# STUDY OF THE SUPPLY AND DEMAND

# FOR SKILLED CONSTRUCTION WORKERS

# IN TEXAS

# STUDY OF THE SUPPLY AND DEMAND FOR SKILLED CONSTRUCTION WORKERS IN TEXAS 1974 - 2000

Final Report For The
Special Project Committee
of
The State Manpower Services Council

prepared
by
The Texas Industrial Commission
May 31, 1975

# TEXAS INDUSTRIAL COMMISSION

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Special Projects Committee
State Manpower Services Council

We are pleased to present the final report of the "Study of Supply and Demand of Skilled Construction Workers in Texas, 1974-2000".

This study was initiated to determine whether the supply of skilled craftsmmen would be adequate to meet the demands of construction in the future if supply mechanisms continued to generate such workers at the current rate.

Embodied in this report are analyses of past, current, and proposed industry-related, water-related, and energy-related construction; analyses of the past, current, and future supplies of construction workers; and analyses of the demands for same. Completing the report are conclusions and recommendations.

Respectfully submitted,

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# INTRODUCTION

Construction is an industry which employs many skilled craftsmen who obtain their journeymen status after long periods of apprenticeship or other type of training. The industry is frequently faced with imbalances in manpower supply and demand and with the anomaly of concurrent shortages and surpluses, partly because of the training requirements, partly because of the fluctuating nature of construction activity and partly because the site of construction work does not remain fixed but often moves from place to place.

Reliable estimates of future construction manpower requirements are of importance to all those in the local community who are involved with construction activity. They are especially important for developing adequate manpower plans and programs and of particular interest to contractors for evaluating potential shortages or surpluses of construction workers in the areas in which they will be working; to trade unions for planning their apprenticeship programs and evaluating the labor market future for their members; and to users for evaluating potential feasibility of planned construction work.

# SECTION I

## Executive Summary

# EXECUTIVE SUMMARY

This analysis of the supply and demand of skilled construction workers includes the four following topics: supply mechanisms; supply of skilled laborers; past, current and projected construction; and manpower requirements for such construction. The types of construction are restricted to energy-related (nuclear and fossil-fueled power plants), industrial-related (petroleum and chemical plants) and water-related (dams, reservoirs and waste-water treatment facilities).

The supply mechanisms include apprenticeship training programs, vocational-technical programs and on-the-job training. The first of these sources is considered to be broad-based training while the latter two are categorized as narrow-based training. Apprenticeship training programs, though long in duration, qualify trainees to practice several different skills, thus creating a better chance for continuous employment. Despite its restrictions, narrow-based training makes its trainees available for employment more quickly.

Statistics concerning the supply of skilled labor reveals that its numbers are increasing, especially the structural metal workers, boilermakers and brickmasons. The supply of employed skilled construction workers, another important barometer, indicates employment increases of millwrights, and cement and concrete workers. At the present,

minorities represent a comparatively small percentage of the total skilled labor supply while women represent an even smaller percent.

Construction of fossil-fueled power plants is moving at a fast pace and should continue to do so, as Texas ranks first in the number of fossil-fueled units proposed for construction in the U.S. Additional energy-related construction will occur as each of the five proposed nuclear power plants receive permits from the Nuclear Regulatory Commission. Growth in the number of petrochemical plants is expected to rise as it has in the past although factual substantiation of this is unavailable. Construction of dams and reservoirs will raise their total storage capacity from the current 30 million acre-feet to over 43 million acre-feet in the next five years.

Manpower requirements in the past have been greatest in the industrial sector. Future demands will be influenced by nuclear power plant construction which requires a greater number of workers as well as requiring a greater length in construction time.

# SECTION II

## Analysis

## SUPPLY MECHANISMS

Historically, skilled construction workers have come from 3 sources: apprenticeship training programs, vocational technical programs and on-the-job training. Each of these training programs has merits as well as disadvantages.

### Apprenticeship Programs

Apprenticeship is a prescribed period of on-the-job training supplemented by related classroom instruction which is designated to familiarize apprentices with the materials, tools and principles of their trade.

The formal apprenticeship agreement calls for a training period of from 2 to 5 years and 144 hours or more a year of related classroom instruction. During this time, students receive instruction in work techniques and in tool operation. Instruction varies among the construction trades, but usually involved are courses such as history of the trade, characteristics of materials, shop mathematics, and basic principles of engineering. It also includes sketching, elementary drafting and interpretation of drawings; safety practices; and special trade theory such as color harmony for painters and elementary sanitation for plumbers.

According to the Bureau of Apprenticeship and Training, apprenticeship programs may be sponsored either by labor and management jointly or by management only. Currently in Texas, there are 637 industrial apprenticeship programs, 59% (376) of which are strictly employer-sponsored programs

while 41% or 261 are sponsored jointly by labor and management. These programs are spread over 21 building trades crafts. As of April 1, 1975, there were 13,682 apprentices enrolled in programs of which 3,258 were minorities. When compared to nationwide statistics, these figures indicate that Texas ranks 5th or 6th in the nation, a status which remains fairly stable from year to year.

Figures in Table 1 from the Texas Employment Commission's Changing Horizons, and those from the 1960 Census, sponsored by the Bureau of the Census, Department of Commerce, differ greatly. Figures for the years 1970, projected 1976, and projected 1980 from TEC are available only in terms of employment of apprentices in Texas. However, figures for both employment and supply of apprentices are available from the 1960 Census for the years 1950 and 1960. The difference between supply and persons employed is minimal. Assuming that such a small difference exists for later years as well, we can theorize that the supply and the number of apprentices employed are roughly the same. Data from the Vocational Education Annual Report, FY 1971 and FY 1972 tend to bear this out.* As indicated in Table 1 there is a great discrepancy between the Bureau of Apprenticeship and Training figures and those of TEC and of the Census. The latter two sets of figures are several times less than the former. Such differences represented one of the problems encountered in this study

*Format of the reports were changed for FY 1973 so that such data no longer are included.

and points up the need for better control of manpower information in the construction field.

Vocational Education

Vocational education falls into four groups: secondary, postsecondary, adult and co-operative programs. The curricula taught in these programs is specialized and emphasizes on-the-job instruction as well as classroom instruction. Curricula are offered that are designated to prepare workers for specific occupations.

Students enrolled in secondary programs receive in-school training for three hours a day in pre-employment laboratories. In these, students are taught the theory and manipulative skills of the trade.

The cooperative program, part of the secondary education program, combines classroom training with on-the-job training. Students attend their regular academic classes plus a co-op class related to the skill in which they are interested for one-half day; the other half is spent actually getting skill experience.

Adult training classes, usually held after school hours, are divided into three groups: apprenticeship, supplementary, and preparatory programs. Apprenticeship classes are related to a specific type of craft and are designated for persons who are already working in construction, usually a helper, and who simply wishes to have additional education in his craft. Supplementary programs are designed for

skilled workers who want to broaden their knowledge of the craft. Preparatory programs, the third subdivision of adult programs, are designed to instruct unskilled, semi-skilled or unemployed persons in a specific craft.

An analysis by levels of vocational education is in Table 2. Schools offering vocational education courses are listed in Listing 1 with an accompanying map.

On-the-Job Training

Many construction tradesmen acquire their skills informally by working as laborers and helpers and observing experienced craftsmen. The level of expertise attained is based to a great extent on the ability to absorb and master the techniques required of the craft without ever having actually received formal classroom instruction.

There are conflicting views concerning whether broad-based training is preferable to on-the-job training. Proponents of broad-based training cite the fact that such trainees will not be hampered by lack of job opportunities. Specifically, there are often times when work is not available for each construction craft. Those workers who have broad training in several craft fields are likely to work more often than the one-skilled workers. Furthermore, studies reveal that workers who have broad-based training are more likely to advance to supervisory positions.

Apprenticeship programs, however, do have their drawbacks. Specifically, the duration in time of such programs is too

extensive. Several sources indicated that the length of these programs could be shortened somewhat without affecting the quality of training.

There are pros and cons to on-the-job training as well. As mentioned earlier, the major disadvantage of such training lies in the fact that the worker is only able to perform one type of skilled labor, thus it is restrictive. However, those who are trained in this program are able to seek employment much quicker than persons receiving the broad-based training.

With the high unemployment in construction present nationwide, reports of an influx of apprentices from other states have been made. However, a survey of 55-60 building trades in April showed no influx at the apprentice level. These reports then must relate to the journeyman level. As of this writing, no documentation is available.

Based on figures for 1970 and 1975 in table 15, it appears that manpower in all crafts is increasing with the exception of 5 groups: carpenters, painters, roofers, cement and concrete finishers, and asbestos workers. The overall supply of workers, however, is increasing steadily.

The largest gain of workers has been in the structural metal workers craft with an increase of 256% or 11,510 workers. Following closely are the boilermakers with a 231% increase or 5,234 additional personnel and the brickmasons whose number has grown by 160% or 12,302 persons.

As mentioned earlier there was a decrease in the number of workers in five fields. The roofing field suffered the greatest with a loss of 68% of its work force. Serious losses also occurred with the asbestos workers whose number decreased 40% and the carpenters who lost 22% of its labor force.

Information concerning strictly supply of skilled workers available does not give a complete overview of the employment situation. For this reason, data concerning the supply of skilled construction workers employed follows.

## Supply of Skilled Employed Construction Workers

The supply of employed labor has been increasing steadily over the past 25 years with only three minor exceptions in the carpenter, brickmason, and boilermaker crafts. (See

Table 16) The supply of electricians, roofers, and structural metal workers employed has doubled in the twenty-year period from 1950 to 1970, while the supply of employed cement and concrete workers has increased two and one-half times and millwrights have almost tripled. Projections for the future indicate that this pattern of increase will continue. Percentage-wise, projected changes in the ten year period from 1970 to 1980 will be greatest for roofers, whose number will increase 57% from 4,600 to 7,200. Following these will be the concrete and cement finishers with a 53% increase. Other patterns of growth, though not so great, are noted in each of the other crafts.

Minorities in Construction

Minorities in construction have, for the most part, only been allowed to hold unskilled labor positions. The reasons for this are various. On the whole the educational level of minority group members is lower than the average for the State of Texas. Among those with little formal schooling, language is often a problem. Communication is essential, and if the channels of communication are clogged by a language barrier, those with the least knowledge of proper English are the losers. Because of this barrier, the minority worker with some on-the-job training is often not considered for advancement into the ranks of the skilled worker. Furthermore, since he does not have the proper educational background, it is felt that training him for a

craft isn't worthwhile. This applies equally to Blacks, Mexican-Americans and other ethnic groups. Interviews with construction contractors tend to bear this out. Several expressed negative feelings for employing minorities in skilled crafts, citing their lack of responsibility in handling construction equipment, inability to learn the craft, and a generally negative or indifferent attitude toward the work assigned.

Thus, it is obvious that many problems exist. However, a small percent of minorities have managed to enter the ranks of the skilled construction worker. Studies conducted by Ray Marshall and others reveal that in 1970 in Houston minorities comprised approximately 9% of the total membership of the mechanical trades union.

The study further revealed that minority membership in building trades unions has increased significantly in recent years among both apprenticeship and non-apprenticeship trained journeymen. Although as late as 1970 minorities were unionized less in construction than in any other industry, the upward trend in minority memberships in the construction crafts is unmistakable. However, the act of unionizing minority workers will not insure that they will be accepted in the skilled craft unions. More likely, these persons would be accepted into unions in which minorities are already heavily represented rather than into mechanical trades where their participation is low.

The future for minorities in construction work is not an especially bright one. The Texas Employment Commission

reports that many well-qualified workers will be seeking employment, making it more difficult for the disadvantaged worker to compete in the job market. Furthermore, approximately 40 percent of the persons or 664,925 persons counted in the Universe of Need will be members of minority groups in FY 1976. No breakout by occupation was included in the report. However, tables indicated that on the average the TEC places 9.4 percent of registered minorities in contract construction. Based on this percent, slightly more than 62,500 minorities will be placed in construction positions. Figures from the Bureau of Apprenticeship and Training indicate that there were approximately 3,300 minority apprentices in April, 1975. If this is considered to be the average number of workers for the year, the difference between total minorities employed and the apprentices is 59,200 persons, a large majority of whom will fill unskilled positions.

Women in Texas Construction

Women in 1960 comprised only 3.6 percent of the experienced civilian labor force aged fourteen years and over in the Texas construction industry, but women made up 31.7 percent of the total labor force. Female workers by 1970 had gained larger shares of the experienced civilian work force in Texas in almost all sectors. Women made up 37.2 percent of the total labor force, and their numbers in construction in 1970 amounted to almost 6 percent of the

total. Of the more than 510,000 women added to the labor force in Texas in the decade of the sixties, less than 8,600 (only 1.7 percent) new female workers entered the construction industry. Few significant opportunities for women existed in construction until recently, however, and this fact is borne out by the insignificant improvement in the situation of women in construction between 1960 and 1970.

Percentage-wise, women's share in crafts in the 1960s increased most rapidly in cement and concrete finishing, in roofing, and especially millwright work. In terms of actual numerical increases, carpentry, electrical work, and painting ranked highest. The dominant female job category in the building industries in this state, however, remains "clerical and kindred workers".

Occupational Shortages

Occupational shortages are compiled by manpower area for each month and distributed by the Texas Employment Commission (see Listing 3). For March, 1975, this document indicates the following shortages:

Boilermakers - Houston

Carpenters - Amarillo; Houston; Longview-Marshall; Lubbock; Waco.

Electricians - Abilene; Brownsville-Harlingen-San Benito; Corpus Christi; Longview-Marshall; Texarkana; Tyler.

Heavy Equipment Operators - Galveston-Texas City; San Angelo.

Operating Engineers - Beaumont-Port Arthur-Orange; Midland-Odessa.

Pipefitters - Amarillo; Longview-Marshall; Beaumont-Port Arthur-Orange.

Plumbers - Houston; Midland-Odessa; Tyler.

Sheet Metal Workers - Dallas; Midland-Odessa.

The data contained in the Occupational Shortages is misleading, however. Skill levels for each of the crafts are not indicated. Additionally, there is no numerical indication of how great the shortage is, only that such a shortage exists. Such inadequacies point up the need for a better reporting system in the construction manpower field.

## Energy-related Construction

Electric power requirements in Texas are increasing at a rate which requires a doubling of electric generating facilities about every seven to nine years. These growing needs are due not so much to increasing population as to the increasing uses of electricity for all purposes, and there is little prospect that the growth rate will decline materially in the next 20 years, short of a major economic reversal or a drastic alteration in the expectations of the public.

The principal power suppliers in Texas, those having a capability of at least 100,000 kilowatts, are 10 investor-owned companies, six cities, one river authority and one electric power co-operative. These and the smaller systems (mostly municipalities) make up the total of 63 electric utilities with power plants occupying 151 separate locations in Texas. The larger plants occupy 57 sites in 39 counties of the state. Most of the major generating facilities in the state are interconnected by a transmission grid composed primarily of 345,000; 138,000; and some 69,000 volt power lines.

The total installed generating capacity of fossil-fueled plants in Texas at the end of 1971 was approximately 28.9 million kilowatts (FPC data). By March, 1975 this figure had risen to over 48 million kilowatts. Expansion of fossil-fueled power plants already completed (Table 4) added

3,636,926 kilowatts to the 1971 figure while the wattage of new power plants (Table 3) (4,911,000 kw) raised the total wattage to approximately 37.5 kilowatts. With the addition of the new power plants under construction (7,345,000 kw) (Table 5) and the power plant expansions under construction (5,114,675 kw) (Table 6) the total kilowattage was raised to about 48,972,600.

Based on these figures it appears that construction is on the rise. Indeed, information from the Contractors Mutual Association's Projected Manpower Requirements for Power Plant Construction (April, 1975) reveals that Texas ranks first in the number of fossil-fueled units proposed for construction (49 fossil-fueled units with a total generating capacity of 26,756 megawatts). (See Listing 2)

Nuclear Power Plant Construction

The availability, until recently, of low cost natural gas and the ability of the utilities in Texas to utilize lignite fuel undoubtedly has delayed the advent of the more expensive nuclear power plants. However, the economically recoverable supplies of lignite are limited and utilities have already announced studies leading towards the probable operation of five plants by the 1980s.

No actual nuclear-related construction has begun so far. However, in December, 1974 the Atomic Energy Commission issued a construction permit for non-nuclear site work to begin on the first nuclear power plant to be built in the

state. Foundation work at the Comanche Peak Power Plant near Glen Rose in Somervell County has begun. Several other of the plants are awaiting construction permits from the Nuclear Regulatory Commission, formerly the Atomic Energy Commission. Specifically, a decision on the permit for Allens Creek near Wallis is expected in September, 1975; for the South Texas Nuclear Project near Bay City in January, 1976; and for the Blue Hills Project near Toledo Bend Lake in August, 1977. According to the Nuclear Regulatory Commission construction of the latter project was postponed for 27 months (will begin construction 27 months later than originally planned.) Construction plans for the nuclear power plant near Amarillo are only in the preliminary stages. The Southwestern Public Service Company has allocated $100 million for the project. Other action concerning this project has been limited. This plant is unique in that, if built, it will have the world's first gas-cooled breeder reactor. (See Table 7 for proposed nuclear power plant construction).

Petroleum Plant Growth

The petrochemical industry in Texas is large, complex, and integrated. It exerts a strong influence on industrial activities and provides a tremendous economic impact upon the state's economy.

A recent survey identified 82 firms operating 139 petrochemical manufacturing plants in Texas. While there

are plants located in every part of the state, more than 67 percent by number and 88 percent by capacity are located in the Coastal Zone. By volume, the Texas Gulf Coast has the greatest United States concentration of chemical plants, producing more than 40 percent of every basic petrochemical, 80 percent of the synthetic rubber, and 60 percent of the nation's sulfur. By conservative estimates, the total production of petrochemicals in Texas in 1971 was between 75 and 85 billion pounds. Ethylene is produced in greatest quantity, with propylene and benzene next.

Future demand for petrochemicals will depend primarily on the growth of plastics, fibers, and other synthetic materials. The total demand for aromatics and olefins used in these consumer products is anticipated to range between 73 and 91 billion pounds per year by 1980. Feedstocks for ethylene production (the major petrochemical) will change from nearly all LP-gas (liquefied petroleum gas) to only 57 percent LP-gas by 1980, with the balance coming from the heavy liquids of naptha and gas-oil cracking.

Texas' petrochemical industry began during the 1920s. The 1950s and early 1960s marked the industry's greatest growth, ranging annually from 10 to nearly 20 percent. Although it dipped in the late 1960s, the growth rate for the next few years appears to be good with estimates between seven and eight percent annually. Indeed, since January, 1971, 21 new facilities have been completed 17 of which were

located along the Gulf Coast. Five of these fell into the category of "large" projects, i.e., $50 million or greater (Table 8). During this same period of time there were 28 expansions of plants already in existence of which 22 were in the coastal area. Only one of these, however, qualified as being a "large" project (Table 9).

Information on current construction projects reveals that there are some 12 new industrial plants being built with only 3 located in non-coastal areas (Table 10). It is interesting to note that 58%, or 7 of the 12, are "large" projects whereas in construction already completed since 1971 only 24% of the projects were "large". This indicates that construction in the petrochemical field is definitely on the upswing in Texas. Much activity is occurring in industrial expansion projects as well. Currently there are 22 companies undergoing expansion of their facilities, of which 6 qualify as being "large" (Table 11). This is a remarkable increase over the expansion projects completed since 1971. (4% of the completed projects fit into the category of "large" while 27% of the current construction projects are in this category.) This further substantiates the idea that the petrochemical industry is growing.

As of this writing such indications are all that is available on future construction in the petrochemical industries. Such information is not revealed to the public for several reasons, some of which include:

(1) listings are not usually compiled by private companies,

(2) any such listings, if they exist, are kept secret until all the plans for such a move are finalized, e.g., land acquired, money for construction allocated, etc.
(3) there is no state regulatory body which has the ability to certify growth of the industries.

All of these factors combine to make growth predictions difficult to document.

Lakes and Reservoir Construction

The large increase in the number of reservoirs in Texas during the past decades has greatly improved water conservation and supplies. In 1940, the Texas Water Commission reported 47 reservoirs with 5,369,550 acre-feet capacity; by 1950, the number had risen to 66 reservoirs with a total capacity of 9,623,870 acre-feet. There was a numerical increase by 1960 to 105 reservoirs (total storage capacity 22,746,200). In October, 1972, Texas had more than 160 major reservoirs existing or under construction, with over 29 million acre-feet conservation storage capacity. Since this date, 18 additional reservoirs have been built, bringing the total storage capacity to nearly 30 million acre-feet. (Table 12)

Data from the Texas Water Development Board, as of December 18, 1974, indicate that 17 reservoirs with a total storage capacity of 14,295,900 acre-feet are proposed for construction within the next 5 years. If all of these are indeed built, the storage capacity of Texas reservoirs will grow to approximately 43,944,629 acre-feet.

Waste-Water Treatment Facility Construction

The Texas Water Quality Board is charged with approving all waste water treatment facilities and with determining

the order in which each facility will be built. Their objectives are to define the potential contribution of waste-water reclamation and re-use for meeting the present and projected water requirements of Texas, and to consider the effects of potential waste-water renovation and re-use projects. Highly treated municipal and industrial return flows are a substantial source of future water supply in each river basin. Return flows presently constitute some part of the total surface-water supply for users in most basins of the state. By the year 2020, non-contaminated return flows are presently estimated to total many millions of acre-feet annually. Thus, potentially they will constitute a significant part of streamflow in almost every area of the state during moderate to low-flow conditions.

## MANPOWER REQUIREMENTS

Growth of the construction industry is highly dependent upon the supply of workers available, for without the necessary labor force, construction would be seriously hindered or stopped completely. There is substantial concern about the availability of an adequate supply of craftsmen to meet the demands for construction work in the late 1970s.

### Past and Current Demands

Past and current demands for skilled construction workers have been greatest in the industrial sectors. Based on minimum estimates, it appears that the pipefitters represent the largest craft required. Following these, though not closely, are the boilermakers, carpenters, and iron and steel workers. Overall demand for skilled labor has increased recently. Current construction manpower requirements have risen 48% over the number needed for past construction, i.e. construction since January, 1971, already completed. This large increase indicates that construction in the petrochemical industry is growing. (See Tables 17 and 18)

Manpower requirements for water-related construction have not been as great as for industries. The total number of skilled workers required for all water-related construction is 4,357 with operating engineers representing the

largest portion, almost a quarter of all the construction personnel needed, both skilled and unskilled. (See Tables 19 and 20)

Future Demands

There is some concern that a greater number of skilled laborers will be required for future construction. The projected volume of power plant construction anticipated for this period represents one of the factors to be considered before reaching a final decision. In many areas of the country, the construction of power plants will result in very large increases in construction labor demand with the possible consequence of a severe disequilibrium in the manpower demand-supply balance. Moreover, the increase in power plant capacity will be brought about by a large increase in nuclear-fueled plants, which require a different mix of crafts than fossil-fueled plants resulting in particularly heavy demand for some crafts.

Since nuclear power plant construction seems to be a major factor in future construction, three sets of projections were drawn, two dealing only with nuclear power plants, the third, nuclear and fossil-fueled plants both. It should be noted that information contained in tables 21 and 22, though similar in appearance, is different. Table 21, whose figures are expressed in terms of number of men, is useful for short-range planning because such needs are more meaningful when expressed in this manner. Table 22, on

the other hand, expresses figures in terms of man-years, a more valid unit for long-range estimates.

The two sets of figures are difficult to compare because of the diversity of units of measurement. It may be noted, however, that there are at least as many required laborers in table 22 whose figures are expressed as man-years, as there are man-years. Based on this one-to-one ratio, the estimates coincide roughly with those in table 21.

It is also difficult to compare either of these two tables to table 23, which represents manpower estimates for nuclear and fossil-fueled plants combined. As would be expected the most rapid increases in demand among the predominant crafts used in power plant construction are for steam and pipefitters. Closely following are the electricians and the boilermakers. (Maps depicting peak period by craft of construction throughout the U.S. may be found in the data display.)

Future water-related construction falls into three categores: reservoirs (which also include dams), sewer lines, and waste-water treatment facilities. The total number of skilled laborers needed is 23,447 with reservoir and dam construction personnel comprising the largest group. Though the percentage of skilled labor varies for each type, operating engineers comprise the largest block of skilled workers for each. (For manpower breakouts for each type of water related construction, see Tables 24, 25, and 26.)

Construction manpower requirements for industrial facilities are unavailable due to the lack of information on construction in this field mentioned elsewhere in the report.

## CURRENT ACTION AFFECTING THE CONSTRUCTION LABOR FORCE

At the present time the federal government is taking steps to aid the construction industry. The following release appeared in the Texas OEO Weekly News, May 16, 1975.

> "Ninety persons will be recruited in Texas as ironworkers trainees, according to the Department of Labor. A total of $182,000 in training contracts will be divided between four areas in Texas as follows: Corpus Christi, $35,000; Dallas-Ft. Worth, $50,000; Houston, $52,000; and San Antonio, $45,000. Under the 11 month contract renewal with the National Ironworkers and Employers Training Program, Vietnam-era veterans will be given priority hiring rights during the recruitment."

Information selected from issues of the Austin American Statesman reveal that the Emergency Employment Appropriations Act passed by Congress but vetoed by President Ford May 29, 1975, authorizes $5 billion for state and local governments to be used in construction and renovation of local public works projects. The bill stipulates that 70 percent of the funds must be used in areas where the unemployment rate exceeds the national average for two of the three most recent months. Indications are that the House will vote to override the veto. Both the House and Senate had approved the bill by votes well over the two-thirds needed to accomplish the move.

# SECTION III

# Conclusions

# CONCLUSIONS

Several influential factors have come to light in the course of this analysis. Based on these, the following conclusions are offered:

1) no central source exists for current statistics on the supply of skilled construction workers;

2) no "ideal" mode of training exists which prepares the worker for employment with creditable skills in a reasonable length of time;

3) a lack of uniformity is evident in craft titles, in methodology for estimating and reporting shortages, and in training requirements for skill levels;

4) a lack of agreement exists concerning how many and what type of energy-related training programs should be implemented; and,

5) for the most part, minorities in construction have been confined to the level of unskilled labor.

## IMPLICATIONS FOR CETA MANPOWER PROGRAMS

Several situations worthy of note have become evident during the course of this study. Some of these have been discussed elsewhere in the report. Those remaining follow.

There has been some speculation concerning the effects of increased Environmental Protection Agency controls over industry. Specifically, if the proposed measures for requiring additional waste treatment facilities for industry were implemented, would this create a greater demand for skilled construction workers?

A second issue for consideration is the influence of unions on the manpower supply. Unions are able to control the labor supply to a great extent by exerting a strong influence in the operation of the apprenticeship programs. Furthermore, unions control their own entrance requirements and do not accept more members than can be put to work on a regular basis. However, if there is a demand for workers that a union believes to be only temporary, it will issue permits to non-members, which enables them to work on jobs in the union's jurisdiction. Often such workers remain in construction in the union's jurisdiction after the temporary work is completed. This represents one of the ways that workers enter the unions.

A third area for consideration is nuclear-related construction. Any such construction has become a political

issue and, therefore, raises many questions and causes heated debate. The issue has yet to be resolved in the public's mind. For these and other reasons such as environmental health hazards, the timing of nuclear construction may be delayed. When the final decision is reached, the question of when additional skilled construction workers will be needed will arise. Characteristically, nuclear construction requires a greater length of time than fossil-fueled construction. The skilled laborers, therefore, would be a more sedentary group, remaining in one location for as long as 5 years before moving to another job site. The situation is complicated by the fact that in general a greater number of craftsmen are required for nuclear construction. It is difficult to answer this question at the present time, but this situation is one which should be kept in mind.

# SECTION IV

## Recommendations

# RECOMMENDATIONS

Research and studies of supply and demand of skilled construction workers reveal that there is a lack of information concerning current and future supplies of such workers. It has become apparent that the greatest projected demand for skilled labor is in the energy-related field -- primarily the field of nuclear energy. This makes any time-linked demands difficult to ascertain because energy policy will dictate fuel mix allowed. Therefore, the following recommendations are offered:

1) greater systematizing in craft titles, training requirements and supply reporting must be attempted to assist in worker allocation and manpower estimates;

2) training curricula of both union and non-union groups should be redesigned for greater flexibility and skill transference;

3) acceleration of energy-related training programs should be implemented by phases related to projected scenarios;

4) the employment situation in the petrochemical construction industry should be better documented by field study to allow definitive conclusions based on actual practice in different regions of the state; and,

5) efforts to assist minorities in construction should be aimed at upgrading skill levels.

# SECTION V

## Appendices

DATA DISPLAY

Table 1

SUPPLY OF APPRENTICES EMPLOYED

| | 1950 | 1960 | 1970 | Projected 1976 | Projected 1980 | Total |
|---|---|---|---|---|---|---|
| Bricklayers and Masons | 161 | 138 | 200 | 200 | 200 | 899 |
| Carpenters | 352 | 159 | 400 | 400 | 500 | 1,811 |
| Electricians | 328 | 492 | 1,000 | 1,300 | 1,500 | 4,620 |
| Painters | -- | -- | 100 | 100 | 100 | 300 |
| Plumbers and Pipe Fitters | 399 | 306 | 600 | 800 | 900 | 3,005 |
| Metal Workers | 168 | 191 | 100 | 200 | 300 | 959 |
| TOTAL | 1,408 | 1,286 | 2,400 | 3,000 | 3,500 | 11,594 |

Sources: Changing Horizons - A Profile of Jobs to 1980. Texas Employment Commission, February, 1975.

Census of Population: 1960. Volume I - Characteristics of the Population, Part 45-Texas. U.S. Department of Commerce, Bureau of the Census, 1961.

Table 2

ACTUAL ENROLLMENTS IN VOCATIONAL EDUCATION PROGRAMS FY 1971 - 1975

| LEVEL | CARPENTERS | | | | | | ELECTRICIANS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | '71 | '72 | '73 | '74 | '75 | Total | '71 | '72 | '73 | '74 | '75 | Total |
| Secondary | 342 | 393 | 631 | 724 | 560 | 2,650 | 5 | 96 | 167 | 214 | 206 | 688 |
| Post-Secondary | 59 | 4 | 23 | 0 | -- | 86 | 0 | 44 | 68 | 0 | -- | 112 |
| Adult-Preparatory | 11 | 87 | 117 | 116 | -- | 331 | 136 | 67 | 219 | 0 | -- | 422 |
| Adult-Supplemental | 0 | 0 | 6 | 51 | -- | 57 | 298 | 978 | 491 | 331 | -- | 2,098 |
| Adult-Apprenticeship | 1,319 | 987 | 1,027 | 1,010 | -- | 4,343 | 179 | 570 | 1,391 | 1,495 | -- | 3,635 |
| Co-Operative | 326 | 337 | 587 | 691 | -- | 1,941 | 5 | 79 | 167 | 211 | -- | 462 |
| Total | 2,057 | 1,808 | 2,391 | 2,592 | 560 | 9,408 | 623 | 1,834 | 2,503 | 2,251 | 206 | 7,417 |

Sources: Annual Vocation Education Report for Fiscal Year 1971; Fiscal Year 1972; Fiscal Year 1973; Fiscal Year 1974. Texas Education Agency.
James Cogdell, Texas Education Agency, Occupational Education and Technology Division.

Table 2

ACTUAL ENROLLMENTS IN VOCATIONAL EDUCATION PROGRAMS FY 1971 - 1975

| LEVEL | MASONRY | | | | | | PLUMBING | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | '71 | '72 | '73 | '74 | '75 | Total | '71 | '72 | '73 | '74 | '75 | Total |
| Secondary | 296 | 249 | 385 | 468 | 393 | 1,791 | 1,306 | 383 | 486 | 584 | 194 | 2,953 |
| Post-Secondary | 0 | 0 | 11 | 10 | -- | 21 | 16 | 680 | 0 | 141 | -- | 837 |
| Adult-Preparatory | 0 | 7 | 51 | 61 | -- | 119 | 23 | 0 | 0 | 28 | -- | 51 |
| Adult-Supplemental | 0 | 0 | 6 | 51 | -- | 57 | 134 | 680 | 45 | 295 | -- | 1,154 |
| Adult-Apprenticeship | 241 | 305 | 282 | 188 | -- | 1,016 | 1,650 | 1,181 | 1,895 | 1,821 | -- | 6,547 |
| Co-Operative | 41 | 55 | 84 | 90 | -- | 270 | 125 | 119 | 204 | 208 | -- | 656 |
| Total | 578 | 616 | 819 | 868 | 393 | 3,274 | 3,254 | 3,043 | 2,630 | 3,077 | 194 | 12,198 |

Sources: Annual Vocational Education Report for Fiscal Year 1971; Fiscal Year 1972; Fiscal Year 1973; Fiscal Year 1974. Texas Education Agency.
James Cogdell, Texas Education Agency, Occupational Education and Technology Division.

Table 2

ACTUAL ENROLLMENTS IN VOCATIONAL EDUCATION PROGRAMS FY 1971-1975

LEVEL — OTHER CONSTRUCTION & MAINTENANCE

| | '71 | '72 | '73 | '74 | '75 | Total |
|---|---|---|---|---|---|---|
| Secondary | 4,543 | 6,114 | 10,342 | 12,041 | -- | 33,040 |
| Post Secondary | 52 | 599 | 155 | 446 | -- | 1,252 |
| Adult-Preparatory | 1,099 | 153 | 1,839 | 1,439 | -- | 4,530 |
| Adult-Supplemental | 0 | 599 | 557 | 1,823 | -- | 2,979 |
| Adult-Apprenticeship | 724 | 760 | 1,092 | 847 | -- | 3,423 |
| Co-Operative | 196 | 670 | 1,087 | 1,638 | -- | 3,591 |
| Total | 6,614 | 8,895 | 15,072 | 18,234 | -- | 48,815 |

Sources: Annual Vocational Education Report for Fiscal Year 1971; Fiscal Year 1972; Fiscal Year 1973; Fiscal Year 1974. Texas Education Agency.
James Cogdell, Texas Education Agency, Occupational Education and Technology Division.

Listing 1

TEXAS SCHOOLS IN WHICH CONSTRUCTION SKILLS ARE TAUGHT

as of February, 1974

Carpentry: 2

Industrial Training Systems, Inc.
4117 Airline Drive
Houston, TX 77022

Southwest Texas Junior College
Outreach Center
Edison Road
Eagle Pass, TX 78852

Operating Engineer: 1

Engineering Extension Service
Heavy Equipment Technician School
Texas A & M University
F. E. Drawer K
College Station, TX 77843

Bricklayer: 3

Henderson County Junior College
Athens, TX 75751

St. Philip's College
2111 Nevada Street
San Antonio, TX 78203

Texas State Technical Institute
Manpower Development Training Program
Box 2628
Rio Grande Campus
Harlingen, TX 78550

Plumbing: 5

American Training Center
150 Wynnewood Village
Dallas, TX 75224

Gulf Coast College, Inc.
2902 Caroline Street
Houston, TX 77004

Texas Vocational School
1913 S. Flores
San Antonio, TX 78204

Bee County College
P. O. Box 100
Beeville, TX 78102

St. Philip's College
2111 Nevada St.
San Antonio, TX 78203

Electrician: 4

ACR Training School, Inc.
10353 Denton Dr.
Dallas, TX 75220

American Training Center
150 Wynnewood Village
Dallas, TX 75224

Dallas Trade School
851 South R. L. Thornton Freeway
Dallas, TX 75203

St. Philip's College
2111 Nevada St.
San Antonio, TX 78203

Sheetmetal Worker: 3

Lubbock Independent School Distric
Manpower Development Training Prog
1628 19th Street
Lubbock, TX 79401

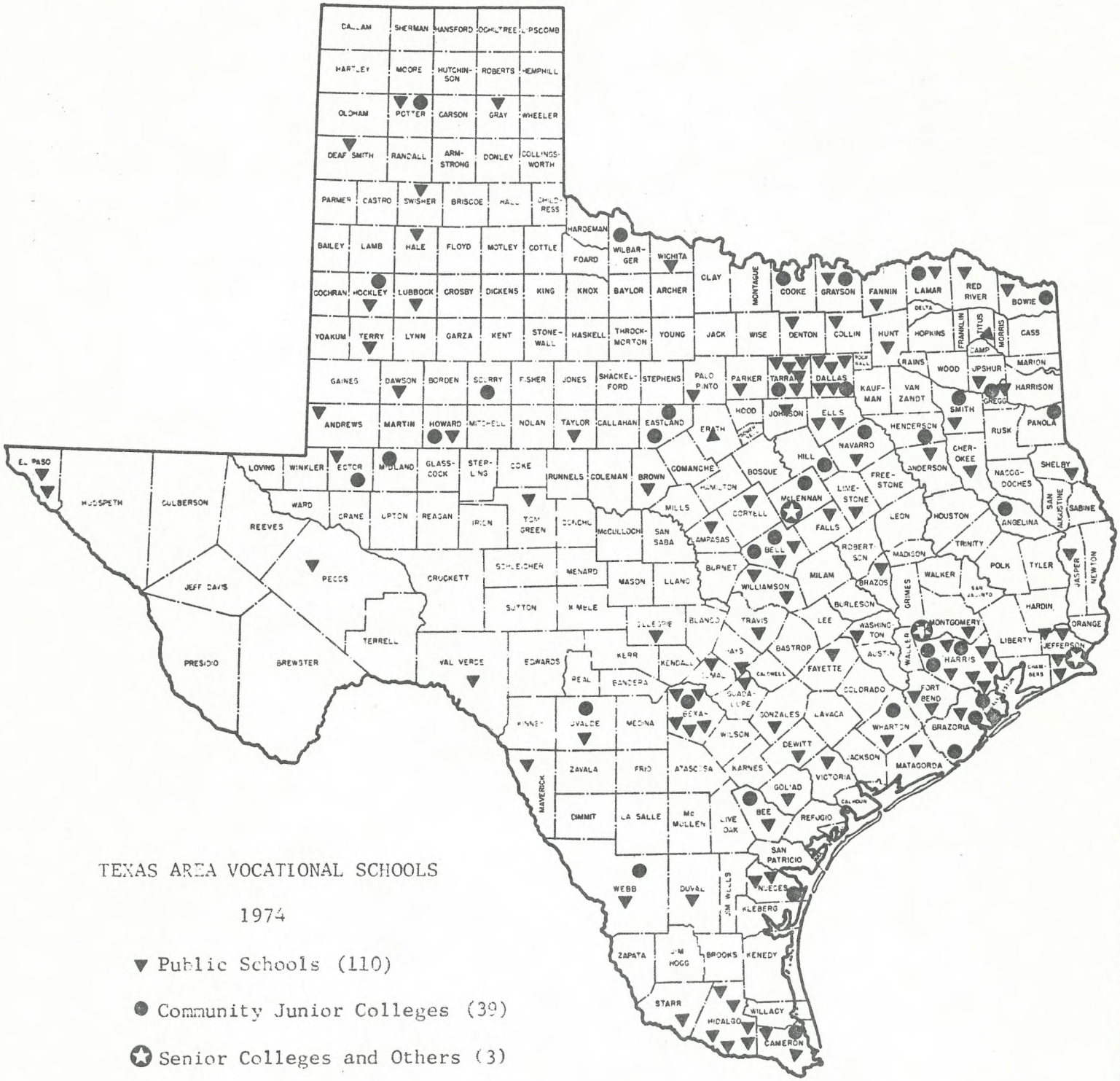
San Angelo School District Area
Vocational School
100 Cottonwood
San Angelo, TX 76901

Texas Southmost College
Brownsville, TX 78250

No Entries

Structural Steel Worker
Steel Worker
Cement Mason
Re-inforcing Iron Worker
Boiler Maker
Painter
Asbestos Worker
Pipefitter
Millwright

Map 1




TEXAS AREA VOCATIONAL SCHOOLS

1974

▼ Public Schools (110)

● Community Junior Colleges (39)

✪ Senior Colleges and Others (3)

Source: Texas Education Agency
Texas State Plan for Vocational Education, Fiscal Year 1975.
May, 1974.

Table 3

LOCATION OF NEW POWER PLANTS
JANUARY, 1971 - MARCH, 1975

as of March 28, 1975

| MANPOWER AREA | ADDED WATTAGE | NAME OF PLANT | LOCATION | COST (MILLIONS) |
|---|---|---|---|---|
| Abilene | 150,000 | -- | Phantom Lake | 15 |
| Amarillo | 300,000 | -- | Amarillo area | -- |
| Ark-Tex Council of Governments | 575,000 | Monticello Power Plant | Mount Pleasant | -- |
| Austin | -- | -- | -- | -- |
| Beaumont-Port Arthur-Orange | -- | -- | -- | -- |
| Brownsville-Harlingen-San Benito | -- | -- | -- | -- |
| Capitol Area Planning Council | -- | Cedar Creek | La Grange | 400 |
| Corpus Christi | -- | -- | -- | -- |
| Dallas | Increase old wattage by 65,000 | Denton Power Plant | Denton | -- |
| Deep East Texas Council of Governments | 1,800,000 (2 Units) | *Toledo Bend Project | Newton | -- |
| El Paso | -- | -- | -- | -- |
| Ft. Worth | -- | -- | -- | -- |
| Galveston-Texas City | -- | -- | -- | -- |
| Houston | 530,000 | Lewis Creek Generating Station | Willis | -- |
| | -- | *Carter Oil Co. Pilot Plant | Baytown | 40 |
| Laredo | -- | -- | -- | -- |
| Longview-Marshall | 345,000 | Knox-Lee Power Plant | Lake Cherokee, Longview | -- |
| Lubbock | -- | -- | -- | -- |

* later deferred

Table 3

LOCATION OF NEW POWER PLANTS
JANUARY, 1971 - MARCH, 1975

as of March 28, 1975

| MANPOWER AREA | ADDED WATTAGE | NAME OF PLANT | LOCATION | COST (MILLIONS) |
|---|---|---|---|---|
| McAllen-Pharr-Edinburg | -- | -- | -- | -- |
| Midland-Odessa | -- | -- | -- | -- |
| North Central Texas Council of Governments | 775,000 | -- | Lake Granbury | -- |
| San Angelo | -- | -- | -- | -- |
| San Antonio | 436,000 | O. W. Sommers Power Plant | San Antonio | -- |
| Sherman-Denison | -- | -- | -- | -- |
| Texarkana | -- | -- | -- | -- |
| Tyler | -- | -- | -- | -- |
| Waco | -- | -- | -- | -- |
| Wichita Falls | -- | -- | -- | -- |

Table 4

LOCATION OF EXPANDED POWER PLANTS
JANUARY, 1971-MARCH, 1975

as of March 28, 1975

| MANPOWER AREAS | ADDED WATTAGE(KW) | TOTAL WATTAGE(KW) | NAME OF PLANT | LOCATION | COST(MILLIONS) |
|---|---|---|---|---|---|
| Alamo Area Council of Governments | 400,000 | ------- | Atascosa & McMullen County Power Plant | Atascosa & McMullen County Line | -- |
| Austin | ------- | ------- | ---------- | ---------- | -- |
| Beaumont-Port Arthur-Orange | 580,000 | 1,500,000 | Sabine Power Sta. | Bridge City | -- |
| Brownsville-Harlingen-San Benito | 49,000 | ------- | La Palma Power Sta. | San Benito | -- |
| Central Texas Council of Governments | 575,000 | 935,000 | Rockdale Smelting Wks | Rockdale | -- |
| Corpus Christi | 325,000 | ------- | Central Power & Light | Corpus Christi | -- |
| Dallas | ------- | ------- | Denton Power Plant | Denton | 1.3 |
| | 150,000 | ------- | City of Garland | Garland | -- |
| East Texas Council of Governments | ------- | ------- | Wilkes Power Plant | Jefferson | -- |
| Ft. Worth | ------- | ------- | ---------- | ---------- | -- |
| Galveston-Texas City | ------- | ------- | ---------- | ---------- | -- |
| Houston | 300,000 | ------- | Dow Chemical Co. Salt Grass Power Plant | Freeport | -- |
| Laredo | ------- | ------- | ---------- | ---------- | -- |
| Longview-Marshall | 345,000 | ------- | Knox-Lee Power Plant | Longview | -- |

Table 4

LOCATION OF EXPANDED POWER PLANTS
JANUARY, 1971-MARCH, 1975

as of March 28, 1975

| MANPOWER AREAS | ADDED WATTAGE(KW) | TOTAL WATTAGE(KW) | NAME OF PLANT | LOCATION | COST(MILLIONS) |
|---|---|---|---|---|---|
| Lubbock | 256,000 | 512,000 | Clifford B. Jones | Lubbock | -- |
| McAllen-Pharr-Edinburg | ------- | ------- | ---------- | ---------- | -- |
| Midland-Odessa | ------- | ------- | ---------- | ---------- | -- |
| Nortex Regional Planning Comm. | ------- | ------- | ---------- | Graham | -- |
| Panhandle Regional | 4,691 | ------- | City of Tulia Power Plant | Tulia | -- |
| Planning Commission | 2,235 | ------- | City of Canadian Power Plant | Canadian | -- |
| Permian Basin Regional Planning Commission | 540,000 | 700,000 | Permian Basin Generating Plant | Monahans | -- |
| San Angelo | ------- | ------- | ---------- | ---------- | -- |
| Sherman-Denison | ------- | ------- | ---------- | ---------- | -- |
| Texarkana | ------- | ------- | ---------- | ---------- | -- |
| Waco | ------- | ------- | ---------- | ---------- | -- |
| West Central Texas Council of Governments | 110,000 | 236,000 | Paint Creek Power Station | Haskell | -- |
| Wichita Falls | ------- | ------- | ---------- | ---------- | -- |

Table 5

LOCATION OF NEW POWER PLANTS CURRENTLY UNDER CONSTRUCTION
JANUARY, 1971 - MARCH, 1975

as of March 28, 1975

| MANPOWER AREA | ADDED WATTAGE | NAME OF PLANT | LOCATION | COST (MILLIONS) |
|---|---|---|---|---|
| Ark-Tex Council of Government | 530,000 | Cason Power Plant | Cason | -- |
| Brazos Valley Development Council | 2-750,000 | Twin Oak Steam Electric Station | Franklin | -- |
| Capitol Area Council of Governments | 440,000 | Grante Shoals | Lake LBJ, Marble Falls | -- |
| Corpus Christi | 325,000 | Barney M. Davis Power Plant | Corpus Christi | -- |
| East Texas Council of Governments | 1,150,000-1,500,000 (2 units) | Martin Creek | Tatum | Multimillion |
| Golden Crescent Council of Governments | 1,100,000 (2 units) | Coleto Creek | Fannin | -- |
| Houston-Galveston Area Council of Governments | -- | -- | Wallis | -- |
| North-Central Texas Council of Governments | 2,300,000 (2 units) | Comanche Peak Steam Electric Station | Glen Rose | 1 billion |

Table 6

LOCATION OF EXISTING POWER PLANTS CURRENTLY UNDER CONSTRUCTION
JANUARY, 1971-MARCH, 1975

as of March, 1975

| MANPOWER AREAS | ADDED WATTAGE | NAME OF PLANT | LOCATION | COST(MILLIONS) |
|---|---|---|---|---|
| Abilene | 200,000 | Fort Phantom | Abilene | 20 |
| Amarillo | 350,000 | Harrington Station | Amarillo | 70 |
| | 822,675 (total) | Nichols Station | Amarillo | 70 |
| Beaumont-Port Arthur-Orange | ------- | ---------- | ---------- | -- |
| Brazos Valley Dev. Council | ------- | Bryan Municipal Elec. Co. | Bryan | 21 |
| Brownsville-Harlingen-San Benito | ------- | ---------- | ---------- | -- |
| Corpus Christi | ------- | ---------- | ---------- | -- |
| Dallas | ------- | ---------- | ---------- | -- |
| El Paso | 230,000 | Newman Plant | El Paso | 30.6 |
| | 240,000 | El Paso Electric Co. | El Paso | 32 |
| Ft. Worth | ------- | ---------- | ---------- | -- |
| Galveston-Texas City | ------- | ---------- | ---------- | -- |
| Houston | 650,000 | Greens Bayou Generating Plant | Houston | multi |
| | 750,000 | Cedar Bayou Plant | Houston | -- |
| | (2 multi-fuel boilers) | W. A. Parish Plant | Ft. Bend County | 44 |
| Laredo | ------- | ---------- | ---------- | -- |
| Longview-Marshall | ------- | ---------- | ---------- | -- |
| Lubbock | ------- | ---------- | ---------- | -- |

Table 6

LOCATION OF EXISTING POWER PLANTS CURRENTLY UNDER CONSTRUCTION
JANUARY, 1971-MARCH, 1975

as of March, 1975

| MANPOWER AREAS | ADDED WATTAGE | NAME OF PLANT | LOCATION | COST(MILLIONS) |
|---|---|---|---|---|
| McAllen-Pharr-Edinburg | ------- | ---------- | ---------- | -- |
| Midland-Odessa | ------- | ---------- | ---------- | -- |
| San Angelo | ------- | ---------- | ---------- | -- |
| San Antonio | 872,000 | Calaveras Lake Site | San Antonio | 214 |
| Sherman-Denison | ------- | ---------- | ---------- | -- |
| Texarkana | ------- | ---------- | ---------- | -- |
| Tyler | ------- | ---------- | ---------- | -- |
| Waco | ------- | ---------- | ---------- | -- |
| Wichita Falls | ------- | ---------- | ---------- | -- |

Listing 2

NEW CAPACITY SCHEDULED FOR COMPLETION

| AREA | NUMBER OF UNITS | | | NUMBER OF MEGAWATTS | | |
|---|---|---|---|---|---|---|
| | TOTAL | FOSSIL | NUCLEAR | TOTAL | FOSSIL | NUCLEAR |
| New England | 17 | 7 | 10 | 15,286 | 3,922 | 11,364 |
| New York | 24 | 14 | 10 | 19,516 | 8,761 | 10,755 |
| New Jersey | 8 | 2 | 6 | 7,359 | 800 | 6,559 |
| Eastern Pennsylvania | 21 | 10 | 11 | 17,909 | 6,525 | 11,384 |
| Delaware, Maryland, Virginia | 22 | 9 | 13 | 18,396 | 6,290 | 12,106 |
| North Carolina | 15 | 5 | 10 | 14,672 | 4,450 | 10,222 |
| South Carolina, Georgia | 26 | 14 | 12 | 22,391 | 10,146 | 12,245 |
| Florida | 31 | 20 | 11 | 27,711 | 16,501 | 11,210 |
| Tennessee, Alabama | 33 | 10 | 23 | 33,941 | 7,489 | 26,452 |
| Western Pennsylvania, West Virginia | 9 | 7 | 2 | 6,697 | 4,993 | 1,704 |
| Ohio | 28 | 17 | 11 | 24,083 | 11,575 | 12,508 |
| Michigan | 15 | 7 | 8 | 13,105 | 5,011 | 8,094 |
| Indiana | 21 | 18 | 3 | 15,165 | 12,555 | 2,610 |
| Kentucky | 15 | 15 | -- | 7,760 | 7,760 | -- |
| Illinois | 27 | 14 | 13 | 22,121 | 8,025 | 14,096 |
| Wisconsin, Minnesota, N. Dakota, S. Dakota | 27 | 19 | 8 | 16,329 | 9,488 | 6,841 |
| Iowa, Nebraska, Kansas, Missouri | 27 | 18 | 9 | 18,930 | 9,723 | 9,207 |
| Louisiana, Mississippi | 19 | 12 | 7 | 14,257 | 6,376 | 7,881 |
| Oklahoma, Arkansas | 26 | 22 | 4 | 16,600 | 12,938 | 3,662 |
| Texas | 57 | 49 | 8 | 35,692 | 26,756 | 8,936 |
| Colorado, Utah, Arizona, New Mexico | 32 | 27 | 5 | 18,400 | 13,490 | 4,910 |
| Montana, Idaho, Oregon, Washington | 22 | 11 | 11 | 20,716 | 7,390 | 13,326 |
| California, Nevada | 18 | 5 | 13 | 17,493 | 2,309 | 15,184 |

*Based on power plants scheduled for completion through 1984 for fossil fueled plants and through 1986 for nuclear fueled plans, as of fourth quarter 1974.

Table 7

NUCLEAR POWER PLANTS
SCHEDULED TO BE CONSTRUCTED IN TEXAS
(as of January, 1975)

| Company Name | Project Name | Location | | Generating Capacity | Expected Start-up Date | Estimated Costs |
|---|---|---|---|---|---|---|
| | | City or Landmark | County | | | |
| Gulf States Utilities | Blue Hills | Near Toledo Bend Lake | Newton | 1,800 MW (2 units) | 1983 | |
| Houston Lighting & Power | Allens Creek | Wallis | Austin | 2,400 MW (2 units) | 1980 - 1982 | $1 billion |
| Central Power & Light; Houston Power & Light; and City Public Service Board of San Antonio | South Texas Nuclear Project | Bay City | Matagorda | 2,300 MW (2 units) | 1980 | $1 billion |
| Texas Power & Light; Dallas Power & Light; and Texas Electric Service | Comanche Peak Plant | Glen Rose | Somervell | 2,300 MW (2 units) | 1980 | |
| Southwestern Public Service | | Amarillo | Potter - Randall | 300,000 KW | 1980's | several hundred million dollars |

Source: Texas Industrial Expansion; Bureau of Business Research, University of Texas at Austin.

Table 8

LOCATION OF NEW INDUSTRIAL PROJECTS
JANUARY, 1971 - MARCH, 1975

as of March 28, 1975

| MANPOWER AREA | SIC NUMBER | NAME OF COMPANY | LOCATION | COST (MILLIONS) |
|---|---|---|---|---|
| Abilene | -- | -- | -- | -- |
| Amarillo | 2992 | Whitmore Manufacturing Co. | Amarillo | 1 |
| Austin | -- | -- | -- | -- |
| Beaumont-Port Arthur-Orange | 29116 | Texaco, Inc. | Port Arthur | 300 |
| | 28 | Pennwalt Corporation | Beaumont | 5 |
| | 2822 | B.F. Goodrich Chemical Co. | Orange | Multimillion |
| | 2911 | Osage Chemical | Beaumont | 100 |
| | 28213 | Sinclair-Koppers Company | Port Arthur | 10 |
| Brownsville-Harlingen-San Benito | -- | -- | -- | -- |
| Coastal Bend Council of Governments | 29114,29117, 29119 | Three Rivers Refining Company | Three Rivers | 5 |
| Corpus Christi | 29111,29114 | Saber Refining Co. | Corpus Christi | 2 |
| | 2992 | International Pollution Control | Corpus Christi | 1.6 |
| | 2813 | Big Three Industries, Inc. | Corpus Christi | 9 |
| Dallas | 28134 | Union Carbide | Garland | Multimillion |
| | 2841,2842,2851 | Economics Laboratory Inc. | Garland | 3 |
| El Paso | 2819 | Chemical Producers Corporation | El Paso | 8 |
| Ft. Worth | -- | -- | -- | -- |
| Galveston-Texas City | -- | -- | -- | -- |
| Houston | 29111,29114,29116 | Hudson Oil Company | La Porte | 500 |
| | 2818 | Diamond Shamrock | Deer Park | Multimillion |
| | 2812,2818 | Diamond Shamrock | Houston | 50 |
| | 2813 | Chemetron Corporation | Stafford | 3.4 |

Table 8

LOCATION OF NEW INDUSTRIAL PROJECTS
JANUARY, 1971 - MARCH, 1975

as of March 28, 1975

| MANPOWER AREA | SIC NUMBER | NAME OF COMPANY | LOCATION | COST (MILLIONS) |
|---|---|---|---|---|
| Houston | 2834 | Hoffman-La Roche, Inc. | Freeport | 150 |
| | 28119 | Mineral Research & Development Corporation | Freeport | 2 |
| | 2821 | Shintech, Inc. | Freeport | 20 |
| | 28 | Armak Chemical Co. | Bayport | Multimillion |
| Laredo | -- | -- | -- | -- |
| Longview-Marshall | -- | -- | -- | -- |
| Lubbock | -- | -- | -- | -- |
| McAllen-Pharr-Edinburg | -- | -- | -- | -- |
| Midland-Odessa | -- | -- | -- | -- |
| San Angelo | -- | -- | -- | -- |
| San Antonio | -- | -- | -- | -- |
| Sherman-Denison | -- | -- | -- | -- |
| Texarkana | -- | -- | -- | -- |
| Tyler | -- | -- | -- | -- |
| Waco | -- | -- | -- | -- |
| Wichita Falls | -- | -- | -- | -- |

Table 9

LOCATION OF INDUSTRIAL EXPANSION PROJECTS
JANUARY, 1971 - MARCH, 1975

as of March 28, 1975

| MANPOWER AREA | SIC NUMBER | NAME OF COMPANY | LOCATION | COST (MILLIONS) |
|---|---|---|---|---|
| Abilene | -- | -- | -- | -- |
| Amarillo | 1929,2892 | Mason and Hanger-Silas Mason Co. | Amarillo | 8.5 |
| Austin | -- | -- | -- | -- |
| Beaumont-Pt. Arthur-Orange | 2879 | Velsicol | Beaumont | 13.5 |
| | 28 | Goodyear Tire and Rubber Co. | Beaumont | 1.5 |
| | 28151,28182 | Mobil Chemical Co. | Beaumont | 13.5 |
| | 2911 | Union 76 Division of Union Oil Co. of California | Nederland | 30 |
| Brownsville-Harlingen San Benito | -- | -- | -- | -- |
| Corpus Christi | 28151,29110,29116 | Suntide Refining Co. (waste-water treatment) | Corpus Christi | 4 |
| | 2815,2911 | Suntide Refining Co. | Corpus Christi | 8 |
| | 2818 | E.I. DuPont de Nemours and Co. | Ingleside | Multimillion |
| Dallas | 2844 | Cosmetic Creations, Inc. | Dallas | 3.1 |
| | 2099,2643,2861 | Arrow Food Products, Inc. | Carrollton | 1 |
| El Paso | 2819 | American Smelting and Refining Co. | El Paso | 18.5 |
| Ft. Worth | 2841,2899 | Petrochemicals Company, Inc. | Ft. Worth | 1.5 |
| Galveston-Texas City | 28692 | G.A.F. Corporation | Texas City | 2 |
| Golden Crescent Council of Governments | 28692 | Union Carbide | Seadrift | 2 |
| | 2812,2819.2861,3334 | Aluminum Co. of America | Point Comfort | Multimillion |
| Houston | 28651 | Upjohn Co. | LaPorte | 20 |
| | 28213 | Phillips Petroleum Co. | Pasadena | 30 |

Table 9

LOCATION OF INDUSTRIAL EXPANSION PROJECTS

JANUARY, 1971 - MARCH, 1975 as of March 28, 1975

| MANPOWER AREA | SIC NUMBER | NAME OF COMPANY | LOCATION | COST (MILLIONS) |
|---|---|---|---|---|
| Houston | 2822,2899 | Goodyear Tire and Rubber Co. | Houston | 1 |
| | 2911 | Shell Oil Company (sulphur recovery plant) | Houston | 3.7 |
| | 2821 | Celanese Plastics, Inc. | Deer Park | Multimillion |
| | 2611,2621,2861 | Champion Papers | Pasadena | 8.8 |
| | 2818,2819,2841,2899 | Dixie Chemical Co. | Houston | 1 |
| | 2899,3611,3622,3662,3821 | Dresser Industries, Inc. | Houston | 3 |
| | 2818 | Ethyl Corporation | Pasadena | Multimillion |
| | 2841,2843 | Retzloff Chemical Co. | Houston | 1.1 |
| | 2815 | Shell Chemical Co. | Deer Park | Multimillion |
| | 2911 | Shell Oil Co. | Deer Park | 100 |
| Laredo | -- | -- | -- | -- |
| Longview-Marshall | -- | -- | -- | -- |
| Lubbock | -- | -- | -- | -- |
| McAllen-Pharr-Edinburg | -- | -- | -- | -- |
| Middle Rio Grande Development Council | -- | -- | -- | -- |
| Midland-Odessa | -- | -- | -- | -- |
| Panhandle Regional Planning Commission | 28191,2873 | Western Ammonia Corp. | Dimmitt | 4 |
| San Angelo | -- | -- | -- | -- |
| San Antonio | -- | -- | -- | -- |
| Sherman-Denison | -- | -- | -- | -- |
| Texarkana | -- | -- | -- | -- |

Table 9

LOCATION OF INDUSTRIAL EXPANSION PROJECTS

JANUARY, 1971 - MARCH, 1975

as of March 28, 1975

| MANPOWER AREA | SIC NUMBER | NAME OF COMPANY | LOCATION | COST (MILLIONS) |
|---|---|---|---|---|
| Tyler | -- | -- | -- | -- |
| Waco | -- | -- | -- | -- |
| Wichita Falls | -- | -- | -- | -- |

Table 10

LOCATION OF NEW INDUSTRIAL CONSTRUCTION PROJECTS CURRENTLY UNDER CONSTRUCTION
JANUARY, 1971 - MARCH, 1975 as of March 28, 1975

| MANPOWER AREA | SIC NUMBER | NAME OF COMPANY | LOCATION | COST (MILLIONS) |
|---|---|---|---|---|
| Abilene | -- | -- | -- | -- |
| Amarillo | -- | -- | -- | -- |
| Austin | 2999 | DG Shelter Products | Austin | 4 |
| Beaumont-Port Arthur-Orange | 28 | American Hoechst Corporation | Port Arthur | 250 |
| Brownsville-Harlingen-San Benito | -- | -- | -- | -- |
| Corpus Christi | 2873 | Good Hope Refineries, Inc. | Corpus Christi | 150 |
| Dallas | 2865,2869 | Quaker Oats Company | Clear Lake City | 26 |
| El Paso | -- | -- | -- | -- |
| Ft. Worth | -- | -- | -- | -- |
| Galveston-Texas City | -- | -- | -- | -- |
| Golden Crescent Council of Governments | 28133 | Southwest Cryogenics, Inc. | Victoria | 2 |
| Houston | 28134, | Big Three Industries, Inc. | Channelview, Freeport | 80-100 |
| | 29110, 29116 | Arco Chemical Company | Channelview | 200 |
| | 29110,29116 | Arco Chemical Company | Channelview | 300 |
| | 28182 | Chemetron Corporation | La Porte | 2.8 |
| | 29110,29114 | Dow Chemical, U.S.A. | Freeport | 200 |
| | 2911 | General Crude Oil Co. | Chocolate Bayou Area | 150 |
| Laredo | -- | -- | -- | -- |
| Longview-Marshall | -- | -- | -- | -- |

Table 10

LOCATION OF NEW INDUSTRIAL CONSTRUCTION PROJECTS CURRENTLY UNDER CONSTRUCTION
JANUARY, 1971 - MARCH, 1975 as of March 28, 1975

| MANPOWER AREA | SIC NUMBER | NAME OF COMPANY | LOCATION | COST (MILLIONS) |
|---|---|---|---|---|
| Lubbock | -- | -- | -- | -- |
| McAllen-Pharr-Edinburg | 3841,3842,2834, 3069,36930 | Erika of Texas | McAllen | 1.7 |
| Midland-Odessa | -- | -- | -- | -- |
| San Angelo | -- | -- | -- | -- |
| San Antonio | -- | -- | -- | -- |
| Sherman-Denison | -- | -- | -- | -- |
| Texarkana | -- | -- | -- | -- |
| Tyler | -- | -- | -- | -- |
| Waco | -- | -- | -- | -- |
| Wichita Falls | -- | -- | -- | -- |

Table 11

LOCATION OF INDUSTRIAL EXPANSION PROJECTS UNDER CONSTRUCTION
JANUARY, 1971 - MARCH, 1975 as of March 28, 1975

| MANPOWER AREA | SIC NUMBER | NAME OF COMPANY | LOCATION | COST (MILLIONS) |
|---|---|---|---|---|
| Abilene | -- | -- | -- | -- |
| Amarillo | 2892,3483 | Mason and Hanger-Silas Mason Co. | Amarillo | 3 |
| Austin | -- | -- | -- | -- |
| Beaumont-Pt. Arthur-Orange | 28,2911 | Texaco, Inc. | Port Arthur | Multimillion |
| | 2815 | Jefferson Chemical Co. | Port Neches | Multimillion |
| Brownsville-Harlingen-San Benito | 28692 | Union Carbide Corporation | Brownsville | Multimillion |
| Corpus Christi | 2911 | Southwestern Refining Company, Inc. | Corpus Christi | 32 |
| | 2911 | Champlin Petroleum Co. | Corpus Christi | 188 |
| Galveston-Texas City | 2813,2841,28651,28692, 29116 | Union Carbide | Texas City | 25 |
| Houston | 2895 | J. B. Huber Corporation | Houston | 4 |
| | 29116 | Soltex Polymer Corporation | Deer Park | 1 |
| | 2842,2843,28692 | Dixie Chemical Company | Houston | 2.3 |
| | 28121,28196,28197, 28651,28692,28693,3399 | Ethyl Corporation | Pasadena | 10 |
| | 2911 | Atlantic Richfield | Houston | 2.1 |
| | 28183,2899,29110,29111, 29114,29116,29117 | Exxon Company, U.S.A. | Baytown | 300 |
| | 2911 | Gulf Oil Chemicals Co. | Baytown | 150 |
| | 2821,2851 | Mobay Chemical Co. | Baytown | 100 |
| | 29 | Atlantic Richfield | Houston | 150 |
| | 28692 | Rhodia, Inc. | Freeport | Multimillion |
| | 28213 | Amoco Oil Co. | Alvin | Multimillion |
| Laredo | -- | -- | -- | -- |
| Longview-Marshall | 28199 | ICI United States, Inc. | Marshall | 2.7 |

Table 11

LOCATION OF INDUSTRIAL EXPANSION PROJECTS UNDER CONSTRUCTION
JANUARY, 1971 - MARCH, 1975 as of March 28, 1975

| MANPOWER AREA | SIC NUMBER | NAME OF COMPANY | LOCATION | COST (MILLIONS) |
|---|---|---|---|---|
| Lubbock | -- | -- | -- | -- |
| McAllen-Pharr-Edinburg | -- | -- | -- | -- |
| Middle Rio Grande Development Council | 2911 | Tesoro Petroleum Co. | Carrizo Springs | 6.35 |
| Midland-Odessa | -- | -- | -- | -- |
| Panhandle Regional Planning Commission | 2895 | J.M. Huber Corporation | Borger | 2 |
| | 2895 | Phillips Petroleum Co. | Borger | 50 |
| San Angelo | -- | -- | -- | -- |
| San Antonio | -- | -- | -- | -- |
| Sherman-Denison | -- | -- | -- | -- |
| Texarkana | -- | -- | -- | -- |
| Tyler | -- | -- | -- | -- |
| Waco | -- | -- | -- | -- |
| Wichita Falls | -- | -- | -- | -- |

Table 12

DAM CONSTRUCTION IN TEXAS FROM JANUARY, 1970 TO FEBRUARY, 1975
(Includes New Structures, Repairs, Modifications, and Enlargements)

| Dam | Reservoir or Lake | Construction Started | Reservoir Storage | Cost | |
|---|---|---|---|---|---|
| Eagle Mountain | Eagle Mountain Reservoir | 01-12-70 | 190,460 | $2,498,750 | New Spillway |
| Conroe | Lake Conroe | 02-09-70 | 430,260 | 9,787,668 | Dam & Spillway |
| Kemp | Lake Kemp | 05-10-70 | 319,600 | 2,841,244 | Modification |
| Lavon Enlarge-ment | Lavon Lake | 05-15-70 | 456,500 | 4,058,285 | Modification |
| | Lynchburg Reservoir | 08-10-70 | 4,700 | 238,872 | Dam & Spillway |
| | Tom Bigbee Creek Reservoir | 09-02-70 | 230 | 332,238 | Dam & Spillway |
| Wirtz (Alvin) | Lake Lyndon B. Johnson | 09-09-70 | 138,500 | 2,719,700 | Spillway Modification |
| | Moss Creek Lake | 11-16-70 | 4,027 | 235,954 | Modification |
| Bridgeport | Bridgeport Reservoir | 12-15-70 | 386,420 | 3,198,048 | Modification |
| | | 01-01-71 | 205 | 10,201 | Dam & Spillway |
| Morris Sheppard | Possum Kingdom Lake | 03-08-71 | 724,700 | 1,183,258 | Spillway Gates Repair |
| SCS Site No. 9 | Rush Creek Watershed | 04-13-71 | 960 | 126,987 | Dam & Spillway |
| Monticello | Monticello Reservoir | 04-16-71 | 40,100 | 3,790,754 | Dam & Spillway |
| | Beard Lake | 09-29-71 | 600 | 29,856 | Dam & Spillway |

Table 12

| Dam | Reservoir or Lake | Construction Started | Reservoir Storage | Cost | |
|---|---|---|---|---|---|
| White Oak Creek | Lake Sulphur Springs | 11-12-71 | 14,160 | 1,524,426 | Dam & Spillway |
| | J. M. Frost Lake | 12 - 71 | 472 | 35,593 | Dam & Spillway |
| | J. M. Frost Lake | 12 - 71 | 480 | 23,885 | Dam & Spillway |
| | Waltrip Ranch Lake | 04-24-72 | 519 | 25,825 | Dam & Spillway |
| Martin Lake | Martin Lake | 05-31-72 | 77,619 | 4,922,100 | Dam & Spillway |
| Barney M. Davis | Barney M. Davis Cooling Reservoir | 07-15-72 | 6,600 | 4,166,760 | Off-channel Levee & Spillway |
| Mackenzie | Mackenzie Reservoir | 08-30-72 | 46,450 | 2,721,380 | Dam & Spillway |
| Millers Creek | Millers Creek Reservoir | 09-25-72 | 25,520 | 1,106,950 | Dam & Spillway |
| North Fork | North Fork Lake | 11-02-72 | 37,100 | 1,846,096 | Dam & Spillway |
| Laneport | Laneport Lake | 11-08-72 | 65,500 | 3,259,280 | Dam & Spillway |
| SCS Site No. 27 | Upper Bosque River Watershed | 03-26-73 | 739 | 378,783 | Dam & Spillway |
| Bryan Utilities | Bryan Utilities Lake | 04-30-73 | 15,227 | 2,163,400 | Dam & Spillway |
| Mineral Wells | Lake Mineral Wells | 06 - 73 | 6,760 | 772,913 | Spillway Repairs |
| | Lake Quail Haven | 07-30-73 | 455 | 76,332 | Dam & Spillway |
| Lake Wichita | Lake Wichita | 08-09-73 | 14,000 | 163,082 | Modification |
| | Lake Carolyn | 09-04-73 | 2,527 | 1,595,371 | Off-channel Spillway |

Table 12

| Dam | Reservoir or Lake | Construction Started | Reservoir Storage | Cost | |
|---|---|---|---|---|---|
| Lake Diversion | Lake Diversion | 11-05-73 | 40,000 | 691,262 | Spillway Repairs |
| | Lake C. B. Long | 03-04-74 | 698 | 260,000 | Dam & Spillway |
| | Copper Breaks St. Park Lake | 03-11-74 | 455 | 483,415 | Dam & Spillway |
| Country Club | Casa Blanca Lake | 05-13-74 | 20,000 | 177,800 | Modification |
| SCS Site No. 4 | Rush Creek Watershed | 05-30-74 | 236 | 201,978 | Dam & Spillway |
| | Leonard Lake | 06-15-74 | 485 | 24,134 | Dam & Spillway |
| Swauano Creek | Swauano Creek Reservoir | 06-24-74 | 23,587 | 2,465,846 | Dam & Spillway |
| | Sky Lake | 07-15-74 | 495 | 72,000 | Dam & Spillway |
| SCS Site No. 10A | Choctaw Creek Watershed | 07-19-74 | 251 | 12,490 | Dam & Spillway |
| Pinkston | Pinkston Reservoir | 08-15-74 | 7,380 | 852,600 | Dam & Spillway |
| Palo Pinto Creek | Lake Palo Pinto | 08-16-74 | 44,100 | 1,808,961 | Spillway Repairs |
| | Crews Lake | 08-20-74 | 590 | 29,358 | Dam & Spillway |
| Fort Sherman | Cherokee Trail Lake | 10-07-74 | 213,350 | 13,414,162 | Dam & Spillway |
| Squaw Creek Dam | Squaw Creek Reservoir | 11-07-74 | 151,133 | 7,520,378 | Dam & Spillway |
| SCS Site No. 1 Mill Creek | Mill Creek Lake | 01-16-75 | 2,261 | 112,507 | Dam & Spillway |

Table 12

| Dam | Reservoir or Lake | Construction Started | Reservoir Storage | Cost | |
|---|---|---|---|---|---|
| | Schaeffer Lake | 02-26-75 | 900 | 44,784 | Dam & Spillway |
| | Off-channel Reservoir | 02-28-75 | 500 | 315,665 | Levee & Spillway |
| TOTAL | 47 RESERVOIRS | | 3,517,811 Ac-Ft | | |

Table 13

RESERVOIRS UNDER CONSTRUCTION

As of December 18, 1974

| Reservoir Project | Storage Capacity (1,000 acre-feet) Water Supply | Flood Control | Estimated Cost (millions) |
|---|---|---|---|
| Cypress Creek Basin | | | |
| Cherokee Trail | 213.4 | --- | 16.6 |
| Sabine River Basin | | | |
| Martin Creek | 77.6 | --- | 9.0 |
| Trinity River Basin | | | |
| Lavon Enlargement | 748.2 | --- | 59.3 |
| Wallisville | 45.6 | --- | 28.8 |
| Lakeview | 143.2 | 168.8 | 105.0 |
| Brazos River Basin | | | |
| Millers Creek | 25.5 | --- | 2.9 |
| Laneport | 37.4 | 162.7 | 52.2 |
| North Fork | 29.1 | 87.0 | 22.8 |
| Lavaca River Basin | | | |
| Palmetto Bend, Stage 1 | 170.2 | --- | 54.7 |
| Red River Basin | | | |
| Mackenzie | 46.5 | --- | 3.4 |

Table 14

RESERVOIRS TO BE PLACED UNDER CONSTRUCTION WITHIN FIVE YEARS AND ACTIVELY PROSECUTED TO COMPLETION

As of December 18, 1974

| Reservoir Project | Storage Capacity (1,000 acre-feet) Water Supply | Flood Control | Estimated cost (millions) |
|---|---|---|---|
| **Sulphur River Basin** | | | |
| Cooper | 273.0 | 131.4 | $51.0 |
| **Sabine River Basin** | | | |
| Lake Fork | 675.5 | --- | 60.0 |
| Carl L. Estes | 386.0 | 985.0 | 125.0 |
| **Trinity River Basin** | | | |
| Aubrey | 650.3 | 257.8 | 110.0 |
| Tennessee Colony | 2,020.1 | 2,051.2 | 362.0 |
| Richland-Tehuacana | 1,535.5 | --- | 132.7 |
| **Brazos River Basin** | | | |
| Aquilla | 11.0 | 89.2 | 27.1 |
| Upper Navasota | 217.5 | --- | 37.0 |
| Millican | 680.2 | 784.8 | 135.0 |
| **Guadalupe River Basin** | | | |
| Clopton Crossing | 274.9 | 119.9 | 55.5 |
| Cuero I | 1,050.0 | 715.0 | 117.5 |
| Lockhart | 69.4 | --- | 12.2 |
| **San Antonio River Basin** | | | |
| Applewhite | 40.0 | --- | 25.8 |
| Cibolo Creek | 178.6 | 200.0 | 59.0 |
| **Nueces River Basin** | | | |
| Choke Canyon | 700.0 | --- | 65.0 |
| **Red River Basin** | | | |
| Big Pine | 84.0 | 54.7 | 18.4 |
| **Canadian River Basin** | | | |
| Palo Duro | 60.9 | --- | 30.0 |

Table 15

SUPPLY OF SKILLED CONSTRUCTION WORKERS

| Craft | 1950 | 1960 | 1970 | *1975 | Total |
|---|---|---|---|---|---|
| Carpenters | 69,019 | 54,136 | 52,560 | 41,000 | 216,715 |
| Brickmasons | 7,509 | 9,545 | 7,698 | 20,000 | 44,752 |
| Electricians | 12,746 | 16,179 | 26,072 | 27,000 | 81,997 |
| Painters | 25,480 | 27,389 | 25,489 | 19,000 | 97,358 |
| Plumbers | 16,258 | 16,983 | 25,214 | 25,000 | 83,455 |
| Roofers | 2,613 | 3,471 | 4,672 | 1,500 | 12,256 |
| Structural Metal Workers | 2,644 | 3,119 | 4,490 | 16,000 | 26,253 |
| Cement and Concrete Finishers | 2,926 | 3,812 | 7,097 | 6,500 | 20,335 |
| Millwrights | 916 | 1,394 | 2,389 | n/a | 4,699 |
| Boilermakers | 2,553 | 2,470 | 2,266 | 7,500 | 14,789 |
| Asbestos Workers | 1,176 | 1,639 | 2,520 | 1,500 | 6,835 |
| TOTAL | 143,840 | 140,137 | 160,467 | 165,000 | 609,444 |

Sources: Census of Population: 1960, Volume I - Characteristics of the Population, Part 45-Texas. U.S. Department of Commerce, Bureau of the Census. 1961.

Census of Population: 1970, Volume I - Characteristics of the Population, Part 45-Texas. U.S. Department of Commerce, Bureau of the Census. May, 1973.

AFL-CIO Texas Building Trades Councils.

*Figures for 1975 are as reported by the AFL-CIO Texas Building Trades Councils obtained from an informal survey. These figures may include workers who are affiliated with either the Texas Building Trades Councils or the AFL-CIO Texas Chapter or both.

Table 16

SUPPLY OF SKILLED CONSTRUCTION WORKERS EMPLOYED

| Craft | 1950 | 1960 | 1970* | Projected 1976 | Projected 1980 | Total |
|---|---|---|---|---|---|---|
| Carpenters | 65,617 | 49,640 | 58,200 | 65,700 | 70,700 | 309,857 |
| Brickmasons | 7,237 | 8,855 | 7,600 | 8,800 | 9,600 | 42,092 |
| Electricians | 12,264 | 15,425 | 24,500 | 28,900 | 31,800 | 112,889 |
| Painters | 24,233 | 25,182 | 29,400 | 31,100 | 32,300 | 142,215 |
| Plumbers | 15,065 | 15,506 | 22,900 | 27,000 | 29,800 | 110,271 |
| Roofers | 2,483 | 3,116 | 4,600 | 6,100 | 7,200 | 23,499 |
| Structural Metal Workers | 2,426 | 2,786 | 4,500 | 5,400 | 5,900 | 21,012 |
| Cement and Concrete Finishers | 2,782 | 3,486 | 6,600 | 8,700 | 10,100 | 31,668 |
| Millwrights | 854 | 1,292 | 2,400 | 2,600 | 2,800 | 9,946 |
| Boilermakers | 2,317 | 2,150 | 2,100 | 2,400 | 2,500 | 11,467 |
| TOTAL | 135,278 | 127,438 | 162,800 | 186,700 | 202,700 | 814,916 |

Sources: Census of Population: 1960, Volume I - Characteristics of the Population, Part 45-Texas. U.S. Department of Commerce, Bureau of the Census. 1961.

Changing Horizons - A Profile of Jobs to 1980. Texas Employment Commission. February, 1975.

* Figures for 1970, obtained from the Texas Employment Commission, are not copied verbatim from the 1970 census for Texas.

| Occupation | Abilene | Amarillo | Austin | Beaumont-Port Arthur-Orange | Brownsville-Harlingen-San Benito | Corpus Christi | Dallas | El Paso | Fort Worth | Galveston-Texas City | Houston | Laredo | Longview-Marshall | Lubbock | McAllen-Pharr-Edinburg | Midland-Odessa | San Angelo | San Antonio | Sherman-Denison | Texarkana | Tyler | Waco | Wichita Falls |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SERVICES (Cont'd.) | | | | | | | | | | | | | | | | | | | | | | | |
| Masseuse | | | | | | | | | | | | | | | | x | | | | | | | |
| Meat Cutter | | | | | x | | | | | | | | | | | | | | | | | | |
| Nursemaid | | x | | | | | | | | | | | | | | | | | | | | | |
| Orderly | | | | | | | | | | | x | | | | | | x | | | | | | |
| Porter | | | | | | | x | | | | x | | | | | x | | x | | | | | |
| Waitress, Cocktail | | x | | | x | x | | | | | x | | | | | | | | | | | | |
| Waitress | x | x | | | | x | x | | | x | x | | | x | | x | x | x | | x | | x | x |
| Ward Attendent | x | | | | | | | | | | | | | | | | | | | | | | |
| PROCESSING, MACHINE TRADES, BENCH WORK, STRUCTURAL WORK, AND MISCELLANEOUS | | | | | | | | | | | | | | | | | | | | | | | |
| Alteration Tailor | x | | | | | | | | | | | | | | | | | | | | x | | |
| Aircraft & Engine Mechanic | | | | | | | | | | | | | | x | | | | | | | | | |
| Automotive Electrician | | | | | | | | | | | | | | | | | | | | | | x | |
| Auto Mechanic | x | x | | x | | x | x | | x | | x | | | x | x | x | | x | | x | x | | |
| Auto Service Sta. Attendant | | | | | | | | | | | x | | | | | x | | | | x | | | |
| Boat Patcher, Plastic | | | | | | | | | | | | | x | | | | | | | | | | |
| Boilermaker | | | | | | | | | | | x | | | | | | | | | | | | |
| Boatmaker | | | | | | | | x | | | | | | | | | | | | | | | |
| Boxmaker | | | | | | | | | | | | | | | | | | | | x | | | |
| Cabinet Maker | | | | x | | | x | | | | | | | | | | | | | | | | |
| Carpenter | | x | | | | | | | | | x | | x | x | | | | | | | | x | |
| Cleaner | | | | | | | | | | | | | | | | | | | | x | | | |
| Compositor | | | | x | | | | | | | | | | | | | | | | | | | |
| Construction Worker | | | | | | | | | | | x | | | | | | | | | | | | |
| Crane Operator | | x | | | | | | | | | | | | | | | | | | | | | |
| Cutter, Machine | | | | | | | | | | | | | | | | | | | | | x | | |
| Dental Laboratory Technician | | | | | x | x | | | | | | | | | | | | | | | | | |
| Diesel Mechanic | x | x | | | x | x | | | x | | x | | | x | x | x | x | x | | | | | |
| Duct Installer | | | | | | | | | | | | x | | | | | | | | | | | |

| Occupation | Abilene | Amarillo | Austin | Beaumont-Port Arthur-Orange | Brownsville-Harlingen-San Benito | Corpus Christi | Dallas | El Paso | Fort Worth | Galveston-Texas City | Houston | Laredo | Longview-Marshall | Lubbock | McAllen-Pharr-Edinburg | Midland-Odessa | San Angelo | San Antonio | Sherman-Denison | Texarkana | Tyler | Waco | Wichita Falls |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PROCESSING, MACHINE TRADES, BENCH WORK, STRUCTURAL WORK, AND MISCELLANEOUS (Cont'd.) | | | | | | | | | | | | | | | | | | | | | | | |
| Electric Motor Winder | | | | x | | | | | | | | | | | | | | | | | | | |
| Electrician | x | | | | x | x | | | | | | | x | | | | | | | x | x | | |
| Electrician, Apprentice | | | | x | | | | | | | | | | | | | | | | | | | |
| Electrician, Journeyman | | x | | | | | | | | | | | | | | | | | | | | | |
| Electronics Mechanic | | | | | | | | | | | x | | | | | | x | | | | | | |
| Engineering Eqpt. Mechanic | | | | x | | | x | | | | | | | | | | | | | | | | |
| Engine Lathe Set-up Operator | | | | | | | x | | x | | | | | | | | | | | | | | |
| Farm Equipment Mechanic | | | | x | | | | | | | | | | | | | | | | | | | |
| Fiber Glass Winding Mach. Opr. | | | | | | | | x | | | | | | | | | | | | | | | |
| Fitter I | | | | | | | | | | | x | | | | | | | | | | | | |
| Foreman | | | | | | | | x | | | | | | | | | | | | | | | |
| Furniture Refinisher | | | | | | x | | x | x | | | | | x | | | | | | | | | |
| Gasoline Engine Mechanic | | | | | | | | | | | | | | | | | | | | | x | | |
| Grounds Keeper | | | | | | | | | | | x | | | | | | | x | | | | | |
| Heavy Equipment Mechanic | | | | | | | | | | | | | | | | | | | | | x | | |
| Heavy Equipment Operator | | | | | | | | | | x | | | | | | | x | | | | | | |
| Industrial Engine Mechanic | | | | | | | | | | | | | x | | | | | | | | | | |
| Laborers (all types) | x | | | | | | | | | | | | | | | | | | | | | x | |
| Laminator, Preforms | | | | | | | | | | | | | | | | | | | | | x | | |
| Lathe Operator | | | | | | | | | | | | x | | | | | | | | | | | |
| Layoutman | | | | x | | | | | | | | | | | | | | | | | | | |
| Lineman | | | | x | | | | | | | | | | | | | | | | | | | |
| Machine Set-up Operator | | | | x | | | | | | | | | | | | | | | | | | | |
| Machine Tool Operator | | | | | | | | | | | | | | x | | | | | | | | | |
| Machinist (all types) | | | | x | | | x | | x | | x | | x | x | | x | | x | | x | x | x | x |
| Maintenance Man | | x | | x | | | | | | | x | | | | | | x | | | x | | | |
| Maintenance Mechanic | | | | x | | | x | | | | x | | | | | x | | | | | | | |
| Mechanic, Fork Lift | | | | | | | | x | | | | | | | | | | | | | | | |
| Milling Machine Set-up Opr. | | | | | | | | | x | | | | | | | | | | | | | | |
| Millwright | | | | | | | | | | | x | | | | | | | | | | | | |

| Occupation | Abilene | Amarillo | Austin | Beaumont-Port Arthur-Orange | Brownsville-Harlingen-San Benito | Corpus Christi | Dallas | El Paso | Fort Worth | Galveston-Texas City | Houston | Laredo | Longview-Marshall | Lubbock | McAllen-Pharr-Edinburg | Midland-Odessa | San Angelo | San Antonio | Sherman-Denison | Texarkana | Tyler | Waco | Wichita Falls |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PROCESSING, MACHINE TRADES, BENCH WORK, STRUCTURAL WORK, AND MISCELLANEOUS (Cont'd.) | | | | | | | | | | | | | | | | | | | | | | | |
| Offset Pressman | x | | | | | | | | | | | | | | | | | | | | | | |
| Operating Engineer | | | | x | | | | | | | | | | | | x | | | | | | | |
| Painter, Auto | | | | | | | | | | | | | | | | | | | | | x | | |
| Painter, Sign | | | | x | | | | | | | | | | | | | | | | | | | |
| Patternmaker | | | | x | | | | | | | | | | | | | | | | | x | | |
| Pipe Fitter | | x | | x | | | | | | | | | x | | | | | | | | x | | |
| Plater | | | | | | | | | | | | | | | | | | | | x | | | |
| Plumber | | | | | | | | | | | x | | | | | x | | | | | x | | |
| Plumber, Journeyman | | x | | | | | | | | | | | | | | | | | | | | | |
| Production Machine Operator | | | | | | | | | | | | | | | | | x | | | | | | |
| Repairman | | | | | | | | | | | | | | | | | | | | | | | |
| Auto Body | | x | | x | | | x | | | | | | | | | | | | | | x. | | |
| Electric Motor | | x | | x | | | | | | | x | | x | | | | | | | | | | |
| Office Machine | | | | x | | | | | | | | | | | | | | | | | | | |
| Outboard Motor | | | | | | | | | | | | | x | | | | | | | | | x | |
| Household Appliance | x | | | x | | | | | | | | | | | | | x | | | | | | |
| Instrument | | | | | | | | | | | x | | | | | | | | | | | | |
| Sewing Machine | | | | | | | | | | | | | | | | | | | | | x | | |
| Shoe | | | | | | x | | | | | | | | | | | | | | | | | |
| Television & Radio | | x | | x | | x | | | x | | | | | | | | | | | | x | | |
| Tire | | | | x | | x | | | | | | | | | | | | | | x | | | |
| Refrigeration Mechanic | x | | | x | x | | | | | | | | | | | x | | | | | | | |
| Roll Mill Operator | | | | | x | | | | | | | | | | | | | | | | | | |
| Seamstress | | | | | | | | | x | | x | | | | | | | | | | | | |
| Sewage Plant Operator | | | | x | | | | | | | | | | | | | | | | | | | |
| Sewing Machine Operator | | | | | | | | x | x | | | | x | | | | | | | | x | | |
| Sheet Metal Worker | | | | | | | x | | | | | | | | | x | | | | | | | |
| Shipfitter | | | | x | | | | | | | | | | | | | | | | | | | |
| Spray Painter | | | | | | | | | | | | | | | | | | | | | x | | |
| Stationary Engineer | | x | | | | | | | | | | | | | - | | | | | | | | |

BOILERMAKER
R-75 805.281

OCCUPATIONAL AND EDUCATIONAL RESEARCH DEPARTMENT
OCCUPATIONAL SHORTAGES STUDY
(TEC DATA)

[RUN DATE 04/03/75
PAGE 13]

| CITY | 1970 JFMAMJJASOND | 1971 JFMAMJJASOND | 1972 JFMAMJJASOND | 1973 JFMAMJJASOND | 1974 JFMAMJJASOND | 1975 JFMAMJJASOND | 1976 JFMAMJJASOND |
|---|---|---|---|---|---|---|---|
| ABILENE | | | | | | | |
| AMARILLO | | | | | | | |
| AUSTIN | | | | | | | |
| BEAUMONT-<br>PORT ARTHUR-<br>ORANGE | | | XX<br>XX<br>XX | X X<br>X X<br>X X | | | |
| BROWNSVILLE-<br>HARLINGEN-<br>SAN BENITO | | | | | | | |
| CORPUS CHRISTI | | | | | | | |
| DALLAS | | | | | | | |
| EL PASO | | | | | | | |
| FORT WORTH | | | | | | | |
| GALVESTON-<br>TEXAS CITY | | | | | X<br>X | | |
| HOUSTON | | | | | XXX XXXX | | |
| [illegible] | | | | | | | |
| [illegible] | | | | | | | |
| LONGVIEW-<br>MARSHALL | | | | | | | |
| LUBBOCK | | | | | | | |
| MCALLEN-<br>[illegible]-<br>EDINBURG | | | | | | | |
| MIDLAND-<br>ODESSA | | | | | | | |
| SAN ANGELO | | | | | | | |
| SAN ANTONIO | | | | | | | |
| SHERMAN-<br>DENISON | | | | | | | |
| TEXARKANA | X | | X | X | | | |
| TYLER | | | | | | | |
| WACO | | | | | | | |
| WICHITA FALLS | | | | | | | |
| TOTAL BY YEARS | (1970) 1 | (1971) 0 | (1972) 3 | (1973) 3 | (1974) 8 | (1975) 0 | (1976) 0 |
| GRAND TOTAL | 15 | | | | | | |

BRICKLAYER
P-14 861.381

OCCUPATIONAL AND EDUCATIONAL RESEARCH DEPARTMENT
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| CITY | 1970 JFMAMJJASOND | 1971 JFMAMJJASOND | 1972 JFMAMJJASOND | 1973 JFMAMJJASOND | 1974 JFMAMJJASOND | 1975 JFMAMJJASOND | 1976 JFMAMJJASOND |
|---|---|---|---|---|---|---|---|
| ABILENE | | | | | | | |
| AMARILLO | | | | XXXX X | | | |
| AUSTIN | | | | | | | |
| BEAUMONT-<br>PORT ARTHUR-<br>ORANGE | | | | XXXX<br>XXXX<br>XXXX | XXX XXXXXX<br>XXX XXXXXX<br>XXX XXXXXX | | |
| BROWNSVILLE-<br>HARLINGEN-<br>SAN BENITO | X<br>X<br>X | | | | | | |
| CORPUS CHRISTI | | | | X | | | |
| DALLAS | X X X | | | | | | |
| EL PASO | | XXXXXXX | XXXXX | XXXX | | | |
| FORT WORTH | XX | | | XXX | | | |
| GALVESTON-<br>TEXAS CITY | | X<br>X | | X<br>X | | | |
| HOUSTON | XX X XXX | XX XXXXXXXXX | X | | | | |
| LAREDO | | | | | | | |
| LONGVIEW-<br>MARSHALL | | | X<br>X | | | | |
| LUBBOCK | | | | | | | |
| MCALLEN-<br>PHARR-<br>EDINBURG | X<br>X<br>X | X X<br>X X<br>X X | X X XXX XX<br>X X XXX XX<br>X X XXX XX | X<br>X<br>X | X X<br>X X<br>X X | | |
| MIDLAND-<br>ODESSA | X<br>X | | | | | | |
| SAN ANGELO | | | | | | | |
| SAN ANTONIO | | | XXXXXX XXX | | | | |
| SHERMAN-<br>DENISON | | | | | X<br>X | | |
| TEXARKANA | | | | | X | | |
| TYLER | XXX | XXXXXXXXXXX | XXX | | | | |
| WACO | X | | | | | | |
| WICHITA FALLS | | | | | | | |
| TOTAL BY YEARS | (1970) 18 | (1971) 33 | (1972) 26 | (1973) 19 | (1974) 13 | (1975) 0 | (1976) 0 |
| GRAND TOTAL | 109 | | | | | | |

Listing 4

CARPENTER
P-18 860.381

OCCUPATIONAL AND EDUCATIONAL RESEARCH DEPARTMENT
OCCUPATIONAL SHORTAGES STUDY
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| CITY | 1970 JFMAMJJASOND | 1971 JFMAMJJASOND | 1972 JFMAMJJASOND | 1973 JFMAMJJASOND | 1974 JFMAMJJASOND | 1975 JFMAMJJASOND | 1976 JFMAMJJASOND |
|---|---|---|---|---|---|---|---|
| ABILENE | | | | XXXXX | XX | | |
| AMARILLO | | | | XXXXXXX | XXXXXXX XXXX | | |
| AUSTIN | | X | | | | | |
| BEAUMONT-<br>PORT ARTHUR-<br>ORANGE | X X<br>X X<br>X X | X<br>X<br>X | | XXX XXXXXXXX<br>XXX XXXXXXXX<br>XXX XXXXXXXX | X XXX X<br>X XXX X<br>X XXX X | | |
| BROWNSVILLE-<br>HARLINGEN-<br>SAN BENITO | X X X<br>X X X<br>X X X | XXXXX<br>XXXXX<br>XXXXX | XX X X<br>XX X X<br>XX X X | XXXX XXXXXX<br>XXXX XXXXXX<br>XXXX XXXXXX | X X<br>X X<br>X X | | |
| CORPUS CHRISTI | X | | | XX | | | |
| DALLAS | X XX XX | XXXXXX | XXXXXXX | XXXXX XXXX | XXXX XXX | | |
| EL PASO | X | XXXXXXXX | X XXXXXXXX | XXXXXX XX | | | |
| FORT WORTH | X | | XX | XXXXX | | | |
| GALVESTON-<br>TEXAS CITY | X<br>X | | X<br>X | | X<br>X | | |
| HOUSTON | XX X XXX | XX XXXXXXXXX | X XXXXXXXXXX | XXXXXXXXXXX | XXXXXXXXXXX | | |
| LAREDO | X | | | | | | |
| LONGVIEW-<br>MARSHALL | | X<br>X | X<br>X | XXX X<br>XXX X | XX XXX<br>XX XXX | | |
| LUBBOCK | | | XXXX | XXXXXXXXXXX | XXXXXXXXXXX | | |
| MCALLEN-<br>PHARR-<br>EDINBURG | X X X<br>X X X<br>X X X | X XXX X<br>X XXX X<br>X XXX X | X XX XXX X<br>X XX XXX X<br>X XX XXX X | XXXXXXX<br>XXXXXXX<br>XXXXXXX | X X X X<br>X X X X<br>X X X X | | |
| MIDLAND-<br>ODESSA | | | X X XXX<br>X X XXX | XX XXX XXX<br>XX XXX XXX | XX XX<br>XX XX | | |
| SAN ANGELO | | | | | X | | |
| SAN ANTONIO | X | XXXXXXXXXXX | XXXXXXXXXXX | XXXXXXXXXXX | XXXXXXX | | |
| SHERMAN-<br>DENISON | X<br>X | | | | | | |
| TEXARKANA | X X X | X XX | XXX X XX X | X XXX XX | XX X XX | | |
| TYLER | X XXX X | XXXXXXXXXXX | XXX XXX XX | X XXXXXX | X X | | |
| WACO | XXXX XX | XX XX X | XXXXXXXXXXX | XXXXXXXXXX | XXXXXXXXX | | |
| WICHITA FALLS | | | | | | | |
| TOTAL BY YEARS | (1970) 40 | (1971) 70 | (1972) 90 | (1973) 136 | (1974) 91 | (1975) 0 | (1976) 0 |
| GRAND TOTAL | 427 | | | | | | |

# Listing 4

CEMENT MASON
P-19 844.884

OCCUPATIONAL AND EDUCATIONAL RESEARCH DEPARTMENT
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| CITY | 1970 JFMAMJJASOND | 1971 JFMAMJJASOND | 1972 JFMAMJJASOND | 1973 JFMAMJJASOND | 1974 JFMAMJJASOND | 1975 JFMAMJJASOND | 1976 JFMAMJJASOND |
|---|---|---|---|---|---|---|---|
| ABILENE | | | | XX | | | |
| AMARILLO | X | | X | XXXXX | XX X | | |
| AUSTIN | XX | | | | | | |
| BEAUMONT-<br>PORT ARTHUR-<br>ORANGE | | | | XX X<br>XX X<br>XX X | XXX<br>XXX<br>XXX | | |
| BROWNSVILLE-<br>HARLINGEN-<br>SAN BENITO | XX<br>XX<br>XX | | | | | | |
| CORPUS CHRISTI | XX | X | XX X | | | | |
| DALLAS | XXXX | XXXXXX | XXXXXXX X | XXXXX | | | |
| EL PASO | | XXXXXX | XXXXXXXXXX | XXXX | | | |
| FORT WORTH | | | | | | | |
| GALVESTON-<br>TEXAS CITY | | | | | | | |
| HOUSTON | XX | | | | | | |
| LAREDO | | | | | | | |
| LONGVIEW-<br>MARSHALL | | | | | | | |
| LUBBOCK | | | | | | | |
| MCALLEN-<br>PHARR-<br>EDINBURG | | | X<br>X<br>X | | | | |
| MIDLAND-<br>ODESSA | | | | | | | |
| SAN ANGELO | | | | | | | |
| SAN ANTONIO | X | | X XXXX | X X XXXXXXXX | | | |
| SHERMAN-<br>DENISON | X<br>X | | | | | | |
| TEXARKANA | | | | X | | | |
| TYLER | XXXX | X | | | | | |
| WACO | X | | | | | | |
| WICHITA FALLS | | | | | | | |
| TOTAL BY YEARS | (1970) 20 | (1971) 14 | (1972) 28 | (1973) 30 | (1974) 6 | (1975) 0 | (1976) 0 |
| GRAND TOTAL | 98 | | | | | | |

# Listing 4

OCCUPATIONAL AND EDUCATIONAL RESEARCH DEPARTMENT
OCCUPATIONAL SHORTAGES STUDY
(TEC DATA)

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ELECTRICIAN
P-32 824.281

| CITY | 1970 JFMAMJJASOND | 1971 JFMAMJJASOND | 1972 JFMAMJJASOND | 1973 JFMAMJJASOND | 1974 JFMAMJJASOND | 1975 JFMAMJJASOND | 1976 JFMAMJJASOND |
|---|---|---|---|---|---|---|---|
| ABILENE | X | | X | XX | XXXXXX | | |
| AMARILLO | X | XXX | X XXXX | XXXXXXXXXXXX | XXXXXXXXXX X | | |
| AUSTIN | | | | | | | |
| BEAUMONT-<br>PORT ARTHUR-<br>ORANGE | XXXX X<br>XXXX X<br>XXXX X | X X X<br>X X X<br>X X X | X XXXX<br>X XXXX<br>X XXXX | XXX XXXXX<br>XXX XXXXX<br>XXX XXXXX | XXXXXXXXXXX<br>XXXXXXXXXXX<br>XXXXXXXXXXX | | |
| BROWNSVILLE-<br>HARLINGEN-<br>SAN BENITO | XX X XX<br>XX X XX<br>XX X XX | X X<br>X X<br>X X | X X<br>X X<br>X X | X XXX X XX<br>X XXX X XX<br>X XXX X XX | XXXXXXX X<br>XXXXXXX X<br>XXXXXXX X | | |
| CORPUS CHRISTI | | | X | X XXXXXXX | XX X XX XX | | |
| DALLAS | XXXXXX XX | XXXXXX | XX XX | | | | |
| EL PASO | XX | | XXXXXX X | XXXX XXXXXX | | | |
| FORT WORTH | | | | XXXX | XXXXXXX X | | |
| GALVESTON-<br>TEXAS CITY | X<br>X | | X X XXX X<br>X X XXX X | XXXXX<br>XXXXX | X X X<br>X X X | | |
| HOUSTON | X XXXX XXXXX | XX XXXXXXXXX | X | | | | |
| LAREDO | | | | XX XXX XX | XX | | |
| LONGVIEW-<br>MARSHALL | XX<br>XX | | X X<br>X X | X<br>X | XXX XXX<br>XXX XXX | | |
| LUBBOCK | | | | | | | |
| MCALLEN-<br>PHARR-<br>EDINBURG | X X X XXXXX<br>X X X XXXXX<br>X X X XXXXX | X X X<br>X X X<br>X X X | X X XXXX<br>X X XXXX<br>X X XXXX | XXXXXX XXXXX<br>XXXXXX XXXXX<br>XXXXXX XXXXX | XX XXX X<br>XX XXX X<br>XX XXX X | | |
| MIDLAND-<br>ODESSA | X<br>X | X XX<br>X XX | XX<br>XX | | | | |
| SAN ANGELO | | | X | X | X X | | |
| SAN ANTONIO | X | XXXXXX | XXXXXXXX | XXXXXXXXXX | X | | |
| SHERMAN-<br>DENISON | | | X<br>X | X<br>X | X<br>X | | |
| TEXARKANA | X X X | XX | X X | XX XXX X | X | | |
| TYLER | X X X XX | | | | XXX | | |
| WACO | X | | XXXXXXX | X | XXX XX | | |
| WICHITA FALLS | | | | | | | |
| TOTAL BY YEARS | (1970) 54 | (1971) 40 | (1972) 61 | (1973) 94 | (1974) 82 | (1975) 0 | (1976) 0 |
| GRAND TOTAL | 331 | | | | | | |

ENGINEER-CONSTRUCTION*
C-11 005.081

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| CITY | 1970 JFMAMJJASOND | 1971 JFMAMJJASOND | 1972 JFMAMJJASOND | 1973 JFMAMJJASOND | 1974 JFMAMJJASOND | 1975 JFMAMJJASOND | 1976 JFMAMJJASOND |
|---|---|---|---|---|---|---|---|
| ABILENE | | | | | | | |
| AMARILLO | | | | | | | |
| AUSTIN | | | | | | | |
| BEAUMONT-PORT ARTHUR-ORANGE | | | | | | | |
| BROWNSVILLE-HARLINGEN-SAN BENITO | | | | | | | |
| CORPUS CHRISTI | | | | | X | | |
| DALLAS | | | | | | | |
| EL PASO | | | | | | | |
| FORT WORTH | | | | | | | |
| GALVESTON-TEXAS CITY | | | | | | | |
| HOUSTON | | | | | | | |
| LAREDO | X | X | | | | | |
| LONGVIEW-MARSHALL | | | | | | | |
| LUBBOCK | | | | | | | |
| MCALLEN-EDINBURG | | | | | | | |
| MIDLAND-ODESSA | | | | | | | |
| SAN ANGELO | | | | | | | |
| SAN ANTONIO | | | | | | | |
| SHERMAN-DENISON | | | | | | | |
| TEXARKANA | | | | | | | |
| TYLER | | | | | | | |
| WACO | | | | | | | |
| WICHITA FALLS | | | | | | | |
| TOTAL BY YEARS | (1970) 1 | (1971) 1 | (1972) 0 | (1973) 0 | (1974) 1 | (1975) 0 | (1976) 0 |
| GRAND TOTAL | 3 | | | | | | |

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IRON WORKERS
V-25 801.781

OCCUPATIONAL AND EDUCATIONAL RESEARCH DEPARTMENT
OCCUPATIONAL SHORTAGES STUDY
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| CITY | 1970 JFMAMJJASOND | 1971 JFMAMJJASOND | 1972 JFMAMJJASOND | 1973 JFMAMJJASOND | 1974 JFMAMJJASOND | 1975 JFMAMJJASOND | 1976 JFMAMJJASOND |
|---|---|---|---|---|---|---|---|
| ABILENE | | | | | | | |
| AMARILLO | | | | | | | |
| AUSTIN | | | | | | | |
| BEAUMONT-PORT ARTHUR-ORANGE | | | | | | | |
| BROWNSVILLE-HARLINGEN-SAN BENITO | | | | | | | |
| CORPUS CHRISTI | | | | | | | |
| DALLAS | | | | | | | |
| EL PASO | | | | | | | |
| FORT WORTH | | | | | | | |
| GALVESTON-TEXAS CITY | | | | | | | |
| HOUSTON | | | | | | | |
| LAREDO | | | | | | | |
| LONGVIEW-MARSHALL | | X<br>X | | | X<br>X | | |
| LUBBOCK | | | | | | | |
| MCALLEN-PHARR-EDINBURG | | | | | | | |
| MIDLAND-ODESSA | | | | | | | |
| SAN ANGELO | | | | | | | |
| SAN ANTONIO | | | | | | | |
| SHERMAN-DENISON | | | | | | | |
| TEXARKANA | | | | | | | |
| TYLER | | | | | | | |
| WACO | | | | | | | |
| WICHITA FALLS | | | | | | | |
| TOTAL BY YEARS | (1970) 0 | (1971) 1 | (1972) 0 | (1973) 0 | (1974) 1 | (1975) 0 | (1976) 0 |
| GRAND TOTAL | 2 | | | | | | |

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MILLWRIGHT
P-75 638.281

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| CITY | 1970 JFMAMJJASOND | 1971 JFMAMJJASOND | 1972 JFMAMJJASOND | 1973 JFMAMJJASOND | 1974 JFMAMJJASOND | 1975 JFMAMJJASOND | 1976 JFMAMJJASOND |
|---|---|---|---|---|---|---|---|
| ABILENE | | | | | XX | | |
| AMARILLO | | | | | | | |
| AUSTIN | | | | | | | |
| BEAUMONT-PORT ARTHUR-ORANGE | | | | XXXXX<br>XXXXX<br>XXXXX | XXXXXXXXXX<br>XXXXXXXXXX<br>XXXXXXXXXX | | |
| BROWNSVILLE-HARLINGEN-SAN BENITO | | | | | | | |
| CORPUS CHRISTI | | | | X XXXX | X | | |
| DALLAS | | | | | | | |
| EL PASO | | | | | | | |
| FORT WORTH | | | | | | | |
| GALVESTON-TEXAS CITY | | | | | | | |
| HOUSTON | | | | | | | |
| LAREDO | | | | | | | |
| LUFKIN-MARSHALL | | | | X X<br>X X | XX X<br>XX X | | |
| LUBBOCK | | | | | | | |
| MCALLEN-PHARR-EDINBURG | | | | | | | |
| MIDLAND-ODESSA | | | | | | | |
| SAN ANGELO | | | | | | | |
| SAN ANTONIO | | | | | | | |
| SHERMAN-DENISON | | | | | | | |
| TEXARKANA | XX | | X | X | X X | | |
| TYLER | | | | | | | |
| WACO | | | | | | | |
| WICHITA FALLS | | | | | | | |
| TOTAL BY YEARS | (1970) 2 | (1971) 0 | (1972) 1 | (1973) 13 | (1974) 18 | (1975) 0 | (1976) 0 |
| GRAND TOTAL | 34 | | | | | | |

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PIPEFITTER
2-32 862.381

OCCUPATIONAL AND EDUCATIONAL RESEARCH DEPARTMENT
OCCUPATIONAL SHORTAGES STUDY
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| CITY | 1970 JFMAMJJASOND | 1971 JFMAMJJASOND | 1972 JFMAMJJASOND | 1973 JFMAMJJASOND | 1974 JFMAMJJASOND | 1975 JFMAMJJASOND | 1976 JFMAMJJASOND |
|---|---|---|---|---|---|---|---|
| ABILENE | | | | | | | |
| AMARILLO | | | | | XXX | | |
| AUSTIN | | | | | | | |
| BEAUMONT-<br>PORT ARTHUR-<br>ORANGE | XX<br>XX<br>XX | X<br>X<br>X | XXX X<br>XXX X<br>XXX X | XXXX XX<br>XXXX XX<br>XXXX XX | XXXXXXX XXXX<br>XXXXXXX XXXX<br>XXXXXXX XXXX | | |
| BROWNSVILLE-<br>HARLINGEN-<br>SAN BENITO | | | | XX<br>XX<br>XX | | | |
| CORPUS CHRISTI | | | | | XX | | |
| DALLAS | | | | | | | |
| EL PASO | | | XXXXX | | X | | |
| FORT WORTH | X | | | | | | |
| GALVESTON-<br>TEXAS CITY | | | X<br>X | | | | |
| HOUSTON | | | | | | | |
| LAREDO | | | | | | | |
| LONGVIEW-<br>MARSHALL | | | | | X X X<br>X X X | | |
| LUBBOCK | | | | | | | |
| MCALLEN-<br>PHARR-<br>EDINBURG | | | | | | | |
| MIDLAND-<br>ODESSA | | | XX<br>XX | | XX<br>XX | | |
| SAN ANGELO | | | | | | | |
| SAN ANTONIO | | | | | | | |
| SHERMAN-<br>DENISON | | | | | | | |
| TEXARKANA | | | X | | | | |
| TYLER | | | | | | | |
| WACO | | | | | | | |
| WICHITA FALLS | | | | | | | |
| TOTAL BY YEARS | (1970) 3 | (1971) 1 | (1972) 13 | (1973) 8 | (1974) 22 | (1975) 0 | (1976) 0 |
| GRAND TOTAL | 47 | | | | | | |

# Listing 4

PLUMBER
P-85 862.381

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| CITY | 1970 JFMAMJJASOND | 1971 JFMAMJJASOND | 1972 JFMAMJJASOND | 1973 JFMAMJJASOND | 1974 JFMAMJJASOND | 1975 JFMAMJJASOND | 1976 JFMAMJJASOND |
|---|---|---|---|---|---|---|---|
| ABILENE | | | | | XX | | |
| AMARILLO | X X X XX | XX X XXX | XXX XXX | XXXXXXXXXXX | XX | | |
| AUSTIN | | | | | | | |
| BEAUMONT-<br>PORT ARTHUR-<br>ORANGE | | | XXXXX<br>XXXXX<br>XXXXX | X<br>X<br>X | | | |
| BROWNSVILLE-<br>HARLINGEN-<br>SAN BENITO | XX X<br>XX X<br>XX X | X X<br>X X<br>X X | X X<br>X X<br>X X | X X<br>X X<br>X X | X X X X<br>X X X X<br>X X X X | | |
| CORPUS CHRISTI | | | X X | | X | | |
| DALLAS | X X XXX | X XXXXX XX | XXXXXXXXXX | XXX | | | |
| EL PASO | | XXXXX | X | X XXXX | | | |
| FORT WORTH | X | | | XX | | | |
| GALVESTON-<br>TEXAS CITY | X X X<br>X X X | | | | X<br>X | | |
| HOUSTON | X X X XXX | XX XXXXX XXX | XXXXX X | | XXXXX XX | | |
| LAREDO | X X | | | | | | |
| LONGVIEW-<br>MARSHALL | | | X<br>X | | X<br>X | | |
| LUBBOCK | XX | | | | | | |
| MCALLEN-<br>PHARR-<br>EDINBURG | | | XX X X<br>XX X X<br>XX X X | | XX X X<br>XX X X<br>XX X X | | |
| MIDLAND-<br>ODESSA | X<br>X | | XX XXX<br>XX XXX | X X<br>X X | X X X<br>X X X | | |
| SAN ANGELO | | | | | | | |
| SAN ANTONIO | X X X | XXXXXXX XXX | XXXXXXXXXXX | XXXXXXXXXXX | | | |
| SHERMAN-<br>DENISON | | | | | X<br>X | | |
| TEXARKANA | X | XX XX | X X | | | | |
| TYLER | | X | | X XX | X | | |
| WACO | | | XX XX | X XXXXX | X X | | |
| WICHITA FALLS | | | | | | | |

TOTAL BY YEARS (1970) 32 (1971) 47 (1972) 60 (1973) 47 (1974) 29 (1975) 0 (1976) 0
GRAND TOTAL 215

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SHEET METAL WORKER
Q-04 804.281

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| CITY | 1970 JFMAMJJASOND | 1971 JFMAMJJASOND | 1972 JFMAMJJASOND | 1973 JFMAMJJASOND | 1974 JFMAMJJASOND | 1975 JFMAMJJASOND | 1976 JFMAMJJASOND |
|---|---|---|---|---|---|---|---|
| ABILENE | X | | | XXXXX | XX | | |
| AMARILLO | XX XXXXX | XXXXXX XXX | XXXXXXX | XX | XXXXXXXXXXXX | | |
| AUSTIN | | | | | | | |
| BEAUMONT-<br>PORT ARTHUR-<br>ORANGE | X<br>X<br>X | | | X<br>X<br>X | XX<br>XX<br>XX | | |
| BROWNSVILLE-<br>HARLINGEN-<br>SAN BENITO | | | | | | | |
| CORPUS CHRISTI | X | | X | X X | | | |
| DALLAS | XXX | | X | XX XXXXXX XX | XXXXXXXXXXX | | |
| EL PASO | X | XXXXX | XXXXX | XX | | | |
| FORT WORTH | X | | | XX XX | XXXXXXX | | |
| GALVESTON-<br>TEXAS CITY | X<br>X XX | X<br>X | X<br>X | | | | |
| HOUSTON | XX XXX X | XX XXXXXXX X | XXXX X XXXXX | XXXXXXXXX XX | | | |
| LAREDO | | | | | | | |
| LONGVIEW-<br>MARSHALL | | | | X<br>X | X XXX XXX<br>X XXX XXX | | |
| LUBBOCK | | XXXX XX X | XXXXXXXXXX | XXXXXXXX XX | XXXXXXXXXX | | |
| ABILENE-<br>SWEETWATER | | | X<br>X<br>X | | X<br>X<br>X | | |
| MIDLAND-<br>ODESSA | X<br>X | | X<br>X | XX X XX<br>XX X XX | XXXXX<br>XXXXX | | |
| WICHITA FALLS | XXXXX XX X | XXXXXXXXXX X | XX XXXXXXXXX | XXXXXXXX XX | XXX XXX X | | |
| SAN ANTONIO | X X X | | | XXXX XX | X | | |
| SHERMAN-<br>DENISON | X<br>X | | | X XX<br>X XX | | | |
| TEXARKANA | | | XX X | X | XX | | |
| TYLER | | XX X | XXX | | | | |
| WACO | X X XXX | | | X | X X | | |
| WICHITA FALLS | | | | | | | |
| TOTAL BY YEARS | (1970) 42 | (1971) 46 | (1972) 54 | (1973) 74 | (1974) 71 | (1975) 0 | (1976) 0 |
| GRAND TOTAL | 287 | | | | | | |

Listing 4

OCCUPATIONAL AND EDUCATIONAL RESEARCH DEPARTMENT
OCCUPATIONAL SHORTAGES STUDY
(TEC DATA)

RUN DATE 04/03/75
PAGE 11

STRUCTURAL STEEL WORKER
Q-09 801.781

| CITY | 1970 JFMAMJJASOND | 1971 JFMAMJJASOND | 1972 JFMAMJJASOND | 1973 JFMAMJJASOND | 1974 JFMAMJJASOND | 1975 JFMAMJJASOND | 1976 JFMAMJJASOND |
|---|---|---|---|---|---|---|---|
| ABILENE | | | | | | | |
| AMARILLO | | | | | | | |
| AUSTIN | | | | | | | |
| BEAUMONT-<br>PORT ARTHUR-<br>ORANGE | | | | X<br>X<br>X | X<br>X<br>X | X<br>X<br>X | |
| BROWNSVILLE-<br>HARLINGEN-<br>SAN BENITO | X<br>X<br>X | | | | | | |
| CORPUS CHRISTI | | | | | | | |
| DALLAS | | | | | | | |
| EL PASO | | | X | | | | |
| FORT WORTH | | | | | | | |
| GALVESTON-<br>TEXAS CITY | | | | | | | |
| HOUSTON | | | | | | | |
| LAREDO | | X | | XX | | | |
| LONGVIEW-<br>MARSHALL | X<br>X | | | | XXXXX<br>XXXXX | | |
| LUBBOCK | | | | | | | |
| MCALLEN-<br>PHARR-<br>EDINBURG | | | | | X<br>X<br>X | | |
| MIDLAND-<br>ODESSA | | | X<br>X | XX<br>XX | X X<br>X X | | |
| SAN ANGELO | | | | | X | | |
| SAN ANTONIO | | | | | | | |
| SHERMAN-<br>DENISON | | | | | | | |
| TEXARKANA | | | | | | | |
| TYLER | | | X | | | | |
| WACO | | | | | | | |
| WICHITA FALLS | | | | | | | |
| TOTAL BY YEARS | (1970) 2 | (1971) 1 | (1972) 3 | (1973) 10 | (1974) 6 | (1975) 0 | (1976) 0 |
| GRAND TOTAL | 22 | | | | | | |

Listing 4

PAINTER
C-99 840.781

OCCUPATIONAL AND EDUCATIONAL RESEARCH DEPARTMENT
OCCUPATIONAL SHORTAGES STUDY
(TEC DATA)

RUN DATE 04/03/75
PAGE 12

| CITY | 1970 JFMAMJJASOND | 1971 JFMAMJJASOND | 1972 JFMAMJJASOND | 1973 JFMAMJJASOND | 1974 JFMAMJJASOND | 1975 JFMAMJJASOND | 1976 JFMAMJJASOND |
|---|---|---|---|---|---|---|---|
| ABILENE | | | | | | | |
| AMARILLO | X | | | | | | |
| AUSTIN | | | | | | | |
| BEAUMONT-<br>PORT ARTHUR-<br>ORANGE | | X<br>X<br>X | X<br>X<br>X | X X X XXXX<br>X X X XXXX<br>X X X XXXX | X X X<br>X X X<br>X X X | | |
| BROWNSVILLE-<br>HARLINGEN-<br>SAN BENITO | X<br>X<br>X | | | X<br>X<br>X | | | |
| CORPUS CHRISTI | XX | | | | | | |
| DALLAS | | | | XX XXXX | XXX | | |
| EL PASO | | XXXX | X | X | | | |
| FORT WORTH | X | | X | | | | |
| GALVESTON-<br>TEXAS CITY | X X<br>X X | | | | X<br>X | | |
| HOUSTON | | X X | X XXXXX | XXXXX XXXXXX | | | |
| LAREDO | | | | X | | | |
| LONGVIEW-<br>MARSHALL | X<br>X | | | | | | |
| LUBBOCK | | | | | | | |
| MCALLEN-<br>PHARR-<br>EDINBURG | X<br>X<br>X | | | | | | |
| MIDLAND-<br>ODESSA | | | | XXX<br>XXX | X XXX<br>X XXX | | |
| SAN ANGELO | | | | X | X | | |
| SAN ANTONIO | X X | | XXXX | X XXX | | | |
| SHERMAN-<br>DENISON | | | | | | | |
| TEXARKANA | X | | | X X | X | | |
| TYLER | | | XXX XXX | X | | | |
| WACO | X | | XX | X XX | XX | | |
| WICHITA FALLS | | | | | | | |
| TOTAL BY YEARS<br>GRAND TOTAL | (1970) 13<br>97 | (1971) 7 | (1972) 21 | (1973) 41 | (1974) 15 | (1975) 0 | (1976) 0 |

Table 17

MANPOWER REQUIREMENTS FOR CONSTRUCTION OF INDUSTRIAL PLANTS
Minimum Estimates

| Craft | Percentage | Number |
|---|---|---|
| Boilermakers | 12% | 1,865 |
| Brick Masons | 2% | 311 |
| Carpenters | 8% | 1,243 |
| Electricians | 6% | 932 |
| Operating Engineers | 7% | 1,088 |
| Millwrights | 1% | 155 |
| Painters | 2% | 311 |
| Pipefitters | 39% | 6,061 |
| Iron and Steel Workers | 8% | 1,243 |
| Cement Masons | 1% | 155 |
| Total | | 13,364 |

Sources: Bill Kacy, Public Relations, Union Carbide Corporation, Austin.
John Callahan, M. W. Kellogg Construction Co., Houston.

Table 18

MANPOWER REQUIREMENTS FOR CONSTRUCTION OF INDUSTRIAL PLANTS UNDER CONSTRUCTION

Minimum Estimates

| Craft | Percentage | Number |
|---|---|---|
| Boilermakers | 12% | 2,761 |
| Brickmasons | 2% | 460 |
| Carpenters | 8% | 1,840 |
| Electricians | 6% | 1,380 |
| Operating Engineers | 7% | 1,610 |
| Millwrights | 1% | 230 |
| Painters | 2% | 460 |
| Pipefitters | 39% | 8,973 |
| Iron and Steel Workers | 8% | 1,840 |
| Cement Masons | 1% | 230 |
| TOTAL | | 19,784 |

Sources: Bill Kacy, Public Relations, Union Carbide Corporation, Austin.

John Callahan, M. W. Kellogg Construction Co., Houston

Table 19

MANPOWER REQUIREMENTS FOR CONSTRUCTION OF DAMS
January, 1970 - February, 1975
Minimum Estimates

| Year | Carpenters (6.4%) | Ironworkers (3.1%) | Operating Engineers (24.1%) | Other Skilled Trades (6.9%) |
|---|---|---|---|---|
| 1970 | 41 | 20 | 153 | 44 |
| 1971 | 11 | 5 | 40 | 11 |
| 1972 | 28 | 14 | 107 | 30 |
| 1973 | 9 | 4 | 34 | 10 |
| 1974 | 43 | 21 | 161 | 46 |
| 1975* | 1 | 1 | 3 | 1 |
| Total | 133 | 65 | 498 | 142 |

*Figures for 1975-incomplete

Source: Contractors Mutual Association. Projecting Construction Manpower Requirements - A Guide to Methods and Sources for Estimating Future Demand, March, 1975.

Table 20

MANPOWER REQUIREMENTS FOR CONSTRUCTION OF RESERVOIRS UNDER CONSTRUCTION
Minimum Estimates

| Skill | Percentage | Number |
|---|---|---|
| Carpenters | 6.4 | 556 |
| Ironworkers | 3.1 | 269 |
| Operating Engineers | 24.1 | 2,094 |
| Other Skilled | 6.9 | 600 |
| TOTAL | | 3,519 |

Source: Contractors Mutual Association, Projecting Construction Manpower Requirements - A Guide to Methods and Sources for Estimating Future Demand. March, 1975.

Table 21

MANPOWER REQUIREMENTS FOR CONSTRUCTION OF NUCLEAR POWER PLANTS
Minimum Estimates

| Skill | '76 | '77 | '78 | '79 | '80 | '81 | '82 | '83 | '84 | '85 | '86 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Boilermakers | 114 | 114 | 255 | 255 | 282 | 200 | 201 | 85 | 86 | 59 | 59 |
| Ironworkers | 174 | 174 | 389 | 389 | 431 | 305 | 305 | 132 | 132 | 90 | 89 |
| Carpenters | 303 | 303 | 681 | 679 | 750 | 531 | 531 | 228 | 228 | 158 | 156 |
| Electricians | 585 | 585 | 1,309 | 1,309 | 1,450 | 1,027 | 1,028 | 439 | 442 | 301 | 302 |
| Millwrights | 87 | 87 | 195 | 195 | 215 | 152 | 154 | 64 | 66 | 45 | 45 |
| Machinists | 42 | 42 | 94 | 94 | 104 | 73 | 74 | 32 | 32 | 22 | 21 |
| Painters | 69 | 69 | 154 | 154 | 173 | 122 | 120 | 53 | 51 | 35 | 35 |
| Bricklayers and Masons | 45 | 45 | 101 | 101 | 111 | 78 | 78 | 34 | 34 | 24 | 24 |
| Steam Fitters | 801 | 801 | 1,793 | 1,792 | 1,985 | 1,408 | 1,409 | 603 | 603 | 414 | 412 |
| Roofers | 3 | 3 | 7 | 6 | 8 | 6 | 4 | 2 | 2 | 2 | 2 |
| Sheet Metal Workers | 99 | 99 | 221 | 221 | 245 | 175 | 174 | 75 | 75 | 50 | 51 |
| Operating Engineers | 165 | 165 | 369 | 369 | 409 | 290 | 290 | 125 | 124 | 84 | 85 |

Source: Budwani, R. "Nuclear Plant Lead Time, Costs, Labor and Material Takeoffs." Power Engineering 78:60-3, April, 1974.

Table 22

MANPOWER REQUIREMENTS FOR CONSTRUCTION OF NUCLEAR POWER PLANTS
Minimum Estimates

| | MAN YEARS | | | | |
|---|---|---|---|---|---|
| Skill | 1977 | 1980 | 1985 | 1990 | Total |
| Carpenters | 386 | 507.2 | 722 | 1,011.6 | 2,626.8 |
| Electricians | 498.4 | 736.4 | 1,092 | 1,629.6 | 3,956.4 |
| Ironworkers | 381.2 | 468 | 669.2 | 936.4 | 2,454.8 |
| Millwrights | 86.4 | 126 | 184 | 268.4 | 664.8 |
| Pipe/Steam Fitters | 1,091.2 | 1,544.8 | 2,196 | 3,193.2 | 8,025.2 |
| Operating Engineers | 284.8 | 351.6 | 514.4 | 719.2 | 1,870 |
| Boilermakers | 248.8 | 345.6 | 466.4 | 686.4 | 1,747.2 |
| Insulation Workers | 57.6 | 138.4 | 179.6 | 277.2 | 652.8 |
| TOTAL | 3,034.4 | 4,218 | 6,023.6 | 8,722 | 21,998 |

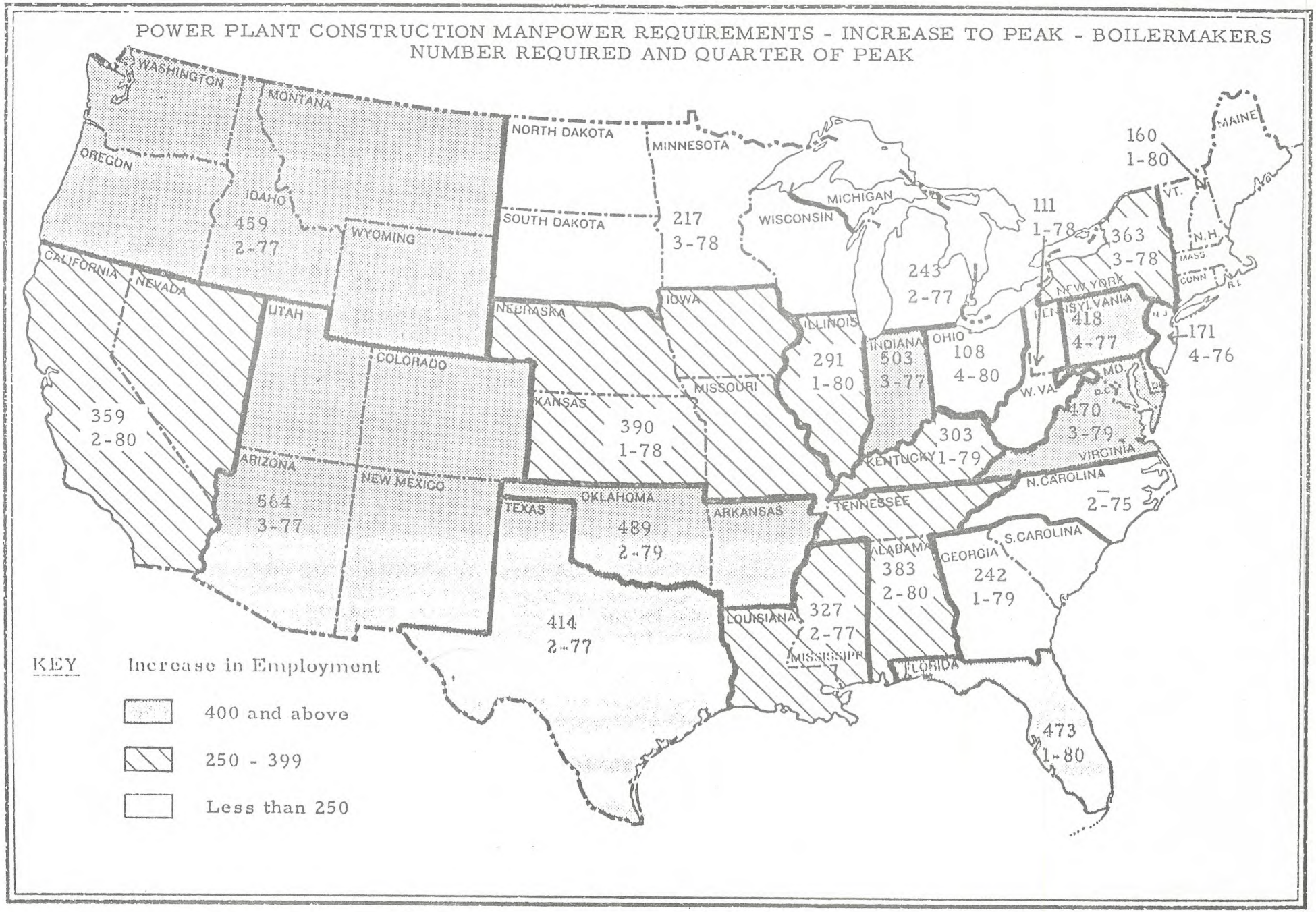
Source: Project Independence, Blueprint, Final Task Report. Labor Report. Federal Energy Administration. Under the direction of the Atomic Energy Commission. November, 1974.

Table 23

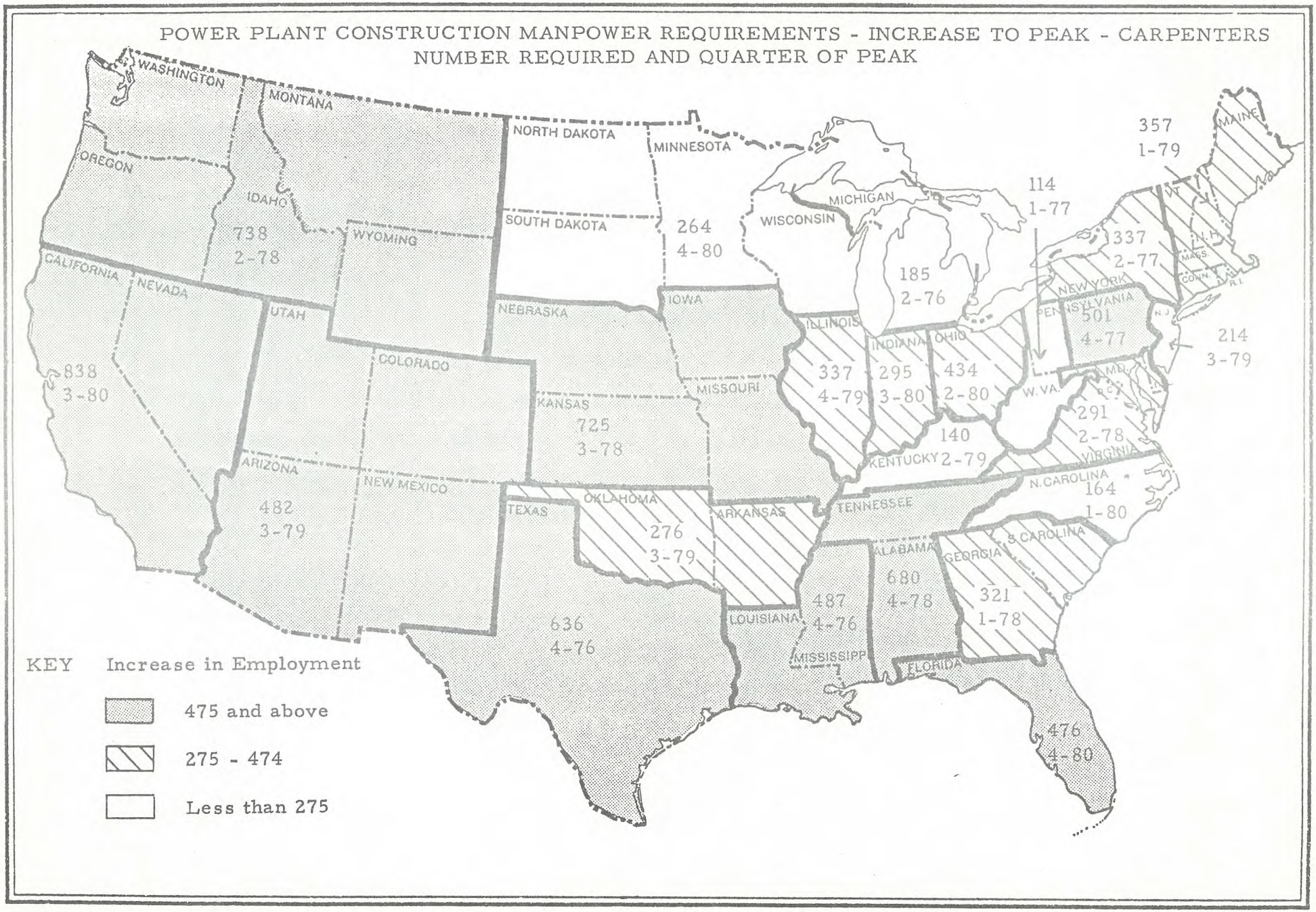
MANPOWER REQUIREMENTS FOR CONSTRUCTION OF
NUCLEAR AND FOSSIL-FUELED POWER PLANTS

| | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | TOTAL |
|---|---|---|---|---|---|---|---|---|
| Boilermakers | 879 | 1,154 | 1,315 | 1,393 | 945 | 891 | 1,134 | 7,711 |
| Bricklayers | 21 | 34 | 31 | 46 | 35 | 32 | 33 | 232 |
| Carpenters | 797 | 1,272 | 1,556 | 1,334 | 1,148 | 1,105 | 764 | 7,976 |
| Cement Masons | 77 | 117 | 176 | 144 | 143 | 114 | 93 | 864 |
| Electricians | 656 | 1,004 | 1,289 | 1,645 | 1,755 | 1,449 | 1,397 | 9,195 |
| Iron Workers | 630 | 897 | 1,127 | 1,065 | 940 | 923 | 719 | 6,301 |
| Millwrights | 138 | 185 | 238 | 279 | 286 | 238 | 230 | 1,594 |
| Operating Engineers | 660 | 961 | 1,027 | 909 | 874 | 936 | 605 | 5,972 |
| Painters | 80 | 135 | 168 | 203 | 228 | 213 | 189 | 1,216 |
| Pipefitters | 810 | 1,460 | 2,064 | 2,731 | 2,871 | 2,336 | 2,034 | 14,306 |
| Sheet Metal Workers | 102 | 131 | 137 | 183 | 188 | 216 | 163 | 1,120 |
| Others | 361 | 597 | 632 | 629 | 563 | 558 | 364 | 3,704 |
| TOTAL | 5,211 | 7,947 | 9,760 | 10,561 | 9,976 | 9,011 | 7,725 | 60,191 |

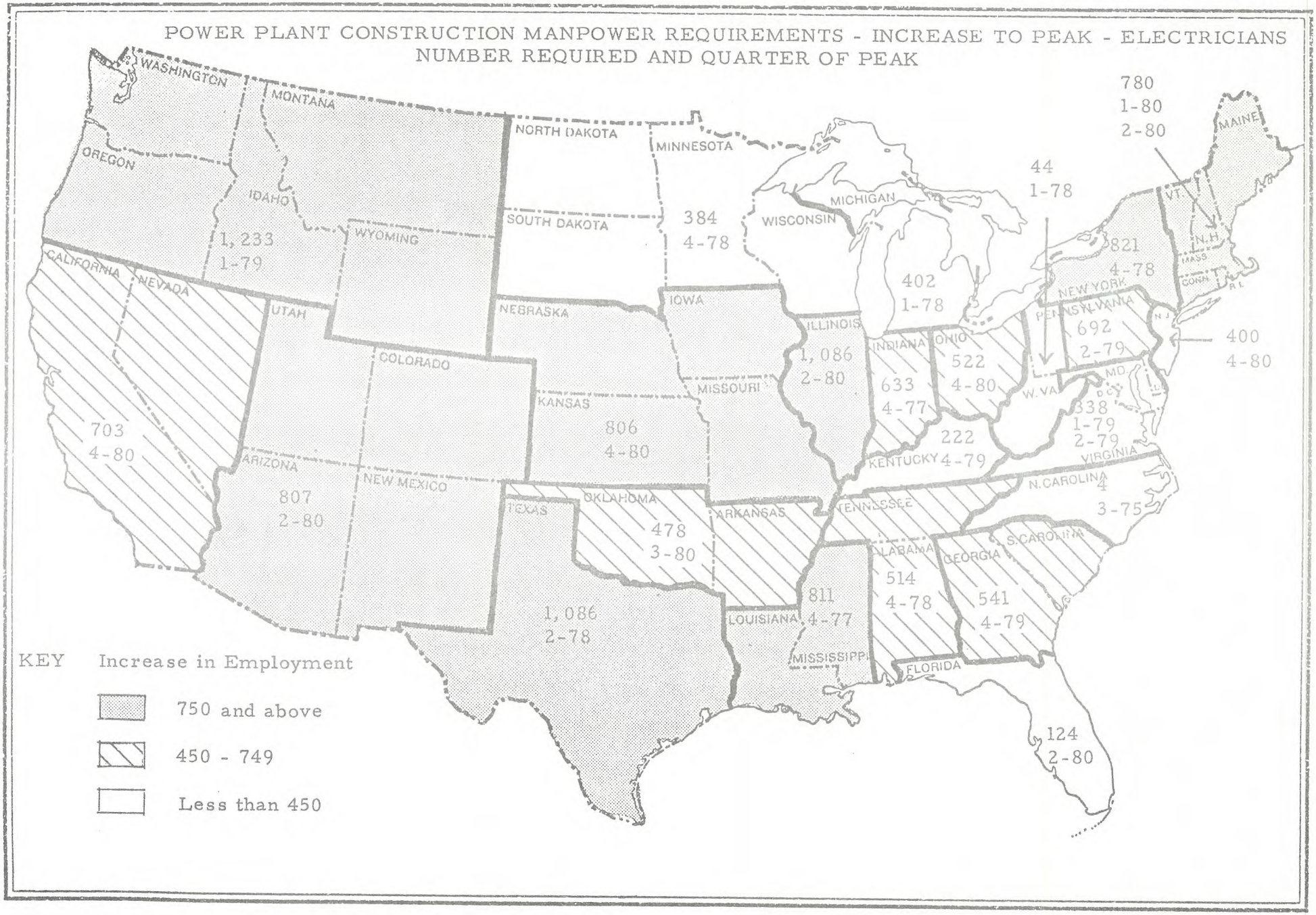
Source: Contractors Mutual Association. Projected Manpower Requirements for Power Plant Construction - Texas. April, 1975.

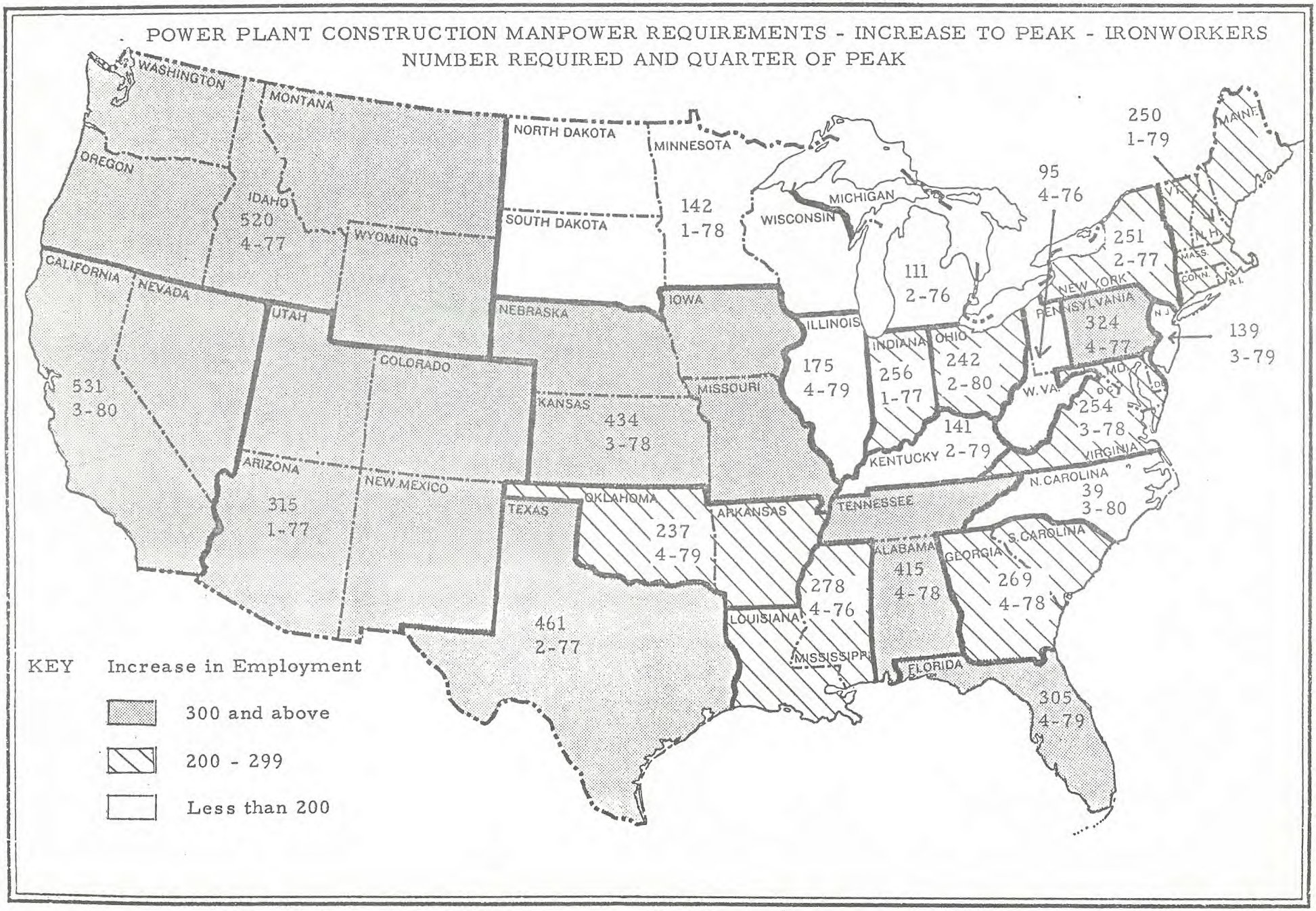

POWER PLANT CONSTRUCTION MANPOWER REQUIREMENTS - INCREASE TO PEAK - BOILERMAKERS
NUMBER REQUIRED AND QUARTER OF PEAK
WASHINGTON
MONTANA
OREGON
IDAHO
459
2-77
WYOMING
NORTH DAKOTA
SOUTH DAKOTA
MINNESOTA
217
3-78
CALIFORNIA
NEVADA
UTAH
COLORADO
359
2-80
NEBRASKA
IOWA
KANSAS
390
1-78
MISSOURI
ARIZONA
NEW MEXICO
564
3-77
TEXAS
OKLAHOMA
489
2-79
ARKANSAS
414
2-77
LOUISIANA
327
2-77
MISSISSIPPI
WISCONSIN
MICHIGAN
243
2-77
ILLINOIS
291
1-80
INDIANA
603
3-77
OHIO
108
4-80
KENTUCKY
303
1-79
TENNESSEE
ALABAMA
383
2-80
GEORGIA
242
1-79
FLORIDA
473
1-80
S.CAROLINA
N.CAROLINA
2-75
VIRGINIA
W.VA.
MD.
D.C.
470
3-79
NEW YORK
PENNSYLVANIA
418
4-77
111
1-78
363
3-78
160
1-80
MAINE
VT.
N.H.
MASS.
CONN.
R.I.
N.J.
171
4-76
KEY
Increase in Employment
400 and above
250 - 399
Less than 250

Map 3

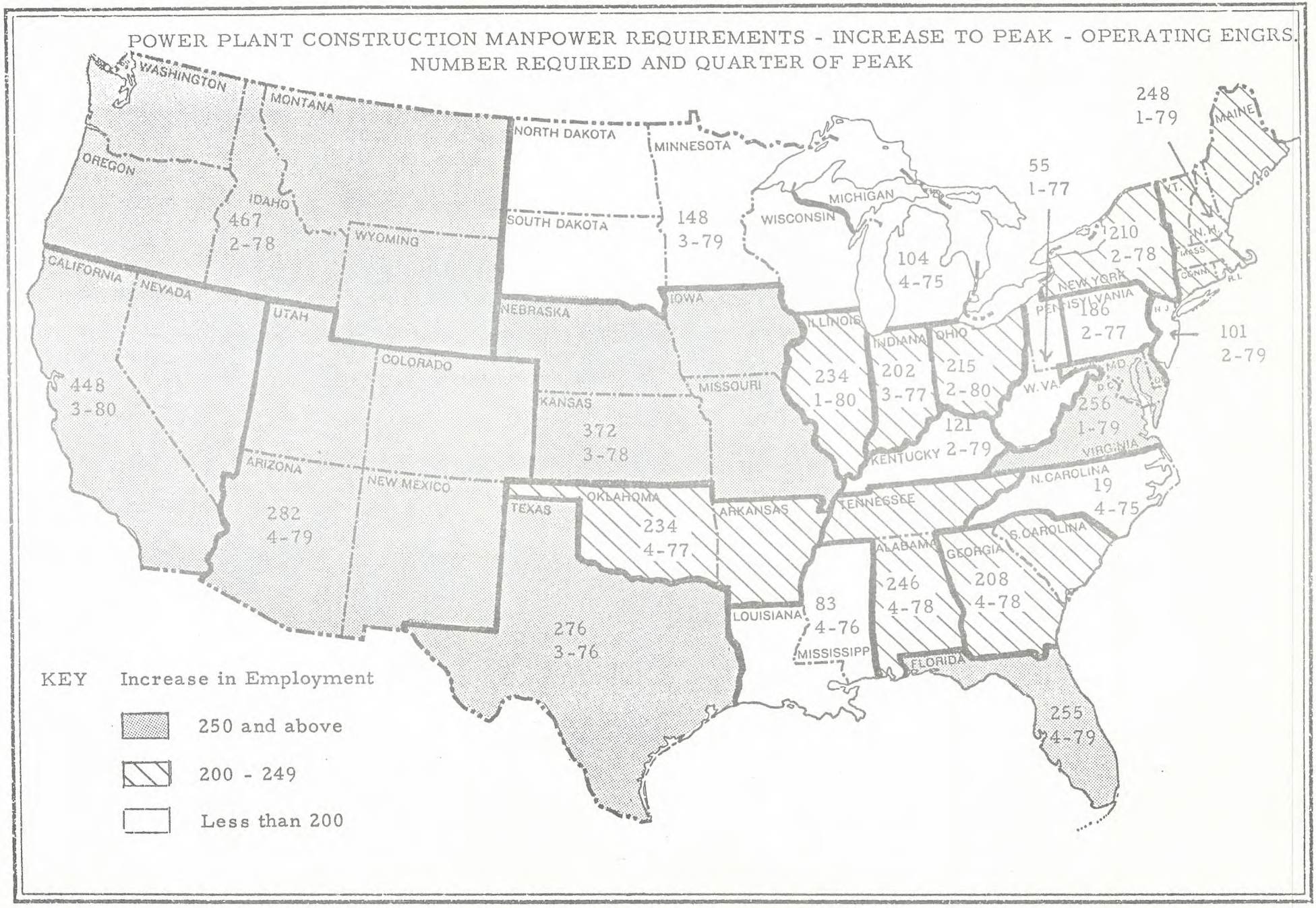

POWER PLANT CONSTRUCTION MANPOWER REQUIREMENTS - INCREASE TO PEAK - CARPENTERS
NUMBER REQUIRED AND QUARTER OF PEAK
WASHINGTON
MONTANA
NORTH DAKOTA
MINNESOTA
OREGON
IDAHO
738
2-78
SOUTH DAKOTA
264
4-80
WYOMING
MICHIGAN
WISCONSIN
114
1-77
185
2-76
357
1-79
MAINE
337
2-77
CALIFORNIA
NEVADA
UTAH
NEBRASKA
IOWA
838
3-80
COLORADO
ILLINOIS
INDIANA
OHIO
337
4-79
295
3-80
434
2-80
NEW YORK
PENNSYLVANIA
501
4-77
214
3-79
MISSOURI
KANSAS
725
3-78
W.VA.
291
2-78
VIRGINIA
140
KENTUCKY 2-79
ARIZONA
NEW MEXICO
482
3-79
TEXAS
OKLAHOMA
276
3-79
ARKANSAS
TENNESSEE
N.CAROLINA
164
1-80
636
4-76
LOUISIANA
487
4-76
ALABAMA
680
4-78
GEORGIA
S.CAROLINA
321
1-78
MISSISSIPPI
FLORIDA
476
4-80
KEY Increase in Employment
475 and above
275 - 474
Less than 275

Map 4


POWER PLANT CONSTRUCTION MANPOWER REQUIREMENTS - INCREASE TO PEAK - ELECTRICIANS
NUMBER REQUIRED AND QUARTER OF PEAK
WASHINGTON
MONTANA
NORTH DAKOTA
MINNESOTA
OREGON
IDAHO
1,233
1-79
SOUTH DAKOTA
384
4-78
WYOMING
WISCONSIN
MICHIGAN
44
1-78
780
1-80
2-80
MAINE
VT.
N.H.
MASS.
CONN.
R.I.
821
4-78
NEW YORK
PENNSYLVANIA
692
2-79
N.J.
400
4-80
CALIFORNIA
NEVADA
UTAH
COLORADO
NEBRASKA
IOWA
ILLINOIS
1,086
2-80
402
1-78
INDIANA
OHIO
522
4-80
633
4-77
W.VA.
MD.
D.C.
338
1-79
2-79
703
4-80
KANSAS
806
4-80
MISSOURI
222
4-79
KENTUCKY
VIRGINIA
ARIZONA
NEW MEXICO
807
2-80
TEXAS
OKLAHOMA
478
3-80
ARKANSAS
TENNESSEE
N.CAROLINA
4
3-75
ALABAMA
GEORGIA
S.CAROLINA
514
4-78
541
4-79
1,086
2-78
LOUISIANA
811
4-77
MISSISSIPPI
FLORIDA
124
2-80
KEY
Increase in Employment
750 and above
450 - 749
Less than 450


POWER PLANT CONSTRUCTION MANPOWER REQUIREMENTS - INCREASE TO PEAK - IRONWORKERS
NUMBER REQUIRED AND QUARTER OF PEAK
WASHINGTON
MONTANA
NORTH DAKOTA
MINNESOTA
OREGON
IDAHO
520
4-77
SOUTH DAKOTA
142
1-78
WYOMING
MICHIGAN
WISCONSIN
95
4-76
250
1-79
MAINE
VT.
N.H.
MASS.
CONN.
R.I.
251
2-77
111
2-76
CALIFORNIA
NEVADA
UTAH
COLORADO
NEBRASKA
IOWA
ILLINOIS
175
4-79
INDIANA
256
1-77
OHIO
242
2-80
NEW YORK
PENNSYLVANIA
324
4-77
N.J.
139
3-79
MO.
W.VA.
D.C.
DEL.
254
3-78
531
3-80
KANSAS
434
3-78
MISSOURI
141
2-79
KENTUCKY
VIRGINIA
N.CAROLINA
39
3-80
ARIZONA
315
1-77
NEW MEXICO
TEXAS
OKLAHOMA
237
4-79
ARKANSAS
TENNESSEE
S.CAROLINA
ALABAMA
415
4-78
GEORGIA
269
4-78
278
4-76
LOUISIANA
MISSISSIPPI
461
2-77
FLORIDA
305
4-79
KEY Increase in Employment
300 and above
200 - 299
Less than 200

Map 6


POWER PLANT CONSTRUCTION MANPOWER REQUIREMENTS - INCREASE TO PEAK - OPERATING ENGRS.
NUMBER REQUIRED AND QUARTER OF PEAK
WASHINGTON
MONTANA
NORTH DAKOTA
MINNESOTA
OREGON
IDAHO
467
2-78
SOUTH DAKOTA
148
3-79
WISCONSIN
MICHIGAN
104
4-75
55
1-77
248
1-79
MAINE
VT.
N.H.
MASS.
CONN.
R.I.
210
2-78
WYOMING
CALIFORNIA
NEVADA
UTAH
COLORADO
NEBRASKA
IOWA
NEW YORK
PENNSYLVANIA
186
2-77
N.J.
101
2-79
ILLINOIS
INDIANA
OHIO
234
1-80
202
3-77
215
2-80
W.VA.
MD.
D.C.
DEL.
256
1-79
448
3-80
MISSOURI
KANSAS
372
3-78
121
KENTUCKY 2-79
VIRGINIA
ARIZONA
NEW MEXICO
282
4-79
OKLAHOMA
TEXAS
234
4-77
ARKANSAS
TENNESSEE
N.CAROLINA
19
4-75
S.CAROLINA
ALABAMA
GEORGIA
246
4-78
208
4-78
LOUISIANA
83
4-76
MISSISSIPP
276
3-76
FLORIDA
255
4-79
KEY Increase in Employment
250 and above
200 - 249
Less than 200

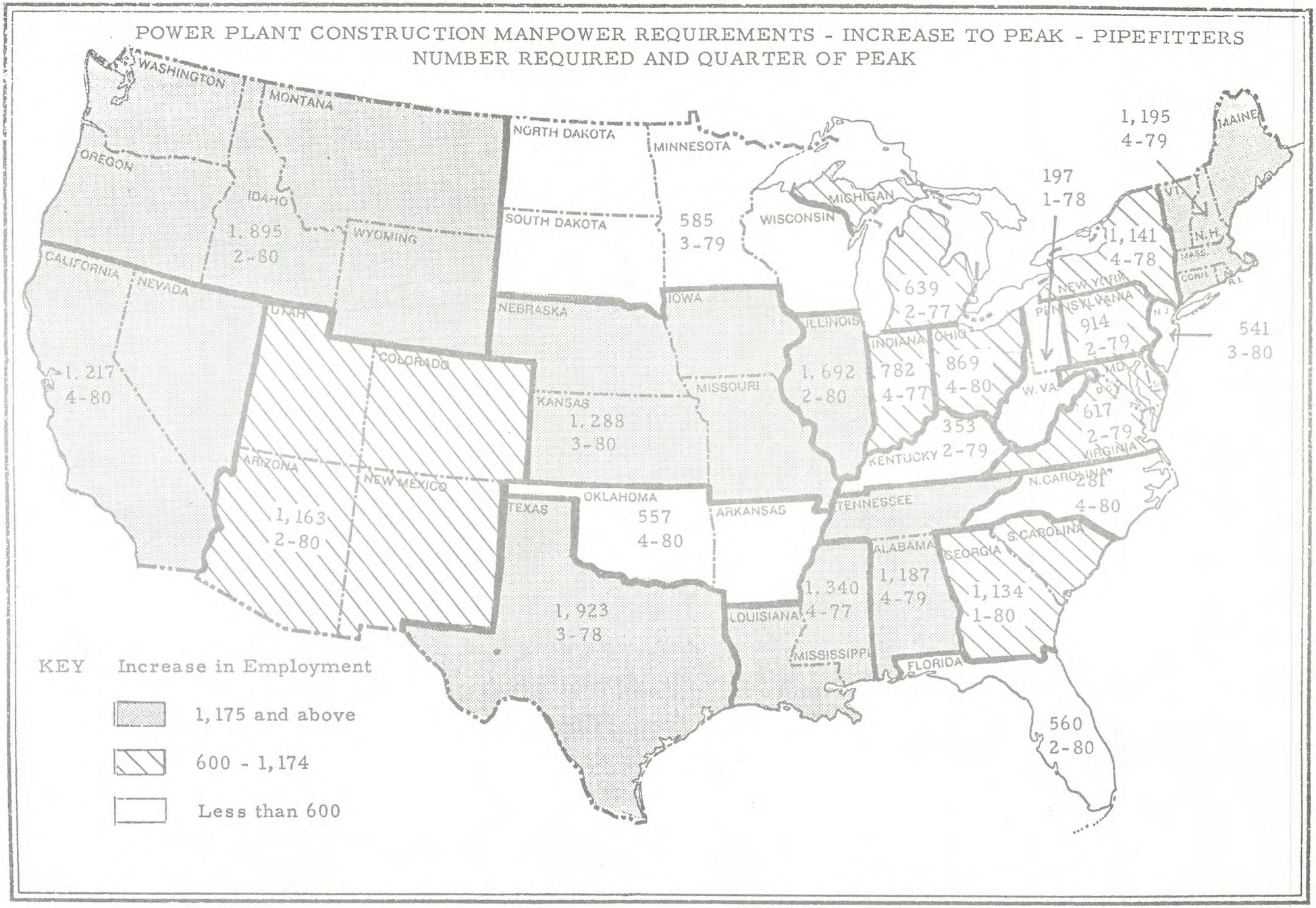

POWER PLANT CONSTRUCTION MANPOWER REQUIREMENTS - INCREASE TO PEAK - PIPEFITTERS
NUMBER REQUIRED AND QUARTER OF PEAK
WASHINGTON
MONTANA
NORTH DAKOTA
MINNESOTA
OREGON
IDAHO
1,895
2-80
WYOMING
SOUTH DAKOTA
585
3-79
WISCONSIN
MICHIGAN
197
1-78
1,195
4-79
MAINE
VT.
N.H.
MASS.
CONN.
R.I.
1,141
4-78
CALIFORNIA
NEVADA
UTAH
COLORADO
NEBRASKA
IOWA
639
2-77
NEW YORK
PENNSYLVANIA
N.J.
914
2-79
541
3-80
ILLINOIS
1,692
2-80
INDIANA
782
4-77
OHIO
869
4-80
MD.
DEL.
617
2-79
1,217
4-80
KANSAS
1,288
3-80
MISSOURI
W.VA.
353
KENTUCKY 2-79
VIRGINIA
ARIZONA
NEW MEXICO
1,163
2-80
OKLAHOMA
557
4-80
TEXAS
1,923
3-78
ARKANSAS
TENNESSEE
N.CAROLINA
281
4-80
ALABAMA
1,187
4-79
S.CAROLINA
GEORGIA
1,134
1-80
1,340
4-77
LOUISIANA
MISSISSIPPI
FLORIDA
560
2-80
KEY Increase in Employment
1,175 and above
600 - 1,174
Less than 600

Table 24

MANPOWER REQUIREMENTS FOR CONSTRUCTION OF RESERVOIRS
FUTURE CONSTRUCTION
Minimum Estimates

| Skill | Percentage | Number |
|---|---|---|
| Carpenters | 6.4 | 2,232 |
| Ironworkers | 3.1 | 1,081 |
| Operating Engineers | 24.1 | 8,403 |
| Other skilled | 6.9 | 2,406 |
| Total | | 14,122 |

Source: Contractors Mutual Association, Projecting Construction Manpower Requirements - A Guide to Methods and Services for Estimating Future Demand. March, 1975.

The percentage does not total 100% because the formula included unskilled laborers and construction engineers as well as skilled workers.

Table 25

MANPOWER REQUIREMENTS FOR CONSTRUCTION OF SEWER LINES
Projected to 1983
Minimum Estimates

| Craft | Percentage | Number |
|---|---|---|
| Bricklayers | 1.3 | 56 |
| Carpenters | 2.4 | 103 |
| Electricians | 0.1 | 4 |
| Ironworkers | 0.4 | 17 |
| Operating Engineers | 19.6 | 844 |
| Plumbers | 0.4 | 17 |
| Other skilled trades | 2.7 | 116 |
| | | 1,157 |

Source: Contractors Mutual Association. Projecting Construction Manpower Requirements - A Guide to Methods and Sources for Estimating Future Demands. March, 1975.

The percentage does not total 100% because the formula included unskilled laborers and construction engineers as well as skilled workers.

Table 26

MANPOWER REQUIREMENTS FOR CONSTRUCTION OF WASTE-WATER TREATMENT FACILITIES
Projected to 1983
Minimum Estimates

| Craft | Percentage | Number |
|---|---|---|
| Bricklayers | 2.0 | 318 |
| Carpenters | 14.3 | 2,277 |
| Electricians | 3.3 | 526 |
| Ironworkers | 3.9 | 621 |
| Operating Engineers | 14.6 | 2,324 |
| Painters | 1.5 | 239 |
| Plumbers | 5.1 | 812 |
| Other skilled trades | 6.6 | 1,051 |
| Total | | 8,168 |

Source: Contractors Mutual Association. Projecting Construction Manpower Requirements - A Guide to Methods and Sources for Estimating Future Demand. March, 1975.

The percentage does not total 100% because the formula included unskilled laborers and construction engineers as well as skilled workers.

# METHODOLOGY

## METHODOLOGY

Projections of the future demand for skilled construction workers were derived from various formulae, several of which were related to cost of the individual projects.

Two sets of projections were made for construction of nuclear power plants. The Project Independence report, done by the Federal Energy Administration under the direction of the Atomic Energy Commission contained estimated manpower construction requirements for the entire nation broken down by years. Estimates for Texas only (4%) were obtained by first determining the percent of wattage of Texas' planned nuclear plants as compared to the nation's planned and total plants. On the assumption that the same percent of workers will be required to build Texas nuclear plants, the manpower requirements were computed for the years indicated (see table 22).

Because these estimates were measured in man-years and were, therefore, not indicative of number of persons required, a second set of estimates were computed from information contained in an article in "Nuclear Plant Lead Time Costs, Labor and Material Takeoffs" in Power Engineering. Percentages of each craft required for nuclear plant construction were computed from information contained in a table; total construction manhours for each of the five currently planned nuclear power plants were obtained by using the ratio 10 manhours per kilowatt. After converting manhours to men, the number

of workers required were computed using the percentage mentioned above. These were then dispersed equally over the years of proposed construction. (See Table 21)

Formulae for projecting construction requirements for water-related construction from the Contractor's Mutual Association's Projecting Construction Manpower Requirements - A Guide to Methods and Sources for Estimating Future Demand were based on dollar value i.e., number of manhours per thousand dollars cost. These are as follows:

Civil Works, Land Projects - 49 manhours per thousand dollars
Sewer Lines - 47 manhours per thousand dollars
Sewer Plants - 48 manhours per thousand dollars

Each one of these ratios was multiplied by the total cost for that particular type of project to determine total manhours required. These were then converted to men required and the percentages of each craft were computed according to the percentages indicated in the formulae. (See tables 19, 20, 24, 25, and 26 for specific percentage distributions.)

Formulae for projecting manpower requirements for industrial-related construction were based on dollar value. For larger projects (50 million dollars or more) manpower requirements were computed on the basis of 9 men per million dollars; for smaller projects (less than 50 million dollars) such requirements were based on 15 men per million dollars construction cost. The percentages of each craft were determined using those indicated in the formulae (see tables 17 and 18 for specific percentages).

Such projections as the proceeding ones are difficult to determine. Individual contractors have their own means of determining manpower requirements, formulae are not well documented; unexpected changes such as labor strikes, foul-weather conditions, and construction delays can affect projections; and pinpointing "average" construction are but a few of the problems encountered in making such projections. However, it is felt that the above information and means of obtaining information represent the most valid data currently available.

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