LEGAL RISKS AND OPPORTUNITIES RELATED TO THE USE OF BLOCKCHAIN TECHNOLOGY IN THE ENERGY SECTOR

DOI 10.18572/2410-4396-2019-1-101-106

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Legal analysis of the regulatory framework governing public relations in the electric power industry makes it possible to conclude that significant changes are required to ensure the possibility of actual implementation of the advanced technologies, to mitigate legal risks for all subjects of the electric power industry, and to ensure protection of the rights and legitimate interests of both the electricity consumers, and the sales, generating and network companies. The legislator and the professional community have a global goal: to develop a concept for the functioning of the electric power industry, which in the medium- and long-term perspective will ensure the high investment attractiveness of the Russian energy sector and maximum satisfaction of all market entities. To that end, first of all, it is necessary to identify those legal risks and opportunities that must be considered and worked out for the evolutionary development of the industry. The author examines the legal basis for implementation of the blockchain and "smart" contracts in the wholesale and retail electricity markets, and considers peculiarities of the legal status of the electricity industry entities in the use of new technologies. The positions, opinions and statements contained in this article are the private opinion of the author and may not coincide with the official position of the entity, for which he works, or of any other entity.

Keywords: *energy law, energy law, legal regulation in the energy sector, legal framework of blockchain in the electric power industry.*

As noted in the literature, the blockchain is a distributed register (database) consisting of interconnected blocks of transactions registered by the users [1]. In fact, transaction entering is an expression of will of the user to perform certain actions, for example, confirmation of the settlement and/or completion of the transaction. It is important to note that, according to the general rule, the created blocks are invariable as they are stored at the same time by all users of the register, and to change them, confirmation by each party is required. Herewith, the validity of the transaction is verified at two levels: by the person settling it and by the user confirming this action (for example, by the payer and the payee). Each subsequent block includes information from the previous one, which makes it impossible to change previously created blocks. To correct them, it is

required to create a separate transaction. A key advantage of blockchain is the increased level of data reliability and their protection against interference and tampering.

Despite the fact that all users of the system have access to the data, which are entered independently by each database participant, the system allows creation of a centralized register, the essence of which consists in the fact that transactions and new blocks are formed by a trusted center (the person responsible for entering information into the register), and the users initiating the relevant transactions are entitled to verify their correctness and control the registration.

Speaking about "smart" contracts, it is necessary to pay attention to the fact that they are a tool derived from the blockchain and operate on its basis. There is no agreement in the doctrine on their definition; however, it seems that it is possible to agree with the definition of a "smart" contract, according to which it means a contract existing in the form of a program code based on the blockchain technology, and ensuring its independence and self-fulfillment of its terms and conditions in the event of occurrence of circumstances predetermined in it [2]. It should be noted that the use of "smart" contracts materially simplifies management of legal documents, in particular, releases the counterparties from the obligation to prepare legal documents in hard copy, and also is as a more reliable alternative to other data transfer methods such as e-mail, etc. [3]. Currently, the most used platform for development and application of "smart" contracts is Ethereum, which comes into use by such major companies as Microsoft, Alibaba, and others [4].

Turning directly to the possibility of application of the considered technologies in the electric power industry, it is possible to make a conclusion about their potential usefulness both in the wholesale electricity and capacity market (hereinafter referred to as the WECM) and in the retail electricity markets (hereinafter referred to as the REM).

As for the WECM, regulation of supply and demand as well as adjustment of automated contract performance and development of distributed generation are among the most obvious means of implementation of the blockchain technology and "smart" contracts.

In case of the REM, the main direction of implementation of these technologies will be improvement and transformation of existing contractual relations. However, taking into account the greater number of details and peculiarities of their regulation, conclusion and performance of the contracts in the REM, the blockchain and "smart" contracts can solve a significant number of current problems. The following can be distinguished among these problems: unreliability of the counterparties, growth of the accounts receivable from the consumers, limitation of the consumption mode, accounting, quality and losses of electricity, and many others. Moreover, the blockchain has a great potential for development of the technology of electricity accumulation and storage [5].

It can be assumed that upon full implementation of the blockchain and "smart" contracts in general, the WECM and the REM in their current form will cease to exist, and some hybrid market with its own peculiarities and the method of functioning will emerge in their place.

As was previously discussed, introduction of the blockchain technology can radically change the functioning of the electric power industry. The current state of laws in the energy sector can be recognized as satisfying the goals of reliable energy supply, energy security, and so on. At the same time, in the context of the sector development, attention should be paid to one of the fundamental principles specified in Federal Law No. 35-ФЗ dated March 26, 2003, *On the Electric Power Industry* (hereinafter referred to as the Law on the Electric Power Industry), keeping the balance of the economic interests of the suppliers and the consumers of electricity. If we consider the technologization and digitalization of the industry under study in the context of the future observance of this principle, it can be concluded that the current laws will not make it possible to fully ensure its proper implementation.

As it was mentioned at the beginning, as a general rule, the blockchain is a decentralized database that ensures equality and independence of all its participants. However, in the course of introduction of this technology in the electric power industry, it is necessary to use both decentralized and centralized registers. This need is caused by the peculiarities of the legal status of various market entities. For example, if the formation of a single electricity market is modelled, it is absolutely unclear how the household consumers will be able to directly interact with the generating entities. Moreover, such a scenario is also economically inefficient, since the latter have no interest in settling many minor transactions and, as a risk, increasing the volume of accounts receivable. Therefore, the guaranteeing supplier of electricity (hereinafter referred to as the GS) ensuring the interests of the consumers, primarily the household ones, in reliable energy supply remains to be an irreplaceable participant of the relations. Let us proceed directly to consideration of various possible applications of this technology and their future legal regulation.

Introduction of the blockchain and "smart" contracts in the WECM, in the author's opinion, significantly modernizes the legal relations between its players.

1. We would like to draw attention to the possibility of energy accumulation and storage. The current systematic growth of production facilities is definitely necessary; however, through the use of "smart" contracts and development of electricity storages, the parties concerned could significantly optimize the process of electricity purchasing in the WECM and reduce costs. It seems that the scheme of contractual relations could look as follows: the consumer and the generating entity enter into a "smart" contract containing the provision that in the event of overgenerated energy, its excess shall be automatically sent to the storage facility, and in the event of undergeneration, the consumer shall retrieve it from the same storage facility. The blockchain will automatically determine both the excess electricity that needs to be distributed to the storage facility and the shortage additionally retrieved to fulfill the contractual obligations to the buyer of the resource. In this case, the key responsibility of the generating entity is to provide a sufficient amount of electricity generated and stored in the storage facilities. It is also worth specifying at the legislative level the minimum level of reserve provided by the producer, including the possibility of changing it (upward) in the contracts. The main responsibilities of the consumer are timely determination of the amount of energy needed for acquisition and provision of a sufficient amount of money on the bank account for automatic payment. Moreover, it is necessary to determine responsibility for failure to fulfill the above obligations; for the generating entity, it may be a fine in the form of a reduction in fees for selling the next amount of electricity, and for the consumer, a penalty.

It is worth paying attention to the fact that it becomes possible to implement the so-called "virtual power plant", which, in fact, is an automated base that regulates the demand and supply in the WECM. From the point of view of the formation of legal relations, it may look as follows: an entity is formed to accumulate information about all generating facilities and required consumption levels, after which the generated electricity is automatically distributed to the consumers. Of course, there may be other models to build this technology. At the same time, the main issues to be settled in such a case include: defining the type and amount of liability for the inappropriate distribution of generated energy, identifying the person acting as the operator of such a system and its legal status, building contractual relations, that is, whether direct contracts will be concluded between the generating entity and the consumer, and the operator only controls the demand, or the specified persons submit some kind of application to the operator, and the latter is independently liable for the undergeneration and/or failure to sell sufficient amount of electricity.

The blockchain will also be useful in automated determination of the degree of wear and damage of generating equipment (including

specific locations to be repaired), forecasting the required level of capacity growth, which will make it possible for the companies to more accurately form investment programs, reduce troubleshooting costs and more efficiently participate in conclusion of contracts for construction and modernization of the generation facilities. With regard to these contracts, the blockchain and "smart" contracts will not only simplify legal document control, but will also help to form an evidential base on the absence of the customer's (generating company's) fault with regard to violation of the terms for construction of production facilities by the contractors and, as a result, to reduce the risks of bringing to liability in the form of fines, which can be expressed in reduction of capital costs, their reduction, etc. Possible forming of such an evidential base will make it possible for the customer to simplify presentation of claims for damages to the contractor since their volume will be unambiguous and there will be no disagreement to this extent.

The most obvious positive effect for the retail markets is represented by "smart" contracts. Firstly, the introduction thereof will simplify management of document flow between the consumers, the GS and the network organizations (hereinafter referred to as the TNO) through elimination of the need for paperwork in writing. Secondly, the business will be significantly improved due to a significant number of innovations. In particular, the following opportunities that will allow implementation of these technologies, may be modelled.

1. The self-performance and independence of "smart" contracts will improve introduction of suspension/limitation of the mode of electricity consumption. Considering that introduction of the blockchain technology is accompanied by the creation of the "Internet of Things" (hereinafter referred to as the IoT) (actually independent interaction of various equipment and devices in accordance with the specified terms and conditions), it is necessary to establish the criteria, under which the consumption mode will be automatically limited (immediately resumed upon debt repayment), and to additionally adjust the procedure for sending notices on the need for its introduction, as stipulated in clauses 9 to 10 of the Rules for Complete and/or Partial Limitation of the Mode of Electricity Consumption approved by Resolution of the Government of the Russian Federation No. 442 dated May 4, 2012 (hereinafter referred to as the Rules), by changing the requirements to the time limits, the methods of its sending, and, most importantly, to eliminate the need to send several notes: to the consumer and to the initiator, since sending of the relevant notice to the consumer should entail the automatic informing of the contractor of the performed actions aimed at limitation. Thanks to implementation of the IoT, it will be possible to adjust the parameters of specific disconnection of individual premises or devices, which is especially important for the consumers, limitation of the mode of electricity consumption of which can lead to economic, environmental, or social consequences (for example, if a person has a debt, it can "turn off" the specific office and prevent the negative consequences associated with the risk of limiting the mode of consumption of the production facilities). Therefore, the risks of claims of supervisory and law enforcement agencies against the initiator and the contractor are eliminated, and for the company, cases of negative consequences (accidents, etc.) are minimized.

2. It is also possible to develop payment and accounting services. For example, the functionality of the blockchain will make it possible to expand the methods of payment of issued invoices through the use of cryptocurrency. Moreover, it is possible to implement the prepayment function, which, according to the author, can work according to the following logic. The consumer determines the estimated level of consumption for the next month, pays an equivalent amount of money and uses electricity to the planned extent; if the actual volumes exceed the estimated level, the consumer will receive a relevant notice from the system and it will have several options: a) to adjust the level of consumption by the IoT and optimize it so as not to exceed the

planned level (for example, to reduce the level of illumination of the territory at night); b) to pay additional funds to the account to increase the limit; c) to prepare for the introduction of a limitation.

The transition of electricity metering systems to blockchain will make it possible to settle a significant number of disputes about the quality of electricity. It will play an important part in the supply of the household consumers in apartment blocks (hereinafter referred to as AB) with electricity since the GS, acting as the resource-supplying entity, currently must prove its innocence in the consideration of actions related to protection of the consumer rights with regard to the damage caused to electric equipment of the individuals by supply of energy of poor quality. Since relevant blocks of information containing information about the quality of energy at a particular moment will be formed at all stages of electricity transmission (upstream the AB, inside the AB, etc.), both the individuals and the GS can unambiguously determine in which networks (TNO or within the building) a violation occurred and present claims against the relevant responsible person.

3. The blockchain will make it possible to create a new type of subjects of the electric power industry: an active consumer. It is assumed that such consumers will actively manage their consumption, production (microgeneration) and storage of energy [6]. Creation of such a category of market entities will allow more accurate forecasting of the need for generating capacity, and for the marketing segment, this will serve as an additional "field" for development of competition as the users will be interested in acquiring the most interesting and efficient technical solutions (for example, such systems as "smart home", etc.).

4. To sum up the consideration of possible changes in the REM, we would like to draw attention to the formation of the special role of the GS. Despite the fact that the blockchain, in general, provides an opportunity to conclude direct contracts between the consumers, for whom there is such expediency, and the generating companies, one cannot agree with the opinion that the GS and the sales organizations will no longer be needed over time. It seems more correct that they will have an important role to play, including the expansion of their activities, for example: in addition to electricity sales, the GS can act as the operator of the centralized register. This is necessary because creation of the blockchain in its "pure" form represents the anonymity of all users, which will not allow observance of the principles of good faith and credibility on the part of all market entities in the energy sector. The main obligations of the operator will include: control of access to the digital platform for electricity supply of new market entities (including control of participants), validation of the entered data, and, if necessary, their amendment based on the application of the participants of the contractual relations, ensuring the security of such a system, and so on.

From a legal point of view, it seems that the GS as the person responsible for quality and reliable energy supply can play this part since, according to the author, it has all resources required for this resource as well as well-established business relations with all subjects of the electricity market.

In conclusion, it seems necessary to pay attention to the key legal risks that arise upon implementation of the studied technologies in practice. First of all, it is necessary to mention the risks of unauthorized interference with the operation of the digital platform despite its high degree of security. Taking into account the requirement to protect the rights and legitimate interests of all participants of legal relations, the subjects of the electric power industry introducing relevant technologies should ensure an adequate level of protection against cyber threats and, from the point of view of legislative regulation, it is necessary to determine the legal status of such digital platforms, to develop legal mechanisms for bringing the persons committing such interference to liability, and the criteria of minimum security of digital technologies, according to which they can be commissioned. Secondly, the issues of

protection of personal data of the electricity consumers as well as identification of persons responsible for their loss upon operation of information technologies in the energy sector will be relevant.

Moreover, in the author's opinion, it is advisable to consider the issue of determining the ownership of the software (manufacturing country) used to create and operate blockchain-based platforms. ■

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