

Introduction

During the recent winter months, North Carolinians, along with other Americans, have witnessed a crisis few believed could have happened. During a time of relative stability in the international petroleum market, this state and nation suffered a severe energy shortage. The culprit: a crippling winter.

In North Carolina, where 99 percent of all energy resources are imported, an energy crisis was declared because of natural gas, fuel oil, and kerosene shortages. Domestic thermostats were lowered to 62°F. Commercial businesses cut operation to 48 hours a week. A four day work week was initiated where possible. Several citizens froze to death in Durham from inadequate fuel oil supply. Some industries shut down. Workers were laid off their jobs.

Other parts of the nation paid a greater price than North Carolina. In Ohio over 5,000 plants closed. In the eastern industrial states and the Northeast, schools recessed, industries shutdown, and commerce was paralyzed. Nationwide, by the end of January, over 1.5 million people had been laid off from their jobs due to the energy shortage.

Direct and decisive action was taken. President Carter requested and received emergency powers from Congress to intervene in intrastate natural gas shipments to provide emergency home heating gas to areas most in need. At the state level, Governor Hunt declared an energy crisis and exercised his powers to mandate and encourage stringent energy conservation measures.

It appears the storm will be weathered. But, the rainy season is just beginning. The events of the recent winter months point inexorably toward one simple fact: a long term shortage of existing energy supply is emerging. Our natural energy resources are finite, and they are being consumed at a quickening pace. According to the Hubbert curve, widely recognized as a reasonable assessment of petroleum resources, this nation's petroleum production began to decline in 1971. The Energy Policy Project of The Ford Foundation, *A Time to Choose: America's Energy Future* indicates the decline in natural gas production could be permanent. Only a few sites remain for additional hydro-electric generation. Coal reserves appear to be adequate for the next century, but can only be used at substantial environmental cost. The volatile debate on the safety of nuclear power still rages.

In North Carolina, the ramification of such an energy shortage would be profound. The special character of the state's highly dispersed and small-sized settlement patterns could create severe problems. The now popular practice of participating in the best of both worlds, that is living in the country or a small town, while working in one of the state's larger cities, requires heavy

dependence on automobiles and few opportunities for mass transportation. As petroleum supplies continue to dwindle and prices climb, something will have to give. Accentuating this spatial problem, will be the population and employment growth North Carolina must expect as a Sunbelt state. If the economy is to continue to thrive, energy consumption by the commercial and industrial sectors will most likely continue to grow—certainly a perplexing dilemma as existing energy sources become more scarce.

What this adds up to for North Carolinians, and for that matter, all Americans, is that state and national attention must focus more directly upon energy supply and use. Energy and energy-related policies must be rethought and reformulated over the next decade. Certainly, it will not be an easy task, or one to which any group has a monopoly on the best solution. Therefore, a competent and far reaching planning effort must be launched. Sensible goals must be established, accurate information gathered, research stepped up, and serious conservation efforts tested. Our policy makers must be well informed in making energy-related decisions.

Admittedly, such an effort is more easily recommended than done, for Congress and the state legislature have been afforded previous opportunities to formulate long-term energy policy and have accomplished little. It seems as though few politicians have been willing to require the abrupt and difficult changes a sensible policy will make in lifestyles. Unfortunately, this past winter, the nation suffered from longstanding Congressional inertia and lack of direction. Action must be taken swiftly and directly. Programs must be launched to determine optimal energy relationships. Conservation efforts must be initiated. And, research for alternative technologies must be advanced dramatically.

This issue of *carolina planning* focuses on energy. The magazine's coverage includes a number of policy alternatives pertinent to state, local, and national decisionmakers in their deliberation over the energy problem. To provide some background information, the periodical begins with a short look at energy patterns and the institutional arrangements presently existing in North Carolina to manage resources. Next, an article and comment discusses national and state strategies for combatting a future petroleum crisis like the 1973 Arab oil embargo. Then, the benefits of a peak load pricing scheme are explained and proposed for North Carolina utilities. Following, are three articles on two widely discussed alternative energy forms: the Liquid Metal Fast Breeder Reactor and solar energy. The magazine concludes with an elaboration on energy conservation and the special role local governments might play in the effort. This collection, we feel, provides a broadly-based, yet in-depth assessment of important aspects of the state's and nation's energy problems, from the point of view of the planner, government official, and citizen.

Craig Richardson

An Overview: Energy and Policy

Over the past three decades, North Carolina, like the rest of the nation, has seen a spectacular rise in the consumption of energy. What are the major forms of energy use in North Carolina? Basically, the state's power comes from four sources: electricity (which is generated from coal, nuclear, hydroelectric, and fuel oil power), natural gas, gasoline, and fuel oil. How do the trends for each source measure up, and what plans are being made for management of the state's energy resources? The following description presents a brief overview of the existing situation, in terms of demand and supply of existing resources, and their management, in order to provide background information for this energy issue.

Electrical Consumption

Electricity, the major source of energy in the state, allows a detailed description of use through universal and use specific

metering and studies of appliance usage. Between 1940 and 1970, consumption of electricity in the state rose 800 percent, and per capita electricity use increased 600 percent.¹ As Figure 1 indicates, this exponential growth is evident in all sectors of consumption since 1960. The residential sector experienced an annual growth rate of 13.4 percent in the consumption of electricity from 1960 to 1973.² This can be accounted for primarily by increasing appliance saturation (televisions, washers, dryers, freezers and refrigerators)—especially in the use of air conditioning, and a 2000 percent increase in the use of electricity for space heating in the same time period. Space heating and cooling, and the heating of hot water account for about 90 percent of residential electricity use.

A 400 percent increase in the use of electricity in the commercial sector is attributable largely to the same factors—increased use of

air conditioning being the most notable. A 300 percent increase in the use of electricity in the industrial sector reflects the changing industrial mix in North Carolina to more energy intensive industries and technologies, as well as an industrial growth rate above that of the nation as a whole.

Electrical Supply

99 percent of North Carolina's electrical energy is generated by four class A (gross operating revenues greater than 2.5 million dollars annually) electric utilities. The four, Duke Power Company, Carolina Power and Light Company, Virginia Electric Power Company and Nantahala Power and Light Company are all investor owned utilities, and all except Nantahala provide substantial service outside the state. In the period from 1950 to 1973 they increased their total installed capacity by 2000 percent.

Up until 1973, when Duke Power opened their first nuclear plant, two-thirds of North Carolina's electrical generation was fired by coal; natural gas, fuel oil, and hydro-electric power accounted for the remaining third. This differs substantially from the nation's electrical generating mix which had only 46 percent of its generating capacity in coal burning plants.

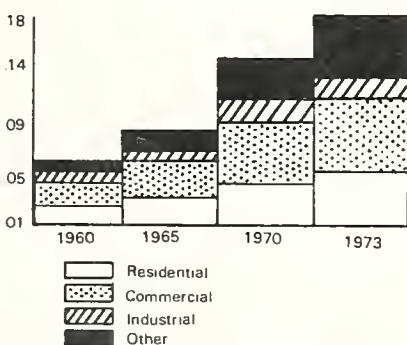
Nuclear power currently accounts for approximately 20 percent of the total electrical generating capacity in North Carolina. Both the Duke Power Company and Carolina Power and Light Company have planned exclusively nuclear development over the next 15 years. Duke has announced their intention to build 7300 megawatts of installed capacity by 1990. Engineering sources at Duke Power have indicated that their decision to move toward nuclear power was based solely on a fiscal benefit-cost analysis.³

Natural Gas Consumption

Natural gas, which did not appear as a viable energy alternative in the state until the pipeline infrastructure was completed in 1958, has risen 300 percent in that short period of time. The industrial sector is the major consumer of natural gas in North Carolina (see Figure 2); its firm and interruptible industrial customers accounted for 70 percent of natural gas consumption in 1974.⁴ The boilers and dryers of the textile industry burned up 35 percent of the natural gas. The fertilizer industry used 7.5 percent of the total as raw material in the production of nitrogen fertilizers. The state's other major consumers are the chemical, stone, glass and clay industries. Together, these activities account for 70.3 percent of the natural gas used in industry.

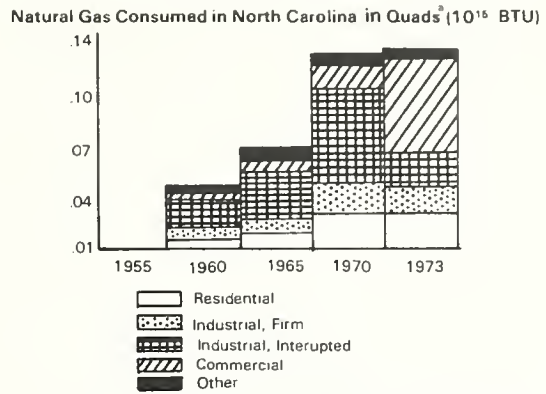
Natural gas consumption in the residential and commercial sectors was mostly for space and hot water heating. In 1972, natural gas accounted for 20.1 percent of residential space heating needs. This was up from five percent in 1960.⁵ Total residential and commercial use of natural gas, as well as industrial use has been rising

Figure 1
Electricity Consumed in North Carolina in Quads^b (10¹⁵ BTU)



a. Source, North Carolina Utilities Commission, 9th Annual Statistical and Analytical Report, 1974
 b. Coal-fired fossil fuel steam plants accounted for 86.7 percent of all coal consumed in North Carolina in 1975. Source: Center for Development and Resource Planning, Research Triangle Institute.
 Drawing by Dan Fleishman

Figure 2



a. Source, The North Carolina Utilities Commission, 9th Annual Statistical and Analytical Report, 1974

Drawing by Dan Fleishman

steadily. However, North Carolina differs drastically from the national pattern in that 13 percent of its energy consumption consisted of natural gas in 1974, in contrast to 39 percent for the nation as a whole. Before 1975, the growth of natural gas use was predicted to be 3.15 percent⁶ per year, but the shortage this winter and the consequent price should force a shift to use of other fuels.

Natural Gas Supply

There are four class A (gross operating revenues over 1 million dollars), one class B, and eight municipal gas companies serving North Carolina.⁷ North Carolina Natural Gas Corporation, North Carolina Gas Service, Division of Pennsylvania and Southern Gas Company, Piedmont Natural Gas Company, Inc., Public Service Gas Company, and United Cities Gas Company North Carolina Division are all served by Transcontinental Pipeline Company, the sole gas supplier to the state. Transco, as it is known, buys gas in Louisiana and Texas, and pipes it to North Carolina for resale to these companies. They in turn sell it directly to the public as well as to the eight municipal gas companies and electric companies that serve the state.

Gasoline

The 350 percent rise in the consumption of gasoline (see Figure 3) is a result of the increased dependency on the use of automobiles and trucks. This has paralleled a decline in the state's already underdeveloped mass transportation system.

Fuel Oil Demand

Fuel oil use in North Carolina is spread across all sectors of the economy. It is used in homes, commercial and institutional buildings for space heating. It is used in industrial plants for the production of process heat and on site generation of electric power. It is used in trucks, trains, and tractors of the transportation sector. And, it is used as a fuel in power plants for the generation of electricity.

There was a large rise in the demand for fuel oil in the last decade, but that trend has begun to reverse. In 1972, fuel oil (kerosene) accounted for 57 percent of residential space heating needs, but by 1975 it was down to 46 percent.⁸

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Fuel Oil Supply

North Carolina has no oil refineries or oil fields. It is dependent on other states or international sources for its petroleum products. The petroleum products are delivered and retailed by a large number of small distributors and several large suppliers.

State Involvement

North Carolina state government's involvement with energy issues was minor prior to 1973. In that year, as the possibility of a serious shortage of petroleum products became apparent, Governor James Holshouser created an Energy Panel of cabinet-level officers, and the North Carolina Legislature established an Energy Crisis Study Commission. Both bodies were to assess the probable impacts on the State of a severe energy shortage and to recommend the types of action which the state government should take in the energy area. Based on the Commission's recommendation, the legislature created a permanent North Carolina Energy Division in the Department of Military and Veterans' Affairs to conduct energy-related research and to deal with emergency fuel allocation and energy conservation. The Governor established an Energy Panel Office to work with federal officials in allocating scarce fuels.⁹

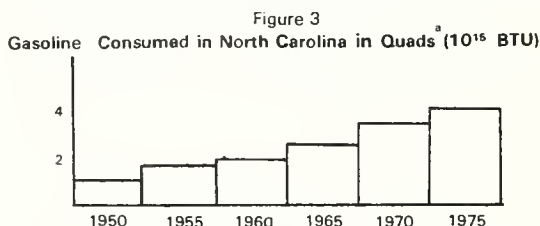
At about this same time, the Office of State Planning and the Center for Development and Resource Planning at the Research Triangle Institute were developing the first part of a State Energy Management Plan. This document, published in June 1974, describes in detail energy use patterns in North Carolina, discusses the sources of that energy, makes assessments of how much energy consumption might increase in the future if present trends continue, and estimates the savings which various energy conservation strategies or changes in human activity patterns might provide. Later stages of the same project were to have produced a comprehensive energy program for the State.¹⁰

With the end of the Arab oil embargo and the immediate fuel shortage, the energy problem slipped to a much lower priority in the minds of the public and state legislators, and the project to develop a State Energy Management Plan was abandoned. However, in 1975 the legislature did appoint a North Carolina Energy Policy Council to work on an energy policy for the State.¹¹

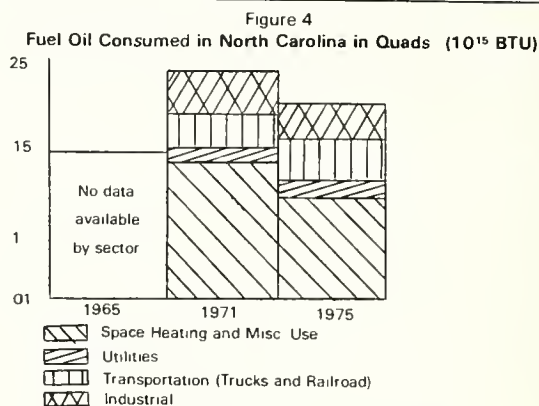
The Council has thus far been concerned with developing recommendations for the Governor and the 1977 Legislature about state energy policy. The Council is proposing plans concerning energy emergencies, energy conservation, energy management, and research and development.

The Energy Division's Activities

At present, the North Carolina Energy Division's activities are plentiful, even though it is not heavily funded. The Research Section of the Division has produced several reports analyzing energy consumption patterns in North Carolina. The Conservation Section, working with the North Carolina Building Code Council, has been active in the area of building code revision in order to incorporate energy conservation requirements in the State Building Code by January 1, 1978. In 1976 the Energy Division obtained funds under the Federal Energy Policy and Conservation Act (PL 94-163) for conservation planning in the state. The plans developed are to include conservation measures which will result in the reduction of North Carolina's projected 1980 energy con-



a. Source, the State Revenue Department, Gasoline Tax Division
Drawing by Dan Fleishman



a. Source, North Carolina Oil Jobbers Association, Raleigh, North Carolina
Drawing by Dan Fleishman

sumption by five percent. If the North Carolina Conservation Plan prepared under this Act is approved by the federal government, federal money will be made available to the state for plan implementation. A draft copy of the North Carolina plan is presently being circulated, and public hearings on the plan have been held.

State Utilities Commission

The North Carolina Utilities Commission, the oldest energy management institution in the state, is presently examining new price schemes. Experiments in peak load pricing, which is designed to "smooth" the peaks in electrical demand, may begin in North Carolina in the near future. A number of public hearings are being held on the subject. Studies are also being conducted by the Commission staff to provide independent forecasts of future electrical demands and the "mix" of types of new generating facilities needed to satisfy those demands.

These activities represent most of what is being done in North Carolina to develop energy plans and policies. A few local governing bodies, such as the Greensboro City Council and the Orange County Commissioners, have appointed Energy Task Forces to prepare energy-related recommendations for them to consider. A handful of cities including Durham and Winston-Salem, have considered or adopted Urban Services Districts, which attempt to contain urban development within a compact area for energy conservation and other reasons. However, these activities are the exception rather than the rule. The lack of a comprehensive energy program or policy at the national level has obviously affected the amount of planning being done at the state and local levels.

Footnotes

1. Dr. Jerome Kohl, "Energy and the Environment in North Carolina," Speech before the North Carolina Conference on the Environment, August 30, 1972.
2. *North Carolina Utilities Commission, 9th Annual Statistical and Analytical Report*, 1974, p. 33.
3. Don Voyles in a talk at the Department of City and Regional Planning, University of North Carolina, Chapel Hill, January 27, 1977.
4. Fowler W. Martin, *Energy Sources and Uses for North Carolina*. Prepared for North Carolina State University Energy group, December, 1976, Table 5.
5. The Center for Development and Resource Planning, Research Triangle Institute, *A State Energy Management Plan for North Carolina*, June 1974.
6. *Ibid.*, p. 9.
7. *North Carolina Utilities Commission Report*, p. 38.
8. *A State Energy Management Plan for North Carolina*
9. Warren V. Rock, "Energy Planning at the State and National Levels," in *Abstracts from Public Seminars on Energy - A National and A Local Concern*, Report Summarizing Proceedings of Seminars Held Oct. 1 to Nov. 19, 1975, Sponsored by The Department of Physics & Astronomy, University of North Carolina, Chapel Hill and the Orange County Energy Conservation Task Force, p. 1-3.
10. The Center for Development and Resource Planning.
11. Rock, "Energy Planning," p. 2.