



GE Multi Area Reliability Simulation (GE MARS*) Software

Accurate system reliability assessment for ensuring system adequacy to satisfy customer load demand

Is your system reliable?

In today's energy industry where participants and their roles are in a constant state of flux, being able to quickly and accurately assess the adequacy of systems is more important than ever. GE's Multi Area Reliability Simulation (GE MARS) program enables quick and accurate assessment of the resource adequacy of a system comprising any number of interconnected areas. Accurate system assessment is crucial for ensuring the adequacy of the system to satisfy future demand. The benefits of using GE MARS include:

- Superior probabilistic algorithm. GE MARS uses Markov Chain Monte Carlo as opposed to recursive convolution to simulate complex operating conditions.
- Reporting the frequency and duration of outages calculated, not just the probability of such events.
- Model emergency operating procedures and their effect on resource adequacy
- Industry-accepted best practices for modeling renewable generation. GE MARS supports unlimited years of renewable generation data while preserving correlation to load.
- Brand new energy storage modeling methods.
- Calculation results go beyond LOLE and LOEE/EUE. GE MARS' detailed and transparent output lets you understand the underlying causes of events.
- Complete and ready-to-use datasets covering all the major North American interconnections (or subsets thereof) are available for license.

GE MARS software puts your system's adequacy to the test

GE MARS is a system simulation program that models the generation system, the interconnections between areas, and the chronological hourly demand. GE MARS software models the system in great detail with accurate recognition of random events such as equipment failures, as well as deterministic rules and policies that govern system operation. GE MARS software can model any number of areas and pools to study multi-area issues such as:

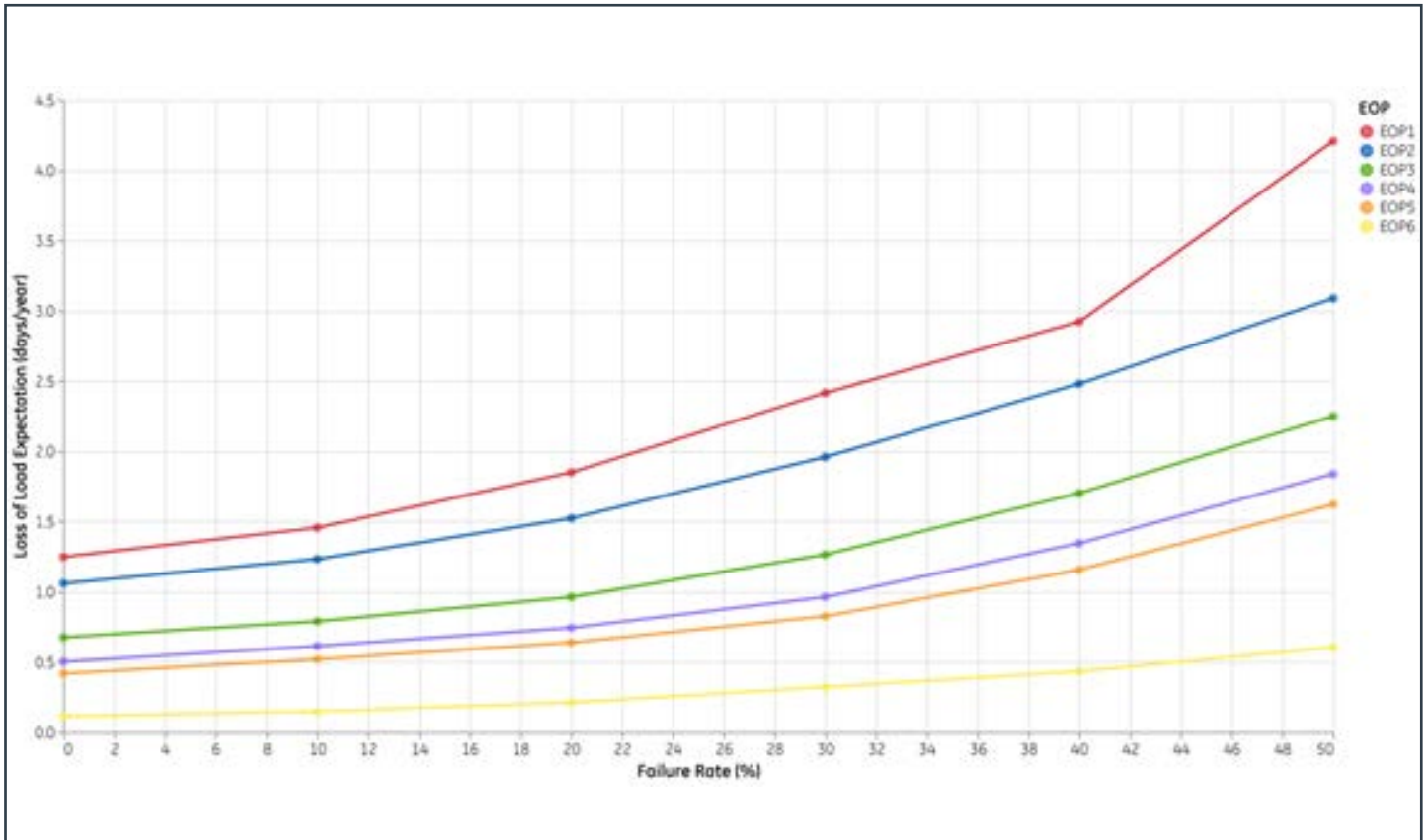
- Probabilistic resource adequacy assessments, such as NERC PROB-A
- Generation system adequacy
- Installed capacity requirements
- Benefits of reserve sharing
- Effects of additional transmission capacity
- Need for implementing emergency operating procedures
- Reliability impact and capacity value of variable resources such as wind and solar
- Influence of energy storage

A chronological, sequential Monte Carlo simulation forms the basis of the GE MARS simulation. The Monte Carlo method provides a fast, versatile, and easily expandable environment that can be used to fully model various generation and reserve sharing options.

GE MARS models different resource types, including thermal, energy-storage, hydro, and variable resources (wind, solar, etc.)

GE MARS reports the following reliability indices on both an isolated (zero ties between areas) and interconnected (using the input transfer limits between areas) system basis:

- Daily LOLE (loss-of-load expectation, in days/year)
- Hourly LOLE (hours/year)
- LOEE/EUE (loss-of-energy expectation/expected unserved energy)
- Frequency of outage (outages/year)
- Duration of outage (hours/outage)
- Need for initiating emergency operating procedures (days/year and hours/year)



High Performance Computing (HPC)

Large simulations can take a significant amount of time to process on standard desktop hardware. With the optional GE MAPS and MARS Client-Server Manager, GE MARS can be run on HPC resources, so rather than running through the entire study on one machine, GE MARS automatically splits the study up into blocks and sends each block to a separate machine/node. This allows the work to be done in parallel, greatly reducing the amount of time required for a single study. Once processed, the data is then merged, allowing the user to view the results of the study as if it had been executed on a single machine.

User Interface and Python Application Programming Interface (API)

GE MARS comes with a graphical user interface and application programming interface (api) that greatly improve the user experience. The user interface provides several features including:

- Easy-to-use, structured file handling for all your cases
 - Special-designed text editor with documentation to make input table handling easier
 - Create and save input and output tables using csv and xlsx formats
 - Intuitive calculation management
 - Professional-quality report creation

The API allows Python users even more power, including:

- Automated postprocessing calculations and report generation
- Prepare and run calculations on a local or remote computer
- Create inputs from any data source that can be handled in Python

The screenshot displays the GE MARS software interface. At the top, there are tabs for 'General', 'File editing', 'Study log', and 'Report'. Below these are icons for 'Show run log...', 'Compare Input Files', 'Open output folder', 'Download', 'Cancel', 'Delete', 'Move', and 'New report'. The main area is titled 'Study viewer' and shows a table of study logs. The table has columns for Number, Status, Start, End, Elapsed, First year, Last year, Engine, Version, and Priority. Below the table, there are tabs for 'Summary', 'Tasks', 'Local files', and 'Output files'. The 'Output files' tab is active, showing a folder structure with subfolders for years (2021, 2022, 2023, 2024) and files (files, logs, tasks). A table of files is shown with columns for Name, Size, and Last Updated.

Number	Status	Start	End	Elapsed	First year	Last year	Engine	Version	Priority
203		3/25/2022 2:54:26 PM		0.00:00:03	2021	2024	GE MARS	14.600.2150	Normal
202		3/25/2022 2:54:23 PM		0.00:00:06	2021	2024	GE MARS	14.600.2150	Normal
201		3/25/2022 2:54:21 PM		0.00:00:08	2021	2024	GE MARS	14.600.2150	Normal
200		3/25/2022 2:54:19 PM		0.00:00:10	2021	2024	GE MARS	14.600.2150	Normal
199		3/25/2022 2:49:38 PM		0.00:04:51	2021	2024	GE MARS	14.600.2150	Normal
198		3/25/2022 2:49:36 PM		0.00:04:53	2021	2024	GE MARS	14.600.2150	Normal
197		3/25/2022 2:49:35 PM		0.00:04:53	2021	2024	GE MARS	14.600.2150	Normal
196		3/25/2022 2:49:32 PM		0.00:04:56	2021	2024	GE MARS	14.600.2150	Normal
195		3/25/2022 2:49:29 PM		0.00:04:59	2021	2024	GE MARS	14.600.2150	Normal
181		3/24/2022 7:40:27 AM	3/24/2022 7:44:39 AM	0.00:04:11	2021	2024	GE MARS	14.600.2151	Normal
180		3/23/2022 9:41:40 PM	3/23/2022 9:54:18 PM	0.00:12:37	2021	2021	GE MARS	14.600.2150	Normal
170		3/23/2022 9:12:05 PM	3/23/2022 9:41:08 PM	0.00:28:03	2021	2021	GE MARS	14.600.2150	Normal

Name	Size	Last Updated
2021	4.5 MB	3/24/2022 7:43:53 AM
2022	4.7 MB	3/24/2022 7:43:51 AM
2023	4.7 MB	3/24/2022 7:44:02 AM
2024	4.7 MB	3/24/2022 7:44:00 AM
files	7.5 MB	3/24/2022 7:40:14 AM
job.json	10.1 KB	3/24/2022 7:40:16 AM

Various ways to tap the benefits of MARS software

GE MARS is available for installation on in-house computing systems through a software licensing agreement with GE Energy Consulting. The program's benefits can also be accessed through contract studies performed by GE Energy Consulting personnel.

Who needs GE MARS?

Power developers, electric utilities, utility planners, financiers, and economic and regulatory consulting firms all can benefit from the system reliability information accessed through MARS software.

For more information, contact:

maps-mars.sales@ge.com

www.geenergyconsulting.com

