# PRiSM Model Guide

PRiSM is an Excel based model developed by Avista to select new resources to meet customer demands for capacity, energy, and clean energy. The model uses mixed integer programming to determine the least cost resources to meet load obligations considering the constraints of resource options and load requirements. More information regarding PRiSM is available in the Preferred Resource Strategy chapter of the IRP document. This document provides an overview and guide to the Excel spreadsheets and worksheets within the PRiSM folder included in the appendix of the IRP document and on Avista's IRP website.

In order to re-solve this PRiSM model, the user will need the industrial version of *What's Best* software by Lindo Systems. Avista also uses *Gurobi* software to promote faster solving of the model - this software is optional to run the model but will require changes to the setup for the model to solve[1].

*What's Best* uses specific formatting to cells and special characters to identify cells that effect the operation of the mixed integer program. Specifically, any cell with a blue font is considered an adjustable cell which means the solver selects the value of the cell using the optimization engine. Cells with constraints are identified by "=>", "=<", or "=" symbols. These constraints enforce user-determined requirements of formulas effected by adjustable cells.

**WB! Status:** This worksheet is generated by the *What's Best* software and provides information related to the optimization solution. This information is useful to determine whether the model optimally solved or stopped with the best solution over a period of time unless an error is detected. This worksheet is also useful in debugging the model if it does not solve due to an error.

**README:** This worksheet shows a description of the study being performed and provides context of the study.

**Results_Summary:** This worksheet includes a summary by year of the resources retired or selected by jurisdiction, and summarizes the cost, risk values, and other key summary information from the study.

**CBI:** This sheet calculates Washington's Customer Benefit Indicator (CBI) metrics for those related to resource planning. For example a calculation of the number of customers with energy burden based on the resource selection for each year is included.

**Position Summary:** Tables of each jurisdiction's monthly capacity and energy position before and after resource acquisition.

[1] Contact Avista for assistance if you plan on running the model.

**Financial Summary:** This worksheet provides detailed line-item accounting of each financial item by jurisdiction in millions of dollars. This sheet includes both the financial values used for solving the model plus the revenue requirements of the solution. The objective cell is included in cell reference C218. This is the value the *What's Best* model minimizes (optimizes) by changing resources. Included in this sheet are the costs[2] and revenues of each plant as well as the load and summary greenhouse gas emissions. Rows 148 through 163 include the summary financial information for each jurisdiction for all costs included in the model.

**Clean Goals:** This worksheet is used to account for the amount of clean energy resources selected in average megawatts each year by jurisdiction. Data is also included for existing resources, new resources selected by the model, and is the worksheet where transfers of REC/clean energy between jurisdictions occur. Lastly, this worksheet includes the constraints for the minimum amount of clean energy the optimization must add.

**WA_LR:** This worksheet includes the load and resource balance for the Washington jurisdiction. In includes the balance for monthly peak and monthly energy. This worksheet includes line items for each existing resource, load, purchases/sales. This sheet also includes the constraints for the minimum amount of resource peak capacity/energy to be acquired.

**ID_LR:** This worksheet includes the load and resource balance for the Idaho jurisdiction. It includes the balance for monthly peak and monthly energy. This worksheet includes line items for each existing resource, load, and purchases/sales. This sheet also includes the constraints for the minimum amount of resource peak capacity/energy to be acquired.

**System_LR:** This worksheet includes the load and resource balance for the system. In includes the balance for monthly peak and monthly energy. This worksheet includes line items for each existing resource, load, purchases/sales. This sheet also includes the constraints for the minimum amount of resource peak capacity/energy to be acquired.

**Selection:** This worksheet is designed to include each of the supply and demand response resource options as an adjustable cell by jurisdiction. Each resource can be chosen in any given year. Further, this worksheet includes adjustments if the resource is selected for nameplate capacity, winter capacity contribution, summer capacity contribution or annual energy delivery that link to the "WA_LR" or "ID_LR" worksheets.

**DR:** This is the demand response (DR) information worksheet. This includes the maximum capability of each of the DR programs, its peak credits (by season), annual events and duration. This worksheet creates the ramp in of DR programs if selected in the "Selection" worksheet. Also included in this sheet is the estimated energy cost savings values for operating the selected programs.

[2] Ongoing O&M and capital costs are included; operating costs from model results is also linked into this sheet.

**Resource_Data:** This worksheet includes information related to each supply resource option. Including capability, qualifying capacity credits (QCC), availability, reserves, capacity factors, wheeling costs, ancillary services, services cost/benefits, integration costs and cost per unit of energy/capacity. Lastly, this worksheet includes the limits (constraints) of the availability of the resource option.

**EE_Selection:** This worksheet includes 3,008 energy efficiency measure types available to reduce demand, sorted by jurisdiction. Each measure can be selected using the value in column "I". Included in the worksheet is a summary of the amount of GWh each program can save, the winter/summer peak savings and the Total Resource Cost (WA)/Utility Cost (ID) estimates for each program option. Monthly factors for peak savings and monthly energy savings are also included.

**Aurora_Res_Results:** This worksheet includes resource output data from the Aurora model. Specifically, the Aurora model results of the costs/revenues for each existing thermal and new resource options; including greenhouse gas emissions. Information included is the average annual values of the 300 simulations.

**Tran-Cap_Rec:** This worksheet accounts for each supply side resource's capital cost to interconnect the resource to the system. If a particular resource is selected, the annual revenue requirement table will be populated with annual cost to be collected each year due to the transmission investment cost. This worksheet also includes constraints to limit the amount of transmission used in a location prior to adding incremental costs.

**New_Resource_Annual_Cost:** This worksheet summarizes the annual cost of each of the new supply side resource options. This includes energy payments (i.e. PPA costs), capacity payments (i.e. PPA or ownership), wheeling costs, and intra-hour benefits/costs (i.e. reserves/integration).

**Res_MWh:** This data is the supply resource monthly output data from the Aurora model. It includes the megawatt-hour dispatch for each supply side resource option for each iteration of the Aurora study. Existing resources are in megawatt-hours and new resources are in megawatt-hours based on a capacity of one megawatt. Resources are also allocated by jurisdiction.

**Risk:** With 300 iterations/simulations of Aurora's market price and dispatch forecast, this worksheet summarizes all costs and revenues of the selected portfolio by iteration to estimate the standard deviation and tail value at risk cost estimates. Costs are divided by jurisdiction, year, and iteration. Also included is input data for contracts, hydro and load for each of the 300 iterations

**Load Costs:** This sheet includes the cost of load and heating end uses for each iteration and year using the hourly Aurora electric price forecast. For system loads the load cost does not include energy efficiency in the cost to serve the load.

**G_A:** This worksheet of general assumptions includes inflation hours per year, jurisdiction PT ratio, REC prices, social cost of carbon, planning margins and many other values that are linked to other worksheets in the model.

**NEI:** This worksheet includes the non-energy impacts for each supply-side resource and demand response for Washington resource options. This sheet also calculates greenhouse gas emissions for social cost of carbon calculations

**Market Impacts:** This sheet is used to estimate the amount of regional greenhouse gas emissions to include for market transactions.

**Air_Emissions**: Estimate the tonnes of NOx, SO2, VOC, Mercury based on resource selection. This tab is used for certain CBIs.

**HHI:** This is a calculation of the Herfindahl-Hirschman Index for Facility, Fuel, and Locational generation resources.

**EE_Mrkt_Value:** This worksheet includes calculations related to the effects of energy efficiency. The market values from the Aurora model for efficiency loads shapes are included. These tables estimate the energy value of energy efficiency programs for the financial evaluation.

**NewCapex:** This worksheet is used to account for future capital investment requirements of existing thermal resources split by jurisdiction. Specifically, the table is used to evaluate the option to retire plants and the avoidance of future capital costs.

**Energy Burden:** This data includes customer demographic energy burden information to estimate the CBI's regarding customer energy burden.

**NG_Clean Goals:** This is an annual accounting of the clean energy requirements for the CCA and CPP for the natural gas LDC.

**Gas Peak Day:** Ensures the natural gas LDC includes enough gas resources to meet the peak day load estimates.

**NatGas_WA:** This is the monthly Load and Resource Balance for the Washington Natural Gas LDC.

**NatGas_ID:** This is the monthly Load and Resource Balance for the Idaho Natural Gas LDC.

**NatGas_ORN:** This is the monthly Load and Resource Balance for the Northern Oregon Natural Gas LDC.

**NatGas_ORS:** This is the monthly Load and Resource Balance for the Southern Oregon Natural Gas LDC.

**NatGas_ORTX:** This is the monthly Load and Resource Balance for the Oregon Transport customers.

**JP Storage:** This is the monthly accounting of how the Jackson Prairie Energy Storage is used to meet model's monthly demands.