

# Energy as a Currency: A Peer-To-Peer Energy Trading Platform built on Ethereum

Vignesh Rajendran, in collaboration with Parker Wild

Advised by Dr. Wyatt Lloyd

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## Motivation & Goal

Innovation has led to an incredible amount of change in the last century in various fields, whether in communication networks, biotechnology, or even car manufacturing. One industry that hasn't changed much at all is energy production, specifically electricity and the grid. It still uses the same technology and layout that has been around for so many decades; there is a one-way, top-down network consisting of a power plant sending electrons through long lines of transmission lines. However, with the rise of households opting to purchase solar panels, more and more people are becoming prosumers: simultaneously consuming and producing energy. The issue is that in the current system, it is very difficult for them to sell any surplus energy back to the power plants, and even if they can, it is typically at a higher price set by the monopolistic power plant.

The goal of this project is to provide a better opportunity for prosumers to sell their surplus renewable energy.

If this goal is achieved, it is a critical step in moving towards a more sustainable, eco-friendly environment. If prosumers are incentivized with extra cash by being able to sell their surplus energy, the number of people who become prosumers by installing solar panels is likely to grow. This is similar to the number of renters increasing as a result of AirBnB giving everyone an opportunity to sell their "surplus" time/space in their homes.

## Problem background and related work

There are about 22 small companies around the world working on a platform to allow prosumers to sell surplus energy<sup>1</sup>. However, they all started within the last year or two, and many within the last 6 months. On the one hand, this is very exciting in that there is not a precedent set forth yet as the right way to do this, yet on the other, for the same reason, there is limited guidance. There are two main frontrunners, PowerLedger and LO3 Energy, that have done some interesting things, but again offer limited information as far as how they implement their platform. From their whitepapers, it seems they are both using blockchain as their platform to allow prosumers and consumers to buy and sell electricity. The specifics of how they are using the blockchain is quite vague, particularly for LO3 Energy. The only details PowerLedger provides is that they have two tokens on this blockchain platform, one, Powr, allows people to have access to and be able to use the platform, and another, Sparkz, is issued against escrowed Powr tokens and used by the host to onboard customers.

Both PowerLedger and LO3 rely at least partly on the utility companies being involved in their systems. We believe the reason they included utilities is so that in case there is an energy crisis, the utilities will be a safe fall-back option for consumers.<sup>2,3</sup>

We would like to explore an even more decentralized state, with no utility company involved, but rather simply focus on a community of just prosumers and consumers, living on a microgrid. Although this might not be completely realistic today, we believe it is important to get rid of any power from the utility, and also believe in the potential of microgrids becoming more of a reality in the future. Thus, in our scenario we make the assumptions that our users are in a microgrid, with both prosumers and consumers, and they all have battery storage (i.e. Tesla PowerPack) and smart meters. Thus, our application will be specifically focusing on a platform for an independent microgrid, and completely omit the utilities.

## Approach

Our system will also use a blockchain to make use of the decentralized nature of the platform. This will control the trading portion of the project. Each participant will be able to send and receive tokens that represent energy at a given price. On the other side, there will be a client facing web application that will allow the users to be able to interact with this blockchain. The web application will likely have more features, such as using machine learning to predict optimal times to buy/sell tokens of energy. This combination of a protocol based on solely prosumers/consumers without a utility company, and a strong client-side application that is made specifically for this purpose, will make this project a more compelling case for utilization in microgrids than existing solutions. Further, it will enable prosumers to make more money in an environment without utility companies, which will increase the number of prosumers, which in turn increases the use of sustainable energy resources.

## Plan

The decentralized application will be built on top of a local Ethereum protocol. This way, we can use the smart contract aspect of Ethereum to send and receive energy tokens on the decentralized application. This will be mostly done by Parker. However, we are both interested in the blockchain aspect of this project, and are actively exploring opportunities for both of us to be involved in the development of this portion. The second component will be the front-end solution. This will be somewhat similar to building a normal web-app, with the main difference being how it interacts with the smart contract. Specifically, we'd use React for the front end library, uPort for identity management, digitally signing transactions, and easy login to the dApp, and IPFS for decentralized storage.<sup>4</sup>

## Evaluation

Since there is limited work on this so far, we have limited datasets to compare to. Thus, we will be using existing smart meter data to create a simulation of how this would work in our system. Using that, we can create an estimation as to how much each prosumer/consumer is paying/making in a monthly basis. Then, we can compare that information with their existing electricity bills to see how much of a change there is.

## Bibliography

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