# The Southeast's Energy Prospects: A Realistic Appraisal

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## INTRODUCTION

Over the past seven years the Oak Ridge National Laboratory (ORNL) has been increasingly involved with research focusing upon the energy problems in the southern United States. Generally, the region referred to is composed of Federal Regions IV and VI as defined by the Department of Energy. This paper, however, involves only Region IV or the Southeast, which includes the states of Kentucky, Tennessee, South Carolina, North Carolina, Georgia, Florida, Alabama, and Mississippi. It does not include Virginia which would be included in most definitions of the Southeast. Data for Virginia, however, have been included in some instances when appropriate.

The focus of this paper is on the energy utilization prospects in the Southeast. Obviously many alternate scenarios may be examined but it is doubtful that the problems identified will vary except possibly in severity. The material was derived from many sources, but mostly from information developed from research conducted at ORNL. Six topical areas are covered. First, a reasonable demographic/economic growth scenario for the area is presented as a basis for discussion. Next, a desirable energy future for the area is suggested that moves away from dependence on oil and natural gas to domestic energy sources such as coal, electricity (generated from either coal or nuclear energy), conservation, and solar energy. To provide perspective on this proposed energy future, present energy use patterns in the Southeast are discussed along with where the region appears to be headed. At the present the trends are away from the use of oil and gas in the Southeast but additional steps must be taken. A few areas are suggested where attention should be focused. Finally, some of the costs and problems associated with this path are discussed. Unfortunately, some of these problems will be present regardless of the development path.

## ECONOMIC OUTLOOK FOR THE SOUTHEAST

A Bureau of Labor Statistics (BLS) national forecast was chosen as the base case but any number of scenarios could have been used.[1] In fact over

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the last 4 or 5 years ORNL has examined the costs and possible impacts of at least six national energy scenarios. It is considered that this BLS scenario represents a reasonable projection for economic growth for the nation and consequently it was chosen for this study.

Recently ORNL disaggregated the 1980 BLS national employment numbers to Bureau of Economic Analysis Regions (BEA's) for the U.S. BEA regions correspond roughly to major metropolitan regions for the U.S. and in the eastern U.S. may comprise of 16 or more counties. They are generally considered to be functional regions consisting of aggregations of counties that are economically tied to their respective metropolitan centers.

To disaggregate the national forecast an ORNL model called MULTIREGION[2] was used. MULTIREGION is a demographic/economic forecasting model which accounts for shifts in population and employment based on historical migration patterns and changes in the spatial patterns of markets.

MULTIREGION has been used to disaggregate a number of national energy scenarios in recent years, and it is interesting to note that the Southeast seems to exhibit continued growth in all scenarios.[3] Figure 1 indicates the average annual percent growth rates by BEA region for population between 1975 and 1990 as projected by MULTIREGION. Figure 2 provides the actual annual percent change between 1970 and 1980 as a comparison. The pattern of population growth is shifting both west and south. In particular, Florida and Texas and most of the major metropolitan areas of the south are projected to continue growing throughout the 1980's.

In contrast figure 3 indicates the average annual percent growth in manufacturing employment based on the BLS scenario. Note that manufacturing employment is projected to be moving south and not west. This may be explained by the fact that population growth in the west is expected to be more from new mining activity and service activity rather than manufacturing. The net result is that the South's share of manufacturing will continue to rise in the 1980's. The reasons for this growth are: better access to markets, relatively cheap labor, climatic amenities, and the ready acceptance of industrial growth as a desirable trend by the region's residents.[4] In addition, many older industries in the north have amortized most of their original capital investment and in the process of rebuilding, have decided to move south rather than reinvest locally.

## CHOOSING THE APPROPRIATE ENERGY DEVELOPMENT PATH

With such an optimistic future, an obvious question is why should the South be concerned about energy? The answers are evident. First of all, the character of economic development is closely tied to resource availabilities, and this includes energy.[5] Second, the rapid rise in world prices since 1973 has had significant impacts on the U.S. economy.[6] Third, the heavy reliance on imported oil is the basis of "the energy crisis," and fourth, the Southeast imports most of its oil and natural gas. To

the degree that the Southeast is dependent upon oil and natural gas, it is vulnerable to an interruption in foreign and domestic imports.

Only two states in the region are energy exporters, Kentucky and Tennessee. Kentucky exports mostly coal but also some electricity. Because of the Tennessee Valley Authority (TVA), Tennessee has become a significant producer of electricity and, given policy changes, could become an exporter in the future. (TVA is prohibited by charter from selling power outside its multi-state service region except in emergencies.) The other states, North Carolina, South Carolina, Georgia, Alabama, and Mississippi, are all importers. Florida, also an importer, is a special case that will be discussed later.

A final point on this subject, it is important to note that in the event of a major oil interruption, the Southeast only has 4% of the U.S. refinery capacity, and even though other regions undoubtedly will share their oil, the internal refinery capacity may be a significant factor in the allocation process and the regional price of refined products. It is clear that the U.S. and the Southeast in particular, must get away from dependence upon oil as an energy source.

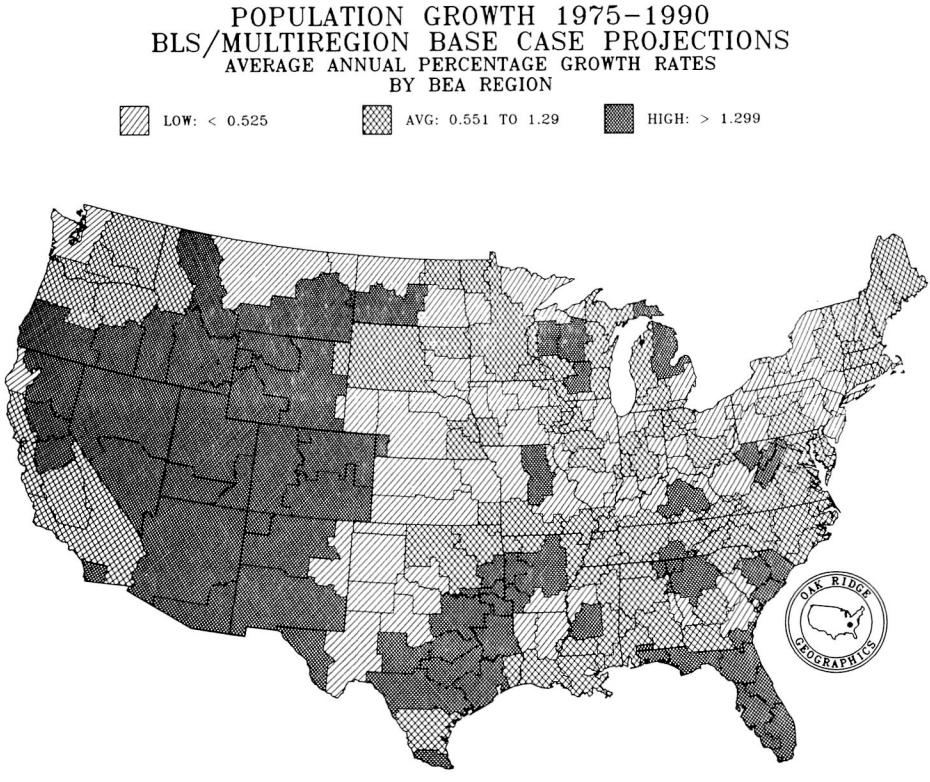


*Figure 1. Percent annual change in population growth by Bureau of Economic Analysis regions 1975-1990.*

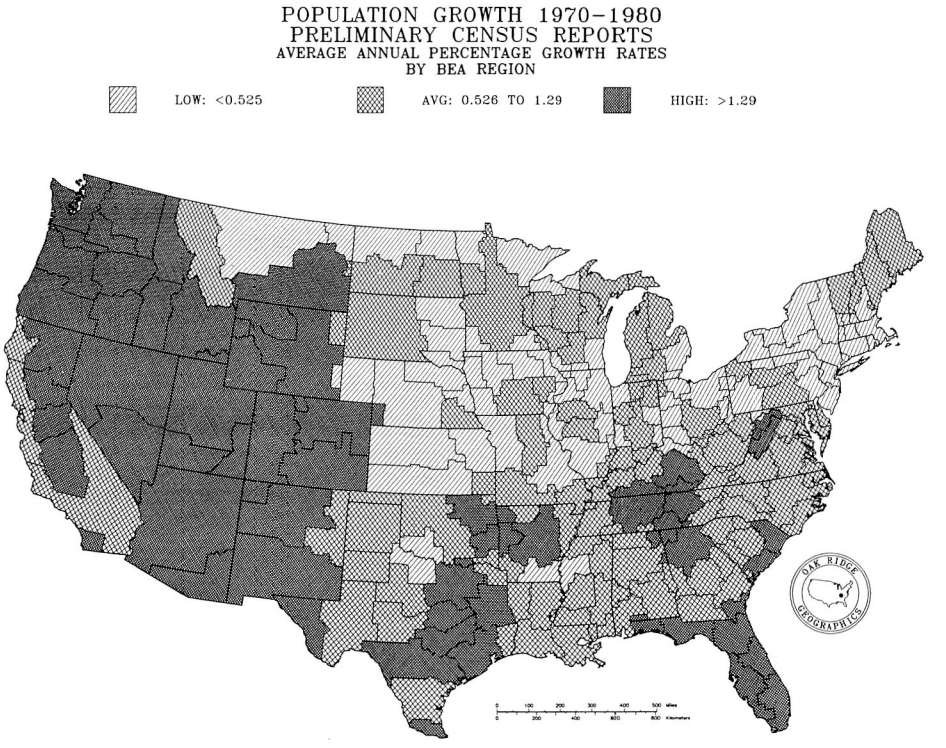


*Figure 2. Actual percent annual change by Bureau of Economic Analysis regions 1970-1980.*

## WHERE SHOULD THE ATTENTION BE FOCUSED

What can the U.S. and the Southeast do to become less dependent on foreign oil? One thing is to produce more domestic oil. The Southeast, however, lacks any significant petroleum reserves and those areas producing are generally in a declining state. Other appropriate responses are to increase conservation efforts and to substitute other domestic energy sources for oil. Conservation is considered one of the most abundant untapped resources that has only begun to be developed. In shifting to other energy sources, one direction is to move to electricity if it is not produced by oil and natural gas. This implies a move to more coal or nuclear energy for producing electricity. The Southeast also has a large solar energy potential that is particularly important in Florida.

With all these options the question becomes, where should attention be concentrated? In 1978, six end uses accounted for over 70% of the nation's oil consumption. In order of diminishing importance, these six use areas are: atuomobiles, residential/commercial, trucks, electric utilities, industrial process heat, and industrial boilers.[7]

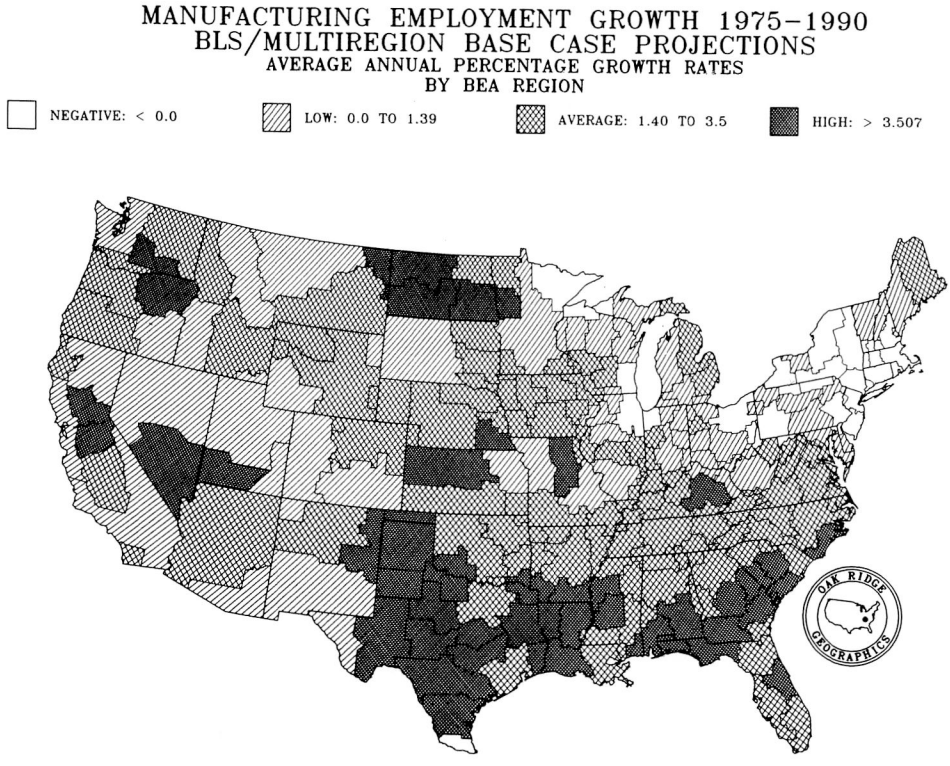


*Figure 3. Percent annual change in manufacturing employment growth by Bureau of Economic Analysis regions 1975-1990.*

| | Million of barrels of oil/day |
|---|---|
| Automobiles | 5.2 |
| Residential/Commercial | 2.2 |
| Trucks | 2.1 |
| Electric Utilities | 1.5 |
| Industry Process Heat | 1.3 |
| Industry Boilers | 1.1 |

Although one cannot foresee the Southeast states taking major action in each of the areas, there are some end uses where action should be focused. But, before discussing these actions it is useful to have a perspective on the present trends in the region in terms of fuel use. The Southeast is not as dependent upon oil as some regions of the U.S. In 1978, oil use was only slightly above the national average, 51% vs. 48%. It should be no surprise that the most heavy user of oil was the Northeast with 71% of their energy

use based upon oil. Interestingly, 71% of the total energy consumption in Florida was accounted for by oil. In fact, Florida alone accounted for 30% of oil use in Region IV.[8]

A favorable trend is that the Southeast is becoming more reliant upon electricity. For example, per capita consumption of electricity in the residential sector was 129% of the national average in 1979. Also, the Southeast is ahead of the nation in the use of coal, 26% for the region vs. 18% for the U.S. in 1979. For large boilers the Southeast is even better off in coal use, 26% for the region vs. 18% for the U.S. as a whole.[9]

In terms of fuel substitution to provide electrical generation, the Southeast is ahead both in practice and in capability. In 1979, the Southeast produced 66% of its thermal electricity by coal compared to 55% for the U.S. In contrast, only 13% of the electricity consumed in the region was produced by oil compared to 15% for the U.S. Florida accounted for 11% of the total oil use for producing electricity in the Southeast. Also, the use of nuclear power to produce electricity in the Southeast is above the national average, 16% vs. 13%.[10]

The advantage of shifting to coal use in large electric utility boilers is becoming increasingly apparent. Recent data (1980) indicated that electricity produced from oil costs $5.20 per million Btu vs. $1.53 per million Btu for coal.[11] In 1979 the average monthly residential bill for the region was one of the lowest in the U.S.—$33.39 for the region vs. $43.17 for the U.S. The Mid-Atlantic DOE region had the highest monthly bill—$54.88.[12] These data are based on a residential use of 1000 kWh per month.

The potential for developing additional electrical generation capacity in the Southeast exceeds almost all other regions of the U.S. The south has more acceptable sites (excluding Florida) for locating new power plants than any region of the U.S. and is generally more receptive to new power plant construction than other U.S. regions. Much of this ideal site suitability is associated with good water availability throughout the South which fares better in this respect than any other region of the U.S. except the Northwest.

TABLE 1.

Trends in steam electric generation capacity by fuel type for Federal Region IV (without Florida included and with Virginia added), 1980-1990

| (steam only) | 1980 | Percent (wo/Fl) | [w/Va] | 1990 | Percent (wo/Fl) | [w/Va] |
|---|---|---|---|---|---|---|
| Coal | 61 | (72) | [59] | 51 | (55) | [49] |
| Nuclear | 20 | (21) | [21] | 37 | (41) | [38] |
| Oil | 17 | (4) | [18] | 11 | (2) | [12] |
| Gas | 2 | (3) | [2] | 1 | (2) | [1] |

Source: ORNL's Generating Unit Reference File, February 1980.

Recent data indicate that in terms of what the electric utilities have planned for new generation capacity they are moving in a desirable direction in fuel choice. Table 1 presents a comparison of steam electric generation capacity by percent fuel type between 1980 and 1990. Note that coal and nuclear capacity become more equal in percent between 1980 and 1990 while oil and gas capacity both decline in percent. Even when we include Virginia, which is heavily dependent upon oil, the trends remain the same.[13]

## FUEL SWITCHING POSSIBILITIES IN INDUSTRY

In addition to the utility sector, the Southeast also has fuel substitution (or switching) capabilities in the industrial sector. In 1975, it was estimated that 23% of the regions large boilers used oil while 28% burned natural gas.[14] Recent studies have indicated that it is economical now for many of these boilers to be totally replaced with coal-fired units.[15] This is not intended as a blanket statement, however. Any decision to convert to burning coal will be tempered by the fact that many of these industries will have to purchase coal at higher "spot prices" and that many industries lack coal handling capabilities. These additional costs together with air pollution control costs may prolong the use of fuels such as oil and natural gas, particularly in the case of industries located in urban areas.

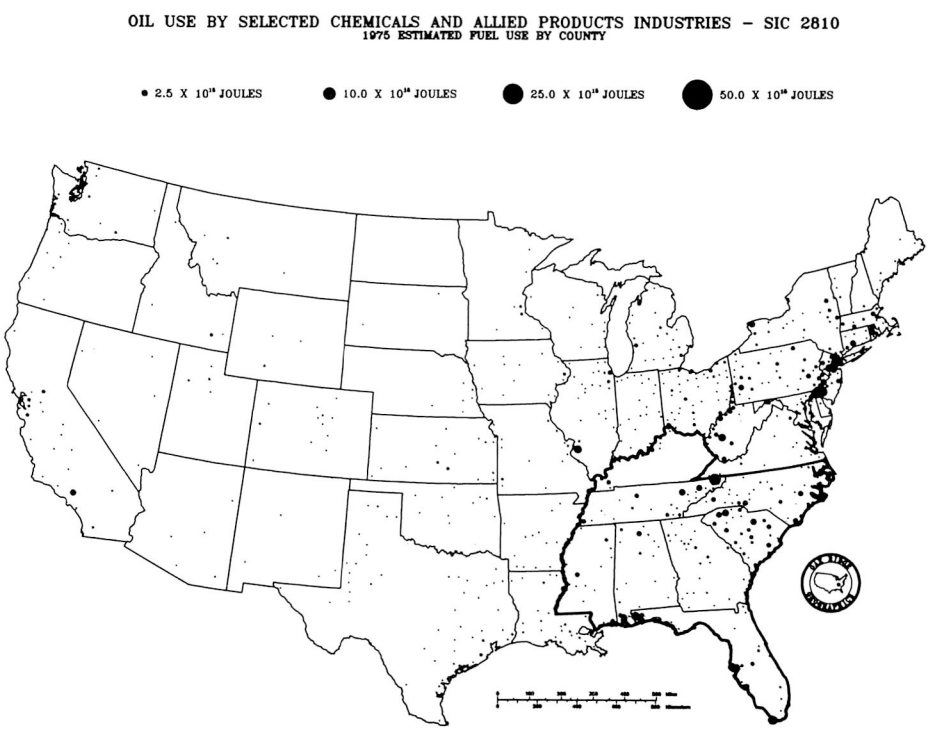


*Figure 4. Estimated oil use by selected chemical and allied products industries by county—1975.*

TABLE 2.

Industries ranked by various measures of energy use.

| SIC | SICNAME | Total Energy Consumption/Dollar of Value Added | Total Energy Consumption/Dollar of Shipments | Total Energy Consumption/ Employee | Total Energy Consumption | Total Quantity Fossil Fuel Consumption |
|---|---|---|---|---|---|---|
| 3274 | Lime | 1 | 1 | 3 | 18 | 14 |
| 3241 | Cement Hydraulic | 2 | 2 | 2 | 5 | 5 |
| 2895 | Carbon Black | 3 | 8 | 6 | 76 | 65 |
| 3334 | Primary Aluminum | 4 | 5 | 5 | 7 | 13 |
| 2873 | Nitrogenous Fertilizers | 5 | 3 | 1 | 8 | 6 |
| 2823 | Cellulosic Man-Made Fibers | 6 | 12 | 28 | 29 | 27 |
| 2812 | Alkalies & Chlorine | 7 | 6 | 4 | 10 | 11 |
| 3251 | Brick & Structural Clay Tile | 8 | 4 | 33 | 33 | 28 |
| 3333 | Primary Zinc | 9 | 14 | 17 | 70 | 60 |
| 2631 | Paperboard Mills | 10 | 10 | 11 | 4 | 4 |
| 3331 | Primary Copper | 11 | 48 | 19 | 22 | 21 |
| 3313 | Electrometallurgical Products | 12 | 13 | 14 | 30 | 52 |
| 2661 | Building Paper & Board Mills | 13 | 11 | 26 | 56 | 49 |
| 3275 | Gypsum Products | 14 | 17 | 24 | 49 | 46 |
| 3259 | Structural Clay Products, Nec. | 15 | 7 | 36 | 109 | 94 |
| 2621 | Papermills, Except Building Paper | 16 | 19 | 21 | 3 | 3 |
| 2063 | Beet Sugar | 17 | 21 | 12 | 19 | 15 |
| 2813 | Industrial Gases | 18 | 9 | 9 | 24 | 35 |
| 2865 | Cyclic Crudes & Intermediates | 19 | 25 | 15 | 9 | 8 |
| 2075 | Soybean Oil Mills | 20 | 147 | 23 | 44 | 42 |
| 2869 | Industrial Organic Chemicals, Nec. | 21 | 18 | 8 | 2 | 2 |
| 2819 | Industrial Inorganic Chemicals, Nec. | 22 | 15 | 18 | 6 | 7 |
| 3332 | Primary Lead | 23 | 61 | 22 | 133 | 110 |
| 3211 | Flat Glass | 24 | 16 | 34 | 33 | 30 |
| 2816 | Inorganic Pigments | 25 | 22 | 27 | 39 | 37 |
| 2611 | Pulpmills | 26 | 20 | 13 | 20 | 20 |
| 3312 | Blast Furnaces & Still Mills | 27 | 34 | 32 | 1 | 1 |
| 3221 | Glass Container | 38 | | 40 | 12 | 10 |
| 2824 | Organic Fibers, Non-Cellulosic | 43 | 47 | 47 | 13 | 12 |
| 2821 | Plastics Materials & Resins | 48 | 52 | 31 | 11 | 9 |
| 3714 | Motor Vehicle Parts & Accessories | 185 | 179 | 175 | 14 | 17 |
| 3711 | Motor Vehicles & Car Bodies | 206 | 382 | 149 | 16 | 16 |

The Petroleum Refining Industry (SIC No. 2911) is not included as it is modeled as a separate component.

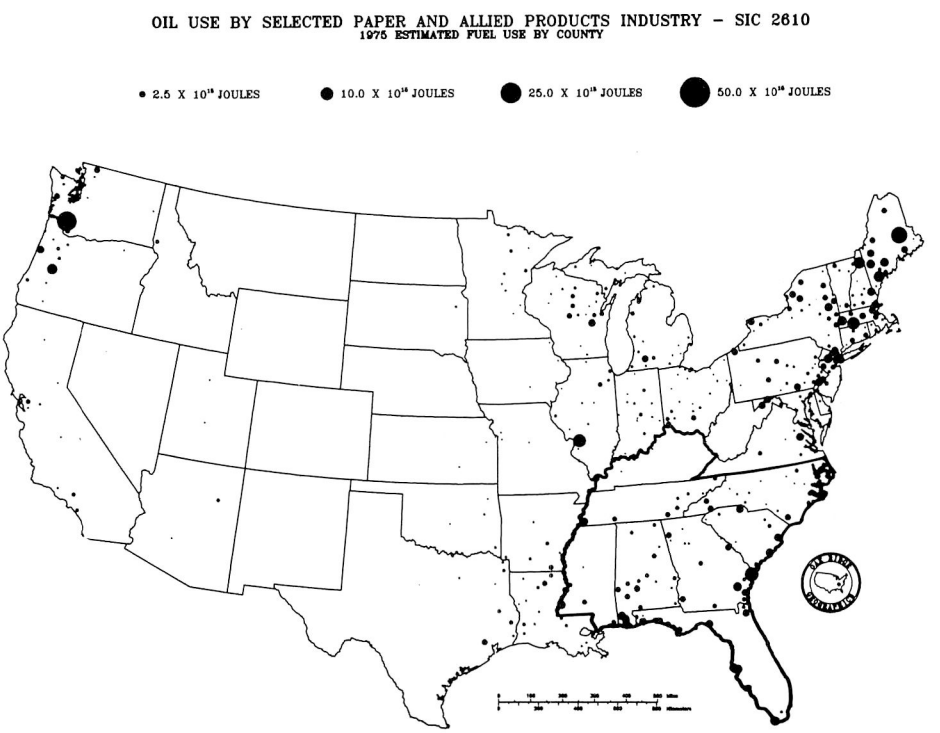


*Figure 5. Estimated oil use by selected paper and allied products by county—1975.*

Obviously then, not all industries in the Southeast are candidates for fuel switching. Where should the attention be focused? In an ongoing study for DOE, ORNL staff have been examining the energy use characteristics for a number of industries. Thirty-two of the most energy intensive industries in the U.S. have been isolated for analysis (Table 2). By energy intensive we are referring to measures such as fuel use per employee or fuel use per unit of value added. Of the total fuel use accounted for by these 32 industries (approximately 60% of the U.S. total) the Southeast accounts for only 17%. But of this 17% there are three large oil and gas consuming industries that are excellent candidates to switch to coal. These are the Organic/Nonorganic Chemicals, the Wood and Paper Products, and the Primary Metals industries.

Recent data accumulated at ORNL indicates that these industries are moving rapidly to the use of alternate fuels. One of the largest fuel users in the Organic/Nonorganic Chemicals sector is Tennessee-Eastman located in Kingsport, Tennessee. Tennessee-Eastman recently announced a decision to install a coal gasifier to produce feed stock for certain processes as well as to produce steam.[16] Also, recent studies indicate that wood products industries are moving rapidly to convert their boilers to burn the residuals from the manufacture of wood products. The National Forest Products Association reported that of the total energy consumed by 14 major

corporations in 1979, over 70% of the energy use was from barkwood residue and other waste.[17]

Figures 4-6 indicate a county-level estimate of oil use by these industries (the Organic Chemical industry, Paper Products industry, and the Primary Metals industry) as well as their distribution across the U.S. and the Southeast. Figures 7 and 8 show the county-level distribution of fuel use for all 32 industries in terms of both oil and natural gas.[18] It is important to note that these data are estimates of fuel use based upon 1975 state fuel use data from the Annual Survey of Manufacturing. Because of disclosure problems some errors are likely.

## THE TRANSPORTATION SECTOR

One important fuel use sector with the potential to either save fuel or move to alternate fuels is the transportation sector. The Southeast population possesses some unusual travel habits. For example, construction workers in the South tend to travel long distances to work. Also, long haul trucking is prevalent in the Southeast. Another characteristic of the Southeast is that the cities tend to suffer from urban sprawl which makes it difficult to implement any type of mass transit system. Obviously correcting these problems is not going to be achieved in a short period of time. In fact some studies indicate that it will take 20-30 years before any effective

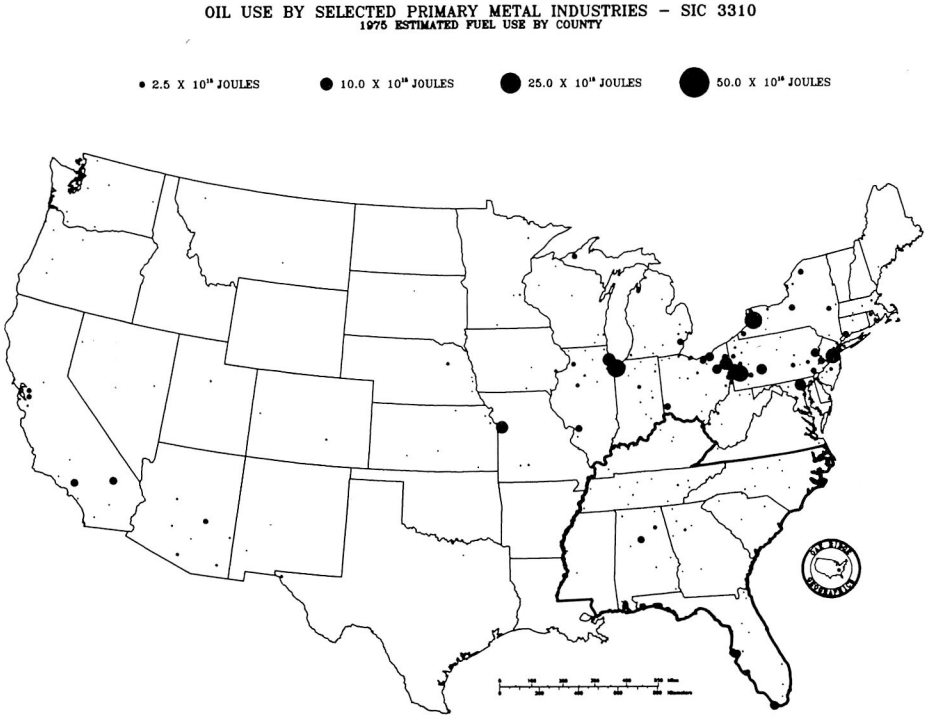


*Figure 6. Estimated oil use by selected primary metals industries by county—1975.*

programs can bring about change in urban commuting habits and one particular study has indicated that, despite increased fuel costs, urban sprawl will continue.[19]

There is one transportation end use category, however, where the Southeast has room for improvement. This is in personal vehicle gasoline consumption. Figure 9 indicates a 1978 estimate in personal vehicle gasoline consumption per household, by state for the U.S. Note that all states in Region IV are above the national mean consumption per household and that Georgia and South Carolina are 10-20% above the mean.[20]

A recent study completed at ORNL indicated that through improved fuel economy alone the efficiency in U.S. automobiles by 2010 will be 3.5 times that for 1978. (For the analysis a 5% increase in personal vehicle miles traveled over 1978 was assumed.) This translates into an average automobile fleet fuel economy of 49 miles per gallon. Because of a present high consumption of gasoline per household, the benefits in fuel saving could be significant for the Southeast.[21]

## COSTS AND PROBLEMS

None of these changes in fuel use discussed previously will occur without costs or creating problems. Southern Florida is a particularly serious problem. In many respects, Southern Florida is unique compared to the

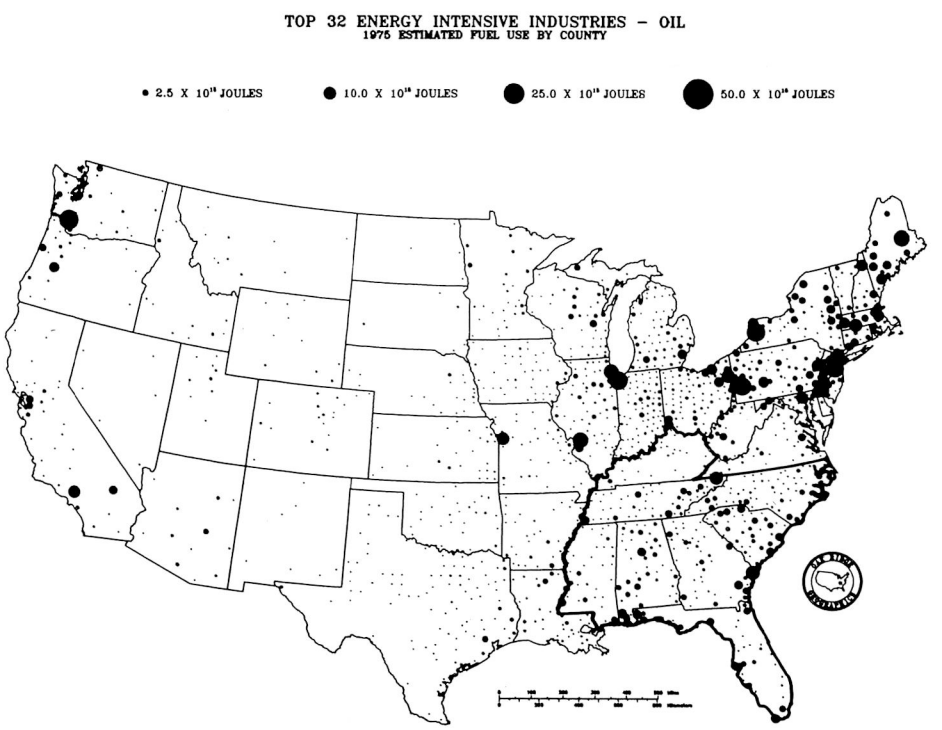


*Figure 7. Estimated oil use by 32 energy intensive industries by county—1975.*

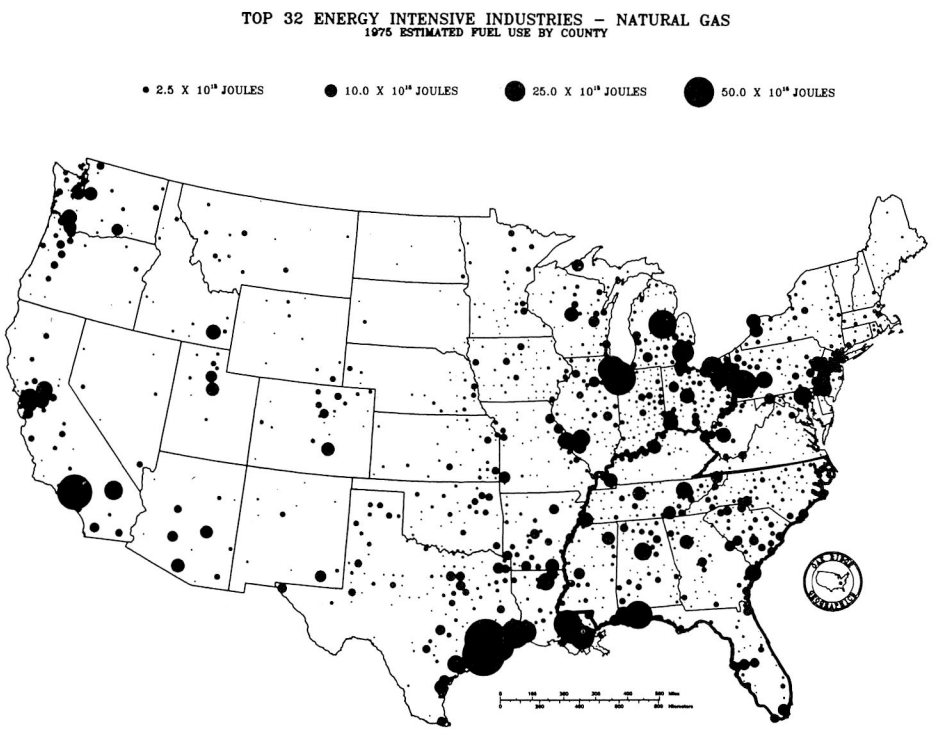


*Figure 8. Estimated natural gas use by 32 energy intensive industries by county—1975.*

remainder of the Southeast. Changing to other fuels such as coal in the electric utility sector undoubtedly will aggrevate existing air quality problems in Florida and air pollution abatement costs will be high. One option in these areas is to construct nuclear power plants but public concern may prevent this from occurring. Regardless of the fuel type, a more serious problem is that Florida is and will continue to suffer from acute water availability problems. Even if the states utilities can build new power plants there may not be enough fresh water for cooling purposes. The option may be to use brackish water for cooling, but even this option may be limited because of ecological and cost problems.

Another solution to the problem in southern Florida may be the connecting of the power grid to the remainder of the Southeast. A recent ORNL study indicated that if other southeast utilities (such as TVA) were permitted to export electricity to Florida the result might bring about a reduction in electricity rates for both the exporting utilities and the importing utilities.[22] This solution is limited, however, because existing transmission lines allows only a 600 Mw (1979) displacement of electrical generation capacity between northern and southern Florida although new connections are being constructed.

Energy development problems in the Southeast are not confined to Florida. If the trends in constructing coal-fired power plants continues, the Ohio River Basin may become the acid rain basin of the U.S. The

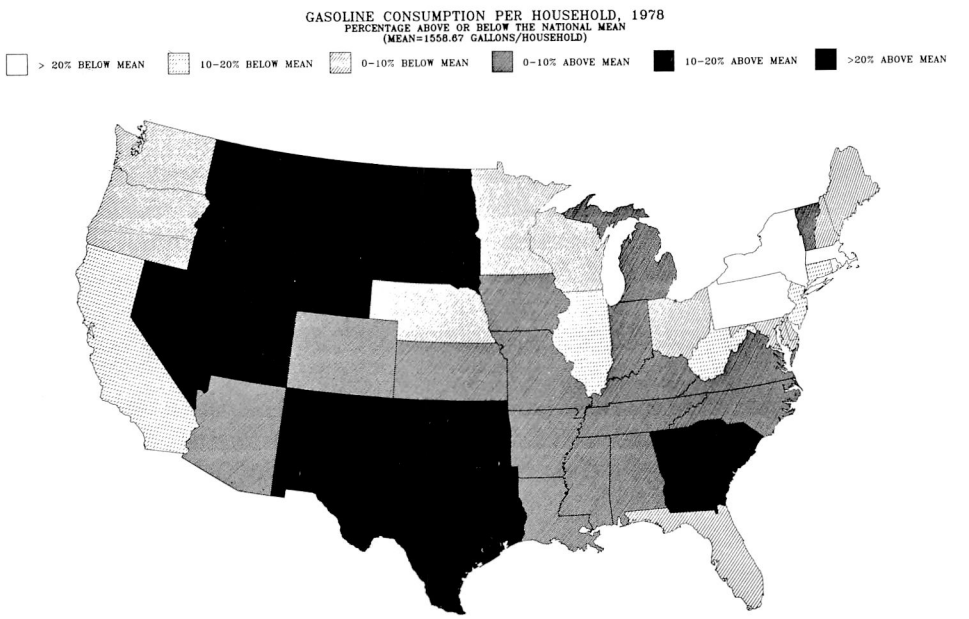


*Figure 9. Average annual gasoline consumption per household by state—1978.*

impacts from this problem are believed to extend across the northeast U.S. and into Canada. ORNL studies also indicate that long-range visability will degrade further in the East particularly in the Smoky Mountains and the Everglades because of an anticipated increased use of coal.[23] Increased development and urban growth in the Southeast will put additional pressure on the land and water resource base of the Southeast. Surface mining impacts will certainly be more significant if the forecasted increased production levels are realized. Some groups are beginning to question the wisdom of this path. Finally, it should be noted that the nuclear waste disposal problem still has not been solved and although it is not as critical an issue as in other regions it must be addressed before the future of nuclear power is assured.

## CONCLUSIONS

In summary, the energy outlook for the Southeast can be said to be optimistic. The Southeast's vulnerability to an oil interruption is decreasing and as this discussion has indicated, the region has the capability to move away from oil and appears to be doing so. Again, southern Florida requires special attention, but the problems are not insurmountable. Finally, if one can take comfort in the plight of others, the Southeastern states may be squeezed in an oil emergency, but they should be better off than most U.S. regions in meeting the emergency.

FOOTNOTES

[1]Personick, Valerie A., "Industry Output and Employment: Bureau of Labor Statistics' Projections to 1990," *Monthly Labor Review*, April 1979, pp. 3-14. (GNP growth rates were 1977-80—4.3%; 1980-85—3.6%; and 1985-90—3.7%)

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[4]Olsen, *op cit.*

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[11]*Ibid.*

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[13]This data were derived from the Generating Unit Reference File (GURF) which is annually updated by the Energy Information Administration in DOE.

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[15]Livingston, *op. cit.*

[16]Personal communication with Richard W. Barnes, Building and Industrial Energy Demand Group, Data Analysis Section, Oak Ridge National Laboratory.

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