

# **Emerging Technologies- Alternative Refrigerants**

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# SCE Background



- One of the nation's largest electric utilities
- Nearly 14 million residents in service territory
- Approximately 5 million customer accounts
- 50,000 square-mile service area
- Over 103,000 miles of distribution and transmission lines
- Over 125 years of experience
- Exploring innovative Demand-Side Management offerings to address locational needs

# Evolving Energy Efficiency Trends

## Early Years

Energy Savings Tips



Energy Audits

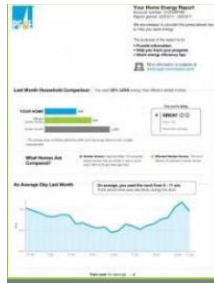


Standard Rebates



## Today

Robust Data Tools and Home Energy Reports



Market Interventions: Retail, Distribution, Wholesale



Deeper Savings



Partnerships



## Continuing Trends

Zero Net Energy



Whole Building



Water-Energy Nexus



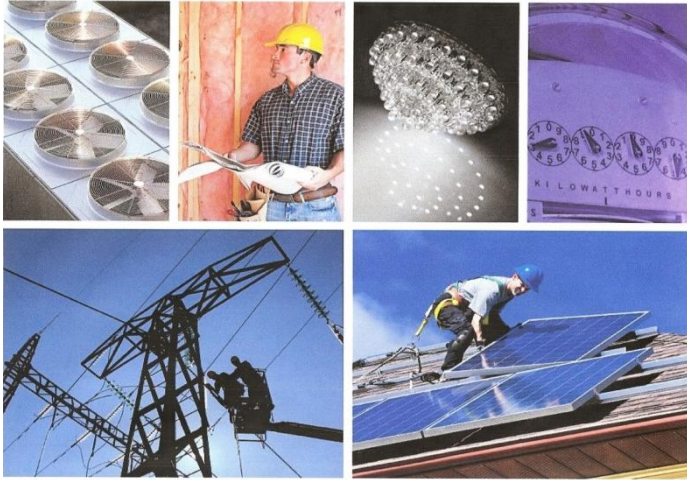
AB 32

RMP

Locational Targeting



# California Goals



## CA Energy Efficiency Strategic Plan

January 2011 Update

[www.Engage360.com](http://www.Engage360.com)

Engage 360

### AB32: GHG Goals

#### CEESP, Big Bold Energy Efficiency Strategies

##### – HVAC Market Transformation

- Goal 4: New HVAC Technologies & System Diagnostics

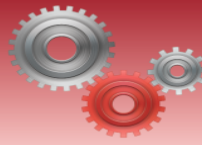
### RMP

- The purpose of this sub-article is to reduce emissions of high global warming potential refrigerants from stationary, non-residential refrigeration equipment and from the installation and servicing of stationary refrigeration and air-conditioning appliances using high-GWP refrigerants

# HVAC Fault Detection & Diagnostics

- 5 million central air conditioners in CA homes<sup>1</sup>
  - 11% of CA electrical energy consumption<sup>1</sup>, 24% CA total electrical peak demand<sup>2</sup>
  - Nearly half are at least 10 years old, 60% do not receive regular maintenance<sup>1</sup>
- Residential HVAC overlooked maintenance
  - What common faults result?
  - Fault impacts on HVAC performance, energy and demand consumption?
- How can current HVAC maintenance practices be enhanced?

1. EIA Residential Energy Consumption Survey (RECS) 2009. <http://www.eia.gov/consumption/residential/data/2009/>  
2. Strategic Plan to Reduce the Energy Impact of Air Conditioners. <http://www.energy.ca.gov/2008publications/CEC-400-2008-010/CEC-400-2008-010.PDF>



PRODUCT/SERVICE AREA:

# Process Loads

## Low and Medium Temperature Refrigeration

### Drivers

- Customer and Shareholder Value
- Regulatory and Policy Drivers
- IDSM Potential
- Need for New Products and Measurement
- Market Status and Realities

Global warming potential and hazardous materials issues.

CFC and HCFC replacements for medium and low temperature cold storage.

Air Resources Board Refrigerant Management Program, Title 40, Code of Federal Regulation, Part 82 drivers for medium sized facilities

EE benefit of about 15% plus DR potential with built in controls, fly wheeling evaluation, etc.

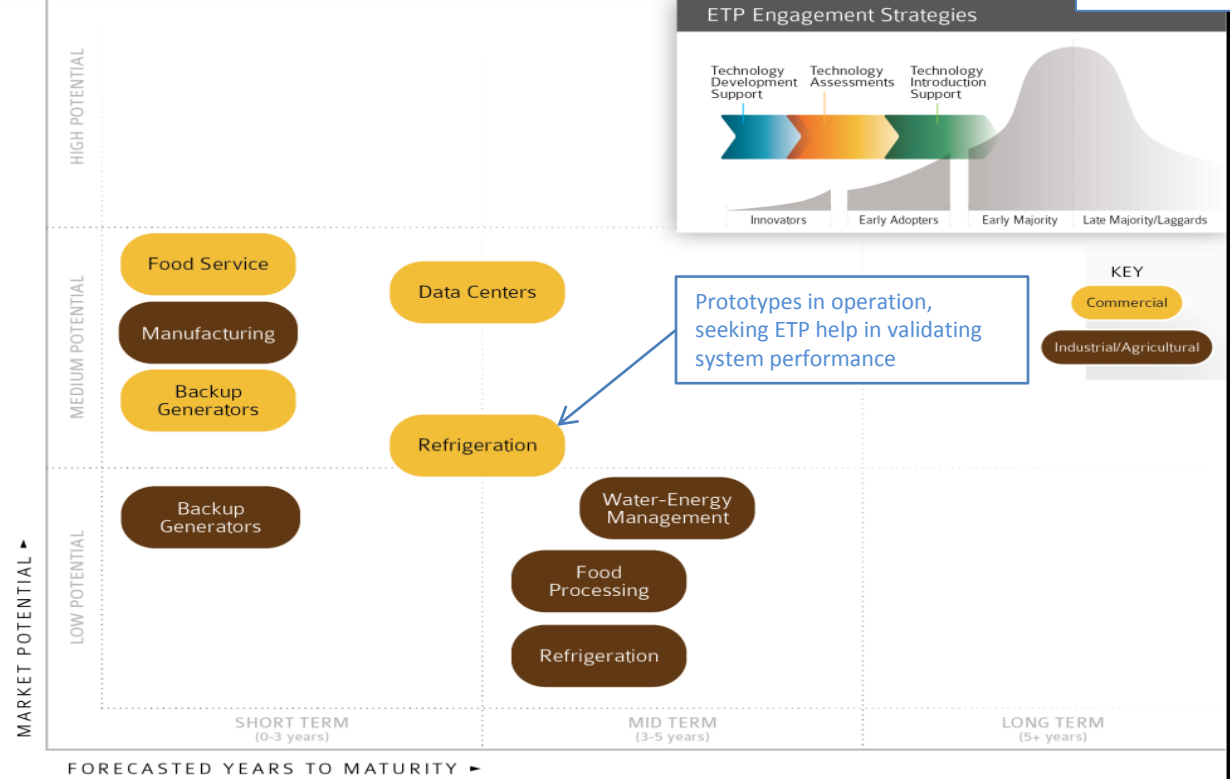
### Gaps and Barriers

- Training and Education
- Performance Uncertainty
- Value Proposition
- Productivity Disruption
- Custom Application

Possible field tests with PG&E customer and existing Lineage refrigerated distribution facility

Vendors indicate secondary market that technology will expand to HVAC markets

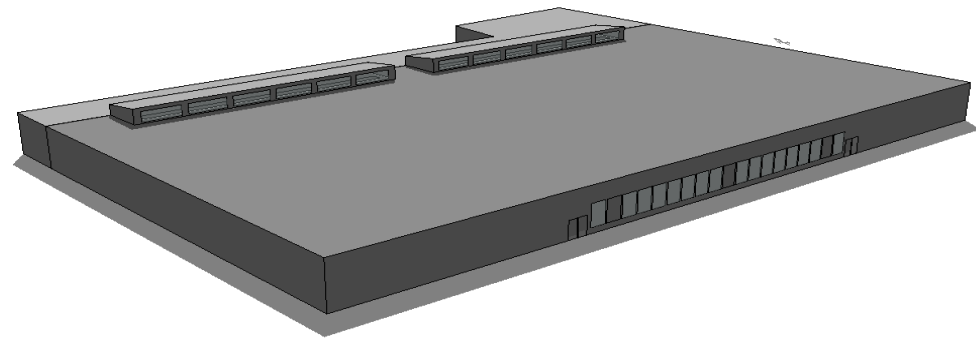
### Promising Product Families



Prototypes in operation, seeking ETP help in validating system performance

# Sustainable Supermarket – Carpinteria, CA

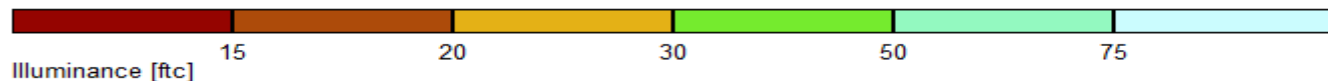
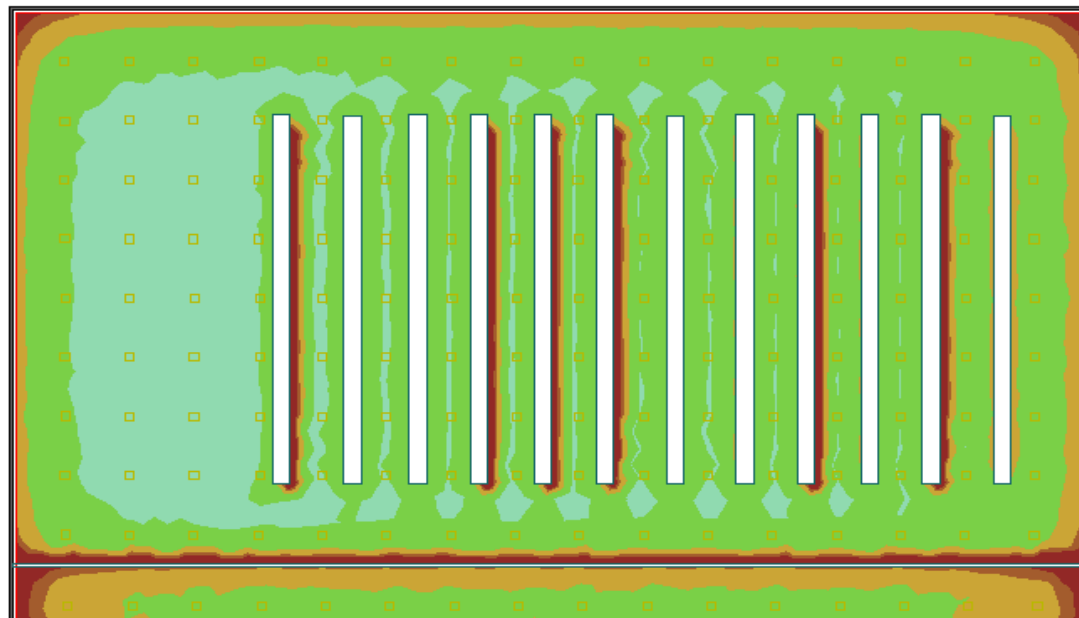
- Size: 45,000 SF grocery retail store
- Initial sustainability goals:
  - Zero-net energy
  - Lighting efficiency
  - Natural ventilation
  - Natural refrigerant





# Sustainable Supermarket – Carpinteria

- Lighting Efficiency: Successes
  - 100% LED lighting design
  - Daylighting analysis resulted in the inclusion of Solatube fixtures and the reduction in light fixtures





# Sustainable Supermarket – Carpinteria

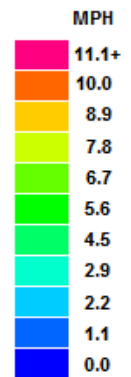
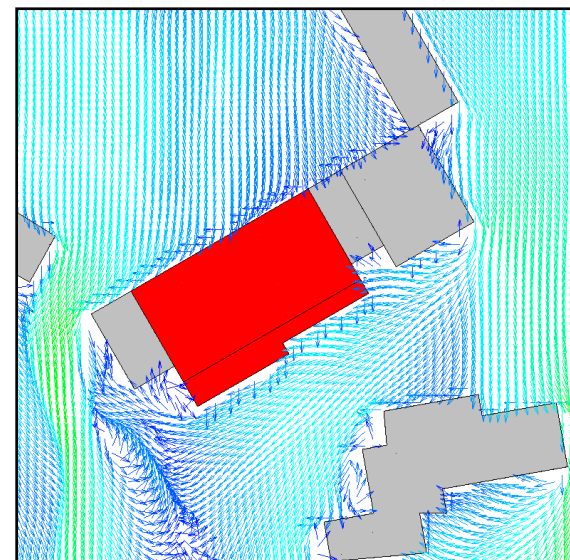
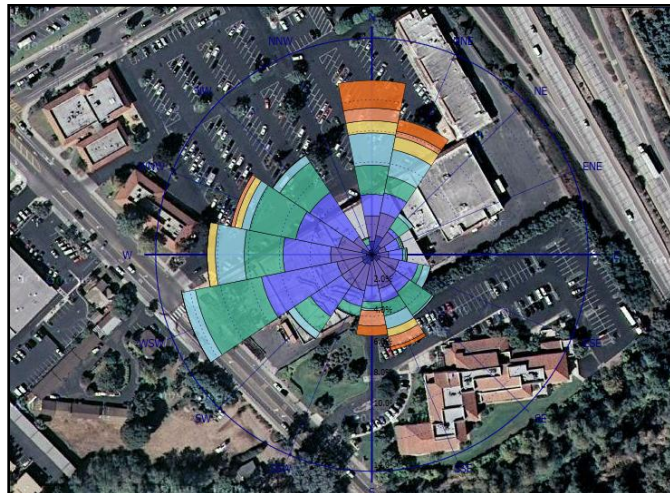
## ❖ Natural Ventilation

### ■ Successes:

- Provided usable detail on air flow and wind conditions
- Presented natural ventilation as a viable option for supermarkets located in temperate zones

### ■ Barriers

- Corporate resistance to natural ventilation system



# SCE – EPRI Emerging Refrigeration Technologies Project

- *Can new technology help companies reduce GWP emissions, save energy, improve performance?*
- Identify new technologies in refrigeration
  - Focus on clean, natural refrigerants – CO<sub>2</sub>, ammonia, hydrocarbon based, etc...
- Laboratory and field assessments
  - Energy, demand savings?



# Refrigerated Warehouse



- Refrigerated space has one of the highest electric usage intensities in the commercial building sector
  - In the 2008 PIER Project Report, *Benchmarking Study of the Refrigerated Warehousing Industry Sector in California*, electric usage (kWh/ft<sup>2</sup>) ranged from a low of 10 kWh/ft<sup>2</sup> to high of 65 kWh/ft<sup>2</sup> depend on end use market

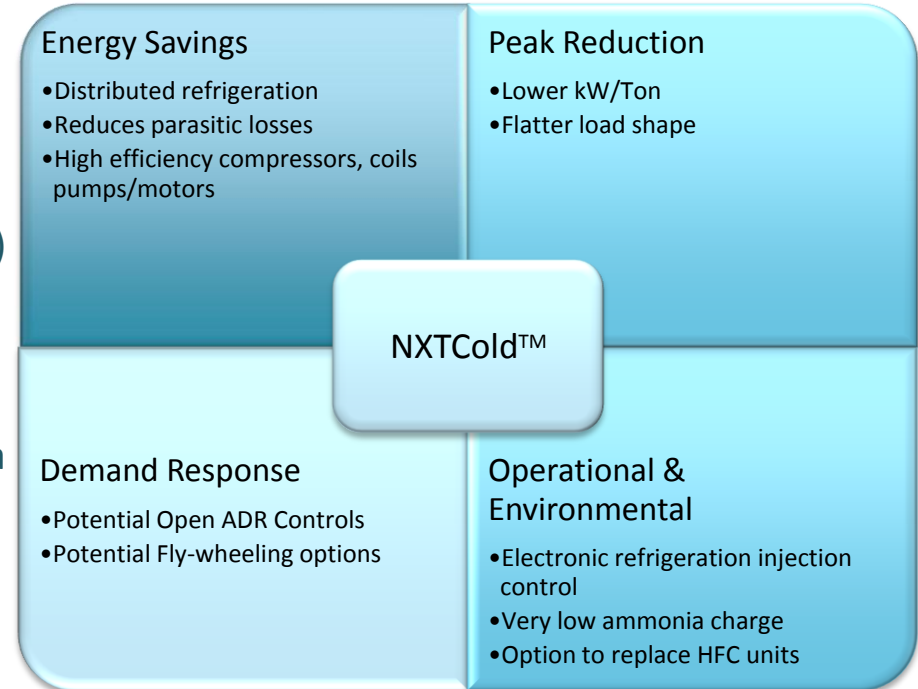
Refrigeration	Primary Electric Use %	Example: Refrigerated Warehouse (million ft <sup>2</sup> )	Example: Refrigerated Warehouse (kWh/End-Use ft <sup>2</sup> )
PGE	15%	30	15
SCE	12%	61	12.5
SDGE	12%	2	22.7
SMUD	11%	2.7	10.3
<b>State</b>	<b>14%</b>	<b>95.7</b>	<b>13.44</b>

- California depends heavily on refrigerated space with temperatures ranging from +40° F to -80° F for preservation and storage of products
  - Restaurants, Food Stores, Agriculture, Processing, Refrigerated Warehouse

# Benefits Examined

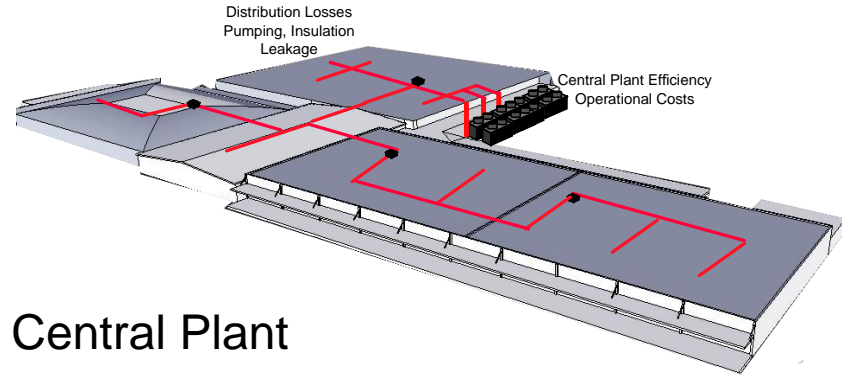


- Improved Energy Efficiency
  - Estimated 15-25% in CA regulated HFC based refrigeration
  - Estimated 5-10% in CA industrial and large refrigerated warehouse (ammonia)
  - Reduced Peak
- Environmental Improvements
  - Significant reduction in ammonia charge
  - Reduced HFC emissions where ammonia system replaces HFC system
- Customer Behavior and Operational Cost Savings
  - Lower Installed Cost
  - Lower Operating and Maintenance Cost
  - Higher Productivity





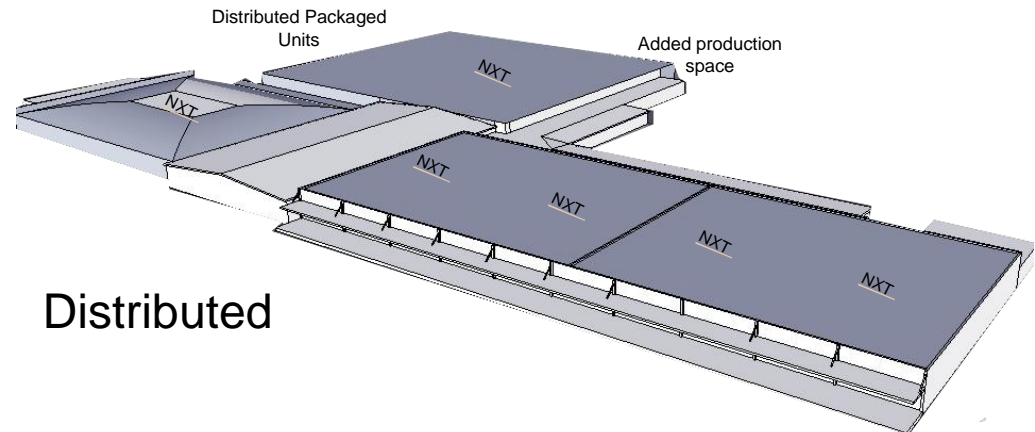
# NXTCOLD Technology Description



Central Plant



Controls and  
Access



Distributed



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