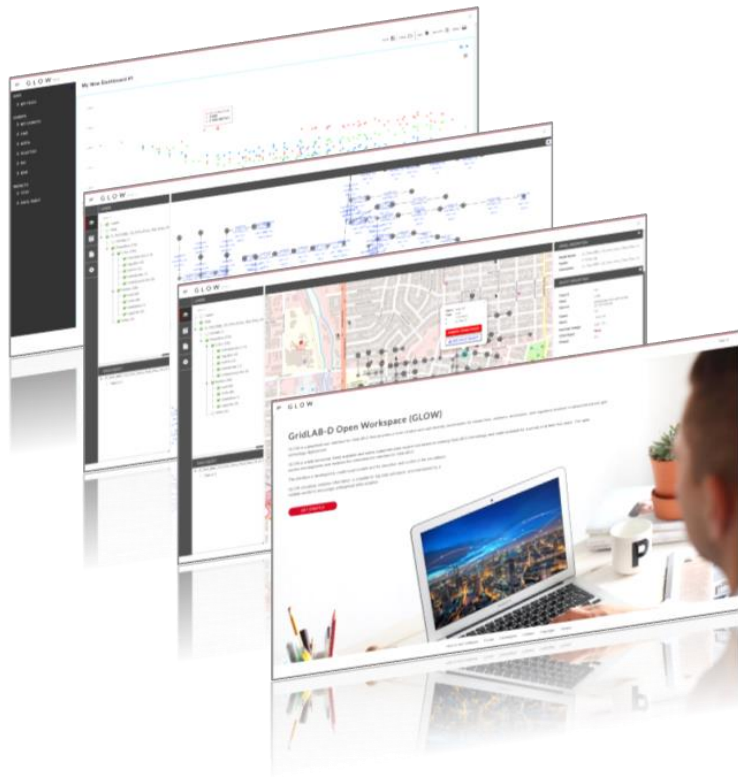

GridLAB-D Open Workspace (GLOW) Orientation and Education

04.06.23, 10:45 PM-11:45 PM

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GridLAB-D Open Workspace (GLOW) is a project to deliver a **web-based graphical user interface for GridLAB-D**. The **open-source** user interface aims to **augment GridLAB-D** in a more intuitive, user-friendly manner, contributing to wider use of the simulation technology.

Hitachi aims to achieve the intuitiveness of the tool by employing human-centered design approach. The process includes defining requirements for the interface through researching the potential users and designing the interfaces according to the discovered requirements.

- Overview
- GLOW Requirements and Installation
- Tutorial
 - Homepage and Model Library
 - Model Library – Create a new model (IEEE 123 with XY)
 - Viewer
 - Model Library – Create a blank model
 - Time-series power flow
 - Integration Capacity Analysis
 - Electrification
 - Grid Resilience



Overview of GLOW

- **GridLAB-D**

- Developed by DOE and PNNL.
- One of the most advanced distribution planning tools
- Ability to model
 - DERs
 - End-use energy consumption

- **Barriers**

- Lacking GUI
- No established method for DERs impact study
- Extensive training and experiences

- **GridLAB-D Open Workspace (GLOW)**

- Distribution planning method and modeling platform
- A user-friendly environment for users
- A web-based GUI



Examples of GridLAB-D CLI

- <https://glow.hero-energy.com>
 - **Keyword:** glow, hero, energy
- **Key Features**
 - An open-source platform for distribution planning
 - Designed for distribution resources planning
 - Web-based GUI for GridLAB-D
- **Other Features**
 - Support deployment on workstation/cloud
 - Standardized analyses examples:
 - Power flow
 - Integration Capacity Analysis (ICA)
 - Post-processing for result realization
 - Generate feeder topology for visualization
 - Designed for cross-organizational collaborations

GLOW Solution Architecture

User Interface

- Model Library/ Viewer
- Simulation Library
- Post-Processing

API

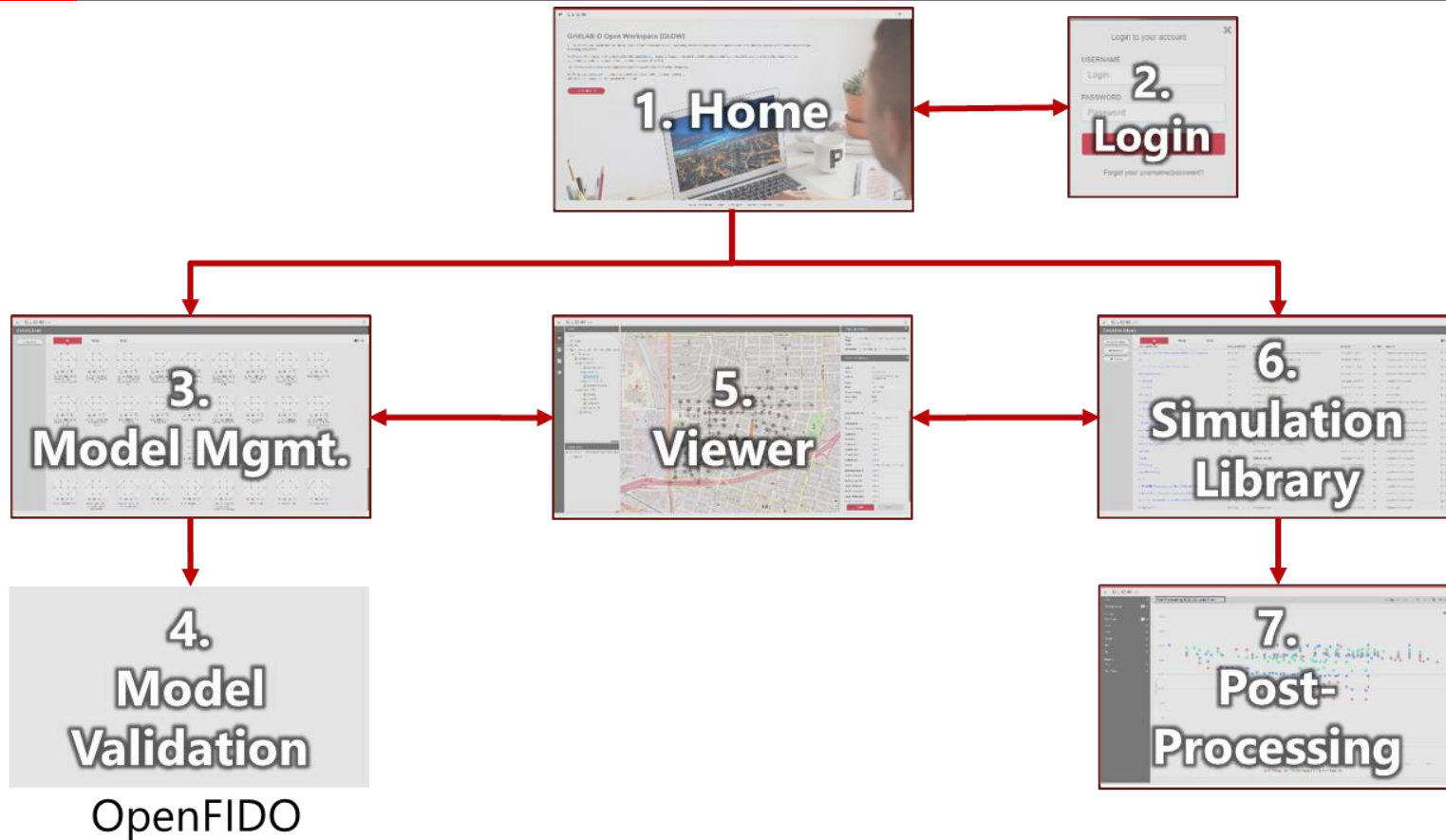
- Data Management
- Analysis
- Configuration

Data Lake

- Input data
- Model data
- Simulation results

Simulation Engine

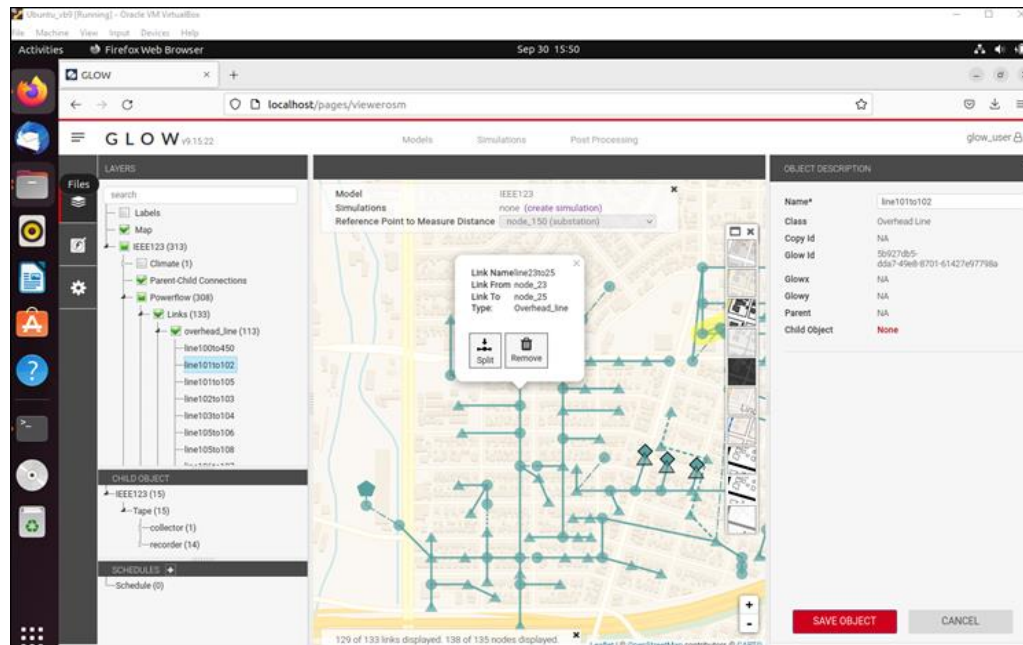
- GridLAB-D
- GLOW



GLOW Requirements and Installation

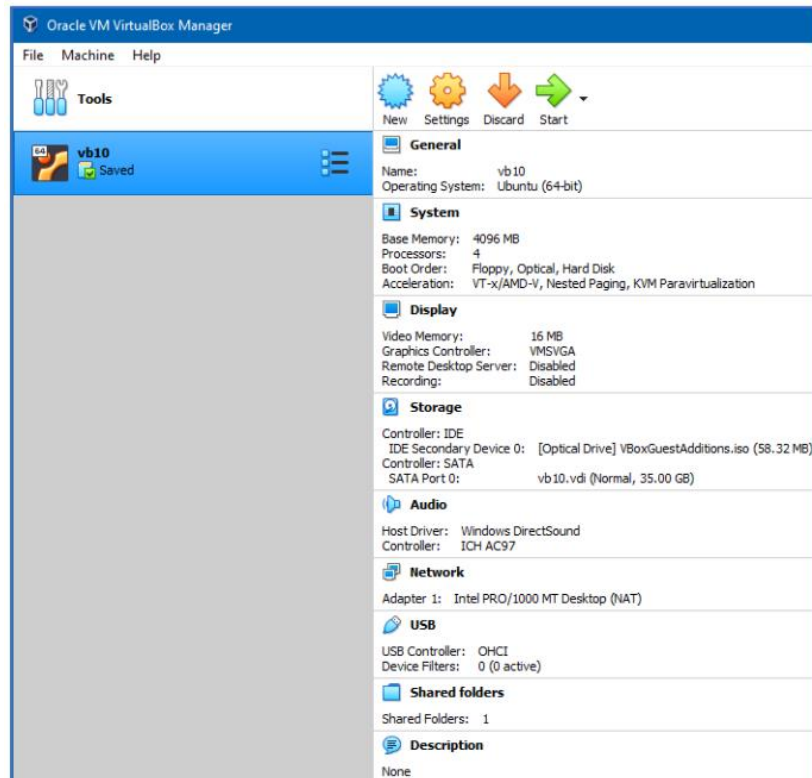
System Requirement for Download Version

- CPU Architecture: AMD64
 - Example: i7 Intel(R) Core (TM) i7-8565U
- Operating System
 - Linux
 - Example: Ubuntu-22.04.1 on AWS EC2
 - Windows 10 Enterprise
 - GLOW cannot be installed directly in Windows 10. It can be installed within Virtual Machine such as Oracle Virtual Box
 - Example: Windows 10 Enterprise with Virtual Box 6.1 and Ubuntu 22.04.1
 - Not support
 - Windows in AWS EC2



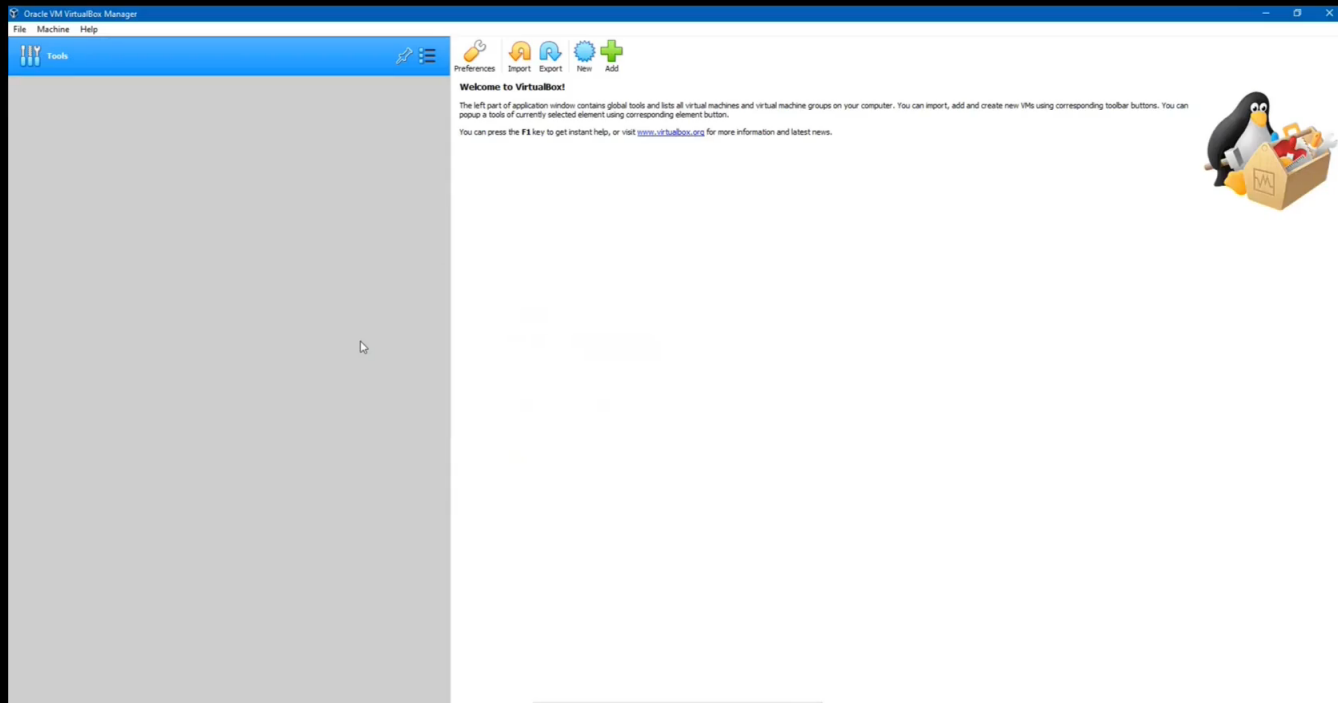
System Requirement for Download Version

- Free Space
 - Before fresh installation of Linux
 - 40GB
 - Before installation of GLOW Docker
 - 25 GB
- CPU Core
 - 4 Cores
- Ram
 - 4 GB
- Operating System
 - Ubuntu 22.04.1



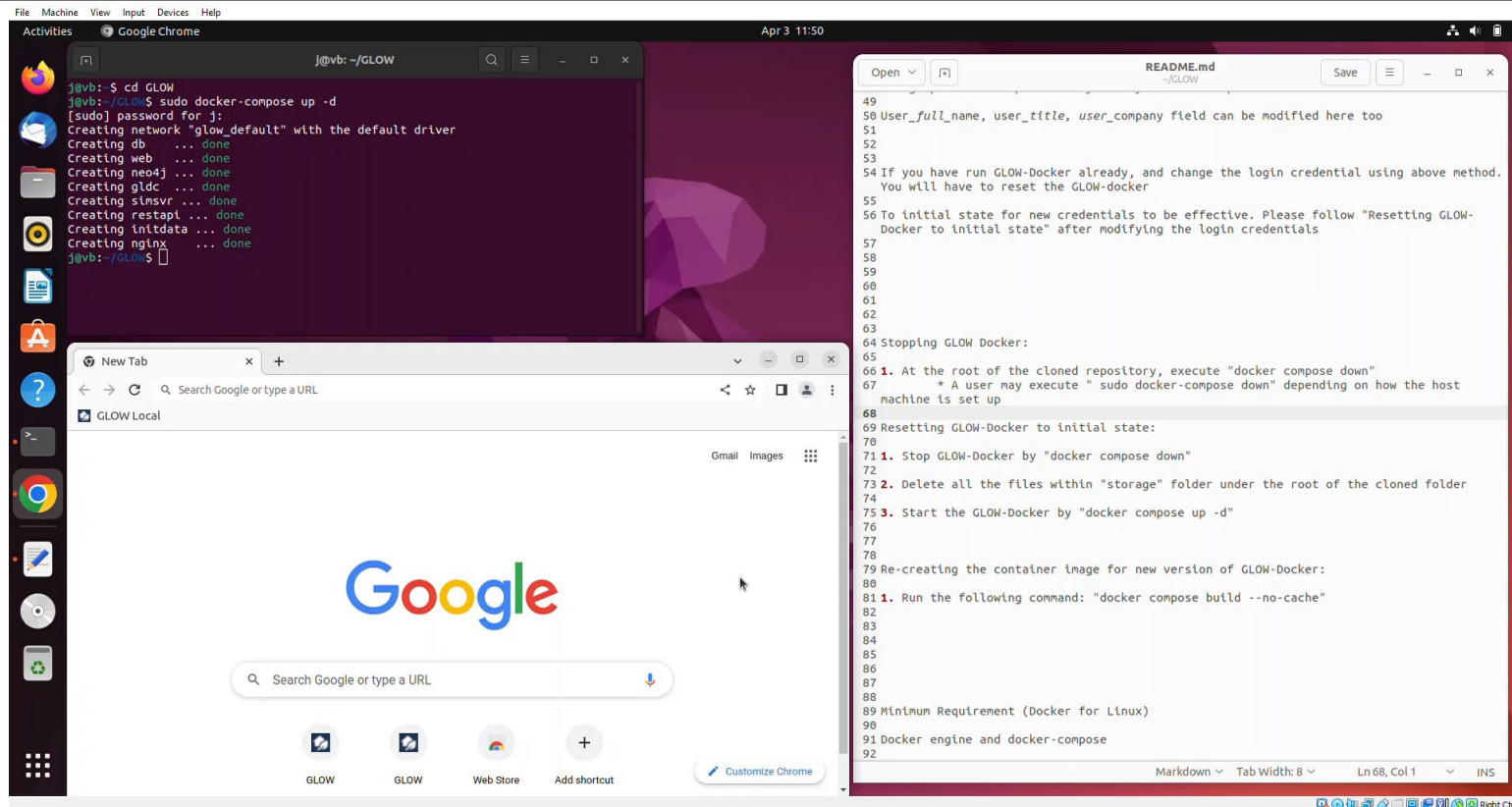
Download and Install GLOW

- With Windows 10, Open VirtualBox
- Install Linux
- Open browser
- Login to GLOW
- Homepage
 - <https://glow.hiro-energy.com/>
- Download GLOW Package
- Check required package
 - Git
 - Docker
 - Docker-compose
- Run GLOW service



Shutdown GLOW

- Open GLOW
- Check some modules
- Shutdown GLOW package
- Error messages
- Open GLOW again (with error)
- Run GLOW service
- Open GLOW





Tutorial

- Homepage
 - <https://glow.hero-energy.com/>
- Login
- 3 Modules
 - Model Library
 - Simulation Library
 - Post-Processing
- Model Library
 - Overview
 - OpenFido

≡ GLOW

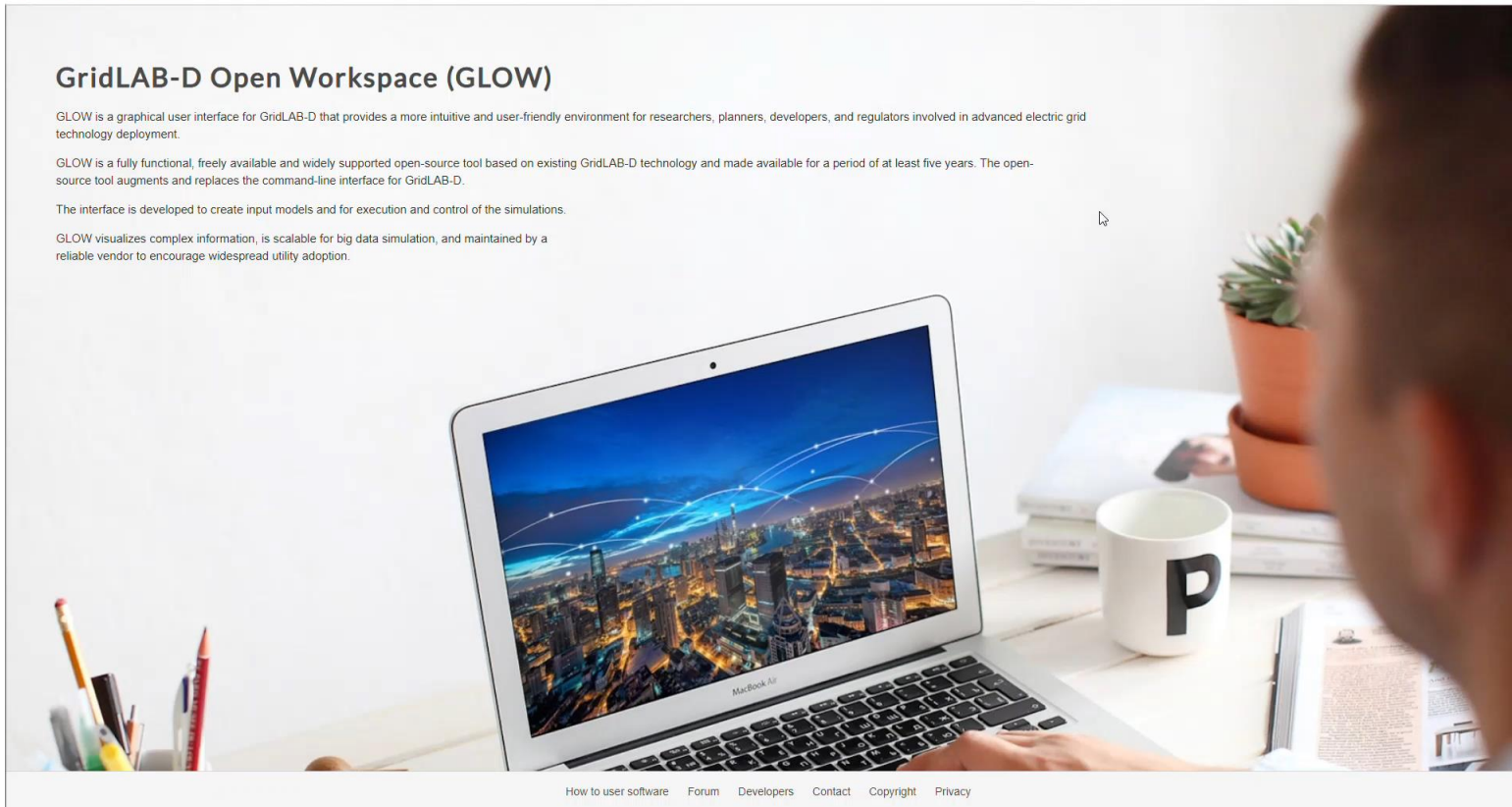
GridLAB-D Open Workspace (GLOW)

GLOW is a graphical user interface for GridLAB-D that provides a more intuitive and user-friendly environment for researchers, planners, developers, and regulators involved in advanced electric grid technology deployment.

GLOW is a fully functional, freely available and widely supported open-source tool based on existing GridLAB-D technology and made available for a period of at least five years. The open-source tool augments and replaces the command-line interface for GridLAB-D.

The interface is developed to create input models and for execution and control of the simulations.

GLOW visualizes complex information, is scalable for big data simulation, and maintained by a reliable vendor to encourage widespread utility adoption.



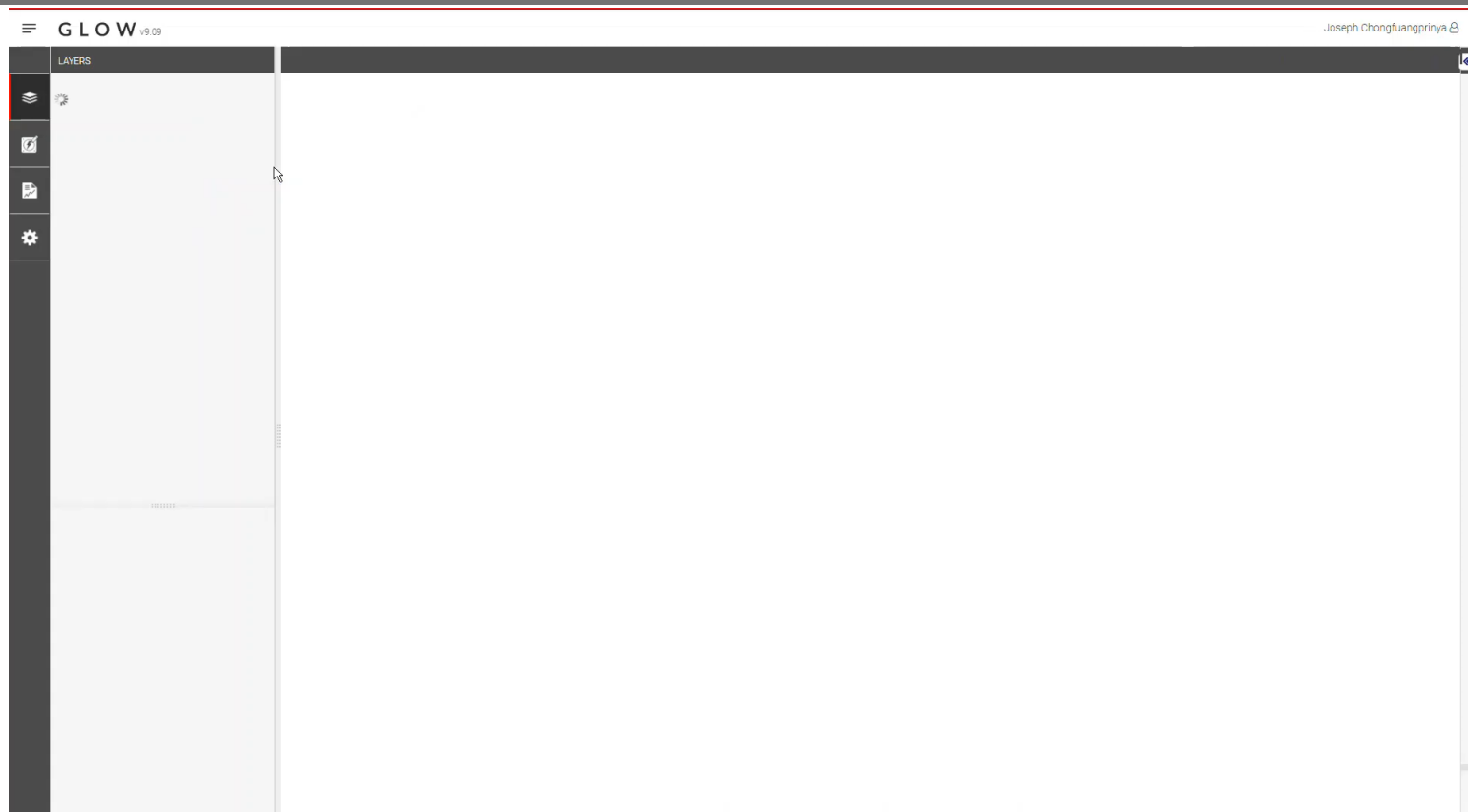
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Model Library – Create a new model (IEEE 123 with XY)

- Model Library
 - Overview
- Create a new model
 - IEEE 123 with XY
 - Validate

The screenshot displays the GLOW Model Library interface. At the top, the GLOW logo and version (v9.01.21) are visible on the left, and the user name 'Joseph Chongfuangprinya' is on the right. The main header is 'Model Library'. Below this, there are three tabs: 'All', 'Private' (which is selected and highlighted in red), and 'Public'. On the left side of the 'Private' tab, there are two buttons: 'New Model' (with a plus icon) and 'Open Fido'. The main area shows a grid of model cards. Each card features a circuit diagram icon, a set of icons (info, lock, edit, share), and a model name. The models listed are: JC_MinModel.Plus_DER_V004_Interpolate_March31, JC_06_IEEE-13_MinModel.Plus_DER_V003_Interpolate, JC_06_IEEE-13_MinModel.Plus_DER_V001, IEEE13_original_github, 8500_V3, JC_Minimum_Model_02.05.21, JC_IEEE123_29_Jan_To_Modify, JC_IEEE123_29_Jan_DO_NOT_DELETE, and R1-12.47-1_Taxonomy_for_Public_Test. At the bottom left, a status bar indicates '10 models used of unlimited'. At the bottom of the interface, there are several circular icons for navigation and search.

- Viewer
- Overview with IEEE 123
 - Map
 - Layer Panel
 - Right-hand Panel
 - Side Bar
 - Setting

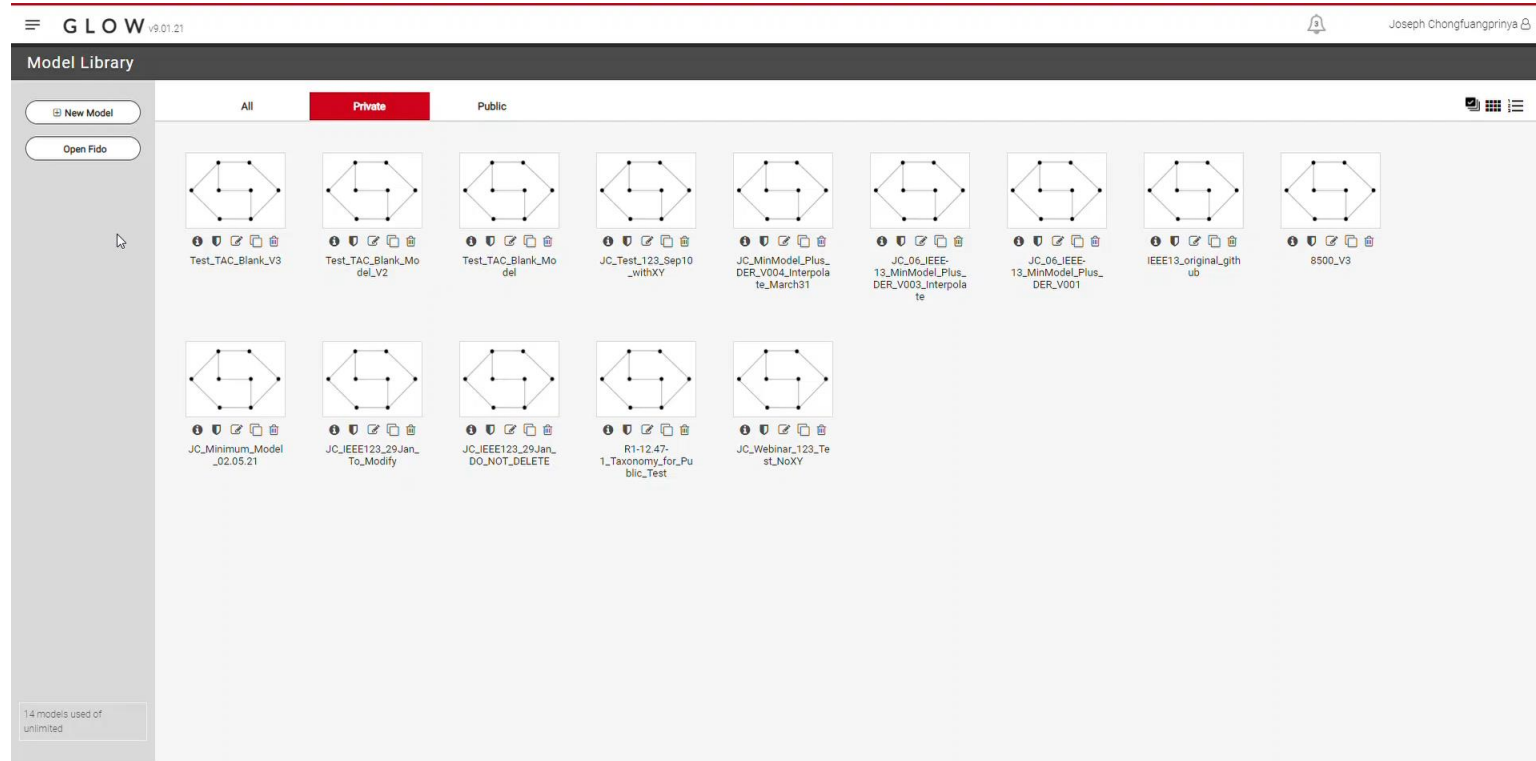


Model Library – Create a blank model

- Model Library
- Create a new model
 - Blank model
 - Validate
- Open in Viewer
- Add
 - Configuration
 - Spacing
 - Conductor
 - Configuration
 - Substation
 - Load
 - Line

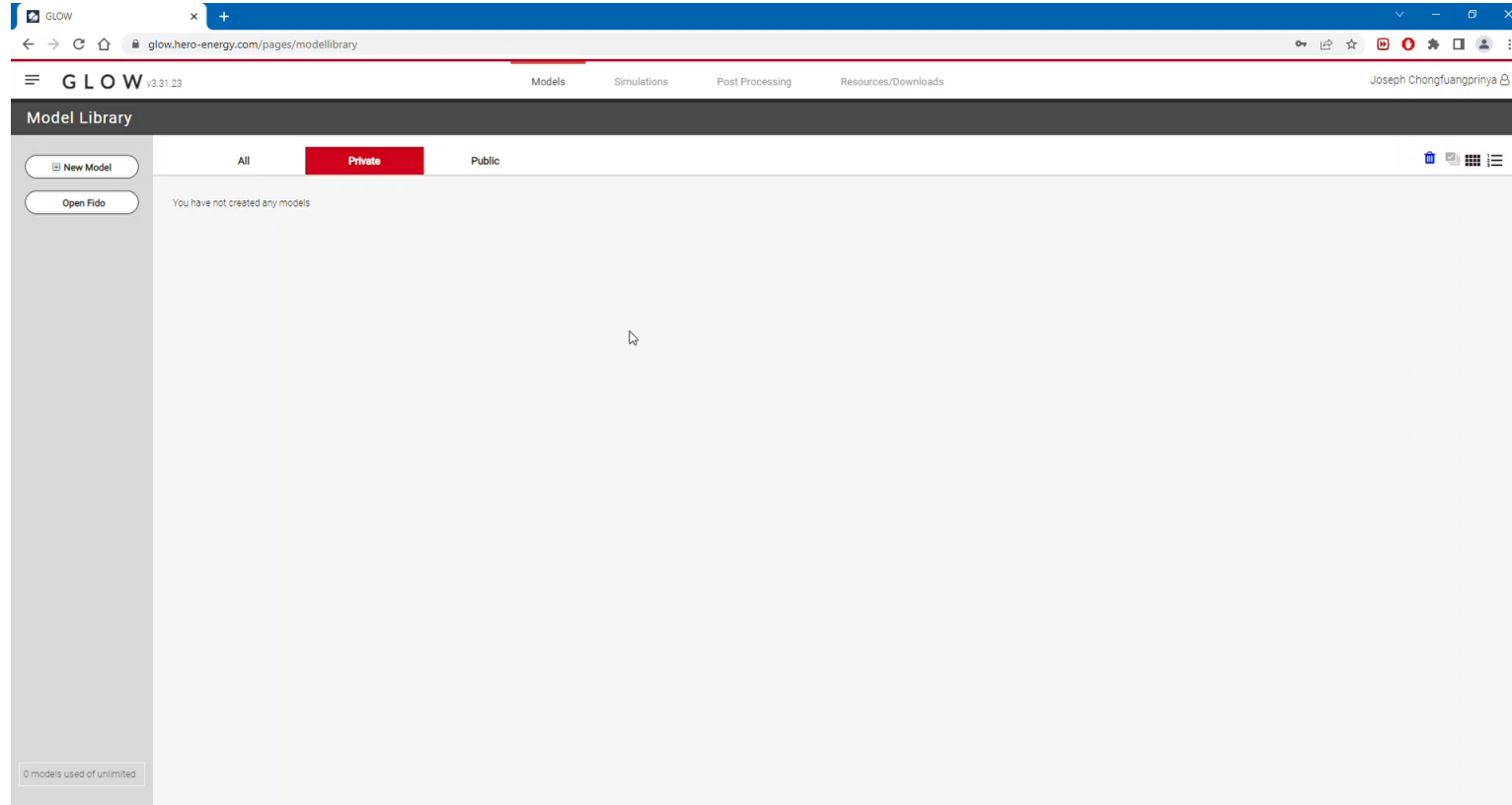
The screenshot displays the GLOW Model Library interface. At the top, the GLOW logo and version (v9.01.21) are shown. A notification bell and the user name 'Joseph Chongfuangprinya' are in the top right. The main header 'Model Library' is centered. Below it, there are tabs for 'All' (selected), 'Private', and 'Public'. On the left side, there are buttons for 'New Model' and 'Open Fido'. The main area contains a grid of 24 model thumbnails, each with a circuit diagram icon and a title. The titles include: Test_TAC_Blank_Model, JC_Test_123_Sep10_withXY, 04_JEEE-13_MinModelPlusEndUseV1_addmarket, IEEE123_ABE_TEST 6, 04_JEEE-13_MinModelPlusEndUseV1_addbattery, 04_JEEE-13_MinModelPlusEndUseV1_addsolarci mate1, 04_JEEE-13_MinModelPlusEndUseV1_addsolarci mate, 04_JEEE-13_MinModelPlusEndUseV1_addapps1, EMPTY_ABE_TEST5, EMPTY_ABE_TEST4, EMPTY_ABE_TEST3, EMPTY_ABE_TEST2, 01_Blank_Model_w_Modules_V01, 02_Blank_Model_w_8500_Lib_V01, Chandra_Grid_Resiliency-IEEE13-based, JC_MinModel_Plus_DER_V004_Interpolate_March31, JC_06_JEEE-13_MinModel_Plus_DER_V003_Interpolate, JC_06_JEEE-13_MinModel_Plus_DER_V001, IEEE8500_SLAC, IEEE13_original_ghub, 8500_V3, Nicky 02-11 validation test, JC_Minimum_Model_02.05.21, JC_JEEE123_29Jan_To_Modify, JC_JEEE123_29Jan_DO_NOT_DELETE, R1-12.47-1_Taxonomy_for_Public_Test, and JC_Webinar_123_TestNoXY. At the bottom left, a status bar indicates '12 models used of unlimited'.

- Create a model from file
 - House 1, Cooling Set Point = 72
 - House 2, Cooling Set Point = 68
 - Inverter, PV 3.0 kW
- Run Power flow
- Create Charts
 - Voltage
 - Current
- Export option



Integration Capacity Analystist (ICA)

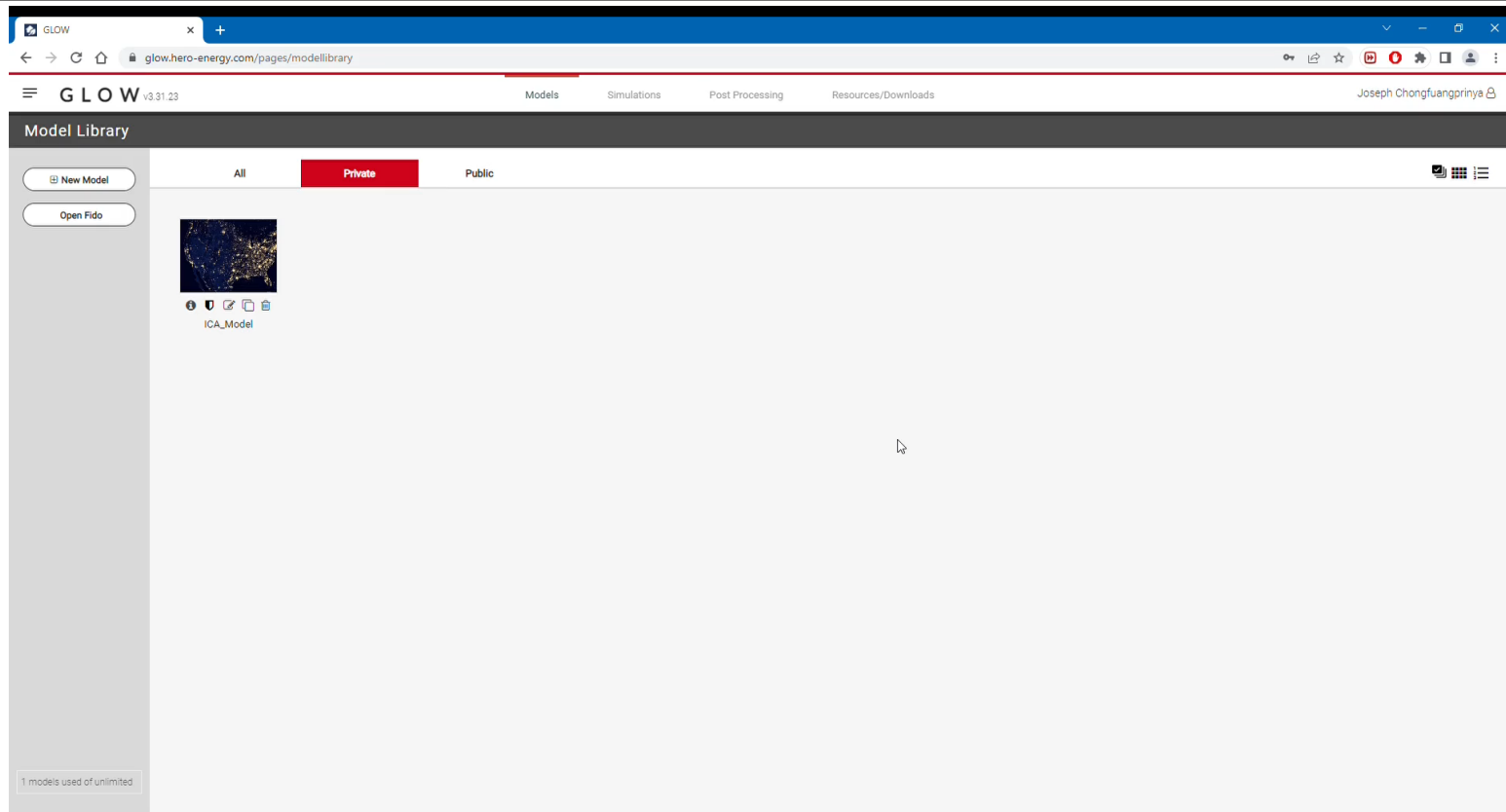
- Create a model from files
- Run ICA
- View result in ICA template
- View result in Viewer



- Create a model from files
- Run Electrification
 - With charging profile
- View result in ICA template

Charging profile

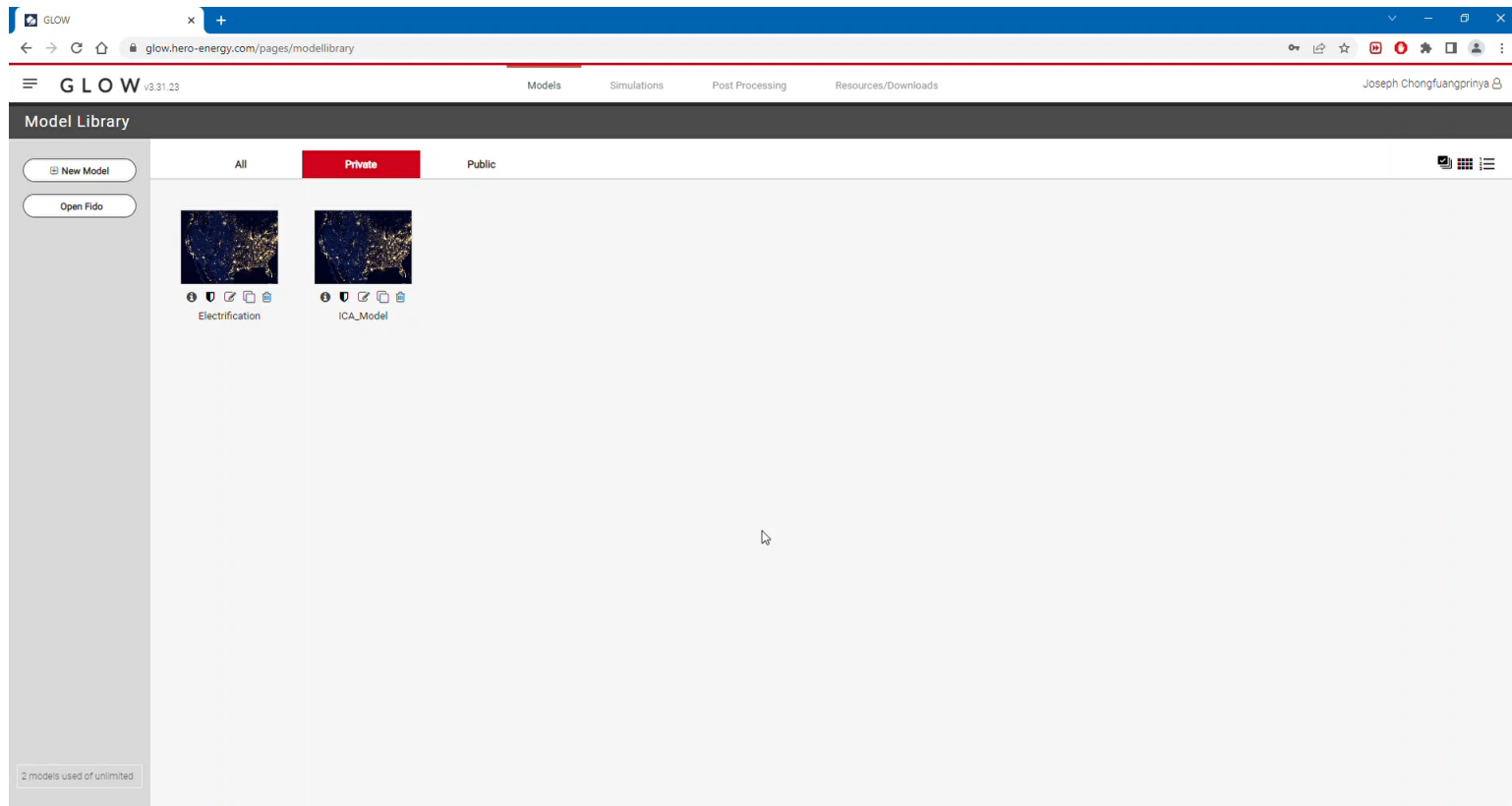
1/1/2000 0:00	1496.67
1/1/2000 0:15	837.33
1/1/2000 0:30	1266.67
1/1/2000 0:45	724.67
1/1/2000 1:00	680.00
1/7/2000 22:45	1676.67
1/7/2000 23:00	886.67
1/7/2000 23:15	880.00
1/7/2000 23:30	880.00
1/7/2000 23:45	580.67



- Create a model from files
- Run Grid Resilience
 - With windspeed profile
- View result in Grid Resilience template

Hourly wind profile

2020-01-01 00:00:00 PST, 5
+3600s,9
+3600s,7
+3600s,13
+3600s,17
+3600s,22
+3600s,35
+3600s,70
+3600s,75
+3600s,80



GLOW is supported with funding from the California Energy Commission under grant EPC-17-043.



- California Energy Commission
- California Public Utility Commission
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- Pacific Gas & Electric
- Sunrun
- Kevala Analytics
- SLAC
- Gridworks