SORPTION FRIENDS III Session Markets and applications

Topics

- What are the most promising markets and applications?
- Heat storage ?
- Gas-fired heat pumps ?
- Solar/waste heat driven cooling ?
- Heat transformers ?

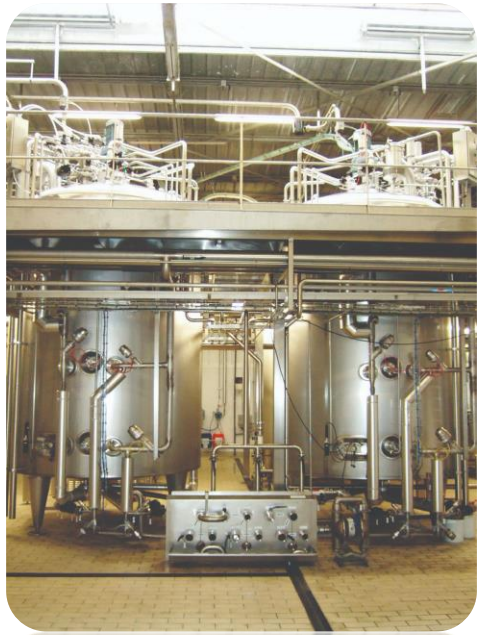
An industrial approach for the optimization of a new performing coated adsorber for adsorption heat pumps

Walter Mittelbach[1], Luigi Calabrese[2], Lucio Bonaccorsi[3] and Angelo Freni[4]

[1] Sorption Technologies GmbH, Freiburg, Germay
[2] University of Messina, Italy
[3] Mediterranean University of Reggio Calabria, Italy
[4] CNR-ICCOM, Pisa, Italy

IMPRES Conference, Kanazawa

21.10.2019



Why industrialize adsorption chillers although the market success was not impressive up to now?

Status of adsorption chiller & heat pump technology in the market

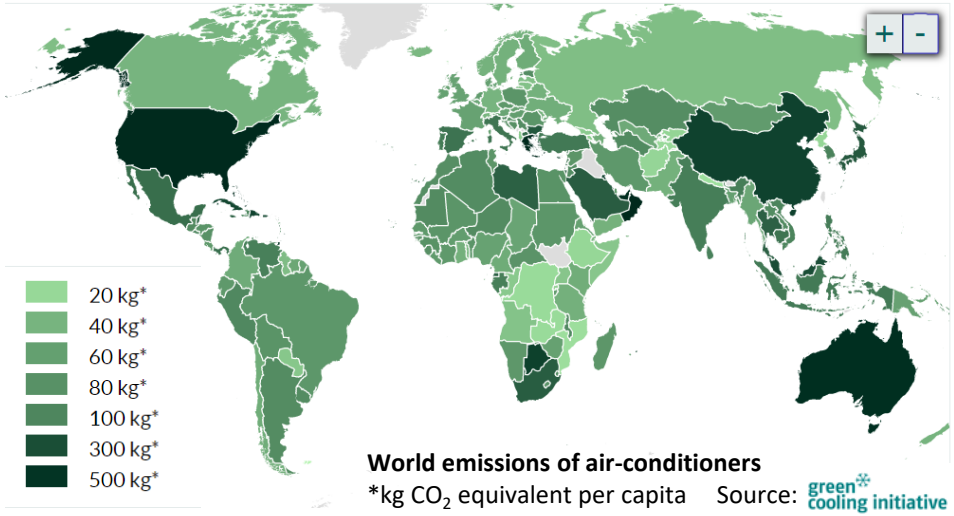
- Europe: A few small companies managed to establish a small but stable adsorption chiller business on the market. Major market is Germany due to high government subsidies.
- Adsorption heat pump activities of major German heating equipment producers cancelled after insufficient market response
- German car industry not interested anymore, because of concentration on electric vehicles, which do not provide enough waste heat
- Asia: Share of adsorption chiller is negligible, absorption chillers established, mainly in large scale cooling applications

Potenti-al share of adsorption chillers in reducing CO_2 emissions is high

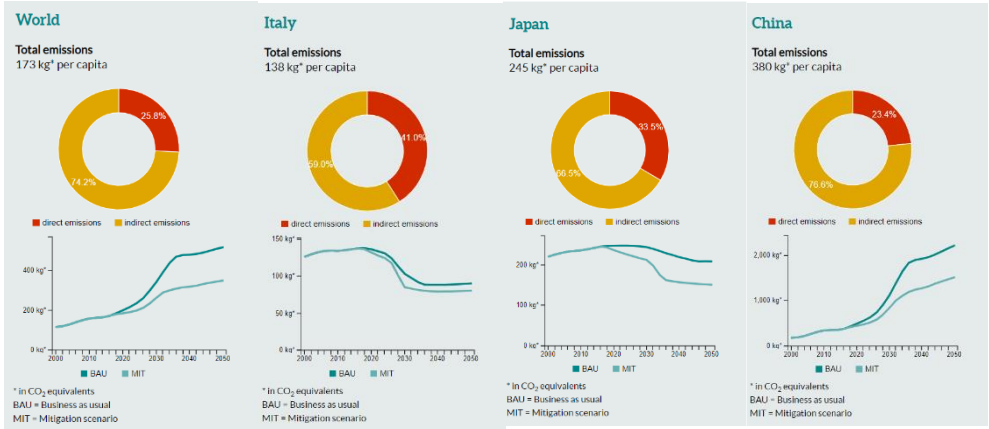
- Refrigerant: Water No direct emissions
- Electricity savings 60-80% Reduction of in direct emissions

Data of green cooling initiative show: **Further action is necessary**

Major tasks: Cost reduction & focus on commercially attractive applications



World emissions of air-conditioners
*kg CO_2 equivalent per capita Source: green cooling initiative



How to define a potentially interesting application ?

ROI is the most important KPI

- All other influences (i.e. CO_2 savings) have a minor role
- ROI target may not be the same in different type of applications
- ROI targets may be influenced by policies, such as CO_2 pricing, subventions, …

Example waste-heat driven cooling

- Cost of waste-heat has to be 0
- Hours of operation have to be high
- Thermal cooling should not be used for peak load coverage
- Complexity/cost of adapation/installation has to be low

Our target: Process cooling – ROI around 3 should be achieved.

Example: Pay Back Time & Savings Adsorption to Compression Chillers

Process cooling with 100 kW cold and 7,500 hours of operation per year (base load application with compression chiller as back-up):

- About 750 MWh of cold generated per year
- Electricity savings 75% : 141 MWh – Electrical efficiency Adsorption Chiller COP_{el} = 16 compared to Compression Chiller with COP_{el}= 4
- Savings: 28,125 €/year (electricity price 0.20 €/kWh_{el})
- CO_2 savings 55 t/year data for Germany 394 $kgCO_2$/MWh*
- **Payback time: 2.7 years (price Adsorption Chiller 75k€/el. saving 28k€)** without any deduction or incentives and with standard cost of Adsorption Chillers from Sorption Technologies. Installation cost not included.

* *Source: https://app.electricitymaps.com/map, 12 months average*

Add on to yesterday‘s discussion about material and components

Relative cost of materials in our current chiller

Current cost of adsorbent: 10 €/kW

If I can increase the specific capacity by a factor of 2-3 the material cost may be much higher, because most other components don‘t scale with the capacity increase very stronly.