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EnergyDAO - Decentralised Autonomous Organisation for energy community governance

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EnergyDAO (Decentralised Autonomous Organisation for energy community governance)

bringing people together to achieve collectively higher goals

Summary

Energy access is liberty. Moreover, energy is a prerequisite for any secure society, and it is the most consumed product worldwide on a daily basis. As a fact, all democratic countries with the least corruption have annual per capita energy consumption of greater than 2 MWh. Moreover, many communities in the world have net energy imports which is one of the major expenses for communities. On one side, communities' well-being is reflected by high energy use, on the other side, in poorer communities' energy import cost is significant, and it impedes communities' well-being. It can be described as a wealth leak problem. However, energy production comes with a cost, consumption of locally produced energy should be maximized to boost communities' wealth and well-being.

Communities' well-being amplification rides on the wheel of governance as a system of control and operation with an accountability mechanism. This brings sustainable benefits to its people within the confines of cultural context through collective decision-making. Technology adoption has continued to change the narration in human society lifecycle, such as the decentralized autonomous organizations (DAOs). DAOs are a type of legal structure-like platform that is purely digitally existing for decentralized rule-based decision-making; DAOs are built on blockchain technology, which enables secure and transparent bookkeeping and transaction processing. In the renewable energy community, DAOs can be used to improve the transparency of local energy management and community governance.

This white paper describes a new way of organizing renewable energy communities [a DAO entity; hereinafter EnergyDAO] by means of community-level joint ownership of energy infrastructure to help reduce the wealth leak in communities. The EnergyDAO allows community members to have ownership of local energy-producing and storage infrastructure. EnergyDAO allows communities to define a rule base for automatic, efficient, and democratic governance and decision-making to organize themselves in a transparent manner and create trust.

Generally speaking, EnergyDAO is a bunch of smart contracts to denote a structure of ownership or control over EnergyDAO treasury and renewable energy assets/ infrastructure. This can include solar panels, windmills, battery storage, electric vehicles (EVs), etc. Moreover, such DAO-based governance can be used by already existing traditional energy cooperatives or by independent individuals working together collaboratively in any community to automate and enforce formal governance rules imposed by cooperate bylaws or law.

VTT proposes, through this white paper, that EnergyDAO-based communities can have enhanced member experience and solve transparency-related governance issues found in traditional cooperatives.

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Introduction: DAOs for Renewable Energy Community

Renewable energy is a crucial component in the energy industry with its projected market value of one trillion dollars by 2050. A "renewable" energy community produces a majority of yearly consumption locally, the community has installed local/near renewable energy production systems for local consumption and storage, metering systems for accurate measurements of local production, and individual consumption.

What can we achieve using EnergyDAO community governance?

1. Trusted, leaderless & democratic energy community governance mechanisms.
2. Horizontal scaling & faster replication of microgrid-based energy communities.
3. Enhance the community member's experience and engagement.

Normally, a DAO community is online members with no geographical boundary; however, in the case of EnergyDAO, most of the community members are neighbors and might know one another. However, we propose it should be possible to have external investors as a part of the community. EnergyDAO as a tool can allow external investment in the community to build local energy infrastructure and by extension, also keep the 'majority' ownership and governance power within the local community. Moreover, there should be mechanisms to give proper Return on Investment (ROI) to external investors depending on the energy wealth created within the community.

Decentralized Decision-Making

EnergyDAO provides a mechanism to:

organize people in the renewable energy community

aggregate references (i.e., voting)

resolve conflicts before and after voting

manage resources in decentralized space

One of the key benefits of using the EnergyDAO community is the decentralized governance and decision-making implementation by means of encoding governance rules as automatically executed computer programs i.e., smart contracts. This means that decisions about the resource allocation for installing renewable energy resources, its maintenance, and energy utility can be made by a distributed network of stakeholders through voting.

EnergyDAO members have the right to submit and promote a new proposal to deploy community funds and all members in the group have a vote on whether they believe it is a good utility of funds or not. The voting is weighed as per member's investment in the EnergyDAO to ensure the risk appetite of each member is commensurate with the individual's owned stake; hence the best interests of the community, rather than just benefiting a select few; also, among approved or legitimate decisions is how proceeds from energy sales are reinvested in the community.

This type of democratic mechanism gives a greater sense of ownership to all stake-holders over their collective energy resources. We recommend deploying the EnergyDAO on a blockchain that is decentralized. Decentralized governance and decentralized implementation of EnergyDAO provide increased robustness against attack from both inside and outside of the community respectively.

Transparent and Accountable Governance

The EnergyDAO is built on blockchain technology; it provides a secure and transparent platform for recording, and tracking decisions and transactions, thus enabling more transparent and accountable governance. EnergyDAO is mainly an off-internet community with a shared wallet account to manage a community energy fund, which is used to finance the local renewable energy infra projects. This helps to increase trust and accountability within the energy community; more so, transparency and accountability help to determine measurable environmental, social, and economic impacts of the EnergyDAO community.

For effectiveness and impact, the EnergyDAO is characterized by a succinct planning process, concise internal and external entities, and a collectively selected voting scheme, in addition to a smart contract for accurate monitoring and evaluation. Again, the decentralized implementation of the EnergyDAO improves efficiency. "Decentralizing for efficiency" is a compelling argument for small-scale projects, highly internationalized projects, and projects located in countries with inefficient institutions and weak rules of law.

The Importance of Local Energy within Each Zip Code

Our world has become increasingly elitist in previous decades because the world's major energy is coming from elite energy sources (fossil and nuclear) i.e., "found at few places and controlled by few". For a more equal world, the consumption of locally produced energy (renewable if possible) should be maximized (at the individual level and at each country level) reflecting the common governance principle.

For a fair future, VTT recommends, a windmill, a solar park, shared EVs, and storage for each zip code community worldwide where wind and/or solar has generation potential.

In addition, as per the Kardashev scale, the overall energy consumption of the world is only going to increase and in exceptional situations, every kWh (from any source) is precious. A diverse energy mix (including local and near energy) seems an effective way forward even though it might be the expensive option. This is the trade-off cost for freedom and energy security in free countries. Local Energy reduces the energy import from outside the EnergyDAO community thereby creating local wealth.

Adjusting Consumption within Community & Communities Sharing Consumption Information with Grid

The need for adjusting power will increase as new weather-dependent variable solar and wind plants are being installed in communities. Also, as the electrification of society increases, it is in communities' interest to maximize the consumption of locally produced electricity first. Although the aim of renewable energy communities' is to be energy self-sufficient, communities are co-dependent on the grid to balance power consumption and production all the time through demand-side management or storage. In demand-side management, electricity demand increases or decreases (i.e., flexible loads) so that the change will result in reaching the balance between production and consumption.

We propose that EnergyDAO should monetarily incentivize the flexible load providers for helping balance the grid.

EnergyDAO community microgrids should communicate the future estimated load with the grid and provide energy flexibility services to the grid for support and earning revenue(incentives). Moreover, EnergyDAO communities can also set up public e-car charging stations to sell extra electricity.

Challenges for horizontal scaling & replication of the EnergyDAO community

Replication of microgrid communities is a very tedious process due to the changed stakeholders in each community. Also, setting up the traditional cooperative entity for microgrid management involves a lot of legal and accounting work and these are major expenses for any traditional cooperative. We propose an EnergyDAO recipe that is faster to replicate and quickly to set up a new microgrid's governance structure. This will result in faster replication of microgrids due to reduced effort in the governance setup of the microgrid community through EnergyDAO.

Governance Model and Legal Wrapper for EnergyDAO

DAOs are always in evolution from the moment they are created with a selected legal wrapper for compliance, dispute resolutions, and better asset management. Often, in the beginning, DAOs are run by the technocracy of the core team, but later delegation is transferred to the community's token holders for on-chain governance. In exchange for their participation, community members get EnergyDAO utility tokens in proportion to their respective contributions to the EnergyDAO treasury. The token holders would want to ensure the project funds are being used in their best interests. Moreover, in return for funding, external investors/backers may also get voting powers (tokens). It is fair if the majority voting power stays within the community. Token holders can bring a governance proposal to be voted on by all token holders, if passed then the treasury will release the funds as proposed in the governance proposal.

TimeLock is the time delay between the time when the vote passed and the time when the funds were released from the treasury. Token holders can elect a governor who is responsible for executing the governance smart contract. Furthermore, there is no voting system that obeys all the desirable criteria of fairness. There are several voting mechanisms such as Condorcet winner mechanisms, plurality voting, majority voting, weighted voting, approval voting, ranked voting, delegative democracy, quadratic voting, and so on. In decentralized networks, the equally weighted voting principle translates to one vote per token holder. Whereas weighted voting (plutocracy) is a system where the number of votes held by any one person or entity is proportional to the number of tokens at stake by each voter.

We recommend weighted voting for EnergyDAO with an upper limit on the number of tokens one can hold since this weighted voting without limit is regressive.
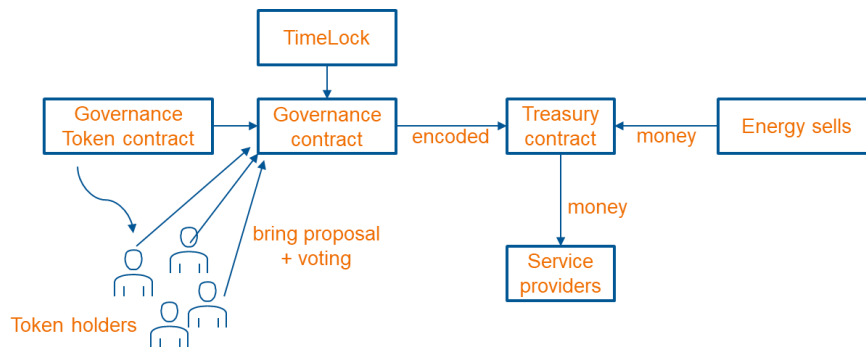
Figure 1: EnergyDAO overview

What is governed in the EnergyDAO community?

The legitimacy of the following topics holds for community decision-making through voting.

- Who is a governor? How is a governor elected?
- Who are the voters? What is the voting mechanism?
- Who can bring a new proposal? How will it be processed?
- What is the process for raising and handling disputes? How to handle disagreements after the vote results?
- How one can join EnergyDAO? What is the process to leave EnergyDAO?
- Does personal identity need to be disclosed to participate in EnergyDAO?
- What is the process to tweak smart contract parameters or upgrade smart contracts related to EnergyDAO?
- What kind of community reputation system is acceptable in EnergyDAO?
- What are the users' (i.e., token holders') responsibilities?
- What kind of community microgrid to set up? How to import services to set up and manage the microgrid?
- How to use revenue from energy sales within the community? How to return the ROI of external investors?

What kind of legal wrapper will be needed for the EnergyDAO?

Regardless of the governance model, EnergyDAO is likely to fall under the jurisdiction of nation-states, and legislators, regulators, and tax authorities will take an interest when EnegyDAO becomes profitable. Therefore, the existence of EnergyDAO as a legal entity is important for it to be a participant in real-world commerce, engage with service providers, as well as be able to pay taxes, EnergyDAO needs a legal wrapper endowing it with a legal identity.

The focal topics for the legal wrapper of EnergyDAO are:

- limiting the liability of EnergyDAO participants,
- reducing the risk of EnergyDAO tokens being declared as securities,
- allowing the participants to waive off fiduciary duties to each other and to the legal entity.

Then, we have diverse ways of setting up DAOs.

1. DAOs without a registered legal entity but operating inside the law. For this full decentralization is needed.

2. Limited liability companies (LLCs) provide the required flexibility to better approximate the DAO infrastructure.

- Model Blockchain-Based Limited Liability Company (BBLLC) Vermont and Delaware LLC.
  - By linking the DAO to this BBLLC, the DAO has an official legal status that allows it to enter into contractual agreements and offer liability protection to participants.
- Model Wyoming Decentralized Autonomous Organization Supplement DAO LLC.
  - The articles of organization filed with the Secretary of State for registration must also describe the structure of the DAO as either a member-managed DAO or an algorithmically managed DAO. Every change in membership needs refiling.

3. Setting up a DAO as a Foundation. Not much useful for small-scale DAOs.

There is no "perfect" solution for DAOs. Until a proper legal framework for DAOs is created, which enables them to operate fully decentralized with limited liability legal recognition and easy taxation, every current legal setup comes with its benefits and downsides as described above.

Conclusion

Energy is the vital bloodstream in digital world. Without a constant supply of energy there is no computing, no internet and no ChatGPT. Renewable energy has now become the most wanted asset in the world. The tide is going from fossil to renewable and thus creating an even growing gap between the wealthy and the poor who just can afford to pay their energy bill. EnergyDAO can be a salvation to this vast amount of people who cannot afford to make the investments needed to get reasonable priced green energy.

EnergyDAO can open a way to make international investment on renewable resources. This is based on trust, open contracts and decision mechanisms. People can join and become investors instead of just donating money for charity not knowing where their money actually goes. People can also become active members of energy community instead of passive receiving alms. EnergyDAO is a tool to bring energy democracy to places where people do not have ample resources for living and education. It also makes sense since the world needs to stop consuming fossil energy and EnergDAO can be the way to help the less wealthy countries to do the same.

To summarize EnergyDAO will:

• Boost energy investments, help managing them in transparent and democratic way, creates trust,

• Enable citizens engagement, makes scaling easier and more efficient,

• Foster new opportunities and growth in the areas with rich population but lack of investment money.

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