Power Converter Topologies for Heat Pumps Powered by Renewable Energy Sources: A Literature Review - SUMMARY

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The research topic of this paper offers a preliminary contribution to the study of converter topologies utilized in **heat pump** (HP) systems powered by a **renewable energy** (RE) mix, including **wind turbines** (WTs), **photovoltaics** (PVs), and **battery energy storage systems** (BESS).

The primary objective of this paper is to provide a **comprehensive review** of **converter topologies** used in HP applications, particularly when integrated with **renewable energy sources** (RES) such as in our case, an energy mix including PVs, WTs and BESS.

This inclusive overview serves as a valuable resource for **researchers** and **industry stakeholders** advancing **converter technologies** for HP **applications**.

The review paper identified gaps in the existing literature, particularly regarding converter topologies employed in PV-HP projects. These gaps indicate a need for further investigation into optimal converter topologies that can be integrated with such energy mixes, focusing on their impact on system efficiency, reliability, and cost effectiveness. Addressing these gaps is critical to enhancing system performance, maximizing RE utilization, thereby fueling the smart integration of RESs into HP systems in order to drive sustainable heating and cooling solutions.

The review examines and analyzes converter topologies, including **DC-DC, AC-DC, DC-AC** that could be applied on both the **source side** of systems powered by a mix of RES, such as PVs (DC-DC), WTs (AC-DC), and ESS (bidirectional DC-DC), as well as the **load** side (DC-AC) while evaluating their strengths and weaknesses. The strengths and weaknesses of these topologies are evaluated without reaching a definitive conclusion on the most optimal choice. Instead, the authors highlight the most relevant topologies identified in the literature.

Finally, the paper offers insights and directions for future research work on power electronics converters in HP systems. Future research should focus on developing new converter topologies that are more efficient, reliable, and cost effective while enhancing compatibility between HPs and various RESs to fully leverage their synergies. Additionally, exploring advanced modulation and control strategies to optimize HP operation under diverse conditions is emphasized as a key area of focus.

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