

U.S. DEPARTMENT OF  
**ENERGY**

Office of  
ENERGY EFFICIENCY &  
RENEWABLE ENERGY

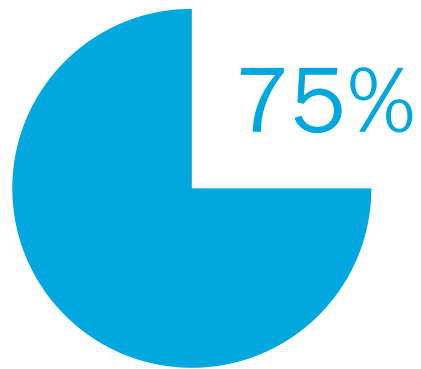
# BTO strategy, goals, and vision for national building decarbonization

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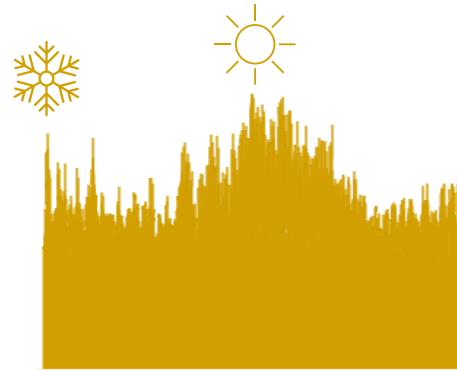
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# Buildings are a top driver of electricity demand



Buildings account for about 75% of U.S. electricity use

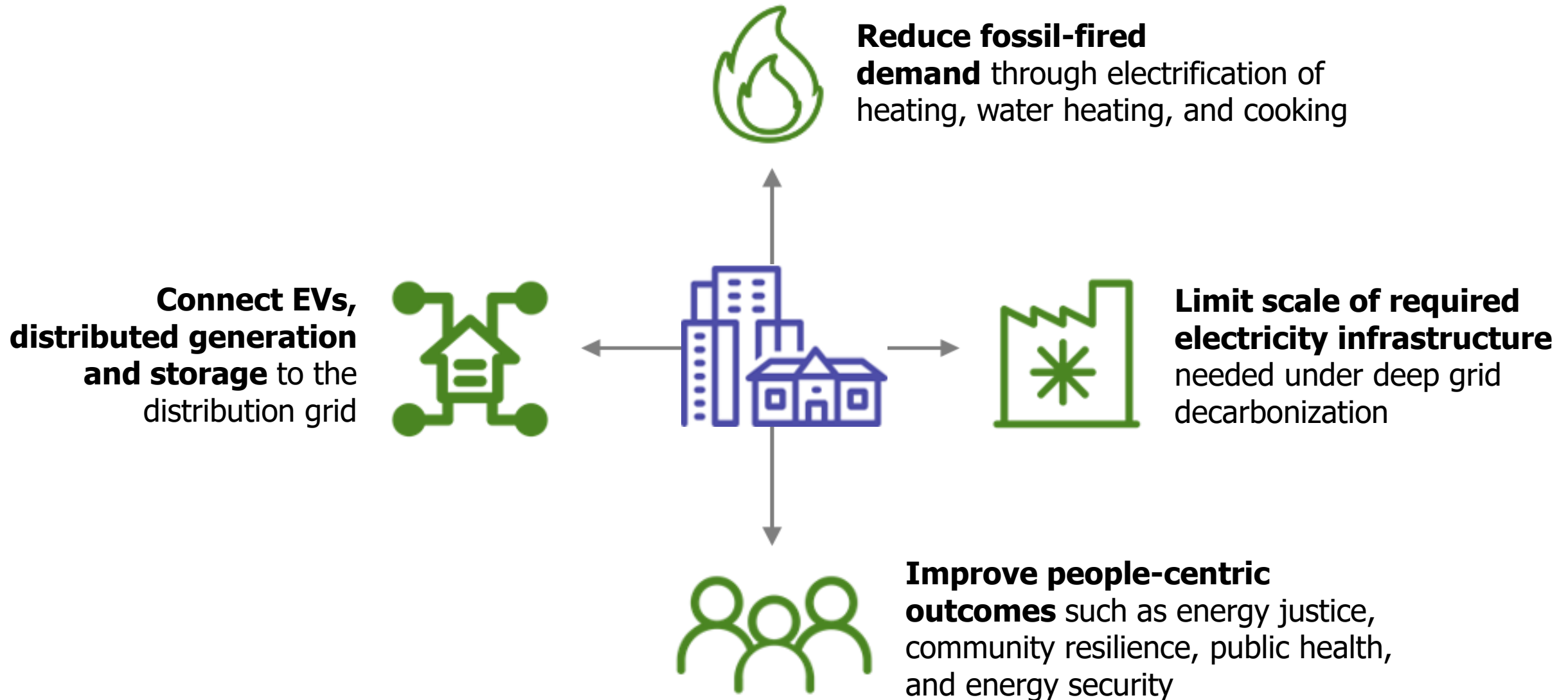


Building heating and air conditioning drive peak demand—and therefore grid infrastructure costs



As heating electrification accelerates, peak demand from buildings could double or triple in some regions

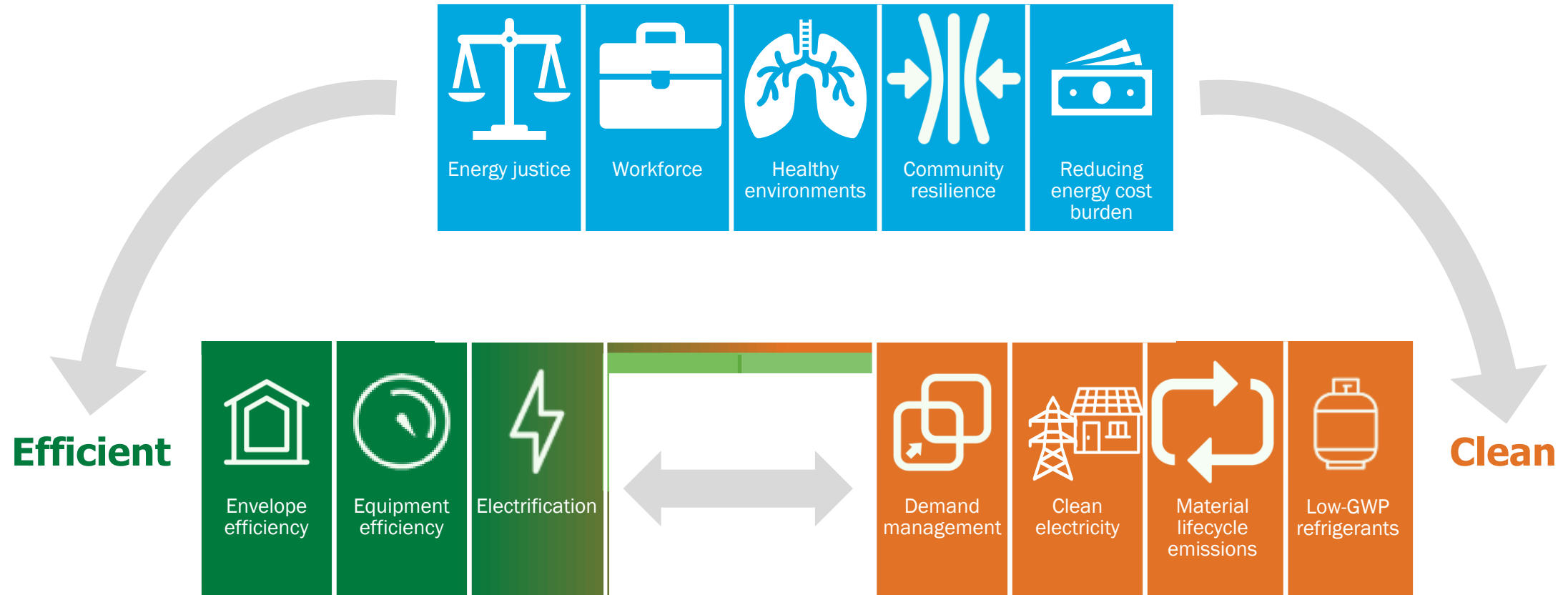
# Buildings are central to multiple decarbonization pillars



# People-centered objectives drive efficient and clean solutions

## People-centered

*Healthy, comfortable, and resilient buildings for living and working are foundational to communities that underpin the human experience*



*Efficiency helps us reduce waste and save money in healthy buildings*

*Decarbonization makes healthy, efficient buildings better for the environment and enhances societal good*

# Key technology solutions and federal levers

## Technology Solutions



### **High performance equipment and envelopes**

Persistent demand reduction, lower energy burden

### **Heat pump heat/WH and induction cooking**

Clean electric service with more efficient equipment

### **Grid edge flexibility and controls**

Reduce costs, coordinate DERs, provide grid services

### **Sustainable building materials**

Lower life cycle emissions outside operation phase

### **Low global warming potential refrigerants**

Minimize added emissions from refrigerant leakage

## Federal Levers



### **Research and innovation**

RD&D for technology performance and cost reduction

### **Investments and financing**

Accelerate deployment scale-up

### **Policy and regulation**

Codes, standards, and regulation to lock-in savings

### **Data, tools, education, and training**

Guide decisions by consumers; build workforce; educate consumers and installers

### **Stakeholder engagement and partnerships**

Ensure community co-creation; accelerate investment and knowledge sharing

# Federal support for state and local action is critical



## Federal agency support for state and local governments:

- Provide guidelines and technical assistance for BIL/IRA programs
- Technical assistance supporting adoption and enforcement of standards and building codes
- Disseminate solutions and best practices
- Create datasets and tools to facilitate decision making
- Recognize leading communities through prizes and designation programs
- Provide resources for under-staffed state regulators and energy offices
- Support NASEO/NARUC task forces and committees

## Key state and local actions:

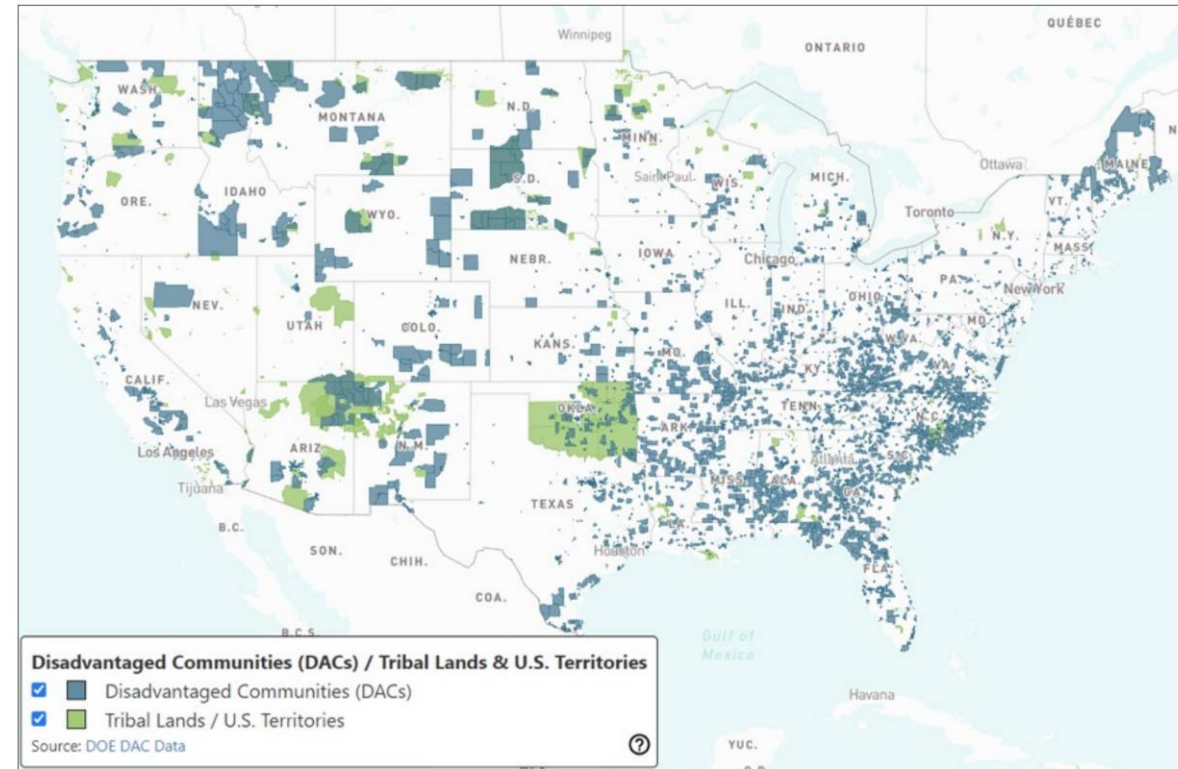
- Deploy BIL/IRA programs
- Enable and deploy financing (green banks, tariff on-bill, PACE, EaaS)
- Utility rate reform
- Building performance standards
- Clean heat and energy efficiency resource standards for utilities
- State-level appliance standards
- Building codes (electric-ready, zero-carbon lifecycle, etc.)
- Zoning reform

# Prioritize equity – Beyond Justice40



Ensure that **40%** of the benefits of federal building decarbonization investments flow to disadvantaged communities

- Prioritization of energy equity and justice goes much deeper than “40% of benefits”
  - No chance of success without prioritizing underserved and overburdened communities
  - Trickle-up instead of trickle-down R&D
- Targeted sub-goal metrics could include
  - Reduce average energy burden for low-to-moderate income households to below 6%
  - Reduce the number of customer meter disconnects by 20%



<https://www.energy.gov/diversity/justice40-initiative>



# Prioritize equity, affordability, and resilience

*Deploying low-cost building decarbonization solutions with a focus on underserved communities will reduce energy burdens and increase the resilience of the building stock*



## KEY ISSUES

### Historical inequities in the distribution of benefits

Technology development and deployment has typically benefitted wealthier building owners who can afford higher upfront investments

### Consumer energy bills are at historic highs

Energy prices have soared and 1 in 5 households are behind on energy bill payments; under these conditions, investing in efficiency is rarely an option

### Increasing challenges to building operations

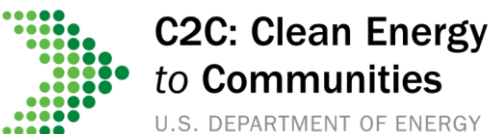
Electrifying buildings could make it more difficult to operate critical loads on a battery or generator; such challenges are magnified by climate risks and grid reliability issues



## EXAMPLE INITIATIVES



### Buildings UP Prize



### Affordable Clean Homes Earthshot





# Increase building energy efficiency

*Building energy efficiency is critical for ensuring affordable, healthy, comfortable, and resilient indoor environments for occupants while reducing overall energy demand*



## KEY ISSUES

### Building stock turns over slowly

76% and 52% of the current residential and commercial building stock is expected to still exist in 2050,<sup>1</sup> respectively

### Building envelopes are rarely renovated

HVAC is 51% of site energy use<sup>2,3</sup> and drives grid size<sup>4</sup> but the main drivers of HVAC demand—envelope and ventilation<sup>5</sup>—are not regularly renovated<sup>6</sup>

### Renovations are invasive and costly

Deeper envelope retrofits often require resident displacement and expensive on-site labor and are not integrated across components



## EXAMPLE INITIATIVES



### Advanced Building Construction Initiative



## Weatherization Assistance Program



### TA for State/Local Building Performance Standards

# ⚡ Accelerate onsite emissions reductions

*Building electrification is widely seen as the most viable path to decarbonize the majority of onsite fossil emissions, 90% of which are attributed to space and water heating*



## KEY ISSUES

### Insufficient electrical capacity

Switching equipment to electric may require expensive electrical infrastructure and service upgrades for consumers

### Lower heating efficiency in cold conditions

Potential need for low-efficiency resistance backup for air-source heat pumps to meet peak heating loads, significantly increasing demand on the electric grid

### High upfront and energy costs

Electric equipment often costs more than gas alternatives and may lead to higher consumer energy costs in some cases

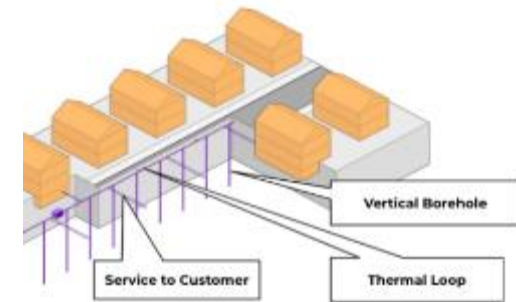


## EXAMPLE INITIATIVES



### R&D for 120V Heat Pumps and Appliances

### Cold Climate Heat Pump Challenge



### Networked Geothermal Heat Pumps

# Transform the grid edge at buildings

*Demand-side management through building energy efficiency and demand flexibility can reduce the cost and scale of grid transformation to meet decarbonization goals*



## KEY ISSUES

### Distribution system challenges

New behind-the-meter loads from heating and transport electrification will strain existing grid distribution infrastructure without effective load management

### Lack of distributed resource integration

Demand management measures are not typically coordinated with other distributed energy resources such as on-site PV, EVs, and batteries

### Lack of valuation and incentives

Demand-side measures are often excluded or undervalued in power markets and stronger regulatory/economic incentives are needed to increase demand flexibility deployment



## EXAMPLE INITIATIVES



## Connected Communities

