MATERIALS FOR PROFESSIONAL TRAININGS

MODULE 2 - HARP Tool

HARP
Heating Appliances Retrofit Planning

Structure

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

Summary

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

Labeling existing heating appliances with the HARP Tool

HARP

Aim

- Define an **energy label for** space heating and water heaters **old appliances**. For the appliances that were in the market before the introduction of energy label directive.
- Give the possibility to final user and to professionals to **compare** the old appliance label with the one of a new product.

The label output is:

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

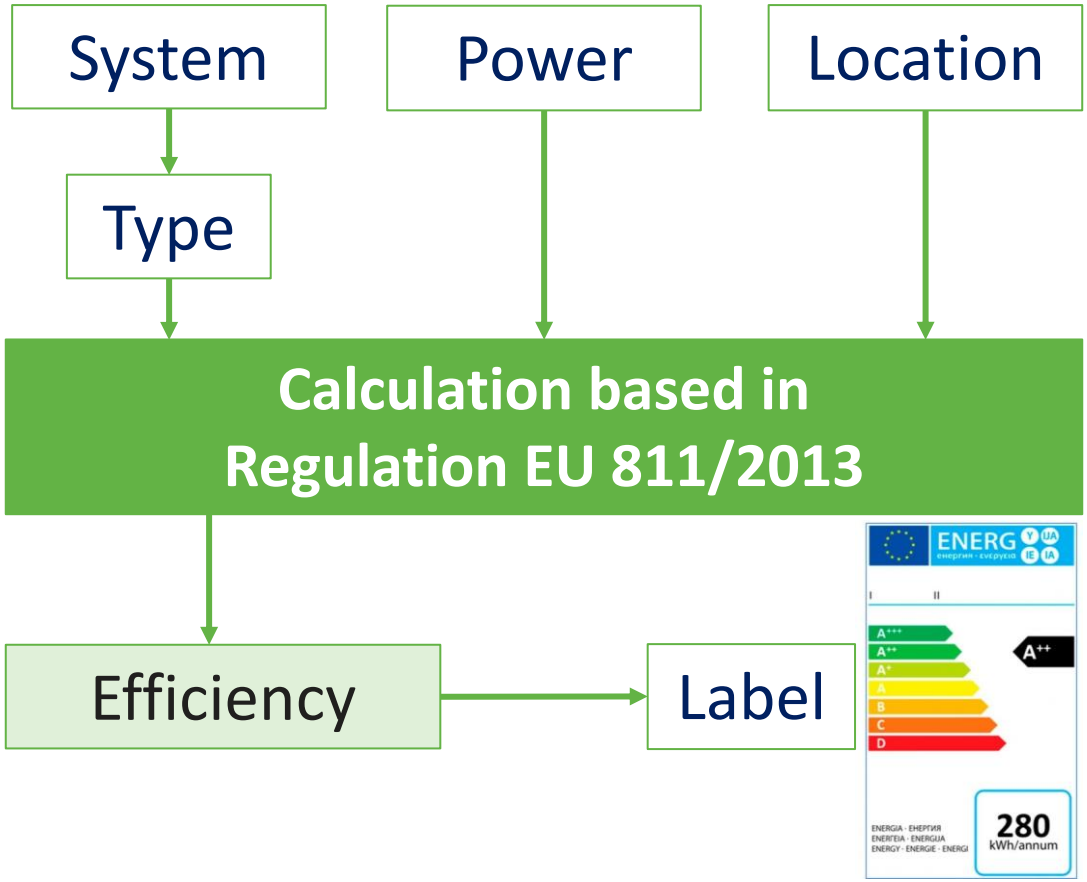
These values will be used in the HARP tool

*SH = Space Heating

Labeling appliances in the HARP tool - boilers

Two versions:

1. *One simplified for consumers*



Labeling appliances in the HARP tool - boilers

Two versions:

2. *A more accurate version for professional use*

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

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

Labeling appliances in the HARP tool – heat pumps

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

- Air to air
- Air to water
- Air (from exhaust air) to water
- Water to water

Energy Labeling for new SH appliances

From (included)	To (excluded)	
150		A+++
125	150	A++
98	125	A+
90	98	A
82	90	B
75	82	C
36	75	D

Efficiency

Classes

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

Energy demand and energy consumption calculation

HARP

Energy de tion

User input

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

1. **Space heating**

2. **DHW**

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

4. **Heating space-square meters**

5. **No. Days (water heating)**

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

7. **SH and SHW fuel:**
- Gas
- Electricity
- Oil

8. **SH and DHW year of installation**

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

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

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

Energy demand and consumption

Information gathered

1. Space heating Energy demand (kWh/m2)

- Location (Country)
- Type of building
- Building construction date
- Source: Buildings load “Eurac”

2. DHW

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

3. System efficiency

- Source. Step 1

4. Energy cost

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

5. CO2 emissions

Energy demand and consumption

Outputs:

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

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

Energy demand kWh/m2 × Heating space = Energy demand (MWh/year)

Energy demand and consumption

Outputs:

3. *Energy consumption (MWh / year)*

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

4. *Energy cost (MWh / year)*

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

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

New system savings

Energy demand and consumption

User input

1. Storage space available

- No
- Limited
- Yes

2. Garden/land available

- No
- Yes

3. Roof available

- No
- Yes

4. Gas network

- No
- Yes

5. Electricity capacity

- No
- Limited
- High

6. Selection criteria

- Profitability
- Energy savings
- CO2 savings

New system savings

Outputs:

1. Thermal power

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

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

New system savings

Outputs:

1. Thermal power – Availability

The tool cross checks the requirements of each system and the user characteristics (roof, garden, gas network). The result is the systems technically available for the user.

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

An example of part of the data that will return the Excel tool

New system savings

Outputs:

2. System results

The tool calculates for every system technically available:

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

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