WattWatt Whitepaper

Decentralized Funding for the Solar Industry

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Wattest (adj.): Describes a loan application that is optimal, desirable, qualified, maximized risk adjusted return, hottest, Wattful. It's whatever the token holders want and entirely subjective in the end but through a bootstrapping effort, we intend to align the token holders with our vision for WattWatt.

Abstract

WattWatt offers enlightened investors a curated list of the Wattest solar crowdfunding opportunities. By reducing the due diligence barrier to investing, WattWatt will increase the pool of available capital competing to invest in solar. This will in turn reduce the cost of capitalizing solar installations and accelerate global solar adoption.

Solar financing opportunities can be rated based on their prospective return and risks including execution risk, default risk, and inflation risk. Rating solar opportunities involves evaluating several factors, including the solar developer's record of successful installations, the credit worthiness of the entity receiving funding, and the political and economic stability of the surrounding region. For individual investors, the cost of appraising each solar financing opportunity can be prohibitively expensive. Larger, institutional investors who can afford to conduct appraisals have no incentive to share their results. WattWatt acts as a coordination platform, establishing the necessary incentivizes for appraisers to transparently share the results of their due diligence and publicly reject undesirable solar financing opportunities.

We introduce the Watt List, a Token Curated Registry (TCR) built on the Ethereum blockchain governed by the WATT ERC20 token. Homeowners and businesses seeking solar financing must stake WATT tokens in order to submit an application to the Watt List. WATT token holders play a voting game to determine whether an application to the Watt List is the Wattest based on the project's risk adjusted rate of return. While WATT token holders curate the Watt List with the Wattest solar projects, investors will place a value premium on the listed projects. This will in turn drive additional projects seeking financing to apply to join the list, which will manifest as upside for the WATT token holders performing due diligence.

In the future, the WATT token holding community could also govern decentralized funding dispute resolution.
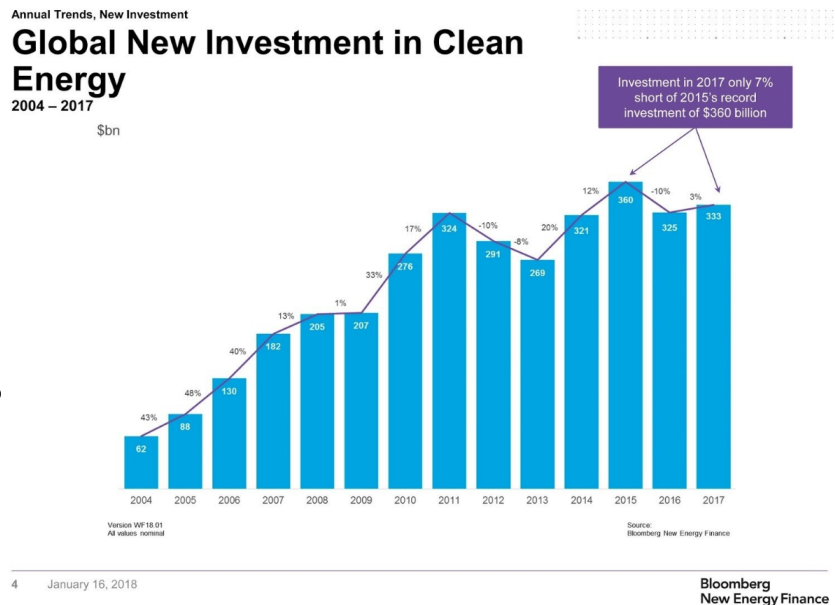
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Background

WattWatt takes advantage of three massive global trends as the solar and blockchain industry evolve and mature. These trends include:

1. Accelerating growth of the solar industry
2. Globalization and democratization of financing with cryptocurrencies
3. Decreased coordination costs from using smart contract platforms

Global Dominance of Solar

The cost to install solar has dropped by more than 70% since 2010, and the cost of solar photovoltaic (PV) generation is now at or about to be at grid parity (often without subsidies) in many regions. Today, solar is the fastest growing source of global energy generation, overtaking the growth of all other forms of power, including oil, coal, nuclear, natural gas and wind. Global solar deployment shows no signs of slowing down, growing 29% in 2017 and is projected to grow at least another 30% by 2022. BP predicts that renewable energy capacity will increase five-fold by 2040.

Annual Trends, New Investment

Global New Investment in Clean Energy
2004 – 2017
$bn

Investment in 2017 only 7% short of 2015's record investment of $360 billion

Version WF18.01
All values nominal

Source:
Bloomberg New Energy Finance

4   January 16, 2018

Bloomberg New Energy Finance

Democratization of Financing with Cryptocurrencies

ICO, initial coin offering, style fundraising using Ethereum smart contracts has proven to be an effective method of collecting funds for a project. These fundraising events are global and sometimes use public auction methods for efficiently determining pricing. Ownership during dispensation and post-sale transfers are kept transparent by virtue of being conducted over a distributed, public ledger, while proper execution of the rules encoded in the token sale smart contracts are enforced by the decentralized network of Ethereum miners who would reject any

incorrect or fraudulent code execution. To date, transaction costs can be kept down to $0.10 each and on average take about 15 seconds to settle. Liquidity for ownership of debt (via security tokens) can benefit from the low, shared cost of tracking transactions while maintaining transparency over a blockchain. In the same way the PC brought computing to individuals, blockchain brings primary finance capability to regular people.

This is in contrast to the existing financial system using legacy transaction tracking technology and contracts built and enforced through lawyers and a government legal system. Specifically:

- Additional costs to receive solar financing including "dealer fees" and "origination fees", which are believed to be around $5,000 or 10-16% of the loan amount, per loan.
- Typical closing costs for loans from banks range from 2% to 5% of the principal.
- The after-tax financial cost of TPO (third party ownership) financing for distributed solar, typical among major large institutions, is estimated to be 7-14% of the capital. Most of these institutions only service loans once they are at least $25,000,000 in size or above. The smallest residential solar securitization involves around 6,000 houses.
- NREL, the National Renewable Energy Lab, an authority in the renewable energy space, reported in 2013 that third party ownership funding new projects added $0.78/Watt for residential projects and $0.67/Watt for commercial/utility. Today's solar installations at commercial/utility scale often cost less than $1.00/Watt total, including equipment and labor, before capital costs.
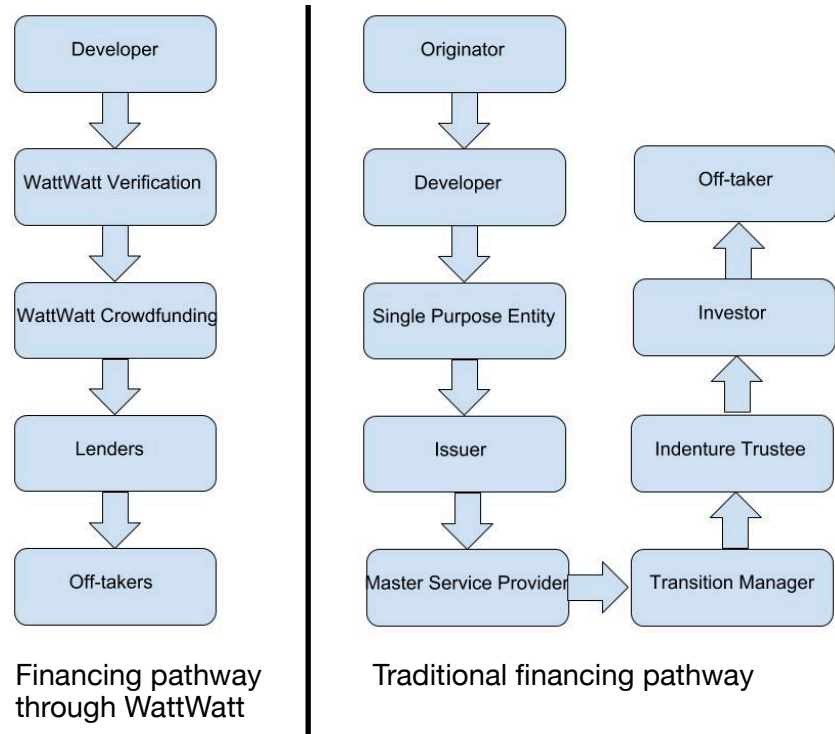
These added fees are not coupon rates that lenders are earning, they are charged by intermediaries to help one find and manage capital. These additional costs significantly lower the savings gained from installing solar. The fixed costs of securitization for traditional financial firms have even led to many of the issuances created thus far being described as "loss leaders" despite being at a scale of millions of US dollars and containing attractive interest rates.

Decreased coordination costs from using smart contract platforms

In comparison, legacy rating agencies have incentives to get paid to rate and grow out business with preferred partners. However, market discovery in these agencies is prolonged; therefore, the time it takes for the market to punish the agency for dishonesty or incompetence makes it

challenging to dissuade these actions.

Smart contracts externally enforce the rules of the game, backed by the operators of the blockchain itself (which is decentralized and difficult to corrupt). The end result is coordination between mutually distrusting actors being able to work together within the rules of the same game and in turn achieve social scalability.

Financing pathway through WattWatt

| Developer |
| WattWatt Verification |
| WattWatt Crowdfunding |
| Lenders |
| Off-takers |

Traditional financing pathway

| Originator |
| Developer |
| Single Purpose Entity |
| Issuer |
| Master Service Provider → Transition Manager |

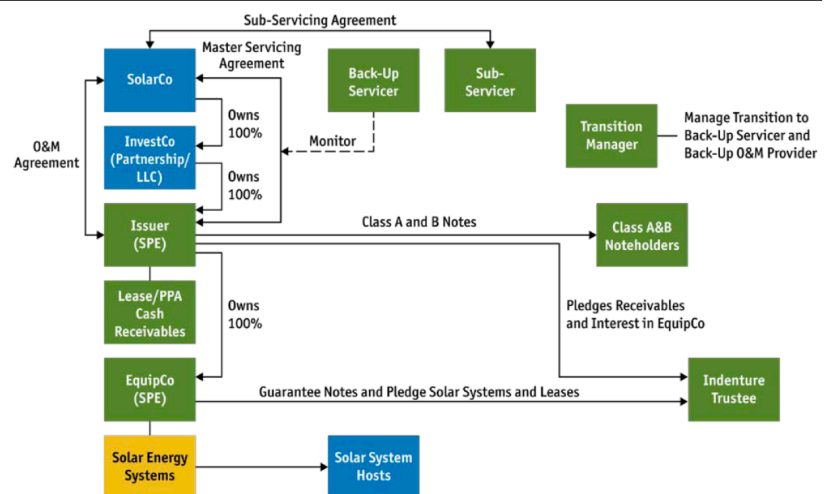| Off-taker |
| Investor |
| Indenture Trustee |
| Transition Manager |

Capital stack in traditional solar

Figure 1. Residential securitization legal structure

Token curated registries (TCRs), a subset of smart contract coordination designs, are unlike oracles in that they do not provide an exact data feed from a source but rather deliver a consensus decision from a network with a mechanism design encouraging honesty and competence. The technological benefits from using a TCR model lead individual actors, in a decentralized paradigm with a traditionally high cost of coordination, to work together while sharing the cost of effectively verifying solar installation opportunities.

As an example of the need for a qualified list- it's obvious why you would be prepared to finance your friendly neighbor's solar installation: you trust them, know they are good for it, and you (probably) want them to succeed. However, if you want to invest in a solar installation for a different community you are not familiar with, you are going to be hesitant because you don't know the trustworthiness of the funding recipient(s) and cannot afford to conduct the due diligence yourself. Decentralizing verification in an efficient manner allows for the facilitation of more solar installation financing and saving the world.

A single actor or entity could conduct the coordination of a registry made up of a list of something desirable. However, the agents operating under this entity would need to trust the operator, hoping that their incentives and those of the coordinating entity are aligned. This is often not the case as the agents operating under the coordinator are seeking high personal gain for less work while the coordinating entity is seeking high personal gain for themselves while maximizing work done by the agents. Blockchain smart contracts provide an alternative to legal contracts enforcing commitments when players stake and token coordination models can reduce the feedback loop to discover whether the coordinator has become malicious. The threat of on-chain economic punishment is designed to be sufficient to guide behavior, often without the additional threat of expensive legal action or a central coordinating person or firm. Agents staking tokens are voluntarily submitting themselves to a potential and transparent economic enforcement action for misbehavior because their token stake can be seized or slashed according to the encoded smart contract rules. Several examples of token coordination include MakerDAO, Adchain, and District0x.

MakerDAO tokens **(MKR)** give holders a proportional control of the Dai stablecoin ecosystem risk management and business logic. Holders submit governance proposals, vote on them and are punished in the case of insolvency by having their token share diluted by newly minted MKR. The result is trustless lending and a stable, USD tracking ERC20 token. Dai stablecoins are minted by smart contracts holding on-chain collateral (for now, Ether; later, security tokens).

Adchain tokens **(ADT)**, governing the original TCR model, coordinate holders to review incoming applications for listing on a whitelist of credible website domains in regards to their advertising.

District0x tokens **(DNT)** also govern a TCR, this one curating 'a collective of marketplaces and communities'. These 'districts' are all built on the d0xINFRA framework, made up of smart contracts and software libraries. Tokens are staked in the different 'districts' to mint new governance tokens in each individual marketplace or community. Also, the DNT tokens curate a whitelist of 'districts', through a TCR mechanism, which can be accessed by the DNT tokens.

The Watt List

We introduce the Watt List, a Token Curated Registry (TCR) built on the Ethereum blockchain governed by the WATT ERC20 token. WATT holders play a voting game to determine whether an application to the Watt List is sufficiently desirable based on the project's risk adjusted rate of return (the Wattest projects). While WATT holders curate the Watt List with desirable solar projects, investors will place a value premium on the listed projects. This will in turn drive additional projects seeking financing to apply to join the list, which will manifest as upside for the WATT holders performing due diligence.
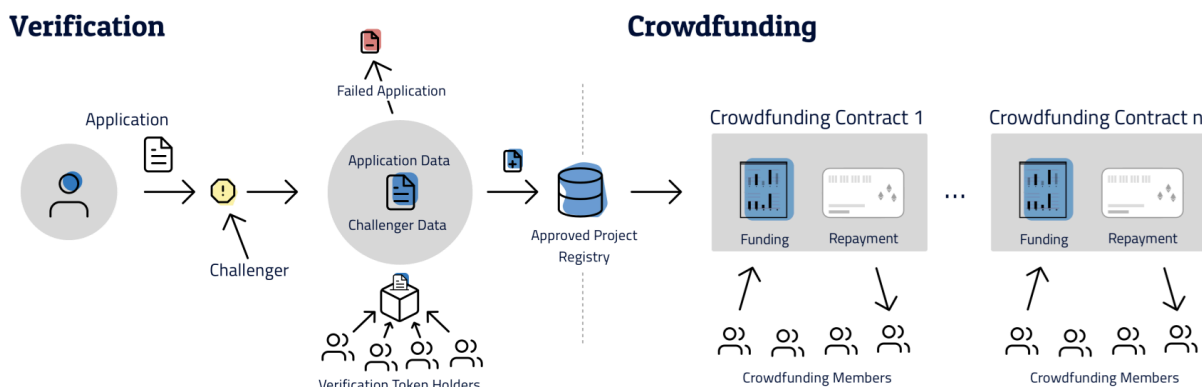
A well formed application to the Watt List will include:
1. Expected energy generation
2. Install firm and their history
3. Solar system equipment manufacturer
4. Expected cost breakdown
5. Building address
6. Homeowner/business name
7. Interconnection agreements with the utility company

8. Credit scores

9. Evidence of consistent utility bill payment

The objective of the Watt List is to curate the most risk adjusted profitable solar financing opportunities. Ultimately, it is the responsibility of the WATT token holders to both challenge undesirable applications and vote diligently to maintain the integrity of the Watt List. At a high level, the Watt List works as follows:

1. A homeowner or business looking to finance their solar installation submits an application to the Watt List and **stakes** the required WATT tokens.

2. Once their application is submitted, a **challenge period** starts during which any WATT token holder can match the applicant's WATT deposit and submit a **verification challenge**. If no challenges are submitted during the challenge period, the solar funding application is accepted into the Watt List, and the applicant's WATT deposit is returned.

3. If a WATT holder decides to issue a challenge and matches the WATT deposit, a **voting period** starts during which the WATT holders participate in a WATT token-weighted vote on the funding application.

4. At this point one of two results can occur:

   A. The applicant wins the vote.

      1. If the challenge is settled in favor of the applicant, the challenger's deposit is forfeited and the applicant is listed on the Watt List.

   B. The challenger wins the vote.

      1. If the challenge is settled in favor of the challenger, the applicant's deposit is forfeited and the applicant is not listed on the Watt List.

      2. Applicants can re-apply for listing as often as they like if their application fails.

5. When the vote concludes, a percentage of the forfeited deposit is awarded directly to the winning party in the challenge (either the applicant or the challenger) as a special dispensation. The remainder of the deposit is divided proportionally among token voters in the winning bloc by token weight. Voters in the losing bloc receive nothing.

Applying to the Watt List

Today, a solar developer with a compelling installation opportunity sold and ready for funding can only get funding from people that trust them or through an expensive financial entity, most often a commercial bank or private equity firm. They could use a third-party verifier to perform due diligence but this only moves the trust onto that entity. If a third-party verifier is being paid by the solar developer, their incentive is to give positive feedback in order to continue getting their business. Historically, ratings agencies have failed because of this structural incentive misalignment. Further, verifiers who do in fact give unjustified positive feedback aren't held accountable because of the market's delayed feedback loop. This makes it difficult for outside investors to trust the verifier's judgement and still limits the pool of investors to those who trust the verifier.

Those interested in investing in projects listed on the Watt List are not trusting any specific verifier but rather the community of WATT holders and their incentives within the Watt List curation game. They are relying on verifiers, acting in their economic self-interest, promptly challenging undesirable applications and WATT holders voting to keep undesirable applications out of the Watt List. WATT holder voters, if making false-positive claims, face a high risk of missing out on winning bloc token dispensation. Since the token holders are distributed, the rational approach is to assume that most of the other token holders will not vote false-positives in to mitigate risk of missing out on winning dispensation. They also have a direct, immediate incentive to challenge undesirable applications in order to win tokens. They have a strategic incentive to keep the Watt List credible to maintain the value of their WATT tokens through demand for use of the Watt List.

Over time, as demand to join the Watt List grows, we expect listing service providers (*registrars)* to emerge which would help homeowners and businesses successfully apply to join the Watt List. If homeowners and business don't want to prepare documentation, stake WATT tokens, and submit their own application, they could pay a registrar a **registration fee** to have a provider handle the process on their behalf. Registrars would vet the prospective applicant, prepare documentation, stake WATT tokens, and apply to the Watt List on the applicant's behalf. Registrars would likely be well-known community members, WATT holders, and be better prepared to defend against challenges that may arise. They want to get the project listed

and funded (reputation) but are not taking capital and funding the project themselves. Rather, they are proving the value of the project to others. This removes conflict of interest by design. Being accepted into the Watt List does not guarantee funding, but increases the likelihood because financiers will be more keen to invest.

Challenging an Application

Once an application is submitted, a **challenge period** starts during which any WATT token holder can match the applicant's WATT deposit and submit a **verification challenge**. If no challenges are submitted during the challenge period, the solar crowdfunding application is accepted into the Watt List, and the applicant's WATT deposit is returned.

A WATT token holder would be driven to stake their tokens and challenge an application if they know of or see something in the application that risks lowering the value of the Watt List. This motivation is a result of the overall WATT token holders coordinated interest in ensuring only solar funding opportunities with reputable installers, creditworthy borrowers, and stable regions are granted a listing. The challenger is relying on this engineered coordination for the confidence to challenge, hoping to bring about a majority vote in their favor, awarding them WATT tokens from the applicant's stake.

Voting is kept commit-reveal (results not listed until completion of vote), so WATT token voters during a challenge are basing their decision of their Schelling Point with all the other voters. The Schelling Point is what they think all the other voters believe is the correct side in the challenge game. This voting decision is motivated by the difficulty of communicating between a decentralized network of voters mixed with the encoded rule dispensing a portion of forfeited WATT tokens from the losing side to all WATT voters in the winning block. There is an opportunity cost for WATT voters to decide against what they think all other voters will choose. A rouge WATT token holder trying to get their solar developer friend listed even though they know it's a high risk project misses out on winning WATT tokens when their friend is challenged and defeated.

Emergent Roles

Several roles will emerge to service the Watt List and in turn be compensated in their own distinct manner. These roles, layered on top of the Watt List, are both checking each other and coordinating in the curation effort.

The virtuous incentive structure is backed by the motivation to drive demand for use of the Watt List.

Registrar: Apply in the place of solar developers, home owners or business owners. May charge a fee for the service. Vested interest in not only listing the project but ensuring successful funding to increase or maintain its reputation.
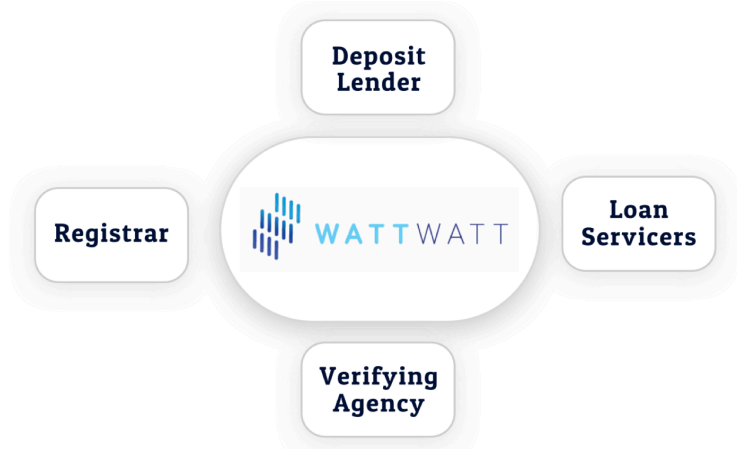
Verifying Agency: Hold a significant stake in the Watt List through their WATT token holdings. Motivated to challenge applications not worthy of listing, vote as often as possible, and coordinate the effort to conduct honest and efficient due diligence. May onboard a verification team and compensate the individuals through steady income while benefiting from the increase in value of their WATT tokens.

Loan Servicer: Facilitate the funding of successfully listed projects and receive compensation from the borrowers or funders. For the sake of its reputation, it should keep execution risk as low as possible, either through its own developed enforcement mechanisms or relying on WATT token holders to resolve disputes. A corporation is formed by the WattWatt team to be the first loan servicer pulling from the Watt List. At the same time, new businesses interested in this model are encouraged by the bootstrapping strategy of the WattWatt team.

Deposit Lender/Broker: Gather data on other roles and determine whether it's worth it to lend WATT tokens or stablecoins to these roles in order to increase the value of their token holdings. May also charge short-term interest to the borrower of their tokens as compensation

Future Additions

WATT tokens and their holders can be leveraged in the future for **decentralized funding dispute resolution**. Execution risk scenarios for solar crowdfunding can be broken down as:

1. Over budget
2. Unexpected blocker
3. Fraudulent borrower/developer
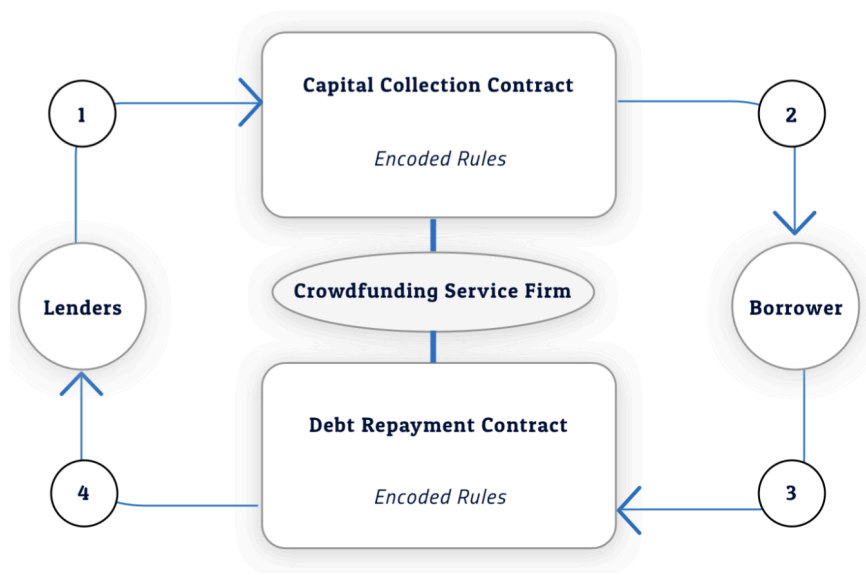
Crowdfunding loan servicers can call on WATT token holders to vote on disputes between funders and borrowers during the capitalization and installation stages.

The project will be exploring advancements of the model, which are subject to change.

Examples of exploration include, but are not limited to:

Stablecoin collateral. May be employed by the crowdfunding efforts to mitigate execution risk throughout the crowdfunding effort. Servicers of a crowdfunding effort may require the borrowing side to escrow stablecoins in a smart contract. The servicer can program the smart contract to be managed by a trusted entity or can place the management in case of a dispute in the hands of the WATT token holders. This allows the manager to leverage the collective knowledge and capability of the Watt List players in regards to solar financial due diligence. Compensation for the WATT holders may be in the form of a management fee paid out of the stablecoin collateral to the participating WATT holders in order to incentivize their involvement.

Ranked TCRs. Have the capacity to improve the curation process past a binary listing, especially once they are used at scale. The Watt List smart contract can be upgraded through a consensus of WATT token holders to allow for WATT holders to stake on specific applications and rank them by amount of WATT staked, for example. Another method of upgrade to a ranked TCR would be playing a Schelling game- projects rated between 1-100 must receive above a configurable threshold rating to be listed at all. Instead of voting yes or no, WATT token holders provide their rating (commit-reveal), the token-weighted average rating is calculated and the 50% of token voters closest to the average rating receive the losers' deposits.

Hierarchical TCRs. Have the capacity to scale the curation community, expanding the coordination effort to sub-communities of TCRs focused on specific regions or installation types. WattWatt would then form a top-level TCR of these TCRs. WATT token holders vote on which other TCRs they would like to qualify and which are either not interesting or fail to meet their standards. The Watt List could then use the specialized TCRs as feeders for its applicants. These sub-TCRs could airdrop their tokens onto WATT token holders to incentivize them in helping verify at the more focused level.

Futarchy Curated Registries (FCRs). Allow for educated players to leverage their knowledge about a project or due diligence to make a bet on which TCR side they believe will win in a verification period. Agents interested in placing a strong position on the challenger or applicant side buy access rights to WATT token winning dispensation if their side wins the WATT vote.

Application Parameters

These parameters will be determined by voting from token holders. These would include:
Application WATT Token Deposit: Number of WATT token needed to apply for the registry.

Application Challenge Period: A determined number of days for each challenge period.

Challenge Deposit: The amount to issue a challenge to an application.

Dispensation Shared: Percent of winner dispensation paid out to voters in the winning bloc, after challenge period vote concludes.

WATT Token

Following the standards set by preceding token models, 1 billion ERC20 WATT will be minted. 15% of WATT tokens will go towards the development team and early investors.

At time of minting, 70% will be programmatically locked up, to be distributed by the inflation model explained in this paper. The enforcement of this inflation distribution will be conducted by the smart contract code holding these WATT tokens.

The remaining 15% of the WATT tokens will be sold and distributed by the WattWatt team to potential users of the platform. Users include solar developers interested in financing, qualified agents for verification, and those interested in becoming involved in the due diligence game.

Reserve Pool for Inflation

The portion of WATT tokens set aside for inflation will be dispensed according to the behavior of WATT token holders. Newly distributed tokens will be periodically distributed to Ethereum addresses actively using their WATT tokens to vote, challenge and apply to the Watt List. This model awards active use of WATT tokens and dilutes out speculators and others offering no benefit to the curation effort of the Watt List.

Team

Vincenz Buhler

Vincenz is a technologist who is deeply passionate about renewable energy. He's worked on energy initiatives at a number companies, like SolarCity, Tesla Energy Mexico, Monolith Solar, and Arcadis. At SolarCity, he spearheaded the opening up of SolarCity's operations in Mexico, lead the designs of residential solar installations and focused on improving the sales process. Vincenz is personally responsible for the designs of over 1,000 projects and indirectly responsible for over 20,000 residential installation designs through the team he managed. Prior to WattWatt, Vincenz worked at Tesla, where he was nominated for the top award in the department for his work in Sacramento and Mexico City. He studied chemical engineering at Rensselaer Polytechnic Institute.

Edward Lee

Edward is experienced in finance and software as it applies to investment banking. Having interned at Loku, Deutsche Bank, and Voya Investment Management before working as a full time credit analyst at S&P Global Ratings in New York, he has been exposed to the existing methods of valuing and rating

investment opportunities. Edward and Vincenz both grew out their passions for renewable energy back at the Hill boarding school, starting in 2007, where they spearheaded a sustainability effort to retrofit the campus with energy efficient equipment and fund trips to bring awareness over the issues of global climate change. Edward was accepted into the Jerome Fisher program at the University of Pennsylvania and graduated with a degree in Economics.

Advisors

Ameen Soleimani

Ameen is co-founder and project lead for SpankChain, payment infrastructure for the adult industry. Prior to SpankChain, Ameen worked as a software engineer at ConsenSys. At ConsenSys, his projects included peer-to-peer energy markets, decentralized hedge funds, state channels research, and AdChain. Ameen studied chemical engineering at Rensselaer Polytechnic Institute, founded Potomac Code Camp to teach middle schoolers programming fundamentals, and founded Filter, a personalized news reader. He is also the founder of Moloch Ventures, a blockchain venture production studio with a focus on state channels and tokenized smart contract platforms.

Shannon Wu

Shannon is a technologist who is passionate about disruptive models, and has been investing, advising and partnering with early stage companies for years. She works closely with projects like Bloom on decentralized credit, MakerDAO on stability on the blockchain and more. She founded Mr.Progress, a leading marketing firm for fast-growing Silicon Valley companies working on transformative technologies. She has worked with brands like Visa, Coach, Jawbone, Branch and others. She is also a co-founder of Sourcerers.io, supporting dominant Ethereum projects and blockchain initiatives. She frequently lecturers on marketing and company building at accelerators and Stanford University, her alma mater. She previously headed marketing at FOUNDER.org, an early stage fund investing in young innovators.

Jarrett Leinweber

Jarrett ("Jarrito") Leinweber is an environmental and sustainable energy specialist with a deep understanding of Mexico's energy reforms, electricity market and renewable energy sector. He provides consulting services and develops solar energy and electrical infrastructure projects. Jarrett dedicates his efforts to help his clients develop opportunities and fast-track their projects. Prior to focusing on the Mexican energy sector in 2015, Jarrett was responsible for managing a diverse portfolio of environmental and regulatory projects in the Canadian oil and gas sector.