



Power Electronics and Electric Machines

Our Expertise

World-Class Power Electronics Thermal Management | Power Electronics Packaging, Module Development, and Characterization | Power Electronics Electrical Design and Characterization | Prototype Fabrication | Microelectronics | Thermomechanical Reliability and Failure Analysis | Electric Motor Thermal Management | Integrated Electric Traction Drives

The Need

Overcoming Technical Barriers to Electric Vehicle Commercialization

On-road, off-road, and non-road vehicles—like planes, trains, trucks, agricultural equipment, and construction vehicles—are some of the largest, heaviest-emitting, and most difficult-to-decarbonize vehicles on Earth. Yet meeting climate goals will require these specialized vehicles to operate emissions-free by 2050.

In order to develop new generations of energy-efficient vehicles, researchers must design cutting-edge power electronics and electric machines capable of high-power energy conversion. And they must be able to function effectively in high-temperature, high-pressure environments.

The Solution

Develop Safe, Reliable, High-Performing Components

NREL's world-class power electronics and electric machines researchers partner with industry, universities, and other research labs to design, build, validate, and deploy efficient, reliable, and power-dense components that can operate in extreme and remote environments.

Our researchers pioneer new methods to make systems and components lighter and more compact, efficient, cost-effective,

and rugged than those currently available on the market. These revolutionary components are capable of propelling heavy-duty electric vehicles like planes, trains, and construction equipment.

In pushing the boundaries of what's possible, NREL's power electronics and electric machines researchers make it feasible to realize widespread, heavy-duty electric vehicle adoption.

The Impact

Giving Manufacturers a Clean Energy Edge

NREL's technology breakthroughs give light- and heavy-duty equipment manufacturers an edge in a market increasingly looking for clean energy solutions.

Collaborations between NREL and manufacturers like General Motors, Daimler Truck, John Deere, General Electric, Cummins,

Eaton, and BorgWarner have reduced investment risk in clean vehicle components—and accelerated adoption of clean energy technologies. These partnerships have resulted in electrified light- and heavy-duty vehicles, construction equipment, and zero-emissions aircraft with all-electric propulsion.

Partners

BorgWarner | Caterpillar Inc. | Cummins Inc. | Daimler Truck North America | General Electric | General Motors | John Deere Electronic Solutions | Marquette University | North Carolina State University | PowerAmerica | Stanford University | The Ohio State University | Toyota | U.S. Department of Energy | University of Arkansas | University of Wisconsin–Madison | Virginia Tech