Membership Overview

This deck is available in your LFX Organizational Dashboard

LF ENERGY

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.

LFENERGY

Antitrust Policy Notice

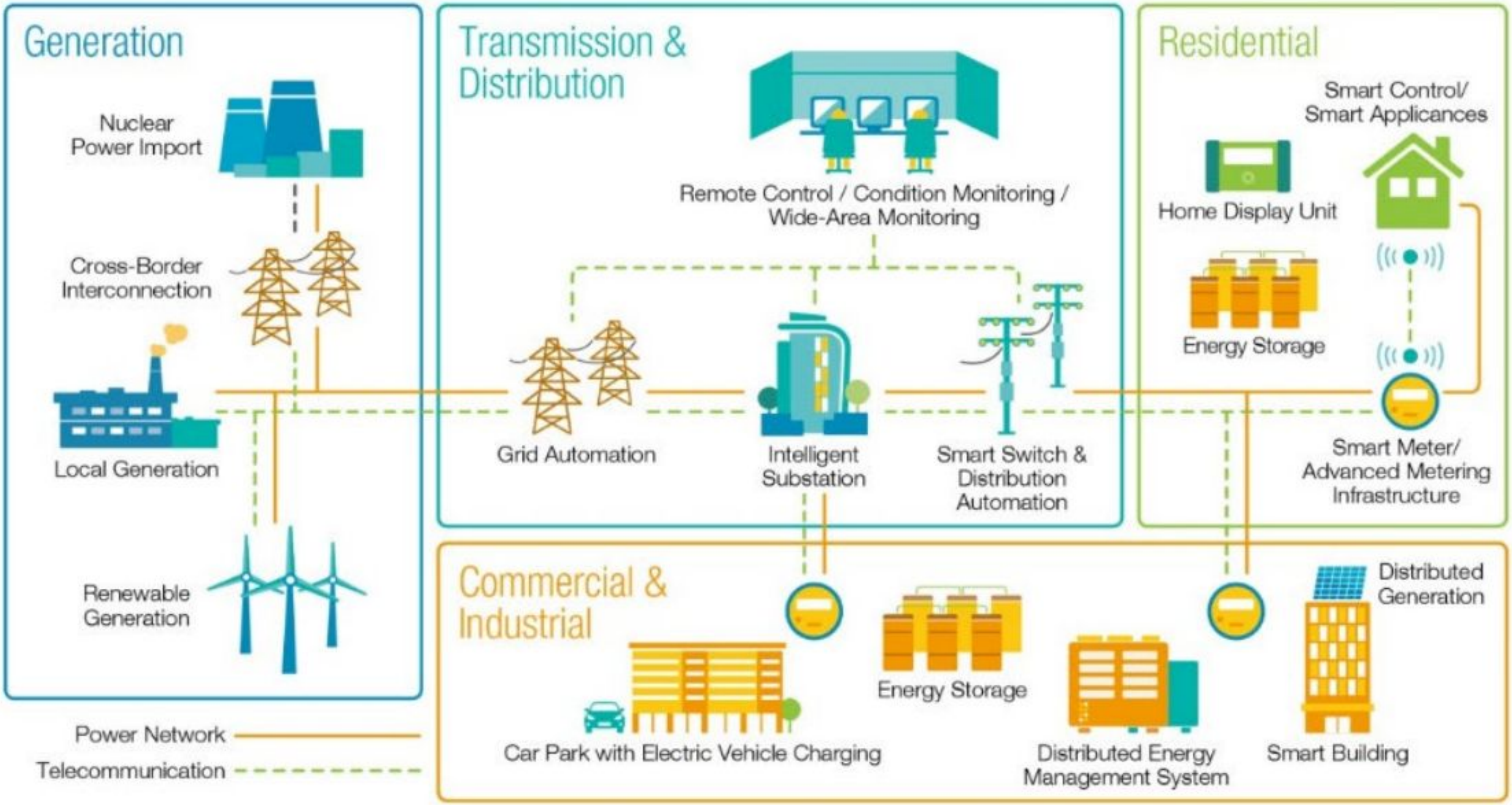
The Linux Foundation is a pre-competitive platform that enables cooperation and leveraged development.

Linux Foundation meetings involve participation by industry competitors, and it is the
intention of the ... ance with
applicable antit... tant that
attendees adhe... e in, any
activities that a... antitrust and
competition la...

Examples of ty... etings 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.

LF Energy accelerates the energy transition by building communities to develop open technologies and standards.

LFENERGY



LF ENERGY

Graphic: DOE 2020 Smart Grid System Report
https://www.energy.gov/sites/default/files/2022-05/2020%20Smart%20Grid%20System%20Report_0.pdf

Members

LFENERGY

LF Energy Member - Strategic (5) +1

LF Energy Member - General (21) +1

LF Energy Member - Associate (41) +3

LF Energy Projects

LF ENERGY

SIG - Digital Substations Automation Systems (DSAS) (4)

- LF ENERGY CoMPAS
- LF ENERGY FLEDGE POWER
- LF ENERGY OpenSCD
- LF ENERGY SEAPATH

SIG - EV Charging (2)

- LF ENERGY CitrineOS
- LF ENERGY EVerest

SIG - Grid Operations (8)

- LF ENERGY FLEDGE POWER
- LF ENERGY FlexMeasures
- LF ENERGY GXF
- LF ENERGY openLEADR
- LF ENERGY OPERATORFABRIC
- LF ENERGY RTDIP
- LF ENERGY SHAPESHIFTER
- LF ENERGY SOGNO

SIG - Grid Simulation and Modeling (8)

- LF ENERGY ARRAS
- LF ENERGY covXtreme
- LF ENERGY Dynaωo
- LF ENERGY GRID CAPACITY MAP
- LF ENERGY GRIP
- LF ENERGY OpenSTEF
- LF ENERGY POWER GRID MODEL
- LF ENERGY POWSYBL

SIG - Data Standards and Tooling (6)

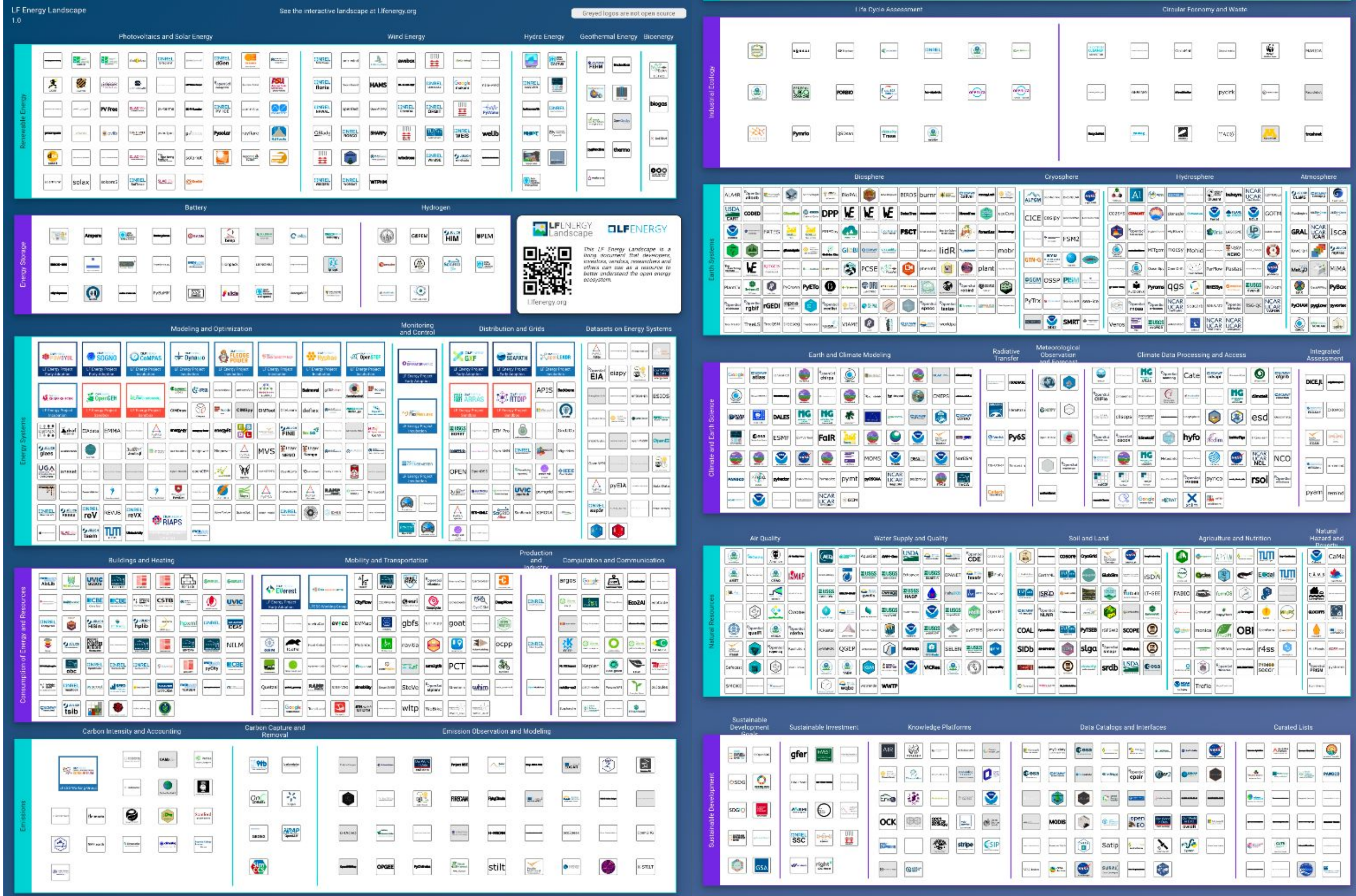
- LF ENERGY Battery Data Alliance
- LF ENERGY CARBON DATA SPECIFICATION CONSORTIUM
- LF ENERGY OPENEEMETER
- LF ENERGY OpenSynth
- LF ENERGY SUPER ADVANCED METER
- LF ENERGY TROLIE

LF Energy Landscape

l.lfenergy.org

1,343 projects, market cap of $7.5T and funding of $17B.

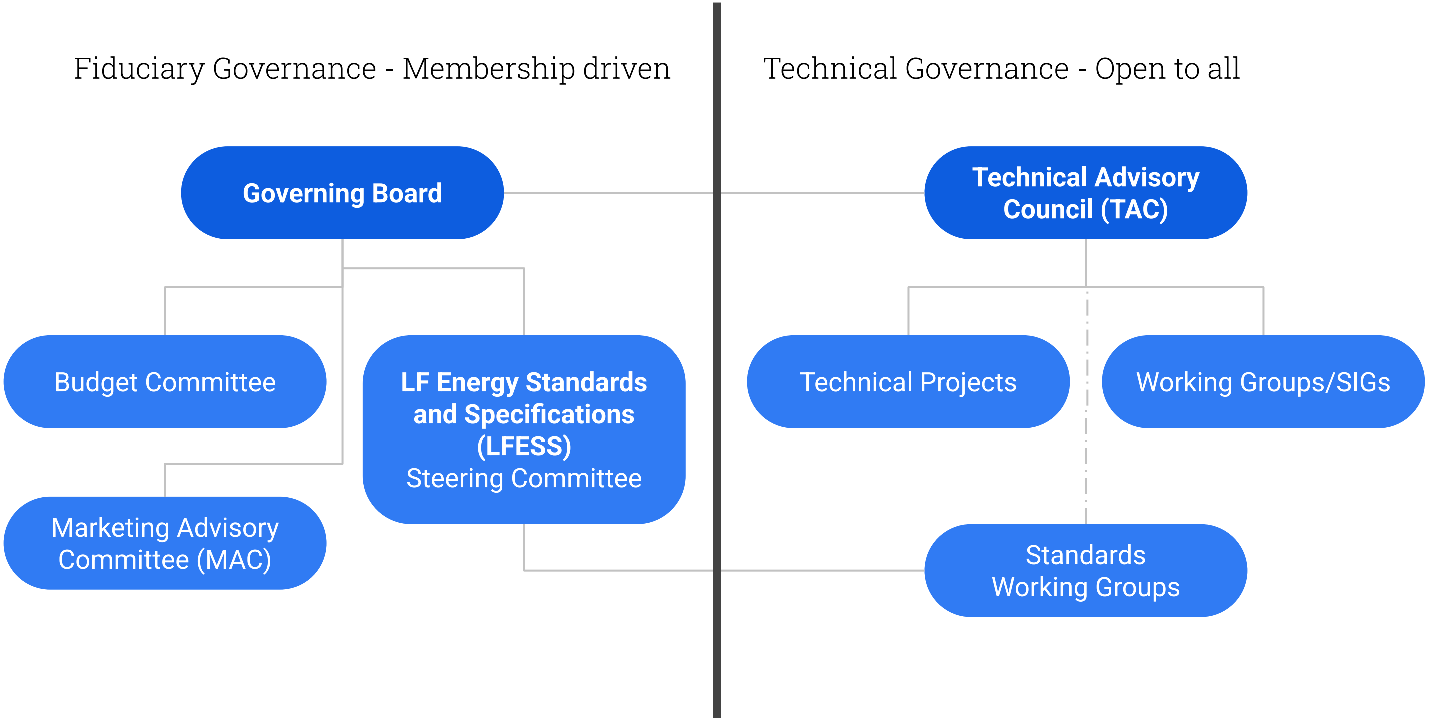
l.lfenergy.org



Governance

LF ENERGY

Governance at a Glance



LF ENERGY

Governing Board overview

Comprised of one (1) voting representative from each Strategic LF Energy member, two (2) annually elected General member, the TAC Chairperson, the Governing Board's responsibilities include:

- Deciding on strategic business orientations, approving budget and new projects
- Electing a Chair to preside over Governing Board meetings, authorize expenditures approved by the budget and manage any day-to-day operations
- Overseeing all Project business, marketing, outreach and trademark matters

LFENERGY

Governing Board

voting representatives

LF ENERGY

Lucian Balea
Chair
Open Source Program Director
RTE (Reseau de Transport dElectricite)

Antonello Monti
Professor
RWTH Aachen University

Arjan Stam
Treasurer
Value Stream Lead
Alliander

Audrey Lee
Senior Director, Energy Strategy
Microsoft Corporation

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

Christophe VILLEMER
Executive Vice President
Savoir-faire Linux

Jordan Hughes
Senior Software Engineer
Apple Inc.

Marco Möller
CEO
Pionix GmbH

Savannah Goodman
Data and Software Climate Solutions
Google LLC

Appointing your Governing Board representative
(Strategic Member benefit)

As a Strategic Member, you are entitled to appoint a representative from your organization to serve on the Governing Board.

Expectations of this role:

- Attend monthly Governing Board meetings (1st Wednesday of the month at 8:00 am US Pacific Time)
- Participate in membership recruitment activities, including monthly membership pipeline review call.
- Be available from time-to-time for strategic discussions and calls.

ACTION: To appoint your representative, please file a request at members.lfenergy.org, and have the representative create an LF ID.

You can change your representative at any time by making a request at members.lfenergy.org.

LF ENERGY

Governing Board representative election
(General Member benefit)

Per the LF Energy charter, Section 2(c):

> *General Members, acting as a class, will be entitled to annually elect one representative to the Governing Board for every ten General Members, up to a maximum of three representatives, provided that there will always be at least one General Member representative, even if there are less than ten General Members. The Governing Board determines the election process.*

The General Member class elects new representative(s) during the month of June to serve a term from July 1st through June 30th the following year.

ACTION: Look for details regarding the election in April/May.

If you have any questions about this process or the role, please contact us at members.lfenergy.org.

CEO AT PIONIX GMBH

Marco Möller

EXECUTIVE VICE PRESIDENT AT SAVOIR-FAIRE LINUX

Christophe VILLEMER

LF ENERGY

Technical Advisory Council (TAC) overview

The TAC is the technical governance heart and soul of LF Energy. As new projects get contributed to LF Energy they get reviewed and approved by this committee.

TAC members consist of Strategic members as well as the project leads for all active projects. Anyone in the community can attend TAC meetings.

The TAC meets every 3 weeks on Tuesdays, and members are invited to attend these calls. Subscribe to the technical mailing list at lists.lfenergy.org/g/tac for more information and add the TAC Meeting to your Calendar Now.

LF ENERGY

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.

Jonas van den Bogaard

Open Source Office Lead

Alliander

Maarten Mulder

PO IoT Field Device Platforms

Alliander

Sophie Frasnedo

Software developer

RTE (Reseau de Transport dElectricite)

Travis Sikes

Data Science Manager

Recurve

Yixing Xu

Senior Program Manager, Energy Strategy

Microsoft Corporation

LF ENERGY

Appointing your TAC representative
(Strategic Member benefit)

As a Strategic Member, you are entitled to appoint a representative from your organization to serve on the TAC. Expectations of this role:

- Attend TAC meetings held every three weeks on Tuesday at 8:00am US Pacific Time.
- Be available to serve as a TAC mentor to new projects coming into LF Energy
- Participate in out of meeting discussions.
- Be available from time-to-time for strategic discussions and calls.

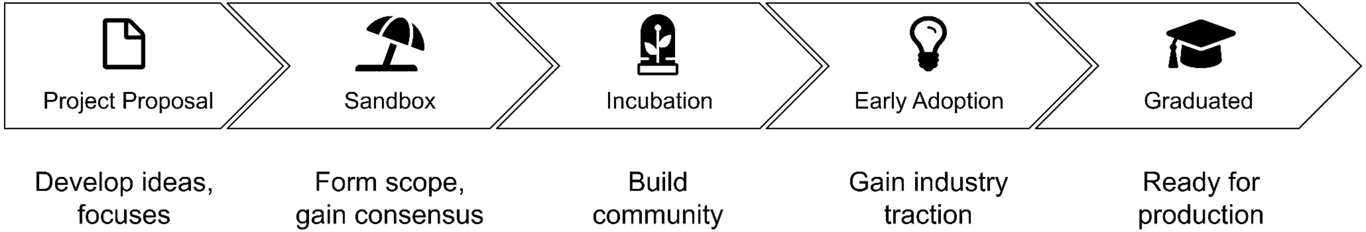
ACTION: To appoint your representative, please file a request at members.lfenergy.org, and have the representative create an LF ID.

You can change your representative at any time by making a request at members.lfenergy.org.

LF ENERGY

LF Energy project lifecycle

- Projects can become part of LF Energy through the submission of a mature code base.
- Projects can also be formed through working groups or special interests groups that submit a proposal and then form as a project.
- Learn more at lfenergy.org/host-your-project



Marketing Advisory Committee (MAC)

The MAC advises on marketing and communications strategies including events and campaigns.

The MAC is made up of representatives from all members. There is no cap on the number of committee members.

The MAC meets the 4th Thursday of each month at 7 am US Pacific, and members are invited to appoint a representative to attend these calls.

Recordings and minutes from prior meetings are available publicly.

Member Representatives (**bold** indicates voting member)

Name	Company/organization
Daniel Lazaro	AVEVA
Duncan Johnston-Watt / Csilla Zsigri	BTP
Jonas van den Bogaard	**Alliander**
Chris Xie (Chair)	Futurewei
Mark Caine	**Google**
Matt Fawcett	Carbon Co-op
Christophe VILLEMER	Savoir-faire Linux
VACANT	**Microsoft**
Louisa Durkin	Open Earth Foundation
Nate Kinsey	UtilityAPI
Kelli Littleton	WattCarbon
Aarthi Thyagarajan	**Shell**
Morten Småstuen	Statnett SF
Sheii Lindley	Recurve Analytics
Tim Krentz	Vanderbilt University
Jessica Ridlen	Utilidata
Ben Mosler	PIONIX GmbH
Katia Di Pace	Areti
Boris Dolley	**RTE**
Fabian Kolley	d-fine

LF ENERGY

Appointing your MAC representative

(Open to all members)

As an LF Energy Member, you are entitled to appoint a representative from your organization to serve on the MAC. Expectations of this role:

- Attend MAC meetings held the 4th Thursday of each month at 7 am US Pacific / 10 am US Eastern / 16:00 Central European Time
- Participate in out-of-meeting discussions.
- Be available from time-to-time for strategic discussions and calls.

ACTION: To appoint your representative, please complete this form (select “Marketing/PR” then “Add or Change Marketing Committee Member”).

You can change your representative at any time by making a request at the same link.

LF ENERGY

LF Energy staff

- Alex Thornton, LF Energy Executive Director
- Dan Brown, Marketing Director
- John Mertic, Program Director
- Yarille Ortiz, Sr. Project Coordinator

Support requests for the staff can be made at support.lfenergy.org.

LFENERGY

LFX Organization Dashboard

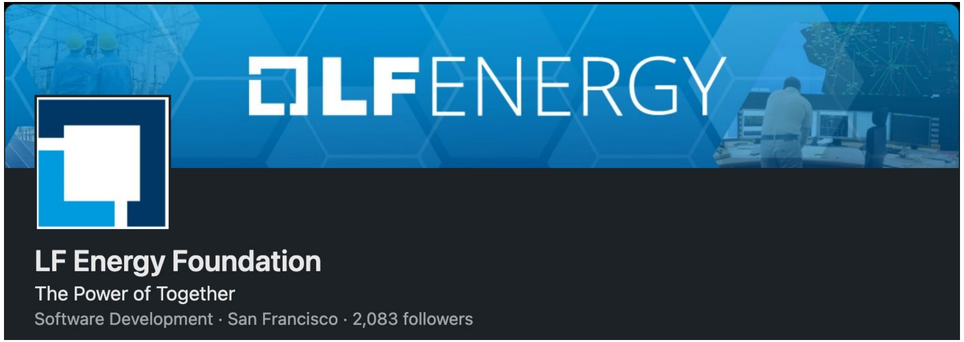
LFX Organization Dashboard provides access to key membership materials, including…

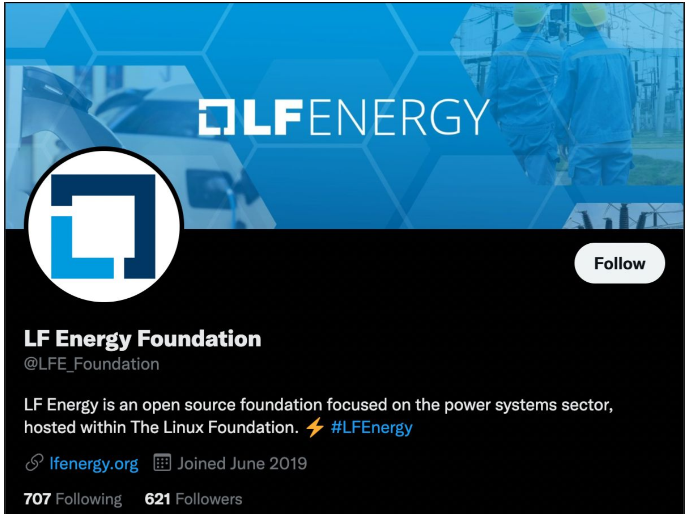
- Member contacts, which you can change at any time (look under 'Users' > and then under the 'Key People' tab)
- Membership details (look under 'Membership' > 'LF Energy Foundation'), including…
  - Membership Overview Deck and High Level Overview Deck (look under the 'Resources' tab)
  - Your fully executed membership agreement (look under the 'Membership' tab)
  - Details on how to leverage membership benefits (look under the 'Benefits' tab)
  - Insights on contributors from your organization (look under the 'Project Contributors' tab)

ACTION: Request access to LFX Organizational Dashboard here.

LF ENERGY

Make sure you are following us on social!





Follow us on LinkedIn at
linkedin.com/company/lf-energy-foundation

Follow us on Twitter at
twitter.com/LFE_Foundation

And sign up for the [LF Energy newsletter]() to keep up to date on project happenings

LFENERGY

Leveraging your membership benefits

LF ENERGY

Announcing your membership

We will include your company in an upcoming momentum press announcement. These are typically done quarterly and timed around events for maximum impact.

ACTION: Please provide 1-2 sentences on your company, name of a spokesperson, and a quote to include in the press announcement. Submit request to members.lfenergy.org.

Please note that these announcements are often picked up by press and media, and there may be requests for briefings.

APR
11

LF Energy Adds New Software and Specifications Projects, Significantly Growing Membership

By LF Energy |

LF Energy, the open source foundation focused on harnessing the power of collaborative software and hardware technologies to decarbonize our global economies, announces five new software projects and 19 new Strategic, General and Associate members.

Read More

LF ENERGY

Marketing and Event Benefits

The LF Energy staff is here to help you get connected with hosted projects and other members, ensuring value for your investment in the LF Energy Foundation.

All members receive the following benefits:

- Support for member announcements and member PRs
- If member requests, LF Energy will provide quote for member press release or blog
- Logo on the website once your membership has been announced
- Discount on Event Sponsorship packages

ACTION: **Contact us at members.lfenergy.org for more details.**

LF ENERGY
GENERAL MEMBER

You can get LF Energy member logos to use on your website and materials at artwork.lfenergy.org/other/lf-energy-member/

LF ENERGY

Participate in Standards Development

LF Energy Members can contribute to the specifications being driven under LF Energy Standards and Specifications by completing the membership agreement at joinnow.lfess.energy.

- ➔ As an LF Energy Strategic Member, you receive representation on the LFESS Steering Committee
- ➔ As an LF Energy General Member, you can run for election to serve on the LFESS Steering Committee.

More information on LFESS Governance at https://github.com/lf-energy/lfess-resources/blob/main/GOVERNANCE.md

LF ENERGY CARBON DATA SPECIFICATION CONSORTIUM

LF ENERGY SUPER ADVANCED METER

LF ENERGY

Additional Benefits for Strategic Members

Strategic members are key partners in driving the direction of the LF Energy Foundation, and we partner closely with in driving the mission and vision of the foundation.

Exclusive benefits for Strategic members include:

- Send signal that you are committed and serious about the energy transition and 100% planetary decarbonization
- Guaranteed seat on the LF Energy Governing Board and LF Energy Technical Advisory Council, where your organization can shape where funds are directed, direction of project investments, branding, messaging, PR, marketing, developer events, training
- Placement of member brand at forefront of LF Energy web properties and promotion in top news outlets
- Participation in Linux Foundation Member Summit (Additional Seat)
- Direct assistance with your open source strategy activities, and R&D portfolio, with premium access to the project ED to understand business goals help you succeed in those goals any way possible and premium access to the LF Energy open source leadership to advise member of advancing brand leadership worldwide in open source
- LF Leadership support to keynote member events, participate in outreach (eg roadshows, events, conference meet ups etc..)
- Priority for hosting LF Energy Roadshows and meetups at the location of their choice
- 2x guest blog pieces on LF Energy blog

ACTION: Contact us at members.lfenergy.org for more details.

LF ENERGY

STRATEGIC MEMBER

Current Strategic Members

alliander

Google

Microsoft

Rte Le réseau de transport d'électricité

LF ENERGY

Contact Us

LF Energy Foundation

548 Market St
PMB 57274
San Francisco CA 94104
Phone/Fax: +1 415 723-9709
www.lfenergy.org

General Inquiries

support@lfenergy.org

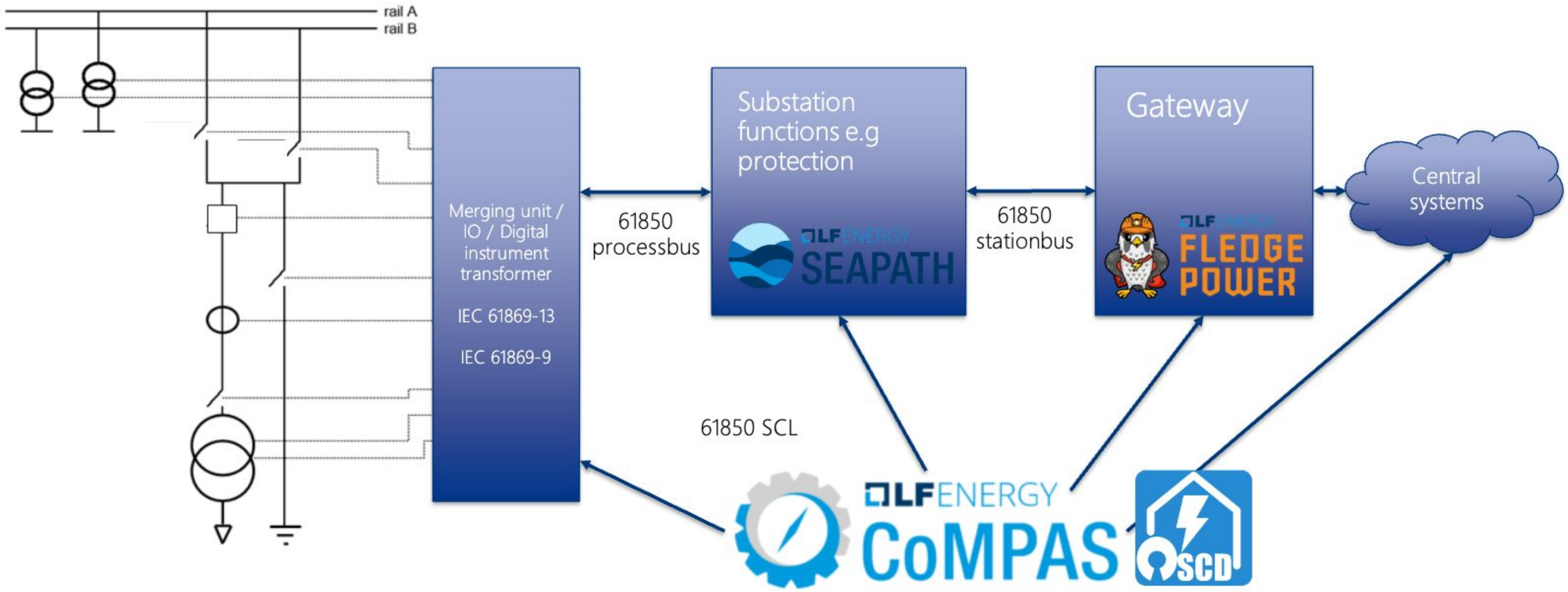
Membership

membership@lfenergy.org

Projects in Detail

Digital Substations

Digital Substation Architecture



SEAPATH

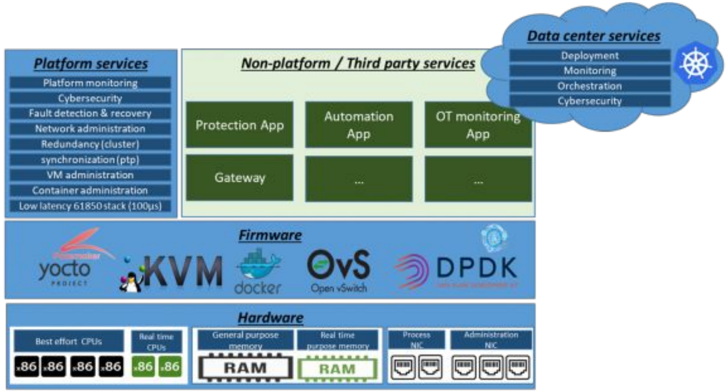
Real-time platform that can run virtualized automation and protection applications

Early Adoption

"Reference design" and "industrial grade" open source real-time platform that can run virtualized protection, automation and control applications.

Meets the high requirements of substation reliability, performance and availability.

- **Hosting of virtualization systems:** an heterogeneous variety of virtual machines can be installed and managed on the platform.
- **High availability and clustering:** machines on the cluster are externally monitored in order to guarantee the high availability in case of hardware or software failures.
- **Distributed storage:** data and disk images from the virtual machines are replicated and synchronized in order to guarantee its integrity and availability on the cluster.
- **Intelligent virtual network:** the virtualisation platform is capable of configuring and managing the network traffic in a data layer level.
- **Administration:** system can be easily configured and managed from a remote machine connected to the network as well as by an administrator on site.
- **Automatic update:** the virtualisation platform can be automatically updated from a remote server.



Learn more at seapath.energy | GitHub | Video

Contributions by

LF ENERGY

Profile management and configuration for IEC 61850 protection, automation and control systems

CoMPAS

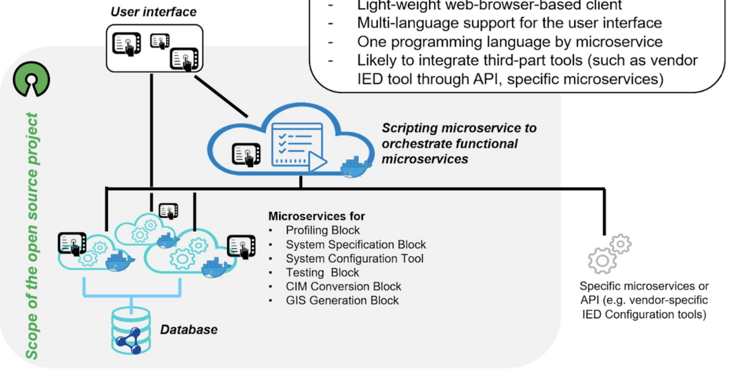
Incubation

Common software blocks for IEC 61850 profile configuration, using an open source shared development model, accelerating conformity to IEC 61850 through software implementation.

Primary use cases:

- Tools for IEC 61850 profile management and configuration are needed at various business processes of the power grid industry
- The planning process for grid infrastructure components facilitates the design of power system adaptations and the engineering of substation PACS to be installed or upgraded
- Specifying requirements and performing multi-vendor system integration and commissioning during the PACS procurement and delivery phase
- Adapting to changes in operational conditions and performing system configuration updates during the operational life of PACS
- Managing assets in order to perform maintenance actions and PACS upgrades
- Improving the interlinkage between grid planning and PACS engineering processes
- Improving the interlinkage between the configuration of PACS and the configuration of central systems, including SCADA and asset management

Principles
- Microservices (Docker)
- Cross-platform (Docker on Windows, LINUX)
- Scriptable
- Database
- Light-weight web-browser-based client
- Multi-language support for the user interface
- One programming language by microservice
- Likely to integrate third-part tools (such as vendor IED tool through API, specific microservices)



Learn more at compas.energy | GitHub | Video

Contributions by

alliander OMICRON Rte SPRINTEINS TRANSNET BW TRANSPOWER

LF ENERGY

LF ENERGY OpenSCD

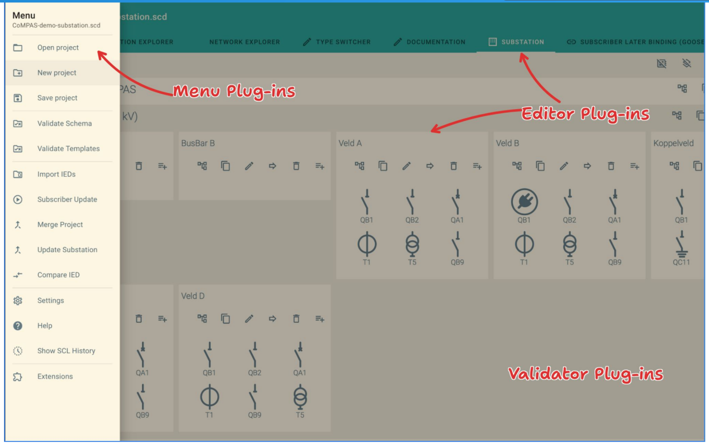
Substation Configuration Designer

Sandbox

From communication design, configuration, and commissioning; through to modelling, monitoring, maintenance and replacement, OpenSCD offers a universal tool built on IEC 61850 industry standards.

Key features:

- **SCD File Improvement:** Enhance existing SCD (Substation Configuration Description) files by seamlessly incorporating crucial substation information, ensuring comprehensive documentation and efficient workflow.
- **IEC 61850 Configuration and Engineering:** Facilitate engineering of compliant IEC 61850 devices with ease, supported by a plug-in architecture for effortless integration of vendor-specific components.
- **IEC 61850 System Design and Configuration:** Realize the vision of a comprehensive system configuration tool with evolving features, enabling top-down engineering of IEC 61850 systems.



Learn more at openscd.energy | GitHub | Video

Contributions by

alliander OMICRON Rte TRANSNET BW TRANSPOWER SPRINTEINS

LF ENERGY

Multi-protocol translation gateway for power systems based on the industrial IoT LF Edge project Fledge

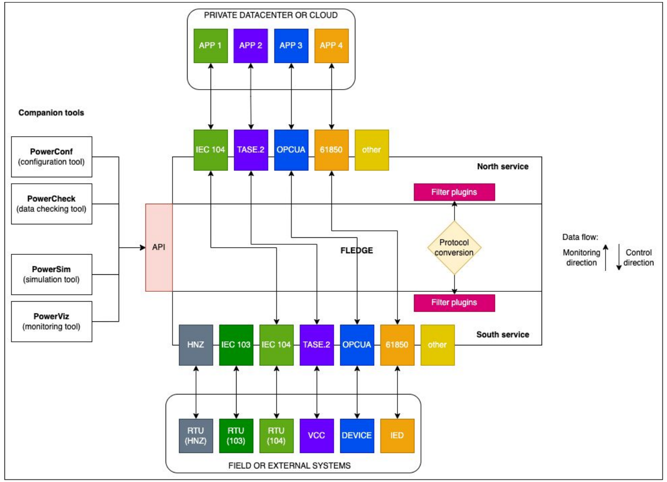
Incubation

Flexible, lightweight, industrial-grade, open source gateway that embeds Fledge (LF EDGE). Additionally, FledgePOWER provides a toolbox for simulation, data configuration, and checking focused uniquely on power systems' protocols translation and power systems' use cases.

Features: lightweight, extensible, modular, flexible, scalable, secured, interoperable

Use cases:

- Improving the availability of an IEC 104 substation by deploying FledgePower with multi-centre IEC 104 redundancy.
- Securing an old generation substation in HNZ protocol, by deploying FledgePower with IEC 104 over TLS.
- Power grid simulation, using FledgePower to integrate with the substation in IEC 104 on the one hand and the simulation system in OPCUA on the other.



Learn more at fledgepower.energy | GitHub | Video

Contributions by

alliander

Rte

AVEVA

DIANOMIC

LF ENERGY

LF ENERGY

EV CHARGING

Open source modular framework for EV chargers

LF ENERGY EVerest

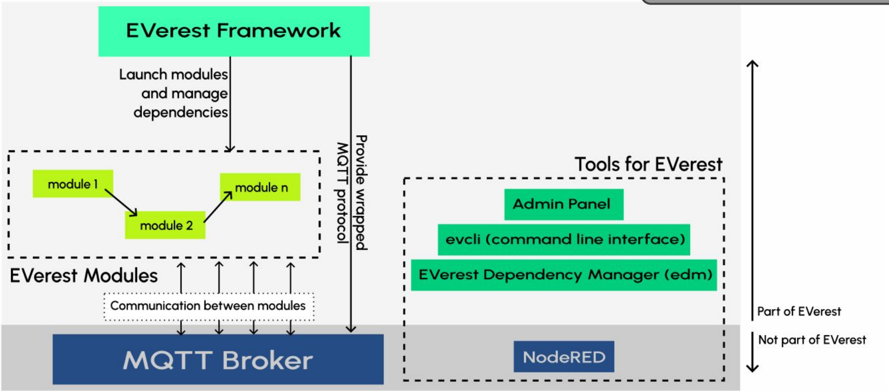
[Early Adoption](#)

Software for EV chargers with implementations of:

- communication protocols
- software modules for representations of hardware devices (chargers, cars, etc.)
- tools for simulating the charging process

By digitally abstracting the complexity of multiple standards and use cases, EVerest runs on any device, from unmanaged AC home chargers to complex multi-EVSE satellite public DC charging stations with battery and solar support.

EVerest supports all protocols needed to facilitate frictionless and reliable charging.



Learn more at [everest-project.energy](#) | [Documentation](#) | [GitHub](#) | [Video](#)

Contributions by

chargebyte
Joint Office of Energy and Transportation
PIONIX
quello

LF ENERGY

LF ENERGY

CitrineOS

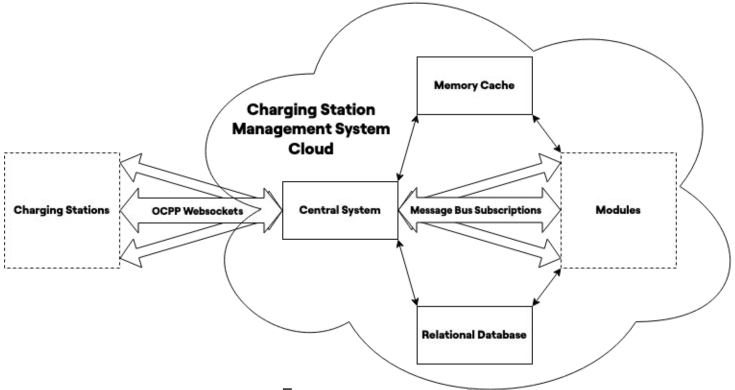
Open source charger network software for rapid OCPP 2.0.1 and NEVI compliant EV charge management

Sandbox

The primary goal of CitrineOS is to develop and maintain an open source Charging Station Management System (CSMS) software stack.

CitrineOS is developed having modularity and extensibility in mind. It consists of logically separated modules, each encapsulating a subset of functionality pertaining to the definitions of OCPP 2.0.1 – the standard protocol for communication between charging stations and charge management software.

All modules handle and emit all necessary OCPP messages and are loosely coupled by a message broker interface connecting them to a central component that relays the messages to the charging station and vice versa.



Learn more at

https://lfenergy.org/projects/citrineos/ | GitHub | Video

Contributions by

LF ENERGY

Data Standards and Tooling

LF ENERGY

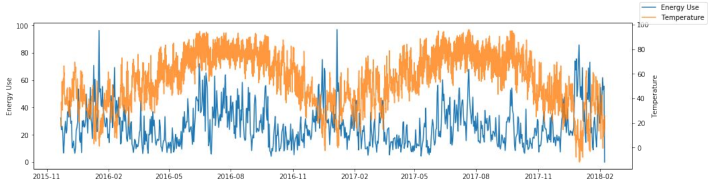
LF ENERGY OPENEEMETER

Computing consistent and replicable estimates of changes in time series of energy consumption, primarily as measured for populations of commercial and residential buildings.

Incubation

Top Use Cases

OpenEEmeter, as implemented in the eemeter package and its companion eeweather package, contains the most complete open source implementation of the CalTRACK methods, which specify a family of ways to calculate and aggregate estimates avoided energy use at a single meter particularly suitable for use in pay-for-performance (P4P) programs



Learn more at openeemeter.energy | GitHub | Video

Technical Summary

OpenEEmeter emphasizes consistency and replicability to facilitate payments and market transactions that may be take the energy savings outputs of the software as inputs.

Project contributed by Recurve

Contributions by

RECURVE

WattCarbon

STATE OF CALIFORNIA ENERGY COMMISSION

LF ENERGY

LF ENERGY

Battery Data Alliance

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

Sandbox

Design: One key challenge arises from the lack of open source battery data and a standardized method to access existing datasets. As a result, companies often find themselves engaged in redundant efforts concerning data collection and conversion.

Testing: Many companies manually configure their testing equipment. There is a gap in the market between available testing standards and the actual execution of tests.

Manufacturing: Variations in battery data structures across manufacturers lead to unnecessary complexities in schema design and data conversion leading to inefficiencies and barriers for collaboration.

Telemetry: The area of battery telemetry remains largely unexplored from an open-source perspective. There is untapped potential for development and growth in this area.

Learn more at

https://lfenergy.org/projects/battery-data-alliance/

Contributions by

AmpLabs

BattGenie.

dox

ionworks powered by PyBaMM

LF ENERGY

LF ENERGY OpenSynth

Open community designed to democratize synthetic data

Sandbox

The initial focus for the community includes:

- Defining what comprises ‘good’ synthetic data (to include how synthetic data in energy might be evaluated for common concepts such as privacy, fidelity and utility)
- Developing an open repository for synthetic smart meter data and algorithms
- Encouraging community members to contribute data by using our initial algorithms

Learn more at

https://lfenergy.org/projects/opensynth/

Contributions by

Centre for Net Zero
Powered by Octopus Energy

LF ENERGY

Specifications for the underlying measured/raw data used to calculate energy and carbon-related metrics.

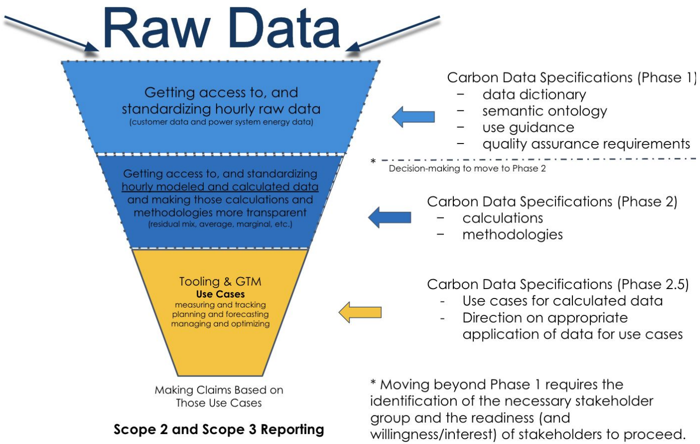
LF ENERGY CARBON DATA SPECIFICATION CONSORTIUM

Use Cases

- Customer data. This may include, but is not limited to:
  - Metering consumption and production data
  - Account and bill data needed for project analysis
  - Authorization and consent processes
- Power systems data. This may include, but is not limited to:
  - Power generation emissions
  - Delivery capacities and/or constraints
  - Generation mix
  - Power imports and exports
  - Power market data
  - Contractual data

Technical Summary

Data dictionary for raw data and a standard for data requirements that enable energy data access for measuring, quantifying, and tracking carbon emissions from energy production and consumption.



Learn more at carbondataspec.org | GitHub

Contributions by

WattCarbon Google Microsoft UtilityAPI

LF ENERGY

LF ENERGY SAM

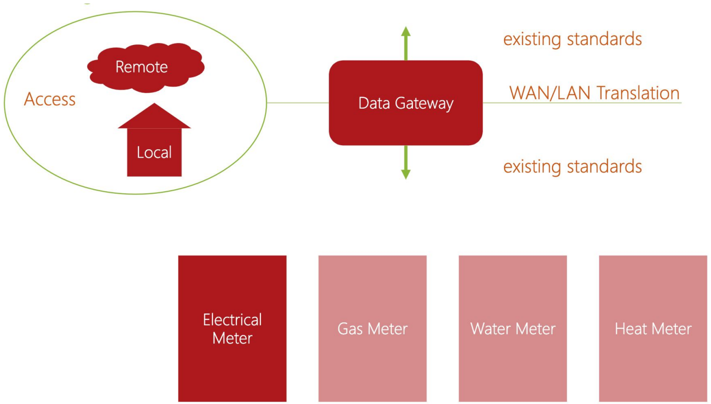
Worldwide applicable meter and respective data gateway specification

Use Cases

- Basic metering functionality
- Country-specific functionality
- Third party functionality and integration capability for system operation applications

Technical Summary

Standards collaboration



Learn more at superadvancedmeter.energy |

GitHub | Video

Contributions by

alliander Utilidata

LF ENERGY

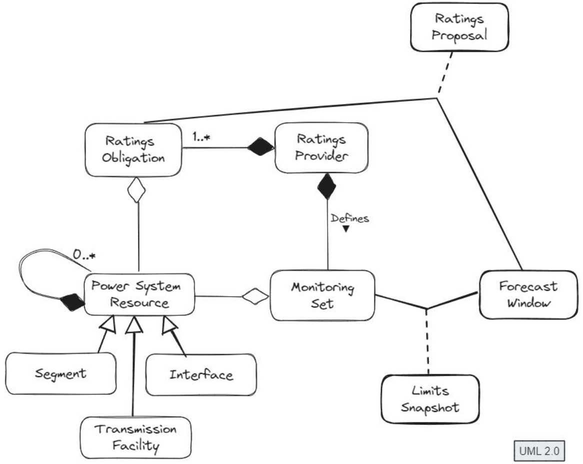
LF ENERGY TROLIE

Accelerating the implementation of interoperable systems for the exchange of transmission facility ratings

With FERC Order 881, North American Transmission Owners, Transmission Operators, Transmission Providers, and Reliability Coordinators must establish a means to exchange ratings information based on current and forecasted ambient conditions.

The project's specific aims are:

- Define API specification for the exchange of ratings and ratings-related information to support organizations working to comply with FERC Order 881.
- A conformance program that emulates that Zowe Conformance Program or the Certified Kubernetes Conformance Program insofar as they give vendors a means to demonstrate their conformance to the above specification and signal their commitment to maintaining their conformance over time.
- An open commons for the development of clients of the API specification.



Learn more at https://lfenergy.org/projects/trolie/

| [Documentation](#) | [GitHub](#) | [Video](#)

Contributions by

GE MISO

LF ENERGY

Grid Operations

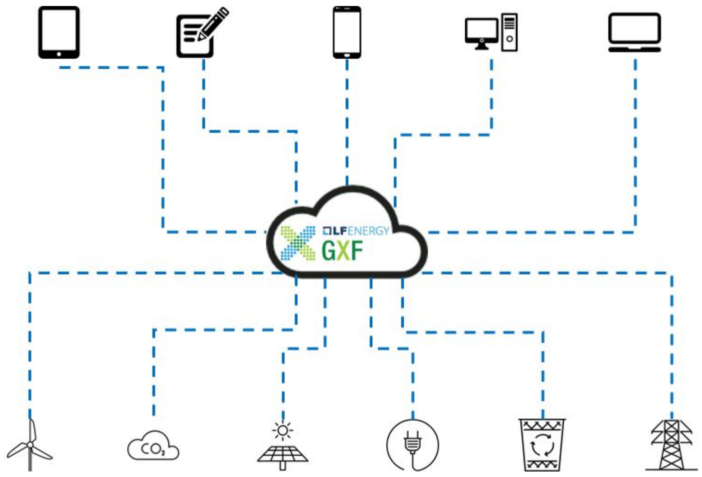
GXF

Industrial IoT backend that enables hardware monitoring and control at scale

Early Adoption

GXF provides several functions out of the box and provides scalability & high availability, high security, a generic design, and no vendor lock-in. GXF is currently deployed in several public use cases, including microgrids, smart metering, public lighting, and distribution automation.

GXF can be deployed to multiple servers or distributed over multiple data centers in an active-active setup so that even if one data center fails, no data or functionality is lost. In a cloud-hosted setup, it is possible to use auto scaling to automatically add or remove servers on any of the platform layers to scale the platform to the current load and use. Servers can automatically be scaled up and down when necessary, thereby reducing hardware costs. This setup can also be used to minimize the costs during the phased rollout of smart devices.



Learn more at gxf.energy | GitHub | Video

Contributions by

alliander

LF ENERGY

LF ENERGY OPERATORFABRIC

Modular, extensible platform for alert management for systems operators

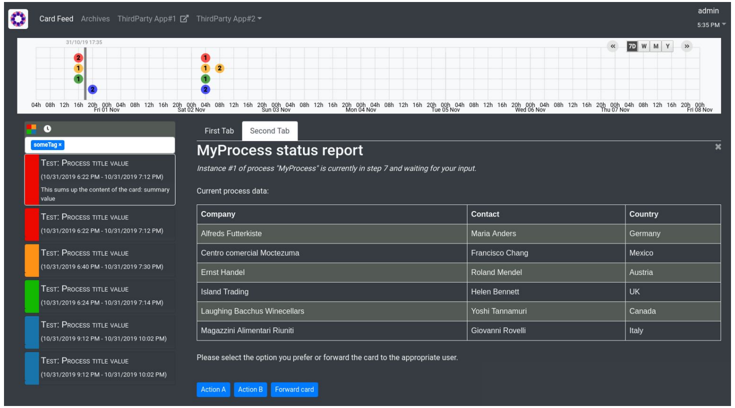
[Early Adoption]

Top Use Cases

- Electricity, water, and other utility operational dashboard for managing field devices and alert response
- Organizational power system coordination, visibility, communication, and workflow between distributed users across national and regional boundaries.

Technical Summary

- Written in Java and based on the Spring framework



Learn more at [operatorfabric.energy] | [GitHub] | [Video]

Contributions by

alliander Rte Softlab

LF ENERGY

LF ENERGY SOGNO

Microservice based architecture for distribution grid automation

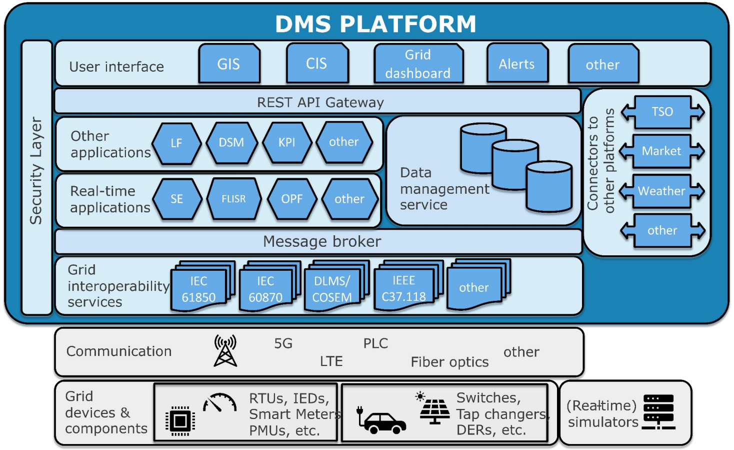
Early Adoption

Top Use Cases

- State Estimation
- Load Prediction
- Voltage Control

Technical Summary

- Microservices architecture; designed to be deployed using Kubernetes, either in the cloud or at the edge
- Seamless integration of development, testing, and deployment enables new automation functionalities to be developed and thoroughly tested against a virtual real-time representation of the power system before deployment.
- Developed under European Union's Horizon 2020 research and innovation programme under grant agreement No 774613, and open sourced by RWTH.



Learn more at sogno.energy | GitHub | Video

LF ENERGY

LF ENERGY FlexMeasures

Intelligent & developer-friendly EMS to support real-time energy flexibility apps, rapidly and scalably

Incubation

Top Use Cases

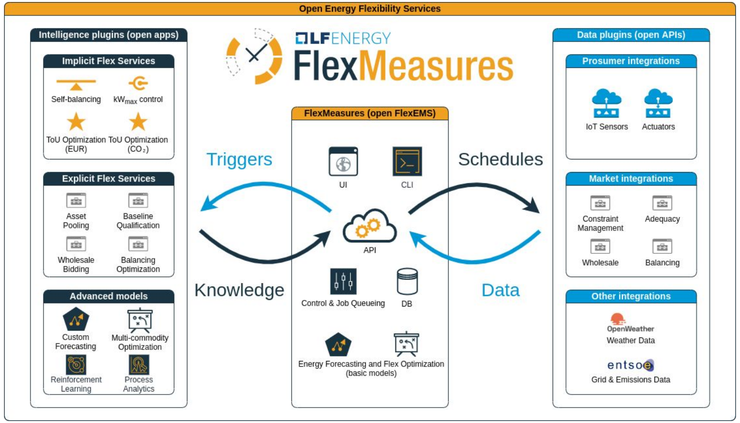
The problem it helps to solve is “What are the best times to run flexible assets, like batteries, heat pumps or industry processes?”

- Industry: Shift process running times to minimize balancing costs as well as CO2 & support network congestion
- Built Environment: Optimize heating to satisfy comfort and energy costs (use rooftop solar & dynamic tariffs)
- E-Mobility (optimal charging time to lower bills, including vehicle-to-grid)

Technical Summary

FlexMeasures is designed to be developer-friendly, which helps you to go to market quickly, while keeping the costs of software development at bay. FlexMeasures supports:

- Real-time data integration & intelligence
- Model data well — units, time resolution & uncertainty (of forecasts)
- Faster app-building (API/UI/CLI, plugin & multi-tenancy support)



Learn more at flexmeasures.energy | GitHub

Contributions by

Seita

LF ENERGY

LF ENERGY

SHAPESHIFTER

Implements the Universal Smart Energy Framework for flexibility forecasting, offering, ordering, and settlement processes.

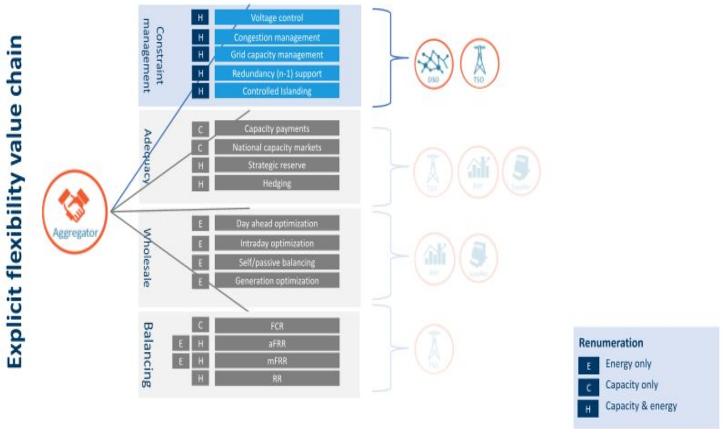
Incubation

Top Use Cases

- Exchange of flexibility between aggregators (AGRs) and distribution system operators (DSOs) or between aggregators and transmission system operations (TSOs).
- Enables DSO and TSO to resolve grid constraints by applying congestion management or grid capacity management

Technical Summary

- Based on the market-based coordination mechanism (MCM) described by USEF



Learn more at shapeshifter.energy | GitHub | Video

Contributions by

alliander EDSN GOPACS

LF ENERGY

LF ENERGY RTDIP

Easy access to high volume, historical and real time process data for analytics applications, engineers, and data scientists wherever they are.

[Sandbox]

Use Cases

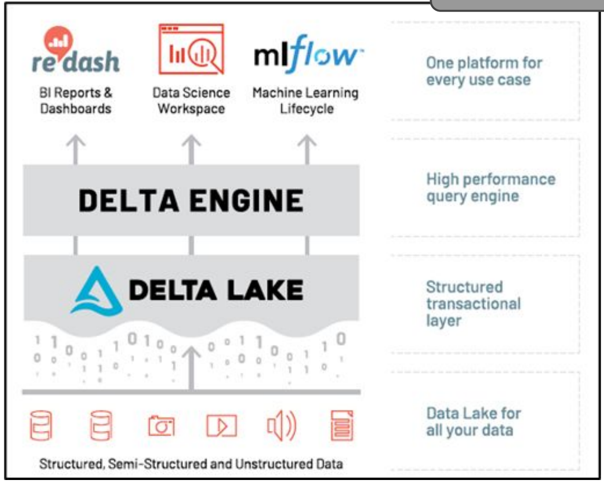
- Process time series data for preventive maintenance management

Technical Summary

Key components are:

- The Delta Ingestion engine used to process streaming data from streaming sources and files stored in cloud storage into Delta format.The data ingested is typically sourced from Pi Historians, OPC UA Servers, IoT Devices 2.
- Python SDK that enables data consumers to read and queryraw, sampled, interpolated or time weighted averages of the data stored in Delta3.
- REST APIs that are wrappers for the Python SDK that enable developers in non-python languages to consume the data

Contributed by Shell



Learn more at rtdip.io | GitHub | Video

Contributions by

LF ENERGY

Grid Simulation and Modeling

LF ENERGY

LF ENERGY POWSYBL

Open source library dedicated to electrical grid modeling and simulation

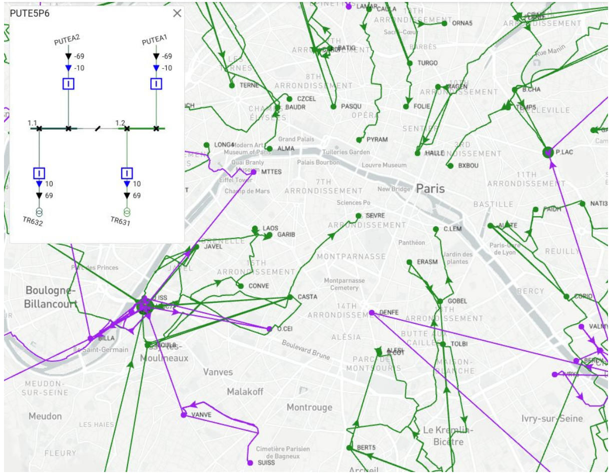
Early Adoption

Top Use Cases

- Dynamic power flow simulations and security analyses across a power grid
- Data exchanges using a variety of formats including ENTSO-E CIM/CGMES, UCTE-DEF, and more.

Technical Summary

- Written in Java
- Can be used for one-off scripting and scale up to production application usage.



Learn more at powsybl.energy | GitHub | Video

Contributions by

Rte

Artelys OPTIMIZATION SOLUTIONS

LF ENERGY

Dynawo

Hybrid C++/Modelica open source suite of simulation tools for power systems

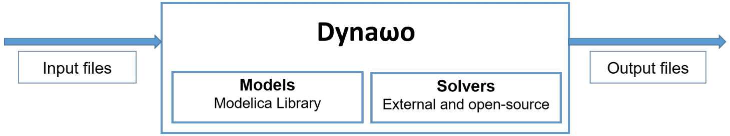
Incubation

Top Use Cases

- Power system simulations
- Decision making on operational grid needs

Technical Summary

- Hybrid C++/Modelica codebase



Learn more at

https://lfenergy.org/projects/dynawo/ | GitHub | Video

Contributions by

Rte

LF ENERGY

Predict future load on the electricity grid using machine learning

LF ENERGY OpenSTEF

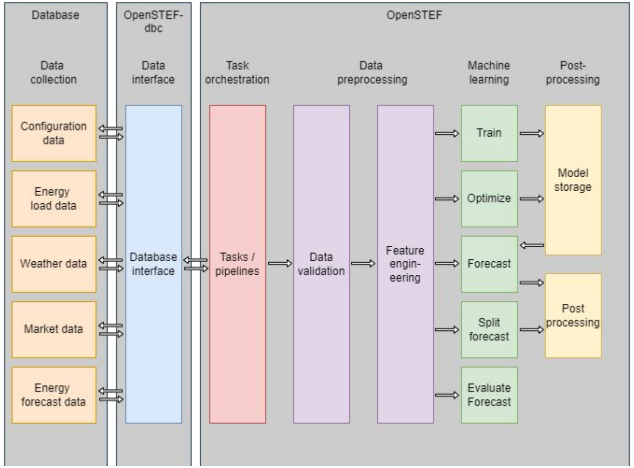
Incubation

Top Use Cases

- Forecasting load at the DSO/TSO interface
- Forecasting load for the DSO to perform congestion management
- Forecasting load on secondary substations or individual customers to facilitate smart-grid applications

Technical Overview

- OpenSTEF validates input data, uses external predictors such as weather and market prices, trains machine learning models, and provides a forecast via API and graphical user interface.
- The stack is based on open source technology, organized in a microservice architecture, and optimized for cloud-deployment.



Learn more at openstef.energy | GitHub | Video

Contributions by

alliander

LF ENERGY

LF ENERGY
POWER GRID MODEL

High performance distribution grid calculation model

Incubation

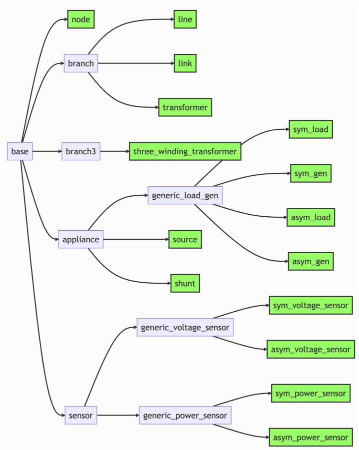
Top Use Cases

- Short term real-time state estimation and forecasting
- Long term grid planning
- Congestion management

Technical Summary

Power Grid Model has a C++ calculation core with a mature C-API and Python API. Currently, it supports the following calculations:

- Symmetric and asymmetric power flow calculation with Newton-Raphson method, iterative current method and linear method
- Symmetric and asymmetric state estimation with iterative linear method



Learn more at powergridmodel.energy | GitHub | Video

Contributions by

alliander

LF ENERGY

LF ENERGY ARRAS

Simulation and analysis tool that models emerging smart grid energy technologies

[Sandbox](#)

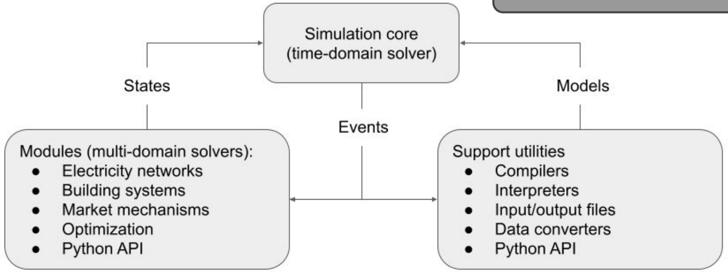
Top Use Cases

- Distributed energy resource hosting capacity, tariff design, and end-use load electrification
- Extreme weather resilience and wildfire safety and protection,
- Peer-to-peer energy and advanced load modeling and forecasting.

Technical Summary

- Originally called HiPAS GridLAB-D.
- Primarily built in C++ and Python.

Project contributed by California Energy Commission and US Department of Energy Cybersecurity Energy Security and Emergency Response Office



Learn more at arras.energy | Website | GitHub

Contributions by

SLAC NATIONAL ACCELERATOR LABORATORY

STATE OF CALIFORNIA ENERGY COMMISSION

Pacific Northwest NATIONAL LABORATORY

aws

SOUTHERN CALIFORNIA EDISON Energy for What's Ahead

HITACHI

LF ENERGY

LF ENERGY

GRIP

Help electric grid operators anticipate, mitigate against, and recover from the effects of extreme weather events

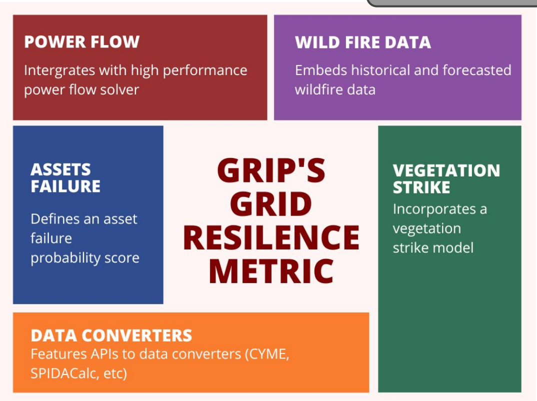
[Sandbox]

GRIP uses telemetry data to identify infrastructure most at risk from severe weather. One of the key strengths of GRIP is its threat-agnostic grid modeling capabilities. Regardless of the type of extreme weather event, if telemetry data is available regarding the failed asset, GRIP's system modeling capabilities can provide actionable insights to the grid operator.

Use cases:

- Anticipating grid events using machine learning and artificial intelligence techniques with diverse data sources.
- Absorbing grid events by employing validated control strategies for distributed energy resources; and
- Reducing recovery time by managing distributed energy resources in the case of limited communications.

With GRIP, electrical utility operators can reduce operating costs by optimizing grid hardening costs and lowering liability costs and shareholder exposure. These grid operator benefits will ultimately lead to lower electricity rates for customers.



Learn more at https://www.grip.energy/ | GitHub | Website

Contributions by

SLAC NATIONAL ACCELERATOR LABORATORY

aws

STATE OF CALIFORNIA ENERGY COMMISSION

SOUTHERN CALIFORNIA EDISON Energy for What's Ahead

Pacific Northwest NATIONAL LABORATORY

HITACHI

LF ENERGY

GRID CAPACITY MAP

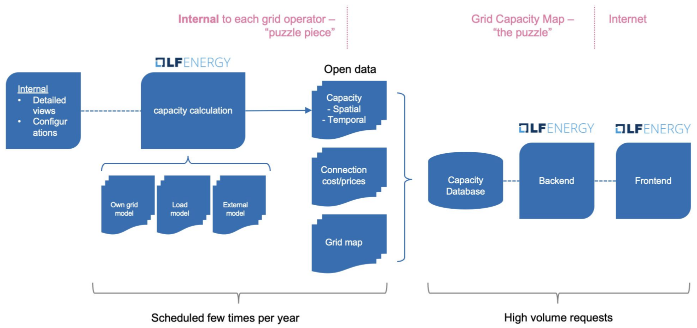
LF ENERGY

Enable grid operators - and the customers they serve - to more easily see when and where connections will be most optimal

Sandbox

Top Use Cases

- Ensure customer and stakeholders expectations on grid connections are realistic to give a better connection experience with fewer surprises for both grid owner (DSO/TSO), grid customers and other stakeholders.
- Giving a utility ability to advise a company to move locations to get connection sooner.



Learn more at [gridcapacitymap.energy] | [GitHub]

Technical Summary

- Built in Python; using the [panda power] grid model and power flow calculation

Contributions by

VATTENFALL

LF ENERGY

LF ENERGY covXtreme

Model and software for hazard risk analysis of extreme events

Sandbox

Hazard risk analysis often involves modelling extreme events, for example of natural phenomena such as rainfall, temperature and ocean waves, or of man-made systems such as industrial processes and stock-markets. We seek to understand the characteristics of the most exceptional (largest or most rare) events we have seen historically, and potentially might see if we look harder.

covXtreme was developed for oceanographic applications, but it has been used more widely. You will probably find covXtreme interesting, if:

- You are interested in quantifying extremes using statistical analysis of a data set, and might want to estimate extreme quantiles or "return levels",
- The characteristics of your data are not steady; that is, they vary with covariates which you know about,
- You may be interested in quantifying extremes of multiple variables at the same time, and
- You want to quantify how confident you can be in your modelling.

Learn more at

https://lfenergy.org/projects/covxtreme/ | GitHub

Contributions by

LF ENERGY