DERConnect
A National Science Foundation User Facility for Control of Distributed Energy Resources
Distributed Energy Resources Connect (DERConnect)

John Dilliott
Energy Manager,
UCSD Facilities Management

Sonia Martinez
Professor, Controls
UCSD

Raymond de Callafon
Professor, Controls
UCSD

Keaton Chia
R&D Engineer

Jan Kleissl, PI
Professor, UCSD

Byron Washom
Director, Strategic Energy Initiatives

Ilkay Altintas
Cybersecurity Researcher

Sonia Martinez
Professor, Controls
UCSD

Adil Khurram
Postdoc

Jorge Cortes
Professor, Control
UCSD

Hamed Haghi
Principal Consultant

3 Graduate Student Researchers

4 Undergraduate Research Assistants
DERConnect is a National Testbed for Autonomous Energy Grids

- 2,500 actual devices. 2M simulated nodes.
- Small form factor DERs jointly serve critical power grid needs.
- Accessible nationally
- Made possible due to a number of technological advances at UCSD:
  - Integration of renewable energy sources
  - Buildings as sensory and control programmable systems
  - EV as programmable systems
Case Study

- Tracking a frequency regulation signal with 176 DERs
- Total RMSE: 9.7%
Building Operations
Social Science Experiments

- Negotiate the conflicts between energy savings, economics, comfort
  - Electric vehicle fast versus flex charging
  - Building air conditioning
  - Building lighting

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Phase 1 – Observe

- Recruit users for research study
- Implement cloud-based monitoring
- Apply immediate charging only

Phase 2 – Learn

- Charging options:
  - Immediate charging (higher price)
  - Flexible/eco charging (lower price)
- Expose research group to various prices, to learn their choice behaviors

Phase 3 - Optimize

- Optimize price on charging menu
  - Immediate charging (higher price)
  - Flexible/eco charging (lower price)
- Maximize net profit, while managing overspend

Scott Moura, UC Berkeley
Optimization in demand charging
DERConnect Buildings

- 12 buildings with >$1M square feet
  - Library
  - Office Buildings
  - Lecture Halls

- Metering and control every 2 seconds
  - 155 air handlers
  - 637 individually controllable LED light fixtures and 1,384 legacy fixtures
  - 1,000 plug load controllers
  - 1,170 Temperature, humidity, occupancy, and CO2 sensors
Energy Storage Innovation Lab

- Current capacity of 250 kW to be increased to 2,000 kW with 4x larger footprint
- Directly interface with DERConnect
- Participate in energy markets