HARP

Heating Appliances Retrofit Planning

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VERSION	DATE	CHANGE
0.1	30/11/2021	Initial ToC
0.2	29/12/2021	Including interviews inputs
0.3	25/01/2022	Starting drafting main conclusions
0.4	18/03/2022	2nd round of interviews with national partners
0.5	05/05/2022	Restructuring the inputs and own policy and subsidies analysis
0.6	04/06/2022	Modification after 7th GA discussions
1.0	30/06/2022	Final version

ABBREVIATIONS AND DEFINITIONS

ABBREVIATION	DESCRIPTION
BAFA	Federal Office for Economic Affairs and Export Control
BEG	Federal Promotion for Efficient Buildings
BMWI	Federal Ministry for Economic Affairs and Energy
DHW	Domestic Hot Water
ELPRE	National Long Term Renovation Strategy
EnVKG	Energy Consumption Labelling Act
EPBD	Energy Performance Building Directive
EPC	Energy Performance Certificate
EPREL	European Product Registry for Energy Labelling
GSE	Gestore Servizi Energetici
NAPE	National Action Plan on Energy Efficiency
NECP	National Energy and Climate Plan
WP	Work Package

EXECUTIVE SUMMARY

This report analyses the legislative framework in place in the countries participating in the HARP project (Germany, France, Italy, Spain and Portugal) with regard to energy labelling of existing heating appliances. Furthermore, it investigates and describes those methodologies already in place in the same countries, providing feedbacks based on the experience so far.

In **Germany**, an extensive and long-lasting subsidy scheme is available for the replacement of heating appliances with more efficient technologies. It is managed by BAFA, the Federal Office for Economic Affairs and Export Control. Regular inspections of chimneys are foreseen at least once per year.

A labelling methodology of existing heating appliances is already in place. It is promoted by the government and is mandatory. Chimney sweepers are supposed to calculate and issue the label, which addresses only space heaters. The methodology is conceived in a way that the professional issuing the label also provides the end-user with technical information on possible alternatives to the currently installed system. The relatively low reward for this service seems a hindering factor. Another relevant feedback is that the awareness about low efficiency of the heating device does not seem to be a major driver. What really seems to tackle replacement is the availability of incentives.

In **France,** two main subsidy schemes are available to help renovate French houses: the "Maprimerénov" and the "Prime CEE".

Yearly maintenance is mandatory for heating appliances, according to decree N°2009-649. This applies to gas, liquid and solid fuel boilers (therefore including biomass, fuel, gas wood chips…).

A voluntary labelling mechanism is in place, developed and promoted by Coénove and Energies et Avenir. It is called *Mon Étiquette Chaudière*. The total number of issued labels is below expectations, but shows that the approach is convincing.

It is worth mentioning that several market players in France have introduced autonomously heating energy labelling services. The most relevant are Engie, Effy and Total).

Italy has a large variety of subsidy schemes, mainly managed by two different public entities. ENEA is in charge of fiscal deduction mechanisms targeting renovation and energy improvement of existing buildings, which cover also the replacement of heating systems. GSE is in charge of Conto Termico, which among other interventions (e.g. energy improvement of the envelope), also addresses heating and cooling systems.

Domestic boilers are subject to periodical inspections. A compulsory plant booklet must be also issued at the installation or during the first maintenance. Better standardization of the booklet is expected in the next years.

A voluntary labelling system promoted by Assotermica is in place. It focusses on space heating and neglects DHW. A past survey from Assotermica among professionals showed that a significant share of interviewees considers the labelling of installed appliances an improvement of the current legislation.

Similar to Italy, also **Spain** has several subsidy mechanisms in place (Real Decreto 691/2021, Real Decreto 853/2021 and Real Decreto 477/2021). The "Código Técnico de la Edificación" defines the technical requirements for building energy efficiency retrofitting activities and also includes recommendations for heating systems replacement.

A voluntary labelling methodology is in place, developed by FEGECA (the national association of heating appliances manufacturers). This labelling system is however not widespread in the country and is not known by most installers. It is intended to be issued by the technical service of the heating systems manufacturers during the maintenance activities. For the sake of easiness, only boiler age and boiler technology are taken into account in the calculation of the label.

In **Portugal**, one of the pillars of the national energy and climate plan is to address households' energy refurbishment. The two main incentive schemes in place are Fundo Ambiental - targets all households owners - and Vale Eficiência - exclusive for energy challenged households, thus targeting energy poverty. Applicants do not have to provide any information regarding the heating appliance to replace and expected savings are not estimated. ADENE aims to include the labelling of existing heating appliances in the incentive programmes, establishing the baseline below which the existing appliances shall be considered inefficient and prioritized for funding.

No mandatory maintenance procedure for residential boilers is in place, but a legal obligation for building owners to ensure inspection of the gas network in the building exists and this should be done by a certified professional.

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1 PROJECT SUMMARY

The HARP project, Heating Appliances Retrofit Planning, created a labelling methodology for the calculation of the efficiency of installed residential heating appliances. This methodology is embedded in HARPa, a web application which is being used by end-users and professionals during the project duration. The goal, in both cases, is to raise end user awareness of the opportunities that underlay the planned replacement of their old and inefficient heating appliance. It has been shown (T5.3) that informing the end users regarding the energy (in)efficiency of their current heating equipment and the saving opportunities that derive from its replacement, can help to accelerate the European replacement rate for heating systems. HARP accompanies the end user decision process, providing an impartial message, based on the energy label and presenting the market solutions that respond to the end user'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. In parallel to the support given to the end users, the consortium studied the policy and market framework in the HARP countries, the existing national labelling methodologies for installed heating appliances and the potential gaps that HARPa can cover with its endorsement at public/private level. WP6 developed this analysis, to understand the national framework conditions (Task 6.1), provide suggestions for HARP endorsement at public/private level in the HARP countries (Task 6.2) and create a long-term sustainability plan for the integration of HARPa at national level (Task 6.3).

1.1 Relationship with other WPs

The need for a widely used methodology and online application for existing heating appliances labelling is at the centre of HARP. Starting from WP3, in which the methodology was developed and the HARPa tool planned, HARP had an EU vision since the calculation methodology was created following the existing EU labelling scheme for new appliances. Together with the national activities performed by the national partners in the two heating campaigns (WP4 – Task 4.4), Task 6.1 analysed the existing drivers and barriers related to the implementation of a labelling methodology in existing policy measures and incentives, discussing with local and regional stakeholders the motivations for this potential integration. The best practices from the two heating campaigns are also the basis for the policy suggestions provided in Deliverable 6.2. The data coming from the WP5 related to the utilization of HARPa, gives an understanding of end users' and professionals' willingness to use the app and increase their awareness of the potential alternatives in the heating market. For example, knowing when the users dropped off in the application use, present to the HARP partners the reasons that are the most important for the users when deciding to replace their heating system (e.g. availability of incentives). Thanks to all these different inputs, Deliverable 6.1 can provide an in-depth overview of the political framework in the HARP countries to then be able to support the endorsement of HARP at the national level during the last phases of the project and after it. Given the European commitments on increasing energy efficiency and to increasing fossil fuel costs, heating systems are on top of the agenda of the EU countries. The HARP methodology is a tool for Member States and/or industry associations to support the increasing replacement of old and fossil-fuels based boilers with more efficient renewable energy solutions.

1.2 Methodology for the development of Deliverable 6.1.

Deliverable 6.1 aims to provide an in-depth analysis of the political and market framework related to heating appliances in Germany, France, Italy, Spain and Portugal. Initially, the existing policy/subsidies framework in the five countries is presented (Section 2). Then, the current existing labelling

methodologies (if any in place) for already installed heating appliances are presented (Section 3) and their pros/cons analysed comparing them to the HARP methodology. The analysis serves among others to understand if an EU unified methodology that can be applied in the different member states. Section 3 presents the list of private and public stakeholders who are involved in the heating sector and how the national partners interacted with them to understand their feedback on HARPa and their willingness to support its endorsement at the national/regional level (interviews with local actors). Section 4 presents the output of Deliverable 6.1, a matrix of technical and non-technical factors that can facilitate the use of HARP results in the HARP countries after the end of the project. The performed analysis is made country-by-country to allow the reader to understand the different national framework conditions. This approach permits to have an in-depth understanding of each national framework and, at the same time, evaluates the differences between countries and specifies the potential exchange of practices and opportunities between them. This cross-country exchange of information is fundamental for the development of policy suggestions and HARP handover in Deliverable 6.2.

2 LEGISLATIVE AND MARKET FRAMEWORK FOR THE RESIDENTIAL HEATING SECTOR IN THE HARP COUNTRIES

In the HARP countries, there are different national strategies for implementing energy efficiency measures in residential and commercial buildings. Clearly, the renovation of heating systems is or should be part of these broader measures. This section provides an in-depth study of the existing legislative and market frameworks and procedures in place, which could be exploited to introduce HARP in each country. Information related to market monitoring (if existing) and the most related subsidy/incentive programmes are also provided. Market monitoring is meant here as monitoring activities of issued labels (e.g., how many, which typologies of devices have been labelled etc). A critical analysis of the policy framework's suitability for the public endorsement of HARP is provided, including a set of broader policy measures which include energy efficiency of heating systems and drivers and barriers that can facilitate or delay HARP goals reach. European-wide policies transposed in National plans, such as the NECP (National Energy and Climate Plan), the EPBD (Energy Performance Building Directive), Plans to fight Energy Poverty, Renovation Passports and National Building Energy Certification Schemes are clearly at the centre of the analysis, being the broadest measures on energy efficiency applicable to each HARP country. In order to evaluate the effectiveness of the national policies and subsidies in place in the HARP countries, HARP partners have been asked if any kind of market activity is in place in the project countries which can provide results assessments for the current methodologies and incentives for the retrofitting of heating appliances, and with which budget this is carried on. Furthermore, details related to the maintenance procedures of heating systems in residential buildings are provided. The benchmarking of the existing labelling methodologies for installed heating appliances is presented in Section 3.

In **Germany**, the only HARP country in which a labelling strategy for existing heating appliances is mandatory, the heating label is part of the Energy and Climate Fund and the National Action Plan on Energy Efficiency (NAPE). The latter describes the Federal Government's energy efficiency strategy. Furthermore, the heating label has been established as an indicator in the Long-

Term Renovation Strategy for Germany. According to HARP German partner DENA, the labelling methodology is currently working and the project they have in place is running smoothly (described in Section 3). Nevertheless, the impacts the methodology has on the renovation rate are limited. Other instruments seem to be more effective than the labelling to push users to change their heating system. For example, this is the case of **BEG subsidy programme**, described below.

With the Federal Promotion for Efficient Buildings (BEG), the federal government's energy-related building promotion has been restructured since the beginning of 2021.

The BEG is divided into a basic structure with three sub-programmes:

- Federal Promotion for Efficient Buildings - Residential Buildings (BEG WG)
- Federal Promotion for Efficient Buildings - Non-residential Buildings (BEG NWG)
- Federal Promotion for Efficient Buildings - Individual Measures **(BEG EM)**

The BEG EM is located at the BAFA (Federal Office for Economic Affairs and Export Control) in January 2021 in the grant variant. The BEG NWG and BEG WG (grant and loan variants) as well as the BEG EM in the loan variant are for implementation by KfW (German promotional bank).

From 2023 onwards, funding in each funding category will be provided either as a direct investment grant from BAFA or as a low-interest promotional loan with a repayment subsidy from KfW.

Inside the **BEG EM** - Heat generation systems (heating technology) are part of the Individual Measures proposed to the end-users.

Funding is available for the installation of efficient heat generators, systems for heating support and the connection to a building or heating network that integrates renewable energies for heat generation with a share of at least 25%. The minimum eligible investment volume is 2,000€, and the subsidy rate for each technology is presented below:

- Gas condensing heating (renewable ready) with 20%;
- Gas hybrid heating systems with 30%;
- Solar collector systems with 30%;
- Biomass heating systems at 35% (for particularly low-emission biomass systems, the subsidy is increased by 5%);
- Heat pumps with 35%;
- Renewable energy hybrid heating systems (EE hybrids) with 35%;
- Innovative heating technology based on renewable energies and Building networks and connection to a building or heating network:
    - Heat transfer stations in a network with a share of renewable energies of at least 25% with a 30% funding;
    - Heat transfer station of a network with a share of renewable energies of at least 55% with a 35% funding.

In addition, the end user can get extra funding of 10% if a dedicated professional verifies that the existing boiler is an oil boiler, and a further 5% if the end user asks for the individual renovation passport report. Both additional percentages in funding are bonuses. This means that if an end user changes their heating system using a renovation passport, they will get additional funding of 5%, and if they replace an existing oil boiler with the new system, they get an additional 10%.

Another heating check-up is offered by the German consumer association and is also funded by the Federal Ministry for Economic Affairs and Climate Action. It is an on-site consulting tool from an energy consultant or online consulting via phone or in locations of the end user association.

According to the German review of the labelling mechanism in place (See Section 3.1), the sales market for efficient heating systems is supported by the labelling actions. The total number of boiler exchanges is estimated to be high and should result in a 25% increase in the efficiency of the entire German stock. This makes an important contribution to the development of an energy-efficient economy. For example, by replacing just 3% of the labelled devices, greenhouse gases in the amount of 3.7 million t CO2 can be avoided. Based on the modelling of the project (IZT 2018, see Section 3.1), by exchanging 3% of the labelled devices, a saving of 608,500 MWh final energy or 708,300 MWh primary energy can be achieved. Around 5% of this is for electricity savings, and the rest for fossil fuels related savings.

Regarding the labelling programme, in Germany the Heizungslabel, includes an obligation for the district chimney sweeper to label existing boilers. The obligation is staggered (e.g., since 2016 ever boiler older than 1986 needs a label, 2022 every boiler older than 2005). If a boiler is already labelled the obligation expires. For each label the chimney sweeper who provides the label receives a compensation of 8€. This is explained in details in Section 3.

Maintenance procedures: The maintenance in France is regulated based on the type of heating system, but also on the degree of use. If an end user has a wood-burning stove, they can be prepared for sweeping from one to three times a year. Less than once per year it is not possible, and more than three times is possible for very old boilers but is rare in ordinary private households.

In **France** there are no direct policy instrument to push for the retrofitting of residential heating systems. There are two main incentives and subsidies provided by the French government towards end users and included in the national program to help renovate French houses: "Maprimerénov" and "Prime CEE".

- ***"Maprimerénov"- Simulez gratuitement votre Prime en quelques clics | Monexpert*** helps the end user get information, to finance, improve its house comfort and renovate it. The renovation incentives concern the heating appliances and the habitat to lean towards better Ecology, savings and comfort.
- ***Prime CEE - La Prime Énergie Monexpert pour rembourser vos travaux*** *is* also part of the national incentives that can give up to 4,000€ to help change the heating appliances.

Regarding these two programmes, market monitoring is carried out by the government. The Ministère de la Transition écologique (Ministry for the Ecologic transition) shares data such as the suitability of the renovation appliance and the replacement rate at a national level. These are the "Lettres CEE" and are shared on the French ecological transition ministry website.(Comités de pilotage - Lettres d'information et Statistiques du dispositif des certificats d'économies d'énergie).

The Previously named FAIR network that is now France rénov' is another national program, launched by the French energy agency (ADEME) to help end users get more efficient heating systems, through putting them in contact with accredited professionals.

Other energy labels were crated during the project period by energy providers, and are on the market promoting services or products offers. These energy labels follow the same model and methodology of the HARPa tool.

In the following some of the heating energy labels introduced autonomously by some market players are listed.

Engie tool: HAPPe - Estimez votre consommation de gaz et d'électricité – ENGIE

Ma nouvelle Chaudière - manouvellechaudiere.fr - Estimation gratuite en 2h

Effy - Remplacez votre ancienne chaudière avec Effy | Simulation gratuite | Effy

Total - Aides & prime pour changer de chaudière ou installer une pompe à chaleur

French subsidies do not require a label but are based on the efficiency of a technology, It is therefore not possible to use the energy labelling as a direct motivational tool in exchange of subsidies for the end user.

Integration ideas of the HARP methodology/the new adopted French tool into the subsidy mechanism:

In France the maintenance is mandatory and essential to the heating sector. Since the energetic performance of those heating appliances are part of the maintenance criteria to be checked in the control documents. A relevant result would be to try integrating the harp methodology or the HARPa national tool since it can simplify the maintenance process and be an added value for the preparation of the maintenance sheets.

Another possible action is to include the HARPa tool in the France Renov' website, enabling the end user to understand their heating appliances before they reach out to professional on the platform.

The **mandatory maintenance for heating appliances** has to be performed every year. The decree N°2009-649 of the 2009 June 9th clearly states that all gas, liquid or solid combustible boilers (biomass, fuel, gas wood chips…) are concerned by this decree and that the maintenance has to be executed by a professional. No sanctions are planned by the French government in case of non-compliance; however, the assurances can deny any responsibility in case of an accident, and some complications with the renter can happen. There is no database to store the information coming from the maintenance procedures. The "Attestation d'entretien" is the only document given by the professional to the end user after the maintenance, and it only includes the certification that the maintenance procedure was executed. Nevertheless, some criteria that need to be included or respected in the document following the annual inspection depending on the appliances. For example, the Attestation d'entretien requires different data depending on the maintained appliance (e.g. boiler, heat pump, thermodynamic generator of heat and cold, aerothermal systems, etc. More information can be found in the Annex I).

In **Italy**, the National Decree referred to as D.P.R. 74/2013 has completed the implementation of the EPBD in the sections related to inspections of the heating and cooling systems and DHW systems. The existing voluntary installed appliances efficiency label is helpful (Etichetta Energetica, described in the next section) and there are no consistent barriers to its expansion to the national policies like the EBPD transposition. Certainly, the use of the app would be an incentive for maintainers if implemented in a legal public framework. In any case, the label could be prepared by

the installer during the periodic maintenance of the appliance, even if the labelling activity should remain voluntary. Potential inclusion of the labelling system in national policies (e.g. National Air quality policies) and incentives (e.g. Conto Termico, EcoBonus and SuperBonus) have been evaluated. For example, Conto Termico provides incentives for a period varying between 2 and 5 years for energy efficiency improvements of existing buildings and small-scale projects concerning renewable heating systems. Conto Termico provides full or partial replacement of heating systems with systems equipped with: a) condensing boilers that are at least class A efficient (50% of incentive) and b) condensing boilers that are at least class A and require installation of advanced thermal control systems (65% of incentive). Other subsidized systems are condensing hot air generators, high-efficiency heat pumps, hybrid applications, micro-CHP systems, etc. To understand the potential of the inclusion of the HARP methodology as a requirement for the above-mentioned incentives, the Italian partners organised meetings with national and local stakeholders.

New and renovated buildings must comply with minimum energy requirements, fixed in the D.M. 26/06/2015. The requirements concern the envelope components, the energy systems and the building as a whole. For existing constructions, the requirements depend on the depth of renovation works. It is worth mentioning also the Legislative Decree 28/2011 (and the recent Legislative Decree 199/2021) as national implementation of the Renewable Energy Directive (and its recast).

Ecobonus (rate is 50% or 65% for heating systems): This fiscal deduction was introduced in 2007 to support the energy improvement of existing buildings (both residential and not), by upgrade measures of envelope and heating system. The incentivized technologies to replace the heating system are fixed by legislation. Specific technical requirements (D.M. 06/08/2020) for each technology must be satisfied, together with the essential condition of achieving quantifiable energy savings.

Bonus Casa (50%): The aim of this incentive is the renovation of existing dwellings. Measures to achieve energy savings and to use energy from renewable sources are supported too; compliance with national (and local) regulation on building energy performance and efficiency is required, but it is not necessary to satisfy the additional technical requirements specific to Ecobonus, because the aim of Bonus Casa is more general (the renovation of buildings).

Superbonus (110%): This initiative started in 2020 and focuses mainly on residential buildings. It has two main goals: energy improvement (Super-ecobonus) and structural reinforcement of existing buildings. For energy improvement, the incentive is strictly linked to Ecobonus and the technical requirements of D.M. 06/08/2020 must be satisfied. Furthermore, an overall improvement of two energy classes of the building must be achieved.

The energy label of the existing heating appliance is not strictly necessary to the mechanism of Ecobonus, Bonus Casa and Super-ecobonus, because the technical data required to compare the efficiency of replaced and new system and to satisfy the requirements for each incentive is already available. Nonetheless, the energy label of the existing heating appliance would make the energy saving – which is the essential goal of the subsidy – clearer and more evident for the end user.

Maintenance procedures: The decree named D.P.R. 74/2013 specifies the periodicity and deadlines for residential and non-residential appliances. Domestic boilers are subject to periodical inspections and these maintenance procedures could be used to introduce energy labels for installed boilers. The professional makes energy efficiency checks in relation to the type of appliance. Heavy fines are expected in the event of non-maintenance. There is a compulsory plant booklet which needs to be emitted by the professional at the installation (or at the first useful maintenance, depending on the

case). The plant booklet should serve as a database for the maintainer in order to know all their clients' appliances and approved maintenance and revision activities. Furthermore, the booklet is an important tool for the user, so that they can know at any time after the periodic maintenance which is the efficiency status of the boiler and therefore make corrective actions if needed (e.g. retrofitting). This is a paper booklet, but in some regions of Italy, it has already been turned into a digital version. Further standardization of the booklet is expected in the next years.

In **Spain,** the main national strategy from which incentives and detailed policies are developed is the plan on energy and climate "Plan Nacional Integrado de Energía y Clima 2021-2030". This plan opens a support scheme for investments in thermal enclosures and thermal installations by means of taxation, legislative measures, public support programmes, financing programmes, training, information and communication (policies and measures, dimension of energy efficiency, measures for compliance with the obligation to save in a cross-sectoral approach).

On the basis of this plan, and with the aim of achieving the proposed objectives, different regulations have been developed. The Real Decreto 691/2021 is the reference policy instrument for the replacement of existing heating systems. Its Article 12 refers to the need for building energy efficiency related subsidies to evaluate the improvement of the building energy label. The intervention made on the building (e.g. installation of an efficient heating system) should improve its efficiency by at least one class, according to the CO_2 emissions scale used by the building labelling scheme in Spain. Other policy measures related to incentives in buildings, such as the Real Decreto 853/2021 and the Real Decreto 477/2021 represent the most recent national policy interventions for improving the energy efficiency of residential buildings and facilitating the implementation of renewable energy technologies in Spain.

Regarding the introduction of an energy labelling informative tool for end-users, the Spanish partners discussed the possibility of its inclusion in the "Reglamento de Instalaciones Térmicas de Edificios" (Regulation of Thermal Installations of Buildings), which is being continuously updated by being more restrictive, for example by prohibiting inefficient systems. The "Código Técnico de la Edificación" defines the technical requirements for building energy efficiency retrofitting activities and therefore includes recommendations for heating systems replacement.

Additionally, further and more specific incentive programmes are developed at the regional level (e.g Castilla y León, Extremadura, Galicia, Madrid y Navarra) and are becoming a useful tool for accelerating the decarbonization of the heating sector in residential buildings.

From the tool, users can reach the website where OCU listed the subsidies for replacing boilers. There are also specific subsidiaries for renewable energies.

The "Calificación Energética de los Edificios", the Spanish EPC, is the official mechanism, both at national and European level, for assessing and comparing the energy efficiency and integration of renewable energies in buildings. The general lines of this mechanism are dictated at European level through the various directives on the energy performance of buildings and are regulated in particular at national level by royal decree. The process of energy certification of a building ends with the issuing of a document called the building energy certificate, signed by a competent technician and containing both information on the energy characteristics of the building or building unit and its energy rating. This rating is a measure of the energy performance of a building or part of a building, which is measured by a given method and expressed through a set of energy indicators. This gives rise to a new

definition, that of the label, which corresponds to the letter and colour scale label that is usually associated with this process, and which in some buildings remains visible to the public. In the case of subsidy eligibility for energy renovation of buildings, depending on the subsidy, it is required that the energy rating is improved by at least one letter, depending on the requirements of the subsidy. Because the energy rating of the building includes all the components that influence the energy performance of buildings, the implementation or renovation of heat production systems in the specific case of boilers depending on the case can achieve great improvements in the energy consumption of the system improving the overall rating of the building, an example of this are the atmospheric boilers which are already discontinued but are still part of many homes in Spain change it for a high efficiency condensing boiler can generate energy and economic savings of up to 25% in the heat production system of a house.

There are 4 different programs of subsidies for replacing heating systems:

- For renewable heating systems (Real Decreto 477/2021): solar thermal, biomass stoves and boilers, heat pumps (air-water and geothermal).

As those technologies are includes on HARPa tool, it could be interesting for end users to do a first calculation to know the benefits for the replacement, in addition of the economic help. These amounts go from 1,800 € to 13,500 €, depending on the technology and the power to be installed.

- Improving the energy building efficiency (Real Decreto 477/2021): it includes not only the renovation of heating systems by renewable ones, also improvement of the thermal envelope. In these cases, the improvement of the energy consumption must be at least a reduction of the 30%.
- Improving the energy building efficiency for condominiums (Real Decreto 853/2021): this program is conducted to condominiums. It includes 3 different programs: a building level, a domestic level, and the elaboration of a “building diary” in order to check the status of the building and programming the different actions to be implemented.
- Improving the energy building efficiency for cities under 5,000 habitants (Real Decreto 691/2021): also, for improving the energy use on buildings, but focused on small villages.

Maintenance procedures: The Regulation of Thermal Installations in Buildings (RITE) is the official mechanism by which the maintenance of thermal installations is regulated in its Technical Instruction 3 Maintenance and establishes the following: “Thermal installations shall be maintained in accordance with the operations and periodicities contained in the preventive maintenance programme established in the "Use and Maintenance Manual" when it exists. The intervals can vary depending on if the heating appliance is installed in a house or for other uses and can vary from yearly maintenance (e.g. gas boilers in shops) to once every 5 years (e.g. water boilers with a nominal power below 24.5kW). Regarding the HARP case, for boilers with a rated output of 70 kW or less in dwellings, the maintenance periodicity is two years and for boilers with a rated output of more than 70 kW it is annual. The RITE reflects and describes how this maintenance should be carried out.


In **Portugal**, there is no active energy labelling for existing heating appliances but ADENE is very active in promoting the use of HARPa for the labelling of installed heating appliances. The National Buildings Energy Certification System is presently regulated within Decreto-Lei n.º 101-D/2020 D.R. nº 237, Série I de 2020-12-07, and, given the recent publication of the new EPBD proposal,

its revision is expected. In this revision process, one of the topics on the table is the potential harmonization of national methodologies with EU regulations, namely the regulations related to the energy labelling of energy-related products, such as heating appliances and solutions, already established in several EU regulations. Given that in the evaluation of a building's energy performance class the existing heating and hot water appliances' efficiency are estimated, the harmonization process with the EU labelling regulations would mean that this calculation methodology would consider the same approach used to establish the energy efficiency and energy class as the ones applied to new products being placed in the market. This would allow for a more transparent calculation process, benefit from the information available in the EPREL database (European Product Registry for Energy Labelling) for all products on the EU market and communicate with the end user in a harmonized way, allowing for a direct comparison between the heating appliance installed and the new ones available on the market.

The transposition from the EU framework to the national context is being prepared by a team of experts, in which ADENE takes part. Already in 2020, this harmonization was discussed with the presentation of the HARP methodology to the team. The topic will again enter the discussion in the new transposition process.

Furthermore, Portugal, like all Member States, defined the national energy and climate plan (NECP). In this document, one of the pillars is to address households' energy refurbishment and works towards improving comfort conditions. To this aim two main incentive schemes have been set into motion: Fundo Ambiental and Vale Eficiência. Fundo Ambiental targets all households' owners and Vale Eficiência is exclusive for energy challenged households, targeting energy poverty.

Within these programs, the replacement of heating and DHW appliances is endorsed. As it is presently, applicants do not have to provide any information regarding the heating appliance to replace and are only required to present technical and financial information on the new appliance bought to replace the existing one. This labelling obligation also covers retrofit systems, meaning existing boilers which are upgraded with a solar thermal system also must submit the package label to access the incentive scheme. Currently, the effective savings are not calculated, nor are they accounted for priority of funding for the most urgent replacements. ADENE aims to include the labelling of existing heating appliances in the incentive programmes for the replacement of heating appliances. The idea would be to establish the baseline below which the existing appliances shall be considered inefficient and prioritized for funding. This would allow targeting the most inefficient heating appliances and effectively support their replacement at first hand.

The main result achieved by the Portuguese Energy Agency is to have obtained the endorsement of HARP in the National Long Term Renovation Strategy (ELPRE) where the HARP labelling scheme is identified as one a preferable tool to support the replacement of energy heating systems.

Maintenance procedures: In Portugal, there is no mandatory maintenance procedure for residential boilers. There are certified professionals for the operation of gas (space and DHW) appliances. A legal obligation for building owners to require the inspection of the gas network of the building (e.g. for gas leaks) is in place and this should be done by a certified professional. Nonetheless, this is not perused and there is a lack of surveillance from the authorities.

3 BENCHMARKING OF EXISTING LABELLING METHODOLOGIES FOR INSTALLED HEATING SYSTEMS

Having analysed the legislative and market framework in the HARP countries in Chapter 2, Chapter 3 investigates how the existing labelling methodologies/practices/procedures are performing, and how they can be improved or substituted by the HARP methodology.

Starting from a first screen showed in Table 1, the labelling methodologies and how they are currently working is further explored. The voluntary labels could be used by anyone (end-users and/or professionals). In Germany, just by authorised professionals. The description of the work done in Portugal is referred to the existing subsidies/incentives in place and on the potential introduction of HARP.

Country	Volunteer or compulsory	Website
Germany	Compulsory	BMWI
France	Volunteer	UNICLIMA
Italy	Volunteer	ASSOTERMICA
Spain	Volunteer	FEGECA
Portugal	Not existing	N/A

3.1 Existing labelling methodologies in HARP countries

In Germany, a national efficiency label ("*National Efficiency Label for Old Heating Systems*") has informed end users about the efficiency status of their old heater since 2016. In the first year of the measure, the devices were voluntarily labelled by chimney-sweepers, heating technicians and energy consultants. The owners have an obligation to allow technicians to issue the label. Since January 2017, the district chimney sweepers, according to the Energy Consumption Labelling Act (EnVKG) which sets out the timetable for which boiler may receive a label and from which actor, should provide labels to heating systems with a certain time interval (e.g. from 2022 label on boilers built up to and including 2005, from 2023 label on boilers built up to and including 2008).

An information brochure provides the heating owners with additional information about the federal government's advice and funding in the area of heating. At the moment, the existing energy labelling is mandatory, managed by the Federal Ministry for Economic Affairs and Energy (BMWI) and promoted by national heating associations (see next section for the list of stakeholders). The energy efficiency class calculator can be found on a BMWI consumer web page.

The measure was intended to increase the annual replacement rate for heating devices in private households from 3% to 3.7% and thus significantly shorten the expected duration for the complete replacement of the previously used and inefficient heating systems in Germany.

The German methodology is synergic with a national database of heating appliances, which was already existing and is created with basic parameters (such as the energy efficiency class calculator)

offered by the BDH (Federation of German Heating Industry). It is available only for space heating appliances.

The Energy Consumption Labelling Act (EnVKG) regulates which persons may issue the label and divides them into two groups:

1) The "authorised persons" (since 01.01.2016) are heating installers, chimney sweepers, building energy consultants of the trade and Engineering Procurement Constructions (EPC) issuers.

2) The "obligated persons" (since 01.01.2017) are the competent authorised district chimney sweeps.

Nobody else is allowed to affix the BMWI label in Germany. The chimney sweepers and the other “authorized persons” are expected to be able to recognise an installed boiler and can consequently find the efficiency values in the above-mentioned database. Before applying the label to the boiler, the efficiency class of the boiler must be determined. To do so, either only the manufacturer and model designation of the boiler are required or - for a manual search - the year of manufacturing, type, design, fuel and nominal output of the boiler. Alternatively, the HeizLabel app is available for download for iOS and Android. It is primarily aimed at professional users such as heating installers and chimney sweepers, but also offers interested private users the possibility to easily determine the efficiency class of their boiler.

Authorised district chimney sweepers (obligated actors) receive the prescribed labels via the responsible regional association of chimney sweepers or via the responsible association. The labels are available in basic packages with 26 labels each and in bulk packages consisting of 5 basic packages each. Eligible actors can request the labels in preassembled packages including enclosed information from BAFA using an online contact form. Only original labels and no printouts may be attached. An EAN code list (sticker with barcodes and label numbers) in DIN A5 format is enclosed with each label package. The district chimney sweepers incur expenses for the award of the energy efficiency label, for informing the owner and for applying for the compensation of expenses. This expense is compensated in each individual case with 8€ (plus VAT). The application for authorised district chimney sweepers is made online. The maximum number of times a year a chimney sweeper may sweep depends on the type of heating system, but also on the degree of use (see Chapter 2).

Before applying the label, the issuer must always check whether the year of construction of the boiler is within the schedule. If this is not the case, the owner can be asked or the year of construction can be estimated by the issuer. Only boilers up to a maximum of 400 kW receive a label.

In the first inspection cycle of the fireplace inspection, heating appliances built up to and including 1994 must be labelled, and in a second inspection cycle, heating appliances built up to and including 2008 must be labelled. Thereafter, heating appliances that are at least 15 years old at the time of the fireplace inspection must be labelled.

The EnVKG specifies the timetable providing the year in which the labelling should be applied to existing old boilers. Essentially, it forecasts the labelling application after 15 years of usage:

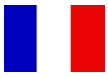
- from 2016 up to and including boilers purchased in 1986
- from 2017 up to and including boilers purchased in 1991
- from 2018 up to and including boilers purchased in 1993
- from 2019 up to and including boilers purchased in 1995
- from 2020 up to and including boilers purchased in 1997

- from 2021 up to and including boilers purchased in 2001
- from 2022 up to and including boilers purchased in 2005
- from 2023 up to and including boilers purchased in 2008
- from 2024 and later from 2009, if at least 15 years old

The market monitoring process to monitor the results of the mandatory labelling system in Germany is called “Evaluation der Maßnahme „Nationales Effizienzlabel für Heizungsaltanlagen“ (in English, Evaluation of the measure "National efficiency label for old heating systems"). Unfortunately, BAFA is not going to release the report to the public, therefore it is not available to the HARP Consortium. Concerning the last available report (end of 2017), some relevant facts regarding the national labelling methodology have been gathered:

- It was estimated that a total of around 1.7 million labels had been issued until then.
- The project-external evaluation assumes that there were 3 boiler exchanges per 100 labels attached.
- Around 60,000 additional boiler exchanges should therefore be carried out per year as a direct consequence of the labelling.

Another relevant feedback from the report is that the level of additional information provided to end-users (e.g., about alternative technologies to replace the existing boilers) is poorer than expected. The reasons are mainly the low expense allowance of 8 euros per label, which does not adequately remunerate the working time for providing such counselling, as well as the lack of knowledge of the chimney sweepers. It is noted that follow-up advice on the label or initial advice from the chimney sweepers is lacking.



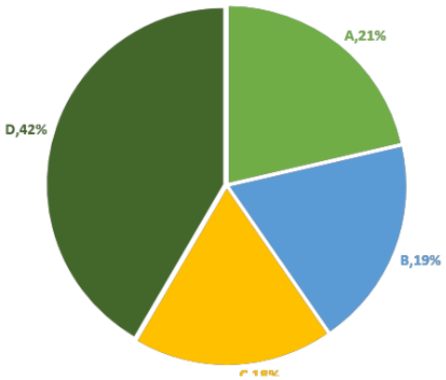
In France, the existing energy labelling (“Mon Étiquette Chaudière”) is voluntary, hosted by Coénove (Association for energetic mix and gas) and Energies et Avenir (HARP partner) and promoted by French professional associations (such as UMGCCP), which together with the manufacturers are the main used channels to promote the use of the tool. The French methodology and the relative heating appliances labelling tool are based on the approved European Algorithm method (UE N°811/2013). It does not concern DHW and is developed just for gas and liquid fuel boilers and it has 4 energetic classes, from A class to D class (A being the most efficient energetic rank, D being the least one).

As for the German label, and differently from HARP, it is thought for professionals (installers and manufacturers) in the heating sector and not for the end users. It is a useful tool because it gives quantitative results regarding the heating efficiency of the system, which has given good professional credibility to the professionals who used it.

In France, it has been used by professionals during maintenance interventions (yearly mandatory inspection for heating appliances in the country). In fact, the decree N°2009-649 of the 2009 June 9th clearly states that all gas, liquid or solid combustible boilers (biomass, fuel, gas wood chips…) are concerned with yearly maintenance that has to be executed by a professional.

During the last surveillance of the tool (privately shared by E&A and Uniclima, Oct 2019-May 2020), only 332 labels were generated through Mon Étiquette Chaudière. Out of them, 138 were in the energy class D, and 60 were in class C, which shows the majority of the appliances installed are low

energy efficiency. On the other hand, the number of appliances with an energy classification of A and B gathered is 40%, which shows a fairly good replacement rate in France. 100 % of the heating appliance installed in energy classes C and D are non-condensing boilers. The majority of the registered heating appliances is using natural gas as source of energy (68%), followed by oil (29%) and LGP (3%). The highest share of appliances (106, corresponding to 32%) was built from 2005 to 2010.



The *Etichetta Energetica* tool by Assotermica used in **Italy** is a voluntary scheme mainly thought for heating system manufacturers and installers. The main difference with HARPa is that the focus is exclusively on professionals (since it was thought to be applied during periodic maintenance of existing boilers). The tool was developed by Assotermica and it does not include DHW. The Etichetta Energetica has a calculation methodology that is in line with the EU calculation method for labelling heating appliances. Corrections with respect to EU labelling for new equipment were adapted to existing equipment, including a strict relationship between the performance and the age of installed boilers. In practice, the calculation method is the same as the one for new appliances placed on the market, except for the application of an ageing coefficient to take into account boilers already installed and their date of installation. Where information is lacking, default values have been defined based on literature and market data.

The objective of the national initiative for labelling existing boilers was to increase the renovation rate from 4% to 5% (190,000 pieces/year), apply the label on 10% of existing appliances subject to periodic maintenance every year and accelerate the replacement on 30% of the labelled appliances.

A past survey from Assotermica through a sample of more than 1,120 professionals (manufacturers, installers, retailers, planners) showed that over 37% of the interviewees considers the application of the label to installed appliances an improvement of the current legislation. The results show that the actual scheme, adopted on a voluntary basis, is not enough to reach the target on renovation rate at 5% and that a national-based legislative framework to boost the labelling of existing appliances is needed. During the last surveillance of the tool (privately shared by Assotermica), directly implemented by Assotermica (from Jun 2019 to April 2020), 906 labels were generated, of which the majority were of class C. Many professionals have been involved in the characterization of the energy efficiency of installed heating appliances (554), and they provided good feedback on the Etichetta Energetica since it needs less than 2 minutes to generate a label and it works as an initial informative tool for the labelling of existing heating systems.

 In Spain, the label developed by FEGECA (Association of thermal equipment manufacturers) is intended to be issued by the technical service of the heating systems manufacturers when they carry out the revision or any kind of maintenance of installed boilers. Easiness in calculating the label is considered a must. For the labelling methodology, FEGECA takes into account only boiler age and boiler technology. Therefore, the methodology is very much simplified compared to the one adopted in the Energy Labelling Regulation. Since there are many models and brands of boilers on the market, it was very difficult for FEGECA to include all of them in a database (similar to the German one). The label is addressing boilers, whether they are heating only or combi (heating + domestic hot water). The FEGECA labelling methodology has generated a lot of interest among manufacturers, but the follow-up of its implementation has been complicated. FEGECA did not organise any market monitoring for this, therefore no data is available regarding the number of labels issued. Being a manufacturer association, and not an association of installers, FEGECA does not provide any maintenance service nor organises visits to end-users' houses. The main difficulties in collecting the data refer to the high number of actors involved and the high variety of available technologies on the market. The FEGECA labelling is considered a very simple tool for labelling the existing heating appliances and is not comparable in effectiveness with the German, Italian and French ones.

3.2 Stakeholders involved and interviews with National and local actors

In this section, the different entities/organizations who have a major/minor role into the labelling methodology development, its promotion and its monitoring are investigated. A first presentation of the meetings had by the National partners is shown here. This information will be useful for providing feedbacks on potential policy integration of the HARP methodology (at EU and/or Member State level).

As descripted in the previous section, in Germany, the mandatory label for the existing heating appliance project is run (and therefore financed) by the BAFA (Federal Office of Economics and Export Control) on behalf of the BMWi (Federal Ministry for Economic Affairs and Energy). DENA, the German energy agency, does not have any direct role in the initiative. The ZVSHK (Central Association for Sanitation, Heating and Air Conditioning) provides information for heating appliances installers, chimney sweepers, building energy consultants of the trade, and from their website, users can also apply for heating labels.

In addition to BAFA, BMWi and ZVSHK, other federations are actively promoting the retrofitting of heating appliances for more efficient alternatives:

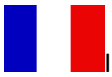
- *BDEW* (Bundesverband der Energie- und Wasserwirtschaft) - Federal Association of Energy and Water Management
- *BWP* (Bundesverband Wärmepumpe) - German Heat Pump Association *(German NEF member)*
- *DEPV* (Deutscher Energieholz- und Pellet-Verband e.V.) - German Energy Wood and Pellet Association *(German NEF member)*
- *BDH* (Bundesverband der Deutschen Heizungsindustrie) - Federal Association of the German Heating Industry
- Bundesverband Solarwirtschaft (BSW) - *(German NEF member)*
- Zentralverband des deutschen Handwerks (ZDH) - *(German NEF member)*
- Bundesverband des Schornsteinfegerhandwerks – Zentralinnungsverband (ZIV) - *(German NEF member)*
- Haus & Grund Deutschland - *(German NEF member)*
- Verband privater Bauherren (VPB) - *(German NEF member)*
- Spitzenverband der Gebäudetechnik (VdZ) - *(German NEF member)*
- Gebäudeenergieberater Ingenieure Handwerker – Bundesverband (GIH) - *(German NEF member)*
- ifeu – Institut für Energie- und Umweltforschung Heidelberg - *(German NEF member)*

As explained in Section 3.1, there are 3 categories of “authorized persons” that can provide a user with the label and that are considered as heating labelling actors: heating installers, chimney sweepers, building energy consultants of the trade and Engineering Procurement Constructions (EPC) issuers.

Interviews with local stakeholders:

Stakeholders/Actor	Outcomes of interaction with HARP partners
Regional agencies:	DENA is in contact with regional energy agencies, and they are suggesting the HARP app to those agencies that are campaigning to end users. The objective is that one or more energy agencies adopt the HARP tool to engage users.
Association of energy consultants	There was a meeting with the association about the HARPa tool. Unfortunately, no joint event took place and only dissemination of harp materials via internal means of GIH took place. Useful to get in contact with energy advisors and not with end users. Energy consultants as multipliers as a starting point for changing the heating system.

NEF	During the three meetings with the National Experts Forum the results of the project and possible adaptions were discussed. The exchange included experiences and needs for action regarding the old system label, the step from information to heating exchange and further implementation of the planned HARP activities and networking with the activities of the German actors. In later meetings some partners pointed out that an app could be useful to accelerate the exchange of heating systems but mostly don't think HARPa can fulfil the task. Also, the main market barrier for the exchange of heating systems is said to be skills shortage. The Application needs to modified to be suitable to the German market. Consumers organizations were not interested in supporting the project (e.g. one of them is involved in HACKS).

 In **France**, as previously depicted, Energies et Avenir and COENOVE are the creators of the voluntary tool. Energies et Avenir took advantage of the fact many of its associated members are leading associations in the professional sector of heating appliances and construction sector, which therefore facilitated the dissemination of the tool:

- *SYNASAV* (maintenance procedures)
- *CAPEB: SME and craft company association*

A special partnership and training session around the HARP methodology and tool was done with the CAPEB association in order to implement as much as possible the harp methodology on the French ground.

- *UMGCCP: heating appliance installers association - NEF member*
- *FNAS: distributors/retailers' association - NEF member*
- *CFBP: energy - NEF member*
- *Afgaz Gas installers and suppliers - NEF member*
- *FEDENE: energy suppliers and professionals - NEF member*
- *Plan Batiment Durable - State initiative for the heating and habitat renovation*
- *FFB – French construction (bâtiment) federation- it is partially involved with the new tool since they are affiliated to the UMGCCP organisation (part of the HARP French NEF)*

Furthermore, Energies et Avenir's is pushing to increase awareness on energy labelling of existing heating appliances among heating products manufacturers, many articles and information about the energetic update were published and sent on both of the French industrial partners websites and also by their newsletter.

Interviews with local stakeholders:

Stakeholders/Actor	Outcomes of interaction with HARP partners
French Directorate General of Energy and Climate ***(DGEC)***	The DGEC is regulating the heating labelling in France. In the past, DGEC already planned for the upcoming regulations to include the energy efficiency class in the maintenance certificate of heating devices. The main aim of the interview was to demonstrate to the French government how HARPa could raise awareness among the French end users on their heating appliances. From

	a more professional-oriented point of view, the French partners have discussed the interest and the co-benefits it could bring to the French market: a global overview of the installed heating appliances stock efficiency. DGEC was interested in embedding the tool (improved or substituted thanks to HARP) in the national legislation for energy efficiency in buildings.
NEF	HARP presented to the group of French stakeholders being part of the NEF the HARP project, its calculation methodology, the database it is based on and the HARPa. All of these private organisations participated in the French webinars and are key influencers in the French sector. They have shared multiple feedbacks on the tool and the project with some proposition of partnership to train/create work groups around the HARPa tool.

 Assotermica is the leader and the developer of the *Etichetta Energetica* methodology and tool in Italy. The tool was developed with own private funding of Assotermica. Stakeholders involved in the sector with which the HARP Italian partners met and who are interested in following the HARPa deployment in the Italian case are presented:

- ACC (Agenzia CasaClima Alto Adige), Energy experts
- AiCARR/ AiCARR Formazione, Energy experts
- AIMSEA, Energy experts (University)
- ANGAISA, Retailers
- ALTROCONSUMO, Consumers
- ASSISTAL, Energy experts
- CIG, Energy experts
- CNA SHV Bolzano, Installers
- CONFARTIGIANATO, Installers
- Comitato Termotecnico Italiano (CTI), Energy experts
- Eliante - Partner of HACKS
- Green Building Council Italia (GBC Italia),Energy experts
- MCE, International exhibition
- Movimento Difesa del Cittadino (MDC) Consumers
- NOI (ex IDM), Installers
- Polytechnic of Milan, Partner of HACKS
- SOS DIFESA LEGALITÀ, Consumers

- Interviews with local stakeholders:

Stakeholders/Actor	Outcomes of interaction with HARP partners
X Commission of the Italian Chamber of	Meetings with several Deputies in the context of the consultation of the National Action Plan of Energy and Climate (NECP). Meetings on Recovery Action Plan, new incentive mechanisms, etc. Every meeting had the objective

***Deputies on the National Action Plan of Energy and Climate*:**	to let HARP known by the different parties in order to have a general consensus on a future legislative initiative. At the moment the process is ongoing and the interested of the involved parties is quite high.
NEF	The HARP National Experts Forum includes the most relevant Italian stakeholders in the heating sector. Several of these stakeholders have a dynamic presence in the energy sector and periodically organize activities, from training actions with professionals to conferences and workshops and communication activities in the media. Benefiting from the resources already in place and to the extent possible, ASSOTERMICA and ENEA have organized some initiatives with these stakeholders. Three meetings were organized in order to show and discuss the following contents: ✓ HARP strategy at the national level, activities and cooperation definition & HARP tools presentation and validation (May 2020); ✓ First results, feedback, best practices and update of the national action plan (October 2020); ✓ Policy integration scenarios for the national follow-up and business models and main results of the project (May 2022).

 In **Spain**, the creation of a labelling methodology for existing heating appliances was an initiative of FEGECA and no other bodies were involved. The labelling of installed equipment is a project that has been developed within EHI (HARP partner) and has been implemented in different countries through EHI member associations. In Spain, it has been FEGECA who has implemented it and it is considered of interest for the heating sector. The autonomous communities which were contacted showed interest in the use of the application.

<u>Interviews with local stakeholders:</u>

Stakeholders/Actor	Outcomes of interaction with HARP partners
IDAE (Instituto para la Diversificación y Ahorro de la Energía)	CREARA contacted the responsible members of the building sector in October 2021 to provide a presentation of the project and evaluate possible synergies. They found the project interesting and many different possibilities for collaboration were discussed. They provided good feedback on the methodology, on the effective dual approach (for end users and professionals) and the simplification of the Spanish climatic zones. However, IDAE will not support the HARP project or the HARPa tool as it includes non-renewable heating systems in the alternatives that the tool proposes to the user, and this goes against its policy and line of actions.

	In May 2022, IDAE was contacted again in order to show the HARP results in Spain and Europe and with the aim of endorsing not the HARPa tool, but the labelling methodology on existing heating appliances. For the time being, IDAE has not responded to the request.
Local autonomous communities	The regional authorities can organize their own incentives. Further information in Deliverable 6.2.
Carrefour	After showing interest on the project and the tool. They told us they could not implement it as they were prioritizing other issues.
ECODES	Meeting to check for synergies on HACKS project and HARP project. Hacks developed a tool similar to the HARP tool. HARP partners decide to have different communication campaigns, the HARP tool includes a links to the HACKS project.
FENIE	FENIE is a utility and a professional association of installers (National Federation of Spanish Installation Businesses). Since August 2021, CREARA has been in conversations and organized bilateral calls presenting the tool and the project at different levels of the company. Initially, FENIE was very interested in the tool, and was willing to adopt HARP as an internal tool for their installers. Also, they wanted to organize several training workshops specifically for their installers (about 80-100 professionals could benefit from these trainings). These conversations were finally materialised in an NDA signed in January 2021. Ever since, Creara has had a weekly call to see the advances in FENIE's structure (FENIE being a large company, the decision-making process is quite long), and to discuss the best way to embed the HARP tool in FENIE's website.
NEF	Three different meetings were organized with the NEF, focused on different topics: - In the first meeting, the Spanish partners presented the HARP project together with the HARPa tool and methodology. - In the second meeting, the Spanish partners presented the new functionalities of the tool and the National Action Plan, in order to see if the strategy and actions were well-designed to reach our objectives. - In the last meeting, the Spanish partners presented the final version of the tool, and the main results of the project. In this meeting, our objective was to extract information about the public incentives and existing mechanisms in Spain and see which of the functionalities are the most valued for the stakeholders. In the three meetings, the Spanish partners got very valuable feedback that helped us to improve the tool, improve the actions, understand the framework and see the potentiality of the different functionalities of the tool.

 Potentially, in **Portugal**, ADENE could be responsible for assuring the access to the HARPa and the labelling methodology. To be in force, namely linked to the Buildings Certification System and/or to voluntary maintenance procedures of heating equipment, this would have to be endorsed by the General Energy Directorate. For the new incentives programme to consider this the Energy Transition Ministry would have to endorse the methodology. The National Environment Agency should also be acknowledged since they also manage the definition of the Energy and Climate Action Plan (NECP). ADENE is individually acting to include HARP in a one-stop-shop for end-users to get all the information for improving their energy efficiency in their houses. HARP is provided as a tool for calculating the efficiency of end-users heating systems. Furthermore, the interaction with the Portuguese NEF was useful to obtain feedback, modify and then validate the HARP methodology at national level.

- *AFIQ* - Heating appliances supplier's association
- *AGEFE* – Eletric appliances supplier's association
- *APED* - Retailers association
- *ANPQ* - EPBD national experts association
- *APIRAC* - Acclimatization equipment supplier's association
- *CASA POR ITM – retailer*
- *CLASSE + - voluntary labelling of construction products*
- *DCG* - Consumer's national direction
- *DGEG - National energy and geology direction*
- *EFRIARC – System designers* association
- *iiSBE* - Non-profit organization for sustainable development
- *LNEG* - National energy and geology laboratory
- *RNAE* - Network of regional and local energy agencies
- *QUERCUS* - Non-profit environmental association (and HACKS Portuguese partner)

Interviews with local stakeholders:

Stakeholders/Actor	Outcomes of interaction with HARP partners
EPBD team	Meetings with the technical team responsible for the transposition of the new EPBD into the Portuguese Buildings Energy Certification System for the consideration of the HARP labelling methodologies to estimate the energy efficiency of existing heating appliances in the building energy performance calculation process. Several meetings were held in 2020 and the topic is in the agenda for the next transposition initiative which should start by the end of 2022.
ADENE's One-Stop-Shop team	Several meetings were held with the team responsible for the management of the Portal Casa Mais, Portuguese one-stop-shop for the implementation of energy efficiency measures at home. These meetings brought important results such as the communication of the HARP project and the HARP app through all the end users and professionals registered in the portal and the integration of the HARPa in the simulators section of the portal. Future

	developments are still expected for the continued and improved use of the app.
ADENE's AQUA+ team	Several meetings were held with the team responsible for the management of the AQUA+ certification system, a system for the classification of houses in terms of their water efficiency performance. Since water heating appliances are also considered in this system, the HARP resources, labelling methodologies and application have been disseminated through their network of professionals, included in the training programme for these professionals and in the initiative's website.
Fundo Ambiental technical team (Environmental Fund incentive)	Three meetings were held with the technical team that supports the definition of the energy efficiency incentives in terms of criteria, eligibility, documentation, etc. and who also supports the evaluation process. They found the HARP labelling methodologies very interesting, namely as a way to prioritize or further support the replacement of inefficient heating systems and quantify the expected savings achieved with public investment. The goal is that they can consider the adoption of this labelling scheme in future energy incentives.
National General Energy Directorate	Which is responsible for the certification of companies responsible for the operation (installation and maintenance) of gas appliances. Proposed endorsement and dissemination of the labelling scheme with the network of certified installers and a voluntary procedure to include in maintenance procedures for gas appliances.
LTRS - EPREL	The HARP methodologies and application were presented to the team responsible for the definition of the Portuguese long-term renovation strategy who endorsed the HARP methodologies and application in this policy document.
Madeira Island Regional Energy Agency	A meeting was held with the Madeira Energy Agency to present the HARP methodologies and application so that they can also consider it in the definition of future regional incentive programmes that include the renovation of heating appliances. For the moment they have included the HARP methodologies and application in a voluntary project for the energy audit of private homes where the energy efficiency of the existing heating appliance is now calculated according to the HARP methodology.
NEF	The three meetings with the Portuguese NEF were especially important to improve the HARP application. The discussions approached also the fact that Portugal does not have compulsory maintenance procedures, a procedure where the labelling of installed heating appliances could definitely make sense. The replacement advice was also very much debated since the adoption of a heat pump to replace a boiler may not always be direct and the houses need to have the necessary infrastructure (something that also the incentives do not consider). From the end user perspective, the tool was well received though it was stressed that it should be more appealing and the translations are not

	always easy to understand and that should be revised in a more autonomous update for the Portuguese reality.

3.3 Pros and cons of the existing methodologies and the improvement brought by HARP

In order to provide suggestions for policies integration of the HARP tool and methodology, it is necessary to understand what is actually motivating the users to change their heating appliances. To this end, a country-by-country analysis is provided in the following paragraphs.

 The measure "National Efficiency Label for Old Heating Systems" is aimed at the private sector, but also addresses municipalities and businesses. Basically, it is suitable for unfolding its effect and for achieving or even exceeding the goals set - increasing the exchange rate, and reducing primary energy consumption. The implementation of labelling by the obligated group is the starting point that can be expected to have the most effects. The basic design of the measure is effective due to the combination of labelling and initial information via personal contact (on-site inspection by the chimney sweepers). This is also the main strength of the measure.

According to the information provided by DENA, in **Germany** the main constraint reducing the interest of the "authorized persons" to provide energy labels is the low reward received for each energy label produced (8 €). Furthermore, the working time that the chimney sweepers must devote to the calculation, printing and application of the label and to explain its meaning to the end-users is not rewarded as expected. For the homeowners, the labelling neither seems to be appealing, because it does not allow them to directly obtain any related subsidy for the change of their heating system.

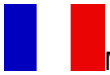
The feedback from the chimney sweepers is that the existing labelling process works well, but this does not translate into a reason to replace the heating system. When the chimney sweepers do their regular visits to houses (at least once per year), they usually have informative talks with the home-owners about energy savings and the renovation of the heating system, but they see that the motivation of end users to change their heating system demands more interactions and more information than what can be provided during a single visit. As suggested in Deliverable 6.2, a more fruitful application of the labelling methodology is included it in the report for housing renovation (renovation passport).

In any case, since chimney sweepers have to visit homeowners at least once per year, there is already a customer relationship in place which can incentivize the customer to ask for this individual renovation report. This should be a win-win situation both for the chimney sweepers (which are in contact with manufacturers and can provide suggestions to the end users) and for the customers (who can trust a professional advice, since it makes them save money). It is interesting to see that according to energy consultant's report, it seems easier to replace a heating system in the countryside compared to the cities (renewable energy sources such as biomass/wood and heat pumps are easier to install due to space and air-quality constraints, lowering the costs of installation thanks to the available incentives).

There is also potential for optimising this program, for example by increasing the allowance and linking the label to existing instruments such as the individual building renovation passport. This would make it possible for end users to receive holistic and more comprehensive advice on their buildings.

The efficiency of water heaters is generally not well known. As the percentage of energy used for hot water in high-efficiency buildings becomes larger and thus more important, professionals are taking on a more important role in educating homeowners about this issue.

The HARPa tool, which can be used independently by both professionals and end-users, can be an initial information tool.

 Mon Étiquette Chaudière, the **French** tool, generated 3,032 labels in two years of operation (until October 2021), a low number compared to the ones generated by HARPa in France.

The existing French label does fit to the demand of professionals, however is totally out of reach for the end users since it does not allow them to get any information without the use of a professional and its recommendation. In any case, it can provide useful statistical data to the associations in charge of it, such as energy sources, efficiency class of the appliances that were estimated, type of appliances and their age.

According to the feedback provided by Uniclima, the existence of two different labelling tools (Mon Étiquette Chaudière and HARPa) created confusion among the professionals, who did not know which was the one to use, since Energies et Avenir was the creator of the French tool but they were also promoting HARPa. After the HARP project started its development phase, being presented at fairs and conferences in France, the mentioned stakeholders (UMGCCP, COENOVE, Energies et Avenir) started to promote it and the installers started to use HARPa. This activity shows how important the support of associations of professionals is in promoting the tool and make it be used.

 Since in **Italy** the methodology for the *Etichetta Energetica* was directly designed with the manufacturing companies, this is in line with the EU labelling methodology and it is seen as a strong validation point for the Italian labelling. Because of the problems to adapt this methodology to DHW, this was excluded in the design phase of the tool, thus reducing its potential. This choice was also made due to the fact the energy class for DWH is high (also if the appliance is obsolete), and this could have only confused the end-user. Furthermore, the use of heat pumps and gas condensing boilers is expected to grow in the near future thanks to the implementation of tax deduction subsidies.

The main barrier for utilization is related to the difficulties encountered to reach the end-users. A closer link between the promoter of the methodology and the end-users needs to be built (e.g. through Altroconsumo, the Italian end-users' association).

According to the Assotermica, in concordance with ENEA's opinion, the HARP methodology should be made voluntary by inclusion in a legislative instrument, after which it would work independently, needing some minor supervision.

 **Spain**: FEGECA tool generated a lot of interest among manufacturers, but the follow-up of its implementation has been complicated. CREARA tested the interest of different companies and associations (e.g., FENIE) during the training of professionals, but they found out that heating sector professionals are currently overloaded with work and they do not have the need to stand out from the competition, learning for example how to use the HARPa. CREARA also tested the interest of

different educational institutions, to see if it would be possible to include the HARP training course within the professional installers' courses. However, no positive response has been received so far.

The general feedback is that energy labelling o installed appliances cannot become a mandatory for getting the subsidies, since the governmental administrations are reluctant to use a tool not developed by themselves and that supports natural gas appliances. The potential inclusion of HARP is to be used as initial information for the end users.

Potential use in large retails (e.g. Carrefour, Leroy Merlin) has been discussed. Carrefour initially showed interest in the HARPa tool, but then they rejected a collaboration due to two reasons:

- Optimization of sales times in their sales points. Having the HARPa tool would increase significantly the time an end user spends in the store.
- Internal timings of the organization did not fit with the times of the HARP project. At the time being, Carrefour does not sale all the alternative technologies that the HARPa tool provides. This was perceived as dangerous for the organization, as the tool may suggest some technology not sold by Carrefour, which could result in the loss of some potential customers.

 The HARP application allows end users to know more about their installed heating appliance and that is unquestionably an added value and an effective support to the planned replacement process. The communication/education about energy efficiency and more specifically about energy efficient heating is not common and end users and professionals should have access to transparent and understandable information on a regular basis. The relation between the heating industry and the national public authorities could be reinforced and the government should be the one endorsing HARP, linking it to energy efficiency incentives and/or regular maintenance procedures.

The HARP methodology could be used to evaluate the requests for incentives and rank the best intervention requests (in €/kWh saved), introducing the “real” expected efficiency of the installed heating solution and expected savings due to the replacement for a more efficient system. For example, via the one-stop-shop portal end users can understand the importance of replacing their inefficient heating system and directly reach out to installers to request information on the most adequate solutions and effective commercial proposals. Incentives are currently given on a “first come first served” basis, HARP can instead support the prioritization of the replacements, ranking the requests related to the most inefficient devices higher. This would automatically also tackle energy poverty, considering that less wealthy families tend to keep their heating system as long as possible.

Furthermore, since there is a legal obligation for the house owner to require an inspection to the gas distribution network every 5 years by a certified professional, this obligation could be further extended to the maintenance of existing heating appliances where the estimation of the efficiency and energy class of the appliance could also be included and communicated to the end user.

4 MATRIX OF TECHNICAL AND NON-TECHNICAL FACTORS

The following table summarizes in a matrix the main technical and non-technical factors that can facilitate/hinder the adoption of the HARP methodology and its application in the HARP countries.

Country	Technical methodology	Procedures in place	Policy framework	Market framework
DE	The Energy Consumption Labelling Act (EnVKG) regulates which persons may issue the label. Methodology based on a national database for each type of heating appliance, which is created with basic parameters.	Mandatory - Class calculator by BWMI. BAFA (Federal Office of Economics and Export Control) applies it.	Federal government's energy efficiency strategy – long term renovation. Related policy is the renovation roadmap, implemented as part of an individual refurbishment roadmap (iSFP)	There is an evaluation tool for the measure. The data is not available.
	Thought for professionals only. 8€ per label generated. It does not motivate stakeholders. No DHW.	Subsidies are more effective than labels for retrofitting actions.	Regional agencies can promote local measures to incentivise end users.	Users prefer cheaper installations (e.g. condensing boilers) when applying retrofit.
FR	Just liquid and fuel boilers. Approved European Algorithm method (UE N°811/2013). Promoted by the heating industry.	Voluntary - Mon Étiquette Chaudière - by Coénove (Association for energetic mix and gas) and E&A	No policy instrument for pushing retrofitting – Main subsidies: Maprimerénov, Prime CEE - FAIRE	*Lettres CEE* by the Ministry for the ecologic transition – for market monitoring. More labels by HARP.
	Methodology works well, programme runs smoothly. Thought for both users and professionals. No DHW.	Impact of the methodology on the innovation ratio is low.	The first one for renovation in the building; the second one for retrofitting heating appliance.	Certain subsidies work better than labelling (e.g. promotion for efficient buildings)
IT	Single methodology in line with the EU calculation method (it is not possible that each manufacturer creates its own)	Voluntary - Etichetta Energetica by Assotermica.	Potential link to the national regulation D.P.R. 74/2013 that has completed the implementation of the EPBD	Market monitoring by Assotermica. Almost all the appliances labelled are below class C

	Thought for manufacturers. No DHW was considered because it could have created confusion in the end users.	The methodology was taught and developed together with the industry for the industry.	Many current subsidies support the retrofitting of existing heating appliances (e.g. Conto Termico, EcoBonus)	Over 37% of the interviewees considers the application of the label to installed appliances an improvement of the current legislation
ES	Simplified methodology, based on the type and the year of manufacturing of the heating system. The label is aimed at boilers, whether they are heating only or mixed (heating + domestic hot water).	Voluntary – FEGECA, association of manufacturers is the only promoter of the initiative.	Regulation of Thermal Installations of Buildings updated with more restricted measures for inefficient appliances	No market monitoring because of the complexity of getting data (many stakeholders involved)
	Thought for when a professional go for inspection and can provide the label.	High interest but lack of following actions. Lack of public engagement.	Subsidies are related to retrofitting of buildings -> improve the energy class.	It could be interesting to apply the methodology to commercial and industrial spaces. Installers do not need a competitive advantage.
PT	Portugal would like to continue to use the HARP methodology at a national level, through the one-stop-shop.	No existing procedure. ADENE is in charge of promoting HARP in Portugal.	One-stop-shops are one of the measures listed in the EPBD to reinforce buildings energy retrofit.	ADENE supports the definition of the incentive's programs, but is not responsible for managing the funds themselves.
	HARP methodologies can also be used in the buildings energy performance system to calculate the efficiency of existing heating appliances.	N/A	Link to the National Buildings Certification Scheme.	Maintenance procedures for space and DHW appliances, either voluntary or compulsory, should be endorsed.

5 CONCLUSIONS: LESSONS LEARNT and NEXT STEPS (Deliverable 6.2)

This report studied the different national legislative frameworks within the HARP countries, including existing subsidies and incentives for the replacement of old heating appliances and the in-place maintenance procedures for residential boilers. An analysis of the existing labelling methodologies in place was conducted and partners' feedback has been collected regarding the improvements that HARP could provide to each country. The relevant stakeholders in each national context have been contacted and their feedback was taken into account to improve the HARP methodology and application. All this background information (technical, based on the market and on the legislative framework) was useful to set the basis for the implementation of the methodology at the national level, with an initial proposal that is represented in the matrix of Section 4. Within the HARP project, another report (Deliverable 6.2 on national policy integration) goes into the details of which are the public and private endorsements received at the policy level in the HARP countries and the potential implementation of the methodology after the end of the project.

6 ANNEX I: Maintenance documents in France

For the maintenance documents, there are the criteria that needs to be included or respected in the document (Attestation d'entretien) following the annual inspection depending on the appliances.

For boilers:

Name and address of the client

Address where the appliance revised is installed and has been checked

Global information about the boiler (brand, model, serial number, type of energy sources used, power Kw, installation and set-up date of the boiler, type of extensions or modifications done previously …)

Information about the burner: Model, power, date of installation and set-up of the burner, serial number.

Date of the last maintenance, sweeping or reparation of the appliances (if available)

Information about the maintenance visit: identification of the company (SIRET/SIREN number) date of the visit and the maintenance, name signature of the person in charge of the maintenance

List of the control points that have to be done.:

Appliance setting / cleaning of the heating body of the boiler and the extractor

Verification of the good conditions and good form of the heating chimney, heating pipes, and their connections

The disassembly and cleaning of the boiler's burner

Verification and setting (if needed) of the gas debit

Verifications of the potential and complementary accessories.

Verification of the smoke temperature/ actual habitation temperature, C02 emissions in the smoke (if possible)

Recommendation about the possible upgrading of your boiler

Recommendation on the best use of your appliances

energetic performance evaluation of the existing boiler (complementary evaluation)

Carbon monoxide detection test (complementary evaluation depending on the boilers energetic classification, power and the energy sources used.)

For heat-pumps:

Name and address of the client (client number)

Information about the maintenance visit: identification of the company (SIRET/SIREN number) date of the visit and the maintenance, name signature of the person in charge of the maintenance

Address where the appliance revised is installed and has been checked.

Global information about the heat pump (brand, model, serial number, type of energy sources used, power -cold and hot, date of installation and set-up of the heat pump, refrigerant fluids, type of extensions or modifications are done previously …. All these details are precise twice in the report. 1 is for the inside/ interior unit and the other one is for the outside/ exterior unit)

Date of the last maintenance or reparation of the appliances (if available)

List of the control points that have to be done.:

For thermodynamic generator of heat and cold:

Thermodynamic systems

- interior unit temperature detection and verification of its good functioning

- verification of the cycle functioning and inversion function (when possible)

- verification of the good state and good form of the pipes, and their connections

- electric tension measurement

-verification of the leakproof and sealing regarding the legislation rules

Aerothermal systems

cleaning (if necessary) and verification of the unit heat exchanger

cleaning of the interior unit and the filter

Distribution system

Water loop distribution system

pressure and inflation control of the expansion vases and re-inflate (if necessary)

verification and cleaning (if necessary, of the filter on the water loop)

verification of the mud level

pressure control

purging of the air bubbles (if the purging spot is accessible.)

verification of the good working of the circulating pump

Air vector distribution system

Pipes accessibility and good conditions verification

verification and cleaning with disinfection of the interior unit and its filter

verification of the good operation and condition of the ventilator

verifications of the potential and complementary accessories.

verification of the interior and exterior unit temperature.

static/ dynamic electric tension check

report of the default seen and fixed

recommendation about the possible upgrading of your heat pump and how to deal with the potential default.

recommendation on the best use of your appliances

performance energetic evaluation of the existing heat pump (complementary evaluation)

refrigerants fluid leak detection test

Here it is the link of the official government page about the general mentions and actions that needs to be done during maintenance checking and to be added in the attestation d'entretien.

https://www.ecologie.gouv.fr/entretien-et-inspection-des-systemes-chauffage-et-climatisation