An Unified Atlas of Hydrocarbon Resources in Russia

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Abstract

The use of GIS technology considerably expands opportunities to analyse hydrocarbon resources. Examples include the spatial representation and joint analyses of statistical analyses, where analysis parameters accompany thematic maps (approx. 300). The use of standard techniques allow to compare results of hydrocarbon resource analyses in different regions (spatial analysis), as well as to monitor oil&gas fields (temporal analysis). Atlases for more than 10 regions of Russia were created in 1999-2002.

The atlas standard with the purpose of the pattern and dynamics of the hydrocarbon resources of Russia analysis was created by the Geological consulting center Gecon experts (the patent application of the Russian Federation on an industrial design #48852, priority from 24.03.2000 The Atlas of the thematic maps Hydrocarbon resources (oil, gas, condensate).

Since 1999 for 2003 a series of atlases on 14 subjects of the Russian Federation, located in the Northwest (Nenetsky autonomous region, Republic of Komi, the Kaliningrad area, the Murmansk area, including shelf of the Barents, Pechora and Baltic seas); Privolzhsky (the Udmurt Republic, Republic of Tatarstan, the Samara, Saratov and Orenburg areas); Southern (the Krasnodar and Stavropol territories, the Dagestan Republic), Ural (Jamalo-Nenetsky autonomous region, including a shelf of the Karsk sea), Far East (the Sakhalin area, including a shelf of the Okhotsk sea) federal districts was created (Fig.1). The use of standard techniques allow to compare results of hydrocarbon resource analyses in different regions (spatial analysis), as well as to monitor oil&gas fields (temporal analysis).

The main customers are: the Federal Assembly of Russian Federation, the RF Ministry of natural resources and the RF ministry of energy, the administrations of federal subjects and regions, oil companies.

Atlases ensure a solution of wide sections of problems:

- Estimation of the hydrocarbon resources of fields, license areas, federal subjects from items of the reserves and resources dynamics, its reproduction, rates of the reserves and production increase, depletion rate, etc.
- Separation of the objects for the priorities of the exploration and reserves revaluation planning.
- Separation of the hard-extracted reserves, residual reserves of the reduced quality and being in complicated mining-and-geological and economic-and-geographical conditions groups with the purpose of the entrails usage payments regulation.
- Regulation of the payments for fields (including frontier) developing inflows in various levels budgets.
- Estimation of the reserves quality variation arising during production, distributions of documentary types of hydrocarbons with the purpose of fuel-and-energy complex infrastructure planning.
- Determination of the hydrocarbons production effect on the environment at the expense of the harmful admixtures contents influencing people's health, flora and fauna.
The use of GIS technology considerably expands opportunities to analyse hydrocarbon resources, for examples - the spatial representation and joint analyses of statistical analyses, where analysis parameters accompany thematic maps.

For each object, irrespective of its rank, the one-type analysis including reviewing more than 100 parameters located in several groups is carried out. The main contents of the parameters mentioned above is described below on an example of the oil resources data. A state of resources: year of discoveries; a state of resource base - the initial, current (Fig.2) and proved resources (values and percentage of the categories), convergence of reserves on field-size categories, a changing and a completion of reserves due to production, geological prospecting, overestimations; number and reserves of new fields and traps etc. Quality of oils: density, viscosity, a content of sulfur, paraffine, gums and asphaltenes. Weighted-mean indexes and convergence of reserves on classes of oils and technological types are analyzed. Hard-extracted reserves (HER): high-viscosity oils, poorly permeable thin reservoirs, under gaseous reservoirs; value of reserves of the given type and its percentage in common pattern of reserves. Production: year of a bringing into development, duration of the field developing input; number of developed reservoirs, a spacing of developed horizons; value of the current production (Fig.3), production from the beginning of mining, production for date of the reserves statement; rates of recoverys; depletion index, coefficient of the developed oil fields resources drawing in the mining; developing stages with separation of objects with the undervalued reserves. Changing of oil quality from the beginning of developing, including HER percentage, at developing fields with the great number of reservoirs etc.

The standard atlas includes about 300 thematic maps introducing the resource base of oil, gas and condensate state analysis results.

GIS-technologies usage has allowed to lead for the indicated above territories a number of additional specialized researches based on atlases data. The modelling of oil-and-gas production centers development (Fig.4), analysis of the license agreements conditions execution, geological-and-economical analysis of the explorations efficiency, evaluation of resources (including with allowance for quality deviations influencing the price), compensatory payments at transportation of oil account, optimization of transport streams of oils, etc. were carried out.

Appendixes
Fig. 1. Index map.
Timan-Pechora Province: current oil resources structure (A C₂ different categories).

Fig.3 Samara area: tectonic elements and fields oil production (2000).
Fig.4. Timan-Pechora Province: modelling of oil production centers development (1999-2010 - 2015).

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