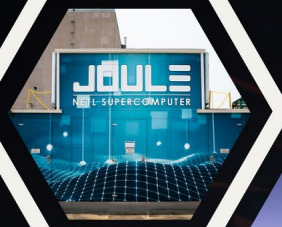




# SPARKING ECONOMIC REVITALIZATION AND ACCELERATING TECHNOLOGY INNOVATION FOR A DECARBONIZED ENERGY FUTURE

Brian J. Anderson, Ph.D.
Director, National Energy Technology Laboratory
Executive Director, Interagency Working Group on Coal and Power Plant Communities and Economic Revitalization

West Virginia Governor's Energy Summit
October 25, 2022




U.S. DEPARTMENT OF ENERGY | NETL NATIONAL ENERGY TECHNOLOGY LABORATORY

# Getting More Funds, to More Places, More Quickly

Upgrade Infrastructure

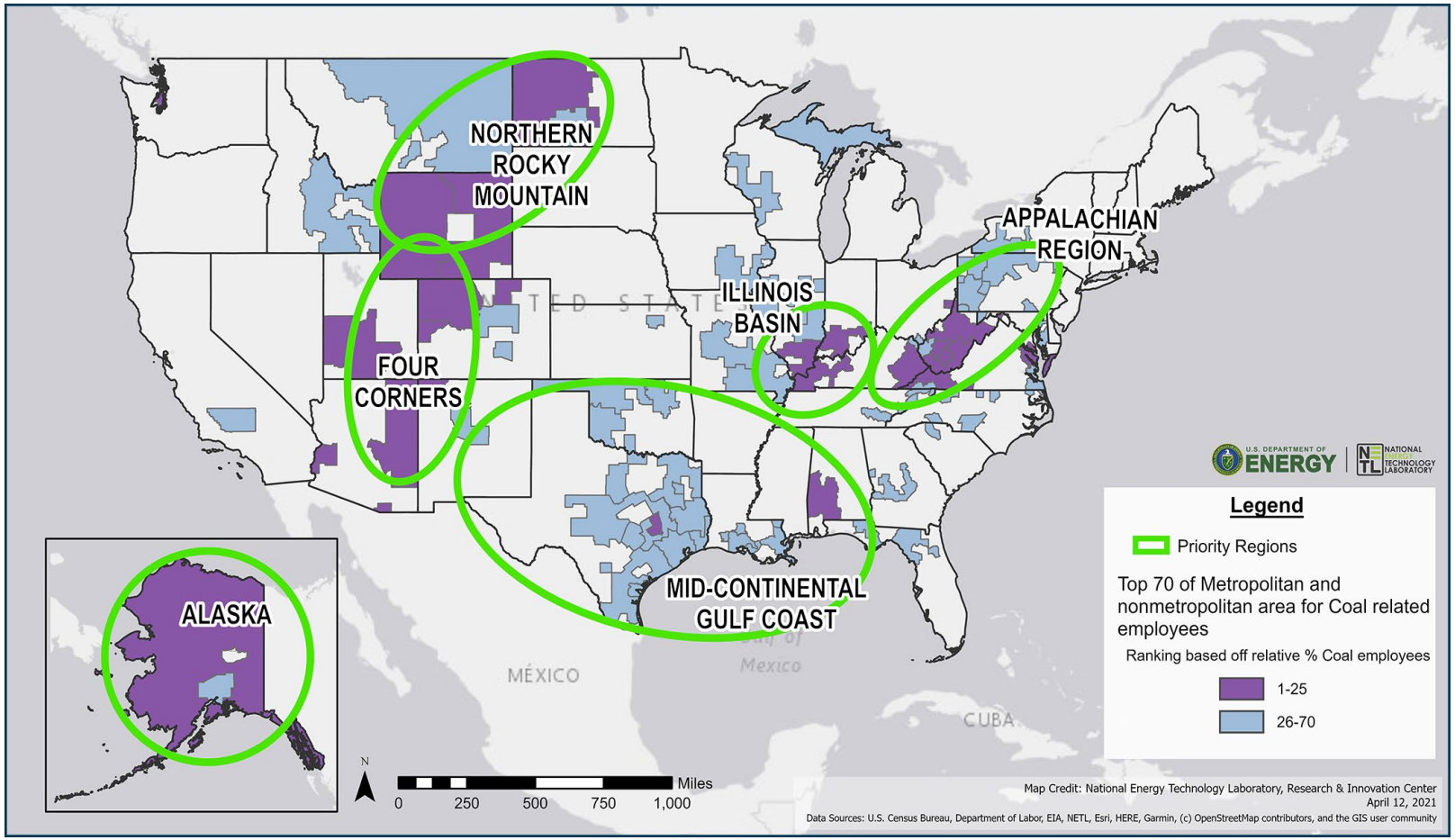
Clean Up Environmental Damage

Promote Entrepreneurship

Support Workforce Development

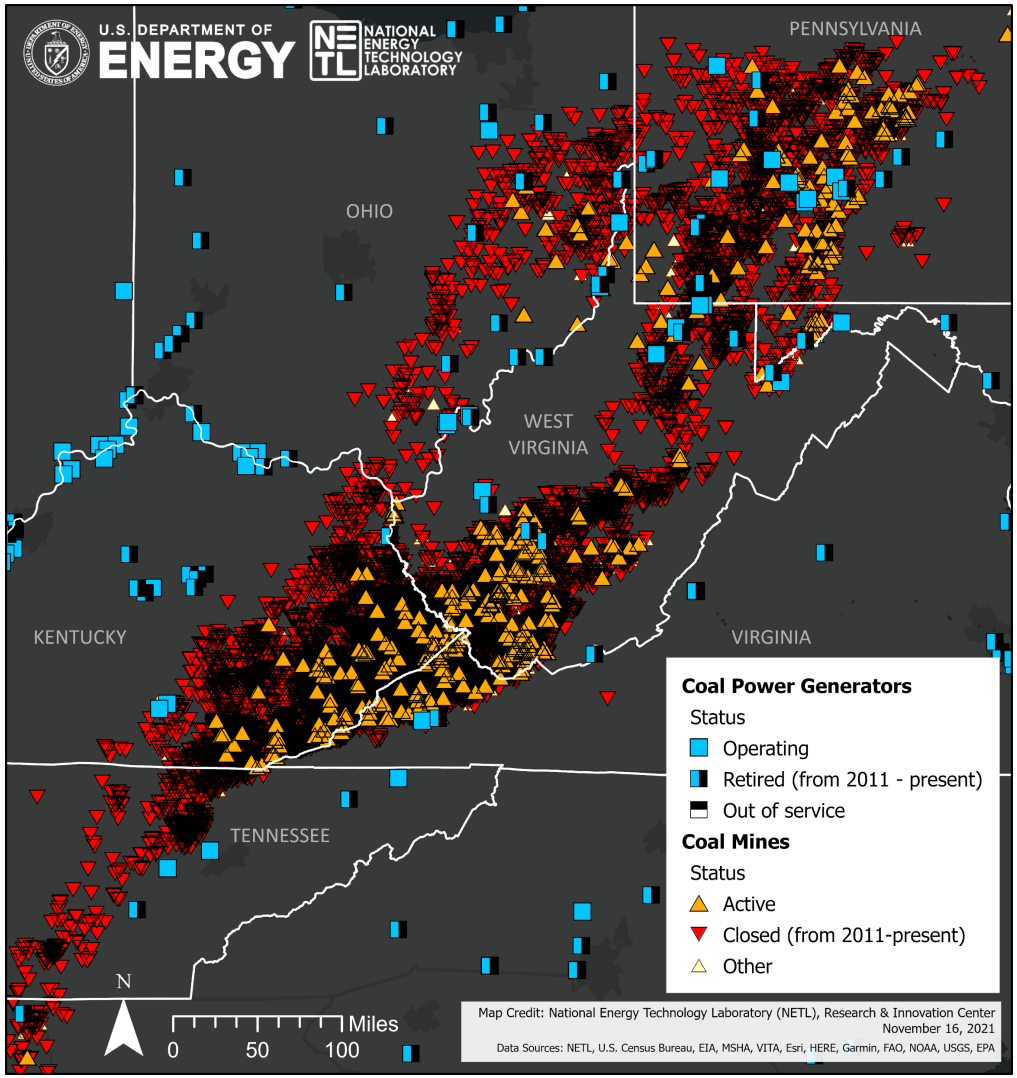
# Initial Report to the President

- Identified **25** priority Energy Communities
- Coal communities identified as immediately challenged
- **5 communities in West Virginia**

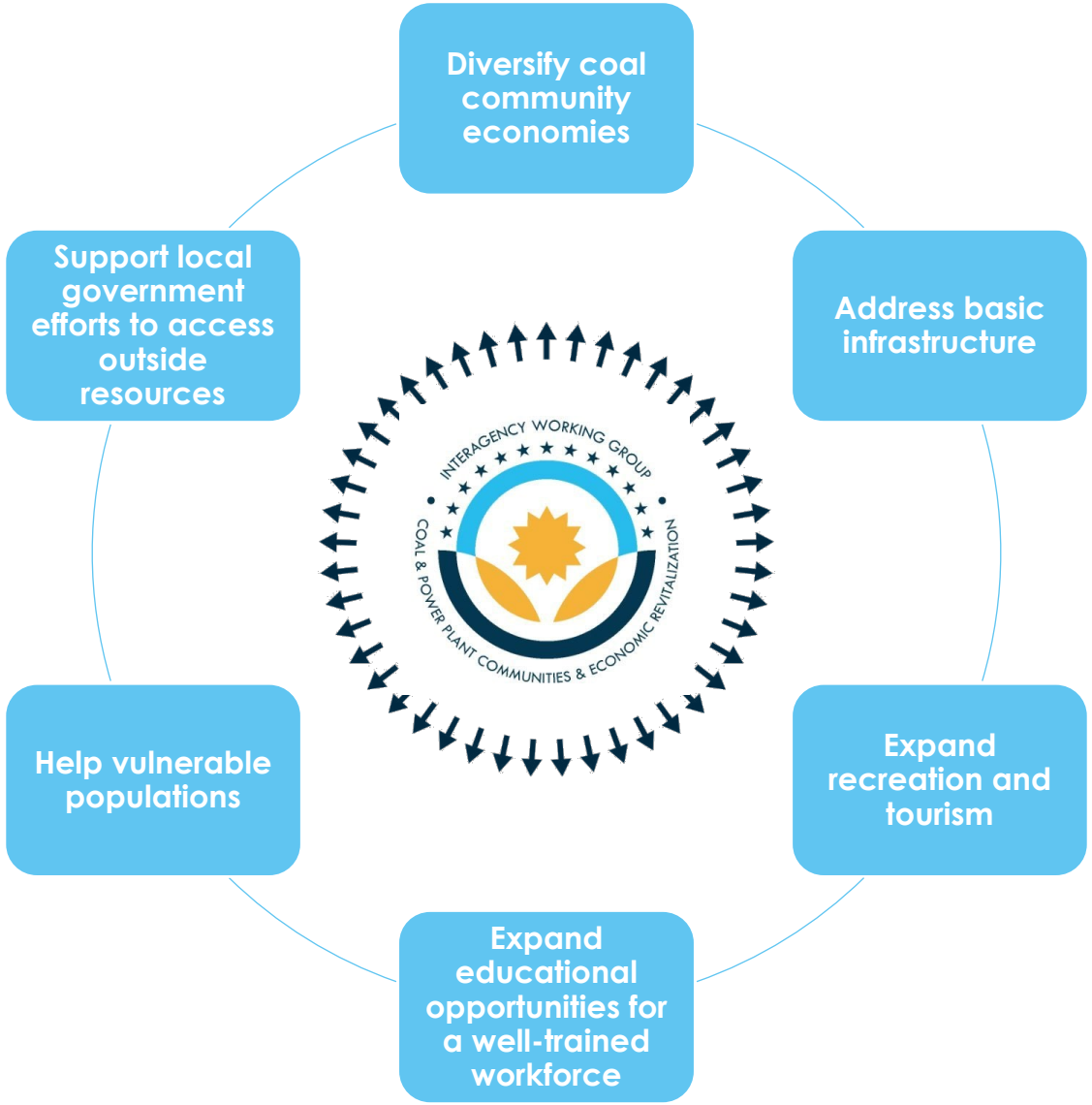


# Coal Mines & Power Plants in Central Appalachia

- Dense coal employment near mine and generator locations
- Large number of closures in last decade
- Wages and tax base critical to communities
- Local assets provide opportunities



# WV House of Delegates: Identified Needs for Coal Communities



# Funding Opportunities in the Clearinghouse


**$198B+**

**Value of Open/Planned Opportunities**


**188**

**Open/Planned Opportunities**

**12**

**Agencies Represented**

**69**

**Opportunities w/ no cost share**

**$138B+ in Bipartisan Infrastructure Law funding in Clearinghouse**

# The Inflation Reduction Act (IRA)

## Tax Credit/Loan Guarantee

The Inflation Reduction Act authorizes **more than $250 billion** for infrastructure and worker investments and helps revitalize economies of energy communities in areas such as:

$250 Billion for Redeveloping & Repurposing

Bonus Tax Credits for Clean Energy Projects

$4 Billion Clean Energy Manufacturing Tax Credits

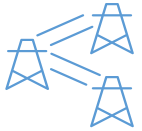
## Energy Justice/Community

In addition, the IRA invests directly in the **energy workers, and their families**, who built this country.

Black Lung Disability Trust Fund Reinstated

$8 Billion Green Bank for Energy Communities

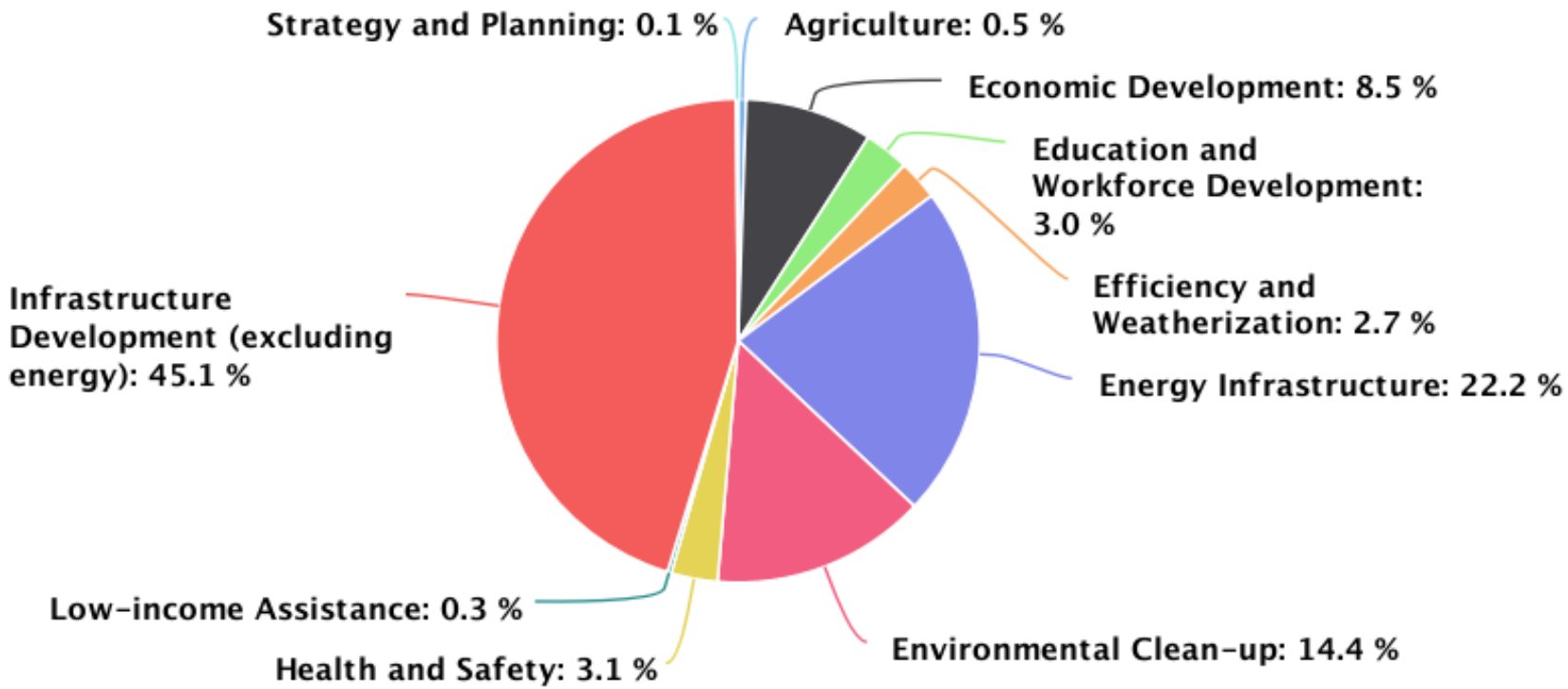
$2.8 Billion Grants for Energy Communities



$145 Million Tribal Electrification

# What Does the Infrastructure Bill Mean for WV?

## Program Purpose



# Build Back Better Regional Challenge WV Awardee

## Coalfield Development Corporation


- Appalachian Climate Technology coalition (ACT Now) received $62.8 million from the EDA
- 21 economically distressed and coal-impacted counties in southern West Virginia
- Main goal: create a clean energy hub and green economy jobs in the region

# Highlight: Rare Earth Elements & Critical Materials

## Growing Industries

- Industry expanding in the clean energy economy
- Minerals and elements needed for clean energy technology
- Grow domestic supply chain

Projects

- Department of Energy lithium-battery workforce initiative
- West Virginia University Rare Earth Recovery Project

# Getting Involved: Calls to Action

## ✓ Stakeholder engagement opportunities

✓Try out the funding clearinghouse
✓ Sign up at website/follow social media
✓ Attend webinars and workshops

## ✓ Act on BIL & IRA funding opportunities

✓Learn about opportunities
✓Cultivate coalitions
✓ Assemble resources for grant writing
✓ Secure matching funds, where necessary

# Sharing Information: IWG Website & Social Media


energycommunities.gov

@EnergyComm_US

@EnergyCommunitiesUS

@energycommunitiesus

# Supporting DOE Priorities

## Enabling the Transformation to a Net-Zero Energy Future

### Investing in Domestic Clean Energy Manufacturing

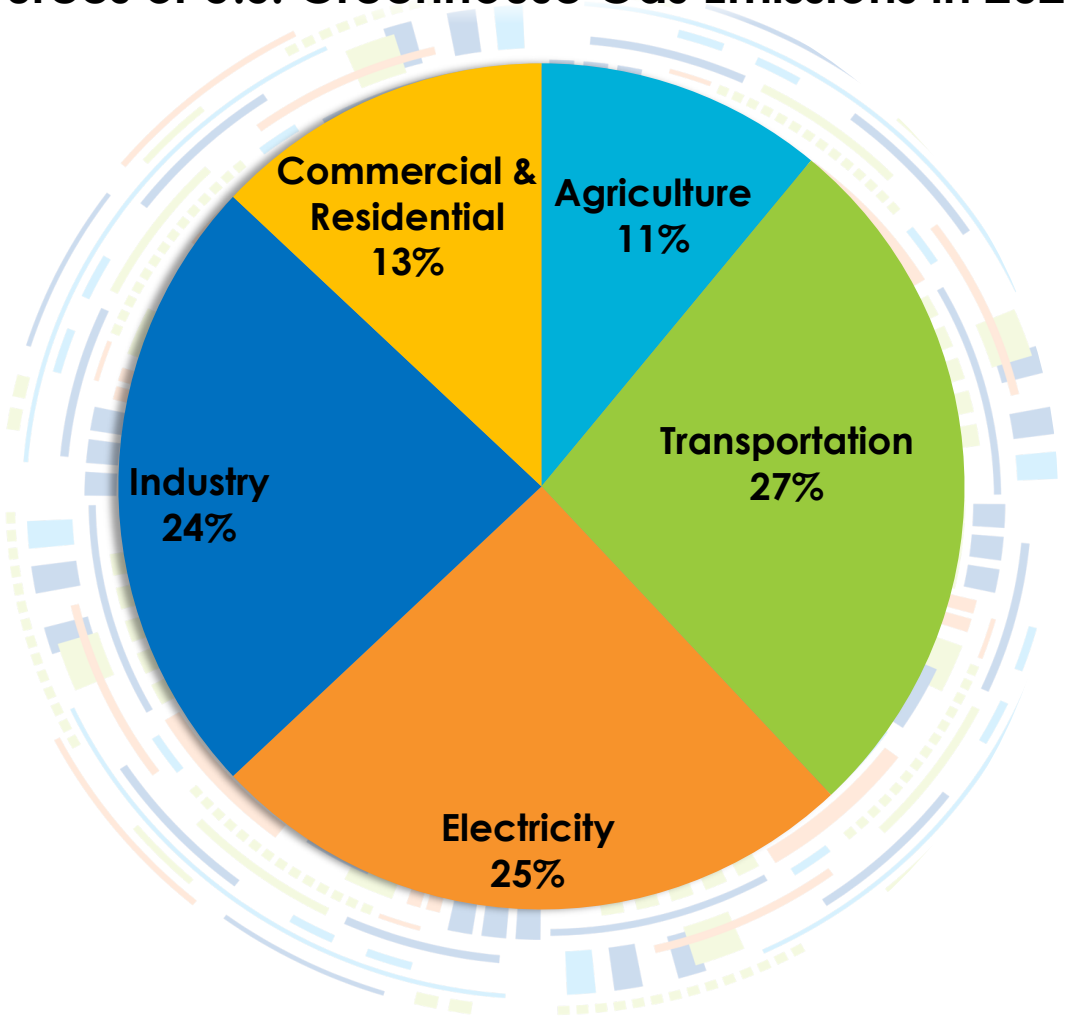
### Advancing Environmental Justice


### Tackling the Climate Crisis

# Transitioning to a Carbon-free Economy

- President Biden's goals:
  - 50% emissions reduction by 2030
  - $CO_2$ emissions-free power sector by 2035
  - Net-zero emissions economy by 2050
- Innovative carbon management technologies will drive the energy transition.
- We must look at every sector to achieve climate goals.
- We must also incorporate environmental justice, equity, and workforce development at the center of our work.

**Sources of U.S. Greenhouse Gas Emissions in 2020**




All emission estimates from the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2020*.

# The National Energy Technology Laboratory

## Organization Snapshot

### MISSION

**Driving innovation and delivering solutions for an environmentally sustainable and prosperous energy future:**

- Ensuring affordable, abundant and reliable energy that drives a robust economy and national security, while
- Developing technologies to manage carbon across the full life cycle, and
- Enabling environmental sustainability for all Americans.

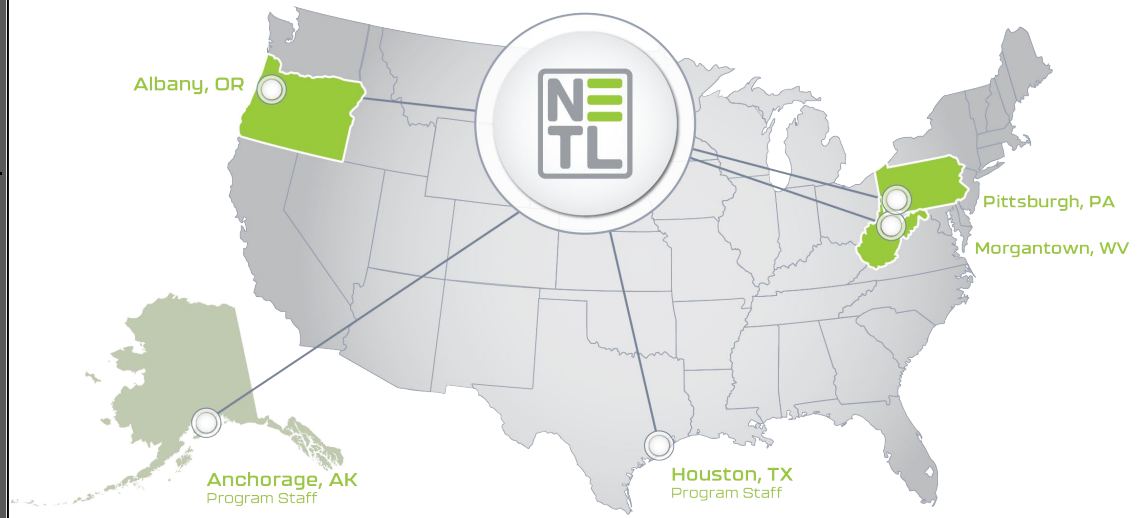
### VISION

**To be the nation's premier energy technology laboratory, delivering integrated solutions to enable transformation to a sustainable energy future.**

### MAJOR INITIATIVES

- **Decarbonization & Carbon Management**
- **Environmentally Sustainable Supply Chains**
- **Integrated Energy & Industrial Systems**
- **Advanced Data & Computing Solutions for Applied Energy Challenges**

### 3 RESEARCH LABS & 2 STRATEGIC OFFICES




- One of 17 DOE national laboratories
- One of three applied research national labs
- Government owned & operated
- **1000+** R&D projects in 50 states
- **$5.0B** total award value
- **$1.2B** FY22 budget

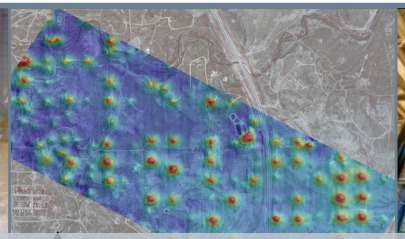
### IMPLEMENTS R&D PROJECTS FOR DOE'S OFFICES OF:

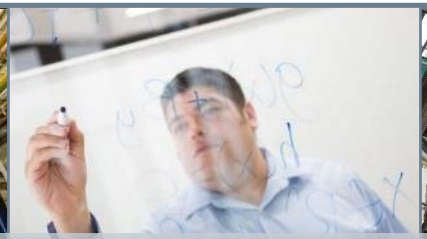
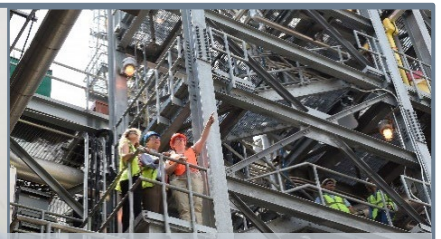
- Fossil Energy & Carbon Management
- Energy Efficiency Renewable Energy
- Electricity
- Cybersecurity, Energy Security, & Emergency Response
- Manufacturing, & Energy Supply Chains
- Grid Deployment
- Clean Energy Demonstrations

# Core Competencies & Technology Thrusts

NATIONAL ENERGY TECHNOLOGY LABORATORY





| Computational Science & Engineering | Materials Engineering & Manufacturing | Geological & Environmental Systems | Energy Conversion Engineering | Strategic Systems Analysis & Engineering | Program Execution & Integration |
|---|---|---|---|---|---|

**CARBON MANAGEMENT**

Carbon Capture & Removal 

Adv Energy & Hydrogen 

Carbon Utilization & Storage 

Crosscutting Research 

Rare Earths & Critical Minerals 

STEP (Supercritical $CO_2$) 

**RESOURCE SUSTAINABILITY**

Methane Hydrates 

Methane Mitigation Technology 

Advanced Remediation Technologies 

**OTHER DOE OFFICES**

*Energy Efficiency & Manufacturing*

Vehicles 

Buildings 

Adv Manufacturing 

Geothermal 

*Office of Electricity*

Adv Grid R&D 

Energy Resilience 

*Cybersecurity, Energy Security, and Emergency Response*

Security & Restoration 

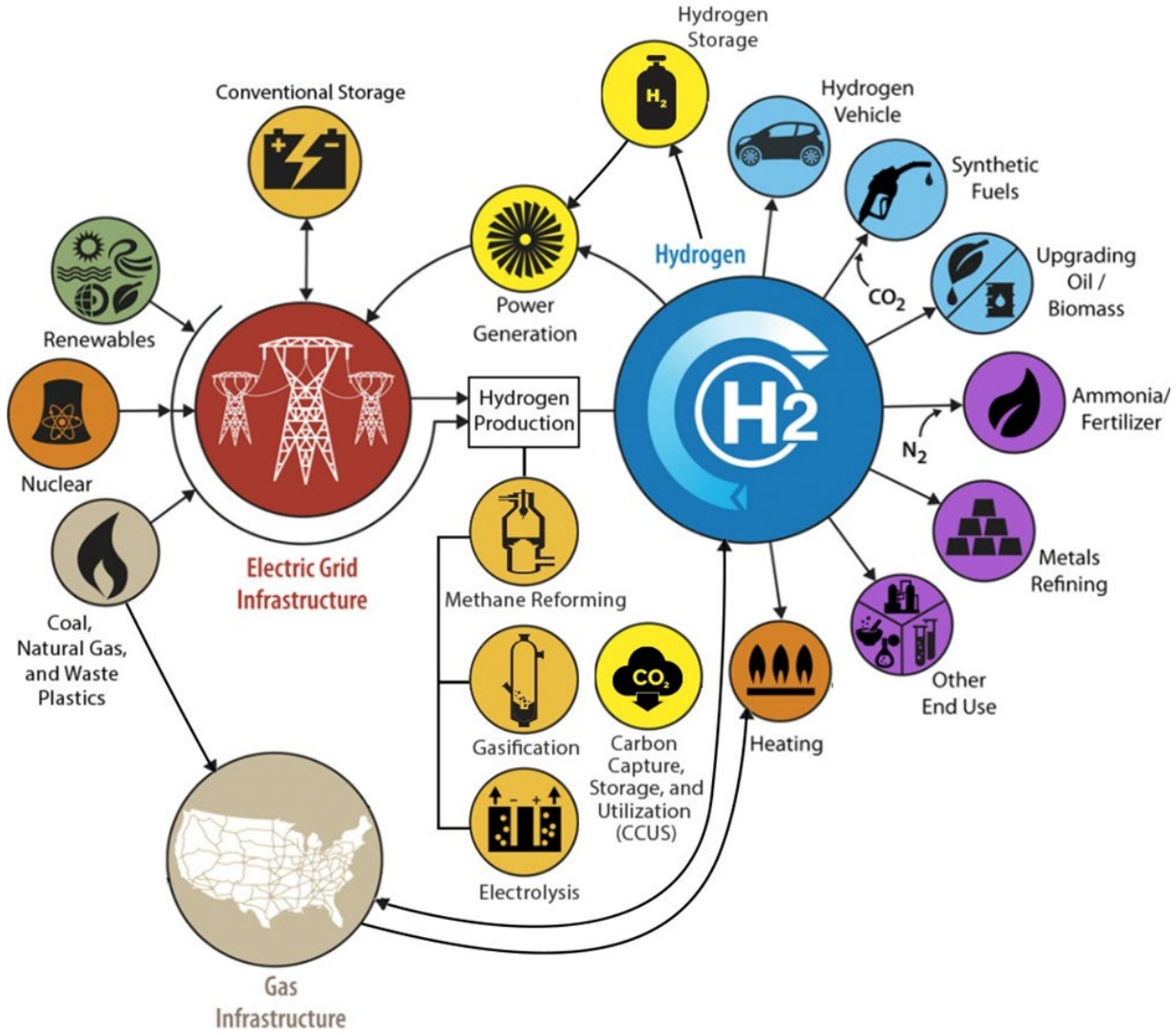
Cybersecurity 

# Hydrogen Economy

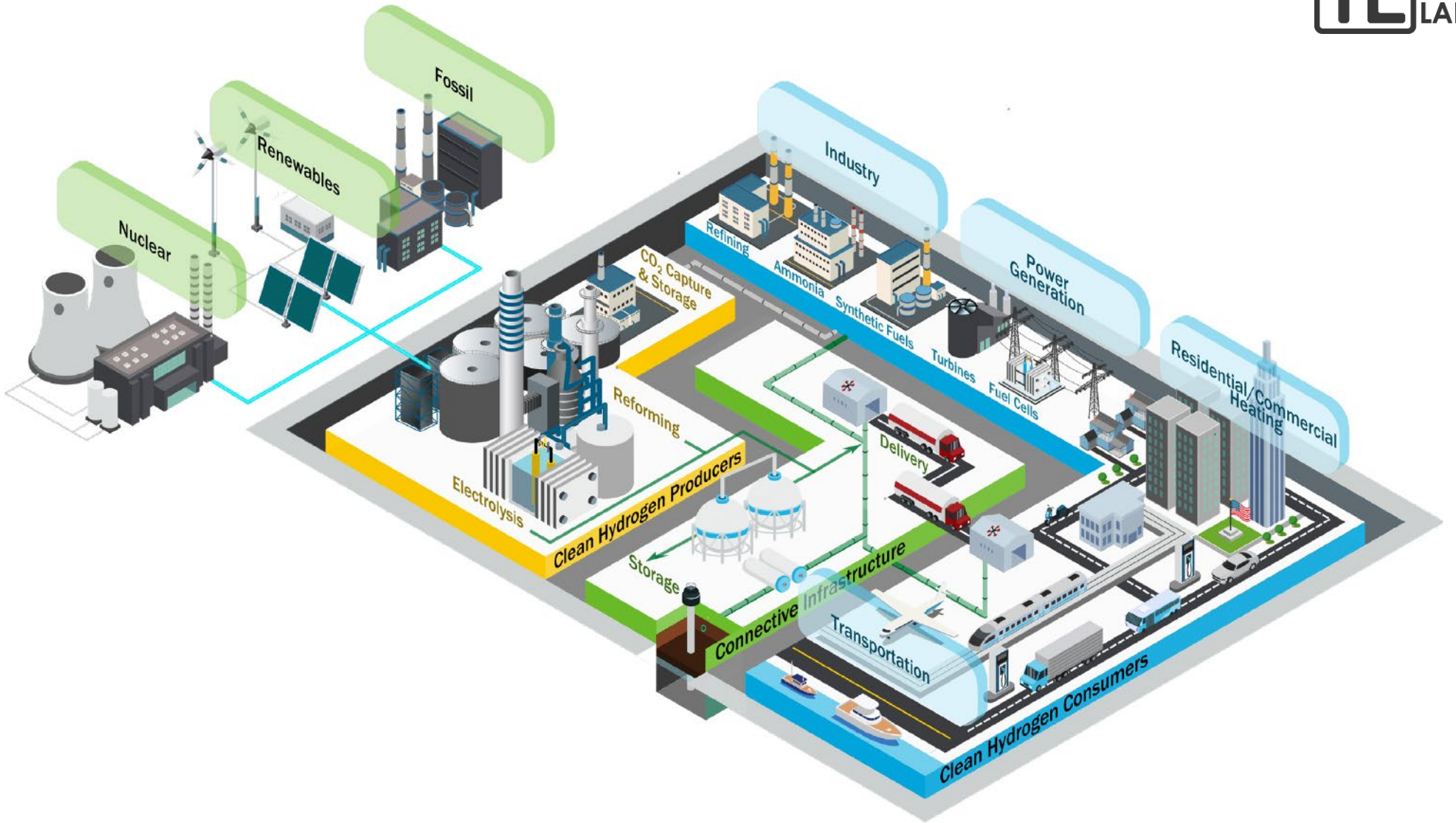
## Deep Decarbonization, Economic Growth, Jobs

### Potential

- 10 MMT of $H_2$/yr produced today with scenarios for ~5X growth.
- 10 MMT $H_2$ would approx. double today's solar or wind deployment.
- Industry study shows potential for $140B in revenue, 700K jobs, 16% GHG reduction.



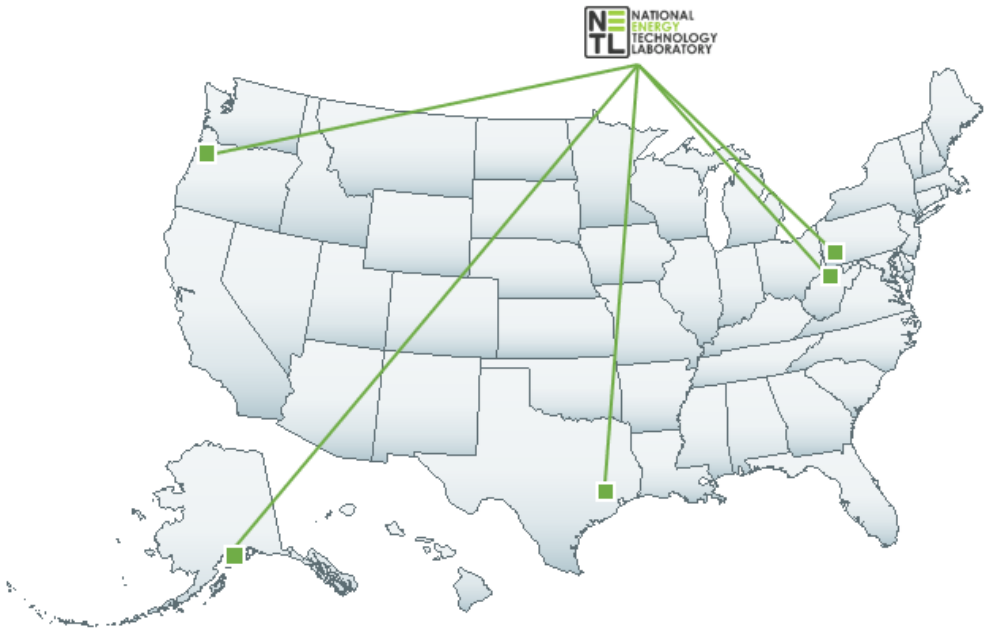
# The Hydrogen Hub Concept



# NETL's Role in the Hydrogen Value Chain

**Production** | **Transport & Storage** | **Utilization** | **Systems Analysis**

- Enable a rapid, cost-effective transition to a hydrogen economy
- Decades of research on carbon capture and storage (CCS) and large-scale fossil fuel production, infrastructure and power systems
- Deliver solutions to challenging hydrogen R&D problems across the hydrogen value chain

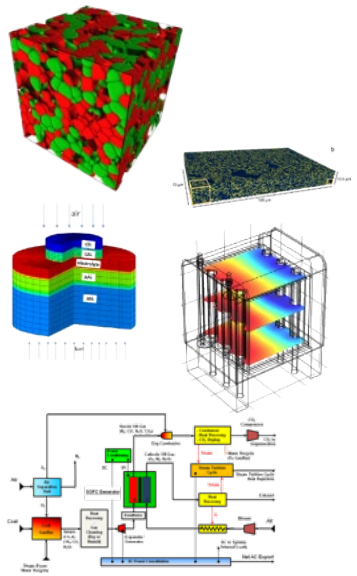


# Innovation Across the Hydrogen Value Chain

## Technology Accelerator

### Production

**Solid oxide electrolysis** of water for hydrogen



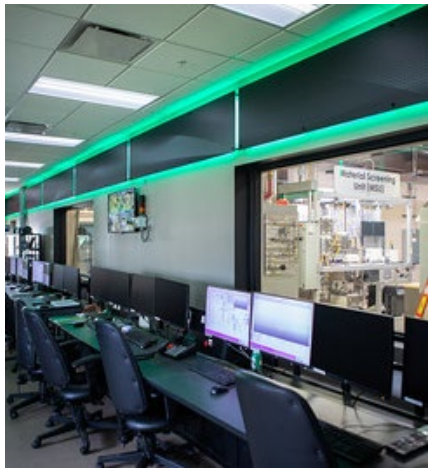
*Multi-scale SOEC Modeling*

Advanced **natural gas reforming** and **gasification** with CCS

*50 kW Chemical Looping Reactor*

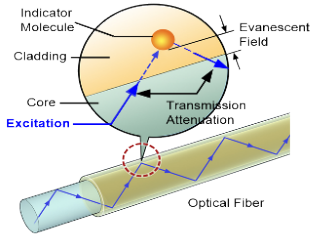
### Transport & Storage

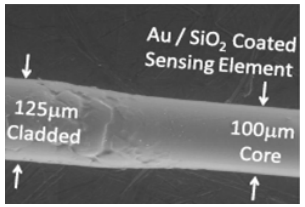
Microwave-enabled **modular ammonia production** from hydrogen



*NETL's ReACT Laboratory*

Sensors for real-time pipeline monitoring and **hydrogen safety**

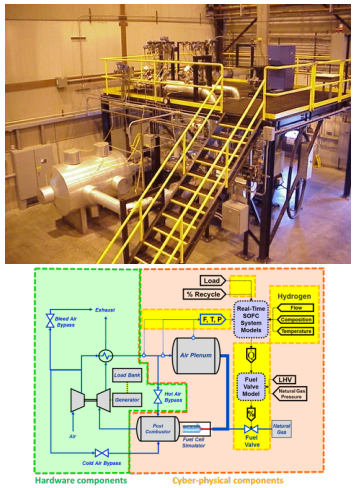



*Distributed Fiber Optics Sensors for temperature, strain, gas chemistry, pH, corrosion, and acoustic vibration*

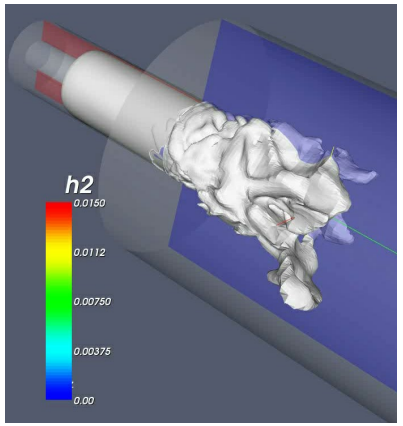
### Utilization

Operability of SOFCs with **integrated energy systems**



*Hybrid Performance Cyber-Physical Test Facility*

Hydrogen and ammonia **gas turbine combustion**



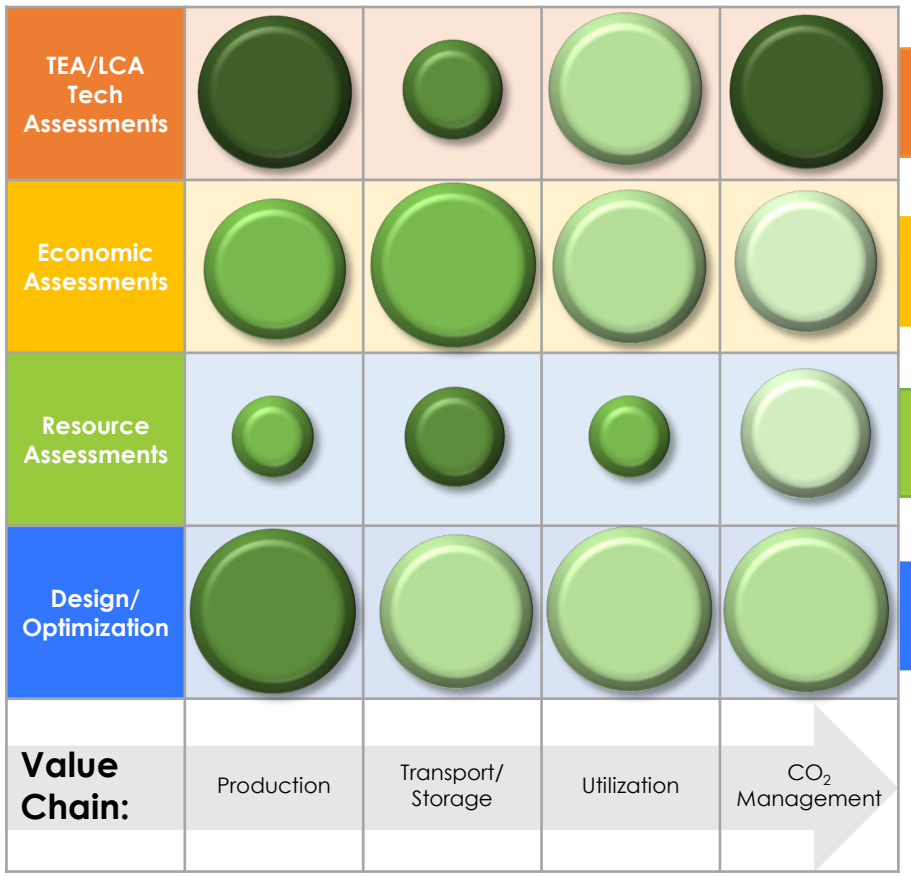

*LES Simulation of combustor flashback with increasing H2 content in natural gas*

# Scaling $H_2$ Technologies with Systems Analysis

NATIONAL ENERGY TECHNOLOGY LABORATORY

- NETL has developed numerous tools to assist with managing the hydrogen value chain, from production, to transport and storage, to utilization, and for carbon emission management.
- These tools assess:
  - Techno-economic and life-cycle analysis technology
  - Economic analysis
  - Resource availability
  - System design and optimization

*Many tools are publicly available*



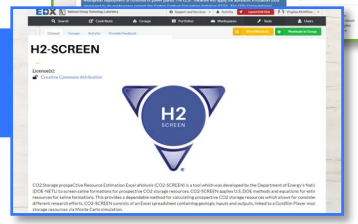

Number of tools within
Degree of relevance to planning $H_2$ Investment


Natural Gas Life-cycle Analysis


$H_2$ Pipeline Cost Model


CCSI²


$H_2$ Screen



# Bipartisan Infrastructure Law (BIL)

**$9.5B** for clean hydrogen:

- **$8B for at least four regional clean hydrogen hubs**
- **$1B for electrolysis RD&D**
- **$500M for clean hydrogen technology manufacturing and recycling R&D**

- Aligns with Hydrogen Shot priorities to reduce the cost of clean hydrogen to $2 per kilogram by 2026
- Requires developing a National Hydrogen Strategy and Roadmap

# Regional Clean Hydrogen Hubs FOA 2779

## Compulsory deliverables for anticipated 6-10 hydrogen hubs

**Concept Papers due 11/7/22**

**Phase I** (Applications due 4/7/23)

**Detailed Project Planning**
$20 million ($40 million w/ cost share)

12-18 months preplanning

**Phase II-IV**

**Project Development, Permitting, Financing (2-4 years)**

**Installation, Integration, Construction (2-4 years)**

**Ramp up and Sustained Operations**
$400 million - $1.25 billion from planning to commission

**50% Cost Share in all Phases**

Path **to reduced production costs** and a **minimum 50-100 MT/d** hydrogen production hurdle

**$1 per kg $H_2$ not a requirement, but a goal**

Path to **reduced carbon emission levels** require improvement scenarios

LCA/TEA required

**Need to show progress in reducing GHG emissions**

Plan viable hydrogen **transportation and storage** that connects identified & committed **users**

**$CO_2$ transport & storage** plan if fossil based

Ready **workforce** and **justice** to underserved communities and regional stakeholders

# Impact from Inflation Reduction Act of 2022

**Expect enhanced investment in hydrogen markets**

## 45Q Provisions for $CO_2$ Capture

- $60 for projects including EOR or utilization
- $85 for projects with geologic storage and *without* EOR
- $180 per metric ton to store captured $CO_2$ in geologic formations, $130 per metric ton for $CO_2$ stored in oil and gas fields
- $130 per ton for carbon utilization

*For carbon capture projects placed in service after December 21, 2022.*

## Qualifications

- Direct Air Capture Facilities: >1,000 tons/year
- Electric Generating Facility: >18,500 tons/year, design capacity capture 75% $CO_2$
- Other industrial facilities: >12,500 tons/year

## Credit for Clean Hydrogen Producers

- $0.60 multiplied by kg of clean hydrogen produced during taxable year.
- Percentage based upon $CO_2$ GHG emissions released per kg of hydrogen produced :
  - 20% - <4kg but not <2.5 kg of $CO_2$
  - 25% - <2.5kg but not <1.5 kg of $CO_2$
  - 33.4% - <1.5kg but not <0.45 kg of $CO_2$
  - 100% - <0.45kg

# Thank You!


CONTACT

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