U.S. House of Representatives
COMMITTEE ON ETHICS

EMPLOYEE POST-TRAVEL DISCLOSURE FORM ☒ *Original* ☐ *Amendment*

This form is for disclosing the receipt of travel expenses from private sources for travel taken in connection with official duties. This form does not eliminate the need to report privately-funded travel on the annual *Financial Disclosure Statements* of those employees required to file them. In accordance with House Rule 25, clause 5, you must complete this form and *file it with the Clerk of the House, by email at gifttravelreports@mail.house.gov*, within 15 days after travel is completed. Please *do not* file this form with the Committee on Ethics.

NOTE: Willful or knowing misrepresentations on this form may be subject to criminal prosecution pursuant to 18 U.S.C. § 1001.

1. Name of Traveler: Daniel Dziadon

2. a. Name of Accompanying Relative: _____ *OR* None ☒
   b. Relationship to Traveler: ☐ Spouse ☐ Child ☐ Other (specify): _____

3. a. **Dates:** Departure: 8/15/2022 Return: 8/16/2022
   b. Dates at Personal Expense, if any: 8/16/2022 *OR* None ☐

4. Departure City: Washington, DC Destination: Chicago, IL Return City: Washington, DC

5. Sponsor(s), Who Paid for the Trip: ClearPath, Inc.

6. Describe Meetings and Events Attended:
   We toured Braidwood Nuclear Plant and received a briefing on their activities. We also toured multiple facilities and laboratories at Argonne National Lab, and met with the scientists and support staff who conduct the research.

7. Attached to this form are *each* of the following, *signify that each item is attached by checking the corresponding box*:
   a. ☒ a completed *Sponsor Post-Travel Disclosure Form*;
   b. ☒ the *Primary Trip Sponsor Form* completed by the trip sponsor *prior* to the trip, *including all* attachments *and* the *Additional Sponsor Form(s)*;
   c. ☒ page 2 of the completed *Traveler Form* submitted by the employee; *and*
   d. ☒ the letter from the Committee on Ethics approving my participation on this trip.

8. a. ☒ I represent that I participated in each of the activities reflected in the attached sponsor's agenda.
   Signify statement is true by checking the box.
   b. If not, explain:

I certify that the information contained on this form is true, complete, and correct to the best of my knowledge.

Signature of Traveler: Daniel Dziadon **Date:** 08/24/2022

I authorized this travel in advance. I have determined that all of the expenses listed on the attached *Sponsor Post-Travel Disclosure Form* were necessary and that the travel was in connection with the employee's official duties and would not create the appearance that the employee is using public office for private gain.

Name of Supervising Member: Frank D. Lucas **Date:** 8/24/2022

Signature of Supervising Member: Frank D Lucas

U.S. House of Representatives
COMMITTEE ON ETHICS

SPONSOR POST-TRAVEL DISCLOSURE FORM

☒ *Original* ☐ *Amendment*

This form must be completed by an officer of any organization that served as the primary trip sponsor in providing travel expenses or reimbursement for travel expenses to House Members, officers, or employees under House Rule 25, clause 5. **A completed copy of the form must be provided to each House Member, officer, or employee who participated on the trip *within ten days of their return*.** You must answer all questions, and check all boxes, on this form for your submission to comply with House rules and the Committee's travel regulations. Failure to comply with this requirement may result in the denial of future requests to sponsor trips and/or subject the current traveler to disciplinary action or a requirement to repay the trip expenses.

NOTE: Willful or knowing misrepresentations on this form may be subject to criminal prosecution pursuant to 18 U.S.C. § 1001.

1. Sponsor(s) who paid for the trip: ClearPath, Inc.
2. Travel Destination(s): Chicago, IL, Braceville, IL, Lemont, IL
3. Date of Departure: 8/15/2022 Date of Return: 8/16/2022
4. Name(s) of Traveler(s): Greg Warren, Parker Bennett, Daniel Dziadon

   Note: You may list more than one traveler on a form only if ***all*** information is ***identical*** for each person listed.
5. **Actual amount** of expenses paid on behalf of, or reimbursed to, each individual named in Question 4:

	Total **Transportation** Expenses	Total **Lodging** Expenses	Total **Meal** Expenses	Total **Other** Expenses (dollar amount per item and description)
Traveler	$344.20	$279	$150.78	$0
Accompanying Family Member				

6. ☒ All expenses connected to the trip were for actual costs incurred and not a *per diem* or lump sum payment. *Signify statement is true by checking box.*

I certify that the information contained in this form is true, complete, and correct to the best of my knowledge.

Signature: _____ Date: 08/09/2022

Name: Rich Powell Title: CEO

Organization: ClearPath, Inc.

☒ *I am an officer of the above-named organization. Signify statement is true by checking box.*

Address: 518 C St NE Suite 300 Washington,DC 20002

Email: powell@clearpath.org Telephone: (202) 670-1021

Committee staff may contact the above-named individual if additional information is required.

If you have questions regarding your completion of this form, please contact the Committee on Ethics at 202-225-7103.

U.S. House of Representatives
COMMITTEE ON ETHICS

TRAVELER FORM

1. Name of Traveler: Daniel Dziadon

2. Sponsor(s) who will be paying or providing in-kind support for the trip:
ClearPath, Inc.

3. City and State **OR** Foreign Country of Travel : Chicago, IL; Braceville, IL; and Lemont, IL

4. a. Date of Departure: 08/15/2022 Date of Return: 08/16/2022
   b. Yes ■ No ☐ Will you be extending the trip at your personal expense?
   If yes, list dates at personal expense: 08/16/2022

5. a. Yes ☐ No ■ Will you be accompanied by a family member at the sponsor's expense? **If yes:**
   (1) Name of Accompanying Family Member: _____
   (2) Relationship to Traveler: ☐ Spouse ☐ Child ☐ Other (specify): _____
   (3) Yes ☐ No ☐ Accompanying Family Member is at least 18 years of age:

6. a. Yes ■ No ☐ Did the trip sponsor answer "Yes" to Question 8(c) on the *Primary Trip Sponsor Form* (i.e., travel is sponsored by an entity that employs a registered federal lobbyist or a foreign agent)?
   b. **If yes**, and you are requesting lodging for two nights, explain why the second night is warranted:
   N/A

7. Yes ■ No ☐ *Primary Trip Sponsor Form* is attached, including agenda, invitee list, and any other attachments and Additional Sponsor Forms.

   NOTE: The agenda should show the traveler's individual schedule, including departure and arrival times and identify the specific events in which the traveler will be participating.

8. Explain why participation in the trip is connected to the traveler's individual official or representational duties.
   Staff should include their job title and how the activities on the itinerary relate to their duties.
   As a Professional Staff Member for the Committee on Science, Space, and Technology, I have direct oversight and legislative jurisdiction over energy research and development, including all DOE National Laboratories. This trip will visit Argonne National Lab and the Braidwood Nuclear Generating Station, both of which are directly applicable to Science Committee activities.

9. **Yes ☐ No ■ Is the traveler aware of any registered federal lobbyists or foreign agents involved planning, organizing, requesting, or arranging the trip?**

10. For staff travelers, to be completed by your employing Member:

ADVANCED AUTHORIZATION OF EMPLOYEE TRAVEL

I hereby authorize the individual named above, an employee of the U.S. House of Representatives who works under my direct supervision, to accept expenses for the trip described in this request. I have determined that the above-described travel is in connection with my employee's official duties and that acceptance of these expenses will not create the appearance that the employee is using public office for private gain.

Signature of Employing Member Frank D Lucas Date 08/09/22

U.S. House of Representatives
COMMITTEE ON ETHICS

PRIMARY TRIP SPONSOR FORM

This form should be completed by private entities offering to provide travel or reimbursement for travel to House Members, officers, or employees under House Rule 25, clause 5. A completed copy of the form (and any attachments) should be provided to each invited House Member, officer, or employee, who will then forward it to the Committee together with a *Traveler Form* **at least 30 days before the start date of the trip**. The trip sponsor should *NOT* submit the form directly to the Committee. The Committee website (ethics.house.gov) provides detailed instructions for filling out the form.

NOTE: Willful or knowing misrepresentations on this form may be subject to criminal prosecution pursuant to 18 U.S.C. § 1001. Failure to comply with the Committee's Travel Regulations may also lead to the denial of permission to sponsor future trips.

1. Sponsor who will be paying for the trip:
   ClearPath, Inc.
2. ☑ I represent that the trip will not be financed, in whole or in part, by a registered federal lobbyist or foreign agent. *Signify that the statement is true by checking box.*
3. ***Check only one.*** I represent that:
   a. ■ The primary trip sponsor has not accepted from any other source, funds intended directly or indirectly to finance any aspect of the trip: **OR**
   b. ☐ The trip is arranged without regard to congressional participation and the primary trip sponsor has accepted funds only from entities that will receive a tangible benefit in exchange for those funds: **OR**
   c. ☐ The primary trip sponsor has accepted funds from other source(s) intended directly or indirectly to finance all or part of this trip and has enclosed disclosure forms from each of those entities.
   If "c" is checked, list the names of the additional sponsors:
4. Provide names and titles of **ALL** House Members *and* employees you are inviting. **For each House invitee, provide an explanation of why the individual was invited** (include additional pages if necessary):
   See attached Congressional invitee list, Legislative Staff from relevant committees of jurisdiction.
5. Yes ☐ No ■ Is travel being offered to an accompanying family member of the House invitee(s)?
6. Date of departure: August 15, 2022 Date of return: August 16, 2022
7. a. City of departure: Washington, DC
   b. Destination(s): Chicago, IL, Braceville, IL and Lemont, IL
   c. City of return: Washington, DC
8. ***Check only one.*** I represent that:
   a. ☐ The sponsor of the trip is an institution of higher education within the meaning of section 101 of the Higher Education Act of 1965: **OR**
   b. ☐ The sponsor of the trip does not retain or employ a registered federal lobbyist or foreign agent: **OR**
   c. ■ The sponsor employs or retains a registered federal lobbyist or foreign agent, but the trip is for attendance at a one-day event *and* lobbyist / foreign agent involvement in planning, organizing, requesting, or arranging the trip was *de minimis* under the Committee's travel regulations.
9. ***Check only one of the following***:
   a. ☐ I checked 8(a) or (b) above; **OR**
   b. ☐ I checked 8(c) above but am not offering any lodging; **OR**
   c. ■ I checked 8(c) above and am offering lodging and meals for one night; **OR**
   d. ☐ I checked 8(c) above and am offering lodging and meals for two nights. If you checked this box, explain why the second night of lodging is warranted:

10. ■ Attached is a detailed agenda of the activities House invitees will be participating in during the travel (i.e., an hourly description of planned activities for trip invitees). *Indicate agenda is attached by checking box.*

11. ***Check only one of the following***:
a. ■ I represent that a registered federal lobbyist or foreign agent will not accompany House Members or employees on any segment of the trip. *Signify that the statement is true by checking box;* **OR**
b. ☐ *Not Applicable.* Trip sponsor is a U.S. institution of higher education.

12. For ***each*** sponsor required to submit a sponsor form, describe the sponsor's interest in the subject matter of the trip ***and*** its role in organizing and/or conducting the trip:

ClearPath has developed The Clean Energy Innovation Academy (CEIA). CEIA is an ongoing educational series with briefings focused on conservative clean energy technology and policy, featuring discussions from industry experts, academia and the public sector. The 2022 series will feature the opportunity for Congressional staff to participate in a site visit to Chicago, and to visit the Braidwood Nuclear Generating Station and Argonne National Laboratory.

13. ***Answer parts a and b. Answer part c if necessary***:
a. Mode of travel: Air ■ Rail ☐ Bus ■ Car ☐ Other ☐ (specify:_____)
b. Class of travel: Coach ■ Business ☐ First ☐ Charter ☐ Other ☐ (specify: _____)
c. If travel will be first class, or by chartered or private aircraft, explain why such travel is warranted:

14. ☑ I represent that the expenditures related to local area travel during the trip will be unrelated to personal or recreational activities of the invitee(s). *Signify that the statement is true by checking the box.*

15. ***Check only one.*** I represent that either:
a. ☐ The trip involves an event that is arranged or organized *without regard* to congressional participation and that meals provided to congressional participants are similar to those provided to or purchased by other event attendees; **OR**
b. ■ The trip involves events that are arranged specifically *with regard* to congressional participation.
If "b" is checked:
1) Detail the cost *per day* of meals (approximate cost may be provided):
$100 (approximate)
2) Provide the reason for selecting the location of the event or trip:
Argonne National Labratory (DOE entity) and Braidwood are located in the Chicago suburbs

16. Name, nightly cost, and reasons for selecting each hotel or other lodging facility:
Hotel Name: Pendry Chicago Hotel City: Chicago, IL Cost Per Night: $279
Reason(s) for Selecting: Proximity to both tour site locations and home base location of educational speakers
Hotel Name: _____ City: _____ Cost Per Night: _____
Reason(s) for Selecting: _____
Hotel Name: _____ City: _____ Cost Per Night: _____
Reason(s) for Selecting: _____

17. ■ I represent that all expenses connected to the trip will be for actual costs incurred and not a per diem or lump sum payment. *Signify that the statement is true by checking the box.*

U.S. House of Representatives
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18. **Total Expenses for each Participant:**

☐ Actual Amounts ■ Good Faith Estimates	Total **Transportation** Expenses per Participant	Total **Lodging** Expenses per Participant	Total **Meal** Expenses per Participant
For each Member, Officer, or Employee	$350	$279	$130
For each Accompanying Family Member			

	Other Expenses (dollar amount per item)	Identify Specific Nature of "Other" Expenses (e.g., taxi, parking, registration fee, etc.)
For each Member, Officer, or Employee		
For each Accompanying Family Member		

NOTE: Willful or knowing misrepresentations on this form may be subject to criminal prosecution pursuant to 18 U.S.C. § 1001.

19. ***Check only one:***
   a. ■ I certify that I am an officer of the organization listed below; **OR**
   b. ☐ *Not Applicable.* Trip sponsor is an individual or a U.S. institution of higher education.

20. I certify by my signature that
   a. I read and understand the Committee's Travel Regulations;
   b. I am not a registered federal lobbyist or registered foreign agent; and
   c. The information on this form is true, complete, and correct to the best of my knowledge.

Signature: _____ Date: 08/09/2022

Name: Rich Powell Title: CEO

Organization: ClearPath, Inc.

Address: 518 C St NE Suite 300 Washington,DC 20002

Email: powell@clearpath.org Telephone: (202) 670-1021

INSTRUCTIONS

Complete the *Primary Trip Sponsor Form* and submit the agenda, invitation list, any attachments, and any *Additional Trip Sponsor Forms* directly to the Travelers.

Written approval from the Committee on Ethics is required before traveling on this trip. The Committee on Ethics will notify the House invitees directly and will not notify the trip sponsors.

Willful or knowing misrepresentation on this form may be subject to criminal prosecution under 18 U.S.C. § 1001. Signatures must comply with section 104(bb) of the Travel Regulations.

For questions, please contact the Committee on Ethics at:

1015 Longworth House Office Building
Washington, D.C. 20515

ethicscommittee@mail.house.gov | 202-225-7103
More information and forms available at **ethics.house.gov**

U.S. House of Representatives

COMMITTEE ON ETHICS

Washington, DC 20515

August 11, 2022

Mr. Daniel Dziadon
Committee on Science, Space, and Technology
H2-394 Ford House Office Building
Washington, DC 20515

Dear Mr. Dziadon:

Pursuant to House Rule 25, clause 5(d)(2), the Committee on Ethics hereby approves your proposed trip to Chicago, Illinois, scheduled for August 15 to 16, 2022, sponsored by ClearPath, Inc. We note that this trip includes one day at your personal expense.

You must complete an Employee Post-Travel Disclosure Form (which your employing Member must also sign) and file it, together with a Sponsor Post-Travel Disclosure Form completed by the trip sponsor, with the Clerk of the House within 15 days after your return from travel. As part of that filing, you are also required to attach a copy of this letter and both the Traveler and Primary Trip Sponsor Forms (including attachments) you previously submitted to the Committee in seeking pre-approval for this trip. If you are required to file an annual Financial Disclosure Statement, you must also report all travel expenses totaling more than $415 from a single source on the "Travel" schedule of your annual Financial Disclosure Statement covering this calendar year. Finally, Travel Regulation § 404(d) also requires you to keep a copy of all request forms and supporting information provided to the Committee for three subsequent Congresses from the date of travel.

If you have any further questions, please contact the Committee's Office of Advice and Education at extension 5-7103.

Sincerely,

Theodore E. Deutch
Chairman

Michael Guest
Acting Ranking Member

TED/MG:kjf

VISITOR INFORMATION

Argonne NATIONAL LABORATORY

Clean Energy Innovation Academy

Monday, August 15, 2022

SITE ACCESS AND DIRECTIONS

Argonne National Laboratory is located at 9700 S Cass Ave, Lemont, IL 60439 just West of the intersection of South Cass Avenue and Northgate Road in Lemont, IL. Follow Northgate Road to the Argonne gate. When approaching Argonne's North Gate, stay in the far-right lane. Before you reach the gate, turn right to access the Argonne Information Center (AIC).

All visitors, including the driver, should proceed inside the AIC. Argonne Security and Sarah Higgins, Deputy Director, Government Relations, will be there to greet you. Submit any outstanding documentation, and obtain your gate passes for site access. Sarah Higgins will board your vehicle and plan to ride in it with you for the duration of your visit. She will provide the driver with directions to each location on the agenda.

CONTACT INFORMATION

Your primary contact at Argonne is Holly Shearer, Head of Events and Protocol, Communication and Public Affairs: 312-399-9267; hshearer@anl.gov.

COVID-19 HEALTH AND SAFETY PROTOCOLS FOR VISITORS

DuPage County, where Argonne National Laboratory is located, is currently in High/Orange per CDC's Covid-19 Community Levels. You will need to show proof of COVID-19 vaccination or a negative COVID test upon arrival.

Face coverings are required, except to the extent necessary to eat or drink when maintaining appropriate physical distance, or when an individual is isolated in an enclosed space. The laboratory will continue to update its site access policies based on the evolution of the COVID-19 pandemic. Please follow all safety protocols posted by the Laboratory.

REQUIRED SAFETY ATTIRE FOR TOURS

For safety purposes, please wear long pants, closed-toe flat or block heel shoes, and at least quarter length sleeves. Tours include short walks, therefore, comfortable footwear is recommended. Safety glasses will be provided as needed.

PHOTOGRAPHY

A photographer will be on site to capture moments throughout your visit. Select images may be used on Argonne's website and/or social media channels following your visit. Argonne personnel will coordinate these efforts with your team. If you consent to being photographed for this purpose, please review, sign, and return the audio visual release form found on the next page. Hard copies will be available for each person to sign at the first meeting location.

Argonne NATIONAL LABORATORY

9700 South Cass Avenue
Lemont, IL 60439

Guest - Video & Audio Release

Title of Presentation, Event or Meeting: Clean Energy Innovation Academy

Sponsoring Division: OTD Date Presented: 08-15-22 Location: ANL

Copyright License. In consideration for my participation in the above presentation, event or meeting, I hereby grant to UChicago Argonne, LLC, Operator of ARGONNE NATIONAL LABORATORY under Contract No. DE-AC02-06CH11357 with U.S. Department of Energy, its assignees, licensees and legal representatives, as well as the U.S. Government and those acting on behalf of the foregoing (collectively, "Argonne"), the irrevocable, royalty-free rights related to any copyrighted works that I have used, provided, published, presented, displayed or reproduced at the above presentation, event and/or meeting. The foregoing grant expressly includes the right to use, copy, modify, prepare derivative works and compilations, and to perform and publicly display the copyrighted materials in all formats worldwide, and without additional review or approval. In connection with the above grant, I also hereby grant to Argonne the nonexclusive right and license to transcribe the presentation, to reproduce and distribute the transcription and any written material submitted in connection with the presentation and the right to use my name, photograph, and biography in connection with the presentation and written materials. I warrant that the above copyrighted works are authored by me, that their publication will not infringe on the rights of others, and that I have full power to grant the foregoing rights. If my presentation or written materials contain copyrighted material, I have obtained permission from the copyright owner and a copy of the permission is attached to this form. I hereby waive any moral rights to the above-referenced copyrighted work.

Use of Likeness. I acknowledge that recording and/or filming may take place at Argonne National Laboratory, including but not limited to the above presentation, meeting or event. In connection with my presence at Argonne National Laboratory, or in the above presentation, meeting or event, I hereby grant to Argonne the irrevocable, royalty-free rights to use, to permit the use of, to project, to distribute, to publish, to reproduce, and to use in advertisement the recorded voice of the undersigned, as well as photographs, likenesses, video and/or other audio or visual recordings of the undersigned and/or of property owned or operated by the undersigned. The foregoing grant shall expressly include the right to use the foregoing in any and all media throughout the world with whatever copy Argonne so chooses, in whole or in part, without restriction as to frequency or duration of usage, and without additional review or approval.

Waiver & Release. I hereby waive any rights under the Illinois Right of Publicity Act, 765 ILCS 1075, as well as any right for pecuniary award, compensation or consideration, including that under the Atomic Energy Act of 1954 for the subject matter of this agreement. I further waive any right of inspection or compensation otherwise available to me under any other applicable law. I hereby release Argonne from any claims, damages or liability in connection with the subject matter of this agreement.

Signature	Print Name
Title	Date

ANL-582 (09/08/2020)

Monday, August 15, 2022

Events team contact: Holly Shearer, hshearer@anl.gov, 312-399-9267

Congressional Staff:

- Greg Warren, Legislative Assistant, Rep. Darin LaHood (R-IL)
- Hannah Anderson, Energy and Commerce Policy Director, Rep. Dan Crenshaw (R-TX)
- Tommy Reynolds, Senior Policy Advisor, Rep. Buddy Carter (R-GA)
- Jake Bornstein, Communications Director, Rep. John Curtis (R-UT)
- Ashley Higgins, Legislative Assistant, Congressional Western Caucus
- Mike Davin, Legislative Director, Rep. Bob Latta (R-OH)
- Parker Bennett, Legislative Assistant, Rep. John Joyce (R-PA)
- Daniel Dziadon, Professional Staff, House Science, Space & Tech Committee
- Ryan Mowrey, Legislative Aide, Sen. Lindsey Graham (R-SC)
- Kalyn Swihart, Legislative Correspondent, Sen. Rob Portman (R-OH)

ClearPath:

- Alex Fitzsimmons, Senior Program Director
- Emily Johnson, External Affairs Manager
- Amanda Sollazzo, Government Affairs Associate
- Luke Bolar, Chief External Affairs Officer
- Niko McMurray, Managing Director, Public Policy
- Grant Cummings, Policy Analyst
- Casey Kelly, Policy Analyst
- Jane Reynolds, Communications Associate

1:30 p.m. **Arrive at Argonne Information Center**
9700 S Cass Ave, Lemont, IL 60439

Visitors, including drivers, should check in at the Argonne Information Center (AIC) upon arrival. Each visitor will be issued a gate pass for site access.

Transportation to Argonne Leadership Computing Facility, Building 240, Room 1501.

1:50 p.m. **Argonne Welcome and Overview**

Location: Bldg 240, Room 1501

***Sarah Higgins**, Deputy Director, Government Relations, Science and Technology, Partnerships and Outreach*
***Kirsten Laurin-Kovitz,** Associate Laboratory Director, Nuclear Technologies and National Security*
***Suresh Sunderrajan,** Associate Laboratory Director, Advanced Energy Technologies*
***Greg Krumdick,** Director, Applied Materials*
***Steve Przesmitzki,** Interim Director, Transportation and Power Systems*

2:20 p.m. **Transforming Science and Society through Exascale Computing and AI**

Location: Bldg 240, Aurora Viewing Platform

***Jini Ramprakash**, Deputy Division Director, Argonne Leadership Computing Facility*

The Argonne Leadership Computing Facility (ALCF), a U.S. Department of Energy (DOE) Office of Science user facility, provides powerful supercomputing resources to the scientific community. ALCF is progressing with the deployment of two new supercomputers: Polaris and Aurora. Polaris is a leading-edge testbed system that will give scientists and application developers a platform to test and optimize codes for Aurora, Argonne's future exascale system. Aurora will feature several technological innovations, including a revolutionary I/O system to support new types of workloads. The system will be highly optimized across multiple dimensions that are key to success in simulation, data, and learning applications.

Argonne is advancing artificial intelligence (AI) to address critical challenges in science, technology and medicine, from healthcare and cancer research, to climate science and clean energy, to fundamental science and cosmological discovery. Researchers are coupling AI methods such as machine learning and deep learning with next-generation supercomputers to accelerate the pace of scientific discovery. A significant scientific thrust is currently underway in autonomous discovery and self-driving laboratories to automate scientific experiments, observations, and data generation to solve challenging research problems at unprecedented scale.

2:45 p.m. **Transportation to Materials Engineering Research Facility**

2:55 p.m. **Energy Storage: From Basic Materials Science to Battery Manufacturing and Recycling**

Location: Materials Engineering Research Facility

Greg Krumdick, *Director, Applied Materials*
Krzysztof Pupek*, Group Leader, Process R&D and Scale Up, Applied Materials*

Argonne's energy storage program brings together a wide-range of unique expertise including fundamental discovery science, application-driven research, scale-up and manufacturing, recycling, and system analysis, working in concert to drive new innovations to societal impact. In performing the research Argonne scientists work closely with other National Labs, Universities, and numerous private industries. Argonne leads multi-institutional flagship programs including the Joint Center for Energy Storage Research (JCESR), focused on the science of beyond Li-ion batteries and the ReCell recycling center. One unique aspect of the energy storage effort is the scale-up of battery and related energy materials at the Materials Engineering Research Facility (MERF). The MERF is a state-of-the-art, 28,000 square foot R&D facility focused on processes for accelerated materials synthesis, scale-up of new chemistries, and the development and validation of emerging materials manufacturing technologies. The MERF houses many capabilities relevant to DOE strategic energy and climate priorities, including energy storage, where work is underway to scale up materials for higher-density, longer-lived, faster-charging, and safer batteries both for long-duration grid storage and the transportation sector.

The MERF is also home to DOE's advanced battery recycling center, ReCell, which develops recycling techniques for lithium-ion and future batteries. ReCell will help create recycling jobs, encourage vehicle electrification, and strengthen the U.S. supply chain of battery materials.

3:20 p.m. **Transportation to Center for Nanoscale Materials**

3:30 p.m. **Tour of the Center for Nanoscale Materials**

Location: Building 440

Connie Pfeiffer*, User Program Manager, Center for Nanoscale Materials, Nanoscience and Technology Division*

The Center for Nanoscale Materials (CNM) at the U.S. Department of Energy's Argonne National Laboratory is a premier national user facility for interdisciplinary nanoscience and nanotechnology research by academic, industrial, and international researchers. These scientists and engineers are provided with state-of-the-art capabilities to fabricate, process, characterize, and model nanoscaled-sized materials. The synergy that results from teams of chemists, materials scientists, physicists, theorists, and engineers working together in the nanoscale regime results in truly remarkable projects and advancements. The center's scientific portfolio includes energy-related research and development programs in areas such as catalysis, solar energy, batteries, sensors, solid-state lighting, micro/nano-electromechanical systems, nanophotonics, nanotomography, and magnetism.

3:55 p.m. **Transportation to Advanced Photon Source**

4:05 p.m. **New Frontiers in Science at the Advanced Photon Source**

Location: Bldg 401

Denny Mills, *Deputy Associate Laboratory Director, Photon Sciences*

The Advanced Photon Source (APS), a DOE Office of Science user facility, provides ultrabright x-rays that researchers use to obtain images of structures and dynamics inside many types of materials, chemical systems, and biological systems. More than 5,500 scientists each year use the APS to spur pivotal discoveries across almost the entire spectrum of science and technology, from clean energy and biology to geology and engineering.

The tour will highlight transformative research using the current APS and provide an overview of the APS Upgrade project, currently scheduled for completion in 2024. The upgrade will increase the brightness of the X-ray beams by up to 500 times, keeping the facility at the forefront of global light sources for decades to come. The APS Upgrade will allow users to probe materials faster and at higher resolutions, opening up new frontiers for both science and industry. The APS Upgrade, combined with the power of the ALCF's Aurora exascale supercomputer, will accelerate discoveries across the scientific spectrum.

4:35 p.m. **Li-Bridge: Improving U.S. Supply Chain for Lithium-based Batteries**

Location: Building 402, Lower Gallery

Venkat Srinivasan, *Director, Argonne Collaborative Center for Energy Storage Science*

Li-Bridge is a public-private alliance committed to accelerating the development of a robust and secure domestic supply chain for lithium-based batteries.

Argonne leads coordination of Li-Bridge by serving as the facilitator between private industry and the Federal Consortium for Advanced Batteries, which released a National Blueprint for Lithium Batteries, 2021 – 2030. The Blueprint aims to put the U.S. on a path to long-term competitiveness in the global battery value chain.

4:45 p.m. **Supply Chain Dynamics**

Allison Bennett Irion, *Director, Supply Chain Research, Nuclear Technologies and National Security/Advanced Energy Technologies*

As noted in the DOE report, "America's Strategy to Secure the Supply Chain for a Robust Clean Energy Transition," a secure, resilient supply chain will be critical in achieving a net-zero emissions economy and capturing the economic opportunity inherent in the energy sector transition. Argonne experts use data analytics, modeling, simulation, and visualization tools that balance supply chain risk and efficiency, respond to disruptive trends and technologies, optimize for cost effective resilience, and assess the consequences of disruptions to complex interdependent supply chains.

4:55 p.m. **Grid Modeling and Valuation**

Vladimir Koritarov, *Director, Center for Energy, Environmental, and Economic Systems Analysis*

Research implications from the nation's ambitious goal to decarbonize the electric grid by 2035 are manifold. Argonne scientists use analytical models of technology, policy, and markets to inform potential decarbonization pathways that are viable, affordable, and reliable.

5:05 p.m. **Argonne Leadership Q&A**

***Sarah Higgins**, Deputy Director, Government Relations, Science and Technology, Partnerships and Outreach*
***Vladimir Koritarov,** Director, Center for Energy, Environmental, and Economic Systems Analysis*
***Greg Krumdick,** Director, Applied Materials*
***Steve Przesmitzki,** Interim Director, Transportation and Power Systems*

5:30 p.m. **Visit Concludes**

BIOGRAPHIES
Argonne National Laboratory

ALLISON BENNETT IRION
Director, Supply Chain Research
Nuclear Technologies & National Security and Advanced Energy Technologies
abi@anl.gov

Allison Bennett Irion is the Supply Chain Research Director in the Nuclear Technologies & National Security and Advanced Energy Technologies directorates and Program Lead at Argonne. She is the chair of the Advanced Supply Chain Analytics team, which is a joint initiative between Strategic Security Sciences and Decision and Infrastructure Sciences on end-to-end supply chain solutions that assure the supply of materials critical to U.S. strategic interests and deny the supply of proliferation-sensitive goods to adversaries. She serves as Argonne's relationship manager for DOE/NNSA's Global Material Security Office, which she has supported as a technical expert for over 15 years; she co-leads a rare-earth supply chain team that supports DOD's Defense Logistics Agency.

Previously, Bennett Irion was a Senior Systems Engineer at Sandia National Laboratories (Albuquerque and DC) and most recently was NA-21's forward deployed expert in London, UK, supporting their radiation detection work in Europe, Middle East and Africa. She has led maritime threat modeling efforts, equipment testing and installation campaigns for several U.S. government agencies and international partners, including supporting the IAEA and the Olympic Games.

She is an appointed member of the Research, Innovation and Strategy subcommittee for APICS, a 45,000-member supply chain professional group and Supply Chain Strategy has published her research on the impacts of container security legislation to global supply chains. She serves as an officer in both the U.S. Navy Reserve and U.S. Merchant Marine.

SARAH HIGGINS
Deputy Director, Government Relations
Science and Technology Partnerships and Outreach
shiggins@anl.gov

Sarah Higgins is the Deputy Director of Government Relations at Argonne National Laboratory. Based in Washington, D.C., Sarah interacts with government agencies, congressional offices and committees and assists in the development of collaborations between industries, universities and other organizations. Previously, Sarah worked on Capitol Hill in the U.S. House of Representatives and the U.S. Senate as a senior advisor for appropriations, as well as science, technology and energy policy. She has a BA in Political Science and International Studies from Loyola University Chicago.

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VLADIMIR KORITAROV

Director, Center for Energy, Environmental, and Economic Systems Analysis
Energy Systems and Infrastructure Analysis
koritarov@anl.gov

Vladimir Koritarov is the Director of the Center for Energy, Environmental, and Economic Systems Analysis (CEEESA) in Argonne National Laboratory's Energy Systems and Infrastructure Analysis division. CEEESA conducts research of complex energy and environmental systems and provides technical support and analysis to the U.S. Department of Energy, other U.S. government agencies, as well as to international organizations and institutions around the world.

Koritarov has over 30 years of experience in the modeling and analysis of electric and overall energy systems in domestic and international applications. He has conducted numerous studies analyzing long-term energy issues, developing energy strategies, and providing technical support for energy policy decision making. Currently, he also serves as Argonne's Program Manager for Water Power Program, which includes hydropower and marine energy technologies. In recent years, he has led several high profile multi-lab projects in this area, including the development of a comprehensive methodology and a guidebook for valuation of pumped storage hydropower.

Most recently, Koritarov has been working on the development of new agent-based modeling approaches for the simulation of energy and electricity markets, as well as on applying advanced simulation methods to study grid modernization, possible evolution paths of electric power systems, integration of high levels of variable renewables and energy storage technologies into the power grid, energy infrastructure analysis, and interdependencies of the electric sector and other sectors of the economy.

GREGORY KRUMDICK

Director
Applied Materials
gkrumdick@anl.gov

Greg Krumdick is the Director of Argonne's Applied Materials division. Previously, he managed Argonne National Laboratory's Materials Engineering Research Facility (MERF). He has been the principal investigator and lead engineer on numerous industrial process scale-up projects. Krumdick holds numerous patents and has earned three R&D 100 awards and a Federal Laboratory Consortium award for technology transfer.

Krumdick designed and helped establish the MERF and today, he leads Argonne's process development and scale-up programs in the Energy Systems division. Krumdick and his team have successfully scaled over 20 advanced battery materials and collaborated with numerous corporations, national laboratories, universities and industrial partners.

He earned his M.S. degree in Bioengineering from the University of Illinois at Chicago, focusing on process control systems.

KIRSTEN LAURIN-KOVITZ

Associate Laboratory Director
Nuclear Technologies and National Security
klaurinkovitz@anl.gov

Kirsten Laurin-Kovitz is Associate Laboratory Director for Nuclear Technologies and National Security at Argonne National Laboratory. She leads an organization that supports a secure and resilient society by advancing nuclear energy and delivering innovative, objective science- and engineering-based solutions to inform decision making. The Nuclear Technologies and National Security directorate leverages Argonne's longstanding, world-leading expertise in nuclear energy, coupled with its unique, first-in-class capabilities in nonproliferation and infrastructure science, to tackle energy and security challenges. In particular, the directorate focuses on enduring and emerging challenges in nuclear reactors and fuel cycles; nonproliferation; infrastructure risk and resilience analysis; intelligence and vulnerability analysis; and emergency and disaster preparedness.

Previously, Laurin-Kovitz was the director of the Strategic Security Sciences division. In this role, she led more than 100 scientists and engineers who worked to prevent, detect, and mitigate chemical, biological, radiological, nuclear, and cybersecurity threats through analytical assessments, applied research, technology development, and global engagement to promote peaceful uses of critical materials and technologies.

She has more than 20 years of experience in nuclear reactor analysis, nuclear nonproliferation, and nuclear material safeguards. Before her directorship of the Strategic Security Sciences division, she led the Nonproliferation Policy Support Group within the Center for Strategic Security for Argonne's Global Security Sciences division, where she managed a team that combined expertise in science and engineering with the knowledge of nonproliferation policies and international affairs. They provided technical advisory services and conducted outreach for policy implementation, including training export control enforcement personnel on strategic weapons of mass destruction–related commodities and nuclear authorities on implementation of the additional protocol.

In addition to her technical work, Laurin-Kovitz actively supports diversity and inclusion efforts. She participates in Argonne's Women in Science and Technology Program, which provides leadership and resources to promote the success of women in scientific and technical positions at Argonne. She was also the co-founder of Argonne's Introduce a Girl to Engineering Day for middle-school girls.

She received the American Nuclear Society Mary Jane Oestmann Professional Women's Achievement Award in 2013. She completed the Strategic Laboratory Leadership Program at the University of Chicago Booth School of Business in 2008 and the U.S. Department of Energy's Oppenheimer Science and Energy Leadership Program in 2018.

Laurin-Kovitz earned her Master of Science and PhD degrees in Mechanical Engineering from Northwestern University and her Bachelor of Science in General Engineering from the University of Illinois at Urbana-Champaign.

DENNIS MILLS

Deputy Associate Laboratory Director
Photon Sciences
dmm@aps.anl.gov

Dennis Mills is the Deputy Associate Laboratory Director for Photon Sciences at Argonne's synchrotron, the Advanced Photon Source. His main scientific interests are X-ray optics for synchrotron radiation applications and the use of the unique properties of synchrotron radiation, such as the polarization and modulated time structure, for studying condensed matter physics.

Mills has a BS in physics from Rensselaer Polytechnic Institute and an MS in applied physics from Cornell University. After obtaining his PhD at Cornell University in 1979, he worked as a staff scientist at the Cornell High Energy Synchrotron Source.

In 1987, he was awarded a Guggenheim Fellowship to continue this work and held a visiting scientist post at Argonne National Laboratory and at the Synchrotron Radiation Source at Daresbury Laboratory, Daresbury, U.K during that year.

He joined the staff of the Advanced Photon Source in 1988 as the group leader for X-ray optics and beamlines at the APS.

Mills served as the main editor of the *Journal of Synchrotron Radiation* from 2000-2008. He received the APS Arthur H. Compton Award in 1998, the University of Chicago Medal for Distinguished Performance at Argonne in 1997, and the Argonne Board of Governor's Pinnacle of Education Award in 2008 for his contribution to the development of an X-ray and neutron summer school.

CONNIE PFEIFFER

User Program Manager, Center for Nanoscale Materials
Nanoscience and Technology
cpfeiffer@anl.gov

Connie Pfeiffer is the user program manager for the Center for Nanoscale Materials in the Nanoscience and Technology division. She is responsible for user administration and the development of collaborative partnerships with academia, industry, and the user community at large.

Her background is in X-ray crystallography and supramolecular, inorganic, and materials chemistry. Specifically in crystal engineering and the synthesis of metal organic frameworks composed of porphyrins and naphthalene diimides for applications in catalysis, and gas and energy storage.

Pfeiffer earned her PhD in Supramolecular Chemistry from the University of Missouri in 2015.

STEVE PRZESMITZKI

Interim Director
Transportation and Power Systems
sprzesmitzki@anl.gov

Steve Przesmitzki is Interim Director of the Transportation and Power Systems division; is currently the Laboratory Program Manager for Vehicle Technologies and Acting Director of the Center for Transportation Research. In his role at Argonne, Steve is working to advance sustainable transportation technologies.

Prior to Argonne, Steve was the head of Strategic Transport Analysis and Outlooks at the Aramco Research Center – Detroit. Steve was also a Technology Development Manager for fuels and lubricants within the United States Department of Energy's Vehicle Technologies Program in Washington, DC, a senior project manager researching fuels for DOE's National Renewable Energy Laboratory in Golden, CO, and a powertrain design and development engineer at Ford Motor Company in Dearborn, MI.

Steve holds a PhD from the Massachusetts Institute of Technology, a MS from the University of Michigan, and a BS from Kettering University; all in Mechanical Engineering. Steve is also a fellow of the Society of Automotive Engineers.

KRZYSZTOF PUPEK

Group Leader, Process R&D and Scale Up
Applied Materials
kpupek@anl.gov

Kris Pupek is the Group Leader for Process R&D and Scale Up in the Applied Materials division.

The group evaluates emerging synthesis techniques and develops scalable processes for manufacturing of advanced materials including organic, inorganic, polymeric and nanomaterials to support basic research and industrial evaluation.

He earned his PhD in Organic Chemistry and Technology in 1993 from Institute of Organic Chemistry, Polish Academy of Sciences. He gained his experience working for nearly 20 years for various contract research and manufacturing organizations leading efforts for developing new chemistry routes and feasible processes for manufacturing pharmaceuticals, agrochemicals and specialty chemicals. In 2010 Pupek joined Argonne National Laboratory as Principal Process R&D Chemist in Material Engineering Research Facility. He has co-authored over 20 publications, 15 issued patents, numerous invention disclosures, technical reports and presentations.

JINI RAMPRAKASH

Deputy Division Director
Argonne Leadership Computing Facility
jini@alcf.anl.gov

Sreeranjani (Jini) Ramprakash is the Deputy Division Director at Argonne National Laboratory's Leadership Computing Facility (ALCF). She manages the operating activities of the division as it relates to ALCF's supercomputers; and promotes ALCF's technical and scientific research objectives with Department of Energy sponsors.

In her previous role at the ALCF, Jini led the team responsible for providing support and services to researchers from all over the world. She also helped develop the facility's business intelligence systems by modeling data and building software to streamline reporting.

Passionate about engaging girls in STEM activities, she volunteers for Systers, mentors for Google Summer of Code and Google Code-In, helps organize Argonne's Introduce a Girl to Engineering Day and Science Careers in Search of Women events, and helps facilitate the National Lab presence at the annual Grace Hopper Celebration for Women in Computing. Jini is the recipient of 2017 Association for Women in Science – Chicago Chapter Motivator Award.

She has an MBA from the University of Chicago Booth School of Business. She also has a master's degree from UT Arlington and a bachelor's degree from Mangalore University, both in Computer Science and Engineering.

VENKAT SRINIVASAN

Director, Argonne Collaborative Center for Energy Storage Science
Deputy Director, Joint Center for Energy Storage Research
vsrinivasan@anl.gov

Venkat Srinivasan is the director of the Argonne Collaborative Center for Energy Storage Science (ACCESS) and deputy director of the Joint Center for Energy Storage Research (JCESR, the battery “Hub”).

ACCESS provides the vision and coordinates the energy storage programs at Argonne and serves as a point of entry for industry to take advantage of the unique capabilities and facilities at Argonne to solve their problems in energy storage. JCESR is a national program led by Argonne that focuses on next-generation energy storage research that goes beyond lithium-ion technology.

He is a former staff scientist at Lawrence Berkeley National Lab (LBNL). His research interest is in developing next-generation batteries for use in vehicle and grid applications, among other things. Srinivasan and his research group develop continuum-based models for battery materials and combine them with experimental characterization to help design new materials, electrodes, and devices.

In addition to his research, Srinivasan is interested in moving technologies to market and has been exploring ways to develop an ecosystem, focused on batteries, to accelerate technology commercialization. In this role, Srinivasan conceived the idea of CalCharge, a one-of-a-kind public-private partnership in energy storage.

Srinivasan has previously served as the technical manager of the Batteries for Advanced Transportation Technologies (BATT) Program, as the acting director of the BATT program, as department head of the Energy Storage and Distributed Resources (ESDR) department at LBNL, and the interim director of the ESDR Division at LBNL. Srinivasan joined the scientific staff at LBNL in 2003 after postdoctoral studies at the University of California, Berkeley and Pennsylvania State University. He received his PhD from the University of South Carolina in 2000. He is also the author of a popular battery blog titled, “This Week in Batteries.”

SURESH SUNDERRAJAN

Associate Laboratory Director
Advanced Energy Technologies
ssunderrajan@anl.gov

Suresh Sunderrajan is Associate Laboratory Director for Advanced Energy Technologies (AET) at Argonne National Laboratory. He leads an organization of scientists, engineers, and analysts working to enable a sustainable, secure, equitable, and prosperous energy future. AET solves the most pressing energy, mobility, materials, and manufacturing challenges by using the laboratory's world-class scientific and engineering expertise and facilities. The AET team collaborates with internal and external partners on cutting-edge research, development, demonstration, and deployment of clean energy technologies.

Sunderrajan was previously the Associate Laboratory Director for Energy and Global Security, from which the Advanced Energy Technologies and Nuclear Technologies and National Security directorates were formed in 2022. In that role, he led an organization that applied crosscutting expertise in science, engineering, and technology to develop solutions to challenging problems related to energy, transportation, manufacturing, and global security including nuclear nonproliferation, CBRN threat detection and critical infrastructure security.

Before that, he served as Associate Laboratory Director for Science and Technology Partnerships and Outreach, Argonne's commercialization and licensing organization which works with the laboratory's research directorates to develop strategies that sustain and expand Argonne's relationships with industry, academia, government, and other sectors.

Prior to his career at Argonne, he worked at United Technologies Corporation, where he served as Director of Innovation Business Development, the Corporate Intellectual Property monetization organization that is responsible for patent and technology licensing, patent sales, and new business incubation opportunities. Before working at United Technologies Corporation, he was a seasoned entrepreneur who was part of the founding teams for four different start-ups.

Sunderrajan also worked at the International Copper Association, where he supervised several globally dispersed, early-stage technology commercialization activities; at Eastman Kodak Company, where he led the commercialization of several generations of photographic imaging supports, led the creation of a silver nanomaterial-based antimicrobial business, and was a Director with the Corporate Venture Capital group; and at Union Camp Corporation (International Paper) as a Senior Process Engineer, where he led the first alkaline conversion of a coated board machine in the United States.

He holds more than 30 U.S. patents and received the Distinguished Inventor Award at Eastman Kodak. He is a Certified Licensing Professional. Sunderrajan earned his Phd in Chemical Engineering at North Carolina State University, Raleigh, and his Master of Science in Management and Engineering from Massachusetts Institute of Technology.

Argonne NATIONAL LABORATORY

ARGONNE NATIONAL LABORATORY
A SCIENCE AND TECHNOLOGY POWERHOUSE

Argonne scientists and engineers make game-changing discoveries and inspire new technology to meet national needs for sustainable energy, economic competitiveness, and security.

From the start, Argonne has been at the forefront of research and innovation. In 1946, as an outgrowth of the Manhattan Project at the University of Chicago, Argonne was established as a chemistry, materials and nuclear engineering laboratory to develop peaceful uses for a revolutionary new source of energy: nuclear power.

The world has changed greatly since then. Growing demands on energy and water resources, nuclear proliferation, aging infrastructure, global economic shifts, and extreme weather events have given rise to new needs for knowledge and solutions. In response, Argonne has evolved into a collaborative, multidisciplinary research powerhouse.

3,523
Full-time employees

1,452
Scientists and engineers

325
Postdocs

1,500 wooded acres in the southeastern corner of DuPage County, near Chicago

$537 million
Procurement in FY 2021

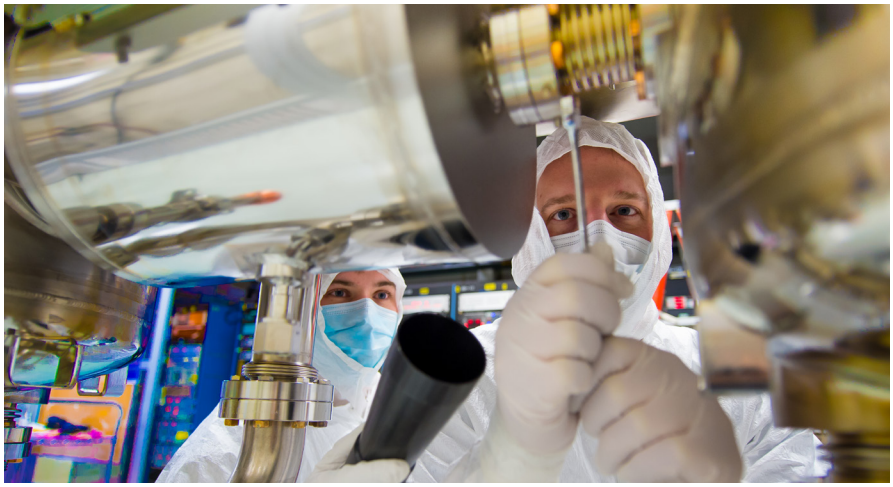
$1.1 billion
Funding in FY 2021

Paul K. Kearns
Laboratory Director

UChicago Argonne, LLC
Operating Contractor

U.S. DEPARTMENT OF ENERGY
Argonne National Laboratory is a U.S. Department of Energy laboratory managed by UChicago Argonne, LLC.

May 2022



Argonne's national user facilities, such as the Center for Nanoscale Materials (pictured here), provide unique experimental opportunities to researchers from industry, universities, and other laboratories.

Today, as a U.S. Department of Energy (DOE) Office of Science national laboratory, Argonne addresses the greatest scientific, technological, and societal challenges facing our nation:

- **Basic science** that seeks to understand how nature works, through experimental and theoretical studies in materials science, nuclear physics, particle physics, chemistry, biology, and atmospheric science.
- **Computation and analysis,** grounded in applied mathematics and computer science, that enable next-generation supercomputing, develop methods to defeat cyber threats, and inform decisions about complex technological and societal issues.
- **Engineering of advanced energy systems** to drive practical advances in nuclear power, transportation, battery performance, and renewable fuels.

BREAKTHROUGH SCIENCE

Argonne's achievements and team-based culture reflect the influence of the University of Chicago. Operating under the University's auspices, Argonne nurtures an environment of rigorous intellectual inquiry and is a testament to the power of ideas. Currently, Argonne and the University share dozens of joint programs and hundreds of joint appointments of individuals who conduct research at both institutions.

COLLABORATION

Along with the University of Chicago, Argonne plays a key role in the Midwest's innovation ecosystem, partnering with other universities, government agencies, and industry.

Argonne brings world-class scientists and engineers from these organizations together with its own staff and the most sophisticated scientific facilities to solve problems too large for any one institution to take on by itself.

These collaborations take on critical challenges in areas ranging from developing new materials and energy technology concepts to meeting human needs for clean water and disease prevention to unlocking the basic secrets of the universe.

SCIENTIFIC USER FACILITIES

Within the research community, Argonne is known for its unparalleled suite of experimental and computing facilities, used by scientists and engineers from the laboratory and organizations across the country and around the world.

The Advanced Photon Source provides high-brightness x-ray beams to a diverse community of researchers in materials science, chemistry, condensed matter physics, life and environmental sciences, and applied research.

Argonne operates six national user facilities that offer extraordinary insights into the structure of matter and physical, biological, and societal processes:

- **Advanced Photon Source**
- **Argonne Leadership Computing Facility**
- **Argonne Tandem Linac Accelerator System**
- **Center for Nanoscale Materials**
- **Atmospheric Radiation Measurement Research Facility—sites in the Southern Great Plains and the Southeast**
- **Intermediate Voltage Electron Microscope**

In FY 2021, 5,995 individuals used these facilities to conduct groundbreaking studies in nearly every field of science and engineering. The first five facilities are supported by the DOE Office of Science and the sixth by the DOE Office of Nuclear Energy.

MAKING AN IMPACT

As they look to the future, Argonne researchers continue to set their sights on the most compelling questions in science and technology, and remain committed to making discoveries and finding solutions that make a real difference in the world.

CONTACT

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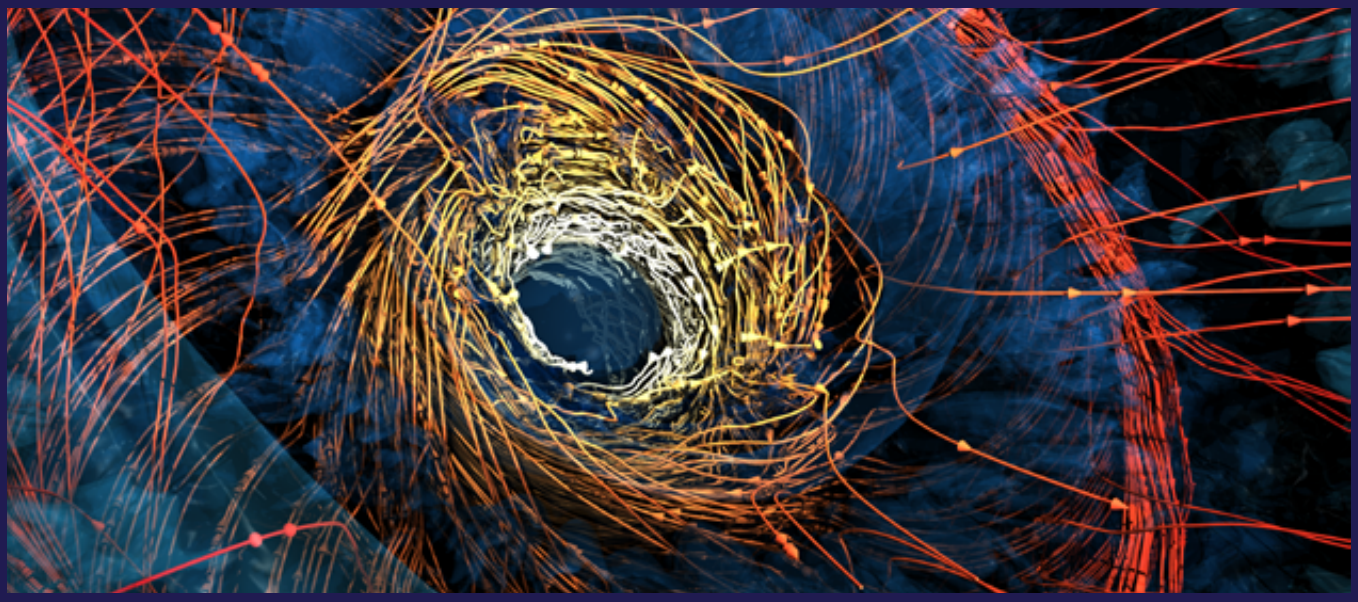
Argonne NATIONAL LABORATORY

Argonne Leadership Computing Facility

The ALCF's supercomputing and AI resources enable researchers to pursue breakthroughs in science and engineering.



A team led by researchers from the Kavli Institute for Theoretical Physics is using ALCF supercomputers to perform radiation hydrodynamic simulations of massive stars with rotation. *Image: ALCF Visualization and Data Analysis Team; Yan-Fei Jiang, Center for Computational Astrophysics, Flatiron Institute; Lars Bildsten, Kavli Institute for Theoretical Physics, University of California, Santa Barbara*

The Argonne Leadership Computing Facility (ALCF), a U.S. Department of Energy (DOE) Office of Science user facility at Argonne National Laboratory, provides supercomputing and AI resources to the scientific and engineering community to accelerate the pace of discovery and innovation in a broad range of disciplines.

Theta is the ALCF's Intel-Cray XC40 supercomputer.

Breakthrough Science and Engineering

The ALCF's unparalleled combination of resources and expertise is helping scientists advance their research in many fields, enabling high-impact scientific discoveries and transformative technologies.

Biological Sciences	Energy Technologies
Chemistry	Engineering
Computer Science	Materials Science
Earth Science	Physics

U.S. DEPARTMENT OF ENERGY

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CONTACT
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alcf.anl.gov

World-Class Supercomputing

The ALCF's leadership-class supercomputers support large-scale computing projects aimed at solving some of the world's most complex and challenging scientific problems. The facility's high-performance storage and networking infrastructure is designed to efficiently handle massive amounts of data. The ALCF also hosts an AI testbed and a visualization and analysis cluster to help researchers accelerate data-driven discoveries.

Simulation, Data, and Learning

The ALCF is opening the doors to new areas of scientific computing research through its efforts to support advanced data analytics, artificial intelligence, and machine learning techniques alongside traditional modeling and simulation campaigns.

Entering the Exascale Era

The ALCF's next-generation system, Aurora, is slated to be one of the nation's first exascale supercomputers. Designed in collaboration with industry leaders Intel and HPE, Aurora will help ensure continued U.S. leadership in high-end computing for scientific research, while also cementing the nation's position as a global leader in the development of extreme-scale computing systems.

Accessing ALCF Resources

The ALCF is available to any researcher in the world with a large-scale computing problem. Researchers gain access to ALCF systems through competitive, peer-reviewed allocation programs supported by DOE and Argonne National Laboratory, and publish their findings in high-impact journals and publications.

Expertise and Support

The ALCF's team of computational scientists, performance engineers, visualization experts, and support staff has the skills and expertise to ensure users get the most out of the facility's high-performance computing systems.

- Multidisciplinary Scientific Expertise
- Visualization And Data Analysis
- Innovative Computational Methods
- HPC Systems Administration
- Code Porting, Tuning, And Scaling
- Technical Support
- Data Sciences
- User Training

CONTACT
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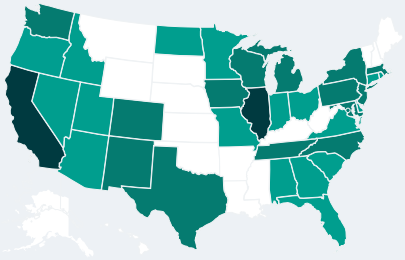
2021 BY THE NUMBERS

U.S. ALCF Users by State



- 100+ Users
- 11–100 Users
- 01–10 Users

Compute Time (Node-Hours)

34M

Active Projects

375

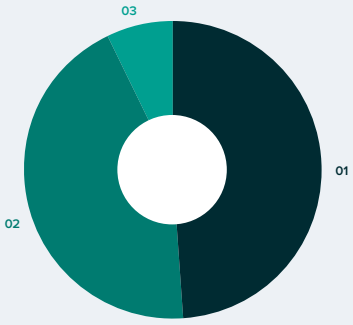
Facility Users

1,168

Publications

249

2021 ALCF Users by Affiliation



01	Academia	571
02	Government	512
03	Industry	82

Argonne NATIONAL LABORATORY

DECARBONIZING THE U.S. ECONOMY WITH SCIENTIFIC BREAKTHROUGHS

Argonne's unmatched expertise and facilities are helping the nation meet its decarbonization goals and combat climate change. The U.S. has committed to reducing our net emissions of greenhouse gases to the atmosphere, by cutting greenhouse gas emissions in half by 2030, removing carbon from—decarbonizing—the electrical grid by 2035 and the entire economy by 2050.

Argonne has been at the forefront of the quest to decarbonize the economy for decades, with a research program that addresses both aspects of decarbonization: eliminating the emission of greenhouse gases into the environment, and using carbon capture technologies to remove carbon dioxide from the air.

Argonne scientists are developing new materials for batteries and researching energy efficient transportation and sustainable fuels. They are expanding carbon-free energy sources like nuclear and renewable power.

Scientists at Argonne shred used batteries to learn how to recycle batteries profitably.

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U.S. DEPARTMENT OF ENERGY
Argonne National Laboratory is a U.S. Department of Energy laboratory managed by UChicago Argonne, LLC.

March 2022

STORING ENERGY

Our scientists are exploring every aspect of storing energy—from discovering and understanding materials to scaling up techniques and recycling minerals such as cobalt and lithium. We develop energy-storage materials to electrify transportation—the biggest source of greenhouse gas emissions—and to help balance renewable energy on the electrical grid.

Argonne scientists discovered the manganese-cobalt cathode material for lithium-ion batteries in the Chevy Volt and Bolt.

PRODUCING LOW-CARBON ELECTRICITY

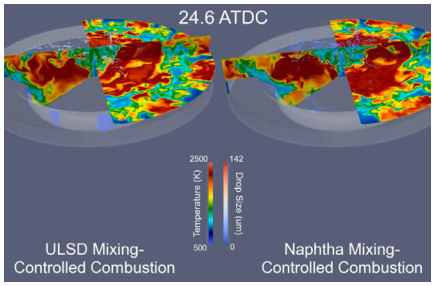
Argonne expands the boundaries of carbon-free sources of energy such as nuclear and renewable power—wind, water, solar and geothermal. As an example, we partner with companies such as TerraPower to help design, build and demonstrate the future Natrium™ nuclear reactor.

We peer into tiny flaws in wind turbines' metal parts to help improve carbon-free wind energy. We do this with the Advanced Photon Source, which works like a giant X-ray microscope.

DISCOVERING ZERO-CARBON AND SUSTAINABLE FUELS

We are developing new zero-carbon and sustainable fuels and expanding the possibilities of existing ones. We are, for example, helping to lead the U.S. Department of Energy's *H2@Scale* program to create, move, store and use clean, carbon-free and affordable hydrogen.

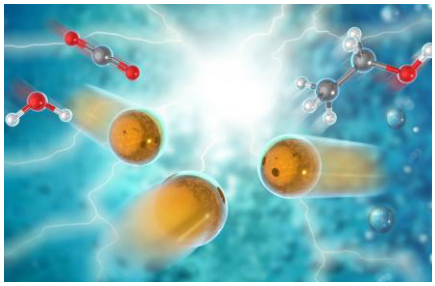
Our scientists also built ground-breaking tools to examine lifecycle greenhouse gas emissions. With those tools, we found sustainable fuels for aircraft that cut emissions, compared to today's jet fuel, a method favored by the International Civil Aviation Organization.



BOOSTING ENERGY EFFICIENCY

We are pioneers in finding energy efficiencies from any area that relies on carbon: industry, transportation, buildings, and stationary power plants.

We discover materials that better conduct electricity and heat as well as tap one-of-a-kind high performance computing at the Argonne Leadership Computing Facility to find efficiencies hidden in internal combustion engines.



REMOVING CARBON FROM THE ATMOSPHERE

We are advancing technology to capture carbon directly from the air and from industrial sources. In addition, our scientists are exploring ways to use carbon in fuels and store carbon in soil or biomass.

Argonne NATIONAL LABORATORY

ADVANCING MATERIALS RESEARCH AND DEVELOPMENT

Argonne's Materials Engineering Research Facility

Argonne's Materials Engineering Research Facility (MERF) develops scalable synthesis, creates quality control methods and assess emerging technologies to aid process intensification for materials manufacturing.

HELPING BRIDGE THE GAP BETWEEN MATERIALS DISCOVERY TO TECHNOLOGY COMMERCIALIZATION

- Developing scalable manufacturing processes for advanced materials that are challenging to make.
- Producing kilogram quantities of experimental materials and distributing for industrial evaluation, prototyping and further R&D in new areas.
- Decreasing discovery to market time with accelerated development and delivery of new technologies.
- Enabling commercial evaluation of new materials with large-scale samples and cost modeling to estimate production costs.
- Evaluating emerging manufacturing technologies that can decrease production time, lower production cost and improve material quality and performance.

The MERF is a 26,000 sq. ft. research facility that employs 20 researchers, engineers and support staff with the majority having extensive industrial experience. Using state-of-the-art equipment and instrumentation, MERF researchers apply advanced synthesis and processing protocols to develop scalable and economically viable manufacturing processes for newly invented experimental materials. MERF staff focus on advanced materials for energy storage and conversion, water purification and catalysis with the circular economy in mind.

MERF's experience and facilities assist innovators and industry in rapidly bringing new materials and technology to market by:

- Combining in situ measurements, real-time analysis, AI, and modeling to accelerate innovation and scale-up for complex materials.
- Generating insights into materials synthesis through feedback to discovery science.
- Enhancing the scientific basis for the next generation of American manufacturing technologies.

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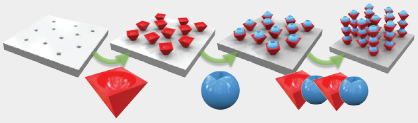
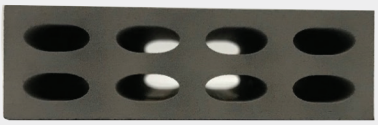
November 2019

ADVANCED MATERIALS SYNTHESIS AND ADVANCED MANUFACTURING CAPABILITES

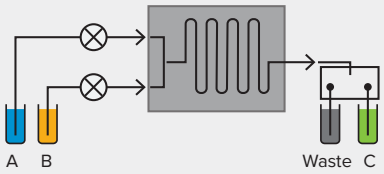
ATOMIC LAYER DEPOSITION



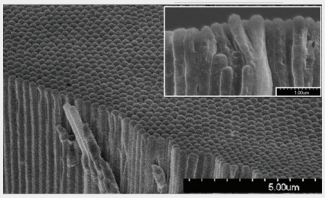
BINDER JET



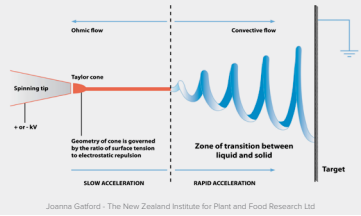
CONTINUOUS FLOW



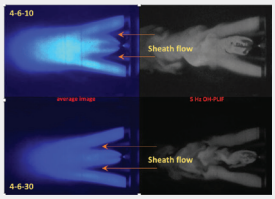
ELECTRODEPOSITION



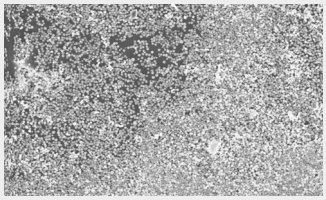
ELECTROSPINNING



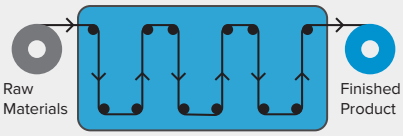
FLAME SPRAY



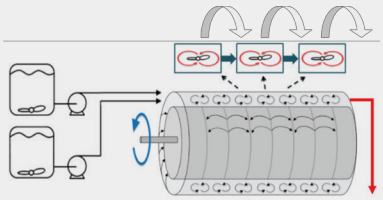
HYDROTHERMAL



ROLL TO ROLL



TAYLOR VORTEX



Pictured top to bottom: Bench Labs, Pilot Labs, and Highbay Space located within the MERF.

- **Continuous Flow Synthesis:** Microfluidic, channels-in-glass and tubular reactors, automated systems for rapid process research, development and optimization.
- **Flame Spray Pyrolysis:** Advanced synthesis systems with sophisticated in situ monitoring, analysis and characterization capability.
- **Hydro/Solvothermal Synthesis:** Advanced reactor system operated under high temperature and pressure for extremely efficient synthesis of highly crystalline materials.
- **Electrospinning Synthesis:** Scalable techniques for production of composite nanofibers with uniform diameters and morphologies.
- **Taylor Vortex Synthesis:** Synthesis platform that utilizes hydrodynamic intensity and dimensions of Taylor vortex for superior mass and heat transfer resulting in high degree of material uniformity.
- **Advanced CSTR Synthesis:** State-of-the-art industrial system for semi-continuous synthesis targeted to large quantities of various materials.
- **State-of-the-art reactors and filter reactors:** Capable of up to 50L production batches.

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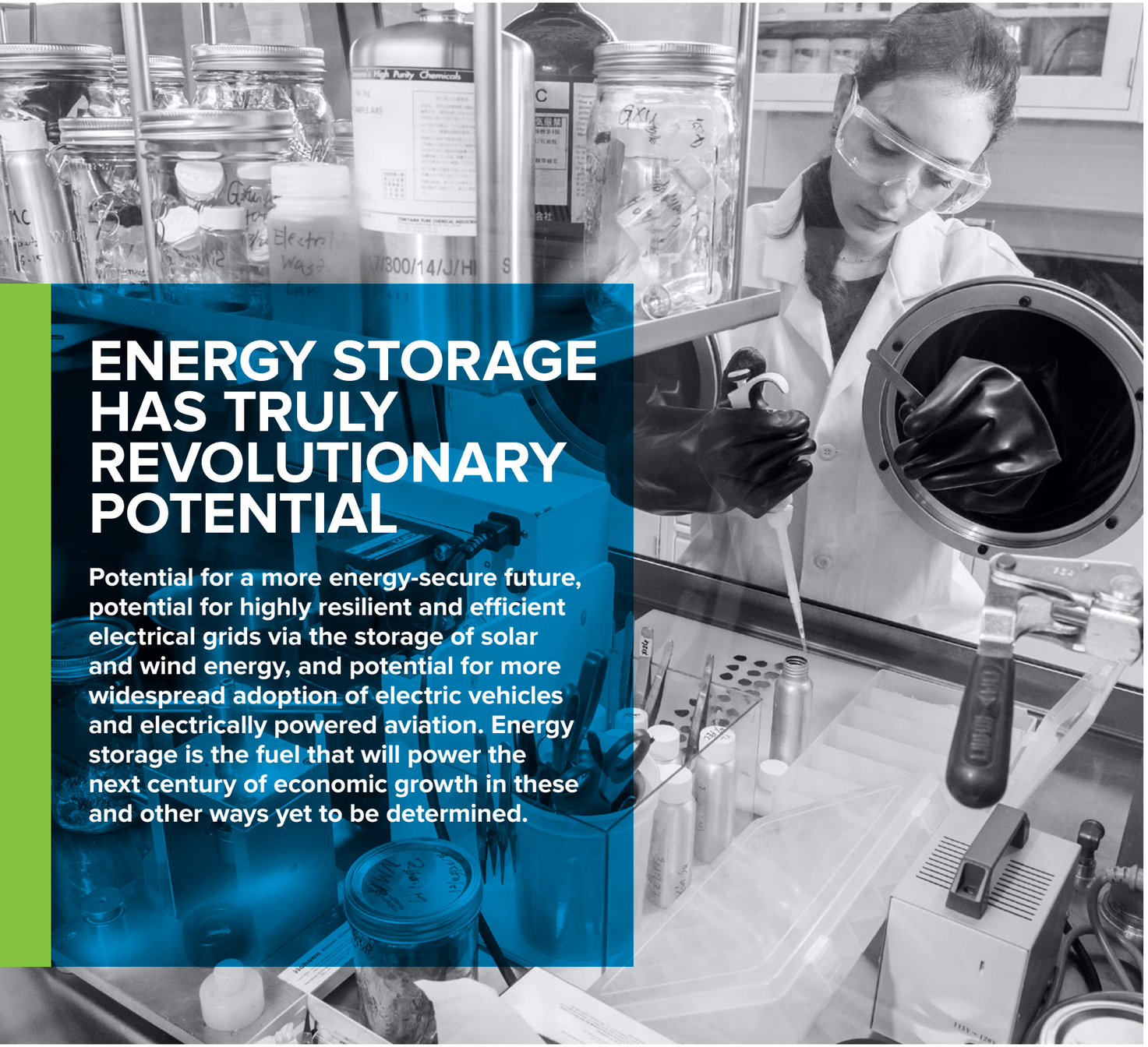
Argonne NATIONAL LABORATORY

ARGONNE COLLABORATIVE CENTER FOR ENERGY STORAGE SCIENCE

Accessing the multidisciplinary teams and world-class facilities at Argonne National Laboratory to solve complex problems in energy storage

ACCESS
Energy Storage at Argonne



ENERGY STORAGE HAS TRULY REVOLUTIONARY POTENTIAL

Potential for a more energy-secure future, potential for highly resilient and efficient electrical grids via the storage of solar and wind energy, and potential for more widespread adoption of electric vehicles and electrically powered aviation. Energy storage is the fuel that will power the next century of economic growth in these and other ways yet to be determined.

With more than 250 battery technologies available for licensing and thousands of publications in scientific journals, Argonne is the global leader in energy storage research.

Over the past fifty years, Argonne scientists and engineers have been helping public- and private-sector customers turn scientific discoveries in energy storage into new technologies. Argonne's expertise runs the gamut from lithium-ion batteries to beyond-lithium-ion systems such as sodium-ion, multivalent, lithium-sulfur, lithium-air, and flow batteries.

In the last decade, Argonne has licensed its new technologies to leading companies—including General Motors, BASF, LG Chem, General Electric, and TODA America—to mass-produce Argonne's patented materials for advanced batteries. These agreements have already led to the construction of new manufacturing plants and the creation of numerous jobs in the U.S. Our expertise, capabilities, intellectual property, and industrial partnerships have put us at the forefront of addressing new challenges in applications that span the energy storage landscape.

Argonne can help you in many ways: license technology from our vast battery portfolio, solve your problems in readying new battery technology to enter the marketplace, address issues in battery manufacturing, and develop new battery technologies from the ground up.

Argonne continues to pursue trailblazing battery research.

- Advanced lithium-ion battery with a low-cost anode based on a mixture of silicon and graphite
- Advanced lithium-ion battery that can be charged in only 15 minutes
- Advanced lithium-ion battery with a nickel-manganese-cobalt cathode that produces much higher energy and voltage
- Advanced solid-state batteries in which novel ceramic and polymer materials replace the typical liquid electrolyte, improving both safety and performance
- Next-generation, beyond-lithium-ion batteries (lithium-air, redox flow, lithium-sulfur, and multivalent)
- Methods for recycling the millions of electric vehicle batteries that will soon be reaching the end of their useful lives

ARGONNE'S ENERGY STORAGE CAPABILITIES

Argonne wields a comprehensive array of capabilities and facilities to address energy storage problems at every link of the energy storage chain, from the analysis of raw materials for impurities to battery end of life and recycling. Collaborators can access this expertise and facilities for any or all of the capabilities displayed.

Argonne's capabilities and facilities can address energy storage challenges at every point on the value chain, from discovery to application.

Material Discovery
Material Characterization
Electrodes and Cells

It all starts with Argonne's renowned scientists and engineers in the discovery and synthesis of new battery materials. Through the interplay of theoretical modeling and applied scientific approaches, Argonne researchers design and synthesize candidate materials and assemble them into electrodes and test cells for characterization at a faster rate and greater depth than any other research institution in the world.

Argonne has world-class facilities for material characterization, such as the Electrochemical Discovery Laboratory, Advanced Photon Source, and Center for Nanoscale Materials, where in-depth analysis is conducted before, during, and after the material has undergone cycling in test cells. Equally impressive are the capabilities for modeling to predict the properties of new or improved materials with extreme accuracy, which can be aided by the Argonne Leadership Computing Facility. These predictions then help to overcome materials shortcomings that arise throughout the discovery process.

Material Process R&D and Scale-up
Large Format Devices
Standardized Testing
Cell Diagnostics and Modeling

Once the most promising materials are identified, Argonne researchers optimize the synthesis process for scale-up to economical commercial production. Argonne's Materials Engineering Research Facility enables the development of manufacturing processes to produce advanced battery materials for industrial testing.

Argonne researchers keep the discovery-to-industry pipeline moving by fabricating commercial-grade, prototype electrodes and battery cells in Argonne's Cell Analysis, Modeling, and Prototyping facility, then testing the new materials in the Electrochemical Analysis and Diagnostics Laboratory.

After standardized testing, the cell and electrodes are sent for advanced characterization and post-test analysis in Argonne's Post-Test Facility, which entails dissecting, harvesting, and analyzing materials in an air-free environment. With knowledge of the causes of performance decline and/or failure, battery developers use this critical feedback to further improve batteries.

Recycling
System-level Analysis

The need to recycle millions of pounds of vehicle batteries is on the horizon as the first generation of plug-in electric vehicles will soon reach the end of their useful lives. In addition, the huge number of consumer electronics device batteries and the use of energy storage on the grid will increase the need to recycle. The Department of Energy recently named Argonne as the lead for the ReCell Center focused on developing cost-effective processes to recycle advanced materials for batteries, including lithium ion.

Argonne has also developed modeling tools that combine performance parameters with cost for various types of batteries aimed at high-energy applications such as transportation or the electric grid. These models can be used to quantify the cost reduction from R&D advances and help better focus future work.

For example, Argonne's EverBatt is an Excel-based model that evaluates cost and environmental impacts for the various lifecycle stages of a lithium-ion battery. It is available open source for download.

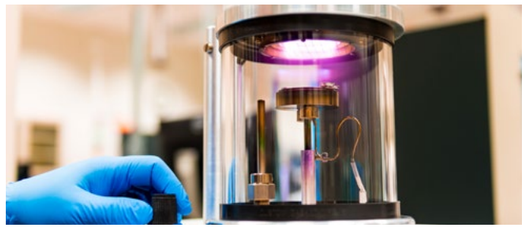
ACCESS TO WORLD-CLASS FACILITIES

Argonne combines expert battery staff with unmatched R&D facilities for the synthesis of battery materials and the testing and failure analysis of cells and batteries.

Discovery labs provide understanding, at atomic and molecular levels, of the chemical changes that occur during battery charging and discharging.

Electrochemical Discovery Laboratory (EDL)

Synthesizes high-quality materials for testing in beyond-lithium-ion batteries, and characterizes their properties with state-of-the-art analytical techniques down to the atomic and molecular scale. This lab makes it possible for scientists to synthesize liquid electrolytes with unparalleled control over water content and other impurities.



The reaction calorimeter gives Argonne researchers the ability to precisely measure how much heat is generated by a chemical reaction.

Materials Engineering Research Facility (MERF)

Enables the development of manufacturing processes for producing advanced battery materials in sufficient quantity for industrial testing. MERF helps bridge the gap between bench-top science and industrial production by using cutting-edge tools to scale up production of newly discovered materials.

Argonne's dry room plays a critical role in the assembly and performance of a finished battery cell.

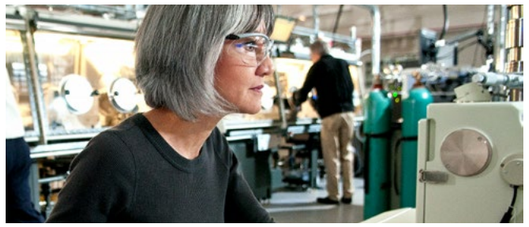
Cell Analysis, Modeling, and Prototyping Facility (CAMP)

Designs, fabricates, and characterizes high-quality prototype cells using anode, cathode, and electrolyte materials for high-energy batteries. CAMP-manufactured cells enable realistic, consistent, and timely evaluation of candidate chemistries in an industrial format.

Information on important battery characteristics such as cycle life and calendar life come from simulations on state-of-the-art, custom-built equipment.

Electrochemical Analysis and Diagnostics Laboratory (EADL)

Provides battery developers with reliable and independent performance testing of their cells, modules, and battery packs. EADL can conduct more than 240 concurrent advanced battery studies under operating conditions that simulate various electric vehicle and utility grid applications, among others. Data is then used for modeling and battery life estimation.



An Argonne scientist analyzes results from battery sample testing that includes characterization in an inert "glovebox" and in a scanning electron microscope.

Post-Test Facility

Enables researchers to dissect cycled battery cells and perform a variety of characterization techniques to determine reasons for performance decline and failure mechanisms without ever exposing the battery materials to oxygen.

The ReCell Center has four focus areas, including the development of new ways to recycle cathode material in a manner that allows direct reuse in new batteries and the recovery of materials not currently targeted.

ReCell Center

Includes an advanced battery recycling R&D facility where experts from national laboratories, academia, and industry are developing cost-effective processes to recycle advanced battery materials.

Cutting-edge scientific research also demands access to world-class user facilities that can characterize materials at the atomic and molecular scale and simulate and model materials behavior. Argonne's energy storage researchers benefit from access to these resources.

Advanced Photon Source (APS)
Provides ultra-bright, high-energy X-ray beams for materials research at the forefront of science, including battery materials.

Argonne Leadership Computing Facility (ALCF)
Provides high-performance computing that is 10 to 100 times more powerful than computing systems typically used for scientific research. This powerful capability is being exploited for the atomic- and molecular-scale modeling of battery processes.

Center for Nanoscale Materials (CNM)
Offers a wide range of capabilities designed to enhance the study and creation of materials, including those related to battery materials.

A LONG TRADITION OF UNRIVALED EXCELLENCE IN ENERGY STORAGE INNOVATION

60s

Argonne's nuclear energy expertise with molten salts leads to exploratory studies of lithium sulfur and lithium phosphorus cells.

70s

Argonne initiates R&D on lithium alloy/metal sulfide batteries with molten salt electrolytes for transportation and electric grid.

DOE establishes National Battery Test Laboratory at Argonne.

80s

Argonne provides technical management of industrial R&D projects on aqueous batteries and initiates R&D on sodium batteries.

90s

Argonne executes R&D agreements with industrial partners on lithium aluminum/iron sulfide and lithium polymer batteries.

Argonne initiates R&D program on advanced lithium-ion batteries that operate at room temperature.

Argonne researchers develop the nickel-manganese-cobalt (NMC) composite cathode—a major leap in lithium-ion battery technology.

2008

TODA America, Inc., licenses Argonne's NMC technology.

2009

BASF Corporation licenses the NMC technology and invests in further R&D and facilities to produce NMC-based products.

Argonne wins a DOE Energy Frontier Research Center (EFRC) for basic research on lithium-ion batteries, the Center for Electrochemical Energy Storage (CEES-I).

2010

Construction begins on TODA's lithium-ion cathode materials plant in Battle Creek, Michigan.

Argonne wins funding to construct CAMP, MERF and Post-Test Facility.

2011

LG Chem licenses the NMC technology.

General Motors licenses NMC for use in the Chevrolet Volt, the first mass-produced plug-in hybrid electric vehicle.

2012

Argonne wins the Joint Center for Energy Storage Research, a DOE Energy Innovation Hub (five years, $120M), for R&D on beyond-lithium-ion batteries.

2014

DOE renews Argonne's EFRC, now denoted the Center for Electrochemical Energy Science (CEES-II).

2017

General Motors uses Argonne's NMC cathode in the battery of the Chevy Bolt, the successor to the Volt.

2018

DOE renews JCESR at $120M for five more years.

DOE names Argonne as the lead for the ReCell Center focused on developing cost-effective processes to recycle advanced battery materials.

ACCESS
Energy Storage at Argonne

Battery Technologies Available for Licensing

- High-energy Cathodes
- Silicon Anodes
- High-voltage Electrolytes
- Additives
- Battery-related Atomic Layer Deposition
- Lithium Sulfur
- Flow Batteries
- Sodium Ion
- Magnesium Ion
- Solid-state/Lithium Metal

Learn more about how the laboratory collaborates with organizations of all sizes.

Argonne has extensive experience in performing proprietary and collaborative research with industrial firms. Licensing and contractual agreements vary based on the particular situation.

For more information about working with Argonne, visit **www.anl.gov/technology/partnerships**

ARGONNE NATIONAL LABORATORY

- U.S. Department of Energy research facility
- Operated by the University of Chicago
- Midwest's largest federally funded R&D facility
- Located in Lemont, IL, about 25 miles (40 km) southwest of Chicago, IL (USA)
- Conducts basic and applied research in dozens of fields
- Unique suite of leading-edge and rare scientific user facilities

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U.S. DEPARTMENT OF ENERGY
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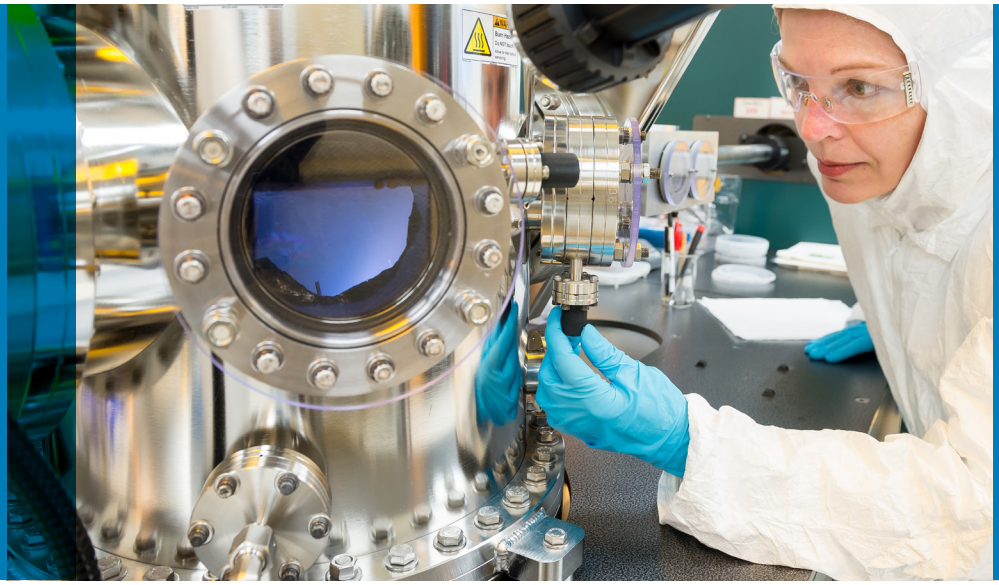
Argonne NATIONAL LABORATORY

CENTER FOR NANOSCALE MATERIALS



We provide free access to leading-edge expertise, instruments and infrastructure for interdisciplinary nanoscience and nanotechnology research

The Center for Nanoscale Materials is one of five U.S. Department of Energy Office of Science Nanoscale Science Research Centers located across the nation.

The Center for Nanoscale Materials (CNM) — a U.S. Department of Energy Office of Science user facility — is located at Argonne National Laboratory, just 30 minutes from Chicago. Academic, industrial and international researchers can access the center through its user program for both proprietary and non-proprietary research. There is no cost to use the CNM if the research is intended for the public domain.

The CNM offers more than 100 tools and capabilities. From X-ray microscopy to cleanroom-based nanofabrication techniques, the CNM provides researchers with a powerful combination of scientific resources found nowhere else.

AREAS OF EXPERTISE

Electron and X-Ray Microscopy

We develop capabilities that go beyond off-the-shelf technology to identify, define and develop electron and X-ray microscopy needs including data science and new modalities such as ptychography.

Nanofabrication and Devices

We fabricate, integrate and manipulate nanostructures including incorporation — under cleanroom conditions — of elements that couple mechanical, optical and electrical signals to produce working nanofabricated structures.

Nanophotonics and Biofunctional Structures

We use ultra-fast spectroscopy and advanced microscopy to understand optical energy transduction and quantum sensing, and also create nature-inspired assemblies for energy conversion, transport and biosensing.

Theory and Modeling

We use molecular dynamics, electronic structure theory, quantum and electrodynamics, multi-scale modeling, machine-learning and data science to understand and predict nanoscale tribology, thermal and charge transport and quantum entanglement in hybrid plasmonic systems.

Quantum and Energy Materials

We design and study atomic-scale to meso-scale materials with implications for energy, the environment and coherent information transfer and sensing.

Access Multiple User Facilities at one Location

Users can also access Argonne's four other user facilities, including the Advanced Photon Source, Argonne Leadership Computing Facility, Argonne Tandem Linear Accelerator System and Atmospheric Radiation Measurement Facility, for multimodal and cross-functional projects.

Apply to Use the CNM

The CNM solicits brief proposals for user-initiated nanoscience and nanotechnology research projects three times per year. Applications are due in March, July and October.

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www.anl.gov/cnm

U.S. DEPARTMENT OF ENERGY
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March 2019

www.anl.gov
www.aps.anl.gov

Argonne NATIONAL LABORATORY

ADVANCED PHOTON SOURCE — LIGHTING THE WAY TO A BETTER TOMORROW

Frontier science serving the national interest and positively impacting nearly every aspect of our lives

THE APS ENABLES RESEARCH IN NEARLY EVERY SCIENTIFIC DISCIPLINE

- Materials science
- Chemical science
- Environmental, geological, and planetary science
- Physics
- Polymer science
- Biological and life science
- Pharmaceutical research
- Nanoscale research

The U.S. Department of Energy Office of Science's (DOE-SC's) Advanced Photon Source (APS) gives scientists access to high-energy, high-brightness, highly-penetrating x-ray beams that are ideal for studying the arrangements of molecules and atoms, probing the interfaces where materials meet, determining the interdependent form and function of biological proteins, and watching chemical processes that happen on the nanoscale.

This remarkable scientific tool helps researchers illuminate answers to the challenges of our world, from developing new forms of energy to sustaining our nation's technological and economic competitiveness to pushing back against the ravages of disease. The DOE confidently invests in world-leading research centers such as the APS and the other SC user facilities because of the positive impacts from the science carried out on behalf of our nation and the world.

Thousands of researchers from universities, industries, and research labs in all 50 states, the District of Columbia, Puerto Rico, and foreign countries come to the APS. Many of these institutions and companies invest millions of dollars to equip APS x-ray beamlines. The APS facility houses x-ray-producing technologies that comprise one of the most complex machines in the world, the result of innovative research and development carried out by scientists, engineers, and technicians from Argonne, other institutions, and industry.

APS UPGRADE

A new effort, the APS Upgrade Project, will deliver an orders of magnitude increase in x-ray brightness and coherent flux, combining a state-of-the-art accelerator with advanced beamline, optics, and detector technologies. The APS Upgrade will provide researchers with a next-generation tool to probe structure and function across length, time, and energy scales, extending the U.S. global leadership in hard x-ray science for decades to come.

NOBEL PRIZE-WINNING RESEARCH

The recipients of the 2009 Nobel Prize in Chemistry published papers on their award-worthy work based on data collected at DOE x-ray light sources: the APS, the National Synchrotron Light Source (Brookhaven National Laboratory), and the Advanced Light Source (Lawrence Berkeley National Laboratory). The 2012 Nobel Prize in Chemistry was awarded for discoveries based in large part on research at the APS.

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U.S. DEPARTMENT OF ENERGY

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Argonne NATIONAL LABORATORY

THE ADVANCED PHOTON SOURCE UPGRADE PROJECT

Building the Next-Generation X-ray Light Source

The Advanced Photon Source (APS), which began operations in 1996, provides hard x-rays to more than 5,700 researchers each year from industry, universities, and federal and private research institutions.

The APS is a major driver of our nation's global scientific and technological competitiveness. Two Nobel Prizes have been awarded for research at the APS.

The APS Upgrade is a highly cost-effective revitalization of this facility, improving capabilities by orders of magnitude, maintaining our competitive advantage over other nations, and keeping the U.S. at the forefront of hard x-ray science for decades to come.

The Advanced Photon Source at Argonne National Laboratory is one of the most productive scientific facilities in the U.S.

The U.S. Department of Energy Office of Science's APS Upgrade Project at Argonne National Laboratory transforms today's APS into a high-energy, storage-ring-based, hard x-ray light source that equips scientists with a vastly more powerful tool for investigating and improving the physical and biological materials and chemical processes that impact nearly every aspect of our lives.

This new light x-ray source will make it possible to see changes at the molecular level that occur:

- before a steel girder starts to crack,
- before a healthy brain succumbs to Alzheimer's, or
- before an electric car's battery begins to fail.

By peering into this world, we will enable scientific discoveries to benefit human life and advance American technology and business.

The APS Upgrade will expand our ability to understand and manipulate matter at the nanoscale. With this versatile scientific tool, researchers will be able to observe individual atoms moving and interacting – in real time – deep inside real samples, biological organisms, and complex engineered systems.

MAINTAINING U.S. LEADERSHIP FOR A NEW CENTURY

Next-generation x-ray light sources are being planned and constructed in other countries including China, Switzerland, France, Japan, Germany, Britain, Sweden, and Brazil. **The U.S. will cede leadership within the next 10 years without the APS Upgrade**, sacrificing a critical component necessary for American innovation, resulting in a major blow for American science and industry, particularly as this fantastic technology was essentially invented in the U.S.

A HISTORY OF TRANSFORMATIONAL DISCOVERY "MADE IN THE U.S.A."

In 1990, the United States invested $500 million in building the Advanced Photon Source, which has been an immensely productive facility for users of synchrotron x-rays. This ground-breaking machine expanded researchers' concept of what was possible, by creating x-rays that are one billion times more powerful than the routine x-rays delivered at doctors' offices.

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September 2019

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CRITERIA: House and Senate Legislative/Policy Staff who cover energy issues for their Members of Congress.			

CLEARPATH

Clean Energy Innovation Academy (CEIA) - Chicago

The Clean Energy Innovation Academy (CEIA) is an ongoing educational series with briefings focused on conservative clean energy technology and policy, featuring discussions from industry experts, academia and the public sector. The 2022 series will feature a site visit to Chicago to visit the Braidwood Nuclear Generating Station and Argonne National Laboratory.

2022 StaffDel Itinerary

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MONDAY, AUGUST 15, 2022

- **7:00 AM ET - 8:05 AM CT– United Flight 1800 to O'Hare International Airport (ORD) from DCA**

- **8:05 AM - 8:30 AM CT – Arrive ORD**

  Collect bags, meet at bus

- **8:30 AM - 10:00 AM CT – Travel from ORD to Braidwood Generation Station (90-minute drive time)**

  Transportation: Coach Bus

  Briefer: *Niko McMurray, Managing Director of Public Policy, ClearPath*

  Topic: *Overview of how facilities such as Braidwood Generating Station and Argonne National Laboratory contribute to U.S. clean energy innovation.*

  Note: *We will leave suitcases on the bus with transportation/logistics staff and check into the hotel later in the day.*

ClearPath is a 501(c)(3) nonprofit organization, and this event is designed to comply with U.S. Senate and House Ethics rules.

- **10:00 AM CT - 10:30 AM CT – Arrive at Braidwood and Process through Security**

  Attire: Business casual; the preference is that visitors wear a dress shoe with a hard sole or boots, no tennis shoes or open toed shoes are permitted.

  Location: *Braidwood Generating Station, 35100 IL-53, Braceville, IL 60407*

  Note: *Please be prepared to present a government-issued photo ID for security processing. You will also need your SSN.*

- **10:30 AM - 11:00 AM CT – Intro from Braidwood Personnel and Nuclear 101 discussion**

  Breakfast provided (coffee, water, rolls/donuts)

  Briefers: *Brett Nauman (Senior Generation Communications Manager), Greg Gugle (Site VP), James Petty (Plant Manager), Dwi Murray (Director of Organizational performance and regulatory)*

  Topic*: Introduction to Braidwood Generating Station and discussion of nuclear power's contribution to U.S. energy security.*

- **11:00 AM - 12:30 PM CT – Tour of Braidwood Generating Station**

  Briefers: *Brett Nauman (Senior Generation Communications Manager), Greg Gugle (Site VP), James Petty (Plant Manager), Dwi Murray (Director of Organizational performance and regulatory)*

  Description: *Braidwood Generating Station's two nuclear reactors can produce up to 2,386 megawatts (MW) of clean, carbon-free energy, enough electricity to power two million homes. The facility is built on a 4,457-acre site in Braceville, Illinois. Participants will have the opportunity to ask questions.*

- **12:30 PM – Tour concludes**

  Boxed lunch provided

- **12:30 PM - 1:30 PM CT – Travel from Braidwood Generating Station to Argonne National Laboratory**

  Bags will be secured on the bus.

- **1:30 PM CT - 1:50 PM CT – Arrive at Argonne National Laboratory**

ClearPath is a 501(c)(3) nonprofit organization, and this event is designed to comply with U.S. Senate and House Ethics rules.

Location: *Argonne Information Center, 9700 S Cass Ave, Lemont, IL 60439 (transportation on site provided)*

Attire: Business casual, attendees will need to wear long pants, closed toe shoes, and ¾ length sleeves.

Transportation to the first meeting.

Note: *Visitors, including drivers, should check in at the Argonne Information Center (AIC) upon arrival. Each visitor will be issued a gate pass for site access. All visitors to Argonne National Lab must show proof of COVID Vaccination or negative COVID test for access.*

- **1:50 PM - 2:20 PM CT – Argonne Welcome and Overview**

  Briefers:
  - **Suresh Sunderrajan,** Associate Laboratory Director, Advanced Energy Technologies
  - **Kirsten Laurin-Kovitz,** Associate Laboratory Director, Nuclear Technologies and National Security
  - **Greg Krumdick,** Director, Applied Materials
  - **Steve Przesmitzki,** Interim Director, Transportation and Power Systems Temitope Taiwo, Director, Nuclear Science and Engineering
  - **Michael Wang,** Interim Director, Energy Systems and Infrastructure Analysis
  - **Mark Williamson,** Director, Chemical and Fuel Cycle Technologies

  Topic: *Overview of the capabilities and entities at Argonne National Lab.*

- **2:20 PM CT - 2:45 PM CT–Transforming Science and Society through Exascale Computing and AI**

  Briefer: **Jini Ramprakash,** Deputy Division Director at Argonne National Laboratory's Leadership Computing Facility

  Topic: The Argonne Leadership Computing Facility (ALCF), a U.S. Department of Energy (DOE) Office of Science user facility, provides powerful supercomputing resources to the scientific community. ALCF is progressing with the deployment of two new supercomputers: Polaris and Aurora. Polaris is a leading-edge testbed system that will give scientists and application developers a platform to test and optimize codes for Aurora, Argonne's future exascale system. Aurora will feature several technological innovations, including a revolutionary I/O system to support new types of workloads. The system will be highly optimized across multiple dimensions that are key to success in simulation, data, and learning applications.

Argonne is advancing artificial intelligence (AI) to address critical challenges in science, technology and medicine, from healthcare and cancer research, to climate science and clean energy, to fundamental science and cosmological discovery. Researchers are coupling AI methods such as machine learning and deep learning with next-generation supercomputers to accelerate the pace of scientific discovery. A significant scientific thrust is currently underway in autonomous discovery and self-driving laboratories to automate scientific experiments, observations, and data generation to solve challenging research problems at unprecedented scale.

- **2:45 PM - 2:55 PM CT – Transportation to Materials Engineering Research Facility**

- **2:55 PM - 3:20 PM CT – Energy Storage: From Basic Materials Science to Battery Manufacturing and Recycling**

***Briefer*: Greg Krumdick,** Director, Applied Materials

Topic: Argonne's energy storage program brings together a wide-range of unique expertise including fundamental discovery science, application-driven research, scale-up and manufacturing, recycling, and system analysis, working in concert to drive new innovations to societal impact. In performing the research Argonne scientists work closely with other National Labs, Universities, and numerous private industries. Argonne leads multi-institutional flagship programs including the Joint Center for Energy Storage Research (JCESR), focused on the science of beyond Li-ion batteries and the ReCell recycling center. One unique aspect of the energy storage effort is the scale-up of battery and related energy materials at the Materials Engineering Research Facility (MERF). The MERF is a state-of-the-art, 28,000 square foot R&D facility focused on processes for accelerated materials synthesis, scale-up of new chemistries, and the development and validation of emerging materials manufacturing technologies. The MERF houses many capabilities relevant to DOE strategic energy and climate priorities, including energy storage, where work is underway to scale up materials for higher-density, longer-lived, faster-charging, and safer batteries both for long-duration grid storage and the transportation sector.
The MERF is also home to DOE's advanced battery recycling center, ReCell, which develops recycling techniques for lithium-ion and future batteries. ReCell will help create recycling jobs, encourage vehicle electrification, and strengthen the U.S. supply chain of battery materials.

- **3:20 PM - 3:30 PM CT– Transportation to Center for Nanoscale Materials**

- **3:30 PM - 3:55 PM CT– Tour of the Center for Nanoscale Materials**

Briefers:

- ***Ilke Arslan,*** *Director, Center for Nanoscale Materials*

- ***Gary Wiederrecht,*** *Deputy Director, Center for Nanoscale Materials*

Topic: The Center for Nanoscale Materials (CNM) at the U.S. Department of Energy's Argonne National Laboratory is a premier national user facility for interdisciplinary nanoscience and nanotechnology research by academic, industrial, and international researchers. These scientists and engineers are provided with state-of-the-art capabilities to fabricate, process, characterize, and model nanoscaled-sized materials. The synergy that results from teams of chemists, materials scientists, physicists, theorists, and engineers working together in the nanoscale regime results in truly remarkable projects and advancements. The center's scientific portfolio includes energy-related research and development programs in areas such as catalysis, solar energy, batteries, sensors, solid-state lighting, micro/nano-electromechanical systems, nanophotonics, nanotomography, and magnetism.

- **3:55 PM - 4:05 PM CT– Transportation to Advanced Photon Source**

- **4:05 PM - 4:35 PM CT– New Frontiers in Science at the Advanced Photon Source**

Briefer: Denny Mills, Deputy Associate Laboratory Director, Photon Sciences

Topic: The Advanced Photon Source (APS), a DOE Office of Science user facility, provides ultrabright x-rays that researchers use to obtain images of structures and dynamics inside many types of materials, chemical systems, and biological systems. More than 5,500 scientists each year use the APS to spur pivotal discoveries across almost the entire spectrum of science and technology, from clean energy and biology to geology and engineering. The tour will highlight transformative research using the current APS and provide an overview of the APS Upgrade project, currently scheduled for completion in 2024. The upgrade will increase the brightness of the X-ray beams by up to 500 times, keeping the facility at the forefront of global light sources for decades to come. The APS Upgrade will allow users to probe materials faster and at higher resolutions, opening up new frontiers for both science and industry. The APS Upgrade, combined with the power of the ALCF's Aurora exascale supercomputer, will accelerate discoveries across the scientific spectrum.

- **4:35 PM - 4:45 PM CT– Li-Bridge: Improving U.S. Supply Chain for Lithium-based Batteries**

Briefer: Venkat Srinivasan, Director, Argonne Collaborative Center for Energy Storage Science

Topic: Li-Bridge is a public-private alliance committed to accelerating the development of a robust and secure domestic supply chain for lithium-based

batteries.Argonne leads coordination of Li-Bridge by serving as the facilitator between private industry and the Federal Consortium for Advanced Batteries, which released a National Blueprint for Lithium Batteries, 2021 – 2030. The Blueprint aims to put the U.S. on a path to long-term competitiveness in the global battery value chain.

- **4:45 PM - 4:55 PM CT– Supply Chain Dynamics**

  Briefer: Allison Bennett Irion, Director, Supply Chain Research, Nuclear Technologies and National Security/Advanced Energy Technologies

  Topic: As noted in the DOE report, "America's Strategy to Secure the Supply Chain for a Robust Clean Energy Transition," a secure, resilient supply chain will be critical in achieving a net-zero emissions economy and capturing the economic opportunity inherent in the energy sector transition. Argonne experts use data analytics, modeling, simulation, and visualization tools that balance supply chain risk and efficiency, respond to disruptive trends and technologies, optimize for cost effective resilience, and assess the consequences of disruptions to complex interdependent supply chains.

- **4:55 PM - 5:05 PM CT– Grid Modeling and Valuation**

  Briefer: Vladimir Koritarov, Director, Center for Energy, Environmental, and Economic Systems Analysis

  Topic: Research implications from the nation's ambitious goal to decarbonize the electric grid by 2035 are manifold. Argonne scientists use analytical models of technology, policy, and markets to inform potential decarbonization pathways that are viable, affordable, and reliable.

- **5:05 PM-5:30 PM CT – Visit at Argonne National Lab Concludes with wrap up discussion and Q&A**

  Briefers:

  - **Suresh Sunderrajan,** Associate Laboratory Director, Advanced Energy Technologies
  - **Kirsten Laurin-Kovitz,** Associate Laboratory Director, Nuclear Technologies and National Security
  - **Greg Krumdick,** Director, Applied Materials
  - **Steve Przesmitzki,** Interim Director, Transportation and Power Systems
    Temitope Taiwo, Director, Nuclear Science and Engineering
  - **Michael Wang,** Interim Director, Energy Systems and Infrastructure Analysis
  - **Mark Williamson,** Director, Chemical and Fuel Cycle Technologies

  Topic: Opportunity for Congressional staff to ask final questions about the tour and educational material.

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- **5:30 PM - 6:30 PM CT– Travel from Argonne National Lab to Pendry Chicago Hotel**
  Location: *Pendry Chicago, 230 Michigan Ave, Chicago, IL 60601*

- **6:30 PM CT - 7:00 PM CT – Executive Time**

  Participants can check into the hotel and drop off luggage.

- **7:00 PM CT - 7:15 PM CT – Meet in Pendy Chicago Lobby, Travel to Dinner**

- **7:15 PM - 9:15 PM CT – Educational Dinner**

  Location: *Girl & The Goat, 809 W Randolph St, Chicago, IL 60607*

  Speakers: *Brooke Fallon, Vice President of Trust Ventures, Alan Hoffman, Chief of Staff, Oklo, and Andrew Ponec, CEO and cofounder of Antora.*

  Topic: *Discussion of the role of venture capital and private finance in driving clean energy innovation. Topics will include advanced nuclear, energy storage, and industrial innovation.*

- **9:15 PM CT - 9:30 PM CT – Travel back to Pendry Chicago Hotel**

TUESDAY, AUGUST 16, 2022

- **6:00 AM CT - 7:00 AM CT – Depart Pendry Chicago for ORD**
  Transportation provided

- **7:00 AM CT - 9:00 AM CT – Arrive ORD/Executive Time**
  Breakfast at airport

- **9:00 AM CT – United Flight to DCA**

- **11:59 AM ET – Arrive DCA**