



# VISUALIZATION OF ENERGY LOSSES DUE TO FAILURES AND NON-PRODUCTION

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## Problem

SMT lines consume energy even when production is stopped (standby/ready mode). Restarting the line also costs energy (warm-up, compressors, stabilization). Main question: for a downtime window T, is it cheaper to shut down or stay on?

### Architecture

Sensors → MQTT Broker → Node-RED logging → SQL DB for logs  
SQL DB for logs → Node-RED loss calculation → SQL DB for result  
Grafana takes data directly from the SQL DB for result

### Evaluation

What the solution enables  
Continuous, line-level visibility of energy behavior (idle vs production)  
Measurable identification of “waste windows” (high power in downtime)  
A quantitative basis for shutdown recommendations

### Key Features

Intuitive dashboard  
Per-line monitoring (separate time series per SMT line)  
Ability to analyze and view historical data  
Easy restructuring of internal structure thanks to the Node-RED node system  
Separation of layers: raw logs vs calculated/visualization-ready datasets  
Automatic line state classification: OFF / STARTUP / STANDBY / PRODUCTION  
Per-line comparisons (SMT1-SMT8)  
Telemetry quality monitoring: packet rate, device coverage, missing-data detection

