

Student Project Activity #3: Distributed Energy Resources

Overview:

This activity introduces students to distributed energy resource (DER) optimization and illustrates the different results obtained when using individual building vs. community-scale optimization approaches. When using URBANopt with REopt optimization, a scenario-level analysis assumes a primary-meter and a feature-level analysis assumes individually-metered buildings. Optimal PV and battery sizes can vary depending on the type and number of buildings (e.g., load diversity) and the utility rate structures. This activity addresses how the optimization results differ between a primary-metered district or community compared to individually-metered buildings.

Utility rate structures typically charge for energy use on a \$/kWh basis. These charges may be constant, but often involve some level of variation based on the time of day (time-of-use). Charges may also be assessed on a “peak demand” basis, where consumers are charged for their maximum power demand over a given period - typically one month. This peak demand is calculated over a short averaging window (e.g., 15-minutes) and priced in terms of \$/kW.

Tasks:

1. (1 min) Create REopt Scenario: Create a REopt compatible scenario file using your baseline scenario file

Tutorial: https://urbanopt-tutorial.s3.amazonaws.com/videos/08_REopt-URBANopt.mp4

```
uo create -r -f <path/to/FEATUREFILE.json> -s <path/to/SCENARIOFILE.csv>
```

This will generate a new scenario file that starts with “REopt_”

2. (30 mins) Run Command: Run the newly created REopt_scenario file using URBANopt and the REopt Lite API by using the command below. Additional instructions can be found on the [REopt Lite](#) pages:

```
uo run --feature <path/to/FEATUREFILE.json> --scenario <path/to/REOPTSCENARIOFILE.csv>
```

3. (60 mins) Process with REopt Commands: Post-process your existing results using REopt:

Tutorial: https://urbanopt-tutorial.s3.amazonaws.com/videos/08_REopt-URBANopt.mp4

- a. Process Scenario with REopt Command: Post-process general results for each project scenario.

```
uo process -r -f <path/to/FEATUREFILE.json> -s <path/to/REOPTSCENARIOFILE.csv>
```

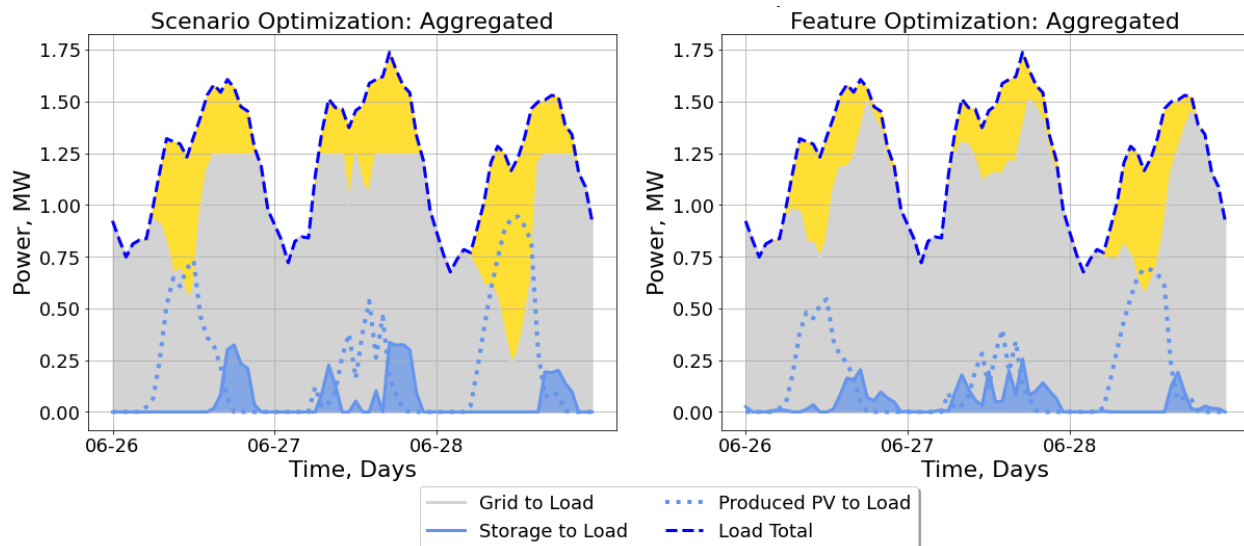
- b. Process Features with REopt Command: Post-process general results for each project feature (building).

```
uo process -e -f <path/to/FEATUREFILE.json> -s <path/to/REOPTSCENARIOFILE.csv>
```

4. (120 mins) Repeat this process for the other project directory/other feature file (coincident or diverse)
5. (120 mins) Write a 1-2 Page Report: Analyze the results and compile a report:
 - a. Size of solar PV and battery (located in the ProjectFolder/run/REopt_scenario folder)
 - i. Scenario Results: scenario_optimization.json

- ii. Feature Results: feature_optimization.json
- b. Other results can be found here (located in the ProjectFolder/run folder)
 - i. Scenario Results: scenario_optimization.csv
 - ii. Feature Results: feature_optimization.csv
- c. Report must contain:
 - i. Brief description of the PV and battery systems to be used by the REopt optimization
 - ii. A table comparing the PV and battery capacities for each building feature when using the two optimization methods.
 - iii. A comparison of total energy use and net present value between the two cases.
 - iv. Figures comparing the timeseries energy performance over a 3-day period of your choosing showing total-load, PV-to-load, grid-to-load, and storage usage. Select data to plot that illustrates the differences in system performance (if there are any). You should have two figures for this purpose, one for each optimization method, both covering the same 3-days. Both figures should plot the baseline (no optimization) total electricity use profile as a reference.
 - v. A discussion on the advantages and limitations of optimization at the community-scale vs. at the individual-building scale.

Note: Below is an example timeseries plot for your reference. This figure is meant to illustrate one option for showing how the REopt results can be visualized using a combination figure with line and stacked area charts



Deliverables: (Week 6)

- o A 1-2 page report as stated in Task #5.