# micro grid

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# Meet the Team

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# AGENDA

01 Present-Day Energy Management

02 Market Landscape

03 Proposed Solution: MicroGrid

04 Design Methodology

05 Feasibility

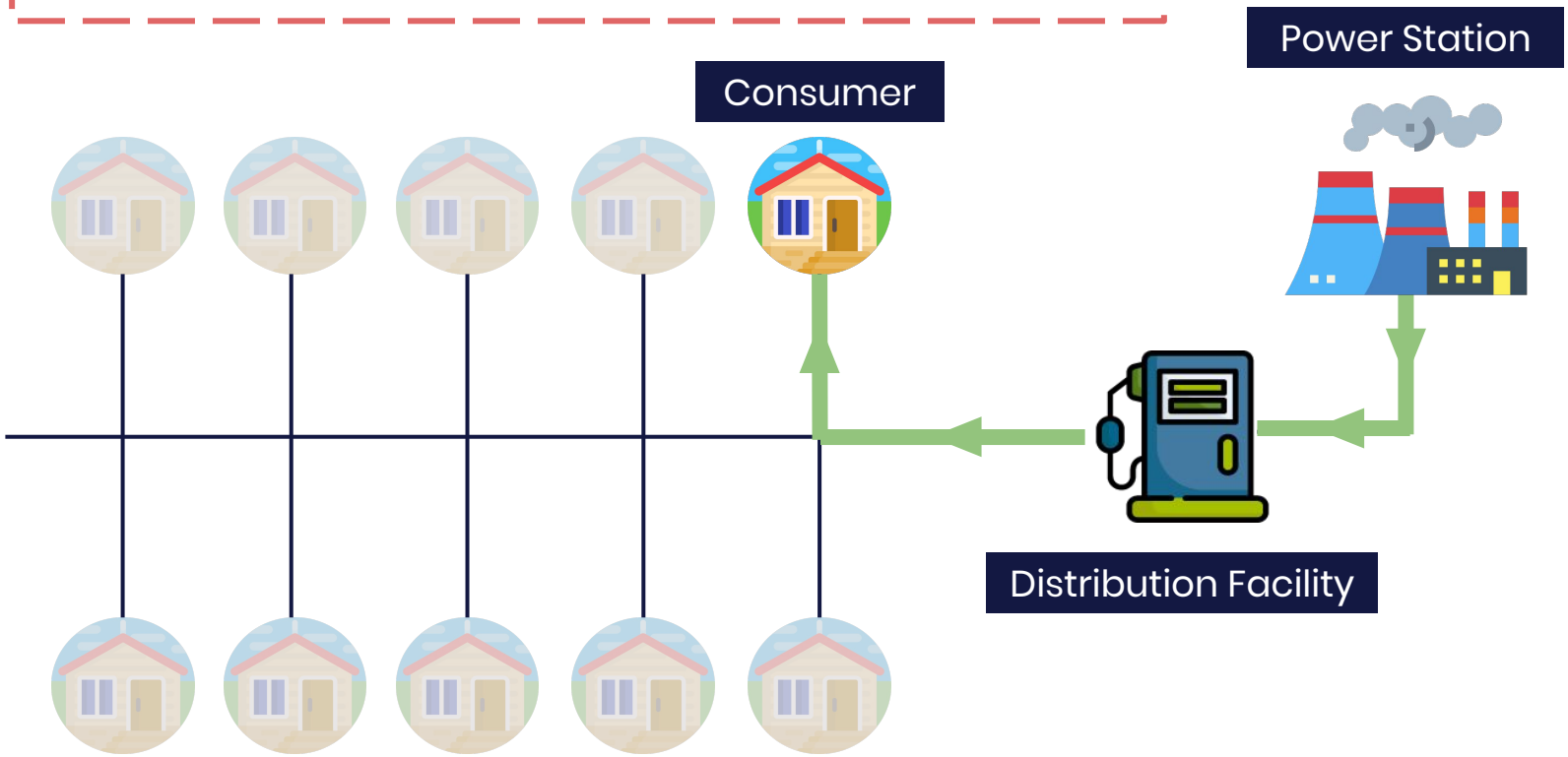
06 User Interface

07 Development

PRESENT-DAY

# Current Energy Market Model

Utility companies own the power grid and facilitate energy distribution, so they charge a (regulated) premium to consumers.



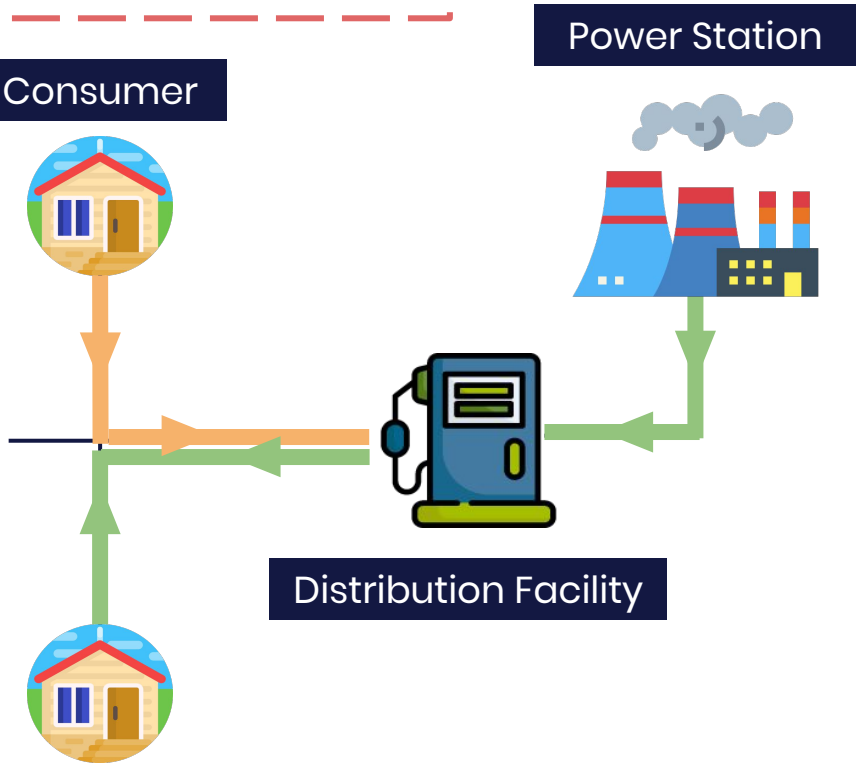
PRESENT-DAY

# Current Energy Market Model

People who can't afford solar panels pay higher rates for energy during peak hours.

## Net Metering

Sending energy back to the grid gives you energy credits for later use.



PRESENT-DAY

# Opportunities for Improvement

Prosumers do not necessarily always receive payment for energy at the rate it is worth at any given time.

Existing energy models are very centralized, which prevents participants from seeing the exact value of their energy.

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# Tony Hartman, CTO at Go Electric

Go Electric delivers turnkey, distributed energy storage solutions that provide energy security and energy efficiency to facilities and the grid.

**1**

Interconnected distributed energy resources can resist high household demand.

Creating “MicroGrid” neighborhood networks will create resiliency during peak demand.

**2**

MicroGrid systems can still participate in net metering programs in excess events.

Existing energy providers can still play a role in the energy trading network.

**3**

Existing microgrid structures only support segregated energy networks.

A P2P marketplace on grid would remove infrastructure barrier..

Microgrids today support resiliency, however are too localized and require additional infrastructure.

LANDSCAPE

# Justin Leroux, Business Dev. at GridPlus

GridPlus Energy works to save residential electricity consumers money with unique capabilities through smart software, hardware, and blockchain technologies.

**1**

Offer IoT devices that turn off non essential appliances during peak hours.

Capturing market efficiency benefits user and utility companies.

**2**

Create demand response market rate for consumers. Seeking gov. blockchain partnerships.

Equilibrium through excess energy supply and demand creates stable rates.

**3**

Customers are only maximizing savings given current utility plan, no better.

Optimal energy pricing comes without a mandatory energy intermediary.

Consumer energy costs can be minimized by with demand response IoT management systems.

# Yasuhiko Ogushi, Business Dev. at LO3

LO3 Energy works with utilities and retailers to deliver a blockchain-based local energy marketplace, Pando, that meets the demands of modern energy customers.

**1**

Cooperate with retail utility providers to rely on their infrastructure

↓

Not only coexist with centralized firms, but also get necessary support from them

**2**

Demand of their services mostly came from request of renewable energy

↓

Confirmed huge market potential & possible future partnerships with businesses

**3**

Simple pricing model: buyers place bids & sellers can only take those prices

↓

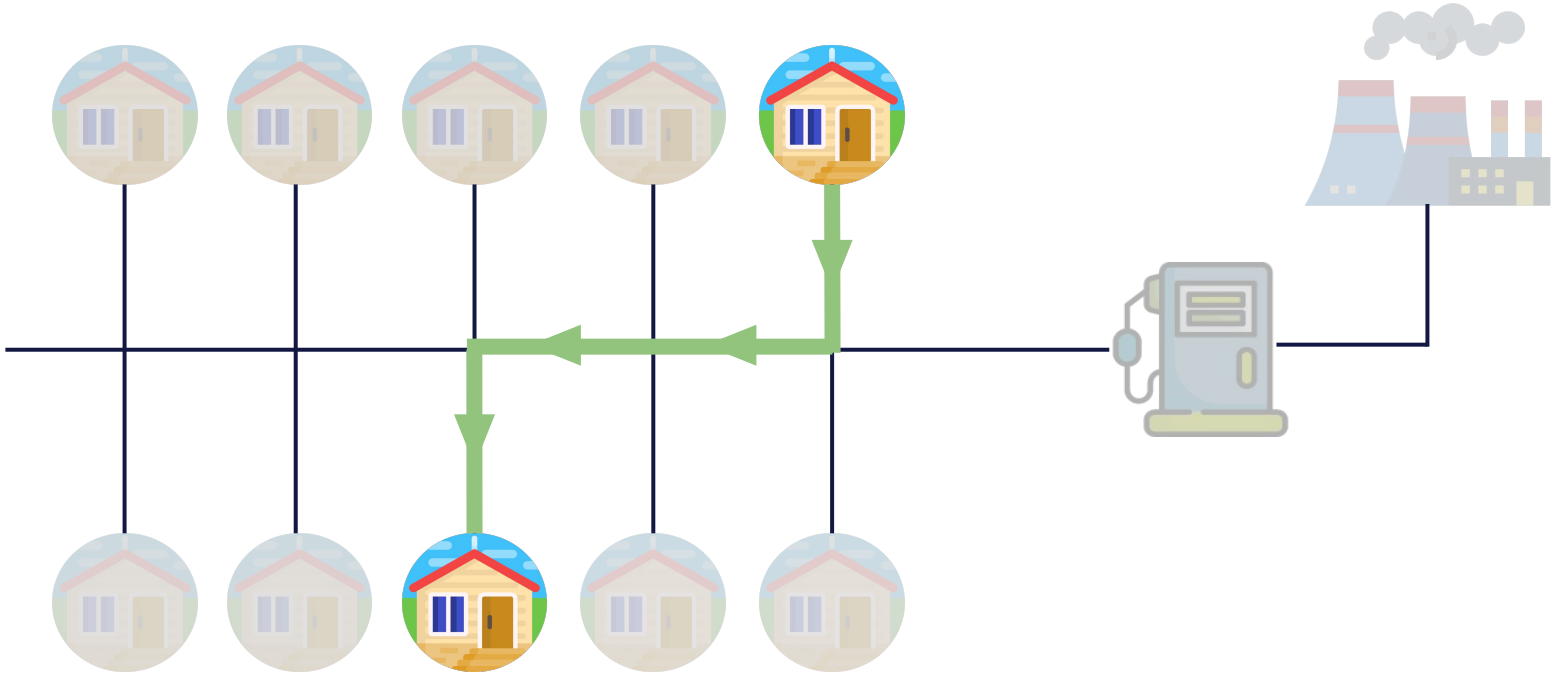
By restricting the sellers' options, it allows better UX and easier backend development

A simpler pricing model can reduce complexity and create a better user experience.

# AGENDA

# Energy sharing, made cheap and easy

Selling excess energy directly to neighbors on the grid. Energy rights and transactions managed on the blockchain.



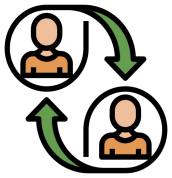
# Product Overview

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| Generate energy | Neighborhoods | Store excess | Sell at peak |
| Distributed energy resources like solar panels on roofs | Separate groups of energy users by geographic region | Home battery that holds unneeded produced power | Offer alternative to energy provider peak pricing locally |

## Unique Value Proposition

P2P transactions **decreases strain** on main power grid, promote **deregulation** of energy and proliferation of **distributed energy resources**. Existing energy providers get **commission** for power grid ownership.

# Why Blockchain?



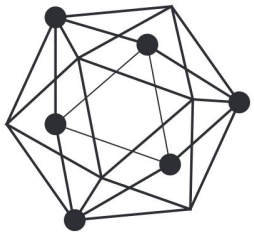
Necessary to build trust among users in P2P energy trading

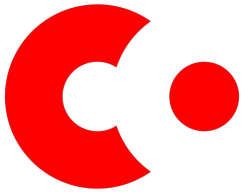
Integrate distributed consensus for energy rights management

Improve transparency in the energy market but also pseudonymity

# AGENDA

# Platform Selection





## Hyperledger & R3 Corda

Pluggable consensus private/consortium platforms, lack native token, single layer chain

Microsoft Azure
Blockchain as a Service

## Microsoft Azure

Simple integration for developers, Microsoft centralization, lacks user privacy emphasis


## Ethereum

Public chain, unable to execute private transactions, low scalability with PoW

# Platform Selection


## Governable

Major/known energy corporations will run validator nodes, also incentivizing honesty

## Scalability

EW Chain leverages Proof of Authority consensus to increase throughput and speed

## Privacy

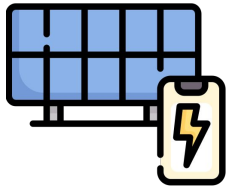
Permissioned ledger access enables the EW Chain to delegate viewer rights between parties

## Accessible

An optimized light client option as part of the EWF stack reduces hardware requirements for users

# dApp Flow

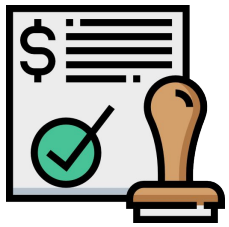
Prosumer produces excess energy



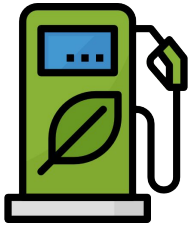
dApp records on prosumer's account

Buyers place bids for excess energy

Prosumer take desirable bids



Smart contract executes the transaction



Energy sent to grid & buyer receives it

# AGENDA

# Customer and Grid Operator Incentives

## Consumer

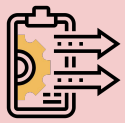
Consistently lower energy prices

Higher energy selling rate

Benefits renewable energy producers

## Utility/Grid Operators

Commission on every transaction



Decreased grid strain during peak

Promote use of distributed energy

Feasibility

# Practical Implementation

## - Challenges

**01** SELLER BATTERY REQUIREMENT

Distributing excess energy P2P at the optimal price means producers must store energy

**02** FINANCIAL LOSS FOR UTILITIES

Energy providers would earn less profit in the short run with decreased peak demand

**03** INFRASTRUCTURE REPAIR

Over time, a single party will not be in charge of repairing the grid in case of damages

## + Mitigations

**01** INSTANT SELL OR MICROGRIDS

Enable non-battery producers to sell excess instantly to existing buy tickets on market or share batteries

**02** OFF-PEAK PRICING OR SMART LOAD MANAGEMENT

Charging more off peak can stabilize revenue, P2P sales are less profitable. Or send energy per regional demand

**03** INTEGRATE REPAIR PROTOCOL

Build dApp functionality for shared expenses and a pre-approved repair process

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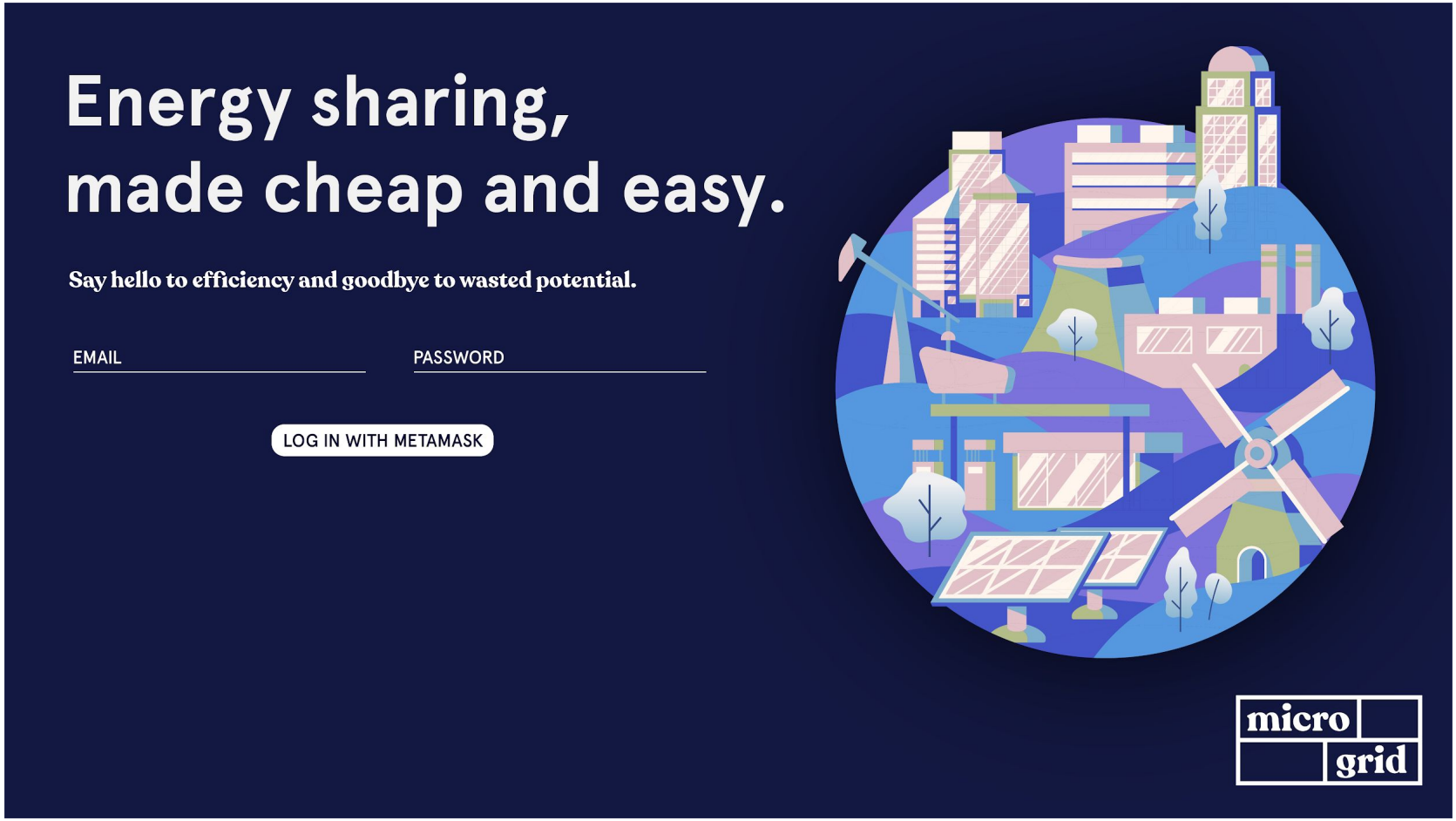
# AGENDA

User Interface

# Primary Views

User Interface

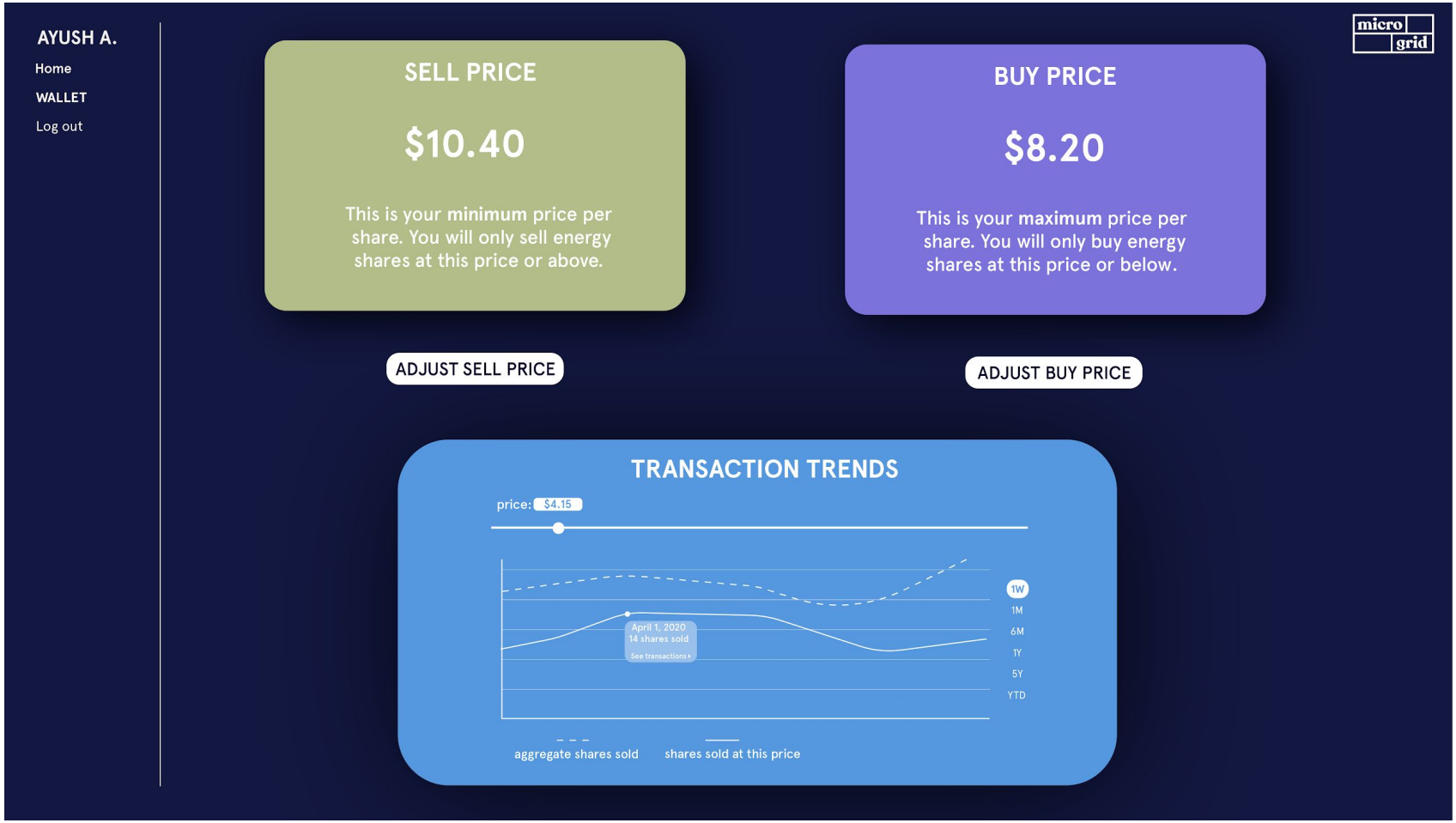
# Landing Page



# User Dashboard

User Interface

# Transaction Ledger



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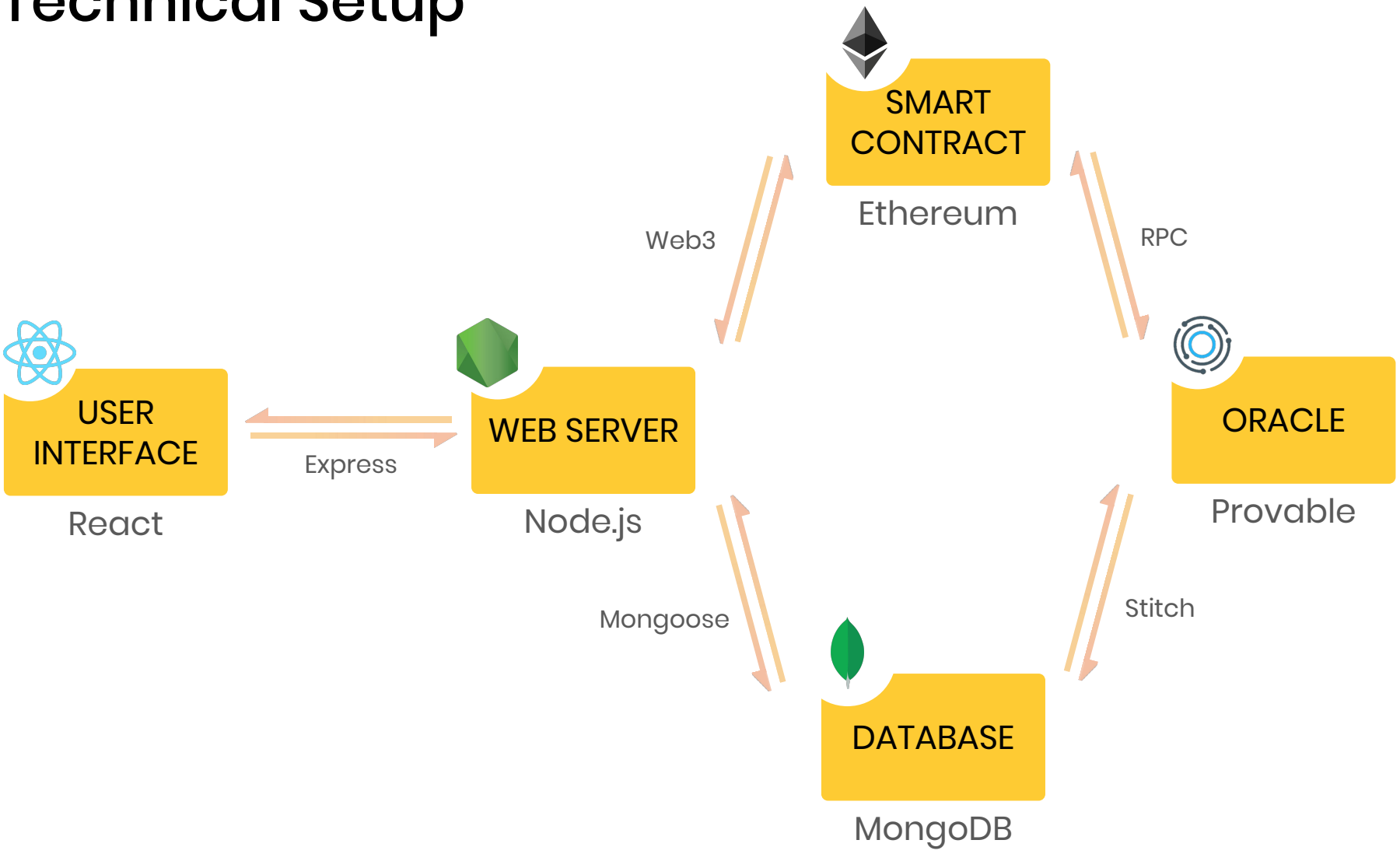
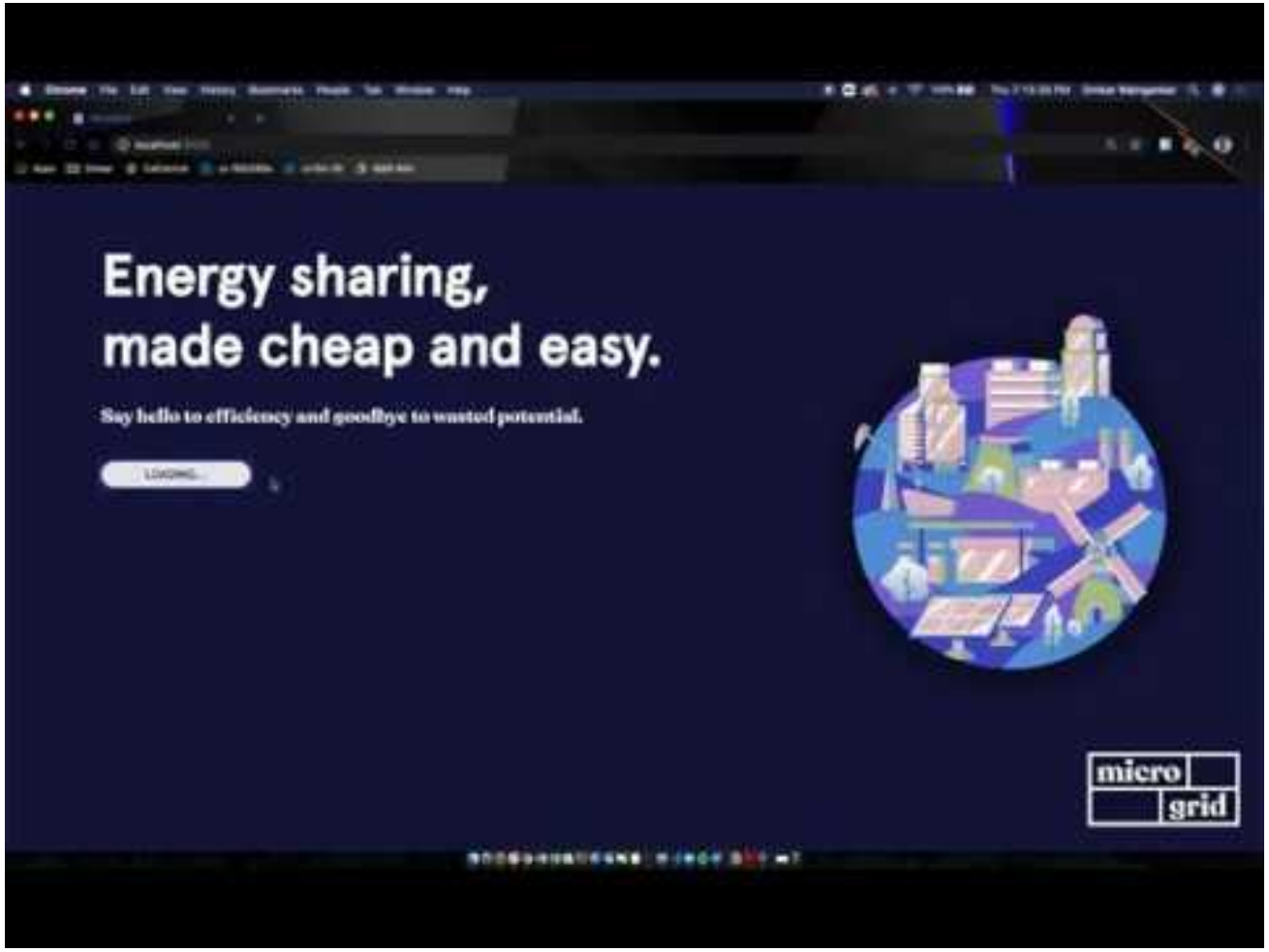
# Technical Setup



# Demo


Energy sharing,
made cheap and easy.
Say hello to efficiency and goodbye to wasted potential.
micro
grid

Development

# Smart Contract

1. **Initialize Sale**
   Set price and amount.

2. **Start Transfer**
   Buyer sends ether & confirmation to smart contract.

3. **Provable**
   Interface with “sensors” via decentralized oracle.

4. **Complete Transfer**
   Interface with “sensors” via decentralized oracle.

*Pseudocode

```
contract EnergySale is usingProvable {

  constructor(energy, price, buyer, seller) public {}

  function completeTransfer() {
    string memory queryUrl = "mongodb.deplete.com";
    queries[provable_query("URL", queryUrl)] = 2;
    }
  }

  function __callback(myid, result) {
    if (queries[myid] == 1) {
      require(sellerBattery >= energyAmount);
      completeTransfer();
    }
    if (queries[myid] == 2) {
      seller.transfer(address(this).balance);
    }
  }

  function transfer() payable {
    require(msg.sender == buyer);
    require(msg.value == totalPrice);
    string memory queryUrl = "mongodb.battery.com";
    queries[provable_query("URL", queryUrl)] = 1;
    }
  }

}
```

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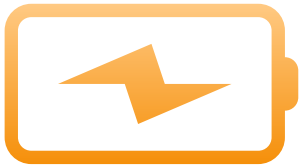
# Next Steps

MicroGrid API

Audit Dashboard



Sensor Integration

Automation

Simulation


Tokenization

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Questions?

# Thank you!