



## REopt Lite Tutorial: Resilience Inputs

This tutorial gives an overview of a resilience modeling analysis in the [REopt Lite™ web tool](#). Find additional REopt Lite [tutorials](#).

The following example uses the same input data as provided in the “sample site” option within the web tool.

### Inputs

Step 1: Choose the resilience focus (Figure 1)

#### Step 1: Choose Your Focus

Do you want to optimize for financial savings or energy resilience?



Figure 1. Choose the resilience analysis button

The primary objective for the resilience and financial focus is the same—life cycle cost minimization. However, the resilience focus adds an additional constraint wherein the technologies must meet the critical load without the utility grid during an outage period.

Step 2: Enter inputs

Mandatory inputs for all analyses include site location and electricity rate in the Site and Utility section (Figure 2), and either custom interval data or a building type and annual energy consumption in the Load Profile section (Figure 3). When the “sample site” option is used, these fields populate with:

- Site location: Palmdale, CA
- Electricity rate: Southern California Edison Co: TOU-GS-3, Option B
- Type of building: Retail Store
- Annual energy consumption (kWh): 1,000,000



## Step 2: Enter Your Site Data

Enter information about your site and adjust the default values as needed to see your results.

Figure 2. Site and Utility data section

Figure 3. Load Profile data section

Additional mandatory resilience inputs are entered in the Resilience section. These required fields include critical load and timing details for the outage that you want to model (Figure 4).

### Critical load

The critical load is the load that must be met during the specified grid outage. It can be entered in three ways: as a percentage of the typical load, specified by hourly interval data, or as a combination of load components through the critical load builder. A critical load can be higher or lower than the typical load, depending on the use of the building during a grid outage.



**Resilience** (required) ⊞

**\* Critical load** ?

How would you like to enter the critical energy load profile?

% Percent    Upload    Build

**Critical load factor (%)** ?  default = 50

[Download critical load profile](#) [Chart critical load data](#)

Figure 4. Resilience section and critical load data

The easiest way to specify the critical load is as a percentage (0%–200%) of the typical load. When estimating this number, consider whether the whole building would need power during an outage, or just portions. The percentage of critical load chosen has a big impact on the outputs.

**\* Critical load** ?

How would you like to enter the critical energy load profile?

% Percent    Upload    Build

**\* Custom load profile** ?  no file selected

[Sample custom load profile](#)

[Chart critical load data](#)

Figure 5. Uploading critical load data

The most accurate way to enter the critical load is to upload it (Figure 5). This data may be available if there are submeters on individual buildings that are part of the critical infrastructure, or if a building has a critical load panel that is metered.



## Critical Load Builder



\* Name

Description

\* Load Type Lighting - LED A19 100W equiv

Sort By

Load Type	Power (W)	Quantity	Start Hr.	End Hr.	Start Month	End Month	
Lighting - LED A19 100W equiv	14 <input type="text"/>	100 <input type="text"/>	6 <input type="text"/>	18 <input type="text"/>	January <input type="text"/>	Decem <input type="text"/>	
HVAC - Airconditioner	1000 <input type="text"/>	1 <input type="text"/>	0 <input type="text"/>	24 <input type="text"/>	May <input type="text"/>	Septem <input type="text"/>	

After saving this custom critical load, it will be available for selection from the Critical Load Profile dropdown.

Figure 6. REopt Lite Critical Load Builder

Finally, you can build your own critical load profile from common load components (Figure 6). To build a critical load, you must be logged in before starting to enter any of your evaluation inputs. The Critical Load Builder allows you to add load types, such as air conditioning units, lighting, or printers. The Power, Quantity, Start Hour, End Hour, Start Month, and End Month fields are prepopulated by defaults, but can be adjusted. Once you save the critical load profile, it will be available for future analyses when you are logged in to REopt Lite.

### Outage information

Unless you are modeling a planned outage, you need to determine what outage timing details will have most relevance for the modeling of unexpected outages at your facility. The outage duration that you need the system to survive might be anything from a few hours to several weeks. In general, selecting an outage start date when the site's load is higher (often summer) will result in larger system sizes that can sustain the critical load during more outages. Selecting an outage period during a time of year when the site's load is lower will result in smaller system sizes that sustain the critical load during fewer outages. However, solar and/or wind resource will also impact the resiliency of the system. You can specify if this is an outage that occurs once a year, or once per project lifetime. Your selection here will not impact the system sizes, just financial results.



The outage details for this tutorial are shown in Figure 7:

- Outage duration: 168 hours (one week)
- Outage start date: January 4
- Outage start time: 12 a.m. (midnight)
- Type of outage event: Major outage (default)

\* Outage information

\* Outage duration (hours) [?](#)

\* Outage start date [?](#)  [Autoselect using critical load profile \[?\]\(#\)](#)

\* Outage start time [?](#)

Type of outage event [?](#)

Figure 7. Modeling a potential grid outage

You can also click the link next to the Outage start date field to autoselect the outage start date based on your critical load profile. By clicking “start outage on peak” on the resulting pop-up window (Figure 8), the maximum power requirement of your critical load will be included in the outage, which can often help to plan for a worst-case scenario.

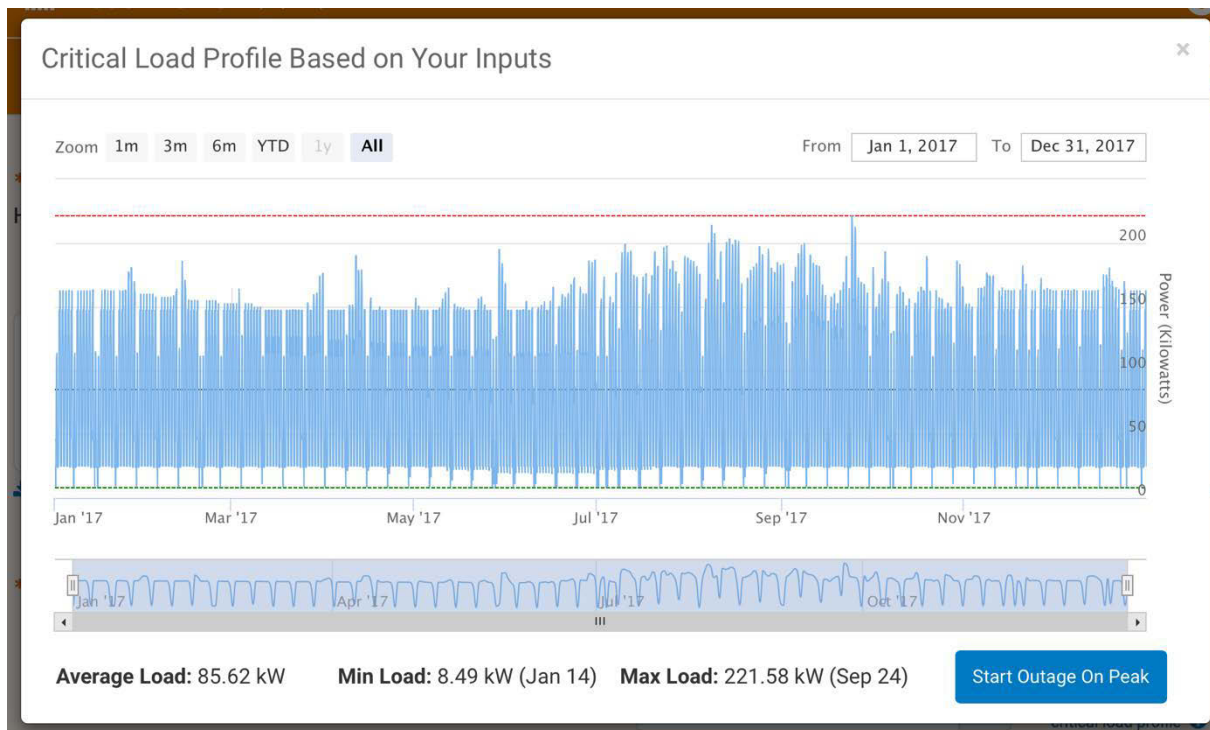


Figure 8. Critical load profile outputs



Step 3: Choose the technology option to be evaluated

## Step 3: Select Your Technologies

Which technologies do you wish to evaluate?

The screenshot shows four buttons for technology selection. The first button, 'PV', has a checked checkbox and a sun icon. The second button, 'Battery', has a checked checkbox and a battery icon. The third button, 'Wind', has an unchecked checkbox and a wind turbine icon. The fourth button, 'Generator', has a checked checkbox and a lightning bolt icon.

Figure 9. Evaluate PV, battery, wind, and/or backup generator technologies in your resilience modeling analysis

Specify details about the technologies chosen for evaluation if desired.

When conducting an analysis with a resilience focus, you can select to model a backup generator during the outage (Figure 9). The generator will not run unless the grid is down. REopt Lite will recommend the optimal size for the generator. For a new generator, the evaluation will include installed costs along with fuel costs. You can also specify an existing generator, which will be the minimum size used in the optimization, although REopt Lite may also recommend additional new generator capacity. The evaluation will include only fuel costs for any existing generator. The default inputs are for a diesel generator, but these can be edited to model a natural gas generator.

### Learn More

For more information on tool inputs and default values, please see the [REopt Lite Web Tool User Manual](#).

Find additional REopt Lite tutorial documents and videos on [reopt.nrel.gov/user-guides.html](https://reopt.nrel.gov/user-guides.html).



NREL's REopt Lite web tool helps users evaluate the economic viability of grid-connected PV, wind, and battery storage systems at a site. It identifies system sizes and battery dispatch strategies to minimize energy costs, and estimates how long a system can sustain the site's critical load during a grid outage.

Learn more about REopt Lite at [reopt.nrel.gov/tool](https://reopt.nrel.gov/tool).

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