# Energy Storage Program Overview Executive Session

March 17, 2021





Solutions for Today | Options for Tomorrow



# WELCOME

# Thank you for joining us!

## **Our NETL Leadership:**



#### Briggs White

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Program Overview and Update

2 FOA Review

3 Interactive Discussion on Policy and Administration Priorities

## 4 Question & Answer



## Crosscutting's Broad Applicability, Multiplier Impact



The NETL <u>Crosscutting</u> <u>Technology Research</u> program portfolio, one of NETL's **fossil energy** programs, can cut across **multiple FE objectives**. Crosscutting focuses on **five** technical programs while housing a student training program.

The Energy Storage For Fossil Fuel Energy Systems Program sits in the Crosscutting Portfolio.





# **Our Energy Storage Program**





Scope

Electricity Generating Units (EGUs)

Fossil-fueled Smaller-Scale Assets

**Fossil-fueled Industrial Facilities** 



## Benefits of Storage: Reliable, Affordable, Clean



**Reliability** in a changing grid

**Resiliency** in unplanned events

Secure energy supply

**Reduced** customer cost

**Clean** infrastructure & end use

**Optimal** asset utilization





# FOA and SBIR Solicitation Details



## **DE-FOA-0002209**

Issue Date: **10/30/2019** Closing Date: **12/16/2019** 

#### **Areas of Interest**

- Existing fleet of fossil-fueled power plants (both coal and natural gas)
- New flexible fossil fueled power plants of the future
- Non-traditional FE System Platforms beyond electric power (e.g., industrial, DG, poly-generation, waste heat recovery, etc.)

## DE-FOA-0002359

Issue Date: **08/24/2020** Closing Date: **10/19/2020** 

#### **Areas of Interest**

- Phase I grants to small businesses
- Office of Basic Energy Sciences Research Areas:
  - Low-Cost Energy Storage Materials & Technologies for Fossil-Integrated Systems



# FOA and SBIR Solicitation Details



## **DE-FOA-0002209**

Issue Date: **10/30/2019** Closing Date: **12/16/2019** 

- \$10,702,972 Total Award Value with maximum award sizes between \$200-250K
- 29 awards via NETL
  - 1 Coal
  - 1 Coal/Natural Gas
  - 3 CHP
  - 8 Fossil Energy
  - 16 Natural Gas

## **DE-FOA-0002359**

Issue Date: 08/24/2020 Closing Date: 10/19/2020

- Maximum award sizes between \$200,000 and \$250,000
- Phase 1 Period of performance will depend on the scope of the effort but will not exceed 12 months. Phase 2 possible via recompete.
- 3 awards via NETL



# **NETL's Diverse Portfolio of ES Projects**





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# **NETL's Diverse Portfolio of ES Projects**





## NGCC with Hydrogen Storage

- NETL has funded 9 H2 Storage Projects at NGCC Plants
  - Surface
  - Subsurface
- These projects span Existing Fleet and Next Generation Plants



## Thermal Storage at a Coal-Fired Power Plant

- NETL has funded 5 Thermal (sensible) Storage projects
  - Thermal Salt
  - Thermal Sand
- These projects are relatively developed at TRL 6 or 7



### **Small Scale Assets**

- 3 Projects leveraging smaller University owned Power Plants
  - Huchinson EGU, (University of Kansas)
  - Abbott CHP, (University of Illinois)
  - Clemson University CHP, (Siemens)





Our diverse portfolio is poised to accelerate the U.S. as an Energy Storage leader, explore solutions, and harness the potential of up-and-coming technologies.



**Actively aligning** our Energy Storage activities to **market trends** and projections while maintaining **policy priorities** through assessment exercises.



Mature **near-term** technologies to support **long-duration** energy storage applications with FE while also identifying and pursuing **emerging** innovative tech.



Large investment in **Chemical Energy Storage**, particularly hydrogen with **16** projects and **\$4.6M** in funding.



## **Technology Development Vision**







# Questions? Initial Reactions?





# WebEx Interactivity 101







# Where are you joining us from?







## **Energy Policies Prioritizes Clean Energy Investments**



## **Emissions-Reduction**

- 100% carbon pollution-free power sector by 2035
- Achieving net-zero emissions by 2050
- Constructing 500,000 electric vehicle charging stations and electrifying the US vehicle fleet



- Electrifying major sectors of the US economy
- Funding public transit and high-speed rail
- \$5 billion will be invested in battery and energy storage technology to help the transition to towards electric cars



- All of government approach
- Focus on Private-public partnerships to drive technology innovation
- Drive innovation to deployment



#### **American Jobs**

- Creating one million new jobs in the auto industry
- Millions of union jobs to build infrastructure
- 250,000 jobs plugging abandoned wells/mines



#### **Environmental Justice**

- Link environmental reform to redressing racial and economic inequality
- 40 percent of the \$2 trillion investment to communities hardest hit by pollution



#### **Climate Leadership**

- Recommitting the US to the Paris Agreement and Green Climate Fund
- Creating a clean energy export initiative
- Imposing carbon adjustment fees on imports
- Establishing ARPA-C



# Policy Impacts on the Energy Storage Program



Must recognize and act on the decreasing coal and address the impacts of retired plants. *Where is the opportunity? How can we transition these assets as they retire over the next 10-15 years?*  How can we get our ES technology to pilot plant demo by 2025? Evaluate technical challenges, feasibility, application, infrastructure, and integration. How can NETL think through this innovative base and find middle ground approaches?





How can NETL adapt to new priorities
as we move to a low-carbon future?
Increase asset flexibility through integrated ES
Commercialization consideration
Supply chain analysis for manufacturing and scaling
VRE development for long duration ES



# It's Your Turn!



Using the annotate feature vote once (1) for which question you would like to explore in greater detail:

How can NETL help **transition coal assets** as they retire over the next 10-15 years? What is needed to be able to pilot **a demo plant by 2025?** 

What does NETL need to consider in regard to a **low-carbon future**?





# **Audience Engagement**



How can NETL help **transition coal assets** as they retire over the next 10-15 years?





# **Audience Engagement**



What is needed to be able to pilot a demo plant by 2025?





# **Audience Engagement**



What does NETL need to consider in regard to low-carbon future?





# Questions? Initial Reactions?







We have a lot planned for the future! Keep up with our Energy Storage work and learn more at <u>www.NETL.DOE.gov</u> or follow us:

💟 @NETL\_DOE

☑ @NETL\_DOE



Our new projects are scheduled to kickoff **April 5-8<sup>th</sup> 2021** 

Check our <u>website</u> for registration details and agendas.

Have questions about the program? Want to get on our mailing list? Email Briggs White for more information!



# THANK YOU

for the subject matter expertise and engagement

Bhima Sastri

Pat Rawls

**Our Researchers** 

**Federal Project Managers** 

FE Headquarters



# Appendix

Solutions for Today | Options for Tomorrow

# Mission

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

## EFFECTIVE RESOURCE DEVELOPMENT

## EFFICIENT ENERGY CONVERSION

## **ENVIRONMENTAL SUSTAINABILITY**



# **Engaging FE Focused Energy Storage**



NETL's Crosscutting program solicited input from entities in the energy storage field through the request for information (RFI): **DE-FOA-0002209** 

Issue Date: 10/30/2019

#### Areas of Interest

- Existing fleet of fossil-fueled power plants (both coal and natural gas)
- New flexible fossil fueled power plants of the future
- Non-traditional FE System Platforms beyond electric power (e.g., industrial, DG, poly-generation, waste heat recovery, etc.)

## Closing Date: 12/16/2019

#### Questions:

- 1. What energy storage concepts are recommended?
- 2. What R&D is needed?
- 3. What are the technology challenges?
- 4. What are the methodologies or tools?
- 5. What is the deployment strategy?
- 6. What characteristics of a host site or pilot facility are needed?
- 7. What are the barriers to deployment?



## **Diverse RFI Responses**





NETL received 23 individual responses from 21 different entities in December 2019. Reponses included academia, new entrants into power, suppliers and more. The responses had two key themes: **Concept Needs** and **FFPP Integration Needs**.

#### Notable absence of responses from

- Owner/operator companies
- ISOs/state legislation
- Industry (e.g., oil & gas, steel)
- Coal companies



Technology	Prime Performer	Project Title	Total Award	
<b>B</b> CHEMICAL	Siemens Energy, Inc.	Advanced Hydrogen Compressor for Hydrogen Storage Integrated with a Power Plant	\$	1,419,700
<b>CHEMICAL</b>	T2M GLOBAL, LLC	Advanced Oxygen-Free Electrolyzer for Ultra-Low-Cost H2 Storage for Fossil Plants	\$	730,000
CHEMICAL	WireTough Cylinders, LLC	Durable Low-Cost Pressure Vessels for Bulk Hydrogen Storage	\$	634,960
<b>B</b> CHEMICAL	Southwest Research Institute	18-89892 Development of an Advanced Hydrogen Energy Storage System using Aerogel in a Cryogenic Flux Capacitor	\$	625,000
CHEMICAL	University of North Dakota EERC	Ammonia-Based Energy Storage Technolgoy (NH3-BEST)	\$	362,500
<b>B</b> CHEMICAL	Gas Technology Institute	Hydrogen Storage for Flexible Fossil Fuel Power Generation: Integration of Underground Hydrogen Storage with Novel Gas Turbine	\$	316,046
<b>B</b> CHEMICAL	Board of Regents of the University of Oklahoma	Reversible Methane Electrochemical Reactors as Efficient Energy Storage for Fossil Power Generation	\$	312,504
<b>B</b> CHEMICAL	C-Crete Technologies	Low-Cost, Scalable Boron Nitride-Based Sorbents with Balanced Capacity-Kinetics-Thermodynamics for Hydrogen Storage	\$	312,500
<b>CHEMICAL</b>	WE New Energy, Inc	Economically Viable Intermediate to Long Duration Hydrogen Energy Storage Solutions for Fossil Fueled Assets	\$	300,000
<b>B</b> CHEMICAL	Gas Technology Institute	Hydrogen Storage for Load-Following and Clean Power: Duct-firing of Hydrogen to Improve the Capacity Factor of NGCC	\$	290,995
<b>B</b> CHEMICAL	The Regents of the University of California, Irvine	Hydrogen Based Energy Storage System for Integration with Dispatchable Power Generator—Phase I Feasibility Study	\$	285,000
CHEMICAL	Siemens Energy, Inc.	Clemson Hydrogen Combined Heat and Power Storage System	\$	274,854
<b>B</b> CHEMICAL	Siemens Energy, Inc.	Hydrogen Energy Storage Integrated With A Combined Cycle Plant	\$	269,193
<b>B</b> CHEMICAL	University of Kansas Center for Research, Inc.	H-2-SALT: Storing Fossil Energy as Hydrogen in Salt Caverns	\$	250,000
CHEMICAL	Gas Technology Institute	Integrated Hydrogen Energy Storage System (IHESS) for Power Generation	\$	250,000
<b>B</b> CHEMICAL	FuelCell Energy, Inc.	Reversible SOFC Systems for Energy Storage and Hydrogen Production	\$	249,999
🚷 THERMAL	Malta Inc.	Repurposing Fossil-Fueled Assets for Energy Storage	\$	312,503
🚯 THERMAL	Electric Power Research Institute, Inc.	Modular, Crushed-Rock Thermal Energy Storage Pilot Design	\$	250,000
🚯 THERMAL	Element 16 Technologies, Inc.	Low Cost Sulfur Thermal Storage for Increased Flexibility and Improved Economics of Fossil-Fueled Electricity Generation Units	\$	250,000
🚯 THERMAL	Southwest Research Institute	18-89798 Integration of Pumped Heat Energy Storage with Fossil-Fired Power Plant	\$	250,000
🚷 THERMAL	Electric Power Research Institute, Inc.	Sand Thermal Energy Storage (SandTES) Pilot Design	\$	249,999
🚷 THERMAL	Siemens Energy, Inc.	Combined Cycle integrated Renewable Energy Storage	\$	249,842
🚷 THERMAL	Electric Power Research Institute, Inc.	Liquid Salt Combined-Cycle Pilot Plant Design	\$	249,664
🚳 MECHANICAL	Southwest Research Institute	Liquid Air Combined Cycle for Power and Storage	\$	319,120
	Board of Trustees of the University of Illinois	Illinois Compressed Air Energy Storage	\$	250,597
	Board of Trustees of the University of Illinois	Phase I: Natural Gas Based Energy Storage at Abbott Power Plant	\$	250,000
	Sustainable Energy Solutions	Energy-Storing Cryogenic Carbon Capture <sup>™</sup> for Utility- and Industrial-scale Processes	\$	249,500
	The Washington University	Titanium-Cerium Electrode-Decoupled Redox Flow Batteries Integrated With Fossil Fuel Assets For Load-Following, Long-Duration ES	\$	625,615
	Pennsylvania State University, University Park	Development of an All-Aqueous Thermally Regenerative Redox Flow Battery to Support Fossil Fuel Assets	\$	312,881

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CHEMICAL





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