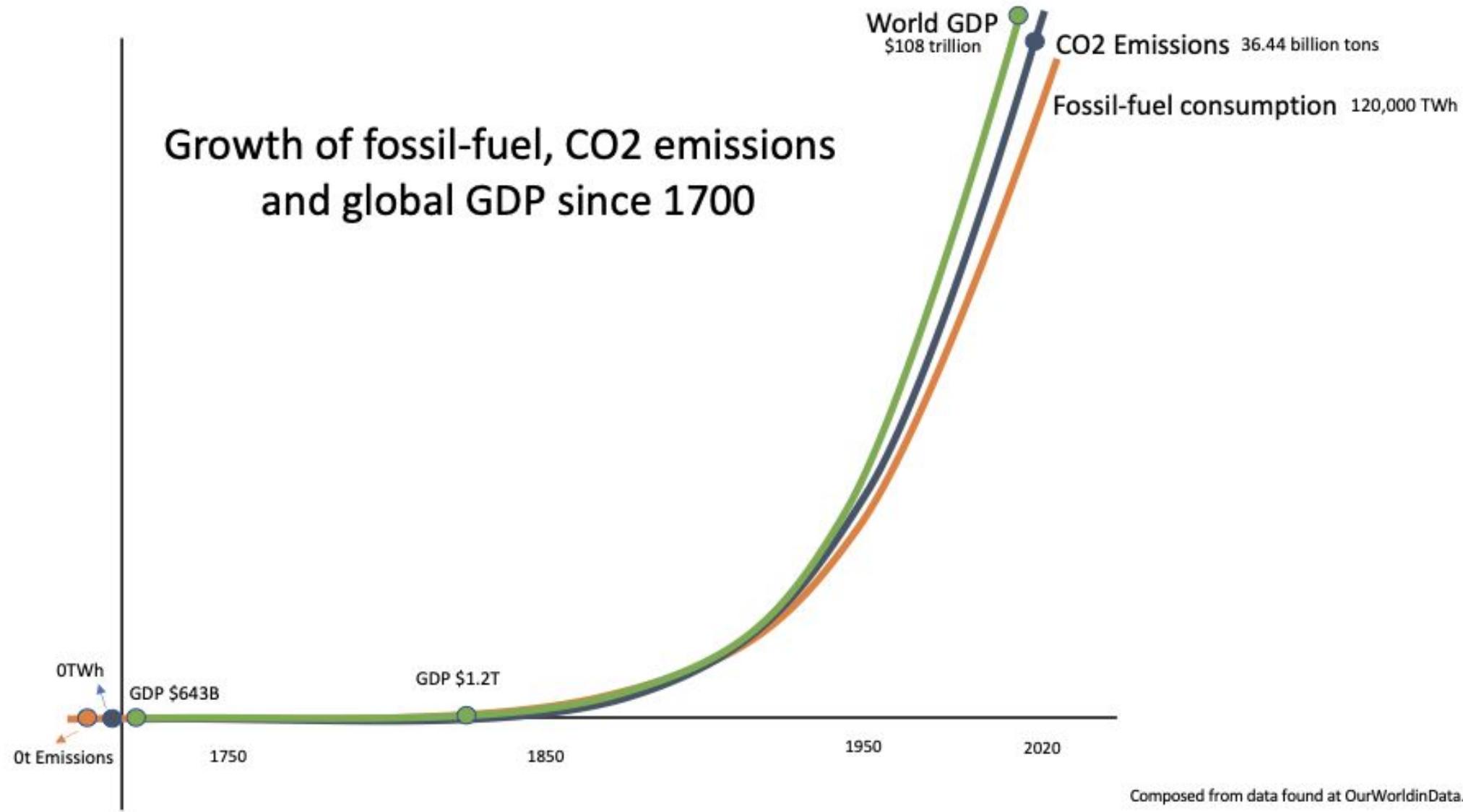




The Power of Together





The world around energy has changed.

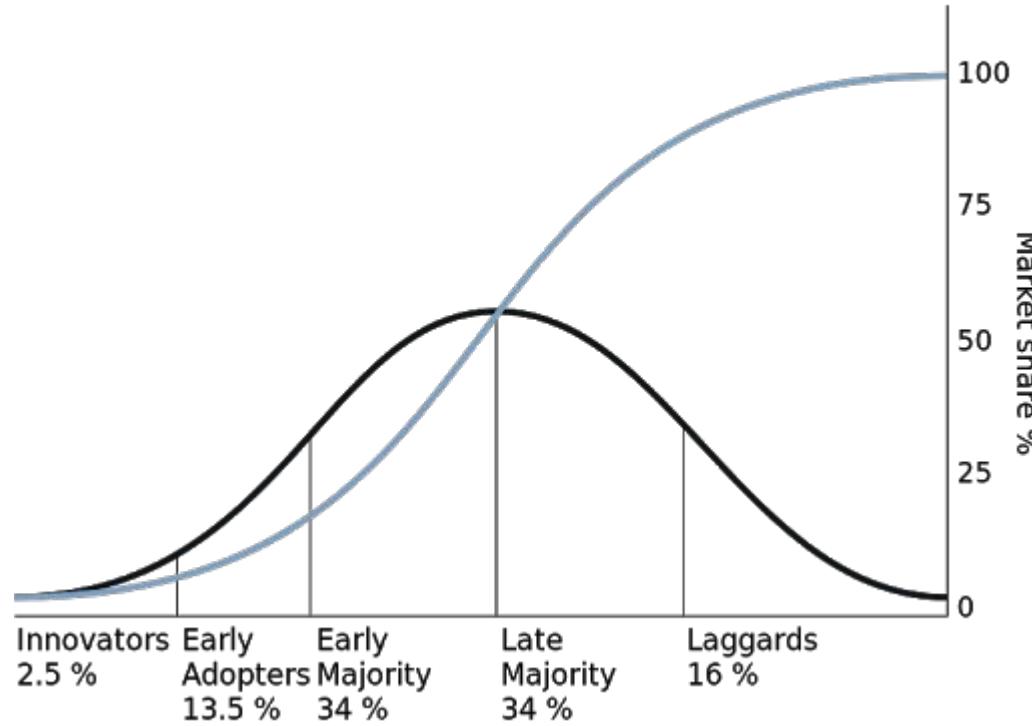


Remove carbon from our **power** and
transportation systems to provide **65%-75%**
of the reduction in CO² emissions that we
need to stay below 1.5°C

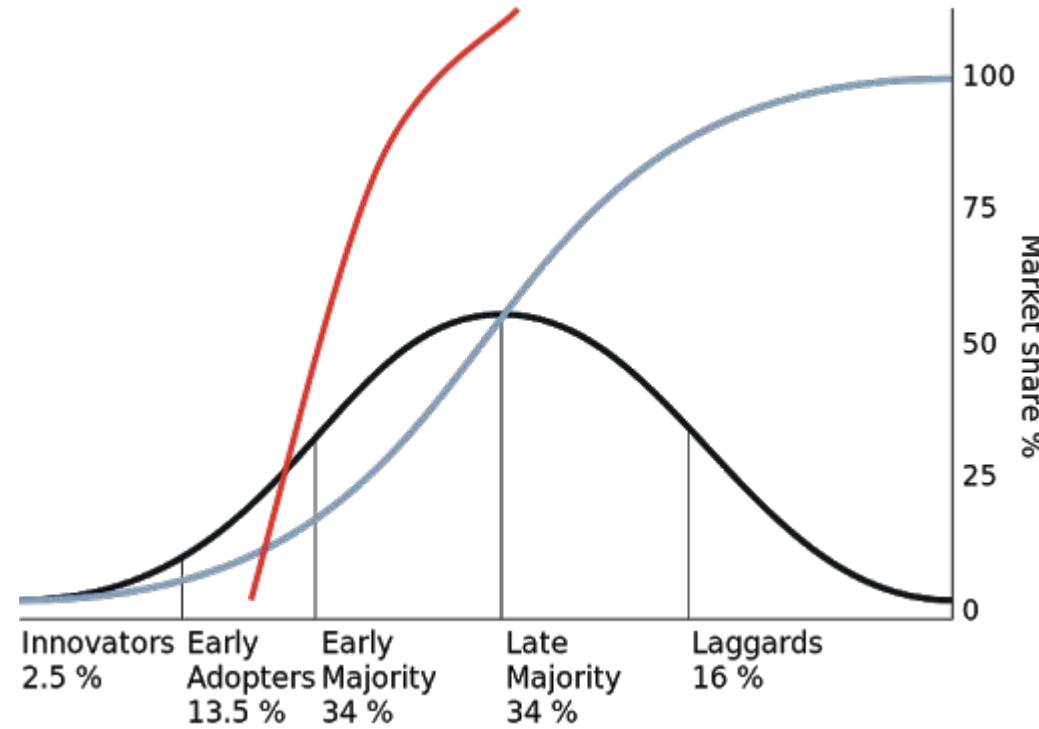
A photograph of a bright sun in a dark blue sky. The sun is partially obscured by a lens flare, appearing as a bright white circle with a red glow. Below it, there are wispy white clouds. The overall mood is dramatic and hopeful.

Providing a 21st century plan of action to decarbonization through open source, open frameworks, reference architectures, and a support ecosystem of complementary projects.

Typical technology adoption curve



The challenge for decarbonization - a technology adoption rate of 9% annual for 30 years!



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 and markets 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.



Isolation and going
it alone are no longer viable.



We need speed, scale,
enhanced security, accelerated
innovation, and global talent.

A photograph of a massive flock of birds, likely starlings, captured in flight against a warm, orange and yellow sunset sky. The birds are concentrated in the upper half of the frame, forming a dense, swirling mass. In the lower right corner, the dark silhouettes of bare trees are visible against the bright sky.

We need mass collaboration.



THE
LINUX
FOUNDATION



The world's dominant open source platform.



100%

Supercomputer
Market



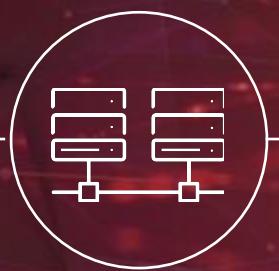
82%

Smartphone
Market Share



2nd

To Windows
in Enterprise



90%

Mainframe
Customers



90%

Public Cloud
Workload



62%

Embedded
Systems Market



#1

Internet
Client

A new member joins The Linux Foundation every day.



\$15.7B

Shared
Value



40,000+

Developers
Contributing Code



100%

of Fortune 100
Tech & Telecom



420+

Open Source
Projects



1625+

Members From
41 Countries



- AT&T saved \$1.6B through dis-aggregation
- In 12 months 80% of the worlds telecom subscribers (~3.5 billion people)
- \$576M of shared development by +2,500 developers.
- Reduced deployment from six months to 15 minutes.



AUTOMOTIVE
GRADE **LINUX**

- Five of Top 10 Automakers aligned and account for 70% of the worldwide vehicle shipments.
- 130+ Members
- Nine Major OEMs and their entire supply chains participating

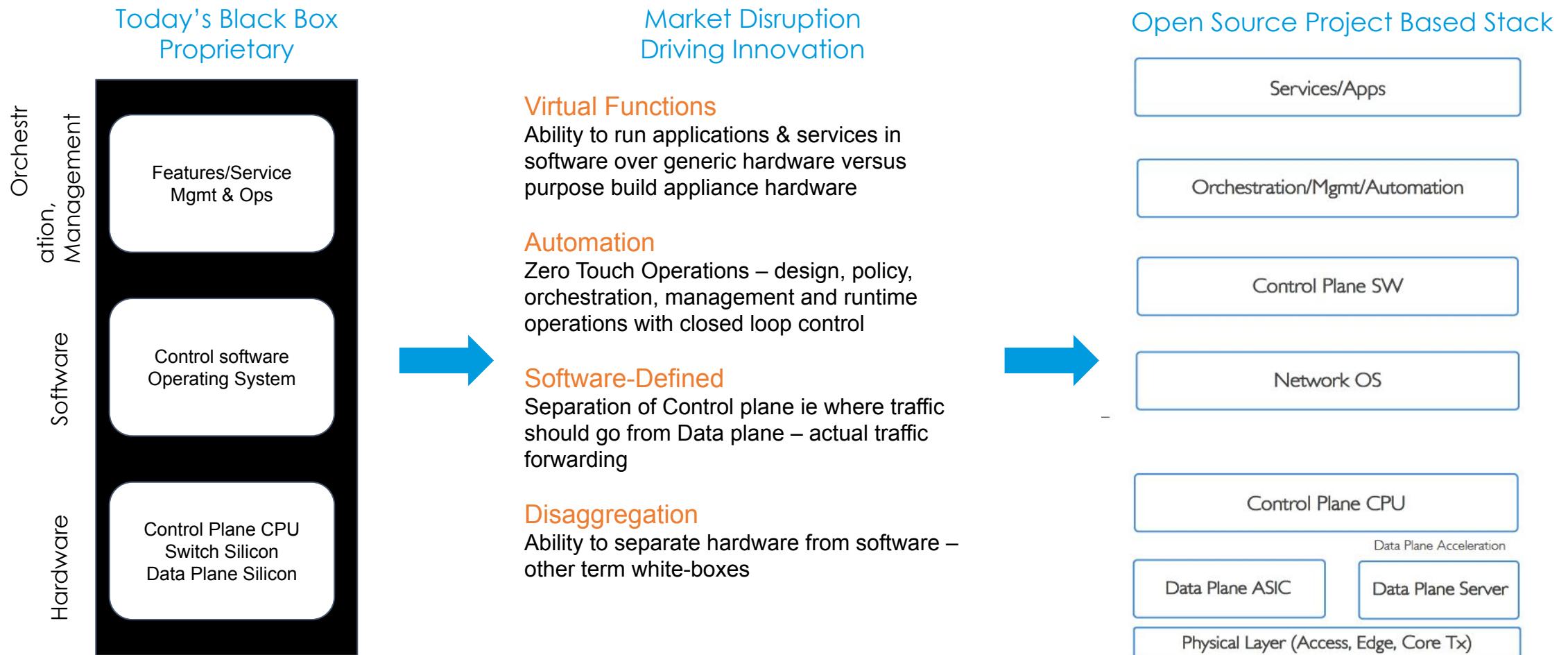


- 530 Members
- Kubernetes de facto standard for container management
- Home to 25 additional projects beyond Kubernetes
- 75 Kubernetes certified providers including 10/10 top public clouds

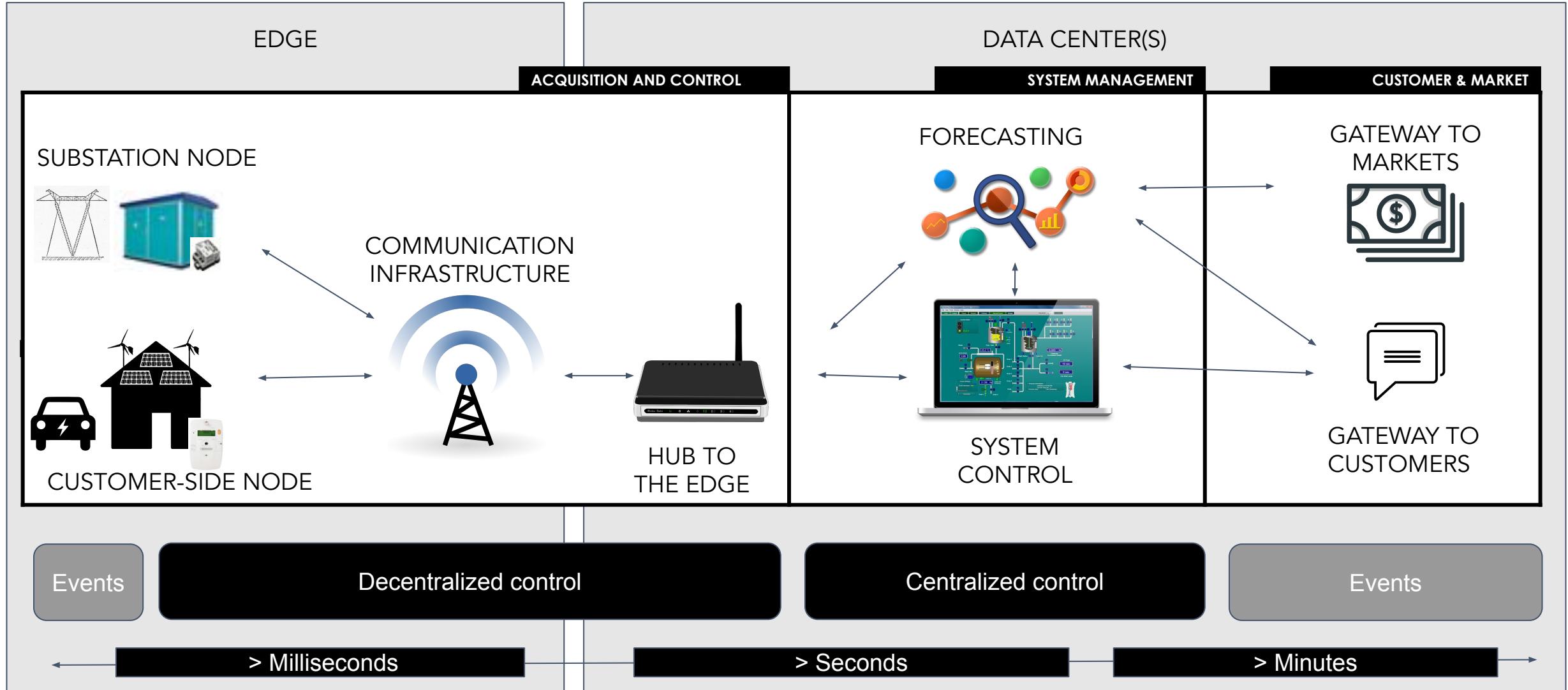


The LF Energy ecosystem alleviates the cost, risk and stagnation of isolated solutions.

Direction of digitalization (Generic)



Distributed control VS centralized control



LF ENERGY



OUR COMMITMENT

To achieve our climate and energy transition goals we have joined together to create a common functional architecture defining a fit-for-the-future grid. Our goal is a common understanding of required functional capabilities. The architecture starts with a top-level view and progresses to a finer granularity. The final slide shows existing and near-future LF Energy projects fits into this architecture.

This 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.

Capabilities related to customer and markets and other third parties

Capabilities related to managing the physical flow and balance of a power system

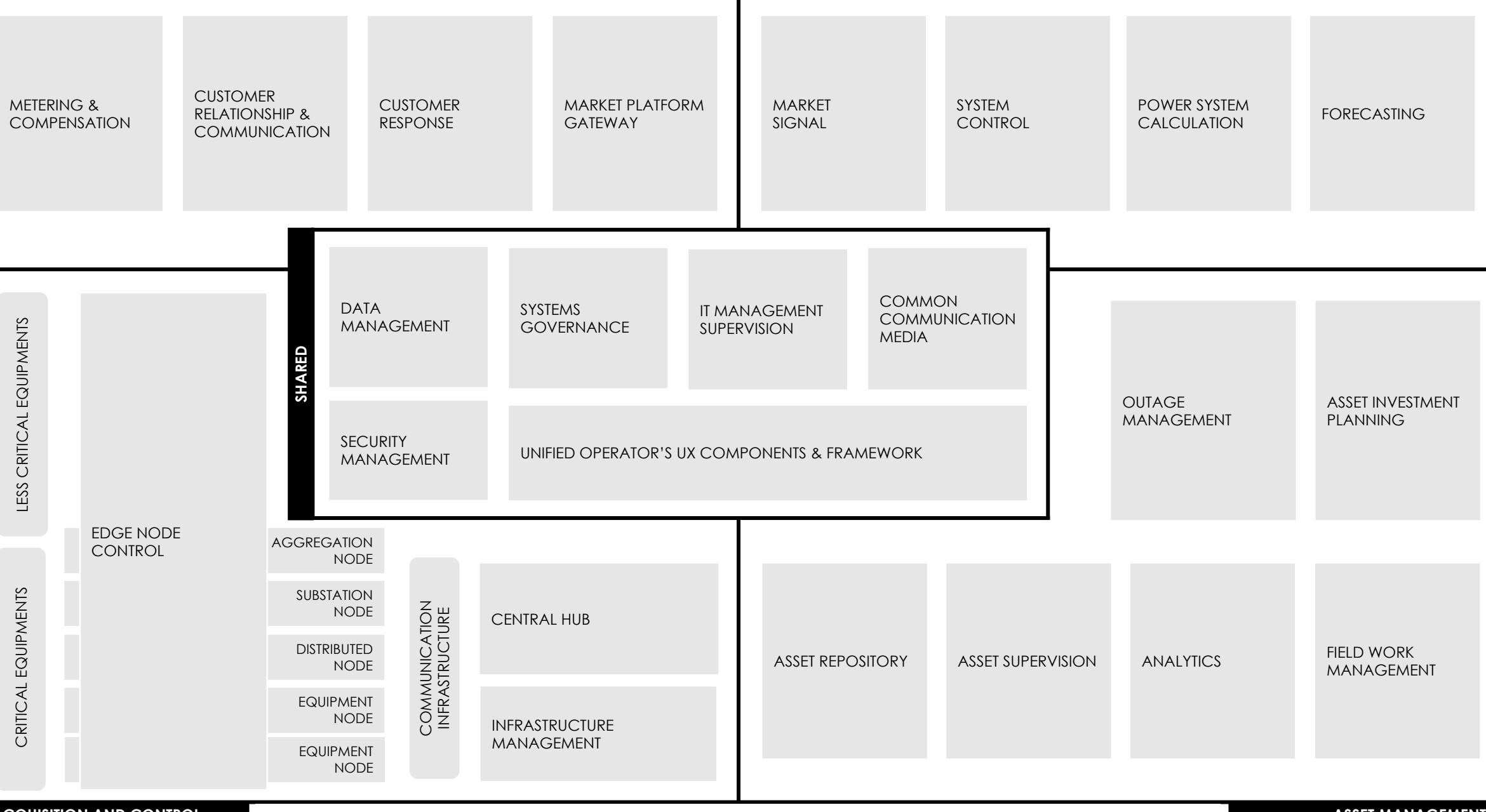
This is the top-level view that shows the 5 main blocks of the functional architecture that we also call categories.

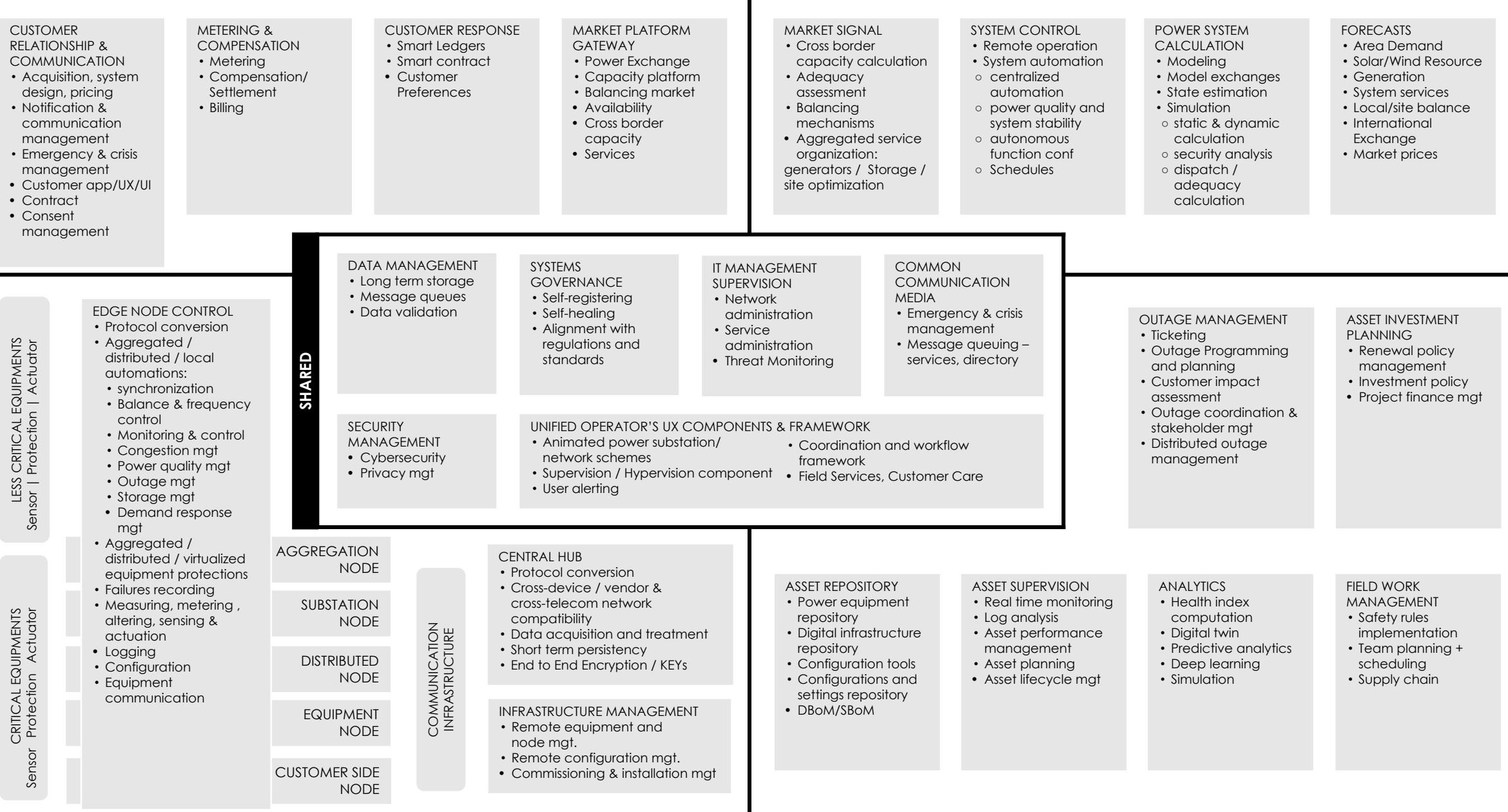
SHARED

Capabilities that are required by each of the other categories

Capabilities related to monitor and control your assets on the grid

Capabilities related to manage your assets





LF Energy Projects



CUSTOMER
RELATIONSHIP &
COMMUNICATIONMETERING &
COMPENSATIONCUSTOMER
RESPONSEMARKET PLATFORM
GATEWAY

MARKET SIGNAL

SYSTEM CONTROL

POWER SYSTEM
CALCULATION
SOGNO
Accepted Fall 2020

FORECASTS

LESS CRITICAL EQUIPMENTS
Sensor | Protection | Actuator

EDGE NODE CONTROL

Open Energy
Systems
December 2020Fault Localization
In planningDIGITAL Substation
Automation SystemsCRITICAL EQUIPMENTS
Sensor Protection ActuatorDATA
MANAGEMENTData Umbrella
Project
Early 2021SYSTEMS
GOVERNANCEIT MANAGEMENT
SUPERVISIONCOMMON
COMMUNICATION
MEDIA

SHARED

SECURITY
MANAGEMENTCyber Security
In planning

UNIFIED OPERATOR'S UX COMPONENTS & FRAMEWORK

OUTAGE
MANAGEMENTASSET INVESTMENT
PLANNINGAGGREGATION
NODEMulti-Protocol
Gateway
December 2020SUBSTATION
NODE

CENTRAL HUB

DISTRIBUTED
NODEEQUIPMENT
NODE

INFRASTRUCTURE MANAGEMENT

CUSTOMER SIDE
NODECOMMUNICATION
INFRASTRUCTURE

ASSET REPOSITORY

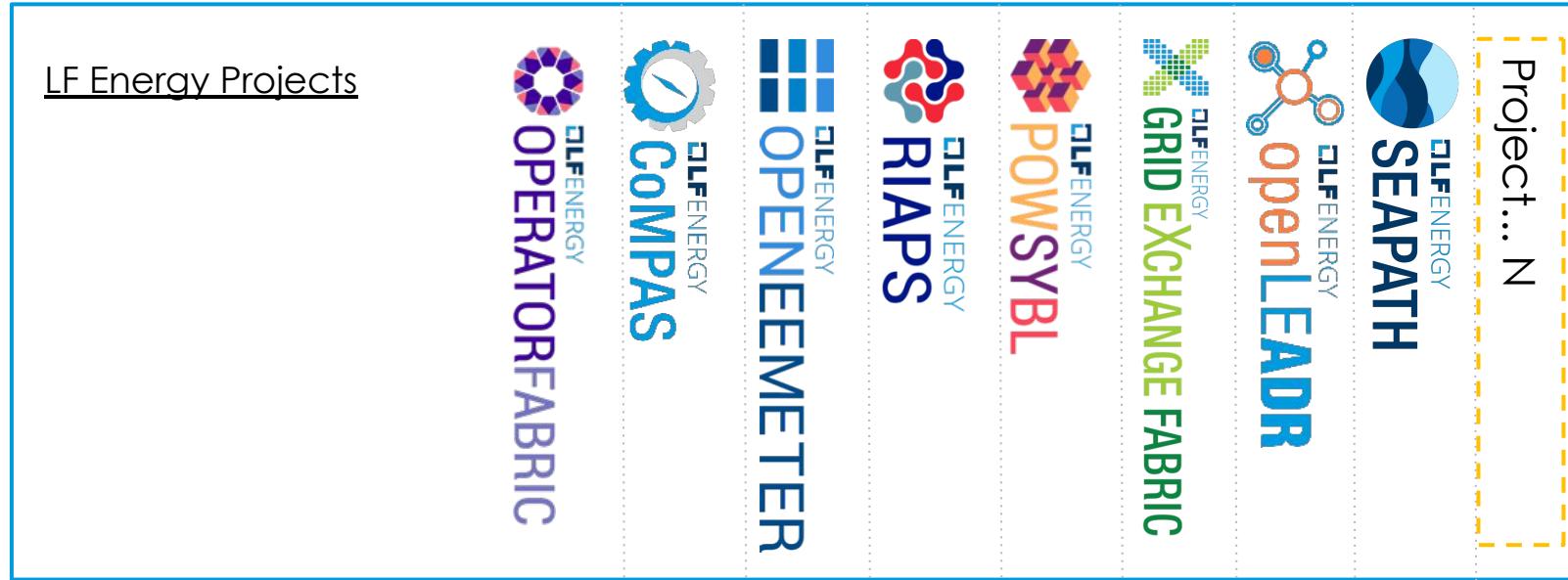
Supply-Chain
DBOM
January 2021

ASSET SUPERVISION

ANALYTICS

FIELD WORK
MANAGEMENT

LF Energy Project/Framework Matrix



Reference implementations

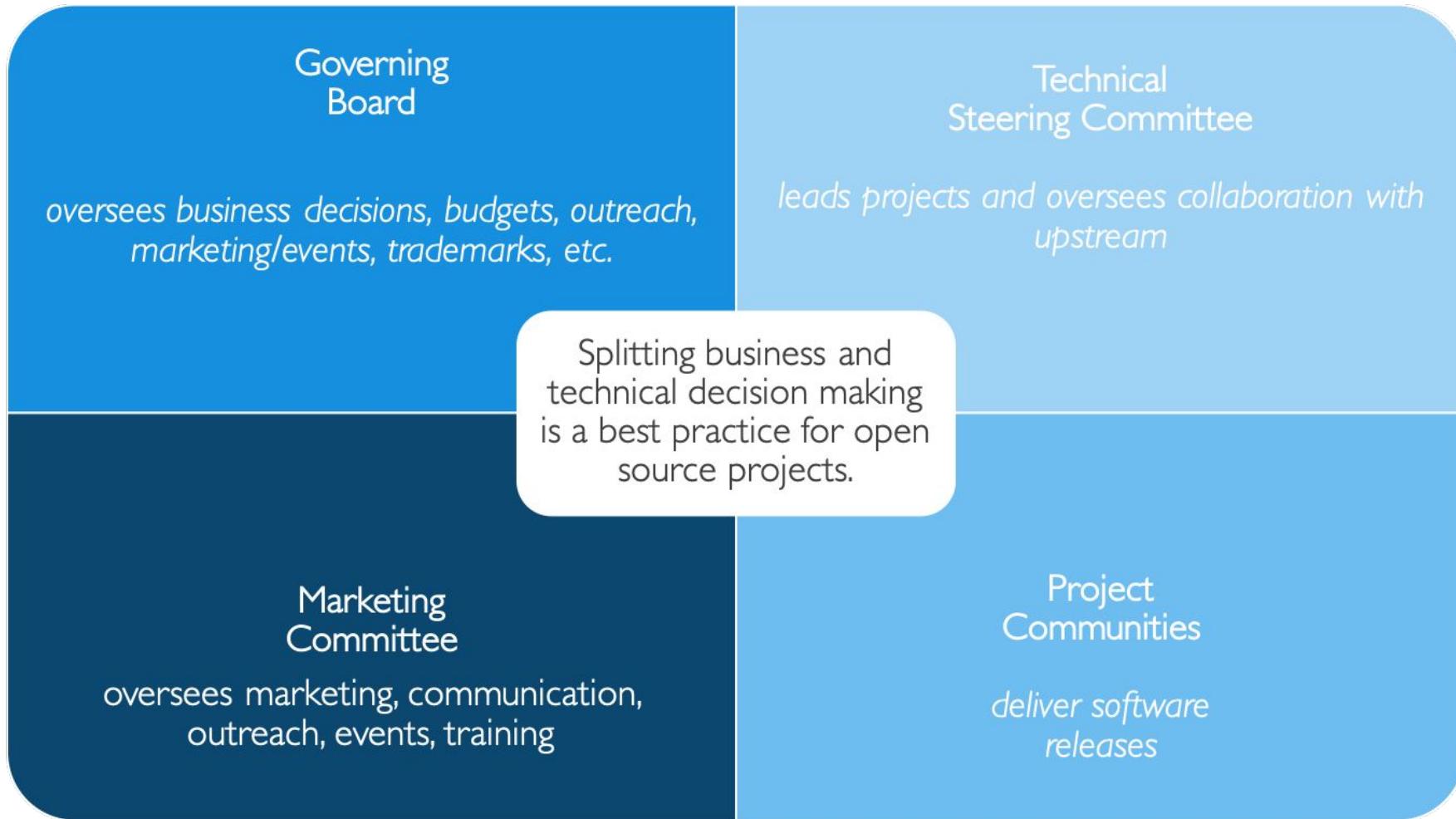


Cross project frameworks officially being integrated into the Technical Advisory Council - Fall 2020

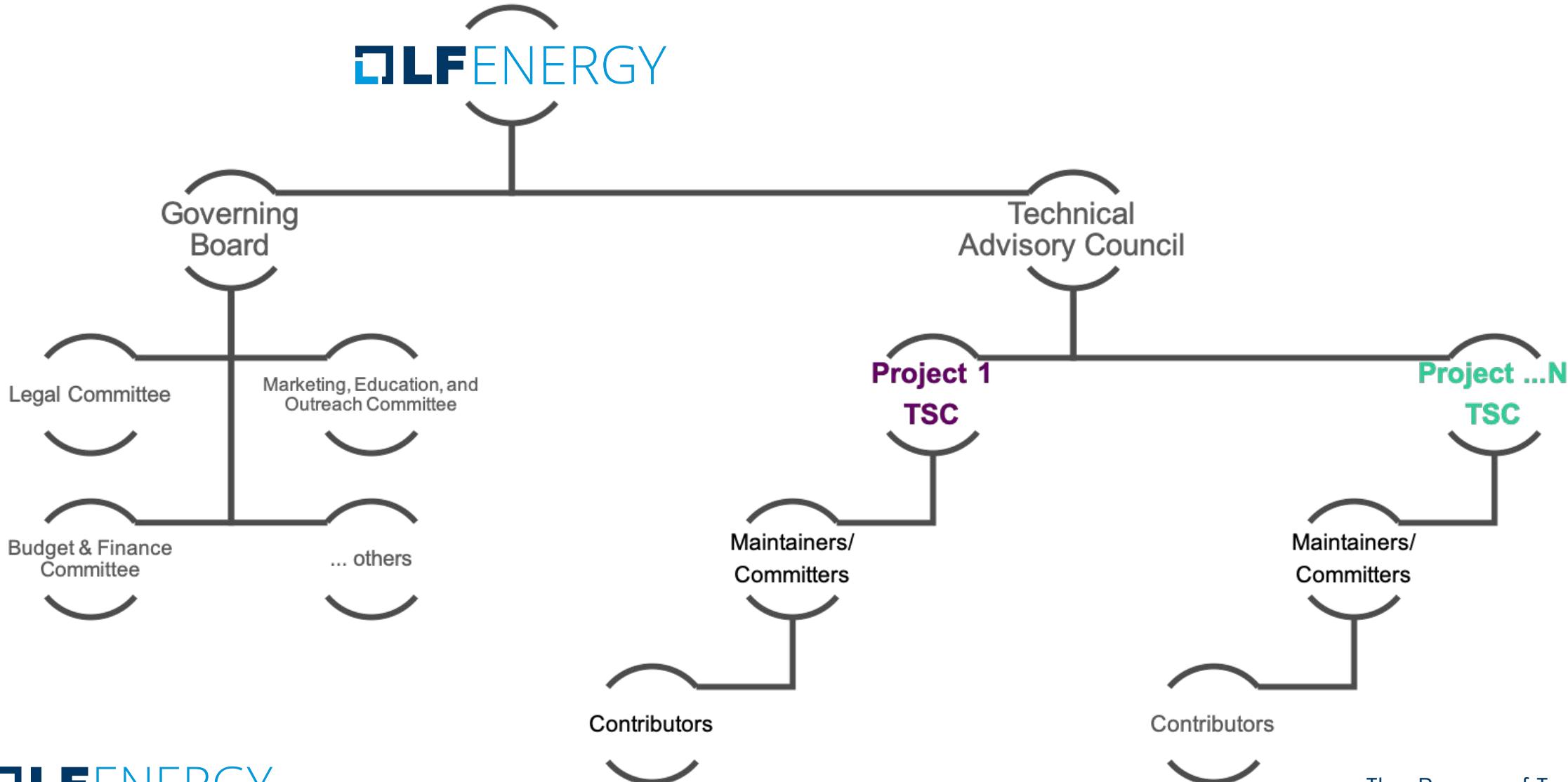
Governance

QLF ENERGY

LF Energy Governance Model



Governance Model

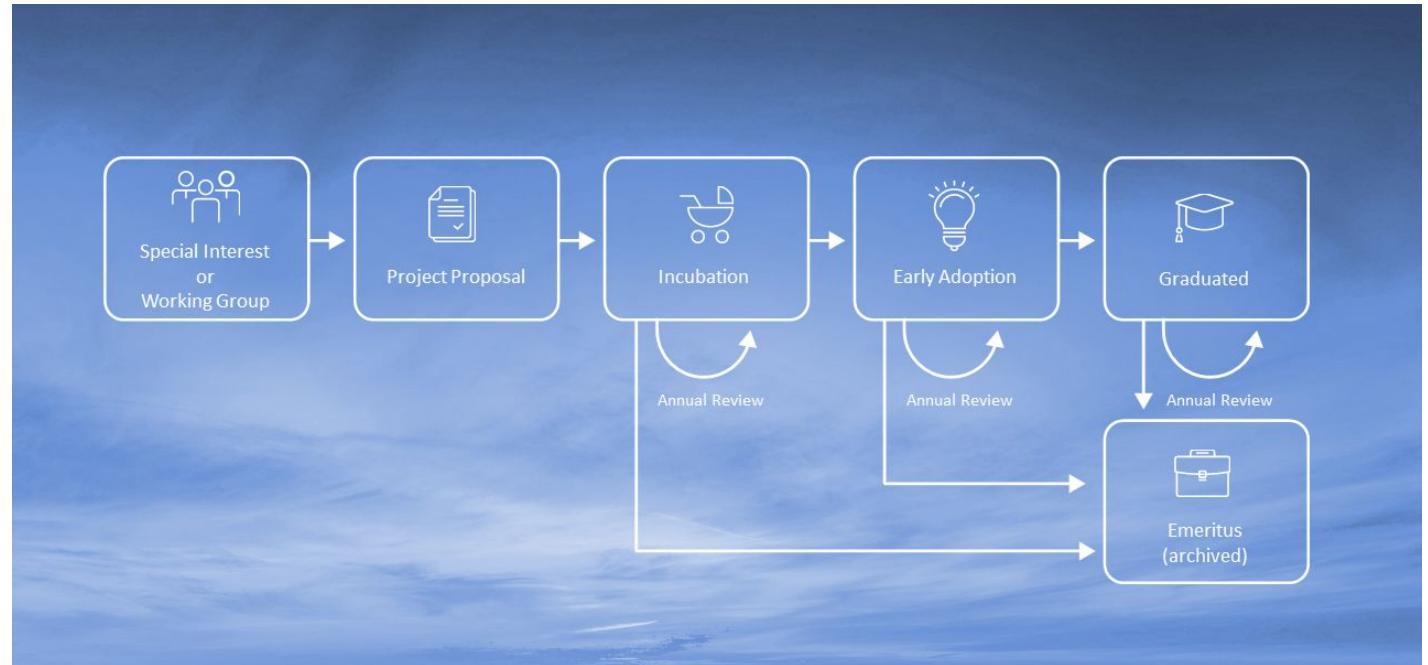


LF Energy Governance in Roles

- A Technical Steering Committee (TSC) oversees each project. Each TSC has an elected Chair who both leads a project TSC and represents the concerns of a project to the Technical Advisory Committee (TAC). Participation on the Technical Steering Committee is based on merit, expertise, and contribution to the code or other artifacts (e.g. testing, documentation) of the technical community.
 - Strategic Members can appoint 1 representative to a TSC for an initial 6-month basis to jump start engagement
 - Membership on a TSC thereafter is based on technical contribution—e.g., contributing a new project
- A Technical Advisory Committee (TAC) addresses technical community concerns such as: new projects, release planning, cross-project collaboration, and documentation practices. The TAC is composed of the Chairs for each project TSC, plus a Governing Board representative to ensure alignment between technical and business concerns. There is an elected TAC Chair who represents the technical community on the Governing Board.
- The Governing Board (GB) is limited to members and the elected TAC Chair. The GB determines allocation of funding to priorities and provides members with control over where their funding goes.
 - Strategic Members each appoint 1 representative
 - General Members can elect 1 representative for every 10 General Members, up to 3 total
 - For the first six (6) months, there will be an assignment of provisional membership to the GB of 1-3 representatives of organizations who can provide leadership and vision to ensure a smooth start to the project
 - Governing Board establishes additional committees to address topics (e.g. legal, marketing, budget)

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 special interests groups that submit a proposal and then form as an incubation project.



Transparency

All project governance documentation can be found at:

<https://wiki.lfenergy.org/display/HOME/LF+Energy>

The screenshot shows the LF Energy Wiki homepage. The left sidebar includes links for LF Energy, Blog, Space Shortcuts (Charter, Code of Conduct, GitHub, Landscape, New Project Proposals), Page Tree (LF Energy Community Calendar, Governing Board, Technical Advisory Council, Project Governance, LF Energy Projects, Technical Frameworks, Special Interest Groups, Resources), and Space tools. The main content area features a large "LF ENERGY" logo with the tagline "LF Energy is a Linux Foundation project that provides a vendor-neutral home focused on building shared open source infrastructure to deliver unprecedented innovation in renewable energy, power electronics, electric mobility, and more." Below this is a section about Current Projects, which is a table with the following data:

Name	Description	Assets	Stage
GXF Grid eXchange Fabric Control and Monitor Smart Devices	Grid eXchange Fabric (GXF) allows you to monitor and control hardware in the public space. With several (generic) functions ready to use, the main benefits of GXF are: scalability & high availability, high security, its generic design, and no vendor lock-in.	Wiki page on this server Web page on lfenergy.org Code repository on github.com Grid eXchange Fabric (GXF) Mailing List	EARLY ADOPTION
RIAPS An Effective Distributed Software Platform for Smart Grid Apps	The Resilient Information Architecture Platform for Smart Grid (RIAPS) provides core infrastructure and services for building effective, secure and powerful distributed Smart Grid applications.	Wiki page on this server Web page on lfenergy.org Code repository on github.com RIAPS Mailing Lists	EARLY ADOPTION
PowSyBl A High-Performance Computing Framework For Grid Simulation and Planning	PowSyBl provides the code building blocks for the simulations and analyses of power systems, for horizons from real-time operation to investment planning.	Wiki page on this server Web page on lfenergy.org Code repository on github.com PowSyBl Mailing Lists	EARLY ADOPTION
OperatorFabric A Smart Assistant For System Operators	OperatorFabric is a modular, extensible, industrial-strength and field-tested platform for use in electricity, water, and other utility operations.	Wiki page on this server Web page on lfenergy.org Code repository on github.com OperatorFabric Mailing Lists	EARLY ADOPTION
OpenEEmeter		Wiki page on this server	

LF Energy Members

Strategic Members



Le réseau
de transport
d'électricité



General Members



CloudBees®

elering

ENERGINET



MONASH
University



RECURVE



Sony CSL

Tennet

Savoir-faire
LINUX

Statnett

UNICORN

WIND™

Associate Members

RWTH AACHEN
UNIVERSITY

ElaadNL

ENERGY FOUNDATION

entsoe

EPFL

EPRI | ELECTRIC POWER
RESEARCH INSTITUTE

FIWARE

Fraunhofer
IEE

FREEDM
SYSTEMS CENTER

FAU
FRIEDRICH-ALEXANDER
UNIVERSITÄT
ERLANGEN-NÜRNBERG

HOCHSCHULE
LUZERN

IOWA STATE
UNIVERSITY

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

openADR
ALLIANCE

PECAN STREET

Project Haystack

Stanford

The
Alan Turing
Institute

theEnergy
Coalition

UNIKASSEL
VERSITÄT

V
VANDERBILT
UNIVERSITY

W
WASHINGTON STATE
UNIVERSITY

Membership Model

QLF ENERGY

Compete on Products & Services

Marketplace

Leveraged Development & Open Source Software Ecosystem

LF ENERGY

Leadership & Support



We insure the neutral ecosystem. Collaborate and form strategic relationships across key stakeholders.

Marketing & PR



Promote your innovations and share definitive action to ALL stakeholders. Gain leading-edge insights, driving faster/better ME&O.

Training & Talent



Access to top talent and training. Expand your resources cost effectively. Develop deeper understanding of specialized subject matter.

Security



Global strength testing; beyond what any one in-house team can do. Surface and drive enhanced cyber security doctrine through insights.

Badging & Certification



Elevate the skills of your team and keep them engaged with emerging breakthroughs.

IP Legal Support



Removes IP ownership issues and costs.

Global Events



Access to global thought leaders and influencers. Seamlessly transitioned to virtual events.

Membership Benefits

Membership and Participation Levels

Membership Level	Annual Fee	Plus Linux Foundation Membership: Silver (if not a member)	Board Seat	TSC Seat	Outreach Committee	Suggested Minimum FTE*	Notes
Strategic	Flat fee: \$150k	\$20k	Yes	Yes	Yes	1	Two year minimum commitment
General	\$5k-50k based on org size ¹	Based on number of employees \$20K (5000+) \$15K (499-4999) \$10K (100-499) \$5,000 (0-99)	(Possible) 1 per every 10 General members	Based on Merit	Yes	N/A	A TSC seat may be earned by technical contribution as a project leader
Associate	No fee	No	(Provisional at start-up)	Based on Merit	Yes	N/A	Limited to academic, research and NGO organizations

General Annual Fee Scale

\$50K - > 5,000 employees

\$30K - 1,000 – 4,999 employees

\$20K - 200 – 1,000 employees

\$10K -100 – 200 employees

\$5K -< 100 employees

* FTE = Full Time Equivalent (e.g. 2 employees each spend 50% of their time on a project). This suggestion is meant to provide a minimum resource investment to ensure members are contributing technically. Most projects see much higher investment of resources than the minimum requirement.

LF Energy Membership Benefits

Details	Strategic	General
Guaranteed seat on the LF Energy Governance Board - shape where funds are directed	□	
Guaranteed seat on the LF Energy Technical Advisory Council - shape the direction of projects	□	
Host strategic and critical projects and lead industry efforts	□	
Direct oversight and influence on all of LF Energy, including access to briefing on the pipeline and inclusion of new projects	□	
Direct ability to govern and create new projects	□	
Direct influence on messaging, PR, marketing, developer events, training	□	
Budget Influence/approval, how and where the project spends money	□	
Advise member of advancing brand leadership worldwide in open source	□	
Promotion in top news outlets	□	
Placement of member brand at forefront of LF Energy web properties	□	
Participation in Linux Foundation Member Summit (Additional Seat)	□	

LF Energy Membership Benefits

Details	Strategic	General
Direct assistance with your open source strategy activities, and R&D portfolio	<input type="checkbox"/>	
Send signal that you are committed and serious about the energy transition and 100% planetary decarbonization	<input type="checkbox"/>	
Premium access to the project ED to understand business goals help you succeed in those goals any way possible	<input type="checkbox"/>	
Premium access to the LF Energy operations staff. This is across all LF Energy functions like IT and technical expertise across projects in the Linux Foundation ecosystem, Marketing, and Operations,	<input type="checkbox"/>	
Participate in any cross project strategy discussions on harmonization and future direction of LF Energy	<input type="checkbox"/>	
LF Leadership support to keynote member events, participate in outreach (eg roadshows, events, conference meet ups etc..)	<input type="checkbox"/>	
Priority for hosting LF Energy Roadshows and meetups at the location of their choice	<input type="checkbox"/>	
2x guest blog pieces on LF Energy blog	<input type="checkbox"/>	
Support for member announcements and member PRs	<input type="checkbox"/>	<input type="checkbox"/>
If member requests, LF Energy will provide quote for member press release or blog	<input type="checkbox"/>	<input type="checkbox"/>
Logo on the website once your membership has been announced.	<input type="checkbox"/>	<input type="checkbox"/>
Discount on Event Sponsorship packages	<input type="checkbox"/>	<input type="checkbox"/>

For Further Information

Shuli Goodman

Executive Director
LF Energy
sgoodman@lfenergy.org

Mike Dolan

VP of Strategic Programs,
Linux Foundation
mdolan@linuxfoundation.org

Our Website: <https://lfenergy.org>

Membership: <https://www.lfenergy.org/join/>

Mailing Lists: <https://lists.lfenergy.org>



Appendix

QLF ENERGY

The Taxonomy and glossary

Functional Architecture		Business Function	Business Function Services	Glossary (yellow = missing, red = needs revision)	Temp TR Comments, can be hidden as needed	Comment	To be included in version 1.0	from "aggregator layer"	Connection	Conn
Category	Subcategory									
Customer & Market	Metering & Compensation	Metering		Covering all the functionalities related to the customer and interaction with markets and other third parties Determination and financially handling realization of market contracts and consequences of system operation. Handles the various physical measurements (energy, power (including active- and reactive power), voltage, frequency, power quality) gathering, storage, and quality management to provide for compensation, control and / or services settlement			TRUE			
		Compensation / Settlement		Compensation and Settlement represents payment or trade of value for transactions between market actors as distinct from customer billing. Includes auditing / verification activities. Settlements are often bi-directional in nature	Added a definition, feel free to edit, Added active and reactive power	Representing trades of value, could be combined with billing if billing was less specific	We should merge them In the deck only billing remains. Definition to be update to cover Compensation/settlement	TRUE		
		Billing		Billing is supported by a combination of software and hardware components that receive consumption details and service usage information, groups this information for specific accounts or customers, produces invoices, creates reports for management / investors, and records (posts) payments made to customer accounts. Includes Auditing / Verification Activities				TRUE		
		Rewards		Monetary or non-monetary compensation for customer provided services / behaviors modified in market integrated and non-market integrated programs	This is intended to represent marketing / customer behavior program activities		Not familiar with that. Is there a link with incentives pass-through/mgt ?	FALSE	TRUE	
		Incentives pass-through/mgt		Calculates the percentage of financial incentives allocated for the production/consumption of specific categories of goods or services	Represents regulatory pass throughs to cust. Could be combined with Balance		And actually, could it be included in Compensation/settlement?	FALSE	TRUE	
Customer / Investor Relationship & Communication	Acquisition, system design, pricing Notification & communication management Emergency & crisis management Customer app/UX/UI Contract (PPA, lease,loan) CRM			Functions required to support customer / investor relationship management and communication. Functions required to acquire the right assets with the right capabilities both in long term and dynamically in short term for services Enables the delivery of information (regularly or in case of specific occurrences) to consumers / partners Communication to customers in event of outage or other reduction in services Customer centric access to energy services, or information of current state of system vs. preferences and economics.	Edited Edited Edited Edited Edited Edited			TRUE	TRUE	
	Consent management			Contractual commitment enabling development / funding of the resource, will typically include performance requirements and reporting The three main commitments of Customer Relationship Management are: Customer Acquisition: Turning prospects into customers and adding services where possible. Customer Retention: Keeping current customers happy and coming back for more. Managing Data: Tracking customer interactions and other information that can improve customer experience / network performance Consent management is a system, process or set of policies for allowing consumers to determine what information they are willing to permit their various energy companies to access				FALSE	TRUE	
Customer Response	Smart Ledgers ("distributed ledgers")			Covering the digital functionalities supporting customers providing information. A distributed ledger (also called a shared ledger or distributed ledger technology or DLT) is a consensus of replicated, shared, and synchronized digital data geographically spread across multiple sites, countries, or institutions, without a central administrator or centralized data storage		Looks good		TRUE		
	Smart Contract			A smart contract is a protocol intended to digitally facilitate, verify, or enforce the negotiation or performance of credible transactions without third party intervention, in a tractable and irreversible way.				TRUE		
	Customer Preferences			A register of customer needs, goals and economics that allows energy system to optimize delivery. Allows users to configure variousied interacting with digital energy services provided by the utility/local energy community. -> device settings: thermostat settings, storage back-up reserve, water heater settings, over-ride, EV charge schedule	This is a critical aspect of the above two items. Preferences are essential to give flexibility in delivery which reduces cost and system demand			TRUE	TRUE	
Market Platform				Platforms allowing energy market participants to retrieve and provide market information and engagements (e.g. providing energy consumption details to energy suppliers). Trading Platform to ensure short-grid stability by injecting or absorbing power depending on observed local conditions or based on remote dispatch request				TRUE		
	Power Exchange			Trading Platform long-term grid reliability by procuring the appropriate amount of power supply resources needed to meet predicted energy demand X years in the future	Edited			TRUE		Market signals generated
	Capacity platform			Trading Platform to insure system balance and frequency, as production and consumption levels must match during the operation of electric power systems.	Edited			TRUE		
	Balancing market			Availability Platform calculates the proportion, expressed as a percentage, of the total Available Time during which assets or services are available.	Edited			TRUE		
	Availability							TRUE	TRUE	

<https://docs.google.com/spreadsheets/d/1snoRu-gBvY1RbpVCUpnpMF1fZQqWRd14SfWwzh1Od4/edit#gid=0>



LF Energy

Data Architecture Working Document

<https://docs.google.com/document/d/1QcHqPRSmUUJQIJnfygGDkOpDPIld6U1V22pBuvZvDYk/edit?pli=1#>