

# Turning Data into Action



31 Chambers Street  
New York, NY

## Decarbonization Pathways for Commercial Office Buildings

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Join Building Energy Exchange for a presentation of strategic retrofit measures that chart a clear course to higher building performance and meaningful decarbonization for commercial office building owners and tenants.

### Speakers

Richard Yancey, Building Energy Exchange  
Helen Chananie, NYC Mayor's Office of Climate and Env. Justice  
Christopher Cayten, CodeGreen Solutions  
Adam Hinge, Sustainable Energy Partnerships  
Lauren Moss, Vornado Realty Trust  
Luis Rios, Rudin Management Company Inc.  
Michael Keaveney, Sage Realty Corporation

April 18, 2023  
9 to 10:30am

1.5 AIA  
LU | HSW

# Findings from Turning Data into Action – Office Buildings

- data-driven pathways for decarbonization
- decision-making tools & actionable guidance
- report team:
  - Richard Yancey, Building Energy Exchange
  - Helen Chananie, Building Energy Exchange
  - Adam Hinge, Sustainable Energy Partnerships
  - Christopher Cayten, Code Green Solutions



**CODEGREEN**

sustainable  
energy  
partnerships



# 1. context

# New York's buildings play a pivotal role in solving the climate crisis

**70%**

of NYC's GHG emissions come from buildings

**40%**

of the State's total emissions come from the building sector

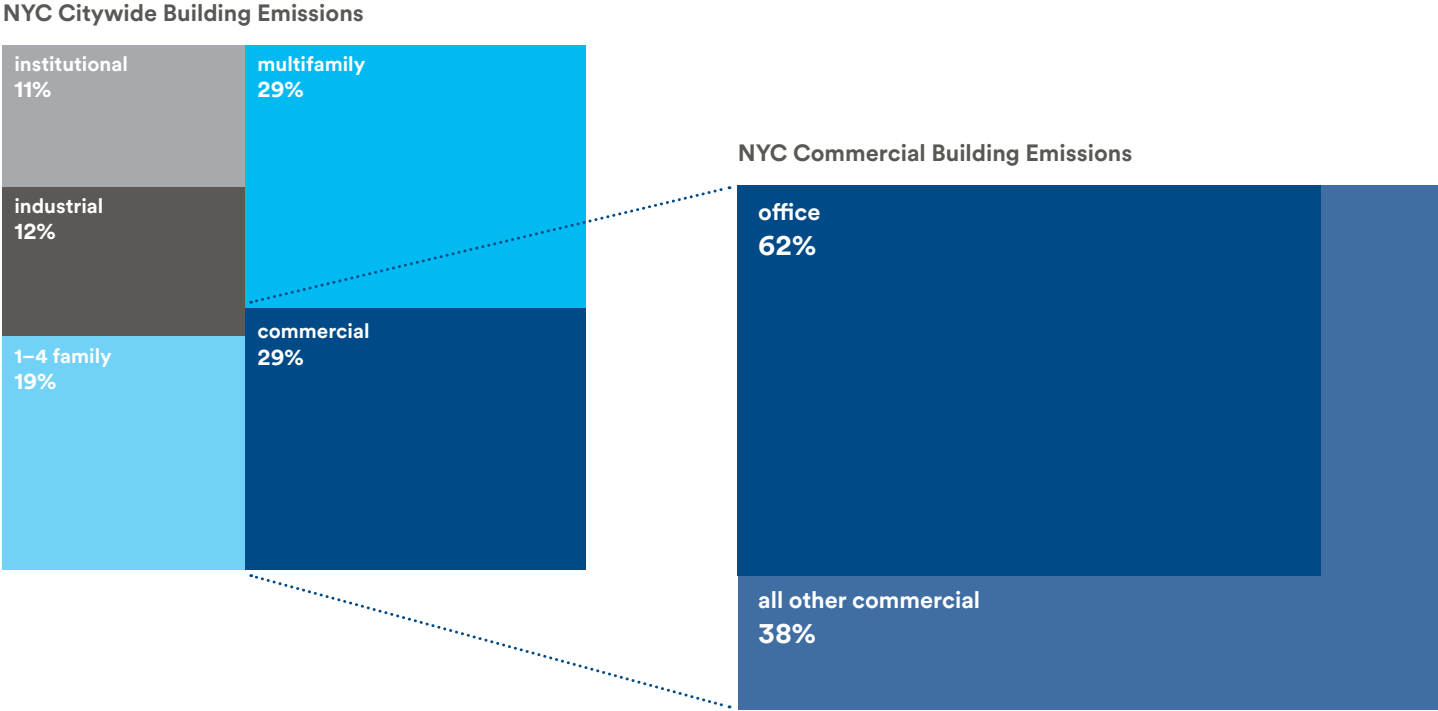
**Most buildings were constructed prior to current energy codes**



# NYC office buildings contribute an outsized share of emissions

- Commercial buildings account for nearly one-third of all NYC building-based GHG emissions
- Within the commercial sector, office buildings contribute the vast majority of emissions

Breakdown of NYC citywide building GHG emissions, by sector



source: BE-Ex analysis, from NYC MOS 2016 and NYC 2019

# Buildings are at the heart of New York City and State climate policies & legislation

## 2009: NYC Greener Greater Buildings Plan

- Local Law 84 (LL84): Annual energy benchmarking
- Local Law 87 (LL87): Energy audits & Rx'g

## 2019: NYC Climate Mobilization Act

- Local Law 97 (LL97): Emissions limits and penalties

## 2019: NYS Climate Leadership & Community Protection Act

- Decarbonize buildings statewide by 2050
- Transition to a clean energy grid by 2040

## 2021: NYC All-Electric Building Law

- Local Law 154: ban on fossil-fuel burning equipment
- Ramps up over next five years



# Building owners will need to make building upgrades at an unprecedented pace and scale

- By 2030, over 300M sf of commercial building space will need to implement energy efficiency retrofits
- By 2050, over 90% of NYC's one million buildings will need to complete upgrades
- This requires a major shift from business-as-usual approaches



# Data into Action 1.0 – savings opportunities for NYC multifamily buildings

Typology-specific recommendations, based on analysis of:

- LL84 energy benchmarking data
- LL87 energy audit data

post-war gas low-rise F14 Building Touchpoints

Energy Conservation Measure	Anytime/Anytime	Multiple Months	Substantial/Retain	Seasonal/Seasonal	Payback (years)	Cost per SF	Energy Savings per SF
Install Exhaust Fan Timers	*	*	*		0.0	0	0
Install Submetering	*	*	*		0.0	000	0
Install Solar Photovoltaics	*	*	*		0.0	0000	0
Upgrade Motors	*	*	*		0.0	00	0
Upgrade Lighting	*	*	*		0.0	0	0
Install Lighting Sensors	*	*	*		0.0	0	0
Upgrade Boilers	*	*	*		0.0	00	0
Upgrade Radiator	*	*	*		0.0	0000	0
Install TRVs and Base Radiator	*	*	*		0.0	000	0
Install Heating Controls and Thermostats	*	*	*		0.0	00	0
Replace Combustion Pans	*	*	*		0.0	0	0
Replace or Repair Steam Traps	*	*	*		0.0	0	0
Replace Pipes	*	*	*		0.0	0	0
Install or Upgrade Water Heating	*	*	*		0.0	00	0
Replace Water Heater Venting	*	*	*		0.0	0000	0
Replace Water Heater	*	*	*		0.0	0000	0
Replace Hot Water Tank	*	*	*		0.0	0000	0
Replace Distribution	*	*	*		0.0	0000	0
Complete All Venting	*	*	*		0.0	00	0
Replace DHW Hot Water Heating	*	*	*		0.0	000	0
Install Low Flow Showerheads	*	*	*		0.0	00	0
Install Low Flow Toilets	*	*	*		0.0	0	0
Install Low Flow Urinals	*	*	*		0.0	00	0
Replace Pipes and Traps	*	*	*		0.0	0	0

Energy Conservation Measure	Cost per Square Foot	Energy Savings per SF (kBtu)	Notes
Insulation & Sealing	\$ 45.00	0-4	*This list of Energy Conservation Measures (ECMs) is based on LL87 audit data and therefore may be incomplete. Suggested ECMs for each building touchpoint are representative and not necessarily applicable to every building. Specific to specific building systems and condition of equipment must be considered in determining the appropriate packages of ECMs for individual buildings. The first step of any upgrade should be to work with a qualified service provider to develop a scope of work appropriate for your building.
Other	\$0.00-\$0.00	0.0-0	
Lighting	\$0.00-\$0.00	0.0-0	
Heating Equipment	\$000	10	

This building segment-specific "heatmap" constitutes relevant packages of retrofit measures applicable at key touchpoints in a building's lifecycle. A heatmap has been created for all building segments, except for Very Large.



retrofit packages: post-war gas low-rise

The heatmap shows packages of energy conservation measures (ECMs) relevant to a building that can reduce utility bills, increase energy savings, and improve value and performance.

Typical Building Characteristics	
Age	1947-1979
Height	7 stories or fewer
Facade	Masonry
Heating System	Hydronic or two pipe steam
Heating Fuel	Gas or dual fuel
Ventilation System	Central ventilation and natural ventilation
Cooling	Through-wall or window A/Cs

Segment Characteristics	
Size	1,032 properties; 152,966,300 square feet
Area	9% of all covered multifamily buildings
Potential Savings	10% of all potential GHG reduction

Touchpoint	Building/Property	Minimum/Retain	Reference	Seasonal/Anytime
Submetering	0000-0000-0000	0000-0000-0000-0000	0000-0000-0000-0000	0000-0000-0000-0000
Other	0000	0000	0000	0000
Lighting	0000	0000	0000	0000
Heating Equipment	0000	0000	0000	0000



## 2. analysis

# Data into Action 2.0 – office building opportunities in the age of emissions limits

## Four commercial office typologies

- 25k to 1M sf in size
- bucketed by primary heating and cooling systems
- most common types & greatest GHG impacts
- collectively represent:
  - 71% of "covered" office sqft citywide
  - 84% of total NYC office sector emissions

	Office Building Type	# Buildings	% Total Buildings Count	% Total Office Gross Floor Area	% Total Office GHG Emissions
1	Central Chiller Systems with District Steam Heating	313	15%	26%	33%
2	Packaged Cooling Systems with Steam Heating	799	39%	30%	34%
3	Decentralized Cooling Systems with Hot Water Heating	102	5%	3%	4%
4	Decentralized Cooling Systems with Steam Heating	467	23%	12%	13%
	Unassigned Office (not in one of the above 4 typologies)	366	18%	29%	16%

Source: BE-Ex analysis of LL84 data, from NYC 2019.

# Office building typologies

## Central Chiller Systems with District Steam Heating

### Cooling Systems

- Chiller - Absorption
- Chiller - Centrifugal
- Chiller - Electric
- Chiller - Reciprocating
- Chiller - Screw Driven
- Chiller - Scroll

### Heating Systems

- District Steam

### Heating Fuel

- District Steam

## Packaged Cooling Systems with Steam Heating

### Cooling Systems

- DX Units
- Packaged Rooftop Units

### Heating Systems

- District Steam
- Steam Boiler

### Heating Fuel

- District Steam
- Dual Fuel
- Electric
- Natural Gas
- Oil

## Decentralized Cooling Systems with Hot Water Heating

### Cooling Systems

- Ductless Mini-Splits
- Multi-Splits
- Single-Splits
- Split System Central Air
- PTAC
- Through-Wall A/C
- Window A/C

### Heating Systems

- Hot Water Boiler

### Heating Fuel

- District Steam
- Dual Fuel
- Electric
- Natural Gas
- Oil

## Decentralized Cooling Systems with Steam Heating

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- Steam Boiler

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- District Steam
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- Electric
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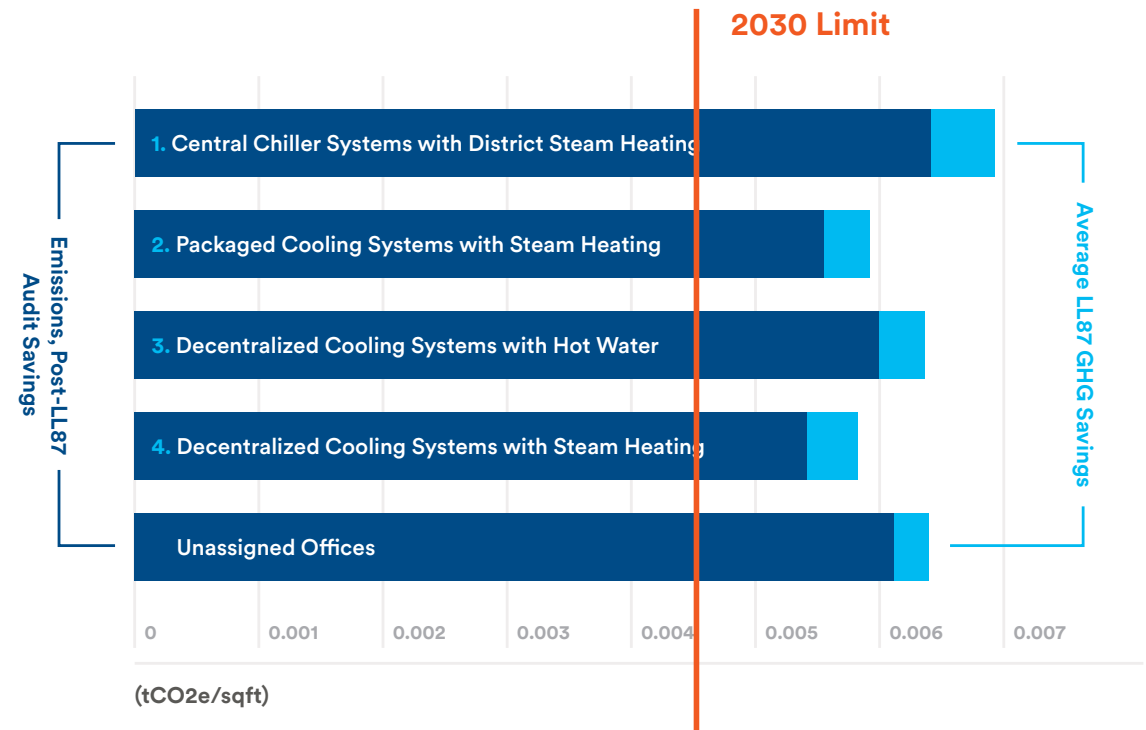
# Audit recommendations tend to fall short of LL97 compliance requirements

## 2024: First LL97 compliance period

- Only 25% of covered buildings affected
- Most office buildings will be in compliance, either without upgrades or with relatively simple measures

## 2030: Second LL97 compliance period

- Roughly 75% covered buildings affected
- Potential emission savings identified in LL87 audits typically fall short of 2030 requirements



This data reflects the average building for each of the four typologies.  
Source: BE-Ex analysis of 2018 LL97 data, NYC 2018.

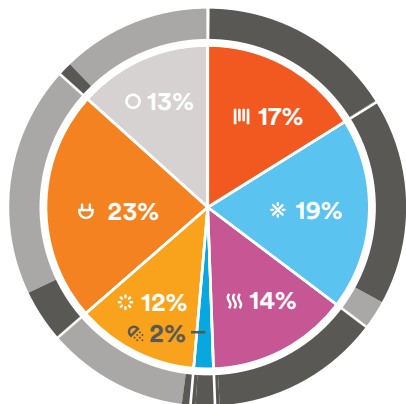
# Addressing the GHG savings gap

LL87 energy audits did not require any action. Audits also tend to miss:

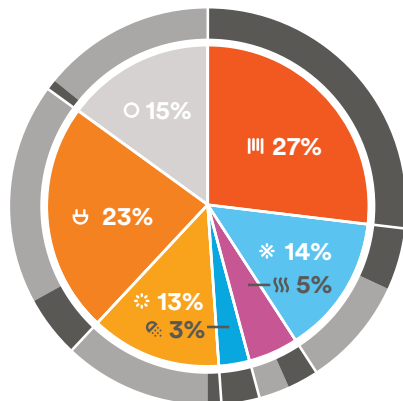
- opportunities in tenant spaces
- efficiency measures with payback periods greater than 3-5 years
- more disruptive measures

Breakdown of whole-building GHG emissions, by end-use system and by base building vs tenant space

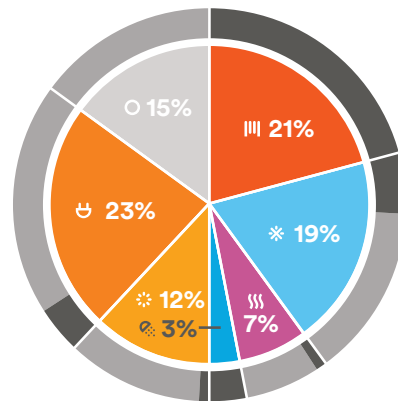
**typology 1:**  
Central Chiller Systems  
with District Steam Heating



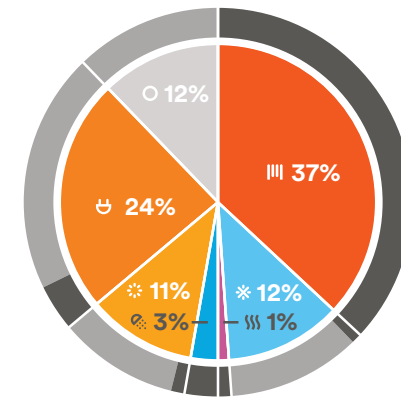
**typology 2:**  
Packaged Cooling Systems  
with Steam Heating



**typology 3:**  
Decentralized Cooling Systems  
with Hot Water Heating



**typology 4:**  
Decentralized Cooling Systems  
with Steam Heating



building systems

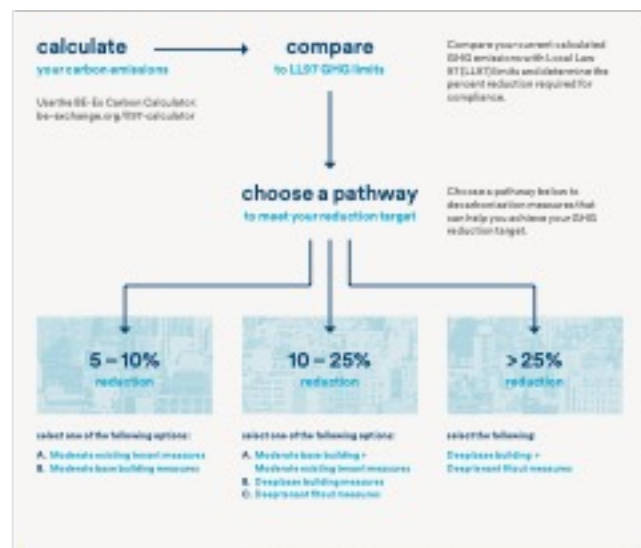
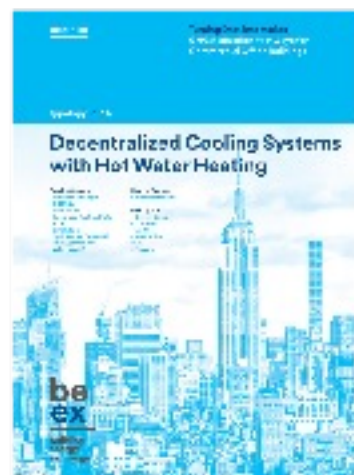
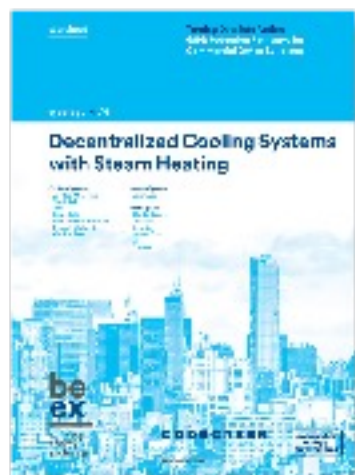


% from tenant

% from base building

## **3. tools for action**

# Tearsheets – custom pathways to compliance



base building measures		deep decarbonization	
17%	2.0%	6.0%	0.5%
19%	6.0%	<0.5%	3.5%
14%	1.5%	3.5%	0.5%
2%	0.5%	0.5%	0.5%
12%	<0.5%	1.5%	<0.5%
23%	0.5%	3.5%	8.5%
13%	9–11%	4–6%	13–15%
total savings from moderate decarbonization measures		total savings from deep decarbonization measures	
13–17%		27–31%	

# BE-Ex carbon calculator – determining targets

calculate

your carbon emissions



compare

to LL97 GHG limits

Use the BE-Ex Carbon Calculator:  
[be-exchange.org/ll97-calculator](http://be-exchange.org/ll97-calculator)





# Retrofit pathways – selecting viable sets of decarbonization measures

**choose a pathway**  
to meet your reduction target

Choose a pathway below to decarbonization measures that can help you achieve your GHG reduction target.

**5 – 10%**  
reduction

**10 – 25%**  
reduction

**> 25%**  
reduction

select one of the following options:

- A. Moderate existing tenant measures
- B. Moderate base building measures

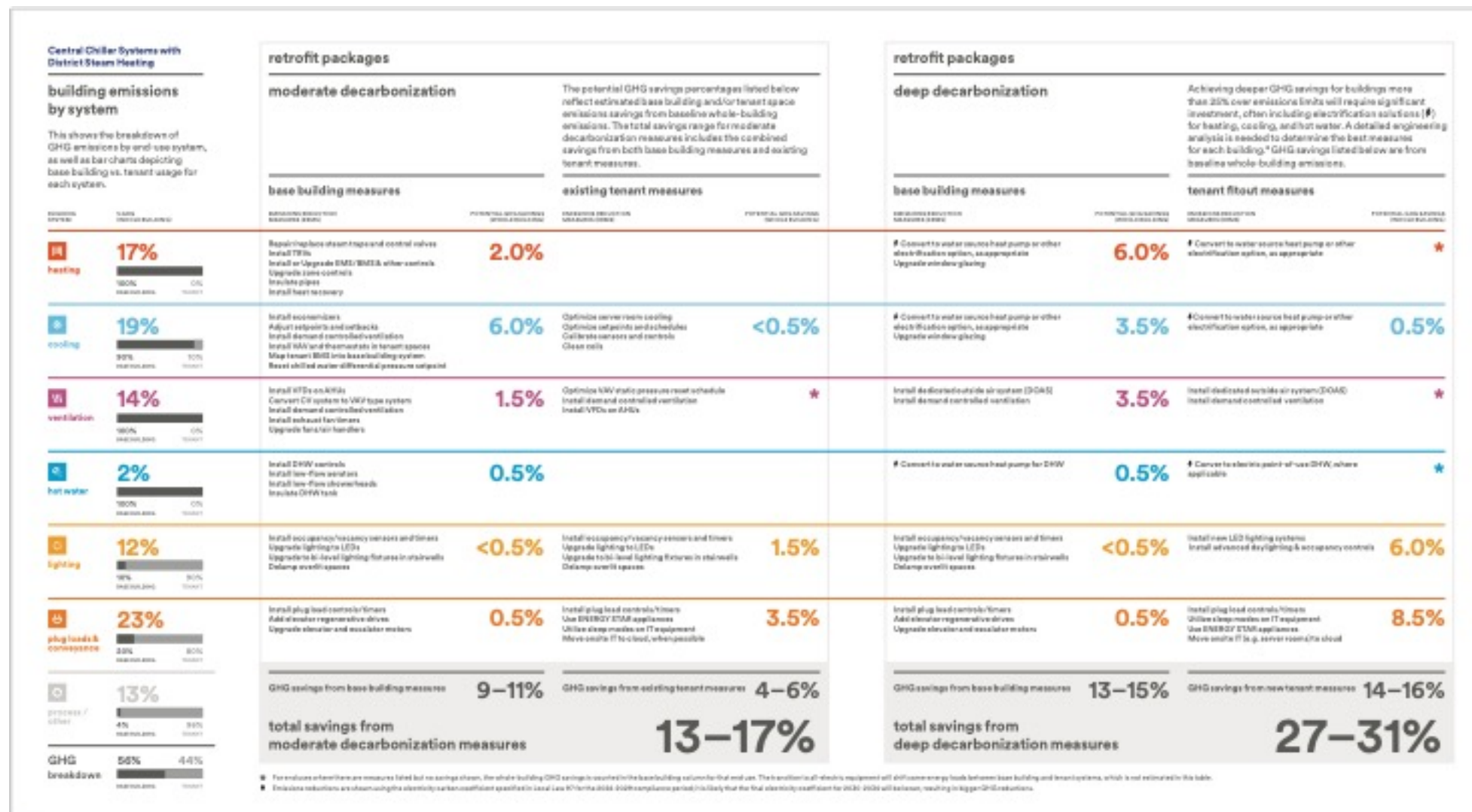
select one of the following options:

- A. Moderate base building + Moderate existing tenant measures
- B. Deep base building measures
- C. Deep tenant fitout measures

select the following:

- Deep base building + Deep tenant fitout measures

# Decarbonization packages – moderate and deep



\* For measures where there are measures listed but no savings shown, the whole-building GHG savings is expected to be in the base building column for that end use. The installation of electric equipment will off-set some energy loads between base building and tenant systems, which is not estimated in this table.

† Emissions reductions are shown using the identical carbon coefficient specified in local law 10/10/14/2014. 2014 compliance period. It is likely that the final identical coefficient for 2024-2026 will be lower, resulting in bigger GHG reductions.

## **4. takeaways – getting to 2030**

# Deep decarbonization – a new business as usual

The following considerations are essential to meeting LL97 2030 limits and achieving our climate action goals:

- Tenant space measures + owner-tenant collaboration
- Electrification of major HVAC systems
- Energy-intensive functions, like IT offsite or to cloud
- Long-term planning starts TODAY!



# questions?

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**ex**

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# Turning Data into Action: Decarbonization Pathways for Office Buildings

## Panelists

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### Moderator

**Adam Hinge, Managing Director, Sustainable Energy Partnerships**

### Panelists

**Lauren Moss, Senior Vice President, Vornado Realty Trust**

**Luis Rios, Assistant Vice President, Operations & Sustainability, Rudin Management Company Inc.**

**Christopher Cayten, Partner & Managing Director, CodeGreen Solutions**

**Michael Keaveney, Director, Operations & Engineering, Sage Realty Corporation**





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**thank you!**