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Surface Mining and Land Reclamation in Germany

E. A. Nephew

OAK RIDGE NATIONAL LABORATORY

OPERATED BY UNION CARBIDE CORPORATION • FOR THE U.S. ATOMIC ENERGY COMMISSION

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This report describes mining and land restoration methods as well as planning and regulatory procedures employed in West Germany to ameliorate environmental impacts from large-scale surface mining. The Rhineland coalfield in North Rhine Westphalia contains some 55 billion tons of brown-coal (or lignite), making the region one of Europe's most important energy centers. The lignite is extracted from huge, open-pit mines, resulting in large areas of disturbed land. The German reclamation approach is characterized by planning and carrying out the mining process as one continuum from early planning to final restoration of land and its succeeding use. Since the coalfield is located in a populated region with settlements dating back to Roman times, whole villages lying in the path of the mining operations sometimes have to be evacuated and relocated. Even before mining begins, detailed concepts must be worked out for the new landscape which will follow: the topography, the water drainage system, lakes and forests, and the intended land-use pattern are designed and specified in advance. Early, detailed planning makes it possible to coordinate mining and concurrent land reclamation activities. The comprehensive approach permits treating the overall problem as a whole rather than dealing with its separate aspects on a piecemeal basis.

1. INTRODUCTION

1.1 Foreword

The Environmental Program of the Oak Ridge National Laboratory is currently investigating the environmental impacts of electricity production and use. As part of this investigation, which is funded by a grant from the National Science Foundation, we are gathering data to describe quantitatively the environmental damage from the coal energy cycle (see Figure 1) to compare it with alternative fuel cycles. We have found that much of the damage associated with the coal cycle is incurred during the mining stage. In the United States, coal surface mining has disturbed large areas of land and degraded the quality of thousands of miles of streams and rivers. The extensive damage from strip-mining has fostered a growing public awareness of the need to develop better methods of mining coal - methods which can meet the nation's demand for energy without causing needless destruction of land, water, and forest resources. To help design effective mining and land conservation measures, it is useful to examine programs which have been adopted by other industrial nations faced with similar problems. This report describes the planning, technological, and regulatory procedures which are used in the Federal Republic of Germany (West Germany) to ameliorate the harmful environmental consequences of large-scale surface mining of brown coal.

1.2 German Strip Mine Reclamation

On March 1, 1966, a special team appointed by President Johnson traveled to West Germany to learn about German conservation efforts and to study air and water pollution control programs. The findings of the study team with regard to strip-mine land restoration are as follows:[1]

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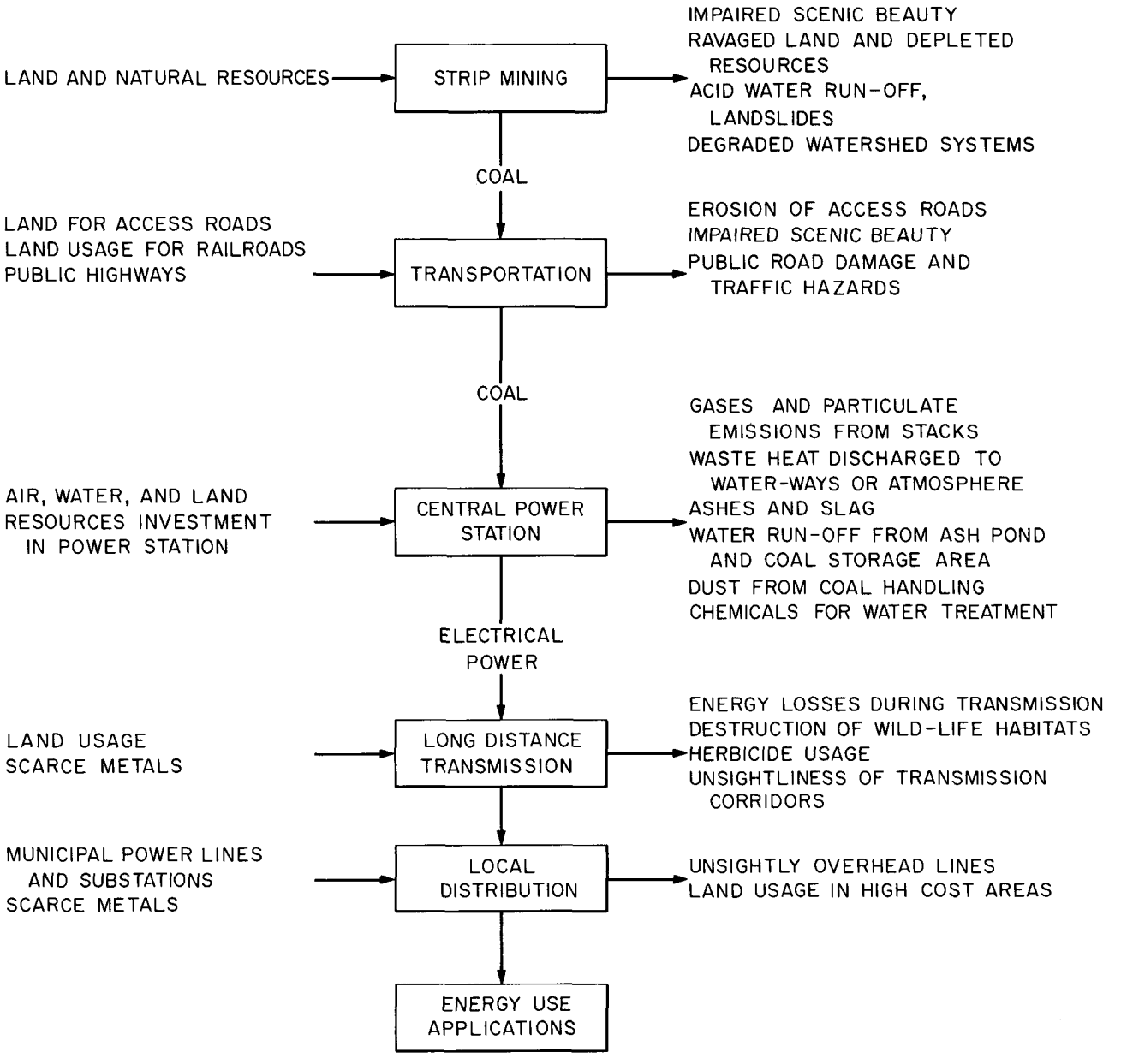


Fig. 1. Some Adverse Environmental Impacts of the Coal Energy Cycle.

> "The German practice of restoring their strip-mined areas to productive use contrasts sharply with common practice in the United States. Restoration of "stripped land" is considered in Germany part of the cost of doing business. Mining firms are required by law to formulate plans for restoring the landscape before the first spade of land is turned. ...The Rhineland brown coal area has developed an exemplary program for exploitation of the resource, restoration of the landscape, and reconstruction of the social, economic, and cultural life of communities formerly located on mine sites. It involves cooperation of the state and mine operators, with consultation by representatives of all affected local citizens. The goal is to exploit the deposits at economic costs but, through planning and the exercise of government initiative, to leave the neighborhood a better place than before the mining started. ...By contrast, the work of mine restoration in the United States is in its infancy. ...A thorough understanding of the German approach to mine restoration would be helpful for those who are now attempting to find solutions to the problem in this country."

The above words, written more than five years ago, are taken from the report "Natural Resources Mission to Germany - A Special Report to the President" by the former Secretary of the Interior, Stewart L. Udall. Since then, the sought-for solutions to the environmental ravages of strip-mining have not been discovered, let alone implemented.

In view of the continuing importance of the strip-mine issue in the United States, we have investigated in greater detail the surface mining methods and land restoration program employed in the Rhineland brown-coal area. A general description of the German land reclamation methods is available in the public literature.[2] We have supplemented this information by making an on-site visit to the West German brown-coal (lignite) fields and by studying the techniques used to rehabilitate land affected by the huge, open-pit mines of North Rhine Westphalia (Nordrhein-Westfalen). Here we were particularly interested in the reclamation laws and how well they are enforced. In general, we found that the land restoration program has been largely successful and that strip-mining is no longer a controversial public issue in Germany. Of particular interest are the institutional

arrangements that have been worked out to assure comprehensive planning for land restoration before the start of mining. Many features of the German approach could be applied to strip-mining problems in the United States.

2. A REVIEW OF U.S. SURFACE MINING DAMAGE

A brief description of the nature and extent of environmental damage caused by coal strip-mining in the United States may help to place the overall problem in perspective and to highlight the importance and relevance of the German land restoration approach to the U.S. situation. The significance of coal surface mining as related to environmental degradation has been well documented in several excellent reports.[3] Essentially, two basic factors have contributed to the magnitude of the problem we face today: the greatly increased consumption of coal for electric power generation since World War II, and the relatively rapid growth of strip coal production during the past decade. Coal consumption for electricity production increased from 51,474,000 tons in 1940 to 310,312,000 tons in 1969 and, during the same period, the amount of coal that had been either strip-mined or augered (mined by boring into the mountainside) rose from 43,167,000 tons to 213,373,000 tons.[4]

In coal surface mining, the overburden (the earth and rocks lying above the coal seam) is first removed, and the exposed coal is then extracted. Surface mining conducted in relatively flat terrain is commonly called area stripping. The surface of the land is first scalped of trees, and a deep trench is then cut through the overburden to expose a long strip of the coal bed. The earth, clay, and rock overburden is deposited

adjacent to the trench to form a long "spoil" bank. After the coal is removed, a second trench is cut parallel to the first, and the overburden is dumped into the first trench. The process is repeated until most of the recoverable coal has been extracted, resulting in a series of parallel, adjacent spoil ridges, which give the mined land the appearance of having been worked over by a giant plow. The final cut produces an open trench bounded by a steep wall called a highwall.

Contour stripping in hilly regions progresses in the same manner except that the process is halted sooner - as the thickness of the overburden becomes too great. Work starts at the outcrop of coal along the hillside: A slice of overburden is removed and dumped on the downslope side. The coal is then removed, and a second cut is made through the overburden to expose more coal. Finally, when the overburden is too thick for further economical stripping operations, augers as large as seven feet in diameter may be used to drill horizontally some several hundred feet into the mountain to bring out additional coal. Using this combination of stripping and augering, the mining operations proceed along the hillside leaving behind a steep, nearly vertical highwall, with the spoil material deposited on the bench or cast down the mountain.

To our knowledge, an accurate survey of the total land area disturbed by the surface mining of coal has never been made. On the basis of data reported by coal producers, Averitt has estimated that, as of January 1, 1970, the cumulative past production of 4.4 billion tons of strip-mined coal resulted in 2,450 square miles of disturbed land in the U.S.[5] He further estimates that the mining of the remaining 128 billion tons of strippable coal in the 0 to 150-foot-thick overburden category would create

an area of disturbed land comprising 71,000 square miles. At present coal strip-mining rates, roughly 100 square miles of additional disturbed land are being created each year. We must consider that advanced earth-moving machinery and changing economic conditions will probably make deeper deposits accessible to surface mining methods. This would expand the strippable coal reserves and the total amount of future land damage.

The damage often extends well beyond the boundaries of the actual mining areas. If, for example, mountains are scarred by contour mining, the whole landscape is rendered less attractive. The destruction of watersheds (catchment areas from which stream waters are drawn) by siltation and acid water run-off also extends the harmful effects of strip-mining. (Acid water is water containing sulfuric acid produced by weathering of sulfur-bearing minerals.) According to a recent study,[6] contamination caused by both deep and surface mining has substantially altered the water quality of some 10,500 miles of streams in Appalachia and acid drainage seriously pollutes some 5,700 miles of streams. A recent study by the U.S. Department of the Interior on the environmental effects of strip-mining in Cane Branch Basin, McCreary County, Kentucky, showed a decrease in the variety and abundance of aquatic life downstream from the strip-mined areas.[7] This decrease was caused by erosion and acid water drainage which effectively destroyed the stream habitat. Annual erosion losses from freshly strip-mined areas in Appalachia are as high as 27,000 tons per square mile, or up to 1,000 times greater than for undisturbed lands. Landslides, damage to timber, and as yet unknown effects such as the spread of heavy metals or carcinogenic materials by leaching of the spoil during rains can add to the list of possible off-site damage.

Strip-mining is only now beginning on a large scale in the western states and the extent of damage is not yet clearly defined for such climates and terrains. In addition to increasing the susceptibility of these lands to wind and water erosion, surface mining in the semidesert regions of the Southwest poses the danger of exposing highly saline material to the surface.[8] This overburden material, enriched in salts by the percolation of surface water, if brought to the surface, would make it difficult to establish any kind of vegetation on the disturbed land. Before the environmental impact of surface mining in arid regions can be fully assessed, revegetation methods effective in regions with low average rainfall must be developed, soil conditions must be investigated, and the groundwater movements must be determined. (Groundwater is the water beneath the earth's surface, between saturated soil and rock, that supplies wells and springs.) Much more study and research is needed. However, it is already clear that strip-mining, whether it is conducted in Appalachia, in the arid regions of the Southwest, or in the harsh climate of the northern coalfields, can seriously affect the natural ecological balance of the region.

2.1 Costs of U.S. Strip Mining

The true economic and social costs associated with the surface mining of coal have not yet been adequately assessed. Coal can be strip-mined at an average cost of about $1.50 per ton less than deep-mined coal, largely because the cost of adequate land reclamation is not included in the production costs.[9] Failure to include reclamation in the mining cycle gives the illusion of a greater labor productivity than is actually justified. For a coal density of 1,800 tons per acre-foot and a coal recovery

factor of 80 percent, the yield of a typical three-foot-thick Appalachian seam is about 4,300 tons per acre. On this basis, some $6,000 per acre could theoretically be spent on land reclamation without destroying the competitive position of strip-mined coal. In West Germany, the actual costs of restoring mined-out land areas to full agricultural productivity range from $3,000 to $4,500 per acre. To the extent that strip-mining is carried out without subsequent restoration of the land and repair of other environmental damages, payment of the true production costs is simply being deferred.

The burden of external costs associated with strip coal production is not fairly borne by all consumers. In some regions of Appalachia, approximately 40% of the maintenance budgets for state and county roads is used to repair damage caused by heavy coal-truck traffic.[10] Land made worthless by strip mining operations no longer serves as a tax base to provide needed revenues for local community development. Floods and landslides, resulting directly from conditions created by coal surface mining, destroy both public and private property. Funds that could otherwise provide needed local services are thereby diverted to repair the damages. Where such conditions prevail, the coal-producing locality is, in effect, subsidizing the rest of the nation.

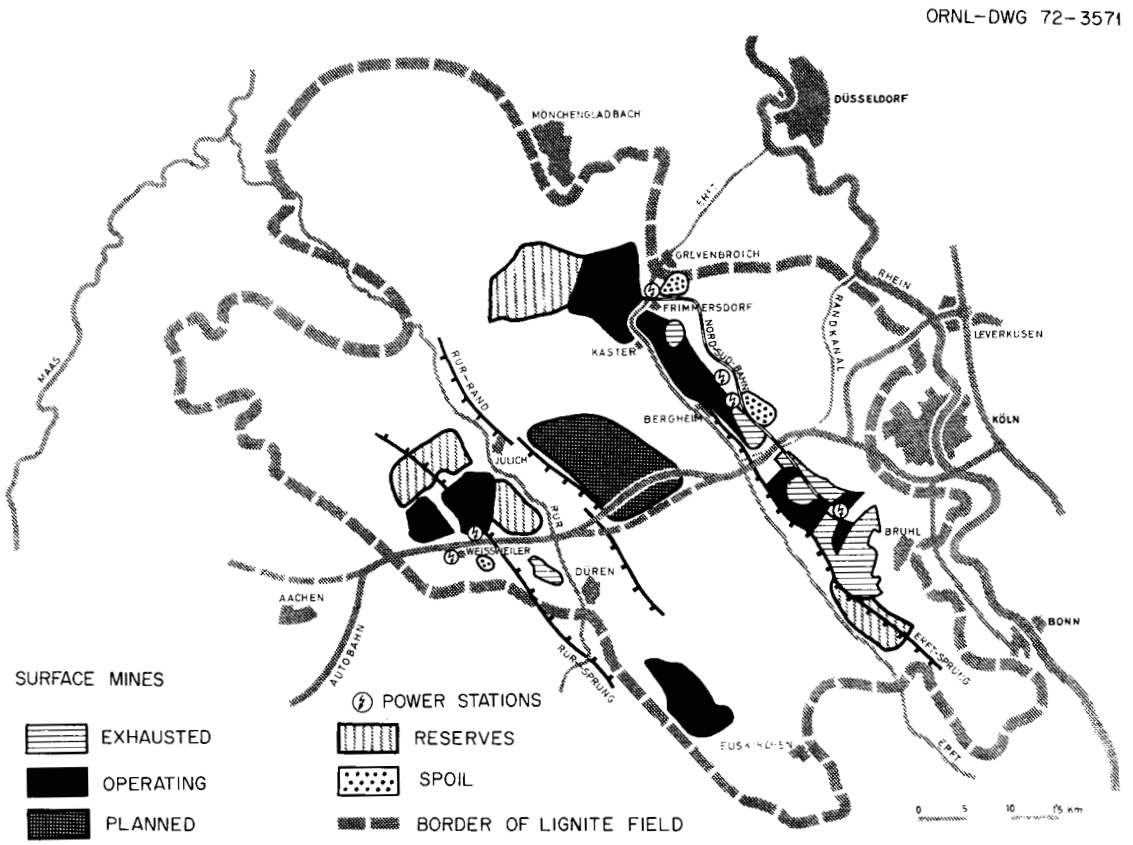
The consumption of coal for electric power generation is expected to increase greatly during the coming decades. Perry has estimated that the use of coal for this purpose alone will reach some one billion tons annually by the year 2000.[11] This would represent nearly a threefold increase over present coal consumption rates for electric power generation. More and larger strip mines may be expected. The problem of meeting the

ever-growing energy demands of society without needlessly destroying land, water, and forest resources must somehow be resolved.

In view of the extensive environmental damage already inflicted by coal surface mining, and the anticipated future growth of the industry, *the adoption of sound mining and land restoration practices is urgently needed.* The environmental effects of coal surface mining are clearly regional in nature, extending across state boundaries, so that it is difficult for the individual states to deal with them effectively. For this reason, federal mining and land restoration standards that would apply equally to all of the coal-producing states seem highly desirable. The national concern over environmental damage from coal production is evidenced by the number of surface-mining regulation bills currently before Congress.

3. THE IMPORTANCE OF LIGNITE IN WEST GERMANY

The consumption of raw materials in the world is growing rapidly, and the development of new sources of supply is increasingly difficult and more expensive. Many industrial nations, therefore, are heightening their efforts to acquire a stable, broadly-based source of vital raw materials and fuels. This intensification includes not only securing supply sources from abroad, but where possible, devoting greater attention to the development of domestic resources. The Federal Republic of Germany is fortunate to possess large reserves of brown-coal (lignite) to serve in electric power production and possibly as a raw material for producing synthetic fuels. The total brown coal reserves of West Germany are estimated to be about 60 billion tons. Of these, some 55 billion tons are located in the



The Rhineland lignite field, some 2500 square kilometers in area, lies near the Dutch border in flat, level country. The remaining reserves of brown-coal are estimated to amount to fifty-five billion metric tons, of which eight to ten billion tons can be recovered by present-day mining methods.

Rhineland coal fields alone, making them the largest continuous deposit of lignite in Europe. (The lignite reserves of the world are estimated to amount to some 2,100 billion tons, as compared to 155 billion tons for all of Europe.) Using present-day mining techniques, approximately eight to ten billion tons of Rhineland lignite lie close enough to the surface for economical recovery. When we consider that improved mining methods will almost certainly be developed in the future, it is clear that brown-coal will continue to play a vital role in the West German economy far into the next century.

Table 1. 1968 Production of Lignite (Thousand short tons)[12]

Rank	Country	Production
1	East Germany	272,491
2	U.S.S.R.	154,323
3	Federal Republic of Germany	111,902
4	Czechoslovakia	82,006
-	United States	4,817
-	World Total	812,799

The production of brown coal has long been an important industry in Germany. Table 1 shows that, even today, the territory comprising pre-war Germany accounts for nearly half of the total world lignite production and that the Federal Republic of Germany is surpassed in lignite mining only by East Germany and the Soviet Union. The beginnings of brown-coal mining in the Rhineland reach far back into the 18th century, with an annual production of about 70,000 tons in the year 1816. Lignite production first exceeded

100,000 tons in the year 1833 and reached an annual rate of 189,000 tons in 1859 before competition from bituminous coal from the Ruhr, made possible by the advent of railroads, caused the brown-coal industry to decline. Lignite, because of its high water content (50 - 60%) and low calorific value (3,500 BTU/lb), could not be transported economically over long distances and, instead, had to be used locally. This situation was changed drastically, in 1877, when the first lignite briquette factory went into operation in Brühl, near Cologne. From 1880 to 1905, the annual lignite production in Germany soared from 128,000 tons to 7,931,000 tons, and the briquette production rose from 128,000 tons to 2,000,000 tons. The manufacture of smokeless briquettes for domestic heating reached a high in 1955, when 61% of the total lignite production was used for this purpose. Today, the briquette market consumes only about 23% of the brown coal, with the rest being burned in thermal power plants.

The total West German production of brown coal in 1970 amounted to some 108 million tons, with 92.6 million tons being mined in the Rhineland alone. About 81 million tons of lignite were burned in thermal power stations to produce 60 billion kilowatt-hours of electricity; 24.7 million tons were used for briquette manufacture; and the remainder was used for miscellaneous purposes. In view of the declining market for briquettes, new applications for brown coal are already under study. It is believed that favorable physical properties of brown coal, such as high chemical reactivity, porosity, and low sulfur content, may make it suitable for a number of different production processes. Some of these potential processes are the reduction of iron ore, the gasification of lignite using nuclear process heat, and the production of metallurgical coke.

Today, 38% of all power generated in German thermal electric power stations comes from lignite-fueled plants. The present and potential uses of brown-coal, both as an energy source and as a raw material, assure that it will eventually be mined to depletion. In Germany, the need to treat effectively the environmental consequences of brown-coal mining has been fully recognized. Furthermore, this necessity will remain even if brown coal is eventually replaced by an alternative fuel for electric power production.

The vital role of lignite in the German economy can be seen from the intensive efforts which have been made to modernize the mines. This modernization process has required an enormous financial investment, more than one billion dollars since the end of World War II, and has led to a consolidation of the brown-coal mining industry. The many shallow surface mines which were formerly common in the Rhineland have been gradually replaced by larger, more efficient open-pit mines. (While the number of active mines in the Rhineland decreased from 23 in 1950 to 6 in 1970, the annual production of lignite increased from 64 to 93 million tons.) The post-war lignite industry in the Rhineland was shared by four major companies: Rheinische Braunkohle A.G., Roddergrube A.G., Braunkohle-industrie A.G. (BIAG), and Neurath A.G. In 1959, these companies merged to form the present-day Rheinische Braunkohlenwerke A.G., which today dominates the brown-coal mining industry. This single company, a subsidiary of Germany's largest electric power utility - the Rheinisch Westfälische Elektrizitäts-werke A.G. (RWE) - employs nearly 16,000 workers and produces 85 percent of the German lignite. Its large size and many resources have helped the Rheinische Braunkohlenwerke A.G. to institute enlightened land reclamation practices which have received worldwide recognition. Table 2 provides

data which show the magnitude of the company's mining operations.

Table 2. Salient Statistics on the Operations of the Rheinische Braunkohlenwerke A.G.

	1969	1970
Spoil material excavated (1000 m^3)	184,691	185,787
Raw lignite produced (1000 tons)	91,327	92,631
Lignite used for briquettes (1000 tons)		24,700
Lignite sold to industry (1000 tons)		1,300
Lignite burned in power stations (1000 tons)		66,431
Briquettes manufactured (1000 tons)	8,830	8,497
Electric power produced (million kWh)		48,400
Power from minemouth plants (million kWh)	2,094	2,033
Total number of employees	15,902	15,699
Average productivity (tons per man-day)	59.18	63.94
Clay production (1000 tons)	151	203
Sand and gravel production (1000 tons)	593	627

4. BROWN-COAL MINING TECHNOLOGY

4.1 Open-Pit Mines

The Rhineland brown-coal field lies in flat, plains country in the 1,000 square mile triangular area formed by the cities of Aachen, Cologne, and Mönchen-Gladbach. The lignite is deposited in highly faulted seams that are from 65 to 350 feet thick, with varying overburden up to 650 feet. The coal bed lies on a slightly-folded, inclined plane, with the shallower seams located at the base of the triangle, in the vicinity of Cologne and Aachen. Mining began in shallow surface mines near Cologne and has moved steadily northward, becoming progressively more complicated as the deeper coal deposits were reached. Prior to World War II, the mining of lignite in the Rhineland area was confined to sites where the brown-coal lay sufficiently close to the surface (< 100 ft.) that conventional surface mining equipment could be used. Since the number of such suitable locations

was limited and would be exhausted in the foreseeable future, it was clear that new mining methods needed to be developed to exploit the deeper lignite deposits.

Attempts to develop suitable new mining techniques began in 1938 when tests were made to explore the possibility of using deep mines to extract the lignite. These experiments were delayed by the war and were finally abandoned in 1953 when it became apparent that the high groundwater level of the region and the unconsolidated nature of the overburden precluded the large-scale introduction of deep mines on an economical basis. At about this time, however, modern, massive excavating machines were developed that made the deeper brown-coal seams accessible for the first time to surface mining techniques. Because the capacity and efficiency of these bucket-wheel type excavators were significantly greater than that of the older equipment, it became possible to design new open-pit lignite mines on a scale not possible heretofore. Thus, in the years 1953 to 1955, a new epoch in the history of the Rhineland brown-coal industry began. The result is such mines as the Fortuna-Garsdorf open-pit mine located near Bergheim. This mine is the largest material handling operation on earth, nearly twice as large as its closest competitor - the Kennecott Copper Bingham pit in Utah. In 1970, a total of 86.8 million cubic yards of spoil material, together with 36.2 million metric tons of lignite, was taken from the Fortuna-Garsdorf open-pit mine alone.

4.2 Mechanization and Automation of the Lignite Mines

The modernization of the Rhineland brown-coal mines, beginning with the introduction of giant wheel-excavators in 1955, has greatly increased productivity and helped to make brown-coal the cheapest source (next to hydroelectric power) of energy in Europe. The process of mechanization

Spreader machines are at work forming level terraces on the refill side of the Fortuna-Garsdorf open pit mine. The cooling towers of the mine-mouth power plant are visible in the background.

The bucket wheel excavators currently in use weigh 7,600 tons and are 230 feet high and 656 feet long. The machines have a reach of about 165 feet and a digging capacity of 130,000 cubic yards per day. The excavator shown above is stripping off overburden to expose the lignite lying beneath.

did not end with the massive, new digging machines. A transportation system, capable of matching the prodigous capacity of the wheel excavators, had to be developed to haul away the spoil material and lignite from the mines. Since full restoration of the land disturbed by the mining operations was planned, giant spreader machines - similar to the wheel excavators - were designed and built to spread the overburden from active mines back into mined-out pits. In addition, because the depth of the the new surface mines extends well below the groundwater level, methods had to be developed to prevent flooding of the pits. That these problems were solved successfully is shown by the fact that lignite has not only held its position with respect to competitive fossil fuels, but has actually expanded its market.

4.2.1 Bucket Wheel Excavators

Presently, each of the large, open-pit, brown-coal mines is equipped with several wheel excavators for stripping off the overburden and extracting the lignite. A single machine costs up to ten million dollars and consumes as much as 10.4 MW of electrical power in operation. Excluding maintenance personnel, only two operators are needed to operate the huge excavator. The lignite or loose overburden is carried by conveyor belt from the excavator wheel to the discharge boom, where it falls into waiting railroad cars. Because of their ability to excavate selectively and deliver the loose overburden, lignite, or topsoil to a separate, interfacing transportation system, the wheel excavator is especially suitable for use in areas where land reclamation is planned. An advanced wheel excavator with more than twice the digging capacity of the present generation machines has been ordered by the Rheinische Braunkohlenwerke A.G. mining company and is scheduled to begin operation in the Fortuna-Garsdorf mine in late 1975. When built, the new wheel-on-boom machine

will be the largest mobile land device in the world - weighing 13,000 metric tons and standing 269 feet high and 704 feet long. Its 85-foot-diameter excavator wheel equipped with 18 separate buckets, each having a volume of 7.2 cubic yards, will give the new excavator a digging capacity of more than 260,000 cubic yards per day.

4.2.2 Transportation of Bulk Materials

Transporting the massive amounts of spoil material and lignite from the mine is accomplished with a specially designed system consisting of conveyor belts, heavy-duty trains, and slurry pipelines. Much of this equipment is automated or remotely controlled, thereby contributing to the high productivity of the overall mining operations. Seven-foot-wide conveyor belts moving on steel rollers at speeds up to 15 miles per hour are used to transport the lignite out of the mine pit. These conveyor belts can be installed in a straight line and operate satisfactorily on relatively steep inclines, thus eliminating ramps which would be required if trains were employed in the pits. The total installed length of the conveyor belt network comes to about 70 miles. The belts are used to haul both lignite and spoil material. A crawler, equipped with special handling devices, is used to move the skid-mounted conveyor belt sideways as mining progresses. This can be done very rapidly, with little interruption of the mining operations.

Bulk material from the mines which must be transported over long distances is hauled on a company-owned railway system. The rail network consists of 310 miles of tracks connecting the active brown-coal mines, the mined-out areas undergoing restoration, the briquette factories, and the power generating stations. The spoil material is hauled in eight-axle-gondolas, each with a capacity of 125 cubic yards and a gross weight of 240

metric tons. The gondolas can be emptied in a matter of seconds by a hydraulic system which tips the cars sideways. Raw lignite is transported in four-axle, ninety-ton rail cars. Specially profiled, heavy-duty rails, with a linear density of 43 pounds per foot, have been designed to accommodate the enormous, 30-ton-per-axle loads which are encountered. Electric locomotives weighing up to 139 tons are used to pull loads of as much as 2,000 tons. This private railroad network carries a larger annual tonnage (not ton-miles) than the whole German Federal Railway system.

4.3 Ground and Surface Water Control

To extract the lignite using surface mining techniques, it is necessary to lower the groundwater level to prevent flooding of the mine pits. This is accomplished by pumping water from some 1850 deep wells which have been drilled in the Erft river basin to an average depth of nearly 600 ft. Submersible motor pumps, some nearly 33 feet long and weighing more than 12 tons, pump water at rates as high as 33 tons per minute. At the present time, 1100 wells in continuous operation provide sufficient water removal capacity for the six surface mines in the Erft region. On the average, 14 tons of water must be pumped out of the ground for each ton of lignite mined.

The water from the deep wells is discharged into the Erft, Inde, and Merzbach waterways and into a special drainage canal which connects the coal fields to the Rhine river. The canal can also be used to provide supplementary flood control benefits to the region north of Cologne. During periods of high-water, a pumping station can divert 10 cubic meters per second from the Erft into the Rhine river. The Rheinische Braunkohlenwerke A.G. mining company is also studying the possibility of converting some of the huge mine pits into a freshwater reservoir to improve the

supply and quality of water for industry in the region. Thus, the brown coal mining activities provide unforeseen community benefits.

5. LAND REHABILITATION

5.1 The Extent and Costs of Land Reclamation

All lignite mining operations to date have affected less than one tenth of the 620,000 acre Rhineland brown-coal area. The total land area disturbed by brown-coal surface mining from the turn of the century to January 1, 1969, amounts to 36,750 acres. Of this, 16,480 acres are not yet restored, representing either active mine sites or depleted pits currently being reclaimed. The remainder, 20,270 acres, has been restored for forestry (10,290 acres), agriculture (7,390 acres), and artificial lakes (2,590 acres). Restoring land to full agricultural productivity is the most expensive type of reclamation, costing from $3,000 to $4,500 per acre. In recent times, rising land prices and lower reclamation costs, due to improved, more efficient methods, have resulted in arriving at an economic break-even point. Today, the market value of the restored farmland compares favorably with the expenditures for reclamation. In the United States, the cost of full land restoration would, in most cases, greatly exceed the value of the land. However, it is interesting to note that land reclamation was required in Germany long before it became marginally profitable.

5.1.1 A Panoramic View of Land Reclamation

The steady, northward progression of mining operations during the past fifty years occurred as the shallow, southern lignite deposits were gradually exhausted. Because of this, today the various stages of the mining and land restoration cycle are open to view, spread out in

sequential order. At the active mines in the northern and central regions of the lignite field, the giant bucket-wheel excavators selectively strip off and save the top layer of loess. (Loess is an extremely fertile type of loam which covers most of the Rhineland region and has gradually come to be regarded as an important mineral in its own right.) The excavators next peel off thick layers of sand, gravel, and clay overburden before extracting the loose, black layers of exposed lignite. Some commercial exploitation of the sand and gravel has begun, thus turning the extraction of brown-coal into a total mining operation.

Further southward, near Quadrath-Ichendorf and Berrenrath, the huge surface mines have been exhausted of lignite, and restoration of the land area is underway. Brought in by trains from the north, the discarded spoil material is filled back into the mined-out pits by mammoth spreader machines and leveled off by bulldozers. The leveled areas are subdivided into 5- to 10-acre tracts, or polders, by six-foot-high dikes of loam. These polders will eventually be filled with a loess slurry, which leaves behind a one- to two-meter-thick top layer of loess when it dries. Still further to the south, near Berrenrath, fields of grain and hay can be seen thriving on restored land which is less than 5 years old. The sequence in the forested areas is similar: To the north are newly planted stands of young trees, and in the south are forested areas reclaimed fifty years ago. The latter are nearly indistinguishable from natural forests and are superior to the stands of scrub timber which originally grew there.

5.1.2 Meticulous Advance Planning

The German land restoration program actually begins, with the

preparation of detailed plans for the relocation of populated settlements and for the restoration of the land, years before the first shovel of brown coal is mined. Land-use patterns are proposed in advance, and the new landscape is designed accordingly - the topography, the drainage system, lakes, and the designation of areas to be restored for forestry and for agriculture. This comprehensive early planning enables the mining operations to be coordinated with concurrent land restoration work. New towns for the displaced people are designed according to modern urban requirements and are more compact than the former, unplanned settlements. The basic resettlement costs are borne by the mining company with local and state governments providing supplementary funds to pay for the incremental costs of better schools, sewer systems, and other community services than those which existed at the former town site.

This comprehensive approach reflects an acceptance of the fact that surface mining affects not only coal, but also trees, buildings, people, and the land itself. In Germany, the State of North Rhine Westphalia and the lignite mining industry have accepted the challenge of finding acceptable solutions to the entire set of social and environmental problems created by brown-coal surface mining. *This approach makes it possible to treat the overall problem as a whole rather than dealing with separate aspects of the problem on a piecemeal basis.* The old concept of mining, which appears to be prevalent in the United States, holds that it consists merely of extracting minerals from the ground in the quickest, most "economical" manner. In the integrated concept, the qualification is added that this must be done in a way consistent with the needs of society as a whole.

5.2 Forests and Lakes

The restoration of brown-coal mining lands began in the Rhineland some fifty years ago. Today, extensive tracts of both first and second generation forests (and some thirty-nine lakes of varying size) can be seen in the area. Historically, the forestland reclamation program divides naturally into three main periods. These are the "greening" action of the 1920's, the extensive planting of poplars and alders after the second world war, and the current phase of reforestation which began about 1958. The current program is distinguished by the planting of commercially valuable trees, with some poplars planted merely to provide a measure of protection against the weather. The present planting program is also concerned with replanting areas which did not take well in earlier actions and the planting of trees and shrubs on slopes to reduce erosion.

The planting of commercial trees directly - without first having to prepare the way by establishing hardy but worthless quick-growth tree types - has been made possible by applying a loess-improved topsoil to the areas which are to be reforested. Instead of simply grading the spoil banks and planting them to pioneer trees, they apply a special layer of loess and overburden mixture in depths of 3 to 5 meters. This mixture forms a loose, porous soil with good physical properties for tree growth. Because of the presence of limestone in the loess, the pH value of the soil ranges from 6.8 to 7.4. At first, the humus and nitrogen are at rather low levels, but this condition is improved by sowing lupine at the time of, or prior to, tree planting. Later, fallen leaves and organic debris resulting from forest thinning activities provide a rapid buildup of the humus content.

The Rheinische Braunkohlenwerke A.G. mining company is currently looking after some 16,000 acres of forests, extending from Bonn in the south to Grevenbroich in the north. During 1970, some 670 acres of land were reforested - three million trees planted - and 9,500 cubic meters of wood harvested. The mining company has established a Forestry Division, with a staff of about 40 foresters and technicians, to plan and supervise these sizeable operations. During peak periods in the planting season, the mining company supplements its forestry division staff by contracting with local firms.

During the past decade, much of the effort of the Forestry Division has been devoted to establishing the large forests in the southern part of the coal field. The focus is gradually shifting as mining operations continue to move northward - into areas primarily used for agricultural purposes. In the future, activities of the Forestry Division will center increasingly on forest maintenance, thinning, and harvesting. A special problem to be dealt with is the upgrading of nearly 5,000 acres of poplars and alders planted during the second reforestation period. Extensive thinning and planting of more valuable trees are needed. More recently, there is a notable diversity in the kinds of trees planted. The tree types selected for a particular location are chosen in accordance with soil conditions and the expected exposure to sun and wind. To promote efficiency and economy in harvesting, the tree mixture in a given section is limited to one or two types, but the mixture varies strongly from section to section.

In all, the reforestation program employs twenty-two different types of deciduous trees (including basswood, oak, ash, beech, willow, alder, locust, poplar, elm, and maple), eleven types of conifers (including pine,

fir, and hemlock), and eighteen different varieties of shrubs, such as hazelnut, dogwood, mountain ash, and wild roses. This mixture of trees and shrubs serves to provide not only an ecologically sound forest, but also the diversity appealing in a recreational forest. Forests in Germany have traditionally been used for recreation by the general public as well as for timber production. In the past, most public and many private forests were open to all for biking, hiking, picnicking, and other recreational uses. In recent times, the accessibility of forests for relaxation and enjoyment has been extended by the 1969 Federal Forestry Law which requires that all private forests be open to the public. Commonly, all agricultural lands as well are open to people wishing to take walks along field paths and farm roads.

5.3 Winning New Farmland

5.3.1 The Rationale - For the Future

In 1970, the Rheinische Braunkohlenwerke A.G. mining company restored some 470 acres of mining wasteland to agricultural productivity and an additional 670 acres as forest land. In view of the high costs of farmland reclamation, it is interesting to examine the considerations which have led to the adoption of this policy. Before improved reclamation techniques were introduced in 1960, the land restoration costs were far higher than the worth of the reclaimed land. Even today there are few economic incentives for rehabilitating the land. It is difficult for German agriculture to compete with neighboring European Common Market countries, and in many instances direct government subsidy is required to keep it viable. Price-support programs of the federal government have

resulted in the accumulation of huge stockpiles of farm surplus, e.g., the "butter mountain" which has been acquired at public expense. Furthermore, the surface mining industry is not even the principal destroyer of farmland in North Rhine Westphalia. While the brown coal mining industry consumes about 600 acres of farmland annually, some 300 acres of farmland are lost each week to city growth, highway construction, and industrial expansion. These considerations clearly demonstrate that the decision to reclaim mined-out areas as farmland was not at all a "foregone conclusion."

The incentives for restoring mining areas to agricultural productivity in the Rhineland are diverse. First, the brown-coal deposits are located in the richest, most fertile farm country of Germany - which is favorably situated near the large population centers of the Ruhr valley. Thus, a ready, nearby market is on hand for the agricultural produce, affording significant savings in transportation costs. Second, the problem of dispossessing and resettling farmers who are in the path of the mining operations is greatly eased by having restored land available as an acceptable substitute. Many of these farmers would be loathe to part with long established family farms were not satisfactory restored areas, fully commensurable in fertility and productivity with their former holdings, available as compensation. Thus, the farmland restoration policy aids greatly in reducing social and political tensions and contributes to public acceptance of the temporary disruptions caused by the mining industry. Probably the most compelling reason for farmland restoration, however, is the prevailing conviction that to allow valuable soil to be irrevocably destroyed by a strictly temporary land use - mining - would represent extreme folly. Saving the loess has become one of the highest priority

items of land planning in the Rhineland, reflecting a basic land ethic which cannot be evaluated or explained in purely economic terms.

5.3.2 Structuring the New Landscape

The spoil material and soil from active mines is transported to the site selected for restoration and is used to fill in the deep pits left by earlier mining operations. There, a completely new landscape, with a topography specified by prior design, gradually takes shape. Mammoth spreader machines, quite similar to the wheel excavators used in extracting the brown-coal, are used to distribute the spoil material evenly over the area being reclaimed. Each spreader weighs 2,300 tons and requires only two operators. A single machine is capable of handling up to 200,000 cubic yards of material daily. The transportation network of conveyor belts and trains on heavy duty tracks described earlier brings a steady stream of spoil material to the spreaders, enabling continuous operation. Ordinary bulldozers are used to level off and compact the overburden in preparation for applying the top layer of loess.

Before the loess is applied, the surface of the prepared area is deliberately furrowed, or deeply roughened, to prevent the formation of a clear interface between the top layer of loess and the substrata. In the past, the same spreader machines used to distribute the spoil material were also used to apply the loess. Again, final leveling of the surface is performed with bulldozers, which produce some undesirable compacting of the top layer to depths of about one foot. Harrow disks are employed to break up the compacted loess before planting. In recent times, an alternative method of applying the top layer of loess has been developed. After the spoil material has been distributed, the surface is divided into

Mined land near Berrenrath, West Germany is being restored to agricultural productivity. Above, a spreader machine distributes loose spoil material which is hauled in by rail and conveyor belt. In the lower foreground, a tract of land has been subdivided into polders in preparation for applying topsoil by the slurry technique. At the right, the roadbed of a future expressway has been left unfilled by the spreader machines, in accordance with long-range regional development plans.

Giant spreader machines, similar in appearance to the bucket wheel excavators, are used to spread spoil material on the disturbed land. In some cases, the machines are also employed to spread out the final layer of topsoil.

small diked areas, or polders. The dikes consist simply of loosely piled loess and are about two yards in height. Loess and water are mixed in a one-to-one ratio and pumped through pipes into the polders, which are from five to ten acres in size. The application of slurry is carried out in successive steps; the polder is flooded with slurry to a depth of about two feet and allowed to dry before more slurry is applied. This process is repeated until the final six-foot-thick top layer of loess has been obtained. Normally, a month or two is required for the drying process, but in unfavorable weather up to eight months may be required.

The slurry technique of applying loess, adapted from methods developed in Holland to reclaim land from the sea, is faster and more economical than mechanical methods. Furthermore, it has been found to possess other superior attributes as well. For example, the pore volume of land prepared by the slurry method is higher than that of either virgin soil or mechanically prepared land. During the past several years, the method has found increasing application in Germany, and much practical experience has been gained. To a large extent, the ease with which the slurry is prepared depends upon the condition of the loess. If the loess is strongly wetted, it does not readily form a suspension and loess-to-water ratios of 1-to-3 may be required. On the other hand, if the loess was mined and stored during relatively dry weather, ratios as low as 1-to-0.7 suffice. The slurry discharge pipe must be relocated several times during the filling of a polder to prevent the formation of zones with different loess particle sizes. During the first slurry application the loess settles out and partly seals the bottom. In subsequent applications, less water penetrates

PHOTO 1008-72

The rich top-layer of loess is selectively stripped off and saved at the active mine sites. Heavy duty trains transport the loess to nearby land areas undergoing reclamation.

PHOTO 1007-72

A loading machine scoops the loess out of the ditch and loads it onto a conveyor belt leading to the slurry station.

PHOTO 1009-72

The loess enters the slurry station where it is mixed with water and pumped to outlying fields.

PHOTO 1005-72

The slurry gushes out of a pipe into specially prepared diked areas, or polders. After drying out, it leaves behind a 6-foot-thick top layer of loess.

into the subsoil and consequently the drying process can be greatly speeded by simply draining off the water after the loess has settled.

Once the land has received the top layer of loess, it is important to establish a vegetation cover as quickly as possible. Such a cover prevents hardening of the ground from heavy rains and siltation and makes it difficult for undesirable weeds and other plant growth to gain a foothold. Working land which has been formed by the slurry method is initially difficult because of its softness. At first, the land cannot sustain the heavy loads of normal farm machinery, and special light-weight equipment must be used to work the ground and sow the first crop of alfalfa. Once established, the vegetation assists in drying out the polder, and the root system penetrates deeply into the fresh land. If reclamation occurs in late fall or early winter so that crops cannot be planted at once, special measures must be taken to prevent surface hardening due to winter precipitation. Experience has shown that the land should be deeply furrowed after the loess is applied. The ground then tends to freeze in rough clumps during the winter, promoting the drying process and allowing early spring planting.

5.3.3 Initial Cultivation and Interim Management

The newly reclaimed farmland is retained by the company for an interim five-year period. During this time it is subjected to intense management by agricultural experts of the brown-coal mining company. The land improvement methods are based on experience and the results of scientific research which has in part been carried out in cooperation with the Agronomy Institute of the University of Bonn. The field work is conducted by trained personnel, working from centrally located company farms,

to assure that uniform methods of soil preparation and fertilization are used. The company farms also serve for conducting diverse experiments in soil physics and agricultural chemistry. A primary objective of the interim management program is to build up the humus and nutrients in the soil. The nutrient level can be regained rather quickly by the use of fertilizer, or by planting leguminous crops such as alfalfa or lupine. Restoring the humus level which prevailed before mining, however, is a much slower process.

The humus content of the newly restored land averages about 0.5 per cent while that of undisturbed areas in the same vicinity ranges from 1.3 to 1.8 percent. For this reason, alfalfa is prized not only for its ability to fix nitrogen, but also because of its deep root system which contributes to the build-up of humus when the plant is harvested. Research has shown that normal crop rotation increases the humus level by only 0.04 to 0.05 percent annually. Therefore, other methods are employed to speed the process of soil conditioning. The stubble from winter rye, which follows the alfalfa crop, is disked and plowed under. Sewer sludge, composted garbage, and other organic wastes have been used experimentally to increase the humus level. Rape, a plant of the mustard family used for fodder, is sometimes sown after the grains have been harvested and the straw and stubble disked into the soil. The plant is fertilized to achieve rapid growth and the plant foliage is then plowed under as a form of green manure. Since rape possesses a flexible planting date and is relatively inexpensive, the method has proved attractive.

The reclaimed land requires higher than usual applications of fertilizer for at least the first ten years of cultivation. Experiments have

shown that the optimal amounts on the newly restored land are: 135 to 180 pounds of P_2O_5 and K_2O per acre, and 180 pounds of nitrogen per acre. Controlled experiments were carried out by the Agronomy Institute of the University of Bonn to determine the crop yields attainable on restored mining lands during the five year period of interim management. Experimental plots of land which had been restored by the slurry technique were selected near Inden, Germany and control experiments were conducted on nearby, similar land which had not been disturbed by surface mining. The restored land was first conditioned by planting a crop of alfalfa. In succeeding years, identical crops were planted on the restored and the undisturbed land. The results are shown in Table 3.

Table 3. Comparison of Crop Yields on Restored Land and Undisturbed Land Over a Five Year Period.*

Year	Crop	Yield (pounds per acre) Old Land	New Land
1962	Winter Rye	3822	4108
1963	Rape (dry mass)	3349	3456
	Oats	3411	3367
1964	Sugar Beets		
	Roots	44025	54652
	% Sugar	16.7	16.7
	Foliage	34291	43489
1965	Sugar Beets		
	Roots	46168	46168
	% Sugar	15.4	16.5
	Foliage	65010	60278
1965	Winter Wheat	5537	5572
1965	Winter Wheat	4688	5019

*Number of pounds to the bushel: rye (56), wheat (60), and oats (32).

6. SOCIAL AND ECONOMIC IMPROVEMENTS

6.1 Agriculture

The principle of primogeniture - or the exclusive right of the eldest son to inherit his father's land - is not embodied in the inheritance laws of North Rhine Westphalia. As a result, once-large farms have gradually become splintered and subdivided over the centuries, as the property passed from one generation to the next. Today, it is not uncommon for a farmer to own, or to have to lease, numerous small parcels of land which may be widely separated from one another. Such a land-holdings pattern is highly inefficient because it precludes the application of modern, mechanized methods of farming. Consequently, a consolidation of the many small holdings to form larger, economically viable units has long been a prime objective of governmental planning. Obviously, the handling of such a sensitive issue requires much care, if the reform is to be accomplished in an equitable manner. Hence, in settled areas, the land consolidation program must proceed slowly and cautiously to avoid arousing dissatisfaction. On the other hand, in the resettlement of reclaimed brown-coal lands, it was recognized at the onset that a unique opportunity existed for quickly accomplishing the desired land consolidation.

Resettlement consists of two distinctly separate transactions: the indemnification of the farmer for property confiscated and the purchase of new, reclaimed land from the mining company. In the sale of restored land, the mining company favors buyers who were dislocated by the mining operations. The purchaser is granted a $190 per acre rebate by the mining company to compensate for the extra fertilizer and seeding costs initially required in cultivating reclaimed land. An intricate method has been

worked out to estimate fairly the worth of farms confiscated by the mining company. State assessors appraise the property and judge the value of the land not only on the basis of its area, but also according to its fertility as established by past records of crop productivity. The farm buildings and such external improvements as woods, orchards, and wells are appraised by taking into account their current replacement cost and their present depreciation based on age. The value of each item is added to obtain the final settlement sum. If the farmer is dissatisfied with the negotiations, he may appeal through the courts. However, this happens in less than one out of six cases. The settlement payment, supplemented by savings and loans, enables the farmer to purchase new land and buildings. How high the replacement costs may be is revealed by a recent survey, which found that the total investment in buildings on an average farm in North Rhine Westphalia amounts to about $70,000.

The nearly 3,000 acre agricultural community which is currently being developed on reclaimed land near Berrenrath, in the southern sector of the brown coal field, illustrates the new socio-economic structure which is being attained. The new community, now nearly one-third completed, will eventually comprise some 27 separate farms, each with 40 to 80 acres in a single tract of land. The community is being built according to plans specified by the winning entry to a landscape design contest sponsored by the state of North Rhine Westphalia. The plan envisages 70 percent of the land being used for cultivation, 20 percent for forested tracts, and the rest for village growth and industry. The farmers are clustered together in small hamlets of about six to eight families each. Contrary to usual German practice, the farm dwellings are located amidst the

The above house and farmyard facilities are constructed on reclaimed land near Berrenrath, West Germany.

A farmer inspects crops of sugar beets and potatoes on restored land near Quadrath-Ichendorf. The crops are growing on fertile, restored land which is less than five years old.

PHOTO 0995-72

In the foreground above, hay is harvested in West Germany on reclaimed land less than two years old. In the background, the adjacent brown-coal mining operation continues.

PHOTO 1002-72

A residential street in Neu-Mödrath, West Germany, which was built to replace an older village caught up in the path of the brown-coal mining operations.

cultivated fields, reducing unnecessary traveling time. The hamlet pattern reduces the isolation of an individual farm family and makes it possible for several farmers to pool resources in purchasing expensive farm equipment since the machinery can then be used communally. The size of the farms, the spacious modern buildings, and the economies afforded by cooperative endeaver make it likely that the Berrenrath agricultural community will remain economically resilient for many decades to come.

6.2 Villages

Whole villages, caught up in the path of the brown coal mining operations, must be torn down and relocated. Thus, the mining juggernaut uproots people and institutions as well as the landscape itself. The number of people evacuated from their homes and resettled in fully new locations reached a total of 19,552 at the beginning of 1971 and is expected to grow to 30,000 by the end of this century. In all, nearly 5,000 homes, farms, and places of business have been forced to yield to the brown-coal industry and move elsewhere. Moving an entire village requires extensive preparations and takes a relatively long time. For this reason, the decision must be reached and made known well in advance of the planned start of mining. Most of the villages which have been relocated are fairly small in size, with a population of about 350 to 2,000 inhabitants. In some few cases, particular villages have been spared because of their historic interest or because they are located close to the edge of the brown coal field.

The villagers participate directly in selecting a new town site, choosing one from a dozen or so possibilities which have been presented to them. All of the sites being considered have previously been approved

by the regional planning commission. Past experience has shown that the villagers prefer to move en masse, retaining some portion of the community identity. This practice tends to avoid excessive social upheaval and the creation of a condition of rootlessness. The village may simply be reconstructed at another site, or the community may decide to join another already existing town. The latter is desirable because the connecting arteries of transportation already exist, and the consolidated population pattern which results makes it possible for the new, merged community to afford improved public services. The new community invariably provides better schools, parks, sports facilities, and playgrounds than the old one. Because of unsatisfactory conditions in the old village, the resettlement in many cases amounts to nearly a complete urban renewal action.

Mining company representatives negotiate directly with the individual villagers to determine a fair settlement payment for the confiscated property. The money paid by the mining company enables the villager to replace his home at the new town site. Generally the new homes are substantially improved - larger than before, and with central heating and indoor plumbing. The added improvements are paid for privately, not by the mining company. The new village is designed according to modern principles by professional architects and planners commissioned by the town council. By-pass roads separate the residential section from areas of heavy traffic, and more space is alloted for playgrounds, ball parks and kindergartens. The businesses are centrally located; the village is provided with a sewer system, more public green areas, and is generally more compact and efficient than the former one. Given this type of choice, the villagers apparently prefer to trade the picturesqueness of

their old towns for a new environment with more modern conveniences.

A sociological survey of some resettled communities reveals that the end result has been generally satisfactory. According to the survey, 85 percent of the resettled people are happier in their new homes, and 57 percent likewise prefer the new location of the town. Some 83 percent of those interviewed believe that the advantages outweigh the disadvantages in resettlement. This does not imply, however, that the resettlement proceeds without a certain quota of worry and concern. The typical evacuee experiences feelings of anxiety about his future job, income, the new school and community accommodations, his social position in the new community, and the unavoidable problems involved in constructing a new house. On the plus side, however, he gains the following:

1. He receives a desirable building lot located on an improved residential street away from areas of heavy traffic.

2. His modern, new home is equipped with central heating and indoor plumbing and is considerably more spacious, - nearly one-third larger than his former dwelling.

3. His new house is worth more, will last longer, and has lower maintenance costs than his old one.

4. In building a new home, he receives substantial federal tax advantages which are provided in Germany to encourage the construction of residential housing.

6.3 Recreation

The recultivation of mined lands furnishes a unique opportunity to sculpture the new landscape to meet the recreational needs of the people as well as to serve the interests of commerce, industry, and agriculture.

The growing population and changing life styles in Germany have combined to create an unprecedented demand for outdoor recreational facilities at the same time that ever greater amounts of land are being consumed for highways, cities, industry, and military uses. For this reason, land reclamation in the Rhineland brown-coal fields is planned in such a way as to provide for multiple land usage. The forests are planted not only to meet the commercial need for lumber production, but also to provide restful settings for weekend relaxation. The agricultural landscape as well is prized for its potential recreational value. Trees and hedges are planted by the mining company on reclaimed farmland to divide the fields and protect the land against moisture loss from action of the sun and wind. These windbreaks and groves of trees amidst the cultivated fields provide a scenic variety which attracts countless city dwellers on Sunday afternoons. The well maintained farm roads, with side paths and benches, enable the elderly as well as the young to undertake leisurely strolls and enjoy a closer contact with nature than would otherwise be possible in their urban life.

The oldest and most impressive restored region lies in the southern section of the coalfield near Brühl, where a forest-and-lake landscape of distinctive charm has been created. The numerous ponds and lakes, formed from deep pits left over from the lignite mining, have been artfully fitted into the landscape and are scarcely distinguishable from natural bodies of water. The lakes have sloping shores and shallow edges which are planted to reeds and grasses to provide wildlife habitats. The restored region comprises some 3,000 acres and serves both as a recreation park and a wildlife preserve. Because of the many opportunities for

A forest and lake landscape has been created on surface-mined land near Brühl, West Germany. Today, the land serves as a wildlife preserve and recreation park. The land was restored some fifty years ago.

The thirty-nine artificial lakes and ponds formed on former mining lands provide opportunities for water sports to thousands of week-end visitors from the greater Cologne area.

water sports and hiking, the park attracts some 20,000 visitors each weekend from the greater Cologne area. It is maintained jointly by the Forestry Division of the mining company and the State Forestry Service in cooperation with civic organizations of neighboring communities. The achievements here, and elsewhere in the Rhineland brown-coal area, demonstrate that, with proper planning and effort, the needs of industry for raw materials and power can be met without producing excessive environmental damage.

7. GOVERNMENT REGULATION AND SUPERVISION

7.1 Historical Development

The present form of the brown-coal industry and the adoption of enlightened land restoration practices in Germany evolved gradually over the past several decades. Although reforestation of land areas disturbed by lignite surface-mining has been carried out in Germany since the early 1920's, the practice of restoring land for agricultural use was not instituted until much later. The location of the Rhineland lignite deposits, in the midst of rich, fertile farmland, provided a strong incentive for this type of land reclamation. Public concern over the large tracts of unreclaimed land left over from World War II began to appear after the war, particularly in the vicinity of Cologne, where the proximity of the mining operations made the disturbed lands highly visible to great numbers of people. As a result, new surface-mining control legislation was enacted in the year 1950 to assure orderly, well-planned mining practices.

On March 11, 1950, the state legislature of North Rhine Westphalia

passed Germany's first Regional Planning Law. This law, modified in May 1962, established a Land Planning Commission charged with the responsibility of developing overall guidelines for land use within the state. The main purpose of the commission is to help coordinate the diverse social, economic, and industrial activities of the region. The commission designates specific land areas for use by agriculture, forestry, and industry and sets the boundaries of populated settlements. It develops long-range plans for transportation arteries and networks, the preservation of historic sites, and the construction of recreational facilities to serve the entire region. On April 4, 1950, the state legislature enacted two additional laws applying specifically to the brown-coal producing areas of the region. These are The Law for Overall Planning in the Rhineland Brown Coal Area (Gesetz über die Gesamtplanung im Rheinischen Braunkohlengebiet - GS NW. S. 450) and another law establishing a Community Fund to finance land restoration. The first of these laws created the Brown Coal Committee which develops detailed plans for exploiting the lignite resources of the state within the framework and spirit of the overall regional planning law.

7.2 The Brown Coal Committee

The basic responsibility of the Brown Coal Committee is to safeguard land areas temporarily used for brown-coal mining from long-term damage and from being rendered unsuitable for more lasting uses. This responsibility encompasses more than merely preventing the creation of desolate areas by requiring that the land be restored for forestry or agriculture. Rather, in light of the general objectives of the overall regional planning, the Brown Coal Committee assures that the land is restored in such a way as to harmonize with the social, cultural, and industrial interests of the rest of the

region. The Brown Coal Committee is composed of 27 members (Fig. 2) especially selected to represent the societal interests most affected by the impact of the mining operations. Members of the committee are the district governors in Cologne, Aachen, and Düsseldorf; the head of the state mining agency; the Rhineland land planning commissioner; the minister of agriculture; a representative of the Rhineland Agriculture Association; the director of the State Land Settlement Office; three representatives from the brown-coal mining industry; three representatives of mining unions; five representatives from county governments, three representatives of the farmers; one representative of Crafts and Trades; one representative from the power industry; one representative of the stoneware industry; one representative from the industrial union for chemistry-paper-ceramics; and one representative from the Erft Basin Conservation Club.

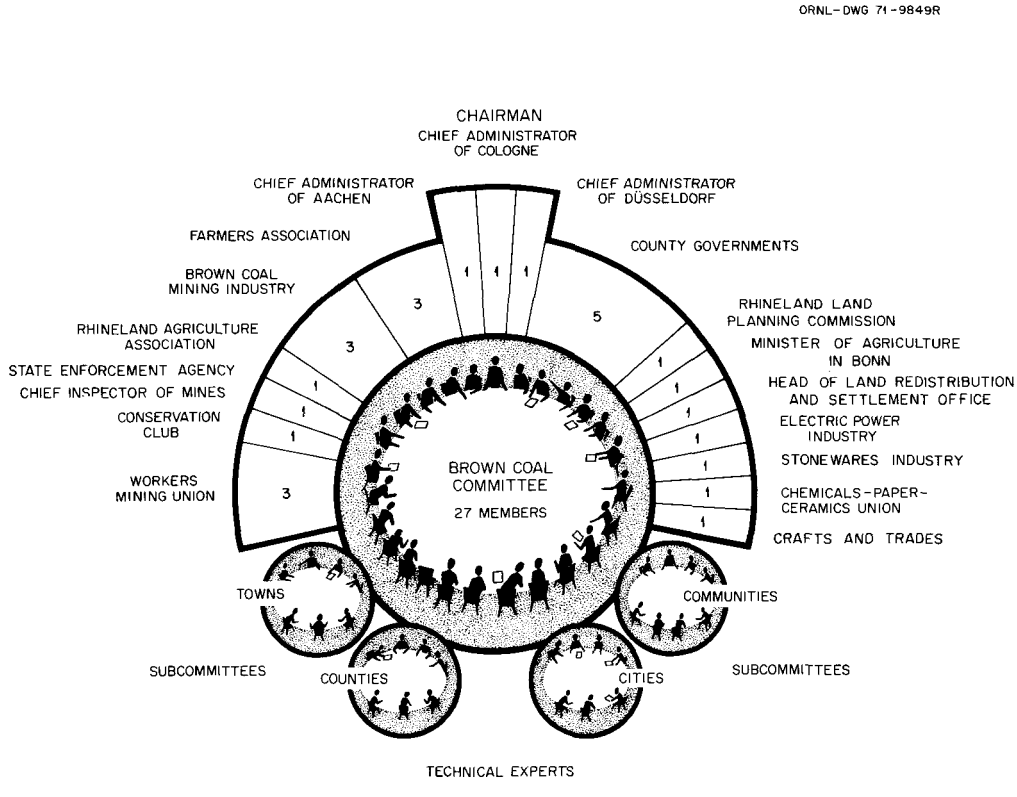


Fig. 2. The Brown Coal Committee of North Rhine Westphalia.

This broad base of representation on the committee affords an opportunity to resolve conflicts long before actual mining activities begin. The committee formulates land restoration requirements based on the future use of the land. These requirements are determined as early as possible to enable the mining company to design its mining operations accordingly. The primary function of the committee is to act as a review body to consider proposals for extending mining operations to new land areas and to make appropriate recommendations to the minister-president of North Rhine Westphalia. As can be expected in view of the composition of the Brown Coal Committee, the final recommendation to the state government is based on considerations of overall land use, conflicting local issues, and national coal requirements. The Brown Coal Committee has gradually emerged as a powerful force, defining the conditions under which the brown coal industry must operate. Its existence subjects the brown coal industry to public scrutiny and has been instrumental in bringing about the conservation practices of the industry. The Brown Coal Committee serves as a quasi-public forum where the divergent interests of society can be considered before mining commences. Public hearings and the signature of the state chief executive are required before the recommendations of the committee become legally binding.

The adoption of requirements that a certain portion of the land disturbed by the surface mining of brown coal be restored to agricultural productivity illustrates the importance of such a planning and review body. Shortly after World War II, a coalition of agricultural groups within the Brown Coal Committee became concerned over the destruction of fertile farmland by the mining operations. In the late 1950's, this coalition of agri-

cultural interests, known as the "green front," successfully campaigned within the committee to require that the valuable top layer of loess, often 15 to 20 feet thick, be saved, and that a portion of the land disturbed by surface mining be restored to agricultural productivity.

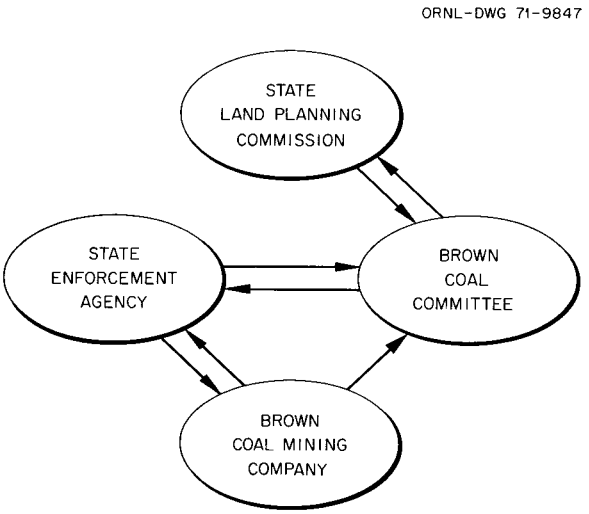


Fig. 3. Control of Coal Surface Mining in Germany

The key to the German land restoration program lies in detailed advance planning based on the needs of the region as a whole. When it becomes necessary to extend mining operations to new, unopened land areas, the brown-coal mining company submits a proposal containing comprehensive mining and land reclamation plans to the Brown Coal Committee. The Committee examines the proposal with respect to regional planning goals and hears testimony from technical experts, representatives from the enforcement agency, and other government agencies which are affected. The plan may be accepted, modified, or rejected after committee discussion and review. If the plan is approved, public hearings are held to discuss its provisions, and the plan is finally sent to the titular head of the state land planning commission for official adoption.

7.3 Implementing the Mining and Reclamation Plan

After the mining and land rehabilitation plan is adopted, the State Mining Office is responsible for supervising its implementation and assuring that the mining and land restoration activities are carried out in accordance with its stipulated provisions. The mining company is required by law to cooperate by providing all information which the state enforcement agency

needs to carry out its regulatory function. For example, the brown-coal mining company routinely submits aerial survey photographs every six months to document its mining and land restoration progress. The planning and enforcement process, with participation of non-mining interests, affords flexibility in resolving the social and environmental problems posed by surface mining. The recommendations of the Brown Coal Committee serve as a living law which changes in accordance with the requirements of specific situations. Since the deliberations take place well in advance of actual mining, amply sufficient lead time is available for full consideration of all of the issues and problems. By virtue of its representation on the Brown Coal Committee, the state enforcement agency is fully cognizant of the spirit and intention behind provisions of the operations plan and is able to draft supplementary regulations accordingly.

7.4 State Mining Office

The State Mining Office (Bergamt) of North Rhine Westphalia is the agency which oversees mining operations and enforces the provisions of the land restoration plan. Since most of the German lignite deposits are located within this single state, nearly all government control of brown-coal surface mining is on the state, rather than the federal, level. The task of setting adequate reclamation standards is facilitated by the lack of significant economic competition from neighboring states. The legal authority to regulate the extraction of minerals in West Germany derives from a general mining law based on an older Prussian model written June 24, 1865. The law reserves nearly all mineral rights to the state which may grant mining concessions to private companies. The concession confers on these companies the right to commercially exploit the mineral resources by

state-approved methods. Traditionally, the concession has generally been granted to the discoverer of new mineral deposits in order to encourage prospecting.

Under the basic Prussian law of 1865, the following minerals are specifically reserved to the state:

- gold, silver, mercury, iron, lead, copper, tin, zinc, cobalt,
- nickel, arsenic, manganese, antimony, sulfur, alum, vitriolic ore,
- bituminous coal, brown coal, graphite, rock salt, potash salt,
- magnesia salt, and borax.

As extensive as this list is, a number of commercially important minerals are omitted. Among these minerals are: sand, gravel, limestone, quartzite, and pumice stone. Pumice stone is used to manufacture light-weight building blocks, and limestone is mined as a raw material for the cement industry. In some regions of Germany, the mining of these materials has produced large, visible scars on the landscape. The practice is being watched with growing concern by German conservationists, some of whom are beginning to advocate that the mining of all minerals should be subject to government control.

The State Mining Office of North Rhine Westphalia has thirteen regional offices to oversee the mining activities in the state, including the mining and reclamation operations of the brown-coal industry, with its annual production of nearly 100 million tons. Each regional office is staffed with about ten mine inspectors, usually trained mining engineers, who spend most of their time in the field observing the progress of operations and checking for compliance with regulations. Typically, a staff member spends only about two days per week at his home office keeping necessary

records and filing reports. Including administrative and support staff, the State Mining Office of the North Rhine Westphalia employs a total of some 200 people at an average salary of about 2,000 DM per month. (The current exchange rate amounts to 3.45 DM per dollar.) Thus, the total outlay of the agency is around 5,000,000 DM per year. According to information from the Cologne regional office, about the same amount of money is expended each year by the brown-coal mining industry to reclaim land for agricultural uses.

Additional study is needed to prorate precisely the budget of the State Mining Office of North Rhine Westphalia among the various extractive industries it regulates. Nevertheless, it is already clear that the cost of administering and enforcing a strip-mine reclamation bill can constitute a substantial part of the overall restoration costs. In spite of the expense, however, a well-supported enforcement agency is vital to the success of any reclamation program. The agency not only enforces the explicit provisions of the law, but also, by writing supplementary regulations as part of its interpretive role, largely sets the tone of the program. In Germany, the brown-coal mining industry was at first reluctant to undertake the highly expensive reclamation of farmland. The regulatory agency, backed up by a strong law, played a highly important role in bringing about an acceptance of the practice - today an even slightly profitable venture.

8. FORMULATION OF A U.S. POLICY ON SURFACE MINING

Some elements of the German surface mining and land reclamation techniques are applicable to U.S. strip-mining in spite of important

differences in the climate, terrain, and geological features of the coal-bearing regions of the two countries. Bucket wheel excavators of the type used in the Rhineland have already been used in North Dakota and Illinois to remove soft, unconsolidated overburden, and in northern Canada to mine tar sand.[13] These machines can operate continuously and deliver the loose overburden by conveyor belt to a separate, interfacing transportation system. Because of its digging selectivity, the bucket wheel excavator is especially suitable for separating the fertile top-soil from the remaining overburden material and saving it for later use in land reclamation. It is not well-suited for hard rock digging or for the handling of drilled or blasted materials. Similarly, the extremely heavy weight and limited mobility of the bucket wheel excavator make it wholly unsuitable for Appalachian contour mining. Nevertheless, the coalfields of the United States - especially those in the interior, northern great plains, and western provinces - contain vast expanses of gently rolling or flat land where the German technology could be applied if there were sufficient incentives for full land restoration.

Whether or not legislation exists, requiring that quality land restoration be integrated into the mining cycle can change the economics of mining and thereby influence the selection of a specific excavation technology. If the digging machines do not have to be coupled to a separate transporation system - to haul away and save the topsoil and to transport massive amounts of spoil material to refill areas - the operational costs of excavating would tend to dictate choosing the giant shovels and draglines currently being used in southern Ohio and Illinois. If full restoration of the land after mining is planned, it may well be that some adaptation

of the excavation and transportation system used in the Rhineland is more economical and efficient. In other words, different conclusions are reached depending upon what portion of the overall mining cycle is included in the optimization process. Since investments for mining equipment can be quite large and the amount of disturbed land is increasing rapidly, a national decision on land reclamation requirements is desirable as soon as possible.

In the main, the methods of land reclamation which are adaptable from those employed in the Rhineland lignite fields apply to the rolling plateau country and the flat lands described earlier. In such topography, the slurry method of spreading loam on graded, filled-in areas is technically feasible. Of course, as in the case of choosing an excavation technology, economic considerations may favor some alternative method of accomplishing the same purpose. The large amount of directed research carried out at the University of Bonn to determine suitable plants and trees for revegetation of the mined lands, and the factors affecting their growth rates, should be valuable and useful in the United States. As we have seen, much of the environmental degradation from surface mining can be prevented by making a conscientious effort in land reclamation. Nevertheless, it is still too early to exclude the possibility of long-range, adverse effects from surface mining. For example, the altered ground strata and mineral content of mined lands could unfavorably affect groundwater movements or percolation characteristics. These could conceivably lead to undesirable long-range results such as increased soil salinity in the mined land areas or elsewhere. Although there is no reason to suspect that such events are actually occurring in the Rhineland, the possibility of subtle, but ultimately

harmful changes cannot be dismissed. For this reason, it is important to gain a better understanding of possible geological effects and to continue to develop improved mining techniques. Preferably, the new mining methods should avoid removing massive amounts of overburden.

In the United States, society has largely failed to provide adequate safeguards against environmental degradation from surface mining. On the whole, state strip-mining and reclamation standards have proved to be inadequate and their enforcement ineffective. Nationally uniform public policies are needed calling for full and prompt restoration of all land areas affected by surface mining activities to slow down the often scandalous devastation of our land resources by current practices. Under such a public policy mining companies could prepare, and submit to authorities, proposed mining plans and analyses of the expected environmental impacts of their proposed actions and, at the very least, could be required to take the necessary steps to stabilize the disturbed land areas created. These mandatory, minimal steps could include prompt revegetation of mined lands, provision of protected water run-off systems and settling ponds, and burial of sulfur-bearing minerals to reduce acid water drainage. The Tennessee Valley Authority has recently taken some initial, unilateral steps in this direction in their coal purchasing contracts. It should be realized, however, that these measures alone will not suffice to ensure wise utilization of natural resources. Planting crown vetch or locust trees on spoil banks may reduce erosion, but it would be a mockery to claim that the land has thereby been restored. A requirement for full land restoration implies that the land be returned to its original condition or, if not, to a condition in conformance with a publicly approved land-use plan.

The restoration achievements in the Rhineland clearly demonstrate that a meticulously planned, well-funded program can produce impressive results in land reclamation. The United States urgently needs a planning institution like the Brown Coal Committee to formulate and enforce land reclamation standards which vary according to the terrain, climate, and land-use pattern of the region being considered. The land restoration requirements should be based on the intended use of the land after mining is completed - specifying restoration results to be achieved rather than simply procedures to be followed. The planning and regulatory agency should be empowered to ban strip-mining in terrain where adequate land reclamation is impossible, and to impose temporary moratoria in other areas where strip-mining would adversely affect the public interest. The same agency, or another, would also require ample powers to enforce compliance with the approved standards.

In summary, there is much that can be learned from the German experience in restoring surface-mined lands. Their program has been in effect for some twenty years and has helped to minimize social dislocations and environmental damage from brown-coal surface mining. Additional study is needed to identify key social and legal differences between the two countries and to ascertain the form of surface mining control best suited to conditions in the United States. The land restoration program in North Rhine Westphalia embodies four main principles which have made it viable and effective. First, the regulation of surface mining is incorporated within an overall regional development plan. This makes it possible to protect the larger interests of the whole region. Second, a planning body composed of representatives from diverse interest groups participates in formulating detailed requirements for mining and land restoration long before the actual

mining begins. Thus, a broad spectrum of society is consulted and untimely haste is avoided. Third, the recommendations of the planning body are submitted for public review before being adopted and implemented. This provides a political pressure relief valve as well as a mechanism for detecting possible adverse side-effects which had escaped consideration. Fourth, an enforcement agency is empowered to enforce the plan which is finally approved and adopted. The German program offers visible evidence that, with detailed advance planning, striking achievements in reducing environmental damage from surface mining are possible at a price that can be borne by the consumer.

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APPENDIX I

A CONTRAST IN ATTITUDES

> "..... and if the public wants us to plant roses along the spoil banks, and is willing to pay the price, we will plant roses. All we want are costs plus profit, it is as simple as that."
>
> Spokesman for the strip-mining industry in Appalachia (1971)

Although privately owned and operated, the Rheinische Braunkohlenwerke A. G. mining company has extensive land holdings in Germany and functions in close cooperation with state and federal agencies. Partly because of its large size and many resources, the company is able to operate in a socially responsible manner and at the same time meet its obligations to its stockholders. The following remarks by Dr. E. Gärtner, the company's chairman of the board, illustrate some important differences in attitude between leaders of the mining industry in Germany and some mining industry spokesmen in the United States. Dr. Gärtner forthrightly acknowledges the responsibility of the surface mining industry, and of all industry, to operate in a way that will preserve and protect the environment. That this represents more than mere lip service to currently popular views, is attested to by the solid conservation achievements of the brown-coal mining industry in the Rhineland. Furthermore, we should keep in mind that the impressive land restoration record of the brown-coal industry in Germany, unlike that of the nationalized industry in Great Britain and the state-owned systems of the communist countries, was achieved wholly without government subsidy.

Address by Dr. Erwin Gärtner Chairman of the Board, Rheinische Braunkohlenwerke A.G.*

New developments in research and technology are continuing to contribute to man's welfare. However, modern technology and the rapidly increasing population also produce a variety of environmental problems. Pollution of land, air, and water has already reached such proportions that in many places the very existence of man is threatened. Protecting the environment and planning for wise land usage, therefore, are among the most urgent problems of today. Appeals alone will not help; the problems must be attacked with vigor and determination. Here we are faced with a societal problem which demands international action and cooperation to assure that land use policies are worked out which will satisfy the growing demands of industry as well as the life support requirements of nature. To meet this goal will require sacrifices from all, not only for our own sakes but also for the coming generations.

The European Declaration for the Protection of Nature, which was announced in February of this year (1970), reminds us that nature is the primary source of man's physical, intellectual, and spiritual well-being. The European Conference on the Environment reminds and admonishes us to use our resources wisely and sparingly. The Conference also appealed to the mining industry to restore fully all lands upon completion of the mining operations. This request is fully justified, but it should be mentioned that the amount of land affected by mining is actually quite small in comparison with that affected by other branches of industry.

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*Translated by E. A. Nephew, ORNL/NSF Environmental Program.

The existence of man today and in the future is unthinkable without the availability of large quantities of raw materials and energy. Shortages in various raw materials are already visible on the world market. The world's supply of minerals is limited. Hence, it is vitally necessary to utilize these resources sparingly and efficiently.

The most advantageous methods of extracting mineral commodities from the earth are surface mining and drilling. Both methods are gaining in importance because of the better working conditions and greater economy which they offer. In addition, they assure the most complete recovery of the mineral deposits.

Surface mining affects the environment in special ways. The extent of its effect can be visualized when one stops to consider that man currently transports a greater mass of solid material than all of the rivers of the world combined. The total quantity of solids transported by rivers, of which some 90% is deposited on continental shelves, amounts to 12 billion cubic meters per year. It is estimated that by the year 2000, man will move some 30 billion tons of sand, gravel and stone annually. Energy requirements for the same year will amount to the equivalent of 23 billion tons of coal. The huge amount of spoil material which will result from such massive mining is not even estimated. These numbers clearly show the great impact which the mineral extraction industry will have on the environment. Man urgently needs raw materials. The achievements of technology have provided him with a means of restoring the land to useful agricultural purposes after mining operations are completed. Furthermore, this can be done economically.

Some 95 million tons of brown coal are produced annually in the Rhineland area, resulting in about 190 million cubic meters of spoil material. Our mining operations are in direct proximity to large population centers and are located on some of the most fertile land areas of Germany. The reclamation of these lands poses varied and complex problems to the mining industry. The efforts of the brown coal industry in the areas of land reclamation, population resettlement, and the creation of a new infrastructure go far beyond the relatively modest legal requirements and are largely financed by the mining industry itself. We perceive it as our responsibility to employ the most up-to-date methods and knowledge in our land reclamation programs. This means comprehensive planning and the improvement of land use patterns wherever possible. In resettling villages we not only concern ourselves with purely technical and administrative procedures, but also strive to effect solutions in the social area which will meet with the approval of future generations.

Notwithstanding this great concern for the common good, the directors of our company must also keep clearly in mind that the Rheinische Braunkohlenwerke A.G. is a private firm that must make a profit and is faced with heavy competition. Clearly, a conflict can occasionally arise between our private economic self interest and our concern for the welfare of society as a whole. By determined effort, however, we have found ways to resolve these problems. By introducing the most modern mining techniques and automation, we have been able to reach the current maximum in productivity.

One important problem which we face is assuring an adequate water supply to agriculture, industry and the people of our region, a region

having an area of about 3000 km^2. This goal is being accomplished by constructing new water works and by making constant measurements of the hydrological conditions of the region. In West Germany, the demand for water will double by the year 2000. The concern for assuring an adequate water supply to meet the needs of the population and of industry is great in all industrialized regions. We, too, are forced to redouble our efforts in this field. The Rheinische Braunkohlenwerke A.G. has proposed a project which would help meet the water needs of a vast region. When brown coal is mined by surface mining, large basins result from removing the billions of tons of coal. Our project involves the use of two such deep holes which will be formed during mining at Garsdorf and Hambach. Complete extraction of the coal deposits in the vicinity of Hambach will result in an enormous hole with a volume of 2.5 billion cubic meters. This volume is greater than the total capacity of all dam reservoirs in Germany. Filling up such a gigantic basin with groundwater would require a prohibitively long period of time. For this reason, we are proposing to construct subterranean tunnels to conduct water from the Rhine River to the site. Water could then be stored as needed and used to supply growing demands for water in Germany and foreign countries as well. In carrying out this project, the Rheinische Braunkohlenwerke A.G. will make a substantial contribution towards improving the infrastructure of the whole Rhineland region.

The brown coal mining industry has long striven to meet the twin goals of protecting nature and improving the quality of the environment. Since the mining of brown coal first began on a commercial basis, some 4 billion tons have been mined in West Germany. The total area of land

disturbed by brown coal mining amounts to 53,000 acres, of which 33,000 acres have been reclaimed. Since 1950, we have included the costs of land reclamation, village resettlement, water supply, and emissions control in our operating cost projections. This fully meets all of the basic requirements of the European Clean Air Charter.

Modern surface mining unavoidably alters the entire landscape. Strata of rock, clay, and gravel which lie above the mineral deposit must be completely removed, leading to total destruction of all vegetation and useful surface lands. The overburden which is removed may be deposited in spoil piles or used to refill the excavated areas after mining is completed. If the latter is done, the land can be restored for useful purposes and reintegrated into the overall landscape. To be sure, the geological structure and topography of former mining areas are vastly altered, but not necessarily in a disadvantageous manner. A carefully planned and supervised restoration program can produce new land having a more favorable overall structure than before.

Here in the Rhineland it was clear to us from the beginning that reclamation of disturbed areas could not be limited to merely restoring the land to agricultural or forest uses. Neither should we attempt to return the land to its original form. Rather the goal of the planning should be recultivation based on sound ecological principles. The recultivated land should also serve as recreational areas.

Because of the rich topsoil in the Erft River basin, the main objective of reclamation in this area has been to restore the land to agricultural productivity. During mining, the valuable loess topsoil is saved and later spread out to form the top layer of restored lands.

A special hydraulic process has been developed for this purpose. The loess, in form of a slurry, is pumped through pipes to fields which have been specially subdivided by small temporary dikes. The Ministry for Food, Agriculture and Forests of the State of North Rhine Westphalia supported the development of this new process in its early stages.

The newly restored agricultural land must be protected against wind erosion. Suitably selected trees and bushes are planted in strips to form wind breaks. The reward for careful and thorough restoration practices in the Rhineland brown coal area has been good harvests and high land productivity. After only a few years, the crop yields are as high as in undisturbed land regions.

The conditions for successful land reclamation in the Rhineland are very favorable. Here we have available pure loess for agricultural reclamation and a mixture of loess, gravel, and sand for forest land reclamation. In other areas of the world where sulfur-containing marcasite is exposed as a result of mining operations, extensive preconditioning of the soil is needed to establish the proper living conditions for higher plant forms.

The reclamation of land for forestry purposes originally began in the Rhineland during the 1920's. At first, experts were very skeptical that the efforts of the brown coal mining industry would meet with success. Many believed that vegetation could never be reestablished on such churned-up lands and that the areas were destined to remain desolate wastelands. These fears have proved unfounded. Today we know that tree growth is fully possible even on poor soils, and that the forests are not limited to worthless quick growth timber but can include many different

types of commercially valuable timber. Beginning in 1955, we have enriched the soil of disturbed lands being reclaimed for forestry by adding a top layer of loess, sand, and gravel. Some 36 different types of trees have been successfully planted.

In the immediate postwar years, large numbers of poplars were planted on unreclaimed lands from brown coal surface mining to provide a quick cover of vegetation. Today, however, they serve mainly as a temporary form of protection for the more valuable trees which have been planted in the meantime. The wildlife of these new forest lands is even more varied in nature than originally. This greater variety represents a distinct success of our forestry program. Also, a number of varieties of water fowl have settled in the lakes, including gulls and northern ducks. The lakes are well stocked with fish by the Forestry Division of the Rheinische Braunkohlenwerke A.G. Mining Company in co-operation with the State Forestry Service and private sport-fishermen's associations.

The former surface mined areas are more and more becoming a fully integrated and recultivated region in the midst of a densely populated industrial area. The recreation areas of lakes and forests which have been created serve a large surrounding region and are visited by ever increasing numbers of people seeking rest and relaxation.

The artificial lakes created in the landscape are of special importance. Systematic planning of shorelines, bays, and coves and sensible revegetation together with directed efforts to support local flora and fauna have combined to make the artificial lakes indistinguishable from natural ones. Swimming areas, sailboat facilities, and campgrounds were

built and are a strong attraction to the public. The recreational areas are barred to vehicular traffic. Parking areas are provided on their periphery. From there, hiking trails lead to the various points of interest.

Further development of the recreational facilities and upkeep of the grounds are being looked after by a special organization, "Zweckverband Erholungspark Ville e.V." In cooperation with the Forestry Division of the brown-coal mining company and the State Forestry Service, the association is developing plans for extending the forested area for recreational purposes.

Present efforts in the Rhineland coal region are increasingly directed towards incorporating land which has been restored for agricultural uses into the recreational program. These regions, with their hedges and windbreaks, patches of trees, and cultivated fields, are ideally suited for walks or hiking. Hence, they can fulfill the dual needs of agriculture and recreation at the same time. A landscape of cultivated fields, forests, and lakes provides a pleasant setting for recreation - lands destroyed by surface mining are reshaped to meet modern needs.

Much more difficult than land reclamation are the problems of air and water pollution, noise, and solid wastes disposal. Here, the world is close to the limits of tolerance, or in some cases has already exceeded them. The dangerous trend towards ever greater air and water pollution levels must be stopped. We must find solutions which will prevent further poisoning of our biosphere, and such solutions are fully possible. The way to accomplish this is the same as for any other form of technological progress. It begins with basic research, still in its infancy with respect

to environmental problems, and it requires an adequate level of funding. Because of the ever greater impacts on our environment, it is absolutely necessary to continually redefine environmental research needs and to seek permanent solutions on an international basis.

All industrial nations face the same environmental problems. We have been following with great interest the approaches and environmental protection measures being formulated in other countries. We are pleased to see that a trend towards international cooperation is developing which will contribute greatly to protecting the quality of the environment. Hopefully, this trend will lead to the following results:

1. The various nations will step up basic research on environmental problems.
2. An exchange of information and experience will be set up between the various countries.
3. Effective environmental protection laws will be adopted which are binding on all nations so that conservation measures will not affect the relative competitiveness.

The European Advisory Council proclaimed the year 1970 as "Nature Protection Year." This was not done out of concern for a few beauties of nature, but because whole segments of nature vital to mankind's well-being face destruction and death. In this sense, protection of the environment is really the same as the preservation of mankind. I believe that I have shown that many undesirable environmental impacts can be alleviated and many more prevented. The "Nature Protection Year" will have served an important function if it helps people become aware that nature, once an eternal, life-sustaining provider of our needs, is in

danger of becoming irrevocably poisoned by man himself. The preservation of nature is within the scope of mankind's vital self interest.

APPENDIX II

GERMAN SURFACE MINING LAWS*

STATE LAND PLANNING LAW

From March 11, 1950

Paragraph 1

Functions of Land Planning

On March 1, 1950, the state legislature of North Rhine Westphalia decreed the following law:

The function of land planning is to develop a general and collective plan for orderly area development in the state of North Rhine Westphalia which answers to the social, cultural, and economic needs of the area and to see to its adherence in concert with the competent special ministries and all other authorities concerned.

Paragraph 2

Structure (Organization)

(1) Highest authority for land planning is the state governor.

(2) Subordinate authorities for land planning are the higher administrative authorities according to the regulations of the law.

(3) Executors of the work are the land planning commissions. They are corporations of the public law and are subject to the supervision of the governor in his capacity as land planning commissioner. They collect information about the present condition in the planning area and develop

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*Translated by M. T. Nephew, consultant to the ORNL/NSF Environmental Program.

together with all pertinent authorities a far-reaching constructive total plan for the area. They advise the land planning authorities. The composition and legal relations of land planning commissions are governed by by-laws. The by-laws need the approval of the state governor.

Paragraph 3

Drafting of the Plan Making it Legally Binding

(1) To carry out the functions according to Paragraph 1 of this law, the land planning commissions must draft area development plans in agreement with the proper authorities and with the participation of the autonomous corporations concerned.

Area development plans are plans which basically regulate the orderly use of the land, with special consideration for the needs of agriculture and forestry, water-use, industry, traffic, building, as well as for the protection of culture and recreation.

(2) Upon recommendation by the land planning commission, the land planning authority can declare as legally binding the proposed area development plan, either as a whole or in parts of the counties and townships.

(3) The land planning authorities may, in agreement with the respective land planning commission, the special ministries, and other concerned offices, demand consideration of larger areas with more than local significance in accordance with legal regulations.

Paragraph 4

Duty to Report and Right to Oppose

(1) All authorities, corporations, and businesses are required to supply information to the authorities and commissioners about plans in

their particular area if such plans are or may become important to the land planning.

(2) The commissions can oppose measures of towns and counties which are not in agreement with area development plans or other goals of land planning. The opposition will delay the measure. The decision lies with the state governor (in consultation with the interested ministries) in his capacity as land planning authority.

Paragraph 5

Execution

The state government in agreement with the land planning commission of the state legislature will set up the necessary legal measures to insure the execution of this law.

Paragraph 6

Effective Date

This law will become effective upon proclamation.

LAW CONCERNING OVERALL LAND PLANNING IN THE RHINE BROWN COAL AREA

April 25th, 1950 (GS.NW. P. 450)

On 13 April 1950 the State Legislature North Rhine Westphalia enacted the following law:

Paragraph 1

Plan

(1) Within the framework of State planning legislation for the State of North Rhine Westphalia and as a part of the State planning, a complete land-use plan should be established to ensure an orderly development of the Rhine brown coal area in this region.

(2) The complete plan includes:

a. the designation of areas wherein mining operations and industrial factories may be developed and of areas which shall be reserved for agricultural and forestry use as well as the designation of settlement areas,

b. the designation of towns, parts of towns, and single dwelling units which are to be removed in the interest of the mining operations and the places where the inhabitants shall be resettled,

c. the designation of areas wherein traffic highways, trains of all sorts, energy and water transmission lines may be established or relocated, as well as of such areas where they are to be removed,

d. the design of waterways,

e. the agricultural and forestry and general landscape design with consideration for preserving historic sites, and the conservation of natural features and scenic points of interest.

Paragraph 2*

Limits of the Planning Area

(1) The planning area includes:

In the governmental district of Cologne

a. the county of Bergheim,

b. in the county of Cologne:

the townships Stommeln, Geyen, Sinnersdorf, Pulheim, Brauweiler, Lövenich, Frechen, Hürth and Brühl,

c. in the county of Bonn:

the part of the township Sechtem which lies west of the road Schwadorf-Kardorf,

d. in the county Euskirchen:

the towns Kierdorf, Liblar, Bleisheim, Weilerswist, Metternich, Müggenhausen, Vernich, Niederberg, Borr, Friesheim, Erp, Dorweiler, Pingsheim, Lechenich, Dirmerzheim and Gymnich, the city of Zülpich, Bessenich, Langendorf and Merzenich;

e. in the city of Cologne:

the area north of Militärringstrape between Niehl and Bickendorf;

In the governmental district of Aachen:

a. in the county of Düren:

the townships Weisweiler, Frenz, Lammersdorf, Pier, Lucherberg, Luchem, Geich-Obergeich, Echtz; from the township Derichsweiler and Gürzenich that part which is to the north of the road Düren-Aachen, and

also the townships Mariaweiler-Hoven, Birkesdorf, Merken, Selhausen,

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*Ordinance about changes in the planning area for the drafting of a complete plan in the Rhine brown coal area, January 5, 1952 (GVNW P.5)

Huchem-Stammeln, Arnoldsweiler, Niederzier, Oberzier, Ellen, Morschenich, Merzenich, Golzheim, Girbelsrath, Eschweiler ü./Feld, Oberbolheim, Nörvenich, Rath, Wissersheim, the office of Fettweis and the townships Eggersheim, Hochkirchen, Irresheim and Poll,

b. in the county of Jülich:
the townships Hambach, Steinstrap, Inden, Dürwip, Lohn, Laurenzberg and Langweiler;

c. in the county of Aachen:
the township Kinzweiler and that part of the township Eschweiler which lies north of the road Düren-Aachen;

d. in the county of Erkelenz:
the townships Holzweiler, Immerath, Borschemich, Keyenberg, Kückhoven and Lövenich;

In the governmental district of Dusseldorf:
in the county Grevenbroich the townships Garzweiler, Hochneukirch, Jüchen, Elfgen, Bedburdyk, Grevenbroich, Gustorf, Frimmersdorf, Neurath and Rommerskirchen.

(2) The planning area may be changed by the Governor in his function as state planning commissioner. The change takes place upon the proposal of the planning committee (brown coal committee), and the proposal is forwarded by the district governor, the head of the district, to the State land planning community.

Paragraph 3

Formulating the Plan and Declaring it Legally Binding

(1) The plan will be drafted by the "Planning Committee for the Rhine Brown-coal Area" (brown coal committee). The brown-coal committee

is a special committee of the State Land Planning Commission for the Rhineland. It must seek the participation of state agencies which are responsible for the execution of the definitely planned measures. The plan is to be open for inspection by all affected parties. The open inspection time should be announced by public notice with an invitation to present to the brown coal committee any objections to the plan within a certain time period. If the brown coal committee does not accept these objections as valid, they will be submitted to the governor, together with the opinions of the brown coal committee at the time of the submission of the plan.

(2) The governor in his capacity as head of the State planning commission (after consulting with appropriate advisory ministers) declares the plan to be legally binding.* If agreement cannot be reached, the state government makes the decision. The plan is then legally binding on all authorities and public and legal corporations of the region.

(3) The plan may be changed according to the same procedure as that by which it was drafted, if circumstances demand such changes.

(4) The drafting and the declaration of legality of the plan may occur in stages as with regards to time, area, and subject matter.

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*Legally binding declarations have taken place on:

May 23, 1953 (GS. NW. p. 452) with respect to partial plans Hürth and Berrenrath
July 29, 1954 (GS. NW. p. 452) with respect to Hochhalde Vollrath
August 29, 1956 (GS. NW. p. 453) with respect to Königshoven-Bedburg
August 29, 1956 (GS. NW. p. 453) with respect to Zülpich-Südfeld
April 5, 1957 (GV. NW. p. 95) with respect to Brühl
January 30, 1957 (GV. NW. p. 27) with respect to Fischbach
October 22, 1957 (GV. NW. p. 263) with respect to partial plan Möderath

(5) Persons living in the affected region, as well as owners and managers of industrial plants and business operations in the area, are obliged to give all necessary information and requisite data to the brown coal committee or to one of its commissioned members if such information and data concerning mining operations is not available at the appropriate state mining agency.

All public authorities and legal corporations are obliged to cooperate in every respect in the drafting of the plan.

(6) Industrial plans of mining companies in the affected area and and land use and cultivation plans of townships are to be reconciled with the overall plan.

Paragraph 4

Planning Committee for the Rhine Brown Coal Area
(brown coal committee)

(1) Members of the committee are:

a. the district governors in Cologne, Aachen, and Düsseldorf,

b. the head of the state mining agency,

c. the land planning commissioner of the joint land planning group Rhineland,

d. the president of the ministry of agriculture in Bonn,

e. a representative of the farmers' union in the area,

f. the head of the State land settlement office,*

g. three representatives of brown coal mining interests,

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*Since renamed: North Rhine Office for Land Redistribution and Settlement according to paragraph 1/2 Law to Simplify County Settlement, November 19, 1957 (GV. NW. p. 271).

h. three representatives of mining unions,

i. five representatives of the county governments,

k. three representatives of the farmers,

l. one representative of crafts and trades,

m. one representative of the power industry,

n. one representative of stoneware industry,

o. one representative of the industrial union representing chemistry, paper, and ceramics.

The Directors of the district mining offices Köln 1 and Aachen-Süd and of the district forestry offices Köln and Aachen, as well as one representative of the State cultural office and the ministry of traffic, participate as experts at the meetings of the brown coal committee.

(2) Subcommittees are to be formed for the planning of particular regions and the treatment of specific measures. One representative each from the townships and from the mining operation involved should be a member of the subcommittee.

(3) The non-governmental members of the committee are to be appointed and withdrawn by the participating member organizations according to regulation.*

(4) The heads of official agencies may delegate a number of their group to act in their behalf. For all other members a substitute is to be appointed.

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*November 21, 1950, p. 372. Their payment is regulated by the law concerning compensation to honorary members of committees (May 15, 1958 GV. NW. p. 193) according to figure 10 of the pertaining list.

(5) The members of the brown coal committee are to pledge to the president their conscientious fulfillment of their obligations. The regulations against bribery and corruption and the revealing of secrets for non-government personnel apply. (RGBl. I p. 351)

Paragraph 5

Meetings and Administration of the Brown Coal Committee

(1) The state governor appoints the chairman. The chairman shall be the district governor in whose district the main part of land recultivation will occur. The chairman calls a session at least twice a year. In addition, the committee must convene if at least 1/5 of the members named in paragraph 4, 1 a. to o. so desire.

(2) The committee will set up a district planning office to conduct day-to-day business.

(3) The committee decrees a standing order of business. It must contain regulations about the purpose, organization, and seat of the agency.

Paragraph 6

Other Obligations of the Committee

The committee has the right and duty to continuously supervise the orderly adherence to the plan and to immediately report deficiencies to the appropriate agencies, as well as to propose fines.

Paragraph 7

Procurement of Land

(1) Current laws apply to expropriations necessary for the implementation of the complete plan.

(2) In the case of ceding property to mining operations according to paragraph 135 ff of the common mining law for the Prussian states of 24, June 1865 (Pr. GS p. 705 ff), legitimate compensation can be expected and claimed upon request in the form of equivalent land instead of money compensation insofar as the laws permit such.

Paragraph 8

Enforcement Provisions

(1) Persons who in spite of written demand neglect to submit within the stated time the information necessary for the drafting, changing, and execution of the plan (paragraph 3, 5) or who are responsible for such neglect alone or together with others may be fined upon request by the committee by the state governor up to 50,000 DM; in case of repetition, up to 100,000 DM.

(2) The respective authorities are not prevented by these regulations from using compulsory means, according to paragraph 132 of the state administration law 30, August 1883 (Pr. GS p. 195)* to ensure an action or an omission. The committee is authorized to request appropriate measures.

Paragraph 9

Complaints

(1) Complaints about the regulations and decisions concerning paragraphs 3 and 6 and 8 of this law may be made to the state governor of the state North Rhine Westphalia.

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*Now paragraph 58 of the administrative (executive) law 23, July 1957 (GV. NW. p. 216).

(2) The complaint to the state governor must be made within a period of one month after notifying the district governor of the reasons for the complaint. If the district governor has failed to adjudicate the complaint in a manner satisfactory to the complainant, the state governor will decide the case in consultation with his ministerial experts.

Paragraph 10

Execution of the Law

The state governor of North Rhine Westphalia in agreement with the competent committees of the state legislature issues the decrees necessary for the execution of this law.* He may order other ministers to issue these decrees.

Paragraph 11

Effective Date

This law will be effective the day following its official proclamation.

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*Compare VO about calling of non administrative members of the Brown coal committee from November 21, 1950 (GS. NW. p. 454).

LAW CONCERNING THE ESTABLISHMENT OF A COMMUNITY FUND WITHIN THE RHINE BROWN-COAL AREA

From April 25, 1950 (GS. NW. p. 453)

On 13, April 1950, the state legislature of North Rhine Westphalia enacted the following law:

Paragraph 1

Establishment, Name, and Seat of the Fund

(1) For the brown-coal mining operations in the Planned Area, described in paragraph 2 of the law concerning the overall planning in the Rhine brown-coal area from April 25, 1950, there will be established a "Community Fund to Ensure the Recultivation of Lands in the Rhine Brown-Coal Area" (henceforth referred to as "Fund").

(2) The fund is a corporation of the public law, seated in Cologne.

Paragraph 2

Purpose of the Fund

(1) The purpose of the fund is to ensure the execution of effort necessary for the recultivation of areas negatively affected by the mining of coal, if these activities are declared to be public responsibility by the state mining office in Bonn.

(2) The state mining office in Bonn decides the necessary measures. These include measures concerning mines that have ceased operations (orphan mines).

(3) The fund shall make available the means for the execution of the previously mentioned measures.

(4) The state mining offices have authority over the fund according to the provisions of mining laws governing mining operations.

Paragraph 3

Members of the Fund

Members of the Fund are all mining operators of the area covered by the plan. Their fees may be collected by the state mining office in Bonn by coercive measures, if necessary.

Paragraph 4

Governing By-Laws

The governing by-laws of the fund must be determined by the members within a period of three months after enactment of the law. They must be sanctioned by the minister for commerce in agreement with the appropriate special ministers. The same procedures holds for changes of the by-laws. If the prescribed period for determination of the by-laws is not adhered to, the minister for commerce will determine the by-laws, also in concert with the special ministers concerned.

Paragraph 5

Contributions to the Fund

(1) The members pay a minimum yearly contribution of 1 Dpf per ton of mined raw brown coal to the fund. The complete contribution for each member will be determined according to the proof of tonnage of the previous year by the state mining office.

(2) The contributions are discontinued if at the end of the fiscal year assets in the amount of one and one-half the sum of the yearly contributions have accumulated in the fund.

(3) If the contributions do not cover the cost of the planned measures, the fund will levy further contributions in the amount necessary. They will be calculated according to (1) and (2).

Paragraph 6

Administration of the Fund

The fund will be administered by a board of directors, who will be elected according to the by-laws by the member mining operators or their delegates.

Paragraph 7

Voting Right of the Members

(1) Each mining operator has one vote per each million tons of output per year.

(2) The voting ratio in the assembly of members is determined by the amount of output during the previous year. If no official determination of the amount has been made yet, the voting rights are regulated by the official determination of output during the year before that.

(3) Simple majority of attending members decides.

Paragraph 8

Supervision of the Fund

(1) The supervision of the fund is controlled by the state mining office in Bonn. A delegate of the state mining office is entitled to participate in all meetings of the board of directors and all meetings of members. The state mining office can demand a meeting of members within a period of two weeks.

(2) Time, place and agenda of meetings are to be made known to the state mining office at least one week in advance. The state mining office must be informed of decisions. The state mining office may raise objections against decisions which are unlawful or do not conform to the by-laws, especially if they concern the budget. It must do so within two weeks after being notified of the decision, which is thereby invalidated. If the funds stands on its decision, the minister for (trade and) commerce decides in concert with his special ministers after hearing both the state mining offices and the fund within a period of four more weeks.

(3) The state mining office has the right at all times to inspect the books and minutes of the fund and to audit the account.

Paragraph 9

Execution of the Law

The minister for commerce in concert with the competent special ministers decrees the ordinances necessary for the execution of this law.

Paragraph 10

Effective Date

This law will become effective one day after its passage.

BY-LAWS AND FINANCING OF THE LAND PLANNING COMMISSION RHINELAND

March 27, 1952

The by-laws and contribution system which were decided on by members of the land planning commission Rhineland on March 27, 1952, and were approved by decree of the governor of the State of North Rhine Westphalia that same day are herewith made public:

By-Laws

I. Fundamentals

Paragraph 1

Function

(1) The land planning commission Rhineland must perform within its planning area all work necessary for the state planning. For that purpose it will gather information about the present condition, explore the fundamentals of planning, and develop together with all agencies of the planned area a future-oriented, creative general plan. The commission will exert a moderating influence upon the most expedient use of the area by striving to harmonize small and large area plans and to mesh private and state planning.

(2) The commission advises the state land planning authority and the members of the state planning commission.

Paragraph 2

Area

The area of the land planning commission Rhineland includes the Rhineland part of the state of North Rhine Westphalia with the exception

of the area of the association of settlers in the Ruhr district.

Paragraph 3

Legal Status and Seat

The land planning commission is according to paragraph 2/(3) of the Law about Land Planning of March 11, 1950 (GV. NW. p. 41) a corporation of public law and has its seat in Düsseldorf.

Paragraph 4

Membership

(1) Members of the commission are:

a. the counties and townships,

b. the district governors,

c. subordinate authorities designated by the federal and state ministries in accordance with the state planning authority.

(2) In addition, on a voluntary basis, the following members may be included:

a. the chambers of agriculture, industry, and commerce; the chamber of trades and crafts,

b. the unions and the employers' associations,

c. the non-profit settlers' organizations and homesteads, the associations for public housing, the agencies and associations of agriculture and forestry, of industry and traffic, of mining, energy management and water management,

d. organizations to preserve nature and culture,

c. scientific establishments.

(3) The board of directors decides matters of membership pertaining to (2). If the decision is negative, the candidate may address the meeting of the whole membership.

(4) Membership under (2) can be cancelled at the end of the fiscal year (paragraph 17). The cancellation is to be expressed at least six months in advance by registered letter.

II. Organization

Paragraph 5

Organs

The organs of the Land planning commission are:

1. the assembly of members,
2. the board of directors,
3. the advisory council, and
4. the land planner.

Paragraph 6

Meeting of Members

(1) The meeting of members is for the purpose of keeping all members constantly aware of the problems of the land planning commission. The meeting is to be informed about all activities of all organs of the land planning commission.

(2) The meeting of members votes into office:

a. the members of the board of directors and their substitutes (paragraph 8),
b. the chairman of the land planning commission and his substitute (paragraph 9),

c. the members of the advisory council and their substitutes (paragraph 10),

d. the land planner and his constant substitute (paragraph 11).

The meeting makes the following decisions:

e. It sets up the order of business;

f. it decrees and changes by-laws and contributions;

g. it handles objections according to paragraph 4 (3);

h. it handles rulings according to paragraph 13;

i. it sets up a budget including the list of salaried positions (paragraph 17); and gives

k. approval of bills and their payments (paragraph 17).

(3) The meeting consists of the delegates of its members. Every member sends one delegate to the meeting of members. The land planner participates in the meetings in an advisory capacity.

(4) The chairman of the meeting is the chairman of the land planning commission or his substitute.

(5) One regular meeting takes place each year. The chairman can call an extraordinary meeting. He must do so if the board of directors requests it of its own account or upon request of the land planner or if at least one quarter of the members demand it.

(6) The meeting must be called in writing two weeks before it will take place, and the order of business must be stated.

Paragraph 7

Voting and Voting Rights

(1) Each township and county has one vote.

(2) The district governors and the lower authorities, which are

delegated by the ministries of the federal and state governments, are entitled to the same number of votes as the townships and counties (1).

(3) Each voluntary member according to paragraph 4 (2), has one vote if he makes a yearly contribution of at least 1200 DM. The voluntary members may have not more than 49% of the votes.

(4) The voting is done by simple majority rule by the members attending the meeting.

(5) For decisions concerning the drafting and changes of the by-laws and contributions, a majority vote of two thirds of the voting members present is necessary. For these decisions, as well as for decisions concerning the budget (paragraph 17) and positions, there must be at least a simple majority vote of the members as defined by paragraph 4 (1a) and paragraph 4 (1b and 1c). For the complete membership, a two thirds majority vote is required.

Paragraph 8

Board of Directors

(1) The board of directors controls the management of the land planning commission. It decides by simple majority rule.

(2) The board of directors consists of twelve members. They are voted into office by the meeting of members for a term of four years. They may be reelected. They remain in office until the following election. For each member a substitute member shall be elected who will take over the functions of the member upon his resignation. The members of the board of directors retire from their position if they lose the office or position for which they were elected.

(3) The board of directors should consist of one delegate each of a city district, a country district, a district office of district township, a district city, in addition to one delegate each of the area of agriculture, mining, industry and unions. The substitutes are to be selected from the same areas.

(4) The land planner participates in the meetings of the board in an advisory capacity.

Paragraph 9

The Chairman

The chairman and his substitute will be elected upon suggestion of the board of directors for a period of four years. They may be reelected. They remain in office until the following election. They discontinue their service if they lose the office or position for which they were elected.

Paragraph 10

Advisory Board

(1) An advisory board of experts will be formed to solve specific planning problems and to advise the members and the board of directors.

(2) The advisory board shall consist of not more than 40 members and their substitutes. They are elected by the general meeting of members for a period of four years. The votes are regulated according to paragraph 8 (2).

(3) The chairman of the land planning commission is also the chairman of the advisory board. He calls a meeting of the advisory board once a year.

(4) The land planner participates in the meetings of the advisory board in an advisory capacity.

(5) The advisory board together with the land planner may form subcommittees to work out specific problems or to advise in specific fields. The land planner or a person designated by him is the head of such subcommittees.

Paragraph 11

The Land Planner

(1) The land planner runs the current business of the land planning commission and represents the commission in and out of court. He is elected by the general meeting of members upon suggestion of the board of directors. The same procedure is used in electing his substitute.

(2) The election of the land planner must be confirmed by the state governor as authority of state planning.

(3) The land planner is the official superior of all civil servant officials, employees, and laborers of the land planning commission. He can give specific instructions to the personnel of the land planning commission (paragraph 13).

(4) Contracts must be signed by the chairman of the board of directors as well as by the land planner. The daily business of administration which is not very important financially may be handled by the land planner alone.

Paragraph 12

Legal Status of Employees

The legal status of officials, employees, and laborers is regulated according to the rules that hold for officials, employees, and laborers of the townships in the State of North Rhine Westphalia.

Paragraph 13

Delegated Employees

Instead of the regulation according to paragraph 11 (1) and paragraph 12, the meeting may decide, upon suggestion of the board of directors, to have the work of the land planner and his staff performed by officials, employees, and laborers of the state or another area corporation, if such a staff is made available by the state or another area corporation.

Paragraph 14

District Planning Offices and District Planner

(1) The land planning commission shall establish district planning offices at the seat of the district governments. These offices shall address themselves to district problems of land planning.

(2) The district planning offices advise the district governor, the counties, and the townships in matters pertaining to their area.

(3) The district planner is under the authority of the district governor, according to regulations of the land planning law of 28, June 1950 (GV. NW. p. 141), article I (1) while performing his duties.

(4) The head of the district planning office is the district planner. The district planner is appointed by the chairman of the

land planning commission upon suggestion of the board of directors after hearing the respective district governor. The same procedure is used to appoint his substitute. Alternately, a solution according to regulations in paragraph 13 may be found. The appointment must be approved by the state governor as head of the land planning authority.

(5) The district planner carries out the daily business of the district planning office. Within his budget he may temporarily employ help on his own.

Paragraph 15

Advisory Board of District Planning Offices

(1) In the district planning office, an advisory board is created to assist in solving specific planning problems.

(2) The advisory board consists of up to 20 members and their substitutes. They are elected by the board of directors upon suggestion of the district governor for a four-year term. The elections are regulated according to paragraph 8 (2).

(3) The district planner attends meetings of the advisory board in an advisory capacity.

(4) The advisory board may form subcommittees (paragraph 10, (5)). The head of the subcommittees is the district planner.

Paragraph 16

Honorary Participation

Participation in the membership of the land planning commission, in the board of directors and all advisory boards is without remuneration.

III. Financing

Paragraph 17

Budget and Accounting

(1) The fiscal year of the land planning commission corresponds to the fiscal year of the state.

(2) For each fiscal year the land planner must set up a budget and present it to the board of directors for discussion. The board of directors presents the budget to the members for decisions. The budget must contain all foreseeable expenses. It must balance.

(3) In addition to approval of the budget, decisions shall be made concerning the fees of counties and townships.

(4) The budget will be set up according to regulations governing state budgets.

(5) At the end of the fiscal year the board of directors presents the account, checked by an official accountant, to the members. The members approve the account.

Paragraph 18

Covering of Expenses

(1) The expenses of the land planning commission are covered by:

a. subsidy of the State of Northrhine-Westphalia,

b. fees of members,

c. other income.

(2) The fees of members are levied according to the regulations of fees. The regulation of fees is part of these by-laws.

IV. State Supervision

Paragraph 19

The land planning commission is supervised by the state governor as the authority of land planning, according to paragraph 2 of the land planning law of March 11, 1950 (GV. NW. p. 41).

V. Final Statement

Paragraph 20

These by-laws will replace the by-laws of October 1, 1945, in the draft of November 1946 and become effective on March 27, 1952.

Regulation of Fees

Paragraph 1

The fees of the counties and townships are calculated in the following manner: First the state subsidy, the voluntary fees of members, and all other expected income are compared with the expenditures. The deficit is then calculated. Half of this deficit should be assessed, according to regulations covering provincial tax assessments, to the respective city and county government agencies. From the assessment the fees are calculated. The other half of this deficit will be carried in the case of the land planning commission by the state instead of the provincial government.

Paragraph 2

The fees of voluntary members will be agreed upon at the time of their admission.

Paragraph 3

The land planner informs the members of the fees by written note. The note is to be served.

Paragraph 4

The fees are to be paid in four installments at the beginning of each fiscal quarter to the respective budget of the land planning commission. Until final decisions are made concerning amount of fees of city and county agencies, the quarterly installments are to be paid according to the previous year's assessment of fees.

Paragraph 5

At the beginning of the fiscal year the land planner may serve the members with a preliminary estimate of their annual fee.

Paragraph 6

The preliminary fee is to be paid. The board of directors will consider objections. The objection does not postpone the necessity of payment.

Paragraph 7

Members who pay after the fees are due must pay interest for the time of delay in the amount of the current rate of discount of the Landes-Zentralbank Düsseldorf or must compensate for the damage resulting from the delay. Interest payment or amount of damage must be stated in a written note to the member and served.

Paragraph 8

The board of directors may in exceptional cases relieve a member from payment of fees, interest, or damage payment, or it may grant a delay of payment of fees due, or it may reduce the fees.

MBI NW 1952 p. 773