

HISTORICAL AND PROJECTED OIL AND GAS CONSUMPTION

JANUARY 1985



Alaska Department of

**NATURAL
RESOURCES**
DIVISION OF OIL & GAS

STATE OF ALASKA

**HISTORICAL AND PROJECTED
OIL AND GAS CONSUMPTION**

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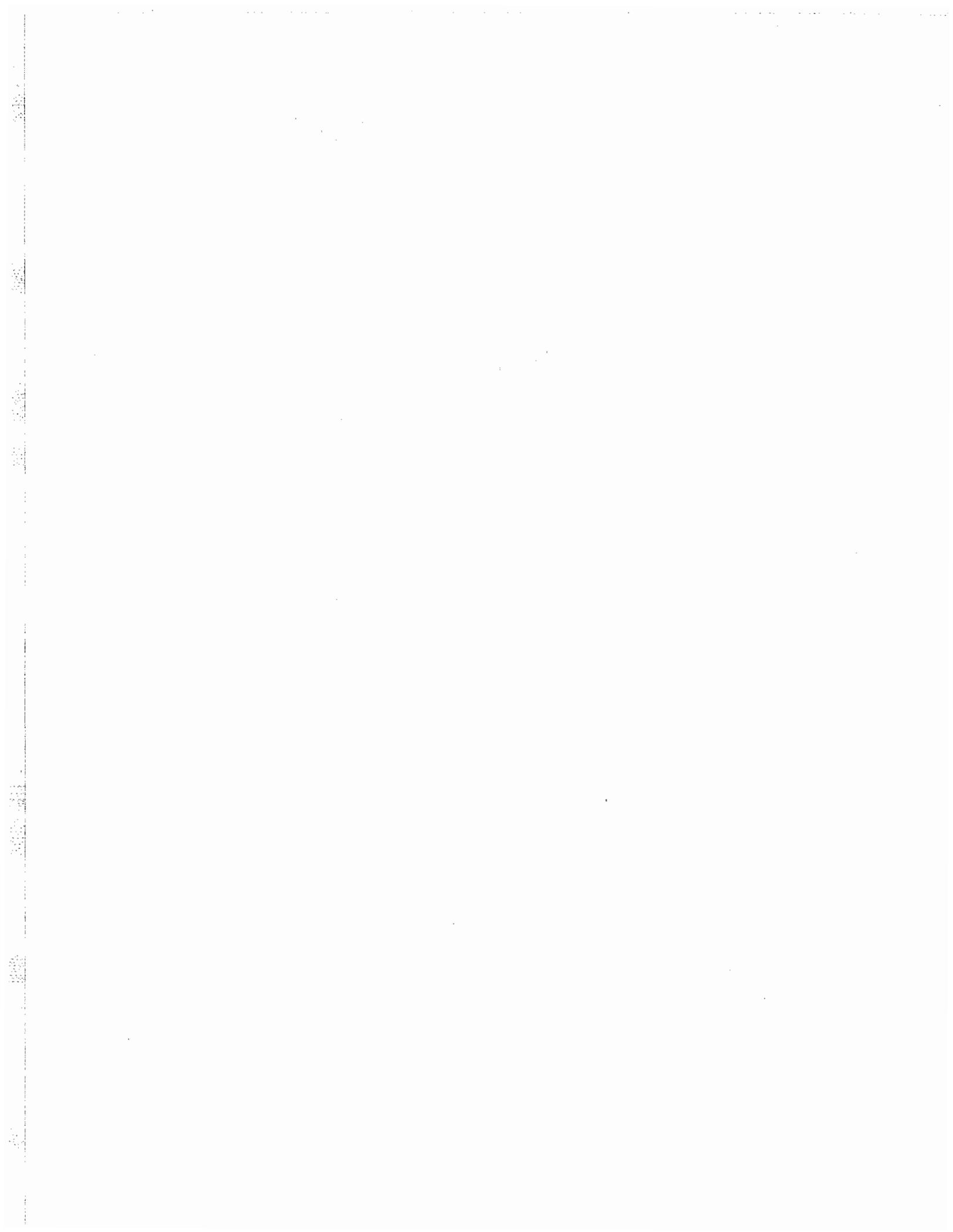


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EXECUTIVE SUMMARY

This document provides data on the in-state supply of and demand for hydrocarbons. It is the intent of this report to address AS 38.05.183(d) which states:

"(d) Oil or gas taken in kind by the state as its royalty share may not be sold or otherwise disposed of for export from the state until the commissioner determines that the royalty-in-kind oil or gas is surplus to the present and projected intrastate domestic and industrial needs. The commissioner shall make public, in writing, the specific findings and reasons on which his determination is based and shall, within 10 days of the convening of a regular session of the legislature, submit a report showing the immediate and long-range domestic and industrial needs of the state for oil and gas and an analysis of how these needs are to be met."

This report contains more than a supply and demand forecast. Chapter I is an explanation of the state's royalty oil program and the public considerations that guide its implementation. Chapter I also includes a summary of the Competitive Royalty Oil Sale held December 11, 1984 in which 90,000 barrels of oil were sold.

Chapter II provides estimates of remaining known hydrocarbon reserves and resources as well as the state's royalty share on state lands. These data are used to project hydrocarbon production over the forecast period (1985-1999) and beyond. Reserve estimates are developed for low, mid and high cases. The low and mid cases are based upon proven and probable reserves as well as relatively stable real oil prices. The high estimates are more geologically probabilistic and assume increasing real oil prices. The low and mid range estimates would seem a more prudent basis for long range policy considerations. The most recent mid-range estimate of remaining oil reserves is 9.14 billion barrels, of which approximately 9 billion are on the North Slope. The state's royalty share is estimated to be 1.15 billion barrels. Remaining gas reserves are estimated at about 39.4 trillion cubic feet (Tcf), of which the royalty share is 4.7 Tcf. Approximately 36 Tcf are located on the North Slope.

The Division of Oil and Gas estimates that North Slope production will peak in 1987 at almost 1.8 million barrels a day. Production will then decline, reaching about 1 million barrels a day in 1994 and 600,000 barrels a day by the end of the century. Cook Inlet production volumes will be relatively insignificant throughout the period.

Forecasts of oil and gas consumption (1985-99) are developed in Chapter III for the Railbelt and the remainder of the state by major use category. Chapter IV derives estimates of the projected surplus. Cumulative state consumption of oil is estimated at almost 621 million barrels over the forecast period. Natural gas demand is projected to be 3.6 Tcf.

Chapter V presents historical production and consumption data for the 1977-84 time period. Growth rates for various end use consumption categories are also calculated. These growth rates are considerably higher than those forecasted in Chapter III. This difference can largely be explained by the reductions in real state spending over the forecast period.

The supply and demand projections used in this report are uncertain by nature and should be viewed as likely outcomes; they are applicable 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 and natural resource prices. Development of the Susitna hydroelectric project would dramatically affect the in-state demand for natural gas, particularly after the late 1990s. The potential growth of a natural gas export market would affect in-state natural gas availability as well as prices.

The supply side of the in-state balancing equation also is probabilistic. The mid-range estimates of oil and gas resources (9.14 billion barrels, 39.4 Tcf) are reasonably certain though transportation of natural gas from the North Slope remains uncertain. Estimates of undiscovered resources (the high range estimates) must be treated as highly speculative and of minimal value for planning or projection purposes. Even if these undiscovered resources exist (which they may not), there is no guarantee that they will be discovered or developed in an appropriate time-frame (if ever) to assure long-run continuous hydrocarbon supplies. Fiscal resources devoted to the hydrocarbon discovery and development process by the major oil firms will be largely determined by world market conditions, not by surplus or deficit conditions in Alaska's relatively small 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. Additionally, significant quantities of hydrocarbons are surplus to present projected in-state domestic and industrial needs, and are therefore presently available for export from the state.¹

¹See Appendix G for discussion of statutory definitions.

I. ROYALTY OIL PROGRAM

When a landowner sells the right to explore and develop oil and gas, it usually reserves to itself a percentage of the oil and gas ultimately produced if the exploration is successful. That percentage is known as a royalty interest or royalty share. The State of Alaska holds a royalty interest in the lands it has leased for oil and gas exploration and development, and is currently receiving royalty payments from oil and gas production in Cook Inlet and from oil production from the North Slope Prudhoe Bay and Kuparuk River Units.

Under Alaska Statutes and state oil and gas leases, the state can take its royalty share of oil and gas either "in-kind" or "in-value." When the state takes its share of production in-kind, the Commissioner of Natural Resources, acting on behalf of the state, disposes of the oil and/or gas through negotiated contracts or competitive sales. When royalty shares are taken in-value, or in-money, individual lessees market the state's share of production and reimburse the state accordingly.

In 1984, the state continued to take its share of Cook Inlet gas in-value and continued to sell its in-kind share of Cook Inlet royalty oil to Tesoro Alaska Petroleum Company under the terms of a negotiated contract. The Tesoro Cook Inlet contract has been cancelled effective October 1, 1985, and the state will take this oil "in-value" on that date.

North Slope royalty oil was taken both in-value and in-kind. Three in-state refiners, Chevron U.S.A. Inc., Tesoro Alaska Petroleum Company, and MAPCO Petroleum Inc., hold long-term negotiated contracts with the state for the purchase of Prudhoe Bay royalty oil taken in-kind. Table 1.1 on page 5 depicts estimated total North Slope production to 2010 and current North Slope royalty oil sales. The Department of Natural Resources is proposing a long-term negotiated contract with Golden Valley Electric Association (GVEA), the public cooperative electric utility in Fairbanks, for approximately 5,000 barrels per day of Prudhoe Bay royalty oil. The Department anticipates signing the contract in early February 1985. A hearing before the Alaska Royalty Oil and Gas Development Advisory Board on the contract is scheduled for February 20, 1985. As required by AS 38.05.055, the administration plans to introduce legislation approving the long-term GVEA contract. The legislation will be submitted not later than March 15, 1985.

As discussed at legislative hearings in 1984, the Department analyzed the possibility of selling some of the remaining in-value royalty oil by competitive bid. On July 12, 1984, the Director of the Division of Oil and Gas, acting on the Commissioner's behalf by departmental delegation of authority, found that there was a surplus of royalty oil available for competitive sale and export from the state and gave notice of the state's intent to sell by competitive bid additional royalty oil from the Prudhoe Bay and Kuparuk River Units.

At the same time, the director solicited proposals for backup contracts which would be activated if the state failed to sell the entire volume of royalty oil at the competitive sale, or if a competitive purchaser failed to take delivery.

Seven companies submitted bids for the state's proposed backup contracts: Texaco Inc., U.S. Oil & Refining Co., Chevron U.S.A. Inc., Union Oil Company of California, MAPCO Petroleum Inc., Shell Oil Company, and Sohio Alaska Petroleum Company.

On August 22, 1984, the director determined that the contingent disposal of the royalty oil in backup contracts to the companies offering the highest premiums was in the best interest of the state. Backup contracts were awarded to Texaco Inc. (for approximately 50,000 bpd of Prudhoe Bay Unit royalty oil at a \$0.38 premium per barrel and approximately 15,000 bpd of Kuparuk River Unit royalty oil at a \$0.07 premium per barrel), U.S. Oil & Refining Co. (approximately 5,000 bpd of Prudhoe Bay Unit royalty oil at a \$0.15 premium per barrel), and Chevron U.S.A. Inc. (approximately 20,000 bpd of Prudhoe Bay Unit royalty oil at a \$0.10 premium per barrel). Should the need arise, the state would activate a backup royalty contract with Texaco Inc. for up to the first 50,000 bpd of Prudhoe Bay royalty oil and approximately 67 percent of available Kuparuk River Unit royalty oil. Prudhoe Bay royalty volumes in excess of that amount would go next to U.S. Oil & Refining Co. and finally to Chevron U.S.A. Inc.

On October 10, 1984, the director issued a Final Notice and Invitation to Bid on six-month and one-year contracts for approximately 90,000 barrels a day of royalty oil from the Prudhoe Bay and Kuparuk River Units to be offered at a competitive sale on December 11, 1984. Fourteen bidders qualified to participate in the competitive sale, and four qualified as "priority" bidders. Priority bidders were those which sold an average of at least 5,000 bpd of refined petroleum products to distributors or consumers within the state between June 1, 1983 and May 31, 1984, and which demonstrated the ability to process crude oil into refined petroleum products at a processing facility owned by the bidder. This priority status gave the in-state refiner or supplier the right of first refusal to meet the highest winning bid in each category for lots remaining after tentative awards were made to the highest bidders and the apparent high priority bidders in each category.

The sale was held at 10 a.m., December 11, 1984 at the Anchorage Westward Hilton. The oil was offered in three categories: Category A was for 66.6667 percent of the royalty oil from the Kuparuk River Unit in three lots of approximately 5,000 barrels per day each; Category B was for 26.6667 percent of the royalty oil from the Prudhoe Bay Unit in 10 lots of approximately 5,000 barrels per day each; Category C was for 13.3333 percent of the royalty oil from the Prudhoe Bay Unit in five lots of approximately 5,000 barrels per day each. Categories A and C were for a six-month term and Category B was for a one-year term.

Forty-nine bids were submitted for the 18 lots available. Of the eight qualified companies that submitted bids at the sale, five were successful: U.S. Oil & Refining Co., Chevron U.S.A. Inc., Texaco Inc., Union Oil Company of California, and Sohio Alaska Petroleum Company. The highest winning bids in each category were: a premium of \$1.04 a barrel for Category B Prudhoe Bay oil from U.S. Oil & Refining Co.; a premium of \$1.03 a barrel for Category C Prudhoe Bay oil from Chevron U.S.A. Inc.; and a premium of \$.82 a barrel for Category A Kuparuk oil from Chevron U.S.A. Inc. First delivery of the oil sold at the competitive sale is April 1, 1985. Tables 2.2 and 2.3 following this narrative summarize the sale results.

STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL AND GAS

Table I.1

ESTIMATED PRODUCTION FOR PRUDHOE BAY AND KUPARUK RIVER UNITS

YEAR	ESTIMATED TOTAL PRODUCTION (BARRELS PER DAY)		ESTIMATED ROYALTY (BARRELS PER DAY)		ESTIMATED SALES OF ROYALTY OIL (BARRELS PER DAY)							ROYALTY IN VALUE
	TOTAL PRUDHOE	TOTAL KUPARUK	TOTAL	TOTAL ROYALTY	MPCO	GVEA (OLD)	GVEA (PROPOSED)	TESORO (OLD)	TESORO (NEW)	CHEVRON	COMPETITIVE SALE	
1984	1,500,000	120,000	1,620,000	15,000	35,000	5,000	5,000	39,765	26,001	18,000	18,000	184,735
1985	1,500,000	180,000	1,680,000	22,500	35,000	5,000	5,000	45,999	26,001	18,000	18,000	15,000
1986	1,500,000	180,000	1,680,000	22,500	35,000	5,000	5,000	45,999	26,001	18,000	18,000	80,000
1987	1,475,000	180,000	1,655,000	22,500	35,000	5,000	4,917	45,233	25,567	17,700	17,700	78,450
1988	1,325,000	200,000	1,525,000	25,000	35,000	5,000	4,417	40,633	22,967	15,900	15,900	71,700
1989	1,175,000	200,000	1,375,000	25,000	35,000	5,000	3,917	36,833	20,367	14,100	14,100	62,450
1990	1,050,000	200,000	1,250,000	25,000	35,000	5,000	3,500	32,200	18,200	12,600	12,600	54,750
1991	950,000	200,000	1,150,000	25,000	35,000	5,000	3,167	29,133	16,467	11,400	11,400	48,583
1992	850,000	200,000	1,050,000	25,000	35,000	5,000	2,833	26,066	14,734	10,200	10,200	42,417
1993	750,000	200,000	950,000	25,000	35,000	5,000	2,500	23,000	13,000	9,000	9,000	36,250
1994	650,000	170,000	820,000	21,250	35,000	5,000	2,167	19,933	11,267	7,800	7,800	26,333
1995	575,000	145,000	720,000	18,125	35,000	5,000						25,000
1996	510,000	120,000	630,000	15,000	35,000	5,000						23,000
1997	460,000	100,000	560,000	12,500	35,000	5,000						21,000
1998	420,000	80,000	500,000	10,000	35,000	5,000						19,000
1999	380,000	75,000	455,000	9,375	35,000	5,000						18,000
2000	340,000	65,000	405,000	8,125	35,000	5,000						17,000
2001	300,000	55,000	355,000	7,125	35,000	5,000						16,000
2002	270,000	50,000	320,000	6,250	35,000	5,000						15,000
2003	240,000	40,000	280,000	5,000	35,000	5,000						14,000
2004	210,000	35,000	245,000	4,375	35,000	5,000						13,000
2005	180,000	25,000	205,000	3,125	35,000	5,000						12,000
2006	160,000	25,000	185,000	3,125	35,000	5,000						11,000
2007	140,000	20,000	160,000	2,500	35,000	5,000						10,000
2008	110,000	20,000	130,000	2,500	35,000	5,000						9,000
2009	80,000	10,000	90,000	1,250	35,000	5,000						8,000
2010	50,000	10,000	60,000	1,250	35,000	5,000						7,000

- NOTES:
- (1) DNR ESTIMATE OF FIELD PERFORMANCE, OCTOBER 1984.
 - (2) GVEA'S CURRENT CONTRACT EXPIRES JUNE 30, 1985.
 - (3) GVEA'S PROPOSED TEN-YEAR CONTRACT WOULD COMMENCE FOUR MONTHS AFTER APPROVAL BY THE LEGISLATURE AND GOVERNOR. QUANTITY IS 2.667% OF DAILY PRUDHOE ROYALTY OIL.
 - (4) TESORO'S CURRENT CONTRACT CALLS FOR A MAXIMUM QUANTITY OF 24,533% OF DAILY PRUDHOE ROYALTY OIL LESS COOK INLET ROYALTY PRODUCTION. THE QUANTITY IS 21.208% IN 1984, AND WILL BE 21.326% STARTING JAN. 1, 1985. THIS CONTRACT WILL BE INCREASED TO ITS MAXIMUM QUANTITY ON OCTOBER 1, 1985 DUE TO CANCELLATION OF THE COOK INLET CONTRACT ON THAT DATE. THE CONTRACT EXPIRES JANUARY 1995.
 - (5) MOST OF THIS VOLUME (ABOUT 25,000 BPD), WHICH IS CURRENTLY BEING TAKEN "IN VALUE," WAS SOLD COMPETITIVELY FOR DELIVERY APRIL 1, 1985 THRU SEPT. 30, 1985. ON OCTOBER 1, 1985 IT IS ANTICIPATED THAT TESORO WILL COMMENCE DELIVERIES UNDER ITS 12/9/83 PRUDHOE CONTRACT, WHICH HAS A MAXIMUM QUANTITY OF 13.86% OF DAILY PRUDHOE ROYALTY OIL AND EXPIRES JAN. 1, 1995.
 - (6) CHEVRON'S CONTRACT CALLS FOR A MAXIMUM QUANTITY OF 9.6% OF DAILY PRUDHOE ROYALTY OIL. THE CONTRACT EXPIRES JANUARY 1, 1995.
 - (7) DELIVERIES WILL COMMENCE APRIL 1, 1985 FOR 50,000 BPD OF PRUDHOE BAY UNIT ROYALTY OIL AND 15,000 BPD OF KUPARUK RIVER UNIT ROYALTY OIL, AND WILL CONTINUE FOR ONE-YEAR, AND SIX-MONTH PERIODS, RESPECTIVELY, AS A RESULT OF THE DEC. 11, 1984 COMPETITIVE SALE. PRIOR TO THAT TIME THIS OIL REMAINS "IN VALUE."

BIDS RECEIVED AT COMPETITIVE ROYALTY OIL SALE
DECEMBER 11, 1984

Table 1.2

Category A	3 Lots	Kuparuk Oil	6-month term
<u>Premium Bid</u>	<u>Company</u>		
* \$0.82	Chevron U.S.A. Inc.		
* \$0.53	Union Oil Company of California		
* \$0.17	Chevron U.S.A. Inc.		
\$0.17	Chevron U.S.A. Inc.		
\$0.14	U.S. Oil & Refining Company		
\$0.08	Texaco Inc.		
\$0.08	Texaco Inc.		
\$0.08	Texaco Inc.		

Category B	10 Lots	Prudhoe Bay Oil	1-year term
<u>Premium Bid</u>	<u>Company</u>		
* \$1.04	U.S. Oil & Refining Company		
* \$1.04	U.S. Oil & Refining Company		
* \$1.03	Chevron U.S.A. Inc.		
* \$1.03	Chevron U.S.A. Inc.		
* \$1.03	Chevron U.S.A. Inc.		
* \$0.64	Texaco Inc.		
* \$0.64	Texaco Inc.		
* \$0.64	Texaco Inc.		
* \$0.64	Texaco Inc.		
* \$0.64	Texaco Inc.		
\$0.64	Texaco Inc.		
\$0.64	Texaco Inc.		
\$0.58	Shell Oil Company		
\$0.51	Texaco Inc.		
\$0.51	Texaco Inc.		
\$0.46	Sohio Alaska Petroleum Company		
\$0.46	Sohio Alaska Petroleum Company		
\$0.46	Sohio Alaska Petroleum Company		
\$0.46	Sohio Alaska Petroleum Company		
\$0.46	Sohio Alaska Petroleum Company		
\$0.46	Sohio Alaska Petroleum Company		
\$0.43	Shell Oil Company		
\$0.39	Texaco Inc.		
\$0.38	Chevron U.S.A. Inc.		
\$0.28	Chevron U.S.A. Inc.		
\$0.22	Golden West Refining Company		
\$0.20	Tesoro Alaska Petroleum Company		
\$0.13	Union Oil Company of California		

* denotes winning bids

Category C 5 Lots Prudhoe Bay Oil 6-month term

Premium Bid

Company

* \$1.03	Chevron U.S.A. Inc.
* \$0.64	Texaco Inc.
* \$0.64	Texaco Inc.
* \$0.64	Texaco Inc.
\$0.51	Texaco Inc.
\$0.51	Texaco Inc.
* \$0.51	Sohio Alaska Petroleum Company
\$0.51	Sohio Alaska Petroleum Company
\$0.51	Sohio Alaska Petroleum Company
\$0.39	U.S. Oil & Refining Company
\$0.37	Golden West Refining Company
\$0.28	Chevron U.S.A. Inc.
\$0.26	Tesoro Alaska Petroleum Company
\$0.13	Union Oil Company of California

* denotes winning bids

STATE OF ALASKA
COMPETITIVE ROYALTY OIL SALE

Table 1.3

DEC. 11, 1984

PURCHASER	LOT #	ESTIMATED BARRELS PER DAY	CONTRACT LENGTH (IN DAYS)	TOTAL EST. BARRELS PER CONTRACT	BASE PRICE	PREMIUM	TOTAL REALIZED (1)	DIFFERENCE REALIZED (1) (2)
CATEGORY A: KUPARUK								
CHEVRON	* 1	5,000	182.5	912,500	\$16.92	\$0.82	\$16,187,750.00	\$804,177.13
UNION	* 2	5,000	182.5	912,500	\$16.92	\$0.53	\$15,923,125.00	\$539,552.13
CHEVRON	* 3	5,000	182.5	912,500	\$16.92	\$0.17	\$15,594,625.00	\$211,052.13
SUBTOTAL		15,000		2,737,500			\$47,705,500.00	\$1,554,781.38
		HIGHEST PREMIUM BID:	\$0.82	AVERAGE PREMIUM BID:	\$0.51			
CATEGORY B: PRUDHOE								
U.S. OIL	1	5,000	365	1,825,000	\$17.92	\$1.04	\$34,602,000.00	\$1,703,655.75
U.S. OIL	2	5,000	365	1,825,000	\$17.92	\$1.04	\$34,602,000.00	\$1,703,655.75
CHEVRON	* 3	5,000	365	1,825,000	\$17.92	\$1.03	\$34,583,750.00	\$1,685,405.75
CHEVRON	* 4	5,000	365	1,825,000	\$17.92	\$1.03	\$34,583,750.00	\$1,685,405.75
CHEVRON	* 5	5,000	365	1,825,000	\$17.92	\$1.03	\$34,583,750.00	\$1,685,405.75
TEXACO	* 6	5,000	365	1,825,000	\$17.92	\$0.64	\$33,872,000.00	\$973,655.75
TEXACO	* 7	5,000	365	1,825,000	\$17.92	\$0.64	\$33,872,000.00	\$973,655.75
TEXACO	* 8	5,000	365	1,825,000	\$17.92	\$0.64	\$33,872,000.00	\$973,655.75
TEXACO	* 9	5,000	365	1,825,000	\$17.92	\$0.64	\$33,872,000.00	\$973,655.75
TEXACO	* 10	5,000	365	1,825,000	\$17.92	\$0.64	\$33,872,000.00	\$973,655.75
SUBTOTAL		50,000		18,250,000			\$342,315,250.00	\$13,331,807.50
		HIGHEST PREMIUM BID:	\$1.04	AVERAGE PREMIUM BID:	\$0.84			
CATEGORY C: PRUDHOE								
CHEVRON	* 1	5,000	182.5	912,500	\$17.92	\$1.03	\$17,291,875.00	\$842,702.88
TEXACO	* 2	5,000	182.5	912,500	\$17.92	\$0.64	\$16,936,000.00	\$486,827.88
TEXACO	* 3	5,000	182.5	912,500	\$17.92	\$0.64	\$16,936,000.00	\$486,827.88
TEXACO	* 4	5,000	182.5	912,500	\$17.92	\$0.64	\$16,936,000.00	\$486,827.88
SOHIO	5	5,000	182.5	912,500	\$17.92	\$0.51	\$16,817,375.00	\$368,202.88
SUBTOTAL		25,000		4,562,500			\$84,917,250.00	\$2,671,389.38
		HIGHEST PREMIUM BID:	\$1.03	AVERAGE PREMIUM BID:	\$0.69			
TOTALS FOR ALL LOTS:		10	90,000	25,550,000			\$474,938,000.00	\$17,557,978.25

(1) THESE PROJECTIONS ASSUME THAT CURRENT MARKET CONDITIONS AND PRICES CONTINUE.

(2) THIS AMOUNT IS THE DIFFERENCE BETWEEN THE ESTIMATED ROYALTY-IN-VALUE RECEIPTS BASED ON THE VOLUME WEIGHTED AVERAGE OF PRODUCERS' REPORTED NETBACK PRICES (OCTOBER) AND THE ESTIMATED RECEIPTS OF THE COMPETITIVE SALE BASED ON THE BID PREMIUM PLUS THE BASE PRICE.

(*) PRIORITY BIDDERS

II. RESERVE ESTIMATES AND ROYALTY SHARE

This chapter discusses estimates of oil and gas reserves in the state and the state's royalty share of these reserves. The reserve estimates have been developed for low, mid and high cases. The low and mid cases are based upon proven and probable reserves. The high cases in some categories also include estimates of undiscovered reserves. Terms of individual oil and gas lease contracts were used to calculate the state's royalty share of the respective reserves. The low estimates assume stable to falling oil and gas prices and less than satisfactory reservoir performance. The high estimates assume rising oil and gas prices and better than expected reservoir performance. The mid case estimates assume stable oil and gas prices and average reservoir performance.

The estimated reserves and royalty share for oil and gas are shown in Table 2.1. The estimates have been developed separately for Cook Inlet, the North Slope and the "undiscovered" category, as different sources of information were drawn upon for each category.

Cook Inlet

Much historical and subsurface 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. Cook Inlet reserves account for about 1.5% of the low and 8% of the mid estimates of total proven and probable oil and gas reserves, respectively. The high estimate of reserves further reduces the Cook Inlet share of total oil and gas reserves to 0.6%.

North Slope

Oil and gas reserve estimates shown in Table 2.1 are for currently leased state lands.

Current North Slope oil production is from the Sadlerochit reservoir in the Prudhoe Bay Unit and the Kuparuk River reservoir in the Kuparuk River Unit. Table 2.2 lists production forecasts for some of the fields listed in Table 2.1. Figure 2.1 graphically portrays these estimates. As illustrated, North Slope production is expected to increase slightly between 1984 and 1987, then begin to decline starting in 1988.

Currently, no gas is exported from the North Slope. The Alaska Natural Gas Transportation System for carrying gas to the Lower 48 is targeted for completion in the late 1980's at the earliest, but it is uncertain when of construction of the line will commence. The proposed pipeline capacity will permit exports in the range of 2.0 to 2.4 Bcf per day, with an expected level of 2.0 Bcf per day. Alternative marketing of North Slope natural gas is being considered, but these prospects are also very uncertain at this time.

Undiscovered Resources

Undiscovered oil and gas resources are computed as the simple average of the low estimates recently developed by the U.S. Geological Survey (USGS) and the National Petroleum Council (NPC) for lands in Alaska. The USGS estimates the quantities of conventionally producible reserves based upon information available to USGS. At the 95% confidence level, the low USGS estimates of undiscovered oil and gas resources are 2.5 billion barrels (Bbb1) and 19.8 Tcf respectively. In the NPC resources estimates, yields on investment of greater than 10% for oil and gas and 15% for oil alone were required before a field was considered "commercial." The NPC estimates that 17.8 Bbl of undiscovered oil and 10.1 Tcf of undiscovered gas could be produced commercially. The averaged low estimate of undiscovered resources is added to the high estimate in this report in order to take a conservative approach on resource estimating, but the estimate should still be treated as a highly speculative number. Many of the oil and gas resources identified by the USGS and the NPC are likely to be found on federal and private lands.

ESTIMATED RECOVERABLE RESERVES AND ROYALTY SHARE

Table 2.1

	RECOVERABLE RESERVES						ROYALTY SHARE					
	OIL (MMbbl)			GAS (Bcf)			OIL (MMbbl)			GAS (Bcf)		
	LOW	MID	HIGH	LOW	MID	HIGH	LOW	MID	HIGH	LOW	MID	HIGH
COOK INLET [1]												
Beaver Creek	1	1	1	231	231	231	--	--	--	--	--	--
Beluga River	--	--	--	778	778	778	--	--	--	59	59	59
Birch Hill	--	--	--	11	11	11	--	--	--	--	--	--
Falls Creek	--	--	--	13	13	13	--	--	--	--	--	--
Granite Point	27	27	27	26	26	26	3	3	3	3	3	3
Ivan River	--	--	--	26	26	26	--	--	--	--	--	--
Kenai	--	--	--	845	845	845	--	--	--	17	17	17
Lewis River	--	--	--	22	22	22	--	--	--	3	3	3
McArthur River	74	74	74	86	86	86	9	9	9	11	11	11
Middle Ground Shoal	15	15	15	11	11	11	2	2	2	1	1	1
Nicolai Creek	--	--	--	3	3	3	--	--	--	--	--	--
North Cook Inlet	--	--	--	859	859	859	--	--	--	107	107	107
North Fork	--	--	--	12	12	12	--	--	--	--	--	--
Sterling	--	--	--	23	23	23	--	--	--	0	0	0
Swanson River	22	22	22	259	259	259	--	--	--	--	--	--
Trading Bay	3	3	3	33	33	33	0	0	0	4	4	4
West Foreland	--	--	--	20	20	20	--	--	--	3	3	3
West Fork	--	--	--	6	6	6	--	--	--	--	--	--
SUBTOTAL	142	142	142	3,264	3,264	3,264	15	15	15	209	209	209
NORTH SLOPE [2]												
Prudhoe Bay Unit												
Sadlerochit reservoir	5,001	5,781	6,171	29,000	29,000	29,000	625	723	771	3,625	3,625	3,625
Sag River reservoir	100	130	200	--	--	--	13	16	25	--	--	--
Lisburne reservoir	300	400	600	800	1,100	1,600	38	50	75	100	138	200
Endicott	275	375	450	600	800	1,200	39	53	63	84	112	168
Point Thomson Area and Flaxman Island Area	300	400	700	3,200	5,000	6,000	38	50	88	400	625	750
North Prudhoe Bay - West Dock Area	50	75	100	--	--	--	6	9	13	--	--	--
Milne Point Area	60	60	95	--	--	--	10	10	15	--	--	--
Gwydyr Bay Area	0	30	60	--	--	--	0	4	8	--	--	--
Shallow Cretaceous Sands	0	750	2,750	--	--	--	0	94	344	--	--	--
Kuparuk River Unit	573	998	1,198	135	220	260	72	125	150	17	28	33
SUBTOTAL	6,659	8,999	12,324	33,735	36,120	38,060	839	1,133	1,551	4,226	4,527	4,776
UNDISCOVERED [3]	N/A	N/A	10,150	N/A	N/A	15,000	N/A	N/A	1,269	N/A	N/A	1,875
STATE TOTAL	6,801	9,141	22,616	36,999	39,384	56,324	853	1,147	2,834	4,435	4,736	6,859

N/A Not applicable.

[1] As of 12/83. Alaska Oil and Gas Conservation Commission, "1983 Statistical Report."

[2] As of 9/84. Van Dyke, W., "Proven and Probable Oil and Gas Reserves, North Slope, Alaska," September 25, 1980, and personal communication, October 10, 1984.

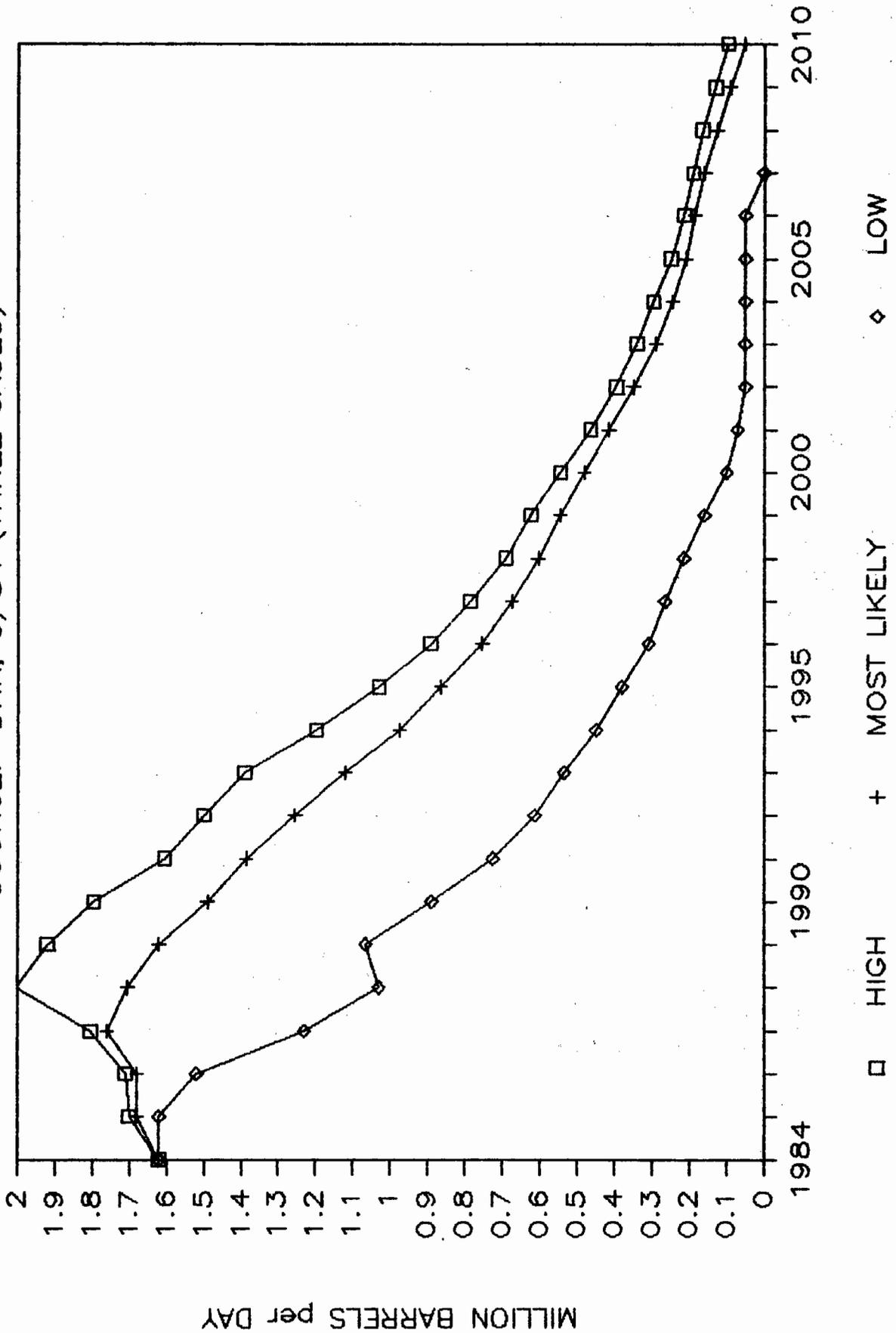
[3] "NPC Sees Big U.S. Arctic Resources," Oil and Gas Journal, November 23, 1981, and "Estimates of Undiscovered Recoverable Resources of Conventionally Producing Oil and Gas in the United States, a Summary," U.S. Geological Survey, OFR 81-192, 1981.

S/D Tbl: T2_1, rev: 1/14/85

FIGURE 2.1

PREDICTED NORTH SLOPE PRODUCTION

SOURCE: DNR, 9/84 (THREE CASES)



ESTIMATED AVAILABILITY OF NORTH SLOPE OIL FOR SALE (Mbbbl/day)
 -Most Likely Case

TABLE 2.2

YEAR:	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	SUM (Mbbbl)	
PRODUCTION																													
Prudhoe Bay	1500	1500	1500	1475	1325	1175	1050	950	850	750	650	575	510	460	420	380	340	300	270	240	210	180	160	140	110	80	50	6,259,750	
Kuparuk	120	180	180	180	200	200	200	200	200	200	170	145	120	100	80	75	65	55	50	40	35	30	25	20	15	10	0	1,056,675	
Lisburne	0	75	100	120	120	120	120	90	75	70	70	65	60	55	50	40	30	20	10	0	0	0	0	0	0	0	0	401,500	
Endicott	0	0	50	100	100	100	100	85	75	70	65	60	55	50	45	40	30	20	10	0	0	0	0	0	0	0	0	374,125	
Milne Point	0	30	30	25	20	15	15	10	10	10	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60,225	
Other	0	30	30	30	50	50	50	50	50	50	50	100	100	125	125	125	120	115	110	105	100	95	90	80	70	60	50	713,575	
TOTAL	1620	1680	1680	1790	1735	1670	1540	1435	1305	1170	1025	965	880	800	730	670	600	530	460	395	345	305	275	240	195	150	100	8,865,850	
ROYALTY OIL FOR SALE																													
Prudhoe Bay	[1] 188	188	188	184	166	147	131	119	106	94	81	72	64	58	53	48	43	38	34	30	26	23	20	18	14	10	6	782,469	
Kuparuk	[1] 15	23	23	23	25	25	25	25	25	25	21	18	15	13	10	9	8	7	6	5	4	4	3	3	2	1	0	132,084	
Lisburne	[1] 0	0	0	9	13	15	15	15	11	9	9	8	8	7	6	5	4	3	1	0	0	0	0	0	0	0	0	50,188	
Endicott	[2] 0	0	0	0	7	14	14	14	14	12	11	10	9	8	7	6	6	6	3	1	0	0	0	0	0	0	0	52,378	
Milne Point	[3] 0	0	0	5	5	4	3	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,636	
Other	[1] 0	0	0	4	4	4	6	6	6	6	6	6	13	16	16	16	15	14	14	13	13	12	11	10	9	8	6	89,197	
TOTAL	203	210	210	225	219	211	195	181	165	148	130	122	111	101	92	85	76	67	58	50	43	38	34	30	24	19	13	1,115,951	
ROYALTY OIL SALES																													
MAPCO	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	255,500	
GVEA (Old)	5	5	5	5	5	4	4	4	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1,825	
(Proposed) [4]																												13,657	
TESORO (Old) [5]	40	46	46	45	41	36	32	29	26	23	20	20	18	16	15	13	11	11	11	11	11	11	11	11	11	11	11	140,074	
(New) [6]	26	26	26	26	23	20	18	16	15	13	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	71,019	
CHEVRON [7]	18	18	18	18	16	14	13	11	10	9	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	55,736	
Competitive Sale	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	23,725	
TOTAL	98	195	130	128	119	109	101	95	89	83	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	561,536	
ROYALTY OIL IN VALUE (Potential)																													
	105	15	80.	97	99	102	93	86	76	65	53	87	76	66	57	50	41	32	23	15	43	38	34	30	24	19	13	554,415	

Note: numbers may not sum to totals due to rounding errors.

- [1] 12.5% of production.
- [2] 14.0% of production (weighted average).
- [3] 16.0% of production (weighted average).
- [4] 1985-1994: 2.6667% of Prudhoe Bay production.
- [5] 1984: 21.208% of Prudhoe Bay production.
- [6] 1985-1994: 21.326% of Prudhoe Bay production.
- [7] 1985-1994: 13.867% of Prudhoe Bay production.
- [8] 1984-1994: 9.6% of Prudhoe Bay production.

EST: estroy, rev: 1/14/85

III. CONSUMPTION FORECAST

Summary

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 1985 to 259 bcf in 1999 (annual growth of 1.5 percent). 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 will outstrip growth in industrial use. Over the next 15 years, use of gas for space heating will increase from 20.2 bcf in 1985 to 34.3 bcf in 1999 (3.9 percent annual growth). Use of gas for electricity generation will grow from 36.1 bcf in 1985 to 43.6 bcf in 1999 (1.4 percent annual growth). The consumption of natural gas for industrial uses will grow from 154.3 bcf in 1985 to 181.6 bcf in 1999 (1.2 percent annual growth).

Consumption of liquid petroleum will increase from 1,546 million gallons in 1985 (about 37 million barrels of crude oil equivalent) to 2,005 million gallons in 1999 (48 million barrels). This represents a 1.9 percent annual growth rate. The five and ten-year annual growth rates are 1.7 and 1.9 percent, respectively. Space heating use of petroleum will grow 2.1 percent annually. Vehicle transportation use will increase 2.0 percent annually. The use of fuel oil for electricity generation in 1985 reflects the introduction of several hydroelectric facilities which replace high-cost fuel oil generation. Fuel oil consumption subsequently increases, and the 15-year growth rate will be 2.0 percent annually. Industrial use of petroleum liquids will remain constant.

Transportation Liquid Fuels

Transportation fuel consumption will grow moderately with population growth in future years, increasing from 1,228 million gallons in 1985 to 1,614 million gallons in 1999 (Table 3.2). Jet fuel consumption will grow most rapidly (2.97 percent annually), followed by diesel fuel consumption (1.4 percent annually) and gasoline (.5 percent annually).

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.

Total consumption projected over the 15-year period from 1985 to 1999 is 21,056 million gallons. This is approximately equivalent to 501 million barrels of crude oil.

¹See Methodology Appendix B for assumptions.

Space Heating

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 20.2 billion cubic feet in 1985 to 34.3 billion cubic feet in 1999 (Table 3.3).

The relatively rapid growth of natural gas is attributable to the rapid growth of population in the railbelt as well as to 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 9 percent by 1995. 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 176 million gallons in 1985 to 237 million gallons in 1999.

Utility Electricity Generation

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 increases from 36.1 bcf in 1985 to 43.6 bcf in 1999. The percentage of electricity in the railbelt provided by natural gas reaches a high of 81 percent in 1992 but declines in 1993 to 72.9 percent, when the Bradley Lake hydroelectric facility comes on line.² After 1993, the proportion of railbelt electricity generated by natural gas begins to increase, reaching 75.4 percent in 1999.

Fuel oil use for utility electricity generation will grow at an average annual rate of only 2.1 percent. This is due to the availability of power from several recently completed hydroelectric plants in locations currently using fuel oil for generation.

Industrial Fuel Use

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.

²Susitna hydro is considered in Chapter IV.

TABLE 3.1

PROJECTED DEMAND FOR OIL AND GAS

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	TOTAL
OIL (Million Gallons)																
STATE																
Vehicle Transportation	1228	1261	1276	1288	1314	1341	1365	1387	1414	1450	1482	1514	1543	1580	1614	21056
Space Heat	176	181	184	185	189	193	195	199	203	207	212	221	224	235	237	3041
Utility Generation	37	32	33	34	34	36	36	37	39	40	41	44	45	49	49	585
Industry	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	1574
TOTAL	1546	1579	1598	1612	1642	1675	1700	1728	1761	1801	1840	1884	1917	1969	2005	26256
RAILBELT																
Vehicle Transportation	931	964	972	984	1007	1030	1056	1075	1097	1132	1158	1173	1204	1215	1261	16258
Space Heat	73	75	75	75	76	76	77	77	77	78	78	79	80	80	82	1158
Utility Generation	14	8	8	8	8	8	8	8	8	8	8	8	8	8	9	127
Industry	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL	138	136	137	137	135	134	132	131	131	127	126	129	126	130	123	1972
NON-RAILBELT																
Vehicle Transportation	103	106	110	111	114	117	118	122	126	129	134	142	144	155	154	1883
Space Heat	23	24	25	26	26	28	28	29	30	31	33	36	37	40	41	458
Utility Generation	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Industry	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL	126	130	135	137	140	145	146	151	156	160	167	178	181	195	195	2341
GAS (BCF)																
STATE																
Vehicle Transportation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Space Heat	20.2	21.3	22.0	22.7	23.7	24.7	25.8	26.7	27.8	29.2	30.4	31.0	32.2	32.8	34.3	404.7
Utility Generation	36.1	38.2	38.3	38.6	39.4	40.2	41.1	41.6	37.9	39.2	40.0	40.6	41.7	42.1	43.6	598.4
Industry	154.3	158.1	162.2	166.6	171.2	176.2	181.6	181.6	181.6	181.6	181.6	181.6	181.6	181.6	181.6	2623.0
TOTAL	210.6	217.6	222.5	227.8	234.3	241.1	248.5	249.9	247.3	250.0	251.9	253.2	255.4	256.5	259.4	3626.1
RAILBELT																
Vehicle Transportation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Space Heat	20.1	21.2	21.8	22.5	23.5	24.5	25.6	26.6	27.6	29.0	30.2	30.8	31.9	32.5	34.0	402.0
Utility Generation	35.6	37.6	37.7	38.0	38.8	39.6	40.5	41.0	37.3	38.5	39.3	39.8	40.9	41.3	42.8	588.8
Industry	87.1	87.1	87.1	87.1	87.1	87.1	87.1	87.1	87.1	87.1	87.1	87.1	87.1	87.1	87.1	1306.5
TOTAL	142.8	145.9	146.7	147.6	149.5	151.2	153.2	154.6	152.0	154.7	156.6	157.8	160.0	160.9	163.9	2297.2
NON-RAILBELT																
Vehicle Transportation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Space Heat	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	2.7
Utility Generation	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8	9.6
Industry	67.2	71.0	75.1	79.5	84.1	89.1	94.5	94.5	94.5	94.5	94.5	94.5	94.5	94.5	94.5	1316.5
TOTAL	67.9	71.7	75.8	80.2	84.9	89.9	95.3	95.3	95.3	95.3	95.4	95.4	95.4	95.4	95.6	1328.8

TABLE 3.2

VEHICLE TRANSPORTATION FUELS DEMAND (1)
(Million Gallons)

STATE	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	TOTAL
Jet Fuel	542	560	573	586	603	621	639	656	676	698	721	743	765	791	816	9991
Civilian Domestic	282	297	308	318	333	348	363	377	394	414	433	453	472	495	517	5806
Military and International	260	263	265	268	271	273	276	279	282	284	287	290	293	296	299	4185
Gasoline	249	253	252	250	252	253	254	255	256	259	261	262	263	265	267	3850
Aviation	19	19	19	19	20	20	20	20	21	21	22	22	22	22	23	310
Highway	220	224	223	221	222	223	224	224	225	227	228	230	230	232	233	3386
Marine	9	10	10	10	10	10	10	10	10	11	11	11	11	11	11	155
Diesel	437	448	451	452	459	466	472	476	483	493	501	508	514	524	531	7215
Highway	303	311	313	313	318	323	327	330	335	342	347	352	357	363	368	5002
Marine	134	138	138	139	141	143	145	146	148	151	154	156	158	161	163	2213
TOTAL	1228	1261	1276	1288	1314	1341	1365	1387	1414	1450	1482	1514	1543	1580	1614	21056
RAILBELT																
Jet Fuel	448	464	472	483	498	512	528	541	556	576	592	603	623	632	660	8197
Civilian Domestic	231	245	252	260	272	284	298	309	322	339	354	365	382	393	416	4722
Military and International	217	220	220	223	225	227	230	232	234	237	238	238	241	239	244	3465
Gasoline	184	187	186	185	186	187	188	188	189	191	192	191	192	190	193	2829
Aviation	15	16	16	16	16	16	17	17	17	17	18	18	18	18	18	252
Highway	163	166	164	163	164	165	166	165	165	167	168	167	168	166	168	2485
Marine	6	6	6	6	6	6	6	6	6	6	6	6	7	6	7	92
Diesel	299	313	314	315	324	332	340	345	352	365	374	379	389	393	408	5242
Highway	205	216	218	219	226	232	239	243	249	260	268	273	280	285	297	3710
Marine	94	96	96	97	98	99	101	102	103	105	107	107	109	108	111	1533
TOTAL	931	964	972	984	1007	1030	1056	1075	1097	1132	1158	1173	1204	1215	1261	16258
NON-RAILBELT																
Jet Fuel	94	96	101	103	106	110	111	115	120	123	129	141	142	159	157	1805
Civilian Domestic	51	53	56	58	60	64	65	68	72	75	80	88	90	102	102	1084
Military and International	43	43	45	45	45	46	46	47	48	48	49	53	52	57	55	720
Gasoline	65	65	66	65	66	67	66	66	67	68	69	72	71	75	73	1021
Aviation	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	58
Highway	57	58	59	58	58	59	58	59	59	59	61	63	62	66	64	901
Marine	4	4	4	4	4	4	4	4	4	4	4	4	4	5	5	63
Diesel	138	136	137	137	135	134	132	131	131	127	126	129	126	130	123	1972
Highway	98	94	95	94	92	91	88	87	85	81	79	80	76	78	72	1292
Marine	40	41	42	42	43	44	44	44	45	46	47	49	49	52	52	680
TOTAL	296	297	304	305	307	310	309	312	318	317	324	342	339	365	353	4798

(1) Includes industrial, military and government use. Excludes pipeline fuel.

TABLE 3.3

SPACE HEAT FUELS DEMAND

YEAR:	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	TOTAL
OIL (Million Gallons)																
STATE	176.4	181.0	184.3	185.4	189.0	193.4	194.6	198.6	202.8	207.0	212.3	220.7	223.8	235.0	236.8	3041.1
RAILBELT	73.2	74.8	74.6	74.6	75.5	76.3	76.9	76.9	77.1	78.2	78.5	78.8	80.1	80.3	82.4	1158.1
NON-RAILBELT	103.3	106.2	109.7	110.8	113.5	117.1	117.7	121.7	125.7	128.8	133.8	141.9	143.7	154.8	154.4	1883.1
GAS (BCF)																
STATE	20.2	21.3	22.0	22.7	23.7	24.7	25.8	26.7	27.8	29.2	30.4	31.0	32.2	32.8	34.3	404.7
RAILBELT	20.1	21.2	21.8	22.5	23.5	24.5	25.6	26.6	27.6	29.0	30.2	30.8	31.9	32.5	34.0	402.0
Current Market	20.0	21.0	21.4	21.9	22.7	23.5	24.3	25.0	25.8	26.9	27.8	28.4	29.5	30.0	31.4	379.9
Matanuska Valley	-0	0.2	0.4	0.6	0.8	1.0	1.3	1.5	1.8	2.1	2.4	2.4	2.5	2.5	2.6	22.0
NON-RAILBELT	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	2.7

TABLE 3.4

UTILITY GENERATION DEMAND

YEAR:	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	TOTAL
OIL (Million Gallons)																
STATE	36.7	31.6	33.1	33.1	34.2	35.5	36.1	37.4	38.6	39.5	41.2	44.3	45.2	48.9	49.2	585.0
RAILBELT	13.6	7.8	7.8	7.8	7.9	8.0	8.0	8.1	8.1	8.2	8.3	8.4	8.4	8.5	8.6	127.5
SOUTHEAST	5.1	5.4	6.6	7.1	6.8	7.4	8.1	9.1	9.3	9.6	10.2	10.9	11.9	12.1	13.2	132.9
REST OF STATE	18.0	18.5	18.7	18.6	19.5	20.1	20.0	20.2	21.1	21.7	22.8	25.0	24.9	28.3	27.4	324.7
GAS (BCF)																
STATE	36.1	38.2	38.3	38.6	39.4	40.2	41.1	41.6	37.9	39.2	40.0	40.6	41.7	42.1	43.6	598.4
RAILBELT	35.6	37.6	37.7	38.0	38.8	39.6	40.5	41.0	37.3	38.5	39.3	39.8	40.9	41.3	42.8	588.8
SOUTHEAST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
REST OF STATE	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.8	9.6

INDUSTRIAL FUELS DEMAND

TABLE 3.5

YEAR:	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	TOTAL
OIL (Million Gallons)	104.9	104.9	104.9	104.9	104.9	104.9	104.9	104.9	104.9	104.9	104.9	104.9	104.9	104.9	104.9	1573.5
STATE	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	1260.0
Pipeline Fuel	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	313.5
Electricity Generation	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	750.0
GAS (BCF)	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	69.0
STATE	99.7	103.5	107.6	112.0	116.6	121.6	127.0	127.0	127.0	127.0	127.0	127.0	127.0	127.0	127.0	1804.0
Ammonia-Urea Production	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	190.5
Military Power Generation	87.0	90.8	94.9	99.3	103.9	108.9	114.3	114.3	114.3	114.3	114.3	114.3	114.3	114.3	114.3	1613.5
Petroleum Production	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	750.0
Pipeline Fuel	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	69.0
Miscellaneous	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	487.5
Item:Injection	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Item:LNG	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	487.5
RAILBELT	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	750.0
Ammonia Urea	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	69.0
Military Power Production	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	487.5
Petroleum Production	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pipeline Fuel	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	487.5
Miscellaneous	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Item:Injection	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Item:LNG	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	487.5
NON-RAILBELT	67.2	71.0	75.1	79.5	84.1	89.1	94.5	94.5	94.5	94.5	94.5	94.5	94.5	94.5	94.5	1316.5
Petroleum Production	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	190.5
Pipeline Fuel	54.5	58.3	62.4	66.8	71.4	76.4	81.8	81.8	81.8	81.8	81.8	81.8	81.8	81.8	81.8	1126.0
Miscellaneous	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Item:Injection	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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. In addition, a significant amount of fuel is used for electricity generation. Both of these uses are projected at constant levels.

IV. ANALYSIS OF SURPLUS

Summary

Under reasonable assumptions about recoverable reserves and Alaska consumption, the current inventories of both oil and gas are more than sufficient to meet the presently identifiable needs of Alaskans for the next 15 years. The state royalty shares are also sufficient to meet in-state demand.

Liquid Petroleum

Table 4.1 shows that the cumulative 15-year Alaska demand for liquid petroleum is approximately 625 million barrels of crude oil equivalent. This is equal to approximately half the reserves of royalty oil and is 7 percent of total reserves. No attempt has been made to compare petroleum products produced at Alaska 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.

Natural Gas

Table 4.1 indicates that the cumulative 15-year Alaska demand for natural gas is 3.626 trillion cubic feet of gas. This is approximately 77 percent of the state royalty share of gas in the combined current inventory at Cook Inlet and on the North Slope.

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 4.1 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

We assume recoverable reserves represent a 15-year inventory of petroleum in the ground based upon historical reserve-to-production ratios. Because a very sizable investment is required to develop a petroleum reservoir into recoverable reserves, reserves will be "proven up" at a rate to maintain sufficient inventory consistent with the growth in demand. Excessive proven reserves, like excessive inventories, result in unnecessary carrying costs to reservoir owners and will be avoided if possible.

This is the basis for the 15-year time horizon for demand used in this analysis. 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.

Sensitivity of Results

The positive net surpluses of oil and gas calculated in this chapter are insensitive to changes in the assumptions underlying the projections. These are discussed in turn and shown in Table 4.2.

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 liquid fuel use is population sensitive. 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. Increased use of natural gas would reduce the surplus by an equally small percentage.

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 about 945 billion cubic feet. If a facility comparable to the Pacific Alaska LNG project were built, it would annually export 160 billion cubic feet. With an assumed first year of operation of 1990, cumulative exports to California through 1999 would be 1,600 billion cubic feet. Combined exports to Japan and California would be 2,545 billion cubic feet, reducing reserves for instate use, and the net surplus, by 9 percent. In the absence of new reserves, the net surplus in Cook Inlet under these assumptions would be negative.

Susitna Hydro

If Susitna hydro were built, it could begin to replace electricity 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 for electricity consumption in the Railbelt could be eliminated at a savings of 50 million gallons (a little more than one million barrels).

Natural Gas Availability in Fairbanks

If, by some means, natural gas became available in Fairbanks, electricity generation and space heating in Fairbanks could be converted to gas. This could increase annual natural gas consumption for electricity generation by 5 billion cubic feet as coal and fuel oil use were backed out. Fuel oil use would fall by 8 million gallons annually.

Natural gas consumption for space heating would gradually replace fuel oil and coal and could eventually 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 25 billion cubic feet, and fuel oil consumption could fall by 145 million gallons.

The net surplus of gas would fall very marginally as a result of these changes and the net surplus of liquid fuels increase very marginally.

SURPLUS OIL CALCULATION (Million Barrels)

TABLE 4.1

	OIL [2] (Million Barrels)		GAS [3] (BCF)	
	Total	State Royalty	Total	State Royalty
STATE				
Reserves [1]	9,141	1,147	39,384	4,736
Estimated Production from reserves thru 1984	220	28	240	29
Estimated reserves as of Jan. 1, 1985	8,921	1,119	39,144	4,707
Estimated cumulative consumption, 1985-1999 (15 years)	625	625	3,626	3,626
NET SURPLUS (DEFICIT)	8,296	494	35,518	1,081
COOK INLET				
Reserves [1]	142	15	3,264	209
Estimated Production from reserves thru 1984	20	2	220	14
Estimated reserves as of Jan. 1, 1985	122	13	3,044	195
Estimated cumulative consumption, 1985-1999 (15 years)	--	--	2,297	2,297
NET SURPLUS (DEFICIT)	--	--	747	(2,102)
NORTH SLOPE				
Reserves [1]	8,999	1,133	36,120	4,527
Estimated Production from reserves thru 1984	200	25	20	3
Estimated reserves as of Jan. 1, 1985	8,799	1,108	36,100	4,524
Estimated cumulative consumption, 1985-1999 (15 years)	--	--	1,329	1,329
NET SURPLUS (DEFICIT)	--	--	34,771	3,195

[1] North Slope as of 9/1/84, Cook Inlet as of 12/1/83.

[2] Author's estimate of production year to end. Production from state royalty share is proportional to state royalty share of reserve.

[3] Total gas disposition net of reinjection, from Section 2. Production from state royalty share is proportion of state royalty gas in total.

SENSITIVITY ANALYSIS OF NET SURPLUS

TABLE 4.2

	Percent Reduction in Net Surplus	
	Liquid Petroleum (million barrels)	Natural Gas (BCF)
Low Reserve Estimate	28.0 %	7.0 %
50% increase in growth of population-related consumption	0.5 %	0.5 %
Export of LNG	--	9.0 %
Susitna Hydro	0.0 %	0.5 %
Natural Gas available in Fairbanks	+2.0 %	0.0 %

V. HISTORICAL OIL AND GAS PRODUCTION AND CONSUMPTION

Oil Production and Consumption

Historical oil production and consumption for 1977-84 are presented in Table 5.1 and Figures 5.1 and 5.2. Consumption data for these years are derived from the Department of Revenue's monthly reports, using that department's present major fuel categories. Between January 1977 and September 1982, several categories were added and deleted. Table 5.2 shows these changes and the correlation between past and present categories. These data are statewide figures only. Regional breakdowns, shown in past issues of this report, are not possible because DOR stopped reporting fuel sales by judicial districts in July, 1982. In-state refinery production and fuel imports for 1982 are tabulated in Tables 2.4 and 2.5. These data are taken from "Fuel Consumption and Pricing in Alaska, A Regional Analysis."¹

Gas Production and Consumption

Historical natural gas production and major consumption items are presented in Table 5.3 and Figures 5.3 and 5.4. Production, consumption by field operations and commercial sales data are compiled from Oil and Gas Conservation Commission monthly reports whereas individual major consumption figures are from consumers or taken from consumer reports to DO&G.

¹Keiser, G., Teal, D., "Fuel Consumption and Pricing in Alaska, A Regional Analysis," Alaska State Legislature, House Research Agency Report 83-C, January 1984.

FIGURE 5.1
OIL PRODUCTION, 1977-1984

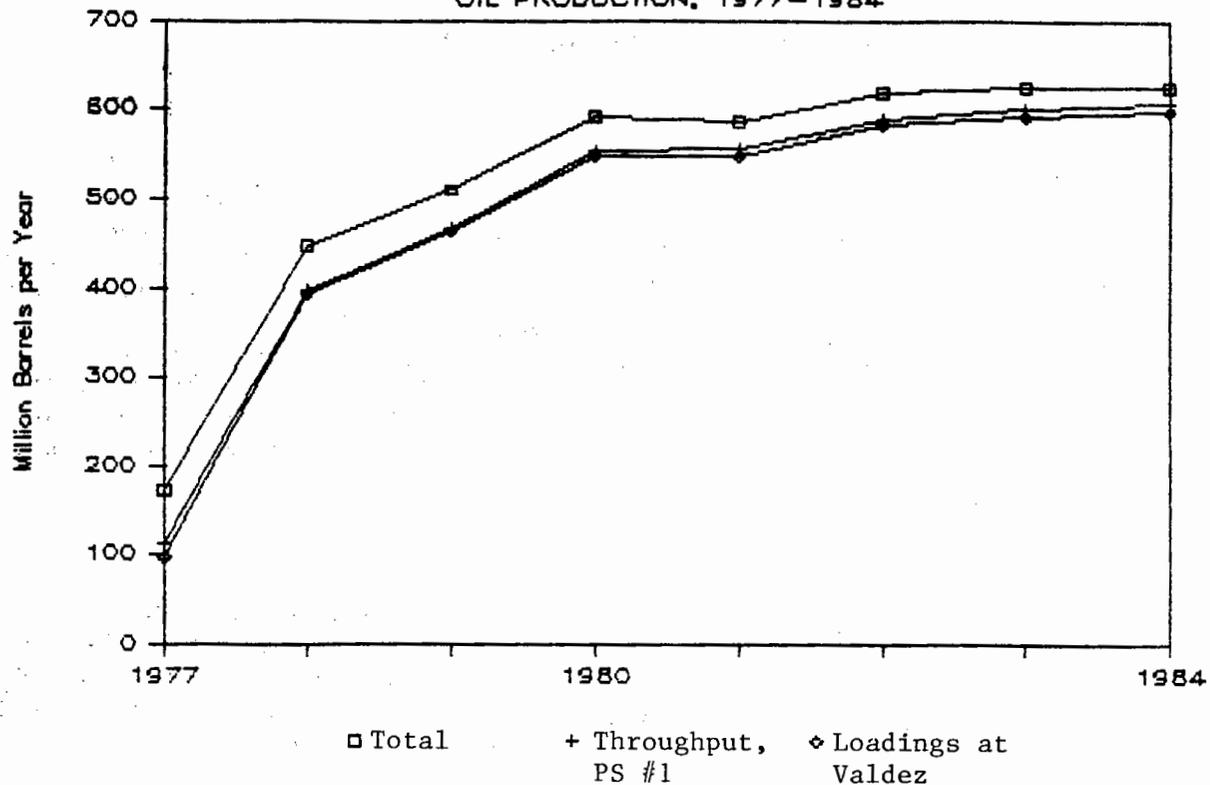


FIGURE 5.2
OIL CONSUMPTION, 1977-1984

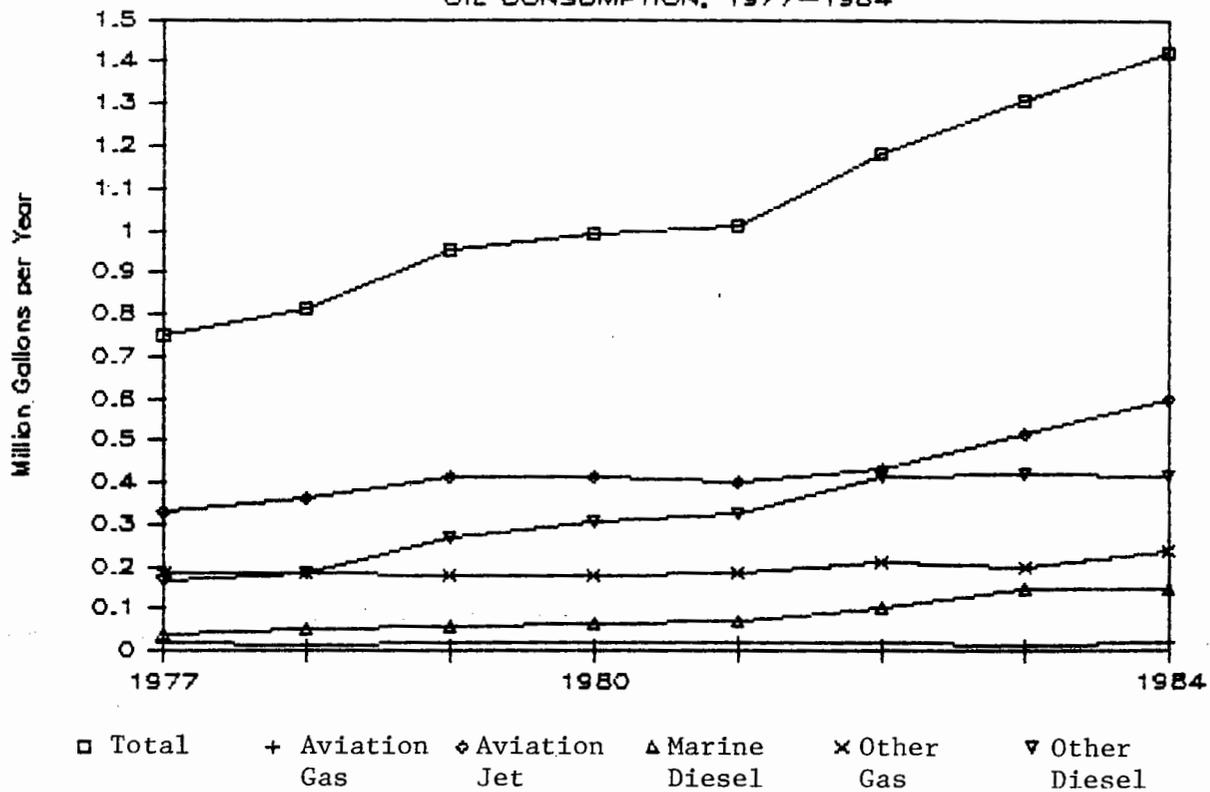


FIGURE 5.3
GAS PRODUCTION, 1971-1984

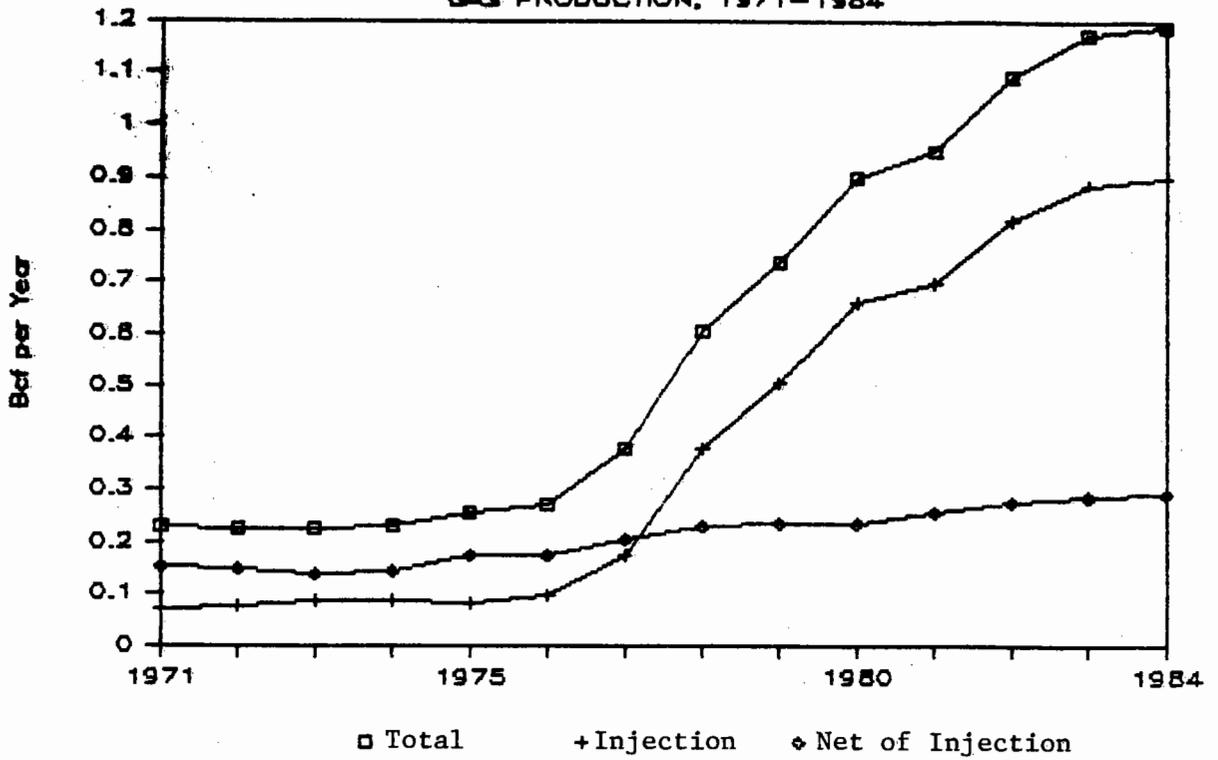
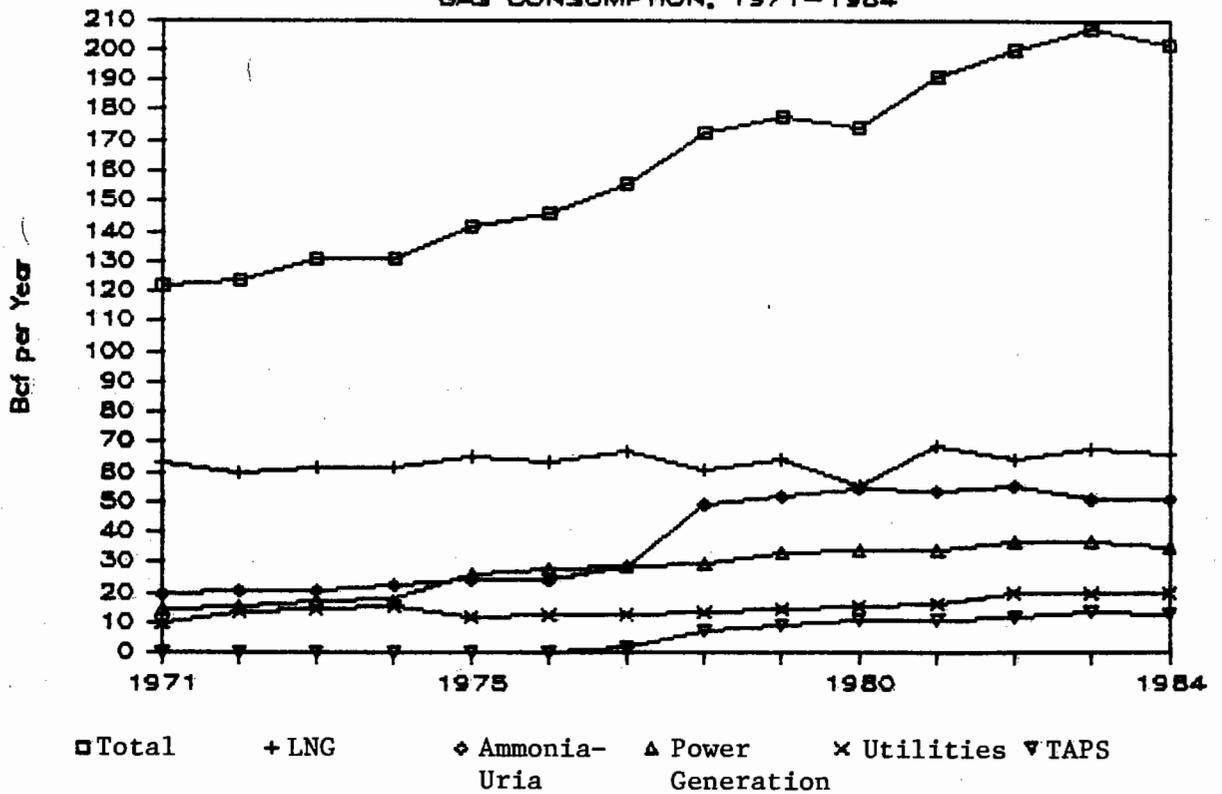


FIGURE 5.4
GAS CONSUMPTION, 1971-1984



HISTORICAL OIL PRODUCTION AND CONSUMPTION: STATE

TABLE 5.1

YEAR:	1977	1978	1979	1980	1981	1982	1983	1984[1]	Growth, 1978- 1984 [4]
PRODUCTION (Million Barrels) [2]									
Gross Production	171.318	447.810	511.335	591.640	587.339	618.910	625.527	626.556	5.76 %
TAPS Throughput, PS #1	112.315	397.149	467.939	554.934	556.067	591.142	600.859	607.961	7.35 %
EXPORTS (Million Barrels) [2]									
Liftings at Valdez	96.669	394.080	464.394	548.895	547.026	583.370	592.319	599.672	7.25 %
CONSUMPTION (Million Gallons) [3]									
Aviation Gas	16.770	15.830	16.925	16.912	18.754	16.596	15.244	17.977	2.14 %
Exempt	1.521	0.685	0.552	0.558	0.574	0.589	0.498	0.647	
Taxable	15.249	15.145	16.373	16.354	18.180	16.007	14.746	17.330	
Aviation Jet	330.744	363.607	415.164	416.184	400.177	432.366	517.575	598.984	8.68 %
Exempt	227.581	250.601	288.974	286.110	247.619	99.957	242.815	293.060	
Taxable	103.163	113.006	126.190	130.074	152.558	332.409	274.760	305.924	
Marine Gas	11.766	7.714	8.296	7.598	7.602	7.878	8.568	9.777	4.03 %
Exempt	5.707	0.554	0.292	0.025	0.085	0.032	0.052	0.114	
Taxable	6.059	7.160	8.004	7.573	7.517	7.846	8.516	9.663	
Marine Diesel	38.613	51.985	59.492	67.711	72.282	99.443	147.569	149.798	19.29 %
Exempt	6.396	10.116	6.325	5.370	5.153	30.443	75.395	72.087	
Taxable	32.217	41.869	53.167	62.341	67.129	69.000	72.174	77.711	
Other Gas	186.213	187.359	181.329	177.353	186.446	210.644	197.968	234.833	3.84 %
Exempt	5.094	8.290	7.527	8.162	9.084	12.809	10.887	19.017	
Taxable	181.119	179.069	173.802	169.191	177.362	197.835	187.081	215.816	
Other Diesel	165.752	184.876	269.377	302.647	326.440	411.125	420.279	410.303	14.21 %
Exempt	46.160	54.050	120.960	120.939	117.074	187.856	178.494	163.082	
Taxable	119.592	130.826	148.417	181.708	209.366	223.269	241.785	247.221	
TOTAL CONSUMPTION	749.858	811.371	950.583	988.405	1,011.701	1,178.052	1,307.203	1,421.672	9.80 %

[1] Estimated from part-yearly reports.

[2] Alaska Oil and Gas Conservation Commission, "Statistical Report," 1977-83.

[3] Alaska Department of Revenue, "Report of Motor Fuel Sold or Distributed in Alaska."

[4] Average annual growth.

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FUEL CATEGORIES, DEPARTMENT OF REVENUE

Table 5.2

1/77-9/82
(Order rearranged)

10/82-Present

	1977	1978	1979	1980	1981	1982		
Aviation Gas	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt	Aviation Gas	Exempt
	Taxable	Taxable	Taxable	Taxable	Taxable	Taxable		Taxable
Aviation Bonded	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt	Aviation Jet	Exempt
Aviation Jet	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt		Exempt
	Taxable	Taxable	Taxable	Taxable	Taxable	Taxable		Taxable
Marine Non-Prop.	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt	Marine Gas	Exempt
Marine Gas	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt		Exempt
	Taxable	Taxable	Taxable	Taxable	Taxable	Taxable		Taxable
Marine Diesel	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt	Marine Diesel	Exempt
	Taxable	Taxable	Taxable	Taxable	Taxable	Taxable		Taxable
Marine Other	Taxable	Taxable	Taxable	Taxable	Taxable	Taxable		Taxable
Off-Highway Gas	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt	Other Gas	Exempt
Highway Gas	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt		Exempt
	Taxable	Taxable	Taxable	Taxable	Taxable	Taxable		Taxable
Off-Highway Diesel	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt	Other Diesel	Exempt
Highway Diesel	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt		Exempt
	Taxable	Taxable	Taxable	Taxable	Taxable	Taxable		Taxable
Highway Other	Taxable	Taxable	Taxable	Taxable	Taxable	Taxable		Taxable
Other Type Fuel	Taxable	Taxable	Taxable	Taxable	Taxable	Taxable		Taxable

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HISTORICAL GAS DISPOSITION AND SALES: STATE (BCF)

TABLE 5.3

	1971**	1972**	1973**	1974**	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984 [11]	Growth, 1978- 1984 [11]
PRODUCTION															
Gross Production [2]	227.940	222.790	225.235	229.909	256.399	271.162	375.832	602.687	738.485	898.155	948.554	1,090.655	1,171.121	1,189.309	12.00 %
Injection [3]	73.88	76.13	87.78	86.91	83.007	97.077	171.188	375.405	503.003	661.947	695.515	817.863	886.364	898.946	15.67 %
Net Production	154.060	146.660	137.455	142.999	173.392	174.085	204.644	227.282	235.482	236.208	253.039	272.792	284.757	290.363	4.17 %
CONSUMPTION															
Field Operations	45.250	36.560	20.900	23.890	31.639	28.322	48.859	55.180	57.865	62.001	62.166	72.876	77.590	88.793	8.25 %
Vented and flared [3]	33.18	20.98	6.93	7.05	10.557	6.674	15.729	6.183	4.551	4.846	5.660	6.983	5.084	6.737	
Used on Leases [3]	10.96	14.86	12.42	14.31	17.963	18.424	29.966	35.055	38.123	43.575	44.592	52.724	58.893	65.641	
Shrinkage [3]	1.11	0.72	1.55	2.53	3.119	3.224	3.145	3.426	2.847	2.438	2.434	2.602	2.726	2.591	
Other [3]	0.00	0.00	0.00	0.00	0.00	0.000	0.019	10.516	12.344	11.142	9.480	10.567	10.887	13.824	
Sold [2]	121.717	123.717	130.937	130.319	141.754	145.763	155.785	172.101	177.616	174.208	190.873	199.914	207.167	201.570	2.67 %
LNG [4]	63.24	59.87	60.99	61.87	64.777	63.509	66.912	60.874	64.111	54.844	68.823	64.438	67.729	65.471	1.22 %
Amonia-Urea [5]	19.49	20.58	20.64	22.10	23.888	24.257	28.620	48.879	51.657	54.699	53.636	55.220	50.338	50.890	0.67 %
Power generation	14.691	15.379	16.700	17.448	25.461	27.613	28.590	29.718	33.141	33.520	33.947	36.222	36.651	35.030	2.78 %
Public [6]	8.142	8.906	10.631	11.764	19.619	22.189	23.590	24.592	28.155	28.757	29.386	31.392	32.055	30.939	
Military [6]	6.549	6.473	6.069	5.684	5.842	5.424	5.000	5.126	4.986	4.763	4.561	4.830	4.596	4.091	
Gas Utilities	10.238	13.099	14.757	15.128	12.092	12.551	12.683	13.454	14.045	15.521	16.213	19.564	19.518	19.807	6.66 %
Residential [6]	5.440	6.027	6.519	6.717	5.548	5.916	6.010	6.536	6.911	7.773	8.385	10.520	10.609	10.641	
Commercial [6]	4.798	7.072	8.238	8.411	6.544	6.635	6.673	6.918	7.134	7.748	7.828	9.044	8.909	9.166	
Producers [7]	*	13.396	12.587	10.414	12.477	11.588	6.703	10.523	6.958	5.190	5.601	11.383	12.698	12.038	
Refiners [8]	*	0.560	1.939	2.465	3.268	1.785	0.199	0.237	0.285	0.380	0.316	0.486	0.502	0.506	8.39 %
TAPS [9]	0.000	0.000	0.000	0.000	0.000	0.000	1.754	6.949	8.647	11.106	11.106	13.277	13.277	12.636	10.48 %
Other Sales [10]	14.058	0.833	3.324	0.894	0.209	4.460	10.324	1.467	(1.229)	(0.632)	1.031	0.649	6.454	5.192	

* Not available.
 ** Railbelt only; does not include North Slope.
 [1] Estimated from part-yearly reports of cited sources.
 [2] Alaska Oil and Gas Conservation Commission, "Report of Gas Disposition," monthly reports.
 [3] 1971-74: Stanford Research Institute, "Natural Gas Demand and Supply to the Year 2000 in the Cook Inlet Basin of South Central Alaska," Nov. 1977.
 [4] 1975-84: Alaska Oil and Gas Conservation Commission, "Report of Gas Disposition," monthly reports.
 [5] 1971-74: Stanford Research Institute, "Natural Gas Demand and Supply to the Year 2000 in the Cook Inlet Basin of South Central Alaska," Nov. 1977.
 [6] 1975-79: Sum of 1) production from Kenai and Beaver Creek gas fields in; Alaska Oil and Gas Conservation Commission, "Report of Gas Disposition," and 2) sales from North Cook Inlet gas field in; Alaska Oil and Gas Conservation Commission, "Kenai Gas Sales."
 [7] 1980-84: Royalty reports from producers to Division of Oil and Gas.
 [8] 1971-74: Stanford Research Institute, "Natural Gas Demand and Supply to the Year 2000 in the Cook Inlet Basin of South Central Alaska," Nov. 1977.
 [9] 1975-79: Sum of 1) sales from Kenai and Beaver Creek gas fields to Collier Chemical in; Alaska Oil and Gas Conservation Commission, "Monthly Report of Gas Disposition," and 2) sales from McArthur River gas field in; Alaska Oil and Gas Conservation Commission, "Monthly Report of Gas Disposition."
 [10] 1980-84: Royalty reports from producers to Division of Oil and Gas.
 [11] Annual reports from Alaska Pipeline Co., ENSTAR and Kenai Utility Service Co. to Alaska Public Utilities Commission and Barrow Utilities and Electric Cooperative Inc., personal communication.
 [12] Royalty reports from Union to Division of Oil and Gas, item Rental Gas.
 [13] Royalty reports from Union to Division of Oil and Gas, items Alaska Pipeline-Nikiski, Chevron Rental Gas and Metering.
 [14] Royalty reports from ARCO to Division of Oil and Gas.
 [15] Calculated difference between "Sold" and sum of listed "Sold" items.
 [16] Average annual growth.

HISTORICAL GAS DISPOSITION AND SALES: RAILBELT (BCF)

TABLE 5.3 (cont.)

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984 [9]	Growth, 1978- 1984 [9]
PRODUCTION															
Gross Production [2]	227,940	222,790	225,235	229,909	252,554	265,253	279,961	293,800	305,075	299,942	299,051	309,119	306,343	300,922	0.40 Z
Injection [3]	73.88	76.13	87.78	86.91	83.007	97.077	103.108	103.551	112.868	115.437	100.410	102.248	94.385	93.925	-1.61 Z
Net Production	154,060	146,660	137,455	142,999	169,547	168,176	176,853	190,249	192,207	184,505	198,641	206,871	211,958	206,997	1.42 Z
CONSUMPTION															
Field Operations	45,250	36,560	20,900	23,890	28,830	24,467	24,416	25,949	24,101	22,304	20,559	20,957	19,380	20,479	-3.87 Z
Vented and flared [3]	33.18	20.98	6.93	7.05	9.496	5.421	4.888	3.870	2.710	3.045	3.175	3.494	2.560	3.292	
Used on Leases [3]	10.96	14.86	12.42	14.31	16.215	15.822	16.404	16.228	14.564	14.608	14,950	14,861	14,056	14,593	
Shrinkage [3]	1.11	0.72	1.55	2.53	3.119	3.224	3.145	3.426	2.847	2.438	2.434	2.602	2.726	2,591	
Other [3]	0.00	0.00	0.00	0.00	0.000	0.000	0.019	2.425	3.980	2.213	0.000	0.000	0.038	0.003	
Sold [2]	121,717	123,717	130,937	130,318	140,717	143,710	152,437	164,300	168,106	162,201	178,082	185,913	192,578	186,519	2.14 Z
LNG [4]	63.24	59.87	60.99	61.87	64,777	63,509	66,912	60,874	64,111	54,844	68,823	64,438	67,729	65,471	1.22 Z
Ammonia-Urea [5]	19.49	20.58	20.64	22.10	23,888	24,257	28,620	48,879	51,657	54,699	53,836	55,220	50,338	50,890	0.67 Z
Power generation	14,691	15,379	16,700	17,448	25,461	27,613	28,590	29,718	33,141	33,520	33,632	35,818	36,169	34,545	2.54 Z
Public [6]	8.142	8,906	10,631	11,764	19,619	22,189	23,590	24,592	28,155	28,757	29,071	30,988	31,573	30,454	3.63 Z
Military [6]	6.549	6,473	6,069	5,684	5,842	5,424	5,000	5,126	4,986	4,763	4,561	4,830	4,596	4,091	
Gas Utilities [6]	10,238	13,099	14,757	15,128	12,092	12,551	12,683	13,454	14,045	15,521	15,778	19,025	19,111	19,293	6.19 Z
Residential [6]	5,440	6,027	6,519	6,717	5,548	5,916	6,010	6,536	6,911	7,773	7,950	9,981	10,202	10,127	
Commercial [6]	4,798	7,072	8,238	8,411	6,544	6,635	6,673	6,918	7,134	7,748	7,828	9,044	8,909	9,166	
Producers [7]	* 13,396	12,587	10,414	12,477	11,588	6,703	10,523	6,958	5,190	5,601	11,383	11,383	12,698	12,038	
Other Sales [8]	14,058	1,593	5,263	3,358	2,022	4,192	8,929	0,852	(1,806)	(1,573)	0,412	0,029	6,533	4,282	

* Not available.

[1] Estimated from part-yearly reports of cited sources.

[2] Alaska Oil and Gas Conservation Commission, "Report of Gas Disposition," monthly reports.

[3] 1971-74: Stanford Research Institute, "Natural Gas Demand and Supply to the Year 2000 in the Cook Inlet Basin of South Central Alaska," Nov. 1977.

[4] 1975-84: Alaska Oil and Gas Conservation Commission, "Report of Gas Disposition," monthly reports.

[5] 1971-74: Stanford Research Institute, "Natural Gas Demand and Supply to the Year 2000 in the Cook Inlet Basin of South Central Alaska," Nov. 1977.

[6] 1975-79: Sum of 1) production from Kenai and Beaver Creek gas fields in: Alaska Oil and Gas Conservation Commission, "Report of Gas Disposition," and 2) sales from North Cook Inlet gas field in: Alaska Oil and Gas Conservation Commission, "Kenai Gas Sales."

[7] 1980-84: Royalty reports of producers to Division of Oil and Gas.

[8] 1971-74: Stanford Research Institute, "Natural Gas Demand and Supply to the Year 2000 in the Cook Inlet Basin of South Central Alaska," Nov. 1977.

[9] 1975-79: Sum of 1) sales from Kenai and Beaver Creek gas fields to Collier Chemical in: Alaska Oil and Gas Conservation Commission, "Kenai Gas Sales," and 2) sales from McArthur River gas field in: Alaska Oil and Gas Conservation Commission, "Monthly Report of Gas Disposition."

[10] 1980-84: Royalty reports of producers to Division of Oil and Gas.

[11] Annual reports from Alaska Pipeline Co., ENSTAR and Kenai Utility Service Co. to Alaska Public Utilities Commission.

[12] Royalty reports from Union to Division of Oil and Gas, item Rental Gas.

[13] Calculated difference between "Sold" and sum of listed "Sold" items.

[14] Average annual growth.

HISTORICAL GAS DISPOSITION AND SALES: NON-RAILBELT (BCF)

TABLE 5.3 (cont.)

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984 [1]	Growth, 1978- 1984 [7]
PRODUCTION															
Gross Production [2]	*	*	*	*	3.845	5.909	95.871	308.887	433.410	598.214	649.504	781.536	864.778	888.387	19.25 %
Injection [2]	*	*	*	*	0.000	0.000	68.080	271.854	390.136	546.509	595.106	715.615	791.979	805.021	19.83 %
Net Production:	*	*	*	*	3.845	5.909	27.791	37.033	43.274	51.705	54.398	65.921	72.799	83.366	14.48 %
CONSUMPTION															
Field Operations	*	*	*	*	2.808	3.856	24.444	29.231	33.763	39.697	41.607	51.921	58.210	68.315	15.20 %
Vented and flared [2]	*	*	*	*	1.061	1.254	10.882	2.313	1.840	1.801	2.485	3.490	2.524	3.446	
Used on Leases [2]	*	*	*	*	1.747	2.602	13.562	18.926	23.559	28.967	29.642	37.864	44.837	51.048	
Shrinkage [2]	*	*	*	*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Other [2]	*	*	*	*	0.000	0.000	0.000	0.000	8.364	8.929	9.480	10.567	10.849	13.821	
Sold [2]	*	*	*	*	1.037	2.054	3.347	7.802	9.512	12.007	12.791	14.000	14.589	15.051	11.57 %
Power generation, Public [3]	*	*	*	*	*	*	*	*	*	*	0.315	0.404	0.482	0.485	
Gas Utilities, Residential [3]	*	*	*	*	*	*	*	*	*	*	0.435	0.539	0.407	0.514	
Refiners [4]	*	0.560	1.939	2.465	3.268	1.785	0.199	0.237	0.285	0.380	0.316	0.486	0.502	0.506	8.39 %
TAPS [5]	0.000	0.000	0.000	0.000	0.000	0.000	1.754	6.949	8.648	10.686	11.106	11.952	13.277	12.636	10.48 %
Other Sales [6]					(2.231)	0.269	1.394	0.616	0.579	0.941	0.619	0.619	(0.079)	0.910	

* Not available.
 [1] Estimated from part-yearly reports of cited sources.
 [2] Alaska Oil and Gas Conservation Commission, "Report of Gas Disposition," monthly reports.
 [3] Barrow Utilities and Electric Cooperative Inc., personal communication.
 [4] Royalty reports from Union to Division of Oil and Gas, items Alaska Pipeline-Nikiski, Chevron Rental Gas and Metering.
 [5] Royalty reports from ARCO to Division of Oil and Gas.
 [6] Calculated difference between "Sold" and sum of listed "Sold" items.
 [7] Average annual growth.

ROYALTY OIL AND GAS DATA BY FIELD

APPENDIX A

FIELD BELUGA RIVER
 LOCATION Cook Inlet, onshore, west side
 BEGAN PRODUCTION 1/68
 OWNER AGEA, ARCO, Chevron, Shell
 OPERATOR Chevron

	OIL	GAS	
		Casinghead	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	Bbl	MCF	1,568,438 MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	Bbl	MCF	175,561,305 MCF
ESTIMATED RESERVES AS OF 9/84	Bbl	MCF	763,884,062 MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	%	%	19 %

 ROYALTY 12.5%, Effective rate: 7.555%

PURCHASER Chugach Electric, ENSTAR /Bbl /MCF RIV: \$ 0.21033 /MCF

LEASES State ADL: 17592, 17599, 17658, 21126, 21127, 21128, 21129
 Federal AO: 29656, 29657

COMMENTS

Until recently, Chugach Electric was the only current purchaser of this gas. Chugach uses this gas for power generation which is delivered to the Anchorage market.

Enstar has recently purchased Beluga River gas under contract from Shell and just completed a pipeline from the field through the Mat-Su Valley to Anchorage.

Due to the existence of several Federal leases, the state's effective royalty share is 7.555%. Royalty ownership was reallocated by changing the ownership determination from surface acreage to reservoir percentage.

FIELD CANNERY LOOP
 LOCATION Cook Inlet, onshore, east side
 BEGAN PRODUCTION Field delineation underway
 OWNER
 OPERATOR Union

	OIL	GAS	
		Casinghead	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	Bbl	MCF	MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	Bbl	MCF	MCF
ESTIMATED RESERVES AS OF 9/84	Bbl	MCF	MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	%	%	%

 ROYALTY

PURCHASER /Bbl /MCF /MCF

LEASES State ADL:

COMMENTS

Shut-in gas field.

Initial hydrocarbon equity ownership calculations underway.

FIELD DUCK ISLAND / SAG DELTA (ENDICOTT RESERVOIR)
 LOCATION North Slope, onshore/offshore
 BEGAN PRODUCTION Facilities design underway, production expected to begin in 1988.
 OWNER
 OPERATOR SDHIO

	OIL	GAS	
		Casinghead	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	Bbl	MCF	MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	Bbl	MCF	MCF
ESTIMATED RESERVES AS OF 9/84	Bbl	MCF	MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	Z	Z	Z

ROYALTY			
PURCHASER	/Bbl	/MCF	/MCF

LEASES	State ADL:		

COMMENTS
 Initial calculation of hydrocarbon ownership underway.
 Unit area expansion application made in December, 1984.

FIELD EPPERSON KNOB UNIT AREA
 LOCATION Cook Inlet, onshore, east side
 BEGAN PRODUCTION Exploration to begin in 1985
 OWNER
 OPERATOR Alaska Crude Corporation

	OIL	GAS	
		Casinghead	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	Bbl	MCF	MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	Bbl	MCF	MCF
ESTIMATED RESERVES AS OF 9/84	Bbl	MCF	MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	Z	Z	Z

ROYALTY			
PURCHASER	/Bbl	/MCF	/MCF

LEASES	State ADL:		

COMMENTS

FIELD
LOCATION
BEGAN PRODUCTION
OWNER
OPERATOR

FALLS CREEK
Cook Inlet, onshore, east side
Shut-in 1961
Chevron

	OIL	Casinghead	GAS	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	Bbl		MCF	0 MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	Bbl		MCF	18,983 MCF
ESTIMATED RESERVES AS OF 9/84	Bbl		MCF	13,000,000 MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	%		%	0 %

ROYALTY

PURCHASER /Bbl /MCF /MCF

LEASES State ADL:

COMMENTS
Shut-in gas field.

FIELD
LOCATION
BEGAN PRODUCTION
OWNER
OPERATOR

GRANITE POINT
Cook Inlet, offshore, west side
12/67
AMOCO, ARCO, Chevron, Getty, Mobil, Phillips, Superior, Texaco, Union
AMOCO, ARCO, Texaco, Union

	OIL	Casinghead	GAS	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	285,255 Bbl	204,099 MCF		MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	97,110,561 Bbl	84,793,308 MCF		MCF
ESTIMATED RESERVES AS OF 9/84	24,432,705 Bbl	24,163,112 MCF		MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	80 %	78 %		%

ROYALTY 12.5 %

PURCHASER Tesoro RIK: \$24.884 /Bbl /MCF /MCF
 ARCO* RIV: \$ 0.118
 AMOCO Platform* RIV: \$ 0.10
 Union* RIV: \$ 0.10

* Small amount of casinghead gas sold to AMOCO for use on platform.

LEASES State ADL: 17586, 17587, 17597, 18742, 18761, 18776, 35431

COMMENTS All royalty oil from this field is taken in kind and sold to Tesoro.
 DL-1 Rev 4/6/81
 DL-1 Rev 4/6/81

Gas from this field is casinghead gas and was formerly flared. DOGC Flaring Order #104, 6/30/71, has prohibited flaring since 7/1/72 and this gas is now recovered and used locally.

FIELD LOCATION
 GMYDYR BAY UNIT AREA
 North Slope, onshore/offshore
 Field delineation underway
 OWNER OPERATOR
 Conoco

	OIL	Casinghead	GAS	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	Bbl		MCF	MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	Bbl		MCF	MCF
ESTIMATED RESERVES AS OF 9/84	30,000,000 Bbl*		MCF	MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	%	%	%	%

* William Van Dyke, personal communication, 10/10/84.

 ROYALTY

PURCHASER	/Bbl	/MCF	/MCF
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LEASES State ADL:

COMMENTS

Further exploration activities planned for 1985.

FIELD LOCATION
 HEMI SPRINGS UNIT AREA
 North Slope, onshore
 Exploration to begin in 1984
 OWNER OPERATOR
 ARCO

	OIL	Casinghead	GAS	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	Bbl		MCF	MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	Bbl		MCF	MCF
ESTIMATED RESERVES AS OF 9/84	Bbl		MCF	MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	%	%	%	%

 ROYALTY

PURCHASER	/Bbl	/MCF	/MCF
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LEASES State ADL:

COMMENTS

Unit agreement approved in 1984.

FIELD
LOCATION
BEGAN PRODUCTION
OWNER
OPERATOR

IVAN RIVER
Cook Inlet, onshore, west side
Shut-in 1966, suspended

Chevron

	OIL	GAS	
		Casinghead	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	Bbl	MCF	MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	Bbl	MCF	0 MCF
ESTIMATED RESERVES AS OF 9/84	Bbl	MCF	26,000,000 MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	%	%	0 %

ROYALTY			
PURCHASER	/Bbl	/MCF	/MCF
LEASES	State ADL:		

COMMENTS
Shut-in gas field.

FIELD
LOCATION
BEGAN PRODUCTION
OWNER
OPERATOR

KATALLA
Gulf of Alaska, onshore
Abandoned 1934

Fee land

	OIL	GAS	
		Casinghead	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	0 Bbl	MCF	MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	154,000 Bbl	MCF	MCF
ESTIMATED RESERVES AS OF 9/84	Not reported Bbl	MCF	MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	%	%	%

ROYALTY			
PURCHASER	/Bbl	/MCF	/MCF
LEASES	State ADL:		

COMMENTS
Alaska Crude Corporation beginning exploration again in 1985.

FIELD LOCATION
 KAVIK
 North Slope, onshore
 Suspended
 OWNER
 OPERATOR ARCO

	OIL	GAS	
		Casinghead	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	Bbl	MCF	MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	Bbl	MCF	MCF
ESTIMATED RESERVES AS OF 9/84	Bbl	MCF	MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	%	%	%

ROYALTY			
PURCHASER	/Bbl	/MCF	/MCF

LEASES State ADL:

COMMENTS
 Shut-in gas field.

FIELD LOCATION
 KENAI
 Cook Inlet, onshore, east side
 BEGAN PRODUCTION 1/62
 OWNER ARCO, Chevron, Marathon, Union
 OPERATOR Union

	OIL	GAS	
		Casinghead	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	Bbl	MCF	9,076,597 MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	11,877 Bbl*	MCF	1,510,682,825 MCF
ESTIMATED RESERVES AS OF 9/84	Bbl	MCF	763,310,628 MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	%	%	66 %

* Natural gas liquids.

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

LEASES State ADL: 00593, 00594, 00588, 02411, 02497, 308223, 324598
 Federal AD: 28047, 28053, 28056, 28103, 28140, 28142, 28143

COMMENTS
 The Kenai Unit provides most of the gas sales in the Cook Inlet area. Estimated Alaska state royalty gas sales were approximately 195,000 MCF as of 1982.

The state does not receive the full 12.5% royalty share because of the predominance of Federal leases in the unit and the recent conveyance of land to Cook Inlet Region Inc. The price the state received from its royalty share results from prices paid under existing contracts between the lessees and their purchasers.

FIELD KUPARUK
 LOCATION North Slope, onshore
 BEGAN PRODUCTION 12/81
 OWNER ARCO, BP, Chevron, Exxon, Mobil, Phillips, Sohio, Union
 OPERATOR ARCO

	OIL	Casinghead	GAS	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	3,498,390 Bbl	511,851 MCF		MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	104,868,433 Bbl	16,508,372 MCF		MCF
ESTIMATED RESERVES AS OF 9/84	1,040,000,000 Bbl*	220,000,000 MCF*		MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	6 %	7 %		%

* William Van Dyke, personal communication, 10/10/84.

ROYALTY 12.5 %

PURCHASER All owners RIV: \$16.83643 /Bbl* RIV: \$2.992356 /MCF

* Weighted average, with field costs.

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

COMMENTS

Unit Area expansion approved in 1984.

FIELD LEWIS RIVER
 LOCATION Cook Inlet, onshore, west side
 BEGAN PRODUCTION 1984
 OWNER
 OPERATOR Cities Service

	OIL	Casinghead	GAS	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	Bbl		MCF	0 MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	Bbl		MCF	53,295 MCF
ESTIMATED RESERVES AS OF 9/84	Bbl		MCF	22,000,000 MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	%		%	0 %

ROYALTY RIV: 12.5%

PURCHASER /Bbl /MCF /MCF

LEASES State ADL:

COMMENTS

Short term gas sales to Enstar began in 1984.

FIELD LOCATION LISBURNE RESERVOIR
 LOCATION North Slope, onshore/offshore
 BEGAN PRODUCTION Field delineation and facilities design underway, production expected to
 OWNER begin in 1986-87.
 OPERATOR ARCO

	OIL	Casinghead	GAS	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	35,140 Bbl	36,178 MCF		MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	613,152 Bbl*	856,938 MCF		MCF
ESTIMATED RESERVES AS OF 9/84	399,683,740 Bbl**	1,099,674,399 MCF*		MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	0 %	0 %		%

* Includes 28,897 Bbl NGL.
 ** William Van Dyke, personal communication, 10/10/84.

ROYALTY	12.5%			
PURCHASER	/Bbl	/MCF	/MCF	

LEASES State ADL:

COMMENTS

FIELD LOCATION MCARTHUR RIVER
 LOCATION Cook Inlet offshore, west side
 BEGAN PRODUCTION 12/69
 OWNER AMOCO, ARCO, Chevron, Getty, Marathon, Phillips, Union
 OPERATOR Union

	OIL	Casinghead	GAS	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	1,030,248 Bbl	501,795 MCF**		753,798 MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	504,364,975 Bbl*	180,731,696 MCF**		105,347,362 MCF
ESTIMATED RESERVES AS OF 9/84	64,727,768 Bbl	21,483,845 MCF		53,215,816 MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	89 %	89 %		66 %

* Includes 8,112,602 Bbl NGL.
 ** Includes tank vapors.

ROYALTY	12.5 %			
PURCHASER Tesoro	RIK: \$28.04 /Bbl	/MCF	/MCF	

LEASES State ADL: 17519, 17594, 17602, 18716, 18729, 18730, 18758, 18772, 18777, 21068 DL-1 Rev 4/61

COMMENTS

All royalty oil from this field is taken in kind and sold to Tesoro.

Gas from this field is casinghead gas and was formerly flared. DOGC Flaring Order #104, 6/30/71, has prohibited flaring since 7/1/72 and this gas is now recovered and used locally.

FIELD NICOLAI CREEK
 LOCATION Cook Inlet, onshore-offshore, west side
 BEGAN PRODUCTION 10/68, now shut-in
 OWNER Superior, Texaco
 OPERATOR Texaco

	OIL	Casinghead	GAS	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	Bbl		MCF	0 MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	Bbl		MCF	1,062,055 MCF
ESTIMATED RESERVES AS OF 9/84	Bbl		MCF	3,000,000 MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	%		%	26 %

ROYALTY	12.5 %			
PURCHASER	AMOCO	/Bbl	/MCF	RIV: \$ 0.15 /MCF

LEASES State ADL: 17585, 17598, 63279
 Federal AO: 34161

COMMENTS
 Gas from this small field, when produced, is used only by platform and shore production facilities. At present there is no production and no prospective purchaser for the state's royalty share.

FIELD NORTH COOK INLET
 LOCATION Cook Inlet, offshore, mid-channel
 BEGAN PRODUCTION 3/69
 OWNER Phillips
 OPERATOR Phillips

	OIL	Casinghead	GAS	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	Bbl		MCF	3,814,191 MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	Bbl		MCF	675,098,122 MCF
ESTIMATED RESERVES AS OF 9/84	Bbl		MCF	824,672,283 MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	%		%	45 %

ROYALTY	12.5 %			
PURCHASER	Alaska Pipeline Phillips	/Bbl	/MCF	RIV: \$2.3405 /MCF

LEASES State ADL: 17589, 17590, 18740, 18741, 37831

COMMENTS
 Gas from this field is primarily delivered to the Phillips LNG plant and subsequently sold in Japan.

FIELD MIDDLE GROUND SHOAL
 LOCATION Cook Inlet, offshore, east side
 BEGAN PRODUCTION 9/67
 OWNER AMOCO, ARCO, Chevron, Getty, Phillips, Shell
 OPERATOR AMOCO, Shell

*Phillips Petroleum Co
 2/15/84 to Phillips Oil Company*

	OIL	GAS	
		Casinghead	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	273,544 Bbl	185,009 MCF	27,835 MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	143,180,432 Bbl	71,657,498 MCF	586,476 MCF
ESTIMATED RESERVES AS OF 9/84	12,538,105 Bbl	9,334,920 MCF	Not reported MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	92 %	88 %	N/A %

1/86 Phillips Petroleum to Amoco

ROYALTY	12.5 %		
PURCHASER Tesoro	RIK: \$28.17 /Bbl		/MCF
LEASES State ADL: 17595, 18744, 18746, 18754, 18756			/MCF

DL-1 Rev 4/61 Sale #9

COMMENTS
 All royalty oil produced from this field is taken in kind and sold to Tesoro.
 Recent increases in gas prices may encourage a reevaluation of this gas.

Gas from this field is casinghead gas and was formerly flared. DOGC Flaring Order #104, 6/30/71, has prohibited flaring since 7/1/72 and this gas is now recovered and used locally.

FIELD MILNE POINT
 LOCATION North Slope, onshore
 BEGAN PRODUCTION Field delineation and facilities design underway, production expected to begin in 1986.
 OWNER Conoco
 OPERATOR Conoco

	OIL	GAS	
		Casinghead	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	Bbl	MCF	MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	Bbl	MCF	MCF
ESTIMATED RESERVES AS OF 9/84	60,000,000 Bbl*	MCF	MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	%	%	%

* William Van Dyke, personal communication, 10/10/84.

ROYALTY	Estimated effective rate, 16%.		
PURCHASER	/Bbl	/MCF	/MCF
LEASES State ADL:			

COMMENTS
 Unit area expansion approved during 1983.

FIELD NORTH FORK
 LOCATION Cook Inlet, onshore, east side
 BEGAN PRODUCTION Shut-in 1965
 OWNER
 OPERATOR Chevron

	OIL	Casinghead	GAS	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	Bbl		MCF	0 MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	Bbl		MCF	104,595 MCF
ESTIMATED RESERVES AS OF 9/84	Bbl		MCF	12,000,000 MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	%		%	1 %

 ROYALTY

PURCHASER	/Bbl		/MCF	/MCF
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LEASES State ADL:

COMMENTS
 Shut-in gas field.

FIELD NORTH MIDDLE GROUND SHOAL
 LOCATION Cook Inlet, offshore, mid-channel
 BEGAN PRODUCTION No production, abandoned 1975
 OWNER
 OPERATOR

	OIL	Casinghead	GAS	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	Bbl		MCF	MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	Bbl		MCF	MCF
ESTIMATED RESERVES AS OF 9/84	Bbl		MCF	MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	%		%	%

 ROYALTY

PURCHASER	/Bbl		/MCF	/MCF
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LEASES State ADL:

COMMENTS

FIELD PRUDHOE BAY - SADLEROCHIT RESERVOIR
 LOCATION North Slope, onshore
 BEGAN PRODUCTION 10/69
 OWNER Amerada-Hess, ARCO, BP, Chevron, Exxon, Getty, LL&E, Marathon, Mobil,
 Petro-Lewis, Phillips, SOHIO
 OPERATOR ARCO, Sohio
 OIL

		GAS	
		Casinghead	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	46,810,092 Bbl	6,209,513 MCF	MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	3,634,014,931 Bbl	402,116,096 MCF	MCF
ESTIMATED RESERVES AS OF 9/84	6,343,000,000 Bbl*	29,000,000,000 MCF*	MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	36 %	1 %	%

* William Van Dyke, personal communication, 10/10/84.

ROYALTY 12.5 %, Weighted average: \$18.09916

PURCHASER	Mapco-GVEA*	RIK: .213334 of Royalty	/MCF	/MCF
	Tesoro*	RIK: .21208 of Royalty		
	Chevron*	RIK: .096 of Royalty		

* New contracts effective 4/1/85.

LEASES State ADL: 28238, 28239, 28240, 28241, 28244, 28245, 28246, 28257, 28258, 28260
 28260, 28261, 28262, 28263, 28264, 28265, 28275, 28276, 28277, 28278
 28279, 28280, 28281, 28282, 28283, 28284, 28285, 28286, 28287, 28288
 28289, 28290, 28299, 28300, 28301, 28302, 28303, 28304, 28305, 28306
 28307, 28308, 28309, 28310, 28311, 28312, 28313, 28314, 28315, 28316
 28320, 28321, 28322, 28323, 28324, 28325, 28326, 28327, 28328, 28329
 28330, 28331, 28332, 28333, 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

COMMENTS

The state's royalty share of oil produced is 12.5%, with 14.9% of this share presently being taken in kind and sold to North Pole Refinery and Golden Valley Electric Assn. An additional 35.5178% of the state's share is taken in kind and sold to Tesoro. The remainder is taken in value. Additional royalty oil sales in 1984 are contemplated to be taken in value.

Small amounts of produced gas are presently sold to the operator of the Trans-Alaska Pipeline. The state is receiving royalty in value with the gas price being set by the owners of the gas. There presently is no other market. The state's royalty share of gas sales is 12.5%.

Unit Area expansion approved 1984, with additional development work continuing.

FIELD
 LOCATION
 BEGAN PRODUCTION
 OWNER
 OPERATOR

PRUDHOE BAY - SAG RIVER RESERVOIR

	OIL	Casinghead	GAS	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	Bbl		MCF	MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	Bbl		MCF	MCF
ESTIMATED RESERVES AS OF 9/84	130,000,000 Bbl*		MCF	MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	%	%	%	%

* William Van Dyke, personal communication, 10/10/84.

ROYALTY

PURCHASER /Bbl /MCF /MCF

LEASES State ADL:

COMMENTS

FIELD
 LOCATION
 BEGAN PRODUCTION
 OWNER
 OPERATOR

POINT THOMSON UNIT AREA
 North Slope, onshore/offshore
 Shut-in
 EXXON

	OIL	Casinghead	GAS	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	Bbl		MCF	MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	Bbl		MCF	MCF
ESTIMATED RESERVES AS OF 9/84	400,000,000 Bbl*	5,000,000,000 MCF*		MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	%	%	%	%

* William Van Dyke, personal communication, 10/10/84.

ROYALTY

PURCHASER /Bbl /MCF /MCF

LEASES State ADL:

COMMENTS

Unit Area expansion approved in 1984. Market analysis underway to determine development potential.

FIELD LOCATION
 REDOUBT SHOAL
 BEGAN PRODUCTION Cook Inlet, offshore, mid-channel
 OWNER Abandoned
 OPERATOR

	OIL	GAS	
		Casinghead	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	0 Bbl	0 MCF	MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	1,596 Bbl	456 MCF	MCF
ESTIMATED RESERVES AS OF 9/84	Not reported Bbl	Not reported MCF	MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	N/A %	N/A %	%

ROYALTY			
PURCHASER	/Bbl	/MCF	/MCF

LEASES	State ADL:		
COMMENTS			

FIELD LOCATION
 SOUTH MCARTHUR RIVER UNIT AREA
 BEGAN PRODUCTION Cook Inlet, offshore
 OWNER Further exploration pending
 OPERATOR Mobil

	OIL	GAS	
		Casinghead	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	Bbl	MCF	MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	Bbl	MCF	MCF
ESTIMATED RESERVES AS OF 9/84	Bbl	MCF	MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	%	%	%

ROYALTY			
PURCHASER	/Bbl	/MCF	/MCF

LEASES	State ADL:		
COMMENTS			
Unit agreement likely to terminate in 1985.			

FIELD LOCATION
 STERLING
 Cook Inlet, onshore, east side
 BEGAN PRODUCTION 5/62
 OWNER Marathon, Union
 OPERATOR Union

	OIL	Casinghead	GAS	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	Bbl		MCF	1,116 MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	Bbl		MCF	2,066,408 MCF
ESTIMATED RESERVES AS OF 9/84	Bbl		MCF	22,989,958 MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	%		%	8 %

ROYALTY	12.5%, Effective rate, 1.55461%			
PURCHASER Sport Lake Greenhouse	/Bbl		/MCF	\$ 0.40 /MCF

LEASES State ADL: 02497, 320912, 324599

COMMENTS

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 LOCATION
 STUMP LAKE UNIT AREA
 Cook Inlet, onshore, west side
 BEGAN PRODUCTION Suspended
 OWNER
 OPERATOR Chevron

	OIL	Casinghead	GAS	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	Bbl		MCF	MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	Bbl		MCF	MCF
ESTIMATED RESERVES AS OF 9/84	Bbl		MCF	MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	%		%	%

ROYALTY				
PURCHASER	/Bbl		/MCF	/MCF

LEASES State ADL:

COMMENTS

Shut-in gas field.

FIELD LOCATION THEODORE RIVER (PRETTY CREEK UNIT AREA)
 BEGAN PRODUCTION Cook Inlet, onshore, west side
 OWNER Suspended
 OPERATOR Chevron

	OIL	GAS	
		Casinghead	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	Bbl	MCF	MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	Bbl	MCF	MCF
ESTIMATED RESERVES AS OF 9/84	Bbl	MCF	MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	%	%	%

ROYALTY PURCHASER	/Bbl	/MCF	/MCF

LEASES State ADL:

COMMENTS
 Shut-in gas field.

FIELD LOCATION TRADING BAY
 BEGAN PRODUCTION Cook Inlet, offshore, west side
 OWNER 12/67
 OPERATOR Marathon, Union
 Union

	OIL	GAS	
		Casinghead	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	51,836 Bbl	75,832 MCF	55,991 MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	85,793,576 Bbl*	57,500,060 MCF**	1,841,467 MCF
ESTIMATED RESERVES AS OF 9/84	2,533,476 Bbl	2,317,509 MCF	29,496,081 MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	97 %	96 %	6 %

* includes 346,543 Bbl NGL.
 ** Includes tank vapors.

ROYALTY	12.5 %		
PURCHASER Tesoro	RIK: \$26.43 /Bbl**	/MCF	/MCF

** Weighted average.

LEASES State ADL: 18731

COMMENTS
 All royalty oil from this field is taken in kind and sold to Tesoro.

Gas from this field is casinghead gas and formerly was flared. DOGC Flaring Order #104, 6/30/71, has prohibited flaring since 7/1/72, and this gas is now recovered and used locally.

FIELD
LOCATION
BEGAN PRODUCTION
OWNER
OPERATOR

WEST FORK
Cook Inlet, onshore, east side

	OIL	GAS	
		Casinghead	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	Bbl	MCF	3,340 MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	Bbl	MCF	1,511,984 MCF
ESTIMATED RESERVES AS OF 9/84	Bbl	MCF	5,969,943 MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	%	%	20 %

ROYALTY			
PURCHASER	/Bbl	/MCF	/MCF

LEASES State ADL:
Federal ADL:

COMMENTS
Shut-in gas field.

FIELD
LOCATION
BEGAN PRODUCTION
OWNER
OPERATOR

WEST MIKKELSEN
North Slope, onshore/offshore
Further exploration pending
ARCO, Shell

	OIL	GAS	
		Casinghead	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	Bbl	MCF	MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	Bbl	MCF	MCF
ESTIMATED RESERVES AS OF 9/84	Bbl	MCF	MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	%	%	%

ROYALTY			
PURCHASER	/Bbl	/MCF	/MCF

LEASES State ADL:

COMMENTS
Unit likely to terminate in 1985.

FIELD WEST SAK RESERVOIR
 LOCATION North Slope, onshore
 BEGAN PRODUCTION Pilot production underway
 OWNER
 OPERATOR ARCO, Conoco

	OIL	Casinghead	GAS	Gas Well
AVERAGE MONTHLY PRODUCTION AS OF 1-9/84	Bbl		MCF	MCF
CUMULATIVE NET PRODUCTION AS OF 9/84	Bbl		MCF	MCF
ESTIMATED RESERVES AS OF 9/84	750,000,000 Bbl		MCF	MCF
ESTIMATED PERCENT OF FIELD DEPLETED AS OF 9/84	%	%	%	%

ROYALTY				
PURCHASER	/Bbl		/MCF	/MCF

LEASES State ADL:

COMMENTS
 Reservoir delineation and engineering/geological studies continuing.

S/D Tbl: Apdxa, rev: 1/8/85

Introduction

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 (including cooking, water heating, and clothes drying), and industrial. A model called ENDMOD (ENergy Demand MODel) has been constructed for calculating future energy demands in Alaska.

The factors most important in projecting future demand will vary by use category. In general, the most important are population (or households) and relative fuel prices. The household is the basic consuming unit for the residential sector and is a good proxy for demand in the commercial sector. In the industrial sector, relative fuel prices are 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

Introduction

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

Gasoline

- a. Highway use (taxable and 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. In Alaska, per capita consumption of highway gas peaked in 1975 at 502 gallons per capita and declined to 383 gallons per person in 1983. The estimated consumption for 1984 is 418 gallons per person. Demand is projected using a per capita coefficient which declines one percent annually from the previous year. The initial value of 411 gallons per capita is the mean of per capita consumption of 1981 through 1984.
- b. Aviation gasoline (taxable and exempt) use has, in the past decade, been roughly 10 percent as large as highway gasoline use. Between 1971 and 1982, consumption of aviation gas per capita varied between 35 and 43 gallons. In 1982, consumption fell to 36 gallons from the peak of 43 gallons in 1981 and to 30 gallons per capita in 1983. Consumption

increased in 1984 to an estimated 33 gallons per capita. The initial value for aviation gas consumption is the 4-year mean of 35 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. Consumption in 1983 was 17 gallons per capita. The initial value used to project consumption is the 4-year mean of 17.5 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 latter categories cannot be separately identified in the historical data, but their combined total has shown relatively modest, although cyclical, growth since the early 1970s. The sharp decrease in reported exempt aviation fuel consumption (and a corresponding increase in taxable jet fuel consumption) in 1982 is probably an error.

We project domestic commercial consumption separately from international commercial and military. We assume that the taxable jet fuel category is primarily domestic commercial consumption and that the exempt jet fuel category includes international commercial and military consumption. The coefficient relating consumption to population for domestic commercial aviation has increased from 153 gallons per capita in 1971 to 350 in 1981 and 575 in 1984. (This excludes the reporting error of 1982.) The initial value for projecting the civilian domestic jet fuel is 525 gallons per capita.

We assume future growth will exceed population but at a slower rate than historically because of increased efficiency of the capital stock. The coefficient grows by 3 percent annually.

International commercial and military consumption of jet fuel is the only transportation fuel not projected on a per capita basis. While variation in international commercial and military consumption is difficult to project, growth during the preceding decade approximated 1 percent per annum. We use this figure to project future growth with 1984 consumption of 260 million gallons as the initial value.

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.

Future growth in consumption is projected at the per capita use rate of 565 gallons. While the most recent reporting system provides a breakout of nontransportation sales in the "exempt other diesel" category, the estimates of highway diesel for earlier years requires the assumption that the magnitude of nontransportation diesel sales is small in the "exempt highway" and later "exempt other" categories. Additionally, we assume that the old "off-highway category" is primarily nontransportation use.

The per capita consumption of highway diesel fuel has grown steadily since 1978, when it reached a post-pipeline construction low. Future growth in consumption is projected, based upon the 3-year mean for 1982-1984.

Marine diesel use has increased extremely rapidly since 1981. The source of this growth is impossible to determine from the data. We assume a constant per capita level of consumption of 250 gallons in future years.

Regional Allocation

Regional allocation of transportation fuels is made using the 1983 allocations of historical consumption as adjusted by projected shifts in regional population.

Electric Utility Use of Liquid Fuels and Natural Gas

Introduction

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, Southeast, and the rest of the state.

Railbelt

a. Consumption of Electricity

The total electricity demand is split into the demand for residential space heat and for all other uses. The space heating consumption rates are based upon the weighted average of electricity consumption for space heat by housing

type as reported in the 1983 version of the Railbelt Electricity Demand (RED) model (Battelle Northwest Laboratories, June 1983). Consumption per household grows over the projection period due to increased electricity consumption for space heat in the new additions to the housing stock.

The number of households using electric space heat depends upon the total number of households and the proportion of housing units which use electric space heat. Two factors are likely to influence the current proportion of households using electric space heat: (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 converting to natural gas from 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, thus causing some households, especially in Fairbanks, to switch from fuel oil to electric space heat.

We assume the gas utility will continue to extend their market into the Matanuska Valley and aggressively market their gas for space heating. Market penetration began in 1984, and during the next ten years, the electric space heating market in the Matanuska Valley will fall to half its current share.

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.

The per-household demand for electricity net of residential space heating uses is based upon historical consumption for 1980-1983 and the projected growth in consumption as reported by Battelle in the RED model documentation. This includes both residential and commercial consumption.

b. Mode Split

Except as noted below, 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 assumptions specifically determine mode split:

1. Coal-fired generation in Fairbanks remains constant at 354 thousand MWH annually.
2. Existing (Eklutna and Cooper Lake) hydroelectric facilities continue to provide railbelt power.
3. Fuel oil generation in Fairbanks declines 50 percent as a result of the intertie.
4. Solomon Gulch provides a firm annual average production of 54.6 thousand MWH annually.
5. Bradley Lake comes on line in 1993 and produces 330 thousand MWH annually. This backs out 4.4 billion cubic feet of natural gas 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. These growth rates are applied to 1983 per capita consumption of 8,000 kwh per capita. 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 recently completed hydroelectric projects 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 consumption of electricity in these communities is estimated using the proportion of Southeast Alaska electricity consumption used by these communities in 1983.

Rest-of-State

Growth in per capita electricity demand in the rest of the state is assumed to occur at twice the rate projected for the railbelt. These growth rates are applied to 1983 per capita consumption rates of 3,900 kwh per capita.

With the exception of Barrow, this region 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 hydropower available in 1985 when the Terror Lake project is completed. This will provide 137 thousand MWH of firm annual energy.

Space Heating Use of Liquid Fuels and Natural Gas¹

Introduction

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 because of differences in data availability. 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 and estimates of mean household fuel oil consumption. This approach 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 retrofitting and expansion of the commercial sector. This trend will moderate in the future, and growth is projected to exceed population by two percent annually.

In addition, a new gas market has opened in the Matanuska Valley. We estimate that by 1995, one-half of the building stock in the Matanuska Valley will utilize natural gas for space heating. 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. The resulting demand level is estimated on a per household basis for residential consumption and a per capita basis for commercial consumption. Residential natural gas consumption is approximately 200 mcf per household. Per capita commercial consumption is 55 mcf.

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 that the proportion of households using fuel oil for space heat declines slightly from the current share of 24 percent to 22.4 percent in 1999. Per household residential and per capita commercial fuel oil consumption are based on gas consumption figures converted to fuel oil on the basis of BTU equivalency.

Nonrailbelt

Outside the railbelt, space heating is almost entirely provided by fuel oil, with the exception of Barrow. Fuel oil consumption is calculated using the share of households with fuel oil space heat and the same per capita coeffi-

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

cient of fuel oil use for space heating as applied to 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.

For natural gas consumption in Barrow, a growth rate which exceeds population growth by 2 percent is applied to a base of current consumption.

Industrial Use of Liquid Fuels and Natural Gas

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 7 percent annually for seven 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. Oil Use in Transportation

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.

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.

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.

LNG

Liquefied Natural Gas (LNG) is defined as export of gas for the purposes of this report.

APPENDIX C
STATE OF ALASKA
REFINERIES
1983

<u>REFINERY</u>	<u>PLANT CAPACITY</u>	<u>DATE IN OPERATION</u>	<u>DATE EXPANSIONS</u>	<u>PLANT PRODUCT</u>	<u>DESTINATION</u>
NIKISKI Chevron Refinery	18,000 BPD	1962	1983 Asphalt capacity increased from 280,000 to 400,000 BPD	JP4, JA50, 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; Crude Unit to 80,000 BPD in 1985 for North Slope Crude. Hydrocracker to 9000 BPD. 14.5 TPD Sulfur Plant.	1969 (17,500 BPD)	1974, 1975, 1977, 1980 Hydrocracker 7500 BPD, Reformer (to 10,000 BPD from 6000 BPD).	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	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 North Pole Refinery	46,600 BPD; 90,000	1977	Fall 1980; Naptha	Military Jet Fuel (JP4), 3000-4000 BPD; Commercial Jet Fuel, 5000-6500 BPD; Diesel/Heating Fuel No. 2; 1800-2500 BPD, Diesel Fuel Type No. 4, 600-1800 BPD.	Fairbanks area, Nenana and river villages, Ellison AFB, Anchorage area.
Phillips-Marathon LNG	230,000 MCF/Day	1969		Liquefied Natural Gas.	Japan, by tanker, 2 tankers capacity 71,500 cu.m. each, avg. one ship every 10 days.
Pacific Alaska LNG	200,000 MCF/Day Initial 400,000 MCF/Day (2nd yr).	Planned 1989		Liquefied Natural Gas.	Southern California, one ship every 13 days, initial phase.

TRANSPORTATION FACILITIES

Economic projections for estimating future petroleum demands are complicated this year because of the unsettled nature of the world oil market and the recent, rapid growth of the Alaska 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 makes the task of relating recent growth to longer-term trends difficult.

The economic growth during the last 4 years, fueled by the dramatic growth in state spending resulting from the increase in oil prices, has generated an increase in population from 420 thousand in 1980 (July 1, 1980) to an estimated 527 thousand in 1984. This increase in population greatly exceeds the magnitude of the growth which occurred between 1974 and 1976 during the peak construction years for the oil pipeline (approximately 67 thousand) and was unanticipated by all forecasts. The annual growth rate of 5.8 percent since 1980 is double the average annual growth rate of 2.9 percent in population between 1960 and 1980. The fact that this population change has been much more rapid than the increase in employment opportunities 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 used in this analysis contains a population growth rate of 1.4 percent annually and an employment growth rate of 1.3 percent. These growth rates are less than those observed over the first two decades of statehood, but are considerably above projections of growth of the national economy. For example, 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.¹ State population grows from 527 thousand in 1984 to 652 thousand in 1999. Nonagricultural wage and salary employment grows from 222 thousand in 1984 to 285 thousand in 1999.²

This growth is consistent with many possible sets of assumptions about future basic sector activity and public sector spending as well as support sector and demographic responses. Future basic sector economic activity underlying this projection is similar to that used in the Revised Reference Case scenario used in the Susitna Studies Program.³

¹Survey of Current Business, November 1980.

²This projection is identified as UP85.16.

³Documented in full in ISER MAP Economic Model: State Model Documentation Version A85.1: December 1984.

The regional distribution of economic activity, employment, and population continues the historical trend of shifting gradually toward the railbelt as the economic center of the state.

CONVERSION FACTORS

APPENDIX E

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

ALASKA CRUDE OIL ASSAYS [1]

APPENDIX F

CRUDE	SADLEROCHIT	KUPARUK	WEST SAKI[2]
Gravity, *API	26.4	23.0	22.4
Sulfur wt %	1.06	1.76	1.82
Pour pt, *F.	0	-55	-50
Rvp, psi	3.55	2.6	2.70
Kin. vis. @60* F.	42.42	cSt: 79.98	95.92
H ₂ S, lb/1,000 bbl	0.35	<5	--
Salt, lb/1,000 bbl	32.7	--	--
Carbon residue, wt %	4.40	7.37	7.62
Neut. no. (D974)	1.12	--	0.68
Ni/V, ppm	11/26	19/57	22/61
Nitrogen, ppm	2090	1980	--
C4 & lighter, yield, vol %	1.17	--	0.63
C5 & lighter, yield, vol %	--	2.12	--
LIGHT GASOLINE			
Range, *F	C5-150	(TPB), C5-150	C5-150
Yield, vol %	2.2	1.6	1.9
Sulfur, wt %	<0.001	0.006	0.004
RON clear	71.5	--	--
MON clear	69.8	--	--
RON + 0.5g TEL/gal	78.4	--	--
NAPHTHA			
Range, *F.	150-380	150-380	150-380
Yield, vol %	15.6	14.5	14.4
Sulfur, wt %	0.013	0.018	0.018
Paraffins, vol %	39.7	38.3	36.4
Napthenes, vol %	43.3	47.0	48.2
Aromatics, vol %	17.0	14.7	15.4
DISTILLATE			
Range, *F.	380-650	380-650	380-650
Yield, vol %	28.6	26.9	27.5
Gravity, *API	33.1	--	31.6
Sulfur, wt %	0.414	0.66	.700
Pour pt, *F	-25	-25	-35
Cetane No.	45.8	45.4	42.1
Total N ₂ , ppm	79	--	--
Vis. cSt @ 100* F.	--	3.083	3.34
Aromatics, vol %	33.6	30.0	31.4
BLENDED GAS OIL		GAS OIL	GAS OIL
Range, *F.	650-840	650-840	650-840
Yield, vol %	16.4	18.9	16.6
Gravity, *API	23.8	20.5	21.1
Sulfur, wt %	1.10	1.79	1.81
Aniline pt, *C	74.7	104.3	--
Pour pt, *F	70	50	60
Kin. Vis. @100* F.	--	34.20	43.99
Carbon residue, %	0.012	wt %: .01	--
Total nitrogen, ppm	950	600	840
Basic nitrogen	0.03	wt %: .02	0.023
V/Ni, ppm	--	<1	--
RESIDUE			
Range, *F.	650+	650+	650+
Yield, vol %	52.4	56.0	55.6
Gravity, *API	15.0	11.7	10.8
Sulfur, wt %	1.63	2.59	2.53
Carbon residue, %	8.82	wt %: 12.61	wt %: 13.15
Total nitrogen, ppm	3600	--	--
Pour pt, *F.	80	40	45
Kin. vis. @ 210 *F.	47.54	97.15	135.3
Kin. vis. @ 275 *F.	15.55	--	--
Pentane insoluble, wt %	--	--	14.97

[1] Aalund, L.R., "Guide to Export Crudes for the '80s," Oil and Gas Journal, Dec. 19, 1983.

[2] Crude not in production, but pilot program is underway in Kuparuk area to determine feasibility. Assay sample obtained during drill stem test.

S/D Tables: CRUDE, rev 11/22/84

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 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 (CH₄), ethane (C₂H₆), propane (C₃H₈), butanes (C₄H₁₀), and pentanes (C₅H₁₂). The gaseous component found most often and in largest volumes is, typically, methane. Heavier fractions 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 liquefied petroleum gas (LPG), composed of hydrocarbons which liquefy 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.

¹Definitions 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. Liquefaction to change the phase of the gas is a less obvious case. The liquefaction 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 future 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 liquefaction. 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.

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 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, 1984. 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" considered in this report includes multifamily residential in "residential" or "domestic" use.

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 encourage in-state economic activity,³ a day-to-day working definition of this industrial priority is that the royalty reserves be committed to the market 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 gas, petroleum, or their products into refined products. This definition counts feedstocks for petrochemical plants and refineries as industrial

³See 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.

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 processing, 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 interstate air travel. There are multiple ways to approach the definition of this consumption. The first is a sales definition: the fuel use 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 sector 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.

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