HEATING AND COOLING
KNOWHOW AND SOLUTIONS

HACKS

POLITECNICO DI MILANO

Deliverable 4.3
Online calculator to visualise and customise the multiple benefits of energy efficient HAC products and solutions

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European portal www.topten.eu/hacks

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About HACKS

The objective of the Heating and Cooling Knowhow and Solutions (HACKS) project is to achieve market transformation for heating and cooling (HAC) appliances and improve comfort and health of European citizens.

Across the EU almost half of all buildings have individual boilers that were installed before 1992 with efficiency of 60% or less. The expected energy savings from a speedy replacement are immense.

To achieve this goal, 17 HACKS partners in 15 countries are working together, thanks to the financial support of the European Horizon 2020 programme.

After scanning market actors, current policies and most commonly used products in each country, starting from April 2020 the HACKS partners will implement involvement campaigns to raise awareness of the economic and environmental benefits brought by good HAC products and solutions:

- HACKS will motivate households equipped with old and inefficient devices – boilers, water heaters, air conditioners, certain types of boilers and stoves, etc. – to replace them with new super-efficient equipment.
- In each country, partners will set-up dedicated on-line platforms to assist consumers in their purchasing process. The platforms will propose: tools to assess households' needs and provide customised information; best product lists with technical specifications; direct links to suppliers of most efficient products; and advice on how to use and maintain equipment.
- For those households who need to improve their situation because they feel too hot, too cold, or too humid but who cannot invest in new equipment or can avoid getting equipped, HACKS will propose simple and low costs solutions. It is possible to reduce energy consumption and energy bills while improving winter and summer comfort, air quality and health conditions through the installation of shading devices, thermostats, water saving taps and showerheads, etc.

Beyond households, HACKS will target all relevant stakeholders (“multipliers”) that participate in the decision-making process of consumers by setting up strategic partnerships to facilitate the purchase of energy efficient appliances. HACKS places a strong emphasis on installers but also retailers and consumer organisations because of their proximity to consumers, their capacity to involve them and bring them guidance on energy efficient equipment.

More information on the HACKS project can be found at www.topten.eu/hacks

Executive Summary

This document provides an overview about the development of an online calculator to visualise and customise the multiple benefits of energy efficient heating and cooling (HAC) products and solutions – part of the activities of the HACKS consumer outreach campaigns.

The main concept behind the calculator is to show, using a reasonable number of input data, the effectiveness and positive impact of the most efficient products for heating and cooling.

The international scope of the action requires a common approach in the development of the tool, however suitable to cover different national specific conditions.

For this reason, a simplified approach was followed, based on a simple set of available data for all the possible users of the tool and suitable for country customization.

The structure of the tool allows continuous improvement in the base parameter used for the calculation and further personalization by the partners.

The tool for heating systems is available for the 15 HACKS partners, at the link https://calculator.topten.eu – and is now being adapted and translated in 12 languages, before their final lay-out is customized to each HACKS platform.

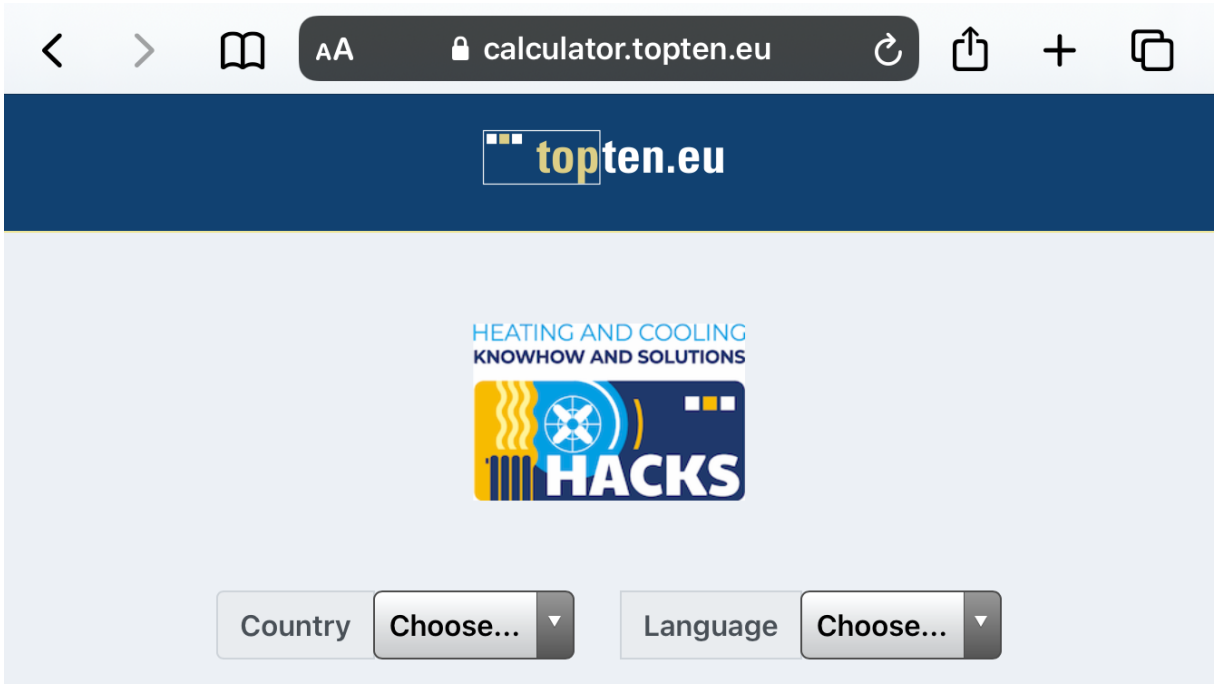

Figure 1: Caption image of the calculator, as visible on a mobile phone screen

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1 Development of the HACKS on-line calculator for heating

The HACKS on-line calculator is originally intended for tenants and product owners, consumer-oriented, easy to use, but providing enough advice to be appealing and to support discussions with installers.

The original scope of the tool was the evaluation of individual heating and cooling needs. The tool should suggest customised products and solutions and adaptation measures and calculate the cost savings for different efficient and sustainable alternatives.

The development of the HACKS calculation tool started since the first months of the project with as first steps:

- A collection of similar available tools at national and international levels (the development of the HARP tool was taken into consideration)
- The analysis of those existing tools, identification of common features and missing information
- A more in-depth evaluation of the useful outcomes of the tools, in order to increase the usability and convenience for users.

A spreadsheet version was first used, in order to simulate the calculation, to check the correctness of the assumptions made. This approach, of using first a simple spreadsheet in order to test several cases and multiple options on the assumptions made regarding the parameters used, made possible the simplification of the complex calculation, preserving a reliable result.

Then, a subcontractor was involved to develop the first version of the online tool.

The beta version of the online tool was submitted and explained to the HACKS partners, in order to identify the missing points and the national needs. A video was made for the presentation of the tool, sharing and explaining in detail also the basic calculation methodology, the assumptions made, the possible national adaptations.

After a first round of comments, partners' suggestions were collected in order to be implemented in a second beta version of the tool which is now on-line on the HACKS European platform. It is now being adapted and translated in national languages.

2 Structure of the tool

The tool is currently targeting heating systems for small-medium size apartments and residential buildings.

It was decided to limit as much as possible the input from the user. The data requested are, after the necessary localization (country and language) are:

- The household size,
- The climate zone,
- The current heating system, with some specifications,
- The current consumption for heating,
- The number of persons living in the household.

After the assessment of the so-called "actual situation", the second step concerns the choice and comparison of the new system(s).

In this step, the consumer can also include possible savings measures (s)he would implement thanks to insulation improvement of the building components. This feature follows the "energy efficiency first" principle.

The third step displays the results, in a simple table in order to be properly displayed in different devices and thus compliant with a multi-platform us (i.e. the HACKS calculator works on different types of devices, operating systems and browsers). In detail, it is possible to evaluate:

- The actual situation (current energy costs, energy needs and consumption, CO_2 emissions),
- The saving measures results, due to the insulation of the building components (using "energy needs" as indicator),
- The new system(s) performances, also in comparison with the current system, with yearly and lifetime indicators (energy costs, consumption, CO_2 emissions).

The displaying of operating costs (current and for the new systems) is necessary for an economical comparison of the alternatives.

The energy need indicator expresses the amount of heat necessary for keeping the house warm in winter. Often it is not considered by the typical consumer, but is necessary to highlight the importance of the insulation measures on the building envelope.

CO_2 emissions and equivalent are important for displaying the impact of more sustainable heating solutions.

The sum of those indicators, their comparison and reduction in absolute number and in percentage, will display the multiple benefits of a more efficient and sustainable system.

3 Further developments

The flexible and parametric structure of the HACKS on-line calculator will be used in the next period for:

- Additional national customization
- Improvement of the parameters used for the calculation
- Inclusion of the cooling systems and strategies

3.1 Improvement of the current tool for heating

A number of critical issues raised during the test phase and some requests were made by national partners for the development of the heating calculator.

In particular, the comfort level is not properly assessed since the calculator is based on a 100% heated and comfortable situation: for energy poor or partially heated households, this is therefore partly inadequate.

For this reason, a new assessment algorithm was developed and will be tested on the online tool. This assessment methodology is based on statistical national data regarding energy need for heating for each climate zone and building age.

The complexity lies in the inclusion in the current structure of the tool, but in the next few months it will be implemented and tested because for some countries, it is really important.

3.2 Calculator for cooling

The cooling calculator is already developed but not yet online, since it needs extra improvement and simplification.

In some countries cooling is not an issue, and at EU level cooling in the residential sector is a small part compared to heating consumption. However, the analysis made in the first Task of the project demonstrated that a significant growth of the cooling appliance number and energy consumption is expected in the next years in all countries involved in the project.

The cooling calculator is based on two approaches:

- A simplified approach, asking for basic data (room size, climate zone / location)
- A more detailed approach at room level, for properly sizing the cooling needs.

The results of the cooling calculator will show:

- The comfort level reached, using active cooling or low energy appliances and/or passive strategies
- The consumption level and the CO_2 emissions linked to cooling needs, with a comparison between highly efficient systems, market average products, low energy or passive approaches. The complexity typically linked to the proper sizing of cooling system is addressed following a “single room approach”.