The Particularities of Russian Surface Mining Equipment Market

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ABSTRACT

Key words: *surface mining, rope shovels, hydraulic excavators, loading and haulage*.

Paper deals with the results of the simulation of Russian market demands of mining excavators up to 2030.

The evaluation of the market has been made on the base on the analysis: of the world tendencies in the design of mining equipment and development of market demands of excavators and trucks: production and import of mining excavators (rope and hydraulic) during last 30 years; the population of the surface mining equipment of Russian mines; the prognosis of the total volumes of the extraction of the solid minerals and overburden of the all the branches of Russian mining industry up to 2030 in a glance of the tendencies of the development Russian heavy, manufacturing , processing industries.

1. THE TRENDS OF RUSSIAN MINING EXCAVATORS FLEET STRUCTURE

According to the returns of domestic excavator manufacturers and reports on imports, for the period from 1980 to 2009 Russian mining enterprises received 5600 electric rope shovels with the bucket capacity from 4.6 to 42 m^3. Domestic rope shovels production felt dramatically at the beginning of 90th last century (Fig. 1).

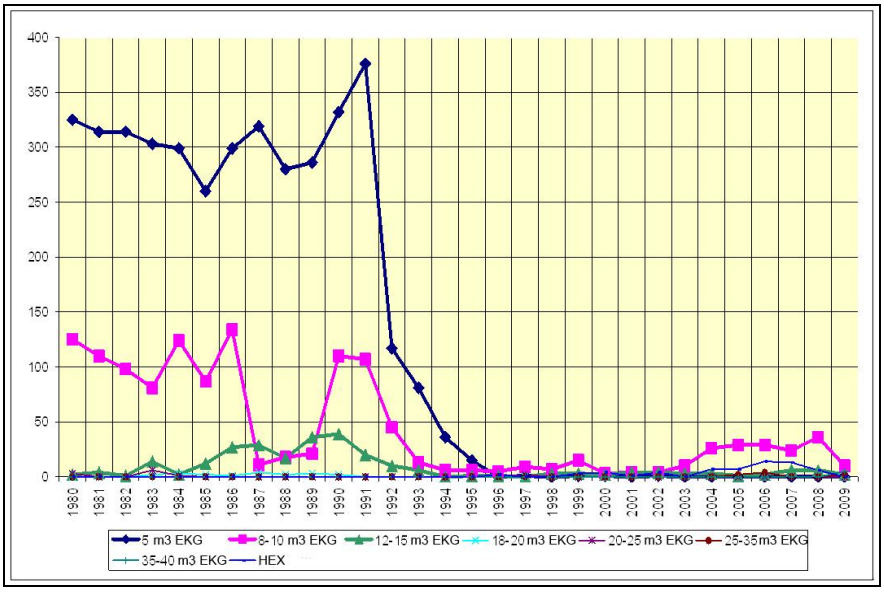

Fig 1. Mining rope shovels production and imported hydraulic excavators in the Russian Federation during the period 1980-2009

The analysis of the excavator fleet being operated in the mining enterprises of Russia and CIS countries (Ukraine, Kazakhstan and Uzbekistan) shows that rope shovels with electro-mechanical drive (EKG) are the main extraction-and-loading equipment.

The fleet of the open pit mines is mainly consists of excavators with the bucket capacity from 5 to 15 m^3 manufactured by OMZ (IZ-KARTEX & UZTM) and modifications thereof (Fig. 2 and 3), than had 89% share of Russian & CIS market in 2010.

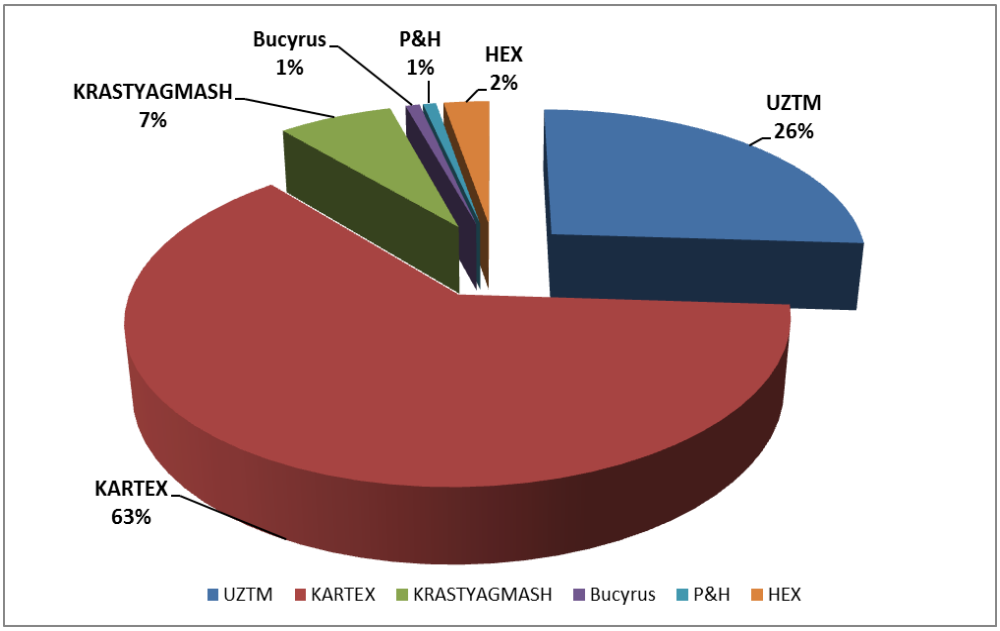

Fig 2. Segmentation of the operable mining excavator fleet structure by the main producers (in 2010)

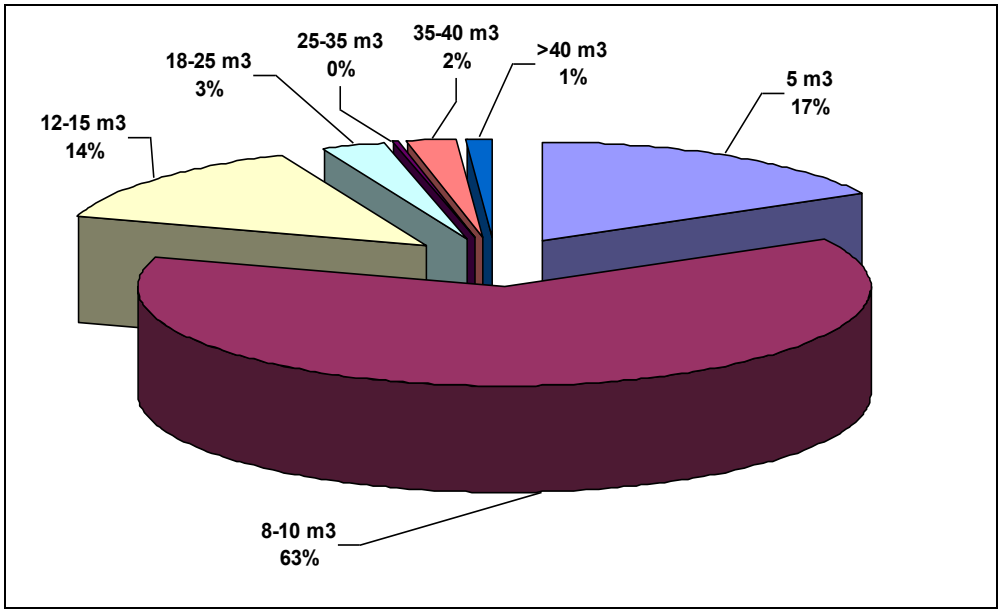

Fig 3. Segmentation of the operable mining excavator fleet structure by the bucket capacity (in 2010)

The main feature of Russian mining excavator fleet structure is 63% of the total amount still belonged to electric rope shovels EKG type with the bucket capacity 8-10 m^3.

The analysis made by Gornoe Delo Ltd. shows follows reasons of the market situation.

1. The most of all surface mining equipment, manufactured up to 1990, have to be discarding by normative depreciation period, but it's still working because from one side the equipment reliability is very high. From another side the extraction of the rock mass in post-Soviet period in 90^{th} felt down in several times. So one part of operable equipment turn to reserve and the rest became the source of a chip spares.

2. The established in Soviet times surface mining enterprises infrastructure of repair and maintenance systems for EKG-excavators proved their relatively low price per extracted m3 in comparison with foreign hydraulic excavators, higher suitability of domestic open-pit excavators for heavy-duty operation.

3. Gornoe Delo Ltd. investigations made on the base numerous statistical analysis of the many years data results of the excavators EKG 5-20 m3 bucket capacity operation on the coal, diamond, iron ore, copper, gold open pit mines proved that the long life of EKG produced UZTM, KARTEX and KRASTIAGMASH is more 25-30 years (100000-150000 availability hours), (fig.4).

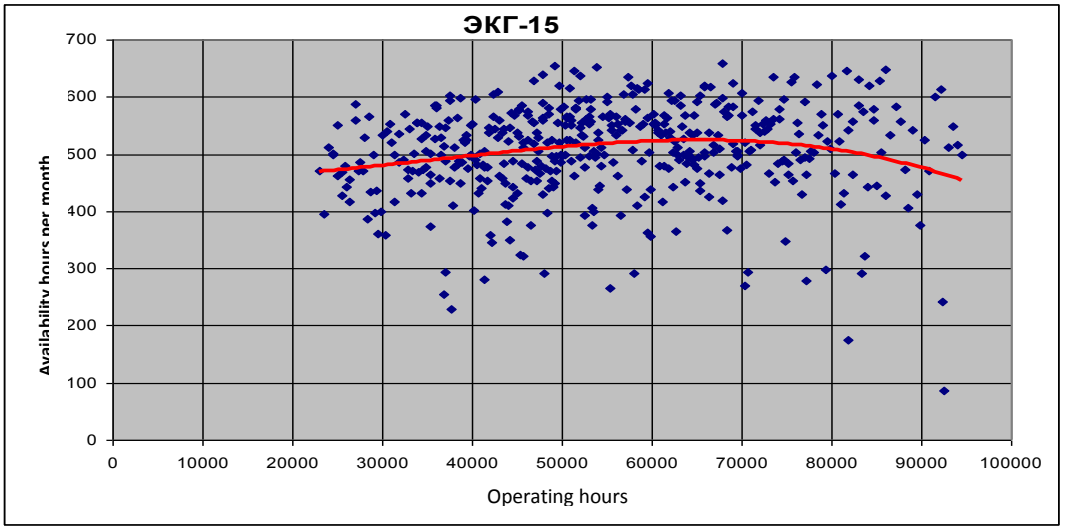

Fig 4. The model of monthly EKG-15 fleet (15 m3 bucket capacity rope shovel) availability dynamic during the operation time operated in the diamond open pit mine

4. Very significant item is that historically (since the USSR) the development of the mining dump trucks BelAZ production has been faster in comparison with electric excavators EKG. Initially EKG-8 and EKG-10 excavators were designed for dump trucks BelAZ with the capacity of 40 – 90 tones and in the time were very modern.

The long life of BelAZ trucks is 40000 availability hours for 30-55 t trucks and 60000 hours for the capacity more than 130 t [1, 2]. Now the most RF and CIS mining enterprises operate more and more 130 – 220 tons capacity dump trucks of.

5. Russian manufactures attempts felt down to reach the world level quality of mining hydraulic excavators. Experimental samples have been made in far 80-th in Soviet Union (150 t, 400 t sizes) and then in 2007 by IZ-KARTEX (100 t size).

That is why the electric rope shovels up to 2009 remain 95% share in Russian mining excavator's fleet, fig.3. It was greatly differed worldwide tendencies where the main purchase volume in quantity was accounted for hydraulic excavators [3].

Last years the tendency of the dynamic of Russian mining excavator fleet structure follows to the direction of increasing the using hydraulic machines.

The regular deliveries of mining hydraulic excavators began in XXI century when in 2000 two Liebherr R-992 front shovels had been imported by Norilsky Nickel to Karierkansky coal mine, two Demag H-285S (one unit is still in operation) to Udachny open pit diamond mine and two CAT-5130 to Nurbinsky mine by AK ALROSA.

Analysis of mining excavator deliveries (Fig. 5) shows that for recent 6 – 7 years the shares of electric and hydraulic excavators in the total volume of deliveries to the RF have been gradually changed. For the period of 2000 – 2011 280 electric excavators and 422 hydraulic excavators (> 80 t weight) were delivered. However, more than the half of the supplied excavators had the bucket capacity less than 8 m^3 (Fig. 6).

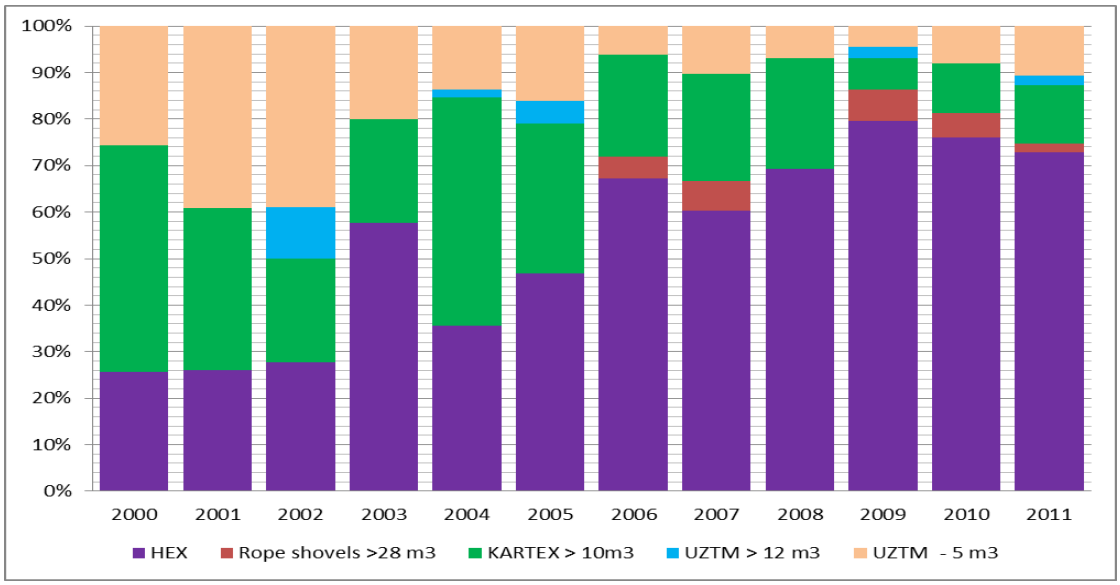

Fig 5. The dynamic of different excavator class deliveries shares (quantity) to Russian open pit mines in 2000-2011

The share of hydraulic excavators reached 73% in 2011 of total deliveries (fig. 5). All world manufacturers: Liebherr, Komatsu, Hitachi, Caterpillar and Hyundai (in 100 t) class are presented at the Russian market (fig.7).

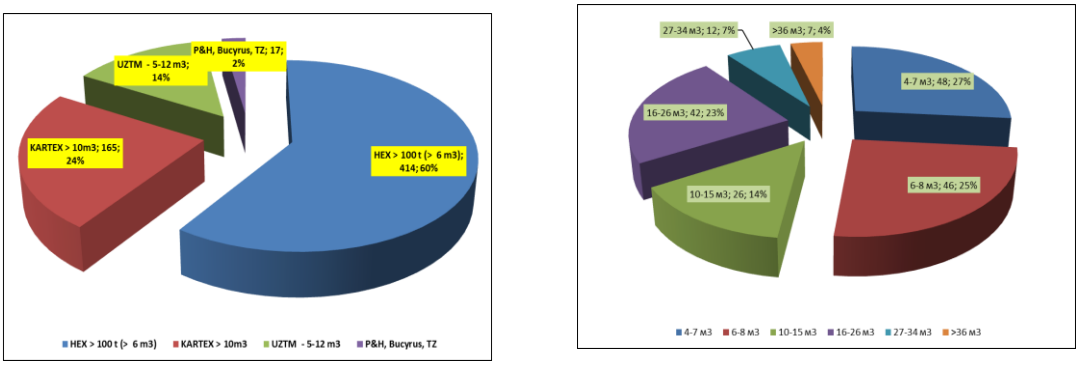

Fig 6. The shares of different types of mining excavators delivered 2000-2011 to Russian open pit mines: a) the shares of domestic, HEX and other foreign producers; b) the segmentation by bucket capacity

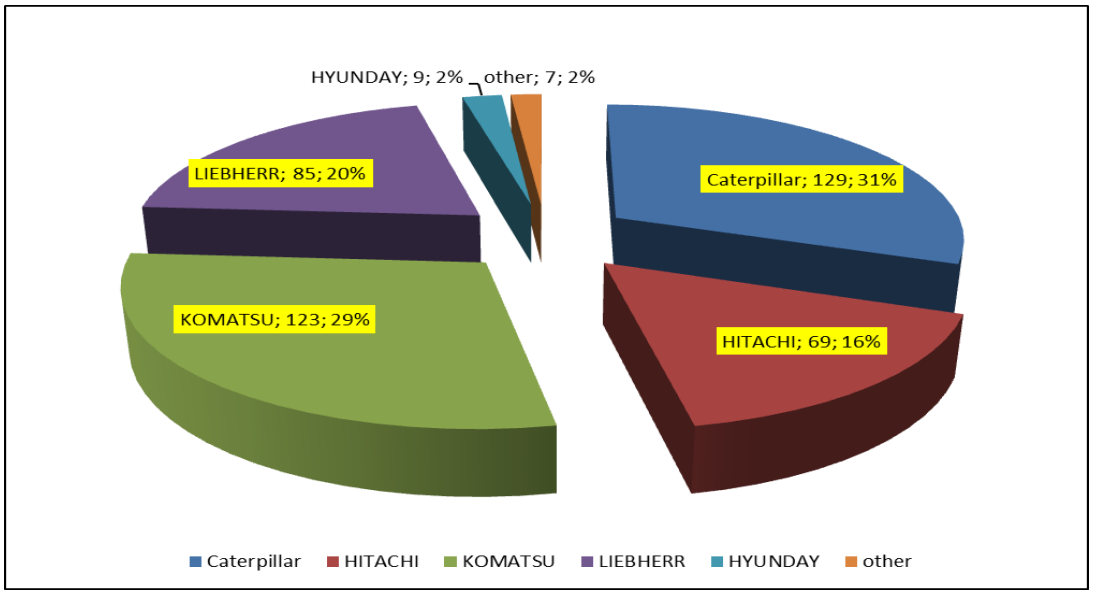

Fig 7. The shares of world manufacturers of HEX in RF.

2. THE FORECAST OF THE DYNAMIC RUSSIAN MINING EXCAVATORS FLEET STRUCTURE

With a view to increase production efficiency and reduce expenses mining enterprises have to improve their mining excavator's fleet structure increasing the unit productivity of excavators. The analysis of changes of average excavator bucket sizes delivered to the open pits during last ten years shows the raise of the excavator sizes (fig.8).

Most of all iron-ore, copper, potash mining and processing integrated works (GOK) began the renovation of their fleets to 18 – 20 m^3 excavator class.

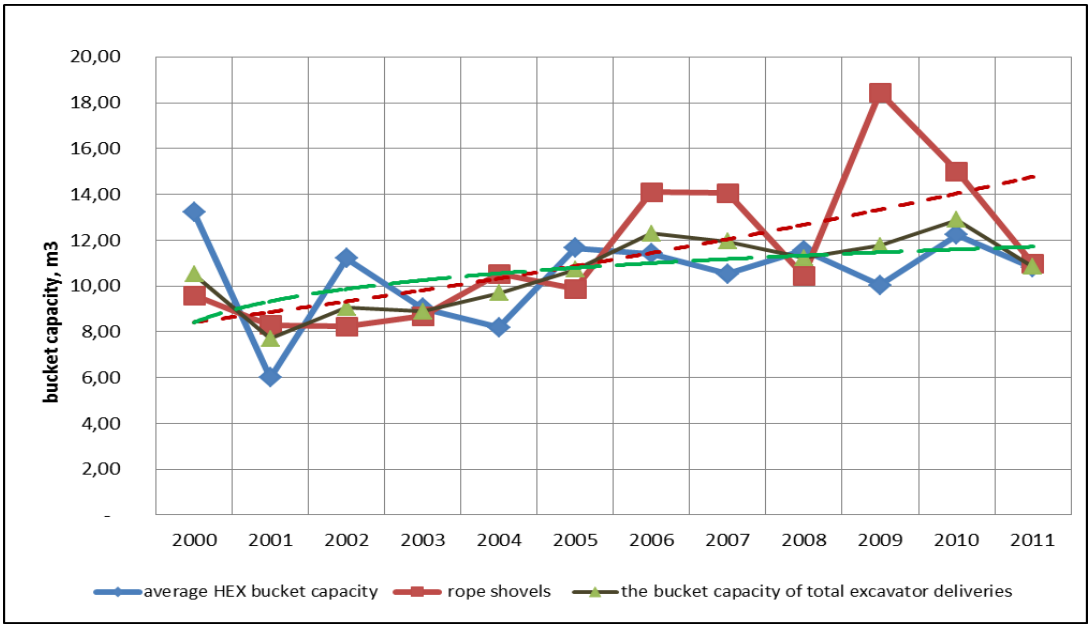

Fig 8. The dynamic of the average bucket capacity of mining hydraulic and electric rope shovel fleets in RF 2000-2011.

The coal surface mines purchased rope and hydraulic excavator 28-50 m3 buckets to reach the 0,8-1,5 Mm^3 monthly productivity. As is known, the optimum ratio between the vehicle capacity and the excavator bucket capacity consider being 3 – 5 passes. That is why the production of large capacity mining trucks increased year to year by BelAZ (fig.9).

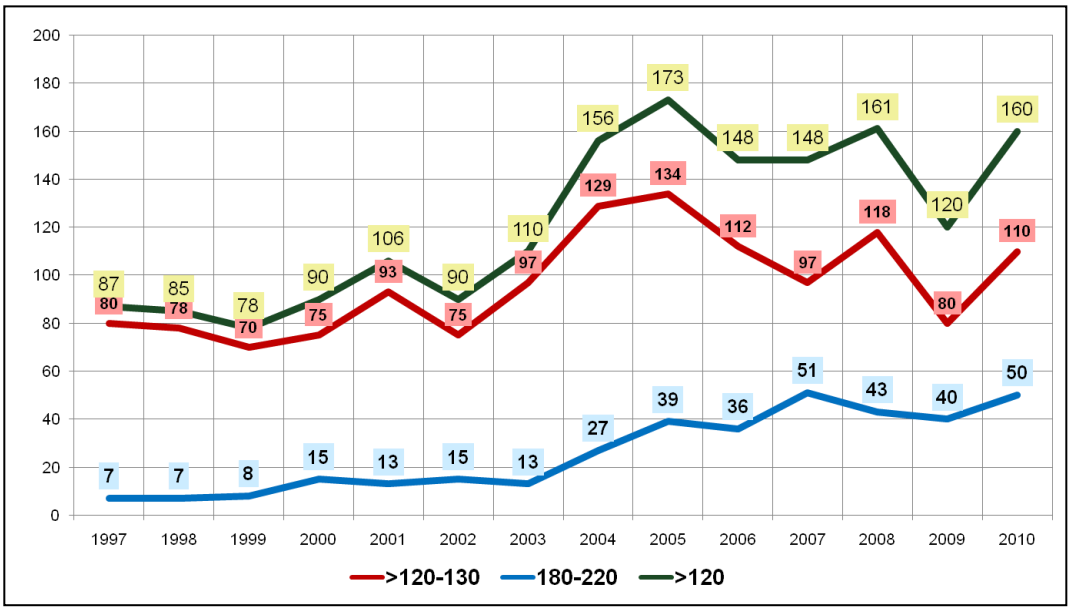

Fig 9. BelAZ production curve 1997-2010.

The import of mining trucks is concentrated 90 tone size (100 short tons) because of the hole in the BelAZ product line (fig. 10).

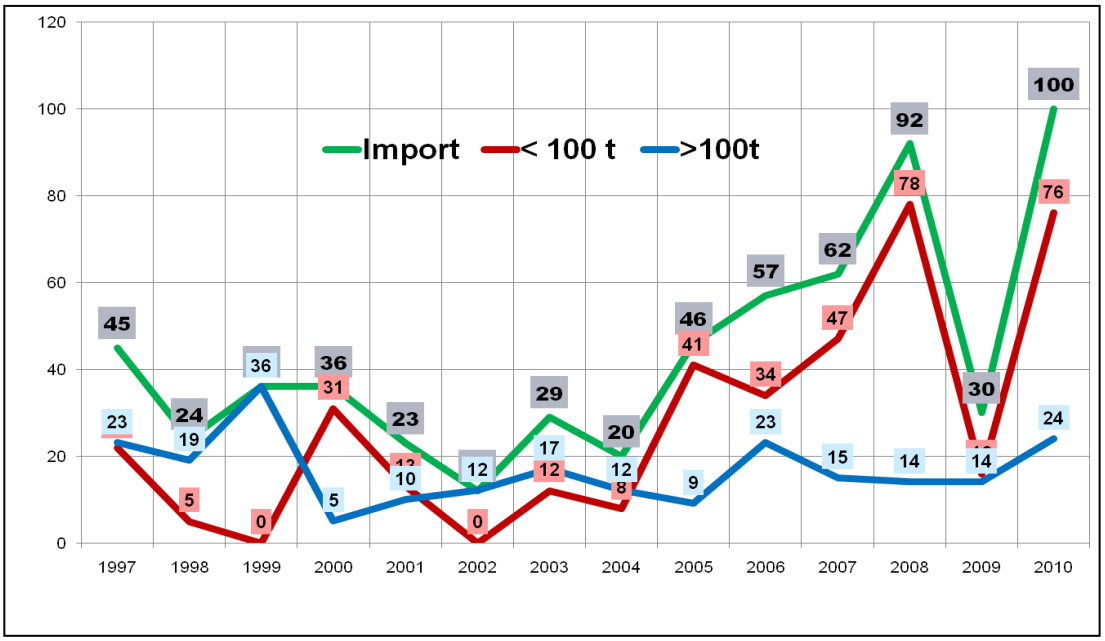

Fig 10. The curves of the mining trucks import to Russian surface mines 1997-2010.

The model of dynamic of Russian mining excavator fleet structure based on the prognosis rock mass extraction four main mining industries - coal industry, ferrous metallurgy, non-ferrous metallurgy and non-metal mining and the model of retirement of operating excavators (fig.11).

The rock extraction prognosis based on forecast data of mining operations of respective industries, which forecasts were performed on request of the Ministry of economic development and trade of the Russian Federation and the main mining CIS-countries for the period till 2030.

The retirement models have been made for the each class of excavators based on the statistic investigation of the mining equipment long life [4, 5]. The retirement model of the production domestic made rope shovels EKG-type fleet is shown at fig.11.

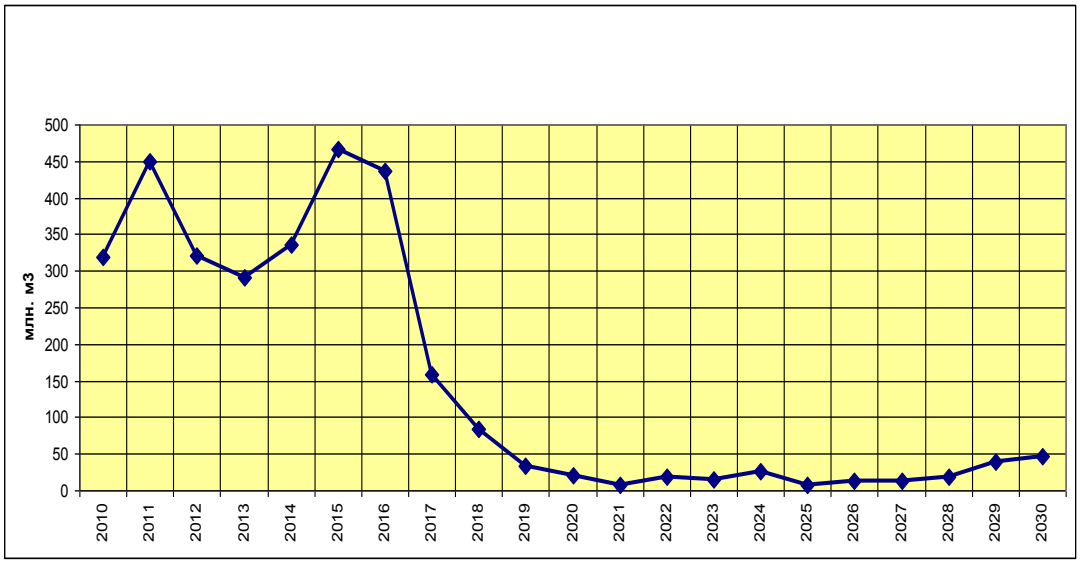

Fig 11. The retirement model of rope shovel fleet production Russian surface mines 1997-2010.

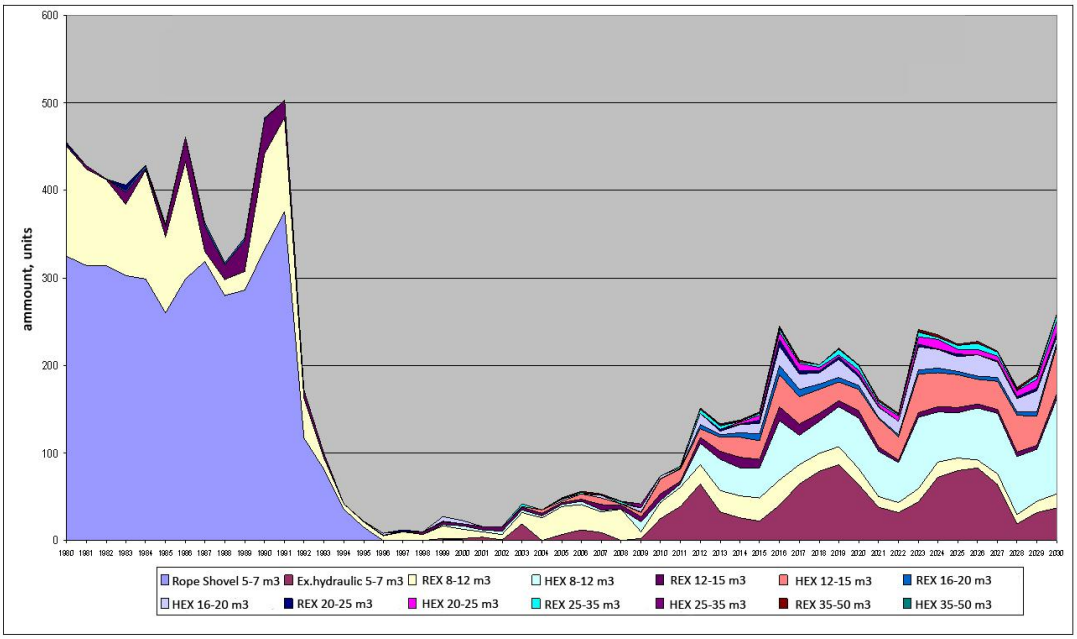

Fig 12. Russian mining excavator fleet structure dynamic the fact and the forecast 1980-2030.

The excavator fleet structure dynamic forecast was made for 6 size classes (with the bucket capacity being 5 m^3, 8 – 10 m^3, 12 – 15 m^3, 8 – 25 m^3, 25 – 35 m^3 and 35 – 50 m^3) and for the rope and the hydraulic machines. The ratio between the forecast volumes of rock mass to the excavator fleet capacity per each year according to the percentage relationship between the size groups to be assumed based on expert estimates.

The final plot of the mine excavator consumption forecast in CIS-countries till 2030 is given in Fig. 12. It is particularly remarkable that the peak periods for main classes are on 2016-2018 and on 2023 – 2024.

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