AUSTRIAN INSTITUTE OF TECHNOLOGY
TOMORROW TODAY

ENERGYbase

Monitoring results DEC systems 2010, 2011

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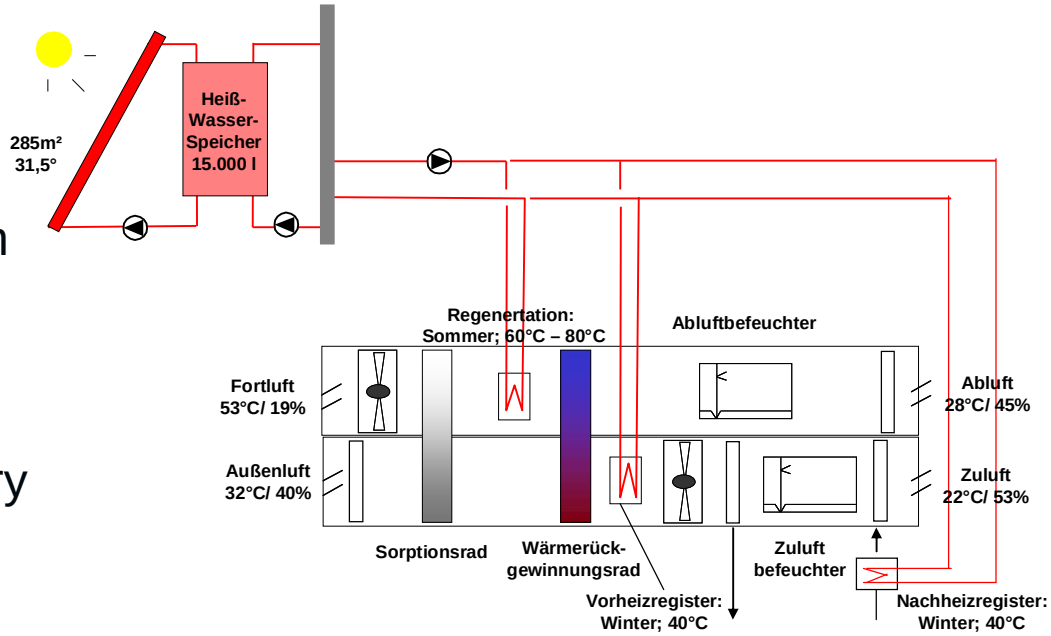
Content

- DEC System
- Monitoring hardware
- Monitoring evaluation
  - Primary energy savings
  - Performance of components
- Conclusions

Solar cooling (DEC-system)

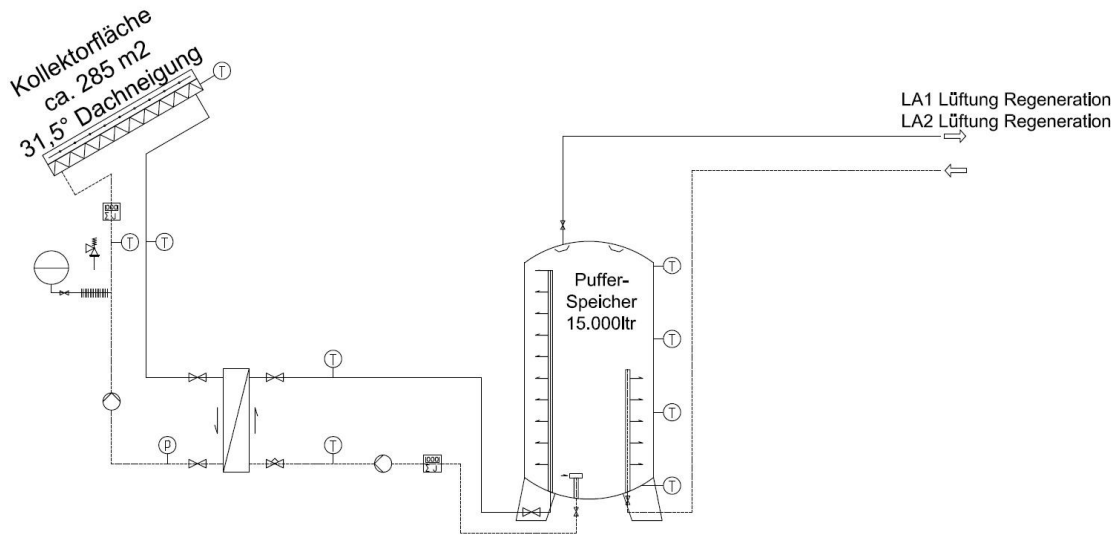
- Concept of operation:
  - DEC-system delivers air conditioned fresh air in summer
  - 100% solar thermal driven solar cooling system by 285m² flat plate collectors
  - Usage of DEC-system for humidity and heat recovery in winter



Source: AIT

Monitoring hardware

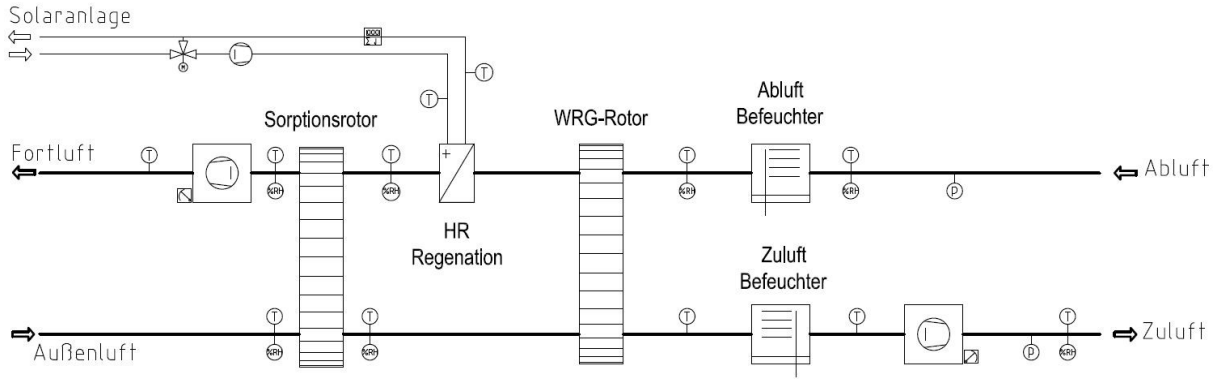
- DEC-System and solar thermal system: 151 sensors
  - Solar thermal system:
    - global irradiation on solar collector area
    - temperatures (primary loop, secondary loop, storage)
    - energy meters (primary loop, secondary loop, solar cooling)
    - pressure



Source: AIT

Monitoring hardware

- DEC-System:
  - temperatures, humidity (outside, after each main component)
  - volume flow (supply air, return air)
  - temperatures (primary loop, secondary loop, storage)
  - energy meters (heating coils)



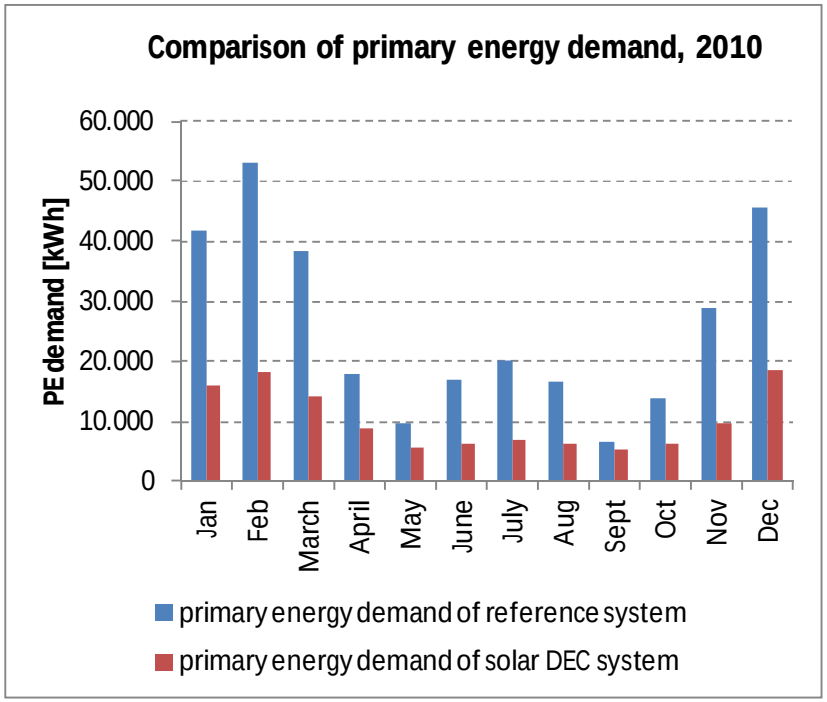
Source: AIT

Monitoring evaluation

- Primary energy savings (absolute per year):
  - **Winter** (Jan – March and Oct – Dec): 138.470 kWh → **73,9%**
  - **Summer** (June, July, Aug): 34.133 kWh → **18,2%**
  - **Transition time** (April, May and Sept): 14.774 kWh → **7,9%**
  - **Highest primary energy saving potential absolute in winter time for Austrian climate**

Used parameters according to Task 38 monitoring procedure:

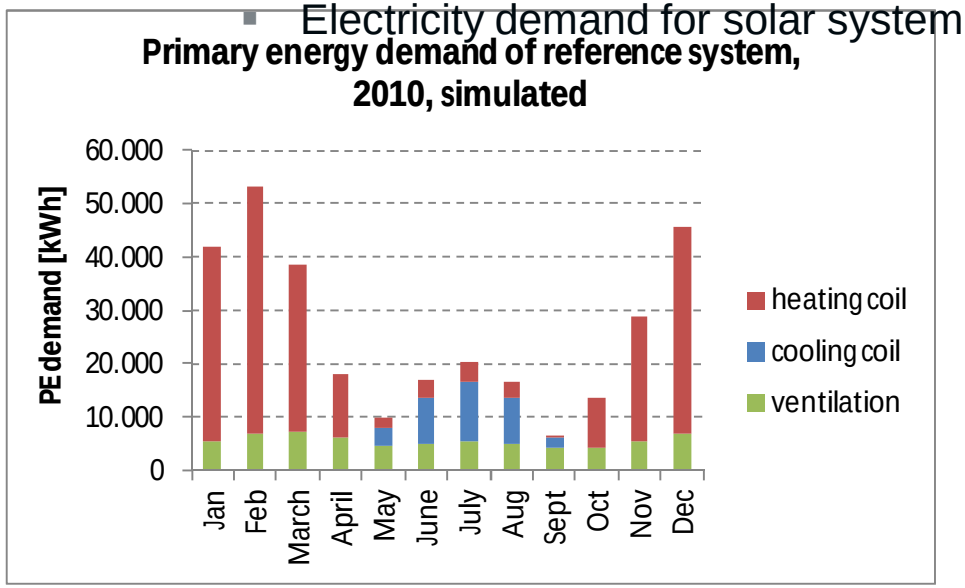
- PE conversion electricity: 2,5
- PE conversion gas: 1,11
- SPF compression chillers: 2,8
- Efficiency gas boiler: 0,95
- SPF heat pump (measured): 3,2



Source: AIT

Monitoring evaluation

- Composition of primary energy demand:
  - Reference system: highest demand for heating coils (supply air 22 ° C; 42% r.H.)
  - Solar DEC system:
    - heating demand in winter much lower due to enthalpy rotor
    - Electricity demand for solar system in summer very low



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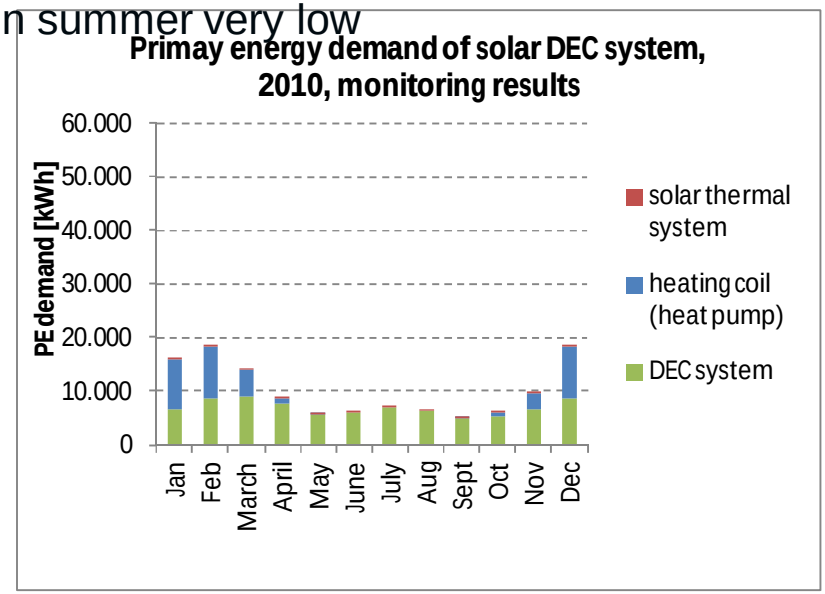
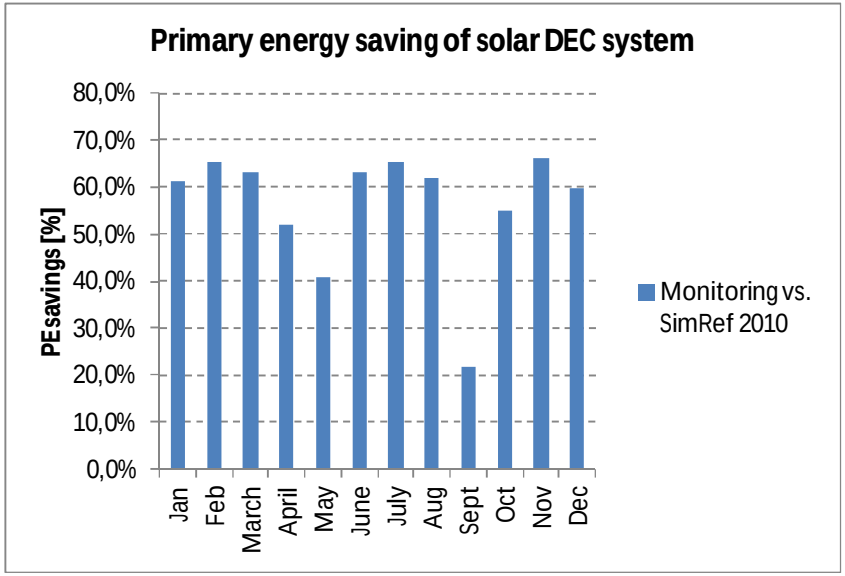


Source: AIT

Monitoring evaluation

- Primary energy savings (relative per month):
  - Quite high primary energy saving potential in summer and winter (~ 60%)
  - Task 38 Level 3 evaluation (right diagram) show monthly differences related to climatic conditions in 2010 and 2011 (July 2010: very hot; July 2011: very rainy and cold)



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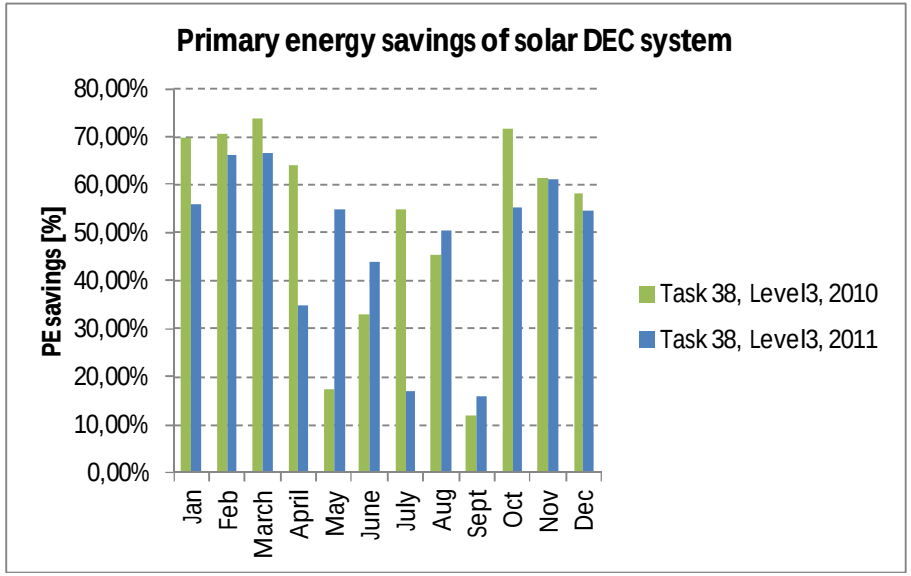
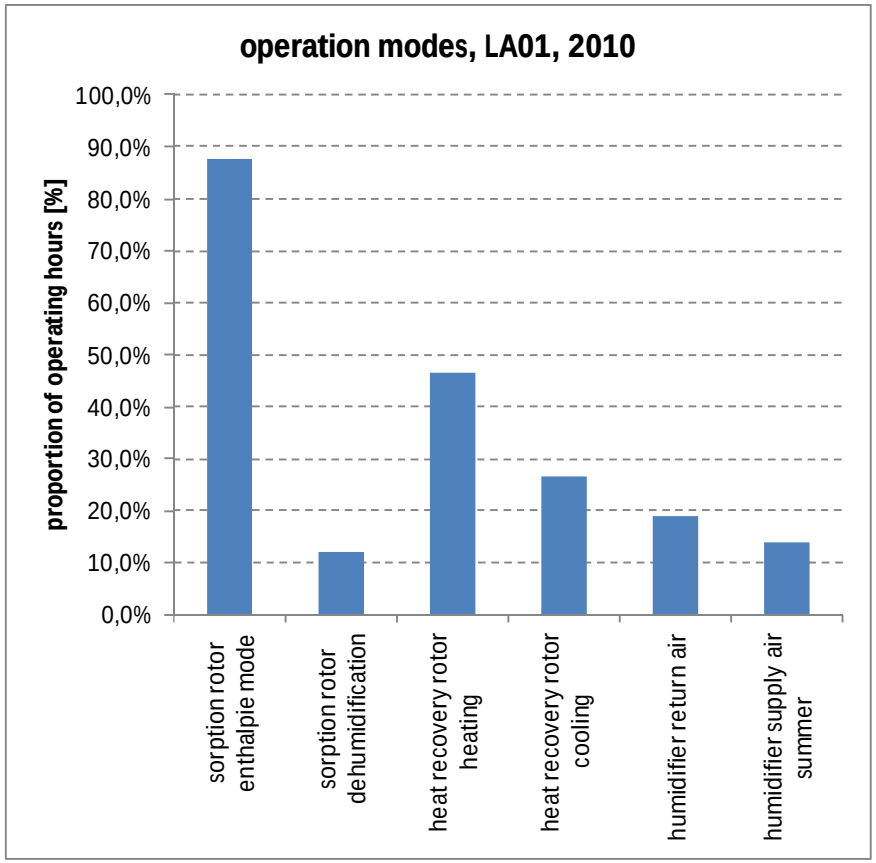


Source: AIT

Monitoring evaluation

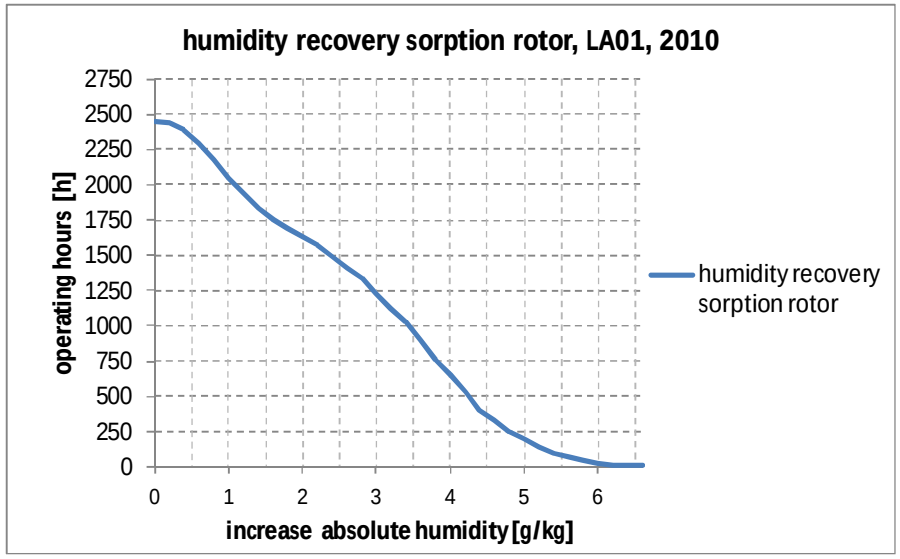
- Operation modes of DEC System
  - Sorption rotor always in operation during office time
    - 87,5 % in heat an humidity recovery mode (enthalpy rotor)
    - 12,0% in dehumidification mode
  - Heat recovery rotor (73,3% in operation)
    - 46,6% heating supply air
    - 26,7% cooling supply air
  - Spray humidifier
    - Return air: 19,0%
    - Supply air (summer): 14,0%



Source: AIT

Monitoring evaluation

- Performance of sorption rotor (LiCl) in 2010
  - Humidity recovery (left diagram): approx. linear between 0 and 6,6 g/kg
  - Dehumidification (right diagram):
    - 62 % of the time nearly constant at 2,8 g/kg
    - 38 % of the time between 3,0 and 4,4 g/kg



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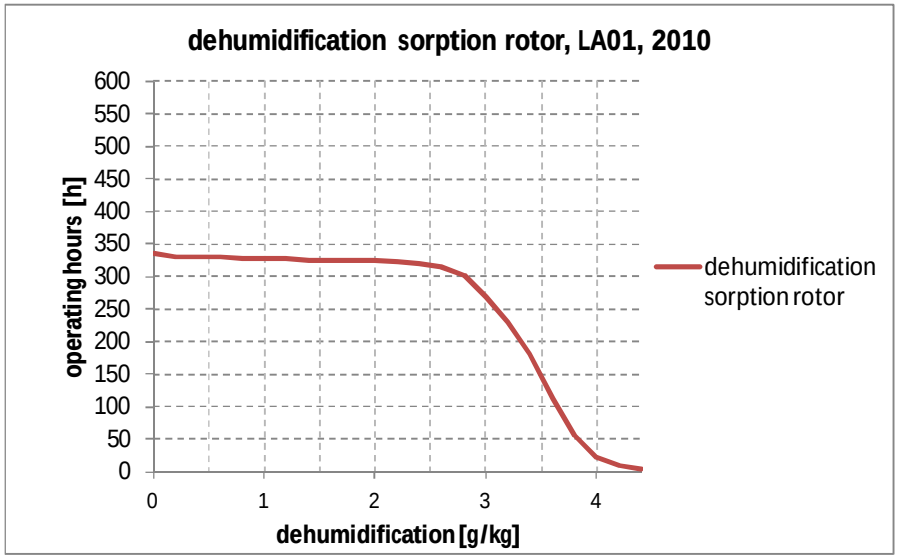
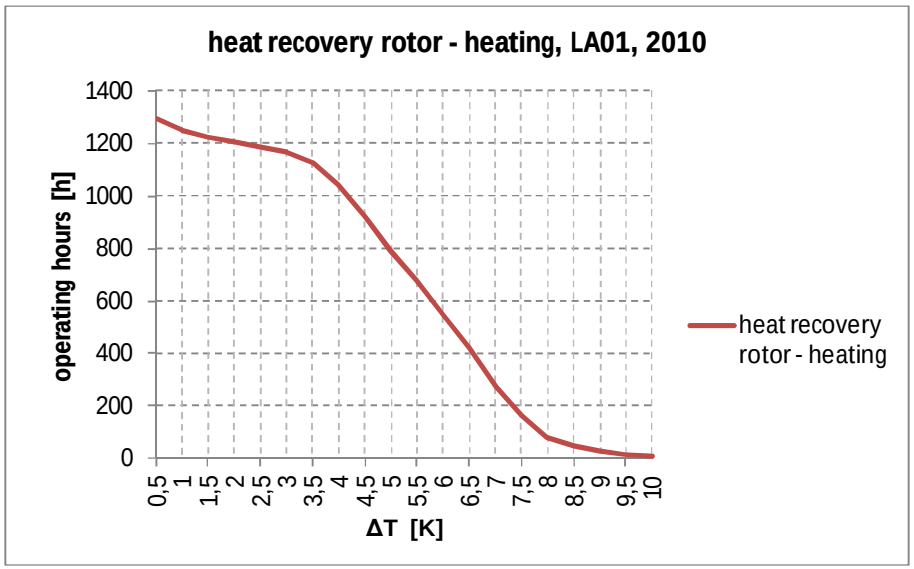


Source: AIT

Monitoring evaluation

- Performance of heat recovery rotor in 2010
  - Heat recovery for heating purposes (left diagram)
  - Heat recovery for cooling purposes (right diagram)



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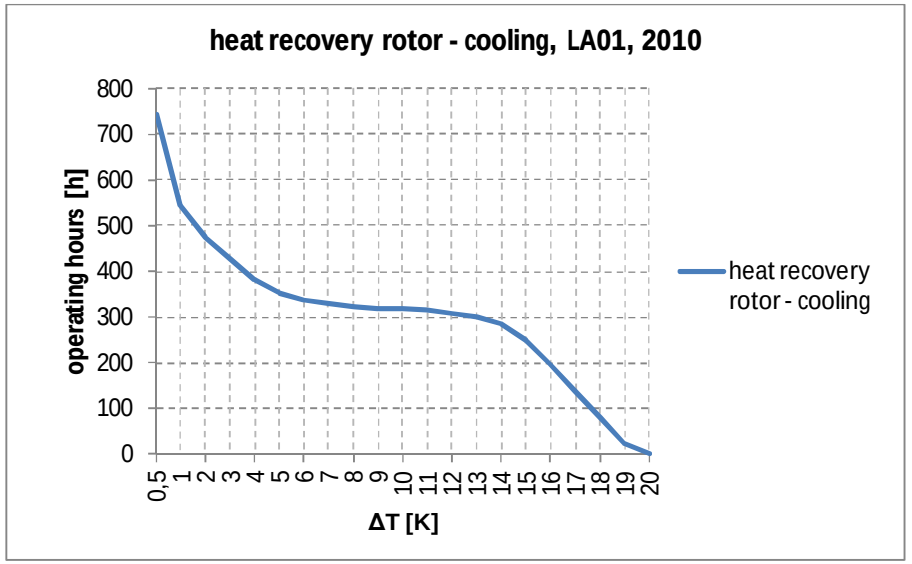
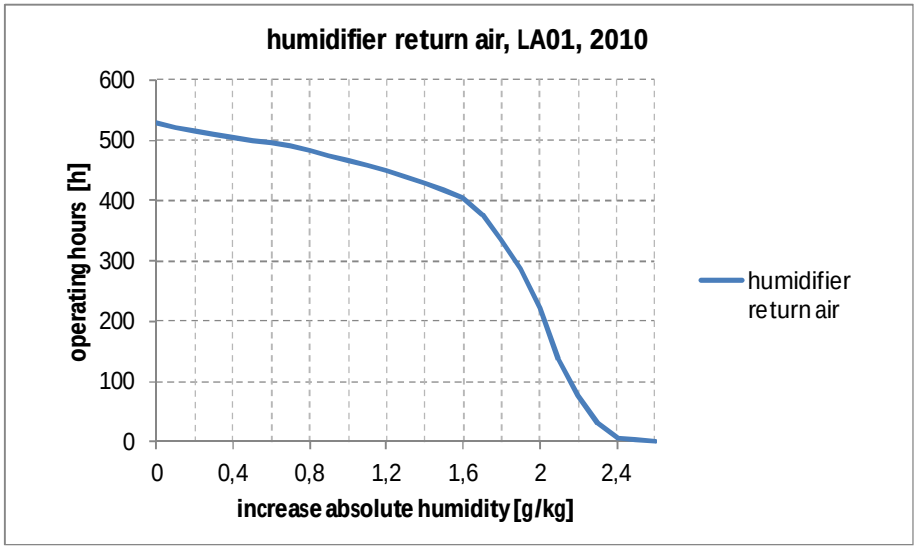


Source: AIT

Monitoring evaluation

- Performance of spray humidifier in 2010
  - Humidifier return air (left diagram)
  - Both humidifier (supply air and return air) during summer (right diagram)



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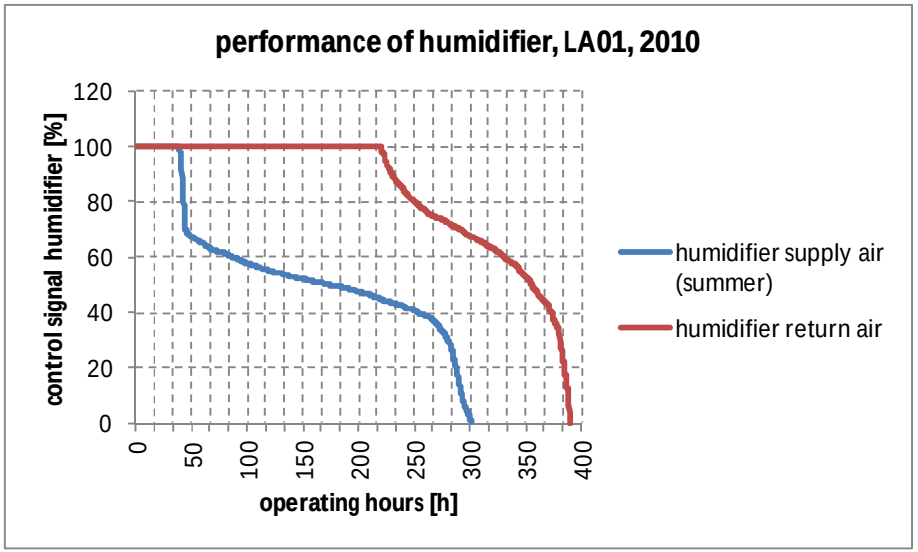

Source: AIT

Conclusions

- Monitoring evaluations show a great primary energy saving potential for solar DEC systems especially in winter time

- Dehumidification performance of sorption rotor is quite low (most of the time not higher than 2,8 g/kg)

- Summer operation is also very energy efficient compared to a reference system with compression chillers (primary energy savings 40 – 60 %)