



Student Project Activity #1: Temporal Demand Diversity

Overview

The purpose of this activity is to learn the basic commands used in an URBANopt project while introducing the students to the concept and benefits of load diversity in terms of building energy modeling. The students will simulate two provided example districts that have the same total annual energy usage, but different operational schedules. Both districts consist of the same buildings including malls, hotels, offices, residences, restaurants, and schools. One of the projects have “coincident” loads meaning that the energy load profiles of all of the buildings happen at the same time, whereas the other project includes “diverse” loads meaning the total energy load profiles vary throughout the day.

Tasks

1. (5 mins) Use the Create Project Command to create your class project directories:

[Create Project Tutorial Video](#)

Create two project directories in a folder in your root directory:

- a. Create a new folder in your working directory (On Windows, creating it in the root directory is recommended, e.g, C:/class_project; for macOS, create the directory in your home directory, e.g., ~/class_project)



Tip: At any time, you can type `uo -h`` to get help on the command line methods. You can also get help with subcommands by appending `-h`` to the commands, e.g., `uo create -h``

- b. In your Git Bash or Terminal go to the working folder created in step 1.1 above and use the `uo “create”` method to create two project directories. Name one ‘coincident’ and name the other ‘diverse’.

```
$ cd <working directory>
$ uo create -p coincident -C
$ uo create -p diverse -D
```

2. (5 mins) For each of the two created projects, run the `create scenario` command to generate the scenario CSV files needed to run each scenario.



Warning - Do not change into the project directory to run the commands. All the `uo` commands are to be run in the working directory, not the created project directory.

[Create Run Scenario Tutorial Video](#)

```
$ uo create -s <working dir>/coincident/class_project_coincident.json
>>> Building sample ScenarioFiles, assigning mapper classes to each feature
from class_project_coincident.json
>>> Done

$ uo create -s <working dir>/diverse/class_project_diverse.json
>>> Building sample ScenarioFiles, assigning mapper classes to each feature
from class_project_diverse.json
>>> Done
```

Take a screenshot of your project file directory after creating the scenario files.

Write a short paragraph explaining the project directory structure:

- a. What files do you see in the directory and what is their purpose?
 - b. How many features are in the coincident project?
3. (120 mins) Run Command: Run each feature file using the `baseline_scenario.csv` scenario file. (It is recommended to give each scenario file a unique name to distinguish between coincident and diverse feature files)

```
$ cd <working>
$ uo run -f coincident/class_project_coincident.json -s
coincident/baseline_scenario.csv

>>> Simulating features of 'class_project_coincident.json' as
directed by 'baseline_scenario.csv'...
>>> Lots of simulation output
>>> DONE, result = true
>>> Done Running Scenario

$ uo run -f diverse/class_project_diverse.json -s
diverse/baseline_scenario.csv
```



Tip: This task will take some time. It may appear stalled at the beginning due to the installation of additional resources. It will also require significant processing power as your computer performs the energy simulations. The processes can run in the background but may take up to an hour to complete. To save computational time, you can run more than 2 building simulations in parallel by editing the runner.conf file to set the "num_parallel" value to the number of cores you would like to use.

- a. This command will generate a run folder located in your project folder that contains all the project results.

Note: Troubleshooting errors: If errors occur during the run command, they will be stored in a log file called "in.osw.log" in the run folder for a given scenario. Refer to

4. (10 mins) Process Command: Post-process general results for each feature file. This command may take a couple minutes each to run.

[Process Scenario Tutorial Video](#)

```
$ cd <working>
$ uo process -d -f coincident/class_project_coincident.json -s
  coincident/baseline_scenario.csv
>>> Done

$ uo process -d -f diverse/class_project_diverse.json -s
  diverse/baseline_scenario.csv
>>> Done
```

The command will create a `default_scenario_report.csv` file in your <working>/[coincident|diverse]/run/ direction. This will be used later in the post processing step 7 below.

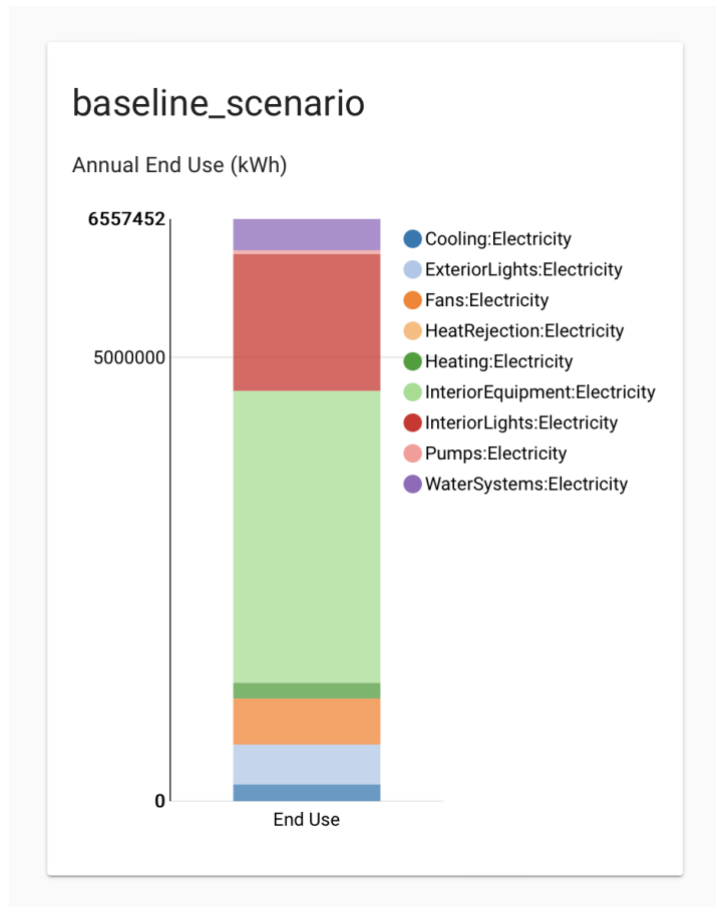
5. (5 min) Visualize Command: visualize the results of each project scenario.

[Visualize Scenario Tutorial Video](#)

```
$ cd <working>
$ uo visualize -f coincident/class_project_coincident.json
>>> Creating visualizations for all Scenario results
>>> Done

$ uo visualize -f diverse/class_project_diverse.json
>>> Creating visualizations for all Scenario results
>>> Done
```

This command will create an HTML file with standard plots of the results of your run. Open the HTML file to view the results for each case (coincident and diverse). Note that more post-processing will be conducted in the following step. An example plot that is contained in the `scenario_comparison.html` is shown below.



6. (180mins) Write a 2-page Report:

- a. Using the results located at <working>/[coincident|diverse]/run/scenario/default_scenario_report.csv file, create figures for both the diverse and coincident projects showing:
 - i. The electrical energy used over a 3-day period of your choosing.
 - ii. The total annual energy use
 - iii. The monthly peak electricity demand

Note: Feel free to use any tool to generate these plots (i.e., you can use MS Excel or a custom Python script to plot)
- b. Using the results located at <working>/[coincident|diverse]/run/scenario_comparison.html file, extract the following figures:
 - i. Monthly Fuel Use, Monthly Net Energy, and Annual End Uses
- c. Discuss the impact of load diversity on district energy use by comparing the energy use between the two projects. Refer to the figures you created in 6a & 6b.

Deliverables (Week 2-3)

- Screenshot of the project directory after creating the scenario files.
- Paragraph describing the files in the project directory
- Screenshot of scenario_comparison.html file charts.
- Graphical comparison between the coincident and diverse load profiles.
- A 2-page report as stated in Task #6.