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## **Economic Evaluation of the International Kyzyl – Urumqi Railway Construction Project in Conjunction with the Ulug-Khem Coal Basin Development**

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*The present article demonstrates that construction of a railway through Tuva and Mongolia to China is an interesting and challenging problem from both economic and geopolitical points of view. Doubtlessly, the solution of this problem opens new opportunities for commercial and economic relations, including import and export of goods both to Mongolia and China and other cross-border countries of Central Asia. The authors remark that the greatest and the most profitable share of railroad cargo is coking coal exported to China, which in the last years has been facing a huge deficit for utilization of its metallurgical plants' capacities. Should the international railway be constructed along Kyzyl – Ulangom – Hovd – Urumqi, almost all large and medium South Siberian deposits will be highly demanded on both domestic and international mineral product markets. The research leads us to the conclusion that the optimal option for Russia China and Mongolia would be a tripartite international treaty, on the basis of which the budgets of the party states finance up to 50% of capital costs provided in the estimate for the Kyzyl – Urumqi construction as per shares stipulated in the treaty, while private investors provide the rest.*

*Keywords: Railway, Tuva, Mongolia, China, Urumqi, mineral resources, coal, export, evaluation, cost-effectiveness, fiscal efficiency, public-private partnership project.*

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*Research area: economics.*

The mineral resources of the Republic of Tuva are comparable with the those of the richest territories of the Siberian Federal District, such as the Krasnoyarsk Territory (Krai), Kemerovo and Tomsk Oblasts; however, concerning social and economic development, Tuva still lags behind. Significant deposits of coking and power

generating coal, cobalt, gold, non-ferrous and rare metals, rare earth elements, various construction materials, mineral and sweet underground waters, geothermal sources have been found in its territory. The cumulative value of the mineral deposits found in Tuva (with the deduction of their extraction and processing costs), as evaluated

by Tuva Institute of Comprehensive Natural Resources Development of the SB of the RAS (TuvICNRD SB RAS), exceeds 4 140 billion US dollars (Lebedev, Kuzhuget, 1998).

However, due to poor transport infrastructure and hard access to the majority of the deposits located in the forest and taiga areas remote from transport communication, they are extremely underdeveloped. In point of fact, Tuva is cut off the main throughways, so in the post-reformation years its mineral resources have been developed only on the private entrepreneurship scale. Despite the few social and economic advantages of such development, transport inaccessibility of the key resource deposits decrease of their competitive ability on the domestic and international markets. At the same time, environmental damage caused by this development and poor geological and economic feasibility study exceeded the tax proceeds. Such factors as underdevelopment and depressiveness of the region, absence of railway communication with other regions, low competitive ability of the produced goods increase investment risks of the region. Therefore, the absence of investments prevent modernization of the outmoded funds of the Republic, which result in poor competitive ability of the exported raw material. In the 1990-s, the volume of investments into the Republic fell by over 20 times in comparison with that of the year 1990. It was only in the early 21<sup>st</sup> century when investments began to grow, though by the year 2008 the investment volume had only reached 3 261 million Russian roubles (Dabiev et al., 2010). Despite the positive tendencies, the main problems are: high wear degree of the main funds, significant decrease of investment into the real sector of economy, low share of private companies' investments etc. Private investors do not keenly contribute their capital (even at the level of 12-15% of the project

cost) into risky deals. It is proven by Kyzyl – Kuragino railway construction project, which was included into the state register and financed from the Investment Foundation of the Russian Federation (by 50%, while the rest was provided by private businesses). Due to the bankruptcy of its private partner, the construction was put off from 2010 to 2011, but was actually resumed only as late as 2013. However, this railway could have dramatically changed the social and economic situation in Tuva, as it could provide it with the railway access to the Kuzbass and the Trans-Siberian railway!

By the year 2006 some scientists of the Siberian Branch of the RAS, including TuvICNRD SB RAS, had developed a series of innovative mineral processing technologies. Moreover, TuvICNRD SB RAS had developed technical and economic feasibility studies for several republic infrastructure projects. These achievements changed the attitude of private investors to the mineral wealth of the Republic. Recently, their interest to the local deposits have dramatically increased; in 2006, Chinese Longxing Company purchased a license for the development of Kyzyl-Tashtyg lead and zinc deposit, in 2007 OJSC GMK Norilsk Nickel purchased a license for survey and extraction of copper, molybdenum, and associated components at Ak-Sug copper-porphyry deposit. In 2009, Kaa-Khem coal deposit was sold to En+Development Company. Indeed, it was greatly aided by the announcement of Kyzyl-Kuragino railway project' commissioning in 2016 (Oiun, 2014). Today, there are the following mining industries in the Republic: Tuva Asbest mining and processing works with the design capacity of 120 thousand tons of textile chrysotile asbestos; Kaa-Khem and Chadaan coal deposits with the design extraction volume over 1.5 million tons; a series of gold mining enterprises selling over 1.8 tons of gold per year for around 1.7 billion US dollars etc.

Under market conditions, federal budget funds cannot be the only source of financing innovations in the region. Nevertheless, the significant proceeds to the Republic from federal budget funds serve as a signal for the private companies of the reasonability of large investment projects in the territory and irreversibility of the national innovative policy. To participate into the investment projects which may considerably increase the local economic potential, private Russian companies normally prefer to wait for the establishment of large national programs of social and economic development in a certain region and resolution of target financing of the region from the federal budget.

The Tuva Republic socioeconomic development strategy to the year 2020 assumes (Strategiia..., 2008) that the main competitive advantages of the Republic are associated with mining, wood processing and agricultural products processing industries, construction materials production, recreation and tourism facilities. However, developed mineral deposits are the only item on the list which has a huge potential to lead the Republic away from beneficiary regions category. That is why, to our mind, it is the mining industry that should serve as a “growth engine”. Though developing at a higher socioeconomic and technological level, other economic branches may be auxiliary, while the Republic will receive great budget proceeds from mining industry. However, raw material development strategy cannot be supported only with innovative development of extraction branches on the basis of the new technologies suggested by the scientists with due regard to traditions, values and rules of the ethnicities populating the region. It cannot develop without new infrastructure projects which are expected to provide transportation access to other regions of Russia and abroad.

Construction of a railway to China via Tuva and Mongolia is a challenging and interesting

problem from both economic and geopolitical points of view. Doubtlessly, the solution of this problem opens new opportunities for commercial and economic relations, including import and export of goods both to Mongolia and China and other cross-border countries of Central Asia.

We should remark that along with that, the opportunity of exporting such raw materials as hard coal, metal concentrates, gold etc. from Tuva will gain the greatest interest. The continue of the railway construction will open great opportunities for the mining industry development in Tuva and Southern parts of the Krasnoyarsk Territory (Krai), Khakassia and Altai, considering that these territories of the Russian Federation possess both developed and underdeveloped mineral deposits, requiring detailed exploration and additional geological survey.

Obviously, should the railway construction be carried this way, the scope of exporting minerals and other raw materials through Kyzyl–Urumqi track would not decrease, as the cargo traffic would mostly consist of coking coal from Elegest, Mezhegy deposits and other hard coal deposits of the Ulug-Khem Basin.

A typical peculiarity of coal export is geographic diversity of supplies, when a half of the coal is exported to Europe, while the other half goes to Asia-Pacific Region. Along with that, low traffic capacity of railways and ports restricts coal production and export in the country (Kichanov, 2013). That is why the issue of constructing additional railways, that would relieve cargo traffic and play an important role in transport and geopolitical strategy of the country, is so acute today.

Let us also remark that the greatest and the most profitable share of railroad cargo is likely to be coking coal exported to China, which in the last years has been facing a huge deficit for utilization of its metallurgical plants' capacities. One of the alternative options of Tuva-Mongolia railway

construction is Kyzyl – Chadana – Khandagayty – Ulangom – Hovd – Urumqi. Consequently, one of the basic products to be exported by Kyzyl – Chadana – Khandagayty – Ulangom – Hovd – Urumqi railway is hard coal of the Ulug-Khem Basin, one of the greatest hard coal deposits of Russia. It is determined by the low tonnage of non-ferrous metals, rare metals and rare earth elements' concentrates, while cement, construction materials and other mineral processing products are most likely to constitute the minor part of the total cargo traffic in relation to coal (Fig. 1).

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Should the railway be constructed along Kyzyl – Ulangom – Urumqi track, almost all large and medium deposits are likely to be demanded on mineral product markets both in Russia and abroad.

In our opinion, in this case the following mineral deposits of the Republic would be the most demanded: hard coal deposits of the Ulug-Khem Basin, deposits of non-ferrous metals, rare metals and rare earth elements, asbestos, construction materials, gold ore etc.

Feasibility study for the construction of Kyzyl – Urumqi railway in conjunction with Ulug-Khem hard coal basin development is based on the following conditions:

1. According to “Methodological recommendations for technical and economic

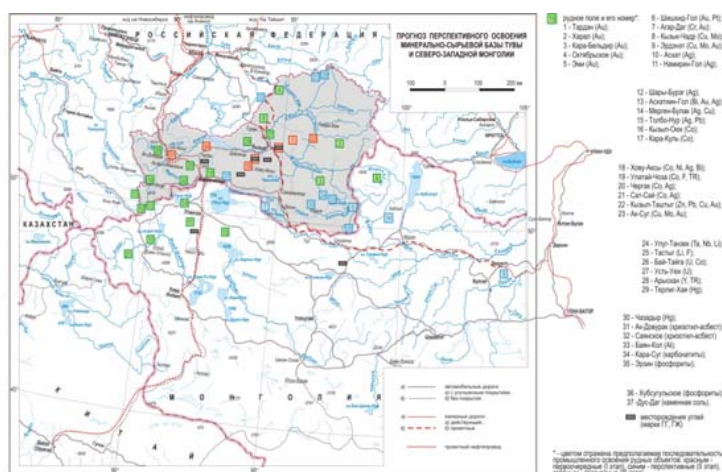


Fig. 1

feasibility studies of conditions for hard mineral deposit development (except for coals and oil shales)”, the main criterion for fiscal evaluation of a mineral deposit is net present value, or NPV. NPV is calculated by subtracting the initial investments (capital investments) from the aggregate present values of cash inflows in compliance with the selected (discount) rate according to the formula:

$$NPV = -\hat{E}_0 + \sum_{i=1}^T (R_i - C_i) / (1 + r)^i$$

where  $K_0$  is the initial capital investment value;  $R_i$  is cash inflows from investments during period  $i$ ;  $C_i$  is expenses resulting from the project during period  $i$ ;  $r$  is discount rate;  $T$  is evaluation period in years.

If NPV calculated with the foregoing formula is positive, it means that within the considered time period  $T$  the capital invested into deposit development will be compensated and the deposit development project will be deemed efficient. The higher NPV, the more efficient the project is.

Negative NPV means that the selected profit value is not received, and deposit development under present conditions will be unprofitable. When NPV equals to zero, it means that the project compensates the capital expenses, though does not bring any profit.

When a deposit development assumes more than single-time investment  $K_0$ , but subsequent financial investments during several periods, the NPV formula is transformed as follows:

$$NPV = -\sum_{i=0}^T K_i / (1 + r)^i + \sum_{i=1}^T (R_i - C_i) / (1 + r)^i$$

where  $K_i$  is the amount of capital invested into deposit development during period  $i$ .

It is important to note that net present value is an additive criterion, i.e. if the object is divided

into separate parts, its NPV equals to the sum of NPVs of its components.

NPV characterizes the excess of aggregate cash inflows over the aggregate expenses, considering the discount rate as well as such factors as the creditor's minimum rate of return and the project's adjustment for risk. Positive NPV is the essential condition of deposit development efficiency.

Deposit evaluation involves the following indicators used in NPV calculation: payback period, internal rate of return, and profitability index.

2. **Taxation.** Financial and economic feasibility study of Kyzyl – Urumqi railway construction in conjunction with Ulug-Khem hard coal basin includes standard taxes foreseen by the Tax Code of the Russian Federation: company income tax, unified social tax, property tax, mineral extraction tax, payments for the use of water, land and other resources.

3. **Input data** (mine development method, loss and ore dilution factors, mining enterprise productivity, operating and capital costs, goods quality) for the studied objects were adopted from technical and economic feasibility studies and reports previously made by specialized organizations, applying the values to the current situation with the conversion deflator coefficients (Shabalinskiy, 2006). For calculations for the deposits with previously evaluated mineral resources, analog method may be used. It may also involve data on specific operating costs and specific capital expenditure for analog objects.

4. **Discount rate** is assumed as 15%.

5. **Time horizon is 25 years.**

6. **Cut-off grade** is 0.4%

7. **Calculations** for the economic feasibility study of the Republic of Tuva mineral deposits development are made in MS Excel software.

8. The calculations are based on the mineral raw materials and products' prices as of July 1, 2014.

**9. Basic conditions for capital expenditure calculations.** According to the calculations, the capital expenditures of the project are evaluated as 560.8 million roubles including Kyzyl – Urumqi railway construction costs of 425.5 million roubles, Ulug-Khem Basin coal deposit mining and processing works construction costs of 88.39 million roubles (Table 1, 2).

**10. Prices.** The calculations were based on the following **prices** for mineral raw materials and products (Table 3):

11. Ulug-Khem hard coal basin coking coal extraction volume at the design capacity (Table 4)

**Fiscal efficiency analysis (provisional data).** Provisional calculations for the project have been made in two variants:

1. All capital expenditures for mining and processing works construction and Kyzyl – Urumqi railway construction are covered by

Table 1. Yearly capital expenditures for the commercial option, million roubles

|   |                  | 1               | 2               | 3               | 4               | 5               |
|---|------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| <b>Including capital</b>                        | <b>560 890.0</b> | 108 178.0       | 108 178.0       | 108 178.0       | 108 178.0       | 108 178.0       |
| <b>Railway construction</b>                     | <b>452 500.0</b> | <b>90 500.0</b> | <b>90 500.0</b> | <b>90 500.0</b> | <b>90 500.0</b> | <b>90 500.0</b> |
| Kyzyl – Urumqi railway construction             | <b>452 500.0</b> | 90 500.0        | 90 500.0        | 90 500.0        | 90 500.0        | 90 500.0        |
|   |                  |                 |                 |                 |                 |                 |
| <b>Mining and processing works construction</b> | <b>88 390.0</b>  | <b>17 678.0</b> | <b>17 678.0</b> | <b>17 678.0</b> | <b>17 678.0</b> | <b>17 678.0</b> |
| Mezhegeysk deposit                              | <b>33 070.0</b>  | 6 614.0         | 6 614.0         | 6 614.0         | 6 614.0         | 6 614.0         |
| For Vostochny area of the Ulug-Khem Basin       | <b>27 660.0</b>  | 5 532.0         | 5 532.0         | 5 532.0         | 5 532.0         | 5 532.0         |
| For Tsentralny area of the Ulug-Khem Basin      | <b>27 660.0</b>  | 5 532.0         | 5 532.0         | 5 532.0         | 5 532.0         | 5 532.0         |

Table 2. Yearly capital expenditures for public and private business partnership, million roubles

|   |                  | 1               | 2               | 3               | 4               | 5               |
|---|------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| <b>Including capital</b>                        | <b>334 640.0</b> | 62 928.0        | 62 928.0        | 62 928.0        | 62 928.0        | 62 928.0        |
| <b>Railway construction</b>                     | <b>226 250.0</b> | <b>45 250.0</b> | <b>45 250.0</b> | <b>45 250.0</b> | <b>45 250.0</b> | <b>45 250.0</b> |
| Kyzyl – Urumqi railway construction             | <b>226 250.0</b> | 45 250.0        | 45 250.0        | 45 250.0        | 45 250.0        | 45 250.0        |
|   |                  |                 |                 |                 |                 |                 |
| <b>Mining and processing works construction</b> | <b>88 390.0</b>  | <b>17 678.0</b> | <b>17 678.0</b> | <b>17 678.0</b> | <b>17 678.0</b> | <b>17 678.0</b> |
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| For Tsentralny area of the Ulug-Khem Basin      | <b>27 660.0</b>  | 5 532.0         | 5 532.0         | 5 532.0         | 5 532.0         | 5 532.0         |



Table 3. Coking coal prices assumed for calculation

|             | Measurement unit |  | <i>Price</i> |
|-------------|------------------|--|--------------|
| Coking coal | roubles/ton      |  | 4 560        |
| Coking coal | dollars/ton      |  | 120          |

Table 4. Ulug-Khem hard coal basin coking coal extraction volume at the design capacity

|  |      |
|--|------|
| Extraction volume, million tones           | 32.0 |
| Mezhegeysk deposit                         | 12.0 |
| For Vostochny area of the Ulug-Khem Basin  | 10.0 |
| For Tsentralny area of the Ulug-Khem Basin | 10.0 |

private investors only. The result is unprofitable for the private investor ( $NPV < 0$ ; profitability index – 0.65, IRR – 9.6%). (commercial option)

2. Upon financing of 50% of the Kyzyl – Urumqi railway construction estimated costs from the state budget, the rest of capital expenditures will be provided by investors (public and private business partnership option)

**Net present value of the investor** 9.2 billion roubles

Non-discounted project payback period – 9.66 years

Discounted project payback period – 21.45 years

Internal rate of return (IRR) 15.6%

**Efficiency for budget**

**Net present value of consolidated budget is 92 981.9 billion roubles**

**Selling price determination.** Siberia occupies a special place concerning both main coal deposit location and coal extraction. The major part of coal resources is located at the Kuzbass, which concentrates over a half of all coal, and 80% of extracted coking coal. Significant role in coal extraction is also played by such regions as: the Krasnoyarsk Territory (Krai), the Republic of Khakassia, Irkutsk Oblast, the Republic of Komi and Sakha.

If until mid-2000-s the country experienced a great growth of coking coal extraction, from 2007 to 2012 coking coal extraction decreased due to the worsening market situation with the increase in other coal grades' extraction. As of 2011, the volume of coal extracted in the Kuznetsk Coal Basin was 192.1 million tons, including 48.8 million tons of coking coal.

Even though by the end of the first half of 2013 metallurgical coal import in Asian countries grew by 34% in comparison with the similar period of the last year, by the mid-2013 Australian coal prices fell to 130-135 US dollars/ton, while in Canadian and American markets the prices dropped to 120-125 dollars/ton. The coking coal price drop was caused by the growth of cheap low-grade material on regional markets, decreasing prices for the high-quality coking coal grades (Koksuiuschiysia, 2013).

Coking coal price drop could not but affect financial indicators of large coal extracting companies. For example, the results of the third quarter of 2012 of OJSC UK Rapsadskaya demonstrated significant fall both in coal extraction and sales of concentrates, associated with forced reduction of process utilization (Rapsadskaia 2014).

As of August 2014, coking coal prices were at the level of 120 dollars per ton (Neobkhodimo..., 2013).

Table 5. Coal extraction in the main coal basins of Russia [9]

| Coal basins   | 2009  | 2011  |
|---|-------|-------|
| Kansk-Achinsk (the Krasnoyarsk Territory (Krai), Kemerovo Oblast) | 37.0  | 40.3  |
| Kuznetsk (Kemerovo Oblast)  | 157.5 | 166.4 |
| Irkutsk (Irkutsk Oblast)  | 9.5   | 11.9  |
| Pechersk (the Republic of Komi)                                   | 9.1   | 10.3  |
| Donetsk (Rostov Oblast)   | 3.5   | 3.6   |
| Yuzhno-Yakutsk (the Republic of Sakha)                            | 6.1   | 9.0   |
| Minusinsk (the Republic of Khakassia)                             | 9.8   | 12.4  |

Table 6. Incomes to the consolidated budget of the Republic of Tuva [12] (in actual prices; million roubles)

|                        |          |
|------------------------|----------|
|                        | 2013     |
| Incomes, including     | 24 275.7 |
| Intrinsic incomes      | 4 476.9  |
| Uncompensated receipts | 19 798.8 |

### Socioeconomic efficiency evaluation

The calculation reveals that Kyzyl – Urumqi railway construction in conjunction with the Ulug-Khem Basin coal development may significantly raise the regional economy.

Annual tax proceeds to the Federal budget from the current project after achievement of its design capacity will constitute 8 599.9 million roubles. Annual tax proceeds to the Republic budget from the current project after achievement of its design capacity will constitute, averagely, 20 666.0 million roubles, which is 4.6 times higher than budget proceeds in 2013.

We should also consider indirect incomes of the republic budget. According to the method proposed by Professor A.A. Arbatov (Council for the Study of Productive Forces), additional incomes to the Tuva budget caused by large-scale projects are evaluated as 1.8 (Biznes-plan..., 2006).

Therefore, intrinsic earnings gain of the Tuva Budget with the Kyzyl – Urumqi railway construction in conjunction with the Ulug-Khem Basin development will exceed 60 billion roubles.

As of 2013, the incomes to the consolidated budget of the Republic of Tuva counted up to **24 275.7** million roubles, 81.6% of which consisted of uncompensated receipts from the federal centre (Table 6).

Besides, annual GNP growth will constitute 118 960.1 million roubles. As, according to Iagol'nitsner M.A. (Institute of Economy and Industrial Production Management of the Siberian Branch of RAS), production increase multiplier for mineral mining industries constituted 6.91, i.e. at the expansion of mineral mining production by 1 rouble the gross product with regard to interbranch influence grew by **6.91** roubles, and we may say that GRP for the Republic with regard to the present project and 6.91 of adjacent branches development will constitute 822 014.3 million roubles.

We should notice that as of November 2012 there were over 22 thousand unemployed in the Republic, which is 18.3% of economically active population. Let us also remark that every vacancy in mineral extraction branch creates, averagely,



three additional vacancies in adjacent branches. Considering that the project coal deposit development assumes creation of over 6 171 new vacancies, the potential number of new jobs may exceed 18 thousand considering the demand for new employees in adjacent branches.

Thus, the Kyzyl – Urumqi railway construction project in conjunction with the Ulug-Khem coal basin development is not just

commercially efficient for investors; it bears great budget and social profit.

Further calculations concerning Kyzyl – Urumqi railway construction project in conjunction with the Ulug-Khem coal basin development may be performed after coordination of the general capital expenditures with the investor and conclusion of a tripartite international treaty between Russia, China and Mongolia.

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## **Экономическая оценка проекта строительства международной железной дороги Кызыл – Урумчи в увязке с освоением Улуг-Хемского каменноугольного бассейна**

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*Показано, что строительство железной дороги через Туву и Монголию в Китай – это одна из сложных и интересных проблем как с экономической, так и с геополитической точки зрения. Безусловно, в результате решения этой проблемы откроются новые возможности торговых и экономических отношений, в том числе для ввоза и вывоза товаров не только в Монголию и Китай, но и другие трансграничные страны Центральной Азии. Укажем здесь, что наиболее весомым и рентабельным в грузопотоке железной дороги, вероятнее всего, станет вывоз коксующегося угля в Китай, который в последние годы испытывает огромный дефицит для загрузки мощностей своих металлургических заводов. В том случае, если международная железная дорога будет построена по трассе Кызыл – Улангом – Ховд – Урумчи, практически все крупные и средние месторождения регионов Южной Сибири будут востребованы на рынках*

*минеральной продукции как в России, так и за рубежом. В результате проведенного анализа оптимальным представляется вариант, при котором на основе трехстороннего международного договора между Россией, Китаем и Монголией за счет государственных средств вышеуказанных стран на долях, предусмотренных данным договором, финансируется 50 % капитальных затрат, утвержденных сметой на строительство железной дороги по трассе Кызыл – Урумчи, а частные инвесторы – остальную часть.*

*Ключевые слова: железная дорога, Тува, Монголия, Китай, Урумчи, минерально-сырьевые ресурсы, каменный уголь, экспорт, оценка, экономическая эффективность, бюджетная эффективность, государственно-частное партнерство, проект.*

*Научная специальность: 08.00.00 – экономические науки.*

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