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Powerledger Lightpaper

Powerledger introduces its multipurpose blockchain, based on high volume and low fees

Powerledger.io

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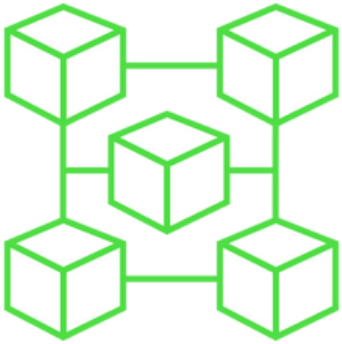
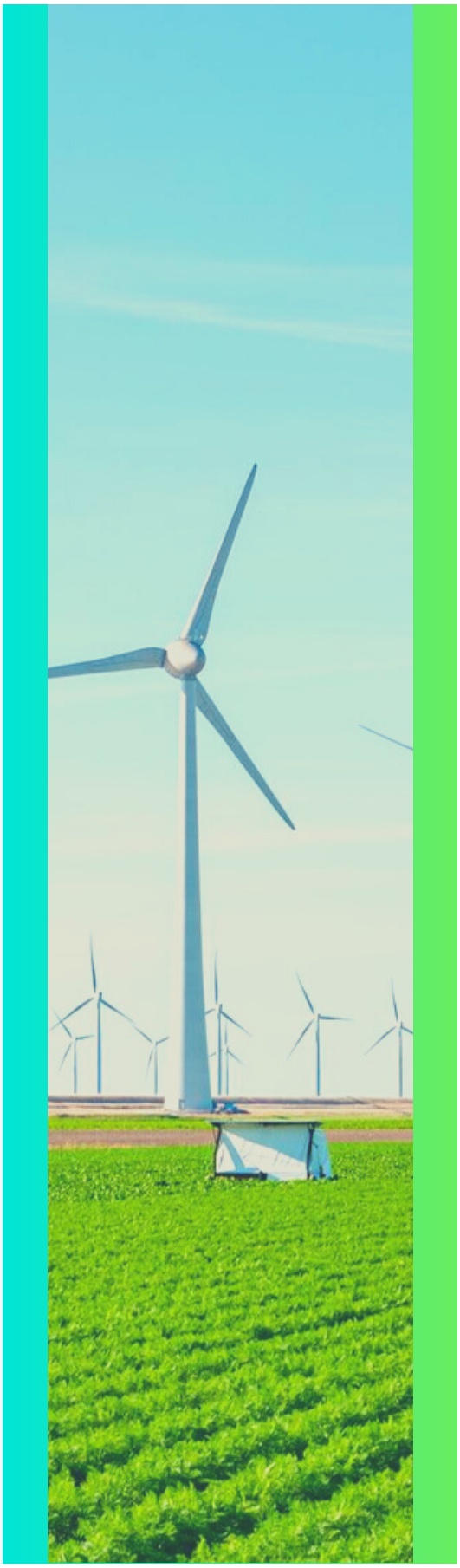


Table of Contents

Executive Summary

In our ongoing commitment to innovation and sustainability, Powerledger proudly introduces a groundbreaking update to our blockchain framework. We have transitioned to a high-performance public blockchain, offering low transaction costs, exceptional scalability and remarkable energy efficiency. By introducing a dynamic transaction fee system, we are making it simpler for energy applications to use the blockchain while retaining the utility of the POWR token. Our ecosystem is poised for future growth and cross-chain compatibility, fostering a vibrant community of developers and entrepreneurs. With this transformation, we are driving the transition towards a decentralised and sustainable energy future.



Introduction

This document is an incremental update to the original Powerledger whitepaper issued in 2017. This revision underscores evolutionary modifications we have implemented through extensive research and development within Powerledger's blockchain components. These adjustments highlight our ongoing work to develop a distributed power system that is resilient, low-cost, and carbon free. Our refined blockchain framework is part of constructing a platform for tracking and trading energy and environmental commodities that is more streamlined, scalable and based on cutting-edge technologies.

Transition to a High-performance Public Blockchain

In step with the rapid advancements of blockchain technology generally, Powerledger has been experimenting with various advanced layer one blockchains in-house. As foreshadowed in the original whitepaper, Powerledger has transitioned from the consortium Ethereum-based blockchain to a proof-of-stake public blockchain for its energy and environmental attributes trading applications.

On 31 July 2023, Powerledger launched its own public blockchain based on Solana code, but with customisations tailored for Powerledger's energy marketplaces and other distributed energy applications. The new Powerledger blockchain offers a combination of low fees and high throughput required to process high-frequency micro transactions for distributed energy marketplaces, for example, peer-to-peer energy trading and tracking.

Due to the efficiency of the proof-of-stake and proof-of-history protocols which allow for a high throughput of transactions, the Powerledger blockchain has remarkable energy efficiency improvements over other layer one protocols on a per-transaction basis.

From a technical perspective, the choice of a performant layer one blockchain was favoured for its compatibility retention, composability with other applications on the same chain, and reduction in overhead from complex cross shard/parachain or cross-rollup communication.

Powerledger Blockchain Capabilities

The Powerledger blockchain presents many new opportunities for participants within the energy and blockchain communities, catering most notably to validators and application developers. Mirroring other proof-of-stake blockchains, the Powerledger blockchain offers mature smart contract capabilities while rewarding validators with staking incentives and transaction fees.

Application developers will find a hospitable environment to launch their own apps, enriched by the Powerledger blockchain's high-speed transaction processing and efficient smart contract execution. These developers will also enjoy the important ability to customise fee structures, aligning pricing with the unique value proposition of their applications.

Introducing A Transaction Fee Model

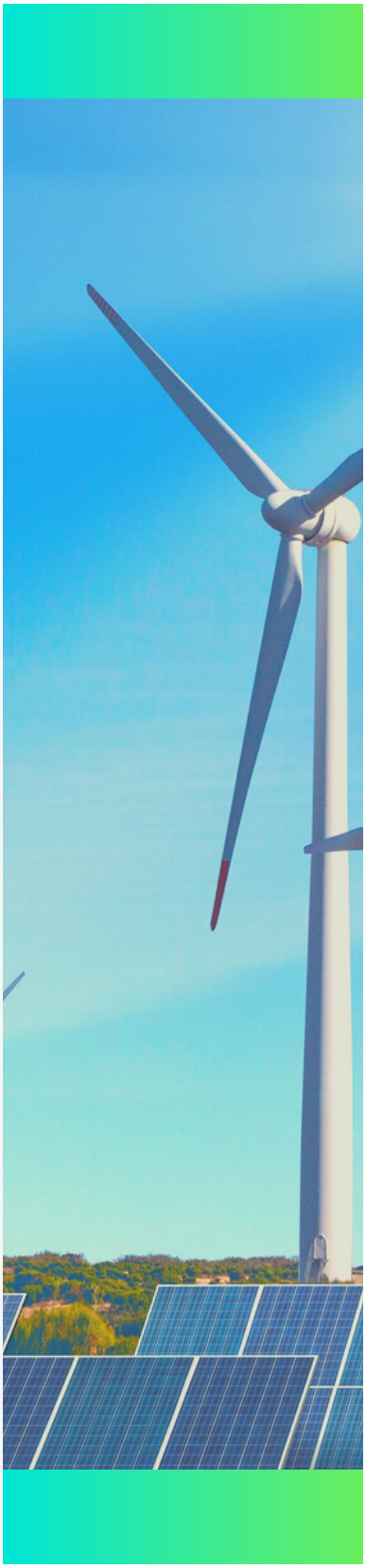
The former escrow model, in which customers held POWR tokens in escrow to gain access to applications, is being phased out and replaced by the transaction fee model. This new model functions across two levels: the layer one blockchain level and the application level.

At the layer one blockchain level, the fee structure includes a small transaction fee to provide compensation to the validator network for the CPU/GPU resources necessary to process transactions, reduce network spam by introducing real cost to transactions, and provide long-term economic stability to the network through a protocol-captured minimum fee amount per transaction.

Meanwhile, each application operating on the Powerledger blockchain has the flexibility to implement its own distinct fee structure. For example, a peer-to-peer[1] application built on top of the blockchain could charge an annual licence fee and a per kWh usage fee, whereas an energy attribute certificate (**EAC**) marketplace[2] built on the same blockchain could charge a percentage fee per EAC transacted.

This model ensures a seamless energy trading experience, reducing complexities and enabling a direct correlation between energy transactions and fees. This enhances user convenience while maintaining the security and integrity of transactions.

Application fees are not necessarily encoded, they can be a combination of encoded fees and traditional fee structures. For example, an annual fee would not be encoded in the blockchain or at the application layer, it would be charged in the same way traditional software fees are charged, via invoice to the customer.



[1] https://www.powerledger.io/platform-features/xgrid
[2] https://www.powerledger.io/platform-features/tracex

Ongoing Use of POWR Token

Whilst Powerledger energy applications will migrate to the new blockchain, our token POWR will continue to exist on Ethereum and maintain its utility as an access token to Powerledger's or third-party applications.

However, implementation of the public blockchain allows Powerledger to streamline the architecture of interaction between the users, the applications and the blockchain, which is more direct and decentralised, and more in line with modern proof-of-stake blockchain economic models. Specifically, instead of the more complicated POWR escrow model, clients can use POWR to pay for transaction fees on the blockchain that correspond to the utilisation of the blockchain by the applications.

As the POWR token was issued as an ERC-20 token on the Ethereum blockchain, it cannot be used directly on the new Powerledger blockchain. A smart contract bridge is intended to be launched, which will allow POWR to be locked up on Ethereum and receive corresponding amounts of native tokens on the Powerledger blockchain.

After bridging the ERC-20 POWR token from Ethereum to Powerledger to receive native tokens, these native tokens can then be used to interact with the Powerledger blockchain and its applications, for example pay transaction fees and secure the Powerledger blockchain by staking and delegation. Importantly, the blockchain bridge will ensure that POWR tokens will only be able to exist on Ethereum or as a corresponding Powerledger native token at any one time.

This ensures the ongoing utilisation of POWR in a unique way that is consistent with modern proof of stake protocols, whilst utilising the established infrastructure and history of POWR as an ERC20 token.

Bridging two ecosystems introduces flexibility and a wider reach, and allows the use of any De-Fi protocols across both blockchains. Further, this configuration encourages participation from all interested parties, whether they aim to engage in validation procedures or contribute to the expansion of the network.

Ongoing Use of POWR Token

The Powerledger blockchain will launch:

- **963 million Native Tokens**
- **Initial programmed inflation rate of 1.25% per year**
- **Reducing by 15% per year until it reaches the terminal programmed inflation rate of 0.75%**

In approximately the fifth year of operation, the supply of native tokens on the Powerledger blockchain is expected to approximately match that of the supply of POWR on Ethereum, i.e. one billion.

There will be no public offering of the native Powerledger tokens. As the Powerledger blockchain works alongside POWR rather than replacing it, it is currently intended that native tokens of the Powerledger blockchain will only be able to be obtained:

- By locking up existing POWR[3] through the existing staking platform
- Through the smart contract bridge that is intended to be deployed in the future; or
- By receiving them as transaction fees or staking rewards through the natural operation of the proof-of-stake blockchain.

Naturally, as the Powerledger blockchain is public, holders of native tokens are free to deal with these tokens within the parameters of the blockchain code and any applications that may be built.

[3]The supply of POWR is limited to 1 billion by the parameters of the ERC-20 contract.

Powerledger Blockchain for the Sustainable Energy Future

Powerledger's global pilots and commercial ventures[4] have underscored that the decentralised energy landscape of the future hinges on a blockchain with very high throughput, minimal energy consumption and negligible transaction fees.

Imagine a network of ten people, each seamlessly sharing electricity with nine neighbours, creating a web of 45 possible transactions between them for each trading interval (typically between five and thirty minutes). Expanding this network to an energy community of 10,000 households where a modest 20% trade with one another, this translates to 1,999,000 transactions for each trading interval, which is over 6,600 transactions per second (assuming a five minute transaction interval).

In stark contrast, Bitcoin can only process five transactions per second, while Ethereum manages just 20, and other layer ones a few thousand at most. These calculations underscore the imperative for a vastly accelerated transaction rate to effectively manage such a complex network in short time intervals.

Data validation also necessitates considerable computational resources, as exemplified by early power-hungry proof-of-work blockchains like Bitcoin. This computational power need invariably leads to escalated energy consumption, a paradigm that is not sustainable for energy market applications. This underscores the urgency for a low electrical power but high computation power blockchain solution, one that pledges its commitment to carbon-free[5] energy sources.

Crucially, this also calls for a blockchain with a transaction fee structure that will not make it prohibitive to process thousands of transactions for each trading interval the energy data is recorded by the meter. The dynamism of innovation flourishes in an environment where transaction costs are within reach for all. Such affordability fuels a surge of creativity, inclusivity, and diverse projects, cultivating a rich and thriving ecosystem.

[4] https://www.powerledger.io/clients

[5] https://www.un.org/sites/un2.un.org/files/2021/09/energy_compact_template_power_ledger_submitted_09232021.pdf

Versioning for Continuous Functionality Expansion

This Lightpaper sets the stage for a more dynamic approach to functionality expansion.

We acknowledge the necessity of continuous improvement and innovation to meet the changing needs of the energy market.

As we develop and integrate new features and capabilities into the Powerledger ecosystem, we may accompany each iteration with version-specific updates to this document. This transparent approach will provide our community with real-time insights into our progress and roadmap.

For Developers

Performance
The Powerledger blockchain offers sub-second confirmation times and can process tens of thousands of transactions per second, ensuring seamless user experiences for your decentralised apps (DApps).

Low Transaction Costs
Minimise costs with Powerledger's affordable transaction fees, making it developer-friendly for both development and usage.

Easier Scalability
Unlike congested networks, Powerledger's architecture allows your decentralised apps (DApps) to scale effortlessly, catering to millions of users without compromising performance.

Developer-Focused Tools
The Powerledger Blockchain will provide a rich set of developer tools, libraries, and API integrations to accelerate your decentralised app (DApp) development journey.

Conclusion

The 2023 Powerledger Lightpaper update reflects our unwavering commitment to pioneering positive change within the energy sector. We have transitioned to a high-performance public blockchain, offering low transaction costs, exceptional scalability, and remarkable energy efficiency.

We invite our community and stakeholders to embrace this evolution and look forward to a future where sustainable energy is more accessible than ever before.

Developers, innovators, entrepreneurs, intrapreneurs, corporations, governments, financial institutions, asset managers, and consultancies can seize the opportunity to build innovative apps that will shape the energy landscape. Energy companies, the door is open for you to usher in a transparent world by integrating your data and systems into this transformative blockchain.

Together, we create a future of sustainable energy for all.

For inquiries and further information, please contact us at enquiries@powerledger.io

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