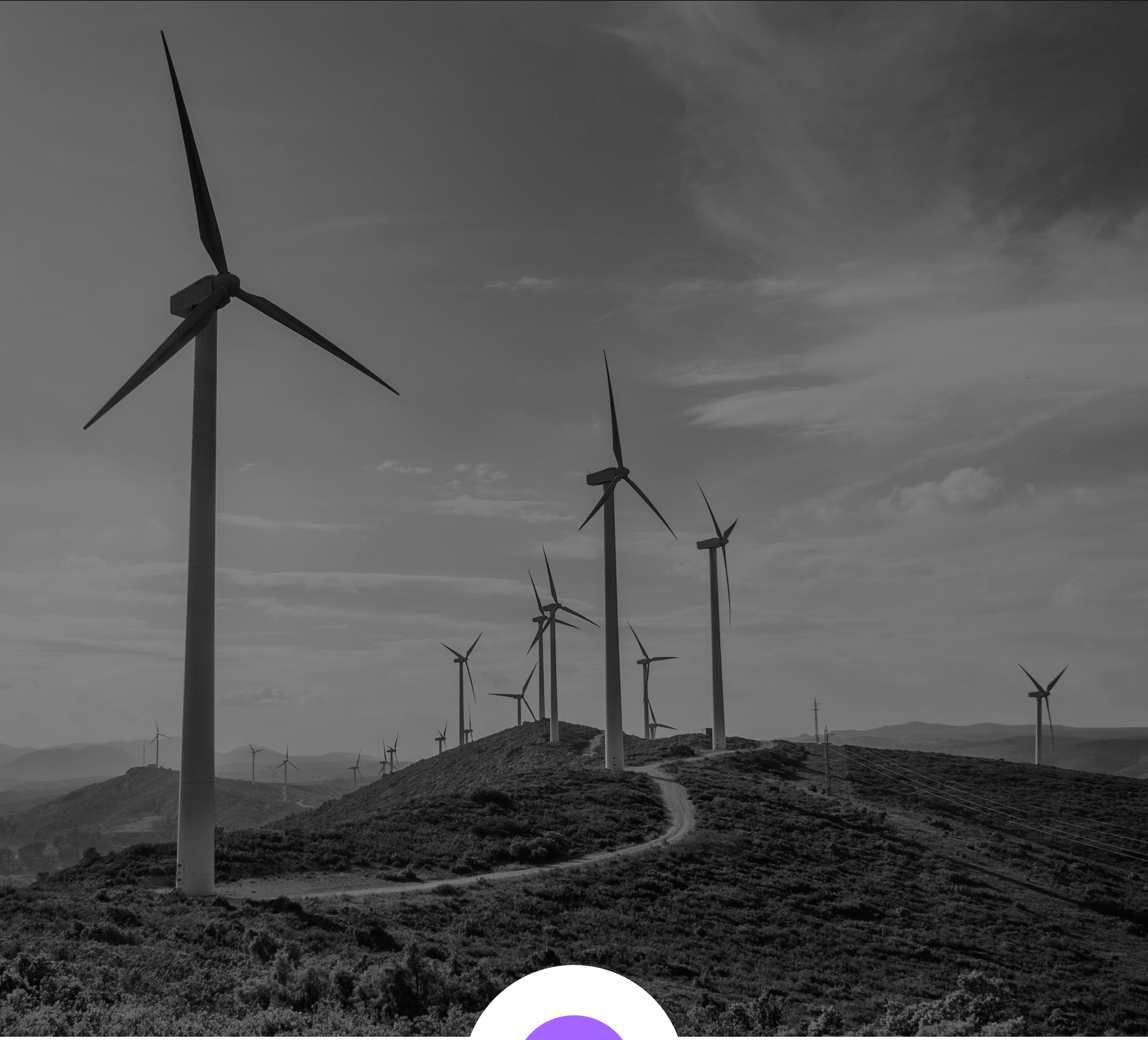

The Energy Web Chain

Accelerating the Energy Transition with an Open-Source, Decentralized Blockchain Platform

Version 2.0 | July 2019

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About Energy Web Foundation

Energy Web Foundation (EWF) is a global, member-driven nonprofit accelerating a low-carbon, customer-centric electricity system by unleashing the potential of blockchain and decentralized technologies. EWF focuses on technology integration and development, co-creating standards and architectures, speeding adoption, and building community.

In mid-2019, EWF launched the Energy Web Chain, the world's first enterprise-grade, open-source blockchain platform tailored to the sector's regulatory, operational, and market needs. EWF also fostered the world's largest energy blockchain ecosystem, comprising utilities, grid operators, renewable energy developers, corporate energy buyers, and others.

The Energy Web has become the industry's leading energy blockchain partner and most-respected voice of authority on energy blockchain.

For more, visit **https://www.energyweb.org**.

Disclaimer

This is a living document. It is an ongoing mechanism to explain current and planned technical and governance features of the Energy Web Chain (EW Chain), as well as to elicit feedback from energy market participants, regulators, and blockchain developers.

The production Energy Web Chain was launched in June 2019, but EW Chain technical features and governance mechanisms will continue to evolve over time. This paper's intent is not to provide definitive answers, but rather describe EWF's leading hypotheses and approaches to development in order to encourage active collaboration with organizations at the nexus of blockchain and energy. We will actively revise this document as we continue to gather input, test, develop, and iterate.

This is version 2.0.

Feedback

This document is a snapshot of our thinking at the time of writing. We welcome your input and feedback, so that we can continue to improve our service to our Affiliates and the broader blockchain community.

Please submit questions, comments and suggestions, revisions, etc. via Github:
https://github.com/energywebfoundation/paper

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Executive Summary

As an entrepreneurial nonprofit foundation building the open-source, blockchain-based, digital infrastructure for the energy sector, three core themes define the Energy Web Foundation and our work:

1. Community

EWF has assembled over 100 energy and blockchain Affiliates, including several of the biggest energy players in the world and many of the most successful innovators in the energy blockchain space. It is deliberately diverse geographically—global in scope—and includes utilities, grid operators, renewable energy and cleantech companies, blockchain developers, startups, and others.

2. Technology

As an integrator and, where necessary, developer of decentralized technology solutions, EWF built and launched a global, blockchain-based software infrastructure: the Energy Web Chain. The EW Chain, in its current instantiation, is a publicly-accessible network with permissioned validators hosted by EWF Affiliate organizations. It relies on a Proof-of-Authority consensus mechanism with capacity for a 30x performance improvement and 2–3 orders of magnitude lower energy consumption compared to Ethereum.

EWF also runs two test networks to support research and innovation in the energy blockchain space: Tobalaba, EWF's beta test network, is a pure sandbox environment for experimentation; Volta, EWF's pre-production staging network, is used for testing updates to the production EW Chain client.

In addition, EWF is continuously developing software and hardware modules to lower the cost of application development and enable developers to focus on their core differentiators. The EW Chain launched in June 2019 with a novel governance roadmap that encourages further innovation. It is designed—both technically and in terms of governance—to be future-proof.

3. Delivery

Since its founding in January 2017, EWF's main objective was to launch an energy-specific blockchain by Q2 2019. With the launch of the production EW Chain in June 2019, we have created a global blockchain infrastructure that we believe to be the only public, Proof-of-Authority blockchain supporting commercial applications with well-known organizations as validator nodes.

In addition, EWF has developed toolkits (SDKs)—software focused on the most common needs of our ecosystem--to streamline the development of applications ranging from energy attribute certificates markets, to electric vehicle charging solutions, to grid flexibility management platforms.

EWF has grown to a full-time staff of over 30 professionals from the energy, technology, and financial sectors. We continue to leverage the strengths of EWF co-founders Rocky Mountain Institute (RMI), a US-based energy think tank with a proven track record in building energy-focused communities, and Grid Singularity (GSy), a Berlin-based energy blockchain developer recognized by the World Economic Forum as one of the most innovative startups globally in 2018. In addition, our software and hardware delivery capabilities are augmented through strategic partnerships with Parity Technologies and Slock.it.

Our Vision

What do we hope to create in the energy sector by 2025?

EWF's mission is to accelerate a low-carbon, customer-centric electricity system using blockchain and decentralized technologies. We aim to bring blockchain technology from "boutique" to "industry" in the energy sector, enabling pioneering market and business models that provide clear societal, environmental, and economic benefits.

> "With the launch of the production EW Chain in June 2019, we have created a global blockchain infrastructure that we believe to be the only public, Proof-of-Authority blockchain supporting commercial applications with well-known organizations as validator nodes."

Our Principles

What guides our work?

To achieve our vision of widespread adoption of mass-market blockchain applications that support a decentralized, democratized, and decarbonized energy system, we are following several principles:

1. Focus on proving the value in one sector—energy,
2. Form interdisciplinary teams of experts,
3. Build a collaborative ecosystem with representatives from across the sector,
4. Build software and tools to accelerate commercial applications,
5. Use innovative governance to balance the benefits of decentralization with regulatory oversight, and
6. Provide open-source, publicly-available foundational technology that solves common developer needs.

Our Ecosystem

Who is involved? What are their roles?

We strongly believe the value of blockchain is captured through active community participation and partnerships. Not only is our open-source technology development collaborative by nature, but the way we operate and bring together developers, regulators, and energy companies (our "ecosystem") is collaborative by design.

Our Software Development Toolkits

What are we building? What is the status?

Software development toolkits (SDKs) are publicly-available hardware and software components built on the EW Chain to accelerate application development. EWF has thus far built three initial versions:

1. EW Origin: a reference application showing the transformative power of blockchain in renewable energy certificate and carbon accounting markets,

2. EW Link: a set of architectures and standards for securely connecting physical devices to the blockchain, enabling them to independently communicate and transact, and

3. D3A: a vision and simulation tool for localized, democratized electricity markets enabled by blockchain.

Moving forward, we will continue to develop these SDKs and add others based on input from the ecosystem.

Our Governance

What makes it unique? What are the benefits?

The rules and processes for making decisions about how the EW Chain operates are crucially important; the network will interact with mission-critical energy infrastructure. Regulatory oversight is required not only to ensure that the EW Chain maintains the stability and safety of energy systems, but also protects consumer interests. At the same time, the global energy blockchain community must be empowered to influence the evolution of the network over time. The EW Chain governance structure has been designed to balance the benefits of decentralization with the oversight needed for regulatory acceptance.

Our Technology

What is our approach? What exists so far?

The EW Chain is an open-source, publicly-accessible blockchain derived from the Ethereum technology stack. It is designed specifically for energy-sector applications, using a Proof-of-Authority consensus mechanism to significantly increase transaction capacity and decrease energy consumption compared to the Ethereum mainnet and other public blockchains. The EW Chain supports novel privacy preservation and permissioning features that make it possible to control data access for competitive and/or regulated energy market applications, in addition to providing technical solutions for secure, low- cost, and efficient integration with hardware (e.g., smart meters). More importantly, EWF has technical development capabilities and resources to continue to develop the EW Chain infrastructure to address the needs of the energy blockchain community, allowing developers to focus on moving their applications swiftly from “proof of concepts” to actual deployment in production environments at scale.

Our Roadmap

What are we working on next?

We will continue to cultivate an active ecosystem of Affiliates, test and refine the existing features on our testnet, build additional features, test and develop a functioning decentralized on-chain governance model, refine our three software SDKs, and launch additional SDKs and tools.

Our Token Secured Operating Model

Why is it needed? How does it work?

As with most public blockchains, the EW Chain features a native first-layer utility token, the Energy Web Token (EWT). Native tokens, intrinsic to a platform’s protocol, serve two main purposes: a) security and b) validator compensation (via transaction fees and/or block validation awards). A total of 90 million EWT have been created to operate the EW Chain and an additional 10 million will be released over ten years as a block validation award.

Our Vision

What do we want to create in the energy sector by 2025?

Energy Web Foundation's overarching objective is to accelerate the global transition to a decentralized, democratized, decarbonized, and digitalized energy system. We do this by unleashing blockchain's potential across the energy sector. To be certain, blockchain technology is not a singular solution; it is one of many tools that will influence the evolution of energy systems. However, we believe blockchain has the potential to play a critical role in transforming energy markets. Below are three specific examples of how blockchains enable our vision, followed by an explanation of the broader trends made possible by introducing blockchain to the energy sector.

Decarbonization: Community solar

Community solar was invented to provide renters and owners of multi-family buildings a way to capture the benefits of solar energy without installing solar panels on their own roofs. A community solar project is normally a ground-mounted solar installation, which tends to be cheaper per installed kW than a rooftop installation and whose ownership and benefits are shared by the community.

Soft costs—the costs of a project that come on top of the actual equipment and installation, such as legal fees, permitting, interconnection, administration, customer acquisition costs—are proportionally higher for community solar projects due to their complexity, often rendering these projects cost prohibitive.

Blockchain technology can help reduce soft costs considerably. Using smart contracts, a community can establish partial asset ownership, governance, and profit division so the entire process of owning one piece of an asset is automatic, trusted, seamless, and cheaper.

The same goes on the revenue side. Currently, community solar projects are constrained by geography. Using a blockchain, production of the community solar project can be shared via the chain for a global set of potential contributors opening new and geographically diverse sources of revenue. In addition, owners—participants in the project—can now have liquidity; they can decide to sell the kWh they are entitled to or even their shares in the project easily, electronically, with no need for complex legal paperwork.

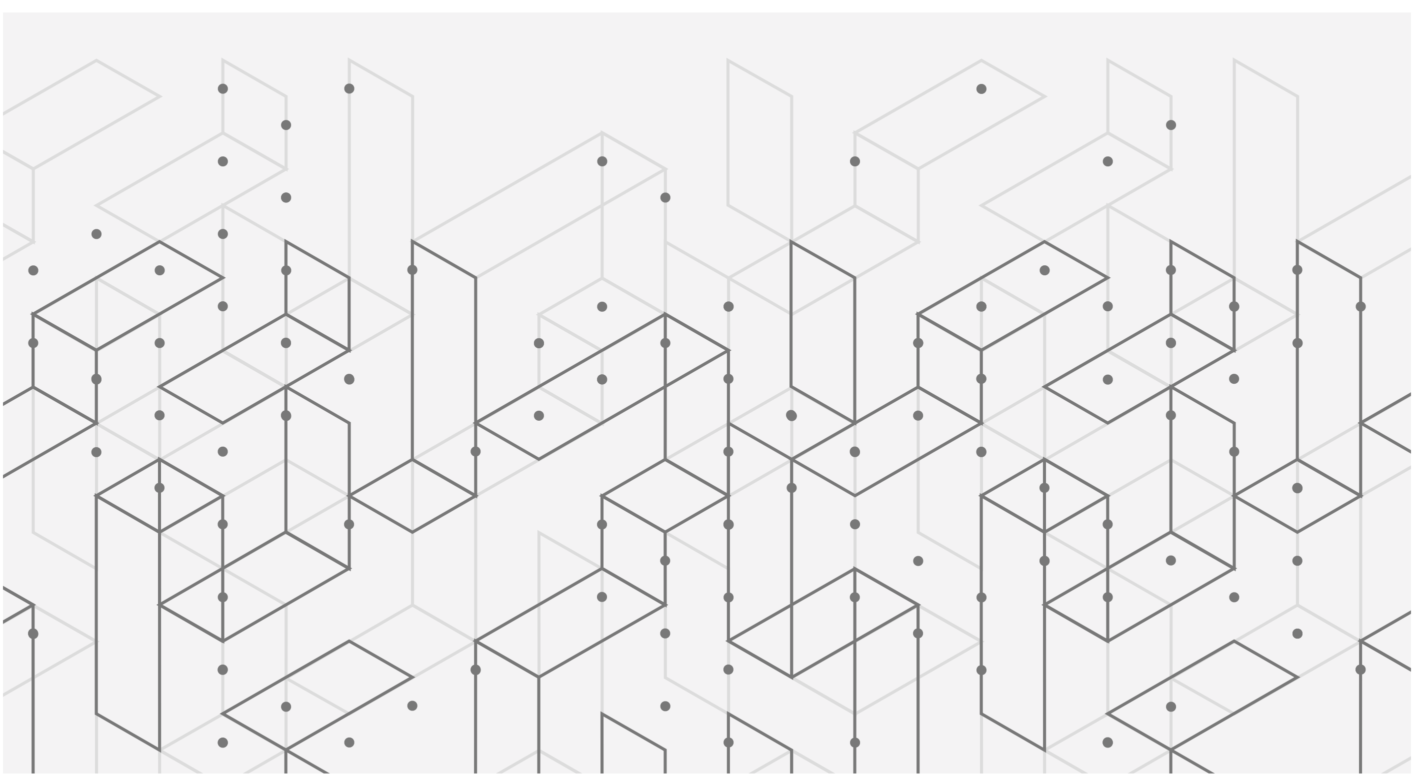
By reducing costs and unlocking additional sources of revenue for community solar projects, blockchain can grow this underutilized source of renewable electricity generation. This approach could also be extended beyond community solar to other renewable energy infrastructure, especially in emerging economies where access to capital can be difficult.

Decentralization: Re-architect the grid from the customer up

Today's grid architecture—a largely one-way relationship between grid operators and customers—is changing. Customers are adopting distributed energy resources (i.e., smart, small, energy-producing or -consuming devices) at unprecedented levels. Collectively, these devices could serve the same function as centralized thermal power plants. However, they are rarely used to their full potential since they are naturally decentralized and distributed, making secure digitization, coordination, control, tracking, and financial settlement with each device expensive and oftentimes cyber-insecure.

Furthermore, the process of aggregating devices into a single grid participant is difficult given the market interests of each individual device manufacturer.

Blockchains could enable grid operators to overcome many of these challenges, effectively re-architecting the grid from the bottom up. Imagine being able to automatically connect a new appliance or entire microgrid to a secure, decentralized platform that incents devices—acting on behalf of their owners—to use or not use electricity at certain times via detailed, close-to-real-time price signals. Imagine renters or homeowners participating in new electric markets by simply setting their home to



"economy mode," making their devices available to grid operators and perhaps being paid to do so.

In a blockchain-based grid system, each distributed energy resource would have a digital identity linked to its corresponding information, such as capacity and consumer preference. Using these identities, each device's actions can be transparently tracked on the blockchain, and revenues can be divided and distributed automatically via smart contracts.

Digitalization: Renewable energy certificate tracking

In response to commercial interest and government regulation, renewable energy certificates and guarantees markets have emerged in the United States, Europe, Australia, and elsewhere. While these markets have noble intentions, their administration is highly manual and costly, rendering the markets opaque, high-cost, and inaccessible for most smaller participants. In addition, these analog, largely manual markets are not able to support any higher-level functionality such as consumption-linked purchasing, carbon-impact selective purchasing, or renewable generator aggregation.

Why can't buying renewable energy credits be like buying an airline ticket–allowing buyers to search for exactly what they want and allowing sellers to join forces to get a buyer to their desired destination? Blockchains can create such a system for renewable energy.

In a blockchain-based renewable energy credit market, each asset would receive a digital identity that links to all production of that asset and subsequently associates with each owner of the credit. This record of identities and ownership would reside on the blockchain for all market participants to use. Smart contracts could then provide automated additional functionality such as mapping kWh production to carbon offset or automating credit purchasing based on a consumption profile. In use cases where privacy is needed, a device owner could cryptographically derive sub-keys off-chain, so the identity of the owner of the device can remain obfuscated.

By digitizing identities, records, ownership, and contracts, blockchain can make renewable energy purchasing transparent, highly functional, and low cost.

Other examples

Beyond the three aforementioned examples, there are many more ways that blockchain can create the value in the energy sector. We will not go into the same level of detail or attempt to be exhaustive with this list; consider it a guide to what future blockchains could enable.

- **Expanded Market Access:** With blockchain-based applications, or smart contracts, automating many of the functions necessary to register, bid, settle, and generally participate in markets, blockchain can open markets to smaller participants. In electricity markets, residential households could allow their smart devices to bid into wholesale markets or whole households could aggregate with their neighbors to sign a direct power purchase agreement with a low-cost bulk supplier. Further, blockchain-based markets may enable more-rapid and efficient electrification in greenfield settings by enabling low-cost implementation of functions traditionally performed by utilities and grid operators.

- **Greater Contract and Market Diversity:** Smart contracts can automate bilateral or multilateral contractual arrangements, and in particular dramatically streamline financial assurance and escrow management processes, allowing for a much greater diversity of contract types and market structures. Wholesale electricity market contract structures can be extended to the edge of the distribution grid and need not be limited by prohibitive back office costs. Forward-looking capacity, real-time energy, and ancillary services markets can be localized, aggregated in a nested hierarchy, and better reflect the value of energy and services over time and place. Automated dispatch, settlement, and reconciliation could enable many more contract types for both individual and aggregated distributed energy resources, making the market more diverse and "complete." Unconventional business models will emerge for existing utilities and new market entrants as operating costs of market management continue to decline, the cost profiles of distributed and renewable resources continue to improve, and technological capabilities of blockchain and other digital technologies continue to expand. In an era where volumetric energy sales no longer grow revenue and the majority of value accrues in balancing services, "energy-as-a-service"—where consumers pay fixed subscription fees to retailers who in turn operate and monetize behind-the-meter assets—may become the norm.

• **Improved Traceability:** Any digital object, whether representing a person, a physical asset, or an abstract concept like a carbon credit or avoided generation, can establish a unique and trusted digital identity. Over time, these identities establish robust digital records that track relationships with other identities, thus creating a common ledger for tracking ownership of assets and data. In carbon and renewable energy credit markets, this creates the potential to seamlessly trace credit ownership with drastically lower overhead and no risk of double counting. Utility customers and regulators alike can obtain increased information about the source and societal and environmental impacts of consumed energy. "Negawatts" (i.e., energy savings) created by demand response and energy efficiency measures can be granularly and perpetually attributed to the appropriate asset or individual, providing utilities, regulators, and consumers with better information for making investment decisions and structuring program incentives.

• **Direct Ownership:** Through automated smart contracts, blockchain makes it possible to raise financing for an asset that directly represents an ownership stake and right to partial profit at a level of granularity not possible or practical with other technologies. As the asset comes online and begins creating value, all owners are compensated directly and automatically. A tenant in an apartment building in New York, whose on-site solar PV and battery system is collectively owned by the equivalent of a real-estate investment trust composed of other tenants, can finance a specific panel on a solar PV installation in rural Tanzania, entitling them to a proportional share of revenue generated.

• **Asset Agency:** For most of history, only people or organizations have had the capacity to conduct economic transactions. Through unique and trusted digital identities combined with software-driven "intelligence," blockchain can enable physical assets to participate directly in markets without the need for a human intermediary. Each asset would have a unique identifier and record of transactions on chain. In electricity markets, electric vehicles could use this functionality to enter into direct legal agreements with counterparties, removing the need for a vehicle to re-enter a legal flexibility service agreement with a grid operator even if the human ownership of the car had changed. This is a powerful foundation for digitalized and distributed ownership, market participation, and wholly new profitable economic models.

• **Data Sovereignty and Democratization:** By creating unique identifiers for asset owners, assets, and the data produced by those assets, blockchain can allow for direct data ownership and selective permissioning. The concept of personal data being "owned" and monetized by centralized service providers and the risk that such data is exposed through a breach of centralized servers is made obsolete. Users of blockchain networks and applications are empowered to control how their data is used and stored. Residential households could bid out their metering data anonymously to a range of retail providers to get the best retail rate, or sell their consumption profile to energy efficiency companies in exchange for the chance to offer goods and services. Not only could data ownership be tracked on a blockchain, but it could be enforced, with encryption protecting data owners from unwanted access and, where data is voluntarily shared, rights ownership ensuring only approved use.

Our Principles

What guides our work?

- **Focus on proving blockchain's value in one sector: energy.** We recognize that we must intimately understand the problems facing a sector to scale up a new technology within it.

- **Form interdisciplinary teams of experts from across the blockchain and energy sectors.** There are very few people who have expertise in both areas.

- **Build a collaborative ecosystem with representatives from across the sector.** Our work will only create value in the energy sector if we have a large ecosystem of users and our technology will only improve if we offer that ecosystem extensive opportunities to collaborate with us and provide input.

- **Build software and tools to accelerate commercial applications.** Blockchain technology is at a very early stage and application developers need framework examples and standards to accelerate their application development.

- **Use innovative governance to balance the benefits of decentralization with regulatory oversight.** In order to take over transactions in the heavily regulated energy sector, public blockchain governance must allow for regulatory oversight.

- **Provide foundational technology that solves common developer problems and which is open-source and publicly-available.** The short blockchain history has shown that public networks foster more innovation than closed networks. We recognize that innovative solutions will come from many hands.

Our Ecosystem

Who is involved? What is their role?

In order to ensure that our work and technology is useful and appropriate for energy-sector blockchain applications, we have been gathering and engaging an ecosystem of market participants and users to inform EW Chain development. We call them EWF Affiliates. EWF Affiliates are companies, large and small, who are playing an active role in informing the early development of the EW Chain during its testnet phase (prior to the launch of the production network). We currently have an ecosystem of over 100 Affiliates, ranging from the largest energy-sector market participants (including utilities, grid operators, and renewable energy and cleantech developers) to the smallest blockchain and energy startups.

Many of our Affiliates are actively working on blockchain applications in the energy sector, on topics ranging from electric vehicle charging to demand response market settlement to certificates of origin tracking to peer-to-peer energy trading. The EWF website **(energyweb.org)** hosts a “dApp & vendor” page highlighting the most recent projects and development teams in our ecosystem. To date we have engaged this ecosystem to gather input into the development of our core technology, governance, and SDKs.

Figure 1: EWF has assembled a growing roster of more than 100 energy and blockchain Affiliates. The logos shown here omit those that have chosen to remain anonymous.

Fig. 1

Our Software Development Toolkits

What are we building? What is the status?

Open-source software development toolkits (SDKs) are software modules or reference applications that developers can use to accelerate and reduce the costs of application development.

The art in SDK development is to provide tools that increase application developer productivity while leaving enough space for competitive differentiation. It is analogous to providing a Wifi or Bluetooth module that can be incorporated into larger systems on chip designs. The modules themselves (SDKs in our terminology) are not the base on which developers will differentiate their product, but rather provide important functionality that would have had to be developed from scratch in the absence of the SDK.

We use the term SDK loosely at EWF. We mean not only 1) open-source modules that can be used to develop applications, but also 2) fully-fledged, open-source reference applications that can be copied, modified, or simply used as a reference to develop commercial applications. Below are descriptions of three SDKs on which we have started development work that fall in one or the other category.

EW Origin: a modular portfolio of toolkits for developing state-of-the-art trading and tracking applications for energy attribute certificate (EAC) markets

EW Origin is a portfolio of customizable, open-source toolkits for companies and regulators to build state-of-the-art decentralized applications (dApps) to issue, trade, track, and report relevant information in renewable energy markets.[1] EW Origin enables the development of new dApps that modernize legacy EAC

[1] EW Origin leverages a modular structure that consists of four distinct layers: 1) the User Registry, 2) the Asset Registry, 3) the Origin Issuer toolkit (administered by the appropriate respective EAC issuing body in a given market), and 4) the Origin Market toolkit (used by any company to build commercial EAC applications that include marketplace features such as matching algorithms to match supply and demand).

markets and position emerging markets for leapfrog solutions, along with providing enhanced experience for buyers, increased market access for new users and assets, granular data, and carbon impact tagging. It supports key components of standard EAC lifecycles and offers new advanced features, such as onboarding buyer demands, aggregating and disaggregating renewables production and demand to meet market participant needs, supporting direct and automated transactions, and streamlining transparent reporting. EW Origin can also be used for innovative product integrations for automated renewable energy purchases from electric vehicle charges, battery storage events, and power purchase agreements (PPAs).

EW Origin is protected by the GPLv3 open-source software license. Companies and regulators wanting to use EW Origin to build dApps without publishing their respective modifications to the codebase can purchase an annual lesser license from EWF. Numerous pilots of EW Origin have been implemented across the globe for different business scenarios—from unbundled EAC purchases based on forecasted or metered consumption to automating EAC purchases from EV charging sessions and documenting battery storage events—with companies like Engie, SP Group, PTT, Iberdrola, Acciona, and Sonnen. Various Affiliates are already working with EWF to scope and develop digital EAC marketplace platforms using EW Origin.

Learn more about the EW Origin reference application by: a) **reading more on the EWF website**, *b)* **watching a commercial showcases Deep Dive from EventHorizon 2019**, *c)* **watching a dApp spotlight from EventHorizon 2019**, *d)* **watching a demo from EventHorizon 2018**, *e)* **watching an overview video**, *and f)* **reviewing the open-source codebase on Github**.

EW Link: a set of reference architectures to bridge the physical and digital worlds

EW Link is a set of reference architectures for connecting physical devices and off-chain systems with the EW Chain so they can communicate and transact on the blockchain in a low-cost, secure, and reliable way. One example—already deployed—is an EW light client on a simple IoT device (the Artik 7) to facilitate communication with utility-grade electricity generation meters.

Moving forward, EW Link will deliver SDKs and reference implementations to support application developers as they connect to the relevant devices for their applications. All EW Link work will be released

> "EW Origin is a portfolio of customizable, open-source toolkits for companies and regulators to build state-of-the-art decentralized applications (dApps) to issue, trade, track, and report relevant information in renewable energy markets."

to the EWF developer community open-source on our **Github repository**.

D3A: a vision and structure for recursive, decentralized electricity markets

To support a future vision of electricity markets, EWF and EWF co-founder GridSingularity have designed a model called the Decentralized Autonomous Area Agent (D3A). In this market model, any energy- consuming or -producing device can collaboratively transact with other devices in its local area in order to optimize operational decisions locally—based on user preferences and system conditions—with canonical data and communications up and down the value chain. This model can apply at the level of a house, a neighborhood block, a distribution feeder, or an entire distribution network.

While the full suite of technologies required to realize this decentralized electricity market, including the blockchain components, are not yet production-ready, the D3A team has built a free software simulation environment to demonstrate the economic impact of a decentralized market model in a variety of grid configurations. In fact, EWF Affiliate Stedin, one of the Netherlands' grid operators, and partners are already piloting a similar blockchain-based solution called the **Layered Energy System**. Like the D3A, smart devices across a neighborhood of houses collaborate at the local level first to balance electricity supply and demand, before turning more widely to the grid to buy and sell energy and grid services.

Learn about the D3A decentralized market model rationale by: a) **reading our April 2018 concept brief**, *b)* **reviewing the Github open-source codebase**, *c)* **watching a dApp spotlight from EventHorizon 2019**, *d)* **watching a Deep Dive from EventHorizon 2019**, *and e)* **watching a demo of the alpha version simulation environment from EventHorizon 2018**.

Our Governance

How does it work today? How will it evolve?

True blockchains are used by many and owned by none. Therefore, one of the most critical design considerations when establishing a new blockchain infrastructure is its governance mechanism. How are changes to the blockchain's protocols designed and implemented? In other words, how does the chain actually work and evolve over time, especially as a founding organization such as EWF pulls back from its initial oversight and stewardship and divests more control to the community?

EWF's goal is to decentralize EW Chain governance as quickly and significantly as possible. In our original whitepaper, we described a "governance by gas" mechanism, in which decision-making power is granted to known, vetted application developers and decisions are made via a combination of on- and off-chain mechanisms.

We continue to believe in this vision, but in the months since publishing our original white paper, we determined that it is not appropriate, nor technically feasible, to implement such a formal on-chain governance mechanism at this time (June 2019). Three primary factors led to this decision:

- The ultimate governance mechanism should not be created or implemented by EWF alone; we must instead formalize a collaborative approach with our Affiliates, others in the blockchain community, and energy market participants.

- On-chain voting mechanisms are an emerging field, and there are few examples of successful on-chain governance to date. Further research is needed to ensure that the final design of such a system is both secure and fair.

• To our knowledge, the EW Chain is the only public blockchain to feature known companies from around the world as validators, and it is designed to support enterprise-grade applications that interface with competitive and highly-regulated energy systems. Accordingly, the EW Chain governance mechanism should be informed by relevant regulations across multiple jurisdictions. It should limit the liability of participants while incentivizing innovation and ensuring network stability.

As described below, in the near term EWF will play an active role in coordinating changes to the EW Chain. For further details on our suggested roadmap to a decentralized on-chain governance mechanism, please see the **EWF Wiki**.

Near-term EW Chain Governance

For the foreseeable future, there are two primary actions that will be subject to a governance decision: 1) adding and removing validators, and 2) installing client updates.

Immediately following launch, the chain will enter a "scaling" governance phase in which EWF maintains the ability to perform both actions. To do so, EWF controls governance tasks through a secure multi-signature contract. Any actions taken by EWF will be documented for the Energy Web community on our Wiki and, prior to implementation, discussed with initial chain validators with the aim of achieving rough consensus. This scaling phase is modeled after other off-chain rough consensus governance models, including the model practiced by the Ethereum Foundation and the Ethereum core development team. This approach will enable any technical issues arising post-launch to be quickly addressed while also preventing individual EWF employees from having unilateral control of the network.

Once the EW Chain is supported by approximately 20 or more validators, EWF will no longer play a leading role in performing such actions. Instead, EWF will primarily support the decisions and strategic direction of the validator set and act as an administrative implementation body. Herein, EWF will implement changes to the chain only if a majority of validators formally support any given proposal through off-chain voting. Proposals may include transitioning EW Chain governance to on-chain voting mechanisms, including gas-weighted signaling votes or, longer term, on-chain "governance by gas" validator and/or developer voting. However, implementation of such governance mechanisms should be a decision of the validator set, not EWF alone. Therefore, any such mechanisms will only be deployed with the majority support of EW Chain validators.

Our Technology

What is our approach? What exists so far?

From EWF's inception, we chose to derive our tailored-to-the-sector blockchain technology from an existing one (i.e., Ethereum), rather than develop our blockchain technology from scratch. That allows us to avoid spending resources reinventing the wheel, and instead focus our software development efforts on functionalities that address the specific pain points of application developers in the energy sector.

In this section, we address major questions about our technology:

1. Why use Ethereum as a starting point?
2. What technical capabilities does EWF have to make competent changes to Ethereum?
3. How does EWF select which adjustments to make to Ethereum?
4. What adjustments has EWF made so far?
5. What tools and solutions currently exist for developers using the EW Chain?

1. Why use Ethereum as a starting point?

We used Ethereum as a starting point for our technology for the following reasons:

- **Open-source:** We wanted EWF's technology to also be open-source from the beginning.
- **Public:** Many of our envisioned applications require a public chain.
- **Robust:** Public chains are more exposed to attacks than private ones. Public chains that have survived attacks and resulting public scrutiny are more resilient than private chains. Ethereum is a public chain that was released in 2015 and has survived several years of public testing.
- **Flexible:** We needed a technology that would allow for a large diversity of applications. Ethereum's key innovation was the Ethereum Virtual Machine (EVM), which is technically Turing complete, and can therefore support any kind of algorithm or application.

EWF has hired a professional team of core technology developers from the market and maintains strategic technical partnerships with co-founder Grid Singularity, as well as Parity Technologies and Slock.it.

- **Popular:** Ethereum has a large developer community and many available open-source extensions. Using a technology with a strong existing developer community would allow us to leverage existing skills and knowledge. Ethereum has the most-robust, fastest-growing developer community in the public blockchain space, with more Github repositories, developers, and code updates than any other open-source blockchain. Ethereum supports thousands of applications. Many functionalities that will be needed for energy applications can be derived from open-source modules developed by the Ethereum community.

To be clear: the EW Chain is not Ethereum. It is derived from the Ethereum code base, but is a different technology stack and a different chain, with a growing number of functionalities designed to meet the specific needs of blockchain applications in the energy sector.

2. What technical capabilities does EWF have to make competent changes to Ethereum?

EWF has hired a professional team of core technology developers from the market and maintains strategic technical partnerships with co-founder Grid Singularity, as well as Parity Technologies and Slock.it.

3. How does EWF select which adjustments to make to Ethereum?

EWF focuses on technology that addresses the most common challenges blockchain application developers face in the energy sector.

To determine which functionalities to provide, EWF remains in frequent contact with Affiliates and other ecosystem participants to understand pain points. We then prioritize based on perceived importance and easiness to address.

Our technical team acts as a first filter, leveraging or adapting existing solutions when possible. In the absence of existing solutions, our team engages our technology partners to develop them in-house. Depending on the difficulty of the challenge, that phase may require some research and development. In other words, some technology enhancements may be straightforward to implement and require a few days of work. Others are difficult problems to solve—like introducing parallelism in blockchain—and may require a multi-year effort involving significant innovation.

4. What adjustments has EWF made so far?

We addressed four major "pain points" identified so far by the application developers in our ecosystem with the April 2018 beta release of Tobalaba, our sandbox test network. Table 1 provides a high-level description of these pain points, together with the adjustments we have made to Ethereum to address them.

Table 1: Energy Web Chain Customizations to Ethereum

Pain Point	Adjustment made to Ethereum
Low network capacity: Due to the way blocks are created, transaction demand often exceeds available computational supply (i.e., there are too many transactions to fit in a given block), resulting in high transaction costs, delayed settlement, and limited scalability for mass-market applications.	**Proof-of-Authority consensus:** EWF replaced the Proof-of-Work (PoW) consensus mechanism used in Ethereum with a Proof-of-Authority (PoA) consensus mechanism. With PoA, the EW Chain has the ability to increase network capacity by 30x compared to Ethereum.
Expensive IoT integration: Large software "clients" cannot be integrated into small devices because of insufficient memory storage and computing power capacity, limiting the applicability of blockchain in IoT.	**Light client:** EWF provides different versions of light clients adapted to various types of IoT devices, enabling the connection of distributed energy resources to the EW Chain.
No differentiation between nodes in the network: The inability to differentiate between nodes and accounts from a rights and obligations perspective restricts higher-level governance and application functionality.	**Permissioning:** EWF provides the technical capability to differentiate between nodes based on governance, applications, and regulatory requirements, all while keeping the chain public.
Low privacy: Little to no ability to execute private transactions limits the ability to develop applications in markets where data privacy is required (e.g., residential customer data, wholesale market transactions).	**Private transactions:** The EW Chain supports a variety of privacy preservation solutions to allow developers to maintain data confidentiality while keeping the validation benefits of a blockchain.

The rest of this section covers each of these adjustments in greater technical detail.

Proof-of-Authority Consensus: improved functionality and increased technical capability for regulatory oversight while maintaining network trust and security

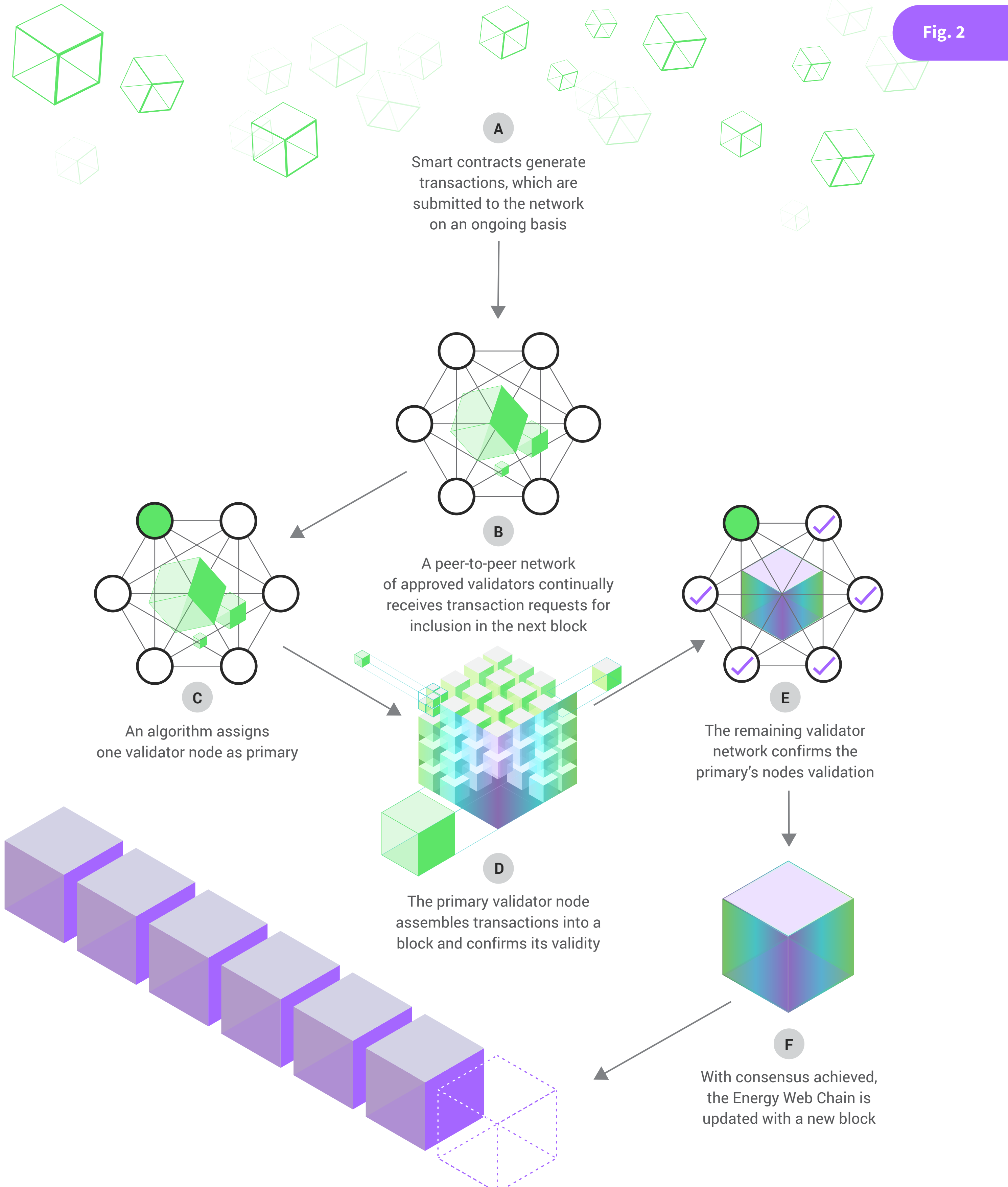
The key criteria for a consensus mechanism compatible with the energy sector are: a) high capacity, b) security, c) resource efficiency, d) regulatability, and e) fidelity.

We are using a Proof-of-Authority [2] consensus mechanism for the EW Chain, in which a pool of known and trusted computers—called validator nodes—are responsible for validating transactions and creating blocks. This approach offers certain security, regulatory transparency, and considerable capacity benefits, though it does sacrifice a small but not insignificant level of decentralization.

Figure 2 provides a high-level overview of how PoA works on the EW Chain:

[2] Proof-of-Authority and PoA refer to the Aura consensus algorithm unless otherwise specified. While we are using Aura PoA on the Tobalaba test network at the moment, we will adopt best-practice PoA mechanisms as the technology advances. To learn more, visit our Wiki.

Figure 2: The Energy Web's Proof-of-Authority (PoA) Consensus Mechanism



By limiting the ability to create blocks to a known pool of validators, we can achieve the following benefits without sacrificing the integrity of the chain:

Table 2: Proof-of-Authority Consensus Mechanism Benefits

Benefit	Explanation
More consistent and predictable time and state finality	The combination of limiting validator status to a defined number of nodes who have passed a vetting process and establishing economic and reputational incentives (validators have something at stake) introduces an inherent level of trust between the participants. Since there is no competition among validators to race each other to create blocks, transaction throughput can be increased (faster block time) while energy consumption and computational complexity is drastically reduced (compared to Proof-of-Work).
Significantly improved resource efficiency (i.e., lower energy consumption)	
Increased throughput	
Reduced transaction costs	The reduced computing and energy requirements in turn reduce the operating cost for validators. In combination with the increased throughput, this makes transaction costs lower and more predictable than those on Ethereum.
Minimal network latency	Validator nodes in the EW Chain are typically run on dedicated hardware in professional server environments with high-speed Internet connections.
Simplified protocol upgrades	Limiting validator status to known and legally registered entities simplifies the process for rolling out upgrades to the core protocol (coordinating a vetted group of validators with aligned incentives is easier than a dynamic group of anonymous miners).

We are aware, as well, of the limitations and risks of adopting a Proof-of-Authority consensus and are adopting the following mitigation strategies. While these are our current hypotheses, EWF will continue to test and develop new solutions over the next year.

Table 3: Risks and Mitigation Approaches to Proof-of-Authority Consensus

Risk	Description	Mitigation Approach
Centralization	A common criticism of PoA is that it is not truly decentralized. By definition, introducing a gatekeeper for validators requires oversight by some kind of central entity. And if the validator pool is not sufficiently large and diverse, the risk of 51% or distributed denial-of-service (DDoS) attack vectors is substantial.	From an architectural perspective, there is no significant difference between Proof-of-Work and Proof of Authority. Both allow an unlimited number of nodes to store a copy of the full ledger. PoA places a constraint on which nodes are allowed to create blocks (in theory there is no limit on the number of validators, although the Aura consensus performance may degrade once the number exceeds ~150). In practice, PoW has limitations, too. To have any hope of successfully mining, one needs to join a mining pool. In most PoW networks, a small number of privately-owned mining pools control the majority of the total network hash power. From a political perspective, we are decentralizing the governance of the EW Chain by giving decision-making power to a diverse group of network participants rather than a limited number of validators. We are also fully transparent with the initial selection criteria (see **EWF Wiki**) for becoming a validator and EWF will relinquish control over the selection criteria post-genesis block; the power to amend the validator requirements will be transferred to participants in the EW Chain governance mechanism with special voting privileges. EWF will actively seek entities from the government, private, and not-for-profit sectors to establish validator nodes over the next year, with a minimum goal of 20 nodes diversified over a minimum of four continents by the end of 2019.
Synchronization	PoA relies heavily on timestamp accuracy and synchronization compared to PoW. There is a risk of inadvertent forks if timestamps on validators become out of sync, competing blocks are created simultaneously, and adversaries potentially manipulate timestamps on validator hardware to disrupt the network.	To mitigate this risk, EWF has established **validator node security and hardware guidelines**, which prescribe functional requirements for client implementation. Outside of a few isolated incidents, synchronization has not emerged as an issue on Tobalaba to date, due in large part to the fact that validators are run on professional servers in secure environments. EWF will continue to identify specific potential attack vectors for validator nodes, update the client as necessary, and publish mitigation techniques.
Predictability	Current implementations of PoA have a highly predictable validation schedule, which offers throughput benefits but potentially opens the door for targeted attack vectors.	One approach to reducing the predictability of the block validation schedule would be to adopt a non-deterministic PoA algorithm that randomly, but with equal probability, selects primary nodes from the pool of validators. This would increase the difficulty of a coordinated attack (DDoS or other) on validators as they are called to validate blocks. Another potential solution is to optimize the number of validators to balance susceptibility to targeted attack with the cost of maintaining the network (i.e., increasing the total number to sufficiently mitigate predictability without incurring unnecessary costs). We are currently in the process of evaluating these and other mitigation strategies for selection.

To qualify to host a validator node on the EW Chain, organizations must be Affiliates of Energy Web Foundation. Affiliates are legally registered corporate entities who participate in energy markets globally, ranging from energy companies and other large corporations, to utilities and grid operators, to recently founded startups.

We believe this is appropriate for several reasons:

1. An initial screen for eligibility will be determined objectively (i.e., it is a binary decision based on Affiliate status), which will reduce potential conflicts of interest, anti-competitive behavior, and decision-making complexity for existing validators.

2. Becoming an EWF Affiliate requires organizations to make a financial contribution to EWF; this effectively acts as an indirect form of staking.

3. The EWF Affiliate onboarding process includes a know-your-customer (KYC) and anti-money-laundering (AML) procedure, so all validators can be assured that organizations hosting validator nodes are legal entities in good standing.

4. All organizations hosting a validator node will be participants of a common consortium and know each other through various channels and events, which will enhance the trust among the validator set.
Notably, EWF cannot unilaterally enforce this eligibility requirement, which could be subject to change over time via a governance decision.

Please visit the EWF Wiki for further detail about **how the PoA consensus mechanism works** on the Energy Web Chain.

The Light Client: shrinking the size of the client to facilitate connecting IoT devices and distributed energy resources (DERs) to the EW Chain

Low-powered devices, ranging from smartphones to smart meters, represent a large class of devices that can interact with the EW Chain. It is essential for these resource-constrained devices to have full access to the network without having to store and maintain a copy of the entire, multi-gigabyte blockchain. Simultaneously, interacting with the blockchain should not compromise the security of these devices.

The EW Chain light client extends Parity Technology's reference light client by allowing it to work with PoA consensus. The light client stores a "light" version of the entire blockchain on these devices and provides a protocol to request additional data from the network as needed at a level of security on par with validator nodes. It includes block headers and relevant state variables, enabling a similar level of trustless knowledge and usability as full nodes while only storing a tiny fraction of blockchain data.

Please **visit Parity's Wiki** to learn more about how light clients work.

Permissioning: providing the technical capability to differentiate between nodes and accounts based on governance, applications, and regulatory requirements

Permissioning features, which grant differing privileges to varying actors, help balance the openness of the blockchain network with regulatory compliance, grid operational needs, and other variables.

Permissioning is most relevant to the EW Chain consensus mechanism. At the consensus protocol layer, permissioning enables a governing body to establish specific criteria that determine the list of validator nodes with the ability to create blocks, and thus define a network boundary by permissioning those specific nodes.

Permissioning can also be applied at the application layer, allowing specific users or smart contracts to conduct particular transactions (e.g., transfer tokens or deploy new smart contracts). For example, by combining a KYC process to identify specific individuals and grid assets with a permissioned smart contract, a solar farm physically located in Australia could be prevented from offering generation capacity and energy for a North American utility service territory but allowed to sell renewable energy credits in a global market. Importantly, this type of permissioning is implemented by developers of smart contracts working in concert with relevant utilities and regulators and requires sufficient information and processes to verify the relationship between EW Chain accounts and physical assets.

For further information on permissioning features, visit the **Permissioning page** on EWF's Wiki.

Private Transactions: allowing application developers to maintain mandated customer privacy

To comply with confidentiality regulations or desire of market participants to avoid making certain data like transaction prices and volumes public, the EW Chain needs the ability to maintain data confidentiality on the platform.

EWF partnered with Parity Technologies to develop private transactions, which address this challenge by introducing smart contracts with encrypted code and state data, where strict controls are enforced as to who may access, alter, and validate data contained within.

Private transactions work as follows (also see Figure 3):

- A public smart contract contains a nested private contract to encrypt state and code data. It also establishes a list (subset) of validators for the private transaction. This group of validators is separate from the general validator pool of the main chain.

- The only way to access the encrypted data is with a unique key. The key is partitioned among a subset of nodes, called Secret Store, whose purpose is to generate and store keys. A separate Registry Contract grants permissions to specific addresses (i.e., users) to access the encrypted private contract by requesting the key elements from the Secret Store to decrypt the data.

- After decrypting the data, the recipient sends a private transaction message to the private transaction validators, which can then execute it, produce the new, encrypted state, and sign it. If all private transaction validators agree on the new state, a regular transaction in the public smart contract containing the new encrypted data is submitted to the main network.

"EWF partnered with Parity Technologies to develop private transactions, which address this challenge by introducing smart contracts with encrypted code and state data, where strict controls are enforced as to who may access, alter, and validate data contained within."

*For further details on private transactions, as well as other privacy preservation solutions available on the Energy Web Chain, visit the **Privacy Preservation Solution page** on the EWF Wiki.*

5: What tools and solutions currently exist for developers using the EW Chain?

The fundamental steps necessary to create smart contracts on the EW Chain—namely, downloading the EW Chain client, creating an account, acquiring tokens, and installing JavaScript packages and related development environments—are identical to Ethereum. The **Energy Web Wiki** provides detailed instructions and tutorials for developers.

Several other tools and solutions are also currently available or under development:

- The EW Chain **block explorer** enables users to examine blockchain transactions and activity;

- A first-come-first-served version of the Ethereum Name Service, enabling users to register unique and memorable domain names to hexadecimal addresses;

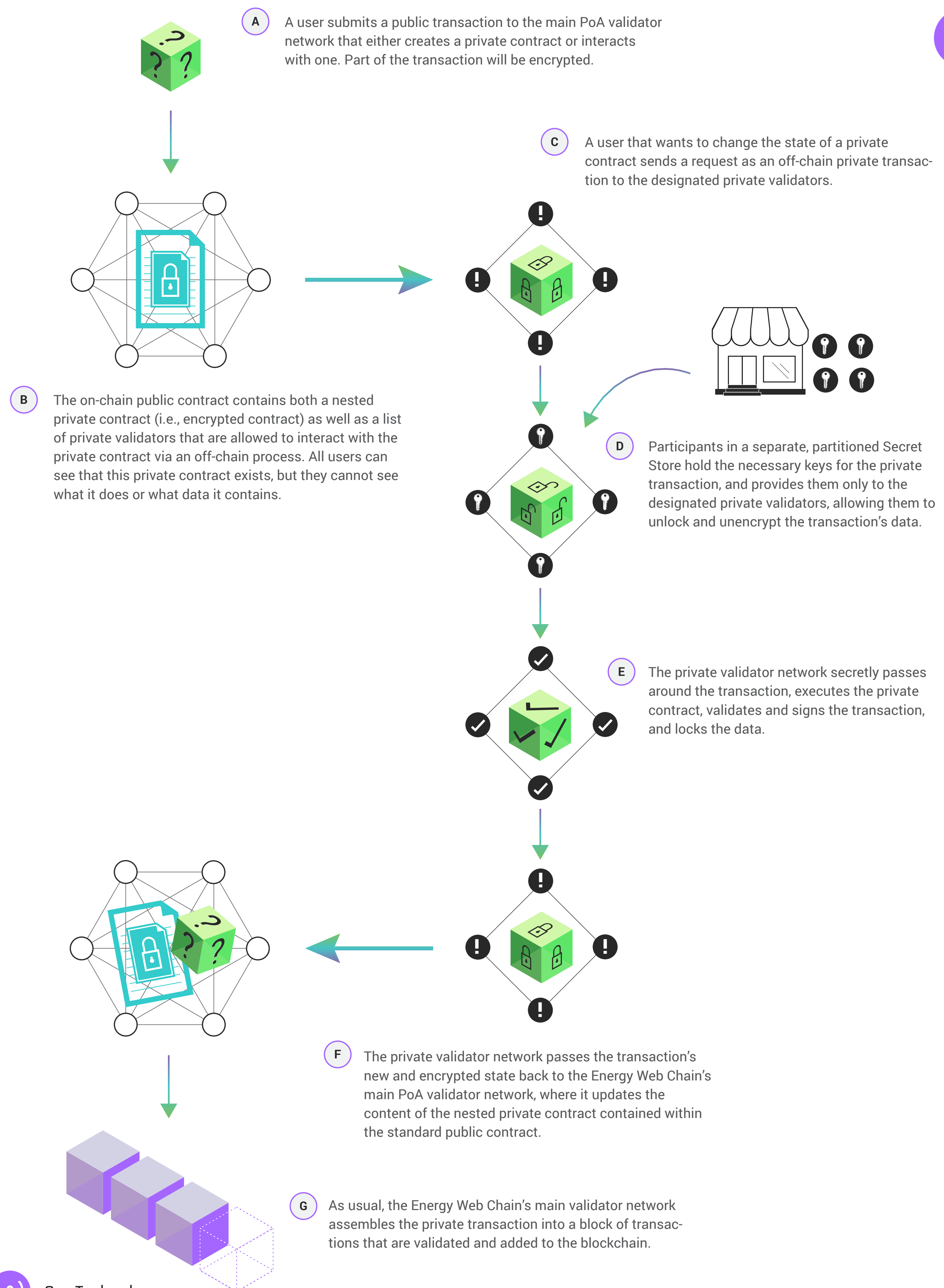
- An EW Chain alarm clock, enabling users to schedule transactions on the network;

- An identity management solution, helping developers better identify devices and individuals transacting on the network; and

- Oracle services, providing a secure method to provide external data to smart contracts.

Figure 3: The Secret Store is one method by which the Energy Web Chain ensures needed data privacy on the otherwise public blockchain

Fig. 3



Our Token-Secured Operating Model

Why is it needed? How does it work?

As with most public blockchains, the EW Chain features a native first-layer utility token, the Energy Web Token (EWT). Utility tokens like EWT derive value from the fact that users of a network extract economic benefits from using it and are willing to pay for those benefits. By attaching economic value in the form of EWT to all transactions flowing across a public network, the network is also protected from various attack vectors.

More specifically, native utility tokens intrinsic to a platform's protocol serve two main purposes.

1. **Security:** the token protects the network against misbehavior (intentional or not) of transaction execution (e.g., infinite loops) or undesirable behavior (e.g., spamming). The mechanism used is similar to Ethereum. Accounts that submit a transaction to the EW Chain are charged a transaction cost based on the computational effort of executing the transaction. That effort is estimated by a proxy of computational effort called "gas." The EW Chain gas fee estimation is the same as the Ethereum mainnet. [3]

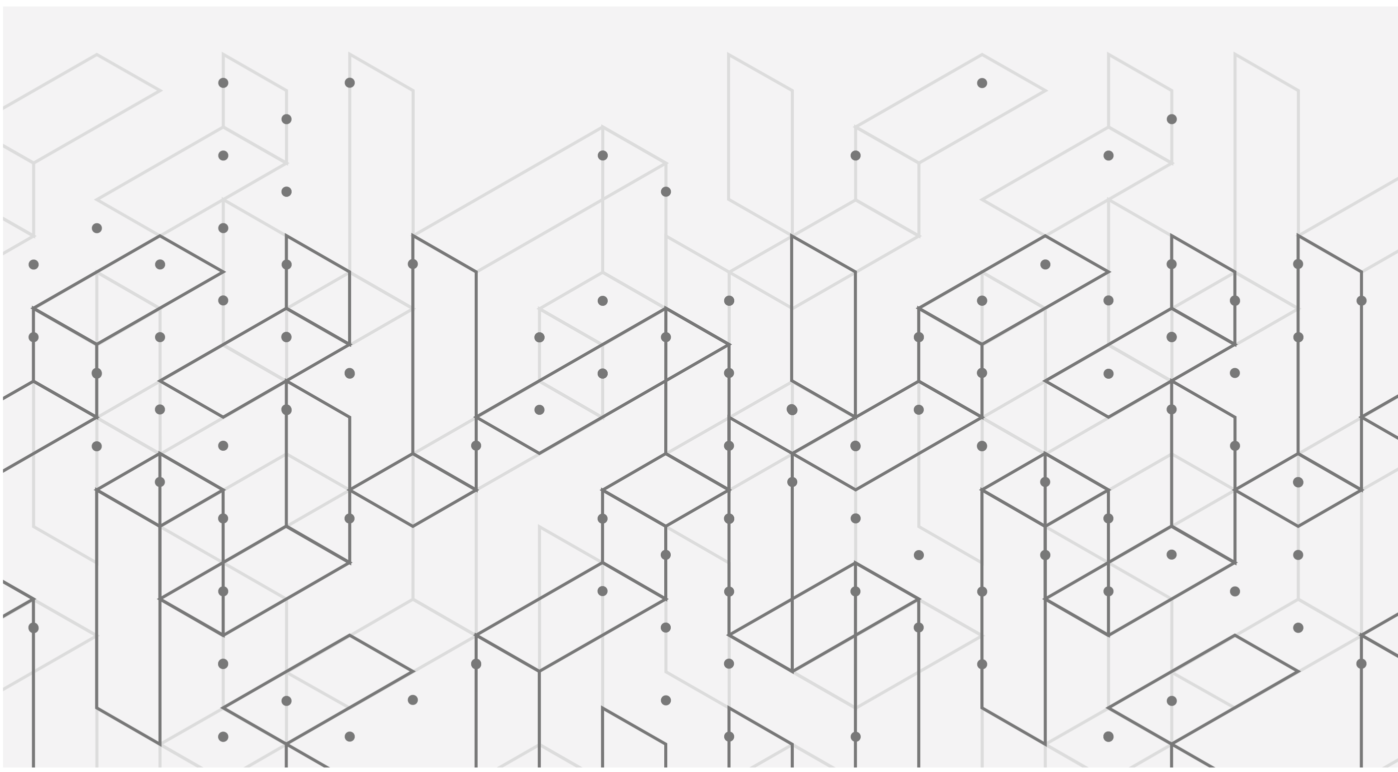
2. **Validator compensation:** EWT from transaction fees and block validation awards compensate validators for the costs of running a node (e.g., capital investment in servers, high-speed Internet connection, operational costs).

Users and application developers are not required to use EWT for their own applications beyond paying for transaction costs on the EW Chain. They can use cryptocurrencies or fiat currencies, as well as second-layer tokens native to their particular applications.

The EW Chain supports all Ethereum smart contracts and therefore all second-layer application tokens deployable on Ethereum.

[3] The fee schedule is available in [Appendix G of Ethereum's Yellow Paper].

EWT might be subject to price volatility, as other blockchain tokens have demonstrated. Token price volatility does not translate directly into changes in transaction costs. The transaction cost or fee in EWT is calculated as the product of gas consumed, expressed as the amount of computation work being performed, and the gas price, denominated in EWT. The gas price is determined by the transaction sender as a function of its own economics.



The higher the gas price, the more likely validators will pick up the transaction for execution (assuming that the sum of all pending transactions exceeds a block's gas limit; in cases where block gas limit is greater than the sum of pending transaction gas, all transactions are included). Each transaction sender is bidding for a place in the current block against all other senders at a given time. The cumulative effect creates an auction, with economically rational validators choosing the highest-value transactions for each block and the market setting the "clearing" gas price.

For additional details on how transaction fees work on public networks visit the **Transaction Costs Overview** *on the EWF Wiki.*

Though an auction is the best way to ensure that transaction fees are fair, a purely market-based approach leaves open the possibility that fees escalate during periods of high activity as time-sensitive transactions compete for limited block space (akin to surge pricing). The most-effective way to ensure low and stable transaction costs is to increase throughput. We are confident that the current iteration of the EW Chain is more than sufficient to support commercial applications. Further, our technology roadmap features multiple solutions to improve the EW Chain's scalability. In public blockchains, there exists an optimal gas price that makes transactions economically attractive to both users and validators, while making it extremely costly to spam the network with superfluous transactions. If gas prices are too low, security may be compromised and validators may not cover their costs. If minimum gas prices are too high, the chain will not be used.

Energy Web Token Distribution

This section outlines the proposed distribution of Energy Web Tokens (EWT). As shown in Table 4 below, 90 million EWT will operate the EW Chain and 10 million more are used as a 10 year block validation award. The following categories of EWT are contained in the genesis block of the EW Chain:

Table 4: Token Allocation and Categories

Category	Description	Token Allocation	Lockup Period
EWF Operating Fund	Tokens for EWF operations	10,901,792	N/A
EWF Endowment	Tokens intended for additional technology development in support of EWF mission	10,000,000	3 months
EWF Community Fund	Community fund tokens will be used to support development of new technologies in the EWF ecosystem	37,900,000	Released linearly over 10 years
Validator Block Reward	Allocated to block validation rewards, and released continuously (on a per-block basis) over a period of 10 years in a logarithmic curve	10,000,000	N/A
Founder Tokens	Allocated to EWF co-founders Rocky Mountain Institute and GridSingularity	10,000,000	24 months
Round A Affiliates	Allocated to the 10 initial Affiliates of EWF	5,000,000	3 months
Round B Affiliates	Allocated to Affiliates who joined EWF in a B round of fundraising	15,863,208	6 months
Round C Affiliates	Allocated to Affiliates who joined EWF	335,000	6 months
	TOTAL	**100,000,000**	

The purpose of the tokens in the EWF Community Fund is to fund bounties or other activities leading to further technical development for the benefit of the Energy Web community as a whole. The tokens in this fund are made available for such use in equal monthly installments over the first ten years following the genesis block (i.e., at a rate of 315,833.33 tokens per month).

Our Roadmap

What are we working on next?

While we have made significant progress since inception of EWF in January 2017, much remains to be done.

In the rest of this section, we give some more detail in each of these categories:

- Ecosystem: expanding our application developer network and engaging regulators
- SDKs: adding software tools to increase application developer productivity
- Governance: strengthening our processes through rigorous testing and review
- Core technology: adding technical features most needed by application developers

If you are interested in engaging with us on any of these topics, please join our community on **Github** *and contribute to our repositories.*

Ecosystem: expanding our application developer network and engaging regulators

Cultivating a robust, diverse, and engaged community of developers and regulators is crucial to achieving our vision.

We will continue to grow our developer community by:

- Recruiting additional Affiliates (contact us to learn more),
- Publishing additional documentation, tutorials, and developer toolkits on our Wiki,
- Developing and releasing additional open-source software and SDKs, and
- Participating in, sponsoring, and hosting design workshops, hackathons, and conferences.

We will engage with key energy, financial, and consumer-protection regulators by:

- Educating regulators (via webinars, conferences, and publications) and collecting feedback from them via in-person workshops,
- Publishing position papers on specific topics in collaboration with industry partners, and
- Inviting regulators to host validator nodes on

Energy Web test networks and providing blockchain tutorials to help them understand how to leverage the technology to better perform their duties.

SDKs: adding software tools to increase application developer productivity

We will continue to work closely with application developers on selecting the most promising areas for SDK development. Our goal is to focus on areas of highest impact—basically on tools that would bring the most value to a larger number of application developers. Our current focus list includes:

1. Asset registry to support all applications that require establishing and managing unique asset IDs;
2. Physical grid integration and device connection via a reference implementation that is small, cheap, and governs electricity grids (i.e., real-time balancing of supply and demand on the grid vs. financial settlement and REC trading only);
3. Standard measurement and verification (M&V) smart contracts for evaluating the behavior and physical impacts of grid-connected devices; and
4. Application programming interfaces (APIs) and application binary interfaces (ABIs) that define data structures for communications between on- and off-chain systems.

We are seeking collaborators to build open-source, commonly valuable SDKs for applications in the energy sector. Also, in the coming months we'll be announcing bounties and partnership opportunities in association with these SDKs.

Governance: strengthening our processes through rigorous testing and review

We recognize the importance of blockchain governance and, as a result, we have set aside a significant testing period to ensure that our governance can 1) withstand attacks of all kinds and 2) be endorsed by energy-sector regulators.

In the coming months we will test iterations of the governance mechanism proposed herein in order to refine the governance model and maximize reliability and resilience of a mission-critical network.

We invite all stakeholders to engage with us in this testing and review process. In particular, we have identified three initial areas that require further input, attention, and innovation.

1. Catalog all current and foreseeable attack vectors in order to improve current and design new dynamic defense mechanisms. For example, social engineering and other manipulative tactics may pose threats to private key management. The governance framework must be capable of withstanding these threats while maintaining the decentralized nature of the network.

2. Implement proper incentives to encourage a geographically and organizationally diverse group of entities to join the EW Chain as validators. EWF's governance approach is intended to minimize the liability and maximize the value proposition for energy-market participants to become validators.

3. Establish and maintain transparency about our governance approach, proposed solutions, and shortcomings. We believe that transparency is essential for establishing a robust governance framework. We will continue to publish results from governance testing on our Wiki. In addition, we welcome active participation from the global community. We will encourage this participation through hosting workshops and posting bounties, among other mechanisms.

The EW Chain governance mechanism will continue to evolve alongside regulation and the underlying technology itself. Our goal is to create a high-integrity structure to establish a technical foundation for long-term success.

We are seeking technical collaborators to think through and test our governance model, as well as regulators to provide further requirements.

Core Technology: adding technical features most needed by application developers

We will continue to identify, prioritize, and build features in close collaboration with application developers in the energy and blockchain space, whether startups or large corporations. All good ideas are welcome, wherever they come from. We invite feedback and proposals via Github.

We will fund and make available features prioritized for implementation and approved via the EW Chain governance mechanism. Implementation will be done by our technical staff or contracted to our strategic partners on a case-by-case basis.

We will continue to identify, prioritize, and build features in close collaboration with application developers in the energy and blockchain space, whether startups or large corporations. All good ideas are welcome, wherever they come from. **We invite feedback and proposals via Github**.