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PowerSim Modeling – Microgrid Example Problem

Fundamentals of Advanced Microgrid Evaluation, Analysis, and Conceptual Design (Consequence Modeling Module)

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PowerSim Modeling – Microgrid Example Problem



Outline of Presentation

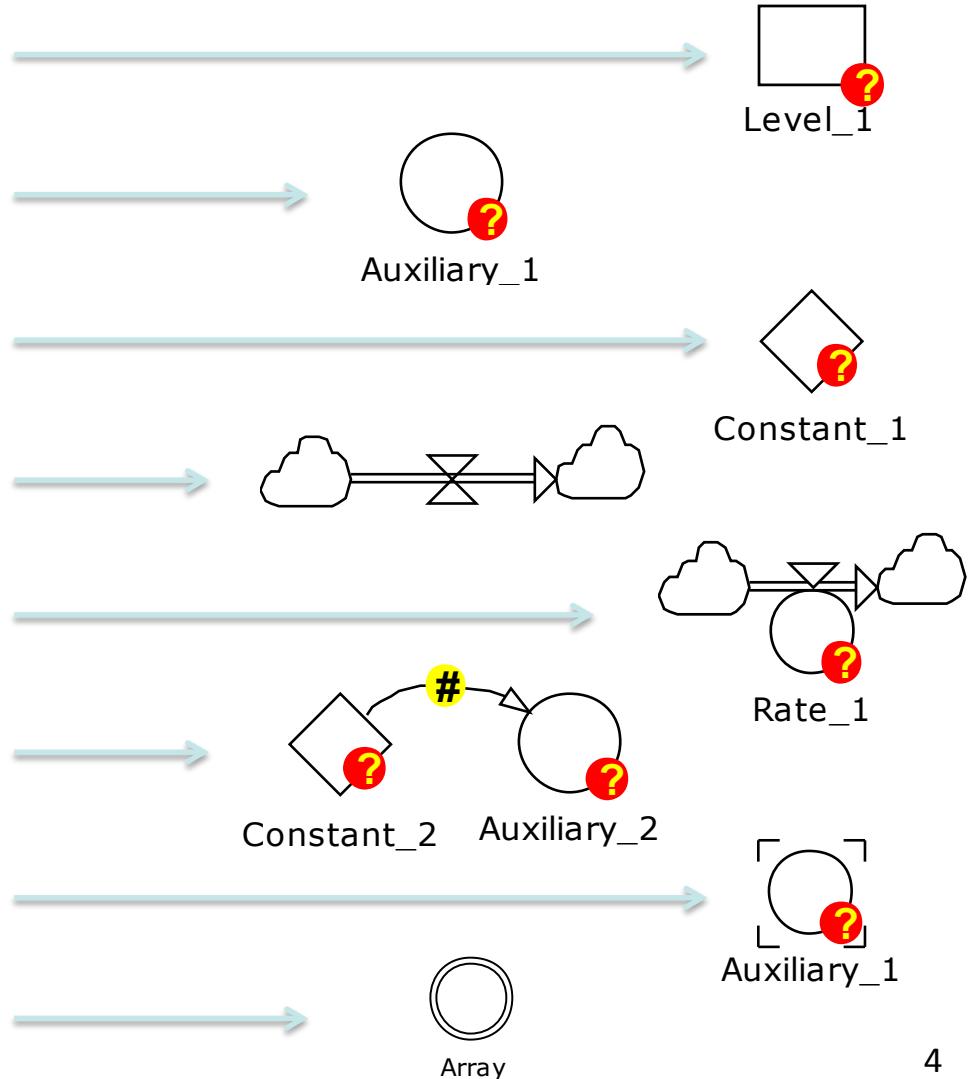
- Simple basics
- Accessing Data Files – Connections
- Managing Input
 - Creating Switches
 - Creating Sliders
 - Creating Figures and Charts
- Model Creation
- Summary
- Question & Answer Session

Basics

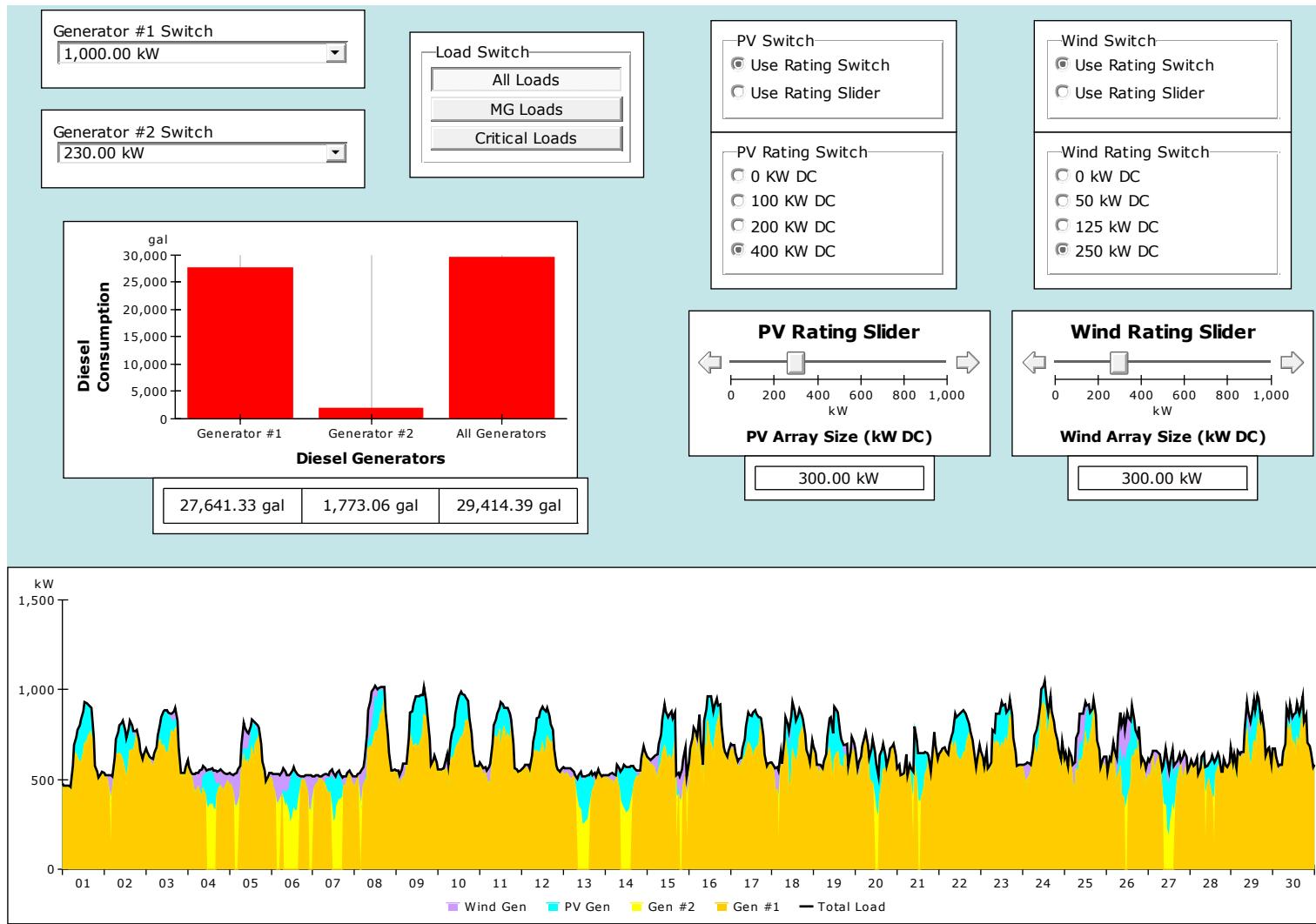
- PowerSim Studio
- Systems Dynamics Code
- Basic Building Blocks
 - Stocks - A stock is a generic symbol for anything that accumulates or drains. For example, water accumulates in your bathtub. At any point in time, the amount of water in the bathtub reflects the accumulation of what has flowed in from the faucet, minus what has flowed out down the drain. The amount of water in the bathtub is the stock of water.
 - Flows – A flow is the rate of change of a stock. In the bathtub example, the flows are the water coming into the bathtub through the faucet and the water leaving the bathtub through the drain.
 - Variables – Constants or auxiliaries are used to: calculate, make a model readable, prepare an interface.
 - Information Links – Connections/relationship between stocks, flows, and variables.

Basic Building Blocks

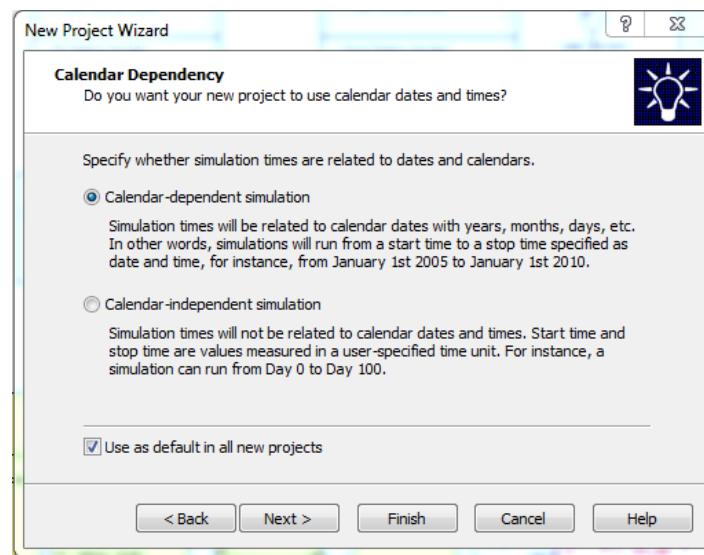
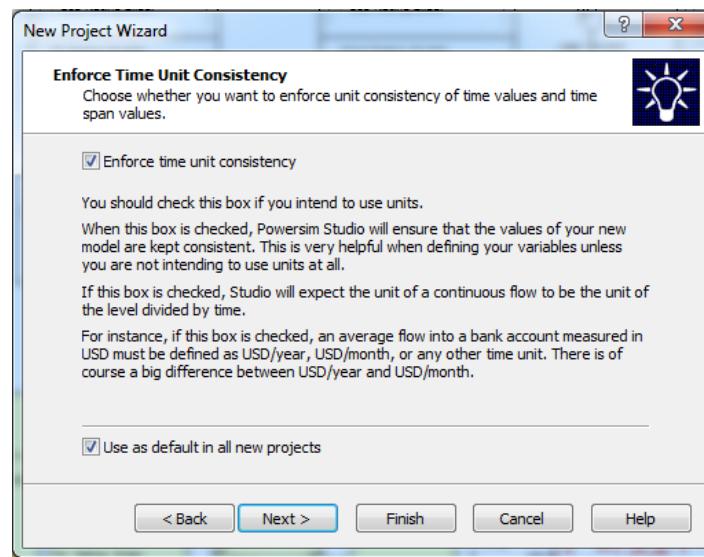
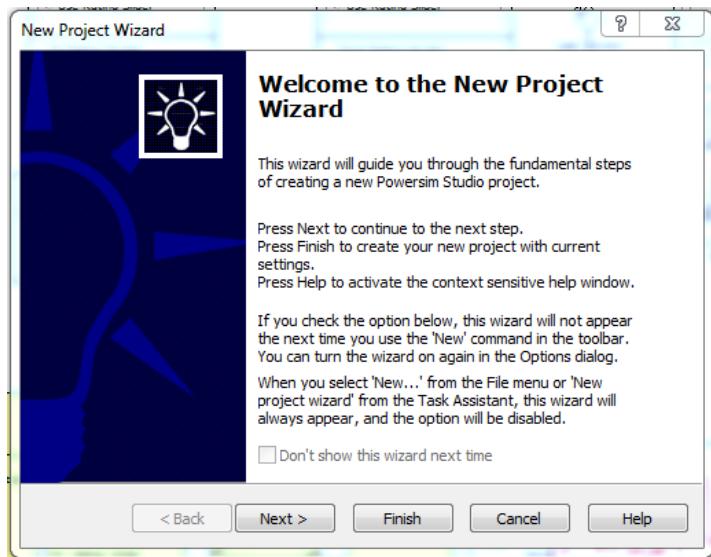
- Level (Stock)
- Auxiliary (Variable)
- Constant (Variable)
- Flow
- Flow w/ Rate
- Link
- Shortcut (“Alias”)
- Arrays



Example MG Model Output

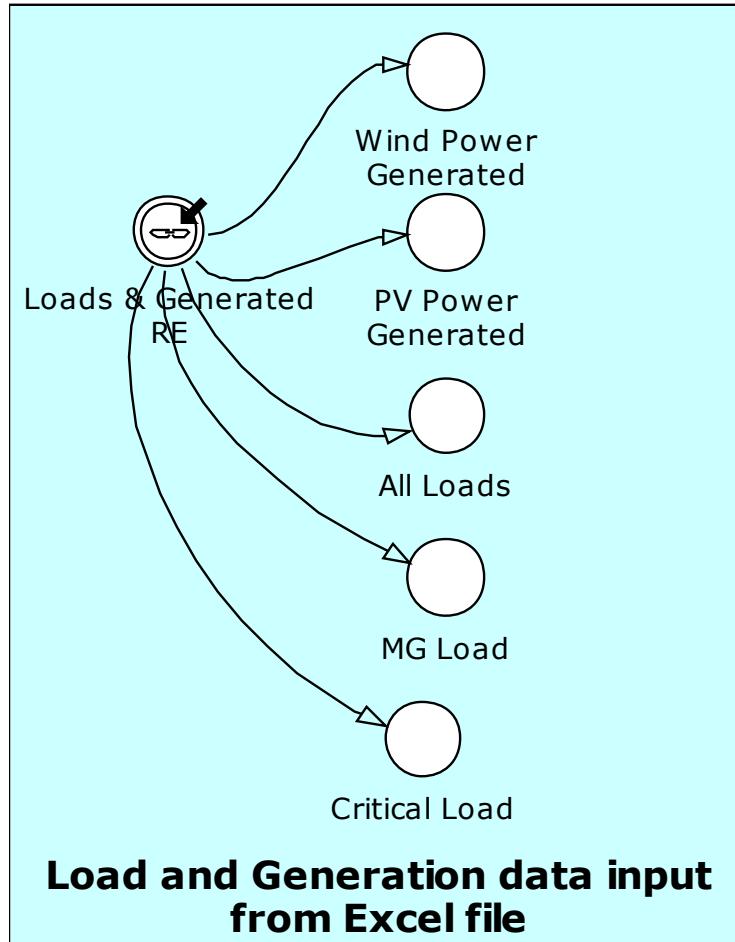


Begin Model Building



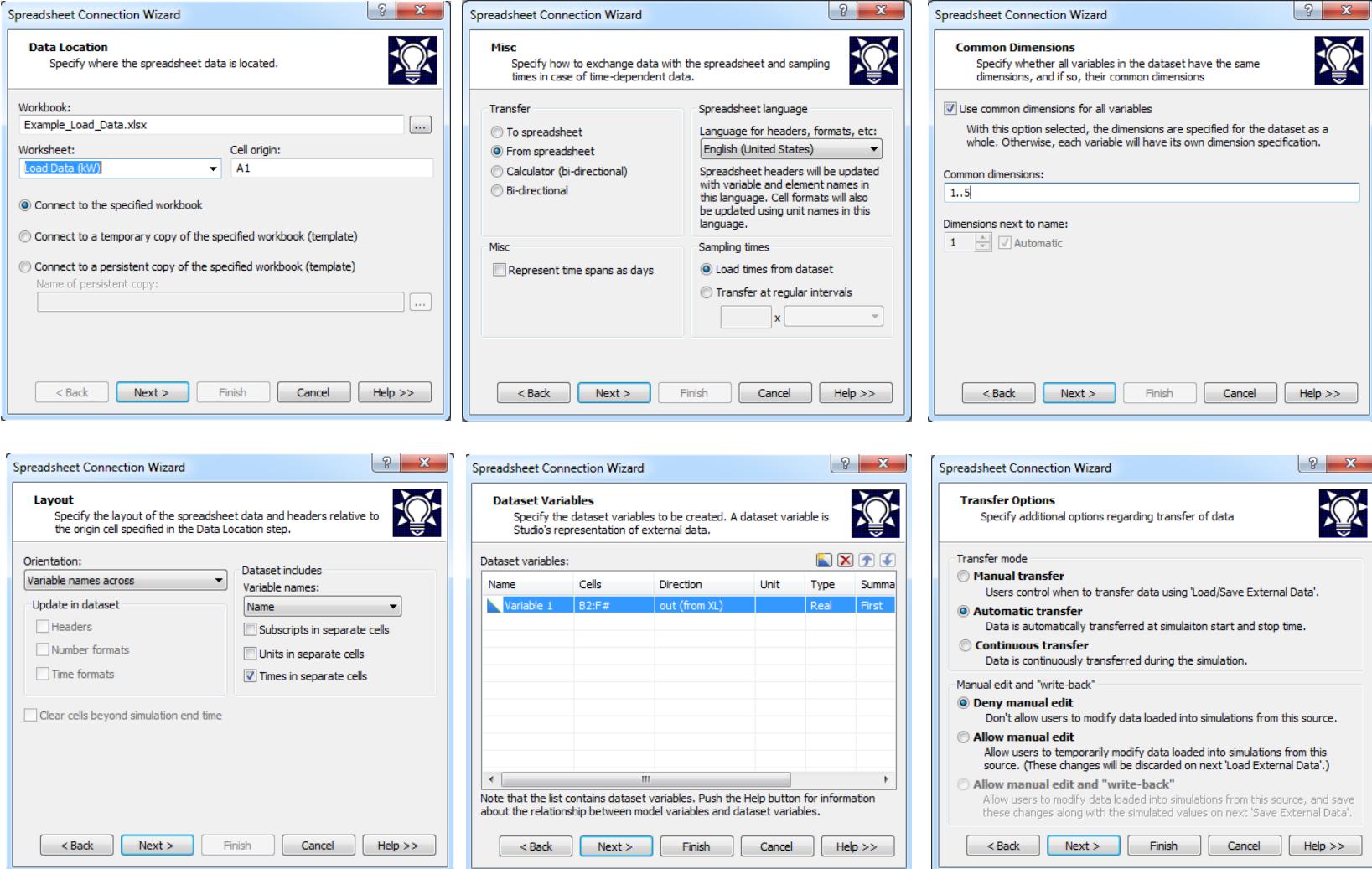
- New Model Wizard
- Step through Wizard

Accessing Data Files – Connections



- Create global dataset
- Add dataset
- Create auxiliary
- Create connection
- Create simple reports/figures

Dataset Creation



Spreadsheet Connection Wizard - Data Location

Specify where the spreadsheet data is located.

Workbook: Example_Load_Data.xlsx

Worksheet: Load Data (W) **Cell origin:** A1

Connect to the specified workbook

Connect to a temporary copy of the specified workbook (template)

Connect to a persistent copy of the specified workbook (template)

Name of persistent copy:

Next > **Finish** **Cancel** **Help >>**

Spreadsheet Connection Wizard - Misc

Specify how to exchange data with the spreadsheet and sampling times in case of time-dependent data.

Transfer

- To spreadsheet
- From spreadsheet
- Calculator (bi-directional)
- Bi-directional

Spreadsheet language: English (United States)

Spreadsheet headers will be updated with variable and element names in this language. Cell formats will also be updated using unit names in this language.

Misc

Represent time spans as days

Sampling times

- Load times from dataset
- Transfer at regular intervals

Next > **Finish** **Cancel** **Help >>**

Spreadsheet Connection Wizard - Common Dimensions

Specify whether all variables in the dataset have the same dimensions, and if so, their common dimensions

Use common dimensions for all variables

With this option selected, the dimensions are specified for the dataset as a whole. Otherwise, each variable will have its own dimension specification.

Common dimensions: 1..5

Dimensions next to name: 1 Automatic

Next > **Finish** **Cancel** **Help >>**

Spreadsheet Connection Wizard - Layout

Specify the layout of the spreadsheet data and headers relative to the origin cell specified in the Data Location step.

Orientation: Variable names across

Update in dataset

- Headers
- Number formats
- Time formats

Clear cells beyond simulation end time

Dataset includes

- Variable names: Name
- Subscripts in separate cells
- Units in separate cells
- Times in separate cells

Next > **Finish** **Cancel** **Help >>**

Spreadsheet Connection Wizard - Dataset Variables

Specify the dataset variables to be created. A dataset variable is Studio's representation of external data.

Dataset variables:

Name	Cells	Direction	Unit	Type	Summa
Variable 1	B2:F#	out (from XL)		Real	First

Note that the list contains dataset variables. Push the Help button for information about the relationship between model variables and dataset variables.

Next > **Finish** **Cancel** **Help >>**

Spreadsheet Connection Wizard - Transfer Options

Specify additional options regarding transfer of data

Transfer mode

- Manual transfer**
- Automatic transfer**
- Continuous transfer**

Users control when to transfer data using 'Load/Save External Data'. Data is automatically transferred at simulation start and stop time. Data is continuously transferred during the simulation.

Manual edit and "write-back"

- Deny manual edit**
- Allow manual edit**

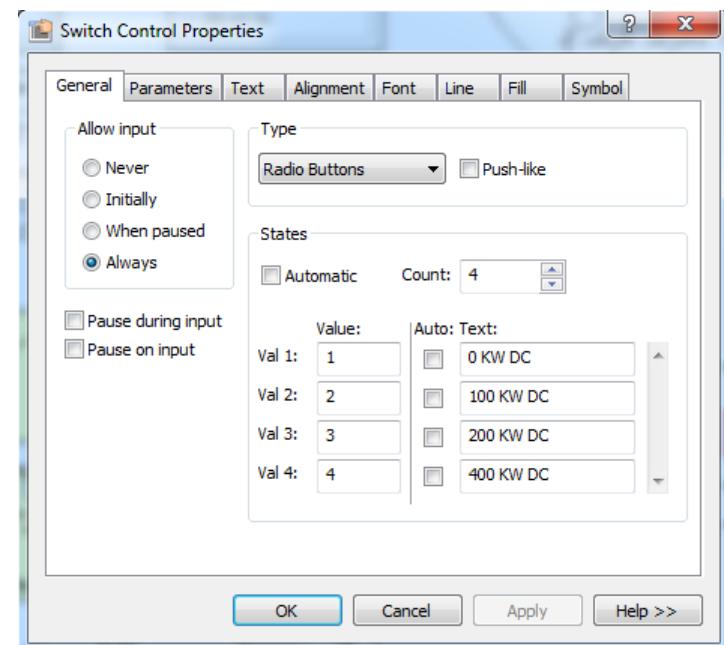
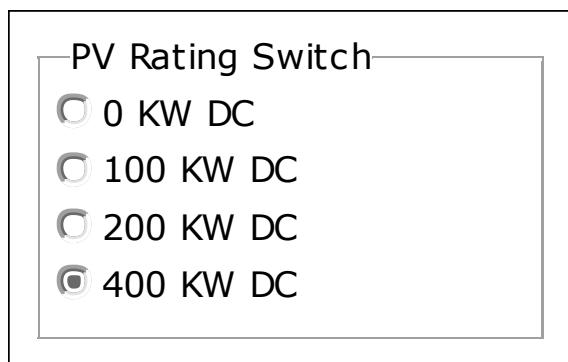
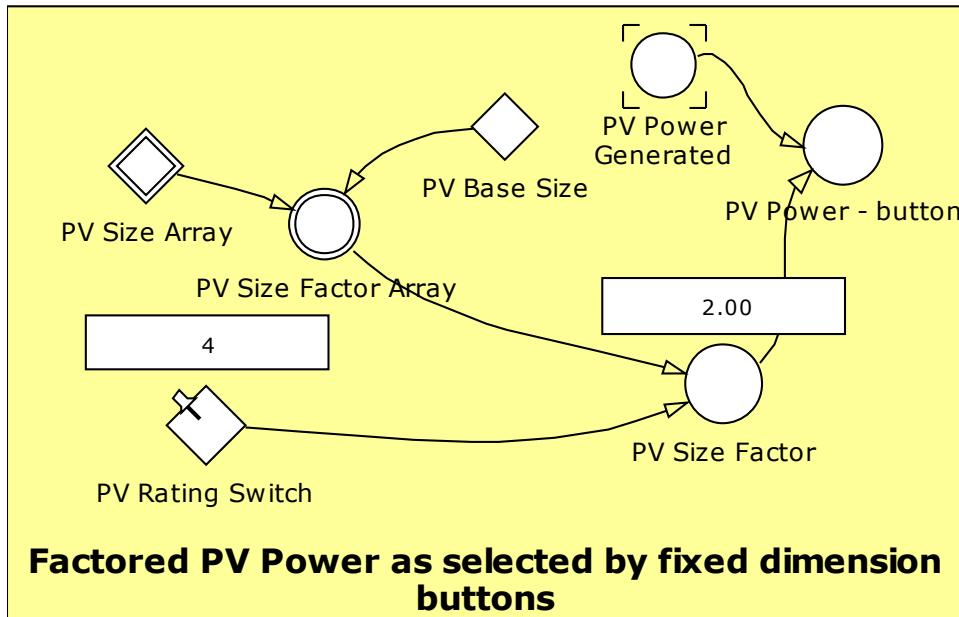
Don't allow users to modify data loaded into simulations from this source. Allow users to temporarily modify data loaded into simulations from this source. (These changes will be discarded on next 'Load External Data'.)

Allow manual edit and "write-back"

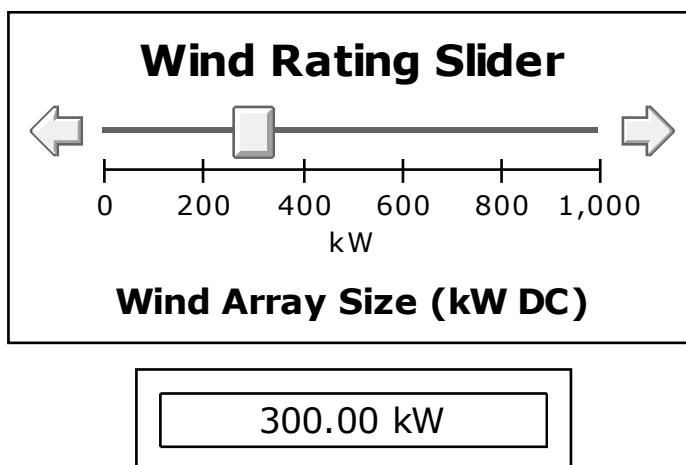
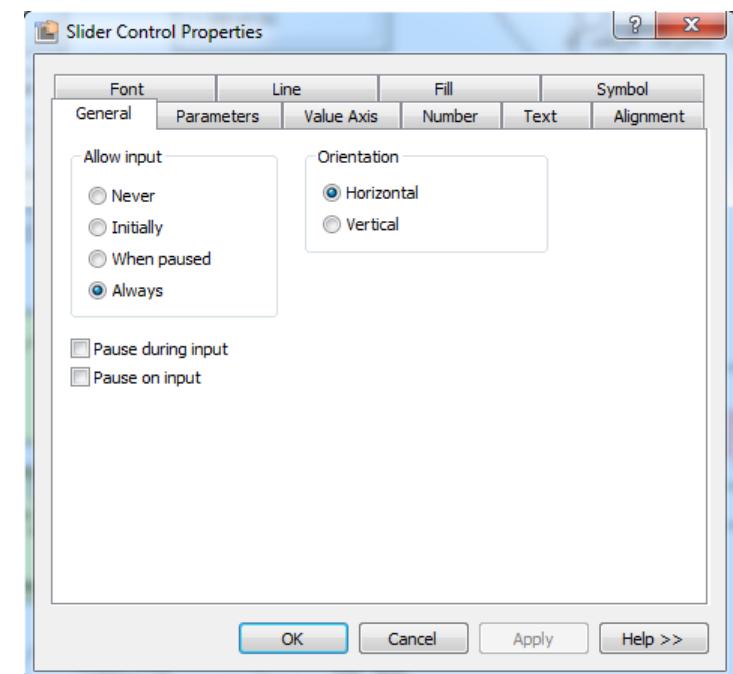
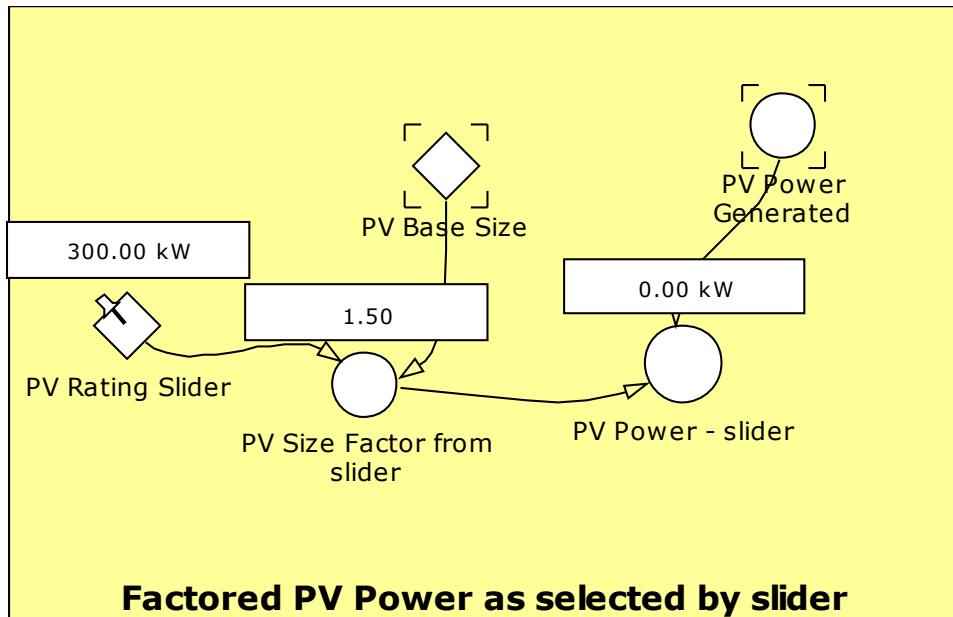
Allow users to modify data loaded into simulations from this source, and save these changes along with the simulated values on next 'Save External Data'.

Next > **Finish** **Cancel** **Help >>**

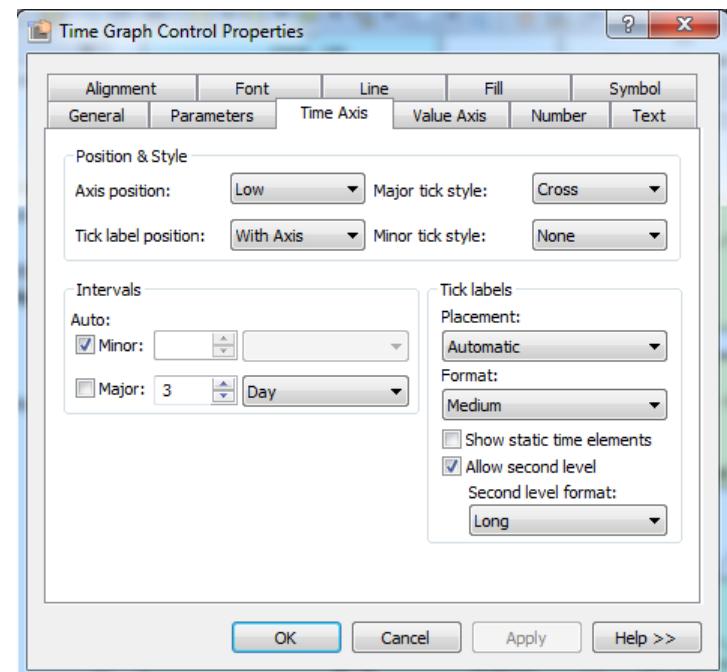
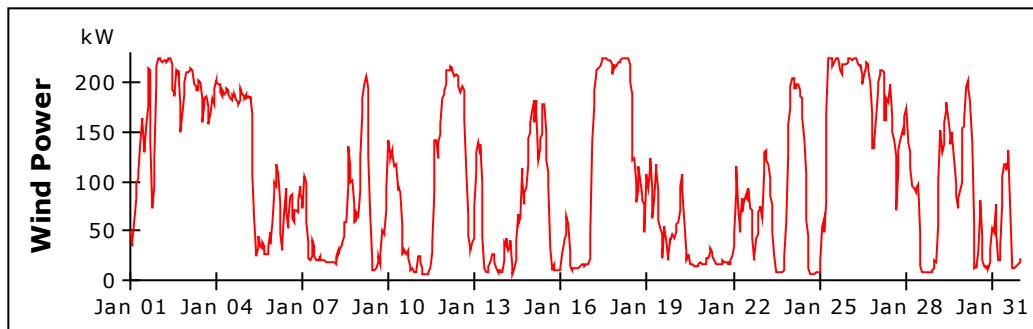
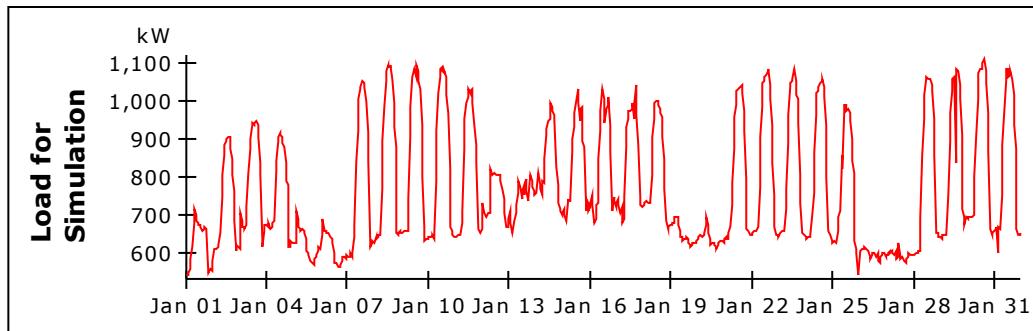
Creating Switches



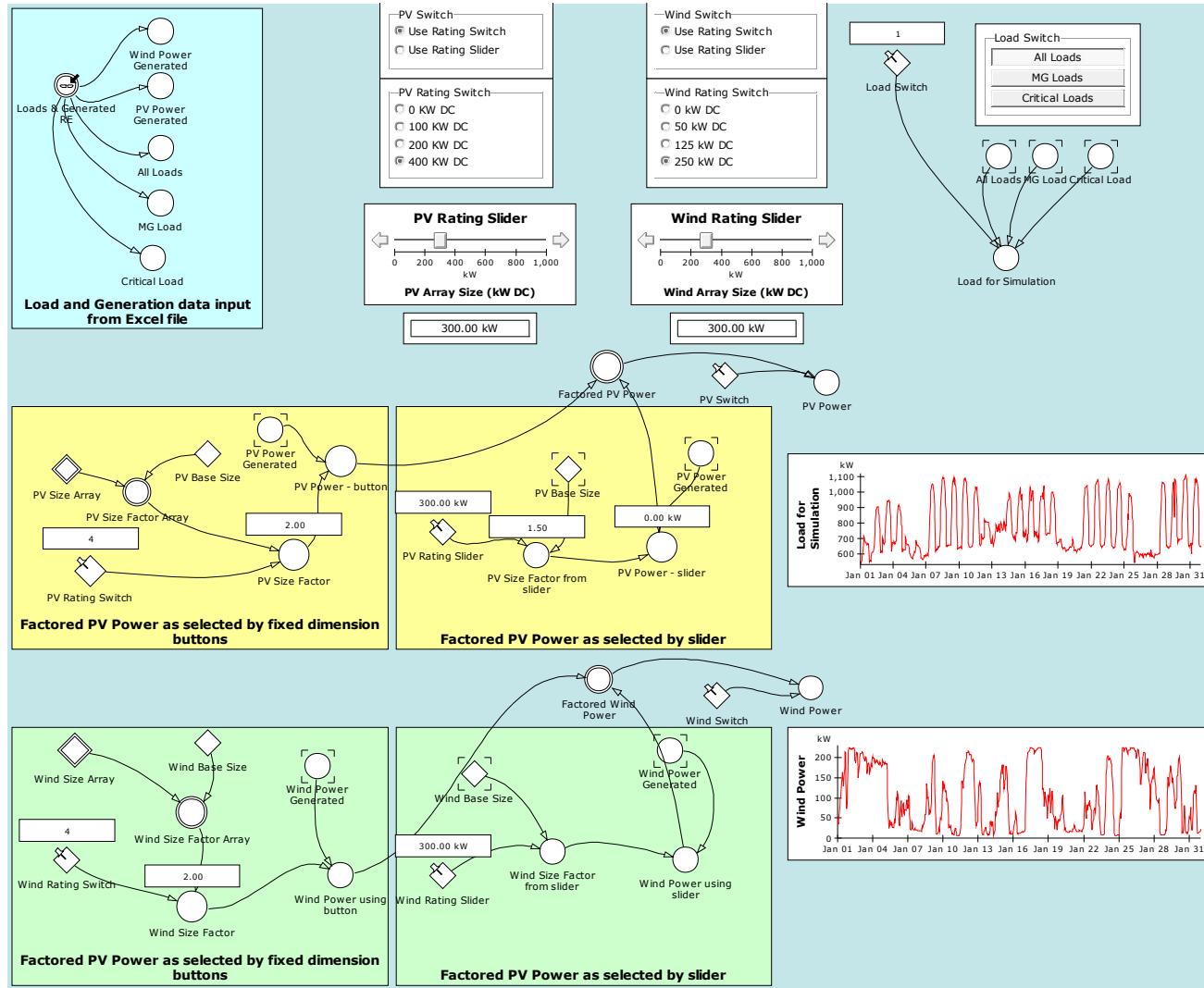
Creating Sliders



Creating Figures and Charts

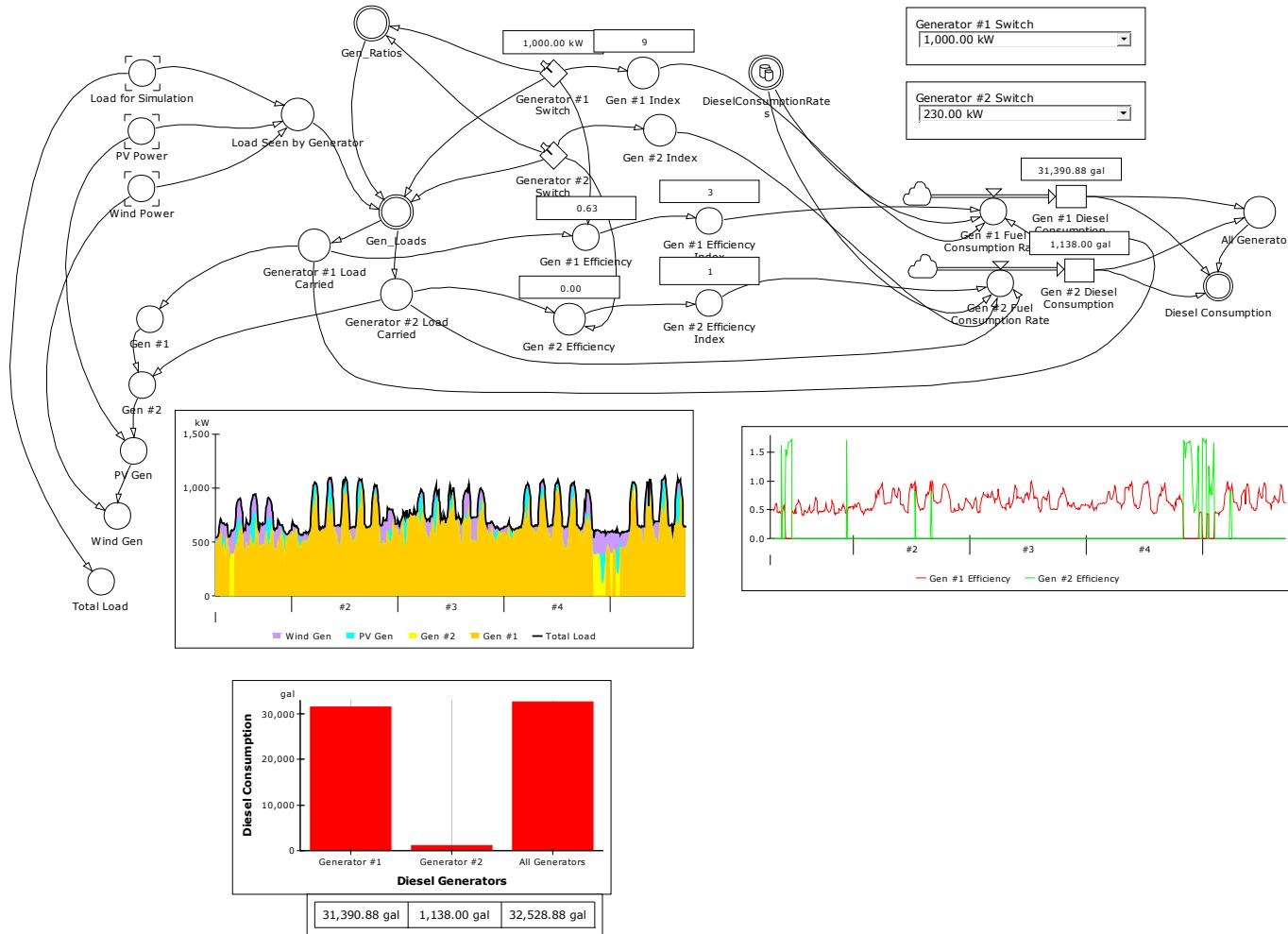


Model Creation



- Create input switches and slider for wind generation
- Create input switch for loads

MG Model



Generator Lists and Switches

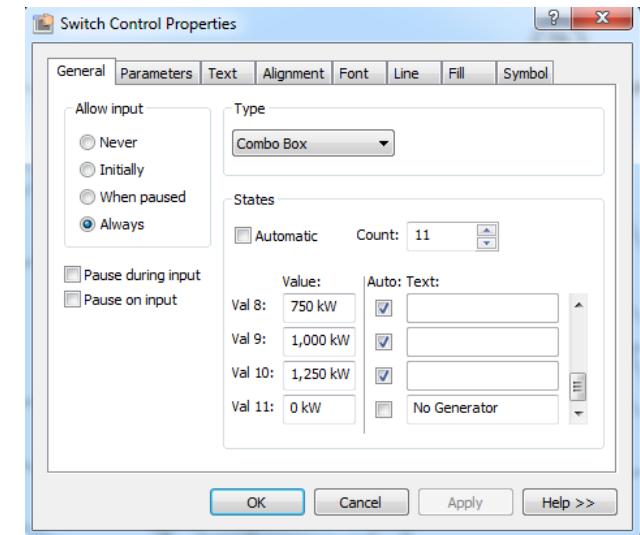
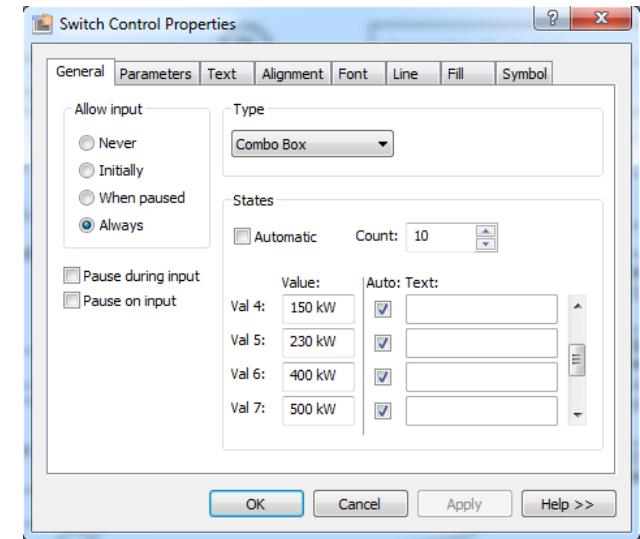
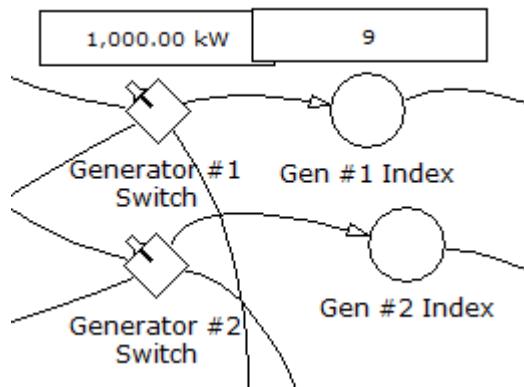
- Include pull-down list

Generator #1 Switch

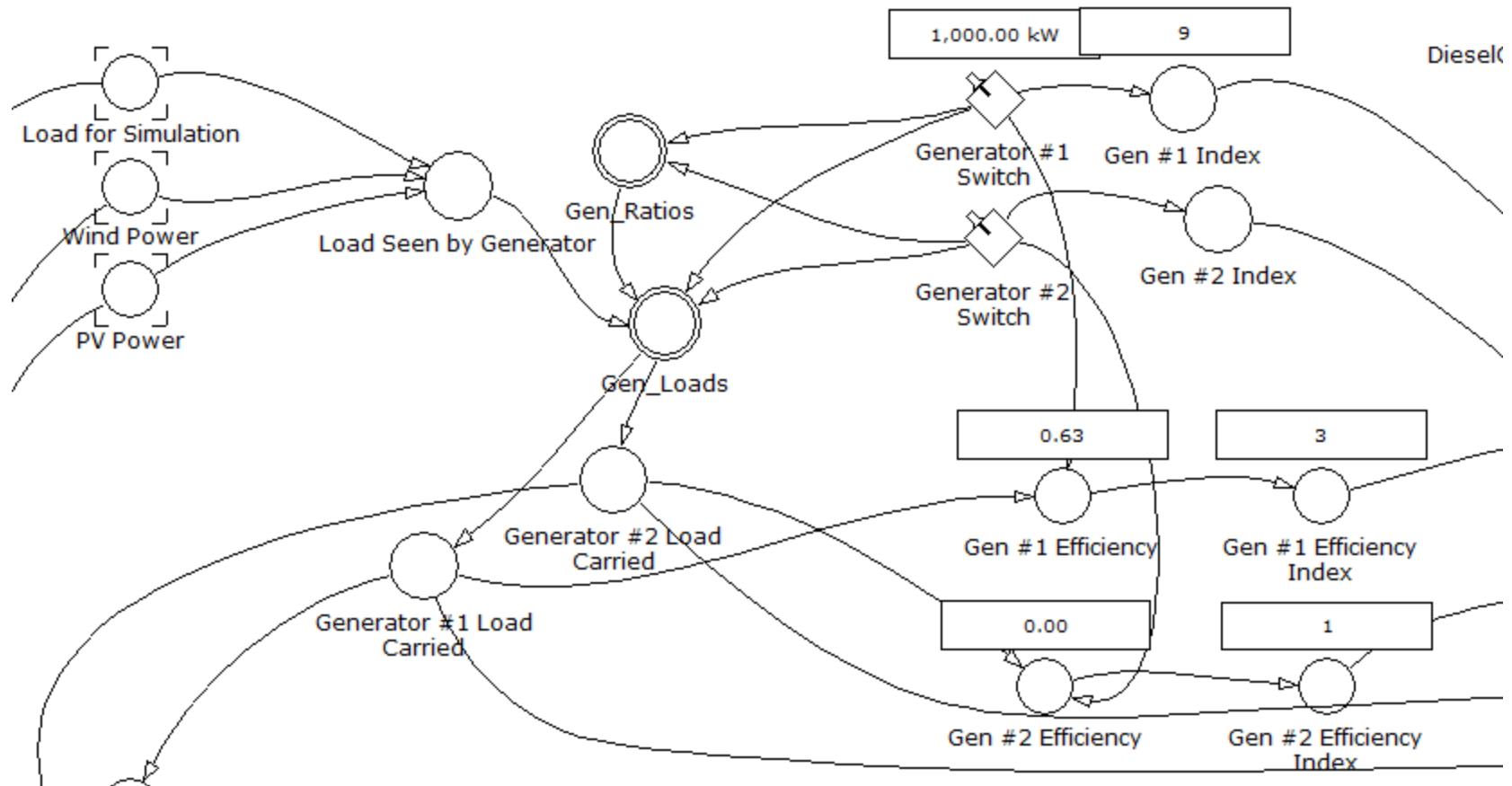
1,000.00 kW

Generator #2 Switch

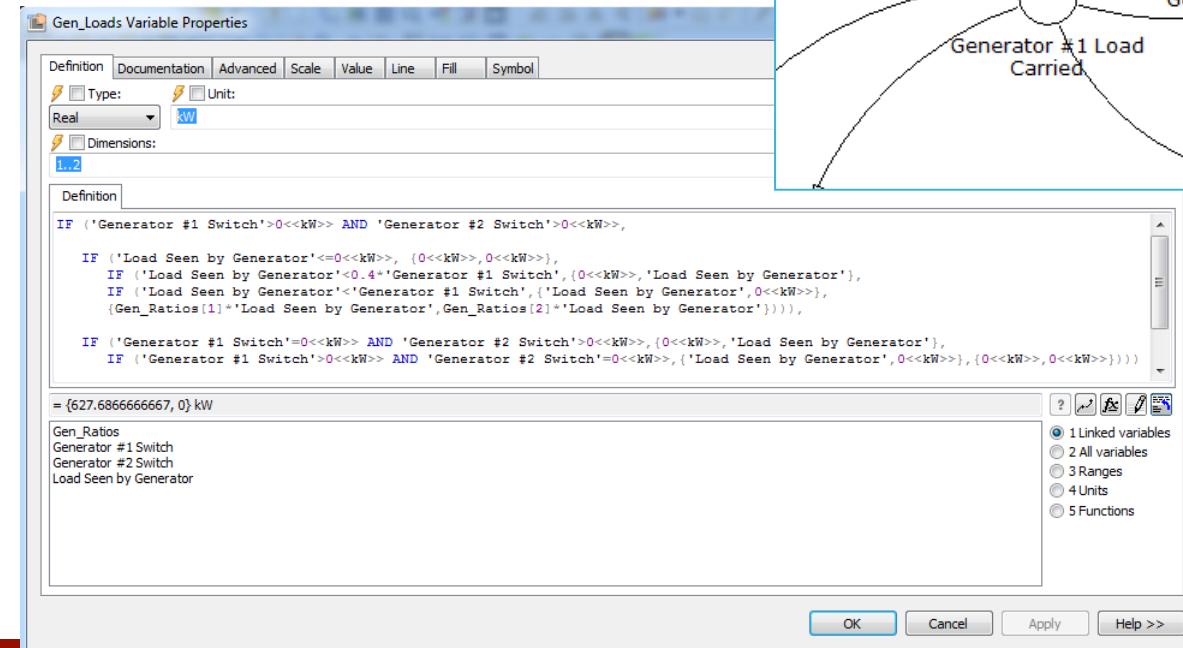
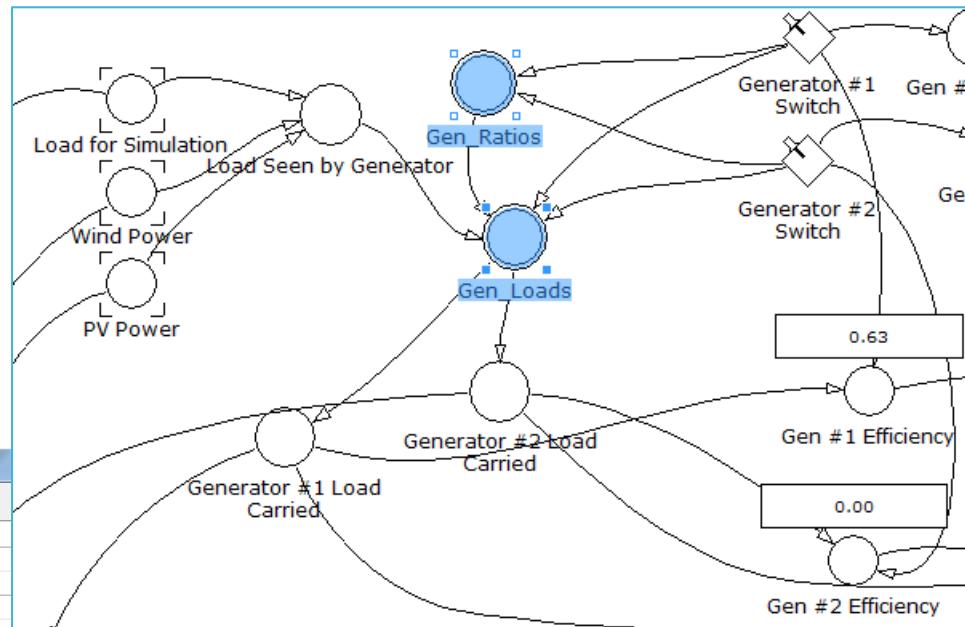
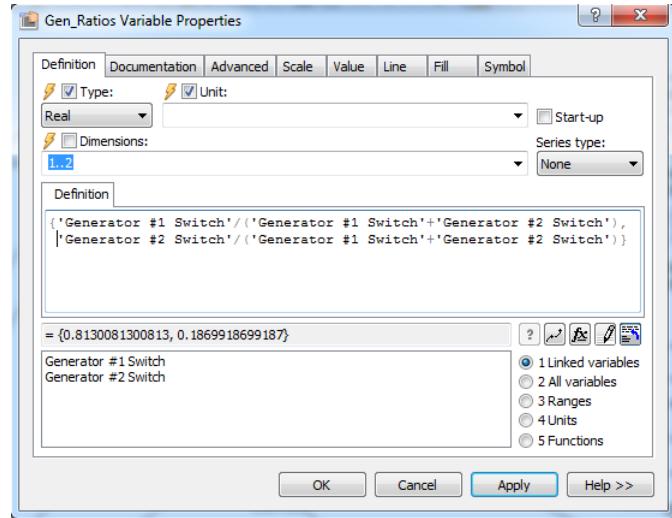
230.00 kW



Load Model

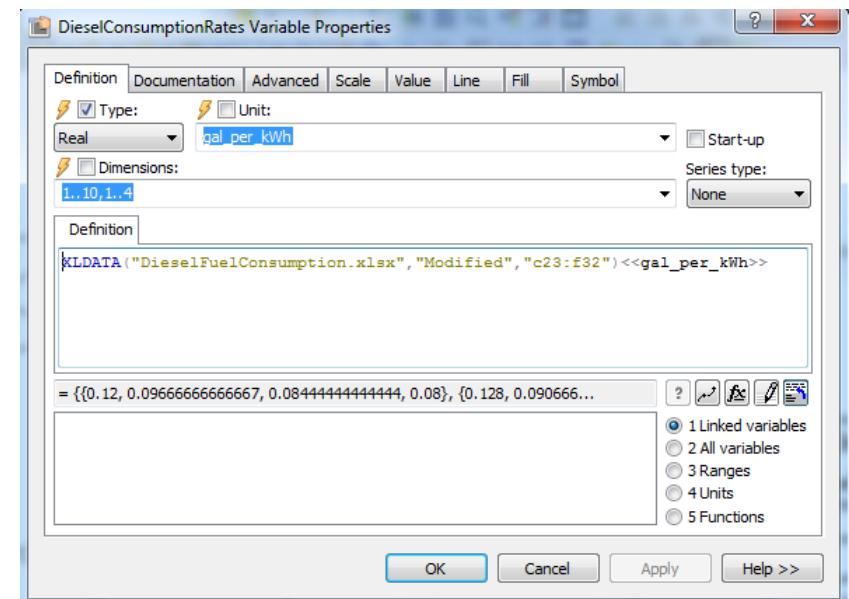
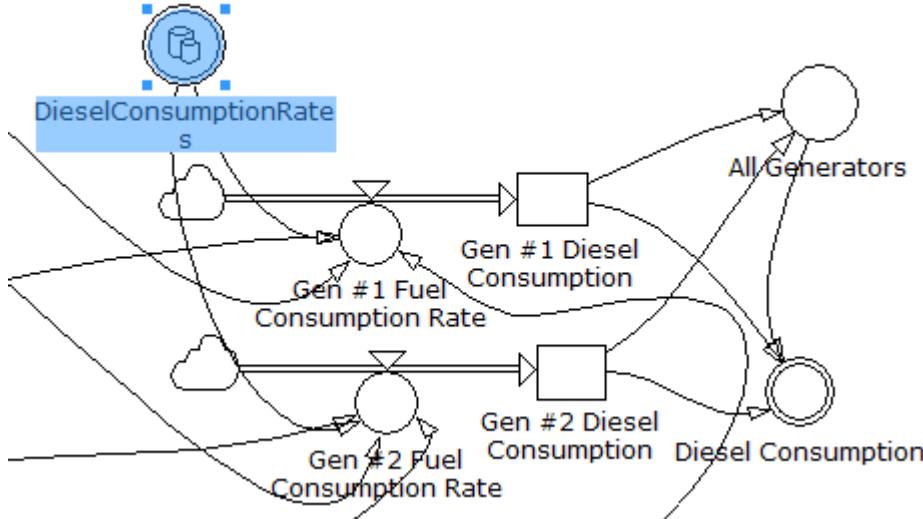


Generator Loads



Diesel Consumption Rate

- Adding time independent dataset using direct call to EXCEL file
- Create array variable



Diesel Consumption

- Link diesel consumption rate to a flow w/ rate to calculate total consumption

Gen #1 Fuel Consumption Rate Variable Properties

Type: Real Unit: gal/hr

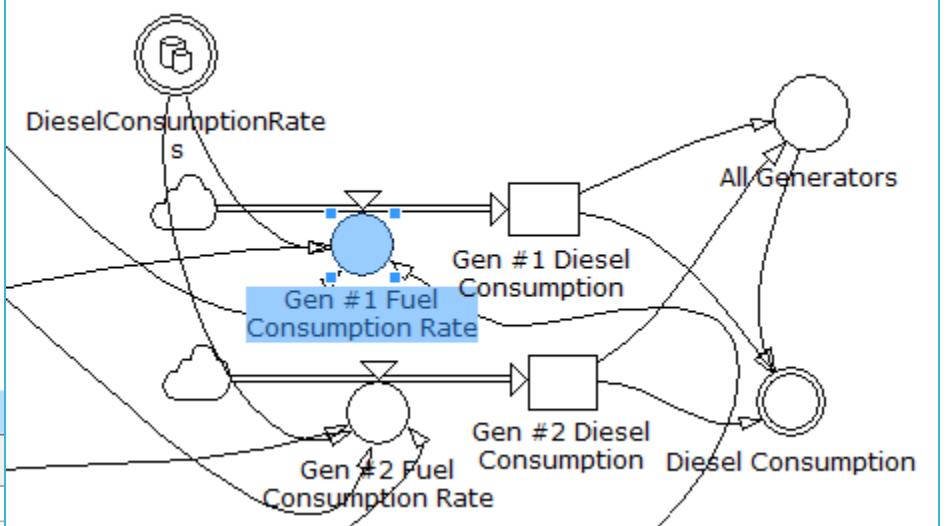
Dimensions:

```
'Generator #1 Load Carried'*DieselConsumptionRates[INDEX ('Gen #1 Index'),INDEX ('Gen #1 Efficiency Index')]
```

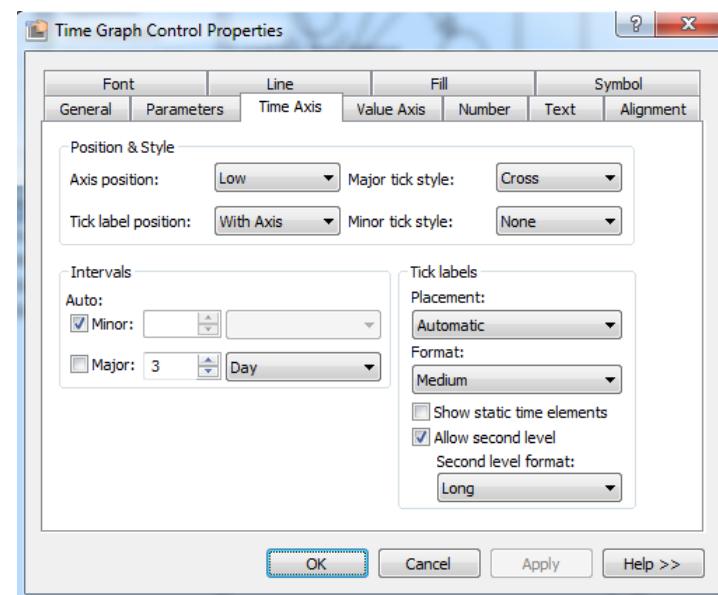
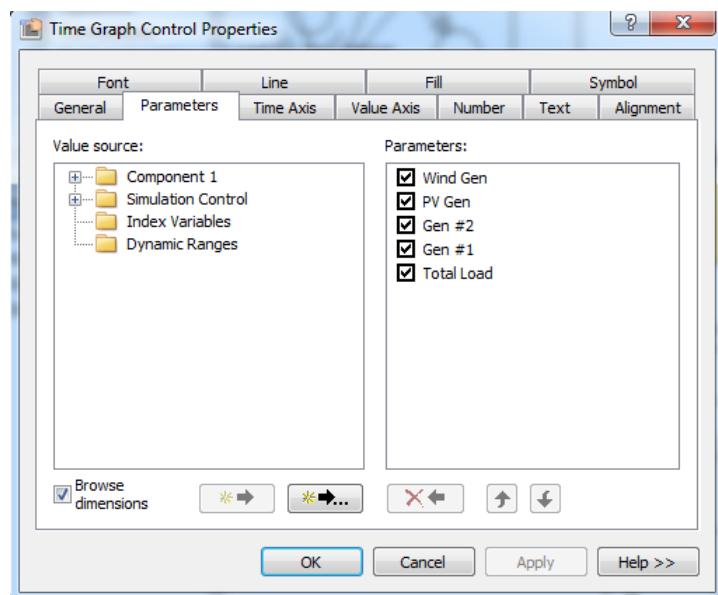
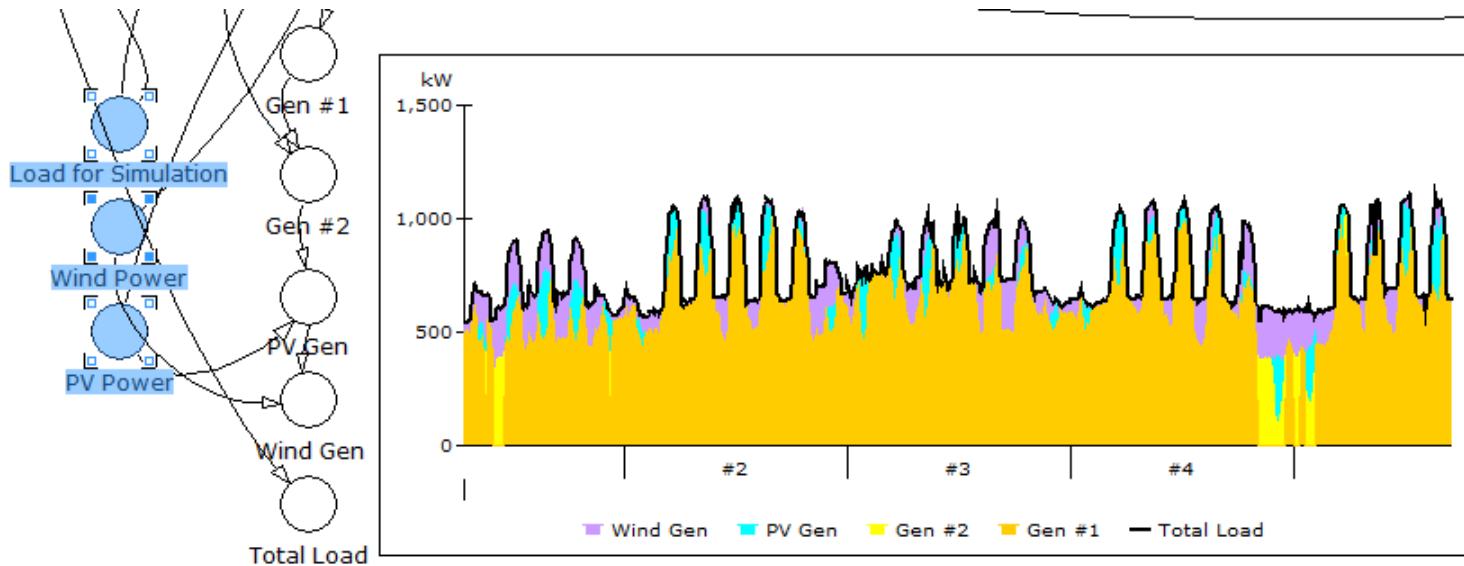
= 43.6033004444 gal/hr

DieselConsumptionRates
Gen #1 Efficiency Index
Gen #1 Index
Generator #1 Load Carried

OK Cancel Apply Help >>

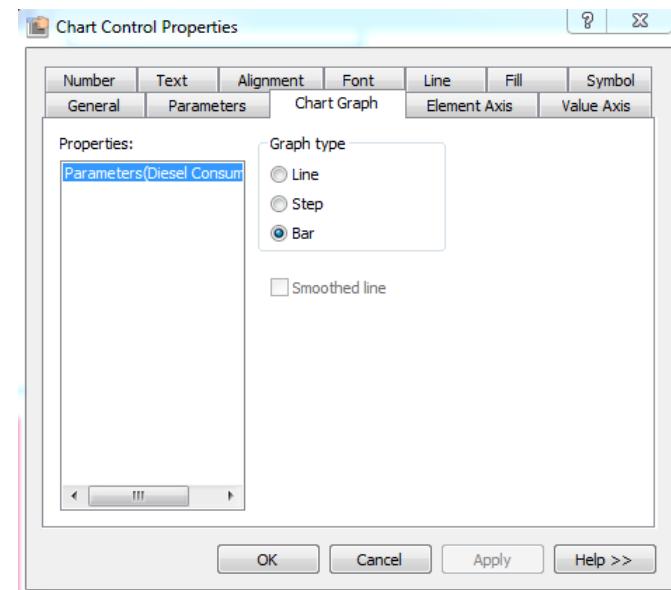
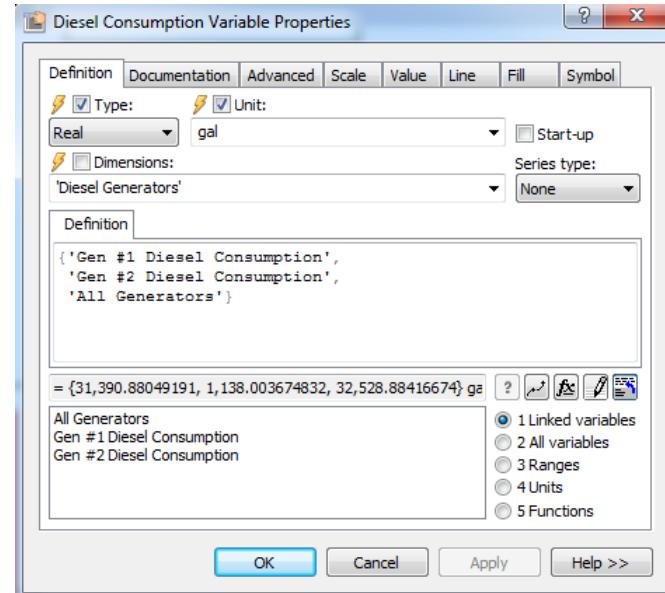
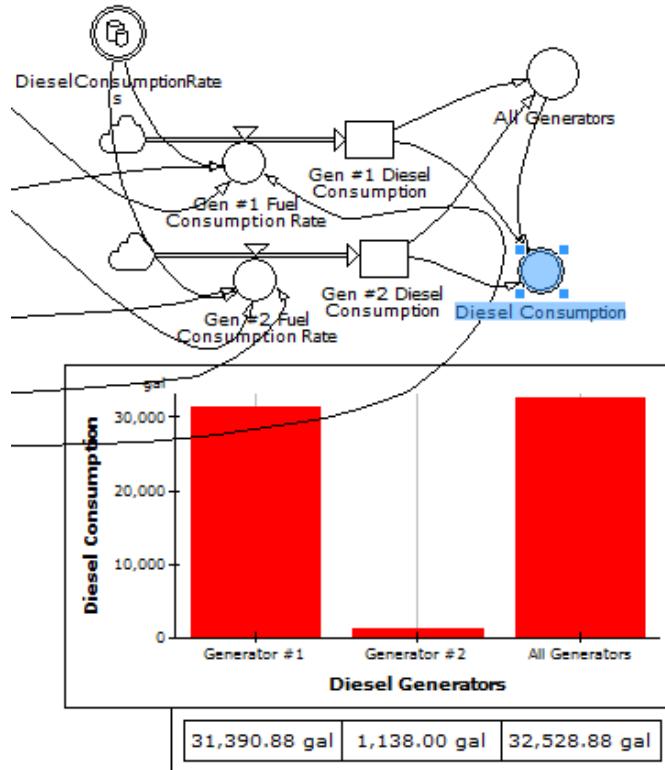


Create Output Figure

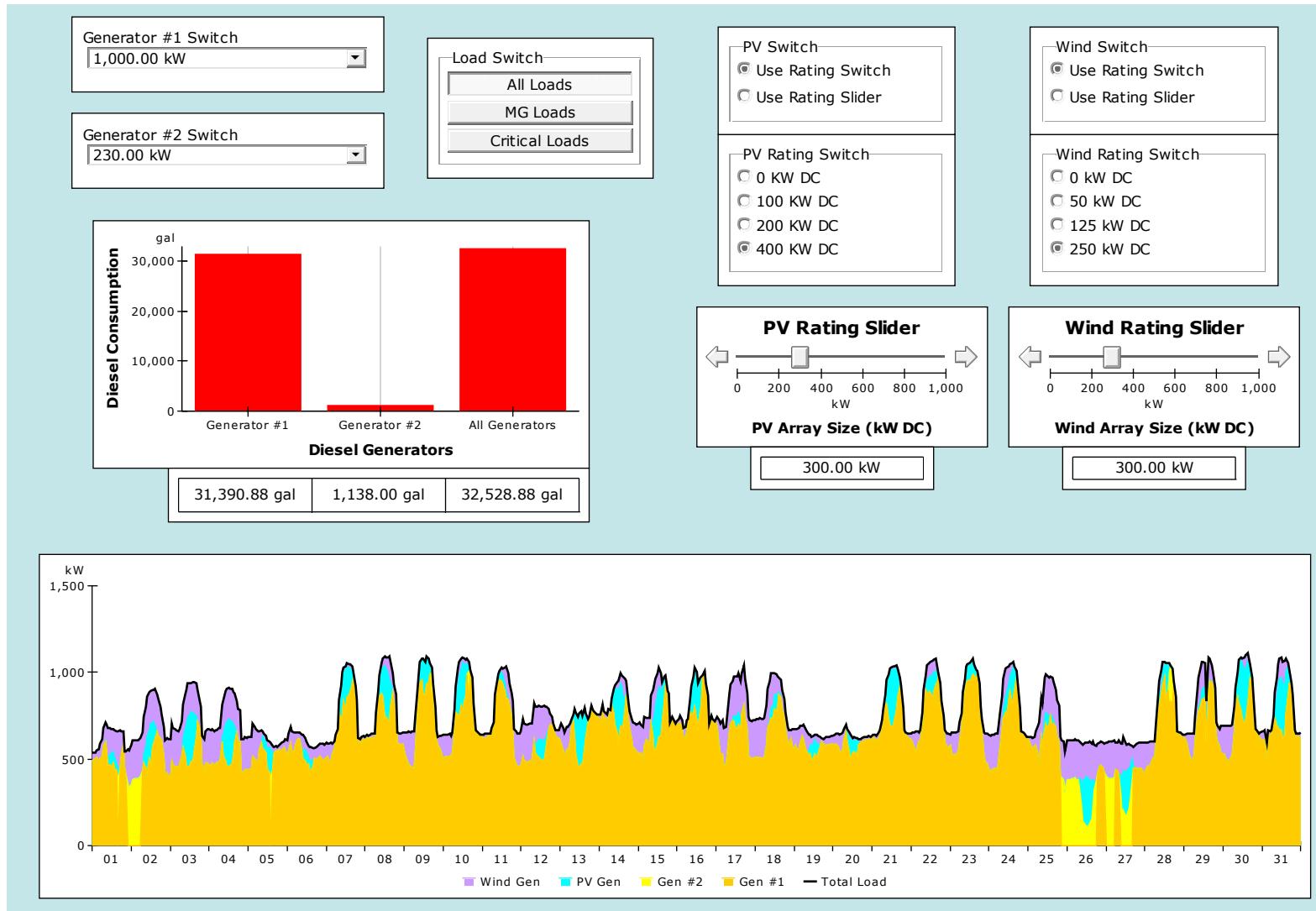


Create Bar Graph

- Create array of “Diesel Consumption”
- Create bar graph of array



Create Input/Output Diagram



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QUESTIONS & ANSWERS

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