

Peak Load Management Alliance

Distributed Energy Storage for AC Induction Motors
Utility Peak Load Shifting
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ICE ENERGY

RESHAPE THE FUTURE.

Ice Energy: Background

- Formed in January 2003 to commercialize patents, intellectual property, and trade secrets for Distributed Energy Storage for commercial buildings, telecom, and small data center cooling systems
- Lake Forest, CA - Sacramento, CA - Windsor, CO, Hammondsport, NY
- 12 Issued U.S. patents and trademarks, 19 more pending
- Over 20 years of technology development
- World class Board and Advisory Council
- Leading Energy Investors:



EnergyCapital
Partners



About Ice Energy's Ice Bear Technology

The Ice Bear unit has won numerous national green building awards:

- 2009 Green Building Innovation Award (ASHRAE/AHR Expo)
- 2009 Platts Global Energy Award Nominee Sustainable Technology Innovation of the Year
- 2009 Frost & Sullivan Best Practices Award (Green Building Technology)
- 2009 Outstanding Smart Grid Initiative (Clasma Buildy Awards)
- 2009 Excellence in Design (Silver Award – Appliance Design)
- 2009 Smart Grid 50 (Cleantech Investor)
- 2008 Top 100 Products (Buildings Magazine)
- 2007 California Flex Your Power Award
- 2005 Most Promising Company (Energy Venture Fair)
- 2005 Top Ten Green Building Product (U.S. Green Building Council)
- 2004 Energy Management Innovation Award (ASHRAE/AHR Expo)
- 2004 Most Promising Company (Energy Venture Fair)
- 2004 World's Best Technology (Gold Award – World's Best Technology Symposium)



**Sustainable Technology Innovation of the
Year**

2009 Platts Global Energy Awards Finalist

**Top Green Building
Initiative**
AHR/ASHRAE Innovation
Awards



About Ice Energy's Peak Load Shifting Technology

Proven Technology

- 25 Successful utility 2-4 year field trials
- Over 4 million hours of operation in the field
- Awarded the largest distributed energy storage project in the world - 53 MW
- Installing 1,000's of units in California
- Highest Smart Grid Readiness Scorecard 90 of 100 best in industry to date
- Advanced Energy Storage Manufacturing Plant, Upstate NY, DOE Tax Credits

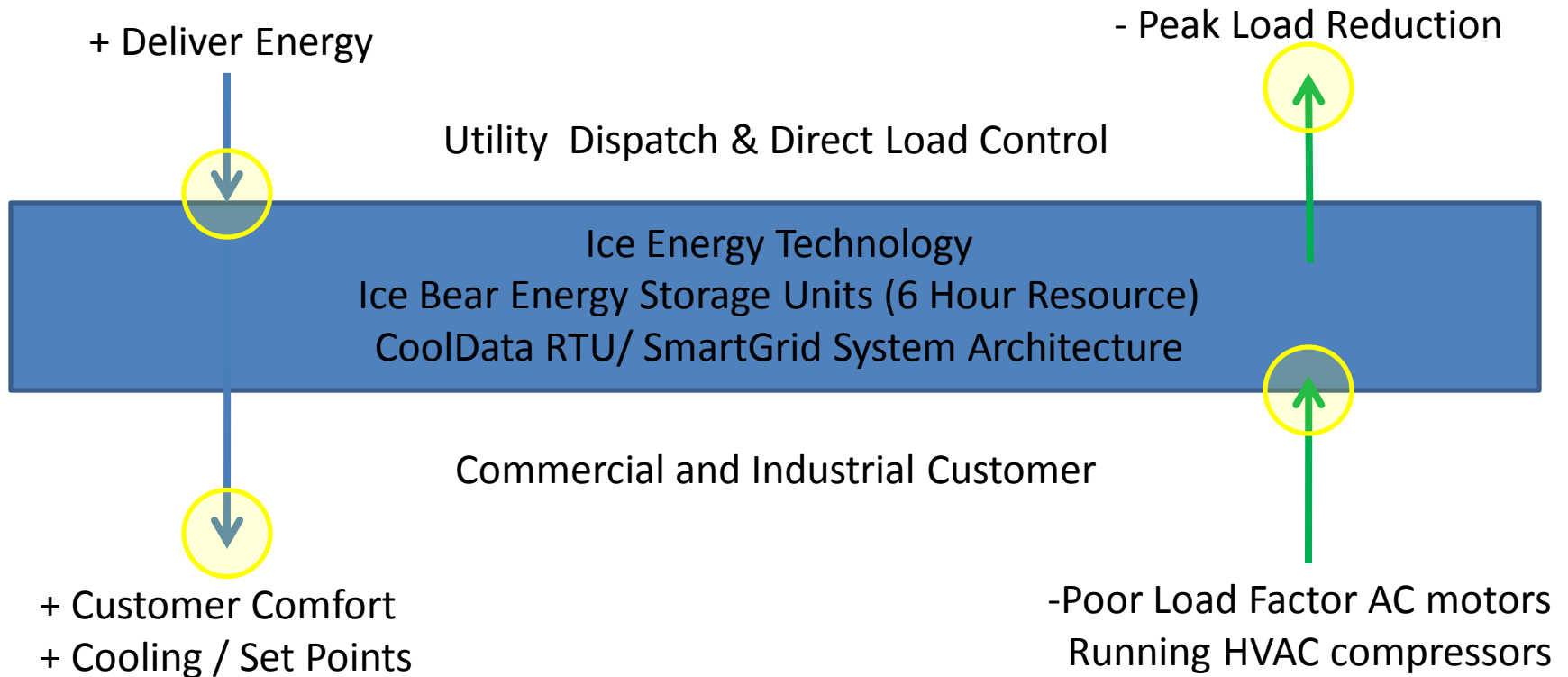
Revolutionary Technology

- 6 Hour daily resource, 10 MW Demand = 13 GWh Load Shift
- Highest efficiency round trip form of energy storage; effectively lossless
- 25 Year asset life
- Storage resource doesn't degrade over time
- Unlimited Cycles: full and partial
- CoolData System Architecture for managing distributed energy resources



Ice Energy's Secret Sauce: Everyone Benefits

 Measure/Validate/Control Points



Large Market for Ice Energy's Peak Load Shifting Storage

70 Gigawatts of Existing Addressable Market

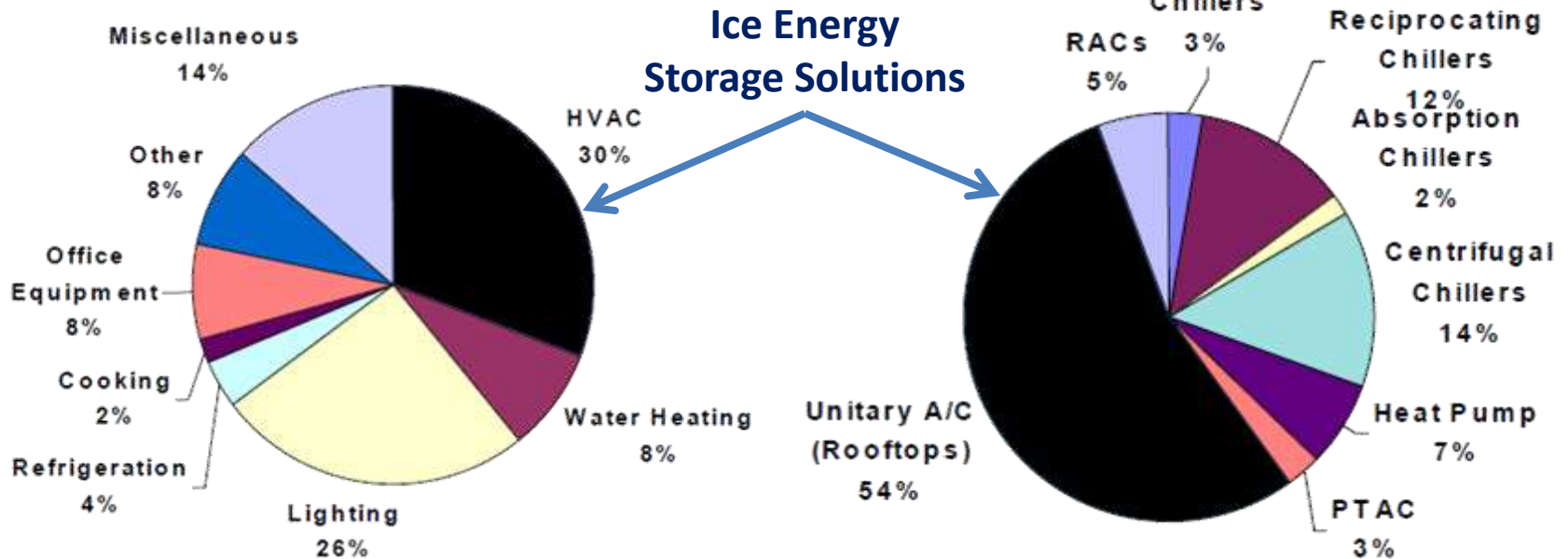
75 Million Existing Units

3.2 Million Annual Shipments

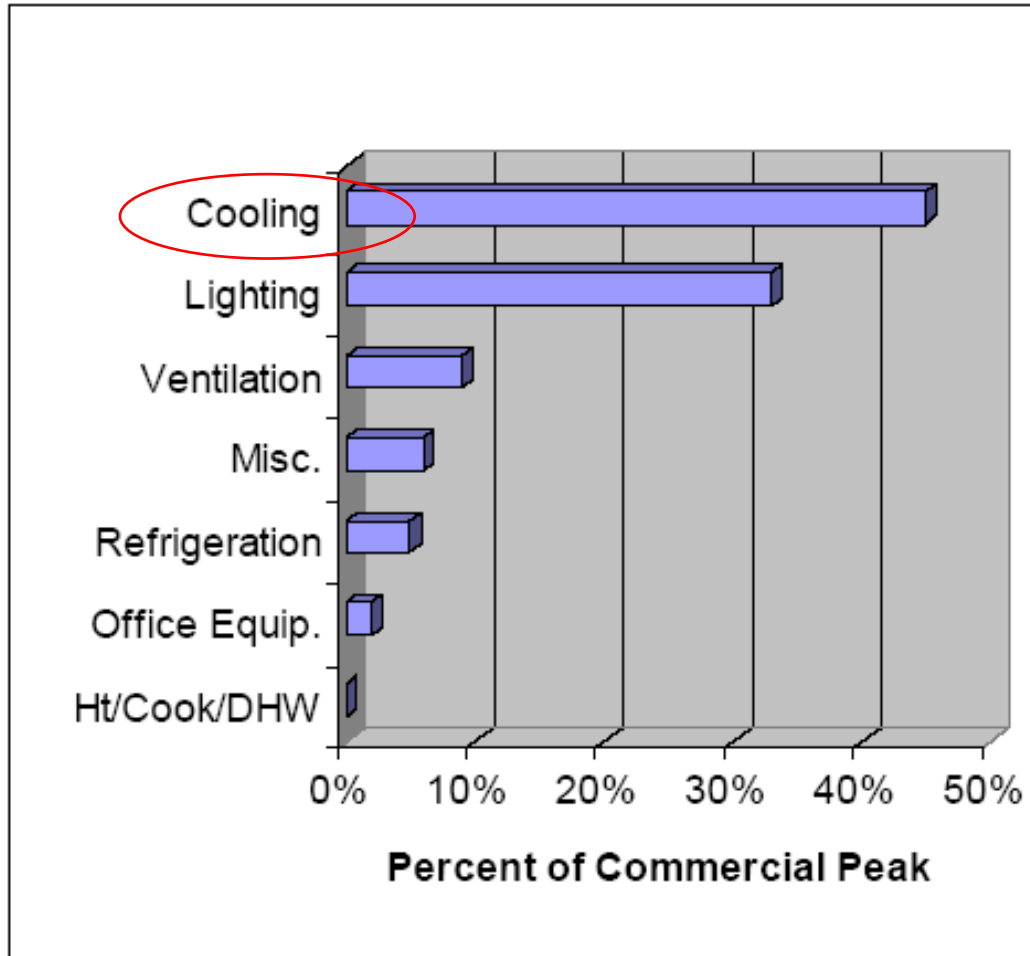
U.S. Domestic Commercial Building Source Energy Use

15 Quadrillion BTU's

1.5 Quadrillion BTU's - Cooling



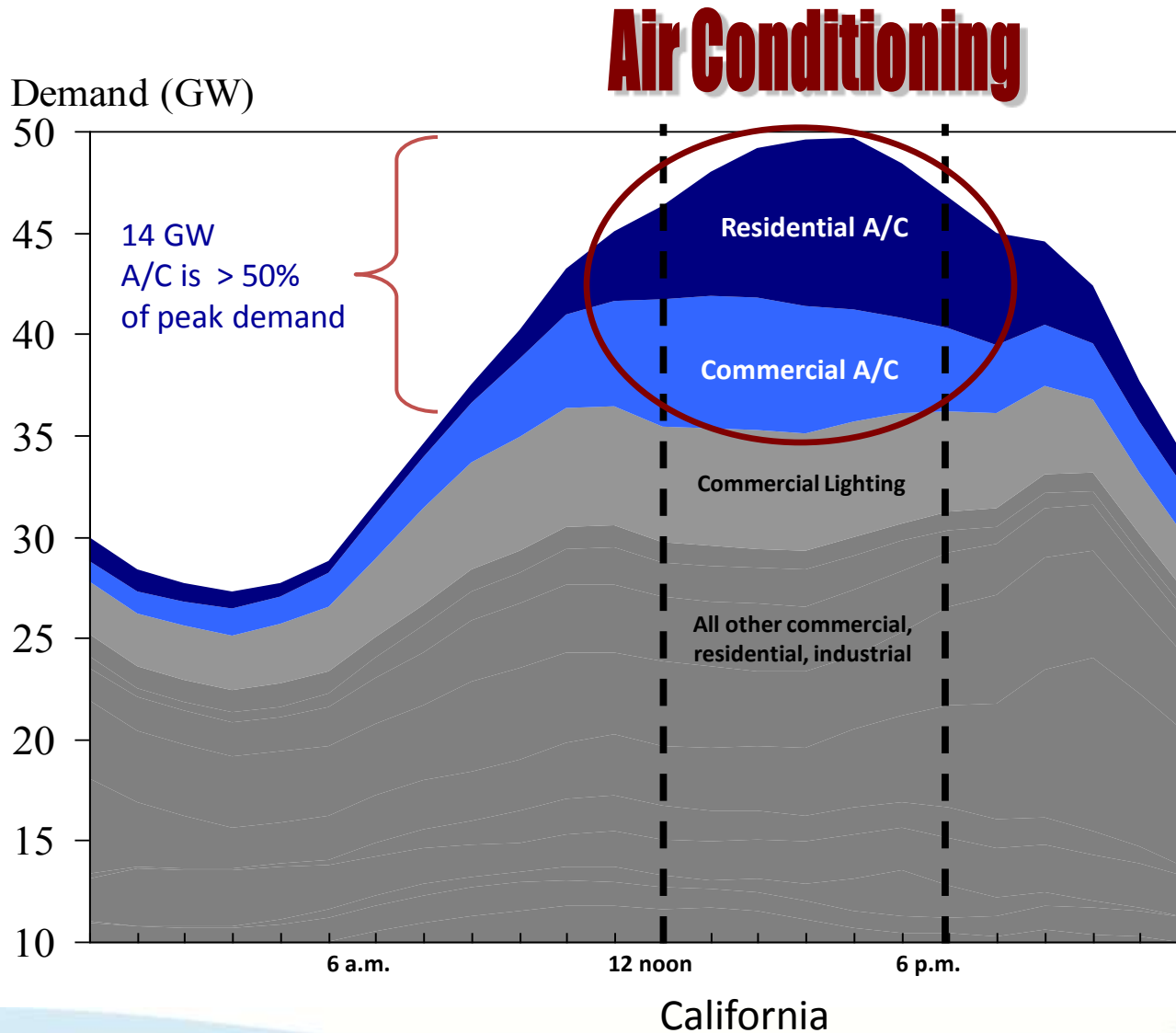
Building A/C and Temperature Drives Utility Peak Demand



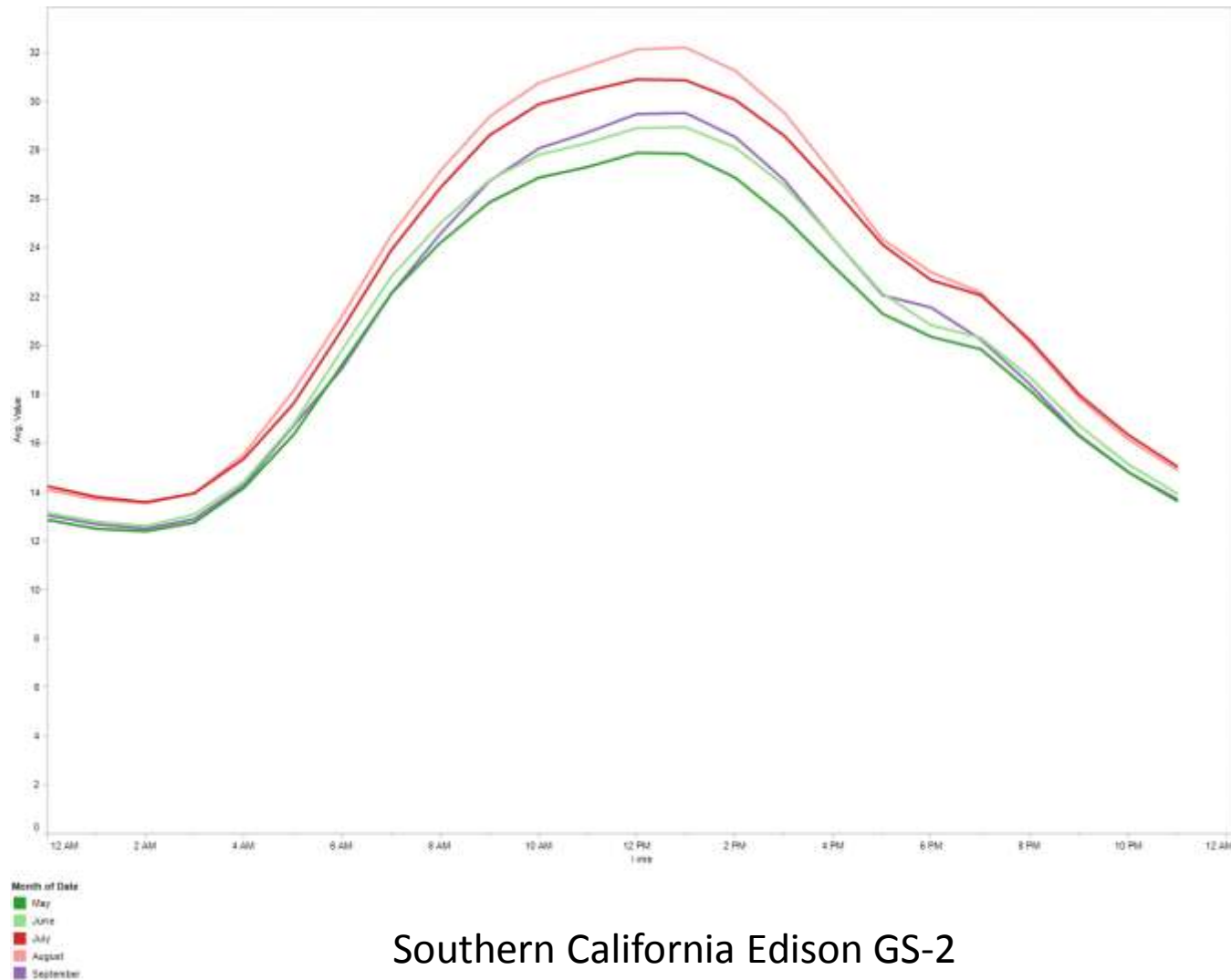
Source: PG&E Program Advisory Group for Energy Efficiency: HVAC PAG White Paper, Proctor Engineering



Typical ISO Peak Day System Load Profile

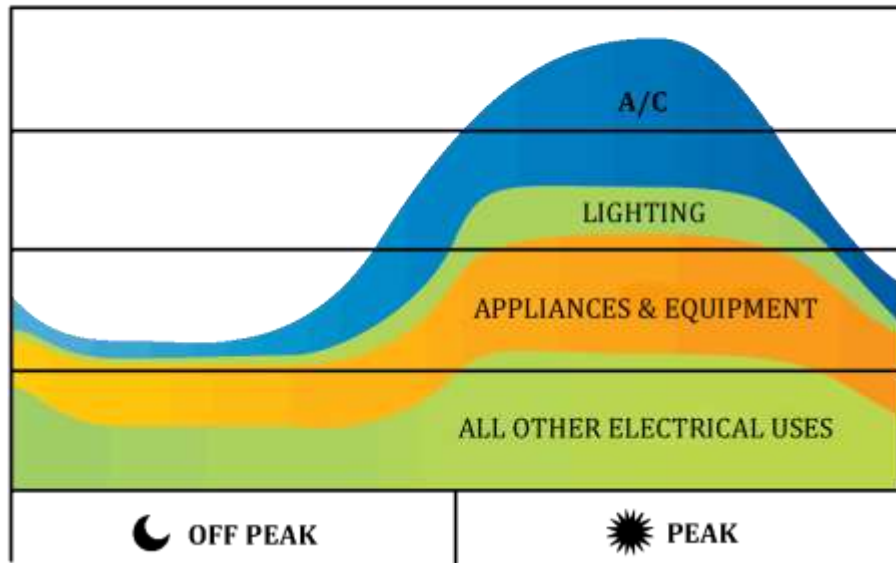


Typical Utility General Service Commercial Load Profile

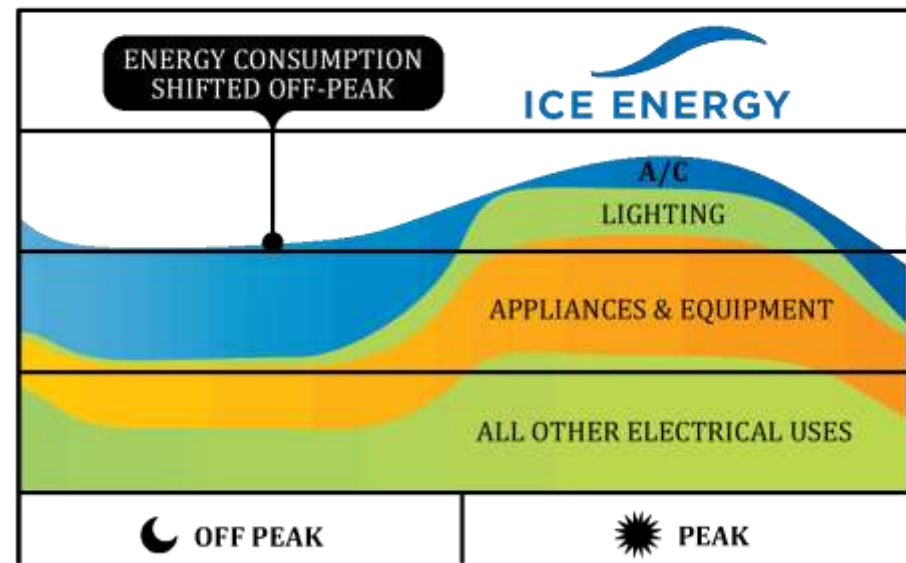


Typical Commercial Building Load Shape

TYPICAL 24 HOUR BUILDING ELECTRICAL LOAD PROFILE



ICE BEAR STORAGE RESHAPES THE ELECTRICAL LOAD PROFILE



Ice Energy – Reshaping the Future

icebear

Energy smart, earth friendly and a real solution to our growing power needs.



Typical Source Energy Calculations for Electro-Thermal Energy Storage; Ice Bear Summer Peak Load Shifting

Purchased by utilities as an aggregated dispatchable distributed energy resource; an alternative to simple cycle aeroderivative natural gas turbine generators.

Ratings:

- Capacity increments range from 5 MW to over 100 MW.
- Rated Capacity is based on historical 10 year monthly average peak temperature
- Ultra-Peak Capacity increases with temperature, 1% per degree F
- Annual capacity factor is 15% or 1300 hours of annual operation
- Day ahead scheduled resource e.g. Noon – 6 PM
- Runs for 6 hours continuously
- 25 year asset life
- No capacity performance degradation over asset life
- 10 MW produces 13 GWh of equivalent generator source energy annually

10 MW Charging Cycle:

- 10 Hours to full charge
- 44 MWh daily charge
- 9.5 GWh hours to charge the resource annually



Typical Source Energy Calculations for Electro-Thermal Energy Storage; Ice Bear Summer Peak Load Shifting

Charging Control Parameters:

- Charging, 10 hours continuous to full charge
- Charging cycle minimum run time = 15 minutes continuous
- Charging cycle 15 minutes dwell between cycles

Discharging Control Parameters:

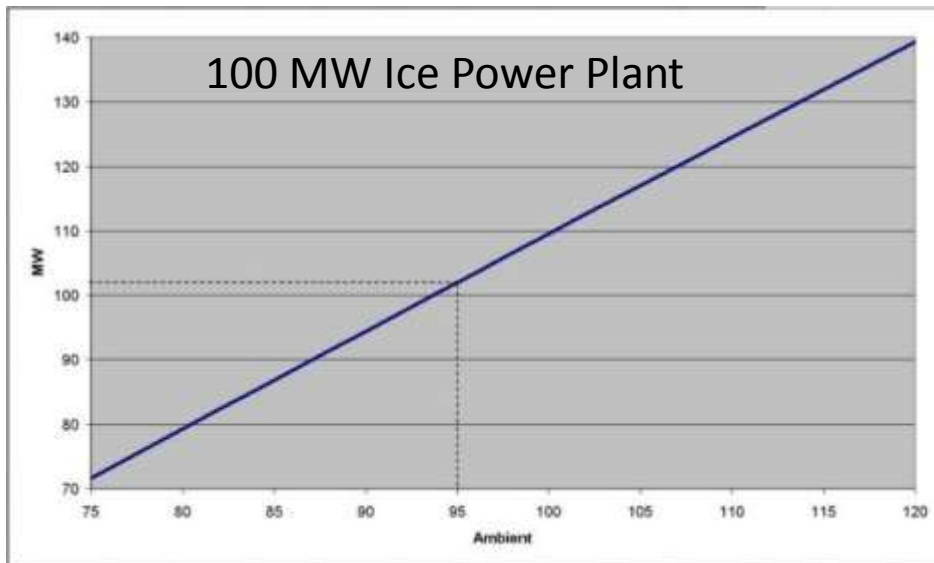
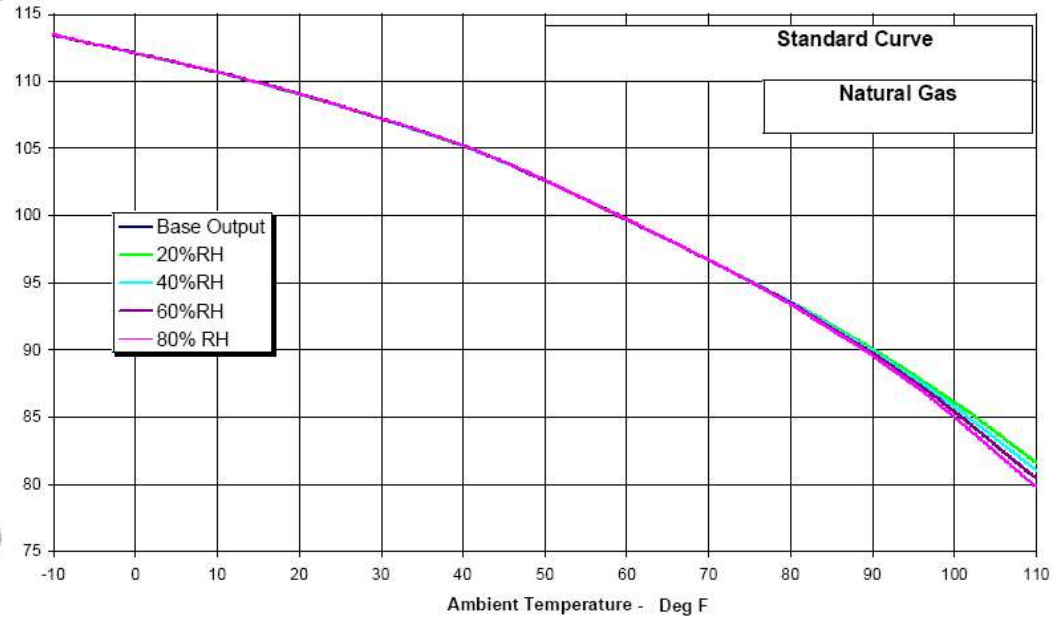
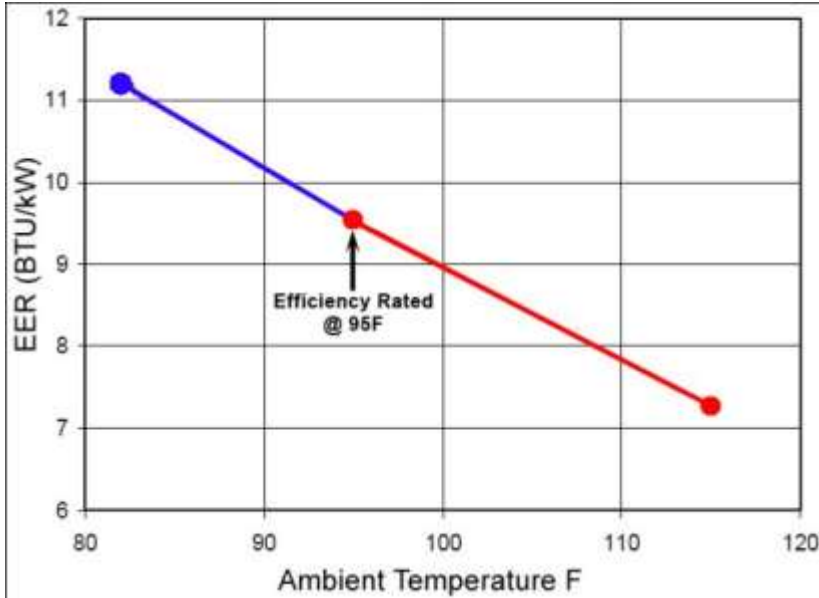
- Day-ahead, scheduled 6 hour resource
- Day-of, change of schedule 5 minute dispatch
- Unlimited number of dispatch commands
- No minimum run time per dispatch



Highly Effective Utility Scale Resource

- The Hotter is Gets the Better Ice Performs

Generator Output vs Ambient Temperature



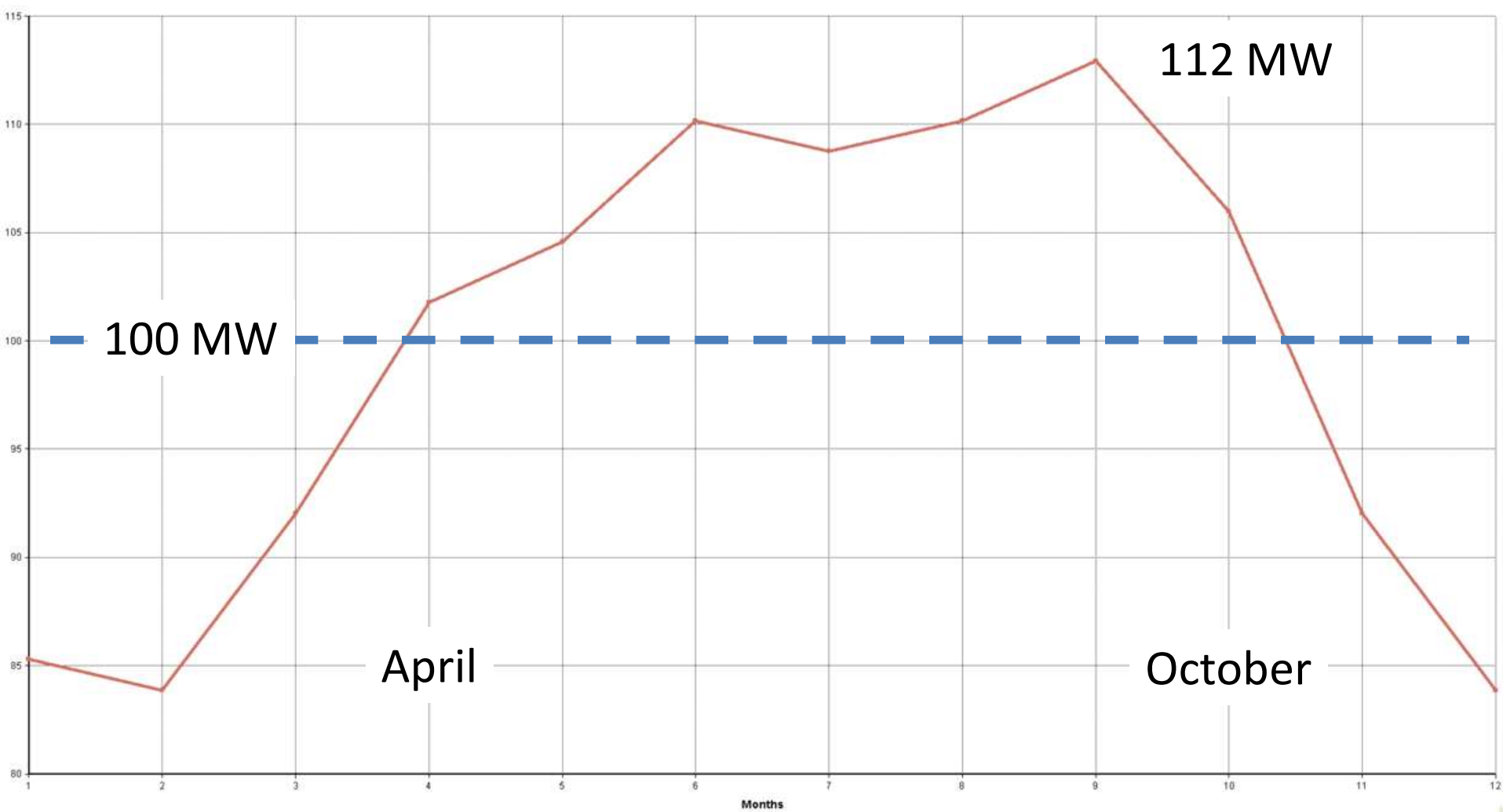
➤ **100 MW @ 60°F**

➤ **83 MW @ 105°F**

➤ **100 MW @ 95°F**

➤ **115 MW @ 105°F**

LA Basin Ice Power Plant Monthly Peak Capacity Ratings

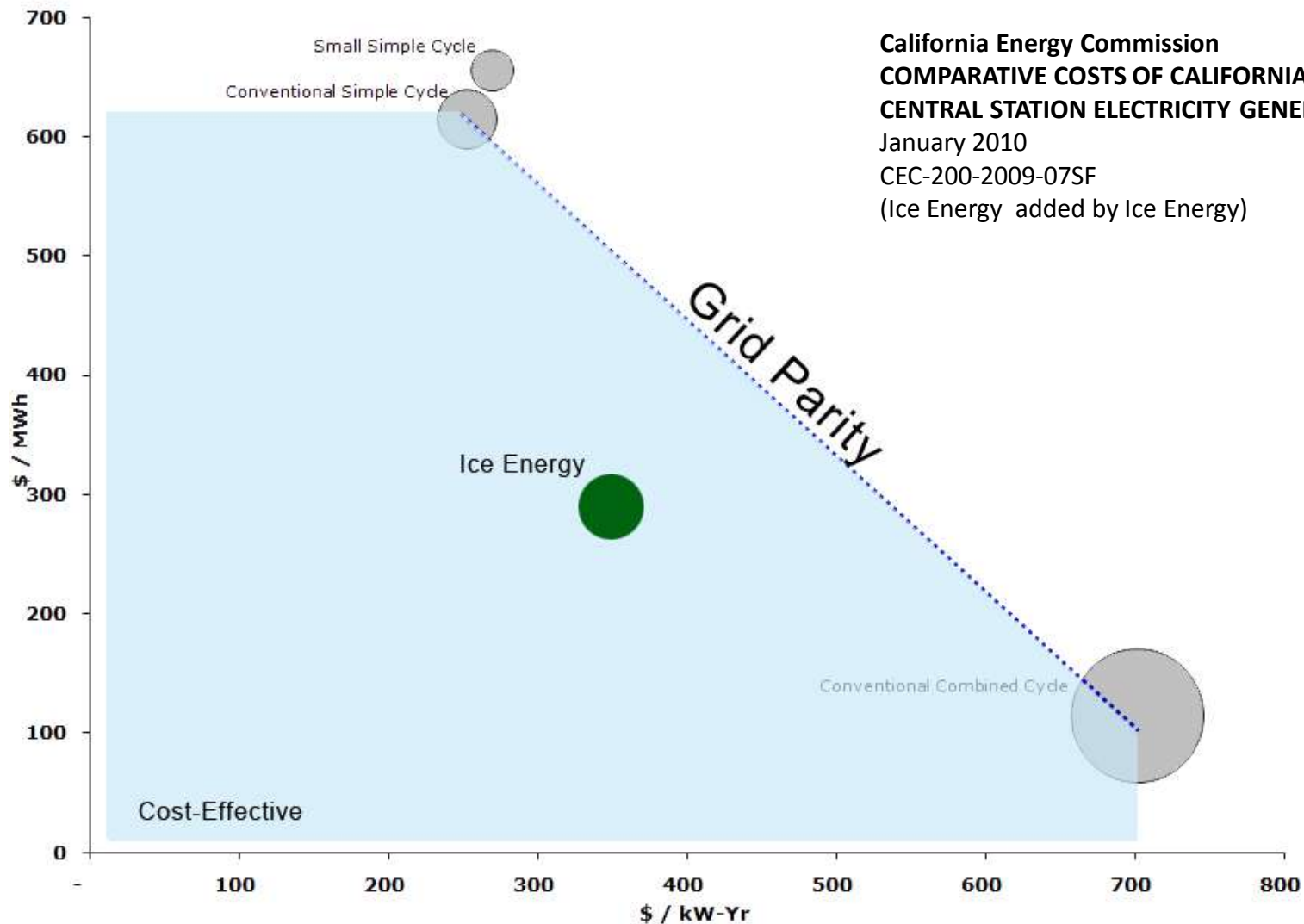


- Average Monthly Peak, 10 year weather history



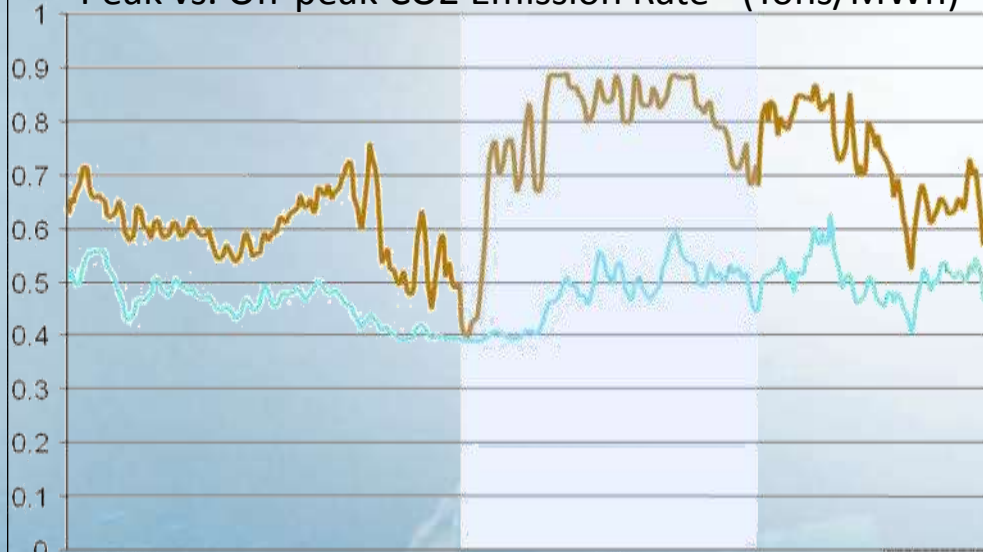
Cost Effective Utility Owned Resource

IOU Levelized Cost Comparison (2009 in service)



IF MOTHER NATURE COULD TALK, SHE'D JUST SAY "COOL"

Peak vs. Off-peak CO2 Emission Rate* (Tons/MWh)



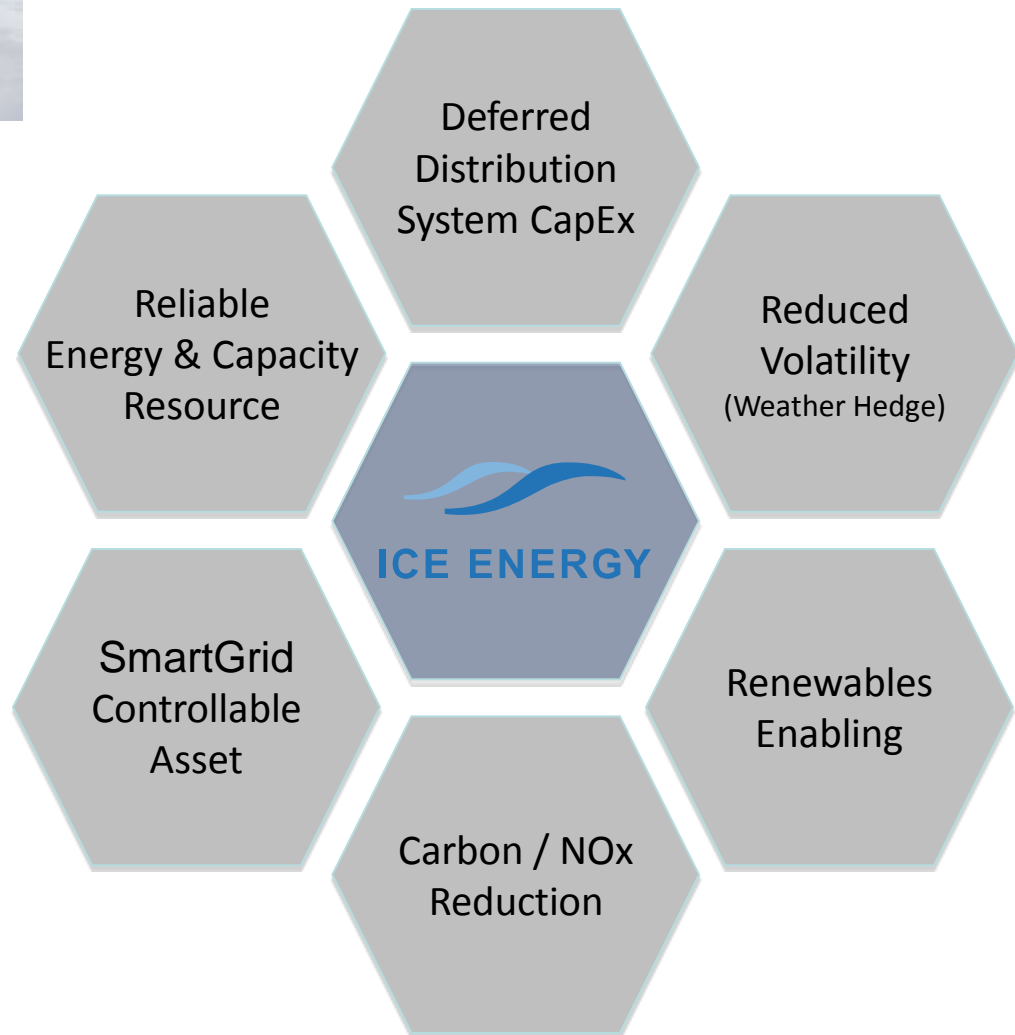
*Southern California Edison Data



- ~ 56% lower NOx emission rate during off-peak
- ~ 40% lower CO₂ greenhouse gas emissions
- ~ 30% source fuel savings



Compelling Utility Value



CoolData® “SmartGrid” Remote Terminal Units

- Tightly integrated into the energy storage device
- Secure network communications
- Two way, closed loop control
- Local scheduling and remote dispatch
- Direct load control for demand response of other building assets
- Real-time status, sub-metering, and data monitoring of customer equipment
- Performance analysis and automated diagnostics
- Remote configuration management



- OSIssoft, PI Enterprise Layer
- RS-485 Sensor Network
- NI LabVIEW Application Layer



Southern California Public Power Authority Project Overview

- **Ice Power Plant - A highly available aggregated resource**
 - Up to 53 MW of Capacity ~ 68 Gigawatt Hours of Energy Shift Annually
 - An integral part of the SmartGrid solution
 - Utility owned and operated resource
 - Installed and Maintained by Ice Energy and its partner GoodCents
 - Installed in phases over three years or sooner
- **EE - Can be combined with HVAC replacement utility rebate programs**
- **EE - Codified by California Energy Commission as an ultra-high efficiency building cooling compliance option for LEED credits and Title 24 code compliance**
- **EE – CoolData controller can be extended for continuous commissioning**
- **EE – CoolData controller can perform advanced HVAC control**
- **DR – CoolData controller can provide “Auto-DR”**



Ice Power Plant Standard Deal Terms



➤ Purchase Quantity

- Utility enters into a contract with Ice Energy for MWs of installed generating capacity
 - 10 MW ~ 13 GWh of load shifting
 - Utility retains ownership of the asset
 - Pay-as-you-go style agreement
- Utility enters into a contract for O&M Services
 - Call center, annual planned maintenance, service including parts and labor
 - Dispatch, optimization, and control: network connectivity /software support
 - Metering: measurement, validation, reporting
 - Availability: maintained and guaranteed minimum over 25 year asset life

Ice Power Plant Commissioning



- **Customer Acquisition ~ 300 per 10 MW**
 - Ideal accounts are 50 – 200 kW peak demand, single story box
 - Telecom/Small Data Centers
 - Work with utility to identify feeders and “planning hot spots”
 - Review databases
 - Review aerial imagery (Google Earth, High Resolution Aerial Photography)
 - Route planning and initial screening
 - Notify customers
 - Walk rooftops and perform an HVAC equipment take-off
 - Qualify/Disqualify rooftops
 - Selection of pre-qualified rooftops – Review with utility
 - Execute utility easement agreement with potential customer
 - Perform detailed mechanical and electrical analysis
 - Go/No-go
 - Build a 3 month backlog with permits in hand
 - Logistics and workflow planning phase: manufacturing , shipment, installation crews
 - Installation – start-up
 - Utility makes final payment for installed capacity
 - Asset added to services agreement

THANK YOU

