

# Case for a Sensing Collaboration

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Vice Chancellor for Science Policy and Research Strategies, University of Pittsburgh

**Bryan D. Morreale, Ph.D.**

Associate Laboratory Director for Research and Innovation Center, NETL

## **Michael Holland, Ph.D.**

Vice Chancellor for Science Policy and Research Strategies, University of Pittsburgh



Mike Holland is the Vice Chancellor for Science Policy and Research Strategies. He manages the Pitt Momentum Funds, runs Big Proposal Bootcamp, and works with faculty on developing large, team-based proposals. Prior to coming to Pitt, Mike served as Executive Director of NYU's Center for Urban Science and Progress. Before that he worked in science policy positions in Washington, DC at the Department of Energy, the White House Office of Management & Budget, the Office of Science & Technology Policy and the US House of Representative's Committee on Science. He's also chairman of the board of directors for the Coleridge Initiative, a non-profit data science company spun out of NYU. Mike earned his Ph.D. in analytical chemistry from the University of North Carolina at Chapel Hill.

## **Bryan D. Morreale, Ph.D.**

Associate Laboratory Director for Research and Innovation Center, NETL



Bryan Morreale is the Associate Laboratory Director for NETL's Research & Innovation Center. Within this capacity, Dr. Morreale has the privilege of leading a diverse and dynamic workforce of several hundred scientists and engineers tackling some of the nation's most pressing energy challenges associated with effective energy production, efficient energy conversion and environmental sustainability.

Prior to his current role, Dr. Morreale has held numerous positions within NETL providing strategic, managerial, and technical leadership, including the Senior Technical Advisor to the Laboratory Director and the Director of the Molecular Science Division.

During Dr. Morreale's professional career, he has contributed to over 100 publications and presentations in areas including hydrogen separation, membrane reactors, carbon capture, natural gas utilization and fluid properties at extreme and conditions.

In addition, Dr. Morreale has been invested in numerous other activities, including academic roles at the University of Pittsburgh and Carnegie Mellon University, organizational roles for The Minerals, Metals and Materials Society and American Institute of Chemical Engineers, an Energy Ambassador for the National Academy, and a member of the Materials Genome Initiative's Strategic Planning Committee.



# Driving Innovation & Delivering Solutions

## *Strategic Partnerships*

Bryan D. Morreale, Ph.D.

*Associate Laboratory Director*



U Pitt – NETL Infrastructure Sensing Collaboration Workshop

*August, 2022*



U. S. DEPARTMENT OF  
**ENERGY**





## Administration Goals

- 50% reduction in U.S. GHG pollution by 2030
- Carbon-neutral power sector by 2035
- Carbon-neutral economy by 2050

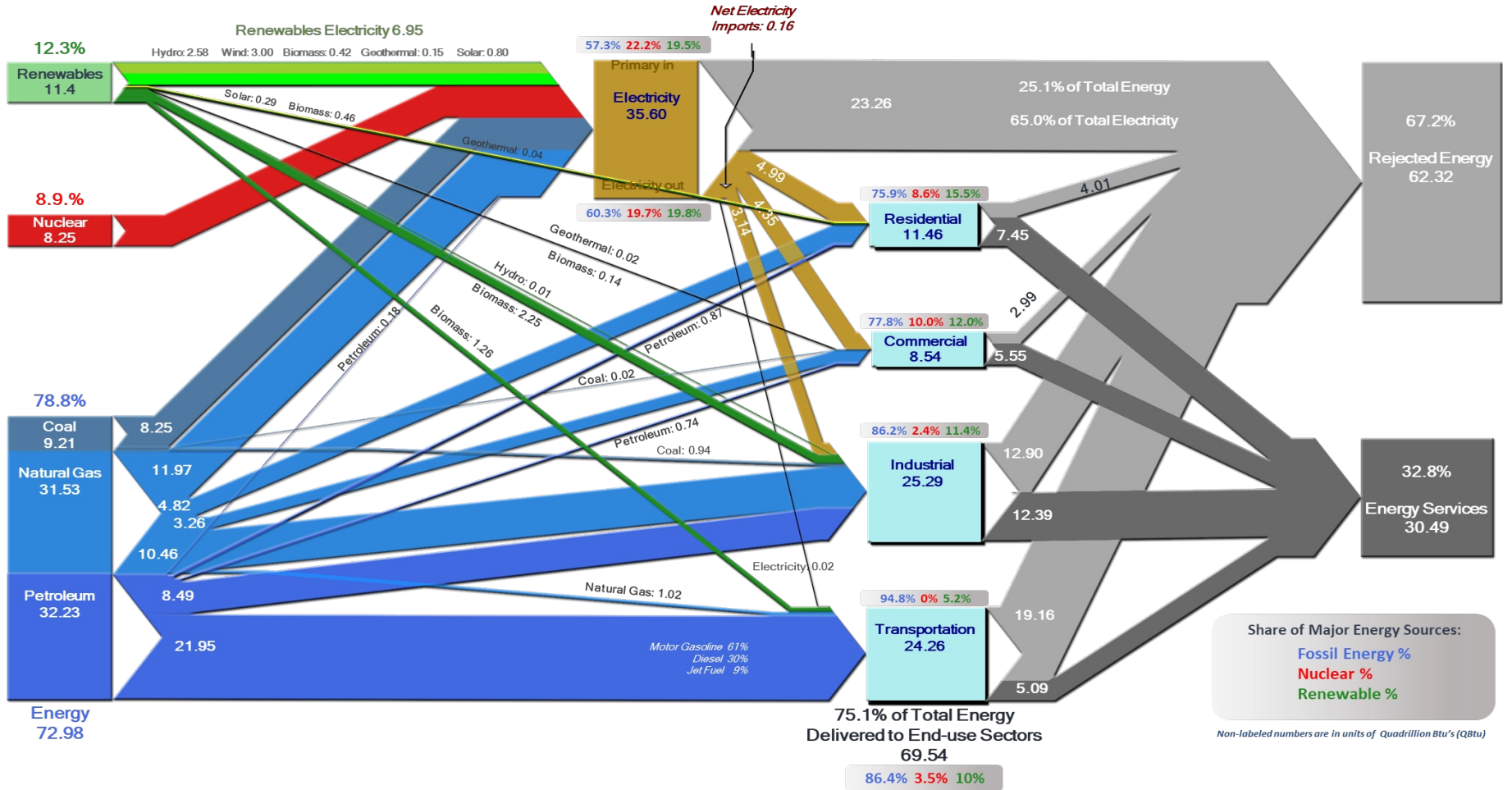
## Industrial Perspective

- Sustainability is a top priority

# 2020 Estimated U.S. Energy Consumption



93 Quadrillion BTUs

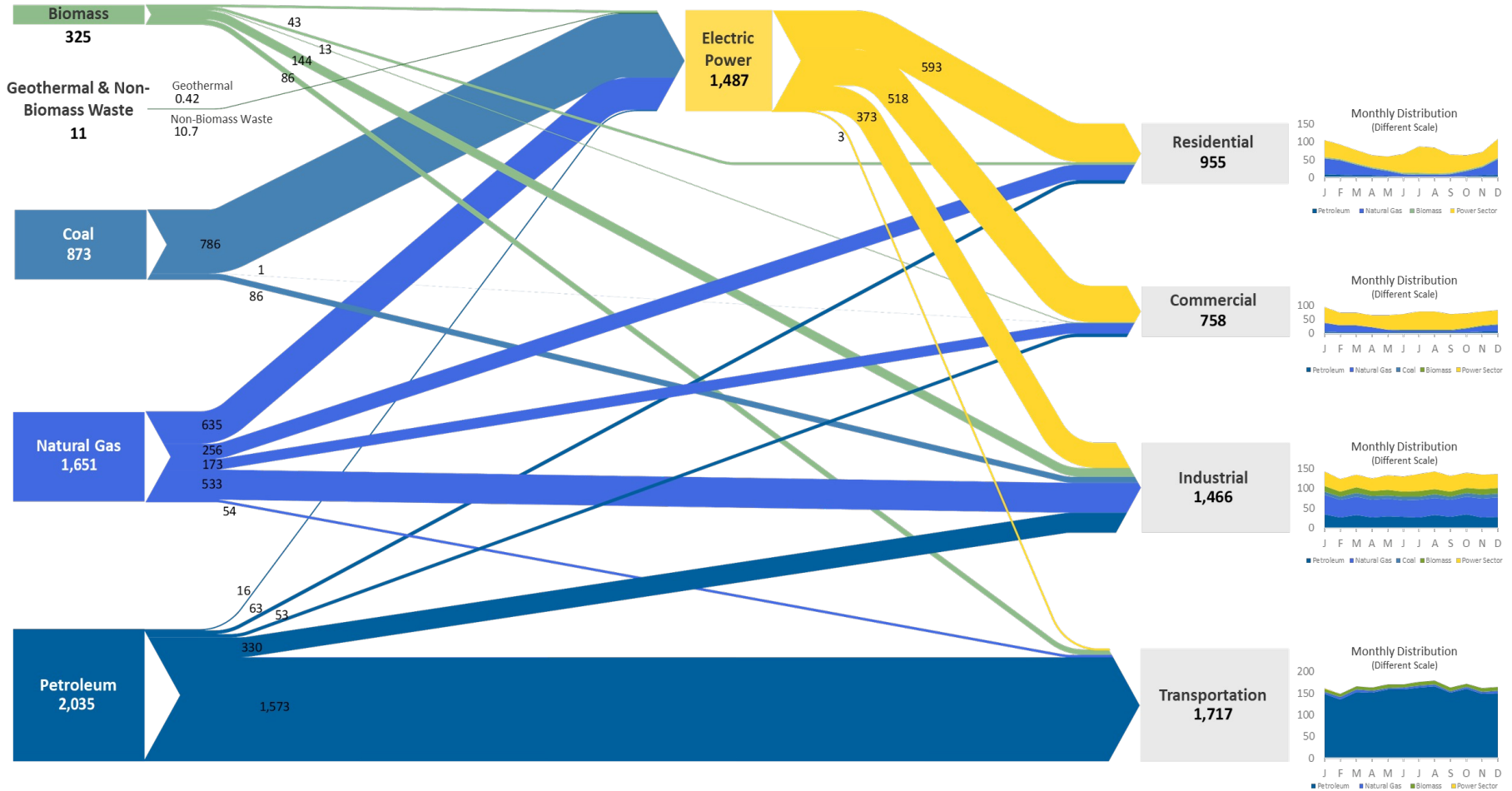




# 2020 Estimated U.S. CO<sub>2</sub> Emissions



4,896 Million Metric Tons



Applicable

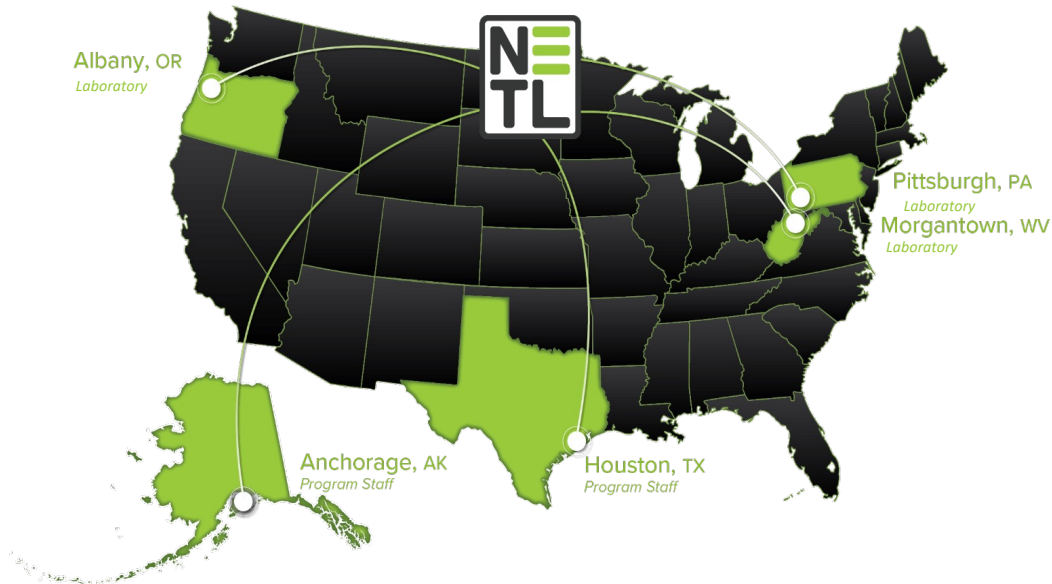
Scalable

Accelerate

# Driving Innovation, Delivering Solutions



National Energy Technology Laboratory (NETL) is **one of 17** U.S. Department of Energy (DOE) national laboratories; producing technological solutions to America's energy challenges.



- NETL has **five locations**
- Only National Lab **dedicated carbon research**
- Only GOGO DOE Lab
- **One of three applied** national labs
- Flexible **Intellectual Property**

## MISSION

**Discover, integrate, and mature** technology solutions to **enhance** the nation's energy foundation and **protect** the environment for future generations.



# Demonstrated Successes

*NETL's Multidisciplinary Approaches Crosscut Industry to Solve Problems*

## Strategic Partnerships Projects/Work for Others



Boston Scientific Coronary Stent



Microwave-Assisted Process  
Intensification for Natural Gas Conversion  
(NETL, WVU, Shell, PNNL)

## Intellectual Property



Erosion Resistant  
Nanocoating Technology

## Start-Up Companies

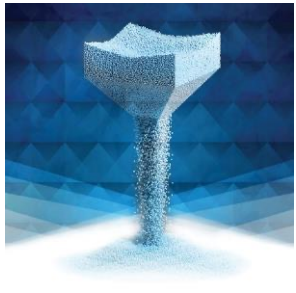


Arc Position Sensing  
Technology

# NETL's Research & Innovation Center



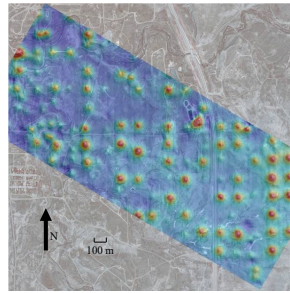
EFFECTIVE RESOURCE DEVELOPMENT • EFFICIENT ENERGY CONVERSION • ENVIRONMENTAL SUSTAINABILITY



COMPUTATIONAL  
SCIENCE &  
ENGINEERING



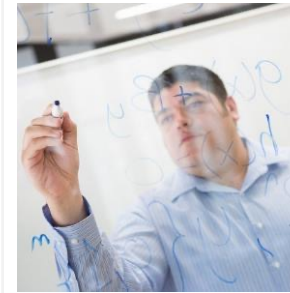
MATERIALS  
ENGINEERING  
& MANUFACTURING



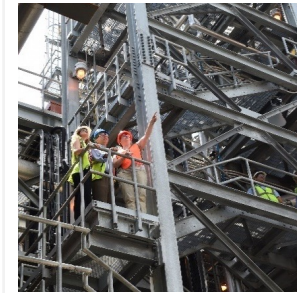
GEOLOGICAL &  
ENVIRONMENTAL  
SYSTEMS



ENERGY  
CONVERSION  
ENGINEERING



STRATEGIC SYSTEMS  
ANALYSIS &  
ENGINEERING

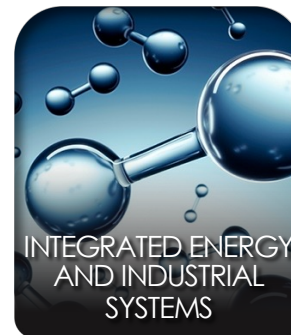


PROGRAM  
EXECUTION &  
INTEGRATION

National Lab

DOE Field &  
Program Office

## STRATEGIC INITIATIVES



## KEY LAB INITIATIVES





## Support Energy Efficiency, Safety, Resilience, and Sustainability

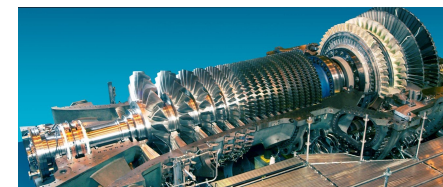
- ✓ Monitor systems and conditions
- ✓ Improve performance & efficiency
- ✓ Enhance reliability & safety
- Temp, acoustics, chemical, gas, corrosion
- Composite nano-materials, thin films & fiber optics, sensor devices development

**Multiple Sensor Platforms**

- Distributed Fiber Optics
- Surface Acoustic Wave

GENERATION

**Turbines:** Real-time fuel composition and combustion temperature for improved service life and efficiency



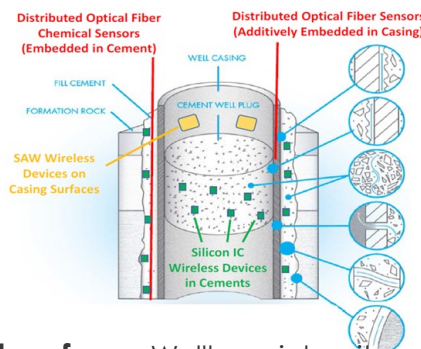
## ENERGY DELIVERY & STORAGE



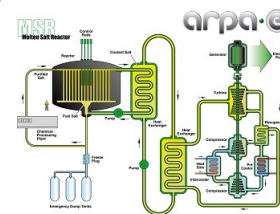
**Pipelines:** Monitor corrosion, gas leaks, T, acoustics to predict/prevent failures. NG, H<sub>2</sub>, CO<sub>2</sub>



**Grid:** Transformer, powerline failure prediction, fault detection, state awareness

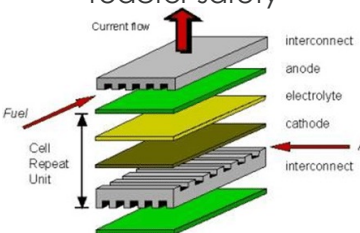


**Subsurface:** Wellbore integrity, failure prediction, leak detection. Geologic storage of CO<sub>2</sub>, H<sub>2</sub>/NG, or abandoned wells.



**Nuclear:** Core monitoring and molten salt temperatures for reactor fuel efficiency & reactor safety

**SOFCs:** Fuel concentration & temperature gradients for improved lifetime and efficiency



# NETL's Sensor Development



No More Lead Pipes



High-Speed Internet Access



Better Roads and Bridges



Investments in Public Transit



Upgrade Airports and Ports



Investment in Passenger Rail



Network of Electric Vehicle Chargers



Upgrade Power Infrastructure

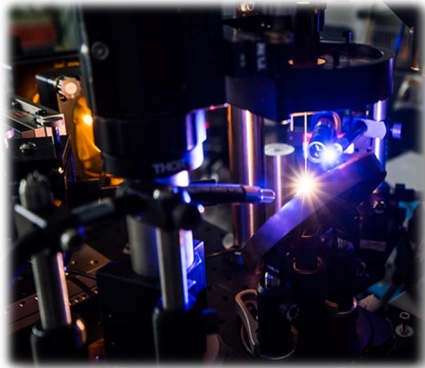


Resilient Infrastructure

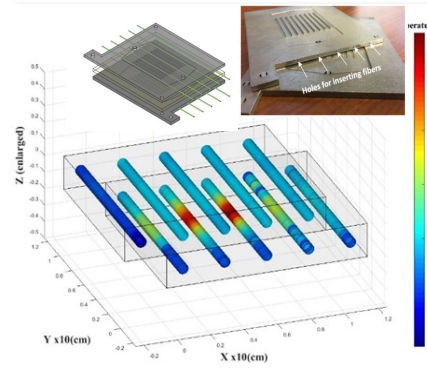


Investment in Environmental Remediation

## Materials Development



## Sensor Manufacturing



## Evaluation at Real Conditions



# Thank You!

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**ENERGY**