AgileEnergy™

Powered by icepoint

The world has changed. Let’s change the way we cool it.

Presented by:
Kimberly Armitage

AEC: 4-IN-1 VALUE

Agile Cooling

Discharge rates up to 150TR deliver cooling to peak loads at a significantly lower capex than traditional cooling.

Plug and play

Simple install with self-contained remote monitoring, digital twin, and universal API and building controls integration.

Moisture Control

Inherently cooler coil temperatures provide superior moisture removal from high-latent loads at a lower cost.

Energy Savings

Build-in energy storage leads to reduced connected load, lower TOU energy rates, and mitigated demand charges.

HOW IT WORKS **(10X HIGHER PERFORMANCE)**

AgileEnergy breakthrough is based on fast harvesting of thin ice.

Coating (<1min)

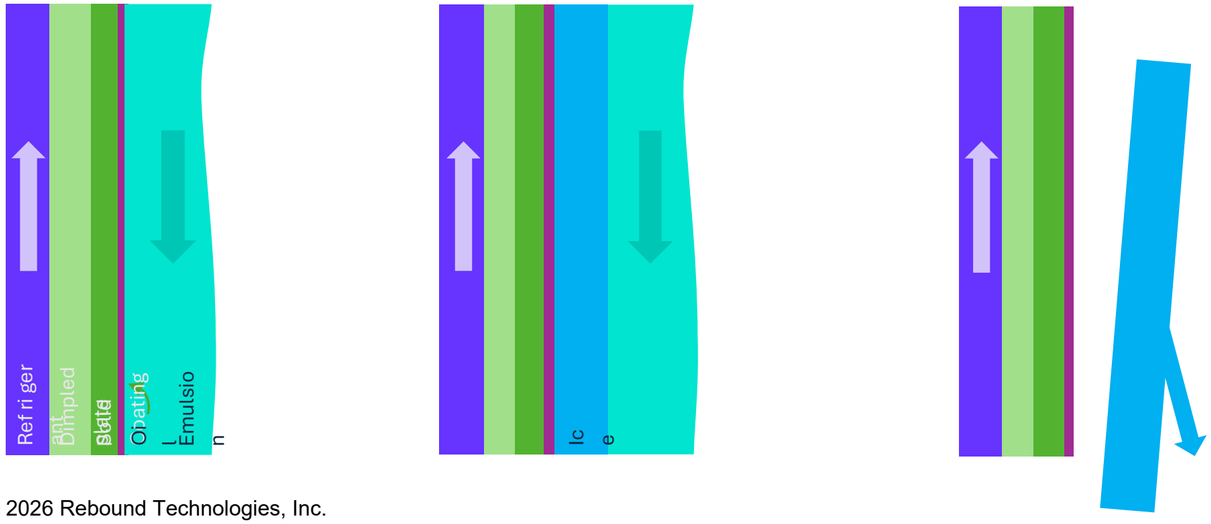
A solid coating pullschemically matched oilfrom an emulsion

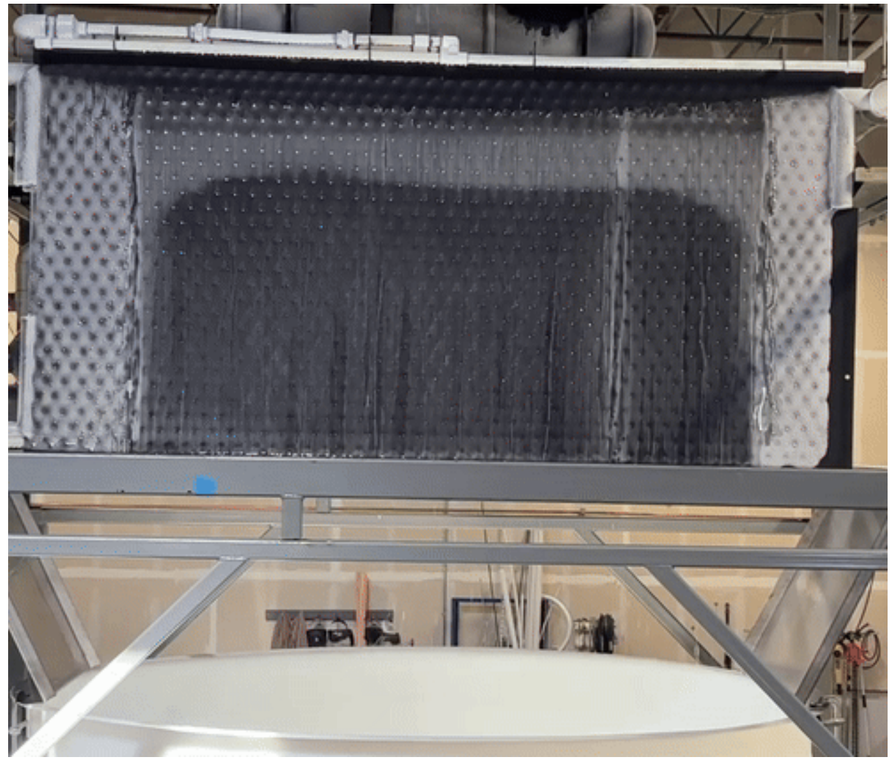
Growth (6min)

Ice forms on top of amicron scale hybridcoating

Harvest (<1min)

Emulsion flow is curtailed,ice sub-cools and falls off.No losses.

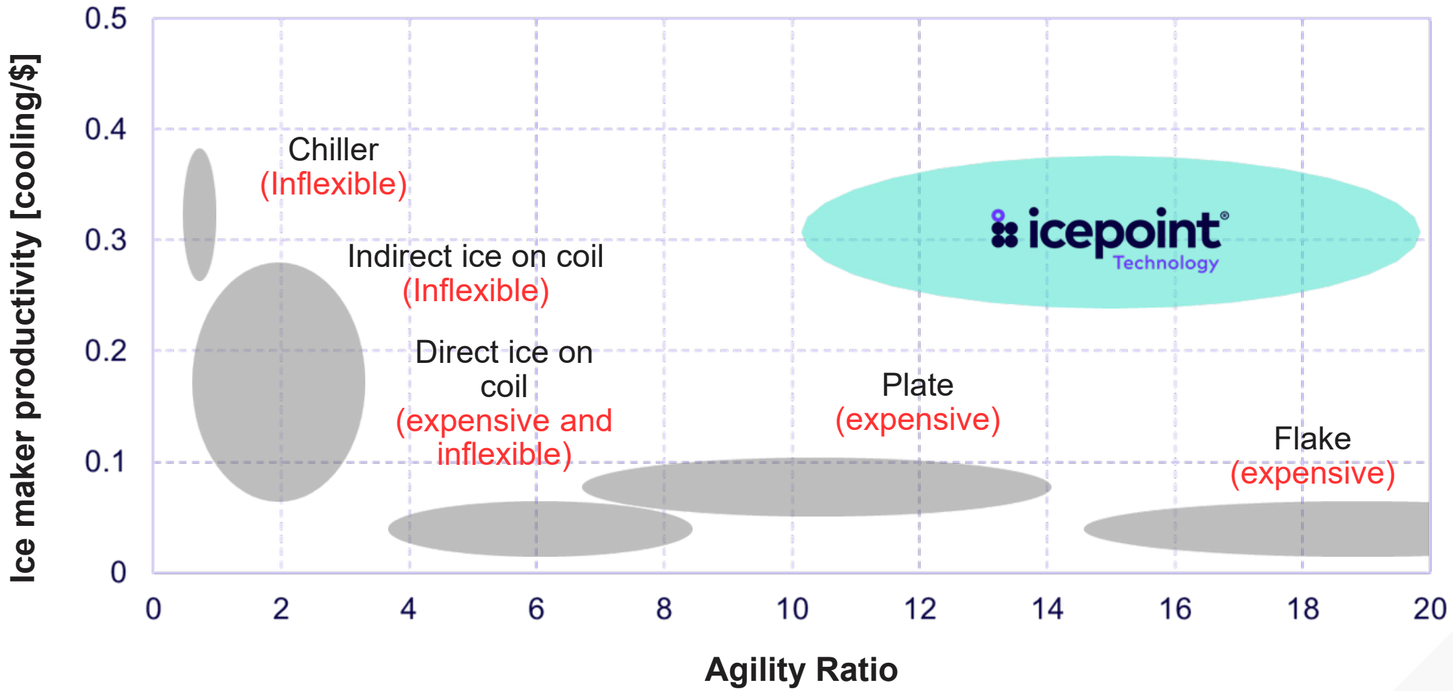




Real-time harvest. Emulsion stops, refrigerant continues to flow, ice pulls away and falls off.

COOLING AND **ICE STORAGE LANDSCAPE**

No other technology offers the low cost and high agile ice required by turbine inlet cooling



AEC PRODUCT **LAYOUT**

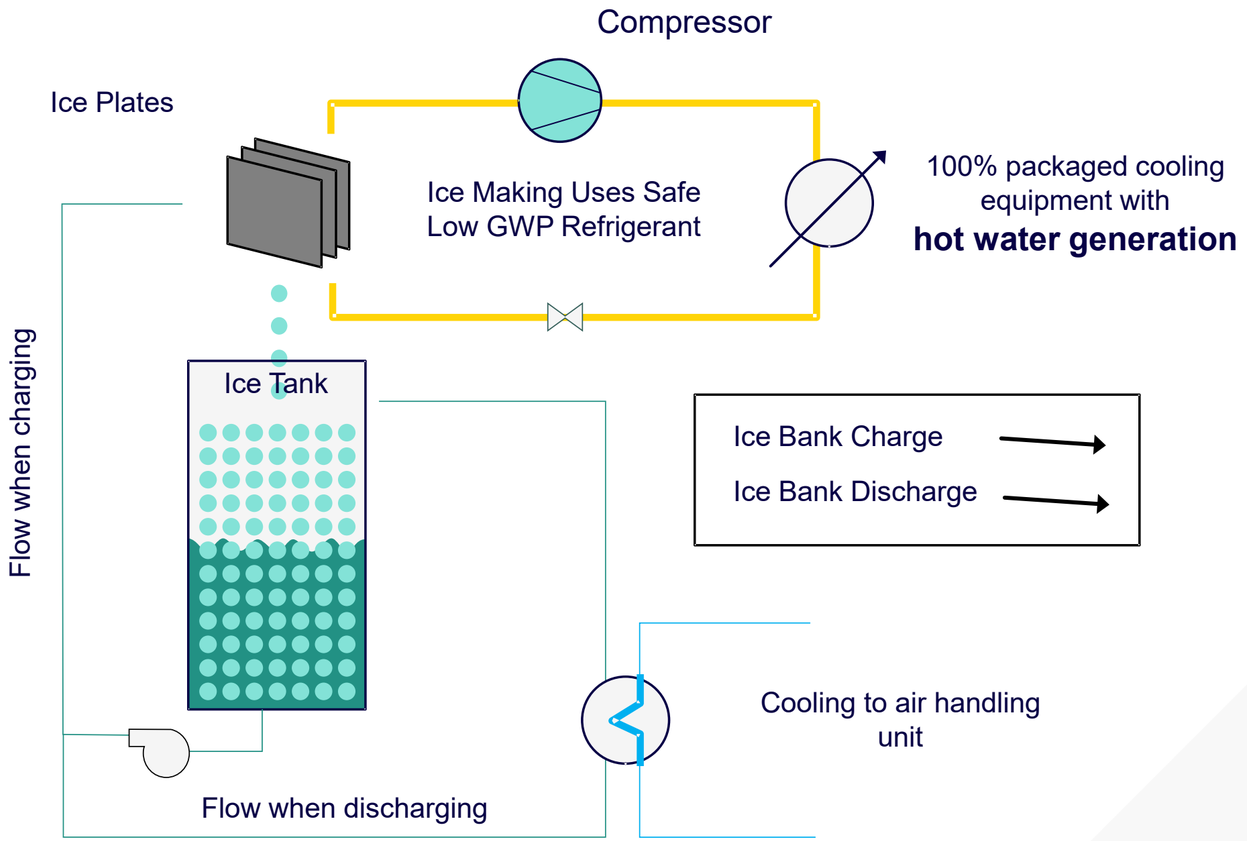
100% of cooling and storage equipment is self-contained. Install is plug and play, capex includes cooling equipment, simultaneous charge and discharge possible.

Charge

A vapor compression (VC) cycle cools the ice maker’s plates to just below freezing. Water/oil emulsion is pumped from the tank to the plates, creating ice.

Discharge

Water is pumped from the bottom of the tank to a heat exchanger where it generated chilled water.



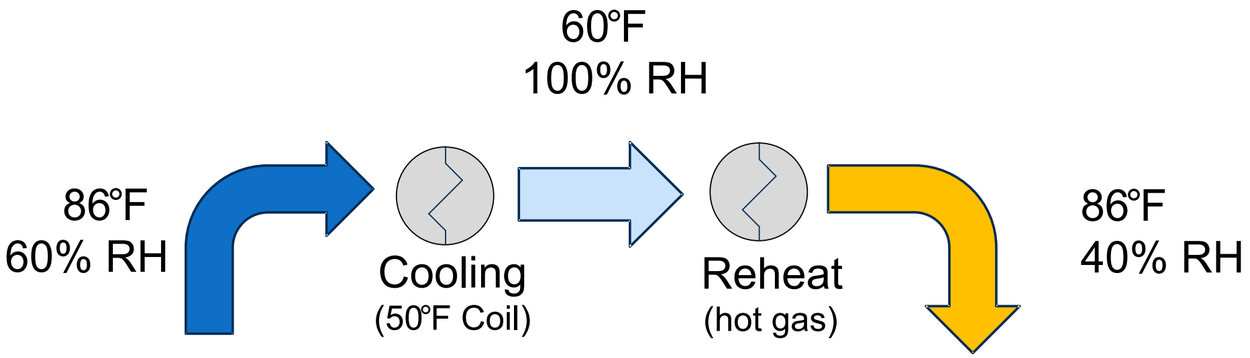
ENERGY **EFFICIENCY**

AEC can achieve significant kWh reduction because it requires less reheat and has a superior sensible heat ratio (SHR)

- Coil temp is limited by capex
- Recuperation has limited value due to high flow rate
- Reheat is “free” but wastes much of the cooling.

$$\text{SHR} = \frac{\textit{sensible cooling}}{\textit{total cooling}}$$

SHR = 0.6



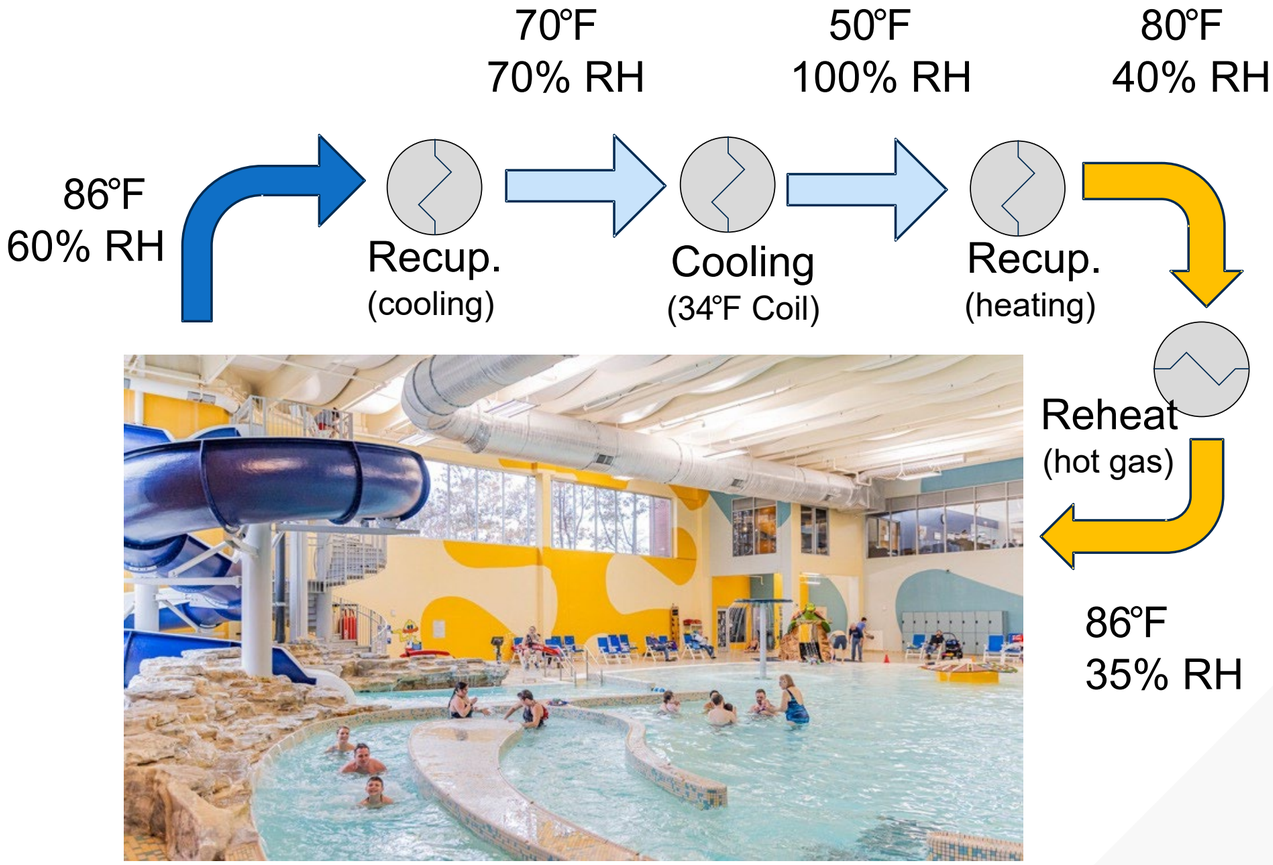
ENERGY **EFFICIENCY**

AEC can achieve significant kWh reduction because it requires less reheat and has a superior sensible heat ratio (SHR)

- Low coil temp is unavoidable
- Cost of low temp is defrayed by storage
- Recuperation is more effective because overall dT is bigger and flow rate is lower
- >30% reduction in air flow

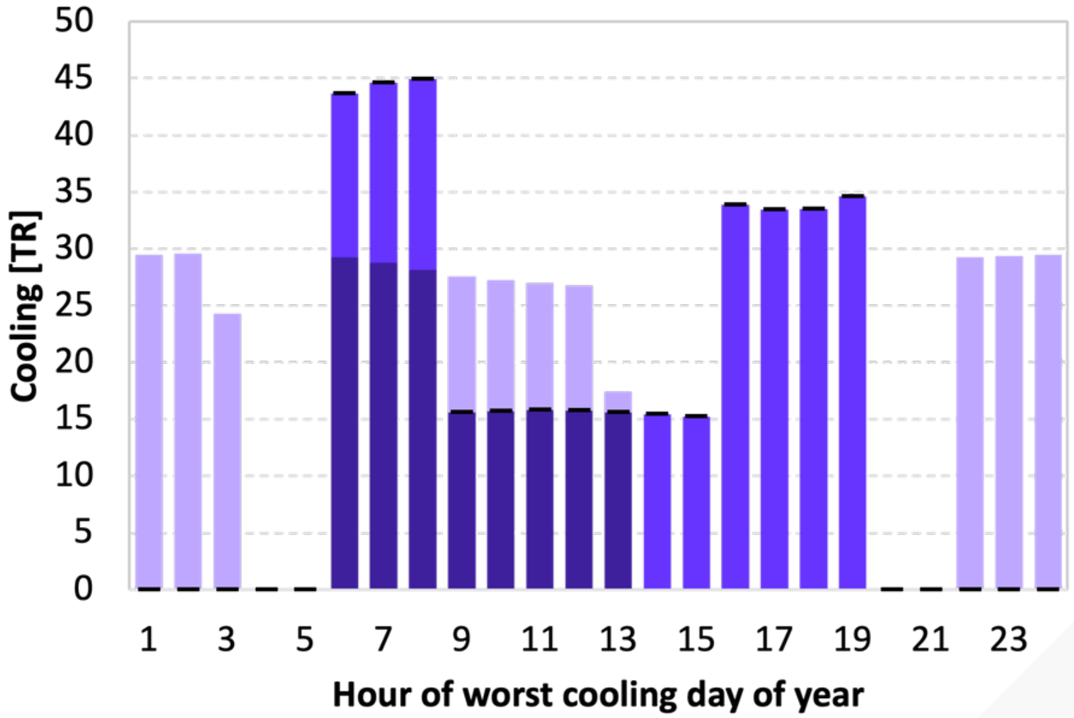
$$SHR = \frac{sensible\ cooling}{total\ cooling}$$

SHR = 0.2



YMCAPIKE'S PEAK EXAMPLE

700sqft pool with potential to upgrade to gym loads



Proposed Solution

AEC system with
advanced air handler

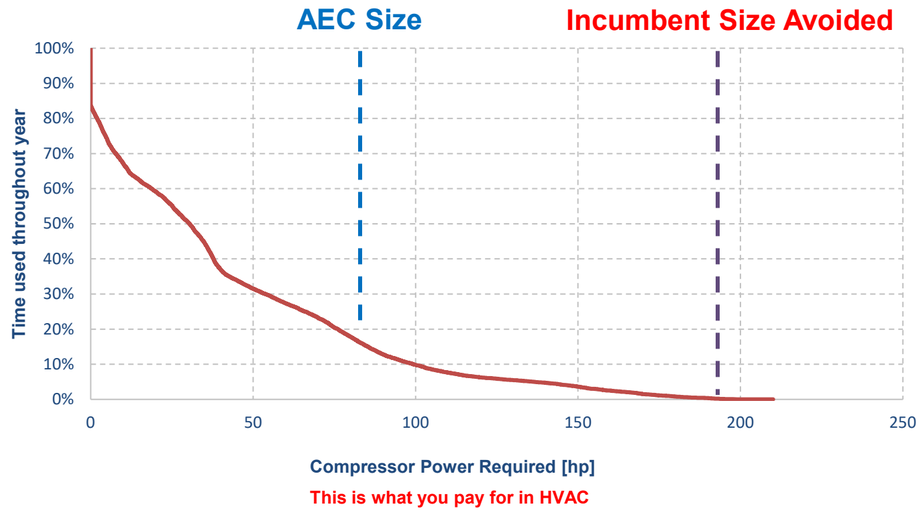
Results

60% reduction in energy cost
26% reduction in connected load
0yr payback with IRA incentives

PAYBACK AND **ECONOMICS**

Would you buy a 200,000sqft home because once a year you throw a large party for 12 hours?

Rec Center Power Curve



Most HVAC systems need to be grossly oversized

Lower First Cost

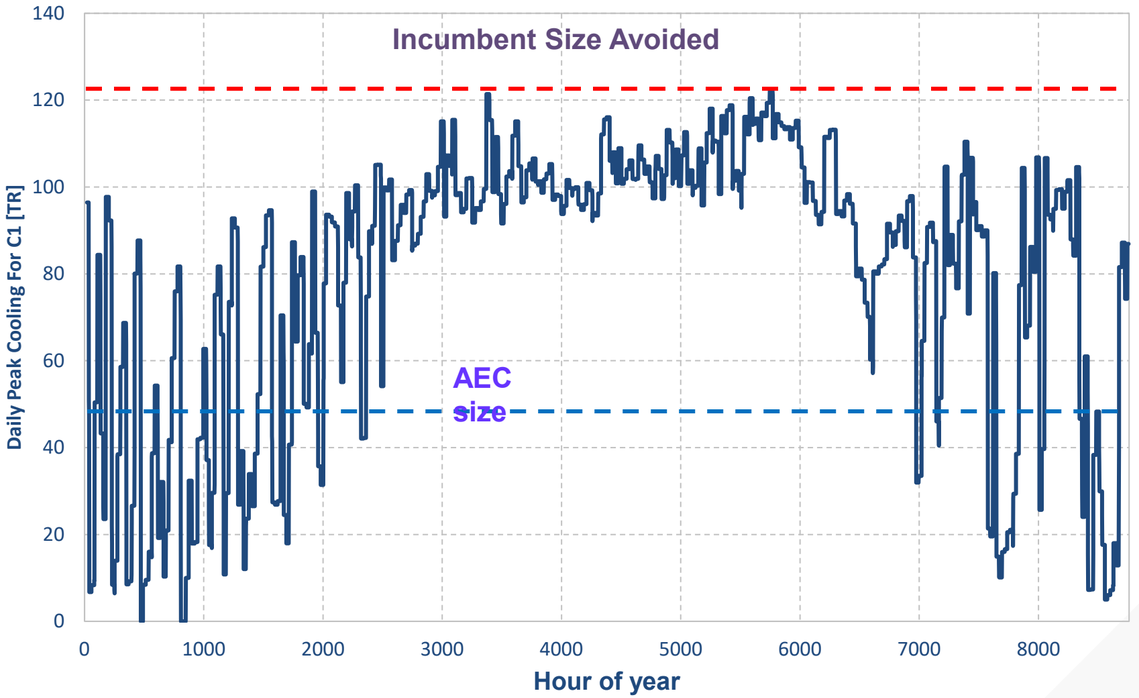
Thermal agility allows AEC units to greatly reduce the size of their refrigeration equipment which leads to lower first costs while delivering better comfort.

Lower Ongoing Costs

Energy storage allows AEC to only operate during lower cost off-peak periods significantly lowering operating costs.

HOUSTON
YMCA EXAMPLE

110,000 sqft facility with pool, multiple gyms, indoor track in hot humid climate.



Proposed Solution

60TR chiller + 120TR IceCase

Results

60% reduction in chiller size
46% reduction in energy cost
10% reduction in connected load
0yr payback with IRA incentives

A SMARTER APPROACH TO **YMCA NATATORIUM ENERGY**

- Lower operating costs and reduced utility expenses
- Healthier indoor environments with better humidity control
- More comfortable spaces for members, athletes, and spectators
- Reliable cooling and dehumidification when it matters most

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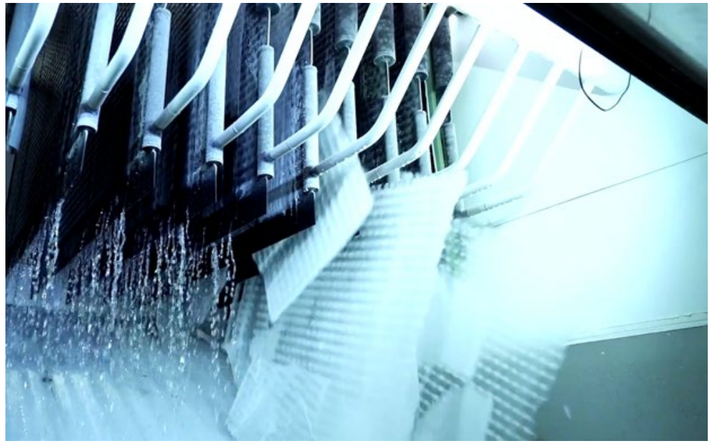
APPENDIX

ICE MAKER **COMPETITION**

Ice maker R&D has been dominated by potable ice market which is poorly suited for ice storage. Indirect Ice-on-coil (IOC) is the exception but is still too expensive and too hard to service.

	Direct IOC	Flake Ice	Plate Ice	Indirect IOC	Rebound
Example	Omega	North Star	Turbo	Calmac	AEC
Harvest method	external flow	mechanical	hot gas	glycol loop	subcooling
Serviceability	hard	easy	easy	impossible	easy
Asymmetric Discharge	no	yes	yes	no	yes
Ice Thickness [in]	>6in	<1/8”	>1/2”	>1”	<1/4”
Suction temp [°C/°F]	-20°F	-10°F	0°F	25°F	23°F
Overall heat transfer [W/m²-K]	40	400	200	100	500
Levelized Capex [$/(lb/day)]	**$50**	**$44**	**$20**	**$7**	**$2**



4.5M lbs of Ice Made to Date

AEC AND **REBOUND TRACTION**

IcePoint equipped technology has a $5m (5 units) PO from Lineage, the Largest cold storage operator in World, with potential to unlock orders of $300m over the next 5 years.

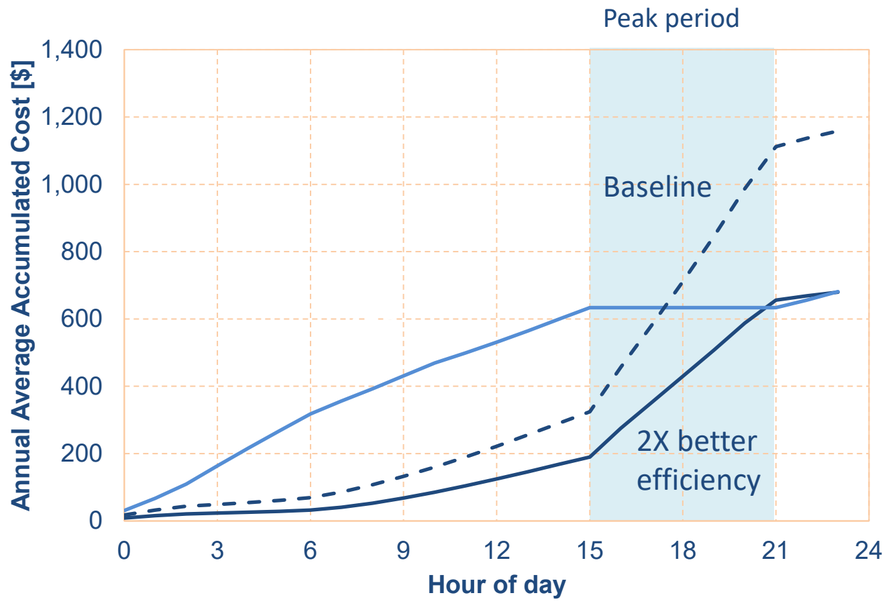
Commissioned April 2023
Lineage invested in company May 2023
Lineage issued PO for 5 units July 2023

Lineage

Largest cold storage company in the world
>400 facilities and 2.8B cubic ft of cold space
$30B IPO targeted for next year

ENERGY STORAGE **EXAMPLE**

AEC uses its internal energy storage to avoid peak rates and demand charges leading to significant opex savings.



Same opex as 2X higher efficiency

Customers accumulate more than 70% of their energy costs in just 25% of operating hours. AEC avoids purchases during these hours and generates the same savings as doubling energy efficiency.

Plot shows results of 8760 modeling for a 40MW load. Data shown is for a perfectly average day that, if multiplied by 365 would yield annual costs.

Rate structure:
$0.05/kWh off peak
$0.08/kWh winter peak
$0.12/kWh summer peak

CAPEX **VALIDATION**

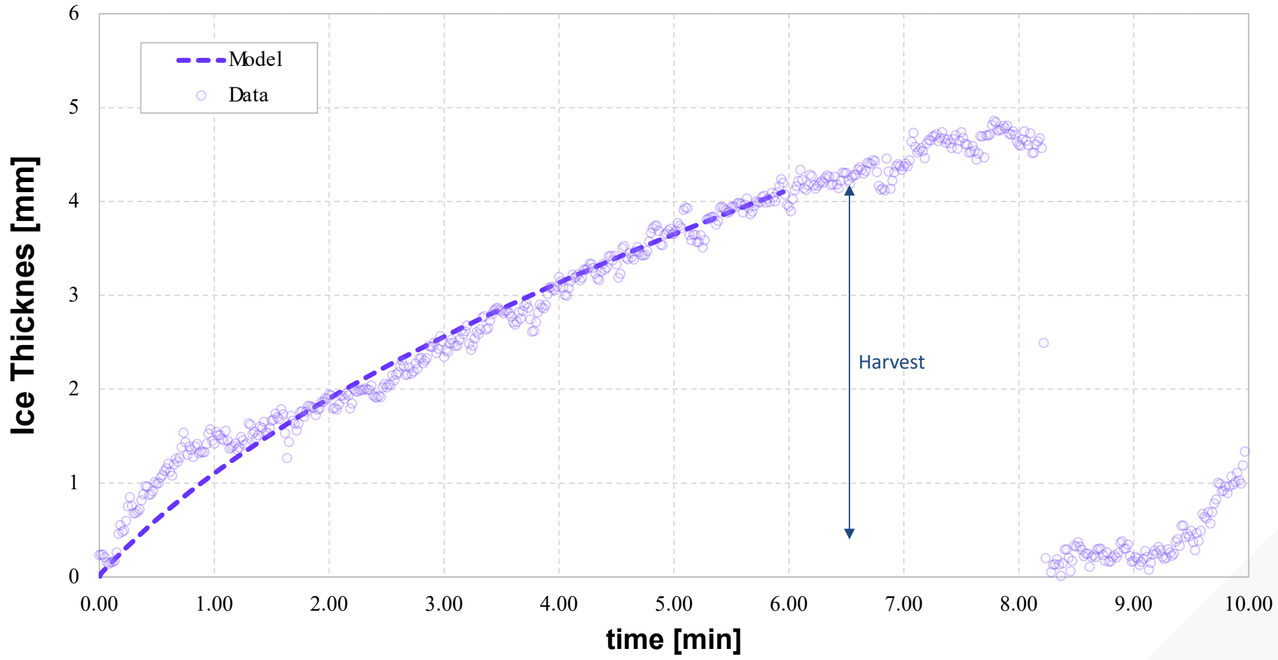
Capex is well understood at any scale so long as thickness growth rate and harvest timing matches models. Rebound has extensive validation in both single plate test cells and full multi-plate multi-suction group large format ice makers.

Thickness

As the primary driver of thermal resistance, thickness of ice is a key driver of capex and ice maker energy consumption. AEC shows ideal ice growth up to 4-5mm before harvest.

Timing

Harvest time is wasted time, so the faster the ice can be harvested, the less time and capex is wasted. AEC harvest time is 1min or less. 3-10X better than other ice makers.



MANUFACTURING

Heavy manufacturing done by partner, electronics, controls, and project execution managed by Rebound

OMEGA

- **#1 ice plate manufacture in US**
- **Robotic manufacturing / laser welding**
- **All heavy manufacturing done in Stratford WI**

- **Multiple ice maker patents issued / pending**
- **“Final mile” electronics and controls install**
- **Project execution and recurring revenue generation**

SELF HEALING
SURFACE CHEMISTRY

Heavy manufacturing done by partner, electronics, controls, and project execution managed by Rebound

Chemours™

Krytox™

>10,000

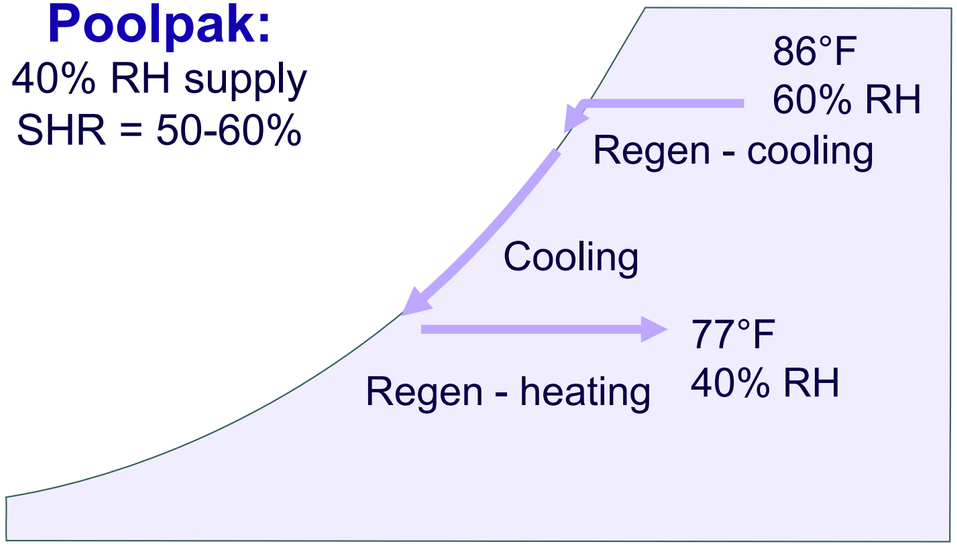
Cycles without coating performance degradation to date

Successful tests: Krytox-Teflon, Duratherm-Polyethylene

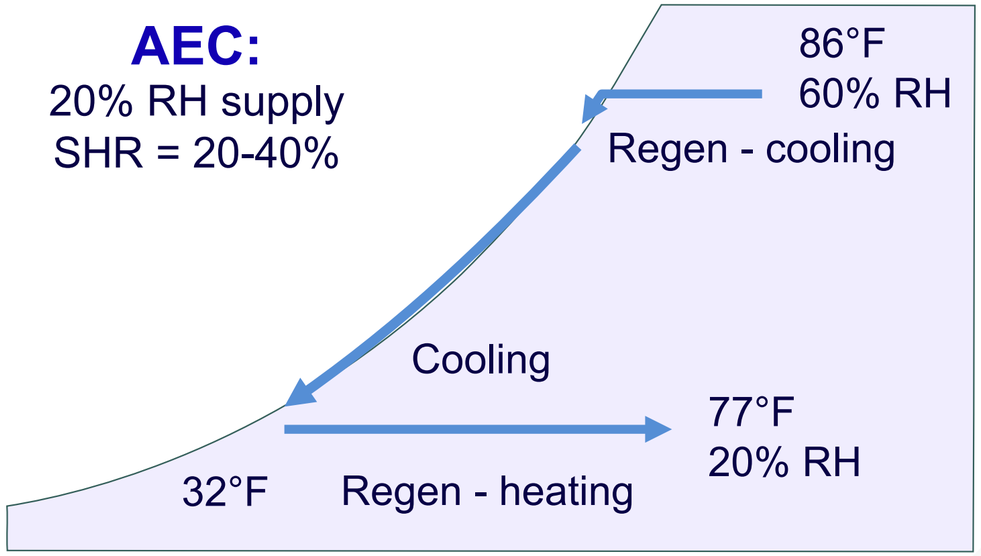
AEC
PSYCHROMETRICS

AEC delivers dryer air at a superior sensible heat ratio and a higher efficiency.

Poolpak:
40% RH supply
SHR = 50-60%

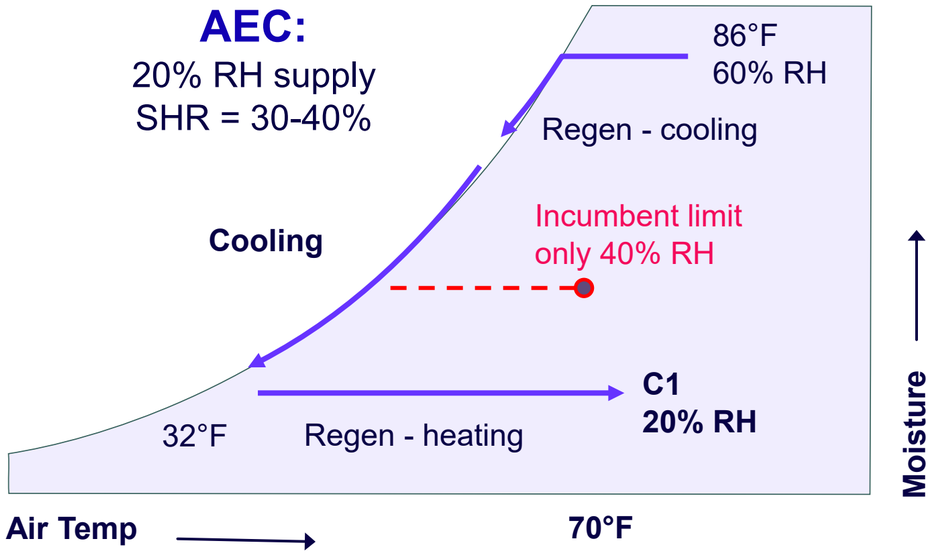


AEC:
20% RH supply
SHR = 20-40%



AEC: SUPERIOR **MOISTURE CONTROL**

Because AEC uses cheap off-peak power, it economically accesses colder coil temperatures that significantly outperform



	Incumbent	AEC
Relative Humidity Limit (lower is better!)	40%	20%
Latent Heat Ratio	**40%:** More than half of the cooling provided is wasted	**70%:** Most of the cooling is used to dry!
Efficiency	Low	High
Reheat requirement	High	Low
Standard wrap around heat regen?	No	**Yes:** C1's higher cooling potential means integrating heat regen is easy!
Blower energy consumption	High	Low
Coil frost risk	High	None