓ improve their quality of life and their indoor living conditions
- ✓ reduce the EU's reliance on external suppliers of oil and gas

To achieve these benefits, the European Commission has established the following legislative framework

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Legislative framework

- **European Green Deal** 'Renovation Wave'
- **Update of the Clean Energy for all Europeans package** 'Clean Energy package'

Energy Performance of Buildings Directive 2010/31/EU (EPBD)

2010

2012

Energy Efficiency Directive (EED) (2012/27/EU)

Clean energy for all Europeans package

Which amends the EED (2018/2002) and the EPBD (2018/844/EU)

2015

2016

Heating and Cooling Strategy (COM 51)

2019

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Most common heating solutions installed

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Most common heating solutions in Europe

Over **160 million space and combi heaters installed** and **93 million dedicated water heaters** in Europe

SPACE & COMBI HEATING

- ✓ The most common heating technology in Europe is the **gas boiler**, installed in approx. 57% of dwellings

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Most common heating solutions in Europe

WATER HEATING

- ✓ 70% of water heating appliances are electrical water heaters
- ✓ 18.5% of water heating solutions are gas instantaneous water heaters
- ✓ 7% are solar thermal solutions

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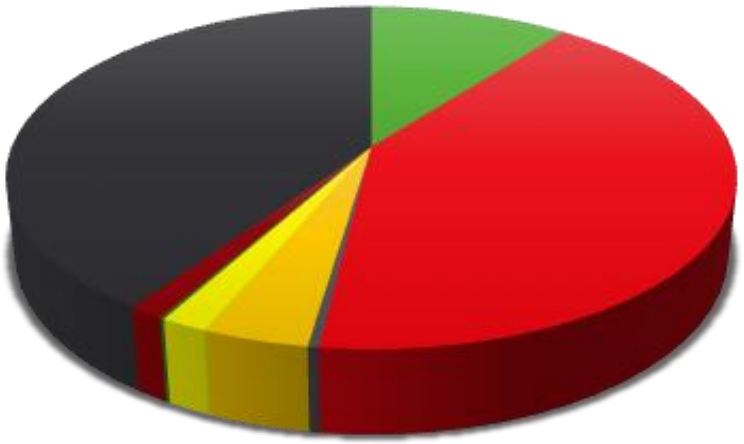
Most common space & combi heating solutions in Spain

The number of space heating units installed in Spain are 18.6M, **condensing gas boilers** being the most common heating technology:



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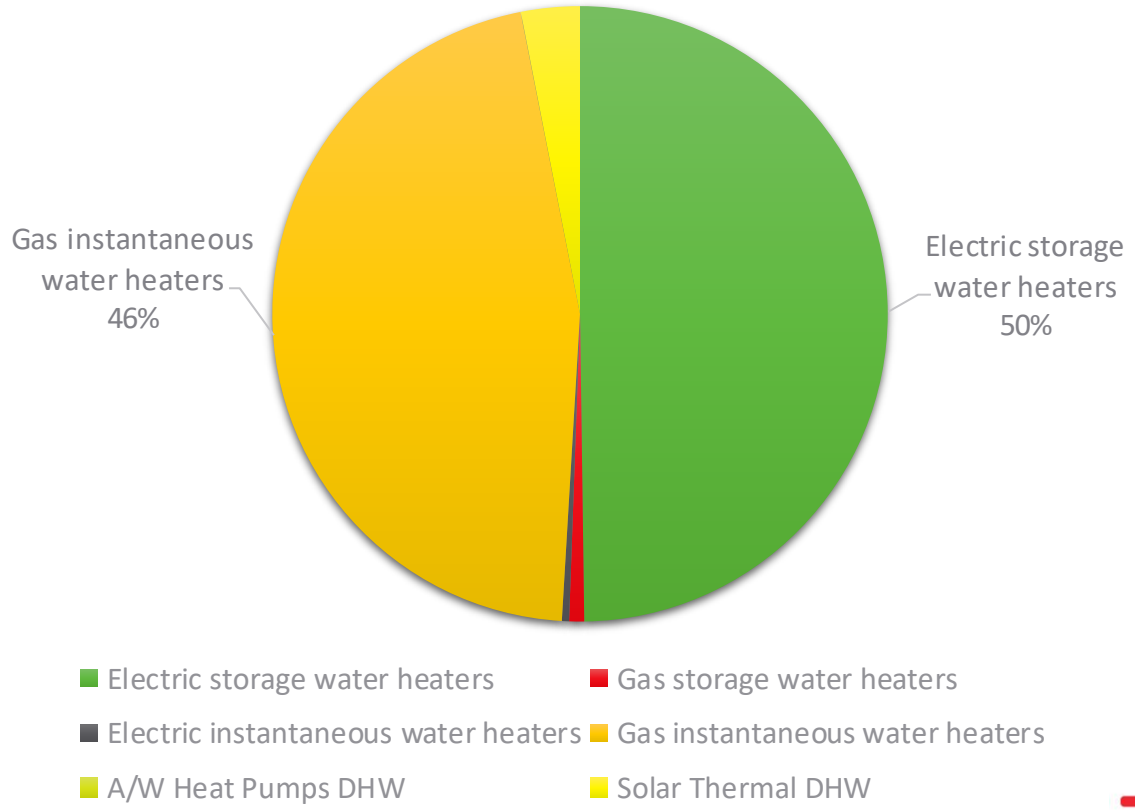
Most common water heating solutions in Spain

Spain has 14,6 million water heaters installed: 57% of the entire dwellings stock in Spain (25.6M) is provided with a water heating unit:



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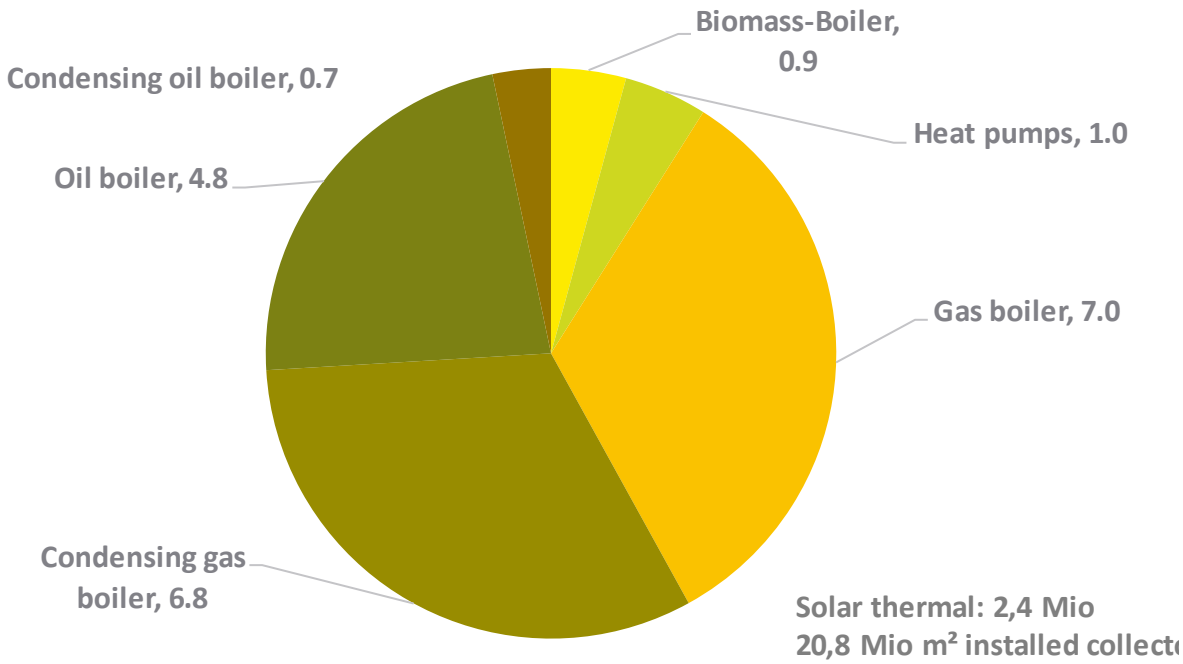
Most common space & combi heating solutions in Germany

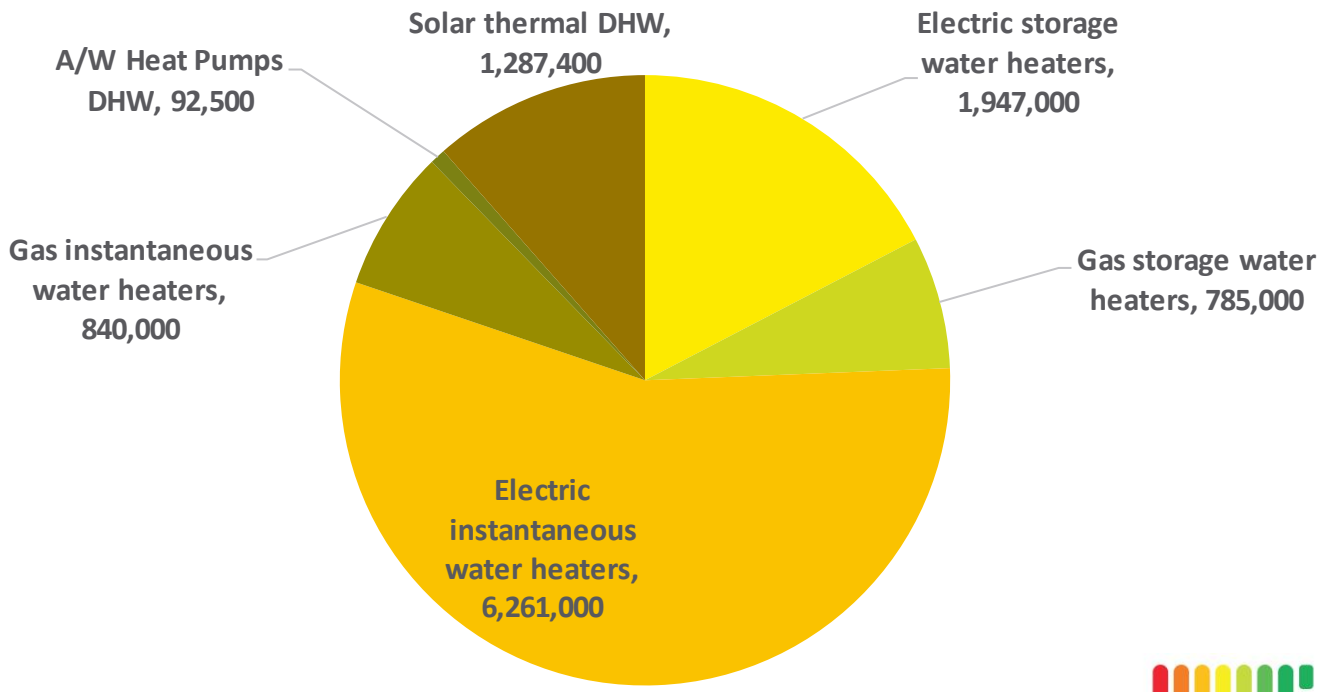
The number of space heating units installed in Germany are about 21.2 million
Gas boilers are the most common heating technology



HARP
Heating Appliances Retrofit Planning

Most common water heating solutions in Germany

More than 2/3 of the hot water is heated by central water heating systems, i.e., in combination with heat generators.
Germany has 11.2 million water heaters installed, see graph.



Prepared by VHK for the European Commission in collaboration with BRG Building Solutions, London (UK)
January 2019. 2016

HARP
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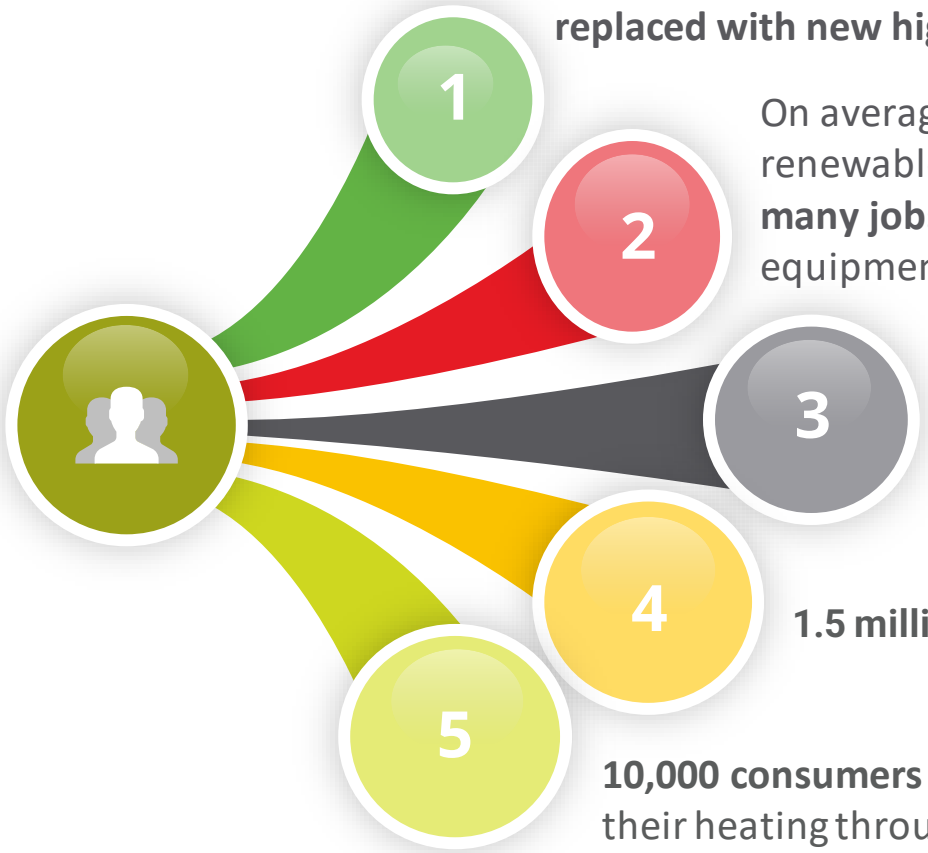
Renovation potential

HARP

Renovation potential



In total, **81 million inefficient installed units in Europe could be replaced with new high-efficiency devices.**

On average, the installation of **EE equipment** based on renewable energy is labor-intensive (**creating twice as many jobs** as conventional energy generation equipment)

Benefits go beyond cost savings:

- ✓ Improved air quality
- ✓ Noise reduction
- ✓ Higher market value of the building

1.5 million consumers expected to be reached

10,000 consumers could be motivated to replace their heating through HARP's initiatives

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Heating Appliances Retrofit Planning

MATERIALS FOR PROFESSIONAL TRAININGS

MODULE 2 - HARP Tool

HARP
Heating Appliances Retrofit Planning

Structure

- Module 0 – Introduction to the training programme
- Module 1 - Current situation of space heating appliances in Europe
- **Module 2 - HARP Tool**
- Module 3 - The HARP Tool. Covering the whole journey
- Module 4 - Embedding HARP to your clients

Summary

- Labeling existing heating appliances with the HARP Tool
- Energy demand and consumption
- New system savings

Labeling existing heating appliances with the HARP Tool

HARP

Aim

- Define an **energy label for old** space and water heating appliances for those that were in the market before the introduction of the energy label directive.
- Enable final users and professional to compare an old appliance's energy label with that of a new one.

The label output is:

- Efficiency for SH* appliances
- Efficiency for water heaters
- Energy class

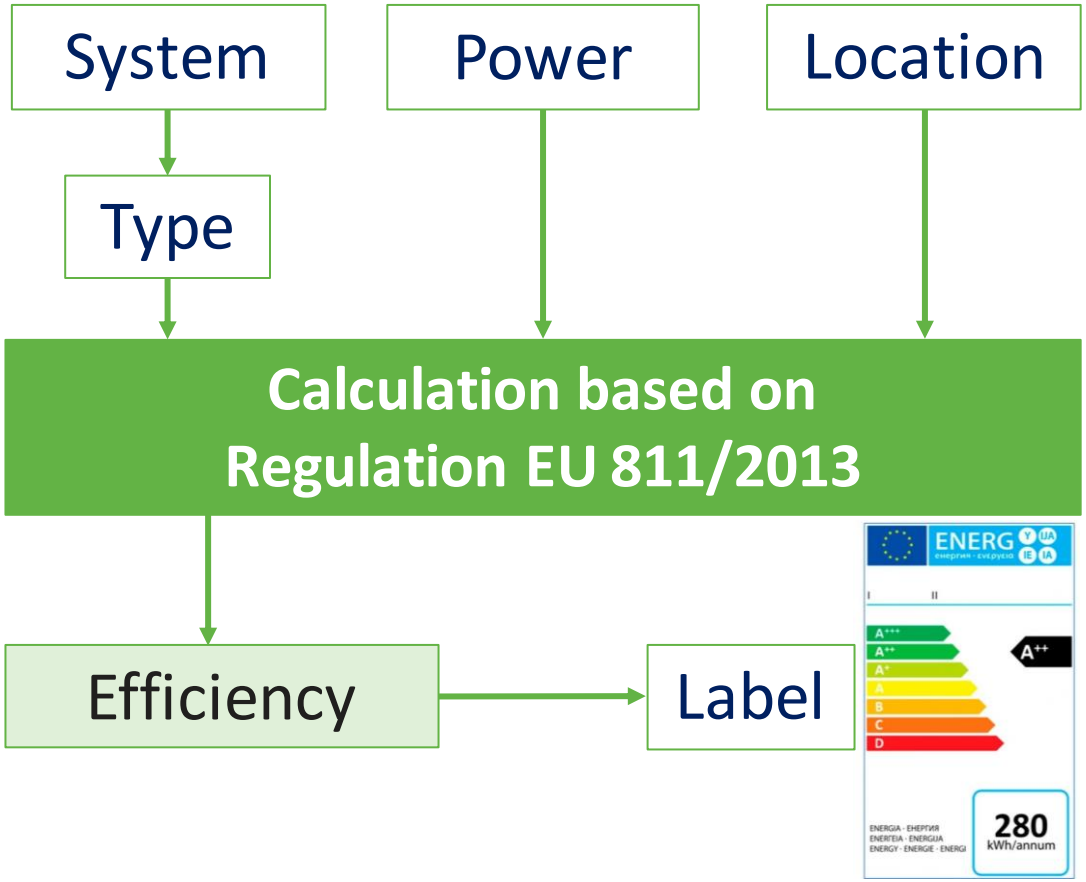
These values will be used in the HARP tool

*SH = Space Heating

Labeling appliances in the HARP tool - boilers

Two versions:

1. *One simplified for consumers*



Labeling appliances in the HARP tool - boilers

Two versions:

2. *A more accurate version for professional use*

In this version, the professional must enter technical characteristics about the boiler:

Useful efficiency at 30 %	η_{30}
Useful efficiency at 100 %	η_{100}
Standby heating loss	P_{stby}
The minimum	
The maximum	

Labelling appliances in the HARP tool – heat pumps

For the heat pumps, there is no significant differences between both versions; basic users and heating professionals will only have to choose the type of heat pump amoing the following options:

- Air to water
- Water to water

Energy Labelling for new SH appliances

Efficiency

From (included) [%]	To (excluded) [%]
150	
125	150
98	125
90	98
82	90
75	82
36	75

Classes

Source: Regulation EU 811/2013 – Annex II – Table 1

Calculation of the energy demand and consumption

HARP

Energy der tion

User input

Consumers will have to select Space Heating, DHW, or both, depending on their household

1. Space heating

2. DHW

3. Location:
- Germany
- France
- Italy
- Spain
- Portugal

4. Heating space - in square meters

5. No. Days (water heating)

6. Space heating system:
- Condensing boiler
- Non-condensing boiler
- Heat pump

7. SH and DHW fuel:
- Gas
- Electricity
- Oil

8. SH and DHW year of installation

9. DHW system
- Condensing boiler
- Non-condensing boiler
- Gas water heater
- Electric inst. water heater
- Gas inst. water heater
- Heat pump
- DHW heat pump

10. Type of building
- Single House
- Small Multi Family Building
- Large Multi Family Building

11. Building construction date
- Up to 1945
- From 1945 to 1970
- From 1971 to 1980
- From 1981 to 1990
- From 1991 to 2000
- After 2000

Energy demand and consumption

Information gathered

1. Space heating Energy demand (kWh/m^2)

- Location (Country)
- Type of building
- Building construction date
- Source: Building's load "Eurac"

2. DHW

- Location (Country)
- Users
- Nº of days
- Source: Spanish Technical building standard

3. System efficiency

- Source. Step 1

4. Energy cost

- Location (Country)
- Fuel
- Source: Eurostat (2019. S1)

5. CO_2 emissions

Energy demand and consumption

Outputs:

1. *Space heating energy demand (MWh / year)*

Space heating Energy demand (kWh/m²)	After 2000	From 1945 to 1970	From 1971 to 1980	From 1981 to 1990	From 1991 to 2000	Up to 1945
LOCATION ↓	BUILDING CONSTRUCTION DATE ↓					
United Kingdom	55	266	208	152	90	268
France	50	252	129	103	82	253
Spain	68	204	202	144	141	222
Italy	72	142	128	79	79	185
Germany	51	235	158	100	68	268
Portugal	68	204	202	144	141	222

Energy demand kWh/m² ✖ Heating space 〓 Energy demand (MWh/year)

Energy demand and consumption

Outputs:

3. *Energy consumption (MWh / year)*

Energy demand × System efficiency = Energy consumption (MWh/year)

4. *Energy cost (MWh / year)*

Country	Gas €/kWh	Electricity €/kWh
Portugal	0,0579	0,1103
Spain	0,0585	0,1889
United Kingdom	0,0451	0,1450
Italy	0,0507	0,1432
Germany	0,0472	0,1473
France	0,0526	0,1138

Energy consumption × Energy cost (€/kWh) = Energy cost (€/year)

New system savings

HARP

Energy demand and consumption

User input

1. Storage space available

- No
- Yes

2. Large garden/land available

- No
- Yes

3. Roof/Garden available

- No
- Yes

4. Gas network

- No
- Yes

5. Electricity capacity

- No
- Limited
- High

6. Selection criteria

- Energy bill savings
- Energy savings
- CO_2 savings

New system savings

Outputs:

1. Thermal power

Space heating Energy demand (kWh/m2)	After 2000	From 1945 to 1970	From 1971 to 1980	From 1981 to 1990	From 1991 to 2000	Up to 1945
LOCATION ↓	BUILDING CONSTRUCTION DATE ↓					
United Kingdom	40	128	98	76	55	128
France	44	150	90	75	63	151
Spain	57	124	122	99	98	140
Italy	67	107	100	73	71	149
Germany	45	130	93	67	54	144
Portugal	57	124	122	99	98	140

Max Power (W/m^2) ✖ Heating space 〓 Max Power (kW)

New system savings

Outputs:

1. Thermal power – Availability

The tool cross checks the requirements of each system and the characteristics of the user's home (roof, garden, gas network). The tool returns the systems which are technically available for the user.

Available heating solutions on the market	Roof available needed	Gas network needed	Energy capacity needed	Temperature limitations	Efficiency
Gas condensing boilers					
Gas condensing boilers. Natural gas (heating only)	0	1	0	0	98%
Gas condensing boilers. Natural gas (combi boilers)	0	1	0	0	98%
Gas condensing boilers. Biomethane (100%; combi)	0	1	0	0	98%
Gas condensing boilers. Hydrogen (100%;combi)	0	1	0	0	98%
Gas condensing boilers. Liquid gas boilers (LPG;combi)	0	0	0	0	98%
Oil condensing boilers					
Oil condensing boilers. Heating	0	0	0	0	95%

An example of part of the data that will be returned by the Excel tool

New system savings

Outputs:

2. System results

For every technically available system, the tool calculates:

1. Energy consumption = Energy demand (obtained in step 2)	5. Energy savings (kWh / year)
2. Energy cost = Energy consumption x Energy price (fuel)	6. Money savings (€ / year)
3. CO_2 emissions = Energy consumption x unit emissions (fuel and market)	7. CO_2 savings (ton CO2 / year)
4. Investment. Considering location, system and power	8. Investment costs

Considering the criteria selected by the user, the tool selects the optimum system

MATERIALS FOR PROFESSIONAL TRAININGS

MODULE 3 - HARP Tool. Covering the whole journey

HARP
Heating Appliances Retrofit Planning

Structure

- Module 0 – Introduction to the training programme
- Module 1 - Current situation of space heating appliances in Europe
- Module 2 - HARP Tool
- **Module 3 - The HARP Tool. Covering the whole journey**
- Module 4 - Embedding HARP to your clients

Summary

- How-to guide of the HARP tool for heating professionals
- The whole journey: entering the data on the HARP tool
- Understanding the results gathered by the HARP tool

How-to guide of the HARP tool for heating professionals

HARP

Aim

To define a clear how-to guide with heating professionals as the target audience.

The users of the tool should be able to:

- Introduce the current situation regarding the heating system they are working with.
- Understand the results offered by the tool.

Click to open the HARP online app

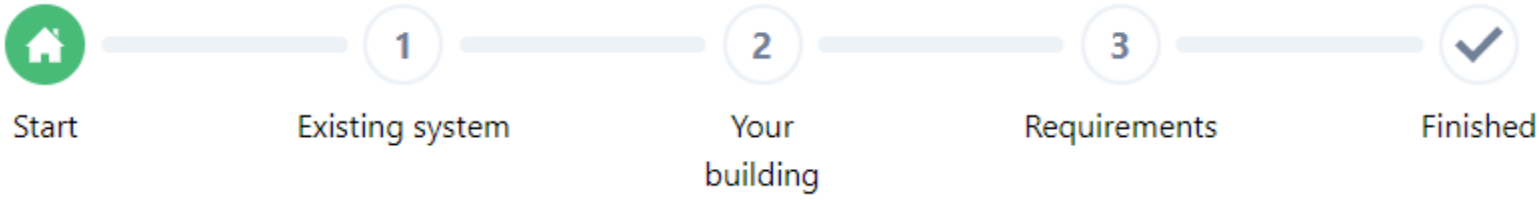
HARP

Tool stages

After answering some general questions, the HARP online tool goes through three main stages. In each of them the user has to introduce the required information.

The stages are:

1. Existing system
2. Your building
3. Requirements



The whole journey: entering the data on the HARP tool

HARP

The whole journey

User inputs:

General questions

When opening the tool, the user will see the first page, common to all users.

This first page overview will ask the user to introduce some basic information.

Next slides present each step in detail.

Figure 1.- First general view

The whole journey

User inputs:

Tool stages – Only water heating

1.1. Existing system - Water heater type

For this stage, users will be asked to introduce their system type, given the options in a dropdown list, as shown in Figure 2.

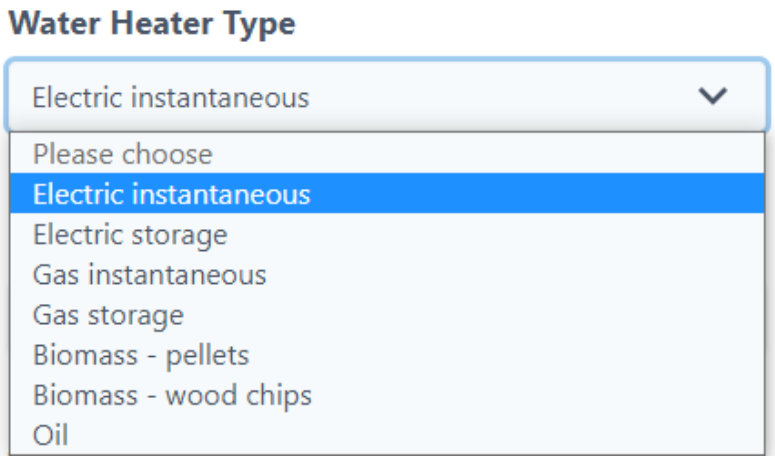


Figure 2 .-User´s existing water heater

The whole journey

User inputs:

Tool stages – Only water heating

1.1. Existing system - Water heater type

Figure 3 shows the next questions the user will have to answer, independently of the chosen water heater type.

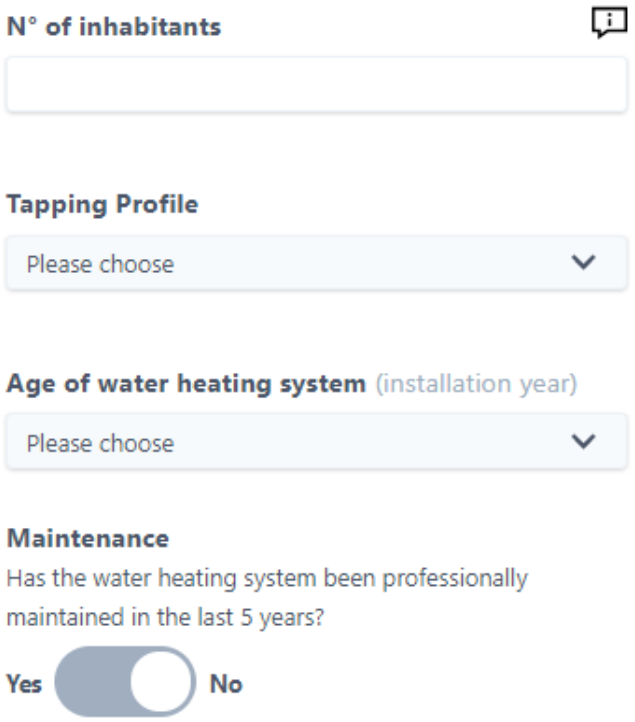


Figure 3 - User´s existing water heater characteristics

The whole journey

User inputs:

Tool stages – Only water heating

1.1. Existing system - Water heater type

Depending on the chosen type of water heater, additional fields can appear such as the ones shown in Figure 4.

For systems which have storage, the tool will ask for the storage volume in liters

When applicable, the tool will ask the nominal power and the full load efficiency of the system. These two fields can remain empty, the tool will provide results anyway.

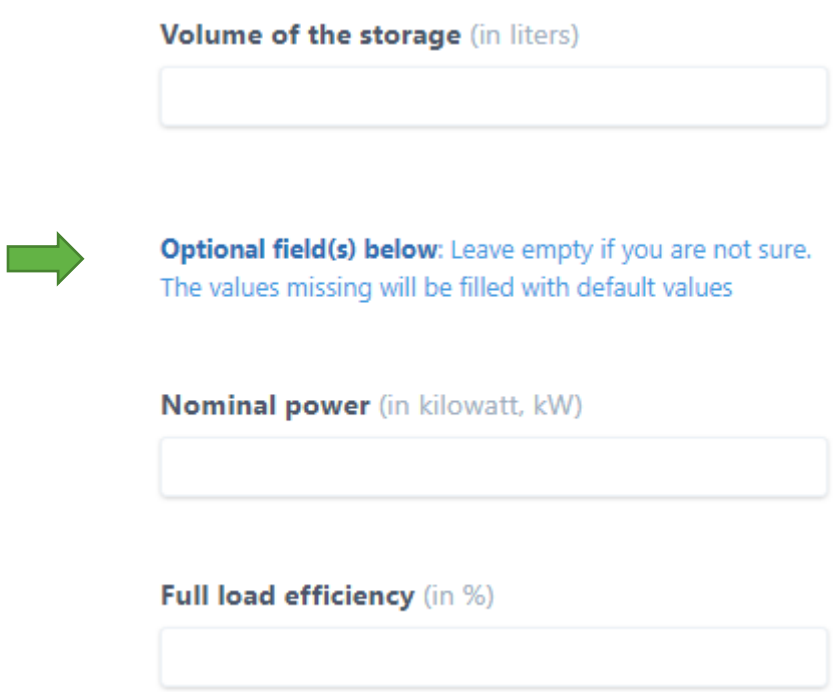


Figure 4 - User´s existing water heater additional characteristics

The whole journey

User inputs:

Tool stages – Only space heating

1.2. Existing system - Space heater type

For this stage, users will be asked to introduce their existing heating system given the options in a dropdown list, like in Figure 5 .

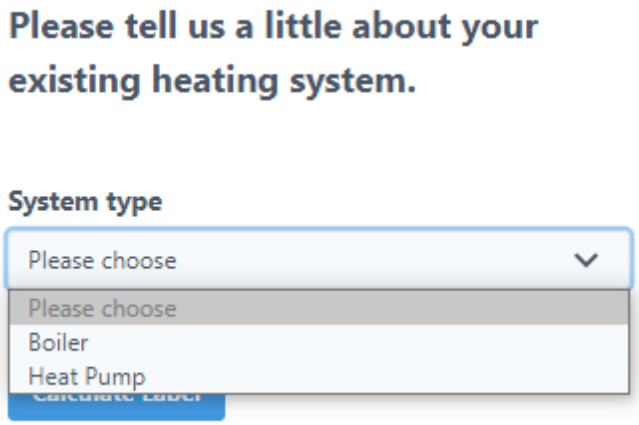


Figure 5 .-User´s existing heating system

The whole journey

User inputs:

Tool stages – Only space heating

1.2. Existing system – Space heating

Boiler

Figure 6 shows the next questions the user will have to answer if the existing system is a boiler.
For the energy source different options can be chosen.

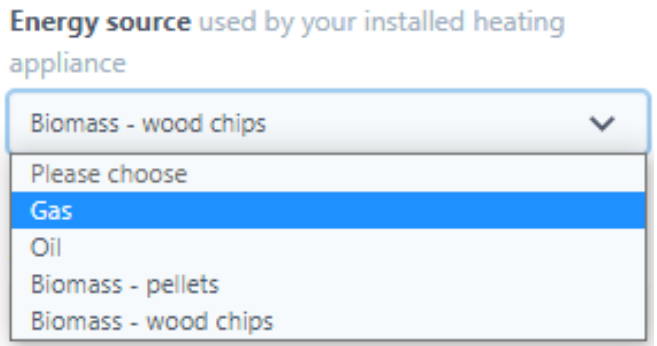


Figure 7 - Energy source options

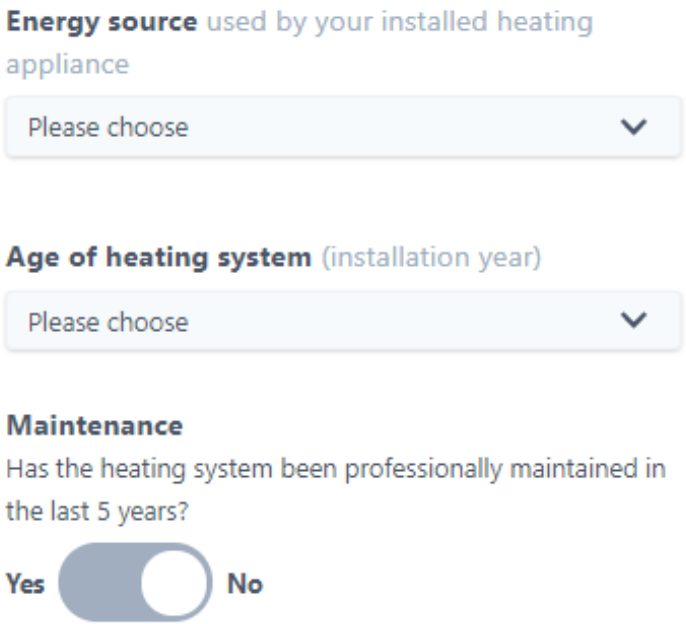


Figure 6 - Boiler's characteristics

The whole journey

User inputs:

Tool stages - Only space heating

1.2. Existing system - Boiler

Boiler

If the existing system is a boiler, figure 8 shows additional and voluntary questions the user will have to answer.
For the first question shown in Figure 8, there are three types of boilers the user can select (Figure 9).

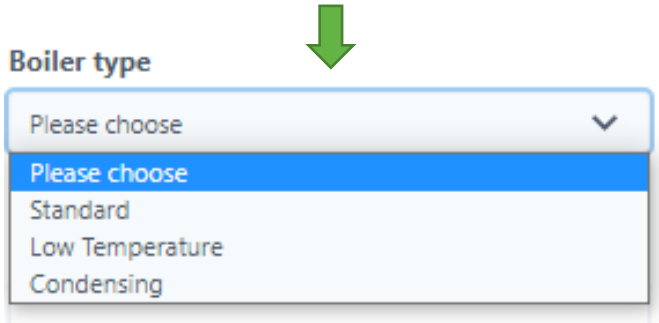


Figure 9 - Energy source options

Figure 8 - Boiler's characteristics

The whole journey

User inputs:

Tool stages - Only space heating

1.2. Existing system - Heat pump

Heat pump

Figure 10 shows the next questions the user will have to answer if the existing system is a heat pump.

For the first question shown in Figure 10, there are two types of heat pump from which the user can choose (Figure 11).

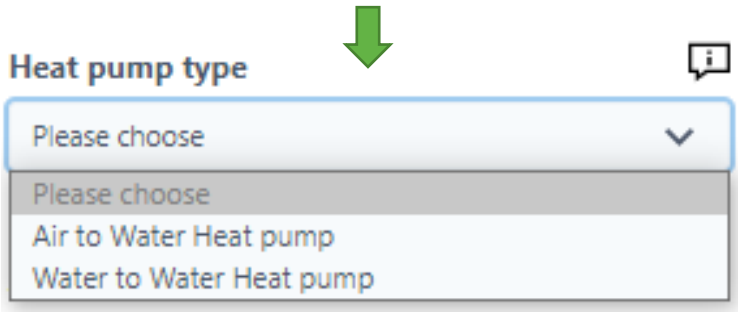


Figure 11 - Heat pump type

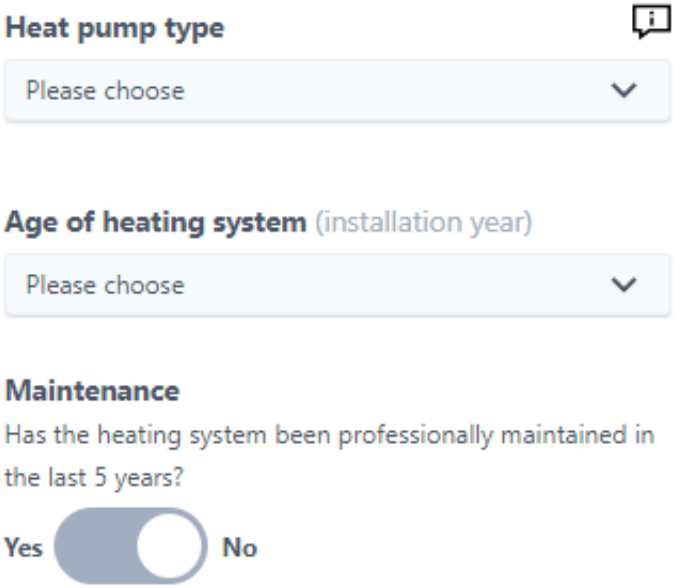


Figure 10 - Heat pump's characteristics

The whole journey

User inputs:

Tool stages - Space and water heating

1.3. Existing system - combi system

When selecting the combi system, questions shown in Figure 12 will appear.

Additionally, some optional fields can be answered

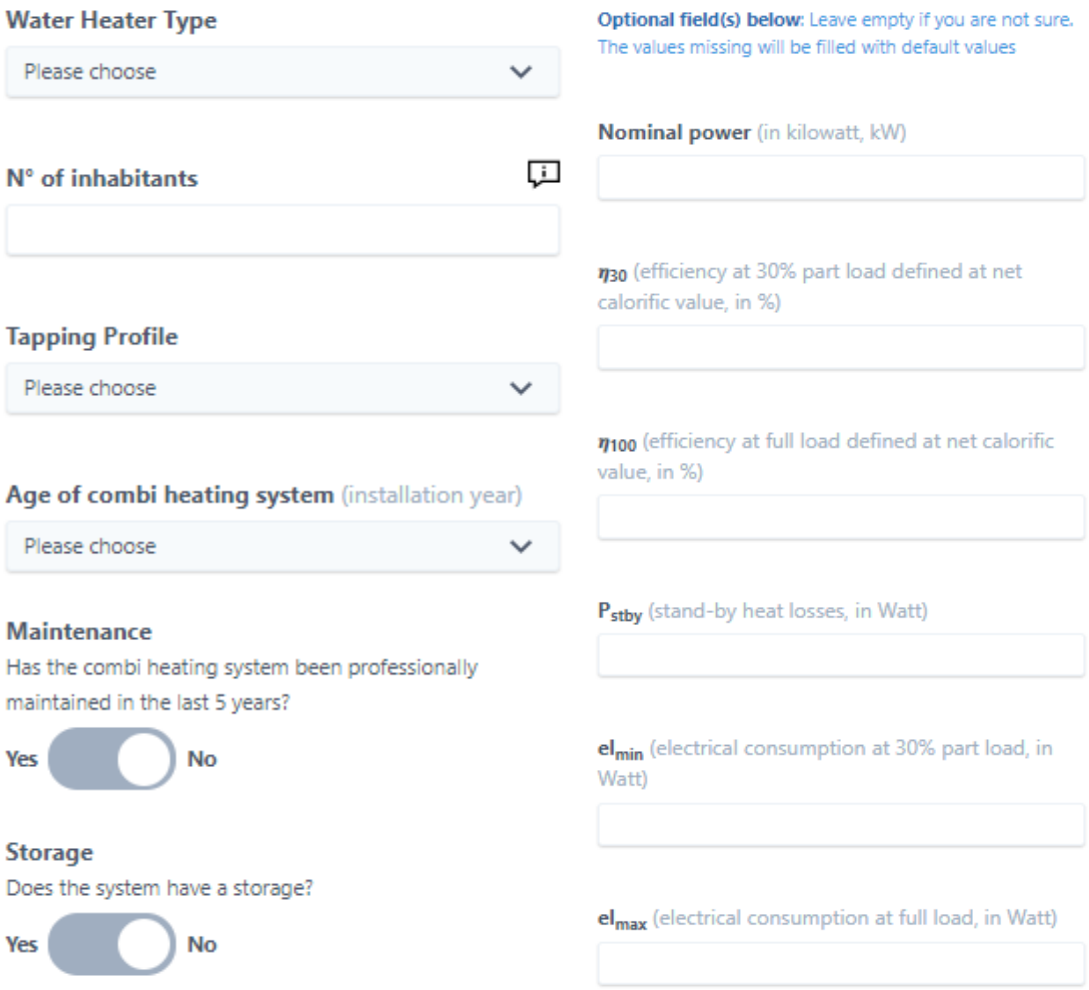


Figure 12 - Combi system characteristics

The whole journey

User inputs:

Tool stages - Space and water heating

1.2. Existing system - Two different appliances

When choosing the “Space and water heating, two different appliances” option, the tool will return two independent stages of questions:

Existing water heating system

The user will have to answer the same questions as for the “only water heating” option

Existing space heating system

The user will have to answer the same questions as for the “only space heating” option

The whole journey

User inputs:

Tool stages

1. Existing system - System type

After clicking the “calculate label” button, the tool provides the efficiency of the existing system and its energy class label, as shown in Figure 13.

Keeping this on mind, the user can click on the bottom below to continue with the simulation.

Calculate Your Options

Your existing boiler has an estimated efficiency of 65%, reaching an energy label class of D.

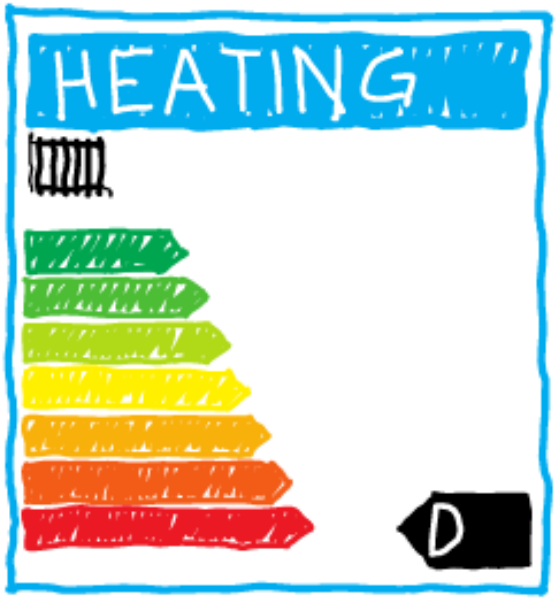


Figure 13 - Existing system: Label

The whole journey

User inputs:

Tool stages

2. Your building

At this stage, users will be asked to introduce some basic information about the building of the case of study.

First, they should choose a building type from the options given in Figure 15.

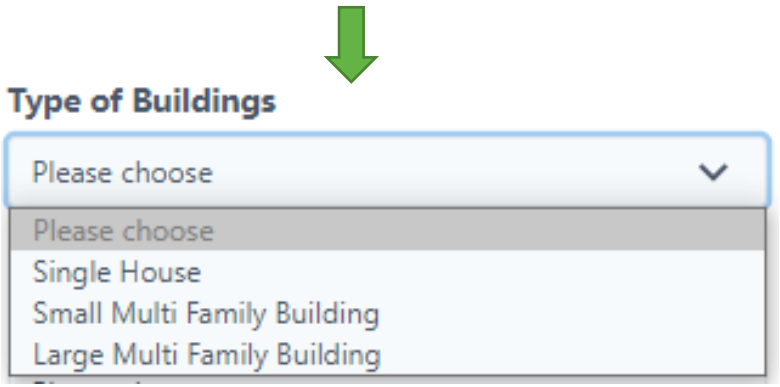


Figure 15 - Building: type

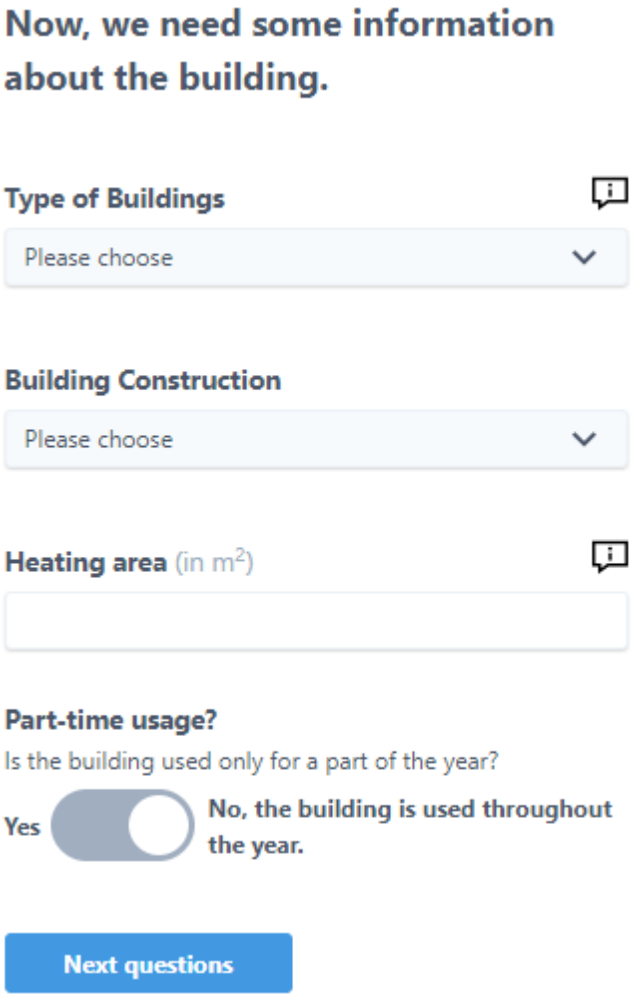


Figure 14 - Building

The whole journey

User inputs:

Tool stages

3. Requirements

At this stage, the users of the tool just have to answer the questions choosing “yes” or “no”. The answers to these questions have a direct impact on the given solutions.

When finished they can click the “Show Results” button to see the results of the simulation

Show Results

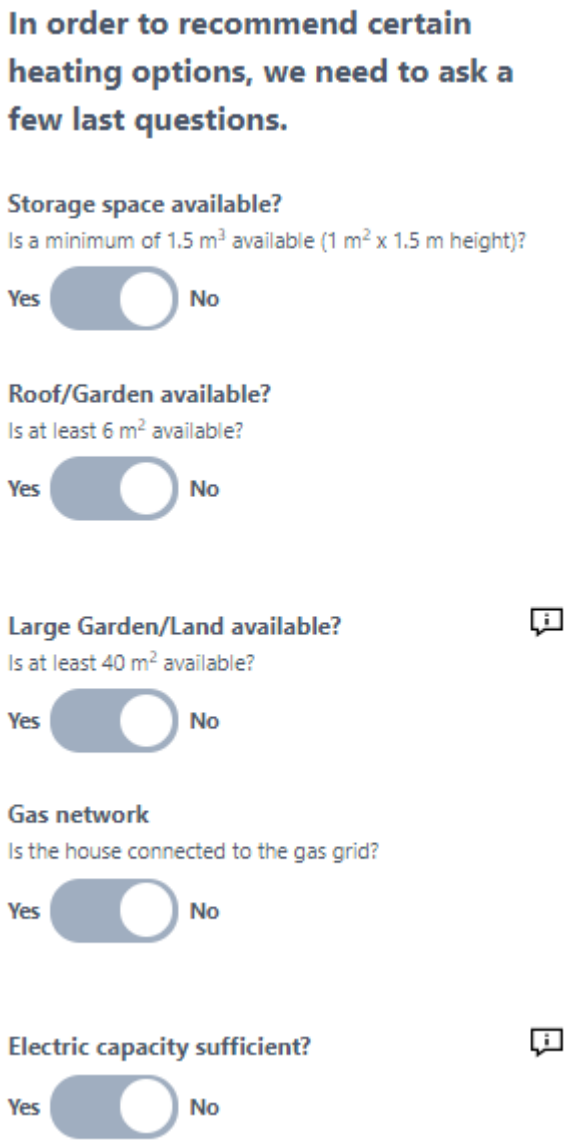


Figure 16.- Requirements

Understanding the results gathered by the HARP tool

HARP

Results

Tool outputs:

After clicking the “show results” bottom, users of the HARP tool will see the results for different technologies and their particular situation.

Figure 17 - Results

Results

Tool outputs:

Results can be seen in more detail by clicking on the "Full table" button and a table like the one shown in Figure 18 will appear.

Full table

It is possible to choose between the three options given in the blue tabs to see the table according to each one of them

Order by Energy Bill Savings | Order by Energy Savings | Order by CO_2 Savings

Technology	Energy	Energy bill savings [€/year]	Energy savings [kWh/year]	CO_2 savings [t/year]	Estimated label class
Biomass boiler	Biomass	68	-8,475	1.196	A
Condensing boiler	Gas	83	-7,458	-1.093	A+
Condensing boiler	Oil	-168	-7,819	-1.874	A

Figure 18 - Detailed results

Results

Tool outputs:

To amplify the information available for each of the technologies, users can click on the magnifying glass button that appears below each of them, and further information will appear for each of the technologies, as shown in Figure 19.

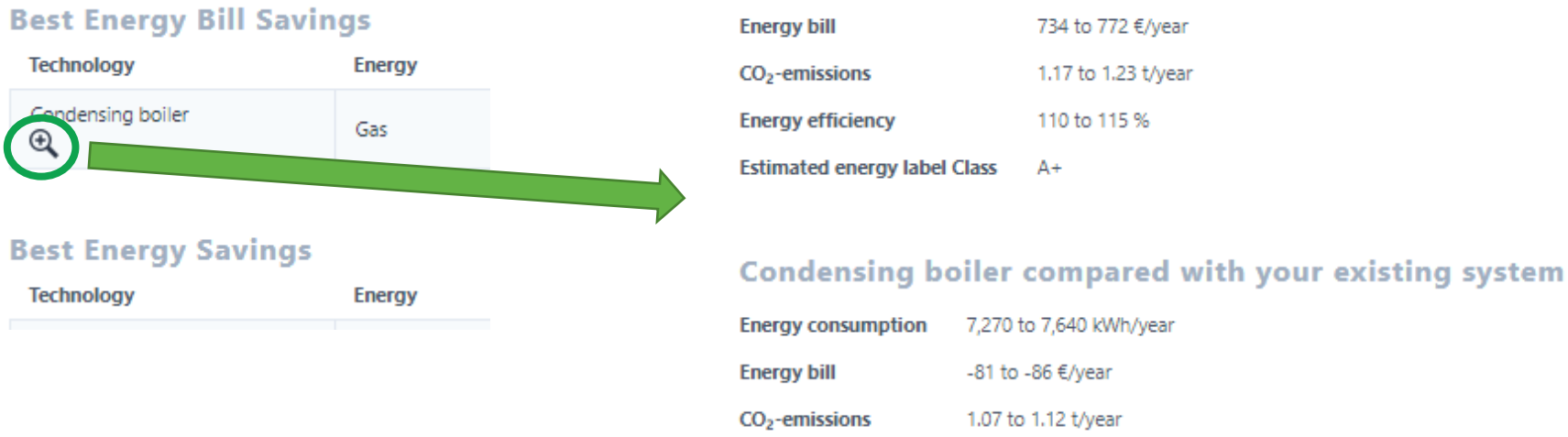


Figure 19 - Technology information

Results

Tool outputs:

By clicking on the "Get your new heating system" button the user will have access to:

- Financial incentives: the tool will give information on existing incentives.
- Installers/Heating professionals: the tool will give the user information on installers/heating professionals that he/she can contact.

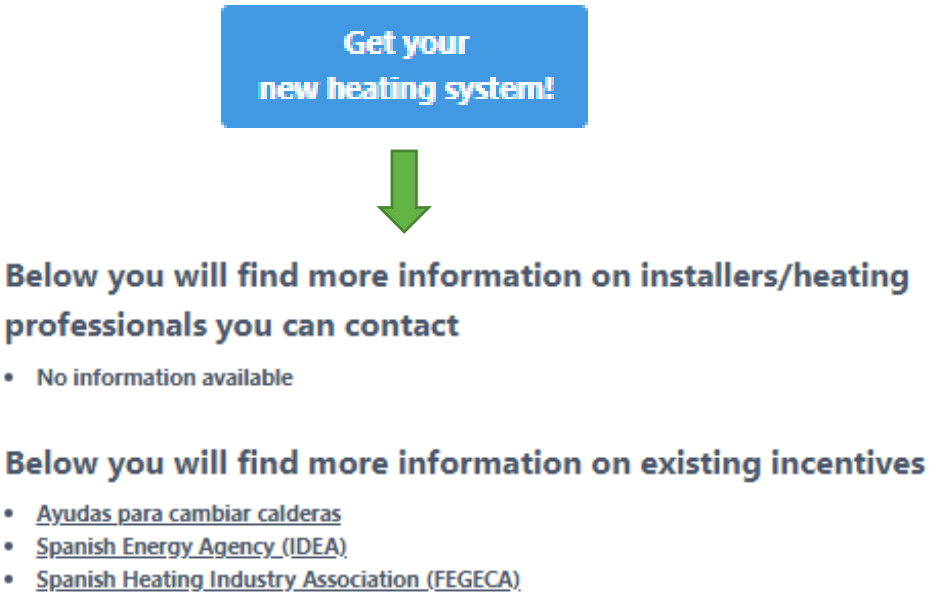


Figure 20.- Results options

Results

Tool outputs:

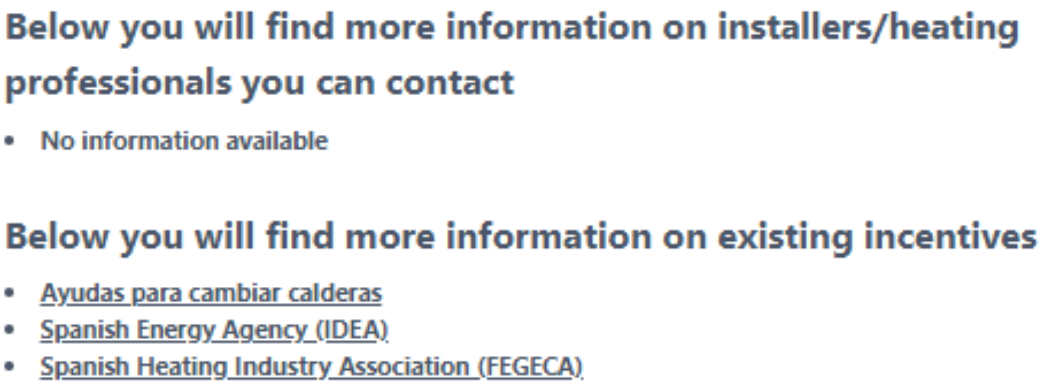


Figure 21 - Results options

By attending this course, you will be able to appear in the professionals contact list of the HARPa tool

Results

Tool outputs:

There is a remote possibility that the program is not able to present any viable option. This can happen if the building does not have any storage capacity, garden, gas network available nor sufficient electric capacity. This is highly unlikely, but Figure 22 shows what the tool would return in this case.

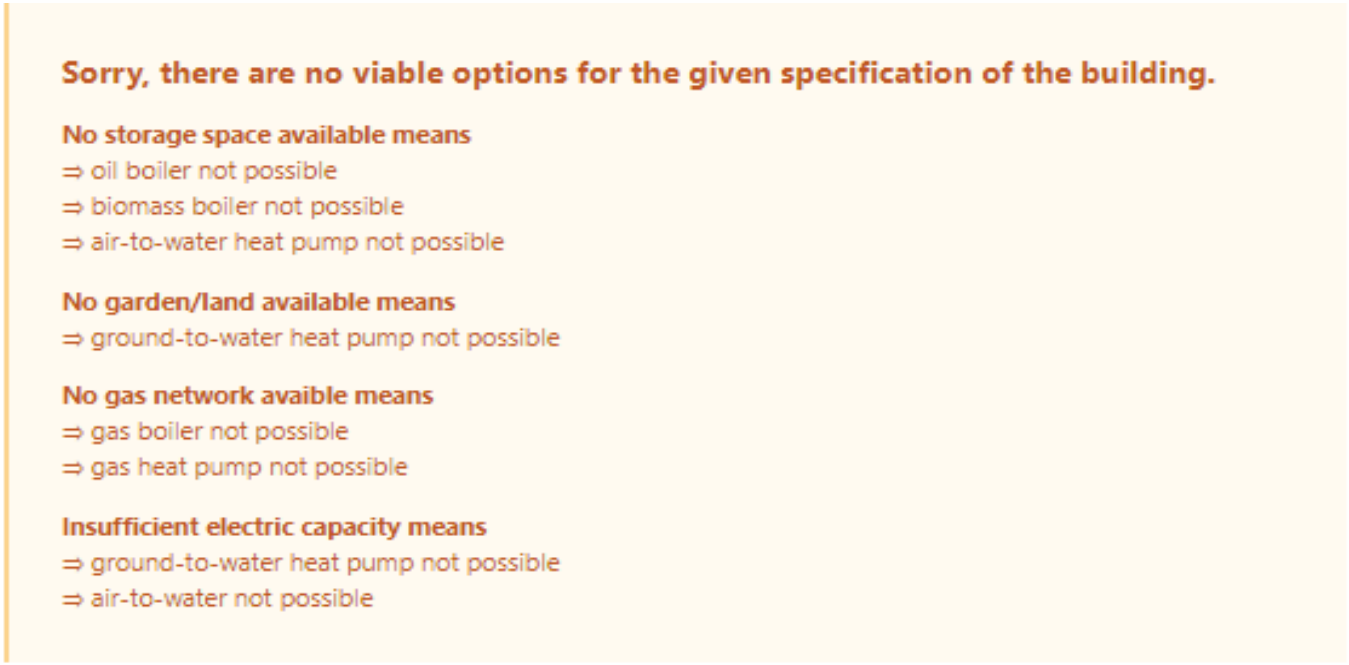


Figure 22 - No viable options

MATERIALS FOR PROFESSIONAL TRAININGS

MODULE 4 - Embedding HARP to your clients

HARP
Heating Appliances Retrofit Planning

Structure

- Module 0 – Introduction to the training programme
- Module 1 - Current situation of space heating appliances in Europe
- Module 2 - Labelling existing heating appliances with the HARP Tool
- Module 3 - The HARP Tool. Covering the whole journey
- **Module 4 - Embedding HARP to your clients**

SUMMARY

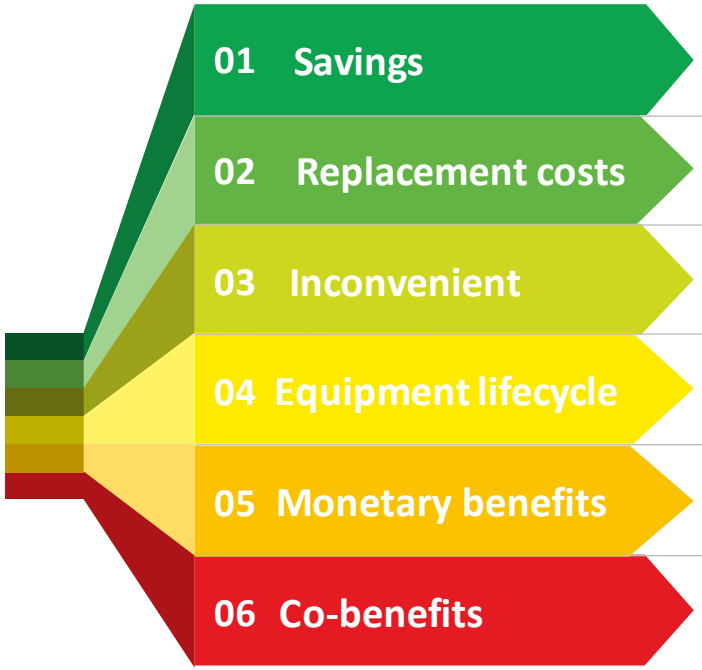
- Consumers’ concerns
- Professionals, the preferred information channel
- Customer service
- Motivating replacement
- Conclusion

Consumers' concerns

Consumers' concerns

In order to prompt consumers' behavioural change, HARP professionals need to have a detailed understanding of consumers concerns and the benefits of the energy efficiency heating solutions

Consumers' concerns & drivers for replacement



- Differences in the costs of the old fuel vs. new fuel
- Economical energy savings

- Purchase of equipment
- Installation costs

- Depending on the conditions, some heating solutions can be perceived as uncomfortable or unesthetic

- Operational costs
- Maintenance costs (frequency of possible breakdowns, price of periodic revisions, etc)

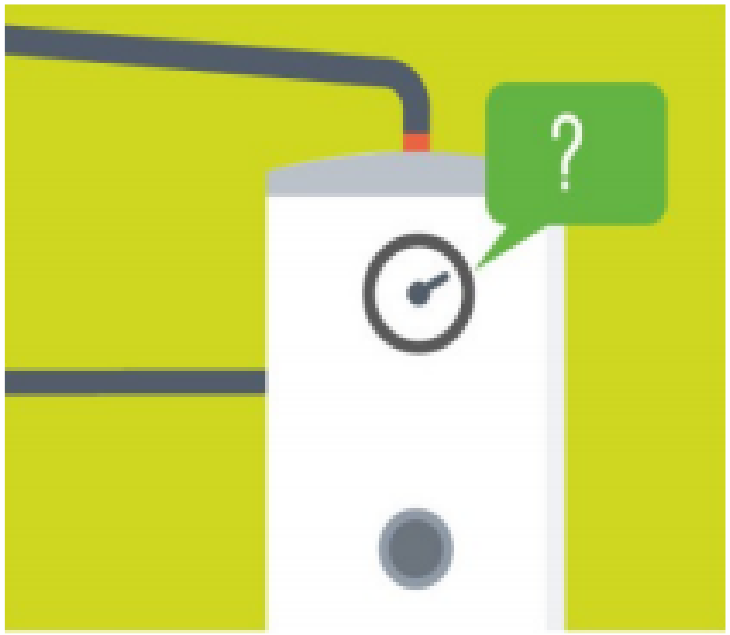
- Revaluation of the property
- Subsidies
- Guarantees

- Noise reduction
- Space improvement
- Improved indoor air quality

Professionals, the preferred information channel

HARP

Professionals, the preferred information channel



- **Most consumers are not informed** about the efficiency of their installed heating systems
- **When acquiring** new heating systems, customers **rely mostly on professionals** when a **maintenance** relationship is in place and on sales agents when going for replacements or new acquisitions
- The **lack of awareness, information and advice** on the technical possibilities and the actual energy costs can be one of the key factors for the low replacement rate of space and water heating appliances

When to talk with consumers? Break-down situation

1. **BREAK-DOWN SITUATION**

- Provide an overview of all the heating solutions available on the market in order to identify the most adequate technology to meet the consumer's needs, indicating the energy efficiency class of the solution

Overview of solutions

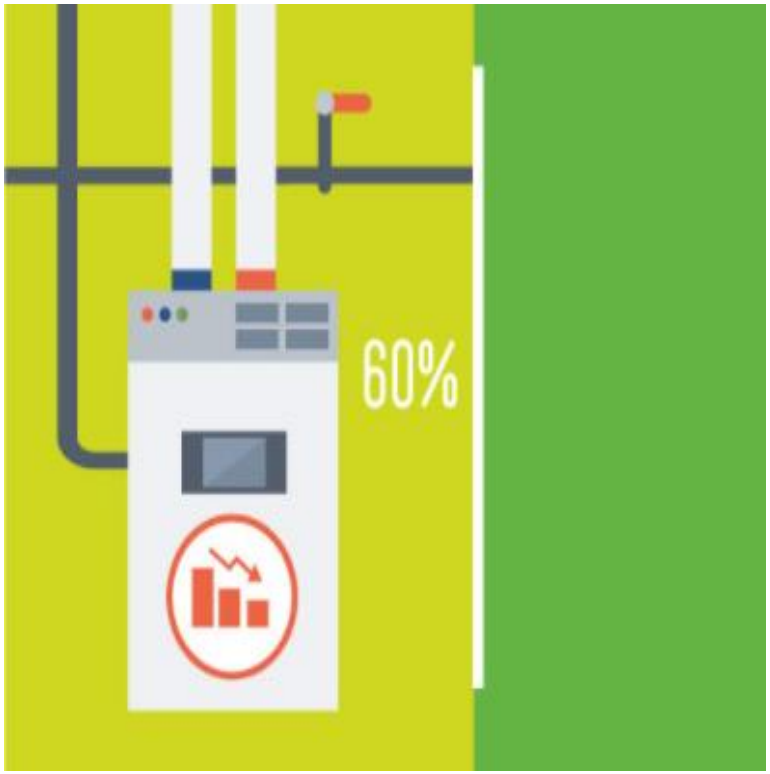
There are a large number of energy efficient heating solutions for all kinds of budgets and situations:

- ✓ Heat pumps
- ✓ Solar Thermal
- ✓ Hybrid heating system
- ✓ Biomass boiler
- ✓ Direct Electric Heating
- ✓ Condensing oil boiler

When to talk with consumers? Maintenance/audit/inspection activities

2. MAINTENANCE/AUDIT/INSPECTION ACTIVITIES

- Exploit the energy label
  - ✓ Calculate and present the label for the existing heating solutions and raise consumers' interest
- When evaluating the replacement opportunities of an appliance, support the consumer by using HARPa and additional information resources provided in the professional's toolbox
  - ✓ Which is the most suitable heating solution?
  - ✓ Potential energy and cost savings
  - ✓ Co-benefits such as improvement of indoor quality, noise reduction, CO_2 emission reduction…
  - ✓ Possible subsidies



At European level, 60% of the installed stock consists of inefficient heating systems.

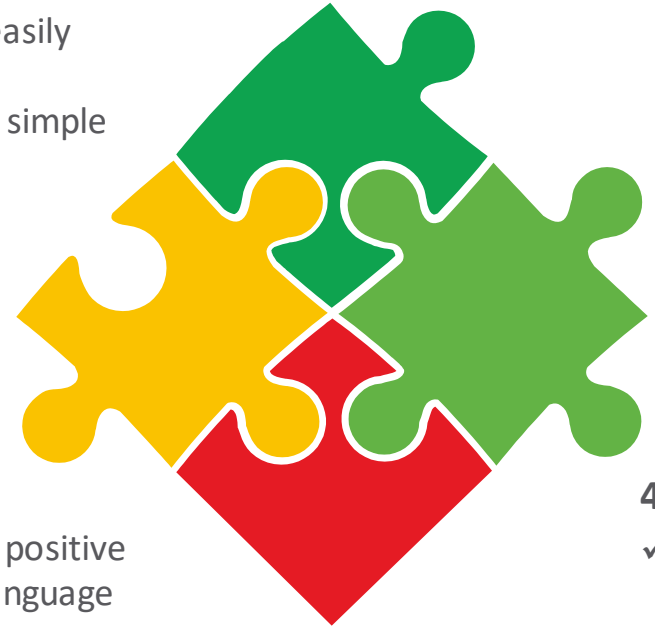
Customer service

HARP

How to talk to consumers?

1. Use clear communication skills

- ✓ Provide effective and reliable quantitative data which can be easily understood by the customer
- ✓ Translating technical details into simple and user-friendly language



2. Always address your customer by their name

- ✓ You will appear more competent
- ✓ It helps to build loyalty
- ✓ People tend to like you more

3. Use positive language

- ✓ Steer the conversation toward a positive outcome with the use positive language
- ✓ Focus on the solution.
- ✓ Consumers do not care about what you cannot do; they want to hear what is going to be done

4. Have empathy

- ✓ Emotions are often more important than facts
- ✓ Put yourself in the shoes of your customer and try to address their concerns with a deep understanding of what they are going through and what their needs are

The importance of customer service

- **GREAT RESPONSIBILITY**: Most people do not think about their heating appliance until it breaks down. Professionals should engage customers to consider their heating systems regularly and start to compare, plan, and choose the solution that fits them best
- **BUILD LOYALTY**: Be part of the European heating community and build trust for future maintenance services
- **STANDARDIZATION OF THE ASSESSMENT PROCESS FOR HEATING APPLIANCES**: in order to facilitate technical designs, and for performance assessment
- **WORD OF MOUTH**: is the most trusted communication channel; it can be a differentiating factor from competition

Motivating replacement

HARP

Huge dissemination campaign

Through HARP initiatives

1.5 million consumers expected to be reached

60% of the heating stock can be replaced since it consists of inefficient heating systems (class C or lower)

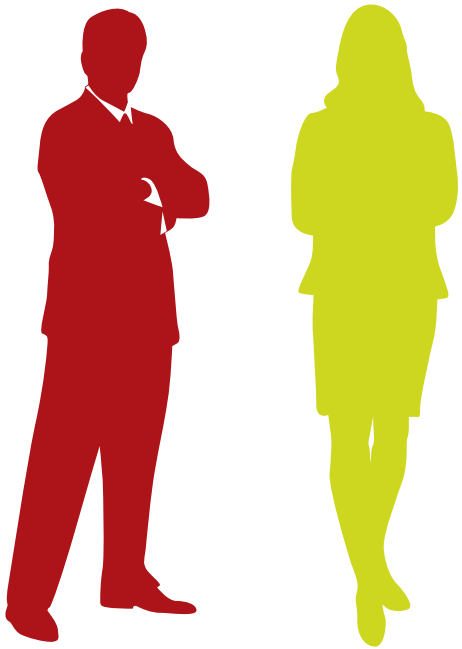
10,000 consumers could be motivated to replace their heating system

Significant efforts will be made to reduce the information gap between consumers and professionals, targeting the development of professionals' competences (via **training activities**) and **consumers perceptiveness (reached out to** via **consumer organizations, energy agencies and market associations**)

National Heating Community

The consumer will have access to the **National Heating Community**, namely providing:

1. Direct contact to **professionals** who have committed to the HARP trained professionals program and can assist customers in acquiring new heating solutions



2. Access to information on the **incentives** made available by the national authorities in the country

Conclusions

- Greater **awareness, information and advice** on the technical possibilities and actual energy costs **would support the** current low **replacement rate** of inefficient heating appliances (4%).
- HARP will create a **National Heating Community** where consumers will have access to **HARP trained professionals**
- **Professionals play a key role in the consumer decision-making process** by providing:
  - ✓ An overview of the most efficient alternatives available on the market
  - ✓ A list of other co-benefits beyond energy and costs savings
  - ✓ Information about the national current public subsidies for the replacement of heating appliances

Thank you for your attention!

Follow us!

heating-retrofit.eu

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