

Energy / Carbon Footprint



Energy / Carbon Footprint

- Air-cooled Chiller Energy: 1.10 kW/ton
- Water-cooled Chiller Energy: 0.60 kW/ton

Substantial difference in
chiller energy between
the two alternatives!



The larger the project, the more benefit
from water cooled systems

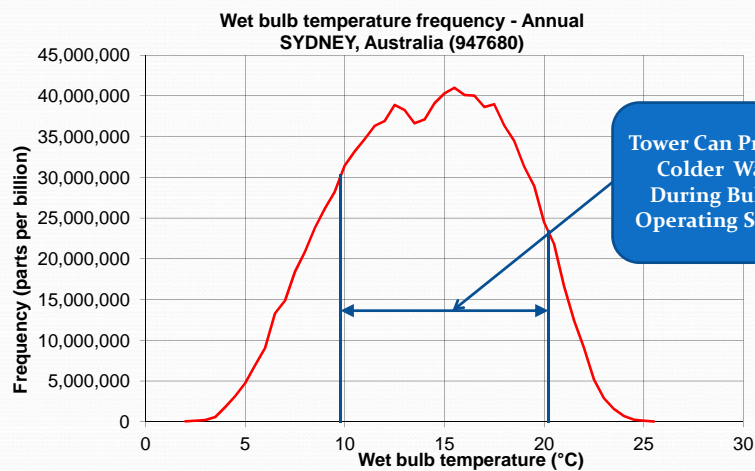
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- Chiller energy: 0.60 kW/ton
- Cooling Tower energy: 0.06 kW/ton

Chiller Energy Consumption Reduces with
Colder Condenser Water Temperature

Let the Cooling Tower Do the Work

Ambient WB Temperature Profile



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- Effect of CWT on Chiller Energy

Condenser Water Temperature	Typical Chiller Energy	Energy Savings
29.5°C	0.570 kW/ton	Base
28.5°C	0.542 kW/ton	5%
26.5°C	0.524 kW/ton	8%
24°C	0.484 kW/ton	15%
21°C	0.450 kW/ton	21%

Tower Operational Strategy – “Run Wild”

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- Lower Design Point Temperatures

Why design for 35°C/29.5°C when the ambient design wet-bulb is lower?



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- Design for Nominal Sized Equipment

City	Design WB (°C)	CWT (°C)	Chiller kW/ton	Chiller Energy Savings
Brisbane	25.5	29.5	0.570	Base
Sydney	24.0	28.3	0.540	5%
Melbourne	23.0	27.6	0.534	6.5%
Adelaide	21.0	26.1	0.518	9%
Canberra	20.0	25.3	0.505	11.5%

Sizing Tower for 1°C Colder Water Yields
Payback in 1 – 2 Years

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- Select larger cooling towers for lower kW/ton

Typically 1 – 2 Year Payback plus
Lower Sound Levels
and Less Costly Electrical Service



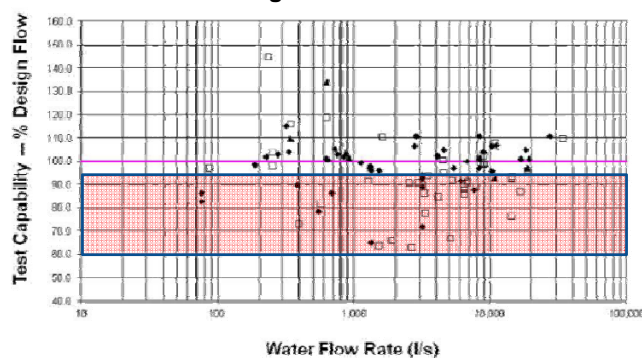
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- Independent Performance Certification is Key



A Case for Certification

CTI Licensed Test Agencies
2011 Cooling Tower Test Results



**ALMOST HALF TESTED
BETWEEN 60% AND 95% CAPABILITY!**

Deficient Performance Can Be Difficult to Detect

- System designed for 1% peak-ambient occurrence
- Building load varies with ambient temperatures
- Occupancy, lighting, and computer loads are independently variable
- Safety factors are often applied to account for uncertainties
- Interconnected system components affect each other, typically through energy consumption

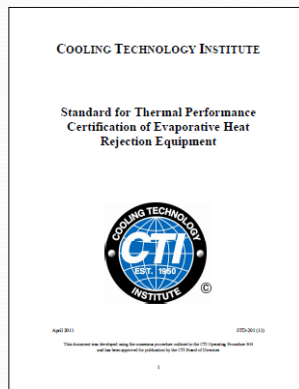
The Cost Effect of Wasted Energy

- At \$0.15 per kWh
 - 90% tower costs \$6,970 each year
 - (46,500 kWh wasted)
 - 80% tower costs \$16,140 each year ←
 - 70% tower costs \$26,780 each year
 - (178,600 kWh wasted)
- At \$0.20 per kWh
 - 90% tower costs \$9,300 each year
 - 80% tower costs \$21,520 each year ←
 - 70% tower costs \$35,720 each year

5 X Tower Cost
over
System Life!

7 X Tower Cost
over
System Life!

Certification Program for Cooling Towers



STD-201
**Standard for Thermal
Performance Certification of
Evaporative Heat Rejection
Equipment**

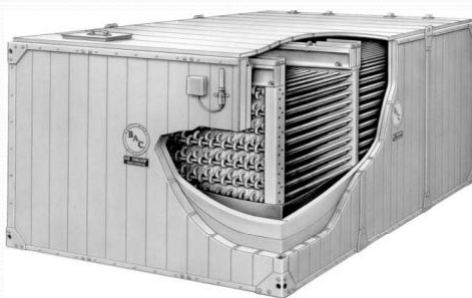


**Cooling Technology
Institute**

Encouraging the wise use of our water resources...

Energy / Carbon Footprint

- Ice Thermal Storage for Most Efficient Energy Production



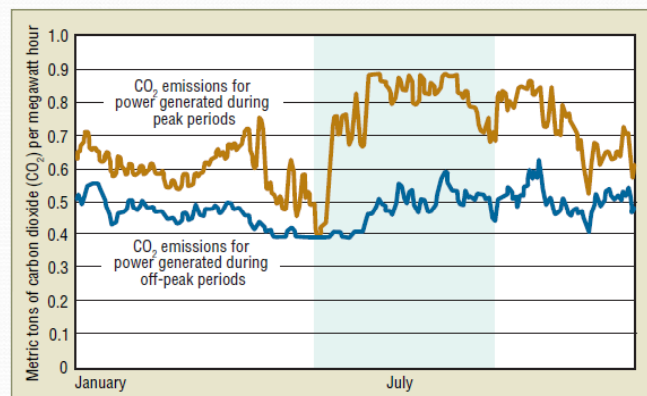
Ice Thermal Storage

- Reduces electrical demand at peak hours
- Allows power plant level loading
 - Base load plants are generally the most efficient
 - Lower power line losses at night



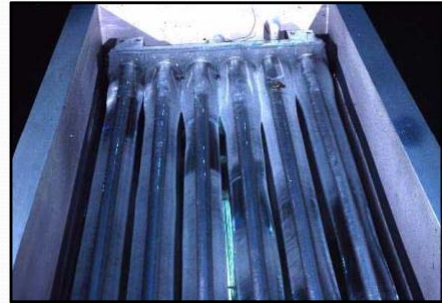
Ice Thermal Storage

- Lower green house gas emissions from power plants during nighttime hours



Ice Thermal Storage

- Smaller refrigeration plant, less refrigerant charge
- Enables the use of lower temperature air distribution which reduces air-handler and pump energy and size

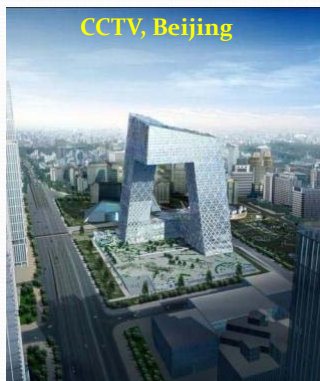


Ice Thermal Storage

District Cooling, Chicago



CCTV, Beijing



Burj Khalifa, Dubai

