Annex 55

Comfort & Climate Box

A Comfort and Climate Box (CCB) solution, which means an integrated combination of a heat pump, energy storage and control, is a key solution for decarbonizing heating and cooling of buildings. It can satisfy consumer demands for comfort, reliability, and affordability and at the same time fulfil the needs from policy makers, utilities and grid operators concerning climate goals, energy security and grid stability.

Key Findings

1 Concerning deployment of CCBs, both the priorities and status of the local markets in different countries differ greatly. The reason is that the technical boundary conditions in different countries differ heavily - the weather, building size, solar orientation, envelope quality, electricity and energy mix, grid status and lifestyle choices etc. Therefore, four archetypes for CCB implementation strategies were defined, see Figure 1. Affordability, Flexibility, Compactness, Energy efficiency.

2 In ongoing and performed research projects and field trials there seems to be a shift away from focus on efficiency only, towards other quality criteria that are indicators for the local requirements like compactness, affordability and flexibility.

3 Standardization worldwide is focused on the solitary and stationary performance of individual components, heat pumps and storage options. There are no standards to be found for the combination of components or real-life performance. The creation of standards that take these aspects into account will enhance the development of integrated solutions.

4 During the execution of the project the energy module concept with a strong focus on the affordability and compactness quality criteria emerged as a CCB on to satisfy demands on some markets. On other markets flexible solutions which could stabilize the grid were introduced. A prototype of a CCB for this purpose was developed and evaluated with the project.

5 A road map giving an overview of actions to be taken by different stakeholders depending on the local demands, to stimulate the deployment of CCBs and thereby heat pumps was developed, see next page.

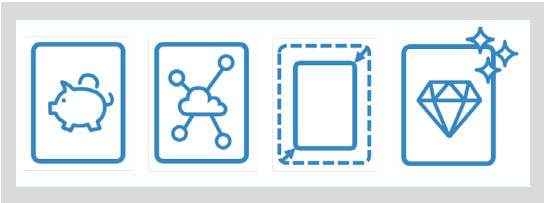

Figure 1. Four archetypes for CCB implementations. From left to right: Affordability, Flexibility, Compactness, Energy efficiency.

Figure 2. Comfort and Climate Box – Indoor climate.

<table>
<tr><th>Policy</th><th>Utilities and aggregators</th><th>Manufacturers</th></tr>
<tr><td rowspan="2">• Promote and prioritize heat pumps and energy storage in policies – a comprehensive approach needed
• Promote standards and communication protocols for smart, flexible combinations of heat pump and energy storage – CCBs
• Develop and revise labeling schemes that promote clean heating solutions which could balance the electricity grid
• Ensure capacity building, to educate installers as well as others in the value chain of CCBs
• Invest in electric infrastructure – both grid and production facilities of renewable electricity</td><td colspan="2">• Offer alternative business models (leasing, rental, heat as a service, etc) for using a heat pump or a CCB as main heating equipment</td></tr>
<tr><td>• Implement tariffs that stimulate off-peak-hour operation of the heating system
• Inform the end users how they can influence their energy bill by being a part of the electricity capacity market and incentivize flexibility
• Be stable in time and use harmonized price structures (over regions and countries)</td><td>• Make the products “sufficient efficient”, avoid additional features and focus on mass production of a limited number of models
• Make control strategies for CCB for combinations with solar PV, EV, and energy storage
• Make your communication protocol standardized and open
• Make the products ”plug-and-play” to minimize installation and maintenance costs
• Design the CCB as compact as possible and “boxify” the products
• Keep the volume of the energy storage limited and utilize the possibility of using the building construction as heat storage</td></tr>
<tr><td colspan="3">Continued research and innovation needed</td></tr>
</table>

Figure 3. Recommendations for accelerated deployment of CCB

Background

According to the IEA report “Net Zero by 2050 – A road map for the global energy sector” (2021) one of the defined key milestones, are **“no new sales of fossil fuel boilers by 2025”** and that **“50% of heating demand is met by heat pumps in 2045”**. To fulfill this the stock of installed heat pumps needs to increase from 180 million units in 2020 to 600 million units in 2030 globally. Integration of heat pump and storage is key to delivering a system that can satisfy consumer demands and at the same time relieve the constraints of the electricity grid that is fed from renewable sources. The challenge is to attract a large group of consumers is not interested in the technology as such but desires a comfortable house, a hot shower, a compact plug & play package, and an affordable energy bill.

Objectives

The objectives of Annex 55 were to speed up the development of CCB solutions and to bring them closer to the consumer market. The technical challenge was the smart combination of different technologies in one system.

Specialists from various fields of technology were required and needed to cooperate in order to accelerate product development. Therefore, this project (HPT Annex 55) was performed as a collaboration between HPT TCP and Energy Storage (ES) TCP, Task 34 and Mission Innovation #IC7 Affordable Heating and Cooling in Buildings.

Further information

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Publications:	Final reports of Annex 55 and Executive Summary of Annex 55, available at https://heatpumpingtechnologies.org/publications/
Internet:	Link to Annex 55