

## 2024 Low Emission Advanced Power (LEAP) Workshop

Co-located with the ASME 2024 Power Conference

The Madison Hotel, Washington, D.C.

September 15–19, 2024

NETL webpage: [Attend the 2024 LEAP Workshop to Learn More on Achieving a Net-Zero Emissions Future | netl.doe.gov](https://www.netl.doe.gov/2024-leap-workshop)

A short video about the LEAP workshop: <https://youtu.be/ZJmIczf3kYY>

### Preliminary Technical Agenda\*

#### *Tutorials*

*Sunday afternoon, September 15, 2024*

**Session A** – Integrated Energy Systems

**Session B** – System Controls

**Session C** – Cyber-physical modeling

#### *Introductory Sessions – Hybrids and Technology Development*

*Sunday afternoon, September 15, 2024*

##### **Session 1 – Technology Development Current Paradigm and New Tools**

Starting with a review of the current paradigm for power systems technology development, this session will provide discussion from technical leaders regarding development tools such as dynamic models, digital twins, hardware-in-the-loop simulations, and cyber-physical modeling to mitigate risk in developing new power technologies.

##### **Session 2 – Penetration of Intermittent Renewable Resources with Electric Integration and Storage**

This session will involve discussion focused on the most recent advances in renewable energy systems with electric energy storage and green hydrogen production/utilization and with an emphasis on challenges in implementation and needs from dispatchable power assets in the transition.

#### *Integrated Energy Systems and Carbon Management*

*Monday & Tuesday, September 16-17, 2024*

##### **Session 3 – Identify Needs for Future Advanced Power Systems**

This session will involve discussion from international leaders regarding economic and environmental drivers for new technologies, identifying technology needs from socioeconomic and social justice point

of view. Also, given the leading role governments are playing to help transition their countries to renewable energy, this session also needs to provide a viable pathway that supports a transition from a dominant fossil energy society to a renewable energy society. Example: what critical role is needed from fossil energy resources to allow a speedy transition to reliable renewable energy? And how far into the future is it needed?

#### **Session 4 – Identify Transition Impacts, Costs, and Opportunities for Early Adoption of Integrated Energy Systems**

This session will involve discussion from power industry leaders (grid operators, generators, retail utilities) with an emphasis on current and anticipated transition impacts and associated costs, including cost of mitigation strategies. Resistance/bottlenecks toward a speedy transition are discussed along with their solutions. This session will also focus on recent integrated energy systems commercialization efforts with discussion on fee structures needed by industry to support investment in hybrid power systems which will enable a speedy transition to renewable energy.

#### **Session 5 – Integrated Energy Systems: Cycles and Integration**

Coupling components with disparate time scales and process sensitivities represents a significant challenge. This session will include discussion focused on matching components for thermal, chemical, and carbon management in integrated hybrid power systems capable of meeting the demands of transitioning to a net-zero carbon energy sector. Focus on challenges associated with integrating components into a single system with thermal, chemical, and electric interactions and coupling. What component coupling brings about nonlinearities? What is the extent of new states brought about by coupling components? What methods can be used to maintain stability when transitioning control states?

#### **Session 6 – Integrated Energy Systems: Dynamics, Performance Optimization, and Controls**

This session will involve identifying challenges for highly coupled hybrid systems with non-linear process interactions and potential control issues, especially under part-load or dynamic load conditions. This session will focus on the control needs for highly coupled novel cycles with an emphasis on the coordination of high-speed dynamics with performance optimization at the dispatch level.

### *Technology Development for Integrated Energy Systems*

*Tuesday & Wednesday, September 17-18, 2024*

#### **Session 7 – Digital Twins, Hardware-In-The-Loop, and Cyber-Physical Systems in Technology Development**

This session will focus on using digital twins and cyber-physical systems to develop cyber-physical models capable of reconfigurability such that several cycle geometries and integration strategies could be evaluated for performance metrics using a single platform.

#### **Session 8 – Co-design and Intelligent Systems**

This session will focus efforts by technical leaders to use cyber-physical modeling and hardware-in-the-loop simulations to simultaneously design the components, system integration, and controls of an integrated energy system to achieve an intelligent or cyber-physical system capable of meeting the

complicated performance needs of the future energy sector. As an example, using the Hyper facility to design the mini-Hyper components, integration, and controls simultaneously.

*Wednesday afternoon, September 18, 2024*

### **Session 9 – Summary and Next Steps**

The final session will provide a venue for open discussion regarding the insights gained from the previous sessions and the papers presented at the ASME 2024 Power conference. Some key questions for consideration:

1. Are hybrid systems likely to provide meaningful support to the energy transition? If so, how/why?
2. What specific forms of hybrid systems (e.g., component integrations) will be needed? Prioritize them.
3. What is a viable roadmap (steps needed) to develop viable hybrid technical solution(s)?
4. What role can the government play to accelerate hybrid system R&D?

### ***Tour & Demo\*\****

*11:00 am to 4:00 pm (Eastern Time), Thursday, September 19, 2024*

#### **Tour & Demo – NETL Morgantown Site\*\***

This is a high-level tour at NETL Morgantown Site (Address: 3610 Collins Ferry Road, Morgantown, WV 26505) for a number of LEAP workshop participants. The visitors will have a chance to learn about NETL priorities, visit world-leading facilities, and see live demonstrations of NETL’s cyber-physical research platform (i.e., Hybrid Performance Project “Hyper”).

*This tour is free of charge, but **participants must register by August 6 while registering for the ASME Power Conference. An updated Curriculum Vitae (CV) with no gaps and Form 142.1-1A must be submitted before August 9 for processing. Please see next page for details.***

*Participants will travel to NETL Morgantown Site at their own expense. NO transportation or hotel will be arranged. It is about 3.5-hour drive from Washington, D.C. to Morgantown. [Greyhound buses](#) and [direct flights \(Dulles International Airport \(IAD\) ↔ Morgantown Municipal Airport \(MGW\)\)](#) are available.*

*\* Subject to change.*

*\*\* Subject to change and requires security approval.*

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Please reach out to us if you have questions. Thanks.

David Tucker, Ph.D.

[David.tucker@netl.doe.gov](mailto:David.tucker@netl.doe.gov)

Biao Zhang, Ph.D.

[biao.zhang@netl.doe.gov](mailto:biao.zhang@netl.doe.gov)

# 2024 Low Emission Advanced Power (LEAP) Workshop

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## Tour at NETL Morgantown Site

**11:00 am to 4:00 pm (Eastern Time), Thursday, September 19, 2024**

Due to the Department of Energy's requirements, all foreign national visitors (to include Lawful Permanent Resident status) must submit an **updated Curriculum Vitae (CV)** detailing education and employment history with **no gaps** (month/year format required for all education/work experience, no unexplained gaps in time). The completed CV must be provided along with **Form 142.1-1A** (see attached) to Holly Biddle ([Holly.Biddle@netl.doe.gov](mailto:Holly.Biddle@netl.doe.gov)) **AND** Dr. David Tucker ([david.tucker@netl.doe.gov](mailto:david.tucker@netl.doe.gov)).

Tour participants must register by **August 6, 2024** while registering for the ASME Power Conference. Forms and CV must be submitted by **No Later Than August 9, 2024** for processing.

For foreign national questions contact Holly Biddle at 412-386-5704 or [Holly.Biddle@netl.doe.gov](mailto:Holly.Biddle@netl.doe.gov).

For other questions contact Dr. Biao Zhang ([biao.zhang@netl.doe.gov](mailto:biao.zhang@netl.doe.gov)) and Dr. David Tucker.

### **Attachment:**

Form 142.1-1A, Request for Unclassified Foreign National Access (short form)