
GreenHP - next generation heat pump for retrofitting buildings



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GreenHP - Next Generation Air-to-Water Heat Pump Project consortium



GreenHP - Next Generation Air-to-Water Heat Pump

Main targets and the project's structure

- **Pushing air/water heat pumps** to show the capabilities of this technology for the market segment **of retrofitted urban buildings**.
- High performance and a low environmental impact are achieved by employing advanced **system integration concepts** as well as **new technological approaches** on unit and component level.
- GreenHP exploitation and dissemination strategy
 - **Abstinance of final device manufacturer as exclusive partners enables a strong diffusion of project results**
 - **Heat pump manufacturers are able to utilize results timely in their own future products**

GreenHP - Next Generation Air-to-Water Heat Pump

Perspective of heat pumps in EU-27 building stock

- 35% of residential buildings are multi-family houses in EU-27
- But to what extent these become equipped with heat pumps?
 - EHPA Outlook 2012: “...The sub-segment for **residential multi-family houses** is only developing slowly. Approximately 10 % of all heat pumps sold have a capacity of more than 20 kW, making them suitable for use in this segment....”

Source: BPIE (www.buildingsdata.eu)

EHPA Outlook 2012

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Unit and System Specifications

Target markets

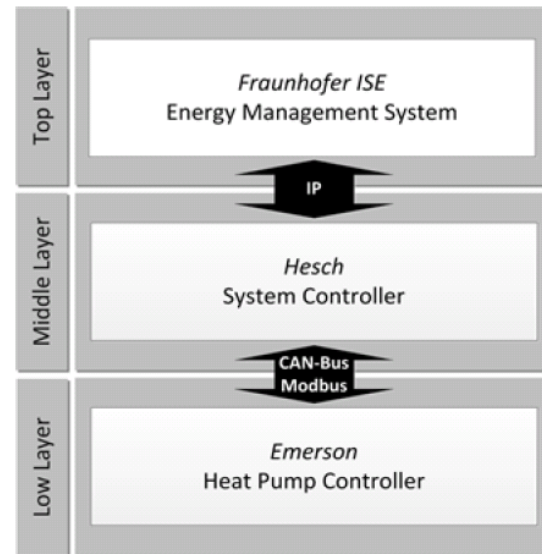
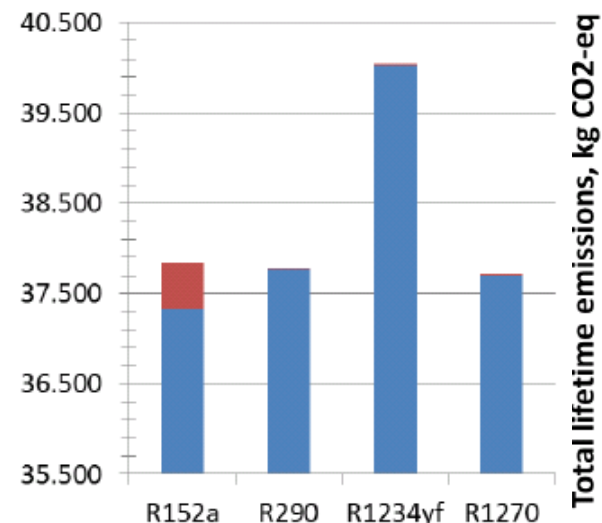
- Multifamily before 1990

Unit

- Load incl. DHW: 30kW (A-10/W55)
- Refrigerant Selection: R290
- Ref. charge: 20g per kW heating capac.
- Compact outdoor, roof-mounted (incl. gable)

System

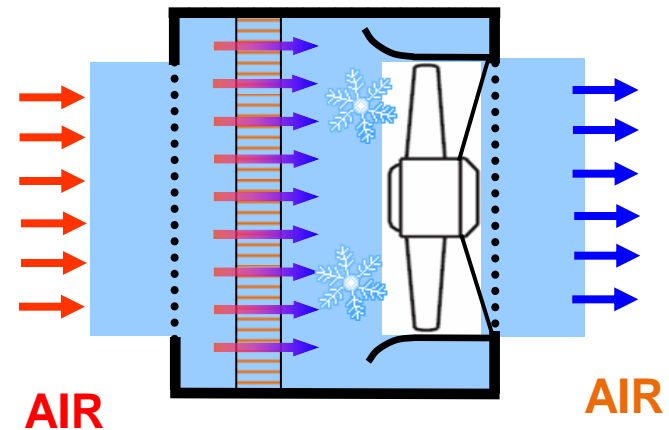
- Three-level control design
 - Energy management
 - System control
 - Refrigerant circuit management



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Duct Design

- Novel duct design with minichannel evaporator
- Fan with low noise development and small energy demand
- Pressure recovery due to nozzle inlet
- Efficient compensating of ice-particle loaded air at evaporator outlet



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Minichannel Evaporator (Air) and Condenser (Water)

Evaporator

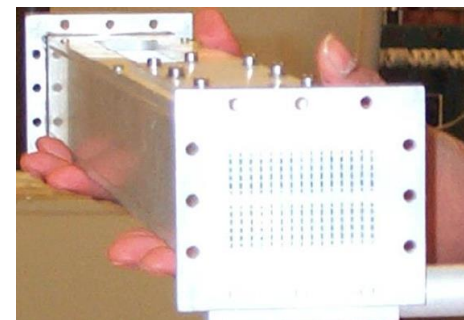
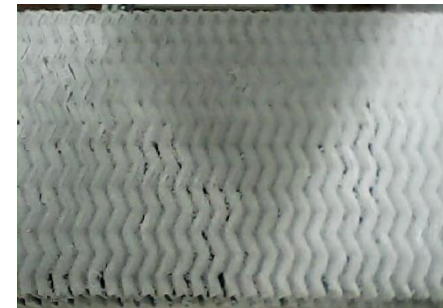
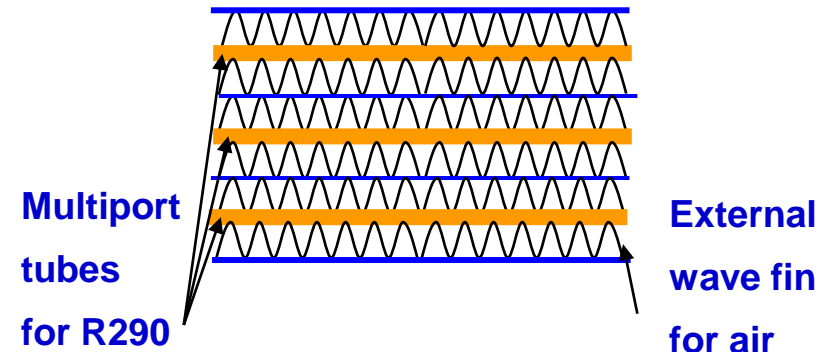
- Fin design optimized for stable operation in frosted conditions (tested with 10 samples, for one sample with promising results)
- Minimized condensate retention
- Low noise generation by minimal air flow velocities

Condenser

- Low refrigerant charge

Preliminary charge calculation

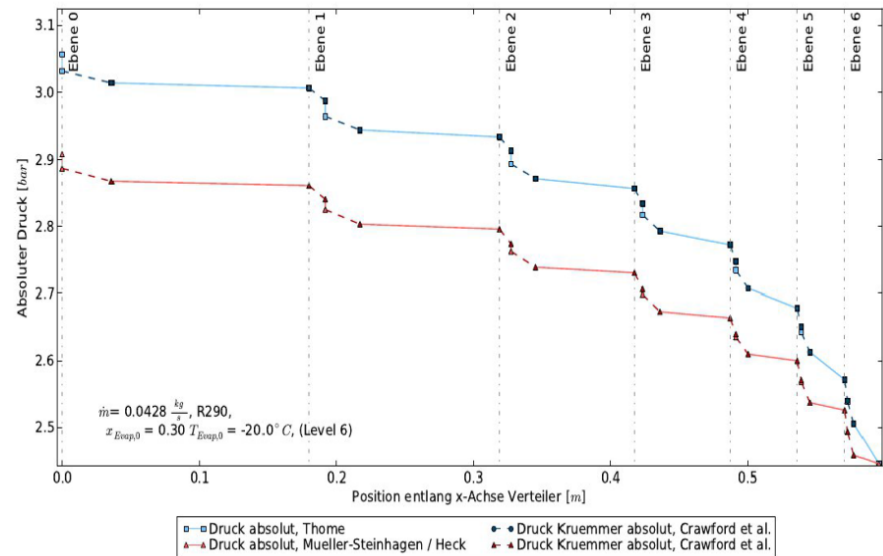
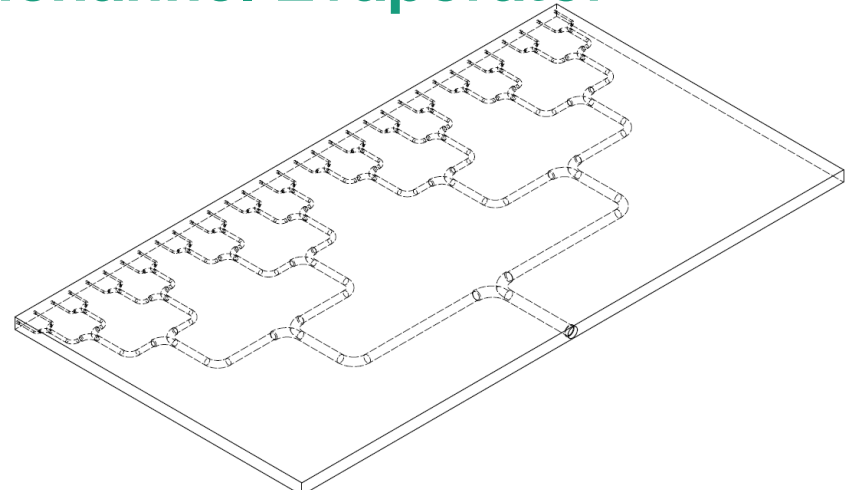
- In total: 500g
→ 17g per kW heating capacity



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Novel Fluid Distributor in Minichannel Evaporator

- Substitution of common manifolds with tree shaped distributor → massive parallelization allows smallest inner volume
- Static device with automated channel design (air-side maldistribution can be a design criterion) and optimized two-phase refrigerant distribution in part load conditions
- Automated manufacturing of distributor possible (hydroforming)
- Patented solution for connecting distributor and MPE tube fin block



GreenHP - Next Generation Air-to-Water Heat Pump Compressor

- Vapor Injection evaluation for R290
 - Performance & operating map impact (ongoing tests on fixed speed)
 - Applied cost evaluation
- New scroll design
 - Reach 30kW heating capacity at -18/58°C
 - Optimized with R290 for moderate climate profile
- Minimized internal free volume & oil
 - Variable speed allow smaller shell diameter
 - Oil Circulation management
- ATEX electrical box

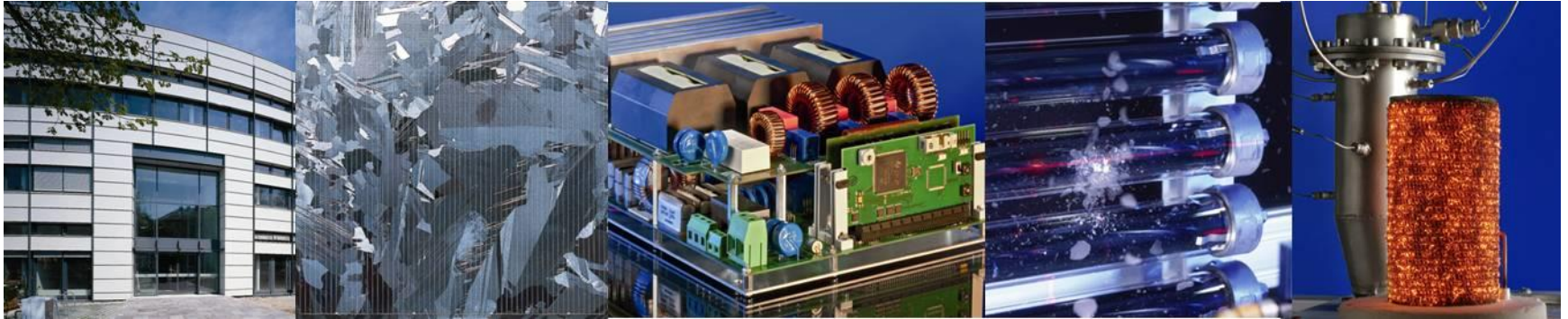


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Conclusions

- Several new component, and system products under development will be freely available from deliverer industry for final device manufacturers
- Feedback from industry (GreenHP Industrial Workshop, 14th October)
 - Participation of 10 manufacturers (GER, A, SE, IT)
 - Top-roof positioning is of no problem and will be accepted
 - 3 large manufacturers (GER, IT) agreed on refrigerant selection
 - Positive feedback regarding minichannel evaporator

Thank you for your attention



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