Argonne
NATIONAL LABORATORY

SCIENCE AND TECHNOLOGY TO **ADVANCE NEXT-GENERATION INFRASTRUCTURE**

Unlocking science and technological frontiers to secure America's energy future.

CONTENTS

Leveraging a 75-year history of cutting-edge R&D, Argonne National Laboratory supports the nation in making the most of historic investments in core infrastructure priorities.

With its mission of accelerating science and technology to drive U.S. prosperity and security, Argonne stands ready to help the nation seize infrastructure-building opportunities with deep and broad R&D expertise in energy storage, hydrogen, transportation and vehicles, manufacturing, critical supply chains, electric power systems and grid analysis, and carbon management.

ENERGY STORAGE

ENERGY STORAGE

RESEARCH FOCUS

Argonne is working to aid the growth of the US battery manufacturing industry, transition the US automotive fleet to plug-in hybrid and electric vehicles, and enable greater use of renewable energy. Argonne develops more robust, safer and higher-energy density lithium-ion batteries, while also using our development capabilities to develop new storage materials that dramatically increase storage capacity and power density. By increasing battery storage capacities and lifetimes, Argonne researchers are paving the way for the more widespread adoption of sustainable and efficient transportation and grid-storage technologies. Argonne's all-encompassing battery research program spans the continuum from basic materials research and diagnostics to scale-up processes and ultimate deployment by industry.

MODELING AND ANALYSIS

Greenhouse Gases, Regulated Emissions, and Energy Use in Technologies (GREET) Model. This model allows the evaluation of lifecycle carbon footprint for battery and battery materials production and enables determination of the decarbonization potential of energy storage production pathways.

Battery Performance and Cost (BatPaC) Model. A techonomic analysis tool for estimating performance and manufacturing cost of lithium-ion batteries. Allows the design of cells and battery packs to meet various performance requirements and estimates the manufacturing cost.

EverBatt. This tool enables the evaluation of cost and environmental impacts for the lifecycle of lithium-ion batteries.

Global Critical Materials (GCMat) Agent-based Model. Enables the analysis of supply chain vulnerabilities in relation to US energy decarbonization goals, including battery manufacturing, through the analysis of mitigation strategies such as new supply sources, product substitution, consumer thrifting, and stockpiling.

Machine Learning Prognosis for Battery Life and Performance. Argonne has developed a comprehensive AI-driven approach to diagnose the health of Li-ion batteries with limited usage data and predict battery life and degradation trends. This advanced diagnosis of battery health can help accelerate development of new battery chemistries and improve cell performance for a wide range of applications.

FACILITIES

Cell Analysis, Modeling, and Prototyping (CAMP) Facility. Enables design, fabrication, and characterization of prototype cells for timely and consistent evaluation of battery chemistries in a close-to-real industrial format. State-of-the-art equipment supports fabrication of high-quality electrodes used to make pouch and 18650 cells using semi automated industrial cell assembly equipment.

Electrochemical Analysis and Diagnostics Laboratory (EADL) and Post-Test Facility (PTF). Reliably and independently test cell, module, and battery pack performance. EADL can conduct more than 240 concurrent studies under operating conditions simulating electric vehicle and utility grid applications. PTF analyzes cycled battery cells to better understand performance decline and failure mechanisms.

Electrochemical Discovery Laboratory (EDL). Enables synthesis of high-quality materials for beyond-lithium-ion batteries and characterization with state-of-the-art analytical techniques. Offers unparalleled control over impurities.

ReCell Center. Includes an advanced battery recycling R&D facility to develop cost-effective processes for recycling advanced battery materials, including direct recycling of cathode materials.

Materials Engineering Research Facility. Enables development of manufacturing processes for producing advanced battery materials in sufficient quantity for industrial testing and for developing scalable, energy- and material-efficient manufacturing processes.

Molten Salt Technology Development Facilities. Molten salt is among the phase-change materials that can contain energy within latent heat storage systems such as Argonne's thermal energy storage system (TESS). These facilities enable molten salt chemistry and process development with an extensive array of inert atmosphere gloveboxes and supporting equipment.

CONTACT

Venkat Srinivasan
Director, Argonne Collaborative Center for Energy Storage Science (ACCESS) and Deputy Director, Joint Center for Energy Storage Research (JCESR)
Phone: 630-252-6003
Email: vsrinivasan@anl.gov

HYDROGEN

HYDROGEN

RESEARCH FOCUS

Clean hydrogen is an essential part of the U.S. plan to achieve net-zero carbon emissions by 2050. Before hydrogen can become a key part of the next-generation US energy technology portfolio it needs to be easier to produce and less expensive. Argonne is helping achieve those goals by investigating methods of producing clean, less expensive hydrogen, including electrolysis and sunlight-driven production. We are also making it easier to use hydrogen by making fuel cells and electrolyzers that are more affordable and that are capable of powering heavy-duty vehicles such as trucks, locomotives, and ships. Finally, we are developing a roadmap that will serve as a guide to the public and private sectors to accelerate the advancement and deployment of hydrogen technologies toward decarbonizing our economy.

MODELING AND ANALYSIS

H2@Scale. Argonne co-leads the analysis component of H2@Scale, a Department of Energy (DOE) initiative that advances affordable hydrogen production, transport, storage, and utilization to increase revenue opportunities in multiple energy sectors and identifies market opportunities and R&D focus areas for early deployment of various hydrogen end-use applications. Argonne participates in 10 industry projects with OEMs and energy companies related to the demonstration of various H2@ Scale applications.

Hydrogen Infrastructure Modeling and Analysis. Argonne developed a suite of hydrogen infrastructure models, including **HDSAM** (Hydrogen Delivery Scenario Analysis Model) and **HDRSAM** (Heavy-Duty Refueling Station Analysis Model) that are used by over 3,000 companies globally to evaluate the economics of hydrogen delivery and fueling options. Argonne will demonstrate the patented technology with a supplier of hydrogen-fuel-cell-powered commercial vehicles in a public fuel station near Argonne.

Hydrogen Modeling. Argonne pioneered and continues to lead life cycle analysis (LCA) through GREET. The Greenhouse gases, Regulated Emissions, and Energy use in Technologies model is a one-of-a-kind analytical tool that simulates the energy use and emissions output of various vehicle and fuel combinations. GREET has been used to inform R&D directions and government actions such as California's Low-Carbon Fuel Standard, the Canadian Clean Fuel Standard, and the International Civil Aviation Organization's Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). GREET will be used to guide DOE's clean hydrogen standard (CHS) and subsequent hydrogen production tax credits. Argonne is also skilled in techno-economic analysis (TEA) of hydrogen production, delivery and fueling, and production of synthetic fuels and chemicals from renewable hydrogen using HDSAM.

High Performance Computing and AI/ML for Hydrogen-based Propulsion and Power. Argonne has developed active-learning-based ML tools for the co-optimization of new fuels with physical hardware to reduce time to design. Argonne also has expertise in developing exascale computational codes that can leverage the next generation of supercomputing facilities and applying high-fidelity, multi-dimensional modeling to hydrogen infrastructure problems, such as blending hydrogen within existing natural gas pipelines and evaluating the impact on gas leakage and embrittlement processes.

FACILITIES

Experimental Facilities for Hydrogen-based Propulsion and Power Systems. Argonne has unparalleled expertise in testing hydrogen-fueled internal combustion engines, with the goal of maximizing engine efficiency and reducing pollutant emissions to near-zero. Experimental facilities can accommodate vehicles of all types, from passenger cars and light-duty vehicles to heavy-duty vehicles for off-road, rail, and marine applications. Argonne's engine test facility is being adapted to add hydrogen fuel-cell system evaluation capability on various specific application operating cycles. Argonne also has extensive expertise in using fuels such as natural gas, hydrogen, and blends thereof in turbines for power generation and combined heat and power.

CONTACT

Ted Krause
Chemical Engineer, Chemical Sciences and Engineering
Phone: 630-252-4356
Email: krauset@anl.gov

TRANSPORTATION AND VEHICLE

TRANSPORTATION AND VEHICLE

RESEARCH FOCUS

Argonne's transportation systems and controls researchers are the leaders in the DOE lab system studying how technology and consumer behavior affect travel patterns, mobility mode choices, goods movement, energy use and emissions. We strive to improve the reliability and efficiency of the nation's transportation network and electrical grid. This work is frequently coordinated with other federal agencies, such as DOT and EPA, state agencies, and multiple industry groups and companies. As DOE's lead energy storage laboratory, Argonne addresses science-based scale-up to support transfer of technology to market. This is especially critical in the push for vehicle electrification and grid storage. Activities range from fundamental materials research through to full vehicle (for on-road) and battery pack (grid and off-road) testing.

MODELING AND ANALYSIS

Aeronomie. Simulates electric and hybrid airplanes, vehicles for urban air mobility, and UAVs for goods delivery.

AFLEET. The Alternative Fuel Life-cycle Environmental and Economic Transportation tool estimates energy, emissions, and costs of alternative fuel vehicles.

Autonomie. Simulates vehicle systems to assess the energy consumption, performance and cost of multiple advanced vehicle technologies across classes, from light- to heavy-duty.

BEAN. BEnefit ANalysis quantifies the impact of individual component technologies on the full life cycle cost of light duty passenger cars and commercial vehicles.

GREET. The Greenhouse gases, Regulated Emissions, and Energy use in Technologies model is a one-of-a-kind analytical tool that simulates the energy use and emissions output of various vehicle and fuel combinations.

NEAT. The Non-highway Energy and GHG emission Accounting Tool estimates impact of freight movement on energy and GHG emissions.

POLARIS. Implements advanced travel and freight demand modeling, dynamic traffic assignment and transportation simulation into an integrated modeling platform.

RoadRunner. Simulates powertrains for connected and automated vehicles.

SVTrip. Stochastic Vehicle TRIp Prediction generates naturalistic vehicle speed profiles necessary for larger-scale modeling following training on a large datasets of recorded driving data.

VERIFI. A high-fidelity computational models and tools for internal combustion engines and gas turbines, which covers a wide spectrum of hydrogen end-use, from mobile applications to stationary power generation and domestic appliances.

VISION. Estimates fleet impacts of highway vehicle technologies and fuels on energy use and greenhouse gas emissions.

FACILITIES

AMTL. The Advanced Mobility Technology Laboratory contains two-wheel drive and four-wheel drive dynamometers and state-of-the-art instrumentation that reveal important information on performance, fuel economy, energy consumption, and emissions output.

EVGI Center. The EV Grid Integration Center enables the development and demonstration of smart-charging equipment, the application of standard communication protocols in the charging infrastructure, site energy management, charge scheduling, and system integration to minimize impacts of high-power charging.

Engine Testing Facility. Allows testing of internal combustion engines fueled by liquid and gaseous fuels to improve engine efficiency and reduce pollutant emissions to near-zero.

APS. The Advanced Photon Source uses high-power X-rays to non-destructively study the details of batteries, engines, and operating power generation equipment.

CONTACT
Steve Przesmitzki
Director, Transportation
and Power Systems
Email: sprzesmitzki@anl.gov

MANUFACTURING

MANUFACTURING

RESEARCH FOCUS

Argonne's cross-cutting collaborative of scientists and engineers accelerate precision scale-up of advanced materials and chemistries in order to more rapidly commercialize advanced materials and chemical manufacturing technologies. They apply innovative process technologies, advanced in situ and operando characterization, high-performance computing, and artificial intelligence to problems in energy storage, air and water purification materials, industrial catalysis, printed electronics, and more. Our researchers have worked with more than 60 companies during the last decade to accelerate scale-up of challenging materials, chemistries and processes, and drive innovative products to the market faster.

MODELING AND ANALYSIS

GCMat. Agent-based model enables analysis of supply chain vulnerabilities and mitigation strategies relative to U.S. energy decarbonization goals.

Bioeconomy AGE. The Bioeconomy Air Emissions, Greenhouse Gas Emissions, and Energy Consumption tool estimates energy and emissions effects of bioenergy and bioproduct scale up.

GREET. The Greenhouse gases, Regulated Emissions, and Energy use in Technologies model simulates energy use and emissions output of vehicle and fuel combinations.

BatPaC. This techonomic analysis tool estimates performance and manufacturing cost of lithium-ion batteries. Enables cell and battery pack designs to meet performance requirements and estimates the manufacturing cost.

FACILITIES

Materials Engineering Research Facility (MERF). Enables development of manufacturing processes to produce advanced battery materials for industrial testing and to develop scalable, energy- and material-efficient manufacturing processes. MERF bridges the gap between bench-top science and industry by using cutting-edge tools to scale up production of new materials and develop process technologies that improve the quality, cost, or efficiency of existing manufacturing. MERF's engineers and scientists have decades of industry experience and have worked with dozens of companies to scale their promising materials. MERF boasts numerous process and materials manufacturing technologies, process development laboratories, an analytical laboratory, in-line characterization tools, and a high-speed research data network enabling near real-time integration with high-performance computing and AI tools that guide process development, perform autonomous experiments, and accelerate scale-up.

Materials Coating Laboratories. Argonne has leading experts and facilities for applying a variety of functional coatings to a variety of materials, including metals, ceramics, composites, soft materials, particles, and more. Coating technologies include atomic layer deposition, chemical vapor deposition, plasma vapor deposition, and sequential infiltration synthesis.

Biomanufacturing. Argonne works to improve the efficiency of the reactions underlying bioreactor and separation technologies for waste management, energy production, and manufacturing. Capabilities include bioprocess and separative reactor technology development and scale-up, unit operations modeling, techno-economic and life-cycle analysis, and bench- and pilot-scale fermenters up to 400 liters.

Electrodialysis Pilot Plant. Argonne's pilot plant can evaluate the feasibility of electrodialysis for a variety of applications. The plant is equipped with a commercial-scale electrodialysis stack served by computer-monitored and -controlled diluate, concentrate, and electrode rinse solution loops.

Argonne Leadership Computing Facility (ALCF). This facility enables breakthroughs in manufacturing R&D by providing supercomputing resources—leadership-class supercomputers, visualization clusters, advanced data storage systems, high-performance networking capabilities, and software tools—and expertise to the manufacturing and materials development community. Companies can apply for dedicated supercomputing time and expert assistance to address their development challenges and improve energy efficiency. The DOE-managed High- Performance Computing for Energy Innovation program includes separate manufacturing and materials tracks.

Cell Analysis, Modeling, and Prototyping (CAMP) Facility. Enables the design, fabrication, and characterization of prototype cells, which allows a timely and consistent evaluation of candidate battery chemistries in a close-to-real industrial format.

ReCell Center. Includes an advanced battery recycling R&D facility where we are developing cost-effective processes to recycle advanced battery materials, including direct recycling of cathode materials.

CONTACT
Aaron Fluitt
Interim Director,
Materials Manufacturing
Innovation Center
Phone: 630-252-0402
Email: afluitt@anl.gov

CRITICAL MATERIALS SUPPLY CHAIN

CRITICAL MATERIALS SUPPLY CHAIN

RESEARCH FOCUS

Argonne conducts research and development in several aspects of the critical materials supply chain, including seeking replacements for scarce or expensive elements, developing materials for a circular economy, strengthening the domestic supply chain, and commercialization of new materials and processes.

PROGRAMS

Argonne's work has advanced the discovery of materials and chemicals that eliminate or reduce the need for critical materials in the supply chain. Specific applications include materials for advanced batteries with reduced cobalt other critical materials; fuel cell catalysts with reduced platinum group metal (PGM) content; and catalysts that use earth-abundant elements. We also use AI approaches to accelerate the development of a fundamental understanding of how to manipulate the chemistries of earth-abundant elements so that they can be used in place of scarce or expensive elements.

Argonne has designed functional materials and chemical processes with particular consideration of product end-of-use and reclamation of reusable resources to deliver a sustainable circular economy. We have partnered with industry to develop an improved understanding of the properties of light rare-earth materials to support the domestic manufacturing supply chain. We have developed comprehensive capabilities in materials processing, synthesis and process scale-up, leveraging DOE investment in energy storage, battery material processing and recycling, and Argonne facilities to accelerate technology transitions across TRLs.

MODELING AND ANALYSIS

GREET. The Greenhouse gases, Regulated Emissions, and Energy use in Technologies model is a one-of-a-kind analytical tool that simulates the energy use and emissions output of various vehicle and fuel combinations.

BatPaC. A techonomic analysis tool for estimating performance and manufacturing cost of lithium-ion batteries. Allows the design of cells and battery packs to meet various performance requirements and estimates the manufacturing cost.

GCMat. Captures interactions, decisions, and dynamics across the entire supply chain from mining to recycling, enabling the evaluation of strategies, risks, and consequences of disruptions to supply chains that rely on critical materials. Specific examples of GCMat capabilities include the ability to simulate supply chains for primary and unconventional sources of rare earth magnets and their major end uses, and for primary and secondary (recycled) sources of battery and energy storage materials.

RELOG. Reverse Logistics Optimization is a supply chain design and optimization package that minimizes the total cost of collecting, storing, and recycling critical and/or strategic materials from end-of-life products.

More generally, Argonne brings to bear a diverse set of data analytics, modeling, simulation, and visualization tools upon the challenges of balancing risk and efficiency, responding to disruptive trends and technologies, optimizing for cost-effective resilience, providing meaningful insights and actionable information for key decision-makers around the globe. Ongoing work for the Advanced Manufacturing Office leverages critical materials expertise to estimate cumulative availability and production cost curves for rare earth elements and the rare earth magnet supply chain.

FACILITIES

ReCell Center. Includes an advanced battery recycling R&D facility where we are developing cost-effective processes to recycle advanced battery materials, including direct recycling of cathode materials.

Materials Engineering Research Facility. Enables the development of manufacturing processes for producing advanced battery materials in sufficient quantity for industrial testing, and for developing scalable, energy- and material-efficient manufacturing processes.

CONTACT

Allison Bennett Irion
Initiative Lead, Supply Chain
Phone: 630-252-6141
Email: abi@anl.gov

ELECTRIC POWER SYSTEMS AND GRID
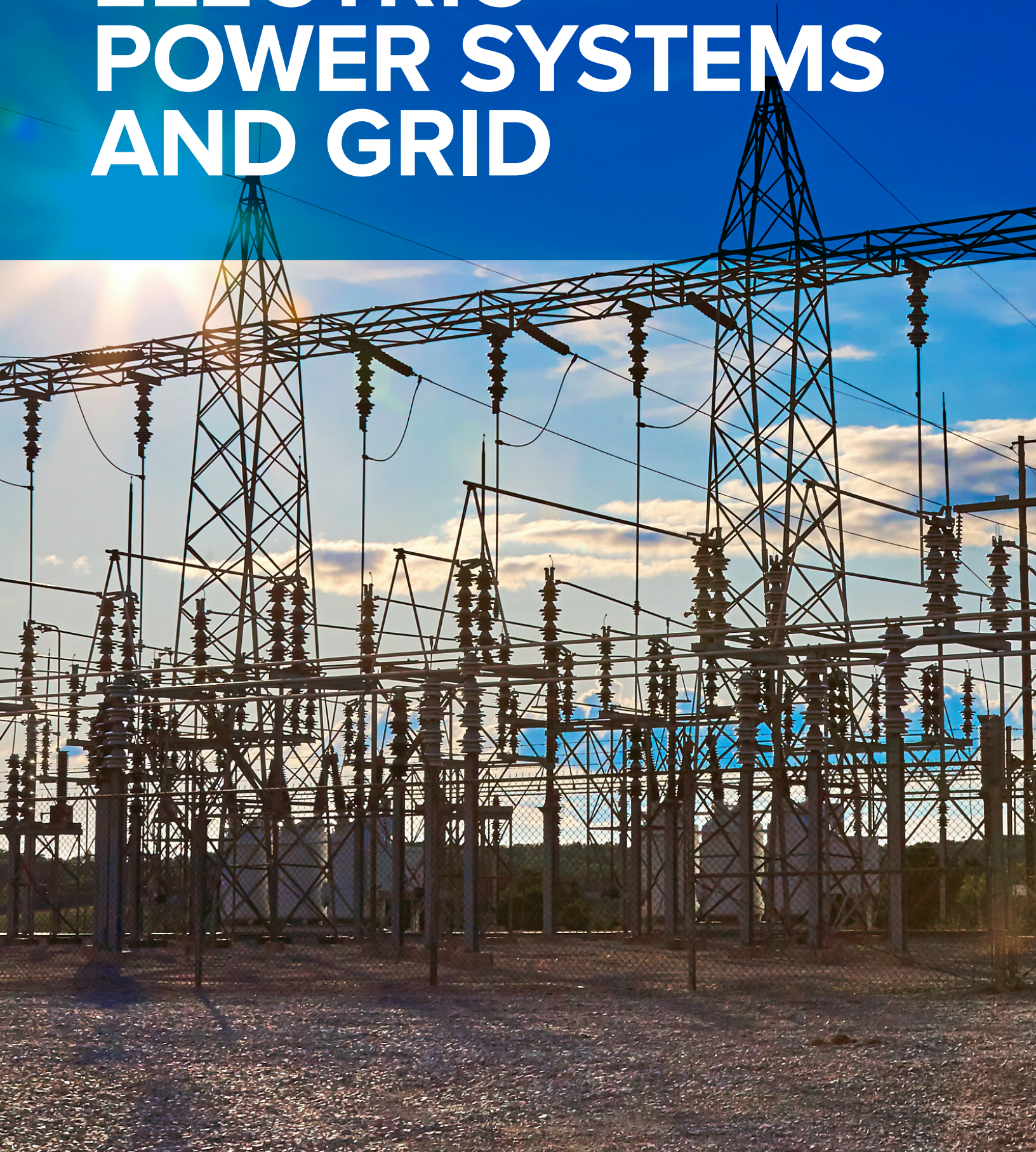
ELECTRIC POWER SYSTEMS AND GRID ANALYSIS

RESEARCH FOCUS

The electric power industry has become more complicated, dynamic, and uncertain over the past several decades, with new energy components integrated into the grid and new technologies, market rules, business models, and regulatory policies to manage. System operators must focus on traditional stability and security requirements as well as emerging resilience and cyber-security concerns. More challenging grid operation and planning demands advanced analytical tools to make better decisions faster. Argonne's expertise in grid resilience, power system optimization and computing, and artificial intelligence enable analysis of the grid's current state and future needs.

MODELING AND ANALYSIS

Integrated Resource Planning. Argonne has analyzed numerous generating system expansions in domestic and international studies, provided long-term energy planning, demand forecasting, and energy system balancing assistance to many countries, and conducted international training courses on energy and electricity demand forecasting, generating system expansion planning, and production cost analysis. Argonne's web-based EZMT (Energy Zones Mapping Tool) assesses energy resources and infrastructure and siting factors, including energy equity and environmental justice metrics. The Lab's assessment of future extreme weather and infrastructure impacts, enabled by high-resolution capabilities supporting hyper-local climate modeling, complement its experience in optimizing microgrid and energy storage systems for grid resiliency.

Production Cost Modeling. Argonne's significant capabilities electric power system modeling and analysis include optimizing power systems operations and analyzing production and marginal cost. Argonne is the lead DOE lab in modeling and analyzing hydro and pumped storage power plants and optimizing hydropower plant operations and reservoir management, hydro-thermal coordination, and cascade operations. Argonne-developed models that can be used for production cost analyses include GTMax (Generation and Transmission Maximization), of which the Western Area Power Administration is a user; CHEERS (Conventional Hydroelectric and Environmental Resource Systems), to simultaneously optimize for power system and environmental objectives; and the flagship A-LEAF (Argonne Low-carbon Electricity Analysis Framework), to analyze both production cost and long-term capacity expansion.

Advanced Grid Modeling. Argonne's significant capabilities in advanced transmission and distribution system modeling include its TDcoSim (Transmission and Distribution Co-Simulation) model. Argonne has significant experience in developing and applying advanced grid simulation algorithms, including using AI in modeling and simulation.

Infrastructure Interdependence Analysis. Argonne is the lead lab in modeling and analyzing interdependencies between the electric sector and other energy infrastructures, especially natural gas supply. Lab-developed NGfast and NGtransient models rapidly assess impacts of natural gas pipeline breaks and flow reductions; other tools assess telecommunications and liquefied natural gas infrastructure interdependencies.

Integration of Variable Renewables, Energy Storage, and Decarbonization Analysis. Argonne has significant experience in modeling the integration of variable renewable energy sources into the power grid and in electricity markets. Using the A-LEAF model, Argonne is currently conducting a national-scale analysis on the role of energy storage, electrification, variable renewables, nuclear energy, and transmission grid in decarbonizing the US electricity sector.

Electricity Market Analysis. Argonne has unparalleled expertise in the modeling and analysis of organized electricity markets The lab has developed the **EMCAS** (Electricity Market Complex Adaptive System) model which utilizes agent-based modeling to simulate competitive electricity markets in the US and abroad. EMCAS has been licensed to several countries where it has been applied to simulate operations of electricity markets.

Power Systems Reliability, Resilience, and Restoration Analysis. Argonne researchers have significant experience in the reliability and resilience analysis of electric power systems, including the assessment of threats, hazards, and system vulnerabilities, and the restoration of power systems after natural or man-made disturbances.

CONTACT

Mark C. Petri
Grid Security and Resilience Lead
Phone: 630-252-1346
Email: petri@anl.gov

Vladimir Koritarov
Director, Center for Energy, Environmental, and Economic Systems Analysis
Phone: 630-252-6711
Email: koritarov@anl.gov

CARBON MANAGEMENT
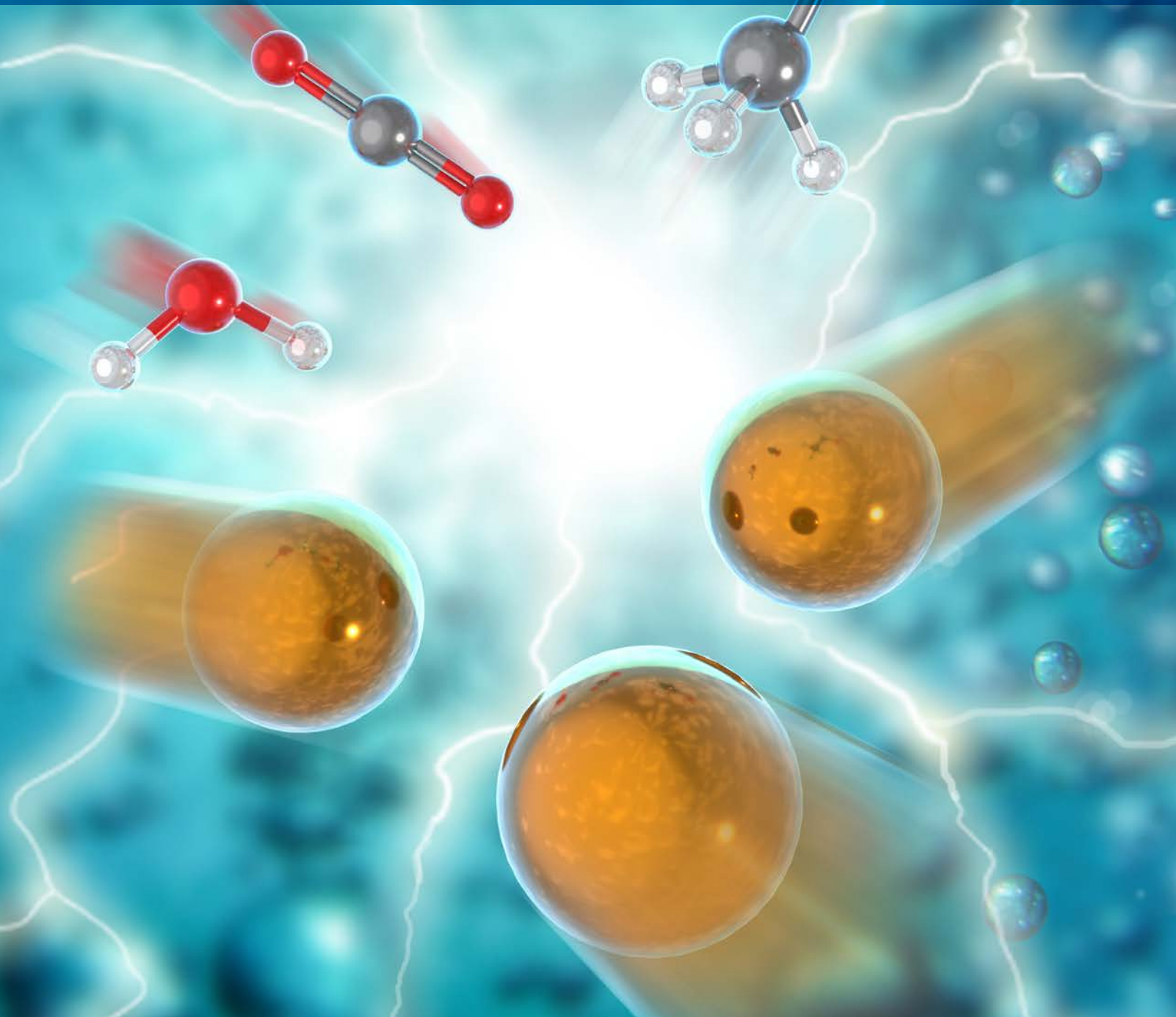
CARBON MANAGEMENT

RESEARCH FOCUS

Achieving a goal of net-zero carbon emissions by 2050 requires science and technology innovations that significantly reduce, or eliminate, CO_2 emissions and enable capture of CO_2 from emissions and from the air; captured CO_2 can be sequestered or converted to valuable products to provide economic benefits. Argonne is pursuing research and development opportunities in four key areas: simultaneous capture and conversion of CO_2 to value-added products, conversion of sequestered CO_2 to value-added products, efficient transport of captured CO_2 from production sites to storage sites, and subsurface sequestration enabled by mineralization.

PROGRAMS

Argonne has established leadership in chemical, electrocatalytic, and photochemical processes that support carbon capture and sequestration technologies. Engineered solutions based on the addition of metal-silicate materials to wastewater streams was established by Argonne for effective CO_2 sequestration. Argonne has a current program on photoreactive capture of CO_2 that combines direct air capture with conversion to fuels and/or value-added chemicals using visible light as an energy input. Chromophores, catalysis, and capture groups combined in metal oxide frameworks (MOFs) enables combined CO_2 DAC and conversion. Argonne developed functional electrocatalysts for efficient electrochemical conversion of CO_2 to valuable chemical products that will support a circular carbon economy.

Bioreactor and separation technologies also offer great opportunities for waste management, energy production and manufacturing. By improving the efficiency of the underlying reactions, Argonne is advancing a wide range of cost-competitive bioreactor technologies for cost-effective and efficient waste-to-energy processing. We are re-engineering plant flow diagrams to develop innovative technologies for industrial applications; developing and applying intensified reactor and innovative separation technologies for bioenergy and bioproducts production, water treatment and manufacturing; and advancing unit operation design, modeling and techno-economic assessment.

MODELING AND ANALYSIS

Argonne merges expertise in chemical kinetics, electrochemistry, techno-economic analysis, and computational fluid dynamics to enable carbon capture technologies. Software developed by Argonne will resolve physico-chemical hydrodynamics of CO_2 capture processes, which will enable rapid deployment of a variety of technologies involving membranes, solvents, and sorbents. Hollow fiber membrane contactors are being modeled, fabricated, and characterized for selective CO_2 transfer for separation at concentrations from 400 to 100,000 ppm. Argonne's high-performance computing capabilities are being combined with a robust electrochemistry infrastructure to explore complex advection-diffusion-reaction mechanisms, allowing accurate calculations of mass transfer coefficients under any set of operating conditions. This information will enable efficient membrane design for CO_2 separation and capture.

Workers in this field make extensive use of the GREET model, the gold standard for the analysis of carbon emissions from industrial processes and the leading model for life cycle impacts of carbon capture, utilization, and storage technologies.

FACILITIES

Materials Engineering Research Facility (MERF). Enables development of scalable and energy- and material-efficient manufacturing processes to produce functionalized membranes to reduce separations costs. MERF bridges the gap between bench-top science and industry by using cutting-edge tools to scale up production of new materials and develop process technologies that improve the quality, cost, or efficiency of existing manufacturing.

CONTACT
Seth Darling
Chief Science and Technology Officer,
Advanced Energy Technologies
Phone: 630-252-4580
Email: darling@anl.gov

GLOSSARY

FACILITIES

AMTL
Advanced Mobility
Technology Laboratory
www.anl.gov/es/advanced-mobility-
technology-laboratory

ALCF
Argonne Leadership
Computing Facility
www.alcf.anl.gov

APS
Advanced Photon Source
www.aps.anl.gov

CAMP
Cell Analysis, Modeling,
and Prototyping Facility
www.anl.gov/cse/cell-analysis-
modeling-and-prototyping-
camp-facility

EADL
Electrochemical Analysis
and Diagnostics Laboratory
www.anl.gov/cse/electrochemical-
analysis-and-diagnostics-laboratory

EDL
Electrochemical Discovery Laboratory
www.anl.gov/jcesr/electrochemical-
discovery-laboratory

Engine Research Facility
www.anl.gov/es/engine-
research-facility

EVGI
EV Grid Integration Center
www.anl.gov/es/evsmart-grid-
interoperability-center

Materials Coating Laboratories
www.anl.gov/manufacturing/scalable-
coating-technologies

MERF
Materials Engineering
Research Facility
www.anl.gov/amd/materials-
engineering-research-facility

PTF
Post-Test Facility
www.anl.gov/cse/posttest-facility

ReCell Center
recellcenter.org

MODELS AND SIMULATION

Aeronomie
Aircraft Simulation Tool
vms.es.anl.gov/tools/aeronomie

AFLEET
Alternative Fuel Life-cycle
Environmental and
Economic Transportation
greet.es.anl.gov/afleet_tool

Autonomie
Vehicle Energy Consumption,
Performance and Cost
System Simulation
vms.es.anl.gov/tools/autonomie

BatPaC
Battery Performance and Cost
www.anl.gov/cse/batpac-
model-software

BEAN
BEnefit ANalysis
vms.es.anl.gov/tools/bean

EZMT
Energy Zones Mapping Tool
ezmt.anl.gov

EverBatt
Battery Life-cycle Model
www.anl.gov/amd/everbatt

GCMat
Global Critical Materials
Agent-based Model
www.anl.gov/argonne-scientific-
publications/pub/79123

GREET
Greenhouse Gases, Regulated
Emissions, and Energy Use
in Technologies Model
greet.es.anl.gov

HDSAM
Hydrogen Infrastructure
Modeling and Analysis
hdsam.es.anl.gov

**Machine Learning Prognosis
for Battery Life and Performance**
www.anl.gov/cels/machine-
learning-prognosis-for-battery-
life-and-performance

NEAT
Non-highway Energy and GHG
emission Accounting Tool
www.anl.gov/es/neat-tool-download

POLARIS
Transportation System Simulation Tool
vms.es.anl.gov/tools/polaris

RELOG
Reverse Logistics Optimization
Supply Chain Optimization Package
www.osti.gov/biblio/1677411

RoadRunner
Powertrain and Driving Dynamics
System Simulation for Connected
and Automated Vehicles
vms.es.anl.gov/tools/roadrunner

SVTrip
Stochastic Vehicle TRIp
Prediction Naturalistic Vehicle
Speed Profile Generation
vms.es.anl.gov/tools/svtrip

TEA
Techno-economic analysis Capability
greet.es.anl.gov/publication-
tea_factsheet

VERIFI
Virtual Engine Research
Institute and Fuels Initiative
www.anl.gov/es/virtual-engine-
research-institute-and-fuels-initiative

VISION
Advanced Light- and Heavy-duty
Vehicle Technologies and Alternative
Fuels Model
www.anl.gov/es/vision-model

Accelerating science and technology to drive prosperity and security.

Argonne's world-class researchers, using state-of-the-art facilities and models, will help advance across-the-board historic transformation.

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

CONTACT
Argonne National Laboratory
9700 S. Cass Avenue
Lemont, IL 60439
Phone: 1-630-252-2000
www.anl.gov