U.S. DEPARTMENT OF ENERGY

Office of
ENERGY EFFICIENCY & RENEWABLE ENERGY

Decarbonizing the U.S. Economy by 2050: A National Blueprint for the Buildings Sector

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A people-centered strategy for catalyzing and scaling U.S. building decarbonization

The Building Decarbonization Blueprint:

- Sets national goals for U.S. buildings sector decarbonization in line with economy-wide climate goals
- Outlines coordinated federal actions and support for state, local, and tribal stakeholders
- Serves as a guidepost for program planning and coordination
- Centers benefits to people and communities

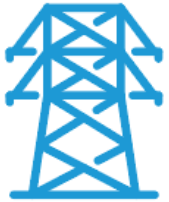
Everyone deserves to live in a safe and health home with access to affordable, clean, and reliable energy

The U.S. is pursuing ambitious national climate mitigation goals

GREENHOUSE GAS EMISSIONS REDUCTIONS

50-52% reduction by 2030 vs. 2005 levels

Net-zero emissions economy-wide by 2050



POWER SYSTEM DECARBONIZATION

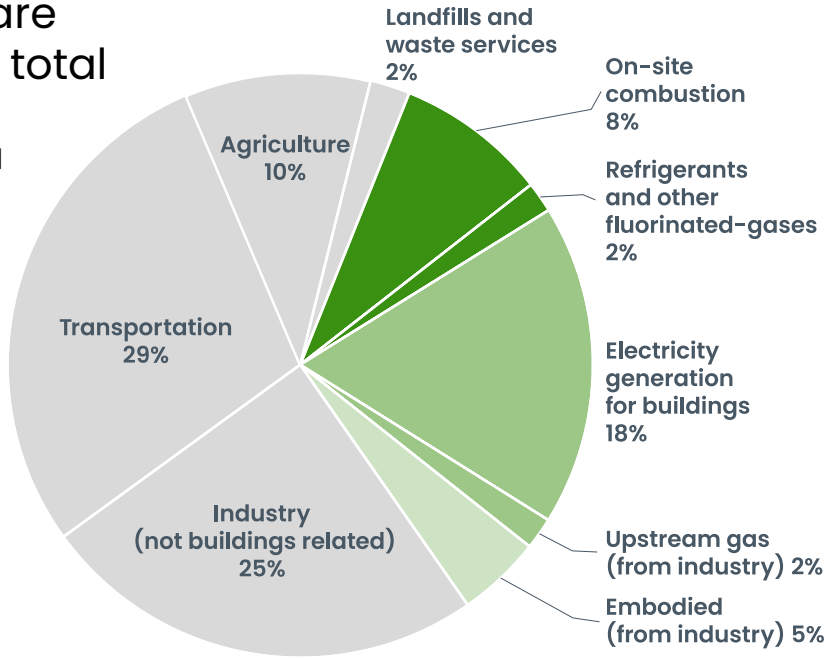
100% clean electricity by 2035

ENERGY JUSTICE

40% of benefits from federal climate and clean energy investments flow to disadvantaged communities

Buildings are a critical pillar of economy-wide decarbonization

Buildings are over 1/3 of total U.S. GHG emissions[1]



Buildings impact our everyday lives in many ways

Buildings are energy intensive and much of that energy is wasted

Most of today's buildings will still be operating in 2050

Buildings consume 3/4 of electricity and drive peak demand

Buildings are where "grid edge" resources intersect with the grid

[1] Source: U.S. EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021, 2021 data, internal DOE analysis. Uses 100-year CO2 equivalencies.

An ambitious but achievable vision for the buildings sector in 2050

The National Blueprint is a plan to **reduce U.S. building GHG emissions 65% by 2035 and 90% by 2050** vs. 2005 while enabling net-zero emissions economy-wide and centering equity and benefits to communities.

Increase building energy efficiency
Reduce onsite energy use intensity in buildings 35% by 2035 and 50% by 2050 vs. 2005

Accelerate on-site emissions reductions
Reduce onsite GHG emissions in buildings 25% by 2035 and 75% by 2050 vs. 2005

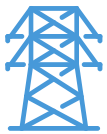
Transform the grid edge
Reduce electrical infrastructure costs by tripling demand flexibility potential by 2050 vs. 2020

Minimize embodied life cycle emissions
Reduce embodied emissions from building materials and construction 90% by 2050 vs. 2005

Cross Cutting Goals: Equity, Affordability, and Resilience

The impacts of achieving the Blueprint's goals are far-reaching

Building upgrades **improve lives** by increasing high-quality jobs *(>$1T jobs investment)*, economic security *(>$100B in energy cost savings)*, health *(~$17B in annual avoided health costs)*, equity, and community resilience



Limit scale of required electricity infrastructure needed under deep grid decarbonization *(>$100B in avoided power system costs)*

Enable fast, secure, and interactive distributed energy resources like EVs, onsite generation, and storage

Support convenient, efficient, and clean mobility options through building codes, zoning, and urban planning

Accelerate demand for low-embodied carbon material manufacturing to reduce life cycle emissions

A wide range of technical solutions and potential emissions impacts

Emissions scope and source (% buildings emissions)		Energy efficiency	Efficient electrification	Grid edge resource managment	Low GWP refrigerants	Low embodied carbon construction
1	On-site fuel combustion (24%)	☁☁	☁☁☁			
	Refrigerants, other HFCs (5%)				☁	
2	Electricity generation (52%)	☁☁☁		☁☁		
	Upstream gas*(~5%)	☁	☁			
3	Embodied life cycle (~14%)					☁☁

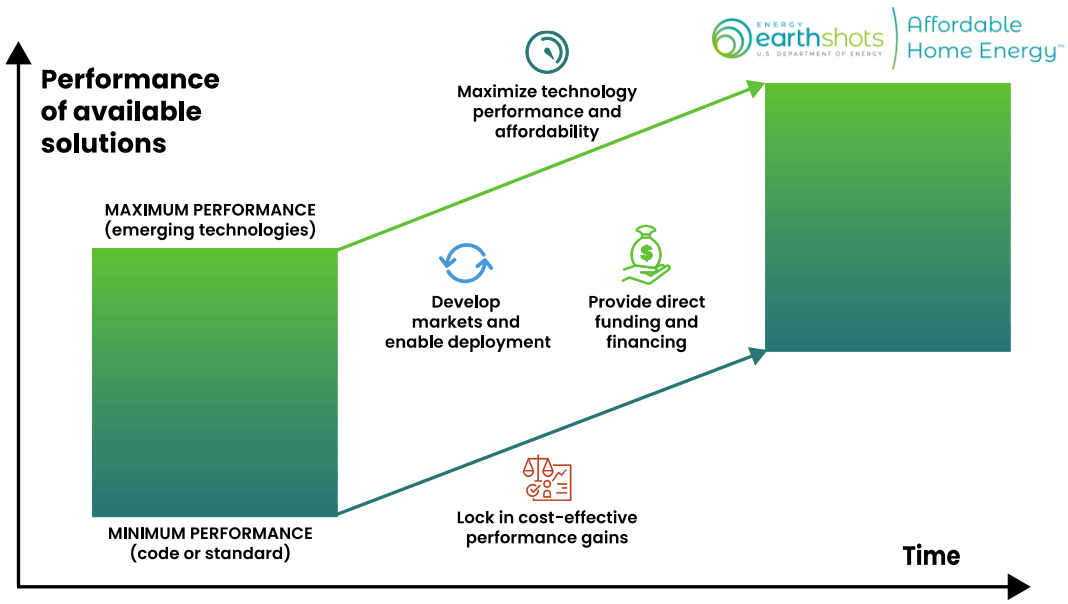
☁ Lower emissions reductions potential

☁☁ Moderate emissions reduction potential

☁☁☁ Higher emissions reduction potential

The Blueprint outlines a three-stage transition to a low-carbon buildings sector

- **By 2030: Catalyze the transition**
- **2030-2040: Adapt and scale**
- **2040-2050: Complete the transition**
- Coordinate federal actions across the full federal toolbox
- Identifies RDD&D activities over the next decade that are critical for the success of future stages



Federal support can accelerate state, local and tribal leadership

Fund investments in building decarbonization

- Deploy BIL/IRA programs
- Enable and deploy innovative financing
- Oversee utility programs

- Tailored technical assistance (TA) and data for program design and implementation
- Fund low-interest financing

Set codes, standards, and other requirements

- Enact/enforce building codes and performance standards
- Enact state-level appliance and procurement standards

- Model code development input
- TA for code/standards adoption and enforcement
- Lead-by-example on codes and procurement standards

Lead policy to enable greater investments

- Utility regulation and reforms
- Energy efficiency and clean heat standards
- Zoning reforms

- TA to support utility decision-making, planning, and compliance assessments
- Land use policy research

Next steps: Continue to vet the strategy, put it into practice, and track progress

- **Engage with a range of stakeholders** at buildings-related conferences (e.g., state, local, federal government, building owners and operators, manufacturers, utilities, affordable housing advocates)
- Join forces with existing **buildings-related working groups to** review recommendations in the Blueprint; form new working groups if needed
- **Host a monthly webinar series** focused on topics in the Blueprint
- Stand up a **new website** with a **schedule of upcoming activities**

Please contact Katharine Kaplan if you would like to partner with DOE on building decarbonization: katharine.kaplan@ee.doe.gov

Download the Blueprint:

bit.ly/buildingsdecarb

Thank you

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The impacts of achieving the Blueprint's goals are far-reaching

Reduce **90% of total GHG emissions**[1] from the building sector

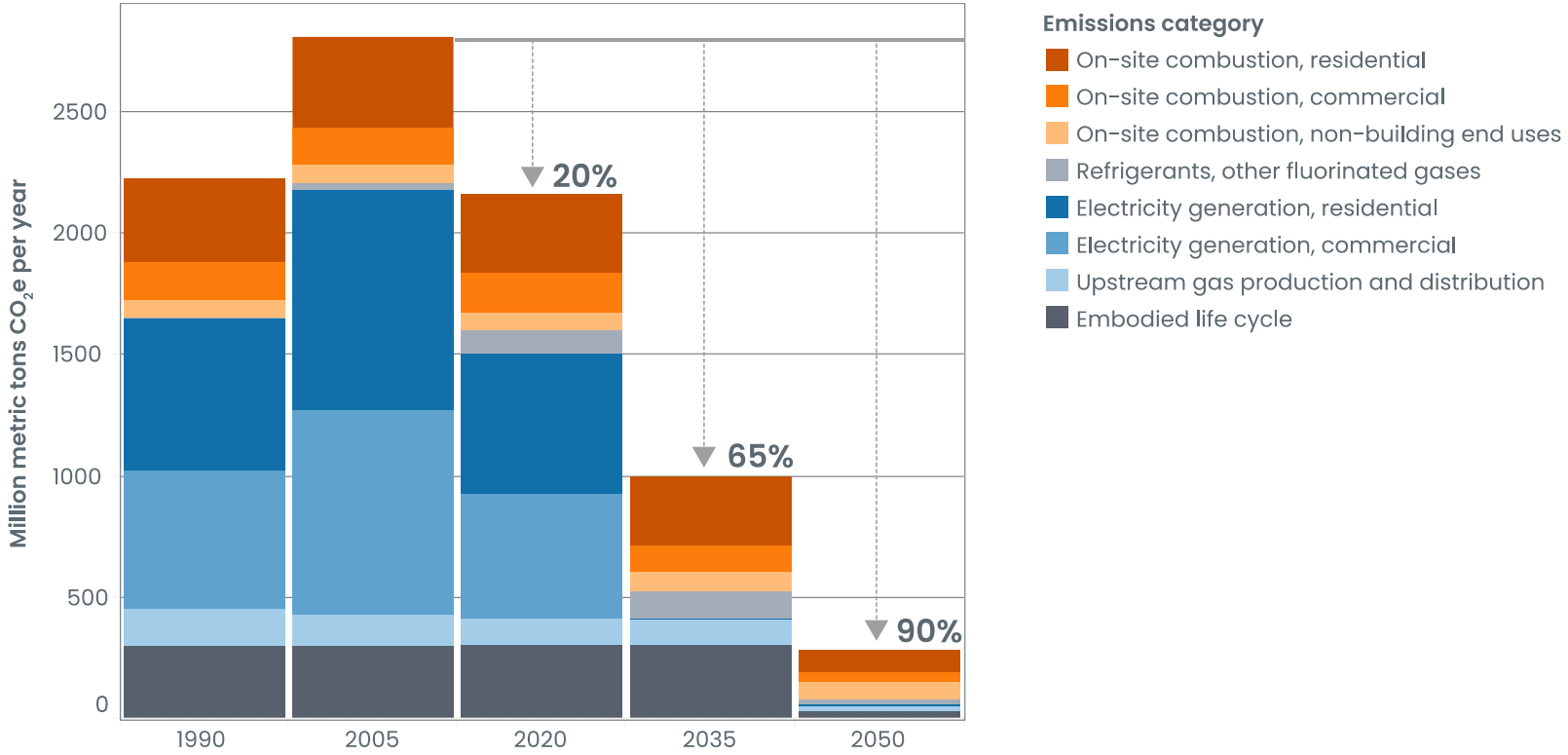
Avoid **7 quads of annual energy use**[2] while converting many building loads to clean electricity

Save consumers more than **$100 billion in annual energy costs**[2] through efficiency improvements

Avoid **$17 billion in annual health costs**[3] and add **$1 trillion of investment in high-quality jobs**[2]

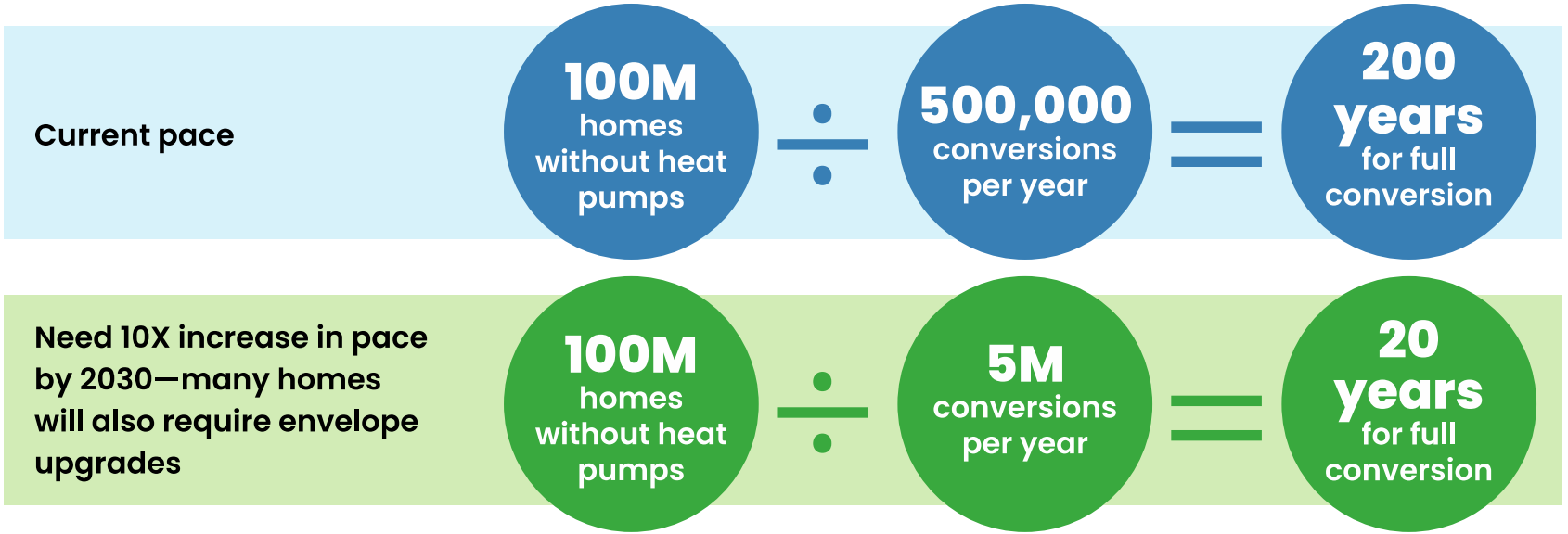
[1] Based on reduction targets shown on previous slide (assume 100% power sector decarbonization consistent with Biden-Harris administration goal)
[2] Based on Langevin et al. "aggressive" decarbonization benchmark, which maps most closely to the targeted pathway
[3] Based on EPA COBRA assessment of avoided health costs of 75% reduction in residential and commercial fossil combustion in contiguous United States (range $10-23B)

The Blueprint's emissions goals are ambitious



Rapid deployment of solutions at scale is urgently needed

Example: Residential space heating



Buildings impact our everyday lives in many ways

90% of people's time
is spent in buildings, which provide shelter and keep us safe

$374 billion is spent annually on building energy costs

2.2 million people
are already employed in jobs related to energy efficiency

2X air pollution from gas appliances in buildings vs. gas power plants

34 million households
experienced energy insecurity

1 in 5 households
were behind on a monthly energy bill payment

1 in 3 Americans live in a community facing climate, health, and economic burdens

[1] Sources to be added