



May 9, 2023

# Transforming the Appliance Market: Strategies for Lower-Emissions Heat and Hot Water

Webinar

---

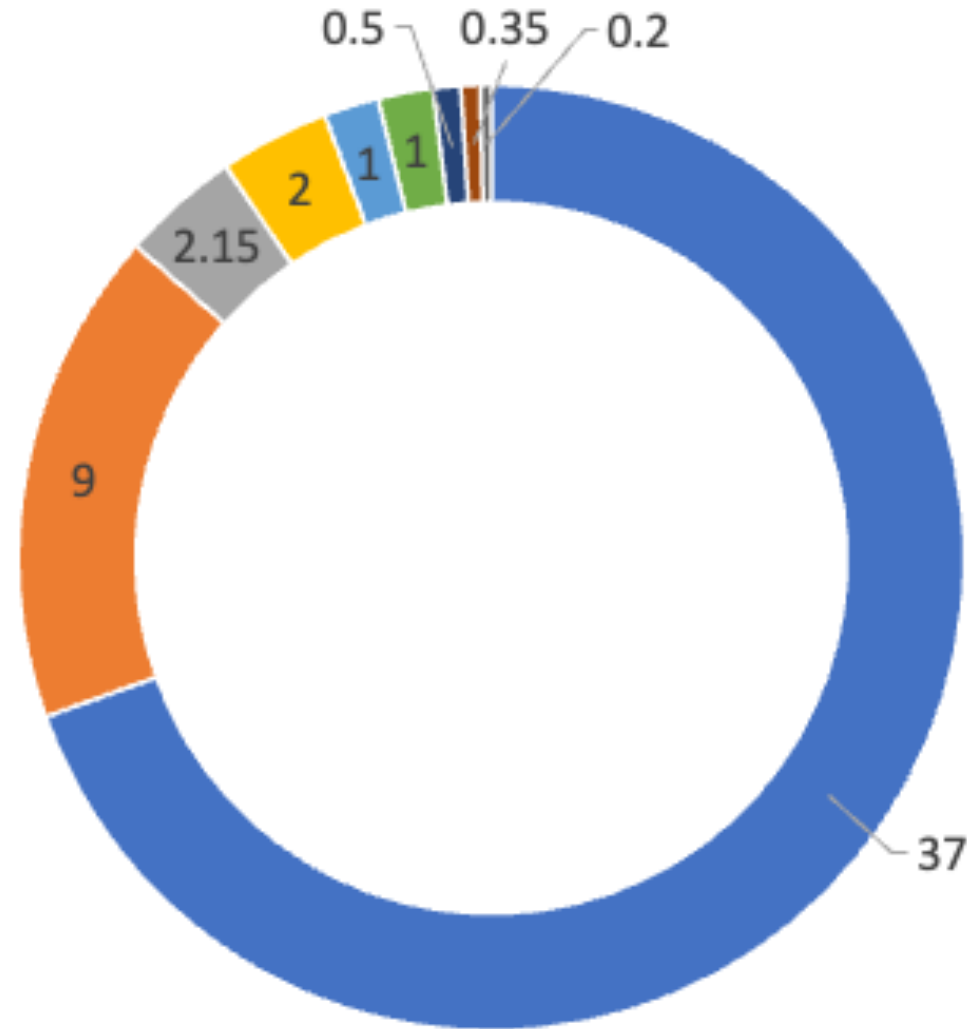
# Why Appliance Standards?

- Appliance emission standards can drive market transformation
- Standards create a long-term market signal
- Addressing consumer barriers is key to driving change
- Environmental and energy offices working together can improve equitable deployment
- IRA and IIJA provide “once in a lifetime” incentive opportunities to support market transformation

# The IRA is a Game-changer for Buildings

**\$50+**  
**Billion**

**~60**  
**MMtCO<sub>2</sub>e**  
**Reductions in**  
**2030**



Building Decarbonization  
Funding in Inflation  
Reduction Act (Billion \$)

- Tax Credits
- Rebates
- Federal EC Fund
- FHWA EC
- HUD
- Codes
- DPA
- EC Labeling
- Workforce Training



# Emission Standards to Reduce Appliance Pollution

**Leah Louis-Prescott**  
**RMI, Carbon-Free Buildings**  
**May 9, 2023**





**In the US, nearly 3 out of every 5 homes  
burns fossil fuels for heat & hot water.**

# Fuel-Burning Appliances Release...

## Carbon Monoxide (CO)

## Nitrogen Oxides (NO<sub>x</sub>)

## Particulate Matter (PM<sub>2.5</sub>)

### What is it?

Odorless, invisible gas

Reddish-brown to colorless gases

Inhalable particles 2.5 microns in diameter or smaller

### What are the health impacts?

Can cause CO poisoning: mild to moderate cases have flu-like symptoms, whereas serious cases can result in death

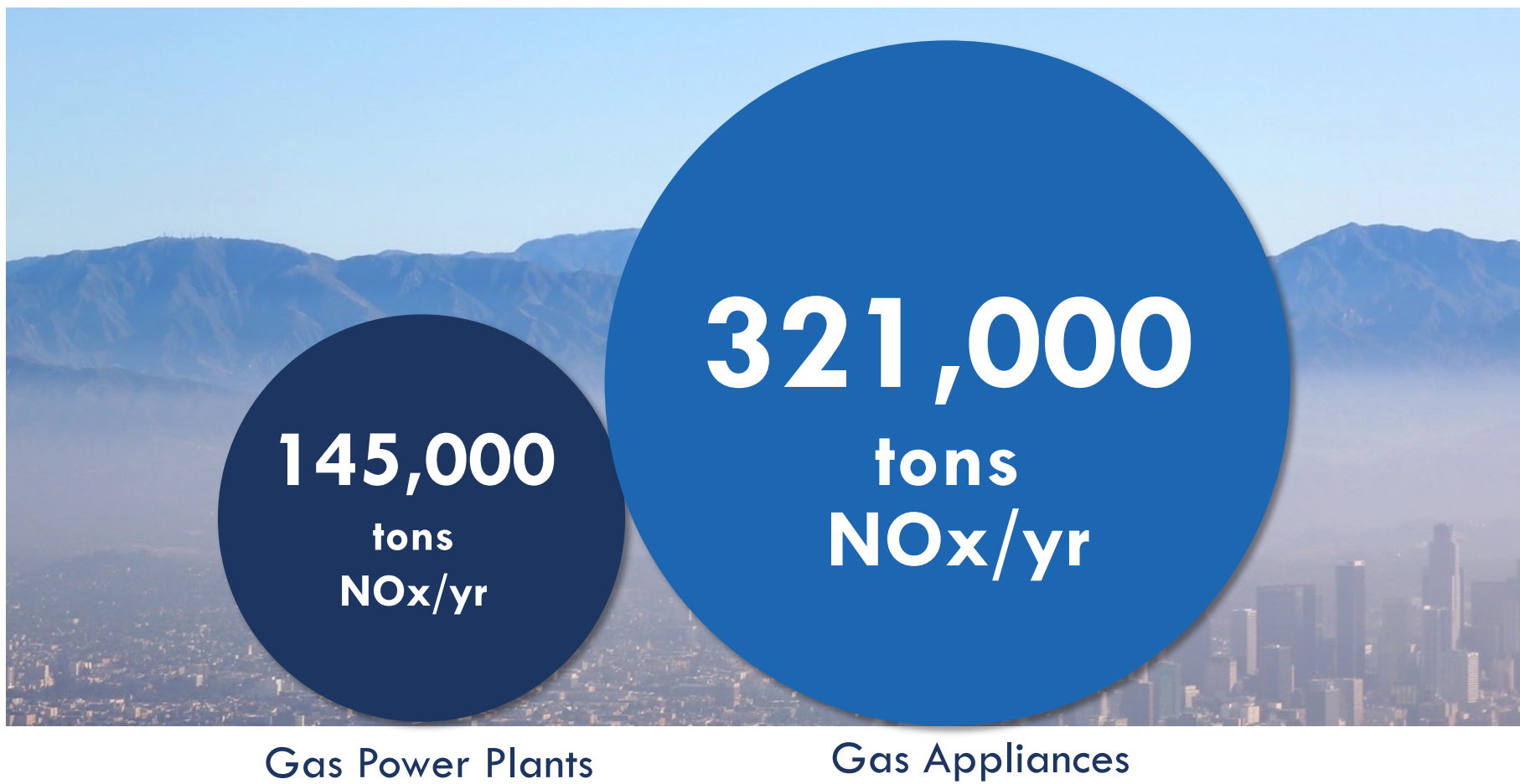
Still studying long-term, low-level exposure to CO

Can inflame lining of lungs. Linked to asthma development & respiratory symptom aggravation

*Not-so-fun fact:* NO<sub>2</sub> reacts with sunlight & other chemicals in air to form particulate matter (soot) & ozone (smog)

Can penetrate the lungs and blood stream. Linked to asthma, respiratory inflammation, & premature death

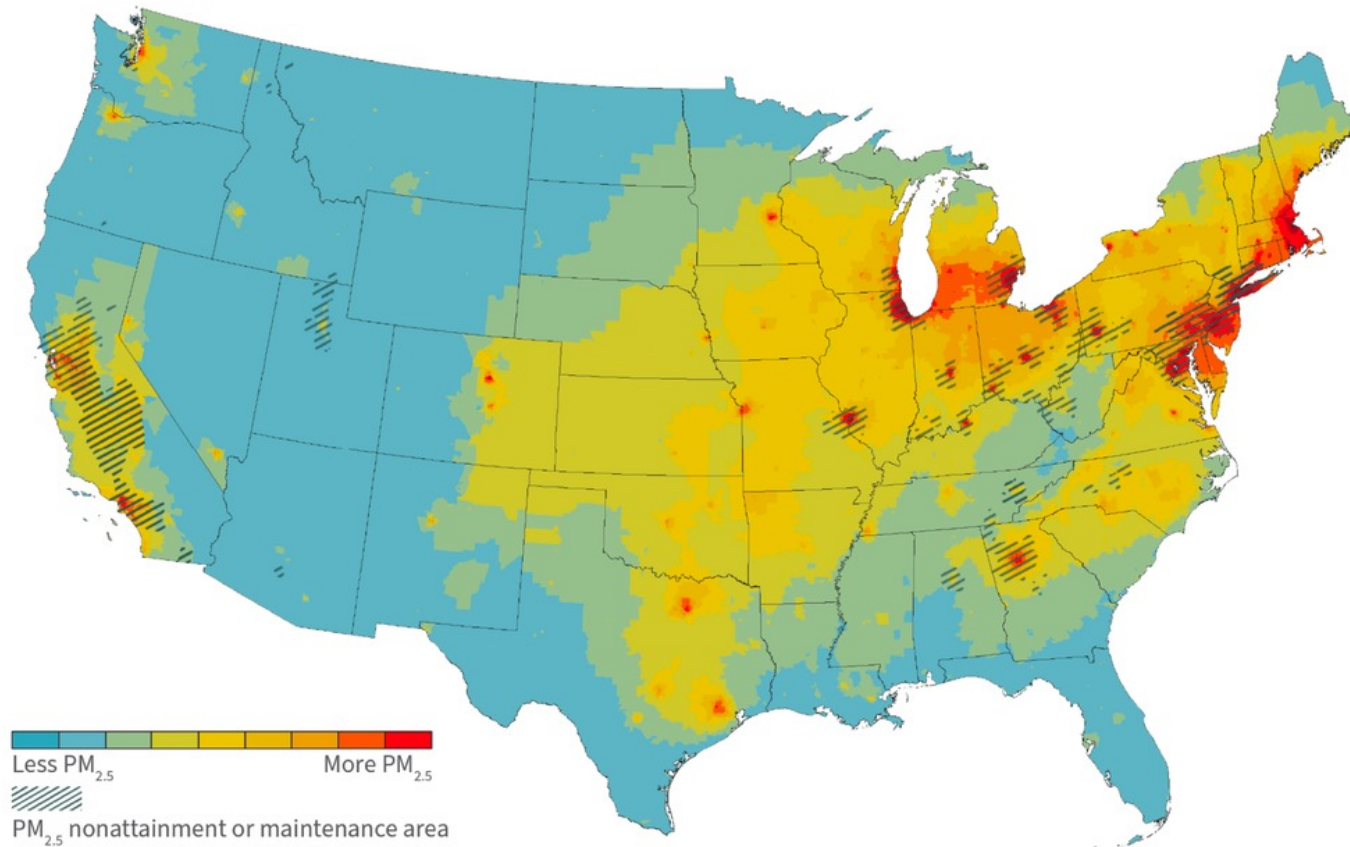
# U.S. gas appliances emit over twice as much NOx pollution as gas power plants, despite burning less gas





# Appliance pollution contributes to nonattainment of federal air quality standards

Exhibit 3      2017 PM<sub>2.5</sub> Concentrations from Fossil Fuel Appliances and  
PM<sub>2.5</sub> Nonattainment/Maintenance Areas

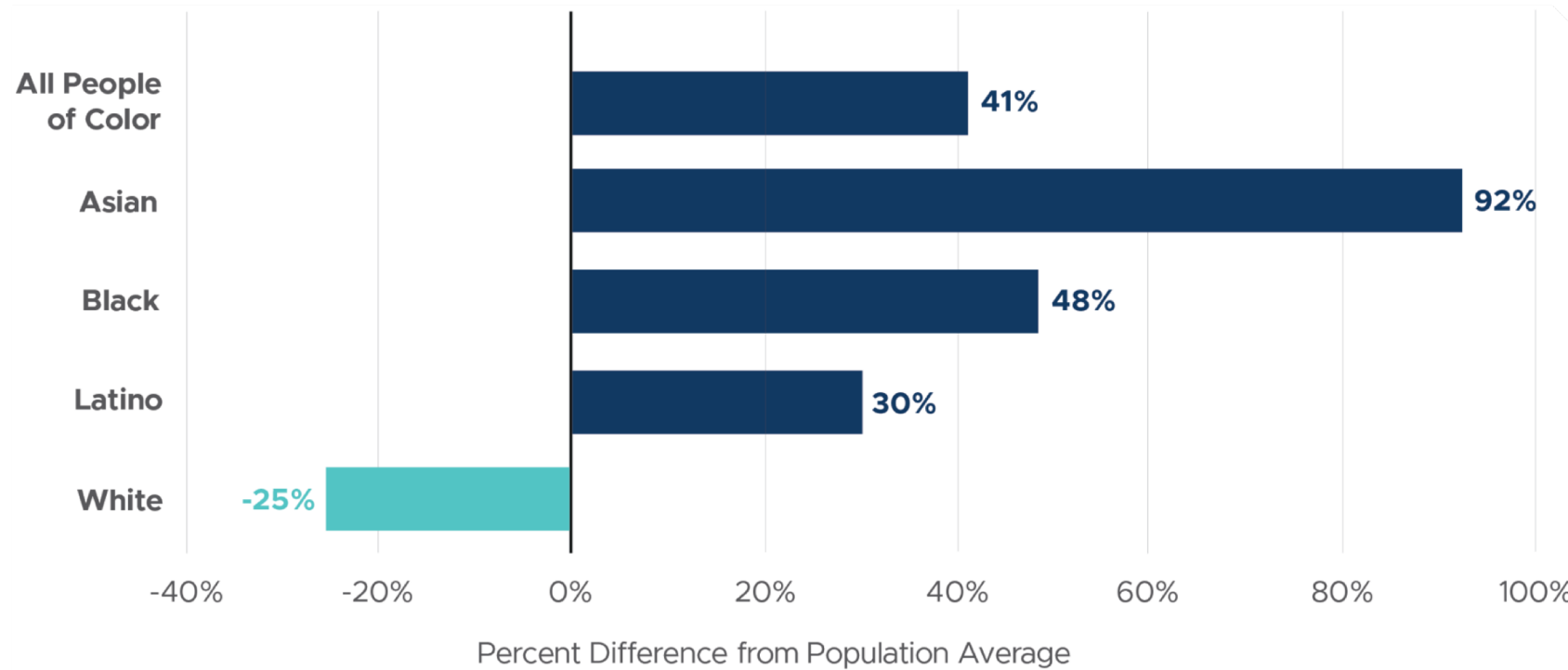


Source: RMI analysis of EPA 2017 National Emissions Inventory and InMAP pollution modeling tool



# Appliance pollution disproportionately harms People of Color

Racial-Ethnic Disparities in Exposure to PM<sub>2.5</sub> Pollution from Residential Gas Combustion



People of Color are exposed to nearly twice as much PM<sub>2.5</sub> formed by residential gas appliances as Whites.

Source: Christopher W. Tessum et al., *PM<sub>2.5</sub> Polluters Disproportionately and Systematically Affect People of Color in the United States*, 7 *Sci. Adv.* eabf4491 (2021).

# If all new appliance sales are electric by 2030, then by 2045 we could avoid:



500 million  
metric tons CO<sub>2</sub>e  
per year



530,000 tons NO<sub>x</sub>  
per year

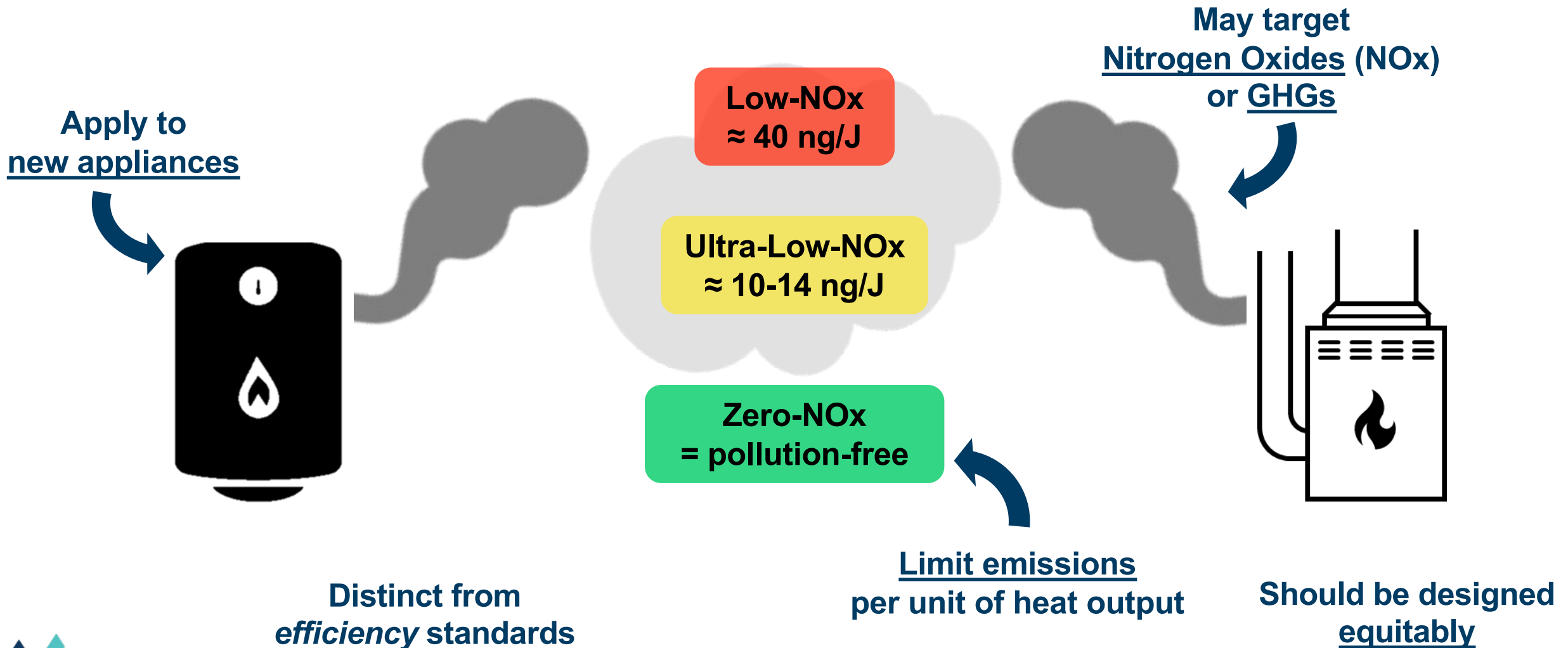


\$42 billion in health  
and climate costs  
per year



About 4,000  
premature deaths  
per year

# Appliance emission standards set pollution limits on appliances sold or installed in a geography



# Appliance emission standards have existed for decades

Regulatory Agency	Water Heater NOx Standard* (date initially enacted)	Furnace NOx Standard* (date initially enacted)
CA South Coast Air District	10 ng/J (1978)	14 ng/J (1978)
CA Ventura County Air District	10 ng/J (1985)	40 ng/J (1993)
CA Bay Area Air District	10 ng/J (1992)	40 ng/J (1983)
CA San Joaquin Valley Air District	0.024 lb/MMBTU (1993)	14 ng/J (2005)
CA Sacramento Metro Air District	10 ng/J (1996)	
TX Department of Environmental Quality	10 ng/J (2007)	
CA San Diego County Air District	10 ng/J (2015)	40 ng/J (1998)
UT Department of Environmental Quality	10 ng/J (2017)	

\*Listed regulations are a sample, not a comprehensive list.  
Please visit regulatory agency websites for more information.

# Bay Area passed nation's first zero-emission furnace & water heater standards to reduce air pollution

Appliance	Size (heat rate input capacity)	NOx Standard	Effective Date
Single-family residential water heaters	75,000 BTU/hour or less	Zero-NOx	2027
Residential furnaces	<175,000 BTU/hour	"Ultra-low-NOx" (14 ng/J)	2024
		Zero-NOx	2029
Multi-family & commercial water heaters	75,001 to 2,000,000 BTU/hr	Zero-NOx	2031

# Zero-emission appliance standards must be equitable

## Equity design elements to consider:



**Lead time**



**Interim evaluations**



**Implementation working group**



# Bay Area's Implementation Working Group will report on rule's technical readiness and equitable transition

Potential topics of discussion...

- Market availability of zero-NOx technology
- Costs of purchase, installation and operation for zero-NOx technology
- Incentives and other funding/financing available, especially for low-income
- Potential challenges and opportunities for an equitable transition



**Thank you!**

**[llouisprescott@rmi.org](mailto:llouisprescott@rmi.org)**



# Tackling Building Emissions in the Northeast

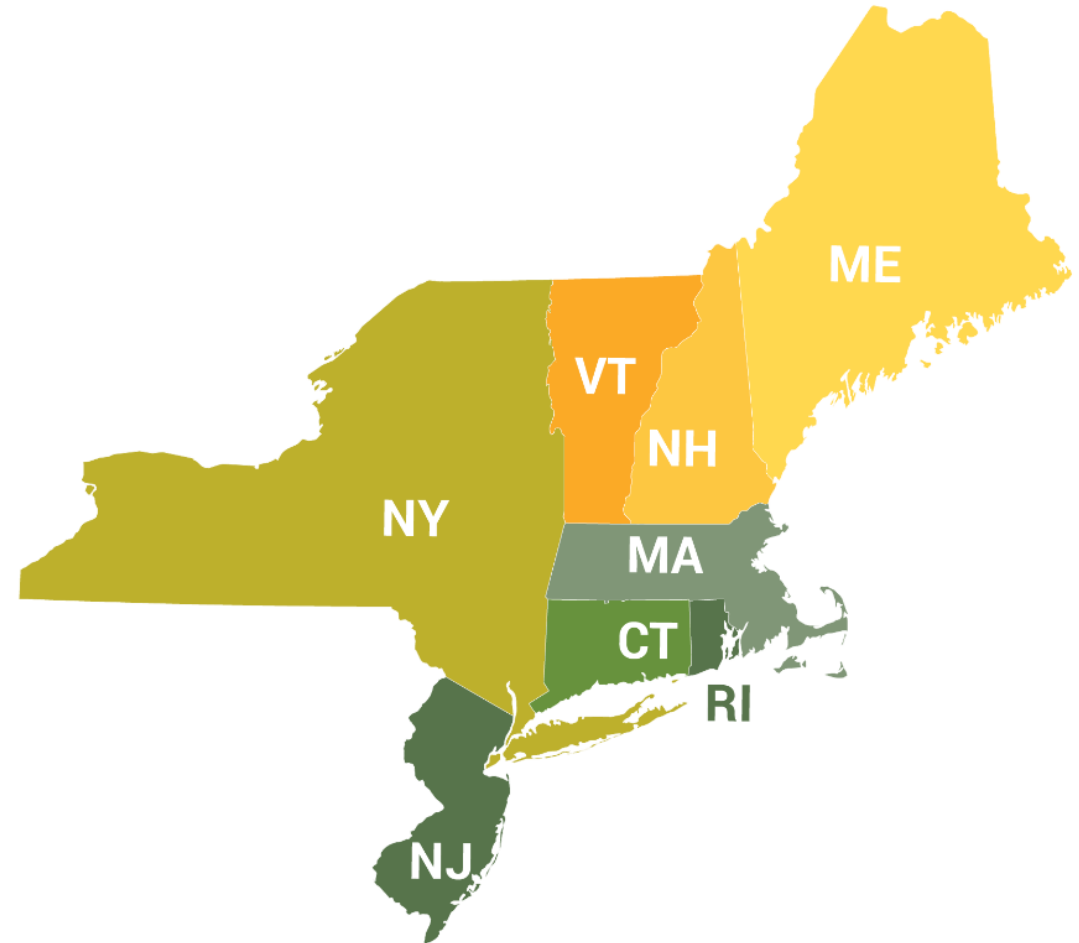
Emily Levin

RAP Webinar: Transforming the Appliance Market

May 9, 2023

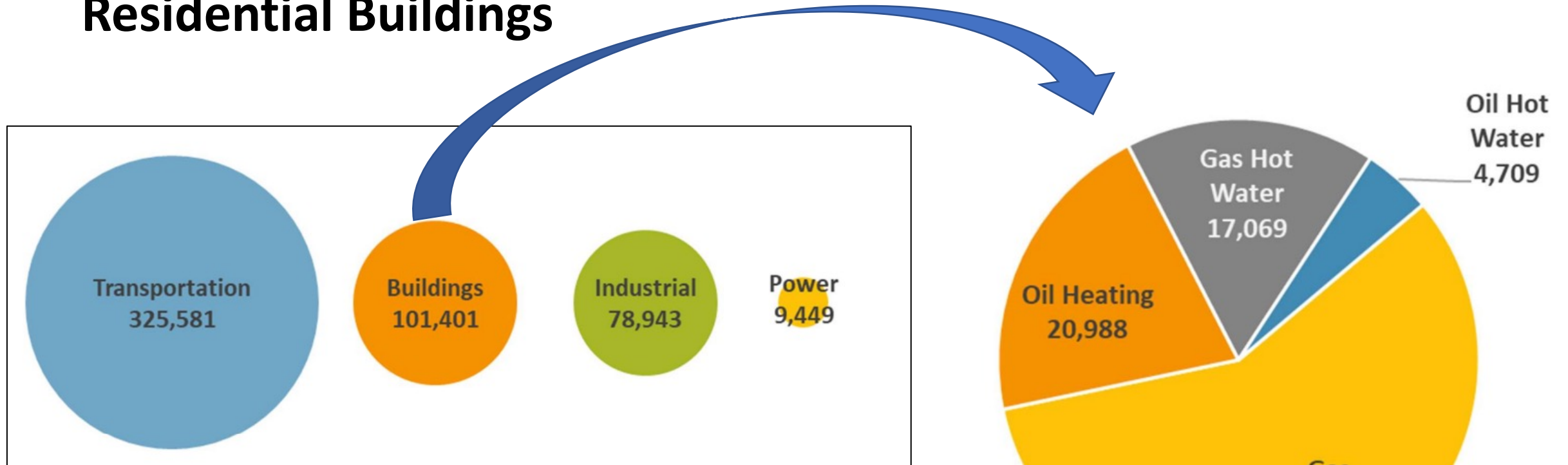
# Northeast States for Coordinated Air Use Management (NESCAUM)

- NESCAUM is the regional nonprofit association of state air quality agencies in the Northeast.
- We assist member states in meeting their air quality, climate, and environmental justice goals.
- We provide scientific, technical, analytical and policy support to states.





# NOx Emissions From On-Site Fossil Fuel Combustion in Residential Buildings



- Data shown for the NESCAUM region
- Data excludes emissions associated with electricity generation



Source: RECS, CBECs, AP42

# Ozone Nonattainment in the Northeast and Mid-Atlantic

- NOx emissions from burning fossil fuels in buildings contributes to ozone non-attainment in the region

Nonattainment Area	Population	2015 NAAQS Status	2008 NAAQS Status
Greater Connecticut, CT	1,629,115	Marginal <sup>a</sup>	Serious
New York City, NY-NJ-CT	20,217,137	Moderate	Serious <sup>b</sup>
Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE	7,437,135	Marginal <sup>a</sup>	Marginal
Baltimore, MD	2,662,691	Marginal <sup>a</sup>	Moderate
Washington, DC-MD-VA	5,136,216	Marginal <sup>a</sup>	Maintenance

<sup>[1]</sup> EPA Air Quality Design Values, <https://www.epa.gov/air-trends/air-quality-design-values#report>. Accessed April 25, 2022.



70 ppb 8-hr average ozone NAAQS

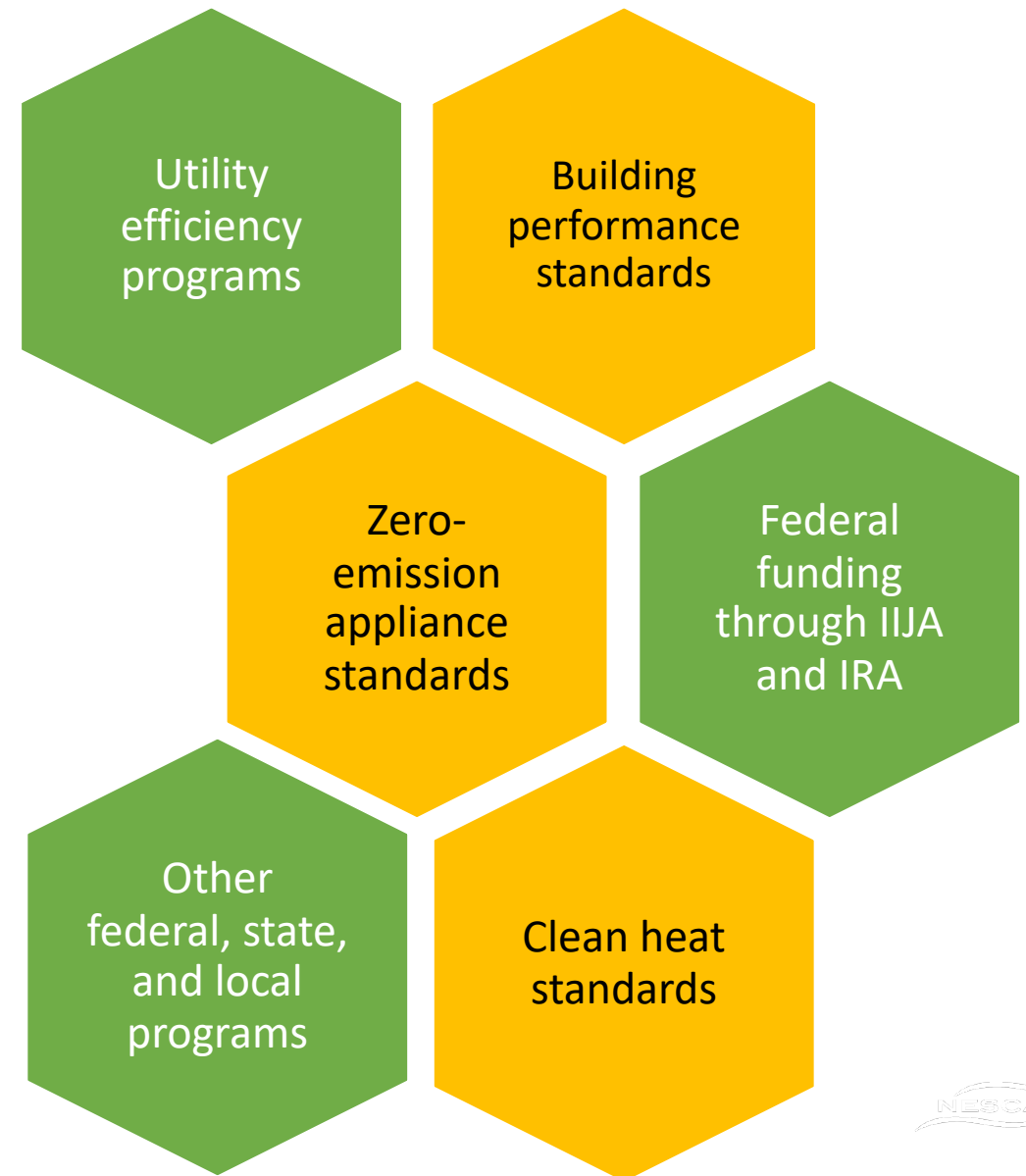


# NESCAUM Building Electrification Task Force

- 11 states participating: NESCAUM states, CA, MD, DC
- Air, energy, and climate program staff participating.
- **2022: Build capacity of state air agencies**
  - Increase knowledge base on building electrification
  - Presentations and case studies on building technologies, costs, and policy options
- **2023-2024: Accelerate progress**
  - Facilitate work group of states considering key policies such as zero-emissions appliance standards (e.g., adopting model rule for NO<sub>x</sub> emissions from water heaters)
  - Conduct or convene research to provide states with the data they need to support new regulations (e.g., CO<sub>2</sub>, NO<sub>x</sub>, and PM<sub>2.5</sub> emissions by state, total and in ozone season)
  - Center equity and environmental justice by learning from community advocates and incorporating feedback and guidance into Task Force technical and policy documents

# Many Levers to Tackle Building Emissions

- Different states in the Northeast and Mid-Atlantic are prioritizing different policies:
  - **MA & VT:** Clean Heat Standards
  - **DC & MD:** Building Performance Standards
  - **NY:** Zero-emission appliance standards and prohibition on fossil fuel equipment in new construction



# For More Information

Emily Levin

Senior Policy Advisor, Building Electrification

617-259-2046

[elevin@nescaum.org](mailto:elevin@nescaum.org)





# **Making Low-Emission Water Heaters Accessible and Affordable**

**Nancy L. Seidman, Senior Advisor  
Regulatory Assistance Project**

---

# Beneficial Electrification — Appliances



1. Saves Customers Money  
Long-Term; New Services



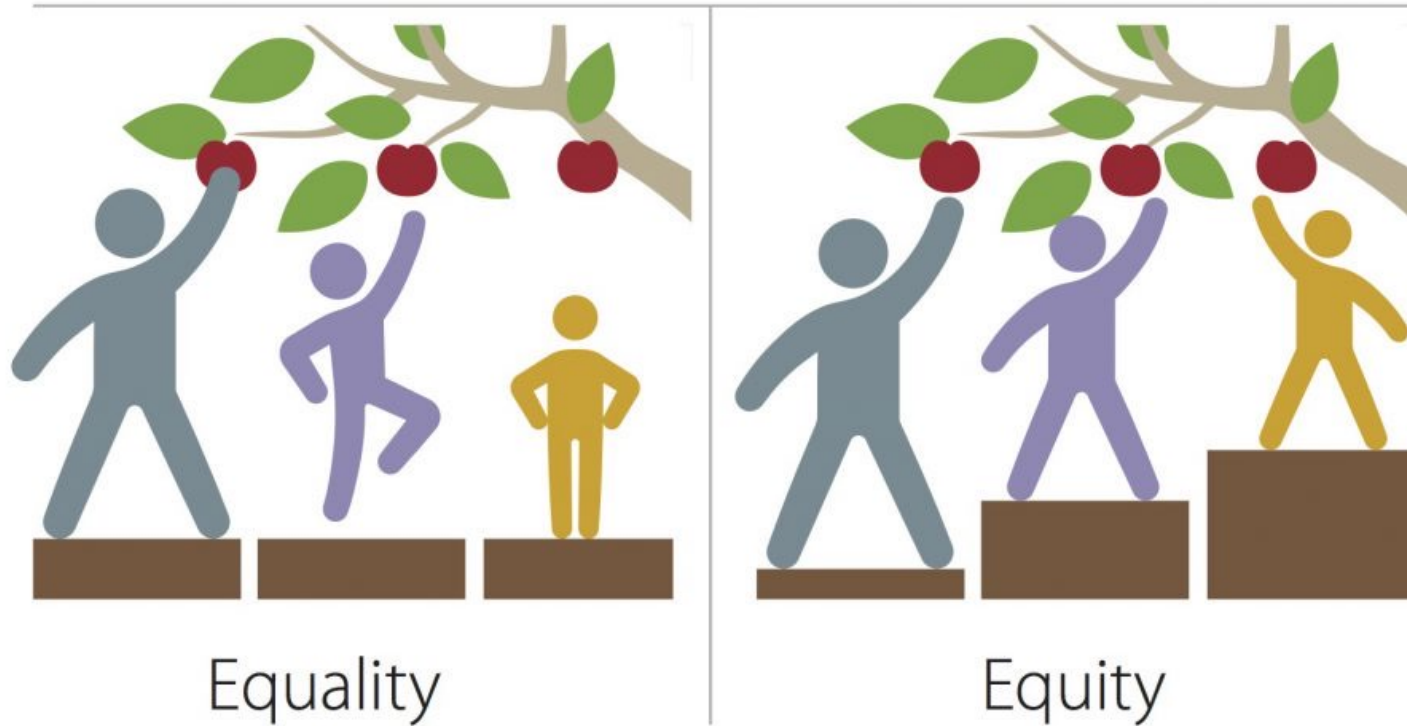
2. Reduces Environmental Impacts



3. Enables Better Grid  
Management

*Three Criteria: Appliance Emission Standards  
Meet all Three*

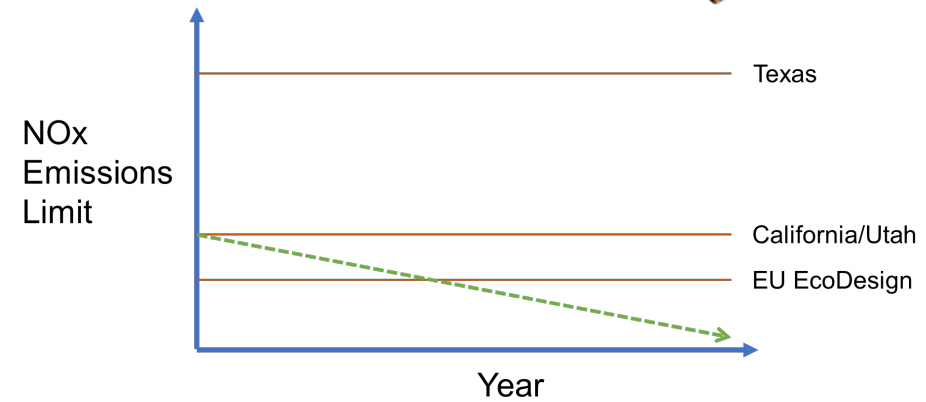
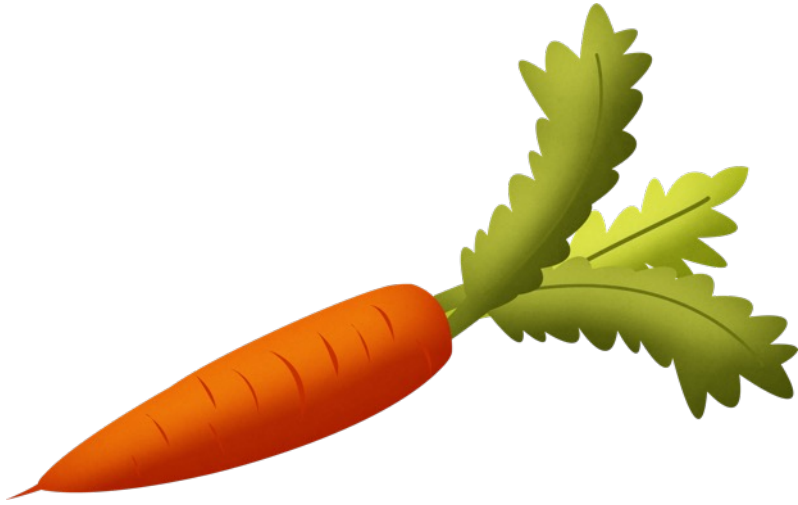
# Leave No One Behind



- Equity requires careful consideration when rolling out any program
- Key - not disrupting access to energy (electricity, heat, hot water, etc.)
- Specific and measurable actions are ways to ensure communities are engaged



# Effective Change Requires Both...



# RAP Water Heater Model Rule

---

# How Does the Model Rule Work?

- Prohibits sale or installation of water heaters that haven't been certified as meeting a NOx emissions limit
- Establishes a schedule of emissions limits for different categories of water heaters that take effect in future years
- Manufacturers must submit 3<sup>rd</sup> party emissions testing of their water heater models to obtain a certificate, or submit a certificate from another air pollution regulatory agency

# Model Rule Emissions Limits

Year	Category 1 (ng/J heat output)	Category 2 (ng/J heat output)	Category 3 (ng/J heat output)
24 months after rule promulgation	10	14	--
2030	7	7	--
2035	0	0	0

---

# The Hot Water Heater Model Rule: Take A Picture For More Information



**Model Rule Overview**



**Technical Support  
Document**



# About RAP

The Regulatory Assistance Project (RAP)<sup>®</sup> is an independent, non-partisan, non-governmental organization dedicated to accelerating the transition to a clean, reliable, and efficient energy future.

Learn more about our work at [raponline.org](https://raponline.org)



Nancy Seidman, Senior Advisor  
nseidman@raponline.org  
The Regulatory Assistance Project (RAP)<sup>®</sup>



# Delivering Results through Innovation: Results from a Heat Pump Water Heater Loaner Pilot

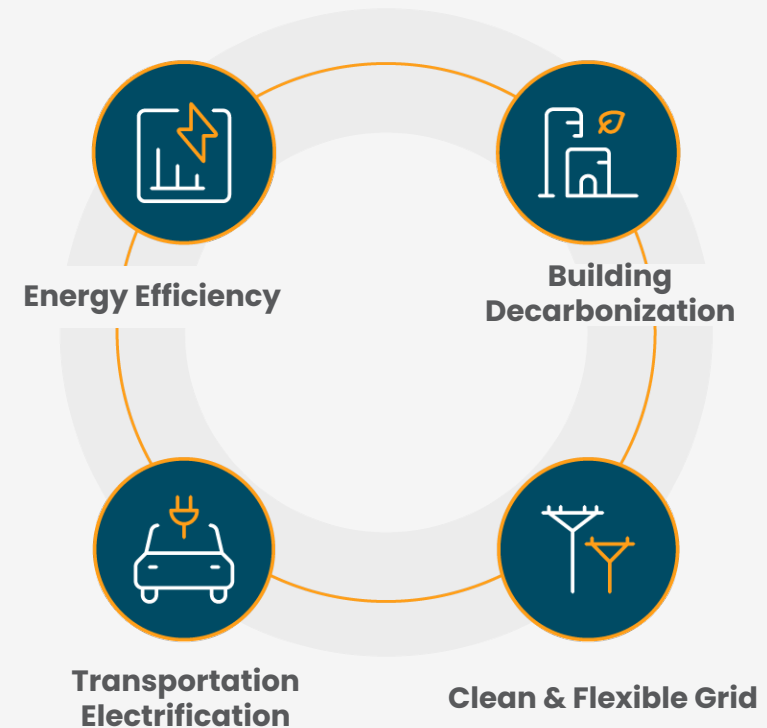
RAP Webinar: Transforming the Appliance Market  
May 9, 2023



# VEIC offers high-impact energy solutions that decarbonize buildings, transportation, and utility grids, today.

- **Nonprofit founded in 1986** with a mission to generate the energy solutions the world needs
- **National consulting practice working across over 75% of the country** advising states, utilities, Federal agencies, nonprofit organizations, and businesses
- **Program design & implementation for award winning energy efficiency and clean energy programs** including program administrator for Efficiency Vermont & the DC Sustainable Energy Utility; on administration team for TECH Clean California (statewide building decarb), CalNEXT (statewide electric emerging tech), Hawaii Energy, and Focus on Energy (WI)

**Making an impact** within each dimension of energy



# TECH Clean California and the Quick Start Grant Program

6 million heat pumps installed by 2030

Climate ready / friendly homes (3 million by 2030)

50% of funding delivered to low-income households or disadvantaged communities



Spur the clean heating market through statewide strategies



Create scalable models through regional pilots



Inform long-term building decarbonization framework

## Encourage deployment innovation

Rapidly **refine** specific needs

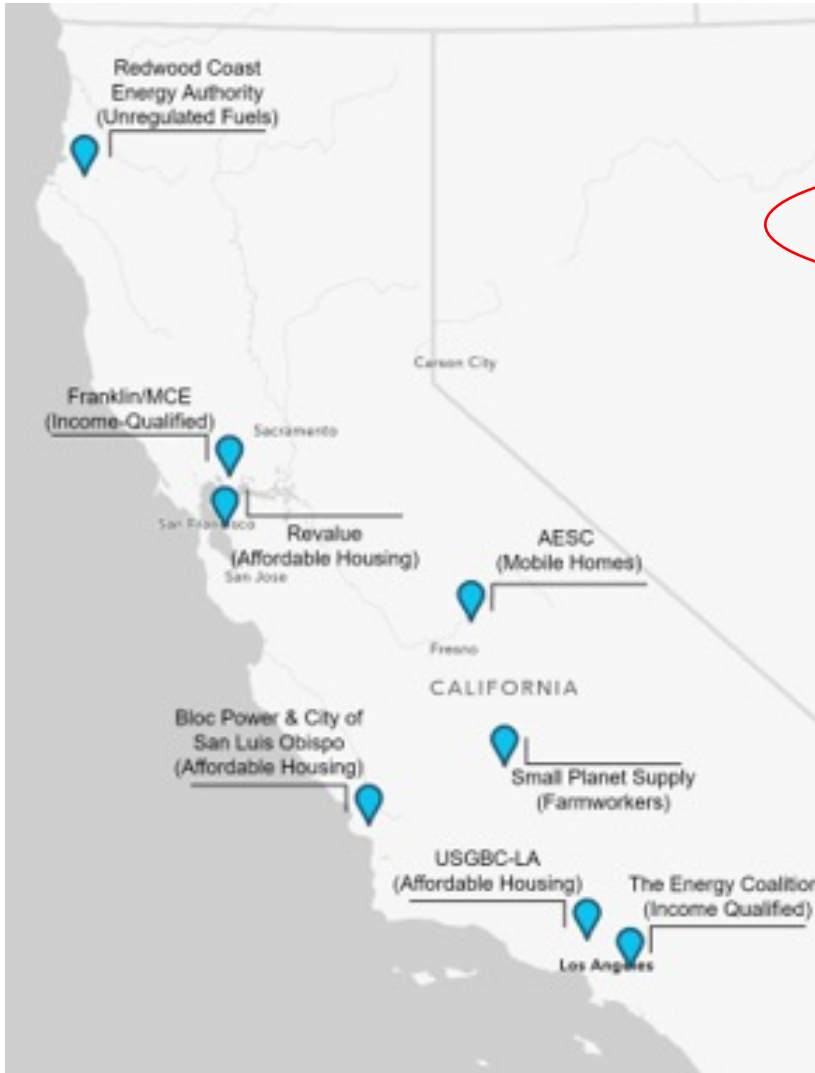
**Test** innovative program delivery models that address key market barriers and increase access to electrification

**Provide the funding** source innovative approaches need to scale

**QUICK START GRANT PROGRAM**

IMPLEMENTATION

# Quick Start Grants: 2022 Projects



## Enabling Faster Installations

- Barnett Plumbing**, Loaner Water Heaters for Emergency Fuel-Switching
- Small Planet Supply**, Parkside Apartments HPWH
- New Buildings Institute**, 120V HPWH Field Test
- IHACI**, Virtual Technician Software Platform

## Making Programs More Inclusive

- Redwood Coast Energy Authority**, Air Source Heat Pump Incentives for Unregulated Fuel Customers
- Franklin Energy and MCE**, Augmentation of Income-Qualified Electrification Program

## Reducing Energy Costs

- The Energy Coalition**, Basset Avocado Heights Advanced Energy Community HPWH
- AESC**, Interactive Impacts of HPWH in Manufactured and Mobile Homes

## Innovation for Hard-to-Reach Housing

- BlocPower and City of San Luis Obispo**, Better Buildings SLO Pilot
- Revalue**, Green and Healthy Homes
- USGBC-LA**, Electrification in Green and Affordable Homes Program

# Quick Start Grants: 2023 projects

## Unlocking access to green financing

**Climate Resolve & USGBC-LA:** HVAC heat pump and HPWH installations, data analysis and creation of a GHG calculator to attract new sources of green financing for the multifamily affordable housing market

## Solutions for Renters

**350 Bay Area,** Air purifier and portable HVAC heat pump for renter-occupied households in pollution-burdened neighborhood

## Solutions for Disadvantaged Homeowners

**City of Sacramento & SMUD,** Heat pump installation and home repairs for low-income single-family homeowners in conjunction with City anti-displacement program.

## Electrifying multi-family properties

**Viridis Consulting for Heather Village:** HPWH demonstration project, technical feasibility study and strategic outreach in HOA-governed multifamily housing  
**Bright Power:** aligning utility allowances with electrification.

## Improving Equitable Outreach

**Diversity Coalition & BlocPower,** Equity-focused education and outreach to chart a path to electrification in high-needs, black-and-brown communities.

## Innovation in Workforce Development

**Goodwill of Southern CA,** HVAC instruments and mentorship for students in low-income areas.  
**RHA,** HPWH Installation Best Practices and Field Guides

Learn more about the Quick Start Grant projects at <https://techcleanca.com/quick-start-grants/>

# Do Heat Pump Water Heaters work for Emergency Water Heater Replacements ?



## Higher Upfront Costs

HPWHs can increase replacement costs by \$3-4k over gas water heaters



## Delay in Restoring Hot Water Service

Additional time required for 240V electrical service and permitting



## Complexity with Permitting and Trades

Need for securing electrical contractor support for permitting and 240V service

# Barnett Plumbing - Loaner Water Heaters for Emergency Fuel-Switching

## An Innovative Solution

Single-family San Francisco Bay area customers committing to a 240V HPWH offered a same-day, no-cost gas loaner water heater installation

## No Incremental Cost

- TECH, BayREN & CCA removed cost barrier for converting to HPWH
- Quick Start Grant covered the gas loaner installation

## Results

- Increase in conversion rate from less than 1% to more than 17%
- Targeted primarily at “good candidate” sites
- 149 HPWHs installed / 127 gas loaners





# Opportunities for Innovation

## Cost and time is critical in emergency replacements

- Bundle/stack incentives ~ no/low incremental cost
- Simplified/expedited permitting
- Technology solutions to reduce cost/time for installations and need for additional trades (e.g. 120V HPWH)

## Simplify HPWH decision for contractors and customers

- Simple messaging & decision paths for emergency replacements
- Proactively target existing customers with older water heaters
- (Multiple) Same day hot water restoration!!!



# Get In Touch



**Chris Badger**

**veic**

Senior Consultant

[cbadger@veic.org](mailto:cbadger@veic.org)

(802) 279-5441



**Ben Foster**

**Barnett Plumbing**

Vice President Operations

[ben@barnettplumbing.com](mailto:ben@barnettplumbing.com)

(802) 279-5441



---

# IRA/IIJA Resources

- Federal
  - EPA - <https://www.epa.gov/inflation-reduction-act>
  - DOE - <https://www.energy.gov/save>
  - Treasury – <https://www.irs.gov/inflation-reduction-act-of-2022>
- NASEO - <https://www.naseo.org/issues/infrastructure-act>
- RMI - <https://rmi.org/ira-implementation-guidance-states/>