sHARPen & heat your memory

RULES BOOK

A HARP's serious game to challenge your memory while considering changing your heating system

“sHARPen & heat your memory” is an adaptation of a classic memory game.

This type of serious game allows everyone to stimulate his/her memory, simultaneously to learn about efficient heating technologies available on the market and to discover key features about heating appliances, eco-design, and energy consumption.

Our game proposes 5 different levels that are based on time constraints and level difficulty increases with shorter time intervals.

Each player can choose which level he/she wants to play in the beginning:

- Novice: 20 mins
- Advanced beginner: 15 mins
- Competent: 10 mins
- Proficient: 5 mins
- Expert: 2 mins
When the game begins,
all cards are hidden and only the back of the cards appears (the same for every card). The player is invited to
click on one card then another; if they match, they will stay face up. If not, they will be turned back. The player
wins a point for each matched pair. After the matched pair has been won, a pop-up window will appear with
the corresponding explanations that can be found in the table below.

The level is completed
when all cards are paired and faced up. When the time is over the player loose and need to start again or
choose an easier level. Sometimes it is not easy to become an expert...

but it is worth to try 😊
There are maximal 24 cards in the game and each level consist of 16 cards pooled randomly for 8 pairs. All
cards are presented hereunder at the end of this document with corresponding explanations of matching
pairs. The fun part of the game is that you need to be quick, while time is running, to find matching cards as in
a classical memory game. For each matching pairs, you will have a pop-up window that includes the
explanation of matching pairs.

In addition,
we will sometimes use heating specifications in units such as MWh (Mega Watt hour) or CO₂ equivalent
(carbon dioxide). These units are very important for e.g. professionals to compare heating system options. We
all regularly hear them in the media when they talk about energy or climate change and greenhouse gas
emissions. But, sometimes, these units are not very meaningful to citizens like all of us. Therefore, we have
decided to use, when possible, “equivalents” to facilitate the understanding of these scientific units to be able
to easy compare with our daily activities.

We use values (e.g. 1.000 kWh) that are averaged numbers and depend on heating parameters that indicate
the production of domestic hot water or heat premises. These values vary depending on the heating
technologies. We invite you to continue your research about heating systems on the HARP project website,
where you can browse many educational documents prepared to answer important questions such as: Is my
heating system efficient enough? Can I install a more efficient heating system to save energy and to save
money?

At the end
of your consumer journey, the overall objective is to help you understanding the significant opportunities to
change your old and inefficient system by a brand new one that is more efficient with a significant number of
benefits.

For the game
the equivalent average values are:

- For a quick 6 min shower at 40°C we use 1.4 kWh
- For a long 10 min shower at 40°C we use 2.21 kWh
- 1 tree absorbs 10 kgCO₂/year
- 1 km in car emits 0.124 kgCO₂
<table>
<thead>
<tr>
<th>Card</th>
<th>Description</th>
</tr>
</thead>
</table>
| ![Solar thermal panels](image1) | **Solar thermal panels**  
Solar thermal panels use heat and radiant light from the sun to provide space and water heating.  
Solar thermal can be used combined with a solar compatible existing heating system. Such system has low maintenance and operations costs and reduces CO₂ emissions and saves energy and money. |
| ![Biomass boilers](image2) | **Biomass boilers**  
Biomass boilers use wood or transformed wood products (for example wood pallets) to provide space and water heating.  
Biomass boilers use carbon neutral fuel generally with locally available resources. Such system can be combined with solar heating and is adapted to all output levels. |
### Condensing gas boilers

Condensing gas boilers use gas as primary energy source to provide space and water heating. Compared to conventional boilers, the condensing technology offers increased energy efficiency and reduced emissions and are easily installed and maintained. Condensing boilers are suitable for renovation in existing buildings as well as for new buildings. They can be easily combined with renewable energies technologies such as a solar thermal system and are extremely reliable.

### Aerothermal heat pumps

Aerothermal heat pumps use air as primary energy source to heat space and water and requires outside and interior installation. Heat pumps are easy to use, and any geothermal heat pump substantially contributes to the reduction of greenhouse gases emissions and combined with renewable electricity the technology is carbon free during operation.

### Energy labels

The most efficient heating technologies have an A or superior class (A+, A++ or A+++ ) energy label. To find out the energy class of your heating system, do not hesitate to use the Harp Online Tool developed by the European project HARP. You will be surprised, and you may want to change your old system. Whether you live in France, Germany, Italy, Portugal and Spain, the most effective options will be presented to you so that you can prepare the replacement of your old system for a new efficient heating solution. The tool is available in English and in all the 5 national languages of the project. When you will be ready for change and, in any case, please contact professionals to finalize your replacement.

The less efficient heating technologies are rated with low energy classes, bellow D to G. To find out the energy class of your heating system, do not hesitate to use the Harp Online Tool developed by the European project HARP. You will, without any doubt, be very surprised and you will probably want to change your old system. Whether you live in France, Germany, Italy, Portugal and Spain, the most effective options will be presented to you so that you can prepare the replacement of your old system for a new efficient heating solution. The tool is available in English and in all the 5 national languages of the project. When you will be ready for change and, in any case, please contact professionals to finalize your replacement.
<table>
<thead>
<tr>
<th>Example of energy consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>The average yearly energy consumption of a condensing gas boiler, to heat an 80 m² house in a temperate climate zone is 18.57 MWh/year. This corresponds to 8.400 showers at 40°C with a duration of 10 mn.</td>
</tr>
<tr>
<td>Example of energy consumption</td>
</tr>
<tr>
<td>--------------------------------</td>
</tr>
<tr>
<td>The average yearly energy consumption of a biomass boiler, to heat an 80 m² house in a temperate climate zone is 20.22 MWh/year. This corresponds to 9.150 showers at 40°C with a duration of 10 mn.</td>
</tr>
<tr>
<td>Example of energy consumption</td>
</tr>
<tr>
<td>--------------------------------</td>
</tr>
<tr>
<td>The average yearly energy consumption of an aerothermal heat pump, to heat an 80 m² house in a temperate climate zone, is 8.81 MWh/year. This corresponds to 3.990 showers at 40°C with a duration of 10 mn.</td>
</tr>
<tr>
<td>Example of energy consumption</td>
</tr>
<tr>
<td>--------------------------------</td>
</tr>
<tr>
<td>The average yearly energy consumption of a heating system combining a solar thermal and an aerothermal heat pump, to heat an 80 m² house in a temperate climate zone, is 8.10 MWh/year. This corresponds to 3.660 showers at 40°C with a duration of 10 mn.</td>
</tr>
</tbody>
</table>
### Example of energy consumption

The average yearly energy consumption of a heating system combining a solar thermal and a geothermal heat pump, to heat an 80 m² house in a temperate climate zone, is 3.35 MWh/year. This corresponds to 1.510 showers at 40°C with a duration of 10 min.

### Example of energy consumption

The average yearly energy consumption of a heating system combining a solar thermal and a biomass boiler, to heat an 80 m² house in a temperate climate zone, is 18.61 MWh/year. This corresponds to 8.420 showers at 40°C with a duration of 10 mn.

### Comparison

Compared to an old oil boiler, a Spanish household living in an individual house of 80 m² can save up to 6.614 tons per year of CO₂ emissions by replacing the old boiler with an efficient biomass boiler. Considering that, in average, a tree absorbs 10 kgCO₂/year, this corresponds to a 661 trees forest.

### Comparison

Compared to an old oil boiler, a French household living in an individual house of 80 m² can save up to 4.034 tons per year of CO₂ emissions by replacing the old boiler with an efficient aerothermal heat pump heating technology. Considering that, in average, a tree absorbs 10 kgCO₂/year, this corresponds to a 403 trees forest.
<table>
<thead>
<tr>
<th>Country</th>
<th>Comparison</th>
<th>Energy Savings</th>
<th>Emissions Savings</th>
<th>Trees Saved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Italy</td>
<td>Compared to an old oil boiler, an Italian household living in an individual house of 80 m² can save up to 2.101 tonnes per year of CO₂ emissions by replacing the old boiler with an efficient condensing gas boiler. Considering that, in average, a tree absorbs 10 kgCO₂/year, this corresponds to a 210 trees forest.</td>
<td>2.101 tonnes per year of CO₂</td>
<td>210 trees forest</td>
<td></td>
</tr>
<tr>
<td>Portugal</td>
<td>Compared to an old oil boiler, a Portuguese household living in an individual house of 80 m² can save up to 969 euros per year on an energy bill by replacing the old boiler with an efficient biomass boiler.</td>
<td>969 euros per year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Germany</td>
<td>Compared to an old oil boiler, a German household living in an individual house of 80 m² can save up to 683 euros per year on an energy bill by replacing the old boiler with an efficient aerothermal heat pump heating system.</td>
<td>683 euros per year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spain</td>
<td>Compared to an old oil boiler, a Spanish household living in an individual house of 80 m² can save up to 1.021 euros per year on an energy bill by replacing the old boiler with an efficient condensing gas boiler.</td>
<td>1.021 euros per year</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Comparison**

Compared to an old oil boiler, a German household living in an individual house of 80 m² can save 6.265 kWh per year of the energy consumption by replacing the old boiler with an efficient biomass boiler. This corresponds to 4.475 showers at 40°C with a duration of 6 mn.

**Comparison**

Compared to an old oil boiler, a French household living in an individual house of 80 m² can save 5.773 kWh per year of the energy consumption by replacing the old boiler with an efficient aerothermal heat pump heating system. This corresponds to 4.120 showers at 40°C with a duration of 6 mn.

**Comparison**

Compared to an old oil boiler, a Portuguese household living in an individual house of 80 m² can save 20.207 kWh per year of the energy consumption by replacing the old boiler with an efficient condensing gas boiler. This corresponds to 14.433 showers at 40°C with a duration of 6 mn.

**Comparison**

Solar thermal heating system can provide enough hot water for 2.000 showers per year. If we consider that, on average, a quick shower of 6 minutes represents a consumption of 1.4 kWh, this represents a total of 2.800 kWh (or 4.420 kWh for a longer shower of 10 minutes which uses 2.21 kWh).
Comparison
Solar thermal heating system can provide enough hot water to wash laundry 2,500 times.
And do not forget that solar thermal can be used combined with a solar compatible existing heating system with low maintenance and operations costs. In addition, available hot water can be stored because solar thermal systems come with a storage.

Comparison
Solar thermal heating system can provide enough hot water to wash dishes 1,600 times per year.
And do not forget that solar energy is free and available to everyone and that allow to reduce CO₂ emissions and saves energy and money.

For those who will want to leave a game in the middle of a series, you will just have to click on the HARP logo in the top bar of the game and you will be returned to the initial game page.

We hope you will enjoy your journey playing this game ...

Efficient heating solutions are there... they just need to be better explained to all of us ... then consumers may change their old inefficient system for a new efficient heating system to save money, time and the environment!

For more information: www.heating-retrofit.eu @HARPproject

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 847049. The sole responsibility for this content lies with the authors. It does not necessarily reflect the opinion of the European Union. Neither the EASME nor the European Commission are responsible for any use that may be made of the information contained therein.