

THE COAL INDUSTRY OF THE FORMER USSR

Coal Supply System and Industry Development

EDITED BY
A. B. KOVALCHUK

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FOREWORD

As Consulting Editor to this volume, I would like to applaud the efforts of Professor Kovalchuk to coalesce the elusive, yet important data collected in this volume. This book represents the efforts of dedicated scientists and researchers who have endeavored to print the most accurate data available on coal resources. Divided into two parts, this book offers a comprehensive inventory and analysis of one of the most vital natural resources of modern Russia and the CIS countries. The first half of Part One discusses the role of coal in the economics of the former USSR and addresses the current status and forecast of eight major coal basins. Environmental problems associated with coal mining and their solutions are then addressed, followed by a brief review of management structures in the coal industry and improvements in the sales management of coal products, such as the establishment of commodity markets. Part One concludes with a discussion of the principals and problems related to the development of regional energy programs. Part Two begins with a section on the carbonisation, gasification, liquification and agglomeration. Also included in this section is information concerning coal waste utilization as part of a larger discussion of methods to improve efficiency. The last section of Part Two addresses the development and rationalization of various coal transport systems.

Having supplied the above synopsis of this book, I would like to remind the reader of the information which lies between the lines of these pages. It is well understood that the citizens of Russia and the CIS countries are expecting a period of transitional economics as they move from a centrally planned to a market economy. During this transition, the value of goods and services cannot be determined with pin-point accuracy. Although every effort has been made to authenticate the data presented herein, those readers interested in business planning or investments regarding the mineral supply of the CIS countries are advised to move cautiously with *this and any* data offered on the topic. In the sources cited at the end of this work in 'Selected Further Reading', the reader will find vital assistance in interpreting the figures offered by today's corporate and government leaders in Russia and the CIS.

Byron C. Hardinge, P.E., Consulting Editor



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PREFACE

This book was originally envisaged as a collection of papers and dealing with the coal supply of the former USSR. However, during work on this book, there have been dramatic changes in the political system of the former USSR, resulting in the disintegration of the country and the appearance of new, independent states. Today, nearly 90% of the total productive capacities of the former USSR is concentrated in just three countries: the Russian Federation, Ukraine and Kazakhstan. As a result, to adequately reflect these changes, we have radically revised the original manuscript and incorporated a large amount of new data.

The authors of this book are well-known researchers and experts in the mining, transport, processing and utilization of coal in CIS and Russia: G.V. Agafonov, M.K. Bandman who worked on Section 1.6; V.K. Branchugov (Sections 1.2, 1.3 and 1.5); Yu. A. Chernegov (Section 2.4); T.I. Filipiev (Section 1.4); A.B. Kovalchuk (Sections 1.1 and 2.1); I.P. Krapchin (Section 2.3); A.M. Krasavin (Section 1.6); A.A. Krichko (Section 1.5); B.P. Saneev (Section 1.6); V.M. Simonov (Section 1.5); A.D. Sokolov (Section 1.6); A.P. Tereshchenko (Section 2.2); M.A. Shchadov (Sections 1.2, 1.3 and 2.2); A.B. Yanovsky and V. Ye. Zeidenwarg (Section 2.1). O.V. Tender proofread and amended the manuscript.

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The Coal Industry of the Former USSR: Coal Supply System and Industry Development is dedicated to Professor Yu. Rudenko, Editor, *Energy Reviews*, who sadly died before the publication of this volume. Professor Rudenko was well known and respected internationally for his work in the area of energy resources and for his contribution to the literature.

Part I

THE COAL SUPPLY SYSTEM OF THE FORMER USSR

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1.1 THE ROLE OF COAL IN THE COUNTRY'S ECONOMY

Coal mining in Russia has a long history, but the bituminous coal industry was created only in the last century. In 1860, Russia's coal output reached the relatively high level of 300,000 tonnes for the first time, and, most importantly, did not drop below this level in subsequent years, but tended to increase steadily till the end of 1990s.

The development of the industry was associated with rapid industrialization of the 1890s. In the nineteenth century, the greatest increases in coal output occurred in the second half of the 1890s, although in the period 1860–1890 coal output effectively doubled every five years. Prior to 1890, the railway system and the domestic sector were the major consumers of coal, but the 1890s saw the rapid development of the iron-and-steel industry, which led to increased rates of bituminous coal production. By the beginning of the twentieth century, Russia's coal output had reached 15.5 Mt, with the Donets Basin – the major coal-mining region – accounting for 65% of the total amount [1].

In 1908, the level of fuel consumption had reached nearly 25 Mt/yr, with mineral fuels accounting for 70% of this. From 1908 to 1914, coal output increased from 20.3 to 32 Mt. According to the estimates of Academician L. A. Melentyev [2], in 1913, the total energy resource consumption in Tsarist Russia reached 150–160 Mt of coal equivalent^a. Considering the pattern of fuel demand in Tsarist Russia Melentyev rightly concluded that it was highly inefficient, mainly because mineral fuel accounted for only 30% of fuel consumption despite major developments within the coal industry at that time.

The First World War, the October Revolution and the Civil War led to economic collapse, severely affecting the fuel and energy complex. However, even during this period, economic recovery led to the increasing use of coal as a source of electricity, especially when the creation of an integrated electrical power supply system was a top priority.

The Soviet period of development may be divided into a number of separate stages and phases, each characterized by large-scale changes in energy sources used [3, 4]. The first stage in the development of the USSR's energy system began with the Fifteen-Year Programme of Electrification (the GOELRO plan). The energy policy envisaged by this plan was pursued for more than three decades, up to the mid-1950s.

During this period coal continued to be a major energy source, with production increasing tenfold from 1928 to 1955, and its market share increasing from 29% to 59% over the same period (at that time crude oil and natural gas accounted for 15–28% of the market share, despite great efforts to expand their output).

Coal tended to replace locally important fuels such as peat, firewood etc., with the contribution of these fuels decreasing from 56% in 1928 to 18% in 1955. However, the increasing demands of the national economy for high-quality fuel could not be met by coal alone. This factor tended to slow scientific and technological progress in industries that consumed large amounts of energy.

In the early 1960s, the discovery of vast oil and gas reserves led to a new phase of development characterized by the widespread adaptation to consumption of oil and gas, the new high-quality fuels. The newly created gas industry made net profits of nearly 80×10^9 roubles over the period from 1960 to 1980. During this time the contribution of oil, gas,

^aMechanical energy was taken into account. It was calculated on the basis of the muscular energy of cattle, as well as wind and water energy.

hydraulic and nuclear power to total energy production increased from 42% in 1960 to nearly 75% in 1980. At the same time coal's contribution decreased from 52% to 24%, and that of the remaining – mainly low-quality – fuels decreased from 6% to 2%. As suggested by Makarov *et al.* [5], the ratio of high- to low-quality energy source consumption was close to the optimum for the level of expected production, and was sufficiently high in the early 1980s.

The relatively low costs of oil and gas production and transportation ensured high economic efficiency (nearly 200×10^9 roubles for the period 1960–1980) and a reliable energy supply for all sectors of the national economy, thus substantially improving the efficiency of the labour force.

However, during the second stage of development of the energy system, some negative trends emerged. For instance, reduced fuel costs led to increasingly inefficient energy use. Also the oil and gas boom adversely affected the coal industry and reduced its importance to the national economy. Under the centrally controlled Soviet economy, this resulted in a lack of investment in new technology and a deterioration in the equipment used, as well as a lack of provision for mining communities. Thus, during this period the coal industry lost its privileged position as the top energy producer, although it did manage to perform very well, both technologically and economically during the mid-1970s, due to significant scientific and technological progress in previous years. However, even in the late 1970s, production capacity was still being lost at an ever-increasing rate, and could not be fully regained by using new technology. The same was also true for the oil industry, and even, to some extent, for the gas industry. Together with the depletion of the more accessible seams, the resultant loss of productive capacity has had to be made up by oil and gas production. According to analyses of a number of researchers, this trend will only be halted when the costs of consuming crude oil become equivalent to those of synthetic oil, and there is large-scale production of coal- and oil-shale-derived synthetic fuels.

The increase in the amount of capital outlay, required for investment in the coal industry, can only be stalled by improvements in coal technology and the increased use of low-cost, more efficient methods of production.

In the early 1980s the USSR's energy infrastructure entered a new phase, characterized by the substitution of more readily available energy sources, such as nuclear power, and later coal, for oil and gas. These trends were reflected in the USSR's Long-Term Energy Programme (EP) [6]. As well as the above-mentioned improvement in the mix of energy production, this Energy Programme proposed a long-term energy-saving policy, together with major developments in the science and technology of production and consumption.

Increases in the contributions of nuclear power and coal as envisaged by the Energy Programme, could be attained only with radical restructuring of the system of power generation with dramatic changes being envisaged for the European part of the USSR. There, it is predicted that the widespread development of nuclear power will lead to a stabilization of the consumption of organic fuels by thermal power stations within the next ten years. By contrast, further expansion of energy resource production was planned for the Eastern regions of the USSR. A planned increase in the organic fuel supply to thermal power stations would be achieved by expanding coal output in the Eastern basins, while stabilizing gas and fuel oil consumption and later even reducing it.

In this context, several different approaches for developing a flexible strategy for fuel supply in the European regions have been discussed. For example, the creation of reserve capacities and fuel stocks for the thermal power stations of the European region has been