ThermCoin (BTUC) – A Self-Regulating Energy-Based Distributed Digital Currency

White Paper

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Abstract

We present a vision for ThermCoin (symbol BTUC), a decentralized, stable, digital currency that will reference the underlying energy content of all energetic substrates in terms of British Thermal Units (Btus). ThermCoin (TC) seeks to give energy producers and consumers alike confidence in using a stable medium of exchange, with a valid energy reference point in which to transact. The organizing principle behind ThermCoin's explicit denomination to energetic value is the idea that all economic activity, and indeed all life, requires heat and movement in order to perform any work at all, and thus always requires the consumption of a stored energy source. As such, the economy is not a money economy that operates on financial transactions, but is in fact an energy economy that operates on energy transactions, subject to the laws of physics. As such it has unwittingly used, and continues to use, man-made fiat currency constructs as a proxy for energy consumption/transactions writ large. Our view is that money, be it fiat, gold, or digital currencies, is inherently a claim on work-energy, regardless of whether its creators and users explicitly express it or not. Thus, this reality is inescapable, whether humanity accepts it or not. The monetary transactions involved in the consumption of goods and services in terms of fiat or other currencies can be reimagined conceptually as a representation of the accumulated energetic input costs utilized, in order to make a finished product. The idea behind ThermCoin proposes a novel monetary system that leverages existing and recently developed and understood nature of decentralized digital currency as a vehicle for implementing an entirely new concept of value exchange. This proposed monetary link to the total energetic content of all energy substrates will thereby serve to auto-regulate the circulating money supply in a congruent, mirror-like fashion to the energy available to humanity to perform economic work.

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1. Introduction

This paper will first outline an economic problem and approach to an energy based digital currency being conceptualized and proposed, as well as additional smart-contract functionality the platform will entail. Being proposed is ThermCoin (TC), an energy-based, dis-intermediated and cryptographically secured, digital token that will be utilized for both commercial and consumer goods and services. ThermCoin will be a stable, decentralized coin, having an underlying ratio of value to Btus, (British Thermal Units of energy) which in turn will tie TC directly to the energetic content value of any energy based commodity. Furthermore, TC will confer confidence along every transactional link of the energetic value-chain, from energy producers, sellers and ultimately consumers, that TC's underlying value will always be bound to a pre-determined quantity of energy, whether crude oil, natural gas, coal, as well as all other modalities of electrical power generation. Once developed to scale, this new paradigm of energy-based monetary transactions from "the cradle to the grave" will provide a never-before-seen homogenous and continuous data set which the ThermCoin ecosystem will utilize to auto-regulate itself as well as the potential to use the carbon based consumption portion of the data for climate-change analysis purposes.

What differentiates ThermCoin from other state sponsored fiat currencies or even newly created decentralized digital fiat currencies, is its reference to Btu content for each coin created. Thus, total circulating ThermCoin (TC) supply is directly tied to global daily energy consumption, on a Btu quantified basis. In addition to the total initial TC circulating supply, additional TC supply will be increased or decreased concurrently, as it self-readjusts periodically, as total global energy consumption increases or decreases accordingly. The ThermCoin ecosystem and protocol will also create an incentive for the adopters of TC to lend computing resources for the purposes of validation of transactions, thus creating additional value. The total circulating ThermCoin supply will not be an artificially and arbitrarily devised number, but a value based on the total of stored on-demand energy daily demand/consumption globally on a per-100k Btu basis. This figure represents the total energy wealth flow available to mankind at any given point in time, and will thus be mirrored in the ThermCoin money stock, with the intent to establish a transparent, universally

reconcilable and verifiable fixed relationship between the two. This, in essence, is the basis of sound money. ThermCoin will initially and thereafter periodically utilize verified consumption/demand data from reputable reporting agencies. By using off-chain databases to adjust the circulating supply based on verified, validated and confirmed increases or decreases in total periodic energy production, storage and consumption, the entire ThermCoin ecosystem will be imbued with confidence within its user base, as well as the entire ThermCoin protocol itself. This process will eventually and ideally be replaced by internally generated data as the TC ecosystem begins to generate energy production, storage and demand/usage data internally, as increased adoption, circulation and utilization of TC increases vis-a-vis transactions using the actual TC token itself. ThermCoin is agnostic to all fiat currencies and seeks to reimagine the pricing of energy transactions via the consumption of energy itself, or the consumption of both goods and services in terms of energy content vis-a-vis ThermCoin.

ThermCoin also seeks to re-envision the way the global populace conceptualizes and values the energetic content of various energy sources. We seek to quantify the energetic value of both the consumption of energy across all energetic substrates, as well as the cost of energy utilization in producing goods and services. Inherent in ThermCoin's utility is a concept of more appropriately valuing energetic substrates such as propane, gasoline, diesel, natural gas, electricity, etc., comparatively on a more empirically-based system as it relates to their respective energetic content. ThermCoin moreover seeks to solve various problems presented below, including transactional frictions inherent to the global banking system and transactional anonymity between participants. A specific aim of ThermCoin is to create an incentive for adoption at the energy producer and end user level, via the lending of computing hardware capacity and energy to authenticate ThermCoin transactions and thus gain ThermCoin payments and rewards. In addition, we envision that when at full scale, nodes throughout the TC network will also receive ThermCoin for reporting energy production, conversion and consumption data as energy is produced, converted or consumed.

ThermCoin will revolutionize the way consumer goods are priced. Energy is required in the manufacturing and upgrading of raw materials to finished products for final delivery through various distribution channels. In each upgrading step from manufacturing to distribution, not only is one of the largest costs energy, but the embedded cumulative energy is carried through to the next step. Instead of thinking about products in terms of fiat currency, ThermCoin introduces a new paradigm of valuing products based on cumulative energy inputs.

We consider ThermCoin to be not just a store of value and medium of exchange, but a digital, blockchain-based technology eco-system, whose ultimate aim will be to value and transact goods and services globally, based on their respective ~~latent~~ energetic inputs and content. All this, while linking the real economy of goods and services, driven by energy inputs, directly to a stable monetary system.

2. Problems Solved

a. Sound Money and Monetary Debasement

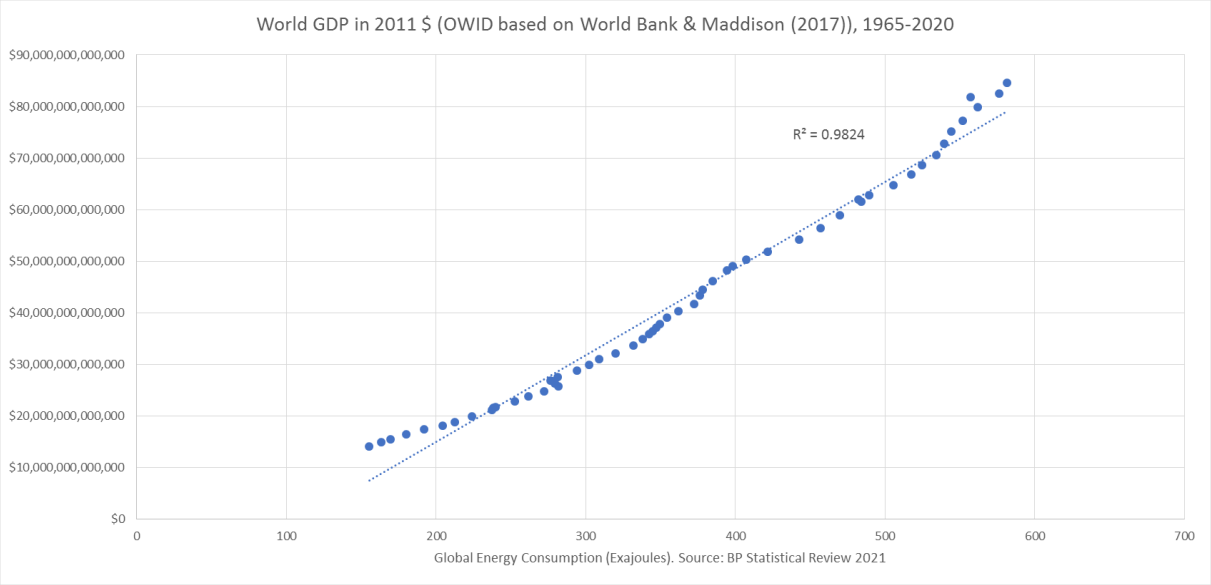
The problem of a money system that provides for stable pricing both across time and geography has never been solved. All attempts at running systems based on fiat currency eventually failed as the temptation of debasement either as a deliberate policy tool or through incompetence proved too great to resist. Money created ex-nihilo can only be as good as the authorities that oversee it. Monetary systems based on a peg to a real-world commodity, most commonly a precious metal such as gold, have fared better in terms of creating price stability because the underlying commodity can only grow in supply as fast as new reserves can be exploited, which is slower than fiat currency which could be multiplied overnight. Even so, there have been historical episodes where a sudden influx of new supply in the underlying commodity created a lot of new money that didn't correspond to any growth in production in the real economy, thus creating high inflation. A textbook example of this is the influx of gold from the New World into Spain in the 17th century.

While a resource-backed monetary system is superior to a fiat monetary system in its durability and stability, it still does not achieve the function of what an idealized monetary system should do, which is to provide as near as is possible a mirror image-like financial representation of the real economy of goods and services.

Because the production of any good or service requires movement and heat, it can be stated that a universal good that is required in all economic activity is a primary energy source. Stated another way, all economic activity (and indeed, all life on the planet) operates in motion by dissipating or converting higher-order stored energy in the form of an energy product into lower-order energy in the form of goods and services, laborers' pay, return to capital, waste heat, and so on. Energy is the prime mover of all economic systems and all living systems. Harking back to the previous example of gold; what else is a gold coin if not an embodiment of the energy consumed in its discovery, mining, refining, delivery, and storage? Taking that concept back even further, what else is gold but an element formed in the energy-consuming forge that is a star?

Cutting to the root of the issue, one then realizes that a truly stable monetary system should peg itself directly to energy consumption, measured in universally understood units of heat energy, and in this way we realize a monetary system that reflects in itself humankind's ability to perform economic activity.

Growing supplies of available energy will grow the economic output of goods and services almost linearly, and the stock of ThermCoins will grow in lockstep; falling supply will shrink global economic output but this will matched automatically by shrinking stock of ThermCoins, thus removing inflationary or deflationary pressures that conventional monetary systems are subject to.



b. Disintermediation of Third Parties in the Financial System

The traditional use of trusted third parties in non-cash financial transactions has been made obsolete, at least in principle, by the rise of cryptographically secured digital currency protocols which allow for trusted payments between participants in a decentralized format. The energy-based digital token we propose would take the form of a distributed digital currency that will realize the benefits of cutting out the middlemen from financial transactions, returning cash-like benefits to participants but without the drawback of requiring physical proximity to transact. Frictions and costs inherent to using the complex structures of financial intermediaries will be greatly reduced and in some cases eliminated by use of established cryptocurrency protocols to authenticate ThermCoin transactions and deliver ThermCoin anywhere in the world in a short amount of time.

c. Block Settlement

The protocol will speed up transaction speed as compared to some other cryptocurrency protocols by utilizing a co-operative, rather than competitive, network format, thus

prioritizing speed of cryptographic authentication without sacrificing security. ThermCoin's protocol will set money stock in such a way as to avoid deflationary tendencies, such as is seen in Bitcoin, thus avoiding the problem of requiring increasing quantities of computing power to produce additional money stock. In fact, computing power on the network will be unrelated to ThermCoin's monetary policy, as the money supply will be determined by measurements of energy quantities in the real world. Open sourced layer-1 protocols in existence already allow for the confirmation of funds transfers within a couple of minutes, while further addition of a layer-2 would reduce this even further.

3. Growth to Scale

As real-world global adoption of the ThermCoin increases, it will feed growing amounts of information about the production, conversion and consumption of energy goods into the network. Measurement of production and consumption of energy won't be measured directly by sensors, but will be measured transactionally inside of the ThermCoin network when an energy producer is paid for its product, or an energy product retailer sells a product to a consumer. The consummation of the real-world transaction is what effectively verifies the existence of the product in the real world and the subsequent hashing of the block that this transaction is a part of is what verifies the transaction in the digital world.

This data will eventually be leveraged by the network itself to derive best estimates of globally available energy supply in real-time, which will allow the network to adjust the money stock as necessary on its own, in perpetuity, without human intervention. New tokens will be minted as payment for new primary energy products (adding to the money stock like-for-like just as Btus are added to the energy supply via produced energy molecules), and tokens that are used in payment for end-use energy consumption will be extinguished permanently (reducing the money stock like-for-like just as Btus have been removed from the energy supply). Date and timestamp based serialization will be used as the basis in creating unique identification markers for every ThermCoin that will ever be

created. Coins that are used in payment for any other converted energetic product, good, or service will be left as they are, only updated for transaction history as they are spent.

4. ThermCoin Circulation and Ratio Factors

According to the International Energy Agency, the world's total population of 7.8 billion people consumes almost 100 million barrels of oil daily and has a total barrel of oil equivalent (BOE) consumption of 200 million BOE per day when all forms of primary energy products are counted (hydroelectric, biofuels, nuclear, coal, etc). Thus, total daily energy consumption equates to around 1.6 quadrillion Btus, or approximately 16 billion ThermCoins (100,000 Btus/TC). ThermCoin supply will re-adjust periodically based on the actual increase or decrease in total available energy supply, which is defined by the daily consumption of primary energy products.

Given a fixed conversion of 100,000Btus per ThermCoin, we find the following implied values for an assortment of well-known energy products:

1 barrel of WTI grade crude oil ≈ 58 ThermCoins.

1 mmBTU of Henry Hub natural gas = 10 ThermCoins.

1 short ton of U.S. coal (2020) ≈ 198.5 ThermCoins.

1kWh of electricity ≈ 0.03412 ThermCoins.

The energetic heat content of various energy products is already known, and adjustments in energy content due to changes in resource quality over time could be factored in as needed on a market-mechanism basis.

Individual energy products won't be pegged to a specific ThermCoin value. Rather, only the overall money stock of ThermCoin will be pegged against the total available energy stock, which we believe is sufficient for the currency to achieve its goal. The implicit heat energy-based ThermCoin value of a given energy product can be thought of as the base value. It could then trade at a ThermCoin-denominated premium or discount to this base value,

determined on a free market basis, that adjusts for the benefits and costs related to a particular product's perceived quality, location advantages/disadvantages, jurisdictional taxation or subsidies, etc.

5. Seed Protocol

Initiation of the quantity of money stock of ThermCoin will be done manually, ex-nihilo, at some zero date d_0. The size of the ThermCoin money stock will be set to equal the best estimate of the sum of total global daily energy consumption and total global inventory of energy stocks, divided by 100,000BTU, as of date d_0. The best estimate will be derived from data provided by major international and national energy agencies, NGOs, trade groups, and private data providers, published openly on the ThermCoin website, and is expected to provide a sufficiently accurate estimate of the true state of globally available energy supply, to begin with.

ThermCoin can be put into circulation out of this initial money stock in three ways:

- ThermCoins can be purchased outright by parties willing to exchange something of value, like goods, services, or fiat currency, for ThermCoin. This exchange will be valued on a free-market basis.

- ThermCoins are awarded as payment to nodes that are willing to donate computing power to hash/authenticate transactions performed on the ThermCoin blockchain. This is meant to incentivize adoption of ThermCoin, but will be phased out as network size grows to a size of critical mass, so as not to create conditions in which a relatively fixed money stock of ThermCoin might end up being cannibalized over time if global energy availability were to start falling, thus reducing the money stock of ThermCoins available for use in transactions. ThermCoin awarded to the mining pool per successful hash, as a percentage of the current core wallet balance, will be set by the formula:

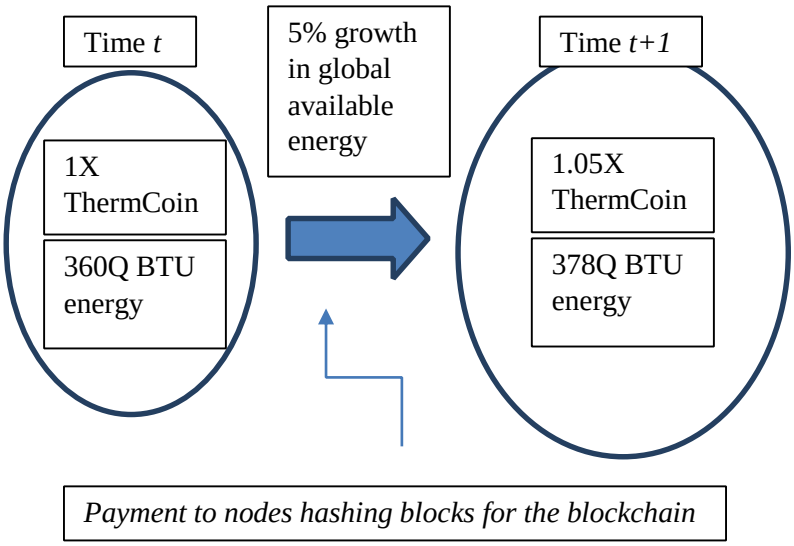
$$1 - \left(\frac{C_T}{C_S}\right) \wedge \left(\frac{1}{((T_t - T0) * (525600/Bm))}\right)$$

Where C_T is the desired terminal balance of the core wallet, C_S is the balance of the core wallet at the start of a block, T_t and T_0 are the terminal date and current date respectively (the difference is in years), and B_m is the block time, in minutes. There are 525,600 minutes in a year. This part of the formula represents an incentive award akin to a profit margin for the nodes. It is designed to be rich in the beginning, in order to drive adoption, and then decay over time towards zero. This reward represents a transaction fee or alternatively a reimbursement for the energy cost and capital costs incurred in the mining process by the nodes.

The total award for a successful authentication will be split equally amongst all nodes that participated. This payment to nodes to secure the ThermCoin blockchain can be thought of in energy terms as a small amount of entropy in the ThermCoin system that is necessary to sustain the system itself.

The stock of available energy supply will be adjusted periodically using the same method as when it was initially set. This method can be phased out as adoption of ThermCoin grows and data on energy-related transactions is increasingly sourced from inside of the ThermCoin network itself. The setting of the size of the ThermCoin money stock thus moves from centralized to decentralized as the network grows, thereby moving towards the goal of a money system whose value cannot be manipulated by a central authority. All holders of ThermCoin will participate pro-rata in any increase or decrease in money stock of ThermCoin, thereby eliminating inflation or deflation in money's value vis-à-vis its ability to call on work-energy.

As globally available energy consumption grows, so does the circulating supply of ThermCoin, and thus per the seed protocol, newly minted TCs will be distributed amongst all wallet-holders in the TC network proportionally, on a pro-rata basis as stated above. This autonomous, self-regulating mechanism, of creating new ThermCoin tokens commensurately as energy consumption in the real world increases, with all ThermCoin nodes receiving the newly created ThermCoins proportionally, will serve to incentivize adoption of TC, by incentivizing TC users to also become verified nodes for confirming and validating network transactions.



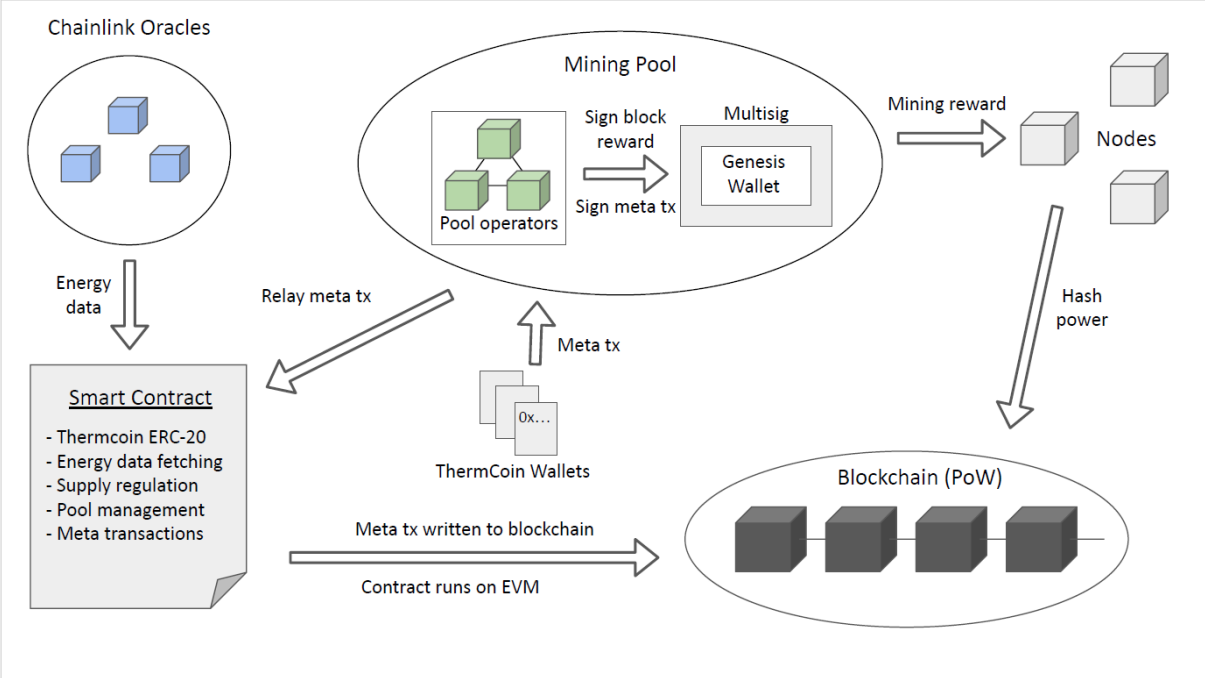
6. Authentication of Transactions

Transactions performed in the real world using ThermCoin in exchange for physical goods and services must be validated and recorded on the ThermCoin network in order to prevent double-spending, which would be devastating to the credibility and confidence imbued in ThermCoin. Taking Bitcoin as an example, the protocol for this coin describes a competitive structure where nodes compete with each other to be the first to validate a transaction, with the reward being the awarding of newly minted coins to the winning node. This sets conditions for an "arms race" of computing power and ultimately leads to enormous quantities of energy being consumed to keep the system going and growing.

We propose a nodal network protocol for ThermCoin that pools cryptographic hashing among all nodes cooperatively and rewards all nodes equally, thus disincentivizing excessive overhead via the increase of inefficient energy consumption in the quest to earn more coins, while incentivizing the addition of verified nodes to the network by interested parties in order to earn larger fractions of the ongoing node rewards. Advances in blockchain

technology over the past few years have put a variety of efficient, fast consensus protocols on the market, thus making selection of blockchain technology, regardless of the cryptographic proof method employed, easier than it was a decade ago. The lower threshold to computing power for individual nodes is still set sufficiently high by the protocol such that any one node must be capable of performing meaningful work for the authentication pool. This does not prevent participants from increasing their share of ThermCoin earned by adding more individual nodes to the pool. Using a lower threshold of computing power with a co-operative model of computing resources hopefully should not only increase the speed at which the network can validate transactions but also keeps barriers to entry low, allowing for greater democratization of the earnings potential of the nodal network.

At the core of ThermCoin is a Proof of Work and EVM-compatible blockchain, where the principal token is governed by a smart contract with an oracle-based supply rebasing mechanism, essential for mirroring energy consumption in usable currency. Critical to this mechanism is the network’s collection of oracle nodes, which provide real-time energy consumption data from a multitude of pre-determined sources. The initial coin supply is pre-mined into a “Genesis wallet", then distributed by “Pool operators” via multi-signature governance. Miner rewards are distributed from this wallet via the ThermCoin pool, and regulated by a decay function to ensure a steady decline in the core wallet's ThermCoin balance over time. These pool operators collectively manage the mining pool and secure the genesis wallet, ensuring equitable reward distribution and maintaining overall network security. In addition to these responsibilities, pool operators process user transactions and relay them to the smart contract, after which the transactions are recorded on the blockchain and verified by miners.



7. Data Sources Used for Setting ThermCoin Stock

Reputable public and private providers of energy data can be used to set estimates for available energy supply, which in turn determine the level of ThermCoin money stock. Agencies such as the International Energy Agency and Energy Information Administration of the U.S. Department of Energy gather a broad range of data on the production, movement, and consumption of a variety of primary and secondary energy sources across the world. Private sources, such as the annual BP Statistical Review, energy data vendors, and industrial trade groups, produce similar data, often based on direct measurement or self-reporting. Several well-established and preferably publicly available sources would be used for the sake of avoiding the possibility of becoming dependent on a single provider, with averages being taken across all data providers where multiple estimates for the same observation are available.

8. Confidence By Human Observation

With any monetary system, trust and transparency is fundamentally essential to adoption and continued use. The ThermCoin principle is simple enough to understand in real, human terms that manual reconciliation of globally available energy supply with stock of ThermCoin money will be possible by any reasonably competent person, at any time, to within a reasonable margin of error. Sources of energy data used in the determination of ThermCoin supply will be published publically on the ThermCoin website, and proposed changes to the methodology will be voted on by node owners. This level of transparency and simplicity will serve to bolster confidence in ThermCoin.

9. Conclusion

We note that over the last decade or so the path of digital currency creation has been well-trodden and that all of these currencies have pursued variations of the same theme, which is the creation of globally fungible digital currencies that disintermediate third parties to create a “people’s currency” that is efficient, immediate, self-regulating, secure, and private. While these goals have simultaneously been met and are still being worked on further, we believe that no digital currency has addressed the elephant in the room, which is that ultimately they all convert back to a form of fiat. What ThermCoin offers that is unique is a framework by which true sound money can be achieved by conceptually collapsing the chain of economic activity down to its prime mover – a source of stored energy – and thus explicitly re-defining the meaning of money as being a call on work-energy. Our goal is no less than to shift humanity’s understanding of the economic activity that it participates in from being that of a money-based economy to that of a physics- and energy-based economy.