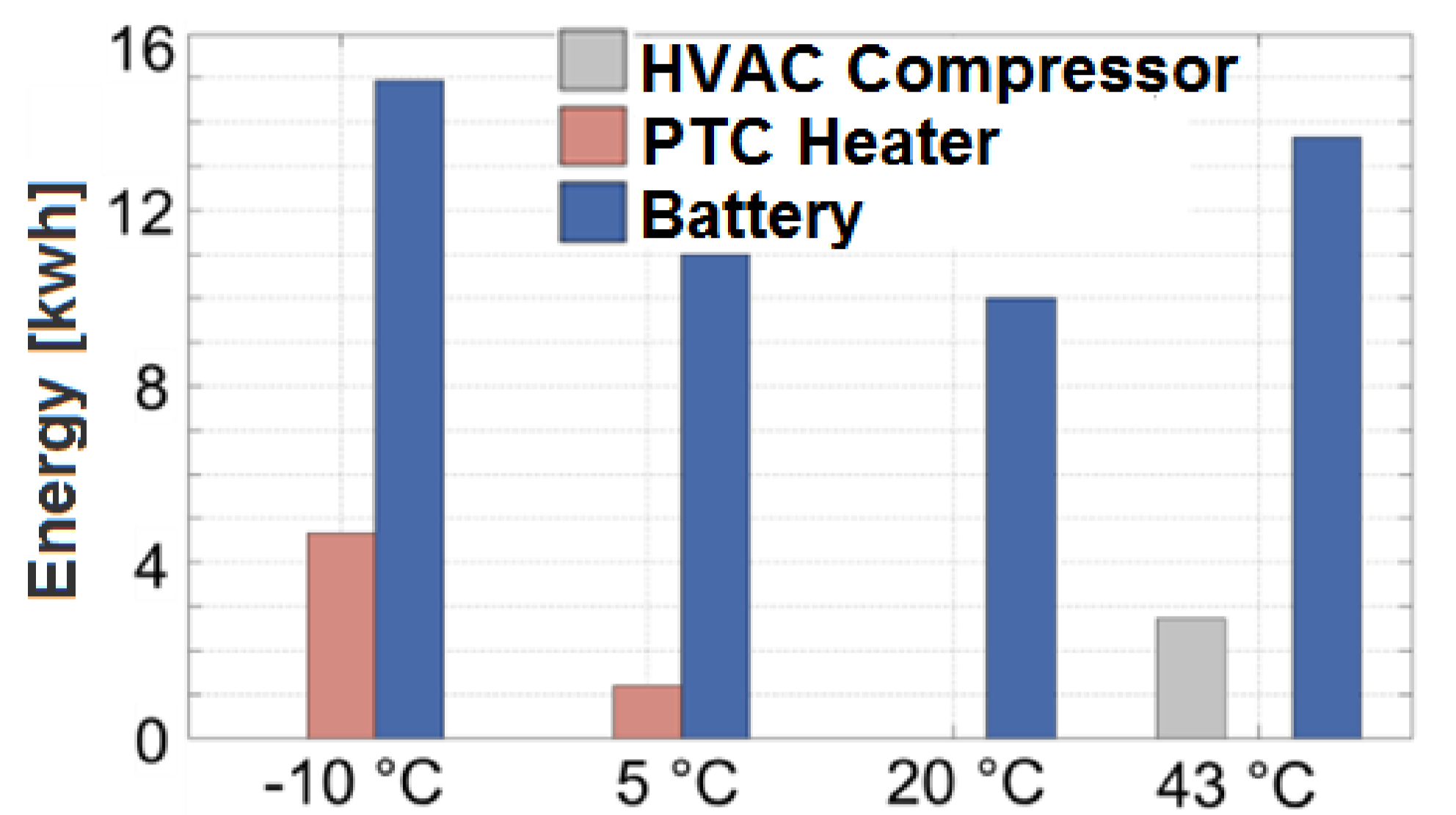


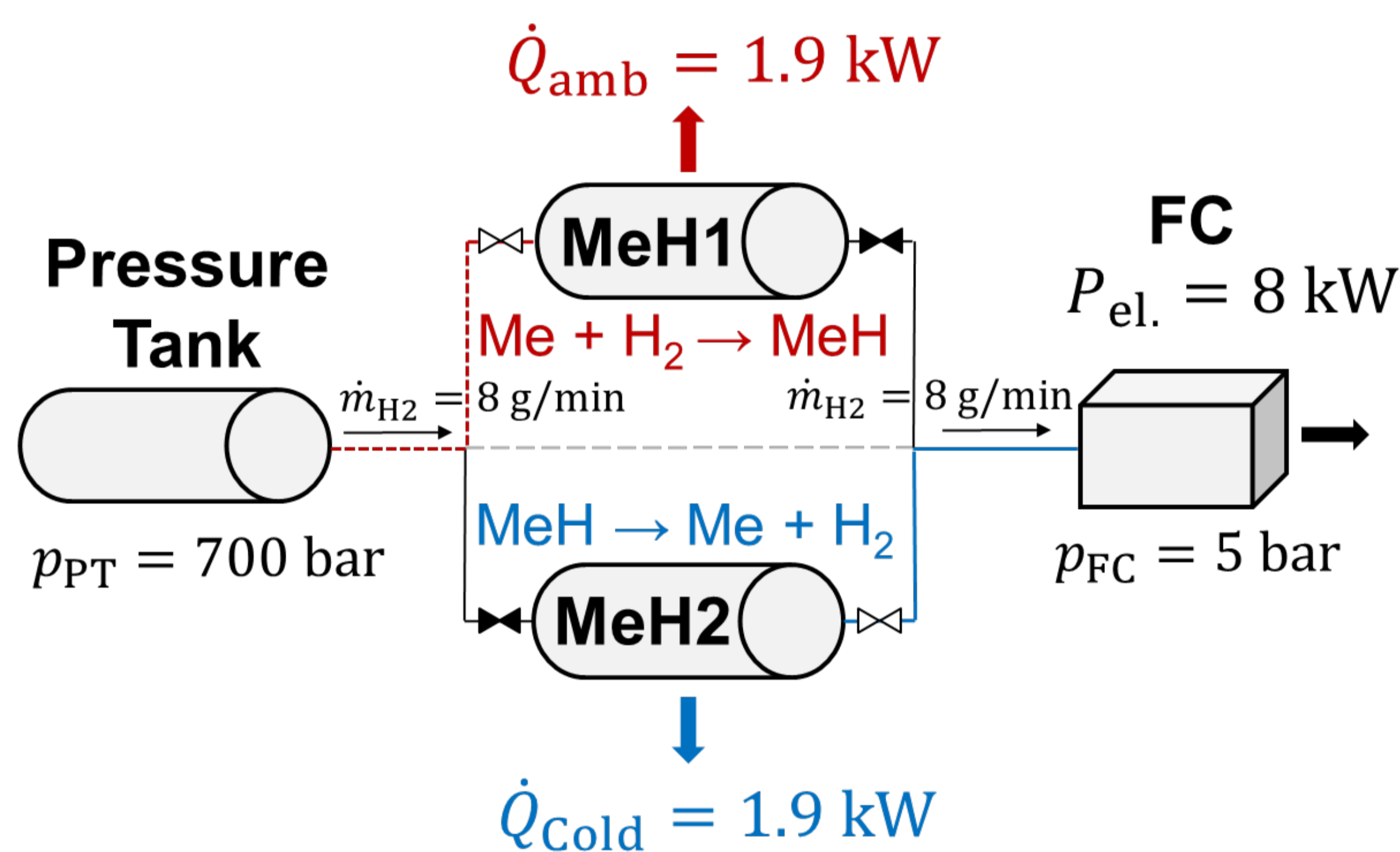
# A/C-APU – Innovative Air Conditioning Unit Based on Hydrogen to Extend the Driving Range of EVs and FCEVs

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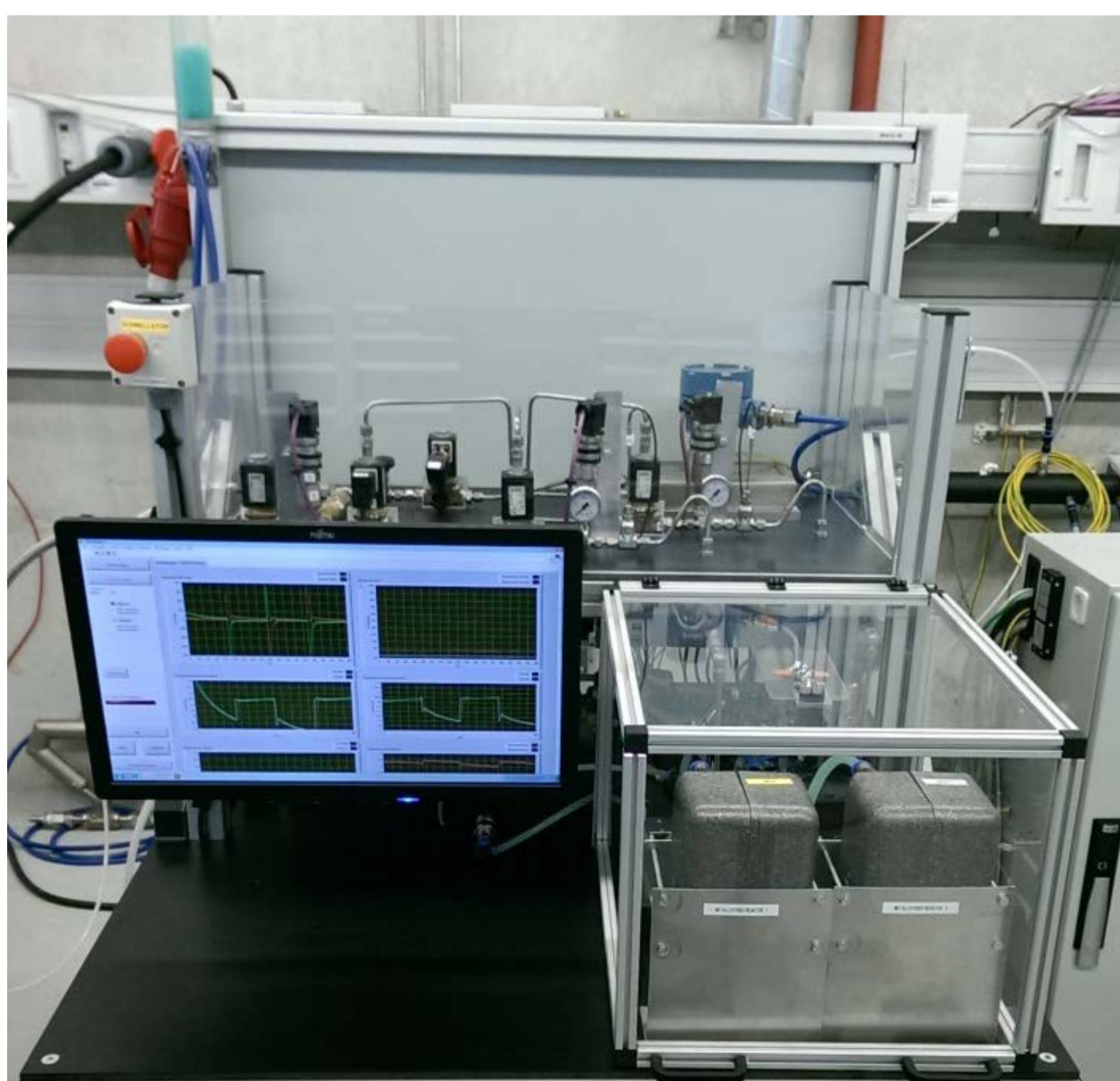
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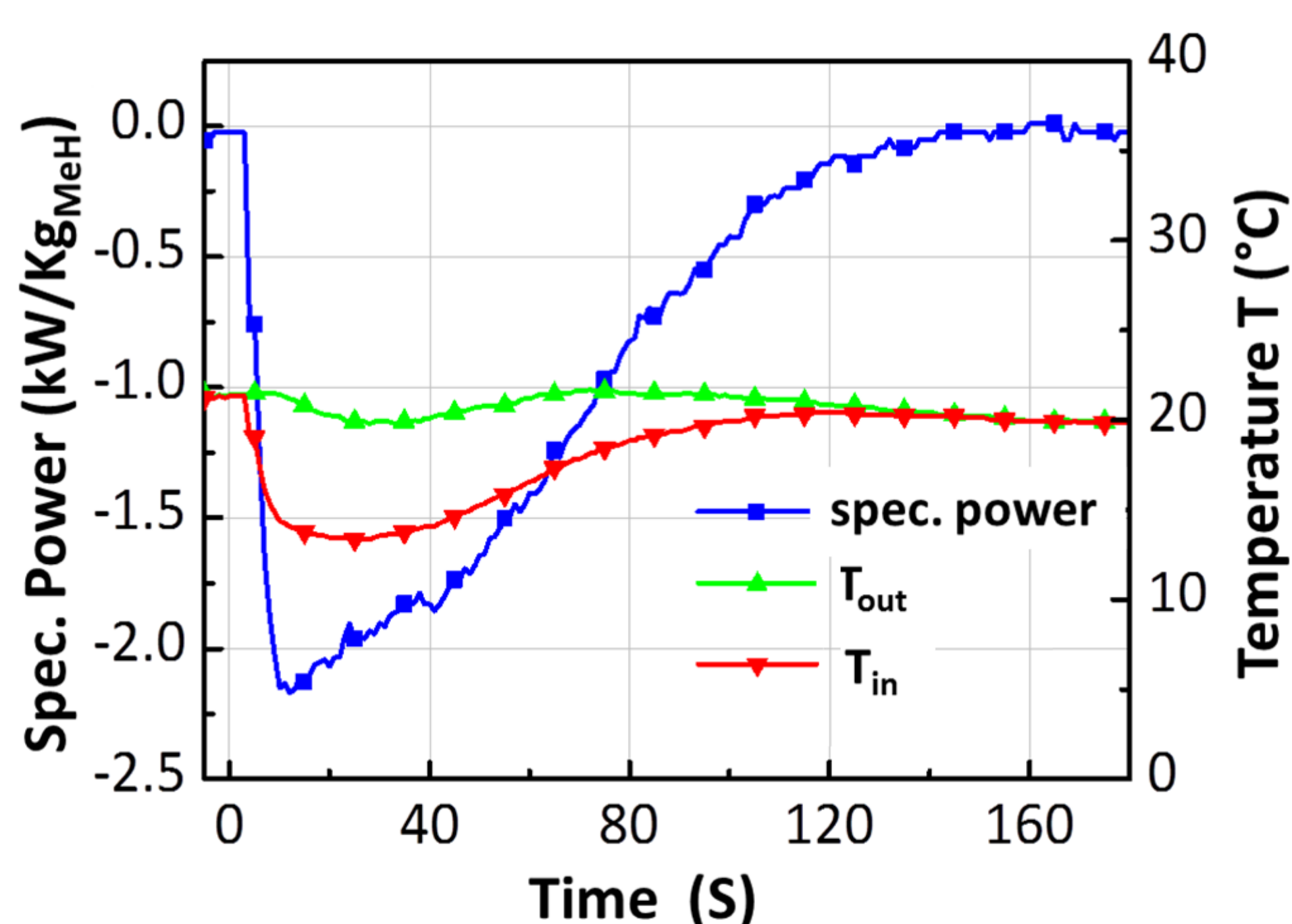
Amount of energy used for air conditioning in the Smart ForTwo ED



Functional principle of the AC-APU



Test bench for the MeH reactors



Specific cooling capacity of a MeH reactor

## Motivation

- Thermal management systems (HVAC, electrical heaters, etc.) have huge electrical energy usage at the expense of the final driving range of electric vehicles.
- As of January 1, 2017, several European Union directives prohibit the use of HFC 134a or any other Refrigerant with a Global Warming Potential (GWP) higher than 150 in new mobile air conditioning systems.

## Research objectives

- An energy efficient and environmentally friendly air-conditioning unit for passenger cars and buses that provides heating, cooling and electric power
- The use of hydrogen for air-conditioning and power generation (A/C-APU technology)

## Functional principle

- The main components of the A/C-APU are a hydrogen pressure tank, a fuel cell and a hydrogen based air conditioning system.
- The air conditioning system consists of compact metal hydride reservoirs and converts potential energy from the pressurized hydrogen into cooling.

## Current research

- Design and development of the metal hydride reservoirs
- Construction of two test benches for fuel cells and the reactors of the air conditioning system
- Design of a modular concept for the A/C-APU for passenger cars and buses
- Evaluation of the A/C-APU at the vehicle-level

## Prospect

- Construction and investigation of an A/C APU demonstrator with 8 kW of electric power, 8 kW of heating power and 2 kW of cooling power by the end of 2018
- Further development of the metal hydride technologies in cooperation with other companies (small, light, automated)