



## Electrifying Existing Buildings: *Challenges and Opportunities*

## Agenda: The What, Why, & How of Electrifying Existing Buildings

- **The What:** Goals, targets, work to date
- **The Why:** A bit about electrification & gas
  - Perspective: East Bay Community Energy
- **The How:** Major Retrofits and Long-Term Planning
  - Current technologies & approaches: AEA
  - Case study: Eden Housing
  - Linkages: Housing & business development goals
  - Real world challenges: Mark Hall, Revalue.IO
- **Wisdom in Community:** Breakouts & discussion
  - What challenges do you see? What are the needs?
  - Policy options: What strategies should we pursue?
- **Next steps & Timeline**





## The What: Goals, Targets, & Work to date

### The Big Goal: Electrify all existing buildings in Oakland by 2040

- Council Commitment (July 2020)
- New construction is already there (Dec. 2020)
- Major retrofits: Next Challenge
- Lots of statewide & Regional support
- Increasingly renewable grid

## The Why

- **Health**

- Indoor air pollution
- Outdoor air pollution
- Better protection from smoke days
- Comfort

- **Safety & Resilience**

- Fires & explosions
- Displacement
- Backup power & affordability
- Aging Infrastructure

- **Climate**

- Methane = "climate forcer"





## The How... But first...

- **Costs are real**

- Upfront costs: \$10,000-\$22,300 per home (*Berkeley*)
- Bill savings 0-91% (*Berkeley*)
- Installed heat pump & PV costs expected to drop 10% between 2020 and 2030 (*NREL*)
- Gas rates increasing faster than electricity rates

- **Challenges are real**

- Equity: who gets it first, when, how, linked to what
- Competing needs: Seismic, other repairs, other needs
- Labor: from where, how, benefitting whom

- **Solutions are real**

- Local, regional, State, Federal



## Developing an Approach that's Guided by Equity

### Greenlining Framework:

1. Assess Community Needs
2. Community-led Decision-making
3. Metrics & Tracking
4. Funding & Program Leveraging
5. Continuous Feedback & Improvement

### REIA Implementation Guide:

- Bundle with weatherization & seismic upgrades
- Expand OBF for residents
- Prioritize med. baseline customers for solar+storage
- Prioritize energy-cost-burdened customers for EE, S+S
- \$\$ assistance
- Local jobs & training
- Tenant protections



# Equitable Decarbonization in Oakland



**July 2020: Council  
commits to a fully-  
electric building  
stock by 2040 and  
Carbon Neutrality  
by 2045**

**Dec. 2020:  
Council  
mandates that  
all new  
construction  
must be all-  
electric**

**March-Dec.  
2021:  
Electrification  
Workforce  
Stakeholder  
series**

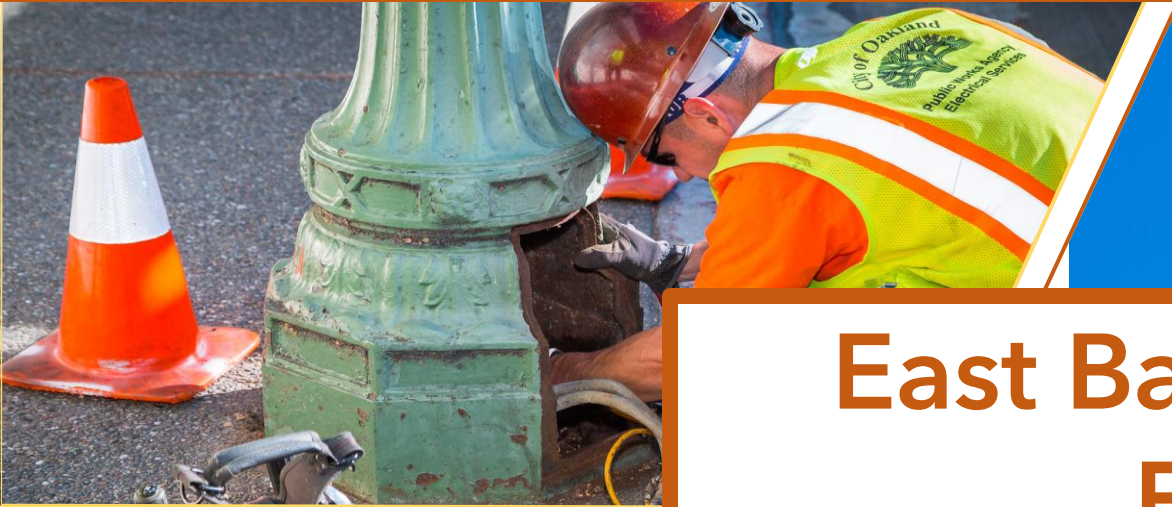
**March 2022: Zero-  
Emission Vehicle  
Action Plan  
Electrification  
Informational  
Reports**

- Workforce needs & opportunities
- Opportunities for Major Retrofits
- Needs & Resources for restaurants & affordable housing

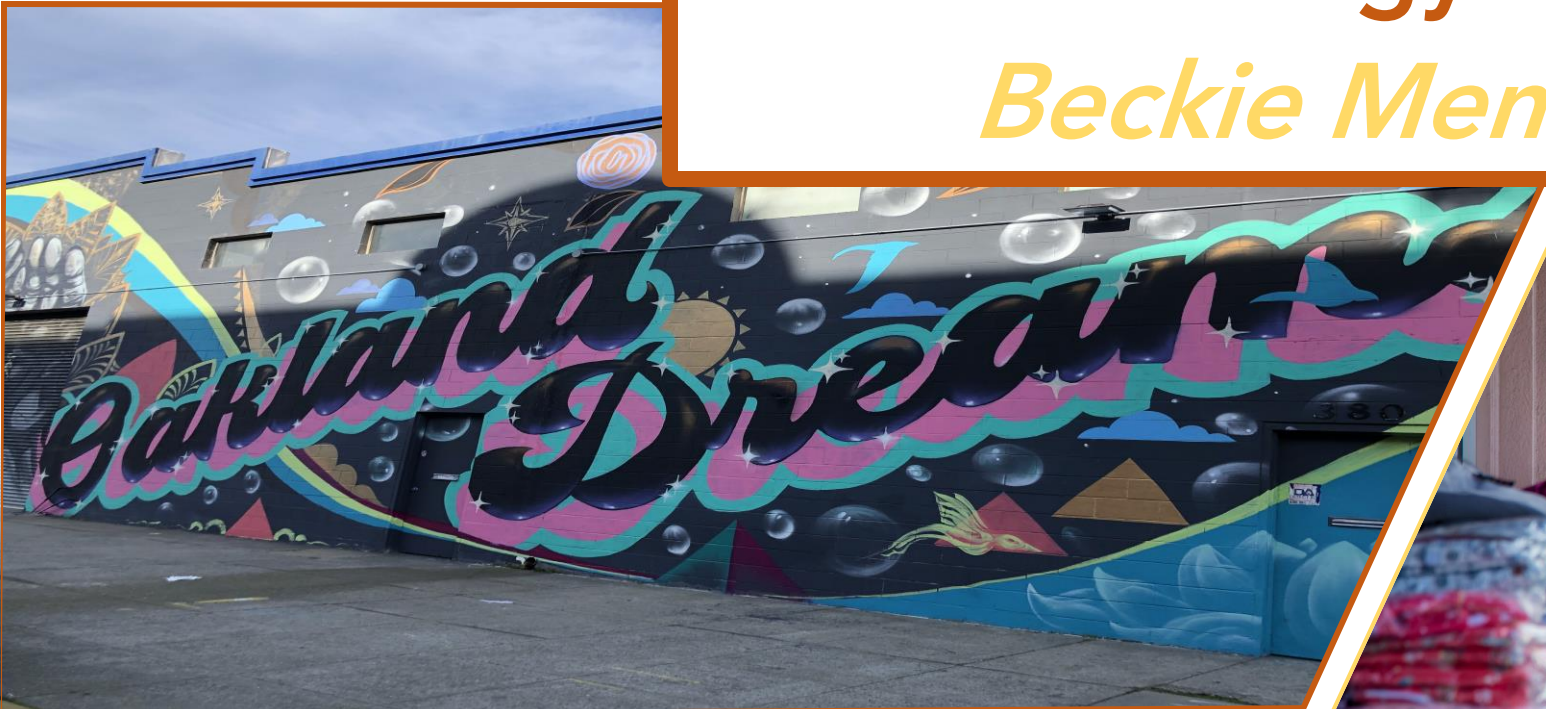
**Jan-Nov.  
2022:  
Ongoing  
Community &  
Stakeholder  
Engagement**

**December  
2022: Final  
Building  
Electrification  
Roadmap**





## East Bay Community Energy: *Beckie Menten*





NOVEMBER 2021

# City of Oakland Existing Building Electrification



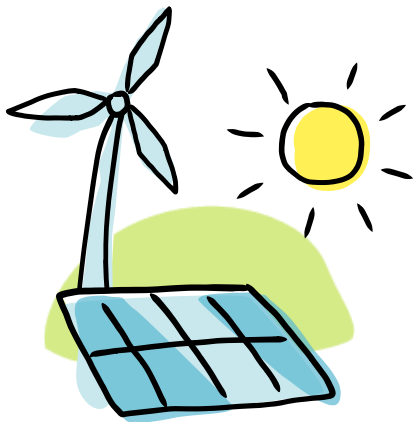
# What is EBCE?

**East Bay Community Energy (EBCE) is our local power supplier committed to providing Alameda County and the city of Tracy with cleaner, greener electricity at lower rates. EBCE reinvests earnings back into the community to create local green energy jobs, local energy programs, and clean power projects.**



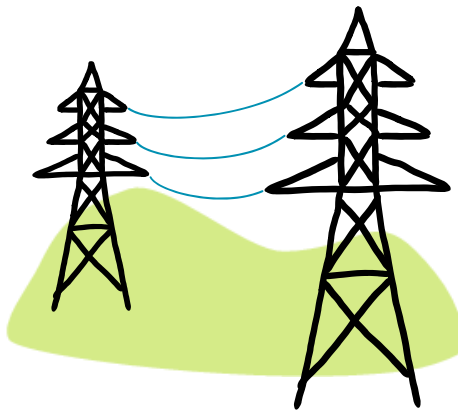


# How it Works



## **EBCE BUYS CLEAN POWER**

EBCE buys from, and is building, clean power plants. EBCE sells the power to customers at low rates.



## **PG&E DELIVERS THE POWER**

**EBCE's power is delivered to customers by PG&E. Customers pay PG&E for power delivery as they always have.**



## **YOU GET THE POWER AND ALL THE BENEFITS**

**You benefit from cleaner energy, low rates, local governance, and innovative programs.**

# EBCE Local Programs



# Buildings and Climate

- California and EBCE are moving towards zero-carbon electricity
  - California: zero-carbon grid by 2045
  - EBCE: zero-carbon electricity product by 2030
- Gas used in buildings becomes a larger contributor to GHG
- Electrified buildings help with matching renewable energy supply to energy demand





# Benefits of Electrification

- **Clean and Healthy**

- Combustion of natural gas in homes has been linked to negative air quality impacts
- Electric appliances can be powered by renewable energy

- **Affordability**

- Combination of energy efficiency and electrification can help reduce energy costs
- Protection against future rate increases



# Thank You!



Questions? Give us a call:  
1-833-699-EBCE (3223)



@PoweredbyEBCE



customer-support@ebce.org

Español  
[ebce.org/es](https://ebce.org/es)

中文  
[ebce.org/cn](https://ebce.org/cn)

# APPENDIX

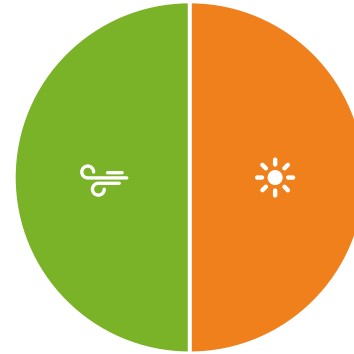


# What Are My Options?



## **BRIGHT CHOICE**

**at least 5% more renewable  
energy than PG&E's target at  
rates 1% below PG&E**



## **RENEWABLE 100**

**100% California solar & wind  
energy at 1 cent per kilowatt-  
hour above PG&E rates**

# What Are the Benefits?



LOWER RATES



**LOCAL CONTROL  
& INVESTMENT**



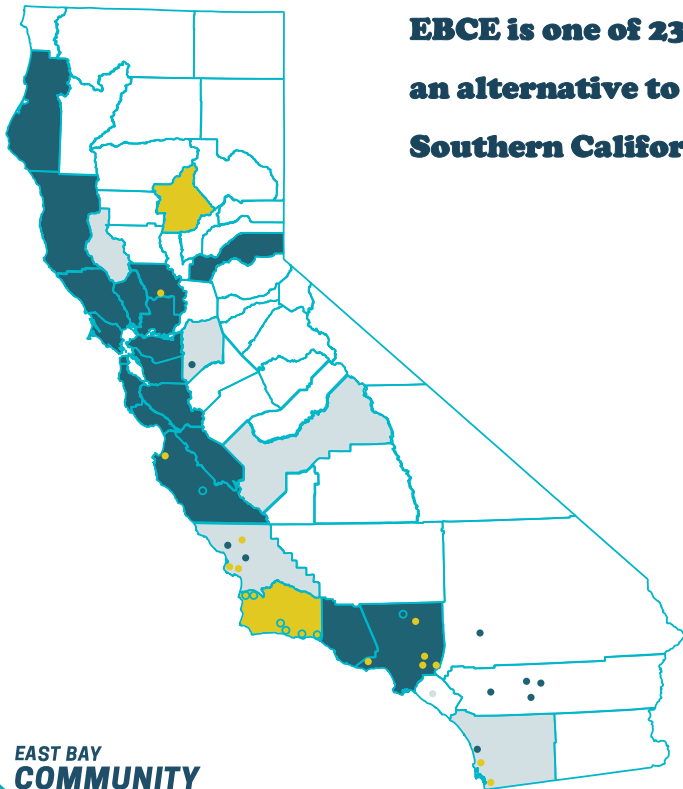
**SUSTAINABILITY**



**CUSTOMER  
CHOICE  
& PROGRAMS**

# CCAs Are Proven Across California

**EBCE is one of 23 Community Choice Agencies in California offering an alternative to the applicable Investor Owned Utilities (PG&E, Southern California Edison, and San Diego Gas & Electric)**



## Over 3,600 Megawatts

of new clean generation capacity contracted through long term Power Purchase Agreements by CCAs across California

**40%**

In 2019, CCA's served over 40% of load in PG&E's service area

**10%**

In 2019, EBCE served about 10% of load in PG&E's service area

**\$10M**

EBCE saved customers \$10 Million in 2020

**\$20M**

EBCE has saved customers \$20 Million since program launch in 2018

# Q & A

“Habitat for Humanity is honored to partner with East Bay Community Energy. From their support of affordable housing to promoting women in leadership, EBCE cares about the communities and people they serve.”

— **Habitat for Humanity East Bay/Silicon Valley**



“EBCE, the City of Fremont, and many others are working together to create a healthy, safe, and vibrant future for our community. Reach out to EBCE to hear about what is in the works and to make sure your business goals are aligned with your energy choices.”

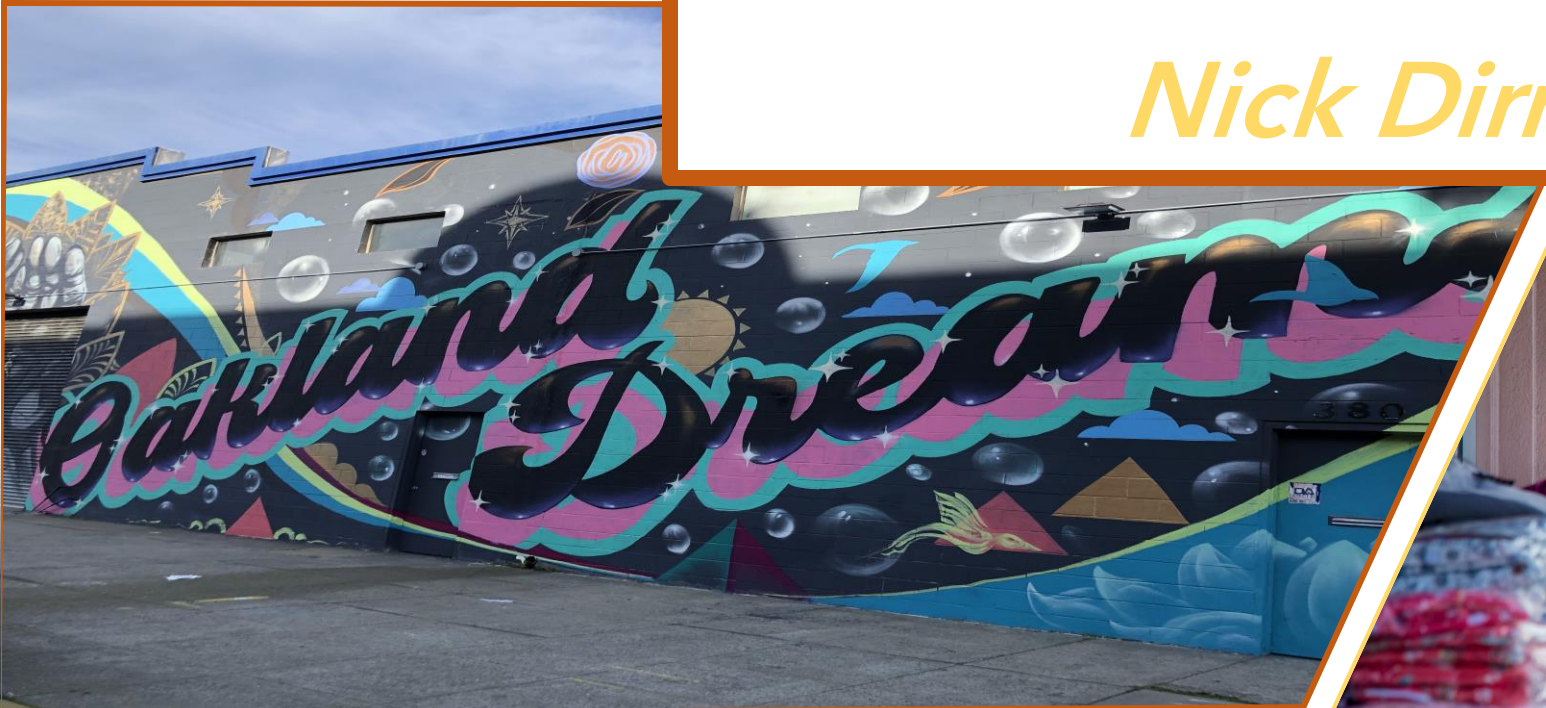
— **Rachel DiFranco, Sustainability Manager, City of Fremont**







## Association for Energy Affordability: *Nick Dirr*





ASSOCIATION FOR

**ENERGY AFFORDABILITY** INC.

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# Electrifying Existing Buildings

Opportunities and Lessons Learned  
from the Field

**Nick Dirr**, AEA

November 17, 2021

# Electric Space Conditioning





# Heat Pumps - Individual



Ducted Heat Pump



Mini-Split Heat Pump  
(Ducted or Ductless)



Vertical Terminal  
Heat Pump  
(VTAC)



Packaged Terminal  
Heat Pump (PTHP) /  
Room Heat Pump

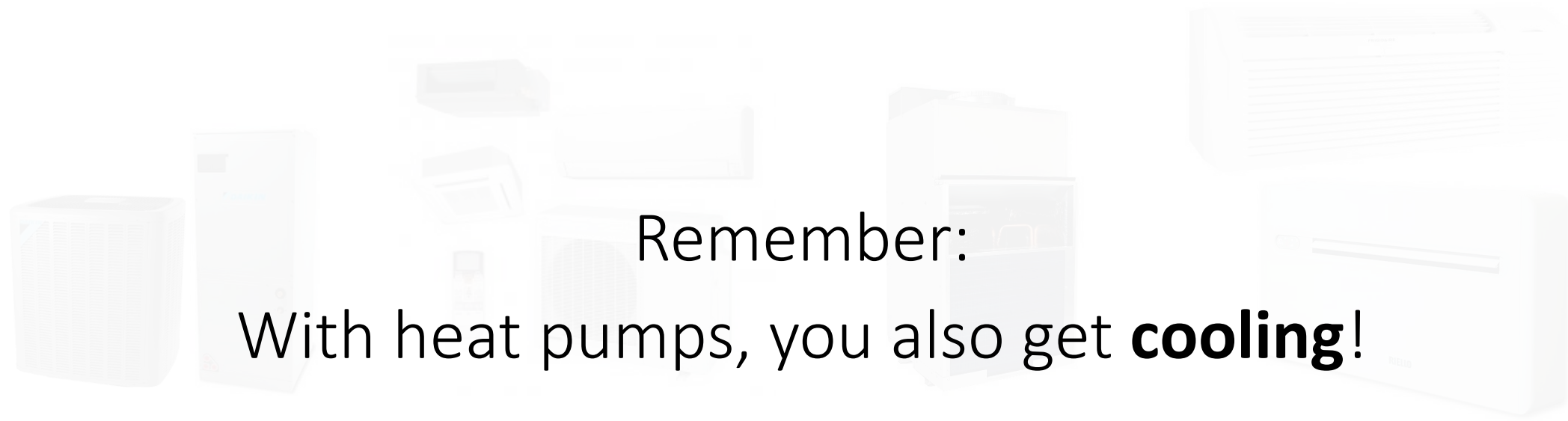




# Heat Pumps - Individual

Remember:

With heat pumps, you also get **cooling!**



Ducted Heat Pump

Mini-Split Heat Pump  
(Ducted or Ductless)

Vertical Terminal  
Heat Pump  
(VTAC)

Packaged Terminal  
Heat Pump (PTHP) /  
Room Heat Pump



# Heat Pumps - Central



Variable  
Refrigerant  
Flow



Packaged Rooftop  
Heat Pump



Heat Recovery Chiller



# Electric **Water Heating**



# Heat Pump Water Heaters - Individual



Split Heat Pump  
Water Heater



Combined Heat Pump  
Water Heater







# HPWH Equipment – Central/Commercial

Monoblock / Built-Up

Integrated Tank







*Photo Credit: Colmac*









Image: AEA







Photo Credit: Nyle















# Electric Cooking



# Electric Cooking



Induction



Radiant



Resistance



# Electric Cooking



Induction



Radiant



Resistance



# Induction: What's so great about it?

- Fastest response time of any heating type (faster than gas!)
- Boils water in ½ the time of any other heating type
- Extremely precise heat control down to very low levels
- Less waste heat = less overheating of kitchen
- No open flames, and only pan gets hot = SAFER



# Induction: Yeah, but what about...

## Equipment Cost

- Induction currently not cheapest electric ranges
- Prices should come down as adoption accelerates

## Compatible Cookware

- Pots and pans must be ferromagnetic
- Cast-iron and many others with sandwich bottom
- Many affordable options available



**Frigidaire** 30 in. 5.4 cu. ft. Induction Range with Self-Cleaning Oven in Stainless Steel

Model# FFIF3054TS

★★★★☆ (68)

**SPECIAL BUY** \$989<sup>10</sup> ~~\$1,099.00~~  
Save \$109.90 (10%)



Utopia Kitchen Nonstick Frying Pan Set - 3 Piece Induction Bottom - 8...

★★★★☆ ~ 199

\$26<sup>99</sup>





# All-Electric Commercial Kitchens

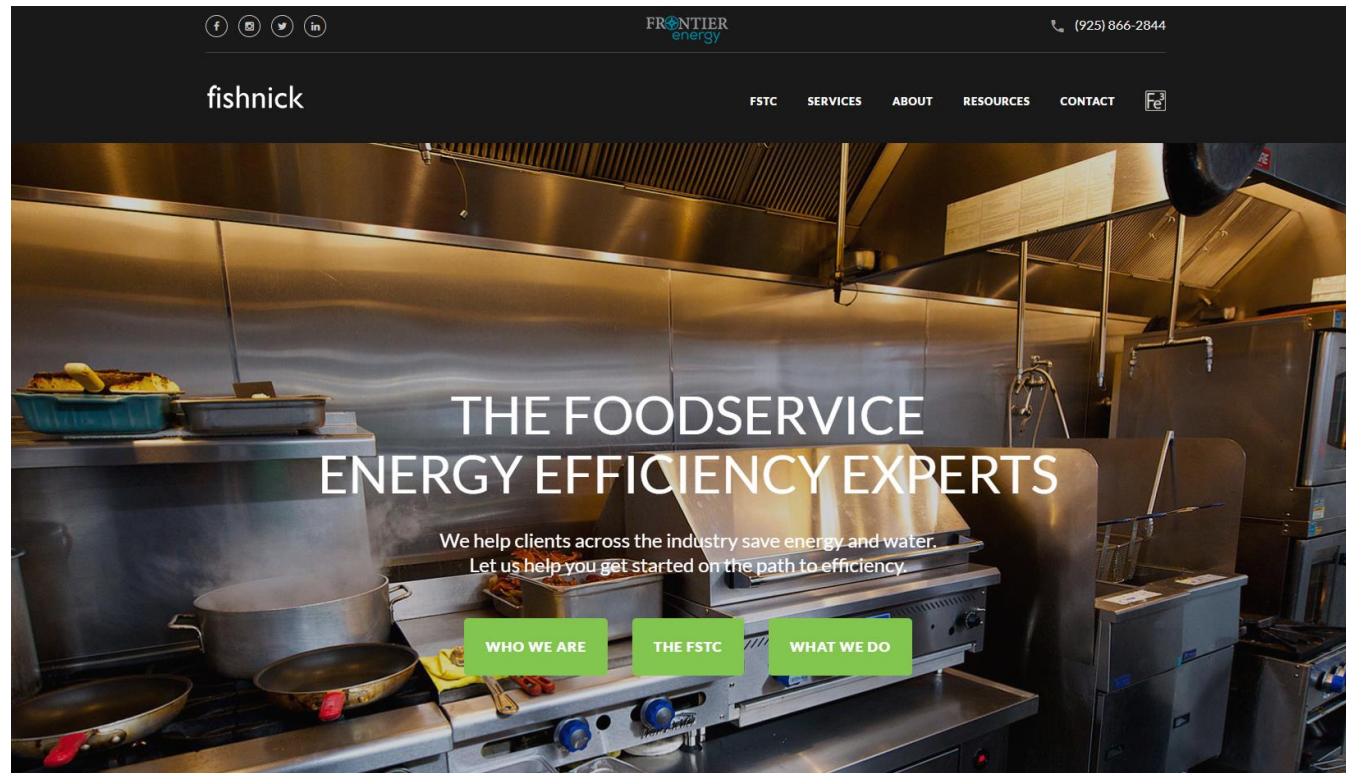


YES



# Food Service Technology Center

San Ramon, CA | [www.fishnick.com](http://www.fishnick.com)



# Electric **Laundry** (Dryers)



# Residential Clothes Dryers



Heat Pump  
Dryer



Electric Resistance  
Dryer



Combo Washer +  
Resistance Dryer



# Commercial Clothes Dryers



Electric Resistance  
Dryer



Electric Heat Pump Dryer  
(Not yet available in US)





# Electric Transportation



# EV Charging Levels



**AC Level One**



**AC Level Two**



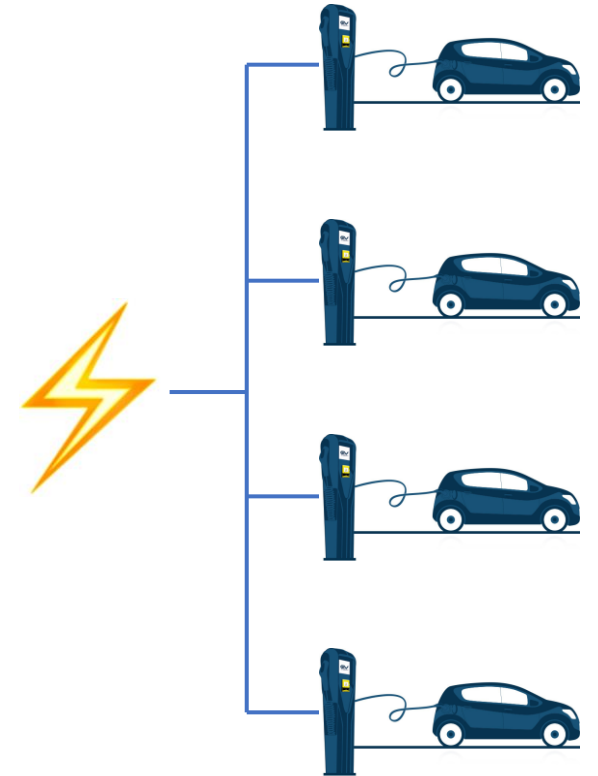
**DC Fast Charge**

<b>Voltage</b>	120v 1-Phase AC	208v or 240v 1-Phase AC	208v or 480v DC
<b>Amps</b>	12 - 16 Amps	12 - 80 Amps (Typ. 32 Amps)	< 125 Amps (Typ. 60 Amps)
<b>Charging Load</b>	1.4 - 1.9 kW	2.5 - 19.2 kW (Typ. 7 kW)	< 90 kW (Typ. 50 kW)
<b>Charge Time</b>	3 - 5 mi range / hr	10 - 20 mi range / hr	80% charge in 20 – 30 min.



# EV Charging – Load Management

- Allows installation of more charging capacity than a building has electrical service.
- Varies power supplied to each charger based on number of vehicles charging.
- Fewer vehicles = more power per vehicle
- More vehicles = less power per vehicle
- Can help **avoid electrical upgrades**, or at least keep them manageable.



# Electric Pools & Spas





# Heat Pump Pool Heaters



# Electric Infrastructure



# Electrical Infrastructure – Plan Ahead!

- All-electric buildings **eliminate gas costs**: main extensions, meters, interconnection fees, and in-building infrastructure.
- With all systems powered by electricity, projects may need **larger electrical service**, and/or panels.
- Consult with electrical engineer early-on and ensure they know that project will be all-electric.
- Start talking to your electric utility ASAP.



# Electrical Infrastructure – Smart Panels

- Replaces traditional electrical panel
- Manages loads, such as appliances, EV charging, & batteries
- Enables electrification without electrical service/transformer upgrades





# Questions?



**Nick Dirr**

Senior Director, Programs

Association for Energy Affordability

[ndirr@aea.us.org](mailto:ndirr@aea.us.org) | 510-431-1792





## Eden Housing: *Tom White*





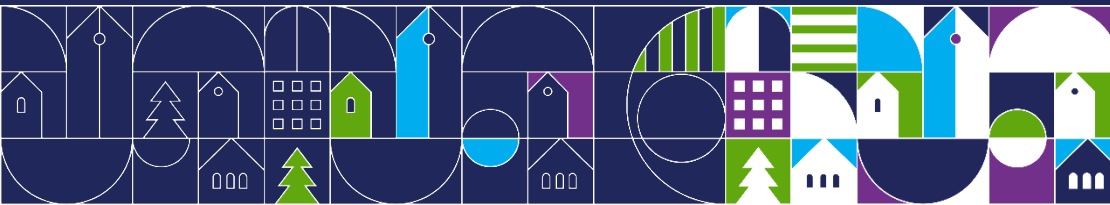
# **Electrifying Existing Buildings in Oakland: Stakeholder Workshop**

## **Case Study: Light Tree Apts -- East Palo Alto**

**Hosts: City of Oakland -- Sustainable Oakland Program**

**Tom White**, Assoc. Director of Building Performance and Sustainability, Eden Housing, Hayward, California

**November 17, 2021**

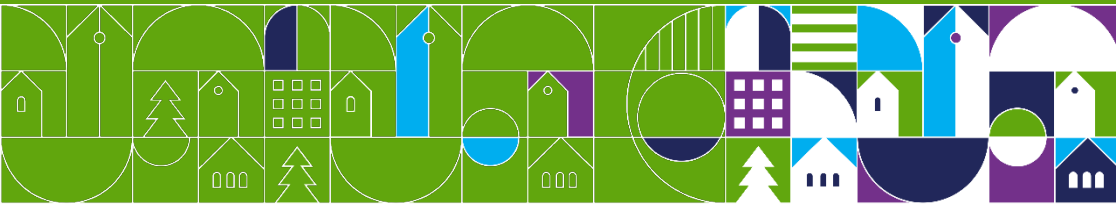






## OUR MISSION

Eden Housing creates and sustains high-quality affordable housing communities that advance equity and opportunity for all.





# ELECTRIFICATION RETROFIT STRATEGIES

- Determine if existing electrical infrastructure sufficient for power demand
- Evaluate and document existing conditions
- Free-up existing electrical capacity for new systems
- Monitor and analyze gas and electricity peak demand loads
- 15amp appliances, 100amp subpanels, single and three phase
- Feeder cables and branch circuit wiring
- Meter banks and service disconnects
- Transformer







# ELECTRIFICATION LOAD REDUCTION STRATEGIES

## DHW loads

- Showerheads, faucets, minimize crossover
- Efficient dishwashers, clothes washers, insulate pipes.

## HVAC Loads

- Insulate envelope
- Minimize duct runs
- Select high efficiency 120V low amperage appliances

## Upgrades

- Lighting
- Cooking
- Miscellaneous Equipment

## Offset Increased Electricity Loads with Photovoltaics

## NON-ENERGY BENEFITS:

- Improved IAQ
- Energy Cost Savings
- Lower GHG





# LIGHT TREE APARTMENTS



Project Owners	Eden Housing & East Palo Alto Community Alliance and Neighborhood Development Organization (EPACANDO)
Project Residents	Low-income and extremely low-income families and individuals, including 30%-60% AMI units set-aside for formerly homeless, former foster youth (FFY) and intellectually and developmentally disabled (I/DD)
Location	1805 East Bayshore Road, East Palo Alto
Site Details	3.38 acres
Units	94 existing units 185 units under construction 57 substantially rehabilitated units, 37 units demolished
Est. Completion Date	January 2023
Est. Development Cost	\$36.2 million rehab portion; ~\$44 million new construction hard costs
Developer	Eden Housing, Inc. and EPACANDO
Architect	Okamoto Saijo Architecture
General Contractor	Johnstone Moyer, Inc.





# LIGHT TREE ELECTRIFICATION

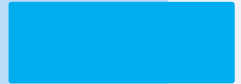
- New HVAC, mechanical, electrical systems,
- New utility service
- Existing gas service discontinued
- New solar photovoltaics system
- New elevators for existing three-story buildings
- EV charging stations





# Apartments and Townhomes





Good incentives offset a lot of the cost of the install

AEA provided technical support throughout electrification process

Construction bid phase incentive would increase savings

Extra coordination with sub for new equipment

Space limitations for indoor/outdoor HPWH systems equipment

Path of transporting/handling larger tank inside a building, existing structural conditions, outdoor placement

Min. piping connections causing conflicts inside building

Title 24 modeling CHPWH

Noise levels of HPWH







## Biggest costs and savings?

- Water heating: 15% premium on electric HPWH
- Cost and time savings in not having to reinstall gas infrastructure
- Grants offset additional costs, exceeding the cost of the premium

## How to make electrification more cost-effective?

- Monitored performance
- Benchmark performance data to track operational savings





## Priorities to smooth path to electrify?

- Solve disconnect between state all-electric program incentives and scoring metrics
- AHSC adds points for generating a 33% energy offset from PV
- Electrification requires more onsite PV to offset added loads
- Scoring system incentives based on offsets generated
- Different scoring system for going all electric
- TCAC policies are not electrification-friendly due to lack of data on utility cost impact to tenants

## Challenges to be addressed ?

- Project sized to support a centralized HPWH to be cost efficient
- HPWH for every unit more expensive per unit than central system
- Maintenance costs due to the sophistication/type of equipment
- 3 different HPWH systems due to grants, equipment funded
- Owner-Tenant split incentives
- IOU high electric rates, both Time of Use (TOU) and non-TOU





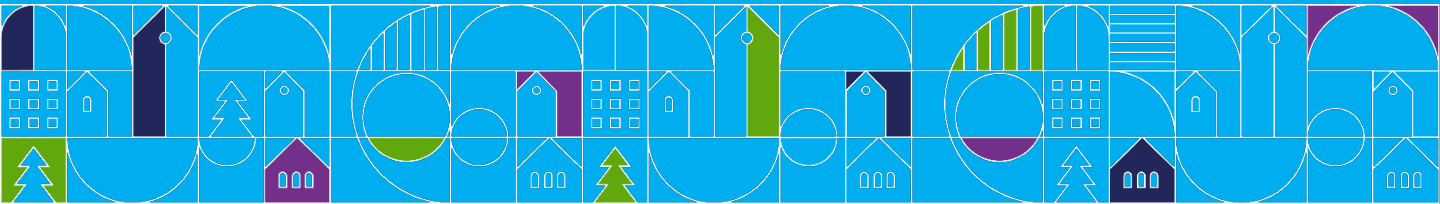
## **What types of incentive programs are needed?**

- Incentive programs that cover equipment, install and design costs
- EPIC program through AEA provided HPWH for free and some at cost
- Cover install and redesign costs associated with swapping out fossil-fueled appliances and DHW & HVAC mechanical equipment
- Public funding sources for construction and operation determine the feasibility of electrification





# RESOURCES







A Zero Emissions All-Electric Multifamily Construction Guide,  
Redwood Energy, 2019

[Accelerating Electrification of California's Multifamily Buildings:](#)  
Policy Considerations And Technical Guidelines, StopWaste  
and Association For Energy Affordability (AEA), 2021

[Electrification Technical Assistance Program](#) brought to you by  
TRC, Peninsula Clean Energy and Silicon Valley Clean Energy

[Low-Income Weatherization Program for Multifamily  
Properties \(LIWP Multifamily\)](#)

**Tom White: [tom.white@edenhousing.org](mailto:tom.white@edenhousing.org)**





## Housing & Business Development Goals:

*Brian Warwick - Housing &  
Community Development*

*Eric Simundza - Economic &  
Workforce Development*





# Equitable Decarbonization in Oakland



## Revalue.IO: *Mark Hall*





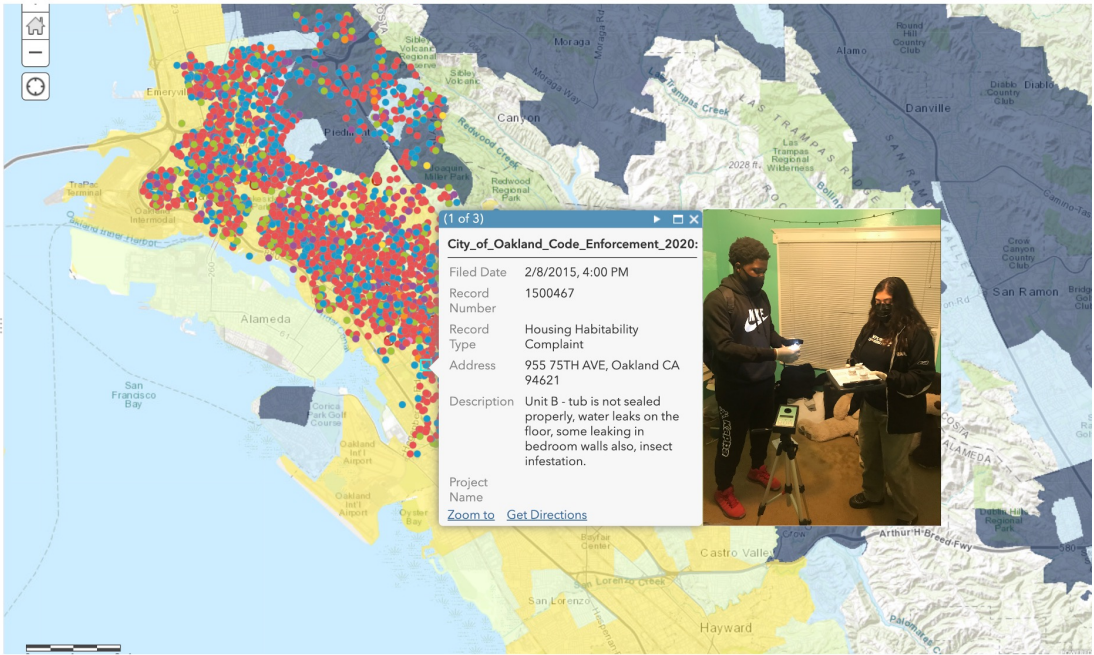
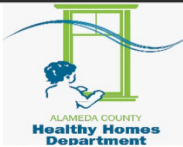
# About us

Revalue.io is a West Oakland based Energy Efficiency Project Developer accelerating the transition to clean energy by eliminating home health hazards and delivering energy savings through building electrification.

Using local demographic and building level building data such as code complaints, permits etc., Revalue.io leverages the intersection of various program resources to serve/target 'hard to reach' communities.

Developing local workforce capacity, Revalue.io trains and employs local residents to identify and deliver installations and home health hazards interventions.

## Revalue.io





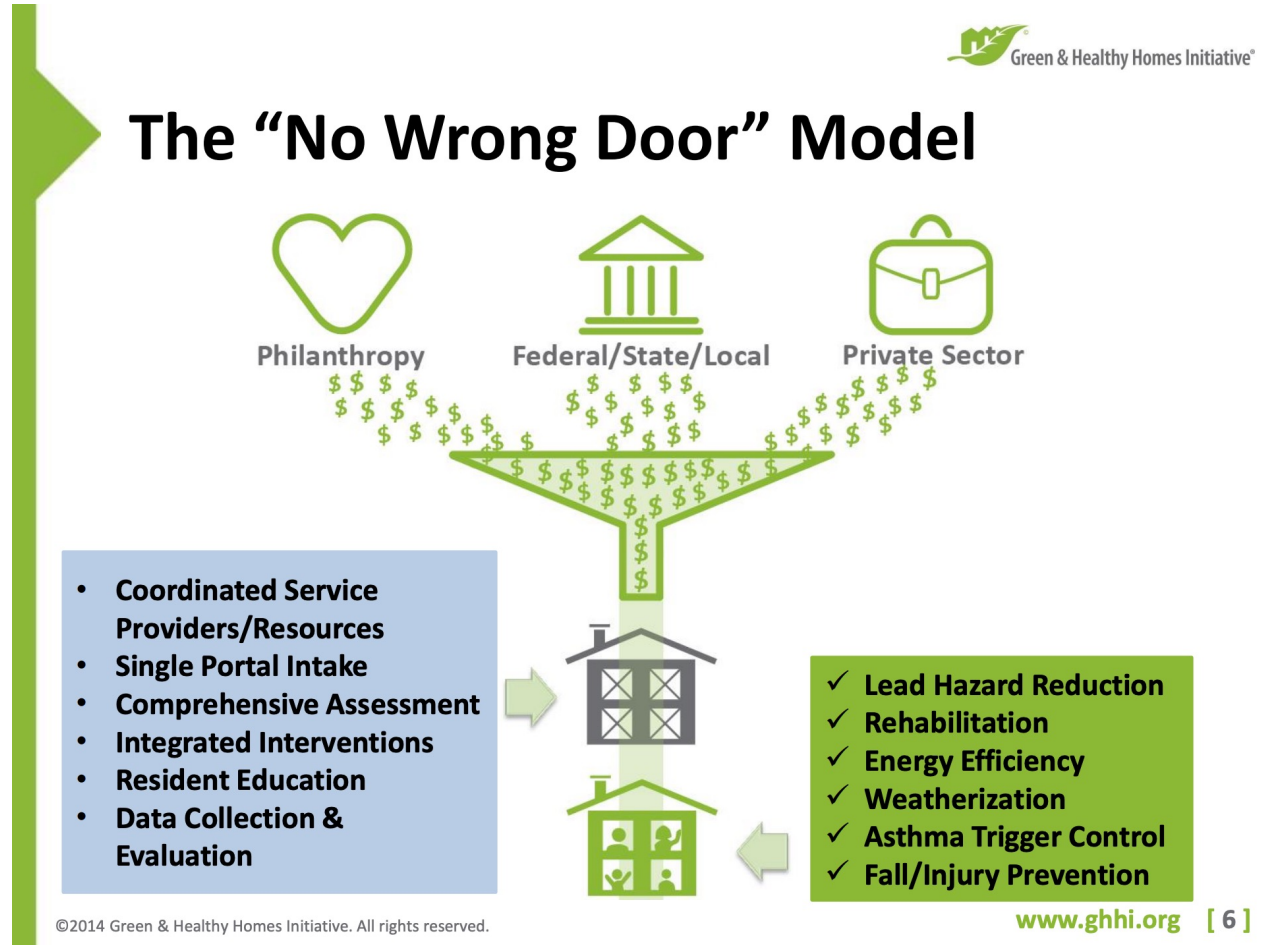
# Building Electrification Problems

## **Barriers/ Challenges/constraints/needs (Hard to Reach/Serve LMI)**

- Technology
  - Unfamiliar with new tech
  - Upfront cost
- Policy
  - Permit process
  - Code complaints, soft story
- Equity
  - Lack of local contractors
  - Split Incentive/ Fear of displacement (NOAH)
  - Diagnosing issues comprehensively (remediation) (Green Healthy Homes)
  - Aligning programs, rebates, grants, incentives (difficult)

# Solution

- Local workforce development
- No Wrong Door Green Healthy Homes (Pay For Success)
- Green Leases
- Eco Block





# 6309 Marshal

## Problem

- Customer complained about uneven heating (comfort & cost)
- Potential lead paint concern (children under 6)

## Solution

- ✓ Lead paint grant (\$10k)
- ✓ Air sealing, insulation, 6 zone mini-split heat pump HVAC with smartphone controls



# 486 36<sup>th</sup> St.

## Problem

- Significant health, life and safety concerns including mold, fall hazards, exposed electrical, pests, etc.
- Existing funding streams would not cover entire project cost

## Solution

- ✓ Conducted home health assessment + Energy audit to qualify for GHHI gap financing (\$172k) leveraging \$30k in rebates and a \$300k forgivable loan from the City of Oakland





# 7762 Outlook Ave.

## Problem

- Senior homeowner has a sinking foundation due to natural spring.
- Potential lead paint
- Lack of insulation, broken windows, working furnace

## Solution

- ✓ Expand contractor network to leverage LIWP/LIHEAP
- ✓ City of Oakland Emergency Repair program
- ✓ Provide flexible term GHHI gap financing
- ✓ Lead paint grant (\$10k)







## Breakout #1: *Needs & Challenges*





## Building Electrification: Categories of Action

Job Creation and  
Training

Incentives and  
Rebates

Education and  
Outreach

Regulation

Tenant Protections

Gas Line  
Decommissioning

## Leading with Equity

- Prioritize & involve most-impacted communities
- Maximize benefits
- Prioritize Health, Safety, & Resilience
- Prevent displacement, maximize affordability
- Center Jobs & Economic opportunity
- Ensure ease of implementation
- Track & report progress, improve implementation over time





# Equitable Decarbonization in Oakland

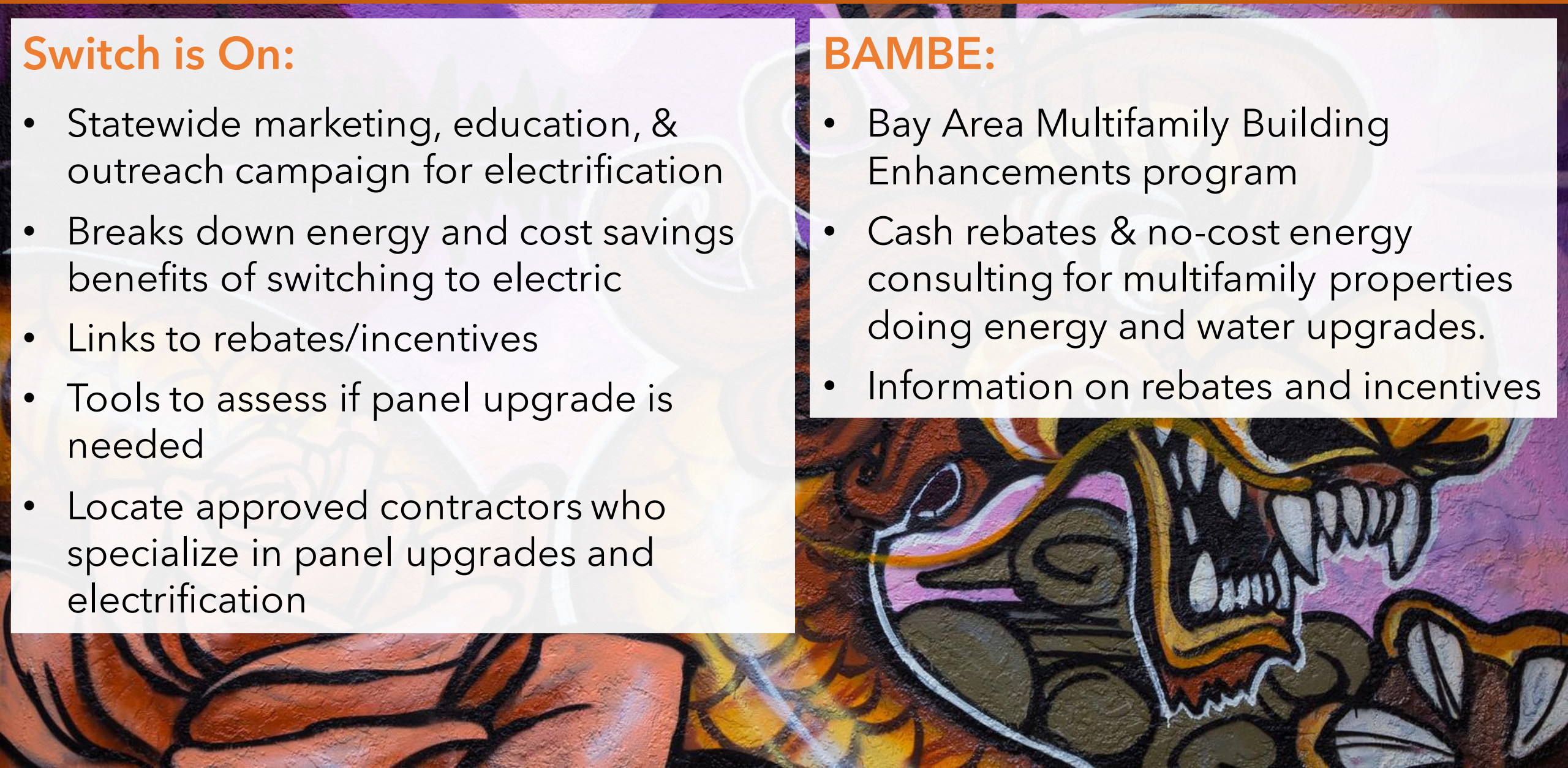


## Switch is On:

- Statewide marketing, education, & outreach campaign for electrification
- Breaks down energy and cost savings benefits of switching to electric
- Links to rebates/incentives
- Tools to assess if panel upgrade is needed
- Locate approved contractors who specialize in panel upgrades and electrification

## BAMBE:

- Bay Area Multifamily Building Enhancements program
- Cash rebates & no-cost energy consulting for multifamily properties doing energy and water upgrades.
- Information on rebates and incentives





## City Action: Options for Consideration

- Incentives to reduce cost burdens
- Government-funded changeout program
- Permit streamlining, fee waiver
- Strengthen Inspections
- CEQA mitigation
- Emissions Limits (Indoor air pollution limits for buildings or appliances; automatic compliance if all-electric)
- Building performance standards
- Benchmarking/Assessments & disclosure
- Replacement @ burnout
- Upgrades/replacement @ resale / occupancy change
- Ban sale of natural gas appliances
- Neighborhood-scale upgrades/pruning



## Berkeley's Existing Buildings Electrification Strategy

- Time of Replacement + Renovation
  - Incentivize replacement of gas systems at burnout
- Time of Sale
  - identify opportunities for electrification when a building is being sold
- Building Performance Standards
  - Set minimum level of performance that buildings must achieve by set target dates
- Neighborhood Electrification and Natural Gas Pruning







## Breakout #2:

### *Identifying Optimal Strategies & Phasing*





# Equitable Decarbonization in Oakland



**July 2020:** Council commits to a fully-electric building stock by 2040 and Carbon Neutrality by 2045

**Dec. 2020:** Council mandates that all new construction must be all-electric

**March-Dec. 2021:** Electrification Workforce Stakeholder series

**March 2022:** Zero-Emission Vehicle Action Plan  
Electrification Informational Reports

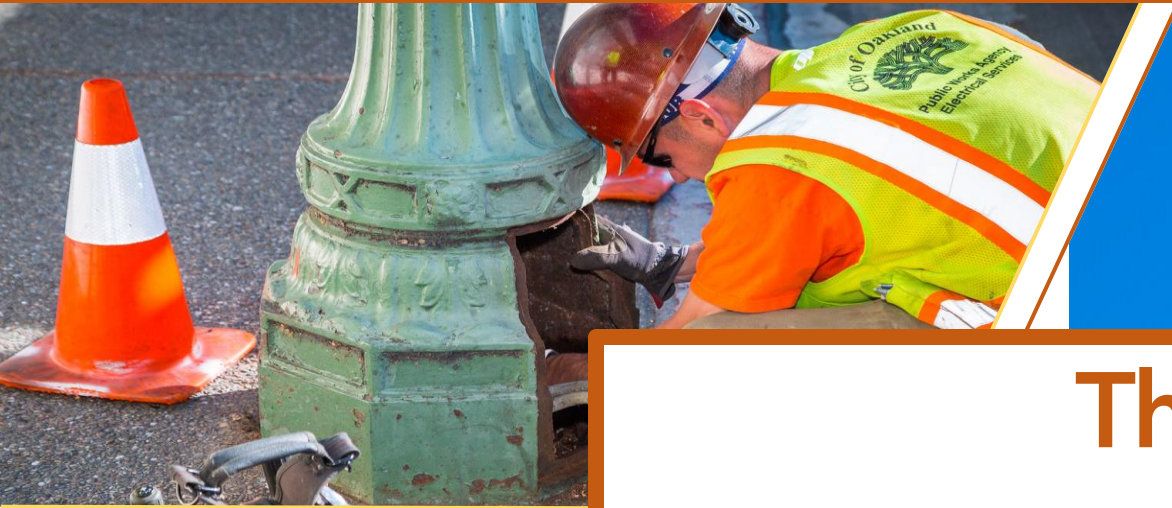
- Workforce needs & opportunities
- Opportunities for Major Retrofits
- Needs & Resources for restaurants & affordable housing

**Jan-Nov. 2022:** Ongoing Community & Stakeholder Engagement

**Survey!**

**December 2022:** Final Building Electrification Roadmap

# Equitable Decarbonization in Oakland



**Thank You!**

*Keep in Touch:*

*[climate@oaklandca.gov](mailto:climate@oaklandca.gov)*

*[www.oaklandca.gov/projects/building-electrification](http://www.oaklandca.gov/projects/building-electrification)*







CITY OF OAKLAND