Resource adequacy

Resource adequacy is the ability of supply-side and demand-side resources to meet the aggregate electrical demand (including losses).

Resource adequacy is quantified using loss-of-load probability (LOLP), loss of load expectation (LOLE), and expected energy not served (EENS):

- LOLE is the number of time units that the load will exceed the capacity.
- LOLP is the probability that the load will be interrupted during a given time period.
- EENS is expected energy not served during a given time period.

A very widely-quoted threshold (maximum) value for LOLE is “1 day in 10 years” which means that during a period of 10 years (87,600) hours, the power system is expected to interrupt load for 24 of those hours (1 day). It can also be expressed as 0.1 days per year.

There are software applications to compute LOLE for large-scale power systems, e.g., GEMARS, PRISM, SERVM; most use Monte Carlo simulation, convolution, or network flows.

Capacity markets, which exist at four RTOs (NYISO, ISONE, PJM, and MISO), are built on resource adequacy calculations. At MISO, the capacity market is called the planning resource auction (PRA).

Thrust 3 work – summary of resource adequacy tools

FEATURE	PSS-SINCAL	PRAS	GE-MARS	MECORE	PRISM	PowerSIMM Planner	SERVM	TransCARE	NH2	GridPath RA Toolkit
Probabilistic Method	Convolution method.	Convolution method and Hybrid Method (convolution and Monte Carlo– considering trans. constraints).	Monte Carlo method.	Monte Carlo and convolution method.	Convolution method.	Monte Carlo method.	Monte Carlo method.	Convolution method.	Users are allowed to select between convolution, Monte Carlo or a hybrid method.	Monte Carlo or weather-synchronized simulations.
Tool's Capabilities	Reliability indices calculated for load nodes, areas, or the entire network.	Reliability indices calculated for areas.	Reliability indices calculated for areas. GE-MARS performs chronological hourly simulations.	Up to 1,000 buses and 2,000 branches. Indices calculated for buses or overall system and monthly, seasonal, or annual.	Up to 700 and 4,500 units. Reliability indices are computed weekly, seasonally, and annually over a two-area model.	Studies include production costs, power flow, financial analysis, and RA.	SERVM simulates hundreds of thousands of independent hourly chronological simulations. Reliability indices calculated for areas. It is linked to SQL-server.	Up to one million contingencies and up to N-9 contingencies (five lines and four generating units tripped) can be evaluated. It uses SQL-server database.	Up to 3,000 buses and 5,000 circuits for short-term planning. Reliability indices can be disaggregated at the system, area, and bus level and classified by failure modes.	Reliability indices are calculated daily, monthly, or annually for areas. It has been tested for a one-year case study.
Indices Computed	SAIDI, SAIFI, CAIDI.	EUE, LOLE.	LOLE, LOEE, frequency and duration of outages.	LOLP, LOLE, LOEE, ENLC, EDLC, ADLC, ELC, EDNS, EDC, BPII, BPECI, BPACI, MBECI, SI.	LOLE, LOLP.	LOLP, LOLH, LOLE.	LOLH, LOLE, EUE.	SAIFI, LOLE, EUE.	SPP, LOLP, LOLE, EPNS, EENS, LOLF, LOLD.	LOLP, LOLE, LOLH, EUE, average event duration.
Integration with other tools and input data interface	Open architecture for data exchange and IT integration, including SCADA, Distribution Management System (DMS), and Meter Data Management System (MDMS).	PRAS could be integrated with other NREL planning tools: Regional Energy Deployment System Model (ReEDS) and the Resource Planning Model (RPM).	Input/output using csv and xlsx formats. Automatic postprocessing calculations and report generation using Python.	Network topology, FOR for each component, and Load Duration Curve (LDC) are required as input data.	PRISM is composed of an analytic engine (SAS) and a database tool (Oracle). The Week Peak Frequency (WKPKFQ) tool could be integrated to define load data as needed for RA assessments.	PowerSIMM Planner integrates expansion planning studies with reliability analysis. FORs, historical weather and load data, and future expectation of load growth are the main inputs.	SERVM integrated LOLE studies with an hourly and intra-hour chronological production cost model.	Based on TRELSS (EPRI software for probabilistic studies). It can be integrated with OFCT and cascading failure analysis tools. It also can read data from PSS/E.	This software works with an auxiliary program called MODCAR to generate stochastic load models from load curve data and group the load at levels for better data management and visualization.	Integrated with an open-source power system tool denominated GridPath to perform production-cost and capacity-expansion modeling.
Other Features	- Compatibility of the software with GIS applications. - Modeling from basic balanced circuits and buses to four-wire circuits with full substation models.	- Results include regional shortfall and surplus, power transfer on interfaces, unit availability, and state-of-charge of storage. - ELCC and EFC calculation.	- It can model as many interconnected areas as needed. - The modeling includes transfer limits and long-term purchases and sales between areas.	- Multiple unit derating states recognized. - MECORE uses OPF to reschedule generation and avoid load curtailments if possible.	- Outage statistics of generators can be represented with more than two states. - Maintenance optimized or manually specified by the user.	- Keep correlation between variables (load-weather, generation-weather) and across time. - ELCC calculation.	- SERVM quantifies the likelihood, magnitude, and economic cost caused by reliability events. - ELCC calculation.	- Studies of the impact of variable resources on system reliability. - Analysis of extreme events by assessing cascading failures.	- NH2 integrates OPF to implement remedial actions. - Users can select the model of the performance analysis (AC or DC power flow).	- Dataset, algorithm, and instructions are publicly available. - Temporal and geographical correlations over the study area.

Resource Adequacy

Resource adequacy ensures there is enough available power to meet peak demand at all times. It is a key function of MISO. MISO serves as an intermediary between energy sellers and buyers in its region through the Planning Resource Auction. MISO's resource adequacy construct complements the jurisdiction that regulatory authorities have in determining the necessary level of adequacy. It also works in concert utilities that provide demand forecasts that help drive the development of local and regional requirements. MISO began determining resource adequacy on a seasonal, rather than annual, basis in Fall 2022.

See BPM-011 Resource Adequacy for more information on resource adequacy and processes.

Planning Resource Auction (PRA) +

Regional Resource Assessment (RRA) +

Seasonal Accredited Capacity (SAC) +

Seasonal Resource Assessments +

Get Involved +

Related Documents

20211201 RASC Supplemental Q and A Document
12/21/2021 + Follow

20211201 RASC Updated Seasonal RA Conceptual Design Document
08/03/2022 + Follow

BPM 011 Resource Adequacy
10/02/2023 + Follow

BPM 012 Transmission Settlements
10/12/2023 + Follow

How to Access CCE Environment
03/22/2022 + Follow

MECT User Guide
10/09/2023 + Follow

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03/22/2022 + Follow