

ET Summit 2021

Presented by



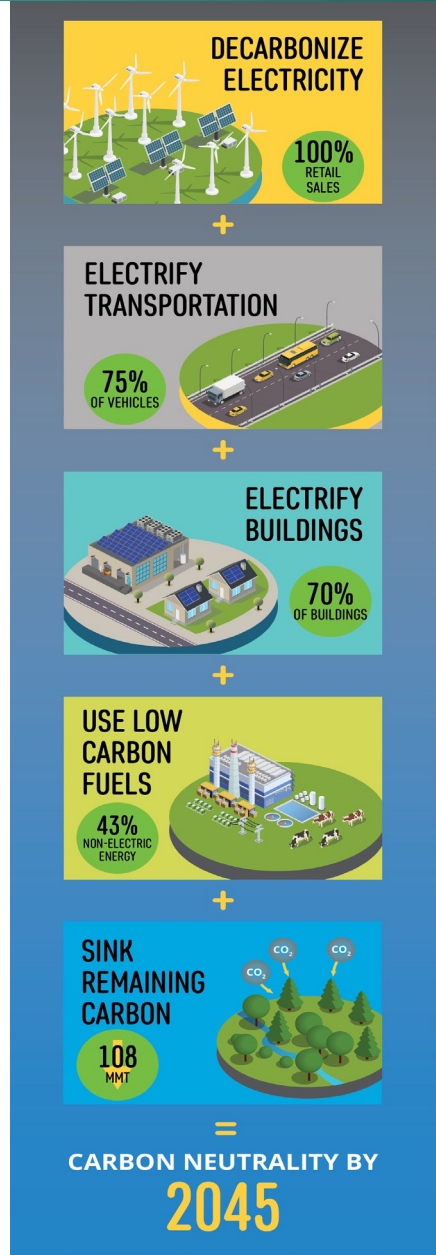
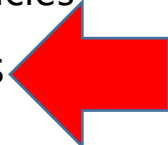
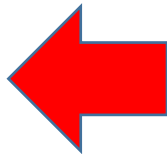


California Utilities and Refrigerants

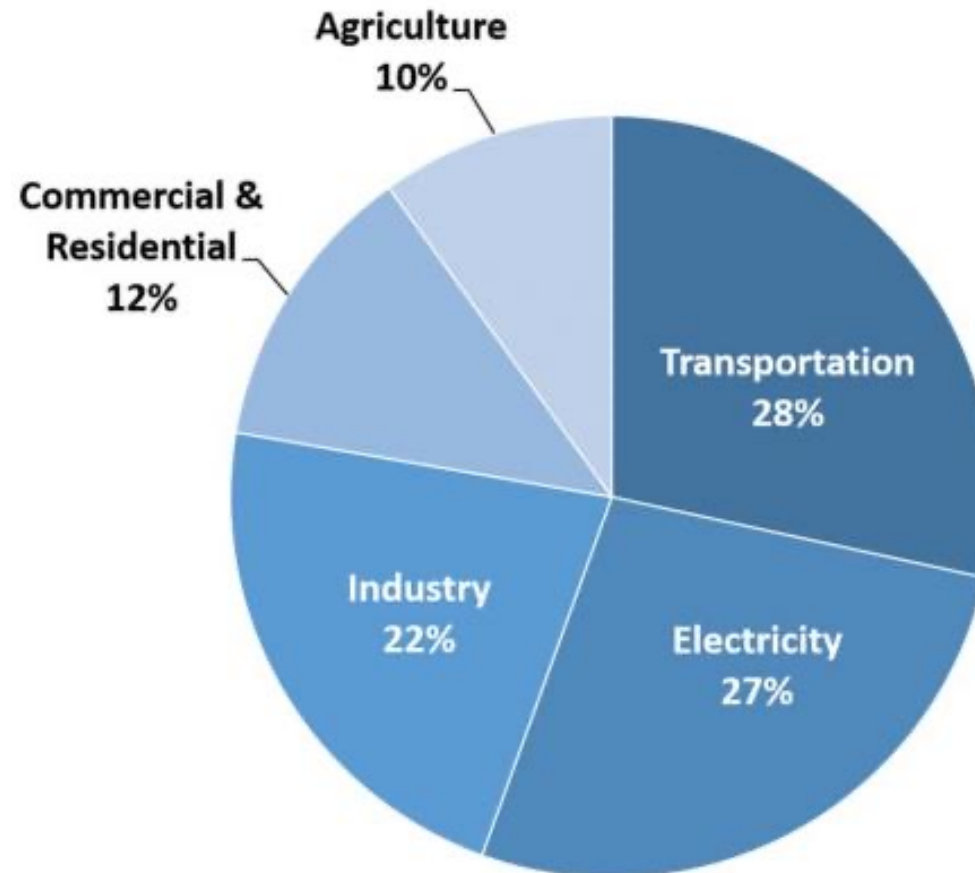
Our Path Forward

SCE's Pathway 2045

- 100% Carbon-Free Electricity
 - Solar
 - Wind
 - Electricity Storage
- Electrify 75% of Vehicles
 - 3/4 of Light-Duty Vehicles
 - 2/3 of Medium-Duty Vehicles
 - 1/3 of Heavy-Duty Vehicles
- Electrify 70% of Buildings
 - Heating
 - Water Heating
 - Cooking
- Low-Carbon Fuel
 - Bio-Methane
 - Hydrogen



Total U.S. Greenhouse Gas Emissions by Economic Sector in 2018

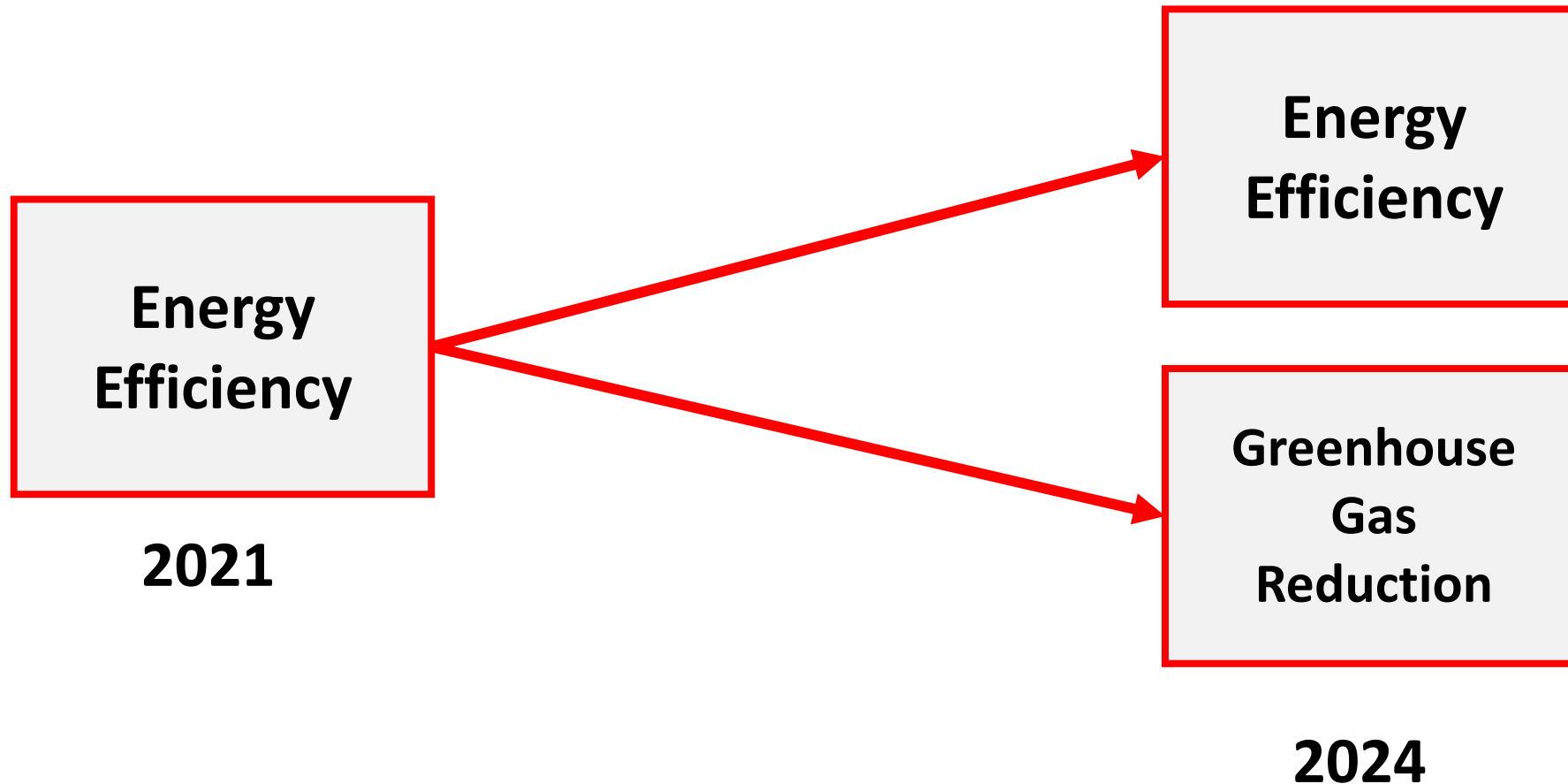


Source - US Environmental Protection Agency
<https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions>

Utility Energy Efficiency Programs

Energy Reduction

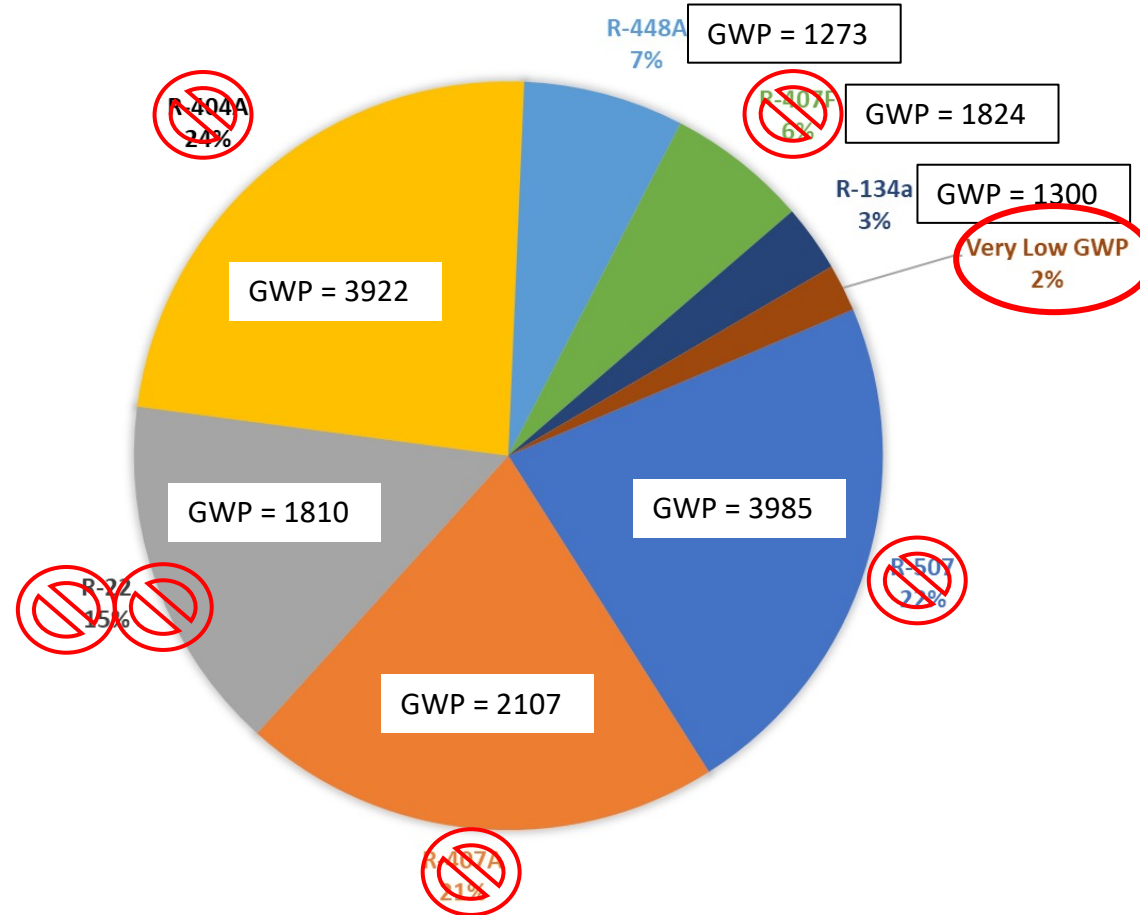
Total System Benefits



Greenhouse Gas Reduction

- Carbon-Based Electricity
 - Reduce consumption during times when carbon-based electricity is needed
- Fuel Substitution –Natural Gas to Electricity
- Refrigerant Change-Outs
 - Leakage reduction

Supermarket Refrigerants – Current Conditions



- Extrapolated from California Air Resources Board 2019 Leakage Reporting (Systems > 50 lbs.)

Meeting California's Refrigerant Milestones

- At current pace of new construction and remodels, milestone wouldn't be met until 2041 (11 years after deadline).
 - 1% new stores/year
 - 3% major equipment remodels/year
- Doubling rate of remodels would be required, or
- Reduce leak rates by 27%, or
- A combination of these

Low GWP Refrigerants

REFRIGERANT	GWP	NOTES
AMMONIA (R-717)	0	Toxic, Mildly Flammable
CARBON DIOXIDE (R-744)	1	
PROPANE (R-290)	20	Flammable

Refrigerant Change-Outs - Challenges

- Cost
- Energy Efficiency
- Safety
 - Flammability
 - Toxicity
- Workforce Education & Training

SCE Emerging Products & Technologies

Supermarket Studies

- Final Report
 - Next Generation Low-GWP Refrigeration Systems; Analysis Tools Assessment and Market Impacts
 - Available on ETCC web page <https://www.etcc-ca.com/reports/next-generation-low-gwp-refrigeration-systems-tools-assessment-and-market-impacts>
 - Many results presented earlier in this session

SCE Emerging Products & Technologies

Supermarket Studies in Collaboration with CARB

- Launching
 - Measurement & Verification of Energy Impacts – 15 California Supermarkets
 - Energy Modeling Versus Baseline Refrigerants
 - Several California Climate Zones
- Refrigerant Systems to Be Studied
 - R-449a Parallel racks
 - CO₂ Trans-critical
 - CO₂ Trans-critical with booster
 - R-448A/CO₂ cascade

SCE Emerging Products & Technologies

Supermarket Studies – New Supermarkets

- Launching
 - Measurement & Verification of Energy Impacts – 3 New California Supermarkets

System Description	Site #1	Site #2	Site #3
Proposed System	MT: R-448A, 1000 lbs. LT Rack: CO2, 400 lbs. (cascade off of MT rack) Adiabatic Condenser	Rack A: CO2, 600 lbs. (cascade off Rack B – MT) Rack B: R-448a, 450 lbs. Rack C (HVAC): R-448a, 500 lbs. Adiabatic gas cooler & Condenser	Hybrid low charge rack <50 lbs. R-448a Air cooled

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Supermarket Studies – Retrofit Supermarkets

- Launching
 - Measurement & Verification of Energy Impacts – 3 Existing California Supermarkets

System	Site #1	Site #2	Site #3
Description			
Proposed System	R-449a	NH3/CO2 Liquid Overfeed	R-449a

SCE Emerging Products & Technologies

Cold Storage Facilities Research

- High Efficiency All-Electric Truck & Trailer Refrigeration Unit Plug Load (Due 2022)
 - PV and batteries on trucks
 - Loading dock plug-in for refrigeration units
 - Low GWP refrigerant for refrigerated trailers
- Refrigerant Replacement for Food Processing (Due 2022)
 - R-22 to Ammonia
 - Use discharge heat from refrigeration system to replace gas-fired water heaters

Discussion