

# SPADES Y2 Outlook

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- ~~Task 1 - Feedback Control Modeling of ESS/Electric Grid Interaction~~
- Task 2 - Supervisory Control System Development
  - Task 2.1 (Mar. 31, 2021) - Development of ESS supervisory control framework
    - Preliminary control algorithm for power electronic control stabilization
  - Go/No-Go: ESS simulations providing grid services (June 30, 2021)
    - ESS devices providing 3 grid services (peak shaving, valley-filling, night-power supply) in simulations
  - Task 2.2 (Sept. 30, 2021) - Development of reinforcement learning control algorithm
    - Investigation of RL algorithms/architecture to include storage devices completed
    - Investigation of linearized power flow to improve reinforcement learning training efficiency
  - Task 2.3 (Dec. 31, 2021) - Creation of software modules for supervisory controller and reinforcement learning controller
    - Finalized supervisory control algorithm for power electronic control integrated into Julia simulation
    - RL policy network/action space extended to manage storage power injections in PyCIGAR

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- Task 3 - Hardware-In-the-Loop Experiment and Red Team Attack
  - Task 3.2 (Dec. 31, 2021) - Development of software module to house attack algorithms
    - Red team software module capable of interacting PyCIGAR framework completed, populated with preliminary attack algorithm, and tested
  - Task 3.3 (Sept. 30, 2022) - Hardware in loop tests and Red Team attack experiment
    - Will assess capabilities of FlexGRID to support red team experiment after architecture for Task 3.2 is determined
- Task 4 - Open Modeling Framework (OMF) Integration
  - Task 4.2 (Dec. 31, 2022) - Integrate reinforcement learning ESS control algorithm into OMF
    - Initial extension of CyberInverter OMF capabilities to support addition of storage devices already underway (Alpha version of ESS controls implementing use cases - 02/28/2020)

# Questions/Discussion

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*Contact:*

*Dr. Daniel Arnold*

*dbarnold@lbl.gov*

*Dr. Sean Peisert*

*speisert@lbl.gov*

*More LBNL CEDS information:*

*<http://dst.lbl.gov/security/research/ceds/>*



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