About Dataset

Overview  
The Smart Grid Real-Time Load Monitoring Dataset is a time-series dataset designed for energy management, load forecasting, and fault detection in smart grids. It includes key electrical parameters, renewable energy sources, environmental factors, and anomaly indicators, making it suitable for machine learning and deep learning applications in energy optimization.

Key Features  
50,000+ records with 15-minute intervals for real-time analysis.  
Smart grid parameters: Voltage, current, power consumption, and reactive power.  
Renewable energy sources: Solar and wind power contributions.  
Grid supply monitoring: Measures power drawn from the main grid.  
Fault detection: Identifies overload conditions and transformer faults.  
Environmental factors: Temperature, humidity, and electricity price fluctuations.  
Predicted Load (kW): Target variable for real-time energy forecasting.  
Use Cases  
Energy Demand Forecasting – Predict future energy consumption trends.  
Renewable Energy Integration – Analyze solar and wind power contributions.  
Fault and Anomaly Detection – Identify voltage fluctuations, overloads, and faults.  
Dynamic Pricing Analysis – Study electricity price variations and their impact.  
This dataset is ideal for machine learning, deep learning, and smart grid analytics, supporting research in real-time energy optimization and predictive modeling.

Data Generation Process  
The dataset consists of experimental data, collected from smart grid systems with a focus on real-time load forecasting and fault detection. The observations were generated based on:

Real-world smart grid logs from operational data (voltage, current, power usage, fault indicators).  
Simulated data based on historical patterns of power demand and disruptions in a Micro Grid environment.  
Time-series data reflecting dynamic changes in energy consumption and load fluctuations.

Fault Detection Target Assignment  
The fault detection target variable was assigned based on a combination of logical-mathematical rules and threshold-based anomaly detection techniques:

Voltage Drop Analysis: If the voltage falls below a pre-defined threshold (e.g., 10% drop from nominal voltage), it is flagged as a potential fault.  
Current Overload Detection: If the current exceeds the system’s rated limit, it indicates a fault due to overload.  
Power Imbalance Check: Sudden variations in power consumption (e.g., extreme peaks or dips) suggest an instability in the grid.  
Blackout Prediction: A combination of multiple failures (voltage instability, frequency fluctuations) indicates a potential blackout risk.  
Machine Learning-Based Fault Prediction: The ABWK-RLSTM model learns from past data trends and predicts whether a given set of readings is likely to cause a failure.  
Each observation in the dataset is labeled as:

0 → No fault detected (normal operation)  
1 → Voltage drop detected  
2 → Overload detected  
3 → Blackout risk identified

Relevant Papers on Smart Grid Fault Prediction  
Here are some research papers that might be useful:

"A Review of Fault Detection Techniques in Smart Grids" – Covers different ML-based approaches for fault prediction.  
"Real-Time Energy Management in Microgrids" – Discusses energy optimization in small-scale smart grids.  
"AI-Based Fault Diagnosis in Smart Grid Systems" – Highlights LSTM and deep learning techniques for fault detection.  
"Load Forecasting and Anomaly Detection in Power Systems" – Explores hybrid deep learning approaches for load prediction.  
If you’re interested, I can find and provide more specific papers related to fault prediction in Micro Grids.