Understanding Emerging Technologies…

Do Low Charge Ammonia Refrigeration Systems Save Energy?

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ATMOsphere America
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Global warming….

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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

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Evolving Energy Efficiency Trends

Early Years

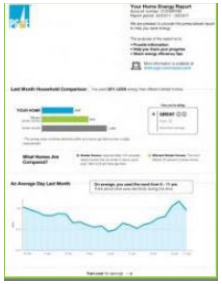
Energy Audits

Energy Savings Tips

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

AB 32

RMP

Water-Energy Nexus

Locational Targeting

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SCE drivers…

Refrigerant Management Program (RMP)

Business with Refrigeration Systems | Refrigerant Reclaimers | Refrigerant Distribution & Wholesalers

Buying a new system? | Technicians & Contractors | Resources

Stopping Leaks

The RMP requires facilities with refrigeration systems with more than 50 pounds of high-GWP refrigerant to:

- conduct and report periodic leak inspections;
- promptly repair leaks; and
- keep service records on site.

These facilities *must* register using the R3 tool; facilities with 200 lbs. or more must also submit annual reports by March 1 of each year.

Click here to watch a video overview of the program

The regulation also affects:

- any person who installs, services or disposes of any appliance using a high-GWP refrigerant; and
- refrigerant wholesalers, distributors and reclaimers.

These facilities are also subject to registration and reporting requirements. Facilities whose systems use only ammonia or carbon dioxide as refrigerants are not subject to the rule.

Click the icon below to visit the R3 tool:

Refrigerant Registration & Reporting Tool (R3)

What size is your facility?

The size of the largest system determines facility size

Large
≥ 2,000 lbs. of high-GWP refrigerant
Large facilities must register and report immediately

Medium
≥ 200 lbs. < 2,000 lbs. of high-GWP refrigerant
Medium facilities must register and report immediately

Small
> 50 lbs. < 2 00 lbs. of high-GWP refrigerant
Small facilities must register by March 1, 2016

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PRODUCT/SERVICE AREA:

Process Loads

Low and Medium Temperature Refrigeration

Global warming potential and hazardous materials issues.

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

Drivers

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

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

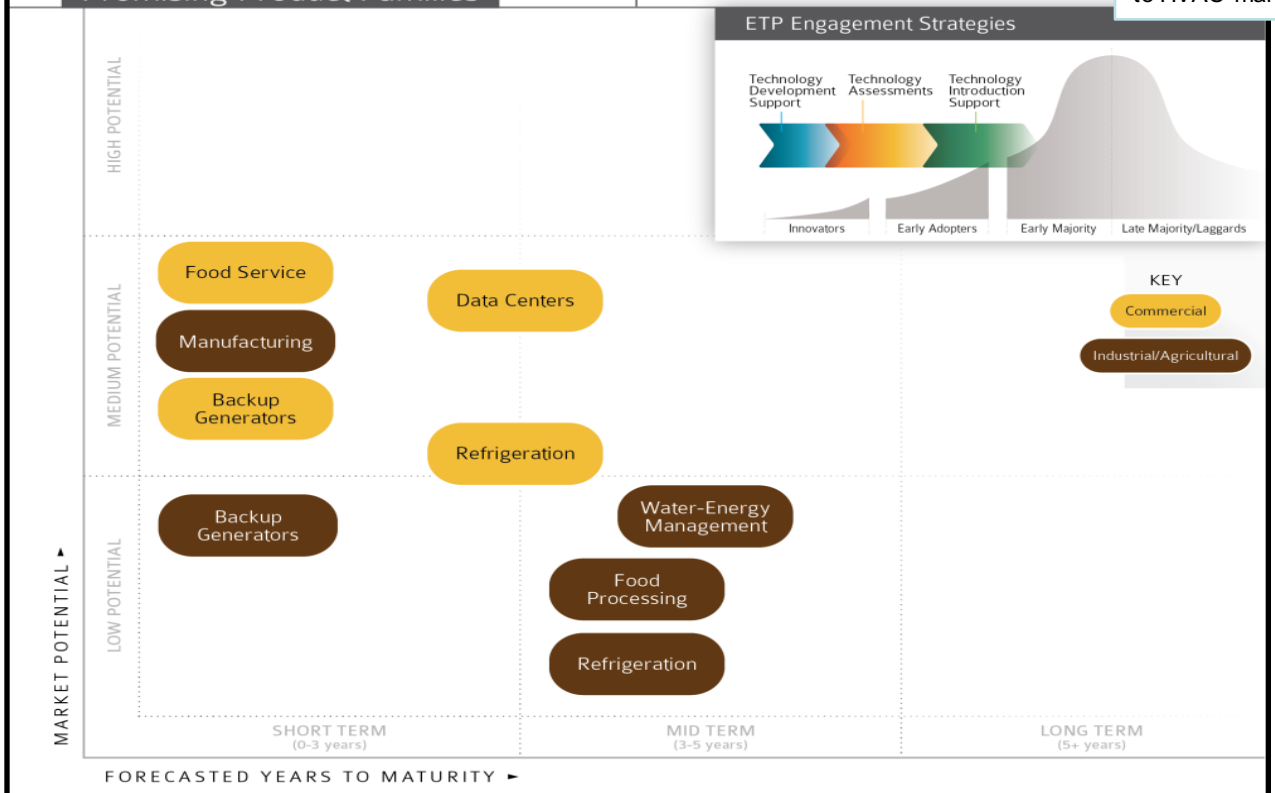
Gaps and Barriers

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

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

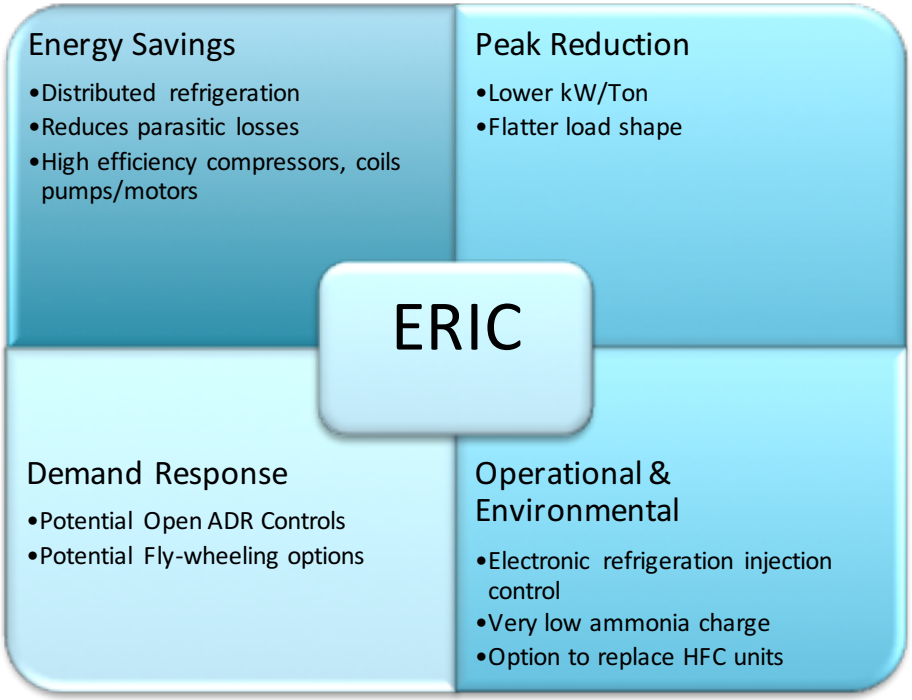
Vendors indicate secondary market that technology will expand to HVAC markets

Promising Product Families



Ultra Low Charge Ammonia 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 Demand
- 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

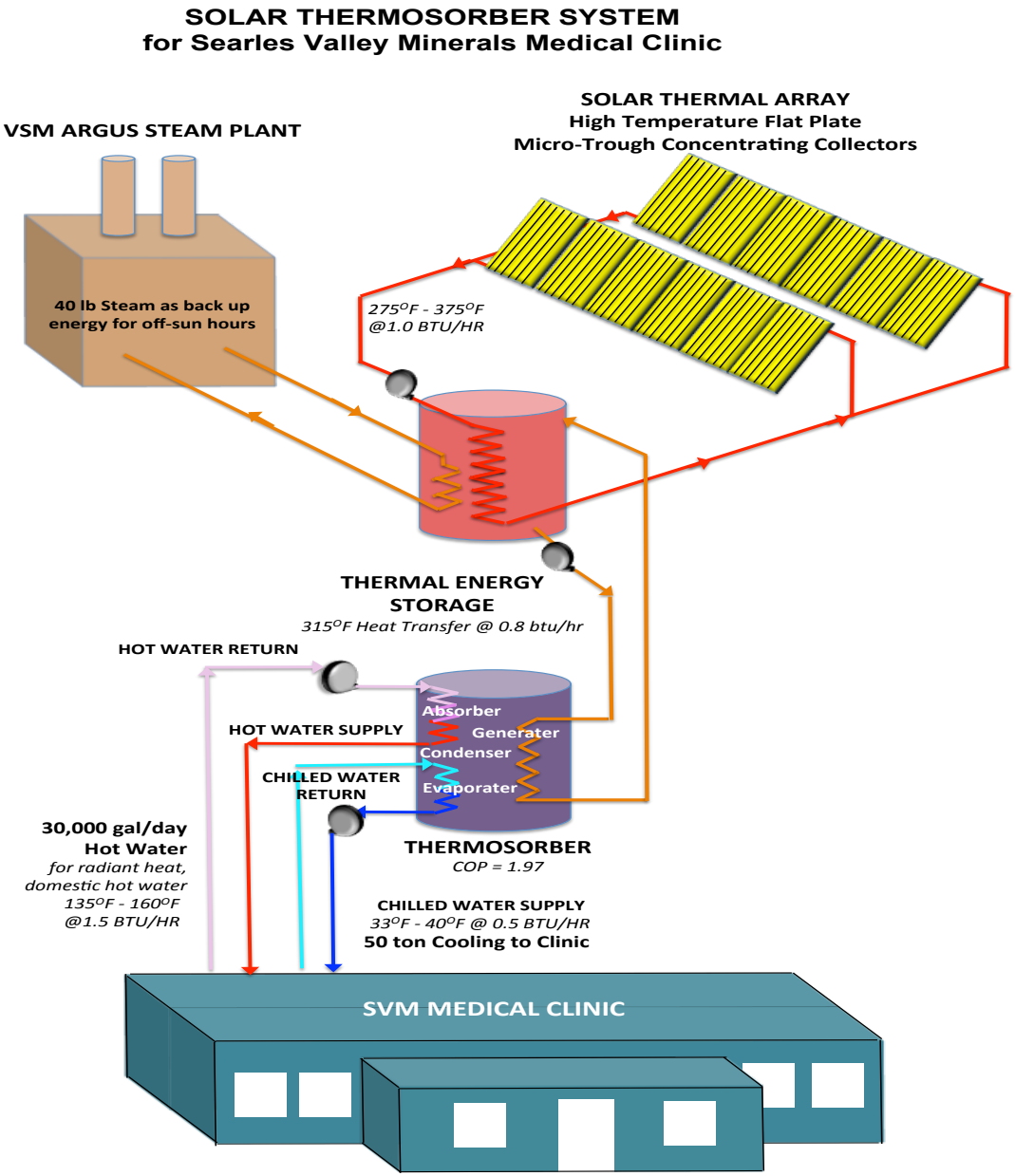


Preliminary results – annual savings about %14
Baseline average – 3.92 kW/ton
Ultra low charge technology - ~ 1.7 kW/ton

Taking a look at refrigerant alternatives….

- Working with EPRI on refrigerant alternatives
  - ✓ CO2 transcritical ambient temperature evaluation at labs in Knoxville
  - ✓ Packaged ammonia/CO2 chiller@ food processing plant in Irvine, CA
- Drop-in R-22 replacements
  - ✓ HFO – so far issues with seals and possibly txv in SCE TTC lab
  - ✓ Field test of blend for medium temp walk-in – Rancho Cucamonga, CA
- Self Contained Propane Display Cases
  - ✓ Lab evaluation of propane cases versus conventional
  - ✓ Potential to create tiered incentives based on increased efficiency levels
  - ✓ Testing to be completed Q3 2015
- Evaluation of Evapco low charge – low water consumption
- Evaluation of low charge Azane product – air cooled

Adjacent technologies….solar thermal absorption cooling & heating



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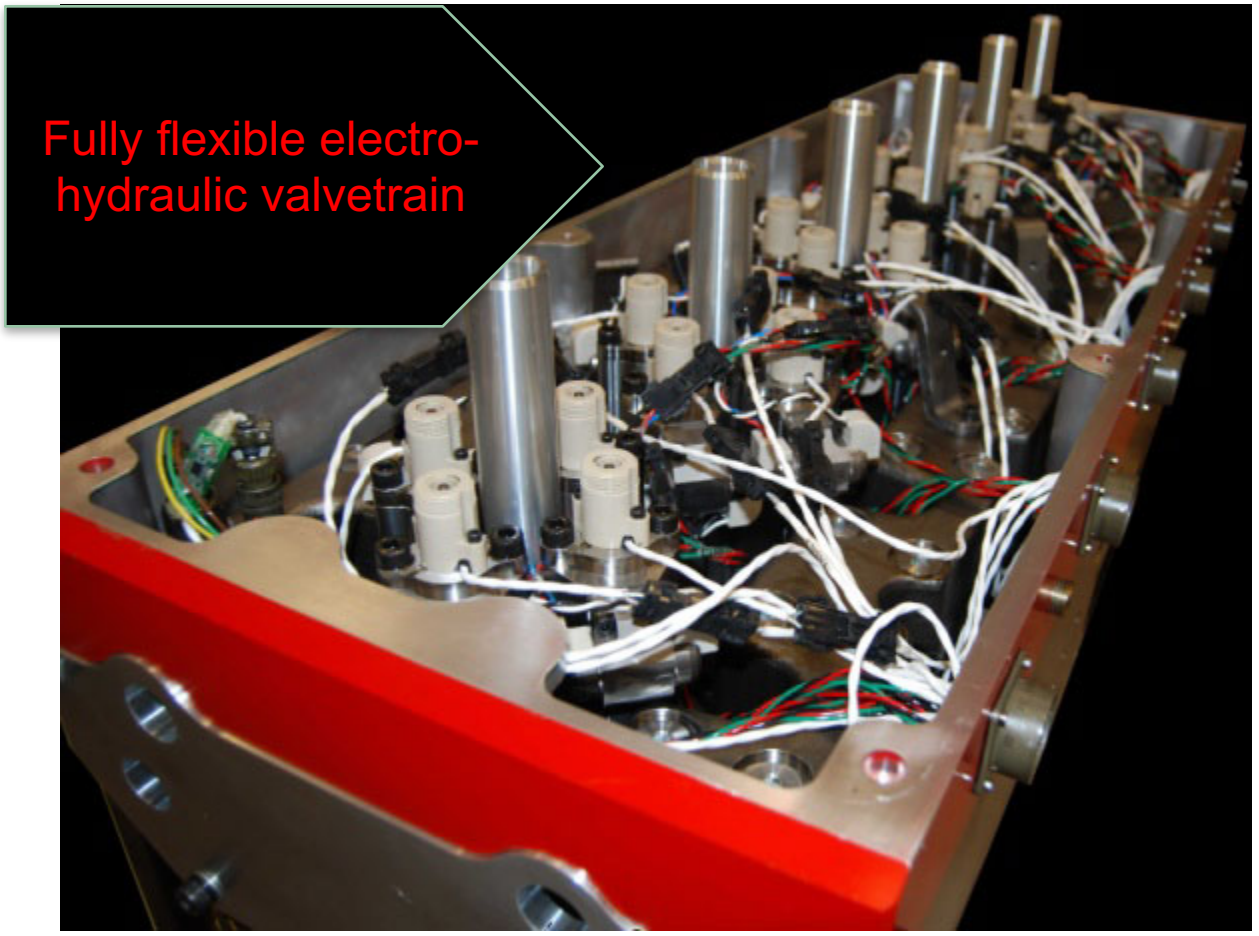
Adjacent technologies….Ammonia as a fuel



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