



# Turn your air conditioner into an advanced energy storage system: Ice batteries

February 16, 2017

# Introduction to Ice Energy

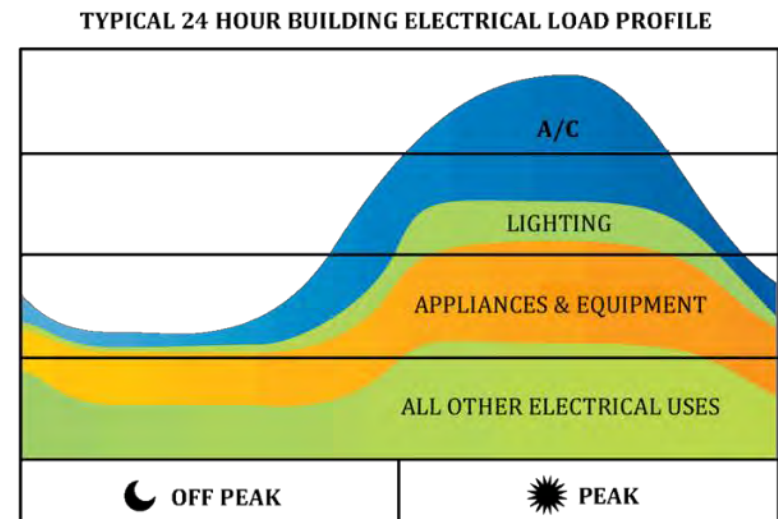
- Thermal energy storage company founded in 2003 and a pioneer in community storage
- Headquartered in Santa Barbara California
- Dedicated to turning biggest problem for the electricity grid – air conditioners – into lowest cost, most reliable and easiest way to get a lot of energy storage onto the grid fast, which is needed to make our grid efficient, reliable and able to replace fossil fuels with renewables

# The grid's problem with air conditioning

AC is the principal contributor to peak demand

Peak demand:

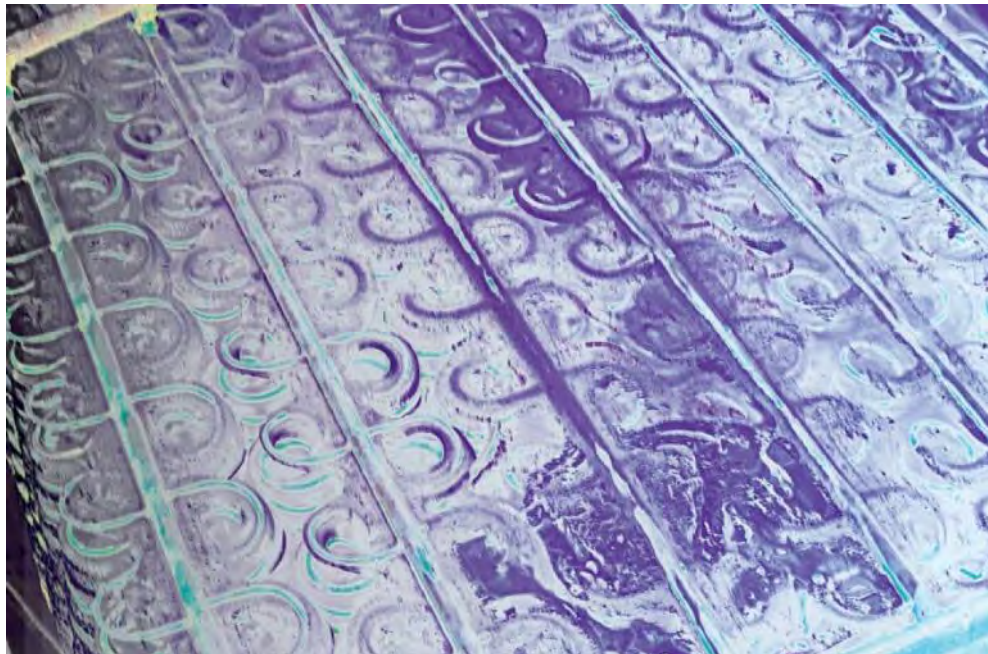
- Requires overbuilding the grid
- Increases risk of blackouts
- Requires gas peaking plants





# Ice batteries

- We set out to make an ice storage system for air conditioners that would eliminate their peak demand by making cooling off-peak, storing it as ice and delivering it on peak just by letting the ice melt



# Ice Bear 30

## 1. ICE BATTERY

A system of copper coils pumps cold refrigerant through regular tap water to make ice when desired (typically at night when electricity is abundant).

## 2. MONITORING AND CONTROLS

The Ice Bear's award-winning smart grid technology seamlessly monitors the cooling process, providing full visibility and control to the utility / project owner.

## 3. ICE BEAR COOLING SYSTEM

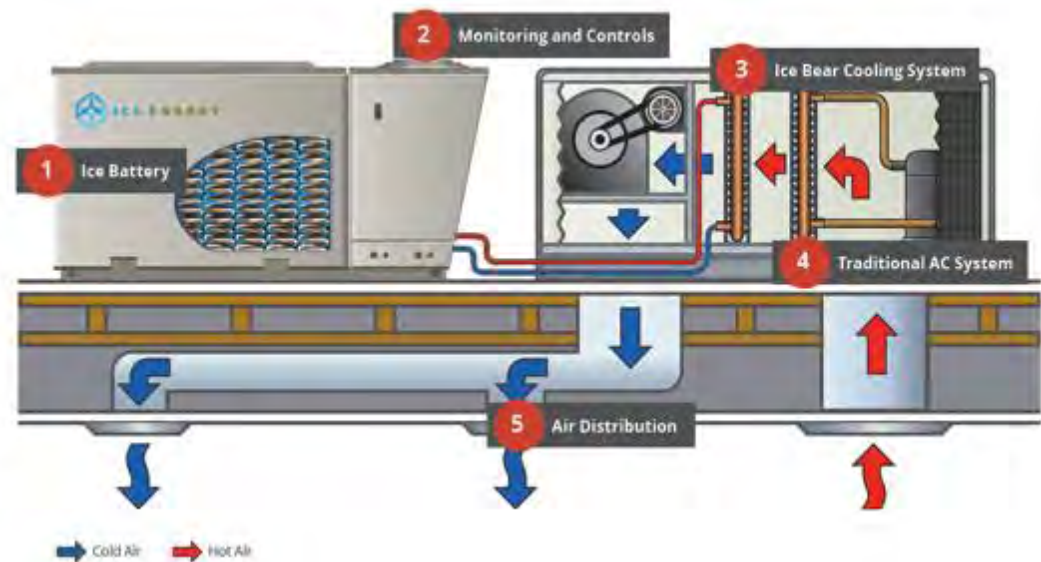
When dispatched to reduce peak demand, the Ice Bear turns off the compressor of the AC unit and uses the ice produced off-peak to efficiently provide exactly the same level of cooling for the building.

## 4. TRADITIONAL AC SYSTEM

The Ice Bear connects directly to a 5-20 ton rooftop AC unit, providing 3 to 6 hours of energy-efficient cooling during peak hours. If needed, the existing AC cools the building during off-peak hours.

## 5. AIR DISTRIBUTION

By using existing ducting to distribute cooled air, there are no costly ductwork retrofits.





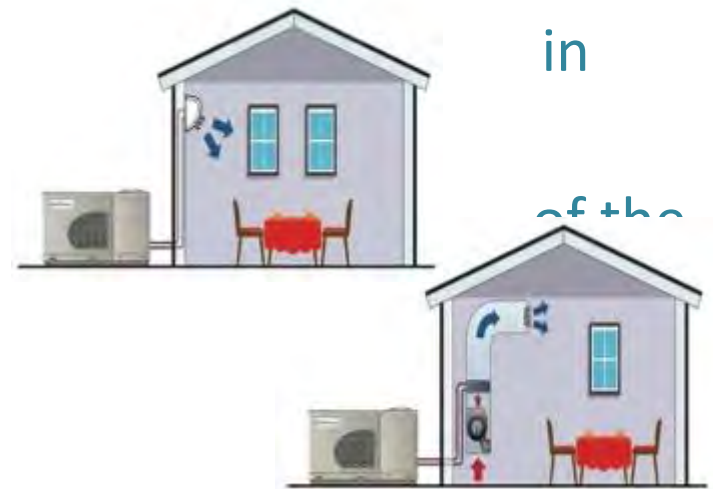
# Example installation – Ice Bear 30

Municipal building Redding, CA operational since 2010



# Ice Bear 20

- Residential unit for larger homes
- Optimized for utilities to deploy congested parts of their grid
- Based on the core technology Ice Bear 30 but
  - Replaces the AC unit



# Ice Cub

- Residential unit for smaller homes
- Optimized for homeowners/builders
- Fast charge for solar pv over-gen
- Heat pump option replaces furnace





# Ice battery advantages

**Lowest cost** – less than ½ the cost of lithium-ion

**Most reliable** - 98%+ availability over 34 million operating hours

**Environmentally Friendly & Safe** – unlike chemical batteries, no heat or hazardous material spillage / disposal risks. Storage medium tap water, filled once. All parts recyclable.

**20 year life** – unlike chemical batteries no repowers, no cycling limitations. no degradation

**Fast deployment** – no complex interconnection and permitting, only building permit

**High efficiency** - 100% effective efficiency, 85% round-trip efficiency