LoT-NET

Advisory Board Meeting 5th October 2021
WP 2.1 – Distribution medium

WARWICK
THE UNIVERSITY OF WARWICK

Low Temperature Heat Recovery and Distribution Network Technologies

Work Package 2.1 – Distribution medium

Thermochemical district networks:

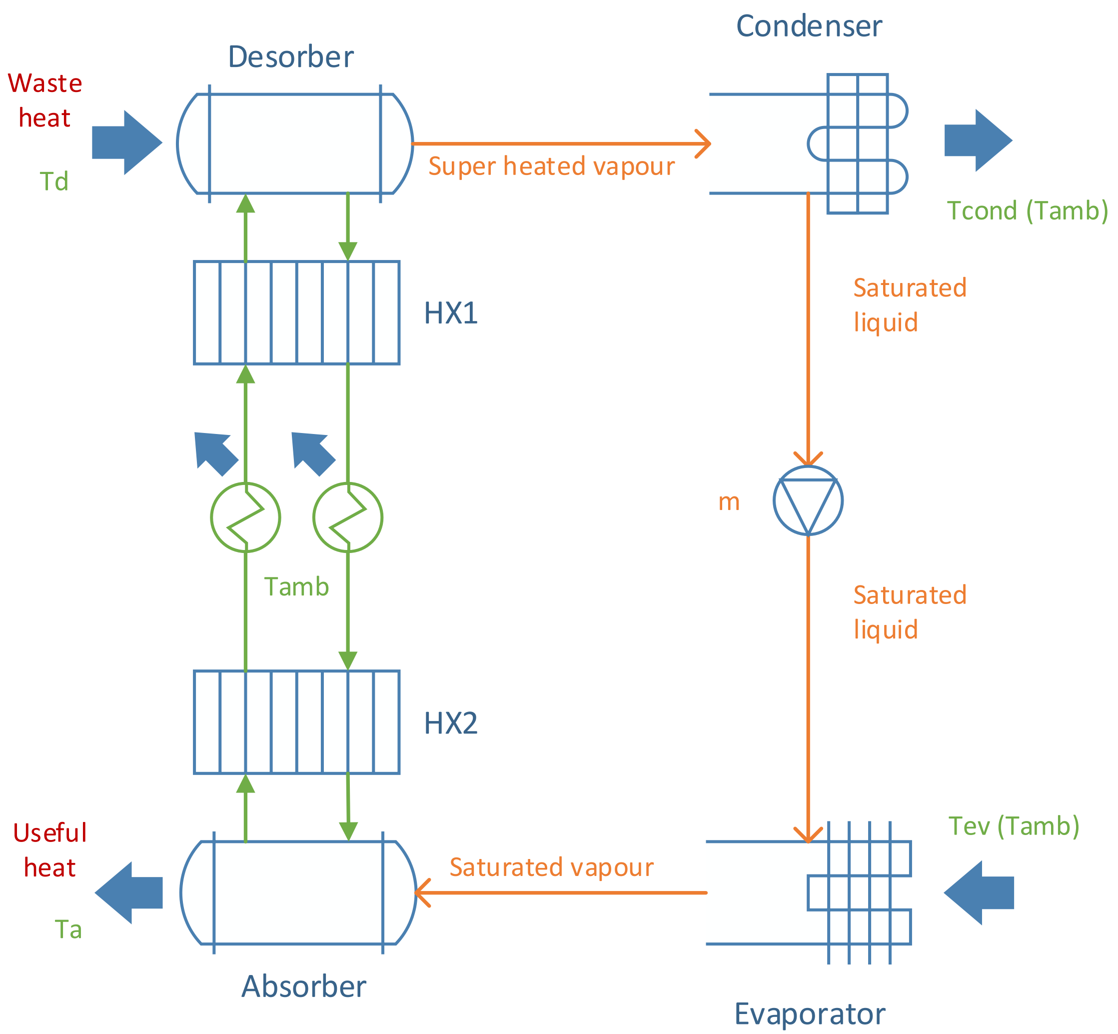
Thermochemical district networks are a new technology for district networks that can provide heating and cooling in one **heat loss-free** network.

The innovation is the use of thermochemical fluids as transport medium (concentrated salt solutions).

The chemical potential is used to generate useful heat (or cold) from ambient heat at the place and time of demand.

Advantages:

- Heat loss free
- Less investment (no insulation, smaller pipe diameters, reduced capital cost of trenches)
- Longer distances

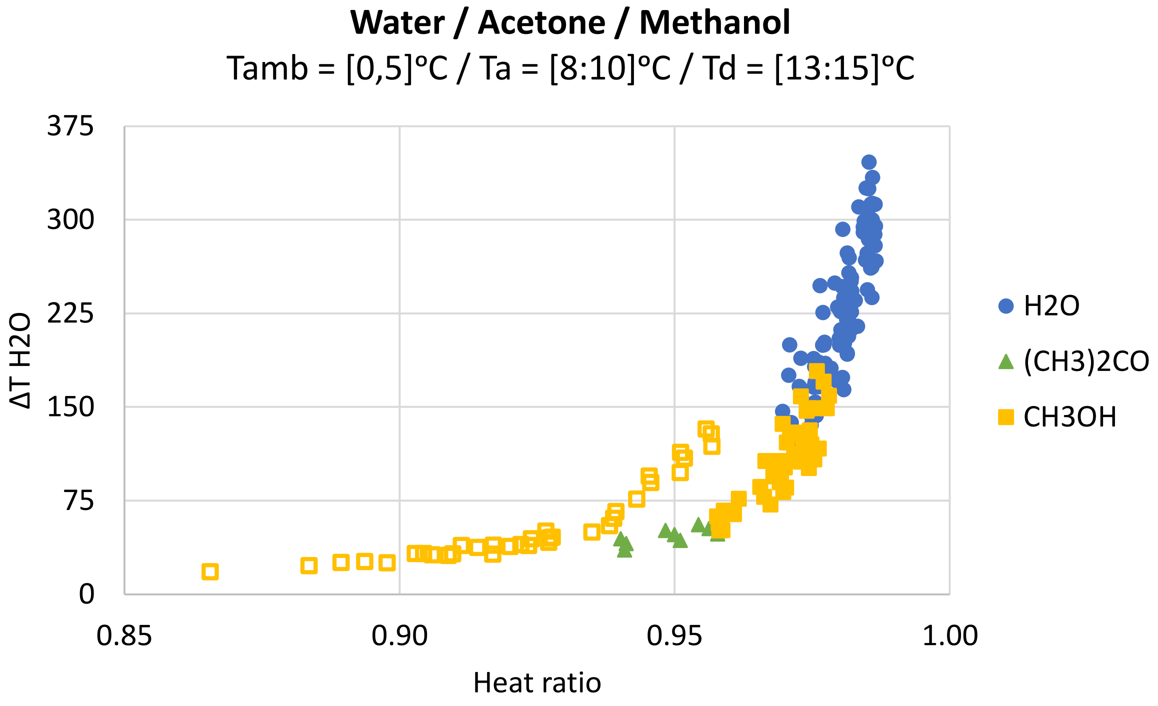


Modelled pairs:

The absorbate must be high latent heat.

Water is ideal, but the lower limit for boiling water in practical equipment is around 5°C, which means that in winter months the system would have to use heat from the ground or an aquifer.

Methanol and **acetone** are not quite as good as water thermodynamically but can be boiled at sub-zero temperatures so could use an ambient air source in winter.



Water pairs

H_2O – LiBr
H_2O – LiCl
H_2O –LiI
H_2O – NaOH
H_2O – LiBr+LiI
H_2O – LiCl+$LiNO_3$
H_2O – LiBr+$LiNO_3$
H_2O – $Ca(NO_3)_2$
H_2O – LiBr+$ZnCl_2$+$CaBr_2$

Methanol pairs

CH_3OH – $ZnBr_2$
CH_3OH – LiBr
CH_3OH – LiBr+$ZnCl_2$
CH_3OH – LiI+$ZnBr_2$
CH_3OH – LiBr+$ZnBr_2$

Acetone pairs

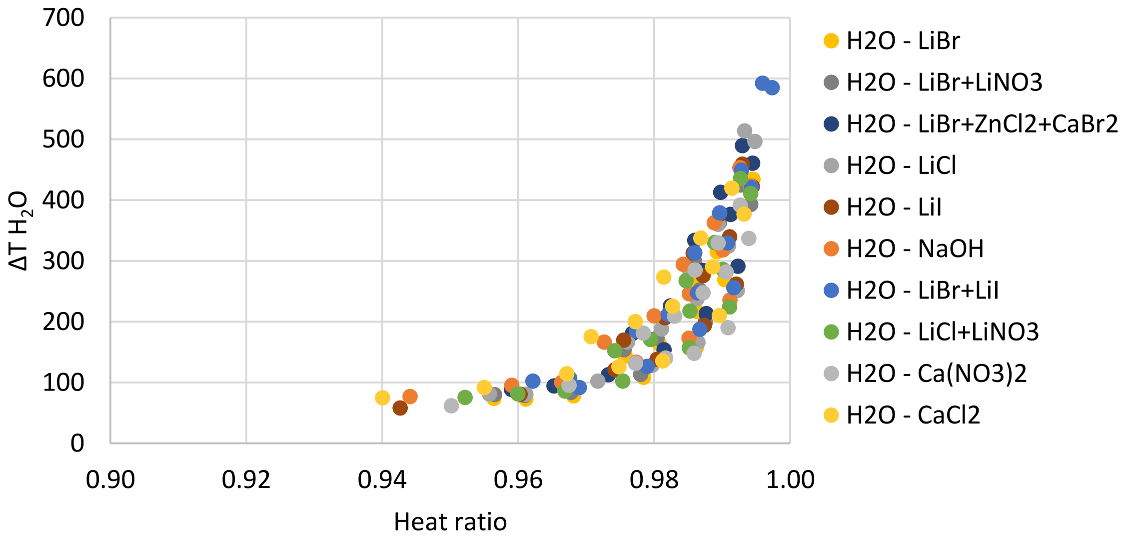
$(CH_3)2CO$ – $ZnBr_2$

Two options have been looked at:

- 'Low temperature loops' (55/45°C)
- 'Ambient loops' (14/4°C)

The former deliver heat to buildings directly or via a HX. The latter transfer heat from waste heat sources to HP that upgrade it for local use or transfer to loads via a low temperature network.

Tamb = [5:10]°C / Ta = [8:2:12]°C / Td = 14°C

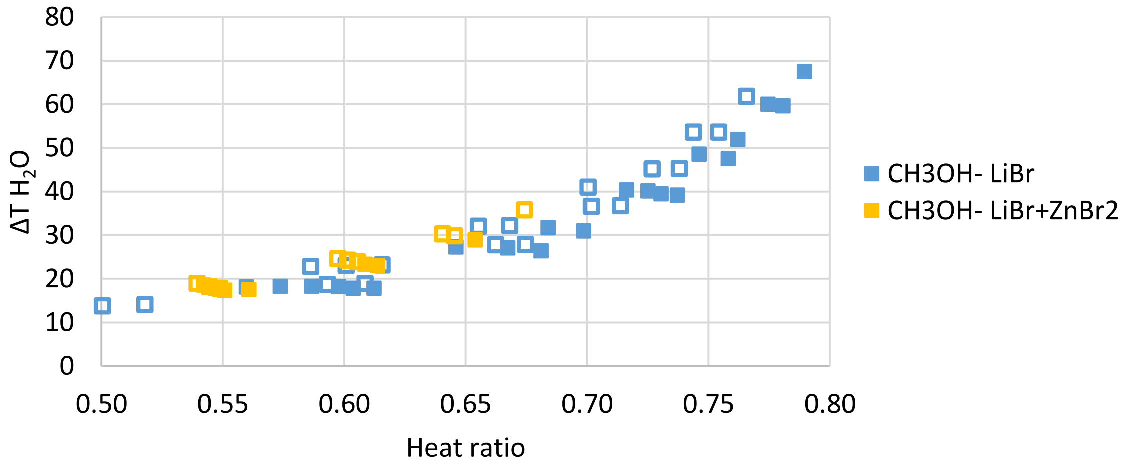


The utility of the TC systems was characterised by:

- 'Heat Ratio'
- 'DeltaT H_2O' (the equivalent temperature differential in a sensible water loop that would transfer the same heat using the same pumped volume).

Thus a value of 10°C would correspond to a normal LT system with a drop from 55 to 45°C and a value of 100°C would require only 10% of the flow to be pumped compared to a conventional system.

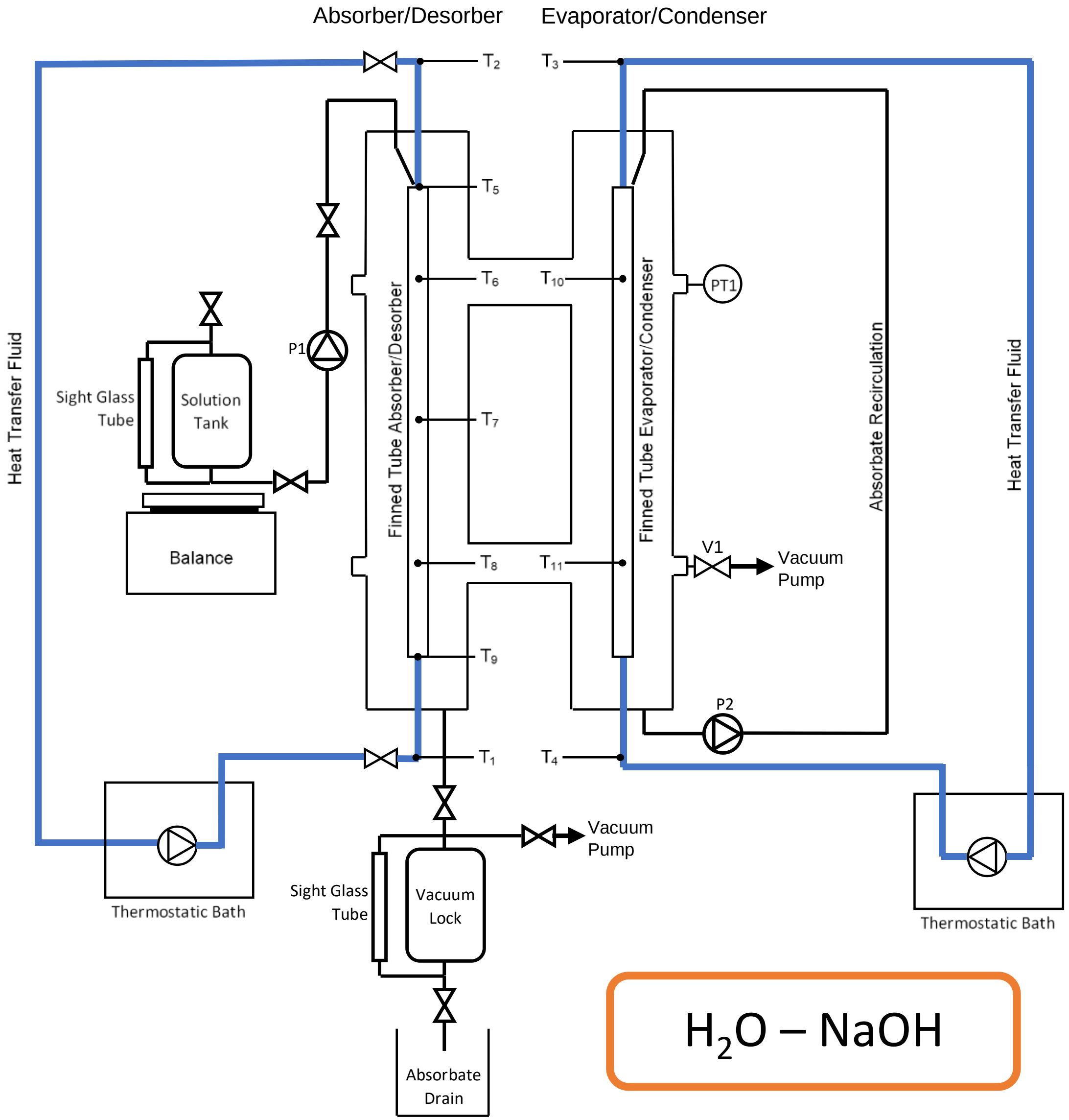
Tamb = [0,5]°C / Ta >= 50°C / Td = Ta+[2:2:14]°C



Future work:

Novel absorber test rig under construction at UoW

Fumey, B., 2020, 'Heat and Mass Exchanger Design for Inter-seasonal Liquid Absorption Heat Storage', PhD Thesis, Ulster University.



H_2O – NaOH

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