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Modern Trends in Legal Regulation of Electricity Storage in the Russian Federation and Foreign Countries

Кологерманская Екатерина Михайловна
Legal Advisor of PromHim LLC, PromHim LLC
Российская Федерация,

Аннотация

The modern fuel and energy complex is in the process of reformation. It is undergoing the fourth energy transition, which is aimed at increasing the role of renewable energy sources. Electricity storage systems are one of the energy technologies that can have an impact on the timely solution of the set goals and objectives. The Russian Federation has developed a number of strategic planning documents in this area, but the legal regulation of electricity storage systems is at the stage of adoption of special legislative acts, and some aspects require further updating. In this regard, it seems necessary to study modern trends in the legal regulation of electricity storage systems in foreign countries. In this article we study the legal experience of some states, which are members of the European Union, namely Germany and Italy, and BRICS member states — Brazil and China. It should be emphasized that the selected countries represent different approaches and levels of legal regulation in the area under study. The results of the study can be used for the development of the Russian energy legislation in order to reduce the barriers to the application of electricity storage systems.

Ключевые слова: energy law, energy legislation, electricity storage systems

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1 **Introduction**

2 With the comprehensive and multi-dimensional energy transition, the modern fuel and energy sector is undergoing reform stages worldwide. The electric power industry is also undergoing significant changes due to the development of the renewable energy sector, the expansion of electric vehicle fleets, the introduction of hydrogen energy, etc.

3 Thus, energy (and especially electricity) storage systems are a complex subject of research. On the one hand, such systems contribute to the further development of the energy sector, ensuring the technological principle of balance of production and consumption levels, as well as uninterrupted power supply to consumers. On the other hand, electricity storage systems can be considered a rapidly developing class of high-tech equipment opening new opportunities for power engineering development.

4 The importance of this field is also confirmed by some statistical forecasts. According to RUSNANO, in 2025 the world market of electricity storage systems will amount to about USD 80 billion. In the optimistic scenario, the Russian market by that time will reach USD 8 billion per year (in the realistic scenario – USD 1.5–3 billion per year). The economic impact (net of investments) will amount to USD 11 billion per year (in the realistic scenario – USD 2.5–5 billion per year) [1].

5 It should be noted that energy storage offers a number of opportunities for independent developers, producers, grid operators and consumers (ranging from large to household energy consumers) and other parties involved in the electric power sector.

6 At the same time, however, electricity storage systems significantly change the current architecture of electricity and capacity markets, as they allow the elimination of the mandatory condition, in particular, the constraint of simultaneous electricity generation and consumption, as well as the active introduction of demand management and price arbitrage technologies [2].

7 As a result, at present it is difficult to speak of a full legal regulation of the field under study, which leads to some problems in the implementation of energy projects. For example, high operating costs (including the cost of batteries and technologies), difficulties in the initial qualification of energy facilities, uncertainty of taxation and network charges, etc.

8 In this regard, it seems necessary to study the current trends of state legal regulation of electricity storage systems in foreign countries.

9 Thus, in addition to analyzing modern legislative measures in this area at various levels in the Russian Federation, the article examines the legal experience of some countries that are members of the European Union, namely Germany and Italy, and BRICS member states – Brazil and China.

10 **I. Russian Federation**

11 The prospects for the development of electricity storage systems (ESS) in the Russian Federation seem quite promising. For example, according to the expert and analytical report “The Electricity Storage Systems Market in Russia: Development Potential” prepared by the Center for Strategic Research, the maximum volume of the Russian segment of the ESS market may reach USD 8.6 billion per year by 2025 (a realistic estimate of the market is USD 1.5–3 billion per year). This will have an impact on the country’s economy (net of investments) of USD 11 billion per year (for a realistic market volume — USD 2.5–5 billion per year) [3].

12 However, the current situation in the power industry is that market players are already building and operating ESS projects. Meanwhile, the conceptual aspects of legal regulation and legal status of these energy facilities are still unresolved [4].

13 According to the Energy Strategy of the Russian Federation until 2035, the formation of the market for electricity storage systems is one of the key measures for solving the problems of the power industry. The strategic document defines the areas that play a role in the development of electricity storage systems, namely:

14 (1) Development of competitive storage devices with high charging and discharging currents, long cycling life, and compact low-cost storage devices.

15 (2) Development of storage devices with high energy intensity and low capital cost, including those based on pneumatic or hydrogen systems.

16 (3) Development of high-efficiency water electrolyzers and compact hydrogen storage and transportation systems.

17 In 2017, the Ministry of Energy of the Russian Federation published the Concept for the Development of the Electricity Storage Systems Market in the Russian Federation, which is aimed at identifying priorities and key measures for creating a new high-tech electricity storage systems industry in Russia. Among other things, the Concept defines the following aspects:

18 (1) Identifies priorities and measures for creating a new promising industry in Russia.

19 (2) Identifies the main scenarios for the development of the electricity storage systems market.

20 (3) Formalizes development priorities such as:

21 1. Battery storage systems of low and medium capacity with long lifetime and low operating costs.

22 2. Critical elements of electricity storage systems (battery cells, power converters, control systems, etc.).

23 3. High capacity electricity storage systems with low capital cost.

24 4. Technologies and techniques for cheap and safe production, transportation and use of hydrogen.

25 5. Comprehensive research to develop the next generation of electricity storage systems.

26 The Ministry of Energy also proposed to support a number of pilot projects, including the implementation of supportive R&D, the removal of regulatory barriers, the development of measures to stimulate demand for electricity storage systems and market development, and the implementation of measures to develop the scientific and technological infrastructure. According to the authors of the Russian concept, a total of RUB 1.3 billion has been allocated for relevant R&D over the past three years as part of the development of science and technology.

27 As part of the implementation of list of instructions of the President of the Russian Federation No. Pr-753 of May 2, 2021, the Government of the Russian Federation and Rosatom State Atomic Energy Corporation concluded a Memorandum of Understanding dd. March 9, 2022 to develop the high-tech area “Technologies for the Creation of Electricity Storage Systems, Including Portable Ones” in the Russian Federation.

28 The main mechanism for the implementation of this Memorandum is Roadmap for the Development of the High-Tech Area “Technologies for the Creation of Electricity Storage Systems, Including Portable Ones” No. 4857п-P51 of May 16, 2022, which was approved by Deputy Prime Minister of the Russian Federation A.V. Novak [5].

29 The Roadmap sets out requirements such as:

30 (1) Forming basic advanced technologies and developing “specific areas” for future technological leadership in the world market of energy storage systems and meeting the needs of the domestic market.

31 (2) Achieving a new technological level of the production capacity and industry of the Russian Federation in the field of electricity storage systems, ensuring competitiveness, import independence, and long-term sustainability. One of the key measures is the construction of a lithium-ion battery gigafactory by Rosatom State Corporation.

32 (3) Creating additional opportunities for the development of low-carbon energy, industrial and transport sectors, including through the effective integration of renewable energy sources and growth in the production of electric vehicles.

33 It is also planned to establish the Association for the Development of Electricity Storage System Technologies, a center of excellence for electricity storage system technologies, including portable ones.

34 At the time of writing this article, the draft Resolution of the Government of the Russian Federation on Amendments to Certain Acts of the Government of the Russian Federation on the Operation of Electricity Storage Systems in the Electric Power Industry [6], which defines the following bases of the legal regime of these energy facilities: attribution of ESS to a certain type of electric power industry facilities and development of the definition of their owner, technological connection of ESS to power grids, the possibility of using ESS by grid operators when providing power transmission services, etc., has passed the final stage of the legislative process.

35 Creating legal conditions for ESS operation requires significant changes in other legal acts (including NP Market Council acts) regulating electric power industry

relations.

36 Thus, the Russian Federation has developed a number of strategic planning documents in the field of electricity storage systems. However, the legal regulation of this area is at the stage of adoption of special legislative acts.

37 II. Member States of the European Union

38 The European Union is actively involved in the development of electricity storage systems under various energy programs, including renewable energy sources. For example, the Clean Energy for All Europeans program, published in 2019, includes the areas and principles of electricity storage [7].

39 Moreover, according to the Energy Storage Study published in May 2020, the main energy storage reservoir in the EU today is hydraulic accumulators, but accumulator projects are growing [8].

40 In 2023, the Commission Recommendation Energy Storage – Underpinning a Decarbonized and Secure EU Energy System was adopted [9], which states that storage is key to the decarbonization of the EU energy system. In addition, EU Member States should take into account the dual consumer-producer role of storage systems by applying the EU electricity regulatory framework and removing barriers, including avoiding double taxation and simplifying authorization procedures.

41 In 2011, the European Association for Storage of Energy (EASE) [10] was founded to support the deployment of energy storage for a cost-effective transition to a sustainable, climate-neutral, and secure energy system. It has around 60 members, including utility companies, technology providers, research institutes, distribution system operators, and transmission system operators.

42 *Germany*

43 Since energy storage systems (ESS) can balance supply and demand in the electricity market, they are an important part of Germany's energy transition. As a result, the market for electricity storage systems is undergoing a process of reform and expansion.

44 According to the German Energy Storage Association (BVES), the industry grew by more than 10 % to EUR 7.1 billion (USD 8.2 billion) in 2020. Nearly half of the revenue comes from the private sector (EUR 3.5 billion/ USD 4 billion), with system infrastructure and industry the second and third largest sources of revenue with EUR 2.1 billion (USD 2.4 billion) and EUR 1.3 billion (USD 1.5 billion), respectively [11].

45 The current German legislation regulating public relations in the field of electricity storage is a rather interesting example of legal regulation.

46 In 2022, the Federal Requirement Plan Act (BBPlG), the Energy Industry Act (EnWG), and the Grid Expansion Acceleration Act (NABEG) were amended to define energy storage as an asset where "the final use of electricity is postponed to a time later than the time of its generation" [12].

47 The Energy Industry Act (EnWG) [13] is the basic legal document, which contains provisions such as:

48 (1) According to clause 38b of §3, fully integrated grid components are grid components that are integrated into the transmission or distribution network, including energy storage systems, and are used solely to maintain the safe and reliable operation of the network and are not used for energy control or congestion management.

49 (2) Section 11a sets out requirements for energy storage system tenders, i.e. a power grid operator may offer the construction, management and operation of an energy storage system owned by a third party electricity producer in an open, transparent and non-discriminatory manner if the power grid operator needs the energy storage system. In this case, the Federal Grid Agency is authorized to provide the power grid operator with specifications for the detailed design of the tender procedure.

50 This tender procedure is intended to identify market failures and allow grid operators to purchase, build, manage or operate energy storage facilities on their own in exceptional circumstances.

51 (3) According to Section 11b, the power grid operator may own or install, manage or operate energy storage systems that generate electricity, provided that:

52 1. The Regulatory Authority has approved this upon application by the grid operator.

53 2. The Regulatory Authority has approved this for energy storage systems that are fully integrated grid components by covering all or a group of grid operators; if a fully integrated grid component is not yet covered by such provision, the regulatory authority may grant approval in individual cases at the request of the grid operator.

54 In doing so, the Regulatory Authority shall grant approval if

55 1. The power grid network operator has demonstrated that an energy storage system:

56 a) Is necessary for the effective fulfillment of its obligations.

57 b) Will not be used, other than for its intended purpose, to buy or sell capacity or to operate, in whole or in part, on electricity markets.

58 2. The power grid network has conducted an open, transparent and non-discriminatory tender procedure, the terms and conditions of which have been examined by the Regulatory Authority in relation to the concept of technical deployment of the energy storage system.

59 Energy storage systems are usually complex projects with different footprints depending on the scale and technology used. Therefore, their construction and operation require a state license. However, the legislator has recognized the increasing importance of storage for the energy market and the energy transition, and as a result, Section 43 (2) of EnWG introduces an optional plan approval procedure for systems with a rated capacity of more than 50 MW.

60 ***Italy***

61 The development of storage systems in Italy is very dynamic and plays a crucial role in decarbonization and energy security. This is confirmed by statistics from ANIE

Rinnovabili, the national association for renewable energy: the capacity of the battery energy storage system (BESS) in Italy reached 587 MW/1,227 MWh in the first three months of 2022, of which 977 MWh is attributed to distributed energy storage [14].

62 On January 21, 2020, the Ministry of Economic Development published the Integrated National Energy and Climate Plan [15], which sets targets for energy efficiency, development of renewable energy sources and reduction of CO_2 emissions. To reach the defined targets, Italy will need to implement an efficient energy storage system.

63 As a result, the integration of storage systems with renewable energy sources will make renewable energy production more efficient while making the transmission and distribution system more stable and secure.

64 Interestingly, according to Terna (an Italian grid operator that tracks energy storage installation trends), as of March 31, 2022, the majority of energy storage in Italy has been built in conjunction with small-scale solar power plants, while medium and large-scale storage systems are less common.

65 The Italian regulatory framework for energy storage has evolved rapidly in recent years. However, the legislation is relatively fragmented due to the large number of laws at different levels.

66 The Regulatory Authority for Energy, Networks and Environment (ARERA) in its Resolution No. 574/2014/R/eel [16], defines a storage system as a set of devices and equipment which function is to absorb and release electricity, and which are designed to operate in the power grid to feed electricity into the grid or to withdraw electricity from the grid. In addition, the Resolution specifies that storage systems:

67 (1) May be connected to a power plant, including a renewable energy power plant.

68 (2) May be stand-alone, without connection to a renewable energy power plant.

69 The definition of storage systems does not include so-called “uninterruptible power supplies”, which are electricity storage systems. Their primary function is to provide emergency power to the grid in the event of an outage.

70 ARERA also states that storage systems should be treated the same way as power plants due to their ability to exchange electricity with the grid. Therefore, in general, the same construction, connection and operation rules that apply to power generation plants should also apply to storage systems. In particular, the installation of storage systems and their integration into the grid shall comply with various metering, transmission, control and distribution regulations. These include specific ARERA resolutions, the Italian Unified Text for Active Connections, and other regional and national laws governing storage facilities [17].

71 One of the most important laws governing the authorization procedures for the installation and operation of storage facilities is Legislative Decree No. 7 “Immediate Measures for the Security of the National Electricity System” of February 7, 2002 [18].

72 According to Art. 2 of the above-mentioned Decree, certain authorization procedures apply depending on the area where the storage facility is to be built; the capacity of the generation unit plant to which the storage facility is connected and the type of energy source (fossil or renewable) feeding the generation facility.

73 Consequently, there are two types of authorization procedures: (1) The Single Authorization (Autorizzazione Unica) issued by the Ministry of Environmental Transition or by the competent regional authorities following an administrative procedure.

74 In this case, the storage systems should meet the following requirements:

75 1. Be built in the same areas where fossil fuel-fired power plants with a capacity greater than or equal to 300 MW are located.

76 2. Be built as detached above non-industrial areas.

77 3. Be connected to renewable energy sources yet to be built.

78 (2) A simplified procedure called PAS (Procedura Abilitativa Semplificata) under Legislative Decree No. 28 "Implementation of Directive 2009/28/EC on the Promotion of the Use of Energy from Renewable Sources and Amending and Subsequently Repealing Directives 2001/77/EC and 2003/30/EC (11G0067)" of March 3, 2011 [19].

79 Here, electricity storage systems include the following systems:

80 1. Built in quarries or industrial areas.

81 2. Built in the same areas where fossil fuel or renewable energy power plants of less than 300 MW are located.

82 3. Being in conjunction with renewable energy facilities already built or permitted, provided that the construction of the storage facility does not exceed the area of the corresponding renewable energy facility.

83 Finally, storage systems of less than 10 MW do not require a construction permit. However, they may still require environmental, landscape and/or connection permits.

84 III. BRICS Countries

85 According to the report "BRICS Countries' Priorities for the Technological Development of the Fuel and Energy Sector" published in 2020 [20], certain areas and technologies can be considered for organizing energy-related cooperation among BRICS countries, including decarbonization through initiatives involving the widespread use of e-transport, *energy storage technologies*, conversion of coal-fired thermal power plants to flexible operating schedules, etc.

86 In addition, lithium-ion battery energy storage systems and battery energy storage systems are among the top 10 areas of mutual technological interest in the electric power sector.

87 Therefore, the importance of studying and analyzing the regulatory experience of BRICS countries in the field of energy storage systems is unquestioned.

88 ***Brazil***

89 The development of energy storage systems in Brazil is gaining momentum and the economic applications are expanding. For example, the grid operator ISA CTEEP has started commercial operation of a large-scale battery energy storage system (BESS) at the Registro substation in São Paulo. The 30 MW/60 MWh BESS is expected to provide backup power to the grid during peak summer hours [21]. However, regulatory, fiscal, and investment barriers have hindered the development of the technology in Brazil[1] [22].

90 In April 2016, the Brazilian Electricity Regulatory Agency (ANEEL) published the first draft of a three-year energy storage initiative as part of a scientific program on technological innovation in the energy sector [23].

91 Energy storage is seen as a solution to Brazil's growing renewable energy capacity and the urgent need to fill the gap in the electricity transmission infrastructure.

92 The initiative is funded by energy companies investing 0.4 % of their annual revenues in R&D projects controlled by ANEEL.

93 In addition, ANEEL is calling for proposals to update the current regulatory framework and develop projects to introduce new technologies and install pilot storage facilities by any generation, transmission or distribution company currently authorized to operate in Brazil.

94 Since 2022, Bill 1224/22 has been pending in the Chamber of Deputies to regulate electricity storage in Brazil [24].

95 The said Bill proposes to formalize the bases of the legal regime of electricity storage systems.

96 Thus, this activity is characterized by the controlled storage of energy produced by the source for subsequent supply to the electric grid based on demand.

97 At the same time, storage can be carried out using various technologies, such as batteries and reversible hydroelectric power plants.

98 In addition, the generation will have to be from a renewable source. The text also establishes that the storage capacity cannot exceed the capacity of the generation system in kW (measurement of the maximum capacity used in renewable sources).

99 The activity in question may only be carried out after obtaining a special license or permit from the competent authorities.

100 The storage facility will supply the stored energy to the grid at a time determined by the National Electricity Regulatory Agency (ANEEL) and will receive credits with a correction factor applied as defined in the relevant regulations.

101 Entities engaged in electricity storage activities may also be authorized to sell accumulated electricity and provide other services to the electric power sector (e.g.

reinforcement of distribution systems and demand-side management, etc.).

102 ***China***

103 Energy storage is critical to China’s green transition, as the country needs an advanced, efficient and affordable energy storage system to meet the challenge of power generation.

104 Meanwhile, China also has one of the largest battery storage markets with a total capacity of about 70 GW with a market value of USD 1.2 billion in 2021, which is expected to increase to 170 GW with a market value of USD 6 billion by 2025 [25].

105 Despite the dynamic development of electricity storage systems, there is currently no specific legislation in China to regulate social relations in this area.

106 However, attention should be paid to strategic planning documents that support the participation of energy storage in end-user consumption.

107 On March 21, 2022, the National Development and Reform Commission (NDRC) and the National Energy Authority (NEA) jointly released the Implementation Plan for the Development of New Energy Storage Technologies during the 14^{th} Five-Year Plan [26] (14^{th} FYP for Energy Storage). The government response document aims to accelerate the development of independent battery storage to help balance the rapidly growing but intermittent generation capacity of wind turbines and solar panels.

108 The Plan sets several benchmarks for creating a broad ecosystem of public and private organizations to build the energy storage sector. It also emphasizes the role of market forces, including generation companies and independent service providers, in investing in storage projects.

109 In addition, the 14^{th} FYP for Energy Storage supports new technological breakthroughs and the commercialization of the storage industry. As a result of the Plan, more than 20 provinces have already announced plans to install more than 40 GW of energy storage in the past year.

110 The Plan also sets a clear target of reducing the unit cost of energy storage by 30 % by 2025, which will reduce the price from RMB 0.8 to RMB 1.0 (USD 0.12 to USD 0.15) per watt-hour.

111 As a result, the Plan paves the way for the market growth of energy storage systems and the large-scale deployment of energy storage systems in the power sector.

112 Since the organization of energy storage systems is seen as an integrated activity involving the use of various technologies and mechanisms, the 14^{th} FYP proposes to develop other technologies such as compressed air, hydrogen, battery, and thermal energy and aims at self-sufficiency. Measures are established to support all types of battery energy storage systems, including sodium-ion, new lithium-ion, lead-carbon, and redox systems, among others.

113 In addition, according to the Guidance on the Promotion of Energy Storage Technology and Industry Development, the development of energy storage in China will

be accelerated in the next five years [27].

114 Energy storage technology is an investment-worthy industry in the energy sector, so according to the current Catalogue for the Guidance of Foreign Investment Industries [28], the area under study is particularly encouraged for foreign investment.

115 Conclusion

116 In the modern era, electricity storage system technologies represent an advanced and relevant sector of development in the energy and economic industries. Playing an important role in the global "energy transition", this field is worthy of scientific and investment attention, including the development of related technologies. In general, energy storage refers to a process or device that captures generated energy for later use to reduce the imbalance between energy demand and energy generation. This is by far the most important benefit of these systems.

117 Considering the perspective areas of development and implementation of electricity storage systems in the fuel and energy sector, some countries have developed program documents and updated the current special legislation.

118 The Russian Federation is not an exception. A number of strategic planning documents, including the investment component of the development of this energy sector, have been developed with electricity storage systems in mind. However, the current Russian legislation (within the framework of special Federal Law No. 35-FZ On the Electric Power Industry dated March 26, 2003 and subordinate regulations) does not contain regulatory requirements for the considered activities.

119 In this regard, it is useful to study the current legal experience of foreign countries. Therefore, this article examined the current trends in the legal regulation of electricity storage in Germany, Italy, Brazil, and China. It should be noted that the selected countries represent different approaches and levels of legal regulation of the studied energy sector.

120 Strategic planning documents of all countries reflect the prospects and areas of development of electricity storage technology, including investment measures, as well as entities involved in this activity – state and commercial corporations.

121 The state legal regulation in Germany is quite advanced and detailed, as it is unified at the level of a special act — the Energy Industry Act (EnWG), which establishes the requirements for tender procedures for electricity storage systems and defines the powers of the state body in determining the legal status of this energy facility.

122 Another promising example is the legislative experience of Italy, where at the level of legal acts issued by the Regulatory Authority for Energy, Networks and Environment (ARERA), both the definitive framework of the field under study and the specifics of the legal regime of energy facilities are defined. The legislation also formalizes the requirements for the authorization procedures for the different types of electricity storage systems.

123 Although Brazil's current legislation does not include regulatory requirements for activities related to electricity storage, a draft law is currently under discussion to

guide further development in this energy area.

124 China, on the other hand, has a clear state regulation in terms of support for pilot projects of electricity storage systems, including as part of the construction and operation of energy facilities based on renewable energy sources.

125 The experience studied can be applied to improve the current Russian energy legislation to reduce barriers to the application of electricity storage systems and increase the efficiency of such systems for end consumers.

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Ekaterina M. Kologermanskaya
Legal Advisor of PromHim LLC, PromHim LLC
Russian Federation,

Abstract

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