Economic Impacts of Extreme Heat: **Energy**

FAS FEDERATION OF AMERICAN SCIENTISTS

As temperatures rise, the strain on energy infrastructure escalates, creating vulnerabilities for the **efficiency of energy generation, grid transmission, and home cooling**, which have **significant impacts on businesses, households, and critical services**. Without action, energy systems will face growing instability, infrastructure failures will persist, and utility burdens will persist. The combined effects of extreme heat cost our nation over $162 billion in 2024 – equivalent to nearly 1% of the U.S. GDP.

The federal government needs to prepare energy systems and the built environment through strategic investments **in energy infrastructure — across energy generation, transmission, and use**. Doing so includes **ensuring electric grids are prepared for extreme heat** by establishing an interagency **HeatSmart Grids Initiative** to assess the risk of energy system failures during extreme heat and the necessary emergency responses. Congress should **retain and expand home energy rebates, tax credits, and the Weatherization Assistance Program (WAP)** to enable deep retrofits that prepare homes against power outages and cut cooling costs, along with **extending the National Initiative to Advance Building Codes (NIABC)** to accelerate state and local adoption of code language for extreme heat adaptation.

Challenge & Opportunity: Grid Security

EXTREME HEAT REDUCES ENERGY GENERATION AND TRANSMISSION EFFICIENCY

During a heatwave, the energy grid faces not only surges in demand but also decreased energy production and reduced transmission efficiency. For instance, turbines can become up to 25% less efficient in high temperatures. Other energy sources are also impacted: solar power, for example, produces less electricity as temperatures rise because high heat slows the flow of electrical current. Additionally, transmission lines lose up to 5.8% of their capacity to carry electricity as temperatures increase, resulting in reliability issues such as rolling blackouts. These combined effects slow down the entire energy cycle, making it harder for the grid to meet growing demand and causing power disruptions.

RISING DEMAND AND GRID LOAD INCREASES THE THREAT OF POWER OUTAGES

Electric grids are under unprecedented strain as record-high temperatures drive up air conditioning use, increasing energy demand in the summer. Power generation and transmission are impeded when demand outpaces supply, causing communities and businesses to experience blackouts. According to data from the North American Electric Reliability Corporation (NERC), between 2024 and 2028, an alarming 300 million people across the United States could face power outages. Texas, California, the Southwest, New England, and much of the Midwest are among the states and regions most at risk of energy emergencies during extreme conditions, according to 2024 NERC data.

Data center build-out, driven by growing demand for artificial intelligence, cloud services, and big data analytics, further adds stress to the grid. Data centers are estimated to consume 9% of U.S. annual electricity generation by 2030. With up to 40% of data centers' total yearly energy consumption driven by cooling systems, peak demand during the hottest days of the year puts demand on the U.S. electric grid and increases power outage risk.

Power outages bear significant economic costs and put human lives at severe risk. To put this into perspective, a concurrent heat wave and blackout event in Phoenix, Arizona, could put 1 million residents at high risk of heat-related illness, with more than 50% of the city's population requiring medical care. As we saw with 2024's Hurricane Beryl, more than 2 million Texans lost power during a heatwave, resulting in up to $1.3 billion in damages to the electric infrastructure in the Houston area and significant public health and business impacts. **The nation must make strategic investments to ensure energy reliability and foster the resilience of electric grids to weather hazards like extreme heat**.

ADVANCING SOLUTIONS FOR ENERGY SYSTEMS AND GRID SECURITY

Investments in resilience pay dividends, with every federal dollar spent on resilience returning $6 in societal benefits. For example, the DOE Grid Resilience State and Tribal Formula Grants, established by the Bipartisan Infrastructure Law (BIL), have strengthened grid infrastructure, developed innovative technologies, and improved community resilience against extreme weather. It is essential that funds for this program, as well as other BIL and Inflation Reduction Act initiatives, continue to be disbursed.

To build heat resilience in communities across this nation, Congress must establish the **HeatSmart Grids Initiative** as a partnership between DOE, FEMA, HHS, the Federal Energy Regulatory Commission (FERC), NERC, and the Cybersecurity and Infrastructure Security Agency (CISA). This program should

- **(i) perform national audits of energy security and building-stock preparedness for outages,**
- **(ii) map energy resilience assets such as long-term energy storage and microgrids,**
- **(iii) leverage technologies for minimizing grid loads such as smart grids and virtual power plants, and**
- **(iv) coordinate protocols with FEMA's Community Lifelines and CISA's Critical Infrastructure for emergency response.**

This initiative will ensure electric grids are prepared for extreme heat, including the risk of energy system failures during extreme heat and the necessary emergency and public health responses.

Challenge and Opportunity: Increasing Household and Business Energy Costs

As temperatures rise, so do household and business energy bills to cover cooling costs. This escalation can be particularly challenging for low-income individuals, schools, and small businesses operating on thin margins. For businesses, especially small enterprises, power outages, equipment failures, and interruptions in the supply chain become more frequent and severe due to extreme weather, negatively affecting production and distribution. One in six U.S. households (21.2 million people) find themselves behind on their energy bills, which increases the risk of utility shut-offs. One in five households report reducing or forgoing food and medicine to pay their energy bills. Families, school districts, and business owners need active and passive cooling approaches to meet demands without increasing costs.

ADVANCING SOLUTIONS FOR BUSINESSES, HOUSEHOLDS, AND VITAL FACILITIES

Affordably cooled homes, businesses, and schools are crucial to sustaining our economy. To prepare the nation's housing and infrastructure for rising temperatures, the federal government should:

- **Expand the Weatherization Assistance Program** (WAP), **the Low-Income Home Energy Assistance Program**, **existing rebates and tax credits** (including HER, HEAR, 25C, 179D, 45L, Direct Pay) **to include passive cooling technology** such as cool walls, pavements, and roofs (H.R. 9894). Revise 25C to be refundable at purchase to increase accessibility to low-income households.

- **Authorize a Weatherization Readiness Program (H.R. 8721)** to address structural, plumbing, roofing, and electrical issues and environmental hazards with dwelling units to make them eligible for WAP.
- Direct the DOE to work with its WAP contractors to ensure **home energy audits consider passive cooling interventions**, such as cool walls and roofs, strategically placing trees to provide shading and high-efficiency windows.
- **Extend the National Initiative to Advance Building Codes (NIABC)** to include (i) the development of codes and metrics for sustainable and passive cooling, shade, materials selection, and thermal comfort and (ii) the identification of opportunities to accelerate state and local adoption of code language for extreme heat adaptation. Partner with the National Institute of Standards and Technology to create an Extreme Heat clearinghouse for model building codes.
- Authorize an extension to the **DOE Renew America's Schools Program** to continue funding **cost-saving, energy-efficient upgrades in K-12 schools**.
- **Provide supportive appropriations to heat-critical programs** at DOE, including: **the Affordable Home Energy Shot**, **State and Community Energy Programs (SCEP)**, **Office of Clean Energy Demonstrations (OCED)**, **Office of Energy Efficiency & Renewable Energy (DOE)**, and **the Home Energy Rebates program**

The Federation of American Scientists: Who We Are

At the Federation of American Scientists (FAS), we envision a world where the federal government deploys cutting-edge science, technology, ideas, and talent to solve and address the impacts of extreme heat. We bring expertise in embedding science, data, and technology into government decision-making and a strong network of subject matter experts in extreme heat, both inside and outside of government. Through our 2025 Heat Policy Agenda and broader policy library, FAS is positioned to help ensure that public policy meets the challenges of living with extreme heat.

CONSIDER FAS A RESOURCE FOR...

- Understanding evidence-based policy solutions
- Directing members and staff to relevant academic research
- Connecting with issue experts to develop solutions that can immediately address the impacts of extreme heat

We are tackling this crisis with initiative, creativity, experimentation, and innovation, serving as a resource on environmental health policy issues. Feel free to always reach out to us:

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