

## BOOK REVIEWS

**Some Problems on Fuel and Energetics.** Z. F. CHUKHANOV, the U.S.S.R. Academy of Sciences Press, Moscow, 1961 (*Nekotorye problemy topliva i energetiki*, Izd. AN SSSR), 478 pp.

DURING the next few decades the main demands of mankind for energy and fuel will undoubtedly be satisfied mainly by organic fuel materials. Therefore, there is no need to prove the extreme importance of fuel and energetics problems for the development of a modern industrial state.

At present, general expenditure of human labour for extraction, processing and transport of fuel are as a rule extremely heavy, and therefore the development of methods giving a radical increase in the efficiency of applying fuels and a decrease in their specific expenditure by the main power and technological consumers is the most important scientific, technical and economic problem of the present.

The monograph considered is devoted to solving these particular problems.

A detailed approach to the development of certain particular problems connected with extraction and application of fuels is a distinctive feature of the monograph. Starting from the general combustion theory and gasification of fuels brought to engineering calculation equations, theoretical and technical prospects for the extraction of fuels by the underground gasification methods are logically and successively analysed in the book.

On the basis of the theoretical investigations of physico-chemical combustion processes and thermal decomposition as well as of heat and mass transfer processes under the conditions of reacting systems and, in particular, of the underground gasification of coals the author of the monograph proves the great difficulty involved in creating controlled methods for the underground gasification of fuels.

The basic regularities of the diffusion-kinetic theory on heterogeneous reaction, and new methods of quantitative calculations which determine the ways of intensification of heterogeneous processes in various "regions" of reaction are formulated and systematized in the first section of the book. In the monograph the results of investigations of the author himself as well as of many others are used, but the development of problems on combustion and gasification, and the general interpretation of the materials are given from the positions developed by the author: bi-reaction combustion theory; theory on the heat regime of heterogeneous reactions and theory on the thermal decomposition of fuels.

The simplified equations take into account, however, all the main factors which determine the process, including a thermal regime and, in particular, the influence of a

non-isothermal heterogeneous reaction on mass transfer processes, are used in the methods of calculation of evaporation processes. The good coincidence of experimental data with calculation cogently proves the possibility of a practical application of the new methods of calculations when designing and developing new industrial apparatuses and intensification of various practically important heterogeneous processes.

The scanty prospects of the practical application of this method to the extraction of fuels connected with the heavy inevitable losses of mineral fuels are proved on the basis of a physico-chemical and economic analysis of processes and technique of the underground gasification.

The second section of the monograph deals with the development of the main methods for a highly effective application of fuels.

On the basis of the analysis of energetic and technological methods of using fuels the author's works prove that a complex application of fuels by an organic combination of powerful energetic plants (electric power stations) with industrial production is the main perspective trend in the development of energetics and industrial large scale fuel consumers. The new branch of science, i.e. energy technology, which for the first time was developed in the works of the author and his colleagues, studies the regularities of processes carried on in combined energy-technological schemes where a combustion process as a rule is combined with other complicated processes including the heterogeneous chemical ones with phase conversions and transfer of heat and mass.

Figuratively speaking, energy technology is the science of processes of combustion and gasification in reacting systems.

The monograph presents some energy-technological schemes with solid, liquid and gaseous fuels which on the one hand allow one to use completely the qualitative fuel peculiarities, and on the other hand to intensify such processes as the production of metals and building materials with a simultaneous decrease in fuel expenditure for their production. Energy technological methods allow not only for the decrease in specific fuel expenditure but also for the solution of a number of such important and complex problems as, for example, production of cast iron and steel without obtaining metallurgical coke (on energetic fuels) in a high-temperature flame, or an effective application of multisulphurous black oils without poisoning the air basin by sulphur oxides in large electric power stations.

The application of energy technology allows the provision of all regions of the country with cheap chemical raw materials, and in some cases, where it is necessary, with a high-calorific gas.

The monograph considers the state and prospects of the development of methods of the energy technology which according to the author's words are the high road in developing energetics and industry.

The third and final section of the monograph closely connected with the first two is devoted to single methods for evaluation of the economic efficiency of the socialist production.

In this section the equation on social cost of production determining actual full labour expenses which are necessary under the conditions of continuously expanding production of products is derived on the basis of the analysis of both economics of various industrial processes and the law of cost.

The new economic method of analysis allows one to take into account the influence of the time factor on the economics of quantitative production. According to the author's data the time factor influences the economics through such indices as annual increase in the production of products; time for building enterprises; period of full amortization and the time for a total production cycle.

The cost equation obtained and the balance of special expenditure allows a univalence evaluation of various methods of production (hydro- and electric heat power stations), different fuels (natural gas, oil, coals etc.) as well as allowing one to determine the economic efficiency of such arrangements as mechanization and automation.

Results obtained from the economic analysis with the help of the new method and experimentally proved by the balance of special expenditure allow the author to draw important general conclusions concerning the ways of determining a new technique; increase in the efficiency of the application of existing funds and trends in the development of concrete branches of national economy and, in particular, in the fuel-energetic industry.

Parallel with positive features it is necessary to note some negative ones in the monograph in question. The fact that the derivation of important equations is presented and interpreted concisely (intermediate equations omitted) is the main drawback of the monograph which causes difficulties in its understanding.

The schematic presentation of theoretical fundamentals of energy technology and the theory of some important processes (with reference to original papers) does not contribute integrally to the second section and causes some difficulty in its understanding.

Finally the third shortcoming which should be noted is an inadequate regard for the latest works in the field of combustion theory and heat and mass transfer non-stationary processes which would allow more precise and cogent development of some important problems on the intensification of heterogeneous processes.

However, in spite of the drawbacks mentioned above the publication of the monograph may be considered to play a significant role both in the field of developing the theory of heterogeneous processes and fuel-energetic industry, and in the development of single methods of economic calculations which are of extreme importance at present.

### Theoretical Fundamentals of Building Thermophysics.

A. V. LUIKOV, Byelorussian Academy of Science Press, Minsk, 1961 (*Teoreticheskie osnovy stroitelnoi teplofiziki*, Izd. AN BSSR), 518 pp.

THIS book by Academician Luikov is a fundamental summarizing presentation containing a wealth of original ideas and perspective problems. Theoretical material in it as well as in his previous books, such as "*Heat Conduction Theory*", "*Mass Transfer under Drying Processes*", "*Transfer Phenomena in Capillary-Porous Bodies*", "*Energy and Mass Transfer Theory*", is accompanied by and combines with practical engineering applications. However, in the reviewed work this peculiarity has revealed itself more vividly.

The point is that up to now neither in the U.S.S.R., nor abroad, has there been any generalized summary work dealing with theoretical fundamentals of buildings thermophysics as well as any corresponding division of science already formed. A number of interesting books are available on thermal endurance of buildings, thermal properties of insulation, house heating and ventilating and on other thermal engineering building problems. However, what branch of science should be the basis of all these important technical engineering problems, on what grounds the problems of thermal engineering building should be solved, what the sources of technical aspects of calculation, planning and regulation of thermal regimes in building are, in short, what physical regularities should be utilized to comprehend and regulate these regimes, remained quite obscure.

In the first place Luikov outlined rationally the bounds of this new branch of science, for the first time formulated the complexity of theoretical knowledge required for a heating engineer and builder and expounded it in a rational progression. This main feature of the book, i.e. the spirit of innovation, should be emphasized first of all. One cannot but note the felicitous character of the material chosen with respect to the contents, breadth of scope, clarity and succession, and based on the group of problems which are to be solved by various specialist representatives.

The author had to face two circumstances. Firstly, here he met with a new body of technical knowledge covering various adjacent branches of science: heat conduction, heat dynamics, physics of capillary-porous media, molecular physics in the region of phase conversions, and so on. This circumstance cannot but give rise to great difficulties when choosing the necessary minimum knowledge from each branch and reasonable combination of it into an indivisible logically exclusive link. There can already be no question of the great erudition required of the author for this. Secondly, certain great difficulties had to be overcome in connexion with the wide statement of the problem intended for satisfying the requirements of representatives of all the links of building thermal physics; starting from investigators who for the most part are interested in the principal and theoretical aspect of the problem and including designers and constructors concerned with practical industrial applications. Moreover, the needs of post-graduates and students