

# An Introduction to the Russian Coal Industry<sup>1</sup>

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In the early 1990s, Russia implemented mass privatization with swift ownership changes in many industries. A notable exception was the coal sector, one of the world's largest, which was deep in crisis and unable to function without massive subsidies.<sup>2</sup> Beginning in 1993, the Government of Russia undertook a far-reaching program of restructuring of the industry, which was virtually entirely State-owned at the time. The positive impact of the restructuring led to a slow but sustained improvement in the industry's attractiveness to private investors. By the end of 2001, some 77% of coal production was controlled by privately-owned Russian coal companies. By the end of 2002 it was estimated perhaps as much as 99 percent of the industry's production would be in private hands.<sup>3</sup>



*Russian Flag*



*Kremlin*

Thoughts of traveling to Russia included a range of emotions from a persistent uneasiness from a fear of the unknown, to the excitement of crossing Red Square and walking inside the Kremlin's fortified walls. I viewed my trip as a once in a lifetime opportunity.

The dissolution of the USSR is unquestionably one of the most profound events which have occurred in my lifetime.

While much of the world has focused on the political implications of this event, the attempt to introduce a market economy to the countries which comprised the former USSR has considerable significance to many sectors of U.S. industry. Not only is there a need for capital, but equally or perhaps more important, there is a need for technology, management, and economic and financial skills.



*Red Square*

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<sup>2</sup> **The Privatization of the Russian Coal Industry**, Igor Artemiev and Michael Haney, April 2002.

<sup>3</sup> Ibid

Given the tremendous energy and mineral potential which is present in many of the former Soviet countries, the potential for joint efforts between U.S. mining companies and their counterparts in the former USSR is significant. The former USSR was the most energy-rich region in the world and ranked first in the world in gas and oil production, second in electric power generation, and third in commercial coal mining.

## Commonwealth of Independent States

The political union which formed after the dissolution of the USSR is known as the **Commonwealth of Independent States (CIS)** with twelve countries making up this union:

Armenia	Azerbaijan	Belarus
Georgia	Kazakhstan	Kyrgyzstan
Moldova	Russian Federation	Tajikistan
Turkmenistan	Ukraine	Uzbekistan

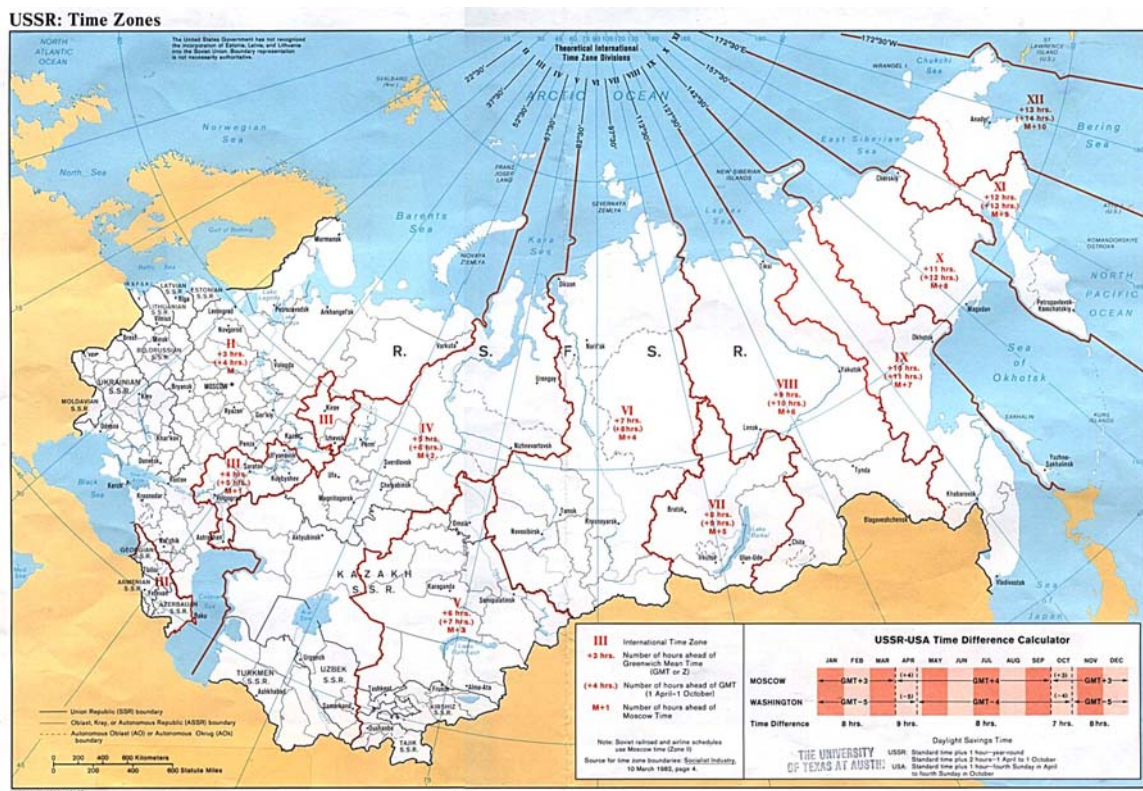


Of these twelve countries, only three possess major coal deposits - **Kazakhstan**, the **Russian Federation (Russia)** and **Ukraine**. There are two major coal producing basins

in Kazakhstan – the **Ekibastuz** and the **Karaganda**, and two major coal producing basins in Ukraine – the **Dnepr** and a major portion of the **Donetskii**. These basins all contain hard coal – bituminous and/or anthracite – with the exception of the Dnepr which contains brown coal or lignite. Kazakhstan and Ukraine account for around 20 percent each of the total coal production of the former USSR, with Russia accounting for the remaining 60 percent.

## Russian Federation

Russia, the largest country in the world, comprises some 6.6 million square miles, spans eleven time zones, and covers one-eighth of the world's land surface. Its population in 1991 was slightly more than 148 million, of which it is estimated, some 80 percent are ethnic Russian.



Russia is the world's leader in coal reserves with the country containing an estimated 6 trillion tonnes of geological coal resources which include 375 billion tonnes in the category of geologic reserves, representing some 20 to 30 percent of the world's total. Of this total, more than 250 billion tonnes are considered to be economically recoverable reserves, with around 140 billion tonnes consisting of lignite.

The third largest coal producer in the world behind China and the U.S., Russia produced on the order of 335 million tonnes in 1992, a decrease from around 415 million tonnes in 1988. Production came from 209 underground mines and 64 surface, or open-cast mines, with approximately 60 percent from the surface mines. While current industrial demand

is on the order of 375 million tonnes annually, the country will likely produce no more than 260 to 270 million tonnes of this demand.

Production is forecast to continue to decline until the year 2000, with some forecasts calling for a subsequent increase to as much as 400 million tonnes by 2010. This increase in production is tied to forecasts of decreasing production of natural gas and oil.

Coals range in rank from lignite to anthracite, with a significant portion of the lignite reserves containing ash in the range of 6 to 10 percent or less, and sulfur in the range of 0.2 to 0.4 percent.

Russia exported around 18 million tonnes of coal in 1992 with a slight increase expected to have occurred in 1993. Japan is the largest importer of Russian coal, followed by European countries such as Rumania, Bulgaria, Finland, Spain and Greece, and by North Korea.

### **Geographic Divisions**

Russia is divided into the European and Asian portions, with the northeast-southwest trending Ural Mountains being the divide. The European portion, which comprises perhaps 20 to 25 percent of the country, lies to the west of the Urals, while the Asian portion which comprises the vast Siberian areas, lies to the east.

When examining Russia it is useful to think in terms of three distinct geographic regions. These regions consist of the European portion lying to the west of the Ural mountains; Western Siberia; and the Russian Far East lying to the east of the Urals. Western Siberia is generally considered to extend from the Urals on the west to the Irkutsk Region on the east, while the Russian Far East extends from the Irkutsk Region on the west to the eastern coast of Russia.

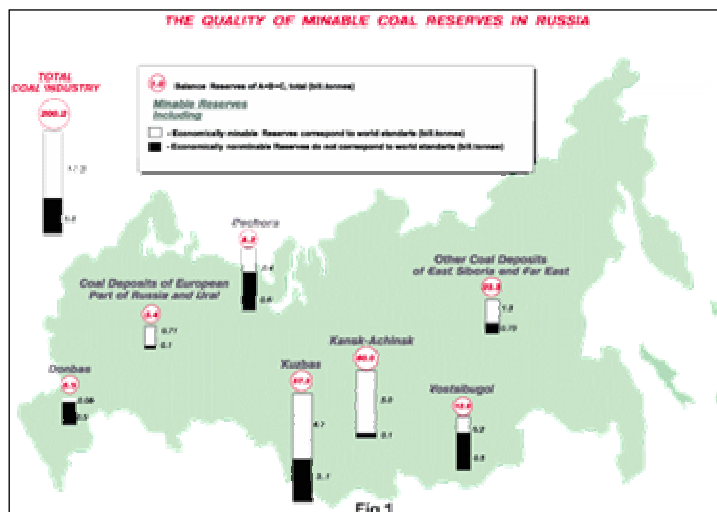




Nearly 75 percent of Russia's proven coal reserves lie in the coal basins to the east of the Urals and this is the area to which attention will be focused in this presentation.

## Major Producing Basins

While there is production from more than 20 coal basins in Russia, the majority comes from seven basins, three which lie to the west of the Ural Mountains in the European portion of Russia, and four which lie to the east in the Siberian Region of Asia. Those producing basins lying in the western portion consist of the **Donetskii Basin** which



straddles the border between Russia and Ukraine to the south of Moscow; the **Moscow Basin**, which lies to the west and southwest of the city of Moscow; and the **Pechora Basin**, which lies in the extreme northeastern part of European Russia.

The Donetskii Basin has the longest history of production of any of Russia's coal basins and is the largest producer from

underground mines. Production is hard coal, ranging in rank from bituminous to anthracite. The basin is a major supplier of metallurgical and thermal coal to the European portion of the CIS.

The Moscow Basin contains lignite which is used extensively for thermal purposes, while the Pechora basin is a producer of hard coal. The higher ash content of much of the coal in the Pechora Basin makes it most suitable for thermal purposes, with lesser portions being used for metallurgical purposes.

The major producing basins lying to the east of the Urals consist of the **Kuznetski**, **Kansk-Achinsk**, and the **Irkutsk** which lie in the southcentral part of Russia, and the **South Yakutsk Basin** which lies in the Russian Far East. Of these the Kansk-Achinsk Basin produces lignite while the remainders produce bituminous and /or anthracite coal.

### **Other Basins**

While there are several dozen smaller coal basins and deposits scattered across the country, by far the two most significant and generally undeveloped basins are the **Tunguski** and the **Lenski**, both of which lie in the northcentral and northeastern portions of Russia in Western Siberia and the Russian Far East, respectively. These basins, which are the two largest in Russia in terms of both area and coal resource potential, extend from the mid-latitudes of the country north to the Arctic circle. The Lenski, or **Lena**, Basin is considered to be the largest coal basin in the world. Much of Russia's long-term coal potential lies in these basins.

### **Geologic Background**

The economic potential of Russia's coal-bearing regions is affected by the geologic framework in which individual basins and deposits lie. Much of the area to the west of the Ural Mountains in the European portion of Russia is comprised of the **Russian Platform**, a relatively undeformed area. The Donetskii Basin, which lies on the southern margin of this platform, is a geologically complex basin containing steeply dipping and locally faulted beds which lie between areas of uplift on the north and south. The Moscow Basin lies on the Russian Platform, while the Pechora Basin represents a tectonic trough along the northeast margin of the Russian Platform. Coal beds are relatively flat-lying in the center of this basin, with dip increasing on the limbs.

To the east of the Urals lie the **Western Siberian Lowlands**, drained by the River Ob, which comprise one of the world's largest depressions with the surface covered primarily by marshes. No major coal deposits have been found in this region.

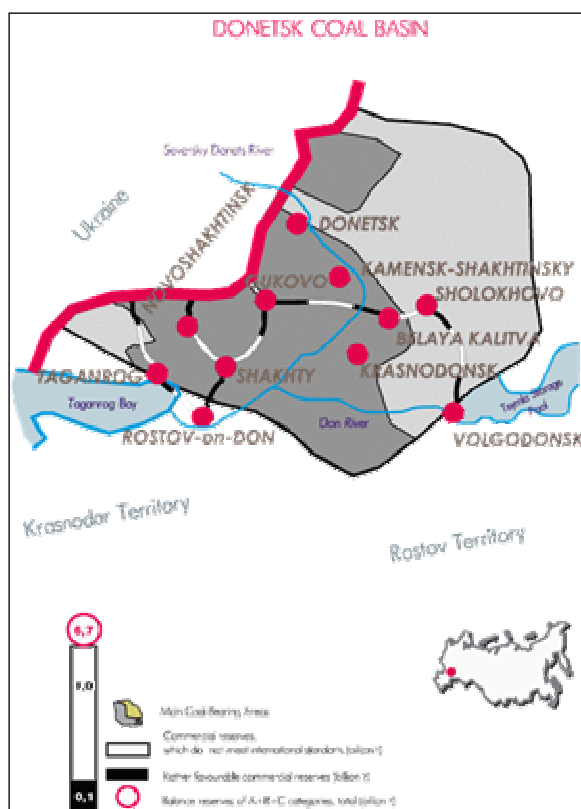
In the southern portion of Western Siberia the predominant feature is the **Angara Geosyncline** which lies across the border between Kazakhstan and Russia. This area contains some of the major coal producing basins of the region including the **Ekibastuz** and **Karaganda Basins** in Kazakhstan and the **Kuznetski Basin** in Russia.

The predominant physiographic feature across central and eastern Russia is the ***Siberian Platform*** which contains essentially flat-lying sediments. The coal potential of much of this region is not fully explored with vast reserve potential present. The region contains the producing basins of **Kansk-Achinsk**, **Irkutsk**, and **South Yakutia**, and the two large undeveloped basins of **Tunguski** and **Lenski**.

In the extreme eastern part of Russia, along its coast, is the ***Pacific Ocean Geosyncline***, which contains a large number of smaller coal deposits.

## Donetskii Basin

The Donetskii Basin, which straddles the border between Russia and Ukraine, is one of the two largest producing basins in Russia and has the longest history of production.



Meaningful reserve estimates for the basin are difficult to come by, although figures as high as 120 billion tonnes have been reported for the entire basin. It is likely that some 20 billion tonnes remain in the Russian portion of the basin. It is reported that 75 percent of the reserves remaining are in beds ranging between 0.7 and 1.2 meters thickness, with the average thickness of beds currently in production being around 0.9 meters. Beds as thin as 0.4 meters are reportedly being mined for the production of coking coal. Production is entirely from underground mines, with around 40 percent of the mines producing from depths in the range of 700 to 1,200 meters. The mines are extremely gassy and have high temperatures with increasing depth.

The basin is now divided into the western, or Ukrainian part, and the eastern or Russian part. The basin contains 29 mining districts, 20 of which occur in the Ukrainian part and nine in the Russian part. There are more than 300 active mines of which around a hundred have operated for more than 50 years.

Production declined from slightly more than 200 million tonnes in 1980 to around 150 million tonnes in 1988. This decline is due primarily to the age of the mines, the complex geology, and the relatively low levels of technology and productivity which exist. Production from this basin is exported through various ports on the Black Sea.

## Moscow Basin

In the Moscow Basin, one bed is typically mined, predominantly flat-lying with an average thickness around 2.5 meters. The average mining depth is around 85 meters.

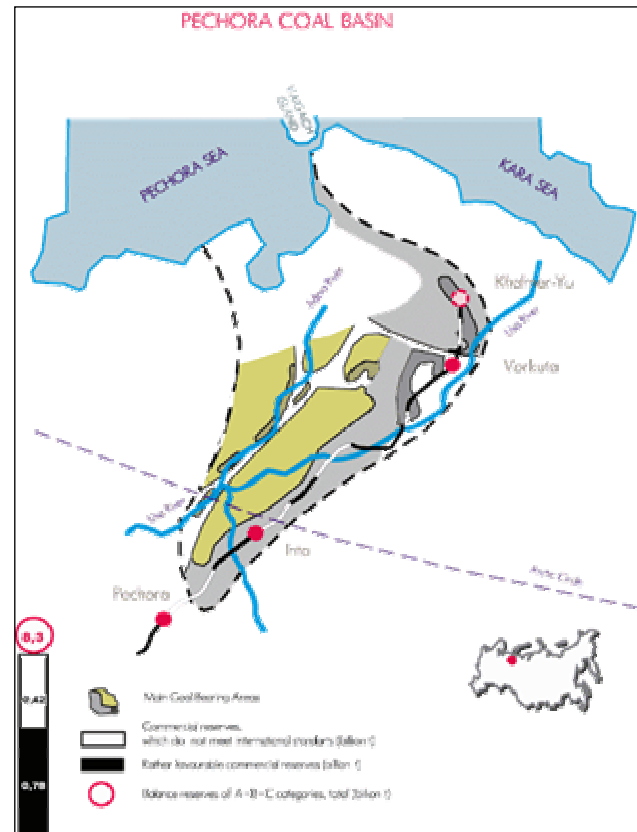
## Pechora Basin

The Pechora Basin, which lies in the extreme northeastern portion of European Russia, contains around 30 individual coal deposits divided among seven individual mining districts. Reserves are reported to be on the order of 45 billion tonnes lying at relatively shallow depth, with as much as 265 billion tonnes of geologic reserves estimated. All production is from underground mines with the average depth being around 500 meters. Mining conditions are generally favorable, although gas is a significant factor in as many as half the mines. The average thickness of beds currently producing is reported to be around 2.4 meters. Most mines employ fairly modern machinery.

Production from the Pechora Basin reached its peak of around 31.5 million tonnes annually in 1988, declining to around 27 million tonnes in 1991. This decline was reportedly due to work stoppages and economic factors and not due to the depletion of reserves.

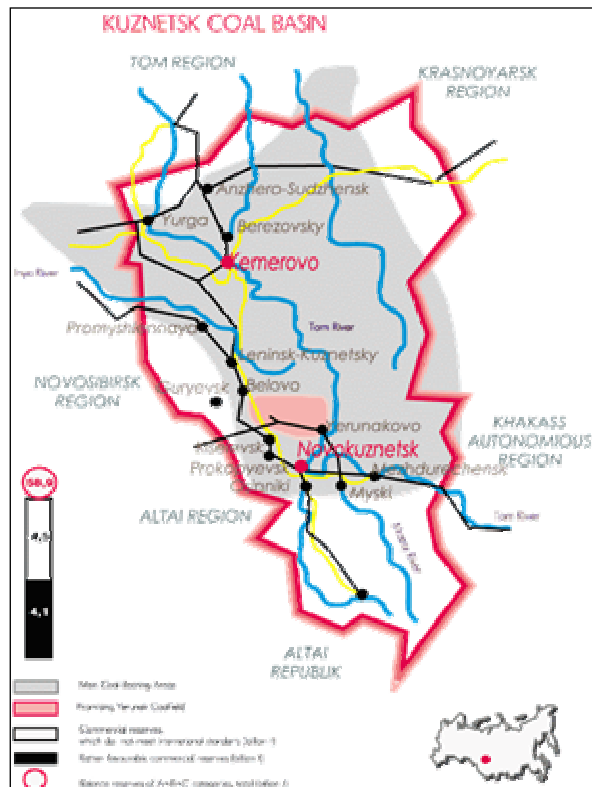
Mines in the Pechora Basin were first developed in the 1930's using slave labor, which continued until the 1950's. It is estimated that as many as a million non-Russians were killed on construction and mining projects in the sub-arctic coal of the Pechora region.

While the quality of production from the Pechora Basin is suitable for export to world markets, there is no efficient means of transportation to suitable ports. The Kara Sea, which lies nearby stays frozen a significant portion of the year and has no suitable harbors.





## Kuznetski Basin



The Kuznetski Basin in western Siberia is the other major producing basin in Russia. The basin, which is divided into 22 mining districts, is the largest exporter of coal from the country, reportedly at a level of around seven to eight million tonnes annually. The high quality of the coals makes this the most attractive basin in the country, with production capable of competing in European and Asian markets. Production goes to both thermal and metallurgical markets, many of which are in European Russia and perhaps as many as two-thirds of the mines produce more than a million tonnes a year. Production was reportedly around 154 million tonnes in 1988. At this time it was estimated 40 percent of the production was from open-cast mines.

Reserves are reported to be in excess of 900 billion tonnes, of which 325 billion tonnes are estimated to lie at depths

tonnes are of metallurgical grade. Some 300 billion tonnes are estimated to lie at depths of less than 600 meters. Beds currently being mined range in thickness between 0.7 and 4.5 meters, with an average around 2.2 meters.

## Kansk-Achinsk Basin

The Kansk-Achinsk Basin, which is the largest supplier of lignite in southern Siberia, has seen considerable expansion due to favorable geologic conditions, thin overburden, and thick coal beds. The largest mine and power generation complex in the world – the **Katek Complex** – is located in the basin. This complex consists of large open-cast mines with productive capacities of as much as 60 million tonnes a year. Of particular importance to the basin is its proximity to the **Trans-Siberian Railroad**.



Virtually all the proven reserves in the basin are recoverable by open-cast mining, and mining conditions are considered to be ideal. Beds are flat-lying, with the thickness of beds currently being mined in the range of 1.3 to 3.5 meters, although thicknesses in the range of 20 to 30 meters are known to exist. Overburden to coal ratios are low.

### **Russian Coal Classification System**

The Russian system of reserve classification is not comparable to the system used in the U.S., since the economic criteria used in the Russian system were designed for a centrally-planned economy. As a result, coal classified under this system would not necessarily correspond to the U.S. concept of reserves, that is – coal which is economically exploitable under present market prices with existing technology.

### **Geologic Reserves**

Geologic reserves are established on the basis of the amount of exploration which has been conducted, with the classification using the letter symbols **A**, **B**, **C1**, and **C2**. These are differentiated on the following basis:

**A** - Detailed exploration work is completed, with drill holes and measurements from mining having a spacing on the order of 600 to 800 meters for beds with lateral continuity and relatively uniform thickness; and 300 to 400 meters for beds with less lateral continuity and less uniform thickness. Geologic features which affect the beds have been identified, and the quality of the beds has been established. Mining conditions have been determined by actual mining, and preparation characteristics have been tested and are known.

**B** - Exploration work is not as detailed as in A, with the distances between drill holes, exploratory shafts, pits, and drifts having a spacing in the range of 1,200 to 1,600 meters.

**C1** - Widely spaced

**C2** - Preliminary calculation

### **Economic Classification**

Geologic reserves are further classified into the categories of “*balance*” and “*sub-balance*” on the basis of economic factors which have been identified and categorized by the State, which was the owner and operator. In the former USSR, the agency with this responsibility was the **State Commission for Mineral Reserves**. The primary function of this agency was to establish and promulgate what are known as “*Conditions*” or “*Kondytsii*”, which are specific for each geographical coal basin. The principal conditions which were established are as follows:

- The demand requirements of the planned economy on a regional and national basis for each grade of coal;
- The geographic location and character of a particular coal deposit, the infrastructure which was in place, and the nature of the economy of the region;

- The cost of production for the specific deposit, including the cost to transport to industrial users;
- The total amount of capital investment needed to develop the mine, and the specific capital costs calculated per unit of production, expressed as rubles/tonnes of standard fuel (7,000 kcal/kg); and
- The payback period, termed the *Coefficient of Effectiveness*, for the required capital investment.

## Reserve Parameters

Once the Commission had classified reserves of a specific deposit as belonging to the balance or sub-balance, it prescribed a series of parameters for use in calculating the tonnage of reserves as follows:

- Minimum bed thickness;
- Maximum average ash content;
- Specified overburden-to-coal ratios; and
- Specific requirements regarding deposit-specific geologic and mining conditions.

The concern with reserve figures reported in both Russian and English-language literature is the uncertainty as to whether they are geologic reserves or balance (economically recoverable) reserves.

## Technical Grade

Coals for each basin are ranked by technical grade, or *sort*, using two criteria – the yield of volatiles during coking and the thickness of the plastic layer. The names which are used are descriptive and presented in the following table:

### Russian Coal Classification System

Technical Grade	Rus.	Eng.	Remarks
Brown	B	Br	Lignite grade
Poorly caking	SS	PoCa	Subbituminous
Long flame	D	LoFl	Free burning, high volatile bituminous
Gas (light, fiery)	G	Gas	Light, fiery, high volatile bituminous; yields large quantities of illuminating gas on distillation
Fat	Zh	Fa	Meta bituminous, 89-91% carbon, still relatively high percentage of volatiles
Coking Fat	KZh	CoFa	Intermediate between Fa and Ca grades
Coking	K	Co	Bituminous with 80 to 90% carbon
Lean	T	Le	Hard coal, low in volatiles, dry burning
Hard caking	OS	HaCa	Low in volatiles (15-17% Ad), high calorific value (6200 – 6900 Qif)
Semi anthracite	PA	SeAn	Intermediate between semi-bituminous and anthracite, non-agglomerating, 86-92% carbon
Anthracite	A	An	Hard coal, 92-98% fixed carbon, smokeless, short flame on ignition – then disappears, 220-330 cm <sup>3</sup> /g of volatiles

## Transportation Issues

### Railroads

Primary rail transportation is the Trans-Siberian Railway which extends from west to east across the southern portion of the country as well as several railways which serve the coal-producing regions of south-central Siberia. The railways are overloaded and poorly run, with high costs due to the recent release of price controls.



*Electric Locomotive with Rail Cars*

### Ports

Currently, around 40 ports remain after dissolution of the Soviet Union, only 11 of which are capable of processing international cargo. Some of the principal coal ports are at **Kaliningrad** on the Baltic Sea, in the **Krasnodar**

**Territory** on the Black Sea, and at **Vanino**, **Vostochny**, and **Nakhoda** on the Pacific Coast.

### Conclusion

The vast, high quality coal reserves of Russia have been suggested by some to be the fuel and energy wealth of the world and there appears to be significant potential for involving various kinds of investment, especially from abroad. In assessing coal opportunities it is necessary to pay particular attention to the present state of the coal industry which entered the 90s with a number of major bottlenecks including lack of modern equipment for coal production and preparation, poor development of social and basic infrastructure, and the lack of modern operating, economic and financial management skills. While the opportunities have been compared to the days of the gold rush in the U.S., western investors must temper their interest in Russia with a balance of entrepreneurship and sound risk assessment. There is little doubt the countries vast energy wealth will be exploited once a stable economic and political climate is achieved.

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1. Coal basin maps, courtesy: "Russia Coal", <http://www.rosugol.ru/eng/index.html>
  2. Railroad image, courtesy: "Railaneurope.net", <http://www.railfaneurope.net>
  3. Image of Kremlin, courtesy: <http://www.wbwilliams.com>
  4. Image of Red Square, courtesy: <http://www.schoolshistory.org.uk>