

Component project

Energy management system in intelligent
buildings

Analytics Component

Oleksandra Turovets

Marta Penina

Software Engineering

Thursday, 10:45

2025/2026

Introduction

- The Analytics Component transforms raw telemetry data into meaningful insights.
- In this integration, we focus on detecting abnormal energy consumption patterns.
- The goal is to support engineers and control systems with early warnings about energy issues.

Purpose of the Integration

The purpose of this integration is to:

01.

Analyze historical telemetry data from IoT devices

02.

Detect energy spikes that indicate abnormal behavior

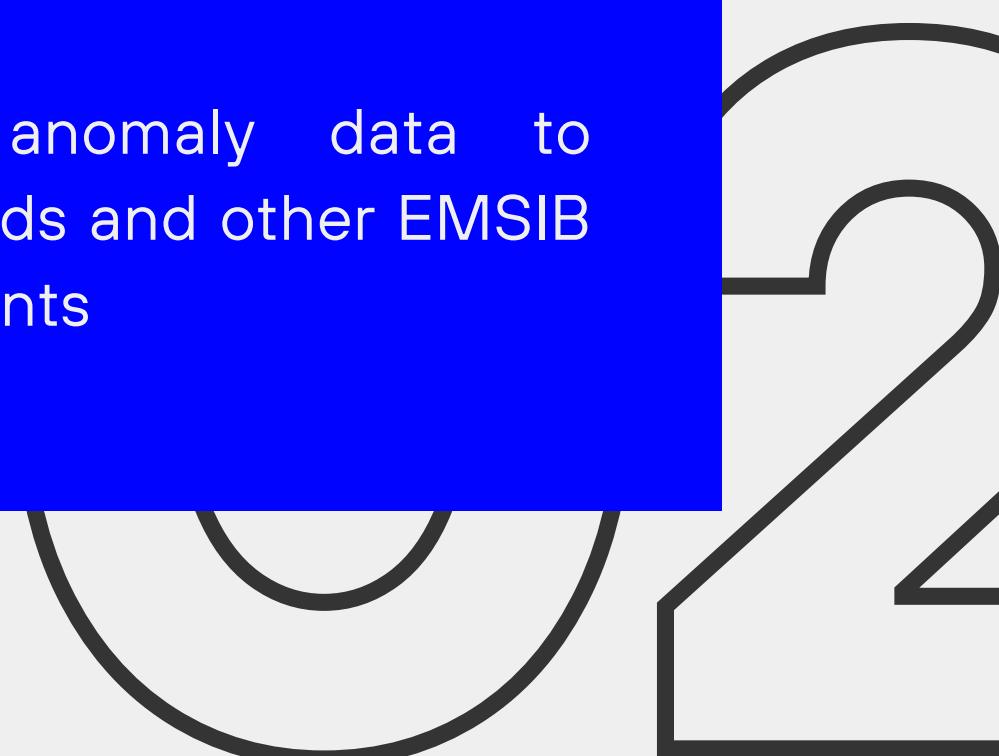
03.

Store detected anomalies for further analysis

04.

Expose anomaly data to dashboards and other EMSIB components

This integration represents the first analytical intelligence layer in EMSIB.



Architecture Overview

Telemetry Data → Analytics Component → Anomalies Storage → Analytics API

- Telemetry data is read from the database (telemetry table)
- Analytics logic processes energy consumption values
- Detected anomalies are stored in the anomalies table
- Results are exposed via REST API for dashboards and control modules

This design follows EMSIB guidelines for modularity and interoperability.



Energy Spike Detection Logic

What the integration does:

Calculates the average power consumption per device

Compares each measurement with the historical average

Detects an anomaly if consumption exceeds:

- **40% above average** → medium severity
- **70% above average** → high severity

Each detected anomaly includes:

Device ID

Timestamp

Severity level

Detailed context (measured vs average power)

Implemented
Analytics
Logic



Implemented API & Data Storage

Implemented API Endpoint

GET /analytics/anomalies

- Returns a list of detected energy anomalies
- Used by dashboards and monitoring tools
- Provides engineers with actionable insights

Data Storage

- Anomalies are stored in the anomalies table
- Structured JSON details allow flexible visualization
- Data is persistent and reusable by other components



Integration Workflow

Telemetry Data



Energy Spike Detection Algorithm



Anomalies Stored in Database



Analytics API



Dashboard / Control Modules

- Entire workflow is based on REST and database integration
- Fully aligned with EMSIB data flow principles
- Ready for future extensions (alerts, optimization triggers)



Conclusion & Next Steps

■ Conclusion

- The Energy Spike Anomaly Detection integration is fully implemented
- It demonstrates real analytics logic, not just data forwarding
- The component adds intelligence and decision support to EMSIB

■ Next Steps

- Connect anomaly detection with alert notifications
- Add building-level aggregation
- Integrate anomaly results with optimization scenarios
- Extend detection using machine learning models