Xebia

# Energy Motion

Revolutionize Energy Operations with AI

# Energy Generation Forecasting

## Business problem statement

- Accurate energy generation forecasting is crucial for wind and solar power. Unpredictable weather conditions can lead to inaccurate forecasts, causing imbalances in supply and demand, increased operational costs, and grid instability.

## Solution overview

**Azure Machine Learning**
Development of timeseries AI models customized to handle complex patterns and seasonality

**Exogeneous Variable Support**
Use of weather forecast and other factors as exogeneous variables to enhance the forecasting accuracy.

**INTELLIGENT AUTOMATION**
Implement feedback loops to refine models continuously

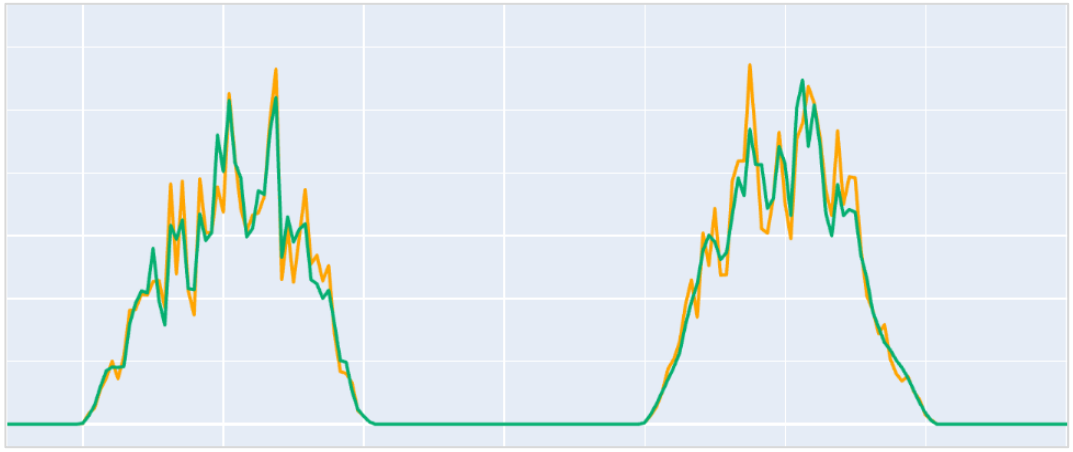
## Solution approach

1. **Data Sources**
   - Maintenance Schedule
   - Temperature
   - Historical Data
   - Weather Data
2. **Data Preprocessing**
   - Missing Value Analysis
   - Outlier Detection
   - Removing Duplicates
   - Scaling and Normalization
   - Datatype checks
3. **Data Analysis**
   - Impact of solar radiation on energy generation
   - Impact of wind speed and direction
   - Impact of different seasons on generation
4. **Modelling**
   - Heuristics & Classical Machine Learning
   - Deep Learning & Time Series Analysis
5. **Intelligent Automation**
   - Energy Forecasting Report
   - Tracking of timeseries metrics and generating alerts

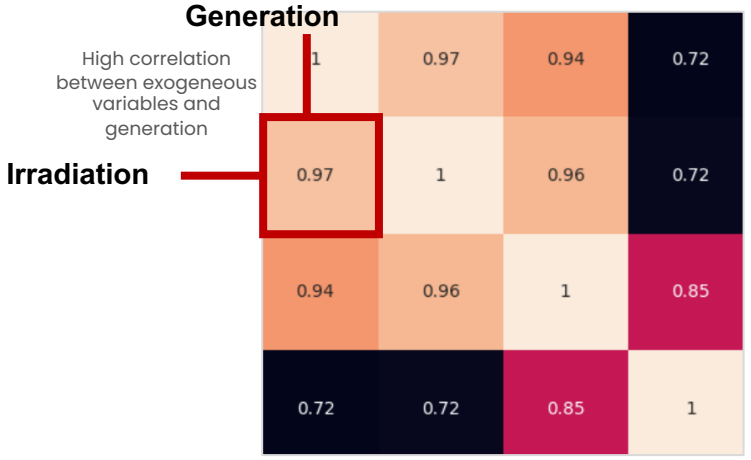
**Accurate Forecasts** — **Grid Stability** — **Cost Savings** — **Meeting SLAs** — **Operational Efficiency**

# Energy Generation Forecasting

## Solar Generation

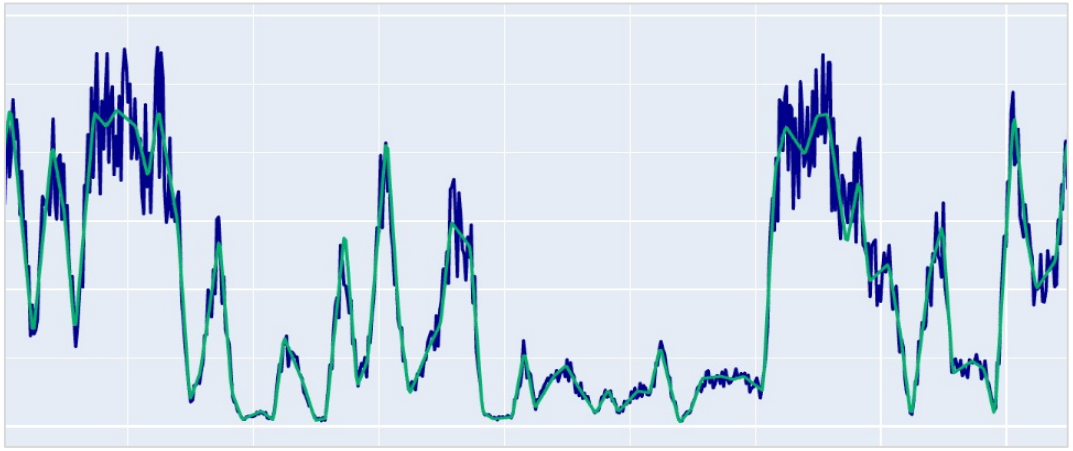


Actual Generation  Forecasted Value

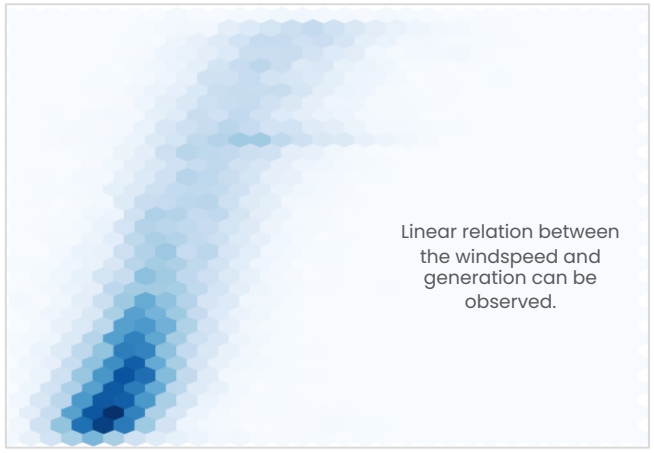



Correlation Matrix

## Wind Generation



Actual Generation  Forecasted Value




Wind Generation(kWh ) vs Wind Speed(m/s)

# Stakeholder Focus & Business Value

| | |
|---|---|
| Grid Operations Managers | Achieving up to a **20% reduction in operational costs** by optimizing generation scheduling and minimizing energy wastage. |
| Energy Analysts | |
| Risk Management Officers | **Increase revenue by up to 10%** by leveraging precise forecasts to participate in lucrative **energy markets and demand response** programs. |
| Data Scientists | |
| Chief Technology Officer (CTO) | Utilize advanced AI algorithms to improve **forecast accuracy by up to 20%,** enabling smarter decision-making and resource allocation. |

Operations | Technology/IT | Finance | Corporate Strategy

Generation Forecasting solution unites operations, technology, finance, and sustainability teams to achieve shared goals of efficiency, innovation and environmental responsibility, enabling a cohesive approach to energy management1

# Transformer Health Analysis

## Business problem statement

- Transformers are vital in the electrical power grid. Unexpected failures cause significant downtime, high repair costs, and safety hazards.
- Reactive maintenance leads to inefficient resource use and increased operational risks.

## Solution overview

**REAL-TIME DATA**
Use Azure IoT Hub to collect sensor data from transformers, inclusion of internal and external parameters.

**PREDICTIVE MAINTENANCE**
Use Azure Machine Learning to predict failures and schedule maintenance.

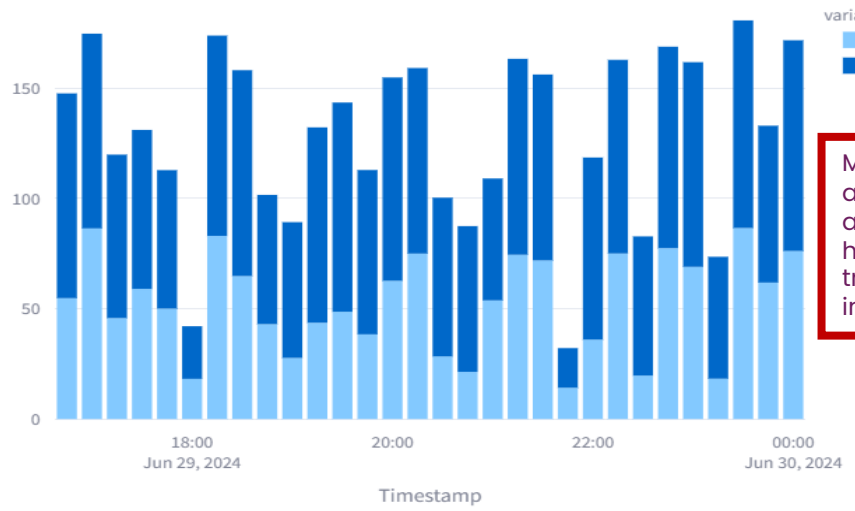
**INTELLIGENT AUTOMATION**
Automated alerts and maintenance with real-time dashboards, events, and triggers.

## Solution approach

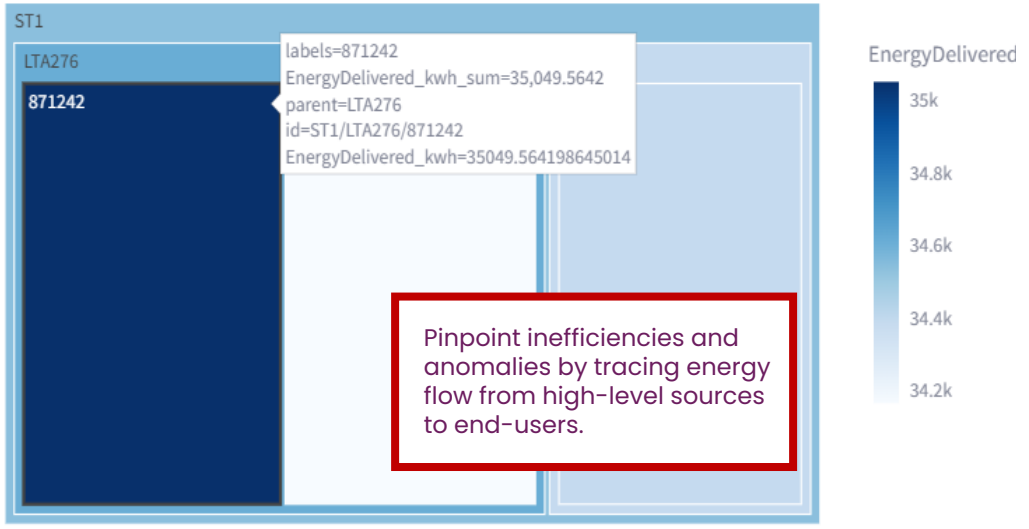
1. **Data Sources**
   -  Oil Temperature
   -  Voltage
   -  Current
   -  Winding Temperature
2. **Data Preprocessing**
   -  Missing Value Analysis
   -  Outlier Detection
   -  Removing Duplicates
   -  Scaling and Normalization
   -  Datatype checks
3. **Data Analysis**
   -  Correlation analysis between error logs and internal parameters.
   -  Identify deviations from normal operating conditions.
   -  Track transformer load to identify stress and potential overloading
4. **Modelling**
   -  Heuristics & Classical Machine Learning
   -  Deep Learning & Time Series Analysis
5. **Intelligent Automation**
   -  Health status monitoring
   -  Alerts and Warnings
   -  Trigger & Schedule Maintenance

**Reduced Downtime** — **Grid Stability** — **Cost Savings** — **Improved Safety** — **Operational Efficiency**

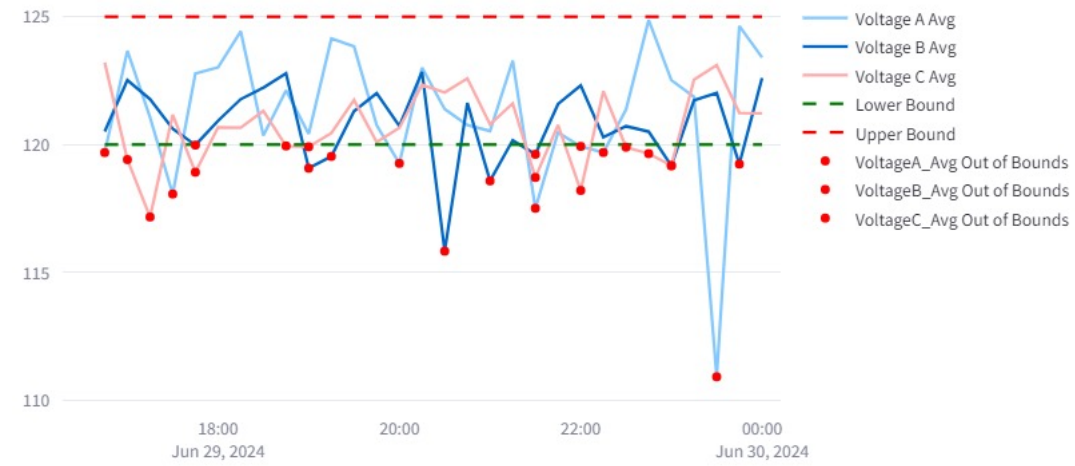
# Transformer Health Analysis

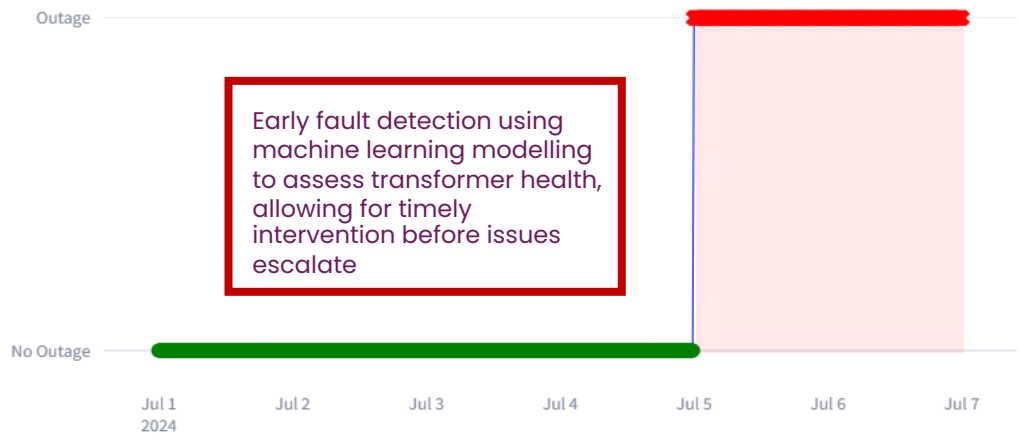



Monitoring apparent and actual energy helps identify transformer inefficiencies.




Pinpoint inefficiencies and anomalies by tracing energy flow from high-level sources to end-users.




Early fault detection using machine learning modelling to assess transformer health, allowing for timely intervention before issues escalate

# Stakeholder Focus & Business Value

- Grid Operations Managers
- Maintenance Engineers
- Asset Management Teams
- Safety Officers
- Chief Technology Officer (CTO)
- Data Scientists

**Proactive Maintenance with AI** to predict transformer failures before they occur**, reducing downtime by up to 20%** and **minimizing repair costs by 15%.**

**Enhance Safety and Compliance** by proactively addressing transformer health **minimizes safety hazards** and ensures compliance with regulatory standards.

Streamlined maintenance processes and resource allocation can increase **operational efficiency by 15%,** optimizing overall grid performance.

| Operations | Technology/\ IT | Finance | Corporate Strategy | Safety & Complianc |
|---|---|---|---|---|

The Transformer Health Analysis solution aligns operations, technology, safety, and asset management teams to proactively address maintenance needs, ensuring safety and efficiency in transformer operations.