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ENVIRONMENTAL REPORT

ADVANCED SYSTEM DEMONSTRATION FOR UTILIZATION OF BIOMASS AS AN ENERGY SOURCE

Technical Appendix E
Socioeconomic Studies

APPENDIX E: Socioeconomic Studies

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PREFACE

This technical appendix is one of a series that reports studies undertaken during the preparation of the Department of Energy's Advanced System Demonstration for Utilization of Biomass as an Energy Source. This document is organized by major environmental topic and does not follow the format of the environmental report. It provides data and analyses to support the environmental report and allows all the material on this topic to be brought together in one report. Although this approach leads to some duplication of text, it allows the reader to understand the conclusions more fully and increases the value of the study for future environmental assessments of biomass facilities.

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Introduction

The proposed plant site is located in Westbrook, Maine, a city within the Standard Metropolitan Statistical Area (SMSA) of Portland, Maine. This SMSA also includes the towns of Cape Elizabeth, Cumberland, Falmouth, Freeport, Gorham, Old Orchard Beach, Portland, Saco, Scarborough, South Portland, Windham and Yarmouth. The land area of the SMSA totals about 360 square miles and accommodates a population of approximately 183,000 people.

Much of the region's industry is located within the cities of Portland, South Portland, and Westbrook. Industrial parks and other developments are spreading into the growing suburban areas of Windham, Scarborough, and Gorham.

Within Westbrook, the proposed wood-fired power plant is located on the property of the S.D. Warren Company, between Cumberland Street and Park Road, two miles from the Maine Turnpike. The proposed site for the boiler and turbine facilities adjoins the existing pulp mill on an area of approximately fifteen acres along the railroad spur.

A number of Westbrook's community services are located within one mile of the plant. The Westbrook Community Hospital is located immediately across the street from the proposed plant site. A nursing home, the Westbrook Fire Department, and the Westbrook Senior Citizen Center are all within a one-mile radius of the plant.

Westbrook has a diverse industrial base. Large industries, other than S.D. Warren, produce ready-mix concrete, mini-computers, dowels and wood turnings, shoes, wood yarn, corrugated shipping containers, and rubber tires and inner tubes.

New, moderate-sized homes are located nearest the proposed plant site; older and larger homes lie within one-half mile of the proposed site. A tree nursery, a chemical company, a pumping station, and horse and produce farms are located within two miles of the site.

Population

In 1977, the Maine State Planning Office estimated the population of the Portland SMSA to be 183,000 people. Westbrook, Portland, and South Portland had populations of 14,590, 59,857, and 22,677, respectively, and together formed the urban core of the area (MSPO 1977a).

The Portland SMSA experienced an 8.4 percent increase in population between 1950 and 1970, far below the national average of 34 percent. The Portland area's slow growth resulted primarily from net outmigration of residents. Between 1950 and 1969, persons leaving the area exceeded those entering by 17,645. Both Westbrook and Portland experienced net outmigration, while suburbs such as Windham and Gorham did not (Census 1960; Census 1970).

In contrast, between 1970 and 1975, the population of the Portland SMSA grew 7.8 percent, from 170,081 to 183,453. This was significantly greater than the national average of 5.3 percent for the same period. During this time period, the region experienced a net inmigration of 9,203. Although Westbrook, Portland, and South Portland experienced net outmigration, rapid growth took place in the suburbs (GPCOG 1977a).

Westbrook's 1950 population of 12,284 grew 14.9 percent to 14,444 by 1970 (Census 1960; Census 1970). Between 1970 and 1975, Westbrook's population increased 1.9 percent to 14,722 (GPCOG 1977a). Tables 1 and 2 summarize population growth in the Portland SMSA between 1950 and 1975.

The rural-suburban-urban composition of the Portland area's population has changed markedly over the last thirty years (see Table 3). In 1950, the population of the metropolitan region was predominantly (73 percent) urban. By the year 2000, the urban segment of the population is expected to have declined to 44 percent of the total population (GPCOG 1977b).

The population of the Portland SMSA is currently 47 percent male and 53 percent female. The median age is 28.9 years, reflecting a large concentration of younger people born in the post-World War II era. The population of the SMSA is 99.4 percent white (GPCOG 1977a).

TABLE 1: POPULATION CHANGES 1950 - 1975 IN SELECTED TOWNS IN THE PORTLAND, MAINE, AREA

Town	1950-1959[4]			1960-1969[5]			1970-1975[6]		
	Natural Growth[1]	Net Migration[2]	Net Population Change[3]	Natural Growth	Net Migration	Net Population Change	Natural Growth	Net Migration	Net Population Change
Gorham	+ 696	+ 416	+1,025	+ 601	+ 1,471	+2,072	+ 274	+1,260	+ 1,534
Portland	+7,561	-12,629	-5,068	+4,704	-12,154	-7,405	+ 681	- 693	- 12
Scarborough	+ 620	+ 1,198	+1,818	+1,457	- 833	+ 624	+ 378	+2,332	+ 2,710
South Portland	+3,059	- 2,137	+ 922	+2,298	- 1,819	+ 479	+ 469	- 2	+ 467
Westbrook	+1,609	- 73	+1,536	+1,457	- 832	+ 625	+ 576	- 298	+ 278
Windham	+ 519	+ 545	+1,064	+ 566	+ 1,529	+2,095	+ 470	+2,143	+ 2,613
Yarmouth	+ 437	+ 411	+ 848	+ 499	+ 838	+1,337	+ 194	+1,167	+ 1,361
SMSA[7]	+17,972	-10,930	+7,042	+14,026	- 6,715	+7,311	+4,169	+9,203	+13,372

1 *Births minus deaths*
2. *Immigration minus outmigration*
3. *Natural growth & net migration*
4. *Source: Census 1960*
5. *Source: Census 1970*
6. *Source: GPCOG 1977a*
7. *Standard metropolitan statistical area, total for 13 towns.*

TABLE 2: CHANGES IN POPULATION 1950-1975 OF TOWNS IN THE PORTLAND, MAINE, AREA

Town	1950[1]	1960[1]	Change (%)	1970[2]	Change (%)	1975[3]	Change (%)
CAPE ELIZABETH	3,816	5,505	44.3	7,873	43.0	8,390	6.6
CUMBERLAND	2,030	2,765	36.4	4,096	48.1	5,007	22.2
FALMOUTH	4,342	5,976	37.6	6,291	5.3	6,631	5.4
FREEPORT	3,280	4,055	23.6	4,781	17.9	5,382	12.6
GORHAM	4,742	5,767	21.6	7,839	35.9	9,373	19.6
OLD ORCHARD BEACH	4,707	4,580	2.0	5,404	17.0	6,014	11.3
PORTLAND	77,634	72,566	7.0	65,116	10.3	65,104	.02
SACO	10,324	10,515	1.8	11,678	11.0	13,120	12.3
SCARBOROUGH	4,600	6,418	39.5	7,845	22.2	10,555	34.5
SOUTH PORTLAND	21,866	22,788	4.2	23,267	2.1	23,734	2.0
WESTBROOK	12,284	13,820	12.5	14,444	4.5	14,722	1.9
WINDHAM	3,434	4,498	30.9	6,593	46.6	9,206	39.6
YARMOUTH	2,669	3,517	31.8	4,584	38.0	6,215	28.0
TOTAL[4]	155,728	162,770	4.0	170,081	4.0	183,453	7.8

1. *Source: Census 1960*
2. *Source: Census 1970*
3. *Source: GPCOG 1977a*
4. *Total for standard metropolitan statistical area*

TABLE 3: RURAL-SUBURBAN-URBAN COMPOSITION OF THE GREATER PORTLAND POPULATION

(Percent)

Segment	YEAR 1950	1975	2000 Projected
Rural	8	13	19
Suburban	19	32	37
Urban	73	55	44

Source: GPCOG 1977b.

Housing

Since 1970, the entry into the housing market of young people born during the post-World War II era, the trend toward smaller households, and high population inmigration rates have markedly increased the demand for housing units in the Portland SMSA. The housing situation is further exacerbated by inflation, which has raised mortgage interest rates and hindered new housing development (GPCOG 1977a).

Between 1970 and 1975, 10,000 new households came into existence in the Portland area. Most new households are located in the outlying municipalities. The availability of housing is indicated by the vacancy rate, defined to be the percentage of all existing housing units that are vacant. Vacancy rates of less than 4 percent are indicators of a tight housing market. In 1970, the average Portland SMSA vacancy rate was about 6 percent. By 1976, the vacancy rate had decreased to 2.3 percent. Westbrook's 1976 vacancy rate was 1.1 percent (GPCOG 1977a).

In 1976, the median sales price for a single family home in the Portland SMSA was $32,500. Cumberland had the highest median sales price of $42,750; Westbrook had the lowest median sales price of $27,250 (GPCOG 1977b). Table 4 summarizes the number of housing units, housing vacancy rates, and the median sales price of homes in the area.

Over half the existing housing stock is over thirty-five years old (GPCOG 1977a). The fact that housing of this age deteriorates at a faster rate than newer housing may further increase the area's new housing needs during the next decade.

Summer tourism within the area causes a temporary increase in population and housing demand. The summer tourist population resides in seasonal housing, commercial housing, and campgrounds. In 1970, the population living in seasonal housing was 19,547; the population of commercial lodging was 18.912; and the population of campgrounds was 7,202. The seasonal increase in population is about 27 percent. Most of the seasonal population reides in Old Orchard Beach, Windham, Scarborough, and Freeport. Westbrook has a minimal increase in seasonal population (GPCOG 1977a).

TABLE 4: HOUSING CHARACTERISTICS OF THE PORTLAND AREA AS OF JANUARY 1, 1976[1]

Town	Total Year-round Housing Units	Units Vacant	Vacancy Rate (%)	Occupied Housing Units	Median Sales Price[2]
Cape Elizabeth	2,564	6	.2	2,558	40,500
Cumberland	1,538	2	.1	1,536	42,750
Falmouth	2,150	4	.2	2,146	34,000
Freeport	1,834	46	2.5	1,788	31,625
Gorham	2,927	43	1.5	2,884	35,000
Old Orchard Beach	2,197	50	2.3	2,147	33,200
Portland	25,232	757	3.0	24,475	29,500
Saco	4,180	138	3.3	4,042	33,200
Scarborough	3,493	99	2.8	3,394	37,500
South Portland	7,804	98	1.3	7,706	27,800
Westbrook	4,930	55	1.1	4,875	27,250
Windham	2,923	73	2.5	2,850	32,000
Yarmouth	2,104	73	3.5	2,031	37,500
Total	63,876	1,444	2.3	62,432	32,500

1. In the Portland standard metropolitan statistical area.
2. For single-family home.

Source: GPCOG 1977a.

The city of Westbrook is constructing public housing to relieve its housing shortage. Government-subsidized low-income housing units have recently been completed. In addition, a 90-unit elderly housing project and 90-unit mobile home park are being constructed (Parks 1978).

Income and Employment

Income. Westbrook, Portland, and South Portland had the lowest mean household income in the Portland area in 1975, while Falmouth and Cape Elisabeth had the highest (see Table 5). In 1975, Westbrook had a median household income of $9,434 and a per capita income of $3,953 (Eyerman 1978).

Employment. The total civilian labor force in the Portland SMSA in June of 1978, was 83,300. Of these persons, 79,400 were actually employed (Donahue 1979). The 1977 labor force participation rate, the percentage of the adult population that is employed, in Cumberland County was estimated by the Maine Department of Manpower Affairs to be about 63 percent. The women's labor force participation rate increased from 41.4 percent in 1970 to 49.5 percent in 1976. The increase of women in the labor market has been absorbed in large part by the service sector and wholesale and retail trade industries, all of which have expanded in recent years (MDMA 1978a).

In 1977, wholesale and retail trade and services accounted for 53.5 percent of total employment. The service sector was the single largest source of employment in the area and accounted for 28.1 percent of all employment. The percentage employed in construction increased from 6.6 to 7.3 between 1970 and 1977 (MDMA 1978a). Figure 1 summarizes 1970 and 1977 employment in the Portland area.

Unemployment. The unemployment rate of the Portland SMSA has varied between 4.1 percent and 10.2 percent over the past decade. Average unemployment in 1978 was 4,100 persons, or 4.9 percent of the total labor force (Donahue 1979).

The only records available on occupations of the unemployed are those of the insured unemployed. However, insured unemployed persons often comprise only one-third to one-half of total

TABLE 5: 1975 INCOME FOR TOWNS IN THE GREATER PORTLAND AREA

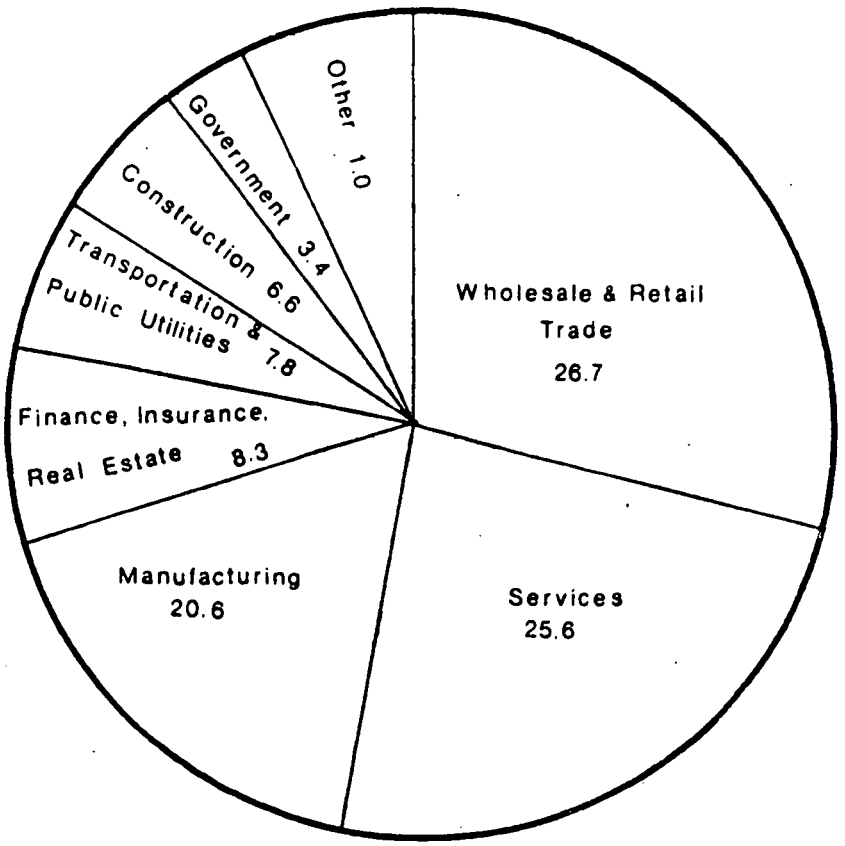
(dollars)

	Per Capita Income	Median Household Income	Mean Household Income
CAPE ELIZABETH	5,653	12,742	16,662
CUMBERLAND	4,510	10,021	13,751
FALMOUTH	6,080	11,223	15,702
FREEPORT	4,334	9,291	11,236
GORHAM	4,068	9,822	11,126
PORTLAND	3,992	7,703	10,114
SCARBOROUGH	5,253	10,345	11,842
SOUTH PORTLAND	4,158	9,429	10,714
WESTBROOK	3,953	9,434	10,392
WINDHAM	3,854	10,011	10,986
YARMOUTH	3,215	10,471	12,350

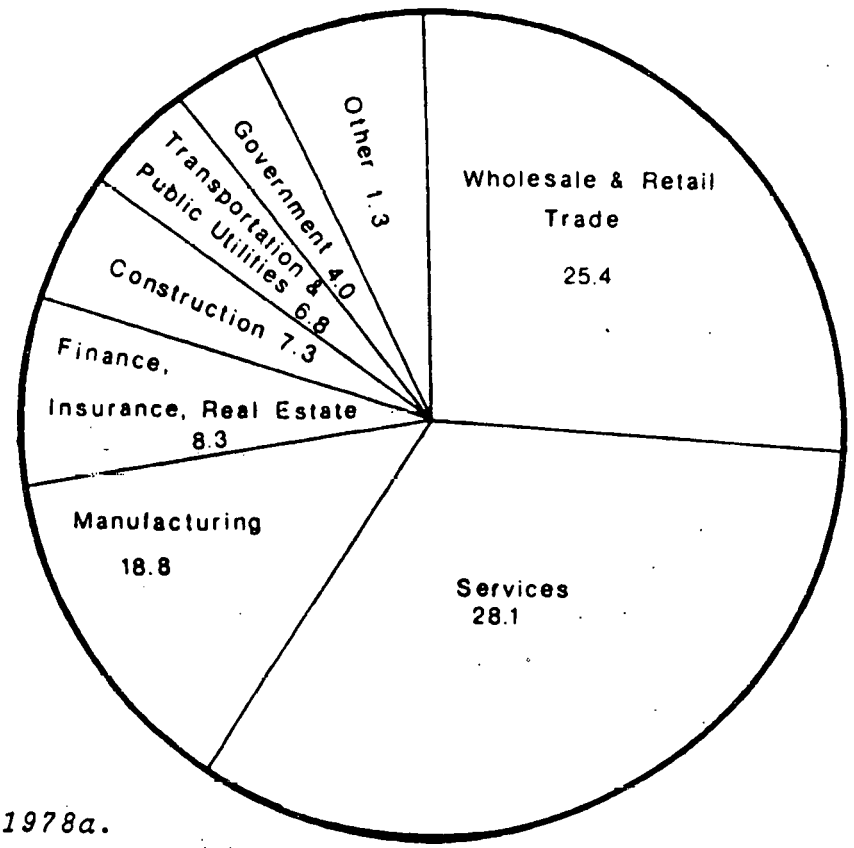
Source: Eyerman 1978.

FIGURE 1: INDUSTRIAL EMPLOYMENT IN THE PORTLAND STANDARD METROPOLITAN STATISTICAL AREA

1970



1977



Source: MDMA 1978a.

unemployed. Table 6 shows characteristics of the 1977 insured unemployed in the Cumberland County area of the Portland SMSA (the SMSA minus the towns of Old Orchard Beach and Saco). Sectors typically comprising a large portion of the insured unemployed are construction, manufacturing, services and retail trade (MDMA 1978a).

Depending on construction projects in the area, unemployment in the construction industry can often run as high as 15 percent. Insured unemployed construction workers numbered 698 in Cumberland County in February of 1977. Of those, 20.2 percent were permanently laid off; the remainder were temporarily idle due to normal seasonality of the trade (MDMA 1978a). During the summer of 1978, about 550 insured construction workers were idle (Donahue 1978).

Education

During the 1975-1976 school year, 27,595 students were enrolled in SMSA elementary schools, while 11,693 students were enrolled in SMSA secondary schools (GPCOG 1977b). Five elementary schools, with a total enrollment of 146 students, are located in Westbrook. One junior high school, with an enrollment of 520 students, and one high school, with an enrollment of 1,155 students, also serve the city (MDECS 1977).

In comparison with the rest of Maine, per-pupil education expenditures in Greater Portland cities and towns are high. Westbrook's per-pupil expenditure during the 1976-1977 school year was $1,223. In that year, the city ranked twenty-seventh in the state in terms of education expenditures (MDECS 1977). Sixty-one percent of the school budget was provided by property tax revenues; the balance was provided by state education subsidies (Westbrook 1977).

In 1970, the median number of school years completed by the population of Greater Portland was 12.4. In Westbrook, the median number of school years completed was 12.1; 56.6 percent of the

TABLE 6: CHARACTERISTICS OF THE INSURED UNEMPLOYED BY INDUSTRY IN THE PORTLAND SMSA[1] - FEBRUARY 1977

Industry	Total Insured Unemployed	Permanent Layoff (%)	Seasonal Layoff (%)	Percentage of Total County Unemployed
Agriculture, Forestry, Fishing	55	24	76	1.6
Construction	698	20	80	21.4
Finance, Insurance, Real Estate	131	37	63	4.1
Manufacturing	838	28	72	25.8
Mining	3	0	100	0.1
Public Administration	5	40	60	0.2
Retail Trade	673	48	52	20.7
Services	484	38	62	14.8
Transportation	164	39	61	5.1
Wholesale Trade	197	44	56	6.1
Other	3	100	0	0.1
TOTAL	3,251	34	66	100.0

1. *Two towns in the Portland standard metropolitan statistical area -- Old Orchard Beach and Saco -- are not included.*

Source: MCMA 1978a.

population had completed twelve or more years of school (Census 1970). Westbrook, like most towns in the region, has a student-teacher ratio well below the state average (14 to 1 versus 18 to 1: GPCOG 1977b). Most area schools are currently underenrolled because of declining birthrates.

Community Services

Westbrook has a firefighting staff of twenty-six full-time paid firefighters and a substantial number of volunteer firefighters. The town participates in a mutual aid agreement with other area fire companies. The police staff includes twenty-seven policemen, one detective, and two youth aid officers. The town also has a volunteer rescue squad, located near the S.D. Warren mill. Emergency patients are usually taken to the Maine Medical Center in Portland (Parks 1978).

A private contractor collects the town's garbage. Rubbish is collected by the town and placed in the Westbrook sanitary landfill, estimated to have capacity for twelve more years of use. The S.D. Warren Company has its own landfill (Parks 1978).

The 1977 budget for the city of Westbrook was $9,085,201, up 5.6 percent from 1976. Of the 1977 budget, $4,013,882 went to municipal expenses, $4,931,917 to schools, and $139,392 to county expenses. Within municipal expenses, $226,050 went to street maintenance and construction (Westbrook 1977; Parks 1978).

More than half of the 1977 expenditures were financed by property taxes totaling $5,295,435. Fifty-three percent of all municipal expenditures and 61 percent of school funding came from property tax, as did all of county expenditures. The remaining municipal revenues came from a number of sources. These sources include police fines, city clerk permits, the automobile excise tax, interest on city investments, and state and federal revenue shares (Parks 1978).

Health and Social Services

The several hospitals in the Greater Portland area together provide more than 800 beds and average about 75 percent occupancy. Because there is a particularly high percentage of elderly in Westbrook, Portland, and South Portland, there are many nursing

homes located in the Portland area. In addition, nineteen health and sixteen mental counseling clinics are located in the area. There are a large number of social service programs in Greater Portland which serve many different groups' needs (Parks 1978).

Crime

The crime rate of Greater Portland is about average for an urban area of its size (FBI 1976). The overall crime rate for the SMSA is 62.4 reported crimes per 1,000 persons; for Westbrook, it is 45.9 per 1,000, below average for a city of its size (GPCOG 1977b).

Economic Base

Sectors of the economy. The Greater Portland area and Cumberland County encompass more than three hundred industrial firms. Apparel, paper, printing, chemicals, stone, clay and glass, miscellaneous manufacturing, and instruments have grown in the last decade. The three largest plants are S.D. Warren and Data General in Westbrook and the semiconductor manufacturing division of Fairchild Camera and Instrument Company in South Portland. Manufacturing in the Portland area is slowly recovering from the recession, with greatest strength in nonelectrical machinery and fabricated metal products (Cleaves 1978). Table 7 summarizes the value of product of Cumberland County industries for the 1971-1976 period.

Westbrook contains approximately thirty-five of the area's total three hundred retail establishments (Cleaves 1978). This total represents an increase of 10 percent since 1972. Retailing generated $440,111,000 in taxable sales in the Portland SMSA in 1977 (Cleaves 1978).

Services and other nonmanufacturing industries continue to grow with the population. The hospitals are the largest employers in the service industry. Approximately one-half of the government sector employment is in the area schools. Employment in this sector may soon experience a decline due to lower birth rates. Contract construction was badly hit by the recession from 1973 to 1975. However, many new construction projects, including Portland's $65 million sewage treatment plant, are helping this

TABLE 7: CUMBERLAND COUNTY VALUE OF PRODUCT 1971-1976

Industry	1971	1972	1973	1974	1975	1976
Food	$117,695,823	$122,173,125	$141,265,779	$168,900,312	$164,888,107	$161,995,974
Textiles	2,463,535	3,670,641	4,744,915	17,842,321	12,779,858	17,718,757
Apparel	12,174,080	14,728,477	17,925,011	19,237,944	23,033,771	27,781,541
Lumber and Wood	13,250,196	16,419,998	18,479,772	21,986,407	20,683,854	18,067,405
Furniture	2,309,133	3,019,543	3,362,520	4,001,947	3,263,463	1,492,031
Paper	86,238,350	87,982,788	102,926,802	112,845,005	93,684,619	113,179,197
Printing	17,616,453	19,342,387	20,113,772	22,186,383	24,054,171	26,909,624
Chemicals	1,129,100	1,339,219	1,241,763	3,501,127	4,018,817	4,306,148
Petroleum	NA	5,907,496	8,341,983	8,612,893	6,791,898	NA
Rubber and Plastics	2,968,410	5,001,842	6,568,523	11,298,822	10,306,598	10,333,486
Leather	45,178,131	48,873,852	58,660,925	44,093,864	43,052,428	55,346,050
Stone, Clay and Glass	7,229,041	3,775,593	4,422,744	3,642,005	3,275,683	4,492,084
Primary Metals	5,215,789	3,021,465	517,359	634,676	886,915	779,172
Fabricated Metals	52,823,874	60,688,705	52,187,778	58,319,600	52,352,992	68,745,299
Machinery	15,398,865	21,269,940	26,541,277	38,012,329	36,355,043	32,520,784
Electrical Machinery	45,255,816	78,085,650	108,718,293	136,814,970	74,519,271	70,102,172
Transportation Equipment	11,601,290	16,499,986	16,896,818	13,075,599	11,378,265	3,275,477
Instruments	1,675,496	2,785,187	3,085,655	3,190,272	2,464,393	5,994,787
Misc. Manufacturing	2,453,304	2,591,522	2,920,781	3,196,443	3,263,893	3,492,831

NA = Not Available
Source: MDMA 1976

sector's recovery (MDMA 1978a).

Taxes. Portland and South Portland have the highest property tax rates in Cumberland County (see Table 8). Westbrook has a tax rate of $26 per $1,000 at a 90 percent assessment ratio (Cleaves 1978). Westbrook has a 1978 assessed valuation of 235,000,000 (MBT 1979).

The sales tax rate in the state is 5 percent of all tangible personal property sold for use or consumption within the state. New manufacturing machinery is exempt from sales tax, but is subject to local property taxation (Cleaves 1978). State corporate income tax is 5 percent of the first $25,000 of net income and 7 percent on all new income in excess of $25,000 (Cleaves 1978).

TABLE 8: 1977 PROPERTY TAX RATES IN CUMBERLAND COUNTY

	Rate per $1,000	Assessment Ratio *(% Market Value)*	Approximate Taxbill per $1,000 of Actual Value
CAPE ELIZABETH	46.30	50	23.15
CUMBERLAND	32.00	57	18.24
FALMOUTH	22.20	85	18.87
FREEPORT	17.50	90	16.02
GORHAM	36.80	47	17.29
PORTLAND	33.70	84	28.30
SCARBOROUGH	26.00	67	17.42
SOUTH PORTLAND	31.30	80	25.04
WESTBROOK	26.00	90	23.40
WINDHAM	14.10	95	13.39
YARMOUTH	29.50	55	16.22

Source: Cleaves 1978.

Impacts

Construction Impacts

Employment. Construction of the proposed wood-fired power plant will require approximately two years for completion. During that period, eight construction supervisors will direct an average of about 240 construction workers. At peak, about 350 construction workers will be employed (Milligan 1977). Table 9 provides an approximate breakdown of the number of each type of construction worker that will be required by the project. In addition to those employed by the construction firm, approximately 262 workers will be employed during each of the two construction years by local subcontractors supplying services to the project. No breakdown on the type of labor required of the subcontractors has yet been prepared.

The employment generated by the proposed construction of the wood-fired power plant combined with local expenditures for construction materials will stimulate indirect employment within the Greater Portland area. To determine the number of indirect employment opportunities likely to be created in addition to those positions with local subcontractors, the Bureau of Economic Analysis regional impact model for Cumberland County was employed. This analysis predicted that approximately 491 persons will be indirectly employed during the two-year construction period. Table 10 summarizes indirect employment due to plant construction by industry. The wholesale trade, retail trade, food, and metals industries will experience the greatest increases in indirect employment. Table 11 compares these increases to 1976 employment levels. Total direct and indirect employment stimulated by the contruction of the proposed plant will average about 1,000 workers during the two-year construction period.

The maximum reduction in regional unemployment will occur if all 240 construction workers, 262 subcontracted workers, and 491 indirectly employed persons are drawn from the local pool of unemployed workers. In 1978, 4,100 workers on average, or 4.9 percent of the Portland area's labor force of 83,700 were unem-

TABLE 9: NUMBER OF CONSTRUCTION WORKERS BY TRADE

TRADE	AVERAGE	PEAK
Laborer	32	46
Carpenter	27	39
Millwright and Rigger	24	35
Iron Worker	28	40
Cement Finisher	4	6
Operator	8	12
Teamster	2	3
Boilermaker	2	3
Steamfitter	74	107
Electrician	39	57
Total	240	348

Source: Calculated from Manar 1978b and Milligan 1977.

TABLE 10: INDIRECT EMPLOYMENT STIMULATED BY PLANT CONSTRUCTION

Industry	Indirect Employment *(number of persons)*
Farms	0.0
Agricultural services	0.0
Forestry and fisheries	0.9
Nonmetallic mineral mining and quarrying	0.5
Food and kindred products	34.7
Textile mill products	0.1
Apparel and other fabricated textile products	8.7
Lumber and wood products except furniture	11.6
Furniture and fixtures	0.6
Paper and allied products	1.8
Printing, publishing and allied products	3.6
Chemicals and allied products	0.2
Petroleum and related industries	0.2
Rubber and misc. plastic products	0.9
Leather and leather goods	2.4
Stone, class and clay products	15.6
Primary metals industries	7.9
Fabricated metals products	21.9
Machinery except electrical	0.5
Electrical machinery	8.3
Motor vehicles	0.0
Other transportation vehicles	0.1
Instruments	0.3
Misc. manufacturing	0.8
Railroad transportation	4.8
Local, suburban and highway passenger transportation	3.0
Motor freight, transportation and warehousing	12.1
Water transportation	1.3
Air transportation	0.3
Pipeline transportation	0.1
Transportation services incl. carrier affiliates	0.2
Communications	6.1
Public utilities	2.3
Wholesale trade	64.8
Retail trade	136.0
Banking	6.3
Credit agencies and holdings and investments	1.8
Security and commodity brokers, dealers and brokers	1.6
Insurance carriers incl. solicitors	11.3
Insurance agents, brokers and services	4.3
Real estate and combinations	1.0
Lodging places	2.8
Personal and misc. repair services	12.4
Misc. business services	11.3
Auto repair and services	7.5
Motion pictures	0.5
Amusement and recreational services excluding movie houses	3.9
Medical and other health services	25.5
Legal and other misc professional service	30.0
Private educational services	6.2
Museums and nonprofit membership organizations	5.1
Households	6.6
Total Indirect Employment	491.0

TABLE 11: 1976 EMPLOYMENT, INDIRECT EMPLOYMENT DUE TO PLANT CONSTRUCTION, AND PERCENT INCREASE IN EMPLOYMENT IN THOSE INDUSTRIES OF CUMBERLAND COUNTY IN WHICH INDIRECT EMPLOYMENT WILL BE GREATEST

Industry	1976 Employment[1]	Indirect Employment[2]	Percent Increase
Retail trade	15,619	136	0.9
Whole sale trade	6,005	65	1.0
Primary & fabricated Metals	996	30	3.0
Food & Kindred Products	2,220	35	1.6

1. *Source: Census 1976a*
2. *Source: Table 10*

ployed (MDMA 1979). If all 993 new positions are taken by those currently without work, the number of unemployed workers will decline by 24 percent to about 3,100, and Greater Portland's unemployment rate will fall to 3.7 percent. However, it is likely that some workers for the project will migrate into the area or transfer from their present employment, so that the actual reduction in unemployment will be somewhat lower.

Upon completion of construction, there will be a decline in business activity. Some workers employed both directly and indirectly by the project may again become unemployed.

Income. Each of the eight construction supervisors will earn $29,000 per year (Milligan 1977). Each of the average 240 construction laborers will earn about $18,400 per year. This latter figure is based on an hourly wage of $8.84 (1977 dollars; Milligan 1977) and assumes a total of 2,080 working hours per year. Salaries and wages paid to supervisors and workers employed directly by the construction contractor will total approximately $4.6 million per year during the two-year construction period. Additionally, $10.5 million per year will be paid to subcontracting companies providing construction services (Milligan 1977). About one-half of this amount will go to labor in the form of wages.

The construction phase will also generate expenditures for materials in the local economy. Annual expenditures for lumber and ready-mix concrete will be $35,000, and $315,000, respectively (Manar 1979b). As these materials are manufactured within the Greater Portland region, all expenditures will accrue to the local economy. About $1.5 million will be spent on piping each year of the construction phase (Manar 1978a). Between one-half and all of this piping will be purchased within Greater Portland: approximately one million dollars worth. However, as no piping is manufactured in Greater Portland, only the piping wholesaler's markup, about 20 percent of this $1 million, will remain in the area. Thus, about $200,000 of the total $1.5 million spent on piping will accrue to the local economy.

Diesel fuel will also be a major construction expenditure. Approximately $180,000 worth (300,000 gallons) of fuel will be purchased each year (calculated from VanderWerf 1978) from a local fuel wholesaler and distributor. Diesel fuel is not produced in the Greater Portland region. About 10 percent of the total expenditure will accrue to the local economy. Five percent, or $9,000 worth, will go to the local wholesale trade. Five percent will also go to the local shipping and motor freight industries (VanderWerf 1978). Approximately $568,000 of direct net local income will be generated annually from materials expenditures.

Total direct regional income resulting annually from the construction of the proposed wood-fired power plant, summarized in Table 12, will average about $15.7 million. The Bureau of Economic Analysis regional impact model predicts that this direct income will generate approximately $18.7 million of indirect income each year. Table 13 summarizes, by industrial sector, the total annual regional income generated by plant construction. The known annual direct income is subtracted from this total amount to obtain annual indirect income. The income indicated for most industrial sectors should nearly equal indirect income. Most of the direct income appears within the contract construction, stone products, metals, and household industries, or within those industries which will receive the expenditures listed in Table 12.

Economic adjustment. The Bureau of Economic Analysis regional impact model, used in the estimation of indirect employment and income, does not consider three economic dynamics: migration, delays, and economic policies used by firms to increase their output. The omission of migration does not significantly alter the results, as the population of the Greater Portland metropolitan region is quite large.

As a result of delays, the construction impacts upon the regional economy will not peak until well after the start of construction. Changes in the economy will take place gradually. As regional businesses begin to experience sales increases, they will begin to buy from each other. In highly flexible industries, like that of insurance, adjustments will be made relatively

TABLE 12: ANNUAL DIRECT LOCAL INCOME ACCRUING FROM PLANT CONSTRUCTION

Construction salaries		$ 4,600,000[1]
Subcontractor fees		10,500,000[1]
Materials expenditures:		
Lumber	$ 35,000[3]	
Ready-mix concrete	315,000[3]	
Wholesale trade	9,000	
Shipping, motor freight	9,000	
Piping	200,000[2]	
Subtotal		568,000
Total		$15,668,000

1. *Calculated from Milligan 1977.*
2. *Calculated from Manar 1978a.*
3. *Calculated from Manar 1979b.*

TABLE 13: INDIRECT AND TOTAL INCOME GENERATED ANNUALLY BY PLANT CONSTRUCTION

Industry	Total Income *(dollars)*
Farms	69,100
Acricultural services	21,400
Forestry and fisheries	83,500
Nonmetallic mineral mining and quarrying	22,700
Contract construction	10,600,000
Food and kindred porducts	1,410,000
Textile mill products	3,510
Apparel and other fabricated textile products	240,000
Lumber and wood products except furniture	501,000
Furniture and fixtures	23,300
Paper and allied products	111,000
Printing, publishing and allied products	93,800
Chemicals and allied	15,400
Petroleum and related industries	19,400
Rubber and misc. plastic products	47,300
Leather and leather goods	59,400
Stone, glass and clay products	387,000
Primary metals industries	221,000
Fabricated metals products	876,000
Machinery except electrical	27,400
Electrical machinery	198,000
Motor vehicles	1,410
Other transportation vehicles	1,380
Instruments	7,460
Misc. manufacturing	26,900
Railroad transportation	209,000
Local, suburban and highway passenger transport	70,100
Motor freight, transportation and warehousing	363,000
Water transportation	42,900
Air transportation	7,280
Pipeline transportation	6,680
Transportation services incl. carrier affiliate	2,990
Communications	276,000
Public utilities	204,000
Wholesale trade	1,210,000
Retail trade	2,140,000
Banking	158,000
Credit agencies and holdings and investments	20,800
Security and commodity brokers, dealers and brokers	29,200
Insurance carriers incl. solicitors	315,000
Insurance agents, brokers and services	89,600
Real estate and combinations	579,000
Lodging places	43,900
Personal and misc. repair services	213,000

TABLE 13: CONT.

Industry	Total Income *(dollars)*
Misc. business services	296,000
Auto repair and services	255,000
Motion pictures	9,690
Amusement and recreational services excluding movie houses	51,500
Medical and other health services	410,000
Legal and other misc. professional service	455,000
Private educational services	98,500
Museums and nonprofit membership organizations	101,000
Households	11,700,000
Total Income	34,400,000
Total Direct Income	15,668,000
Total Indirect Income	18,732,000

quickly (VanderWerf 1978). Other industries, particularly capital and land intensive ones, will not be able to adjust quickly. The short-run impacts of the increased demand for services and goods, stimulated by construction, could be shortages, higher prices, and greater imports (VanderWerf 1978). Since the increase in demand in the Greater Portland area will be less than 2 percent, however, these impacts are unlikely to occur.

On account of these delays, regional businesses may not expand to the full extent predicted by the model forecasts. The first reaction of most businesses to an increase in sales is to utilize existing labor and equipment more intensively, especially if the increase in sales is thought to be temporary. Businesses selling directly to the construction project or to its workers will most likely realize that their increase in sales is temporary and, thus, take easily reversible measures to increase output (VanderWerf 1978).

State revenues. The state of Maine will receive additional revenues as a result of the construction of the proposed wood-fired power plant. Direct and indirect salaries and wages will be subject to the state's personal income tax. Personal income tax paid annually on the salaries and wages of the eight supervisors, 240 construction workers, and 262 subcontracted employees will total approximately $317,000. The 491 persons indirectly employed by the project together will pay about $125,000 of combined personal income tax (see Table 14). State income tax revenues from salaries will total about $442,000 per year (calculated from CCC 1978).

The subcontractors employed by the prime construction contractor will expect to receive a return of approximately 10 percent on their total revenues of $10.5 million. This percentage will be taxable either as corporate income or personal capital gains, depending on the legal standing of the particular subcontractor. These subcontracting companies will pay between $52,500 and $73,500 in taxes to the state government each year (Calculated from CCC 1978).

TABLE 14: MAXIMUM ANNUAL STATE INCOME TAX REVENUES FROM WORKERS DURING CONSTRUCTION PERIOD

	SUPERVISORS	CONSTRUCTION WORKERS	SUBCONTRACTED WORKERS *(Indirect Construction)*	OTHER INDIRECT EMPLOYMENT
Average Number of Workers	8	240	262	491
Average Salary	$29,000	$18,837	$18,837	$13,000
less standard deductions[1]	2,800	2,800	2,800	2,100
less exemptions[1]	3,000	3,000	3,000	3,000
Total Taxable Income per Person per Year	23,200	12,587	12,587	7,900
Maine State Income Tax[1]	1,538	607	607	254
Total State Income Tax Revenue	$12,304	$145,680	$159,034	$124,714

Total State Income Tax Revenues from Salaries $441,732

1. *Source: CCC 1978*

Sales tax must be paid to the state of Maine on taxable construction material purchased directly (see Table 15). Annual expenditures on lumber, ready-mix concrete, and piping will total $1,850,000. Given Maine's sales tax rate of 5 percent (Cleaves 1978), tax revenues from direct construction purchases will be $92,500 per year. Additionally, some expenditures stimulated indirectly through the multiplier effect will be taxable and will generate revenues for the state. Sales tax on these expenditures is expected to total about $516,000 annually.

When combined, personal income tax on direct and indirect construction salaries, sales tax on direct and indirect construction purchases, and tax on subcontractor revenues will total approximately $1.1 million per year (see Table 16).

Population. It is expected that the majority of construction positions, subcontracted jobs, and indirect employment opportunities will be filled by persons currently living within the Greater Portland area. The magnitude of the proposed construction project is small when compared with the level of economic activity in the Greater Portland area and a boom town atmosphere will not be created. Additionally, two major construction projects will be completed in the period of time before construction of the proposed wood-fired power plant and approximately 772 construction workers (Clifford 1978; McPherson 1978) therefore, will be seeking new employment opportunities. Nonetheless, an analysis of available construction workers does indicate that some workers with specific skills will have to come to the project from outside the region.

In order to determine how many of the workers will have to migrate into Greater Portland, a range of unemployed workers in each of the construction trades is first calculated (see Table 17). As the current unemployment rate in these trades is about 5 percent but can run as high as 10 percent (MDMA 1978a), 5 percent and 10 percent of the current number of workers in each trade are said to be good estimates of the lower and upper limits of the range of available workers. These ranges are then compared to the number of needed workers to obtain a range of the number of

TABLE 15: ANNUAL SALES TAX ON DIRECT CONSTRUCTION PURCHASES

ITEM	RETAIL COST *(dollars)*	SALES TAX[3] *(dollars)*
Piping	1,500,000[1]	75,000
Lumber	35,000[2]	1,750
Ready-mix concrete	315,000[2]	15,750
Total Sales Tax on Direct Purchases		92,500

1. *Source: Manar 1978a*
2. *Source: Manar 1979b*
3. *Source: Calculated from Cleaves 1978*

TABLE 16: TOTAL ANNUAL STATE TAX REVENUES DURING PLANT CONSTRUCTION

Tax	Revenues *(dollars)*
Personal Income Tax[1]	$ 441,732
Tax on Subcontractor Revenue Returns[2]	73,500
Sales Tax on Direct Purchases[3]	92,500
Sales Tax on Indirect Purchases[4]	516,350
Total	$1,124,082

1. *Source: Table 14*
2. *Source: Calculated from Milligan 1977 and CCC 1978*
3. *Source: Table 15*
4. *Source: Calculated from Table 13 and Cleaves 1978*

TABLE 17: CALCULATION OF WORKERS EXPECTED TO MIGRATE TO THE GREATER PORTLAND AREA FOR CONSTRUCTION OF THE PROPOSED POWER PLANT

Trade	Average Number Needed[1]	Current Number in Greater Portland[2]	10% of Current Number	5% of Current Number	Estimated Range of Migration
Labor	32	1,052	105	53	0
Carpenter	27	640	64	32	0
Millwright	24	156	15	7	9-17
Iron Worker	28	286	29	14	0-14
Cement Finisher	4	256	26	13	0
Operator	8	20-99	2-10	1-5	0- 7
Teamster	2	NA	NA	NA	NA
Boilermaker	2	167	17	9	0
Steamfitter	74	289	29	15	45-59
Electrician	39	418	42	21	0-18
TOTAL	240				54-115

NA = Not Available
1. Source: Table 9
2. Calculated from Census 1976a

NA = Not Available

workers who are likely to inmigrate. The total number of workers expected to inmigrate ranges between 54 and 115. In addition, eight construction supervisors will certainly also come from outside the region. Assuming that half of these project employees bring average size families (3.2 persons) with them, a total of 130 to 260 people will migrate into the region for the construction phase. This influx of people will increase the population of the Greater Portland area by approximately 0.1 percent.

Social impact. The proposed power plant will be constructed on S.D. Warren Company land. No houses will have to be sold or demolished prior to the construction of the plant nor will there be speculative gains from the sale of land.

Local construction workers may feel some resentment of other workers immigrating from outside the region. However, while Westbrook's sewage treatment plant was being constructed, there were 157 construction workers in the city (Clifford 1978) and no adverse impacts occurred within the community (Parks 1978).

Education. Some of the construction workers migrating to the Greater Portland Area can be expected to bring their children with them. Of the maximum 260 people expected to migrate to the region, no more than seventy-five would be likely to be school age children. This figure asssumes sixty-two families of 3.2 persons each. There are currently about 39,000 children enrolled in schools throughout the Greater Portland Standard Metropolitan Statistical Area. Thus, the additional children would result in a school enrollment increase of about 0.2 percent. Even if all 240 projected construction workers immigrated from outside the region and each brought a family of three people on average, school enrollments would increase by no more than 290 children, or about 0.7 percent.

Health and social services. There will be a decline in aid to families with dependent children and food stamp expenditures if persons currently unemployed are hired by the project. After construction, these expenditures may return to their original or slightly higher levels.

Construction work in Maine has an incidence rate of injury and illnesses related to work of 14.7 per 100 fulltime workers per year (MDMA 1976). Therefore, of the 240 construction workers and 280 subcontracted employees, approximately 75 injuries or illnesses can be expected during each of the two years of construction. Of these work-related injuries, approximately 44 percent or 33 in total could be expected to result in work-days lost. This accident rate will not strain hospital capacity in the Greater Portland area.

Operation Impacts

Operation of the proposed wood-fired power plant will require the thirty-two employees listed in Table 18. S.D. Warren currently employs thirty-five persons in the operation of the No. 17 and 18 oil boilers and the bark boiler, which will be shut down when the wood-fired boiler begins operation. Thus, there will be a reduction of three positions at the S.D. Warren mill (Manar 1979). Supplies used in the operation of the new boiler system will be similar to those currently used in the boiler area of the plant. Therefore, the plant will not increase local sales.

With only a small decrease in employment and no net change in local purchases during operation, the operation of the proposed wood-fired power plant will not significantly alter regional income. There will be no change in indirect employment or income associated with the operation of this plant. Nonetheless, this facility will help to secure the contribution of the S.D. Warren Company to the local and regional economy by drastically reducing its dependence on increasingly scarce and expensive oil.

The plant will have a tax impact on the town of Westbrook. Assessed valuation of Westbrook in 1978 was $235,000,000 (MTB 1979). S.D. Warren currently has an assessed value of $66,521,120 Miller 1979). Present construction costs of the plant are estimated to be $56 million (Manar 1979a). Of this amount, $6.5 million is for pollution control equipment, which is exempt from property tax valuation. Current assessed value of the No. 17 boiler, No. 18 boiler, bark boiler, and bark handling equipment which will be shut down is $628,590. Thus, assessed value for the

TABLE 18: EMPLOYEES REQUIRED TO OPERATED PROPOSED PLANT

JOB	NUMBER OF EMPLOYEES
Control Room Operator	4
Assistant Control Room Operator	8
Woodyard Operator	4
Water Treatment Plant Operator	4
Maintenance Personnel	4
Scaleman	2
Clean-up	4
Mobile Equipment Operator	2
Total	32

Source: Manar 1979b

plant would increase about $48.9 million. This increase would raise the assessed value of the town to $283,900,000. The 1978 assessed value of $235,000,000 at 90 percent valuation and a tax rate of $26 per 1000 produced approximately $5,499,000 in revenue. With an assessed value of $283,871,410, Westbrook could lower its local property tax rate to about $22 per 1000 (if all assumptions remained as stated).

However, this increase in assessed value could cause a decrease in state education funding. This plant would cause a twenty-one percent increase in the assessed value of the town. The state education funding to Westbrook could decrease if the total statewide assessment increased at a rate substantially less than 21 percent in the year that the plant was completed. This change cannot be accurately predicted. In 1978, the statewide increase in assessed value was 10.6 percent (Hickey 1979). If Westbrook's assessed valuation did increase by 21 percent, and the state's by only 10.6, Westbrook would see a decrease in state education funding.

The sale of electricity from the proposed wood-fired power plant will probably generate state and federal corporate income tax revenues. The amount generated, however, will depend on how the plant is financed, the final costs of producing the electricity, the agreed-upon selling price for the electricity, and other income that the power plant owner receives. Since many of these variables are uncertain at this time, it is impossible to predict the amount of corporate income tax that will be generated.

THE FUELWOOD HARVEST REGION

Present Socioeconomic Setting

Introduction

Fuelwood harvesting for this project will occur within a fifty mile radius of Westbrook, Maine. Most of this area is heavily forested and, therefore, could supply fuel to the proposed plant. In this region are located all of Cumberland, York, and Sagadahoc Counties in Maine, as well as portions of Kennebec, Lincoln, Androscoggin, and Oxford Counties in Maine and Belknap, Carroll, and Strafford Counties in New Hampshire.

The Portland Standard Metropolitan Statistical Area (SMSA), Maine's largest urban center, includes a large portion of Cumberland County and part of York County. Androscoggin County contains the Lewiston-Auburn SMSA, the second largest urban center in the state. Augusta, the state capital, is located in Kennebec County. The largest city in the New Hampshire portion of the region is Dover, located in Strafford County. The more urbanized areas of the fuelwood harvest region will not be primary sources of fuelwood.

Population

The seven Maine counties have shown steady population growth since 1950. However, growth rates for the 1950-1970 period were below the national average of 34 percent (see Table 19). York County had the highest growth rate from 1950 to 1970, with a total increase of 19.3 percent. Only Oxford County's population declined over the period, at a rate of 1.7 percent (Census 1960; Census 1970). Five Maine counties grew at a rate above the national average of 5.3 percent for the five-year period from 1970 to 1975, as shown in Table 19. Cumberland and Kennebec experienced the highest growth rates, while Lincoln experienced the least growth (Census 1976b). The growth in Strafford County is due partially to the advancement of Boston suburbs and partially to the location of many businesses in southern New Hampshire.

TABLE 19: POPULATION GROWTH IN TEN COUNTIES COMPRISING FUELWOOD HARVEST AREA

County	Population			Rate of Change (%)	
	1950	1970	1975	1950-1975	1970-1975
Androscoggin, ME	83,594	91,279	93,863	12.3	2.8
Cumberland, ME	169,101	192,528	202,972	19.9	5.4
Kennebec, ME	83,881	95,247	100,647	19.9	5.7
Lincoln, ME	18,004	20,537	23,163	28.5	12.7
Oxford, ME	44,221	43,457	44,459	0.5	2.3
Sagadahoc, ME	20,911	23,452	26,459	26.5	12.8
York, ME	93,541	111,576	121,499	29.9	8.9
Belknap, NH	26,632	32,367	35,900	34.8	10.9
Carroll, NH	15,868	18,548	22,600	42.4	21.8
Strafford, NH	57,567	70,431	77,800	35.1	10.5

Sources: Census 1960, 1970, 1970b

All counties except Androscoggin experienced net inmigration between 1970 and 1975. Cumberland, Carroll, Strafford, and York Counties have experienced the greatest net inmigration (see Table 20). The Maine State Planning Office predicts that all counties will experience continued growth in the years ahead (MSPO 1977a).

Within the counties, the major cities have experienced declining population, while their suburbs have grown (see Table 21). This is true of the Portland, Lewiston-Auburn and Augusta regions (MSPO 1977a).

Changes are also occurring in the rural-urban population distributions of these counties. Some counties have seen a decline in people living in urban areas, while other counties have experienced an increase. The shifts in rural-urban distributions between 1960 and 1970 were generally small, however, as Table 22 shows (Census 1970).

Housing

In 1970, there were 196,991 year-round housing units throughout the seven Maine counties in the harvest region (see Table 23). The greatest number of units were located in Cumberland County, while Lincoln and Sagadahoc Counties claimed by far the fewest (Census 1970). In 1970, there was a total of approximately 17,500 vacant housing units in these counties (Census 1970). This figure represents a vacancy rate of about 8.9 percent.

Between 1970 and 1977, an estimated 40,000 new homes were constructed. The breakdown of new homes by county is shown in Table 23. The number of new homes for each county was calculated by multiplying the average annual increase from the 1972-1976 period (from Hasbrouck 1978) by seven. These figures were then added to the 1970 housing unit figures to obtain the estimated number of housing units in each county for 1977. To derive the 1977 housing vacancy rate for each county, the 1977 number of households was subtracted from the 1977 number of housing units, to obtain the estimated number of vacant units. The 1977 vacancy rate for Kennebec County was 3.5 percent, an indication of a tight housing market. Other counties had estimated vacancy rates rang-

TABLE 20: NET MIGRATION* IN TEN COUNTIES OF THE FUELWOOD HARVEST REGION

Maine County	1975 Population[1]	1970-1975[1] Net Migration
Androscoggin	93,863	- 647
Cumberland	202,972	+4378
Kennebec	100,649	+2218
Lincoln	23,163	+2413
Oxford	44,459	+ 316
Sagadahoc	26,227	+1820
York	121,499	+6095

New Hampshire County	1976 Population[2]	1970-1975[1] Net Migration
Belknap	36,200	3,900
Carroll	22,800	4,400
Stafford	77,900	4,700

* *In-migration less out-migration*

1. *Source: MSPO 1977a*
2. *Source: Census 1976b*

TABLE 21: POPULATION GROWTH IN SELECTED MAINE CITIES AND THEIR SUBURBS 1970-1977

CITY	1970	1975	1977
Augusta	21,945	21,029	21,300
Gardiner	6,685	6,723	6,830
Hallowell	2,814	2,790	2,830
Belgrade	1,302	1,675	1,760
Winthrop	4,335	4,941	5,090
Auburn	24,151	23,304	23,450
Lewiston	41,779	41,045	41,390
Liston	6,344	7,765	7,980
Sabattus	1,681	2,223	2,320

Source: MSPO 1977a

TABLE 22: PERCENTAGE OF POPULATION LIVING IN URBAN REGIONS IN THE MAINE COUNTIES OF THE FUELWOOD HARVEST REGION 1960 AND 1970

County	1960 % urban	1970 % urban
Androscoggin	81.9	75.0
Cumberland	67.9	62.7
Kennebec	60.6	60.3
Lincoln*		
Oxford	31.2	21.9
Sagadanoc	47.0	52.8
York	56.3	56.8

**Lincoln County has no land classified as urban.*
Source: Census 1970.

TABLE 23: HOUSING CHARACTERISTICS FOR MAINE COUNTIES OF THE FUELWOOD HARVEST REGION 1970-1977

County	Housing Units 1970[1]	Estimated Housing Unit Increase 1970-1977[2]	Estimated Housing Units 1977	Households 1977[3]	Estimated Vacant Housing Units 1977	Estimated Vacancy Rate 1977
Androscoggin	30,579	5,376	35,955	32,250	3,705	11.5
Cumberland	64,672	12,516	77,188	69,320	7,868	11.4
Kennebec	30,336	6,132	36,468	35,220	1,248	3.5
Lincoln	7,975	1,722	9,697	8,538	1,159	13.6
Oxford	15,602	2,240	17,842	15,473	2,369	15.3
Sagadahoc	8,670	1,638	10,308	9,380	928	9.9
York	39,157	10,290	49,447	42,270	7,177	17.0
Total	196,991	39,914	236,905	212,351	24,544	11.6

1. *Source: Census 1970*
2. *Calculated from Hasbrouck 1978*
3. *Source: MSPO 1978*

ing from 9.9 to 17.0 percent; housing supplies there are considered to be more than adequate.

The housing supply in Maine has remained relatively constant since 1975. The state did not experience the 1977 boom in residential construction that other sections of the country did. Bank-financed housing construction has decreased since 1972-1973. Shipments of new mobile homes into Maine now number 1,200 to 1,300 a year compared to 3,000 to 3,500 in the early 1970s (MSPO 1977b).

In 1970, there were 43,698 housing units in the three New Hampshire counties (Census 1970), with 6,551 vacant. Between 1970 and 1976, 7,479 new units were constructed (NHOCP 1978), and population increased by 16,824 (Census 1976b), or approximately 5,427 households.

Table 24 summarizes the estimated 1976 population and number of households in each of the three New Hampshire counties. The number of households was derived from population figures and assumed 2.9 persons per household. The housing vacancy rate, for each county, was then calculated in the same manner as were the Maine vacancy rates. The estimated 1976 number of total and vacant housing units and housing vacancy rates are also summarized in Table 24. Carroll County was, in 1976, the only county with a tight housing market. This situation was caused by a large increase in population from 1970 to 1976 (Census 1976b).

Income and Employment

Income. The 1975 average effective buying income for families of each Maine county of the fuelwood harvest region and the 1976 median income for families of each New Hampshire county are summarized in Table 25.

In the first quarter of 1978, annual per capital income was $4,308 in Maine and $4,917 in New Hampshire (Wharton 1978). Total personal income received in Maine during the first three months of 1978 was $6.8 billion; in New Hampshire it was $6.2 billion. Annual projected 1978 total personal incomes in the two states were, therefore, $27.2 billion and $24.8 billion respectively (Wharton 1978).

TABLE 24: HOUSING CHARACTERISTICS FOR NEW HAMPSHIRE COUNTIES OF THE FUELWOOD HARVEST REGION (1976)

County	Estimated[1] 1976 Population	Estimated 1976 Households	Estimated[2] 1976 Housing Units	Estimated 1976 Vacant Housing Units	Estimated Housing Vacancy Rate (%)
Belknap	37,200	12,828	14,414	1,586	11.0
Carroll	22,800	7,862	8,149	287	3.5
Strafford	77,900	26,862	28,614	1,752	6.1

1. *Source: Census 1976b.*
2. *Source: NHOCP 1978.*

TABLE 25: 1975 AVERAGE PER FAMILY EFFECTIVE BUYING INCOME* FOR MAINE COUNTIES AND 1976 MEDIAN PER FAMILY INCOME FOR NEW HAMPSHIRE COUNTIES OF THE FUELWOOD HARVEST REGION

COUNTY	1975 AVERAGE EBI[1]	1976 MEDIAN INCOME[2]
Androscoggin	12,294	
Cumberland	15,227	
Kennebec	14,657	
Lincoln	13,314	
Oxford	11,445	
Sagadahoc	12,806	
York	12,961	
Belknap		13,792
Carroll		11,793
Strafford		13,884

**Effective Buying Income consists of wages, salaries, interest, dividens, profits, and property income; minus federal, state, and local taxes.*

1. *Source: Census 1976b.*
2. *Source: NHOCP 1978*

Employment. In Maine's section of the potential fuelwood harvest region there were an average of 269,610 persons employed in 1978, a 2 percent increase over 1977 (MDMA 1979). Forty-two percent of the jobs were within the Portland and Lewiston-Auburn metropolitan areas. In May of 1978, the civilian labor force of the three New Hampshire counties potentially affected by the harvesting for the proposed project totaled 75,780, up 9 percent from 1977 (NHDES 1978b).

Table 26 indicates that manufacturing employs the largest number of persons in both the Maine and New Hampshire parts of the region, followed by retail trade and services (MDMA 1978c & d; NHDES 1978b). The latter two sectors serve a large tourist industry throughout the region.

Within the Maine portion of the fuelwood harvest region, there are 292 logging firms (MDC undated) employing between 800 and 1,000 loggers (Census 1976b). There are currently 600 loggers in the state of New Hampshire; their number is expected to increase moderately through 1985 (NHDES 1978a).

Unemployment. Unemployment in the seven Maine counties has decreased since 1975, when it averaged 8.6 percent. In 1978, an average of 14,810 individuals were reported to be employed, representing an unemployment rate of about 5.2 percent (MDMA 1978c & d). Table 27 summarizes June of 1978 insured unemployment in Maine by labor market area. As can be seen, forestry and related occupations do not represent a large portion of the insured unemployed. However, logging operators and loggers frequently do not have unemployment insurance.

In May of 1978, 1,880 persons were unemployed in the three New Hampshire counties. Belknap County had an unemployment rate of 2.2 percent, and the rate for both Carroll and Strafford Counties was 2.6 percent. Unemployment has been dropping since 1975, due to large increases in employment opportunities over the last few years (NHDES 1978b). Table 27 shows a percentage breakdown of January, 1978, insured unemployment in these counties.

TABLE 26: EMPLOYMENT IN SELECTED SECTORS IN THE FUELWOOD HARVEST REGION

Maine - 1976[1]

Sector	No. Employed
Manufacturing	59,619
Retail Trade	42,627
Services	40,794
Wholesale Trade	12,849
Finance, Insurance, Real Estate	11,449
Contract Construction	10,494
Transportation & Public Utilities	8,378
Administrative	947
Agriculture, Forestry, Fishing	619
Mining	138

New Hampshire - December 1977[2]

Manufacturing	16,775
Wholesale & Retail Trade	10,979
Services & Other	7,165
Construction & Mining	2,493
Finance, Insurance, Real Estate	1,614
Transportation & Public Utilities	1,540

1. *Maine data given for Androscoggin, Cumberland, Kennebec, Lincoln, Oxford, Sagadahoc, and York Counties.*
2. *New Hampshire data given for Belknap, Carroll, and Strafford Counties.*

Sources: for Maine data - Census 1976b; for New Hampshire data - NHDES 1978b.

TABLE 27: DISTRIBUTION OF INSURED UNEMPLOYED IN THE FUELWOOD HARVEST REGION

Maine - June 1978[1]

SECTOR	% UNEMPLOYED
Professional, Technical & Managerial	16.8
Structural Work	16.7
Miscellaneous	15.7
Clerical & Sales	14.4
Services	10.5
Processing	9.5
Bench Work	8.3
Machine Trades	6.6
Farming, Forestry, Fishing & Related	1.5

New Hampshire - January 1978[2]

Manufacturing	26.9	
Durable goods		10.4
Nondurable goods		16.5
Nonmanufacturing	73.1	
Construction		41.2
Trade		14.3
Services		11.3
Other nonmanufacturing		6.3

1. *Source: MDMA 1978b*
2. *Source: NHDES 1978b.*

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TABLE 28: EDUCATIONAL CHARACTERISTICS OF FUELWOOD HARVEST REGION

Maine: 1976 - 1977

COUNTY	TOTAL ENROLLMENT	STUDENT/TEACHER RATIO	MEDIAN SCHOOL YEARS COMPLETED
Androscoggin	20,423	20:1	10.8
Cumberland	43,905	18:1	12.3
Kennebec	22,717	18:1	12.1
Lincoln	5,147	16:1	12.1
Oxford	11,709	18:1	12.0
Sagadahoc	6,763	18:1	12.1
York	27,703	20:1	12.0
New Hampshire: 1976 - 1977			
Belknap	8,346	20:1	12.1
Carroll	5,017	18:1	12.3
Strafford	15,433	21:1	12.1

1. Median school years completed based on population 25 years and older.

Source: for Maine data-MDECS 1977 and Census 1970; for New Hampshire data-NHDE 1978 and Census 1970.

state's underprivileged. Major programs include Aid to Families with Dependent Children and the Maine Food Stamp Program.

Within close vicinity of Belknap, Carroll, and Strafford Counties are located ten hospitals. This number includes some hospitals in Maine and those bordering New Hampshire counties.

The New Hampshire Division of Public Services offers a variety of services to residents of the state. Services include an alcohol and drug abuse program, emergency health services, a heart program, public health nursing, consumer protection services, and nutrition services (NHDW undated).

The State of New Hampshire has two systems of public welfare administration. The state administers categorical programs, while the general assistance program currently in existence include: Aid to Families with Dependent Children, Aid to the Permanently and Totally Disabled, Medicaid, and the New Hampshire Food Stamp Program (NHDW undated).

Crime

Cumberland County, the region's most urbanized area, has its highest crime rate. All crime rates in the fuelwood harvest region are below national averages (FBI 1976).

Economic Base

Sectors of the economy. The industrial base contained within the seven Maine counties is complex. It includes many types of manufacturing as well as forestry, agriculture, and a substantial tourist industry. Growth in the tourist industry is reflected in the expansion of trade and services. Health services have also increased in the past few years. Manufacturing is recovering from the recession, with particular strength in the nonelectrical machinery production sector. Leather, leather products, textile and apparel industries have recently seen marginal growth (MDMA 1978c).

Lumber and wood products, furniture and fixtures, and paper and allied products industries employ approximately 6 percent of the total labor force in the fuelwood harvest region. Logging makes up .43 percent of the total. All forest-related sectors have seen moderate growth since 1977 (MDMA 1978b; NHDES 1978b).

TABLE 29: 1976 VALUE OF PRODUCT IN SIX MAINE COUNTIES OF THE FUELWOOD HARVEST REGION

(dollars)

Industry	Androscoggin County	Kennebec County	Lincoln County	Oxford County	Sagadahoc County	York County
Food	95,185,771	85,917,823	1,681,520	2,098,663	2,098,663	9,587,850
Textiles and Apparel	50,617,501	66,490,459				68,727,986
Chemicals, Rubber and Plastic	58,966,563					60,171,159
Stone, Clay and Glass	8,642,689			2,668,014		3,570,263
Leather	92,718,766	19,068,423		35,276,268		99,129,482
Metals	16,913,566	11,956,507				46,546,443
Machinery and Equipment	27,299,979	2,850,448	3,204,183	2,272,422		61,776,604
Lumber and Wood	5,692,160	12,336,236	1,200,428	70,199,630	480,062	8,539,488
Furniture						10,493,199
Printing and paper	55,566,949	191,460,144		1,014,046	641,480	9,719,903
Miscellaneous Manufacturing	1,998,754		1,016,083	5,876,667		

Source: MDMA 1976

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Impacts

Introduction

The proposed wood-fired power plant will consume about 680,000 green tons of wood and wood waste per year. Approximately 70 percent of this wood, or 480,000 green tons, will be harvested directly for the plant; the remaining fuel will consist of bark, shavings, and sawdust, available as mill residues.

Employment

The number of harvesters required to produce 480,000 green tons of chips per year depends on the harvesting systems employed, but will be between sixty and seventy (adapted from VanderWerf 1978 and Dashaw 1978). The project will also require three foresters to supervise the harvesting and ensure that sound forest practices are followed. Thirty-six truckers will be needed to transport the wood and wood waste (see Appendix F) and the equivalent of three or four mechanics jobs and a secretary-bookkeeper position will be created in the region to service the trucking operations (VanderWerf 1978). This brings the total number of persons directly employed in harvesting operations to 114.

The Bureau of Economic Analysis regional impact model predicts that the stimulation to the economy due to fuelwood procurement and transportation activities will create approximately 134 indirect jobs in the fuelwood harvest region. Table 30 summarizes indirect employment by economic sector and type of expenditure. Thus, combined direct and indirect employment will total 248 jobs, an increase in regional employment of 0.07 percent over the 1978 employment level of 342,000 (Noyes 1979; MDMA 1979).

Average annual unemployment in the fuelwood harvest region totaled 17,060 or 5 percent of the labor force during 1978 (Noyes 1979; MDMA 1979). Table 31 summarizes unemployment by occupation, as estimated from the total unemployment figure and the occupations' known shares of total insured unemployment. Persons of the indicated occupations have skills which enable them to occupy positions as harvesting equipment operators, truckers, and mechanics, or in the principal indirect employment categories.

TABLE 30: TOTAL, INDIRECT, AND DIRECT EMPLOYMENT GENERATED BY THE PROPOSED PROJECT IN THE FUELWOOD HARVEST REGION

Industry	Indirect Procurement Employment	Indirect Transportation Employment	Total Indirect Employment
Farms	0.1	0.1	0.2
Agricultural services	0.0	0.0	0.0
Forestry and fisheries	0.3	0.0	0.3
Nonmetallic mineral mining and quarrying	0.0	0.0	0.0
Contract construction	0.6	0.1	0.7
Fabricated metal products	0.0	0.0	0.0
Food and kindred products	6.6	2.3	8.9
Textile mill products	1.2	0.3	1.5
Apparel and other fabricated textile products	4.4	1.7	6.1
Lumber and wood products except furniture	1.8	0.1	1.9
Furniture and Fixtures	0.2	0.1	0.3
Paper and allied products	14.5	0.2	14.7
Printing, publishing and allied products	0.6	0.2	0.8
Chemicals and allied products	0.1	0.0	0.1
Petroleum and related industries	0.0	0.0	0.0
Rubber and misc. plastic products	0.8	0.2	1.0
Leather and leather goods	0.7	0.2	0.9
Stone, glass and clay products	0.1	0.0	0.1
Primary metals industries	0.0	0.0	0.0
Fabricated metals products	0.5	0.1	0.6
Machinery except electrical	0.1	0.0	0.1
Electrical machinery	0.7	0.3	1.0
Motor vehicles	0.2	0.1	0.3
Other transporation vehicles	0.1	0.0	0.1
Instruments	0.1	0.0	0.1
Misc. manufacturing	0.6	0.5	1.1
Railroad transportation	0.9	0.2	1.1
Local, suburban and highway passenger transportation	0.6	0.2	0.8
Motor freight, transportation and warehousing	1.6	0.8	2.4

TABLE 30: CONT.

Industry	Indirect Procurement Employment	Indirect Transportation Employment	Total Indirect Employment
Water Transportation	0.2	0.0	0.2
Air Transportation	0.0	0.0	0.0
Pipeline Transportation	0.0	0.0	0.0
Transportation services incl.carrier affiliates	0.1	0.1	0.2
Communications	1.1	0.4	1.5
Public utilities	1.0	0.3	1.3
Wholesale trade	8.9	2.7	11.6
Retail trade	34.6	8.3	42.9
Banking	1.2	0.4	1.6
Credit agencies and holdings and investments	0.3	0.1	0.4
Security and commodity brokers, dealers	0.2	0.0	0.2
Insurance carriers incl. solicitors	2.2	0.7	2.9
Insurance agents, brokers and services	0.8	0.3	1.1
Real estate and combinations	0.2	0.1	0.3
Lodging places	0.7	0.3	1.0
Personal and misc. repair services	2.8	1.0	3.8
Misc. business services	1.2	0.3	1.5
Auto repair and services	1.4	0.5	1.9
Motion pictures	0.1	0.0	0.1
Amusement and recreational services excluding motion pictures	1.1	0.4	1.5
Medical and other health services	5.9	2.1	8.0
Legal and other misc. professional service	1.5	0.4	1.9
Private educational services	1.4	0.5	1.9
Museums and nonprofit membership organization	1.0	0.3	1.3
Households	1.4	0.5	1.9
Total Indirect Employment	107.0	27.2	134.2
Total Direct Employemnt	73.0	41.0	114.0
Total Employment	180.0	68.2	248.2

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Clearly, most of the 248 positions could be filled by the estimated 8,104 unemployed persons of the indicated occupations. Indeed, the fact that mechanized harvesting will be employed may attract workers who have not previously considered logging as an occupation. Construction workers skilled in heavy equipment operation may be particularly well-suited to this employment. The most significant impact on unemployment would occur if a program were established to train unemployment persons to operate mechanized harvesting equipment. Most of the harvesting will take place in southern Maine and southeastern New Hampshire; it is unlikely that Canadian woods workers will be employed by this project. If all persons employed directly and indirectly by the project came from those currently unemployed in the region, unemployment would be reduced by 243 persons or 0.1 percent (Noyes 1979; MDMA 1979).

Income

Table 32 summarizes the direct income in the form of salaries paid to workers engaged in harvesting operations. Loggers in Maine receive between $7,500 and $11,300 per year (Census 1976a). As the loggers employed by the project will primarily be skilled equipment operators, an annual salary of $11,000 is assumed here. Truckers in New England typically earn $20,000 per year, working 250 days at $8.00 per hour (Adler, Blakey & Meyer 1978). Mechanics will receive about $10,400 per year. The secretary-bookkeeper will receive about $7,800 per year (VanderWerf 1978); and the foresters will receive about $12,000 per year. A total of approximately $1.6 million will be paid annually to employees of firms supplying or shipping wood to the proposed wood-fired facility.

Stumpage fees paid to landowners will provide another source of income. The average stumpage fee paid for firewood in the region is approximately $1.96 per green ton (MFS 1978b). At this rate, stumpage fees paid annually as a result of the facility would total about $940,000. Low-quality millwood residues can be obtained from the forest products industries for an average of about $4.50 per ton without shipping (Hewett 1978). Annual regional income from this expenditure will total $800,000.

TABLE 32: DIRECT INCOME IN SALARIES TO WORKERS EMPLOYED IN HARVESTING OPERATIONS

(1977 dollars)

JOB	SALARY	NUMBER EMPLOYED	TOTAL INCOME
Harvesters	$11,000[1]	70[2]	$770,000
Truckers	20,000[3]	36[4]	720,000
Mechanics	10,400[5]	4[5]	41,600
Secretary	7,800[5]	1[5]	7,800
Foresters	12,000	3	36,000
TOTAL		114	$1,575,400

1. *Source: Derived from Census 1976a.*
2. *Derived from VanderWerf 1978 and Dashnaw 1978.*
3. *Source: Adler, Blakey & Meyer 1978.*
4. *Source: Appendix F.*
5. *Source: VanderWerf 1978.*

Prediction of the exact numbers of the type of harvesting equipment that will be purchased is difficult, as fuelwood for the proposed plant will be obtained from private contractors. Table 33 summarizes an average equipment configuration for the projects's ten whole-tree harvesting operations. The configuration assumes a mixture of moderately-mechanized and highly-mechanized operations. Table 33 also includes the average service lifetime of each equipment type and the numbers of each type of equipment expected to be purchased each year. While there may be a surge in equipment purchases during the first year of plant operation, it is unlikely that all equipment will be purchased immediately. Different equipment lifetimes will also stagger purchases once the plant is in operation; therefore, it is assumed that equipment will be purchased in direct proportion to its lifetime and the total numbers required. Calculation of the average annual regional income resulting from harvesting equipment purchases is summarized in Table 34. As harvesting equipment is not manufactured in the fuelwood harvest region, only its retail markup value will accrue to the regional economy. The annual direct regional income from harvesting equipment purchases stimulated by this project will total $168,550.

Chip vans for the project are expected to be purchased outside of the fuelwood harvest region. However, purchases of diesel fuel, used to power both harvesting equipment and chip transportation vans, will provide direct income to the regional economy. Large harvesting operations of the type required by this project consume about 160 gallons of diesel fuel per day (Percival 1978; Dashnaw 1978). With ten contractors supplying wood to the power plant and each one operating 250 days per year, diesel fuel consumed in the harvesting of wood will total about 400,000 gallons per year. Trucks transporting wood chips and residues also burn diesel fuel. These trucks, which have a capacity of twenty-seven tons, will transport 680,000 tons of wood per year over an average distance of about fifty miles (see Appendix F). Thus, about 25,200 round trips, each one hundred miles in length, will be made each year. As chip vans consume one gallon of fuel for every 5.7

TABLE 33: AVERAGE EQUIPMENT CONFIGURATION OF THE PROPOSED PROJECT'S TEN WHOLE-TREE HARVESTING OPERATIONS

EQUIPMENT TYPE	NUMBER PER OPERATION	NUMBER PER PROJECT	AVERAGE SERVICE LIFETIME (YEARS)	ESTIMATED NUMBER PURCHASED PER YEAR
Skidder	2	20	5	4
Feller Buncher	1	10	5	2
Chipper	1	10	5	2
Low Boy Trailer	.5	5	10	.5
Used Bulldozer	.5	5	5	1
3/4-Ton Pick	1	10	2	5
Chainsaws	4	40	1	40

Sources: JPR 1979; Thomas 1978; Viking 1978

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miles traveled (TRB 1977), these trucks will consume about 440,000 gallons of diesel fuel per year. Total annual fuel consumption for both harvesting and transportation will equal about 840,000 gallons. At spring 1979 prices, the cost of fuel will total $504,000 per year. Of this amount, 5 percent, or $25,200, will accrue to regional wholesalers. Five percent will also accrue to local fuel delivery companies (VanderWerf 1978). Thus, approximately $50,400 of direct regional income will result annually from diesel fuel purchases.

Table 35 summarizes annual direct income to the fuelwood harvest region resulting from the proposed project. Annual direct regional income will total $3.5 million.

As a result of salaries and expenditures for fuelwood procurement and transportation, additional indirect regional income will be stimulated through an economic multiplier effect. The Bureau of Economic Analysis Regional Impact Model was employed to determine the approximate level of indirect income resulting from this project. Table 36 provides a breakdown, by economic sector, of the total, direct, and indirect income generated by the harvesting and transportation of fuelwood for the proposed plant. Total direct income of fuelwood harvesting and transportation is subtracted from these levels to obtain the total indirect income generated. A total of $7,810,000 of income will be generated in the fuelwood harvest region. Of this amount about $4,280,000 will be indirectly created.

The sectors of the economy which will receive the most income are food products, paper products, wholesale trade, and retail trade. Table 37 summarizes the trade increases of each of these four sectors.

State Revenues

As a result of harvesting for the proposed project, the state of Maine will receive additional tax revenues from personal income tax on salaries and stumpage fees, from sales tax on direct and indirect purchases, and from vehicle registrations and excise taxes. New Hampshire has neither a personal income tax nor a sales tax, and chip vans servicing the proposed plant are most

TABLE 35: ANNUAL DIRECT INCOME ACCRUING TO THE FUELWOOD HARVEST REGION

SECTOR	INCOME FROM PROCUREMENT OF FUELWOOD (Dollars)	INCOME FROM TRANSPORTATION OF FUELWOOD (Dollars)	TOTAL INCOME (Dollars)
Labor[1]	806,000	769,400	1,575,400
Stumpage Fees[2]	940,000		940,000
Wood Waste[3]	800,000		800,000
Retail Trade (equipment)[4]	168,550		168,550
Wholesale Trade (diesel fuel)[5]	12,000	13,200	25,200
Shipping (diesel fuel)[5]	12,000	13,200	25,200
TOTAL	2,738,550	795,800	3,534,350

1. *Source: Table 31*
2. *Source: MFS 1978b*
3. *Source: Hewett 1978*
4. *Source: Table 33*
5. *Source: VanderWerf 1978*

TABLE 36: ANNUAL TOTAL, DIRECT, AND INDIRECT INCOME ACCRUING TO THE FUELWOOD HARVEST REGION

Industry	Total Procurement Income *(dollars)*	Total Transportation Income *(dollars)*	Total Income *(dollars)*
Farms	124,000	49,200	173,200
Agricultural services	5,460	1,800	7,260
Forestry and fisheries	24,500	3,520	28,020
Nonmetallic mineral mining and quarrying	1,960	56	2,016
Contract construction	26,800	6,110	32,910
Fabricated metal products	1,240	451	1,691
Food and kindred products	292,000	101,000	393,000
Textile mill products	52,600	14,400	67,000
Apparel and other fabricated textile products	125,000	49,200	174,200
Lumber and wood products except furniture	80,200	2,630	82,830
Furniture and fixtures	5,540	1,990	7,530
Paper and allied products	902,000	11,600	913,600
Printing, publishing and allied products	16,900	5,080	21,980
Chemicals and allied products	7,340	1,230	8,570
Petroleum and related industries	0	0	0
Rubber and misc. plastic products	33,200	7,650	40,850
Leather and leather goods	19,000	6,690	25,690
Stone, glass and clay products	1,790	518	2,308
Primary metals industries	507	114	621
Fabricated metals products	19,200	3,260	22,460
Machinery except electrical	6,380	953	7,333
Electrical machinery	22,100	7,820	29,920
Motor vehicles	13,000	4,780	17,780
Other transportation vehicles	2,910	955	3,865
Instruments	1,720	764	2,484
Misc. manufacturing	19,900	16,400	36,300
Railroad transportation	38,900	8,190	47,090
Local, suburban and highway passenger transportation	14,200	5,000	19,200
Motor freight, transportation and warehousing	49,900	23,600	73,500

TABLE 36: CONT.

Industry	Total Procurement Income *(dollars)*	Total Transportation Income *(dollars)*	Total Income *(dollars)*
Water transportation	6,030	949	6,979
Air transportation	1,210	656	1,866
Pipeline transportation	1,420	560	1,980
Transportation services incl. carrier affiliates	1,050	873	1,923
Communications	52,200	16,100	68,300
Public utilities	88,600	24,800	113,400
Wholesale trade	167,000	50,100	217,100
Retail trade	553,000	133,000	686,000
Banking	29,900	9,010	38,910
Credit agencies and holdings and investments	3,470	1,360	5,030
Security and commodity brokers, dealers	2,750	780	3,530
Insurance carriers incl. solicitors	61,300	20,000	81,300
Insurance agents, brokers and services	17,100	5,430	22,530
Real estate and combinations	110,000	33,100	143,100
Lodging places	10,300	3,850	14,150
Personal and misc. repair services	48,300	16,400	64,700
Misc. business services	33,300	7,460	40,760
Auto repair and services	48,300	16,500	64,800
Motion pictures	1,950	663	2,613
Amusement and recreational services excluding motion pictures	15,400	5,350	20,750
Medical and other health services	93,400	32,700	126,100
Legal and other misc. professional service	23,400	6,050	29,450
Private educational services	22,300	7,780	30,080
Musuems and nonprofit membership organization	18,800	6,270	25,070
Households	2,760,000	995,000	3,755,000
Total Income	6,080,000	1,730,000	7,810,000
Total Direct Income	1,938,550	1,595,800	3,534,350
Total Indirect Income	4,141,450	134,200	4,275,650

TABLE 37: INCREASE IN TRADE DUE TO THE PROPOSED PROJECT, OF EACH OF FOUR SECTORS OF THE FUELWOOD HARVEST REGION ECONOMY

Sector	1976 Value[1] of Product	Value of Product Increase	Percentage Increase	1977[1] Taxable Sales	Sales Increase	Percentage Increase
Food and kindred products	360,000,000	393,000	0.1			
Paper and allied products	508,000,000	913,600	0.2			
Retail trade				1,700,323,000	686,000	.04
Wholesale trade				NA*	217,100	

NA = Not Available
1. Source: MDMA 1976

likely to be based in the state of Maine. Therefore, it is unlikely that New Hampshire will receive substantial tax revenues as a result of this project.

Table 38 summarizes the calculation of income tax revenues to be paid on workers' salaries to the state of Maine. All salaries are assumed to be paid to Maine residents, and all workers are assumed to claim one exemption of $3,000. An average deduction for each income tax bracket was used. Total state income tax revenues paid by those directly and indirectly employed by the project will be approximately $66,000 per year. As stumpage fees are considered as capital gains, the annual state income tax revenues generated by this expenditure will total approximately $47,000. Maine income tax generated by the proposed project will total about $113,000. However, as it is almost certain that some wood will be harvested in New Hampshire, the actual Maine tax revenue increase will probably be somewhat smaller.

The state of Maine will receive revenues from sales tax on direct expenditures for harvesting equipment and wood waste. An estimated total of about $870,500 will be spent on harvesting equipment each year. This figure is derived from information provided in Table 34. At the sales tax rate of 5 percent (Cleaves 1978), this expenditure will generate revenues totaling about $44,000 per year. Approximately $800,000 of wood waste will be purchased each year. The sales tax paid on this amount will total about $40,000 per year. The sales tax return on indirect expenditures is calculated using the sum of the taxable portions of indirect income generated by fuelwood procurement and transportation (see Table 36) which total about $3,600,000. Given a sales tax rate of 5 percent, indirect expenditures will return $180,000 to the state's general fund.

Maine state sales tax will also have to be paid on the purchase of chip vans, even though they will not be purchased in the fuelwood harvest region. Given a fleet size of thirty-six trucks and an average truck lifetime of five years, about seven trucks will be replaced each year. At an average cost of $49,500, the

TABLE 38: CALCULATION OF INCOME TAX REVENUES PAID TO STATE OF MAINE ON EARNINGS OF WORKERS EMPLOYED BY THE PROPOSED PROJECT

Occupation	Average Number of Workers	Average Annual Income	Less[1] Deductions	Less[1] Exemptions	Average Annual Taxable Income	Maine State Income Tax	Total State Revenue
Harvesters	70	$ 11,000	$ 2,100	$ 3,000	$ 5,900	$ 136	$ 9,520
Truckers	36	20,000	2,800	3,000	14,200	596	21,456
Secretary	1	7,800	2,100	3,000	2,700	48	48
Mechanics	4	10,400	2,100	3,000	5,300	112	448
Foresters	3	12,000	2,100	3,000	6,900	194	582
Indirect	134	13,000	2,100	3,000	7,900	254	34,036
Total							$ 65,890

1. *Source: Table 32*
2. *Source: Segerson 1978*
3. *Source: Calculated from CCC 1978*

sales tax on each truck will equal $2,475. The total annual sales tax will be about $17,300.

The state of Maine will also receive revenues from truck registration fees. The annual Maine fee for a five-axle tractor trailer truck is $705 (CCC 1978). Given a fleet of thirty-six trucks, the annual revenue due to truck registration will equal $25,380.

An excise tax must also be paid each year on each truck of the fleet. The excise tax rate is based on truck age. The older the truck, the lower the rate. The average lifetime of a chip van is five years. Thus, the excise tax rate for the fleet will range from $24 per each $1,000 of purchase price, to $6.5 per $1,000 of purchase price (CCC 1978). Thus, for each truck, the appropriate excise tax rate must be multiplied by the truck purchase price, which will average $49,500. Assuming the fleet will be evenly distributed in age, approximately $25,200 in excise tax revenues will be generated annually.

Fuel use taxes will be paid on the 440,000 gallons of diesel fuel which wiil be consumed annually by the chip vans. At a tax rate of nine cents per gallon (CCC 1978), revenues from this source will total $39,600 per year.

The maximum annual revenues that the state of Maine will receive as a result of fuelwood procurement and transportation for the proposed wood-fired facility is $484,000 (see Table 39). As some purchases and income may accrue to New Hampshire, which does not have a state income or sales tax, Maine state revenues may be somewhat less than projected.

Highway Maintenance Expenditures

Projected increases in state highway maintenance expenditures are discussed in detail in Appendix F. Chip vans of approximately 80,000 pounds gross vehicle weight are expected to deliver chips to the proposed wood-fired power plant. Approximately 25,000 trucks are expected to arrive at the plant site annually (see Appendix F). Projection of the highway costs resulting from chip transportation depend on the total vehicle miles traveled, the types of roads driven, and the extent of operations during the

TABLE 39: SUMMARY OF ANNUAL MAINE STATE REVENUES GENERATED BY THE PROPOSED PROJECT

		Revenue *(dollars)*
Income Tax[1]:	Salaries	65,890
	Stumpage Fees	47,000
Sales Tax:[2]	Wood Waste	40,000
	Equipment	43,525
	Indirect Income	180,262
	Trucks	17,325
Truck Registration Fees[1]		25,380
Excise Tax[1]		25,240
Fuel Use Tax[1]		39,600
	Total	$ 484,222

1. *Source: Calculated from CCC 1978*
2. *Source: Calculated from Cleaves 1978*

spring thaw season. Greatest uncertainty in such projections, however, stems from the uncertainties inherent in studies predicting the actual impact of trucks on highways. It is expected that road maintenance impacts resulting from chip transportation would not exceed $222,000 annually and could be as low as $7,400 each year (Adler, Blakey & Meyer 1978). Total highway maintenance costs in 1977 were approximately $41 million for Maine (MDOT 1978) and $19 million for New Hampshire (NHDPW 1978).

Population

The impact on the population of the region of harvesting and transporting wood chips will be small. Even if all direct and indirect positions created by the project were filled by immigrants into the region, the population would increase only by 248 persons, or .03 percent of the 1975 area population of 749,362 (Census 1976b). Most harvest-related jobs will be filled locally, however, so population growth will be negligible.

Housing, Education, and Community Services

Harvesting for this project is not expected to draw logging operators from outside of the region and is therefore not expected to impact significantly on public expenditures for housing, education, or other community services. Even if all 114 workers to be employed in harvesting operations were to immigrate into the region, these workers would live in many communities scattered throughout the harvest region and impacts on housing, education, and community services would be too dispersed to measure.

Health Service

Loggers have the highest work-related injury or illness rate of all occupations in Maine (MDMA 1976). The annual injury rate for loggers in 1976 was 27.5 per 100 full-time workers employed. Of these 27.5 accidents, 15.5 resulted in work time lost (MDMA 1976). The increased logging employment of sixty to seventy positions created by the project will cause approximately twenty additional injuries requiring treatment annually. This accident rate will not stress existing hospital capacity in the fuelwood harvest region.

Wood Products Industry

The proposed wood-fired power plant will demonstrate the feasibility and economic viability of collecting, handling, and burning wood for steam and electricity generation. As a publicly funded demonstration project, the plant will attract media coverage and public attention. Construction data, environmental analysis, and economic studies for the project will be available publicly and will provide an incentive for others, including those in the wood products industry, to investigate conversion to woodfired cogenerating boilers.

In its heating and drying processes, the pulp and paper industry uses 84 percent of all energy consumed by the wood products industry. In the Northeast, oil is the industry's major fuel source, providing 56 percent of the energy consumed (USFS 1976).

Price increases of the past decade and concern over supply reliability have forced the industry to consider alternative fuels. The environmental control costs of burning coal and the limited availability of natural gas in New England present problems similar to those associated with fuel oil. Thus, wood is becoming an attractive alternative for the industry. The use of wood residue as an energy source in new mills is usually advantageous, but retrofitting an existing plant to burn chips requires a large capital investment for the boilers, fuel storage and handling equipment, and air quality control systems (Saeman 1977). The proposed plant will demonstrate the feasibility of increasing energy self-sufficiency by retrofitting a mill for cogeneration of steam and electricity.

A major drawback to investment in cogeneration is the loss of flexibility in fuel type and energy use. However, with accurate projections of energy needs and relative fuel costs, a cogenerating firm can buffer its production from increasing energy costs and improve the competitive position of its products. In addition money that would otherwise be drained from the economy in purchasing oil will remain in the local economy (GCC 1978).

Feasibility of whole-tree chipping. The project will also demonstrate the feasibility of whole-tree chipping for fuelwood. The proposed wood-fired plant may precipitate an increase in whole-tree harvesting and chipping in the fuelwood harvest region. Five whole-tree chipping operations presently operate in the area. If all the plant's projected requirement of 680,000 green tons of fuel were harvested each year, eleven to fifty-four new chipping operations would be needed (Calculated from Dashnaw 1978; Percival 1978). However, since mill residues will probably comprise 40 percent of the plant's fuel supply, chipping operations will number about ten, unless double shifts or extended working hours are instituted.

If whole-tree chipping proves a commercially viable way to produce low-grade fuel chips, other wood industries will be encouraged to institute this harvesting method for the production of both fuel and higher-quality pulp chips. The whole-tree chipping associated with this project wil not only demonstrate the viability of the technology but also the acceptability of mechanized harvesting on small private woodlands prevalent in the region. The absence of slash following a whole-tree harvest may convince previously reluctant landowners to allow harvesting in their forests. A market for low-quality material may also improve the economics of harvesting woodlands previous uneconomic to cut. Combined with the higher yield of whole-tree harvesting over traditional methods, these factors may increase the supply of wood available for fuel chips, pulp chips, and other products, and thus help to dampen price escalation for wood products.

Regional expertise in whole-tree chipping would attract the interest of particleboard manufacturers and other producers of reconstituted wood products. These products are expected to fulfill a rapidly increasing demand for wood products on a national basis (USFS 1974; Stone 1977). However, the commitment of 680,000 tons of wood to the proposed power plant, combined with commitments to existing and planned wood products mills, may discourage other wood industries from locating within the fuelwood harvesting region.

Competition with existing markets. Both fuel chips and roundwood for domestic space heating can be produced from low-quality wood. Although the sources for these products overlap, the price of firewood is higher than that of fuel chips. Retail firewood sell at $45 to $85 per cord ($18 to $34 per green ton), with $51.50 the statewide average ($20.60 per ton) (MFS 1978b). Increasing reliance on wood for heat seems inevitable; recent and predicted increases in the prices of home heating oil enhance the attractive economics of this fuel (News 1978; Times 1978). Delivered fuel chips for the proposed plant will cost an estimated $13.50 per green ton (Rich 1978). Even though the chips sell for lower prices, some wood contractors prefer a relatively stable relationship with an established mill to an uncertain relationship with an unstructured firewood market in which they must advertise and sell wood as well as cut, process, and truck it.

The raw material for bolter, pallet, and shingle mills may overlap with the wood used for fuel chips. In most cases, however, the stricter species and quality requirements and higher mill-delivered prices for the wood for these products will prevent competition with fuel chips for stumpage (see Table 40). However, if fuelwood chip prices rise significantly, certain smaller bolter, shingle, and pallet mills may experience difficulty competing for wood.

Competition for stumpage between pulp chips and fuel chips is also possible. Mill-delivered prices for pulp are shown in Table 41. However, pulp mill operations prefer "clean" chips (without bark or dirt), while fuel chips have no specifications of this type. Pulpwood is ordinarily delivered to the mill or concentration yard where it is debarked and chipped. Fuel chips, because of their relatively low value, must be chipped in the woods to minimize costs. Thus, some differentiation in product quality and value does exist.

Since the fuel chips for the proposed power plant will be used by a wood products industry, fuel chip price will be linked to pulpwood prices. The availability of stumpage and labor for harvesting will determine whether or not the price of chips rises

TABLE 40: MAINE STATEWIDE AVERAGE MILL DELIVERED PRICE OF BOLTWOOD[1]

(dollars/green ton)

Species	Prices		
	Fall 1977[2]	Spring 1978[3]	Fall 1978[4]
White Pine	14.80	14.60	17.80
Cedar	17.60	16.40	18.60
White Birch	31.20	32.20	35.60
Yellow Birch		30.80	32.60
Hard Maple	28.80	26.80	28.40
Oak	27.20	29.00	29.60
Beech	19.60	19.20	20.60
Aspen	16.00	16.40	15.00
Soft Maple	19.00	18.20	20.80
White Ash	28.40	32.00	30.00
Pallet			20.00
Basswood	18.00		
Red Pine	16.00		
Spruce	17.00		
Firewood	15.00	18.90	20.60
White Pine Shingle Stock	12.00	12.00	14.40

1. *Assumes 500 board feet/cord and 2.5 tons/cord.*
2. *Calculated from MFS 1977.*
3. *Calculated from MFS 1978a.*
4. *Calculated from MFS 1978b.*

TABLE 41: MAINE STATEWIDE AVERAGE MILL-DELIVERED PRICE OF PULP[1]

(dollars/green ton)

Species	Four-foot Lengths	Tree Lengths
White Pine	14.90	12.50
Red Pine	14.90	
Hemlock	15.50	13.25
Spruce/Fir	19.50	22.00
Tamarack	15.50	13.25
Aspen	13.90	
Other Hardwoods		21.25

Source: MFS 1978b

with increased demand. Competition for wood could force stumpage prices up; however, as stated above, the availability of stands formerly withheld from harvest may counteract this trend. Logger unemployment and wood availability studies (Sewall 1978) indicate a current surplus in these inputs of wood production. In the short term (a year or less), availability of harvesting equipment may limit wood production and temporarily affect chip prices. Careful scheduling of contracts by the boiler operator during the construction and initial operation of the proposed plant could mitigate this problem.

An important opportunity may also arise for the establishment of integrated harvest operations in the fuelwood harvest region. These operations - harvesting pulpwood, sawtimber, and fuel chips - may be able to produce these materials more economically than is possible at present. The beneficial effects of these economics would accure to both the harvesters and mill operators.

ANALYSIS METHODS AND SOURCES OF ERROR

Introduction

In this study, input-output analysis was used to estimate the multiplier effects of plant construction and fuelwood harvesting and transportation expenditures. The input-output data was obtained from the Regional Economic Analysis Division of the Bureau of Economic Analysis of the U.S. Department of Commerce.

Analysis Methods

Input-output analysis is a method of data organization and manipulation designed to estimate the multiplier effect of any new expenditure within an economy (VanderWerf 1978). First, the descriptive data for a specific economic region are collected and organized. An economic region may be a country, state, county, or metropolitan area. Second, anticipated expenditures to be made in the region are specified, including the dollar amount and recipient industry of each. These inputs are manipulated to obtain a set of estimates that indicate how much extra income will accrue to each industry of the study region, as a result of the economic multiplier effect. To estimate the combined multiplier effect of the expenditures associated with the introduction of a new industrial facility, the increases in regional income brought about by each individual purchase are added together.

Estimates of income increases for individual industries can be used to estimate the associated employment increases, if the average employment per dollar of sales in each industry is known.

The U.S. Bureau of Economic Analysis supplied all of the input-output data, industrial multipliers, and industrial employment data necessary for this study. For the estimation of plant construction impacts, Cumberland County was the specified economic region. For the estimation of fuelwood harvesting and transportation impacts, the seven Maine counties of the fuelwood harvesting region comprised the study region.

The input-output model was implemented with a computer program written in BASIC by VanderWerf (1978) and modified to fit the data requirements of this study. This program and associated documentation may be obtained from the Resource Policy Center, Thayer School of Engineering, Dartmouth College, Hanover, New Hampshire.

Sources of Error

Due to difficulties in separating multiplier effects from actual business activity, there exists no real empirical analysis of the predictive accuracy of input-output analysis. It is possible, however, to determine which aspects of input-output analysis allow inaccuracy to enter. Inaccuracy enters input- output analysis in two major ways. First, the analysis is based on several simplistic assumptions of how actual economic processes occur. Second, limits to the input-output data exist because of the methods used by the Bureau of Economic Analysis to prepare them (VanderWerf 1978)

Input-output analysis assumes instantaneous adjustment and linearity. instantaneous adjustment implies that industries are able to increase their output by any amount as soon as sales increase. In reality, there exist many delays in this process; these delays are not represented within the framework of the input-output analysis. Production adjustments may also be incomplete. The buyer may purchase goods and services from outside the area, rather than wait for a local firm to increase capacity (VanderWerf 1978).

Linearity implies that businesses and people always spend their income in the same pattern, regardless of scale (VanderWerf 1978). However, a business that receives an increase in income may decide not to purchase more machinery, but instead to hire additional labor. At another point in time, this same business may choose to purchase additional machinery rather than more labor. These decisions are dependent upon the long-range planning of the particular business firm.

The data received from the Bureau of Economic Analysis is adapted from national data, rather than calculated directly from local data. For this reason, the data may not accurately reflect all characteristics peculiar to the study region. The Bureau of Economic Analysis adjustments also ignore local differences in buying patterns; they assume that the firms of a given industry within a given region spend their income in the same manner as does the average U.S. firm in that same industry (VanderWerf 1978).

In general, forecasted input-output and employment changes:

- are best considered as "ball park" estimates; good as indicators of the general pattern of adjustment of multiplier effects, but not totally precise in their absolute amounts;
- tend to be high rather than low;
- are more detailed than if the analyst were relying on his own judgement (VanderWerf 1978).

SUMMARY

The Plant Site Community

The 1977 population of Greater Portland was about 183,000; that of Westbrook was 14,590. The population growth rate has been high in recent years due to net inmigration. The 1977 Greater Portland labor force participation rate was 63 percent; the 1978 unemployment rate was 4.9 percent. Unemployment in the construction industry can run as high as 15 percent. A large number of the metropolitan region's industrial firms are located in Westbrook. The region's health and social services are adequate to meet the needs of the population.

Construction of the proposed plant will directly employ 510 persons and indirectly employ 491. If all jobs are taken by persons who are currently unemployed, unemployment in the region will decline by 24 percent. However, migration and job transferral will reduce this impact. An estimated 62 to 123 of the direct employees will migrate into the area. Assuming that half of these persons will bring families, the population of Greater Portland will increase by 0.1 percent. Health and social services will not be strained. Direct income - from salaries, fees, and materials expenditures - accruing to the local economy will total about $15.7 million per year. Indirect income will total about $18.7 million per year. Of these amounts, about $1.1 million per year will go to the state in the form of tax revenues. Operation of the proposed plant will not significantly alter regional employment or income. However, the assessed value of the S.D. Warren industrial complex will increase by about $48.9 million.

The Fuelwood Harvest Region

The fuelwood harvest region includes all or a portion of seven Maine and three New Hampshire counties. The population of

this region has been increasing steadily since 1950 and should continue to grow. The industrial base of the region is complex. Manufacturing, forestry, agriculture, and tourism are important industries. The unemployment rate of the Maine portion of the area is about 5.2 percent; that of the New Hampshire portion is about 2.5 percent.

The proposed project will directly employ 114 persons. An estimated 8,104 unemployed persons possess job skills which would allow them to fill these positions. The project will indirectly employ 134 persons. Annual direct regional income will total about $3.5 million; annual indirect regional income will total about $4.3 million. Annual Maine revenues will total about $484,000. The project will not increase the population of the region. Health and social services will not be affected.

The proposed plant will demonstrate the feasibility of burning wood for steam and electricity generation in the pulp and paper industry, which consumes most of the energy used by the wood products industries. The project will also demonstrate the feasibility of whole-tree chipping for fuelwood, especially on the small private woodlots that are prevalent in the region. However, the commitment of wood to the proposed plant may discourage other wood-based industries from locating within the fuelwood harvest region. Fuel chips may compete with existing wood markets, such as those of firewood, bolters, pallets, shingles, and pulp chips. However, the instabilities and stricter quality requirements of these markets may minimize competition, as will the availability of stands currently withheld from harvesting.

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