

STATE AND TRENDS OF THE URANIUM SECTOR IN THE WORLD FUEL-ENERGY COMPLEX

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The paper present statistical material and analysis of one of the natural fossil power resources – uranium. A situation of uranium stocks in various regions and countries, dynamics of its extraction, consumption, export, import and average annual prices have been analyzed for the past several years. In addition trends of the world uranium sector for the nearest future have been considered.

Uranium is a strategic type of raw stock and the most important energy carrier.

It is mainly used in the atomic power engineering that at the moment is producing about 17% of the world capacities of electricity, while nuclear sources cover 7% of the world energy resources [1].

World resources of natural uranium according to [2] make up 17 million tons, 21% of which are profitably mineable total reserves with the basic price of USD 80 per kg maximum (including 2,6 million tons of confirmed reserves).

Table 1. Confirmed reserves of uranium, dated of 01.01.2005. (thousand tons) [2]

| | Europe and Asia (incl. Russia) | Asia | Africa | America | Oceania and Australia | Total |
|--------------------|--------------------------------|--------|--------|---------|-----------------------|---------|
| Reserves (t.t.) | 212,0 | 570,34 | 560,91 | 613,4 | 714 | 2670,74 |
| World quantity (%) | 7,9 | 21,4 | 21,0 | 23 | 26,7 | 100 |

According to [3] dated 01.01.2005 the world reserves of uranium make up over 14,8 million tons. A part of them is total reserves (profitably mineable) make up slightly over a quarter, probable reserves – 68%, and a reminder, 6,3 %, is the below-balance reserves, the waste cost price of which is USD 80-130 per kg.

About 80% of reserves are in seven countries. The largest reserves of uranium are in Australia (26,7%), Kazakhstan (14,2%), Canada (12,9%).

The share of Australia makes up over a quarter of the reserves, and 97 % of them are characterized by an extraction cost price of USD 40 per kg maximum. 67 % reserves of Kazakhstan, 84 % of Canada, 77 % of Niger and 100 % of Uzbekistan are of the same category. This type reserves in Russia make up 46 % [3].

Brazil, Uzbekistan, Namibia and Niger have got a significant total stock of 9,5%.

During 2003 to 2005 a small stock and probable addition of uranium took place. Its total reserves increased by 7,6 % (basically at the expense of increase in the confirmed reserves – 7.5 %). Volume of probable reserves – by 2,7 %, addition of below-balance reserves made up 1% [3].

This addition was mainly provided by Niger and Australia, while reserves in the rest of the countries are of the same level, or are decreasing as a result of the deposits' spent [2].

Rise in the world reserves during the mentioned period took place not so much due to exploration work, as a result of recalculation of reserves with the reduction of uranium cutoff grade made tanks to a sharp increase in its price.

Uranium concentrates from the extracted ores are produced in 18 countries with the capacity of over 40 thousand tons converting to uranium (table 2) [2,4].

Table 2. Dynamics of uranium concentrates' production (t), converting to uranium

| | 1995 | 1996 | 1997 | 1998 | 2001 | 2002 | 2003 | 2004 | 2005 |
|-----------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Europe (incl. Russia) | 4991 | 4668 | 4477 | 4057 | 4460 | 4524 | 4565 | 4615 | 4668 |
| Asia | 4159 | 3549 | 3493 | 3973 | 4923 | 5658 | 6095 | 6760 | 7475 |
| Africa | 7031 | 7777 | 7974 | 8186 | 6059 | 7268 | 6562 | 7062 | 7248 |
| America | 13029 | 14237 | 14234 | 12831 | 13586 | 12796 | 11555 | 12743 | 12803 |
| Oceania and Australia | 3712 | 4974 | 5520 | 4885 | 7652 | 6854 | 7633 | 8982 | 9516 |
| Total | 32922 | 35205 | 35698 | 33932 | 36680 | 37100 | 36410 | 40162 | 41610 |

In 2005 the biggest capacity of uranium production was in Canada (27,9%), Australia (22,8%), Kazakhstan (10%). These countries together with Russia, Niger, Namibia and Uzbekistan (where extraction capacity is over 2 thousand tons) provided 89% of the world production.

A basic part of uranium is extracted on a Canadian deposit – McArthur River, brought in operation in 2000. An underground pit of the deposit is the largest on the world – its annual capacity is 7,2 thousand tons of uranium. The second biggest metal extraction deposit is an Australian deposit – Ranger, with 0,5 thousand tons, the third biggest deposit is one more Australian deposit, a complex copper-gold-uranium object – Olympic Dam, with 3,69 thousand tons [5].

An Australian company BHP Billiton is working on a feasibility study of the project on enlarging of Olympic Dam. This project requires from 7 to 10 milliard dollars. As a result of its implementation an annual production of uranium will be tripled and make up 12,7 thousand tons [5].

Plants producing uranium hexafluoride from natural resources are operating in six

countries and over a third of the total production capacity is in Russia (24 thousand tons), France (14,4 thousand tons), the USA (14,0 thousand tons), Canada (10,5 thousand tons), Great Britain (6 thousand tons), China (0,4 thousand tons). A total world capacity makes up 69,53 thousand tons of uranium hexafluoride per year [6].

Further processing of natural uranium hexafluoride and secondary raw materials are realized by isotope-separation plants in a limited number of countries: the USA (34%), Russia (28%), France (20%), Great Britain, the Netherlands, China, Germany and Japan (total capacities – 18%). [6].

At the moment 440 nuclear power plants are operating in the world that annually consume over 60 thousand tons of uranium (table 3) [2,4].

The largest consumption of uranium falls to the share of the USA CIAA (32,45%), France (15,29%) and Japan (11,99%). Germany consumes 5,4%, Russia 5%, South Korea 4,4%, Great Britain 3,5%. [7].

Exporting data are illustrated in table 4 [2,4].

Table 3. Annual consumption of uranium for nuclear power engineering (thousand tons)

| | 1995 | 1996 | 1997 | 1998 | 2001 | 2002 | 2003 | 2004 | 2005 |
|-----------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Europe (incl. Russia) | 29,34 | 30,08 | 32,01 | 29,88 | 29,95 | 29,89 | 28,35 | 28,44 | 29,03 |
| Asia | 11,46 | 12,15 | 11,08 | 11,88 | 11,83 | 12,11 | 12,99 | 13,02 | 13,97 |
| Africa | 0,28 | 0,29 | 0,3 | 0,31 | 0,36 | 0,36 | 0,36 | 0,36 | 0,36 |
| America | 20,33 | 21 | 24,46 | 20,73 | 22,81 | 22,98 | 24 | 24,72 | 24,88 |
| Total | 61,41 | 63,52 | 64,84 | 62,81 | 64,96 | 65,43 | 65,7 | 66,53 | 68,23 |

Table 4. Dynamics of export of natural uranium from the countries, leading manufacturers (tons)

| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|-----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Australia | 3727 | 5424 | 6916 | 5553 | 6426 | 7436 | 7834 | 6476 | 8151 | 8181 |
| Canada | 16404 | 16326 | 11127 | 9984 | 7146 | 10966 | 10029 | 11543 | 11741 | 9719 |
| Namibia | 2007 | 2452 | 2905 | 2762 | 2689 | 2714 | 2231 | 2346 | 2039 | 3039 |
| Niger | 2970 | 3160 | 3497 | 3731 | 2918 | 2895 | 2923 | 3077 | 3154 | 3269 |
| USA | 3783 | 4424 | 6534 | 5798 | 3272 | 5222 | 4512 | 5919 | 5072 | 5081 |
| NIS | 12100 | 17600 | 12200 | 11600 | 9400 | | | | | |
| Russia | | | | | | | 2780 | 3900 | 3444 | 2336 |
| SAR | 1424 | 1436 | 1100 | 962 | 981 | 878 | 885 | 808 | 769 | 769 |
| Total | 42415 | 50822 | 44279 | 40390 | 32832 | 30101 | 31194 | 34060 | 34370 | 32394 |

Major exporters of uranium are Canada, Australia, SAR, the USA and Russia [2,4].

Table 5. Dynamics of import of natural uranium to countries of EU and the USA (tons)

| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2004 | 2005 |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| EU | 16250 | 15814 | 15625 | 15588 | 16857 | 15909 | 13784 | 16900 | 14600 | 17600 |
| USA | 15884 | 17469 | 16538 | 16810 | 18297 | 17273 | 17953 | 17887 | 19910 | 21056 |
| Total | 32134 | 33283 | 32163 | 32398 | 35154 | 33182 | 31737 | 34787 | 34510 | 38656 |

Under the conditions of high prices on oil and severe air pollution control advantages of nuclear power engineering have recently becoming more obvious and a demand for uranium products has a growth trend.

Uranium market has been scarce for a number of years. In 2004 a supply deficit was 14,7%. From year to year a market deficit of uranium products has been covered from the commercial stocks that are quite difficult to estimate.

By analyst calculations uranium stocks accumulated from all available resources are enough to satisfy needs of nuclear power engineering of the world up to 2010. [8].

This means that owners of nuclear power plants will soon face a real deficit of uranium.

As a result price growth has been increasing: 2004 – wholesale price was increase by 74%, its maximum was USD 45,5 per kilo. By November 2005 the price made USD 73 per kilo of uranium concentrate.

Among raw products, prices on which are controlled by Reuters/JefferiesCBR Index, in 2005 a uranium price was the second highest after a sugar price [90].

Thus, a new relationship between uranium products' manufacturers and their consumers has been developed. The market has been transformed from "the consumers' market" to "the sellers' market".

As a result of recent changes in the market conditions manufacturing companies

has become more active in investing in expansion of uranium production and projects providing stock addition.

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