A decentralized system for interaction between retail electricity market participants (a pilot project for Rosseti grid company)

waves
ENTERPRISE

> *Waves Enterprise has developed a decentralized platform for interaction between key participants of retail electricity markets, featuring a more efficient electricity consumption metering system based on blockchain technology.*

Problem

Disputes between electricity grid companies and suppliers often arise over the amount of power provided to end consumers. To eliminate intermediaries (including financial ones) and possible disputes, a single information system is needed.

Market expectations

For a specific region, we pinpoint the following expectations

▶ Eliminating intermediaries in interactions between consumers and grid companies.

▶ A single, transparent and immutable source of data concerning electricity consumption, bills and payments, available to all participants with manageable access rights. This would eliminate potential disputes.

▶ Reducing operational costs due to automatic splitting of payments based on previously agreed conditions.

▶ Reducing operational costs through banking integration.

▶ Consumers have the opportunity to sign their contract in digital form, control consumption, make payments and switch between tariff plans in their personal accounts.
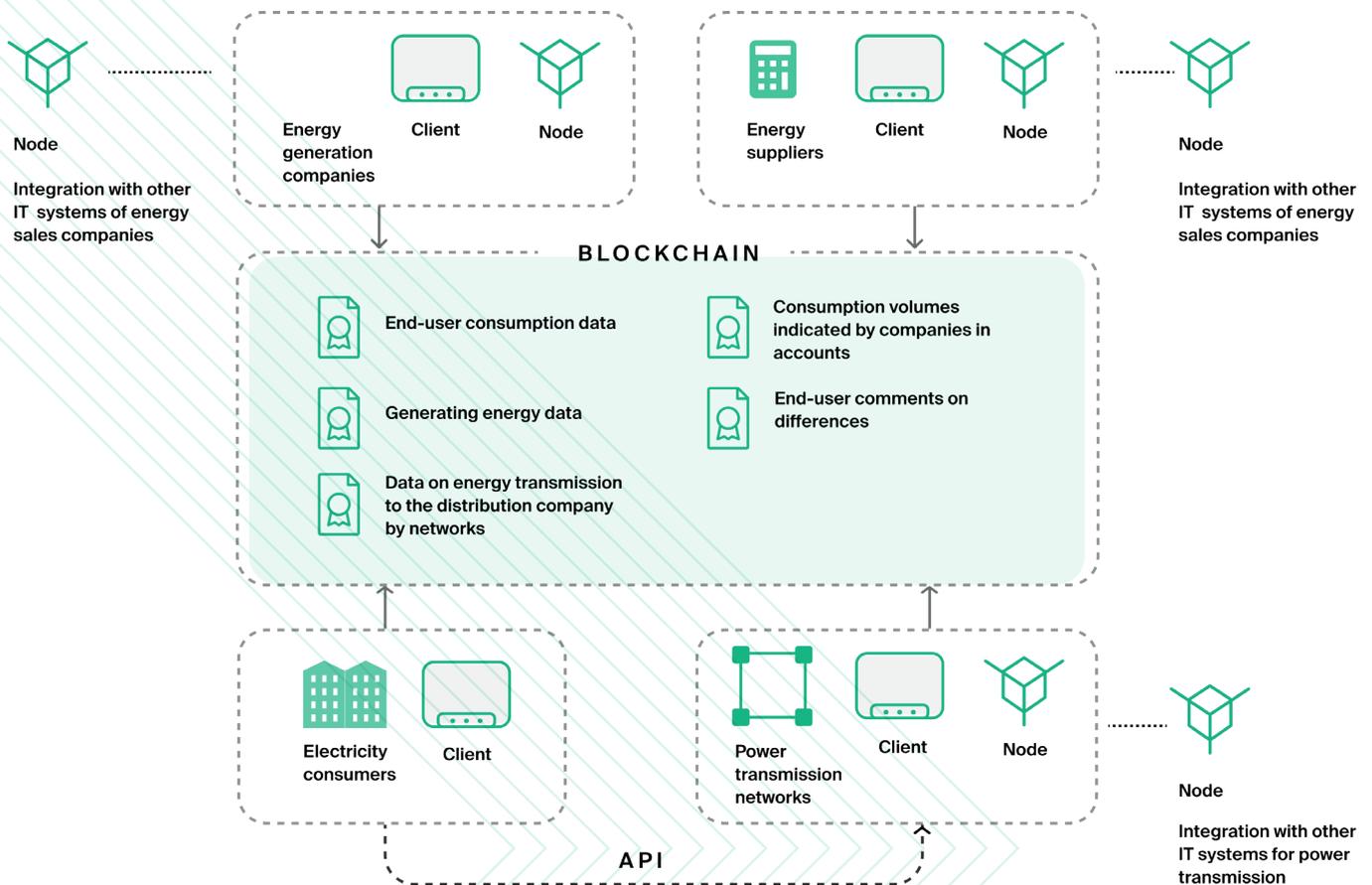
Description of solution

Blockchain enables companies and their partners to interact within a single trustless environment, digitizing and automating existing processes, eliminating intermediaries and building new and efficient business models.
This will lead to reduced costs, as well as the reduction of technical and other overheads, and significantly improve the quality and speed of operational decision-making.

A grid company, an electricity supplier and a bank deploy nodes and build a blockchain network. Electricity consumption data from meters installed in apartments participating in the pilot project is written to this blockchain. A smart contract processes the data to record and store consumption, bill and payment information. When a consumer makes a payment, it is split between the grid company and electricity supplier according to a pre-agreed formula.

Money trail: a consumer sends payment to a payment-collecting bank (in this trial, Alfa Bank), which sends data on all daily payments to a settlement bank (also Alfa Bank). The settlement bank splits payments between grid companies and electricity suppliers.

Node

Integration with other IT systems of energy sales companies

Energy generation companies

Client

Node

Energy suppliers

Client

Node

Node

Integration with other IT systems of energy sales companies

BLOCKCHAIN

End-user consumption data

Generating energy data

Data on energy transmission to the distribution company by networks

Consumption volumes indicated by companies in accounts

End-user comments on differences

Electricity consumers

Client

Power transmission networks

Client

Node

Node

Integration with other IT systems for power transmission

API

The introduction of digital technologies offers an updated model of interaction between electricity producers and consumers. Contemporary consumers need more electricity than previous generations, and want to maintain a reliable and variable supply, on-demand. It's time to graduate from a centralized energy supply model to one that reflects the needs of active energy consumers.
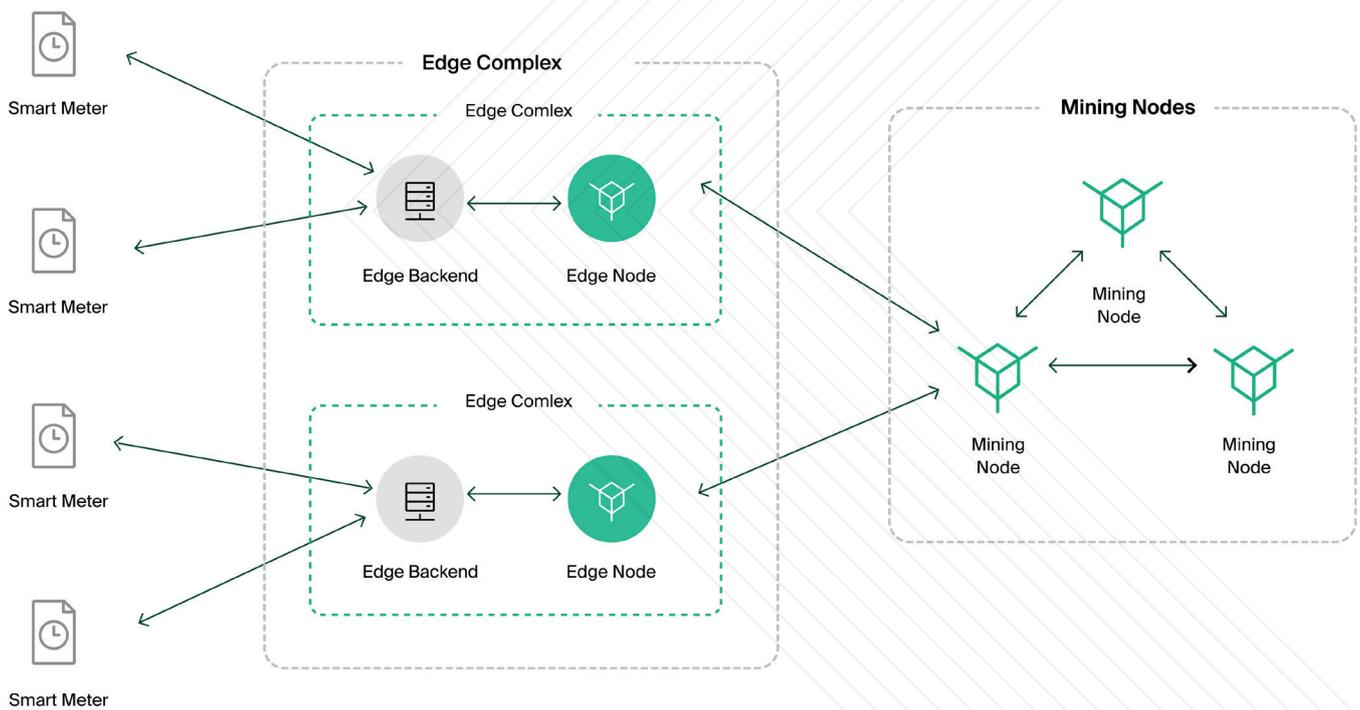
The system offers the following advantages to consumers

▶ Transparency and immutability of reports, bills and payments.

▶ Elimination of intermediaries and digitalization of the entire electricity transmission process, enabling a smooth transition to the competitive retail model of the future.

▶ Extra features, including the ability to view reports, bills and arrears, or switch to another payment plan, can be implemented at the application level and can be expanded to suit consumers' demands.

Under this model, the key benefits are reliability, delivery speed and immutability of consumption data, as well as the absence of intermediaries. The solution, based on the Waves Enterprise blockchain platform, facilitates the creation of a single, transparent and immutable source of data on consumption, bills, arrears and payments for all participants, with variable access rights. Potential disputes are eliminated.

Further advantages

▸ Reducing technical and other losses

▸ Cutting electricity rates for consumers

▸ Reducing operational and capital spending

▸ Increasing revenues via the creation of new consumption management services and flexible pricing

▸ Creating the conditions for the entry of prosumers, including those using renewable energy

▸ Reducing grids' incident rates

Solution architecture

Smart Meter

Smart Meter

Smart Meter

Smart Meter

Edge Complex

Edge Comlex

Edge Backend

Edge Node

Edge Comlex

Edge Backend

Edge Node

Mining Nodes

Mining Node

Mining Node

Mining Node

The architecture consists of two levels: Edge Complex is used for data collection, and Mining Nodes are used for smart contract execution and block generation.

Edge Complex is a metering system that includes an entry gateway, message line, the backend app section responsible for data collection, and a blockchain node for data storage. Consumption data is collected by several methods: automated metering systems, directly from smart meters, or manual entry by users. Ideally, a system of this kind should be deployed at a level that aggregates consumption data from a number of apartment blocks.

A Mining Node is a full blockchain node. It enables execution of smart contracts, block generation and processing of data provided to users. At the regional level, at least three nodes of this type are required: one each for the grid company, bank and electricity supplier. We define a node as a server in a decentralized network that has pre-installed Waves Enterprise software and is linked to other servers by a P2P protocol for exchanging data on blocks and transactions. It is also advisable to deploy data aggregation nodes, responsible for several apartment blocks. At the regional level, several nodes for smart contract execution and block generation should be deployed. Stable network operation is required to minimize transaction processing times. This primarily applies to Mining Nodes.

Executed pilot project

- Launched in February 2019

- Pilot territories: Yekaterinburg (325 households), Kaliningrad (75 households)

- Integration with automatic electricity metering system (Energia and Teleskop meters)

- Integration with banking infrastructure (Alfa Bank)

- A multilevel infrastructure using the sharding model has been developed

- A concept for recording data from a meter directly to the blockchain has been tested

Key results

- Creation of a single digital environment

- Reduced costs, as well as lower technical and other losses

- Significantly improved quality and speed of operational decision-making

- Efficient management of accounts receivable

- Cutting costs due to the support of a single solution for all regions (no need to support and develop multiple systems)

- Unification of user interfaces for grid companies, electricity suppliers and consumers