

Better HVAC Systems Can Deliver the Smart Grid Promise



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What's the “promise of Smart Grid”, to most commercial building owners?



1

- Smart grid, today, means smart use of our energy resources

2

- Smart grid can mean: minimizing energy use and increased efficiency

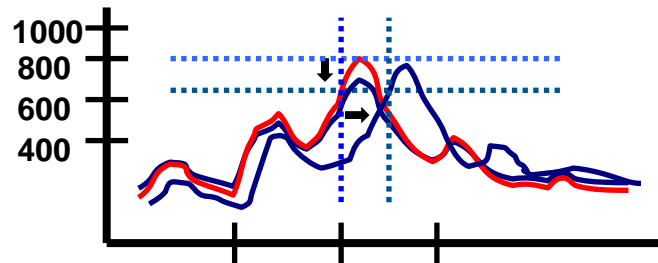
3

- Smart grid can help us use less energy, cheaper energy, and cleaner energy with lower emissions

Can HVAC Systems be designed to take better advantage of the Smart Grid?

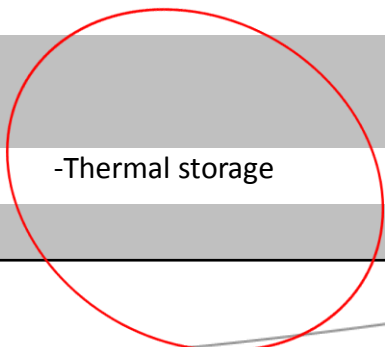


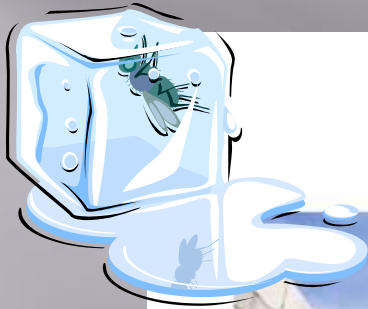
- Yes, here are several control strategy examples:
 - Load Reduction
 - Load Shedding
 - Load Shifting
- The HVAC Industry has the experience and capabilities with all of these strategies





Load Reduction	Load Shedding	Load Shifting
-Optimal Start / Stop	-Setpoint Reset	-Pre-cooling
-Setpoint Management	-Soft start of motors	
-Schedule Optimization	-Staggered load start	
-VAS/Area control	-Energy Source Selection (heat source, gen-sets)	
-Control Upgrades	-Round robin cycling	
-Chiller Plant Control	-Lighting Circuit management	
-VFD		
-Lighting Retrofit		
-Chiller-Tower Optimization		
		-Thermal storage
-Chiller Retrofit		





ICE



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Ice Storage Systems from CALMAC.

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IB-198-NY

04/08

PROJECT PROFILE



ICE STORAGE

FIRST PLACE

2008 ASHRAE TECHNOLOGY AWARD:
INSTITUTIONAL CATEGORY

LEED® Silver: Fossil Ridge H.S.

1.44 PEAK WATTS/SQ.FT. AND 1050 SQ.FT./TON



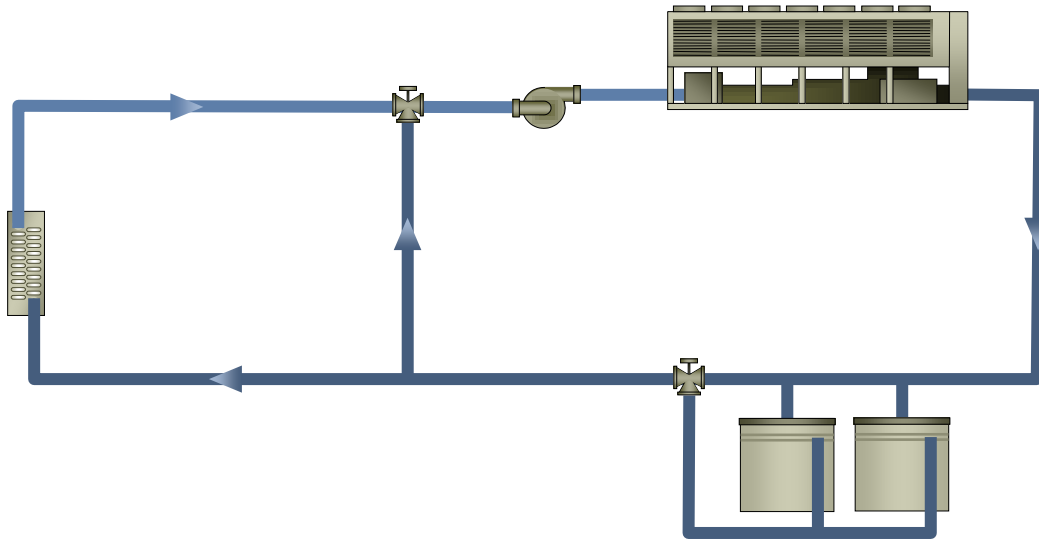
Smart Grid



- **ICE:**
 - **Ability to shift the load to off peak times**
 - **This not only helps minimize heavy on-peak loading of the utilities' infrastructure**
 - **But also increases the chance of using lower emissions electricity generation; nuclear and wind being two good examples**
 - **And it allows for the production of electricity when it is most efficient to do so..night.**
 - **Can be included in a new design for similar or lower first cost!**
 - **Creates the opportunity take advantage of RTP, (Real Time Pricing)----now or in the future**

Lower First Cost...How?

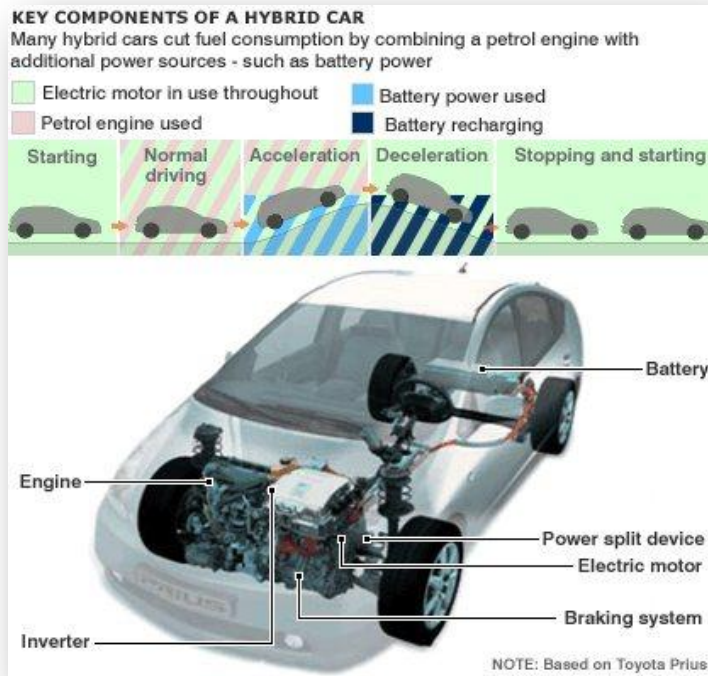
- On air cooled chiller jobs
- Key is partial ice storage
- **If not lower you likely have too much ice**



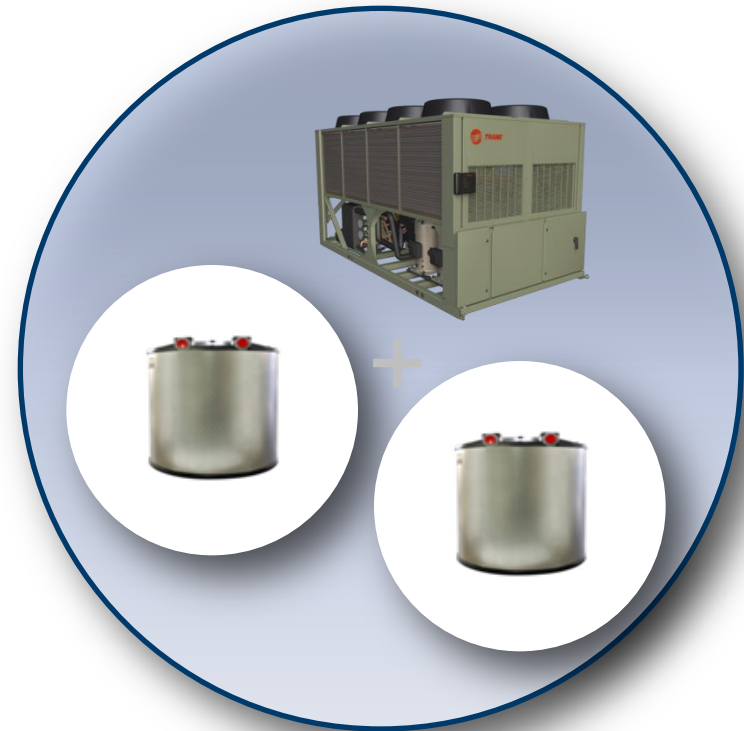
Good Analogy for Partial ICE...



Hybrid Car



Hybrid Cooling

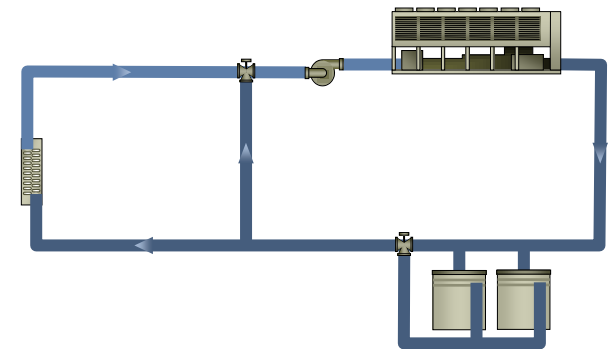
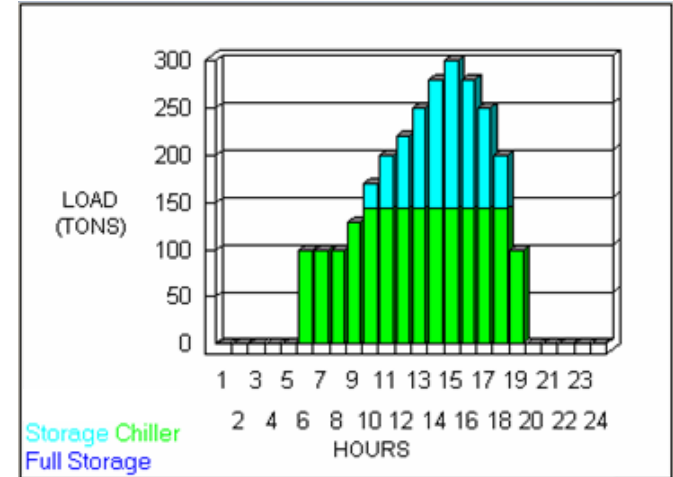




Peak Design Load – 300 Tons



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



Real Time Pricing (RTP)



DALLAS TRANE OFFICE

OA Humidity : 32
OA Temp : 96.7

Main Menu

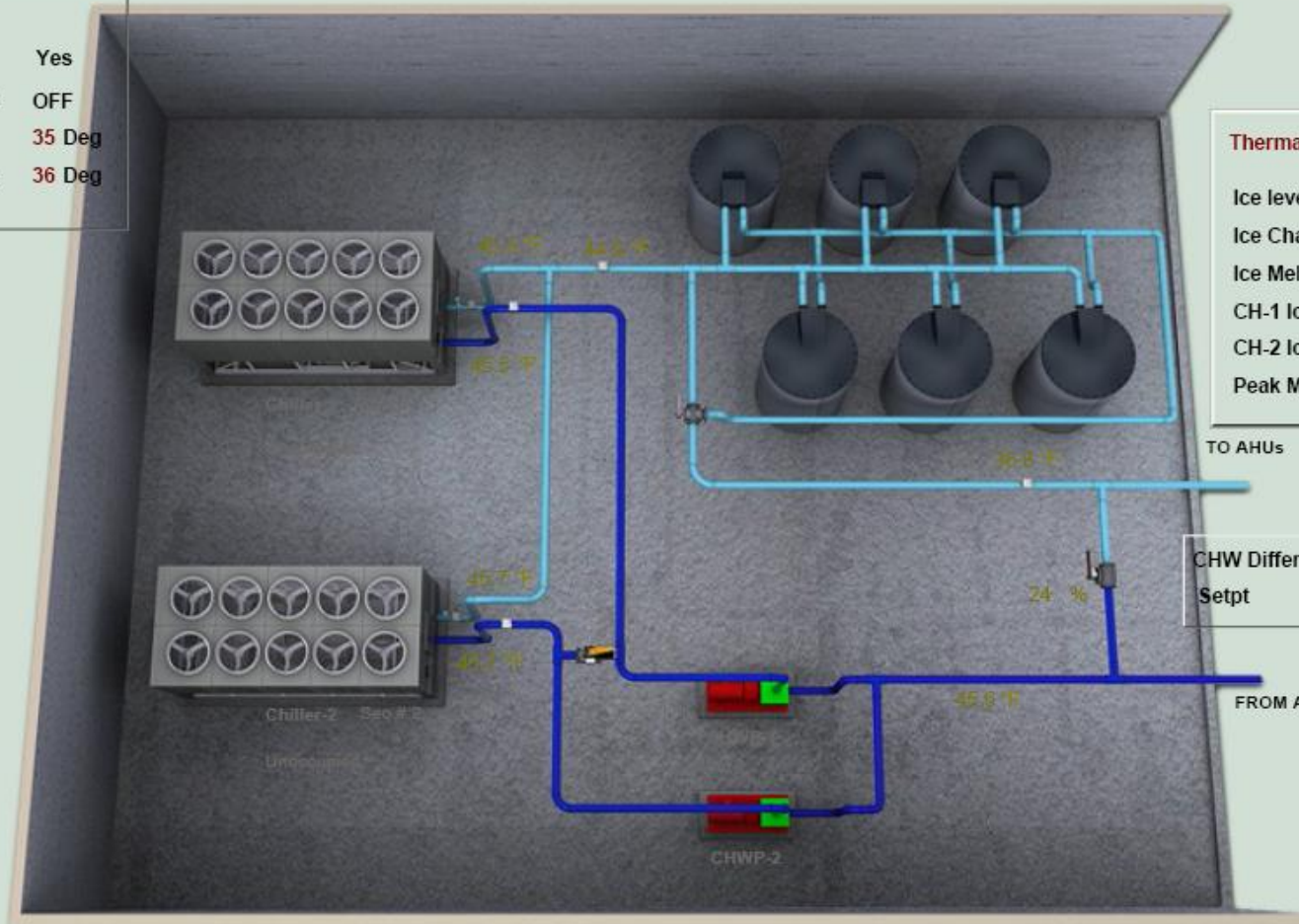
CHW system

Equipment Menu

System Summary

System

Area Cooling Request	Yes
Chiller Plant Control System	OFF
System CHW Supply Setpt	35 Deg
Mix Valve CHW Supply Setpt	36 Deg



Thermal Storage Data

Ice level	24 %
Ice Charge Mode	OFF
Ice Melt Mode	ON
CH-1 Ice Mode	OFF
CH-2 Ice Mode	OFF
Peak Mode	YES

CHW Differential	16.3Psi
Setpt	16 Psi



DALLAS TRANE OFFICE

OA Humidity : 77

OA Temp : 75

Main Menu

CHW System

Equipment Menu

System Summary

AHU 1-1

AHU 1-2

AHU 2-1

Ex. Fans

Lighting

Outside Air

Outside Air Temp 75 °F

Outside Air Humidity 77 %

OK to Economize: No

Outside Air Flow 704 CFM

Trac Damper 71 %

Minimum Outside

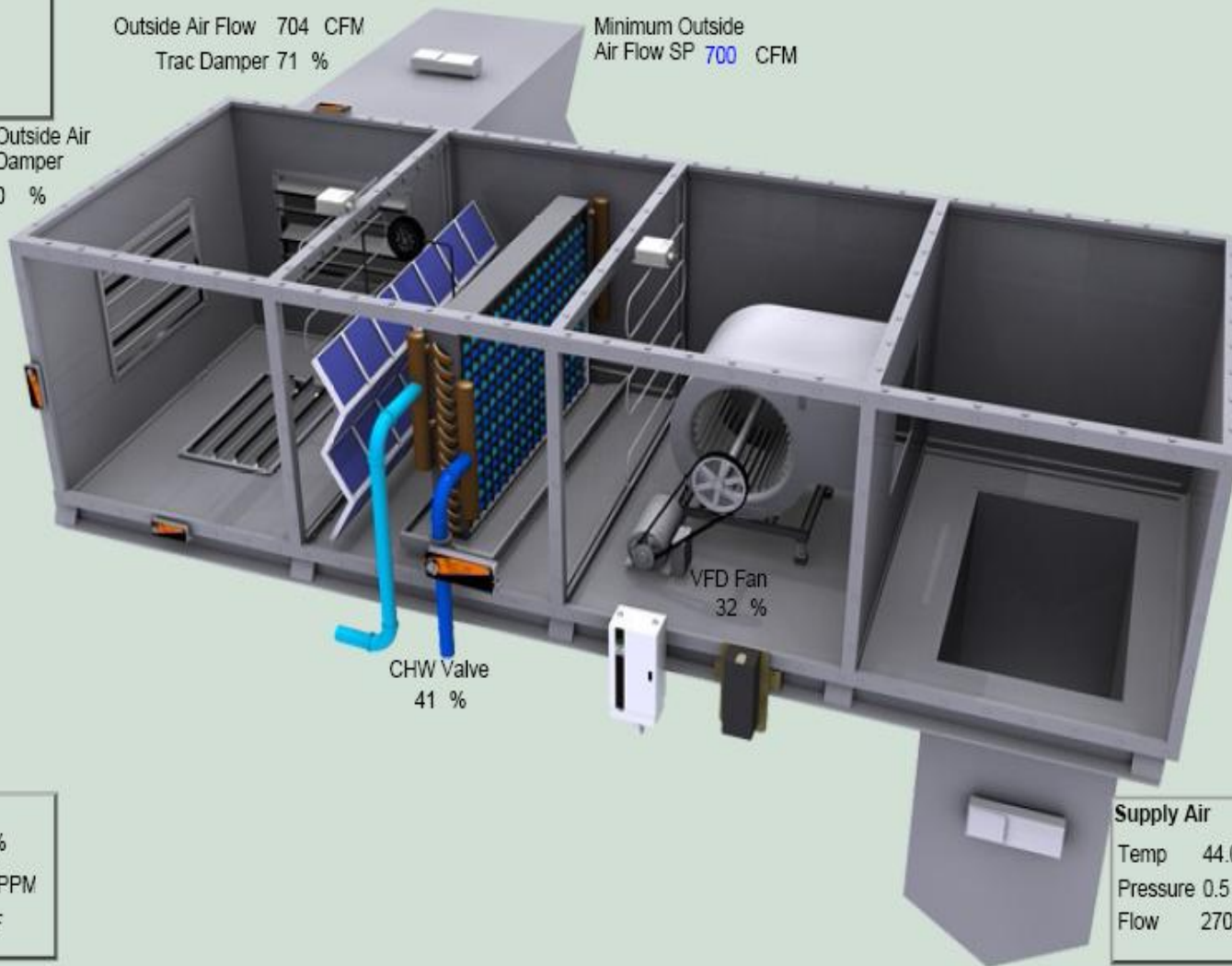
Air Flow SP 700 CFM

Outside Air

Damper

0 %

Override Control



VFD Fan

32 %

CHW Valve

41 %



Supply Air

Temp 44.0 °F SP 44 °F

Pressure 0.5 In SP 0.5 In

Flow 2705 CFM

Office Air

Relative Humidity: 41 %

CO2 Level: 608 PPM

Average Temp: 74 °F

Consumption	kWH	
Today	1170	
Yesterday	3561	
This month	37955	
Last month	75651	

Demand	kW	Date / Time
Current demand	170.40	
Today's peak	212.53	05/15/08 02:51:00
Yesterday's peak	263.17	05/14/08 07:33:00
This month's peak	263.17	05/14/08 07:33:00
Last month's peak	326.13	04/29/08 13:24:00

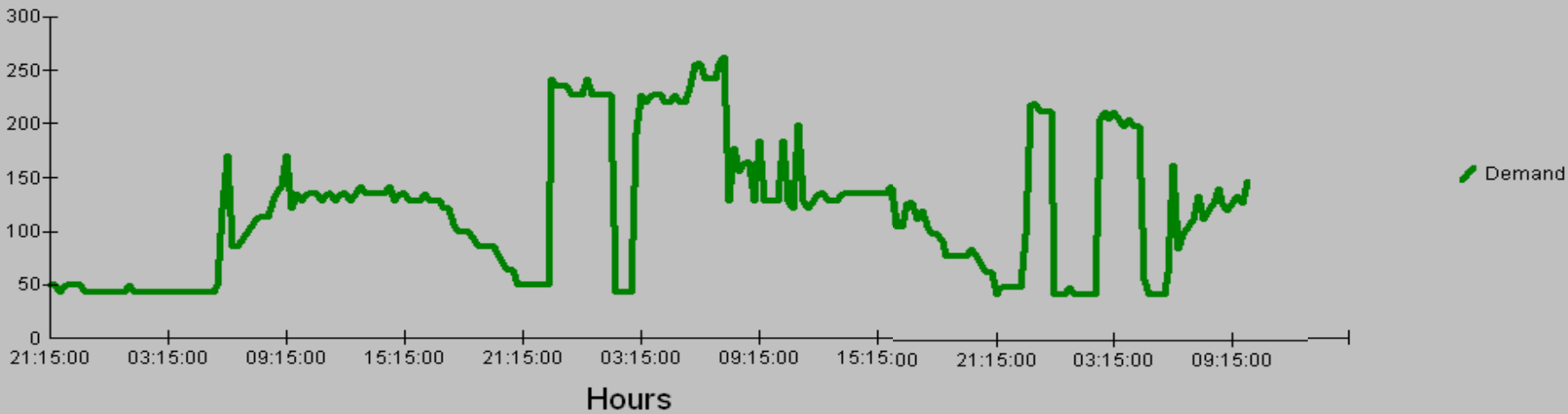
[Click Here for Chart of Daily KWH](#)

[Main Menu](#)

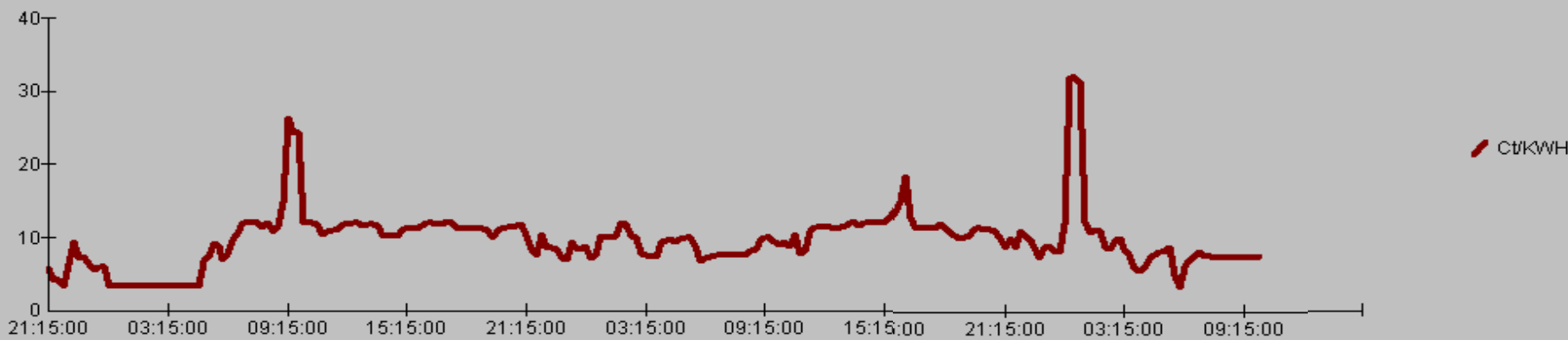
[Price Feed Details](#)

Cents per KWH	7.579	
Price End Time	615	Min
Time Now	602	Min
		Limit Status
Ice Charge Price Limit SP	9.0	OFF
Lighting Price Limit SP	20.0	OFF
All Systems Off Price Limit SP	30.0	OFF

Building KW Demand



Price Feed



Last month	89961	
Demand	kW	Date / Time
Current demand	234.30	
Today's peak	299.62	06/17/08 12:32:00
Yesterday's peak	337.96	06/16/08 09:03:00
This month's peak	369.20	06/02/08 15:34:00
Last month's peak	339.38	05/21/08 13:23:00

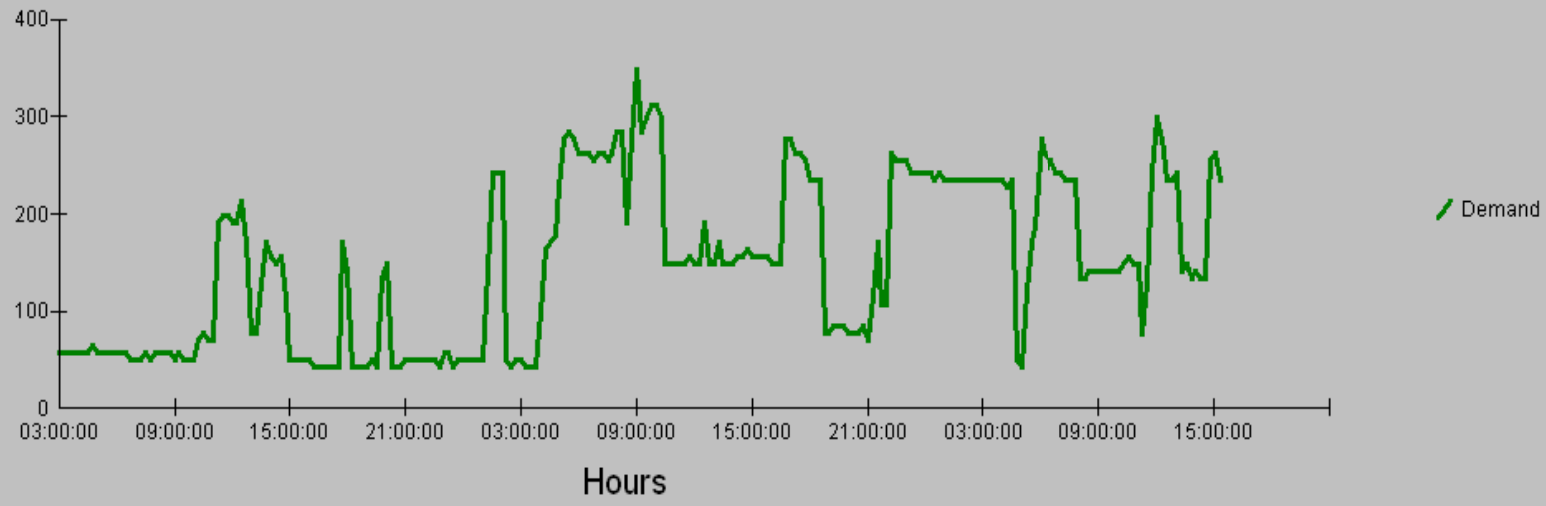
[Click Here for Chart of Daily KWH](#)

Ice Charge Price Limit SP	11.0	Limit Status	OFF
Lighting Price Limit SP	250.0		OFF
All Systems Off Price Limit SP	250.0		OFF

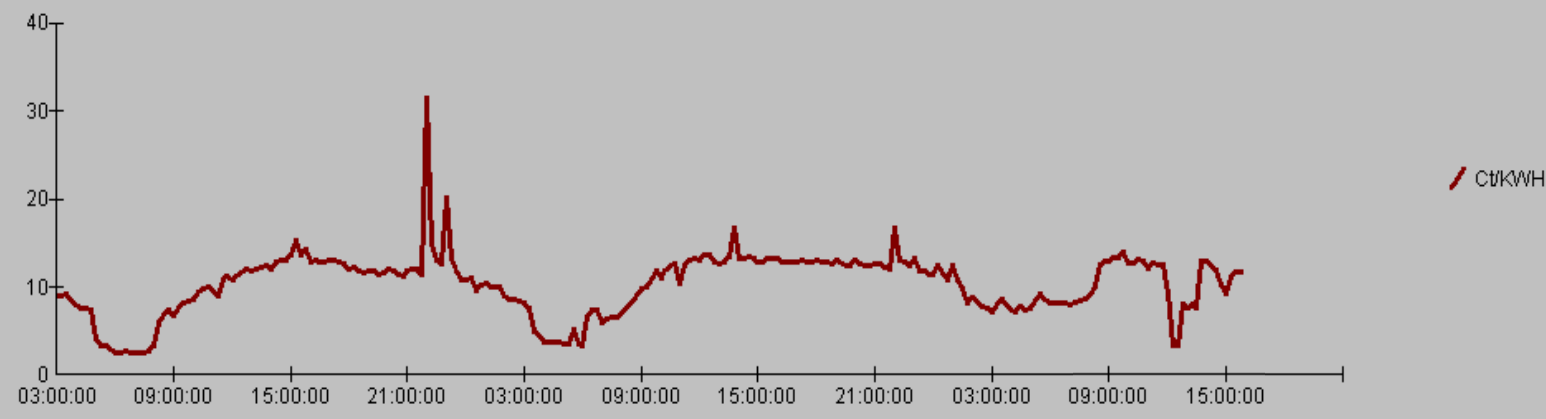
[Main Menu](#)

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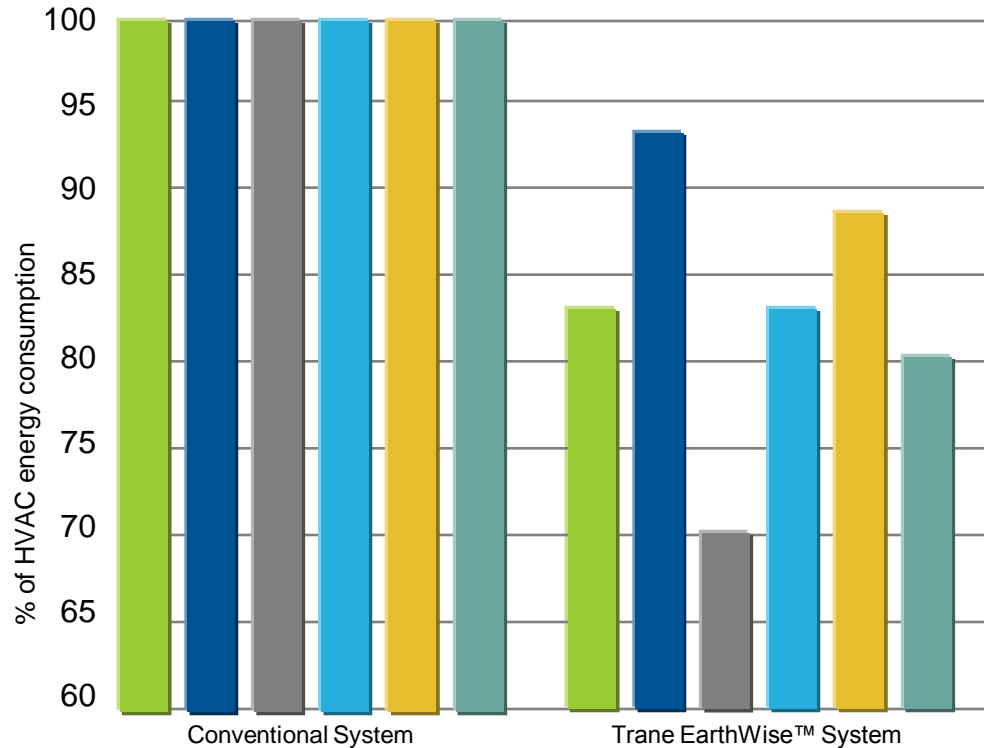
Building KW Demand



Price Feed



But At What Efficiency?

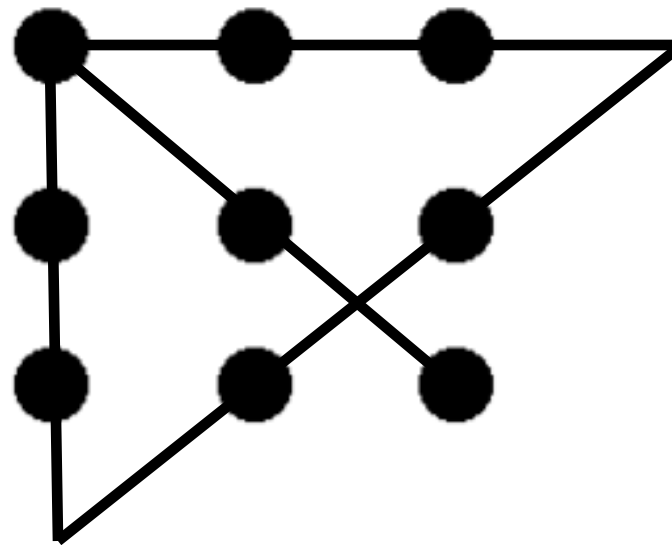


TRACE

Atlanta	100%	83%
Minneapolis	100%	93%
Los Angeles	100%	70%
Denver	100%	83%
Philadelphia	100%	89%
Portland	100%	80%



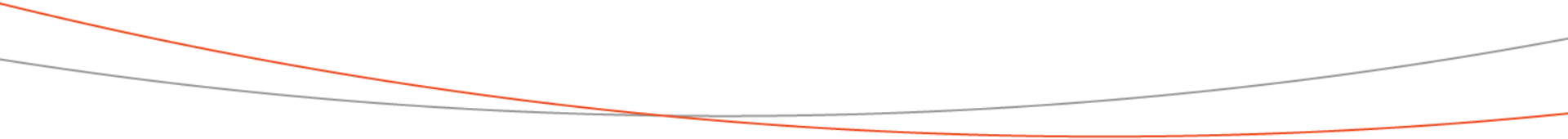
Outside the Nine Dots Thinking



New Building Designs in Singapore



New Building Designs in Singapore



New Building Designs in Singapore











A SINGLE SUPPORT BRIDGE IN MALAYSIA



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