2024-2025 Efficient and Healthy Schools Program

Bright Futures: Technologies Transforming Schools





## Efficient and Healthy Schools Recognition Launch



- → Webinar is being recorded
- → All attendees are muted during this webinar
- $\rightarrow$  Please enter questions into the Q&A
- → Slides and recording will be sent out shortly after



3

4

## Agenda

- 1 2024-2025 Efficient and Healthy Schools Program
- 2 Hamilton Southeastern Solar Project
  - Los Angeles USD Heat Pump Projects
  - **Question and Answer Session**





## Today's Presenters



**Bob Rice** Hamilton Southeastern School District



**Christos Chrysiliou** Los Angeles Unified School District



**Saad Saleem** Commercial Building Heat Pump Accelerator

Δ



## The Efficient and Healthy Schools Program Team

**Berkeley Lab** 

#### U.S. Department of Energy















### New Buildings Institute









## 2024-2025 Efficient and Healthy Schools Program

#### **Mischa Egolf**

New Buildings Institute Efficient and Healthy Schools Program







Aims to improve energy performance, advance resilience, and promote a **healthy learning environment** in schools.

Engages **K-12 schools**, especially those serving low-income student populations and in rural areas. Provides **technical assistance** through direct consultations and **recognition** of exemplary school improvements.



Honoree Participant

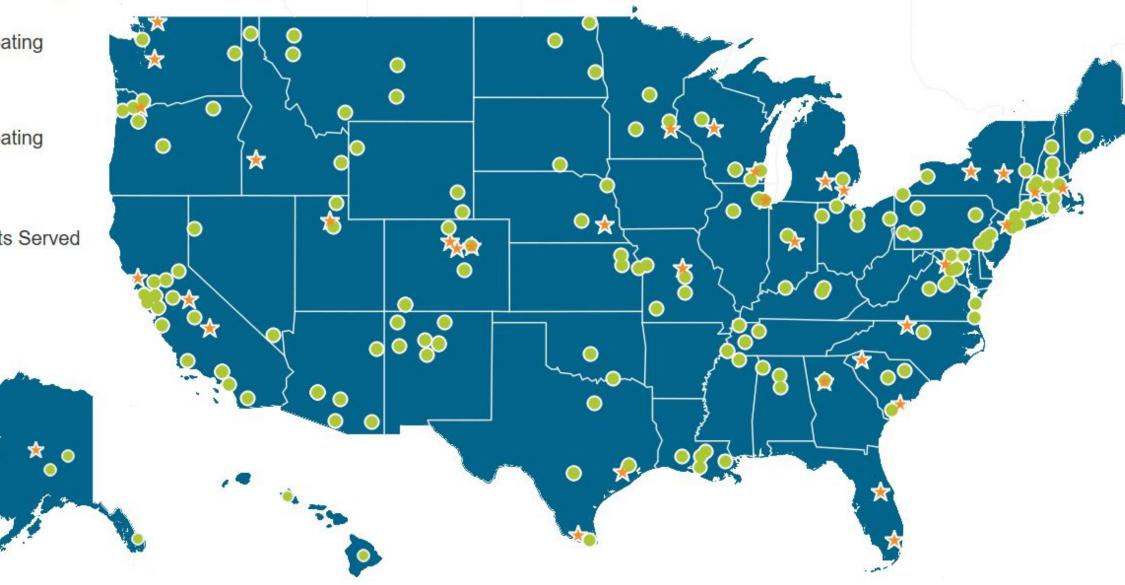
Total Participating Districts

236

Total Participating Schools 9,412

Total Students Served > 5.5 million

### Efficient and Healthy Schools Program Participants to date – October 2024





## Three ways to get involved



## Join the Program

- National support network of best practices
- Free Technical Assistance
- One-on-one onboarding



### **Support Schools**

- Engage with active schools and districts
- Be listed on program website
- National network of leading organizations



## **Gain Recognition**

- National recognition
- Free Technical Assistance
- Onboarding and coaching





## **Technical Assistance: Categories**

#### **General Program Support**

- Onboarding
- Identifying first steps & next steps
- Recognition submission assistance

#### **Energy management**

- Benchmarking
- Building assessments
- Energy analytics
- Retro commissioning



#### **Goal Setting and Planning**

- Develop district roadmap
- Facility planning & prioritization
- Documentation development: SOW, RFP, OPR



#### **Technologies and Systems**

- EEM identifications: HVAC, lighting, water, kitchens
- Energy Management Information Systems (EMIS) & Controls
- Commissioning
- Performance verification

#### **Indoor Air Quality**

- IAQ assessments and planning
- IAQ monitoring

#### Decarbonization



 Electrification approaches Emissions reduction calculations



#### **Solar and Renewables**

- Solar potential
- Program and funding opportunities

#### Resilience



#### Technical Resilience Navigator

 Approaches to manage emerging risks e.g., extreme heat, wildfire smoke

#### Funding



- Identify federal, state, local and utility funding available
- Value proposition for funding pitch
- Performance based contracting





# Support Schools!

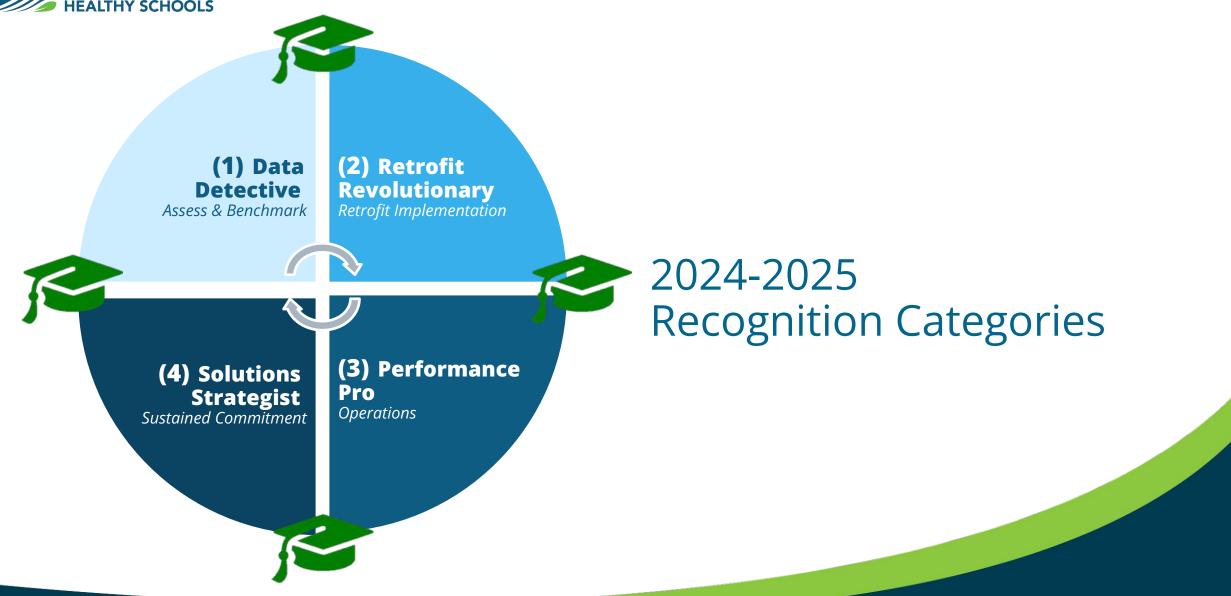
Interested in energy performance or healthy learning environments? Want to join our list of supporting organizations? Join today!

## Join the DOE Teaming List

To facilitate such partnerships collaboration between school districts and industry experts willing to support them in meeting their energy goals, and to help school stakeholders in the Renew America's Schools Program, the Efficient and Healthy Schools Program, the ESPC Campaign, and the Better Buildings/Better Climate Challenge connect and communicate, DOE is compiling a Teaming Partner List.

**Join the Teaming Partner List** to let prospective partners know you are interested in working together. Please note that this is not an application for any DOE programs or campaigns.







## 2024-2025 Recognition Categories

## Data Detective

Honoring schools and districts that demonstrate best practices to prioritize school improvements through:

- → Building assessments
- → Benchmarking
- → Utilizing building data

## Retrofit Revolutionary

Honoring schools and districts that showcase exemplary retrofit projects that improve and promote:

- → Energy efficiency projects
- → Resilience upgrades
- → Healthy learning environments improvements





## 2024-2025 Recognition Categories

## Performance Pro

Honoring schools and districts that strive for continuous improvement throughout the organization through:

- → Operations and maintenance activities
- → Performance evaluations
- → Retro-commissioning activities



## **Solutions Strategist**

Honoring schools and districts that develop plans and make committed goals to improving their buildings that:

- → Advance district-wide initiatives
- → Set broad-reaching goals
- → Include diverse stakeholder input







## 2023-2024 Recognition Honorees





U.S. DEPARTMENT OF Office of ENERGY EFFICIENCY & RENEWABLE ENERGY



## **Preparation**

Interested schools and districts will fill out a recognition application and request assistance from the Program if needed.

## **Announcement & Celebration**

Schools and districts will be notified of recognition in January and will be invited to attend an in-person celebration in March 2025.



INTERGY OF OF CONTROL OF



## Key Program Dates

### March 3<sup>rd</sup>, 2025 in-person celebration at the Green Schools Conference award luncheon.

- Conference dates: March 3-4, 2025
- Conference location: Orlando, FL
- Attend <u>School District Facilities Summit</u> on March 5-6, 2025 and apply for travel support

### **KEY DATES**

- Recognition Office Hours
  - $\rightarrow$  December 12, 2024
- Recognition application due
  - $\rightarrow$  December 20, 2024

# For more information, email <u>schools@lbl.gov</u>

DEPARTMENT OF **NERGY** Office of ENERGY EFFICIENC & RENEWABLE ENERGY



RECOGNITION OPPORTUNITY

Apply for Recognition opportunities today!





# Technology Spotlight: Solar

#### **Bob Rice**

Energy Manager Hamilton Southeastern Schools

# Solar & Energy Efficiency Projects



# **Keeping funds in the classrooms**

# **Introduction: Bob Rice**

### **PROFESSIONAL EXPERIENCE**

- Energy Manager and Indoor Air Quality Coordinator for Hamilton Southeastern Schools
  - June 2017 Present
- Secondary Science Teacher
  - Aug 2010 June 2017
    - AP Environmental Science, Biology, Zoology, Genetics, Microbiology, Astronomy 1, Astronomy 2, Earth & Space Science, 7<sup>th</sup> Grade Science, 8<sup>th</sup> Grade Science, Honors Biology, Football, Wrestling, and Track Coach

### **EDUCATION**

- Bachelor of Science in Production & Operation Management from Tri State University (Trine)
- Education Graduate Certification in Secondary Science Education from Indiana University Kokomo



brice@hse.k12.in.us

#### WORK ORDERS

# **About Hamilton Southeastern Schools**

- HSE Facilities oversees 4,000,000 square feet under roof.
  - That is roughly the same size as the four largest buildings in Indianapolis combined: Indianapolis Convention Center, Gainbridge Fieldhouse, Lucas Oil Stadium, and the Sales Force Tower
  - 2 High Schools ٠
  - 4 Junior High Schools
  - 4 Intermediate Schools
  - 13 Elementary Schools
  - 2 Alternative Schools
  - Transportation Center
  - Administrative Building
  - Warehouse ٠
  - 6 football fields
  - 48 tennis courts
  - 2 swimming pools
  - 28 gymnasiums
  - 4,800 solar panels (3 arrays)
  - 962.58 acres of property

•To do this, HSE Facilities averages 15,000 work orders per year. •HSE Schools tracks over 10,000 individual pieces of equipment.

•Preventive maintenance is key to extend the usable life of all equipment.

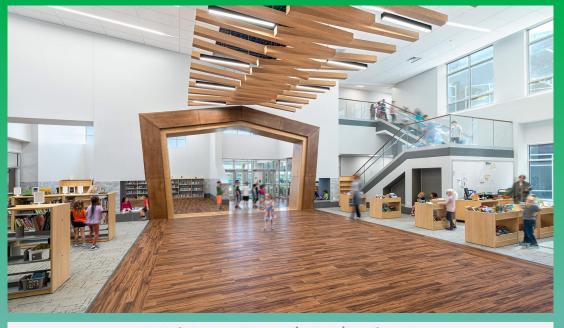
		Work Order #	Title		WO Status	Priority
Qa		9		9	9	
School ry School		0000001501	FCES Chiller Glycol Check Annual		Completed	Medium
		000001502	FCES Chiller Glycol Check Annual		Completed	Medium
		000001503	FCES Chiller Glycol Check Annual		Completed	Medium
		000001504	FCES Chiller Glycol Check Annual		Completed	Medium
		000001505	FCES Chiller Glycol Check Annual		Completed	Medium
		000001506	FCES Chiller Glycol Check Annual		Completed	Medium
		000001507	We have received our "National Blue Ribbon" Banner		Completed	Medium
		000001508	I have a teachers light table that needs a leg pu		Completed	Medium
		000001509	sensory path		Completed	Medium
		0000001510	Furniture B102		Completed	Medium
	1511		groom football field		Completed	
			We have 6 light posts out, out		Complet	

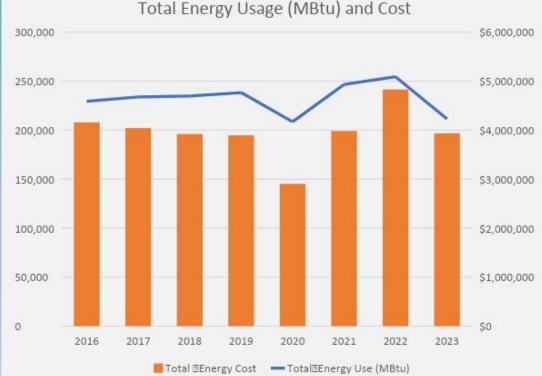
## **About HSE Continued...**

Since 2019 HSE has added over 200,000 square feet of property but has seen our overall energy consumption reduced.

- In 2019 HSE opened Southeastern Elementary 93,000 sq feet
- In 2022 HSE opened Deer Creek Elementary 102,787 sq feet
- In 2022 HSE renovated Fall Creek Junior High and added 6,000 square feet
- Energy costs are on the rise, so it is important to become more efficient!









# BENEFITS OF GOING SOLAR



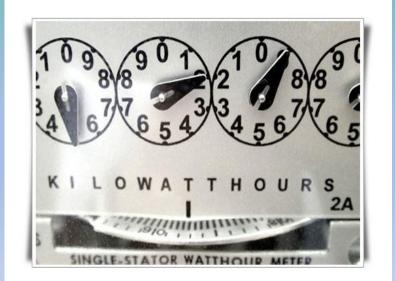
# Educational

# Awareness

# **Environmental**

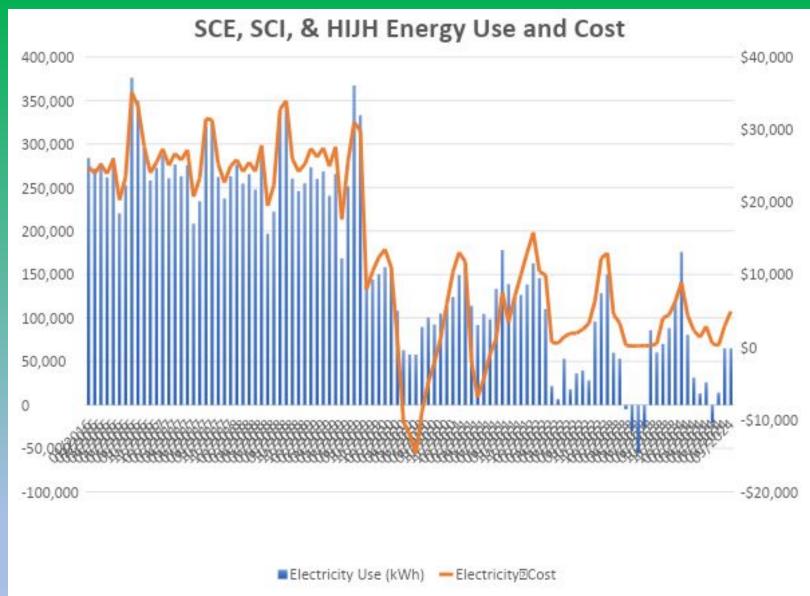
# **Financial**



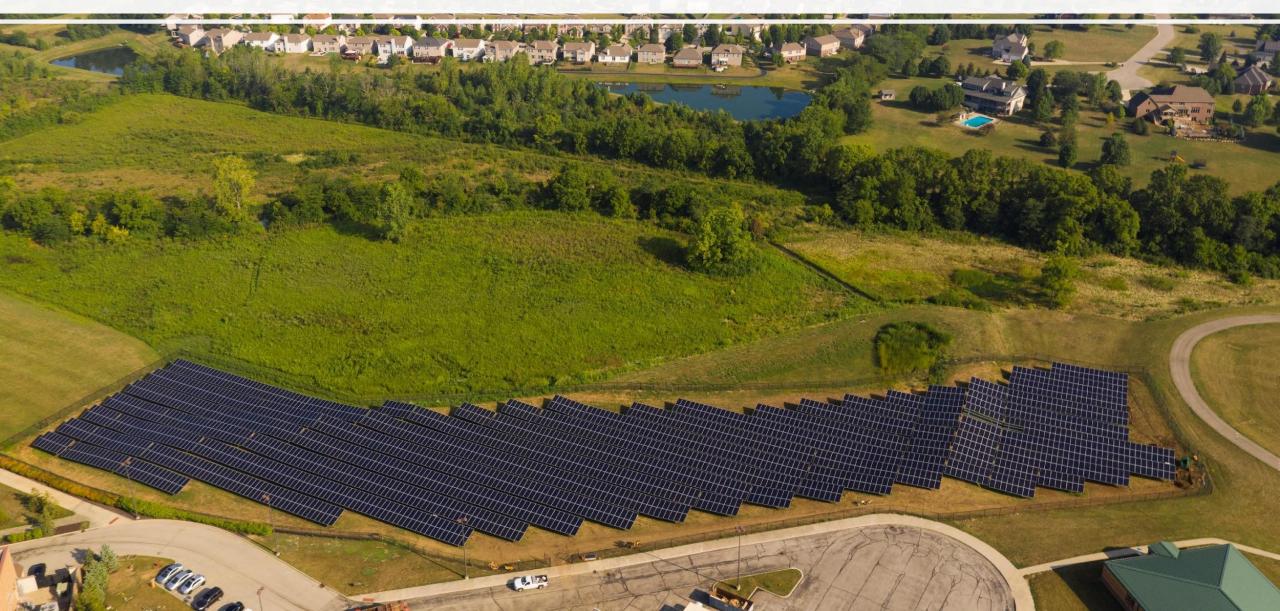


# **HSE Solar Update**

- •In 2019, HSE Schools installed three solar arrays to reduce operational costs under a guaranteed energy savings contract with Ameresco.
- •4,800 solar panels were installed at Sand Creek Elementary (SCE), Sand Creek Intermediate (SCI), and Hamilton Southeastern Intermediate and Junior High School (HIJ) for a price of \$2,806,317 (G.O. Bond).
- •Prior to going solar, SCE, SCI and HIJ used an average of 3,270,538 kWh annually. At today's rate that would cost the corporation an estimated \$364,992.
- •In 2023, HSE purchased 570,731 kWh of power at a cost of \$36,671. This is an avoided cost of \$328,321.
- •Return on investment in 9-10 years and a guaranteed production for 20 years.



## Sand Creek Elementary & Sand Creek Intermediate





## Sand Creek Elementary & Sand Creek Intermediate



## Hamilton Southeastern Intermediate & Junior High



## Hamilton Southeastern Intermediate & Junior High

## **Additional benefits:**

- □ Solar has become a large component in our classrooms
- □ Increase stakeholder buy-in
- □ Increased push for more renewable energy projects
- Became a leader in the state helping other districts go solar
  - Numerous state and national awards
    - Efficient and Healthy Schools New Building Institute
    - Green Ribbon Schools
    - NEED.org
    - Energy Star
    - Fishers OneZone
    - Duke Energy
    - IN Department of Energy





# **Bob Rice**

Energy Management Director and Indoor Air Quality Coordinator for Hamilton Southeastern Schools – Fishers, IN

- Brice@hse.k12.in.us
- Office: 317-570-3378
- Mobile: 317-998-0385
- X: @HSEsavingenergy
- Linkedin: https://www.linkedin.com/in/bob-rice-a3b99b180/





## **DOE Program Opportunities**

**Rengie Chan** 

Lawrence Berkeley National Lab Efficient and Healthy Schools Program





- Commercial Building Heat Pump Accelerator
- Integrated Lighting Campaign
- Smarter Small Building Campaign
- <u>Energy Savings Performance</u>
   <u>Contracting (ESPC) Campaign</u>
- Better Climate Challenge



#### 2022 Exemplary Participant: Holt Public Schools

				Light Commercial BAS			
Manufacturer	Solution	Networked Thermostatic Control	Advanced RTU Control	Integrates with Multiple- Zone HVAC Systems	Integrates with Other Energy End Uses	Components	
Cognition Controls	Smart HVAC Control Solution	1	$\checkmark$			Smart thermostats, wireless sensors, Cognition Controls web platform, and dedicated Cognition Controls support	
Contemporary Controls	<u>BASstat Thermostats</u> + <u>BASview3</u>	~				BASstat BACnet thermostat and BASview3 supervisory graphical interface	
	BAScontrol Unitary Controller + BASview3	~	~		~	BAScontrol unitary controller, BASview supervisory graphical interface, and third party wall setters (provides zone conditions and setpoint adjustment)	
ecobee	SmartBuildings	~				Smart Thermostat Premium, Smart Thermostat Enhanced, or ecobee3 lite and SmartBuildings desktop and mobile apps	
Emerson	<u>Sensi Multiple</u> <u>Thermostat Manager</u>	~				Emerson Sensi™ smart thermostat or Sensi™ Touch smart thermostat and Multiple Thermostat Manager	
ENTOUCH	ENTOUCH.one Primary <u>Controller +</u> ENTOUCH.cloud	~	$\checkmark$			ENTOUch.one primary controller and ENTOUCH.cloud analytics engine	
	ENTOUCH.one Product Line + ENTOUCH.cloud	1	$\checkmark$	~	1	ENTOUCH.one family of products and ENTOUCH.cloud analytics engine	
GridPoint	Energy Optimization Platform	~	$\checkmark$		~	Controller, networked thermostats, sensors, energy meters, and Energy Manager cloud platform	



SmarterSmallBuildings https://smartersmallbuildings.lbl.gov/guidance-documents





# Technology Spotlight: Heat Pumps

**Christos Chrysiliou** Chief Eco-Sustainability Officer Los Angeles Unified School District

Saad Saleem Commercial Building Heat Pump Accelerator





## The Better Buildings Commercial Building Heat Pump Accelerator

November 14th, 2024



## Why?

- Commercial building space conditioning accounts for approximately 40% of commercial energy use
- Heat pump rooftop units (RTUs) are estimated to reduce GHG emissions and energy costs by up to 50% compared with conventional RTUs (with natural gas heating)
- Commercial heat pump adoption is far lower than residential: 10% vs 35%

## How?

Two complementary efforts:

- Supply: Commercial Building Heat Pump Technology Challenge – Produce advanced commercial building heat pump technology to meet market demand
- Demand: Commercial Building Heat Pump Campaign – Work with end users and other stakeholders to increase the adoption of both existing and emerging technologies



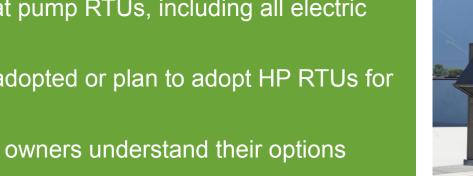


#### **Campaign Goals and Current Partners**

#### **Campaign Goals**

- Accelerate adoption of today's heat pump RTUs, including all electric and dual fuel products
- Highlight organizations that have adopted or plan to adopt HP RTUs for their sustainability goals
- Provide resources to help building owners understand their options
- Showcase successful adoption of HP RTUs in case studies

•





- REEF
- Slipstream
- SPEER
- Sustainable Energi
- Target
- Slipstream
- VEIC
- Whole Foods Market



#### **Current Campaign Partners**

- Amazon
- Budderfly
- CLASP •
  - Columbia Association
- Effecterra
- General Motors •
- ICAST •
- IGSD •

Los Angeles Unified School District

kW Engineering

IKEA US Retail LLC

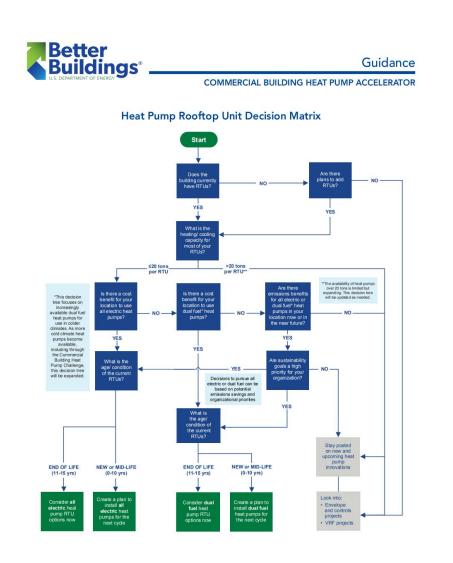
- Life Time, Inc.
- Mace Group
- MN CEE
  - Monaire
  - Prologis



37

#### **Campaign Educational Resources**

- Decision trees and guidance documents to support site- and portfolio-level evaluations
- Estimates on the energy, economic, and emissions comparisons for different geographic areas
- Case studies showcasing how building owners have successfully implemented HP RTUs to achieve their decarbonization goals
- Peer-to-peer learning through working groups on topic areas, including manufacturers' equipment specifications, validation activities, workforce challenges, utility engagement, and more







#### **Campaign Case Studies**

Case studies will describe how organizations overcame barriers to adopt HP RTUs and their experiences with the technology.

#### Los Angeles Unified School District (CA)

- Replaced 65% of decentralized HVAC • units with electric heat pumps
- Reduced heating emissions by 33% •
- Saved ~\$140,000 monthly on utility costs •

#### Columbia Association (MD)

- Replacing gas-fired RTUs with dual fuel RTUs as existing equipment fails
- Projected to reduce natural gas use by 70% in early pilot
- Reserved the facility's spare electrical capacity for future HPWHs

Case Study
COMMERCIAL BUILDING HEAT PUMP CAMPAIGN

Better

**Buildings**<sup>®</sup>

#### LAUSD: Heat Pump Rooftop Units

Los Angeles Unified School District (LAUSD) is one of the largest districts in the nation with a portfolio of 13,500 buildings and 81 million square feet distributed across 6,387 acres of land in Southern California.

LAUSD's portfolio-wide climate commitments include reducing energy and water usage 20% by 2024 and greenhouse gas (GHG) emissions by 50% over the next 10 years, with a 2040 goal of 100% clean energy and elimination of all fossil fuels.

To achieve energy and GHG emissions reduction goals, LAUSD utilizes electric heat pump rooftop and wall-hung units, and other heat pump technologies, as the primary option for space heating and cooling systems for its school and administrative facilities.

#### **Project Overview**

Better

To meet its decarbonization goals LAUSD has been transitioning to unitary heat pumps for space heating of buildings with a capacity of 3-10 tons with plans to expand to larger spaces as larger heat pumps become commercially available. There were many considerations that lead LAUSD to pursue heat pumps.

1. Even in warmer climates, space heating is a significant load, especially during morning warm up periods before the school day starts. LAUSD determined that heating electrification, along with their renewable electricity procurement



#### IMPACTS OF HEAT PUMP ROOFTOP UPGRADES

•	Organization Name, Location	Los Angeles Unified School District (LAUSD), Los Angeles California
•	Building Type, Number, Size	School Buildings, 13,500 buildings, total of 70 million square feet of building space
•	Project Description	LAUSD has replaced 65% of their decentralized HVAC units with electric heat pumps, with plans to achieve 100% by 2040 (year)
•	Emissions Savings	LAUSD plans to reduce GHG emissions by 50% in 10 years (compared to a 2014 baseline).
•	Energy Performance and Savings	LAUSD plans to reduce energy intensity by 20% compared to a 2014 baseline
•	Financial, Comfort, Maintenance, and Other Benefits	The benefits of heat pumps include low noise, fully electric heating and cooling, and ease of maintenance



Case Study

<b>Columbia</b> Association
IPACTS OF HEAT PUMP ROOFTOP UPGRADE

COMMERCIAL BUILDING HEAT PUMP CAMPAIGN

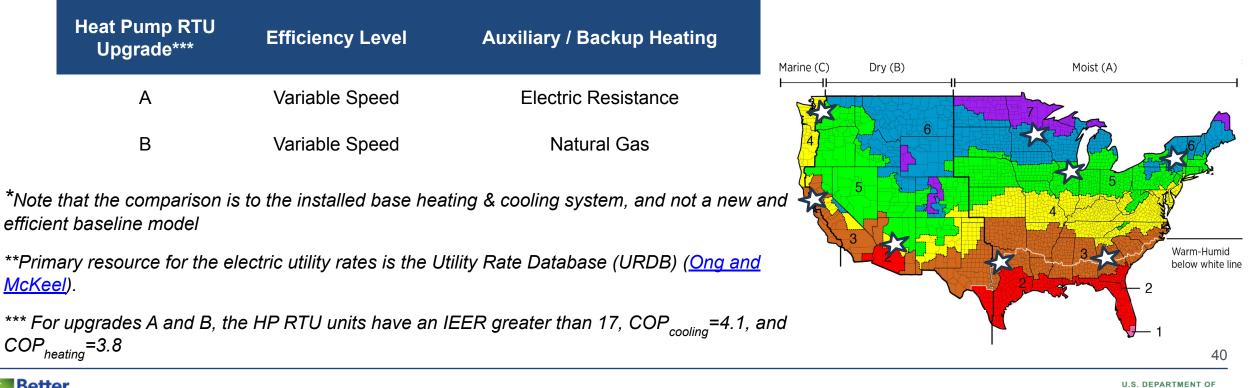
Organization Name, Location	Columbia Association, Columbia Maryland		
Building Type, Number, Size	500,000 square feet of public and community building space including fitness clubs, community centers, indoor swimming pools, golf clubs, etc.		
Project	Dual Fuel Heat Pump RTUs		
Description	to reduce emissions		
Emissions	Reduce emissions by 18		
Savings	metric tons/year		
Energy Performance and Savings	Avoid 3,500 therms/year in gas consumption		
Financial,	The benefits of dual fuel		
Comfort,	units include comparable		
Maintenance,	cost and facility comfort,		
and Other	minimal retrofits, and ease		
Benefits	of maintenance		





#### **Energy Modeling of School Buildings with different HP RTU technologies**

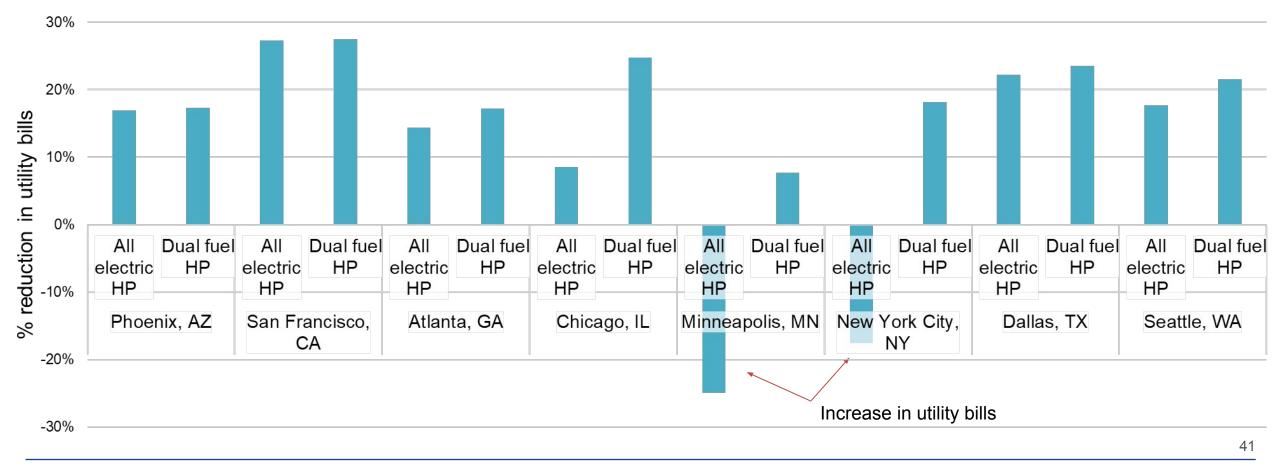
- The goal was to model several commercial building types (offices, primary/secondary schools, retail establishments and warehouses) over a subset of regions that can capture variations in Climate, Grid Emissions Factors, and Utility Rates, to see how various upgrades (A and B) to their existing (baseline\*) heating and cooling systems would affect GHG emissions and operating costs\*\*
- We looked at the modeled energy consumption, operating costs and greenhouse gas (GHG) emissions, that were modeled as part of NREL's commercial building sector stock model <u>ComStock™</u>
- The fuel for the baseline heating systems was natural gas (NG)





#### **Utility Bill Savings Modeling for Schools**

 The figure provides comparisons of savings in utility bills for schools across the different locations, for each RTU upgrade, in comparison to the baseline system (standard performance AC RTU with natural gas heating)

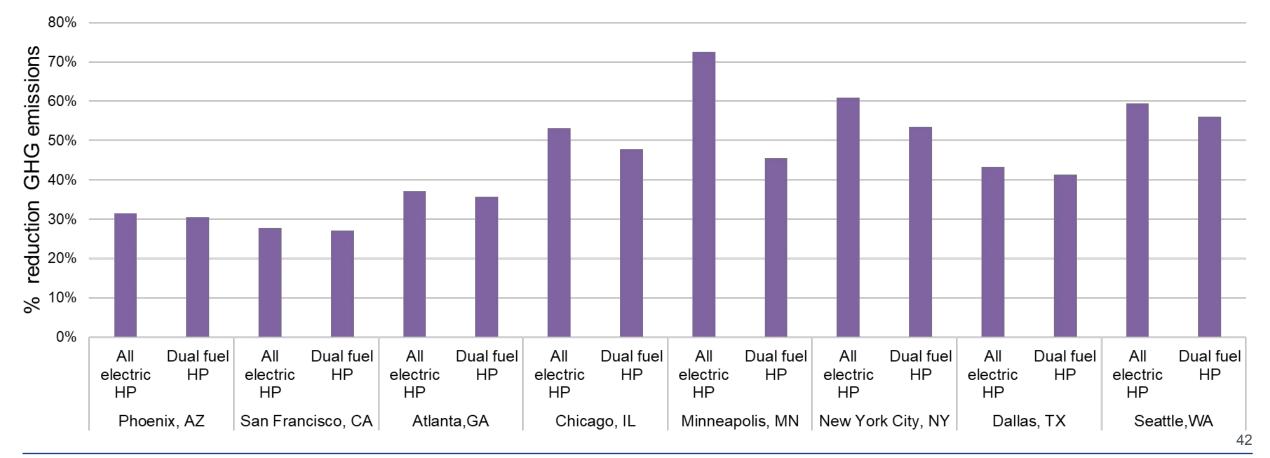






#### **GHG Reduction Modeling for Schools**

 The figure provides comparisons of reduction in GHG emissions for schools across the different locations, for each RTU upgrade, in comparison to the baseline system (standard performance AC RTU with natural gas heating)







#### Summary of ComStock Energy Modeling Results

- Utility bill and GHG emissions savings for specific locations are driven by several factors, such as electricity-to-gas price ratios\*, climate zone, geography, and how clean\*\* is the local electric grid.
  - All-electric HP RTUs show the greatest savings in utility bills in southern states (TX) and the Pacific Northwest (CA & WA) due to lower electricity-to-gas price ratios.
  - NY state shows negative utility bill savings with all-electric HP RTUs, due to higher electricity-to-gas price ratios in the Northeast states along with a higher heating load in colder climates.
- Across all locations, all-electric HP RTUs show slightly higher reductions in GHG emissions, when compared to dual fuel HP RTUs
- However, dual-fuel HP RTUs are still a good option, since they have the advantage of significant utility bill reductions across the US, especially in the colder Midwest and Northeast regions.
- Next-generation all-electric cold climate HP RTUs have the potential to reduce operating costs and GHG emissions, when compared to standard AC RTUs. *Key focus of the Challenge!*

\*Ratio of state average electricity prices in cents/kwh to natural gas prices in \$/MCF (cents per kWh / \$ per MCF) \*\*Clean is a relative term to indicate electric grids that have a high share of renewables and other zero-carbon generation in the grid mix, resulting in a low grid emissions factor





43

#### **Commercial Building Heat Pump Accelerator: Technology Challenge**

- As part of the Commercial Building Heat Pump Technology Challenge, manufacturers will develop new emissions-effective HP RTUs that meet the advanced technology specification developed by DOE
- The specification aims to improve cold weather performance at 5°F, minimize electricity upgrades, and minimize the impact of peak electricity demand and refrigerant Global Warming Potential (GWP)\*
- The performance of these new products will be tested at national labs, followed by field validation with Better Buildings Partners
- These new generation HP RTUs will be available for purchase as soon as 2027

\*GWP is a metric that measures how much heat a greenhouse gas traps in the atmosphere compared to carbon dioxide over a specific time frame







# We want you to join the Campaign!

betterbuildingssolutioncenter.energy. gov/commercial-bldg-heat-pump/ca mpaign



# Thank you!

# Please contact us with any questions:

Saad Saleem Senior Consultant, Guidehouse ssaleem@guidehouse.com





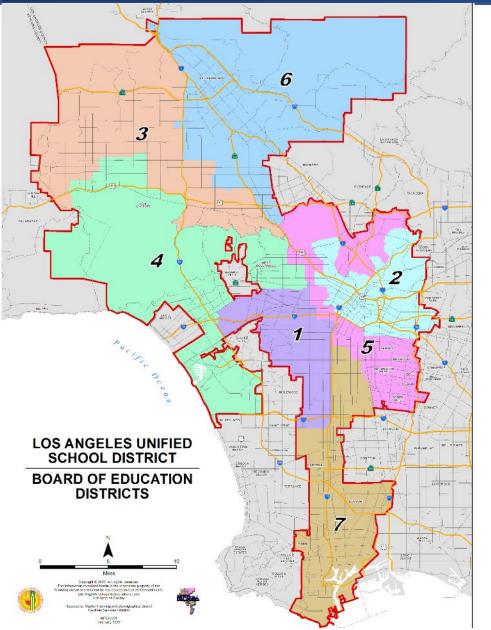


# LAUSD UNIFIED

Christos Chrysiliou, FAIA Chief Eco-Sustainability Officer LAUSD



#### LOS ANGELES UNIFIED SCHOOL DISTRICT – DEMOGRAPHICS



- **80,890,070** building square footage
- 25,392 structures
- **31,700** classrooms
- 6,389 acres of land
- 800+ campuses
- **710** square miles of site boundaries
- 565,479 students (K-12)
- **66,757** employees
- District uses about 500,000-530,000 MWh of electricity and 4.8M Therms of natural gas per year.
- Environmental Footprint (GHG) is 400,000 MTCO2e



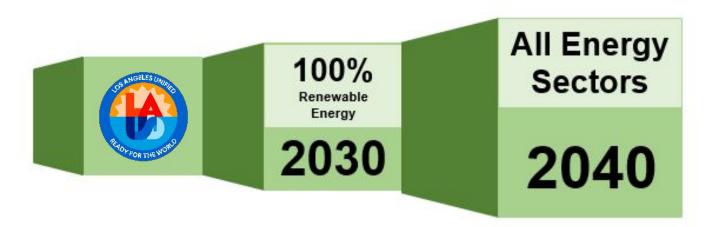
# **Mission and Goals**

#### Resolution

Transitioning LAUSD to 100% Clean, Renewable, Energy Resulting in Healthier Students and More Sustainable, Equitable, Communities (Board Resolution Res-018-19/20)

#### Goals

- 100% clean, renewable energy in its electricity sector by 2030
- all energy sectors, including heating, ventilation, air conditioning (HVAC), cooking, and transportation by **2040**



#### GHG Emissions in Metric Tons of Carbon Dioxide Equivalent

	2014 Baseline	2024 Target	2030 Target	2040 Target
Electricity	387,135	309,708	0	0
Natural Gas	28,405	22,724	22,724	0
Total	415,540	332,432	22,724	0

# All Sectors Electric!



#### 100% Electric | All Sectors





Transitioning by:



- Updating specifications
  - Replacement with all-electric after service life



- Modernizations
- Pilot projects
- Grant opportunities







#### Roadmap to Decarbonization – Heat Pumps Lead the Way

#### Continuing Energy Efficiency

Lighting Retrofit Projects:

- Prop 39 112 Sites Completed
- LADWP MOU 120 Sites Completed
- LADWP MOU 2 Sites in Construction
- High Performance Schools (CHPS):
  - 142 (7 LEED)
- **Education & Awareness:** 
  - HEROES for Zero Contest, emPowered,

**GPro Certification, Magenta House** 

#### **HVAC Critical Repair Program**

• 65% of 50,552 Units Electrified since 2015 2030 Goal: 100% Renewable Energy

LADWP:

• 80% Clean Electricity by 2030

Solar:

• 14 Sites pending Board approval

#### 2040 Goal: Clean Energy for All Sectors

**New Energy Dashboard** 

Updating Specifications to Electrify Source Energy

**Pilot for Electric Kitchen** 

Water Heaters

• All-Electric Heat Pumps

**Replacing Gas HVAC systems** 

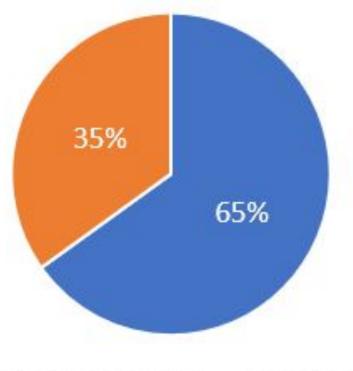
• All-Electric Heat Pumps

Upgrades to existing EMS



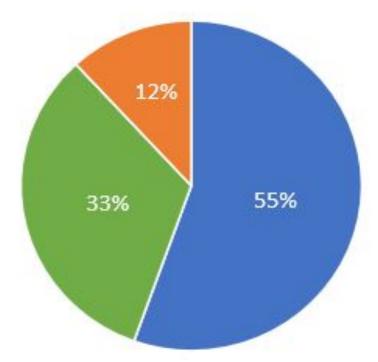
#### Roadmap to Decarbonization - HVAC Systems

Current Status 50,552 Units



Electric Heat Pump 32,920 Units
 Gas HVAC Equipment 17,632 Units

#### Replacement Plan 2023-2040 17,632 Units



- Gas Units < 20 tons with Remaining Service Life < 7 years to be replaced by 2033</li>
- Gas Units < 20 tons with Remaining Service Life ≥ 7 years to be replaced by 2040
- Gas Units ≥ 20 tons to be replaced by 2040

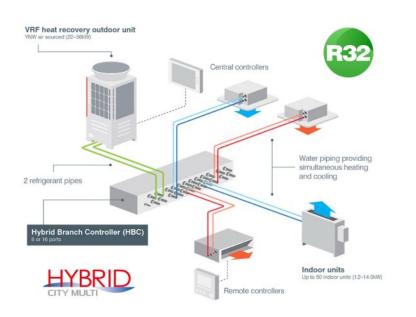


#### Next Generation HVAC Systems

#### **Challenges:**

Multi-zone Units ≥ 20 tons require adoption of new technology

- Minimal track record at present time
- May require modified distribution layouts
- More difficult in more extreme micro-climates





#### Next-Generation Refrigerants Hybrid VRF Systems

#### Water-Cooled Screw Chiller with Heat Pump Hot Water and R134A Refrigerant



#### Transitioning To All Electric | HVAC Specifications

Building Type	Legacy HVAC Units	<b>Proposed Electric Units</b>		
Classroom	Roof-mounted gas/DX unit Exterior gas/DX AC unit Gas furnace	Roof-top heat pumps Wall-mount heat pumps		
	Wall-mount electric heat pump	VRF system	Classrooms	Classrooms
Administration	Roof-mounted gas/DX unit Split system Window air-conditioner	Multi-zone ducted HVAC Split system VRF system		
Kitchen	No cooling Roof-top makeup air unit; Gas heater	Indirect evaporative cooler Roof-top makeup air unit	Kitchen	Administration
Cafeteria	Roof-mounted gas/DX unit	Water-cooled chiller with heat pump hot water		
Gymnasium	Roof-mounted gas/DX unit	Water-cooled chiller with heat pump hot water		
Auditorium	Roof-mounted gas/DX unit	Water-cooled chiller with heat pump hot water	Emer	ging systems



## HVAC Equipment Upgrades

#### **Challenges of Larger Units:**

**STRATIFICATION:** A high ceiling or a **large volume of space** may limit the ability of a heat pump to achieve thermal comfort

DISTRIBUTION: The existing locations of supply and return registers may not be optimized for thermal comfort and may require modification for a heat pump to work efficiently

FAMILIARITY: Need minimum 5-year track record. Staff lacks familiarity with maintenance, repair, and replacement

**RESILIENCY:** Larger units impact more spaces during break-downs and repair





#### **Opportunities:**

**IMPACT:** Even in warmer climates, space heating is a significant load

**FEASIBILITY:** Small-to-medium gas units of 5-20 tons at end of service life can readily switch to unitary heat pumps

**BEST RETURN ON INVESTMENT:** Most LAUSD schools have sufficient electrical capacity for the Heat Pump transitions

EMISSIONS REDUCTIONS: Transition from Gas HVAC to Heat Pumps reduces Carbon Emissions by 30% or more

LIFE CYCLE COST REDUCTIONS: Transition from Gas HVAC to Heat Pumps reduces Life Cycle Costs by 12%

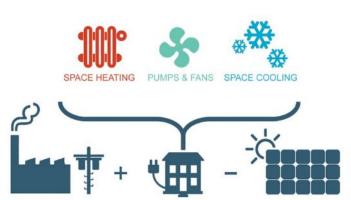


## **Electrical Infrastructure Upgrades**

#### **Challenges:**

- Many schools have insufficient

   electrical capacity for current electrical
   loads that have increased over the
   years for technology, cooling, and other
   equipment.
- Increased cooling days during extended warmer months require larger units to be installed (e.g. 4 tons replacing original 3.5 ton units).
- Spaces that normally were not mechanically cooled **now require cooling,** e.g. kitchens and locker rooms.



#### **Opportunities:**

 The new electric units have less amperage draw than the old gas/electric units with the same capacity, due to generally higher EER and COP for electric heat pumps.



#### **Equipment Upgrades** | Classrooms – Unitary Systems









De La Torre Span - Before (Gas)



Location	Size	Proposed Equipment	Status
	< 5 tons	Roof-top heat pump	Underway
Classrooms	< 5 tons	Wall-mounted heat pump	Underway
Science, Arts, Industrial Arts Classrooms	5 - 10 tons	Roof-top heat pump	Underway



#### Equipment Upgrades | Classrooms - VRF

#### **Challenges:**

- Risk of having multiple classrooms out of commission simultaneously when repairs or replacement of systems are necessary
- Lack of expertise in installing VRF systems available in local market
- Special expertise needed to properly level VRF refrigerant pipes to avoid system failure due to refrigerant oil backflow



#### **Opportunities:**

- VRF is generally the most feasible option to install in historic school buildings
- Allows individual control of zones for centralized system
- High efficiency

Location	Size	Proposed Equipment	Status
Classrooms	< 36 tons	Centralized VRF systems	Underway



## Equipment Upgrades | Kitchen



#### Constraints

- No existing cooling, so energy usage will increase with new cooling system.
- High make-up air ventilation rate required due to hood exhaust requirements.

ocation	Proposed Equipment	Status	Pros	Cons
litchen	Indirect evaporative make-up air unit with heater	Cost/ benefit analysis underway	Evaporative cooling is highly efficient	<ul> <li>System is not yet integrated with electric heating.</li> <li>Gas heater lowest initial cost;</li> <li>Electric resistance heater not Title 24 compliant;</li> <li>Heat pump heater high initial cost if just for heating</li> </ul>
	DX heat pump	Cost/ benefit analysis underway	Reduced first cost	<ul> <li>Less energy efficiency (typically 1.5 KW/ton)</li> <li>Reduced service life (15 years).</li> </ul>

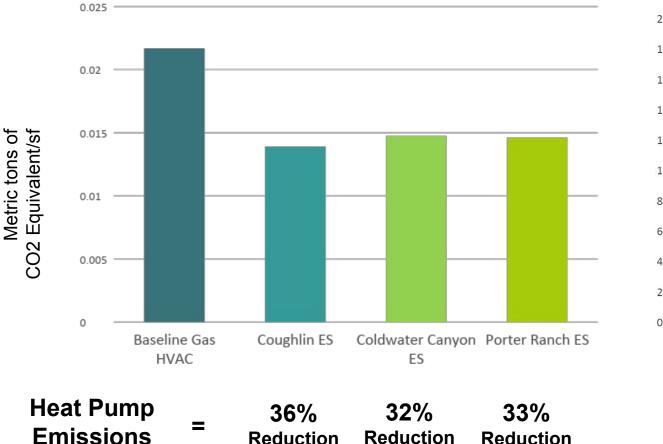




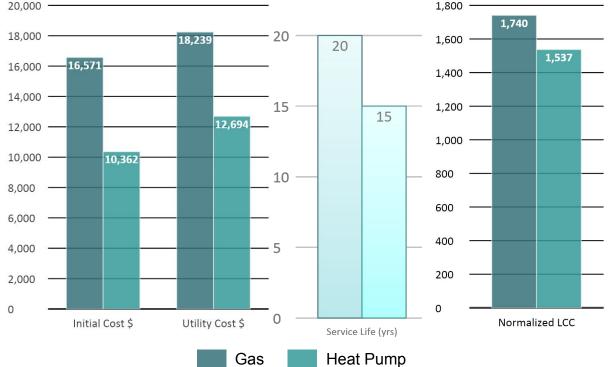
#### **HVAC Comparative Performance Metrics**

#### \$1,670,352 per Year Utility Savings (for existing HVAC heat pump compared to gas units)

Emissions Reductions from Gas HVAC to Electric Heat Pump



Life Cycle Cost Reductions from Gas HVAC to Electric<sup>5</sup>Heat Pump



Heat Pump Life Cycle Cost = 12% Reduction



Keys to Success



- District-wide commitment to make heat pumps a priority
- Input from multiple LAUSD stakeholders (maintenance + operations, technical units, design, standards, commissioning, project planning + development)
- Identifying **funding sources:** grants and critical repair programs
- On-site solar PV systems to offset electricity source emissions
- Heat pump training for engineering and maintenance staff
- Advanced controls to allow centralized monitoring for efficient maintenance and operations





#### 100% Renewable and Clean Energy by 2040



# **THANK YOU!**

Visit our website: www.lausd.org/eso







## THANK YOU – Connect with us!!

Join | <u>Healthy Schools (lbl.gov</u>)

 Subscribe to the Efficient and Healthy Schools Program <u>Mailing List</u>

Resources | <u>Healthy Schools (lbl.gov</u>)

Apply for recognition today!



