

# Advanced Liquid Desiccant Technology Solar Cooling Applications

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# Definitions for the Uninitiated

- **Desiccants** are materials that have a high affinity for water vapor
  - lithium chloride solutions
  - calcium chloride solutions
  - glycols
- Dehumidification is also called **latent** cooling
- **Sensible** cooling refers to temperature reduction
- **Over-cooling/reheat** is the process in which air is cooled below its dewpoint to remove water and then reheated so that the building does not become too cold

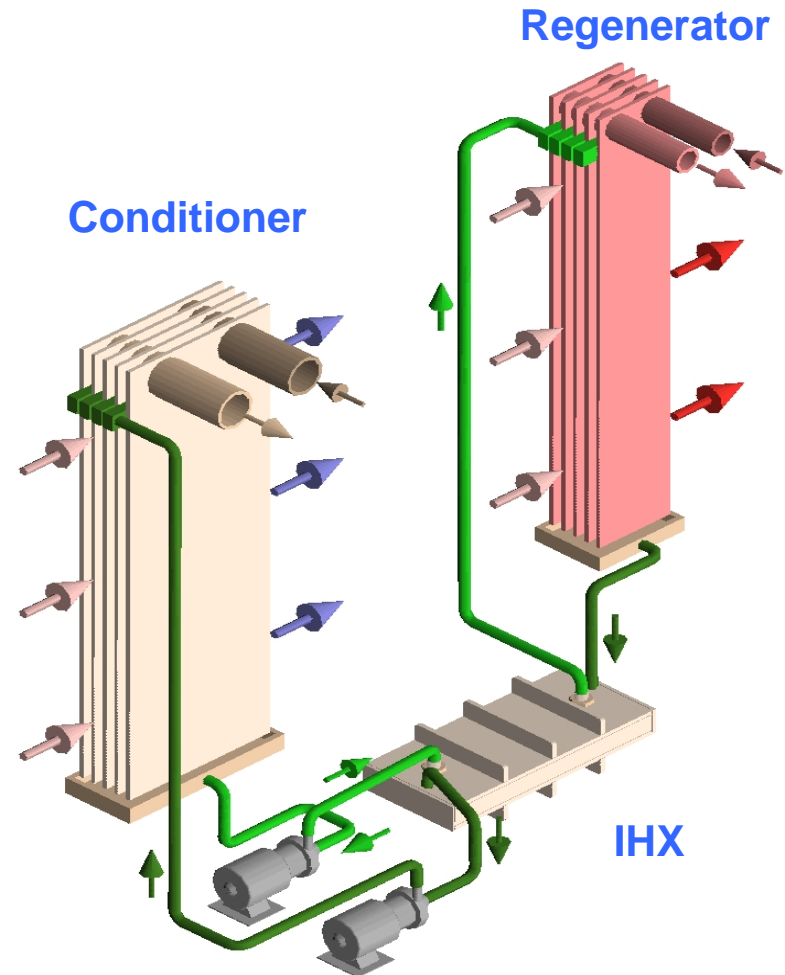
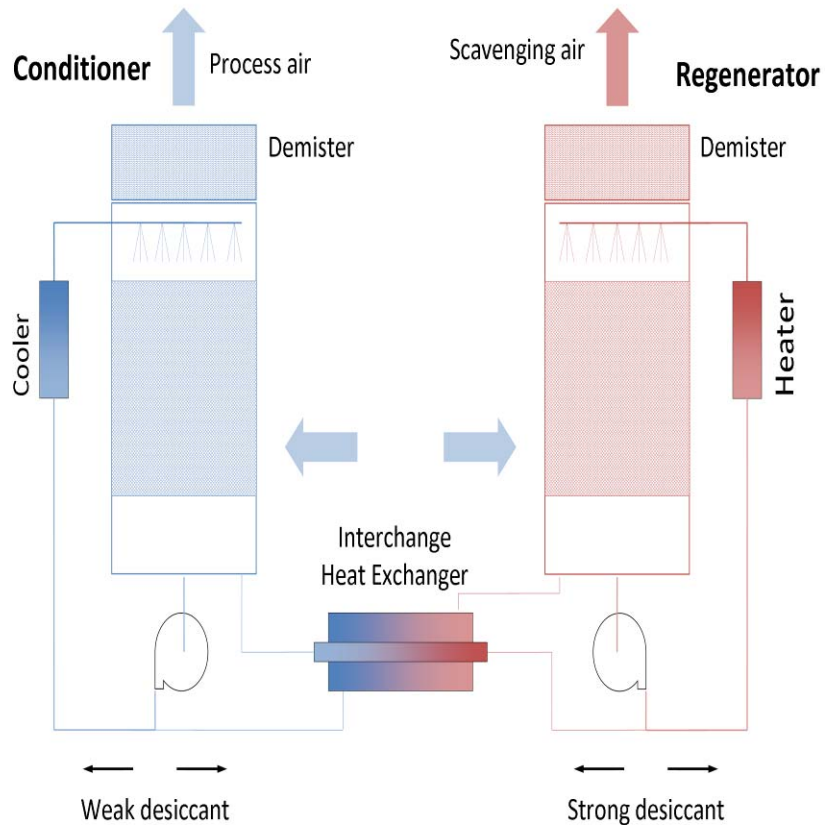
# **A solar LDAC solves multiple problems for the customer**

- **Humidity control is a major HVAC problem**
  - advanced technology reduces sensible loads
  - ventilation in humid climates is a mostly latent load
- **Controlling humidity by overcooling and reheating wastes energy**
- **High latent compressor-based air conditioners are available**
  - expensive
  - lower efficiency

# Liquid desiccant air conditioners available from several sources

- Kathabar/Niagara Blower (US)
- DuCool (Israel)
- PAX Streamline (US)
- Menerga (German)
- Tsinghua U. (China)
- American Genius (US)
- L-DCS (German)
- Ficom (Australia)
- Drykor (Israel)
- American Energy Exchange (US)

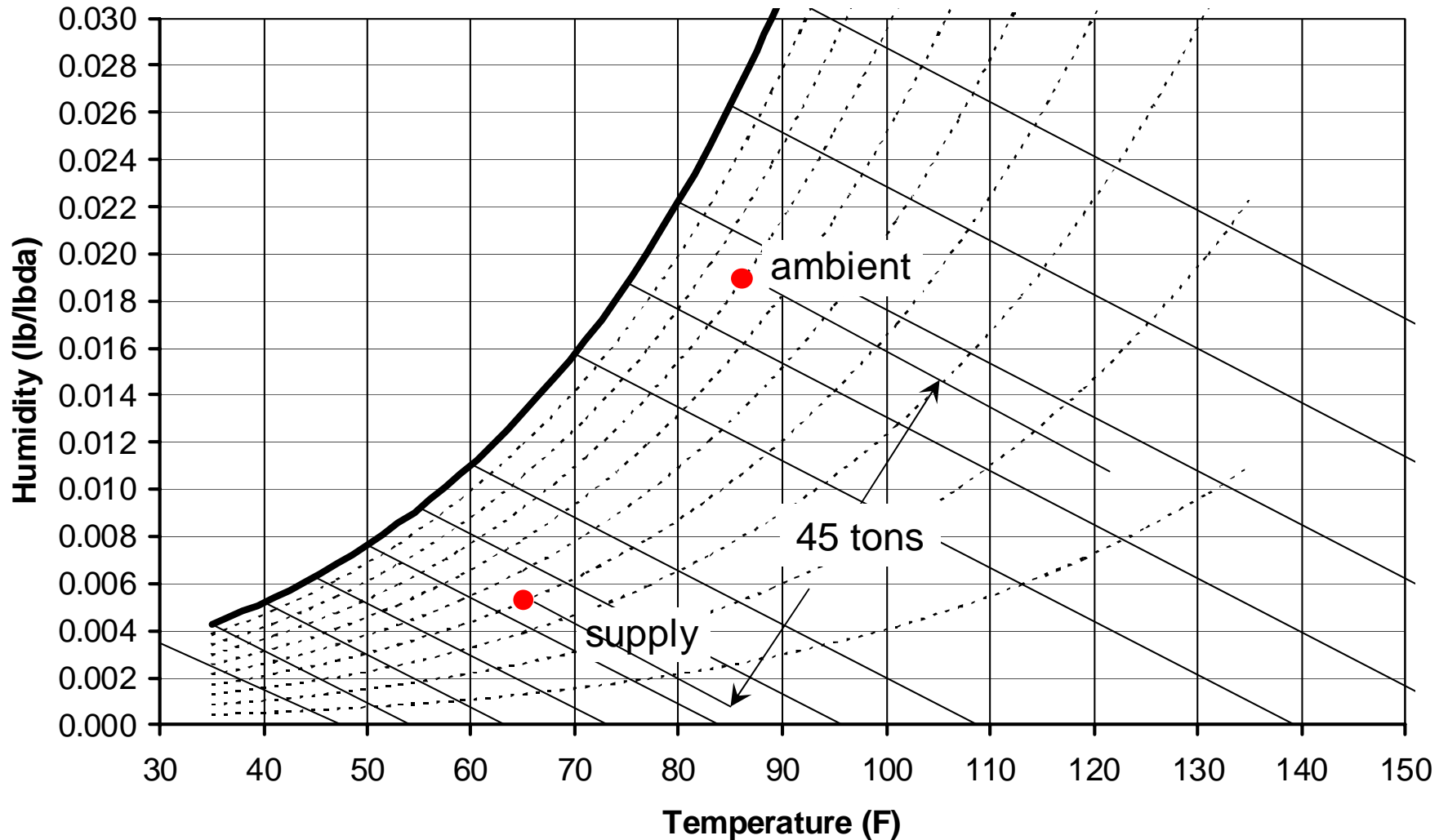
# High-Flow versus Low-Flow LDAC



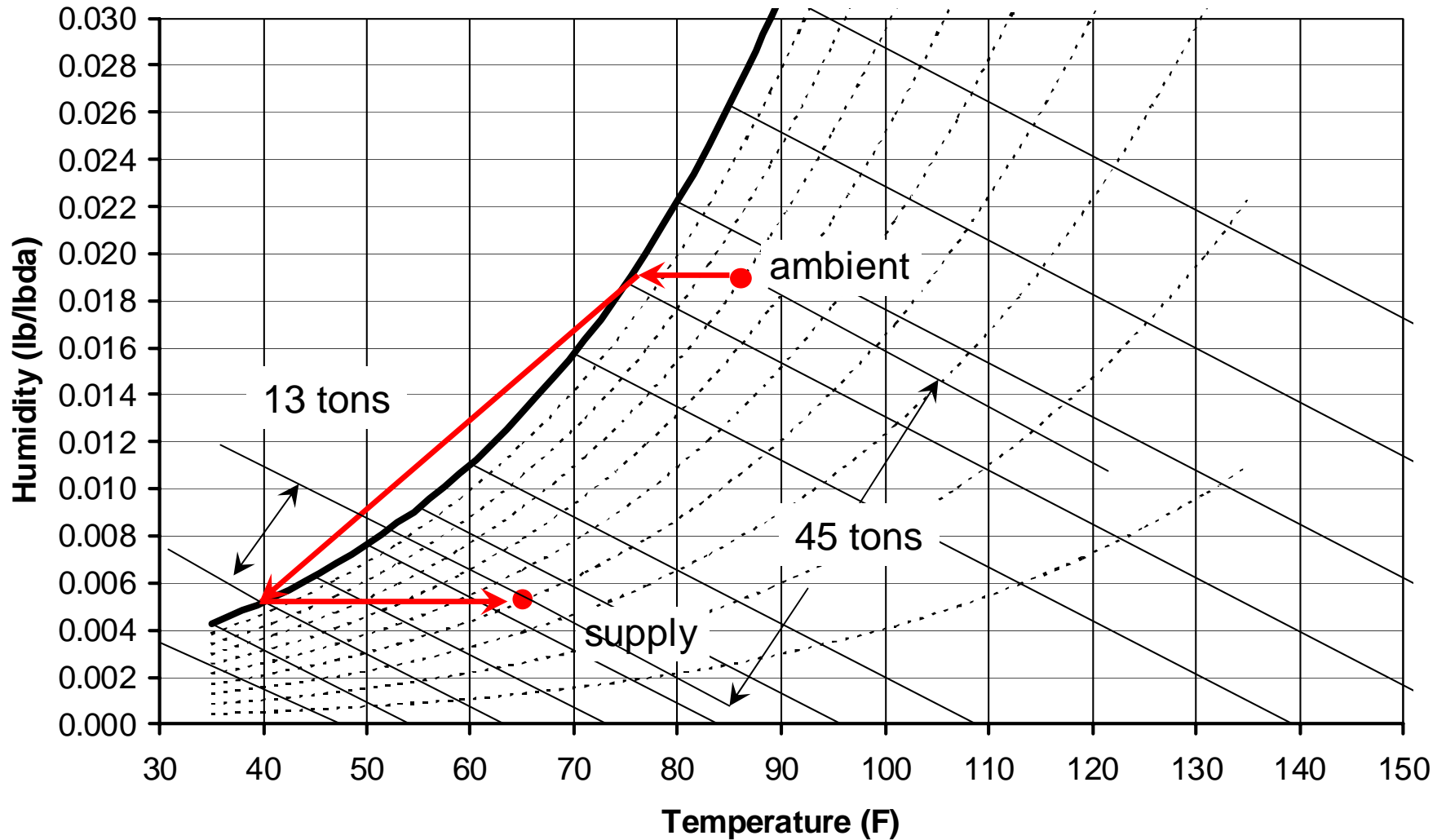
# Low-Flow Desiccant technology overcomes earlier problems

- **Low desiccant flow rates suppress droplets**
  - flow rate reduced to 1/20<sup>th</sup> of earlier value
  - desiccant flow contained within wick
  - low air-side pressure drops
  - no sprays, no drip pans, no droplets
- **Desiccant must be cooled on contact surface**
  - plastic heat exchangers
  - simultaneous drying and cooling of process air

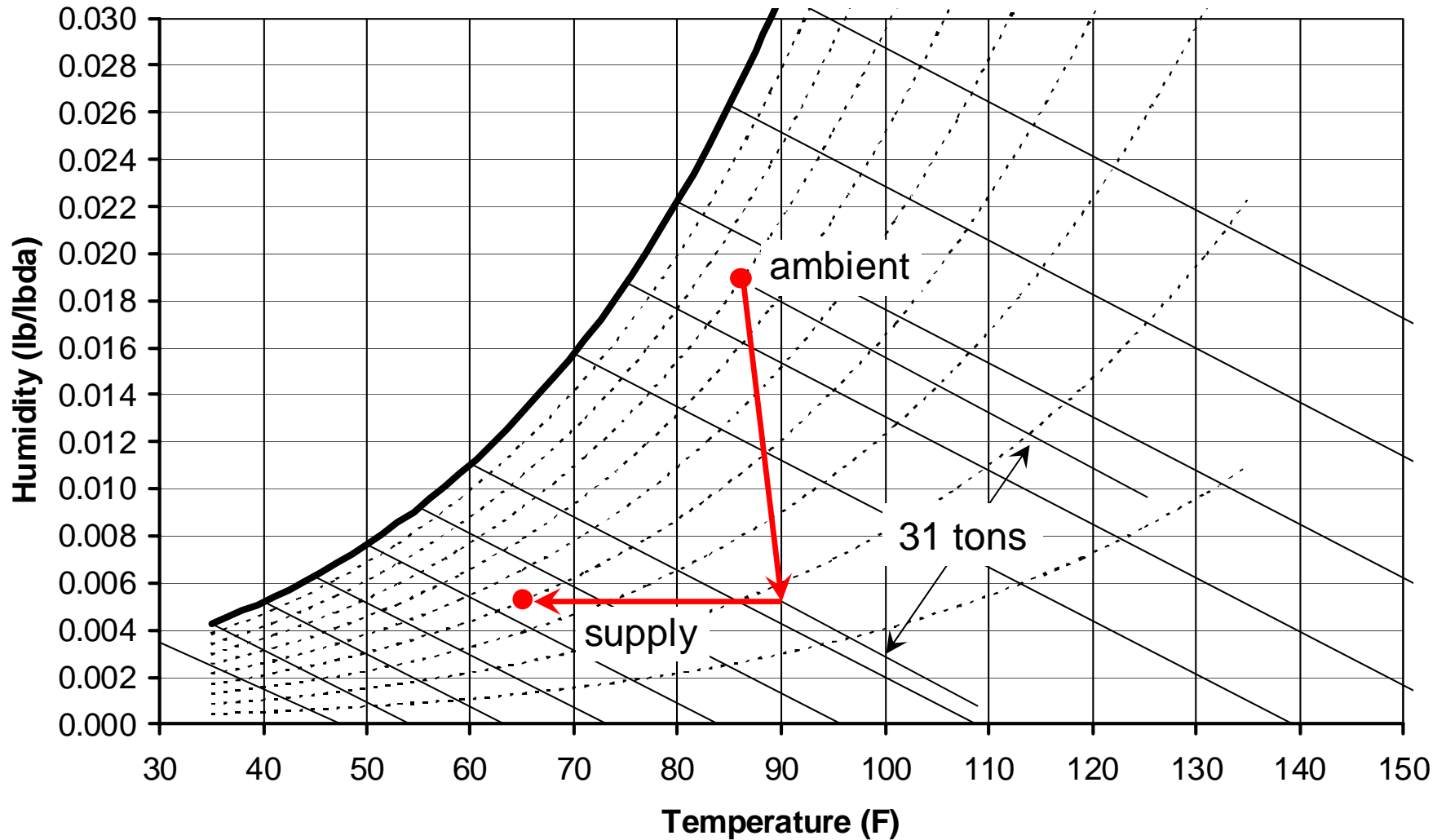
# A solar LDAC will require a significantly smaller array than a solar absorption chiller



# A chiller must overcool and reheat if it is to supply air at less than 100% rh



# A LDAC can simultaneously cool and dry the air



# Gas-Fired Low-Flow LDAC installations



2,400 cfm, Munich Jazz Club



3,000 cfm, Queens U.



6,000 cfm, PA machine shop



6,000 cfm, LA supermarket

# Canteen at Munich Airport



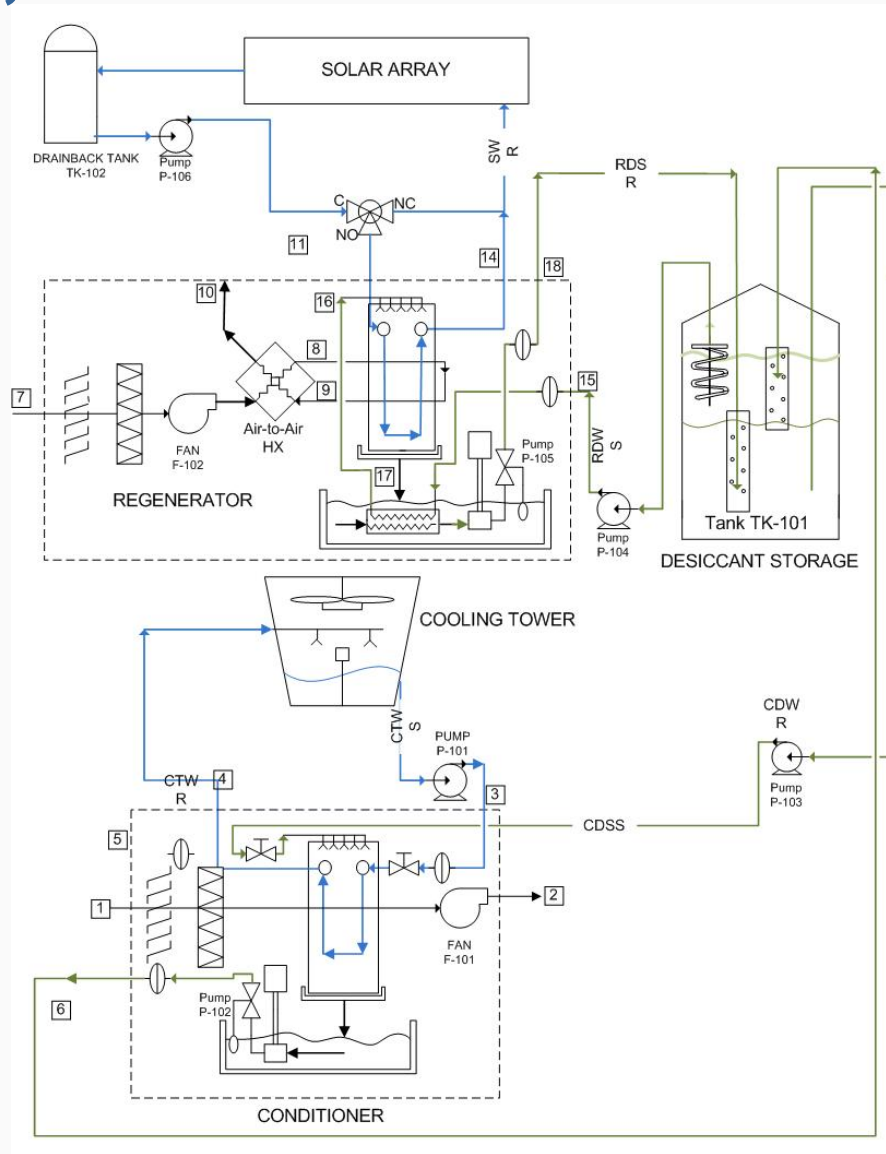
# 3,000 cfm Solar LDAC

Tyndall AFB  
Panama City, FL



# 3,000 cfm Solar LDAC

Tyndall AFB  
Panama City, FL



# Comparison of Thermally Driven Cooling Systems

		Adsorption Chiller	Absorption Chiller	LDAC DOAS
Capacity (29 C CT, 7.2 C CW)	kW	72.4	75.9	89.0
COP (90 C HW)		0.66	0.67	0.71
Cooling Tower Factor		<b>2.52</b>	<b>2.49</b>	<b>1.09</b>
Power	W	200	260	600
Width	cm	180	105	203
Height	cm	239	201	196
Length	cm	358	130	259
Weight	kg	<b>5000</b>	<b>1158</b>	<b>1364</b>
Storage Medium		HW	HW	CaCl <sub>2</sub>
Storage Volume Factor		<b>9.7</b>	<b>9.7</b>	<b>1.0</b>

# Advanced liquid desiccant technology will accelerate solar cooling

- **An integrated absorption/LDAC requires smaller array than absorption only**
- **Lower cost for energy storage**
  - concentrated desiccant
  - uninsulated plastic storage tank
- **Solves humidity problems (wet climates)**
- **Augments evaporative cooling (dry climates)**
- **Easier installation than adsorption or absorption chillers**

**Thank you  
Questions?**