-ALASKA-

HISTORIC AND PROJECTED OIL AND GAS CONSUMPTION

DIVISION OF MINERALS & ENERGY MANAGEMENT
DEPARTMENT OF NATURAL RESOURCES

AND

DIVISION OF ENERGY AND POWER DEVELOPMENT
DEPARTMENT OF COMMERCE AND ECONOMIC DEVELOPMENT

FOR

THE ALASKA ROYALTY OIL AND GAS DEVELOPMENT ADVISORY BOARD

by

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INTRODUCTION AND SUMMARY

The oil and gas consumption analysis for 1977 and 1978 is presented to update the 1978 report entitled Oil and Gas Consumption in Alaska: 1976-2000. Data for all consumption categories are provided for 1977, and transportation fuels and natural gas statistics are presented. The amount of fuel consumed for power generation and heating uses has not yet been tabulated by the Department of Energy, the primary source for petroleum liquids data.

Natural gas consumption continues to increase, in 1977 by 36.7% and in 1978 by 18.9%. Gas consumption for power generation in 1977 increased by 10.2% and virtually remained constant through 1978. Residential/Commercial Consumption increased by 11.3% and 9.6% for the respective years. Industrial consumption grew by 60% in 1977 and 28.2% in 1978, with the greatest increase occurring in the amount of natural gas consumed during petroleum production.

Petroleum liquids consumption decreased by 6.1% from 1976 to 1977. Declines occurred in each major category. Consumption of oil products for power generation decreased by 12.5%, heating by 0.2% and transportation fuels by 6.5%. Transportation fuels experienced mixed gains and losses with marine gasoline consumption increasing by 8.5%, marine diesel by 24%; aviation gasoline increasing by 21.7% and jet fuel decreasing by 6.8%; highway gasoline showed an increase of 1.8% and diesel decreased by 22.6%. In 1978, transportation fuels consumption decreased by 2.9%. Marine gasoline increased by 18.8%, marine diesel grew by 13%. Aviation gasoline decreased by 10.1% while jet fuel increased by 1.5%. Highway gasoline and diesel decreased by 7.4% and 2.9%, respectively.

HISTORIC OIL AND GAS CONSUMPTION

NATURAL GAS

Annual natural gas consumption statistics are presented for the years 1972 through 1978. The consumption data are divided by use into the following categories: Power Generation, Residential/ Commercial, and Industrial. Industrial Consumption includes natural gas consumed as a result of Petroleum and Ammonia-Urea Production. The Petroleum Production sub-category encompasses on-lease consumption (for power generation, space heating, etc.), flaring, shrinkage, and petroleum refinery consumption. Another category included on Table I is Natural Gas Use which is distinguished from consumption in that the gas is recoverable or is not consumed within Alaska. Use in Alaska is confined to the industrial sector. Natural gas is exported to Japan in the form of LNG, and gas is reinjected into the oil fields to enhance recovery of the oil. Most of the reinjected natural gas can be recovered at some time in the future.

Natural gas data is relatively easy to acquire. A great majority of the information is accumulated by the Oil and Gas Conservation Commission and is very accessable. Some power generation and all residential/commercial consumption statistics were provided by Anchorage Natural Gas. Additional power generation data were gathered from the Alaska Power Authority and Chugach Electric Association. The Oil and Gas Conservation Commission keeps very detailed records on natural gas production including the amounts sold, flared, used (on-lease), and shrinkage. Most fields sell to just one buyer, and it is a fairly simple matter to follow where the gas goes to its end use. Individual buyers are monitored by the Revenue Audit Supervisor of the Division of Minerals and Energy.

At the time of this compilation, 1978 data was available for January through October only. November and December were estimated to derive total estimated natural gas consumption and use for 1978. Actual totals are presented for the other years.

Two new years (1977-1978) have been added to the previously compiled natural gas consumption statistics. The data base now extends from 1972 through 1978. Interesting consumption patterns are beginning to emerge, and we now have more data points with which to compare previous demand projections. The data are presented on Table I and Figure I.

One of the interesting patterns which develop between 1976 and 1978 is expressed in the Total Consumption figures for 1976, 1977, and 1978. The numbers show that Total Consumption increased

dramatically from 1976 to 1977 with a 36.7% increase to 133.7 Billion Cubic Feet. The growth rate then slowed to 18.9% and 1978 Total Consumption is estimated to be about 159.0 BCF. The consumption between 1976 and 1977 shows the greatest increase in the history of data collection. The rate of growth increases each year to 1977 then drops drastically in 1978. An explanation of this phenomenon will become apparent as we examine the various categories included in Total Consumption.

The amount of natural gas consumed in the generation of electric power has increased steadily during the data collection years with the exception of 1978. The greatest increase is noted between 1975 and 1976 at 15.4% with the 1977 consumption up only 10.2%. The 1978 power generation consumption figure shows virtually no growth, only increasing by 0.6%.

Residential/Commercial consumption continues to increase with the greatest amount of growth shown from 1975 to 1976. Data for 1977 shows home and business consumption up 11.3%, and 1978 is estimated to have risen 9.6% again indicating a slowing in the rate of growth from 1977 to 1978.

Trans-Alaska Pipeline construction was in full swing in 1976 and the increase in population and resulting support facilities could account for the tremendous increases in natural gas consumption that year. The actual construction ended in 1977, and Alaska has been feeling the effects of a population and monetary decline since then, thus, resulting in lower consumption growth figures for the years 1977 and 1978 in the Power Generation and Residential/Commercial categories.

Industrial consumption also shows the effect of the pipeline boom and bust cycle also, but its peak growth occurs in 1977 when Prudhoe Bay oil production began. The sub-category, Petroleum Production, reflects the beginning of Prudhoe production when natural gas began to be produced along with the oil. The 92.7% increase exhibited in 1977 in natural gas consumed during petroleum production reflects the amount of natural gas burned during Prudhoe Bay oil production.

As can be seen on Table I, only a small increase in petroleum production consumption occurs in 1978. The amount of natural gas consumed increased only 6.4% to 56.2 BCF. The production facilities at Prudhoe Bay were complete and production was in full swing in 1978. In 1977, consumption of natural gas during petroleum production accounted for almost 40% of the total natural gas consumed in the State. In 1978, this percentage dropped to about 35% due to increases in other use categories.

The Carbon Collier and Chemical Plant in Kenai completed their plant expansion and increased their natural gas consumption from 24.3 BCF in 1976 to 29.9 BCF in 1977, an increase of 23.1% and to a new consumption rate of 49.8 BCF in 1978 (an increase of 66.6% over 1977).

Natural gas use includes the amount of natural gas liquified and exported to Japan, and the amount of gas reinjected during petroleum production. LNG conversion increased from 1976 to 1977 by 5.4% but decreased by 1.8% in 1978. An overall upward trend can be seen developing in LNG exportation; however, the average yearly increase is very small (1.6%).

The quantities of reinjected natural gas had been declining from 1973 to 1975; however, 1976 saw a 16.7% increase over 1975, and 1977 shows an 82.3% increase due to increased production activity at Prudhoe Bay. The total amount of natural gas re-injected in various fields around the State in 1977 was 202.5 BCF (about 1.5 times the total consumption). A somewhat smaller increase of 62.9% was noted in 1978 where reinjected gas totalled 329.8 BCF (about 2 times the total amount consumed statewide).

The overall trend which becomes apparent in examining the historic natural gas consumption statistics is a steady but gradual increase. Some years show a greater increase than others, but the general trend is upward.

Total consumption increased an average of 17.3% per year over the seven years for which data are available. This large average increase is due primarily to the growth taking place in the petroleum production consumer sector.

Power generation consumption has shown a steady increase over the years with some years such as 1976 showing a slightly greater increase than others.

Residential/Commercial consumption has grown a bit more rapidly than power generation. It's annual increase averages 14.1%.

Total Industrial consumption increased an average of 22.9% per year with the greatest increases occurring from 1975 through 1978. Petroleum Production consumption alone increased an average of 33.5% per year with the most significant growth occurring in 1977. Ammonia-Urea Production increased an average of 17.1% annually, but most of the increases took place in 1977 and 1978 after plant expansion was completed.

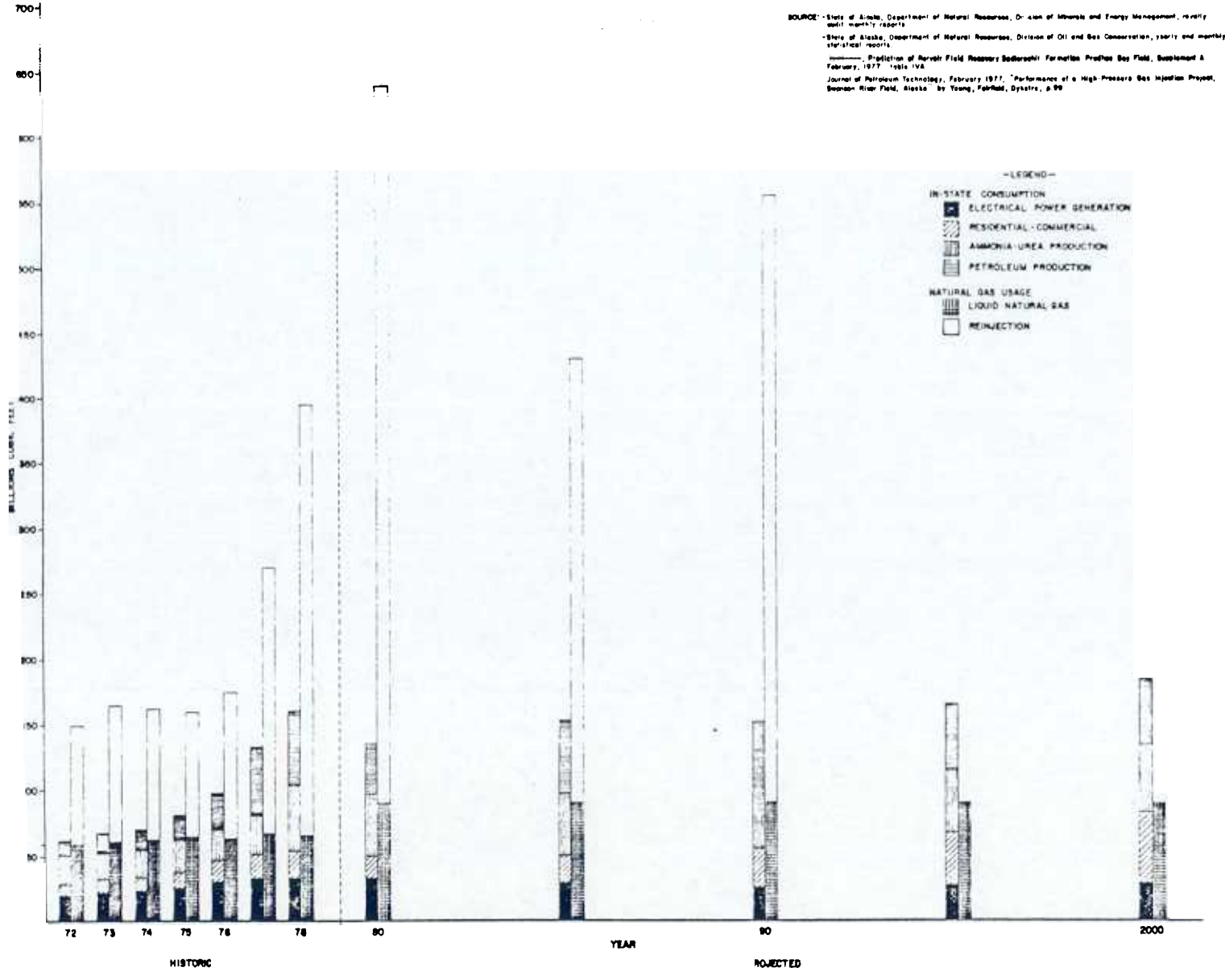
COMPARISON OF NATURAL GAS CONSUMPTION AND
USE IN ALASKA FROM 1972 THROUGH 1978
(Billion Cubic Feet)

	1972	1973	1974	1975	1976	1977	1978[1]
Power generation	20.0	22.1	23.6	25.4	29.3	32.3	32.5
Residential/ Commercial	9.5	10.1	10.4	12.7	16.8	18.7	20.5
Industrial Consumption	32.8	33.8	36.3	43.0	51.7	82.7	106.0
Petroleum Production	11.2	13.3	15.3	19.1	27.4	52.8	56.2
Ammonia-Urea Production	21.6	20.5	21.0	23.9	24.3	29.9	49.8
TOTAL CONSUMPTION	62.3	66.0	70.3	81.1	97.8	133.7	159.0
TOTAL USE (Industrial)	149.7	164.8	162.4	160.0	174.6	269.4	395.44
LNG	60.0	61.1	62.5	64.8	63.5	66.9	65.65
Reinjection	89.7	103.7	99.9	95.2	111.1	202.5	329.79

[1] At the time of this compilation, 1978 data was available for January through October only. November and December figures were estimated to derive a total natural gas consumption for 1978.

TABLE 1

HISTORIC AND PROJECTED NATURAL GAS CONSUMPTION IN ALASKA



SOURCE: - State of Alaska, Department of Natural Resources, Division of Minerals and Energy Management, royalty audit monthly reports

- State of Alaska, Department of Natural Resources, Division of Oil and Gas Conservation, yearly and monthly statistical reports

———, Prediction of Reservoir Field Reasons Sedimentation Formation Prudhoe Bay Field, Supplement A February, 1977 Table IVA

Journal of Petroleum Technology, February 1977, "Performance of a High Pressure Gas Injection Project, Swanson River Field, Alaska" by Young, Fahrland, Dykstra, p 99

FIGURE I

PETROLEUM LIQUIDS

Several peculiar things are happening in the various consumption categories of petroleum liquids. It is unfortunate that 1978 data for the Power Generation and Heating categories are as yet unavailable; another data year would be extremely interesting. Historic petroleum consumption data are presented on Table II and Figure II

Substantial annual increases in all categories can be noted from 1972 through 1975; however, in 1976 a substantial decrease in consumption occurs in the Heating category. The decrease was severe enough to bring about an overall decrease of 0.3% in total petroleum liquids consumption even though healthy increases occurred in all of the other categories. Power Generation increased by 23.7% from 1975 to 1976, and Transportation Fuels increased by 2.1% while heating decreased by 19.6%. (Goldsmith also mentioned a "large decline in residual oil consumption" in his 1978 report.) A thorough discussion of the 1976 data is presented in Goldsmith and Lane, 1978. Interested readers should turn there for further details.

The data year 1977 continued and even accelerated the decline in total petroleum consumption with an overall decrease of 6.1%. Declines are found in each category. Power Generation decreased by 12.5%, Heating by 0.2%, and Transportation Fuels by 6.5%. Marine Fuel consumption increased by 8.5% (gasoline) and 24.0% (diesel). Aviation fuel consumption showed that Aviation Gasoline increased (21.7%) while Jet Fuel decreased (6.8%). Highway fuel indicated an increase of 1.8% for gasoline and a decrease of 22.6% for diesel fuel.

TransAlaska Pipeline construction most likely influenced all of these figures greatly. However, the continuing drop in Heating fuel consumption warrants further research.

It is unfortunate that Power Generation and Heating data are not available for 1978, so that the developing trends could be observed over a longer time period. The Transportation fuels consumption figures do show some interesting trends taking shape. Marine fuels show increases of 18.8% for gasoline and 13% for diesel. This continues the trend of gradual increases shown since 1975-1976. Aviation fuels were mixed from 1977-1978. Aviation Gasoline consumption decreased by 10.1% while Jet Fuel increased by 1.5%. In general, aviation fuels have shown an overall increase in consumption, but there is little continuity. The increases in aviation gas and jet fuel seem to take place sporatically and independent of each other. Highway gasoline registered a decrease for the second time by dropping at a rate of 7.4%. Highway diesel continued its decline at a rate of 2.9%.

PETROLEUM LIQUIDS CONSUMPTION
1972 through 1978
(millions of gallons)

	1972	1973	1974	1975	1976	1977	1978
Power Generation	72.7	76.9	76.9	79.5	98.3	86.0	N/A
Heating	139.7	158.1	168.0	194.0	156.0	155.7	N/A
Transportation							
Marine							
Gasoline	4.8	6.4	6.4	5.4	5.9	6.4	7.6
Diesel	27.8	40.1	30.2	38.4	35.4	43.9	49.6
Aviation							
Gasoline	13.4	12.5	14.9	16.5	13.8	16.8	15.1
Jet Fuel	278.2	316.9	341.0	338.4	351.1	330.8	335.8
Highway							
Gasoline	140.6	134.3	143.5	174.8	182.9	186.2	172.5
Diesel	83.8	113.8	165.8	204.0	204.9	158.6	140.9
Subtotal (Transportation)	548.6	624.0	701.8	777.5	794.0	742.7	721.5
TOTAL CONSUMPTION	761.0	859.0	946.7	1051.0	1048.3	984.4	Incomplete

TABLE II

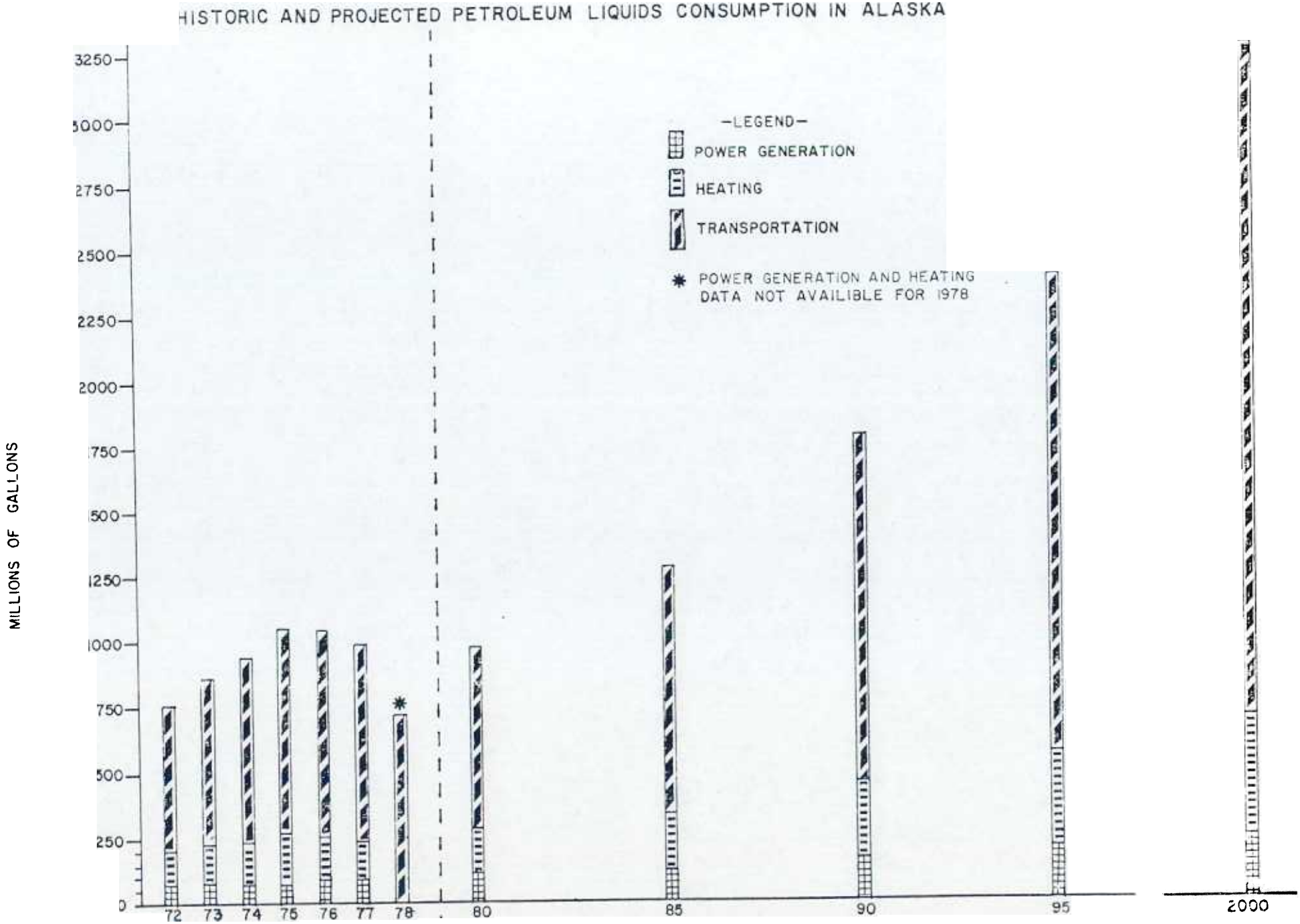

HISTORIC AND PROJECTED PETROLEUM LIQUIDS CONSUMPTION IN ALASKA
MILLIONS OF GALLONS
3250
3000
2750
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
-LEGEND-
POWER GENERATION
HEATING
TRANSPORTATION
* POWER GENERATION AND HEATING DATA NOT AVAILIBLE FOR 1978
72
73
74
75
76
77
78
80
85
90
95
2000
HISTORIC
PROJECTED

FIGURE II

PROJECTED OIL AND GAS CONSUMPTION

The projections of future oil and gas consumption included in this report were generated by Scott Goldsmith and Tom Lane for Oil and Gas Consumption in Alaska: 1976-2000 (January 1978). The base case projections assume "strong growth of the economy resulting in population growth of about 3 percent annually, continued strong per capita energy demand although somewhat moderated by high energy prices, and no significant new industrial consumers of large blocks of energy." Readers are referred to the 1978 study for a detailed description of the assumptions utilized. Goldsmith and Lane also examined the sensitivity of the base projections by increasing oil and gas per capita demand, instituting a more rapid economic growth, and changing various other factors which cause increases in demand. The first two variables were quantitatively compared to the Power Generation and Residential/Commercial categories of the base projections and show that a larger economic growth factor will cause a greater increase by 1995 than an increase in per capita demand. However, an increase in per capita demand results in a larger increase in the same categories in 1985.

NATURAL GAS

A comparison of the 1977 and 1978 natural gas consumption to the base projection shows that Goldsmith's estimate of consumption for power generation is fairly accurate. Consumption in this category seems to have levelled off.

The Residential/Commercial base projection for 1980 falls (20.11 BCF) short of the actual 1978 consumption (20.5 BCF), so it appears that Residential/Commercial consumption is increasing much faster than Goldsmith anticipated. This particular category has increased at an average rate of 14.1% per year; however, the growth rate itself has been declining over the past two years. The amount of increase between 1975 and 1976 was 32.3%. Between 1976 and 1977 it was 11.3%, and between 1977 and 1978 the increase measured 9.6%. Goldsmith assumed a 5% growth rate throughout the projection period for this category in the base case projections. Even his alternative case of increased per capita demand which forecast a Residential/Commercial consumption of 27.29 BCF in 1985 seems the low.

The Industrial Consumption category predictions are also low when compared to the actual consumption in 1978. The Petroleum and Ammonia-Urea Production projections fall short

PROJECTED NATURAL GAS CONSUMPTION IN ALASKA
(Billions of Cubic Feet)

	1980	1985	1990	1995	2000
Greater Growth Power Generation		28.85		30.77	
Base Case	32.74	28.23	24.56	26.41	28.68
Greater Demand		30.22		29.75	
Greater Growth Residential/Commercial		25.93		55.23	
Base Case	20.11	25.30	34.34	44.48	59.04
Greater Demand		27.29		52.64	
Industrial (Total)	92	97	97	99	99
Petroleum Production	45	50	50	52	52
Ammonia-Urea Production	47	47	47	47	47
Total Consumption	145	150	156	170	187
Total use (Industrial)	663	440	568	88	88
LNG	88	88	88	88	88
Reinjection	575	352	480	0	0

TABLE III

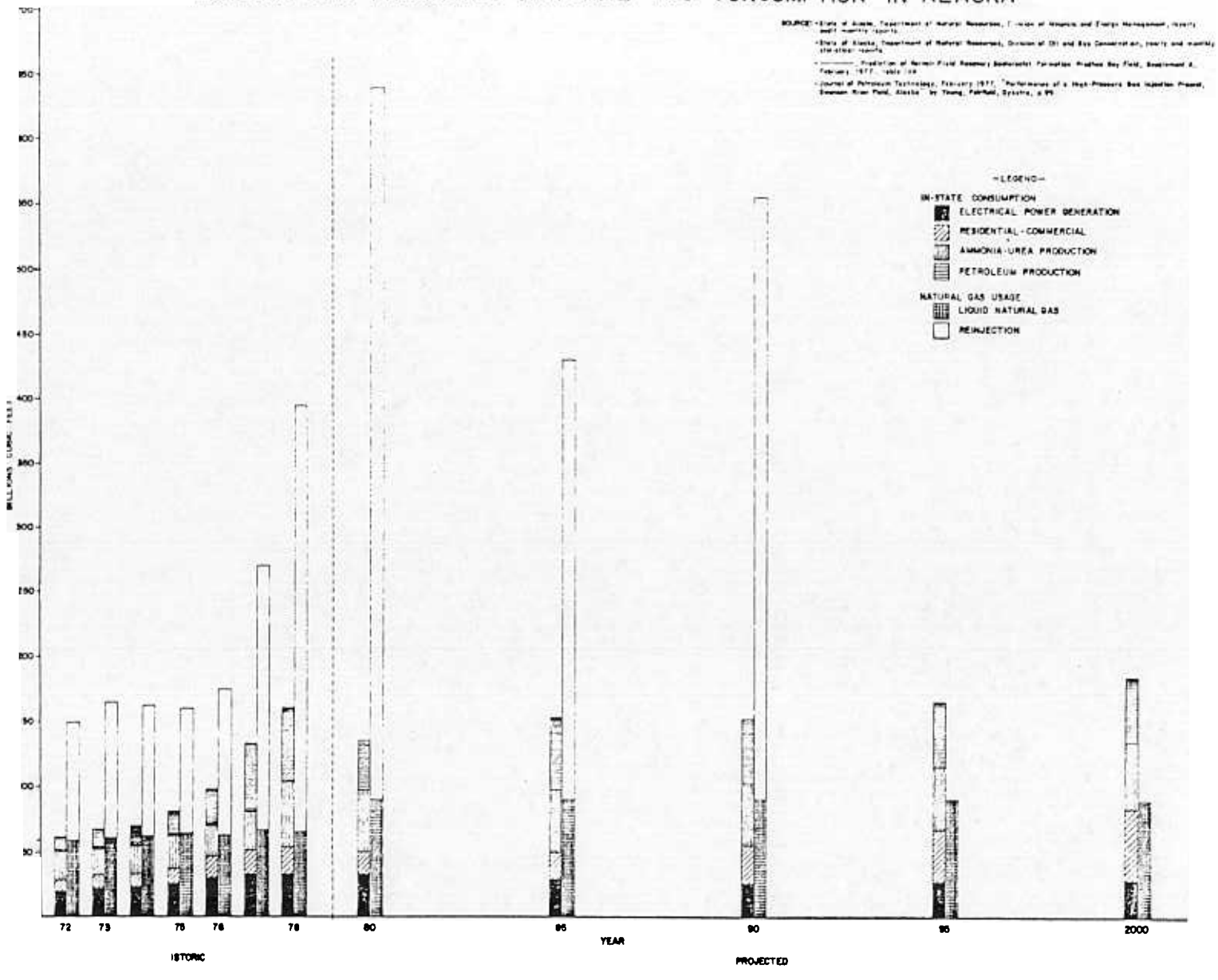

HISTORIC AND PROJECTED NATURAL GAS CONSUMPTION IN ALASKA
SOURCE:
-LEGEND-
IN-STATE CONSUMPTION
ELECTRICAL POWER GENERATION
RESIDENTIAL-COMMERCIAL
AMMONIA-UREA PRODUCTION
PETROLEUM PRODUCTION
NATURAL GAS USAGE
LIQUID NATURAL GAS
REINJECTION
BILLIONS CUBIC FEET
72
73
75
76
78
80
85
90
95
2000
YEAR
ISTORIC
PROJECTED

FIGURE III

of the 1978 actual consumption by 4 BCF and 2.8 BCF respectively.

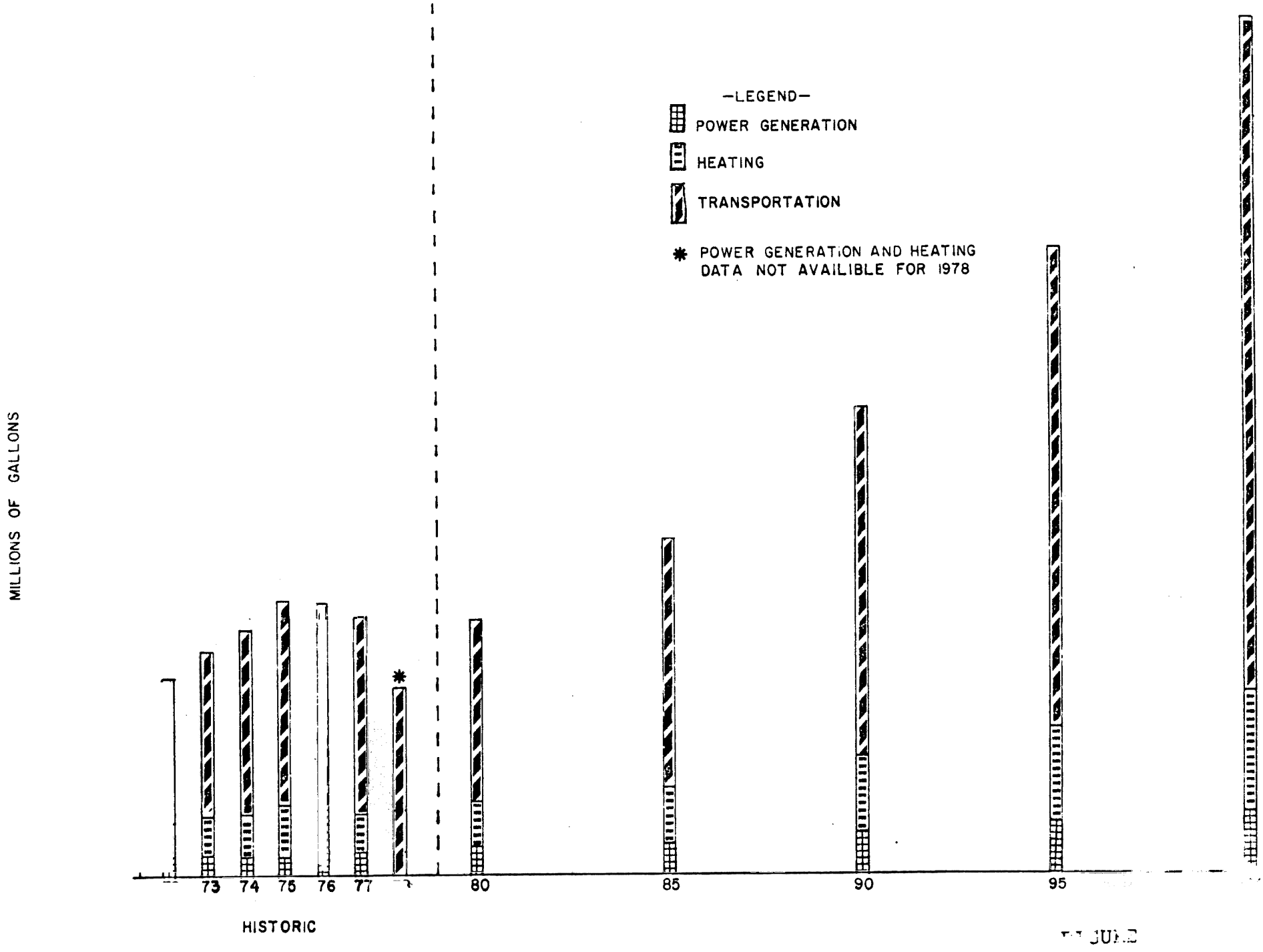
PETROLEUM LIQUIDS

The projections of petroleum liquids consumption provided by Goldsmith and Lane indicate a general upswing in oil consumption after the post-pipeline recession. It is too soon to know for sure, but the projections do look plausible. In 1977 total petroleum liquids consumption declined. Each major category showed decreases. The only consumption data available for 1978, Transportation Fuels, shows another decline. However, the amount of decrease is smaller. Perhaps this is indicative of a slowing of the downswing. Until more recent consumption and economic information becomes available, Goldsmith and Lane's projections are valid.

PROJECTED PETROLEUM LIQUID CONSUMPTION IN ALASKA
(Millions of Gallons)
Goldsmith's Base Case

	1980	1985	1990	1995	2000
Power Generation	115.21	124.42	164.68	209.58	240.71
Heating	173.34	219.24	288.02	354.85	456.26
Transportation					
Marine					
Gasoline	6.34	6.68	7.01	7.35	7.73
Diesel	30.28	38.64	49.31	62.92	80.30
Aviation					
Gasoline	18.06	24.99	36.50	50.06	70.94
Jet Fuel	288.96	391.27	553.52	766.29	1097.25
Highway					
Gasoline	235.37	323.74	470.74	643.36	909.72
Diesel	105.67	146.16	213.57	292.70	414.92
Subtotal (Transportation)	684.68	931.48	1330.65	1822.68	2580.86
Total Consumption	973.23	1275.14	1783.35	2387.11	3277.83

TABLE IV


HISTORIC AND PROJECTED PETROLEUM LIQUIDS CONSUMPTION IN ALASKA
—LEGEND—
POWER GENERATION
HEATING
TRANSPORTATION
* POWER GENERATION AND HEATING DATA NOT AVAILIBLE FOR 1978
MILLIONS OF GALLONS
73
74
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77
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HISTORIC

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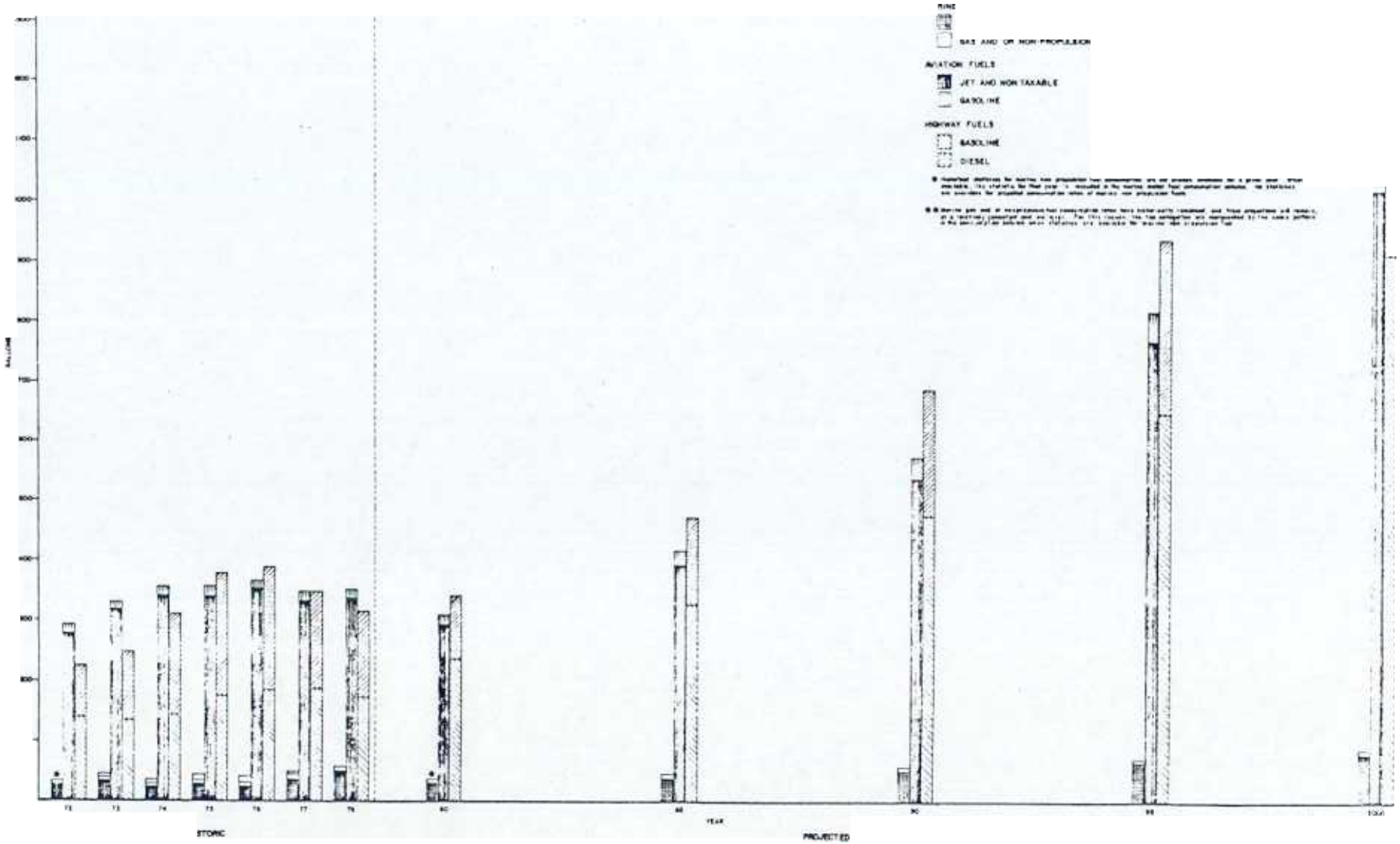
AVIATION FUELS
JET AND NON TAXABLE
GASOLINE
HIGHWAY FUELS
GASOLINE
DIESEL
STORIC
PROJECTED

RE

OIL AND GAS SUPPLY

The Prudhoe Bay and Cook Inlet petroleum fields are currently the only in-state sources of oil and gas products. In 1977 a total of 171.4 million barrels (7,198.8 million gallons) of crude oil and 373.9 billion cubic feet of natural gas were produced from these two areas, in 1978, 447.8 million barrels (18,807.6 million gallons) of of oil and 600.9 billion cubic feet of gas were produced from the same areas. Most of the gas produced at Prudhoe Bay was reinjected. Precise amounts of royalty petroleum produced have not been tabulated for this report.

The demand/supply picture has not changed radically from 1976 to now, so the conclusions reached by Goldsmith and Lane are still valid. For a complete discussion of the supply problem, the reader should consult Oil and Gas Consumption in Alaska: 1976-2000 by Goldsmith and Lane. The conclusions are presented in an abbreviated form here.

1 Alaska's royalty oil is excess to instate needs through 2000.
2) Alaska's royalty natural gas (from Prudhoe Bay and Cook Inlet) plus committed reserves cannot meet the natural gas needs through 2000.

RECOMMENDATIONS

1. The oil and gas consumption projections ought to be updated.

2. A more systematic data-gathering procedure should be devised and utilized so that the most recent consumption information can be compiled and analyzed. Natural gas data for the most immediate preceding year are available about March as are transportation fuels statistics. Petroleum liquids information is available about May or June. The consumption analysis could be issued as a mid-year report with greater amount of information and timeliness.

DATA SOURCES

The natural gas consumption information came from the Alaska Oil and Gas Conservation Commission records. Of all of the data used in the report, these data are probably the most reliable. Power generation data for natural gas petroleum liquids were supplied by the Alaska Power Administration.

Petroleum Liquids information was gathered from the FEO-1000 Prime Suppliers Reports. Transportation Fuels data were gathered from the Alaska Department of Revenue's Motor Fuel reports. The utilization of all of these figures assumes that the quantities of fuels mentioned were actually consumed.

It was originally intended that a subcategory of Military Oil and Gas Consumption be included in this report; however, no information had been received from the Air Force and Army at the time of printing so the category had to be deleted. Hopefully, information-gathering for future analyses will be standardized and simplified and problems such as this can be avoided in the future.

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