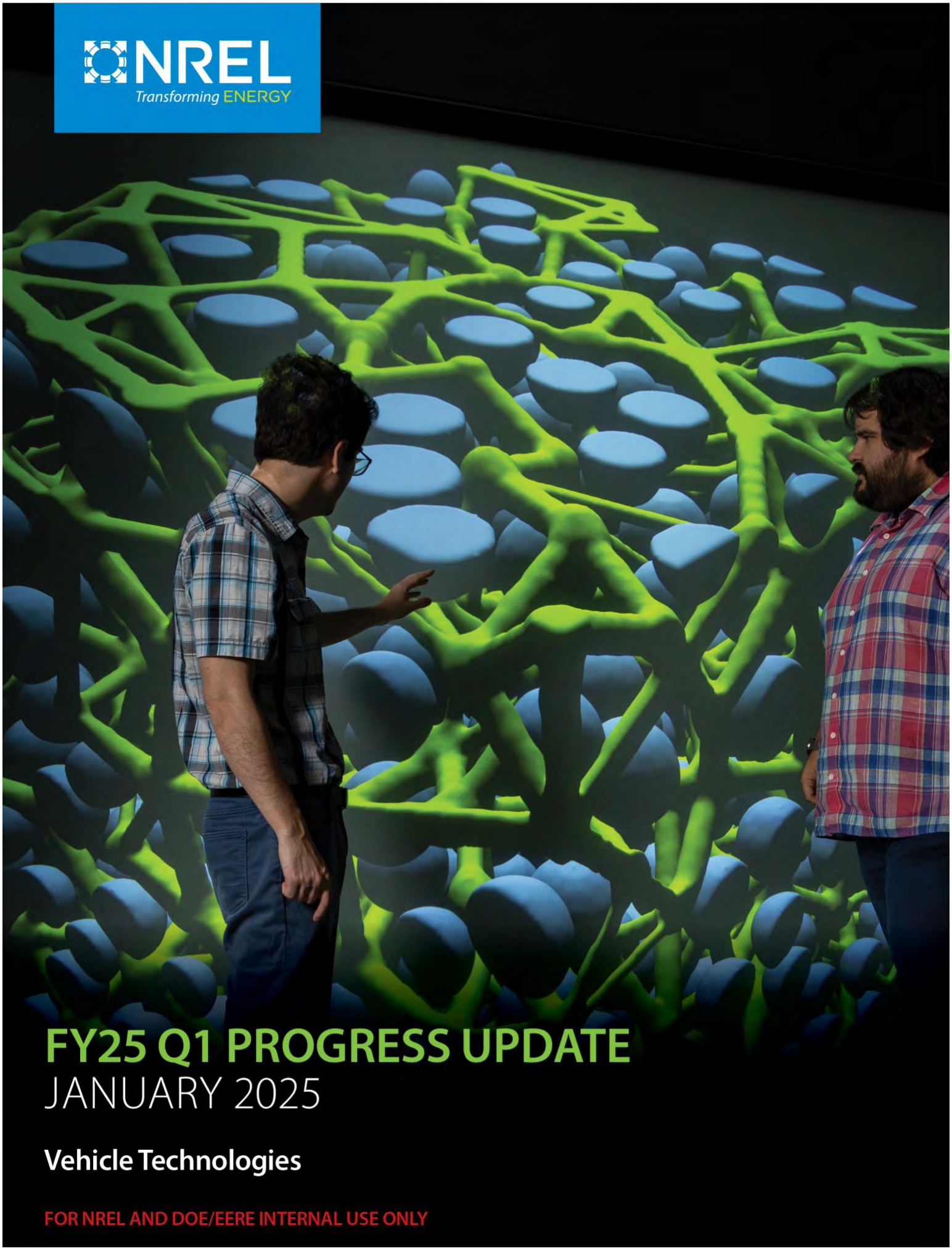
NREL
Transforming ENERGY



FY25 Q1 PROGRESS UPDATE
JANUARY 2025

Vehicle Technologies

FOR NREL AND DOE/EERE INTERNAL USE ONLY

TABLE OF CONTENTS

R&D HIGHLIGHTS

BATTERY TECHNOLOGIES

Battery R&D

Quarter One

Lithium-Ion Battery Recycling Prize Cultivates Battery Recycling Solutions With Breakthrough Winner Selection

The Breakthrough phase of the Lithium-Ion Battery Recycling Prize is nearing completion, advancing the goal of developing and demonstrating processes that, when scaled, have the potential to capture 90% of lithium-based battery technologies in the United States for recycling and reuse. NREL prize administrators coordinated the selection of Breakthrough contest winners and finalized the briefing of proposed winners for approval by the Vehicle Technologies Office (VTO). NREL also finalized rules and voucher guidelines for participants moving forward to Phase IV: Demonstration of Impact. Breakthrough winners participating in Phase IV will demonstrate the efficacy of their solution to establish infrastructure to move spent or discarded lithium-ion batteries from consumers to recyclers across all commercial uses. Phase IV participants can use voucher funding to validate their solutions with approved Evaluation Entities—qualified lithium-ion battery recyclers and second-life testing organizations. Participants can also apply voucher funding to work alongside a voucher service provider to perform techno-economic analysis and life cycle analysis of their solution. NREL is coordinating approvals of the rules and guidelines and preparing to launch approved email, social media, and web content through NREL and U.S. Department of Energy (DOE) channels to announce Breakthrough winners and launch Phase IV of the prize.

NREL Develops Fabrication Protocols for Electrode and Electrolyte Materials

NREL is focused on developing physics-based models to understand limitations in promising lithium-sulfur battery chemistry. The chemistry uses earth-abundant/low-cost sulfur cathodes and has the potential to exceed 500 Wh/kg at the cell level to improve electric vehicle (EV) driving range. However, current performance is poor, and understanding is lacking. Within the Coupled Multi-Scale Modeling and Diagnostics For Lithium-Sulfur Battery Design Project, NREL developed protocols for fabricating sulfur composite cathodes and electrolytes, including determining the material suppliers and all processing steps for these protocols. The sulfur cathodes will consist of sulfur, polyvinylidene fluoride binder, and acetylene carbon black. The electrodes will be cast using *n*-methylpyrrolidone with a target loading of 1–2 mg/cm^2 and high porosity of 55%. The electrolyte will consist of lithium bis(trifluoromethanesulfonyl)imide in tetraethylene glycol dimethyl ether. It is critical for the project team to be able to use electrodes with repeatable and reliable performance. Thus, all *in situ* characterization studies at the multiple locations will be studying the same physical behavior, which will accelerate learning. The documented procedures for fabrication enable each electrode batch to be equivalent.

Modeling Estimates Lifetime of Electric Heavy-Duty Vehicle Batteries From Real-World Data

Electrification of all heavy-duty truck trips requires both high-performing batteries and good economics, pushing the boundaries of current battery cost and performance trade-offs. NREL simulated battery degradation for real-world, heavy-duty truck trips, by using data from real-world truck trips in NREL's Fleet DNA database, simulating the electric drivetrain using the Future Automotive Systems Technology Simulator (FASTSim™), and the resulting battery life using the Battery Lifetime Analysis and Simulation Tool (BLAST). Findings allowed researchers to study the impact of battery performance and durability, as well as truck design, on the total ownership costs. An initial set of representative real-world truck trips was collected from the Fleet DNA database, and then FASTSim was used to simulate the power needs from the battery pack. These data were used to inform the design of lab-based drive cycles for accelerated aging tests at Idaho National Laboratory (INL). The battery degradation expected under these lab-based drive cycles and the original representative Fleet DNA cycles were all then simulated using BLAST to illustrate the effect of battery design

on lifetime. Next steps will include simulating battery degradation across large numbers of real-world truck trips from Fleet DNA to gather distributions of results, helping determine battery requirements for the U.S. DRIVE Partnership's heavy-duty truck electrification goals in 2030, 2040, and 2050.

Research Uncovers Differences Between Cells Fabricated With Commercial Solid Electrolyte

Fabricating reliable, reproducible, solid-state cells with high active material utilization remains a challenge for the research community. NREL researchers used two commercially sourced Li_6PS_5Cl solid electrolytes with the same composition to fabricate cells with identical processing parameters and other cell materials—isolating particle morphology effects. The team will report how the two different commercial sources affected cell performance with all other parameters being the same. Initial results indicate the solid-state cells using Vendor A solid electrolyte material had higher cathode utilization. Nano-computed tomography imaging shows cells with this material had fewer voids and better uniformity. This is likely due to the smaller particle size distribution of Vendor A's material. Understanding how particle morphology affects solid electrolyte cell performance is critical and somewhat overlooked in the literature. The results help provide insight into the amount of particle sieving and milling that must be done to materials prior to cell assembly to optimize performance. The material from Vendor B is considerably cheaper and available in much larger quantities to support cell fabrication. Thus, NREL will perform milling and sieving of Vendor B material to see if performance with this lower-cost and more readily available material can be improved.

eXtreme Fast Charge and Cell Evaluation of Lithium-Ion Batteries (XCEL) Program Makes Progress in Fast-Charging Technologies for EVs

Extreme fast charging is critical for accelerating public adoption of EVs, as charging times of 15 minutes or less are necessary to compete with the refueling times of combustion engines. As part of DOE's XCEL program, NREL is establishing benchmark designs demonstrating how emerging technologies can achieve extreme fast charging. Achieving this in energy-dense batteries (≥4 mAh/cm^2) requires an in-depth understanding of internal resistances and rate-limiting mechanisms within battery systems. This quarter, the XCEL team made significant progress in fast-charging battery technologies. These advancements include integrating single-walled carbon nanotubes into cathode materials to enhance conductivity, laser-ablating electrolyte "highways" into the anode to improve lithium transport and mitigate harmful lithium plating and formulating novel electrolytes with superior lithium-ion transport properties. A recent study demonstrated that these innovations enabled the development of energy-dense cells (3.3 mAh/cm^2) capable of achieving more than 80% charge in just 12 minutes for 800 cycles, with minimal capacity fade of only 13%. Although the XCEL program is nearing its conclusion, this groundbreaking work will be disseminated in several manuscripts slated for publication early in FY 2025, including studying ultra-energy-dense cells (3.62 mAh/cm^2 designed to charge in 10 minutes, and 4.37 mAh/cm^2 designed to charge in 15 minutes).

Machine Learning Helps Predict Aging Behavior of Silicon Batteries

Lithium-ion batteries with silicon anodes have high energy density but poor calendar lifetimes. Improving the calendar life of silicon batteries requires many iterations of testing, which is prohibitively slow and resource-consumptive. The ability to accurately predict aging early in testing is crucial to minimize the cost of improving silicon batteries. Previously developed machine-learning pipelines were improved by including information about cell chemistry and test conditions as additional inputs, as well as by reducing dimensionality of correlated features. An initial model was also developed to predict resistance growth. After 1 month of calendar testing, the models can predict lifetime with 1.4-month average error, capacity retention 12 months into the future with 5% average error, and resistance growth after 12 months with 17% average error. Predicting the aging behavior of batteries with silicon anodes is critical to minimize the cost of testing new designs toward improved calendar life. Incorporating additional cell information as model inputs provides insight into their relationship with lifetime and the evolution of capacity and resistance over time. The machine-learning pipeline will be used to validate physics-based hypotheses for calendar life. Next steps include quantifying prediction uncertainty and incorporating uncertainty into the decision-making process when projecting lifetime.

Tier 3 Protocol Illuminates New Understanding of Calendar Life Fade Mechanisms in Silicon Anodes

Silicon anodes are a promising technology for lithium-ion batteries due to their high energy density, but batteries with silicon anodes typically have short calendar lifetimes. The NREL-led Silicon Consortium Project has been conducting detailed experiments that are beginning to shed light on why silicon behaves differently than graphite active anode material. Researchers examined two hypotheses describing why calendar life fade remains a challenge in silicon anodes. NREL executed an experimental matrix exploring a range of anode and electrolyte chemistries, anode prelithiation state and method, and electrochemical protocols. Cells are being evaluated using our United States Advanced Battery Consortium-style Tier 3 calendar life testing protocol with single-layer pouch cells, in which the data will be fed into our machine-learning/artificial intelligence calendar life prediction model. Understanding the mechanistic details underlying silicon anode calendar life fade is crucial to devising strategies to mitigate this failure process. This work directly probes the ways that silicon differs from graphite anodes and will point to design pathways to overcome calendar life fade in silicon anodes. NREL will next input multi-month calendar life data into a machine-learning/artificial intelligence model to statistically analyze the causes of calendar life fade and prove or disprove the two hypotheses.

ELECTRIFICATION TECHNOLOGIES

Electric Drive Technologies

Quarter One

Cross-Lab Collaboration Accelerates High-Voltage, High-Power Traction Inverter

While thermal issues are one of the primary reasons an inverter fails, a well-designed thermal management system can be the secret to its success: It can lower operating temperatures, increase the inverter's power density, and improve its reliability. NREL researchers are currently collaborating with Oak Ridge National Laboratory (ORNL) to design and fabricate a high-voltage, high-power traction inverter for EVs, including a novel thermal management system. In the first step of the process, Researchers completed an extensive literature review focused on thermal management systems for aircraft and military applications and advanced technologies for the inverter's auxiliary components. This research will now inform NREL's design for a high-performance thermal management system for ORNL's inverter, which will be developed under the DOE VTO Electric Drive Technologies program.

Grid and Infrastructure

Quarter One

New Reports From Next-Generation Profiles (NextGen Profiles) Provide Better Understanding of EV and Infrastructure Performance Under Varying Conditions, Ways To Improve Site Design Tools

EVs and chargers (EVSE) capable of charging power levels greater than 200 kW are now widely deployed. However, EV and EVSE performance can vary dramatically based on multiple factors, including temperature, grid conditions, state of charge, and other variables, which are often not clearly stated by original equipment manufacturers. In Q1 FY 2025, the NextGen Profiles team—a collaboration between NREL, Argonne National Laboratory (ANL), INL, and ORNL—characterized multiple new types of EVSE and EVs under various conditions, integrating these data into multiple EV charging models. The NREL NextGen Profiles team led updates to the EVSE characterization report, which includes results from two new NREL-performed EVSE

characterizations, as well as one new NREL-performed EV characterization in the EV profiles report. Finalized reports will be publicly released in January 2025and will provide station operators, grid modelers, and other stakeholders with a more accurate understanding of EV and EVSE performance under different conditions. Additionally, these results will improve various modeling tools used for EVSE site design, EV rental fleets, and other scenarios. In 2025, the NextGen Profiles team will continue to characterize new EV and EVSE assets. Moreover, NREL will conduct new experiments to better characterize EVSE thermal management system performance.

Defining Standard Test Requirements Advances Grid Safety, Enables Vehicle-to-Everything (V2X) EVSE

Supporting the standardization of V2X alternating current (AC) is critical to streamlining the EV-grid interconnection process and supporting grid safety. To this end, NREL researchers analyzed SAE J3072 and the draft UL 1741SC standards and identified 39 test cases. Of these, NREL determined that 26 test cases are oversight and extra protective requirements designed to enhance grid safety for vehicle-to-grid AC applications. Additionally, the team identified requirements to integrate V2X AC features into NREL's existing testbed. Using insights from both documents, researchers documented the requirements for UL 1741SC-compliant EVSE and shared with potential partners as a foundational reference. UL 1741SC is a pivotal standard for V2X AC, bridging the gap between the automotive sector and the utility/stationary distributed energy resource industry. As the first of its kind, its conformance approach must be carefully evaluated to ensure clarity and feasibility. In future work, researchers will build the evaluation platform and collaborate with partners to demonstrate compliance with UL 1741SC.

Newly Prepared EV Load Profile Datasets and Documentation for Four Vehicle Segments Fill Critical Data Gap

An NREL research team has prepared draft datasets and documentation to address the lack of detailed electricity demand projections for four rapidly electrifying vehicle segments—transit buses, government fleets, port cargo-handling equipment, and airport ground support equipment. Such resources equip utilities and energy planners with critical data for future planning. Now in review by DOE, the datasets and documentation will soon be published and incorporated into a future update of the Electric Power Research Institute's eRoadMAP data platform. This work projects the potential electricity load profiles of rapidly electrifying vehicle segments that are currently underrepresented in energy planning. Filling this data gap supports utilities, policymakers, and planners in making informed decisions for grid integration, infrastructure investments, and implementing sustainable transportation strategies. Next, the team will refine the datasets and develop new, highly detailed load profiles for electric construction vehicles.

Flame Self-Extinguishing Time (SET) Electrolyte Testing Improves Safety for Behind-the-Meter Storage

Evaluating and downselecting the most promising nonflammable electrolytes will inform selection for large-scale cells fabricated next year for safety analysis. While $Li_4Ti_5O_{12}$/$LiNi_{0.90}Mn_{0.10}O_2$ batteries provide energy density advantages, poorer safety attributes than previously evaluated systems need to be addressed by nonflammable electrolytes. Several nonflammable electrolytes exhibiting promising electrochemical performance were downselected for flammability testing. A SET apparatus was designed and fabricated to test electrolyte flammability. Conventional electrolytes readily ignited, as did an ethylene carbonate electrolyte with no other cosolvents, despite ethylene carbonate's high flash point. Only electrolytes with fluorine or phosphorous radical scavenger groups on the solvent molecules prevented sustained flame during testing. Behind-the-meter storage electrolytes must balance performance and safety. SET, vapor pressure, and flash point testing are important to understand the flame retarding properties of nonflammable electrolytes compared with conventional electrolytes. The best nonflammable electrolyte candidates will be delivered to partners at Sandia National Laboratory for safety evaluation in a larger cell format (18650) cells to further evaluate safety considerations.

MATERIALS TECHNOLOGY

Lightweight Materials

Quarter One

Polyester Covalent Adaptable Network (PECAN) Carbon-Fiber-Reinforced Composites Exhibit Competitive Cycle Times for Fabrication and Thermoforming

Curing cycle times are a significant cost driver for high-volume materials like vehicle components and inform the material's technology readiness level. NREL researchers used rheology and differential scanning calorimetry to quantify PECAN resin polymerization (curing) cycle times at temperatures from 60°C to 140°C and importantly discovered the PECAN resin experiences full conversion in less than 10 minutes at 140°C. The lab team found this cycle time can be reduced to <2 minutes with an alternatively formulated PECAN network or increased temperatures, and thermoforming, a composite metric, exhibits nominal strain (>0.2%) after 60 minutes at 100°C with the inclusion of polyethylene. The vehicle industry requires cycle times of <10 minutes for industry adoption, while preferring times less than 2 minutes. Notably, researchers were able to prove that the PECAN system meets the needs of the intended industry and can be reformulated for even faster cycle times. Next, the team will explore the manufacturability of the PECAN resin through fabrication demonstrations and techno-economic analysis.

TECHNOLOGY INTEGRATION

Data and Systems

Quarter One

Review of EV Emergency Response Guides Generates Insights To Help First Responders Minimize Risk During EV Incidents

Emergency responders are increasingly asking questions about the risks they face on the scene of an incident involving EVs and how they can be better prepared to minimize hazards and engage safely. The need for clear, concise, and consistent first responder resources has grown due to expanding media coverage on this topic and increased questions received from emergency responders as part of NREL's transportation technical assistance efforts. To help address this gap, NREL researchers reviewed a sample set of publicly available rescue sheets and emergency response guides to identify industrywide best practices and potential opportunities for improvement. NREL summarized the results of this review in a white paper that presents high-level findings alongside "starter" questions to help vehicle manufacturers, standards developers, and other industry stakeholders create their own materials to support EV incident emergency response. NREL's findings will also be presented at an upcoming SAE J2990 committee meeting and will inform other emergency responder educational resources the team in development.

Initial Release of Athena Zero-Emissions Vehicles (Athena ZEV) Aeroportal Helps Airports Identify Power Demand

NREL researchers recently released the initial version of Aeroportal, a web application that makes research findings from the Athena ZEV project more readily available to airport stakeholders across the nation to better identify and understand future power demand, solar and storage requirements, that will make their facilities' operations cost-more effective and predictable. NREL's Aeroportal is built on HERO, a framework for web applications that offers essential services for building and configuring interactive applications. HERO provides features such as authentication, task management, and multiple storage options. These components are integrated into the Aeroportal, enabling stakeholders to quickly access initial data through interactive visualizations and a machine-learning-enhanced knowledge base. The Aeroportal is a general-purpose tool designed to serve all U.S. airports. To operate at this scale, it is built to be intuitive, enabling users to answer questions, understand how Athena ZEV research applies to their unique situation, and run additional models on back-end systems without needing assistance from NREL. Next, researchers plan to enhance Athena ZEV models, introduce new ones, and continuously add features and improvements to Aeroportal based on stakeholder feedback.

Multilab Collaboration Improves Participation Potential for Clean Cities and Communities (CC&C) Workforce Development Initiative

NREL collaborated with ANL to build three new webpages to promote ANL's Clean Cities and Communities Accelerate workforce development initiative on the CC&C website as a tool to increase awareness and access to application materials (cleancities.energy.gov/internship-opportunities/). The Accelerate initiative develops future clean transportation professionals interested in on-road transportation innovation by facilitating internships with CC&C coalitions. Both labs came together to develop the content and webpages to ensure coalitions and interested candidates can easily find information and apply. NREL web developers provided guidance on the right level of detail and format to clearly communicate information in one place utilizing tabs, anchor links, accordions, and callout boxes. Drawing from ANL's expertise on the initiative, NREL produced concise, well-designed webpages to improve user experience and potentially increase the number of internship applications. Next, NREL and ANL will add key resources and information in the password-protected side of the CC&C website for coalitions and interns actively participating in Accelerate.

Coalition-Building Efforts Extend Reach of CC&C Through Eight New Coalitions and Statewide Expansions

NREL efforts to expand the reach of CC&C coalitions contributed to more than 93% of the U.S. population now living within the boundaries of a coalition, up from 83% 2 years ago. This increase comes from eight coalitions joining the partnership, as well as several existing coalitions expanding their territories. NREL helped expand the network by working with DOE to establish an "apprentice" coalition designation category that provides high-touch support for aspiring coalitions, as well as providing coalition-building support to existing coalitions. Coalition-building efforts involved facilitating statewide coordination in states with multiple coalitions and establishing branch offices to provide localized support in states with single coalitions. NREL is continuing these efforts in FY 2025, working with current apprentice coalitions to achieve full designation and creating the foundations for new apprentice coalitions.

Flexible, Short-Term Funding for CC&C Coalitions Enables Quick Response to Local Needs

An NREL-managed funding initiative for CC&C coalitions provides low-barrier, short-term financial support that enables coalitions to quickly respond to local clean transportation stakeholder needs. This initiative, called Jumpstart, enables coalitions to explore a broad range of activities, such as trial efforts, higher-risk projects, peer education, and unanticipated opportunities and challenges. Thus far, NREL has managed five rounds of funding, issuing a total of $276,000 to support 17 projects, including needs assessments, fleet planning, alternative fuel market development, infrastructure rightsizing analysis, and technical training and education. In addition to managing the funding, NREL provides coalitions with project guidance and technical assistance as needed. Working with coalitions through Jumpstart also helps NREL identify additional opportunities for coalition training. For example, reviewing Jumpstart proposals prompted NREL to develop an in-person grant

writing workshop that will take place in Q2 of FY 2025 and build coalition capacity to develop and write strong funding applications.

Regional Fleet Electrification Workshops Provide Peer Sharing and In-Depth Learning Opportunities

The State and Alternative Fuel Provider Fleet Program is partnering with CC&C coalitions to host regional fleet electrification workshops that provide opportunities for peer sharing and training on fleet electrification planning tools. The workshops are designed for state, federal, and local light-duty fleets to gain more familiarity with EV technologies and electrification planning and implementation best practices. While many tools and resources are available, the workshops allow fleets to learn directly from subject matter experts and peer fleets with local fleet electrification experience. More than 120 fleet representatives attended the first two workshops, hosted by New Jersey Clean Cities Coalition and Drive Clean Indiana. Attendees gained knowledge and connections that will help them meet regulations to utilize alternative fuel vehicles, including EVs, in their light-duty fleets. The NREL-led program team is collaborating with the Federal Energy Management Program team to evaluate outcomes from the initial workshops and implement improvements for the next two workshops in St. Louis and Denver in early 2025.

ANALYSIS

Modeling

Quarter One

Heterogeneity in EV Adoption Impacts Energy Use and Battery Manufacturing Requirements

Even with a set target for zero-emission vehicle (ZEV) sales, energy impacts can vary depending on the types of households that adopt EVs and the types of vehicles that electrify. Preliminary results from NREL's Transportation Energy & Mobility Pathway Options (TEMPO™) model inform how heterogenous adoption by vehicle class for a fixed sales scenario (e.g., 50% EV sales by 2030) impacts fuel use, electricity demand, and battery manufacturing requirements. In a scenario where electrification of long-range SUVs and pickup trucks—versus shorter-range compact and midsize vehicles—is initially preferred, in 2035 cumulative gasoline savings increase by 18%. However, annual electricity demand increases by 56%, and annual battery manufacturing requirements more than double. This understanding helps inform the implications of electrification and how heterogeneity in adoption, even for a fixed sales target, can lead to varying impacts on energy use, emissions, and manufacturing requirements. Next steps are to finalize the scenario results—including the potential addition of sensitivities on technology advancement and overall preference for vehicle size classes—and document findings in a journal article.

Applied Analysis

Quarter One

Modeling and Analysis of Travel Demand Strategies Identifies Opportunities for Efficiency and Emissions Improvements

How future travel demand management strategies could impact national energy and emissions is uncertain. Since the COVID-19 pandemic, uncertainty has grown in how future transit and housing density will impact travel and transport energy and emissions. An NREL research team used the TEMPO model to simulate hundreds of national scenarios focusing on future transit evolution (transit availability, service quality, and

affordability) and housing growth trends. TEMPO results show moderate potential for individual dimensions to impact energy or emissions (up to 5% reductions from baseline 2050), but greater potential for emissions and energy savings when combining expanded household transit access with factors like increasing service quality and higher demand for shorter urban trips. Increasing the quality of transport alternatives such as transit can alleviate national vehicle miles traveled—supporting increased energy efficiency and reduced emissions in urban areas—and is most utilized by households with lower incomes or reduced access to driving by car. Results and analysis from this project will support other projects aiming to further regionalize the impacts of this work.

Enhanced Spatial Resolution of EVI-X Framework for Modeling EVs on the Distribution Grid Enables Detailed Electricity System Analysis

Without proper planning, the electrification of transportation can pose significant challenges to the electricity grid, particularly at the distribution level. An NREL research team has enhanced the spatial resolution of the EVI-X framework to address the challenge of translating national-scale EV charging station deployment simulations into detailed, spatially resolved data for electricity distribution planning and analysis. Such granularity is critical to evaluate localized grid impacts, optimize station siting, and ensure grid readiness for the growing adoption of EVs. The team developed a methodology to disaggregate national-scale EV charging station deployment simulations into parcel-level infrastructure projections tailored for electricity distribution planning. This approach can be extended to generate highly resolved data on EV load and flexibility potential, enabling integration into power flow analyses, hosting capacity studies, and other distribution grid assessments. Granular, parcel-level data enable NREL to model these potential localized grid impacts and explore mitigation strategies, such as managed charging. This enhancement will be used to update EVI-Pro Lite—NREL's public decision-support tool for EV planning—to better support proactive grid planning efforts.

NREL Kicks Off Locomotive Study To Enable DOE Industrial Locomotive Research

While industrial locomotives likely account for a small fraction of U.S. transportation energy demand, they can have a disproportionate impact on local air quality. Their highly localized operations are well suited to emerging electrified technologies that could simultaneously reduce harmful emissions, energy use, and operating costs. NREL has conducted initial research into industrial locomotive use in the United States, beginning to fill a critical data gap and setting the stage for detailed data collection that DOE can use to develop measurable research strategies for the sector. Assessing the benefit of new technology investments and research efforts will require accurate baseline data on the number of industrial locomotives in use by private companies and their age, fuel consumption, and emissions. NREL will first focus data collection efforts on large industrial operators and locomotive leasing companies and will include business information to enable scaling the results to represent the full population of locomotives in use. The team will further refine this initial survey and outreach with lessons learned as the project progresses. Researchers are developing methodologies to estimate the number of industrial, private locomotives, including their baseline energy and emissions, and will begin outreach and data collection efforts in Q2 FY 2025.

ENERGY EFFICIENT MOBILITY SYSTEMS (EEMS)

Computational Modeling and Simulation

Quarter One

Updates to Livewire FAQ Webpage Increases Usability and Fosters Long-Term User Following

NREL, Pacific Northwest National Laboratory, and INL revised the Livewire Data Platform FAQ page (livewire.energy.gov/faq) to highlight the value users can gain from engaging with Livewire's datasets and data

sharing capabilities. Updates included adding information to better explain how to navigate Livewire, referencing the recently added publications database, and creating a section about Livewire's metadata standards and processes. More detailed metadata supports the team's effort to standardize this information across all datasets on the platform, helping users view and compare information about datasets so they can more easily find what they need. Standardized metadata will also enable future enhanced capabilities, such as searching across the entire catalog's data fields. The Livewire team will continue to add and update information on the FAQ page to engage more users and promote Livewire's value in advancing transportation mobility research.

Commercial Vehicle Cost of Ownership Visualized Through Tool's T3COCharts Feature

Determining a commercial vehicle's total cost of ownership can be complex—and NREL's Transportation Technology Total Cost of Ownership (T3CO) tool can make it simpler. Now, a new feature called T3COCharts can help users extract the insights they need about the cost of owning and operating a commercial vehicle, along with data visualizations. T3COCharts provides users with an accessible and flexible module to plot and compare results across scenarios using the parameters of their choice. The feature's options include generating a stacked bar chart of the total cost breakdown, generating and visualizing results for thousands of scenarios from T3CO's batch mode, and further customizing the underlying plotting script to create even more individualized outputs. Looking forward, T3COCharts' visualization capability will be integrated into a web-based interface so users can easily run the model, edit their results, and visualize insights.

Battery and Other Thermal Models and Controls for EVs in FASTSim Improve Accuracy of Results

Ambient temperature and thermal management have a significant impact on range and energy consumption rate in electrified vehicles because of reduced component efficiencies and increased auxiliary loads in extreme temperatures. An NREL research team implemented thermal models and corresponding controls for all powertrain types; batteries; engines; cabins; heating, ventilating, and air-conditioning systems; and auxiliary load impacts in Version 3 of FASTSim. These semi-empirical models account for temperature-sensitive air properties and vehicle geometry and have calibratable, scalable parameters that should—pending validation on real-world data—be useful in extrapolating from a calibrated vehicle model to other vehicles of similar style (e.g., SUVs) and powertrain type (e.g., hybrid electric vehicle). Particularly hot or cold weather can reduce battery-electric vehicle range by about 50% due to decreased component efficiencies and increased auxiliary loads for thermal management systems. Accounting for these impacts in Version 3 of FASTSim improves accuracy and expands the breadth of analyses for which FASTSim is applicable. Next, the team will obtain real-world and/or dynamometer data for numerous ambient and initial temperature conditions and powertrain types to calibrate and validate the thermal model parameters and verify that this modeling approach is broadly scalable.

Automated Input Processing Enables Deployment of Online Shopping Models to Various Regions

The online shopping models embedded in NREL's Freight Integrated Simulation Model (FRISM) are essential for evaluating the impact of online shopping on urban mobility and the environment. However, variations in reporting standards and formats in regional survey data make it challenging to deploy those models across regions nationally. To remedy this, an NREL research team has developed an automated input processing module to identify, classify, and standardize variables for online shopping models. The proposed module allows users to select proper variables from a preprocessed list of candidate variables obtained from a regional household travel survey. Those variables will be used to estimate the online shopping models for a target region. National data are applied for a region without data to provide the modeling capability. This approach can drastically reduce the burden of deploying FRISM to a new region and help integrate the online shopping models into existing regional transportation models and mobility analyses. Next, researchers will develop generalized, input-oriented online shopping models and a module to automatically calibrate and validate them.

AOP CHANGES & MILESTONE STATUS

AOP CHANGES

A compilation of all Q1 FY 2025 Annual Operating Plan (AOP) changes recorded to date is provided on the next page.

MILESTONE STATUS

Fifty Q1 milestones have been completed and delivered on time, as detailed on the following pages. Select milestones have been delayed with DOE approval.

FY25 Q1 AOP Changes

Program Name	Activity Name	WBS Number	Project Title	PI Name	Type of Change
Battery Technologies	Battery R&D	1.1.3.439	Advanced Characterization to Guide and Validate the Design of Long-Life EaCAM Li-Ion Cells	Tremolet de Villers, Bertrand	Cancelled with DOE approval
		1.1.3.439	Advanced Characterization to Guide and Validate the Design of Long-Life EaCAM Li-Ion Cells	Tremolet de Villers, Bertrand	Added to AOP with DOE approval (delayed from FY24)
		1.1.3.439	Advanced Characterization to Guide and Validate the Design of Long-Life EaCAM Li-Ion Cells	Tremolet de Villers, Bertrand	Added to AOP with DOE approval (delayed from FY24)
		1.1.10.425	Li-Ion Battery Recycling R&D Center	Keyser, Matthew	Milestone delayed until 6/30/2025
		1.1.10.441	Lithium-Ion Battery Recycling Prize (Cash & Vouchers)	Lynch, Lauren	Milestone delayed until 3/31/2025
		1.1.10.442	Lithium-Ion Battery Recycling Prize Administration	Lynch, Lauren	Milestone delayed until 3/31/2025
		1.1.19.444	EVALs: Validation of Advanced Battery Supply Chains	Burrell, Anthony	Milestone delayed until 3/31/2025
EEMS	Computational Modeling and Simulation	9.1.2.403	FY19 Lab Call – Livewire Data Sharing Platform	Spath Luhring, Lauren	Milestone delayed until 3/31/2025

FY25 Q1 Milestone Status								
Program	**Activity**	**WBS Number**	**Project Title**	**Milestone**	**Milestone Type**	**Due Date**	**Lab Lead**	**Q1 Status**
Battery Technologies	Battery R&D	1.1.10.425	Li-Ion Battery Recycling R&D Center	Second-Use Study: Update 2nd-use battery repurposing cost calculator spreadsheet. Survey present 2nd-use literature, business models, best practices, and barriers. Circulate first draft of white paper to DOE management on the business and technical viability of battery 2nd use for feedback.	Quarterly Milestone Regular	12/31/2024	Keyser, Matthew	Delayed with DOE Approval
		1.1.10.441	Lithium-Ion Battery Recycling Prize (Cash & Vouchers)	Finalize Breakthrough Competition and Kick off Phase IV	Quarterly Milestone Regular	12/31/2024	Lynch, Lauren	Delayed with DOE Approval
		1.1.10.442	Lithium-Ion Battery Recycling Prize Administration	Finalize Breakthrough Competition and Kick off Phase IV	Quarterly Milestone Regular	12/31/2024	Lynch, Lauren	Delayed with DOE Approval
		1.1.14.435	VTO High-Performance Computing (HPC) Cluster	Progress Measure	Quarterly Milestone Regular	1/30/2025	Andersen, Aaron	Met On Time
		1.1.14.435	VTO High-Performance Computing (HPC) Cluster	Kestrel Buy-in procurement. Procurement of a GPU buy-in on Kestrel.	Go/No-Go	1/15/2025	Andersen, Aaron	Met On Time
		1.1.14.443	Coupled Multiscale Modeling and Diagnostics for Lithium-Sulfur Battery Design	Report conservation equations for initial continuum-scale model	Quarterly Milestone Regular	12/31/2024	Colclasure, Andrew	Met On Time
		1.1.19.444	EVALs: Validation of Advanced Battery Supply Chains	Establish and characterize baseline LFP material.	Quarterly Milestone Regular	12/31/2024	Burrell, Anthony	Delayed with DOE Approval
		1.1.2.434	Heavy-Duty Vehicle Optimized Li-Ion	Have at least 3 use profiles to present to 21st Century truck battery working group that are	Quarterly Milestone Regular	12/31/2024	Smith, Kandler	Met On Time

			Technologies (HD VOLTS)	developed based on current regulations for team, long-haul applications and aligned with FASTSim data.				
		1.1.3.439	Advanced Characterization to Guide and Validate the Design of Long-Life EaCAM Li-Ion Cells	Combining in situ ATR-FTIR with in situ Raman for detailed structural information of the transition metal redox characteristics.	Quarterly Milestone Regular	12/31/2024	Tremolet de Villers, Bertrand	Cancelled with DOE Approval
		1.1.3.439	Advanced Characterization to Guide and Validate the Design of Long-Life EaCAM Li-Ion Cells	Combining in situ ATR-FTIR with GC-MS-FID to correlate the electrochemical degradation of the electrolyte with gas evolution.	Quarterly Milestone Regular	12/31/2024	Tremolet de Villers, Bertrand	Met On Time
		1.1.3.439	Advanced Characterization to Guide and Validate the Design of Long-Life EaCAM Li-Ion Cells	Coupling in situ quantification of electrode morphological, crystallographic, and compositional evolution with cell performance.	Quarterly Milestone Regular	12/31/2024	Tremolet de Villers, Bertrand	Met On Time
		1.1.3.440	Mechanistic Studies of Cathode-Electrolyte Interface	Acquisition and characterization of epitaxial NMC 811 films	Quarterly Milestone Regular	1/15/2025	Tenent, Robert	Met On Time
		1.1.4.436	Low-Pressure All-Solid-State Cells	Report differences between Ampcera and NEI SE material based on observed dispersion of materials in the microstructure and cell performance	Quarterly Milestone Regular	12/31/2024	Burrell, Anthony	Met On Time
		1.1.8.437	Electrochemical/ Thermal-Optimized Solutions for Extreme Fast Charge	Submit journal article, based on Round 4 cell data and models, that quantifies the fast-charge benefits of laser-ablated anodes and cathodes containing carbon nanotubes. Outline a second journal article, based on Round 5 cell data and models, that document XCEL program final achievements	Quarterly Milestone Regular	12/31/2024	Keyser, Matthew	Met On Time

		1.1.9.429	Integrated Modeling and Machine Learning of Solid-Electrolyte Interface Reactions of the Si Anode	Calendar Life Update + Feature Engineering/Cell Chemistry Effects	Quarterly Milestone Regular	12/31/2024	Colclasure, Andrew	Met On Time
		1.1.9.433	NREL Silicon Consortium Project (SCP)	Have cells on Tier 3 test with multiple silicon types including SiOx and PECVD-PEO electrodes, that include different electrolytes, prelithiation protocols, that test hypotheses from the FY24 Q4 milestone. Cells will have to include prelithiated and non-prelithiated examples of each cell type.	Quarterly Milestone Regular	12/31/2024	Burrell, Anthony	Met On Time
Electrification Technologies	Electric Drive Technologies R&D	2.2.6.401	Electric Drive System Technology R&D	Summarize all the work performed under the EDT Consortium in an annual/consortium report.	Annual Milestone (Regular)	12/31/2024	Narumanchi, Sreekant	Met On Time
		2.2.7.402	NREL Next-Generation Reliable Electric Drive Systems for MD/HD Vehicles	Conduct a literature review to identify advanced packaging and thermal management concepts that can enable increased power density, lower cost, and be used for this project.	Quarterly Milestone Regular	12/31/2024	Narumanchi, Sreekant	Met On Time
	Grid & Infrastructure R&D	2.3.2.450	EVs@Scale Lab Consortium	A.1.3.13 Roll out SCM ecosystem to support field demonstration with industry partner(s)	Quarterly Milestone Regular	12/31/2024	Meintz, Andrew	Met On Time
		2.3.2.450	EVs@Scale Lab Consortium	A.1.3.14 Highlight cost trade-off benefits to support utility justification of SCM (NREL) identification of potential benefits for utility customers (Sandia), and benefits of SCM/VGI for CNOs (INL)	Quarterly Milestone Regular	12/31/2024	Meintz, Andrew	Met On Time

		2.3.2.450	EVs@Scale Lab Consortium	B.2.4.5 Complete nominal-weather profile capture for (ANL = 4 additional EVs) (NREL = 2 additional EVs)	Quarterly Milestone Regular	12/31/2024	Meintz, Andrew	Met On Time
		2.3.2.450	EVs@Scale Lab Consortium	E.2.3.3 IEEE P2030.13 demonstration of control and grid impacts analysis for first use case.	Quarterly Milestone Regular	12/31/2024	Meintz, Andrew	Met On Time
		2.3.2.450	EVs@Scale Lab Consortium	E.3.4.1 Define test requirements UL 1741SC and support an EVSE manufacturer to develop the EVSE	Quarterly Milestone Regular	12/31/2024	Meintz, Andrew	Met On Time
		2.3.2.450	EVs@Scale Lab Consortium	F.1.18 Consortium Leadership, LC planning, semiannual mtg, AMR, and Contribute to Annual Report.	Quarterly Milestone Regular	12/31/2024	Meintz, Andrew	Met On Time
		2.3.2.450	EVs@Scale Lab Consortium	B.2.5.1 Results Analysis and Annual Report	Annual Milestone (Regular)	12/31/2024	Meintz, Andrew	Met On Time
		2.3.2.450	EVs@Scale Lab Consortium	E.2.3.4 IEEE P2030.13 demonstration of control and grid impacts analysis for second use case.	Annual Milestone (Regular)	12/31/2024	Meintz, Andrew	Met On Time
		2.3.2.451	VTO Electrification Program, FY25 - EV Modeling	Grid Loads for “Overlooked” EV Segments Publish EV load datasets and data documentation (NREL technical report) online for four EV segments modeled in FY24 – transit buses, government fleets, port cargo-handling equipment, and airport ground support equipment.	Quarterly Milestone Regular	12/31/2024	Borlaug, Brennan	Met On Time
		2.3.5.423	Beyond Batteries: Behind the Meter Storage	Perform self-extinguishing time (SET), flash point, and vapor pressure testing of promising nonflammable electrolytes tested in FY24.	Quarterly Milestone Regular	12/31/2024	Burrell, Anthony	Met On Time

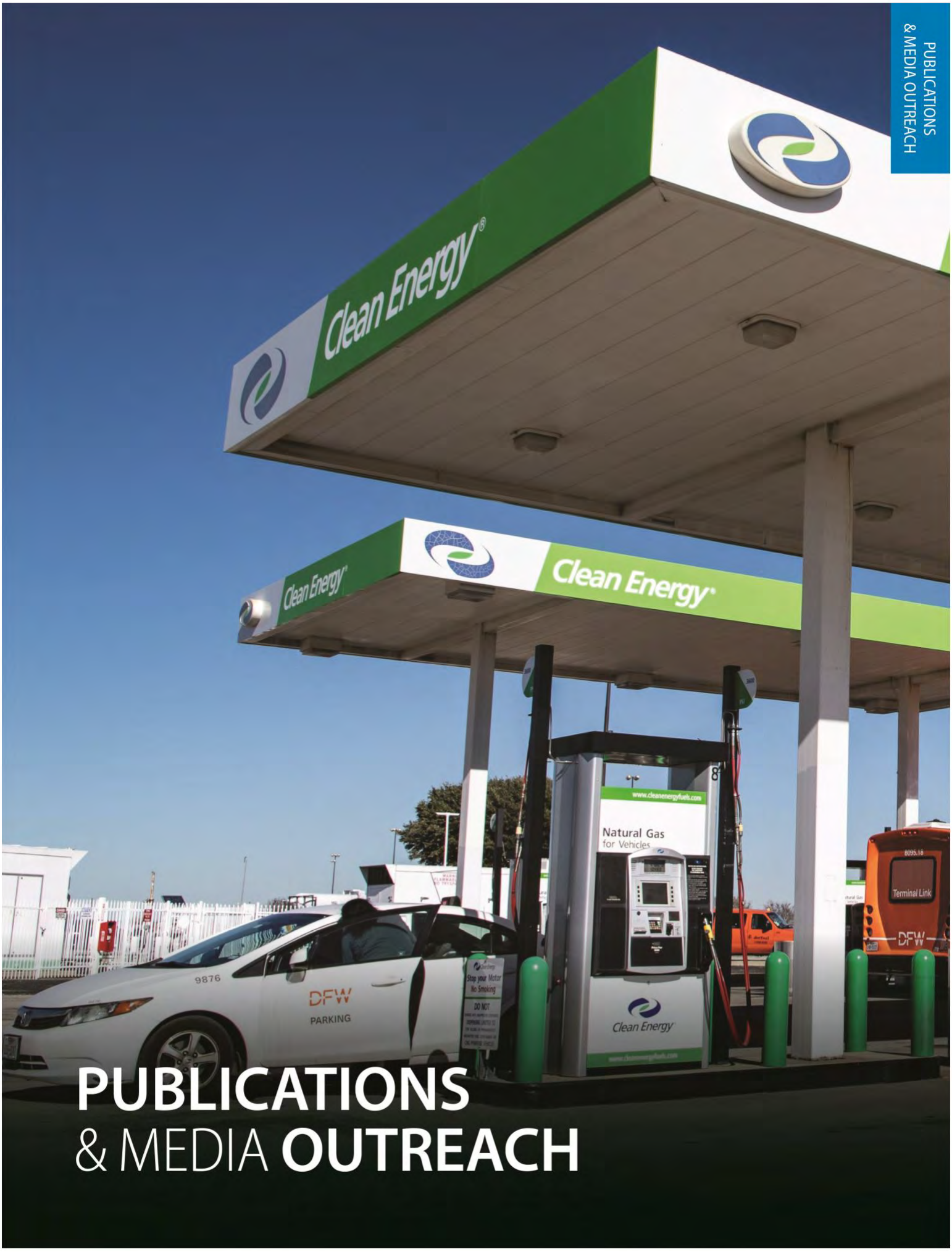
Materials Technology	Lightweight Materials	4.2.4.401	Materials and Manufacturing Innovation for Sustainable Automotive Composites - NREL	Demonstrate the cycle time of the PECAN CFRCs, both for their first life via liquid compression molding or other processes and subsequent lives via thermoforming. Understand the cycle time(s) as a function of technique, fiber reinforcement, and resin chemistry.	Quarterly Milestone Regular	12/31/2024	Rorrer, Nicholas	Met On Time
Technology Integration	Data and Systems Research	6.3.1.401	Info & Tools - Alternative Fuels Data Center	Provide a summary report of accomplishments and activities. Conduct a briefing with DOE on the websites task.	Quarterly Milestone Regular	2/1/2025	Rahill, Matt	Met On Time
		6.3.2.403	Technologist in Communities (TIC)	Summary of mobility and energy estimated potential for on-demand transit applications in communities ranging from urban to rural.	Quarterly Milestone Regular	12/31/2024	Young, Stanley	Met On Time
		6.3.2.404	NREL - Technical Assistance and EEMS Insight Sharing	Summary report of TA, TRS, Analysis and EEMS activities, trends, and key collaborations	Quarterly Milestone Regular	1/15/2025	Cardinali, Sarah	Met On Time
		6.3.2.405	DFW Electrification	Aeroportal Initial Release	Quarterly Milestone Regular	12/31/2024	Lunacek, Monte	Met On Time
		6.3.3.402	NREL - Outreach, Training, Partnerships and Coalition Support	Identify the activities that were highly successful with positive outcomes for more durable coalitions and propose a path forward for training, outreach, mentoring, P2P and coalition support projects.	Quarterly Milestone Regular	12/1/2024	Melendez, Margo	Met On Time
		6.3.3.402	NREL - Outreach, Training, Partnerships and Coalition Support	Conduct a briefing with DOE to develop priorities for FY25. Identify the benefits of key projects and priorities moving forward.	Quarterly Milestone Regular	12/1/2024	Melendez, Margo	Met On Time

		6.3.3.402	NREL - Outreach, Training, Partnerships and Coalition Support	Provide a summary of activities for each task, including barriers overcome, successes, and ongoing challenges.	Quarterly Milestone Regular	1/15/2025	Melendez, Margo	Met On Time
		6.3.4.403	Clean Cities and Communities Projects	Provide a summary of activities for each task, including barriers overcome, successes, and ongoing challenges.	Quarterly Milestone Regular	1/16/2025	Melendez, Margo	Met On Time
	Alternative Fuels Regulatory Program	6.4.0.400	Alternative Fuels Regulatory Program	Program guidance documents reviewed with recommendations complete for revisions.	Quarterly Milestone Regular	12/31/2024	Andrews-Sharer, Erin	Met On Time
Analysis	Data	7.1.0.401	Heavy Truck Data Framework Project	Market data interactive dashboard for website developed using VIUS and/or Experian registration data.	Quarterly Milestone Regular	1/31/2025	Birky, Alicia	Met On Time
	Modeling	7.2.0.402	VTO Analysis Program Modeling Activities at NREL	Annual publication of model enhancement(s) #2: Publication (draft paper) of at least one model enhancement and related results and insights for FY 2024	Quarterly Milestone Regular	12/31/2024	Jadun, Paige	Met On Time
		7.2.0.404	NREL - Electric Vehicle Load Shape ResStock - TEMPO	Q1 progress report	Quarterly Milestone Regular	12/20/2024	Yip, Arthur	Met On Time
	Applied Analysis	7.3.0.402	VTO Analysis Program Applied Analysis Activities at NREL	Travel Demand Management Draft journal paper documenting project findings submitted for peer review.	Quarterly Milestone Regular	12/31/2024	Borlaug, Brennan	Met On Time
		7.3.0.402	VTO Analysis Program Applied Analysis Activities at NREL	EVI-X Presentation describing approach for spatially disaggregating EVSE ports simulated by the EVI-X national framework to a geographic resolution that is conducive to electricity distribution planning and analysis.	Quarterly Milestone Regular	12/31/2024	Borlaug, Brennan	Met On Time

Vehicle Technologies Office Crosscutting	Lab-based Crosscutting Projects	8.3.0.402	Locomotive Fleet Survey	Initial outreach plan competed.	Quarterly Milestone Regular	12/15/2024	Birky, Alicia	Met On Time
EEMS	Computational Modeling and Simulation	9.1.2.403	FY19 Lab Call – Livewire Data Sharing Platform	(NREL/TSDC – Task 4) Produce TSDC fact sheet for data providers	Quarterly Milestone Regular	12/31/2024	Spath Luhring, Lauren	Met On Time
		9.1.2.403	FY19 Lab Call – Livewire Data Sharing Platform	(NREL – Task 5) Convene one Livewire Data Working Group meeting with goals of:- demoing new and/or little-known capabilities (e.g. uploader client) to data owners- understanding data priorities through distribution of a survey.	Quarterly Milestone Regular	12/31/2024	Spath Luhring, Lauren	Delayed with DOE Approval
		9.1.2.403	FY19 Lab Call – Livewire Data Sharing Platform	(NREL – Task 1) Review and update FAQ to increase usability and eliminate duplication	Quarterly Milestone Regular	12/31/2024	Spath Luhring, Lauren	Met On Time
		9.1.2.405	Core Modeling & Decision Support Capabilities: FASTSim, RouteE, T3CO, and OpenPATH	Implement battery thermal model and controls for HEV and BEV in FASTSim-3. This will include temperature-dependent modeling that has demonstrable effect of reducing powertrain efficiency when comparing cold or hot weather operation against operation at ~70°F (e.g., achieving energy consumption impacts >20%). Calibration/validation against available data will be accomplished by tuning thermal component parameters (e.g. thermal mass, heat transfer surface area, temperature-dependent efficiency) so as to minimize RMS error between experimental and modeled	Quarterly Milestone Regular	12/31/2024	Gonder, Jeff	Met On Time

				component temperature and energy consumption. 70% of data will be randomly selected for calibration with 30% held out for validation.				
		9.1.2.405	Core Modeling & Decision Support Capabilities: FASTSim, RouteE, T3CO, and OpenPATH	Provide T3CO results visualization template in Python.	Quarterly Milestone Regular	12/31/2024	Gonder, Jeff	Met On Time
		9.1.2.406	BEAM CORE Core Tools (NREL)	Task 4: FRISM - Initial module for automated input data processing complete, including variable identification, classification, and standardization.	Quarterly Milestone Regular	12/31/2024	Gonder, Jeff	Met On Time
		9.1.2.407	Energy Metrics in Traffic Signal Performance Measures	Progress Report: Identify case study locations.	Quarterly Milestone Regular	12/31/2024	Fish, Joseph	Met On Time
		9.1.2.409	Multi-Region Stakeholder Driven BEAM CORE Application (NREL)	Task 3 – High-level overview of demonstration plan for upstream BEAM CORE module implementation in all major CA regions	Quarterly Milestone Regular	12/31/2024	Gonder, Jeff	Met On Time
		9.1.2.410	FY24 Spring Energy I-Corps Topic 3 – NREL: RouteE-BEAT	RouteE tools will be refined to address the barriers identified by the stakeholders, including data and vehicle specifications relevant to the stakeholders for this project, e.g., GTFS data for the municipalities with transit stakeholders involved with this project. The project team to implement at least 3 key refinements to RouteE-BEAT based on transit stakeholder feedback and additional	Quarterly Milestone Regular	12/31/2024	Gonder, Jeff	Met On Time

				refinements as necessary to other RouteE tools in response to commercial fleet priorities. Project team to upload to PICS a slide deck summarizing the key refinements mapped to stakeholder input, any additional feedback received, and with whom pilots/ deployments are expected.				
		9.1.2.411	MEP Core Tools	Task 1.1: Establish an automated data ingestion pipeline for the (base) OSM network for the whole country.	Quarterly Milestone Regular	12/31/2024	Garikapati, Venu	Met On Time
	Connectivity and Automation Technologies	9.2.0.402	Improved Mobility and Energy Savings Through Optimization of CDA Application in Signal Controls for Arterial Mixed Traffic Scenarios	Full integration of two computers, with one running network mixed traffic microscopic traffic simulation in Aimsun, and the other running V2X modeling; building interfaces and communication in between the two computers to synchronize the two at each time step; resolving computation overhead issues for V2X simulation.	Quarterly Milestone Regular	12/31/2024	Wang, Qichao	Met On Time
		9.2.0.402	Improved Mobility and Energy Savings Through Optimization of CDA Application in Signal Controls for Arterial Mixed Traffic Scenarios	System integration at ACM facility: 3 CACC capable passenger cars, V2V, V2I, I2. System integration at ACM facility: 3 CACC capable passenger cars, V2V, V2I & I2V, and I2I, traffic signal control with CAV trajectory planning, real-time simulation; initial field test	Go/No-Go	10/31/2024	Wang, Qichao	Met On Time



PUBLICATIONS & MEDIA OUTREACH

FY 2025 YTD NREL VT PUBLICATIONS – Q1

VT Publication Metrics

Publication Type	Q1
Books/Chapters	0
Brochures	0
Conference Papers	7
Fact Sheets	10
Journal Articles	19
Newsletters	0
Other Marketing Materials	0
Patents	0
Posters	7
Presentations	19
Technical, Management, and Subcontractor Reports	16
Total YTD Publications	78

Note: This publications listing pertains to projects fully or partially funded by VTO.

VT Journal Article Impact Factors: Q1 FY 2025

Article	Journal	Impact Factor
Assessing Cathode-Electrolyte Interphases in Batteries	*Nature Energy*	49.7
Characterization of Pitch Carbon Coating Properties Affecting the Electrochemical Behavior of Silicon Nanoparticle Lithium-Ion Battery Anodes	*Journal of Materials Chemistry A*	10.7
Predicting U.S. Federal Fleet Electric Vehicle Charging Patterns Using Internal Combustion Engine Vehicle Fueling Transaction Statistics	*Applied Energy*	10.1
Does Electric Mobility Display Racial or Income Disparities? Quantifying Inequality in the Distribution of Electric Vehicle Adoption and Charging Infrastructure in the United States	*Applied Energy*	10.1
a priori Uncertainty Quantification of Reacting Turbulence Closure Models Using Bayesian Neural Networks	*Engineering Applications of Artificial Intelligence*	7.5
Mitigating Calendar Aging in Si-NMC Batteries with Advanced Dual-Salt Glyme Electrolytes	*Chemistry of Materials*	7.2
Porous Mesh Manifold for Enhanced Boiling Performance	*Applied Thermal Engineering*	6.1
A Comprehensive Assessment of the Marginal Abatement Costs of CO_2 of Co-Optima Multi-Mode Vehicles	*Energy & Fuels*	5.2
Chemical Kinetics Investigations of Dibutyl Ether Isomers Oxidation in a Laminar Flow Reactor	*Energy & Fuels*	5.2
Potential Adoption and Benefits of Co-Optimized Multimode Engines and Fuels for U.S. Light-Duty Vehicles	*Energy & Fuels*	5.2
Cycloalkane-Rich Sustainable Aviation Fuel Production via Hydrotreating Lignocellulosic Biomass-Derived Catalytic Fast Pyrolysis Oils	*Sustainable Energy & Fuels*	5
Evaluating the Impacts of Autonomous Electric Vehicles Adoption on Vehicle Miles Traveled and CO_2 Emissions	*Energies*	3
Operando Freezing Cryogenic Electron Microscopy of Active Battery Materials	*Microscopy and Microanalysis*	2.9
Lightweighting Cost Impacts on Market Adoption and GHG Emissions in U.S. Light-Duty Vehicle Fleet	*Environmental Research Communications*	2.5
Connected Traffic Signal Coordination Optimization Framework Through Network-Wide Adaptive Linear Quadratic Regulator-Based Control Strategy	*Journal of Transportation Engineering, Part A: Systems*	1.8
Analyzing School Bus Electrification in Richmond, Virginia	*Transportation Research Record*	1.6

In Situ Characterization of the Oxidation Behavior of Carbonate-Based Electrolytes for Lithium-Ion Batteries by Scanning Electrochemical Microscopy	*ACS Electrochemistry*	n/a
Overcoming Limitations of Higher Biomass-Based Diesel Blends	*Biodiesel Magazine*	n/a
The State of Electric Vehicle Adoption in Colorado for Multifamily Versus Single-Family Dwellings: A Methodology for Quantifying Deviation from Parity	*Findings*	n/a
Total Average Impact Factor (for journals with impact factors)		**8.36**

VT Publications – Q1 FY 2025

Conference Papers

1. Campos, Gustavo; Zhang, Mingzhi; Mann, Margaret. 2024. "Optimal Managed Fast-Charging Model for Electric Vehicle Fleets with High Utilization and Multiple Charge-Acceptance Curves." Presented at the 2024 IEEE Power & Energy Society General Meeting, 21–25 July 2024, Seattle, WA. doi.org/10.1109/PESGM51994.2024.10688826.
2. Islam, Sarwar; Khan, Faisal. 2024. "Wireless Pulse-Width Modulation Control of Power Converters Using Ultra-Wideband Technology for Distributed High-Voltage Systems: Preprint." Presented at ECCE 2024, 20–24 Oct. 2024, Phoenix, AZ. www.nrel.gov/docs/fy25osti/90684.pdf.
3. Jiang, Kaiying; Kong, Daeyoung; Kim, Kiwan; Sreekant, Narumanchi; Palko, James; Dede, Ercan M.; Ahn, Chulmin; Lee, Hyoungsoon; Asheghi, Mehdi; Goodson, Kenneth. 2024. "Pool Boiling Reliability Tests and Degradation Mechanisms of Microporous Copper Inverse Opal (CuIOs) Structures." Presented at the IEEE Intersociety Conference on Thermal and Thermomechanical Phenomena in Electronic Systems (ITherm), 28–31 May 2024, Aurora, CO. doi.org/10.1109/ITherm55375.2024.10709500.
4. Laarabi, Haitam; Xu, Xianodan; Poliziani, Cristian; Jeong, Kyungsoo; Birky, Alicia; Needell, Zachary; Spurlock, C. Anna. 2024. "Understanding Regional Freight-Related Air Pollution Using Agent-Based Models: A Case Study Across Nine Counties of the San Francisco Bay Area (Citation Only)." Presented at the Transportation Research Board Annual Meeting 2025, 5–9 Jan. 2025, Washington D.C.
5. Mir, Faizan; Young, Stanley; Sandhu, Rimple; Wang, Qichao; Tripp, Charles; Osborn, Todd. 2024. "Infrastructure-Based Cooperative Perception at a Traffic Intersection: Overview and Challenges: Preprint." Presented at the Transportation Research Board Annual Meeting 2025, 5–9 Jan. 2025, Washington D.C. www.nrel.gov/docs/fy25osti/92133.pdf.
6. Steuteville, Robin; Baker, Chad. 2024. "Implementing Ordinary Differential Equation Solvers in Rust Programming Language for Modeling Vehicle Powertrain Systems: Preprint." Presented at the Society of Automotive Engineers (SAE) 2024 WCX World Congress Experience, 16–18 April 2024, Detroit, MI. www.nrel.gov/docs/fy25osti/91707.pdf.
7. Wang, Yuetong; Jeong, Kyungsoo; Garikapati, Venu. 2024. "Quantifying E-Commerce Efficiency: A Consumer-Centric Analysis of Online Shopping (Citation Only)." Presented at the Transportation Research Board Annual Meeting 2025, 5–9 Jan. 2025, Washington D.C.

Fact Sheets

8. 2024. "Advancing Affordable, Efficient, and Clean Transportation." www.nrel.gov/docs/fy25osti/92214.pdf.
9. 2024. "Lessons Learned from the Clean Energy to Communities (C2C) Peer-Learning Cohort Enhancing Resilience at Critical Facilities through Solar, Storage, and Microgrids." www.nrel.gov/docs/fy25osti/91764.pdf.
10. 2024. "Lessons Learned from the Clean Energy to Communities (C2C) Peer-Learning Cohort Evaluating and Prioritizing Municipal Buildings for Energy Efficiency and Decarbonization Investment." www.nrel.gov/docs/fy25osti/91766.pdf.
11. 2024. "Lessons Learned from the Clean Energy to Communities (C2C) Peer-Learning Cohort Incorporating Community Priorities into Electric Vehicle Plans and Projects." www.nrel.gov/docs/fy25osti/91765.pdf.
12. 2024. "Sustainable Port Operations: Powered by NREL." www.nrel.gov/docs/fy25osti/89892.pdf.
13. 2024. "Transportation Secure Data Center: Frequently Asked Questions for Data Owners/Contributors." www.nrel.gov/docs/fy25osti/92143.pdf.
14. Anderson, Shannon; Blanco, Lis; Reichelt, Lauren. 2024. "Clean Energy to Communities: Gap Region Outreach Project." www.nrel.gov/docs/fy25osti/90968.pdf.
15. Kotz, Andrew; Fakhimi, Setayesh; Ledna, Catherine; Lustbader, Jason. 2024. "Estimating Electrification Potential for Class 8 Regional-Haul Trucks." www.nrel.gov/docs/fy25osti/91369.pdf.
16. Rosner, Nicole. 2024. "Guidance for Ethical Engagement in and with Communities." www.nrel.gov/docs/gen/fy25/91011.pdf.

17. Sigler, Cory; Alexeenko, Polina; Birky, Alicia; Kotz, Andrew; Lustbader, Jason; Jeffers, Matt; Lammert, Mike. 2024. “Electrification Analysis: All Aboard America!” www.nrel.gov/docs/fy25osti/91370.pdf.

Journal Articles

18. Carlson, Nicholas A.; Talmadge, Michael S.; Zaimes, George G.; Hawkins, Troy R.; Jiang, Yuan. 2024. “A Comprehensive Assessment of the Marginal Abatement Costs of CO_2 of Co-Optima Multi-Mode Vehicles.” *Energy & Fuels* 39 (1): 444–453. dx.doi.org/10.1021/acs.energyfuels.4c03451.
19. Chen, Xiaolin; Orton, Kellene A.; Mukarakate, Calvin; Gaston, Katherine; Fioroni, Gina M.; McCormick, Robert L.; Griffin, Michael B.; Iisa, Kristiina. 2024. “Cycloalkane-Rich Sustainable Aviation Fuel Production via Hydrotreating Lignocellulosic Biomass-Derived Catalytic Fast Pyrolysis Oils.” *Sustainable Energy & Fuels* 8: 5504. www.nrel.gov/docs/fy25osti/91024.pdf.
20. Dutta, Nikita S.; Carroll, Gerard Michael; Neale, Nathan R.; Han, Sang-Don; Al-Jassim, Mowafak; Jungjohann, Katherine. 2024. “*Operando* Freezing Cryogenic Electron Microscopy of Active Battery Materials.” *Microscopy and Microanalysis* 30 (5): 844–852. dx.doi.org/10.1093/mam/ozae097.
21. Ficenec, Karen; Singer, Mark; Hodge, Cabell. 2024. “Predicting U.S. Federal Fleet Electric Vehicle Charging Patterns Using Internal Combustion Engine Vehicle Fueling Transaction Statistics.” *Applied Energy* 378 (A): 124778. dx.doi.org/10.1016/j.apenergy.2024.124778.
22. Giglio, Roman; Shattique, Muhammad R.; Dede, Ercan M.; Narumanchi, Sreekant; Asheghi, Mehdi; Goodson, Kenneth E.; Palko, James W. 2024. “Porous Mesh Manifold for Enhanced Boiling Performance.” *Applied Thermal Engineering* 260: 124918. www.nrel.gov/docs/fy25osti/90309.pdf.
23. He, Rong; McDonough, Liam; Seitz, Liam; Ou, Wenhan; Marks, Samuel D.; Ferreira de Menezes, Rafael; Allan-Cole, Elizabeth; Luo, Hongmei; Toney, Michael F.; Sprenger, Kayla G.; Zhou, Meng; Tenent, Robert C. 2024. “In Situ Characterization of the Oxidation Behavior of Carbonate-Based Electrolytes for Lithium-Ion Batteries by Scanning Electrochemical Microscopy.” *ACS Electrochemistry*. dx.doi.org/10.1021/acselectrochem.4c00106.
24. He, Yi; Bruchon, Matthew; Liu, Zhaocai; Bennett, Jesse. 2024. “Analyzing School Bus Electrification in Richmond, Virginia.” *Transportation Research Record*. dx.doi.org/10.1177/03611981241284620.
25. Hoopes, Luna; Wilson, Alana. 2024. “The State of Electric Vehicle Adoption in Colorado for Multifamily Versus Single-Family Dwellings: A Methodology for Quantifying Deviation from Parity.” *Findings*. www.nrel.gov/docs/fy25osti/91452.pdf.
26. Huey, Zoey; Schulze, Maxwell C.; Carroll, G. Michael; Engtrakul, Chaiwat; Jiang, Chun-Sheng; DeCaluwe, Steven C.; Tremolet de Villers, Bertrand J.; Han, Sang-Don. 2024. “Characterization of Pitch Carbon Coating Properties Affecting the Electrochemical Behavior of Silicon Nanoparticle Lithium-Ion Battery Anodes.” *Journal of Materials Chemistry A* 12: 30465–30475. dx.doi.org/10.1039/D4TA04478A.
27. Lee, Dong-Yeon; Wilson, Alana; McDermott, Melanie H.; Sovacool, Benjamin K.; Kaufmann, Robert; Isaac, Raphael; Cleveland, Cutler; Smith, Margaret; Brown, Marilyn; Ward, Jacob. 2024. “Does Electric Mobility Display Racial or Income Disparities? Quantifying Inequality in the Distribution of Electric Vehicle Adoption and Charging Infrastructure in the United States.” *Applied Energy* 378 (A): 124795. www.nrel.gov/docs/fy25osti/90960.pdf.
28. McCormick, Robert. 2024. “Overcoming Limitations of Higher Biomass-Based Diesel Blends.” *Biodiesel Magazine*. biodieselmagazine.com/articles/overcoming-limitations-of-higher-biomass-based-diesel-blends.
29. Naser, Nimal; Mohamed, Samah Y.; Fioroni, Gina M.; Kim, Seonah; McCormick, Robert L. 2024. “Chemical Kinetics Investigations of Dibutyl Ether Isomers Oxidation in a Laminar Flow Reactor.” *Energy & Fuels* 38 (22): 22501–22515. www.nrel.gov/docs/fy25osti/92649.pdf.
30. Oke, Doris; Sittler, Lauren; Hawkins, Troy R.; Zaimes, George G.; Cai, Hao; Brooker, Aaron; Longman, Douglas; Vijayagopal, Ram; Gohlke, David; Newes, Emily; Singh, Avantika; Dunn, Jennifer; Gaspar, Daniel J. 2024. “Potential Adoption and Benefits of Co-Optimized Multimode Engines and Fuels for U.S. Light-Duty Vehicles.” *Energy Fuels* 38 (22): 22230–22244. dx.doi.org/10.1021/acs.energyfuels.4c02837.
31. Park, Jiho; Liu, Tong; Wang, Chieh 'Ross'; Berres, Andy; Severino, Joseph; Ugirumurera, Juliette; Kohls, Airton G.; Wang, Hong; Sanyal, Jibonananda; Jiang, Zhong-Ping. 2024. “Connected Traffic Signal Coordination Optimization Framework Through Network-Wide Adaptive Linear Quadratic

Regulator-Based Control Strategy." *Journal of Transportation Engineering, Part A: Systems* 151 (2). dx.doi.org/10.1061/JTEPBS.TEENG-8376.
32. Pash, Graham; Hassanaly, Malik; Yellapantula, Shashank. 2024. "*a priori* Uncertainty Quantification of Reacting Turbulence Closure Models Using Bayesian Neural Networks." *Engineering Applications of Artificial Intelligence* 141: 109821. doi.org/10.1016/j.engappai.2024.109821.
33. Xiao, Jie; Adelstein, Nicole; Bi, Yujing; Bian, Wenjuan; Cabana, Jordi; Cobb, Corie L.; Cui, Yi; Dillon, Shen J.; Doeff, Marca M.; Islam, Saiful M.; Leung, Kevin; Li, Mengya; Lin, Feng; Liu, Jun; Luo, Hongmei; Marschilok, Amy C.; Meng, Ying Shirley; Qi, Yue; Sahore, Ritu; Sprenger, Kayla G.; Tenent, Robert C.; Toney, Michael F.; Tong, Wei; Wan, Liwen F.; Wang, Chongmin; Weitzner, Stephen E.; Wu, Bingbin; Xu, Yaobin. 2024. "Assessing Cathode-Electrolyte Interphases in Batteries." *Nature Energy* 9: 1463–1473. dx.doi.org/10.1038/s41560-024-01639-y.
34. Xiao, Jingyi; Goulias, Konstadinos G.; Ravulaparthy, Srinath; Sharda, Shivam; Jin, Ling; Spurlock, C. Anna. 2024. "Evaluating the Impacts of Autonomous Electric Vehicles Adoption on Vehicle Miles Traveled and CO_2 Emissions." *Energies* 17: 6127. www.nrel.gov/docs/fy25osti/92605.pdf.
35. Yang, Fan; Brooker, Aaron; Kleinbaum, Sarah; Gotthold, David. 2024. "Lightweighting Cost Impacts on Market Adoption and GHG Emissions in U.S. Light-Duty Vehicle Fleet." *Environmental Research Communications* 6: 101017. www.nrel.gov/docs/fy25osti/82994.pdf.
36. Yang, Guang; Browning, Katie; Meyer III, Harry M.; Li, Yuanshun; Neale, Nathan R.; Veith, Gabriel M.; Nanda, Jagjit. 2024. "Mitigating Calendar Aging in Si-NMC Batteries with Advanced Dual-Salt Glyme Electrolytes." *Chemistry of Materials* 36 (21): 10902–10911. dx.doi.org/10.1021/acs.chemmater.4c00971.

Posters

37. Dufek, Eric; Stetson, Caleb; Tanim, Tanvir; Burrell, Anthony; Harrison, Katharine; Brow, Ryan; Martin, Trevor; Pereira, Drew; Weddle, Peter; Vaughey, Jack; Jansen, Andrew. 2024. "EVALS: Enhanced VALidation of Advanced Battery Supply Chains." Presented at the Inaugural Battery Materials and Mines Summit, 10–12 Dec. 2024, Las Vegas, NV. www.nrel.gov/docs/fy25osti/91886.pdf.
38. Jeong, Kyungsoo; Harris, Tom; Morris, James; Wang, Qichao; Ugirumurera, Juliette; Birky, Alicia; Lustbader, Jason; Dick, Tyler; Kontou, Eleftheria; Berndt, Mark; Xie, Weiwen; Zhang, Xi-Ying; Mesineni, Shilpa; Omrani, Ala Eddine; Anderson, Garrett; Schlenker, Marty. 2024. "INFORMES Intermodal Freight Optimization for a Resilient Mobility Energy System (NREL Internal Use Only)." Presented at the 2024 ARPA-E Energy Innovation Summit, 22–24 May 2024, Dallas, TX. www.nrel.gov/docx/gen/fy25/89949.pdf.
39. Lee, Dong-Yeon; Sun, Bingrong; Wilson, Alana; Sarvas, Gregory. 2024. "Increasing Electric Vehicle Adoption Among Disadvantaged Populations: A Case Study in Los Angeles." Presented at the 37th International Electric Vehicle Symposium & Exhibition (EVS37), 23–26 April 2024, Seoul, Korea. www.nrel.gov/docs/fy25osti/89396.pdf.
40. Major, Joshua; Calder, Julian; Khan, Faisal. 2024. "An Organic, Direct Bonded Copper, Multi-Layered, Ultra-Low Inductance Package for High-Power UWBG MOSFETs." Presented at the 6th U.S. Workshop on Gallium Oxide (GOX 2023), 13–16 Aug. 2023, Buffalo, NY. www.nrel.gov/docs/fy25osti/87152.pdf.
41. Wilson, Alana; Young, Stanley; Freeman, Luisa; Duvall, Andy; Sperling, Joshua. 2024. "Use of the Mobility Energy Productivity (MEP) Metric to Understand Time, Cost, and Energy Implications of the Environmental Justice-Focused NYSERDA Clean Transportation Prize Program (Citation Only)." Presented at the Transportation Research Board (TRB) 2nd Conference on Advancing Transportation Equity (CATE), 15–18 July 2024, Baltimore, MD.
42. Xu, Xiaodan; Yang, Hung-Chia; Jeong, Kyungsoo; Bui, William; Ravulaparthy, Srinath; Laarabi, Haitam; Needell, Zachary; Spurlock, C. Anna. 2024. "Teaching Freight Mode Choice Models New Tricks Using Interpretable Machine Learning Methods." Presented at the Transportation Research Board (TRB) 103rd Annual Meeting, 7–11 Jan. 2024, Washington, D.C. www.nrel.gov/docs/fy25osti/88324.pdf.
43. Xu, Xiaodan; Yang, Hung-Chia; Laarabi, Haitam; Poliziani, Cristian; Birky, Alicia; Jeong, Kyungsoo; Lu, Hongyu; Guensler, Randall; Spurlock, C. Anna. 2024. "Improving Commercial Truck Fleet Composition in Emission Modeling Using 2021 US VIUS Data (Citation Only)." Presented at the Transportation Symposium on Environment, Energy, and Livable Economies, 25–28 Aug. 2024, Denver, CO.

Presentations

44. Bennett, Jesse. 2024. “Flexible Charging to Unify the Grid and Transportation Sectors for EVs at Scale (FUSE).” Presented at the 5th EVs@Scale Semiannual Stakeholder Meeting, 25–26 Sept. 2024, Idaho Falls, ID. www.nrel.gov/docs/fy25osti/91419.pdf.
45. Borlaug, Brennan. 2024. “Commercial EV Charging Infrastructure: Modeling Concepts & Techniques.” Presented at the CEM EVI Workshop, EV Charging Infrastructure: Global Modeling Approaches, 22–24 Oct. 2024, Madrid, Spain. www.nrel.gov/docs/fy25osti/91824.pdf.
46. Borlaug, Brennan. 2024. “Integrating Electric Vehicles into the Grid.” Presented at the U.S. Department of Transportation Workshop: State EV Infrastructure Planning, 3 Dec. 2024, Tijuana, Mexico. www.nrel.gov/docs/fy25osti/92396.pdf.
47. Crisostomo, Noel; Borlaug, Brennan; Moran, Chuck. 2024. “Transportation Electrification Impact Study (TEIS) (NREL Internal Use Only).” www.nrel.gov/docx/gen/fy25/89845.pdf.
48. Cryar, Ryan. 2024. “Electric Vehicle Supply Equipment Cybersecurity Through Emulation.” Presented at the 2024 IEEE Power & Energy Society General Meeting, 21–25 July 2024, Seattle, WA. www.nrel.gov/docs/fy25osti/90408.pdf.
49. Cryar, Ryan; Sanghvi, Anuj; Hatic, Dana; Jun, Myungsoo. 2024. “Electric Vehicle Supply Equipment Security Solutions.” Presented at EVs@Scale Cybersecurity Pillar Deep Dive, 6 Nov. 2024. www.nrel.gov/docs/fy25osti/91776.pdf.
50. Desai, Ranjit; Gerdes, Mindy L.; Peng, Peng; Andrews-Sharer, Erin; Niaz, Haider; Peddireddy, Shashi; Sekar, Ashok; Coburn, Timothy C.; Schey, Stephen; Benoliel, Peter; Taylor, Margaret. 2024. “EVSE Soft Costs.” Presented at the DOE Vehicle Technologies Office 2024 Annual Merit Review, 3–6 June 2024, Arlington, VA. www.nrel.gov/docs/fy25osti/89856.pdf.
51. Dutta, Nikita; King, Madison; Weddle, Peter; Wang, Bingning; Hathaway, Oscar; Liao, Chen; Jungjohann, Katherine. 2024. “Revealing Local Environments at Electrochemical Interfaces with Ex-Situ & Operando Freezing Cryo-EM (Citation Only).” Presented at the 2024, Materials Research Society (MRS) Fall Meeting and Exhibit, 1–6 Dec. 2024, Boston, MA.
52. Duvall, Andrew; Wheelis, Abigail. 2024. “Electric Vehicle Supply Equipment (EVSE) Study for Vernon County, Wisconsin.” www.nrel.gov/docs/fy25osti/92422.pdf.
53. Jeong, Kyungsoo. 2024. “Assessing the Quality of Online Shopping Influenced by Emerging Mobility Solutions from a Consumer's Perspective (Citation Only).” Presented at the Transportation Symposium on Environment, Energy, and Livable Economies, 25–28 Aug. 2024, Denver, CO.
54. Jeong, Kyungsoo. 2024. “Modeling Framework for a Sustainable and Resilient Intermodal Freight System (Citation Only).” Presented at the Transportation Symposium on Environment, Energy, and Livable Economies, 25–28 Aug. 2024, Denver, CO.
55. King, Madison; Dutta, Nikita; Mangum, John; Walker, Patrick; Wang, Bingning; Gannon, Renae; Liao, Chen; Jungjohann, Katherine. 2024. “Understanding Degradation in Earth-Abundant Cathode Particles through Cryo-STEM Electron Energy Loss Spectroscopy (EELS) (Citation Only).” Presented at the Four Corners Section (4CS) 2024 Annual Meeting, 11–12 Oct. 2024, Flagstaff, AZ.
56. Lavin, Luke; Hale, Elaine; Yip, Arthur; Cowiestoll, Brady; Zhang, Jiazi; Jadun, Paige; Muratori, Matteo. 2024. “Valuing EV Managed Charging for Bulk Power Systems.” Presented at Energy Systems Integration Group (ESIG) 2023 Spring Technical Workshop, 27–30 March 2023, Tucson, AZ. www.nrel.gov/docs/fy25osti/85618.pdf.
57. Meintz, Andrew; Kisacikoglu, John; Kogalur, Namrata; Carlson, Barney; Ucer, Emin; Thurlbeck, Alastair. 2024. “Nov. 2024 EVs@Scale High-Power Charging Deep Dive Technical Meeting.” Presented at the EVs@Scale Lab Consortium High-Power Charging Pillar Deep-Dive Technical Meeting, 31 Oct.–19 Nov. 2024. www.nrel.gov/docs/fy25osti/92274.pdf.
58. Nobler, Erin; Kotz, Emily; Bentley, Julian; McLaren, Joyce. 2024. “EV Champion Training Webinar 1: ZEV and EV Charging Fundamentals.” www.nrel.gov/docs/fy25osti/90973.pdf.
59. Pereira, Drew J.; Zhang, Yicheng; Ha, Yeyoung; Schulze, Maxwell; Gim, Jihyeon; Trask, Stephen; Burrell, Anthony; Harrison, Katharine L. 2024. “Electrolyte and Cutoff Potential Effects on Cycle Life of $Li_4Ti_5O_{12}$/$LiNi_{0.9}Mn_{0.1}O_2$ Batteries for Behind-the-Meter Storage Applications.” Presented at the 245th Electrochemical Society (ECS) Meeting, 26–30 May 2024, San Francisco, CA. www.nrel.gov/docs/fy25osti/89959.pdf.
60. Siddiq, Fariba. 2024. “Do Flexible Work Arrangements Reduce Travel? (Citation Only).” Presented at the ACSP2024 Annual Conference, 7–9 Nov. 2024, Seattle, WA.

61. Young, Stanley; Duvall, Andrew; Lott, Sam; Carnes, Peter; Smolinski, Sharon. 2024. “Clean Energy to Communities Expert Match: North Central Texas Council of Governments (Citation Only).”
62. Zhang, Mingzhi; Sundarrajan, Manoj; Schmidt, Steven; Chu, Jean; Pennington, Timothy; Panossian, Nadia; Paudyal, Priti; Wang, Wenbo; Manne, Nithin; Choi, Jeewon; Haines, Thad; Mammoli, Andrea; Moog, Emily; Vining, Will; Hashmi, Abdullah; Ucer, Emin; Hatagishi, Yukihiro; Bennett, Jesse. 2024. “EVs@Scale FUSE Fall '24 Deep Dive.” Presented at the EVs@Scale Deep Dive Technical Meetings, 31 Oct.–19 Nov. 2024. www.nrel.gov/docs/fy25osti/91860.pdf.

Technical and Management Reports

63. Brown, Abby; Cappellucci, Jeff; Gaus, Madeline; Buleje, Heather. 2024. *Electric Vehicle Charging Infrastructure Trends from the Alternative Fueling Station Locator: Second Quarter 2024*. www.nrel.gov/docs/fy25osti/91053.pdf.
64. Gasper, Paul. 2024. *Battery State of Health Estimator: Cooperative Research and Development Final Report, CRADA Number CRD-23-24455*. www.nrel.gov/docs/fy25osti/91880.pdf
65. Hodge, Cabell; Rathod, Bhavesh; Shmigelsky, Matt; Singer, Mark; Esparza, Eliseo; Myers, Tom; Sanghvi, Anuj; Desai, Ranjit R.; Becker, Bill; Niaz, Haider; Markel, Tony; Bougard, Joseph. 2024. *Electric Vehicles as Mobile Power*. www.nrel.gov/docs/fy25osti/91358.pdf.
66. Jun, Myungsoo; Cryar, Ryan; Markel, Anthony. 2024. *Investigate the Security of Electric Vehicle (EV) Ecosystem Applications*. www.nrel.gov/docs/fy25osti/90388.pdf.
67. Kraft, Kelcie; Harris, Sydney; Moriarty, Kristi; Newes, Emily; Roberts, Billy. 2024. *Potential Availability of Alternative Fuel to Supply Maritime Activities in Pacific Northwest Ports*. www.nrel.gov/docs/fy25osti/90072.pdf.
68. Lee, Dong-Yeon; Winofa, Nevi Cahya; Pattany, Jasmine; Brooker, Aaron; Ghosh, Tapajyoti; Gonder, Jeffrey. 2024. *Analyzing Potential Greenhouse Gas Emissions Reductions from Plug-In Electric Vehicles: Report for CRC Project, 'Carbon Return on Investment for Electrified Vehicles.'* www.nrel.gov/docs/fy25osti/89174.pdf.
69. NREL. 2024. *Example Alternative Compliance Annual Report: EPAct State and Alternative Fuel Provider Fleet Program User Guide*. www.nrel.gov/docs/fy25osti/90630.pdf.
70. NREL. 2024. *Example Alternative Compliance Waiver Application: EPAct State and Alternative Provider Fleet Program Guidance Document.* www.nrel.gov/docs/fy25osti/90614.pdf.
71. NREL. 2024. *Guidance on EPAct section 707 Emergency Repair and Restoration Vehicle Exclusions: EPAct State and Alternative Fuel Provider Fleet Program Guidance Document.* www.nrel.gov/docs/fy25osti/90628.pdf.
72. NREL. 2024. *Navigating the Compliance Reporting Tool: EPAct State and Alternative Provider Fleet Program User Guide.* www.nrel.gov/docs/fy25osti/90632.pdf.
73. NREL. 2024. *Requesting an Exemption from Standard Compliance: EPAct State and Alternative Fuel Provider Fleet Program Guidance Document.* www.nrel.gov/docs/fy25osti/90626.pdf.
74. NREL. 2024. *Submitting a Standard Compliance Annual Report: EPAct State and Alternative Fuel Provider Fleet Program User Guide.* www.nrel.gov/docs/fy25osti/90606.pdf.
75. NREL. 2024. *Vehicle and Mobility Technologies 2024 Annual Impact Report.* www.nrel.gov/docs/fy25osti/91530.pdf.
76. Powell, Bonnie; Johnson, Caley; Yip, Arthur; Snelling, Amy. 2024. *Electric Medium- and Heavy-Duty Vehicle Charging Infrastructure Attributes and Development*. www.nrel.gov/docs/fy25osti/91571.pdf.
77. Sharda, Shivam; Garikapati, Venu; LaClair, Tim; Viz, Nicole; Stenger, Katelyn; Sun, Bingrong; Ruth, Mark. 2024. *From Silos to Synergy: Identifying a Roadmap for Cross-Sector Research to Accelerate the Clean Energy Transition*. www.nrel.gov/docs/fy25osti/91793.pdf.
78. Watt, Ed; Savargaonkar, Mayuresh; Gadamsetty, Pranav. 2024. *Recommended Practice: Seamless Retry for Electric Vehicle Charging*. www.nrel.gov/docs/fy25osti/91461.pdf.

MEDIA OUTREACH

Quarter One

1. Transportation Research Board To Recognize NREL Mobility Researchers at Annual Meeting (Dec. 31, 2024). www.nrel.gov/news/program/2024/transportation-research-board-to-recognize-nrel-mobility-researchers-at-annual-meeting.html
2. Two NREL Researchers Selected as Fellows of the American Society of Mechanical Engineers (Dec. 30, 2024). www.nrel.gov/news/program/2024/two-nrel-researchers-selected-as-fellows-of-the-american-society-of-mechanical-engineers.html
3. NREL's International Work Bridges Innovation and Development—With Benefits at Home and Abroad (Dec. 20, 2024). www.nrel.gov/news/program/2024/nrels-international-work-bridges-innovation-and-development-with-benefits-at-home-and-abroad.html
4. NREL Collaboration Could Realize Significant Energy Savings for Farm Tractors (Dec. 19, 2024). www.nrel.gov/news/program/2024/nrel-collaboration-could-realize-significant-energy-savings-for-farm-tractors.html
5. NREL Cultivates a Fresh Crop of Rural Transportation Options (Dec. 5, 2024). www.nrel.gov/news/features/2024/nrel-cultivates-a-fresh-crop-of-rural-transportation-options.html
6. 2024 Transportation Annual Technology Baseline Update Now Available (Nov. 12, 2024). www.nrel.gov/news/program/2024/2024-transportation-annual-technology-baseline-update-now-available.html
7. Interactive Playbook Helps Communities Boost Electric Vehicle Charging (Nov. 11, 2024). www.nrel.gov/news/program/2024/interactive-playbook-helps-communities-boost-electric-vehicle-charging.html
8. NREL's Commercial Electric Vehicle Cost-of-Ownership Tool Is Best in Class—And Free (Oct. 29, 2024). www.nrel.gov/news/program/2024/nrels-commercial-electric-vehicle-cost-of-ownership-tool-is-best-in-class-and-free.html
9. Biofuels and Batteries Gain From the System Dynamics Behind the Research (Oct. 10, 2024). www.nrel.gov/news/features/2024/biofuels-and-batteries-gain-from-system-dynamics-behind-research.html

NREL'S **VTO TEAM**

Technical Team and Facility Leaders

Advanced Biofuels and Combustion ..... **Robert McCormick**
Commercial Vehice Technologies ..... **Andrew Kotz**
Data Sciences ..... **Monte Lunacek**
Electric Vehicle Grid Integration ..... **John Kisacikoglu**
Energy Storage – Systems Data Science and Modeling ..... **Kandler Smith**
Energy Storage – Advanced Cathode Material Development ..... **Rob Tenent**
Energy Storage – Materials Development and Modeling ..... **Andrew Colclasure**
Legislative/Regulatory Support ..... **Erin Andrews-Sharer**
Lightweight and Recyclable Composite Materials ..... **Nicholas Rorrer**
Mobility Systems ..... **Andrew Duvall**
Power Electronics & Electric Machines ..... **Doug DeVoto and Gilbert Moreno**
Technology Integration/ Data & Tools ..... **Emmy Feldman**
Technology Integration/Technical Assistance ..... **Abby Brown**
Vehicle Modeling and Analysis ..... **Brennan Borlaug**

Directorate, Program & Center Leadership

Adam Bratis
Associate Lab Director, BioEconomy and Sustainable Transportation

John Farrell
Laboratory Program Manager, Vehicle Technologies Office

Chris Gearhart
Director, Integrated Mobility Sciences

Ray Grout
Director, Computational Science

Jao Van de Lagemaat
Director, Chemistry & Nanoscience

Tony Burrell
Chief Technologist, Energy Storage

Ken Kelly
Chief Engineer for Commercial Vehicle Electrification

Faisal Khan
Principal Researcher, Power Electronics

Andrew Meintz
Chief Engineer for EV Charging and Grid Integration

Ahmad Pesaran
Chief Energy Storage Engineer

Sarah Cardinali
Group Manager, Transportation Technical Assistance

Mark Chung
Group Manager, Mobility Infrastructure and Impacts Analysis

Marc Day
Group Manager, High-Performance Algorithms & Complex Fluids

Gina Fioroni
Group Manager, Fuels & Combustion Science

Venu Garikapati
Group Manager (Acting), Behavior & Advanced Mobility

Jeff Gonder
Group Manager, Transportation Energy Transition Analysis

Cabell Hodge
Group Manager, Analysis of Vehicles and Infrastructure Deployment

Wesley Jones
Group Manager, Complex Systems Simulation and Optimization

Matt Keyser
Group Manager, Electrochemical Energy Storage

Jason Lustbader
Group Manager, Commercial Vehicle Technologies

Margo Melendez
Chief Transportation Technology Deployment & Integration Engineer

Juliane Mueller
Group Manager, AI, Learning, and Intelligent Systems

Sreekant Narumanchi
Group Manager, Advanced Power Electronics & Electric Machines

Nate Neale
Group Manager, Interfacial Materials Chemistry

Kristi Potter
Group Manager, Data, Analysis & Visualization

Jibo Sanyal
Group Manager, Hybrid Energy Systems

Lauren Spath Luhring
Group Manager, Transportation Applications & Data Analysis

Alex Schroeder
Group Manager, Electric Vehicle Charging

Liz Weber
Group Manager, Sociotechnical Transportation Engagement Projects

Stan Young
Advanced Mobility Technical Lead

Affiliated Lab-Wide Leadership

Jaquelin Cochran
Associate Lab Director (Acting) Strategic Energy Analysis and Decision Sciences

John Farrell
Associate Lab Director (Acting), Mechanical & Thermal Engineering Sciences

Juan Torres
Associate Lab Director Energy Security, Resilience, and Integration

Bill Tumas
Associate Lab Director Materials, Chemical & Computational Sciences