U.S. DEPARTMENT of ENERGY | Office of Energy Efficiency and Renewable Energy

U.S. Department of Energy Priorities and Opportunities for Technology Innovation in Buildings and Industry

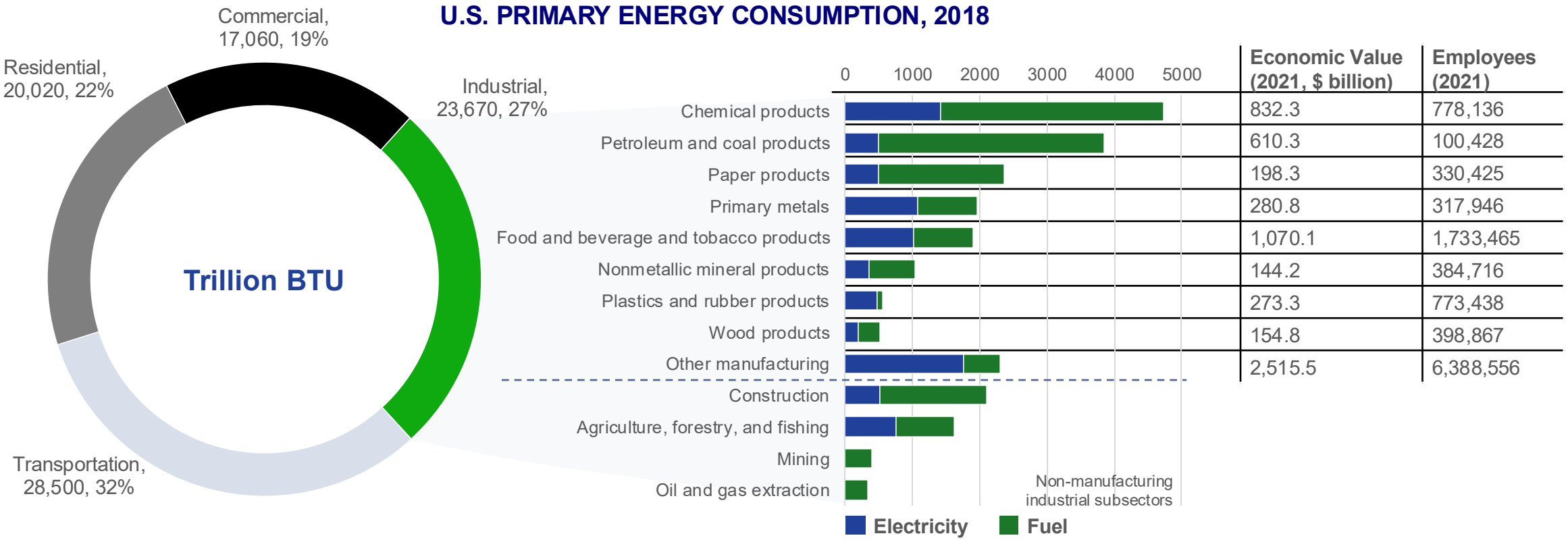
NASEO National Buildings Summit
September 8, 2025

U.S. DEPARTMENT of ENERGY | Office of Energy Efficiency and Renewable Energy

Industrial Technologies Office

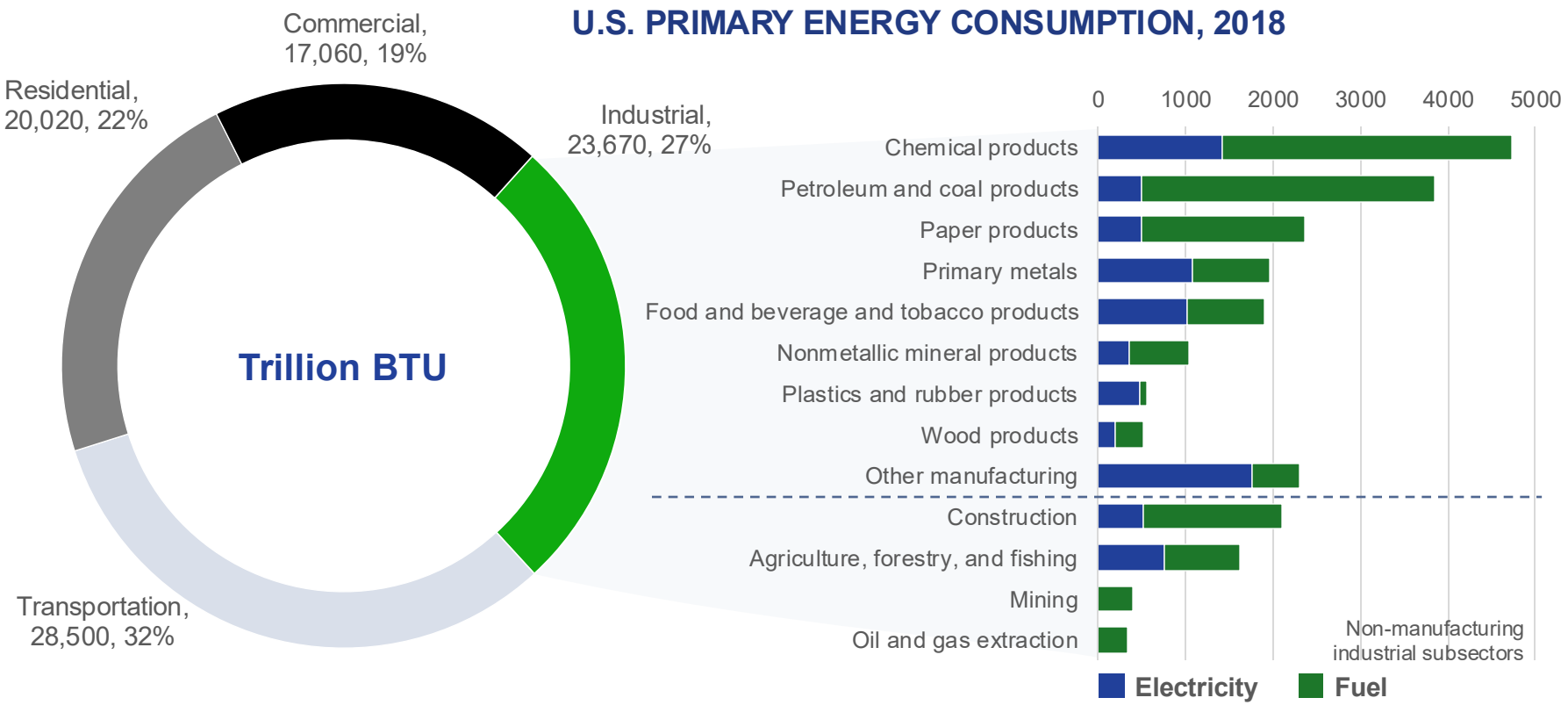
Dr. Avi Shultz, Director of the
Industrial Technologies Office

U.S. Industrial Sector: Energy



	Economic Value (2021, $ billion)	Employees (2021)
Chemical products	832.3	778,136
Petroleum and coal products	610.3	100,428
Paper products	198.3	330,425
Primary metals	280.8	317,946
Food and beverage and tobacco products	1,070.1	1,733,465
Nonmetallic mineral products	144.2	384,716
Plastics and rubber products	273.3	773,438
Wood products	154.8	398,867
Other manufacturing	2,515.5	6,388,556

U.S. Industrial Sector: Energy



CONTRIBUTES

$4.8 trillion to the U.S. economy annually [1]

CREATES

21.6 million jobs [2]

BOLSTERS

U.S. competitiveness in global markets

1. *Interactive Access to Industry Economic Accounts Data,* Bureau of Economic Analysis (2023).
2. *Goods-Producing Industries,* Bureau of Labor Statistics (2023).

Industrial Technologies Office

Mission: Accelerate the innovation and adoption of cost-effective technologies that position American industry to lead on the competitive stage in evolving domestic and global markets.

Priorities:

- Ensure energy abundance through **industrial efficiency**.
- Modernize America's industrial infrastructure to **strengthen national security** and **compete globally**.
- Fortify **grid reliability** and **security** through industrial innovation.
- Unlock industrial **energy and cost savings**, **generate American jobs**, **and improve the lives of Americans**.

Research & Development Strategy

Energy-Intensive Industries

Cross-Sector Technologies

Thermal Processes & Systems

On-site Fuels, Feedstocks, & Energy Sources

Emerging Efficiency

Water & Wastewater Treatment

Technical Assistance & Workforce Development

Public /private partnerships

to help manufacturers and industrial organizations set and achieve long-term energy intensity reduction goals

Education and Training

for the current and future manufacturing workforce

No-cost tools and resources

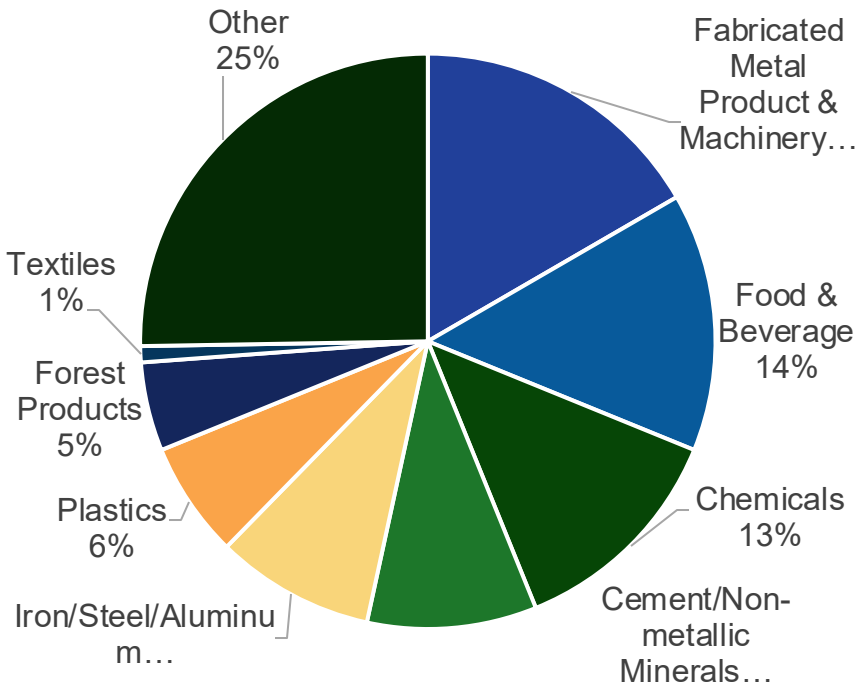
for manufacturers to improve energy efficiency and competitiveness

End-user support

stakeholder engagement, and technical services for the industrial sector

843
Manufacturer Partners

Manufacturer Partners by Sector



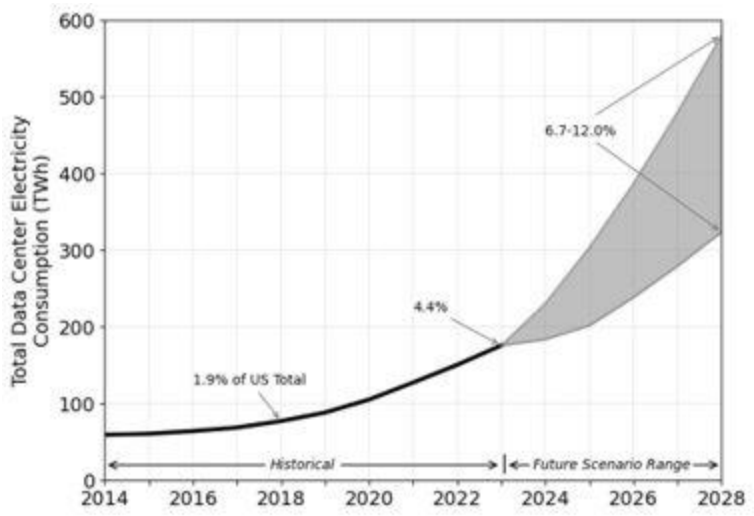
$14.1B
saved by mfrs since 2009

2.2QBTU
energy saved by mfrs since 2009

> $250M
potential energy cost savings identified in FY24

Growing Industrial Energy Demand: U.S. Data Centers

Results from ITO-Funded LBNL Study



ELECTRICITY USE ESTIMATES:

- Data centers consumed about 4.4% of total U.S. electricity in 2023
- Data center energy consumption is expected to consume approximately 6.7 to 12% of total U.S. electricity by 2028
- TOTAL US Industrial electricity demand projected by EIA to increase between 3% and 38% by 2050

DATA CENTER ELECTRICITY USE OVER TIME:

- **2014**: 58 TWh
- **2023**: 176 TWh
- **2028**: estimate: 325 to 580 TWh
- TOTAL 2022 US Industrial Sector demand:
- ~1025 TWh

ITO Activities Supporting Data Center Development

Cross-Sector Technology R&D

- **Thermal Management:** immersion cooling systems; waste heat recovery and utilization.
- **Energy Systems Integration:** combined cooling, heating, and power (CCHP); energy storage systems

Center of Expertise for Energy Efficiency in Data Centers (@ LBNL)

- Market analysis, tools, training, and technical expertise in efficient energy management

Onsite Energy Program

- Technical assistance, market analysis, and best practices to help industrial facilities, data centers, and other large energy users increase the adoption of onsite energy technologies

Data Centers: The Present Moment

The AI Action Plan was developed to maintain U.S. leadership in AI innovation—including through the rapid development of data center infrastructure—a key national and economic security priority that **cannot be advanced by individual private companies on their own.**

Obstacles include:

- Energy generation and transmission bottlenecks.
- Lack of grid interconnectivity and onsite energy infrastructure.
- Negative impacts to local communities from new energy deployment.
- Technology development plans that differ between subsectors of the industry, making rapid, holistic technological advancement challenging.

Industrial Technologies Office (ITO) Data Center Activities

Industry Engagement

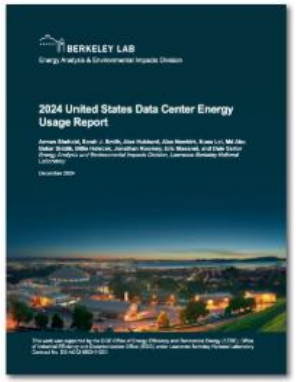
Through the **Better Buildings, Better Plants** program, ITO partners with data centers that seek to make their operations more energy efficient. Through the **Onsite Energy** program, ITO performs technology screenings for data centers that are considering deploying onsite energy generation.

Technology R&D

Through the **ITO Lab Call (2025)**, the office will establish capabilities to accelerate development of efficient thermal management systems for data centers. ITO also provides funding for R&D hubs, institutes, and programs such as the **National Alliance for Water Innovation (NAWI)**, which considers innovations in industrial water use, relevant for data centers.

Collaboration with Lawrence Berkeley National Lab (LBNL)

ITO's collaboration with the Center of Expertise for Energy Efficiency in Data Centers at LBNL resulted in the **US Data Center Energy Usage Report (Dec 2024)**. Data center energy consumption is expected to consume approximately 6.7 to 12% of total U.S. electricity by 2028.



LBNL hosted an interactive **Data Center Load Flexibility Workshop (Nov 2024)** with ITO and industry stakeholders. Some key takeaways:

- Viable load flexibility strategies include shifting non-critical compute tasks to align with grid needs, as well as leveraging **onsite energy generation and thermal storage** to enhance grid reliability
- Clear policies, **meaningful incentives** that speed up project approvals, and standardized protocols are needed to encourage the adoption of flexible practices

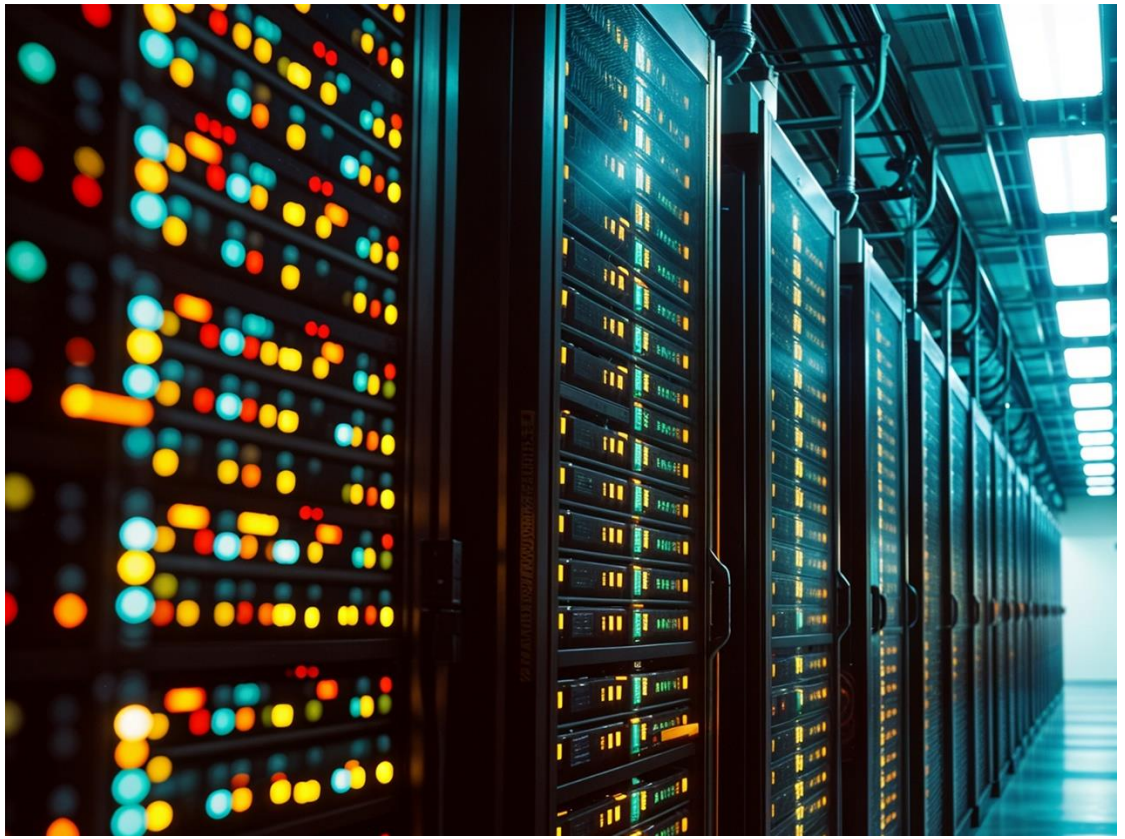
Public-private partnerships and regional planning were deemed essential to align data center growth with grid capacity

Continued Data Center Support

Industry leaders have **proactively sought to engage with ITO** after hearing us speak at external engagements.

We are working directly with data center partners to hear from industry and use that feedback to develop:

1. Resources for energy management and generation.
2. R&D roadmaps for our office.



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Building Technologies Office

Hayes Jones, Deputy Director

Buildings by Numbers

90%

Proportion of people's time spent in buildings.

75%

Proportion of U.S. electricity consumed by buildings.

40%

Proportion of total U.S. energy consumed by buildings.

$374 billion

Amount of money spent annually on building energy costs.

75%

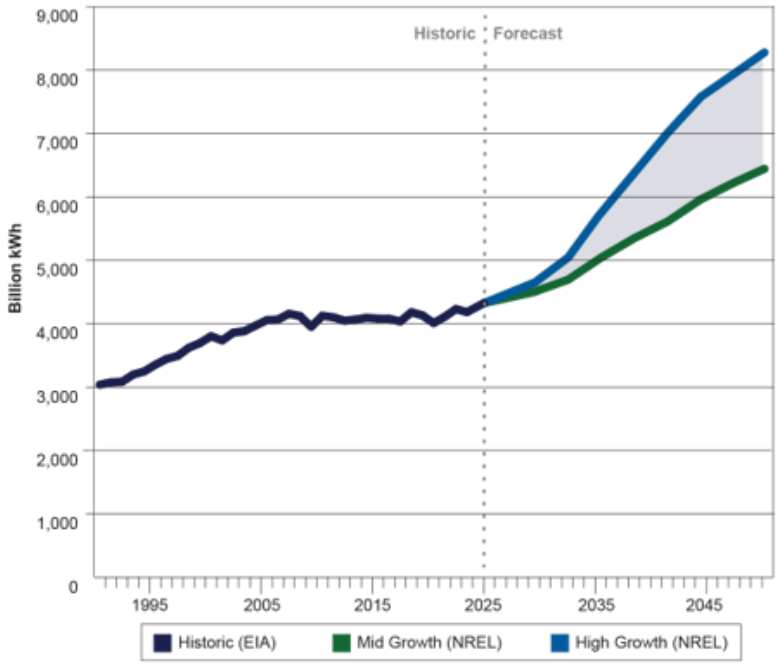
Proportion of U.S. GDP from commercial and public companies operating in buildings.

2.3 million

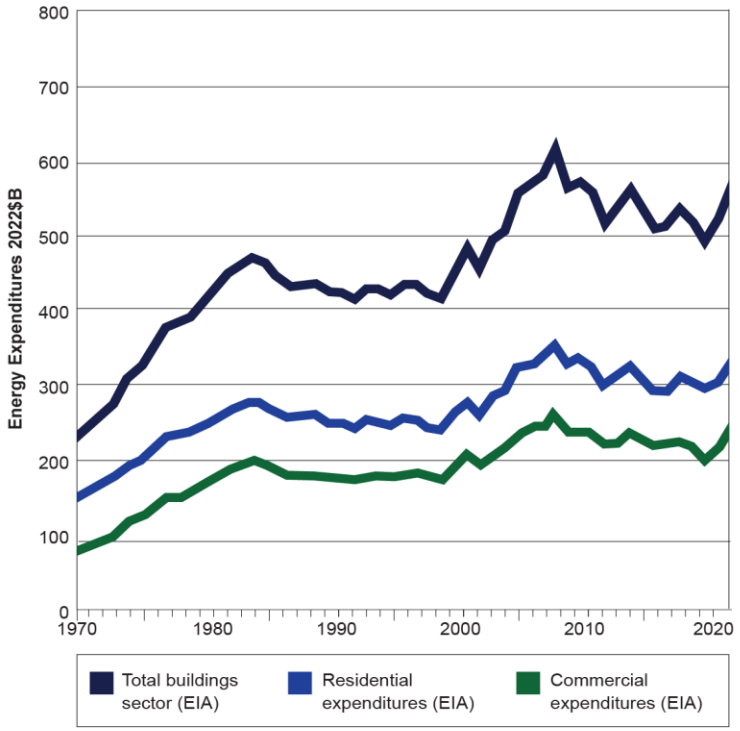
Number of people already employed in jobs related to energy efficiency.

Context

INCREASING ELECTRICITY DEMAND



RISING ENERGY EXPENDITURES



HOUSEHOLD ENERGY COSTS

- 50 million U.S. households were unable to pay an energy bill in full in year ending August 2024.
- Energy costs prevent 20 million U.S. households from using the energy services they would like to use.
  - Shelter consumes 18% of household income and rising.
  - Energy bills are included in shelter costs and consume 5% of total household income.

The Need for Government Funding for Buildings R&D

Buildings are a fragmented market leading to underfunding R&D.

The industry invests only 0.3% of revenues in R&D compared to the U.S. average of 3%, and 10%+ for leading industries such as tech and pharma.

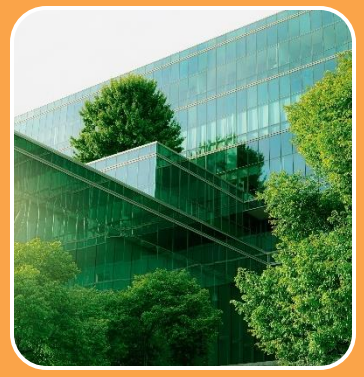
BTO Priorities

Fund research and development activities to accelerate the validation and adoption of technologies that enable affordable and reliable energy choices for Americans.

Affordability

- Advance energy efficiency to lower operational costs for homes and businesses.
- Reduce costs to construct new buildings.
- Increase consumer choice.

Reliability and Security

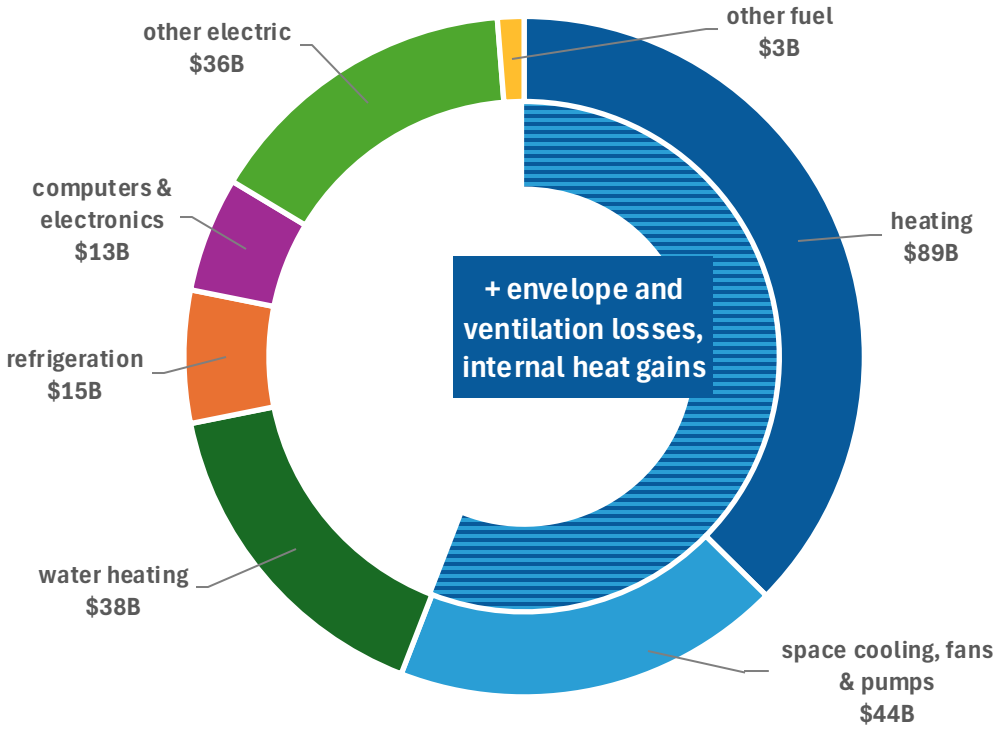


- Leverage all energy sources.
- Improve demand flexibility that mitigates infrastructure needs for load growth.
- Ensure U.S. competitiveness.

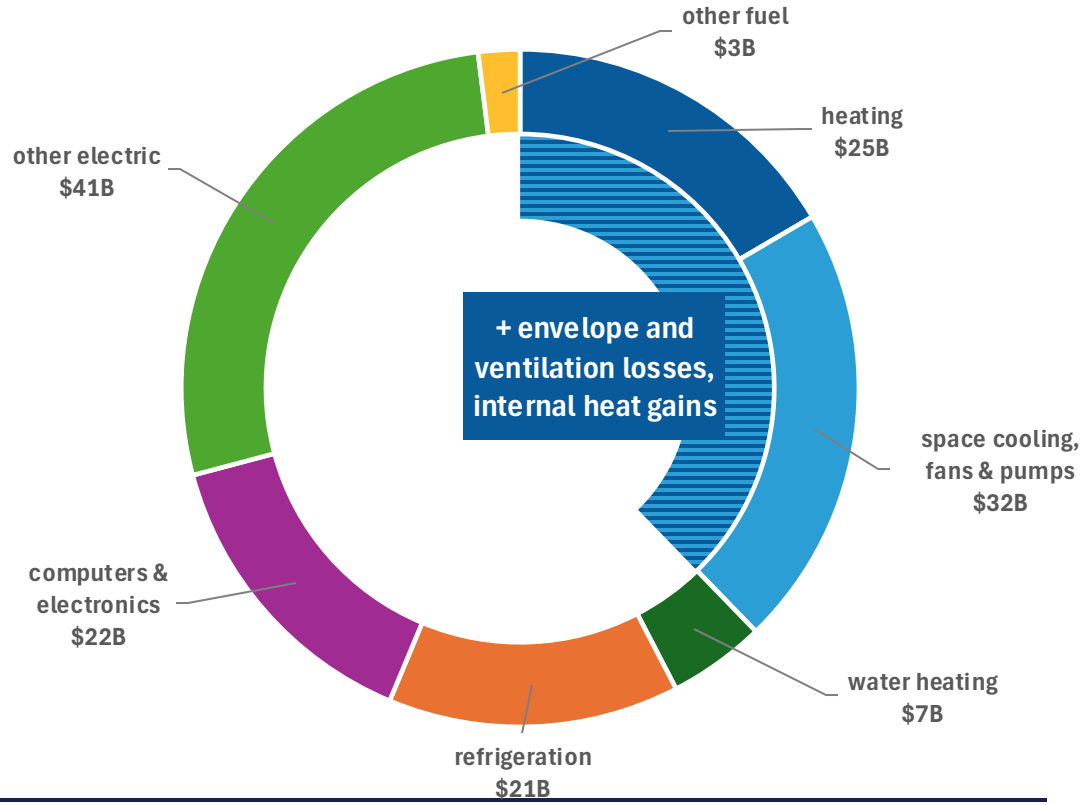
Advancing Affordability

2024 Energy Cost of U.S. Buildings, $389 billion

Residential, $238B (61% of total)



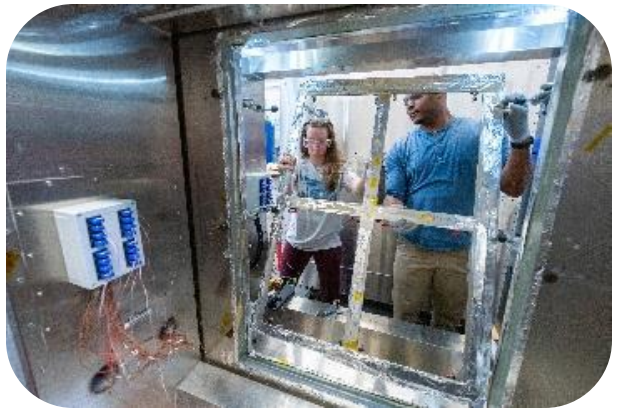
Commercial, $151B (39% of total)



Source: ResStock and ComStock, circa 2023

BTO Envelope R&D Solutions

Problem: Envelope energy waste accounts for 23% of energy use in residential buildings. Existing buildings are poorly insulated, with prevalent moisture issues. Industry finds that existing solutions have **high costs, long implementation times, and disruptive practices**.



Secondary glazing systems: Designed for commercial building retrofits, secondary glazing systems can be installed without replacing existing glass or frames—**reducing installation costs with less disruption**. Durability testing at the National Renewable Energy Laboratory validates system performance.

AI-enhanced thermal diagnostics: Hearth Labs, Lawrence Berkeley National Laboratory, and GTI are combining **advanced LiDAR technology** (for 3D geometry) and **thermal imaging** (for temperature differences) to develop a cost-effective diagnostic tool to identify air leaks in commercial buildings.

BTO Thermal R&D Solutions

Problem: HVAC and water heating account for approximately 40% of energy use in buildings in the U.S.

Rooftop units: BTO is working with eight of the largest commercial HVAC manufacturers and partnering with dozens of large commercial end users to **develop and test new high-performance rooftop units in real-world settings**.

All prototypes are currently undergoing lab validation, to be followed by field validation. If deployed at scale, these next-generation RTUs could save American businesses and commercial entities **$5 billion on utility bills every year**.

Catalytic conversion: Oak Ridge National Laboratory is developing a “catalytic converter” for furnaces that eliminates 99.5% of corrosive condensates, which increases the life of the heat exchanger and avoids replacement of the venting in the home.

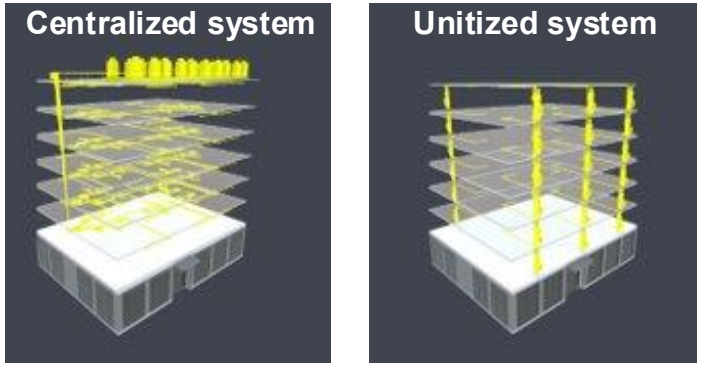
As a result, it can **reduce installation costs by $1,000+** and increase utility incentives.

BTO New Construction R&D Solutions

Problem: Reducing the cost of energy-efficient new construction to help homebuilders and developers deliver affordable, resilient and comfortable homes and buildings.

Modular home design: GTI Energy, Dvele Inc., and Oak Ridge National Lab seek to reduce the cost of modular homes through energy-focused design, factory automation, and an enhanced factory software platform.

New automated steel-framing machines increased automation in Dvele's manufacturing process, demonstrating a **46% improvement in construction efficiency** compared to wood-framing methods.



High-efficiency modular hotel design: Marriott and the National Renewable Energy Laboratory are collaborating to compress the first cost of modular hotels through energy and cost modeling for high efficiency unitized domestic hot water systems.

Results show **11% cost compression** compared to business as usual and **50% compression of construction timeline**.

DOE's Better Buildings & Better Plants

Enhancing State Insight, Engagement, and Technology Innovation

Better Buildings & Better Plants is a market leadership program for states, manufacturers, businesses, cities, and schools to further strengthen America's buildings and industrial sectors while advancing a more competitive, energy-secure future. The program delivers real-world, cost-effective solutions that lower energy bills and improve productivity, service, and quality through efficient, well-managed facilities.

Key Program Pillars

- Innovation and Emerging Technologies
- Market Leadership
- Better Information
- Workforce Development

Resources and Opportunities

- Technology Research Teams & Technical Assistance
- Recognition
- Solution Center
- Peer Collaboration
- Webinar Series

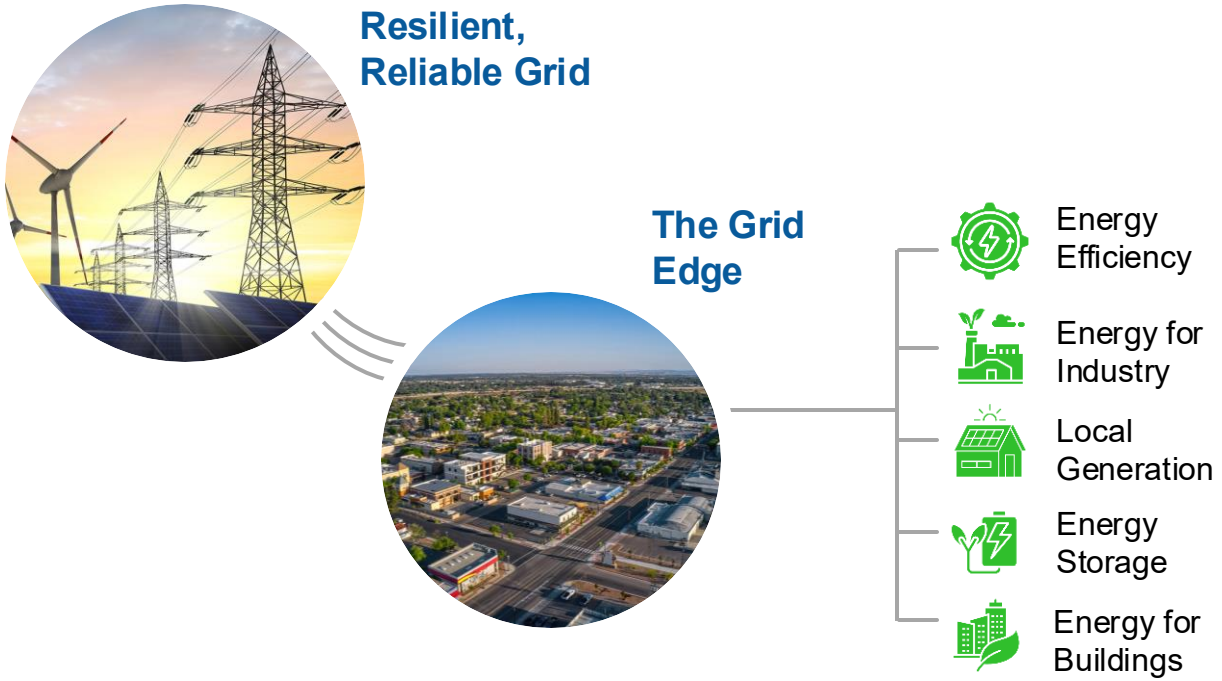
National Recognition and Leadership

- Summit Session: Massachusetts's Prioritization of Central Plant Efficiency Strategies
- Case Study: Maryland's Energy Saving Working Group Series
- Webinar Series: North Carolina's Energy Data Management

37 State Partners have engaged with the Initiative*

**This includes participants in Accelerators, Challenges, and other associated programs.*

Reliability and Security: Enabling New Load Growth on the Energy System



Connected Communities projects demonstrate innovative R&D with utilities to reduce grid demand, improve energy reliability, and right-size grid infrastructure.

- Rocky Mountain Power in Utah is working with residential developers, universities, and Salt Lake City to demonstrate demand flexibility **solutions linking systems, equipment, and end uses across a diverse set of buildings** to avoid infrastructure upgrades and offer greater resiliency. They have launched a PUC-approved Wattsmart® program leveraging results from BTO partnership.
- Edo, in partnership with Avista Utilities in Spokane, Washington, has achieved 2.25 MW of demand flexibility capacity as part of its goal to validate **solutions for scheduling and dispatching commercial building load**, rapidly identifying congestion at the substation and feeder levels, and developing a community with flexible load across a range of building types.

Panel discussions offer more insight

Energy Efficiency, Demand Flexibility, and the Grid: Opening Opportunities in the Era of Load Growth

Monday, 2:45 p.m.

Dr. Brian Walker
Emerging Technologies Program Manager, DOE Building Technologies Office

Expanding the Affordability Toolbox: Energy-based Approaches to Easing Housing and Economic Challenges

Tuesday, 3:00 p.m.

Gilly Plog
Home Energy Score, Energy Cost Estimator Tool, DOE Building Technologies Office

Thank You

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