



# Overview: DOE Initiatives to Support Decarbonization

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**Angela Becker-Dippmann**  
Energy & Environment Directorate



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BUSINESS SENSITIVE



# Administration priorities are clear



THE WHITE HOUSE

- **2030** – 50-52% reduction from 2005 levels in economy-wide net greenhouse gas pollution
- **2035** – 100% carbon pollution-free power sector
- **2050** – net-zero emissions, economy-wide



# DOE program offices have realigned for decarbonization

## Goals and mission

### ▶ EERE MISSION

Our mission is to drive the research, development, demonstration and deployment of innovative technologies, systems, and practices that will put America on an irreversible path to:

- Achieve a carbon-free electricity sector by 2035; and
- Equitably transition America to net-zero greenhouse gas emissions economy-wide by no later than 2050

### ▶ KEYS TO ENSURE THE GREATEST IMPACT



Environmental and Energy Justice



Workforce Development



Diversity in STEM



State and Local Partnerships

### PRIORITIES

100% decarbonized electric grid by 2035

Decarbonize energy intensive industries


Decarbonize transportation across all modes

Reduce the carbon footprint of buildings

Enable a net-zero agricultural sector



# DOE has reorganized to span from science to deployment



Office of the Secretary  
**Jennifer Granholm**



Advanced Research Projects Agency – Energy (ARPA-E)  
**Jennifer Gerbi (acting)**




Environmental Management (EM)  
**Ike White**



Office of the Under Secretary for Science and Innovation (S4)  
**Geri Richmond**




Office of the Under Secretary for Infrastructure (S3)  
**Kathleen Hogan (acting)**



Energy Efficiency & Renewable Energy  
**Alejandro Moreno (acting)**




Nuclear Energy (NE)  
**Kathryn Huff**



Office of Clean Energy Demonstrations  
**Kelly Cummins (acting)**



Cybersecurity, Energy Security & Emergency Response (CESER)  
**Push Kumar**




EERE Renewable Power  
**Alejandro Moreno**




Office of Electricity  
**Gil Bindewald (acting)**




Office of Federal Energy Management Programs  
**Mary Sotos**



Indian Energy Policy & Programs (IE)  
**Wahleah Johns**



EERE Sustainable Transportation  
**Michael Berube**




Office of Science  
**Asmeret Asefaw Berhe**




Grid Deployment Office  
**Maria Robinson**



Loan Programs Office (LPO)  
**Jigar Shah**



EERE Energy Efficiency  
**Carolyn Snyder**



Fossil Energy & Carbon Management  
**Brad Crabtree**



Manufacturing & Energy Supply Chains  
**Dave Howell**



Office of State and Community Energy Programs  
**Anna Garcia**

# DOE budgets are growing, and are focused on deployments

	FY 19	FY20	FY 21	FY22
Energy Efficiency & Renewable Energy (EERE)	2,379	2,770	2,862	3,200
Office of Electricity Delivery and Energy Reliability (OE)	156	190	212	277
Cyber Security, Energy Security & Emergency Response (CESER)	120	156	156	186
Nuclear Energy (NE)	1,326	1,493	1,508	1,655
Fossil Energy & Carbon Management (FECM)	740	750	750	825
Environmental Management (EM)	6,024	6,255	6,426	6,710
ARPA-E	366	425	427	450

# New initiatives: Energy Earthshots

Energy Storage Grand Challenge

## Energy Secretary Granholm Announces Long Duration Storage Shot at American Public Power Association Conference



...reduce the cost of grid-scale **energy storage** by 90% for systems that deliver 10+ hours of duration within the decade.

Department of Energy

## Secretary Granholm Launches Hydrogen Energy Earthshot to Accelerate Breakthroughs Toward a Net-Zero Economy



...reduce the cost of clean **hydrogen** by 80% to \$1 per kilogram in one decade

Department of Energy

## Secretary Granholm Launches Carbon Negative Earthshots to Remove Gigatons of Carbon Pollution from the Air by 2050

NOVEMBER 5, 2021

Home » Secretary Granholm Launches Hydrogen Energy Earthshots to Accelerate Breakthroughs Toward a Net-Zero Economy

**First Energy Earthshot Aims to Slash Costs of Critical Clean Energy Technology**

WASHINGTON, D.C. — Secretary of Energy Jennifer M. Granholm announced today the U.S. Department of Energy's (DOE) new goal to remove gigatons of carbon dioxide (CO2) from the atmosphere and durably store it for less than \$100/ton of net CO2-equivalent. The "Carbon Negative Shot," the third target within DOE's Energy Earthshots Initiative, is the U.S. government's first major effort in carbon dioxide removal (CDR) and is an all-hands-on-deck call for innovation in the expanding field of CDR—a key facet of the plan to achieve net-zero emissions by 2050.

"By slashing the costs and accelerating the deployment of carbon dioxide removal — a crucial clean

Department of Energy

## Secretary Granholm Launches Carbon Negative Earthshots to Remove Gigatons of Carbon Pollution from the Air by 2050

NOVEMBER 5, 2021

Energy.gov » Secretary Granholm Launches Carbon Negative Earthshots to Remove Gigatons of Carbon Pollution from the Air by 2050

**New Target Aims to Dramatically Scale Up Responsible Carbon Dioxide Removal, Slash Costs of Critical Clean Energy Technology**

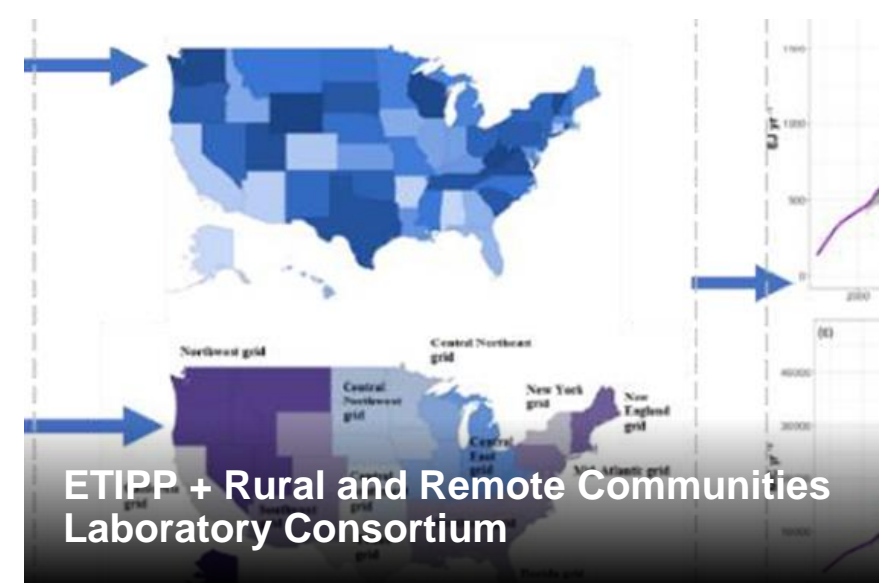
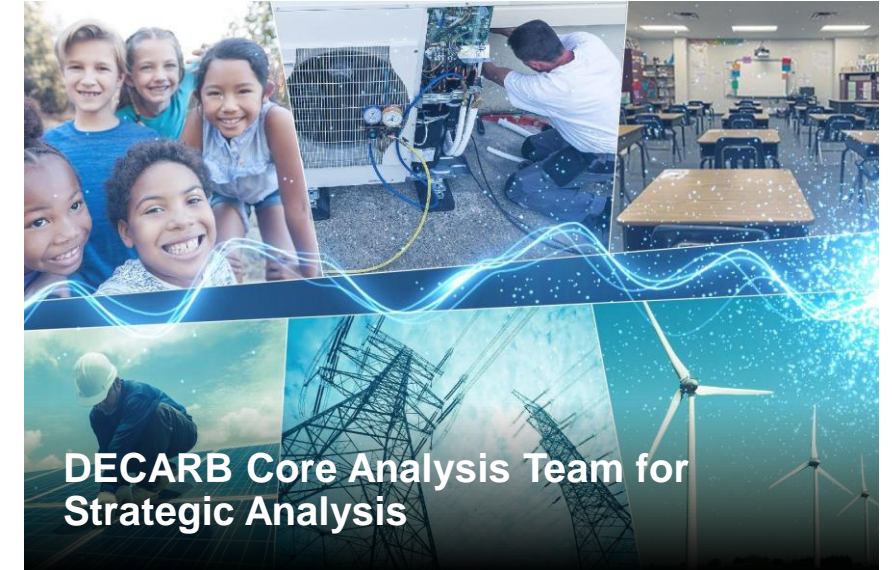
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... remove gigatons of **Carbon Dioxide** from the atmosphere and durably store it for less than \$100/ton

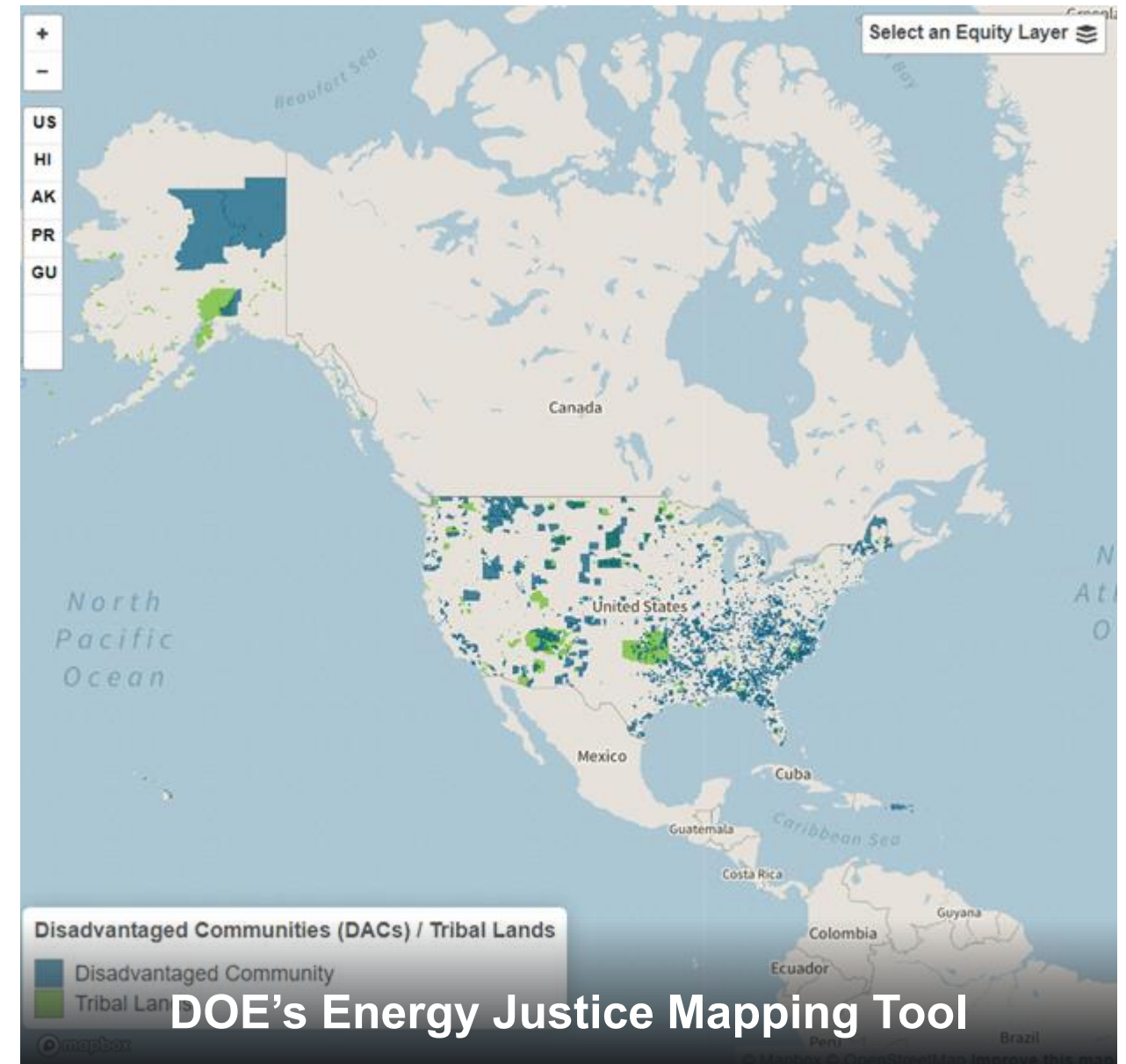
# Many new cross-cutting DOE initiatives



# Implementing Justice40

Office of Economic Impact and Diversity identified eight policy priorities to guide DOE's implementation of Justice40:

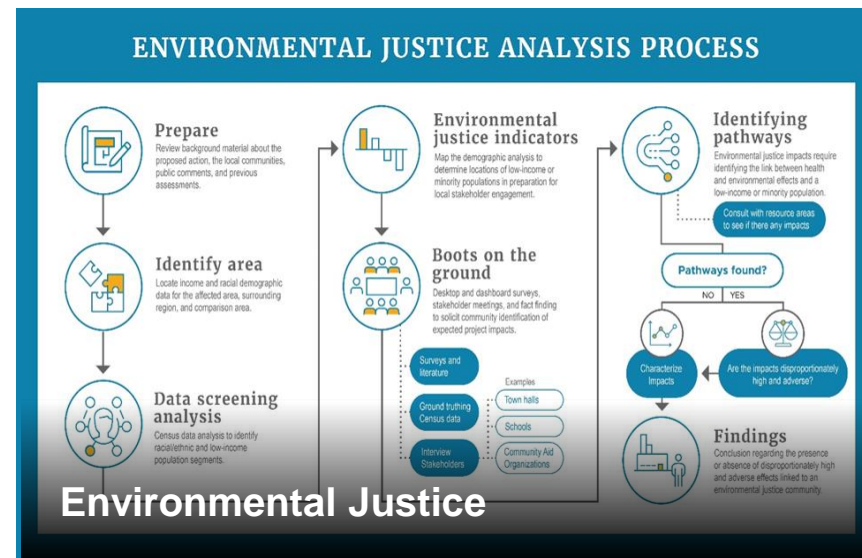
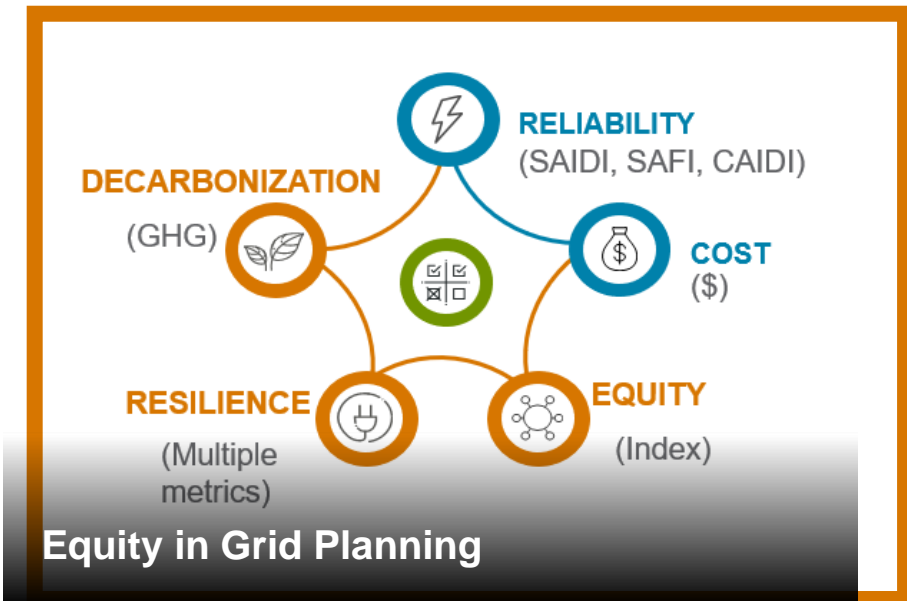
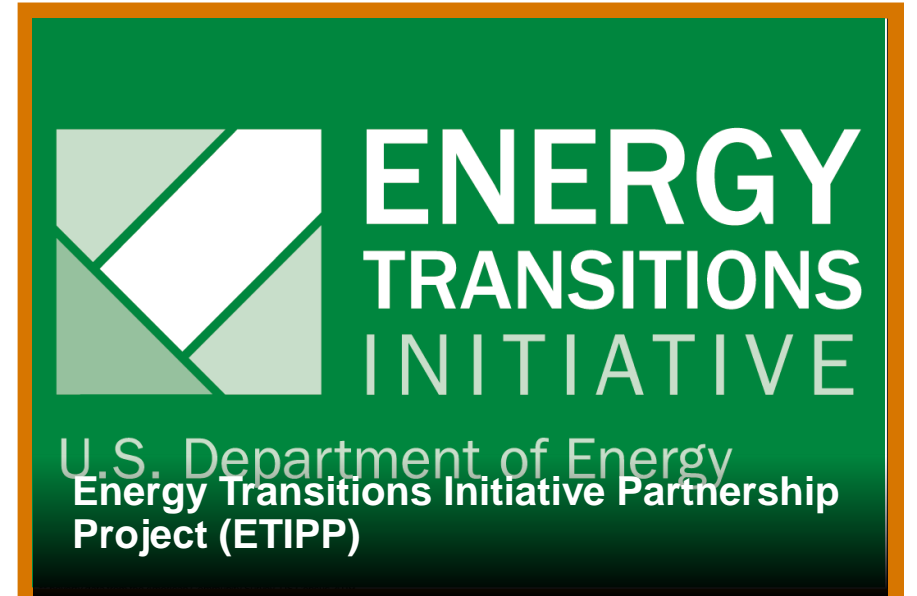
1. Decrease energy burden in disadvantaged communities (DACs).
2. Decrease environmental exposure and burdens for DACs.
3. Increase parity in clean energy technology (e.g., solar, storage) access and adoption in DACs.
4. Increase access to low-cost capital in DACs.
5. Increase clean energy enterprise creation and contracting (MBE/DBE) in DACs.
6. Increase clean energy jobs, job pipeline, and job training for individuals from DACs.
7. Increase energy resiliency in DACs.
8. Increase energy democracy in DACs.



**DOE's Energy Justice Mapping Tool**



# Community engagement and equity initiatives



# Office of Clean Energy Demonstrations: \$21.5b

*[T]he Office of Clean Energy Demonstrations...shall conduct administrative and project management responsibilities for the demonstration projects ...[and] shall consult and coordinate with technology-specific program offices to ensure alignment of technology goals and avoid unnecessary duplication*

## Office of Clean Energy Demonstrations

- Energy Storage Demonstration Pilot Grant Program: \$355m
- Long Duration Demonstration Initiative & Joint Program: \$150m
- Advanced Reactor Demonstration Program: \$2.477b
- Carbon Capture Large-Scale Pilot Projects: \$935m
- Carbon Capture Demonstration Projects: \$2.537b (6 projects: 2 each from coal, natural gas, industry)
- Industrial Emission Demonstration Projects: \$500m
- Clean Energy Demos on Current and Former Mine Land: \$500m
- Regional Clean Hydrogen Hubs: \$8b
- Grid Upgrade/Resilience Program: \$5b
- Energy Improvement for Rural/Remote Areas: \$1b

# Grid Deployment Office

Administering the [Building a Better Grid Initiative](#), GDO works to modernize and upgrade the nation's power sector, deploying cost-effective, cleaner, reliable, and more resilient electricity delivery technologies...

## Grid Deployment Office

- Grid Resilience Grants (\$5b)
  - \$2.5b State/Tribal
  - \$2.5b Federal
- Innovative Grid Resilience Program (\$5b)
- Transmission Facilitation Program (\$2.5b)
- Modeling & Assessing Energy Infrastructure Risk (\$50m)
- Expanded Smart Grid Investment Grants (\$3b)

*\*The Inflation Reduction Act includes additional transmission-related programs, including loans, grants to siting authorities and investment in interregional planning and offshore wind planning, modeling and analysis*

# BACK-UP SLIDES

# Grid Deployment Office- Smart Grid Investment Grants: \$3b (\$600m/year)

**Key features:** Re-ups the 2009 ARRA program, with a few new technologies explicitly included in scope--

- Data analytics that enable smart grid functions
- Investments to enable flexible loads from buildings
- Communications networks
- Advanced transmission technologies to enable additional transfer capacity
- Technologies to redirect power, reduce black-outs and enable power shut-off in face of extreme weather events.
- Definition of 'smart grid functions' expanded, including to include vehicle/grid integration, use of data analytics enabling autonomous control, etc.

## GDO- Grid Resilience Grants: \$5b (\$1b/year)

### Key features:

- Subdivided into grants to grid operators (\$500m/year); Formula grants to states and tribes (\$500m/year), that may be subsequently allocated to entities eligible for the first pot, within their respective jurisdictions. (Formula does not yet exist!)
- Grants must be additional to existing planned “hardening” efforts; **and** must reduce the risk of any power lines causing a wildfire; **or** increase the ability to reduce the likelihood and consequences of disruptive events, defined as events where the grid is disrupted, preventively shut off, or cannot operate safely due to extreme weather, wildfire, or a natural disaster.
- Small utility set-asides in each pot; 15 percent matching requirement for states/tribes; 5 percent available for technical assistance; 5 percent available for admin.

# GDO- Grid Resilience Grants: \$5b (\$1b/year; continued)

## Formula Considerations:

- Total population and area of a state or territory
- Probability of events based on number of disasters and disruptive events over past 10 years
- Some quantification of impact of those disasters since 2011
- Per capita expenditures made in public and private funds over past 10 years to mitigate potential for disruptive events

## Key Questions:

- PMAs eligible?
- How to determine potential battery storage usage?
- How to prevent all the money from being spent on vegetation management?

## GDO: Grid Innovation Program (\$5b)

### Key features:

- Competitive financial assistance to a single state, 2 or more states, public utility commissions, local governments and tribes
- Purpose: to collaborate and coordinate with electric sector owners and operators to
  - Demonstrate innovative approaches transmission, storage and distribution infrastructure to harden and enhance resiliency and reliability; and
  - Demonstrate enhanced regional grid resilience, implemented through states and public and rural electric cooperative entities on a cost-shared basis



# GDO- Program to Assess & Model Energy Infrastructure Risk (\$50m)

**Objective:** Increase functional preservation of electric grid, natural gas and oil operations in the face of natural and human-made threats and hazards

**Key Features:** Explicitly includes natural gas as well as oil networks within OE scope. Eligible activities:

- Develop capabilities to identify vulnerabilities and critical components that pose major risks to grid security if destroyed or impaired
- Provide modeling at the national level to predict impacts from natural or human-made events
- Add physical security to the cybersecurity maturity model
- Conduct exercises and assessments to identify and mitigate vulnerabilities to the electric grid, including providing mitigation recommendations
- Conduct research on hardening solutions for critical components of the electric grid
- Conduct research on mitigation and recovery solutions for critical components of the electric grid
- Provide technical assistance to States and other entities for standards and risk analysis

# Cyber Security Office: Cyber RD&D (\$250m, \$50m/year)

## A program in 5 parts

### 1. Develop advanced cyber applications and technologies:

- to identify and mitigate vulnerabilities, including interdependencies, weather and fuel supply; inverter-based systems; unpatched software and hardware; and
- to advance security of field devices and third-party control systems, including grid networks, market functions, specific grid elements including metering, demand response and storage; forensic analysis of infected systems, secure communications and application of in-line edge security solutions.

### 2. Leverage grid-architecture to assess risk to the energy sector (including communications and controls)

### 3. Conduct pilot demonstration projects for new approaches

### 4. Develop workforce curricula

### 5. Improve supply chain security, particularly for new digital components and power electronics.

# Cyber Security Office: Energy Sector Operational Support for Cyber resilience (\$50m)

## The Secretary may develop and carry out a program—

- A. to enhance and periodically test
  - (i) the emergency response capabilities of the Department; and
  - (ii) the coordination of the Department with other agencies, the National Laboratories, and private industry
- B. to expand cooperation of the Department with the intelligence community for energy sector-related threat collection and analysis
- C. to enhance the tools of the Department and E-ISAC for monitoring the status of the energy sector;
- D. to expand industry participation in ES-ISAC
- E. to provide technical assistance to small electric utilities for purposes of assessing and improving cyber maturity levels and addressing gaps identified in the assessment

# Cyber Security Office: Rural/Muni Cybersecurity Grant and TA Program (\$250m, \$50m/year)

## Key features:

- Public utilities, consortia of public utilities and small IOUs eligible
- Funds awarded via grants and cooperative agreements, pursuant to criteria or formulae developed by the Department
- Purpose is to deploy advanced cyber technologies for electric utilities, and increase participation in cyber risk information sharing programs
- Preferences given to utilities with limited resources, owning defense critical energy infrastructure or assets critical to the reliability of the bulk power system

# OCED: Energy Storage Demonstration Pilot Grant Program (\$355m)

## Key features:

- By September 2023, DOE directed to fund 3 energy storage demos
- At least one demonstration must advance long duration (10 to 100 hours) or seasonal energy storage concepts
- State energy offices, tribes, universities, utilities and storage companies are eligible entities
- Projects must demonstrate regional diversity, with broad set of possible use cases: critical infrastructure security; reliability, especially in rural areas; optimization of transmission and distribution systems for maintenance deferral; support fast charging; increase feasibility of microgrids)

# OCED: Long Duration Demonstration Initiative & Joint Program (\$150m)

## Key features:

- Establishes a Joint Program between DOE and DOD for purposes of advancing long-duration storage solutions
- DOE directed to leverage existing test bed infrastructure, DOE and DOD facilities—but allows for new infrastructure where appropriate
- Prioritizes regional diversity, and investing in a portfolio of projects of smaller and larger scales, different physical, environmental and market conditions

# OCED: Energy Improvement for Rural/Remote Areas (\$1b, \$200m/year)

## Key features:

- Rural/remote defined as city, town or unincorporated areas with no more than 10,000 inhabitants
- Purpose: to improve resilience, safety, reliability and availability of energy; and improve environmental protection from adverse impacts of energy generation.
- In consultation with DOI, DOE may provide federal financial assistance for purposes of:
  - overall cost-effectiveness of energy generation, transmission, or distribution systems
  - siting or upgrading transmission and distribution lines
  - reducing greenhouse gas emissions from energy generation by rural or remote areas;
  - providing or modernizing electric generation facilities
  - Developing microgrids
  - Increasing energy efficiency