

Technical Advisory Council (TAC) Meeting

2 September 2025



Meeting information

- Meeting to begin at 5:00 pm Central European Time
- Join the meeting at the link in your calendar in [LFX Individual Dashboard](#)
- Any problems with connectivity, you can contact John Mertic from the Linux Foundation at +1 234-738-4571
- Previous TAC Meeting notes, deck, and recording, at
<https://wiki.lfenergy.org/display/HOME/Technical+Advisory+Council#TechnicalAdvisoryCouncil-MeetingMinutes>



Antitrust Policy Notice

Linux Foundation meetings involve participation by industry competitors, and it is the intention of the Linux Foundation to conduct all of its activities in accordance with applicable antitrust and competition laws. It is therefore extremely important that attendees adhere to meeting agendas, and be aware of, and not participate in, any activities that are prohibited under applicable US state, federal or foreign antitrust and competition laws.

Examples of types of actions that are prohibited at Linux Foundation meetings and in connection with Linux Foundation activities are described in the Linux Foundation Antitrust Policy available at linuxfoundation.org/antitrust-policy. If you have questions about these matters, please contact your company counsel, or if you are a member of the Linux Foundation, feel free to contact Andrew Updegrove of the firm of Gesmer Updegrove LLP, which provides legal counsel to the Linux Foundation.



Agenda

All Times in Central European Time Zone

- 5:00 pm - 5:10 pm - Opening and General Updates
 - TAC member updates and annual review date reminders
 - SIG updates and meeting schedule
 - Project Pipeline
 - TAC Priorities 2025 [#436](#)
 - Project Services Funding [#613](#)
 - Project website policy [#582](#)
 - PowSyBL Security audit complete! [#594](#)
- 5:10 pm - 5:30 pm - New Project/Working Group Proposal: RTC-Tools [#344](#)
- 5:30 pm - 5:50 pm - New Project/Working Group Proposal: Power Stability Wide Area Monitoring Protection (p-SWAMP) [#585](#)
- 5:50 pm - 6:10 pm - Annual Review: Battery Data Alliance [#57](#)
- 6:10 pm - 6:30 pm - Annual Review: OperatorFabric [#71](#)
- 6:30 pm - 6:30 pm - Closing and Next Meeting

Marketing/PR/Events updates in APPENDIX



Opening and General Updates

5:00 pm - 5:10 pm



Technical Advisory Council (TAC) voting representatives



Antonello Monti

Chair
Professor
RWTH Aachen
University



Art Pope

Member of
Technical Staff
Google LLC



Boris DOLLEY

Director of OSPO
and Sustainable IT
Strategy
RTE (Reseau de
Transport
dElectricite)



Bryce Bartmann

Chief Digital
Technology Advisor
Shell International
Exploration &
Production, Inc.



Clément Bouvier
Software engineer

RTE (Reseau de
Transport
dElectricite)



**Jonas van den
Bogaard**
Vice Chair

Open Source Office
Lead
Alliander



Maarten Mulder
PO IoT Field Device
Platforms

Alliander



Moise Kameni
Entreprise Architect
and Head of Open
Source Program
Office
Hydro-Québec



Sophie Frasneda
Software developer

RTE (Reseau de
Transport
dElectricite)



Travis Sikes
Data Science
Manager

Recurve



Yixing Xu
Senior Program
Manager, Energy
Strategy
Microsoft
Corporation



Projects



TAC Meeting Schedule 2025

The TAC meetings are monthly, on the second Tuesday of the month at 8:00am US Pacific Time/11:00am US Eastern Time unless otherwise noted.

~~February 11~~
~~March 11~~
~~April 8~~
~~May 13~~
~~June 10~~
~~July 8~~

- ***September 2*** (*one week earlier*)
- *September 9 (joint meeting with GB - 4:00pm CET at LF Energy Summit)*
- October 14
- November 11
- December 9

Project and Working Group Leads

Name	Chair
Arras	David Chassin
Battery Data Alliance	Gabe Hege
CitrineOS	Thana Paris
CoMPAS	Sander Jansen
Connected Data Specification - Customer Data Working Group (CDS WG3)	Daniel Roesler
Connected Data Specification - Power Systems Data Working Group (CDS WG2)	Stephen Suffian
Connected Data Specification - Registration Working Group (CDS WG1)	Daniel Roesler
covXtreme	Sachin Bhakar
CUPID (Controllable Unit Protocol Interface for DER)	
Dynawo	Marco Chiaramello
EVerest	Marco Möller
FIDOPower	David Chassin
FledgePower	Romain Lebrun Thauront
FlexMeasures	Nicolas Höning
Grid Edge Interoperability & Security Alliance (GEISA)	Michael Stuber, Richard Lam
Grid eXchange Fabric (GXF)	Maarten Mulder

Grid Vantage	Alyona Teyber
Grid2Op	Benjamin Donnot
GridFM	François Mirallès
Hyphae	Arila Barnes
LF Energy Semantic Energy Framework (LFE-SEF)	Barry Nouwt
NODE Collective	Deandrea Salvador
OpenDSM	Travis Sikes
OpenLEADR	Arila Barnes, Stan Janssen, Hugo Van De Pol
OpenSTEF	Daan Van Es
OpenSynth	Gus Chadney
OperatorFabric	Frédéric Didier
ORES (Open Renewal Energy Systems)	Chris Xie
Power Grid Model	Peter Salemink
PowSyBL	Sophie Frasnedo
Real Time Data Ingestion Platform (RTDIP)	Bryce Bartmann
SC Decarbonisation Hub	Sachin Bhakar
SEAPATH	Eloi Bail
Shapeshifter	Robben Riksen
SOGNO	Antonello Monti
TROLIE	Christopher Atkins

SIGs and SIG Leaders

Name	Chair
AI SIG	Alexandre Parisot
Digital Substations SIG	Jos Zenner, Maxime Pelletier
EV Charging SIG	Robert De Leeuw, Thana Paris
Grid Simulation and Modeling SIG	Thomas Van Dijk

TAC Resources

- TAC Website -
<https://tac.lfenergy.org>
 - Contains all the TAC policies and meeting materials, as well as guides to using the various LF Energy tools
- TAC Overview -
https://github.com/lf-energy/foundation/blob/main/overview_deck/LF%20Energy%20TAC%20Overview.pdf
 - Guide for TAC members on their role and how to navigate LF Energy

Questions/feedback - let us know!



The image shows a screenshot of the LF Energy Foundation TAC website and its corresponding overview document.

Website Header: The header includes the LF ENERGY logo, a search bar with the placeholder "Search LF Energy Foundation TAC", and a link "Need help or have a question? Contact us here".

Website Navigation: A sidebar menu with the following items: Home, Getting Involved, Processes, Meetings, Programs, Tools, Resources, and Code of Conduct. The "Processes" item has a dropdown arrow indicating it has sub-items.

Section Title: "LF Energy Foundation TAC"

Description: Per the [Directed Fund Charter](#), the role of the Technical Advisory Committee (TAC) is to facilitate communication and collaboration among the Technical Projects. The TAC will be responsible for:

- Coordinating collaboration among Technical Projects, including development of an overall technical vision for the community;
- Making recommendations to the Budget Committee of resource priorities for Technical Projects;
- Electing annually a chairperson to preside over meetings, set the agenda for meetings, ensure meeting minutes are taken and who will also serve on the Governing Board as the TAC's representative (the "TAC Representative");
- Creating, maintaining and amending project lifecycle procedures and processes, subject to the

Document Preview: The preview shows the title "Technical Advisory Council (TAC) Overview" and the date "December 2024". The document content is partially visible, mentioning "communicated to the TAC", "participate in TAC", "project inclusion or", and "technical steering".

Annual Review Schedule - TAC

Source:

https://tac.lfenergy.org/processes/review_cycle.html

Name	Last Review Date	Next Review Date
Battery Data Alliance	8/27/2024	9/2/2025
OperatorFabric	7/16/2024	9/2/2025
Grid Edge Interoperability & Security Alliance (GEISA)		10/14/2025
GridFM	10/29/2024	10/14/2025
NODE Collective	4/2/2024	10/14/2025
AI SIG	10/29/2024	11/11/2025
FlexMeasures	11/20/2024	11/11/2025
SC Decarbonisation Hub		11/11/2025
Connected Data Specification - Customer Data Working Group (CDS WG3)		12/9/2025
Connected Data Specification - Power Systems Data Working Group (CDS WG2)		12/9/2025
Connected Data Specification - Registration Working Group (CDS WG1)		12/9/2025
Digital Substations SIG		12/9/2025
TROLIE	9/6/2023	12/9/2025
EV Charging SIG		1/13/2026
Grid Simulation and Modeling SIG		1/13/2026
Grid2Op	2/11/2025	2/10/2026
Hyphae	2/11/2025	2/10/2026
LF Energy Semantic Energy Framework (LFE-SEF)	4/23/2024	3/10/2026
OpenSynth	3/11/2025	3/10/2026
ORES (Open Renewal Energy Systems)	4/8/2025	4/14/2026
Shapeshifter	4/8/2025	4/14/2026
OpenDSM	5/13/2025	5/12/2026
SOGNO	5/13/2025	5/12/2026
Grid eXchange Fabric (GXF)	7/8/2025	7/14/2026

Annual Review Schedule - SIG

SIG Leaders - please share how recent reviews have went, and let us know if the schedule/alignment is still correct - contact email
support@lfenergy.org

Source:

https://tac.lfenergy.org/process/review_cycle.html

Name	Last Review Date	Next Review Date	SIG
Grid Vantage	9/26/2023	6/4/2025	Grid Simulation and Modeling
Arras	7/16/2024	10/1/2025	Grid Simulation and Modeling
Dynawo	1/30/2024	10/1/2025	Grid Simulation and Modeling
CitrineOS	11/27/2024	11/26/2025	EV Charging
SEAPATH	1/14/2025	1/13/2026	Digital Substations
EVerest	1/22/2025	1/28/2026	EV Charging
OpenSTEF	2/5/2025	2/4/2026	Grid Simulation and Modeling
Power Grid Model	2/5/2025	2/4/2026	Grid Simulation and Modeling
covXtreme	4/2/2025	4/1/2026	Grid Simulation and Modeling
CoMPAS	6/10/2025	6/2/2026	Digital Substations
FledgePower	6/10/2025	6/2/2026	Digital Substations
FIDOPower	6/4/2025	6/3/2026	Grid Simulation and Modeling

SIG Meeting Schedule for September

All SIG meetings can be found on the LF Energy calendar (calendar.lfenergy.org) as well as the SIG Calendar (sigcalendar.lfenergy.org)

Days/times listed are US Eastern Time

The screenshot shows a digital calendar interface for September 2025. At the top, there are buttons for 'iCal' and 'Today', and navigation arrows for 'September 2025'. Below these are buttons for 'Day', '4 Days', 'Week', 'Month', and 'List', with 'List' being the active view. The date 'Wednesday 24' is highlighted in a large box. Underneath, the time '9:00am - 10:00am' is listed next to a blue circular icon followed by the text 'EV Charging SIG Monthly Meeting'.

→ **SIG Leaders - share any updates for your SIGs**

Project Pipeline

<https://github.com/orgs/lf-energy/projects/2/views/5>

- [RTC-Tools](#) is a mature, leading open-source solution for the operational optimization of water and energy systems. Contributed by Deltares and Shell. LF Onboarding completed and presenting in today's TAC meeting.
- [CityLearn](#) is an open source Farama Foundation Gymnasium environment for the implementation of advanced controllers for demand side building energy coordination and demand response in cities. It's focus is on residential buildings with the goal to shape the aggregated load profile using local and coordinated DERs. Submitted April 23, 2025; currently in LF Onboarding
- [Global Granular Certificate Registry](#) is a vendor-neutral, open-source, cloud-native ledger that issues, tracks, and retires Granular Certificates (GCs). Submitted June 11, 2025; currently in LF Onboarding
- [Project-Origin](#) is an open-source initiative to create a federated, decentralized infrastructure for issuing, transferring, and verifying granular, time-based energy certificates. Submitted July 8, 2025; currently in LF Onboarding.

- [Power Stability Wide Area Monitoring Protection \(p-SWAMP\)](#) is a microservices based project focused on work within Wide Area Monitoring, Protection and Control (WAMPACS). LF Onboarding completed and presenting in today's TAC meeting.
- [PowerCore](#) will provide a vendor-agnostic, hardware-generic industrial informatics API for power-electronics systems, enabling portable, maintainable control firmware across diverse microcontroller SoCs. Submitted July 28, 2025; currently in LF Onboarding.
- [Utility Rate Plan Exchange \(URPX\)](#) aims to develop a comprehensive, standardized method for representing and exchanging utility rate plan data in machine-accessible format. Submitted August 3, 2025; currently in LF Onboarding.

Older projects in LF Onboarding

- [OneNet Framework](#) - awaiting approval of governance documents
- [pyELO: python Emission Localization and Quantification](#) - working on name rights issues

TAC Priorities as aligned to with TAC

DONE

- ✓ Move to monthly TAC meetings instead of every 3 weeks
- ✓ Start office hours for SIG leaders to share best practices (working on date/time reschedule)
- ✓ Spin down Data Standards and Tooling and Grid Operations SIGs
- ✓ Move affected project annual reviews to the TAC
- ✓ Security Audits - TAC align on two projects to prioritize (EVerest, PowSyBL)
- ✓ Project workshops with LF Energy Summit (tentatively Sep 10-11 in Aachen, Germany)
- ✓ Revisit TAC Leadership structure
- ✓ Project landscape <https://landscape.lfenergy.org/> - Update this to reflect the latest projects and how we want to message the ecosystem
- ✓ Include LFESS Working Groups in TAC annual review process.
- ✓ Process for projects to request resources/funding for cloud infrastructure (<https://github.com/lf-energy/tac/issues/477>)
- ✓ Improve SIG support and interface to the TAC (<https://github.com/lf-energy/tac/issues/544>)

CURRENT FOCUSES

- Documentation audit/support (<https://github.com/lf-energy/tac/issues/546>)

NEXT FOCUSES

- Security Audits - TAC to prioritize next project(s) to focus on ([Determine prioritization for Security Audits #408](#))
 - Considering lighter weight “security threat model analysis” for Incubation level projects
- Project Lifecycle - Review and make adjustments to align with current project needs (last changes made in 2021)
 - Perhaps should we start with a project questionnaire?
- Assemble and execute on a plan to inject fresh energy and increase engagement with the TAC

Project Services Funding #613

The LF Energy Governing Board has approved an initial fund of \$50,000 to go towards specific project infrastructure or services needs. These services could include marketing websites, documentation support, sandbox demo infrastructure, and release engineering.

- The Project Resource Request process has been updated to include this (see https://tac.lfenergy.org/tools/resource_request.html).
- Project board to track requests at <https://github.com/orgs/lf-energy/projects/2/views/6>
- We've also had one application already (see [#596](#)).

TAC Actions:

1. Align on the focus for funding to be Early Adoption stage projects; Incubation and Sandbox projects may be considered after Early Adoption project requests are fulfilled.
2. Discuss and get alignment on the operational plan:
 - LF Staff review for applicability and budget space.
 - LF Staff sends to the TAC for initial review within three business days of the submission.
 - TAC has seven business days for feedback/questions.
 - If nothing, do an LFX Vote to approve. If there are questions, resolve and then do an LFX vote, then if the TAC chooses to move forward
 - LF Staff to follow up with the project on the resource request and engage any other teams to fulfill the request.

Project website policy [#582](#)

We've formalized the policies around project websites, specifically:

- The website MUST have the 'Linux Foundation Projects' header, cookie consent integration, and legal footer. Contact LF Staff if you need the code/language to include.
- The website MUST NOT collect any personally identifiable information (PII) unless it goes through an approved LF data collection system. This means that the project can't set up a separate Google Form for collecting PII, or have PII collected go to a system owned by a separate entity.
- The website MUST provide admin access to the LF. This includes any code repository used to build the site, access to a hosting provider that hosts the site, and the ability to manage the site's content. The LF will ensure these credentials are only used for exceptional circumstances.
- The website MUST NOT enable any third-party functionality or integrations, particularly those that collect and/or share any user-submitted data without LF approval.
- The domain name and DNS for the website MUST be owned by the LF and managed in LFX PCC. LF IT and PMO can easily make any adjustments on behalf of the project.
- Ensure that the website does not bias any particular company (e.g., no links to a vendor's products from the website, no promotions or offers).
- Any use of LF marks must comply with the [LF Trademark Policy](#) and [LF Projects Trademark Policy](#).

We can help any projects needing assistance here, and we will be also proactively auditing projects.

PowSyBL Security audit complete! [#594](#)

More details at

<https://lfenergy.org/audit-of-lf-energy-powsybl-ensures-security-of-power-systems-tool/>

Jul 30, 2025

ADA LOGICS

Audit of LF Energy PowSyBl Ensures Security of Power Systems Tool

PowSyBl Security Audit

In collaboration with LF Energy, OSTIF and the PowSyBl maintainers

Arthur Chen, Adam Korczynski, David Korczynski, Ada Logics

1st July 2025

LF Energy is pleased to announce the publication of a comprehensive security audit of the PowSyBl project, conducted by Ada Logics and coordinated by the Open Source Technology Improvement Fund (OSTIF). This audit was funded by LF Energy as part of our ongoing commitment to improving the security and resilience... [Read More.](#)

New Project/Working Group Proposal: RTC-Tools [#344](#)

5:10 pm - 5:30 pm



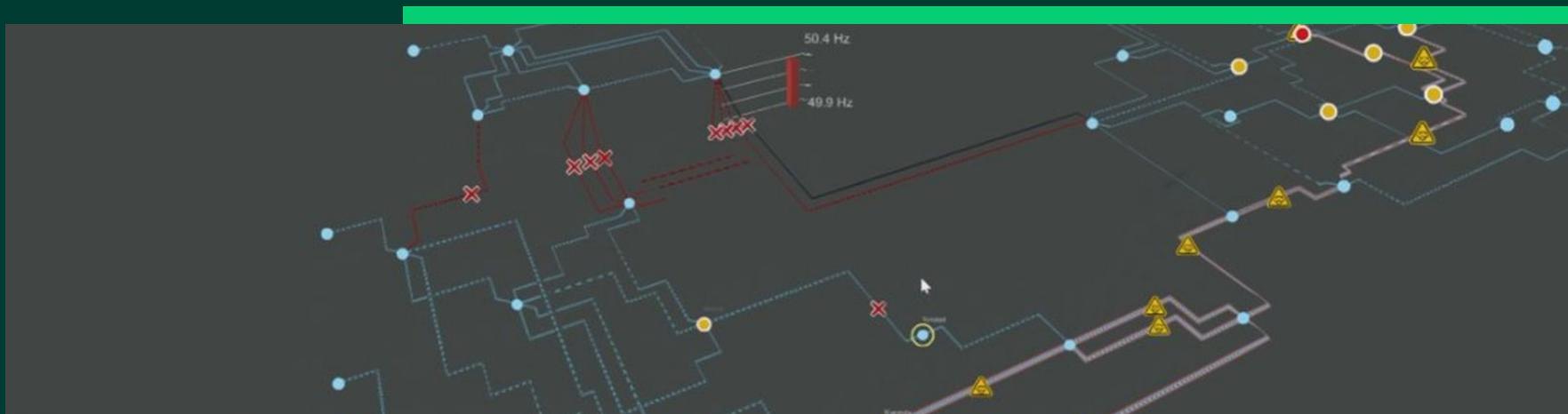
New Project/Working Group Proposal: Power Stability Wide Area Monitoring Protection (p-SWAMP) [#585](#)

5:30 pm - 5:50 pm



Statnett

– Statnett R&D WAMPAC power- Stability Wide Area Monitoring Protection (p-SWAMP)

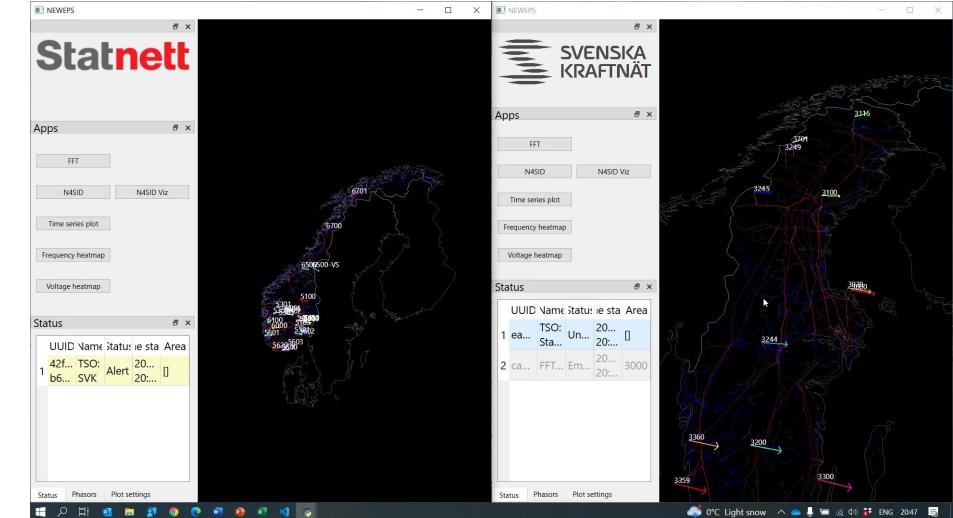


Motivation



[What's Happening in Spain? The 2025 Blackout and the Global Threat Ahead!](#)

[28 April Blackout](#)



[NEWEPS - Nordic Early Warning Early Prevention system](#)

[NEWEPS Demo C - Part 2, Voltage Stability Monitoring on Vimeo](#)

The Norwegian Transmision System Operator (TSO)

Owned by the Norwegian State through the Ministry of Energy

Owns and operates the national high voltage transmission grid in Norway, i.e. the electricity highways.

Operation of the Nordic power grid is a collaboration between Statnett in Norway , Svenska kraftnät in Sweden, Fingrid in Finland and Energinet in Denmark.

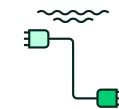
[Grid Map downloads](#)



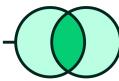
Statnett SF



11 500 km high voltage lines



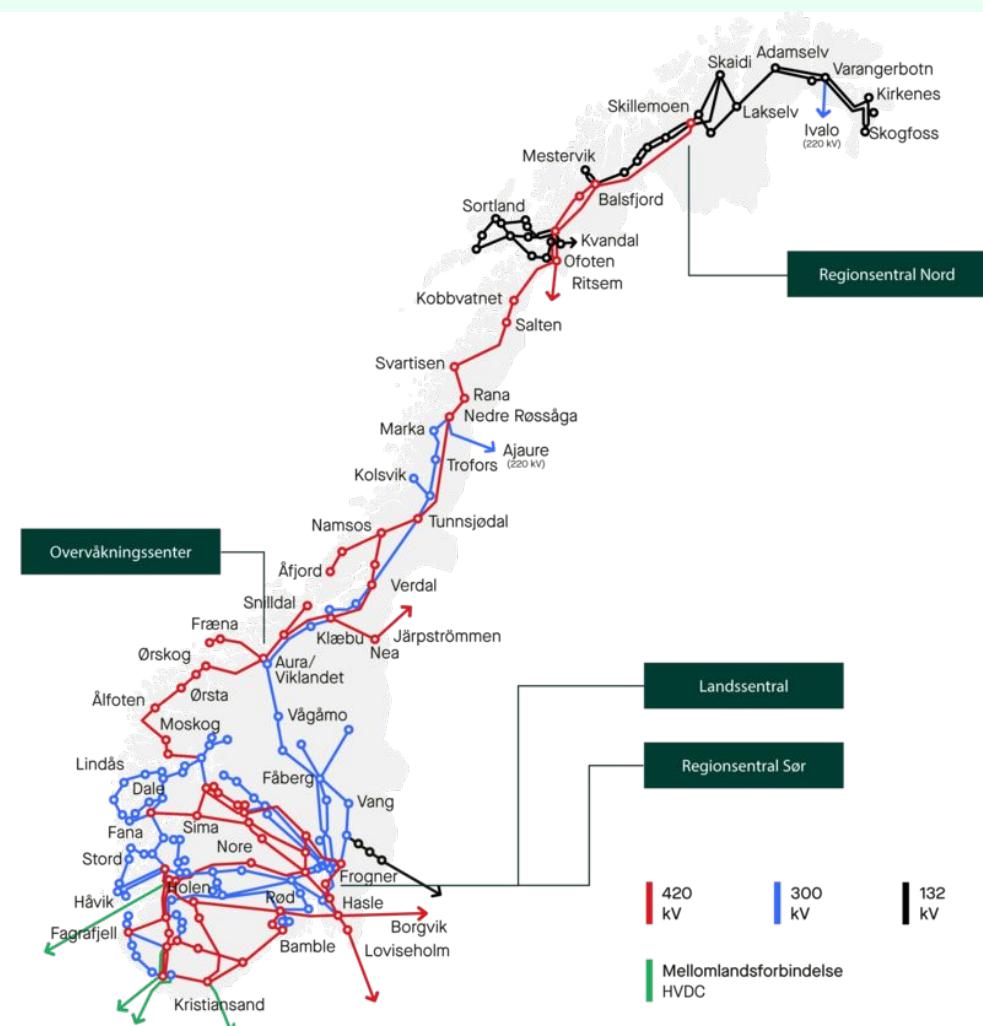
2 550 km subsea and underground cables



190 substations



1 600 employees, 5 office locations (Oslo, Alta, Trondheim, Sunndalsøra and Sandnes)



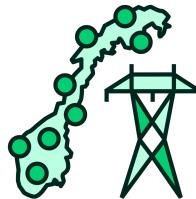
The Norwegian power system



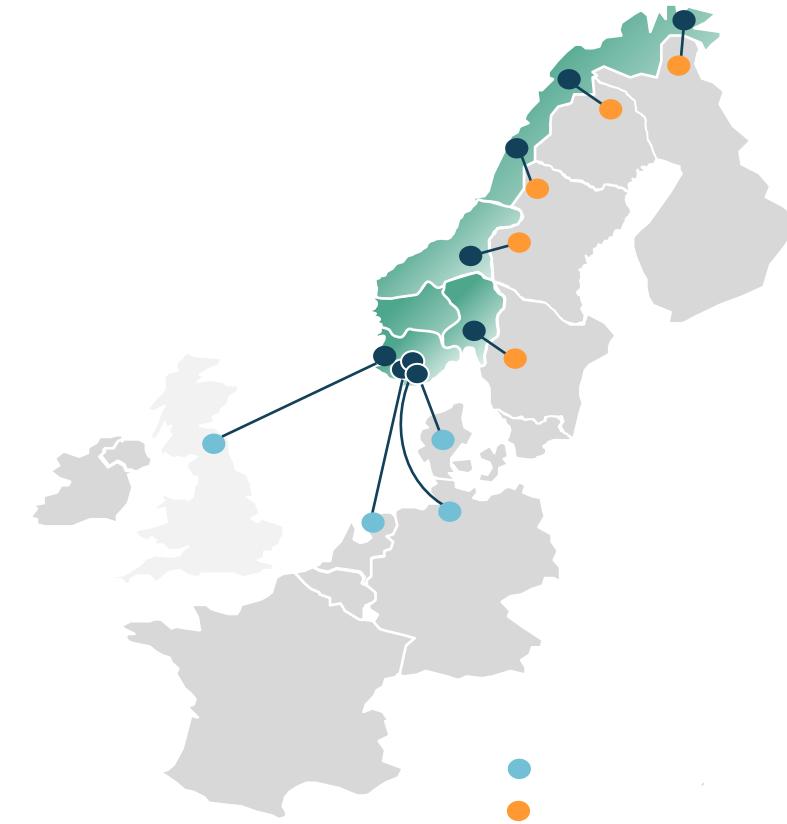
Consumption
134 TWh



Production
146 TWh



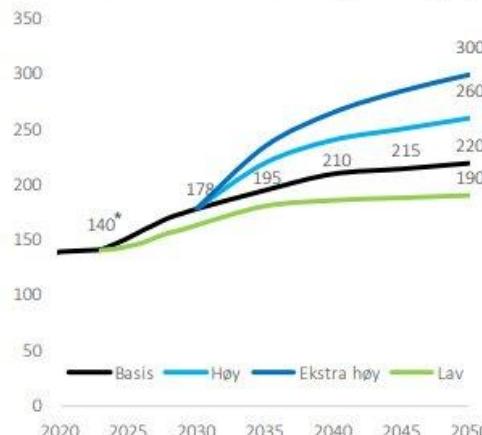
Net exchange
12.5 TWh to:
Sweden, Finland, Denmark, UK, Germany
and Netherlands



Statnett – Challenges

Prognoses indicate higher consumption in Norway, connection of new larger consumers and more renewable production units (off-shore wind, on-shore wind and photovoltaic).

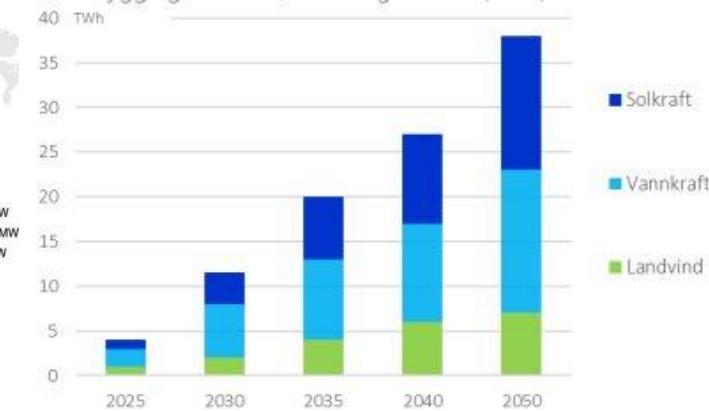
Ulike scenario for forbruksutviklingen i Norge (TWh)



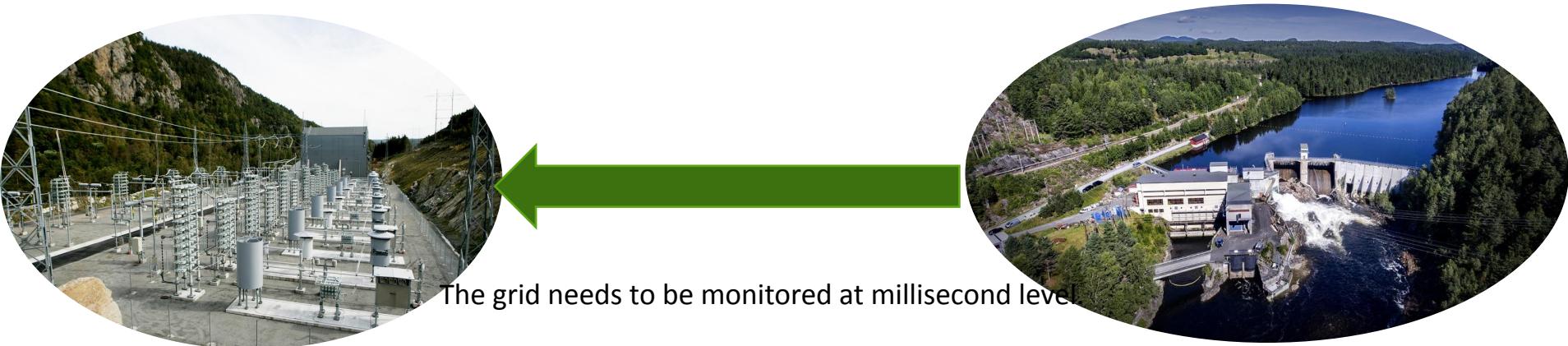
Oversikt over lokalisering og volum på tilknytningssaker



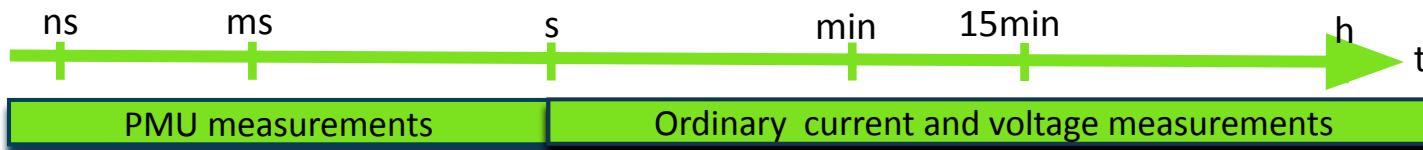
Utbygging landvind, vann- og solkraft (TWh) i Basis**



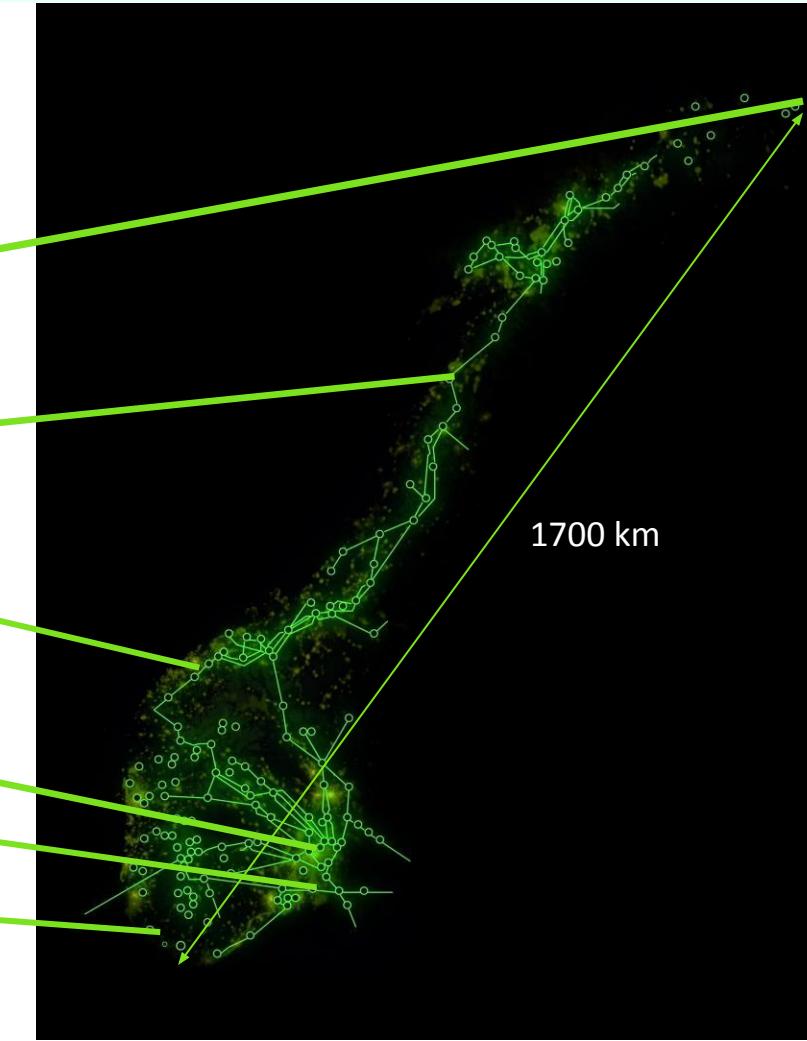
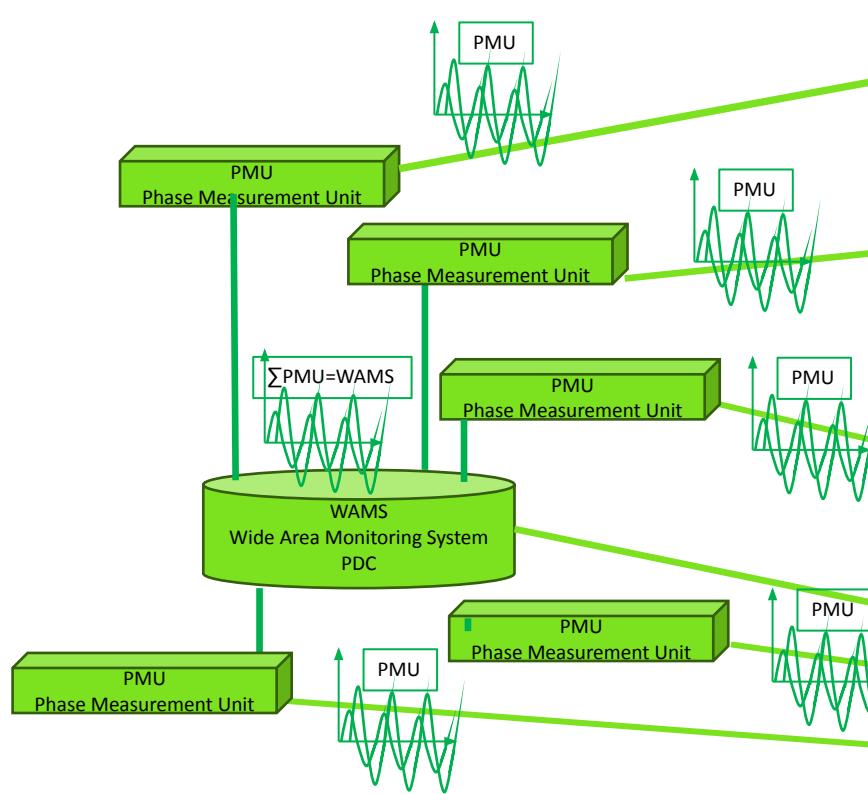
Power production change from hydro, to mix of sun and wind, connected to the grid via power electronics, gives the grid new characteristic, and needs to be monitored in a new way.



The grid needs to be monitored at millisecond level.



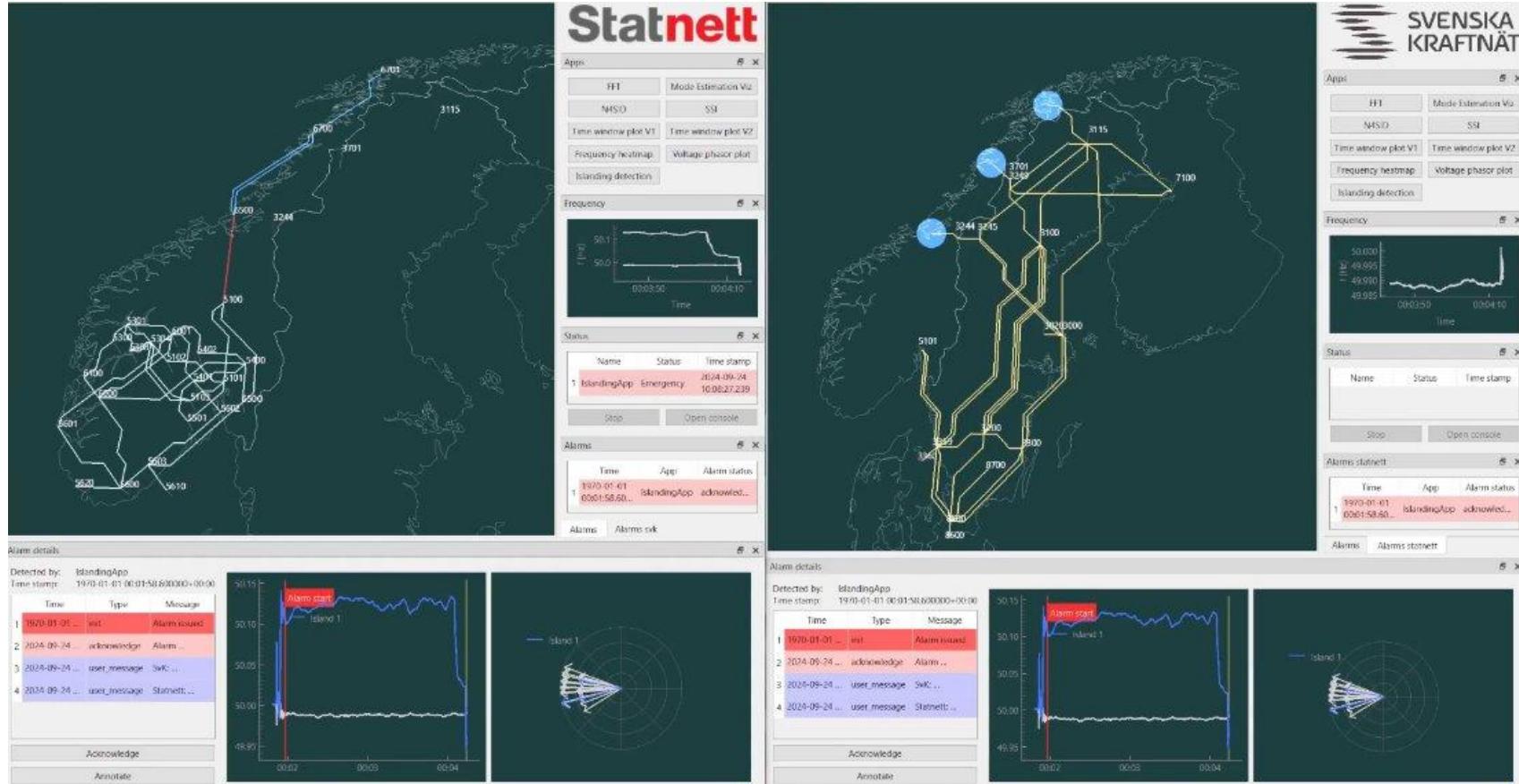
Coordinated time-synchronization across Norway and Europe



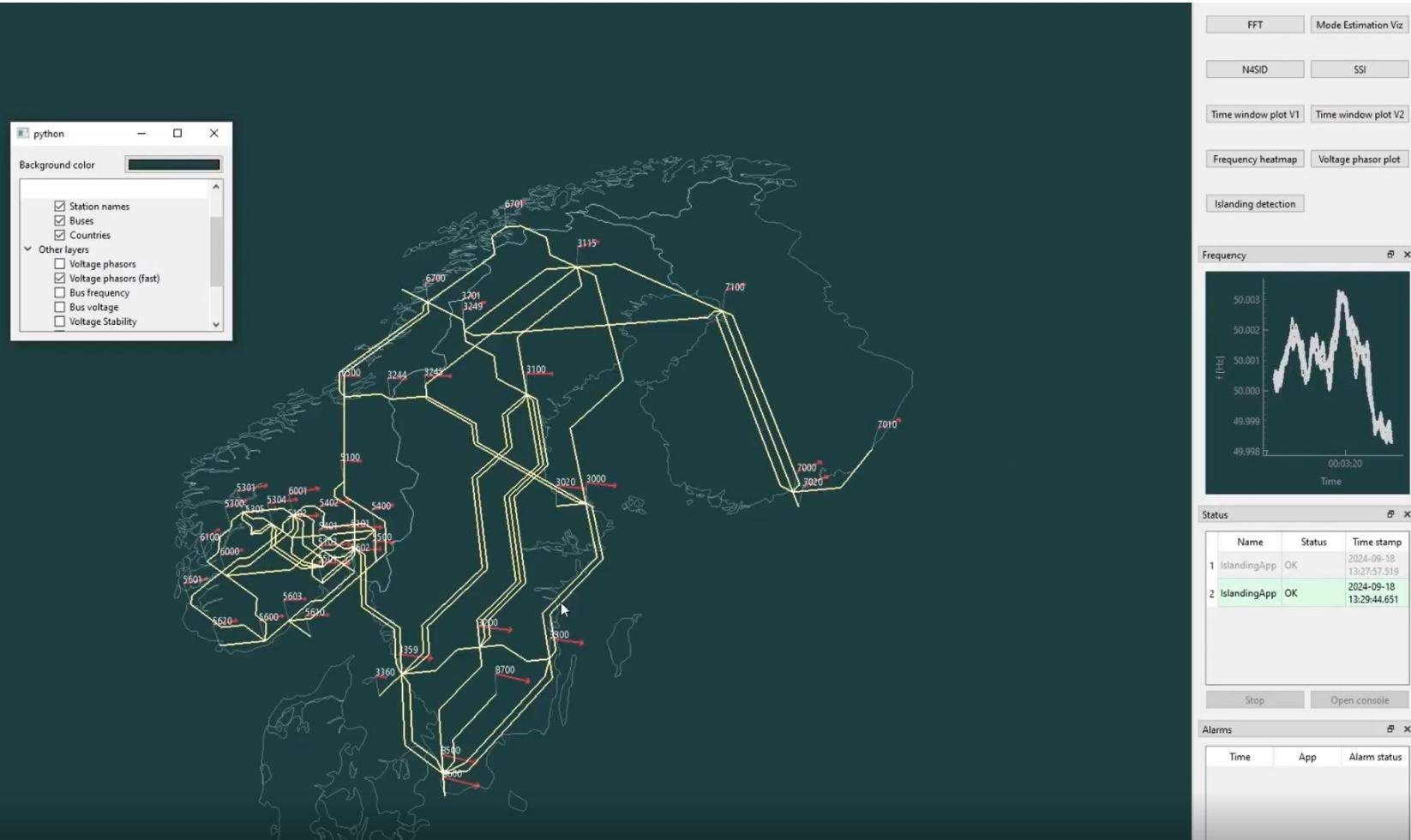
information

Alarm coordination between TSOs

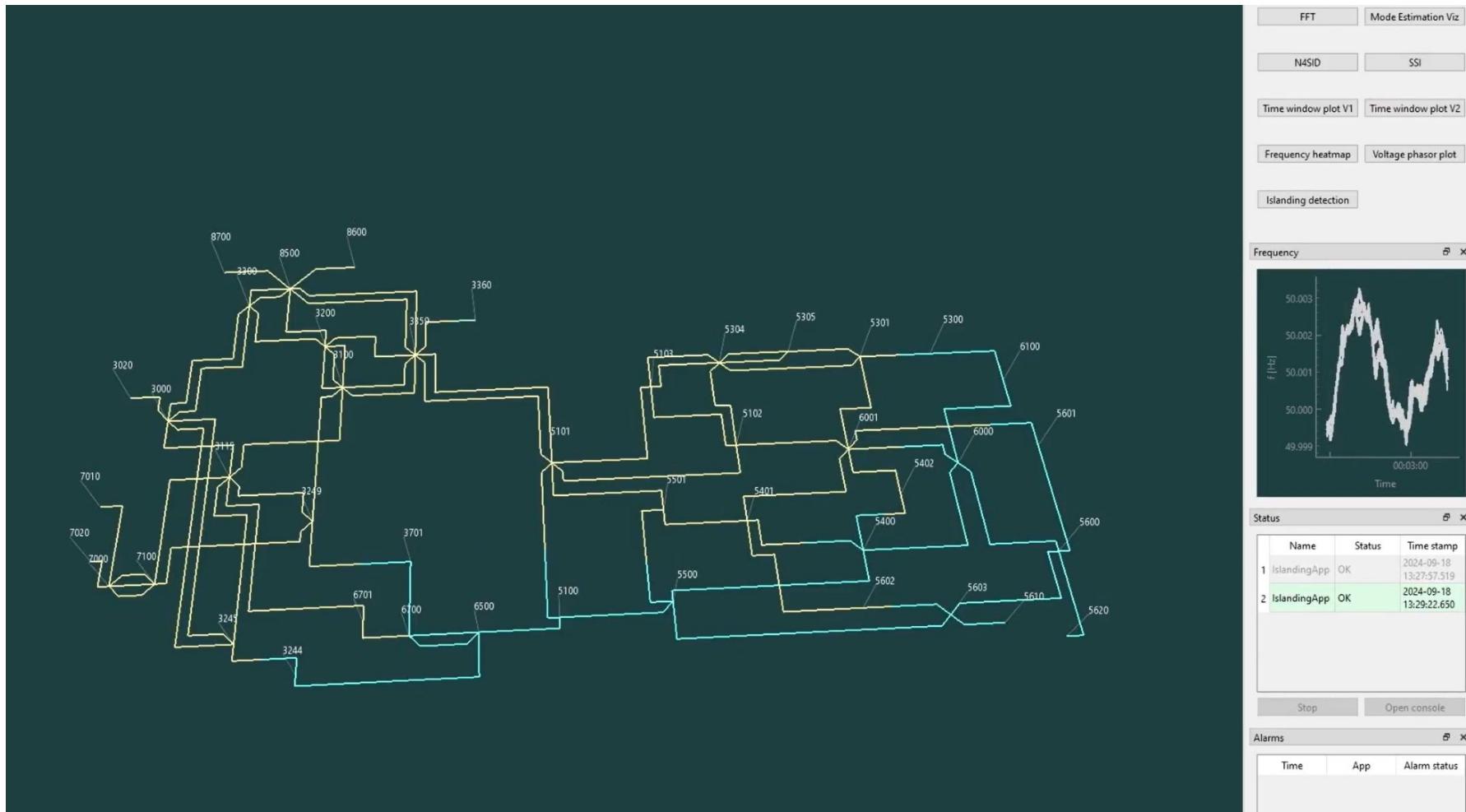
Alarm coordination between TSOs for Island detection



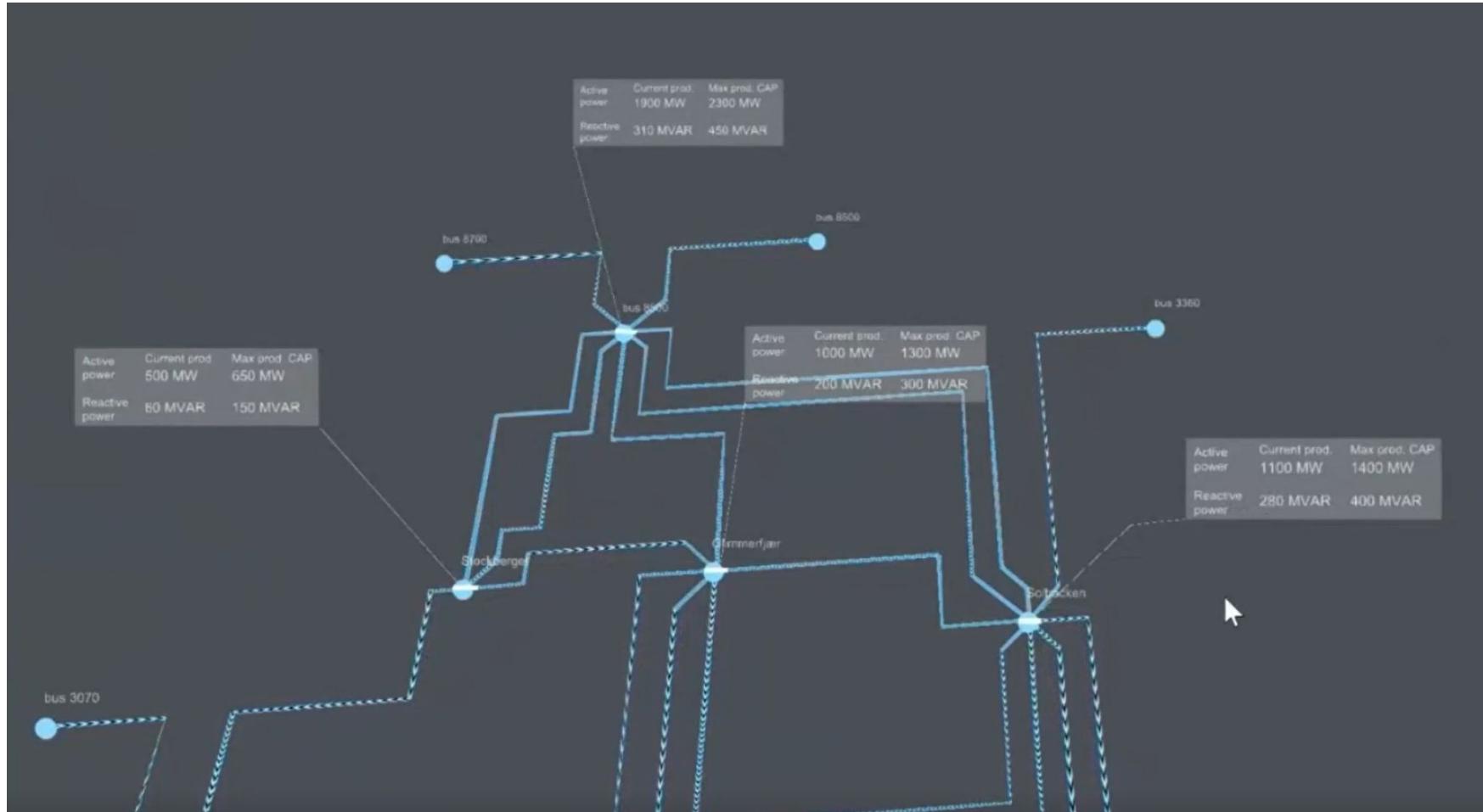
All simulations based on CIM -models



All simulations based on CIM -models



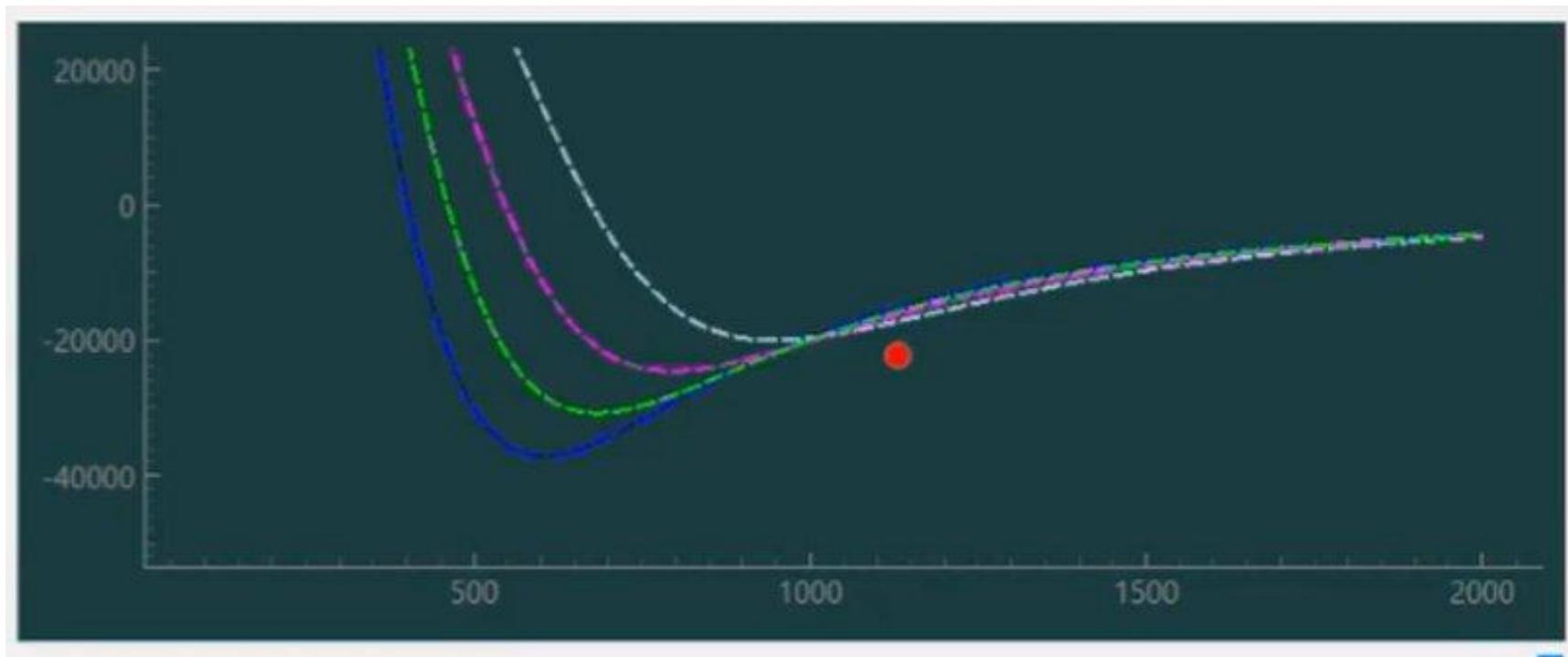
Drill down functionality for alarm handling in sub grid by use of 3D



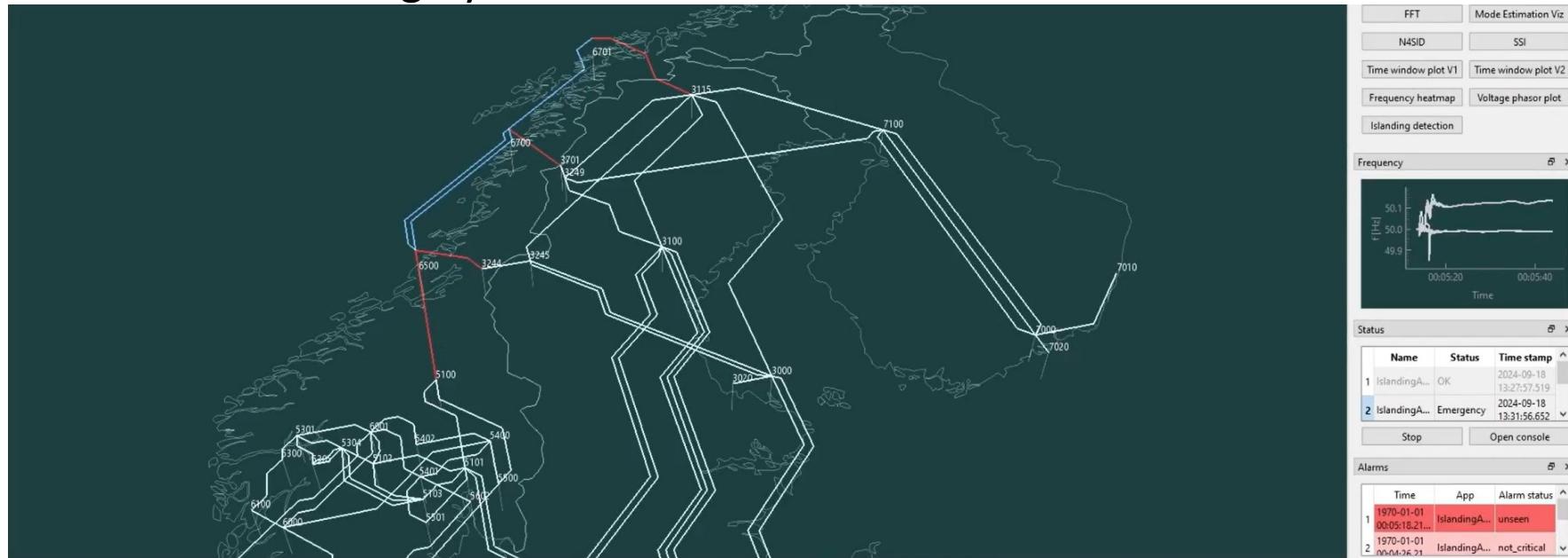
Drill down functionality for alarm handling in sub grid by use of 3D



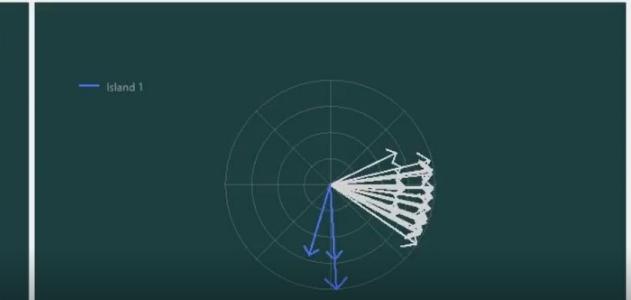
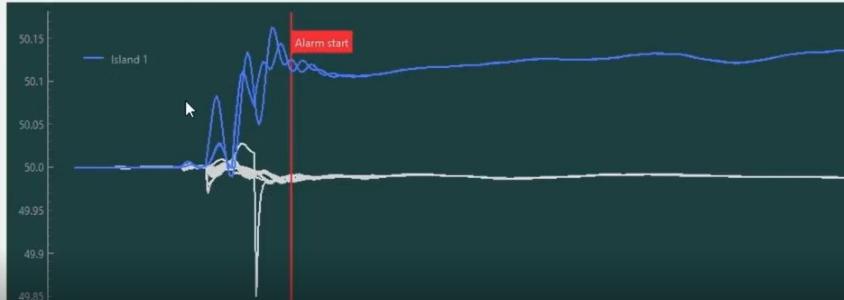
Detection voltage stability



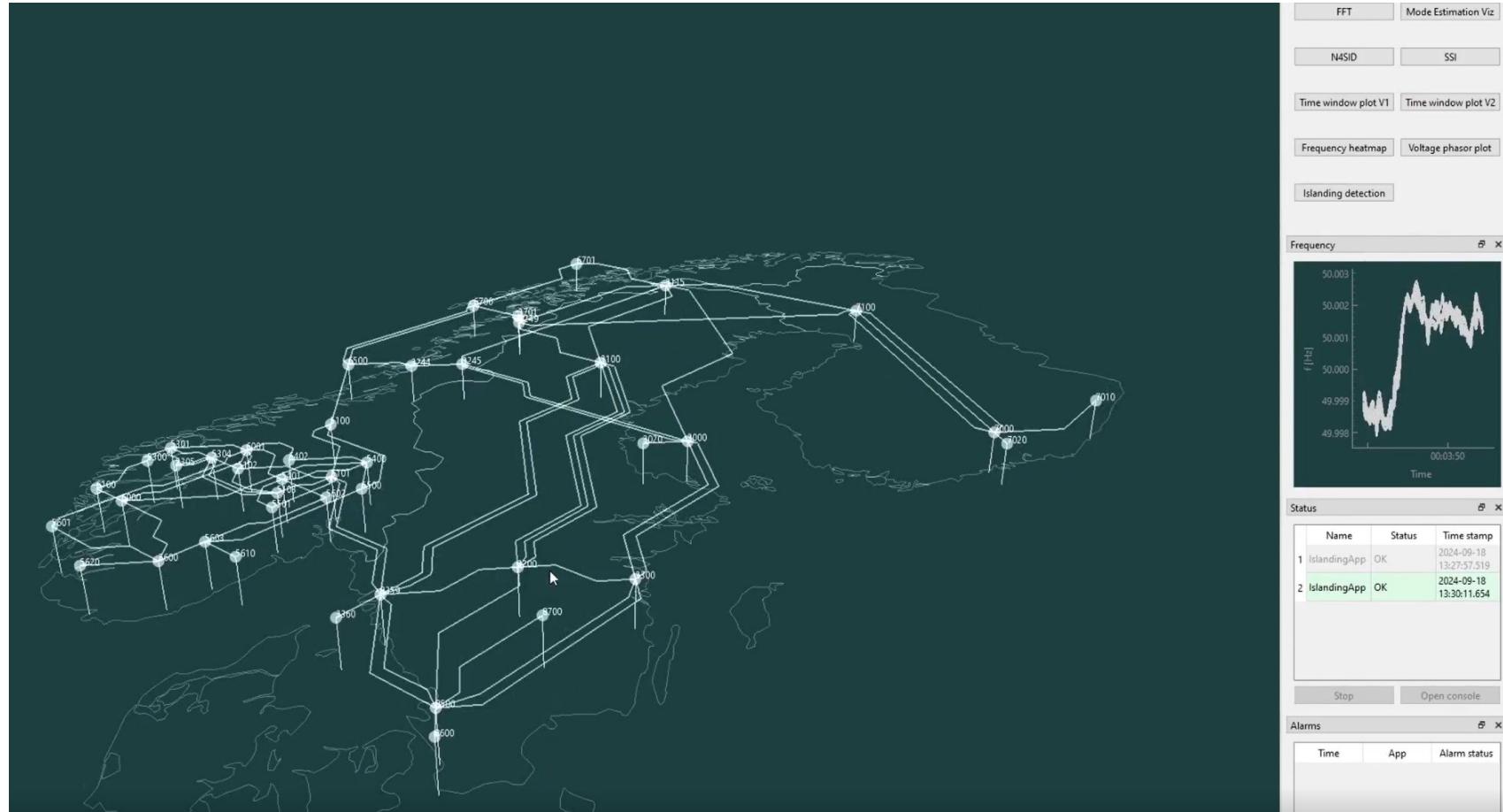
Detection of Islanding by use of 3D



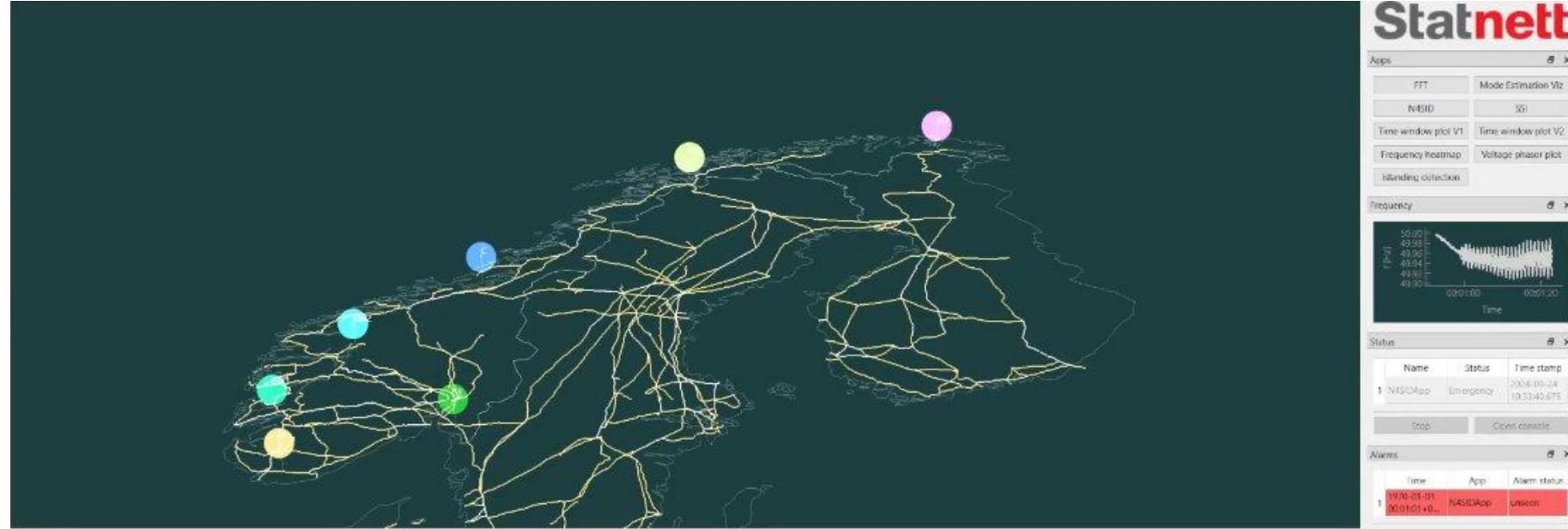
Alarm details



Oscillation detection by use of advanced UI to show how nodes interacts

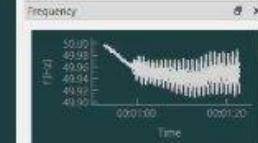


Visualization of Oscillation by use of 3D



Statnett

Apps	
FFT	Mode Estimation V2
N4SID	SGI
Time window plot V1	Time window plot V2
Frequency heatmap	Voltage phasor plot
Islanding detection	



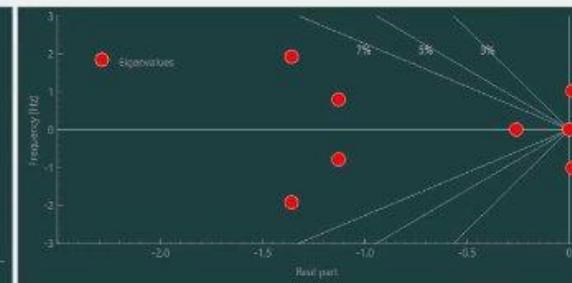
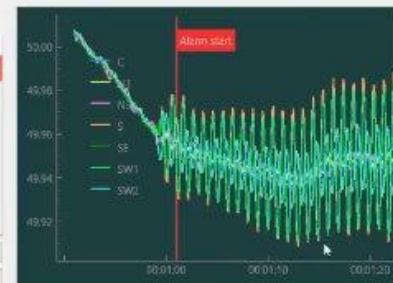
Status	Name	Status	Time stamp
Normal	N4SIDApp	Emergency	2004-05-14 10:33:40.675

Alarms	Time	App	Alarm status
1	1970-01-01 00:01:01 +0000	N4SIDApp	Unknown

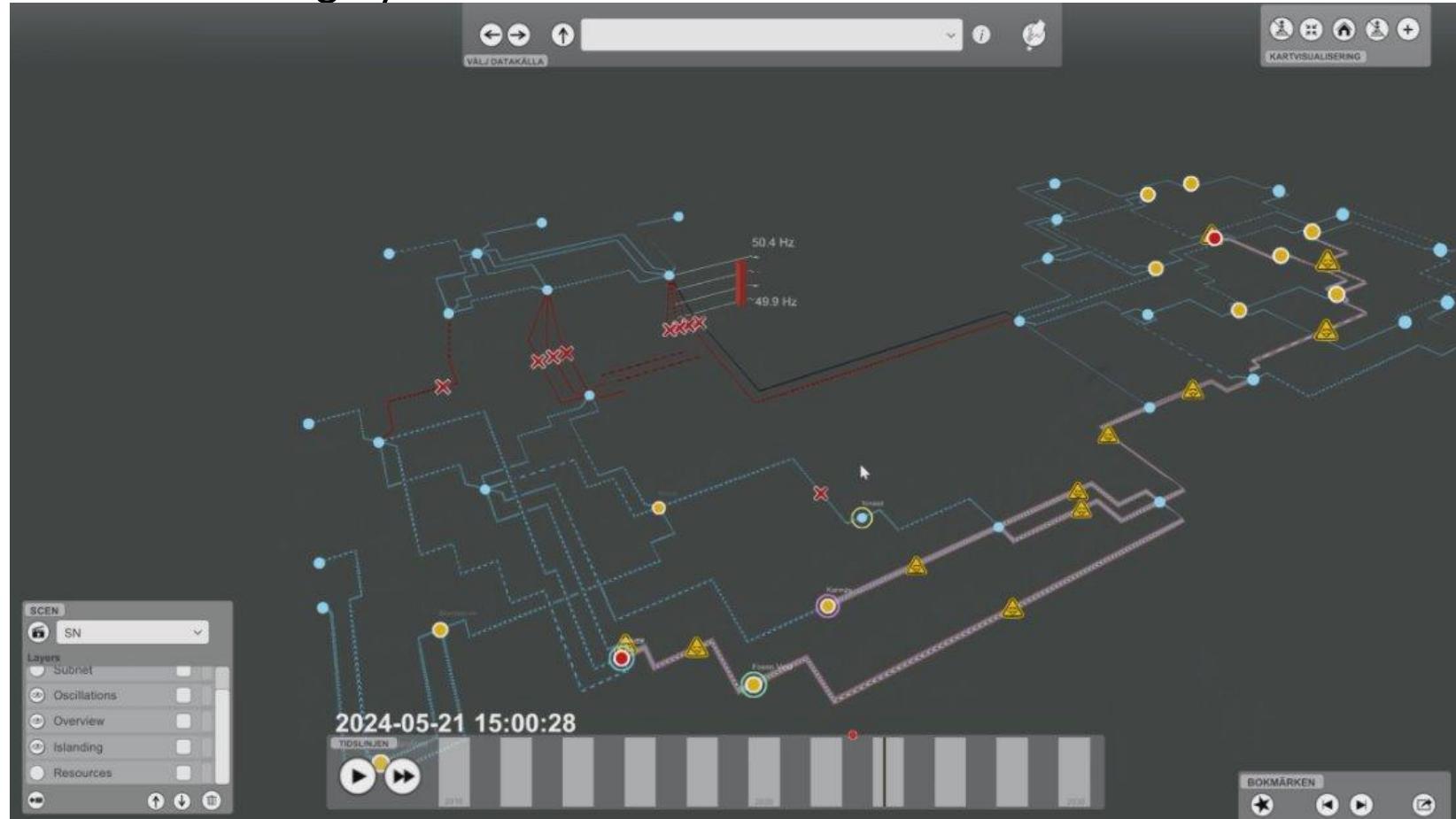
Alarm details

Detected by: N4SIDApp
Time stamp: 1970-01-01 00:01:01+0000

Time	Type	Message
1 1970-01-01...	par	Alarm issued



Oscillation detection by use of advanced UI to show how nodes interacts Detection of Islanding by use of 3D



Operation awareness on contingency analyze and Corrective actions

ASAP Panel - Example

The screenshot displays the ASAP Panel interface. On the left is a map of a power system with various buses labeled by ID (e.g., 6701, 3115, 7100, 7010). A red line highlights a specific line segment between buses 3115 and 3249, with the text "Line outage L3115-3249". A green arrow points from this text to the line on the map. Another green arrow points to bus 7100 with the text "7100: V=1.05". Below the map, a table titled "Contingency Analysis" lists 16 entries under the heading "ASAP", all of which are "line_outage" events involving bus 3115.

Frequency

A line graph titled "Frequency" showing power system frequency over time. The y-axis ranges from 49.97 to 50.02 Hz. The x-axis shows time from 00:05:00 to 00:05:20. A sharp dip occurs at approximately 00:05:15, where the frequency drops from about 50.01 Hz to 49.99 Hz before returning to baseline.

Status

Name	Status	Time stamp
1 Contingenc...	Undefined	2024-09-10 14:05:44.374

Stop Open console

ASAP Panel

Alarm details

Contingency Analysis

ASAP
C4: L3000-3245-2, line_outage
C5: L3000-3300-1, line_outage
C6: L3000-3300-2, line_outage
C7: L3100-3115, line_outage
C8: L3100-3200-1, line_outage
C9: L3100-3200-2, line_outage
C10: L3100-3200-3, line_outage
C11: L3100-3249, line_outage
C12: L3100-3359-1, line_outage
C13: L3100-3359-2, line_outage
C14: L3115-3245, line_outage
C15: L3115-3249, line_outage
C16: L3115-6701, line_outage

L3249-7100: Thermal RATE1
3360: Voltage Stability Index

Contingency happens (line falls out)

A line graph titled "Contingency happens (line falls out)" showing power system frequency over time. The y-axis ranges from 2500 to 4000 Hz. The x-axis shows time from 00:04:50 to 00:05:20. A very sharp dip occurs at approximately 00:05:15, where the frequency drops from about 3800 Hz to 2500 Hz. A green dashed box highlights the "Apply corrective actions" button, which is positioned between the two frequency plots. An arrow points from this button to the dip in the frequency plot.

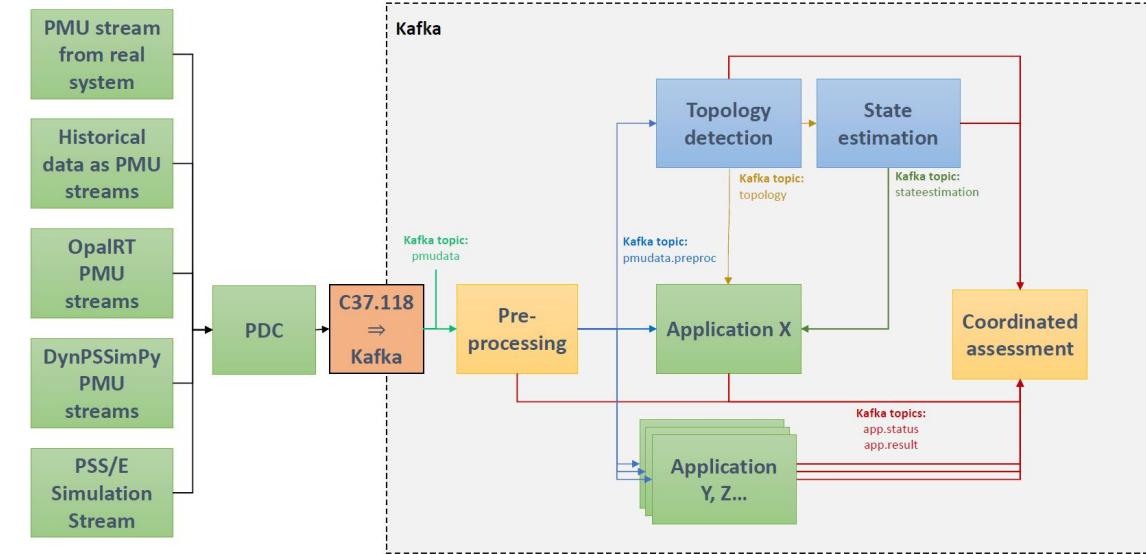
Architecture of the implemented platform

Development of a software platform to validate the detection and visualization methods

Core programming in Python

Modular structure with several independent applications

Communication between applications with a Kafka stream



Voltage Stability

<https://youtu.be/B2XXrjwevcs>

Oscillations

<https://youtu.be/lB7JYJ0BG9U>

TSO Coordination

<https://youtu.be/PCm2WNXBtj0>

SCOPF (ASAP-NEWEPS)

<https://youtu.be/wAdYy3pgG5A>



RNDP Platfor m



Kubernetes hosted on Azure



Notebook interface
(Jupyter)

Robust ecosystem for data science
Rich visualizations
Supports Python (mamba), R, Julia, and more



Shared POSIX filesystem (Ceph)



Kubernetes namespace
isolation

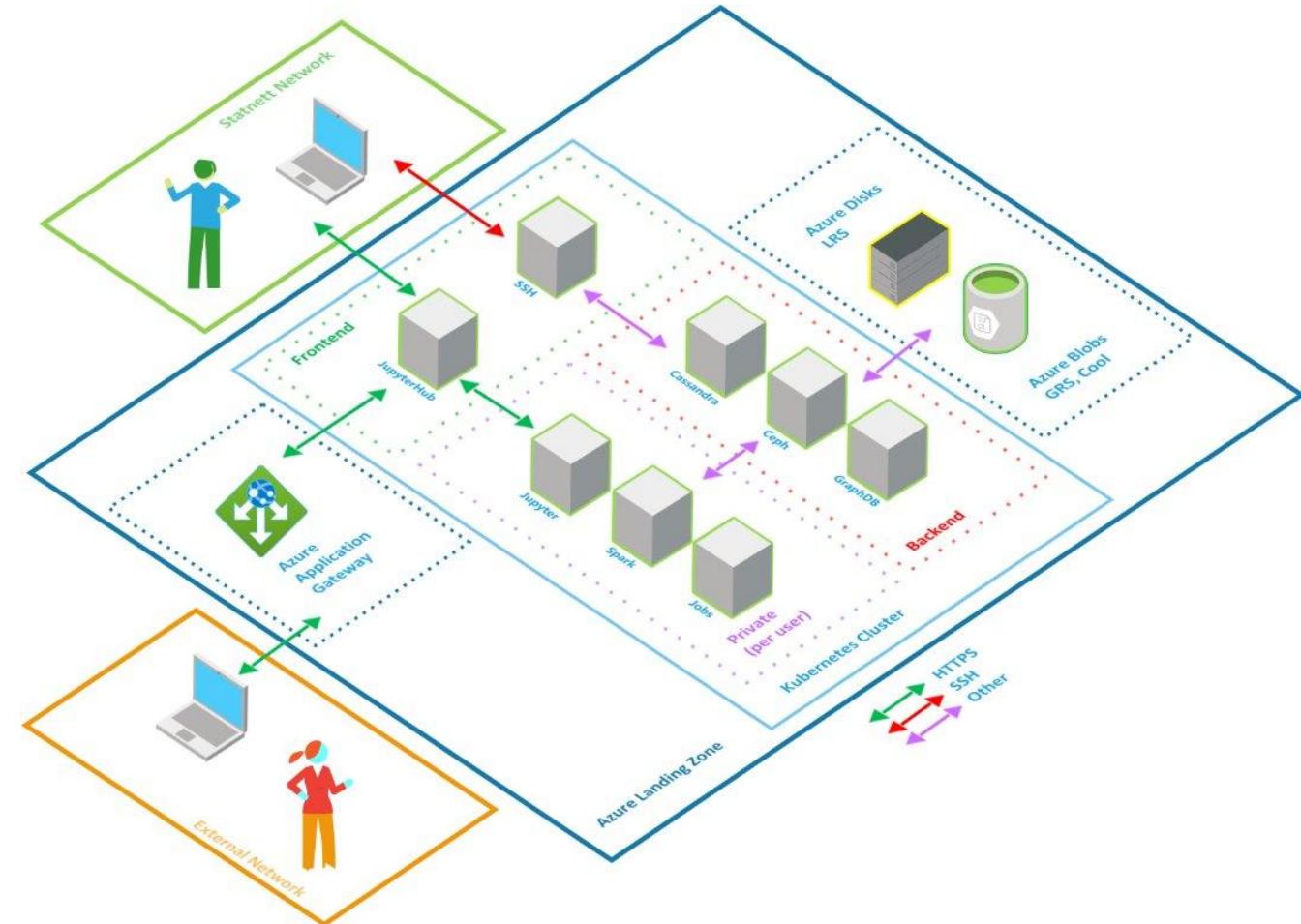
Spark clusters for big-data workloads
Kubernetes jobs for long-running
workloads

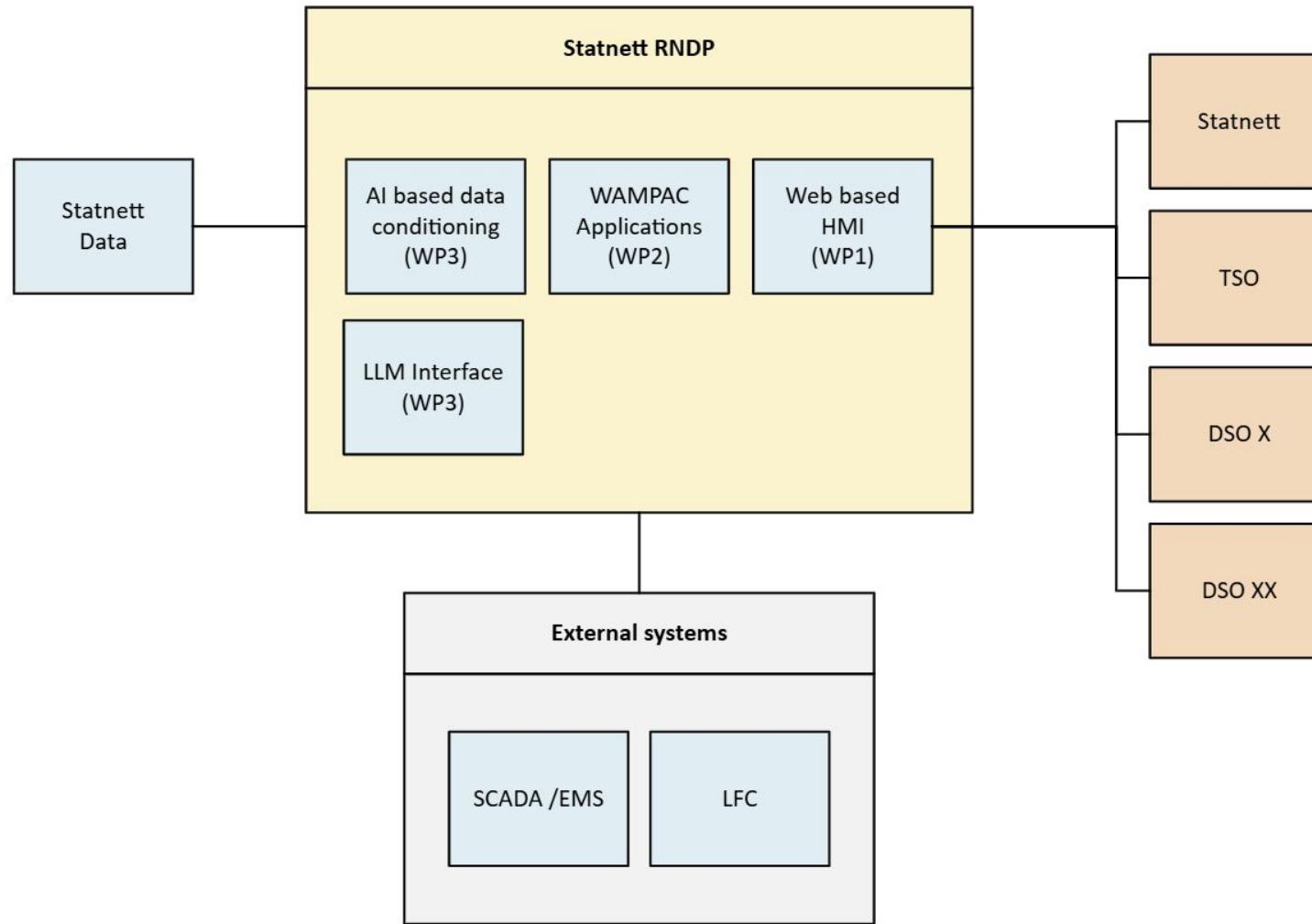


Statnett integrated

Entra
GitLab
Artifactory

- **Backend**
 - Ceph
 - Cassandra
 - Hosted (GraphDB)
- **Frontend**
 - JupyterHub
 - Services
 - SSH
 - Hosted
- **Private**
 - Jupyter
 - Spark
 - Kubernetes (Jobs)





Project p-SWAMP Tasks and work packets

- WP0 Management, communication, dissemination
- WP1 Advanced Web based HMI
- WP2 WAMPAC applications for operation support
- WP3 Data conditioning and linear state estimation
- WP4 Modules integration and deployment
- WP5 Module validations and pilot demonstration

Project p-SWAMP timeline

Annual Review: Battery Data Alliance #57

5:50 pm - 6:10 pm





Sustainable open source software and best practices for the battery industry

LF Energy Summit September 2025 Meeting
Presented by: Gabe Hege

Agenda

Review Mission & Value Proposition

Battery Data Landscape

Key Projects

Connector Library (from AmpLabs, Admiral, BattGenie)

BattETL & BattDB (from BattGenie)

Battery Data Format (from Ohm)

BattInfo - Battery Ontology

How to Participate

Key Problem

- No clear standards
- + Redundant work
- + Lack of collaboration
- = **Slow Progress**

Our Solution

Strong Community

- + Open Source Software
- + Best Practices
- = **Safer/Cheaper Batteries**

Industry Focus

Design



Lack of Open Source
battery data

Lack of common
platform & format

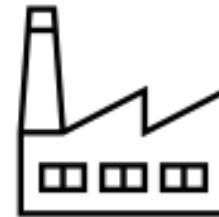
Testing



Manual configuration of
testing equipment

Standards vs.
Execution = Huge Gap

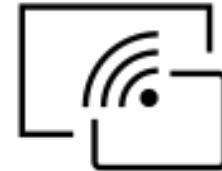
Manufacturing



Repetitive work on
schema design

Barriers for
collaboration

Telemetry



Untapped Area in the
Open Source World

Software Projects

BattETL & BattDB

BattInfo - Battery Ontology

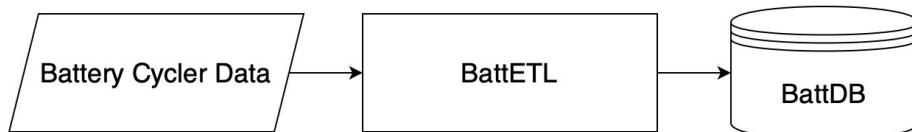
Battery Data Format

BattETL & BattDB



BattETL

BattETL is a well-tested and an enterprise-ready python module for Extracting, Transforming, and Loading battery cycler data to a [database](#). BattETL can also be used just for data extraction and transformation if a database is not desired. Currently data from Maccor and Arbin cyclers are supported.



Battery Data Format

Donated by Ohm.ai

BDA can use this format if one is needed as reference for industry use cases

The screenshot shows the GitHub repository page for `battery-data-alliance / battery-data-format`. The repository is public and has 6 commits, 3 branches, and 0 tags. The README file is the current view, titled "Battery Data Format for Time-Series Data (.bdf)". It discusses the need for an industry standard for battery data and highlights a 2024 Forrester study. The goal of launching the BDF is mentioned, along with its purpose to provide a standard structure for data generated in battery labs. The repository details sidebar includes links to Readme, Apache-2.0 license, Activity, Custom properties, stars, forks, and a report button.

Battery Data Format for Time-Series Data (.bdf)

Why introduce an industry standard format for battery data?

It is well known that organizing, cleaning, and preparing battery data for analytics takes significant time and effort, creating a high barrier to leveraging advances in battery modeling for battery development cycles.

A 2024 Forrester study surveyed 165 decision-makers in the automotive industry responsible for EV battery testing, validation, and development in the US and Europe. Among the respondents, 57% cited deciphering complex relationships in vast, multiparameter datasets as a significant barrier to battery validation, and 61% estimated months to years of time savings from AI-powered cell characterization testing that leverages standardized data sets.

Goal of launching the BDF

The **Battery Data Format (BDF)** provides a standard structure for data generated in battery labs, offered to the community by the **Battery Data Alliance**, a Linux Foundation Energy project. It is our hope that adoption of the BDF will empower the battery science community to leverage advances in open-source battery models.

Developed with input from leading scientists and engineers, the BDF addresses two main challenges:

- **Data Consistency:** With a common format, labs and cycler brands can eliminate the inconsistencies in data structure that arise with each software update.
- **Model Compatibility:** A unified format means battery model developers can easily adapt their models to accept BDF data, making it possible for scientists to experiment with multiple models without custom coding each time.

BattInfo

Battery Ontology

Linked Data Primer
([slides](#))

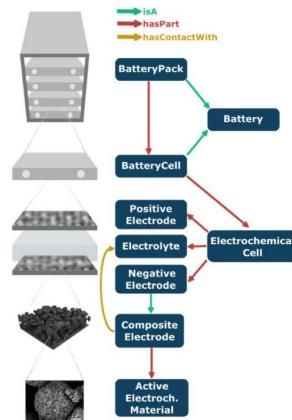
Takeaway: If we can map each cycler format to the ontology, we will inherit the value of ‘conversion’



How to link data

2. Use open, controlled vocabularies

BattINFO: a machine-readable description of concepts in batteries and electrochemistry.



Concepts are organized as a network:

Nodes: Battery Concepts

Edges: relations among concepts

Provides:

- The vocabulary to index battery data
- The connections representing battery knowledge

BDF Supports FAIR Data Practices

Published March 22, 2025 | Version 1.2.1

Dataset Open

Discharging Time Series of a CR2032 Battery at 11 mA

Clark, Simon (Data collector)¹

Wagner, Nils Peter (Data collector)¹,
2

Show affiliations

FAIR Score:  **91.67%**

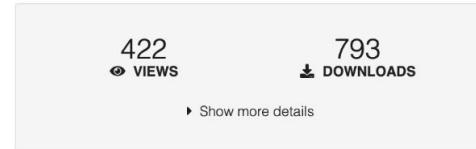
Scope

This record contains raw data from the constant-current discharge of a CR2032 lithium coin cell at 11 mA. The test was performed using a BioLogic battery cycler with data recorded at 1-second intervals. The CR2032 cell is manufactured by VARTA and was tested in ambient laboratory conditions. The dataset is intended to demonstrate ontology-based linked data reporting that is also consistent with the FAIR principles. RDF metadata is made available in [metadata.jsonld](#) and [metadata.html](#) formats.

Files

Raw Data

Filename	Description	Format	Usage
sintef_cr2032_discharging_11_mA_20240216.bdf.csv	Raw discharge time series in CSV format.	CSV	Main file for time series visualization and processing.
sintef_cr2032_discharging_11_mA_20240216.bdf.json	Time series data in structured JSON format.	JSON	Demonstration of alternative formats for time series data.
sintef_cr2032_discharging_11_mA_20240216.bdf.txt	Tab-separated plain text file containing the same data.	TXT	Demonstration of alternative formats for time series data.
sintef_cr2032_discharging_11_mA_20240216.bdf.parquet	Compressed binary format optimized for large-scale data processing.	Parquet	Demonstration of high-performance serialization of time series data.



Versions

Version 1.2.1 10.5281/zenodo.15069341	Mar 22, 2025
Version 1.2.0 10.5281/zenodo.15069316	Mar 22, 2025
Version 1.1.0 10.5281/zenodo.15069182	Mar 22, 2025
Version 1.0.0 10.5281/zenodo.15067970	Mar 22, 2025

[View all 4 versions](#)

Cite all versions? You can cite all versions by using the DOI [10.5281/zenodo.15067969](#). This DOI represents all versions, and will always resolve to the latest one. [Read more](#).

External resources

Indexed in

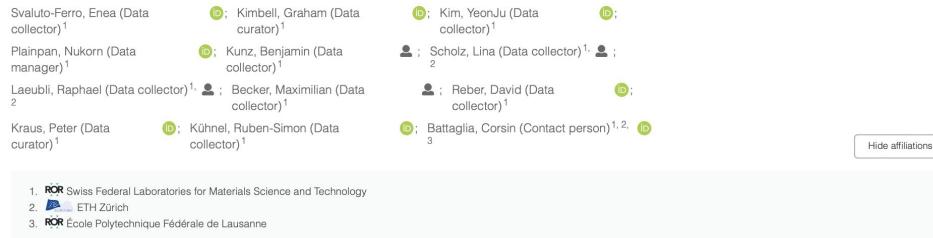
 [OpenAIRE](#)

Largest Open Source Datasource in BDF

Published July 1, 2025 | Version v1

Dataset 

Dataset for publication "Toward an Autonomous Robotic Battery Materials Research Platform Powered by Automated Workflow and Ontologized Findable, Accessible, Interoperable, and Reusable Data Management"



Svaluto-Ferro, Enea (Data collector)¹  Kirnbill, Graham (Data curator)¹  Kim, YeonJu (Data collector)¹  Scholz, Lina (Data collector)¹  Kunz, Benjamin (Data collector)¹  Becker, Maximilian (Data collector)¹  Laebuli, Raphael (Data collector)¹,  Becker, Maximilian (Data collector)¹  Kraus, Peter (Data curator)¹  Kühnel, Ruben-Simon (Data curator)¹  Battaglia, Corsin (Contact person)^{1, 2},  Hide affiliations

1.  Swiss Federal Laboratories for Materials Science and Technology
2.  ETH Zürich
3.  École Polytechnique Fédérale de Lausanne

Contributors



Data curator: Clark, Simon¹  Hide affiliations

1. Stiftelsen for industriell og teknisk forskning

Scope

This dataset comprises detailed data from 199 coin cell batteries featuring either NMC//graphite or LFP//graphite chemistries cycled for 1000 cycles. All batteries were assembled and cycled using the automated robotic battery materials research platform, Aurora, at Empa, the Swiss Federal Laboratories for Materials Science and Technology, within the Laboratory for Materials for Energy Conversion.

This dataset accompanies the publication:
Toward an Autonomous Robotic Battery Materials Research Platform Powered by Automated Workflow and Ontologized Findable, Accessible, Interoperable, and Reusable Data Management.
Batteries & Supercaps, 2025, <https://doi.org/10.1002/batt.202500155>

Battery cell metadata file:

- **Filename:** empa_ccid000XXX.metadata.json
- **Description:** Contains semantically annotated battery assembly data along with the cycling protocol applied to the specific battery cell. The file is structured in JSON-LD format and leverages the Battery Interface Ontology (BattINFO) domain to ensure semantic interoperability and rich data description.
- **Reference:** Battery Interface Ontology – BattInfo documentation

Battery cell cycling data files:

- **Filenames:**
 - empa_ccid000XXX.bdf.csv
 - empa_ccid000XXX.bdf.parquet
- **Description:** Cycling data is provided in two formats: CSV and Parquet. Both contain identical data. The CSV format enables straightforward human inspection, while the Parquet format supports faster parsing and is optimized for automated processing. These files follow the Battery Data Format (BDF) for Time-Series Data, as recommended by the Battery Data Alliance.
- **Reference:** Battery Data Alliance - Battery Data Format Definition

Files

Dataset-rocrate.zip		
D Dataset-rocrate.zip		
■ empa_ccid000001		
□ empa_ccid000001.bdf.csv		17.6 MB
□ empa_ccid000001.bdf.parquet		5.1 MB
□ empa_ccid000001.metadata.json		55.8 kB
■ empa_ccid000002		
□ empa_ccid000002.bdf.csv		19.8 MB
□ empa_ccid000002.bdf.parquet		5.5 MB
□ empa_ccid000002.metadata.json		55.9 kB
■ empa_ccid000003		
□ empa_ccid000003.bdf.csv		18.6 MB
□ empa_ccid000003.bdf.parquet		5.3 MB
□ empa_ccid000003.metadata.json		55.8 kB
■ empa_ccid000004		
□ empa_ccid000004.bdf.csv		20.3 MB

Discourse Community

The screenshot shows the Discourse platform interface for the "Battery Data Alliance" community. The left sidebar contains navigation links for Topics, Categories, and Channels. The main content area features a large "Welcome to our community" message and a search bar. Below it, three topics are listed: "Information on BattDB and Battery Ontology", "Python Package for Simple BDF Operations", and "Open standard for cycler output data".

Battery Data Alliance

Getting started

Topics

- My posts
- My messages
- Review
- Admin
- Invite
- More

CATEGORIES

- Site Feedback
- Staff
- General
- Cyclers
- Software Development
- Standards & Best Practices
- All categories

CHANNELS

- General
- Cyclers

Topics

Search

Welcome to our community

We're happy to have you here. If you need help, please search before you post.

categories ► tags ► **Latest** Hot Categories

New Topic

Topic

Replies Activity

Information on BattDB and Battery Ontology

Standards & Best Practices

Hi! I'm new to BDA and saw a great presentation by Gabe on youtube talking about BattDB and the Battery Ontology. I would like to know; What is the planned scope for this ontology and BattDB? Is it going to be cell-level... [read more](#)

3 2d

Python Package for Simple BDF Operations

Software Development

Thinking about a small, no-frills Python tool to help people use the Battery Data Format: Convert to/from BDF Visualize a couple of standard quick-look plots Publish a simple, valid BDF bundle Keep it tiny (C... [read more](#)

1 4d

Open standard for cycler output data

Standards & Best Practices

Purpose This opening post sets the stage for a comprehensive discussion on

39 Jun 2

New Website

BATTERY DATA ALLIANCE

Support Contribute Become a Member News & Updates About Us Contact Us

Developing Open Standards and Tools to Accelerate Battery Innovation

Connecting industry, academia, and open source to unlock the full potential of battery technology.



[Who We Are](#)

Building sustainable open source software, best practices, and delivery standards for the battery industry

The LF Energy Battery Data Alliance (BDA) was created to bring battery companies together to work jointly to unify how batteries are handled in terms of software. Battery data is core to creating a decarbonized economy and power systems, yet companies waste tremendous amounts of time implementing battery data schemas, integrations/conversions, typical calculations, etc. BDA believes that an open source tool should exist to enable researchers and engineers to focus on bringing more innovative solutions to market rather than each organization duplicating the same work.

Thank You!

 **LF ENERGY** Battery Software Landscape



Battery Software Landscape

Modeling & Optimization Software

PyBaMM
Liionpack
PETLION
BattMo

Cycler Converters

Cellpy
PyMacNet
pycti-arbin

Data Management

Galv
Battery Archive
Universal Battery Database
Beep
battery-schema-utility

Ontology

BattInfo

API & Framework Definition

impedance.py
Battery-api (Galv)
Battery-lcf
CAEBAT OAS/VIBE
ISEAFramework

Annual Review: OperatorFabric #71

6:10 pm - 6:30 pm



Closing and Next Meeting

6:30 pm - 6:30 pm



Next TAC Meeting

The next meeting of the LF Energy TAC is scheduled for September 9, 2025 at 4:00 pm Central European Time as a joint meeting with the LF Energy Governing Board in person at LF Energy Summit. Meeting is for TAC representative ONLY.

The following meeting of the LF Energy TAC is scheduled for October 14, 2025 at 4:00 pm Central European Time
Agenda tentatively to include:

- General Updates
- Annual Review: GridFM [#260](#)
- Annual Review: Archimate SIG [#93](#)
- Annual Review: NODE Collective [#108](#)
- Annual Review: Grid Edge Interoperability & Security Alliance (GEISA) [#230](#)
- Marketing/PR/Events update

To add agenda items, go to <https://github.com/lf-energy/tac/issues/new/choose>.

You can review the TAC Agenda at <https://github.com/orgs/lf-energy/projects/2/views/1>

ELF ENERGY



APPENDIX

Marketing/PR/Events Updates



Marketing and PR Updates

- Webinars
 - [OpenDSM webinar](#) scheduled for 24 September
- Project News
 - [OpenSynth: beyond demand data](#)
 - [LF Energy Power Grid Model v1.12.0 Released: Enhanced State Estimation and Improved Observability](#)
 - [LF Energy OpenDSM Completes Development of New Hourly Model](#)
- Content
 - [PowSyBl security audit](#) was published on July 30
- Use this [form](#) to submit any comms/marketing support requests
- See [media coverage spreadsheet](#) or [website](#) for recent articles

Upcoming Events

- LF Energy Summit Europe
 - Sept 10-11 – Aachen, Germany
 - Confirmed to be the biggest LFE Summit yet!
 - <https://events.linuxfoundation.org/lfenergysummit/>
- LF Energy Summit North America
 - Oct 3, 2025 – Montréal, Québec
 - <https://events.linuxfoundation.org/lfenergysummit-north-america/>
- OSPOlogy Live France
 - Nov 5-6 (tentative) - Lyon, France
 - Hosted by RTE
 - This is actually organized by the TODO Group in partnership with LF Energy.
 - Goal: educate utilities and other energy stakeholders on open source best practices
 - Looking for a few more speakers for these sessions:
 - Cross-Border Collaboration in Energy Innovation. What's Next
 - Open Source Management Tooling to advance digitalization of the energy industry
 - <https://community.linuxfoundation.org/events/details/lfhq-ospology-european-chapter-presents-ospologylive-lyon/>



Upcoming Event CFPs

Europe

- Energy Tech Summit - April 15-16 - Bilbao - Speaking submissions due September 29
- CIRED - June 9-10 - Brussels - Speaking submissions open on 10 September; close 1 December

