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ENERGY DIGITAL MARKETS IN UKRAINE AS A COMPONENT OF SUSTAINABLE ENERGY DEVELOPMENT[18]

The development of a sustainable energy sector in Ukraine is impossible without introducing digital technologies and creating efficient energy markets. Energy digital

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markets contribute to increased transparency, efficiency, and integration of distributed energy resources into the overall energy system [1].

One of the key aspects of the digital transformation of the energy sector is the introduction of a system of smart grids that ensure the integration of renewable energy sources, optimization of consumption, and effective control over energy supply [2]. The European experience shows that the digitalization of the electricity market reduces losses in the grid, increases the flexibility of balancing, and ensures energy availability for the end consumer [3].

Blockchain technology is one of the key tools that ensure the safe and efficient operation of digital electricity markets [4]. It allows creation of decentralized platforms for energy trading, automating metering and payment processes through smart contracts, and ensuring a high level of cybersecurity for energy data [5-6].

The experience of the EU countries shows that the combination of digital technologies and flexible market mechanisms allows for greater efficiency in managing energy flows, reducing the cost of energy production and transportation.

The main advantages of blockchain solutions in the energy sector include the following:

- ✓ *transparency* - all transactions are recorded in an open register, which reduces the risk of manipulation and fraud;
- ✓ *decentralization* - blockchain allows for the creation of peer-to-peer (P2P) energy markets where consumers can directly buy and sell electricity;
- ✓ *automation* - smart contracts can be used to automatically conclude agreements for the purchase and sale of electricity in real-time;
- ✓ *cybersecurity* - the distributed structure of the blockchain increases the resilience of energy networks to cyberattacks [5].

Successful cases using peer-to-peer energy platforms are already operating in Germany, the Netherlands, Australia, and the United States [7]. In particular:

- ✓ Germany is implementing the Enerchain blockchain network, which allows companies to trade electricity directly without a central regulator [6].
- ✓ The Netherlands has launched the Powerpeers project, which allows private consumers to exchange electricity generated from renewable energy sources [7].
- ✓ Australia has developed the Power Ledger platform, which uses blockchain to trade green energy in microgrids [8].

In Ukraine, blockchain technologies can become the basis for the development of decentralized electricity markets and the integration of renewable energy sources. To do this, it is necessary to adapt the legal framework, create incentives for the implementation of blockchain projects, and provide technical support for the integration of these solutions into the power system [9].

Several solutions may be promising for the development of digital energy markets in Ukraine today. The introduction of digital solutions for managing energy supply and demand is also an important area. Intelligent systems for analysing electricity consumption (Big Data, AI, IoT) make it possible to limit the load on the grid, effectively control generation, and reduce up-loads [10].

The conditions for the effective development of digital energy markets in Ukraine are the creation of a favorable regulatory environment, the development of digital energy infrastructure, and raising public awareness of the latest energy trading mechanisms. An important tool is the adaptation of European directives on the digitalization of the energy sector and the attraction of international investment in the development of relevant technologies.

Ukraine has significant potential for the introduction of digital electricity markets. Digital energy markets can be an important factor in increasing energy independence, adapting to European standards, and attracting international investment in the sector.

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