Valuable Geology

VALUABLE GEOLOGY

is the first company ever to make oil & gas prospecting work practically free from financial risk

it provides tools to form E&A Programs (portfolios of O&G prospecting projects), the financial failure of which is practically impossible

it unveils a new era of colossal business opportunities and new rates of subsoil survey, research and development

With Valuable Geology's products you will be able to:

- **conduct a geological exploration without financial risks**
  (the probabilities of making a profit are 99.000 – 99.999% and above)
- **win auctions for the most attractive subsoil blocks**
- **implement the most challenging and ambitious E&A and technological ideas without the threat of financial losses**
- **solve the reserves increment task with a guarantee**
  (the probability of achieving a given reserve increment is 95,000–99,999% and higher)
- **convert an exploration into the globally best investment option**
  (which is as reliable as US Treasury bonds but with its profitability amounting not to a number of percent but to hundreds and thousands of percent)

Key points

A revolutionary breakthrough has taken place in E&A risk management practice

The impression of extremely high risks related to E&A works, which is created by present-day probabilistic E&A risk management methods, is, in many cases, erroneous. Actual financial risks of scheduled E&A operations, which are assessed, not as individual project risks, but as risks of a developed E&A Program (oil and gas prospecting projects portfolio), are radically lower and can practically tend towards zero. In reality, major and medium companies would currently be able to elaborate E&A Programs with probabilities of a complete return on investments and profit-making at 99.000–99.999% and above, while expected profitability can amount to hundreds and even thousands of percent. But companies may not even be aware of the high financial reliability and the high expected profitability of elaborated E&A Programs that they feasibly achieve, since, due to the hypothetical nature of modern risk management, they are forced to assess the financial risks of planned E&A works as financial risks of each individual project.

It is the first time in the oil and gas industry that we have managed to solve the problem of the hypothetical (assumptive, unsubstantiated) nature of E&A risk management practices – the uncertainty of specific management results those, due to the imperfections of the applied management algorithm, can eventually turn out to be unacceptable.

The solution of the problem related to the hypothetical nature of present-day probabilistic E&A risk management makes it possible for real work practices to bring down the overall financial failure probability of a developed E&A Program so close to zero that occurrence of a financial failure event can be deemed to be practically impossible (1.000–0.001% or lower), while specific numerically quantified evidence of such a probability decreases.

The scale of new opportunities gained by the business and industry as a result of solving the issue of the hypothetical nature of present-day probabilistic E&A risk management is so huge than it is hard to capture at first glance. Possession of Valuable Geology products grants business opportunities which are as huge as those provided by a perfect E&A team (i.e. an exploration team with oil and gas prospecting projects being always a success). The only difference lies in the fact that in the case of a perfect exploration team, as an investment unit shall be deemed an individual oil and gas prospecting project, while in the case of Valuable Geology products, as an investment unit shall be regarded a single financially Risk-Free E&A Program which can now be formed thanks to our software products.

The possibility of confirmed achieving a financially, practically risk-free status of E&A operations, provided by Valuable Geology, makes a revolution in the oil and gas industry, unveils a new era of the industry development where pre-revolutionary oil and gas business tools and practices are no longer capable of providing companies with competitive power sufficient for stable existence and sustainable development. Making the E&A segment free from the threat of huge financial losses fundamentally changes the principles of competition and business in the oil and gas industry, introduces new tools and practices of competition and profit-making with their efficiency being so high that pre-revolutionary companies could never compete against them. The first companies to switch to real, non-hypothetical E&A risk management will have unprecedented opportunities to gain regional or global leadership and create a quantum leap in the efficiency of all business segments of the oil and gas industry, which is going to be insuperable for competitors.

The task of probabilistic E&A risk management is to bring the probability of financial failure of scheduled E&A works down to zero

The history of the oil-and-gas industry flourishing development for a century and a half demonstrates that, on a large number of projects, oil and gas field prospecting works are not only free from financial risks but also deliver extremely high profits – when implementing large numbers of oil and gas prospecting projects, successful projects pay back all costs, including costs related to implementation of projects that turn out a failure, and ultimately deliver a huge profit. We can witness this, not only across the industry in general, or a specific country, but also across individual major – and even medium companies – on the scale of several or even one ten delivered oil and gas prospecting projects.

The task of probabilistic E&A risk management is the determination of the quantity and the relevant economic and probabilistic characteristics of oil and gas prospecting projects planned for implementation, which would bring the probability of overall financial failure of the scheduled E&A works (E&A Program) so close to zero that occurrence of a financial failure event can be deemed to be practically impossible. In other words, probabilistic E&A risk management determines how many and what specific projects need to be implemented so that it is practically guaranteed (with a probability very close to 1) that successful projects will recoup absolutely all costs and deliver the minimum desired, or even greater, profit.

The task of probabilistic E&A risk management can be quite accurately described by the following metaphor.

Let's say we have the opportunity to choose any number of 30 different coins to toss. We must pay different amounts for the right to toss each coin. For example, to toss coin A we will have to pay $10, to toss coin B we will have to pay $5, to toss coin C we will have to pay $8, etc. For each “head”, we will receive some kind of winnings, different for each coin. For example, if coin A lands on heads, we will get $23, if coin B lands on heads, we will get $17, if coin C on lands heads, we will get $20, etc. If a coin lands on tails, we will not receive anything for it. Our task is to make such a choice of coins that the probability of total winnings from tossing the coins we have chosen is not lower than the level we set, for example, not lower than 99% or, which is the same, so that the probability of the total loss (probability of overall financial failure) from tossing the coins we have chosen is less than 1%.

A simple selection of the most profitable coins, without calculating the probabilities of the total win, does not guarantee a solution to the problem - it does not guarantee the achievement of a 99% probability of total winning - it leaves open questions about both the required quantity and the nomenclature of the selected coins. The real task of managing exploration risk is further complicated by the fact that, unlike coins, exploration projects typically have different values of success probabilities. In addition, in real practice, there are usually restrictions on the company’s budget, time, scientific and production capacity, etc.

All present-day probabilistic E&A risk management is hypothetical in its nature

A valid solution of the E&A risk management task has long been unachievable as it requires a large number of computations. Therefore, all present-day methods applied to E&A risk management use the Law of Large Numbers (LLN) algorithm, which does not require similar levels of computations but at the same time does not guarantee the above task delivery.

As a result of using the LLN algorithm, all present-day probabilistic E&A risk management practices are characterized by their hypothetical, assumptive, unsubstantiated nature. Due to a lack of relevant mathematical framework and computation capacity, LLN-based risk management results (specific value of probability of overall financial failure of the formed E&A Program) remain unknown. Due to the fundamental inconsistency of the LLN algorithm with the industry specifics (actually elaborated E&A Programs in real operational practice cannot consist of hundreds or thousands of projects), the LLN-based risk management results can be unacceptable – the probabilities of such large financial losses, which remain unknown, can be too high.

The non-competitive use of the LLN algorithm is the reason for the hypothetical nature of absolutely all methods of present-day probabilistic E&A risk management.

Due to this hypothetical nature, all present-day methods suggest only an abstract "empowering teams and decision makers by risk assessment training and tools" or "determination of the true value of opportunities" or “better decisions with the power of predictability” etc., instead of providing specific risk management results, i.e. specific values of achieved reduction of the overall financial failure probability of an elaborated E&A Program. Present-day probabilistic E&A risk management is so generalized, abstract and assumptive in its nature that most explorationists and even certain specialists who actually carry out risk management activities are not aware of the fact that all present-day probabilistic E&A risk management practices are not aimed at reducing E&A risks. Project E&A risks remain the same and are merely assessed while absolutely all present-day risk management methods try to mitigate the financial risks of scheduled E&A operations on the basis of such E&A risk assessments.

The hypothetical nature of present-day probabilistic risk management creates a false impression of extremely high financial risks accompanying E&A operations

The probabilities of oil and gas prospecting projects exploration success normally vary in the range from 10 to 80 percent, while investments related to the acquisition of a subsoil block and E&A operations within one project may amount to tens, hundreds of millions and even a few billion USD.

The impossibility to know the specific results of all present-day probabilistic risk management practices (i.e. the impossibility to know the probability of the overall financial failure of an elaborated E&A Program) forces companies to assess the financial risks of planned E&A works, not as a risk of an E&A Program in general but as risks of individual projects. It means that companies arrive at extremely high estimates of planned E&A financial risks – risks of completely losing investments of dozens, hundreds of millions or billions of USD with a probability of 20–90%.

As we said earlier, the impression of extremely high risks related to E&A works, which is created by present-day methods, is erroneous. Actual financial risks of scheduled E&A operations, which are assessed not as individual project risks but as risks of a developed E&A Program, are radically lower and can practically tend towards zero. In reality, major and medium companies would be currently able to elaborate E&A Programs with probabilities of a complete return on investments and profit-making at 99.000–99.999% and above, while expected profitability can amount to hundreds and even thousands of percent. But companies may not even be aware of the high financial reliability and the high expected profitability of elaborated E&A Programs they feasibly achieve, since, due to the hypothetical nature of modern risk management, they are forced to assess the financial risks of planned E&A works as financial risks of each individual project.

The financially, practically risk-free nature of the oil and gas field prospecting works unveils a new era of the oil and gas industry

The advanced computation capacities and revolutionary computation methods created by Valuable Geology make it possible to actually bring down the overall financial failure probability of elaborated E&A Programs so close to zero that occurrence of a financial failure event can be deemed to be practically impossible (with the financial failure probability being 1.000–0.001% and below, while the complete return on all investments and profit-making probability being 99.000–99.999% and above). Thus, the solution suggested by Valuable Geology, with regard to the hypothetical risk management issue, is the first one in the industry to relieve the exploration segment from the financial loss hazard.

The DSS “ABVG” software developed by Valuable Geology provides all relevant quantified evidence of achieving a financially, practically risk-free status of planned E&A works – it makes it possible to determine the probabilities of getting any possible values of financial and non-financial indicators of E&A Programs, even those comprising a very large quantity of projects (dozens and hundreds of projects). The software does not only provide a company with confidence in achieving the target return on all investments in the E&A Program but also makes it sure it will discover specific hydrocarbons (HC) reserves volumes in the course of the E&A Program implementation – in other words, it makes it possible to form E&A Programs with practically certain delivery of reserves increment in volumes not lower than a certain pre-set level.

The opportunity to set the exploration segment free from financial losses, which is provided by Valuable Geology software products, and each time is supported by specific quantified evidence, opens a new era in the oil and gas industry, i.e. an era of formerly inaccessible colossal business opportunities, new rates of subsoil survey, research and development.

Possession of Valuable Geology products grants business opportunities which are as huge as those provided by a perfect E&A team (i.e. an exploration team with oil and gas prospecting projects being always a success). The only difference lies in the fact that in the case of a perfect exploration team, as an investment unit shall be deemed an individual oil and gas prospecting project, while in the case of Valuable Geology products, as an investment unit shall be regarded a single financially Risk-Free E&A Program which can now be formed thanks to our software products.

Valuable Geology products open up colossal business opportunities of the new era of the industry

Given the real, non-hypothetical E&A risk management practices provided by Valuable Geology, companies obtain colossal business opportunities which seemed unbelievable as recently as yesterday:

- a financially, practically risk-free status of E&A operations – actual and evidenced bringing of the planned E&A financial failure probability down to zero given any possible demand in computations encountered in real practice;
- ensuring ultra-high reliability and extremely high profitability of E&A investments at the same time (the probability of return on all investments and profit-making of 99.000–99.999% and above, actual profits of hundreds and even thousands of percent);
- short timeframes of complete return on investments and E&A profit delivery within 1–3 years;
- leadership and domination across all segments of the oil and gas industry, which results from the leading positions in the scope and unit costs of commissioned production reserves;
- leadership in the scope and unit costs of commissioned production reserves as a result of leading positions in the scale and economic efficiency of E&A works;
- leadership in the scale and economic efficiency of performed E&A works as a result of leading positions in terms of attractive project acquisition, development of E&A competencies, knowledge and technologies, as well as the scope, quality and relevancy of available E&A data, the ability to enhance the E&A operations scope without a threat of financial losses;
- leadership in terms of attractive project acquisition as a result of using such powerful management tools as the Risk-Free Value of an E&A Program, Focused RMSEE Delivery and Focused GSEE Delivery, and leadership in development of exploration competencies, knowledge and technologies, as well as the volume, quality and relevancy of available E&A information;
- leadership in development of E&A competencies, knowledge and technologies, as well as in the volume, quality and relevancy of available E&A information as a result of the ability to enhance the E&A operations scope without taking financial risks, and implement the most challenging and ambitious E&A ideas;
- colossal E&A prospects beyond the reach of other companies, which are provided by the powerful management tools, i.e. the Risk-Free Value of an E&A Program, Focused RMSEE Delivery and Focused GSEE Delivery;
- a powerful management tool known as the Risk-Free Value of an E&A Program;
- a powerful management tool known as the Focused RMSEE Delivery;
- a powerful management known as the Focused GSEE Delivery, etc.

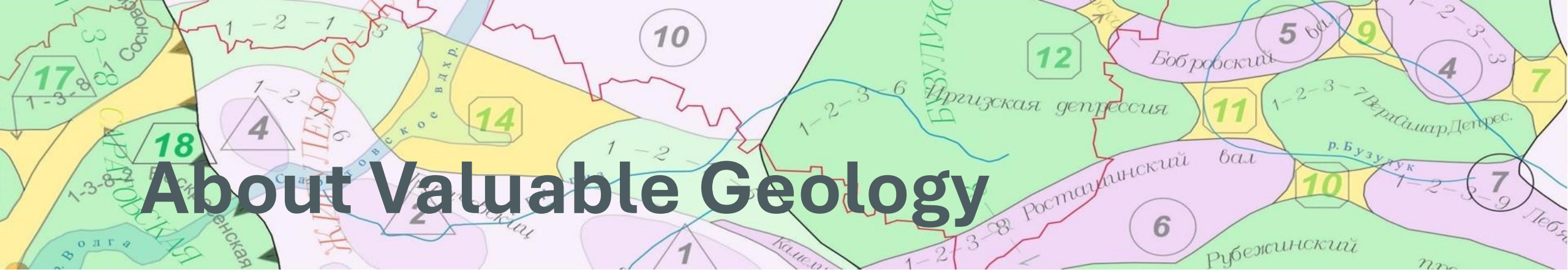
Possession of Valuable Geology products will become a must to sustain the companies' competitive positions

The possibility of achieving a financially, practically risk-free status of E&A operations makes a revolution in the oil and gas industry, unveils a new era of the industry development where pre-revolutionary oil and gas business tools and practices are no longer capable of providing companies with competitive power sufficient for stable existence and sustainable development. Making the E&A segment free from the threat of huge financial losses fundamentally changes the principles of competition and business in the oil and gas industry, introduces new tools and practices of competition and profit-making with their efficiency being so high that pre-revolutionary companies could never compete against them. The first companies to switch to real, non-hypothetical E&A risk management will have unprecedented opportunities to gain regional or

global leadership and create a quantum leap in the efficiency of all business segments of the oil and gas industry, which is going to be insuperable for competitors. The companies staying behind, in terms of transition from hypothetical to real E&A risk management, will face a cascading loss of competitive positioning across all integration segments, posing a threat to their existence. Possession of the Valuable Geology tools unveiling a new era of development within the industry is currently a must for oil and gas companies in order to keep competitive, stable positions and ensure sustainable development.

The Valuable Geology products will provide your companies with all the colossal business opportunities of the new era, as well as business tools capable of ensuring the utmost competitive positioning and flourishing prospects for many decades ahead.

Contents



About Valuable Geology

What we do

Valuable Geology is the first and still the only company with the capability to provide oil and gas customers with the possibility of achieving financially, practically risk-free E&A operations in any conditions encountered in real practice – the computation capacity of Valuable Geology software fully covers any demand in the computation scope potentially faced in real operations.

The Valuable Geology solution of the key problem of present-day probabilistic E&A risk management makes it possible to bring the threat of E&A financial losses down to zero, thus making a revolution in the oil and gas industry:

- fundamentally changing the competition and profit-making mechanisms;
- fundamentally expanding the development prospects;
- making it possible to reverse the long-term industry-wide trend of increasing marginal production unit costs;
- converting the oil and gas prospecting segment from an extremely financially highly risked and planned loss-making activity of oil and gas companies into an ultra-reliable and disproportionately highly profitable independent business stream.

The false impression of extremely high financial risks of E&A operations, for no objective reason, because of current hypothetical E&A risk management, was the key constraint of the industry development. Overcoming this, i.e. bringing the threat of E&A financial losses down to zero with valid evidence thereof, provides the oil and gas industry with unprecedented scientific and business opportunities, unveils a new era of evolution – the era of new rates of subsoil survey, research and development.

In the new era of the oil and gas industry development, pre-revolutionary oil and gas business tools and practices are no longer capable of providing companies with competitive power sufficient for stable existence and sustainable development.

Implementation of revolutionary VG business models suggested by Valuable Geology, which are based on application of VG revolutionary software and business products, provides customer companies with business opportunities which are, in principle, inaccessible for other companies and competitive advantages beyond the reach of other players, such as:

- financially, practically risk-free status of E&A works;
- guaranteed solution of the reserves increment task (increment volumes, HC phase state) and the task of reducing production unit costs (reserves quality enhancement task);
- instantaneous expansion of E&A prospects beyond the reach of other companies;
- advantages in terms of acquisition of attractive projects (subsoil blocks), which are beyond the reach of other companies;
- a most powerful tool of enhancing profitability of new plays prospecting projects, which is practically unattainable by other companies. *Note. A "play" means a family of inter-related fields, deposits or potential traps of hydrocarbons characterized by similar geologic history and common generation conditions of hydrocarbons, reservoirs and traps, and similar development parameters of the deposits, and similar economics*;
- a most powerful tool of enhancing the risk-free value and profitability of planned E&A operations, which is beyond the reach of other companies;
- advantages in justification and raising of investments, which are inaccessible for other companies, etc.

Thanks to the advantages, in terms of the use of new colossal business opportunities related to the new era of oil and gas industry development, revolutionary VG client companies are able to promptly gain leadership and domination positions across all industry business segments. Companies hesitating to transition to VG business models will face a consequential loss of competitive power across all integration segments, posing a threat to their existence, and can be ousted from the business.

Valuable Geology – the company whose unique theoretical, computation and business tools have made a revolution in E&A risk management – was founded by:

- Oleg Georgievich Brajnikov (Nov 17, 1940 – Nov 23, 2020).
- Artyom Olegovich Brajnikov.

Oleg G. Brajnikov – founder of Valuable Geology

All the unique theoretical and computation tools of Valuable Geology, which make it possible to carry out financially risk-free exploration, thus giving way to a new era in the oil and gas industry development, are based on six decades of an extremely successful operational track record and outstanding deliverables of intensive daily scientific and operational work, performed by Prof. Oleg Georgievich Brajnikov, Dr. Sci. in Geology and Mineralogy, till the very last day of his life (Nov 17, 1940 – Nov 23, 2020).

Prof. Brajnikov is one of the few contemporary scientists who combined a broad mental outlook and the deep scientific knowledge of an academic with his extensive experience of on-site operations. Oleg Georgievich chose to be present, in person, and supervise delivery of the most critical stages of drilling and geophysical operations. The following oil and gas fields in Kalmykia were discovered with his involvement and under his management: Severo-Kamyshanskoe; Krasno-Kamyshanskoe; Nadezhdinskoe; Dvoynoye; Vostochno-Kamyshanskoe; Yekaterininskoe; Komsomolskoe; Naryn-Khudukskoe; Tumannoe; Pologoe; Severo-Komsomolskoe; Shakhmetskoe; Mayli-Kharanskoe; Kurgannoe, etc. He is one of those who discovered the unique Astrakhanskoe gas condensate field (design, drilling and testing of well 1, Volozhkovskaya, with a gas gusher coming from under salt deposits, yielding a flow rate of 230 thou. m3 per day, including metering of condensate and acid components content). All prospecting and appraisal wells were tested under his personal supervision on site. Between 1980-1983, being the Chief Geologist of the Soviet Geologists Team in the Republic of Cuba, the Top Level Advisor to the Ministry of Basic Industry of Cuba, he deve-

loped a core sampling technology intended for an oil bath (el banõ de petroleo). The technology application increased the proven reserves threefold, which made it possible to enhance oil production up to a level fully covering the demand of the Republic of Cuba in the event of a military blockade.

Oleg Georgievich is the author of five monographs, one educational guide, over eighty handwritten reports, and over fifty articles in scientific journals.

Key results of his scientific work include development and practical geological implementation of:

- genetic classification of geological bodies for estimation of oil and gas bearing prospects (synthesis of the theory of formations by N.S. Shatsky, V.D. Nalivkin's theory about interrelations of nimias, servias, facies and lithotypes, and the system approach);
- comparative planetology method;
- methods of mapping local uplifts with rupture anomalies ("broken-plate method");
- palinspatic maps and profiles generation methods;
- palinspatic reconstruction of lithospheric blocks;
- methods of determination of hydrocarbons migration timing and field generation timeframes;
- methods of calculating the number of fields and their relations in terms of reserves size, which may hypothetically be discovered in various tectonic zones, within administrative areas and license blocks of companies;
- methods of comparative geological-and-economic estimation of oil and gas bearing prospects of various areas (co-author of the Methodological Guidelines for Quantitative and Economic Estimation of Oil, Gas and Condensate Resources in Russia. RF Ministry of Natural Resources. Moscow, 2000);
- algorithm of the Deposit software intended for express estimation of reserves in layer-arch structures and massive deposits; algorithm development for the Stratigraphic Screen software intended for estimation of reserves in stratigraphic screen traps, size of traps with minimal commercially viable reserves, determination of the first prospecting well location, etc.

Oleg Georgievich also had a number of research publications regarding the use of a system-based approach and comparative planetology method for handling such controversial issues as:

- energy sources of tectonic movements;
- antecedence of basaltic or granitic crust;
- paleo- and future-ecology;
- causes of extinction of fossil animal species;
- fluctuations in the global sea level;
- causes of the Earth magnetic field inversion;
- global calamities, logic of their occurrence, and the course of activities of human species;
- protoplanetary cloud formation and its further evolution hypothesis;
- hydrocarbon supercluster location patterns, etc.

Artyom O. Brajnikov – founder of Valuable Geology

Artyom O. Brajnikov is the author of all unique software algorithms which have made a revolution in probabilistic E&A risk management. The Valuable Geology revolutionary software products developed on the basis of such algorithms are the first ones to provide the oil and gas industry with real risk management instead of hypothetical approaches envisaged by the other present-day methods (assumptive, unsubstantiated, unable to provide guarantees or evidence of decreasing the financial failure probability of planned E&A works).

The DSS “ABVG” revolutionary software, based on algorithms developed by A.O. Brajnikov allows oil and gas companies to reduce planned E&A financial failure probability so close to zero that occurrence of an E&A financial failure can be deemed to be practically impossible, i.e. it provides the possibility to achieve a practical, financially risk-free status of performed exploration activities. It is the first time that companies can actually have the chance to carry out exploration activities without any concerns about financial losses – the revolutionary software is able to ensure financially, practically risk-free status of scheduled E&A and provides all relevant evidence of the results. Such software is able to ensure financially, practically risk-free status in any actual and commonly encountered conditions – the available computation capacity meets any potential demand of actual E&A planning and risk management in terms of required calculation scope.

A.O. Brajnikov is the author of revolutionary VG business models based on risk-free E&A principles, as well as all underlying unique theoretical, practical and software business tools supporting the use of VG business models.

A.O. Brajnikov graduated from the Bauman Moscow State Technical University and the State University of Management. He worked as Assistant to Deputy Chairman of the Economic Policy Committee under the State Duma of the RF Federal Assembly for Service in the State Duma (1999-2000), managed the Representative Office of Scientific Technological Company, Russian Inter-Branch Scientific-and-Technical Complex, Nefteotdacha, in the Pre-Caspian Region, managed Interneft – operator of joint oil and gas prospecting activities arranged by LUKOIL, Slavneft, SIDANCO (TNK-BP), VNK in the Pre-Caspian Depression and the near edge zone of the Pre-Caspian Depression.

He is the author of six monographs and about twenty articles in scientific journals.

He has made significant contribution to industry-specific economic theory, industry risk management practices, theory and practice of oil and gas prospecting operations in the industry. E.g., A.O. Brajnikov:

- has developed and implemented, at theoretical and practical levels, such important concepts and effective tools as:
  - Financially Risk-Free E&A Program;
  - Prospecting target of a prospecting project from the standpoint of the system-based approach to subsoil survey and exploration;
  - Tactical Set of Conditions for the Implementation of a Prospecting Project (TSC IPP);
  - Risk-Free Value of an E&A Program, etc.
- was the first one to identify, study and describe the economic effects which are critical for the theory and practice of oil and gas company and industry management, i.e.:
  - Geological System Economic Effect (GSEE)
  - Risk Management Scale Economic Effect (RMSEE);

- has created highly effective practical tools to enhance oil and gas prospecting projects and E&A Programs economic efficiency, improve companies' competitive power in terms of attractive projects acquisition, expand the prospects for resource base development for companies and the industry in general:
  - Focused GSEE delivery;
  - Focused RMSEE delivery;
  - Risk-Free E&A Program;
  - Risk handover tactics, etc.
- has created effective tools for analysis, forecasting and design of the industry development processes:
  - a model of development of petroleum-bearing systems (PBS);
  - a model of the global PBS development;
  - a mechanism for the formation and reproduction of favorable conditions for E&A under a conventional business model;
  - a conceptual model of subsoil usage, etc.

A.O. Brajnikov, in his publications, using both theoretical reasoning and practical data, was the first one to demonstrate the fundamental inefficiency and irreparable inconsistency with the industry specifics of risk management methods based on the LLN algorithm, the erroneous nature of the theoretical grounds of FSD Methods in E&A risk management, as well as describe and justify the causes of the all-round use of LLN and FSD Methods and dramatically negative consequences of their widespread practical application for the present-day oil and gas industry. The E&A risk management methods and tools developed by A.O. Brajnikov make it possible for companies and the industry to break free from the negative implications of LLN and FSD Methods, and provide conditions for the sweeping implementation of robust pre-requisites of colossal industry-wide economic growth.

The theoretical and practical tools developed by A.O. Brajnikov opened up incredible, unprecedented opportunities and development prospects **for explorationists**:

1. **The main obstacle to the rapid, intensive development of exploration science and technologies has been eliminated** – for the first time ever, the opportunity to free oil and gas prospecting work from the risk of financial losses is here.
2. For the first time, **explorationists have got the opportunity to fully realize their scientific and creative potential** – the opportunity to implement their boldest scientific and technological exploration ideas without financial risks and with guaranteed profit.
3. **Explorationists have been freed from the threat of unfair assessments of their work, knowledge and competencies**, which are often received by them in cases of exploration failures, i.e. in cases which, in fact, are:
   - a natural consequence of the industry specifics, of high geological exploration risks – of working in conditions of insufficient information, of a high degree of uncertainty of possible results;
   - a natural, almost inevitable part of the overall economic success of the full implementation of the formed financially risk-free E&A Program.
4. **Explorationists were given the opportunity to receive appropriate recognition** of their real significant contribution to the profits of oil and gas companies and the industry – the works of A.O. Brajnikov destroyed the embedded myths about the planned loss-making of exploration, its inability to generate profit, its inevitable high financial risk.
5. The works of A.O. Brajnikov gave enormous economic value to exploration information, knowledge competencies and scale. **The explorationists' knowledge and competencies**, the scale of exploration, exploration technologies and information **have dramatically increased their importance in the competitive struggle and have become tools for guaranteed, financially risk-free profits**.
6. With the tools developed by A.O. Brajnikov, **exploration acquires enormous investment attractiveness** - exploration becomes a more attractive business from the investment standpoint if compared to HC production. While characterized by a financially, practically risk-free status, it features a materially shorter return on investment timeframes and substantially greater profitability values than the production segment.

Industry management received new powerful tools from A.O. Brajnikov for increasing business profitability, gaining competitive advantages, enhancing manageability and expanding development prospects:

1. **Tools to guarantee a determined volume of incrementing HC reserves** as a result of the implementation of planned exploration work.
2. **Tools to guarantee the profitability of the exploration business segment.** From a financially high-risk, planned-loss segment of business activity for oil and gas companies, the exploration segment becomes an independent, extremely reliable and highly profitable type of business, capable of bringing in huge profits separately from the production segment.
3. **The most powerful tools, enabling competition and increasing profitability, unavailable to traditional companies**:
   - The Focused RMSEE Delivery tool, which provides unattainable competitiveness in acquiring attractive projects.
   - The Focused GSEE Delivery tool, which significantly increases the risk-free profitability and value of E&A Programs.
   - The Risk-Free Value of the E&A Program tool, which multiplies the economic efficiency of new plays prospecting projects, etc.
4. **Tools that provide a never-before-available high level of efficiency in managing** the work and development of the exploration segment. For the first time, industry management has at its disposal:
   - Objective criteria for assessing the physical and financial results of exploration work carried out, freed from its random nature, subjectivity and bias.
   - Practically reliable values of the predicted physical and financial indicators of planned exploration work (predicted values of indicators, obtaining actual indicators below which is practically impossible).

Shareholders, private, venture and institutional investors, thanks to the work of A.O. Brajnikov, **received one of the best investment options in the world** with the reliability of US Treasury bonds, but with a profitability of not a few, but hundreds of percent. The theoretical and practical tools developed by A.O. Brajnikov turn oil and gas exploration into an investment option with extremely attractive characteristics:

- colossal reliability, which is beyond the reach of the absolute majority of investment options (probability of complete return on investments is 0.99000–0.99999 and above);
- colossal expected profitability beyond the reach of investment options that are comparable in terms of reliability (hundreds of percent);
- colossal, risk-free profitability, beyond the reach of investment options comparable in terms of reliability (tens of percent). *Note. The Practical Risk-Free Profit is the lowest practically possible value of profit-making – getting a still lower value is practically impossible (the probability of getting a still lower value is very small – equal to the pre-set level of significance)*;
- short timeframes of complete return on investments and profit-making in full (1–3 years).

The works of A.O. Brajnikov opened a new era of development of the oil and gas industry, geological exploration sciences and technologies - an era of formerly inaccessible opportunities and new rates of subsoil survey, research and development. The industry, companies, specialists and managers received:

- Incredibly high motivation and unprecedented attractiveness of investments in the industry development - the opportunity to convert, without financial risks, the growth of the scale of exploration and the growth of exploration knowledge and competencies into profit growth and a cumulative increase in competitive advantages in all industry segments.
- A colossal expansion of the conventional hydrocarbon resources prospects - the works of A.O. Brajnikov made an incredibly large number of previously unattractive oil and gas prospecting projects attractive for implementation. A large-scale expansion of the prospects for the discovery of conventional high-quality hydrocarbon reserves additionally meets the needs of civilization for hydrocarbons for many decades to come, opening up new development prospects for the oil and gas industry and new areas of application of hydrocarbons.

History of Valuable Geology products

The key stages of the Valuable Geology revolutionary products development process are as follows:

2000 – intensive work on developing a theoretical framework of computation tools for achieving a practically, financially risk-free status of exploration works;

2009 – obtaining the first practical results of applying the developed theoretical principles of practically, financially risk-free E&A works delivery with quite simplified computations done almost “manually”,

as part of the research assigned by V.S. Chernomyrdin, Advisor to the President of the Russian Federation, within the framework of the Program devoted to the creation of a new major fuel and energy complex in the south of Russia;

2014 – availability for practical use of the first portion of fundamental algorithms implemented in special-purpose software, identifying a subset of Financially Risk-Free E&A Programs out of the variety of all feasible E&A Programs which can be formed on the basis of the entirety of oil and gas prospecting projects potentially available to the company;

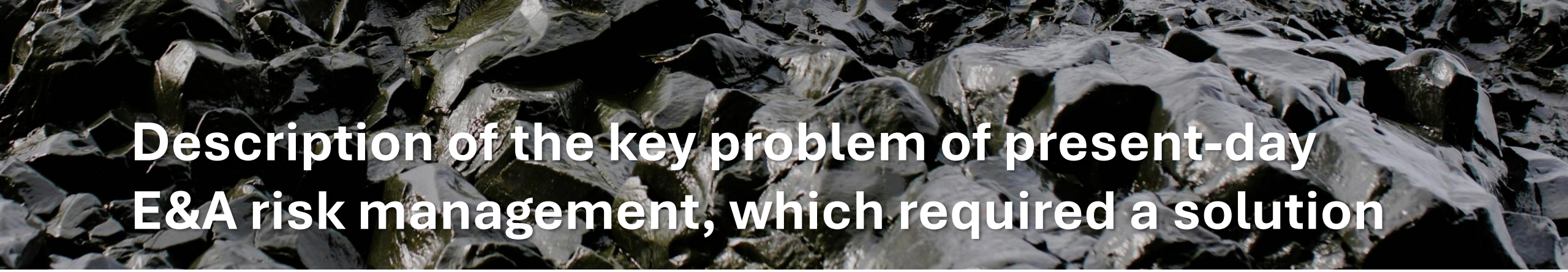
2019 – implementation, at a software level, of another, equally significant, range of algorithms converting the previously developed theoretical and computation tools into a product understandable by the target user and ready for commercial distribution;

2022 – availability of the Valuable Geology revolutionary products promotion strategy and finalization of the respective implementation support framework;

2024 – availability of relevant support means and launch of the Valuable Geology revolutionary products promotion strategy.

Mission of Valuable Geology

The Valuable Geology mission is to create tools for the setting and guaranteed solution of complex and most ambitious tasks related to cognition of the universe; cognition of the phenomenon of Life; the cognition, development and preservation of the environment.



Description of the key problem of present-day E&A risk management, which required a solution

The essence of the key problem of present-day probabilistic E&A risk management, which required a solution

All present-day probabilistic E&A risk management practices are aimed at bringing down to zero the probability of the overall financial failure of an E&A Program under development, i.e. bringing down to zero the probability of getting a negative total of financial success and failure events (profits and losses) of respective constituent oil and gas prospecting projects.

The history of the oil-and-gas industry flourishing development for a century and a half demonstrates that, on a large number of projects, oil and gas field prospecting works are not only free from financial risks but also deliver extremely high profits – when implementing large numbers of oil and gas prospecting projects, successful projects pay back all costs, including costs related to implementation of projects that turn out a failure, and ultimately deliver a huge profit. We can witness this, not only across the industry in general, or a specific country, but also across individual major – and even medium companies – on the scale of several or even one ten delivered oil and gas prospecting projects.

In real operational practices, when many projects are implemented, the probability of them all failing is tending to zero, and the proceeds generated by the minimum number of projects which succeed with a probability almost equal to 1, do not only cover all costs incurred by failing projects but also deliver colossal profits ensuring the flourishing existence of the civilization, industry and individual companies implementing a sufficiently high quantity of projects.

The task of present-day probabilistic E&A risk management is the elaboration of Financially Risk-Free E&A Programs, i.e. determination of the appropriate amount and economic and probabilistic characteristics of oil and gas prospecting projects planned for implementation, which will ensure the probability of the overall financial failure of planned E&A works (E&A Program) is brought so close to zero that occurrence of a financial failure event can be deemed to be practically impossible. In other words, the task of probabilistic E&A risk management is to determine how many and which specific projects need to be implemented so that it is practically guaranteed (with a probability very close to 1) that successful projects will offset all other costs and deliver the minimum desired, or even greater, profit.

The key problem of present-day E&A probabilistic risk management which requires a solution lies in the fact that it was only hypothetical (assumptive, unsubstantiated), and thus cannot guarantee solution of the risk management task. It means that:

1. It is unable to formulate requirements as to the quantity and characteristics of projects planned for implementation, which would be sufficient for the target delivery. It remains unknown how many and which specific projects should be implemented to achieve practically, financially risk-free status of planned E&A works, to ensure the actual impossibility of loss-making and practically guaranteed delivery of intended profit.
2. In conditions commonly encountered in actual practice, the observance of the present-day probabilistic E&A risk management recommendations leads to unacceptable management results – the probability of obtaining unacceptably high financial losses is too great.
3. The actual management results remain unknown – it is impossible to check the acceptability or unacceptability of the delivered management results.
4. As a result of the observance of recommendations of present-day E&A risk management, the probability of the overall financial failure of scheduled E&A works can increase.

Reasons for the hypothetical nature of present-day probabilistic E&A risk management

As has been mentioned above, the task of probabilistic E&A risk management lies in bringing the probability of the overall financial failure of the elaborated E&A Program so close to zero that occurrence of a failure event could be deemed to be practically impossible.

A valid solution of the E&A risk management task has long been unachievable as it requires a large number of computations. Therefore, all present-day methods applied to E&A risk management use the Law of Large Numbers (LLN) algorithm, which does not require similar levels of computations but at the same time:

- does not guarantee solution of the risk management task;
- does not guarantee reduction of the overall financial failure probability of planned E&A works;
- does not provide specific and quantified management results.

The mathematical framework of reasons for the hypothetical nature of E&A risk management practices based on the LLN algorithm is reviewed in detail in publications [1, 2], which can be found at our website valgeology.com in the “Library” section.

The only recommendation given by present-day E&A risk management practices, based on the LLN algorithm, is the positive Expected Net Present Value (ENPV) of projects planned for implementation ($ENPV_{project\ i} > 0$). As a result of the LLN algorithm incompliance with the industry specifics (actual impossibility for the companies to form E&A Programs comprising hundreds, thousands and more projects; huge scale and high variances of project costs) marginal observance of the only LLN algorithm recommendation (selection of projects with positive ENPV close to zero) guarantees absolutely unacceptable risk management results, i.e. excessively high probabilities of significant financial losses.

Due to the lack of an appropriate computation framework, non-marginal requirements to project ENPVs, which guarantee acceptable risk management results (to what extent the project ENPV should be above zero), remain unknown.

Due to the lack of an appropriate computation framework, the results of LLN-based risk management also remain unknown, i.e. it is impossible to check whether the obtained performance is adequate or not.

The lack of alternatives for the LLN algorithm results in the hypothetical nature of all methods of present-day probabilistic E&A risk management.

The hypothetical nature of present-day E&A risk management includes the following components:

1. Unknown results of risk management;

2. Marginal observance of the only recommendation ($ENPV_{project\ i} \approx 0$) guarantees delivery of unacceptable risk management results;
3. Non-marginal requirements to project ENPVs, which would guarantee acceptable risk management results, are unknown;
4. Conditions triggering unacceptable results are quite often experienced in common practice;
5. A lack of guarantees of obtaining acceptable results;
6. A lack of control over obtaining acceptable results;
7. Sweeping reduction of possibilities to get acceptable management results accompanied by the increasing level of exploration maturity of the global petroleum-bearing system.

The LLN algorithm practice has become obsolete. Development of appropriate computation methods and increase of the computation capacity have given way to formerly inaccessible opportunities which make it possible to actually handle the E&A risk management task in any conditions encountered in real practice – the computation threshold provided by the Valuable Geology revolutionary software bridges all potential demand in terms of calculations faced by the actual E&A planning practice.

Consequences of the hypothetical nature of present-day E&A risk management for companies and the industry

The hypothetical nature of present-day E&A risk management, without justification by actual circumstances and E&A prospects:

The hypothetical nature of present-day risk management creates an unreasonable impression of extremely high financial E&A risks, which does not correspond to reality

Probabilistic risk management methods do not work if applied to a single project but should only be applied to E&A Programs, i.e. certain sets (portfolios) of oil and gas prospecting projects scheduled for implementation. It means that probabilistic management deliverables can only be represented by economic and probabilistic characteristics of elaborated E&A Programs.

Probabilities of oil and gas prospecting projects exploration success normally vary in the range 10% – 80%. Therefore, the values of the probability of oil and gas prospecting projects exploration failure events normally vary within the range 20% – 90%. Investments in subsoil block acquisition and E&A operations of a single project may amount to tens, hundreds of millions, or billions of USD.

Uncertainty of specific results of all methods of present-day probabilistic risk management (uncertainty of the overall financial failure probability of the elaborated E&A Program) forces companies to assess financial risks of scheduled E&A works not as risks of an E&A Program but as risks of each individual project. It means that companies assess the financial risks of planned E&A works as being extremely high – the probabilities of a complete loss of investments amounting to tens, hundreds of millions, or billions of USD within the range 20% – 90%.

The impression of extremely high financial risks of E&A works as created by present-day methods is an erroneous one. The actual financial risks of planned E&A activities, which are assessed, not as individual project risks but as risks of an elaborated E&A Program in general, are radically lower and can practically tend towards zero.

Major companies typically implement several dozen oil and gas prospecting projects every year. Medium companies typically implement several dozen projects over several years.

Let us consider the following example of a company implementing 20 projects:

- The probability of an E&A success event of every such project is estimated by the company as p=30%. Investments in implementation of the prospecting stage of every such project amount to 50 mln USD.
- The hypothetical nature of present-day probabilistic E&A risk management forces the company to assess the financial risks of planned exploration separately for each project out of the 20. This implies risks of the complete loss of 50 mln USD with a probability of 70% in each of the 20 cases , which may amount to 1 bln USD in total.
- In actual practice, in case of implementation of all 20 projects, the probability of completely losing all investments is not the "unacceptably high 70%" in each specific case out of the 20 cases but is a vanishingly small (0.70)20=0.08% (the probability of the fact that all 20 projects are failures). In addition, about 6 projects will most likely be successful, and given the rather high forecast projects economics, the probability of not only getting a complete return on all investments amounting to 1 bln USD but also obtaining a high profit – not lower than the target value, will be almost equal to 100%, i.e. it will exceed 99.92%. In cases of projects' success probabilities higher than p=30%, the probability of overall financial success of planned exploration activities can be even higher and can be achieved with a smaller number of projects.

The practice of the Valuable Geology software application demonstrates that major and medium companies can come up with E&A Programs which possess the following economic and probabilistic characteristics:

- the probabilities of complete loss of investments amounting to thousandths (10–3), millionths (10–6), billionths (10–9) and lower fractions of a percent;
- probabilities of return on all investments and profit-making amounting to 99.000–99.999% and above;
- expected profitability amounting to hundreds and even thousands percent;
- risk-free P99 profitability amounting to many tens of percent. *Note. Practically Risk-Free Profit is the lowest practically possible value of profit-making – acquiring a still lower value is practically impossible (the probability of getting a still lower value is very small – equal to the pre-set level of significance of 5–1% or below. For P99, the level of significance is 1%)*;
- risk-free P95 profitability, amounting to many tens and hundreds percent. *Note. For P95, the pre-set level of significance is 5%*.

It means that the hypothetical nature of present-day risk management unreasonably creates a false impression of extremely high E&A financial risks:

- probabilities of complete loss of investments up to 90% instead of the actual 0.001% and below;

- probabilities of a complete return on investments and profit-making from 10% – 80% instead of the actual 99.000–99.999% and above.

Thus, due to the uncertainty of present-day E&A risk management results, companies assess the financial risks of planned E&A works not as risks of an E&A Program on the whole but as risks of each individual project. Therefore, the hypothetical nature of present-day risk management does not make it possible for companies to objectively assess the very high potential attractiveness of E&A investments, and creates a false impression of extremely high financial risks.

The hypothetical nature of present-day risk management does not make it possible to objectively assess explorationists' performance

In the context of present-day E&A risk management, assessment of exploration team performance is biased.

In order to make objective assessment of exploration team performance, it would be necessary to make sure that financial or operational (physical) performance of E&A works can be non-random. In other words, their statistical significance should be assured by risk management results, i.e. the resulting probability of the E&A Program financial or operational (physical) failure event should be brought down to the pre-set level of significance, or below such level, as a result of risk management efforts. *Note. The level of significance means a relatively low probability of an event at which (in the given task), the event occurrence can be deemed to be practically impossible.*

In the context of present-day risk management, it turns out to be impossible to confirm the non-random nature of a success event or failure event resulting from conducted E&A works because the probabilities of financial or operational failure of developed E&A Programs (risk management results) remain unknown and can, therewith, be a lot higher than acceptable levels of significance (5–1% and below).

The random nature of actually obtained financial and physical E&A results means a lack of a clear connection between present-day E&A risk management and actual operations deliverables. Given the random nature of actually obtained results of conducted E&A works, any statement regarding a connection between risk management and E&A planning decisions and actually obtained E&A performance can always be reasonably put into doubt by applying the "luck" or "no luck" statement.

Lack of such connection is reflected in the impossibility to establish relevant objective criteria for management performance assessment, i.e. the impossibility to use objective criteria as a basis for the following:

- promptly identify errors in the risk management, assessment and field forecasted reserves estimation processes, as well as establish and eliminate the causes of such errors;
- check the efficiency of newly implemented methods, practices and other measures taken in order to improve the processes of risk management, assessment and field forecasted reserves estimation;
- assess the performance of specialists, managers and the exploration segment in general.

Therefore, present-day risk management practices do not make it possible to objectively assess the performance of an exploration team. Given present-day risk management, an exploration team performance assessment, based on actually obtained financial or physical deliverables of conducted E&A works, can only be subjective, i.e. it can always be validly challenged by applying the "luck" or "no luck" statement.

The hypothetical nature of present-day risk management logically and inevitably causes the occurrence of an informal practice of avoidance of high exploration risks

In the case of the real solution of the risk management task, costs related to implementation of projects that eventually fail as a result of the E&A Program implementation are an integral part of the overall E&A Program costs which guarantee delivery of its overall significant financial success.

Present-day risk management provides no guarantees of delivering overall financial success of planned E&A works. It means that the quantity of projects ensuring delivery of the overall financial success is unknown. Therefore, an exploration failure of each individual project is perceived by companies as a direct financial loss, directly affecting the company's current financial status and future production proceeds. Thus, in the absence of objective criteria of E&A Program financial performance assessment, an increase in the frequency of exploration failure events is subjectively perceived by companies to be attributed to the

poor performance of the exploration team.

Implementation of projects with relatively low success probabilities naturally entails an increase in the number of exploration failure events. Therefore, an increase in the quantity of implemented projects with relatively low success probabilities naturally leads to an increase in companies' subjective dissatisfaction with the performance of their respective exploration teams.

Therefore, both explorationists and managers have a natural desire to avoid implementation of projects with relatively low success probabilities, to the maximum possible extent, i.e. a desire to avoid implementation of projects characterized by relatively high E&A risks.

Such desire is seamlessly implemented in actual practice as the lack of a clear cause-and-effect relationship between risk management decisions, and actually obtained exploration deliverables makes it possible to make any decisions at the E&A planning stage. Efficiency or inefficiency of this or that decision cannot be objectively checked and proven via present-day risk management practices.

Thus, the hypothetical nature of present-day risk management practices (uncertainty of risk management results, lack of a clear relationship between management results and actual E&A performance, biased assessment of exploration team performance) logically and inevitably leads to an occurrence of an informal practice of E&A risk avoidance across companies, which supplements or completely replaces formal practices of present-day E&A risk management.

The hypothetical nature of present-day risk management gives rise to trends of available reserves quality degradation across companies, which is not justified by actual E&A prospects

The lowest E&A risks and the least degree of E&A uncertainty are characteristic of oil and gas prospecting projects with the best level of awareness regarding the laws of formation, geological features and spatial location patterns of forecasted fields. These are oil and gas prospecting projects in discovered plays.

Note. A "play" means a family of inter-related fields, deposits or potential traps of hydrocarbons characterized by similar geologic history and common generation conditions of hydrocarbons, reservoirs and traps, and similar development parameters of the deposits, and similar economics.

Prospecting projects in yet-to-discover plays (play discovery projects) imply high E&A risks as the assumed patterns of spatial arrangement, geological and geophysical properties and characteristics of the play fields are not yet confirmed and imply a high level of uncertainty.

In the course of the development of a discovered play, the priority projects, in terms of implementation, are those which are considered to be the most attractive ones, i.e. projects with the largest volumes and best production characteristics of forecasted reserves. It means that major discoveries are related to the early development stage while projects featuring the smallest volumes and/or worst production characteristics of reserves within the play are left as pending implementation at later development stages.

Given the informal practice of companies avoiding high E&A risks, which is an inevitable result of present-day E&A risk management, exploration teams and management do their best to address the reserves increment tasks faced by the company by means of implementing projects with low E&A risks, i.e. projects in discovered plays, and, to the extent possible, avoid projects in yet-to-discover plays, i.e. projects with relatively high E&A risks.

Projects in nearly exhausted discovered plays, with minimal reserves and not so high production characteristics, become more preferable for companies compared to projects in yet-to-discover plays, which are characterized by the highest potential but imply higher risks. Given the same E&A budgets and the same level of cumulative probabilities of reserves increment, such a policy leads to a smaller scale of the overall reserves increment and lower reserves quality (lower reserves quality means smaller field reserves volumes and worse production characteristics).

For instance, the same probability level equal to 99% is characteristic of opportunities to gain from a 25 projects implementation:

- at least 3 success events of projects featuring high E&A risks in yet-to-discover plays, where each of 25 projects characterized by an E&A success probability of 30%;
- at least 15 success events of projects featuring low E&A risks in nearly exhausted discovered plays, where each of 25 projects characterized by an E&A success probability of 80%.

Successful projects in yet-to-discover plays will feature high production characteristics and reserves exceeding over 50 mln tonnes (350 mln bbl) each, and successful projects in old discovered plays will feature low production characteristics and reserves not exceeding 300 thou. tonnes (2.1 mln bbl).

This means that as a result of implementing 25 high-risk projects, the company, with a probability of 99%, will gain a reserves increment from 150 mln tonnes (1.05 bln bbl) up to 1.25 bln tonnes (8.75 bln bbl) with high production characteristics. And as a result of implementing 25 low-risk projects, the company, with a probability of 99%, will gain a reserves increment from 4.5 mln tonnes (31.5 mln bbl) up to 7.5 mln tonnes (52.5 mln bbl) with low production characteristics.

Therefore, in the context of a rather large quantity of implemented projects, avoidance of E&A risks given the same E&A budgets and the same cumulative reserves increment probabilities results in smaller volumes and worse production characteristics of incremental reserves – it gives rise to an unreasonable trend of the companies' available reserves quality degradation, which is not justified by actual exploration prospects.

Present-day risk management gives rise to an unreasonable trend of decrease in the economic efficiency of the production segment across companies, cuts down the development opportunities for other vertical integration segments

The hypothetical nature of present-day risk management practices (uncertainty of risk management results, lack of a clear relationship between E&A planning management decisions and actual E&A performance, biased assessment of exploration team performance) logically and inevitably leads to an occurrence of an informal practice of E&A risk avoidance across companies, which supplements, or completely replaces the formal practices of present-day E&A risk management.

The industry-wide prevalence of the informal E&A risk avoidance practice unreasonably reduces the quantity of projects implemented by companies in yet-to-discover plays, which creates a shortage of projects with low E&A risks. To solve reserves increment tasks, companies have to implement projects with progressively smaller reserves volumes and progressively worse production characteristics, which entails an escalating trend of quality degradation across available reserves. The trend of degradation of the quality of discovered reserves is the reason for higher unit costs of such reserves exploration, and thus, a decrease in the economic efficiency of the production segment.

A decrease in the current and potential profitability of the production segment, which is not justified by the actual exploration prospects, results in the weakening of other vertical integration segments, thus unreasonably limiting their development opportunities.

Present-day risk management gives rise to a vicious circle of growing discontent with performed E&A deliverables

Nowadays, the objective of E&A works carried out by oil and gas companies is maximizing follow-up production profits from fields discovered during E&A operations.

As a result of present-day risk management, the E&A risk avoidance practice results in the degradation of reserves quality and a corresponding decrease in production profitability, i.e. failure to deliver tasks faced by the exploration segment in terms of sustaining and fostering production economic efficiency.

Companies' growing discontent with the exploration segment performance caused by the degradation of available reserves quality forces explorationists to implement projects with high forecasted reserves quality, i.e. projects in yet-to-discover plays – projects characterized by high E&A risks.

In the context of present-day risk management, the number and characteristics of projects ensuring the delivery of the overall financial success remain unknown. Therefore, an exploration failure of each individual project is perceived by companies to be a direct financial loss, affecting the company's current financial status and future production proceeds. Thus, an increase in the frequency of exploration failure events is subjectively perceived by companies to be attributed to the poor performance of the exploration team.

The forced implementation of projects in yet-to-discover plays (projects with relatively low success probabilities) logically leads to an increase in the frequency of eventual exploration failures, i.e. an increase in companies' subjective discontent with the performance of their respective exploration teams.

Companies' discontent with exploration teams' performance, which is caused by increasingly frequent E&A failure events, results in the restitution of the informal practice of high E&A risk avoidance, as well as attempts to address reserves increment tasks by means of projects in almost depleted discovered plays, which leads to the further degradation of available reserves' quality. Thus, the circle of companies' growing discontent with results of conducted E&A works triggered by present-day E&A risk management is eventually closed. This circle can be summarized via the following pattern: *Present-day E&A risk management → Inevitable occurrence of an informal practice of high E&A risk avoidance → Degradation of available reserves quality → Decrease in economic efficiency of the production segment → Increasing discontent with performance of the exploration segment triggered by the reserves quality degradation → Forced implementation of projects with high E&A risks → Logical scale-down of E&A success indicators → Increase in subjective discontent with the E&A segment performance triggered by the increasing rate of E&A failure events → Return to the informal practice of high E&A risk avoidance → Further degradation of available reserves quality, etc. → …*

The vicious circle of increasing discontent with the results of conducted E&A works, which is a logical and inevitable result of the hypothetical nature of present-day risk management, entails loss of companies' faith in the economic feasibility and efficiency of E&A based reserves replacement for no objective reason, encourages them to search for alternative reserves increment solutions instead of E&A efforts (acquisition of explored reserves, enhancing oil and gas recovery of available reserves, development of hard-to-recover reserves, etc.).

The growing discontent with E&A performance, along with increasing investments in alternative reserves increment solutions, instead of E&A efforts, normally results in companies' cutting down E&A investments and, respectively, decreasing the physical E&A scope.

The hypothetical nature of present-day risk management unreasonably hampers the development of companies and the industry in general

Since the mid-1980s, advanced technologies (in geology, geophysics, drilling, production, transportation, etc.) have formed a highly potent testbed for economic growth in the industry:

- have materially enhanced the scope and quality of the knowledge base regarding patterns of HC clusters spatial arrangement – they have provided new methods and opportunities of gathering, storage, analysis and generalization of geological data;
- have increased the probability levels of prospecting project success – if compared to preceding periods, they have significantly enhanced the success rate and accuracy of handling similar E&A tasks;
- continuously enhance the already huge economic potential of the global Petroleum Bearing System (PBS) development, expand its technologically available and economically attractive space – make new extensive subsoil blocks technologically available and economically attractive in terms of development – have enhanced economic efficiency of prospecting and production projects, and have provided opportunities for handling formerly unsolvable prospecting and development tasks.

The development potential of remaining technologically available and highly economically attractive, easy-to-recover conventional HC reserves within the global PBS is huge.

Numerous scientific studies devoted to the level of exploration maturity of global oil and gas resources, based on conservative estimates, assume that about 35–40% of initial global recoverable crude resources, i.e. more than 200 bln tonnes (1.4 tln bbl), and 55–60% of initial global recoverable gas resources, i.e. about 400 tln m3, still remain undiscovered. The global PBS keeps in place a huge economically attractive potential of conventional easy-to-recover HC reserves with a value amounting to hundreds of trillions of USD – tens of thousands of yet-to-discover HC fields.

At the same time, the evolution of global oil and gas resources estimates is characterized by a clear trend of increasing size of reserves within yet-to-discover, conventional, easy-to-recover HC reserves. The estimates of global initial recoverable resources of conventional, easy-to-recover oil have increased approximately four-fold since the 1950s – from circa 150 bln tonnes (1.05 tln bbl) to 600 bln tonnes (4.2 tln bbl). The estimates of global initial recoverable resources of conventional easy-to-recover natural gas have increased approximately three-fold since the 1960s – from circa 250 tln m3 to 750 tln m3 [6].

The impossibility of objective justification of potential truly high reliability and huge profitability of E&A investments, as well as the industry-wide popularity of the E&A risk avoidance practice, companies' loss of faith in economic feasibility and efficiency of E&A based reserves replacement for no objective reason and other negative implications of the hypothetical nature of present-day E&A risk management practices, unreasonably hamper development of the huge remaining potential of non-discovered conventional easy-to-recover HC reserves. This does not make it possible for the companies to implement robust drivers of the industry economic growth, which have been formed by the advanced technologies in geology, geophysics, drilling, production, transportation, etc.

Colossal business opportunities unveiled by the Valuable Geology solution of the key problem of present-day E&A risk management

With Valuable Geology products, you will be able to conduct a geological exploration without financial risks, win auctions for the most attractive subsoil blocks, and implement the most challenging and ambitious E&A and technological ideas without the threat of financial losses. The solution we have developed for handling the key problem of E&A risk management enables colossal business opportunities for companies, which seemed unbelievable until very recently:

Leadership and domination across all segments of the oil and gas industry

In the context of real, non-hypothetical E&A risk management, the company obtains the best possible opportunities for gaining leadership and domination across all segments of the oil and gas industry thanks to the following benefits enabled by real, non-hypothetical E&A risk management:

- advantages over other companies (companies with hypothetical risk management) in terms of volumes and unit cost of commissioned reserves production;
- possibilities of guaranteed delivery of the pre-set reserves increment rate, i.e. secure achievement of the pre-set production scope target.

Leadership in terms of volumes and unit cost of commissioned reserves production

In the context of real, non-hypothetical E&A risk management, the company obtains the best possible opportunities for gaining leadership in terms of increment volumes and unit cost of commissioned reserves production thanks to the following benefits enabled by real, non-hypothetical E&A risk management:

- advantages in terms of E&A scope (the quantity of implemented projects) inaccessible to other companies, i.e. the possibility to enhance the E&A operations scale without the threat of financial losses, which is beyond the reach of other companies;
- advantages inaccessible to other companies, which include acquisition of the most attractive projects, i.e. projects with the best production characteristics (depth, flow rates, etc.), with the largest reserves volumes, located in the most attractive and high-potential sites globally from the economic and geographical standpoint, etc.

Implementation of a larger quantity of the most attractive projects enables advantages in terms of both discovered reserves volumes and the quality of such – the larger amounts and better production and other economic characteristics of field reserves, and therefore, advantages related to lower production unit costs.

Leadership in terms of E&A scale and economic efficiency

In the context of real, non-hypothetical E&A risk management, the company obtains the best possible opportunities of gaining leadership in E&A scale and economic efficiency thanks to the following benefits enabled by real, non-hypothetical E&A risk management:

- an opportunity to enhance the E&A scope without the threat of financial losses;
- an opportunity to be guaranteed to convert the enhanced E&A scope into higher risk management efficiency, increasing risk-free profits of planned E&A and competitive power in terms of project acquisition, which are beyond the reach of other companies;
- fundamentally greater resource base development prospects versus other companies – a fundamentally larger quantity of attractive projects, which is beyond the reach of other companies, thanks to the application of such revolutionary tools as the Risk-Free Value of an E&A Program, Focused RMSEE Delivery, Focused GSEE Delivery, etc.;
- advantages in the development of E&A knowledge, competencies and technologies, in the scope and quality of available E&A data;
- supreme advantages in terms of attractive project acquisition, which are inaccessible to other companies and enabled by such revolutionary tools as the Risk-Free Value of an E&A Program, Focused RMSEE Delivery, Focused GSEE Delivery, etc.;

- advantages in raising E&A investments, which are beyond the reach of other companies, i.e. the financially, practically risk-free status of the oil and gas field prospecting works converts them from a planned loss-making and extremely highly risked type of activity into an extremely attractive investment option as reliable as US Treasury bonds but with its risk-free profitability amounting to tens and hundreds of percent, and the expected and actual profitability amounting to hundreds and thousands of percent while the complete return on investment and profit-making term is normally 1 – 3 years.

Leadership in attractive project acquisition

In the context of real, non-hypothetical E&A risk management, the company obtains the best possible opportunities for gaining leadership in attractive project acquisition thanks to:

- competitive power in project acquisition beyond the reach of other companies, i.e. the ability to pay several times more for a particular project than other companies can afford, which is enabled by the Risk-Free Value of an E&A Program tool inaccessible to other companies;
- a significant increase in the risk-free values of E&A Programs thanks to the use of the Focused RMSEE Delivery tool, which is inaccessible to other companies;
- a multi-fold increase in the forecast economic efficiency of new play prospecting projects thanks to the application of the Focused GSEE Delivery tool inaccessible to other companies;
- advantages in terms of project success probabilities, which result from advantages in development of E&A knowledge, competencies and technologies, and in the volume and quality of available E&A data, which are provided by the financial risk-free status of E&A operations.

Notes:

The Risk-Free Value of an E&A Program is the lowest practically possible NPV of an E&A Program – getting a still lower value is practically impossible (the probability of getting a still lower value is very small – equal to the pre-set level of significance).

RMSEE – the Risk Management Scale Economic Effect (RMSEE): the Risk-Free Value of an E&A Program is higher than the sum of Risk-Free Values of the corresponding constituent E&A Subprograms.

GSEE – the Geological System Economic Effect (GSEE) shall mean a change in the value of one subsoil feature of a petroleum-bearing system (play, PS, PR, PP) as a follow-up to a survey of another feature (element, subsystem).

Leadership in development of E&A competencies, knowledge and technologies, in the volume, quality and relevance of available E&A data

In the context of real, non-hypothetical E&A risk management, the company obtains the best possible opportunities of gaining leadership in development of E&A competencies, knowledge and technologies, as well as in the volume, quality and relevance of available E&A data, thanks to:

- advantages versus other companies in terms of the conducted E&A operations scope, which are enabled by opportunities to enhance the E&A scope without the threat of financial losses and to be guaranteed to convert them into quick colossal risk-free expected and actual profits from the E&A operations, which is beyond the reach of other companies (companies applying hypothetical risk management practices);
- fundamentally larger investments in the development of E&A competencies, knowledge and technologies as well as acquisition of E&A data thanks to the opportunity to promptly convert the obtained E&A advantages directly into quick colossal risk-free, expected and actual profits from E&A operations, which is beyond the reach of other companies;
- an opportunity to assess the efficiency of applied methods and technologies, perform unbiased assessment of involved specialists' and managers' performance, promptly identify and eliminate failure causes on the basis of objective criteria, which is beyond the reach of companies applying hypothetical risk management practices;

- an opportunity to implement the most ambitious and challenging E&A ideas, test and implement the most challenging and ambitious E&A practices, methods and technologies without the threat of financial losses.

Colossal E&A prospects inaccessible to other companies

Implementation of real E&A risk management practices immediately results in a significant expansion of the company resource base prospects – a huge quantity of projects seemingly unattractive to companies applying hypothetical risk management become attractive for implementation thanks to the use of robust revolutionary management tools, such as the Risk-Free Value of an E&A Program, Focused RMSEE Delivery, Focused GSEE Delivery:

- The Focused RMSEE Delivery tool is capable of scaling down requirements to the forecasted profitability of projects by hundreds of percent;
- The Focused GSEE Delivery tool is capable of increasing the forecasted profitability of new play prospecting projects by hundreds of percent;
- The Risk-Free Value of an E&A Program tool makes it possible to implement extremely challenging and ambitious E&A projects without affecting the target profitability and failure probability significance level of the E&A Program.

Powerful management tool – the Risk-Free Value of an E&A Program

The Risk-Free Value of an E&A Program is a management tool provided by the ability to actually handle the E&A risk management task, regardless of the computation demand encountered in real practice, which is beyond the reach of companies using hypothetical E&A risk management practices.

The Risk-Free Value of an E&A Program is:

- the E&A Program NPV which matches the pre-set level of significance and is received from the cumulative distribution function of the E&A Program NPV probabilities;
- the lowest practically possible NPV of an E&A Program – getting a still lower value is practically impossible (the probability of getting a still lower value is very small – equal to the pre-set level of significance);
- the amount of money which the company can spend on aggregate to acquire all the projects comprising the E&A Program to securely guarantee the target profitability and financial failure probability levels of the E&A Program.

In the context of competition with companies applying hypothetical E&A risk management practices, the Risk-Free Value of an E&A Program tool can provide companies using non-hypothetical, real E&A risk management methods with an opportunity to acquire any project the company is interested in. The total Risk-Free Value may be distributed among projects in any proportion, and it makes it possible to pay several times more for an attractive project than any company applying hypothetical E&A risk management practices because it determines an attractive acquisition price for each specific project.

Acquisition of best projects provides a company applying real E&A risk management practices with increasing advantages in terms of volumes and quality of discovered reserves versus companies using hypothetical E&A risk management.

Enhanced advantages in terms of the volumes and quality of discovered reserves provide companies using real E&A risk management with greater advantages in production economic efficiency.

Enhanced advantages in production economic efficiency provide companies using real E&A risk management with greater advantages in economic efficiency of other vertical integration segments.

Thus, the Risk-Free Value of an E&A Program tool inaccessible for companies using hypothetical E&A risk management practices constitutes a robust source of advantages in terms of performance of exploration, production and other vertical integration segments.

Powerful management tool – Focused RMSEE Delivery

Focused RMSEE Delivery (the Risk Management Scale Economic Effect) is a management tool that is provided by the ability to actually handle the E&A risk management task regardless of the computation demand encountered in real practice, which is beyond the reach of companies using hypothetical E&A risk management practices.

The RMSEE for real E&A Programs implies that *the Risk-Free Value of the E&A Program is higher than the sum of Risk-Free Values of constituent E&A Subprograms*.

In other words: *provided observance of certain conditions, increase in the quantity of projects within a developed E&A Program (enhanced risk management scale) fundamentally mitigates requirements to the project economics required for achieving a financially, practically risk-free status of planned E&A operations*.

Therefore, the Focused RMSEE Delivery tool:

- fundamentally enhances the company's competitive power in terms of project acquisition;
- fundamentally expands the existing resource base development prospects – grants attractiveness to a large quantity of formerly unattractive projects;
- ensures a financially, practically risk-free status of planned E&A in conditions where project economics do not envisage such a status with a smaller quantity of projects;
- significantly enhances the risk-free profitability and risk-free values of E&A Programs, which means a material increase in respective investments attractiveness.

A significant RMSEE can be obtained without actually increasing the E&A scope, i.e. as a result of organizational steps – through risk management centralization and E&A planning horizon extension.

The Valuable Geology revolutionary software unveils practically unlimited opportunities for Focused RMSEE Delivery, makes it possible to accurately estimate economic and probabilistic characteristics of E&A Programs consisting of many tens and hundreds of projects, which, by a large margin, meets the potential practical needs of any companies.

Powerful management tool – Focused GSEE Delivery

Focused GSEE Delivery (delivery of the Geological System Economic Effect) is a tool that can be rolled out on a large scale thanks to the financially, practically risk-free status of E&A operations, which is beyond the reach of companies applying hypothetical E&A risk management practices.

A Positive GSEE (Geological System Economic Effect) means: increase in the value of a certain subsoil part of a petroleum-bearing system (play, PS, PR, PP) based on the results of exploration of another part (element or subsystem) of that system.

The Focused GSEE Delivery tool makes it possible to:

- enhance the profitability of new play prospecting projects multi-fold;
- significantly enhance the company's competitive power in terms of acquisition of subsoil blocks for new play prospecting projects;
- fundamentally expand the resource base development prospects for the company – fundamentally increase the quantity of new play prospecting projects which are attractive for the company;
- significantly increase the Risk-Free Values of E&A Programs, i.e. materially enhance the company's competitive power in terms of acquisition of all projects making part of E&A Programs;
- significantly increase the risk-free profits of E&A Programs, i.e. materially enhance the attractiveness of investments in E&A operations;
- provide the best possible opportunities for boosting the frequency and quantity of new play discoveries made by the company.

Focused GSEE Delivery makes it possible to gain advantages in the development of all vertical integration segments. Along with discovery of a new play, a large quantity of new projects with high E&A success

probabilities and high reserves quality are supplied to the company's operational envelope, which envisages exploration and economic advantages for the company, and the latter faces the best possible opportunities of addressing tasks related to available reserves volume increase and quality improvement. Implementation of such opportunities makes it possible to enjoy the advantages in the evolution of production and, respectively, development of the other vertical integration segments.

Focused GSEE Delivery is practically beyond the reach of companies with hypothetical risk management. The hypothetical nature of present-day E&A risk management inevitably results in the occurrence of an informal practice of high E&A risk avoidance, i.e. the desire of specialists and managers to avoid projects envisaging new plays prospecting, i.e. projects normally characterized by high E&A risks, as much as possible.

Financially, practically risk-free status of the oil and gas field prospecting works – actual and verified opportunity to bring the planned E&A financial failure probability down to zero for any computation demand encountered in practice

Financially, practically risk-free status of E&A works means an ability verified by actual quantified evidence to solve the risk management task validly and not hypothetically, i.e. bringing the E&A Program overall financial failure probability so close to zero that occurrence of such an event can be deemed to be practically impossible.

Financially, practically risk-free status of E&A works provides companies with colossal business opportunities, which are in principle beyond the reach of companies using hypothetical risk management:

- a possibility to securely convert E&A scope expansion into increasing efficiency of risk management, enhanced competitive power in terms of project acquisition, quick colossal risk-free, expected and actual profits from E&A operations;
- an opportunity to securely convert E&A scope expansion into a solution of reserves increment tasks (increment volumes, HC phase state) and reserves quality improvement tasks (tasks of reducing the production unit costs);
- fundamentally greater resource base development prospects versus other companies – a fundamentally larger quantity of attractive projects, which is beyond the reach of other companies (companies with hypothetical risk management);
- unprecedented competitive power in terms of attractive project acquisition, which is beyond the reach of companies using hypothetical risk management;
- advantages in the development of exploration knowledge, competencies and technologies, as well as in the volume and quality of available exploration data;
- an opportunity to promptly convert the acquired exploration advantages directly into quick colossal risk-free, expected and actual profits from E&A operations without a threat of incurring financial losses;
- an opportunity to implement the most ambitious and challenging exploration ideas, test and implement the most challenging and ambitious exploration practices, methods and technologies without a threat of financial losses;
- an opportunity to perform objective assessment of the efficiency of applied practices, methods and technologies, as well as managers' and specialists' performance, which is beyond the reach of companies applying hypothetical risk management;
- an opportunity to promptly identify and eliminate failure causes on the basis of objective criteria, which is beyond the reach of companies applying hypothetical risk management;
- advantages in raising E&A investments, which are beyond the reach of other companies, i.e. the financially, practically risk-free status of the E&A segment converts it from a planned loss-making and extremely highly risked type of activity into an extremely attractive investment option as reliable as US Treasury bonds but with its risk-free profitability amounting to tens and hundreds of percent, and the expected and actual profitability amounting to hundreds and thousands of percent while the complete return on investment and profit-making term is normally 1 – 3 years.

Valid and quantified reduction of the financial failure probability of planned E&A operations down to zero is ensured by present-day advanced computation capacities and revolutionary computation methods

developed by Valuable Geology and implemented in the DSS "ABVG" software.

DSS "ABVG" makes it possible to actually handle the E&A risk management task – it elaborates E&A Programs for a company with a financial failure event being practically impossible.

Out of the variety of all E&A Programs which can be made on the basis of all oil and gas prospecting projects potentially available for the company, DSS "ABVG" identifies a subset of Risk-Free E&A Programs – E&A Programs with the overall financial failure probability below the established level of significance (adjustable, typically 5–1% or lower), i.e. so small that advent of the E&A Program failure event can be deemed to be practically impossible.

Based on the identified subset of Risk-Free E&A Programs, DSS "ABVG" allows the company to select a Risk-Free E&A Program which is optimal in terms of established business criteria.

The DSS "ABVG" software is capable of providing cumulative distribution functions of financial and physical metrics of planned E&A works at any stage of the respective E&A Program development.

Thus, DSS "ABVG":

- actually handles the E&A risk management task – it elaborates E&A Programs for a company with a financial failure event being practically impossible (the failure probability is below the pre-set level of significance);
- optimizes the generated Risk-Free E&A Programs in line with an unlimited number of business criteria (E&A budget, expected reserves size and characteristics, expected profit, research and production capacity loading, etc.);
- provides quantified evidence of addressing the risk management task, i.e. it determines the probability of getting any of the potential values of the E&A Program financial and non-financial performance indicators, determines the values of the E&A Programs' financial and non-financial performance indicators that can be obtained with a pre-set probability level.

The DSS "ABVG" software makes it possible to effectively solve the E&A risk management task in any conditions encountered in actual practice – the computation capacity limit of DSS "ABVG" meets all potential demands in the computation scope encountered in actual practices of E&A planning.

Note. The actual practice of DSS "ABVG" application demonstrates that the pre-set significance level of 1% is optimal in current conditions and is normally easily achieved when elaborating E&A Programs for major and medium companies. Probabilities of a complete return on investments and profit receipt as part of E&A Programs in major and medium companies normally amount to 99.000% – 99.999% and above.

E&A segment conversion from an financially highly risked and planned loss-making activity into the best investment option globally, which is capable of providing an investor with ultra-high reliability while securing extremely high profitability

Winning over the hypothetical nature of E&A risk management constitutes a fundamental transformation in operational, financial, economic and investment opportunities of the E&A segment.

All present-day oil and gas companies use a conventional economic approach to E&A operations, which is characterized by two main statements:

1. The exploration work is not a stand-alone business but rather a planned loss-making and highly risked stage of a forecasted HC field full-scale prospecting and development project, which is viewed as unable to deliver profit.
2. Profit is only made at the production stage while exploration does not make profit but its objective is to supply new reserves for further development at the production stage.

As all present-day oil and gas companies use a conventional approach to exploration, positive financial E&A deliverables are not highlighted against the forecasted and actual financial performance of production projects across HC fields discovered at the E&A stage. It means that:

- the forecasted and actual income from E&A operations is concealed deep within the financial performance of a production project;
- proceeds from E&A operations (production income) are deferred for a very long term – from 5–7 years to several decades.

The hypothetical nature of present-day risk management, which forces companies to assess the financial E&A risks as risks of individual projects, creates an unreasonable impression of high and extremely high financial E&A risks. Thus, present-day probabilistic risk management and the conventional economic E&A approach currently applied by all oil and gas companies do not make it possible to objectively justify the advantages of exploration investments, both for external investors and internally in the company:

- the scale of required E&A investments in each project is very large – tens, hundreds of millions, and sometimes, billions of USD;
- the probability of complete loss of E&A investments in each project is very high – from 20% to 90%;
- E&A proceeds in the case of a project exploration success event are not calculated;
- potential proceeds (production proceeds) are deferred for a very long period of time – from 5–7 years to several decades.

The business approach views exploration as a standalone type of business, independent from the production segment, which is aimed at gaining proceeds from an increase in the subsoil blocks value as a result of conducted exploration. The business approach allows for easy estimation of E&A proceeds, and the timeframes of return on investment and profit-making become very short. Financial results of an E&A project are equal to the larger of the user value or exchange value of the discovered field, without E&A costs and subsoil block acquisition costs. Respectively, the financial results of an E&A Program amount to the sum total of financial results of the constituent projects. *Note. The exchange value of a field shall mean the maximum value at which the discovered field can be sold. The user value of a field shall mean the maximum value at which we would buy such discovered field.*

A combination of a business approach to exploration and real risk management practices, ensuring its confirmed financially, practically risk-free status, makes E&A works an investment option with extremely attractive properties:

- colossal reliability, which is beyond the reach of the absolute majority of investment options (probability of complete return on investments is 0.99000–0.99999 and above);
- colossal expected profitability beyond the reach of investment options that are comparable in terms of reliability (hundreds of percent);
- colossal, risk-free profitability, beyond the reach of investment options comparable in terms of reliability (tens of percent). *Note. The Practical Risk-Free Profit is the lowest practically possible value of profit-making – getting a still lower value is practically impossible (the probability of getting a still lower value is very small – equal to the pre-set level of significance)*;
- short timeframes of complete return on investments and profit-making in full (1–3 years).

Given real, non-hypothetical risk management and a business approach to E&A delivery, the exploration segment becomes as equally reliable an investment as US Treasury bonds but with profitability amounting not to a number of percent but to hundreds and thousands of percent. The actual practice of the Valuable Geology revolutionary software use demonstrates that probabilities of a complete return on investments and profit receipt as part of E&A Programs in major and medium companies under current conditions may easily amount to 99.000% – 99.999% and above. Therefore, the probability of losses only amounts to 1.000% – 0.001% and below. Expected profits from E&A Programs amount to values from a few hundred to many hundred and even several thousand percent for a period of 1–3 years. P99 and P95 risk-free profits from E&A Programs amount to tens and even hundreds of percent.

Thus, the Valuable Geology revolutionary software tools make the exploration segment a more attractive business from the investment standpoint if compared to HC production – while characterized by a financially, practically risk-free status, it features a materially shorter return on investment timeframes and substantially greater profitability values than the production segment can afford. Therefore, new business models of a financially risk-free E&A company and financially risk-free E&A venture fund, which are focusing on making profit, not from HC production but from the discovery of new fields and sales of fields discovered as a result of exploration, are now characterized by great potential and colossal advantages.

Alternatives to our solution of present-day E&A risk management issues

A need for improvement of present-day probabilistic E&A risk management practices across companies

Companies' needs for improving the present-day probabilistic E&A risk management practices is very high.

The hypothetical nature of present-day risk management gives rise to a vicious circle of companies being increasingly discontent with E&A deliverables:

- The impossibility to objectively assess the exploration team performance results in the unreasonable discontent of the companies with the E&A deliverables of projects featuring high E&A risks, which logically and inevitably leads to an informal practice of avoidance of projects characterized by high E&A risks;
- The reserves quality degradation, escalating along with the avoidance of projects with high E&A risks, results in discontent with E&A deliverables of projects featuring low E&A risks, which makes companies return to projects with high E&A risks, and thus, the circle of companies' growing discontent with the results of conducted E&A works is eventually closed.

Thus, due to the hypothetical nature of all present-day E&A risk management practices, companies are constantly experiencing discontent with E&A deliverables, which is the reason for a permanent need for improvement of risk management methods.

Ways to improve present-day probabilistic E&A risk management methods

All attempts to improve present-day E&A risk management practices are aimed, not at solving the key problem of present-day risk management, i.e. its hypothetical nature, but at the elimination of the resulting consequences:

- The industry scientific community is still governed by established obsolete ideas regarding the lack of relevant computation methods and insufficiency of computation capacities for a valid solution of risk management tasks, i.e. an idea that there are no viable alternatives to the LLN algorithm.
- The obsolete ideas regarding the impossibility to get rid of the LLN algorithm, i.e. the essential impossibility to solve the key problem of present-day E&A risk management – its hypothetical nature, have focused all improvement attempts on the elimination of, or offsetting of the negative implications brought about by the key problem, instead of addressing the problem itself.

For instance, there have been multiple attempts to solve the issue of the guaranteed absolute inadequacy of risk management results in the case of marginal observance of the only recommendation suggested by the LLN algorithm (selecting projects with a positive ENPV close to zero), and the uncertainty of requirements to the ENPV of projects, which would guarantee acceptable management results (to what extent should project ENPV be above zero).

Note. Project ENPV means mathematically expected NPV (Net Present Value) of a project.

Such attempts came down to a search of a certain universal enhanced requirement or a certain universal set of enhanced requirements to project ENPVs, which could guarantee delivery of acceptable risk management results by means of the LLN algorithm, given any number and other characteristics of projects planned for implementation.

A universal enhanced requirement to project ENPVs can be demonstrated by the company, ARCO's practice, represented by systematic understatement of the expected net present value of the Gulf of Mexico projects by 0.35 times (0.35×ENPV) [5].

The risk management results, i.e. the probability of the overall financial failure of an E&A Program, depend on a number of mutually dependent parameters:

- the quantity of projects in the E&A Program;
- the success probabilities of the projects making up the E&A Program;
- the economic performance indicators of the E&A Program projects;
- the project cost value, spread within the E&A Program;
- the pre-set level of required return on investments.

Requirements applied to each project ENPV, which are used for achieving the target reduction of probability of the planned E&A overall financial failure outcome, should take into account the full range of such mutually dependent parameters. Requirements to the economic characteristics of one and the same project vary as per the number and characteristics of the other constituent projects of the E&A Program (economics and success probabilities) and vary as per the target parameters of the E&A Program (target decrease in the failure probability level, required return).

Establishment of a universal project selection criterion, which would ensure a target decrease of the failure event probability without taking into account a complete set of the above, mutually dependent parameters, i.e. without a valid solution of the risk management task, is impossible. Enhancing requirements to project economic and probabilistic characteristics applied without taking into account the entire range of parameters of a specific E&A Program under development does not provide any guarantees of getting acceptable risk management results, and will always be inadequate – either surplus or insufficient:

- Surplus requirements will result in loss of competitive power, in terms of project acquisition – the company will most likely fail to acquire and implement attractive projects;
- Insufficient requirements will bring down the competitive power in terms of project acquisition and will not make it possible to achieve acceptable risk management results.

Thus, the company, while unreasonably undermining its competitive power in project acquisition:

- faces a threat of the impossibility to handle reserves increment tasks due to the inability to acquire relevant attractive subsoil blocks;
- gets no guarantees of the adequacy of risk management results.

Apart from the Valuable Geology method, all other currently available attempts to improve present-day probabilistic E&A risk management practices keep in place the LLN algorithm, thus maintaining the hypothetical nature of risk management. In other words, they keep in place such aspects as the uncertainty of risk management results, the random nature of actually obtained E&A results, the lack of objectivity in assessing exploration teams' performance, the inevitable occurrence of the informal risk avoidance practice, as well as all the other aforementioned implications of hypothetical E&A risk management (*see the Section "Consequences of the hypothetical nature of present-day E&A risk management for companies and the industry", p. 16 – p. 21*).

The hypothetical nature of present-day risk management (uncertainty of management results) makes it impossible to objectively assess the efficiency of applied methods and practices, i.e. makes companies vulnerable to the implementation and practical establishment of erroneous risk management methods capable of incurring dramatic and even existentialistic threats for companies and the industry in general.

Present-day E&A risk management methods which are widespread in the industry

Theoretic rationale of FSD Methods

Since the early 2000s, FSD (Field Size Distribution) Methods have gained industry-wide popularity.

FSD Methods set forth a task to eliminate the reasons for companies' discontent with E&A performance. The hypothetical nature of present-day risk management gives rise to a vicious circle of companies being increasingly discontent with E&A deliverables. Therefore, the task of eliminating the reasons for companies' discontent with E&A deliverables is really a highly relevant one.

FSD Methods constitute an erroneous attempt to solve this problem. The **falsity of the solution** suggested by FSD Methods is **due to the triple fake** in its theoretical rationale:

1. **Problem substitution.** The key reason for the lack of companies' satisfaction with poor E&A performance, i.e. the problem of the hypothetical nature of risk management, as a result of the applied algorithm inconsistency with present-day industry specifics, is substituted with a lower-priority problem of the high inaccuracy of project reserves estimation.
2. **Substitution of the substituted problem solution task.** The stated task of studying and accommodating the high inaccuracy levels of reserves estimation is replaced with the task of the probabilistic estimation of a random variable of the filling level of a trap with a certain size.

3. **Substitution of the substituted task of the substituted problem solution.** In the substituted task solution suggested by FSD Methods, the probabilistic characteristics of the alleged random variable of a trap filling level are substituted with the probabilistic characteristics of the random variable of a field size in a certain petroleum-bearing system (PP, play, etc.).

Note. The logic framework of the theoretical rationale supporting FSD Methods is reviewed in detail in publication [2], which is available at our website valgeology.com in the "Library" section.

Practical results provided by FSD Methods

Taking false theoretical grounding as a basis entails the following range of results of FSD Methods application.

Result 1. **FSD Methods do not solve the stated problem** of companies being discontent with risk management and E&A deliverables. FSD Methods apply the LLN algorithm, which, in principle, does not make it possible to get rid of the fundamental inefficiency and hypothetical nature of risk management that are specific of all LLN-based methods, and, in principle, does not make it possible for companies to get out of the vicious circle of growing discontent with E&A deliverables.

Result 2. **FSD Methods do not solve the substituted problem** – the suggested solution of the problem related to high inaccuracy levels of forecasted reserves estimation is false.

Result 3. **Observance of FSD recommendations results in the unjustified understatement of oil and gas prospecting projects reserves estimates by 2.5–4 times.** Thus, the same as the aforementioned ARCO practice, FSD Methods are aimed at enhancing the requirements to project ENPVs, but, unlike ARCO, they do not do it directly but disguise it by falsely justified project reserves underestimation (by 2.5–4 times).

Result 4. While keeping in place absolutely all negative implications of hypothetical E&A risk management, FSD Methods artificially undermine companies that use such methods and dramatically cut down their development prospects. **In addition to the negative implications of the hypothetical nature of all LLN-based risk management methods, FSD Methods incur numerous additional problems** created by the falsely justified multi-fold understatement of project reserves estimates, such as:

- falsely justified artificial projects shortage;
- unreasonable decrease in competitive power in terms of project acquisition;
- artificial pushing of E&A operations into a high-risk zone;
- E&A Programs' enrichment with projects characterized by overestimated reserves;
- accelerating the companies' growing discontent with E&A deliverables;
- unreasonable loss of competitive power in exploration, production and other vertical integration segments, etc.

Let us look at the negative implications of FSD Methods in more detail.

For no objective reason, FSD Methods **dramatically decrease companies' competitive power in the acquisition of projects (subsoil blocks)** – falsely justified reserves underestimation by 2.5–4 times understates for FSD companies a project (subsoil block) attractive acquisition costs by several times.

For no objective reason, FSD Methods **dramatically cut down the resource base development prospects** for companies applying such methods. The ARCO practice, without taking due account of the entirety of all parameters of a specific E&A Program under development, understates the actual project ENPV while leaving the understated ENPVs as positive values as it uses a positive reducing factor – 0.35 – for such understatement purposes. It means that, in the absence of sufficient grounds for scaling down competitive power in project acquisition, the ARCO practice still keeps such projects attractive for potential implementation. The falsely justified reserves underestimation by 2.5–4 times does not only decrease project ENPVs but also converts the ENPVs of a large number of projects into negative values. In other words, being based on false theoretical rationale, FSD Methods do not only unreasonably decrease a company's competitive power, in terms of attractive projects acquisition, but also make a huge number of projects unattractive for implementation. Therefore, falsely justified multi-fold understatement of reserves estimates by FSD Methods **creates an artificial shortage of attractive projects for companies**, which is not justified by the actual economic environment and geological prospects. A company applying FSD Methods will not only fail to acquire attractive projects but will also refuse to implement many of the attractive pro-

jects that actually belong to the subsoil blocks already in the possession of such a company.

FSD Methods **form an artificial upside bias of reserves estimates** and unreasonably entail the enrichment of companies' E&A Programs with projects characterized by overestimated reserves, which decreases the efficiency of risk management and the economic performance of conducted E&A operations. The mechanism is as follows. The reserves estimation procedure, suggested by FSD Methods, is based on traditional deterministic estimation which is scaled down multi-fold due to the falsely justified manipulations of FSD Methods. Reserves understatement decreases project ENPV values several times and can result in the company's refusal to implement such projects. If taking a set of field prospecting projects with equal actual reserves, companies will primarily deny projects with originally understated or correct deterministic estimate, and in the last turn, projects with originally overstated estimates. It means that the falsely justified understatement of deterministic reserves estimates, by 2.5–4 times, leads to companies' primarily denial of projects with originally understated or accurate estimates and primarily keeping of projects with originally overstated estimates. Thus, falsely justified underestimation of reserves, by means of FSD Methods, leads to the exclusion of projects with understated and accurate deterministic estimates from the E&A Program and the E&A Program enrichment with projects characterized by overestimated reserves.

FSD Methods **artificially push E&A works into the higher E&A project risk segment**. It is done in the following way. In the case of companies applying FSD Methods, projects with relatively low reserves estimates are unreasonably the ones to primarily lose attractiveness as projects with originally higher reserves estimates have more chances to remain attractive following the falsely justified 2.5–4-fold underestimation. For instance, all projects with relatively small reserves volumes that originally exceed the minimum profitable field size by less than 2.5–4 times will lose their attractiveness for companies, regardless of the exploration success probability level. Relatively small forecasted reserves volumes are normally characteristic of projects within discovered and well explored plays, i.e. projects with the lowest E&A risks. Large forecasted reserves volumes are normally characteristic of projects with high E&A risks. It means that falsely justified, multi-fold understatement of reserves estimates will mostly contribute to the unattractiveness of projects in discovered and well explored plays – projects characterized by the lowest E&A risks, and will mostly contribute to the attractiveness of projects with high E&A risks. Thus, falsely justified understatement of project reserve estimates by FSD Methods primarily excludes projects with low E&A risks from E&A Programs, i.e. artificially pushes E&A works into the higher E&A project risk segment.

FSD Methods **artificially accelerate companies' growing discontent with the conducted E&A performance**. Artificial shortage mainly of projects with low E&A risks accelerates the occurrence of a situation when the company becomes unable to address reserves increment tasks by means of avoiding projects with high E&A risks. Thus, the application of FSD methods accelerates the company's spiral movement along the vicious circle of growing discontent with E&A results (*see the Section "Present-day risk management gives rise to a vicious circle of growing discontent with performed E&A deliverables", p. 20*), thus leading to a still earlier loss of faith in economic efficiency and the feasibility of the reserves increment task solution by E&A operations, which is not justified by actual exploration prospects and economic environment, and encouraging FSD companies to look for alternative ways of addressing reserves increment tasks other than E&A (purchase of already explored reserves, enhanced oil recovery for existing reserves, development of hard-to-recover reserves, etc.). Increasing discontent with the deliverables of conducted E&A works, along with increasing investments in alternative ways to solve reserves increment tasks, other than E&A, normally result in reducing the company's investments into prospecting of conventional, easy-to-recover HC reserves.

FSD Methods **result in the unreasonable loss of companies´ competitive power across all vertical integration segments**. As a result of the unjustified loss of competitive power, in terms of the acquisition of attractive projects, the artificial shortage of the resource base development prospects, loss of faith in economic efficiency and feasibility of conventional HC reserves prospecting, which is not justified by actual exploration environment, FSD companies are unable to counter the escalating trend of developed reserves quality deterioration and become sensitive to the loss of competitive power in production and other integration segments.

Reasons for the industry-wide popularity of FSD Methods

Since the early 2000s, FSD Methods have gained industry-wide popularity. Such universal application of FSD Methods has been a result of the following factors:

- companies' vulnerability, in terms of the implementation of erroneous solutions, methods and practices, which is caused by the hypothetical nature of risk management practices, i.e. the uncertainty of specific management results and the impossibility to perform objective assessment of such;
- FSD Methods positioning, as a compilation of practices used by the major and most successfully performing companies.

Unprecedented favorable conditions for VG companies' expansion, in the context of the universal use of FSD Methods

VG companies are companies possessing financially, practically risk-free status of E&A works

All present-day methods of probabilistic E&A risk management are aimed at decreasing the probability of the overall financial failure of a certain set of oil and gas prospecting projects (project portfolio, E&A Program). However, absolutely all such methods, except the Valuable Geology methods, use the Law of Large Numbers algorithm to deliver such objective, i.e. they keep in place all negative implications brought about by hypothetical E&A risk management for companies and the industry.

We are not aware of any other successful software products, other than our own, which would allow companies to actually address the E&A risk management task, given any computation demand faced in real practice.

The Valuable Geology method, based on the application of the DSS "ABVG" revolutionary software product, developed by Valuable Geology, is the first, and still the only, one to enable not hypothetical but real risk management, which has made a revolution in E&A risk management practices by granting companies the opportunity to achieve financially, practically risk-free status of E&A operations.

VG companies are, in our understanding, companies that perform E&A risk management based on the Valuable Geology methods, i.e. these are companies capable of achieving a financially, practically risk-free status of E&A works.

VG companies possess still greater competitive advantages versus FSD companies than versus other companies using hypothetical E&A risk management

The financially, practically risk-free status of E&A works provides VG companies with advantages that companies using hypothetical risk management (LLN companies) cannot compete with:

- unprecedented competitive power, in terms of attractive projects acquisition, which is beyond the reach of companies using hypothetical risk management;
- the possibility to securely convert E&A scope expansion by increasing efficiency of risk management, enhanced competitive power, in terms of project acquisition, and colossal profits from E&A operations;
- the opportunity to securely convert the E&A scope expansion into a solution of reserves increment tasks (increment volumes, HC phase state) and reserves quality improvement tasks (tasks of reducing the production unit costs);
- fundamentally greater resource base development prospects versus LLN companies;
- advantages in terms of company management efficiency and the development of exploration knowledge, competencies and technologies, the volumes and quality of available exploration data, which are

beyond the reach of LLN companies and are due to the following opportunities essentially inaccessible for LLN companies:

- securely convert the obtained E&A advantages directly into colossal profits from E&A works;
- implement the most ambitious and challenging E&A ideas, test and implement the most challenging and ambitious E&A practices, methods and technologies without the threat of financial losses;
- objectively assess the efficiency of applied practices, methods and technologies;
- objectively assess the performance of managers and specialists;
- based on objective criteria, promptly identify and eliminate potential failure causes.

- advantages in terms of raising E&A investments, which are beyond the reach of companies using hypothetical risk management, etc.

VG companies possess still greater competitive advantages versus FSD companies than versus other LLN-based companies, i.e. companies using hypothetical E&A risk management practices:

- FSD Methods are a variety of LLN Methods (they are based on the LLN algorithm), i.e. VG companies possess the same colossal competitive advantages versus FSD companies that they have with regard to all companies applying hypothetical E&A risk management practices;
- FSD Methods use falsely justified reserves underestimation by 2.5–4 times, thus undermining the companies applying such methods, which provides VG companies with huge additional competitive advantages.

The universal popularity of FSD Methods has formed unique favorable conditions for VG companies' large-scale sweeping expansion

Universal, industry-wide application of FSD Methods has formed unique favorable conditions for instant large-scale expansion of VG companies in the exploration, production and other integration segments.

Self-weakening of FSD companies provides VG companies with:

- additional competitive power in project acquisition;
- additional profitability of E&A operations;
- additional increase in E&A risk management efficiency;
- easy access to a great number of ready-to-implement attractive projects which seem unattractive to FSD companies;
- easy access to exploration data, technologies and exploration competence carriers;
- best conditions for expansion in production and other vertical integration segments.

The unreasonably justified, multi-fold understatement of an attractive purchase price of a project (subsoil block) by FSD companies additionally scales up the advantages for VG companies, in terms of project acquisition.

Due to the widespread use of FSD Methods, the pioneer VG companies will have to compete with FSD companies to acquire attractive projects (subsoil blocks). Thus, VG companies will acquire projects at prices approximately equal to the maximum prices attractive to FSD companies. Therefore, falsely justified, multi-fold understatement of project (subsoil block) reserves estimate by FSD companies leads to a multi-fold reduction of costs incurred by VG companies to acquire the projects, thus providing VG companies with additional risk management efficiency and E&A profitability.

Widespread use of FSD Methods provides VG companies with easy access to a great number of ready-to-deliver, attractive projects, which seem unattractive to FSD companies. Falsely justified understatement of project reserves estimates by 2.5–4 times results in FSD companies' disinterest of a huge number of actually attractive projects (subsoil blocks). Exploration data and subsoil blocks, making part of such projects, are often of no interest or value to FSD companies, and therefore, can be acquired by VG companies without any competition, i.e. quite seamlessly and at almost no cost.

FSD companies are subject to a trend of being increasingly discontent with E&A deliverables and thus, they do not gain development momentum or have to reduce the research and production potential of oil and gas prospecting works, which provides VG companies with easy access to exploration data, technologies and competency carriers.

As a result of the unjustified loss of competitive power, in terms of the acquisition of attractive projects, artificial shortage of the resource base development prospects, unreasonable loss of faith in the economic efficiency and feasibility of conventional HC reserves prospecting, FSD companies are unable to counter the escalating trend of developed reserve quality deterioration and become exposed to a loss of competitive power in production and other integration segments. A loss of competitive power in the production and other integration segments by FSD companies, which is not justified by actual E&A prospects and economic environment, provides VG companies with better conditions for instant large-scale expansion in such segments.

The era of formerly inaccessible opportunities and new rates of subsoil survey, research and development

The financially, practically risk-free status of E&A operations provided by Valuable Geology unveils a new era for the oil and gas industry – an era of formerly inaccessible opportunities and new rates of subsoil survey, research and development:

Exploration becomes the best investment option globally while being both extremely profitable and ultra-reliable

Thanks to real, non-hypothetical E&A risk management provided by Valuable Geology, the E&A segment is converted from an extremely financially high risk and planned loss-making type of activity into an ultra-reliable and profitable investment option:

- Actual profits amount to hundreds and thousands of percent.
- The profit-making probabilities are 99.000–99.999% and above.
- Short timeframes of complete return on investments and profit-making – 1–3 years.
- Risk-free (practically guaranteed) profits – many tens and hundreds of percent.

Growth of the E&A scope and development of E&A advantages become a must to sustain companies' competitive power across all integration segments

Thanks to real, non-hypothetical E&A risk management methods and revolutionary management tools provided by Valuable Geology (Risk-Free Value of an E&A Program, Focused RMSEE Delivery, Focused GSEE Delivery, etc.), greater E&A scope and E&A advantages (advantages in exploration data, knowledge, competencies and technologies), become powerful tools enabling:

- fast and guaranteed colossal profits;
- fast and guaranteed colossal advantages in terms of production units cost and volumes, i.e. colossal competitive advantages across all vertical integration segments.

Thus, continuous increase in the E&A works scope and development of E&A advantages, i.e. advantages in exploration data, knowledge, competencies and technologies, become an obligatory condition for sustaining competitive positioning across all integration segments.

An explosive growth of investments in increasing the E&A scope and development of E&A advantages – an explosive growth of efficiency, rates, depth and scale of subsoil research and development

The binding necessity of larger E&A scope and greater E&A advantages to maintain competitive positioning, as well as their extremely high investment attractiveness, will result in an explosive growth of efficiency, rates, depth and scale of subsoil research and development, i.e. an explosive growth of investments in:

- E&A works;
- acquisition of exploration data;

- development of exploration knowledge and competencies;
- development of exploration methods and technologies;
- fundamental scientific research.

Financially, practically risk-free status of E&A works will provide the oil and gas industry with new colossal development prospects and discovery of new HC application areas

Obtaining the financially, practically risk-free status of the exploration segment will make it possible to transform the industry-wide trend of increasing production unit costs, and will unveil new development prospects and new areas of HC application.

Revolutionary tools provided by Valuable Geology, along with an explosive growth of exploration knowledge and efficiency of exploration methods and technologies, will bring forward immeasurable sweeping amplification of local and global prospects of discovery of conventional high-quality HC reserves:

- An explosive growth in volumes and quality of E&A knowledge, as well as efficiency of E&A methods and technologies, will quickly and quite significantly expand technologically available and economically attractive subsoil space in terms of development – it will make it possible to identify and discover a variety of new PBS (plays, PS, PR, PP), and materially enhance the exploration prospects of “old” PBS.
- Thanks to Valuable Geology revolutionary tools, a huge number of ready-to-deliver projects will become attractive – those which used to be left aside due to the avoidance of E&A risks for decades, multi-fold understatement of reserves estimates by FSD Methods, companies’ inability to deliver focused GSEE or RMSEE.

A sweeping increase in E&A scope, resulting from the financially, practically risk-free status of the exploration segment, along with fast, large-scale expansion of local and global prospects of discovery of conventional high-quality HC reserves, will result in a quick increase in the volumes and quality of discovered conventional HC reserves.

A quick increase in the volumes and quality of discovered conventional HC reserves will make it possible to reverse the long-term industry trend of production unit cost growth.

Large-scale expansion of local and global prospects of discovery of conventional high-quality HC reserves will make it possible to additionally capture the global HC demand for decades ahead.

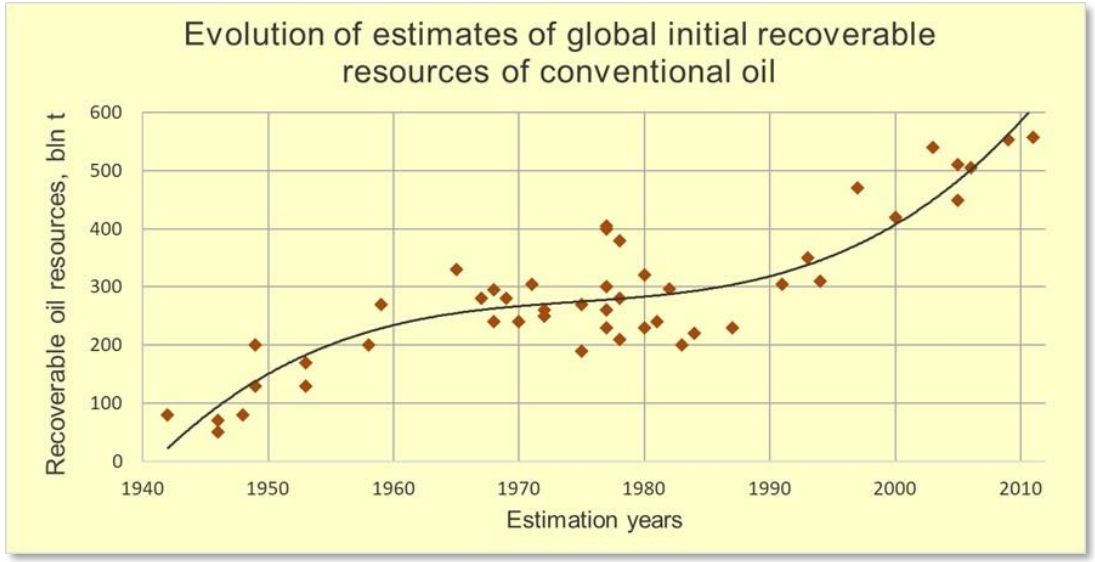
Reversal of the industry-wide trend of production unit cost growth, along with the ability to additionally capture the global HC demand for decades ahead, will fundamentally enhance the current and long-term competitive power of the oil and gas industry in conventional markets and will unveil new development prospects and areas for HC use.

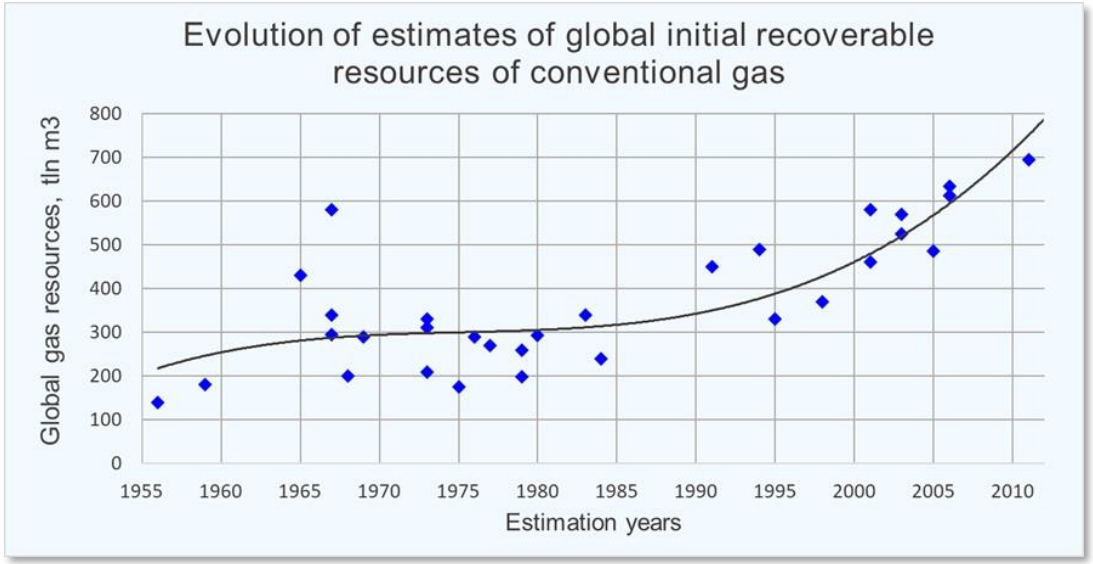
Colossal remaining potential of yet-to-discover, easy-to-recover HC fields is expected to increase further in a fast and considerable way

The global economically attractive development potential of yet-to-discover conventional easy-to-recover HC reserves is huge – it amounts to tens of thousands of yet-to-discover HC fields with the total value amounting to hundreds of trillions of USD.

Conservative estimates outlined in numerous scientific studies assume that about 35–40% of initial global recoverable crude resources (i.e. over 200 bln tonnes / 1.4 tln bbl) and 55–60% of initial global recoverable gas resources (i.e. about 400 tln m3) still remain undiscovered. At the same time, evolution of global oil and gas resources estimates is characterized by a clear trend of an increasing size of reserves within yet-to-discover, conventional, easy-to-recover HC reserves:

- The estimates of global initial recoverable resources of conventional easy-to-recover oil have increased approximately four-fold since the 1950s – from circa 150 bln tonnes (1.05 tln bbl) to 600 bln tonnes (4.2 tln bbl).
- The estimates of global initial recoverable resources of conventional easy-to-recover natural gas have increased approximately three-fold since the 1960s – from circa 250 tln m3 to 750 tln m3 [6].





Source: V.I. Vysotsky, V.I. Yermolkin. Global Oil and Gas Resources and Development Forecast // Publications of the Gubkin Russian State University of Oil and Gas. — 2012. — No. 1 (266).

New technologies in geology, geophysics, drilling, production, transportation, etc. are continuously expanding the technologically available and economically attractive subsoil space. As can be seen from the charts above, there is currently no evidence pointing to any trend of such estimates growth suspension in the near future. The observed trend makes it possible to assume that in the coming 20 years, the estimates

of yet-to-discover resources will still increase by about:

- 1.75 times (from 200 – 350 bln tonnes or from about 1.4 – 2.45 tln bbl) in the case of conventional easy-to-recover oil;
- by 1.6 times (from 400 – 650 tln m3) in the case of conventional easy-to-recover natural gas.

The explosive growth of efficiency, rates and scope of subsoil research and development, as a result of the financially, practically risk-free status of E&A works will fundamentally increase the already impressive rates of estimates growth, and, in the short term, will lead to significant enhancement, and provide for most efficient development of the remaining colossal potential of yet-to-discover fields of conventional, easy-to-recover HC reserves.

Pioneer VG companies will gain leadership and create a quantum leap in efficiency for all business segments of the oil and gas industry, which is going to be insuperable for competitors

As a result of several decades of the industry-wide informal practice of high E&A risk avoidance, as well as falsely justified, multi-fold reserves understated by FSD Methods, a huge E&A jackpot, represented by ready-to-deliver but not yet implemented, high-potential prospecting projects of conventional, easy-to-recover HC reserves has been accumulated.

The industry-wide trend of companies' reserves quality degradation, which is the result of decades of E&A risk avoidance, has caused a considerable increase in marginal production unit costs and, respectively, a considerable growth of profitability of high-quality conventional HC reserves development. As a result, an enormous economic jackpot, represented by super-profitability of developing the huge, yet-to-deliver potential of conventional, easy-to-recover HC reserves discoveries has been generated.

While making E&A free from the threat of huge financial losses, real risk management introduces new tools and practices of competition and profit-making with their efficiency being so high that pre-revolutionary companies could never compete against them. Pioneer VG companies will get an unprecedented opportunity to gain regional or global leadership and create a quantum leap in the efficiency of all business segments of the oil and gas industry, which is going to be insuperable for competitors.

VG companies overcoming the key industry development constraint, i.e. the threat of suffering huge financial losses when conducting E&A works, triggers an instant actualization of a huge jackpot, represented by ready-to-deliver but not yet implemented high-potential projects, which have been accumulating for the recent decades of E&A risk avoidance.

Sweeping implementation of accumulated drivers for new major discoveries of conventional, easy-to-recover HC reserves and extremely high profitability of such reserves development will make it possible for pioneer VG companies, in the shortest possible term and without taking financial risks:

- to obtain colossal super-profits from E&A operations;
- to create a quantum leap in the volumes and quality of available reserves, a quantum leap in the economic efficiency of production, which will be insuperable for their competitors;
- to obtain colossal super-profits from the development of discovered high-quality reserves;
- to create a quantum leap in the economic efficiency of exploration, i.e. create a barrier of exploration advantages insuperable for competitors in terms of:
  - the scope, relevancy and quality of exploration data;
  - development of exploration knowledge, competencies, methods and technologies;
  - scientific and operational capacities of the exploration business segment.

A drastic increase in the volume of available reserves, characterized by relatively low unit production costs will unveil possibilities of sweeping expansion across both HC markets and, respectively, markets of other vertical integration segments for VG companies.

Companies hesitating in terms of transitioning from hypothetical to real E&A risk management will face the risk of losing everything quite quickly:

- The threat of huge financial losses brought about by the hypothetical nature of present-day E&A risk management practices does not make it possible for such companies to enhance the scope of conducted E&A works.
- The intention to avoid implementation of projects with high E&A risks to the extent possible does not allow such companies to bring to life the most highly-potential projects.
- Inaccessibility of revolutionary tools does not make it possible for such companies to acquire the most attractive projects when competing with VG companies.
- Avoidance of high E&A risks, along with the loss of competitive power in the acquisition of attractive projects, will result in such companies losing competitive positioning, in terms of reserves increment quality and scale, when compared to VG companies.
- Degraded quality and smaller reserves increment volumes versus those of VG companies will create a trend of diminishing competitive positioning of such companies in terms of production volumes and unit costs, i.e. a trend of decreasing shares of such companies' presence across HC markets and other integration segments, thus posing a threat to their existence.

Thus, companies staying behind, in terms of transition from hypothetical to real E&A risk management will face a cascading loss of competitive positioning across all integration segments, posing a threat to their existence.

Advent of the new era in the oil and gas industry will result in the generation of fundamentally new revolutionary business models

Real risk management makes a revolution in the oil and gas industry, unveils a new era of the industry development, where pre-revolutionary tools and practices of the oil and gas business are no longer capable of providing companies with competitive positioning sufficient for stable existence and sustainable development. While making E&A free from the threat of huge financial losses, real risk management fundamentally changes the principles of competition and business in the oil and gas industry and introduces new tools and practices of competition and profit-making with their efficiency being so high that pre-revolutionary companies could never compete against them.

The huge scale of new business opportunities provided by the revolution made by Valuable Geology in the E&A risk management segment will result in the elaboration of fundamentally new business models in the oil and gas industry, which are able to maximize the efficiency of new profit-making tools, new tools for gaining competitive advantage, and new practices of oil and gas business sustenance and development.

Revolutionary business models developed by Valuable Geology (VG business models) will provide companies with E&A advantages beyond the reach of pre-revolutionary companies:

- Financially, practically risk-free status of E&A works;
- Vast business opportunities, the same as a perfect exploration team would provide:
  - guaranteed financially safe solution of identified tasks of reserves increments;
  - colossal expansion of the resource base development prospects, which is beyond the reach of pre-revolutionary companies;
- A powerful tool of enhancing the risk-free profitability of E&A operations, which is beyond the reach of pre-revolutionary companies;
- A tool of new play prospecting projects, causing a multi-fold increase in the profitability, which is practically beyond the reach of pre-revolutionary companies;
- Competitive power, in terms of project (subsoil block) acquisition, which is, in principle, beyond the reach of pre-revolutionary companies;

- Guaranteed financially risk-free conversion of advantages related to exploration data, knowledge and competencies into advantages in efficiency and expansion in production and other integration segments;
- Exploration becomes an investment option, which is as reliable as US Treasury bonds but with its profitability amounting to hundreds and thousands of percent.

E&A advantages possessed by VG companies, which are inaccessible to pre-revolutionary companies, create an insuperable foundation for VG companies, making it possible to gain advantages in production and the other integration segments.

Real (non-hypothetical) E&A risk management provides VG companies with a guaranteed solution of reserves increment tasks, i.e. the possibility of a guaranteed solution of tasks to achieve and sustain a pre-set production level.

The VG companies' advantages, in terms of project acquisition; E&A risk management efficiency; E&A economic efficiency; justification and raising of investments; development of E&A competencies, etc. are converted into advantages in the quality and volumes of reserves increment, i.e. advantages in production unit costs – advantages in production economic efficiency.

The chance to ensure guaranteed solution of tasks related to the achievement of a pre-set production level, along with production economic efficiency advantages, unveil the best possibilities for VG companies to gain advantages in the economic efficiency of other integration segments.

Thanks to possessing advantages in the development of new business opportunities offered by the new era of significantly higher rates of subsoil survey, research and development, revolutionary VG companies will be able to gain leadership and dominant positions across all business segments of the oil and gas industry.

Practical acquisition of opportunities provided by the new era – Valuable Geology's revolutionary business models

The opportunities granted by the new era of the oil and gas industry development can be attained thanks to the VG business models developed by Valuable Geology:

Business Model of a Financially Risk-Free Vertically Integrated Company (FRF VIOC BM)

The fundamental principles of the FRF VIOC BM are as follows:

1. Financially risk-free E&A operations – non-hypothetical, real reduction of the E&A financial failure probability down to zero, with specific quantified supporting evidence;
2. Focused GSEE and RMSEE delivery;
3. Use of the Risk-Free Value of an E&A Program tool for project acquisition;
4. Use of the Risk-Free Value of an E&A Program tool for expanding the resource base development prospects;
5. Management of the E&A segment as a standalone business capable of making profit:
   - setting E&A targets expressed not in physical but in numerically quantified financial indicators (expected and non-random);

- the key criterion of an E&A Program formation is the maximum value of the expected or risk-free profit of the E&A Program, which reflects the expected or risk-free profit of the company in general as it is based on the economics of projects, envisaging a complete cycle of discovered HC reserves development;
- assessment of the exploration segment performance based on real E&A financial performance indicators freed from random nature.

Competitive advantages of the FRF VIOC BM versus conventional VIOCs:

- Financially, practically risk-free status of E&A operations;
- E&A investments becoming an investment option as reliable as US Treasury bonds but with profitability amounting to hundreds and thousands of percent;
- Guaranteed financially safe solution of identified tasks of reserves increment;
- Colossal expansion of the resource base development prospects, which is beyond the reach of conventional VIOCs;
- Competitive power in terms of project (subsoil block) acquisition, which is, in principle, beyond the reach of conventional VIOCs;
- A powerful tool of enhancing risk-free profitability of E&A operations, which is beyond the reach of conventional VIOCs;
- A tool of multi-fold increase in the profitability of new play prospecting projects, which is practically beyond the reach of conventional VIOCs;
- Advantages in the acquisition and development of exploration advantages in terms of exploration data, knowledge and competencies;
- Guaranteed financially risk-free conversion of E&A advantages into advantages related to the efficiency and expansion in production and other integration segments.

Business Model of a Financially Risk-Free E&A Company (FRF EAC BM)

Fundamental principles of the FRF EAC BM – the FRF EAC Business Model keeps in place all the fundamental exploration management principles envisaged by the FRF VIOC BM, supplemented with profit-making as a follow-up to third-party E&A risk takeover, the BM focus on making profit from sales of discovered HC reserves, a focus on the acquisition and implementation of advantages in terms of E&A competencies and E&A risk management scale.

Thus, the FRF EAC BM envisages the following fundamental principles:

1. All the fundamental principles envisaged by the FRF VIOC BM;
2. The Business Model focus on getting profit from sales of discovered fields – getting profit from subsoil block value increase as a follow-up to performed E&A works, without implementation of projects involving production of discovered HC reserves;
3. The Business Model focus on acquisition and implementation of advantages in terms of exploration data, knowledge and competencies, as well as the E&A risk management scale;
4. Making profit from the takeover of third-party E&A risks – conduction of E&A works at third-party subsoil blocks, taking over financial risks related to potential E&A failures and getting risk-free profit due to the larger scale of risk management and implementation of other E&A advantages.

The fundamental difference of the FRF EAC BM from the business models used by conventional service E&A companies lies in the focus on getting profit from subsoil block value increase as a follow-up to performed E&A works (sales of rights to production of HC reserves discovered in the course of such E&A works) and not on profit resulting from provision of E&A services (the approach used by conventional service E&A companies).

The fundamental difference of the FRF EAC BM versus the FRF VIOC BM lies in the focus on getting profit from the increasing value of subsoil blocks as a result of the performed E&A works, i.e. profit-making from sales and not from production of HC reserves discovered in the course of conducted E&A works, which is the normal practice of conventional VIOCs and FRF VIOCs.

The focus on getting profit from subsoil block value increase as a result of the performed E&A works makes it possible for a FRF EAC to get profit from the takeover of third-party E&A risks, i.e. profit from E&A works conducted at third-party subsoil blocks while taking over financial risks related to potential E&A failures.

FRF EAC profit-making as a result of the third-party E&A risk takeover means gaining profit as a follow-up to the implementation of the FRF EAC advantages versus third-party companies in terms of exploration data, knowledge, competencies, technologies and E&A risk management scale in the course of E&A operations held at third-party subsoil blocks at its own expense while taking over the respective financial risks of potential E&A failure events.

The conceptual framework of E&A operations by the FRF EAC at third-party subsoil blocks while taking over all the financial risks of potential E&A failures is described below.

The FRF EAC receives a subsoil block from a third-party company in exchange for the commitment to carry out E&A operations at its own expense, and:

- in case of the E&A success, shall pay a certain share of the proceeds from the auctions for the right to develop the fields discovered by the FRF EAC within such subsoil block;
- in case of the E&A failure, shall hand the subsoil block back.

The third-party company gets:

- freedom from financial risks envisaged by E&A operations within the block;
- freedom from the need to invest into E&A operations within the block;
- the possibility to gain profit from E&A operations held within the block without making respective investments;
- the possibility to gain profit from E&A operations within the block in the absence of relevant data, knowledge, competencies and technologies;
- the possibility to acquire reserves discovered within the block with a considerable discount (the discount is represented by the company's share in the auction proceeds).

As a result of carrying out E&A works at third-party subsoil blocks while taking over the financial risks of potential E&A failures, the FRF EAC gains an increase in the profitability and E&A risk management efficiency as a follow-up to more comprehensive implementation of available advantages in terms of exploration data, knowledge, competencies, technologies and E&A risk management scale. E&A works delivery at third-party subsoil blocks provides the FRF EAC with a wider range and freedom of choice of the most attractive and highly-potential projects, i.e. it expands the following opportunities for the FRF EAC:

1. Obtaining the best E&A scale advantages:
   - increasing E&A risk management efficiency;
   - delivering a greater RMSEE.
2. More comprehensive implementation of advantages in terms of exploration knowledge and competencies:
   - more comprehensive implementation of advantages in terms of project success probability values;
   - more comprehensive implementation of GSEE advantages.

Competitive advantages of the FRF EAC BM versus conventional VIOCs:

- Financially, practically risk-free status of E&A works;
- E&A investments becoming an investment option as reliable as US Treasury bonds but with profitability amounting to hundreds and thousands of percent;
- Guaranteed financially safe solution of identified tasks of reserves increment;

- Colossal expansion of the resource base development prospects, which is beyond the reach of conventional VIOCs;
- Competitive power in terms of project (subsoil block) acquisition, which is, in principle, beyond the reach of conventional VIOCs;
- A powerful tool for enhancing the risk-free profitability of E&A operations, which is beyond the reach of conventional VIOCs;
- A tool of multi-fold increase in the profitability of new play prospecting projects, which is practically beyond the reach of conventional VIOCs;
- Advantages in the acquisition and development of exploration advantages in terms of exploration data, knowledge and competencies;
- Guaranteed financially safe conversion of E&A advantages into additional advantages related to competitive positioning in terms of project acquisition, as well as risk management efficiency and E&A profitability.

Competitive advantages of the FRF EAC BM versus the FRF VIOC BM

In the case of real risk management, profitability obtained as a result of carried out E&A works and the development of exploration advantages may be no more risk than production profitability but it can be many times higher.

As a result of the focus on profit-making from E&A works, i.e. from sales of fields discovered in the course of E&A works, and not from HC production operations, the FRF EAC has no geographical and economic reference to own production assets and has the chance to carry out E&A works at third-party subsoil blocks.

The FRF EAC BM focus on making profit from sales of fields discovered in the course of E&A works, and not from HC production operations, provides the FRF EAC with extra possibilities of gaining advantages in terms of project acquisition, risk management efficiency and E&A profitability. Thus, the focus on gaining profit from exploration, and not from production, provides the FRF EAC with the following results unachievable by the FRF VIOC:

- The possibility to increase the profitability of conducted E&A by means of selling discovered reserves to third-party companies that are the most efficient ones in terms of production projects implementation;
- The possibility to focus investment and operational resources on development of exploration advantages;
- A wider range and freedom of choice of the most attractive and highly-potential projects;
- More possibilities of obtaining exploration advantages;
- The possibility of larger-scale execution of advantages in terms of exploration data, knowledge and competencies:
  - more comprehensive implementation of advantages in terms of project success probabilities;
  - more comprehensive implementation of GSEE advantages;
- More opportunities in terms of E&A scale advantages:
  - higher efficiency of E&A risk management;
  - greater RMSEE.

Business Model of a Financially Risk-Free E&A Venture Fund (FRF EAVF BM)

The fundamental principles of the FRF EAVF BM – the FRF EAVF Business Model incorporates all the fundamental exploration management principles envisaged by the FRF EAC BM supplemented with the BM focus on receiving advantages related to the scale of delivered E&A works as a result of attracting a wide range of investors. Thus, the FRF EAVF BM envisages the following fundamental principles:

1. All the exploration management principles and practices of the FRF EAC BM;
2. Focus on enhancing the advantages in terms of the larger scale of performed E&A works as a follow-up to engaging a wider range of investors.

Competitive advantages of the FRF EAVF BM versus conventional VIOCs:

- Financially, practically risk-free status of E&A works;
- E&A investments becoming an investment option as reliable as US Treasury bonds but with profitability amounting to hundreds and thousands of percent;
- Guaranteed financially safe solution of identified tasks of reserves increment;
- Colossal expansion of the resource base development prospects, which is beyond the reach of conventional VIOCs;
- Competitive power in terms of project (subsoil block) acquisition, which is, in principle, beyond the reach of conventional VIOCs;
- A powerful tool for enhancing the risk-free profitability of E&A operations, which is beyond the reach of conventional VIOCs;
- A tool of multi-fold increase in the profitability of new play prospecting projects, which is practically beyond the reach of conventional VIOCs;
- Advantages in the acquisition and development of exploration advantages in terms of exploration data, knowledge and competencies;
- Guaranteed financially safe conversion of E&A advantages into additional advantages related to competitive positioning in terms of project acquisition, as well as risk management efficiency and E&A profitability.

Competitive advantages of the FRF EAVF BM versus the FRF VIOC BM

In the case of real risk management, profitability obtained as a result of carried out E&A works and development of the exploration advantages may be no more risk than production profitability but it can be many times higher.

As a result of the focus on profit-making from E&A works, i.e. from sales of fields discovered in the course of E&A works, and not from HC production operations, the FRF EAVF has no geographical and economic reference to own production assets and gets the chance to carry out E&A works at third-party subsoil blocks.

The FRF EAVF BM focus on making profit from sales of fields discovered in the course of E&A works, and not from HC production operations, provides the FRF EAVF with extra possibilities of gaining advantages in terms of project acquisition, risk management efficiency and E&A profitability. Thus, the focus on gaining profit from exploration, and not from production, provides the FRF EAVF with the following results unachievable by the FRF VIOC:

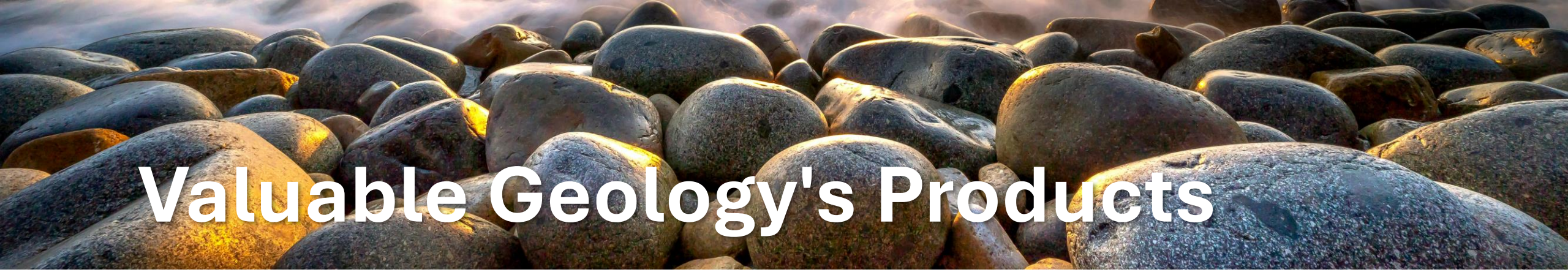
- The possibility to increase the profitability of conducted E&A by means of selling discovered reserves to third-party companies that are the most efficient ones in terms of production projects implementation;
- The possibility to focus investment and operational resources on development of exploration advantages;
- A wider range and freedom of choice of the most attractive and highly-potential projects;

- More possibilities of obtaining exploration advantages;
- The possibility of larger-scale execution of advantages in terms of exploration data, knowledge and competencies:
  - more comprehensive implementation of advantages in terms of project success probabilities;
  - more comprehensive implementation of GSEE advantages;
- More opportunities in terms of E&A scale advantages:
  - higher efficiency of E&A risk management;
  - greater RMSEE.

Competitive advantages of the FRF EAVF BM versus the FRF EAC BM

Greater investment opportunities of the FRF EAVF versus a FRF EAC, thanks to raising funds from a wide range of investors can be converted to:

- A greater scale of E&A works;
- A wider range and freedom of choice of the most attractive and high potential projects;
- A larger scale and rate of knowledge accumulation and exploration competency development – advantages in terms of project success probability values and GSEE;
- Advantages in terms of the delivered RMSEE values;
- Advantages in acquisition of attractive projects;
- A higher rate and integrity of implementing the obtained exploration and economic advantages;
- Advantages in terms of E&A risk management efficiency and profitability.



Valuable Geology's Products

Valuable Geology provides the following products:

VG Business Models implementation service

Valuable Geology provides a service assisting in the implementation of the following VG Business Models:

Service for implementation of the VG financially risk-free VIOC Business Model (FRF VIOC BM)

Implementation of the FRF VIOC BM reveals the following colossal business opportunities:

- Financially, practically risk-free status of E&A operations;
- E&A investments becoming an investment option as reliable as US Treasury bonds but with profitability amounting to hundreds and thousands of percent;
- Guaranteed financially safe solution of identified tasks of reserves increment;
- Colossal expansion of the resource base development prospects, which is beyond the reach of conventional VIOCs;
- Competitive power in terms of project (subsoil block) acquisition, which is, in principle, beyond the reach of conventional VIOCs;
- A powerful tool of enhancing risk-free profitability of E&A operations, which is beyond the reach of conventional VIOCs;
- A tool of multi-fold increase in the profitability of new play prospecting projects, which is practically beyond the reach of conventional VIOCs;
- Advantages in the acquisition and development of exploration advantages in terms of exploration data, knowledge and competencies;
- Guaranteed financially risk-free conversion of E&A advantages into advantages related to the efficiency and expansion in production and other integration segments.

Expected economic deliverables gained by the company E&A business stream upon implementation of the FRF VIOC Business Model:

- The probabilities of a complete return on investments and profit-making across the E&A business stream at 99.000–99.999% and above, instead of the probabilities of 20–90% of complete loss of all investments in the context of present-day hypothetical E&A risk management;
- Expected and actual profits of the E&A segment amounting to several hundred, many hundred or even several thousand percent, i.e. hundreds of millions and billions of USD per annum instead of the planned loss-making status of the E&A segment envisaged by present-day hypothetical E&A risk management;
- Practical risk-free (practically guaranteed) P95 net profits amounting to many tens and hundreds of percent instead of the lack of profit-making guarantees in the context of present-day hypothetical E&A risk management. *Note. Practical risk-free profit is the lowest practically possible value of profit-making – getting a still lower value is practically impossible (the probability of getting a still lower value is very small – equal to the pre-set level of significance).*
- Practical risk-free (practically guaranteed) P99 net profits amounting to many tens of percent instead of the lack of profit-making guarantees in the context of present-day hypothetical E&A risk management;
- Effective investment capacity: hundreds of millions and billions of USD per annum instead of the high probability (20–90%) of complete investment loss in the context of present-day hypothetical E&A risk management. *Note. Effective investment capacity of a business model means the maximum amount of funds which can be invested in a business activity without affecting the pre-set levels of investment reliability and profitability.*
- The timeline of investments pay-back and profit-making in full amounts to 1–3 years instead of the decades envisaged by present-day, pre-revolutionary E&A risk management.

Minimal requirements of the FRF VIOC Business Model to company features required for successful application of the Business Model:

- The minimal quantity of implemented oil and gas prospecting projects should be no less than 10 projects per annum;
- The minimal annual budget of the E&A segment should be no less than 1 bln USD.
- The minimal 3-year budget of the E&A segment shall be about 3 bln USD.

Approximate cost of the FRF VIOC BM project development and implementation: 50–250 mln USD.

Approximate timeframes of the FRF VIOC BM project development and implementation: 1.5 years.

Service for implementation of the VG financially risk-free E&A Company Business Model (FRF EAC BM)

Implementation of the FRF EAC BM reveals the following colossal business opportunities:

- Financially, practically risk-free status of E&A works;
- E&A investments becoming an investment option as reliable as US Treasury bonds but with profitability amounting to hundreds and thousands of percent;
- Guaranteed financially safe solution of identified tasks of reserves increment;
- Colossal expansion of the resource base development prospects, which is beyond the reach of conventional VIOCs;
- Competitive power in terms of project (subsoil block) acquisition, which is, in principle, beyond the reach of conventional VIOCs;
- A powerful tool for enhancing the risk-free profitability of E&A operations, which is beyond the reach of conventional VIOCs;
- A tool of multi-fold increase in the profitability of new play prospecting projects, which is practically beyond the reach of conventional VIOCs;
- Advantages in the acquisition and development of exploration advantages in terms of exploration data, knowledge and competencies;
- Guaranteed financially safe conversion of E&A advantages into additional advantages related to competitive positioning in terms of project acquisition, as well as risk management efficiency and E&A profitability;
- Significant competitive advantages versus the FRF VIOC BM.

Expected E&A economic deliverables gained by the company upon implementation of the FRF EAC Business Model:

- The probabilities of a complete return on investments and profit-making across the E&A business stream at 99.000–99.999% and above, instead of the probabilities of 20–90% of complete loss of all investments in the context of present-day hypothetical E&A risk management;
- Expected and actual profits of the E&A segment amounting to several hundred, many hundred or even several thousand percent, i.e. hundreds of millions and billions of USD per annum instead of the planned loss-making status of the E&A segment envisaged by present-day hypothetical E&A risk management;
- Practical risk-free (practically guaranteed) P95 net profits amounting to many tens and hundreds of percent instead of the lack of profit-making guarantees in the context of present-day hypothetical E&A risk management. *Note. Practical risk-free profit is the lowest practically possible value of profit-making – getting a still lower value is practically impossible (the probability of getting a still lower value is very small – equal to the pre-set level of significance).*
- Practical risk-free (practically guaranteed) P99 net profits amounting to many tens of percent instead of the lack of profit-making guarantees in the context of present-day hypothetical E&A risk management;
- Effective investment capacity: hundreds of millions and billions of USD per annum instead of the high probability (20–90%) of complete investment loss in the context of present-day hypothetical E&A risk management. *Note. Effective investment capacity of a business model means the maximum amount of funds which can be invested in a business activity without affecting the pre-set levels of investment reliability and profitability.*
- The timeline of investments pay-back and profit-making in full amounts to 1–3 years instead of the decades envisaged by present-day, pre-revolutionary E&A risk management.

Minimal requirements of the FRF EAC Business Model to company features required for successful application of the Business Model:

- The minimal quantity of implemented oil and gas prospecting projects should be no less than10 projects per annum, at least 10% out of which shall be represented by new play prospecting projects;
- The minimal annual budget of the E&A segment should be about 2 bln USD.
- The minimal 3-year budget of the E&A segment should be about 6 bln USD.

Approximate cost of the FRF EAC BM project development and implementation: 50–250 mln USD.

Approximate timeframes of the FRF EAC BM project development and implementation: 1.5 years

Service for implementation of the VG financially risk-free E&A Venture Fund Business Model (FRF EAVF BM)

Implementation of the FRF EAVF BM reveals the following colossal business opportunities:

- Financially, practically risk-free status of E&A works;
- E&A investments becoming an investment option as reliable as US Treasury bonds but with profitability amounting to hundreds and thousands of percent;
- Guaranteed financially safe solution of identified tasks of reserves increment;
- Colossal expansion of the resource base development prospects, which is beyond the reach of conventional VIOCs;
- Competitive power in terms of project (subsoil block) acquisition, which is, in principle, beyond the reach of conventional VIOCs;
- A powerful tool for enhancing the risk-free profitability of E&A operations, which is beyond the reach of conventional VIOCs;
- A tool of multi-fold increase in the profitability of new play prospecting projects, which is practically beyond the reach of conventional VIOCs;
- Advantages in the acquisition and development of exploration advantages in terms of exploration data, knowledge and competencies;
- Guaranteed financially safe conversion of E&A advantages into additional advantages related to competitive positioning in terms of project acquisition, as well as risk management efficiency and E&A profitability;
- Significant competitive advantages versus the FRF VIOC BM;
- Significant competitive advantages versus the FRF EAC BM.

Expected E&A economic deliverables gained by the company upon implementation of the FRF EAVF Business Model:

- The probabilities of a complete return on investments and profit-making across the E&A business stream at 99.000–99.999% and above, instead of the probabilities of 20–90% of complete loss of all investments in the context of present-day hypothetical E&A risk management;
- Expected and actual profits of the E&A segment amounting to several hundred, many hundred or even several thousand percent, i.e. hundreds of millions and billions of USD per annum instead of the planned loss-making status of the E&A segment envisaged by present-day hypothetical E&A risk management;
- Practical risk-free (practically guaranteed) P95 net profits amounting to many tens and hundreds of percent instead of the lack of profit-making guarantees in the context of present-day hypothetical E&A risk management. *Note. Practical risk-free profit is the lowest practically possible value of profit-making – getting a still lower value is practically impossible (the probability of getting a still lower value is very small – equal to the pre-set level of significance).*
- Practical risk-free (practically guaranteed) P99 net profits amounting to many tens of percent instead of the lack of profit-making guarantees in the context of present-day hypothetical E&A risk management;

- Effective investment capacity: billions and tens of billions of USD per annum instead of the high probability (20–90%) of complete investment loss in the context of present-day hypothetical E&A risk management. *Note. Effective investment capacity of a business model means the maximum amount of funds which can be invested in a business activity without affecting the pre-set levels of investment reliability and profitability.*
- The timeline of investments pay-back and profit-making in full amounts to 1–3 years instead of the decades envisaged by present-day, pre-revolutionary E&A risk management.

Minimal requirements of the FRF EAVF Business Model to company features required for successful application of the Business Model:

- The minimal quantity of implemented oil and gas prospecting projects should be no less than 30 projects per annum, at least 10% out of which shall be represented by new play prospecting projects;
- The minimal annual budget of the E&A segment should be about 3 bln USD.
- The minimal 3-year budget of the E&A segment should be about 10 bln USD.

Approximate cost of the FRF EAVF BM project development and implementation: 120–400 mln USD.

Approximate timeframes of the FRF EAVF BM project development and implementation: 1.5 years.

Service ensuring financially risk-free E&A operations before complete roll-out of the VG business model

The fantastic opportunities provided by Valuable Geology tools can be gained almost at once before the rollout of the VG business model is completed in the company. E&A planning and risk management services provided by Valuable Geology make it possible to rapidly obtain the competitive advantages inaccessible to companies with hypothetical E&A risk management, such as:

- Financially, practically risk-free status of E&A works;
- Instantaneous expansion of E&A prospects beyond the reach of companies applying hypothetical E&A risk management;
- Advantages in terms of attractive project (subsoil block) acquisition, which are beyond the reach of companies applying hypothetical E&A risk management;
- A powerful tool of multi-fold increase in profitability of new play prospecting projects, which is practically beyond the reach of companies with hypothetical E&A risk management;
- A powerful tool of enhancing the risk-free value and profitability of planned E&A works, which is, in principle, beyond the reach of companies applying hypothetical E&A risk management;
- Advantages in terms of the justification and raising of investments, which are in principle beyond the reach of companies applying hypothetical E&A risk management, etc.

The provided service offers the following benefits to customer companies:

- Generation of financially risk-free E&A Programs which are optimal in terms of specified business criteria (E&A budget, expected reserves size and characteristics, research and production capacity loading, etc.);
- Instantaneous expansion of E&A prospects beyond the reach of companies applying hypothetical E&A risk management;
- Practically guaranteed solution of the reserves increment task (increment volumes, HC phase state);
- Supremely competitive advantages versus companies with hypothetical risk management in terms of attractive project (subsoil block) acquisition;

- Estimation of attractive project acquisition prices and tactical scenarios for auctions;
- Maximization of profits from E&A operations;
- Optimal project shares;
- Optimal timelines of projects implementation within the framework of a developed E&A Program;
- Focused GSEE Delivery;
- Focused RMSEE Delivery;
- Calculation of actual financial results of performed E&A works, etc.

Approximate cost of the service provision: from 1 mln USD.

Approximate timeframes: from 20 days.

E&A Planning and Risk Management Back Test

The E&A Planning and Risk Management Back Test presumes determination of potential results of Valuable Geology products application in certain historical periods on the basis of respective historical data related to E&A planning and conduction.

The back test results regarding the implementation of VG business models and tools may include the following estimates, assessments and statements:

- objective assessments of E&A risk management efficiency delivered by methods historically applied in previous periods on the basis of specific quantified metrics;
- estimation of forecasted probabilistic and actually obtained economics of conducted E&A works assuming application of VG business models in certain historical periods;
- estimation of forecasted probabilistic operational physical indicators of conducted E&A works assuming application of VG business models in certain historical periods;
- objective assessment of the economic performance of the corporate exploration team / E&A business segment on the basis of specific quantified metrics normalized to a non-random format;
- estimation of fulfilled and missed opportunities in terms of attractive project acquisition;
- estimation of gained and missed GSEE in historical periods;
- estimation of gained and missed RMSEE in historical periods;
- alternative E&A scenarios versus those implemented in historical periods – missed profit-making opportunities which were not fulfilled in historical periods, missed opportunities of the company resource base development, etc.

Valuable Geology recommends that all customers should try the E&A Planning and Risk Management Back Test tool before making a decision on a VG business model implementation in order to be able to witness the colossal power and efficiency of Valuable Geology tools on the basis of their own historical E&A planning and delivery data, i.e. make sure that in real operational practice, such tools are able to ensure:

- financially, practically risk-free E&A works;
- guaranteed solution of reserves increment tasks;
- supremely competitive positioning in the acquisition of attractive projects (subsoil blocks), which is beyond the reach of companies applying hypothetical risk management;

- Extremely high values of the risk-free, expected and actual profitability of E&A works.

The E&A Planning and Risk Management Back Test service is also needed to provide customer companies with a chance to use their own data to check whether available financial resources, scientific and operational capacities are sufficient for the effective application of Valuable Geology tools and VG business models.

Approximate cost of the service provision: from 1 mln USD.

Approximate work timeframes: from 30 days.

Ideal customer profile for Valuable Geology's products

The ideal customer profile (ICP) is description of a customer capable of gaining the maximum benefit from the product.

The ideal customer profile with regard to the Valuable Geology products includes two constituent elements.

The first element of the ideal customer profile with regard to the Valuable Geology products **is possession of** at least **one of the following needs:**

- ultra-high reliability of investments;
- extremely high profitability of investments;
- ultra-high reliability along with extremely high profitability of investments;
- highly efficient investment capacity, i.e. the need for an investment option to be capable of accepting large and very large investment volumes with required (in our case – highest possible) levels of reliability and profitability;
- financially risk-free status of conducted E&A works;
- truly high financially risk-free profitability of conducted E&A works;
- guaranteed solution of identified tasks of oil and gas reserves increment;
- guaranteed solution of identified tasks related to increasing the quality of available oil and gas reserves (decrease in production unit costs);
- highly competitive positioning in acquisition of the most attractive subsoil blocks, which is beyond the reach of the other action participants;
- implementing the most challenging exploration ideas without the threat of financial losses;
- implementing and testing the most ambitious innovative exploration methods and technologies without the threat of financial losses;
- implementing the most ambitious oil, gas and E&A companies development plans without the threat of financial losses;
- implementing, without the threat of financial losses, the most ambitious plans for increasing financial capital;
- gaining and sustaining the respective company leadership positions in terms of development of exploration knowledge, competencies and technologies;
- gaining and sustaining the respective company leadership positions in exploration economic efficiency;
- gaining and sustaining the respective company leadership positions in the economic efficiency of oil and gas production (production volumes and unit costs);
- gaining and sustaining the respective company leadership positions across all segments of the oil and gas industry.

The second element of the ideal customer profile of Valuable Geology products **is their** possession or their **ability to obtain a sufficient scope of at least one of the following resources:**

- sufficient volume of exploration data, knowledge and competencies;
- sufficient volume of financial funds.

Possession of sufficient scope of one of such resources generally makes it possible to acquire a sufficient scope of the other one.

Availability of sufficient scope of financial funds makes it possible to acquire relevant exploration data, knowledge and competencies in respective markets. In current conditions, the minimal volume of funds sufficient for the arrangement of financially risk-free E&A works is around 1 bln USD.

Availability of sufficient exploration data, knowledge and competencies makes it possible to attract a sufficient volume of financial funds in financial markets – the Valuable Geology products make exploration an extremely attractive investment option. *In the current conditions, the minimal volume of exploration data, knowledge and competencies sufficient for arrangement of financially risk-free E&A works means the ability to prepare for implementation of around 10 oil and gas prospecting projects – depending on their economic and probabilistic characteristics.*

Thus, **the total of the two constituent elements of the Valuable Geology products ideal consumer profile can be attained by:**

- investors; shareholders; managers; explorationists and specialists representing investment; financial; oil and gas and exploration companies interested in achieving high financial and operational performance of their respective companies, as well as sustaining or increasing their competitive power;
- investors; shareholders; managers; explorationists and specialists representing investment; financial; oil and gas and exploration companies and other entities who are interested in obtaining the ability to implement the most challenging and ambitious exploration, technological and investment ideas and plans, without the threat of financial losses, i.e. those who are interested in gaining an opportunity to make a notable contribution in science, progress and prosperity of current and future generations of the mankind, as well as solving the most urgent, highly-potential and ambitious tasks related to the perception, development and preservation of the environment, and interested in getting merited awards and recognition of such contribution.

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