

# QuEST Performance Tutorial



# QuEST Performance Tutorial

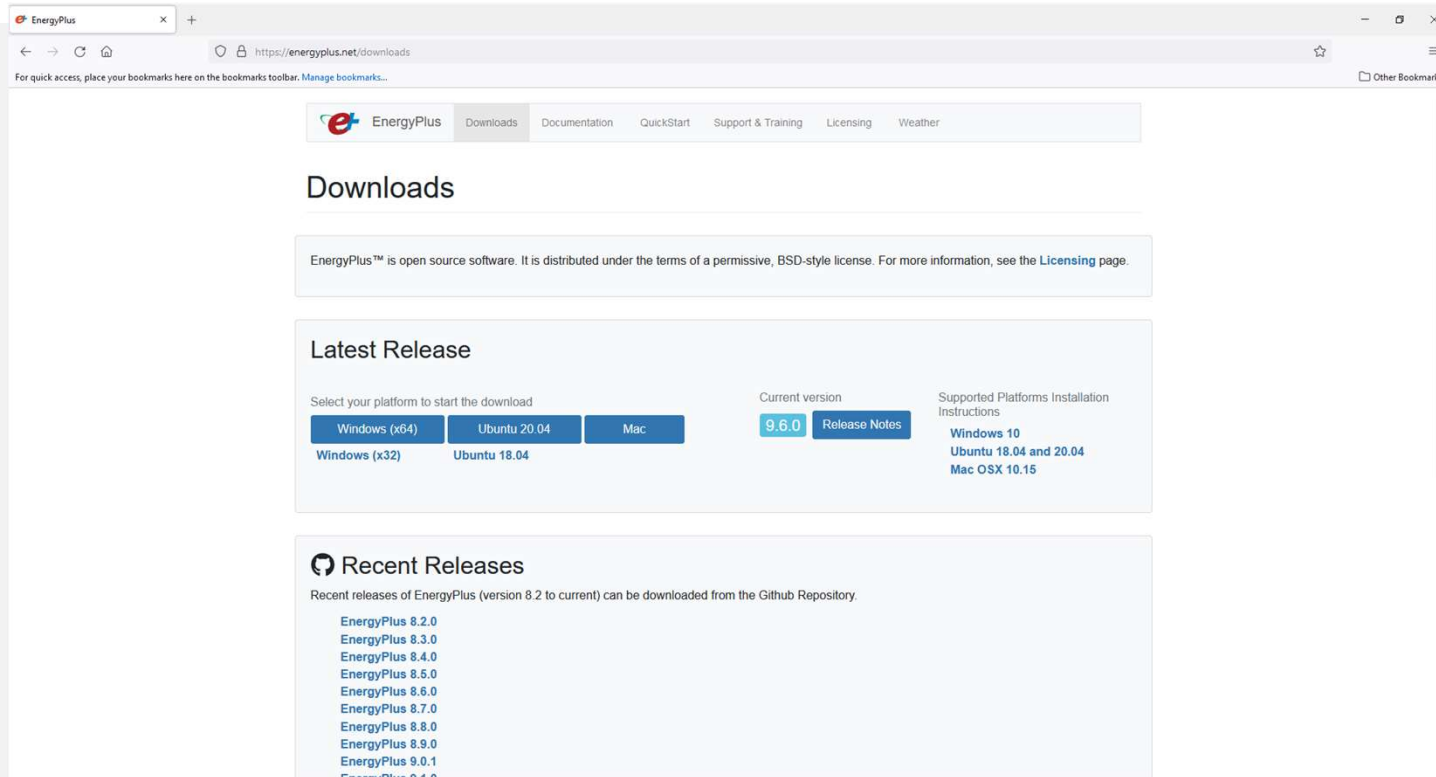
In this tutorial, a basic example will be introduced to enable the user to use the QuEST Performance Tool

The tutorial will cover the following:

- How to download EnergyPlus
- How to download the weather data using QuEST Data Manager
- How to run a QuEST Performance simulation after a QuEST valuation run

For this example, our location will be New York City.

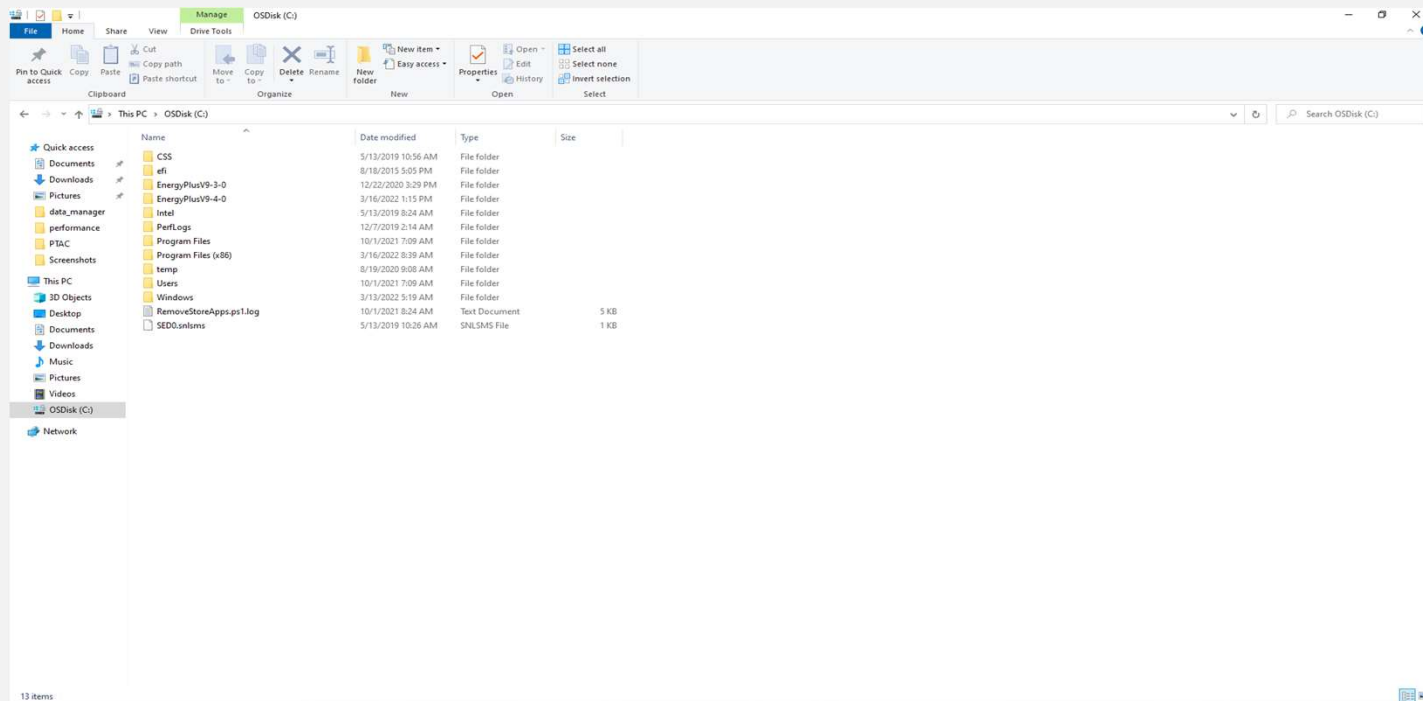
# Download EnergyPlus



Open a web browser and navigate to <https://energyplus.net/downloads>



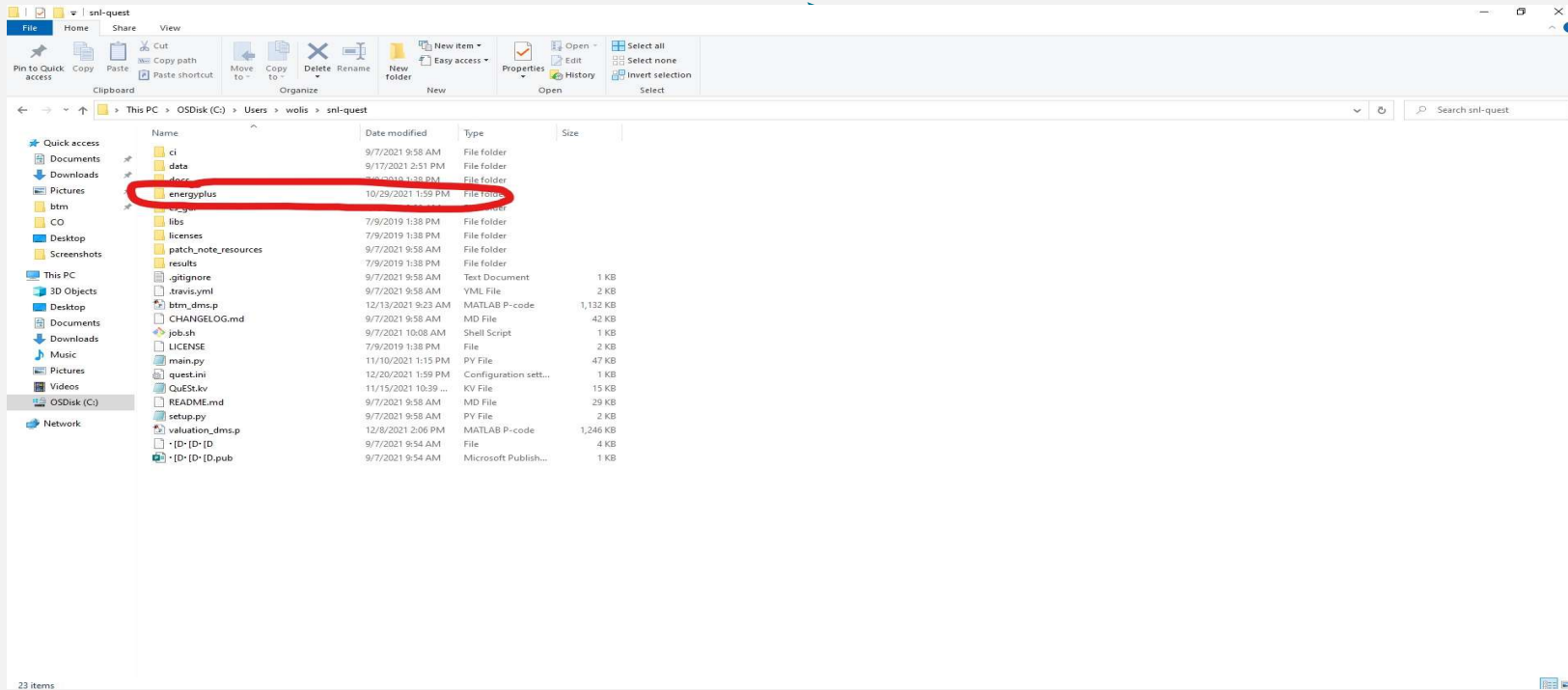
# Download EnergyPlus



Download the latest version

Find the EnergyPlusVx-y-z on your drive (x, y, and z represent the version number)

# Download EnergyPlus



Copy and paste this file into the Quest directory (folder). Rename to “energyplus”

# Download Weather Data

The screenshot shows the QuEST web application interface. At the top, there is a dark blue header with the QuEST logo on the left and navigation links (home, about, settings) on the right. Below the header, the main content area is divided into two columns. The left column features a vertical stack of four tool icons and labels: QuEST Data Manager (with a server rack icon), QuEST Valuation (with a dollar sign icon), QuEST BTM (with a power plant icon), QuEST Performance (with a line graph icon), and Technology Selection (with an eye icon). The right column contains a user prompt 'New or returning user?' with a 'Take a quick tour' button. Below this is the 'QuEST Data Manager' section, which describes its function in managing data from various sources and lists specific data types: ISO/RTO historical market data, U.S. utility rate structures/tariffs, Commercial and residential building load profiles, Photovoltaic power system profiles, and Weather data. A large blue 'Get started' button is positioned below the list. At the bottom of the page, there is a copyright notice and logos for the U.S. Department of Energy and the National Nuclear Security Administration.

QuEST

home about settings

New or returning user?

Take a quick tour

**QuEST Data Manager**

Manages the acquisition of data from ISO/RTOs, databases, and other sources for use in QuEST applications, including:

- \*ISO/RTO historical market data
- \*U.S. utility rate structures/tariffs
- \*Commercial and residential building load profiles
- \*Photovoltaic power system profiles
- \*Weather data

Get started

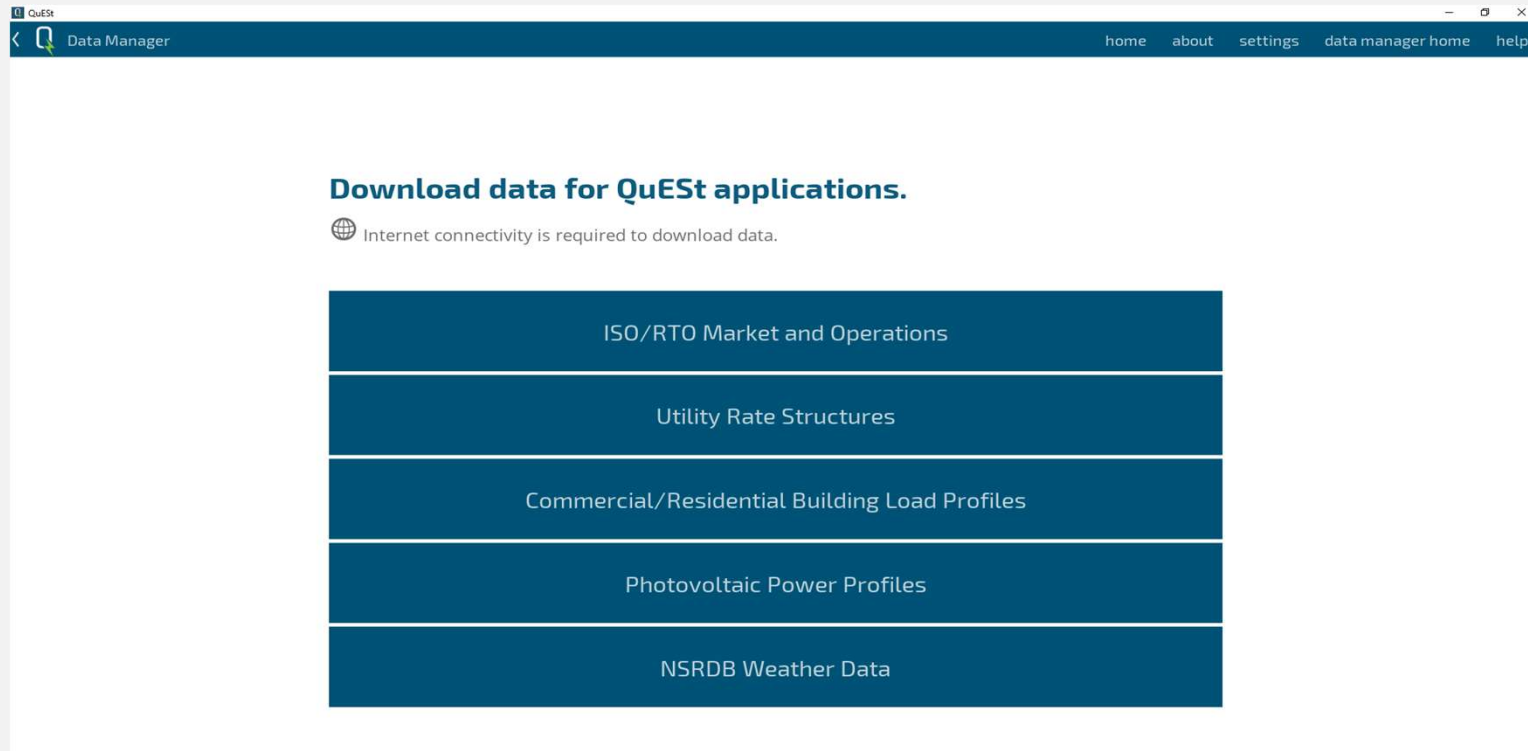
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Open QuEST, head to the Data Manager Tool.




# Download Weather Data



Open NSRDB Weather Data tab.

# Download Weather Data

**Search for a weather file.**

Data.gov API key 

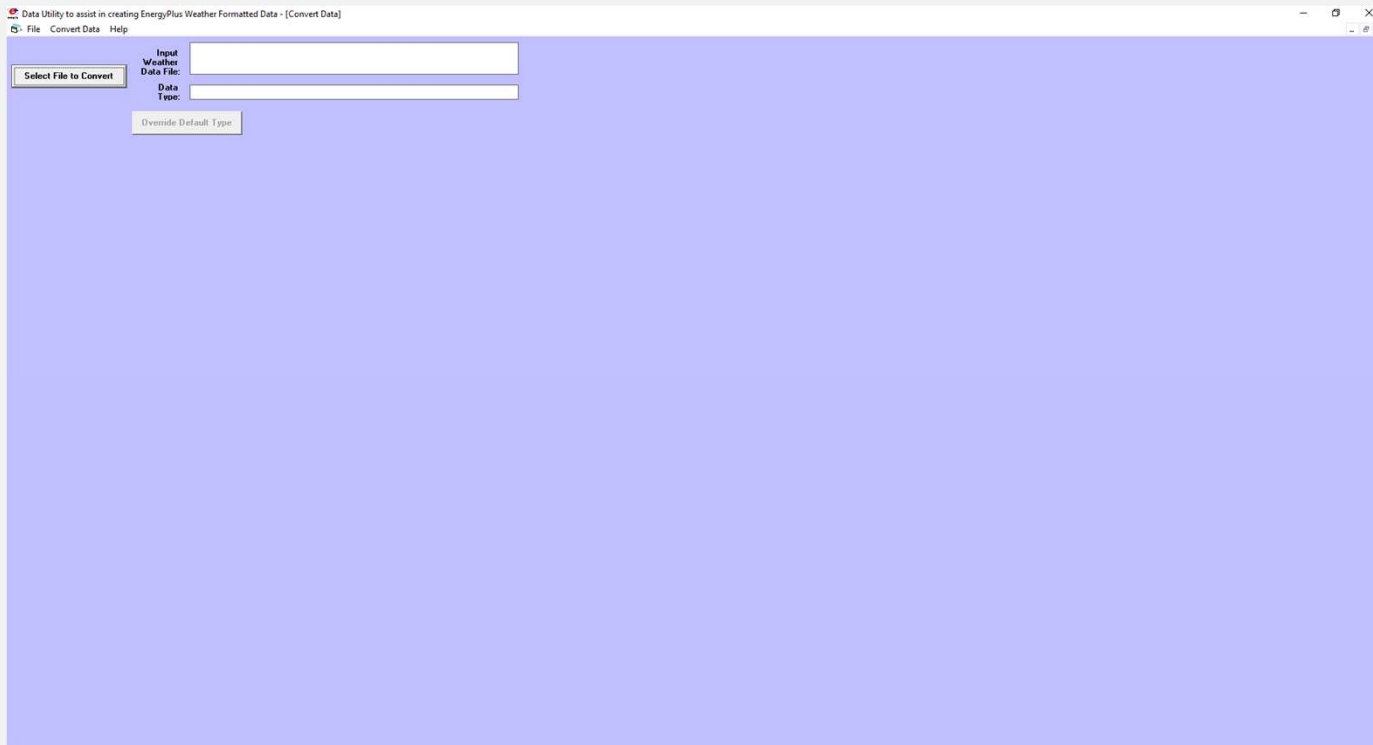
<b>location</b>	Location for directory purposes.	<input type="text" value="NY"/>	<b>latitude</b>	The latitude of the site in the range (-90, 90).	<input type="text" value="40.73061"/>
<b>longitude</b>	The longitude of the site in the range (-180, 180).	<input type="text" value="-73.935242"/>	<b>year</b>	Year of requested data	<input type="text" value="2020"/>
<b>leap year</b>	The leap year parameter. If true will return leap day data if present.	<input type="text" value="true"/>	<b>utc</b>	Universal time code. True will use UTC, false will use local time zone of data.	<input type="text" value="false"/>
<b>email</b>	Your email	<input type="text" value="nail@email.co"/>	<b>mailing list</b>	Do you want to sign up for their mailing list?	<input type="text" value="false"/>

Enter your data.gov API key along with the information requested for the download. All fields are required. Once ready click save.





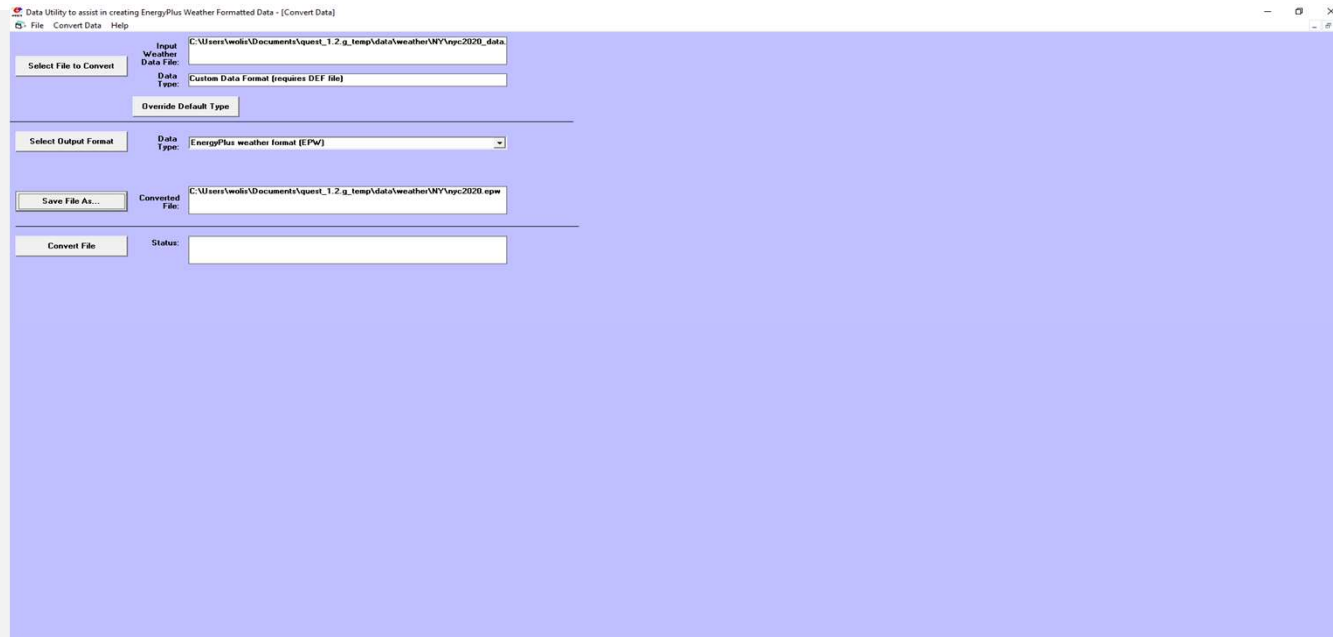
# Download Weather Data



After clicking the save button, the EnergyPlus weather converter will open.

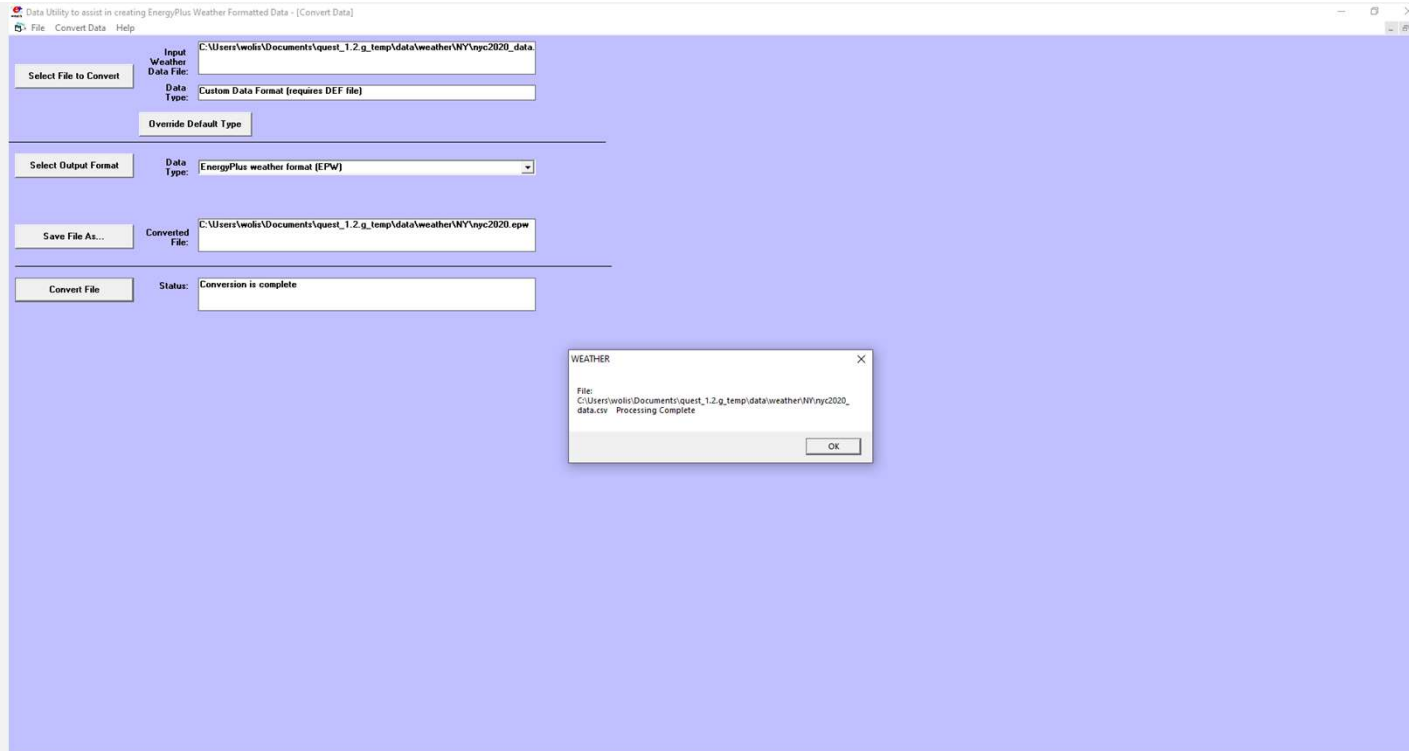


# Download Weather Data



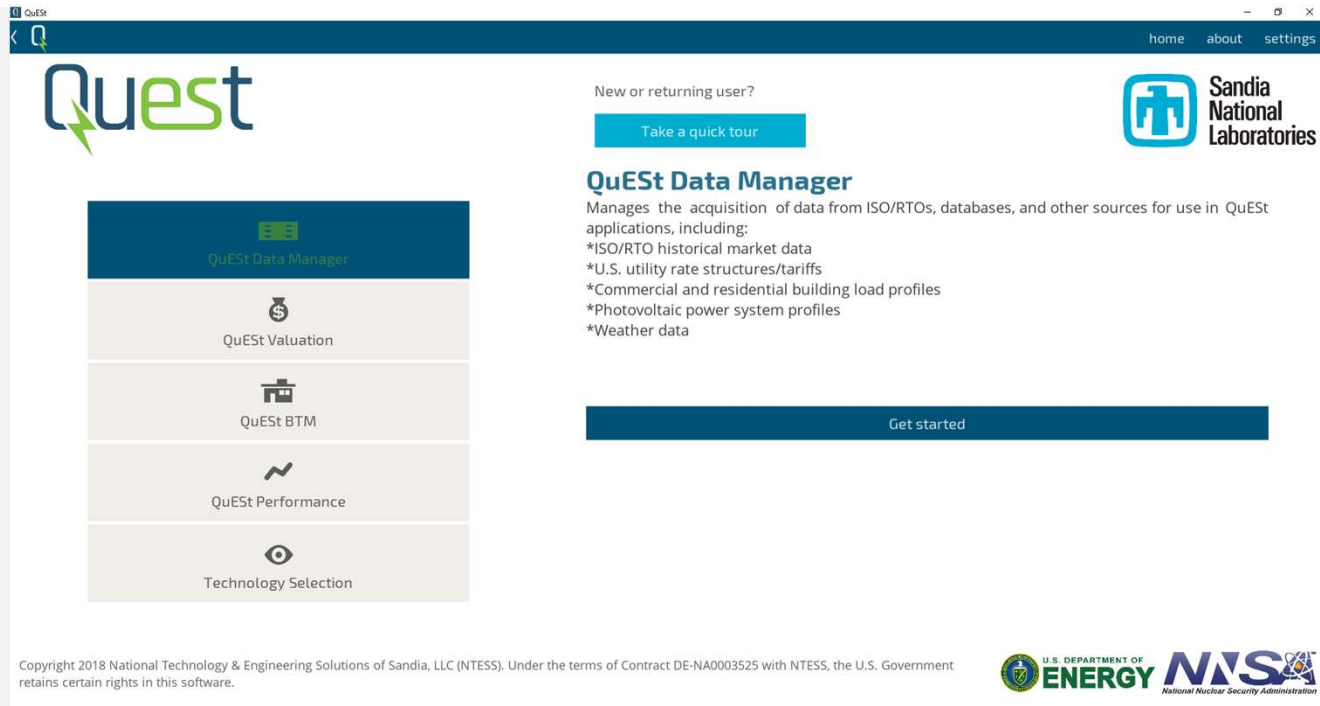
To convert the weather data, click “Select File to Convert” and navigate to QuEST/data/weather/NY/. Select the “nyc\_2020\_data.csv”. Click select output format which will default to EnergyPlus weather format (EPW). Click save file as and enter your desired file name.

# Download Weather Data



Click convert file. When finished click ok and close out the weather converter. Done!

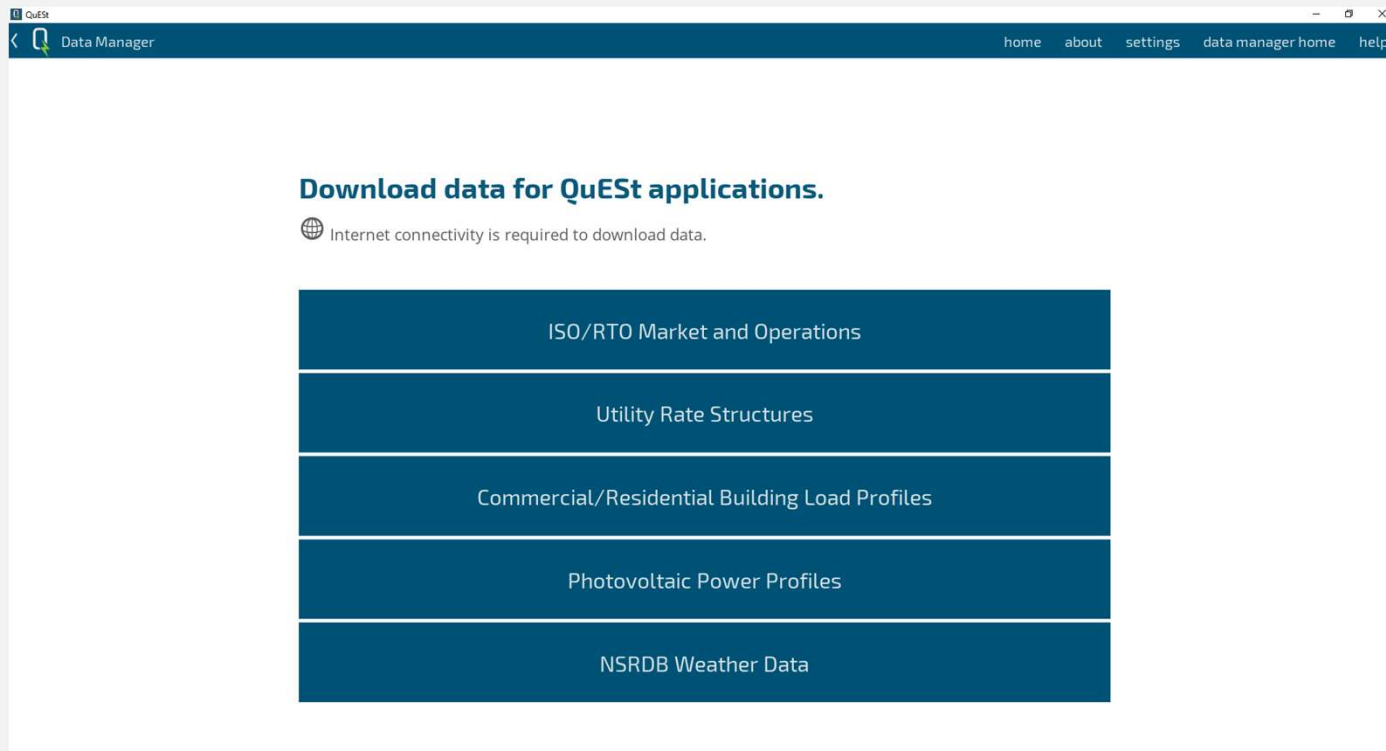
# Run QuEST Valuation



- First we need to download NYISO data. If you are familiar with this, feel free to skip ahead.
- Open QuEST, head to the Data Manager Tool.



# Run QuEST Valuation



- Select ISO/RTO Market and Operations from the options.

# Run QuEST Valuation

The screenshot shows the QuEST Data Manager interface. At the top, there's a navigation bar with links: home, about, settings, data manager home, and help. Below this, the main heading is "Download ISO/RT0 market and operations data." Underneath, there are tabs for different ISOs: SPP, PJM, NYISO (which is highlighted), MISO, ISO-NE, ERCOT, and CAISO. The NYISO tab is active, showing a form with two sections: "Range of months" and "Types of nodes". In the "Range of months" section, the "Start:" field is set to "January 2020" and the "End:" field is set to "January 2021". In the "Types of nodes" section, the "Zonal" checkbox is checked, and the "Generators" checkbox is unchecked. At the bottom right of the form, there are "Download" and "Cancel" buttons. Below the form, there is a "Settings" button.

- Select the NYISO tab. Set the range of months from January 2020 to December 2020. Check the Zonal nodes box. Make sure your settings are correctly configured, click download.

# Run QuEST Valuation

The screenshot shows the QuEST web application interface. At the top, there is a dark blue header with the QuEST logo on the left and navigation links for 'home', 'about', and 'settings' on the right. Below the header, the main content area is divided into two columns. The left column features a vertical menu with five options: 'QuEST Data Manager' (with a list icon), 'QuEST Valuation' (highlighted in dark blue with a green dollar sign icon), 'QuEST BTM' (with a house icon), 'QuEST Performance' (with a line graph icon), and 'Technology Selection' (with an eye icon). The right column contains a 'New or returning user?' section with a 'Take a quick tour' button. Below this is the 'QuEST Valuation' section, which includes a brief description: 'Estimates value for an energy storage system providing ISO/RTO services. Uses historical data to determine the maximum amount of revenue that the energy storage system could have generated by stacking multiple services/value streams (e.g., ancillary services, energy arbitrage). This retrospective analysis estimates value from future cash flows.' A large 'Get started' button is positioned below the description. In the top right corner, the Sandia National Laboratories logo is displayed. At the bottom of the page, there is a copyright notice: 'Copyright 2018 National Technology & Engineering Solutions of Sandia, LLC (NTESS). Under the terms of Contract DE-NA0003525 with NTESS, the U.S. Government retains certain rights in this software.' To the right of the notice are the logos for the U.S. Department of Energy and the National Nuclear Security Administration (NNSA).

QuEST

home about settings

New or returning user?

Take a quick tour

**QuEST Valuation**

Estimates value for an energy storage system providing ISO/RTO services. Uses historical data to determine the maximum amount of revenue that the energy storage system could have generated by stacking multiple services/value streams (e.g., ancillary services, energy arbitrage). This retrospective analysis estimates value from future cash flows.

Get started

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- Navigate to the QuEST Valuation tool.



# Run QuEST Valuation

The screenshot shows the QuEST Batch Runs interface. At the top, there's a navigation bar with links: home, about, settings, view results, and batch runs. Below the navigation bar, the main heading is "Run multiple valuations with one click." The interface is divided into two main sections: "NYISO" and "Arbitrage".

**NYISO Section:**

- Section title: "Select a pricing node."
- Filter by name: A text input field.
- Node list: A list of pricing nodes: CAPITL, CENTRL, DUNWOD, GENESE, HUD VL, LONGIL, MHK VL, MILLWD, **N.Y.C.** (highlighted), NORTH, and WEST.

**Arbitrage Section:**

- Section title: "Select months to evaluate."
- Month list: A list of months from January 2020 to December 2020, all of which are selected (highlighted in blue).

At the bottom of the interface, there are three buttons: "Data" (grey), "Parameters" (blue), and "Go!" (green).

- Click on the Batch Runs Button -> select NYISO from the pull down options -> select N.Y.C. from the node options -> select arbitrage from the pull down options -> select all months of the year.



# Run QuEST Valuation

The screenshot shows the 'Batch Runs' interface of the QuEST tool. The header bar includes a back arrow, the QuEST logo, and the text 'Batch Runs'. On the right side of the header are navigation links: 'home', 'about', 'settings', 'view results', and 'batch runs'. Below the header, the main heading reads 'Run multiple valuations with one click.'.

The interface contains a grid of input fields for various parameters:

self-discharge efficiency (%/h)	100	round trip efficiency (%)	85	energy capacity (MWh)	1
power rating (MW)	1	initial state of charge (%)	50	minimum state of charge (%)	5
maximum state of charge (%)	95	% of reg. bid reserved for discharging	0	% of reg. bid reserved for charging	0
frac. of reg. up capacity deployed	0.25	frac. of reg. down capacity deployed	0.25	performance score	0.95

Below the input fields, there is an 'Optional: parameter sweep' section. It includes a dropdown menu labeled 'Select a parameter to sweep' and three input fields: 'min', 'max', and '# of steps'.

At the bottom of the interface, there are three buttons: 'Data' (dark blue), 'Parameters' (grey), and 'Go!' (green).

- Click the Parameters tab. Change the energy capacity to 1 MWh and the power rating to 1 MW. Change the minimum state of charge to 5% and the maximum state of charge to 95%.
- Once everything looks correct, click Go! Once the simulations are finished, navigate back to the home page.

# Run QuEST Performance

The screenshot shows the QuEST web application interface. At the top, there is a dark blue header with the QuEST logo on the left and navigation links (home, about, settings) on the right. Below the header, the main content area is divided into two sections. On the left, there is a vertical menu with five options: QuEST Data Manager, QuEST Valuation, QuEST BTM, QuEST Performance (highlighted in dark blue), and Technology Selection. On the right, there is a section for new or returning users with a 'Take a quick tour' button. Below this, the 'QuEST Performance' section is displayed, featuring a description: 'Estimates the effect heating and cooling loads have on battery energy storage performance.' and a large 'Get started' button. At the bottom of the page, there is a copyright notice and logos for the U.S. Department of Energy and NASA.

QuEST

home about settings

New or returning user?

Take a quick tour

**QuEST Performance**

Estimates the effect heating and cooling loads have on battery energy storage performance.

Get started

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U.S. DEPARTMENT OF ENERGY NASA National Nuclear Security Administration

- Navigate to the QuEST Performance tool.



# Run QuEST Performance

The screenshot shows the QuEST Performance Simulations web interface. At the top, there is a navigation bar with links for home, about, settings, and help. Below the navigation bar, the main heading is "Run performance simulations." The interface is divided into three main sections: "Select an input file", "Select weather file", and "Select battery profile".

- Select an input file:** This section has a dropdown menu showing "1ZoneUncontrolled\_wESS\_hvactemplate\_ptacexp2.idf" and "container\_wESS\_ptac.idf".
- Select weather file:** This section has a dropdown menu showing "nyc2020.epw".
- Select battery profile:** This section has a dropdown menu showing months from December to January.

At the bottom of the interface, there are two buttons: "Ready" (green) and "Go" (grey). The "Ready" button is currently active.

- Enter the Performance Simulations option. Select PTAC from the HVAC options. Select the provided input file describing a BESS in a shipping container. Select NY from the location dropdown. Select the weather file downloaded previously. Select the Valuation run from the Profile dropdown. Select the six months available.

# Run QuEST Performance

The screenshot shows the 'Performance Simulations' window of the QuEST software. The window has a dark blue header with the QuEST logo and navigation links: 'home', 'about', 'settings', and 'help'. Below the header, the title 'Run performance simulations.' is displayed. The main area contains ten input fields for various parameters, arranged in two columns. The parameters and their values are: Energy Capacity (MWh) = 1, Power Rating (MW) = 1, Self-Discharge Efficiency = 1, Power Electronics Efficiency = 0.93, Battery Cell Ah Rating = 2.5, Battery Cell Voltage Rating = 3.6, Battery Cell Internal Resistance = 0.02, Battery Cell k Parameter = 0.005, Heating Setpoint (C) = 15, Cooling Setpoint (C) = 40, and Insulation (m² K/W) = 0. At the bottom, there are four buttons: 'Data' (dark blue), 'Parameters' (light gray), 'Ready' (green), and 'Go!' (light green).

Parameter	Value
Energy Capacity (MWh)	1
Power Rating (MW)	1
Self-Discharge Efficiency	1
Power Electronics Efficiency	0.93
Battery Cell Ah Rating	2.5
Battery Cell Voltage Rating	3.6
Battery Cell Internal Resistance	0.02
Battery Cell k Parameter	0.005
Heating Setpoint (C)	15
Cooling Setpoint (C)	40
Insulation (m² K/W)	0

- Click the Parameters tab. Leave the default parameters as is, click the Ready Button.

# Run QuEST Performance

The screenshot shows a web application titled "Performance Simulations" with a navigation bar containing "home", "about", "settings", and "help". The main heading is "Run performance simulations." Below this, there are three sections: "HVAC:", "Location:", and "Profile:". The "HVAC:" section shows "PTAC" and "container\_wESS\_ptac.idf". The "Location:" section shows "NY" and "nyc2020.epw". The "Profile:" section shows "Valuation Jul 18, 2022 13:59:38" and a list of months from December to January. To the left of the "Profile:" section is a red label "Selections". To the right of the "Profile:" section is a "System Parameters:" section with various values: Insulation (m² K/W): 0.0, Cooling Setpoint (C): 40.0, Heating Setpoint (C): 15.0, Battery Cell k Parameter: 0.005, Battery Cell Internal Resistance: 0.02, Battery Cell Voltage Rating: 3.6, Battery Cell Ah Rating: 2.5, Power Electronics Efficiency: 0.93, Self-Discharge Efficiency: 1.0, Power Rating (MW): 1.0, and Energy Capacity (MWh): 1.0. At the bottom, there are four buttons: "Data", "Parameters", "Ready", and "Go".

**HVAC:**  
PTAC  
container\_wESS\_ptac.idf

**Location:**  
NY  
nyc2020.epw

**Profile:**  
Valuation Jul 18, 2022 13:59:38  
December  
November  
October  
September  
August  
July  
June  
May  
April  
March  
February  
January

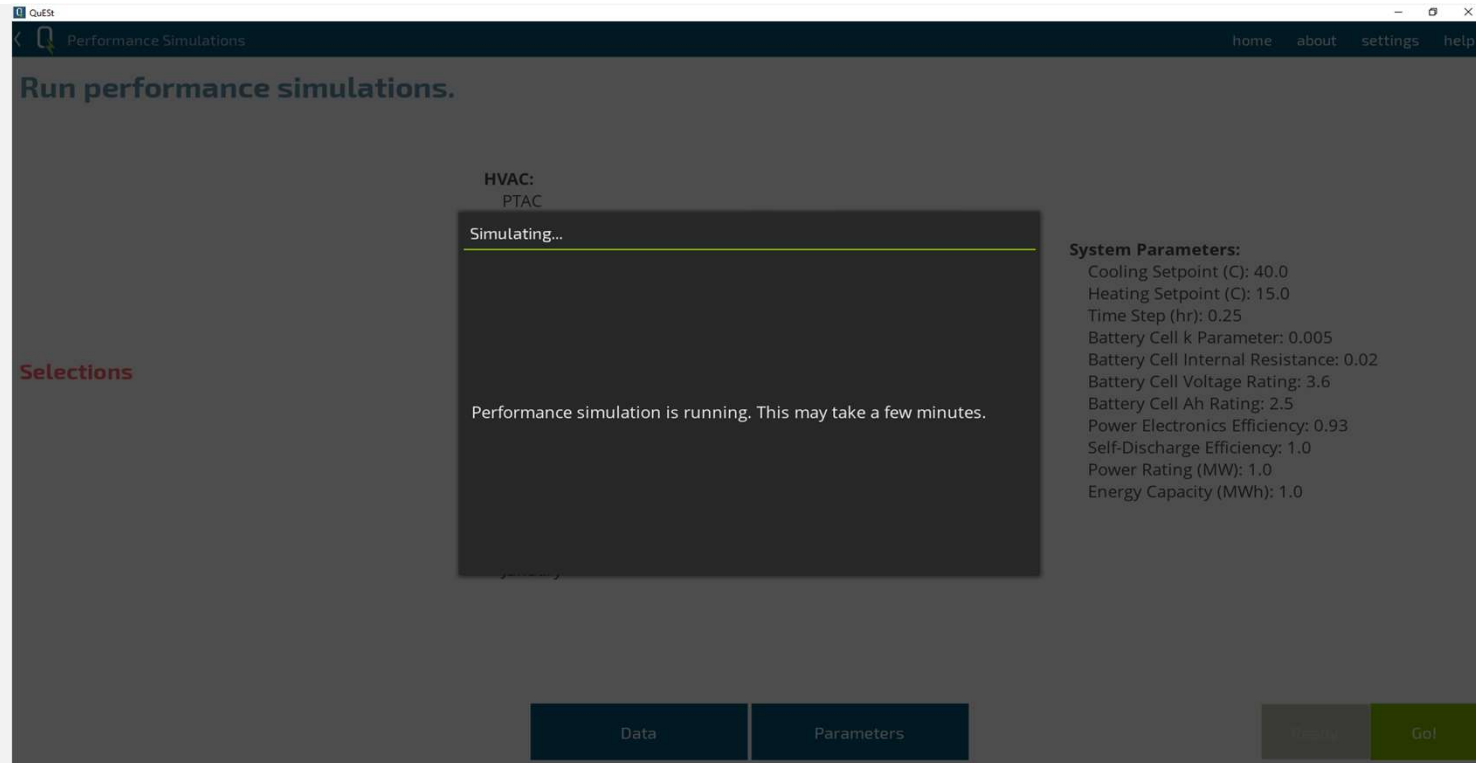
**System Parameters:**  
Insulation (m² K/W): 0.0  
Cooling Setpoint (C): 40.0  
Heating Setpoint (C): 15.0  
Battery Cell k Parameter: 0.005  
Battery Cell Internal Resistance: 0.02  
Battery Cell Voltage Rating: 3.6  
Battery Cell Ah Rating: 2.5  
Power Electronics Efficiency: 0.93  
Self-Discharge Efficiency: 1.0  
Power Rating (MW): 1.0  
Energy Capacity (MWh): 1.0

**Buttons:** Data, Parameters, Ready, Go

- The selections made will be displayed. If everything looks correct, press Go!

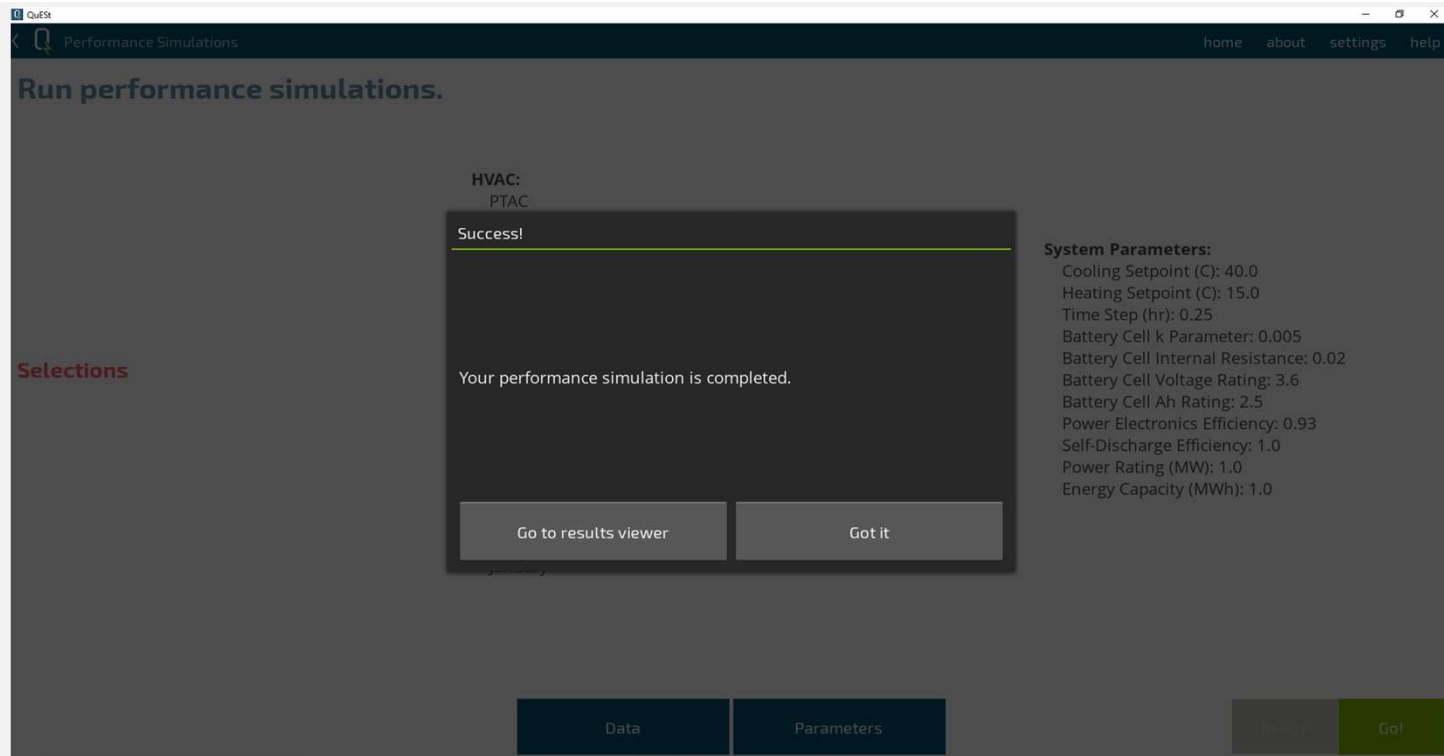


# Run QuEST Performance



- A popup will appear reassuring that the performance simulation is running, which may take a few minutes.

# Run QuEST Performance



- Once the simulation is completed, a new popup will appear saying the simulation is completed. Click "Go to results viewer".

## Run QuEST Performance

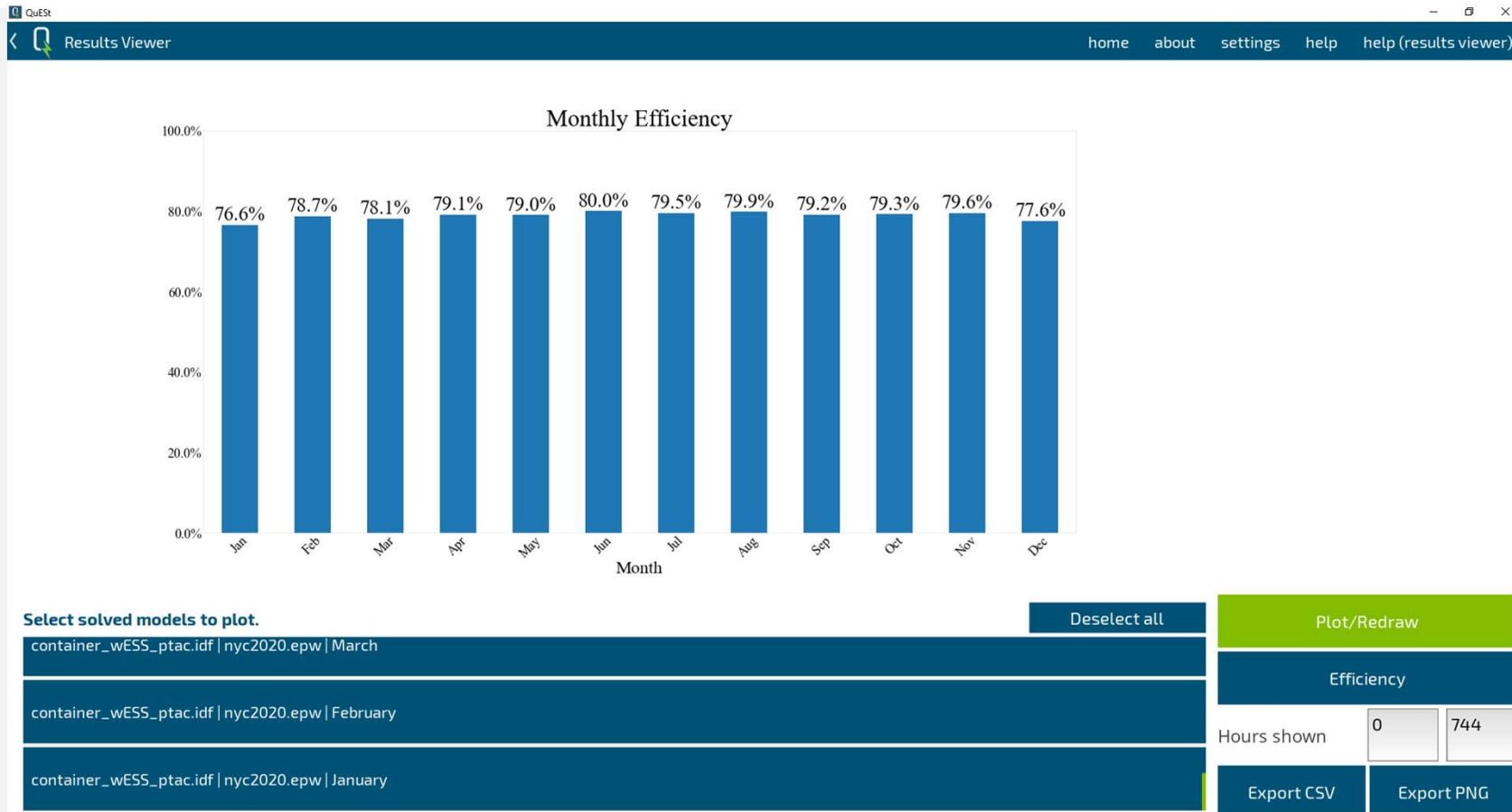
- Select as many runs as you want, the pictures displayed here show all twelve.
- Options to plot are the monthly energy consumption of battery and HVAC, Hourly HVAC or Battery power throughout each month, and the month efficiency of the battery.



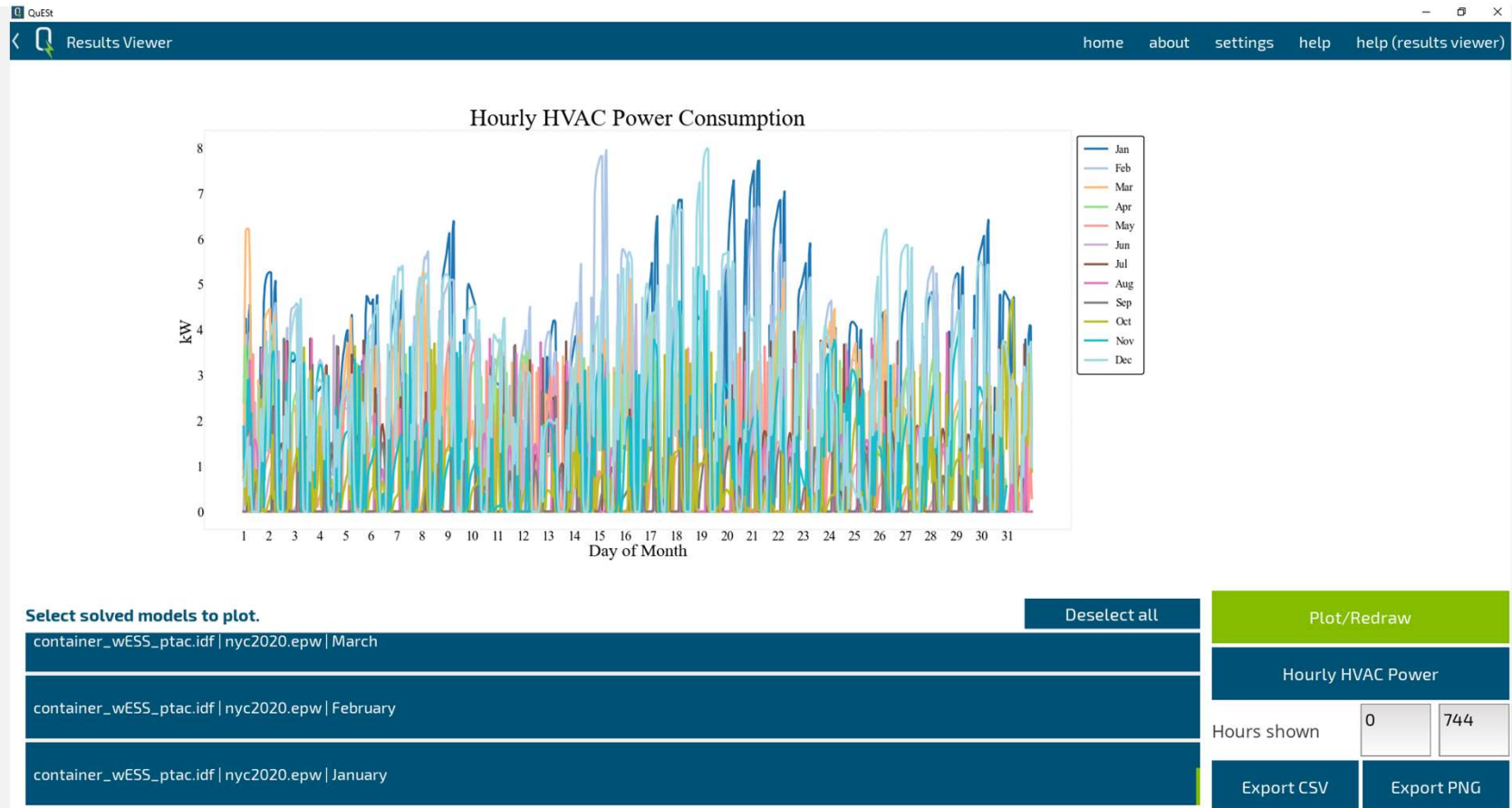
# Run QuEST Performance



# Run QuEST Performance



# Run QuEST Performance



# Run QuEST Performance

