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# Rapid Deployment of Energy Upgrades Through a Community-Scale Approach: Leveraging Partnerships to Achieve Equitable Clean Energy Goals

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# DOE ABC Research Partnership

Chicago Energy Efficiency Planning and Analysis, and Integrated Retrofit Strategy Validation in Single-Family Homes

DOE's Advanced Building Construction Initiative

**Goal: Demonstrate that 50% energy reduction is feasible in the existing Chicago single-family and 2-4 unit housing stock.**

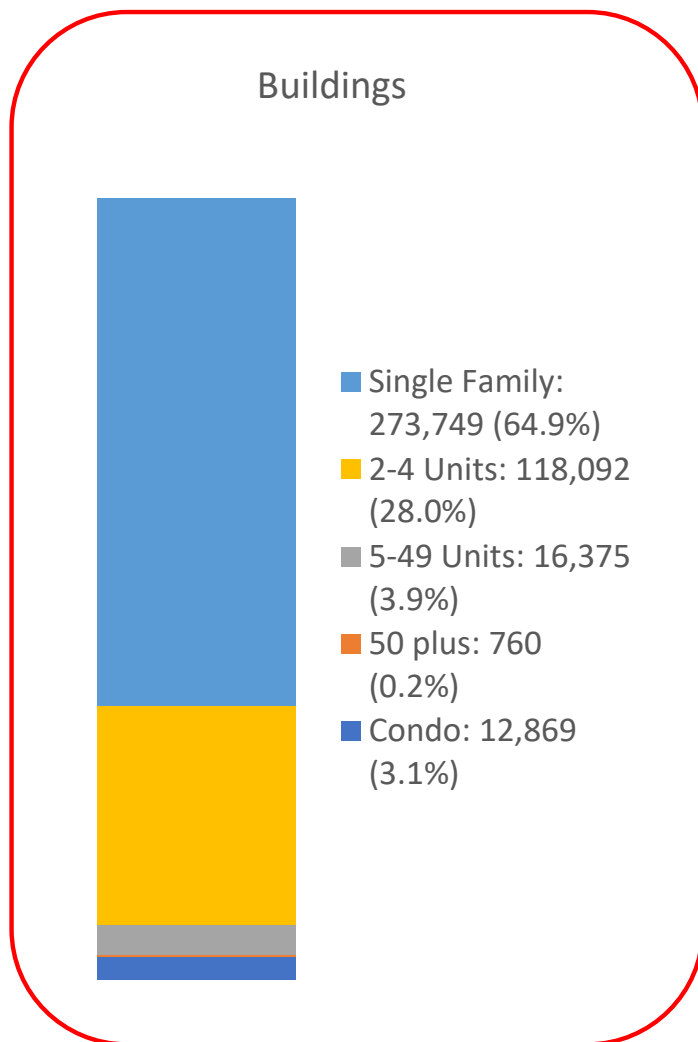


# Primary Research Questions

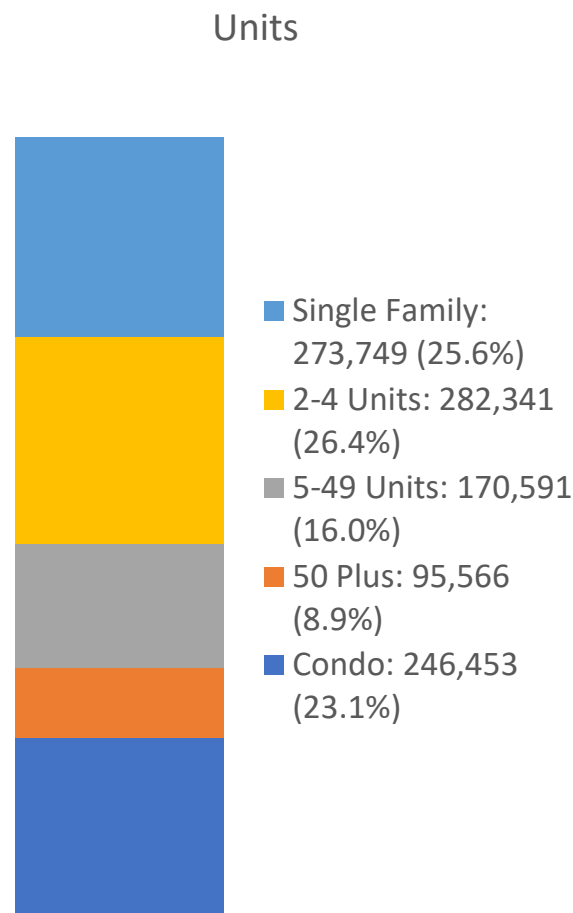
- What are the best retrofit packages to achieve deep energy savings (50%+) in Chicago homes?
- What would be the energy use, utility bill, and carbon impacts from installing these retrofit packages city-wide?
- How can Chicago prioritize and achieve deep energy savings in a short timeframe, in the communities that need it most?

# The Chicago Housing Stock

SF and  
2-4 unit:  
92.9%



TOTAL = 438,054



TOTAL = 1,068,700

# Five home types are 80% of Chicago residential buildings, and 85% of 1-4 unit buildings



Single family, Pre-1942  
Frame construction  
83,028 (19.0%)



Single family, Pre-1942  
Masonry/brick construction  
60,993 (13.9%)



Single family, 1942-1978  
Masonry/brick construction  
82,256 (18.8%)

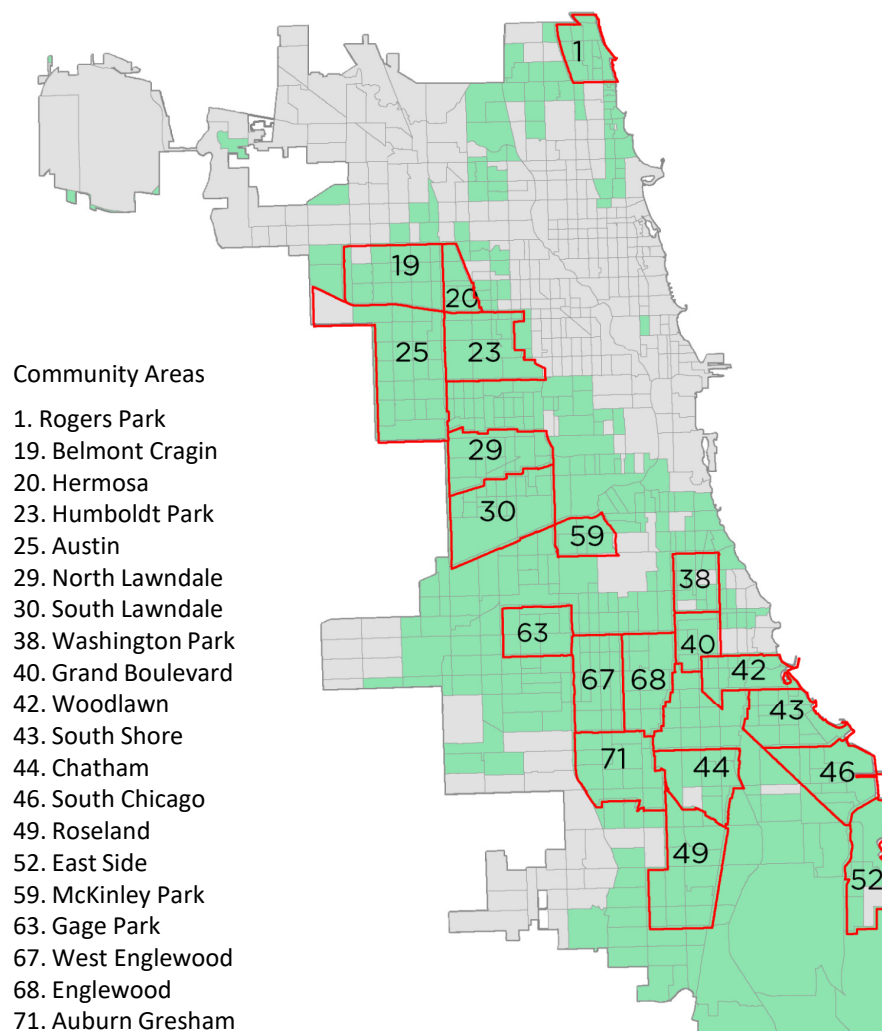


2-4 flat, Pre-1942, Frame  
43,812 (10.0%)



2-4 flat, Pre-1942, Masonry  
63,732 (14.5%)

# Priority Community Areas



	Total residential buildings	Single-family detached buildings		2-4 unit buildings	
	#	#	%	#	%
Priority Community Areas total	133,406	77,814	58.3%	45,817	34.3%
Chicago total	438,054	274,072	64.9%	123,563	29.3%

- ~ 580,000 households in Chicago earn  $\leq 80\%$  area median income (54%)
- 204,500 households in these 20 community areas earn  $\leq 80\%$  area median income (70%)

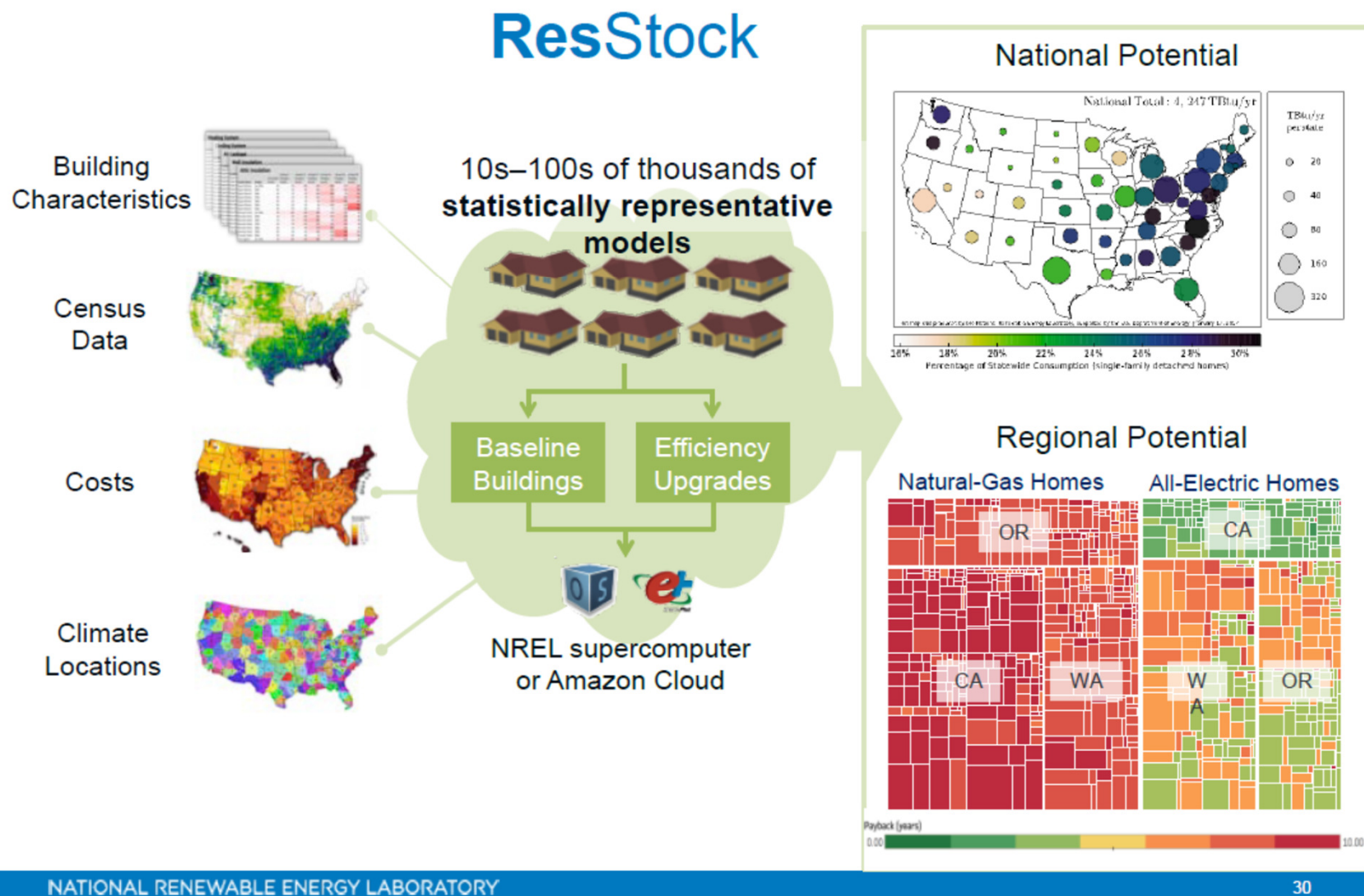


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## **Data and methodology**



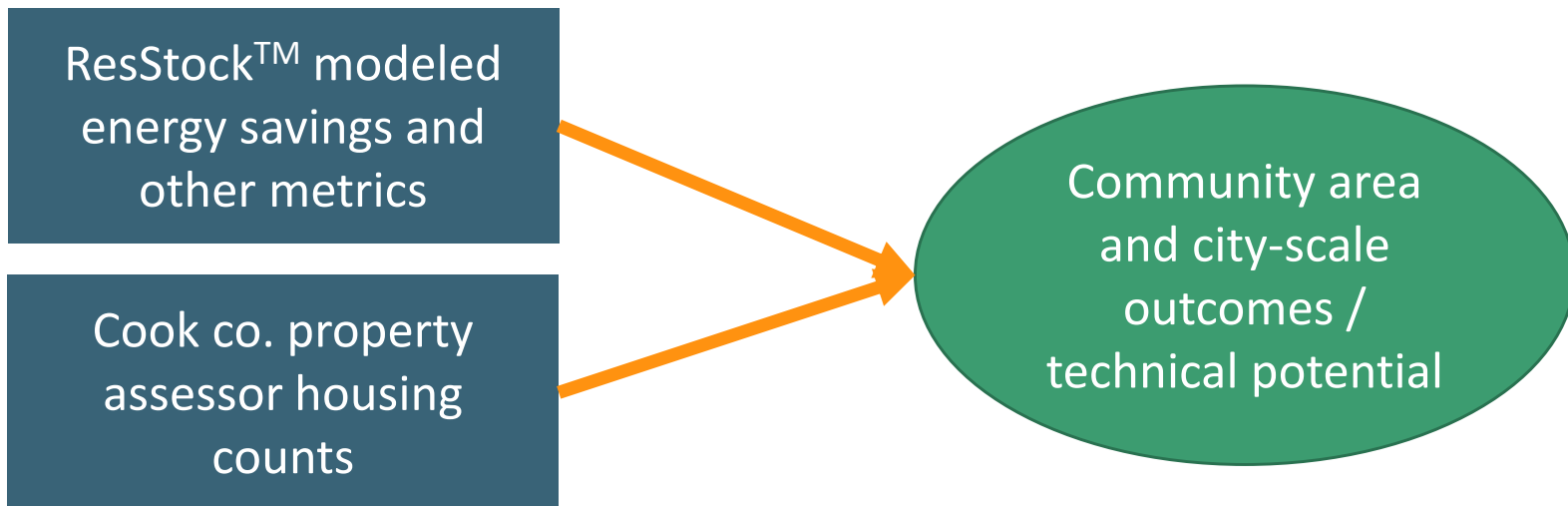
# Data: ResStock™





# Methodology: City-Scale Analysis

- 1) Identify all priority housing type buildings
- 2) Apply ResStock™ modeled outcomes for various retrofit packages
- 3) Aggregate up by summing outcomes for all priority housing type buildings in geography





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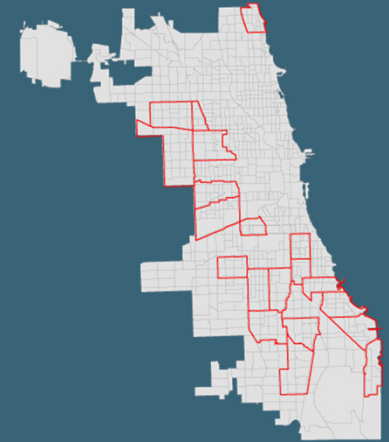
## **Technical Potential and Key Takeaways**



392k



323k



110k

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## Chicago Annual Savings Potential

≥ 59% MBTUs

\$130 – >\$300 million (\$400 – \$1,000 per building)

2.5M metric tons CO<sub>2</sub>-equivalent

Solar offset of ≥ 30% of post-retrofit electricity use

- + Air conditioning
- + Improved respiratory health
- + Improved thermal resilience
- + Home value & household wealth
- + Prioritized investment in the communities that need it most

# Energy and Utility Bill Savings

- Electrification with heat pumps can save Chicagoans \$ millions per year; savings will increase as gas prices go up

Technical potential for packages assuming installation in all applicable Chicago homes from the 5 priority building types

	% energy savings (annual MBTUs)			Utility bill savings (annual)		
	City-wide mean	Per-building mean	Interquartile range	City-wide mean	Per-building mean	Interquartile range
Comprehensive energy efficiency + heat pump	62%	61%	59% - 63%	\$217 million	\$670 (19%)	\$130-305 million
Full electrification	66%	66%	64% - 66%	\$442 million	\$750 (21%)	\$160-333 million

# Community-Scale Implementation

- Large #s of buildings with high technical potential are concentrated in community areas that are also investment priorities

Community Area	# of buildings from the 5 priority housing types
Auburn Gresham	9,080
Austin	13,970
Belmont Cragin	10,634
Humboldt Park	7,072
Roseland	10,233
South Lawndale	7,161
West Englewood	7,597
<b>Total</b>	<b>65,747</b>

# Key Takeaways

1. Deep energy savings (>50%) can be achieved in the Chicago housing stock with off-the-shelf measures and technologies, and help reduce energy costs and energy burdens
  - Heat pumps are a major driver of energy savings
2. Additional benefits amplify the impact:
  - Climate resilience: heat pumps add efficient cooling in homes that don't have it (~77% of Chicago's 1-4 unit buildings lack central A/C)
  - Improved indoor air quality
  - Thermal resilience in case of power outages

# Key Takeaways

3. Adding solar would offset  $\geq 30\%$  of post-retrofit electricity use
4. Methodology: an important first step was to calibrate ResStock<sup>TM</sup> to local housing stock
5. This partnership represents a model for rapidly scaling up equitable climate action that could be readily replicated in other cities and regions.
  - Technical research and tools + Local knowledge and experience + Existing planning work





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# **City of Chicago Planning and Investments**

# A Just and Equitable Climate Future for Chicago



Center Equity  
and  
Environmental  
Justice



Uphold  
Commitment  
to Climate  
Goals



Address  
Profound  
Environmental  
Challenges



Generate  
Economic  
Benefits for  
Local  
Communities



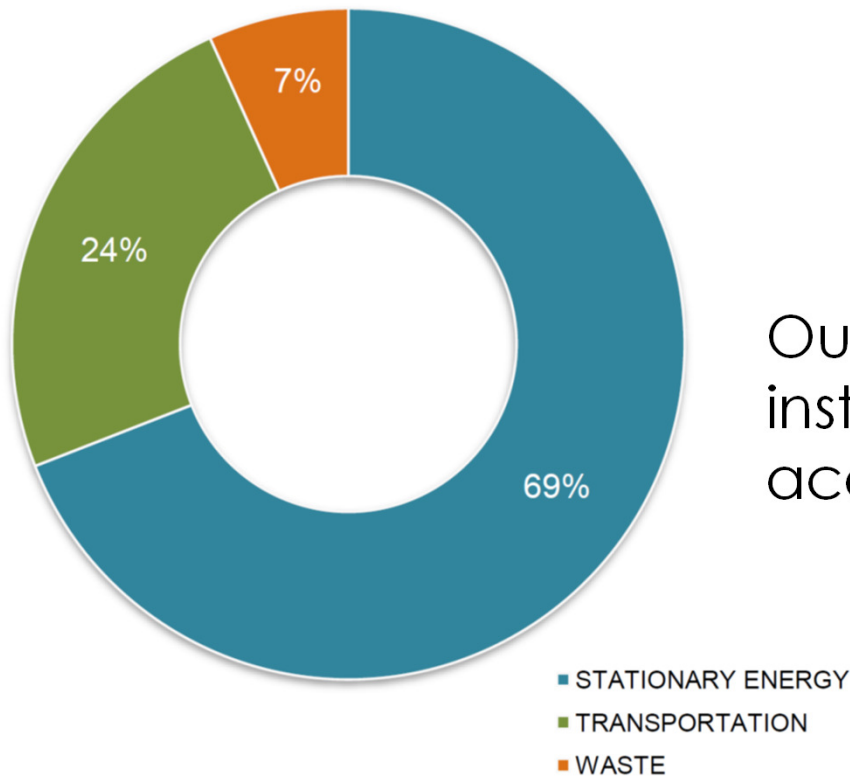
# Chicago Green Recovery Agenda



The Green Recovery is advancing four strategies to accelerate a just transition to a green economy for the City of Chicago:

- Climate Action Plan
- Decarbonization
- 100% Renewable Energy by 2025
- Electricity Franchise Agreement

# Chicago's built environment represents the largest portion of our emissions profile



Our residential, commercial & institutional, and industrial buildings account for nearly 70% of city's emissions

# Chicago Building Decarbonization Working Group

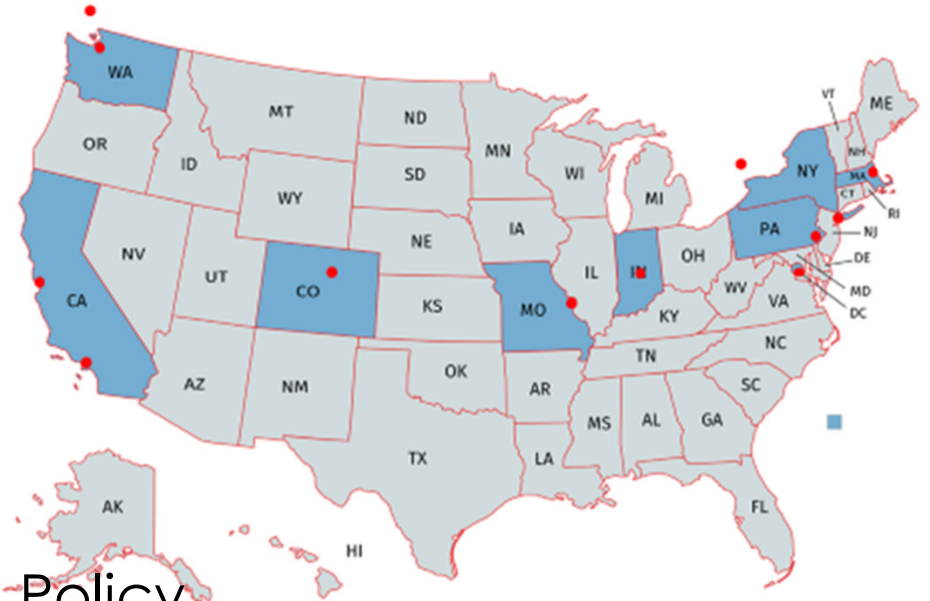


*Installation of a “solar flower” garden in Bronzeville, as a result of a public-private partnership.*

- **Lower economic burdens** on residents and businesses
- **Reduce energy insecurity** for communities of color
- Use an **equity lens** to assess the costs and burdens of strategies
- Create **economic and health benefits** for those who need them the most

# Overall Project Scope

- **Fall 2020**
  - ✓ Best practices research in 12 North American cities
- **November 2020 – May 2021**
  - ✓ Two rounds of stakeholder engagement; 200+ touchpoints\*
- **June 2021 – December 2021**
  - ✓ Chicago Building Decarbonization Policy Working Group Convenings





# The Working Group



- 54 Working Group members
  - Supported by Project Team: Office of Sustainability; other City of Chicago staff; NRDC; Delivery Associates; and Elevate
- 11 big ideas:
  - New construction
  - Retrofits for existing buildings
  - Programmatic and technical support



# Chicago Policy Scan

## EXISTING

2008  
Climate  
Plan

Energy  
Benchmarking

Building  
Code

Many  
independent  
community-  
based efforts

INVEST  
South/West

Sustainable  
Development  
Code

Retrofit  
Chicago

Neighborhood  
Power Program

2022 Climate  
Action Plan

## UPCOMING

**Community Goal:**  
100% renewable  
energy by 2035

**Building Code  
Improvements**  
(Cycle: 2022-2025-2028)

**Municipal Goal:**  
Municipal Energy  
Supply 100% renewable  
(2025)

**Building  
Performance  
Standards**  
(TBD)

**We Will  
Chicago**  
(2020-2023)

**Electricity  
Franchise  
Agreement**  
(TBD)

# Chicago Recovery Plan

## INVESTMENTS



### Community + Environmental Justice Investments

- Land + river remediation
- Organic waste diversion
- Low carbon mobility
- Decarbonization of City fleet and vehicles
- Historic trail development

### Equitably Growing the Tree Canopy

- Planting 75k additional trees to provide co-benefits to local communities

### Energy and Equity

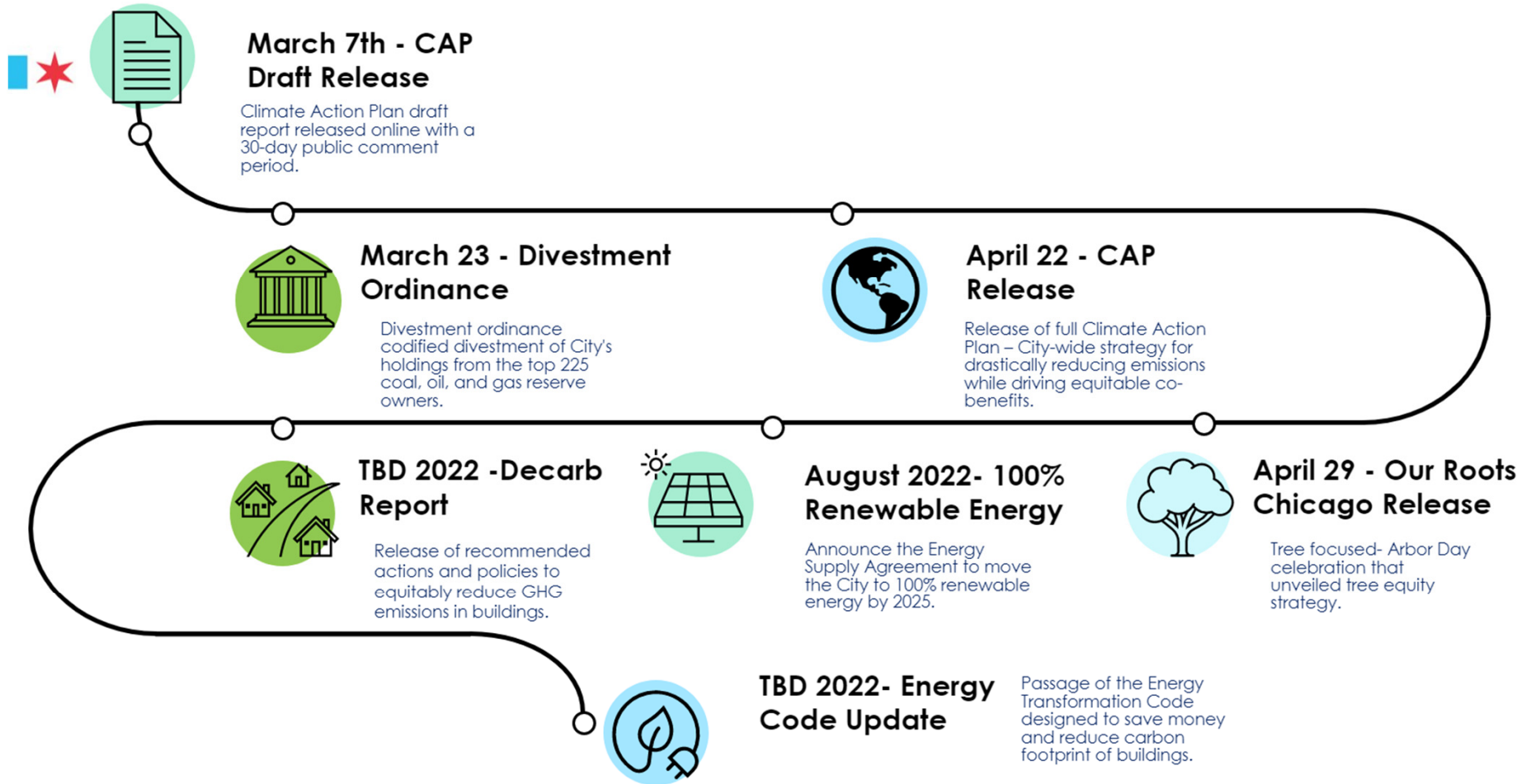
- Retrofitting single and multifamily affordable housing
- Retrofitting neighborhood anchor buildings
- Installing library solar
- Pilot industrial community solar project

### Green Infrastructure

- Developing 20 resilient schoolyards
- Strategic expansion of green alleys, bioswales, and other flood mitigation projects
- Investing in flood-vulnerable neighborhoods

In October 2021, City of Chicago adopted a budget that included \$188,000,000 for environmental justice and climate investments.





# 2022 Key Dates



# Thank you

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More info:

<https://www.elevatenp.org/climate/cutting-chicagos-carbon-emissions-through-deep-home-retrofits/>