

OPPORTUNITIES FOR USE OF CRYPTO-ASSETS IN RENEWABLE ENERGY SECTOR WITHIN EUROPEAN UNION LEGAL FRAMEWORK

Anete Kalnina, Gunita Mazure

Latvia University of Life Sciences and Technologies, Latvia
anetei.kalnina@gmail.com, gunita.mazure@lbtu.lv

Abstract. The issues regarding consumption of energy generated from fossil resources have become particularly relevant in 2022 due to the aggravation of political and economic circumstances causing an energy crisis. Taking into account the existing need to increase the amount of energy produced from renewable energy resources in the European Union, the development of the digital and innovation economy as well as the fact that the mining of crypto-assets can consume large amounts of energy, the study aims to evaluate the impact of the introduction of crypto-assets regulation on the possibilities of using crypto-assets in the renewable energy sector. The results of the NOISE (Needs, Opportunities, Improvements, Strengths, Exceptions) method used indicate the main need – to introduce regulation in an industry where it has not existed before. The most important identified opportunity is to create new crypto-assets and renewable energy business models; improvements are related to transparency of operations and environmental awareness. Main strengths – the introduction of a single, globally new regulatory framework. Regulation's exceptions are mainly related to even more significant responsibility towards the environment and sustainability issues. Statistical analysis of Bitcoin energy consumption data was performed and it indicates increasing consumption of energy to generate crypto-assets. The share of renewable energy resources used for crypto mining is decreasing, while the use of fossil resources (e.g. natural gas) is increasing. The results of the study, in general, form one of the first scientific opinions on the use of crypto-assets specifically in the renewable energy sector, considering the current legal framework's development process and indicating future research topics.

Keywords: crypto-assets, renewable energy, European Union, regulatory framework, MiCA.

Introduction

In order to ensure uniform regulation of financial services in the European Union (EU) in accordance with the Digital Finance Package (DFP), the EU has concluded that there is a need for a uniform regulation of crypto-assets, i.e. one of the most important use of blockchain technology (BT) in the financial field. In line with the European Commission's priority to make the EU ready for the digital age and create an economy that works for its people [1], a comprehensive regulation of consumer protection and fair operating practices for crypto-asset transactions is determined by the EU as needed.

According to the EU Blockchain Strategy [2], the EU wants to be a leader in BT, becoming an innovator and a major base for platforms, applications and companies. It is also essential to ensure the sustainability and energy efficiency of BT, which has contributed to the requirements of the crypto-asset regulation, also regarding the provision of information, which consensus algorithm is used in the "mining" of the crypto-asset, or to be exact – which one is used by its underlying BT.

It has been studied that currently the "mining" of Bitcoin using the *proof-of-work* (PoW) consensus algorithm in 2022 consumed 107.65 TWh of electricity [3]. Therefore, the EU states that it is necessary to determine that activities consuming such amounts of energy do not comply with the Regulation (EU) 2020/852 of the European Parliament and of the Council (June 18, 2020) on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088 (EU Taxonomy) [4] as well as *environmental, social and governance* (ESG) principles.

These energy issues, incl. the use of fossil resources, have become particularly relevant in 2022 with the war in Ukraine carried out by the Russian Federation, which has caused an energy crisis and a cold war in the natural gas market in Europe [5], thus, a rapid transition to renewable energy sources (RES) within the EU is necessary as well as the fastest possible determination of requirements for such energy-intensive processes as "mining" of crypto-assets using the PoW consensus algorithm.

The aim of this study is to evaluate the impact of the introduction of crypto-asset regulation on the possibilities of using crypto-assets in the RES sector. Research tasks are: 1) to analyse the legal framework proposed by the European Parliament and the Council; 2) using the NOISE analysis, evaluate the applicability of the legal framework for the use of crypto-assets in the EU, more specifically in the RES sector; 3) by evaluating the energy data used to generate Bitcoin, formulate prerequisites for sustainable "mining" of crypto-assets.

Materials and methods

The study was conducted using the proposal “Regulation of the European Parliament and of the Council on Markets in Crypto-assets, and amending Directive (EU) 2019/1937”, and other planned and current EU legislation. The following methods were used:

- content analysis to determine how the changes in the legal framework would affect the RES sector;
- analysis of scientific publications to collect and analyse the insights expressed by other authors on the regulation of crypto-assets and their use in the RES sector;
- NOISE analysis to identify needs, opportunities, improvements, strengths, and exceptions that will be addressed by introducing crypto-asset regulation in the EU and applying it to the RES sector;
- analysis of the Cambridge Bitcoin Energy Consumption Index (**CBECI**) data in MS Excel to identify the current share of resources for the electricity required to generate Bitcoin in 2019-2022 (Bitcoin is chosen based on data availability and considerable popularity among crypto-assets).

Results and discussion

Legal framework analysis

The crypto-asset transactions at the EU level are currently regulated, taking into account the risks associated with money laundering and terrorist financing, but in reality, the use of crypto-assets is linked not only to those types of risks. Also, their application can provide significant advantages in the development of the EU economy. Taking these aspects in mind, in 2020 the European Parliament and the Council issued a proposal for the “Regulation of the European Parliament and the Council on crypto-asset markets and amending Directive (EU) 2019/1937” (Markets in Crypto-assets or **MiCA**) [6].

With the introduction of MiCA, the EU is solving the following important issues that have not been regulated so far, like transparency and disclosure requirements for the issuance of crypto-assets, ICOs, access to the crypto-asset trading platform, also registration and supervision of crypto-asset service providers, protection of crypto-asset holders, measures that prevent insider dealing and market manipulation in order to ensure the integrity of the crypto-asset market [7].

The authors’ opinion is that the most important benefit of the MiCA regulation directly related to environmental requirements and the use of renewable energy (**RE**) is that an agreement has been reached at the EU level that in the future the issuer of crypto-assets will have to disclose the impact on the environment, publicly reporting on the energy consumed and carbon emissions generated [8]. Currently, the regulatory proposal stipulates that the issuer of crypto-assets will have to indicate which consensus algorithm is used by the underlying distributed ledger technology (**DLT**) of the crypto-asset. This information will have to be specified in a “whitepaper” – a document containing mandatory disclosure information [7]. Taking into consideration the fact that the operation of PoW algorithms has previously caused discussions about its energy consumption [9], this step in the implementation of the regulation indicates the EU’s desire to provide crypto-asset service clients with comparative and reliable information about the amount of energy consumed for the creation and maintenance of a particular crypto-asset. In this way, customers will be able to choose to buy crypto-assets that, for example, are built on the *proof-of-stake* (**PoS**) algorithm DLT, which does not consume such amounts of energy as PoW-based DLT, or whose “mining” uses RE (if this will be specified by the crypto-asset issuer).

NOISE analysis (incl. for the regulation of crypto-assets in the context of RE)

Needs (N):

- to regulate an industry that has not had comprehensive regulation so far – taking into account the transition to the digital age, to increase the trustworthiness of crypto-assets [6];
- the need for innovative economic and technological development at the EU level in accordance with the European Commission’s DFP and the need to ensure the EU’s competitiveness in this area;

- moving towards sustainable development-oriented policy planning documents such as the European Green Deal and its supplement “Fit for 55%” as well as the fulfilment of the “REPowerEU” goals;
- in the view of the authors, it is very important to limit the emissions that are formed from the use of fossil resources which are necessary to ensure the operation of the DLT required for the crypto-assets (especially in the case of using the PoW algorithm, which, compared to the PoS algorithm, uses up to 99.95% more energy [10]);
- provide information to clients about untrustworthy crypto-asset service providers, thereby ensuring client protection against loss of funds.

Options (O):

- the development of RES-based crypto-assets as a business model, considering the possibility of providing such information to clients in an official way;
- considering the fact that the storage of energy produced by RES requires significant additional infrastructure, the authors of the paper see an opportunity to use RE when it is not needed for the “mining” of crypto-assets [11], placing the necessary infrastructure near RES;
- to expand crowdfunding projects for RE production (through ICOs);
- the client has the opportunity to make a choice based on official data when deciding on investments in specific crypto-assets and their sustainability;
- as the regulation develops, it is possible to introduce taxes or fees for the “mining” of crypto-assets that do not comply with the EU Taxonomy (see the discussion section).

Improvements (I):

- the European Securities and Markets Authority (crypto-asset supervisory authority, **ESMA**) will be obliged to issue permits to crypto-asset service providers [7], which create and provide control functions;
- the mandatory information allows the customer to choose in which crypto-assets to invest by looking at the “whitepaper” of the crypto-asset and reduce the risks associated with providing false, incorrect information or greenwashing;
- for violations of consumer protection rights, the MiCA stipulates fines of up to EUR 5 million for legal entities and EUR 700 thousand for natural persons [7];
- a logical, legal, and comprehensible sequence of actions is created to ensure the operation of newly created crypto-assets in the EU, which provides for responsibility towards the client;
- since it will be necessary to provide more information about the environmental impact, in the opinion of the authors, it can increase environmental consciousness, thus making a choice and stimulating the transition to the use of RES or the reduction of energy consumption when switching to PoS algorithm.

Strengths (S):

- the need for information disclosure creates a more transparent business environment for crypto-assets, which in turn creates greater reliability for investments in such assets;
- actions are foreseen in case of non-fulfilment of the requirements of the regulation, thus, reducing uncertainty, risks, and an uncontrolled market in this area;
- uniform regulation will be ensured at the EU level, taking into account that so far some countries (for example, France [12]) have created national regulation, which may lead to the development of imperfections in the EU’s single (internal) market;
- the EU is the first block of countries with an initiative to pay attention (at the regulatory level) to such an issue as energy sources used in the creation of crypto-assets, which indicates action to achieve climate neutrality and sets an example for other countries to become more and more realistically aware of such a problem and to include it in the scope of regulatory acts;
- the need to disclose information about both the consensus algorithm used and potentially other environmental and energy issues can create conditions in which crypto-assets whose “mining” has used only RES become more competitive than others in the customer’s opinion.

Exceptions (E):

- MiCA regulation does not affect the aforementioned financial instruments, NFTs as well as crypto-assets that represent services or physical assets that are unique and irreplaceable, such as product guarantees or real estate [7];
- the “whitepaper” does not have to be prepared if the total remuneration for the offer of crypto-assets in EUR does not reach 1 million within 12 months [6], which is especially important if energy is generated at home with RES and used for peer-to-peer energy trading [13];
- it is not determined how to evaluate crypto-assets based on the PoW algorithm in the context of sustainability, for the “mining” of which only RE is used, and what is the opinion of the EU in such cases.

MiCA currently does not envisage the measures that should be implemented and the rules that should be applied to facilitate the transition of fossil resource energy-intensive crypto-assets to the reduction of energy consumption, the wider use of RES, or the transition to consensus algorithms that consume significantly less energy in the near future. The authors believe that such information, which indicates the EU’s planned goals, in the form of guidelines and recommendations should be available as soon as possible, because issuers may need more time and resources to perform activities to ensure compliance with the requirements. In the opinion of Stefan Berger, the officer responsible for the MiCA regulation of the Economic and Monetary Committee of the European Parliament, MiCA will be an innovative regulation that attracts innovation, protects consumers, creates legal certainty and a reliable supervisory structure [14]. The authors agree with the opinion that the existence of such regulation will increase initiatives to create regulatory acts due to the financial risks associated with crypto-assets, as well as environmental risks. This opinion is also confirmed by the statement of the White House of the United States of America in September 2022 for the responsible development of digital assets, in which similar requirements are indicated in the future as in the case of the EU [15].

Bitcoin electricity consumption data analysis

The CBECI data was analysed for an overview of the energy sources used to generate crypto-assets (in this example – Bitcoin). The total energy required to generate Bitcoin in 2019 was 57.09 TWh, in 2020-68.52 TWh (an increase of 20.02% compared to 2019), in 2021-104.89 TWh (+ 53.08% compared to 2020) but in 2022-107.65 TWh (+ 2.63% compared to 2021). CBECI data shows that the total electricity consumption is increasing every year, and even with the market crash in 2022 it exceeded the amount of electricity consumed in 2021. Although the total consumption of electricity is increasing, the data shows (see Fig. 1) that the share of RES is decreasing over the years, mainly due to the decrease in the share of hydropower.

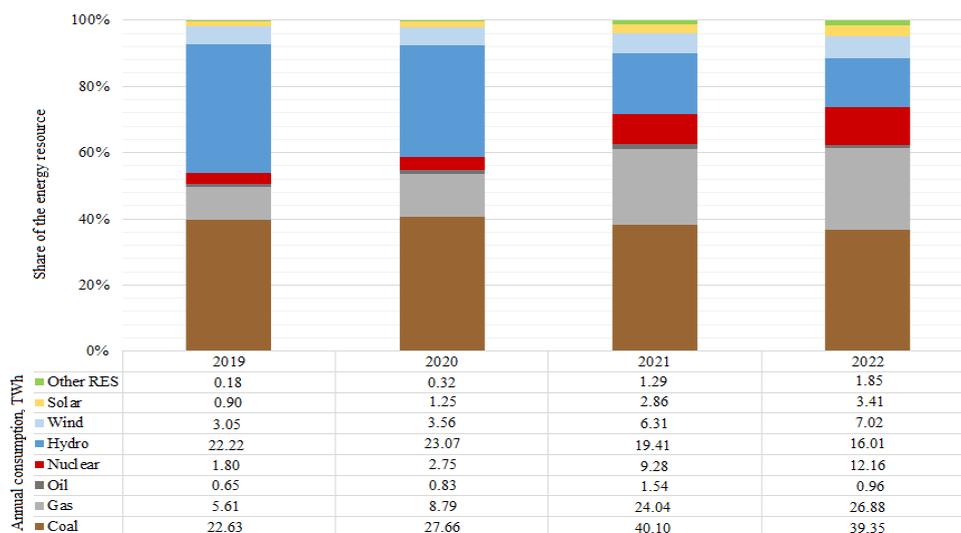


Fig. 1. Sources of electricity used to generate Bitcoin in the world (made by the authors, using [3])

The amount of electricity generated by hydropower is decreasing in 2021 and 2022 due to persistent droughts in Brazil, China, India and the United States of America, which are considered hydropower-

rich countries [16]. The hydro capacity utilisation is lower than usual and other resources are necessary to compensate the needed amount of electricity. So, the share of natural gas is increasing, which indicates an increase in the total share of fossil resources. While the EU is looking forward to reducing the amount of nuclear power, the rest of the world are opening new plants, following the World Nuclear Association's Harmony programme (provide 25% of electricity from nuclear power before 2050) [17]. The rapid increase of wind and solar capacity depended not only on the general transition to RES (according to, e.g., the Paris Agreement) but also on the issue of energy independence in 2022.

Such data indicate the prerequisites for sustainable "mining" of crypto-assets – to look for solutions to increase the use of RES and the ability to use RE even when the weather is not suitable to generate it (storage solutions). However, more important is the reduction of electricity consumption, so that there is no need to produce and consume so much electricity based on neither fossil nor RES.

The European Parliament has asked the European Commission to develop an offer to improve the legal framework by January 1, 2025, in order to include in the EU Taxonomy such crypto-asset "mining" activities that are considered sustainable [14], which, in the opinion of the authors, could lead to an increase in the use of RE in the "mining" of crypto-assets, thereby moving this area towards achieving climate neutrality in 2050 in accordance with the European Green Deal.

In the opinion of the authors, sustainability standards (perhaps voluntary) [18] are also one of the prerequisites for further reducing the impact of crypto-assets on the environment, which could lead to a decrease in demand for unsustainably obtained crypto-assets from customers who consciously choose sustainable investments. Therefore, the use of RES in the "mining" of crypto-assets could develop, also because of the creation of a regulatory framework, increasing trust in this technology, as well as the growing need for decentralized energy management systems, since RE production occurs locally, and not using centralized, monopolized systems [19].

Conclusions

The amount of electricity used for Bitcoin "mining" is increasing each year, thereby the decreasing share of RES becomes a more and more important issue – serious attention at the global level must be paid to electricity consumption reduction, full usage of generated RE, and how not to waste it, and the increase of RES share in general. According to the authors, the most significant benefit of the discussed opportunities for the use of crypto-assets in the RE sector is the use of crypto-assets in peer-to-peer energy exchange in local RES microgrids to facilitate the operation of such systems, thereby promoting the full usage of energy produced by RES.

It is also important that the requirements of MiCA will have to be taken into account when implementing ICOs related to RE development. In the opinion of the authors, along with the introduction of the regulation, a certain transitional period with stimulating measures for the transition to the partial or full use of RES (depending on the possible future requirements), reduction of energy consumption, application of the PoS algorithm should be provided. This should be done in order to reduce the negative impact of the value of the crypto-asset, which could be caused by, for example, non-compliance with the regulation in a short period of time. The purpose of this would be to protect customers from losing the value of their assets. The authors see following topics for further research:

- how the choice of customers is influenced by information about the energy used in the "mining" of a crypto-asset, the emissions generated, and how important these aspects are in the investment choice;
- changes in the value of crypto-assets upon MiCA regulation entry into force;
- how to ensure the sufficiency of the energy produced by RE for all activities, without hindering the development of other sectors (for example, electrification of the transport sector).

Author contributions

Writing – original draft preparation, A.K.; writing – review and editing, G.M.; visualization, A.K. Both authors have read and agreed to the published version of the manuscript.

References

- [1] Communication from the Commission. 2030 Digital Compass: the European way for the Digital Decade, Official Journal of the European Union. [online] [17.02.2023]. Available at: https://eur-lex.europa.eu/resource.html?uri=cellar:12e835e2-81af-11eb-9ac9-01aa75ed71a1.0001.02/DOC_1&format=PDF.
- [2] European Commission. European Blockchain Strategy – Brochure. [online] [17.02.2023]. Available: <https://digital-strategy.ec.europa.eu/en/library/european-blockchain-strategy-brochure>.
- [3] Cambridge Bitcoin Energy Consumption Index, [online] [17.02.2023]. Available at: <https://ccaf.io/cbeci/ghg/index>.
- [4] Regulation (EU) 2020/852 on the establishment of a framework to facilitate sustainable investment, Official Journal of the European Union. [online] [17.02.2023]. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32020R0852>.
- [5] Lambert L. A. et al. The EU's natural gas Cold War and diversification challenges. *Energy Strategy Reviews*, vol. 43, 2022.
- [6] Proposal for a Regulation of the European Parliament and of the Council on Markets in Crypto-assets, and amending Directive (EU) 2019/1937. Official Journal of the European Union. [online] [17.02.2023]. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020PC0593>.
- [7] Proposal for a Regulation of the European Parliament and of the Council on Markets in Crypto-assets, and amending Directive (EU) 2019/1937 (MiCA) - Letter to the Chair of the European Parliament Committee on Economic and Monetary Affairs. [online] [17.02.2023]. Available at: <https://data.consilium.europa.eu/doc/document/ST-13198-2022-INIT/en/pdf>.
- [8] Council of the EU. Digital finance: agreement reached on European crypto-assets regulation (MiCA).[online] [17.02.2023]. Available at: <https://www.consilium.europa.eu/en/press/press-releases/2022/06/30/digital-finance-agreement-reached-on-european-crypto-assets-regulation-mica/>.
- [9] Andoni M. et al. Blockchain technology in the energy sector: A systematic review of challenges and opportunities. *Renewable and Sustainable Energy Reviews*, vol. 100, 2019, pp. 143-174.
- [10] London stock exchange group. Proof-of-Stake: A crypto path to lower energy consumption and yield [online] [17.02.2023]. Available at: https://content.ftserussell.com/sites/default/files/education_proof_of_stake_paper_v6_0.pdf.
- [11] Vega-Marcos R., Colmenar-Santos A., Mur-Pérez F. Study on the economics of wind energy through cryptocurrency. *Energy Reports*, vol. 8, 2022, p. 970-979.
- [12] de Vauplane H., Smadja J. The Virtual Currency Regulation Review: France [online] [17.02.2023]. Available: <https://thelawreviews.co.uk/title/the-virtual-currency-regulation-review/france>.
- [13] Gawusu S. et al. Renewable energy sources from the perspective of blockchain integration: from theory to application,” *Sustainable Energy Technologies and Assessments*, vol. 52, part B, 2022.
- [14] European Parliament. Cryptocurrencies in the EU: new rules to boost benefits and curb threats. [online] [17.02.2023]. Available at: <https://www.europarl.europa.eu/news/en/press-room/20220309IPR25162/cryptocurrencies-in-the-eu-new-rules-to-boost-benefits-and-curb-threats>.
- [15] The White House. FACT SHEET: White House Releases First-Ever Comprehensive Framework for Responsible Development of Digital Assets. [online] [17.02.2023]. Available at: <https://www.whitehouse.gov/briefing-room/statements-releases/2022/09/16/fact-sheet-white-house-releases-first-ever-comprehensive-framework-for-responsible-development-of-digital-assets/>.
- [16] The International Energy Agency. Hydroelectricity. [online] [17.02.2023]. Available at: <https://www.iea.org/reports/hydroelectricity>.
- [17] World Nuclear Association. The Harmony Programme. [online] [17.02.2023]. Available at: <https://world-nuclear.org/our-association/what-we-do/the-harmony-programme.aspx>.
- [18] The Greens/EFA. Crypto-Assets. [online] [17.02.2023]. Available: <https://www.greens-efa.eu/en/article/press/crypto-assets-mica-agreement-sets-a-common-eu-harmonised-framework-for-crypto-assets-and-will-provide-security-for-investors-support-sustainability>.
- [19] Juszczak O., Shahzad K. Blockchain Technology for Renewable Energy: Principles, Applications and Prospects. *Energies*, vol. 15, no. 13, 2022.