

Formula 1

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Formula 2

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Formula 3

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Detailed Explanation

Annex J of IEEE 1547-2018 addresses the growing need for accurate, standardized forecasting of distributed energy resources—particularly inverter-based renewables like solar PV and wind—to support safe, stable, and efficient grid integration. It establishes a framework where forecast data (e.g., active power output, ramp rates, uncertainty bounds) must be provided at defined temporal resolutions (e.g., 1–60 minute intervals), with specified latency, update frequency, and metadata (e.g., confidence intervals, forecast horizon, model version). The annex mandates interoperable data formats (e.g., IEEE 2030.5-compliant RESTful APIs or CSV/JSON schemas), traceable provenance, and verifiable forecast quality metrics such as MAE, RMSE, and skill scores relative to persistence or climatological baselines. Critically, the annotated version expands on these requirements by contextualizing them for modern AI-driven forecasting stacks—highlighting how machine learning models (e.g., ensemble LSTM, graph neural networks), explainable AI (XAI) techniques, and probabilistic forecasting pipelines can satisfy—and exceed—Annex J’s functional and verification criteria. It also clarifies roles and responsibilities across stakeholders: DER owners supply forecasts, aggregators normalize and validate them, and utilities ingest and use them for real-time dispatch, contingency analysis, and market participation—each step requiring auditable, time-synchronized, and version-controlled data flows.

Key Components

#	Component
1	Forecast Data Schema & Metadata Requirements
2	Performance Validation Metrics & Reporting Protocols
3	Interoperable Communication Interfaces (e.g., IEEE 2030.5, IEC 61850-7-420)

Applications

#	Application
1	Real-time DER dispatch coordination in distribution management systems (DMS)
2	Probabilistic forecasting for ISO/RTO day-ahead and intraday market bidding
3	AI model certification and audit trails for regulatory compliance and utility procurement

Related Concepts

#	Concept
1	IEEE 2030.5 Smart Energy Profile
2	Probabilistic Forecasting
3	Grid-Interactive Efficient Buildings (GEB)

Tags

grid integration, forecasting standards, AI in energy