# HISTORICAL AND PROJECTED OIL AND GAS CONSUMPTION JANUARY 1983

STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF MINERALS AND ENERGY MANAGEMENT

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## EXECUTIVE SUMMARY

This report provides background on the in-state supply of, and demand for, hydrocarbons. This report fulfills the requirements of Alaska Statute 38.05.183, which requires the Commissioner of the Department of Natural Resources to submit an annual report to the Legislature, within 10 days of the convening of the regular session, that shows the immediate and long-range domestic and industrial needs for oil and gas in Alaska.

The statute requires that royalty oil and gas be used to satisfy present and projected intrastate domestic and industrial needs before being sold for export from the state or otherwise disposed of. The statute contains several ambiguities in wording leading to a variety of possible definitions of "needs." Therefore, in meeting the requirements of the statute, this report first develops a number of definitions of consumption. The purpose of these definitions is to provide a framework for identifying intrastate and industrial needs.

Historical consumption by major use category is then presented. This section updates the January 1982 report and provides estimated 1982 consumption for the state and for three regions, Rail Belt, Rest-of-Alaska and Southeast. Natural gas consumption in the Railbelt increased at about 3% per year over the past decade, while petroleum fuels consumption has been increasing at about 9% per year statewide.

Forecasts of oil and gas consumption are developed for the Rail Belt and the remainder of the state (including Southeast) by major use category. These forecasts show cumulative consumption of natural gas over the next 15 years of 3.9 trillion cubic feet. Cumulative refined product demand over the same period is forecast to be 524 million barrels of crude oil equivalent (22,043 million gallons).

Low, medium, and high estimates of oil and gas reserves and the corresponding state royalty share of these reserves are presented. The mid-level estimates show that of the total crude oil reserves of 9.7 billion barrels, about 98% are on the North Slope. Of these crude oil reserves, the state owns about 1.2 billion royalty barrels; about 99% of the state's royalty share is located on the North Slope. The middle case gas reserves of the state total about 39.0 trillion cubic feet (Tcf) with about 90% located on the North Slope. The state's royalty share is about 4.6 trillion cubic feet, of which only 0.2 Tcf are located in the Cook Inlet, the state's major demand center. The remaining reserves lie on the North Slope, and the timing of this gas development can have a significant impact upon the state's royalty surplus/deficit situation.

The cumulative 15-year demand for natural gas of approximately 4.0 trillion cubic feet is slightly less than the state's royalty share. The cumulative refined product demand of 524 million barrels of oil equivalent is considerably less than the existing royalty oil inventory of 1.2 billion barrels.

Major in-state demands for hydrocarbons are for transportation, electrical generation and residential space heating. Transportation uses are forecast to consume 402 million bbls of crude oil equivalent between 1983 and 1997. The use of natural gas for electrical generation in the Rail Belt is forecaste to grow rapidly over the next 15 years. In the base case, demand grows from 32.9 Bcf in 1983 to 62.4 Bcf in 1997. Residential space heating consumption of natural gas is forecast to grow from an annual rate of 18.2 billion cubic feet (Bcf) in 1982 to 37.4 Bcf by 1997. This increase is related to economic and population growth in the Rail Belt area and to the expansion of gas delivery systems into the Matanuska Valley.

The supply and demand projections used in this report are by their very nature probabilistic and should be viewed as likely outcomes only if the underlying assumptions presented here are approximated by future events. For example, in-state consumption will be influenced by economic and population growth which will in turn be fueled by world energy prices. In addition, the development of the Susitna hydroelectric project would dramatically affect the in-state demand for natural gas, particularly after the late 1990s. Finally, the growth of a gas export market would affect in-state availability as well as prices.

Even the supply side of the in-state balancing equation is probabilistic. Only the mid-range estimates of oil and gas resources (9.7 million bbls, 39.0 Tcf) are reasonably certain. Estimates of undiscovered resources must be treated as highly speculative and of minimal value for projection purposes. Even if these resources exist (which they may not), there is no guarantee that they will be discovered in the appropriate time-frame (if ever) to assure long-run supplies. Resources devoted to the discovery process by the major oil firms will be largely determined by world market conditions, not surplus or deficit conditions in the intrastate market.

In summary, under reasonable assumptions about in-state reserves and consumption, the current inventory of hydrocarbon reserves is more than adequate to meet the estimated demands of Alaskans for the next 15 years.

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AS 38.05.183 states that oil and gas taken in kind as the state's royalty share of production may not be sold or otherwise disposed of for export from the state until the Commissioner of Natural Resources determines that the royalty-in-kind oil or gas is surplus to the present and projected intrastate domestic and industrial needs for oil and gas. The statute also requires an annual report to the state legislature showing the immediate and long-term domestic and industrial needs of the state for oil and gas and an analysis of how these needs are to be met.

The statute contains several key terms whose meaning must be resolved before an estimate can be made of oil and gas surplus to the state's needs. These key terms are: 1) "oil and gas," 2) "export," 3) "present," 4) "projected," 5) "domestic," 6) "industrial," 7) "intrastate," and 8) "how these needs are to be met." Each key term affects the size of the estimated demand for oil and gas in Alaska and consequently, the size of the projected surplus or deficit. The meaning of each term is discussed below.

## Oil and Gas

Crude oil and natural gas are fluids containing hydrocarbon compounds produced from naturally occurring petroleum deposits. Typical crude oil contains several hundred chemical compounds. The lightest of these are gases at normal temperatures and pressure, described as "natural gas." These light fractions of the crude oil stream include both hydrocarbon and non-hydrocarbon gases, such as water, carbon dioxide, hydrogen sulfide, helium, or nitrogen. The principal hydrocarbons are methane ($CH_4$), ethane ($C_2H_6$), propane ($C_3H_8$), butanes ($C_4H_{10}$), and pentanes ($C_5H_{12}$). The gaseous component is found most often and in largest volumes, typically methane. Heavier factions of the crude stream are usually liquids. If a given hydrocarbon fraction is gaseous at reservoir temperatures and pressures, but is recoverable by condensation (cooling and pressure reduction), absorption, or other means, it is classified by the American Gas Association (AGA) as a natural gas liquid (NGL). 1/ Natural gas liquids include ethane if ethane is recovered from the gas stream as a liquid. A related term is liquified petroleum gas (LPG), composed of hydrocarbons which liquify under moderate pressure under normal temperatures. LPG usually refers to propane and butane. A second related term is condensate, which refers to LPG plus heavier NGL component (natural gasoline). The lightest hydrocarbon fraction is methane, which is almost never recovered as a liquid, and which makes up the bulk of pipeline gas. If a natural gas stream contains few hydrocarbons which are commercially recoverable as liquids, it is considered "dry gas" or "lean gas." The distinction between "wet" and "dry" is usually a legal one, which varies from state to state. "Crude oil" usually means the non-gaseous portion of the crude oil stream.

1/ Definitions vary with processes.

Natural gas may occur in reservoirs which are predominately gas-bearing or in reservoirs in which the gas is in contact with petroleum liquids. Non-associated gas is natural gas from a reservoir where the gas is neither in contact with nor dissolved in crude oil. Associated gas occurs in contact with crude oil, but is not dissolved in it. A gas cap on a crude oil reservoir is a typical example of associated gas. Dissolved gas is dissolved in petroleum liquids and is produced along with them. Dissolved and associated gases are usually good sources of NGL while non-associated gases are often "dry."

The distinction between natural gas and its NGL components is important to a study of the supply and demand of royalty oil and gas because natural gas liquids have a multitude of uses when separated from the gas stream. For example, propane is both produced in Alaska and sold in Alaska as bottled gas for residential, commercial, and limited transportation uses, while butane is used for blending in gasoline and military jet fuel and as a refinery fuel. In addition, Marathon Oil uses LPG to enrich crude oil at its Trading Bay facility. It ships the combined fluids to the Drift River terminal for export.[2/] Potential uses for NGL also include the enriching ("spiking") of pipeline gas and crop drying. The Dow-Shell Petrochemical Group and Exxon have also recently studied the feasibility of utilizing the NGL contained in Prudhoe Bay natural gas as the basis for an Alaska petrochemicals industry. Since the State has the option of considering NGL separately from the gas stream, two definitions of natural gas consumption and reserves are possible. One of these would consider natural gas liquids as part of the gas stream. The second definition would treat the markets for LPG and ethane separately from those for gas. This requires a separate estimate of LPG consumption and gas liquids reserves. In this report, demand for LPG and ethane is estimated separately from that for gas; however, no separate estimate is made of gas liquids reserves.

Export

Taken in context, this term appears to mean the direct physical sending of oil and gas out of the state. However, when one considers the fact that much of Alaska's industrial use of oil and gas is processed directly for export markets, the meaning of export versus "intrastate" is not so obvious. For example, it appears that processing of gas into another product, e.g., anhydrous ammonia, would probably be an "industrial" use rather than "export" of gas, even though the ammonia is mostly exported. Liquification to change the phase of the gas is a less obvious case. The liquification of natural gas will be considered a transportation process in this report. Still more troublesome is the use of gas and oil for transportation related to export.

2/ Kramer, L., Williams, B., Erickson, G., In-State Use Study for Propane and Butane. Prepared for the Alaska Department of Natural Resources. Kramer Associates, Juneau, October 1981.

Is the gas and oil consumed in TAPS pipeline pump stations, for example, an "industrial" use in state? Or is it really "export" of that energy, since it is consumed in the exporting process? There is no reason why the State may not be approached in the furture to commit royalty oil and gas to quasi-export uses. Indeed, a top dollar offer was made by the ALPETCO (later, Alaska Oil Company) for royalty oil ultimately destined (as petrochemical products) for out-of-state markets. Though the offer was made, payments in full were not made. Also, the state once committed royalty gas to the El Paso gas pipeline proposal for export of Prudhoe Bay gas, which involved liquefication. Neither proposal was clearly for in-state industrial use. In this report, industrial demand is treated with multiple definitions as outlined later in the chapter to show how different definitions of "export" affect the estimate of total consumption in Alaska.

Present

The problem here is that the term "present" may mean "latest year" consumption, "average recent year" consumption, "weather-adjusted" consumption, or "worst case" consumption. In the residential and commercial sector particularly, each definition gives a somewhat different answer because of the variability of weather. Even the "worst case" scenario could be interpreted in varying ways. Consider Alaska Gas and Service Company residential gas consumption form 1970 to 1980. Base year present consumption plausibly could be figured any of the ways shown in Table 1.1.

Obviously, based on even simple calculations like those in Table 1.1, the "worst case" consumption calculation can result in considerably higher gas consumption than the most recent year, if the most recent year happens to have been a relatively warm one. While it is not correct forecasting procedure to make long run forecast of intrastate residential consumption of natural gas which assume worst case forecasts for every year, it may be prudent in practice to reserve part of the the State's gas and oil supply for bad weather. For forecasting, variability of weather makes the picking of a starting value for consumption somewhat tricky. In this report, Rail Belt consumption is based on average weather years. For the remainder of the state, trended per capita consumption is used, which approximates average weather conditions.

Projected

This is a very difficult concept, since many different projections of consumption would be possible even if it were possible to agree on a single concept defining consumption. Rates of economic development, population growth, and relative energy prices are key features of any consumption forecast, but assumptions concerning any of these variables are necessarily controversial. This report describes a range of possible consumption figures under precisely articulated definitions of consumption and varying paces of

Base Year Consumption of AGAS Natural Gas
in the Residencial Sector, 1970 to 1980 TABLE 1.1

| | | |
|---|---|---|
| 1. | Actual Residential Consumption, | 7.577 BCF |
| 2. | 1980 Total Based on Average Consumption | 7.794 BCF |
| 3. | 1980 Total Based on Weather-Adjusted Average Consumption Per Customer, 1970-1980 | 8.083 BCF |
| 4. | 1980 Total Based on Highest Per Customer Use, 1970-1980 | 8.416 BCF |
| 5. | 1980 Total Based on Most Recent Customer Per Degree Day Use and Coldest Weather Year 1970-1979 (21.43 cf/HDD/customer x 35,482 customers x 12,016 HDD)1/ | 9.137 BCF |

(1/) cf = cubic feet; BCF = billion cubic feet, HDD = Heating degree days.

economic, population, and fuel price growth. The economic and population forecasts used in this report were done by the University of Alaska Institute of Social and Economic Research in December, 1982. The assumptions used to run their economic model are shown in Appendix D.

Domestic

Domestic consumption appears to mean Alaska residential consumption. As we saw above under the subheading "present", it is not at all obvious which definition of domestic consumption is the most appropriate, even when the identity of the customer is not in dispute. Some multifamily residential use may be described as "commercial," obscuring the definition of the customer and causing forecasting problems for natural gas. The definition of "domestic" used in this report considers multifamily residential as "residential" and "domestic" use, rather than commercial.

Industrial

As described above, "industrial" energy use has a number of potential definitions. Since one intent of giving in-state industrial needs priority over export uses of royalty oil and gas seems to be to encourage in-state economic activity, 3/ a day-to-day working definition of this priority is that the royalty reserves be committed to the market, such as Alpetco, which has the largest potential economic impact in Alaska. For forecasting purposes, however, it is difficult to say which markets will prove to be of the most economic benefit to the state. As a compromise, we will adopt four alternative definitions of "industrial" in this study.

The four alternative definitions of industrial use of oil and gas used in this report are outlined below, beginning with the most restrictive and moving to the most liberal.

> Definition 1: Industrial use consists of any consumption of natural gas, petroleum, or their products in combustion (except that required to export oil or gas); or the chemical transformation of natural gas, petroleum, or their products into refined products for local markets. This definition explicitly excludes the exported products from refineries, as well as uses which merely change the physical form of the product (gas conditioning or liquefaction) for export, or which move the product to an export market (pipeline fuel, fuel used on lease, shrinkage, injection, vented and flared gas).
>
> Definition 2: Industrial use consists of any consumption of natural gas, petroleum, or their products in combustion (except in oil and gas production and transportation); or the chemical transformation of natural

3/ See however, the short discussion of legislative intent beginning on page 9 of Kramer, Williams and Erickson, op. cit. That study raises many of the issues regarding surplus gas and oil discussed in this report.

gas, petroleum, or their products into refined products. This definition counts feedstocks for petrochemical plants and refineries as industrial consumption. It also counts energy consumed by an LNG facility as industrial consumption. It excludes the feedstocks of LNG plants and fuel consumption by conditioning plants, pump stations, fuel used on lease, shrinkage, injection and flared gas.

Definition 3: Industrial use consists of any consumption of natural gas, crude oil, or their products in combustion (except in oil and gas transport and extraction) or their chemical transformation into refined products. This definition permits the feedstocks of refineries to be counted as industrial consumption. It excludes fuels used in pump stations, in conditioning plants, fuel used on lease, and gas shrinkage, injection, or venting.

Definition 4: Industrial use consists of any use of natural gas, crude oil, or their products in combustion, or their transformation into chemically different products. This definition permits feedstocks of refineries to be counted as industrial consumption, as well as energy consumption in conditioning plants and pump stations. It excludes injected gas, which is ultimately recoverable for other uses, and LNG, which is considered an export. Definition of 4 will be used for the purposes of this report.

None of the four definitions treats industrial use (including transportation) to include gas injected to enhance oil recovery, since in theory this gas remains part of the ultimately recoverable gas reserves of the state. Thus, is not "consumed."

Intrastate

It is unclear what is meant by intrastate consumption. Some uses, such as combustion of oil and gas products in fixed capital facilities in Alaska, are reasonably easy to categorize as intrastate. There are several uses in transportation which are not obviously within Alaska. These categories include the fuel burned in marine vessels such as cargo vessels, ferries, and fishing boats, and fuel burned in international and interstate air travel. There are multiple ways to approach the definition of this consumption. The first is a sales definition: the fuel used in transportation which is sold in Alaska. The second approach is to base consumption on fuel used in Alaska or related to Alaska's economy and population, regardless of the point of sale. This results in three logical definitions, described below:

Definition 1: Intrastate consumption in transportation includes all sales of fuels to motor vehicles, airplanes, and vessels in Alaska, including bonded fuels. It excludes fuel consumed by motor vessels which was purchased in other states, and fuel consumed by airlines between Alaska locations unless the fuel was sold in Alaska. It also excludes out of state military fuel purchases.

Definition 2: Intrastate consumption includes fuel consumed by motor vessels, airlines, and vehicles engaged in Alaskan economic activity. It includes use of fuel by American fishing boats in Alaskan waters regardless of where the fuel was purchased, use of fuel purchased in Washington State by Alaska State ferries, and fuel consumed by ships and aircraft involved in Alaska trade. It excludes sales to aircraft on international flights (bonded and unbonded), but includes military out of state purchases.

Definition 3: The final definition is a compromise between the first two. It includes all fuel purchased within the state, plus military uses, but excludes fuel purchased out of state except for military uses.

The basic definition in this report is the third definition. By excluding bonded and exempt jet fuel, the report also approximates Definition 2. Lack of data on out-state purchases by the military makes Definition 1 impractical.

## How These Needs Are To Be Met

Any analysis of how the oil and gas needs of intrastate domestic and industrial sectors are to be met could include several sources of supply: state royalty oil and gas, in-state oil and gas reserves under other ownership, probable extensions of proven reserves, and imports of crude oil, petroleum products, and (in theory) natural gas. Since some of the state's needs are currently met with imported petroleum products, the state seems to be allowed to export oil and gas as long as in-state needs are being met from some source. This meets the intent of other parts of Alaska state law to receive top dollar for the State's royalty oil and gas. Since it may be cheaper to meet certain of Alaska's energy needs with imported products than with instate refineries, AS 38.05.183 might allow the state to seek buyers for its royalty oil who are willing to pay more than Alaska refiners and ship petroleum products back to Alaska at competitive prices. The intent of the law does not seem to be actual Alaska self-sufficiency in petroleum and gas products; rather, it seems to be aimed at adequate overall supplies. It may permit intrastate uses to be met from a variety of sources as long as they are identified and discussed. Thus, it might be acceptable to say that consumption can be met with imported product, even while exports are taking place, so long as it benefits Alaskans. This is the position taken in this report.

The only problems occur if the cost of imported product were significantly above the cost of products which could be refined in Alaska, or if Alaska users were suffering an absolute shortfall in petroleum products which could be made up by product shipped from out of state. In such a circumstance, the state might not be able to continue exporting.

## METHODOLOGY 2.1

In this chapter the State of Alaska is divided into three regions: Rail Belt, Rest-of-State and Southeast. Figure 2.A shows the three regions, Judical Districts and pertinent Census Areas. Each region has distinctive energy consumption patterns which reflect differing geography, economic activity and mixes of available fuels.

### Oil Consumption

All or nearly all oil consumed in Alaska is consumed as fuels. The Alaska Department of Revenue's monthly Report of Motor Fuel Sold or Distributed in Alaska for January through June were used for projecting 1982 fuel consumption. During this period, data were reported by Judicial Districts (JD). Fuel data for Judicial Districts were allocated to the three regions of this chapter by computing:

Rail Belt = population share X (JD III + JD IV)
Rest-of-State = JD II + JD III + JD IV - Rail Belt
Southeast = JD I

where: the Rail Belt population share of (JD III + JD IV) = 85%. The population of Rail Belt as delineated on Figure 2.A included:

| | |
|---|---|
| urban and rural population of: | Anchorage Borough<br>Fairbanks Northstar Borough<br>Prince William Sound census subarea |
| within Rail Belt boundary, urban and areal share of rural population of: | Kenai Peninsula Borough<br>Matanuska-Susitna Burough<br>Southeast Fairbanks census area<br>Valdez-Cordova Census Area<br>Yukon-Koyukuk Census Area[1/] |

These computations assume that the Rail Belt/Rest-of-State population ratio within JD III and JD IV has not changed significantly since the 1980 census.

### Natural Gas Disposition and Consumption

Estimated gas disposition figures for 1982 were derived from several sources. Primary categories of gas use were compiled from monthly Oil and Gas Conservation Commission (OGCC) reports[2/] for January through July. The OGCC categories are: Injection, Vented, Used (on Leases), Shrinkage Other and sales.

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1/ U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population, Number of Inhabitants, Alaska, PC80-1-A3, November, 1981.

2/ Alaska Oil and Gas Conservation Commission, State of Alaska Report of Gas Disposition, monthly publication.

The "Other" category applies only to North Cook Inlet and Prudhoe Bay fields and was handled differently for the two fields. For North Cook Inlet "Other" was ignored because its volume was included in "Sold". For Prudhoe Bay "Other" was merged with "Used" category because this volume is consumed by the Central Compression Plant.

Gas "Sales" was subdivided by major purchasers. Data for these subdivisions came from consumers themselves and from DMEM royalty receipts. Specific data sources are identified in footnotes to Tables 2.7 and 2.8.

Oil and Gas Consumption for Electricity Generation

Historical data on fuels used to generate electricity were compiled from Alaska Power Authority (APA) publications.3/ Each local utility reports generation information to APA so allocation into the three regions is easily done (See Table 2.1). The APA report for 1982, however will not be available until after this report is produced. While it was possible, using gas sales data, to project the amount of gas used in 1982 for power generation, it was not feasible to extrapolate the amount of oil used for generation of electricity. Oil fired generations figures are therefore the product of modeling described in Chapter 3.

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3/ U.S. Department of Energy, Alaska Power Administration,
Alaska Electric Power Statistics, 1960-1981, Seventh Edition, August, 1982
Alaska Electric Power Statistics, 1960-1980, Sixth Edition, August, 1981
Alaska Electric Power Statistics, 1960-1976, Fifth Edition, July 1977

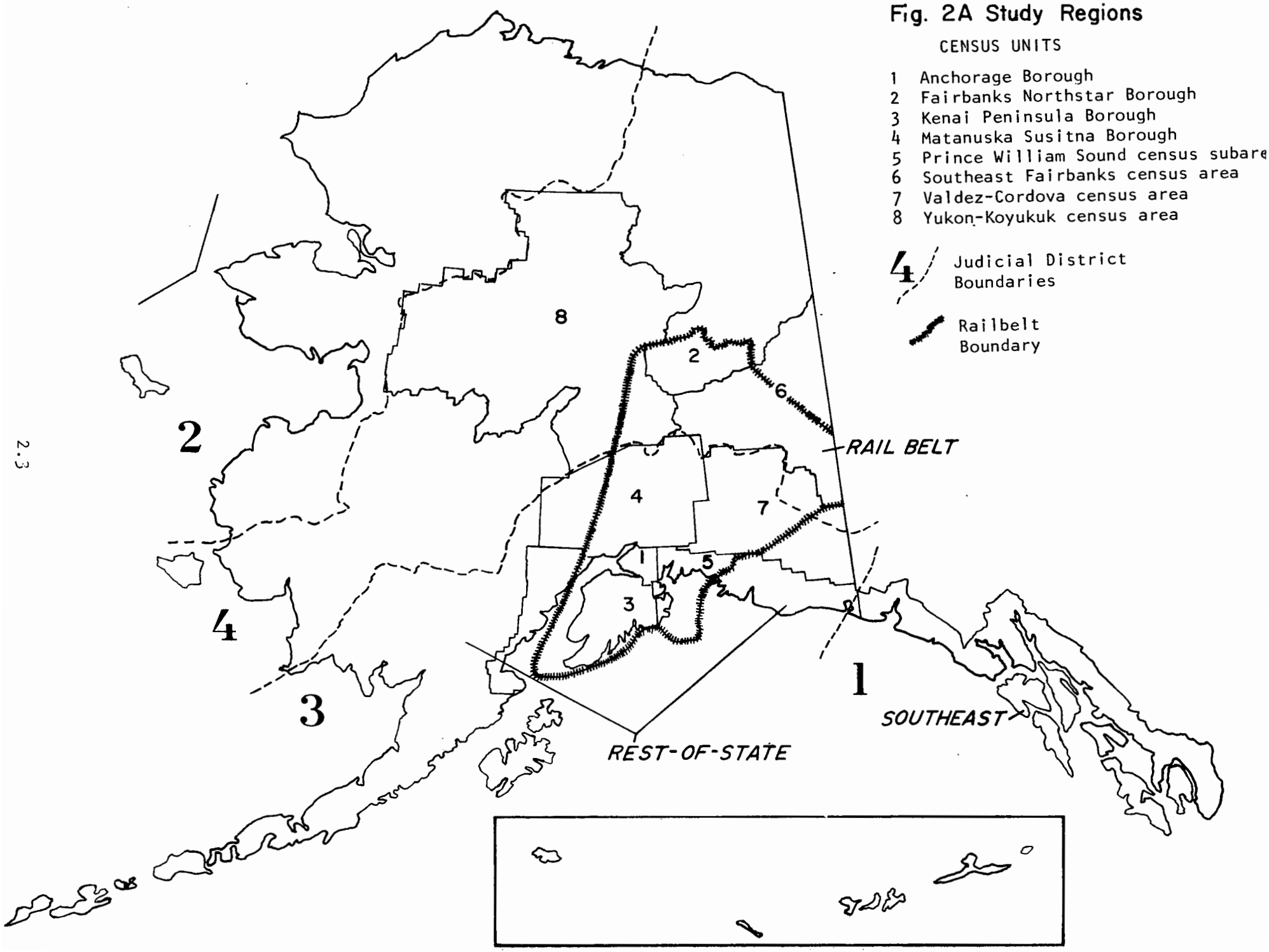


Fig. 2A Study Regions
CENSUS UNITS
1 Anchorage Borough
2 Fairbanks Northstar Borough
3 Kenai Peninsula Borough
4 Matanuska Susitna Borough
5 Prince William Sound census subare
6 Southeast Fairbanks census area
7 Valdez-Cordova census area
8 Yukon-Koyukuk census area
Judicial District Boundaries
Railbelt Boundary
RAIL BELT
SOUTHEAST
REST-OF-STATE
1
2
3
4
5
6
7
8

Utilities Reporting to the Alaska Power Administration TABLE 2.1

| Railbelt | Rest-of-State | | Southeast |
|---|---|---|---|
| Anchorage | Alakanuk | Mekoryuk | Angoon |
| Chistochina | Ambler | Minto | Craig |
| Dot Lake | Anaktuvak Pass | Mt. Village | Haines |
| English Bay | Aniak | Naknek | Hoonah |
| Fairbanks | Anvik | Egegik | Hydaburg |
| Glennallen | Atkasook | Napaklak | Juneau |
| Homer | Barrow | New Stuyahok | Kake |
| Kenai | Bethel | Nikolski | Kasaan |
| Northway | Bettles | Noatak | Ketchikan |
| Palmer | Chevak | Nome | Klawock |
| Paxson Lodge | Cold Bay | Noorvik | Klukwan |
| Port Graham | Cordova | Nuigsut | Metlakatla |
| Seldovia | Deadhorse | Nulato | Pelican |
| Seward | Dillingham | Nunapitchuk | Petersburg |
| Talkeetna | Aleknagik | Kasigluk | Sitka |
| Tok | Eek | Old Harbor | Skagway |
| Valdez | Elim | Pilot Station | Tenakee Springs |
| | Emmonak | Point Hope | Wrangell |
| | Ft. Yukon | Point Lay | Yakutat |
| | Gambell | Point Lions | |
| | Goodnews Bay | Quinhagak | |
| | Grayling | St. Mary's | |
| | Holy Cross | Pitkas Point | |
| | Hooper fBay | Andreafski | |
| | Huslia | St. Michael | |
| | Iliamna | Sand Point | |
| | Newhalen | Savoonga | |
| | Nondalten | Scammon BAy | |
| | Kaktovik | Selawik | |
| | Kalskag, Lower | Shageluk | |
| | Kalskag, Upper | Shaktoolik | |
| | Kaltag | Shismaref | |
| | Kiana | Shungnak | |
| | Kivalina | Stebbins | |
| | Kodiak & Pt. Lions | Tanana | |
| | Kotzebue | Teller | |
| | Koyuk | Togiak | |
| | Koyukag, Lower | Toksook Bay | |
| | Lake Minchumina | Tununak | |
| | Larsen Bay | Unalakleet | |
| | Manley Hot Springs | Unalaska | |
| | Manokotak | Wainwright | |
| | Marsnall | Wales | |
| | McGrath | | |

## OIL CONSUMPTION 2.2

Estimated 1982 consumption of petroleum fuels is tabulated on Table 2.2. and graphed on Fig. 2B. All figures in the text below are estimates of 1982 fuel consumption. Consumption figures for 1977-82 are listed on Tables 2.3 through 2.6.

It is important to recognize that data for 1981 and 1982 are not comparable with each other nor with preceeding years. This is because, though the fuel category names have remained the same during 1981 and 1982, several types of fuel use have shifted from category to category during both years. Footnote 4 following Table 2.6 lists the current end-uses of fuel categories.

### State Consumption

Aviation fuels accounted for 41.0% of state fuel consumption, most of this, 39.1%, being aviation jet fuel. Highway fuels accounted for about the same percentage as aviation fuels, 39.9%, but this was apportioned between highway diesel, 22.0% and highway gasoline, 17.9%. Off-highway diesel accounted for 13.1% of state consumption and marine fuels accounted for 6.0%, most of which was diesel.

### Regional Consumption

The Rail Belt, the most heavily populated and industrialized region, relies on a mix of petroleum, natural gas, coal and hydroelectricity for its energy needs. This variety increases security of supply and stability of price for consumers. The Rest-of-State region relies primarily on petroleum fuels, though Barrow and Prudhoe Bay needs are supplemented by local natural gas supplies. The Southeast region energy requirements are almost totally supplied by petroleum (by tanker and barge) and hydroelectricity. The Rest-of-State and Southeast are thus more vulnerable than the Rail Belt to fluctuations in the world oil market.

The Rail Belt uses 70.9% of the petroleum fuels consumed in the state, whereas Rest-of-State uses 21.0% and the Southeast uses 8.1%. Each region has a distinctive fuel use pattern.

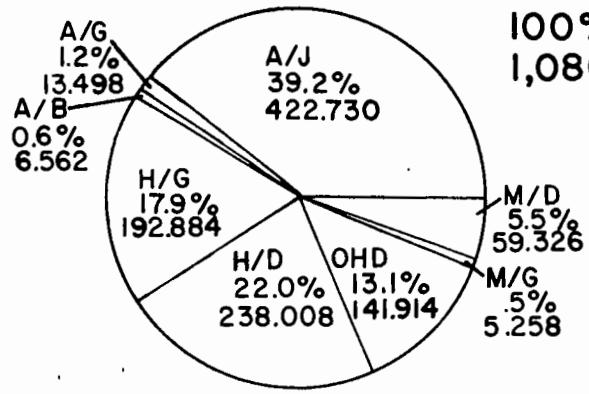
- Rail Belt. Aviation fuels account for 48.0% of the region's consumption nearly all of which, 46.1%, is aviation jet fuel. Highway fuels account for 35.3% of regional use, divided between gasoline at 19.0% and diesel at 16.3%. Off-highway diesel consumes 10.9% and marine fuels account for 5.8%, most of which is diesel. Much of this marine fuel is consumed at Valdez by tankers which transport Prudhoe Bay and Kuparuk River oil.

- Rest-of-State. Highway fuels are the dominent categories, totaling 56.8% of regional use. Highway diesel is the largest single catagory, consuming 42.5%. This diesel is used in large volumes by pipeline companies for electric generation and by construction companies for trucks hauling heavy equipment. Aviation fuels total 30.4% and off-highway diesel accounts for 9.2% of regional use. Marine fuels, sold principally at Cordova, Kodiak and Dutch Harbour and a few ports in southwest Alaska, account for 3.6%, most of which is diesel.

- Southeast. The major regional use is off-highway diesel, at 42.5%. Highway fuels consumed 36.9% of the local fuel budget, divided nearly equally between diesel at 18.8% and gasoline at 18.1%. Marine fuels use, 13.3%, is proportionally higher than in other regions. Aviation fuel use, at 7.3%, however, is proportionally much lower than in Rail Belt or Rest-of-State.

# Fig 2.B ESTIMATED 1982 FUEL CONSUMPTION

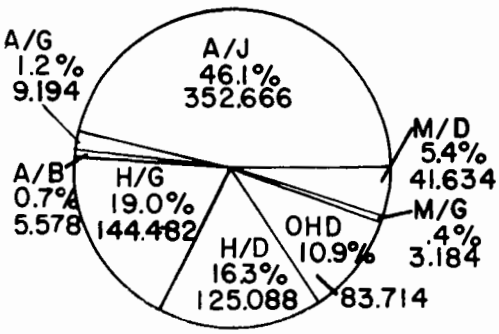
## FUEL CONSUMPTION STATEWIDE




100% OF STATE CONSUMPTION
1,080.202 MILLION GALLONS

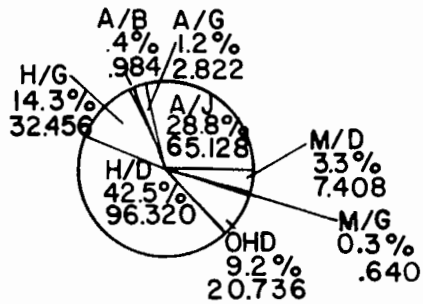
## FUEL CONSUMPTION RAIL BELT

70.9% OF STATE CON.
765.554 MIL.GAL.



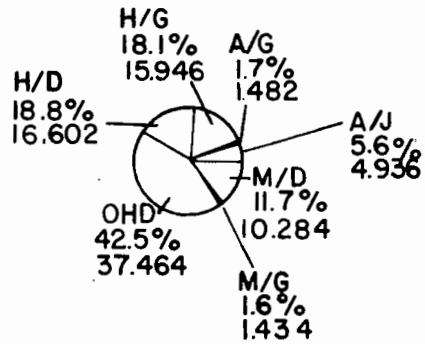

## FUEL CONSUMPTION REST-OF-STATE

21% OF STATE CON.
226.500 MIL.GAL.




## FUEL CONSUMPTION SOUTHEAST

8.1% OF STATE CON.
88.148 MIL.GAL.




## FUEL CATEGORY

- A/J - AVIATION JET
- A/G - AVIATION GAS
- A/B - AVIATION BONDED
- H/G - HIGHWAY GAS
- H/D - HIGHWAY DIESEL
- OHD - OFF HIGHWAY DIESEL
- M/G - MARINE GAS
- M/D - MARINE DIESEL

H/G
19.0% — VOLUME PERCENTAGE WITHIN GRAPH
144.482 — VOLUME IN MILLION GALLONS

Motor Fuel Sales, 1982 1/, 4/ (Million Gallons) TABLE 2.2

| | RAILBELT | REST-OF -STATE | SOUTH -EAST | STATE |
|---|---|---|---|---|
| Aviation-Jet | 352.666 | 65.128 | 4.936 | 422.730 |
| Aviation-Gas | 9.194 | 2.822 | 1.482 | 13.498 |
| Aviation-Bonded | 5.578 | .984 | .000 | 6.562 |
| Highway-Gas | 144.482 | 32.456 | 15.946 | 192.884 |
| Highway-Diesel | 125.088 | 96.320 | 16.600 | 238.008 |
| Highway-Other | .014 | .006 | .002 | .022 |
| Off-Highway Diesel | 83.714 | 20.736 | 37.464 | 141.914 |
| Marine-Gas | 3.184 | .640 | 1.434 | 5.258 |
| Marine-Diesel | 41.634 | 7.408 | 10.284 | 59.326 |
| Subtotal | 765.554 | 226.500 | 88.148 | |
| Total | | | | 1,080.202 |

Historical Motor Fuel Sales: RAILBELT 1/ (Million Gallons) TABLE 2.3

| | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 4/ |
|---|---|---|---|---|---|---|
| **Aviation - Jet** | | | | | | |
| Taxable | 83.555 | 91.783 | 102.585 | 106.451 | 123.660 | 281.258 |
| Exempt | 3/ | 3/ | 189.785 | 163.754 | 129.194 | 71.408 |
| **Aviation - Gas** | | | | | | |
| Taxable | 10.413 | 10.370 | 11.339 | 11.242 | 12.365 | 8.844 |
| Exempt | 3/ | 3/ | .453 | .345 | .341 | .350 |
| **Aviation Bonded** | | | | | | |
| Exempt | 37.189 | 2/ | 67.986 | 95.229 | 80.754 | 5.578 |
| **Highway - Gas** | | | | | | |
| Taxable | 14.023 | 140.250 | 133.261 | 128.190 | 133.050 | 138.532 |
| Exempt | 5.094 | 8.290 | 7.527 | 8.162 | 7.032 | 5.950 |
| **Highway - Diesel** | | | | | | |
| Taxable | 118.999 | 101.598 | 56.597 | 64.791 | 69.606 | 118.792 |
| Exempt | 45.162 | 54.050 | 39.477 | 23.935 | 11.506 | 6.296 |
| **Highway - Other** | | | | | | |
| Taxable | 2/ | 2/ | 91.562 | 116.897 | 47.425 | .014 |
| **Off-Highway Diesel** | | | | | | |
| Exempt | 2/ | 2/ | 81.483 | 97.004 | 47.438 | 83.714 |
| **Marine - Gas** | | | | | | |
| Taxable | 6.059 | 7.160 | 8.004 | 7.573 | 4.553 | 3.180 |
| Exempt | .384 | .554 | .292 | .025 | .026 | .004 |
| **Marine - Diesel** | | | | | | |
| Taxable | 32.217 | 41.869 | 53.167 | 62.341 | 47.018 | 39.904 |
| Exempt | 6.396 | 10.116 | 6.325 | 5.370 | 4.149 | 1.730 |
| **Marine - Non-propulsion** | | | | | | |
| Exempt | 5.323 | 2/ | 2/ | 2/ | 2/ | 2/ |
| **Marine - Other** | | | | | | |
| Taxable | .593 | 29.228 | .258 | .020 | .002 | .000 |
| Exempt | .998 | 2/ | 2/ | 2/ | 2/ | 2/ |

Historical Motor Fuel Sales: REST-OF-STATE 1/ (Million Gallons) TABLE 2.4

| | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 4/ |
|---|---|---|---|---|---|---|
| Aviation - Jet | | | | | | |
| Taxable | 14.844 | 16.057 | 18.691 | 19.863 | 24.142 | 52.358 |
| Exempt | 3/ | 3/ | 30.977 | 26.750 | 22.917 | 12.770 |
| Aviation - Gas | | | | | | |
| Taxable | 2.984 | 3.232 | 3.277 | 3.400 | 3.929 | 2.662 |
| Exempt | 3/ | 3/ | .075 | .099 | .122 | .160 |
| Aviation Bonded | | | | | | |
| Exempt | 2/ | 2/ | 2/ | 2/ | 14.251 | .984 |
| Highway - Gas | | | | | | |
| Taxable | 25.994 | 24.688 | 26.675 | 26.675 | 29.294 | 31.158 |
| Exempt | 3/ | 3/ | 1.146 | 1.316 | 1.418 | 1.298 |
| Highway - Diesel | | | | | | |
| Taxable | 33.512 | 17.878 | 23.462 | 39.833 | 74.455 | 91.322 |
| Exempt | 3/ | 3/ | 9.801 | 7.053 | 4.734 | 4.998 |
| Highway - Other | | | | | | |
| Taxable | 2/ | 2/ | 12.819 | 16.366 | 8.370 | .006 |
| Off-Highway Diesel | | | | | | |
| Exempt | 2/ | 2/ | 14.635 | 19.307 | 16.102 | 20.736 |
| Marine - Gas | | | | | | |
| Taxable | .690 | 1.144 | 1.316 | 1.375 | 1.318 | .638 |
| Exempt | 3/ | 3/ | .053 | .005 | .006 | .002 |
| Marine - Diesel | | | | | | |
| Taxable | 3.684 | 4.804 | 6.366 | 7.902 | 9.230 | 7.100 |
| Exempt | 3/ | 3/ | .830 | .742 | .733 | .308 |
| Marine - Non-propulsion | | | | | | |
| Exempt | .883 | 2/ | 2/ | 2/ | 2/ | 2/ |
| Marine - Other | | | | | | |
| Taxable | .107 | 4.089 | .061 | .015 | .000 | .000 |
| Exempt | 3/ | 2/ | 2/ | 2/ | 2/ | 2/ |

Historical Motor Fuel Sales: SOUTHEAST 1/ (Million Gallons) TABLE 2.5

| | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 4/ |
|---|---|---|---|---|---|---|
| Aviation - Jet | | | | | | |
| Taxable | 4.765 | 5.167 | 4.914 | 3.760 | 4.756 | 4.644 |
| Exempt | 3/ | 3/ | .226 | .377 | .503 | .292 |
| Aviation - Gas | | | | | | |
| Taxable | 1.852 | 1.543 | 1.757 | 1.712 | 1.886 | 1.420 |
| Exempt | 3/ | 3/ | .023 | .115 | .111 | .062 |
| Aviation Bonded | | | | | | |
| Exempt | 2/ | 2/ | 2/ | 2/ | .000 | .000 |
| Highway - Gas | | | | | | |
| Taxable | 14.102 | 14.131 | 13.867 | 14.612 | 15.018 | 15.262 |
| Exempt | 3/ | 3/ | .590 | .570 | .634 | .684 |
| Highway - Diesel | | | | | | |
| Taxable | 10.746 | 5.731 | 6.578 | 7.293 | 9.506 | 8.420 |
| Exempt | 3/ | 3/ | 5.660 | 6.144 | 6.584 | 8.180 |
| Highway - Other | | | | | | |
| Taxable | 2/ | 2/ | .002 | .003 | .002 | .002 |
| Off-Highway Diesel | | | | | | |
| Exempt | 2/ | 2/ | 20.157 | 26.192 | 30.710 | 37.464 |
| Marine - Gas | | | | | | |
| Taxable | 2.135 | 2.128 | 2.075 | 1.739 | 1.646 | 1.430 |
| Exempt | 3/ | 3/ | .103 | - .011 | .053 | .004 |
| Marine - Diesel | | | | | | |
| Taxable | 7.707 | 8.773 | 9.888 | 10.569 | 10.881 | 9.892 |
| Exempt | 3/ | 3/ | .498 | .111 | .271 | .392 |
| Marine - Non-propulsion | | | | | | |
| Exempt | .667 | 2/ | 2/ | 2/ | 2/ | 2/ |
| Marine - Other | | | | | | |
| Taxable | .131 | .139 | .134 | .045 | .002 | .000 |
| Exempt | 3/ | 2/ | 2/ | 2/ | 2/ | 2/ |

Historical Motor Fuel Sales: STATE 1/ (Million Gallons) TABLE 2.6

| | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 4/ |
|---|---|---|---|---|---|---|
| Aviation - Jet | | | | | | |
| Taxable | 103.163 | 113.006 | 126.190 | 130.074 | 152.558 | 338.262 |
| Exempt | 190.392 | 220.789 | 220.988 | 190.881 | 152.614 | 84.468 |
| Aviation - Gas | | | | | | |
| Taxable | 15.249 | 15.145 | 16.373 | 16.354 | 18.180 | 12.926 |
| Exempt | 1.521 | .685 | .552 | .558 | .574 | .572 |
| Aviation Bonded | | | | | | |
| Exempt | 37.189 | 29.812 | 67.986 | 95.229 | 95.005 | 6.562 |
| Highway - Gas | | | | | | |
| Taxable | 181.119 | 179.069 | 173.802 | 169.191 | 177.362 | 184.952 |
| Exempt | 5.094 | 8.290 | 7.527 | 8.162 | 9.084 | 7.932 |
| Highway - Diesel | | | | | | |
| Taxable | 118.999 | 101.598 | 56.597 | 64.791 | 153.567 | 218.534 |
| Exempt | 45.162 | 54.050 | 39.477 | 23.935 | 22.824 | 19.474 |
| Highway - Other | | | | | | |
| Taxable | 2/ | 2/ | 91.562 | 116.897 | 55.797 | .022 |
| Off-Highway Diesel | | | | | | |
| Exempt | 2/ | 2/ | 81.483 | 97.004 | 94.250 | 141.914 |
| Marine - Gas | | | | | | |
| Taxable | 6.059 | 7.160 | 8.004 | 7.573 | 7.517 | 5.248 |
| Exempt | .384 | .554 | .292 | .025 | .085 | .010 |
| Marine - Diesel | | | | | | |
| Taxable | 32.217 | 41.869 | 53.167 | 62.341 | 67.129 | 56.896 |
| Exempt | 6.396 | 10.116 | 6.325 | 5.370 | 5.153 | 2.430 |
| Marine - Non-propulsion | | | | | | |
| Exempt | 5.323 | 2/ | 2/ | 2/ | 2/ | 2/ |
| Marine - Other | | | | | | |
| Taxable | .593 | 29.228 | .258 | .020 | .002 | .000 |
| Exempt | .998 | 2/ | 2/ | 2/ | 2/ | 2/ |

1/ Alaska Department of Revenue, Report of Motor Fuel Sold or Distributed In Alaska, monthly reports.

2/ Data not reported.

3/ Data not reported by Judicial District

4/ Current (12/1982) major end-uses of fuel categories (Exempt fuels, except for Aviation Jet Exempt, are sold to Federal, State and local governments and to charitable institutions):

| | |
|---|---|
| Aviation - Jet | |
| Taxable | Commercial and private: domestic flights |
| Exempt | Commercial: foreign flights (this use continues to shift from Aviation-Bonded to this category). |
| Aviation - Gas | Commercial and private: domestic and foreign flights |
| Aviation - Bonded | Jet fuel for commercial foreign flights (this use continues to shift from this category to Aviation Jet Exempt). |
| Highway - Gas | Highway vehicles and construction industry. |
| Highway - Diesel | Highway vehicles and construction industry (non-public utility turbine fuel shifted from Highway-Other to this category). |
| Highway - Other | Category closed July, 1982 (major use as non-public utility turbine fuel shifted to Highway Diesel). |
| Off-Highway Diesel | Power generation and heating fuel (heating fuel use has shifted to this catagory since mid 1981). |
| Marine - Gas | Use in or on watercraft |
| Marine - Diesel | Use in or on watercraft |
| Marine - Other | Fuel additives |

Estimated 1982 figures for natural gas disposition and consumption are shown on Table 2.7, with 1981 figures added for comparison. In the following text, all percentages are of estimated 1982 gas consumption. In principle, gas which has been extracted then injected has not been consumed; most is available for later extraction, though some is "used" in maintaining oil field reservoir pressure. For this reason, Fig. 2.C shows state and regional disposition of all gas extracted in 1982, whereas Fig 2.D shows the end use of gas actually consumed. Gas disposition and consumption figures for 1971-1982 are shown on Table 2.8.

State Disposition and Consumption

Of the gas extracted in 1982, 74.5% was injected, 18.6% was sold and 6.9% was consumed in field operations. Overall 1982 gas extraction increased by 9.6% over 1981. Injection increased by 11.5% and field operations, including venting, used on leases, shrinkage and other, increased by 12.6% over 1981 levels. These increases were primarily due to Kuparuk River field production which began in December, 1981. Total state sales categories increased by 1.7% over 1981.

Regional Disposition and Consumption

All of Alaska's gas is extracted in the Rail Belt, in and around Cook Inlet, and in Rest-of-State at Barrow, Prudhoe Bay and Kuparuk River fields. The extraction/consumption ratios of the two regions are quite different. Most of the state's gas is extracted in the Rest-of-State region but a great proportion of that gas is injected and little is consumed. The Rail Belt, however extracts less total volume of gas but more of that extracted gas is consumed and less is injected than in Rest-of-State.

- Rail Belt. Of the gas extracted in this region in 1982, 66.2% was consumed, 59.2% in sales and 7.0% in field operations. The remaining third was injected.

Liquification of natural gas accounted for 31.2% of gas sales while the manufacture of Ammonia - Urea consumed 27.4%. Other regional uses accounted for about one-quarter of the regional consumption, power generation at 17.4% and gas utilities at 8.7%.

- Rest-of-State. Virtually all of the region's gas is extracted from Prudhoe Bay and Kuparuk River fields. South Barrow field is locally important, but produces only 0.07% of the region's gas.

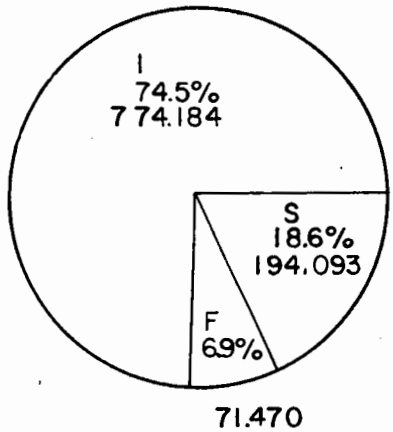
By far the largest part, 91.3%, of the extracted gas was injected, whereas 6.8% went to field operations and 1.9% was sold.

Of the gas consumed, 78.9% was used in field operations. Most of the remainder was sold to TAPS or used by Prudhoe Bay refineries. Non-industrial sales at Barrow accounted for 1.4% of regional consumption, 0.8% for utilities and 0.6% for power generation.

# Fig. 2.C ESTIMATED 1982 GAS DISPOSITION

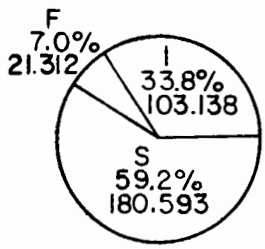
## NATURAL GAS DISPOSITION STATEWIDE

100.0% OF STATE EXTRACTION
1,039.747 BCF



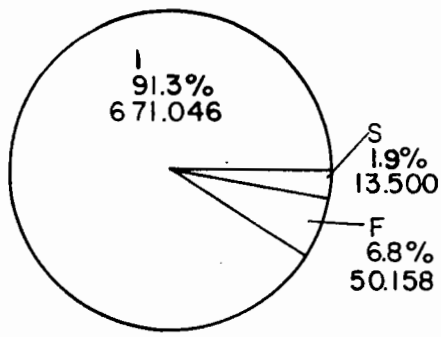

## NATURAL GAS DISPOSITION RAIL BELT

29.3% OF STATE EXTRACTION
305.043 BCF




## NATURAL GAS DISPOSITION REST-OF-STATE

70.7% OF STATE EXTRACTION
734.704 BCF



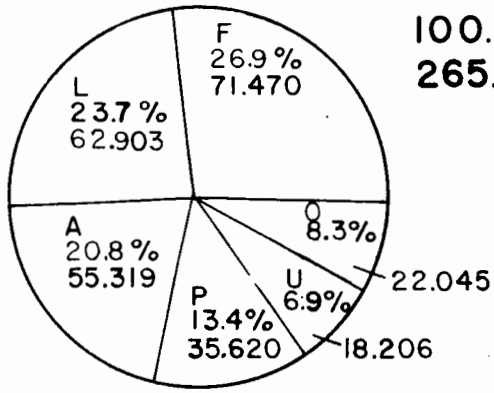

## DISPOSITION

I-INJECTION
F-FIELD OPERATIONS
S-SALES

I
33.8% — VOLUME PERCENTAGE WITHIN GRAPH
103.138 — VOLUME IN BCF

# Fig. 2.D ESTIMATED 1982 GAS CONSUMPTION

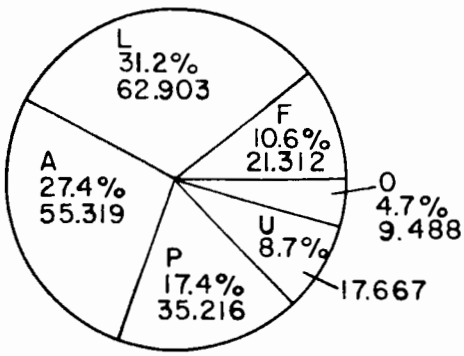
## NATURAL GAS CONSUMPTION STATEWIDE




100.0% OF STATE CONSUMPTION
265.563 BCF

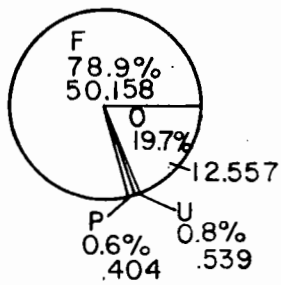
## NATURAL GAS CONSUMPTION RAIL BELT

76.0% OF STATE CONSUMPTION
201.905 BCF




## NATURAL GAS CONSUMPTION REST-OF-STATE

24.0% OF STATE CONSUMPTION
63.658 BCF




## CONSUMPTION USE

F-FIELD OPERATIONS
L-LNG
A-AMMONIA-UREA
P-ELECTRIC POWER GENERATION
U-GAS UTILITIES
O-OTHER SALES

A
27.4%
55.319

VOLUME PERCENTAGE WITHIN GRAPH
VOLUME IN BCF

Gas Disposition and Sales, 1982 (BCF) TABLE 2.7

| | 1981 STATE | 1982 1/ RAIL BELT | REST-OF -STATE | SOUTH EAST | STATE | CHANGE, 1981-82 |
|---|---|---|---|---|---|---|
| Injection 2/ | 694.196 | 103.138 | 671.046 | 0 | 774.184 | +11.5% |
| Field Operations: Vented, Used, Shrinkage, Other 2/ | 63.485 | 21.312 | 50.158 | 0 | 71.470 | +12.6% |
| Sales 2/ | 190.873 | 180.593 | 13.500 | 0 | 194.093 | +1.7% |
| LNG 3/ | 68.823 | 62.903 | 0 | 0 | 62.903 | - 8.6% |
| Ammonia Urea 3/ | 53.707 | 55.319 | 0 | 0 | 55.319 | +4.2% |
| Power Generation 4/ | 33.631 | 35.216 | .404 | 0 | 35.620 | +4.9% |
| Civilian | (29.072) | (30.544) | (.404) | 0 | (30.948) | |
| Military | (4.56) | (4.672) | 0 | 0 | (4.672) | |
| Gas Utilities 4/ | 16.215 | 17.667 | .539 | 0 | 18.206 | +12.3% |
| Residential | (8.386) | (9.215) | (.539) | 0 | (9.754) | |
| Commercial | (7.829) | (8.452) | | 0 | (8.452) | |
| Other Sales 3/ | 18.497 | 9.488 | 12.557 | 0 | 22.045 | +19.2 |
| Producers | (6.009) | (9.488) | | | (9.488) | |
| Refiners | (.414) | | (.467) | | (.467) | +12.8% |
| TAPS | (11.106) | | (11.942) | | (11.942) | + 7.5% |
| Misc. | (.968) | | (.148) | | (.148) | |
| Sub Total 2/ | | 305.043 | 734.704 | 0 | | |
| TOTAL 2/ | 948.554 | | | | 1,039.747 | +9.6% |

1/ Estimated from part-year reports of sources cited below.

2/ Alaska Oil and Gas Conservation Commission, State of Alaska Report of Gas Disposition, monthly reports.

3/ Alaska Division of Minerals and Energy Management royalty reports from producers.

4/ Alaska Public Utilities Commission, annual reports from vendors, Alaska Oil and Gas Commission, op.cit. and personal communications with Alaska Gas and Service, Kenai Service Utility and Barrow Utilities and Electric Cooperative.

TABLE 2.8

Historical Gas Disposition and Sales[2/] (BCF)

| | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982[1/] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RAIL BELT | | | | | | | | | | | | |
| Injection | 73.88 | 76.13 | 87.78 | 86.81 | 95.183 | 111.082 | 115.131 | 114.074 | 119.825 | 115.4 | 100.410 | 103.138 |
| Field Operations: Vented, Used on Leases, Shrinkage | 45.25 | 36.56 | 20.90 | 23.89 | 28.830 | 24.466 | 24.396 | 23.524 | 17.520 | 28.0 | 20.569 | 21.312 |
| Sales | | | | | | | | | | | | |
| LNG[3/] | 63.24 | 59.87 | 60.99 | 61.87 | 64.777 | 63.509 | 66.912 | 60.874 | 64.111 | 55.3 | 68.823 | 62.903 |
| Ammonia Urea[4/] | 19.49 | 20.58 | 20.64 | 2.10 | 23.888 | 24.257 | 28.620 | 48.879 | 51.657 | 47.6 | 53.707 | 55.319 |
| Power Generation[5/] | 10.31 | 13.16 | 15.48 | 17.11 | 19.619 | 22.188 | 23.590 | 24.591 | 28.155 | 28.7 | 29.072 | 30.544 |
| Military[6/] | 6.549 | 6.473 | 6.069 | 5.684 | 5.842 | 5.424 | 5.100 | 5.126 | 4.986 | 4.8 | 4.560 | 4.672 |
| Gas Utilities[7/] | 8.243 | 8.952 | 9.653 | 9.816 | 12.044 | 12.552 | 12.683 | 13.454 | 14.045 | 15.5 | 16.215 | 17.667 |
| Other Sales | 0.97 | 1.08 | 1.59 | 1.16 | 2.371 | 1.775 | 3.529 | 3.277 | 4.757 | 5.1 | 5.732 | 9.488 |
| REST-OF-STATE | | | | | | | | | | | | |
| Injection | | | | | | | 68.080 | 271.854 | 390.136 | 546.5 | 593.786 | 671.046 |
| Field Operations: Vented, Used on Leases, Other | | | | | 2.808 | 3.856 | 24.444 | 29.231 | 33.763 | 39.6 | 42.916 | 50.158 |
| Sales | | | | | 1.037 | 2.053 | 3.347 | 7.802 | 9.512 | 12.0 | 12.764 | 13.500 |
| STATE | | | | | | | | | | | | |
| Injection | | | | | | | | | | | 694.196 | 774.184 |
| Field Operations: Vented, Used on Leases, Other | | | | | | | | | | | 63.485 | 71.470 |
| Sales | | | | | | | | | | | 190.873 | 194.093 |
| TOTAL | | | | | 256.399 | 71.162 | 375.832 | 602.687 | 738.485 | 898.554 | 948.554 | 1,039.747 |

1/ Estimated from part-year reports of sources cited below.

2/ All data, except where specifically cited, from Alaska Oil and Gas Conservation (OGCC), State of Alaska Report of Gas Disposition, monthly reports.

3/ For 1971-74: Stanford Research Institute (SRI), Natural Gas Demand and Supply to the year 2000 in the Cook Inlet Basin of South Central Alaska, November 1977; 1975-1979: sum of 1)production from Kenai and Beaver Creek gas fields, reported in Alaska Oil and Gas Conservation Commission (OGCC), Kenai Gas Sales and 2) sales from North Cook Inlet gas field reported in OGCC, op.cit.; 1980: direct communication with Phillips Petroleum Company; 1981-82, Alaska Division of Minerals and Energy Management, royalty reports from producer.

4/ For 1971-74: SRI, op.cit.; 1975-79: sum of 1) sales from Kenai and Beaver Creek gas fields to Collier Chemical reported in OGCC, Kenai Gas Sales and 2) sales from McArthur River gas field reported in OGCC, op.cit.; 1980: direct communcation with Union Oil Co.; 1981-82: Alaska Division of Minerals and Energy Management royalty reports from producers.

5/ For 1971-74: SRI, op.cit.; 1975-80: sum of 1) sales reported by Anchorage Natural Gas to Alaska Public Utilities Commission (APUC) and 2) deliveries from Beluga River gas field to Chugach Electric, reported in OGCC, op.cit.; 1981-82: APUC annual reports from vendors, personal communications with Alaska Gas and Service and OGCC, op.cit.

6/ For 1971-80: Sales reported by Anchorage Natural Gas to APUC, op. cit.; 1981-82: personal communications with Alaska Gas and Service.

7/ For 1971 - 1975 Gas Rate Schedule revision: internal records of Anchorage Natural Gas; 1975-81: sales reported by Anchorage Gas and Service Co. and Kenai Utility Service Corp. to APUC, op. cit.; 1982: personal communication with Anchorage Gas and Service and Kenai Utility Service.

## OIL AND NATURAL GAS CONSUMPTION FOR ELECTRICITY GENERATION 2.4

Table 2.9 lists the oil and gas consumed for electricity generation in the three regions for the last eleven years. Following the surge of energy consumption during the Alaska Pipeline construction years, oil fired generation has decreased in the Railbelt and Southeast.

- Rail Belt. In the Railbelt the diminishing oil share is being replaced by an increasing gas share. Industry and population growth plus the attractive pricing of natural gas have contributed to this increase.

- Rest-of-State. Gas used in Rest-of-State is primarily at Barrow. This use is increasing though absolute quantities are small. Oil use is increasing reflecting increased exploration and development activity for oil, gas and minerals.

- Southeast. The Southeast's population growth has leveled off. This leveling off has resulted in tapering oil use with a very slight increase in hydroelectricity.

Tables 2.10 through 2.13 show net generation by fuel for the three regions and the state.

- Rail-Belt. Since 1976 the oil share has decreased while the gas share has increased. Increases in oil prices versus more attractive gas prices account for this. The coal share has also declined whereas the hydroelectric share has remained relatively steady, varying seasonally with load needs.

- Rest-of-State. The Rest-of-State use is all oil and natural gas with gas starting to make inroads by 1976. Oil and gas shares have not change significantly. Absolute quantities are increasing, primarily due to increased oil field activity.

- Southeast. Electric generation in the Southeast is presently split approximately 4 to 1 by hydroelectric and petroleum fuels.

Historical Oil and Gas Consumption for Electricity Generation 1/ TABLE 2.9

| | RAIL BELT | | REST-OF-STATE | | SOUTHEAST | |
|---|---|---|---|---|---|---|
| | Oil | Gas | Oil | Gas 5/ | Oil | Gas |
| | (Million Gallons) | (BCF) | (Million Gallons) | (BCF) | (Million Gallons) | (BCF) |
| 1971 | 9.903 | 9.980 | 4.859 | .22 | 4.299 | 0 |
| 1972 | 9.882 | 12.780 | 7.345 | .33 2/ | 6.791 | 0 |
| 1973 | 8.579 | 15.683 | 8.603 | .49 2/ | 6.818 | 0 |
| 1974 | 7.050 | 17.117 | 9.357 | .73 2/ | 6.252 | 0 |
| 1975 | 13.921 | 19.619 | 11.332 | .109 2/ | 7.289 | 0 |
| 7976 | 19.397 | 22.204 | 12.342 | .162 | 5.174 | 0 |
| 1977 2/ | 23.087 | 23.534 | 13.913 | .183 | 5.076 | 0 |
| 1978 2/ | 20.265 | 24.557 | 15.167 | .200 | 7.115 | 0 |
| 1979 2/ | 19.638 | 28.295 4/ | 16.003 | .228 | 6.905 | 0 |
| 1980 | 19.664 | 28.763 | 16.105 | .228 | 6.011 | 0 |
| 1981 | 13.359 | 29.071 | 16.483 | .300 | 6.232 | 0 |
| 1982 3/ | 10.000 | 30.544 | 18.232 | .404 | 6.777 | 0 |

1/ U.S. Department of Energy, Alaska Power Administration, Alaska Electric Power Statistics 1960 - 1980, Sixth Edition August, 1981 and Alaska Electric Power Statistics 1960 - 1976, Fifth Edition, July, 1977.

2/ Preliminary data from Alaska Power Administration.

3/ Estimated from: gas - Alaska Oil and Gas Conservation Commission, State of Alaska Report of Gas Disposition, monthly reports; oil - modeling described in Chapter 3 of this report.

4/ AGA Gas Facts

5/ Principally Barrow

Historical Utility Electricity Generated: RAIL BELT[1/]

TABLE 2.10

| | Oil | | Gas | | Coal | | Hydro | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | Thousand MWh | Share (%) | Thousand MWh | Share (%) | Thousand MWh | Share (%) | Thousand MWh | Share (%) | Thousand MWh |
| 1971 | 48.0 | 4.4 | 612.6 | 56.0 | 262.1 | 24.0 | 170.6 | 15.6 | 1093.3 |
| 1972 | 59.1 | 4.7 | 748.2 | 59.8 | 281.2 | 22.5 | 162.6 | 13.0 | 1251.1 |
| 1973 | 66.4 | 4.6 | 973.1 | 67.0 | 278.5 | 19.2 | 134.4 | 9.3 | 1452.4 |
| 1974 | 66.1 | 4.2 | 1049.1 | 66.7 | 305.0 | 19.4 | 153.0 | 9.7 | 1573.2 |
| 1975 | 126.9 | 6.8 | 1246.3 | 66.7 | 328.5 | 17.6 | 168.1 | 9.0 | 1869.8 |
| 1976 | 179.8 | 8.4 | 1473.8 | 68.5 | 318.3 | 14.8 | 179.8 | 8.4 | 2151.7 |
| 1977 | 182.0 | 7.8 | 1596.4 | 68.4 | 315.1 | 13.5 | 240.64 | 10.3[4/] | 2333.9[4/] |
| 1978 | 193.5 | 7.9 | 1719.6 | 70.2 | 313.5 | 12.8 | 221.84 | 9.1[4/] | 2449.6[4/] |
| 1979 | 191.0 | 7.5 | 1826.0 | 71.2 | 313.2 | 12.3 | 215.73 | 8.5[4/] | 2546.7[4/] |
| 1980 | 187.4 | 7.2 | 1857.9 | 71.6 | 296.3 | 11.4 | 254.0 | 9.8 | 2595.6 |
| 1981 | 120.5 | 4.5 | 1900.2 | 71.6 | 354.3 | 13.3 | 280.4 | 10.6 | 2655.5 |

Historical Utility Electricity Generated: REST-OF-STATE[1/]

TABLE 2.11

| | Oil | | Gas | | Coal | | Hydro | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | Thousand MWh | Share (%) | Thousand MWh | Share (%) | Thousand MWh | Share (%) | Thousand MWh | Share (%) | Thousand MWh |
| 1971 | 95.6 | 98.7 | 1.3 | 1.3 | 0 | 0 | 0 | 0 | 96.93 |
| 1972 | 100.2 | 100.0 | 0 | 0 | 0 | 0 | 0 | 0 | 100.2 |
| 1973 | 100.8 | 100.0 | 0 | 0 | 0 | 0 | 0 | 0 | 100.8 |
| 1974 | 102.4 | 100.0 | 0 | 0 | 0 | 0 | 0 | 0 | 102.4 |
| 1975 | 130.4 | 100.0 | 0 | 0 | 0 | 0 | 0 | 0 | 130.4 |
| 1976 | 142.5 | 94.5 | 8.3 | 5.5 | 0 | 0 | 0 | 0 | 150.8 |
| 1977 | 165.5 | 94.2 | 10.2 | 5.8 | 0 | 0 | 0 | 0 | 175.7[5/] |
| 1978 | 173.0 | 93.8 | 11.4 | 6.2 | 0 | 0 | 0 | 0 | 184.4[5/] |
| 1979 | 179.2 | 93.5 | 12.5 | 6.5 | 0 | 0 | 0 | 0 | 191.7[5/] |
| 1980 | 184.7 | 93.2 | 13.4 | 6.8 | 0 | 0 | 0 | 0 | 198.1 |
| 1981 | 211.6 | 92.4 | 17.5 | 7.6 | 0 | 0 | 0 | 0 | 229.0 |

Historical Utility Electricity Generated: SOUTHEAST[2/]

TABLE 2.12

| | Oil | | Gas | | Coal | | Hydro | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | Thousand MWh | Share (%) | Thousand MWh | Share (%) | Thousand MWh | Share (%) | Thousand MWh | Share (%) | Thousand MWh |
| 1971 | 51.5 | 21.1 | 0 | 0 | 0 | 0 | 192.4[2/] | 78.9 | 243.9 |
| 1972 | 85.3 | 31.7 | 0 | 0 | 0 | 0 | 183.4[2/] | 68.3 | 268.7 |
| 1973 | 83.3 | 35.5 | 0 | 0 | 0 | 0 | 151.6[2/] | 64.5 | 234.9 |
| 1974 | 78.9 | 31.4 | 0 | 0 | 0 | 0 | 172.6 | 68.6 | 251.5 |
| 1975 | 96.0 | 33.6 | 0 | 0 | 0 | 0 | 189.6 | 66.4 | 285.6 |
| 1976 | 61.8 | 23.4 | 0 | 0 | 0 | 0 | 202.8 | 76.6 | 264.6 |
| 1977 | 47.1 | 14.8 | 0 | 0 | 0 | 0 | 271.38[2/] | 85.2 | 318.5 |
| 1978 | 81.9 | 24.7 | 0 | 0 | 0 | 0 | 250.2[2/] | 75.3 | 332.1 |
| 1979 | 103.2 | 29.8 | 0 | 0 | 0 | 0 | 243.27[2/] | 70.2 | 346.5 |
| 1980 | 75.4 | 20.6 | 0 | 0 | 0 | 0 | 289.9 | 79.4 | 365.3 |
| 1981 | 76.7 | 19.4 | 0 | 0 | 0 | 0 | 318.1 | 80.6 | 394.8 |

Historical Utility Electricity Generated: STATE[1]

TABLE 2.13

| | Oil | | Gas | | Coal | | Hydro 2 | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | Thousand MWh | Share (%) | Thousand MWh | Share (%) | Thousand MWh | Share (%) | Thousand MWh | Share (%) | Thousand MWh |
| 1971 | 195.1 | 13.6 | 613.9 | 42.8 | 262.1 | 18.3 | 363.0[2] | 25.3 | 1434.1 |
| 1972 | 252.5 | 15.6 | 742.2 | 45.8 | 281.2 | 17.3 | 346.0[2] | 21.3 | 1621.9 |
| 1973 | 250.6 | 14.1 | 966.9 | 54.3 | 278.5 | 15.6 | 286.0[2] | 16.0 | 1782.0 |
| 1974 | 246.5 | 12.8 | 1049.1 | 54.5 | 305.0 | 15.8 | 325.6 | 16.9 | 1926.2 |
| 1975 | 352.8 | 15.4 | 1246.4 | 54.5 | 328.5 | 14.4 | 357.7 | 15.7 | 2285.4 |
| 1976 | 384.2 | 15.0 | 1482.0 | 57.7 | 318.3 | 12.4 | 382.6 | 14.9 | 2567.1 |
| 1977 | 359.2 | 12.7 | 1634.6 | 57.8 | 322.4 | 11.4 | 512.0[2] | 18.1 | 2828.1 |
| 1978 | 436.0 | 14.7 | 1732.2 | 58.4 | 326.3 | 11.0 | 472.0[2] | 15.9 | 2966.1 |
| 1979 | 481.2 | 15.6 | 1823.2 | 59.1 | 320.8 | 10.4 | 459.0[2] | 14.9 | 3084.9 |
| 1980 | 447.5 | 14.2 | 1871.3 | 59.2 | 296.3 | 9.4 | 543.90 | 17.2 | 3159.0 |
| 1981 | 408.76 | 12.5 | 1917.70 | 58.5 | 354.34 | 10.8 | 598.52 | 18.2 | 3279.32 |

1/ U.S. Department of Energy, Alaska Power Administration, Alaska Electric Power Statistics 1960 - 1981, Seventh Edition, August 1982. Alaska Electric Power Statistics 1960-1980, Sixth Edition, August 1981 and Alaska Electric Power Statistics 1960-1976, Fifth Edition, July 1977.

2/ U.S. Department of Energy, State Energy Data Report, September 1981. All hydroelectric sources are found within Southeast and Railbelt regions. Alaska total figures for 1971-1973 and 1977-1979 are split 53%-47% (1980 reported split) between the Southeast and Railbelt respectively.

3/ Includes industrial, utility production and net imports.

4/ Estimated

Note: 1977-1979 figures estimated for Oil, Gas, and Coal shares since data were not available from sources cited.

## CONSUMPTION FORECAST 3.0

Consumption of oil and gas in all major categories is forecast to increase in future years.1/

Consumption of natural gas will grow from 211 billion cubic feet (bcf) in 1983 to 243 bcf in 1987 (annual growth of 2.9 percent), 286 bcf in 1992 (3.1 percent annual growth), and 309 bcf in 1997 (2.6 percent annual growth). Although industry currently consumes the majority of natural gas and is forecast to continue to be the dominant user, growth of gas use for space heating and electricity generation will outstrip growth in industrial use. Over the next 15 years, use of gas for space heating will more than double, from 18.9 bcf in 1983 to 37.4 bcf in 1997 (4.7 percent annual growth). Use of gas for electricity generation will grow from 32.9 bcf in 1983 to 62.4 bcf in 1997 (4.4 percent annual growth).

Consumption of liquid petroleum will increase from 1,251 million gallons in 1983 (about 30 million barrels of crude oil equivalent) to 1,713 million gallons in 1997 (41 million barrels). This represents a 2.1 percent annual growth rate. The five- and ten-year growth rates are both 2.0 percent annually. Space heating use of petroleum will grow most rapidly, at 2.5 percent annually, due to size increases in the building stock outside the railbelt. Vehicle transportation use will increase 2.0 percent annually, a modest rate of increase due to increases in motor vehicle fuel use efficiencies. Electric utility use of fuel oil will decrease in the mid-1980s as several hydroelectric facilities replace high cost fuel oil generation, but total consumption will subsequently increase and the 15-year growth rate will be 2.2 percent annually. Industrial use of petroleum liquids will remain constant.

1/ See Appendix B for assumptions.

Projected Consumption of Oil and Gas
(Liquids - Million Gallons)
(Natural Gas - BCF)

TABLE 3.1

| | 1982 | | | 1983 | | |
|---|---|---|---|---|---|---|
| | Total State | Rail-Belt | Non-Railbelt | Total State | Rail-Belt | Non-Railbelt |
| **Vehicle Transportation** | | | | | | |
| Liquids | 938 | 682 | 256 | 977 | 704 | 273 |
| Natural gas | 0 | 0 | 0 | 0 | 0 | 0 |
| **Space Heat** | | | | | | |
| Liquids | 169 | 64 | 105 | 174 | 66 | 108 |
| Natural gas | 18.2 | 17.7 | .5 | 18.9 | 18.4 | .5 |
| **Utility Electricity Generation** | | | | | | |
| Liquids | 35.1 | 10 | 25.1 | 37.7 | 10 | 27.7 |
| Natural gas | 30.9 | 30.5 | .4 | 32.9 | 32.5 | .4 |
| **Industry** | | | | | | |
| Liquids | 94.8 | - | - | 94.8 | - | - |
| Natural gas | 154.4 | 91.7 | 62.7 | 158.8 | 91.8 | 67 |
| **Total** | | | | | | |
| Liquids | 1236.9 | - | - | - | - | - |
| Natural gas | 203.5 | 139.9 | 63.6 | 210.6 | 142.7 | 67.9 |

For detail, see following tables.

Projected Consumption of Oil and Gas
(Liquids - Million Gallons)
(Natural Gas - BCF)

TABLE 3.1 (cont.)

| | 1984 | | | 1985 | | |
|---|---|---|---|---|---|---|
| | Total State | Rail-Belt | Non-Railbelt | Total State | Rail-Belt | Non-Railbelt |
| **Vehicle Transportation** | | | | | | |
| Liquids | 996 | 720 | 277 | 1,017 | 736 | 280 |
| Natural gas | 0 | 0 | 0 | 0 | 0 | 0 |
| **Space Heat** | | | | | | |
| Liquids | 179 | 68 | 111 | 185 | 70 | 115 |
| Natural gas | 20 | 19.4 | .6 | 20.8 | 20.2 | .6 |
| **Utility Electricity Generation** | | | | | | |
| Liquids | 38.6 | 10 | 28.6 | 31.8 | 10 | 21.8 |
| Natural gas | 35.1 | 34.6 | .5 | 37 | 36.5 | .5 |
| **Industry** | | | | | | |
| Liquids | 94.8 | - | - | 94.8 | - | - |
| Natural gas | 163.6 | 91.8 | 71.8 | 168.6 | 91.8 | 76.8 |
| **Total** | | | | | | |
| Liquids | 1308.4 | - | - | 1328.6 | - | - |
| Natural gas | 218.7 | 145.8 | 72.9 | 226.4 | 148.5 | 77.9 |

For detail, see following tables.

Projected Consumption of Oil and Gas
(Liquids - Million Gallons)
(Natural Gas - BCF)

TABLE 3.1 (cont.)

| | 1986 | | | 1987 | | |
|---|---|---|---|---|---|---|
| | Total State | Rail-Belt | Non-Railbelt | Total State | Rail-Belt | Non-Railbelt |
| **Vehicle Transportation** | | | | | | |
| Liquids | 1,037 | 754 | 283 | 1,056 | 770 | 286 |
| Natural gas | 0 | 0 | 0 | 0 | 0 | 0 |
| **Space Heat** | | | | | | |
| 7 Liquids | 190 | 72 | 118 | 195 | 74 | 121 |
| Natural gas | 22 | 21.4 | .6 | 23.4 | 22.8 | .6 |
| **Utility Electricity Generation** | | | | | | |
| Liquids | 32.7 | 10 | 22.7 | 33.5 | 10 | 23.5 |
| Natural gas | 38.4 | 37.9 | .5 | 39.9 | 39.4 | .5 |
| **Industry** | | | | | | |
| Liquids | 94.8 | - | - | 94.8 | - | - |
| Natural gas | 174 | 91.8 | 82.2 | 179.7 | 91.8 | 87.9 |
| **Total** | | | | | | |
| Liquids | 1354.5 | - | - | 1379.3 | - | - |
| Natural gas | 234.4 | 151.1 | 83.3 | 243 | 154 | 89.0 |

For detail, see following tables.

Projected Consumption of Oil and Gas
(Liquids - Million Gallons)
(Natural Gas - BCF)

TABLE 3.1 (cont.)

| | 1992 | | | 1997 | | |
|---|---|---|---|---|---|---|
| | Total State | Rail-Belt | Non-Railbelt | Total State | Rail-Belt | Non-Railbelt |
| **Vehicle Transportation** | | | | | | |
| Liquids | 1,174 | 869 | 306 | 1,313 | 987 | 328 |
| Natural gas | 0 | 0 | 0 | 0 | 0 | 0 |
| **Space Heat** | | | | | | |
| Liquids | 221 | 82 | 139 | 253 | 92 | 161 |
| Natural gas | 30.3 | 29.7 | .6 | 37.4 | 36.8 | .6 |
| **Utility Electricity Generation** | | | | | | |
| Liquids | 40.6 | 10 | 30.6 | 51.9 | 10 | 41.9 |
| Natural gas | 45.8 | 45.2 | .6 | 62.4 | 61.6 | .8 |
| **Industry** | | | | | | |
| Liquids | 94.8 | - | - | 94.8 | - | - |
| Natural gas | 209.6 | 91.8 | 117.8 | 209.6 | 91.8 | 117.8 |
| **Total** | | | | | | |
| Liquids | 1530.4 | - | - | 1712.7 | - | - |
| Natural gas | 285.7 | 166.7 | 119 | 309.4 | 190.2 | 119.2 |

For detail, see following tables.

Projected Consumption of Oil and Gas
(Liquids - Million Gallons)
(Natural Gas - BCF)

TABLE 3.1 (cont.)

| | 1983-1997 Total | | |
|---|---|---|---|
| | Total State | Rail Belt | Non-Railbelt |
| **Vehicle Transportation** | | | |
| Liquids | 16,882 | 12,418 | 4,464 |
| Natural gas | 0 | 0 | 0 |
| **Space Heat** | | | |
| Liquids | 3,147 | 1,174 | 1,973 |
| Natural gas | 408.6 | 399.7 | 8.9 |
| **Utility Electricity Generation** | | | |
| Liquids | 590.8 | 150 | 440.8 |
| Natural gas | 668.1 | 659.4 | 8.7 |
| **Industry** | | | |
| Liquids | 1,423 | - | - |
| Natural gas | 2,866 | 1,377 | 1,489 |
| **Total** | | | |
| Liquids | 22,042.8 | - | - |
| Natural gas | 3,942.7 | 2,436.1 | 1,506.6 |

For detail, see following tables.

## TRANSPORTATION LIQUID FUELS 3.1

Transportation fuel consumption will grow moderately with population growth in future years, increasing from 938 million gallons in 1982 to 1,313 million gallons in 1997 (Table 3.2). Growth will be relatively evenly divided among the three types of fuels--jet fuel, diesel, and gasoline.

Fuel use efficiency will increase in all types of uses but will be most evident in highway gasoline consumption which is projected to decline on a per capita basis. In aviation, marine, and diesel highway uses, economic growth will result in a continued increase in per capita consumption levels.

Total consumption projected over the 15-year period from 1983 to 1997 is 16,882 million gallons. This is approximately equivalent to 402 million barrels of crude oil.

Projected Consumption of Vehicle Transport Fuels[1/]
(Million Gallons)

TABLE 3.2

| | 1982 | | | 1983 | | |
|---|---|---|---|---|---|---|
| | State Total | Railbelt | Non-Railbelt | State Total | Railbelt | Non-Railbelt |
| **Gasoline** | | | | | | |
| Total | 212 | 157 | 55 | 236 | 170 | 66 |
| Highway | 193 | 144 | 48 | 206 | 148 | 58 |
| Marine | 5 | 3 | 2 | 39 | 6 | 2 |
| Aviation | 13 | 9 | 4 | 21 | 15 | 6 |
| **Diesel** | | | | | | |
| Total | 297 | 167 | 131 | 303 | 219 | 85 |
| Highway | 238 | 125 | 113 | 243 | 175 | 68 |
| Marine | 59 | 42 | 18 | 60 | 44 | 17 |
| **Jet Fuel** | | | | | | |
| Total | 429 | 358 | 71 | 438 | 315 | 122 |
| Civilian Domestic | 338 | 281 | 57 | 159 | 114 | 44 |
| Military & International | 91 | 77 | 14 | 279 | 201 | 78 |
| **Grand Total** | 938 | 682 | 256 | 977 | 704 | 273 |

Numbers may not sum to total due to rounding.

1/ Includes industrial, military, and government use. Excludes space heating, utility generation and pipeline fuel.

Projected Consumption of Vehicle Transport Fuels[1/]
(Million Gallons)

TABLE 3.2 (cont.)

| | 1984 | | | 1985 | | |
|---|---|---|---|---|---|---|
| | State Total | Railbelt | Non-Railbelt | State Total | Railbelt | Non-Railbelt |
| **Gasoline** | | | | | | |
| Total | 238 | 172 | 66 | 241 | 175 | 65 |
| Highway | 208 | 150 | 58 | 210 | 153 | 58 |
| Marine | 9 | 6 | 2 | 9 | 6 | 2 |
| Aviation | 22 | 16 | 6 | 22 | 16 | 6 |
| **Diesel** | | | | | | |
| Total | 309 | 224 | 86 | 316 | 229 | 86 |
| Highway | 248 | 179 | 69 | 253 | 183 | 69 |
| Marine | 62 | 45 | 17 | 63 | 46 | 17 |
| **Jet Fuel** | | | | | | |
| Total | 449 | 324 | 125 | 460 | 332 | 128 |
| Civilian Domestic | 167 | 121 | 46 | 175 | 127 | 48 |
| Military & International | 282 | 203 | 79 | 285 | 205 | 80 |
| **Grand Total** | 996 | 720 | 277 | 1,017 | 736 | 280 |

Numbers may not sum to total due to rounding.

(a) Includes industrial, military, and government use. Excludes space heating, utility generation and pipeline fuel.

Projected Consumption of Vehicle Transport Fuels[1/]
(Million Gallons)

TABLE 3.2 (cont.)

| | 1986 | | | 1987 | | |
|---|---|---|---|---|---|---|
| | State Total | Railbelt | Non-Railbelt | State Total | Railbelt | Non-Railbelt |
| **Gasoline** | | | | | | |
| Total | 244 | 178 | 66 | 245 | 179 | 66 |
| Highway | 212 | 155 | 58 | 214 | 157 | 57 |
| Marine | 9 | 7 | 3 | 9 | 7 | 3 |
| Aviation | 22 | 16 | 6 | 23 | 17 | 6 |
| **Diesel** | | | | | | |
| Total | 322 | 235 | 87 | 328 | 240 | 88 |
| Highway | 258 | 188 | 70 | 263 | 192 | 71 |
| Marine | 64 | 47 | 17 | 66 | 48 | 18 |
| **Jet Fuel** | | | | | | |
| Total | 471 | 341 | 130 | 483 | 351 | 132 |
| Civilian Domestic | 184 | 134 | 50 | 193 | 141 | 52 |
| Military & International | 287 | 207 | 80 | 290 | 209 | 81 |
| **Grand Total** | 1,037 | 754 | 283 | 1,056 | 770 | 286 |

Numbers may not sum to total due to rounding.

1/ Includes industrial, military, and government use. Excludes space heating, utility generation and pipeline fuel.

Projected Consumption of Vehicle Transport Fuels[1/]
(Million Gallons) TABLE 3.2 (cont.)

| | 1992 | | | 1997 | | |
|---|---|---|---|---|---|---|
| | State Total | Railbelt | Non-Railbelt | State Total | Railbelt | Non-Railbelt |
| **Gasoline** | | | | | | |
| Total | 260 | 194 | 66 | 275 | 210 | 66 |
| Highway | 225 | 168 | 57 | 236 | 180 | 56 |
| Marine | 10 | 8 | 3 | 11 | 9 | 3 |
| Aviation | 25 | 19 | 6 | 28 | 21 | 7 |
| **Diesel** | | | | | | |
| Total | 362 | 270 | 92 | 400 | 305 | 96 |
| Highway | 290 | 217 | 74 | 320 | 244 | 77 |
| Marine | 72 | 54 | 18 | 80 | 61 | 19 |
| **Jet Fuel** | | | | | | |
| Total | 552 | 405 | 148 | 638 | 472 | 166 |
| Civilian Domestic | 248 | 185 | 63 | 317 | 241 | 76 |
| Military & International | 305 | 220 | 85 | 321 | 231 | 90 |
| **Grand Total** | 1,174 | 869 | 306 | 1,313 | 987 | 328 |

Numbers may not sum to total due to rounding.

1/ Includes industrial, military, and government use. Excludes space heating, utility generation and pipeline fuel.

Projected Consumption of Vehicle Transport Fuels[1/]
(Million Gallons)

TABLE 3.2 (cont.)

| | 1983 - 1997 Total | | |
|---|---|---|---|
| | State Total | Railbelt | Non-Railbelt |
| **Gasoline** | | | |
| Total | 3,806 | 2,816 | 990 |
| Highway | | | |
| Marine | | | |
| Aviation | | | |
| **Diesel** | | | |
| Total | 5,211 | 3,860 | 1,351 |
| Highway | | | |
| Marine | | | |
| **Jet Fuel** | | | |
| Total | 7,865 | 5,742 | 2,123 |
| Civilian Domestic | | | |
| Military & International | | | |
| **Grand Total** | 16,882 | 12,418 | 4,464 |

Numbers may not sum to total due to rounding.

1/ Includes industrial, military, and government use. Excludes space heating, utility generation and pipeline fuel.

## SPACE HEATING 3.2

Space heating fuel consumption will increase moderately with population and an increase in the size of the building stock relative to population. Natural gas use will grow more rapidly than fuel oil, from 18.2 billion cubic feet in 1982 to 37.4 billion cubic feet in 1997 (Table 3.3).

The relatively more rapid growth of natural gas is attributable both to the more rapid growth of population in the railbelt as well as the extension of the natural gas market into the Matanuska Valley. The expansion of the natural gas market is estimated to increase gas use by about eight percent in the 1990's. Barrow, on the North Slope, is the only location outside of the railbelt presently served by natural gas.

The majority of fuel oil used for space heating is consumed outside the railbelt although fuel oil is important where natural gas is not available. Outside of the railbelt most space heating is done with fuel oil. Fuel oil consumption for this use grows from 170 million gallons in 1982 to 253 million gallons in 1997.

Projected Consumption of Oil and Gas for Space Heat TABLE 3.3

| | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|
| Natural Gas (BCF) | | | | | | |
| Total | 18.21 | 18.9 | 20.0 | 20.8 | 22.0 | 23.4 |
| Railbelt | 17.67 | 18.4 | 19.4 | 20.2 | 21.4 | 22.8 |
| Current Market | 17.67 | 18.4 | 19.4 | 20.2 | 21.0 | 22.0 |
| Matanuska Valley | 0 | 0 | 0 | 0 | .4 | .6 |
| Non-Railbelt | .54 | .5 | .6 | .6 | .6 | .6 |
| Fuel Oil (Million Gallons) | | | | | | |
| Total | 169.9 | 174.3 | 179.2 | 184.7 | 189.5 | 194.4 |
| Railbelt | 65 | 66.4 | 68 | 70 | 71.6 | 73 |
| Non-Railbelt | 104.9 | 107.9 | 111.2 | 114.7 | 117.9 | 121.4 |

| | 1992 | 1997 | 1983-1997 Total |
|---|---|---|---|
| Natural Gas (BCF) | | | |
| Total | 30.3 | 37.4 | 408.6 |
| Railbelt | 29.7 | 36.8 | 399.7 |
| Current Market | 27.4 | 33.9 | |
| Matanuska Valley | 2.3 | 2.9 | |
| Non-Railbelt | .6 | .6 | 8.9 |
| Fuel Oil (Million Gallons) | | | |
| Total | 221.5 | 253.2 | 3147.9 |
| Railbelt | 82.4 | 92.4 | 1174.6 |
| Non-Railbelt | 139.1 | 160.8 | 1,973.1 |

## UTILITY ELECTRICITY GENERATION 3.3

Natural gas use for utility electricity generation will exhibit strong growth in the next 15 years as the majority of incremental electricity demand growth in the railbelt is met with additions to natural gas-fired generation. Natural gas use nearly doubles from 32.9 bcf in 1983 to 62.4 bcf in 1997 (Table 3.4). The percentage of electricity in the railbelt provided by natural gas reaches a high of 81 percent by 1997 after temporarily falling below its current level of 77 percent when the Bradley Lake hydroelectric facility comes on line.[2/]

Fuel oil use for utility electricity generation will grow at an average annual rate of only 2.6 percent. This is due to the expected completion of several hydroelectric plants in locations currently dependent entirely upon fuel oil for generation. Because of this, fuel oil use will actually fall in the mid-1980s, but continued growth in electricity demand will cause fuel oil use to resume its upward trend shortly thereafter.

2/ Susitna hydro is considered in Chapter 5.

Projected Consumption of Oil and Gas for
Utility Electricity Generation

TABLE 3.4

| | 1982 | | | |
|---|---|---|---|---|
| | State Total | Railbelt | Southeast | Rest of State |
| Electricity Production (Thousand MWH) | 3,625 | 2,971 | 415 | 239 |
| Percent Natural Gas | - | 76 | 0 | 7 |
| Percent Fuel Oil | - | 3 | 23 | 93 |
| Natural Gas (BCF) | 30.9 | 30.5 | 0 | .4 |
| Fuel Oil (Million Gallons) | 35.1 | 10 | 7.8 | 17.3 |

| | 1983 | | | |
|---|---|---|---|---|
| | State Total | Railbelt | Southeast | Rest of State |
| Electricity Production (Thousand MWH) | 3,786 | 3,102 | 431 | 253 |
| Percent Natural Gas | - | 77 | 0 | 7 |
| Percent Fuel Oil | - | 3 | 26 | 93 |
| Natural Gas (BCF) | 32.9 | 32.5 | 0 | .4 |
| Fuel Oil (Million Gallons) | 37.7 | 10 | 9.2 | 18.5 |

Projected Consumption of Oil and Gas for
Utility Electricity Generation

TABLE 3.4 (cont.)

| | 1984 | | | |
|---|---|---|---|---|
| | State Total | Railbelt | Southeast | Rest of State |
| Electricity Production (Thousand MWH) | 3,962 | 3,244 | 448 | 270 |
| Percent Natural Gas | - | 78 | 0 | 7 |
| Percent Fuel Oil | - | 2 | 24 | 93 |
| Natural Gas (BCF) | 35.1 | 34.6 | 0 | .5 |
| Fuel Oil (Million Gallons) | 38.6 | 10 | 8.8 | 19.8 |

| | 1985 | | | |
|---|---|---|---|---|
| | State Total | Railbelt | Southeast | Rest of State |
| Electricity Production (Thousand MWH) | 4,122 | 3,375 | 463 | 284 |
| Percent Natural Gas | - | 79 | 0 | 7 |
| Percent Fuel Oil | - | 2 | 18 | 68 |
| Natural Gas (BCF) | 37 | 36.5 | 0 | .5 |
| Fuel Oil (Million Gallons) | 31.8 | 10 | 6.6 | 15.2 |

Projected Consumption of Oil and Gas for
Utility Electricity Generation TABLE 3.4 (cont.)

| | 1986 | | | |
|---|---|---|---|---|
| | State Total | Railbelt | Southeast | Rest of State |
| Electricity Production (Thousand MWH) | 4,237 | 3,472 | 472 | 293 |
| Percent Natural Gas | - | 79 | 0 | 7 |
| Percent Fuel Oil | - | 2 | 18 | 68 |
| Natural Gas (BCF) | 38.4 | 37.9 | 0 | .5 |
| Fuel Oil (Million Gallons) | 32.7 | 10 | 7.0 | 15.7 |

| | 1987 | | | |
|---|---|---|---|---|
| | State Total | Railbelt | Southeast | Rest of State |
| Electricity Production (Thousand MWH) | 4,352 | 3,569 | 481 | 302 |
| Percent Natural Gas | - | 80 | 0 | 7 |
| Percent Fuel Oil | - | 2 | 19 | 68 |
| Natural Gas (BCF) | 39.9 | 39.4 | 0 | .5 |
| Fuel Oil (Million Gallons) | 33.5 | 10 | 7.4 | 16.1 |

Projected Consumption of Oil and Gas for
Utility Electricity Generation

TABLE 3.4 (cont.)

| | 1992 | | | |
|---|---|---|---|---|
| | State Total | Railbelt | Southeast | Rest of State |
| Electricity Production (Thousand MWH) | 5,190 | 4,265 | 550 | 375 |
| Percent Natural Gas | - | 75 | 0 | 7 |
| Percent Fuel Oil | - | 2 | 24 | 68 |
| Natural Gas (BCF) | 45.8 | 45.2 | 0 | .6 |
| Fuel Oil (Million Gallons) | 40.6 | 10 | 10.6 | 20.0 |

| | 1997 | | | |
|---|---|---|---|---|
| | State Total | Railbelt | Southeast | Rest of State |
| Electricity Production (Thousand MWH) | 6,518 | 5,370 | 651 | 497 |
| Percent Natural Gas | - | 81 | 0 | 7 |
| Percent Fuel Oil | - | 1 | 29 | 68 |
| Natural Gas (BCF) | 62.4 | 61.6 | 0 | .8 |
| Fuel Oil (Million Gallons) | 51.9 | 10 | 15.3 | 26.6 |

Projected Consumption of Oil and Gas for
Utility Electricity Generation

TABLE 3.4 (cont.)

| | 1983-1997 Total | | | |
|---|---|---|---|---|
| | State Total | Railbelt | Southeast | Rest of State |
| Electricity Production (Thousand MWH) | - | - | - | - |
| Percent Natural Gas | - | - | - | - |
| Percent Fuel Oil | - | - | - | - |
| Natural Gas (BCF) | 668.1 | 659.4 | 0 | 8.7 |
| Fuel Oil (Million Gallons) | 590.8 | 150 | 148.8 | 292 |

## INDUSTRIAL FUEL USE 3.4

Increased use of natural gas in future years will be related to petroleum production. This will be concentrated on the North Slope where expanded petroleum activity will be concentrated. The other large use of natural gas, the production of Ammonia-Urea, will continue requiring constant amounts of natural gas.

The major industrial use of fuel oil (not including transportation) is also in the petroleum industry. Pipeline fuel for the Alyeska pipeline is the largest element of this use. In addition, a significant amount of fuel is used for electricity generation. Both of these uses are projected at constant levels.

Projected Consumption of Oil and Gas for Industry TABLE 3.5

| | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|
| **Natural Gas (BCF)** | | | | | | |
| Total Consumption | 154.4 | 158.8 | 163.6 | 168.6 | 174 | 179.7 |
| Petroleum Production Related | 94.5 | 98.8 | 103.6 | 108.6 | 114.0 | 119.7 |
| Pipeline Fuel | 12.9 | 13.7 | 14.6 | 15.6 | 16.6 | 17.7 |
| Railbelt | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Rest of State | 11.9 | 12.7 | 13.6 | 14.6 | 15.6 | 16.7 |
| Other 1/ | 81.6 | 85.1 | 89.0 | 93.0 | 97.4 | 102.0 |
| North Slope | 50.8 | 54.3 | 58.2 | 62.2 | 66.6 | 71.2 |
| Cook Inlet | 30.8 | 30.8 | 30.8 | 30.8 | 30.8 | 30.8 |
| Ammonia Urea | 55.3 | 55.3 | 55.3 | 55.3 | 55.3 | 55.3 |
| Military | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 |
| Item: Injection | 774.1 | - | - | - | - | - |
| North Slope | 671.0 | - | - | - | - | - |
| Cook Inlet | 103.1 | - | - | - | - | - |
| **Oil (Million Barrels)** | | | | | | |
| Total | 2.258 | 2.258 | 2.258 | 2.258 | 2.258 | 2.258 |
| Pipeline Fuel | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 |
| Electrical Generation | .258 | .258 | .258 | .258 | .258 | .258 |

1/ Includes natural gas in field operations, sales to producers and refiners, and miscellaneous sales.

Projected Consumption of Oil and Gas for Industry TABLE 3.5 (cont.)

| | 1992 | 1997 | 1983-1997 Total |
|---|---|---|---|
| **Natural Gas (BCF)** | | | |
| Total Consumption | 209.6 | 209.6 | 2840.8 |
| Petroleum Production Related | 149.6 | 149.6 | 1966 |
| Pipeline Fuel | 18.9 | 18.9 | 264.2 |
| Railbelt | 1.0 | 1.0 | 15.0 |
| Rest of State | 17.9 | 17.9 | 249.2 |
| Other1/ | 130.7 | 130.7 | 1701.8 |
| North Slope | 99.9 | 99.9 | 1239.8 |
| Cook Inlet | 30.8 | 30.8 | 462.0 |
| Ammonia Urea | 55.3 | 55.3 | 70.5 |
| Military | 4.7 | 4.7 | 829.5 |
| Item: Injection | - | - | - |
| North Slope | - | - | - |
| Cook Inlet | - | - | - |
| **Oil (Million Barrels)** | | | |
| Total | 2.258 | 2.258 | 33.870 |
| Pipeline Fuel | 2.000 | 2.000 | 30.000 |
| Electrical Generation | .258 | .258 | 3.870 |

1/ Includes natural gas in field operations, sales to producers and refiners, and miscellaneous sales.

## RESERVE ESTIMATES AND ROYALTY SHARE 4.0

This section develops estimates of oil and gas reserves in the state and the royalty share of these reserves. The reserve estimates are developed for low, mid and high cases. The low and mid estimates are based upon proven and probable reserves. The high estimates also contain undiscovered reserve estimates. The royalty share is based upon existing contracts and best estimates of future royalty contracts.

### RESERVE ESTIMATES 4.1

The estimated reserves for oil and gas are shown in Tables 4.1 and 4.2, respectively. The estimates are developed separately for Cook Inlet, the North Slope and "undiscovered" as different sources of information were drawn upon for each category.

#### Cook Inlet

Much information is available about the oil and gas reserves in the Cook Inlet area, and major new discoveries are not considered likely at this time. The reserves are assumed to remain constant for low, mid and high estimates. In addition, Cook Inlet reserves account for about 2% and 9% of the state's low and mid estimates of proven and probable oil and gas reserves, respectively. The high estimate of reserves further reduces the Cook Inlet share of total reserves to 1% and 6% respectively.

#### North Slope

Oil and gas reserve estimates for the North Slope are taken from a report to the Governor.(1) These estimates provide the low, mid and high proven and probable oil reserves on currently leased state onshore lands. These estimates were compiled from public information available to the author.

Current North Slope oil production is from the Sadlerochit reservoir in Prudhoe Bay Unit and the Kuparuk River reservoir in Kuparuk River Unit. The other fields and areas listed in the Van Dyke report are lumped together because production is not expected to begin until the mid to late 1980s.

(1) Van Dyke, W., Proven and Probable Oil and Gas Reserves, North Slope, Alaska, Division of Minerals and Energy Management, September 25, 1980, and personal communication 11/10/82.

Estimated Recoverable Oil Reserves (MMBBL) TABLE 4.1

| Location/Field | Reserve Estimate Low | Mid | High |
|---|---|---|---|
| Cook Inlet 1/ | | | |
| Beaver Creek | 1 | 1 | 1 |
| Granite Point | 35 | 35 | 35 |
| McArthur River | 90 | 90 | 90 |
| Middle Ground Shoal | 26 | 26 | 26 |
| Swanson River | 19 | 19 | 19 |
| Trading Bay | 4 | 4 | 4 |
| Subtotal | 175 | 175 | 175 |
| North Slope 2/ | | | |
| Prudhoe Bay, Sadlerochit Reservoir | 6,170 | 6,950 | 7,340 |
| Kuparuk | 600 | 1,000 | 1500 |
| Other North Slope | 1,090 | 1,580 | 2,375 |
| Subtotal | 7,860 | 9,530 | 11,215 |
| Undiscovered 3/ | | | 10,150 |
| Total | 8,035 | 9,705 | 21,540 |

1/ Alaska Oil and Gas Conservation Commission, 1981 Statistical Report.
2/ Van Dyke, W., Proven and Probable Oil and Gas Reserves, North Slope, Alaska, September 25, 1980, and personal communication 11/10/82.
3/ "NPC Sees Big U.S. Arctic Resources," Oil and Gas Journal, November 23, 1981; and "Estimates of Undiscovered Recoverable Resources of Conventionally Producible Oil and Gas in the United States, a Summary," U.S. Geological Survey, Open-File Report 81-192, 1981.

Estimated Recoverable Gas Reserves (BCF) TABLE 4.2

| Location/Field | Reserve Estimate Low | Mid | High |
|---|---|---|---|
| Cook Inlet 1/ | | | |
| Beaver Creek | 240 | 240 | 240 |
| Beluga River | 742 | 742 | 742 |
| Birch Hill | 11 | 11 | 11 |
| Falls Creek | 13 | 13 | 13 |
| Granite Point | 26 | 26 | 26 |
| Ivan River | 26 | 26 | 26 |
| Kenai | 1,109 | 1,109 | 1,109 |
| Lewis River | 22 | 22 | 22 |
| McArthur River | 90 | 90 | 90 |
| Middle Ground Shoal | 14 | 14 | 14 |
| Nicolai Creek | 17 | 17 | 17 |
| North Cook Inlet | 951 | 951 | 951 |
| 7North Fork | 12 | 12 | 12 |
| Sterling | 23 | 23 | 23 |
| Swanson River | 259 | 259 | 259 |
| Trading Bay | 13 | 13 | 13 |
| West Foreland | 20 | 20 | 20 |
| West Fork | 6 | 6 | 6 |
| Subtotal | 3,594 | 3,594 | 3,594 |
| North Slope 2/ | | | |
| Prudhoe Bay, Sadlerochit Resevoir | 29,000 | 29,000 | 29,000 |
| Other North Slope | 4,500 | 4,500 | 4,500 |
| Subtotal | 33,500 | 35,400 | 37,800 |
| Undiscovered 3/ | N/A | N/A | 15,000 |
| Total | 37,094 | 38,994 | 56,394 |

1/ Alaska Oil and Gas Conservation Commission, 1981 Statistical Report.

2/ Van Dyke, W., Proven and Probable Oil and Gas Reserves, North Slope, Alaska, September 25, 1980.

3/ "NPC sees Big U.S. Arctic Resources," Oil and Gas Journal, November 23, 1981; and U.S. Geological Survey, Estimates of Undiscovered Recoverable Resources of Conventionally Producible Oil and Gas in the United States, A Summary, Open-File Report 81-192, 1981.

No gas is currently exported from the North Slope. The Alaska Natural Gas Transportation System for carrying gas to the Lower 48 is targeted for completion in 1987 or 1988, but is problematic at this time. The pipeline capacity will then permit exports in the range of 2.0 to 2.4 Bcf per day, with an expected level of 2.0 Bcf per day.

Undiscovered (Resources)

Undiscovered oil and gas resources are taken as the simple average of the low estimates recently developed by the U.S. Geological Survey and the National Petroleum Council (NPC). The USGS estimates are for conventionally producible reserves based upon information available to USGS. The low USGS estimates of undiscovered oil and gas resources are 2.5 Billion barrels and 19.8 Tcf, respectively at the 95% confidence level. The NPC resources estimates were developed for yields on investment of 10% for oil and gas and 15% for oil. These estimates are 17.8 BBbl of oil that will yield a 15% return on investment and 10.1 Tcf of gas that will yield a 10% return on investment. The average low estimate of undiscovered resources is entered as the high estimate in this report in order to present a conservative estimate.

## ROYALTY SHARE 4.2

The royalty share assigned to each field may vary according to field ownership and the terms of the contract. The share used for the Cook Inlet fields and the Prudhoe Bay Sadlerochit Reservoir are taken from the "Disposition of the States Royalty Share of Its Oil and Gas," prepared by the Division of Minerals and Energy Management (Appendix A). The share for the other existing North Slope fields is set at 12.5% and at 0% for the undiscovered resources, due to the fact that not enough information is available to estimate what portion of undiscovered North Slope resources if any may be on state lands.

The royalty share of oil and gas reserves based upon these shares are presented in Tables 4.3 and 4.4, respectively. In the middle case the royalty oil available from Cook Inlet Fields is less than 2% of the State total reserves and about 5% for gas reserves.

Estimated Royalty Share of Oil (MMBL) TABLE 4.3

| Location/Field | Royalty Share Corresponding to Reserve Estimate | | |
|---|---|---|---|
| | Low | Mid | High |
| Cook Inlet | | | |
| Beaver Creek | | | |
| Granite Point | 4.4 | 4.4 | 4.4 |
| McArthur River | 11.2 | 11.2 | 11.2 |
| Middle Ground Shoal | 3.2 | 3.2 | 3.2 |
| Swanson River | | | |
| Trading Bay | 0.5 | 0.5 | 0.5 |
| Subtotal | 19.3 | 19.3 | 19.3 |
| North Slope | | | |
| Prudhoe Bay, Sadlerochit Reservoir | 771 | 869 | 918 |
| Kuparuk | 75 | 125 | 188 |
| Other North Slope | 136 | 198 | 297 |
| Subtotal | 982 | 1,192 | 1,403 |
| Undiscovered | N/A | N/A | 0 |
| Total | 1001.3 | 1211.3 | 1422.3 |

Estimated Royalty Share of Gas (BCF) TABLE 4.4

| Location/Field | Royalty Share Corresponding to Reserve Estimate Low | Mid | High |
|---|---|---|---|
| Cook Inlet | | | |
| Beaver Creek | | | |
| Beluga River | 56.0 | 56.0 | 56.0 |
| Birch Hill | | | |
| Falls Creek | | | |
| Granite Point | 3.3 | 3.3 | 3.3 |
| Ivan River | | | |
| Kenai | 22.9 | 22.9 | 22.9 |
| Lewis River | | | |
| McArthur River | 11.2 | 11.2 | 11.2 |
| Middle Ground Shoal | 1.8 | 1.8 | 1.8 |
| Nicolai Creek | 2.1 | 2.1 | 2.1 |
| North Cook Inlet | 118.9 | 118.9 | 118.9 |
| North Fork | | | |
| Sterling | .4 | .4 | .4 |
| Swanson river | | | |
| Trading Bay | 1.6 | 1.6 | 1.6 |
| West Foreland | | | |
| West Fork | | | |
| Subtotal | 218.2 | 218.2 | 218.2 |
| North Slope | | | |
| Prudhoe Bay, Sadlerochit Reservoir | 3,625 | 3,625 | 3,625 |
| Other North Slope | 563 | 800 | 1,100 |
| Subtotal | 4,188 | 4,425 | 4,725 |
| Undiscovered | N/A | N/A | 0 |
| TOTAL | 4,406.2 | 4,643.2 | 4,943.2 |

## ANALYSIS OF SURPLUS 5.0

Under reasonable assumptions about recoverable reserves and Alaskan consumption, the current inventory of both oil and gas is more than sufficient to meet the presently identifiable needs of Alaskans for the next 15 years. The state royalty share is also sufficient.

### LIQUID PETROLEUM 5.1

Table 5.1 shows that the cumulative 15-year Alaskan demand for liquid petroleum is approximately 525 million barrels of crude oil equivalent. This is equal to approximately half the reserves of royalty oil and is 5 percent of total reserves. No attempt has been made to compare petroleum products produced at Alaskan refineries with petroleum products consumed in the state. Currently the capacity of Alaskan refineries exceeds Alaskan consumption (about 81 thousand barrels per day), but the product mix which the refineries can produce does not match the product mix demanded. The resulting cross hauling of crude oil out of Alaska and refined products into the state is a common feature of petroleum markets in general and does not represent an inefficient distribution of refining capacity or mismatch of supply and demand.

Surplus Oil Calculation (Million Barrels) TABLE 5.1

| | Liquid Petroleum | | | | | |
|---|---|---|---|---|---|---|
| | Statewide | | North Slope | | Cook Inlet | |
| | Total | State Royalty | Total | State Royalty | Total | State Royalty |
| Recoverable Reserves 1/ | 9,705 | 1,211 | 9,530 | 1,192 | 175 | 19 |
| Estimated Production for remainder of 1982 2/ | 117 | 15 | 92 | 12 | 25 | 3 |
| Estimated Remaining Recoverable Reserves as of Jan. 1, 1983 | 9,588 | 1,192 | 9,438 | 1,180 | 150 | 16 |
| Item: Estimated Alaskan Consumption during 1982 3/ | 29 | - | - | - | - | - |
| Estimated Cumulative Alaskan Consumption from 1983 to 1997 (15 years) | 525 | - | - | - | - | - |
| Net Surplus (Deficit) | 9,063 | 667 | - | - | - | - |

1/ From Chapter 4. North Slope is as of 11/1/82. Cook Inlet is as of 1/1/82.

2/ Author's estimates. State royalty share is proportion of state royalty oil in total.

3/ From Chapter 3.

## NATURAL GAS 5.2

Table 5.2 shows that the cumulative 15-year Alaskan demand for natural gas is 3.943 trillion cubic feet of gas. This is approximately 85 percent of the state royalty share of gas in the current inventory at Cook Inlet and on the North Slope combined.

Since the transportation of natural gas normally requires a pipeline, particular markets for gas which are linked by pipeline to supplies are relevant for the determination of excess supply. Table 5.2 shows that there is a net surplus in both the Cook Inlet and North Slope markets. The Alaskan royalty share of Cook Inlet gas alone, however, is insufficient to meet the projected Cook Inlet requirements over the next 15 years.

## PROJECTIONS BEYOND CURRENT INVENTORY 5.3

We assume recoverable reserves represent a 15-year inventory of petroleum in the ground based upon historical reserve to production ratios. The idea of an inventory of reserves is based on the notion that because a very sizable investment is required to develop a petroleum reservoir into recoverable reserves, such developments will occur at a pace consistent with the growth in demand. Excessive reserves, like excessive inventories, result in excessive carrying costs to the oil companies.

Consequently, a 15 year time horizon for demand is also used in the analyses. As time passes, the growth in demand will stimulate the search for reserves to replace those produced, and markets will work to keep supply and demand in balance.

Surplus Gas Calculation (BCF) TABLE 5.2

| | Natural Gas | | | | | |
|---|---|---|---|---|---|---|
| | Statewide | | North Slope | | Cook Inlet | |
| | Total | State Royalty | Total | State Royalty | Total | State Royalty |
| Recoverable Reserves 1/ | 39,994 | 4,643 | 35,400 | 4,425 | 3,594 | 218 |
| Estimated Production for remainder of 1982 2/ | 213 | 13 | 11 | 1 | 202 | 12 |
| Estimated Remaining Recoverable Reserves as of Jan. 1, 1983 | 38,781 | 4,630 | 35,389 | 4,424 | 3,392 | 206 |
| Item: Estimated Alaskan Consumption during 1982 3/ | 203 | - | 64 | - | 139 | - |
| Estimated Cumulative Alaskan Consumption from 1983 to 1997 (15 years) | 3,943 | - | 1,507 | - | 2,436 | - |
| Net Surplus (Deficit) | 34,838 | 687 | 33,882 | 2,917 | 956 | (2,230) |

1/ From Chapter 4. North Slope is as of 11/1/82. Cook Inlet is as of 1/1/82.

2/ Total gas disposition net of reinjection, from Chapter 2. State royalty share is proportion of state royalty gas in total.

3/ From Chapter 3.

## SENSITIVITY OF RESULTS 5.4

The conclusions of this chapter are sensitive to several assumptions made in the analysis which may turn out to be incorrect. These are discussed in turn and shown in Table 5.3.

### Reserve Estimates

Because the low reserve estimates are quite similar to the mid-range estimates, the positive oil and gas surpluses are not significantly affected by using low reserve estimates.

### Economic Growth

Faster population growth will accelerate the use of liquid fuels more than natural gas because a larger portion of natural gas is used by large industrial users. Even so, the net surplus of petroleum liquids would be reduced only marginally by growth of population-related consumption at double the base case rate. Use of natural gas would expand by a smaller proportion.

### Export of Gas

To the extent natural gas is exported, it is unavailable for the local market. Cumulative exports over the next 15 years from current operations are projected to be 945 billion cubic feet. If the Pacific Alaska LNG facility were built to currently proposed specifications, it would annually export 160 billion cubic feet. With an assumed first year of operation of 1990, cumulative exports to California through 1997 would be 1,280 billion cubic feet. Combined exports to Japan and California would be 2,225 billion cubic feet, reducing reserves for instate use, and the net surplus, to 30,713 billion cubic feet. The net surplus in Cook Inlet under these assumptions becomes a net deficit.

### Susitna Hydro

If Susitna hydro is built according to the current schedule, it would begin to replace generation by natural gas and fuel oil in 1994. If natural gas use were cut back 75 percent beginning in that year, cumulative gas consumption would decline 182 billion cubic feet. Fuel oil use could be eliminated at a savings of 40 million gallons (about one million barrels).

Sensitivity Analysis of Net Surplus TABLE 5.3

| | Net Surplus | |
|---|---|---|
| | Liquid Petroleum (Million barrels) | Natural Gas (BCF) |
| Base case | 9,063 | 34,838 |
| Low reserve estimates | 7,393 | 32,938 |
| 50% increase in growth of population-related consumption | 8,997 | 34,538 |
| Export of LNG | N/C | 30,713 |
| Susitna hydro | 9,062 | 35,020 |
| Natural gas available in Fairbanks | 9,243 | 34,779 |

N/C = no change

## Natural Gas Availability in Fairbanks

If, by some means, natural gas became available in Fairbanks, all electricity generation and space heating might convert to gas. This could increase annual gas consumption for electricity generation by 6.3 billion cubic feet as coal and fuel oil use are backed out. Fuel oil use would fall by 10 million gallons annually.

Natural gas consumption for space heating would gradually replace fuel oil and coal and could capture 75 percent of the market. If gas became available in 1993 and captured this share of the market by 1997, gas consumption for space heat could increase 20.7 billion cubic feet and fuel oil consumption fall by 120 million gallons. The net surplus of gas would fall very marginally because of this.

| | |
|---|---|
| FIELD | Beluga River |
| LOCATION | Cook Inlet, onshore, west side |
| OWNER | Chevron, ARCO, Shell |
| OPERATOR | Chevron |
| LEASES | State ADL: 17592, 17599, 17658, 21126, 21127, 21128, 21129<br>Federal AO: 29656, 29657 |

| | OIL | GAS<br>CASINGHEAD GAS | GAS WELL |
|---|---|---|---|
| BEGAN OPERATION 1/68 | | | |
| CUMULATIVE PRODUCTION AS OF 7/31/82 | BBL | MCF | 135,481,681 MCF |
| AVERAGE MONTHLY PRODUCTION 1-7/82 | BBL | MCF | 1,539,061 MCF |
| ESTIMATED RESERVES AS OF 7/31/82 | BBL | MCF | 742 BCF |
| ESTIMATED PERCENT OF FIELD DEPLETED AS OF 7/31/82 | % | % | 16% |
| ROYALTY 12.5%, Effective rate: 7.555% | | | |
| PURCHASER Chugach Electric | BBL | MCF RIV: | $ 0.20 MCF |

## Current Status

Chugach Electric is the only current purchaser of this gas. It is understood that Pacific Alaska LNG has contracted to purchase gas from this field in the future. Enstar has recently purchased gas under contract from Shell and tentatively plans to build a pipeline through the Mat-Su Valley to Anchorage.

Chugach Electric uses this gas for power generation which is delivered to the Anchorage market.

There is no gas pipeline currently available to deliver gas from this field to any other market.

Other than Chugach, there is no current purchaser for the State's royalty share. Due to the existence of several Federal leases, the State's effective royalty share is 7.55%, which resulted from a reallocation of the royalty ownership. The reallocation was due to changing the ownership determination from surface acreage to reservoir percentage.

| | |
|---|---|
| FIELD | Granite Point |
| LOCATION | Cook Inlet, offshore, west side |
| OWNER | ARCO, Chevron, Amoco, Getty, Phillips, Union, Superior, Texaco, Mobil |
| OPERATOR | Amoco, Texaco, ARCO, Union |
| LEASES | State ADL: 17586, 17587, 17597, 18742, 18761, 18776, 35431 |

| | OIL | GAS | |
|---|---|---|---|
| | | CASINGHEAD GAS | GAS WELL |
| BEGAN OPERATION 12/67 | | | |
| CUMULATIVE PRODUCTION AS OF 7/31/82 | 89,571,680 BBL | 79,384,772 MCF | MCF |
| AVERAGE MONTHLY PRODUCTION 1-7/82 | 292,152 BBL | 255,078 MCF | MCF |
| ESTIMATED RESERVES AS OF 1/1/82 | 35 MMBBL | 26 BCF | BCF |
| ESTIMATED PERCENT OF FIELD DEPLETED AS OF 7/82 | 73% | 77% | % |
| ROYALTY 12.5% | | | |
| PURCHASER Tesoro | RIK: $28.66 BBL | RIV: $ . MCF | RIV: $ . MCF |
| Amoco Platform* | | RIV: $0.10 MCF | |
| ARCO* | | RIV: $0.118 MCF | |
| Union* | | RIV: $0.10 MCF | |

*small amount of casinghead gas sold to Amoco for use on platform.

## Current Status

All Royalty oil produced from this field is taken in kind and sold to Tesoro-Alaska Petroleum Company.

Gas produced from this field was formerly flared. DOGC Flaring Order Number 194 dated June 30, 1971, has prohibited flaring since July 1, 1972, and this gas is now recovered and used locally.

| | |
|---|---|
| FIELD | Kenai |
| LOCATION | Cook Inlet, onshore, east side |
| OWNER | Union, Marathon, ARCO, Chevron |
| OPERATOR | Union |
| LEASES | State ADL: 00593, 00594, 00588, 02411, 02497, 308223, 324598 |
| | Federal AO: 28047, 28055, 28056, 28103, 28140, 28142, 28143 |

| | OIL | GAS | |
|---|---|---|---|
| | | CASINGHEAD GAS | GAS WELL |
| BEGAN OPERATION 1/62 | | | |
| CUMULATIVE PRODUCTION AS OF 7/31/82 | BBL | MCF | 1,265,649,770 MCF |
| AVERAGE MONTHLY PRODUCTION 1-7/82 | BBL | MCF | 9,413,658 MCF |
| ESTIMATED RESERVES AS OF 1/1/82 | BBL | BCF | 1,109 BCF |
| ESTIMATED PERCENT OF FIELD DEPLETED AS OF 7/82 | % | % | 55% |

| | | | | | |
|---|---|---|---|---|---|
| ROYALTY | 12.5%, Effective rate: Kenai, 2.06879%; Kenai Deep, 0.0% | | | | |
| PURCHASER | City of Kenai | $ . BBL | $ . MCF | RIV: | $0.29 MCF |
| | Union Chemical Corp. | | | | $0.53 |
| | Marathon LNG | | | | $2.02 |
| | Alaska Pipeline | | | | $0.605 |
| | Rental gas (Swanson River oil field) | | | | $0.18 |
| | Chevron Refining | | | | $0.605 |
| | Union-Chevron exchange | | | | $0.605 |
| | | | Weighted average | | $0.526 |

* Natural gas liquids

## Current Status

The Kenai Unit provides most of the gas sales in the Cook Inlet area. The estimated quantity of Alaska State royalty gas sales amounts to approximately 195,000 MCF as of 1982. The State does not receive the full 12 1/2% royalty share because of the predominance of Federal leases in the unit and the recent conveyance of land to Cook Inlet Region Incorporated. The price the State received for its royalty share results from prices paid under existing contracts between the lessees and their purchasers.

FIELD Kuparuk River
LOCATION North Slope, onshore
OWNER ARCO, BP, Chevron, Mobil, Phillips, Sohio, Union
OPERATOR ARCO
LEASES State ADL: See following page.

| | OIL | GAS | |
|---|---|---|---|
| | | CASINGHEAD GAS | GAS WELL |
| BEGAN OPERATION 12/81 | | | |
| CUMULATIVE PRODUCTION AS OF 7/31/82 | 19,766,184 BBL | 3,984,797 MCF | MCF |
| AVERAGE MONTHLY PRODUCTION 1-7/82 | 2,666,960 BBL | 481,137 MCF | MCF |
| ESTIMATED RESERVES AS OF 1/1/82 | 1,000 MMBBL* | 206 BCF | BCF |
| ESTIMATED PERCENT OF FIELD DEPLETED AS OF 7/82 | 2% | 1% | |
| ROYALTY 12.5% | | | |
| PURCHASER NONE | RIV: $17.015 BBL | RIV: $2.71 MCF | RIV: $ . MCF |

*source: William Van Dyke, personal communication, 1982.

Field Kuparuk River
Leases State ADL:

25512, 25513, 25519, 25520, 25521, 25522, 25523, 25531, 25547, 25548, 25569, 25570, 25571, 25585, 25586, 25587, 25588, 25589, 25590, 25603, 25604, 25605, 25628, 25629, 25630, 25631, 25632, 25633, 25634, 25635, 25636, 25637, 25638, 25639, 25640, 25641, 25642, 25643, 25644, 25645, 25646, 25647, 25648, 25649, 25650, 25651, 25652, 25653, 25654, 25655, 25656, 25657, 25658, 25659, 25660, 25661, 25664, 25665, 25666, 25667, 25668

| | |
|---|---|
| FIELD | McArthur River |
| LOCATION | Cook Inlet, offshore, west side |
| OWNER | Union, ARCO, |
| OPERATOR | Union |
| LEASES | State ADL: 17519, 17594, 17602, 18716, 18729, 18730, 18758, 18772 18777, 21068 |

| | OIL | GAS | |
|---|---|---|---|
| | | CASINGHEAD GAS | GAS WELL |
| BEGAN OPERATION 12/69 | | | |
| CUMULATIVE PRODUCTION AS OF 7/31/82 | 466,923,271 BBL | 147,029,282 MCF | 87,071,920 MCF |
| AVERAGE MONTHLY PRODUCTION 1-7/82 | 1,297,273 BBL | 522,646 MCF | 724,152 MCF |
| ESTIMATED RESERVES AS OF 1/1/82 | 90 MMBBL | 27 BCF | 63 BCF |
| ESTIMATED PERCENT OF FIELD DEPLETED AS OF 7/82 | 85% | 86% | 60% |
| ROYALTY 12.5% | | | |
| PURCHASER Tesoro | RIK: $28.04 BBL | RIV: $ . MCF | RIV: $ . MCF |

Current Status

All Royalty oil produced from this field is taken in kind and sold to Tesoro-Alaska Petroleum Company.

Gas Produced from this field is casinghead gas and was formerly flared. DOGC Flaring Order Number 104 dated June 30, 1971 has prohibited flaring since July 1, 1972, and this gas is now recovered and used locally.

FIELD Middle Ground Shoals
LOCATION Cook Inlet, offshore, east side
OWNER Amoco, ARCO, Chevron, Getty, Phillips, Shell
OPERATOR Shell, Amoco
LEASES State ADL: 17595, 18744, 18746, 18754, 18756

| | OIL | GAS | |
|---|---|---|---|
| | | CASINGHEAD GAS | GAS WELL |
| BEGAN OPERATION 9/67 | | | |
| CUMULATIVE PRODUCTION AS OF 7/31/82 | 135,887,301 BBL | 66,666,495 MCF | 34,812 MCF |
| AVERAGE MONTHLY PRODUCTION 1-7/82 | 303,298 BBL | 188,355 MCF | MCF |
| ESTIMATED RESERVES AS OF 1/1/82 | 26 MMBBL | 14 BCF | BCF |
| ESTIMATED PERCENT OF FIELD DEPLETED AS OF 7/82 | 85% | 84% | % |
| ROYALTY 12.5% | | | |
| PURCHASER Tesoro | RIK: $28.17 BBL | RIV: $ . MCF | RIV: $ . MCF |

## Current Status

All Royalty oil produced from this field is taken in kind and sold to Tesoro-Alaska Petroleum Company.

Gas produced for this field is casinghead gas and was formerly flared. DOGC Flaring Order Number 104 dated June 30, 1971, has prohibited flaring since July 1, 1972, and this gas is now recovered and used locally.

Recent increases in gas prices may encourage a reevaluation of this gas.

| | |
|---|---|
| FIELD | Nicolai Creek |
| LOCATION | Cook Inlet, onshore - offshore, west side |
| OWNER | Texaco, Superior |
| OPERATOR | Texaco |
| LEASES | State ADL: 17585, 17598, 63279<br>Federal AO: 34161 |

| | OIL | GAS | |
|---|---|---|---|
| | | CASINGHEAD GAS | GAS WELL |
| BEGAN OPERATION 10/68 | | | |
| CUMULATIVE PRODUCTION AS OF 7/31/82 | BBL | MCF | 1,062,055 MCF |
| AVERAGE MONTHLY PRODUCTION 1-7/82 | BBL | MCF | MCF |
| ESTIMATED RESERVES AS OF 1/1/82 | BBL | BCF | 17 BCF |
| ESTIMATED PERCENT OF FIELD DEPLETED AS OF 7/82 | % | % | 6% |
| ROYALTY 12.5% | | | |
| PURCHASER Amoco | $ . BBL | $ . MCF | RIV: $0.15 MCF |

## Current Status

Gas from this small field, when produced, is used only to provide fuel for platform and shore facilities supporting petroleum production in this area. However, at the present time, there is no production. At this time, there is no prospective purchaser for the State's royalty share.

FIELD North Cook Inlet
LOCATION Cook Inlet, offshore, mid-channel
OWNER Phillips
OPERATOR Phillips
LEASES State ADL: 17589, 17590, 18740, 18741, 37831

| | OIL | | GAS | | GAS |
|---|---|---|---|---|---|
| | | | CASINGHEAD GAS | | GAS WELL |
| BEGAN OPERATION 3/69 | | | | | |
| CUMULATIVE PRODUCTION AS OF 7/31/82 | | BBL | | MCF | 572,856,539 MCF |
| AVERAGE MONTHLY PRODUCTION 1-7/82 | | BBL | | MCF | 3,403,286 MCF |
| ESTIMATED RESERVES AS OF 1/1/82 | | BBL | | BCF | 951 BCF |
| ESTIMATED PERCENT OF FIELD DEPLETED AS OF 7/82 | | % | | % | 38% |
| ROYALTY 12.5% | | | | | |
| PURCHASER Alaska Pipeline | $ . | BBL | $ . | MCF | RIK: $3.033 MCF |
| Phillips | $ . | BBL | $ . | MCF | RIV: $0.4165725 MCF |

## Current Status

Gas from this offshore field is primarily delivered to the Phillips LNG plant and subsequently sold in Japan. However, in 1977, the State entered into agreements with Phillips and Alaska Pipeline Company to sell the royalty share to Alaska Pipeline Company for delivery to the Alaska market. Royalty gas not purchased by Alaska Pipeline Company is taken by Phillips.

| | |
|---|---|
| FIELD | Prudhoe Bay |
| LOCATION | North Slope, onshore |
| OWNER | Amerada-Hess, ARCO, BP, Chevron, Exxon, Getty LL&E, Marathon, Mobil, Phillips |
| OPERATOR | ARCO, Sohio |
| LEASES | See following page. |

| | OIL | GAS: CASINGHEAD GAS | GAS: GAS WELL |
|---|---|---|---|
| BEGAN OPERATION 10/69 | | | |
| CUMULATIVE PRODUCTION AS OF 7/31/82 | 2,418 MMBBL | 255,760,068 MCF | MCF |
| AVERAGE MONTHLY PRODUCTION 1-7/82 | 46,462,764 BBL | 4,788,212 MCF | MCF |
| ESTIMATED RESERVES AS OF 7/3/82 | 6,950* MMBBL | 28,778 BCF | BCF |
| ESTIMATED PERCENT OF FIELD DEPLETED AS OF 7/82 | 26% | 1% | % |
| ROYALTY 12.5% | | | |
| PURCHASER Tesoro | RIK: $28.04 BBL | RIV: $ . MCF | RIV: $ . MCF |

* William Van Dyke, personal communication, 1982

## Current Status

Small quantities of casinghead gas are presently being sold to the owners of the Trans-Alaska Pipeline. The State is receiving royalty in value with the gas price being set by the owners of the gas cap. There presently is no other market. The State's share of sales is 12 1/2%.

The State's royalty share of the oil produced is 12 1/2% with 14.9% of this share presently being taken in kind and sold to North Pole Refinery, and Golden Valley Electric Assn. The State requested that an additional 35.5178% of the State's share be taken in kind, which goes to Tesoro Alaska Petroleum Company. The remainder is taken in value.

Field: Prudhoe Bay
Leases: State ADL:

28238, 28239, 28240, 28241, 28241, 28244, 28245, 28246, 28257, 28257, 28258, 28260, 28261, 28262, 28262, 28263, 28263, 28264, 28265, 28277, 28278, 28279, 28280, 28281, 28282, 28283, 28284, 28285, 28286, 28287, 28288, 28289, 28289, 28290, 28299, 28300, 28301, 28302, 28303, 28304, 28305, 28306, 28307, 28308, 28309, 28310, 28311, 28312, 28313, 28314, 28315, 28316, 28316, 28320, 28321, 28322, 28323, 28324, 28325, 28326, 28327, 28328, 28329, 28330, 28331, 28332, 28333, 28334, 28334, 28335, 28339, 28343, 28344, 28345, 28346, 28349, 34628, 34629, 34630, 34631, 34632, 47446, 47447, 47448, 47449, 47450, 47451, 47452, 47453, 47454, 47469, 47471, 47472, 47475, 47476

| | |
|---|---|
| FIELD | Sterling |
| LOCATION | Cook Inlet, onshore, east side |
| OWNER | Union, Marathon |
| OPERATOR | Union |
| LEASES | State ADL: 02497, 320912, 324599 |

| | OIL | GAS | |
|---|---|---|---|
| | | CASINGHEAD GAS | GAS WELL |
| BEGAN OPERATION 5/62 | | | |
| CUMULATIVE PRODUCTION AS OF 7/31/82 | BBL | MCF | 2,024,290 MCF |
| AVERAGE MONTHLY PRODUCTION 1-7/82 | BBL | MCF | 1,986 MCF |
| ESTIMATED RESERVES AS OF 1/1/82 | BBL | BCF | 23 BCF |
| ESTIMATED PERCENT OF FIELD DEPLETED AS OF 7/82 | % | % | 8% |
| ROYALTY | 12.5%, Effective rate,1.55461% | | |
| PURCHASER | Sport Lake Greenhouse $ . BBL | $ . MCF | $0.40 MCF |

STERLING

Statistics relating to this field are shown on the attached table.

Current Status

Since Federal and Cook Inlet Region Inc. leases are involved, the state's royalty share is approximately 1.6%. The only gas sold from this field is consumed locally. There is no gas pipeline currently available to deliver this gas from this field to any other market. Because of limited reserves, there is no current prospect of additional markets.

FIELD Trading Bay
LOCATION Cook Inlet, offshore, west side
OWNER Marathon, Union
OPERATOR Union
LEASES State ADL: 18731

| | OIL | GAS | |
|---|---|---|---|
| | | CASINGHEAD GAS | GAS WELL |
| BEGAN OPERATION 12/67 | | | |
| CUMULATIVE PRODUCTION AS OF 7/31/82 | 83,352,631 BBL | 53,929,018 MCF | 469,236 MCF |
| AVERAGE MONTHLY PRODUCTION 1-7/82 | 120,092 BBL | 98,359 MCF | 24,770 MCF |
| ESTIMATED RESERVES AS OF 1/1/82 | 4 MMBBL | 3 BCF | 10 BCF |
| ESTIMATED PERCENT OF FIELD DEPLETED AS OF 7/82 | 96% | 96% | 5% |
| ROYALTY 12.5% | | | |
| PURCHASER Tesoro | RIK: $26.43 BBL* | RIV: $ . MCF | RIV: $ . MCF |

*weighted average.

## Current Status

All Royalty oil produced from this field is taken in kind and sold to Tesoro-Alaska Petroleum Company.

Gas produced for this field is casinghead gas and was formerly flared. DOGC Flaring Order Number 104 dated June 30, 1971, has prohibited flaring since July 1, 1972, and this gas is now recovered and used locally.

# DEMAND PROJECTION METHODOLOGY

# APPENDIX B

Demand for oil and gas is best calculated if divided into use categories because of similarity in the factors affecting the level and growth rate of demand by use. In addition, oil and gas often compete with one another in a market for a particular use, such as space heating or electricity generation. The use categories in this study are transportation, electricity, space heat, and industrial.

The factors most important in projecting future demand will vary by use category. In general, the most important are population (households) and relative fuel prices. The household is the basic consuming unit for the residential sectors and is a good proxy for demand in the commercial sector. In the industrial sector, relative fuel prices is the primary demand determinate; while in the residential and commercial sectors, fuel prices are more important in determining the type of fuel used.

## TRANSPORTATION USE OF LIQUID PETROLEUM B.1

The method of projecting transportation fuel use is with consumption per capita coefficients.

### Gasoline

a. Highway use (taxable & exempt) is the largest category of gasoline consumption in Alaska. Historically, demand is related to population, personal income, and the fuel efficiency of the automobile stock. In Alaska, growth in the first two factors will tend to offset the effect of increased fuel efficiency in future years resulting in aggregate growth in use of this fuel. Nationally, per capita consumption of gasoline has fallen in recent years. We assume a continuation of this per capita trend for Alaska. Demand is projected using a per capita coefficient which declines one percent annually from the previous year. 1981 consumption was 444 gallons per capita.

b. Aviation gasoline (taxable and exempt) use has, in the past decade, been roughly 10 percent as large as highway gasoline use. The sharp decline in 1982 is probably a reporting error. We assume that a strong income elasticity of demand for general aviation will result in a maintenance of the current per capita use coefficient in future years. 1981 consumption was 44.7 gallons per capita.

c. Marine gasoline (taxable and exempt) use has, in the past decade, been roughly 50 percent of the aviation gasoline consumption level with an apparently slightly slower growth rate. We assume a strong income elasticity of demand will result in maintenance of the current per capita use coefficient in future years. 1981 consumption was 18 gallons per capita.

Jet Fuel

Jet fuel consumption consists of domestic commercial operations, international commercial operations, and military operations. Domestic commercial operations is a function of the Alaskan population and economy and as such has grown rapidly in per capita terms historically (taxable). International commercial operations are a function of world economic and political conditions as well as aviation technology. Military operations are broadly a function, albeit a different one, of the same factors. These two later categories, accounting for about 2/3 of jet fuel consumption, cannot be separately identified in the historical data, but their combined total has shown relatively modest, although cyclical, growth since the early 1970s.

Using 1981 as a base (since that is the last year for which domestic commercial jet fuel consumption can be separately identified in the data), we project domestic commercial consumption separately from international commercial and military. The coefficient relating consumption to population for domestic commercial aviation has increased from 161 to 316 gallons per capita since 1971.

We assume future growth will exceed population but at a slower rate because of increased efficiency of the capital stock. The coefficient grows by three percent annually.

Variation in international commercial and military consumption is difficult to project. Growth during the preceding decade approximated one percent per annum. We use this figure to project future growth.

Diesel

The categories used to report diesel fuel sales in Department of Revenue tax records have changed at least twice since 1979, making use of this source of data for projecting highway diesel consumption (or any type of consumption) difficult. The difficulties are that "exempt highway fuel" includes some nontransport fuel use and "off highway fuel" includes an unknown portion of electrical utility fuel use and space heating use (see Table B.1).

State Consumption of
Motor Vehicle Diesel Fuel 1/ (Million Gallons) TABLE B.1

| Year | Total | Highway Taxable | Highway Exempt | Off Highway Exempt | Other Taxable Highway |
|---|---|---|---|---|---|
| 1971 | 107 | 35 | 72 | - | - |
| 1972 | 84 | 29 | 55 | - | - |
| 1973 | 114 | 25 | 89 | - | - |
| 1974 | 166 | 66 | 100 | - | - |
| 1975 | 204 | 133 | 71 | - | - |
| 1976 | 205 | 140 | 65 | - | - |
| 1977 | 144 | 99 | 45 | - | - |
| 1978 | 156 | 102 | 54 | - | - |
| 1979 | 269 | 57 | 69 | 81 | 92 |
| 1980 | 302 | 65 | 24 | 97 | 117 |
| 1981 | 336 | 36 | 22 | 103 | 75 |
| 1982 | 380 | 19 | 19 | 142 | 0 |

1/ Department of Revenue, Tax Records

We assume 1982 highway sales (taxable and exempt) represent all highway transport use of diesel and no nontransport use. Future growth in consumption is projected at the current per capita use rate of 512.9 gallons. "Off highway fuel" use and "other taxable highway" as reported by the Department of Revenue are components of utility and space heat fuel use. Projections of these uses of diesel fuel are separately calculated (see below).

Marine diesel use is roughly one quarter that of highway diesel. Its use displayed very rapid growth in the mid 1970s and now appears to be stabilizing. We assume a constant per capita level of consumption of 127.8 gallons.

Regional Allocation

Regional allocations of transportation fuels are made on the same basis as the allocations of historical consumption in Chapter 2.

## ELECTRIC UTILITY USE OF LIQUID FUELS AND NATURAL GAS B.2

Electric utility use of oil and gas is a derived demand based upon the demand for electricity and the methods used to generate it. We project this use of liquid fuels and natural gas by first estimating electricity demand for space heating and nonspace heating uses, then determining the proportion generated by fuel oil and natural gas and, finally, determining demand based upon the efficiency of generation (heat rate). Since the electricity generation alternatives vary by region in Alaska, we project fuel use by three major regions of the state.

### Railbelt

a. Consumption

The space heating and nonspace heating components of electricity consumption per capita in the railbelt are based upon the Railbelt Electricity Demand Model (Table B.2) updated to estimated 1982 electricity consumption levels.

Rail Belt Consumption of Electricity
Net of Space Heating

TABLE B.2

| | Consumption 1/ (MWH) | Population | Consumption per Capita (KWH) |
|---|---|---|---|
| 1980 | 1498 | 284,392 | 5265 |
| 1985 | 2059 | 341,169 | 6035 |
| 1990 | 2355 | 370,445 | 6350 |
| 1995 | 3091 | 421,983 | 7325 |
| 2000 | 3866 | 472,551 | 8180 |

1/ Total consumption in medium case minus twice the residential space heating consumption, Electric Power Consumption for the Railbelt; Goldsmith and Huskey, ISER 1980.

Non-space heating railbelt electricity consumption per capita is projected to grow according to the growth in Table B.2.

Electricity consumption for space heating depends upon population growth but also upon two other factors: )1) the extension of the gas utility into the Matanuska Valley, and (2) the completion of the electric intertie between Anchorage and Fairbanks. The former will result in a portion of existing structures utilizing natural gas rather than electricity for space heating. This will slow the growth rate of electricity use but increase the use of utility gas. The second factor may alter the relative price of electricity in both Anchorage and Fairbanks relative to natural gas and fuel oil.

We assume the gas utility will extend their market into the Matanuska Valley and aggressively market their gas for space heating. Market penetration begins in 1985, and during the next five years the electric space heating market in the Matanuska Valley falls to half its current share. Subsequent to that, it resumes the growth rate of per capita space heating consumption.

We assume the completion of the Anchorage-Fairbanks intertie does not significantly alter the price of electricity faced by consumers in either location. In particular, there is no shift towards electric space heating in Fairbanks as a result of the tie-in to the inexpensive gas-fired electricity from Anchorage.

b. Mode Split: Future additions to capacity within the projection period are all gas-fired turbines. Incremental generation in Anchorage is entirely natural gas. Incremental generation in Fairbanks will depend upon the cheaper of the cost of purchased electricity from Anchorage generated by natural gas and the marginal cost of locally produced electricity generated by fuel oil. We assume electricity moves in both directions in the line at different times. Fairbanks excess capacity provides reserves to Anchorage and cheap Anchorage generation provides off peak electricity to Fairbanks. Incremental generation in Fairbanks comes from Anchorage produced electricity. The following exceptions modify these rules:

    1. Coal-fired generation in Fairbanks remains constant at 354 thousand MWH annually.

    2. Bradley Lake comes on line in 1988 and produces 300 thousand MWH annually. This backs out 4.5 billion cubic feet of natural gas annually.

    3. Solomon Gulch comes on line in 1982 with a firm annual energy of 55 thousand MWH. This backs out 3 million gallons of fuel oil annually.

    Heat rates are projected to remain at current levels.

Southeast

a. Consumption

The growth rate in consumption per capita in Southeast is assumed to be the same rate as in the railbelt. The advent of less expensive electricity provided by hydroelectric power may cause electric space heating demand to grow and accelerate that growth rate. We assume this effect is insignificant.

b. Mode Split

As hydroelectric projects, now in the planning stage or under construction, are brought on line, they will back out the use of fuel oil in electricity generation in those locations linked to the hydro power. The schedule of hydroelectric projects assumed is as shown in Table B.3.

Scheduled Southeast Alaska Hydroelectric Projects TABLE B.3

| Name | Location | Scheduled Completion | Capacity (MW) | Annual Energy (MWH) |
|---|---|---|---|---|
| Swan Lake | Ketchikan | 1984 | 22 | 103 |
| Tyee Lake | Wrangell/Petersburg | 1985 | 20 | 133 |

## Rest-of-State

The rest of the state, with the exception of Barrow, currently relies on fuel oil for electricity generation. This dependence is projected to continue into the future with the exception of Kodiak, which will have some hydropower available in 1985 when the Terror Lake project is completed. This will provide 132 thousand MWH of firm annual energy.

Growth in per capita electricity demand is assumed to occur at twice the rate projected for the railbelt.

In the Anchorage area, natural gas is the most economical fuel for space heating. Elsewhere fuel oil is least expensive except where electricity generated by natural gas is available. In projecting future demands, we use different procedures for gas and fuel oil. Natural gas is based upon a projection of the current level of consumption. Fuel oil demand is estimated based upon the proportion of the population assumed to heat with fuel oil. This is necessitated because there is no reliable direct estimate of current fuel oil consumption for space heating.

Railbelt

Natural gas for space heating (and a small amount of related uses for gas purchased from utilities) is projected to grow as a function of population. Growth historically has occurred at a rate in excess of population due to gas retrofiting and expansion of the commmercial sector. This trend will moderate in the future, and growth is projected to exceed population by two percent annually.

In addition, a new market will open in the Matanuska Valley in 1985. We estimate that by 1990, one-half of the building stock in the Matanuska Valley will utilize natural gas for space heating. The resulting demand level is estimated on a per capita basis. Currently total natural gas consumption (residential plus commercial) per capita for the gas using population is 113 mcf. The proportion of railbelt population heating with gas is 47 percent. This factor forms the basis for estimating the growth of space heating demand for natural gas in the Matanuska Valley.

Fuel oil use for space heating is generally preferred only where gas or gas-fired electricity is not available. Growth in its use will depend upon the location of new structures in the railbelt. We assume consumption grows at one percent in excess of the rate of population increase. The base, from which this growth is projected, is the per capita gas consumption figure converted to fuel oil on the basis of BTU equivalency. The proportion of railbelt population dependent upon fuel oil for space heating is estimated to be 12 percent.

1/ Includes water heating, cooking, and other minor uses.

## Nonrailbelt

Outside the railbelt, space heating is almost entirely provided by fuel oil, with the exception of Barrow. Growth in consumption is assumed to occur two percent faster than population due to a continuation in the decline of average household size and upgrading of the average size and number of structures relative to population. The same growth rate is applied to gas use in Barrow.

The base from which growth is projected is the same per capita coefficient of fuel oil use for space heating used for the railbelt population. This estimate is consistent with surveys and small region studies of fuel oil use in rural Alaska. This estimate entails compensating errors. On the one hand, the heating degree days are greater in most parts of the state which rely on fuel oil relative to Anchorage. On the other hand, the stock of structures is smaller outside Anchorage.

## INDUSTRIAL USE OF LIQUID FUELS AND NATURAL GAS B.4

Industrial consumption is not a function of population, but rather of the availability of supplies and market opportunities. Since the major industrial users of petroleum fuels are small in number, they are best projected on a case by case basis.

### Ammonia Urea Production

Ammonia Urea production using natural gas is assumed to continue at a constant level.

### Petroleum Production Related Use

a. Gas Use in Production

Natural gas is utilized in petroleum production in Cook Inlet and on the North Slope for a variety of purposes, including space heating, electricity generation, pump fuel, etc. The level of consumption is difficult to project because of its many uses, but is primarily dependent upon petroleum production levels and petroleum employment levels. We assume the level remains constant in Cook Inlet. On the North Slope it grows seven percent annually for ten years and is constant thereafter.

b. Oil Use in Production

A small quantity of fuel oil is used in oil production. This is included in the miscellaneous industrial category.

c. Gas Use in Transportation

Included in gas use in production.

d. Transportation-Oil

Fuel oil fuels the pumps for most of the Alyeska pipeline. Annual consumption is estimated to be two million barrels of oil. This level is projected to remain constant.

e. Oil-Miscellaneous

Some fuel oil is used in electricity generation for industrial self-supplied power. This amount, taken from Alaska Power Administration, is projected to remain constant.

f. Military

The military uses natural gas for electricity generation and space heating in the Anchorage area and fuel oil elsewhere. Military transportation use of fuel oil is counted in the transportation sector. Military natural gas use is projected to remain constant. Lack of data prevents the calculation of military fuel oil consumption for space heating.

Injection

Gas is injected into petroleum reservoirs to enhance oil recovery. Because this is only a temporary use of gas, it is not counted a part of final consumption.

## PROCESSING PLANTS

| REFINERY | PLANT CAPACITY | DATE PLANT IN OPERATION | DATE EXPANSION | PLANT PRODUCT | DESTINATION |
|---|---|---|---|---|---|
| NIKISKI<br>Chevron Refinery | 18,000 BPD, North Slope Crude | 1962 | | JP4, Furnace Oil, Diesels, Fuel Oil, Asphalt, Unfinished Gasoline. | JP4, JA50, Furnace Oil, Diesels, and Asphalt for Alaska; Unfinished Gasoline, High Sulfur Fuels to Lower-48 states. |
| Tesoro Refinery | 45,500 BPD | 1969 (17,500 BPD) | 1974,1975,1977 1980(7500 BPD Hydrocracker Unit.) | Propane, Unleaded, Regular, and Premium Gasoline, Jet A, Diesel Fuel, No. 2 Diesel, JP 4 and No. 6 Fuel Oil. | Alaska except No. 6 Fuel Oil to Lower-48 states. |
| Union Chemical Division | Ammonia 1,100,000 tons/yr Urea 1,000,000 tons/yr | 1969 | 1977 | Anhydrous Ammonia, Urea Prills and Granules. | West Coast and export by tanker and bulk freighter. |
| INTERIOR ALASKA<br>North Pole Refinery | 46,600 BPD | 1977 | Fall 1980 | Military Jet Fuel (JP4), 3000-4000 BPD; Commercial Jet Fuel, 5000-6500 BPD; Diesel/Heating Fuel No. 1, 1000-1500 BPD; Diesel/Heating Fuel No. 2, 1800-2500 BPD, Diesel Fuel Type No. 4, 600-1800 BPD. | Fairbanks area, Nenana and river villages, Eilson AFB. |

## TRASPORTATION FACILITIES

| | | | | | |
|---|---|---|---|---|---|
| Phillips-Marathon LNG | 230,000 MCF/Day | 1969 | | Liquified Natural Gas. | Japan, by tanker, 2 tankers capacity 71,500 cubic meters each, avg. one ship every 10 days. |
| Pacific Alaska LNG | 200,000 MCF/Day initial 400,000 MCF/Day (2nd yr) | Planned 1986 | | Liquified Natural Gas. | Southern California one ship every 13 days. |

Trans-Alaska Pipeline Statistics [1/]

| 1982 | Pump Sta. 1 Throughput | Closing Valdex Storage | # Ships | Ship Cargo | Ship Liftings |
|---|---|---|---|---|---|
| January | 50,385,826 | 6,130,687 | 61 | 811,669 | 49,511,820 |
| February | 45,548,631 | 5,242,503 | 53 | 852,308 | 45,172,305 |
| March | 50,379,849 | 2,919,529 | 65 | 800,744 | 52,048,334 |
| April | 48,431,614 | 1,721,105 | 64 | 765,986 | 49,023,096 |
| May | 50,583,201 | 4,519,692 | 56 | 840,479 | 47,066,819 |
| June | 47,693,327 | 3,679,775 | 56 | 855,928 | 47,931,968 |
| July | 50,739,029 | 3,499,471 | 60 | 836,602 | 50,196,146 |
| August | 50,191,592 | 3,365,599 | 58 | 854,876 | 49,582,797 |
| Sept. | 48,998,195 | 6,790,667 | 52 | 863,280 | 44,890,561 |
| October | 50,404,233 | 5,832,173 | 61 | 829,994 | 50,629,644 |
| November | 48,082,928 | 4,061,822 | 61 | 806,667 | 49,206,687 |
| December | 49,703,120 | 4,785,900 | 59 | 804,102 | 47,441,992 |
| TOTAL | 591,141,545 | | 706 | | 583,370,439 |
| Average Month | 49,261,795 | | 59 | 826,886 | 48,614,203 |

[1/] Personal communication with Alyeska Pipeline Service.

Economic projections for estimating future petroleum demands are particularly difficult to develop this year because of the unsettled nature of both the world oil market and the national economy. The former makes it difficult to project activity in the petroleum industry, the most important basic sector industry in the economy, and activity generated by state government spending, which is primarily a function of the availability of petroleum revenues. The latter affects the short and medium term level of economic activity in the state as the recession in the Lower 48 states makes the in-migration of people and money to Alaska more attractive.

This phenomenon during the last two years, amplified by the dramatic growth in state spending fueled by the increase in oil prices, has generated an increase in population from 400 thousand in 1980 to 464 thousand in 1982 (Alaska Department of Labor). This two-year increase in population matches the magnitude of the growth which 7ccurred between 1974 and 1976 during the peak construction years for the oil pipeline (approximately 67 thousand), and was unanticipated by all forecasts. This annual growth rate of 7.7 percent during the past two years contrasts sharply with an average annual growth rate of 2.9 percent in population between 1960 and 1980. The fact that population change can display such a wide variation in growth in only two years demonstrates the difficulty in accurately projecting longer range population trends for Alaska, particularly within the context of a temporary boom generated by state spending.

The base case economic projection assumes a population growth rate of 2 percent annually with an employment growth rate of 1.8 percent. These growth rates are down from those observed over the first two decades of statehood, but are considerably above projections of growth of the national economy. The U.S. Department of Commerce has recently projected population growth for the nation to the year 2000 at .8 percentage annually, and employment growth at 1.2 percent annually (Survey of Current Business, November 1980).

These rates of growth are obviously consistent with many possible sets of assumptions about future basic sector activity and public sector spending. For future basic sector activity the particular "scenario" employed to generate the population numbers for this projection was similar to that used in the moderate case scenario presented in last year's study (Historical and Projected Oil and Gas Consumptions, Division of Minerals and Energy Management, January 1982), with the following exceptions:

1. Pacific Alaska LNG - deleted

2. Petroleum Refinery - deleted

3. U.S. Borax Molybdenum - added

4. Alaska Natural Gas Pipeline - two-year delay

Public sector spending is constrained by the flow of petroleum revenues. This projection of employment is consistent with a growth in state spending consistent with the current spending limit until 1988 at which time the revenue constraint supersedes the expenditure limit ceiling. Non-essential programs are eliminated (transfers and subsidies), taxes are reinstituted and tax schedules raised, and the growth in the capital and operating budgets stops. State government employment remains constant after 1987.

The regional distribution of economic activity, employment, and population continues to shift in favor of the railbelt as the economic center of the state.

The population projections and distribution used in the demand calculations are shown in Table D.1.

Population Projections TABLE D.1

| Year | State Total | Railbelt 1/ | Southeast Alaska | Rest-of-State |
|---|---|---|---|---|
| 1982 | 464,047 | 333,009 | 59,201 | 71,837 |
| 1983 | 473,328 | 341,001 | 59,812 | 72,515 |
| 1984 | 482,795 | 349,185 | 60,392 | 73,218 |
| 1985 | 492,450 | 357,566 | 60,968 | 73,916 |
| 1986 | 502,299 | 366,147 | 61,541 | 74,611 |
| 1987 | 512,345 | 374,935 | 62,109 | 75,301 |
| 1992 | 565,670 | 422,139 | 64,876 | 78,655 |
| 1997 | 624,546 | 475,286 | 67,466 | 81,794 |

1/ Railbelt includes the following Census Divisions: Anchorage, Kenai Peninsula, Matanuska-Susitna, Fairbanks, Southeast Fairbanks, and Valdez Cordova net of the Cordova census subarea.

## Conversion Factors

| | | |
|---|---|---|
| 1 gallon diesel | = 0.0239 | barrel crude oil equivalent |
| 1 gallon gasoline | = 0.0215 | barrel crude oil equivalent |
| 1 gallon jet fuel | = 0.023 | barrel crude oil equivalent |
| 1 gallon crude oil | = 0.1387 | million BTU |
| 1 MCF natural gas | = 1.000 | million BTU |
| 1 barrel diesel | = 5.825 | million BTU |
| 1 barrel gasoline | = 5.248 | million BTU |
| 1 barrel jet fuel | = 5.604 | million BTU |

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# STATE OF ALASKA

# HISTORICAL AND PROJECTED OIL AND GAS CONSUMPTION

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