



Monitoring & Forecasting CERN's Energy Consumption Challenges & Opportunities

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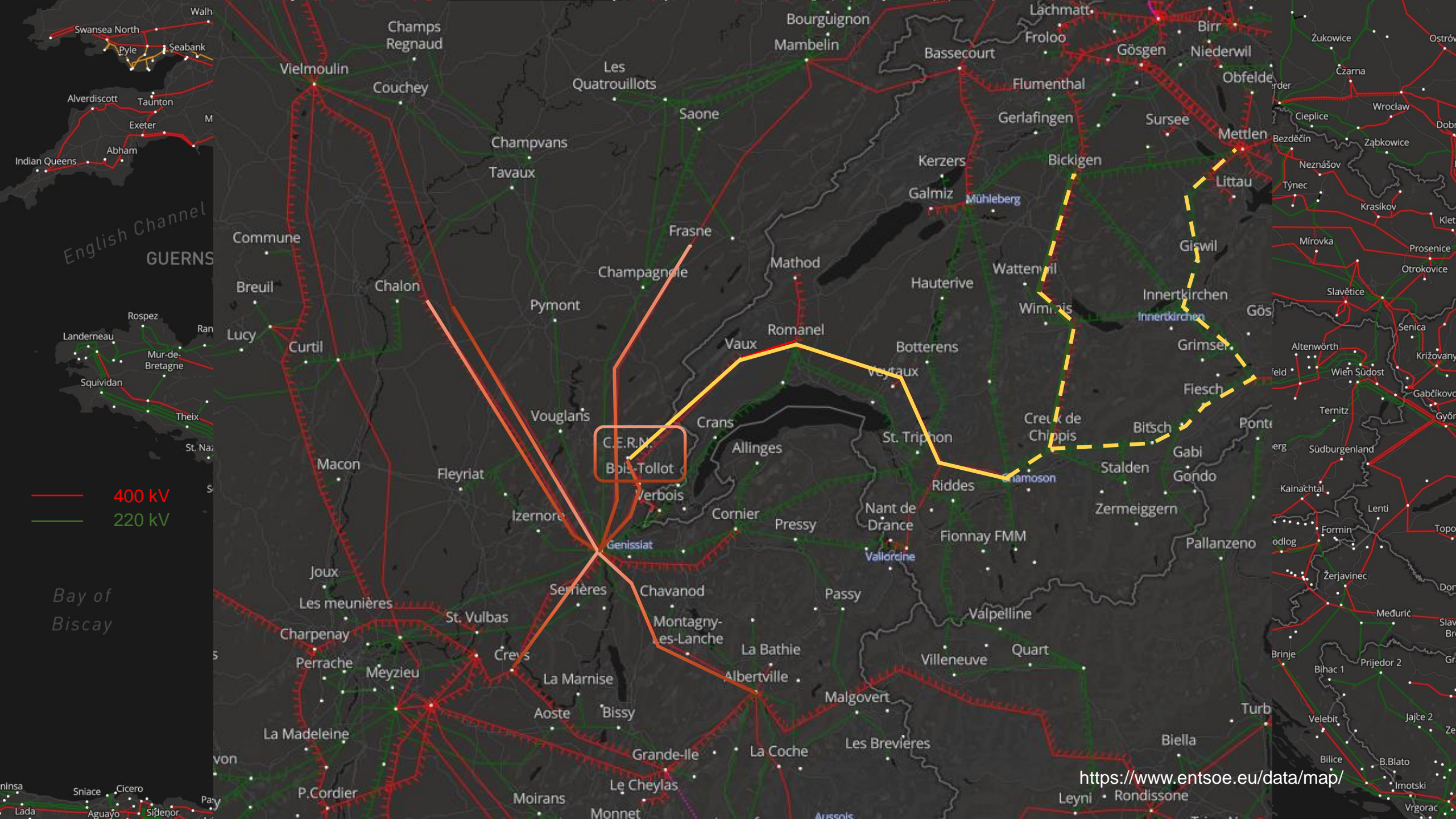
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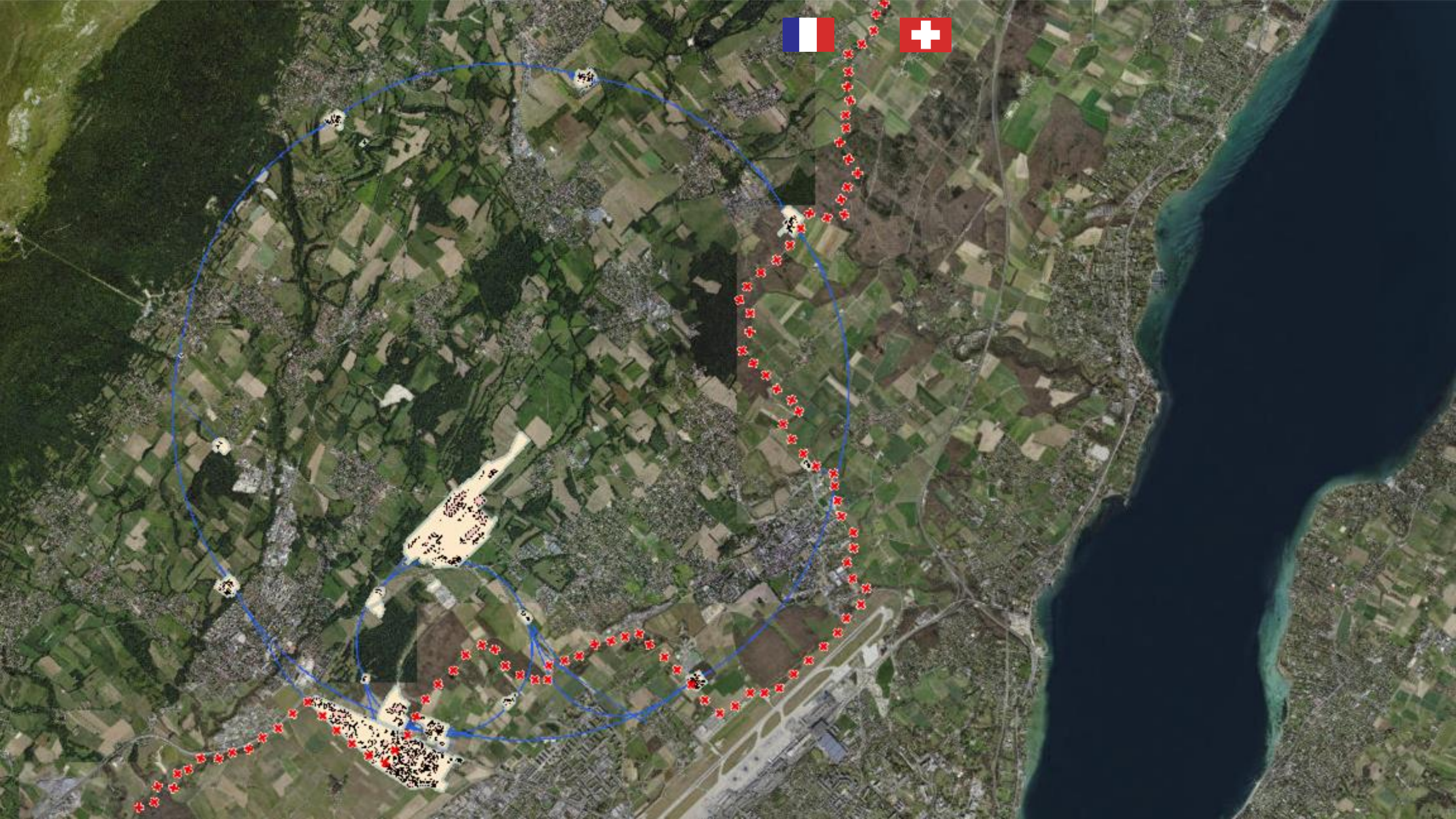
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Agenda

- **CERN's Electrical Network**
- **Energy consumption at CERN**
- **Energy Monitoring**
- **Forecasting**
- **Anomaly detection**
- **On-going works**

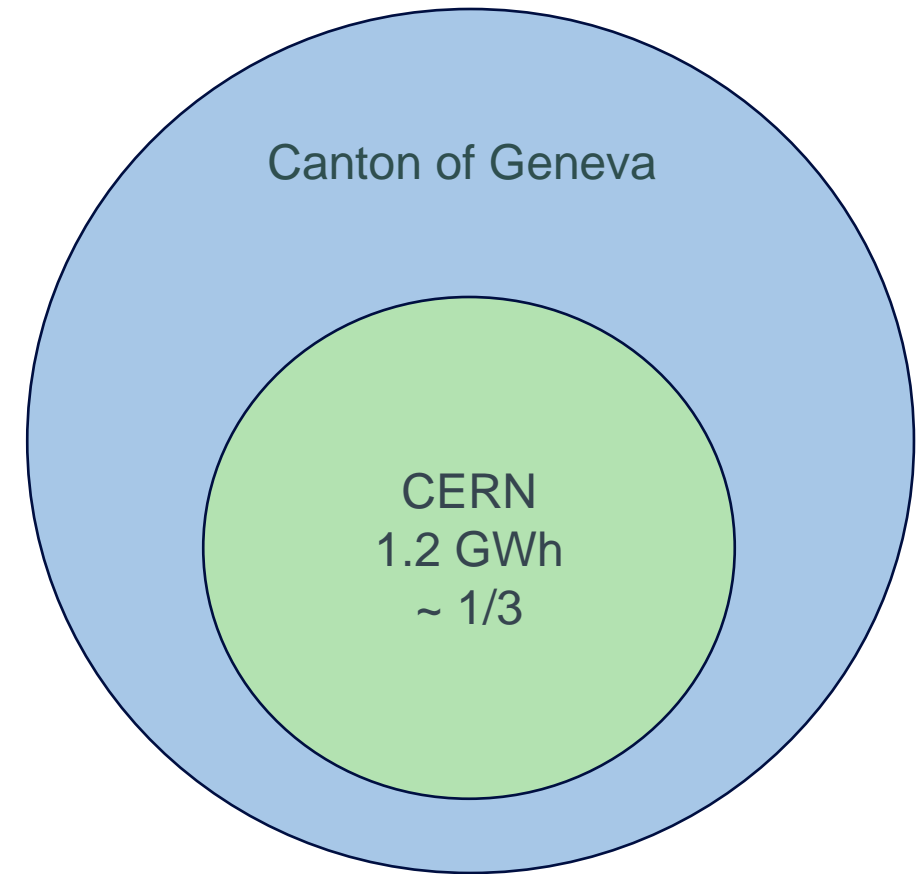






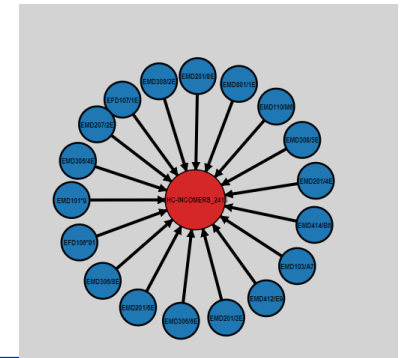
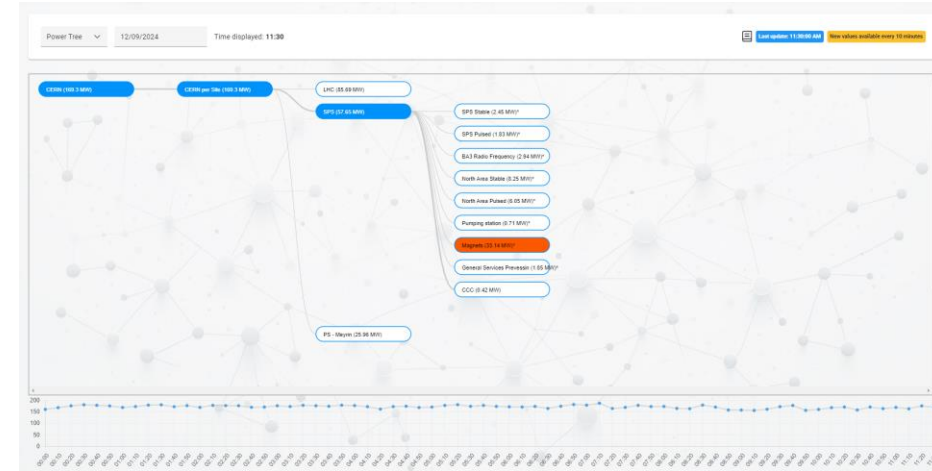
Energy consumption @ CERN

- High-energy physics is energy-intensive.... ☹️
- Magnets
- RF Cavities
- Cooling systems
 - Cryogenics
 - Cooling and Ventilation
- Data Centers
- General Infrastructure



Web Energy

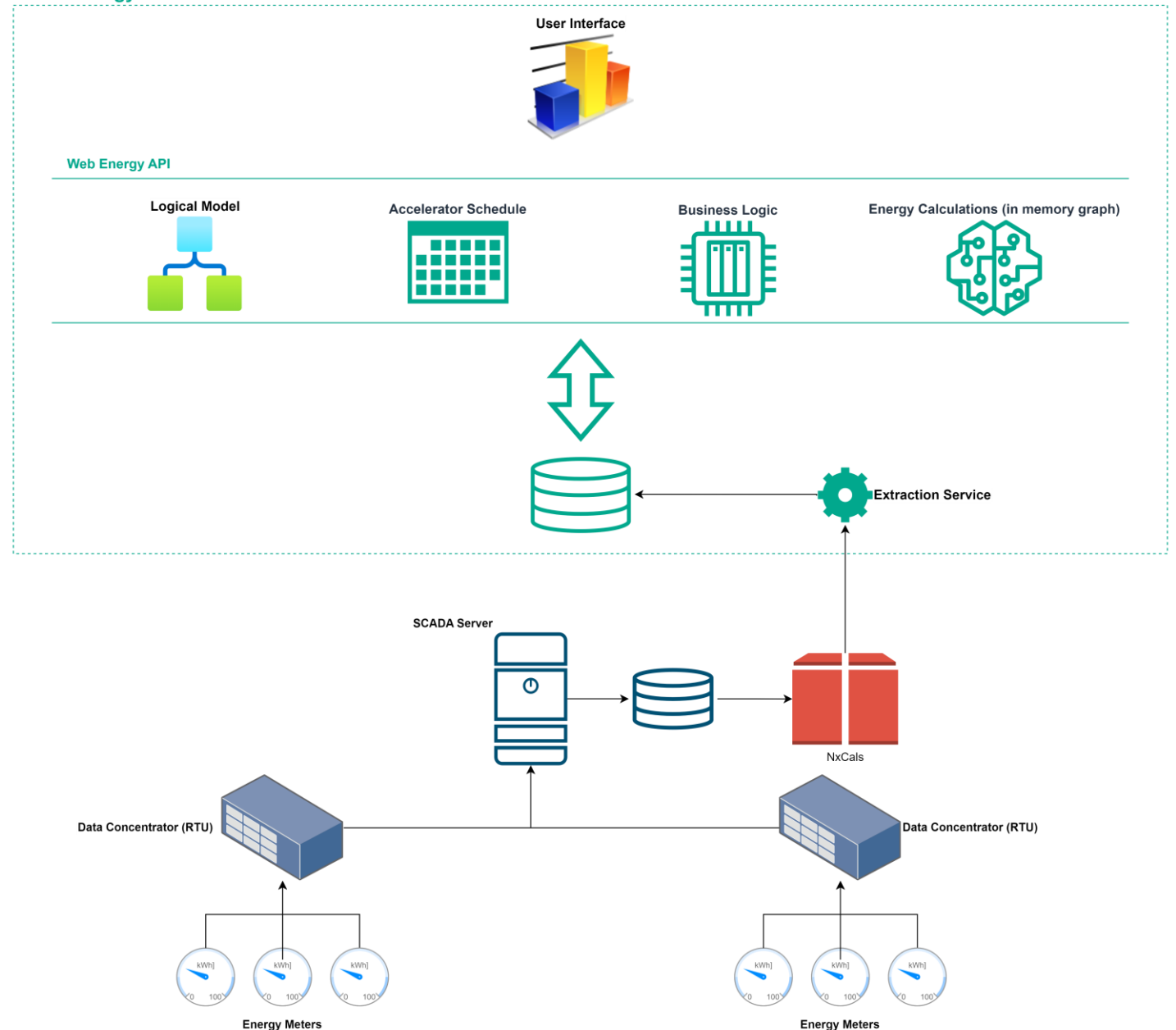
- Energy Management System developed @ CERN.
- Records and monitors energy consumption.
- Forecasts energy consumption.
- Detects anomalies.
- Facilitates the management of the electricity contract.
- Provides users with visibility into energy consumption.
- Contains the experience of CERN's energy management team.



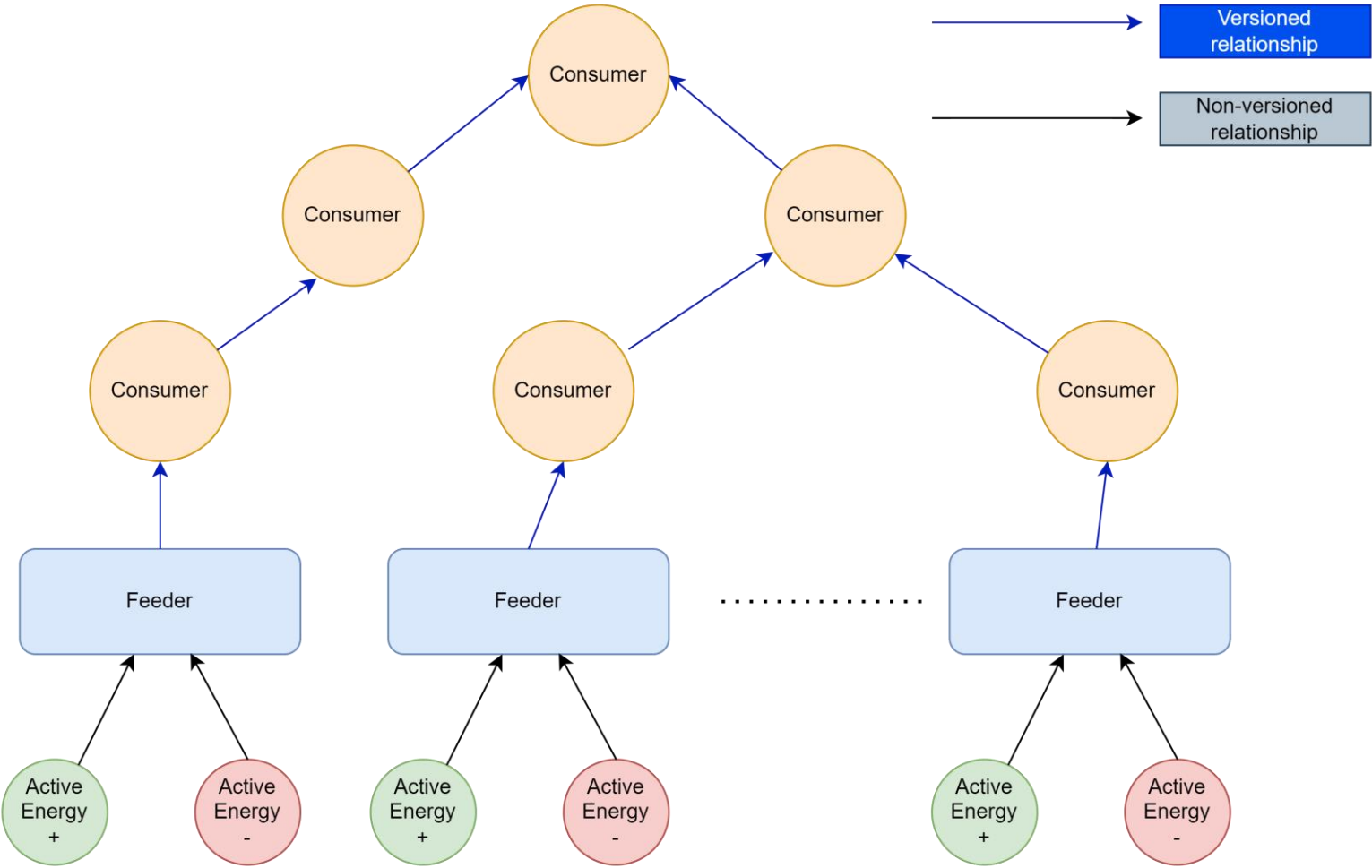
Architecture

- Cloud native architecture.
- Various data sources.
- Flexible & scalable.
- Import-export of data using open formats.
- Based on open-source technologies.

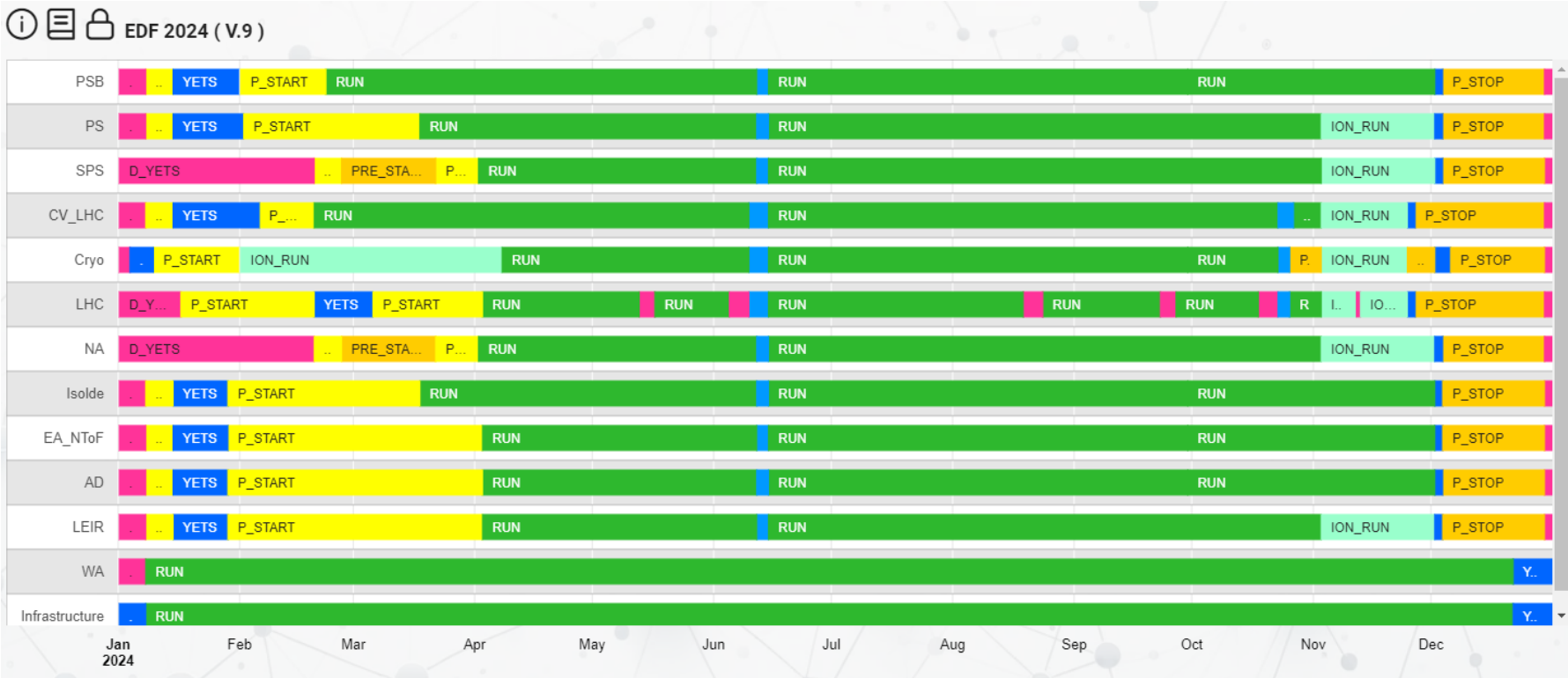
Web Energy EMS



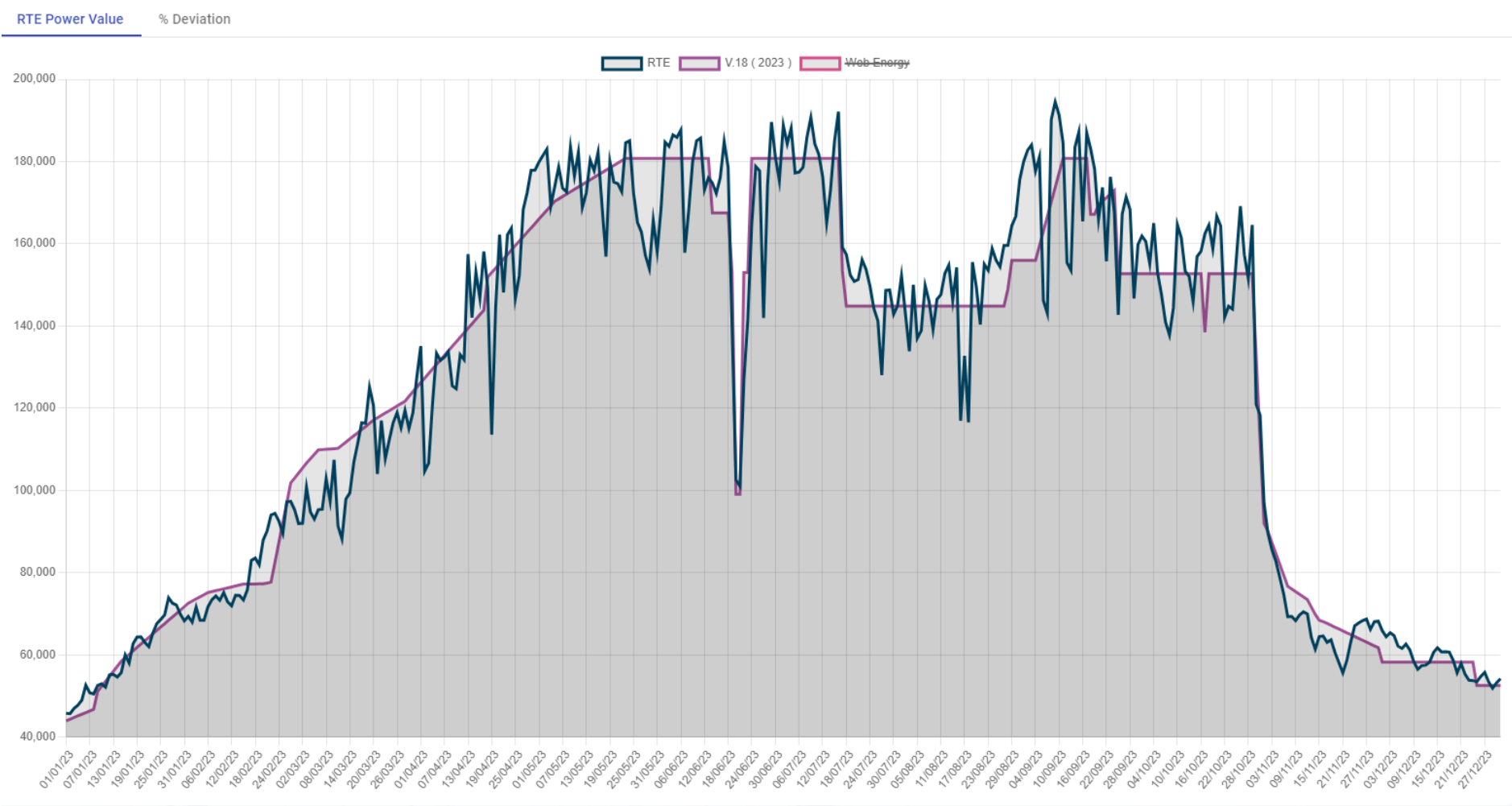
Data Model & Versioning



Forecasting

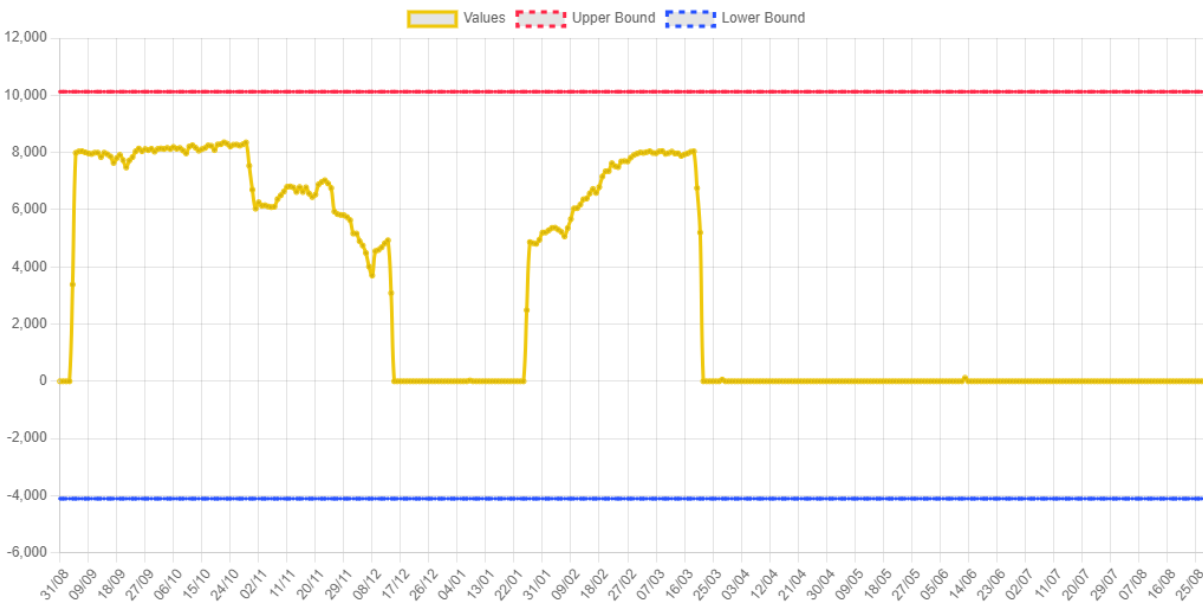


Forecasting

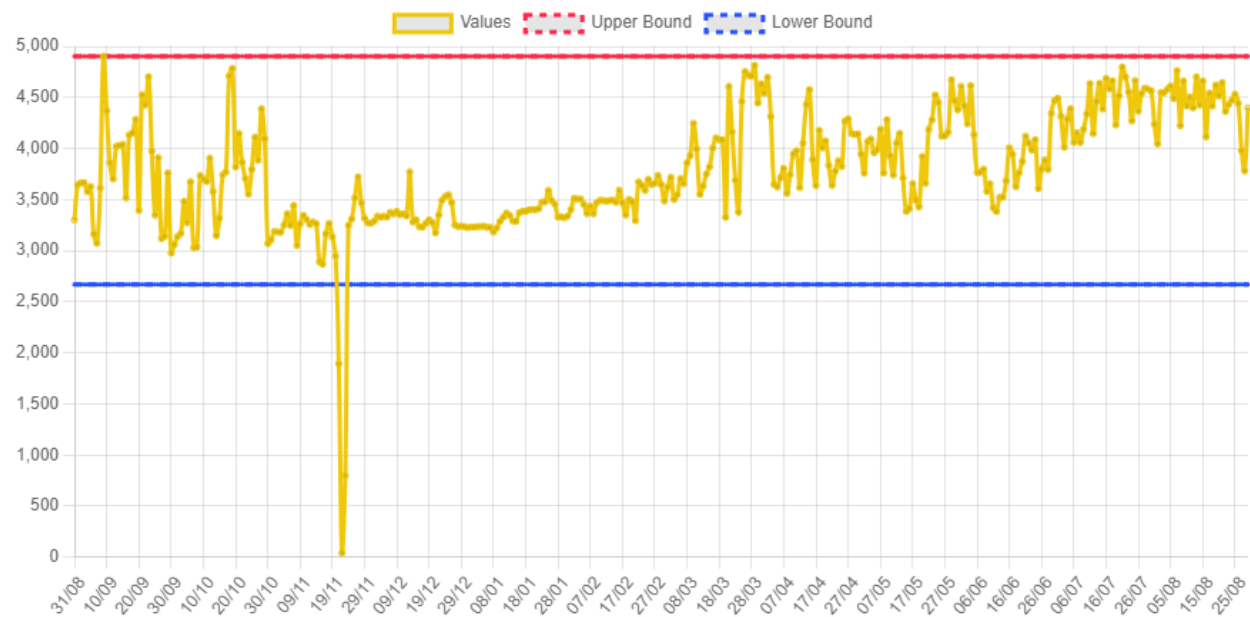


Anomaly Detection

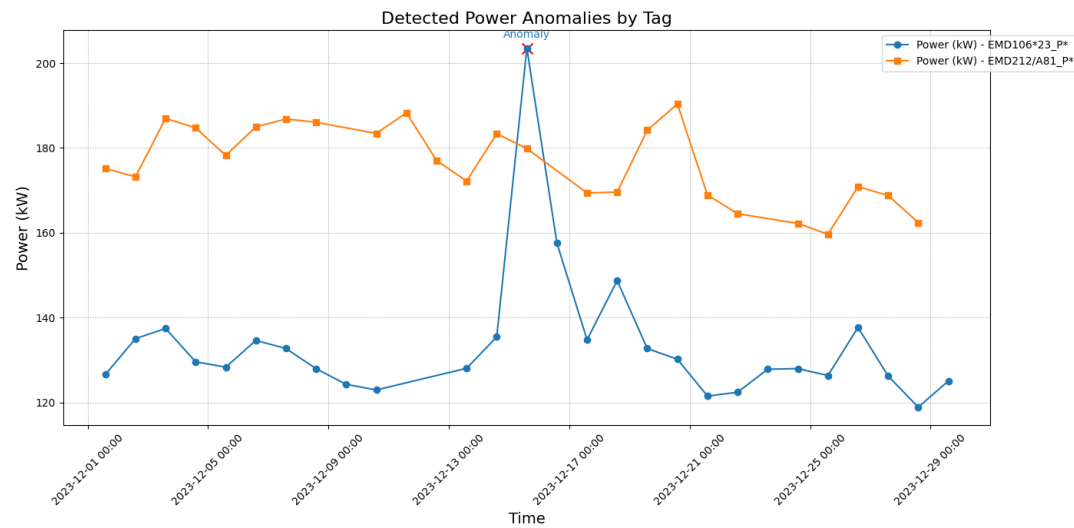
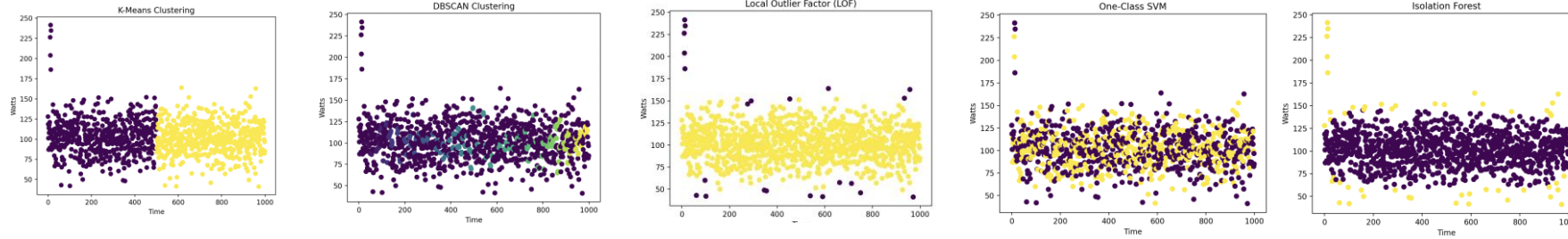
Last 30 days (Chart) **Std Deviation (Chart)** Values Table Raw Values Used in consumers Audit Log



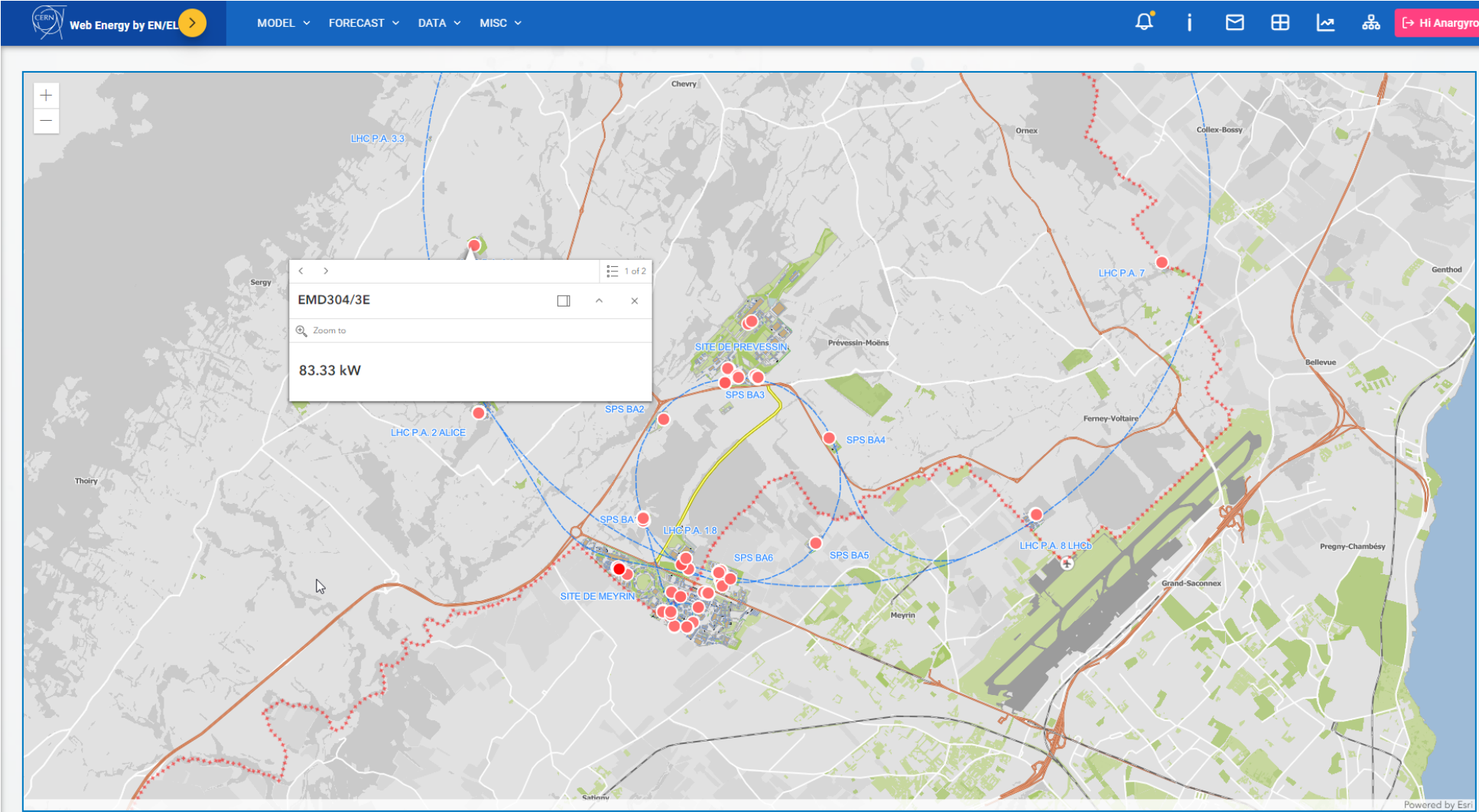
Last 30 days (Chart) **Std Deviation (Chart)** Values Table Used in consumers Uses cons/feeders Audit Log



Anomaly Detection



On-going works – GIS Integration



On-going works



Gas and Water monitoring.



KPIs according to ISO 50001.



Short term forecasting and analysis using AI.



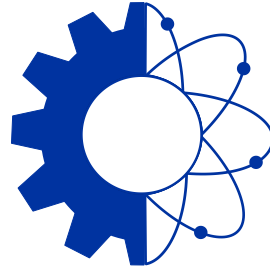
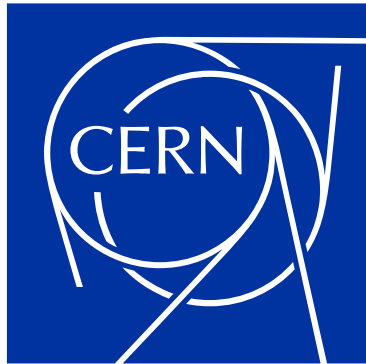
Advanced reporting capabilities



Customizable dashboards

Questions?

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