

SWITCH Model Capability Overview

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Category	Currently, SWITCH can:	Currently, SWITCH cannot:	Planned capability:
Model uses	Create long-term investment plans that meet load, reliability requirements, operational constraints, and policy goals using projected technology costs. A simplified hourly dispatch algorithm within the investment framework captures aspects of wind and solar variability and mitigation measures for such variability	Perform detailed unit commitment and economic dispatch to simulate day-to-day grid operations	Check feasibility and performance of investment plans with an industry standard security-constrained unit commitment and economic dispatch model such as PLEXOS
Geographic extent and resolution	Model the Western Electricity Coordinating Council (WECC): California, Oregon, Washington, Idaho, Montana, Utah, Wyoming, Nevada, Colorado, Arizona, New Mexico, Baja Mexico Norte, British Columbia, Alberta		Expand to the electric power system of the entire continental United States and Canada
	Model 50 load areas or “zones” in the WECC within which demand must be met and between which power is sent	Perform bus or substation level analysis	
Technology options	Operate the existing generation within operational lifetimes		
	Retire existing generation infrastructure		
	Install and operate conventional and renewable generation capacity using projected fuel and technology costs. Natural gas fuel costs can be modeled with price elasticity	Determine economy-wide fuel prices	
	Install and operate storage technologies with multiple hours of storage duration for power management services		Install and operate storage technologies with shorter storage duration
	Use supply curve for biomass to deploy bioelectricity plants	Determine the optimal ratio of biomass allocation between electricity and other end uses	Determine the optimal ratio of biomass allocation between electricity and transportation
Transmission network	Install new transmission lines and operate them as a transportation network	Enforce AC power flow, stability, and N-1 contingency constraints for the transmission network in the investment optimization	Enforce DC power flow, stability, and N-1 contingency constraints in PLEXOS
	Operate existing transmission lines subject to thermal limits		Enforce DC power flow for the existing transmission network and limit power flow of existing network via phase angle in the investment optimization
Demand	Detailed hourly demand forecasts for 50 load area throughout WECC through 2050, including energy efficiency, electric vehicles, and heating electrification	Evaluate optimal energy efficiency installation or electrification decisions	

Reliability	Ensure load is met on an hourly basis in all load areas	Account for sub-optimal unit-commitment due to forecast error; include treatment of electricity market structures	
	Maintain spinning and non-spinning reserves in each balancing area in each hour to address contingencies	Explicitly balance load and generation on the sub-hourly timescale; model system inertia or Automatic Generation Control (AGC)	Maintain regulation reserves
	Maintain a capacity reserve margin in each load area in each hour		
Operations	Cycle baseload coal and biomass generation on a daily basis and enforce heat-rate penalties for operation below full load		Enforce ramping constraints
	Enforce startup costs and part-load heat-rate penalties for intermediate generation such as combined cycle gas turbines (CCGTs)	Perform detailed unit-commitment in the investment optimization	Perform unit-commitment in PLEXOS
	Enforce startup costs for peaker combustion turbines		
	Shift loads within a day using projections of demand response potential		
	Operate hydroelectric generators within water flow limits	Model detailed dam-level water flow or environmental constraints	
Policy	Enforce Renewable Portfolio Standards (RPS) at the load-serving entity level using bundled Renewable Energy Certificates (RECs)	Model unbundled RECs	Enforce NOx and SOx caps
	Enforce a WECC-wide carbon cap or carbon price that escalates over time	Provide global equilibrium carbon price or warming target; assess leakage or reshuffling from carbon policies	
	Enforce the California Solar Initiative (CSI) and other distributed generation targets	Assess incentives for distributed generation	
Environmental Impacts	No capabilities currently	Enforce localized criteria air pollutant, water use, land use, and wildlife constraints	Tabulate regional criteria air pollutant, water use, and land use values for each scenario
Uncertainty	Perform deterministic, scenario-based planning	Perform stochastic planning	Develop robust optimization plans using multiple scenarios