SOLARCOOLING WORKSHOP
2014 Brisbane

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IceBook

A new approach to ammonia/water absorption refrigeration

Marshal Rubinstein
New World Machines
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Content

- Brief background to the IceBook project
- Basic Principals in ammonia absorption cooling
- Shortcomings of existing technology
- “IceBook Concept” - Efficient, scalable, modular cooling
- How it Works - Key Elements
- Practical Challenges
- Future Roadmap

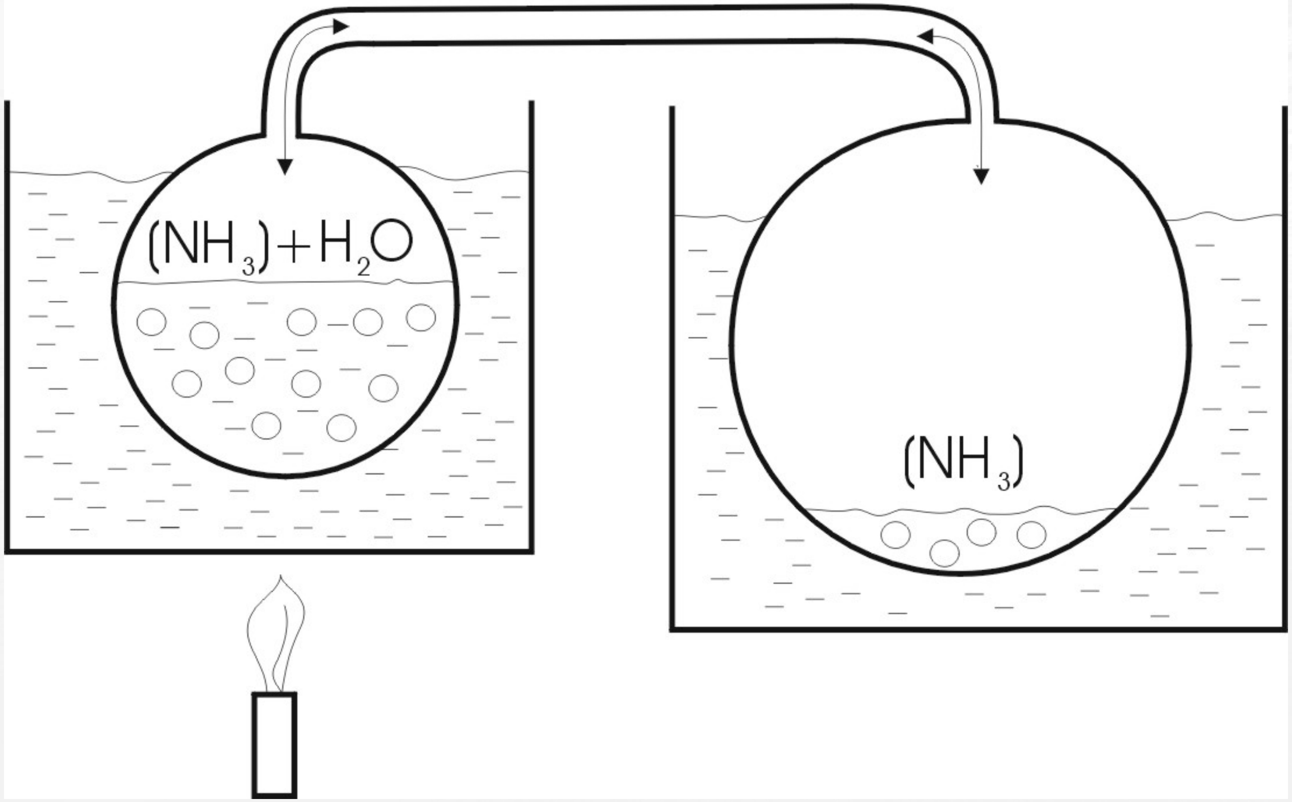
Project Background

- 1996: Dr Gerhard Kunze, Professor of Physics (Vienna) heads up an Aid project in Tanzania to create dairy solar cooler.
- Dr Kunze continues the development of these concepts, working with the Group for Appropriate Technology (GrAT).
- 2001: SolarFrost Research formed to further the development of absorption chillers suitable for use with Solar Energy.
- 2010: SolarFrost Research partners with New World Machines to develop and commercialise high efficiency, compact, scalable and modular absorption chillers.
- 2014: Release of "IceBook", Version 6, a modular, high efficiency absorption chiller, co-invented by Gerhard Kunze and Marshal Rubinstein. The chiller includes novel electronic optimisation techniques.

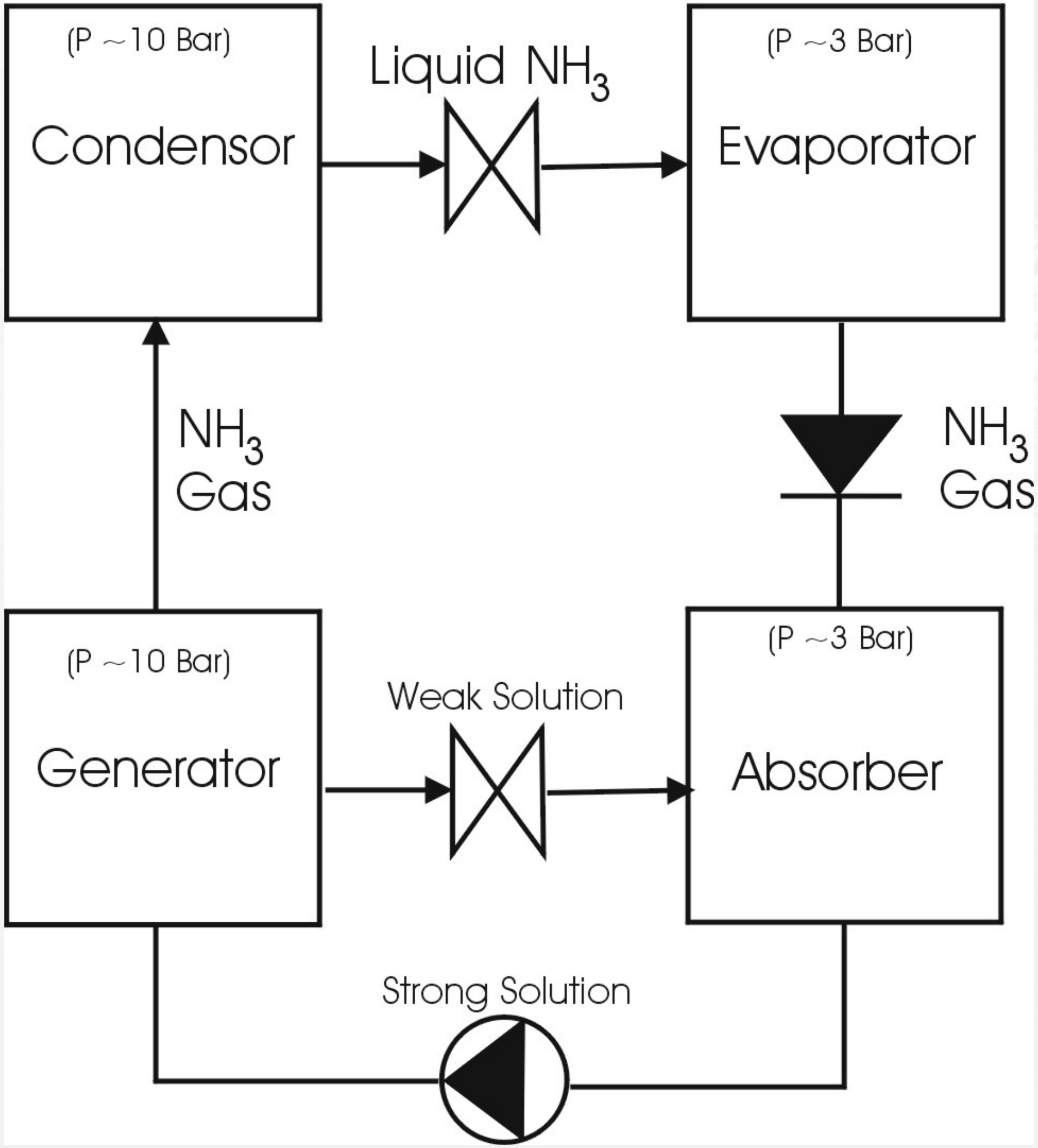
How can we cool with heating?
The simplest example: Crosley IcyBalls

Source: crosleyicyball.com

Icy-Ball



NH_3 Absorption Machine



Absorption Chiller Challenges

- Poor performance at high back-cooling temperatures
- Don’t scale well to small, low powered units
- Expensive
- High volume / kW cooling
- Typically have low efficiency (heat exchanger **Δ** T is high)

The IceBook

- Operates at high back cooling temps.
- High Efficiency
- Compact and Scalable
- No ammonia pumps
- Minimal moving parts
- Economical to mass produce
- Can scale to both very small and large sizes because of modular design.

Key Elements

- Novel Layered Architecture
- Special Heat Exchangers
- Pressure Injection mechanism
- Novel refrigeration cycle
- Adjustable Cooling temperature
- Electronic performance control

Novel Layered Architecture

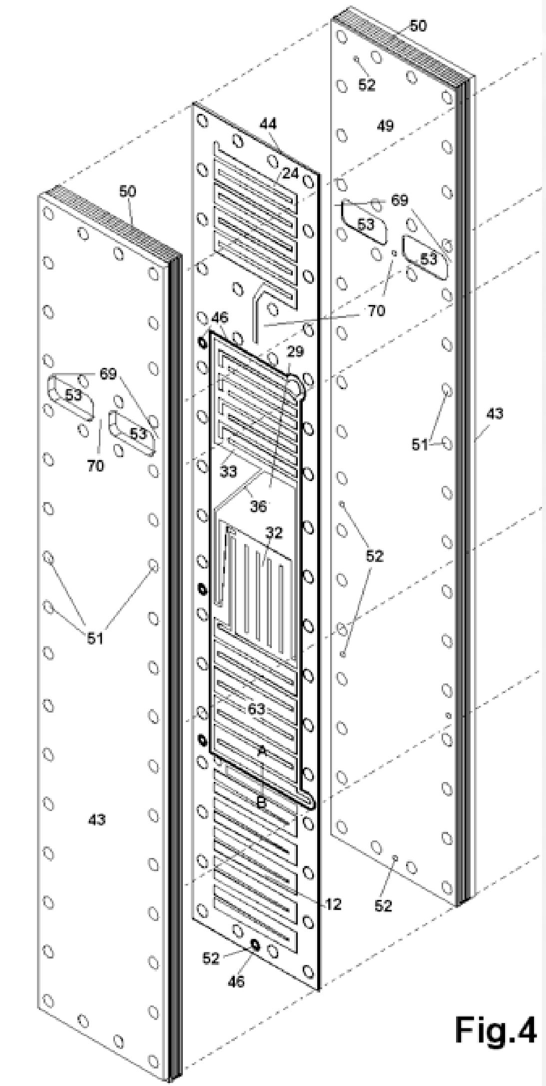
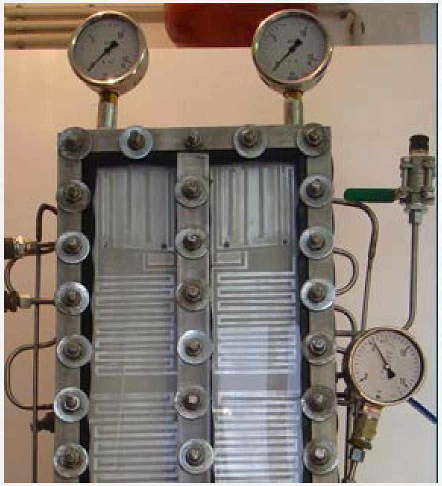
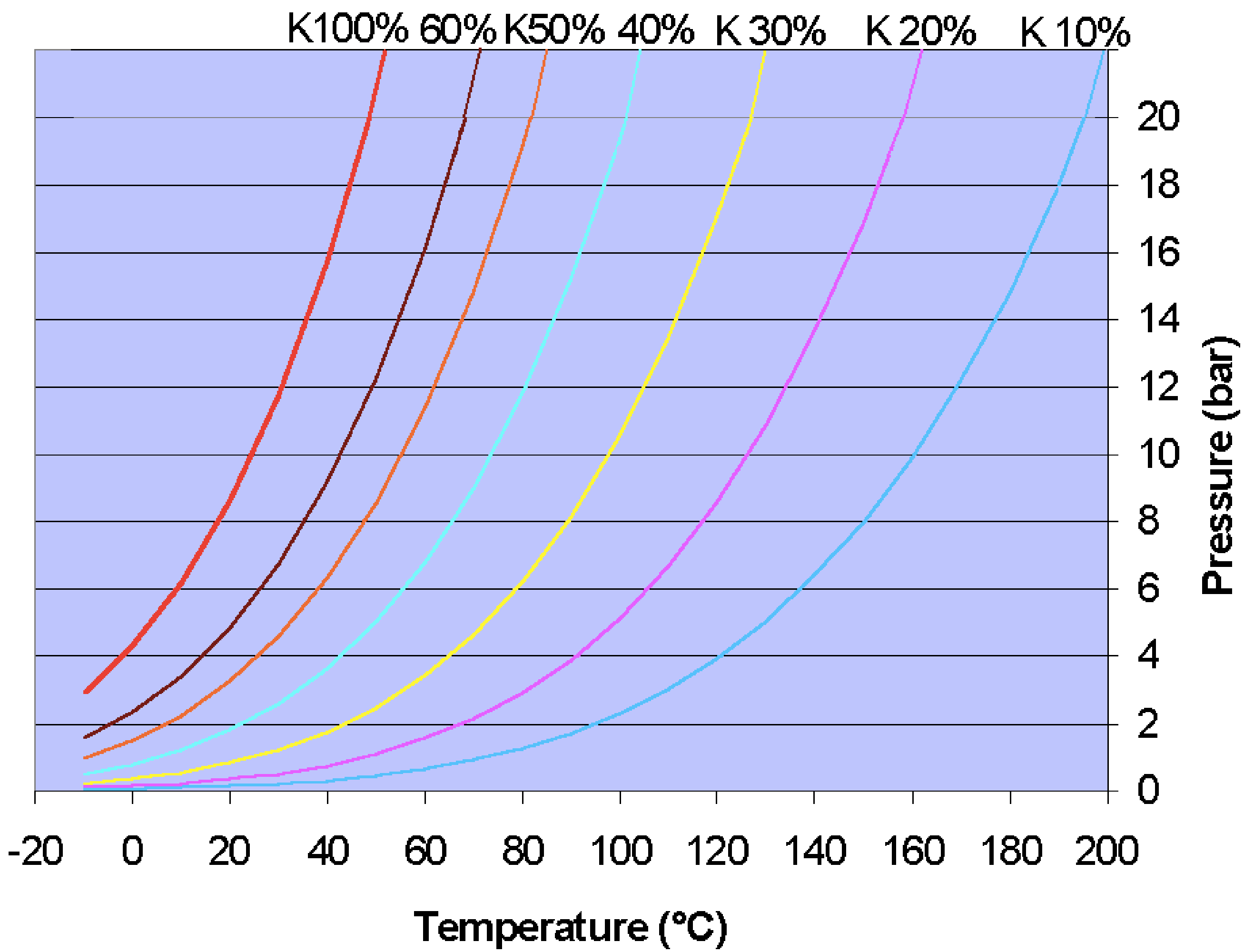


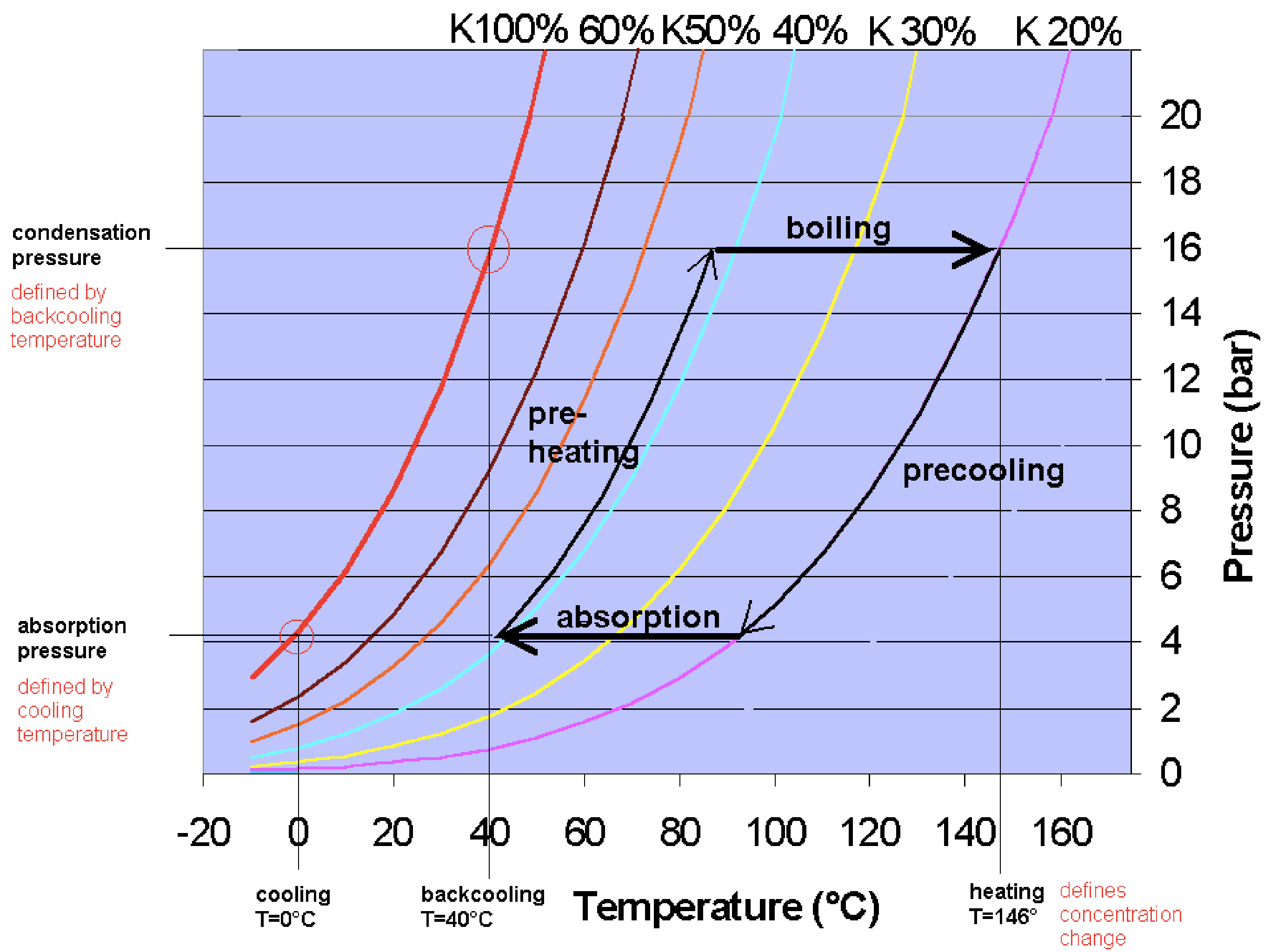
Fig.4



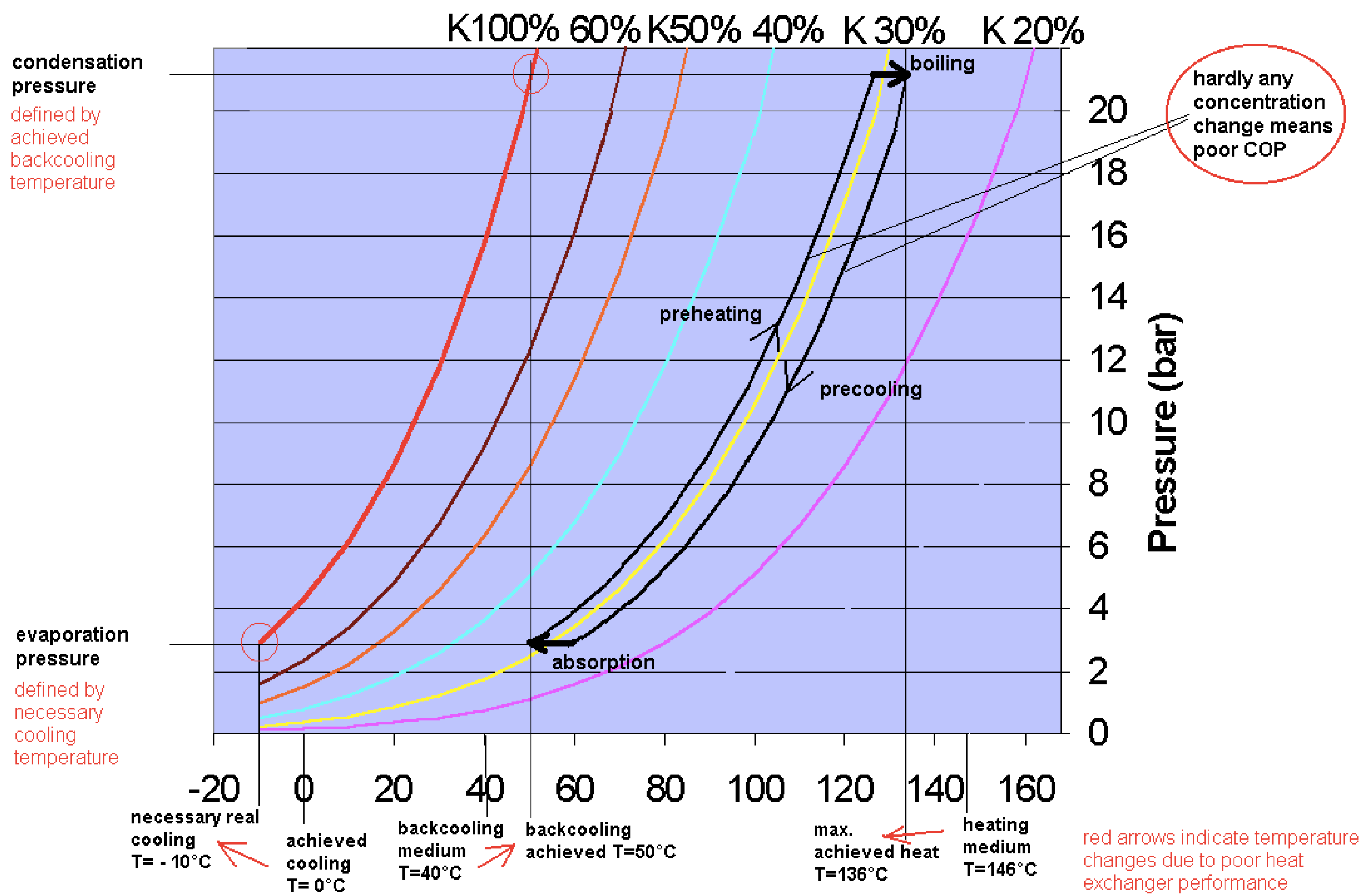
Steam Pressure for NH3-H2O Solutions of Different Concentrations "K"



Ideal Cooling Cycle



Real Cooling Cycle with Heat-Exchanger Temperature Drop of DeltaT= 10°C



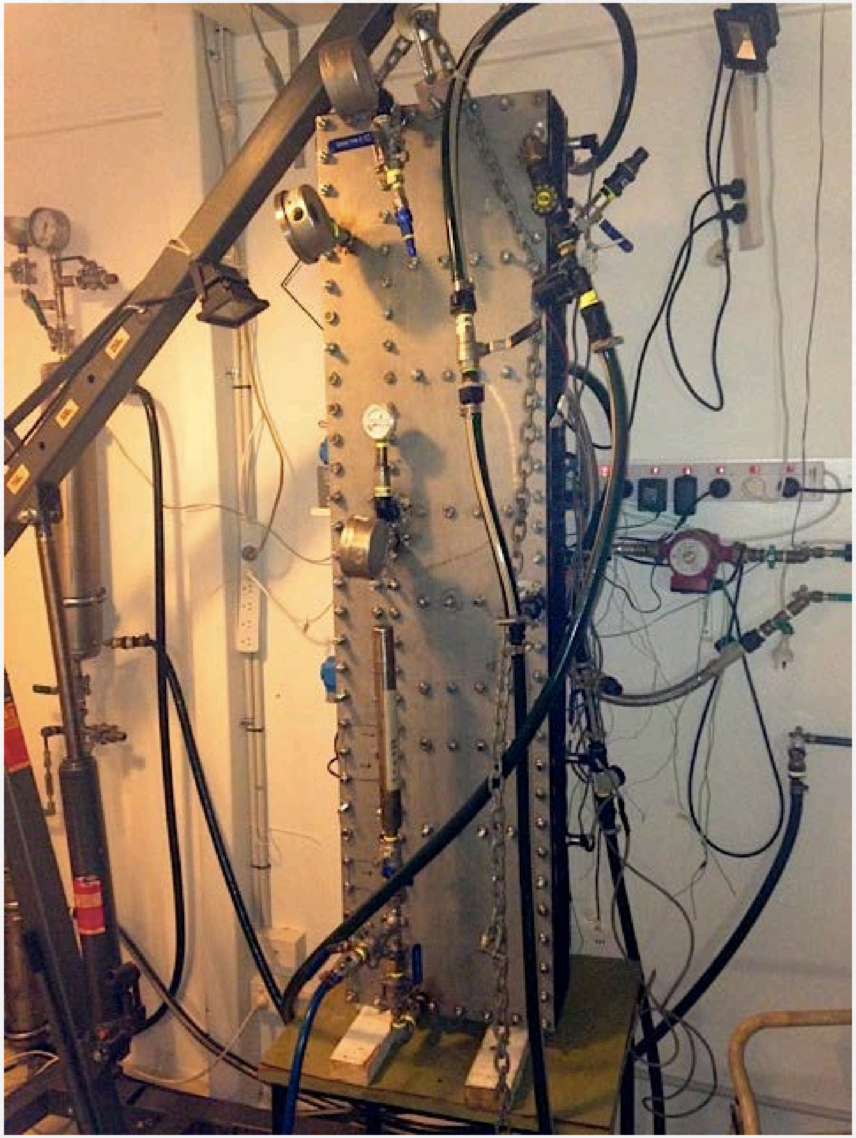
The Challenges

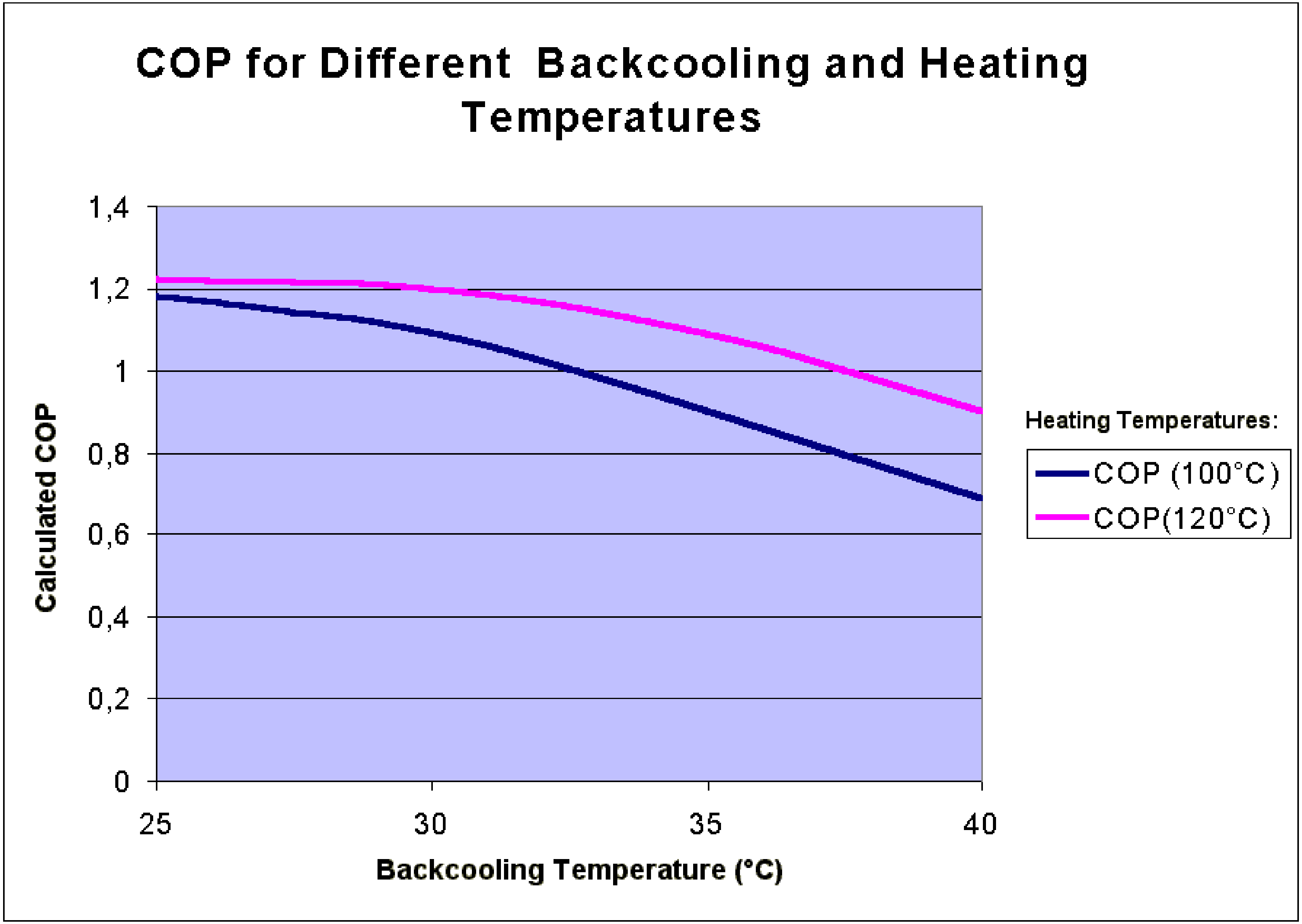
- Building absorption chillers is really hard!
- High Pressures
- Corrosive and Toxic Ammonia
- High Temperatures
- Critical design parameters (complex thermodynamic calculations)
- Time consuming design iteration loop
- Expert work, no existing workforce skilled in this area.

Making IceBook Pages

Prototype Assembly

Test Bench





COP for Different Backcooling and Heating Temperatures
1,4
1,2
1
0,8
0,6
0,4
0,2
0
Calculated COP
25
30
35
40
Backcooling Temperature (°C)
Heating Temperatures:
COP (100°C)
COP(120°C)

Roadmap forward

- Completion of Version 7 IceBook, 3.5kW Cooling
- Independent Testing at Oak Ridge National Lab (USA)
- Completion of Version 8 IceBook, 17.5 kW Cooling
- 2 Pilot Installations scheduled in USA
- Move to Mass production
- IceBooks for solar powered refrigerated food storage
- Third world humanitarian impact (OneFridge)

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Thank You

NWM
NEW WORLD MACHINES

MARSHAL RUBINSTEIN
T+61 2 8003 4777
newworldmachines.com

marshal@newworldmachines.com

AIRAH