

OLFENERGY

High-level Architecture

Open Source to Accelerate the Energy Transition

OUR COMMITMENT TO THE FUTURE DIGITAL GRID

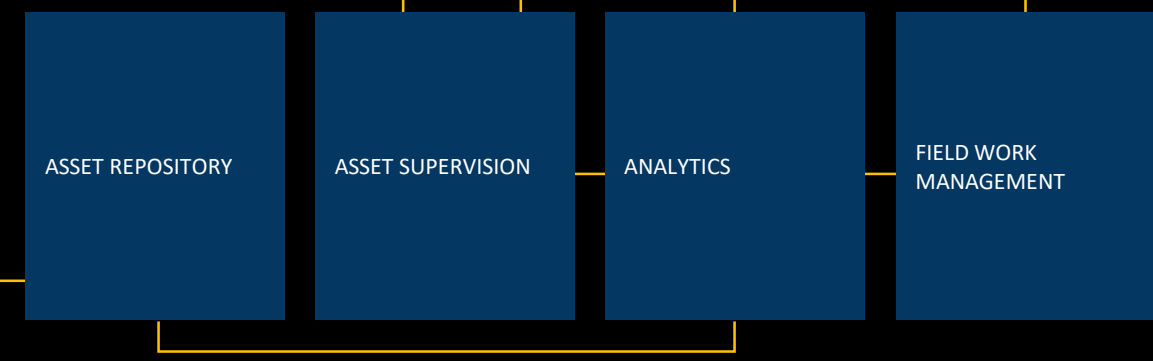
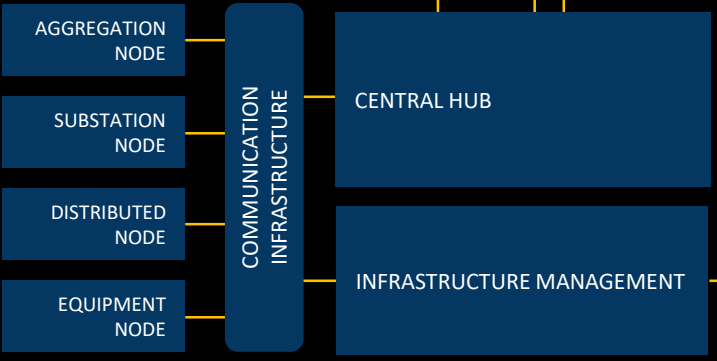
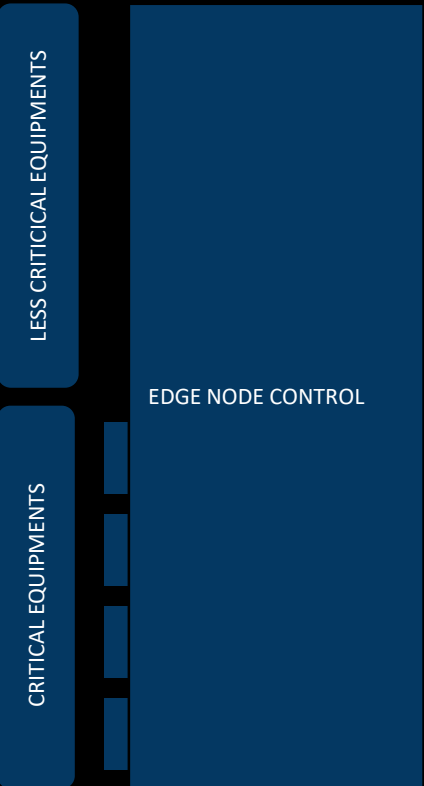
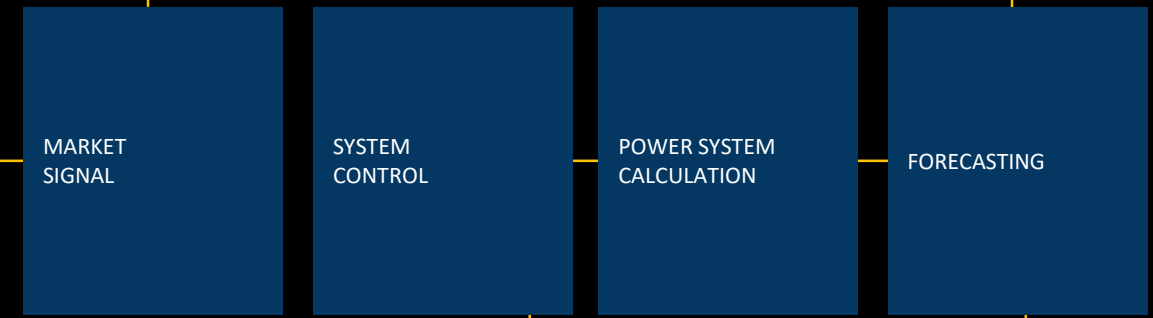
To achieve our 2050 climate and energy goals we, as TSOs and DSOs, have **joined together** to create a common high-level architecture defining a **fit-for-the-future** grid. What follows is a start. We want your **feedback and involvement**. With this we proclaim a **commitment** under LF Energy to find shared **strategic** dependencies. By utilizing open source we can **accelerate** a technology **revolution** that enables rapid decarbonization by **digitalizing** the **global** energy grid.

We see that cooperation and working together is the only path to individual and collective success.

Join us.

CUSTOMER & MARKET

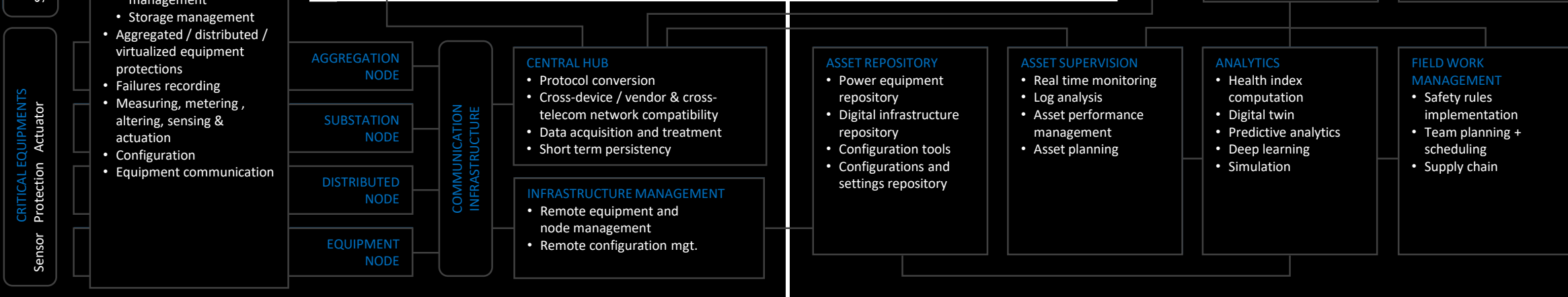
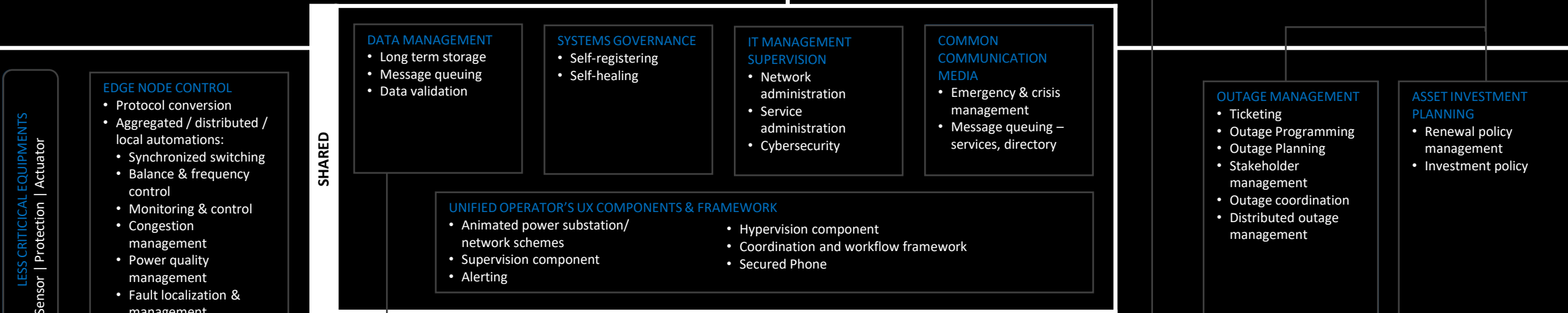
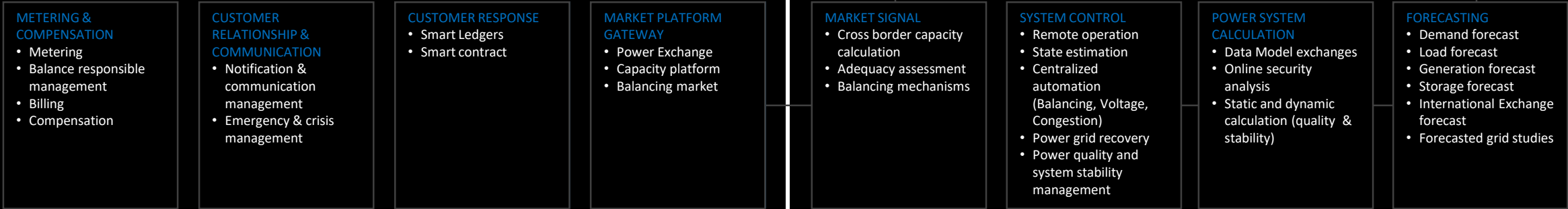
SYSTEM MANAGEMENT



ACQUISITION AND CONTROL

ASSET MANAGEMENT

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METERING & COMPENSATION



CUSTOMER RELATIONSHIP & COMMUNICATION



CUSTOMER RESPONSE

- Smart Ledgers
- Smart contract

MARKET PLATFORM GATEWAY

- Power Exchange
- Capacity platform
- Balancing market

MARKET SIGNAL

- Cross border capacity calculation
- Adequacy assessment
- Balancing mechanisms

SYSTEM CONTROL

- Remote operation
- State estimation
- Centralized automation (Balancing, Voltage, Congestion)
- Power grid recovery
- Power quality and system stability management

POWER SYSTEM CALCULATION



FORECASTING

- Demand forecast
- Load forecast
- Generation forecast
- Storage forecast
- International Exchange forecast
- Forecasted grid studies

SHARED

DATA MANAGEMENT



SYSTEMS GOVERNANCE

- Self-registering
- Self-healing

IT MANAGEMENT SUPERVISION

- Network administration
- Service administration
- Cybersecurity

COMMON COMMUNICATION MEDIA

- Emergency & Crisis management
- Message queuing – services, directory

UNIFIED OPERATOR'S UX COMPONENTS & FRAMEWORK



OUTAGE MANAGEMENT

- Ticketing
- Outage Programming
- Outage Planning
- Stakeholder management
- Outage coordination
- Distributed outage management

ASSET INVESTMENT PLANNING

- Renewal policy management
- Investment policy

CRITICAL EQUIPMENTS
Sensor | Protection | Actuator

EDGE NODE CONTROL



LESS CRITICAL EQUIPMENTS
Sensor | Protection | Actuator

FAULT LOCALIZATION & MANAGEMENT

AGGREGATION NODE

SUBSTATION NODE

DISTRIBUTED NODE

EQUIPMENT NODE

COMMUNICATION INFRASTRUCTURE

CENTRAL HUB



INFRASTRUCTURE MANAGEMENT

ASSET REPOSITORY

- Power equipment repository
- Digital infrastructure repository
- Configuration tools
- Configurations and settings repository

ASSET SUPERVISION



ANALYTICS

- Health index computation
- Digital twin
- Predictive analytics
- Deep learning
- Simulation

FIELD WORK MANAGEMENT

- Safety rules implementation
- Team planning + scheduling
- Supply chain

METERING & COMPENSATION

- Metering
- Balance responsible management
- Billing
- Compensation

CUSTOMER RELATIONSHIP & COMMUNICATION

- Notification & communication management

CUSTOMER RESPONSE

- Smart Ledgers
- Smart contract

MARKET PLATFORM & GATEWAY

- Power Exchange
- Capacity platform
- Balancing market

USE CASE

MARKET SIGNAL

- Cross border capacity calculation
- Adequacy assessment
- Balancing mechanisms

SYSTEM CONTROL

- Remote operation
- State estimation
- Centralized automation (Balancing, Voltage

POWER SYSTEM CALCULATION

- Data Model exchanges
- Online security analysis
- Static and dynamic

FORECASTING

- Demand forecast
- Load forecast
- Generation forecast
- Storage forecast
- International Exchange forecast
- Forecasted grid studies

- Identify on slide 4 the other functional areas that OSGP touches.
- Identify roadmap and opportunities for others to join
- Highlight a use case and walk people through that.
- If you get this to us by 10/25 we will try to get the designer to create an animation for you to talk through.
- Use your talk to address ways that OSGP is critical to the future grid
- Highlight OSGP does even more of this and that
- Plus blah, blah, OSGP, etc.
- **BLAH**
- **POINT**
- **POINT**
- **NEXT POINT**

LESS CRITICAL EQUIPMENTS

Sensor | Protection | Actuator

EDGE NODE CON

- Protocol conver
- Aggregated / distributed local automation
- Synchronize
- Balance & frequency control
- Monitoring
- Congestion management
- Power quality management
- Outage man
- Storage ma

CRITICAL EQUIPMENTS

Sensor | Protection | Actuator

- Aggregated / distributed / virtualized equipment protections
- Failures recording
- Measuring, metering, altering, sensing & actuation
- Configuration
- Equipment communication

AGGREGATION NODE

SUBSTATION NODE

DISTRIBUTED NODE

EQUIPMENT NODE

COMMUNICATION INFRASTRUCTURE

CENTRAL HUB

OSGP

INFRASTRUCTURE MANAGEMENT

ASSET REPOSITORY

- Power equipment repository
- Digital infrastructure repository
- Configuration tools
- Configurations and settings repository

ASSET SUPERVISION

- Real time monitoring
- Log analysis
- Asset performance management
- Asset planning

ANALYTICS

- Health index computation
- Digital twin
- Predictive analytics
- Deep learning
- Simulation

FIELD WORK MANAGEMENT

- Safety rules implementation
- Team planning + scheduling
- Supply chain

ASSET INVESTMENT PLANNING

- Renewal policy management
- Investment policy

Glossary

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Glossary of Customer and Market

CUSTOMER RELATIONSHIP AND COMMUNICATION

Covering the digital functionalities supporting customer relationship management and communication.

CUSTOMER RESPONSE

Covering the digital functionalities supporting customers providing information .

MARKET PLATFORM GATEWAY

Covering the digital functionalities supporting markets participants retrieving and providing information (e.g. providing energy consumption details to energy suppliers).

METERING AND COMPENSATION

Covering the digital functionalities supporting determination and financially handling realization of market contracts and consequences of system operation.



Glossary of System Management

FORECASTING	Covering the digital functionalities used to forecast Power system, Market and System variables or subjects to enable signaling, calculation and control (e.g. load forecast per substation).
MARKET SIGNAL	Covering the digital functionalities used to control system behavior targets like adequacy, balance and capacity.
POWER SYSTEM CALCULATION	Covering the digital functionalities used to calculate targets or variables related to power delivery and system stability.
SYSTEM CONTROL	Covering the digital functionalities used to control power delivery, system balancing, quality and stability.



Glossary of Asset Management

ANALYTICS	Covering the digital functionalities used to determine causes, draw conclusions and give advice (e.g. predicting fault locations).
ASSET INVESTMENT PLANNING	Covering the planning of the asset investments on strategic, tactical and operation level.
ASSET REPOSITORY	Covering the digital functionalities used to keep track of asset and asset related information and configuration.
ASSET SUPERVISION	Covering the digital functionalities used to determine asset status and replacement plans (e.g. using condition monitoring for predictive maintenance plans).
FIELDWORK MANAGEMENT	Covering the digital functionalities used to prepare and execute work with the right resources.
OUTAGE MANAGEMENT	Covering the digital functionalities used to prepare and execute planned and unplanned outages.



Glossary of Acquisition and Control

AGGREGATION NODE

Covering the digital functionalities of a regional hub (e.g. set of connected substations)

CENTRAL HUB

A central platform for data collection, monitoring and control equipment and nodes in the smart grid (e.g. SCADA or IoT platform).

CRITICAL EQUIPMENT

Assets that are vital for the grid (e.g. a line, circuit breaker or transformer).

DISTRIBUTED NODE

Covering the digital functionalities of a group of assets (e.g. bay, rail, circuit or group of bays).

EDGE NODE CONTROL

Covering the digital functionalities that are shared amongst all nodes .

EQUIPMENT NODE

Covering the digital functionalities of a single asset or a small group of the same assets (e.g transformer, set of three circuit breakers in 3-phase system or in case smart meter: a single electricity connection) or

INFRASTRUCTURE MANAGEMENT

A central platform management equipment and nodes in the smart grid remotely.

LESS-CRITICAL EQUIPMENT NODE

Assets that are non-vital for the grid (e.g. substation door).

SUBSTATION NODE

Covering the digital functionalities of a substation (e.g. high-voltage substation, mid-voltage substation or low-voltage substation).

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Glossary of Shared

COMMON COMMUNICATION MEDIA

Covering the digital functionalities supporting emergency and crisis management.

DATA MANAGEMENT

Covering the digital functionalities supporting data retrieval and management.

IT MANAGEMENT

Covering the digital functionalities supporting IT systems, infrastructure and security management.

SYSTEMS GOVERNANCE

Covering the digital functionalities supporting systems monitoring, registering and healing to make sure that all systems together establish a grid that is stable, reliable and flexible.

UNIFIED OPERATOR'S UX COMPONENTS AND FRAMEWORK

Covering the digital functionalities supporting operators in their interaction with systems and stakeholders .



THE VISION & MISSION OF LF ENERGY

VISION:

The grid of the future is composed of loosely coupled systems that are resilient, manageable, and observable. Combined with robust automation, the digitalization of energy enables engineers to make high-impact changes frequently and predictably with minimal toil.

MISSION:

- The LF Energy Foundation's mission is to accelerate the energy transition by fostering and sustaining an ecosystem of open source, vendor-neutral projects.
- We democratize state-of-the-art patterns to make these innovations accessible for everyone.
- LF Energy empowers the energy systems of the world to build and run scalable applications, composed of open source, in modern, dynamic environments to transform the grid from purely centralized to distributed.



VISION OF THE FUTURE DIGITAL GRID

We, as TSOs and DSOs, see the grid evolve into an energy system that, with the energy transition taking place at full speed, requires a continuous changing governance. Besides organizational flexibility, we need flexibility for energy system connectivity and configuration, which can be realized with advanced digital technologies.

We see a large set of shared business needs that can be accomplished through a shared technology stack even though high voltage provides different complexities than mid and low-voltage. TSOs and DSOs both must solve: balancing, congestion, power quality, outage, 3rd party access, etc. By undertaking this work together we see a tremendous opportunity to accelerate development, share the burden of maintenance, achieve costs efficiencies, and all while ensuring enhanced cyber-security.

Please join us.

For Further Information

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