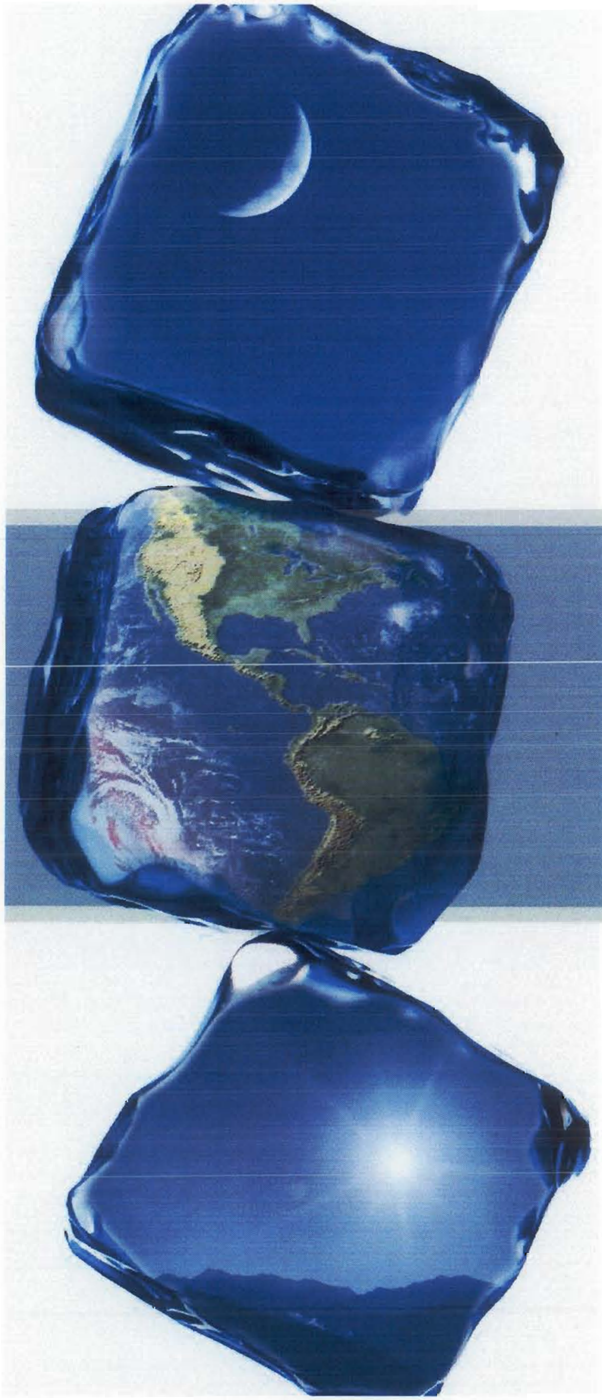

California Energy Commission
Docket No. 08-DR-01 March 3, 2008
Energy Efficiency Committee Workshop

End use storage systems which store energy during off-peak periods for use during peak periods

Opportunities for capturing the peak load reduction and conservation potential of energy storage and permanent load-shifting technologies

Ice Bear Hybrid A/C

ICE ENERGY
CLEAN ENERGY DOESN'T GET ANY COOLER THAN THIS.

- Thermally driven air conditioning load is the root cause of California's summer peak demand problem
- Load management using distributed energy storage applied to air conditioning is a persistent solution to the problem
- Ice Storage Air Conditioning is a form of A/C control
  - Used ~ 225 days per year, ~ 6 hours per day
  - 1 MW of demand reduction includes ~ 1 GW-hr of energy shifting
- Storage achieves many associated goals without the need to control customer comfort

It's the right time.
Storage is a tangible, utility scale resource

The CEC should exercise its authority to adopt load management standards

We encourage the CEC, CPUC, CAISO, Office of the Governor, & Legislature to:

1. **Adopt standards of regulation that direct the load serving entities in the State to implement efficient energy storage technologies that reduce peak demand and reshape the utility load duration curves**
2. **Use elements of the time and locational TDV energy efficiency metric, that is part of the Title 24 building standards, as the measure for determining whether or not an end use storage device is efficient**
3. **Codify energy storage in utility integrated resource plans**
4. **Quantify the environmental benefits of efficient energy storage in support of the State's greenhouse gas reduction goals**

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It's the right time.
Storage is a tangible, utility scale resource

We encourage the CEC, CPUC, CAISO, Office of the Governor, & Legislature to:

5. **Quantify the financial and technical grid related benefits of efficient energy storage that shifts thermally driven summer peak electrical load to the off-peak, creating load for the increasing excess of off-peak wind energy in the state, particularly during heat storms**

6. **Quantify the financial and technical grid related benefits generated by the combination of efficient energy storage for air conditioning and building mounted solar PV, where the storage both firms the intermittent output of the Solar PV and levels the distribution circuit load in the afternoon when the energy from the sun decreases and the energy needed for cooling increases, avoiding the "post solar peak" and utility resources to service the load**

7. **Qualify efficient energy storage peak load reduction impacts to contribute toward renewable energy resource goals**

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It’s the right time.
Storage is a tangible, utility scale resource

We encourage the CEC, CPUC, CAISO, Office of the Governor, & Legislature to:

8. **Allow the efficiency benefits of qualifying energy storage to be counted as part of each IOUs’ energy efficiency goals.**

9. **Allow the demand reduction benefits of qualifying energy storage to be counted as part of each IOUs’ demand response goals.**

10. **Allow utilities to expense investments they make in qualifying energy storage resources in the year that the investments are made**

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Site Energy Efficiency & Load Shifting

- **"Site energy" has been a useful metric.**
  - Simple to understand
  - Easy to measure
  - Attention to site energy has prompted desirable improvements in many sectors (building codes, appliances, technology …)

- **But site energy reduction itself does not *directly* create value. More precisely, reducing site energy *indirectly* creates substantial value by:**
  - Reducing fuel consumption
  - Reducing emissions
  - Improving T&D constraints (esp. important when on-peak)
  - Saving money (tariff savings)

- **The above four factors are how value is actually created**

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Site Energy HVAC Example 7.5 Ton RTU*

Typical Western U.S. Hot Dry Climate

	Shifting from 10.3 EER to High Efficiency (12.7 EER) Roof Top Unit (RTU) saves…
Fuel Consumption	20 MBTU / Yr
Emissions	.9 Tons CO_2 / Yr
Peak Reduction (T&D)	1.7 KW
Tariff Savings	$350 / Yr

* 10.3 is standard EER for RTUs larger than 5 Tons, and 12.7 EER is the highest commonly available RTU efficiency. Fuel and Emissions estimates based on the avoided cost model adopted by the CA CPUC for evaluation of energy efficiency programs for 2006-2011.

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Title 24 Compliant Ice Storage Air Conditioner (ISAC) Comparison to a High Efficiency RTU

	Shift from 10.3 EER to High Efficiency (12.7) RTU saves…	Shift from 10.3 EER to ISAC saves…	Comparison
Fuel Consumption	20 MBTU / Yr	60 MBTU / Yr	3x improvement
Emissions	.9 Tons CO_2 / Yr	1.8 Tons CO_2 / Yr	2x improvement
Peak Reduction (T&D)	1.7 KW	8.8 KW	5x improvement
Tariff Savings	$350 / yr	$1100 / yr (on TOU rate)	3x improvement

Ice Storage Air Conditioner (ISAC)
makes substantially more contribution to the factors that matter.

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Metric Comparison

	Shift from 10.3 EER to High Efficiency (12.7) RTU saves…	Shift from 10.3 EER to ISAC saves…	Comparison
Fuel Consumption	20 MBTU / Yr	60 MBTU / Yr	3x improvement
Emissions	.9 Tons CO_2 / Yr	1.8 Tons CO_2 / Yr	2x improvement
Peak Reduction (T&D)	1.7 KW	8.8 KW	5x improvement
Tariff Savings	$350 / Yr	$1100 / Yr (on TOU rate)	3x improvement
Site Energy	11% - 25%	2% - 15*% (*varies by climate zone)	
TDV (CA Building code, sample building in zone 14. TDV addresses fuel, emissions, and T&D)	42	107	2.5x (comparable to actual savings above)

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ISAC Green & Savings Impact ~ EER 19.8!

	Shift from 10.3 EER to High Efficiency (12.7) RTU saves…	Shift from 10.3 EER to ISAC saves…	Shift from 10.3 to 19.8 EER saves…
Fuel Consumption	20 MBTU	60 MBTU	50 MBTU
Emissions	.9 Tons CO_2 / Yr	1.8 Tons CO_2 / Yr	2.4 Tons CO_2 / Yr
Peak Reduction (T&D)	1.7 KW	8.8 KW	4.4 KW
Tariff Savings	$350 / yr	$1100 / yr (on TOU rate)	$877 / yr
TDV	47	107	107

To achieve results comparable to an ISAC unit, an RTU would need to have an EER of almost 20!

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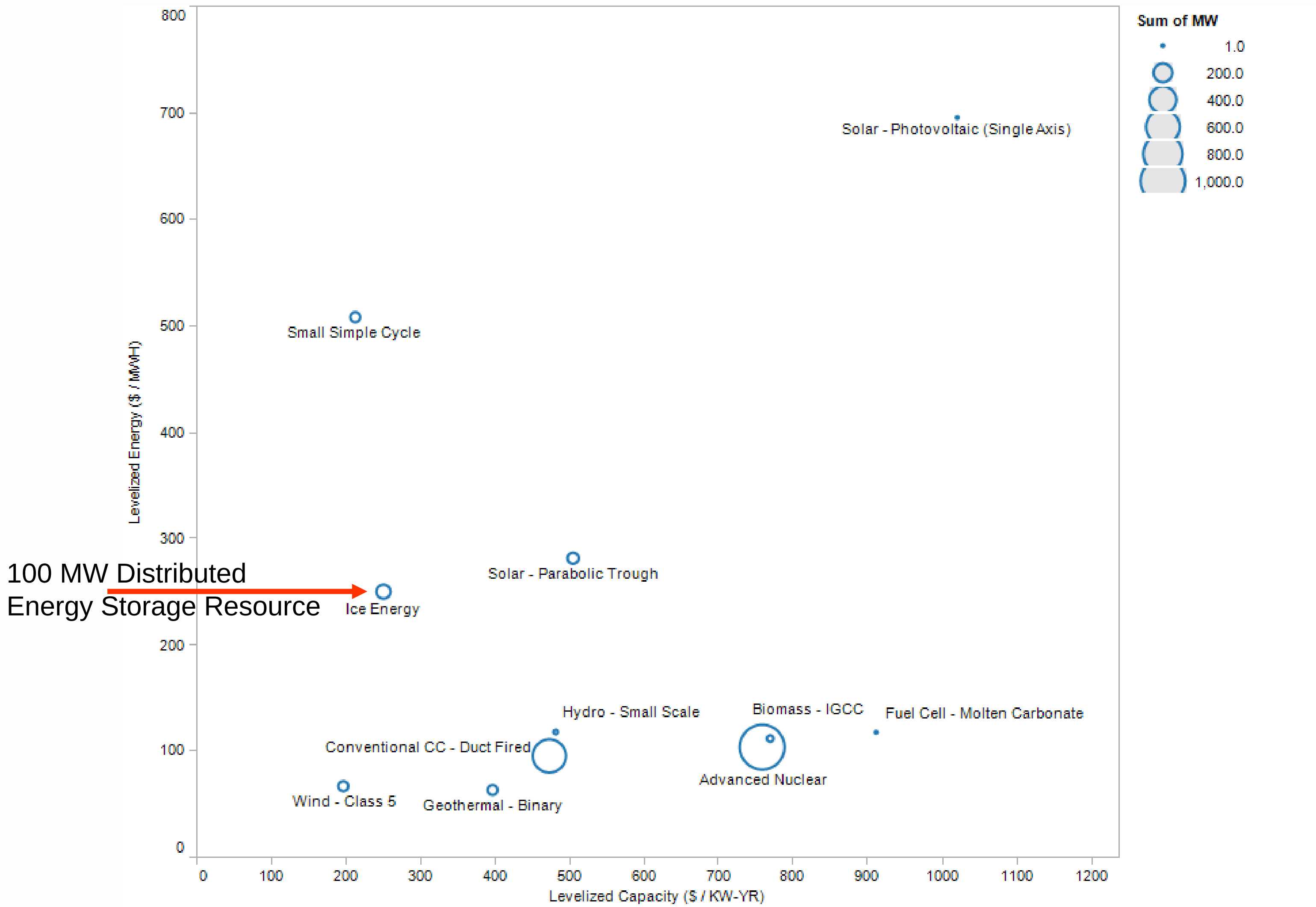
Comparative Levelized IOU Generation Resource Cost Analysis



Comparative Costs of California Central Station Electricity Generation Technologies
Based on June 2007 CEC-200-2007-011-SD,
Ice Energy Plant added by Ice Energy in consultation with E3 (Energy and Environmental Economics, Inc.)

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Ice Storage Air Conditioning & Title 24

- **California Energy Commission April, 2006**
  - Residential and Non-Residential Buildings
  - Residential ~ 50% reduction in building cooling energy in hot dry climates
  - Non-Residential ~ 20% reduction in building cooling energy
  - 95% reduction of building cooling energy during peak period (Noon – 6 PM)

Climate Zone	Standard cooling energy (TDV KBtu/sqft-yr)	ISAC cooling energy (TDV Kbtu/sqft-yr)	Reduction in cooling energy
10	23.23	11.36	51%
11	22.09	10.68	52%
12	14.33	6.9	52%
13	31.93	15.77	51%
14	32.07	15.63	51%
15	74.25	37.89	49%

Source CEC Staff Report: CEC-400-2006-006-SF

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Source & Site Energy Savings

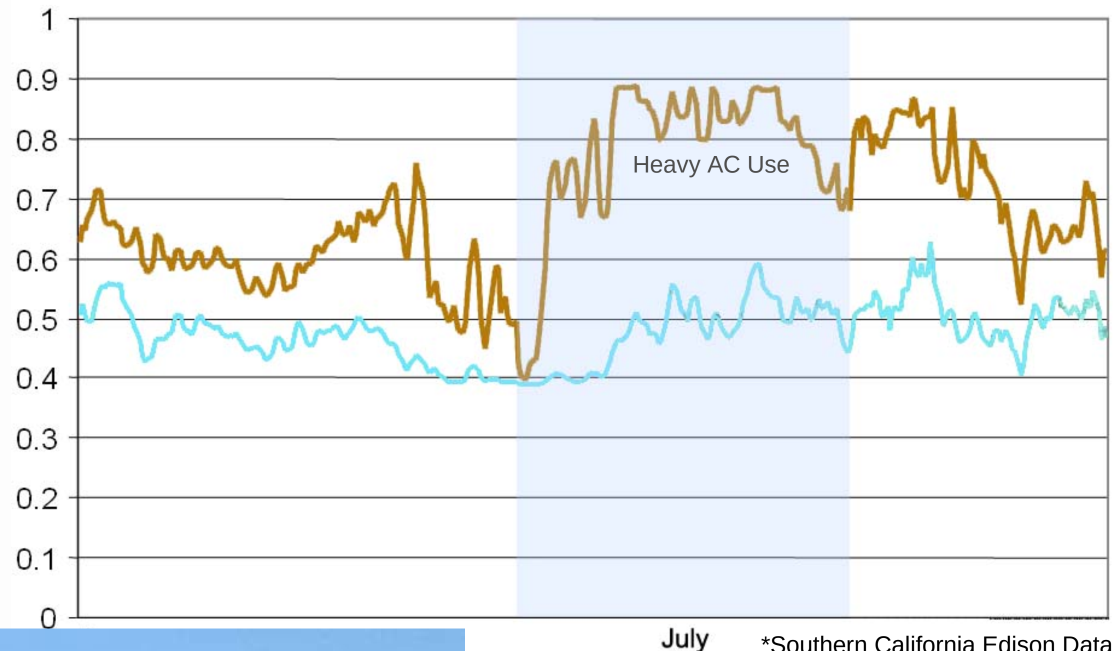
Potential Source of Carbon Credits

Reduced Greenhouse Gas Emissions

Reduced Smog Potential on 2% days

Ice Storage A/C is Good for the Planet Too

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



*Southern California Edison Data

- ~56% lower NOx emission rate during off-peak
- ~40% lower CO_2 greenhouse gas emissions

Thank-You

www.ice-energy.com

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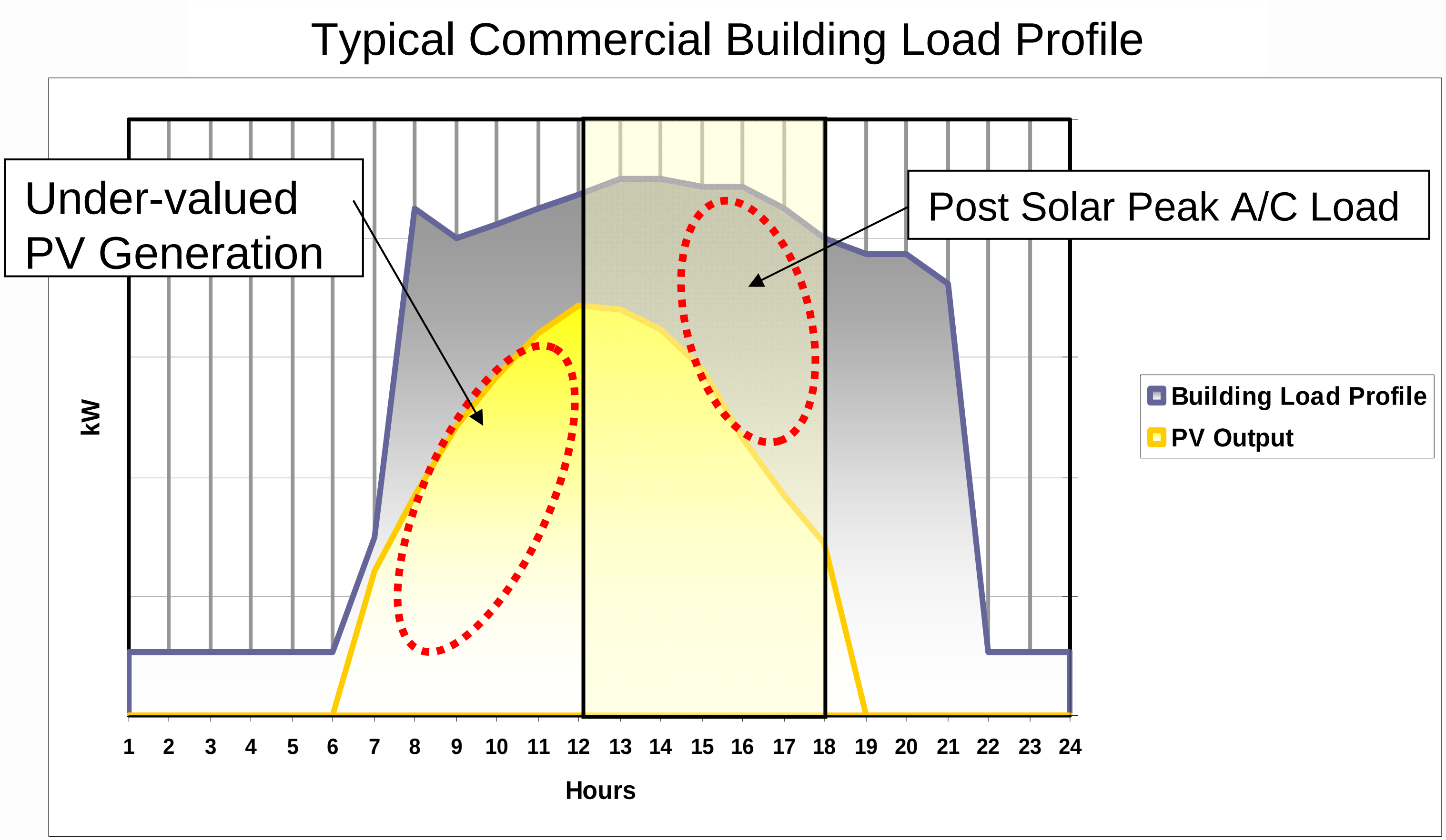
Ice Storage A/C Improves Building Solar PV Investments



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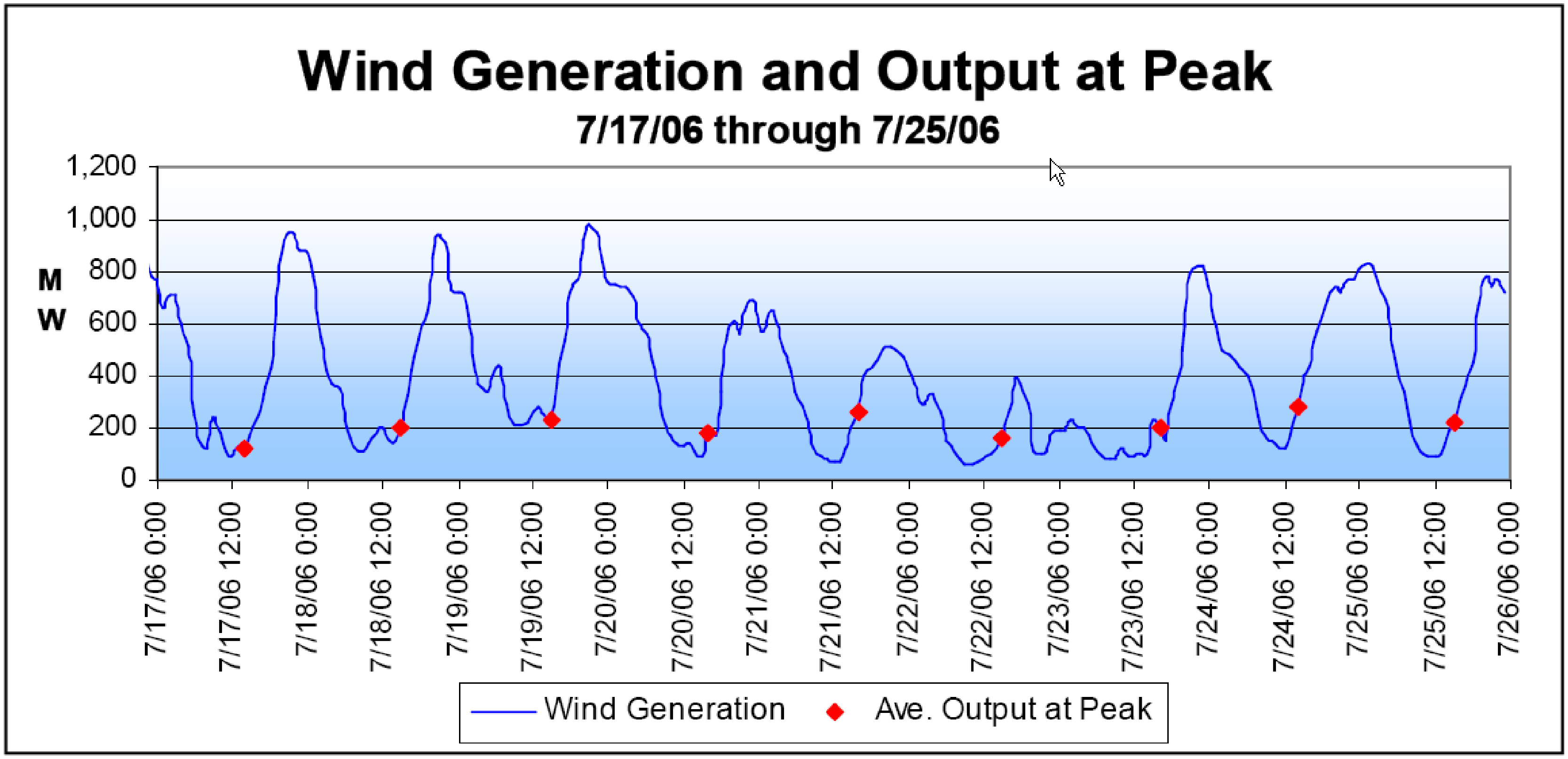
Wind resources are out of phase with heat storm peak demand



Source CAISO 2007 Summer Loads and Resources Operations Assessment March 8, 2007

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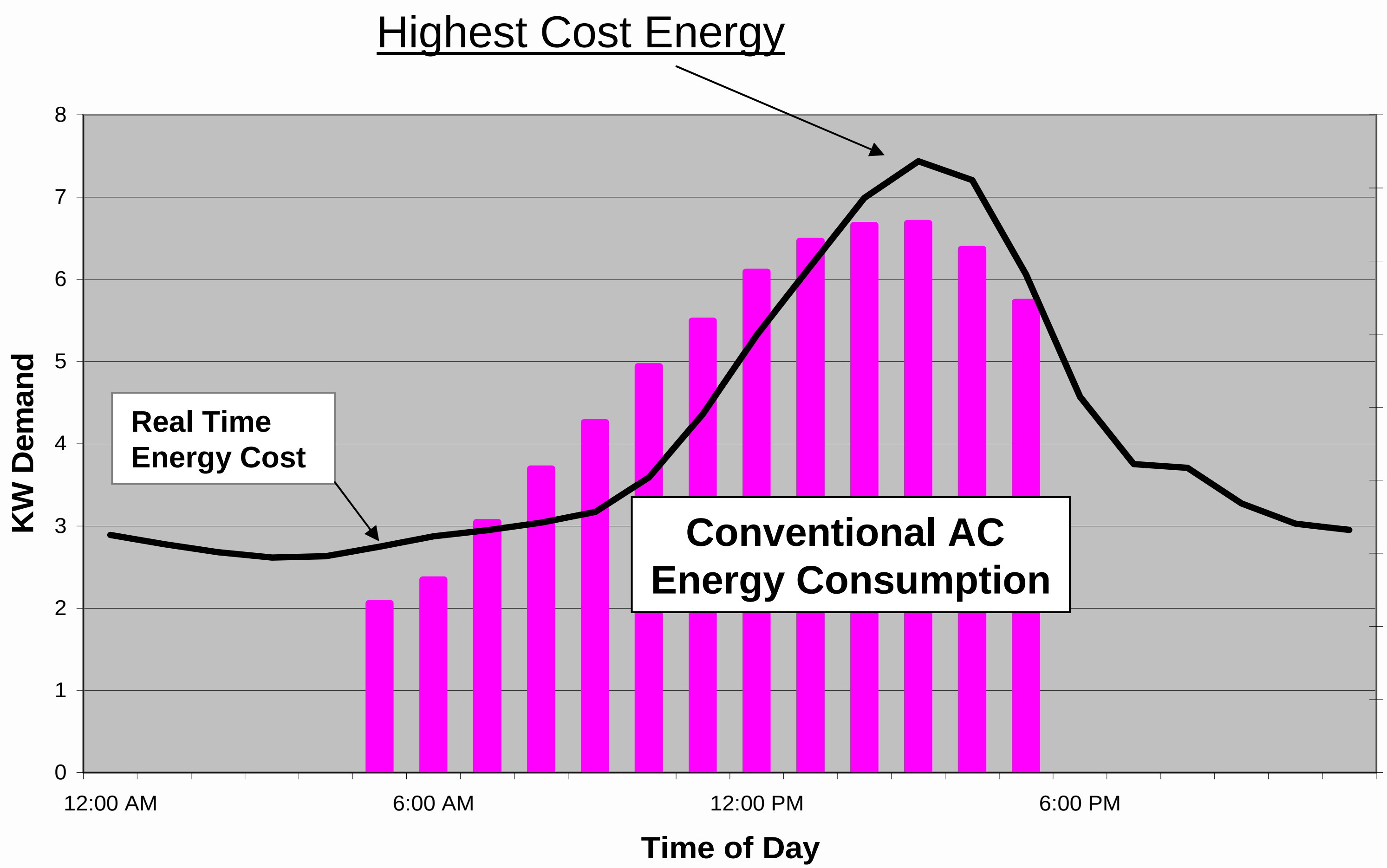
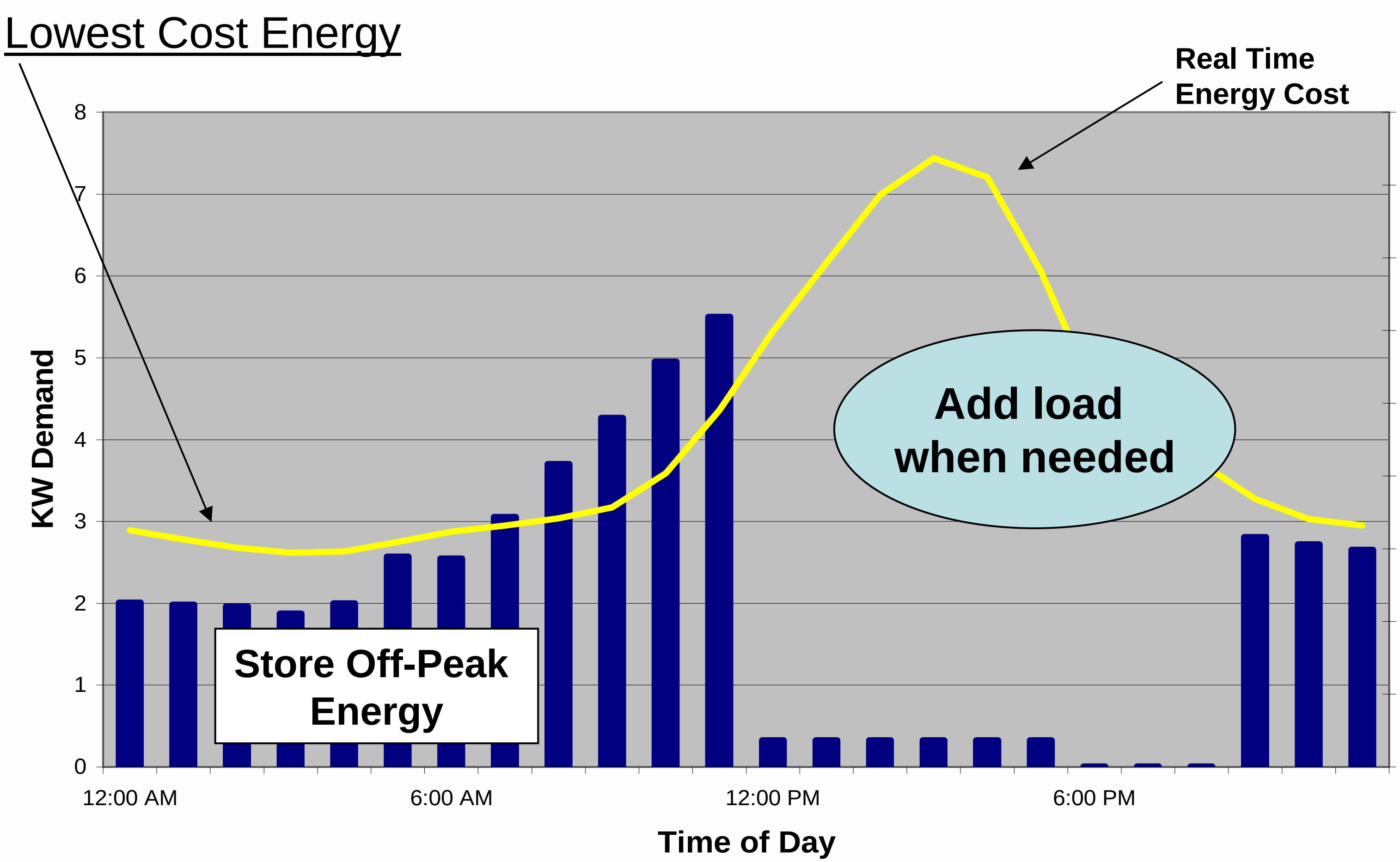
Weather Driven Air Conditioning Load Drives System Peak

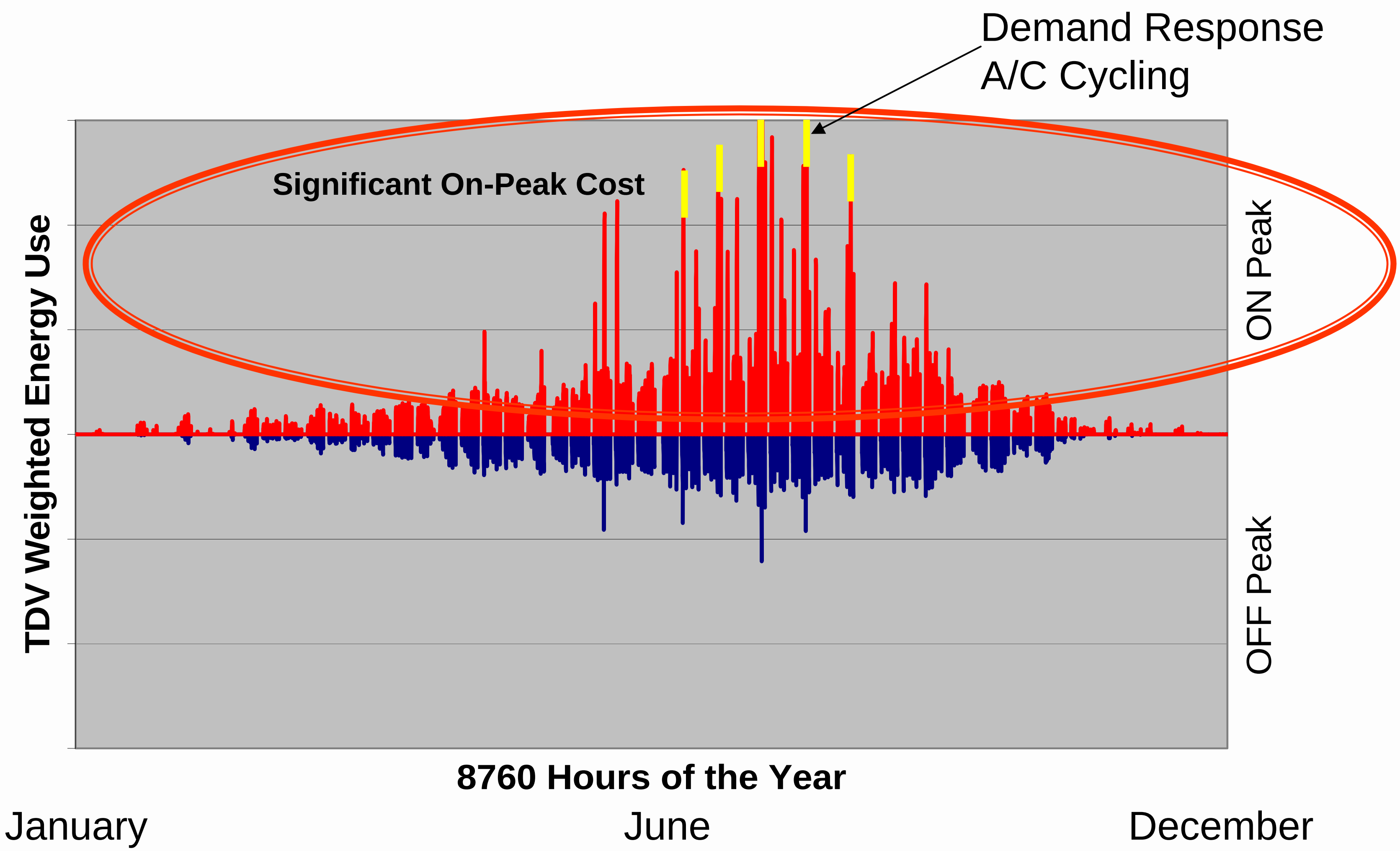


Distributed On-Site Storage Is Offset Energy + Demand

Bi-Directional Utility Controlled Regulation Energy Resource



A Large Scale Cost Effective Load Management Resource



TDV = time dependent value of energy; for additional information search: TDV cookbook

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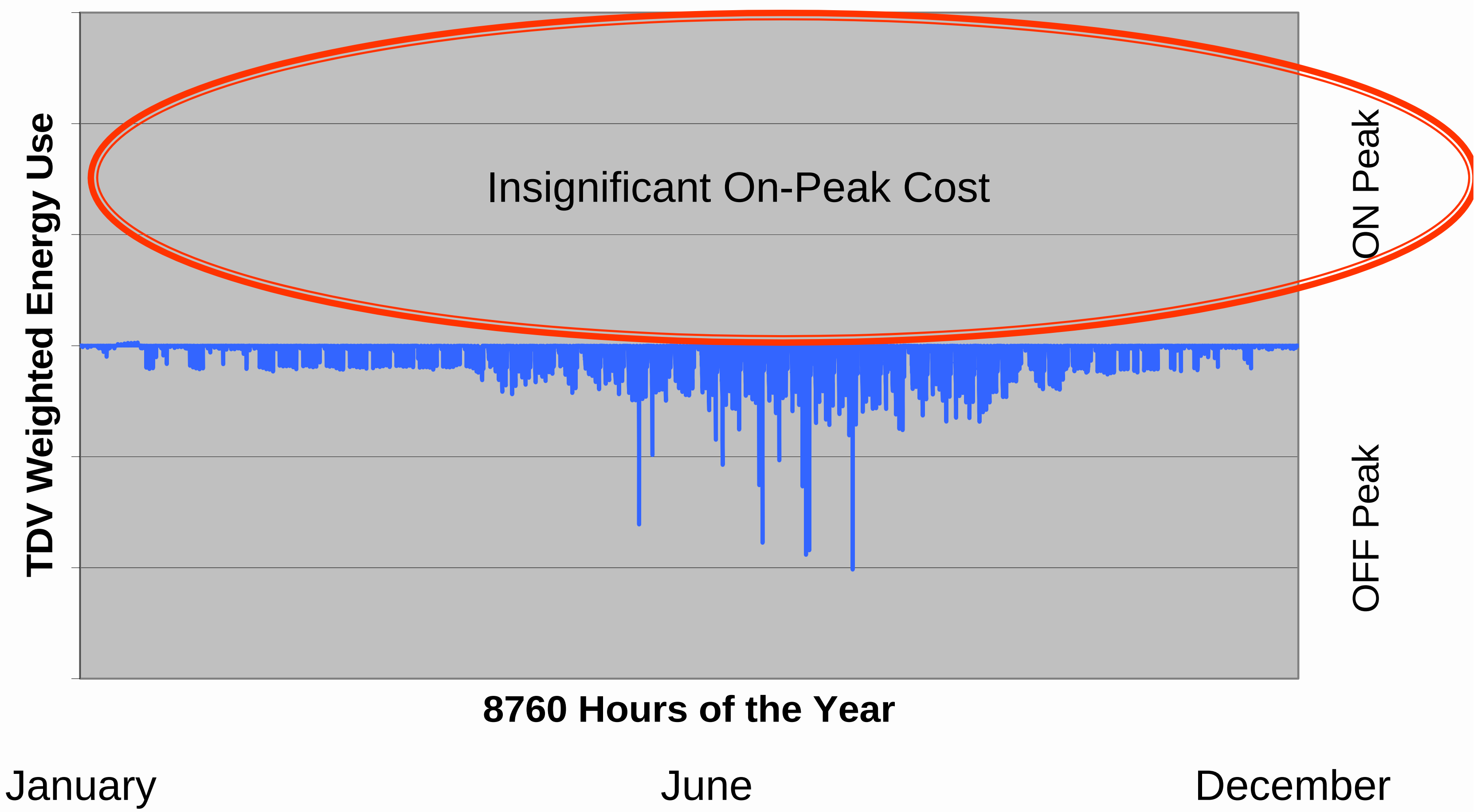
Ice Storage A/C is a Firm On-Peak Utility Scale Energy Resource

A <u>resource</u> that delivers system value ~310 days per year



Ice Energy's, Ice Bear® Hybrid Air Conditioning

Ice Bear 50

Ice Bear 30

Transformational Energy Efficiency
and Peak Demand Performance

Good	Better	Best
Conventional	High Efficiency	Hybrid*
11.5 EER	12.5 EER	300 EER

GREEN TECH
ICE ENERGY ICE BEAR
FREEZING YOUR AC TO SAVE ENERGY

3 – 5 Ton Residential Prototype

* Peak EER Rating, Listed California Title 24 Building Energy Efficiency Measure: Best is 15X Improvement Over Better

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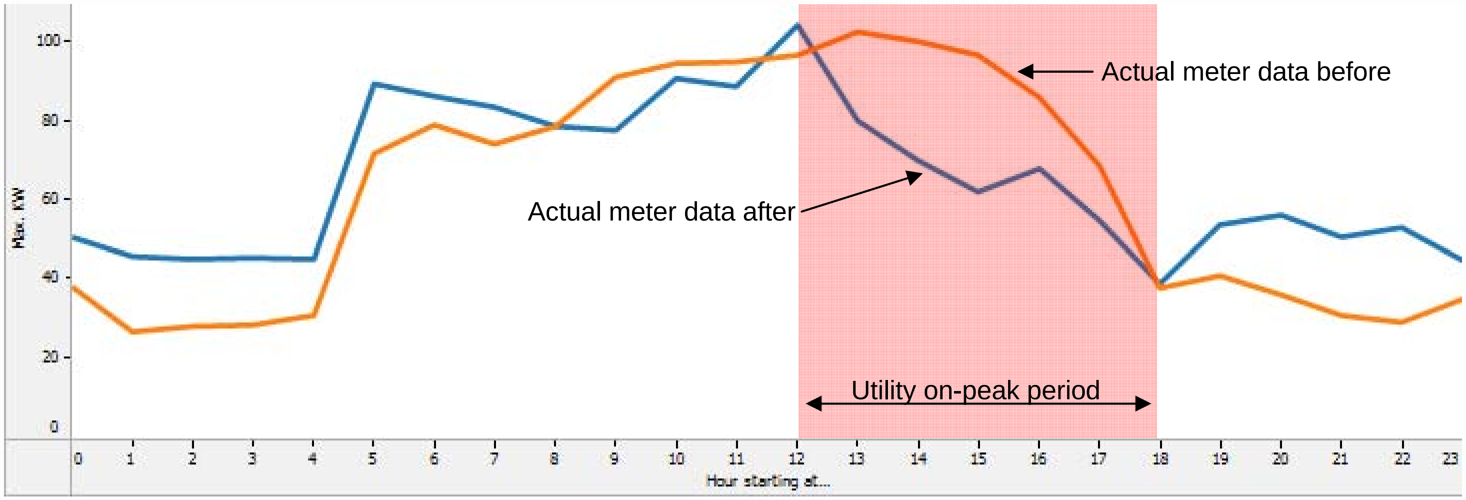
Si Manufacturing: 5 Ice Bear Units, Anaheim California

Si Interval Meter Data, Average of 5 Consecutive Weekdays



Utility award barbeque luncheon at Si