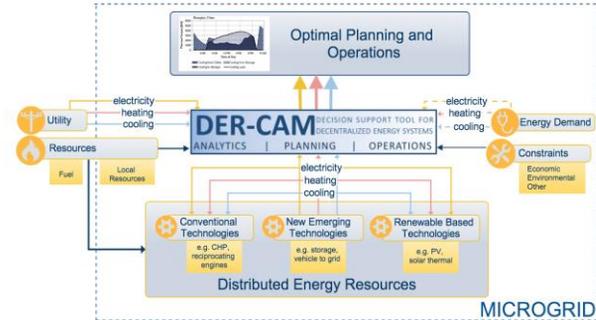


## Microgrid Research at Berkeley Lab

The microgrid team at Berkeley Lab studies customer adoption patterns of grid technologies and distributed energy resources (DER) optimization in microgrids and buildings. The team has been developing the Distributed Energy Resources Customer Adoption Model (DER-CAM). DER-CAM is a tool that outputs microgrid investment and dispatch results that minimize costs or emissions. The graphic below left shows a high level schematic of the model and the right one detailed investment results delivered by DER-CAM. Currently, multiple DER-CAM versions are available (deterministic, stochastic dynamic programming, predictive control, etc.) and used for microgrid adoption, policy analyses, and microgrid controller design. DER-CAM usage is free.



## Selection of Current Projects

### Closed Loop Customer and Utility Interactions with DER-CAM and OpenADR

California Rule 21 requires identification of customer-side Distributed Energy Resources (DER) controls, communication technologies, and standards. Besides reducing customer's need to grid power, the customer-side DER plays a key role for Demand Response (DR) options. The customer-side DER technology can be leveraged to enable optimized cost, energy, and carbon choices. This project studies cost-effective communication technologies for DER integration and interoperability using tools and open standards, as well as optimization models for resource planning based on day-ahead price notifications. Please see <https://building-microgrid.lbl.gov/projects/closed-loop-customer-and-utility>

### Microgrid Design Using DER-CAM

The use of microgrids to improve the reliability, resiliency and efficiency of the electrical power grid is a concept that is gaining popularity and is expected to continue to receive attention in coming years. LBNL conducts engineering and economic analyses of microgrid development options for the St. Elizabeth's campus in Washington, DC. The application is well suited to supporting community efforts to design and implement microgrid projects. On behalf of the project team at the District of Columbia Department of General Services (DGS) the Metropolitan Washington Council of Governments (COG) works with the Lawrence Berkeley National Lab to transfer the DER-CAM tool to COG for use in analyzing microgrid projects in Washington, DC and the region. COG works with an engineering team from the Electric Power Research Institute (EPRI) to use the DER-CAM tool to evaluate microgrid options for the campus. LBNL will transfer DER-CAM to DC, provide training, and assist in the microgrid analysis. Please see <https://building-microgrid.lbl.gov/projects/microgrid-design-using-der-cam>

## Microgrid Controller Projects

The "Dynamic Control and Microgrid Controller" projects are supported in part by the US Department of Defense, US Department of Energy, and an expansion of an ongoing project at Fort Hunter Liggett (link [here](#)) supported by California Public Utilities Commission (CPUC). The "Dynamic Control and Microgrid Controller" projects provide a development pathway to implementing full microgrid controllers at multiple test sites and making the Berkeley Lab technology widely available through demonstration and commercialization efforts. Please see <https://building-microgrid.lbl.gov/projects/dynamic-control-microgrid-controller>

## Other Projects

- ✓ Microgrid Controller design at Fort Hunter Liggett
- ✓ Evaluation of Fast Response Capability and Development of Fast Response Models of Flexible Loads for Use in China
- ✓ University of New Mexico Mechanical Engineering Building Thermal System Optimization
- ✓ Los Angeles Air Force Base Vehicle To Grid And Building Integration Project
- ✓ Multi-year DER Decision Support System
- ✓ Passive measures in DER-CAM (Thermodynamics)
- ✓ Stochastic Electric Vehicle Fleet Management
- ✓ Non-linear Efficiency Curves in DER-CAM

## Research Partners

Brookhaven National Laboratory, Burns Group Engineering and Construction, CSIRO, Australia; General Electric (GE) Energy Consulting, Electric Power Research Institute (EPRI), Fort Hunter Liggett, IIT Comillas, Spain; Instituto Superior Tecnico, Lisboa, Portugal; McGill University, Canada; Mines ParisTech, France; Massachusetts Institute of Technology (MIT), Vienna University of Technology, The EnergyCoalition, Tri-Technic, University of California at San Diego, University of Freiburg, Germany; University of New Mexico, US Department of Defense; US Air Force; Willdan Energy Solutions; etc.



Contact: Michael Stadler  
Email: [MStadler@lbl.gov](mailto:MStadler@lbl.gov)  
Tel: 510-486-4929