



LEVERAGED-RESOURCE MODEL — TRANSLATIONAL R&D

**ACTION:**

Leverage user facilities at one of the U.S. Department of Energy (DOE)'s National Labs or research facilities

Eaton Electric Vehicles Integration

Overview

Eaton's push for electric vehicle integration shows how private companies can leverage resources from key public partners to boost the commercial viability of the products they develop.

Challenge

Electric vehicle (EV) technology has improved dramatically in recent years, but these improvements have often not yet been incorporated into EV fleets (of buses, for example). This will be an expensive problem—and while there is a desire to collaborate across the public and private sectors to solve it, strong partnerships have not yet developed.

Goals

Eaton, a power-management company, set out to develop a framework for integrating advanced-mobility and distributed-energy technologies onto the grid. Eaton's partnership with the U.S. Department of Energy (DOE)'s National Renewable Energy Laboratory (NREL) is designed to expedite research on, and the commercialization of, new energy-related technologies. This partnership will provide opportunities for regional transportation and utility partners to optimize their vehicle technologies and provide services to the grid, such as voltage regulation and additional energy-storage capacity. (See more [here](#).)

Managing fleets of electric buses for grid services means:

- 1 Reviewing operating data for commercial fleets;
- 2 Analyzing grid services from electric vehicles; and
- 3 Hardware-in-the-loop simulation of the control strategies.

Operational Overview

In January 2018, building on a decade-long relationship, [NREL and Eaton signed a cooperative research and development agreement \(CRADA\)](#) that would enable both organizations to collaborate closely on the evolving state of energy solutions such as microgrids, energy storage systems, and grid intelligence. The collaboration is based at NREL's Energy Systems Integration Facility (ESIF), a 182,500-square-foot research user facility that provides laboratory and support infrastructure to optimize the design and performance of electrical, thermal, fuel, and information technologies and systems at scale.



The public-private collaboration (between Eaton and NREL) gave NREL the industry input it needed to understand the economics and energy dynamics of fleets, which the agency can use in sectors such as shipping and mobility.

This is a new kind of partnership for ESIF. Eaton received access to NREL's lab, where the company sent more than a dozen employees to work closely with agency experts on research involving the integration of EV fleets with grid and new energy technologies. This public-private collaboration also gave NREL the industry input it needs to understand the economics and energy dynamics of fleets, which the agency can use in sectors such as shipping and mobility. (See video [here](#).) NREL and Eaton also launched an industry advisory board to provide additional expertise and oversight for the project.

Key Inputs and Resources

There are currently 20 Eaton employees from the Eaton Research Labs team based at the NREL Energy Systems Integration Facility (ESIF).

NREL ESIF is financially supported by DOE's Office of Energy Efficiency and Renewable Energy (EERE). Through this collaboration, Eaton receives access to DOE facilities and sites to demonstrate the technology as well as experts from NREL.

Key Outputs

The NREL ESIF reports [from 2018 and 2019](#) show some preliminary measures of success and returns on investment. Eaton was able to identify and evaluate scenarios that represent varied use of the EV fleet, which make it possible for researchers to develop real-time strategies for maximum benefit or maximum battery life cycle. Eaton also completed an integration demonstration of its Power Xpert Energy Optimizer (PXEO) controller at a simulated school site in real time. These results are used in techno-economic comparisons of the control strategies. Finally, Eaton was able to engage an industry advisory board to discuss broader challenges; and in September 2020, the company was [awarded](#) a Department of Energy grant to advance its electric grid cyber-resilience work with NREL.

Replicating for Impact

Larger companies are often better positioned to work with the National Labs due to the quantity of resources available to them, but many National Labs also have strong relationships with small to mid-size enterprises (SMEs). National Labs with a heavier focus on applied research are best suited to work collaboratively with industry on the development of technologies that have commercial goals and applications. For the success of these collaborations, it is critical to have corporate senior executives lead the effort, as well as innovative leadership at the National Lab that is willing to work with a corporation on clear commercial goals.

This type of engagement—offering long-term access to the labs and offices of federal user facilities—could be the first of many. It should be considered at other facilities and other labs.