

*2011 IEPR Committee Workshop  
on Energy Storage for  
Renewable Integration*



**ICE ENERGY®**

**INTELLIGENT STORAGE AT WORK.**

*Panel 2: Energy Storage  
Applications and Economics  
(Costs, Benefits and Revenue)*

**DOCKET**

**11-IEP-1N**

DATE Apr 28 2011

RECD. May 03 2011

***Smart, Distributed  
Thermal Energy Storage***  
*Cost-effective and commercially viable*

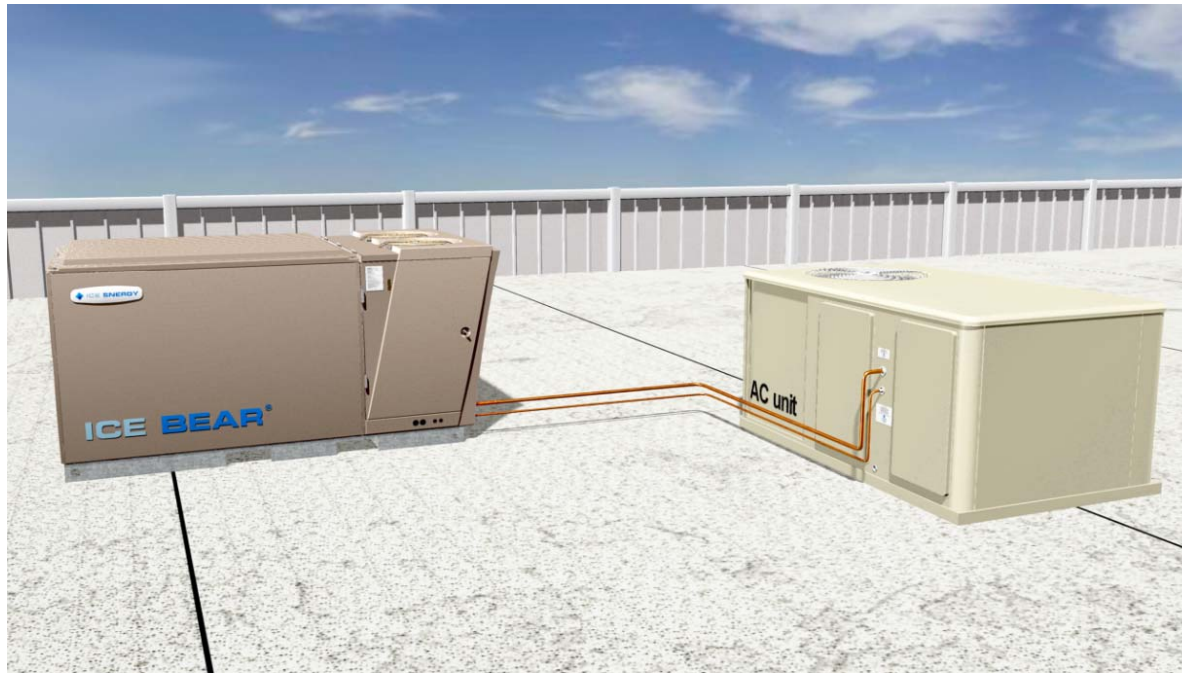
April 28, 2011



David Nemtzow  
[dnemtzow@ice-energy.com](mailto:dnemtzow@ice-energy.com)



# Smart, distributed energy storage is utility-scale



Real-time control

Distributed resources



Aggregated units  
managed as a  
single resource



# Benefits of Distributed Energy Storage

## Improves System Operations

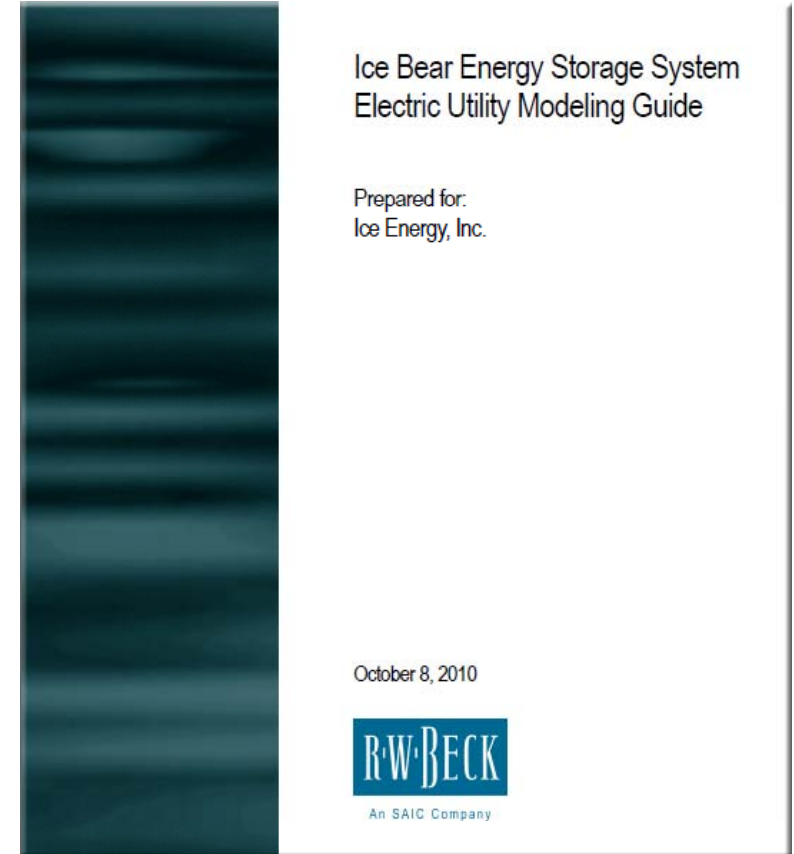
- ☐ Improved system efficiency
- ☐ Improved system power factor & voltage support
- ☐ Improved daily electric system load profile

## Avoided Costs

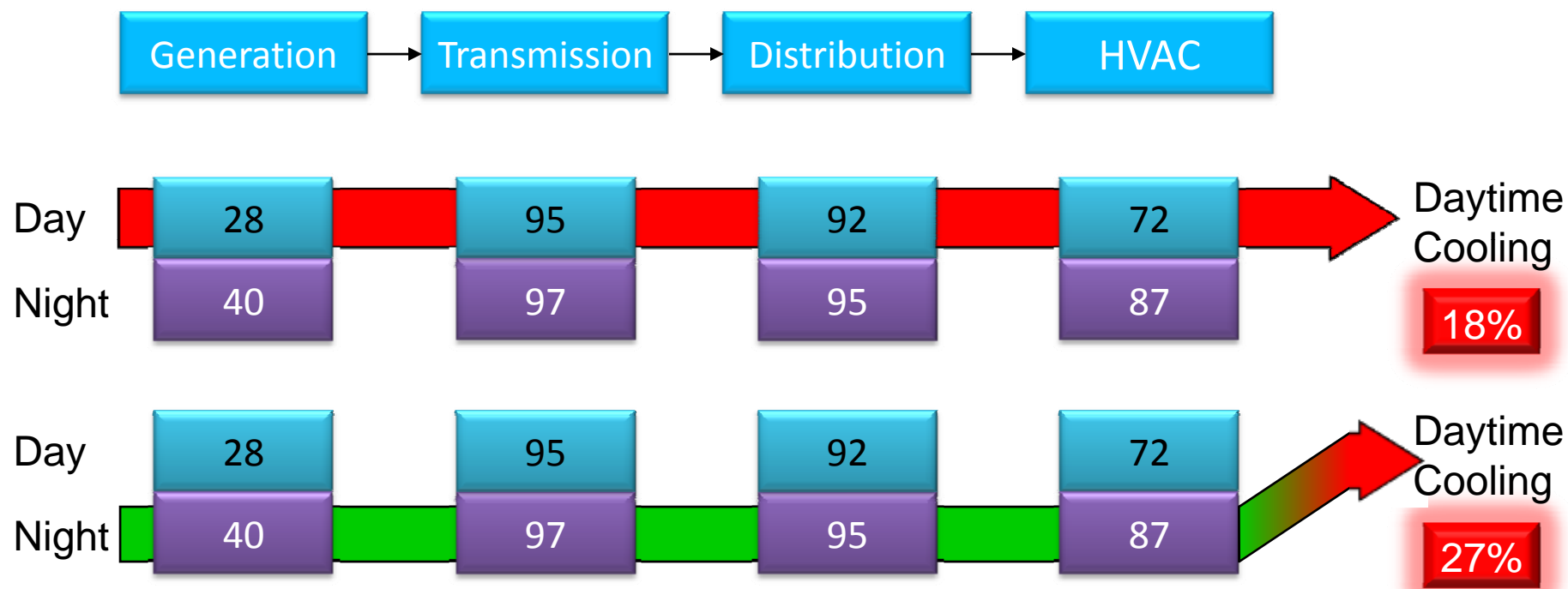
- ☐ Avoided or delayed peakers/generators
- ☐ Avoided or delayed T&D system expenses
- ☐ Avoided electric system losses

## Enhances System Capacity

- ☐ Increased system power transfer capability
- ☐ Enhanced integration of renewable resources
- ☐ Eliminates fault-induced delayed voltage recovery (AC stalling)

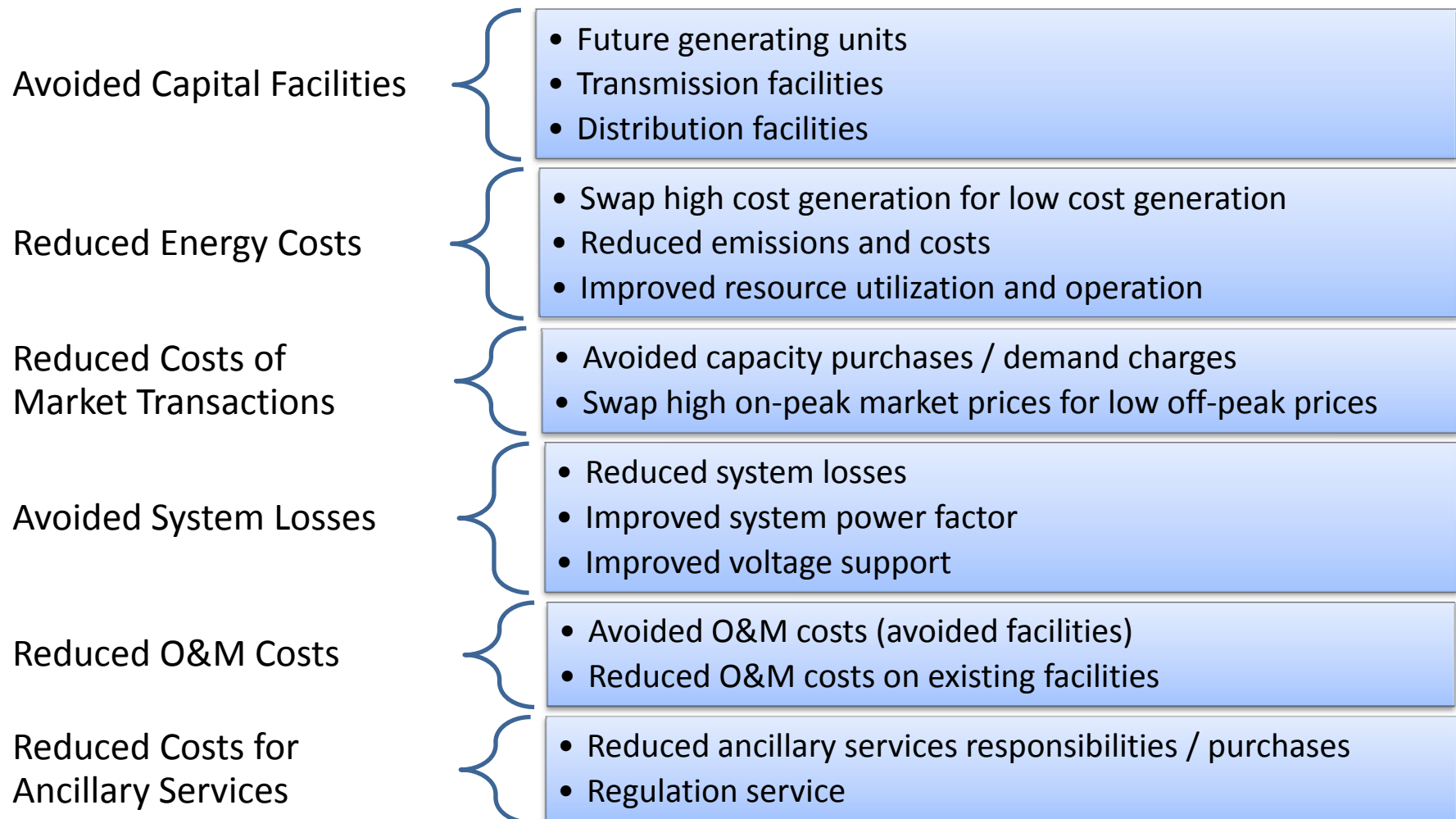


# Power and Storage Efficiency and Cost Is Temperature- and Time-Sensitive



- *Ice Bear thermal storage uses fuel ~50% more efficiently (18% \* 1.5 = 27%)*
- *Ice storage avoids interconnection issues, safety concerns, and conversion losses – uses water as a storage medium.*

# Avoided Utility Costs



# Value of Avoided Capacity

---

Avoided per-unit (\$/kW) capital cost of planned generating unit

---

## Avoided Generation Fixed Costs

Avoided demand charges for power purchases

---

Deferred generation expansion plan (with and without Ice Bear System)

---

Fixed O&M costs of avoided/deferred generating units

---

Average cost of historical or budgeted facilities (divided by load growth)

---

## Avoided T&D Fixed Costs

Targeted T&D upgrades avoided or deferred by distributed storage

---

Adjust for peak ambient conditions and losses

---

Fixed O&M costs of avoided/deferred T&D facilities

---

# Example of Equivalent Generating Capacity Calculation

	Adj. Factor	MW Rating
Ice Bear System Site Capacity at Design Conditions (95°F)		100
Ice Bear Rating at Peak Ambient Conditions (105°F)	15%	115
T&D Avoided Peak Demand Losses	12%	129
Capacity Planning Margin (Reserve Margin)	15%	148
Generator Rating at Peak Ambient Conditions (105°F vs. 60°F)	20%	178
Equivalent Generation Capacity (% of Ice Bear Capacity)	178%	

## Example of Equivalent T&D Capacity Calculation

	Adj. Factor	MW Rating
Ice Bear System Site Capacity at Design Conditions (95°F)		100
Ice Bear Rating at Peak Ambient Conditions (105°F)	15%	115
Avoided Demand Losses (btwn site and avoided T&D facilities)	6%	122
Power Factor Adjustment (avoided load at 80% PF)	25%	152
T&D Design/Planning Margin	20%	183
Equivalent T&D Capacity (kVA as % of Ice Bear MW Capacity)	183%	



# Other Utility Benefits

Enhanced integration  
of renewable  
resources

- Addition of more renewable resource capacity
- Augment operation / dependability of renewable resources

Improved system  
efficiency & reliability

- Reduced average system heat rate
- Improved system reliability

Increased potential  
for market sales

- *Frees-up* generation that can be sold during peak periods
- Surplus capacity sale
- Surplus energy sale

Natural hedge  
against power prices

- Swap high on-peak prices for low off-peak prices
- Swap high on-peak volatility for low off-peak volatility

Reduced costs for  
fuel procurement

- Higher utilization of base / intermediate resources
- Less reliance on peaking resources (higher cost fuel)
- Better utilization of fuel reservations

# Considerations and Recommendations re: Cost, Benefits and Revenues of Storage

- ❑ Needs to be a widely recognized cost-effectiveness methodology (inc. recognizing variances among storage technol./applications)
- ❑ Challenge of optimally and cheaply integrating renewables has to be fully recognized
- ❑ Need appreciation of Utility ownership of storage – to both decrease deployment costs and increase benefits
- ❑ Recognize that storage products often provide much more than just “traditional” storage services; the value of the other services – such as EE, direct load control, etc. – need to be factored in
- ❑ The multiple benefits of storage need to be aggregated up – it touches many departments/silos – including generation, transmission, distribution and demand-side