THE FORMATION OF REGULATION SYSTEM AIMED TO DEVELOP MORE COMPLEX AND LESS CONVENTIONAL HYDROCARBON SOURCES

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Abstract. The paper considers problems of the formation and evolution of the institutional environment, which determines the direction of mineral resources development. It is noted that Russian approaches to justify and make decisions in the field of mineral resources development hardly consider the rapidly changing conditions of the functioning of the modern economy sector and go back to the features of the industrial economy. Strengthening of the economy role leads to the fact that the perception of rational strategies for exploration and development of mineral sources and fields significantly changes.

The most important aspects and features of the rules and procedures that determine the approaches to develop mineral resources in modern conditions include: increasing the role of knowledge, transition from the linear forms of interaction between participants in the process of prospecting and exploration of mineral resources to the network forms; alignment in time and within the framework of integrated technologies of previously disparate steps (these changes are largely due to the increase of volatility in the economy and the natural resources sector). Development of resource regimes in marked direction is associated with an increased degree of flexibility of the entire study system, regulating the use of the mineral resource potential of the country.

Keywords: resource regime, mineral resource potential, knowledge economy, irrecoverable losses, rational development

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Resource regime – composition, structure, direction of changes. The role of characteristics of assets and technologies

Natural resources sector is one of the leading sectors of the Russian economy (irrespective of how much and how often we talk and write about the need for innovation-directional development and the speedy overcoming of the so-called 'orientation on raw materials'). This sector includes economic activities related to prospecting, exploration, development, production, transportation and primary processing of a wide range of mineral resources – not just oil and gas, but also solid minerals (from precious metals to common building materials).

The institutional structure of a country, of a sector of the economy has significant differences, not only because of the historical and cultural features. Such factors are important as the structure of the economy (the ratio of manufacturing and primary industries, for example), as well as the specifics and peculiarities of its assets in the leading sectors. In Russia, for example, not just the natural specificity of the assets plays an important role, but their so-called system-specific features that substantially define its current status, and the range of possible conditions that may be achievable in the foreseeable future (Kryukov, 2014). In doing so, to the system-specific characteristics of the assets we include features that are determined not as mush by peculiarities of the technology (known phenomenon of assets idiosyncrasy, marked by O. Williamson and put by him in the basis of the analysis of interaction between economic entities), but by features of applying the technology in question in a particular socio-economic system (more precisely, its practical implementation).

Institutional structure that provides development of mineral resources, as well as their subsequent use and distribution of effects and benefits obtained, is defined as 'resource regime' (or just 'regime').

Review and analysis of resource regimes of development and usage of mineral resources (and the whole of natural resources) was largely due to the fact that the neoclassical paradigm could not explain the differences in the socio-economic impact from the development of very similar sources of mineral resources in different countries and in different situations. By

the early 1980s, a logical, consistent and analytically rigorous neoclassical theory of development and use of exhaustible resources has been formed (its synthesis is presented in papers (Dasgupta, Heal, 1974; Stiglitz, 1974)). A distinctive feature of the developed approach in its framework is the passive role of the government in carrying out the functions of the arbitrator and the guarantor of stable functioning of the private sector and the realization of entrepreneurial initiatives. The problem of social choice, associated with the development and utilization of mineral resources, in this case, is not considered and is not taken into account (especially environmental issues and, in general, environmentally sound development of natural resources). Also, it is implicitly assumed that the government is able to provide a selection of the best solutions from among all possible and available alternatives and development capabilities and the use of different types of natural resources.

Performing this role allows the government to ensure the country's optimal development and use of exhaustible natural resources. At the same time, of course, the social costs (externalities) shall not be accepted or considered. It is clear that the situation described above can be, rather, an exception and does not take into account not only the multiplicity of interests of parties involved in the development of natural resources, and that is especially distinctive for the current situation, the involvement in the development of new kinds of natural resources (related to the rapid development of technologies and the influence of the knowledge economy).

To a large extent the solution of social choice problems associated with the development and use of natural resources, corresponds to extending the neoclassical analysis by considering the interests of the different parties involved, as well as the forms and the scope of their cooperation in this process.

Forms and scope of cooperation constitute the institutional structure, which is defined in this case as a resource regime. Resource regimes may vary significantly and, in general, include:

a) the property rights that define access to resources;

b) a bundle of rules and procedures for determining (defining) transactions relating to the use of resources and the results of their development.

Variety of resource regimes leads to the fact that they, respectively, may also function very differently.

Social costs arise not only due to insufficient consideration of environmental factors, but because of such reasons as limitation at each moment of the best (by natural properties and economic characteristics) mineral raw materials, as well as due to exhaustion and therefore instability and socio-economic systems associated with them. Pioneering works in the field of resource regimes phenomenon are associated with the work of American researcher Oran Young (Young, 1981). The structure of resource conditions was first proposed and investigated by Young. In his opinion (with which the present author agrees), resource regime includes:

• rights (especially the right of ownership of natural resources – the most important element in the structure of the resource regime);

• rules – clearly defined guidelines or standards of actions of participants of natural resources development and utilization (their specific types in very different conditions, exploration and development);

• procedures – approaches to resolving ambiguity or conflict situations that arise in difficult conditions of practice.

It should be noted that features of various forms of property rights (including natural resources) were studied in detail, but this is not true for rules and procedures – about their correlation in a variety of countries and circumstances. Undoubtedly, the distinction between the rules and procedures lies in the detail presentation of development and use of subsoil plots, for example.

Rules – it is prescriptive guidance of certain requirements that are met with more or less clearly defined quantitative parameters of natural resources sources. At the same time procedures are focused on the search for compromise solutions (especially in solving problems of social choice) in poorly structured and unforeseen situations. The latter is especially important with an increase in the complexity and diversity of natural objects and problems of their development (that – see below – is a distinctive feature of modern processes).

In general, as noted in (Vatn, 2005, p. 252), three directions prevail in in the study of resource regimes. The first – the problem of access to natural resources; the focus is on distribution of natural resources sources. The second – formation of the costs of creation and the use of institutions that provide development and utilization of natural resources; emphasis is on the consideration of factors that determine the formation of transaction costs associated with it. The third – the effectiveness of various resource regimes; the emphasis is directed at issues of resource regime operation as well as on whose interests it represents, and the formation of which values it promotes.

There is no doubt that often there are situations in which the efficiency and rationality in the sense of a separate economic entity (or actor) can turn into its opposite by summing all individual effects and rational choices (this is what we are seeing in today's mineral resources sector in Russia) (Kryukov, 2006).

In addition to the fact that resource regime (as well as any institutional structure) is determined by historical, cultural and economic circumstances and conditions, a special role in its formation is played by two important circumstances (without diminishing the importance

of priorities of the government economic policy and relative prices):

1) the peculiarities of natural resource;

2) the specifics of the development of techniques and technologies in the field of development and its further use (Elster, 1983).

Previously, we noted this fact in a very general way. Namely, (Kryukov, 2006), "World experience shows that, with the acquisition of skills of application of certain rules and procedures in the field of oil and gas operations control, the latter are increasingly formed on the basis of not direct guidance, but compilation and distribution of 'best practices'. Thus, the institutional structure (or resource regime) evolves with not only changes in asset characteristics (especially in connection with the transition of resource-producing provinces in the stage of maturity due to the depletion of mineral resources), but also the accumulation of experience in the formation of stable 'specific knowledge organizations' (or 'routines' – by definition of R. Nelson and S. Winter[1])."

At the same time "the institutional environment in the oil and gas sector in Russia is characterized by not only lack of effective procedures aimed at solving the problem of public choice, but effective rules for the use of natural resources. However, there is a desire to unify approaches to conflict resolution, as well as the 'transition' of subsoil conditions management procedures into bureaucratic coordination" (Kryukov, 2006).

The behavior of any company in the mineral resources sector is largely determined by the balance between the rules and procedures governing the prospecting, exploration and development of raw materials and energy sources. At various stages of formation and development of the institutional structure in the field of subsurface composition and ratio of the role of rules and procedures differ considerably.

Thus, there are always two ways to overcome the increasing complexity of reclaimed natural objects (see below):

a) more detailed regulation of the rules defining the process of development and use of natural objects (in preparation of design solutions and their possible revision);

b) the formation and development of procedures for the formation of mutually acceptable solutions (from the point of view of the government – at the federal, regional and municipal levels, as well as various companies – resource users).

In Russia, in the present time regulation of the activities of subsoil users is based on the requirements set forth in the permits (or licenses) for subsoil use. Gradually a transition to enhance the role of design solutions takes place parallel to the complication of the rules of their development (due to changes in characteristics of natural objects) and, moreover, clarification. However, this approach has a very serious drawback: changes in raw material source operating conditions (including economic) require a revision of the entire development project.

But this is very long and expensive process. Thus, there is a significant increase in transaction costs arising from the use of such an institutional structure. The functioning of a complex institutional structure is associated with elevated costs – from the government and resource users. The feasibility of such changes depends on the added social and economic benefits that can get government-owner of natural resources.

At the same time, the implementation of more complex and flexible measures in the field of control and monitoring of development and exploitation of natural objects, despite the costs involved, makes it possible to take greater account of the diversity of natural resources, expanding the sources and conditions of their development. From this point of view, this approach is able to take greater account of the interests of the government-owner of the subsoil resources and to limit the possibility of opportunistic behavior of subsoil companies. However, this approach involves a significant decentralization of mutually agreeable solutions and requires highly skilled specialists in the field of natural resource management (which can competently and responsibly participate in the implementation of procedures for resolving ambiguous situations).

The above-mentioned conflicts – in general – are quite obvious. However, the scope of these approaches is not obvious: on the basis of dominance rules of direct (prescriptive) actions or procedures for resolving potentially conflicting and ambiguous situations.

Particularly urgent to seek solutions to the above-noted problem in today's oil and gas sector in Russia gives rapid change of perceptions about the sources of hydrocarbons, as well as those technologies which are connected with it. It seems to the author, this trend has not only 'nature of oil and gas' – the rapid change in the composition of sources of mineral resources production and used technical solutions is virtually ubiquitous in nature (for many types of solid minerals, energy resources and so forth).

'Shale revolution' – features and characteristics. Resource regime and the 'learning process'

The oil and gas sector of the United States is an illustration (more precisely, the proof) of the significant role of social institutions during the development and utilization of mineral resources. At the beginning of the

[1] «The general term for all normal and predictable patterns of behavior of companies, will be 'routine'» (Nelson, Winter, 2000, p. 31).

2000s, almost all, without exception, researchers and specialists characterized it as having a high degree of maturity for the development of the conventional resource base. This meant that the main large conventional hydrocarbon deposits were identified; new discoveries have smaller size of recoverable resources; extraction of raw materials and energy resources gradually (and at the same time steadily) decreases. This fact (with a high level of domestic oil and gas consumption in the country) induces to increase imports of oil and gas.

However, for a long time in the United States (as well as many other countries around the world – from Argentina to Russia included), there are significant hydrocarbon resources associated with different geological conditions of their bedding structures. Such structures, on the one hand, cover large areas; on the other hand, occurrence of hydrocarbons is highly localized. This characteristic means complete or partial absence of hydrocarbon flows on the so-called productive horizons in the process of exploration and development.

For the purposes of our further analysis it is important to mention the fact that the project of the development of this hydrocarbon production source (not field, but a small portion of the immense geological formation area) at the same time is significantly reduced in size. At the same time, each such local project has a very significant specificity. Ultimately, it is 'compressed' to the project of construction of a single well and the choice of its operation mode (including the creation of an artificial reservoir by fracturing).

Thus, there is a complex problem. On the one hand, there is the decline in production from conventional sources of raw materials (such as conventional fields), on the other – a huge resource potential of non-conventional sources of raw materials (in the case of the US – shale deposits). Feature of the development of alternative sources of raw materials – shale deposits (or so-called tar sands in Canada) – the inevitable increase in costs when using traditional approaches and solutions, based, inter alia, on the action and compliance with the rules of direct prescriptive action.

One of the ways to solve the problem is the improvement of technologies and the development of institutional structure that corresponds to changing conditions. US have taken fully advantage of such an approach (Kryukov, Grinets, 2015). A distinctive feature of the implemented approach is focus on the formation of procedures aimed at achieving mutually acceptable solutions in the implementation of projects for construction and operation of the individual wells. The result is well known: oil production in the US increased for 2005-2014 by almost 100 %, gas production for 2004-2014 increased by more than 40 % (US Field Oil Production of Crude Oil, 2016; US Natural Gas Production (Gross Withdrawal), 2016).

The most important feature is that at the rising variety of oil and gas sources from shale deposits (primarily due to the specific conditions of the environment) it is not possible and feasible to implement an approach based on strict prescriptive rules.

A significant feature of the created resource regime is that the producers of shale oil, unlike their competitors, take months, not years for the development of raw materials – "they can ruin any predictions: if prices jump to $50 per barrel, in six months we just face another problem" (Nevelskiy, Overchenko, 2016).

The combination of new technologies and the resource regime adequate to the changed conditions led not only to an increase in production volumes, but also to a decrease in the absolute values of raw material production costs.

The competitive environment, a flexible system of assessment and decision-making (in conjunction with a significant decentralization of these procedures) 'launched' an action of 'learning effect'. So, in 2003, US companies have only begun to combine the technology of horizontal drilling and hydraulic fracturing: Four Sevens Oil Company drilled on the field Barnett Shale its gas well, called Brumbaugh, the best in Texas. According Drillinginfo, for that purpose the company has used 10.6 million liters of liquid and 100 tons of sand. As a result, the peak value of gas production from the wells was 167.1 thousand cubic meters per day. However, already in 2013, Cabot Oil & Gas drilled the most productive gas well in the US, using four times more employees than Four Sevens Oil, 47.3 million liters of liquid and 6 thousand tons of sand. This enabled to produce 858 thousand cubic meters of gas per day, which is five times higher than the maximum level of production from well of Four Sevens Oil, made ten years earlier.

Currently, the method of horizontally branched wells, called 'octopus', is one of the most rapidly progressing technologies used in the US during the development of unconventional hydrocarbon deposits. According to American experts, this technology by eight times (!!!) improves drilling performance compared with conventional drilling technology (http://www.angelnexus.com/o/web/61109, 2014). This technology is an extension of the other technology, also established in our country – multi-well pad drilling. Not so long ago, as part of the development of shale hydrocarbons in the basin Paysens, company Encana has completed an impressive project on drilling on the same site of 52 wells. This site is less than 0.1 square miles. However, the technology has provided access to productive reservoirs in an area of full square mile.

It is important that while many previous successive jobs are combined – drilling of exploration wells combined with production drilling; exploration seismic

survey – with well logging; measures to improve oil recovery start at a very early stage and 'integrated' in the production technology. For example, in the US the number of seismic crews reached its peak in 1981 – 8172 parties, by 1999 their number decreased by more than seven times – 1125 parties, and in 2000 the value was reduced to unobtrusive value – 63 parties. At the same time the number of drilling rigs decreased from 3970 units in 1981 to 1862 units in 2014 (United States Petroleum Statistics, 2014).

Launched 'learning effect' has such a significant 'safety margin' that, for example, the Ministry of Energy of the Russian Federation is compelled to state that "... In spite of the decrease in the number of drilling rigs by about 70% compared with 2015, according to Baker Hughes, shale oil production drops in much smoother pace. This demonstrates the inelastic supply of shale oil: the decline in oil prices has not led to a similar decrease in production. Companies extracting shale oil now optimize processes, achieve lower costs for oilfield services and reduce staff, providing a break-even point at a lower level – about 40 dollars per barrel, as well as solve financial problems by means of public offering and attracting capital stock (Tereshok, 2016)".

Seismic surveys are increasingly being integrated into the works performed in the process of drilling wells, which reflects the 'blurring' of the line between exploration and production wells. The main reason is the economic unreasonableness to carry out detailed purely geophysical and exploration surveys within the boundaries of quite well studied geological formation. On the other hand, the share of horizontal wells sharply increased (in the United States, taking into account the development of shale fields – 68 %), as well as productivity in drilling operations (more than five times over the past 10 years in terms of the depth of penetration per one drilling rig). It is assumed that the above-mentioned features are not unique to unconventional sources of raw materials in the US and Canada. In general, the nature and characteristics of the world's mineral and raw material base for many types of minerals undergo a similar change.

Such rapid changes would not have been possible within the scope of the resource regime based on the dominance of prescriptive rules.

Historical features of the development of oil and gas resources in Russia

The expediency of the strategic objectives, based on the growth of physical volumes of mineral deposits prepared for development, to a small extent consistent with modern concepts of efficient economy-oriented solutions to complex socio-economic and environmental problems. The distinctive feature of such a system is a focus on the use of prescriptive rules of direct action. It is based on 'industrial paradigm' of knowledge distribution, which is characterized by a linear unidirectional model of the innovation process with a gradual transition from basic to applied research, and then – to the implementation of the results into practice in the form of new products, processes and sequence of work stages.

At that, such an important task as increasing the flexibility of the entire oil industry functioning system (for a quick and effective response to changing conditions of exploration, prospecting and development of hydrocarbon fields) is not considered. Organization of the industry has been focused primarily on the search for solutions that provide a rapid return (usually in the short term). This involves regular transition from one new province to the other, identifying the major fields, the search for effective engineering solutions for commissioning of unique objects. Ultimately, this means a constant focus on economies of scale – to minimize cost per volume unit of extracted raw materials due to natural causes (in the application of technologies and approaches used for a long time).

Therefore, all of the interactions that are lined up in the Russian oil and gas sector and industries associated with them, were aimed primarily at improving, in modern parlance, manageability (handling with an emphasis on simplicity and transparency). Vertical hierarchical relationships were the main in this system – on the implementation of targets and their logistical support. This was manifested in all, not only in control, but also in the formation of technical and technological systems (from private technical solutions at device level to determination of the configuration of piping systems, well placement, measuring systems and scheduling) and in the accounting system (for example, classification of oil reserves was based on geological and technological principle – accuracy and validity of the definition of basic deposit parameters and all its characteristics).

All this was aimed at the implementation of the main tasks of central planning and control systems. The system worked very well in the case of large and unique objects and began to falter as soon as conditions of its operation changed (especially with regard to the size and extent of deposits depletion, as well as the strengthening of 'non-conventionalism' of involved raw materials).

Horizontal relations and interactions at the level of enterprises of different departments (for example, between the mining, geological, construction and transport companies) are practically absent. Ways to overcome the arising problems were in the development of 'missing' activities within an organization, or from the beginning of the 1980s, in the formation of 'supradepartmental' organizations (such as the Bureau of the USSR Cabinet on fuel and energy complex, the West Siberian interdepartmental territorial commission of the

State Planning Committee of the USSR, and others).

But unfortunately, winning the speed of development of deposits and timing of the high levels of production, we lost elsewhere: in the ultimate oil recovery, in operating costs for the production period, in the environment. For example, the widely used (and still used) waterflood technology: not clean water is pumped into the reservoir, but mineralized – more heavy and having high displacing properties. However, mineralization with displacing fluid leads to a drastic reduction in the service life of the equipment due to corrosion of the metal (especially quality of the metal, which was heading into the oil industry in the USSR). Therefore, costs of repair, replacement of equipment were increasing; the number of pipeline ruptures and spills of oil and corrosive liquid directly on the earth's surface were increasing.

Focus on fast terms of fields development and their commissioning not only led to complications in their development (redevelopment) in the future, but also to the fact that in the framework of universal management procedures we tended to universalize the rules for their exploration and development. One of the hottest topics of discussion in the oil industry of the USSR was, for example, the well spacing in justifying the technological scheme of development of conventional oil fields. Much effort and energy (and, in this regard, a lot of broken lives) was spent on the 'evidence' of the possibility of using the universal well spacing – the number of wells per area unit of the deposit.

The underlying reason lies not only in monopolizing the position of an organization in the system of study and development of design solutions, but also in simplicity and 'handling routine' process of functioning and development of the oil industry. It is easy to consider the investment, to control the development process, to evaluate the effectiveness of the criterion 'production/ costs'. However, in general, within the framework of the economic system, which was based on a rigid chain of command and was aimed at achieving the priorities that were largely determined on the non-economic basis, the desire for uniqueness and simplicity of production, decision-making and coordination was certainly dominant. The results of actions of this universal approach to the formation and use of prescribing rules to the deposits exploration and development is not difficult to predict: rising costs, steady decline in the degree of development of reserves.

The absence in the USSR and now in Russia of the so-called 'problem of unitization', when development projects of all areas are combined into a single design solution, is among the obvious advantages of the domestic design and arrangement system of the development of conventional deposits. Such problem did not exist in the system of centralized planning and control when connecting the owner of subsoil and subsoil user in one party. In this regard, for example, one of the leading specialists in the development of oil fields, professor V.N. Shchelkachev noted that there are "certain advantages of our domestic system, when each field owned by the government has been developed on a single plan" (Schelkachev, 2004).

To a large extent this was due not so much with the field development system, as with the absence in the planned system of the concept 'economic/ financial/ household risk'. Combining the efforts of several economic entities is necessary to reduce each individual risk and, thereby, increase investment attractiveness of the project. Understanding the practical impossibility of typical single-valued solutions for new unconventional sources of mineral resources, the difference in approaches to development in the case of objects that are at different stages of depletion, in different areas and developed in different time periods – all this with a certain difficulty steadily have worked its way in life.

The most important feature of the generated domestic model of exploration and development of oil and gas fields – is not so much the pursuit of universalization (which in itself is not so bad, but on the level of, for example, separate processing elements), as linear connection of all stages in a single chain. First, the transition is carried out from the identification of resources to the determination of reserves, followed by the dynamics of production, and then – justification for the field arrangement solutions; and only then calculation and evaluation of investment and performance. In this approach, all other circumstances seem less significant. These include the environment and conditions for the implementation of decisions, risk tolerance etc.

As indisputable result, in the oil and gas sector in view of the complexity of geological conditions, costs can have only one trend – a steady growth (we talk, of course, not about the absolute costs, but about specific ones). As noted in the December 2013 by analysts of the company "Finam", "Russian companies in the development of fields have traditionally been guided not by the expected return on investment, but production volumes. ... Companies are trying to apply new technologies to extend the life of oil fields. But it also leads to an increase in costs ... In addition, the oil production moves in Eastern Siberia and the North. But for this we need to build additional infrastructure. Infrastructure is built by "Transneft", which means that the tariffs for transportation of oil grow. ... Meanwhile, in the first three quarters of 2013 increased costs for oil production accelerated sharply. The average growth rate is 16.9 % compared to the average growth rate of 9.7 % over the last four years" (Analitiki: Dobycha nefti v Zapadnoy Sibiri …, 2016) (it should be noted that the devaluation of the ruble in 2014-2015 only mitigated this trend, but obviously did not suspend its effect).

Another estimate for the same period of time shows similar values: "Capital expenditures for the extraction in average rose faster than inflation (+ 15 % annually), which is explained by the increase in drilling depth and the rise in prices of services in drilling" (Arutyunyan et al., 2015).

In the planned economy, it was more or less clear and understandable: it was done by the government and at the government expense. In this economy, in which we are now, the answer is not obvious: the government has no money, and the business has their own ideas about efficiency. This presentation largely emerged as a response to poorly balanced and inefficient resource regime. It is characterized not so much by imbalance in rules and procedures for the development of subsoil, as the absence of many significant and important components. The most important of them is the lack of communication between production and reproduction of the resource base.

One of the reasons was that by the end of 1980 vast industrial and production potential had accumulated, especially in the form of discovered and previously introduced in the development of unique (with reserves of over 300 million tons) and large (with reserves of more than 30 million tons) fields. Until now, the role of the largest fields is very considerable: at the beginning of 2013 in the West Siberian petroleum basin more than 40 % of oil production was provided by 21 fields (from more than 770 explored within its limits). Therefore, the main motive of many companies for a long time – the intensification of production on previously entered and developed areas of mineral resources.

This explains why experts state that "... today, there is no actual clear criteria for field development, non-fulfillment of which is a violation of the project. During the so-called licensed amnesty, primary focus in the field of subsoil use regulation is transferred from the license on the development project. ... Rosprirodnadzor proposes to provide in the conditions of license agreements the possibility of adjusting production levels depending on the needs of the market" (Andrianov, 2015).

We do not intend to challenge the validity of such approaches, we note only that they can and should be considered as the basic units of formed system to ensure the best use of the oil and gas potential of the country. With the exhaustion of reserves in conventional fields and changing production conditions it makes little sense to follow once established design solutions. It is better to clarify and detail the major decisions in the monitoring mode (e.g., with yearly pace) based on wider application of agreed procedures for mutually acceptable solutions (many similar procedures have been developed in the world, including in view of the anti-corruption component).

The main strength of the established and still used resource regime lies in its focus on the exploration and the transmission for development of all new sources of mineral raw materials of conventional type. They include such occurrences and deposits of minerals in new areas and in areas of long-term development. At the same time, a distinctive feature of the current stage of the mineral resource potential development of Russia is a sharp decrease in development opportunities by engaging in exploration and development of previously discovered major (or relatively large) conventional fields of most minerals.

Among these are objects that are characterized by the presence of 'good' reservoir properties (in the case of deposits of hydrocarbons) and local structures, the presence of a significant content of minerals in volume unit, a relatively small depth of occurrence, a small distance from the created infrastructure objects, etc. All of these characteristics for most species and types of mineral raw materials today, unfortunately, turned out to be 'in the past'.

There is a certain contradiction between the significant mineral potential of the country and the growing complexity and heterogeneity of its composition. Resolution for the contradiction is seen not only in strengthening and intensification of geological study and exploration of new conventional fields, but also in the formation of a consistent resource regime that is adequate to the changed conditions.

Ways and directions. The processes of formation and changes of rules, regulations and procedures in the conditions of transformed economy

The solution for this situation is seen in the formation of conditions and environment that would stimulate reduction (firstly pace, and then the absolute values) of costs for the development of these sources of minerals. One of the main factors is other sequence and other time frames for the various phases (steps) of exploration and development of mineral projects.

What are the characteristics of interaction of design process of field development and its actual development in the present conditions? It is obvious that the project is constantly lagging behind reality. At the same time, once and for all the following of approved project leads to a significant deviation from its actual parameters (indexes). This, for example, leads to many misunderstandings and problems in the relations between subsoil users and the government (the shortfall of production or above-standard extractions are not welcomed equally and even punished). Constant revision and reassertion of the project is expensive and in many cases simply unreal. It is no coincidence therefore that leading experts in the field of exploration and development of oil and gas resources have noted that "the development of non-

conventional, hard-to-recover oil and gas reserves using traditional methods and technologies is not rational. It is necessary to find and use innovative ideas, methods, technologies...” (Zakirov et al., 2016).

The solution is seen in the formation of flexible procedures for cooperation between the government and subsoil users. For example, there is a need for approval of not detailed project, but conceptual scheme for the object development and design that contains not only hydrocarbons, but also other minerals. Not the approval of reserves, but resource potential assessment – on the basis of ‘best practices’ and based on the interest of the investor in return of their invested funds. In the future with a certain periodicity – its clarification in a dialogue form rather than control over execution of rules of direct action.

Russia needs not only efficient (especially with ecological products) use of mineral resources, but, above all, oriented on the growth of social and economic return on the huge resource potential, which the country possesses. The latter involves the development of high technology and competitive industry for the production of machinery and equipment for the mineral resource sector, as well as the implementation of systemic effects in the processing and use of extracted minerals in the country. The costs at all stages of development of mineral resources and the qualitative characteristics of the equipment produced and manufactured products are of paramount importance.

Resolution for contradictions noted above is seen in the work on the three areas (Donskoy, Kryukov, 2014):

First. There is a need in adequate resource regime of the development of fields and natural objects previously granted for the use. This requires economic incentives, clear and consistent rules and operation procedures. Issues of the reasonable ratio of prescriptive rules and procedures for handling non-standard situations are among the priorities.

Second. There is a need to intensify work on the study, exploration and prospecting (primarily due to the financing of exploration by private sources) in conventional and new areas of production (including the Arctic, Eastern Siberia and the Far East, offshore and inland waters). The tool for this is in targeted economic incentives for geological exploration, reduction of administrative barriers in the provision of subsoil use, development of junior business.

Third. There is a necessity for new adequate resource regime of development of ‘poor’, ‘difficult’, ‘heavy’ deposits – low-margin, hard-to-recover resources (in the case of oil – low permeability and oil recovery).

The difficulty, however, is as follows. The current system of regulation, recorded, for example in the Law of the Russian Federation “On Subsoil”, is good for the development of promising sites and fields at the expense of exploration and survey- assessment work, financed by the government. But it works inefficiently when exploration and evaluation is necessary for: a) conventional fields with a significant depletion of reserves; b) new objects different from the conventional fields.

The first case is fields that are in a long-term development. They are characterized by an increasing localization – fragmented into separate sections of subsoil. This causes the change and redesign of the entire exploration and development system, causing a steady increase in costs. The second case is non-conventional objects (subsoil areas). Both options lead to a faster growth of costs for new or additional knowledge to develop or start development of subsoil areas. As a result, they can become economically inefficient even in the provision of benefits and preferences from among the now possible.

The solution is seen in promoting cost savings during the development of such fields. Scientific and technical progress and the competitive environment in all stages of development and mining provide it. Technological progress does not provide a return without a competition. This is evidenced by the Russian experience of tax privileges and preferences without changing the subsoil use regulation. It provides short-term effect, without creating conditions for increasing the contribution to the total production of new and non-conventional sources of raw materials.

To realize the potential of unconventional hydrocarbon sources there is a need for different configuration of the resource regime – from the property rights for the subsoil to the distribution of potential effects. For the formation of innovation-oriented and competitive environment in this area it is necessary to radically simplify the licensing and technical rules and procedures. It is advisable to issue licenses for the production of hydrocarbons in such areas on the basis of the application of the person concerned, without bidding and collection of a single payment for the use of mineral resources, in the boundaries stated by subsoil user.

Controller functions in this case are to quickly verify that the claimed area is not imposed on the territory of wildlife sanctuary and the defense lands, and is not subject to other restrictions. If everything is in order, a license is promptly issued, substantially free of the obligations related to geological exploration. They are not necessary, since the main geological risks have paid off: the absence/presence of minerals is already defined. The licensing will be given to subsoil areas that are confined not to supposed prospective structures, but to individual areas, sufficient for the implementation of modern technological solutions. The only license obligation is to start trial operation or pilot working out within 4-5 years. If during this time they could not work

out the possible exploitation of the technology, the area may be transferred to another interested party.

In this system there is no need to insist on the approval of the reserves prior to their exploration and development, to coordinate design decisions with the government. If we are talking about the development of new technologies and approaches, project solutions agreement process on the basis of prescriptive rules, focused on the development of conventional deposits, is more than an obstacle. The only document required for the subsoil user, can be the project of land construction of the license area (the subject of urban planning expertise of the land part and environmental impact assessment).

The main emphasis is expedient to make to the environmental conditions of the commercial buildings construction (such as the requirements for hydraulic fracturing and horizontal drilling conditions), on the regularity of reports for the carried operations, unification of measurement conditions and reporting. A crucial role in the development of these fields is given to a security of transport and pipeline infrastructure, the presence of contractors with modern technologies and management skills. For new players ('technological juniors') it is advisable to ensure access to the refining capacities of vertically integrated oil companies. Otherwise, 'the innovative oil' will be processed in a 'samovar' way (illegally?). Also, access of innovative companies to sources of debt financing plays an important role.

The participants of the development of new and depleted objects have to include only the national oil companies, but especially small and medium-sized companies with the knowledge, experience and desire to work with such objects. Global fuel and energy complex has been developing dynamically due to a flexible and dynamic balance between the power of giants and flexibility of small and medium-sized innovators (in the countries involved in the active development of non-conventional reserves, more than 60 % of oil production is provided by such companies; 'shale revolution' – is largely the result of their active efforts).

Current knowledge and innovations in the mineral resource sector (which 'set' its modern trend), as a rule, have a different nature of origin, distribution and commercialization, which significantly differs from the industrial system. Influence of environment affects on the fact that traditional 'linear model' of involving all without exception natural resources is replaced by more complex 'network structure'. Its distinguishing feature is the presence of constant 'returns' in the 'linear model' to the early stages or, vice versa, 'running too far' ahead, bypassing some of the following stages. These circumstances form the different ideas about appropriate temporal sequence of the various stages of the study, exploration and development of objects containing minerals. Based on these representations it is appropriate to consider questions of the relation of prescriptive rules and procedures aimed at finding mutually acceptable solutions in each case.

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