

LF Energy Foundation

November, 2018

 THE **LINUX** FOUNDATION

Introduction



The Energy Transition

- There are many technological innovations—renewable energy, batteries, power electronics, electric mobility, blockchain, and rapid digitalization
- And many business model innovations—rapid integration of distributed energy resources, decentralized markets, and P2P energy exchanges--that are driving differentiation and commodification across the energy sector leading to the electrification of everything
- All of this is being driven by intense political and societal changes— national and regional efforts, local initiatives, and global climate demands

The external environment is evolving quickly, and it demands that we evolve more rapidly than we have ever adapted in the past. We believe we are in danger.

The solution is an open source initiative
for the power systems industry

Announcing the LF Energy Foundation

Open Source for the Energy Transition

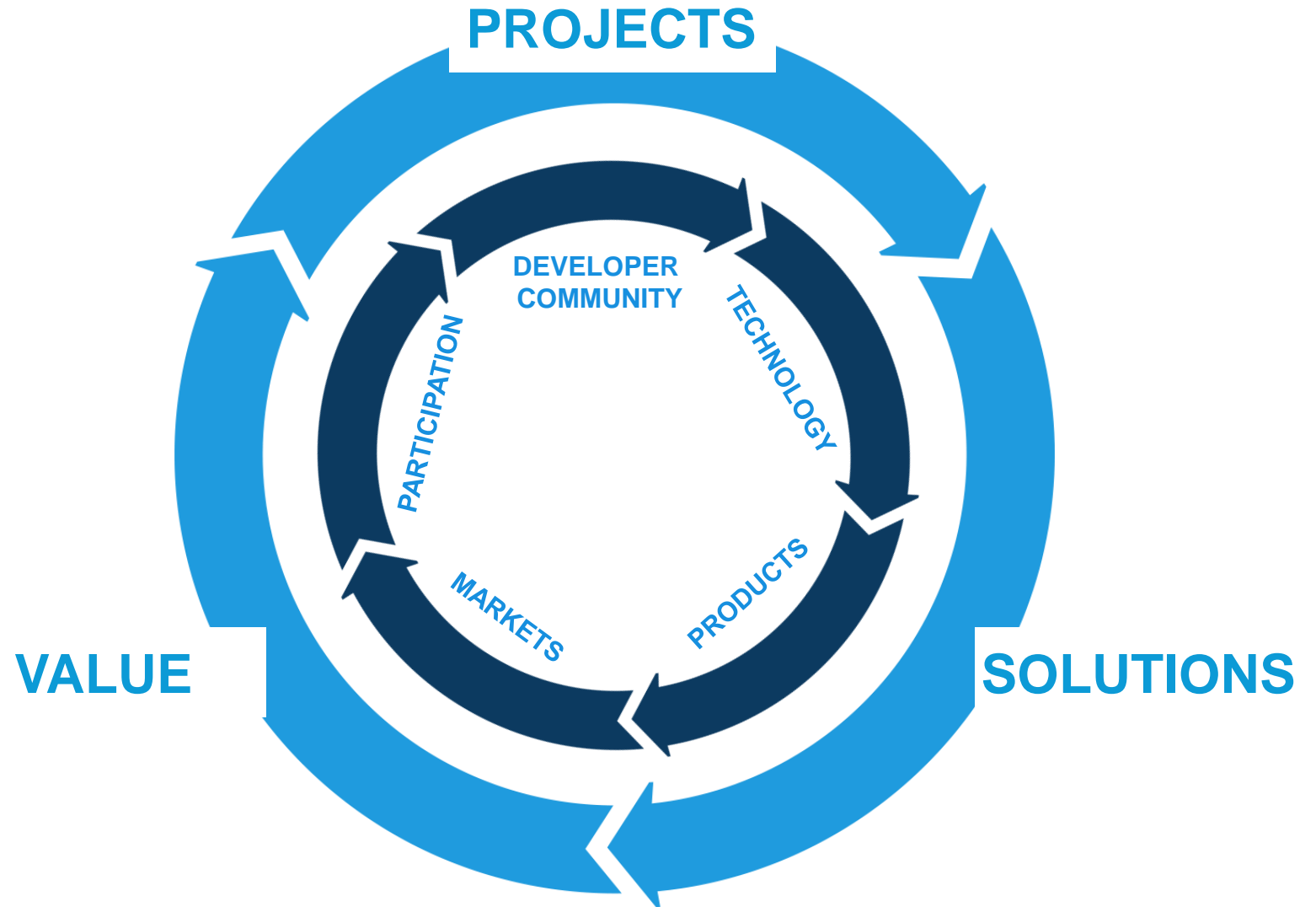
- LF Energy is a Linux Foundation project that supports multi-vendor collaboration and open source innovation in the energy and electricity sectors.
- LF Energy was created to support numerous ICT projects within this important space.
- LF Energy members are collaborating on several independent technical projects to accelerate the energy transition, including the diffusion of renewable energy resources, electric mobility, and connected sensors and devices—while modernizing and protecting the grid.

What is Multi-Vendor Open Source?

- Open source is a software development method that harnesses the creativity of global industry experts and the power of multiple organizations, including competitors, for distributed and collaborative development.
- Open source results in better quality, higher reliability, more flexibility, lower cost, faster times to market, increased innovation, and the opportunity to drive open standards.
- Open source software is modular and enables open APIs so members of the community can “scratch their own itch” and contribute back to the community in a virtuous cycle.
- Open source is not the death of IP or innovation. Open source facilitates standardizing, normalizing, and removing competition for shared “plumbing” to expedite the delivery of new products and services and market differentiation.

Our Strategy: Create A Sustainable LF Energy Ecosystem

Successful open source projects depend on members, developers, standards and infrastructure to develop products that the market will adopt.



The LF Energy Ecosystem Exists to Drive Value

Open source has enabled the digital transformation of telecommunications, financial services, automobiles, healthcare, consumer products, and the explosion of technology platforms.

The same model is now shaping power systems

YOUR VALUE

Spend your valuable time and resources developing the 20-30% that is **your secret sauce**.

**LF ENERGY
SOFTWARE
STACK**

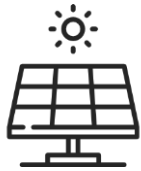
Multi-vendor open source: collaboratively develop and support 70-80% of the starting point for a production-ready project – collaborating across the industry in order to **achieve scale and value FASTER!**

LF Energy Benefits

- Enable de-facto standards of open source, reusable components that implement common APIs and interfaces
- Neutral and transparent governance
 - › Collaborative development between many companies and entities
 - › Community norms that ensure strategic inputs from end-users
- Provides shared plumbing and functionality [similar to Linux OS facilitating growth of the Internet]
 - › Lower cost, by sharing development of common elements
 - › Faster systems integration—avoiding stranded investments, and removing the risk of vendor lock-in
- Enable an ecosystem of “ready” suppliers for hardware, software, UI, services, applications
 - › A global developer ecosystem
 - › Universal set of drivers to encourage fast project starts

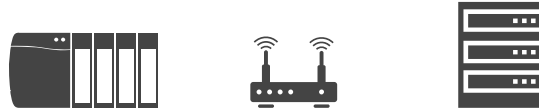
Stakeholders Have Different Value Propositions

Utilities & System Operators



Can deploy solutions quickly and easily with the flexibility to dynamically adapt to changing business needs

Hardware OEMs



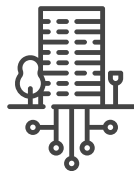
Scale faster with an interoperable partner ecosystem and more robust security and system management

ISVs



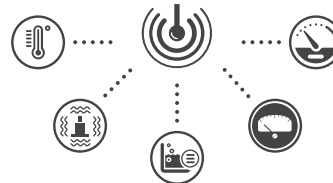
Interoperate with 3rd party applications and hardware without reinventing connectivity

End Users



Able to contribute to and influence the features and design of advanced power systems for the future

Sensor Device Manufacturers



Write a device driver with your selected protocol once using the SDK and get pull from all Solution Providers

System Integrators



Get to market faster with plug-and-play ingredients combined with your own innovations

The Need for Safe, Shared, Scalable Code

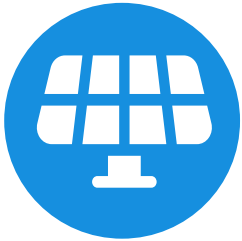
“No single entity can create, test, and scale the code necessary to bring this new grid to life. We propose that, like other industries, we turn to open source.”

Gabriel Bareux, Deputy Director of Information & Communication Systems, RTE

- Most industries today run primarily on open source modules and APIs creating a platform that a global community of software developers can enhance, test and build upon to deliver new products and services. Power systems ICT can learn from others who have gone before us!
- Open source supports business agility, while preserving IP, by standardizing, normalizing, and removing competition for shared components.
- Open source code is more flexible, economical, and safer than any alternative.

LF Energy Can Address These Use Cases

CONNECTED ASSETS



Connecting a DER network of networks

Interoperability to facilitate distributed control applications

Decreases the costs and time for systems integration

CONNECTED BUILDINGS



Control & management of energy for buildings

Building control enables managers to shape demand and resources

Increases intelligence to lower costs and support building resilience

CONNECTED VEHICLES

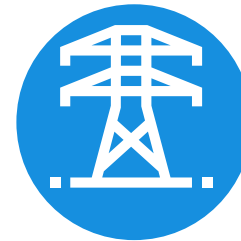


Enabling EV infrastructure

Digital connectivity to coordinate vehicles as load and resource

Provides critical grid resilience while on-boarding new mobility solutions

CONNECTED INFRASTRUCTURE



Optimization of the distribution system

Grid edge integration to enable the utility of the future to be responsive

Allows us to scale DER and new technologies safely and reliably

CONNECTED MARKETS



Opening new markets

Digital infrastructure that supports micro and bulk transactions of DER

Unleashes new markets that drive innovation

CONNECTED HOMES



Making homes smart

Digital foundations for net zero homes

Provides consumers with choice will offering critical load shaping capacity

Starting the Technical Collaboration

RTE is contributing three significant projects to The Linux Foundation to form LF Energy. These projects will fuel an entire open source ecosystem for TSOs, DSOs, utilities, aggregators, generators, vendors, and other power system stakeholders:



OperatorFabric A smart assistant for system operators. An industrial strength, field tested, extensible and flexible grid operations platform that provides strategic management of information with a modular approach to applications, easy-to-add new functionality, and open APIs. For use in electricity, water, and other utility operations.



Let's Coordinate An extensible solution of « OperatorFabric » that enables organizational power system coordination, visibility, communication, and workflow between actors (e.g., across national and regional boundaries).



PowSyBL A framework of reusable modular components for a high-performance computing platform that enables grid modeling (e.g, CGMES) & simulation in a highly distributed energy resource environment from system expansion studies to planning and operation.



Vanderbilt University is contributing RIAPS an ARPA-E project.

Resilient Information Architecture Platform for the Smart Grid (RIAPS) A software platform to build and operate distributed real-time applications that provide new functions and improve the performance of Smart Grids. The Microgrid Synchronization application implements microgrid synchronization. The RIAPS platform provides software-defined decentralized controllers to enable transactive energy applications. Finally, the enhanced capability design enables resource management, fault management, time-sensitive messaging and distributed coordination services.

This is only the start. What are your strategic projects that could benefit from open community development?

LF Energy Membership

- LF Energy, like other projects of the Linux Foundation, is funded through membership dues and contributed engineering resources
- Membership levels include: Premium, General
- Government entities, academic and nonprofit organizations can join as Associate Members
- Governance:
 - › Governing Board handles the budget, strategy and marketing
 - › Projects encompass the core day to day activities of collaboration and managing their own communities and releases, overseen by a Technical Steering Committee of the core maintainers/committers
 - › Technical Advisory Committee is a blend of architect and project reps and determines what projects come in, coordinates activities across project communities

LF Energy Membership Tiers

> Premier: \$150,000 annual dues plus Linux Foundation Membership (if not an LF Member); initial 2-year commitment

- Appoint one (1) representative to the Governing Board
- Appoint one (1) representative as a voting member in any subcommittee or activity of the Governing Board
- Appoint one representative to a TSC (for initial 6 months)
- Enjoy most prominent placement in displays of membership
- Access to LF's invitation-only Open Source Leadership Summit
- Ongoing, individual engagement with [Connected Energy Initiative] executive director and staff

> General: \$5,000 to \$50,000 annual, based on employee count, plus LF Membership (if not an LF Member)

- Participate as one of up to three (3) General representatives to the Gov. Board (1 representative per 10 GMs)
- Earn a TSC position through leadership in the community
- Enjoy prominent placement in displays of membership
- Ongoing engagement with executive director and staff

■ Associate (for academic, nonprofit and government entity organizations)

- Limited to pre-approved organizations
- Entitled to identify their organization as an Academic or Non-Profit supporting the mission with other benefits determined by the Governing Board
- No fee, no membership required

Non-members may participate fully in the technical community with contributions, earn committer, or TSC roles on merit.

Membership and Participation Levels

Membership Level	Annual Fee	Plus Linux Foundation Membership: Silver (if not a member)	Board Seat	TAC Seat	Outreach Committee	Suggested Minimum FTE*	Notes
Premier	Flat fee: \$150k	Based on number of employees	Yes	Yes	Yes	1	Two year minimum commitment
General	\$5k-50k based on org size ¹		(Possible) 1 per every 10 General members	Based on Merit	Yes	N/A	A TAC 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, nonprofit and government entity 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 Governance Roles (In Detail)

- 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.
 - › Premier 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.
 - › Premier 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)

Get involved – visit LFenergy.org

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