Empowering the Masses with Open Renewable Energy Systems (ORES)

Energy systems are evolving quickly to cope with the challenges of climate change. Explore the benefits of open renewable energy systems and their core architecture components, gaps and opportunites.

Chris Xie
Head of Open Source Strategy, Futurewei
Chair of Marketing Advisory Committee, LF Energy

Overview of Energy Systems

Centralized Energy Systems

- Use mostly non-renewable resources, 16% renewable
- Far from consumption sites
- High transmission costs and losses
- Reliability & Vulnerability to Disasters
- Pollution & Resource Depletion

Decentralized Energy Systems

- Use renewable resources
- Modular and flexible
- Closer to consumption sites
- Reduced transmission costs and losses

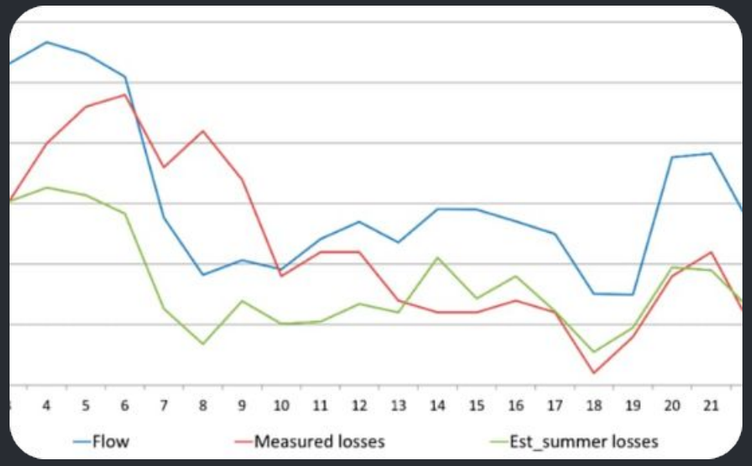
Open Source Distributed Renewable Energy Systems

- Decentralized & modular
- Built and maintained by the community
- Fast iteration, innovation, and accessible

Challenges of Centralized Energy Systems

Pollution

- Rely on non-renewable resources like coal, oil, and gas
- Highly polluting
- Contribute to climate change
- Cause environmental degradation
- Produce toxic waste that is difficult to dispose of



Transmission Costs and Losses

- Located far from where energy is consumed
- Result in high transmission costs and losses
- Require complex and vulnerable grid infrastructure
- Prone to outages and cyber attacks

Lack of Resilience and Flexibility

- Vulnerable to natural disasters, terrorist attacks, and other emergencies
- Less flexible than decentralized systems
- Decentralized systems can adapt to different contexts and needs

Introduction to Open Renewable Energy Systems (ORES)

1 Renewable Resources

- Clean, abundant, and free
- No toxic waste or fuel costs
- Solar, wind, and geothermal resources

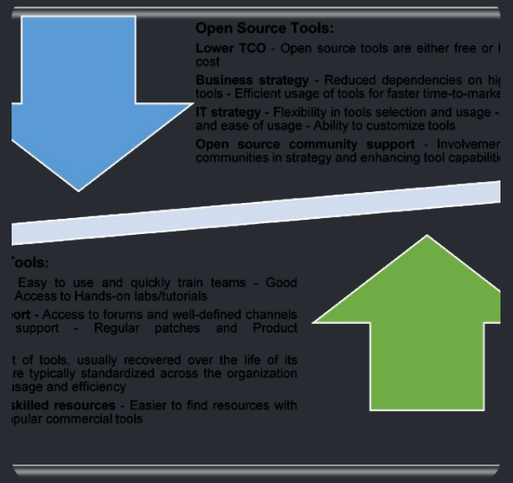
2 Modularity and Flexibility

- Built to fit different contexts and needs
- Combined with other technologies
- Energy storage and demand response

3 Locality and Self-Sufficiency

- Built closer to energy consumption
- Reduces transmission costs and losses
- Communities more self-sufficient and resilient

Benefits of Open Renewable Energy Systems

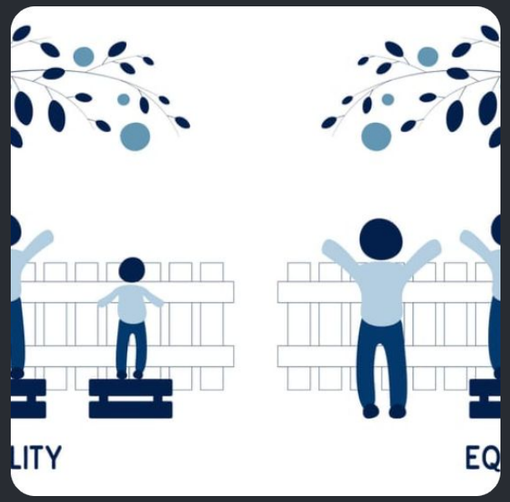


Lower Costs

- Built and maintained by a community
- Reduces costs and risks

Increased Innovation

- Freely modified and improved by a community
- Results in increased innovation



Greater Access and Equity

- Adapted to different needs
- More accessible for marginalized people and regions

Core Architecture Components

Renewable Energy Sources

- Solar
- Wind
- Geothermal

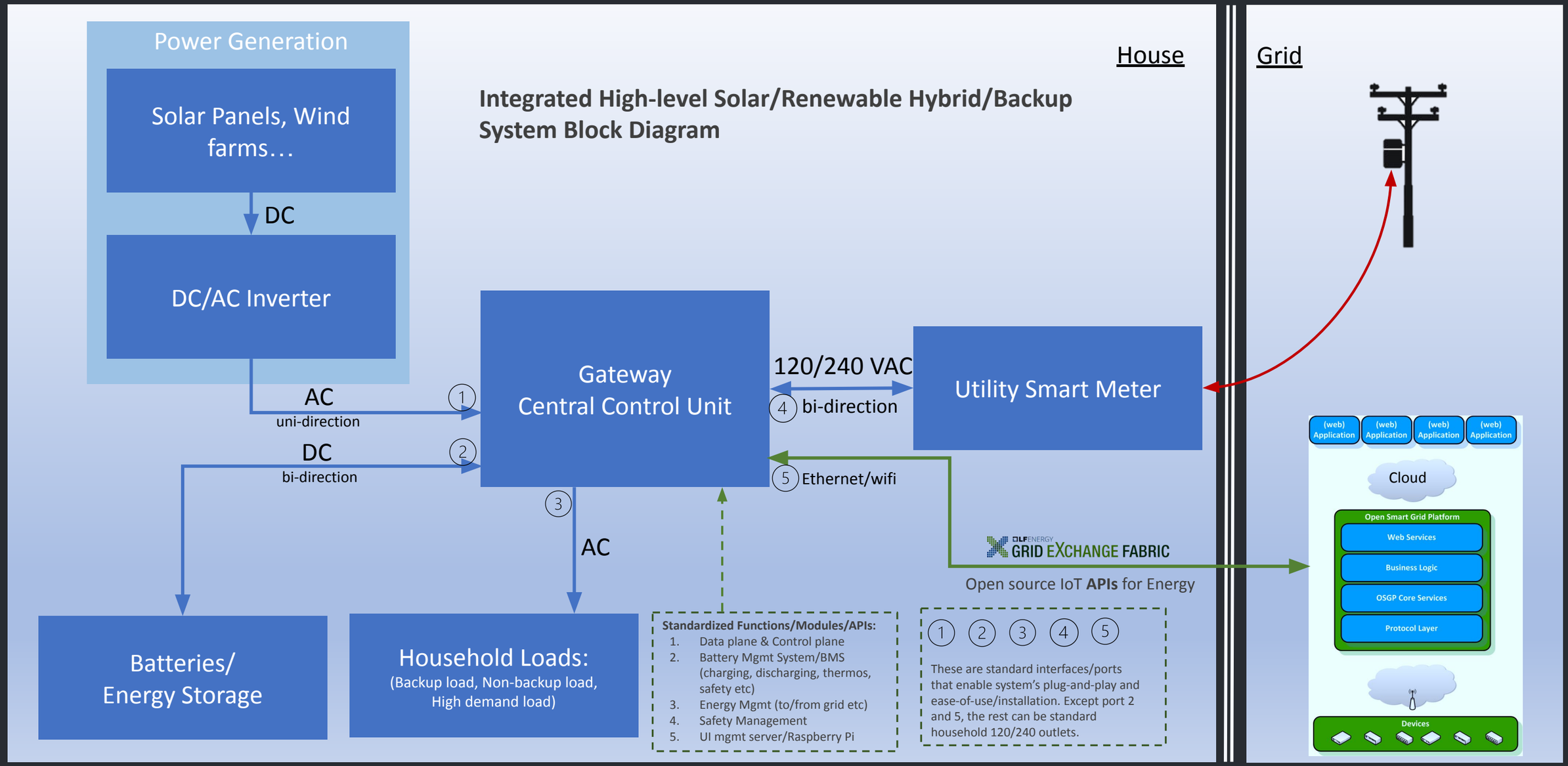
Energy Storage and Management

- Batteries
- Hydrogen
- Thermal storage

Monitoring and Control

- Sensors
- IoT devices
- Software apps

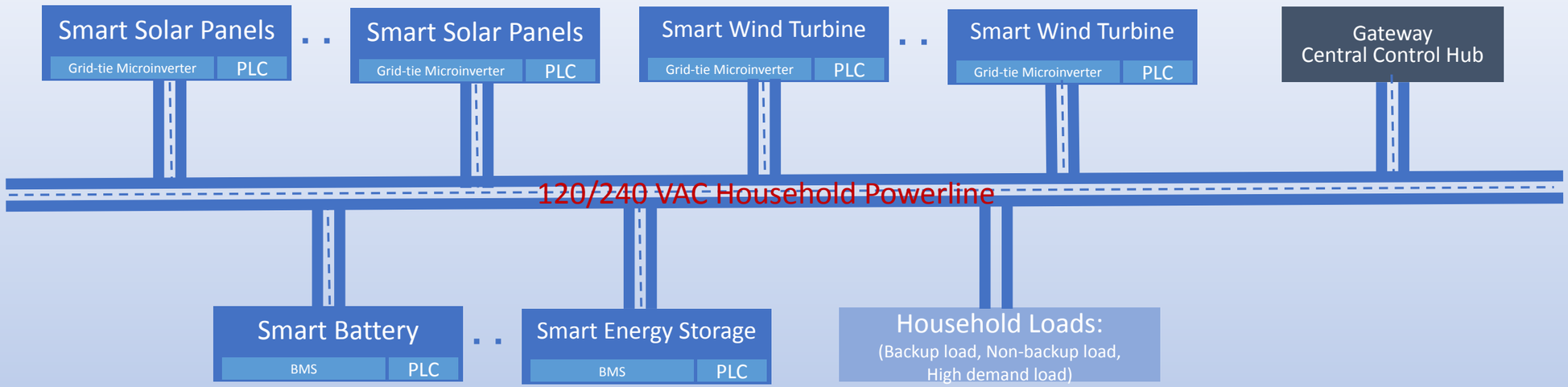
Integrated ORES Block



Disaggregated ORES Architecture and APIs

Disaggregated Smart Household Renewable Hybrid/Backup System Block Diagram

House



System Functional Specifications:

1. PLC: Power Line Communication: allows sending control signals over powerlines, open source hardware/software protocols
2. ═══ Standard household power lines
3. - - - - Virtual/Control lines/signals running through the power lines
4. Each module can work independently, e.g. the system can have one battery, one hub, or one solar panel, one hub, or simply any one module can be plugged in to work its functions.
5. Linearly scalable: new modules can be added on with plug-and-play, energy storage/battery devices, smart batteries can be added over time, and can be configured to charge during night when rate is low, and discharge during day time when rate is high, etc.

Central Hub Functional Specifications:

1. Grid friendly
2. As an node/agent on a decentralized grid network, cooperate with other Hubs on the Grid or local network, to enable info exchange, energy trading etc
3. System management(mgmt): Monitor and Control
4. Device mgmt
5. Cloud mgmt/interface
6. Mgmt server

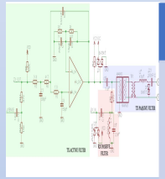
Key Benefits:

- Simplicity, enables plug and play over existing household power lines
- No need to modify electric panel or install power inlet
- Horizontally scalable
- Reduce significant cost of system installation, 50% off

Components on the market

Portable Power Station

- Isolated
- Can't connect to Grid
- Commercial Reference link



Power Line Communication

- Open Source
- As a reference design
- Link

Wind Turbine

- More efficient than solar panel
- US$5k
- Link

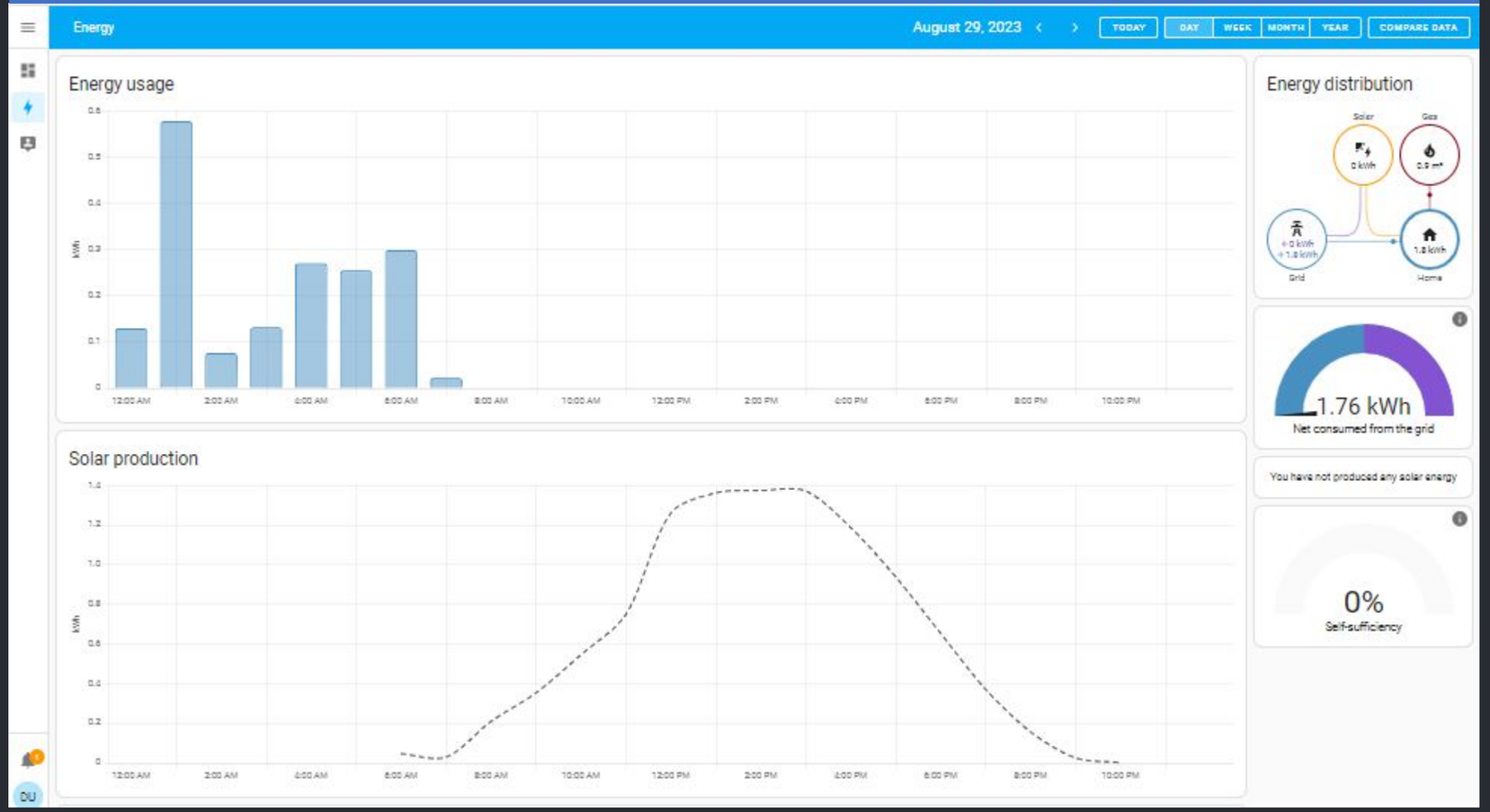
Central Control

- Integrated
- Needs common protocols

ORES: Integrate and Innovate

Integrate when there are available solutions, Innovate when there is a gap.

Open Source Home Energy Management: Home Assistant



Open/DIY Solutions

Commercial Solutions Examples

Solar-ready, do-it-yourself (DIY) offgrid battery, from 4.3 kWh to 27.6 kWh, comes with a pre-wired, single-phase AC inverter, starting at **$6999**, not including solar panels

Gaps

Cost

Available components

Policy & regulations

ORES: Technical Working Group at LF Energy

Open source / DIY kits with ease of installation

Affordability: Panels, Batteries, etc

Seamless Integration with Grid

Disaggregation, Interoperability, Scalability, Efficiency

Empowering Safe and Legal code-compliant installations

- Addressing these technology challenges requires collaboration between researchers, manufacturers, utilities, governments/regulators, and communities.
- Open source initiatives and innovative partnerships can play a significant role in technology innovation and low-cost renewable energy solutions.

ORES: Policy & Regulation Working Group to Address Gaps & Requirements

Equipment

Hardware and software Standardization and Interoperability

One-stop shopping for Streamlined Permitting

Grid Upgrade to adapt to massive DER

Regulations

Improved Net Metering Policies to encourage DERs

Policy and regulations to promote Local Energy Marketplaces

Tax, Liability, Insurance

From Residential to Services:
Empowering Energy Services

Community Solar Farms

The Brooklyn Microgrid is a community-led initiative using blockchain to enable local, peer-to-peer solar energy trading for resilience and sustainability.

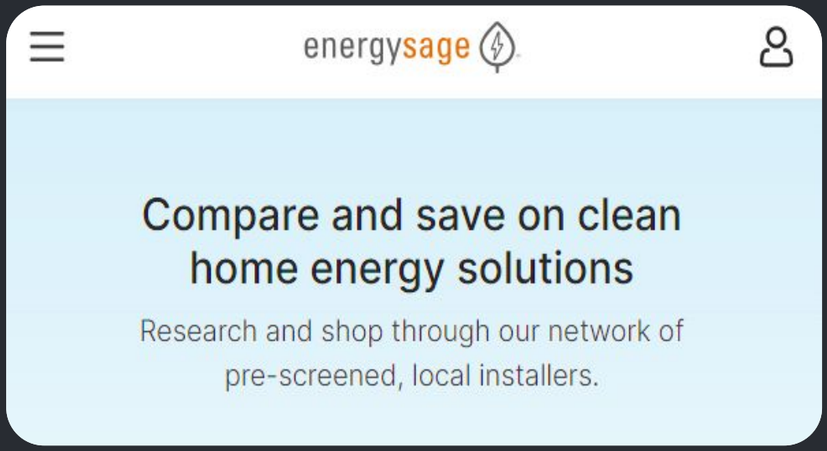
https://www.brooklyn.energy/

https://www.communitysolarplatform.com/

Off-Grid Microgrids

Renewable energy systems that are designed and operated for communities not connected to the centralized grid.

https://www.gogla.org/



Smart Home Energy Management Systems

Renewable energy systems that allow households to monitor, optimize, and control their energy consumption.

https://www.energysage.com/

Build standard specifications from residential to VPP & Energy Marketplaces to enable multiple “Energy Appstores” for the masses

The Future of Renewable Energy

- **Democratization:** create reliable and affordable renewable solutions
- **Infrastructure:** upgrade Grid for massively decentralized systems.
- **Innovation:** open source innovation and fast iteration
- **Policy & Regulation:** update for a future of decentralized energy
- **Resiliency & Security:** Self-sufficiency and self-sustainability

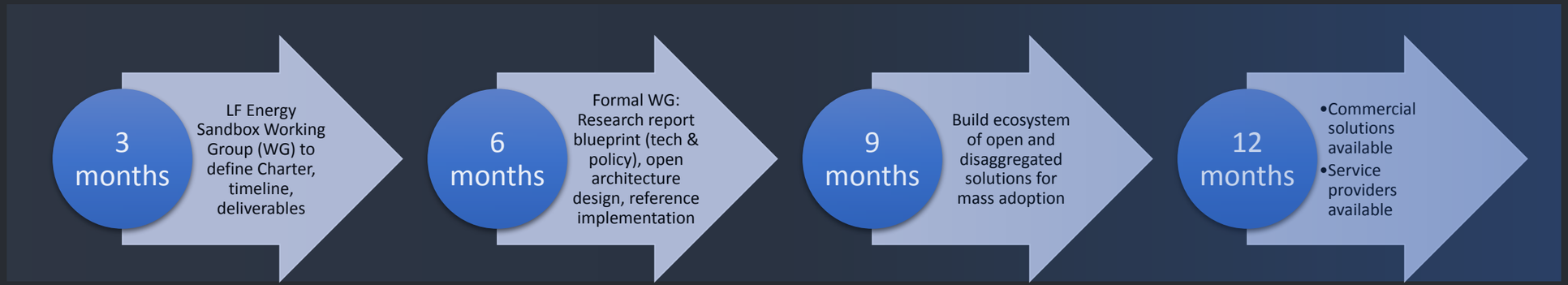
Together, we can create open source solutions that are innovative, sustainable, and accessible. By embracing decentralized energy, we can create a more equitable and resilient energy future for all.

Our Vision: Generating power will be as easy as plug it in!

Scan to connect!

Summary Action Items and Next Steps: Join the Conversation, Seeking Synergetic Partnerships for a Brighter Energy Future, For All

Technology	Policy, Regulations, Standards	Incumbents	BD and Marketing	Personas:
• Define roadmap for technical architecture, standard modules, functions, interfaces, tech requirements • Identify partner ecosystem of vendors and suppliers to build reference implementations, proof of concepts	• Recruit standard setting experts and organizations, regulators and policy makers • Identify the gaps and pathways to promote the distributed energy solutions	• Recruit Utilities to get buy-in • Focus on benefits: ✔ increased efficiency ✔ new business models and opportunities, ✔ reduced risk and liabilities, ✔ elevate Utilities from dumb pipes to smart service providers.	• Advocate the project vision in various open source conferences and organizations • Recruit members	• Academia/researchers • Manufacturers • Utilities • Governments/regulators • Open source communities



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ORES Charter

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