# Reliable modeling, analysis and planning tools to improve distribution system performance

## Base package

CYMDIST is the distribution system analysis base package of the CYME power system analysis software. It bundles all the modeling and analysis tools required to perform the various types of simulations involved in electric distribution system planning. The calculation engines support balanced or unbalanced distribution models that are built with any combination of phases and operated in radial, looped or meshed configurations. CYME software is part of the Brightlayer Utilities suite, a set of digital solutions to help you optimize grid performance and resilience while helping to accelerate decarbonization. Following is a list of the capabilities of CYMDIST as well as option modules to expand the capabilities to meet your needs.

| Software | Details | Description |
|---|---|---|
| CYMDIST distribution analysis software | Unbalanced load flow | Balanced/unbalanced voltage-drop and Newton-Raphson unbalanced (radial, looped or meshed). |
| | Fault analyses | Fault current calculations for RMS, asymmetrical and peak values for all shunt fault configurations.<br>Short-circuit and fault voltage analysis throughout the network taking into account pre-fault loading conditions.<br>Includes conventional/ANSI/IEC 60909/IEC61363 short-circuit, series fault, simultaneous fault, voltage sag, fault locator and equipment rating verification. |
| | Load allocation | Load estimation using customer consumption data (kWh), distribution transformer size (connected kVA), real consumptions (kVA or kW) or the REA method. The algorithm supports multiple metering units as fixed demands and large metered customers as fixed load. |
| | Load growth | Load growth studies for multiple years. |
| | Optimal capacitor placement | Optimal capacitor placement and sizing to minimize losses and/or improve voltage profile. |

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| Software | Details | Description |
|---|---|---|
| CYMDIST distribution analysis software | Load balancing | Load balancing to minimize losses, or to balance the current/load/voltage. |
| | Motor starting analysis | Voltage dip and maximum motor size calculations. |
| | Batch analysis | Several analysis scenarios are performed on a selection of study files, self-contained files or circuits. Detailed reports of every simulation as well as summary reports for network results are available. |

| Additional modules | Requirement | Description |
|---|---|---|
| **MODELING** | | |
| Enhanced substation modeling | CYMDIST | Modeling of all the major components of the distribution substation and the detailed modeling of any sub-network such as an industrial facility. |
| Low-voltage secondary distribution modeling | CYMDIST | Detailed modeling of low-voltage distribution systems including center-tapped distribution transformers (120/240V) and triplex/quadruplex cables. |
| Secondary grid network analysis | CYMDIST | Detailed modeling of secondary network distribution systems which include network protectors. Allows the power flow and short circuit analyses of heavily meshed secondary network distribution systems for any voltage level. |
| Microgrid modeling and analysis | CYMDIST | Modeling and simulation of grid-tied microgrids operating in either islanded or grid-connected mode as well as isolated microgrids, such as those of remote communities far from any transmission and distribution infrastructure. |
| Geographic overlay | CYMDIST | The display of raster or vector map images (geographical land base such as DWG, DXF, SHP, etc.) as layers directly underneath the electrical model. |
| Online maps service | CYMDIST | A complement to the CYME Geographic Overlay module to provide the capability to display Google™ maps and MapQuest™ Open maps as layers underneath the geographical view of your electrical network model. |

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|---|---|---|
| **PLANNING** | | |
| Advanced project manager | CYMDIST | Extensive tool that supports the collaborative and detailed preparation of future grid projects and mitigations. It enables tracking the chronological evolvement from as-built to as-planned networks. |
| Automated network forecast analysis | CYMDIST | Planning and management of expansions and changes over time on your distribution network (includes the Advanced Project Manager). |
| Long-term planner | CYMDIST | Powerful forecast visualization and analytics capabilities paired with a robust reporting technology that aggregates data from multiple contexts to bridge the gap between forecasting and system analysis. The embedded Analysis Orchestrator enables automation of area-wide engineering studies on the as-planned network model. |
| Techno-economic analysis | CYMDIST | Analysis to help electric utilities invest into their infrastructure by analyzing the technical impacts of modifications made to the network and the cost they entail. Assists in the determination of the feasibility and the profitability of a project. |
| **OPERATION** | | |
| Distribution state estimator | CYMDIST | Estimation of the unbalanced power consumption and the voltages at every level of a distribution power system. |
| Contingency assessment and restoration | CYMDIST | The impact of single outages on the electrical distribution system are studied to find the optimal switching plan to restore electrical power to priority customers and to recover the maximum possible load in the affected areas. |
| Load flow contingency (N-p) | CYMDIST | Assist in the power-flow-related static contingency analysis. To create contingency events and single- or multiple-outage scenarios and compare them to a base case. |
| Advanced fault locator | CYMDIST | Quick and precise identification of possible fault locations based on a mix of inputs such as fault indicator status, telemetry data during fault condition, range of possible fault impedance, etc. Field measurements can be read directly from COMTRADE oscillography files. |

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|---|---|---|
| **PROTECTION** | | |
| Protective device analysis | CYMDIST | Wide range of tools to efficiently and accurately design and validate the coordination scheme of the power system. Includes system-wide analysis, minimum fault analysis, sequence of operation and branch device coordination. TCC library of more than 15,000 devices. |
| Arc flash hazards | CYMDIST | Assessment of the electrical safety of employees working on or near electrical equipment by computing the necessary parameters required to assess the risk level and adopt the adequate safety procedures. |
| Distance protection | CYMDIST | Module to assist electrical engineers in identifying challenges and find solutions to power system protection problems using distance protection relays. |
| **DER** | | |
| Integration capacity analysis | CYMDIST | Assessment of the generation or load hosting capacity of the system without compromising system reliability and power quality. Different limiting criteria with adjustable thresholds can be considered. |
| EPRI DRIVE | CYMDIST | The EPRI DRIVE software determines the maximum amount of DER each distribution feeder can accommodate in its current state before unacceptable reliability, power quality, protection and thermal issues start to emerge.* |
| DER impact evaluation | CYMDIST | Verification criteria, multiple loading scenarios and distributed generators contribution levels are integrated into a comprehensive system impact study that generates a tabulated report where results for each criterion are color-coded based on limit violations. |
| Network disturbance assessment D-A-CH-CZ | CYMDIST | Evaluation of network disturbances caused by new load, motor or generator interconnections based on a set of technical rules established by a European working group. |
| Load relief DER optimization | CYMDIST | Determination of the optimal sites and sizes for energy storage systems and dispatchable generation in support to load relief projects based on non-wires alternatives. Sizing of non-dispatchable generation is also supported. |

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|---|---|---|
| **POWER QUALITY** | | |
| Reliability assessment | CYMDIST | A framework within which predictive and historical reliability assessment scenarios are run and the impacts of the related investment such as DA (Distribution Automation) can be evaluated and understood. |
| Harmonic analysis | CYMDIST | Harmonic penetration assessment in electric power systems. |
| Dynamic motor start | CYMDIST | Simulation of the dynamic behavior of starting motor to assess system voltage dips and acceleration times using a variety of starting methods. |
| **OPTIMIZATION** | | |
| Network configuration optimization | CYMDIST | Determination of the optimal feeder configuration that will minimize losses, improve the voltage profile and balance the load between feeders. |
| Volt/VAR optimization | CYMDIST | Optimal settings for Volt/VAR control devices are evaluated to optimize distribution networks. |
| Optimal voltage regulator placement | CYMDIST | Optimal regulator locations are identified to improve the network conditions based on selected objectives. |
| Optimal recloser placement | Reliability assessment | Optimal recloser locations are identified to improve the network conditions based on selected objectives. |
| **TIME-SERIES** | | |
| Steady state analysis with load profiles | CYMDIST | This tool uses historical or forecasted data to create profiles for network demands, loads, DERs and customer types to execute time-series load flow studies. The time span of the study can be from a single day to multiple years. |
| Long-term dynamics analysis | CYMDIST | Time-series simulation to study the impact of insolation variations, wind fluctuations and load variations on network controls. |
| Transient stability analysis | CYMDIST | Simulation of the dynamic behavior of distribution systems with distributed generation under various transient events. |

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|---|---|---|
| **SCRIPTING** | | |
| Scripting tool with Python | CYMDIST | Assists in the automation of routine studies, creates new algorithms, quickly retrieves network/equipment information and performs batch analysis through a simple mouse-click on a Python® script. |

* Distribution Resource Integration and Value Estimation (DRIVE) is provided under license and is powered by technological research developed by the Electrical Power Research Institute, Inc. (EPRI).

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