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Application of Blockchain Technology as a Crowdfunding Tool for Solar Renewable Energy Development: Introducing the Solarenergycoin Cryptocurrency

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Abstract

The energy industry is a cornerstone of economic development, characterized by high market penetration, substantial capital requirements, and attractive returns on investment. Over 30% of the final price of manufactured goods is directly linked to energy consumption during production. In Iran, where energy security is paramount, financing large-scale energy projects remains a critical challenge. Traditional financing mechanisms, such as bank loans, struggle with liquidity constraints, inflationary pressures, and bureaucratic inefficiencies. Crowdfunding models—particularly those leveraging blockchain technology—offer a decentralized alternative to mobilize .domestic and international micro-investments

This study proposes **Solarenergycoin**, a blockchain-based cryptocurrency designed to crowdfund $90 million for constructing 180 MW of solar power plants. By utilizing distributed ledger technology (DLT), smart contracts, and tokenized assets, the model reduces investment risks, ensures transparency, and bypasses sanctions-related financial barriers. Economic simulations

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indicate a 22% internal rate of return (IRR) over an 8-year period, with token value appreciation mechanisms to stabilize market volatility.

Keywords: Blockchain, Solar Energy, Tokenization, Cryptocurrency, Binance Smart Chain, Crowdfunding

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1. Introduction

In the past decade, domestic barriers and international restrictions have posed significant challenges to Iran's energy sector, particularly in financing oil, gas, and power plant projects. Unprecedented sanctions and the absence of accessible financial resources are the primary obstacles to developing these fields. While Iran faces no critical shortages in human resources, equipment, or national grid infrastructure, securing adequate financing to operationalize this economic sector remains a fundamental challenge.

Although the development of investments in Iran's energy sector has been emphasized in the 5th and 6th National Development Plans with estimates of 120–150 billion required for oil and gas projects and 30–50 billion for electricity foreign direct investment (FDI), inflows have remained unsatisfactory over the past decade. Data from the United Nations Conference on Trade and Development (UNCTAD) on FDI indicates that Iran has not attracted more than $5 billion annually in foreign investment across all sectors (UNCTAD, 2023).

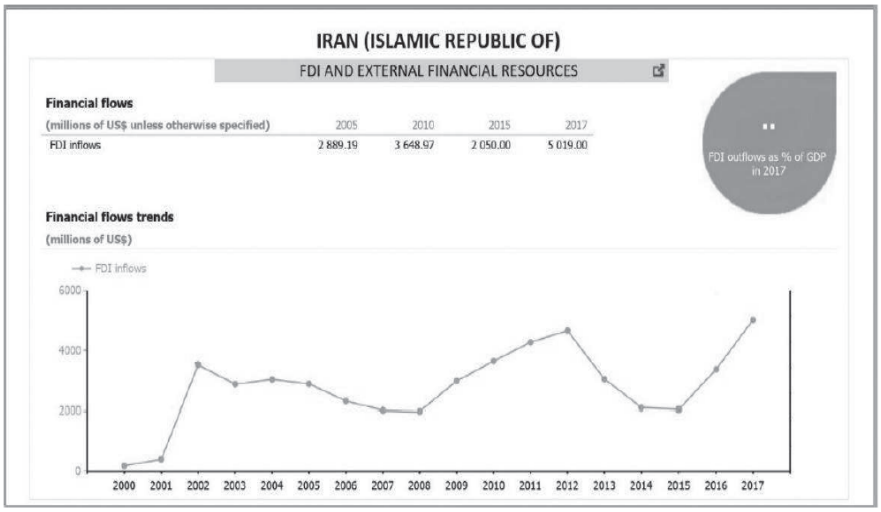

Figure 1- **Statistics on Iran's foreign investment since 2000**

As illustrated in Figure 1, Iran's total FDI inflows across all sectors from 2000 onward have been modest. This suggests that conventional foreign investment pathways cannot meet the energy sector's substantial capital needs, particularly under new sanctions, which have rendered even these limited inflows unattainable.

Currently, Iran's electricity sector faces a 20% deficit (equivalent to 17 GW), which cannot be cost-effectively addressed through fossil fuel power plants due to high costs, long timelines, and environmental concerns. Meanwhile, renewable energy markets have experienced over 20% annual growth in recent years, positioning them as high-growth sectors (*International Renewable Energy Agency [IRENA], 2023*).

Concurrently, the cryptocurrency market has expanded significantly, reaching a capitalization of over 3.5 trillion by early 2025. Iran now hosts millions of active crypto users, with daily transactions exceeding 100 million across more than 50 domestic exchanges. Over 2.5 million crypto trading accounts were registered on Iranian platforms by March 2021, reflecting the population's growing engagement with digital assets (*Tehran Chamber of Commerce, 2023*).]

Given public interest in cryptocurrencies and blockchain's inherent features—such as smart contracts, borderless transactions, 24/7 trading, and sanction resistance—this technology could serve as a third financing tool alongside traditional banking and capital markets, particularly for renewable energy projects. This study examines the legal, contractual, economic, and business model aspects of **Solarenergycoin**, a new cryptocurrency designed to fund the construction of solar power plants with a cumulative capacity of 180 MW, requiring approximately $90 million in capital. Investment returns will be generated from electricity sales over the plants' minimum 20-year lifespan, ensuring stable cash flow to mitigate crypto market volatility.

2. Technology Background

New businesses require financial resources to succeed, and they have multiple methods at their disposal, such as using personal capital, seeking venture capital, obtaining bank loans, or utilizing crowdfunding. Crowdfunding is a method that allows business owners to raise capital through small or large contributions from a crowd of investors. However, a significant limitation of this method is the lack of liquidity for shares purchased through crowdfunding platforms.

In 2013, a novel and efficient method for financing startups emerged: Initial Coin Offerings (ICOs). This method involves issuing blockchain-based tokens that are tradable, similar to crowdfunding but with enhanced liquidity. By June 2017, ICOs had raised 550 million, surpassing traditional methods like venture capital and angel investments. By the end of 2017, this figure 2.5 billion.

Despite being a nascent concept, ICOs demonstrated significant growth potential. In 2017, 366 ICOs raised 6.2 billion, and by the first quarter of 2018, 254 ICO shad raised 7.8 billion. In contrast, Kickstarter—the most successful traditional crowdfunding platform—raised only $4.1 billion from its inception in 2009 to 2019. This underscores ICOs as a competitive alternative in crowdfunding, warranting further research into the factors driving their success.

Today, blockchain networks such as Ethereum, Bitcoin, Binance, and Solana support the creation of smart contracts and the tokenization of physical assets. Solarenergycoin leverages these technologies, adhering to legal and economic standards for asset-backed tokens. The development of such tokens requires a precise understanding of a project’s economic fundamentals and legal requirements, including permits, token issuance, and code development..

3. Results and Discussion

3.1 Economic Evaluation of Solarenergycoin

A solar power plant consists of several simple components that, when properly engineered, convert sunlight into electricity. The most critical components include:

1. **Solar Panels**: Convert sunlight into direct current (DC) electricity.
2. **Inverters**: Convert DC electricity into alternating current (AC) compatible with the national grid.
3. **Meters**: Precisely measure real-time electricity production.
4. **Mounting Structures**: Designed to withstand corrosion and high wind speeds.
5. **Grid Connection**: Utilizes Iran's nationwide electricity grid.

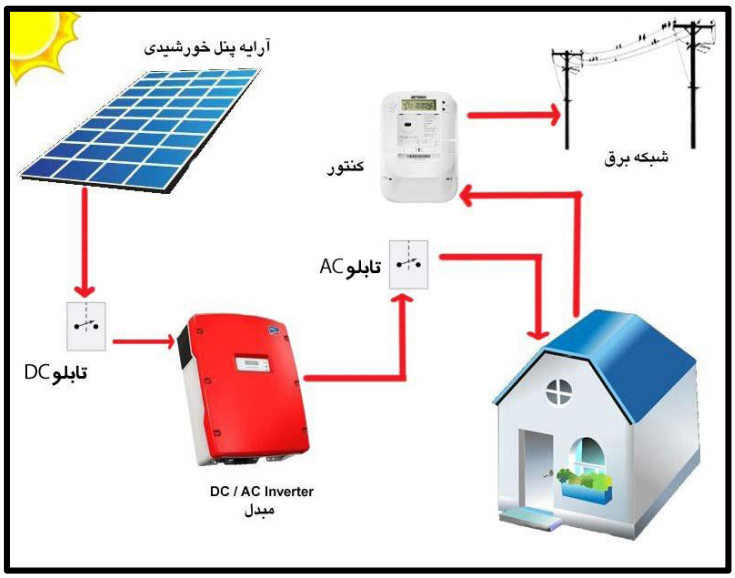

Figure 2. Layout of Equipment Required for a Residential Solar Power Plant

Economic studies indicate that for every 100 units of capital expenditure in a solar power plant:

- 60 units cover equipment costs.
- 20 units cover installation.
- 17 units cover land acquisition.
- 3 units cover permits and design.

Operational costs amount to approximately 1% of the initial investment. Solar energy production depends on factors such as geographic location, solar irradiation levels, number of sunny days, temperature, and air pollution. Scientific assessments confirm that Iran ranks among the world's most solar-rich regions, with potential annual production exceeding 2,000 kilowatt-hours (kWh) per square meter.

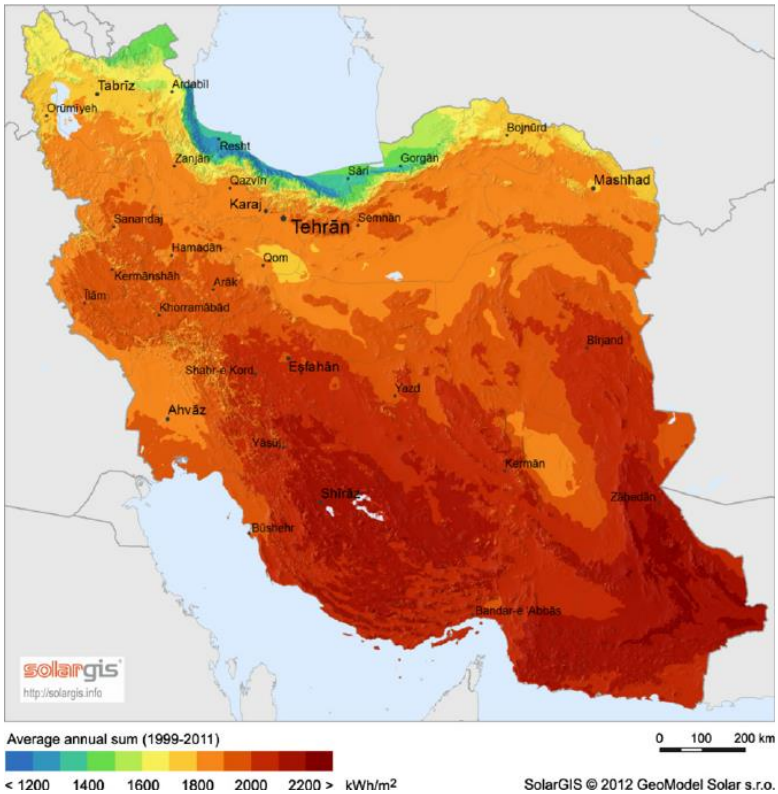

Figure 3**: Status of solar energy radiation in the geography of Iran (taken from the solargis website)**

Software simulations show that in most parts of the south and southeast of the country, there is a possibility of developing a one-megawatt power plant with a capacity to produce 1750 megawatt-hours of solar electricity. Technical and economic information related to the development of a one-megawatt solar power plant is presented in Table 1.

Table 1. Investment and Operational Costs for a 1 MW Solar Power Plant

Parameter	Value
Capital Investment	$420,000
Annual Electricity Output	1,750 MWh
Electricity Price	$0.05/kWh
Annual Operational Costs	$16,000
Internal Rate of Return (IRR)	22% (over 8 years)
Construction Period	3 months

As evidenced by the economic evaluation of a solar power plant, the return on investment (ROI) for this technology is highly attractive. Given the increasing energy demands of the country and environmental imperatives, the growth rate of the solar renewable energy market has been reported at 17% to 23% annually in recent years, signifying robust industrial expansion.

Aligned with this approach, financing renewable energy projects has been structured through an intermediary entity or financial brokerage responsible for token creation, project promotion, and marketing. In the token architecture of Solarenergycoin, for every cent raised through the initial token offering (ITO), 3% is allocated to fees, 7% to a decentralized liquidity pool, and 90% to solar power plant construction. This allocation aligns with the European Union’s regulatory standards for crypto asset markets. Under these assumptions, 9 billion tokens have been minted on the Binance network, with each token’s initial value set at one cent. Annually, 13% of the capital raised in the preceding year is distributed to investors through token buybacks and burning, funded by proceeds from

plant construction, electricity sales, and market repurchases. The blockchain employs a Proof-of-Stake (PoS) consensus mechanism, with a phased capital-raising process spanning 10 years. Table 2 outlines the stages of token issuance, capital acquisition, buybacks, and net asset appreciation over time.

Table 2: Stages of Solarenergycoin Cryptocurrency Issuance, Token Burning Process, and Value Appreciation Over 20 Years

Token Value Compared to ICO	Number of Equivalent Tokens in the Market	Net Token Issuance in the Market	Number of Equivalent Tokens Burned	Number of Tokens Issued	Total Physical Power Plants (MW)	Power Plant Capacity (MW)	Year
1/00	233,000,000	233,000,000	0	233,000,000	5	5	1
1/05	668,710,000	435,710,000	(30,290,000)	466,000,000	15	10	2
1/12	1,250,487,700	581,777,700	(86,932,300)	668,710,000	30	15	3
1/21	1,921,582,766	671,095,066	(162,563,401)	833,658,467	50	20	4
1/34	2,440,410,112	518,827,347	(249,805,760)	768,633,106	70	20	5
1/49	2,820,416,830	380,006,718	(317,253,315)	697,260,032	90	20	6
1/66	3,080,521,938	260,105,108	(366,654,188)	626,759,296	110	20	7
1/87	3,240,148,983	159,627,045	(400,467,852)	560,094,898	130	20	8
2/11	3,317,414,075	77,265,091	(421,219,368)	498,484,459	150	20	9
2/38	3,328,472,121	11,058,047	(431,263,830)	442,321,877	170	20	10
2/71	3,091,563,223	(236,908,898)	(432,701,376)	195,792,478	180	10	11
3/12	2,689,660,004	(401,903,219)	(401,903,219)	-	180	0	12
3/58	2,340,004,204	(349,655,801)	(349,655,801)	-	180	0	13
4/12	2,035,803,657	(304,200,546)	(304,200,546)	-	180	0	14
4/74	1,771,149,182	(264,654,475)	(264,654,475)	-	180	0	15
5/44	1,540,899,788	(230,249,394)	(230,249,394)	-	180	0	16
6/26	1,340,582,816	(200,316,972)	(200,316,972)	-	180	0	17
7/19	1,166,307,050	(174,275,766)	(174,275,766)	-	180	0	18
8/27	1,014,687,133	(151,619,916)	(151,619,916)	-	180	0	19
9/50	882,777,806	(131,909,327)	(131,909,327)	-	180	0	20

Based on this framework, capital raised over 10 years will fund the construction of 20 MW of renewable energy capacity annually ($8.4 million per year), with plant development halting after the tenth year. Due to returns from electricity generation and token buybacks, the token's base value increases by at least 5% annually, compounded over time, reaching 950% of its initial value by year 20. It is important to note that these calculations assume real prices, while price discovery for this cryptocurrency is decentralized and based on the exchange rate between Tether (USDT) and Solarenergycoin in the liquidity pool (equivalent to 7% of the total raised capital).

Consequently, investors and token purchasers will benefit both from profits generated by renewable energy production and gains derived from transactions in this cryptocurrency's market.

3.2 Legal Framework

In Iran’s domestic market, cryptocurrency transactions have grown exponentially in recent years. Research by the Tehran Chamber of Commerce’s "Money and Capital Market" and "Digital Innovation and Transformation Economy" commissions reveals that in March 2021, daily cryptocurrency trading volumes in Iran ranged between 50 to 100 billion tomans (approximately 1.2–1.2–2.4 million). During this period, global cryptocurrency trading volumes reached $2.4 trillion. Notably, 77% of Iranian crypto participants cited "preserving wealth" and "investment" as their primary motivations, while 15% identified crypto trading as their profession. By April 2021, Iranian exchanges reported 2.5 million registered crypto accounts, reflecting engagement by 10 to 12.5 million Iranians. Key concerns among market participants include regulatory ambiguity, extreme price volatility, security risks, fraud, lack of transparent asset backing, and Sharia compliance.

To address the legal dimensions of Solarenergycoin, domestic and international regulations governing asset-backed cryptocurrencies were analyzed. The Central Bank of Iran (CBI), in line with its monetary policy mandates, has established guidelines for crypto activities impacting fiscal and monetary stability, including but not limited to:

A. Initial Coin Offerings (ICOs): ICOs refer to the issuance of new digital tokens by individuals or entities within Iran to raise capital. Tokens may be asset-backed or unbacked.
B. Crypto Exchanges and Related Entities: Exchanges must operate under the oversight of the Securities and Exchange Organization (SEO).
C. Crypto Wallets: Mandatory security standards for digital asset storage and transfers.
D. Cryptocurrency Mining: Prohibited due to excessive energy consumption.

These regulations have been formulated in accordance with Iran’s current monetary and banking conditions. The activities conducted in this study

fall under the domain of Initial Coin Offerings (ICOs). According to the Central Bank's directive, "an ICO (Initial Coin Offering) refers to a process in which a natural or legal person within the country issues a new cryptocurrency or digital token and offers multiple units of it to investors for purposes such as raising capital. Such cryptocurrencies may be issued either as asset-backed or unbacked tokens." For asset-backed tokens, the following requirements apply:

- **Asset-Backed Token Issuance:** The issuance of tokens backed by tangible or intangible assets falls outside the Central Bank's supervisory scope and is governed by the Securities and Exchange Organization of Iran.
- **Regulatory Framework:** Regulations in this domain will be drafted and enforced by the Securities and Exchange Organization in collaboration with the Central Bank.
- **Trading Eligibility:** Asset-backed tokens are tradable on commodity and securities exchanges.
- **Payment Prohibition:** Asset-backed tokens may not be used as payment instruments in the country.
- **Mining Ban:** Asset-backed tokens cannot be mined.

In developing Solarenergycoin and its whitepaper, all these requirements have been adhered to. The token is built on the Binance blockchain under the BEP20 standard, with a consensus mechanism based on Proof-of-Stake (PoS) rather than cryptocurrency mining.

The second regulatory framework guiding the whitepaper and token design is the European Union's Markets in Crypto-Assets Regulation (MiCA), which for the first time comprehensively regulates all crypto assets and related services across the EU. MiCA aims to harmonize EU regulations with recommendations from the Financial Action Task Force (FATF). This regulation applies directly across the European Economic Area (EEA) without requiring national ratification, establishing a unified legal framework to prevent inconsistencies arising from divergent national interpretations. MiCA prioritizes consumer and investor protection,

emphasizing transparency, legal oversight, and the alignment of traditional financial industries with crypto assets. Key mandates include:

- Operating as a registered legal entity.
- Committing to refund crowdfunded amounts if the ICO fails.
- Conducting annual independent audits of crypto projects.
- Establishing liquidity pools to prevent money laundering, safeguard public assets, and ensure market integrity.

To comply with MiCA, the following measures have been implemented for Solarenergycoin:

- Registration of a private joint-stock company, *Dāyān Blockchain*, to centralize investment activities.
- Mandatory annual independent audits of the token issuer's financial performance, as stipulated in the whitepaper.
- Allocation of 7% of crowdfunded capital to a decentralized liquidity pool, enabling investors to trade tokens without corporate price manipulation.

A binding commitment to refund all crowdfunded capital within a limited timeframe if the ICO fails.

3.3 Business Model

The Solar Energy Coin cryptocurrency was developed with the idea of financing the construction of solar power plants from the crypto market and directing the volatile liquidity of cryptocurrencies into the production cycle. In this business, first, solar power plants with a construction permit and guaranteed purchase by the employer or contractor of these power plants are introduced to the project financing company. After the technical, economic and legal evaluations of the parties' agreement for financial participation and the rate of return on investment, the cryptocurrency is released in proportion to the dimensions of the project for crowdfunding and attracting capital on the project's dedicated platform. After going

through the process of advertising, token sales and capital attraction, the financial resources obtained are injected into the power plant construction project based on the contract, and the investment company, on behalf of investors and buyers, monitors the proper implementation of the project, the production and sale of renewable electricity, and the return of profits from the investment funds. This process is shown in the figure below.

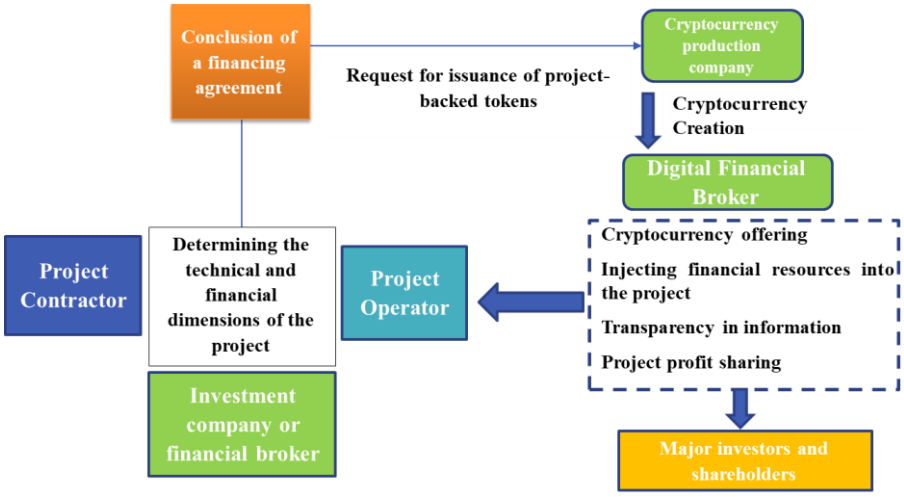

Figure 4: **Proposed financing model for a solar power plant project using the issuance of the solarenergycoin cryptocurrency**.

In order to understand the business model of this cryptocurrency, the Strawwalder business canvas has been used. In this model, the main customers of this product are cryptocurrency market activists who are familiar with the nature of the crypto market. Also, the main platform for communicating with customers is based on the project website at www.solarenergycoin.com and the company page on Telegram, LinkedIn, and Facebook. The most important value proposition in this project is simultaneous participation in the production of renewable solar electricity and participation in the life cycle of a cryptocurrency with physical backing. The company's revenue stream in the first year, based on various advertising scenarios, is estimated to be between 2 and 3 billion Tomans, and the company's costs are estimated at about 2 billion Tomans.

Table 3- Osterwalder Business Framework for SolarEnergyCoin Development.

<table>
<tr>
<td rowspan="2">Key Partners
Ministry of Energy and Subsidiaries
Renewable Energy Contractors or Investable Companies
Cryptocurrency Buyers
Cryptocurrency Exchanges
Advertising and Marketing Company</td>
<td>Key Activities
Explanation and introduction of blockchain technology in the Ministry of Energy and its subsidiaries
Contracting with a cryptocurrency development and issuance company
Advertising and marketing to attract capital from cryptocurrency market players
Holding coordination meetings to exchange information on cryptocurrency development and issuance
Providing progress reports and receiving the desired audit and financial management output within specific time frames
Holding legal consultation meetings according to a specific schedule</td>
<td rowspan="2">Proposed values
Fixed interest on the redemption of the dowry at the end of the project with daily payment
Possibility of exchanging the dowry price 24/7
Transparent, flexible contract and guarantee with the physical asset of the project
Low price volatility
Conversion of an inflationary rial into a highly reliable capital goods
Possibility of investment by any individual with any amount of capital
Investment without intermediaries with low cost and high security and confidentiality
Possibility of investment from abroad for available financial resources without the impact of sanctions</td>
<td rowspan="2">Customer relationship
Standard and SEO-oriented web service
Online communication and support for customer segments
Activists of the digital currency market
Overseas investors
Individuals interested in investing in the digital capital market
Companies and startups

Distribution channels
Nobitex and Valex exchanges
LinkedIn, Telegram, Yes Website</td>
<td rowspan="2">Customer relations
Standard and SEO-oriented web service
Online communication and support for customer departments
Activists Digital currency market
Offshore investors
Individuals interested in investing in the digital capital market
Companies and startups</td>
</tr>
<tr>
<td>Key resources
Company brand
Human resources of the executive director and legal experts, financial plan evaluation and software term
Support for physical assets of the project, project site, equipment, etc.
Electronic contract
Legal and scientific documents in Bahamehr
Existing laws and legal documents in the field of cryptocurrency and the blockchain industry</td>
</tr>
<tr>
<td colspan="2">Cost structure
Human resource costs: 1,400 million Tomans
Cost of registering and issuing a cryptocurrency: 400 million Tomans
Marketing costs and marketing costs: 60 million Tomans</td>
<td colspan="3">Revenue streams
Based on the second scenario: 2 billion and 775 million Tomans</td>
</tr>
</table>

4. Conclusion

The presented materials reflect part of the efforts made by researchers over the past two years to leverage blockchain technology for financing energy industry projects. Currently, Iran's economy faces two critical challenges: securing capital for production and addressing the imbalance between energy supply and demand. Over the last five years, both renewable energy technologies and blockchain have emerged as high-growth sectors with

significant market potential. Thus, the integration of these two technologies could resolve some of the country's challenges in energy investment and production. This study aimed to establish a precise economic definition of the problem and utilize blockchain's capabilities to propose an innovative financing method.
As an economy analyses of solarenergycoin, its tokenomics model allocates:

- 90% of raised funds ($81 million) to plant construction.
- 7% ($6.3 million) to decentralized liquidity pools.
- 3% ($2.7 million) to platform fees and audits.

The token's value appreciation mechanism includes:

- **Annual Buyback**: 13% of profits used to burn tokens, reducing supply.
- **Price Stability**: A decentralized liquidity pool (7% of funds) ensures market liquidity.
- **Projected Appreciation**: Token value increases by 5% annually, reaching 950% of the initial price over 20 years.

Solarenergycoin token is developed on the Binance Smart Chain (BEP-20 standard) and utilizes a Proof-of-Stake (PoS) consensus mechanism, avoiding energy-intensive mining. Additionally, the legal aspects of creating and issuing a physically backed cryptocurrency were examined under the regulations of the Central Bank of Iran and the European Union. These guidelines were applied in developing the cryptocurrency's whitepaper and economic logic.

The project also aligns with the European Union's Markets in Crypto-Assets (MiCA) regulation, which harmonizes crypto asset rules across the European Economic Area (EEA). MiCA prioritizes consumer/investor protection through transparency, legal oversight, and anti-money laundering (AML) measures. Key requirements include:

- Mandatory registration of crypto firms.
- Annual independent audits.
- Liquidity pool creation (7% of funds).
- Full refund guarantees if ICOs fail.

To comply with MiCA, Solarenergycoin established a registered joint-stock company, Dāyān Blockchain, to manage investments. The whitepaper mandates annual third-party audits and allocates 7% of raised capital to a decentralized liquidity pool, enabling investor trading without corporate interference. The company also pledges to refund all contributions if the ICO fails.

The success and commercialization of any technology depend on having a suitable business model. Such a model must clarify various dimensions, including target customers, communication channels, product distribution methods, key partners, core activities, and revenue/cost projections. In this study, a business model canvas based on Osterwalder's framework was developed to outline these components.

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