

current lines and automatic controls required to allow a parallel operation with alternating-current systems.

6. Development and application of alternating-current and direct-current conversion equipment and cable installations which will permit wider use of the inherently lower cost direct-current cable systems.

7. Transmission of electric power by use of superconductivity. This is accomplished by using a refrigerant to reduce the conductor temperature nearly to absolute zero (-459°F.), which practically eliminates electrical losses and heating problems.

8. Transmission of power by microwaves through wave guides. This concept involves converting the energy to be transmitted to very high frequency radio waves which are beamed through a hollow pipe to the receiving end where the energy must be reconverted to a form suitable for normal use.

9. Study of the opportunities of synthesizing a molecular structure having superconducting properties at temperatures well above those of present materials. Such a conductor would permit loss-free underground transmission at reduced cost over long distances.

BRIEF DESCRIPTIONS OF ADDITIONAL PROGRAMS IN ENERGY

COAL AS A SOURCE OF ELECTRIC POWER

By far the largest use of coal today is for generating electricity in central station power plants. This use of coal is increasing but, because of developments in nuclear energy, there is some uncertainty as to how long this increase will continue, and whether there may be a large decline in the use of coal for power generation in 20 to 25 years. The Office of Coal Research (OCR) has a statutory responsibility to develop projects beneficial to the coal industry. Consequently, OCR is supporting a number of projects designed to both increase the efficiency of coal-fired thermal power plants and reduce their capital costs. If these projects are successful, the position of coal in the face of increasing competition would be considerably enhanced. A side benefit, inherent in some of these projects, is the reduction of thermal and atmospheric pollution. Both of these forms of pollution are becoming of increasing concern, and are an increasing additional cost factor in the location of coal-fired power plants.

OCR's oldest power project is the fuel cell, being developed under contract with Westinghouse. Technical feasibility of a high-temperature, solid-electrolyte, coal-energized, fuel-cell system has been demonstrated. A great deal of work has been done in developing a low-cost method of fabricating the large number of fuel cell elements that would be needed in a plant of practical scale. Indications are that the desired goals can be achieved. Plans are underway for the design, construction, and operation of a 100-kilowatt demonstration unit.

Feasibility studies have indicated that the coal energizing, fuel-cell system may be able to operate with thermal efficiencies approaching 60 percent, with capital costs below those of conventional central stations. Additionally, such a system would discharge no sulfur or nitrogen oxides to the atmosphere, and would require practically no cooling water. Thus, this system has a potential for greatly enhancing the competitive position of coal in power generation and, at the same time, achieving the conservation goals of reduced thermal and atmospheric pollution.

OCR also has had a study of magnetohydrodynamic (MHD) coal-fired electrical power generation performed under contract by Westinghouse, and is considering the support of a 30,000-kilowatt demonstration plant. This would be two-thirds financed by organizations outside of the Government. MHD has reached a relatively advanced scale of development in relation to other exotic power systems, and it appears the time has come to proceed to large-scale demonstration in order that its potential for increasing thermal efficiency can be shown.

OCR is preparing to contract for development of a thermionic topper as an auxiliary to coal-fired steam power plants. This device, which has the advantage that it may be used to modernize existing older power plants, appears to be capable of increasing over-all thermal efficiency by as much as 10 to 12 percent, at low capital cost, thus also enhancing coal's competitive position and helping to assure continued development and use of abundant domestic coal resources.

Work has just started on development of the electrogasdynamic (EGD) system of coal-fired power generation. One development contract is about a year old, and several interesting proposals are being evaluated. EGD, somewhat analogous to a Van de Graaff generator, uses a stream of gas containing charged