Annex 55

Comfort & Climate Box – towards better integration of heat pumps and storage

Executive Summary

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Summary report of the combined Annex 34 (Energy Storage) and Annex 55 (Heat Pumping Technologies), A compact package for heating, hot water, and energy storage

According to the IEA report "Net Zero by 2050 – A roadmap 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. Heat pumps will have to be combined with an energy storage solution that is more versatile than only the standard domestic hot water buffer. The challenge is after the early adaptors, to attract a much larger group of consumers that is not particularly tech-savvy or green. This group 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. Therefore, integration of heat pump and storage, but also integration within the home, personal preferences, and the electricity (smart) grid are key items to be recognized.

The Annex on the *Comfort & Climate Box* (CCB) has been jointly set up by both ES (Task #34) and HPT (Annex #55) because the 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.
A way to increase the number of heat pumps & energy storage options installed is by integrating the heat pump with thermal storage and intelligent control into a 'comfort and climate box' (CCB) type solution. This can be an integrated package in one sheet metal casing or a heat pump with a physical separate energy storage solution, but still under one controlling device and control strategy. The goal of this project was 'to speed up the development of CCBs and to bring CCBs closer to the consumer market'. Integration of the three components can satisfy different implementation strategies: affordability, flexibility, compactness, and energy efficiency. These implementation strategies relate to nine quality criteria as defined within this project: Affordability, customer appreciation, compactness, plug and play, energy efficiency, monitoring and control, smart grid performance, market suitability and level of integration.

The market status report investigates the local situation in the participating countries, to see what the local differences and similarities are. Which quality criteria have a priority in the respective countries and how much work is there still to be done on these quality criteria? It is concluded that both the priorities and status of the local market differ greatly. This makes sense as the technical boundary conditions in the participating countries also differ heavily. The weather, building size, solar orientation, envelope quality and lifestyle choices, to name a few, are very different between the countries.

An overview of a research project and field trials reveals that research efficiency is still the main focus, whereas field trials' focus is more divided over the different implementation strategies. The closer one gets to the actual implementation of technology, the more relevant boundary conditions become. In the Netherlands for example they created a special set of boundary conditions, that led

to the introduction of ‘energy modules’ by more than ten different companies. Energy modules fit the CCB concept nicely and show the technical and commercial feasibility of the concept.

The journey starts with the definition of a CCB. The annex started from the Mission Innovation Affordable heating and cooling workshop result: a request for an integrated HP and storage box, to speed up the development of CCBs and to bring CCBs closer to the consumer market. IEA HPT and ES TCP networks took over with the Dutch government providing financing for the operating agent.

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 with better real-life performance.

At the start of this project, the CCB approach was a paper concept. 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 that fits the market demands. The introduction of these CCBs proves that the CCB concept can be translated into technically and commercially viable products. That does not mean that our final goal has been reached and the mission has been accomplished, there is still plenty of work to be done. The roadmap gives an overview of actions to be taken depending on the local demands, to promote the development of CCBs and therewith the promotion of heat pumps and thermal storage.
A condensed overview of policy recommendations has been included in the report package as a separate document.
We hope to see more CCB developments that solve the local challenges to a more sustainable heating and cooling infrastructure.

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