Energy Exemplar

SEPTEMBER 2023

AURORA

Release Notes

VERSION 15.0

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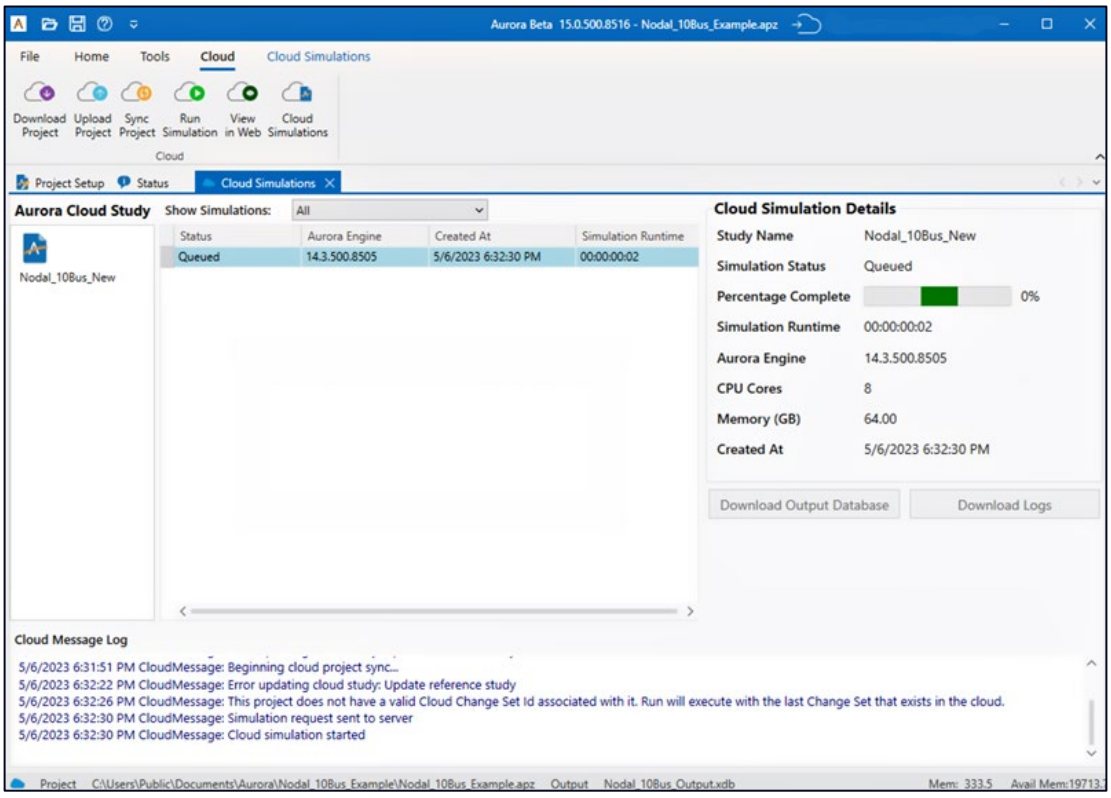
1. Introduction

Cloud Simulation processing is the headline feature of Aurora 15.0. However, this also contains many modeling improvements including better storage performance and a more detailed representation of electrolyzers. You will also see new output database formats.

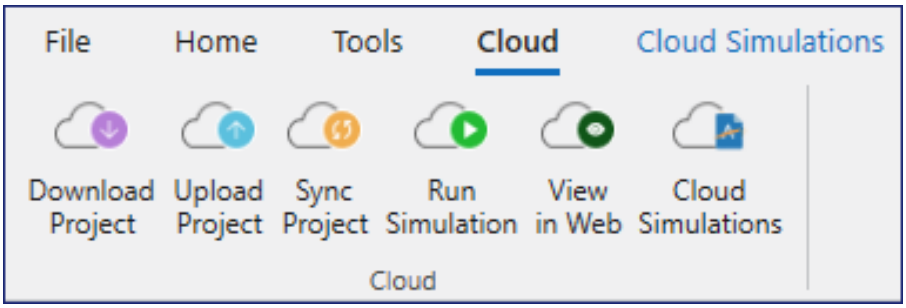
During installation, register Aurora by using your company's registration credentials. Contact Energy Exemplar support at (208) 255-3993 or support@energyexemplar.com if you need assistance.

1.1 Cloud Simulation Processing

Aurora Cloud places powerful, accurate analysis capabilities in your hands with high-performance, cloud-enabled features to scale with your needs. Taking a cloud-enabled approach to your studies enables you to facilitate improved collaboration and access high-performance computing power integrating PLEXOS Cloud, the next-generation SaaS delivery of PLEXOS, which brings you deeper contextual insights into energy market modeling.

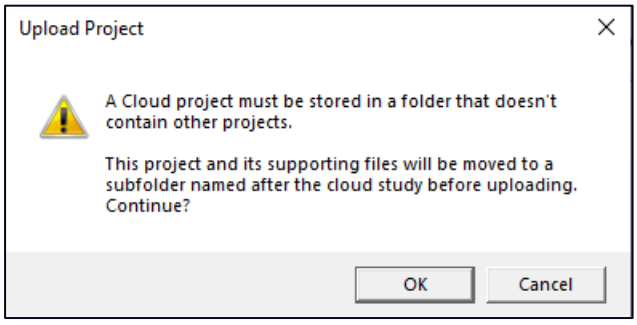


Using Aurora Cloud, you can now upload your projects to the Cloud, sync them, run the simulation in the Cloud, and then download your project results from the Cloud to your local machine. You can view your simulations on the Web and view the status of all your projects in one place.

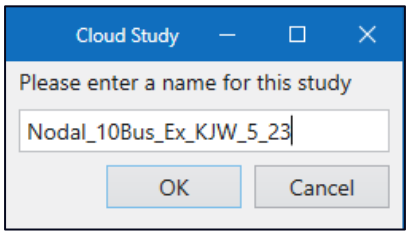


1.2 Upload Project

Use this option to upload an existing local Aurora project to the Cloud environment. When a new project is created, it will copy and move the Aurora project (.apz file and any related files) to a new folder with the same name as the Cloud project. Project references to these files (such as Change Set file or Quick View file) will also be updated in the newly created folder.

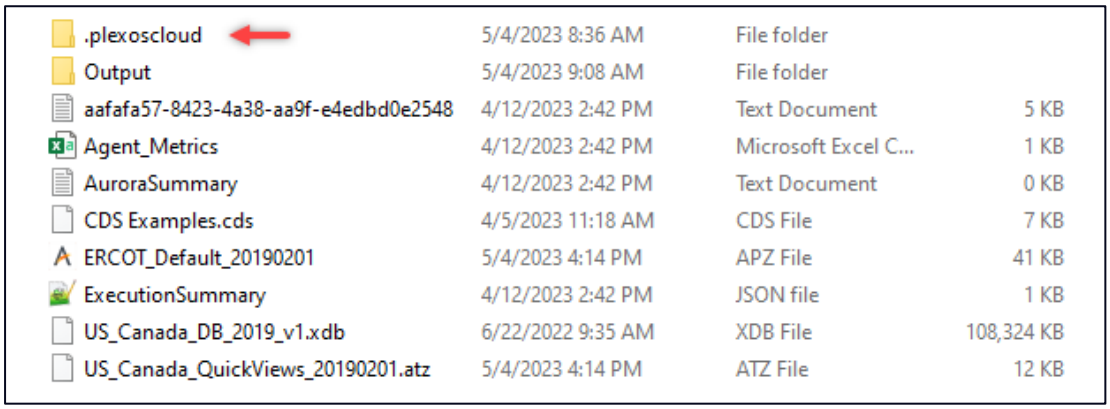


Click OK and then enter the name of your project where you will store the files from your Cloud study.



This folder will have a **.plexoscloud** folder included in it, holding necessary information connecting and synching the project with the Cloud. Do not delete this folder. Once

this project is uploaded, you should not manually move the Cloud project folder to a different location.

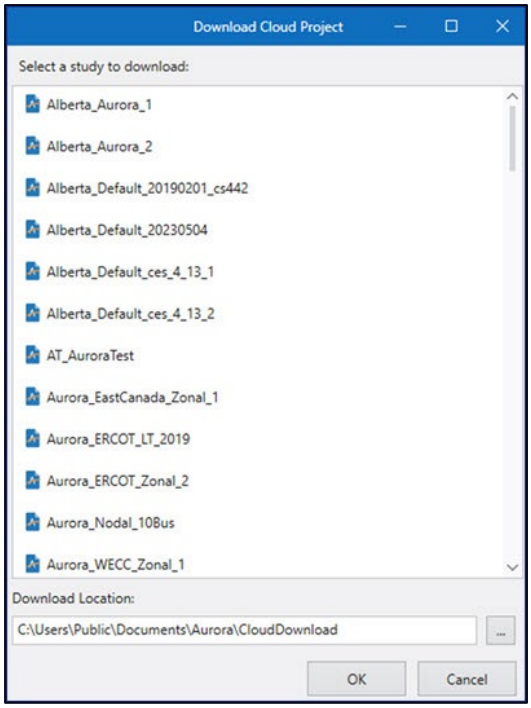


We recommend that you delete that project locally and then use the downloaded project to move Aurora Cloud projects to a different location on your local machine.

For the SQL Server Input database, when the project is first uploaded, an .xdb database will be created with the same information as your SQL Server Input database. The Cloud instance will use that SQLite database instead of the SQL Server database when running since it will not have access to your SQL Server instance. However, locally, your project will still be linked to the SQL Server database to SQLite again. This is useful when changes have been made to the SQL Server Input database. If no changes have been made to the Input database, the database will not be re-uploaded and synced with the Cloud project again to save time.

1.3 Download Project

Use this option to download an Aurora project existing in your Cloud environment to your local desktop. An Aurora Cloud Project must be downloaded to a local machine to modify and run the project.



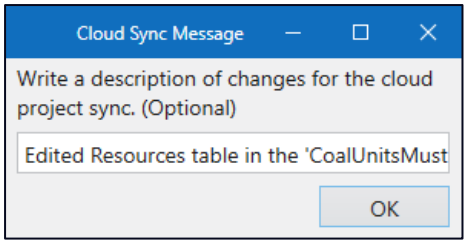
Choose the location where you want the Aurora Cloud project downloaded. The project file, and any related files to the project (such as Input Database or Change Set files, will be downloaded to the folder. Once the project is downloaded, it will automatically open in Aurora.

1.4 Sync Project

Use this option to pull down changes that have been made and uploaded to the Cloud project to your local project file. This will also push any changes that have been made on your local project to the Cloud project.

When you make changes to your local project, you must use Sync Project before using Run Simulation to have those changes appear in the next Cloud simulation.

When using Sync Project, a dialog will display asking you if you would like to write a message detailing the changes that have been made since the last sync. Since you cannot see what specific changes have been made to your Aurora project for a sync, this is useful for keeping track of changes.

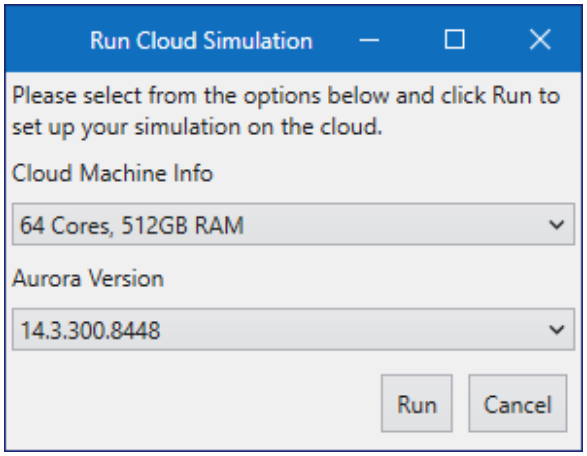


For SQL Server Input databases, when the project is first uploaded, a .xdb database will be created with the same information as your SQL Server input database. The Cloud instance will use that SQLite database instead of the SQL Server database when running since it will not have access to your SQL Server instance. However, locally, your project will still be linked to the SQL Server database.

During the Sync Project, you will have the option to convert the SQL Server Input database to SQLite again. This is useful when changes have been made to the SQL Server Input database. If no changes have been made to the Input database, the database will not be re-uploaded and synced with the Cloud project again to save time.

1.5 Run Simulation

This option will start a simulation in the Cloud. There are four several options to choose from in the Run Cloud Simulation dialog. These options will be saved with the project so it will default to those options.

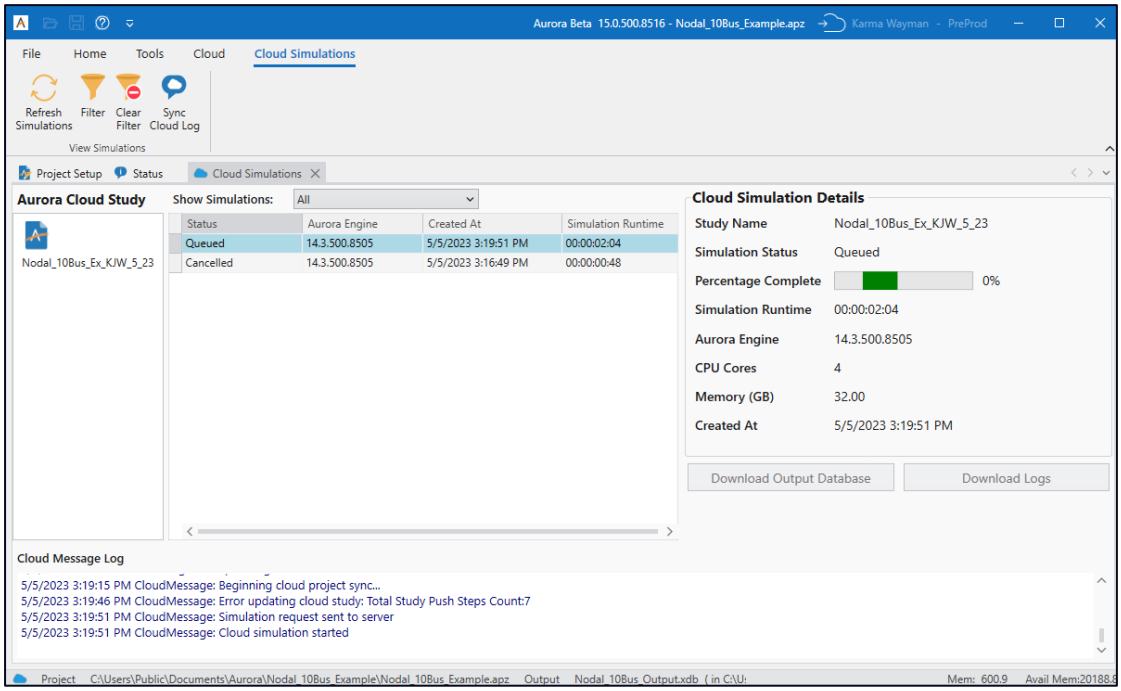


Choose the number of CPU Cores and the amount of memory to run the Cloud simulation. These options will be determined by the Cloud environment you are signed into. Choose the Aurora version to run the simulation.

You can choose to sync the project with the cloud before running the simulation. By default, this occurs automatically to ensure you are running with your latest changes.

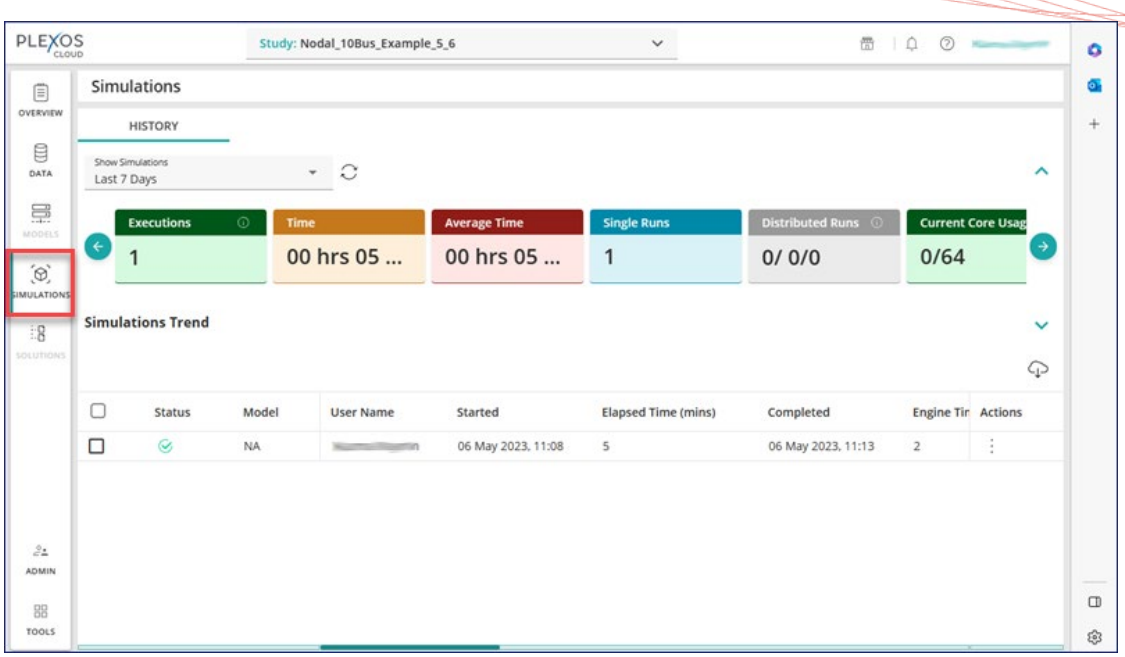
1.6 Cloud Simulation Window

A Cloud Simulations window displays when the Cloud Simulation starts running to show you that the Aurora Cloud Study is in the queue to start running a simulation.



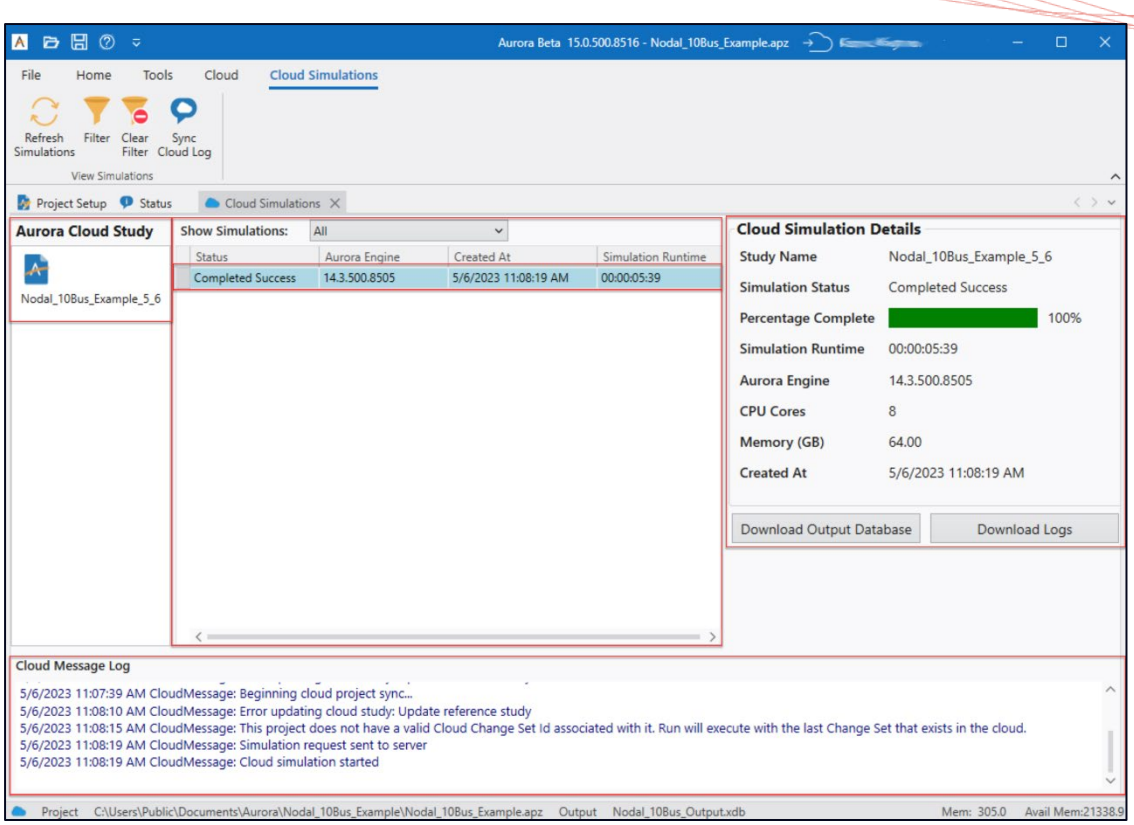
1.7 View Study in Web

This option will open your Aurora Cloud simulation on the PLEXOS Cloud website environment.



1.8 Cloud Simulations

This option displays a window that shows the Cloud study associated with your project along with all the Cloud simulations that have been run previously. This window is also where Output databases and their log files can be downloaded from Cloud simulations.



This window is also where Output databases and their log files can be downloaded from Cloud simulations. Any information or messaging related to your Cloud project will appear in the Cloud Message Log section.

1.8.1 Aurora Cloud Study

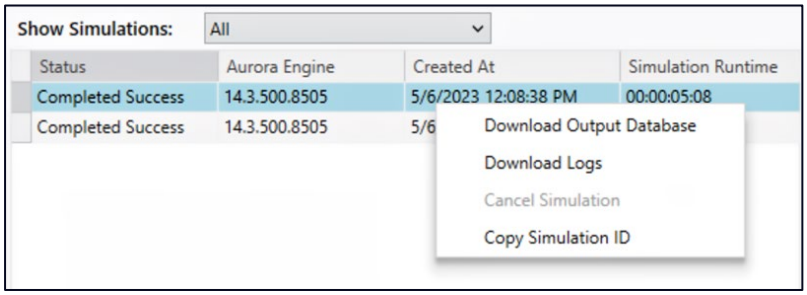
The Aurora Cloud Study section will show the name of the Cloud project associated with your local Aurora study. The status of your selected study is shown in the middle section of the window. This section keeps an account of your simulation runs and their results.

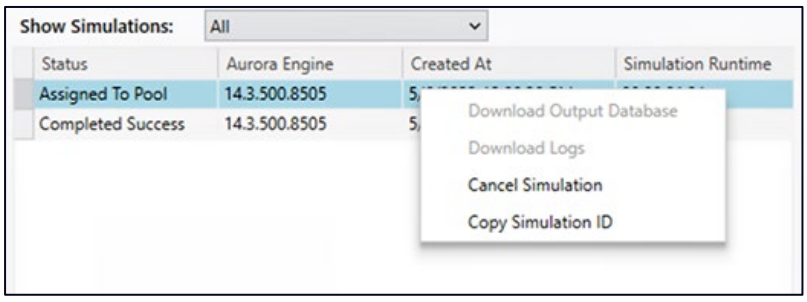
1.8.2 Cloud Simulations

In the section in the middle, all the Cloud simulations associated with your Cloud studies are displayed. You can filter what simulations appear in this section by using the Show Simulations dropdown to filter by date or using the Filter button to filter by specific column information.

If you right-click on a simulation in this panel, you will see options to download the Output Database, Download Logs for this simulation, Cancel the simulation, or Copy the Simulation ID.

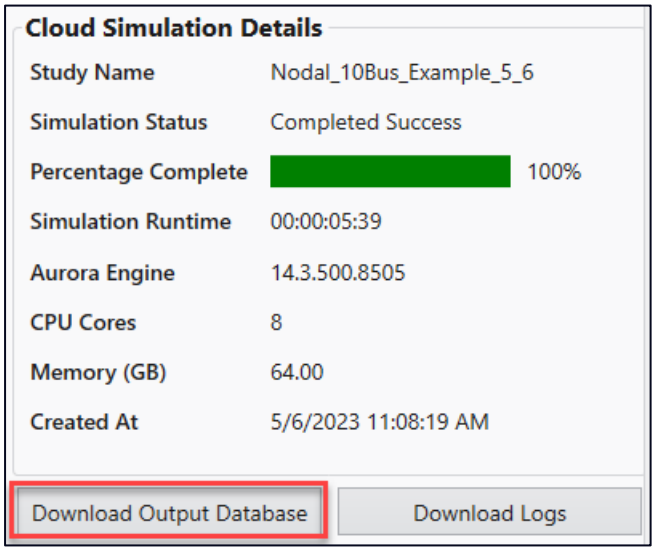
The Simulation ID is a unique identifier for the Cloud simulation. This can be helpful when you are looking for corresponding Cloud logs for the simulation (which are titled by the Simulation ID). Whenever you reach out to support for a specific simulation, this ID will help Energy Exemplar identify your simulation to troubleshoot it.





1.8.3 Cloud Simulation Details

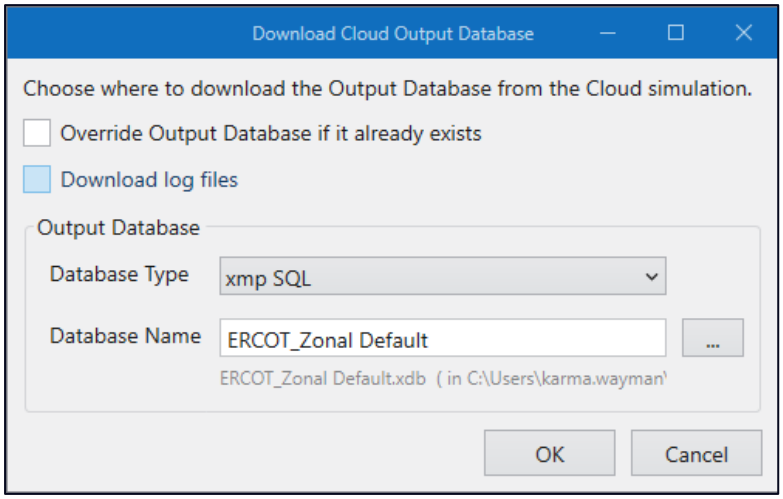
This section will provide more information about the selected simulation. In this section, you can see the current percentage complete of the simulation, along with what CPU Cores and memory were selected for the simulation.



When the simulation successfully completes, the green bar in the Cloud Simulation Details will show 100% and the buttons below are no longer grayed out.

1.9 Download Output and Logs

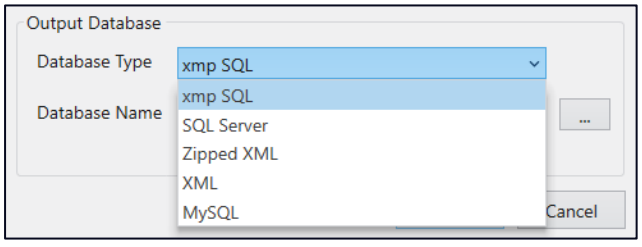
This option in Cloud Simulation Details will open a dialog allowing you to download the Output database for simulation.



You can choose to override the Output database if the database exists with the same name locally. If you tried to download an Output database, and an Output database already exists with the same name, the Output database cannot be downloaded until you use this option to rename it.

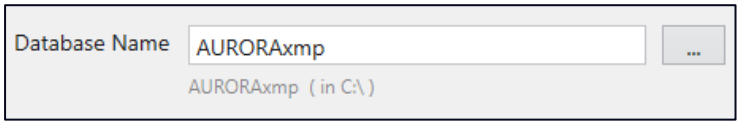
Check the boxes to override any existing database files if they already exist and download any log files created during the simulation.

The Database Type list lets you select the type of file format for the output database. By default, the Cloud Output database is xmpSQL. Energy Exemplar recommends xmpSQL for most users.



You can choose what the Output database name will be, but it defaults to the project's current Output database name. Change the name and location of the Output database using the ellipsis button. Navigate to the appropriate location,

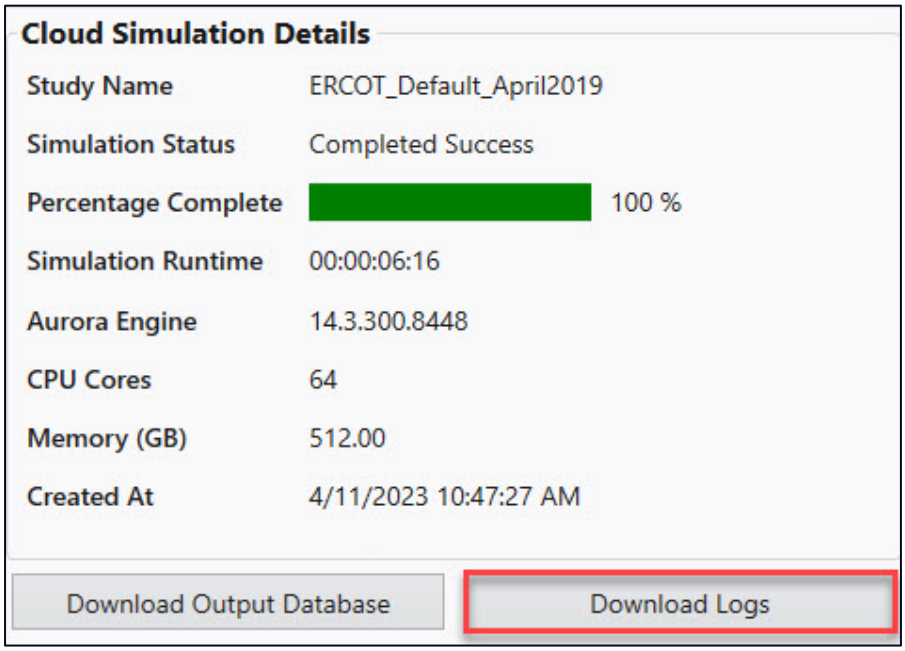
enter the file name, and then click Save.



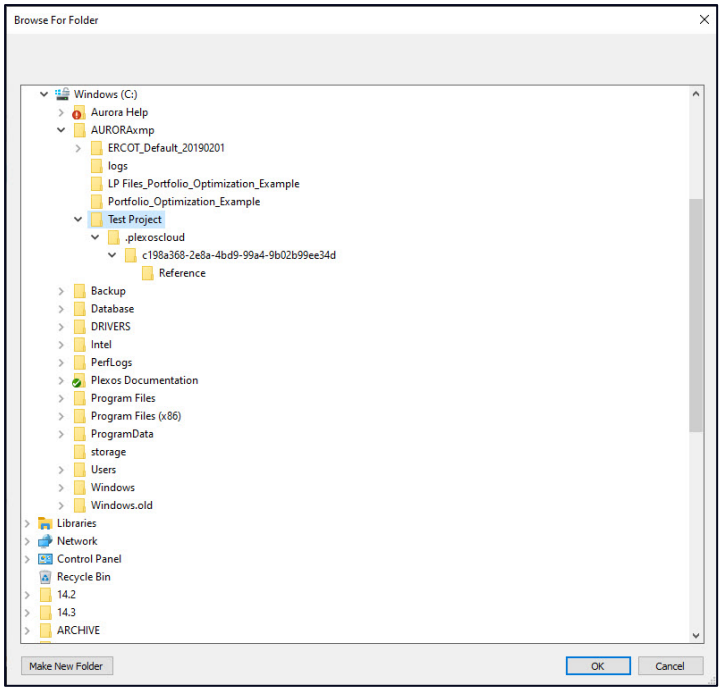
Note that if using the SQL Server Database Type, there can be no spaces in the Output database filename. Enter the name of the database and click the ellipsis button to select the directory where you want your Output database to be stored.

1.9.1 Download Log Files

Download Logs will download the simulation log files to the same folder where the Output database was downloaded.



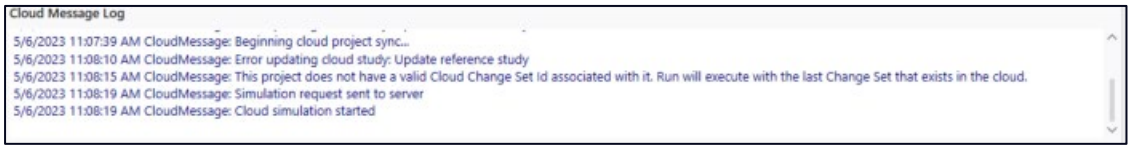
This will let you choose a folder to download all log files associated with the Cloud simulation.



Downloading Logs is useful when you want to see logs of the Cloud simulation without having to also download the Output database. This functionality is especially useful when the simulation finishes with an error, and you want to better assess the nature of the error to get a better understanding of its cause.

1.9.2 Cloud Message Log

This section will show all messages relating to Cloud functionality in Aurora. You will find information and error messages about uploading, syncing, or running Cloud projects.



1.9.3 Sync Cloud Log

When you use Sync Cloud Log, it will take the log of the Cloud CLI that is used to communicate with PLEXOS Cloud for Aurora to send and receive information from the Cloud and show the log in the Cloud Message Log section. This is for ease of use, so users do not have to find specific Cloud CLI files themselves when they want more information about an error that happened using Cloud functionality.

2. Modeling Enhancements

2.1 Electrolyzers

The energy converter logic has several notable enhancements to make electrolyzer modeling easier and fit your specific use case.

In the Energy Conversion input table, we have added a new Contributing Resources column which can be used with the Zone input type. The input for this column is a list of resources or resource group. When specified, the input amount will be limited so that it does not exceed the total output of the resources.

Additionally, there is a new Fuel output type that utilizes the all-new fuel inventory logic to inject the conversion output into the fuel's inventory.

We have included two new Fuel table columns, Initial Inventory and Injection that can be used with or without the new energy conversion fuel output type. The Initial Inventory column is used to specify the mmBtu available in the fuel at the start of the study. The Injection input is time series enabled and can be used to inject fuel into the inventory each hour. The usage of the fuel will be limited by the total inventory each hour.

We have included Working_Inventory and Total_Injection in the Fuel output tables to make tracking a given fuel's inventory and injection as clear as possible.

2.2 Storage

For Aurora 15.0 we have rounded out the generation limit offerings with the new Daily Generation Limit column in the Storage table. This column is time series enabled and accepts a factor that is multiplied by the resource capacity and will limit the storage generation by that amount each day.

A significant improvement to storage performance has also been added in Aurora 15.0. There is a new supplemental parameter Storage Hours Per Period which governs the formulation of the month-ahead storage solve. By setting this to a value greater than 1, the size of the optimization solve is reduced by joining multiple hours into a single period. When running with commitment optimization, this value defaults to 4 hours, making the optimization problem for each storage solve 1/4th the original size. The standard commitment and dispatch optimization problems, whether hourly

or sub-hourly, will then adjust this month-ahead solve by using the daily end contents to co-optimize with the rest of the system.

2.3 Other Topics

2.3.1 Long-Term

There is a new supplemental parameter Write RMT To Output which will include the Resource Modifier and Capacity Price tables in the output database. If using the option to Keep All Iterative RMT, all iterations will be written to the output database. This switch is enabled automatically when running long-term studies in Cloud.

2.3.2 Portfolio Optimization

There is a new option to use monthly reserve margin targets with Portfolio Optimization studies. This option is called Port Op Use Monthly Reserve Margin Targets and can be found in the Supplemental Parameter table. Specifying True for this parameter will enable the logic for monthly reserve margins.

In addition to this enhancement, there is a new output table, PortOp_MonthReport which contains portfolio performance information at the monthly level. To enable reporting, the portfolio optimization Output Report Level must be 2 or greater and the Time Period must be less than Year.

2.3.3 Inertia

The Operating Pools table has a new column Inertia Requirement to enter a pool-wide inertia target for the system. Each commitment resource in the pool can contribute to the inertia requirement as specified in the Inertia Constant column. The total inertia provided by each online resource is equal to [Inertia Constant]*[Capacity]. When these inputs are populated, a constraint will be added to the optimization problem for each period to ensure that the online capacity provides enough inertia to meet the pool requirement. If it cannot be met, the requirement can be relaxed based on the Inertia Relaxation Cost. In the output, the Inertia column in the Pool and Resource tables report the total inertia provided.

2.3.4 Custom Constraint

We have added new decision variables to the Custom Constraint Matrix table. Specify single-direction flow limits using the new Area Flow or Zone Flow variables.

Combine this with the Period Offset capability to limit the change in flow between hours.

Additionally, Storage Gen Status and Storage Charge Status binary variables have been added and indicate if the storage unit is charging or generating. Use of the new storage status variables requires a Minimum Generation (for Storage Gen Status) and Minimum Charge (for Storage Charge Status).

2.3.5 Emission

This release includes enhancements to the emissions logic with the ability to model emissions curves. This logic was implemented for the NOx emissions type to specify a different emission rate for different segment levels. However, the logic is generic and can be used with any type.

There is a new column in the Heat Rate Definition table called Emission Rate Factor 1 (2,3, ...). It is used to specify a factor to be applied to the base emission rate and can be changed for each segment. In the Emission Rate table, we have added the Emission Rate Factor Reference column. This column is used to link the emission type with the factor from the heat rate definition table. The input for the Emission Rate Factor Reference column is the number from the Emission Rate Factor column. With these two new inputs, emission curve modeling is as flexible as you need it to be.

Furthermore, to address chronological Emission constraint relaxations, we have added a new Relaxation Cost column to the Constraint table. An input of -1 into this column will ensure that your emission (or other) constraint is prevented from relaxing for the chronological portion of the constrained dispatch solve.

2.3.6 CSV Output Format

Clients can now directly output simulation results as comma separated values or CSV files. Previously, this format was only available through an output plugin, but it is now natively supported right alongside XMP SQL, XML, SQL Server and others.

And, with the extensibility of our new output code, we have asked Aurora users to tell us about other output formats they'd like us to support. In the future we may ship support for Oracle, Parquet or something completely new.

2.4 Solvers

2.4.1 Gurobi

This release updates the Gurobi optimization engine to the version of Gurobi 10.0.1.

2.4.2 Mosek

This release includes an update of the Mosek solver to version 10.1.9.

3. New Output Database Types

The following Output Database columns have been added for this release:

OUTPUT TABLE(S)	COLUMN(S)
Zone	Act_Capacity_Surplus
Pool	Act_Capacity_Surplus Inertia
Resource	Variable_Cost_Charging Inertia ORDC_Revenue
Resource Group	Variable_Cost_Charging ORDC_Revenue
Energy Conversions	Input_Price Total_Cost
Fuel	Working_Inventory Total_Injection
PortfolioResources	ORDC_Revenue

4. Support Information

4.1 Updates on the Web

All updates to Aurora are available in the Client Portal, https://energyexemplar.com/client - login/.

Enter your username and password to select the desired update. Contact Energy Exemplar if you do not know the username and password. Be sure to review the Aurora Enhancement Log before downloading a new version of the software from the website.