

THE BURNHAM COAL GASIFICATION COMPLEX

J. P. Musick, Jr.

At the outset, may I express the appreciation of all of us at El Paso for your gracious invitation to share with you some of the details of what we consider to be a most significant and worthwhile project.

As many of you here today are aware, El Paso announced several years ago that it plans to construct the world's first commercial plant for the conversion of coal into a synthetic high BTU gas suitable for pipeline transmission. This announcement stated that the complex would be located in New Mexico near El Paso's existing pipeline system.

On November 15 of 1972 El Paso filed an application with the Federal Power Commission for approval to construct the Burnham Coal Gasification Complex, some 35 miles south of Farmington, New Mexico, on the Navajo Indian Reservation. That application is now under consideration by the FPC.

Today I wish to further explain to you this historic facility, and to discuss its significance to the United States.

J. P. Musick, Jr. is manager of Community Services, Services Department, El Paso Energy Resources Company, El Paso, Texas.

I do not plan today to belabor the very serious energy, and more particularly, natural gas shortage faced by this nation before a group such as this. Someone said recently that if all the energy consumed in making energy studies could be diverted to other uses, there wouldn't be an energy shortage. And indeed it does seem that way.

However, the very sobering facts of the energy shortage have prompted El Paso to investigate other sources of gas supply in recent years, for example: Increased conventional exploration efforts, both foreign and domestic; the development of underground nuclear stimulation technology; a proposal to bring base load supplies of liquified natural gas into the east coast of the U. S. from Algeria; and a feasibility study, now underway, to build a pipeline across the State of Alaska to its southern coast.

In recent years El Paso has acquired substantial reserves of low-sulfur coal in the West. The idea of coal gasification is, of course, not new. El Paso has conducted research in the field since the early 1950's. But only recently has the national energy situation become such that the public interest requires a decision to move forward with building the commercial-sized coal gasification complex you will hear about today.

El Paso purchased in 1968 a 40,286 acre coal lease from the Navajo Indian tribe. The lease is located in San Juan County, New Mexico approximately 35 miles south of the City of Farmington. An extensive evaluation program has been completed. The coal underlying this lease is sub-bituminous and comes from the Fruitland Formation. It is Upper-Cretaceous in age. Four principal coal seams have been ascertained and mapped, ranging in depth from less than 20 feet of overburden to over 200 feet of cover. In addition to the four main seams, numerous other less consistent and thinner seams are present in many areas of the lease. On this lease there are more than 700 million tons of recoverable coal under less than 150 feet of cover. These are all proven reserves. They do not include additional reserves which are inferred but not proven. These coal deposits can be readily surface mined.

The coal is adaptable to gasification processes and can thus be used both to contribute to the Western economy and to aid in solving the nation's environmental problems. Of considerable economic and environmental significance is the fact that there are three existing El Paso Pipelines--two 24-inch and one 34-inch -- situated on or adjacent to the coal lease.

The gasification complex itself is designed to produce 288 million cubic feet per day of 954 Btu per cubic foot gas.

Conventional natural gas now delivered by El Paso is almost wholly methane. The product of the coal gasification complex will also be primarily methane and will be interchangeable with conventional natural gas.

Only one commercially proven high-pressure process exists today of converting coal to synthetic gas. This is a process developed by a West German Firm, Lurgi Mineroeltechik GmbH and referred to as the "Lurgi Process." It has been utilized in some 16 plants around the world and is the process El Paso will use. No such commercial gasification facility exists in the United States today,

although several processes are under study. All of these processes under study in this country involve essentially the same chemical principle.

Basic coal gasification involves adding oxygen and steam to coal under conditions of heat and pressure to form a synthesis gas composed of hydrogen, carbon oxides, methane, and various sulfur compounds. The carbon dioxide and sulfur compounds are then removed, leaving a usable gaseous fuel having a low Btu content. This gas is sometimes referred to as "town gas." To this process El Paso will add a further step, methanation, which will increase the heating value of the gas from about 415 Btu to 954 Btu per standard cubic foot. This process will be accomplished by catalytically reacting the carbon monoxide and hydrogen to produce methane and water. The gasification complex will be located on the lease and near El Paso's pipeline system. The main complex area will cover about 960 acres. It will be modern, attractive, and esthetically sound.

The coal mine will be one of the largest in the United States. The Gasification Complex, when fully operational will process over 32,000 tons of coal per day, or about 10 million tons per year. The proposed mining plan is quite similar to that being employed successfully in numerous surface mines throughout the world.

After FPC approval, about 3 years will be needed to construct the complex.

In addition to engineering studies currently underway, extensive environmental investigations are in progress. Substantial amounts of water will be necessary in order to gasify the presently proven, recoverable coal reserves on this lease. The acquisition of dependable, long-range supplies of water is vital to such a project. The energy output of the proposed complex is large - equivalent to that of a 3,300 megawatt electric generating plant, but requiring less than 1/4 of the water required by such a plant. As stated before, the lease contains conservatively, some 700 million tons of recoverable coal. To gasify this much coal will require 28,250 acre-feet per year. Negotiations are currently underway with the Bureau of Reclamation to purchase water from the Navajo Reservoir, at a diversion point downstream of the reservoir in the San Juan River North of the complex site. For this first gasification complex, producing 288 million CFPD of pipeline quality gas, approximately 10,000 acre-feet of water per year will be required.

We are well aware that a project of this magnitude and duration will have an impact on the environment. This has been carefully considered from the beginning of our planning, and it will continue to receive foremost consideration in the construction and operation of both the gasification complex and mine.

Our investigations indicate that the project will have minimal adverse effect on the environment.

Air and water pollution are not expected to be problem.

Both the plan for mining the coal and the plan for restoration of the mined area are subject to approval by the Navajo Tribe, the Department of the

Interior and the Bureau of Indian Affairs. The project must also comply with applicable laws of the State of New Mexico, as well as Federal regulations resulting from the National Environmental Policy Act, to assure that all operations are in the public interest. In addition, at least three federal governmental agencies will review the project plans. These agencies include the Federal Power Commission, the Department of the Interior, and the Department of Transportation.

The mined area will be reclaimed as a part of the mining operation. The planned reclamation activities include burial of the ash generated by the Gasification Complex, grading of overburden, reseeding of graded areas and controlled utilization of the reclaimed and revegetated areas until seeded vegetative cover is established. The mined land will be returned to productive use, in consultation with the Navajo Tribe, Federal, State and Private agencies. Where soil conditions and topography will permit, surface runoff water will be directed into constructed lakes and stock-watering ponds for use by resident ranchers and sheep grazers.

We plan to take every reasonable step to guarantee that no part of the project will adversely affect the environment. In this matter, may I add one personal note:

For some 25 years El Paso has carried on its business in the Four Corners Area. The Company has the reputation of being a good citizen, good neighbor, and a good housekeeper in all its operations. We intend to continue these practices.

The project will provide benefits of major significance, not only to the Navajo Tribe, to the State of New Mexico, and to the adjoining area, but to the entire country.

(1) The project will supply substantial amounts of much-needed energy in the form of a fuel which when burned produces virtually no pollution. This new technology could have far-reaching effects on the energy shortage of the country, perhaps far beyond the imagination of most of us here today.

(2) The economic and social impact on the State of New Mexico, the Navajo Tribe and this general area will be immediate, substantial and will make a continuing contribution to the business, and more important, the well-being of many of the people who live and work there.

The Construction Phase of the complex will require up to 3,500 employees for a period of 3 years, with a peak annual payroll of \$70 million.

The Operational Phase of the completed gasification complex and coal mine will provide approximately 1,234 new jobs, with an annual payroll estimated to be \$16 million. In addition to these employees, the complex will supply indirect support of 1,850 service jobs in the area. New people will be absorbed into the existing communities in the area, although many employees will live nearby on the Reservation. It is El Paso's intent to train and employ a maximum number of personnel from the Navajo Tribe.

In addition to such employment, the Tribe should realize annual royalty and rental payments in excess of \$5 million annually.

Taxes payable to Federal, State, and local entities will amount to an estimated \$20 million annually.

Of equal importance - perhaps greater importance - are the social, educational, and cultural benefits which can be provided for many citizens of this area and their families. It is impossible to place a value on such things, and yet, in the final analysis, they are perhaps the most valuable of all.

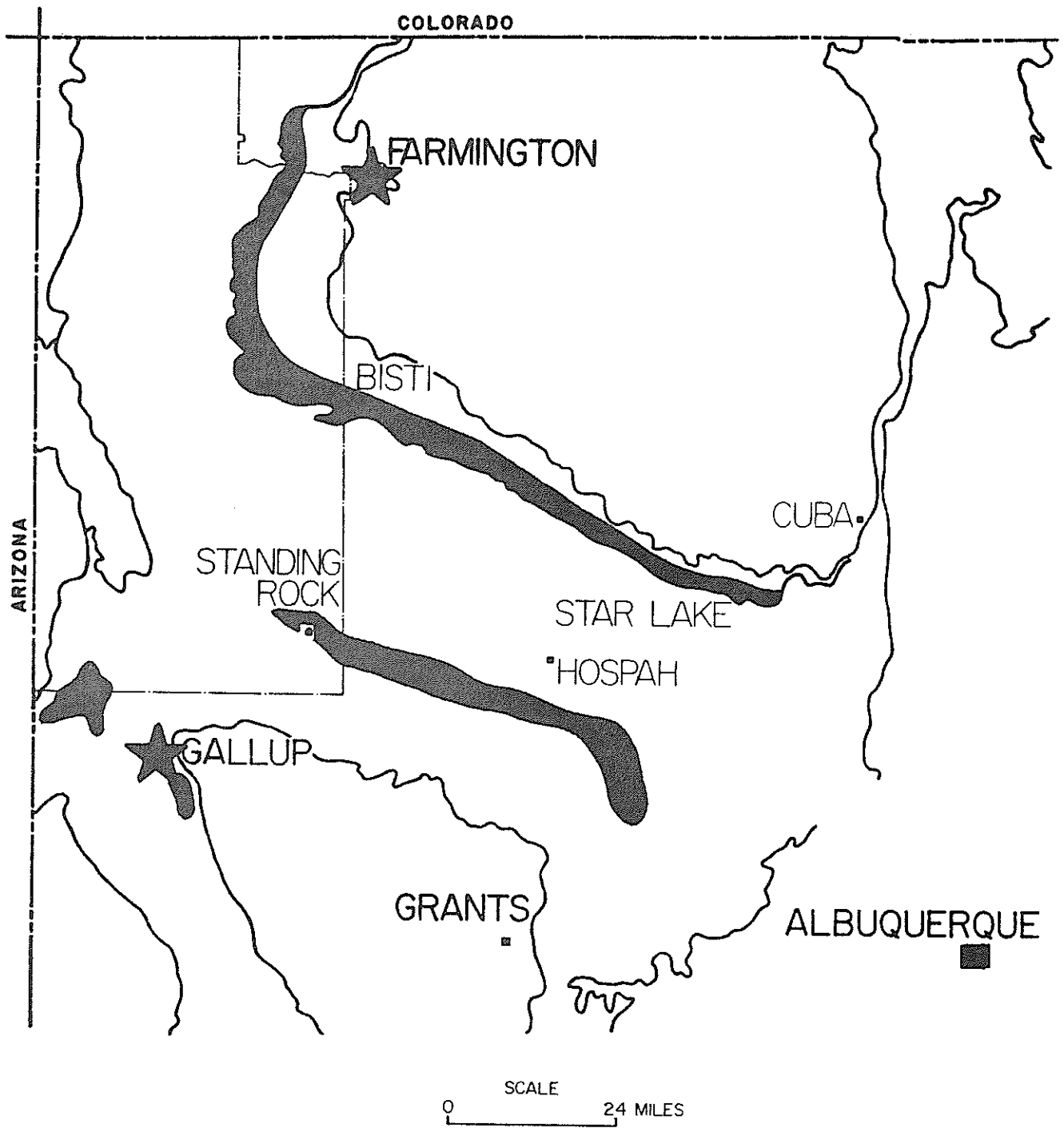


FIGURE 4. AREA OF SURFACE-MINABLE COAL,
NORTHWESTERN NEW MEXICO

The Menefee has not been extensively explored, but it is known to contain several large areas of thick coal at depth, and some extensive barren areas. Some of the strippable areas are of economic size.

The principal undeveloped area lies north of Grants, and is owned in large part by a subsidiary of Santa Fe Industries. The area has been explored in detail. A reserve estimate made by the State Bureau of Mines in 1971 of 60 to 75 million tons is certainly far too low. West of it, near Standing Rock on the Navajo Reservation, drill holes have revealed more strippable coal. This area was estimated to contain at least 64 million tons, and probably contains far more. It is currently being examined again, relying on surface mapping only. The coal in these areas is mostly of high-volatile bituminous C rank and contains 0.5 to 1.1 percent sulfur.

Small strippable reserves have also been found just south of Cuba, near Lake Valley south of Bisti Trading Post, and near Newcomb, north of Gallup. None of these appear to be economic at present; only the last-mentioned appears to contain more than 75 million tons.

The only important production now from the Menefee (and the related Crevasse Canyon Formation) is from two strippable areas near Gallup. Northwest of Gallup, partly on the Navajo Reservation is a block estimated to contain 358 million tons or more of strippable coal. A much smaller reserve is being worked just south-east of Gallup. The coals of these areas are also of high-volatile C bituminous rank, with sulfur content around 0.5 percent.

The Menefee has also been estimated to contain on the order of 34.3 thousand million tons of deep coal; current work being done by the State Bureau of Mines indicates that this figure may be low.

One body of Menefee coal which has recently been described alone contains on the order of 22 thousand million tons. It is a zone composed of many individual beds. The trend is 92 miles long and up to 12 miles wide, running from Torreon School on the southeast to Hogback Mountain on the northwest. Virtually all of the coal is well beyond stripping depth, but it appears to be well suited to more futuristic extractive processes such as in-place gasification or solvent mining.

The State Bureau of Mines is beginning a small drilling program to verify the presence of this body of coal, which so far has been described only from the logs of oil and gas tests.

One point worth mentioning is that the coals of our region were laid down in a succession of grand advances and retreats of the ancient sea, themselves made up of countless small ins and outs; the coal is thus disposed in rather small irregular lenses. This habit of southwestern Cretaceous coals of occurring in overlapping lenses of irregular size, shape, and thickness is in profound contrast with the extensive, uniform seams of the eastern United States. In the San Juan Basin it is often difficult to correlate coal beds in drill holes a quarter of a mile apart, while back east the Pittsburgh and Kittanning seams can be traced over thousands of square miles.

It is the Fruitland Formation that contains the San Juan Basin's really major coal reserves. Figure 4, the upper solid dark-shaded band represents

the Fruitland Formation strippable areas. Within the band, the entire area is underlain by both deep Fruitland and deep Menefee coal. On the Navajo Reservation, (west of the dashed line) and to the north of the San Juan River, strippable reserves have been well-explored, and are under lease and committed to various development plans. I'll discuss these further on.

From the Colorado line southward to Bisti (almost on the eastern boundary of the Reservation), there is a total of some 1.1 thousand million tons beneath less than 150 feet of over-burden, and another 1.4 thousand million tons from 150 feet down to 250. Most of this is on the Navajo Reservation.

From the Navajo Reservation eastward, there is another 1.3 thousand million or more tons above 150 feet and 1.2 thousand million more between 150 and 250. Much of this is under lands belonging to the Federal Government, and has been fairly extensively explored. I'll describe some plans for some of this coal a little further on too.

Beyond a depth of 250 feet, the Fruitland contains a staggering amount of coal. An estimate by Fassett and Hinds of the U.S. Geological Survey indicates a total of some 154.2 thousand million tons.

A word about the land situation in the basin might be of interest; aside from the Navajo Tribe, most of whose coal is committed, most of the mineral ownership is either state, federal, or Santa Fe Pacific Railroad Co., a subsidiary of Santa Fe Industries and sister of AT&SF Railway. The Santa Fe is finishing exploration of its coal lands, has published a reserve figure of 370 million tons, and is working toward development.

The State of New Mexico has eagerly leased its scattered tracts, which rarely amount to more than four isolated sections per township.

The United States Government's Bureau of Land Management, the big coal owner, however, has put a virtual moratorium on coal development. Prospecting permits which allowed a qualified operator to spend his own money exploring federal lands and then lease them on the Government's terms if he liked the looks of the coal, have not been issued since January 1, 1971; permit applications made since then were summarily rejected, and no more can be filed. Officially, the BLM is willing to lease coal to qualified operators but in fact it will not do so. Several large tracts have been explored thoroughly and are ready to mine; markets are lined up for the coal. These tracts were explored under prospecting permits which guaranteed the right to a lease, but the permits are now expired and the BLM has not acted to issue leases. The operators are qualified--one is Peabody Coal, the largest in the country.

The last federal prospecting permit was issued in January of 1971, and the very last lease in New Mexico was issued in January of 1970--well over 5 years ago. What says there is an energy shortage?

In the San Juan Basin alone, there were permit applications totalling over 270,000 acres when all the applications were rejected. There are three thoughts on this mess that you might consider:

1. There is a very prevalent attitude among us these days that big coal companies already control vast acreages of federal coal lands that they have little investment in and no immediate market for. As far as New Mexico is concerned, this is utterly erroneous; there isn't any federal coal acreage claimed by private interests from which the economically minable coal wouldn't be sold tomorrow, and there's no shortage of utilities that desperately need it to fulfill long-term commitments.

2. Some say that coal can't possibly meet our rapidly increasing short-term needs. That is a true statement, but only because the Government has systematically stymied coal development, and because the Government's non-policy has made it impossible for equipment suppliers and mining and engineering schools to prepare to provide the machinery and trained people that rapid coal development will need. The manufacture of equipment and training of personnel take a long lead time, and suppliers and schools need to be confident of long-term policy before committing themselves.

3. Before very long, it is going to be popular to say "private enterprise has failed to provide the energy we need", so we will see lots of crash programs in which the Government will attempt to develop coal. Those who so far have succeeded in keeping coal development in abeyance because of fear of "rip-offs" by large corporations, and of damage to the environment, are in for a damned rude shock when they see the BLM, the USGS, the EPA, the USBM, the MESA, and who knows what other agencies stumbling over each other trying to produce coal and regulate each other at the same time.

From inside the industry it seems obvious that we Americans are afraid of each other; only the Government is considered trustworthy enough to develop our coal resources, and I expect we will soon see an American counterpart of Britain's National Coal Board. I don't know your feelings on that kind of thing, but I'm apprehensive about it.

I would like now to turn to the position of New Mexico coal in the nationwide market picture, or in simple words, to answer the question "why us?" Figure 5 shows the general distribution of coal resources, both strippable and deep, in light shading, and the country's major population centers as dark circles proportioned to population. At first glance several things seem obvious: (1) the heavily-populated east has plenty of coal of its own, (2) the population centers of the west have coal resources closer than ours to draw upon, and (3) the vast resources of Wyoming, Montana, and North Dakota seem well situated to fill demands from the north-central and northeastern parts of the country.

There are several complications, however. Eastern coals are at a great disadvantage in the market because they include a large amount of deep coal and have, in general, high sulfur contents. Surface mining is effectively banned in several states. Arizona and Utah appear to be geographically well-situated to supply the southern California market, but the Utah coals are almost entirely deep and the only major reserve in Arizona--Black Mesa--is already committed. Northern Arizona and southern Utah are not served by rail transportation either. Montana and Wyoming coals are flowing into distant markets; for example, San Antonio, Texas is now converting to Wyoming coal for electricity generation.

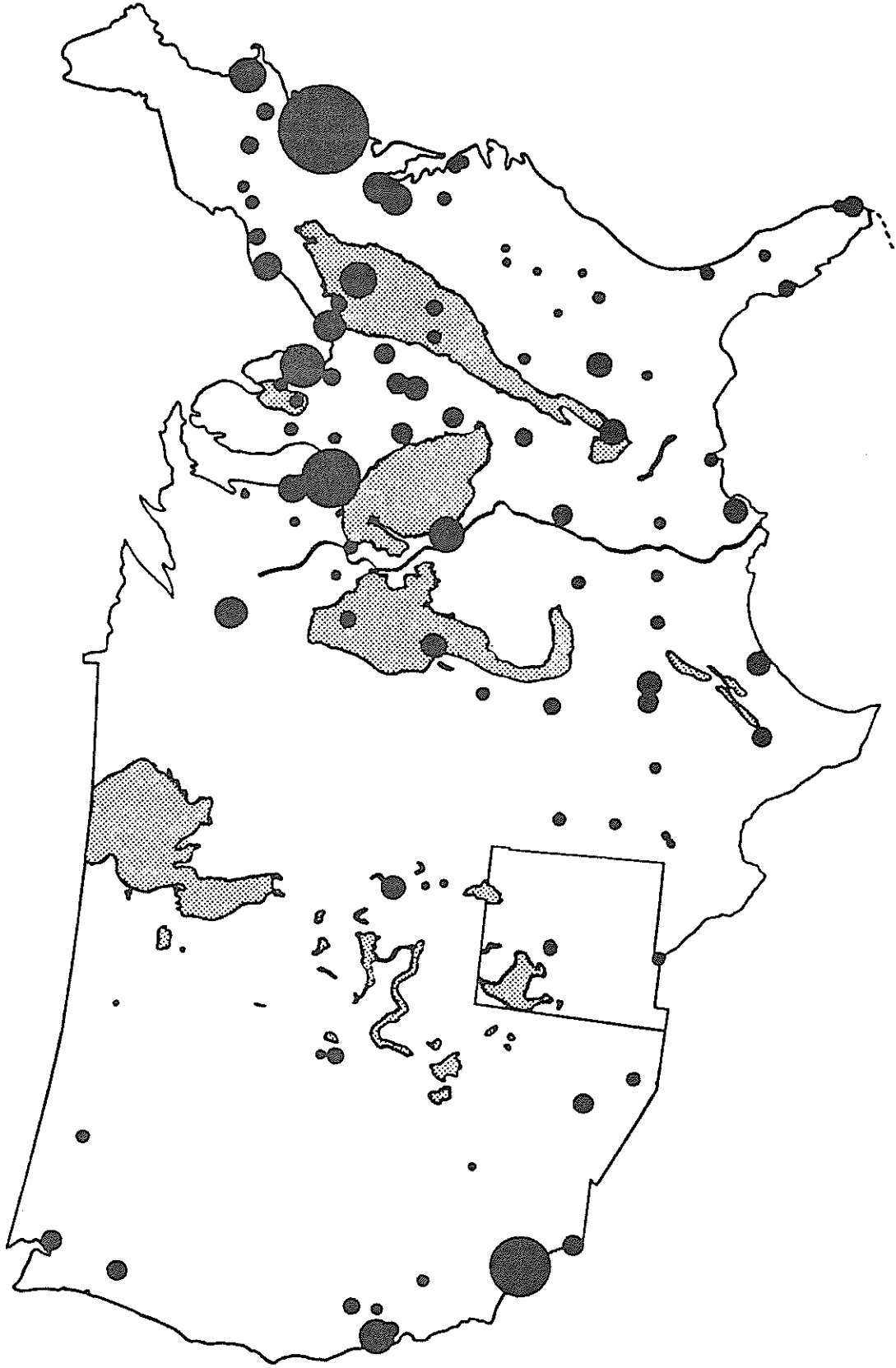


FIGURE 5. COAL AREAS AND POPULATION CENTERS IN UNITED STATES

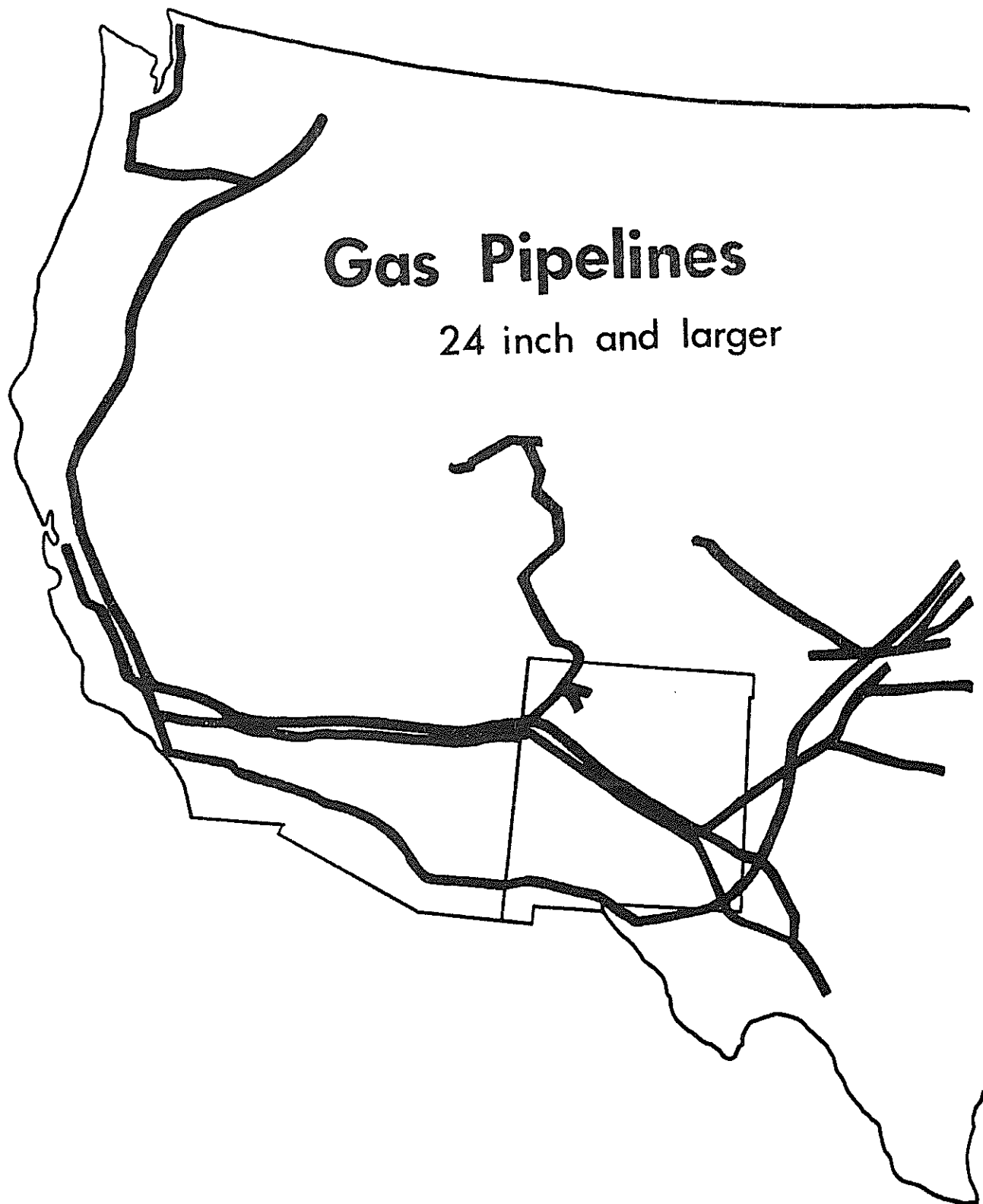


FIGURE 6. GAS PIPELINES IN WESTERN UNITED STATES

Another important factor is illustrated here on Figure 6. New Mexico is a major gas producing state and is on the trans-continental pipeline routes, so we are very well placed to supply synthetic gas made from coal into the gas distribution network. The San Juan Basin, which as I have pointed out contains almost 6 thousand million tons of strippable coal, also is the home of the country's second largest gas field. Gas production has peaked and synthetic gas could pick up the load and carry on very smoothly.

The map of the San Juan Basin and surrounding areas (Figure 7) shows existing and planned coal developments. Triangles are strip mines, boxes are power plants with associated strip mines, and circles represent gasification plants with associated mines.

The two squares just west of Farmington are the Four Corners power plant south of the river and the San Juan generating station north of the river. The Four Corners plant is owned by a consortium including Arizona Public Service Co., Southern California Edison Co., El Paso Electric Co., Tucson Gas and Electric, the Salt River Project, and New Mexico Public Service Co.

This plant is rated at 2,085 megawatts, and is now using between six and seven million tons of coal per year. Coal is supplied by the Navajo Mine of Utah International. This has been the largest coal mine in the United States since 1971. The combined payroll of mine and power plant is about 4.5 million dollars, much of it to members of the Navajo Tribe.

The San Juan Generating Station, north of the river, which belongs to Public Service Company of New Mexico and Tucson Gas and Electric, will have an ultimate capacity of 1,660 megawatts. Coal will be furnished from a mine at the plant owned by Western Coal Co. and operated by Utah International.

The McKinley mine, of Pittsburg and Midway Coal Mining Co. is located northwest of Gallup. It is partly on the Navajo Reservation and partly off. Its production--463,000 tons in 1973--is shipped by rail to the Arizona Public Service Co. Cholla Plant at Joseph City. The McKinley is planning a roughly ten-fold expansion by the early 1980's.

The two gasification complexes in the planning stages are close together on the Navajo Reservation. One is being planned by El Paso Natural Gas Co. near Bisti; it would ultimately consist of two units, together producing 785 million cubic feet of pipeline--quality gas per day from some 73,000 tons of coal. The coal would be mined at the site. It is estimated that the complex will eventually employ 2,800 people with a combined payroll of over 35 million dollars per year. In addition, well over 5 million dollars would go to the Navajo Tribe in the form of royalties would be over six million dollars yearly.

In the next decade coal production on the Reservation alone could reach over 70 million tons per year, a gross value of perhaps 300 million dollars; this would represent several thousand good jobs, and some 18 million dollars in royalty payments.

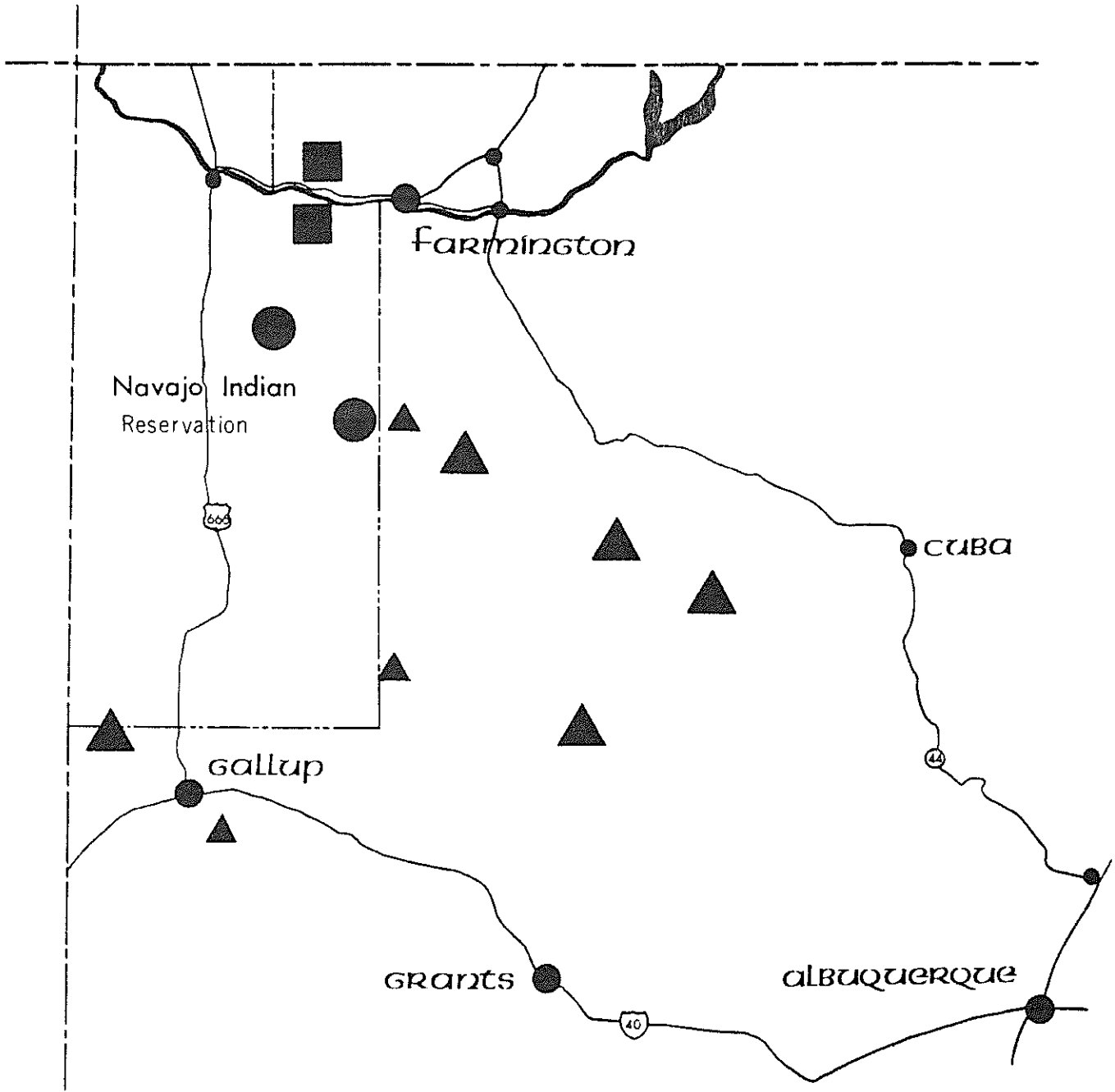


FIGURE 7. EXISTING AND PLANNED COAL DEVELOPMENTS, NORTHWESTERN NEW MEXICO

The triangles east of the Reservation some on federal acreage and some off, represent my guesses as to where new strip mines would be located. Coal from these mines would probably be shipped out of the basin by rail, or perhaps be utilized in air-cooled electrical generating plants. There is no foreseeable source of water on a scale suitable for conventional gasification or water-cooled electricity generation. Rail connection to the eastern part of the basin (where the triangles are) has been a subject of speculation for some years.