



## Department of Public Service

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Three Empire State Plaza, Albany, NY 12223-1350  
[www.dps.ny.gov](http://www.dps.ny.gov)

October 9, 2018

Ms. Kathleen Burgess  
New York State Public Service Commission  
Three Empire State Plaza  
Albany, NY 12223-1350

Re: Case 18-M-0084 – In the Matter of a Comprehensive Energy Efficiency Initiative

Dear Secretary Burgess:

On October 3, 2018 the Department of Public Service convened a stakeholder forum regarding heat pumps. Enclosed, please find the presentations provided during the forum.

Sincerely,

/s/

Peggie Neville  
Deputy Director, Clean Energy

Enc.



**NYSERDA**

# **Clean Heating & Cooling Current NYSERDA Heat Pump Initiatives**

October 3, 2018

Wendy MacPherson  
Program Manager

# Clean Heating & Cooling (CH&C)

- **Policy Framework Published February 7, 2017**
  - First step in longer-term effort to accelerate the Clean Heating & Cooling market
  - Options for policies and market-based strategies for initial years and concepts for longer-term action
- **Policy Framework's Three Pillars**
  - Reducing Technology Costs and Lowering Barriers
  - Policies to drive demand
  - Incentives
- **Clean Energy Fund (CEF) CH&C Investment Plans, Approved Q1 - Q2 2017**
  - Over \$30 million to be invested in this first phase on soft cost reduction & incentives:
    - Heat pump incentive programs (air source & ground source heat pumps)
    - Community-based campaigns
    - Technical Assistance for large commercial
    - Workforce development
    - Marketing, awareness and education

# CH&C Heat Pump Incentive Programs

NYSERDA	ASHP Air Source Heat Pump	GSHP Ground Source Heat Pump
Program Funds	\$10.95 M	\$15 M
Incentive Level	\$500 per outdoor unit	\$1200 - \$1500 per thermal ton
Applicant	Approved Contractor	Approved Contractor, Designer, Driller
Paid to	Contractor	Contractor to Customer
Eligible Project	NYS, Electric System Benefit Charge	NYS, Electric System Benefit Charge
Eligible Site	Residential Single family & Multi family	Residential, Multi family, Commercial
Eligible Equipment	Northeast Energy Efficiency Partnership (NEEP): Cold Climate Specification List	Air conditioning, Heating & Refrigeration Institute (AHRI): Efficiency Standard
Quality Assurance	Completed Commissioning Check List	Site Inspections
Financing	Green Jobs Green NY (GJGNY) in Q4 2018	Green Jobs Green NY (GJGNY)
End Date (or until funds are exhausted)	December 2020	June 2019
Program Performance through September 2018		
Contractors to date	218 Contractors	58 Contractors, 19 Drillers
Projects to date	3,397 Projects (average 2 units/project)	452 Applications 282 Completed projects





# CH&C Community Campaigns

- **Program size:** \$3.3 million to date
- **Target:** locally organized community efforts at the county, city, borough, or regional level
- **Objective:** for communities to increase customer awareness of CH&C technologies, reduce installed costs, and jump-start the market by implementing multi-year outreach & education campaigns focused on CH&C
- Encouraging installations in low-to-moderate income residents
- NYSERDA funded technical assistance to run effective campaigns

## Round 1: Active CH&C Campaigns

Communities	Campaign Organizer
Sullivan and Ulster Counties	Catskill Mountainkeeper
Cayuga, Cortland, Madison, Onondaga and Oswego Counties	CNY Regional Planning and Development Board
Tioga, Broome, Chenango, and Delaware Counties	Binghamton Regional Sustainability Coalition
Orange County	Energy Improvement Corporation
Otsego County	Otsego County Conservation Association
City of Rochester	City of Rochester
Tompkins County (& bordering areas in contiguous counties)	Solar Tompkins
Westchester County	Sustainable Westchester

## Round 2: Proposals due October 30, 2018

# CH&C Technical & Financial Assistance

- **Geothermal Clean Energy Challenge [\$3.5 Million]**
  - NYSERDA and NYPA joint program
  - Identify best candidates for large, multi-building geothermal installations
  - Large commercial buildings/campuses
  - Screening & additional financial support
- **NextGen HVAC Technology Challenges [\$15 Million Available in 4 Rounds]**
  - Innovation challenges
  - Focused on improving performance & value proposition of current & next generation HVAC
  - Challenge Areas:

Round 1	Round 2	Rounds 3 & 4
Compressor-less HVAC	HVAC controls and control products	TBD
Ground Source Heat Exchanger	Advanced solutions for packaged terminal air conditioners (PTAC)	
Heat Pumps	Advanced solutions for packaged terminal heat pumps (PTHP)	
HVAC Controls		

- **Financing Solutions**
  - Green Jobs Green NY (GJGNY) Loan Program
  - Financial Solutions Market Research Study underway

# CH&C Marketing, Awareness & Education

- **Cooperative Advertising & Training for CH&C Partners [\$2 Million]**
  - Objective: support advertising, special promotions and/or events, including training, for eligible HVAC technologies
  - Eligible participants: HVAC manufacturers, distributors/vendors, rebate program installers
  - Incentive: cost share up to 50 percent of the total cost for advertising, marketing & promotions, training
- **Marketing and Customer Acquisition**
  - Developing clean heating & cooling messaging with marketing consultants
  - Collaborating with utilities
  - Marketing and awareness campaigns in targeted areas
  - Marketing tool kit for communities & broader distribution
  - Developing customer targeting tool to identify high potential customers
- **Workforce Training**
  - Conducted: 5 installer, 6 architect and engineer and 2 inspector trainings
  - Developing comprehensive strategy to support market growth
    - Current constraints: drillers & heat pump project managers
    - Future supply chain

# CH&C Pilot Projects

## Performance Validation & Demonstration Projects

### Goals

- Determine what information the market needs regarding technical & economic performance
- Collect performance information/data that can be communicated accurately and confidently
- Disseminate the information to the market & make data available to create change

### Projects

- Ground Source Heat Pumps:
  - 50 existing residential systems statewide
  - 45 new on Long Island
- Air Source Heat Pumps
  - 20 each residential replacements & displacements
  - 5 residential air to water systems
  - 5 residential low capacity gas furnace/ASHP hybrids
  - 2 VRF systems



**nationalgrid**

## **Electric Heat & Products Programs**

**October 3, 2018**



# Agenda

- Heat Pump Rate Case
- Strategic Electric Heating & Products Program Overview
- Heat Pump Program Design
- UNY Service Territory
- Customer Eligibility
- Equipment Eligibility
- Incentives
- Electric Products Program
- National Grid & NYSERDA- Collaboration



# Electric Heat Objectives

Details of Rate Case: 17-E-0238 & 17-G-0239, Section 13.9

The electric heat initiative is designed to encourage customers to convert to efficient electric heat pump when replacing older, less efficient, and more carbon intensive heating equipment. The initiative will provide rebates to promote the installation of electric heat pumps so as to accelerate efficient heat electrification in support of New York's climate goals.

- Reduce carbon emissions
- Facilitate the penetration of heat pumps
- Earnings Adjustment Mechanisms (EAMs) are new upside performance incentives agreement in NMPC JP
- Heat pumps are part of our Beneficial Electrification EAM goals (Carbon Savings Goals)



## National Grid's 80x50 Pathway

- Reduce carbon emissions- targeting highest emitting fuels first
- Maintain affordability for our customers
- Transform the heating sector

# Strategic Electric Heating & Products Program Overview

- In our Upstate New York region we launched a new combined residential Electric Heat Pump (EHP) and Electric Products Program that will provide incentives and direct install energy saving measures to a residential segment of our customers in UNY region.
- The Heat Pump component of the combined program will provide customer incentives for the adoption of new high efficiency cold climate Air Source and Ground Source Electric Heat pumps.
- As a value added service to our customers that install electric heat pumps we will be offering direct install measures under the electric products program, which will run concurrent with the HP Program and bundle “instant savings measures”.
- The combined program will increase customer access to high efficiency electric heat by animating markets for ccASHP and GSHP, reduce greenhouse gas (GHG) emissions from fossil fuels (oil or propane) heating units and help with achieving the Company carbon reduction EAM goals.

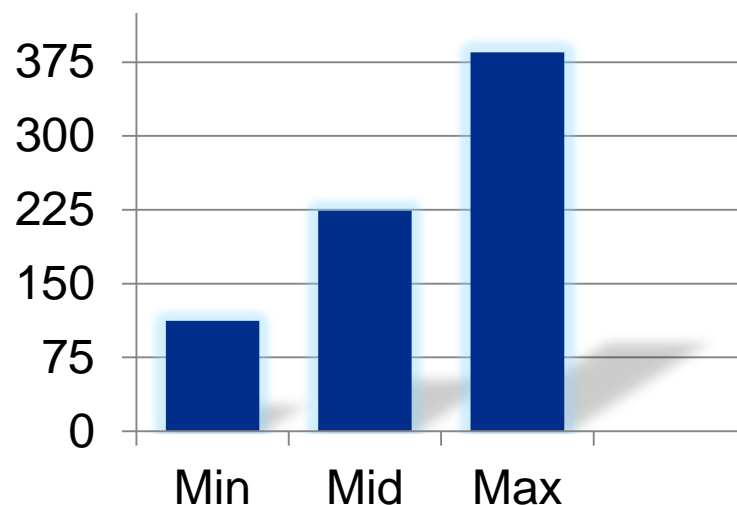




# Heap Pump Program Design

- Budget: \$2 million
- Residential Program
- Program approved through 12/31/2020
- Incentive year – 4/1/18 to 12/31/18, calendar year in 2019 and 2020
- Incentives paid on a first-come, first-served basis
- Customer based incentives
- Installed by a professional contractor

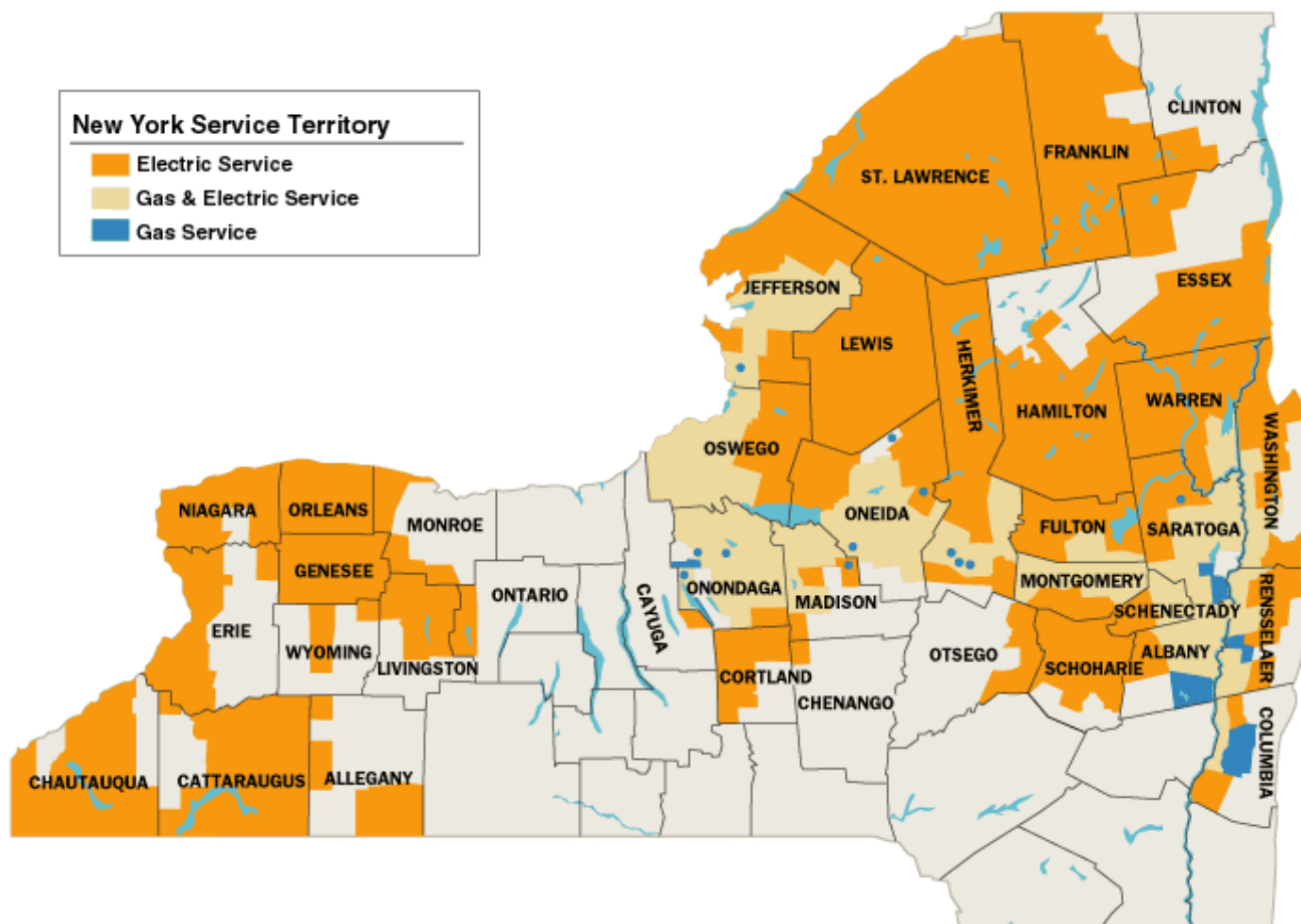
## cc Heat Pumps Annual Targets



# UNY Service Territory

**nationalgrid**

HERE WITH YOU. HERE FOR YOU.



# Customer Eligibility

- UNY Service Territory
- Active National Grid residential electric customers
- Currently heat with oil, propane, & electric resistance heat  
***(Natural Gas customers, from any utility, are not eligible)***
- Equipment meets eligibility requirements
- Installed 4/1/2018 - 12/31/2018



# Equipment Eligibility- Air Source

- Only cold climate systems
- Must be listed on “NEEP Cold Climate Air Source Heat Pump Specification Product Listing”
- Ducted, central and Mini split. Cooling only mini split not eligible.

Measure Description	SEER	HSPF	Cooling EER	Heating COP
Cold Climate AS Central Heat Pump	$\geq 18.0$	$\geq 10$	12.5	1.75
Cold Climate AS Central Heat Pump	$\geq 20.0$	$\geq 10$	12.5	1.75
Cold Climate Ductless Mini-Split Heat Pump*	$\geq 18.0$	$\geq 10$	12.5	1.75
Cold Climate Ductless Mini-Split Heat Pump*	$\geq 22.0$	$\geq 10$	12.5	1.75

# Equipment Eligibility- Ground Source

- Variety of ground loop configurations- open and closed loop; vertical, horizontal, standing column, etc.
- Must be Energy Star Certified and AHRI- rated

Measure Description	SEER	HSPF	Cooling EER	Heating COP
GSHP (lower rating)**	N/A	N/A	12.1 to less than 21	3.1 – 4.1
GSHP (higher rating)**	N/A	N/A	21.1 or greater	3.1 – 4.5

# Incentives

Tier	Incentive per ton	Tonnage	Measure Description	SEER	HSPF	Cooling EER	Heating COP
1	\$200		Cold Climate AS Central Heat Pump	$\geq 18.0$	$\geq 10$	12.5	1.75
2	\$350		Cold Climate AS Central Heat Pump	$\geq 20.0$	$\geq 10$	12.5	1.75
1	\$200		Cold Climate Ductless Mini-Split Heat Pump*	$\geq 18.0$	$\geq 10$	12.5	1.75
2	\$375		Cold Climate Ductless Mini-Split Heat Pump*	$\geq 22.0$	$\geq 10$	12.5	1.75
1	\$200		GSHP (lower rating)**	N/A	N/A	12.1 to less than 21	3.1 – 4.1
2	\$400		GSHP (higher rating)**	N/A	N/A	21.1 or greater	3.1 – 4.5

Tonnage calculated by dividing rated cooling Btu's by 12,000  
No rounding of SEER/EER ratings

Maximum ASHP incentive of \$1,100 per project  
Maximum GSHP incentive of \$1,500 per project



# Electric Products Program Overview

To further encourage participation and provide greater energy savings for our participating customers, the Electric Products program will offer free installation of saving products during the post inspection.

## Free Instant Savings Measures:

- Water
- Electric

Products will be installed by National Grid Implementation vendor RISE Engineering



# FREE Energy Efficiency Measures



All Customers

- Advanced Power Strip Tier 2
- LEDs: A19, candle and globe



Customer with Electric Hot Water

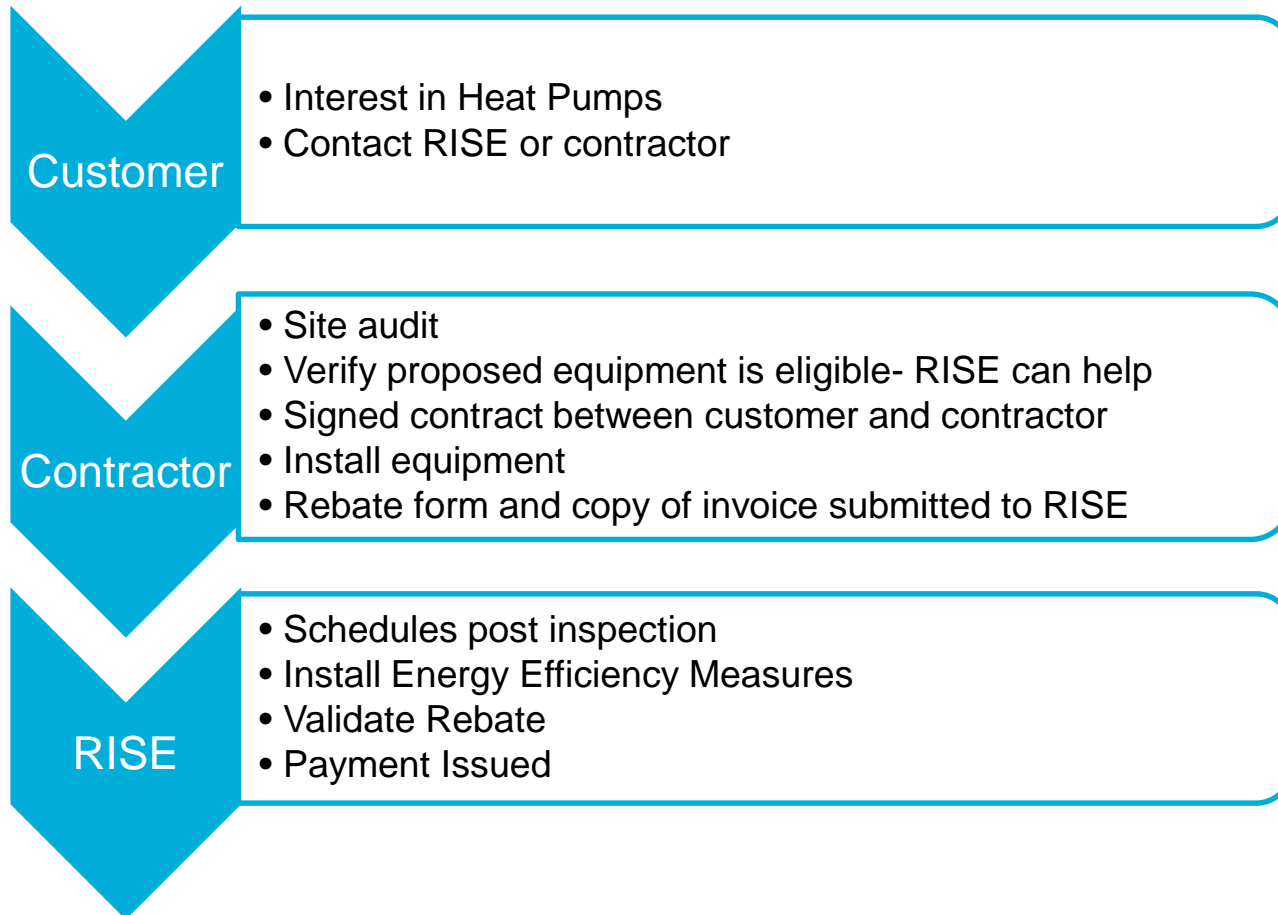
- 1.5 GPM Showerheads
- 0.5 and 1.0 GPM Kitchen & Bathroom Aerators
- Pipe wrap



# National Grid & NYSERDA- Collaboration

- National Grid has partnered with NYSERDA to provide complimentary and not duplicative incentive.
- ccASHP & GSHP
  - National Grid will be provide incentives directly to customers
  - NYSERDA will be providing incentives directly to contractors.

# Customer Journey



# Coming Soon

- Updated application – PDF fillable form!
- Dedicated web landing page
- Customer focused brochures
- Program announcement in Home Energy Reports; September - November

## Save more with a heat pump upgrade



### Do you use oil or propane to heat your home?

National Grid may be able to help cut your heating bills with our new incentives for qualified electric Heat Pumps.

Contact our team at RISE Engineering, with questions, and start saving today!



888-889-7207

[NGridheatpumpNY@RISEengineering.com](mailto:NGridheatpumpNY@RISEengineering.com)

- Further collaboration with NYSERDA & Other Utility partners

# Questions?



# Heat Pumps

Lisa DeVito

Con Edison Energy Efficiency and Demand  
Management

October 3, 2018

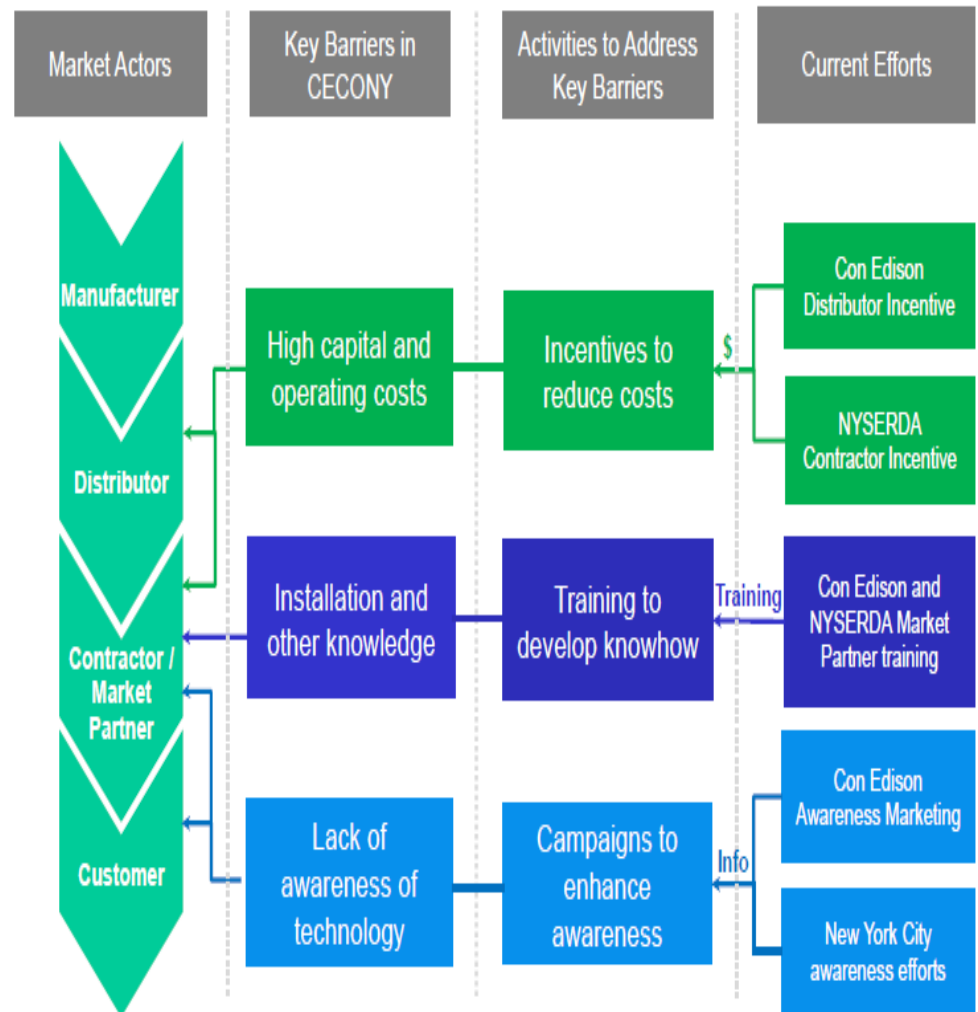
# Residential HVAC

- In 2018 transitioned from a downstream rebate to an upstream model with the incentives going to the distributor
  - Entire residential electric HVAC portfolio, includes:
    - Ductless air source heat pumps
    - Central air / central air source heat pumps
    - Electric heat pump hot water heaters
  - 18 distributors participating
    - 200+ contractors have completed the program participation agreement
    - Require 50% of incentives be passed from distributor to contractors
- Inserting further up in the supply chain to further leverage efforts
  - Drive down up front capital costs of projects
  - Develop buy-in from distributors
  - Engage contractors

# Air Source Heat Pumps

## Seeking meaningful adoption through coordinated efforts

- Con Edison is working to gather information on the potential for air source and ground source heat pumps in our service territory
  - Partnering with NYSERDA
  - Considering a heat pump pilot
  - Working with NYC to conduct market research study
  - Partnering with NYC on pathway to 80x50
- Pilots, Partnerships and Studies building up significant expertise on heat pumps



# Central Hudson Gas & Electric Heat Pump Technology Initiatives

Michael Lauchaire

Program Analyst – Energy Efficiency and Carbon Reduction





# Air Source Heat Pump Incentives

## *Eligible Electric Heat Pump Measures and Incentive Levels*

Measure Name	EE Incentive	Carbon Incentive
Electric ASHP (Existing Heating Type: Fuel Oil/Propane)	\$50	\$450
Electric ASHP (Existing Heating Type: Electric)	\$300	N/A
Electric ASHP (Existing Heating Type: Natural Gas/Other)	\$50	N/A
Heat Pump Water Heater <55 gallons EF >= 2.3	\$750	N/A
Heat Pump Water Heater >=55 gallons EF >= 2.3	\$125	N/A

# Geothermal Heat Pump Rate Impact Credit



# Geothermal Rate Impact Credit (“RIC”)

- Annual \$264 Rate Impact Payment to Customer
  - Residential Customers (SCs 1 and 6)
  - Participation in NYSERDA Geothermal Rebate Program
  - Enrollment in Insights+
  - Applicable to units installed after June 30<sup>th</sup>, 2018
- The rate impact credit will be paid to participating customers on an annual basis on June 30 of each year
- Funded by incremental heating usage that would be monetized and provided to non-participants through the RDM.

\* Following the development of a technology agnostic DER or mass market default rate or a rate that is specifically intended to mitigate the rate impact of geothermal heat pump systems, no further rate impact credits will be paid out. It is expected that this rate will be designed as part of Case 15-M-0751, Value of Distributed Energy Resources.

# Marketing & Coordination Efforts



## Clean Heating And Cooling Central Hudson Campaign

8.29.18



**WARMER.**  
**COOLER.**  
**CHEAPER.**  
**GREENER.**

Heat pumps are a **better** way  
to heat and cool your home.

**Get Pumped**



# Clean Heating & Cooling Marketing Plan



## Clean Heating & Cooling

Central Hudson Awareness Pilot

Media Plan  
9/17/2018



Channel	Tactic	Targeting/ Placement	August				September				October					November				December				
			6	13	20	27	3	10	17	24	1	8	15	22	29	5	12	19	26	3	10	17	24	31
DIGITAL	Cross-screen Digital Ads	Contextual, Audience & Retargeting																						
	Digital Video																							
	Streaming Radio	Spotify & Pandora																						
	Paid Social	Facebook & Instagram newsfeeds																						
	Paid Search	Keywords/Ad Copy																						
PRINT/RADIO	Dutchess News	1/4 PG 4C																						
	Hudson Valley Press	1/4 PG 4C																						
	Middletown Times Herald-Record	1/4 PG 4C																						
	Orange County Marketplace (Zone A & D)	1/4 PG 4C																						
	Pennysavers (Zones 5)	1/4 PG 4C																						
	Local Radio Note: Radio buy benefits from 30% negotiated savings	:30 spot in AM, MD, PM Dayparts with Drivetime heavy up Added Value :10 sponsorship reads																						
OOH	Billboards	Digital & Analog Roadside Boards																						

# Heat Pump Email Blasts Examples

**Smart savings  
help beat the  
heat.**

**FIND A TRADE ALLY**



Summer is a great time to upgrade your home's A/C or heat pump system—you'll improve performance and save all season long. Energy-efficient models reduce your energy consumption and costs year-round. Central Hudson can help with great incentives on the latest technology. Plus, you can save more than ever on a new heat pump water heater!

ENERGY-EFFICIENT EQUIPMENT	INCENTIVES
Central or Mini-Split Air Conditioner	\$100–\$300
Central Air-Source or Mini-Split Heat Pump	\$350–\$500
Electric Heat Pump Water Heater	\$450

Visit [SavingsCentral.com](https://www.savingscentral.com) to find a Trade Ally who'll bring cool savings to your house.



**Gear Up for Fall!**

**GET SAVINGS FORM**



Are you ready to get back in the swing of things this fall? What about your water heater? Central Hudson offers up to \$450 in incentives on ENERGY STAR® certified hybrid heat pump water heaters, which cost \$999 on average. Your water heater is a major energy-using appliance, so upgrading could save you up to \$330 a year on energy costs! Upgrade now to save energy and money all year long.

Central Hudson Incentive	up to \$450
Federal Tax Credit*	\$300
Estimated Annual Energy Savings**	\$330
Estimated First Year Savings	\$1,080

Maximize your savings! Visit [SavingsCentral.com](https://www.savingscentral.com) to learn about incentives on other energy-efficient appliance upgrades.

\*For more information on the Federal tax credits, including maximum total yearly credits, consult your tax advisor or visit [www.energystar.gov/taxcredit](https://www.energystar.gov/taxcredit).

\*\*Source: [energystar.gov](https://www.energystar.gov)



# Online Customer Engagement

## Cenhud.com/cenhubsavings

The screenshot shows the CenHub Savings website in a browser window. The address bar displays <https://www.cenhud.com/cenhubsavings>. The page features the CenHub logo with the tagline "My Account" and the Central Hudson logo with the tagline "People. Power. Possibilities. A FORTIS COMPANY". A navigation bar includes links for REBATES, FORMS, TRADE ALLIES, CONTACT US, and BUSINESS SOLUTIONS. The main content area is divided into several sections: "Insights+" with a tablet image, "Residential Lighting" with a person installing a light fixture, a central video player titled "CenHub: Central Hudson's online..." showing energy-saving products, "CenHub Peak Perks" with a couple's photo, and "Current Rebates" with a green dollar sign graphic. Below these is a large "Welcome to CenHub!" message, followed by the text "Managing your energy just got easier!" and "Sign in to start earning rewards, view your usage and manage features of your account." Three blue buttons are provided: "Shop", "Sign In/Create Account", and "Earn Rewards". At the bottom, a banner promotes the "Reduce Your Carbon Footprint" campaign, encouraging users to enter the "Carbon Reduction Sweepstakes" for a chance to win a home energy audit and energy efficient upgrades. The banner includes an "Enter Now" button and a small note: "\*In partnership with Scobee".

https://www.cenhud.com/cenhubsavings

CenHub Savings

**CenHub**  
My Account

Central Hudson  
A FORTIS COMPANY

REBATES FORMS TRADE ALLIES CONTACT US BUSINESS SOLUTIONS

Insights+

Residential Lighting

CenHub: Central Hudson's online...

SHOP FOR THE LATEST ENERGY SAVING PRODUCTS

FEATURED ENERGY SAVING PRODUCTS

CenHub Peak Perks

Current Rebates

Welcome to CenHub!

Managing your energy just got easier!

Sign in to start earning rewards, view your usage and manage features of your account.

Shop Sign In/Create Account Earn Rewards

**Reduce Your Carbon Footprint**

Enter the **Carbon Reduction Sweepstakes** for a chance to win a home energy audit and energy efficient upgrades\*

\*In partnership with Scobee

Enter Now



October 3, 2018

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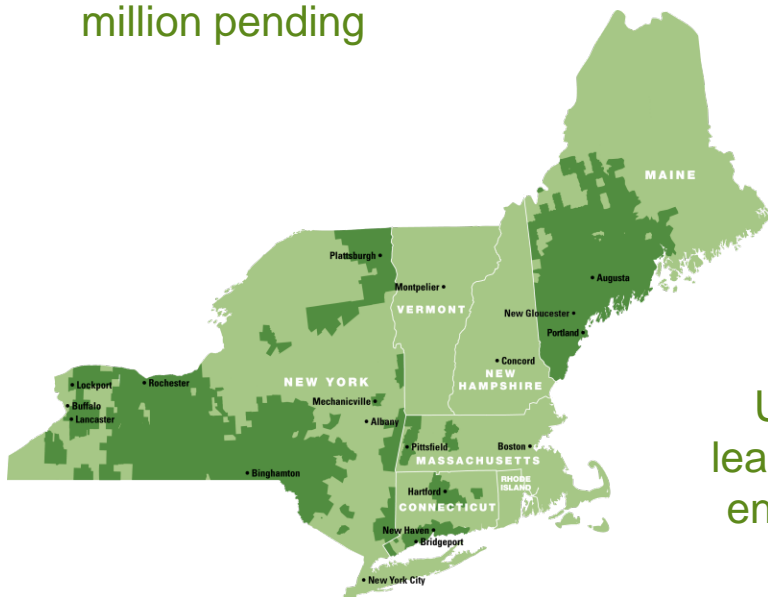
# **NYSEG + RG&E Heat Pump Efforts**



# AVANGRID (NYSEG/RG&E)

## Avangrid Networks

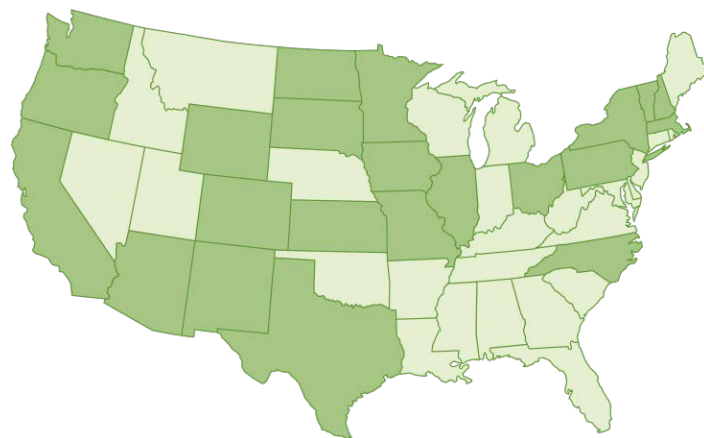
- 8 regulated electric and gas utilities in the Northeast including NYSEG & RGE
- 3.2 million customers
- ≈ 1 million smart meters with 1.8 million pending



Utility industry  
leader in customer  
engagement and  
satisfaction

## Avangrid Renewables

- 2nd largest wind energy generator in U.S.
- 53 operating wind farms
- 22 states in U.S.



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## Coming in 2019:

- RG&E and NYSEG incentives for air source, ground source, and heat pump water heaters

## Goals:

- Complement NYSERDA incentives
- Encourage customers to choose the most efficient options when making investments
- Promote heat pump technologies for all residential end uses

## Heat and Cool your Home More Efficiently with Heat Pump Technology

Save money and energy with high efficiency heat pump technology. With heat pumps you can save 15-50% of energy used to heat or cool your home or heat water! Rebates and incentives are available for Water Heating and HVAC Heat Pump Products.

### 2019 Heat Pump Program Equipment and Qualification Criteria

Equipment Type	Incentive	SEER	HSPF
Air Source Central Heat Pump	\$300 per unit	$\geq 16$	$\geq 9$
Ductless Mini-Split Heat Pump Single Zone	\$200 per unit	$\geq 20$	$\geq 10$
Ductless Mini-Split Heat Pump Multi Zone	\$300 per unit	$\geq 18$	$\geq 10$
Ground Source Heat Pump (Geothermal)	TBD	TBD	TBD

\*Incentive levels and qualification criteria are currently in draft form and subject to change.

### Heat and Cool your Home More Efficiently with Heat Pump Technology

Save money and energy with high efficiency heat pump technology. With heat pumps you can save 15-50% of energy used to heat or cool your home or heat water! Rebates and incentives are available for Water Heating and HVAC Heat Pump Products.

#### 2019 Heat Pump Program Equipment and Qualification Criteria

Water Heating Products Measure Description	Incentive	Uniform Energy Factor
ENERGY STAR <sup>®</sup> certified Heat Pump Water Heater - $\leq$ 55 gal	\$300.00	$\geq$ 3.0
ENERGY STAR <sup>®</sup> certified Heat Pump Water Heater - $>$ 55 gal	\$150.00	$\geq$ 2.7

Limit two units of any equipment type per household. Installation of measures must be completed between 01/01/2019 and 12/31/2019. All equipment must have an AHRI reference number. Split system air source heat pumps must be AHRI matched systems. Mini-split heat pump units that only provide cooling are not eligible. Geothermal heat pumps require pre-approval.

\*Incentive levels and qualification criteria are currently in draft form and subject to change.

# PSEG LONG ISLAND

2018 Cool Homes Program

October 2018

# Welcome

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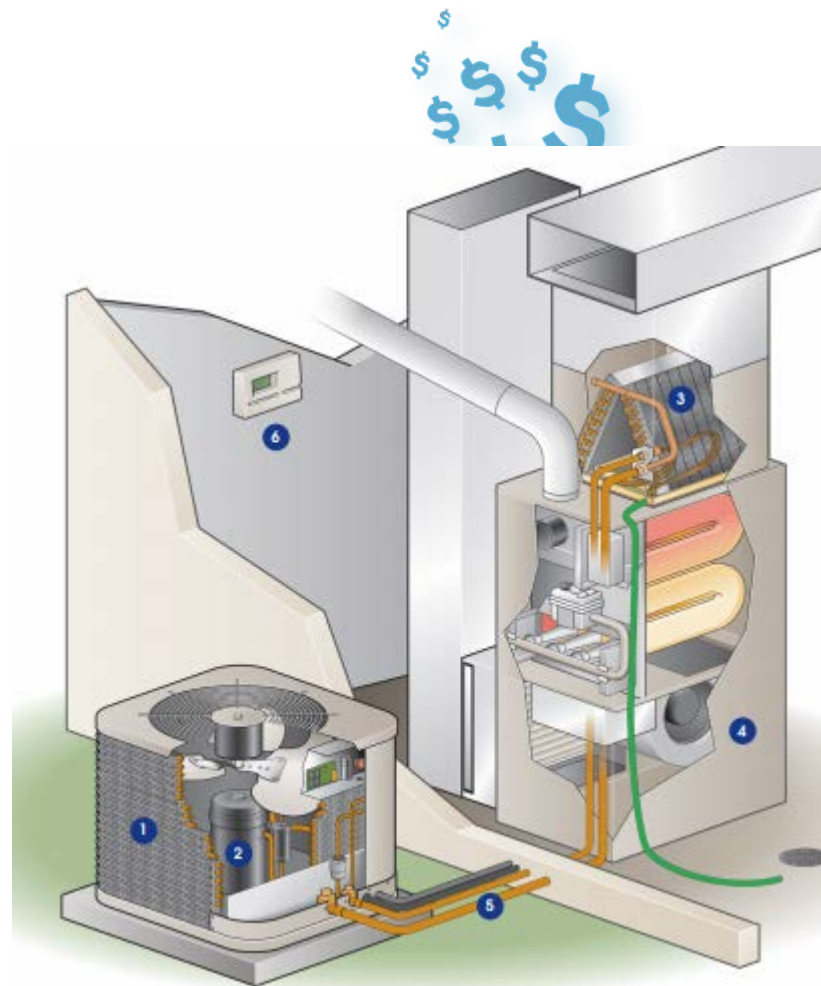
## Greetings and introduction

Jonathan Tham – Cool Homes Program Administrator

Joshua Ebner – Cool Homes Program Coordinator

# Cool Homes Program

**Cool Homes - Central Air Conditioning Rebate Program** is designed to promote energy efficiency and customer comfort with the installation of high efficiency, properly-sized and quality installed residential Central Air Conditioning (CAC) systems



# Program Evolution

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## New York State Reforming the Energy Vision

### 2030 Goals

- 40% reduction in **greenhouse gas**
- 50% of electricity from **renewable**
- 23% reduction in energy consumption
- Summer peak kW to year round kWh savings
- Less fossil fuels - Electrification of heating systems

Solution: Heat pumps – ccASHP and geothermal





# Program Evolution

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## New York State Reforming the Energy Vision

- LESS **greenhouse gas**; LESS **fossil fuels**
- MORE **renewable** – wind and solar

### Opportunities:

- Electric resistance - increase efficiency
- Propane - lower cost
- Fuel oil - cleaner and lower cost

Solution: Heat pumps – ccASHP and geothermal



# 2018 Goals

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- \$3.2 million rebate - \$2.2 million heat pumps
  - 2.4 MW
  - 3,200,000 kWh
  - 5,000 HVAC units - 2,350 heat pumps
- 
- Less 16 SEER ducted air conditioners
  - More ducted/ductless ASHP and GSHP
  - 625 tons of ducted ASHP (250 units)
  - 2,550 tons of ductless ASHP (1,700 units)
  - 1,200 tons of GSHP (400 units)



# Program Changes

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- 2016 - Increase the GSHP incentives
- 
- 2017 - GSHP Alignment w/ ENERGY STAR minimum energy efficiency requirements (NYSERDA)
- 2017 - ASHP Alignment w/ ENERGY STAR (SEER 15)
- 2017 - Removing EER requirements (ccASHP)
- 2018 - Residential and commercial GSHP alignment
- 2018 - Increase rebate for ccASHP
- 2019 - Continue heat pump support



# Incentives & Efficiency Requirements

- \$1,000/ton or \$2,000/ton

<p><b>Geothermal/Ground Source Heat Pumps<sup>1</sup></b></p> <p><sup>1</sup>Does not need to be a participating contractor. New – installation of new geothermal system</p> <p>Retrofit – replacement of heat pump for an existing geothermal system</p> <p>Wells are to be adequately sized for the load of the incentivized systems. Tonnage is based on full-load rated capacity on AHRI certificate.</p> <p>The efficiency requirement apply to single stage GSHP models. Multi-stage GSHP models may be qualified based on:</p> <p>EER = (highest rated capacity EER + lowest rated capacity EER) / 2  COP = (highest rated capacity COP + lowest rated capacity COP) / 2</p>	1	<p><u>Water to Air:</u>  Closed: EER ≥ 17.1 and EER &lt; 20, and COP ≥ 3.6  Open: EER ≥ 21.1 and EER &lt; 25, and COP ≥ 4.1</p> <p><u>Water to Water:</u>  Closed: EER ≥ 16.1 and EER &lt; 17.5, and COP ≥ 3.1  Open: EER ≥ 20.1 and EER &lt; 23, and COP ≥ 3.5</p> <p><u>DGX:</u>  EER ≥ 16 and EER &lt; 21, and COP ≥ 3.6</p>	<p>\$1,000/ton (new)  \$500/ton (retrofit)</p>
	2	<p><u>Water to Air:</u>  Closed: EER ≥ 20 and COP ≥ 3.8  Open: EER ≥ 25 and COP ≥ 4.5</p> <p><u>Water to Water:</u>  Closed: EER ≥ 17.5 and COP ≥ 3.1  Open: EER ≥ 23 and COP ≥ 3.7</p> <p><u>DGX:</u>  EER ≥ 21 and COP ≥ 4.0</p>	<p>\$2,000/ton (new)  \$700/ton (retrofit)</p>

# Incentives & Efficiency Requirements


Eligible Equipment	Tier	Efficiency Requirements	Customer Rebate
Ducted Split Central Air Conditioners	1	SEER $\geq$ 16	\$150/system
	2	SEER $\geq$ 17	\$250/system
	3	SEER $\geq$ 18	\$350/system
Ducted Split Air Source Heat Pumps	1	SEER $\geq$ 15 and HSPF $\geq$ 8.5	\$350/system
	2	SEER $\geq$ 16 and HSPF $\geq$ 8.5	\$450/system
Ductless Mini Split Air Conditioners	3	SEER $\geq$ 18	\$150/system
Ductless Mini Split Heat Pumps	3	SEER $\geq$ 18 and HSPF $\geq$ 8.5	\$250/system
Smart Thermostat			\$35/thermostat




# Ad Campaigns (Print, Radio and Internet)

Advertorial


## 7 good reasons to consider geothermal



**Efficient**  
Geothermal heat pumps are three to four times more efficient than ordinary forced air systems, with about 70% of the energy used by a geothermal system coming from the ground.



**Economical**  
Operating costs are significantly lower. When choosing geothermal heat pumps to heat and cool your home, you can expect to reduce your cost by 25% to 60% or more.




## Geothermal energy.

Efficient.  
Renewable.  
Economical.



Learn about available rebates




**Renewable**  
Geothermal energy is renewable – as used, it can be pumped a ground. It's cleaner than so, generating less gas emissions.



**Flexible**  
Geothermal systems can provide heating, cooling and supplemental water heating from a single unit. And geothermal units can be integrated with existing systems or installed in new home construction.


Small heat rebates  
incentives  
it.



## Renewable, sustainable energy could be right in your backyard.

**Use the energy from the earth to heat and cool your home, efficiently and cost-effectively.**

Geothermal heat pumps are three to four times more efficient than ordinary forced air systems and offer substantially lower operating costs. Geothermal heat pumps are better for the environment – generating less greenhouse gas emissions than fossil fuels. Plus they can be installed in both new and existing homes.



Find out if geothermal is right for you – and learn about available rebates through the Cool Homes Program. Visit [pseglin.com/Geothermal](http://pseglin.com/Geothermal)



# Professional Organizations

**NYPH** | NEW YORK  
PASSIVE HOUSE



**AIA**  
Long Island



**AIA**  
Peconic





# Training

- IGSHA Installers and Inspectors
- Continuing Education - Jay Egg Geothermal





# More Information

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## Contact Info

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<https://psegliny.com/coolhomes>





**NYSERDA**

# **Analysis of heat pump potential and economics in New York**

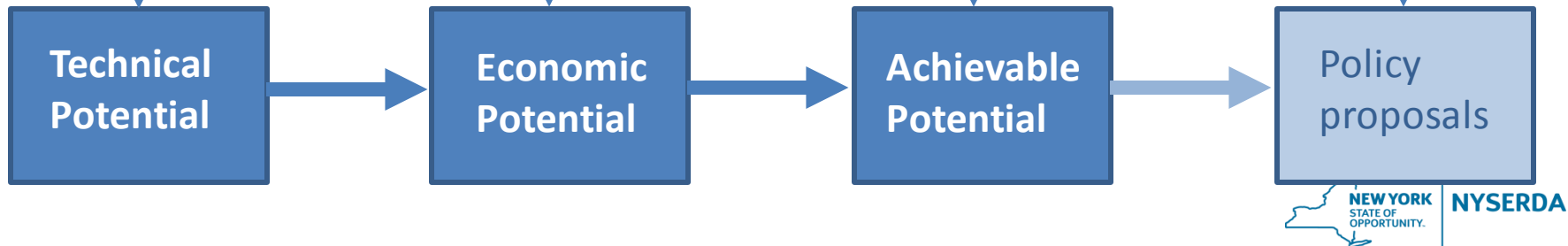
**October 3, 2018**

**Erich Scherer,  
Senior Advisor,  
Energy and Environmental Analysis**

# Analytical approach

**Objective:** assess the technical, economic and achievable potential for heat pump deployment in New York State, which facilitates program cost analysis

- Segmentation
- Number of sites that heat pumps can serve
- Energy per site that heat pumps can serve
- Installation costs
- Energy bill savings
- Carbon savings
- Value analysis
- Societal Cost Test
- Customer payback and hurdle rate
- Missing money
- Uptake trajectory
- Program structure options
- Ambition level or target



## New Efficiency: New York White Paper

*“Within the residential heating oil market segment, heat pumps could provide nearly eight TBtus of onsite energy savings in 2025, at an incentive level comparable to other energy efficiency solutions, while still providing substantial net value to all ratepayers. (...) could potentially deliver low-carbon heating and cooling solutions to more than 100,000 households.”*

- This presentation discusses the analysis that supports these White Paper statements
- Current analysis covers **single family and small multifamily** heat pump installations. Further refinement of analysis of large multifamily and commercial underway.
- Space heating and cooling included, hot water heating not included at this stage but will need to be addressed.

# Technical and economic potential

- **Large technical potential** – heat pumps could currently serve around 70% of New York's building heating and cooling needs; more as the technology evolves (eg current analysis excludes heat pumps for hydronic distribution systems)
- **Economic potential:** the analysis applies an approach similar to the "Societal Cost Test" to identify initial heat pump market segments that are attractive for early policy intervention. For each reference installation, the net present value of the following is calculated:
  - Cost of net installation capex (after avoided capex and federal tax credits)
  - Net reduction or increase in bulk electricity, capacity and distribution cost;
  - Value of avoided heating oil or natural gas cost;
  - Value of net carbon savings (including carbon value of oil and gas);
  - Net on-site operation/maintenance cost.
- **Conclusion:** replacing oil and electric heating with heat pumps in the single family/ small multifamily market meets the SCT and is a high potential entry market for policy intervention and early action.

## Capex and cost reductions

Heat pump capex has come down significantly in New York, particularly for GSHP, over the past two years. The following table shows capex (single family, Hudson Valley) as well as past and assumed future cost reductions.

	Capex 2016	Current capex	Capex reduction 2016-2018 (real)	Capex reduction 2018-2025 (Real)
<b>GSHP</b>	\$48,000	\$35,000	~30%	~35%
<b>ASHP</b>	\$13,100	\$12,400	~9%*	~20%
<b>Minisplit</b>	\$5,800	\$5,500	~9%	~20%

\* Ducted ASHP cost reduction based on minisplit data.

Future cost reduction estimates are a combination of:

- Research carried out for the RH&C Policy Framework
- Ongoing feedback from the market that further cost reductions are feasible given supportive policy environment (lower-cost devices, economies of scale, soft cost reductions)
- Objective for the industry to meet (eg GSHP cost reductions to keep up with reduction of the federal tax credits)

# Achievable potential - approach

- Identify “**missing money**” **requirement** from the customer’s perspective for each market segment within the economic potential
- Assume that missing money would be addressed to achieve uptake
  - *The analysis makes no assumption as to what type of program would be provided; this discussion will be pursued in the afternoon session*
  - The analysis applies an optimized assumption that all market segments within the economic potential will receive the “right” level of missing money payments; in practice, policies cannot be tailored for each individual installation, but this analytical approach serves to size the market
- Estimate **value/benefits from heat pumps**:
  - Carbon value
  - Peak reduction value
  - Inverse cost shift
- Apply an **adoption trajectory** in each market segment (expressed as % uptake of end-of-life replacement situations each year) to derive a **projection of achievable potential**.



## “Missing money” case studies

Numbers shown for single family oil replacement installations in Hudson Valley, 2019, per installation

- **GSHP** missing money is similar order of magnitude to current NYSERDA rebate
- **ASHP/minisplit** missing money is greater than current rebates

	ASHP	Minisplit	GSHP
Capex	\$12,249	\$5,444	\$32,658
Avoided capex*	\$0	\$607	\$6,892
Tax credit	\$0	\$0	\$8,171**
<b>Net capex</b>	<b>\$12,249</b>	<b>\$4,837</b>	<b>\$17,108</b>
Annual energy bill and O&M savings	\$1,497	\$532	\$1,997
<b>Missing money (upfront)</b>	<b>\$3,901</b>	<b>\$1,869</b>	<b>\$5,422</b>
Average lifetime carbon cost***	\$26/t	\$35/t	\$27/t

\* Accounts for the value of avoided conventional heating and cooling equipment

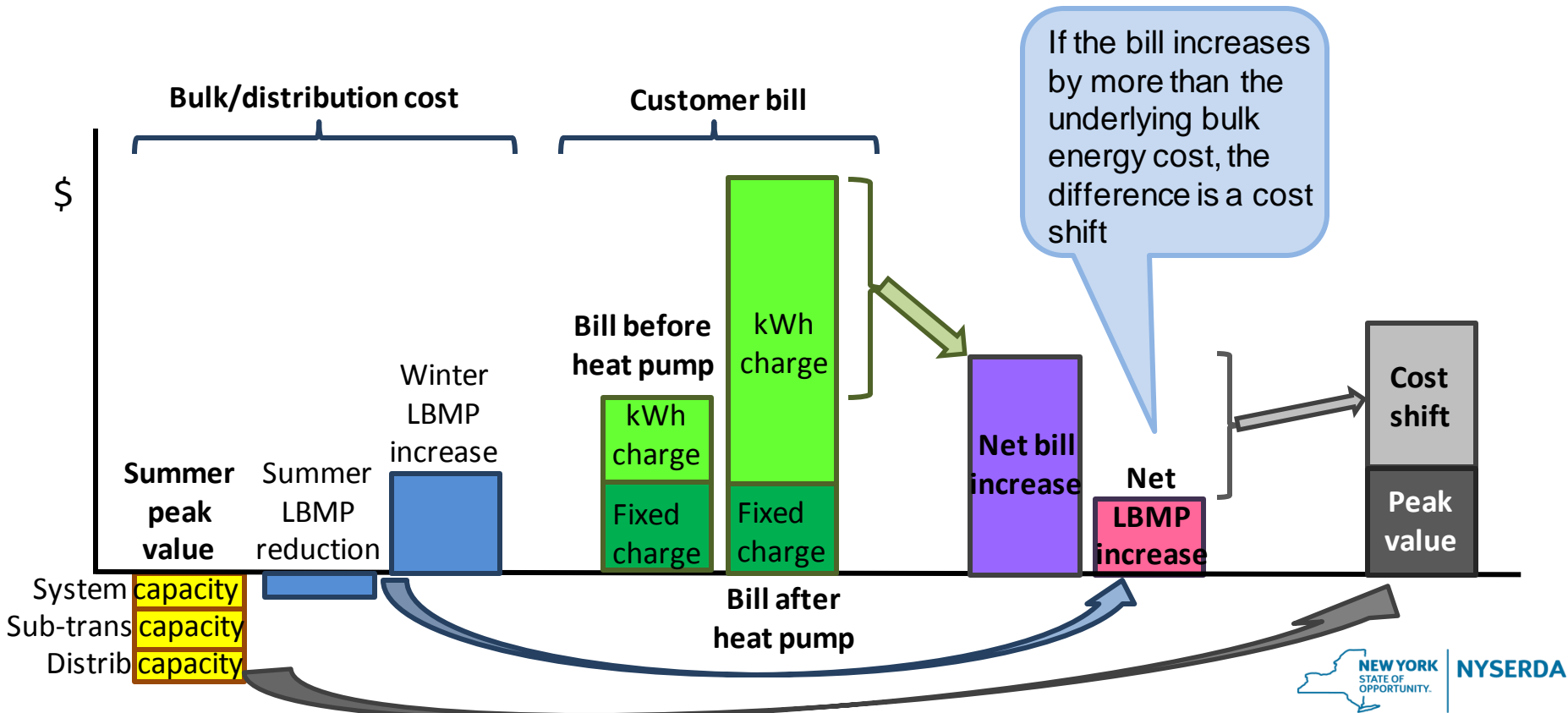
\*\* GSHP tax credit amount corrected for reduction in asset base as a result of state rebate payment.

\*\*\* Over the period 2019-2025

# Summer peak reduction and inverse cost shift

- **Summer peak reduction value.** During the summer, heat pumps can contribute to reduction of the systemwide demand peak, due to their increased efficiency in delivering cooling compared to air-conditioning. This would result in value of avoided grid investments. Residential rate structures do not (fully) compensate heat pump customers for this value.
- **Winter electricity use cost shift.** Switching from oil or gas heating to heat pump heating increases the customer's winter electricity use above that of a current typical customer. Current residential rate structures charge a proportion of fixed costs through volumetric charges, Where heat pumps increase the volume of energy consumed, heat pump customers can bear a disproportionate amount of fixed costs. In other words, a **cost shift** from non-participating ratepayers to heat pump customers occurs:

# Summer peak reduction and inverse cost shift



## Value and benefits – case studies

Numbers shown for single family oil replacement installations, year 1 value in 2019, per installation

Peak value	ASHP	Minisplit	GSHP
Central Hudson	\$15	\$8	\$34
ConEd	\$62	\$36	\$143
National Grid	\$10	\$6	\$23
NYSEG	-\$11	-\$2	\$11
O&R	\$26	\$15	\$60
RG&E	\$7	\$4	\$19
LIPA	\$56	\$32	\$130

Carbon value	ASHP	Minisplit	GSHP
Statewide	\$222	\$87	\$281

Cost shift	ASHP	Minisplit	GSHP
Central Hudson	\$537	\$205	\$375
ConEd	\$1,187	\$454	\$827
National Grid	\$534	\$210	\$396
NYSEG	\$940	\$370	\$698
O&R	\$786	\$300	\$545
RG&E	\$596	\$235	\$443
LIPA	\$906	\$347	\$637

# Statewide heat pump achievable potential – single family and small multifamily

Cumulative 2019-2025

	ASHP	Minisplit	GSHP	Total
Installations (1,000s)	38	55	25	<b>118</b>
Thermal load (TBtu)	3.2	1.8	2.2	<b>7.2</b>
Site energy savings (TBtu)	3.0	1.7	2.4	<b>7.1</b>
Carbon savings (Million Metric Tons)	3.0	1.6	3.7	<b>8.3</b>

- Estimate of statewide thermal load (all sectors, space heating/cooling and hot water): 989 TBtu
- Estimate of single family/ small multifamily space heating and cooling load: 364 TBtu

# Large multifamily and commercial

- Analysis underway
- Priority in NYC to meet policy goals but there are some technical challenges
- Preliminary estimates suggest these sectors could contribute a similar level of energy savings by 2025 as the single family/ small multifamily market – around 7 TBtu.



## Questions and comments

October 3, 2018

# **Ramping Up Heat Pump Adoption in New York State**

## **Targets and Programs to Accelerate Savings**

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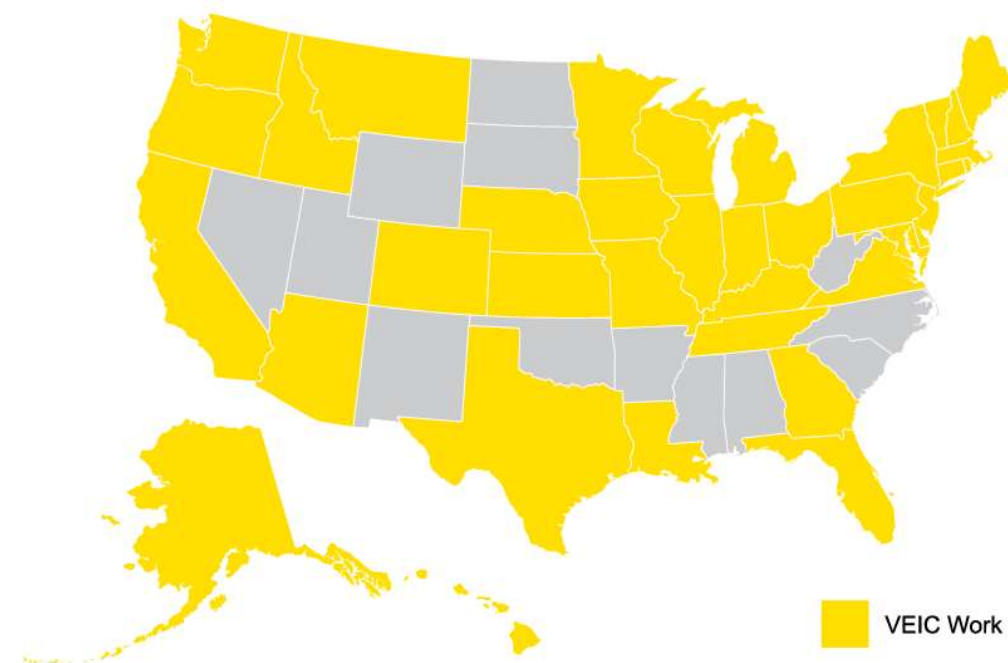
Emily Levin  
VEIC





# About VEIC

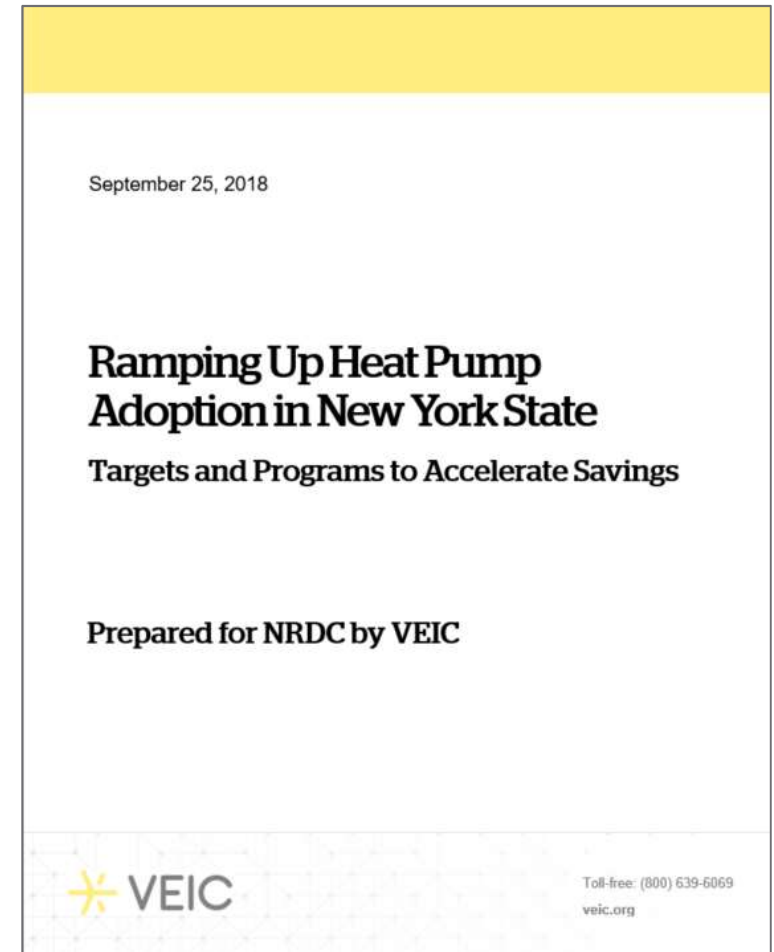
- Nonprofit founded in 1986
- 300+ employees
- Locations: DC, NY, OH, VT
- Design and deliver programs and policies nationwide:
  - Energy efficiency
  - Clean transportation
  - Renewable energy



- Our customers:
  - Utilities
  - Government
  - Foundations
  - Environmental & consumer groups
  - Business

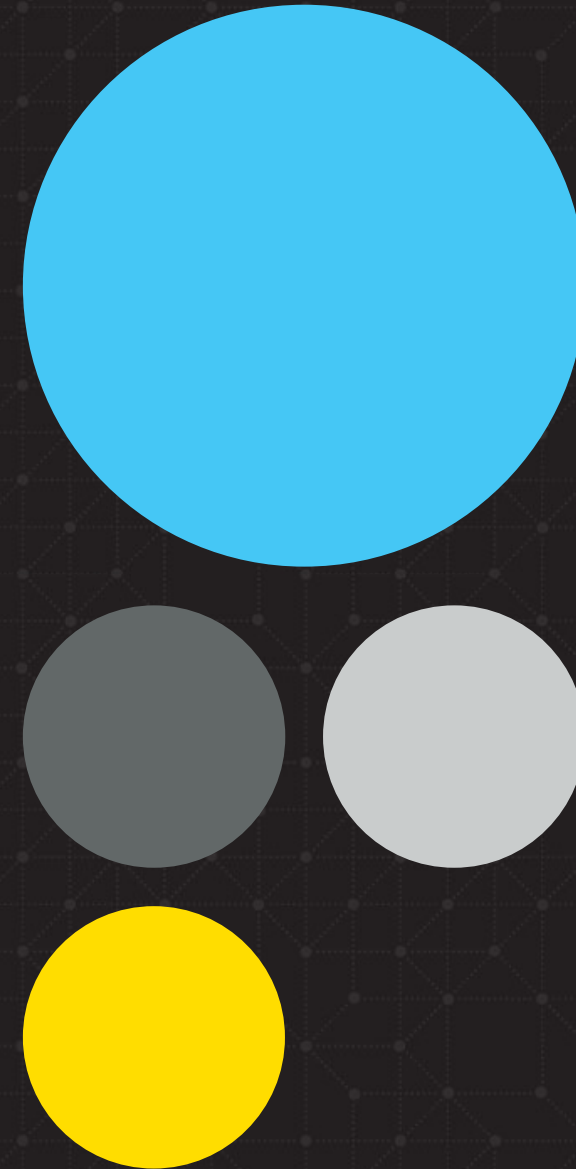
# Topics

- The landscape for heat pumps in NY
- State and utility targets
- Policy and program recommendations



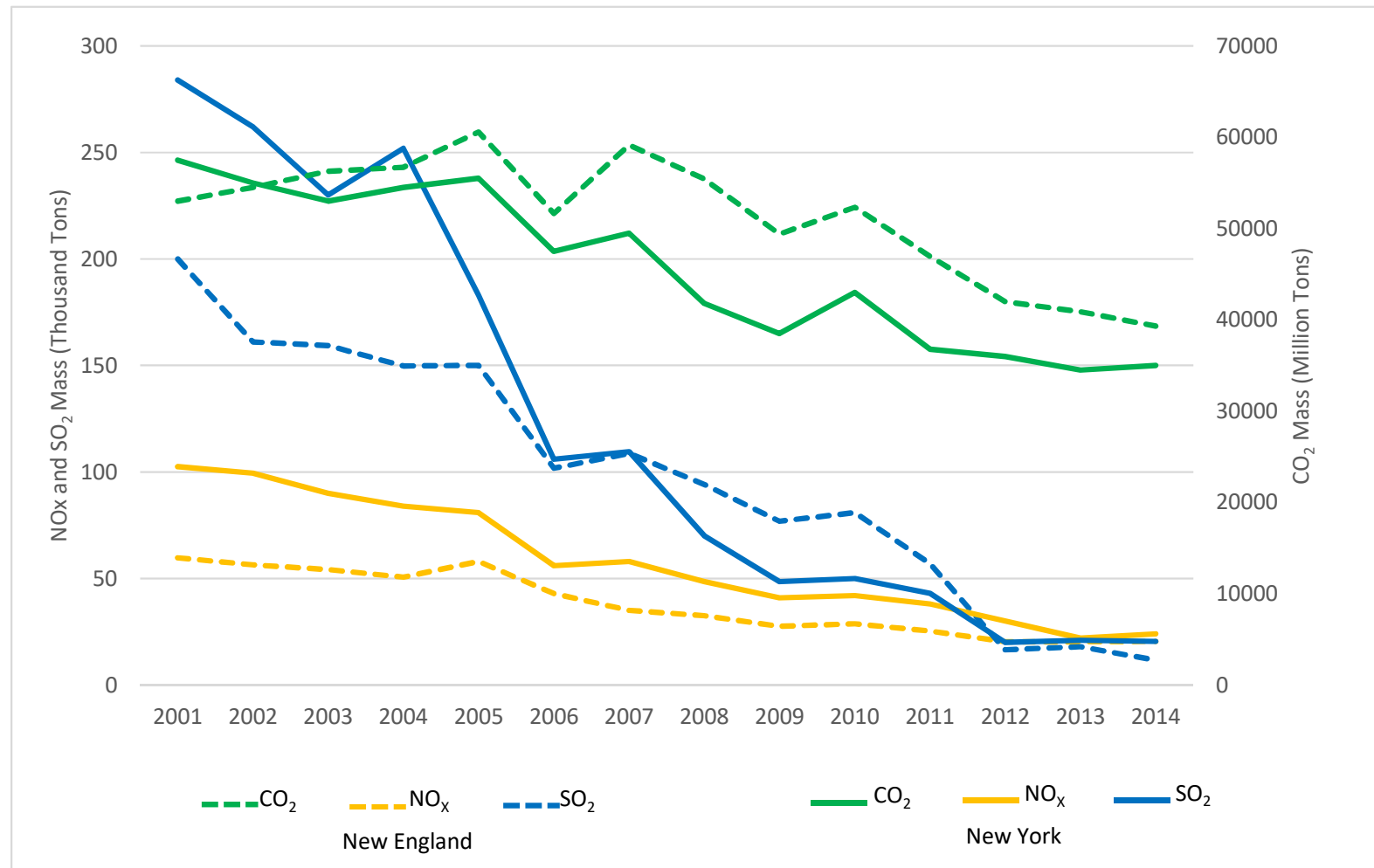
<https://www.veic.org/resource-library/ramping-up-heat-pump-adoption-in-new-york-state-targets-and-programs-to-accelerate-savings>

# The Landscape for Heat Pumps in NY



# New York Electric Grid is Getting Cleaner

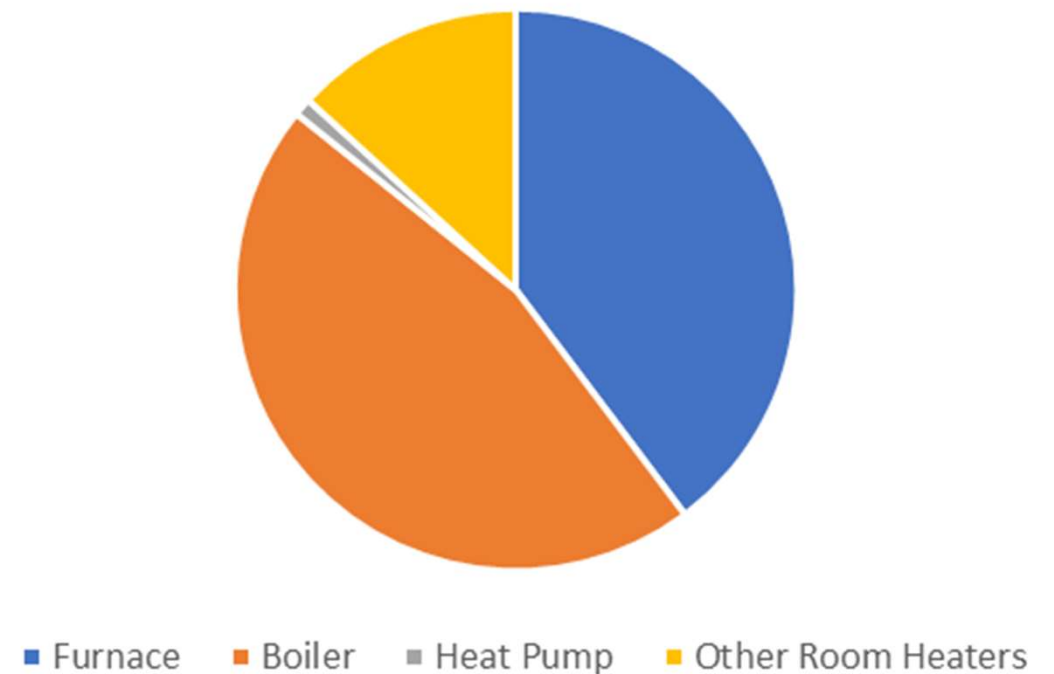
Emissions from Electricity Generation 2001-2014 (New York and New England)



# Current New York Heat Pump Market

- Low penetration relative to neighboring states
- Heat pump technologies represent 1% of the heating and cooling market
- Close to 50% met NEEP's Cold Climate ASHP specification

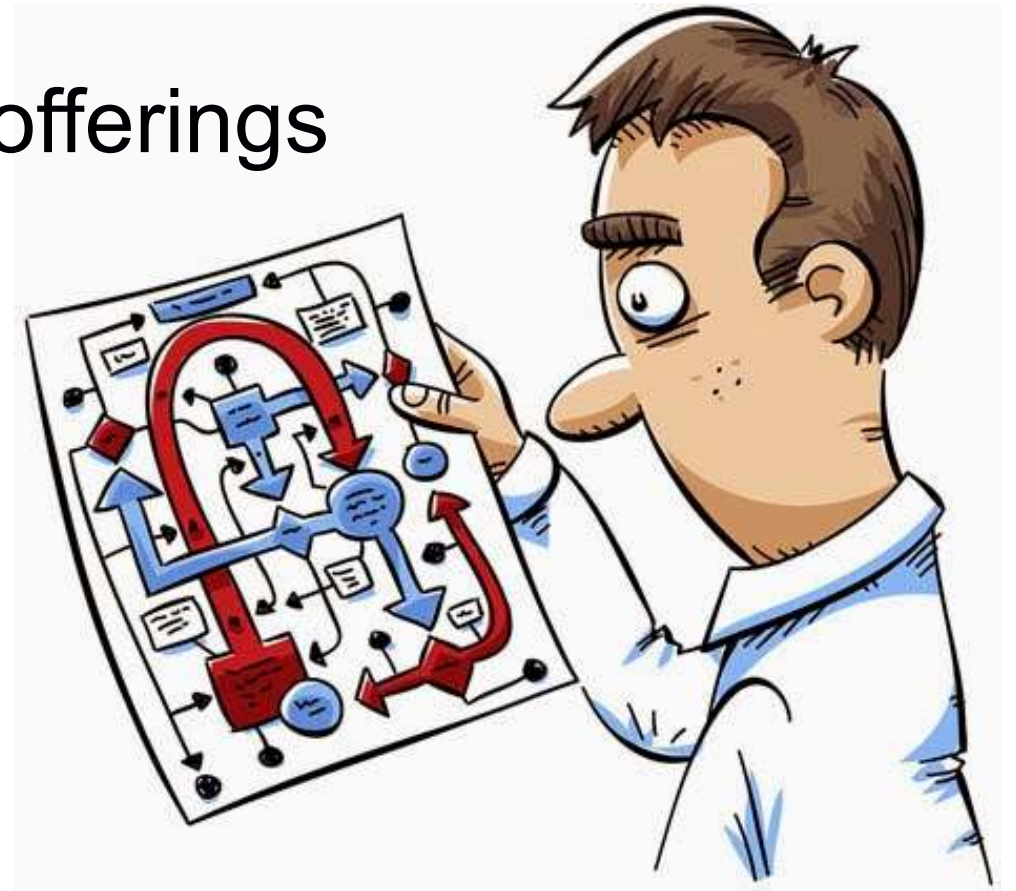
Americal Housing Survey 2015  
New York State Main Heating Equipment



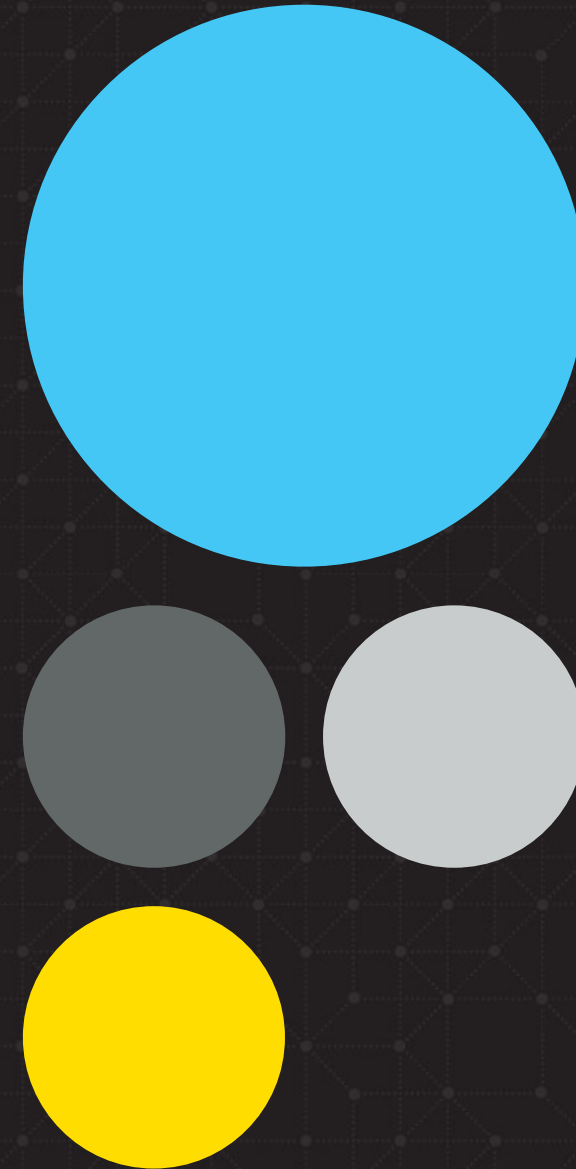


# Current New York Heat Pump Programs

- NYSERDA leads market development activities
- Wide variation in utility program offerings
  - Supported technologies
  - Incentive design
  - Incentive levels
  - Sectors served



# State and Utility Targets



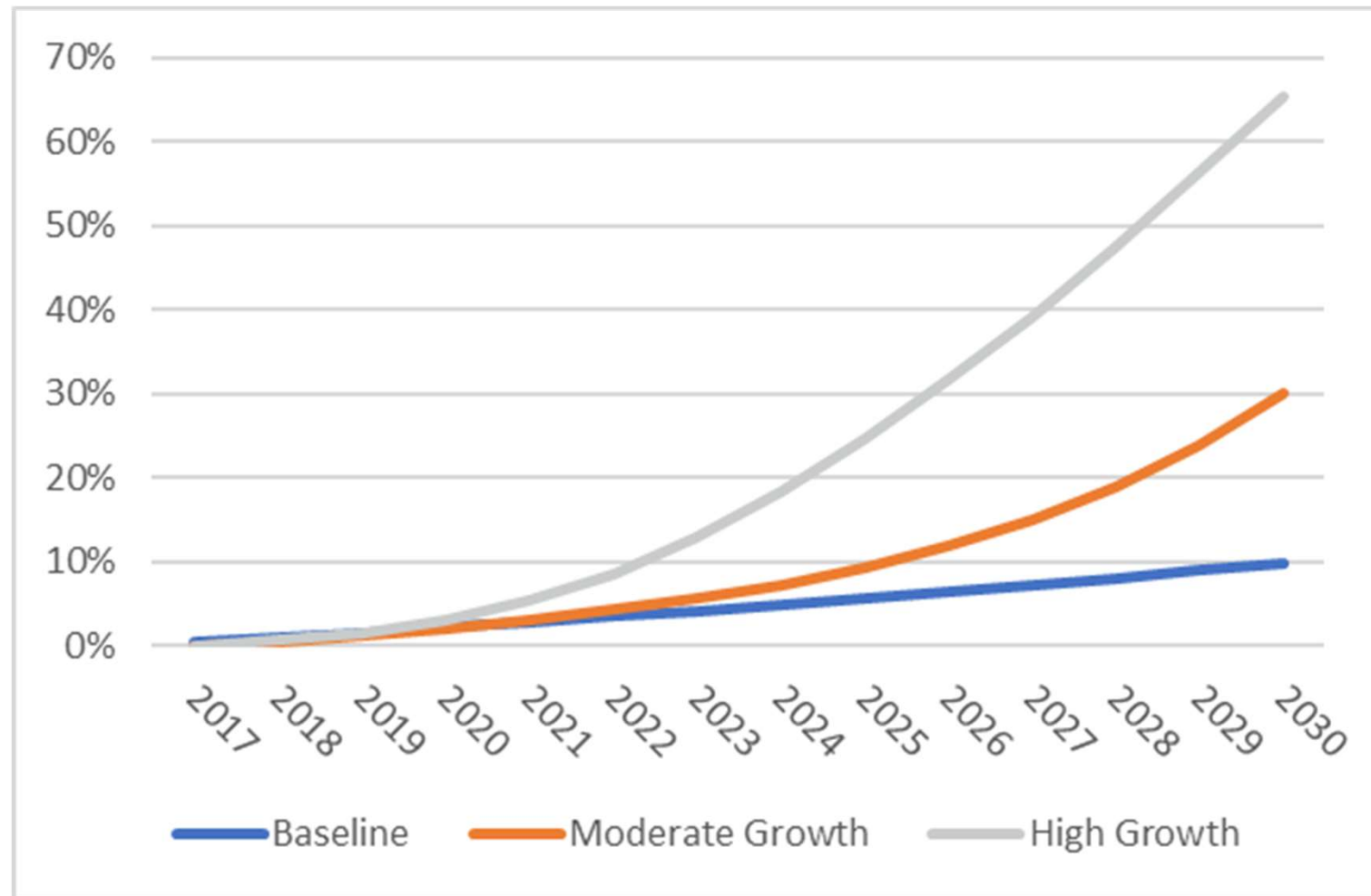
# Heat Pump Ramp-Up

## *Three Scenarios*

Statewide Goals		Baseline	Moderate Growth	High Growth	
Net Total Energy Savings (TBtu) 2025	185 TBtu	7.3 TBtu	12.3 TBtu	31.3 TBtu	17% of target
GHG Emissions Savings (% of 1990) 2030	40%	0.5%	1.5%	3.5%	9% of target



# ASHP Market Share by Scenario



# Key Assumptions

- Analysis starts with baseline installation levels
  - Where available
  - For all heat pumps, not just cold-climate or program-qualifying heat pumps
- Scenarios ramp up based on annual growth rates
  - Growth rate is limited to 59%, which is the national average annual growth rate in the solar photovoltaic (PV) market the last 10 years
  - Cumulative market share limit is 70%, the technical potential from NYSERDA's Renewable Heating and Cooling Policy Framework
- Analysis counts all savings, not just incremental electric savings
- Analysis assumes that some households retrofit to heat pumps, not only install at end of life

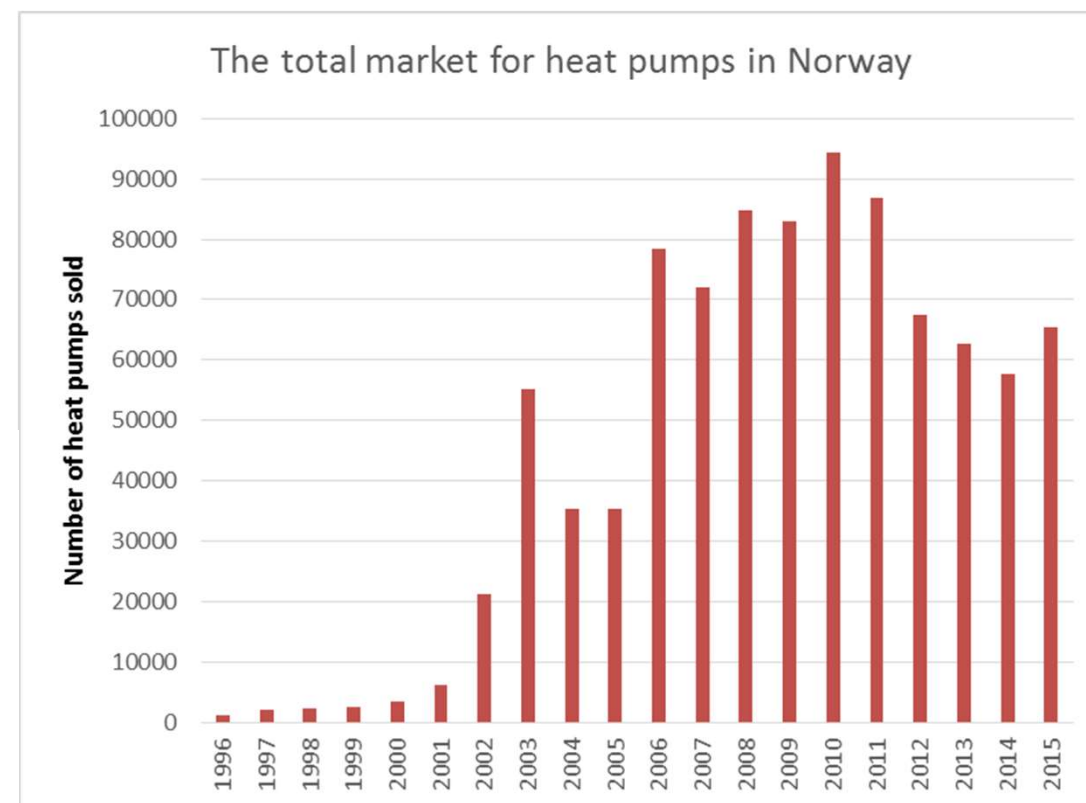
# Ambitious Targets Are Achievable

Northwest Energy Efficiency Alliance (NEEA) set a target market saturation of 85% of single family homes by 2029

**Table 4: World HVAC Market Overview – DHPs**

	Market Share	Number of Systems
Japan	90%	7.2M
China	86%	16.7M
Europe	81%	7.6M
United States	4%	0.4M

Source: EnergyStar.gov (<http://www.energystar.gov/ia/partners/downloads/Mitsubishi-Doppel.pdf>) Mitsubishi Electric, *32 Years of Leadership in Providing Unique Solutions for the HVAC Market ... and Counting*, BSRIA (Building Services Research and Information Association) report 2005/2007.



# Strong Statewide Targets for New York

- Fuel-neutral target of 30 TBtu of energy savings from heat pumps by 2025

	2016 Baseline	2025 Target	2030 Target
Statewide energy savings from heat pumps (TBtu)	--	30	85
Residential heat pump market share	2%	25% of households have a heat pump	65% of households have a heat pump
Heat pump capacity, average installation (BTU/hr)	28,000	35,000	40,000
Heat pump efficiency (HSPF)	~9.5	14	15

# Building Electrification in Utility EAMs

- Set fuel-neutral energy savings goals in TBtu
  - Not only MWh and therms
- Update savings methodologies to count all savings
  - Displaced fossil fuel savings for heating
  - Electric savings for cooling
  - Increases in electric use due to fuel switching
- Adjust outcome-oriented EAMs (e.g., energy intensity) to account for beneficial electrification
- Set utility sub-targets and associated EAMs for both program-based and outcome-based total energy savings from heat pumps



# Earnings Adjustment Mechanisms : New Upside Performance Incentives in Niagara Mohawk Power Co. Joint Proposal

**nationalgrid**

EAM Category	Metrics	Measurement	Drivers
System Efficiency	Peak Reduction	NYCA-coincident peak load	Demand response, Storage, Peak-focused EE, DG Interconnection, VDER, VTOU, off-peak EV Charging, heat electrification, VVO/CVR
	DER Utilization	Sum of annualized MWh for incremental load-reducing DERs	
Energy Efficiency	Incremental EE	Incremental MWh EE Savings	ETIP, incremental NMPC administered EE, EE financing, E-Commerce Platform, LED Street Lighting, Project Juniper, NYSERDA coordination, 3 <sup>rd</sup> party coordination
	LED Street Lighting	LED SL conversions	
	Resi Energy Intensity	% decrease in MWh/customer	
	C&I Energy Intensity	% decrease in MWh/customer	
Interconnection	Meeting SIR standards is threshold for earning		Developer cost sharing; Developer opportunity to construct upgrades; online interconnection portal
	Developer Satisfaction	Survey score	
Carbon Reduction	Beneficial Electrification	MT CO2 reduced from incremental heat pumps and EVs	Electric heat initiative, EV charging & marketing, rate design, Juniper

VEIC

# Savings Targets: Building Blocks

30 TBtu Statewide EE Target for Heat Pump Savings

Utility A Outcome-Based Target for  
TBtu Savings from Heat Pumps

Utility B Outcome-Based Target for  
TBtu Savings from Heat Pumps

Utility A  
Program-  
Achievement  
Based Heat  
Pump Savings

Market  
Transformation  
Heat Pump  
Savings  
Contributed by  
NYSERDA in  
Utility A Service  
Territory

Utility B  
Program-  
Achievement  
Based Heat  
Pump Savings

Market  
Transformation  
Heat Pump  
Savings  
Contributed by  
NYSERDA in  
Utility B Service  
Territory

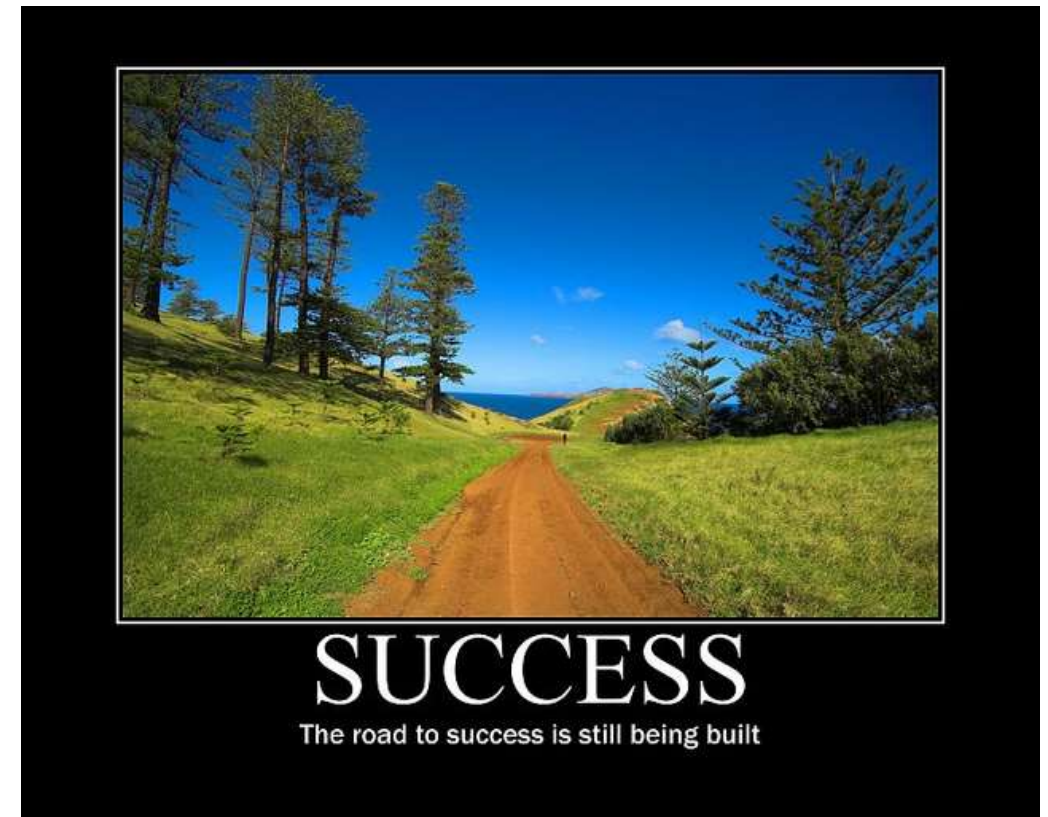
# Policy and Program Recommendations



# Driving the Heat Pump Market

The most successful programs combine two implementation elements:

- ✓ Midstream program design and supply channel engagement, to move the market and support marketing and training
- ✓ Robust incentives for end-use customers



# Program Coordination

- Statewide initiative to engage supply chain and administer midstream heat pump programs, led by NYSERDA
- Central advisory group to facilitate statewide coordination on:
  - Energy efficiency and electrification target-setting
  - Budgets
  - Program implementation
- Utilities lead end-use customer engagement and incentives
- Utility incentives delivered in coordination with statewide midstream initiative

# Example: NEEA GoingDuctless.com

**DUCTLESS**  
HEATING & COOLING SYSTEMS

[WHAT IS A DUCTLESS SYSTEM?](#) [UTILITY REBATES](#) [PROMOTIONS](#) [FIND AN INSTALLER](#) [FIND A RETAILER](#)

[GET STARTED](#)



Select **YOUR** Electric Utility for Information Specific to Your Area

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06804

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[Use Current Location](#)



## Save up to \$450 on selected ductless systems

Instant rebates are available on qualifying ductless heating and cooling systems now through November 31

[LEARN MORE](#)



# Program Funding & Incentives

- Dedicate funding for building electrification
- Increase heat pump incentives above current levels
- Enhance heat pump incentives for low and moderate-income (LMI) customers
- Integrate financing options for heat pumps, building on existing NYSERDA financing and the New York Green Bank





# Electric & Gas Coordination

- Phase out conversions from unregulated fuels to natural gas
- Offer incentives for hybrid heat pumps
- Promote all-electric heating equipment in new construction
- Promote fuel switching in gas utility service territories with pipeline capacity constraints
- Develop methods to adjust utility targets and EAMs for overlapping electric-gas service territories

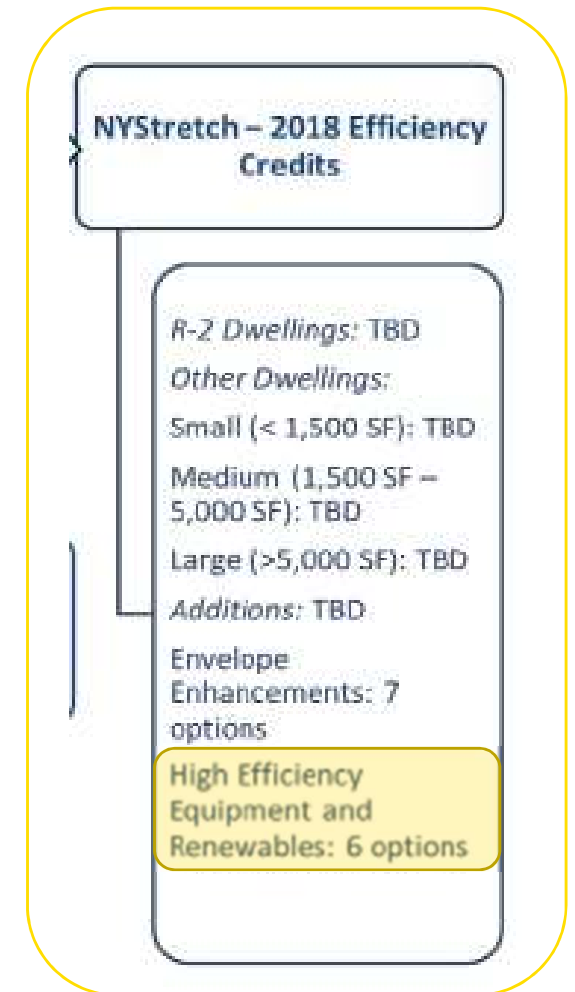


# Encouraging Heat Pumps Through Building Energy Codes

## Energy Efficiency Credit Options

*Allows builders to consider high efficiency heat pumps as a means to code compliance without triggering federal preemption laws*

- ✓ Adopt NYStretch Code-Energy 2018
- ✓ Incorporate this approach in base energy code in subsequent code cycles



# ASHP Market Development

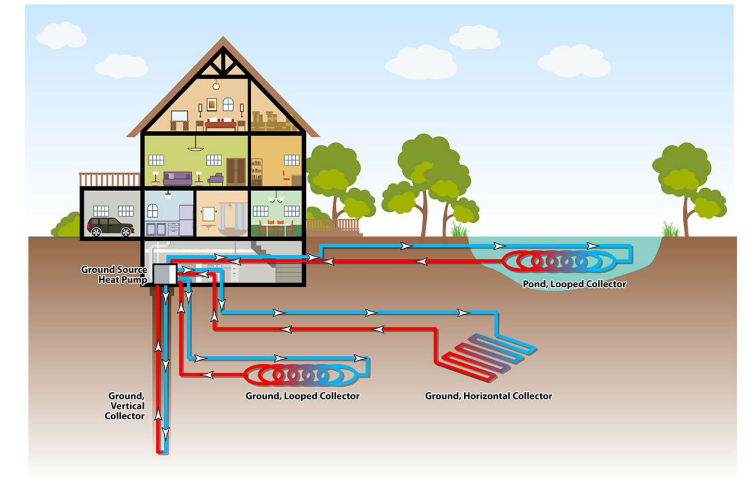
Build on NYSERDA's current activities to advance the ASHP market:

- ✓ Build cross-industry links with the electrical wholesale supply channel
- ✓ Adopt the NEEP Cold Climate Heat Pump Specification
- ✓ Work with heat pump and thermostat manufacturers to develop and integrate control capabilities



# VRF & GSHP Market Development

- VRFs:
  - Case studies and marketing materials
  - Aggressive promotion in new construction
  - Supply channel engagement and incentives
  - Regional standards for VRFs
  - Lower global warming potential (GWP) refrigerants
  - Encourage VRFs in state buildings
- GSHPs:
  - Accelerate NYSERDA's soft cost reduction strategy
  - GSHP demonstration projects to promote grid flexibility





# Looking Ahead

- ✓ Building electrification is an important contributor to NY's efficiency and climate goals
- ✓ Strong targets and dedicated funding will help the heat pump market achieve its full potential
- ✓ The state has a strong foundation of market development activities to build on
- ✓ Coordinated delivery of programs promoting EE, DR, RE, storage, and electrification is crucial
- ✓ Demand flexibility pairing heat pumps with controls is key to reduce GHG emissions



**Emily Levin**  
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Thank  
you!



**NYSERDA**

# **Future heat pump program and policy options**

**October 3, 2018**

**Carl Mas,  
Director,  
Energy and Environmental Analysis**

# Context / objective

- Thermal energy usage in residential and commercial sectors accounts for ~1/3 of the energy consumption and greenhouse gas emissions in New York.
- Heat pumps (“beneficial electrification”) are the most compelling potential solution to decarbonize buildings.
- Heat pump adoption and penetration levels are currently very low in New York (~1%), reflecting a range of market barriers including high equipment cost and inadequate customer payback
- Opportunity to switch from conventional to clean heating and cooling arises typically at the end of the current equipment life – only one or two opportunities between now and 2050 in a given building.
- 2017 RH&C Framework publication put forward the case for a long-term policy framework that supports the transition of heat pumps from niche to mainstream. Now is the time to consider the specifics of the long-term framework.
- The New Efficiency: New York White Paper identified an early-market trajectory of nearly 8 TBtu of site energy savings or over 100,000 installations in the residential sector, at a cost comparable to other energy efficiency investments.

# What barriers need to be addressed?

- **High upfront costs and inadequate return on investment in many market segments**
  - Install costs starting to decrease but still high upfront & low fossil fuel prices
  - Some benefits currently unmonetized (GHG reductions, cost shift, peak reduction value)
- **Limited consumer finance options or new business models that avoid large capital outlays**
- **Lack of supply chain**
  - Skilled drillers & installers
- **Customer awareness and risk aversion**
  - Poor customers awareness and confidence in heat pump technologies
  - Tendency to replace like with like equipment
- **Limited windows of opportunity to reach customers**
  - Customers tend to consider new HVAC equipment only at the end of life of the current installation
- **Policy and institutional barriers**
  - State & local building code, energy code & permitting often do not address heat pumps

# Long-term policy principles and delivery roles

In order to scale up, the market needs a policy framework that:

1. is **long-term** and consistent, and provides a **clear market signal**;
2. provides adequate, **bankable** missing money and **drives cost reductions** over time;
3. addresses **non-financial barriers**.

Capitalize on relative strengths of program delivery partners:

Utilities	NYSERDA
<ul style="list-style-type: none"><li>• Utilities can target locational value (eg peak reduction value) and have a role on rate reform (addressing inverse cost shift)</li><li>• Utilities can leverage their customer relations to support customer acquisition initiatives (marketing).</li><li>• Potentially: utility ownership may offer finance cost or other cost reductions</li></ul>	<ul style="list-style-type: none"><li>• NYSERDA can provide long-term program consistency across the State</li><li>• NYSERDA can address certain cross-cutting non-financial barriers, e.g. workforce development, consumer awareness and confidence, etc.</li></ul>

# Scope/ timing

- Ensure continuity with anticipated end dates of NYSERDA GSHP and ASHP
- Program horizon to match the 2025 energy efficiency target
- Important to consider both the residential, commercial and multifamily market
  - Start with the residential market (single family and small multifamily)
  - Initial focus on delivered fuels (oil/propane) and less efficient electric heating
  - Most significant target market for current installer supply chain
- Follow with program options to drive large multifamily and commercial heat pump sectors
  - Requires more understanding of installation complexities and design specifications of both larger-scale conventional and heat pump HVAC systems and their costs.
  - Significant non-financial barriers compared to small-scale residential
  - Studies underway both within and outside NYSERDA (eg NYC, Urban Green)

# High-level program options to address “missing money”

1. **Utility rebate or similar programs under rate cases:** under this approach, utilities have authority to offer programs for the duration of the relevant rate case.
2. **Rebate program(s) administered either by NYSERDA or by utilities under central, longer-term direction:** this approach would differ from Option 1 in ensuring that program(s) provide long-term market certainty and consistency on critical program structure issues (such as payment levels and eligibility requirements).
3. **Rate reform:** revised electric rates would aim to deliver more efficient pass-through of the costs of the electricity system to customers; as a result such rates would be expected to reduce or eliminate the inverse cost shift burden on heat pump customers.
4. **Hybrid option:** this approach would combine elements of Options 2 and 3, by providing a rebate structure (or similar) that includes a rebate component aimed at addressing inverse cost shift (eg “Rate Impact Credit”).

This list reflects options with general applicability across relevant market segments. **Program options that may be available in specific circumstances** (eg Non-Wire or Non-Pipeline Alternatives for locational value, or potentially utility ownership for GSHP loop fields) could be supplemental.



# Option assessment

Decision criteria include lowest cost to ratepayers; long-term market certainty and consistency; bankability.

	Pros	Cons
<b>1: Utility rate case rebate programs</b>	Utilities can tailor rebate levels to local needs to minimize ratepayer cost	Rate case programs have a short duration of a few years and can be subject to inconsistent design approaches and ambition levels between utilities
<b>2: Centrally-coordinated long-term rebate program</b>	Can provide long-term market certainty if implemented either as a NYSERDA program or under central direction to utilities	Central programs may lose some efficiency in favor of statewide consistency
<b>3: Reform of residential electric rates</b>	Likely the most efficient way of addressing the inverse cost shift burden on heat pump customers under current standard residential rates	Benefits are less transparent and bankable to customers than a rebate program
<b>4: Hybrid: bankable rate reform + long-term rebate program</b>	Bill credit payments could be more bankable than rate reform and could ensure continued performance of the equipment over time; this option could be structured to provide the same long-term market certainty as Option 2	Bill credit payments over time can be more costly to ratepayers than upfront rebates due to high customer discount rate. The combination of regular rebates and bill credits could result in some additional program complexity

# Option 2 (rebate) – illustrative structure

The below table illustrates how the missing money and cost reduction findings from NYSERDA's heat pump analysis could be translated into program payment levels over time, expressed as an upfront rebate under Option 2.

Single family residential, per installation

	Current programs	2019	2020	2021	2022	2023	2024	2025
GSHP	~\$7,000	\$6,000	\$6,000	\$6,000	\$6,000	\$4,700	\$3,400	\$2,100
ASHP	~\$1,000	\$4,000	\$4,000	\$3,300	\$2,600	\$2,000	\$1,400	\$800
Minisplit	~\$1,000	\$2,000	\$2,000	\$1,700	\$1,400	\$1,100	\$800	\$600

***Illustrative for discussion – not policy proposals.***

# Option 2 (rebate) – illustrative portfolio projection

Adoption	
Number of installations (1000s)	101
Site energy savings (TBtu)	6
Program cost	
Payments to participants (\$ million, undiscounted)	\$230
Benefits	
Peak reduction value (\$ million, discounted at social discount rate)	\$30
Inverse cost shift (\$ million, discounted at social discount rate)	\$340
Lifetime carbon savings (millions of metric tons)	8
Lifetime Social Cost of Carbon value (\$ million, discounted at social disc.rate)	\$220
<b>Total (\$ million)</b>	<b>\$590</b>
Metrics	
Net ratepayer burden (program cost minus peak value and cost shift, \$M)	-\$150
Program cost per lifetime ton of carbon	\$30/t

**Single family and small multifamily.** ASHP, minisplit and GSHPs. Oil and electric replacements. Cumulative figures 2019-2025. Long Island included.

Preliminary estimate indicates large multifamily and commercial could deliver a similar level

***Illustrative for discussion – not policy proposals.***

# Critical market development needs

Barrier	Planned future activities
High customer acquisition costs	<ul style="list-style-type: none"><li>• Continue co-operative marketing</li><li>• Strengthen and replicate utility co-branded Marketing and Awareness in other areas</li><li>• Refine community campaign approach and replicate in over 20 other communities to achieve scale</li></ul>
Lack of trained installers, designers and drillers	<ul style="list-style-type: none"><li>• Ground heat exchanger installer (driller) training and development</li><li>• Comprehensive workforce development pipeline<ul style="list-style-type: none"><li>• Work with market to educate on Clean HVAC career opportunities</li><li>• Develop a map of Clean HVAC career paths</li><li>• Develop and integrate Clean HVAC curriculum in K-12, BOCES, Community Colleges, Universities</li><li>• Emphasize mentorship, internships and on-the-job training</li><li>• Retrain existing fossil fuel based HVAC workforce</li></ul></li></ul>

# Next steps

- Develop single family/ small multifamily missing money proposal
  - Delivery mechanism including role of utilities and NYSERDA
  - Ensure continuity with current offerings
- Refine market support initiatives to address non-financial barriers through the Clean Energy Fund
- Complete analytical work on (i) market sizing and strategies for large buildings, and (ii) potential costs/benefits of utility ownership of GSHP loop fields

## Questions and comments

# Exploring the Future of Heat Pumps

Owen Brady, Emerging Products

Chong Lin, Innovation & Development

10/3/2018

**nationalgrid**



# Our New York Business

We deliver safe, affordable, reliable and sustainable energy.

## 4 million gas and electric customers



8,000 employees

**\$10.7 billion** of rate base

**\$1.5 billion** annual O&M budget

**\$1.2 billion** of annual capital spending

New York represents  
60% of National Grid's  
U.S. business



# Our Position on Climate Change is Clear

**National Grid supports ambitious regional GHG emission reduction targets in all of the jurisdictions where it has business operations**

Region / State	Midterm*	2050*
Massachusetts	25% by 2020	80%
Rhode Island	45% by 2035	80%
New York	40% by 2030	80%
UK	40% by 2030	80%
National Grid	45% by 2030	80%

\*1990 baseline used for all targets



# Northeast Emissions 1990-2015

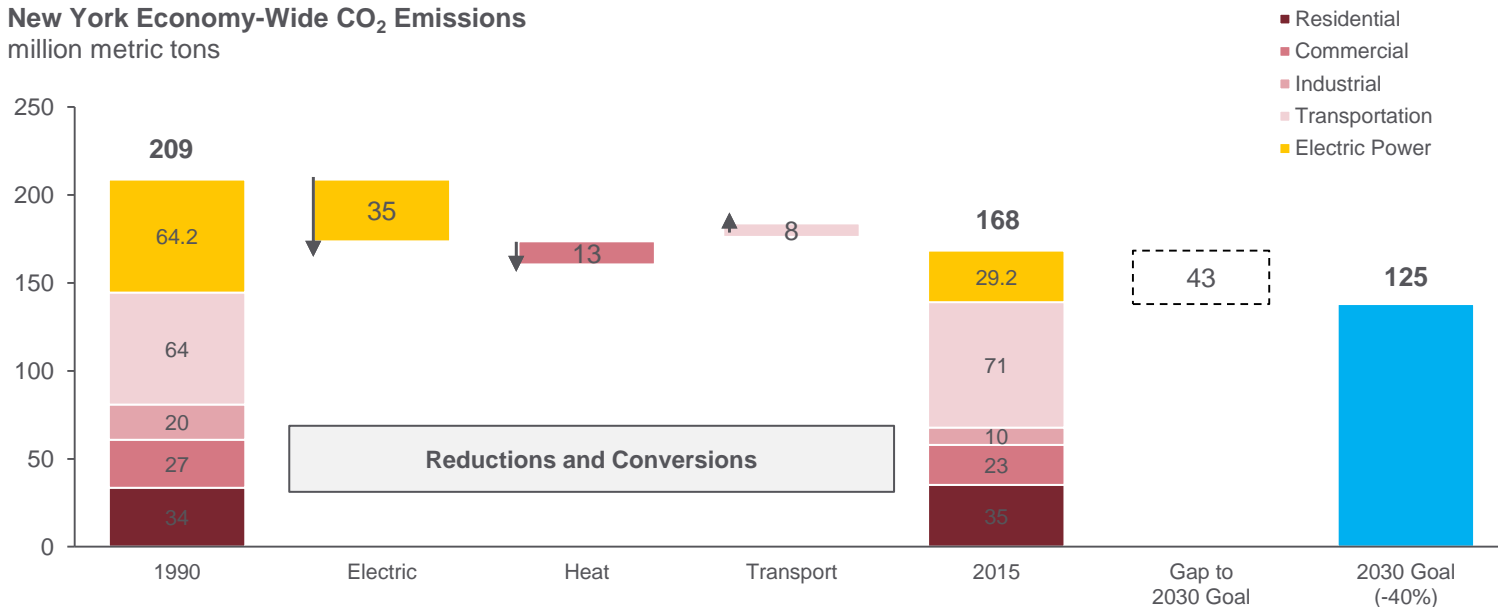
Significant progress in the electric sector

Progress in heat

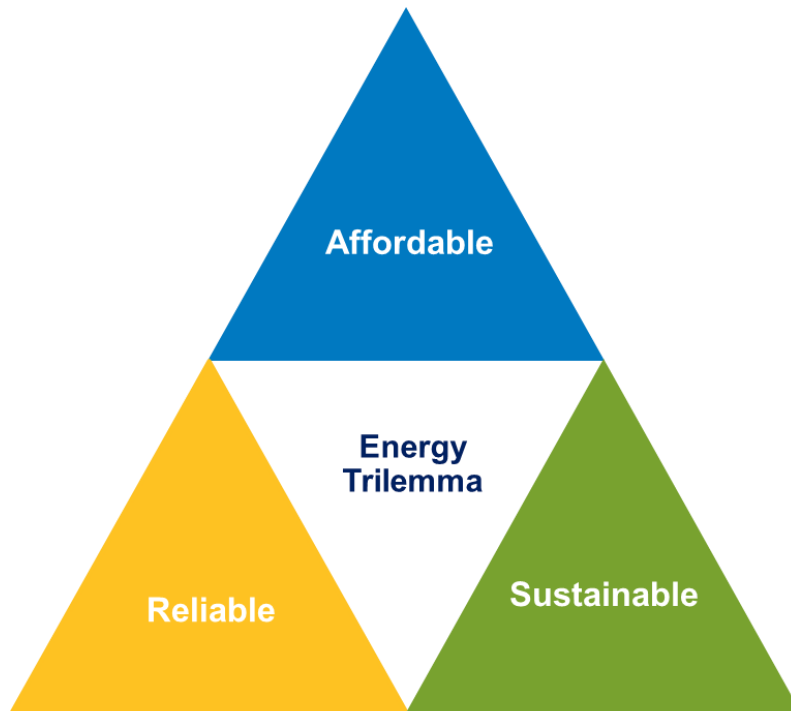
Backsliding in transport

The remaining challenge is in transport and heat

New York Economy-Wide CO<sub>2</sub> Emissions  
million metric tons



# The Challenge = The Opportunity

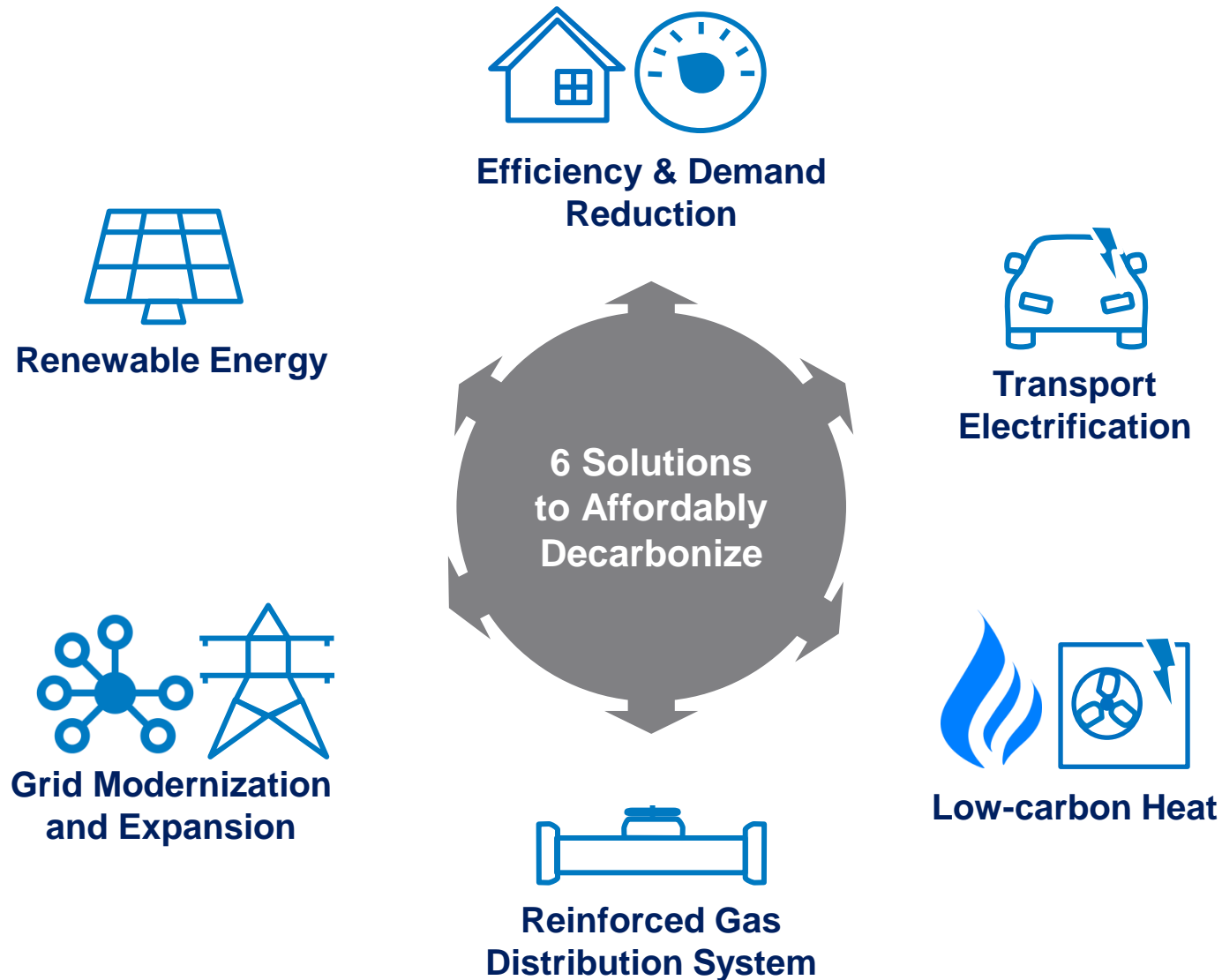


**Decarbonizing transport, heat, and electricity**

**Keeping it affordable for everybody**

**Creating good clean energy jobs across all sectors**

# Affordable Solutions for Decarbonization



# The National Grid Northeast 80x50 Pathway

Our 80x50 Pathway is ambitious and comprehensive, with implications for customers, communities, utilities, automakers, and policymakers.

**40% x 2030**

**80% x 2050**

## Power

- Ramp up renewable electricity deployment to achieve 67% zero-carbon electricity supply vs. 45% today

- Zero carbon electricity system
- Increase large-scale renewables
- Inter-seasonal energy storage
- New clean electricity options (gas + CCS, modular nuclear)

## Transport

- Reach more than 10 million light-duty electric vehicles on Northeast roads (50% of all light-duty vehicles) vs. < 75,000 today

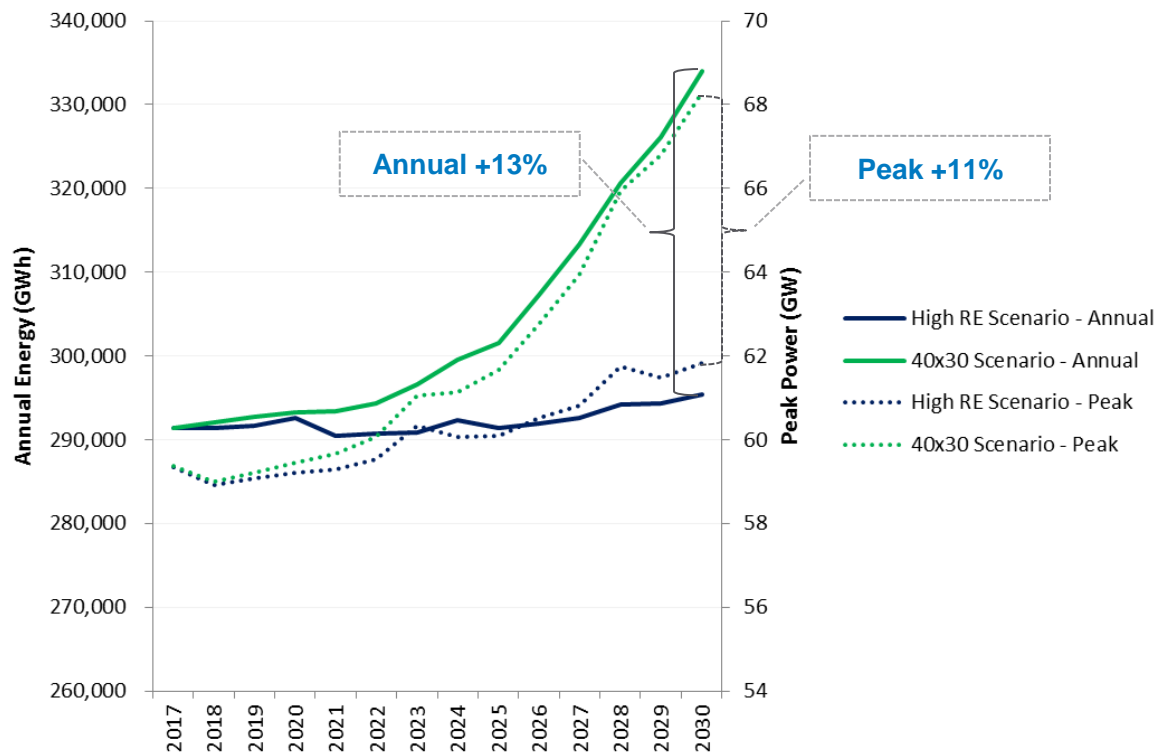
- More than 20 million light-duty vehicles (100% of the fleet)
- Low-carbon heavy duty, rail, and off-road transportation
- Reductions in vehicle miles traveled

## Heat

- **Facilitate the adoption of heat electrification (10x)**
- Double the rate of EE retrofits
- Triple the rate of oil-to-gas heating conversions

- Sustain thermal efficiency investment
- Decarbonize natural gas supply for heating
- Hybrid gas/electric heating

# 40 x 30 Pathway Increases Annual and Peak Load by 13% and 11% respectively



Note: Peak load presented here does not include DG impact

## Headline Messages

- In National Grid's Pathway, 2030 annual load is ~13% higher than a "Business as Usual" load growth scenario.
- Most growth after 2023, driven by EV and electric heat adoption assumptions.
- In the Pathway, peak load grows 11% over the BAU case.
- Since annual load grows more than peak load in the 40x30 Pathway, load factor improves. As a result, all else being equal, delivery rates would be lower in 40x30 Pathway compared to a BAU pathway.

# Gas REV – Long Island Geothermal Demonstration

**Determine cost-effectiveness and efficiency of community loops, renewable heating and cooling to 10 residents**

**Evaluate environmental and health benefits, energy bill savings, carbon savings, and increased comfort levels.**

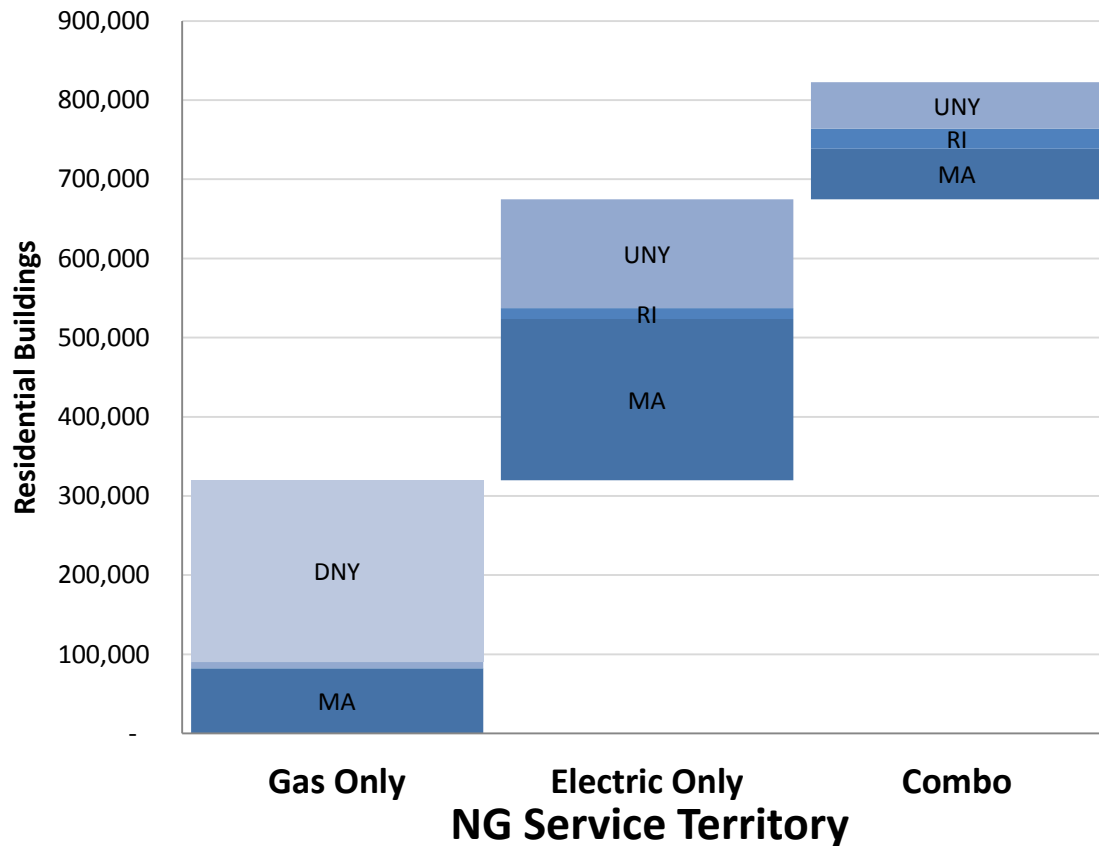
**Partnering with NYSERDA to collect and analyze data and LIPA/PSEG-LI on EE programs**



# Market Potential

## Residential Target Market: 822K homes

Buildings >200ft from gas mains heating with oil or propane



**Annual spend on Oil and Propane in National Grid Territories**

**~\$1.8 billion**



# Collaboration

**None of us can achieve 80x50 alone.**

**To guide the economy-wide transformation, we will need:**

- **Active customer engagement**
- **Transformative industry partnerships**
- **Comprehensive policy and regulatory frameworks**
- **Rapid, widespread technological innovation**

**National Grid is ready to innovate together with our stakeholders in pursuit of reliable, least-cost decarbonization.**



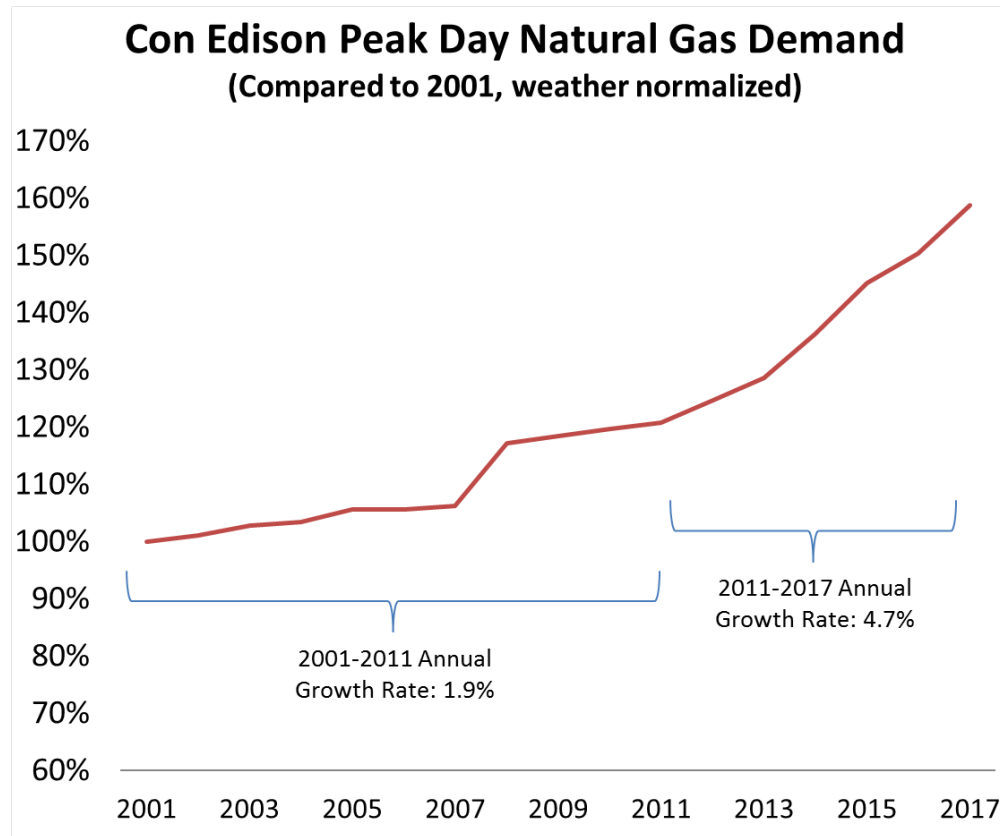
national**grid**

# Smart Solutions for Natural Gas Customers and Heat Pumps

Christopher Raup, Director, Utility of the Future

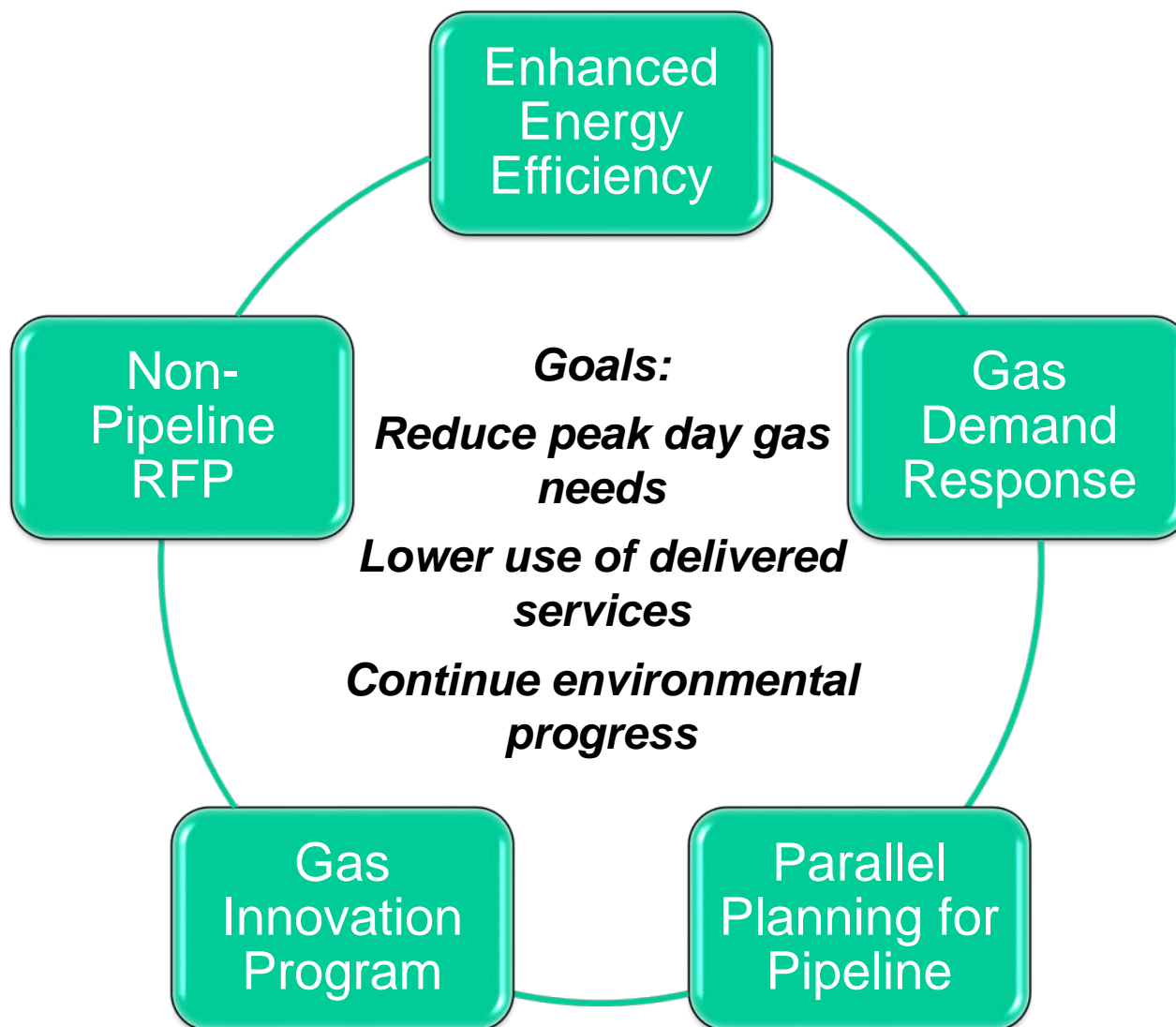
October 3, 2018

# Uncertainty in meeting peak gas demand growth



- Peak day demand has grown quickly
  - More than 30% from 2011 to 2017
- Ability to build new pipelines facing regional permitting challenges

# Smart Solutions for Natural Gas Customers



# Solution 1: Enhanced Gas Energy Efficiency

*Double Gas EE achievements with more funding to existing, successful offering designs*

- Program approved by PSC in July 2018, with modifications
- Annual incremental cost: ~\$5.5M
- Incremental peak savings: ~25,000 dekatherms per day by 2023

## Key Measures:

- High efficiency condensing boilers
- Upgrade obsolete heating system controls
- Smart Thermostats
- Streamlined custom measure process

## Program Strategy:

- Raise customer awareness with immediate-value, educational messaging
- Expand existing program implementation contracts
- Increased incentives for high peak day impact measures; geographic targeting
- Leverage internal sales team and market partner network of over 100 vendors
- Collaborate with NYSERDA's upstream/midstream initiatives

# Solution 2: Gas Demand Response Pilot

*Developing new gas demand response pilot to address daily pipeline capacity need*

- Pilot approved by PSC in August 2018
- Three year cost: ~\$5M
- First gas DR program focused on addressing daily pipeline capacity needs
- Flexibility on time of day reductions occur, as long as net daily usage is reduced
- Incremental peak savings: ~7,000 dekatherms per day by 2023

## Key Measures include:

- Residential: thermostat set back,
- Commercial: thermostat set back, curtailment
- Fuel oil switching not eligible
- **Heat Pump opportunity: Facilitate gas DR for hybrid heat pump use**

## Pilot Strategy:

- Work with demand response aggregators and other stakeholders during design period
- Leverage knowledge and processes from electric DR program
- Address interim metering needs as smart meter roll out is underway
- Adjust key parameters after each season



# Solution 3: Gas Innovation Program

*Exploring challenges and opportunities of Renewable Heating and Cooling (RH&C)*

- Request for Information issued June 2018; 28 proposals received August 2018
- Evaluation of proposals is in process; expect to recommend 1-3 proposals
- Estimated cost: ~\$10M
- Incremental peak savings: initially nominal, but long term may be substantial

## Key Measures:

- Business model innovations associated with RH&C and electrification, including:
  - **Ground source heat pumps (geothermal)**
  - **Air source heat pumps**
  - **Open to other clean thermal technologies**

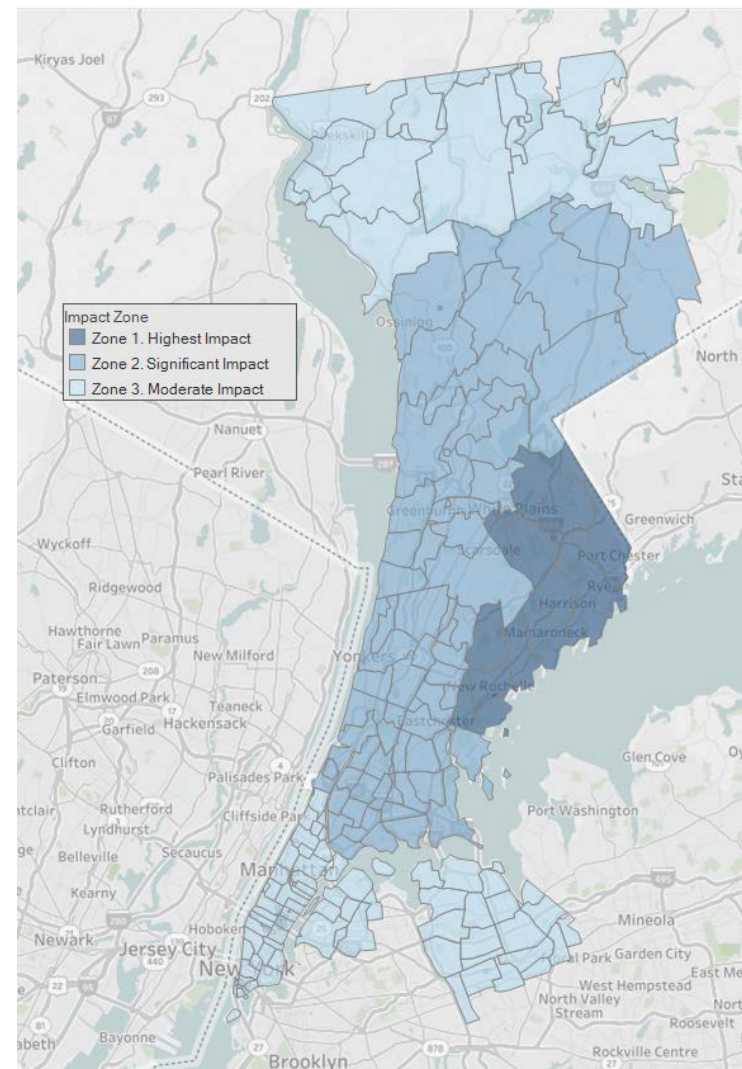
## Program Goals:

- Increase renewable thermal adoption in Con Edison's service territory
- Reduce market barriers and accelerate renewable thermal industry
- Identify scalable projects that inform the Company's long term strategy
- Implement multiple business models
- Provides access to fuel oil customers and LMI customers transitioning to alternative resources

# Solution 4: Non-Pipeline Solutions RFP

## Background

- RFP Issued December 1, 2017
  - Invited peak demand reduction proposals and local gas supply resources
    - Enforceable 5+ year commitments (3+ for DR)
    - Focus on relief in Lower Westchester, Bronx
    - Switching to oil or propane not eligible
    - Required commercially-proven technologies
- Potential budget of \$100M/year or more thru 2023
- Sought relief of > 100,000 dekatherms/day



# Solution 4: Non-Pipeline Solutions RFP

## *Summary of Responses*

- Received 28 proposals in March 2018
- Demand-Side (16 proposals)
  - Proposals received from customers and from reputable program managers
  - Includes large EE and electrification proposals and a small number of gas demand response proposals
- Supply-Side (12 proposals)
  - Includes multiple renewable natural gas proposals, CNG/LNG trucking, LNG liquefaction and storage, and propane transportation and storage
  - Many proposals did not identify specific sites for their projects



# Solution 4: Non-Pipeline Solutions RFP

## Overview of NPS Portfolio

- NPS Portfolio projects:
  - Meet RFP requirements
  - Meet statutory requirements
  - Commercially proven technology
  - Good quality, from qualified entities
- Selected both demand-side and supply-side proposals
- Reduced peak day gas needs by 85 Mdt
  - Does not full meet need for pipeline
- Non-O&M funding request of \$305 million
- Benefit-Cost Analysis Ratio of 1.05, reduce GHGs by 5 million tons
  - Benefits focused on reducing use of delivered services, avoided local T&D

BEFORE THE NEW YORK STATE  
PUBLIC SERVICE COMMISSION

-----X  
Petition of Consolidated Edison Company of :  
New York, Inc. for Approval of the : Case 17-G-0606  
Smart Solutions for Natural Gas :  
Customers Program :  
-----X

REQUEST FOR APPROVAL OF NON-PIPELINE SOLUTIONS PORTFOLIO IN THE  
SMART SOLUTIONS FOR NATURAL GAS CUSTOMERS PROGRAM

CONSOLIDATED EDISON COMPANY  
OF NEW YORK, INC.

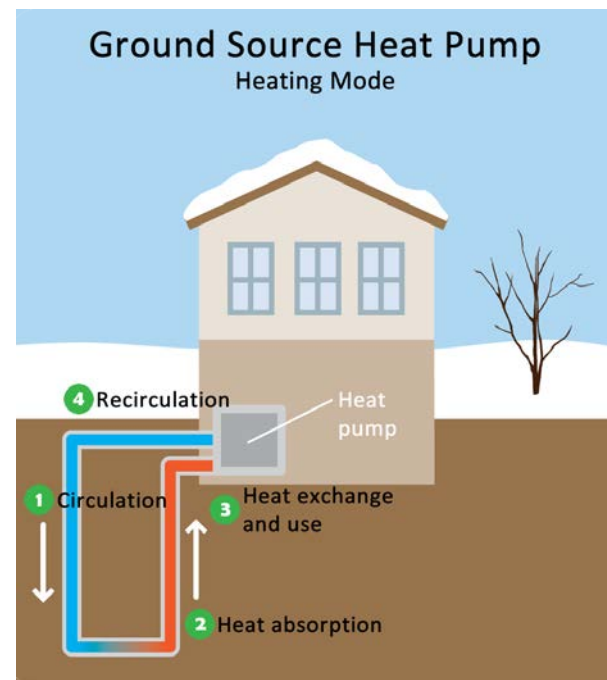
By its Attorney

Enver Acevedo  
Associate Counsel  
4 Irving Place, 18<sup>th</sup> floor  
New York, NY 10003  
(p) 212-460-3762  
(f) 212-677-5850  
E-mail: acevedoe@coned.com

# Solution 4: Non-Pipeline Solutions RFP

## *Heat Pumps in the NPS Portfolio*

- Two proposals, to be implemented by third-party respondents to the RFP
  - \$75 million in funding requested
  - 12 Mdt of peak day gas reduction
- Ground source heat pumps for residential customers in Westchester
  - More than 8,000 installations at single family homes
- Air source heat pumps for multifamily customers in the Bronx
  - More than 1,000 installations
  - Focus on low income customer benefits
- Outreach includes community based organizations



Thank you!

Christopher Raup

raupc@coned.com

212-460-3651





**NY Green Bank**  
A Division of NYSERDA

# NY Green Bank Heat Pump Public Forum

October 3, 2018 | Jessica Renny, Associate

New York, NY



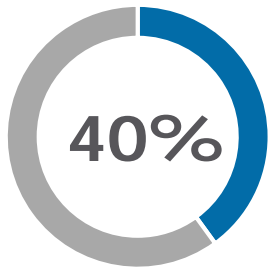
# NY Green Bank Advances New York's Clean Energy Opportunities

## Mission:

To accelerate clean energy deployment in New York by working in collaboration with the private sector to transform financing markets

- **What:** A \$1 Billion State-sponsored investment fund
- **How:** By mobilizing greater private sector activity to increase the availability of capital for clean energy projects
- **Why:** To alleviate financing gaps in New York's clean energy markets and create a cleaner, more resilient and affordable energy system

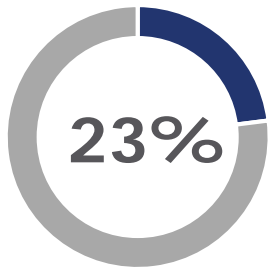
# Advancing NYS Clean Energy Goals



Reduction in greenhouse gas emissions from 1990 levels by 2030



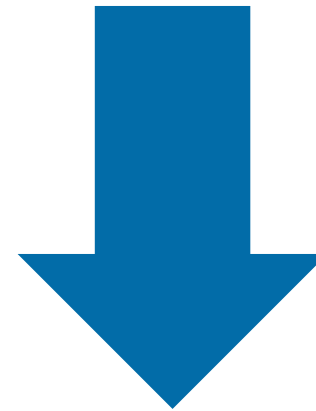
New York State's electricity must come from renewable energy sources by 2030



Decrease in energy consumption of buildings from 2012 levels by 2030

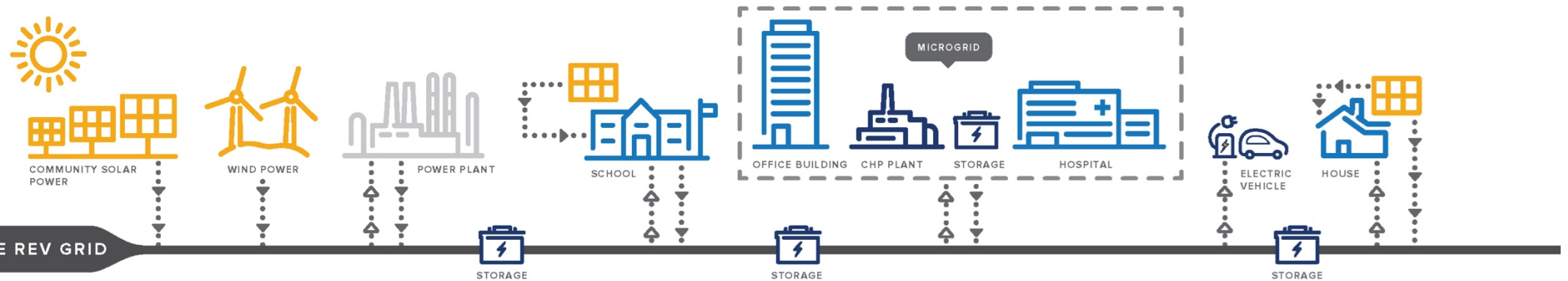


**2018 State of the State Address:** 1,500 MW energy storage target for NYS by 2025



**Earth Day 2018 Announcement:** Reduce energy consumption by 185 trillion Btus below forecasted energy use by 2025

# Resulting in New York's: Reforming the Energy Vision



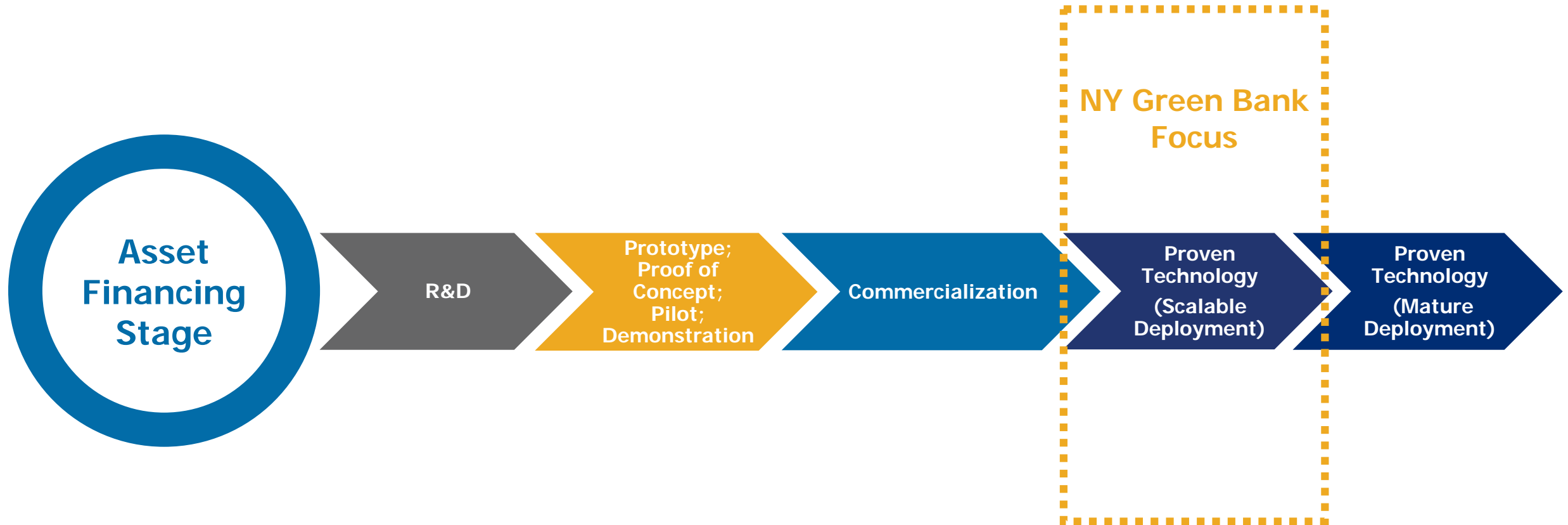
## Reforming the Energy Vision (REV):

Governor Andrew M. Cuomo's strategy to build a clean, resilient and affordable energy system for all New Yorkers

# NY Green Bank's Role in Overcoming Financing Barriers

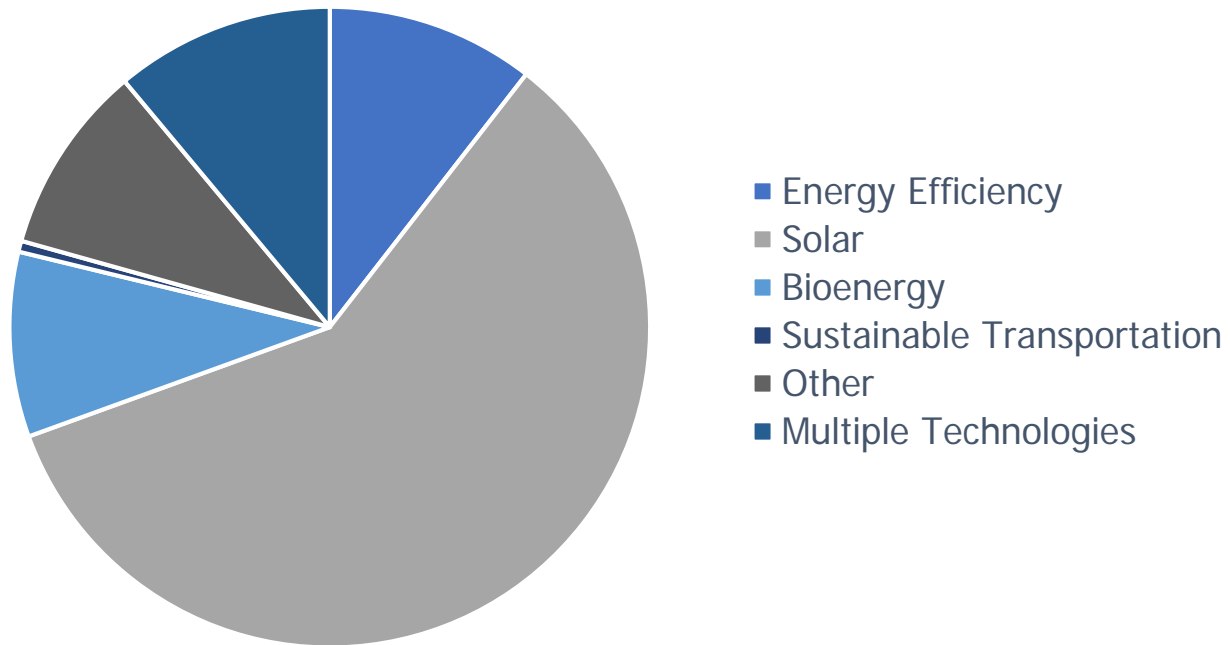
Financing Barrier		NY Green Bank Solution
Minimal Standardization	➡	Be solution oriented in finding credit worthy approaches to financing clean energy projects with limited transactional precedent
Uncertainty of Revenue Streams	➡	Consider all types of revenue contracts, merchant markets, and incentive payments
Limited Number of Financing Partners	➡	Be a first-mover to build market scale and standardization attracting private capital to the sector
Unfamiliarity with Asset Class	➡	Build upon experience financing clean energy projects and leverage expertise of NYSERDA colleagues
Small Transaction Size	➡	Participate in portfolios of small to mid-sized transactions

# NY Green Bank Investment Focus



# Areas of Focus within Sustainable Infrastructure

## Active Pipeline by Technology Type (\$542.2 Million)



# NY Green Bank's Investment Strategy

## Primary Investment Criteria:

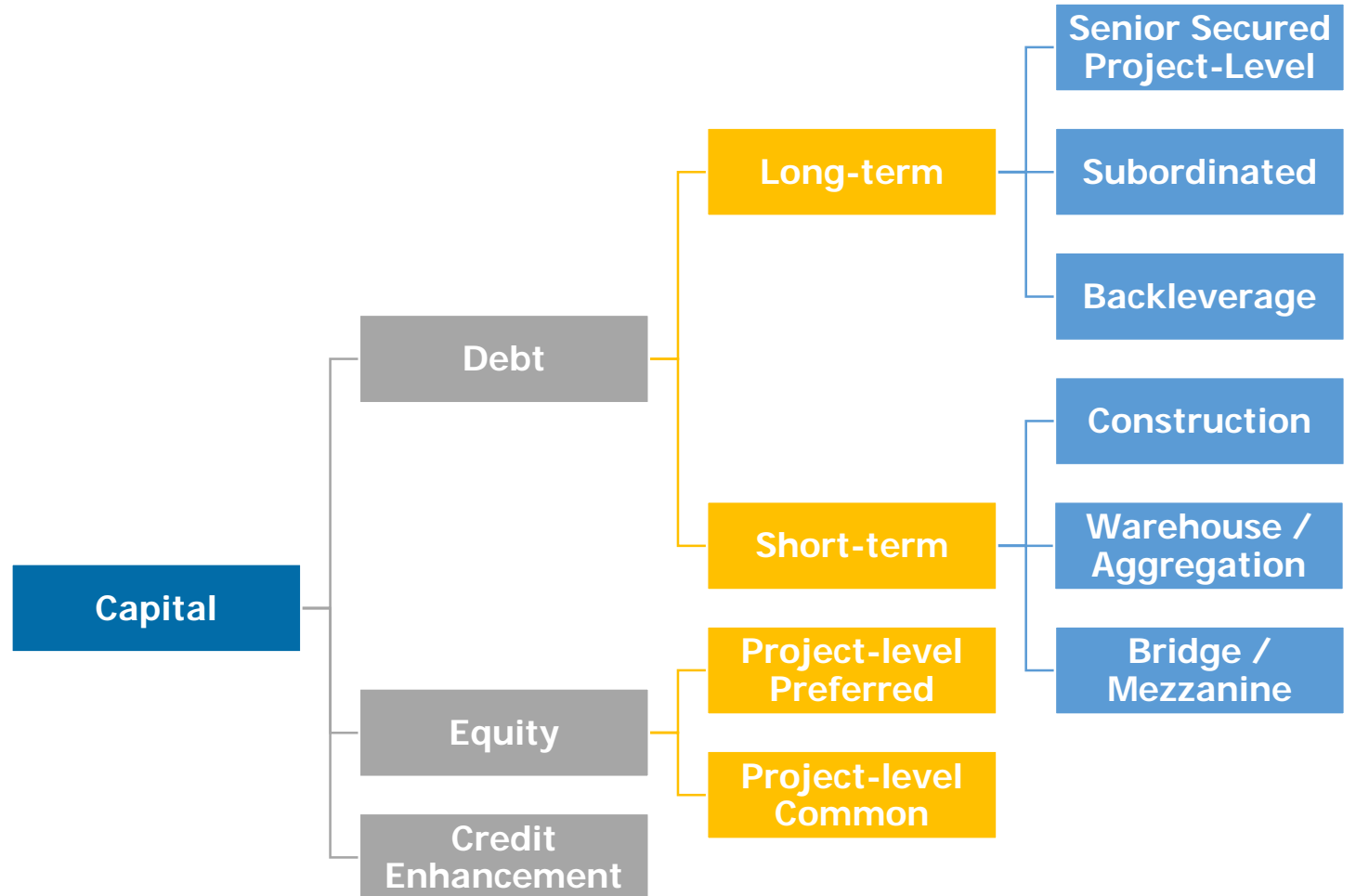
- ✓ Demonstrate potential energy savings and/or GHG reductions
- ✓ Demonstrate how the transaction contributes to market transformation
- ✓ Be economically and technically feasible, and provide financial returns to NY Green Bank

## Elements of a Strong Transaction:

- ✓ Capable and experienced management team
- ✓ Quality counterparties
- ✓ Interested and engaged private sector capital providers
- ✓ Identified and articulated role for NY Green Bank
- ✓ Economically viable business model that is replicable and scalable
- ✓ A financial model with realistic assumptions

# NY Green Bank Potential Roles in Transactions

- NY Green Bank can invest at any level of the capital structure of a project
- Focused on deployment of clean energy assets rather than investments directly in companies
- Can invest in multiple tranches of same project (*For example, senior secured and term loan B in the same deal*)





# Select Counterparties to Date



# Working with NY Green Bank

## Open Solicitations

- **RFP 1:** Clean Energy Financing Arrangements
  - **RFP 7:** Construction & Back-Leveraged Financing for Ground-Mounted Solar
  - **RFP 8:** Efficiency & Renewables Financing Arrangements: Building & Property Owners
  - **RFP 10:** Construction and Aggregation-to-Term Financing for CDG Solar Projects
  - **RFI 4:** Financing for Energy Storage Projects in New York State

# Credit Approval Process

## Scoring Committee

- Screening Process
- 1 - 2 weeks from submission of proposal

## Greenlight Committee

- Initial Diligence
- 1 - 6 months from submission of proposal

## Investment & Risk Committee

- Final Approval
- 2 - 12+ months from submission of proposal

# Contact NY Green Bank

**Address:**

1359 Broadway  
19th Floor  
New York, NY 10018

**T:** (212) 379-6260

**E:** [info@greenbank.ny.gov](mailto:info@greenbank.ny.gov)  
[www.greenbank.ny.gov](http://www.greenbank.ny.gov)

- Sign up for our mailing list for periodic updates on our website [here](#)
- All additional information is available on the website: [www.greenbank.ny.gov](http://www.greenbank.ny.gov)
- Follow us on social media:



[@ny-green-bank](#)



[#nygreenbank](#)

Contact us at [info@greenbank.ny.gov](mailto:info@greenbank.ny.gov)  
to discuss potential investment ideas



**NY Green Bank**  
A Division of NYSERDA



# ADVANCING ELECTRIFICATION

A (FUTURE) ROADMAP FOR  
NYC MULTIFAMILY BUILDINGS

*Heat Pump Forum, Oct. 3, 2018*

# AGENDA

Why Multifamily Buildings?

Issues/Challenges

Upcoming Study

# WHY MULTIFAMILY BUILDINGS?

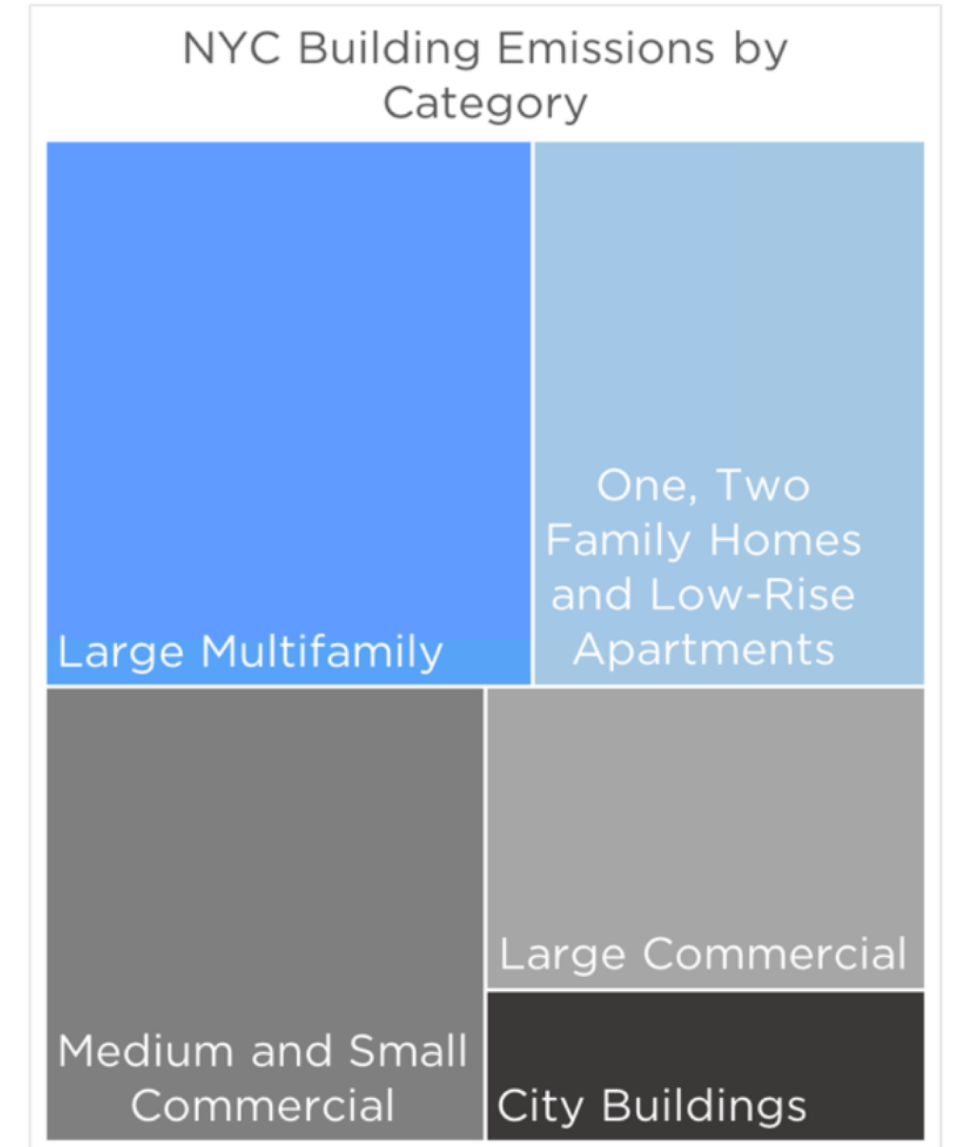


# IN NYC, LARGE MF BUILDINGS DOMINATE

Multifamily buildings > 25,000 sf:

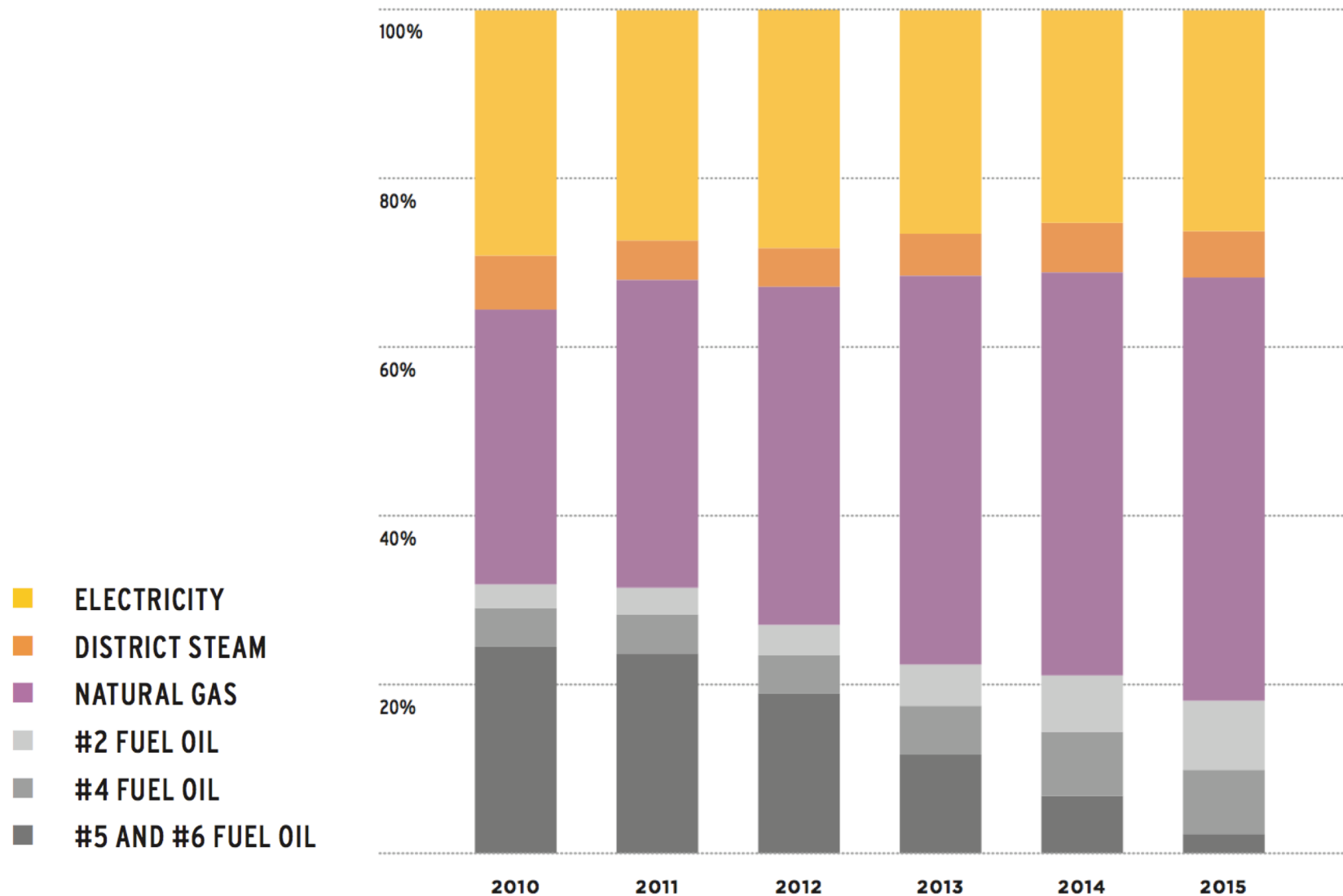
**~40%** of NYC building area

**~30%** of NYC building emissions



## MF ENERGY MIX

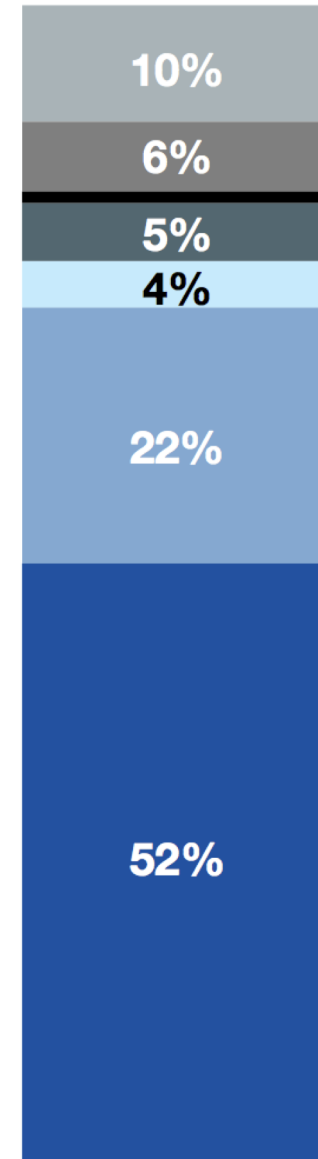
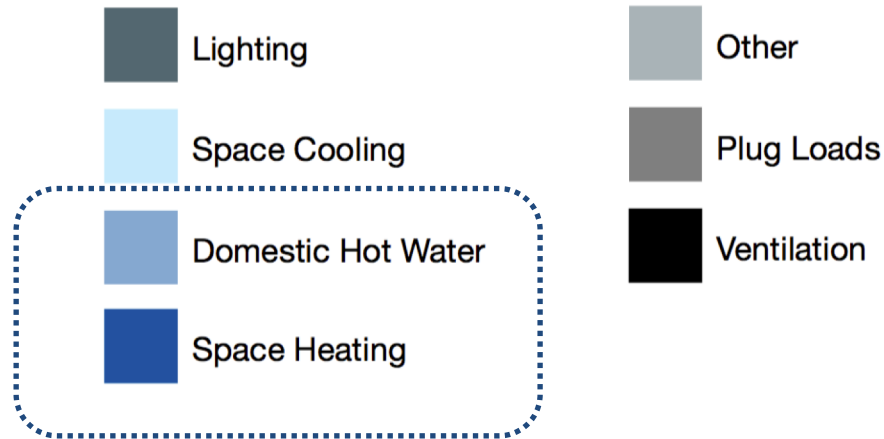
PERCENT OF SITE ENERGY CONSUMPTION



~70%

of multifamily  
site energy from  
fossil fuels

# URBAN GREEN | MF GHG EMISSIONS

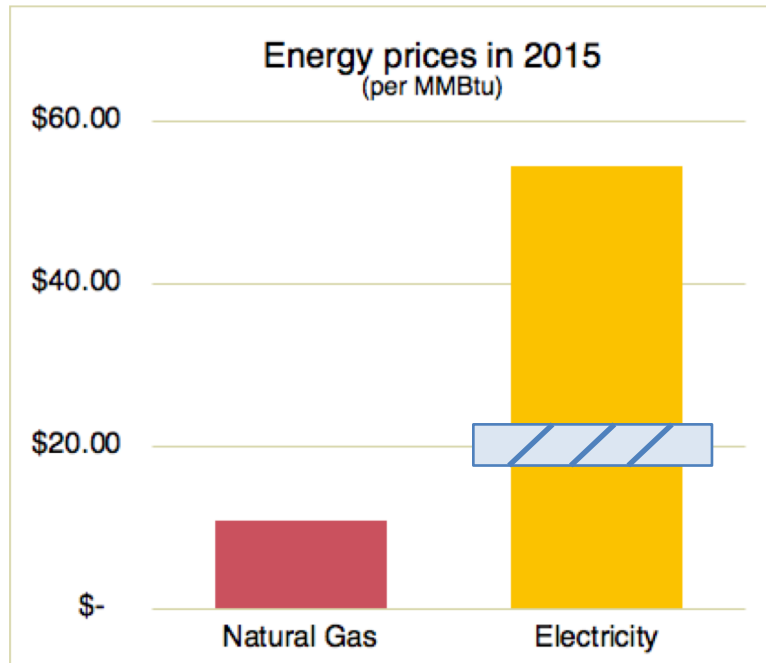


**74%**  
of multifamily  
greenhouse gas  
emissions from  
heating and hot  
water

## SHIFT TO LOW-CARBON:

1. Reduce energy demand through increased efficiency
2. Green the electrical grid
3. Shift building heating & hot water from fossil fuels to electricity

# ISSUES/ CHALLENGES



## COST

- **Multifamily heating:** narrow business case for heat pump retrofits with current costs and gas prices
- **Multifamily hot water:** Better case for heat pump retrofits but largely untested

## TECHNOLOGY & APPLICATION

- Most thinking and experience with heat pumps in 1-4 family
- Differences with large existing multifamily buildings?
  - Technological uncertainty
  - Installation challenges
  - Regulatory issues

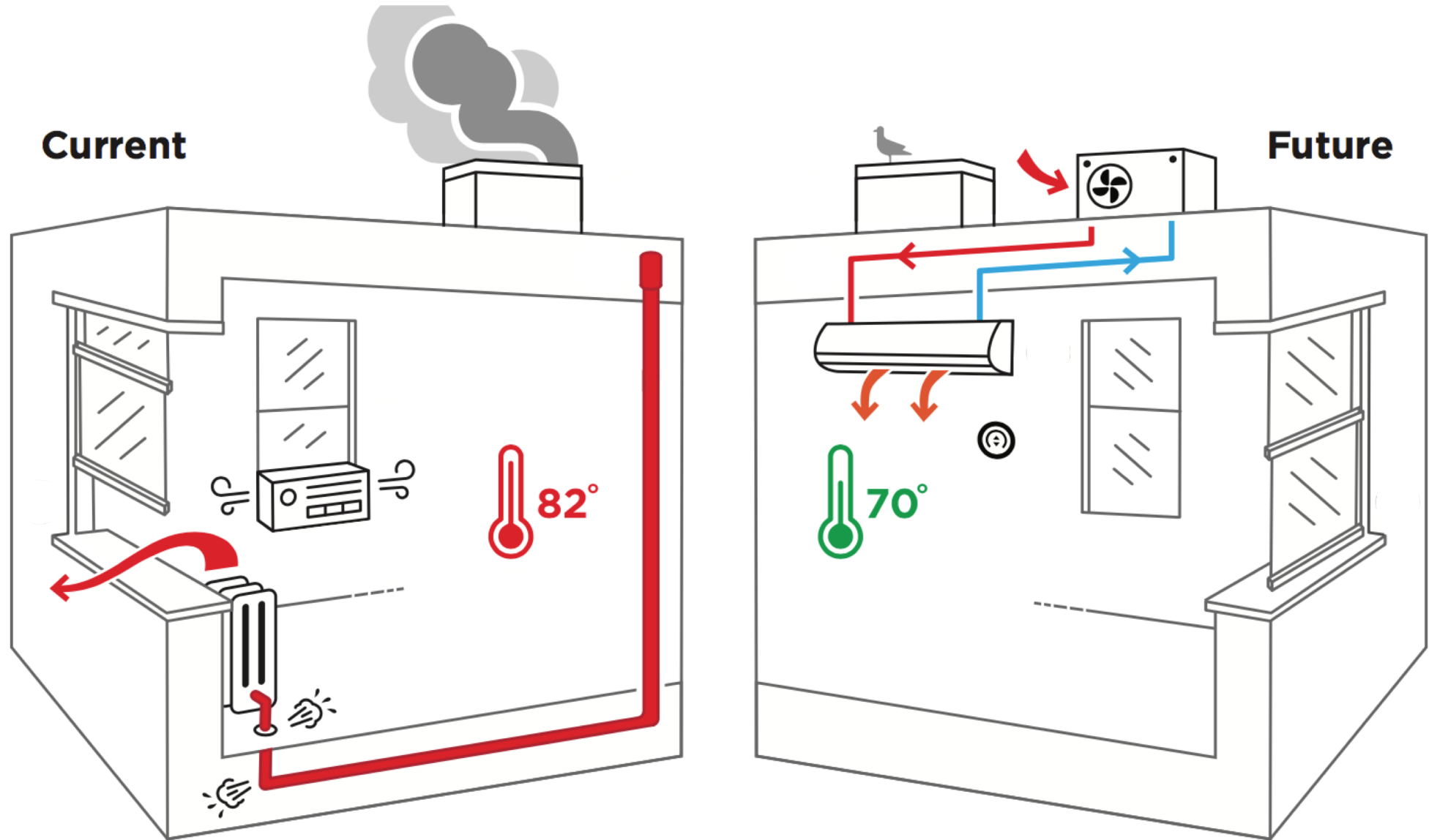
## TIME HORIZON

- Getting heat pumps to scale in the multifamily sector is a long-term challenge
- Rapidly developing area, with significant shifts likely in the next in 5-10 years



## INDUSTRY ENGAGEMENT

- Not sufficient for policymakers to agree on need and feasibility
- Scope of challenge requires active industry engagement



# UPCOMING STUDY

# ELECTRIFICATION ROADMAP

- Develop 5-year roadmap for electrification of multifamily buildings in NYC
- Convene key stakeholders to inform scope and analysis
- Collaborating with NSYERDA
- Launch later this year

## GO DEEP ON HEAT PUMPS

- What technology exists now?
- What sizes and configurations are most desirable in multifamily?
- Where are the gaps?

## DETERMINE FEASIBILITY

- Where will everything go?
- Is there enough power supply?
- What regulations might get in the way?

## EXAMINE TENANT IMPACT

- How to fairly allocate costs between tenants and landlords
- Implications for affordable and rent-stabilized housing
- Issues around access to tenant spaces

## RESULT

- Key steps and milestones to advance electrification in the multifamily sector in the medium term
- Identify pilots, technology gaps, industry education needs, policy recommendations
- Follow with focus on implementation



# QUESTIONS?

Chris Halfnight  
Associate Director, Policy  
Urban Green Council  
[ch@urbangreencouncil.org](mailto:ch@urbangreencouncil.org)



## Geothermal Clean Energy Challenge

# Geothermal Clean Energy Challenge Program Update Heat Pump Forum (October 3, 2018)



**NY Power  
Authority**

**NYSERDA**



**Guy Sliker**

Director, Product Development  
New York Power Authority  
[Guy.Sliker@nypa.gov](mailto:Guy.Sliker@nypa.gov)

# Geothermal Clean Energy Challenge: Program Overview

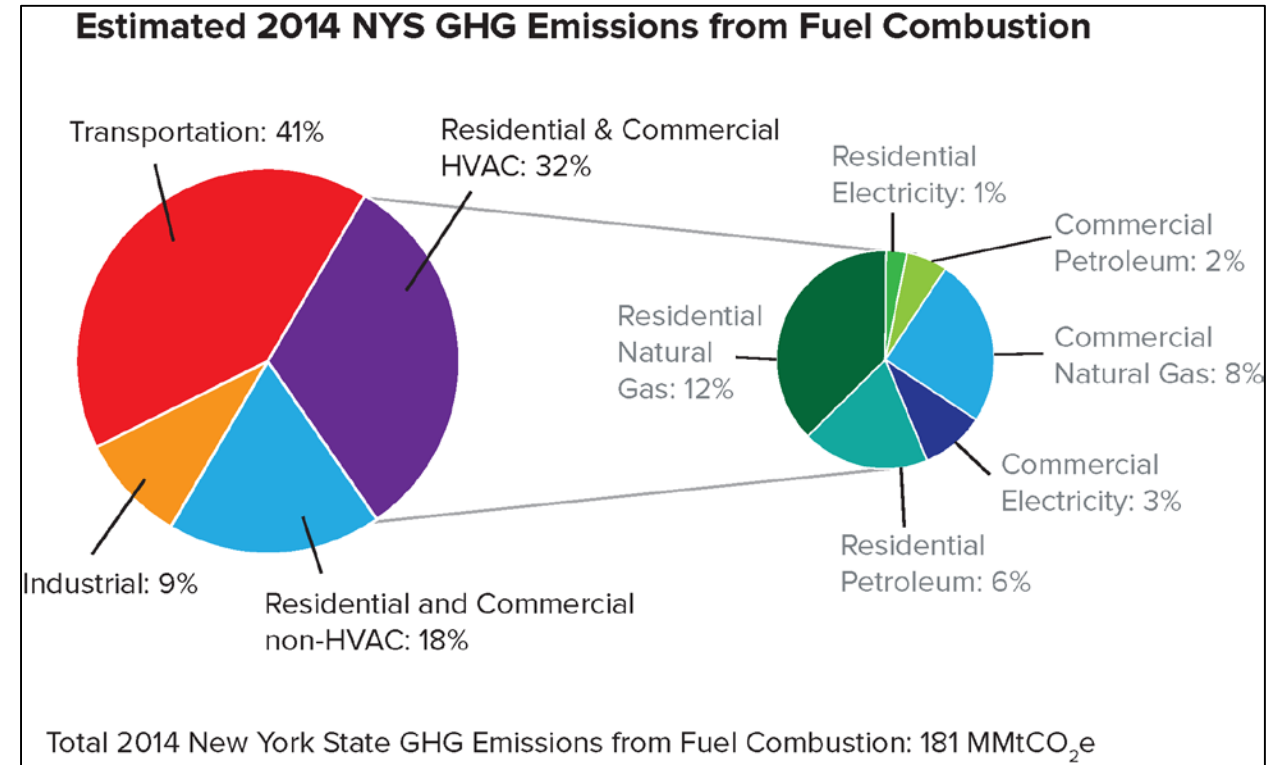
- Objective: identify the best candidates for large, multi-building GSHP systems
- Eligible NYS sites:
  - State and local governments entities
  - P-12 schools
  - College and university campuses
  - Healthcare organizations
- Eligible system size:
  - Heating and cooling requirements of at least 1.2MM Btu per hour (100 refrigeration tons or 40,000 square feet of conditioned space for one or more buildings combined)
- Offering: Eligible applicants determined to have the best sites for GSHP systems will be offered the opportunity to receive financial assistance for detailed energy audits and schematic designs for a GSHP system.

# The Geothermal Clean Energy Challenge

## Background:

- NY State is committed to reducing greenhouse gas (GHG) emissions 40% by 2030 and 80% by 2050 compared to 1990 levels
- Heating and cooling buildings contributes about 1/3 of GHG emissions in New York State
- Geothermal (i.e., ground source heat pump or GSHP) systems can significantly reduce GHG emissions compared to conventional HVAC
- GSHP have low market penetration, in part due to lack of awareness of high-performing installations

The Geothermal Clean Energy Challenge was created to accelerate the market for large-scale (> 100-ton) geothermal systems



**NY Power  
Authority**

**NYSERDA**

# Structure of the Geothermal Clean Energy Challenge

*December 2017  
– August 2018*

Stage 1  
Summary Reports

*September –  
November 2018*

Stage 2  
Advanced Reports

*November 2018  
– December 2019*

Stage 3  
Detailed Design Studies

*Start March 2019*

Stage 4  
Project Implementation  
Assistance

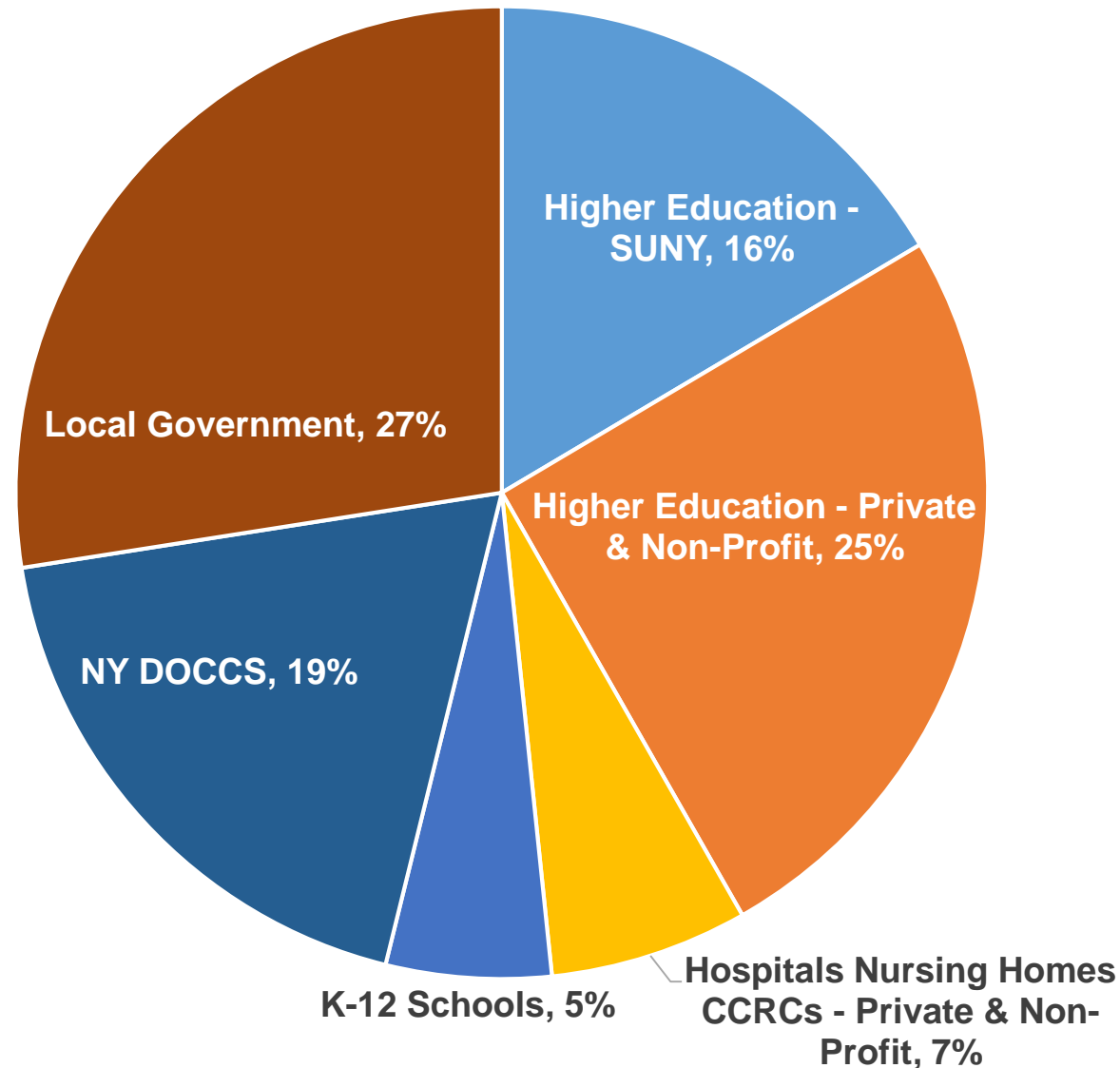
- **Stage 1:** Eligible GSHP sites with complete applications received free technical and economic summary report
- **Stage 2:** Top ranked sites from Stage 1 receive free refined economic analysis including building energy models
- **Stage 3:** Stage 2 participants will be offered 50% co-funding and contractor resources for detailed design studies
- **Stage 4:** Stage 3 participants who elect to implement projects will receive co-funding from NYSERDA's Renewable Heat and Cooling program to install best-in-class GSHP systems

A GSHP “site” is defined as a single geothermal loop connected to one or more buildings. The average site in this program had 4 buildings.

# GCEC Results to Date

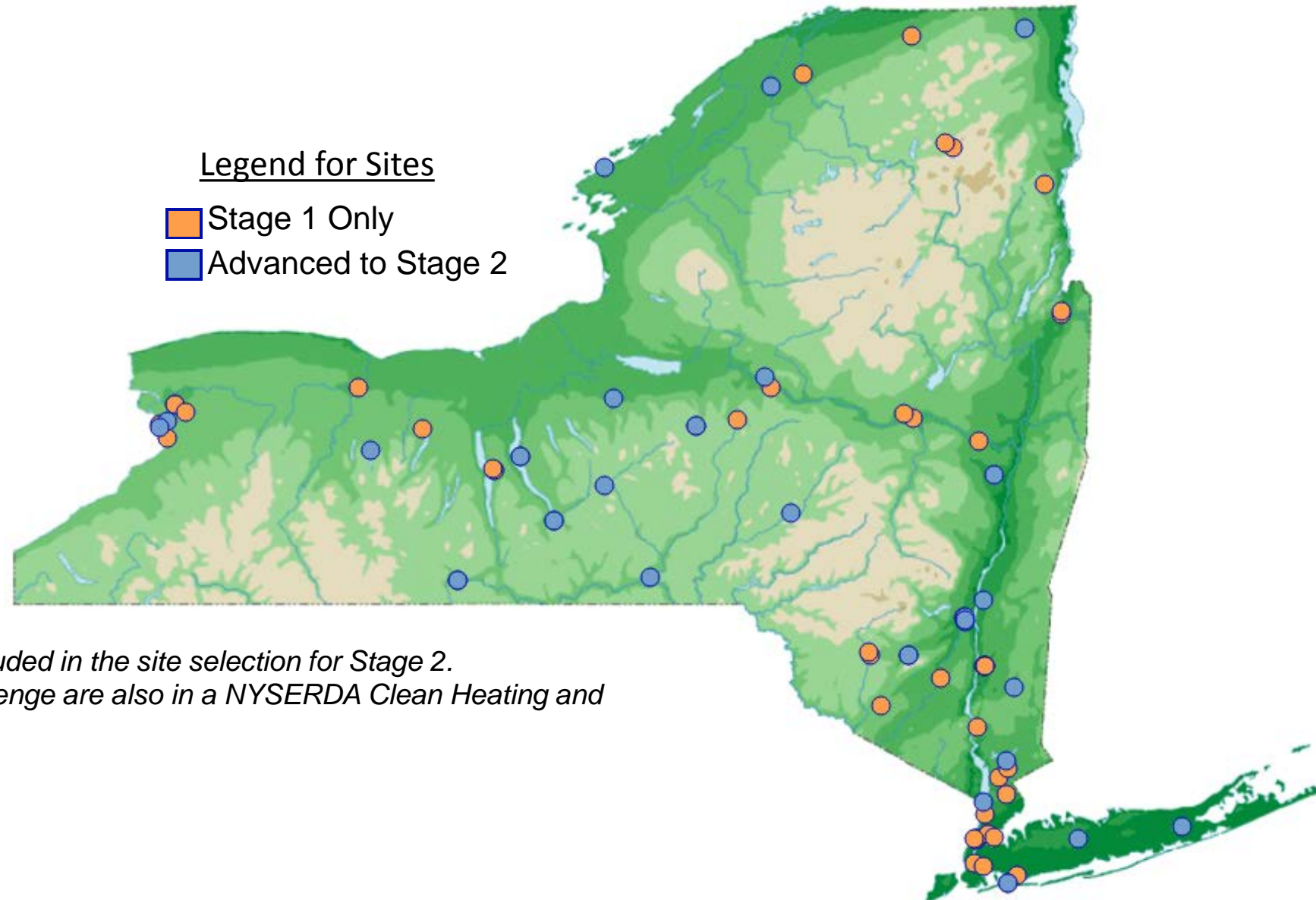
Program Metric	Total for all Stage 1 participants (n = 91)	Total for Stage 2 participants (n = 30)
Building Floor Space (square feet [sf])	16.1 million sf (avg/site = 177K sf)	4.4 million sf (avg/site = 148K sf)
Heating & Cooling Capacity of GSHP Systems (in tons)	40,025 (avg/site = 440)	11,467 (avg/site = 382)
New GSHP Capital Investment	\$474 million (avg/site = \$5.2 MM)	\$123 million (avg/site = \$4.1 MM)
Annual Energy and O&M Cost Savings from GSHP Systems	\$15.0 million (avg/site = \$164K)	\$5.3 million (avg/site = \$177K)
Investment Payback Ranges (in years)	< 2 to 50+	< 2 to 27
Annual GHG emissions reductions (in metric tons of CO <sub>2</sub> e)	72,000	23,000
GHG emissions reduction equivalencies	219 MW of solar PV capacity	71 MW of solar PV capacity

# Sectors of Geothermal Clean Energy Challenge Stage 1 Sites





# Map of Stage 1 and 2 Participants



- *Geographic and sector diversity were included in the site selection for Stage 2.*
- *31 of the 91 sites that applied to the Challenge are also in a NYSERDA Clean Heating and Cooling Communities*



# Additional information & resources

- Program Website: <https://www.nypa.gov/about/geothermalchallenge>
- Resource documents:
  - [Standardized Measurement & Verification Requirements for Ground Source Heat Pumps](#)
  - [Targeted Geothermal Audit & Conceptual Design](#)
  - [Best Practices and Lessons Learned for Large Scale Geothermal Installations](#)
- For more information contact: [geothermal@nypa.gov](mailto:geothermal@nypa.gov)

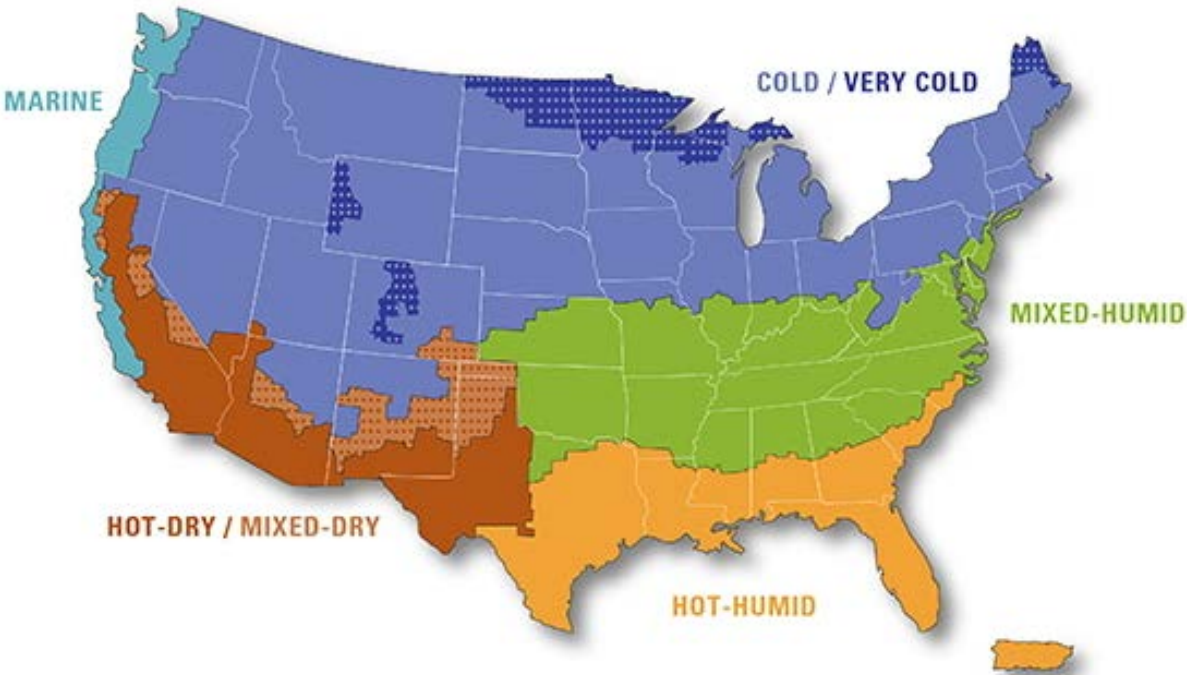
# Development of Heat Pumps

Ron Domitrovic  
Program Manager  
End-Use Technologies EE and DR  
10/01/2018



# Existing Markets

## -Heating



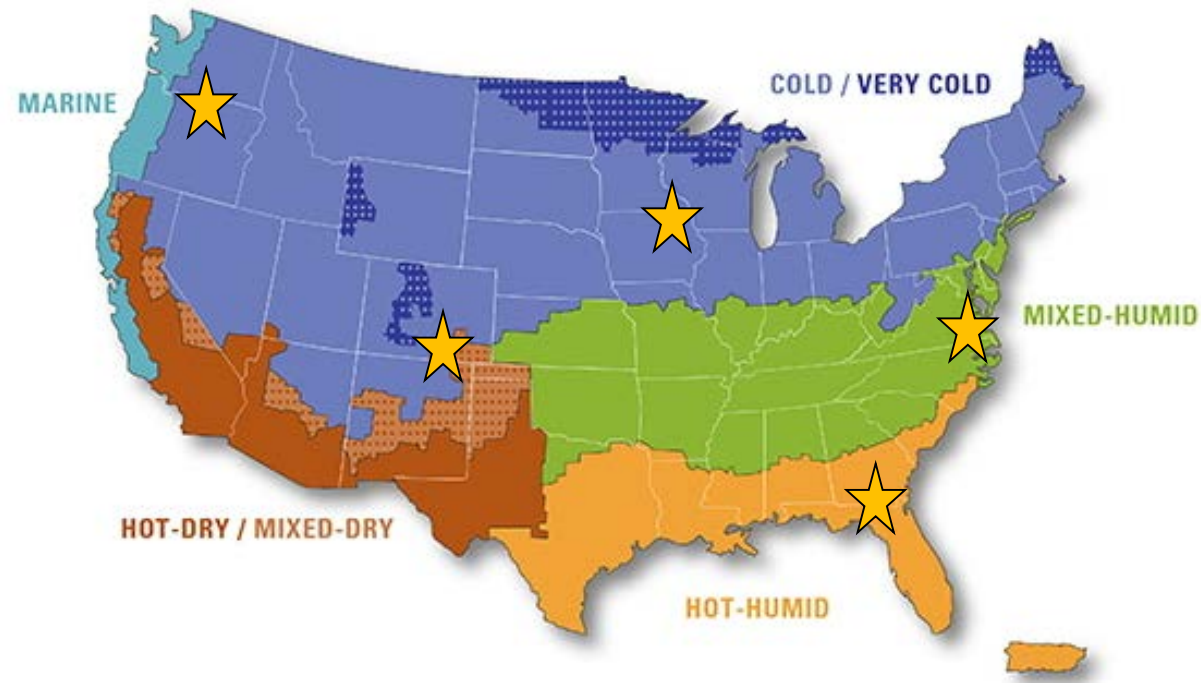
*\*Includes heat pumps*

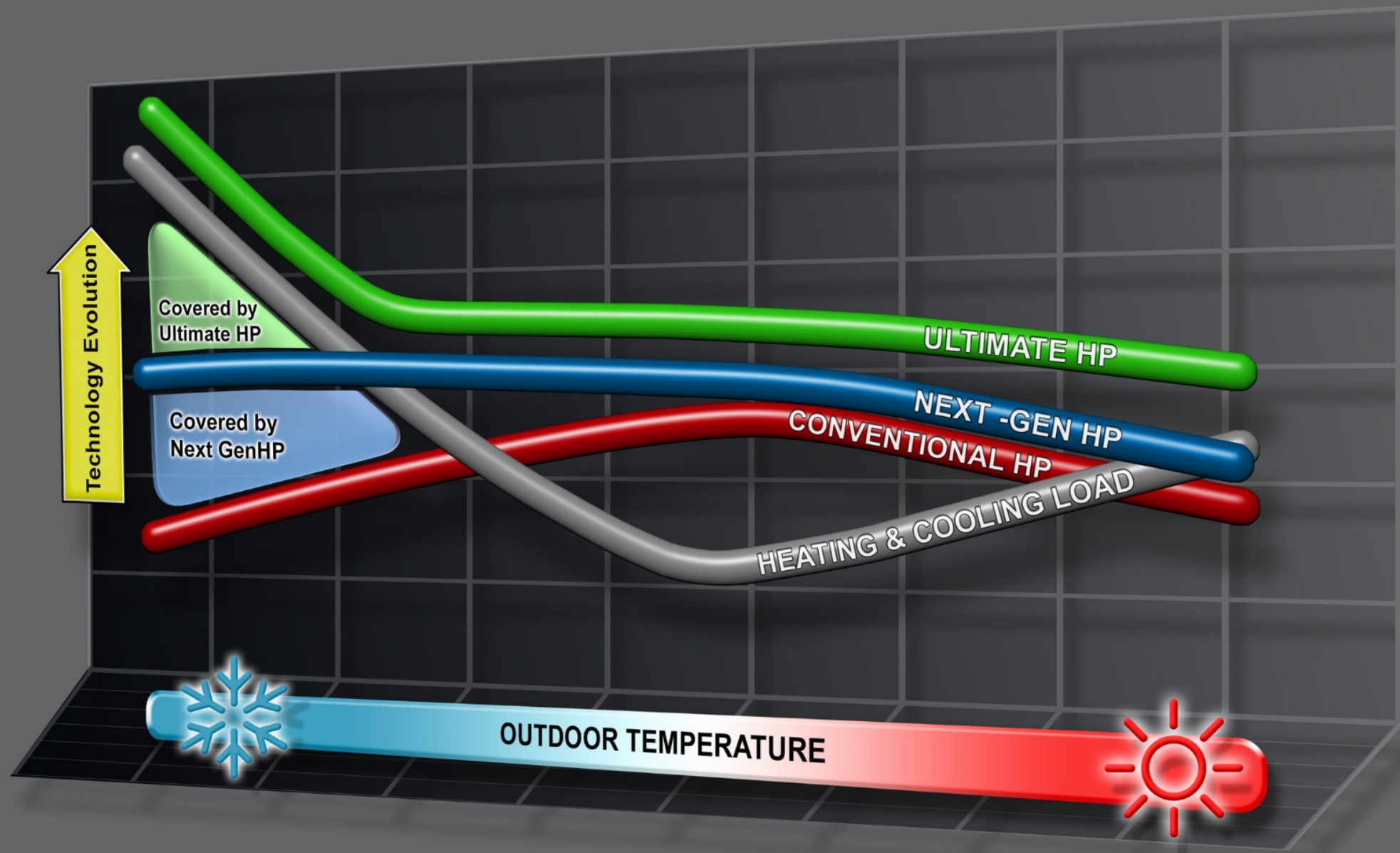
Source: Residential Energy Consumption Survey, U.S. Energy Information Administration

	Very Cold/Cold	Mixed-Humid	Mixed Dry/Hot Dry	Hot Humid	Marine	Total (USA)
# of Homes (millions)	38.8	35.4	14.1	19.1	6.3	113.6
# Heat Pumps	0.8	4.7	0.9	3	0.4	9.8
% Heat Pumps	2%	13%	7%	17%	7%	9%
# Electricity*	5.6	13.6	4.1	12.4	2.5	38.2
# Natural Gas	24.8	15.5	7.7	4.6	3.1	55.7
# Fuel Oil	4.1	2.7	n/a	n/a	n/a	6.8
# Propane	2.4	2.2	0.3	0.5	0.1	5.5

# Selected City Heating Requirements

Selected Cities	Annual Heating Hours	Outdoor Temperature Bin (F)					
		50	40	30	20	10	Below 0
Minneapolis	5375	20.2%	21.1%	24.5%	19.1%	7.9%	7.2%
Denver	4920	26.4%	30.0%	26.5%	13.7%	2.9%	0.5%
Baltimore	4238	36.1%	30.2%	23.4%	8.0%	2.4%	0.0%
Atlanta	2992	46.2%	34.3%	15.0%	4.1%	0.3%	0.0%
Seattle	5544	54.0%	38.2%	7.6%	0.2%	0.0%	0.0%



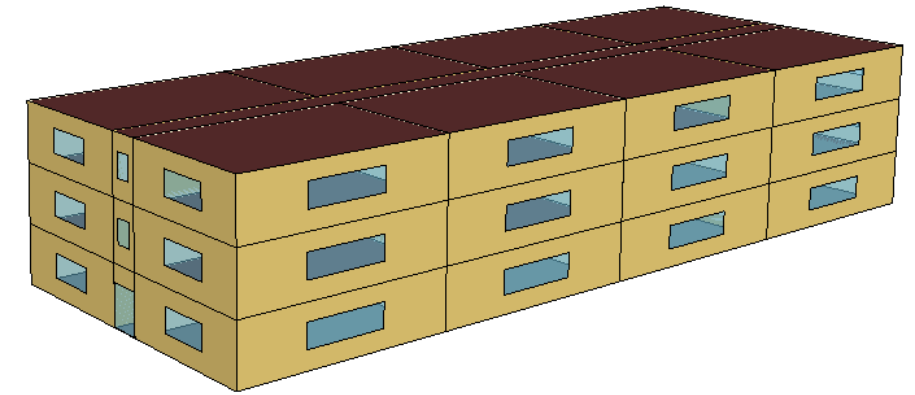




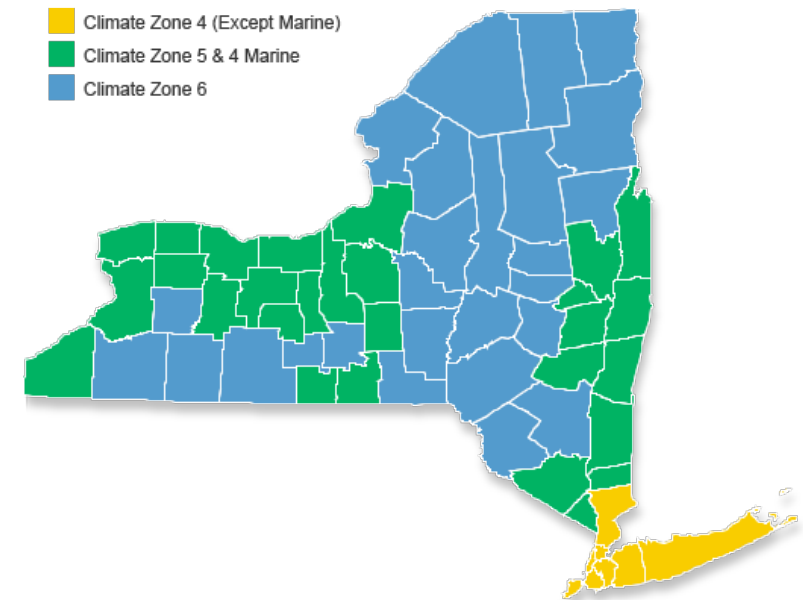
# EPRI State Electrification Assessment

## -Multi-Family Buildings

- EPRI utilized DOE's EnergyPlus
- Selected cities for representing NY are:
  - New York City (4A), Buffalo (5A), and Utica (6A)
  - Multi-family (Low-rise) (Conditioned Area: 25,500 ft<sup>2</sup>, Number of Units: 24)
- For all the electrification technologies, resistance backup, fossil fuel backup, and no backup scenarios are considered



Number of Floors	Number of Units	Conditioned Area	Unconditioned Area	Total Area
3	24	25,500 ft <sup>2</sup>	-	25,500 ft <sup>2</sup>



# Summary of Key Findings (Multi-Family Low Rise)

- Some initial findings:
  - ASHP with resistance backup is economical option compared to A/C with oil or propane furnace.
  - ASHP with resistance backup can increase peak during colder months by at a factor of ~3
  - Ductless mini-split system without backup heat can be cost competitive to A/C + furnace.
  - Many system options and many design considerations...



# Together...Shaping the Future of Electricity



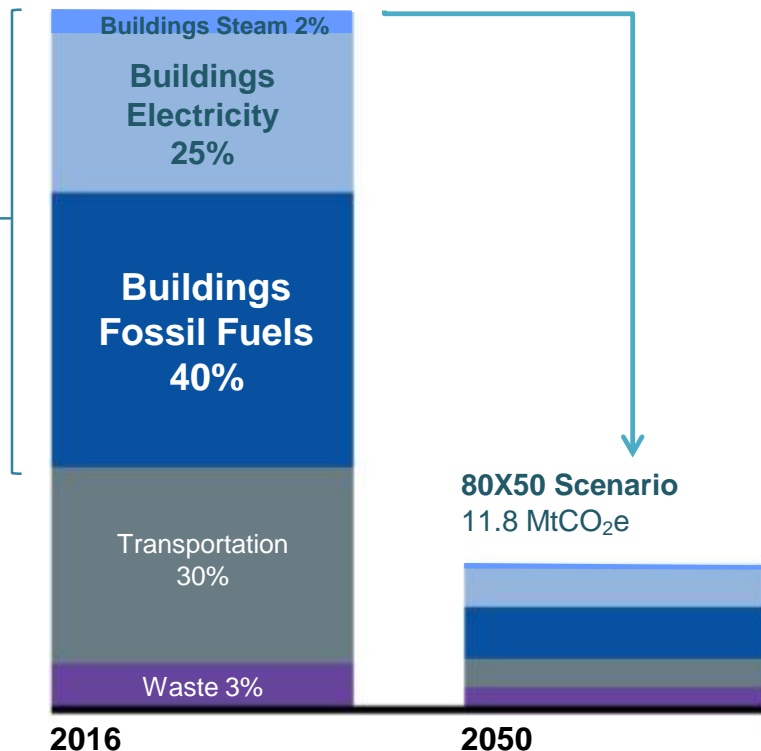


## THE MAJORITY OF GREENHOUSE GAS EMISSIONS IN NYC COME FROM ENERGY USED IN BUILDINGS

- Fossil fuel combustion in buildings must be reduced to reach 80X50
- Overall energy reductions through efficiency improvements are necessary to transition to a cleaner grid

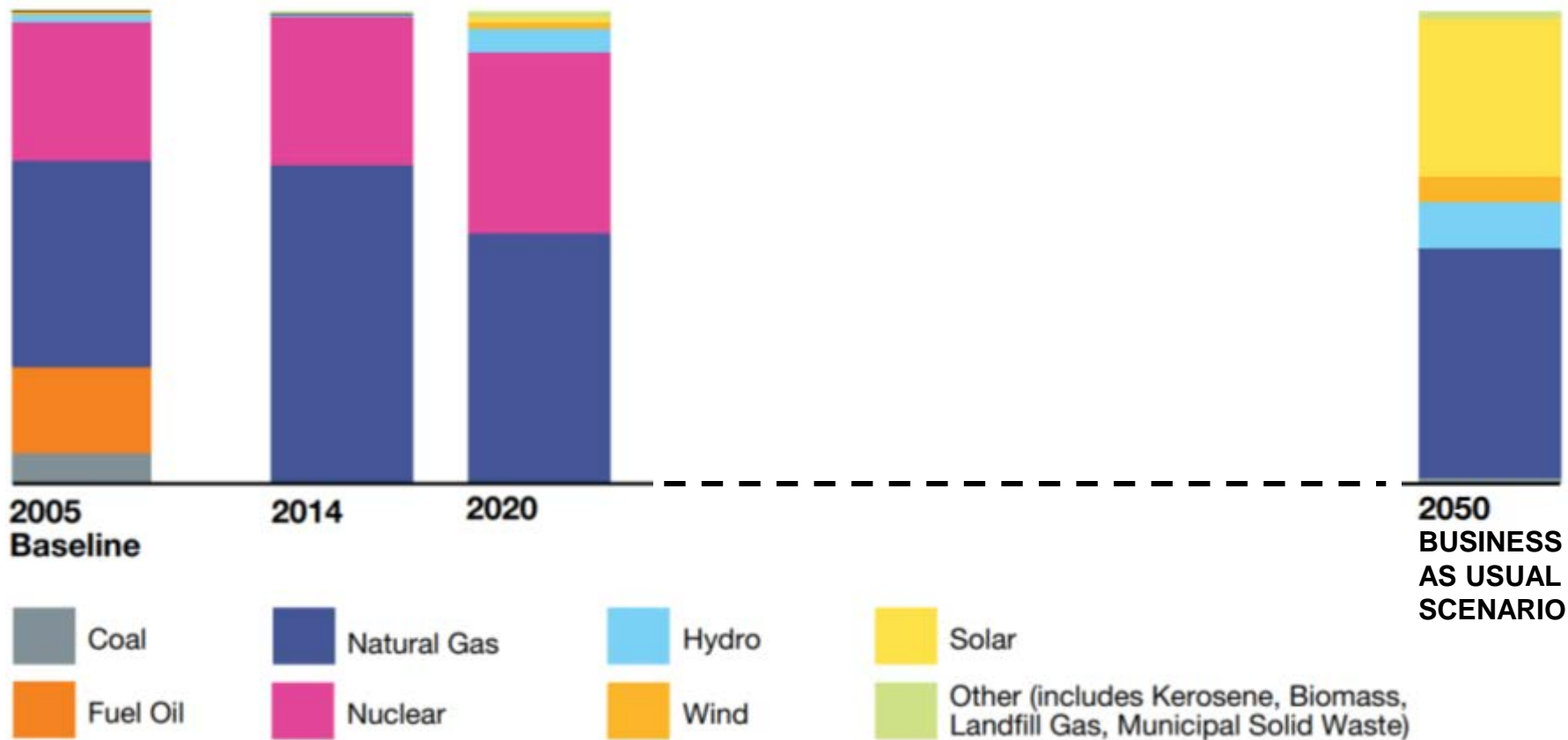
### NYC GHG Emissions

51.7 MtCO<sub>2</sub>e





## FUEL SOURCES OF NYC ELECTRIC GRID

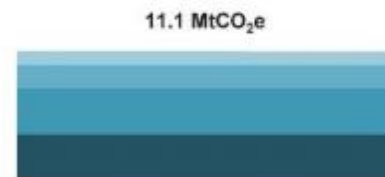




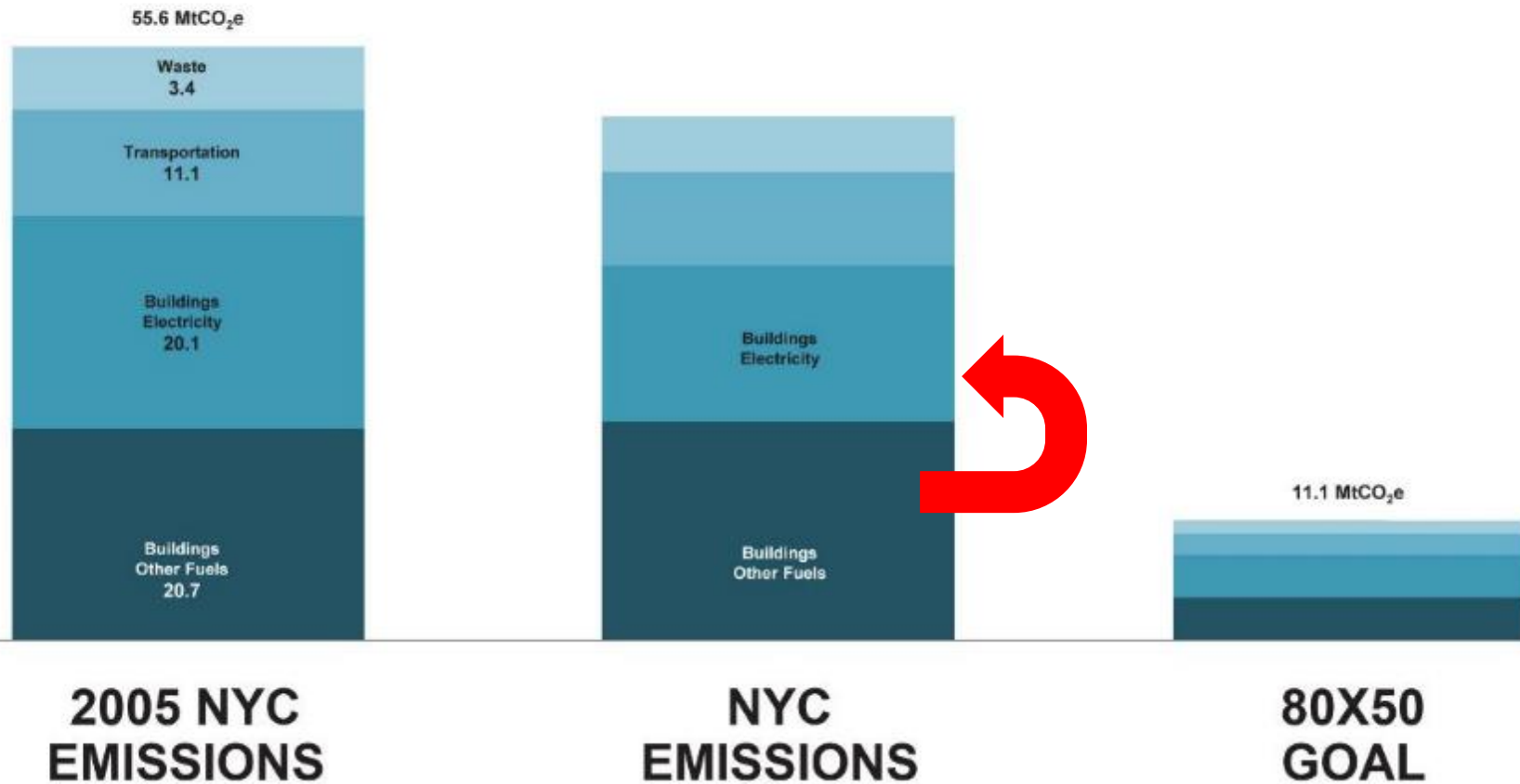
**2005 NYC  
EMISSIONS**



**2014 NYC  
EMISSIONS**

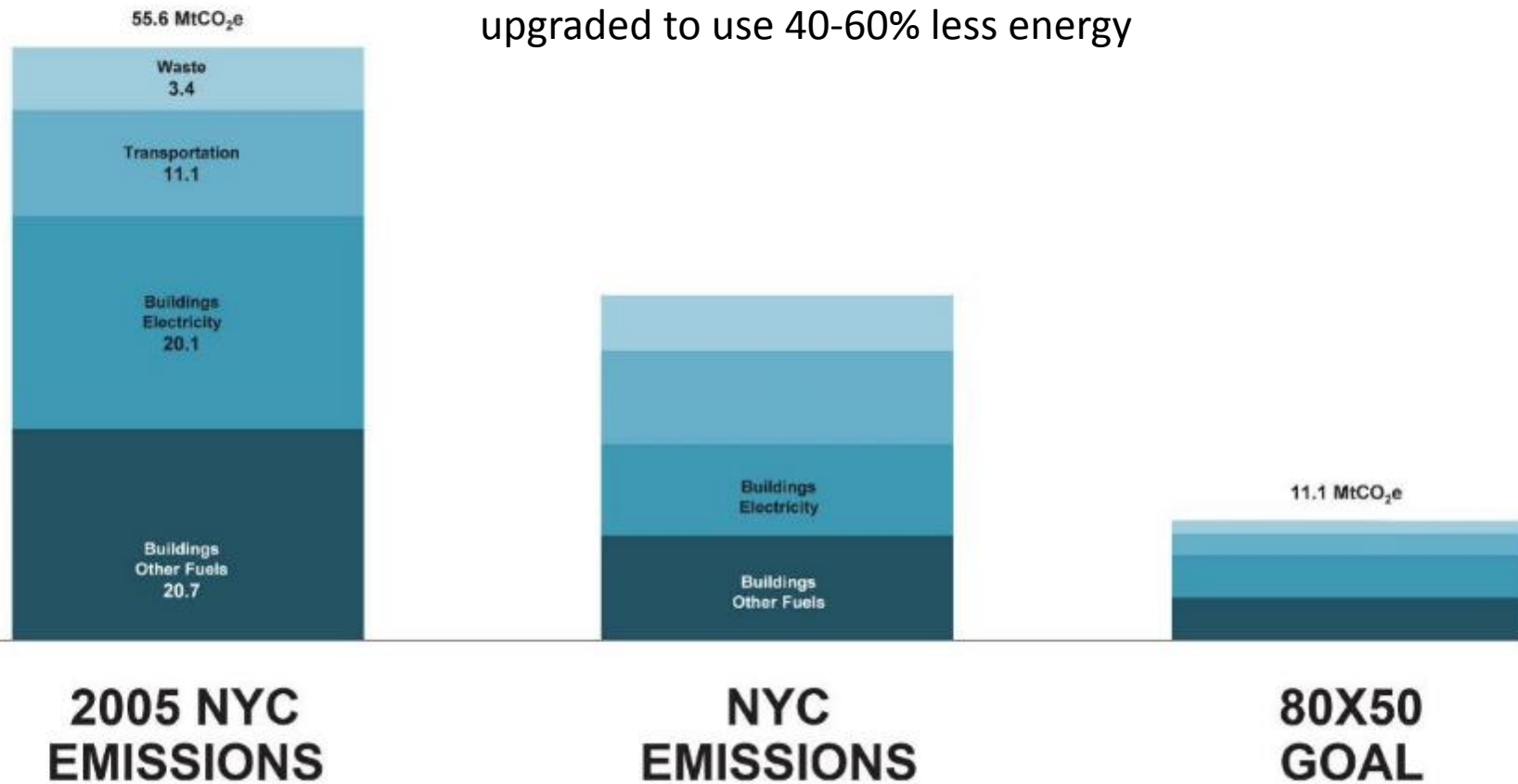


**80X50  
GOAL**



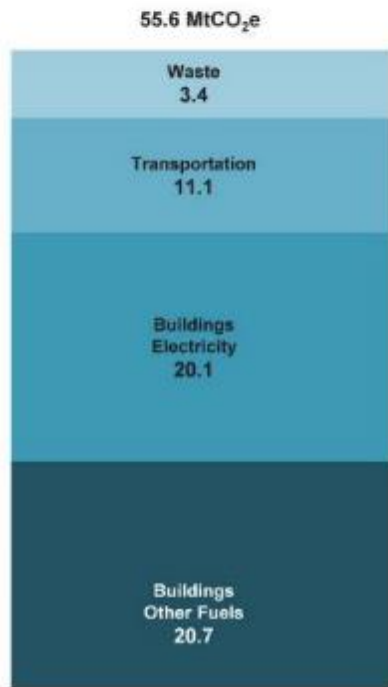


**In 2050...** nearly all of our existing buildings will be upgraded to use 40-60% less energy

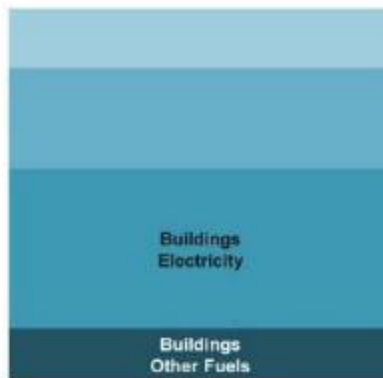




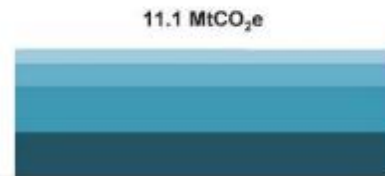
**In 2050...** nearly all of our existing buildings will be upgraded to use 40-60% less energy  
**and at least 50% of buildings will need to transition to electrified heating**



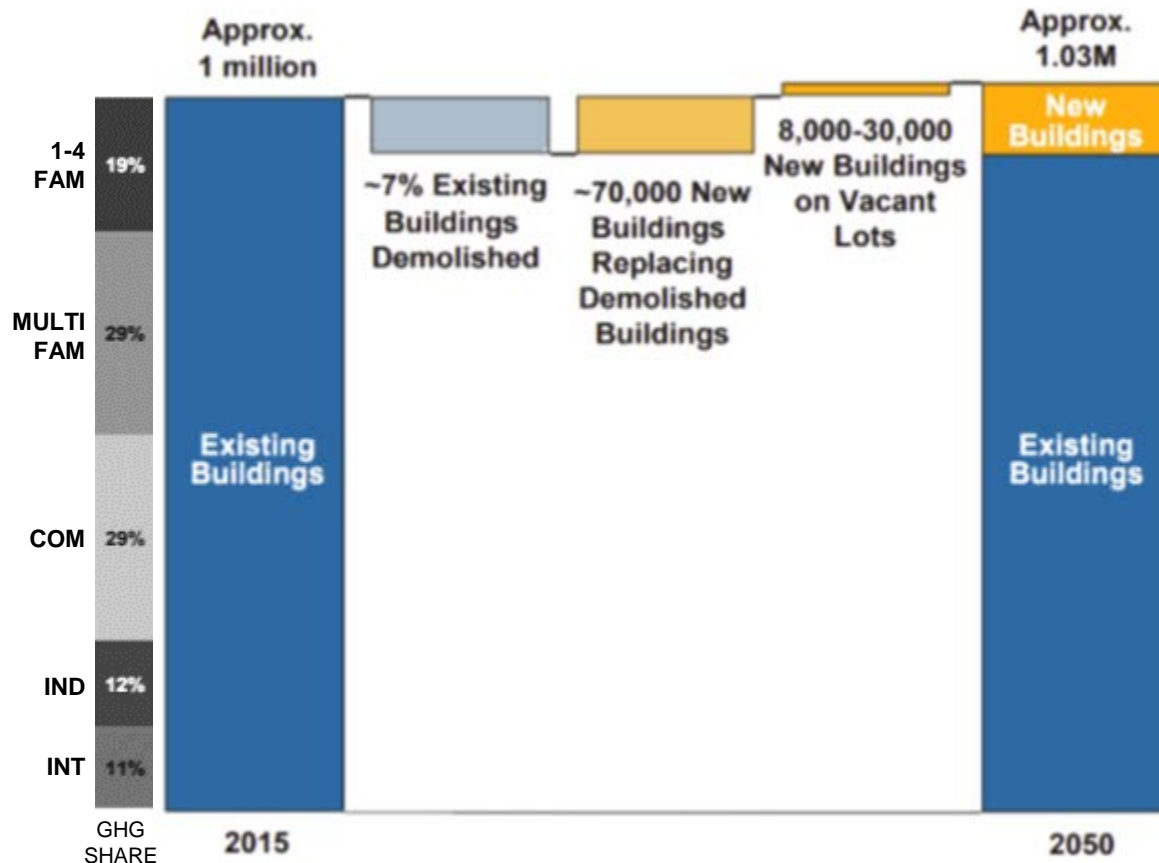
**2005 NYC  
EMISSIONS**



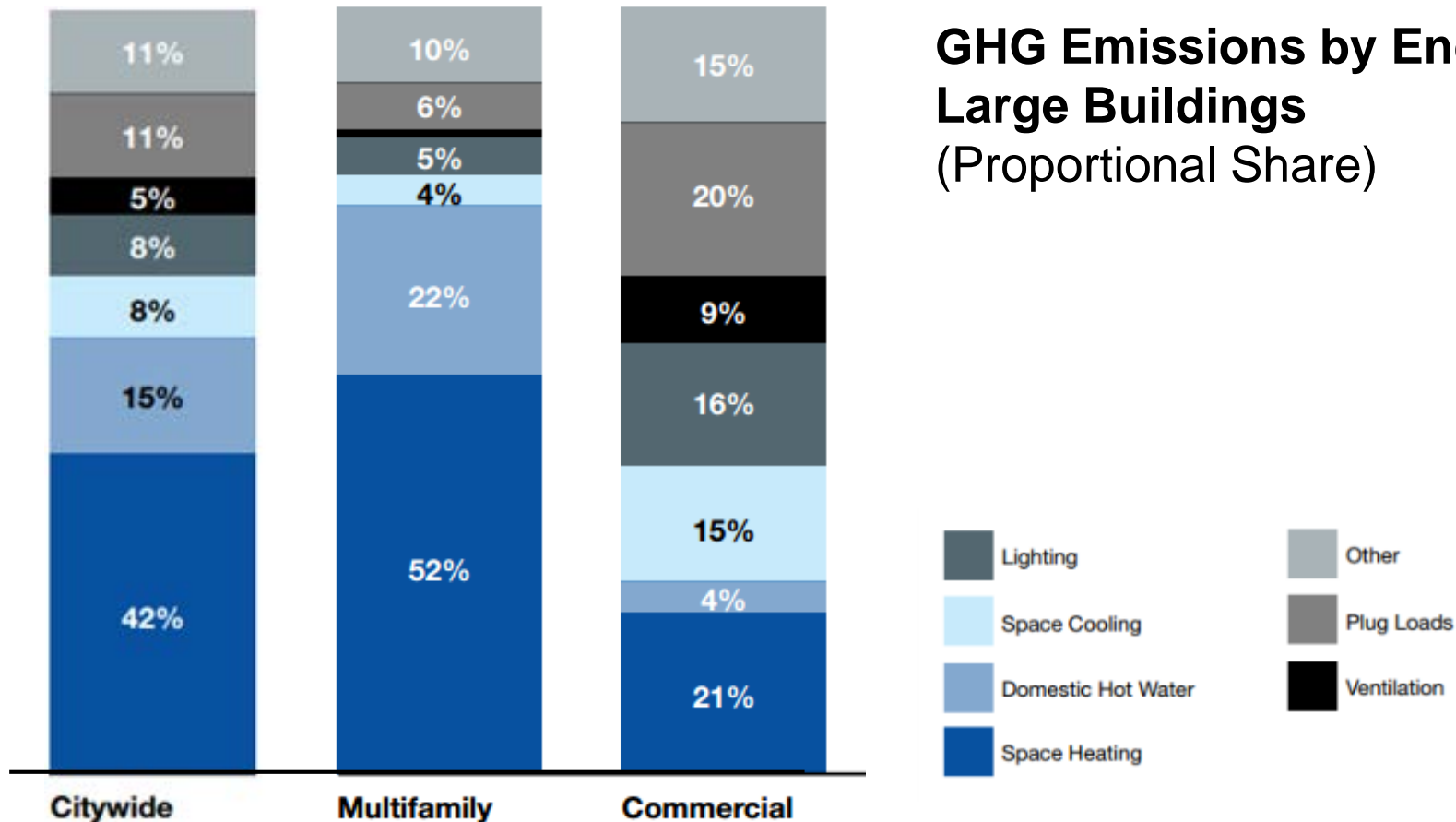
**NYC  
EMISSIONS**



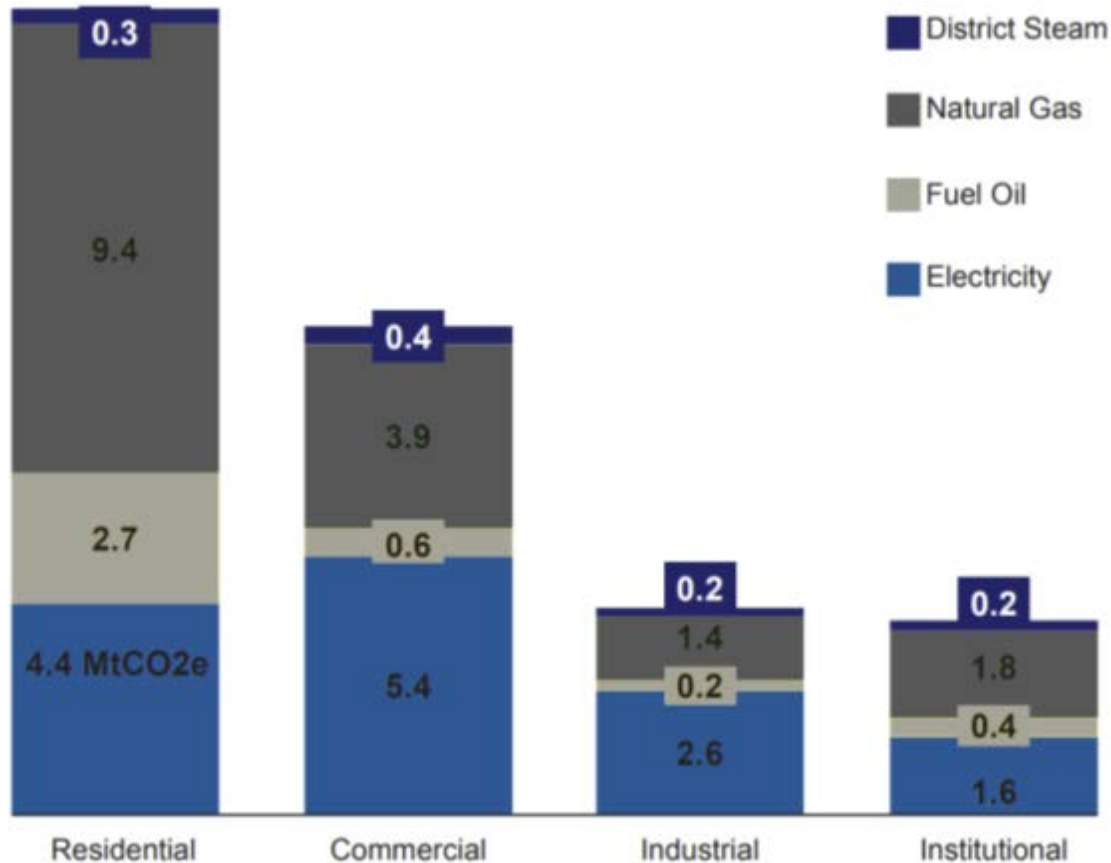
**80X50  
GOAL**



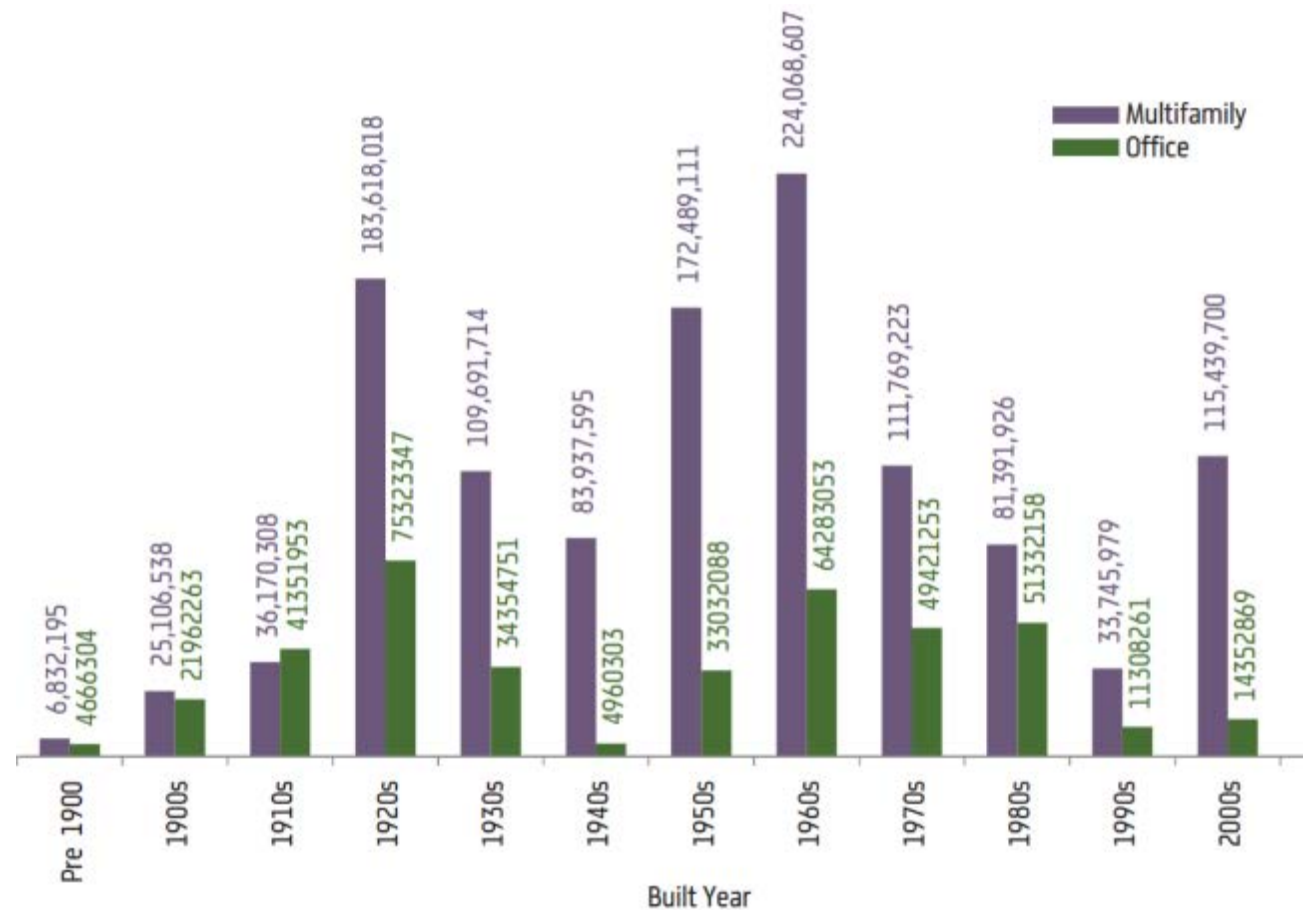
**Nearly every building will need to complete a deep energy retrofit, and move away from fossil fuel-based heating and hot water systems.**



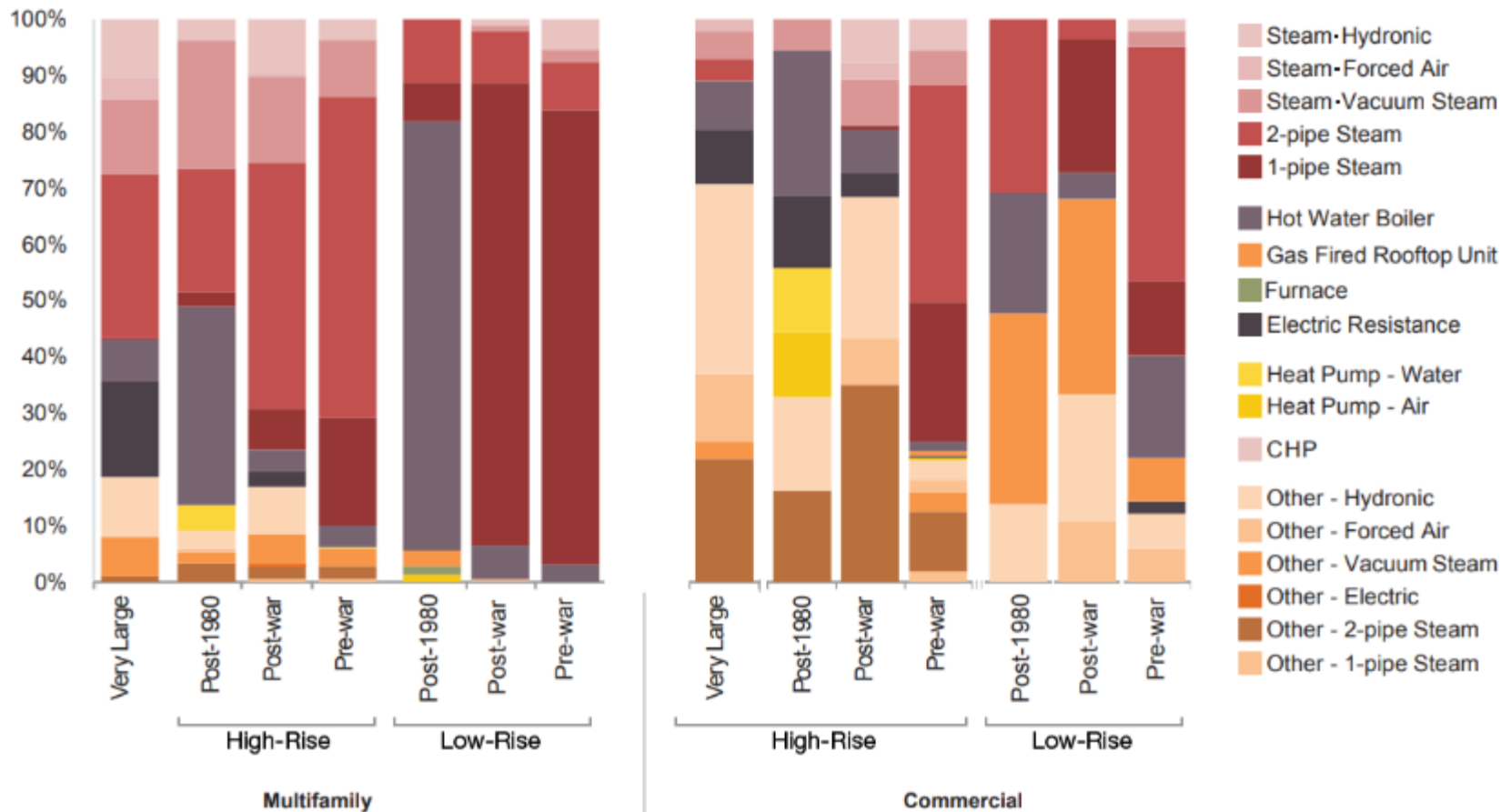


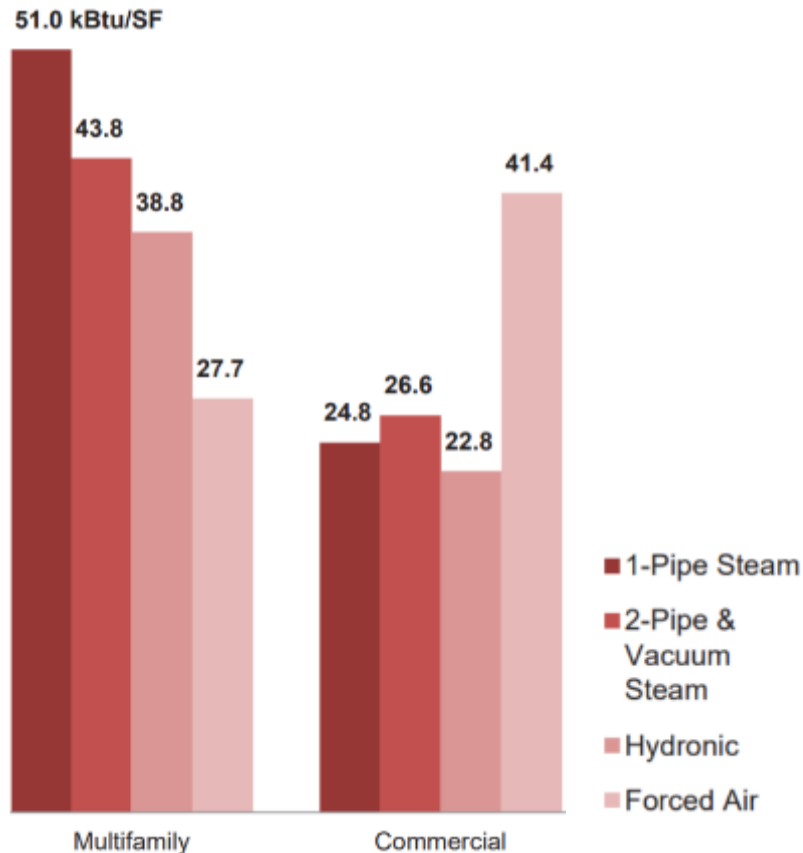


## GHG Emissions by Occupancy Type in Large Buildings



## Floor area distribution by year built among large office and multifamily buildings





## Median Heating EUI by heat system type among NYC large buildings

- More than 70 percent of large buildings use some form of steam heating

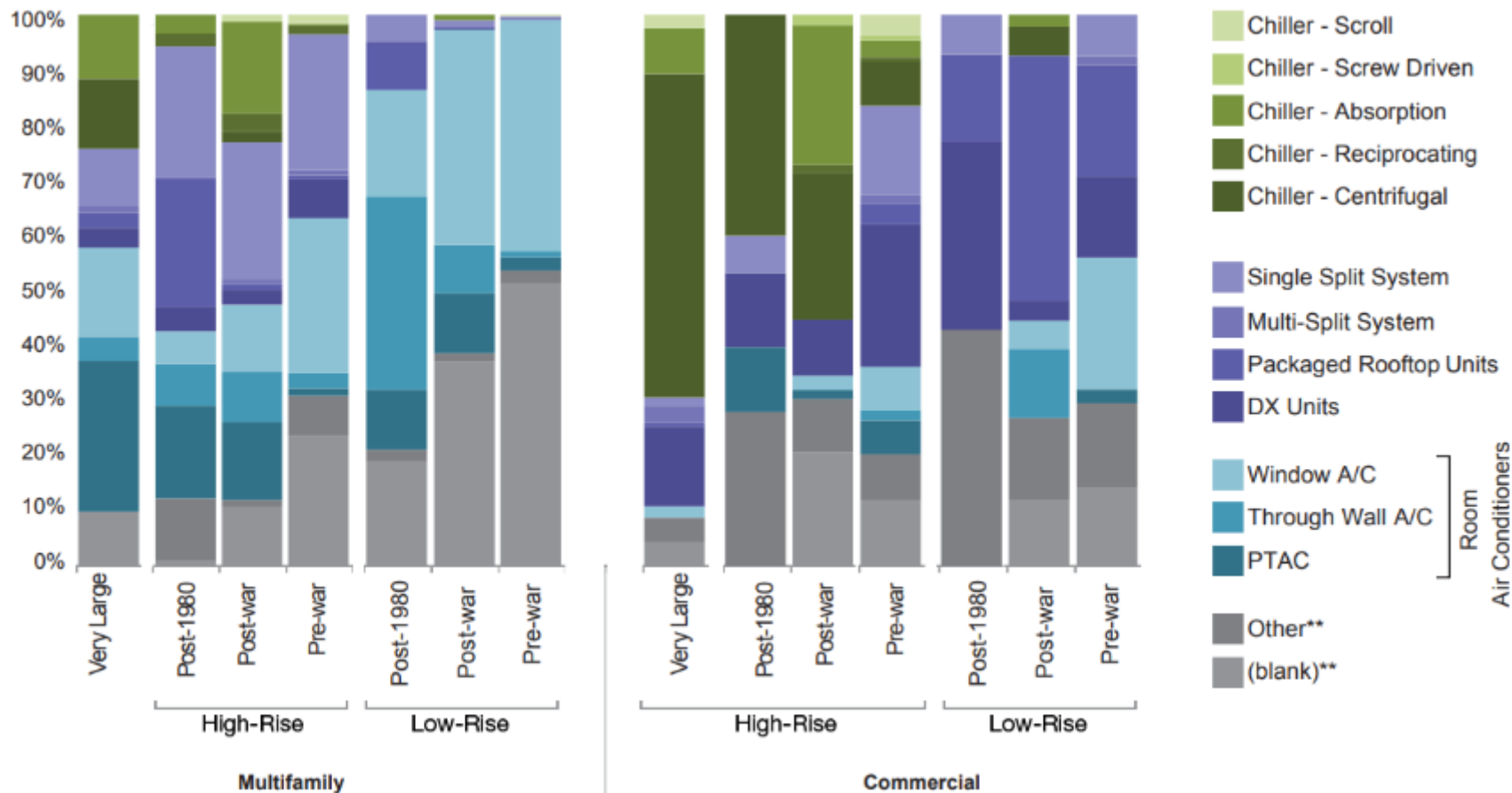


# Steam Heat: The Problem

- **70% of large buildings** in NYC have steam heating systems
- They are often **poorly maintained**
- The **market lacks services** for comprehensive upgrades

A photograph of a dark, cast-iron radiator in a room with yellow and white patterned wallpaper. A white speech bubble is positioned above the radiator, containing the text "IT'S NOT YOU. IT'S ME.".

IT'S NOT YOU.  
IT'S ME.

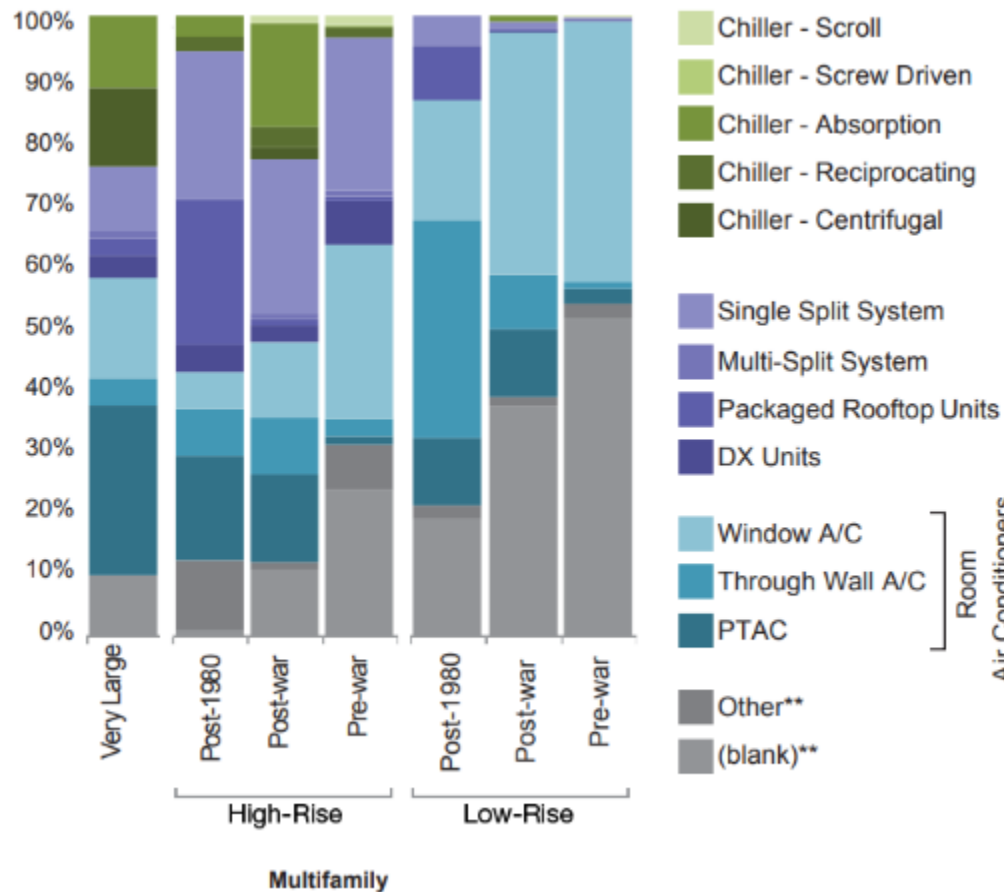




## **“Drop-in” heat pump opportunity in 1-4 family homes**

- **Off-the-shelf solutions commercially available**
- **176,000 1-4 family buildings citywide** identified as good candidates for ASHPs
  - Focused on Staten Island and the Bronx
  - Criteria included owner-occupancy, building and fuel type
  - Launch an assistance program to overcome customer barriers to conversion of heating systems to heatpump

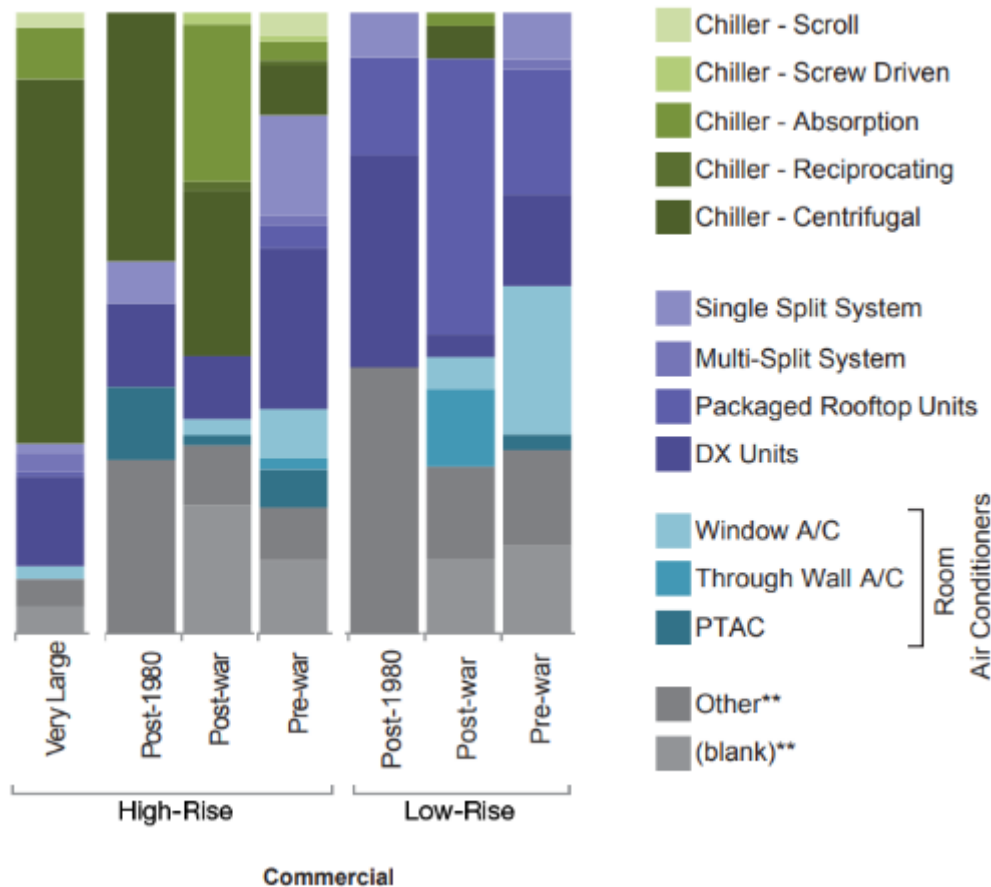




## “Drop-in” heat pump opportunities in Multifamily









## OUTSTANDING QUESTIONS:

1. Grid management and load growth?
2. Customer demand for expensive new technology in the face of cheap gas?
3. Contractor training and service professionals?
4. Refrigerant leakage and Global Warming Potential?

# Mitsubishi City Multi VRF:

# Heat Pump Multi-Family Applications and Case Studies in the Urban Environment

***Kyle Korman***

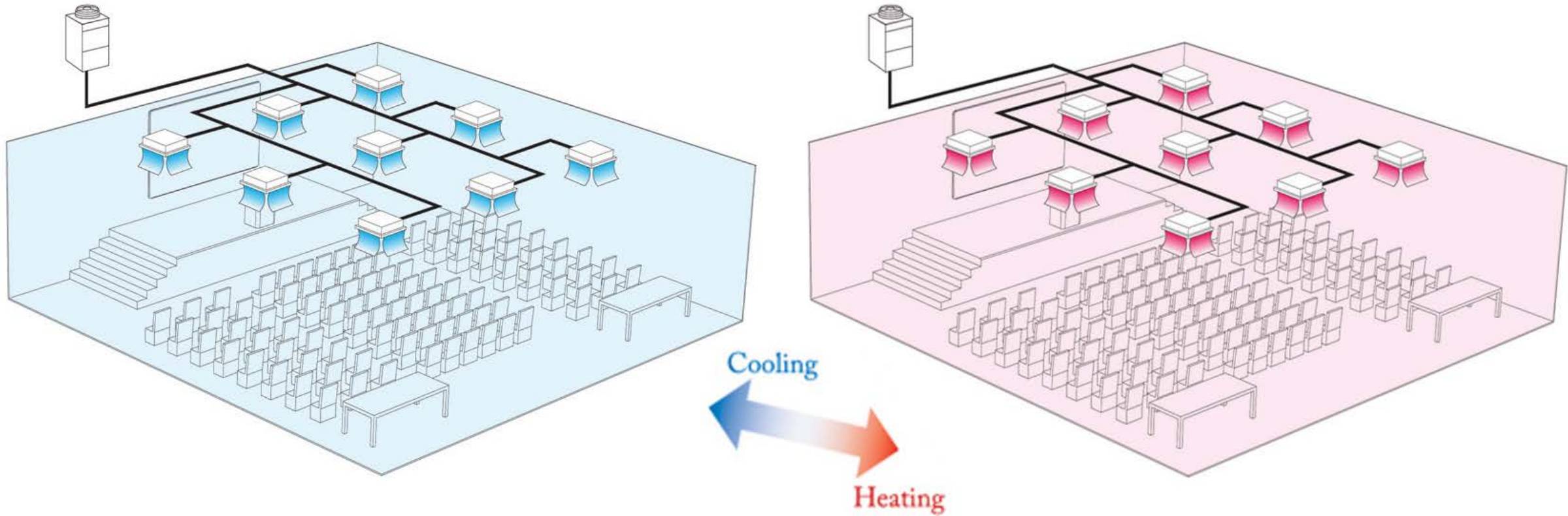
kkorman@hvac.mea.com

585-478-5431

# What is VRF Technology?



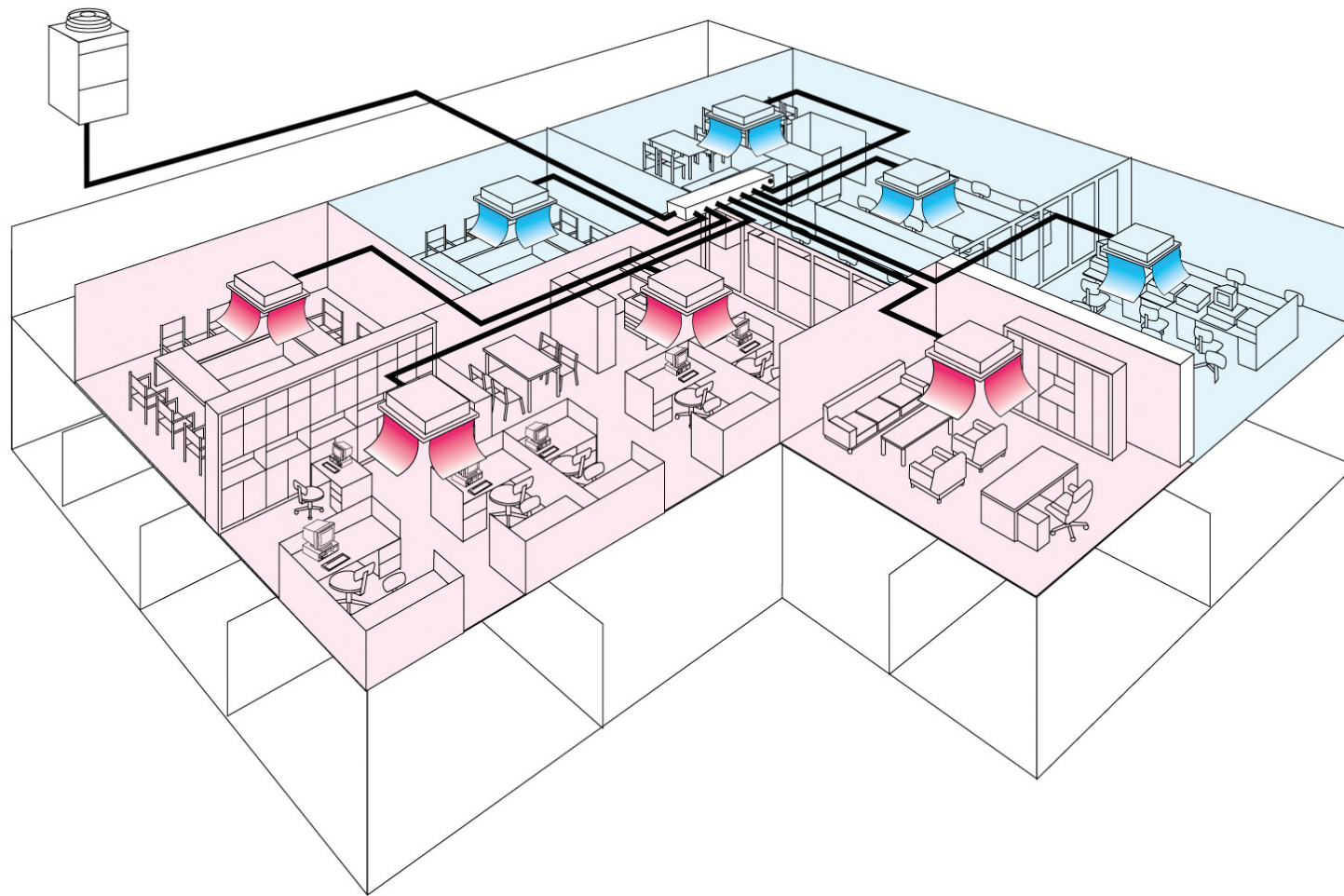
# Heat Pump





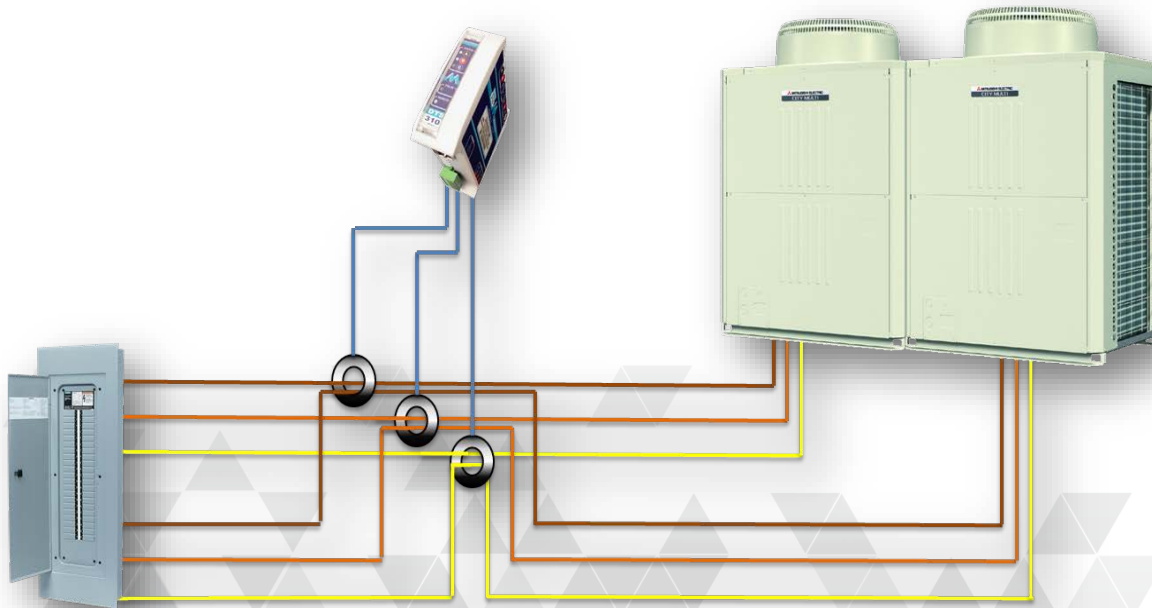
# Heat Pump with Heat Recovery

Simultaneous Cooling & Heating



# Energy Apportionment

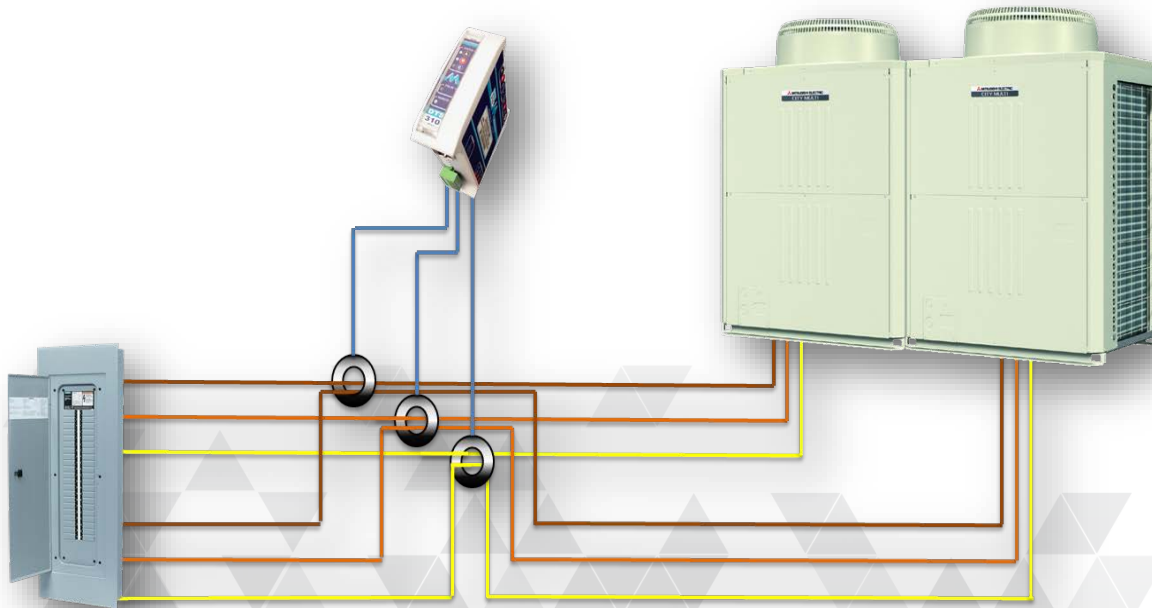
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- Allows Building Owner or Landlord to Allocate Heating & Cooling Consumption per Tenant or Business.
- By IDU or Group of IDU's

# Energy Apportionment

## Application

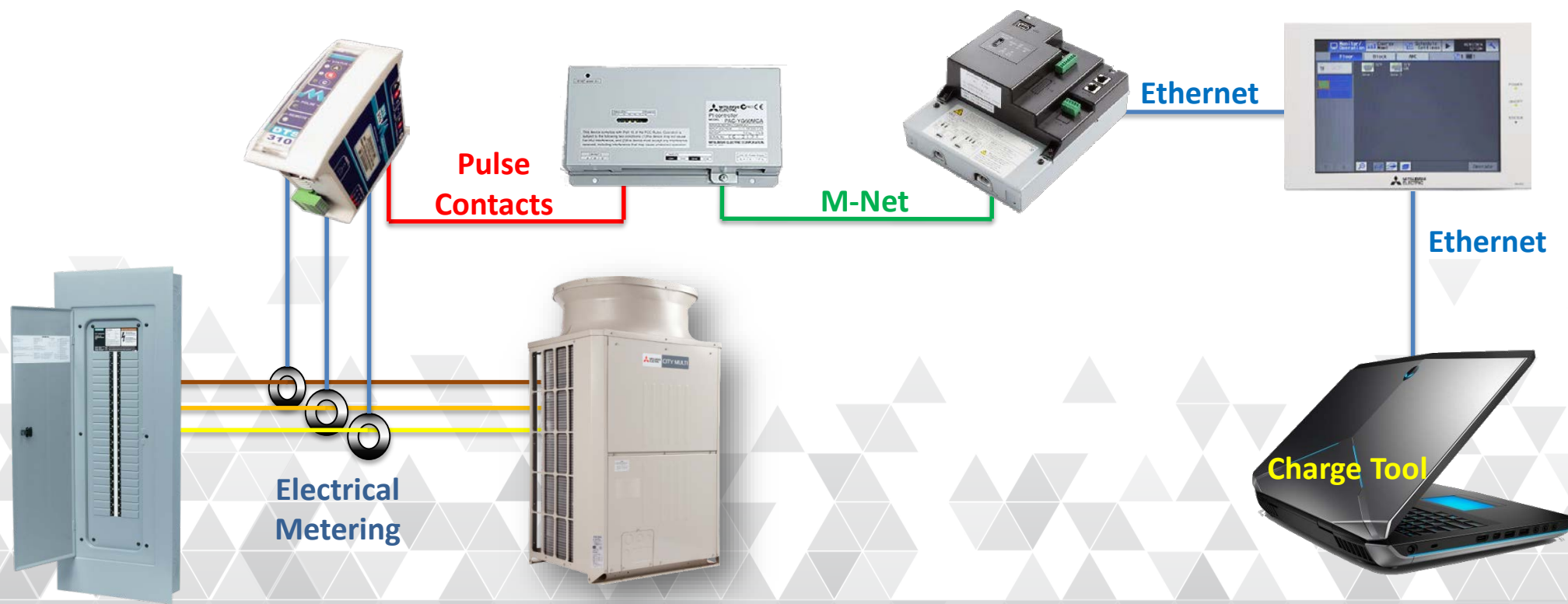


- Multi-tenant buildings (condos & apartments)
- Property management companies in multi-tenant office buildings
- Any facility that needs to be able to track electricity use



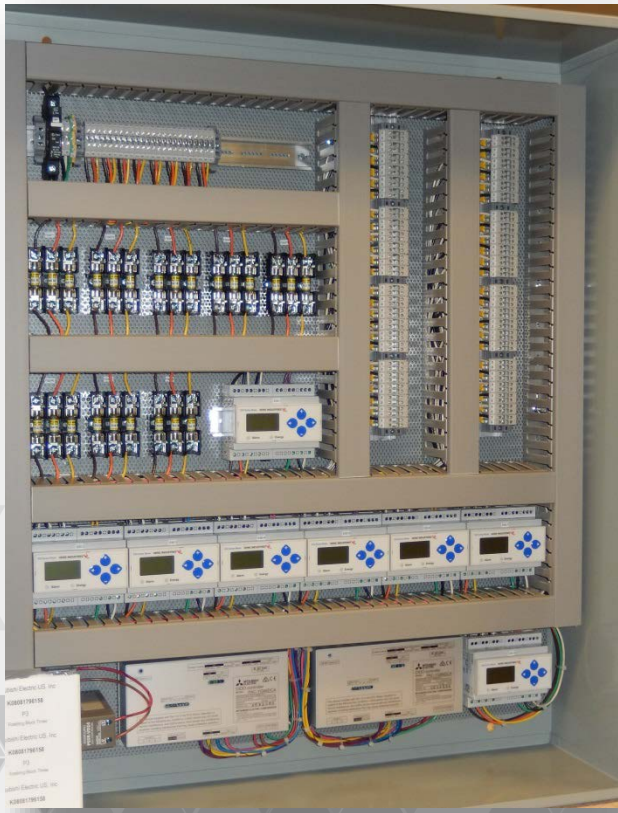
# Energy Apportionment

## Layout



# Roebling Lofts – Trenton NJ

## ENERGY APPORTIONMENT



### CASE STUDY:

- Custom panel packages with electrical meters, PI controllers, terminal and fuse blocks for energy apportionment
- High efficiency, high tech, lofts built in a former industrial warehouse







# Cornell Tech Dormitory @ Roosevelt Island



# 10 Madison Square West – Midtown Manhattan





# 150 Charles Street - Manhattan



# 211 East 13<sup>th</sup> Street - Manhattan



# 101 Bedford - Brooklyn





# What are the features of CITY MULTI VRF?

- Two-pipe System
- INVERTER Technology
- Multiple Indoor Units
- Variable Capacity System
- Zoning System
- Complete Control Offering
- Minimally Intrusive Install
- Reduced Mechanical Space
- More Comfort, Less Energy Usage

