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Emerging Technologies and Future Incentives...

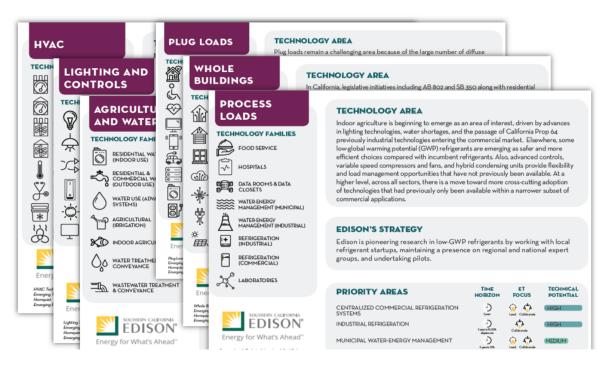
Three things to think about...

Paul Delaney
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





HOSPITALS



DATA ROOMS & DATA



WATER-ENERGY WATER-ENERGY
MANAGEMENT (MUNICIPAL)



WATER-ENERGY MANAGEMENT (INDUSTRIAL)



REFRIGERATION (INDUSTRIAL)



REFRIGERATION (COMMERCIAL)



LABORATORIES



Energy for What's Ahead"

Process Loads Technical Area Lead: Paul Delaney Emerging Technologies Program Manager Edwin 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

ET







FOCUS





TECHNICAL

POTENTIAL





MEDIUM

SCE Process Loads Technology Priority Map - Page 1 of 5



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....

		Technology	New Default PT
AC-10166		Controls	BRO-RCx
AC-11324	Under-floor air distribution with displacement ventilation - operational	Air distribution Configuration	вко-ор
AC-19384	Kitchen exhaust fan - VFD - add-on equipment	Controls	AOE
AC-19642 AC-19755		Controls	BRO-RCx BRO-RCx
	Adjust or re-fit fan belts - retrocommissioning	Fans	BRO-RCX
		Cooling Tower	BRO-RCX
AC-19760	Cooling system tune-ups - retrocommissioning Clean evaporator coils - retrocommissioning	Systems Evaporators	BRO-RCV
AC-19761		Evaporators Systems	BRO-RCV
AC-19763	Fan static pressure reset - retrocommissioning	Controls	BRO-RCx
AC-19765		Piping	BRO-RCx
AC-19789		Economizers	AOE
AC-19790		Controls	AOE
AC-19792		Evaporative Coolers	AOE
AC-19793	Condenser fan - VFD - add-on equipment	Controls	AOE
AC-19794	HVAC occupancy sensor thermostat - add-on equipment	Controls	AOE
AC-19845	Optimize room temperature setpoints - retrocommissioning	Controls	BRO-RCx
AC-21061	Optimize HVAC system high volume low speed circulation fans - operational	Fans	BRO-Op
AC-21212		Controls	BRO-RCx
AC-24436	Optimize return fan VFD - retrocommissioning	Controls	BRO-RCx
AC-27534	Optimize fan static pressure controls - retrocommissioning	Controls	BRO-RCx
AC-28476	Optimize exhaust fan VFD - retrocommissioning	Controls	BRO-RCx
AC-32882 AC-34251		Evaporative Coolers	AOE NR
AC-34251 AC-35444		Systems	ADE
AC-37684		Controls	BRO-RCx
AC-38143		Controls Controls	BRO-RCX
AC-40390		Insulation	RW RW
AC-43654		Controls	AOF
AC-48587		Controls	BRO-RCx
	Optimize exhaust fan schedule - retrocommissioning	Controls	BRO-RCx
AC-56476	Optimize return fan schedule - retrocommissioning	Controls	BRO-RCx
AC-56543		Systems	BRO-RCx
AC-56832	Economizer - Split DX System with VAV controls - Add-on Equipment	Economizers	AOE
AC-57213		Boilers	BRO-RCx
AC-58687	Calibrate HVAC sensor - retrocommissioning	Sensor	BRO-RCx
AC-20867		Air Distribution	AR
AC-59408	Reconfigure HVAC condenser water system - retrocommissioning	Systems	BRO-RCx
AC-59491	Adjust supply air temperature reset - retrocommissioning	Controls	BRO-RCx
AC-59870	Optimize space static pressure controls - retrocommissioning	Systems	BRO-RCx
AC-60598	Variable air volume for fumehoods - add-on equipment	Controls	AOE
AC-60890	Optimize HVAC flow sensor - retrocommissioning	Sensor	BRO-RCx
AC-64388 AC-65342	Optimum start/stop EMS control - retrocommissioning	Controls	BRO-RCx BRO-RCx
AC-65342 AC-67504		Controls	BRO-RCX
AC-67584 AC-68030		Insulation	BRO-BCY
AC-68473	Constant air volume to variable air volume conversions - retrocommissioning Economizer - water side - add-on equipment	Controls Economizers	AOE
AC-68894			BRO-RCx
		Systems	BRO-RCV
AC-69902			
AC-69803 AC-70772		Systems Europerative Confess	
AC-70772	Evaporative precoolers - add-on equipment	Evaporative Coolers	AOE AOE
	Evaporative precoolers - add-on equipment Condenser water pump motor - VFD - add-on equipment	Evaporative Coolers Controls	AOE
AC-70772 AC-74984	Evaporative precoolers - add-on equipment Condenser water pump motor - VFD - add-on equipment HVAC - energy management system (EMS) - add-on Equipment	Evaporative Coolers Controls Controls	AOE AOE
AC-70772 AC-74984 AC-75930	Evaporative precoolers - add-on equipment Condenser water pump motor - VFD - add-on equipment HVAC - energy management system (EMS) - add-on Equipment Optimize air handler controls - retrocommissioning	Evaporative Coolers Controls Controls Controls	AOE AOE AOE
AC-70772 AC-74984 AC-75930 AC-78325	Evaporative precoclers - add-on equipment Condenser water pump motor - VFD - add-on equipment HYAC - energy management system (EMS) - add-on Equipment Optimize air handler controls - retrocommissioning Ventilation fan - VFD - add-on equipment	Evaporative Coolers Controls Controls Controls Controls Controls	AOE AOE AOE BRO-RCx
AC-70772 AC-74984 AC-75930 AC-78325 AC-78722	Evaporative precoolers - add-on equipment Condenser water pump motor - VFD - add-on equipment HVAC - energy management system (EMS) - add-on Equipment Optimize air handler controls - retrocommissioning	Evaporative Coolers Controls Controls Controls	AOE AOE AOE BRO-RCx AOE
AC-70772 AC-74984 AC-75930 AC-78325 AC-78722 AC-79531	Exporative precoders - add on equipment Condenser water num motor - VMD - add on equipment HVAC - energy management system (EMS) - add-on Equipment Optimize air handler controls - retrocommissioning Vertilation fan - VVD - add-on equipment HVAC compressor controls - add-on equipment RVAC compressor controls - add-on equipment RVAC compressor controls - add-on equipment	Evaporative Coolers Controls Controls Controls Controls Controls Controls Controls	AOE AOE AOE BRO-RCX AOE AOE
AC-70772 AC-74984 AC-75930 AC-78325 AC-78722 AC-79531 AC-79695	Exporative precoders - add-on equipment Condenser water pum portor - VIPD - add-on equipment HMAC - energy management system (8M5) - add-on Equipment Optimize air handler controls - retrocommissioning Ventilation fan - VFD - add-on equipment HMAC compressor controls - add-on equipment	Evaporative Coolers Controls Controls Controls Controls Controls Controls Controls Controls	AOE AOE BRO-RCX AOE AOE BRO-RCX
AC-70772 AC-74984 AC-75930 AC-78325 AC-78722 AC-79531 AC-79695 AC-81711 AC-84943 AC-85607	Expositive precoders - add on equipment Condenser water pum protes - VED - add on equipment HMAC - energy management aystem (EMS) - add-on Equipment HMAC - energy management aystem (EMS) - add-on Equipment Quential air handler controls - retrocommissioning Ventilation fan - VED - add-on equipment Hevise supply fan schedule - retrocommissioning Multiple fan array in handling system - operational	Evaporative Coolers Controls Controls Controls Controls Controls Controls Controls Fans	AOE AOE BRO-RCX AOE BRO-RCX BRO-RCX BRO-RCX BRO-RCX BRO-RCX BRO-RCX
AC-70772 AC-74984 AC-75930 AC-78325 AC-78722 AC-79531 AC-79695 AC-81711 AC-84943 AC-85607 AC-86734	Exporative preceders - add on equipment Condenser water pum moter - VED - add on equipment HMAC - energy management system (EMS) - add-on Equipment HMAC - energy management system (EMS) - add-on Equipment Optimize air handle controls - restoromissioning Verification fan - VED - add-on equipment HMAC compressor centrols - add-on equipment Revies august fan orteidule - retrocommissioning Algulic condenser water reset - retrocommissioning Optimize HMAC temperature sensor - retrocommissioning Optimize fan statel greasure reset - retrocommissioning	Evaporative Coolers Controls Controls Controls Controls Controls Controls Controls Controls Controls Fana Controls Sensor Controls Controls Controls Controls Controls	AOE AOE BRO-RCX AOE BRO-RCX BRO-RCX BRO-RCX BRO-RCX BRO-RCX BRO-RCX BRO-RCX BRO-RCX BRO-RCX
AC-70772 AC-74984 AC-75930 AC-78325 AC-78722 AC-79531 AC-79695 AC-81711 AC-84943 AC-85607 AC-86734 AC-87967	Expositive precoders - add on equipment Condenser water pum prote > VPD - add on equipment HMAC - energy management aytem (EMS) - add-on Equipment HMAC energy management aytem (EMS) - add-on Equipment Quentials air handler controls - attraction missioning Ventilation fan - VPD - add-on equipment Revise supply fan schedule - retrocommissioning Multiple fan array in handling system - operational Adjust condenser water reset - retrocommissioning Optimise HMAC emperature sensor - retrocommissioning	Evaporative Coolers Controls Sensor	AOE AOE BRO-RCX AOE BRO-RCX
AC-70772 AC-74984 AC-75930 AC-78325 AC-78722 AC-79531 AC-9695 AC-81711 AC-84943 AC-85067 AC-86734 AC-87967 AC-89065	Exporative preceders - add on equipment Condenser water pum motor - VID - 3 did on equipment HMAC - energy management system (EMS) - add-on Equipment HMAC energy management system (EMS) - add-on Equipment Quential air handle controls - retrocommissioning Ventilation fan - VID - add-on equipment HAC compressor entrols - add-on equipment Revise supply fan scheduler - retrocommissioning Multiple fan array is handling systems - operations Multiple fan array is handling systems - operations Gutimiter HAC temperature sensor - retrocommissioning Optimiter fan state pressure rests - retrocommissioning Perform air balance - retrocommissioning Including refiseperature place - retrocommissioning	Evaporative Coolers Controls Aran Controls Genore Controls Aran Controls Ara	AOE AOE AOE AOE AOE AOE AOE AOE BRO-RCX
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AC-70772 AC-74984 AC-75930 AC-78325 AC-78325 AC-78722 AC-79531 AC-81711 AC-84943 AC-85607 AC-8734 AC-89965 AC-9965 AC-9965 AC-99657	Exporative precoders - add on equipment Condenser water pum motor - VPD - add on equipment HMAC - energy management system (EMS) - add-on Equipment HMAC energy management system (EMS) - add-on Equipment Opinities air handles controls - restoroum/sissioning Versitation fan - VPD - add on equipment HMAC compressor controls - add-on equipment Revise supply fan schedule - retrocommissioning Multiple fan anys by handling systems - episonial Multiple fan anys by handling systems - retrocommissioning Adjust condenser water reset: - retrocommissioning Opinities fan state pressure seater - retrocommissioning Perform air balance - retrocommissioning Including retriepers pressure seater - retrocommissioning Opinities fan state in piese - weatheringston Opinities HMAC pressure seating - retrocommissioning Opinities HMAC pressure seating - retrocommissioning Opinities have state reset - retrocommissioning	Evaporative Coolers Controls Ar Distribution Insulation Controls	AOE AOE AOE BRO-RCX AOE BRO-RCX
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AC-70772 AC-74984 AC-79390 AC-78325 AC-78325 AC-79531 AC-97855 AC-97856 AC-87967 AC-8774 AC-8794 AC-8794 AC-89657 AC-89657 AC-89657 AC-89657 AC-89657 AC-89657 AC-89657 AC-89657 AC-89657 AC-89657 AC-89657 AC-89657 AC-89657 AC-89678 AC-89678 AC-89678	Exporative precoders - add on equipment Condenser water pum motor - VPD - add on equipment HMAC - energy management system (EMS) - add-on Equipment HMAC energy management system (EMS) - add-on Equipment Opinities air handler controls - restorounisationing Ventilation fan - VFD - add-on equipment HMAC compressor controls - add-on equipment Revise supply fan schedule - retrocommissioning Multiple fan anysi by handling systems - retrocommissioning Adjust condenser water reset - retrocommissioning Opinities HMAC entrepe state sensor - retrocommissioning Perform air haldings - retrocommissioning Perform air haldings - retrocommissioning Opinities HMAC entrepe state sensor - retrocommissioning Opinities HMAC pressure acting - retrocommissioning Opinities HMAC pressure acting - retrocommissioning Reduced air change rate - fettocommissioning Opinities and reset in retails - retrocommissioning Opinities and reset in retails - retrocommissioning	Evaporative Coolers Controls Are Destrous Are Destrous Controls	AOE AOE AOE BRO-RCX AOE BRO-RCX BRO-DP BRO-RCX
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BE-19812	Window film - weatherization	Window Film	BW
BE-60912	Building shell improvements - weatherization	Building Shell Improvements	BW
BE-78594	Efficient windows	Window	NR
FS-19589	Foodservice high density holding cabinet	Holding Cabinet	NR
LT-19796	Lighting controls - occupancy sensors - add-on equipment	Controls	AOE
LT-21354	4 foot LED T8 lamp UL type B tube - accelerated replacement, interior only	LED	AR
LT-23143	Interior LED menu board	LED	NR.
LT-23876	Optimize lighting occupancy sensors - retrocommissioning	Lighting Controls	BRO-RCx
LT-36754		Controls	BRO-RCX
	Optimize daylighting controls - retrocommissioning	LFD.	
LT-46594	Exterior LED advertisement sign/smart sign		NR
LT-50567	Lighting controls - energy management system (EMS) - add-on equipment	Controls	AOE
LT-58676	Interior LED recessed surface and pendant mounted downlights	LED	NR
LT-74751	Day lighting systems with dimmable ballast - accelerated replacement	Controls	AR
LT-79695	Reduce lighting schedule - retrocommissioning	Controls	BRO-RCx
LT-90853	Day lighting controls - add-on equipment	Controls	AOE
PM-60798	Optimize condenser water pump configuration - retrocommissioning	Systems	BRO-RCx
PR-67492	Efficient curing ovens	Oven	NR.
RF-79158	Low charge ammonia	Systems	AR
RF-90876	Oversized air cooled condenser - accelerated replacement	Condenser	AR
RF-10217	Optimize refrigeration compressor controls - retrocommissioning	Controls	BRO-RCx
RF-10512	Optimize refrigeration pressure setting - retrocommissioning	Controls	BRO-RCx
RF-12524	High Efficiency Refrigerated Display Case	Display Cases	NR.
RF-16294		Doors Doors	NR NR
	High-speed cold storage doors		
RF-16859	Reduced load on refrigeration system (using cooling tower to partially offset loa		AOE
RF-18607	Refrigeration - energy management system (EMS) - add-on equipment	Controls	AOE
RF-19213	Oversized evaporators - operational	Evaporators	BRO-Op
RF-19787	Efficient refrigeration - operational	Systems	BRO-Op
RF-19788	Reduce refrigeration valve leakage - retrocommissioning	Valve	BRO-RCx
RF-19803	Floating head pressure controls - add-on equipment	Controls	AOE
RF-19804	Strip curtains for walk-in boxes - low temp - add-on equipment	Strip Curtains	AOE
RF-19805	Rapid close doors for coolers - add-on equipment	Doors	AOE
RF-19806	Refrigerated case doors - add-on equipment	Doors	AOE
RF-19807	Floating suction pressure controls - add-on equipment	Controls	AOE
RF-19808	Evaporator coil fan control (cycling) - add-on equipment	Controls	AGE
RF-19809	Strip curtains for walk-in boxes - med temp - add-on equipment	Strip Curtains	AGE
RF-19810	Insulate bare suction pipes - add-on equipment		AGE
		Insulation	
RF-19811	Rapid close doors for freezers - add-on equipment	Doors	AOE
RF-20293	Low GWP Refrigerant Replacements for Refrigeration	Multiple Refrigeration	NR
RF-20654	Insulating storage tanks - add-on equipment	Insulation	AOE
RF-20963		Controls	
	Optimize refrigeration pump VFD - retrocommissioning		BRO-RCx
RF-21441	Condenser fan - VFD - add-on equipment	Multiple Refrigeration	AOE
RF-21451	Condenser fan - VFD - add-on equipment VFD on evaporator coil fan - new	Multiple Refrigeration Evaporators	AOE NR
RF-21441 RF-21451 RF-28375	Condenser fan - VFD - add-on equipment	Multiple Refrigeration Evaporators	AOE
RF-21451 RF-28375	Condenser fan - VFD - add-on equipment VFD on evaporator coil fan - new	Multiple Refrigeration Evaporators	AOE NR NR AOE
RF-21451 RF-28375 RF-28734	Condenser fan - VFD - add-on equipment VFD on evaporator coil fan - new Single stage system to two stage refrigeration system conversion (industrial and Subcooling refrigeration controls - add-on equipment	Multiple Refrigeration Evaporators Systems Controls	AOE NR NR AOE
RF-21451 RF-28375 RF-28734 RF-43876	Condenser fan - VFD - add'on equipment VFD on evaporator coil fan - new Single stage i system to two stage refrigeration system conversion (industrial and Subcooling refrigeration controls - add-on equipment Defrost controls - add-on equipment	Multiple Refrigeration Evaporators Systems	AGE NR NR
RF-21451 RF-28375 RF-28734 RF-43876 RF-49983	Condenser fan 'VFD - add-on equipment VFD on evaporater coil fan - new Single stage system to two stage refrigeration system conversion (industrial and Subcooling refrigeration controls - add-on equipment Efficient refrigeration condensing unit	Multiple Refrigeration Evaporators Systems Controls Controls Condensing Unit	AOE NR NR AOE AOE
RF-21451 RF-28375 RF-28734 RF-43876 RF-49983 RF-53109	Condenser fan - VFD - add-on equipment VFD en exaportrool fan - new Single stage system to two stage refrigeration system conversion (industrial and Subcooling refrigeration controls - add-on equipment Defrost controls - add-on equipment Efficient refrigeration condensing unit Oversized evaporative cooled condenser	Multiple Refrigeration Evaporators Systems Controls Controls Condensing Unit Condenser	AOE NR NR AOE AOE NR
RF-21451 RF-28375 RF-28734 RF-43876 RF-49983 RF-53109 RF-53890	Condenser fan - VFD - add-on equipment VFD on enaporation offin - new Single stage system to two stage refrigeration system conversion (industrial and Single stage system to two stage refrigeration exprove) - add-on equipment Effection controls - add-on equipment Efficient refrigeration controls - add-on equipment Oversized e supportative cooled condenser Opening enfergeration control loop tuning - retrocommissioning	Multiple Refrigeration Evaporators Systems Controls Controls Condensing Unit Condenser Controls	AOE NR NR AOE AOE
RF-21451 RF-28375 RF-28734 RF-43876 RF-49983 RF-53109 RF-53890 RF-57763	Condenser fan - VFD - add-on equipment VFD on enaportoor loff an new VFD on enaportoor loff an new Single stage system to two stage refrigeration system conversion (industrial and Subcooling refrigeration controls - add-on equipment Defrost controls - add-on equipment Efficient refrigeration condensing unit Operation of the control of	Multiple Refrigeration Evaporators Systems Controls Controls Condensing Unit Condenser Controls Systems Systems	AOE NR NR AOE AOE NR AR BRO-RCX NR
RF-21451 RF-28375 RF-28734 RF-48876 RF-49983 RF-53109 RF-53890 RF-57763 RF-58475	Condenser fan - VFD - add-on equipment VFD on exappartoe oli fan - new Single stage system to two stage refrigeration system conversion (industrial and Single stage system to two stage refrigeration system conversion (industrial and Subcooling refrigeration controls - add-on equipment Efficient refrigeration condensing unit Oversized evaporative cooled condenser Opinible refrigeration control loop stuming - retrocommissioning Indirect to direct evaporative refrigeration system conversion Opinible refrigeration pressure sensor - retrocommissioning	Multiple Refrigeration Evaporators Systems Controls Controls Condensing Unit Condenser Controls Systems Sensor	AOE NR NR AOE AOE AOE NR BRO-RCX NR BRO-RCX
RF-21451 RF-28375 RF-28734 RF-43876 RF-49983 RF-53109 RF-53890 RF-57763 RF-58475 RF-58724	Condenser fan - VFD - ado-n equipment VFD en exapporteo life n- reu Single stage system to two stage reffigeration system conversion (industrial and Single stage system to two stage reffigeration system conversion (industrial and Subcooling reffigeration controls - add-on equipment Efficient reffigeration controls - add-on equipment Efficient reffigeration controls on the controls - add-on equipment Optimize reffigeration control loop tuning - retrocommissioning Indirect to direct expansible reffigeration system convention Optimize reffigeration pressure sensor - retrocommissioning Refigeration (put receive capacity polimization - retrocommissioning)	Multiple Refrigeration Evaporators Systems Controls Controls Condensing Unit Condenser Controls Systems Sensor Liquid Receiver	AOE NR NR AOE AOE AOE NR AR BRO-RCX NR BRO-RCX BRO-RCX
RF-21451 RF-28375 RF-28734 RF-43876 RF-49983 RF-53109 RF-57763 RF-58475 RF-58724 RF-63798	Condenser fan - VFD - add-on equipment VFD on exappartoe olf fan - new Single stage system to two stage refrigeration system conversion (industrial and Single stage system to two stage refrigeration system conversion (industrial and Subcooling refrigeration controls - add-on equipment Efficient refrigeration condensing unit Oversized exappartive cooled condenser Optimize refrigeration control loop tuning - retrocommissioning Indirect to direct exappartive refrigeration system conversion Optimize refrigeration (psycle receiver apach) optimization - retrocommissioning Refrigeration Inquid receiver apach) optimization - retrocommissioning Refrigeration Inquid receiver apach) optimization - retrocommissioning Refrigeration Inquid receiver apach) optimization - retrocommissioning	Multiple Refrigeration Exaporators Systems Controls Controls Controls Condensing Unit Condensing Condensing Systems Systems Liquid Receiver Fans	AOE NR NR AOE AOE NR AR BRO-RCX NR BRO-RCX NR BRO-RCX NR RO-RCX
RF-21451 RF-28375 RF-28734 RF-43876 RF-49983 RF-53109 RF-53890 RF-5763 RF-58475 RF-58724 RF-63798 RF-65403	Condenser fan - VFD - ado-n equipment VFD en expaprente oor lên - new Single stage system to two stage refrigeration system conversion (industrial and Single stage system to two stage refrigeration system conversion (industrial and Subcooling refrigeration controls - add-on equipment Efficient refrigeration controls - add-on equipment Efficient refrigeration condensing unit Oversized expostrative cooled condenser Quinties refrigeration control logs but notes a primer commercion Optimize refrigeration control logs but notes a primer commercion Optimize refrigeration pressure sensor - retrocommissioning Refrigeration (april receiver capacity optimization - retrocommissioning Refrigeration fair cereiver capacity optimization - retrocommissioning Optimize refrigeration defenso control - retrocommissioning	Multiple Refrigeration Evaporators Systems Controls Controls Condensing Unit Condenser Controls Systems Sensor Liquid Receiver Fans Controls	AOE NR NR AOE AOE NR AR BRO-RCX NR BRO-RCX NR BRO-RCX BRO-RCX BRO-RCX BRO-RCX
RF-21451 RF-28375 RF-28734 RF-43876 RF-49983 RF-53109 RF-53890 RF-5763 RF-58475 RF-58724 RF-63798 RF-65403 RF-65700	Condenser fan - VFD - add-on equipment VFD on exappartou off an - new Single stage system to two stage refrigeration system conversion (industrial and Sizulosaling refrigeration controls - add-on equipment Efficient refrigeration controls - add-on equipment Efficient refrigeration condensing unit Oversized exappartive cooled condenser Optimize refrigeration control loop tuning - retrocommissioning Indirect to direct exappartive resident controls on optimize refrigeration in pressure sensor - retrocommissioning Refrigeration liquid receiver capacity optimization - retrocommissioning Refrigeration face retroffs Optimize refrigeration defends control - retrocommissioning Efficient refrigeration compressors - add-on equipment	Multiple Refrigeration Evaporators Systems Controls Controls Condensing Unit Condensing Unit Condensing Condenser Controls Systems Sensor Usquid Receiver Fars Controls Compressor	AOE NR NR AOE AOE NR AR BRO-RCX NR BRO-RCX NR BRO-RCX NR BRO-RCX NA BRO-RCX NA AOE AOE
RF-21451 RF-28375 RF-28734 RF-48876 RF-49983 RF-53109 RF-53890 RF-57763 RF-58475 RF-58724 RF-65403 RF-65403 RF-65700 RF-67581	Condenser fan - VFD - ado'n equipment VFD on exapporteo of Fan - rete Single stage system to two stage refrigeration system conversion (industrial and Single stage system to two stage refrigeration system conversion (industrial and Subcooling refrigeration controls - add-on equipment Efficient refrigeration controls - add-on equipment Efficient refrigeration condensing unit Oversized exapporative cooled condenser Optimize refrigeration control loop busing - retrocommissioning Indirect to direct exapporative control condension conversion Indirect to direct exapporative entry exapporation system conversion Refrigeration is found retenier caspacity optimization - retrocommissioning Efficient refrigeration demos control - retrocommissioning Efficient refrigeration compressors - add-on equipment Low temperature resolvindor - and found in equipment	Multiple Refrigeration Eupparation Systems Systems Centrols Deors	AOE NR AOE AOE AOE AOE NR AR BRO-RCX NR BRO-RCX NR BRO-RCX NR BRO-RCX AOE AOE AOE
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RF-21451 RF-28375 RF-28375 RF-28376 RF-38796 RF-9993 RF-53109 RF-7763 RF-98724 RF-63798 RF-65403 RF-65700 RF-65700 RF-65774 RF-68733	Condenser fan - VFD - add-on equipment VFD on evappartoe ooi fan - new Single stage system to two stage refrigeration system conversion (industrial and Single stage system to two stage refrigeration system conversion (industrial and Subcooling refrigeration controls - add-on equipment Defrost controls - add-on equipment Efficient refrigeration controls condensing unit Oversitated evaporative cooled condenser Optimize refrigeration control loss plusing - retrocommissioning Indirect to direct evaporative refrigeration system conversion Optimize refrigeration control loss plusing - retrocommissioning Refrigeration fan retroffits Optimize refrigeration defrost control - retrocommissioning Efficient refrigeration compressors - add-on equipment Loss temperature restoration door and refrigeration compressors - add-on equipment Replaing refrigeration whey processing system Optimize refrigeration emperature septions - retrocommissioning	Multiple Refrigeration Expansion Systems Controls Systems Controls Controls Controls Controls Systems Controls Controls Controls Systems Controls Systems Controls Controls	AOE NR NR AOE AOE NR AR BRO-RCX NR BRO-RCX NR BRO-RCX AOE AOE AOE AOE AOE BRO-RCX AOE AOE BRO-RCX
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RF-21451 RF-28375 RF-28734 RF-28734 RF-38169 RF-33109 RF-53109 RF-53890 RF-57763 RF-58724 RF-68798 RF-65403 RF-65700 RF-67701 RF-68778 RF-68778 RF-68778 RF-68778 RF-68778 RF-68778 RF-68778 RF-68778	Condense fan - VFD - ado-n equipment VFD en engaporteo life n- rees Single stage system to two stage refrigeration system conversion (industrial and Single stage system to two stage refrigeration system conversion (industrial and Subcooling refrigeration controls - add-on equipment Defrost controls - add-on equipment Operation of several controls on the stage of the	Multiple Refrigeration Expansion Systems Controls Systems Controls Controls Controls Controls Systems Controls Controls Controls Systems Controls Systems Controls Controls	AOE NR NR AOE AOE NR AR BRO-RCX NR BRO-RCX BRO-RCX AOE AOE AOE NR BRO-RCX BRO-RCX NR BRO-RCX NR BRO-RCX AOE AOE AOE BRO-RCX
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Commercial NMEC Design

Baseline Model Acceptance Criteria

Criteria 1: NDBE < 0.005%

Criteria 2: CV(RMSE) < 25%

Criteria 3: ΔE_{save} / E_{save} < 50% at 68% confidence*

Design Element	Explanation	
Performance Payment Tool	per kWh reduced during the study	
Performance	 \$0.08/kwh in 1st year and \$150/kw. Persistent performance Payment	
Payment Amount	is \$0.01 for 2 nd and 3 rd year	
Performance	Total of 4 installments-Twice during 12 months study based on	
Payment Frequency	performance, later once per year as perform	

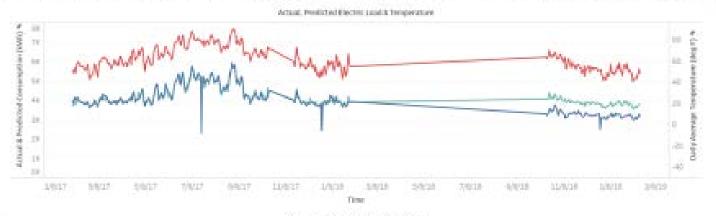


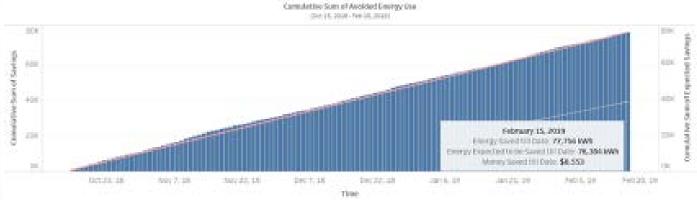
Measure List

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 -

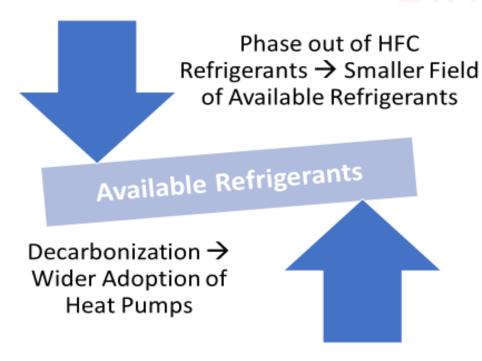
- Quick turnaround to review and approve project scope of work
- Eliminates time consuming preparation of energy savings calculations
 & formulas
- 3) More freedom to install any energy efficiency measure
- 4) Incentives based on true project performance
- 5) Larger incentives compared with traditional 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!

Paul Delaney

Senior Engineer Southern California Edison paul.D.delaney@sce.com