Chiller Replacement and System Strategy

Timmins and District Hospital
L'Hôpital de Timmins et du district

TRANE

Colin Berry – Account Manager

Current Situation

- 4 Existing RTAA chillers
- All units 23 years old
- Limited service history
- One unit MUST be replaced immediately
- One unit operating on single circuit
- Two machines operating normally

- System has 4 chillers feeding a main chilled water line
- Chilled water used for cooling of OR rooms
- Critical cooling system, redundancy required.

Possible Option #1

- OPTION 1
  - Replace 4 existing chillers with 4 identical new chillers
    - Fixes immediate deficiency
    - Will require heavy maintenance on remaining chiller(s) that will be replaced at a later date
    - Potential for chiller failure at any time
    - Lowest 1st capital cost
    - Limited expandability
    - No load shedding capability
    - Unable to take advantage of peak demand savings
    - Phase two would consist of replacing the remaining chillers at a later date.

Possible Option #2

- OPTION 2
  - Replace two chillers with a single Ice enhanced chiller, Phase 2 will add a second screw chiller to the system
  - Fixes immediate deficiency
    - Less than five year payback on investment
    - Lowest life cycle cost
    - Leading technology with built in redundancy
    - Ice Storage system allows load shifting and lower ambient operational efficiency gains.

Possible Option #2 Continued

- OPTION 2
  - Utility rates forecast to increase 40% in 5 years
  - Time of day billing is immanent
  - Future incentives may be available for load shifting to off peak
  - Less mechanical equipment for future maintenance
  - Packaged controls
  - Remote monitoring of system to address problems before the occur

Economics Review

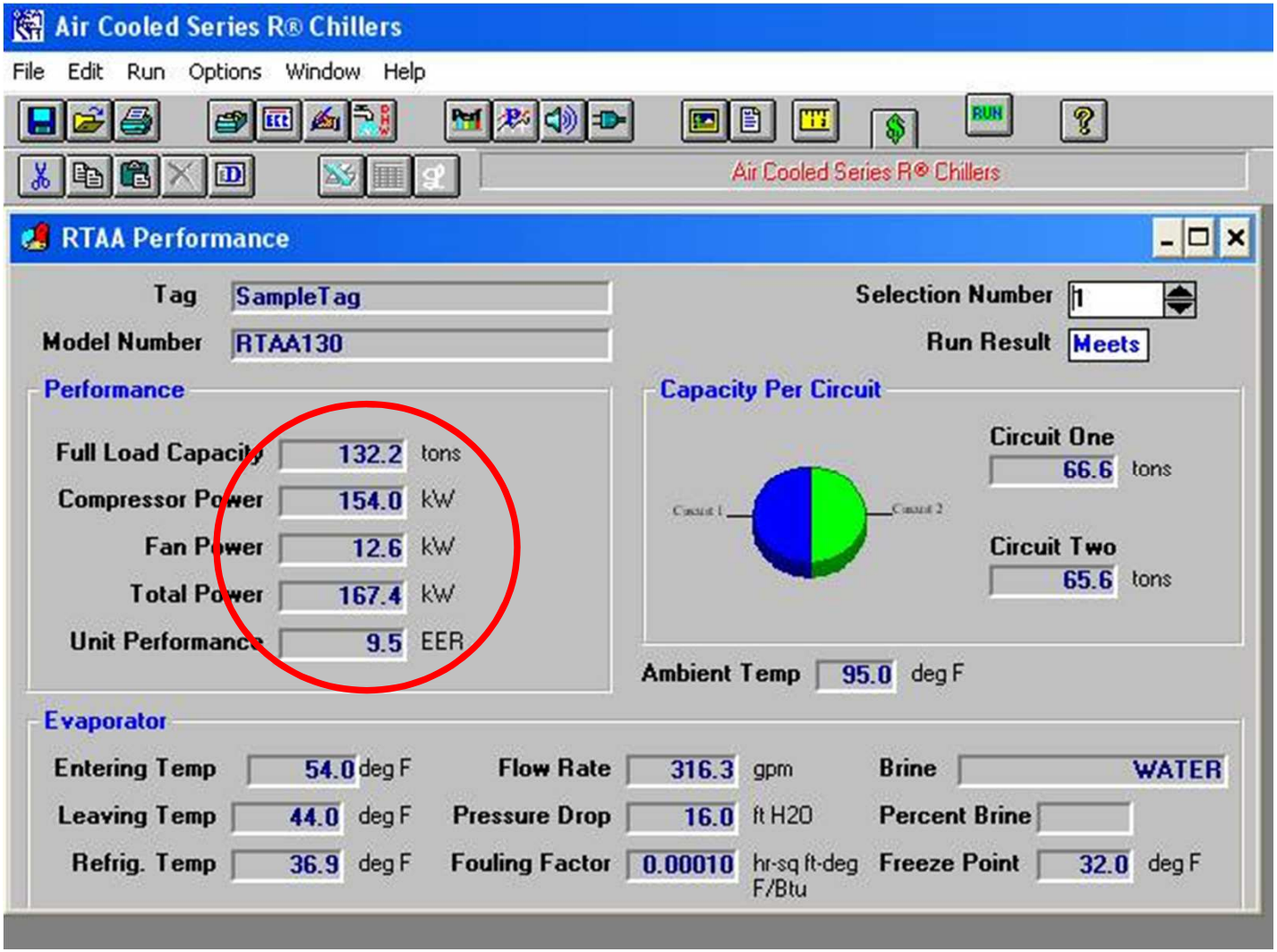
Option #	Approximate Installed Cost	Yearly Utility Cost	1st Year Maint.	Final Year Maint.
1	$462,975	$70,494	$10,500	$12,634
2	$770,637	$46,703	$8,500	$11,434

Note: Figures above do not include rebates

Rebates

- Hydro One offers a very enticing rebate program
- Based upon removing KW from the grid
- Thermal storage adds cooling tons while reducing mechanical system KW
- **This can fund a good portion of this project.**

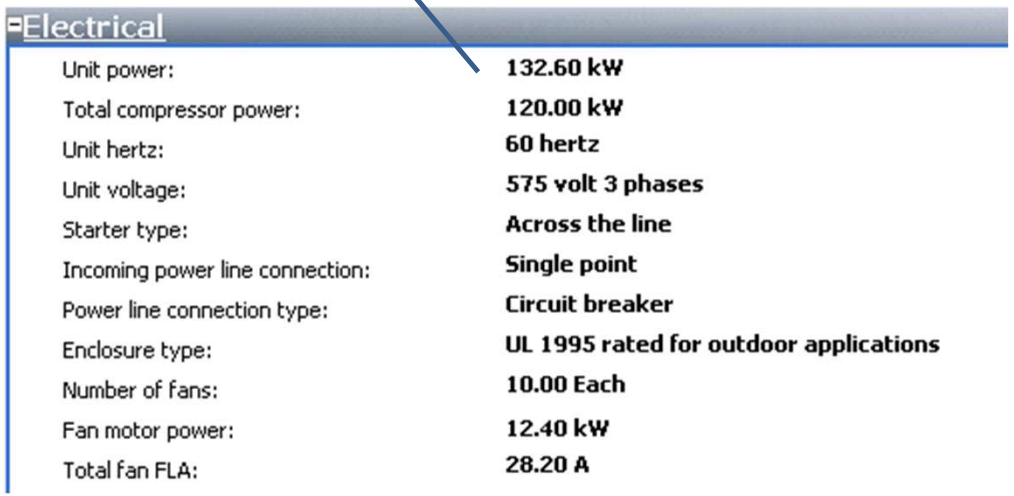
Rebates – Review existing system



Rebates – Review direct replacement system

Unit Power = 132.6KW

New 130 ton Trane CGAM



Electrical

Unit power:	132.60 kW
Total compressor power:	120.00 kW
Unit hertz:	60 hertz
Unit voltage:	575 volt 3 phases
Starter type:	Across the line
Incoming power line connection:	Single point
Power line connection type:	Circuit breaker
Enclosure type:	UL 1995 rated for outdoor applications
Number of fans:	10.00 Each
Fan motor power:	12.40 kW
Total fan FLA:	28.20 A

Rebates – Direct replacement calculations

Option 1:
replace all four existing chillers with new Scroll Chillers, controls
Current installed kW: 167 x 4 = 668 kW(4 X 130 ton chillers)
Future installed kW: 152 x 4 = 608 kW(4 X 130 ton chillers)
Rebate: (668-608) x $800 =
$48,000
Phase 1: [(167 x 2) – (134.5 x 2)] *$800 = $24,000 (Based on 2 replacements each phase)
Phase 2: [(167 x 2) – (134.5 x 2)] *$800 = $24,000 (Based on 2 replacements each phase)
Installed cost: up: $462,975 (Estimated budget after all phases completed)
After rebate first cost roll up: $414,975
Total installed tons: 544 tons in 4 chillers
N-1 tons: 408 tons if one chiller is unavailable

Rebates – ICE Storage calculations

Option 2:
In three phases, replace all four existing chillers with 2 Screw chillers (178 tons) plus 9 tanks, controls
Current installed kW: 167 x 4 = 668 kW(4 X 130 ton chillers)
Future installed kW: 126 x 2 = 252 kW(2 X Trane chillers, thermal storage system)
Rebate: (668-252) x $800 = **$ 332,800**
Phase 1: [(167 x 2) – 126] * $800 = **$166,400**
(1 new Trane chiller, remove 2 chillers)
Phase 2: no rebate (Install thermal storage system, 9 tanks)
Phase 3: [(167 x 2) – (126)] * $800 = **$166,400**
(1 new Trane chiller, remove 2 chillers)
Installed cost rolls up: $ 770,637 (Estimated budget after all phases completed)
After rebate first cost roll up: $ 504,397
Total installed tons: 536 tons in 2 chillers and 9 tanks N-1 tons: 403 tons if one chiller is unavailable assuming 25 tons per tank (6 hours of discharge, 12 hours of charge) (Capacity left – 1 chiller = 178 tons plus 25 tons X 9 tanks = 403 tons)

Energy Consumption Summary

	Yearly Savings vs Alt 2	Yearly Total Operating Cost ($)	Yearly Utility Cost ($)	Yearly Maintenance Cost ($)	Plant kWh/ton-hr	
Alt 1	-23,790	70,494	70,494	0	0.933	1. like-for-like 341,352 kWh 365,864 ton-hr
Alt 2	0	46,703	46,703	0	0.776	2. thermal storage 287,462 kWh 370,440 ton-hr
Alt 3	-7,880	54,583	54,583	0	0.718	3. variable speed 263,355 kWh 366,789 ton-hr
Alt 4	-64,336	111,039	91,039	20,000	1.214	4. existing (base) 443,374 kWh 365,464 ton-hr

Notes:
Alt 1 – 4 New 130 ton chillers
Alt 2 – Ice Storage
Alt 3 – Variable speed Option (JCI Proposal)
Alt 4 – Existing Conditions.

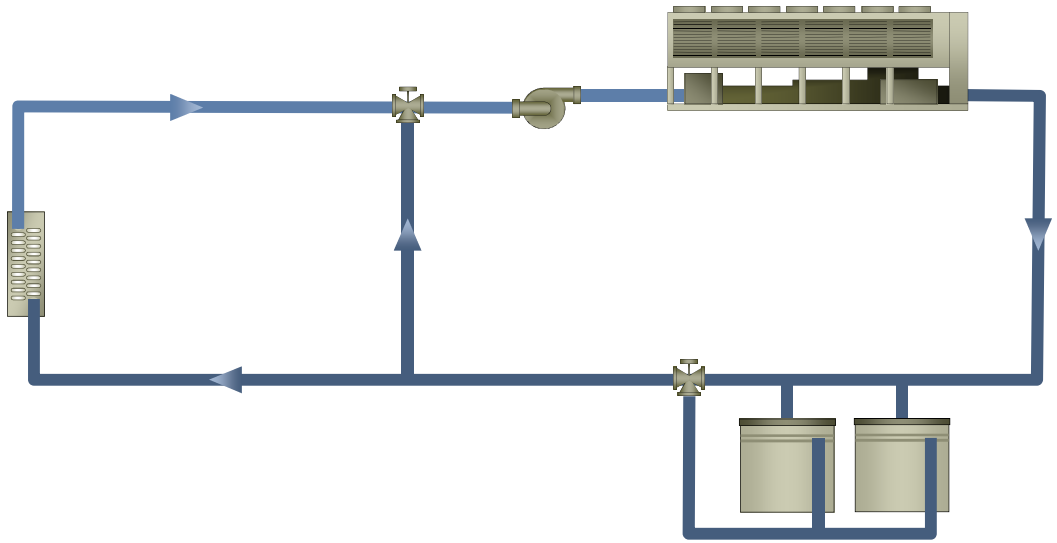
What Does Trane Bring to the Table?

- Turnkey contracting service
- Controls, Service and Equipment from one supplier
  - Can tie into existing BMS
  - Preventative maintenance to avoid losing efficiency
  - Engineering and System Design
  - Project Management including rebates

We will be your single point of contact for the entire project and service period.

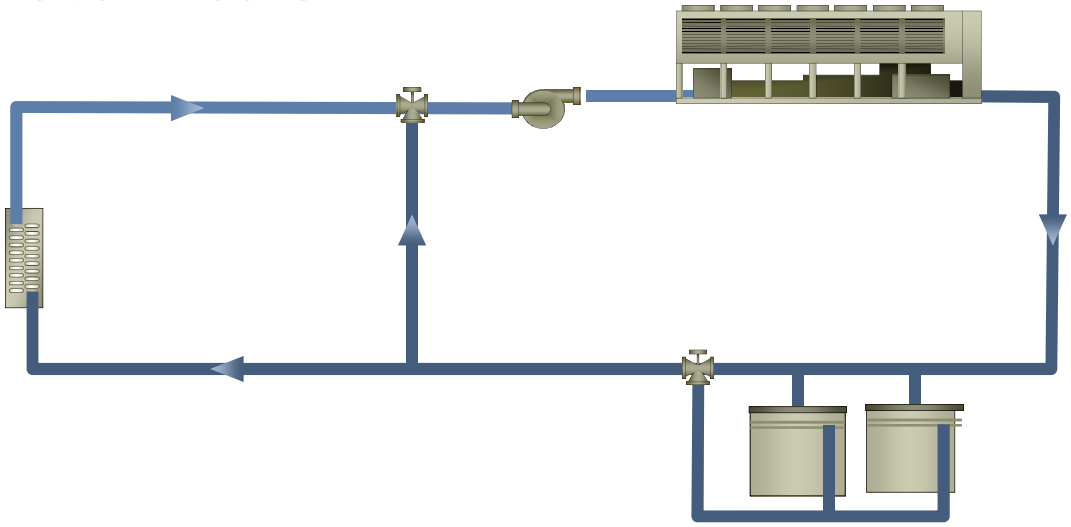
Similar First Cost…How?

- On air cooled chiller jobs
- Key is partial ice storage
- If not lower you likely have too much ice
- REBATES



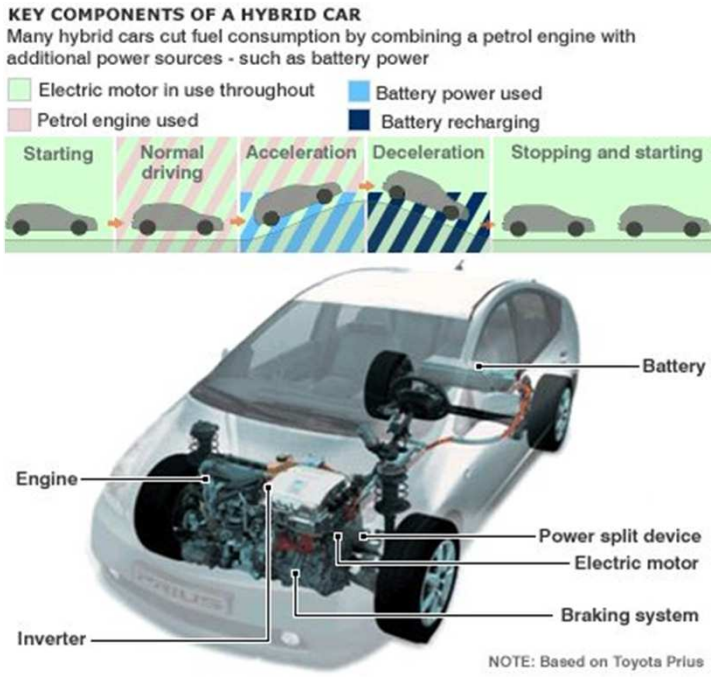
Important Notes on ICE Systems

- ICE tanks can be viewed as chillers in series.
- General rule of thumb is that chiller can be sized to 65% of total cooling load.
- Not Only are night electrical rates lower but the air cooled chiller is more efficient at low ambient.
- Each ICE tank is roughly 25 tons peak discharge and 160 useable ton-hours.

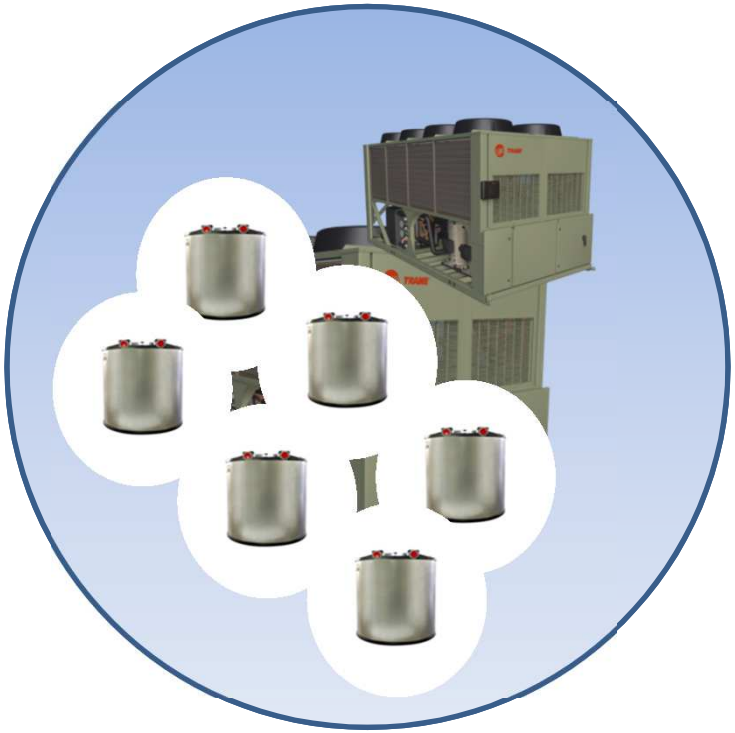


Good Analogy for Partial ICE…

Hybrid Car



Hybrid Cooling



Partial Storage Basics

Hybrid Car

- Reduced size, efficient engine
  - Handles lo
    most of th
- Electric motors
  - Kick in when extra power is needed
- Electric motors
  - Are charged when plugged in, or braking, or by the engine

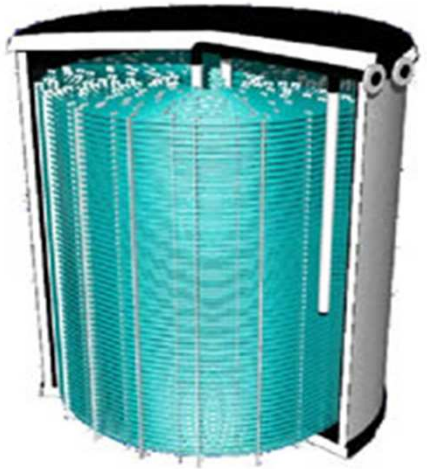
Both can have similar 1st cost!!!

Hybrid Cooling

- "Right" sized chiller(s)
  - Handles load efficiently
  - Kick in when extra cooling is needed
- Storage tanks
  - Are efficiently charged at night when costs are low.

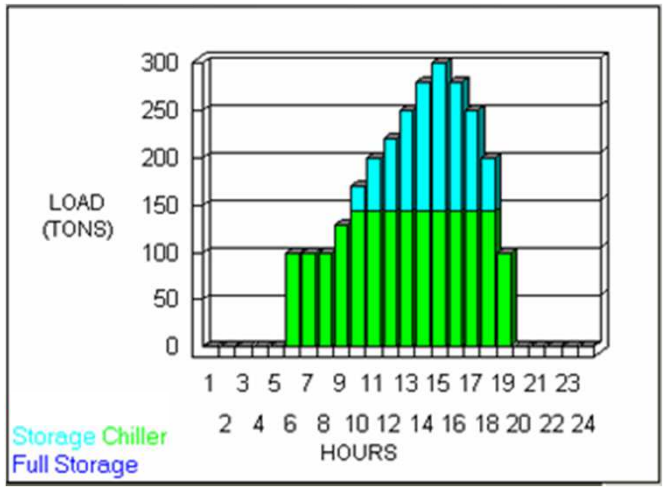
Model Number - 1190A

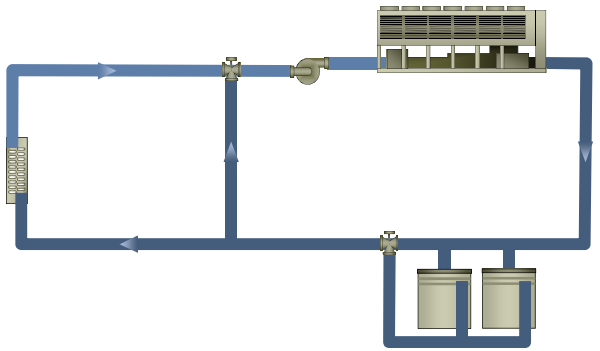
Dimensions - OD x H	89" x 101"
Filled Weight	16765 lb
Floor Loading	388 lb/sq ft
Inlet-Outlet Flange Connection Size	2"
Manufacturer Product Line	ICEBANK®
Maximum Operating Pressure	90 psi
Maximum Operating Temperature	100 deg F
Net-Usable Capacity	162 ton-hr
Shipping Weight	1950 lb
Volume Of Water-Ice	1655 gal
Volume of Solution in HX	148 gal



Peak Design Load – 300 Tons

ICE percent	Chiller Capacity (tons)	Chiller Cost ($500/ton)	No. of Tanks	Tank Cost	Total Cost
100% Full Storage	450	$225k	18	$270k	$495k
80%	358	$176k	14	$210k	$386k
60%	198	$99k	10	$150k	$249k
40%	144	$72k	6	$90k	$162k
0%	300	$150k	0	0	$150k





Why It Makes Sense for the Customer

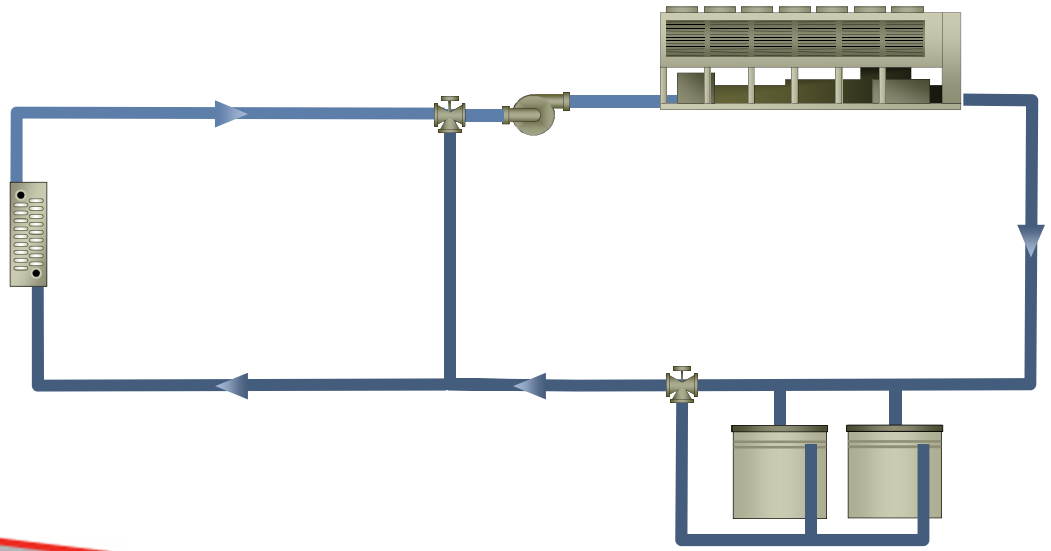
Lower first costs (both new construction and existing buildings)

- **If Chillers are being replaced…..**
  - **With a Combo of ice & chiller of same total capacity, properly sized , this can have basically have the same 1st cost.**
  - **And adding ice to same size chiller , this will increase overall system capacity.**
- **By keeping existing piping, pumps, and airside – this is now a great opportunity to use the colder water and add VFDs to save pump and potentially airside energy**
- **Or with reduced supply air temperature**
  - **Provide more cooling with same infrastructure**
  - **Eliminate hot spots**
- **Reduced maintenance cost because of less tonnage**

Single Pump System

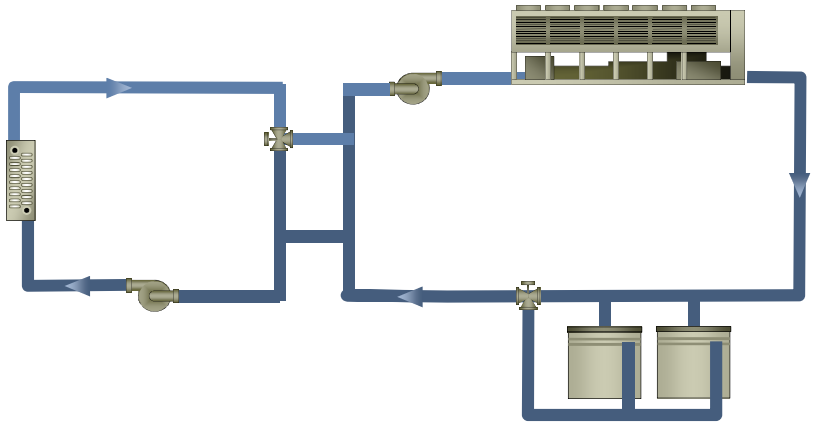
And We Can Keep These Systems Simple

- **Lowest cost and simplest controls**
- **Often smaller systems**
- **But…There are a few things to be aware of.**
  - **Glycol throughout system**
  - **Night cooling with cold water**



Existing Chiller Plants –

Two Alternatives that Keep It Simple, and solve one or both problems.



Eliminates the distribution of cold water during ice making, But still glycol in total system

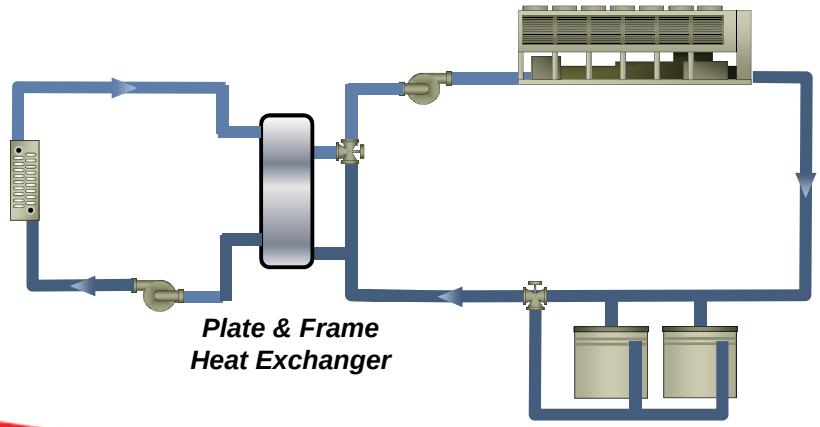
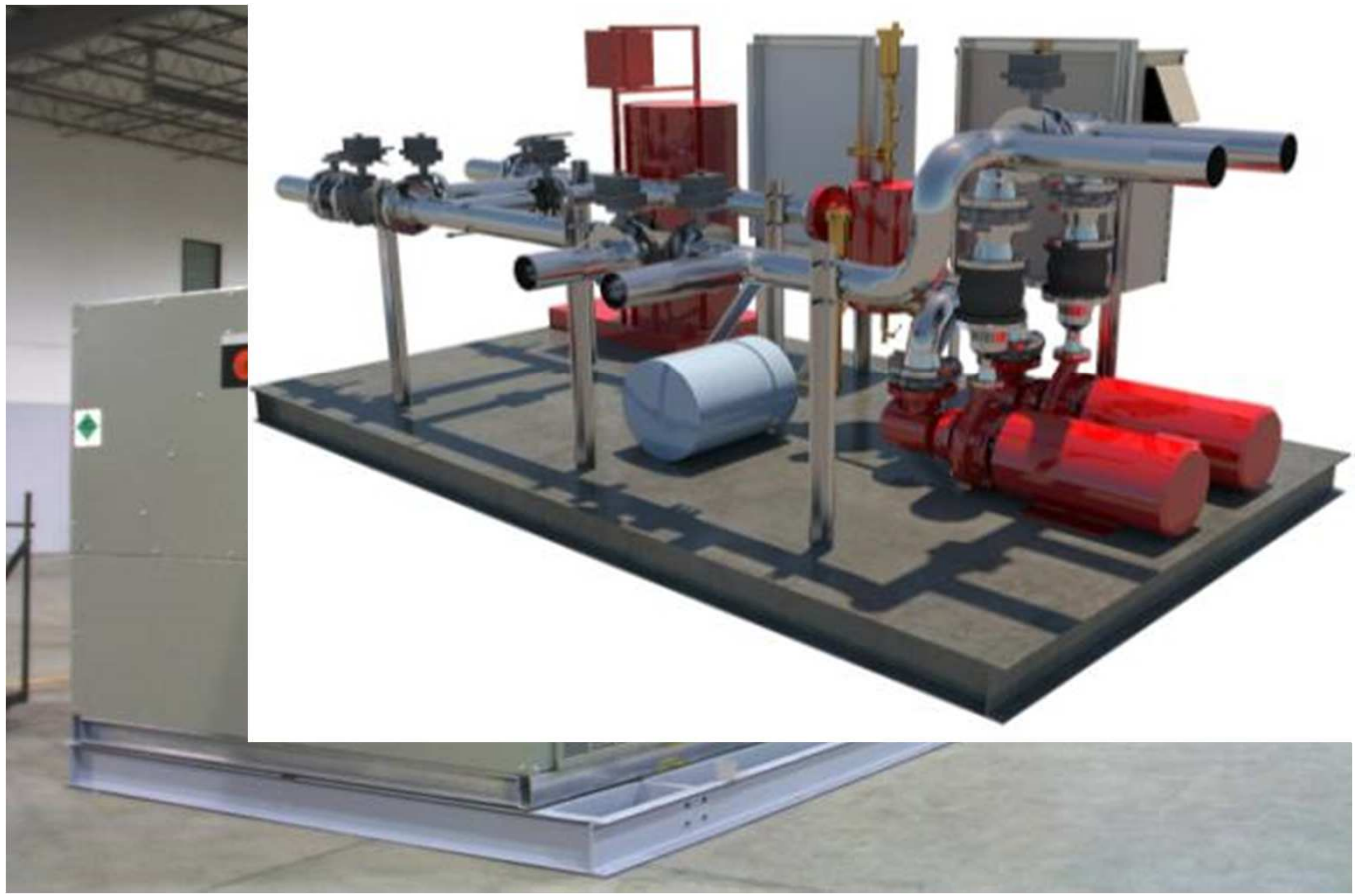
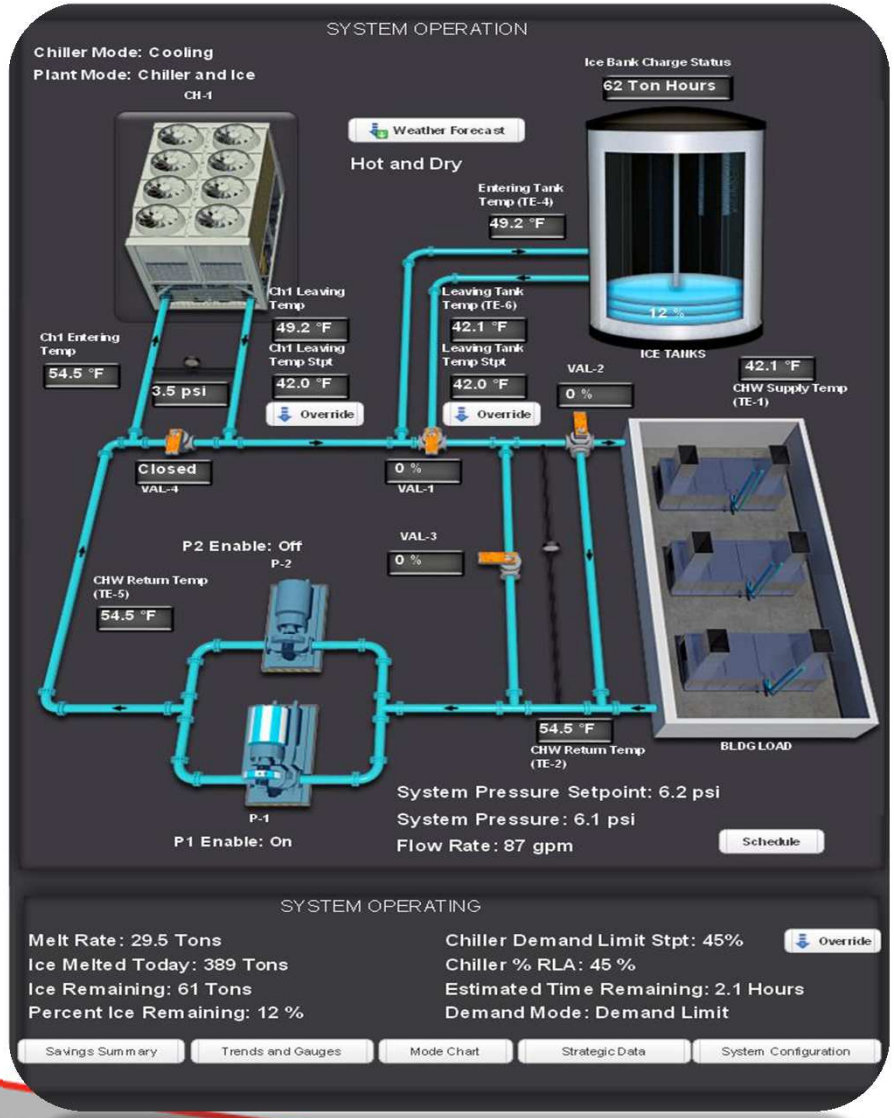


Plate & Frame Heat Exchanger

No glycol in the distribution system

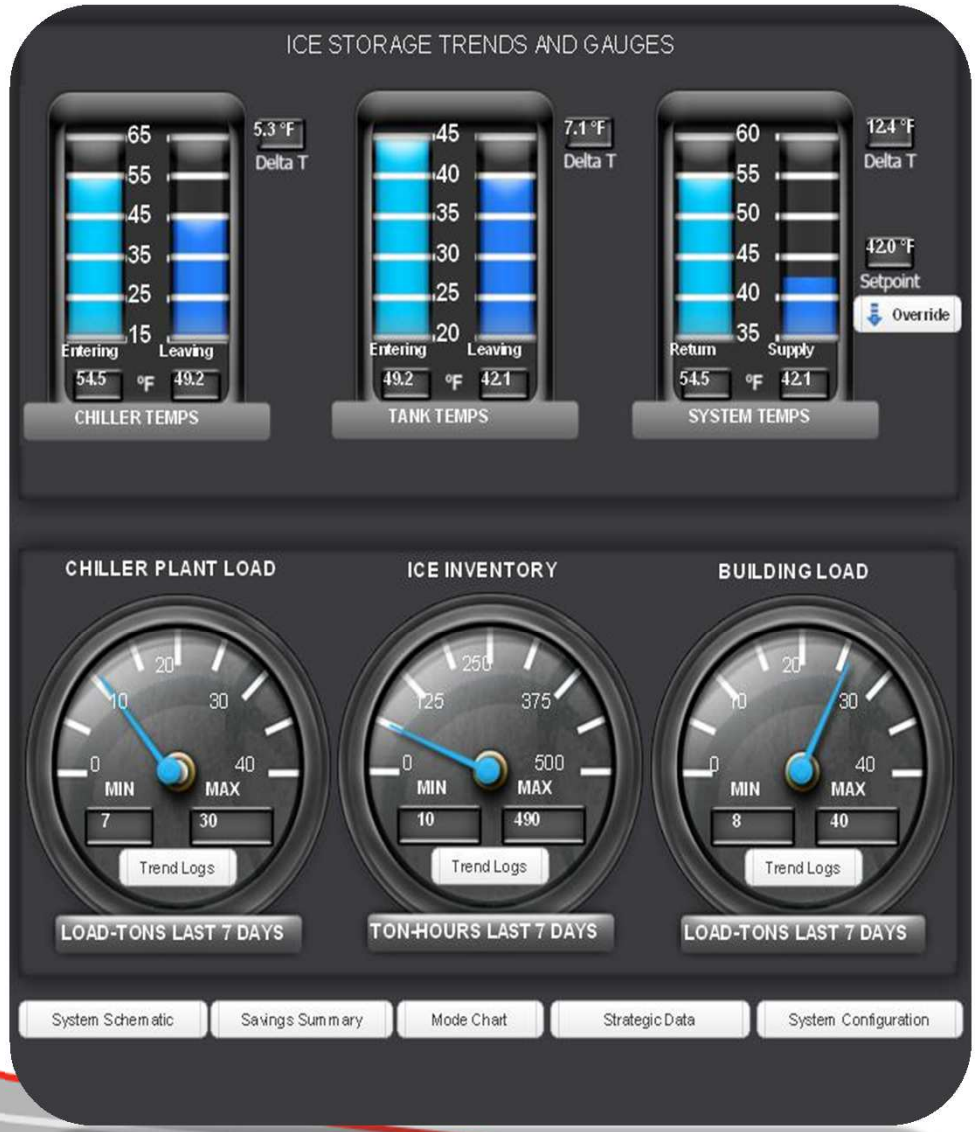
How Do You Make ICE Easy?





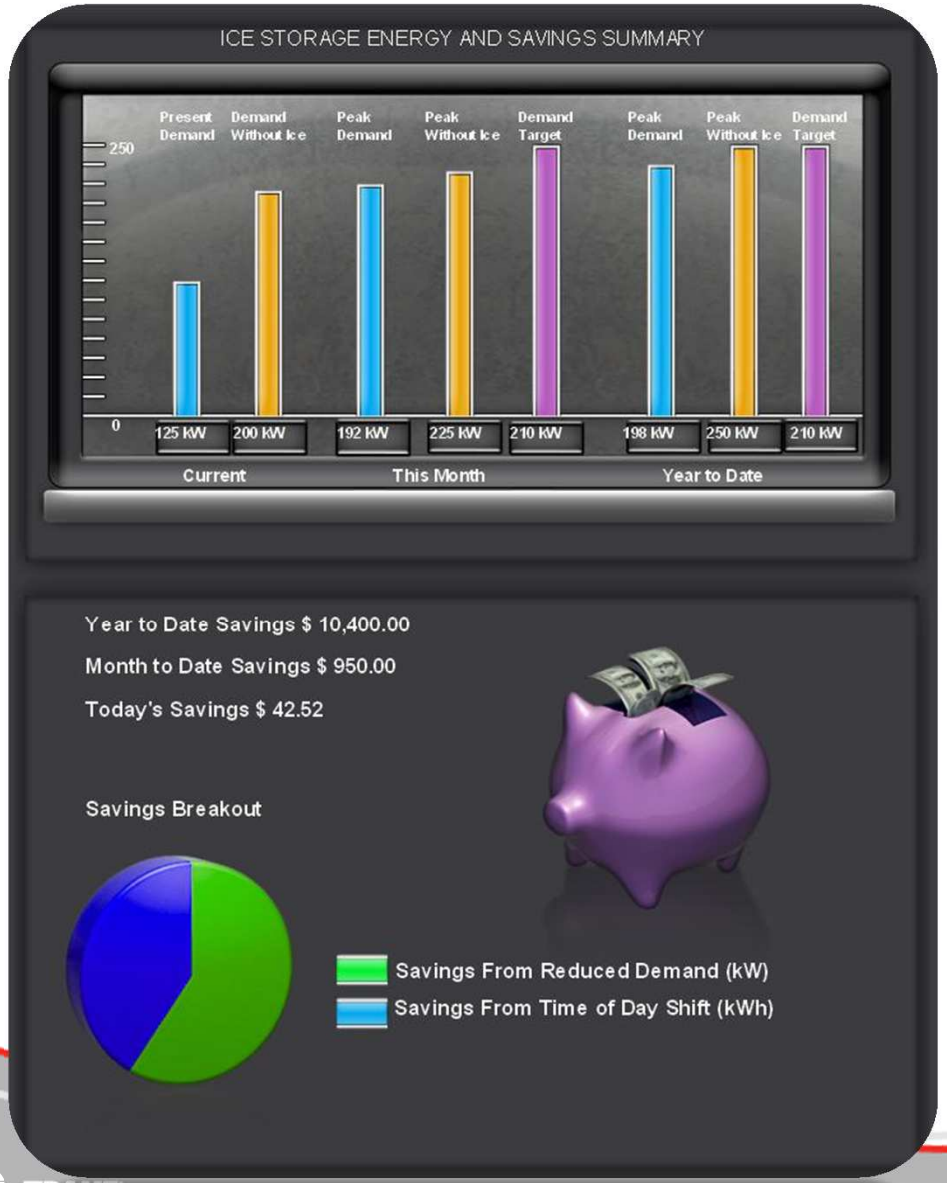
System Schematic

- ***Schematic representation of plant layout***
- ***At a glance view of key system operating parameters***



Trends and Gauges

- ***Dashboard style gauges and dials***
- ***Links to Trend Logs showing key data***



Savings Summary

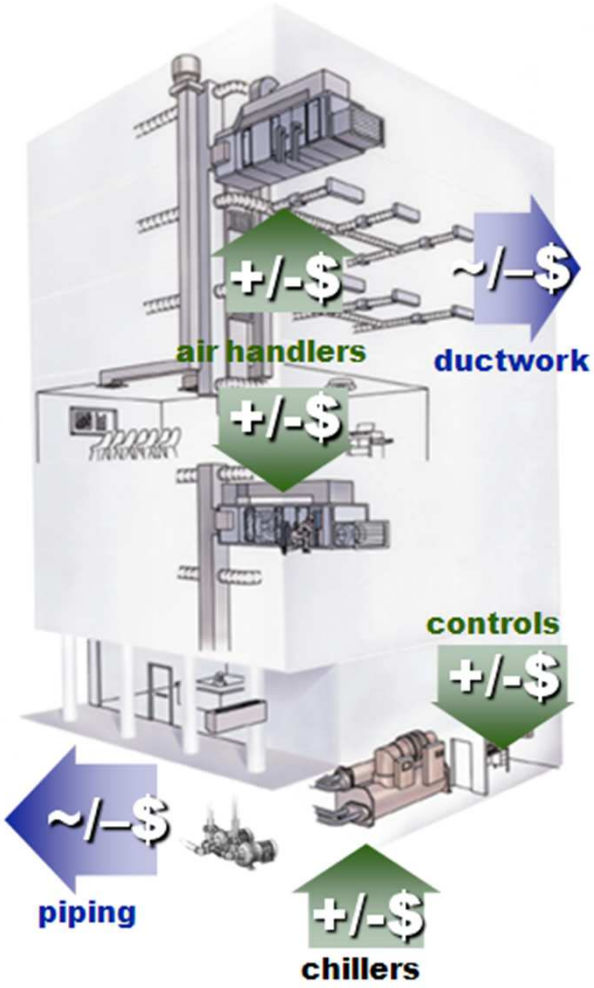
- ***Quantifies savings associated with Ice storage***
- ***Simulates system energy use without Ice***
- ***Visual breakout of peak kW and electrical consumption savings***

All Can be viewed…

AC Chillers + ICE Storage

Which can lead to…

- Lower temperature fluid
  - Can drive lower temperature air = less fan energy
  - Will increase chilled water ΔT on retrofits
- Larger chilled building loop ΔT
  - Drives lower flow rates = less pump energy
- AC chiller in series with ice storage tanks
  - Series arrangement supports Variable Primary Flow (VPF)
  - VPF saves on part-load pump energy
- All of the above help with earning LEED® points via reduced energy costs!



Decision To Use ICE?