

ET Summit 2019

Presented by



Emerging Technologies and Future Incentives...

Three things to think about...

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Senior Engineer

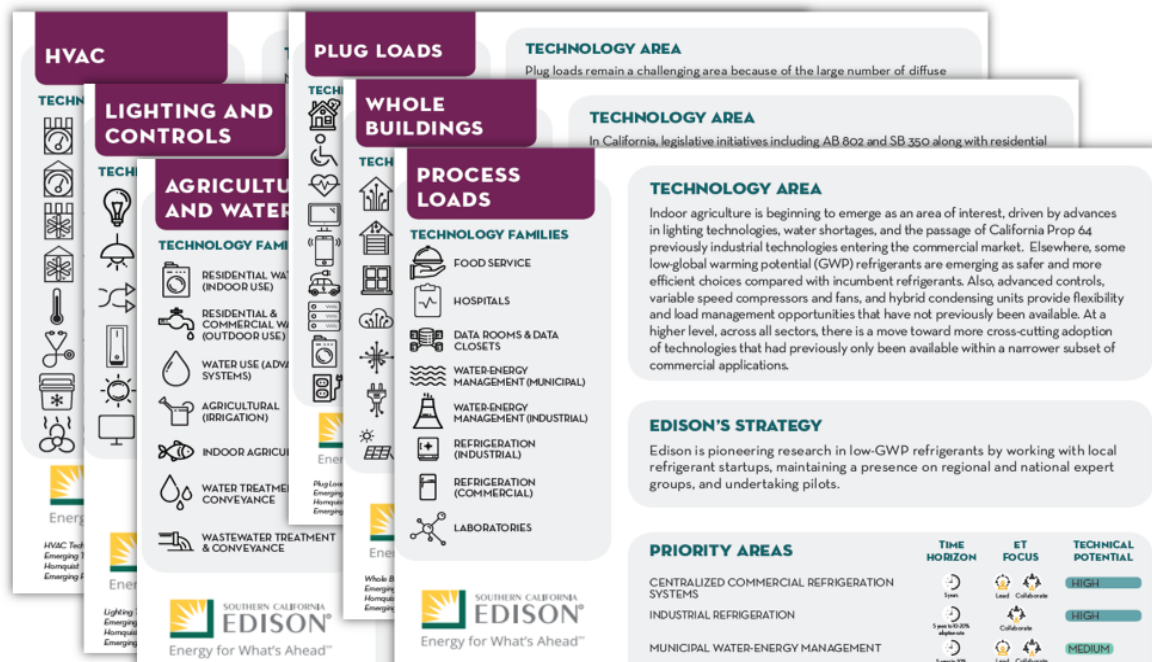
Southern California Edison

Need

- To create an outcome-based, long-term vision for Emerging Technology (ET) efforts at SCE

Goals

- Strategically guide SCE's ET research efforts in the most efficient manner over the next 10 years
- Align our ET focus with key SCE priorities such as GHG reduction
- Increase the effectiveness of SCE's development of new technologies into viable measures
- Optimize internal resources and identify opportunities for strategic partnerships



PROCESS LOADS

TECHNOLOGY FAMILIES



FOOD SERVICE



HOSPITALS



DATA ROOMS & DATA CLOSETS



WATER-ENERGY MANAGEMENT (MUNICIPAL)



WATER-ENERGY MANAGEMENT (INDUSTRIAL)



REFRIGERATION (INDUSTRIAL)



REFRIGERATION (COMMERCIAL)



LABORATORIES



SOUTHERN CALIFORNIA
EDISON

Energy for What's Ahead™

Process Loads Technical Area Lead: Paul Delaney
Emerging Technologies Program Manager: Edwin Hornquist
Emerging Products Senior Manager: Gary Barsley

TECHNOLOGY AREA

Indoor agriculture is beginning to emerge as an area of interest, driven by advances in lighting technologies, water shortages, and the passage of California Prop 64 previously industrial technologies entering the commercial market. Elsewhere, some low-global warming potential (GWP) refrigerants are emerging as safer and more efficient choices compared with incumbent refrigerants. Also, advanced controls, variable speed compressors and fans, and hybrid condensing units provide flexibility and load management opportunities that have not previously been available. At a higher level, across all sectors, there is a move toward more cross-cutting adoption of technologies that had previously only been available within a narrower subset of commercial applications.

EDISON'S STRATEGY

Edison is pioneering research in low-GWP refrigerants by working with local refrigerant startups, maintaining a presence on regional and national expert groups, and undertaking pilots.

PRIORITY AREAS

CENTRALIZED COMMERCIAL REFRIGERATION SYSTEMS

INDUSTRIAL REFRIGERATION

MUNICIPAL WATER-ENERGY MANAGEMENT

TIME HORIZON



5 years



5 years to 10-20% adoption



5 years to 10% adoption

ET FOCUS



Lead



Collaborate



Collaborate



Lead



Collaborate

TECHNICAL POTENTIAL

HIGH

HIGH

MEDIUM

SCE Emerging Products and Technologies...

- ET11SCE1200 Deep Energy Reduction Supermarket – ammonia/CO2
- ET13SCE1230 HVAC & Refrigeration Systems using Advanced Refrigerants – low charge ammonia/CO2
- ET13SCE7210 Electronic Refrigerant Injection Control- ultra-low charge ammonia packaged unit
- ET15SCE1030 Laboratory Assessment of Propane Type Horizontal Self-Contained Display Cases
- ET15SCE1040 New Alternative Refrigerants - HFO Study
- ET18SCE1161 Understanding and Optimizing Advanced Refrigeration Systems - CTS
- ET18SCE1141 Ultra Low Charge NH3 Packaged Refrigeration Technology – field assessment, commissioning
- ET18SCE7080 Modeling Tool Assessment for Low GWP Refrigerants for Supermarkets
- EPIC/EPRI Flexible Demand Response – Refrigerated Warehouse – central engine room, ammonia
- EPIC/EPRI Low charge ammonia/glycol for food processing (beverage) replacing R-22 and R-507A
- New/under development
 - ✓ ET19SCE1070 Refrigerated Warehouse/Plant Automated Energy Scheduling, Optimization and Control
 - ✓ Replacing R-22 refrigeration system for bakery with ammonia, integration with hot water/steam system

The Need for Incentives....

- *Custom Solution Codes*
- *Pay for Performance...NMEC*
- Deemed Solution Codes

Custom Solution Codes...

Solution Code	Solution Description	Technology	New Default PT
AC-10466	Optimize supply fan VFD - retrocommissioning	Controls	BRD-RVx
AC-11324	Under-floor air distribution with displacement ventilation - operational	Air Distribution Configuration	BRD-Op
AC-13304	Kitchen exhaust fan VFD - add-on equipment	Controls	AOE
AC-13643	Optimize carbon dioxide (CO2) demand control ventilation - retrocommissioning	Controls	AOE
AC-13705	Adjust on-re-fit fan belts - retrocommissioning	Fans	BRD-RVx
AC-13774	Condenser water reset - retrocommissioning	Cooling Tower	BRD-RVx
AC-13775	Cooling system tune-ups - retrocommissioning	Systems	BRD-RVx
AC-13760	Clean evaporator coils - retrocommissioning	Evaporators	BRD-RVx
AC-13761	Adjust refrigerant level - retrocommissioning	Systems	BRD-RVx
AC-13763	Fan static pressure reset - retrocommissioning	Controls	BRD-RVx
AC-13765	Repair cooling medium piping leaks - retrocommissioning	Piping	BRD-RVx
AC-13768	Economizer - air side - add-on equipment	Economizers	AOE
AC-13790	HVAC occupancy sensor - add-on equipment	Controls	AOE
AC-13792	Indirect evaporative cooling - dual stage - add-on equipment	Evaporative Coolers	AOE
AC-13793	Condenser fan - VFD - add-on equipment	Controls	AOE
AC-13794	HVAC occupancy sensor thermostat - add-on equipment	Controls	AOE
AC-13945	Optimize room temperature setpoints - retrocommissioning	Controls	BRD-RVx
AC-14061	Optimize HVAC system high volume low speed circulation fans - operational	Fans	BRD-Op
AC-14121	100% outside air to minimum outside air HVAC conversion - retrocommissioning	Controls	BRD-RVx
AC-14405	Optimize return fan VFD - retrocommissioning	Controls	BRD-RVx
AC-17354	Optimize fan static pressure controls - retrocommissioning	Controls	BRD-RVx
AC-18476	Optimize exhaust fan VFD - retrocommissioning	Controls	BRD-RVx
AC-18482	Direct evaporative pre-cooler for condensing units - add-on equipment	Evaporative Coolers	AOE
AC-18425	Central plant consolidation	Systems	NR
AC-18444	HVAC Time Clock Control - add-on equipment	Controls	AOE
AC-18764	Optimize VAV box flow - retrocommissioning	Controls	BRD-RVx
AC-18148	HVAC control loop tuning - retrocommissioning	Controls	BRD-RVx
AC-40380	Insulating cool air ducts - weatherization	Insulation	AOE
AC-43354	HVAC zone control - add-on equipment	Controls	AOE
AC-43357	Optimize zone set-up and setback - retrocommissioning	Controls	BRD-RVx
AC-43373	Optimize exhaust fan schedule - retrocommissioning	Controls	BRD-RVx
AC-43476	Optimize return fan schedule - retrocommissioning	Controls	BRD-RVx
AC-43483	Optimize sizing of cooling equipment - retrocommissioning	Controls	BRD-RVx
AC-56833	Economizer - Split DX System with VAV Controls - Add-on Equipment	Economizers	AOE
AC-57218	Optimize HVAC boiler sequencing - retrocommissioning	Boilers	BRD-RVx
AC-58487	Calibrate HVAC sensor - retrocommissioning	Sensor	BRD-RVx
AC-12687	Air Handling Unit (VAV only) 25 ton - Accelerated Replacement, To Standard Practice	Air Distribution	BRD-RVx
AC-59403	Recirculate HVAC condenser water system - retrocommissioning	Systems	BRD-RVx
AC-59491	Adjust supply air temperature reset - retrocommissioning	Controls	BRD-RVx
AC-59870	Optimize space static pressure controls - retrocommissioning	Systems	BRD-RVx
AC-60590	Variable air volume for fumehoods - add-on equipment	Controls	AOE
AC-60890	Optimize HVAC flow sensor - retrocommissioning	Sensor	BRD-RVx
AC-63488	Optimum start/stop EMS control - retrocommissioning	Controls	BRD-RVx
AC-63492	Optimize HVAC boiler schedule - retrocommissioning	Controls	BRD-RVx
AC-67564	Insulating chiller water pipes - weatherization	Insulation	AOE
AC-67630	Constant air volume to variable air volume conversions - retrocommissioning	Controls	BRD-RVx
AC-68473	Economizer - water side - add-on equipment	Economizers	AOE
AC-68894	Optimize HVAC water loop balancing - retrocommissioning	Systems	BRD-RVx
AC-69693	Removal or adjustment of inlet guide vanes for fans with VFDs - retrocommissioning	Controls	BRD-RVx
AC-70772	Evaporative precoolers - add-on equipment	Evaporative Coolers	AOE
AC-74884	Condenser water pump motor - VFD - add-on equipment	Controls	AOE
AC-75330	HVAC - energy management system (EMS) - add-on equipment	Controls	AOE
AC-75333	Optimize air handler controls - retrocommissioning	Controls	BRD-RVx
AC-77122	Ventilation fan - VFD - add-on equipment	Controls	AOE
AC-79531	HVAC compressor controls - add-on equipment	Controls	AOE
AC-79689	Revised supply fan schedule - retrocommissioning	Controls	BRD-RVx
AC-81711	Multiple fan array air handling system - operational	Fans	BRD-Op
AC-81843	Adjust condenser water reset - retrocommissioning	Controls	BRD-RVx
AC-82607	Optimize HVAC temperature sensor - retrocommissioning	Sensor	BRD-RVx
AC-82764	Optimize fan static pressure reset - retrocommissioning	Controls	BRD-RVx
AC-82767	Perform air balance - retrocommissioning	Air Distribution	BRD-RVx
AC-85653	Insulating refrigerant pipes - weatherization	Insulation	AOE
AC-89233	Optimize HVAC pressure setting - retrocommissioning	Controls	BRD-RVx
AC-89657	Optimize hot water reset - retrocommissioning	Controls	BRD-RVx
AC-89648	Reduced air change rate - Retrocommissioning	Controls	BRD-RVx
AC-89765	Optimize outdoor air intake - retrocommissioning	Controls	BRD-RVx
AC-89837	Ventilation thermostat controls - add-on equipment	Controls	AOE
AC-89804	Optimize hot water pump VFD - retrocommissioning	Controls	BRD-RVx
AC-89875	Insulating condenser pipes - weatherization	Insulation	AOE

BE-15812	Window film - weatherization	Window Film	BW
BE-60812	Building shell improvements - weatherization	Building Shell Improvements	BW
BE-73294	Efficient windows	Window	NR
ET-13358	Foodservice high density holding cabinet	Heating Cabinet	NR
ET-13796	Lighting controls - occupancy sensors - add-on equipment	Controls	AOE
ET-21244	4 foot LED T8 lamp UL type B tube - accelerated replacement, interior only	LED	AR
ET-21245	Interior LED menu board	LED	NR
ET-21278	Optimize lighting occupancy sensors - retrocommissioning	Lighting Controls	BRD-RVx
ET-36754	Optimize daylighting controls - retrocommissioning	Controls	BRD-RVx
ET-46294	Exterior LED advertisement sign/smart sign	LED	NR
ET-50267	Lighting controls - energy management system (EMS) - add-on equipment	Controls	AOE
ET-50676	Interior LED recessed surface and pendant mounted downlights	LED	NR
ET-74791	Day lighting systems with dimmable ballast - accelerated replacement	Controls	AOE
ET-75695	Reduce lighting schedule - retrocommissioning	Controls	BRD-RVx
ET-80833	Day lighting controls - add-on equipment	Controls	AOE
RF-40798	Optimize condenser water pump configuration - retrocommissioning	Systems	BRD-RVx
RF-41483	Efficient curing oven	Oven	NR
RF-79150	Low charge ammonia	Systems	AR
RF-80876	Overized air cooled condenser - accelerated replacement	Condenser	AR
RF-10217	Optimize refrigeration compressor controls - retrocommissioning	Controls	BRD-RVx
RF-10212	Optimize refrigeration pressure setting - retrocommissioning	Controls	BRD-RVx
RF-11254	High Efficiency Refrigerated Display Case	Display Cases	NR
RF-16294	High-speed cold storage doors	Doors	NR
RF-16299	Reduced load on refrigeration system (using cooling tower to partially offset load)	Systems	AOE
RF-18607	Refrigeration - energy management system (EMS) - add-on equipment	Controls	AOE
RF-18213	Overized evaporator - operational	Evaporators	BRD-Op
RF-18787	Efficient refrigeration - operational	Systems	BRD-Op
RF-18788	Reduce refrigeration valve leakage - retrocommissioning	Valve	BRD-RVx
RF-18803	Floating head pressure controls - add-on equipment	Controls	AOE
RF-18804	Strip curtains for walk-in boxes - low temp - add-on equipment	Strip Curtains	AOE
RF-18805	Rapid close doors for coolers - add-on equipment	Doors	AOE
RF-18806	Refrigerated case doors - add-on equipment	Doors	AOE
RF-18807	Floating suction pressure controls - add-on equipment	Controls	AOE
RF-18808	Evaporator coil fan control (optional) - add-on equipment	Controls	AOE
RF-18809	Strip curtains for walk-in boxes - med temp - add-on equipment	Strip Curtains	AOE
RF-18810	Insulate bare suction pipes - add-on equipment	Insulation	AOE
RF-18811	Rapid close doors for freezers - add-on equipment	Doors	AOE
RF-20229	Low GWP Refrigerant Replacements for Refrigeration	Multiple Refrigeration	AOE
RF-20424	Insulating storage tanks - add-on equipment	Insulation	AOE
RF-20963	Optimize refrigeration pump VFD - retrocommissioning	Controls	BRD-RVx
RF-21441	Condenser fan - VFD - add-on equipment	Multiple Refrigeration	AOE
RF-21451	VFD on evaporator coil fan - new	Evaporators	NR
RF-20173	Single stage system to two stage refrigeration system conversion (industrial and commercial)	Refrigeration	NR
RF-20774	Subcooling refrigeration controls - add-on equipment	Controls	NR
RF-43876	Defrost controls - add-on equipment	Controls	AOE
RF-48863	Efficient refrigeration condensing unit	Condensing Unit	NR
RF-51019	Overized evaporator-cooled condenser	Condenser	NR
RF-53880	Optimize refrigeration control loop tuning - retrocommissioning	Controls	BRD-RVx
RF-57763	Indirect to direct evaporative refrigeration system conversion	Systems	NR
RF-58475	Optimize refrigeration pressure sensor - retrocommissioning	Sensor	BRD-RVx
RF-58724	Refrigeration liquid receiver capacity optimization - retrocommissioning	Liquid Receiver	BRD-RVx
RF-61785	Refrigeration fan retrofit	Fans	NR
RF-63403	Optimize refrigeration defrost control - retrocommissioning	Controls	NR
RF-63700	Efficient refrigeration compressors - add-on equipment	Compressor	AOE
RF-67381	Low temperature reach-in door - anti fog film - add-on equipment	Doors	AOE
RF-68754	Refrigeration valve processing system	Systems	NR
RF-68793	Optimize refrigeration temperature setpoints - retrocommissioning	Controls	NR
RF-70693	Optimize refrigeration floating head pressure controls - retrocommissioning	Controls	BRD-RVx
RF-72638	Calibrate refrigeration sensor - retrocommissioning	Sensor	BRD-RVx
RF-72994	Compressor sequencing (industrial and commercial refrigeration) - retrocommissioning	Compressor	BRD-RVx
RF-73143	Refrigeration system retrofit	Multiple Refrigeration	NR
RF-75593	Optimize refrigeration temperature sensor - retrocommissioning	Sensor	BRD-RVx
RF-79521	Refrigeration compressor controls - add-on equipment	Controls	AOE
RF-79695	Insulating refrigeration lines - add-on equipment	Insulation	AOE
RF-80493	Optimize refrigeration flow sensor - retrocommissioning	Sensor	BRD-RVx
RF-80748	Air curtains	Strip Curtains	AOE
RF-87644	Evaporator coil fan - VFD - add-on equipment	Controls	AOE
RF-89043	Optimize refrigeration evaporator fan controls - retrocommissioning	Controls	BRD-RVx
RF-89331	High curtains - add-on equipment	Strip Curtains	AOE
UW-43372	HVAC package system with heat recovery unit supplying heat to domestic hot water	Heat Recovery	AOE

Commercial NMEC Design

Baseline Model Acceptance Criteria

Criteria 1: NDBE < 0.005%

Criteria 2: CV(RMSE) < 25%

*Criteria 3: $\Delta E_{save} / E_{save} < 50\%$ at 68% confidence**

Design Element	Explanation
Performance Payment Tool	<ul style="list-style-type: none">per kWh reduced during the study
Performance Payment Amount	<ul style="list-style-type: none">\$0.08/kwh in 1st year and \$150/kw. Persistent performance Payment is \$0.01 for 2nd and 3rd year
Performance Payment Frequency	<ul style="list-style-type: none">Total of 4 installments- Twice during 12 months study based on performance, later once per year as perform

Measure List

EEM-#	Description	Estimated Savings, kWh/year	Estimated Cost
1	Install sales floor LED lighting with daylight controls	85,000	\$120,000
2	Install VFDs on Selected Compressors	40,000	\$30,000
3	Install Electronic Evaporator Pressure Regulator	35,000	\$35,000
4	Install Pre-Coolers on Air Cooled Condensers	40,000	\$25,000
5	Install Electronic TXVs in Refrigerated Cases	25,000	\$50,000
Total		225,000	\$260,000
Annual Use (kWh)		1,550,000	
% savings expected		14.5	

Expected and Actual Savings Are Tracking Closely After 4 Months

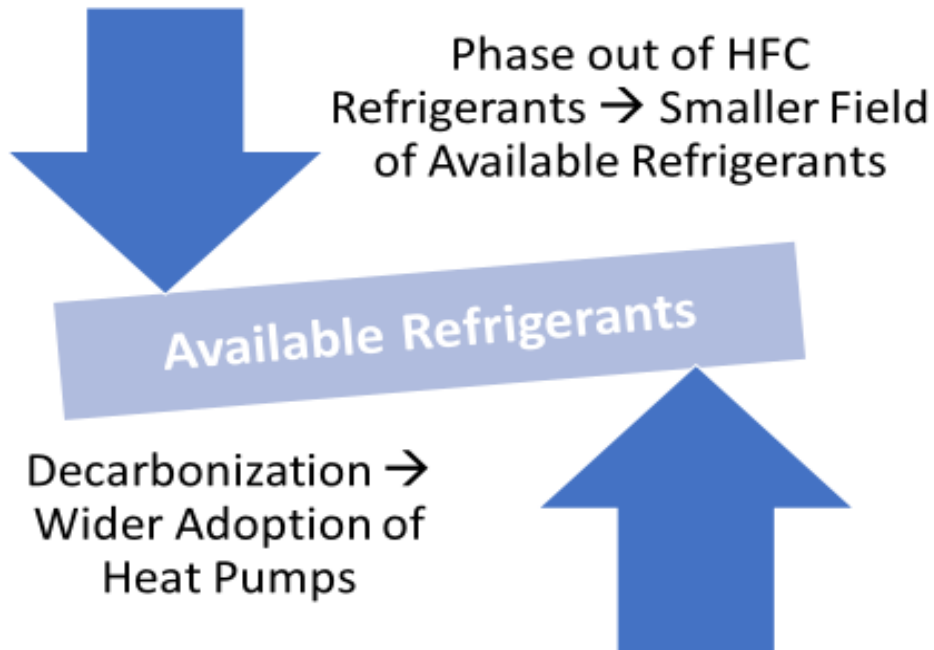


Feedback from Customer –

- 1) Quick turnaround to review and approve project scope of work
- 2) Eliminates time consuming preparation of energy savings calculations & formulas
- 3) More freedom to install any energy efficiency measure
- 4) Incentives based on true project performance
- 5) Larger incentives compared with traditional Edison programs
 - 1) Which allows company to do more projects.

Trends in Collision?

Desire to Reduce GHG Emissions on two fronts



Electrification!



The opportunities ahead...

- ✓ Energy Efficiency incentives
- ✓ GWP reduction incentives
- ✓ End-user awareness and education!

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