

Partnerships Impact Report: Fiscal Year 2023



Director's Note

Since the late 2000s, NREL has generated partnership projects across the world with industry, government, research organizations, and nonprofits. In Fiscal Year 2023 alone, the lab had 1,105 active partnership agreements that helped ensure we're making the greatest impact possible. At NREL, we define impact in a few ways. We have an impact when partnership work builds a capability at NREL or applies a capability that a partner cannot find elsewhere. Collaborating on projects that further a partner's role in the energy transition or make a major technological contribution with lab-developed intellectual property also makes an impact. At the end of the day, we are making an impact when we leverage the U.S. Department of Energy's investment in the lab to accelerate the transition to clean energy and support the U.S. Office of Energy Efficiency and Renewable Energy's ambitious goals.

Partnerships are one of the most important ways NREL works toward combatting climate change, impacting industry and the economy, and supporting national security and energy resilience. NREL is the leading national laboratory in market-facing activities and recognizes that when we partner, we expand the transfer of technologies to the marketplace, helping partners reach their goals and accelerating progress toward our vision: a clean energy future for the world.

Andrea Watson, Director, Strategic Partnerships Office





Partnership Highlights

NREL signed 340 new partnership agreements in Fiscal Year 2023, spanning topic areas from power grids and wind power to analysis and carbon management. Three-hundred partners awarded NREL with \$143 million in funding to work on high-impact projects, many of which stood out as highlights from the year. Through this level of funding, NREL's partners are delivering real-world impact by de-risking new technology investment, accelerating innovations to market, advancing economic growth, and reaching clean energy goals.

Tennessee Valley Authority

The nation's single largest public power provider, Tennessee Valley Authority (TVA), is tackling one of the largest challenges facing the nation—how to transition its heavy fossil fuel portfolio to carbon-free energy. TVA is partnering with NREL to leverage the lab's energy system analysis, modeling, and demonstration capabilities to help implement the energy system of the future and power the new clean economy.



Lithuanian Energy Agency

Lithuania is partnering with NREL as the country explores pathways to reaching a 100% decarbonized grid. To get there, Lithuania will need to more than triple its renewable energy generation, a big challenge for a country that imports two-thirds of its electricity. The collaborative effort is the first time NREL's 100% renewable energy analytic capabilities will be on the international stage. Research areas included in the project are distribution grid planning and analysis, hydrogen production and utilization, and analysis of key energy transition impacts including greenhouse gas emissions reductions and air quality improvements. Results from the study will empower Lithuania to effectively harness the country's domestic energy resources; maintain a secure, stable electricity grid; and accelerate its journey to energy independence.



General Services Administration

The General Services Administration (GSA) owns and leases more than 8,000 buildings in more than 2,200 communities nationwide. Together, NREL and GSA are developing methodologies and data to characterize, analyze, and evaluate the embodied carbon of buildings and historic building retrofits. Findings will be used to inform investment and decision-making with their existing building portfolio, help meet federal buy clean requirements, and qualify for Inflation Reduction Act funding for low embodied carbon materials. Other work includes collaborating on GSA's Green Proving Ground (GPG) program, which utilizes their real estate portfolio to test and evaluate emerging and underutilized sustainable building technologies.



NREL provides technical expertise to support these technology validations that lead to greater deployment opportunities and market transformation. From graduate technologies of the program, GSA has deployed solutions in over 700 facilities, resulting in \$30 million of annual energy savings and a reduction of 117 tons of annual greenhouse gas emissions.

U.S. Department of Homeland Security

Energy and water infrastructure resilience—the ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions—is front of mind for federal agencies around the country. Agencies, including the U.S. Department of Homeland Security (DHS), have a vested interest in ensuring its buildings and energy and water infrastructure assets can withstand and recover from deliberate attacks, accidents, or naturally occurring hazards or incidents. With a portfolio of diverse assets facing a wide range of potential natural hazards and man-made threats, DHS is partnering with resilience planning experts at NREL for policy and guidance, training, and technical assistance to not only develop resilience plans but to help them



meet net-zero energy emission targets and create climate adaptation plans. In addition, DHS's Federal Emergency Management Agency (FEMA) partners with NREL for recovery and resilience assistance in response to federally declared disasters through FEMA's long-term recovery operations.

Kern Community College District

The first community college to partner with NREL, Kern Community College District (KCCD) in Bakersfield, California, is located in a community in transition. The county is simultaneously the No. 1 oil producer and renewable energy producer in the state. As renewable energy becomes more prominent, community members need to learn the skills to work on today's advanced energy technologies. In their work with NREL, KCCD's focus is two fold. The collaboration trains students, the workforce of the future, to ensure they will be ready for jobs in clean energy while also helping the community advance its progress toward renewable energy. Focus areas for training center around carbon capture, microgrids, clean



transportation, and agrivoltaics. The partnership also includes participation in the Regional Direct Air Capture Hubs program, which helps accelerate the demonstration and deployment of direct air capture technologies.

U.S. Department of Defense Environmental Security Technology Certification Program

Advanced microgrid technologies with large-scale energy storage are a key form of reliable energy for U.S. military installations to retain uninterrupted electricity despite grid outages, cybersecurity threats, or aging infrastructure. Through a partnership with the Environmental Security Technology Certification Program (ESTCP), NREL demonstrated the use of automated demand response technologies. These will be used in managing building loads within a microgrid to help maintain mission-critical functions, stabilize the microgrid when isolated from the main electric grid, and enable smoother transitions between grid-connected and -independent modes. By funding these early demonstration projects of new



technologies and making them publicly releasable, ESTCP can present the technologies to the world and motivate risk-averse utilities and military bases to adopt the projects themselves.

U.S. Agency for International Development

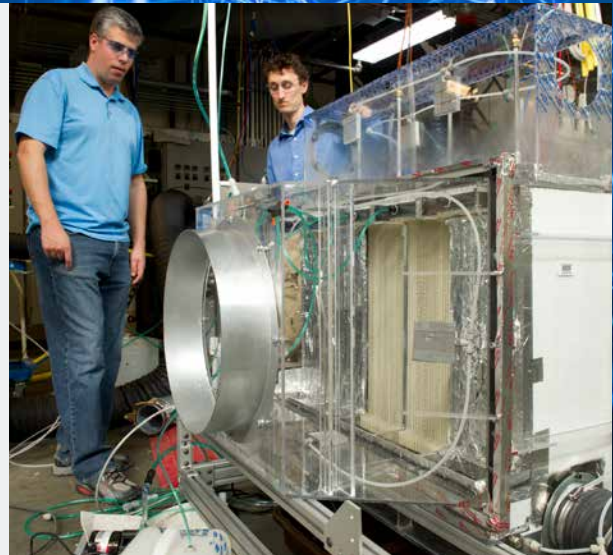
The more work researchers and the laboratory do with countries around the world, the more we can learn from one another to make the clean energy transition as successful as possible. Through the U.S. Agency for International Development (USAID)-NREL Partnership, USAID and NREL collaborate internationally to do just that by addressing key energy sector challenges and working together on cutting-edge analysis and deployment efforts. In Fiscal Year 2023, USAID-NREL Partnership efforts included providing best-in-class tools, data, and technical collaboration to support Ukraine in building a resilient, decentralized, renewable energy grid; developing a framework for just and sustainable transitions in the transport sector; and designing a “hydrogen considerations tree” to support countries



in exploring hydrogen opportunities. NREL and USAID also work together on the Women in Power System Transformation initiative, implemented to address educational and professional barriers to women's entry and advancement in power systems operation organizations.

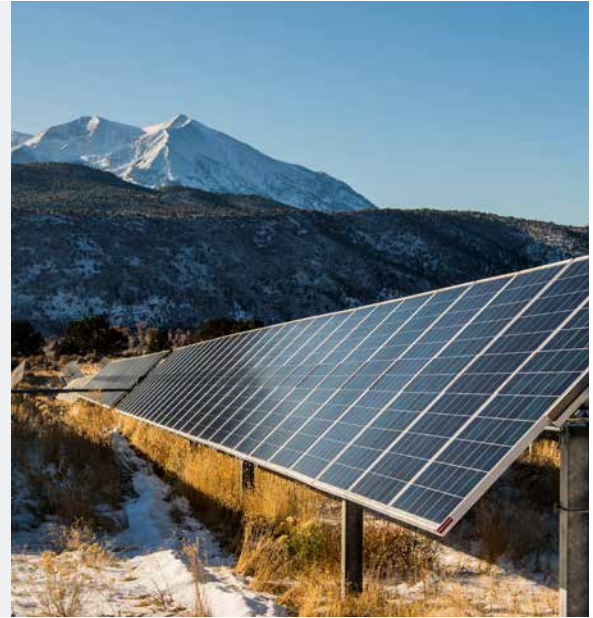
Blue Frontier

Blue Frontier's partnership with NREL was spurred by the startup's participation in the Wells Fargo Innovation Incubator. Upon completing the program, Blue Frontier partnered with NREL to perform experiments on its second-generation air conditioner design, which can reduce electricity consumption by more than 60% and reduce global warming impact by 85%. Through this collaboration, the partner has support in validating its technology and bringing it to the market faster.



U.S. Bureau of Land Management

For more than a decade, the U.S. Bureau of Land Management (BLM) has trusted NREL's subject matter expertise to advance energy projects on its 245 million acres of public land. By collaborating with the lab, the agency gains confidence that renewable energy development will be environmentally sound, have the greatest potential, and create the fewest conflicts with other resources. The latest round of BLM funding for NREL will help the agency bring the best available technological and environmental research into the planning, permitting, storage, and monitoring of geothermal, wind, and solar developments on public lands.

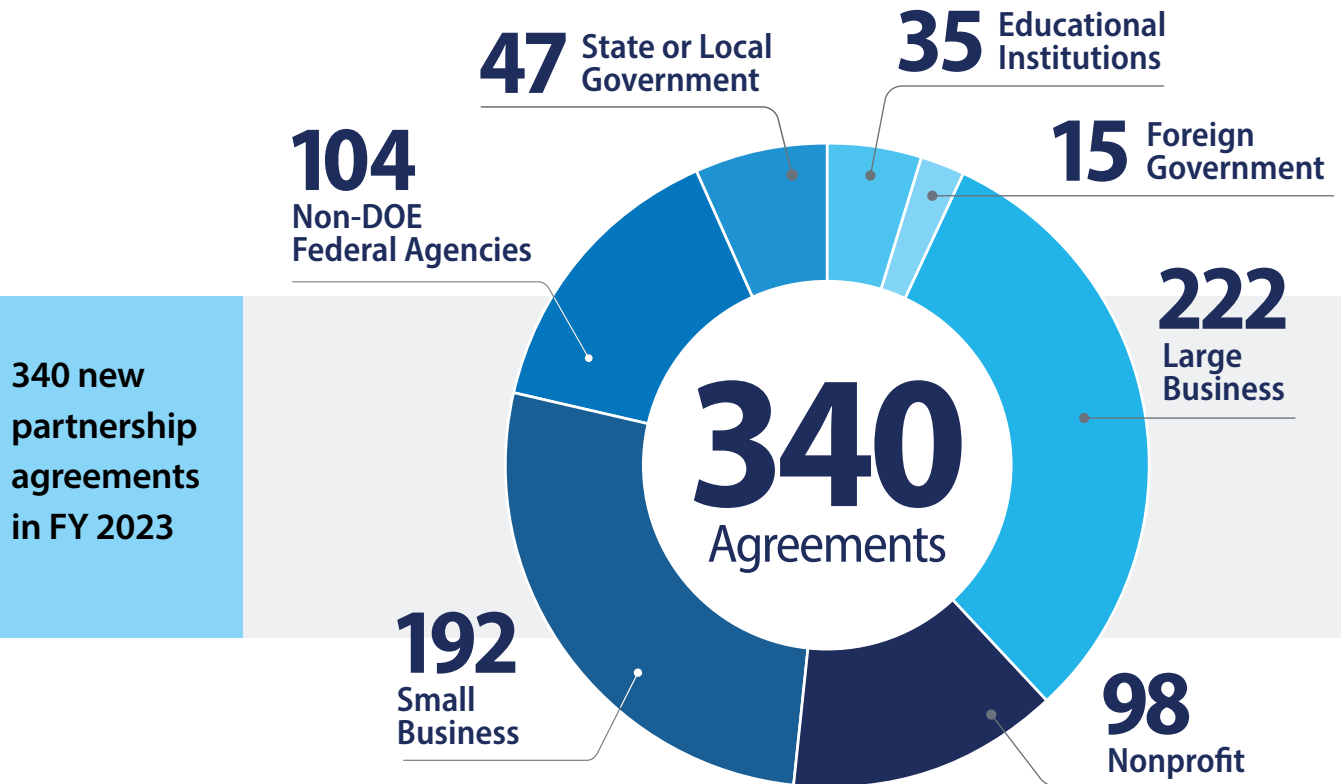


U.S. Bureau of Ocean Energy Management

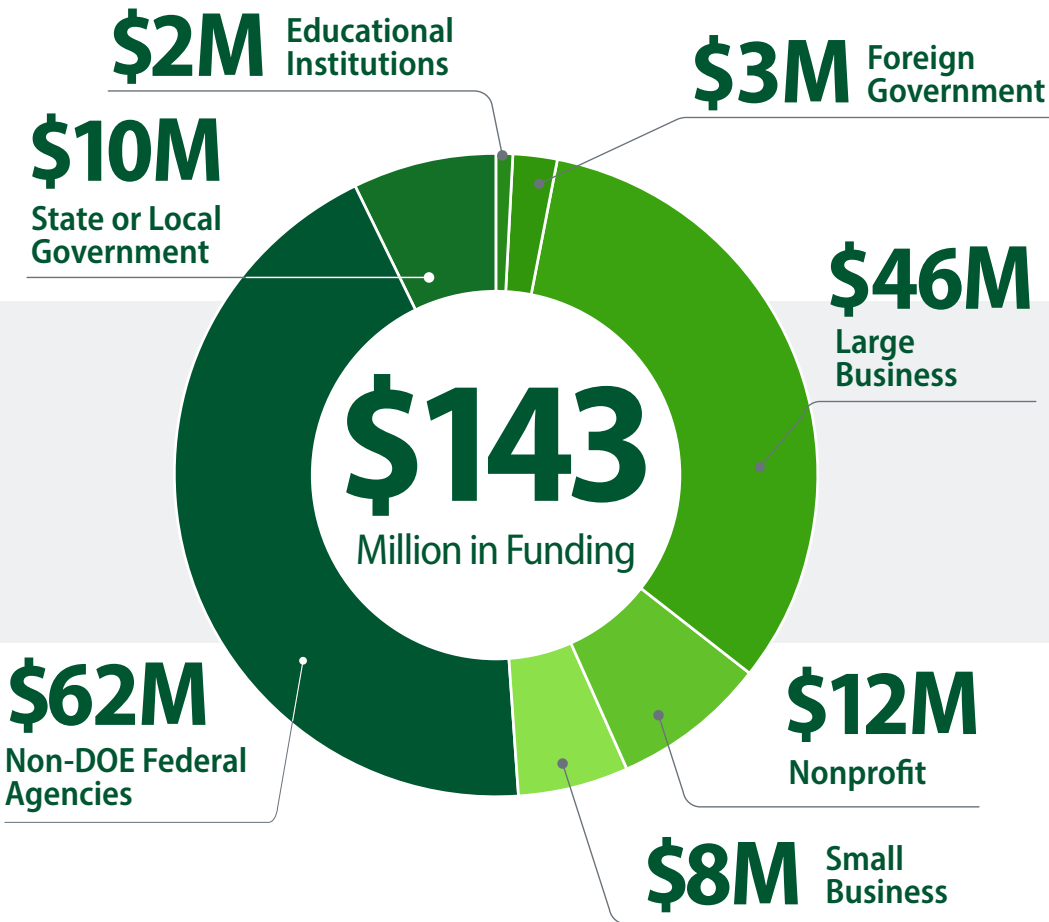
Floating offshore wind energy is the newest form of offshore wind energy, allowing wind farms to be deployed in deeper waters than a traditional fixed-bottom offshore wind turbine. Such deep waters can create challenges, which is the latest focus in the U.S. Bureau of Ocean Energy Management's partnership with NREL. Laboratory teams are looking at elements that can impact the amount of energy each plant could generate, including mooring arrangements, wake effects within the wind plant, and different delineations of turbine layout configurations. Wind power plants in these deep-water areas could be among the first commercial-scale floating wind power plants in the United States, leading the deployment of new technology that has potential to deliver clean energy to coastal regions worldwide.



By the Numbers



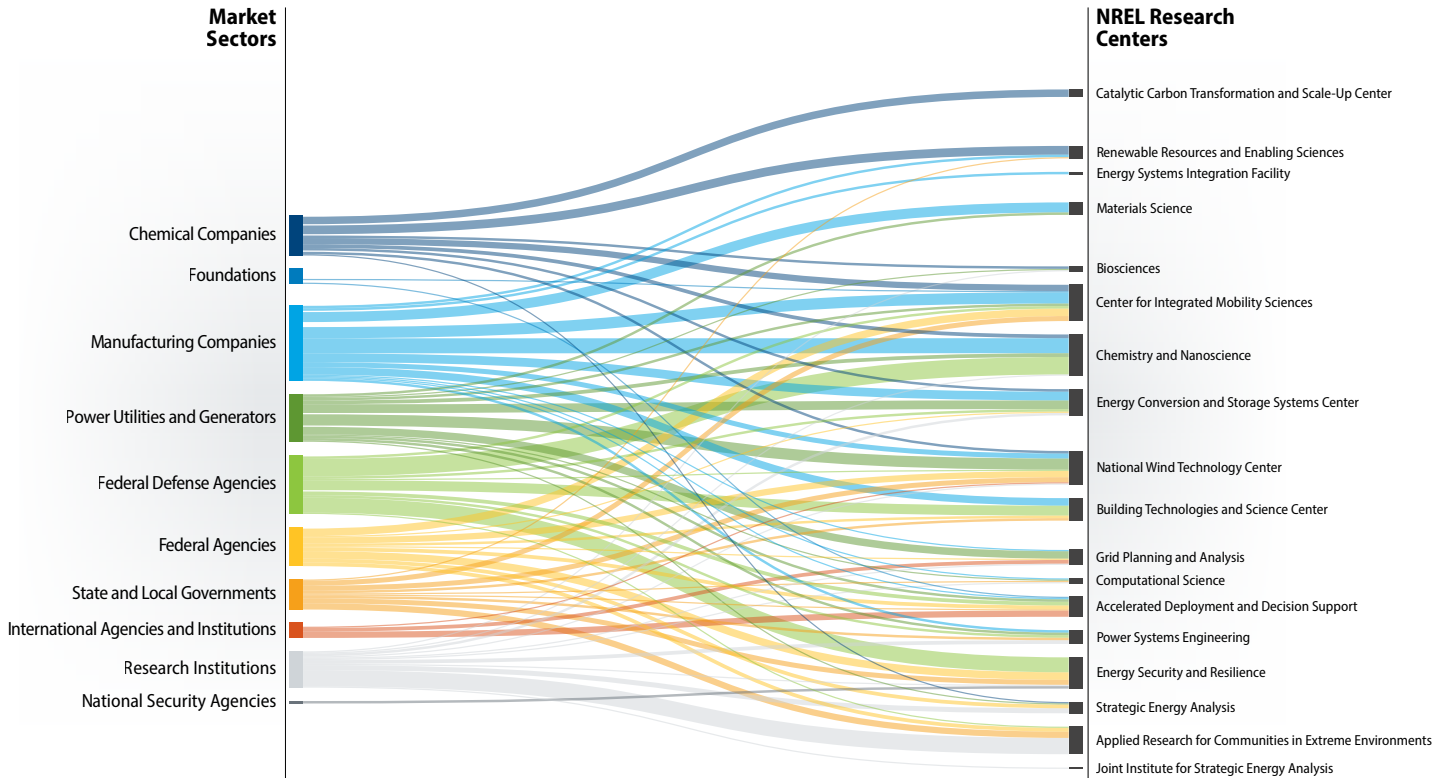
Including NREL's 340 new agreements in FY 2023, a 7% increase from FY 2022, the laboratory maintained more than 1,100 active partnerships.



\$143M in new partnership agreement funding in FY 2023

NREL saw a 9% increase in partner funding from FY 2022, which will help accelerate the commercialization of energy efficiency and renewable energy technologies.

How Partner Market Sectors Map to NREL's Research Areas



NREL partner projects are categorized by these market sectors and work across all NREL research areas.

Sustained Relationships

NREL has been working with many of its strategic partners for more than a decade. Because of these long-term collaborations, partners are reaching their clean energy targets and making an impact around the world. For partners like **Eaton** and the **U.S. Agency for International Development**, NREL is helping bring relevant technologies to diverse communities and stakeholders while also supporting **Dallas-Fort Worth International Airport**, **Fortescue**, and the **U.S. Department of Defense** in understanding, and solving, the critical challenges our nation is facing. Collaborating helps both partners and NREL reach goals faster, and we can't do it alone.

Dallas-Fort Worth International Airport

Aviation emissions greatly impact air quality in and around airports, with the sector accounting for nearly 8% of all transportation-related greenhouse gas emissions. Identifying solutions to electrify airport operations and prioritizing energy efficiency are crucial to decarbonizing the U.S. transportation system. Dallas-Fort Worth International Airport (DFW), in partnership with NREL, is at the forefront of reaching ambitious energy and climate goals. Through the Project Athena, NREL helped DFW's transportation hubs integrate and adapt to transformative technologies. The second phase of the project, Athena ZEV, recently launched and is focused on supporting development of an electrification pathway for U.S. airports, starting with analyzing the complicated needs associated with rental car fleet electrification.

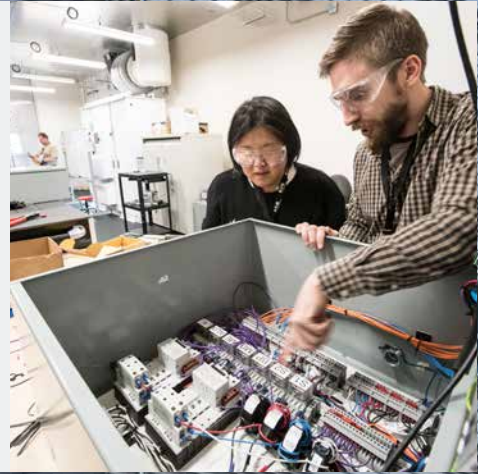


“DFW values its partnership with NREL because of the wealth of technical and financial resources it provides to tackle challenging industry problems.”

– Robert Horton

Eaton

Eaton and NREL have collaborated for more than a decade, creating a portfolio that includes projects to develop a predictive battery system for hybrid electric vehicles as well as optimizing energy systems for microgrids, buildings, and communities. The partnership aims to boost research, increase the pace of innovation, and help Eaton get energy-related technologies to market faster. A large step in the relationship was colocating Eaton employees at NREL's Energy Systems Integration Facility to boost research outcomes and combine diverse perspectives.



U.S. Department of Defense

The U.S. Department of Defense (DOD) partners with NREL on a variety of research areas to accelerate achievement of several energy objectives. Collaborative efforts have included providing reliable, flexible, and resilient supplies of energy to meet installation and mission needs; improving the future of warfighting capabilities by leveraging integrated, resilient, and efficient energy systems that reduce logistics and operational risks; and improving control system cybersecurity at mission-critical facilities. Through these projects, DOD has seen increased resilience, improved mission capabilities, and significant cost savings at their facilities.



ESIF
15257
Energy Systems
Integration Facility

Fortescue

Fortescue and NREL's 10-year, \$80 million partnership will yield commercially viable solutions to decarbonize major industrial sectors around the world. In 2022, Fortescue created the Colorado Innovation Center in Golden, Colorado, to facilitate robust research programs with NREL including green hydrogen, batteries, grid technologies, and solar. Fortescue's arrival in Colorado brings the potential to create more than 350 jobs between the company and NREL, with future work planned in energy systems integration, high-performance computing, water electrolysis, and more.



U.S. Agency for International Development

The U.S. Agency for International Development (USAID) and NREL work together to deliver clean, reliable, and affordable power in partnership with developing countries. Since 2009, USAID, NREL, and partners in more than 50 countries around the world have achieved:

- Conducting data-driven analysis to inform over 70 clean-energy laws, policies, and regulations internationally
- Building capacity within 758 institutions and training over 15,000 people, 40% of whom were women
- Developing cutting-edge and timely USAID-NREL knowledge platforms, datasets, and open analysis tools to inform decisions with over 1.2 million users.

Based on the activities above, 360 million metric tons of CO₂ is projected to be reduced or avoided, with \$1.8



billion of investment mobilized to enable clean energy transitions and expanded impact. Strategic pillars of this partnership focus on power systems, built environment, sustainable transportation, and integrated energy solutions. All pillars are underpinned with best-in-class energy data and analytics and a focus on just energy transitions.

Other Ways To Partner

From advancing innovations to market, catalyzing cleantech ecosystems, and accelerating the speed and scale of our partners' clean energy solutions, NREL offers additional opportunities for partners to make a real-world impact.

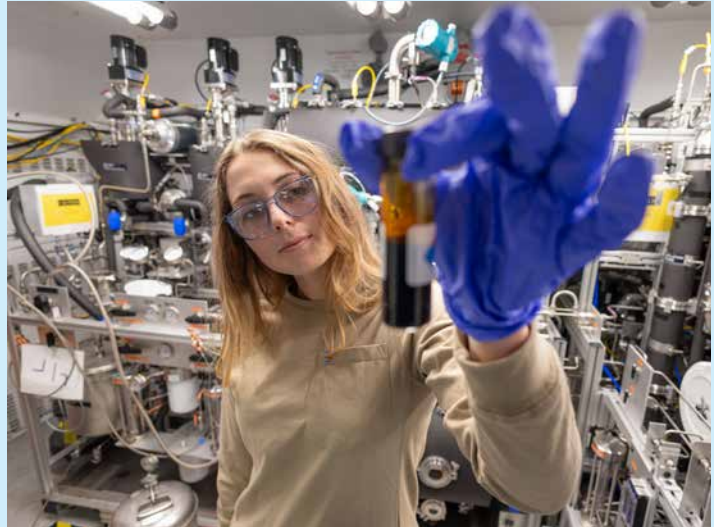
Innovation and Entrepreneurship Center

NREL's Innovation and Entrepreneurship Center (IEC) brings economically viable cleantech innovations to market by connecting our world-class researchers and facilities with a network of startups, investors, foundations, and industry partners. IEC programs support research areas across NREL and foster the development of cutting-edge innovations, accelerating their path to the market.



Strategic Public-Private Partnerships

The Strategic Public-Private Partnerships Office leads NREL's effort to develop high-impact, multipartner, multiyear partnerships and aims to drive clean energy transformation at scale, domestically and globally. NREL's cross-functional teams build on the research, development, demonstration, and deployment work and examine how we can achieve strategic alignment to advance the lab's vision among partners with shared interests.



University Partnerships Program

By partnering with leading universities and research institutions, we bring together scientific knowledge, leverage NREL's state-of-the-art facilities, and collaborate to solve complex, multidisciplinary challenges in clean energy technology research. The goal is to enhance research, foster the exchange of ideas, attract rising talent, create pathways for graduate and undergraduate students, and explore new ways to engage with educational institutions.



What Our Partners Are Saying...

“The energy transition will require innovation across the value chain, from driving down the cost of green hydrogen to developing the technologies that enable uptake of this green hydrogen. NREL, with over 45 years of experience in green energy innovation, inspires us to challenge our assumptions about what is possible. Over the last year, Fortescue worked side by side with NREL to find the right opportunities for commercializing those innovations. Furthermore, NREL has capabilities that cannot be found anywhere else in the world. Our partnership with NREL allows us to leverage those world-class capabilities to advance our R&D projects.”

– **Barbara Van Bossuyt, Fortescue**

“We are proud to have partnered with the National Renewable Energy Laboratory for more than a decade where we have co-designed and co-developed cutting-edge, high-performance computing innovation that has significantly driven energy efficiency. Together, we have created initiatives for smarter, more energy-conscious computing environments with warm-water cooled supercomputing solutions, hydrogen fuel cell data centers, and artificial intelligence operations. We are also honored to have built NREL’s supercomputers, including the new Kestrel system, to fuel its world-leading research to make breakthroughs in designing next-generation clean energy technologies.”

– **Trish Damkroger,
Hewlett Packard Enterprise**

“Eaton and NREL have a long, successful history of collaboration, working together to advance a new energy future. NREL’s experts offer Eaton valuable, world-class insights, and their facilities offer unique advantages through access to state-of-the-art R&D resources. The capabilities NREL offers, such as ESIF’s multiscale, hardware-in-the-loop test capabilities, open up new research opportunities across Eaton’s mobility products and advanced, power system solutions. Our continued partnership with NREL reflects a fantastic model of national lab collaboration with industry.”

– **Calvin Zhang, Eaton**



“DFW values its partnership with NREL because of the wealth of technical and financial resources it provides to tackle challenging industry problems. These resources include computational science and researchers who can manage the scale and complexity we encounter daily. We have benefited from our partnership by accelerating our decarbonization strategies through research initiatives like Athena, Morpheus, and the most recent, Athena ZEV, to meet our net zero by 2030 goal.”

– Robert Horton, Dallas-Fort Worth International Airport



Convening Power

To better facilitate engagement with a range of partners from academia; industry; and city, state, local, and national governments, NREL hosts a variety of events throughout the year, with the largest being the annual Partner Forum.

The Partner Forum provides a unique opportunity for partners to connect with NREL and one another, learn about and explore current and future activities, and discuss new trends and innovations in renewable energy technologies. In 2023, industry partners, researchers, and leaders discussed decarbonizing and integrating energy systems for a clean energy future.

By facilitating these discussions, the Partner Forum helps set the stage for future collaborations.

In Fiscal Year 2023 we hosted more than 150 partner organizations from all over the world at our South Table Mountain Campus and Flatirons Campus, both in Colorado. These important visits allow guests to tour NREL facilities, learn more about capabilities, meet with researchers, and discuss potential high-impact projects and collaborations.



Meet the Strategic Partnerships Team

NREL's Strategic Partnerships Office focuses on executing an enterprisewide, coordinated business strategy to grow mission impact through strong partnerships with commercial, government, and noncommercial entities. Many thanks to our incredible partners, dedicated researchers, and NREL and DOE leadership for your support. Together in 2023, we moved the needle closer to a clean energy future. We look forward to what the next year brings.

For more information about partnering with NREL, visit our website at [NREL.gov](https://www.nrel.gov).



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