Technological Implementation and Future Prospects of a New Financial System Based on Energy Monetization

Yingquan Ye[1*], Zhanghai He[1], Xiangtao Liao[1], Jing Mo[1], Zhulin Fu[2], Yong Li[1], Le Chen[1], Bo Liang[1]

[1]Guangxi Power Grid Co.,Ltd., Nanning, China
[2]Guangxi Hongtai Survey and Design Co.,Ltd., Nanning, China

*41270949@qq.com

Abstract. With the accelerating digitalization of the global financial system, the problems inherent in traditional monetary systems have become increasingly pronounced, including excessive currency issuance, inflation, and systemic financial risks. Meanwhile, decentralized digital currencies represented by Bitcoin, while offering new conceptual approaches, struggle to fully replace traditional currencies due to issues such as lack of intrinsic value and high energy consumption. This paper proposes an energy monetization system based on the constant principle of energy work. By converting physical-world energy into a digital currency termed "Energy-Time Coin (ETC)," and integrating technologies such as blockchain, the Internet of Things (IoT), and artificial intelligence, a secure, efficient, and sustainable new financial architecture is constructed. This paper first analyzes the limitations of traditional currencies and existing digital currencies, then elaborates on the technical foundation and implementation steps of energy monetization, including energy harvesting and digitization, blockchain network construction, and pilot operations. Subsequent analysis of system advantages indicates that the energy currency system offers significant benefits in preventing over-issuance, optimizing energy utilization, and enhancing financial transparency, while simultaneously promoting global green development. However, the system also faces challenges in technological, policy, and social acceptance dimensions, which need to be progressively overcome through technical optimization, policy support, and public education. This paper posits that the energy monetization system represents not only a major innovation upon existing financial models but also an important means of achieving global sustainable development goals. Future research should further explore more efficient and environmentally friendly technological solutions, develop application scenarios for energy currency across various industries, and lay the foundation for constructing a more robust and sustainable global financial system.

Keywords: Energy Monetization; Energy-Time Coin (ETC); Digital Currency; Blockchain; Internet of Things (IoT); Decentralization; Financial Innovation; Sustainable Development; Energy Digitization; Financial System Reform

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1 Introduction

With the deepening development of globalization, the role of the traditional financial system in resource allocation, currency circulation, and economic growth has become increasingly prominent. However, in a rapidly changing economic environment, the financial system has revealed more and more issues. In recent years, decentralized digital currencies represented by Bitcoin have attracted widespread attention and, to some extent, have posed challenges to the traditional financial system. Nevertheless, these virtual currencies still have numerous limitations, making it difficult for them to completely replace the existing financial framework. Therefore, this paper proposes a new financial system based on the constant principle of energy work, known as energy monetization. From the perspectives of technical implementation and practical application, it explores the feasibility and potential impact of this system, aiming to eliminate excessive leverage effects inherent in the traditional financial system and build a more stable and sustainable new transaction structure.

2 Research Background

2.1 Problems Facing the Current Financial System

2.1.1 Excessive Currency Issuance and Inflation.

In the current financial system, currency issuance typically relies on the monetary policies of central banks. However, in order to stimulate economic growth or respond to crises, central banks often inject large amounts of currency into the market. This excessive issuance can easily lead to inflation, eroding the purchasing power of money. Historically, several economies (such as Venezuela and Zimbabwe) have experienced severe inflation and even the collapse of their monetary systems due to excessive currency issuance. With the advancement of currency digitalization, the threshold for excessive issuance will be significantly lowered. As paper currency gradually exits the historical stage and currency issuance relies entirely on digital means, large-scale over-issuance can be easily achieved with just a few keystrokes. Although this convenience enhances the efficiency of liquidity management, it also very easily triggers systemic risks, further exacerbating inflation and instability in financial markets[1].

2.1.2 Periodicity of Financial Crises.

The traditional financial system relies heavily on centralized institutions such as banks, which play critical roles in financial markets. However, when risks become concentrated in a few institutions or market fluctuations exceed control, financial crises can be triggered. The 2008 global financial crisis was caused precisely by excessive leverage within the banking system and the spread of credit risk.

2.1.3 Inequality in the Financial System.

In the existing financial system, resource allocation and wealth accumulation are often concentrated in a few developed countries and large financial institutions. This unequal distribution model exacerbates the global wealth gap and limits sustainable economic development.

2.2 Limitations of Bitcoin and Other Virtual Currencies

Bitcoin has a fixed total supply (21 million coins), and its issuance mechanism strictly limits the quantity of new currency added. Its high energy consumption characteristic (Bitcoin mining consumes vast amounts of electricity) places a significant burden on the environment. The mining process consumes energy without creating actual physical value. Coupled with its drastic price volatility, it is difficult to serve as a stable store of value or medium of exchange. Its anonymity and decentralization make it highly susceptible to use in illegal transactions such as money laundering and tax evasion, and it is almost impossible to regulate[2].

2.3 Research Objectives

2.3.1 A New Transaction System Based on Energy Digitization.

To address the shortcomings of the traditional financial system and existing virtual currencies, this paper proposes a new transaction system based on energy monetization. This system digitizes measurable physical energy forms such as electrical and thermal energy, and utilizes blockchain technology to achieve decentralized energy trading. Energy itself is a resource with intrinsic value; digitizing it allows for the construction of a financial system closely integrated with the real economy.

2.3.2 Exploring Technical Feasibility and Potential Impacts.

This paper aims to study the technical implementation pathways of energy monetization, exploring its application potential in energy metering, data transmission, and decentralized trading. Concurrently, this paper will analyze the profound impacts of this new financial system on existing economic models, monetary policies, and global financial markets. Through a combination of theoretical analysis and practical case studies, it seeks to provide new ideas for the transformation of the future financial system.

3 Technical Theoretical Foundation

The energy monetization system proposed in this paper is based on the integration and application of various advanced technologies. The following sections elaborate on its core technical principles and implementation pathways, focusing on energy conversion and storage, as well as the technical support for the digital currency system.

3.1 Energy Conversion and Storage

3.1.1 Definition and Characteristics of Energy.

Energy is a fundamental concept in physics, existing in various forms such as electrical energy, thermal energy, solar energy, and wind energy. These energy forms possess the following characteristics[5]:

3.1.1.1 Measurability. Energy can be accurately measured using specific physical units (joules, kilowatt-hours).

3.1.1.2 Convertibility. Different forms of energy can be converted into one another, such as converting solar energy into electrical energy, or electrical energy into mechanical energy.

3.1.1.3 Storability and Transmissibility. Energy can be stored in forms such as batteries or thermal storage devices, and transmitted via media such as power grids, pipelines, or batteries.

3.1.2 The Core of Monetizing Physical Energy Lies in Achieving its Digital Representation, which Requires the Following Technologies.

3.1.2.1 Energy Metering Equipment. Utilizing advanced sensor technology to record the production, storage, and consumption of energy in real time.

3.1.2.2 Digital Marking. Each unit of energy (e.g., 1 kWh) generates a unique digital mark via blockchain technology to ensure traceability in transactions.

3.1.2.3 Blockchain Recording. Recording energy generation, transaction, and consumption data on the blockchain to achieve distributed storage and immutable transaction tracking.

3.2 Technical Support for the Energy Monetization System

3.2.1 Internet of Things (IoT). The interconnection of energy harvesting equipment and smart contracts plays a key role in the energy monetization system[4].

3.2.1.1 Interconnection of Energy Harvesting Equipment. Real-time monitoring and collection of distributed energy production and consumption data via IoT devices (e.g., smart meters, sensors).

3.2.1.2 Automatic Execution of Smart Contracts. Based on blockchain smart contracts, transaction rules for energy (e.g., price, supply-demand matching) can be automatically executed, improving transaction efficiency and reducing manual intervention.

3.2.2 Blockchain and Distributed Ledger Technology (DLT).

DLT ensures the security and transparency of energy transaction data. Blockchain technology provides a secure and reliable data foundation for energy monetization[6].

3.2.2.1 Decentralization. Energy transaction records are jointly maintained by multiple nodes, avoiding single points of failure and centralized control.

3.2.2.2 Immutability. The data structure of blockchain ensures that every transaction is verified through a consensus mechanism and is irreversible.

3.2.2.3 Transparency. Transaction data is open to all participants, increasing trust and reducing transaction friction.

3.2.3 Artificial Intelligence and Big Data Analytics.

Optimizing energy usage efficiency and forecasting market demand; AI and big data technologies further enhance the system's intelligence.

3.2.3.1 Energy Supply and Demand Forecasting. By analyzing historical data and real-time information, AI can accurately predict future energy demand and supply, helping the market match resources more efficiently.

3.2.3.2 Dynamic Pricing Mechanism. Based on supply and demand relationships, AI dynamically adjusts the trading price of energy coins to ensure efficient market operation.

3.2.3.3 Energy Efficiency Optimization. Big data analysis helps identify inefficient links in energy usage, providing optimization solutions to improve overall energy efficiency.

3.3 Energy Monetization

With the support of the aforementioned technologies, establishing the energy monetization system requires consideration not only from the perspective of energy production and consumption but also the value decay of energy throughout its full lifecycle. A review of existing literature reveals that current research on energy monetization generally overlooks the energy consumption during the production and use of goods generated from energy work, as well as the ultimate value decay. Therefore, the energy monetization model proposed in this paper introduces a time dimension to ensure that the value of monetized energy dynamically decays throughout its lifecycle until it reaches zero.

3.3.1 Energy Monetization Principle 1: Linking Energy Production with Total Energy Currency Supply.

The issuance of energy currency must be strictly based on actual measurable energy output to ensure the robustness of the system. A national intelligent agent calculates the energy consumption ratio per unit time for each citizen and each physical region across various industries, including agricultural production, urban infrastructure construction and maintenance, entertainment, culture and education, military industry, and aerospace. Only energy used to produce goods, whose full lifecycle value can be dynamically tracked and statistically analyzed by the ETC intelligent system, can be included in the currency pool; otherwise, it is excluded. If certain products have expired warranties but are assessed by product value evaluation institutions as still possessing continued use value, their warranty periods may be modified; otherwise, they are excluded[10].

3.3.1.1 Total Supply Constraint. The total amount of energy participating in monetized valuation shall not exceed the net energy output generated by existing production facilities (such as thermal power plants, photovoltaic power stations, wind farms, etc.) after deducting losses.

3.3.1.2 Dynamic Tracking and Adjustment. As energy production facilities are added or decommissioned, the total amount of monetized energy must be dynamically adjusted in real time to avoid over-issuance of currency. To prevent energy waste, the total national energy output should not exceed demand by a certain margin (e.g., 0.2, specifics to be determined based on the nation's risk aversion and crisis defense strategies).

3.3.1.3 Regarding Energy Freedom. Based on the above two points, state institutions distribute energy coins equally according to the average total individual energy demand for ages 0-120 (upper limit set based on current statistically recorded maximum human lifespan), ensuring every citizen achieves energy freedom.

3.3.2 Energy Monetization Principle 2: Time Dimension and Value Decay.

3.3.2.1 Energy monetization must fully consider the lifecycle decay characteristics of energy, i.e., the dynamic process from the issuance of energy currency to its value reaching zero[8].

3.3.2.2 Additional Decay Factor. Each unit of energy currency must be attached with a decay coefficient linked to the product lifecycle (e.g., warranty period).

3.3.2.3 Coexistence with Product Value. The value decay process of energy currency accompanies the use value of the product, ensuring that energy consumption matches the use value of the commodity.

3.3.2.4 Naming "Energy-Time Coin (ETC)". To highlight its dynamism and time dimension, this paper proposes naming this new energy currency unit "Energy-Time Coin (ETC)," reflecting the value of a unit of energy within a specific time frame.

3.3.3 Energy Monetization Principle 3: Comprehensive Coverage and Gradual Substitution.

3.3.3.1 Energy monetization should not be limited to specific fields but should cover all aspects of energy consumption in human production and life.

3.3.3.2 Comprehensive Energy Accounting. Includes energy consumed in traditional activities such as manual labor, as well as energy consumed in modern production processes such as machine farming and industrial production.

3.3.3.3 Coexistence with Traditional Transaction Methods. Retain traditional gold and silver currency transaction methods, especially applicable to special fields such as spiritual products and artworks, and link them with energy monetization.

3.3.3.4 Gradual Replacement of Some Paper Currency. The energy currency system will gradually replace traditional paper currency transactions, but must follow a step-by-step principle, avoiding a "one-size-fits-all" approach to ensure a smooth socio-economic transition.

3.3.4 Energy Monetization Homogeneity Principle 4: Associated with fixed ETC, qualification value, quality value, product warranty period; develop a unified measurement tool using the joule as the statistical unit to ensure the homogeneity of ETC throughout the full lifecycle from energy to product value conversion to zero.

3.3.5 Energy Monetization Value Preservation Principle.

Energy monetization is based on physical laws and the constancy of time, possessing stronger value preservation attributes compared to traditional currencies (including Bitcoin).

3.3.6 Energy Monetization Transferability and Universality Principle.

The energy monetization process covers the entire physical process from energy generation, conversion into products, to eventual zeroing, with real-time datafication. Its metering, recording, statistical analysis, and distribution, among other digital activities, occur with near-zero latency. Furthermore, most human activities, including life and production, are related to energy; thus, energy monetization meets the requirements of transferability and universality.

3.3.7 Energy Monetization Stability Principle.

Energy monetization is based on physical laws and the constancy of time. The growth and reduction of "ETC" strictly follow physical and mathematical rules and operate under a decentralized control model, free from human intervention, thus possessing high stability.

3.3.8 Principle of Seeking Common Ground while Allowing Pricing Differences.

Energy monetization is based on physical laws and the constancy of time, utilizing blockchain technology to achieve data security, transparency, and immutability, ensuring authentic and effective value. The value-zeroing timeline for similar energy output products supports dynamic real-time measurement, allowing for the existence of value differences.

3.3.9 Issuance and Operation Principle.

With the survival and development of humanity as its purpose, adhering to the principle of decentralization, its issuance mechanism differs from traditional monetary systems.

By introducing the aforementioned principles of energy monetization, it is possible to construct a new financial system based on the full lifecycle from actual energy generation to zeroing, dynamically adapting to market demands, while ensuring system stability and economic sustainability.

4 Implementation Steps

To achieve the implementation and sustainable development of the energy monetization system, it is necessary to advance technological research and development, system construction, pilot verification, and application in a phased and step-by-step manner. The implementation steps for each phase are detailed below.

4.1 Technology Development Phase

4.1.1 Establish Energy Digital Infrastructure and Build an Anti-Leverage Technical System.

Digital Infrastructure: Includes platforms for energy data collection, transmission, storage, and processing, ensuring the digitization of the entire lifecycle from energy production to consumption.

Anti-Leverage Technical System: Develop a set of real-time monitoring and risk warning systems to limit excessive speculation and high-risk financial behaviors, ensuring that the total amount of energy currency matches actual output.

4.1.2 Develop Energy Harvesting and Metering Equipment.

Precise Measurement of Multiple Energy Forms: Research and develop equipment such as smart meters and thermal sensors to ensure accurate collection and measurement of various energy forms including electrical, thermal, solar, and wind energy.

Unified Measurement of Work Done and Real-time Data Transmission: Energy harvesting equipment transmits data in real-time to the blockchain network via IoT technology, ensuring data timeliness and integrity.

4.1.3 Convert Energy into Digital Units (e.g., "Energy-Time Coin").

Unified Digital Unit: Develop an energy currency issuance system to convert different forms of energy into a unified digital currency unit, "Energy-Time Coin (ETC)."

Dynamic Decay Model: Set decay values for "ETC" to ensure its value changes dynamically over time and with the product lifecycle.

4.2 Constructing the Blockchain Network

4.2.1 Design a Decentralized Distributed Ledger.

Transaction Recording: Utilize blockchain technology to achieve decentralized recording of each energy transaction, ensuring data security, transparency, and immutability.

Node Distribution: Establish a distributed node network among energy producers, consumers, and regulatory agencies to jointly maintain the ledger.

4.2.2 Develop Smart Contracts.

Automatic Settlement: Based on smart contract technology, achieve automatic settlement and value transfer for energy transactions.

- Rule Execution: Embed transaction rules (e.g., price, decay mechanism) within smart contracts to ensure an efficient and fair transaction process.

4.3 Pilot Operation Phase

4.3.1 Select Pilot Areas.

Pilot Areas: Select national-level new areas such as Xiong'an New Area as energy monetization pilots.

- Policy Support: Pilot areas possess policy advantages and infrastructure support conducive to the application and promotion of new technologies.

4.3.2 Pilot in Energy Production and Consumption Intensive Areas.

Renewable Energy Parks: Conduct pilots in renewable energy production parks such as photovoltaic and wind power plants to test the stability and efficiency of the energy trading system.

Industrial Clusters: Select industrial parks with high energy consumption concentration to facilitate energy coin transactions between enterprises.

4.3.3 Enterprises and Residents Conduct Energy Transactions Using Energy Coins.

Multi-scenario Applications: Residents can use energy coins to pay electricity bills, heating fees, etc.; enterprises can use them to purchase energy required for production.

User Feedback: Collect feedback on user experience from pilot participants to optimize transaction processes and user interfaces.

4.4 Data Monitoring and Optimization

4.4.1 Collect Real-time Data via IoT Devices.

Dynamic Monitoring: Real-time collection of energy production, storage, and consumption data through IoT devices.

Data Analysis: Utilize AI and big data analysis to monitor the dynamic balance of energy supply and demand.

4.4.2 Adjust System Algorithms.

Transaction Efficiency Optimization: Adjust energy coin transaction pricing and settlement algorithms based on market demand to improve transaction speed and user experience.

Energy Efficiency Improvement: Optimize energy usage efficiency through data analysis, reducing unnecessary energy consumption.

4.5 Promotion and Application Phase

4.5.1 Expand Scope of Use.

National Promotion: Gradually expand the energy monetization system nationwide to achieve cross-regional energy trading.

International Cooperation: Collaborate with other countries to promote cross-border energy currency trading and establish a global energy currency market.

4.5.2 Compatibility with Multiple Energy Forms.

Multi-Energy Support: Support various forms of energy such as electrical, thermal, solar, and hydrogen energy to enhance system applicability.

Global Unified Currency System: Gradually form a global unified energy currency system compatible with multiple energy forms, promoting the efficient development of international energy trade.

4.5.3 Energy Monetization Unit Definition and Conversion Formulas.

To achieve unified measurement and trading within the energy monetization system, this paper proposes a standard unit of energy, X, pegged to the "Energy-Time Coin (ETC)." X serves as the basic measurement unit for energy currency, convertible across energy forms (electrical, thermal, kinetic, etc.), and combined with product lifecycle coefficients to achieve dynamic pricing of energy currency.

4.5.3.1. Definition of Standard Unit Energy X.

Using electrical energy as a reference benchmark, assume 100 kWh = 1X. Other energy forms are converted according to unified measurement standards.

For example:

1 kilowatt-hour (kWh) = 3,600,000 joules (J)

1X = 100 kWh = 360,000,000 J

This conversion formula is applicable to all energy types and is defined and periodically calibrated by the International Bureau of Weights and Measures (BIPM) and national metrology institutes.

4.5.3.2 Energy-Time Coin Value Formula.

The value of an Energy-Time Coin is jointly determined by the standard energy baseline value embodied in the product, the energy conversion efficiency, and the warranty coefficient K reflecting its remaining useful life. The core calculation formula is:

$ETC = X \times \eta \times K$

Where:

X: The total standard energy consumed in manufacturing the product (unit: kWh or J). This is the energy baseline of its intrinsic value.

η: The average system energy conversion efficiency coefficient from primary energy to the completion of product manufacturing ($0 < \eta \leq 1$). It reflects losses during energy acquisition and conversion; a smaller η value indicates more primary energy is required to obtain a unit of useful product.

K: The warranty coefficient, a dynamic coefficient linearly decreasing from 1 to 0, used to quantify the remaining value of a product throughout its full lifecycle.

Precise Definition and Calculation of K Value:

The K value is not fixed at 1 but is directly linked to the product's official warranty period. It is defined as the ratio of the product's remaining warranty time to its total warranty time.

Starting Point (K=1): When the product leaves the factory, the remaining warranty time equals the total warranty time, K=1, representing complete lifecycle value.

Dynamic Attenuation ($1 \rightarrow K > 0$): During product use, the K value decreases linearly with the reduction in remaining warranty time. For example, a product with a 5-year warranty, after 2 years of use, has a remaining warranty time of 3 years, so K = 3 / 5 = 0.6.

Endpoint (K=0): When the product exceeds its warranty period, the remaining warranty time is 0, hence K=0. This signifies that its lifecycle value as a "commodity under warranty" has ended, and its embodied energy enters the recycling or disposal phase.

4.5.3.3 Specific Case.

Assumptions:

Total energy consumption X for manufacturing household appliance A = 200 kWh.

Average energy conversion efficiency η of the power grid and manufacturing system = 0.90.

Official total warranty period of the product = 5 years.

Scenario 1: Brand new product leaving factory

Remaining warranty time = 5 years, $K = 5 / 5 = 1.0$

Initial ETC value: ETC = 200 kWh × 0.90 × 1.0 = 180.0 (energy value units)

Scenario 2: Product after 2 years of use

Remaining warranty time = 3 years, $K = 3 / 5 = 0.6$

Current ETC value updated to: ETC = 200 kWh × 0.90 × 0.6 = 108.0 (energy value units)

This system can dynamically generate and update the ETC asset balances of companies or individuals, ensuring transparent and traceable value transactions based on energy consumption and product lifecycle.

4.5.3.4 Real-time Monitoring and Disclosure Mechanism.

The system records and publicizes the following via the blockchain network:

Proportion and quantity of state-owned ETC

Proportion and quantity of corporate-owned ETC

Proportion and quantity of individually-owned ETC

Proportion and quantity of other ETC

Real-time tracking of currency circulation via smart contracts, formulating reasonable quantities of energy products based on demand, preventing over-issuance and value fluctuations, ensuring system transparency and fairness, and guaranteeing its emergence as a new monetary system truly beneficial to humanity.

By defining the standard energy unit X and the corresponding energy conversion and pricing mechanisms, the energy monetization system can provide a unified standard for the measurement and trading of various energy types. This system can not only promote the deep integration of finance and energy but also construct a more transparent, efficient, and sustainable global financial framework.

4.6 Policy Support and Regulation

4.6.1 Collaborate with Governments to Formulate Relevant Laws and Regulations.

4.6.1.1 Legislative Support. Cooperate with governments and legislative bodies to establish a legal framework for energy currency, ensuring its legality and security.

4.6.1.2 Policy Guidance. Encourage enterprises and individuals to use energy currency through policy support and tax incentives.

4.6.2 Introduce Financial Regulatory Mechanisms.

4.6.2.1 Risk Prevention and Control. Establish a financial regulatory system for energy currency trading to prevent systemic financial risks.

4.6.2.2 Transparent Regulation. Introduce third-party regulatory mechanisms to ensure fairness and transparency in energy trading and currency issuance.

4.6.3 Establish an Anti-Leverage System.

4.6.3.1 Total Supply Control. Strictly control the total issuance of energy currency to prevent risks similar to traditional financial leverage.

4.6.3.2 Dynamic Monitoring. Real-time monitoring of the market circulation of energy currency to ensure it matches actual energy output.

By implementing the above steps in phases, the implementation and promotion of energy monetization can be progressively achieved, constructing an efficient, sustainable, and globalized new financial system.

5 System Advantage Analysis

The energy monetization system proposed in this paper not only addresses the issues of traditional currencies and existing digital currencies but also offers multiple advantages, including promoting efficient energy utilization and enhancing financial system resilience. The following analyzes its advantages from different dimensions.

5.1 Solving Traditional Currency Problems

5.1.1 Physical World Constraints Prevent Over-issuance.

Traditional currencies, especially fiat currencies, often face the risk of over-issuance, leading to currency devaluation and inflation. In contrast, energy currency is based on the actual output of physical energy.

5.1.1.1 Strict Total Supply Control. The total issuance of energy currency is constrained by energy production capacity and cannot exceed actual energy supply.

5.1.1.2 Intrinsic Value Backing. Each unit of energy currency is backed by actual physical energy, ensuring the stability and credibility of the monetary system.

5.1.2 Intrinsic Value Prevents Inflation.
Energy itself is a fundamental resource for human survival and development, possessing unique intrinsic value.

5.1.2.1 Stable Store of Value. As a form of "hard asset," energy currency avoids devaluation issues faced by traditional currencies due to policy changes or economic fluctuations.

5.1.2.2 Inflation Hedge. The supply-demand relationship for energy currency is relatively stable, helping to maintain market price balance during economic volatility and reducing inflation risk.

5.2 Improving Energy Utilization Efficiency

5.2.1 Energy Monetization Promotes Optimized Energy Use.
Energy monetization closely links energy usage with economic value, incentivizing individuals and enterprises to optimize energy use.

5.2.1.1 Energy Saving Incentive Mechanism. High energy consumption behaviors are directly reflected as higher currency costs, encouraging users to adopt more efficient equipment and processes, reducing energy waste.

5.2.1.2 Market-Driven Optimization. The transparent pricing mechanism of the energy market encourages consumers to choose cheaper and more efficient energy sources.

5.2.2 Promoting Green and Sustainable Development.
In the context of global climate change, energy monetization contributes to achieving sustainable development goals.

5.2.2.1 Prioritization of Renewable Energy. By setting higher currency values for green energy (e.g., wind, solar), enterprises and consumers are encouraged to prioritize renewable energy sources.

5.2.2.2 Carbon Emission Control. The energy currency system can be linked with carbon emission management systems, imposing higher costs on high-carbon energy sources to promote low-carbon transition.

5.3 Decentralization and Security

5.3.1 Blockchain Technology Ensures Transaction Security.
Security threats faced by traditional financial systems (such as data breaches, financial fraud) are effectively mitigated in the energy monetization system.

5.3.1.1 Data Encryption and Consensus Mechanisms. Based on blockchain encryption algorithms and consensus mechanisms, the security and immutability of transaction data are ensured.

5.3.1.2 Reduced Fraud Risk. All transactions are recorded in a distributed ledger, open and transparent, making financial fraud through data tampering or transaction forgery difficult.

5.3.2 Decentralized System Enhances Financial System Resilience.
The traditional financial system relies heavily on a few central institutions; systemic risks (such as bank runs, institutional failures) can lead to severe consequences. The decentralized nature of the energy currency system significantly improves system resilience.

5.3.2.1 Distributed Node Operation. The system is jointly maintained by multiple nodes; failure of any single node does not affect overall operation.

5.3.2.2 Reduced Single Point of Risk. No reliance on central banks or financial institutions reduces risks arising from institutional errors or policy changes.

The analysis of the above advantages demonstrates that the energy monetization system not only brings stability and security to financial markets but also effectively promotes efficient energy utilization and contributes to the global green economy. This system is expected to become an important direction for the future integration of finance and energy, promoting the coordinated development of the economy and ecosystem.

6 Challenges and Countermeasures

Although the energy monetization system possesses numerous advantages, it inevitably faces technical, policy, and social challenges during implementation. This paper discusses these challenges and corresponding countermeasures from the following aspects.

6.1 Technical Bottlenecks

6.1.1 Precision Issues in Energy Collection, Measurement, and Digitization.
In the energy monetization system, the accurate collection and measurement of energy data are fundamental to the stable operation of the system.

1) Difficulty in Collecting Multiple Energy Forms: Different forms of energy (e.g., electrical, thermal, solar) have distinct physical characteristics; the accuracy of collection and measurement equipment directly impacts the fairness and reliability of the currency.

2) Data Transmission and Recording Errors: Potential data loss or latency during real-time transmission and recording can affect the timeliness and accuracy of the system.

6.1.2 Blockchain Energy Consumption and Transaction Speed Bottlenecks.

As a core technology of the energy monetization system, blockchain itself faces performance and efficiency challenges.

High Energy Consumption: Traditional blockchain technologies (such as PoW consensus mechanisms) consume vast amounts of energy, conflicting with the energy-saving philosophy advocated by the system.

Transaction Speed Limitations: The transaction confirmation speed of blockchain is relatively slow and may not meet the real-time requirements of high-frequency energy trading.

6.1.3 Countermeasures.

Technological Innovation and Optimization:

1) High-Precision Measurement Equipment: Introduce new sensor technologies to improve the accuracy of energy collection and measurement.

2) Improved Blockchain Consensus Mechanisms: Adopt more energy-efficient consensus algorithms (such as PoS, PoA, or hybrid consensus) to reduce energy consumption while increasing transaction speed.

3) Edge Computing and Data Compression: Introduce edge computing technology in IoT devices for data preprocessing and compression to reduce transmission and storage costs.

6.2 Policy and Legal Obstacles

6.2.1 Varying Levels of Acceptance for New Currencies.

As a new type of financial instrument, the legality and regulation of energy currency urgently need to be addressed.

Lack of a Unified Legal Framework: Different countries and regions have vastly different attitudes and policies towards digital currencies, potentially affecting the cross-border trading and promotion of energy currency.

Financial Stability Concerns: Some governments may worry about the impact of a new currency system on the existing financial system.

6.2.2 Countermeasures.

Cooperation with Governments and International Organizations:

1) Establish a Unified Regulatory Framework: Promote cooperation among governments and international organizations to formulate relevant laws and regulations for energy currency, ensuring its legality and security[10].

2) Policy Pilots: Accumulate experience for the full-scale promotion of the new currency system through policy innovations implemented in pilot areas.

3) Ensure Financial Stability: During the initial introduction of energy currency, operate it in parallel with the traditional currency system, transitioning gradually to reduce risks.

6.3 Social Acceptance

6.3.1 User Trust and Adaptation Require Time.

As a completely new financial model, user acceptance and adaptation to the energy currency system face certain difficulties:

Lack of Awareness: Public understanding of energy currency and its operational principles is low, potentially leading to doubts about its safety and reliability.

Change in Usage Habits: Transitioning from traditional currency to energy currency requires users to change their existing habits of payment, saving, and investment.

6.3.2 Countermeasures.

6.3.2.1 Strengthen Publicity and Education.

1) Increase Public Awareness: Promote the concept and advantages of energy currency to the public through various channels such as media campaigns, popular science activities, and professional forums.

2) User Training and Support: Provide detailed usage guides and technical support for enterprise and individual users to lower the barrier to entry.

6.3.2.2 Pilot Area Demonstration.

Enhance public trust in the new currency system through successful case studies from pilot areas.

By implementing countermeasures against the aforementioned challenges, resistance at the technical, policy, and social levels can be effectively reduced, paving the way for the smooth implementation and promotion of the energy monetization system. This will not only facilitate financial innovation but also provide crucial support for global energy efficiency and sustainable development.

7 Emergency Measures for Large-Scale War

Wartime brings immense shocks to the economy, energy, and financial systems, easily paralyzing traditional currency and energy supply systems. Therefore, the energy monetization system needs to establish an emergency mechanism for extraordinary times to ensure the stability of basic financial functions and energy supply, and to support post-war recovery. The following are specific preventive measures and transformation plans.

7.1 Core System Prevention Mechanisms

7.1.1 Distributed Ledger and Data Redundancy Storage.

7.1.1.1 Most Direct Impact. War may lead to the destruction of infrastructure (e.g., data centers, power grids), causing data loss or inaccessibility.

7.1.1.2 Countermeasures. Establish a global distributed node network to ensure ledger data and energy transaction records are backed up in multiple countries. Utilize satellite internet technology and quantum communication technology to ensure the system maintains communication and transaction capabilities even if key regional networks are disrupted.

7.1.2 Emergency Allocation and Dynamic Regulation of Energy Currency.

7.1.2.1 Most Direct Impact. During wartime, energy resources become scarce, markets fluctuate violently, and currency value may become imbalanced.

7.1.2.2 Countermeasures. Establish an Energy Currency War Reserve Mechanism, reserving a portion of energy currency in peacetime for emergency distribution during war. Introduce a dynamic regulation model to adjust the value coefficient of ETC in real-time based on the progress of the war and energy supply conditions, prioritizing basic energy and livelihood needs.

7.2 System Transformation Strategies during Wartime

7.2.1 Prioritize Basic Livelihood and Military Needs.

7.2.1.1 Lock the flow of energy currency via smart contracts, prioritizing its use for military defense, medical care, food and water production and supply.

7.2.1.2 Impose energy transaction restrictions on non-essential consumption (e.g., luxury goods, entertainment industry) to ensure rationality in energy supply and currency use.

7.2.2 Tiered Trading Mode.

7.2.2.1 Most Direct Impact. War may cause imbalances in economic and energy supply across different regions.

7.2.2.2 Countermeasure. Implement a tiered trading mode. Classify regions into emergency zones, stable zones, and recovery zones based on security and supply conditions, applying different energy currency usage policies. In emergency zones, energy currency is used directly to sustain basic survival and combat needs; in stable zones, the system maintains limited trading functions; in recovery zones, normal trading is gradually restored.

7.2.3 Dual Currency System: ETC and Emergency Token.

7.2.3.1 Most Direct Impact. War may cause imbalances in economy and energy supply across different regions.

7.2.3.2 Countermeasure. Introduce a temporary emergency token (e.g., a "War-Time Coin" issued corresponding to rare metals like gold) pegged to ETC for transactions and energy allocation during special periods.

7.2.3.3 After the war ends, gradually convert War-Time Coins into ETC or cancel them based on circulation and remaining energy reserves, restoring normal system operation.

7.3 Post-War Recovery Mechanism

7.3.1 Rapid Reconstruction of Energy and Financial Infrastructure.

Prioritize the reconstruction of energy production and energy monetization infrastructure (such as power grids, energy harvesting equipment, data centers) after the war. Activate data backups in the distributed ledger to quickly restore the system's ledger records and ETC circulation.

7.3.2 Dynamic Restoration of Energy Currency Value.

Re-establish the initial value and decay coefficients of ETC by analyzing energy consumption and economic losses during the war. Gradually restore the normal energy currency trading system through international coordination, rebuilding economic trust and market vitality.

7.3.3 International Cooperation and Assistance.

Collaborate with international organizations and neighboring countries to coordinate post-war reconstruction efforts through the cross-border energy currency system. Promote the international circulation of post-war energy currency, providing financial support for economic recovery.

The energy monetization system faces significant challenges during wartime, but its decentralization, transparency, and intrinsic value based on physical energy endow it with considerable resilience even in extreme environments. Through multi-layered preventive measures, including distributed storage, dynamic regulation, and an emergency token system, this system can not only maintain basic financial and energy functions during war but also provide strong support for rapid post-war recovery and global economic reconstruction.

8 Conclusion and Future Prospects

8.1 Summary

8.1.1 Energy Monetization is an Innovative Solution to Problems in the Traditional Financial System.

Based on the constant principle of energy work, this paper proposes a new financial system based on energy monetization. Compared to the traditional financial system, this system can effectively avoid problems such as excessive currency issuance and inflation, while providing a novel solution for global energy trading and management. Energy monetization, by digitizing physical-world energy and combining it with technologies like blockchain and IoT, infuses the monetary system with intrinsic value and transparency. This solution not only overcomes the limitations of existing digital currencies but also provides a more robust foundation for the future financial system.

8.1.2 It Will Drive the Transformation of the Global Financial System and Contribute to Sustainable Development.

Energy monetization is not only an innovation in the financial system but also has profound impacts on energy management and usage patterns. By optimizing energy utilization efficiency and promoting the development of green energy, this system contributes to achieving global sustainable development goals. Simultaneously, the decentralized and transparent transaction model will enhance the security and fairness of the financial system, providing crucial support for the long-term development of the global economy[9].

8.2 Future Research Directions

8.2.1 Exploring More Efficient and Environmentally Friendly Blockchain Technologies.

Current blockchain technology plays a core role in the energy monetization system, but its high energy consumption and transaction speed limitations remain significant bottlenecks. Future research can focus on the following directions:

8.2.1.1 More Environmentally Friendly Consensus Mechanisms. Explore more energy-efficient consensus algorithms such as Proof of Stake (PoS), Delegated Proof of Stake (DPoS), etc., to reduce system energy consumption[3].

8.2.1.2 Improving Scalability and Transaction Efficiency. Research sharding technology, Layer 2 solutions (such as Lightning Network), etc., to support large-scale, high-frequency energy transactions.

8.2.1.3 Energy and Data Fusion Chain. Develop multi-dimensional blockchain applications integrating energy trading with other economic activities (such as carbon trading), enabling cross-domain data sharing and collaboration.

8.2.2 Researching Application Scenarios of Energy Currency in Different Industries.

8.2.2.1 The potential application scenarios for energy currency are extensive; different industries can customize suitable trading and management models based on their specific characteristics.

8.2.2.2 Manufacturing. Track energy consumption during the production process via energy currency, optimize production efficiency, and simultaneously attach energy consumption labels to products to enhance green competitiveness.

8.2.2.3 Agriculture. In smart agriculture, use energy currency to measure energy consumption in machinery, irrigation, etc., enabling refined energy management and green production.

8.2.2.4 Service Industry. In sectors like logistics and retail, use energy currency to price the energy consumption of transportation and storage, promoting energy conservation and emission reduction across the entire industrial chain.

8.2.2.5 International Trade. Study the application of energy currency in cross-border transactions to reduce foreign exchange fluctuation risks and promote fair exchange of international energy and commodities.

9 Concluding Remarks

The fundamental reason developing countries find it difficult to escape the rules set by developed nations is that we have long relied on the tools and logic invented by established capitalist countries to manage our own economic and social systems. This has kept us perpetually constrained by the rules of the game of traditional capital, reducing us to pawns or even discarded pieces in capital operations. However, energy, as the foundation for creating most material substances in the world (excluding the spiritual realm), offers a completely new perspective. By seizing the core characteristic of energy and constructing a deleveraged energy interaction system, we can not only serve national development but also effectively break free from the constraints of the traditional capital system. This will provide developing countries with an independent, fair, and efficient new type of transaction cycle, helping them achieve genuine equality and sustainable development within the global economic system.

The proposal of the energy monetization system opens new possibilities for the deep integration of finance and energy. Although numerous challenges remain in terms of technology, policy, and social acceptance, its potential advantages and immense influence cannot be ignored. In the future, through continuous technological research and development, policy innovation, and social promotion, energy currency is expected to become a crucial pillar supporting the coordinated development of the global economy and ecosystem[7].

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