Voltreum

Transforming the Energy Sector and Curtailing Climate Change with Peer-to-Peer Energy Trading

White Paper

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Disclaimer

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This whitepaper is not an investment document and it does not provide any kind of advice on investments. Voltreum expressly recommends readers to do their own research and seek advice from a financial adviser before making any investment decisions.

Abstract

Voltreum is a future-focused technology company seeking to democratize renewable energy (RE) trading over power grids, increase RE penetration, and create a more sustainable future by developing innovative, eco-friendly solutions. Our first offering, Volt-X, is a blockchain-based peer-to-peer (P2P) platform for transparent energy trading across power grids, including smart microgrids and localized distribution networks, with a clear focus on fair pricing.

Volt-X, in conjunction with Voltreum's cryptocurrency VOLT, will enable producers and consumers to seamlessly transact RE over smart and interconnected localized grids and microgrids to address two of the most critical problems of the 21st century: ***increasing energy demand and climate change.***

Backed by a blockchain-enabled energy trading platform, Volt-X will allow the peer-to-peer trading of clean, renewable energy via interconnected localized distribution networks and microgrids on a significant – and eventually, global – scale. It will enable transparent energy trading and increase RE penetration by integrating distributed energy resources (DERs) and battery storage technologies.

For an energy trading platform to be effective, it must resolve two critical challenges in renewable energy penetration and availability: ***time problem and space problem.*** Volt-X will address the time problem by increasing the availability of RE via P2P trading, regardless of when the demand surge occurs. Volt-X will also address the space problem by facilitating a borderless trading mechanism. Essentially, Volt-X will ensure energy reaches where the demand exists irrespective of geographical barriers.

Besides addressing the problems of time and space, Volt-X creates opportunities for asset monetization for prosumers (producers + consumers) and DER owners. Through this approach, Volt-X will drive deeper renewable energy penetration.

Volt-X will support countries looking to leverage blockchain technology's power to enhance their grids' performance and efficiency, particularly those focused on RE generation and distribution. Volt-X aspires to unlock crucial blockchain-enabled functionalities for large UK- and US-based utility companies that are funding research and testing blockchain applications on their systems.

The on-demand energy trading over localized grids and smart microgrids will be driven by the underlying blockchain and cutting-edge technologies such as the Internet of Things (IoT) and cloud computing. For Voltreum, Volt-X is key to creating a multi-directional and borderless ecosystem for trading clean, renewable energy between energy surplus (sellers) and energy deficit (buyers) entities.

Voltreum aspires to create an interconnected mesh of independent power producers (IPPs), DER owners, Battery Energy Storage (BES) and Demand Response Service providers, industrial and commercial entities, business parks, Special Economic Zones (SEZs), public departments, government buildings, and domestic consumers.

While enhancing RE transactions remains one of the fundamental aspirations of Voltreum, transparency, fair pricing, and equitability – before, during, and after each transaction – will be the guiding lights. Volt-X will be the driving force behind Voltreum's vision to enhance the availability of RE while reducing the global dependence on conventional fossil fuels to combat global warming and climate change.

Volt-X is the first step towards realizing Voltreum's vision of revolutionizing RE technology. Initially, the focus will be on promoting RE trading and asset monetization. Voltreum will eventually offer mutually-enhancing solutions to incentivize the shift to clean energy. Voltreum will do this by leveraging powerful technologies like Blockchain and IoT.

Our roadmap to a cleaner and ecologically aware future comprises several key milestones:

- **Renewable Energy Certificate (REC) trading;**
- **Energy savings certificate trading;**
- **Energy efficiency certification;**
- **Procurement and utilization of green attributes by corporates across their global network.**

These applications will be available separately and in bundles. Our solutions will be scalable because they will continually facilitate P2P trading of RE and RE-related assets and contribute to enterprise CSR initiatives and sustainability.

Background

> ” Pour ce qui est de l’avenir, il ne s’agit pas de le prévoir, mais de le rendre possible.“
> “As for the future, it is not a question of foreseeing it but of making it possible.”
>
> Antoine de Saint Exupéry, Citadelle, 1948

A recent IPCC (Intergovernmental Panel on Climate Change) report warned if global warming increases by more than 1.5 °C above pre-industrial levels in the coming years, by the turn of the century, the frequency and the intensity of droughts, heat waves, and floods will surge manifold. Besides, the resulting global warming and climate change would push millions into poverty and trigger large-scale food and water shortages.

According to the BP Statistical Review of World Energy 2022, energy demand worldwide increased by 5.8% in 2021, exceeding 2019 levels by 1.3%. Although the share of fossil fuels in energy consumption dropped from 85% in 2016 to 82% in 2021, there was no let-up in CO2 emissions, attributed mainly to the post-COVID economic rebound.

These findings have resonated with countries across the globe, with many stepping up their efforts to combat the underlying issues causing global warming and climate change. However, individual efforts to mitigate the causes will not suffice in the current scenario, where energy demand and consumption are rising.

The answer lies in a concerted, global effort to clamp down on conventional fossil fuel consumption. The Paris Climate Conference (COP21) was convened to build an international consensus on climate change and mitigation efforts. During the landmark conference, 189 countries ratified the Paris Agreement, wherein they agreed to keep global warming at 1.5°C - 2°C, following the recommendations of the IPCC.

However, one significant roadblock in achieving this objective is the increasing demand for energy from a rapidly expanding population. As the population grows, the energy demand will only surge, making it very difficult to abandon planet-damaging fossil fuels.

Difficult, but not impossible.

Renewable energy sources like solar and wind have the potential to wean away the global consumers from fossil fuels. RE sources can help reduce emissions while satiating the ever-increasing demand for energy.

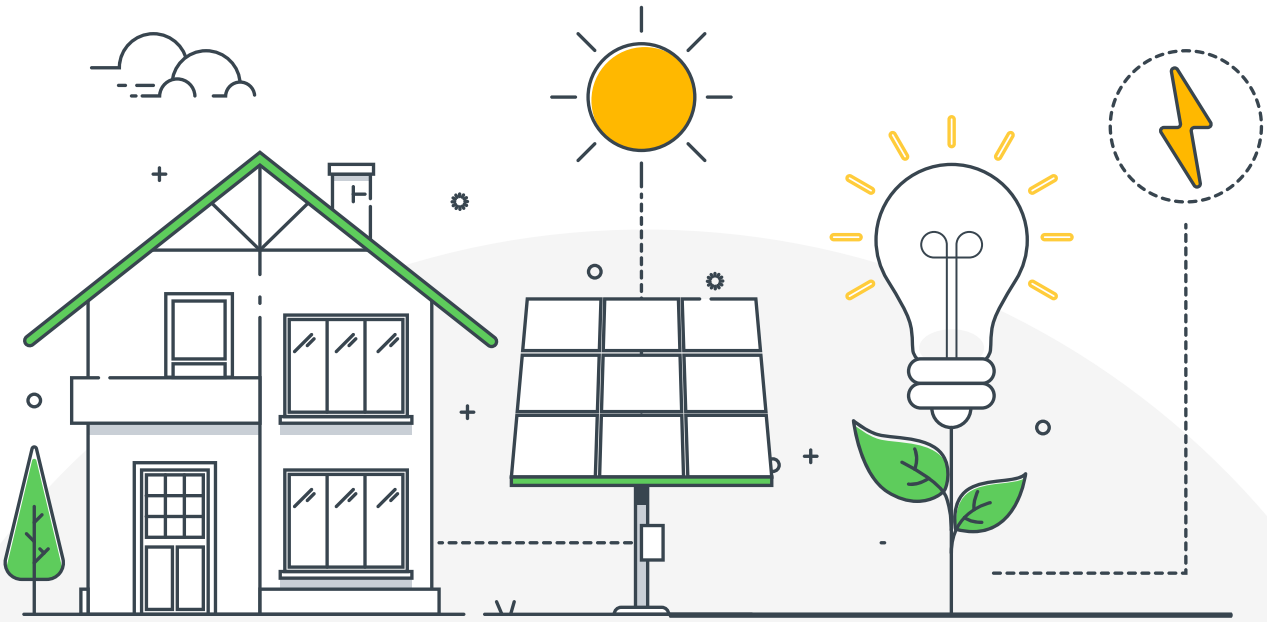
Over the past decade, many countries have started leveraging renewable sources to complement fossil fuels and slowly reduce their dependence on them. This transition partly explains why the adoption of renewable energy has consistently increased in recent years. In 2021, it increased by 5.1 exajoules (EJ) – an annual growth rate of 15% – compared to 2020's growth rate of 9%.

Nonetheless, RE penetration remains low due to challenges in generation and distribution. New and innovative methods are required to reduce the reliance on highly polluting conventional fossil fuels. Such methods must offer some or all of the critical benefits mentioned below to emerge as an effective alternative:

1. **Improve the efficiency and predictability of clean energy production;**
2. **Increase the quantum at which it can be generated with minimal interruptions;**
3. **Enhance its availability and penetration.**

Users can tap all these benefits by leveraging the blockchain-backed P2P energy trading via Volt-X.

The blockchain underlying the Volt-X solution offers a transparent and shared transaction ledger. This ledger is replicated across all devices and confirmed by transaction participants (prosumers and consumers), thus enabling seamless P2P exchange of RE. Volt-X incentivizes conservation and transaction to catalyze penetration and availability.

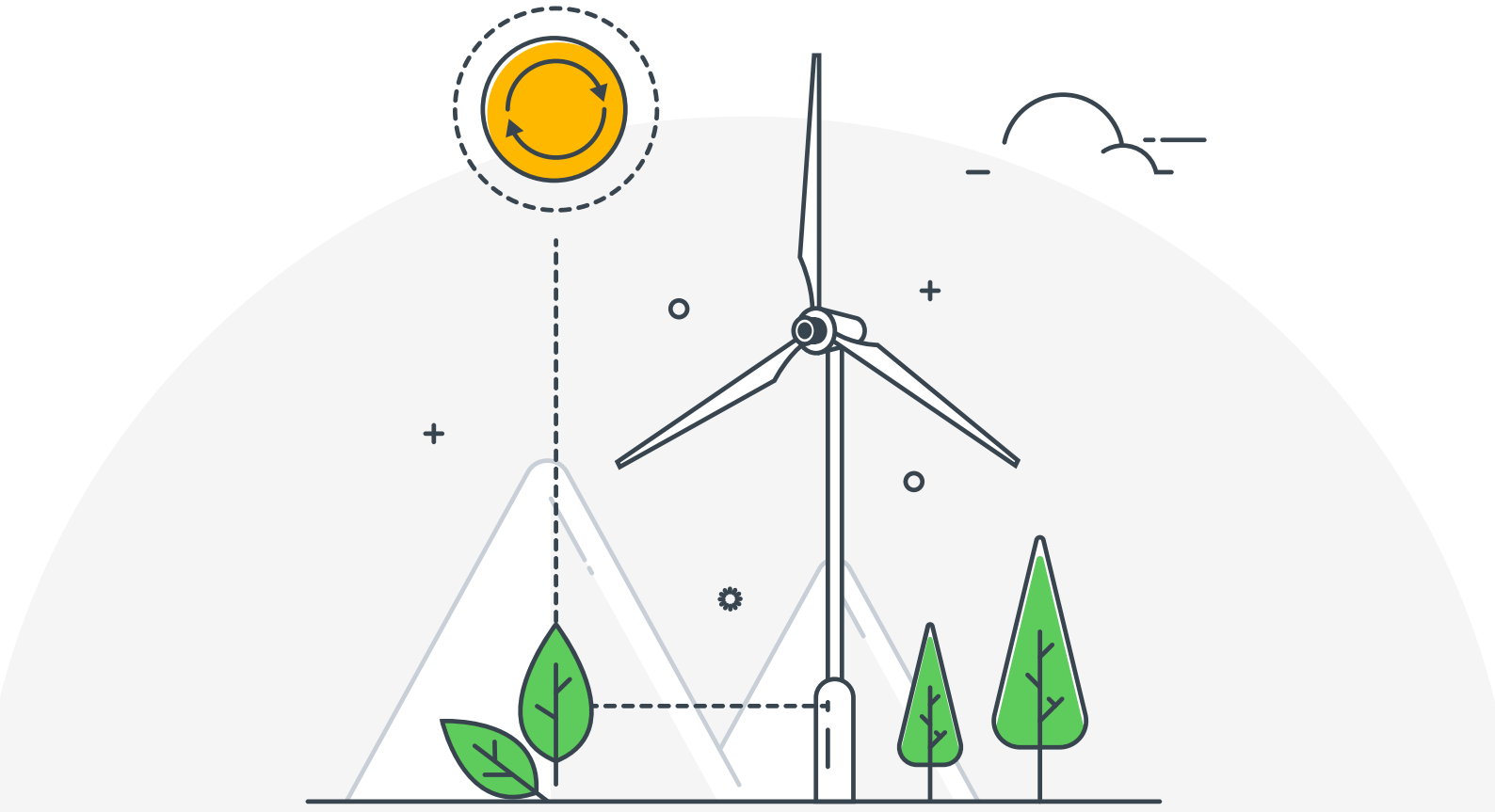


Further, the blockchain is based on smart contracts that leverage open ledger production data and even the variability of P2P energy transfers within the localized grids and microgrids. Volt-X also drives overall grid stability; it is a salient solution because grid instability during RE generation is quite normal owing to RE being an infirm power. Such infirmity tends to stress existing grid operations.

The P2P energy trading facilitated by Volt-X can help meet the localized power demand by utilizing DERs and local RE capacities. Thus, it will eliminate the need to make capital-intensive investments in transmission and distribution (T&D) networks and address the challenge of high T&D losses.

Besides rendering heavy investments redundant, Volt-X will help prosumers monetize assets they already own. For example, many modern prosumers invest in solar panels but cannot leverage their full capacity due to lower power requirements during the daytime. As a result, prosumers cannot monetize the surplus and unused solar energy.

However, by leveraging Volt-X, prosumers can sell the surplus using its P2P energy trading platform. This way, prosumers can make money without investing in the infrastructure. Further, an energy-deficit entity can buy energy at will without installing power generation infrastructure.



Current Challenges in the Energy Sector

For many countries, the energy distribution is one of the biggest challenges in their supply chain. Due to expensive and long-term power purchase agreements, poor infrastructure, and inefficient operations, many power distribution utilities – especially in developing economies – are debt-ridden and operating at a loss.

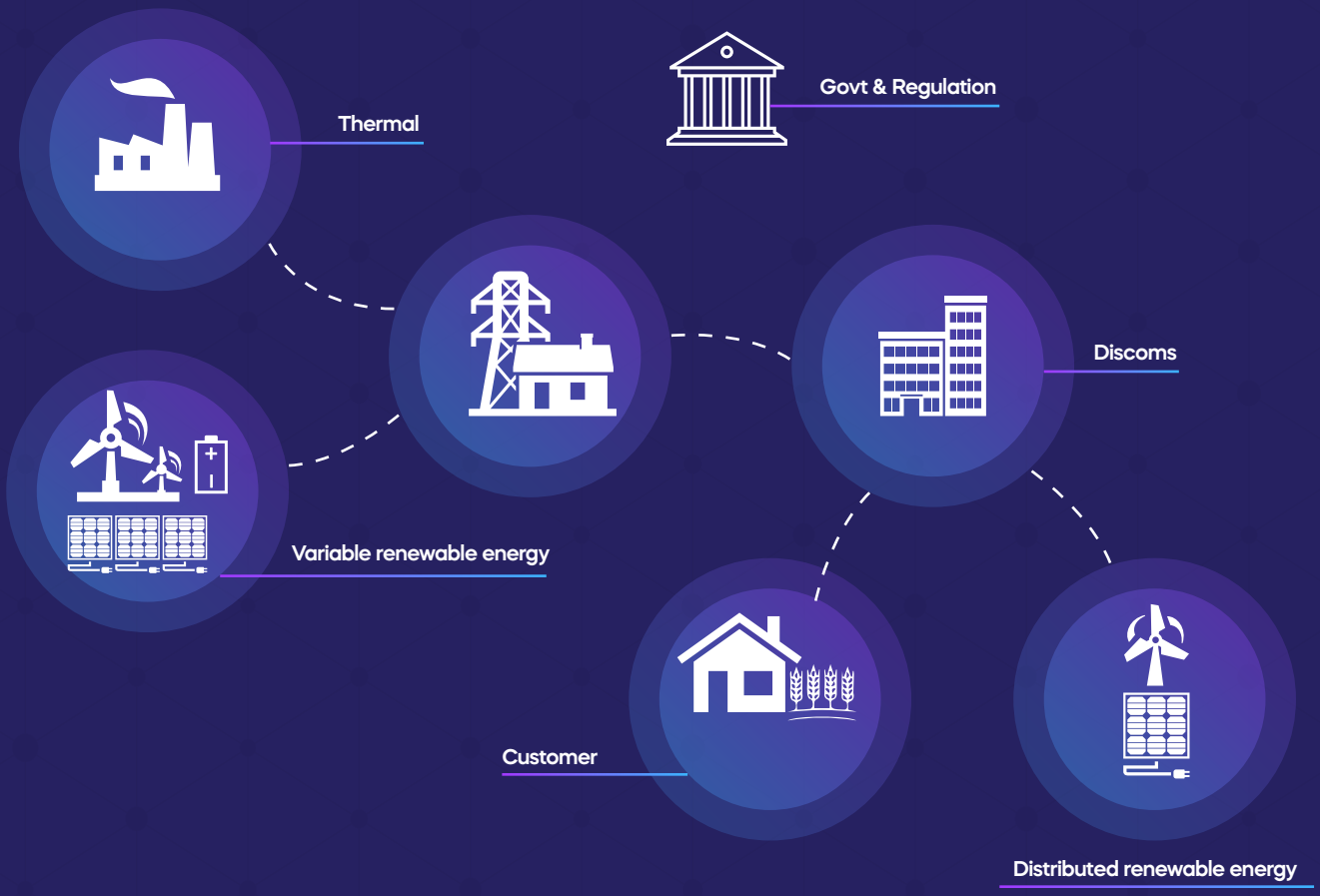
Consequently, utilities cannot make the critical investments required to improve the quality and continuity of power supply. They also lack the wherewithal to build the infrastructure to transition from fossil fuels to renewable energy sources like solar or wind. Further, many utilities are struggling to pay for power generators, which not only impacts the financial health of the latter but also affects the national economy.

The current renewable energy ecosystem is also riddled with challenges. For example, in theory, solar energy users in many countries can monetize their solar rooftops by selling the surplus to distribution companies (discoms). In this sense, these users are not just consumers but also prosumers.

Even so, the possible role of prosumers is relatively limited in present-day energy markets. One reason is that it is not economical for energy distribution companies to purchase power from prosumers as it entails additional infrastructure expenditure.

Significant challenges hindering the production and distribution of renewable energy are:

Some of the other challenges curtailing the production and distribution of renewable energy are:



Thermal

- **Inefficient cost optimization**
- **Older generators**
- **Inadequate ramping capacity**

Discoms

- **Non-cost reflective tariffs**

Variable Renewable Energy

- **Grid constraints**
- **Inadequate renewable energy generation**
- **Inefficient generator operations**

Customer

- **Inadequate meter penetration**
- **Billing challenges**
- **Collection challenges**

Govt & Regulation

- **Political complexities**
- **Economic complexities**

Distributed Renewable Energy

- **Energy theft**
- **Inadequate demand-side management**

If effectively addressed, all these challenges will pave the path for the prosumers to participate fully in the energy economy. They can help them:

- **Bring more energy choices into the market;**
- **Spur greater competition and innovation in the energy sector;**
- **Drive economic development;**
- **Preserve the natural environment.**

Voltreum seeks to address these challenges through continuing investment in developing solutions through connected technologies and help prosumers tap into the numerous long-term economic and ecological benefits.

Addressing the Challenges through Infrastructure Reforms, Renewable Energy, and Microgrids

The power sector worldwide is transforming with advancements in electric mobility, energy storage technologies, and the increased thrust on RE technologies. There has been a marked rise in the deployment of clean, renewable energy alongside an uptick in the prevalence of grid-connected distributed generation and publicly-available electric vehicle (EV) charging infrastructure.

However, the transformation is not in tune with the requirements of the world battling emissions and climate change. Further, the geographical spread of the transition is neither equitable nor economical. For the benefits of RE to percolate, regardless of the geography, the power sector worldwide must become flexible in terms of generation, both physical (flexible generation and demand response) and institutional (such as access to markets).

Governments must play an enabling role so that utilities and distributors can easily access energy markets. More private investments in RE generation must be encouraged. Grids and DERs catering to localized demand should be digitalized to enable a bidirectional flow of information and power.

Energy storage technology enabled through EV charging infrastructure and distributed RE generation that can act as both load and supply will play an essential role in enhancing the physical flexibility of the energy system.

The development of virtual microgrids using peer-to-peer energy trading will enable institutional flexibility by providing access to localized markets with blockchain as the critical element in transforming electricity supply. Blockchain, based on Distributed Ledger Technology (DLT), will give the members of a peer-to-peer energy network or microgrid a reliable, low-cost digital platform for making, validating, recording, and settling energy transactions.

Moreover, these transactions will happen near real-time across a localized and decentralized energy system for seamless and transparent trading of clean, renewable energy. Also, the virtual microgrids and blockchain will create opportunities for asset monetization for prosumers, Distributed Energy Resource (DER) owners, BESS, and demand response service providers.

While P2P trading will help integrate different entities with grids, a mechanism will be required to enable renewable energy transfers and trading. This mechanism will balance the energy demand-supply paradigm and act as a regulator to control energy prices and democratize its availability and use. Volt-X is poised to emerge as the mechanism to balance the demand and supply paradigm, besides acting as a regulator.

Volt-X will enable a market mechanism for P2P RE trading, which will be powered by blockchain and DLT. It will connect prosumers with surplus energy to consumers with a deficit, thus bridging the demand-supply gap while also creating opportunities to monetize existing RE assets. The system is entirely democratic, transparent, and borderless, so anyone looking to trade energy can proceed unhindered, regardless of their scale, identity, location, or time.

Solution: Borderless P2P Energy Trading with Voltreum

Innovation is the key to addressing global warming and climate change. Smart grids are one such innovative solution. Several countries have already switched to smart grids, while many more are expected to complete the transition in the coming years.

Energy trading is one of the most efficient and cost-effective ways to successfully adopt a smart grid infrastructure, generate non-polluting energy, and meet energy requirements. Currently, energy trading is mainly confined to smaller localities or neighborhoods. While such small-scale trading provides an excellent start to transition from polluting fossil fuels like coal to cleaner renewable energy, they are not enough to make a tangible impact amid the rising effects of climate change.

One of the ways to combat global warming and climate change on a globally-effective scale is to create a borderless energy trading ecosystem for the smart grid. This system should allow for trading clean, renewable energy via interconnected microgrids on a large scale. Voltreum and VOLT aspire to do this.

Voltreum underpins a global and borderless microgrid architecture to create a multi-directional ecosystem for trading renewable energy. Through near real-time and transparent blockchain-based energy exchange, Voltreum enables seamless, trustworthy, and decentralized exchange of clean energy between energy-surplus and energy-deficit entities, thus helping create a more energy-equitable world.

Voltreum will enable speedier, more accurate, and highly transparent energy trading transactions through decentralization, interconnected microgrids, and advanced energy meters. It will empower countries to transition to renewable energy, thus creating greater momentum to achieve energy sufficiency and fight climate change.

Along with the deregulation of energy markets and the rise of knowledgeable prosumers, Voltreum's cutting-edge technologies will play a critical role in democratizing energy trading and creating a more sustainable future.

Introduction to Voltreum Energy Trading Platform

Voltreum provides a decentralized solution for smart microgrids and enables various entities to trade energy easily and on-demand. It also gamifies the bi-directional trading process to motivate prosumers to save energy and money.

The Volt-X application and VOLT hold the key to true borderless and decentralized energy trading between smart grid-enabled individuals, companies, neighborhoods, and even countries. With Volt-X, energy exchange won't be limited by geographical borders. **The solution can be rolled out globally with zero dependencies on geographical location or geography-limited factors.** It will allow energy-deficit entities to efficiently meet their requirements and energy-surplus entities to monetize their excess energy and avoid wastage.

Furthermore, the energy exchanged will be renewable and clean. Voltreum, Volt-X, and VOLT will incorporate solar, wind, water, and other renewable energy sources on the same microgrid, thus facilitating the shift to clean energy available on demand.

Over time, Voltreum and VOLT will bring transparency and equitability into RE trading over microgrids. They will accelerate the global move towards sustainable, clean energy and stave off the damaging effects of climate change on the planet.

Who will benefit from Voltreum

Utility companies

- Compliance with Renewable Purchase Obligations (RPOs).
- Reduce carbon emissions and achieve carbon neutrality.
- Reduce transmission and distribution (T&D) losses.
- Expand capacity utilization without major/new infrastructure investments.
- Energy arbitrage through peak/off-peak demand management.

Commercial & Industrial (C&I) consumers

- Lower energy costs.
- Lower burden of high tariffs for cross-subsidization.
- Opportunities to sell excess energy to other C&Is or residential units.

Residential units

- Lower energy costs.
- Better control over energy expenditures.
- Direct energy purchases from C&Is or other residential.
- Less dependence on the tariffs and energy controls implemented by private/state-owned utility companies.

P2P Energy Trading and Volt-X Market Mechanism

A P2P energy trading system allows users in a smart grid to trade renewable energy with each other for profit. Thus, users with insufficient power can meet their demand by buying energy from users with a surplus. In reality, many users are unwilling to engage in energy trade if it is not beneficial, i.e., not profitable. Privacy concerns also prevent them from sharing their private information with other prosumers, thus curtailing their free participation in the energy trading market.

Moreover, the energy trading system must facilitate efficient energy exchange among all participants. For this, it must satisfy the following requirements:

Reliability: To prevent data tampering or leakage

Security: To protect prosumers' identities

Scalability: To ensure that more participants can join in the system as the microgrid expands in size and reach

A secure and decentralized energy trading system is essential to meet these requirements. The system must protect users' information and facilitate transparent and traceable energy transactions. Moreover, it must be easy to manage over the smart grid infrastructure, regardless of the number of prosumers or the amount of renewable energy produced, consumed, or traded. Voltreum ticks all these boxes.

Market mechanism

Voltreum supports P2P energy trading, wherein prosumers can directly buy or sell energy profitably. They can trade directly with each other, independently of the main grid. Cutting out the intermediaries enables faster and mutually-beneficial energy exchanges over a smart microgrid.

The energy exchange via Voltreum-enabled microgrids happens over the blockchain using the VOLT crypto. The blockchain is a decentralized and distributed ledger that records every transaction on the Volt-X P2P network. Individuals trade surplus RE energy (after self-consumption) with other consumers at a mutually agreed upon price.

These flexible pricing and exchange mechanisms -- plus blockchain smart contracts -- ensure that every transaction is transparent, auditable, and trustworthy for all participants. It also encrypts all information; any data manipulation will be immediately visible to all the parties involved. This way, the blockchain ensures complete security, transparency, and reliability of every transaction.

Since the system is entirely decentralized, no third party or centralized authority – such as a government electricity regulation board – can set energy rates or control energy distribution. Thus, Voltreum will help democratize the energy market and lower energy costs for all.

P2P Trading Options

Volt-X supports fixed and dynamic price energy trading on its P2P network. The fixed price mechanism ensures price certainty, so users know exactly what they will receive for their energy traded through the P2P. Under the dynamic trading option, prosumers and consumers set their own prices. Ultimately, the cleared price can be the highest price offered by the buyer, the lowest price acceptable to the seller, or even an average of buyer-seller prices.

In the future, Volt-X will also support dynamic price trading with preferential trading. This system allows prosumers to identify their preferred consumer and offer a percentage of their excess energy at bespoke pricing models.

Voltreum also enables the gamification of energy trading which will help to:

Change energy consumption behaviors

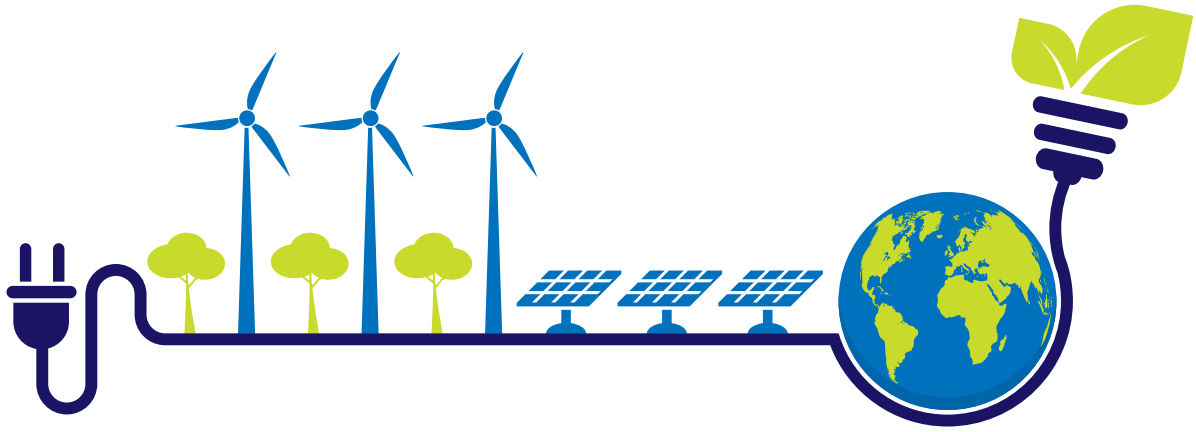
Save more energy

Help prosumers trade more energy for profits.

How Voltreum Revolutionizes Renewable Energy Markets for Producers and Consumers

Volt-X speeds up energy trading on smart and other power grids and brings greater convenience, trust, and cost savings with each transaction and for both parties involved in the trade. As it removes geographical boundaries, all entities can participate in trading energy to meet their needs.

Over time, Voltreum will make it easy to connect multiple microgrids into progressively larger grids. We are leading a global mission to clamp greenhouse gas emissions by helping build large grids that generate clean energy and facilitate seamless intra- and inter-country energy exchange.



Since the traded energy is renewable, it will enable the world to move away from fossil fuels to accelerate the global transition to cleaner, greener energy. This transformation in generation, transmission and consumption patterns will bolster the fight against global warming and climate change.

By gamifying the trading process, Voltreum will motivate consumers and prosumers to save energy. They will be active elements in the energy exchange program and earn great rewards if they generate (and sell) excess power or consume less. As more microgrids connect via Voltreum, neighborhoods, towns, cities, and entire countries can become energy self-sufficient.

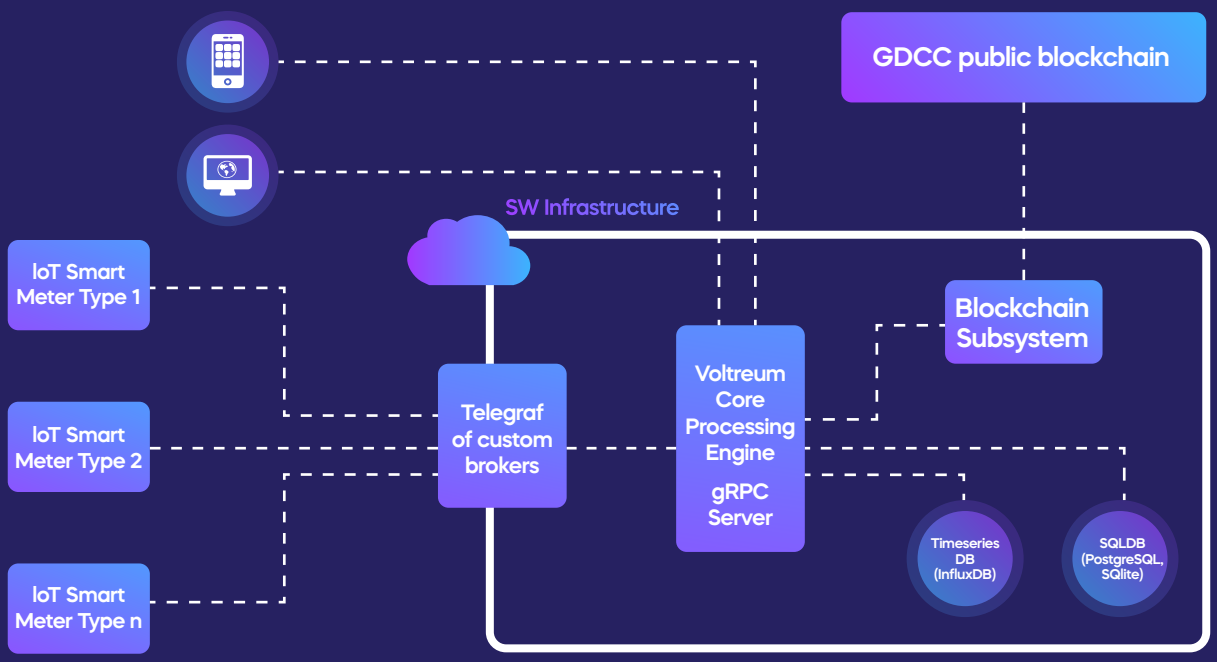
How Volt-X Works

Volt-X uses modern digital technologies like blockchain, IoT, and Artificial Intelligence for the smart, seamless energy exchange. The system consists of an app and a browser, both of which constitute the platform's front end, which is visible to users. These users may be energy buyers or sellers.

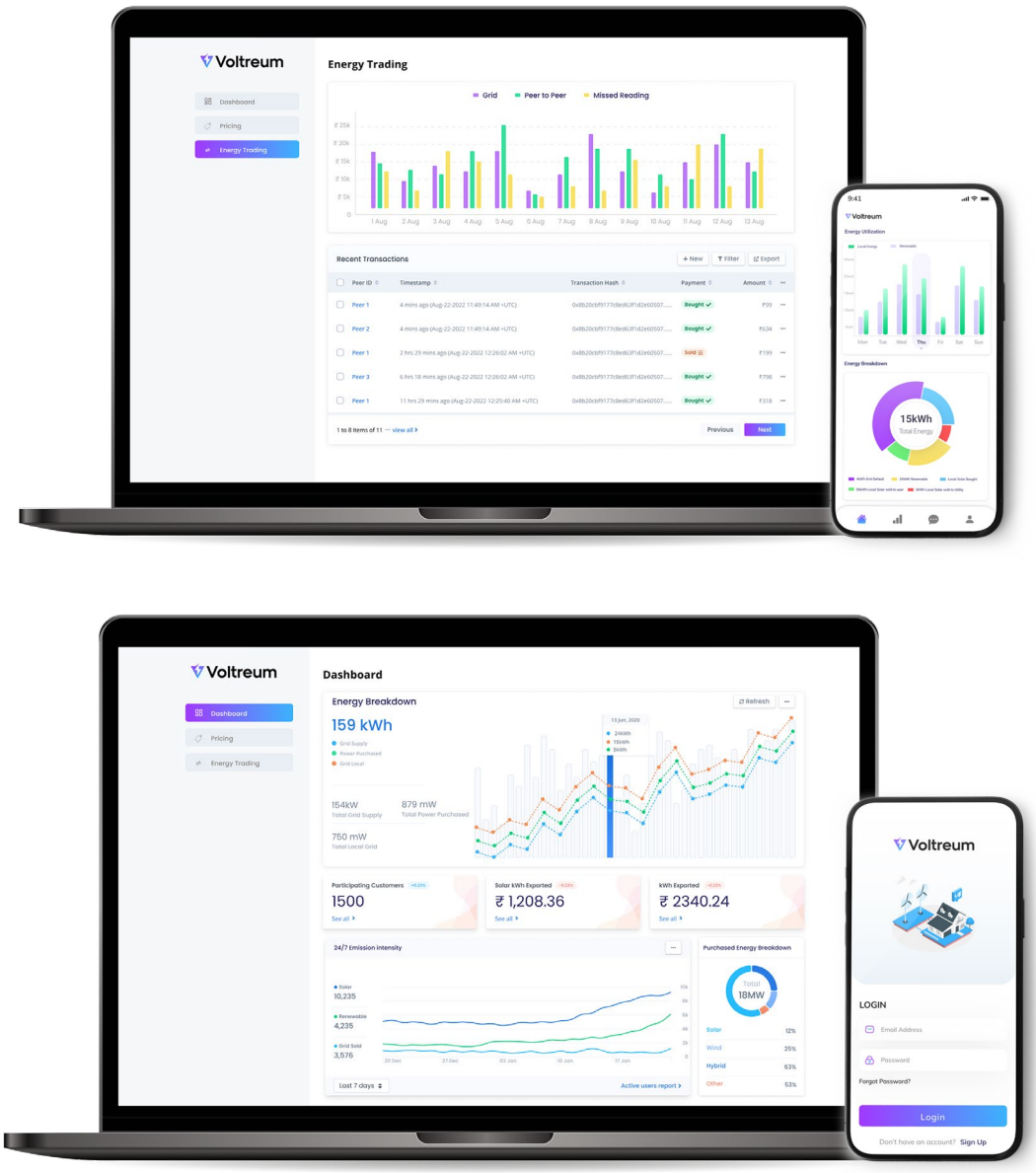
Volt-X will help create a hyper-connected and decentralized P2P system based on a microgrid architecture in conjunction with standardized tools and blockchain-based smart contracts. This architecture can quickly scale to meet its community's evolving energy needs.

Each microgrid will connect small neighborhoods or residential units and enable them to exchange renewable energy that's clean, locally produced, and easy to buy and sell – just like any other commodity. Thus, the microgrid will provide a near real-time, transparent, and secure system to generate renewable energy on demand. It will also monitor energy generation and distribution to maintain fairness and equitability in the trading system.

Volt-X Platform Architecture



Users can trade energy either through the Voltreum app or Voltreum's website, using browsers like Microsoft Edge, Firefox, Google Chrome, etc. These users include buyers or sellers, such as residential units, C&Is, or utility companies.



Voltreum's backend consists of numerous interconnected elements, communicating with each other in near real-time:

- Voltreum Core Processing (VCP) Engine, which is a gRPC server.
- Hardware data sources, such as various types of IoT meters.
- Telegraf or custom brokers.
- Two databases for data storage:
  - **Influx:** Time series database (TSDB) to store IoT smart meter data
  - **SQL:** To store user data and other metadata
- Grafana for data visualization and analytics.
- Operating system: RHEL 9.0 or its binary-compatible derivatives like Oracle Linux 9.0 or Rocky Linux 9.0; users have no OS limitations, meaning they can use any OS as long as they have a browser or mobile app.

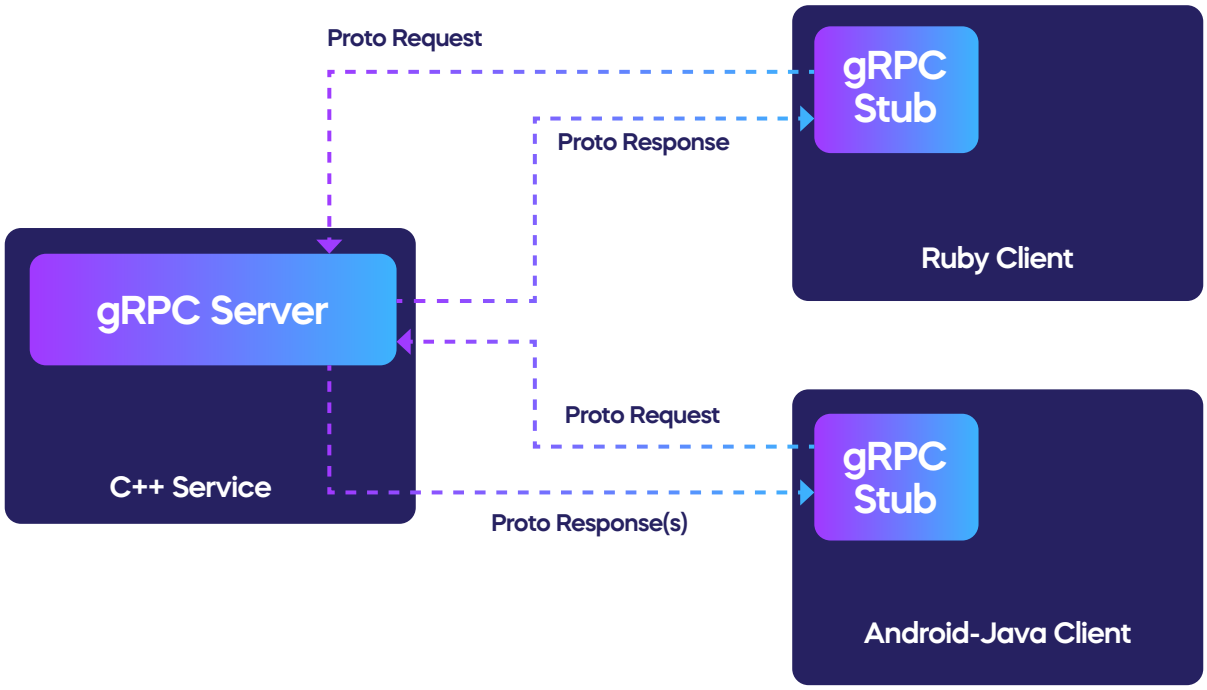
Volt-X uses custom brokers and Telegraf, a server-based agent that collects all energy metrics for further downstream processing. The agent streams metrics from various sources into registered outlets. Both the custom brokers and Telegraf facilitate seamless and uninterrupted communication between the IoT smart meters and the VCP engine.

The Telegraf agent is capable of ingesting data from a wide range of sources, including:

- HTTP
- IoT sensors/smart meters connected to a microgrid
- Cloud
- PLCs
- HMIs
- Robotics
- Devices

Telegraf and the custom brokers understand the IoT smart meter protocols, allowing them to ingest data quickly. Additionally, they transform all incoming multi-format data into a uniform format for the VCP Engine to easily consume and process.

The time-series data collected by Telegraf or custom brokers from microgrid smart meters is stored in an InfluxDB database. All user data and metadata is stored in a SQL database. It is encrypted (SHA-2 encryption) to protect user data from cyberattacks and breaches.



The VCP Engine consists of a gRPC server and gRPC clients. gRPC is a high-performance, open-source universal RPC (remote procedure call) framework. The VCP Engine, built on top of the gRPC framework, manages and makes sense of the data ingested from IoT smart meters. It incorporates smart business logic and provides data – that's filtered through this logic – to the Voltreum web and mobile frontend clients.

Voltreum's blockchain-based subsystem is based on a powerful Proof of Stake (PoS) algorithm and smart contracts that help create a connected and decentralized peer-to-peer ecosystem based on a microgrid architecture. This subsystem connects to the Global Digital Cluster Coin (GDCC), a community-driven public blockchain that allows anyone to develop decentralized applications, create web3.0 services, and code immutable smart contracts.

The entire Voltreum system is cloud-based, providing advanced flexibility, agility, and resilience. We chose AWS Cloud because it gives all the services for seamless Voltreum operations and energy trading, including:

- EC2 computing power for VCP Engine SW;
- EC2 for InfluxDB and other SQL DBs;
- Elastic Block Storage (EBS) for extending EC2 storage;
- S3 buckets to store data for immediate use;
- Glacier to archive data based on regulatory requirements (Users can change the archival policies and SOPs depending on region-specific or regulator-specific conditions).

Smart Meter Infrastructure and Voltreum

Smart meters are a vital component of advanced metering infrastructure (AMI), which is crucial for creating smart grids. Next-gen energy networks include AMI powered by Edge computing over 5G networks. Advances in data analytics, IoT, and cloud computing are also helping create a solid foundation to improve energy production and distribution, utility operations, and customer experiences with the smart grid.

Smart meter advantages

Smart meters and AMI bring a host of benefits to all energy stakeholders, including utility companies and their customers:

- Faster outage detection and service restoration;
- Provides customers with greater control over electricity consumption and bills;
- Increases energy efficiency by reducing reliance on older, less-efficient power plants;
- Leverages AMI meter usage and events, thus reducing costs for both utilities and customers;
- Reduces the need to build new power plants, thus helping the environment;
- Protects customer privacy since energy usage information is relayed automatically to the utility for billing.

A combination of smart meters, digital sensors, and advanced analytics help build a smarter, more productive, safer, and more cost-efficient grid than traditional grids. Utilities can understand demand in real time and proactively help customers control their energy consumption and costs. AMI also enables utilities to maintain regulatory compliance.

The Voltreum solution is designed to work with smart grids and various smart meters and communication systems, including:

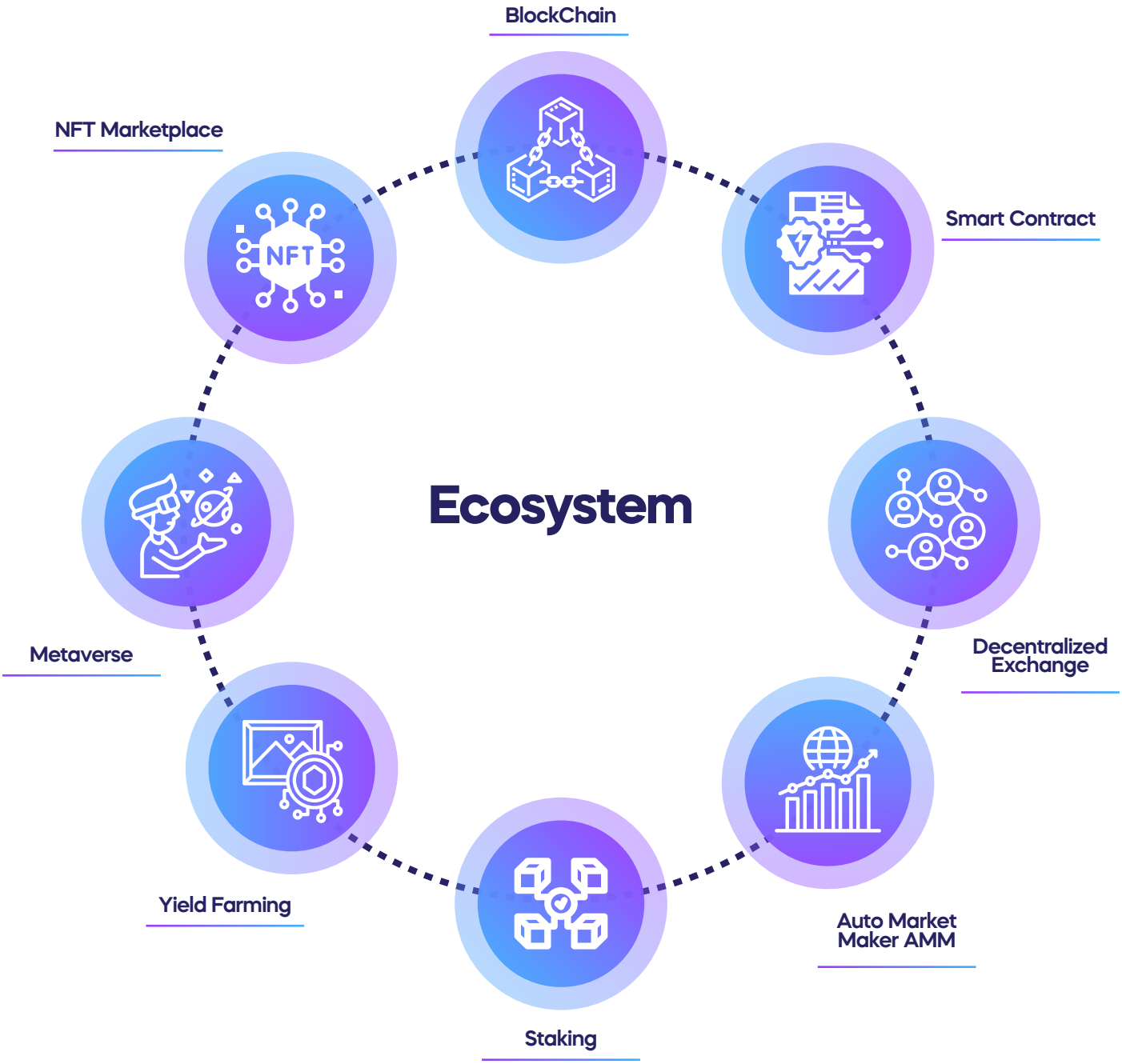
- **RF Mesh:** a P2P network in which devices and routers communicate continuously to extend the energy network's coverage, throughput, and reliability and minimize latency.
- **GSM:** a flexible smart meter that provides customers greater control over energy supply with real-time usage data.
- **Power-line Communication (PLC):** a reliable communication technology that can transmit electric power and data simultaneously and without interference. It uses existing power lines to reduce the need for multiple cables and makes building energy networks at a low cost possible.
- **Radio frequency (RF) communication:** a wireless communication technology that reduces the running cost for utilities, making it an economical long-term energy generation option. Utilities can pass on these cost savings to consumers through lower tariffs.
- **3G/4G (cellular) network:** this wireless technology is ideal for smart metering. It offers fast data transfers and can handle both voice and data on the same network, reducing the maintenance burden on utilities. 3G/4G networks also promise better reach – a considerable advantage for power service providers in developing countries and smaller/far-off towns.

The Voltreum solution, platform, and application have been extensively tested on each of these smart meters. Additionally, Voltreum's technical and engineering teams understand that different countries use different types of smart metering technology. To this end, they continually test various technologies against Voltreum. The goal is to speed up roll-out and ensure the system is ready for any country to provide true borderless and democratic trading of renewable energy over microgrids.

Voltreum Blockchain Technology

Voltreum's blockchain subsystem underpins the platform's energy trading capability, transaction transparency, and immutability. It is based on the Global Digital Cluster Coin or GDCC, a blockchain protocol that allows Voltreum users to conduct transactions directly with each other.

Global Digital Cluster Coin Blockchain



As a P2P network, GDCC eliminates the need for or intervention of intermediaries, so buyers and sellers can directly trade renewable energy. Moreover, no single entity or institution controls GDCC or Voltreum, which means no one can manipulate transactions or restrict users from buying, selling, or paying for energy in a way that maximizes their benefits.

GDCC is based on Ethereum and offers these advantages:

- **Enhanced security** with immutable smart contracts;
- **Compatible with GDCC virtual machine** for an efficient blockchain system for energy trading;
- **Cross-chain functionality** for seamless connections between different blockchain networks;
- **High-speed energy trading transactions** confirmed in just a few seconds;
- **Support for highly scalable decentralized** applications on the blockchain.

GDCC is based on the go-Ethereum (Geth) fork, a mature implementation of the Ethereum node software. Since it is written in the Go language, the fork supports the high performance and security that Voltreum aims to provide during energy trading.

Nethereum and Web3.js

The Voltreum blockchain's core infrastructure is based on the Nethereum protocol for the GDCC blockchain connection and Web3.js for client Dapp connection to the blockchain. Nethereum, an open-source .NET integration library for blockchain, simplifies smart contract management and interaction with EVM-compatible chains. At the same time, Web3.js provides a collection of libraries that allow users to interact with an Ethereum node (local or remote) using HTTP, IPC, or WebSocket.

Proof of Stake (PoS) Algorithm

Voltreum's blockchain is an EVM-compatible network based on the Proof of Stake (PoS) algorithm. Ethereum Virtual Machine (EVM) compatibility solves the long-standing lack of interoperability between blockchains. It also enables faster transactions, higher capacity, and much lower energy consumption than Ethereum while providing enhanced decentralized user experiences with Voltreum.

The PoS algorithm is a consensus-based algorithm in which crypto validators "stake" some of their crypto coins in a wallet. Then, if they discover that a block has been added to the blockchain, they will validate it. Occasionally, they may also create and propagate new blocks on the blockchain. In return, they will be rewarded, such that their stake increases proportionately to their bet, based on the added blocks. The user's stake acts as collateral that can be destroyed if they behave dishonestly, ensuring the system's honesty and trustworthiness.

The PoS algorithm is the perfect choice for the Voltreum blockchain since it doesn't involve solving complex computational problems and, therefore, consumes less energy than other algorithms. In addition, PoS also:

- Reduces the need for elite hardware to create and validate new blocks;
- Supports short block times and fast transactions;
- Lowers the trading fees for both energy buyers and sellers;
- Reduces the risks of centralization;
- Supports both fiat and cryptocurrencies for payments.

Voltreum's underlying blockchain network architecture (GDCC) is supported by a consensus-based PoS mechanism and in-depth algorithm analysis to provide an energy trading solution that:

- Enables affordable, seamless, and borderless energy trading among energy-deficient and energy-surplus entities.
- Is fully decentralized to prevent an entity from manipulating transactions or the blockchain.
- Is highly scalable to accommodate any number of microgrids.
- Can process energy transactions at extraordinarily fast speeds.
- Brings full transparency and auditability into the trading infrastructure.

Voltreum billing and invoice generation system

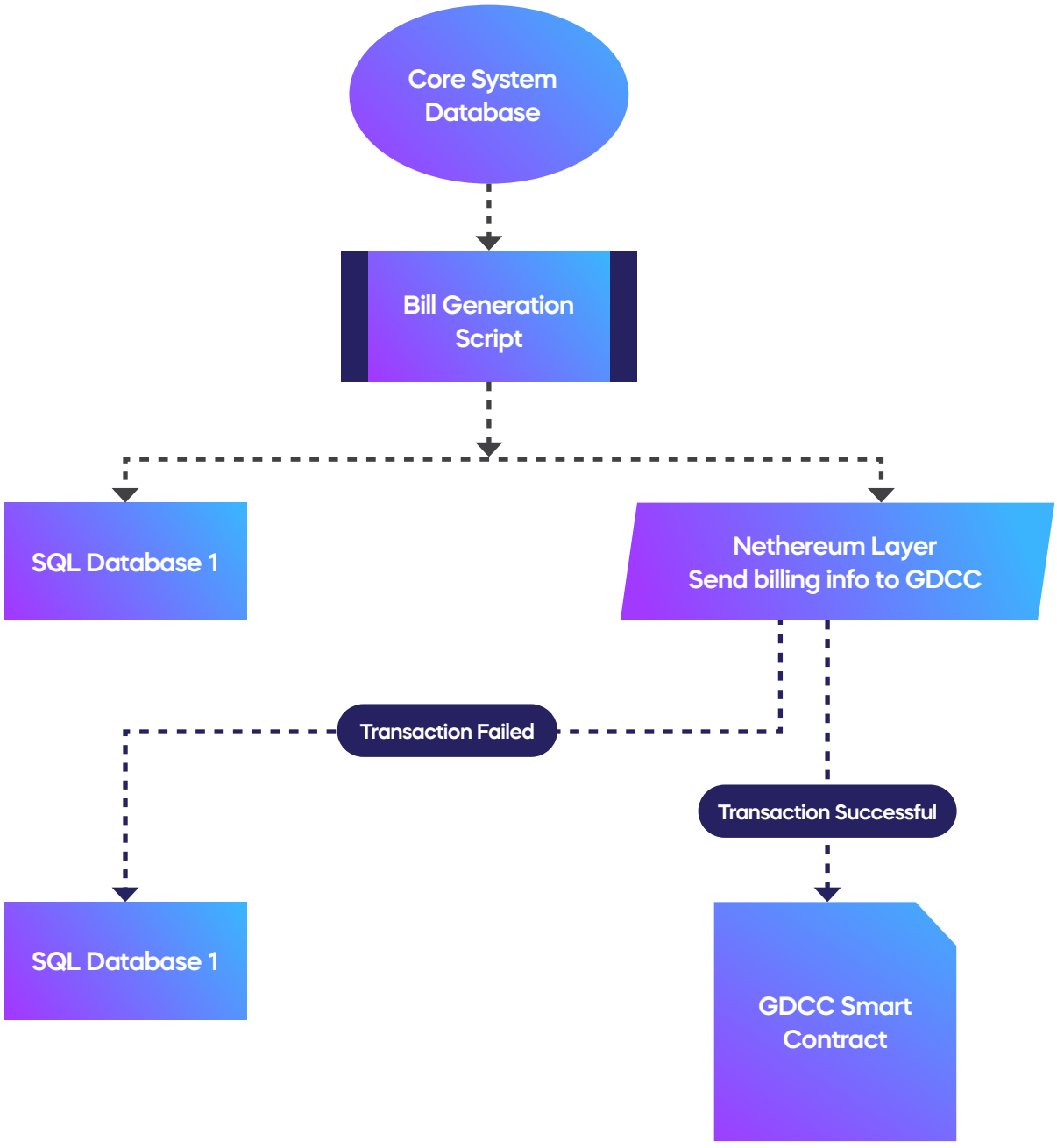
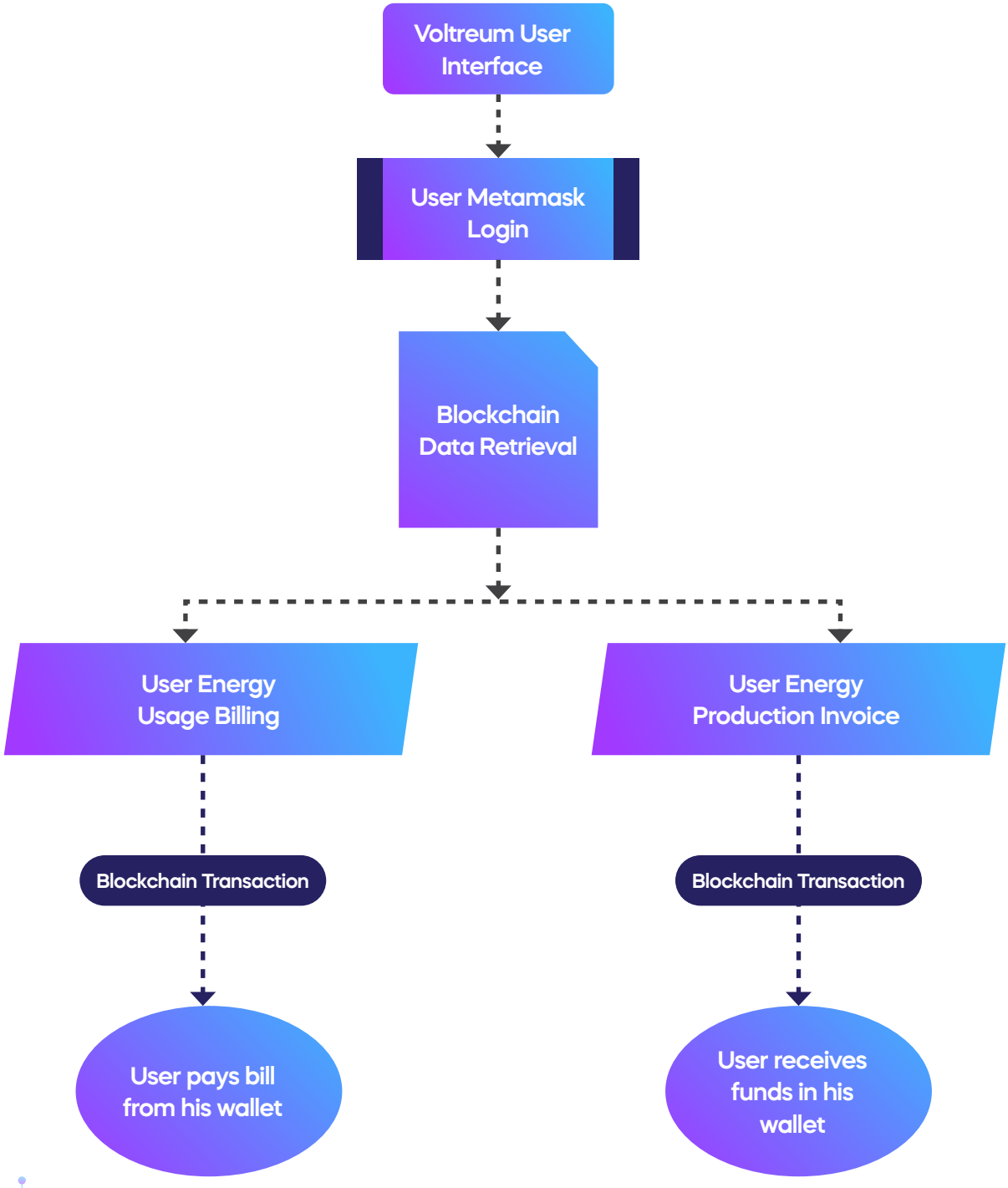


Fig.1 **Voltreum users billing and generation invoice system**

The Voltreum Core Processing (VCP) Engine, with its Influx and SQL databases, runs the billing cycle based on a predefined period. All billing information – like user-related information – is stored in an encrypted format in the SQL database. Additionally, the blockchain acts as the primary database, which allows users to settle payments. The SQL database also creates a backup of all data, which is stored securely for a period determined by a particular country's or region's regulatory requirements regarding data archival and backup.

Voltreum will handle all billing-related actions, including invoice generation at a configurable frequency (e.g., every 30 minutes). Moreover, since the system is blockchain-based, all records will be completely transparent and immutable. Finally, users have the flexibility to choose to pay or receive their dues either using crypto tokens or fiat currencies.



Voltreum User Interface module

The user interface module is accessible via the Volt-X app and the Volt-X website with a web-based browser. It allows both consumers and producers to:

- Initiate energy trades (buy/sell)
- Track energy usage and production
- View transaction history (1, 3, or 5 years or another configurable period)
- Pay bills
- Clear production invoices

The user first logs into their account through a crypto wallet or via social media platform login options to use the module. Volt-X supports single sign-on (SSO) from Facebook, Twitter, and Google. Once the user logs in successfully, they can use either crypto tokens or a fiat payment gateway to pay their bills or get paid for their energy production and sale.

Fully Secure and Foolproof Energy Trading Ecosystem

According to estimates, there will be almost 31 million connected IoT devices worldwide by 2025, up from just 11.7 million in 2020. From connected cars and smart home devices to connected industrial equipment, the IoT sector is expanding at a fast clip. In comparison, non-IoT connections such as smartphones and laptops will likely touch just over 10 billion units by 2025.

An unfortunate side-effect of the growth in IoT-connected devices is that the systems relying on these devices have become an attractive target for cyberattacks. This assumes graver proportions as operational technology (OT) and information technology (IT) systems converge. The convergence increases the attack surface of IoT networks, thus increasing their vulnerability to cyberattacks.

The Volt-X platform is designed to keep such attacks at bay.

> ***The Voltreum ecosystem is based on the IEC 62443 standards and adheres to most of its recommendations. These standards specify the cybersecurity technical requirements and provide a robust framework to manage and mitigate the security vulnerabilities in the industrial control systems of power grids.***

The underpinnings of IEC 62443 ensure that Voltreum provides a high level of cybersecurity during energy trading transactions. It does this by providing a high level of:

Access control

the identity of every user is verified before they can engage in or complete transactions.

User control

the system automatically verifies whether a user has been granted the necessary privileges before they are allowed to perform specific actions.

Data integrity

all components in the Voltreum system will continue to perform as intended at all times, such as during energy production, energy storage, maintenance shutdown, and invoice/bill generation.

Data confidentiality

all sensitive information, particularly user data and metadata, will be stored in an encrypted format in Voltreum's SQL/PostgreSQL databases, whether at rest or in transit.

In addition to the IEC 62443, Volt-X's design will also comply with industry-leading data privacy and security standards, including:

PCI-DSS **GDPR** **ISO 27001**

Voltreum Revenue Model

Voltreum's revenue model is based on multiple revenue streams:

Technology

- Solution roll-out in markets; partnerships with utility companies.
- Commissions from every energy transaction.
- Recurring maintenance charges for software updates, patch updates, etc.

Advisory

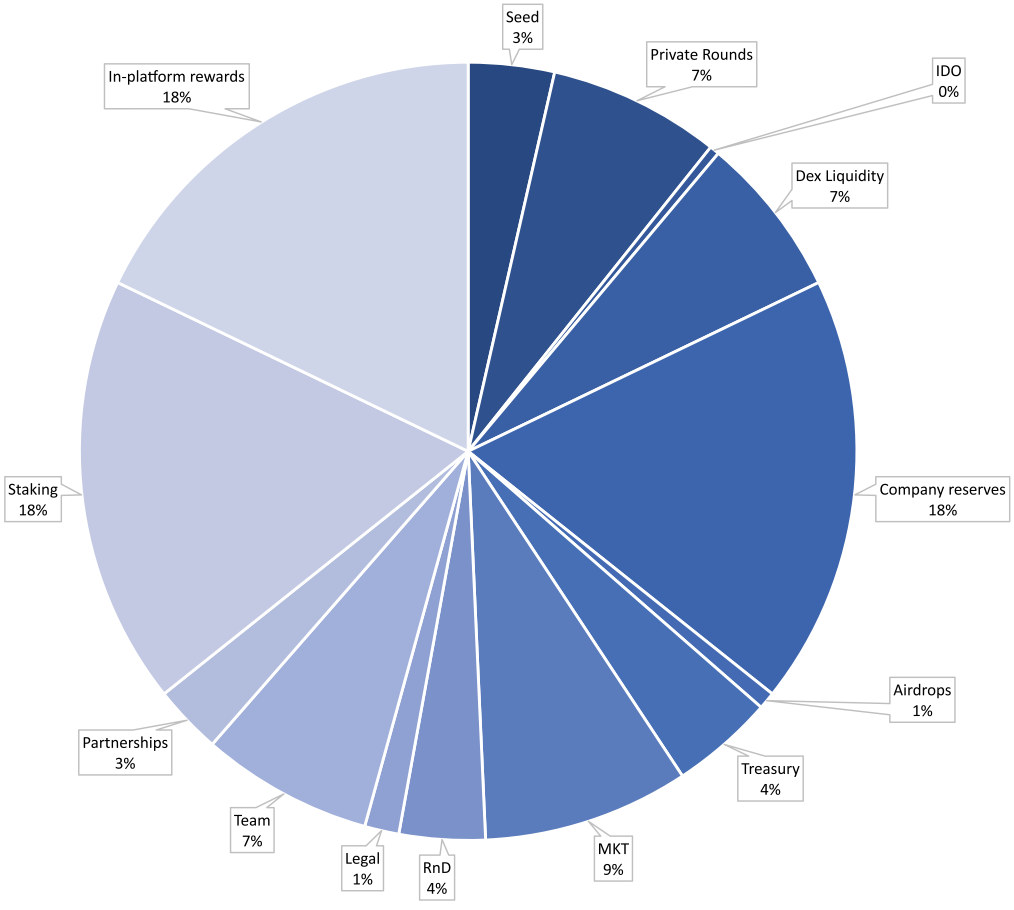
- Advisory/consulting services offered to government agencies to guide them toward digital transformation.

Other revenue streams

- Machine NFT sale.
- Participation fee for energy trade summits held in the metaverse.

Voltreum Tokenomics

	Price	Discount	VOLTZ	Percentage	Initial release %	Initial release $	Cliff	Vesting	Unlocking
Seed	0.02	60%	50,000,000	3.57%	1.00%	501,126	0	12	Exponential
Private Rounds	0.05	50%	100,000,000	7.14%	1.00%	1,002,251	0	12	Exponential
IDO	0.1		5,625,000	0.40%	100.00%	5,625,000	0	1	Monthly
Dex Liquidity			94,375,000	6.74%	5.96%	5,625,000	0		Conditional on the growth of the grid
Company Reserves			250,000,000	17.86%	25.00%	62,500,000	12	12	Quarterly
Airdrops			10,000,000	0.71%	20.00%	2,000,000	0	5	Monthly
Treasury			60,000,000	4.29%	25.00%	15,000,000	0	4	Quarterly
MKT			120,000,000	8.57%	10.00%	12,000,000	0	10	Monthly
RnD			50,000,000	3.57%	12.50%	6,250,000	0	8	Monthly
Legal			20,000,000	1.43%	25.00%	5,000,000	0	4	Monthly
Team			100,000,000	7.14%	8.33%	8,333,333	12	12	Monthly
Partnerships			40,000,000	2.86%	12.50%	5,000,000	0	8	Monthly
Staking			250,000,000	17.86%	8.33%	20,833,333		12	Monthly
In-platform rewards			250,000,000	17.86%	8.33%	20,833,333		12	Monthly
Hard cap			1,400,000,000	100%	9%	128,836,710			



Voltreum Team

Voltreum is led by a dynamic team of professionals passionate about technology and leveraging it to solve the world's most pressing energy and climate change problems.

Bhakti Vaidya
Co-founder

Rahul Awati
Co-founder

Mohan Sreekant
Senior IT Advisor

YK Jain
Senior Energy Consultant

Himanshu Gautam
Senior Blockchain Consultant

Vaibhav Ghatge
Senior Project Management Consultant

Srinath Iyer
Senior Editorial Consultant

Leandro Marcarian
Chief Tokenomist

Bindeshwary Rai
Strategic Advisor - Partnerships and Communication

Voltreum Roadmap

Q3 2021 Completed

Due diligence

- Deep dive analysis of the Energy market
- Study of the current energy requirements/forecast for the next decade
- Study of the problems with the current state of the energy market, challenges with global energy generation, transmission and distribution
- Study of the problems faced by gencos, transcos and discoms
- Evaluation of country wise energy market regulations
- Articulating the problem statement
- Competitor analysis - Including software and hardware players across the globe
- Evaluation of key feature offerings by each player in the field
- GAP assessment / SWOT analysis

Q4 2021 Completed

Core team formation

- Identifying and interviewing subject matter experts from the industry
- Shortlisting and rolling out of contracts/NDAs with selected members

Q2 2022 Completed

Project planning

- Formulating the scope of work (SoW) document to cover the proof of concept testing and final state system development
- Creating the work breakdown structure and timelines for tasks related to the power syste design, technology development, marketing, sales, and partnerships
- Identifying the stakeholder management plan and RACI matrix
- Formulating key project milestones with clearly defined timelines
- Financial projections required throughout the project lifecycle

Q3 2022 In progress

Proof of concept / Minimum viable product development

- Drafting of physical line diagrams and load profiles for the PoC
- Evaluation of the various load profiles as per electric standards
- Drafing of test cases based on variations in generation andusage considering differential loads
- Procurement of smart meters and power/load equipments for the PoC
- Development of a broker service for establishing communication with various smart meters (GSM, PLC, Modbus, Radio frequency mesh, SCADA)
- Development of Voltreum Core Processing (VCP) engine and backend logic for recording transactions on the blockchain system
- Smart contract deployment on the testnet server
- Fine-tuning the VCP engine logic with an aim to develop a robust and resilient core
- Security audit of the VCP engine
- Deriving key metrics and associated costs for the end to end transaction to develop the business case and financial projections
- Business case creation

Q3 2022 In progress

UI/UX development

- Finalizing a list of top features/parameters in line with feedback from key stakeholders (Discoms, Govt agencies, End users)
- User access management in line with significant data security and compliance standards
- Mobile app and web interface UI and UX design

Q3 2022 Scheduled

Go to market / Whitepaper launch

- Setting up of social media channels
- Roll-out of community management services to build brand awareness
- Whitepaper launch
- Creation of marketing collateral and business pitch
- Website launch

Q4 2022 Scheduled

Seed sale

- Secure funding through a seed sale

Q1 2023 Scheduled

Private sale

- Secure funding through a private sale

Q1 2023 Scheduled

IDO

- Official listing on a decentralized exchange

Q1 2023 Scheduled

Strategic partnerships for pilot testing

- PAN India expansion
- Documenting key lessons learnt
- Optimizing the application based on lessons learnt

Q4 2023 Scheduled

Global ramp-up

- Global expansion in various markets

Conclusion

Energy shortages and climate change are two of the most urgent problems currently affecting the planet. As the scale of urbanization, globalization, and digitization increases, the world's 7 billion+ denizens need reliable and ongoing access to energy. Without this energy, life as we know it will come to a standstill. Equally important, this energy needs to be clean and renewable – capable of supporting human life without stressing the planet's ecological health or environmental sustainability.

There's already a concerted global effort to increase energy generation and match supply to demand. And fortunately for the planet (and for us!), more and more countries are looking to move away from polluting fossil fuels and towards cleaner, greener renewable energy (RE) sources. Now, we need a mechanism to increase the availability and penetration of this energy to match the energy needs of the human race while also protecting the natural world.

Energy trading via a peer-to-peer network is one such mechanism. P2P energy trading has the potential to deliver all the life-sustaining, planet-nurturing benefits of RE. Through its democratic, borderless, and transparent trading mechanism, all kinds of energy prosumers and consumers can effectively fulfill their energy needs while also wholeheartedly participating in the RE revolution.

And this idea is no longer a pipe dream because Voltreum brings the mechanism to life. Through the Volt-X energy trading platform, VOLT cryptocurrency, and powerful applications to trade energy certificates and procure green attributes, we are leading the charge to increase RE penetration and create a more sustainable future for Planet Earth.

The future is green. The future is Voltreum.

Voltreum

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www.voltreum.com