State of Alaska
Department of Natural Resources
Division of Geological and Geophysical Surveys *
and
The Alaska State Energy Office

ALASKA OIL AND GAS DEVELOPMENT ADVISORY BOARD

This study is in response to AS 38.06, Sec. 38.06.070 (2) that the board shall consider "the existence and extent of present and projected local and regional needs for oil and gas products and by-products, the effect of state or federal commodity allocation requirements which might be applicable to those products and by-products, and the priorities among competing needs."

This report is preliminary. Input data and results have not been thoroughtly checked or reviewed. All demand outputs have not had economic parameters applied for industrial expansion.

* SCS Data Corporation provided computer program and technical assistance.

Alaska Open File Report #91

ALASKAN OIL DEMAND 1975-2000

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August 1975

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PROJECTED DEMAND

The following regional future demand analysis is limited to oil since we have not completed sufficient computer runs for gas to give meaningful results. Economic industrial parameters must also be included before realistic demand scenarios can be calculated. SCS Data Processing Incorporated of Anchorage assisted in the formulation of the method, provided the probability program and furnished the computer technology for the analysis.

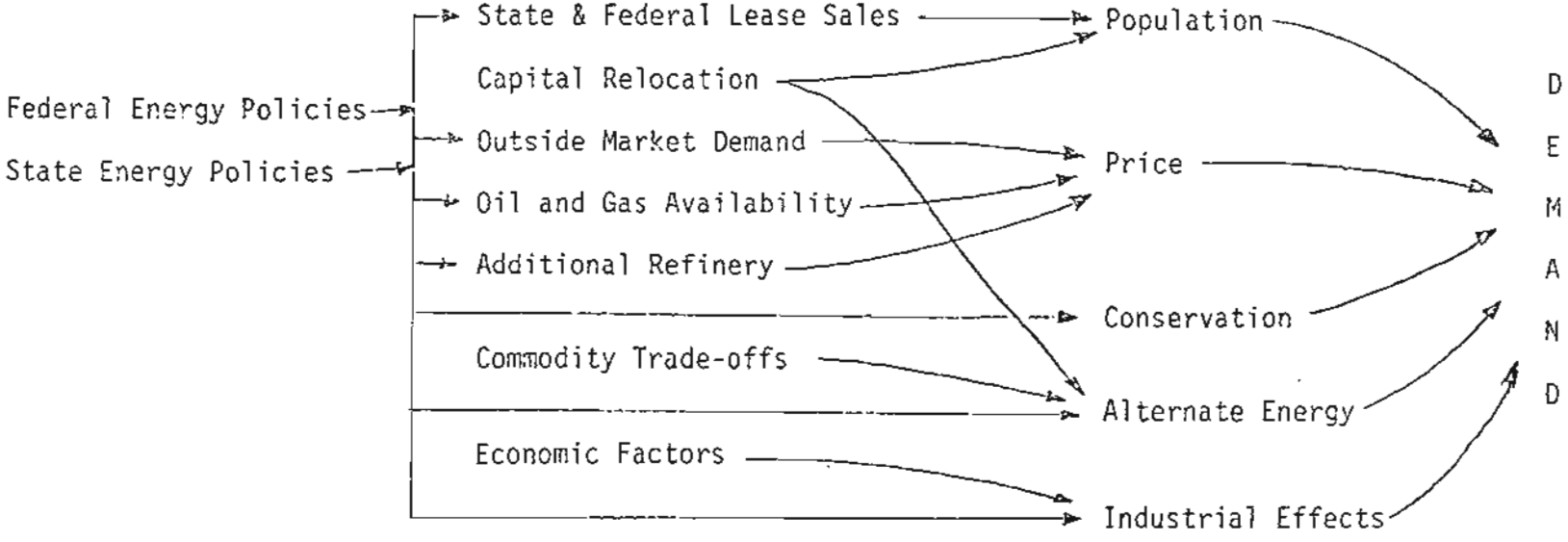
Each demand analysis consists of a scenario or set of general circumstances that would logically cause certain reactions from the primary demand parameters; population, per capita consumption, price, rationing, alternative energy use, industrial effects and miscellaneous. These scenarios then set the scene for the researched inputs to the computer. All inputs were in the form of a triangular probability distribution.

Generally, the results indicate that it will be nearly impossible to consume all of our royalty oil from todays known reserves in the State before 1990. After 1990, unless there is a low consumption rate or new royalty reserves have been found, internal oil consumption will exceed a value greater than our royalties.

Only two gas scenarios are presented; one assuming hydroelectric power development from Devil's Canyon in 1985, and Watana in 1990. The other assuming a strong reliance on oil and gas for power generation plus a high population factor.

METHOD

Demand can be expressed as a function of population, per capita consumption and industrial effects. Per capita consumption of oil and gas is directly related to three factors: (1) price, (2) alternate energy use and (3) conservation. Other projection factors can either be related to these factors or directly to industrial effects or population.



Because of the uncertainty inherent in the projection factors, risk analysis will be employed.

METHOD (CONT.)

This method of analysis is best illustrated by example. A sample scenario for gasoline and diesel demand in 1980 follows.

GENERAL EQUATION

$D = F(M, P, C, A, P, I, \text{OTHERS})$ $D_{1980} = {}^{M}_{1980} \times {}^{P}_{1980} [1 - {}^{P}_{1980} - {}^{C}_{1980}] + {}^{I}_{1980}$

WHERE,

D = DEMAND (BOE)

M = PER CAPITA CONSUMPTION (BOE/PERSON)

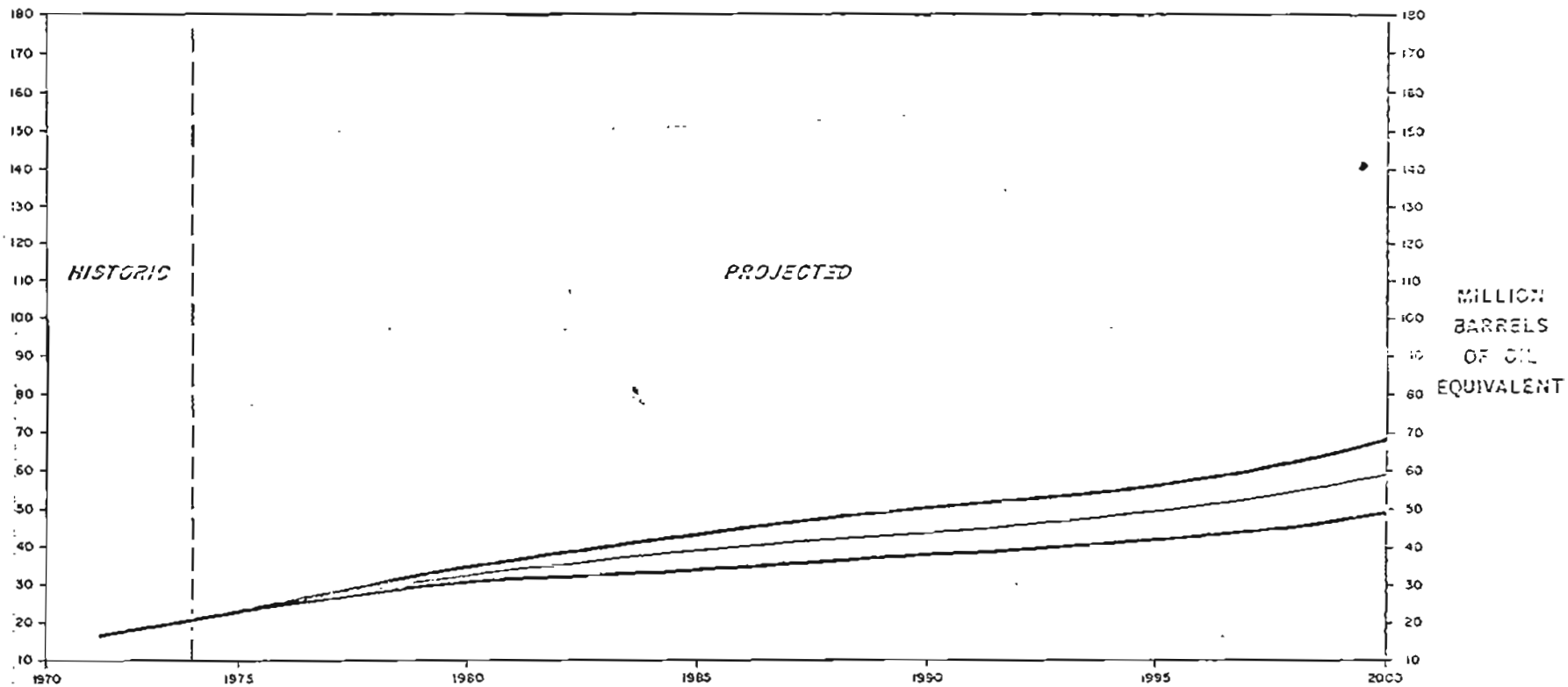
P = PRICE SENSITIVITY (% CHANGE OF PER CAPITA CONSUMPTION)

C = EFFECT OF CONSERVATION (% CHANGE OF PER CAPITA CONSUMPTION)

A = EFFECT OF ALTERNATIVE SOURCES OF ENERGY (% CHANGE OF PER CAPITA CONSUMPTION)

P = POPULATION (NUMBER OF PEOPLE)

I = INDUSTRIAL CHANGES (BOE)



PROJECTED ALASKAN OIL DEMAND

SCENARIO 00

FIGURE

ALASKA OIL & GAS DEMAND
1975-2000

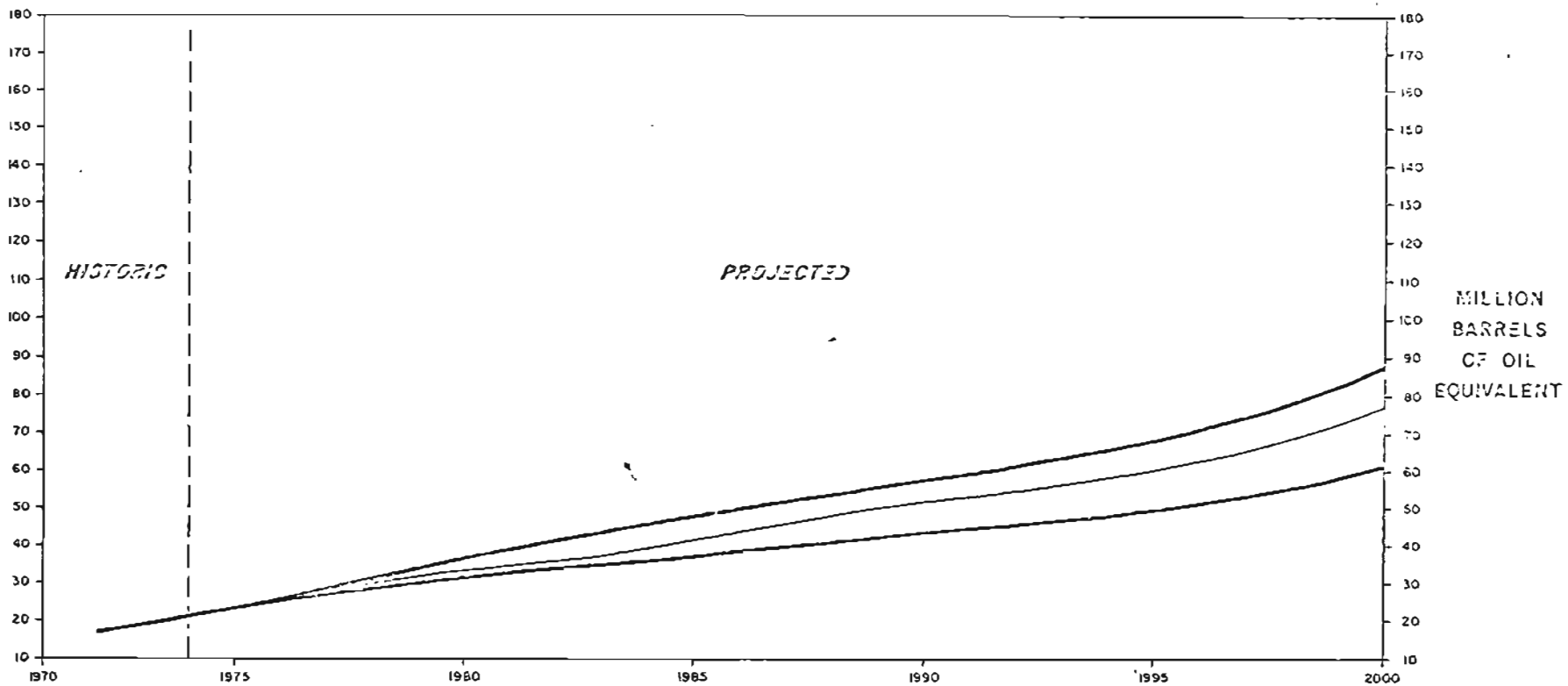
Scenario 0 Case: Medium

I. Background Assumptions

A. None. Control scenario based on population

II. Variable Reaction to Assumptions.

A. Population - Medium projection
B. Per capita consumption - remains constant
   1. Price - No effect
   2. Rationing - No rationing
C. Power generation - Medium projection, moderate development of hydroelectric power.
D. Industrial changes - None



PROJECTED ALASKAN OIL DEMAND

SCENARIO 0

FIGURE

ALASKA OIL & GAS DEMAND
1975-2000

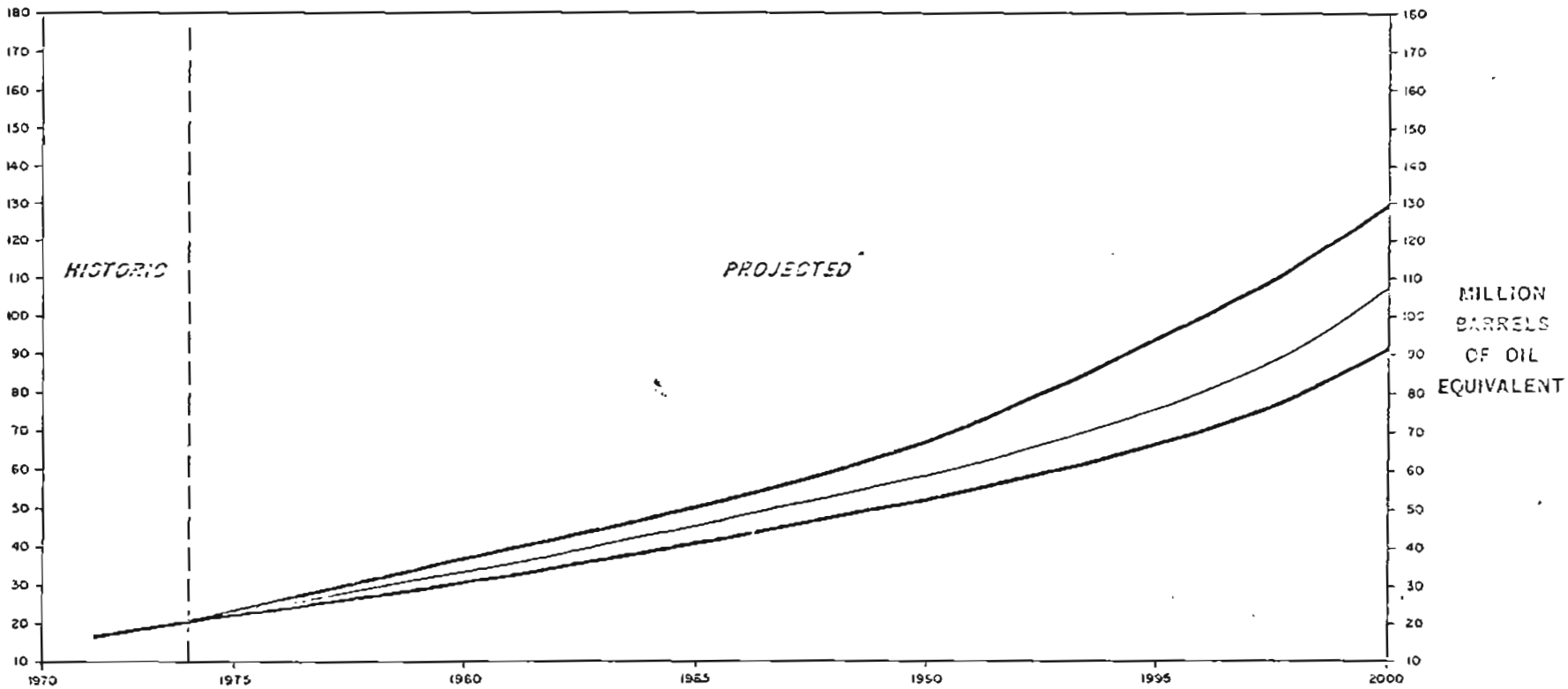
Scenario 000 Case: High

I. Background Assumptions

A. None. Control scenario based on population.

II. Variable Reaction to Assumptions

A. Population - Maximum projection
B. Per capita consumption - Remains constant
   1. Price - No effect
   2. Rationing - No rationing
C. Power generation - Medium projection, moderate development of hydro-electric power.
D. Industrial changes - None



PROJECTED ALASKAN OIL DEMAND

SCENARIO 000

FIGURE

ALASKA OIL & GAS DEMAND
1975-2000

Scenario IV

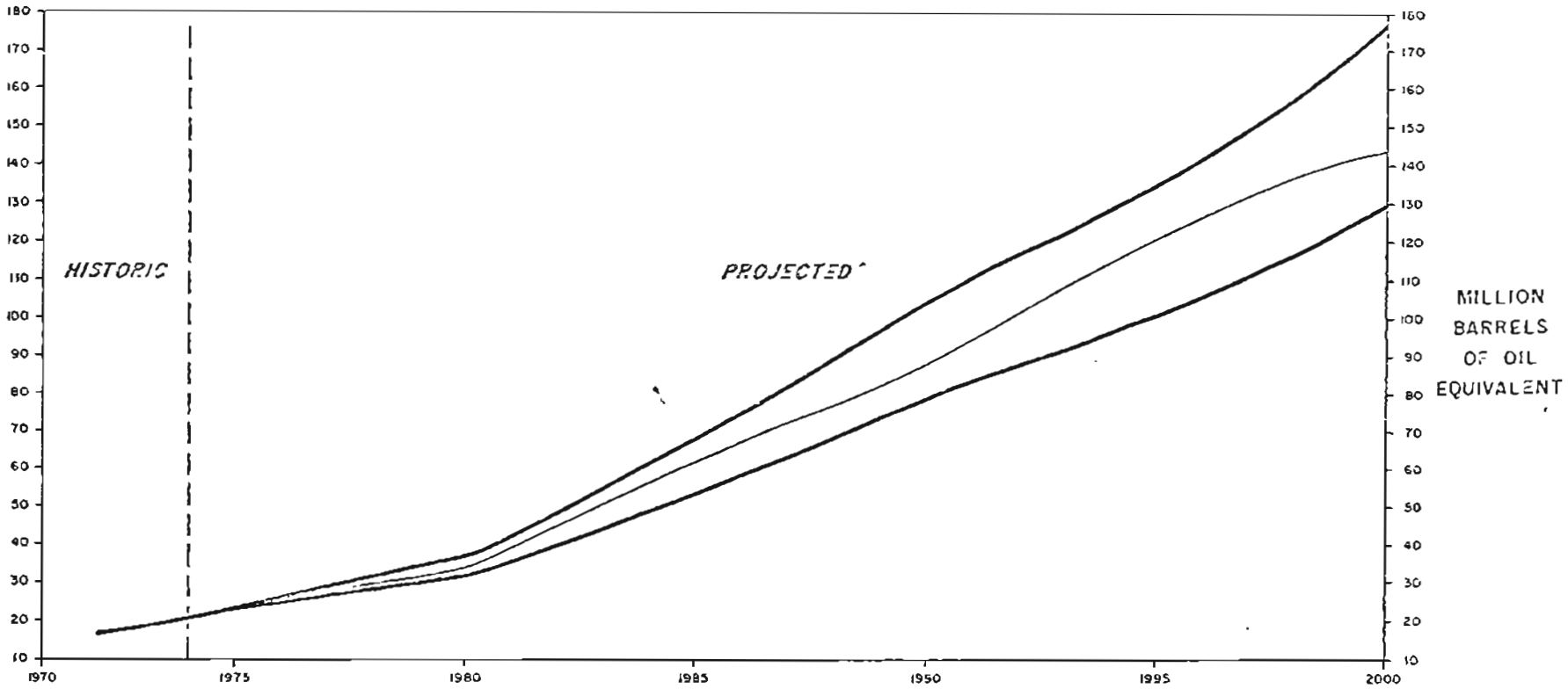
Case: Maximum
No Conservation

I. Background Assumptions

A. Balance of payments favorable, world oil prices are stable, (wellhead price for Alaskan crude is equal to world price)
B. Domestic production increases, Alaska OCS development is at maximum
C. Trans-Alaska gas pipeline complete 1980, full production 1985, terminal at Gravina
D. Abundance of natural gas in Alaska & creates
E. Alternate energy in lower 48 reduces demand for oil and gas Alaskan surplus
F. Federal policy keeps domestic price of oil lower than world price
G. Gasoline price is stable except for inflationary increases
H. Industrial development in Alaska is at high level
J. Continued reliance on oil and gas for power

II. Variable Reaction to Assumptions

A. Population - maximum projection
B. Per capita consumption - remains constant
    1. Price - No effect
    2. Rationing - No rationing
C. Power generation - Continued reliance on oil and gas
D. Industrial changes - Agriculture, fishing and forestry develop at high rate
    1. 1985 - one uranium enrichment plant
    2. 1990 - one aluminum reduction plant



PROJECTED ALASKAN OIL DEMAND

SCENARIO 4

FIGURE

OIL SCENARIO 4 1980

30745152.	31543120.	31215120.	45.	0.045	0.045	0.955
31543104.	32341072.	31978864.	123.	0.123	0.168	0.832
32341056.	33139024.	32748704.	206.	0.206	0.374	0.626
33139008.	33936976.	33530056.	216.	0.216	0.590	0.410
33936960.	34734928.	34340512.	192.	0.192	0.782	0.218
34734912.	35532880.	35139232.	121.	0.121	0.903	0.097
35532864.	36330832.	35860240.	64.	0.064	0.967	0.033
36330816.	37128784.	36673936.	28.	0.028	0.995	0.005
37128768.	37926736.	37162032.	2.	0.002	0.997	0.003
37926720.	38724688.	38088144.	3.	0.003	1.000	0.000

1000

```
                                        PROBABILITY
      DEMAND           0    10    20    30    40    50    60    70    80    90   100
    GT         LE      .     .     .     .     .     .     .     .     .     .     .
 29947200  30745168  .
 30745152  31543120  .**
 31543104  32341072  .******
 32341056  33139024  .**********
 33139008  33936976  .***********
 33936960  34734928  .**********
 34734912  35532880  .******
 35532864  36330832  .***
 36330816  37128784  .*
 37128768  37926736  .
 37926720  38724688  .
                     .     .     .     .     .     .     .     .     .     .     .
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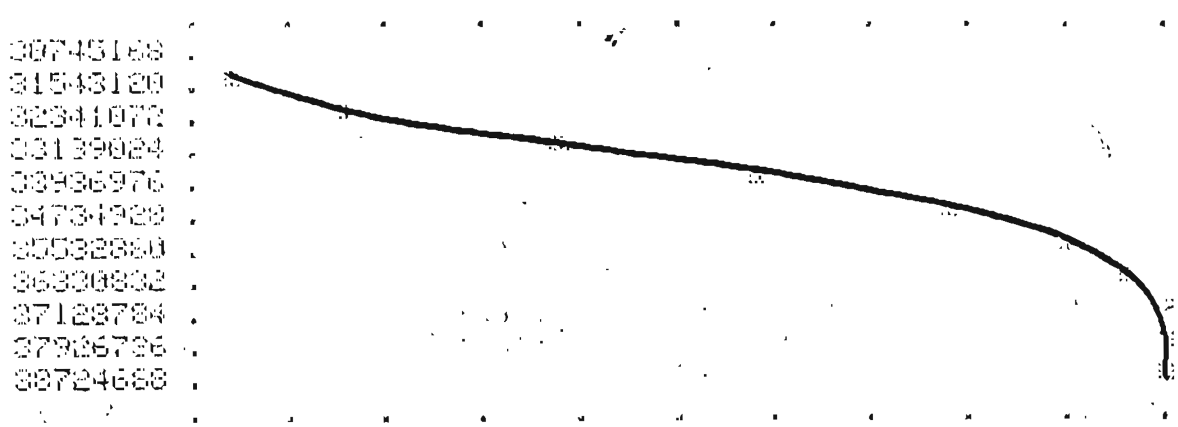
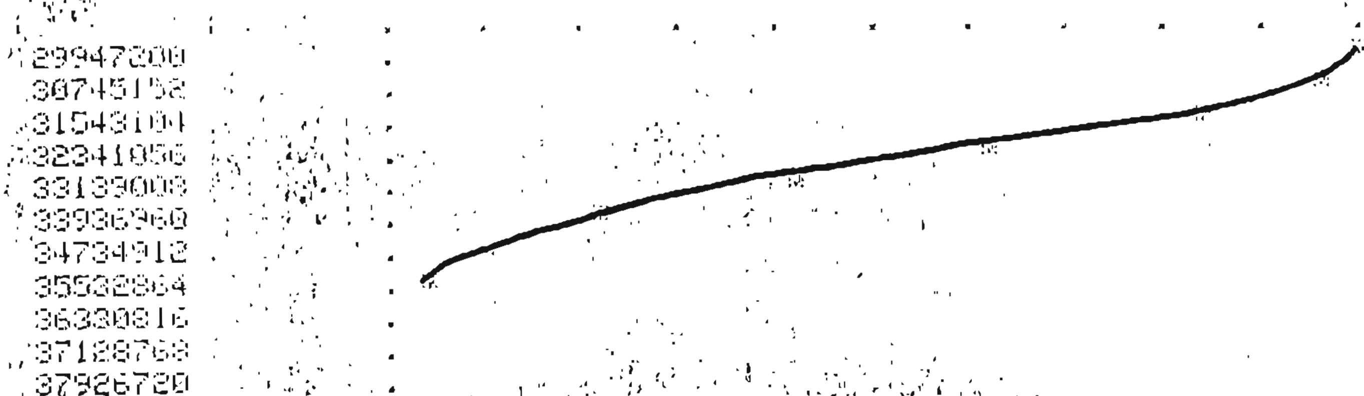
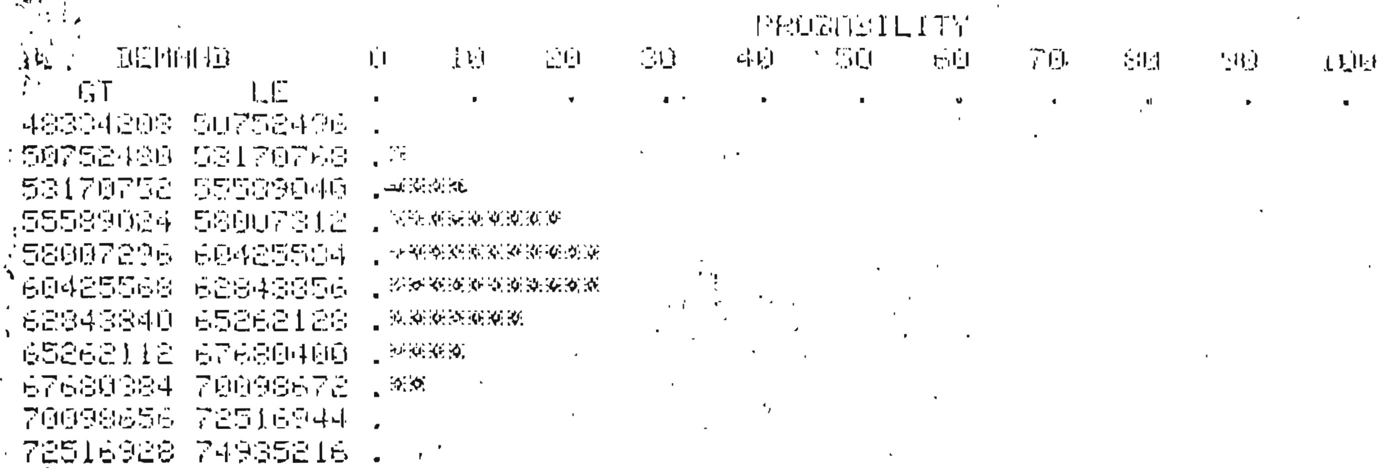


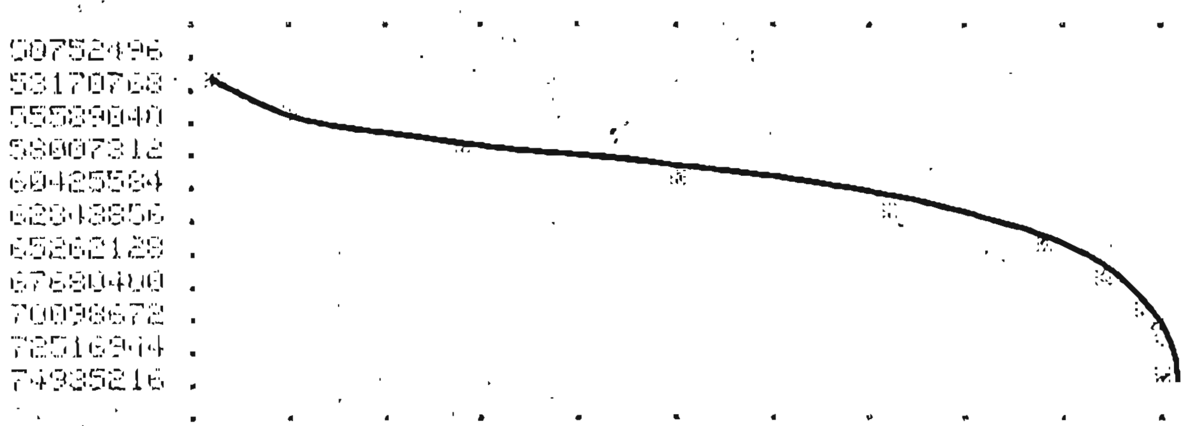


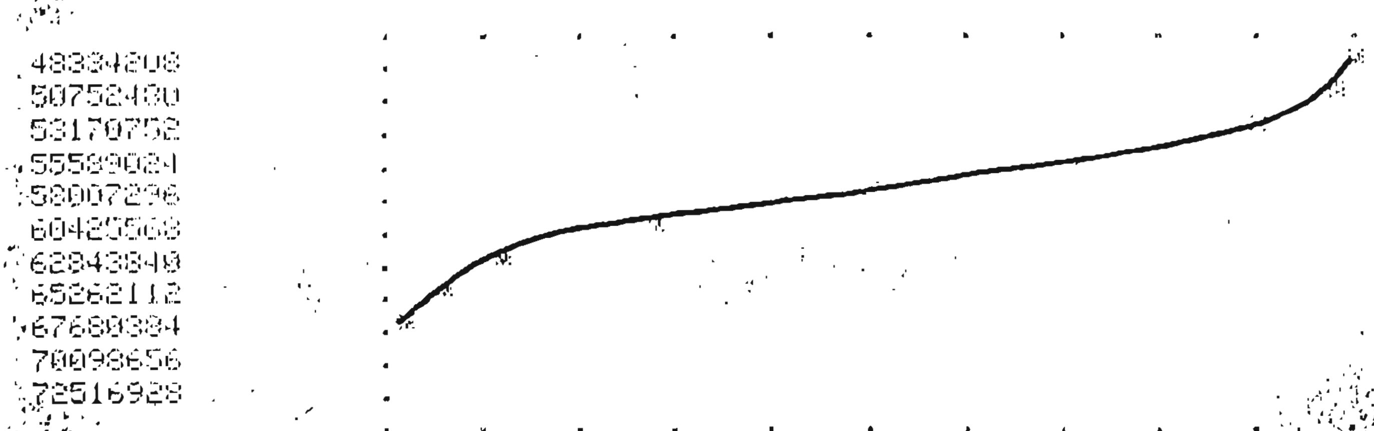
OIL SCENARIO 4 1985

55589024.	58007312.	[illegible]	177.	0.177	0.282	0.718
58007296.	60425584.	[illegible]	221.	0.221	0.503	0.497
60425568.	62843856.	[illegible]	222.	0.222	0.725	0.275
62843840.	65262128.	[illegible]	148.	0.148	0.873	0.127
65262112.	67680400.	[illegible]	77.	0.077	0.950	0.050
67680384.	70098672.	[illegible]	39.	0.039	0.989	0.011
70098656.	72516944.	[illegible]	9.	0.009	0.998	0.002
72516928.	74935216.	[illegible]	2.	0.002	1.000	0.000

1000







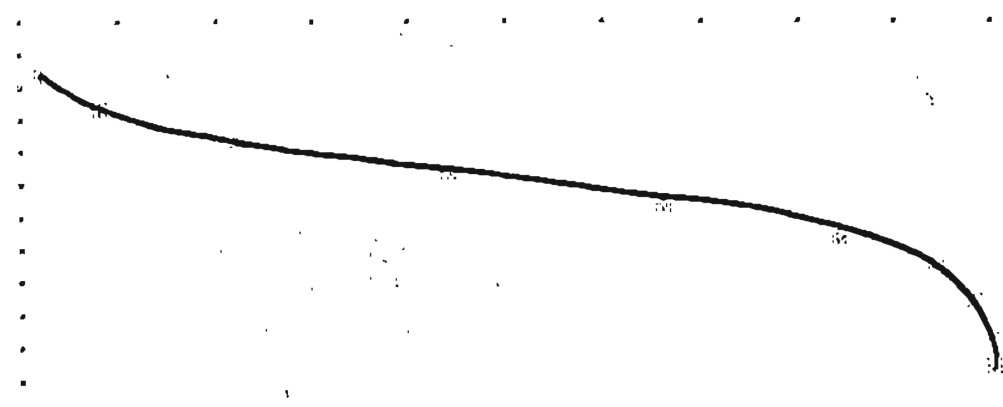
68982624.	73166912.	71074768.	1.	0.001	0.001	0.999
73166912.	77351200.	75311440.	1	0.018	0.019	0.981
77351200.	81535488.	79443008.	61.	0.061	0.080	0.920
81535488.	85719776.	83318640.	126.	0.126	0.206	0.794
85719776.	89904064.	87874784.	227.	0.227	0.443	0.557
89904064.	94088352.	91997600.	223.	0.223	0.666	0.334
94088352.	98272640.	96109168.	173.	0.173	0.839	0.161
98272640.	102456928.	99996624.	95.	0.095	0.934	0.066
102456928.	106641216.	104220880.	49.	0.049	0.983	0.017
106641216.	110825504.	108439056.	15.	0.015	0.998	0.002
110825504.	115009792.	112008096.	2.	0.002	1.000	0.000

OIL
SCENARIO 4
1990

1000

```
                                              PROBABILITY
      DEMAND           0    10    20    30    40    50    60    70    80    90   100
    GT        LE       .     .     .     .     .     .     .     .     .     .     .
 68982624  73166912  .
 73166912  77351200  .*
 77351200  81535488  .***
 81535488  85719776  .*******
 85719776  89904064  .*************
 89904064  94088352  .*************
 94088352  98272640  .**********
 98272640 102456928  .*****
102456928 106641216  .**
106641216 110825504  .*
110825504 115009792  .
                       .     .     .     .     .     .     .     .     .     .     .
```

73166912
77351200
81535488
85719776
89904064
94088352
98272640
102456928
106641216
110825504
115009792



68982624
73166912
77351200
81535488
85719776
89904064
94088352
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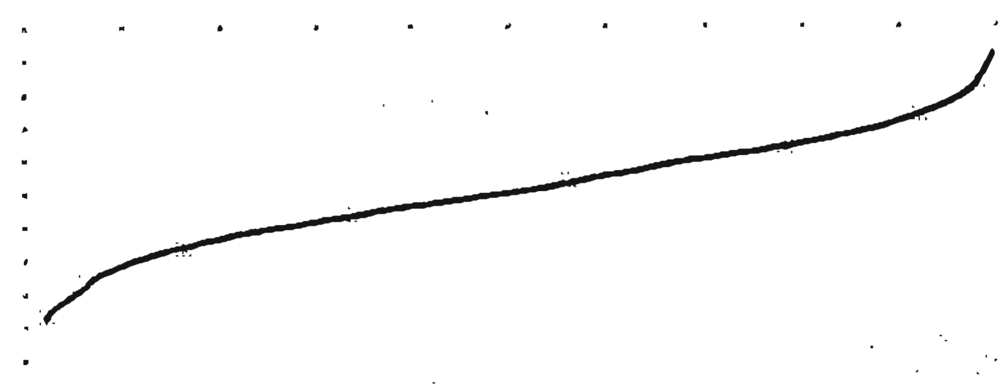
102456928
106641216
110825504



[illegible]	[illegible]	[illegible]	5.	0.005	0.005	0.995
94807936.	100551536.	[illegible]	25.	0.025	0.030	0.970
100551520.	[illegible]	[illegible]	95.	0.095	0.125	0.875
106295104.	112038704.	[illegible]	156.	0.156	0.281	0.719
112038688.	117782288.	115076768.	221.	0.221	0.502	0.498
117782272.	123525872.	120585728.	226.	0.226	0.728	0.272
123525856.	129269456.	126164608.	153.	0.153	0.881	0.119
129269440.	135013040.	131667800.	79.	0.079	0.960	0.040
135013024.	140756624.	137277920.	31.	0.031	0.991	0.009
140756608.	146500208.	143211936.	6.	0.006	0.997	0.003
146500192.	152243792.	149099744.	3.	0.003	1.000	0.000

OIL SCENARIO '1995

1000

```
                                            PROBABILITY
        DEMAND          0    10    20    30    40    50    60    70    80    90   100
     GT        LE       .     .     .     .     .     .     .     .     .     .     .
  89064352  94807952   .
  94807936 100551536   .*
 100551520 106295120   .*****
 106295104 112038704   .********
 112038688 117782288   .***********
 117782272 123525872   .***********
 123525856 129269456   .********
 129269440 135013040   .****
 135013024 140756624   .**
 140756608 146500208   .
 146500192 152243792   .
                        .     .     .     .     .     .     .     .     .     .     .
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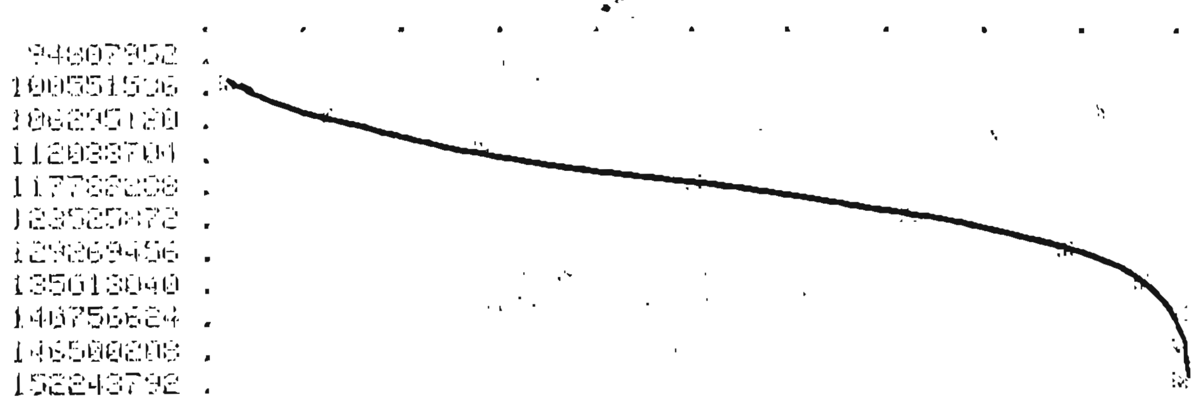
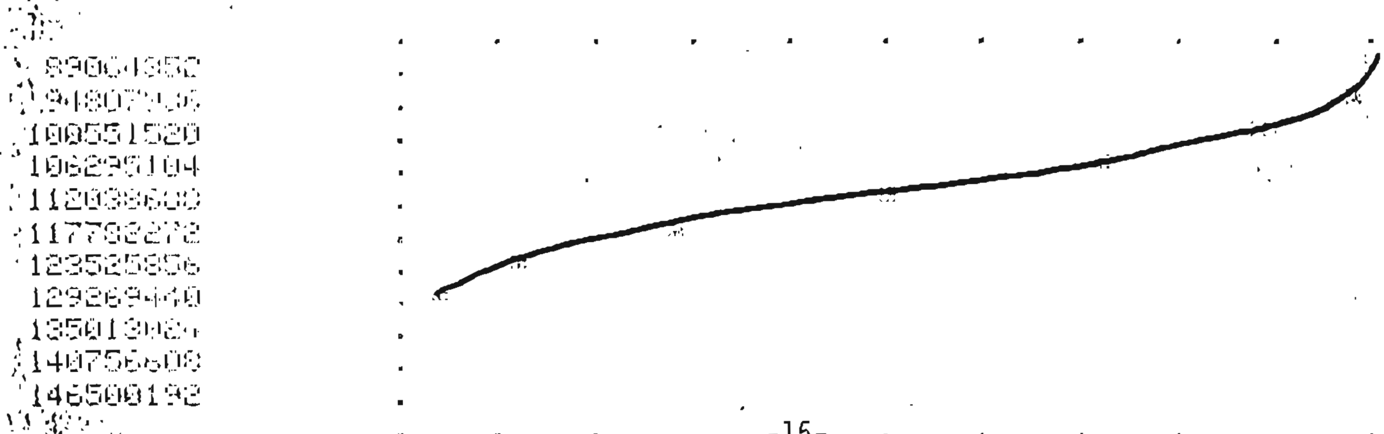
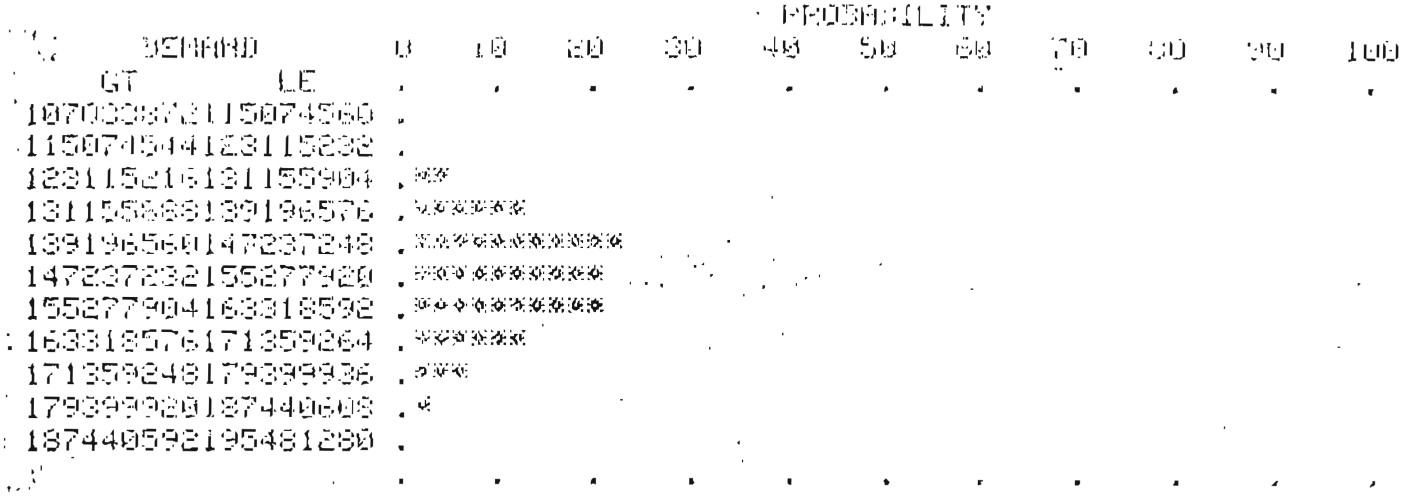


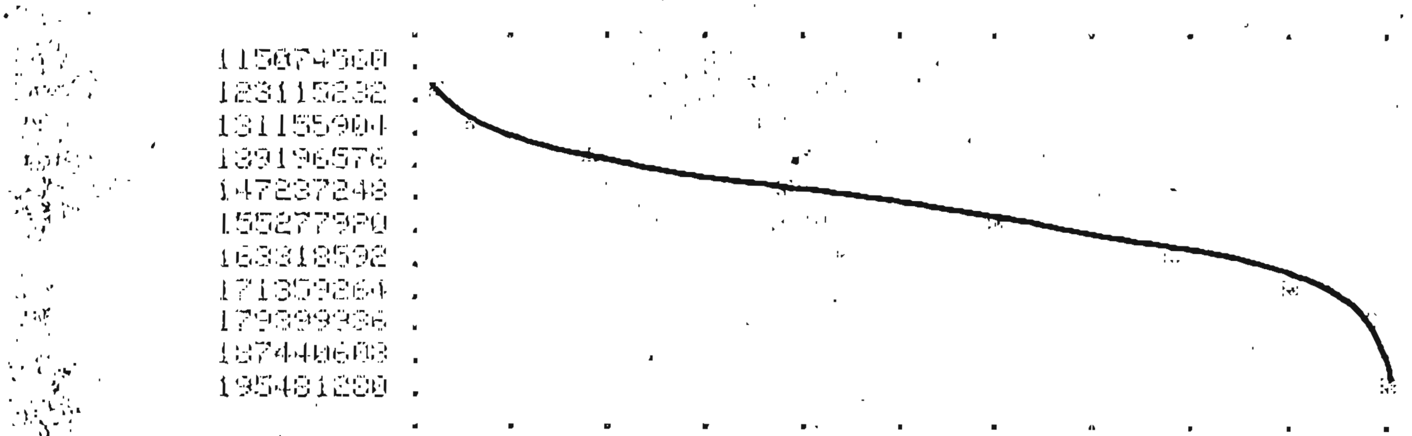


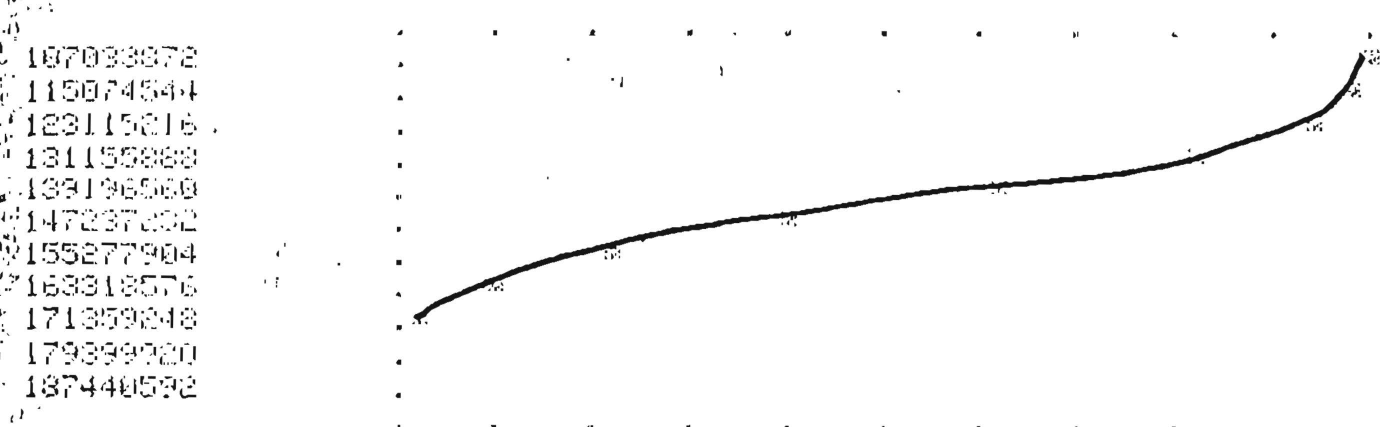
139196560.	147237[illegible].	[illegible].	[illegible]	0.213	[illegible]	[illegible]
147237232.	155277[illegible].	[illegible]7728.	[illegible]	0.200	0.592	0.408
155277904.	163318[illegible].	[illegible]8496.	[illegible]	0.193	0.785	0.215
163318576.	171359[illegible].	[illegible].	125.	0.125	0.910	[illegible]
171359248.	179399[illegible].	17497[illegible]976.	6[illegible].	0.062	0.972	0.028
179399920.	187440[illegible].	[illegible]455616.	23.	0.023	0.995	0.005
187440592.	195481280.	[illegible]605312.	5.	0.005	1.000	0.000

1000

OIL SCENARIO 4 2000







ALASKA OIL & GAS DEMAND
1975-2000

Scenario V

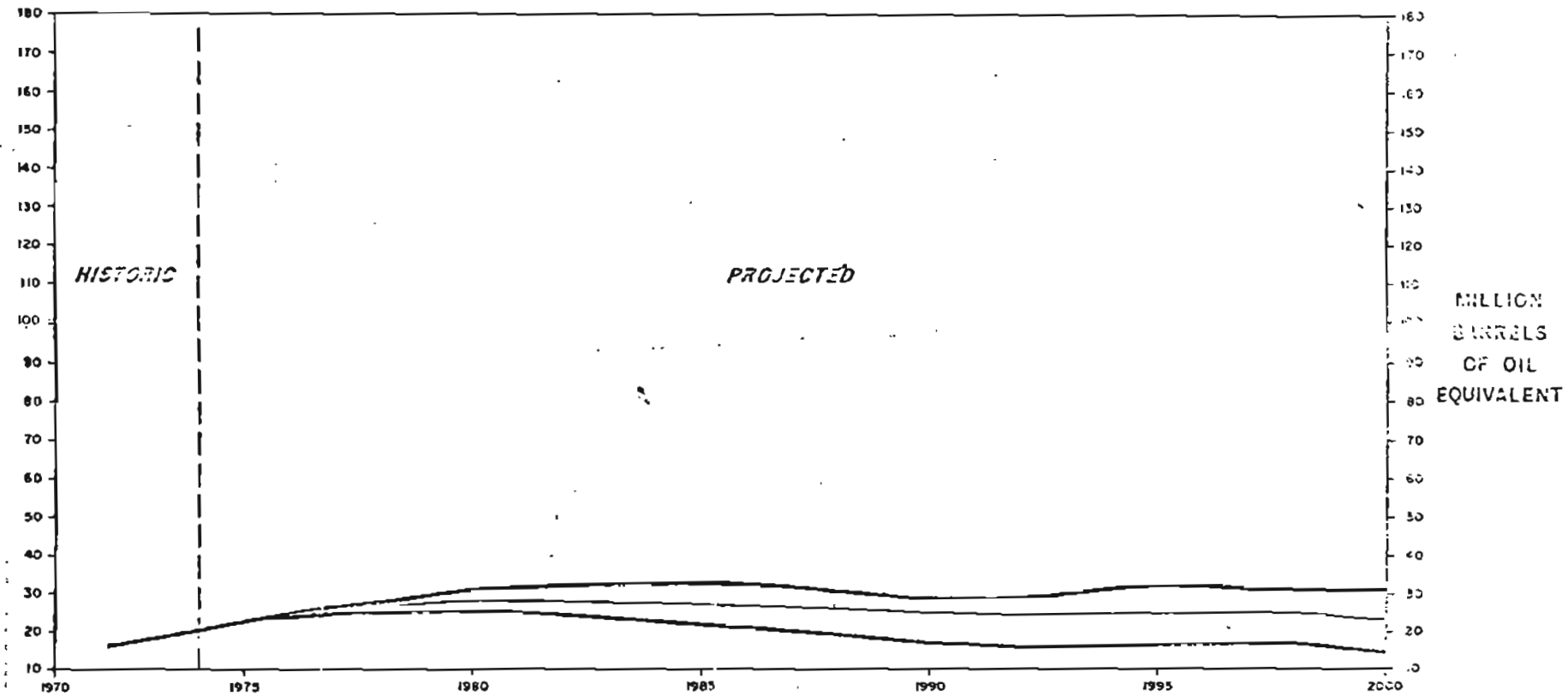
Case: Minimum
Conservation Needed

I. Background Assumptions

A. Balance of payments unfavorable, world oil prices rise, wellhead price for Alaskan oil is low
B. Domestic production low, Alaska OCS development delayed and stretched for maximum long-range conservation
C. Gas pipeline is across Canada
D. Alaska natural gas development is retarded and maximum export of gas encouraged
E. Maximum alternate energy development in Alaska
F. Federal policy allows oil and gas prices to rise
G. Rationing is instated in later periods
H. Low industrial growth
I. Fishing and forestry decline

II. Variable Reaction to Assumptions

A. Population - minimum projection
B. Per capita consumption
    1. Price - High prices decrease demand as indicated on price schedule
    2. Rationing - Rationing in later years 5% demand decrease in 1990, increasing to 20% by the year 2000
C. Power generation - Maximum alternate energy sources for power generation developed
D. Industrial changes - None



PROJECTED ALASKAN OIL DEMAND

SCENARIO 5

FIGURE

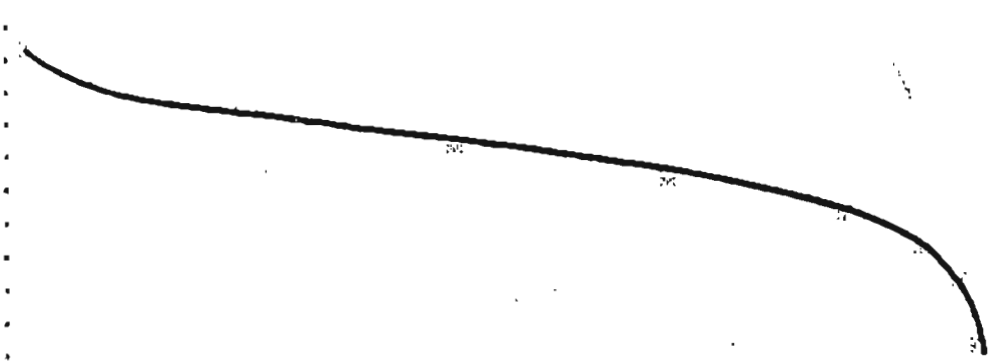
OIL SCENARIO 1980

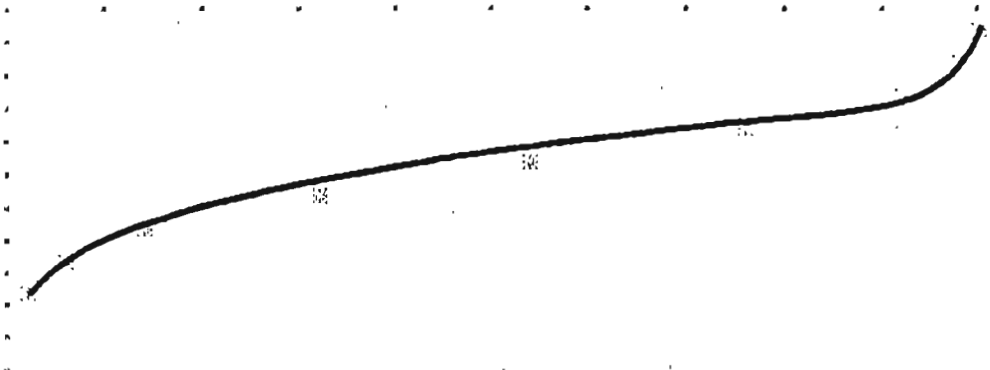
23890200.	24842496.	952296.	1.	0.001	1.000	0.000
24842496.	25791792.	949296.	1.	0.001	0.999	0.000
25791792.	26741088.	949296.	1.	0.001	0.998	0.000
26741088.	27690384.	949296.	1.	0.001	0.997	0.000
27690384.	28639680.	949296.	1.	0.001	0.996	0.000
28639680.	29588976.	949296.	1.	0.001	0.995	0.000
29588976.	30538272.	949296.	1.	0.001	0.994	0.000
30538272.	31487568.	949296.	1.	0.001	0.993	0.000
31487568.	32436864.	949296.	1.	0.001	0.992	0.000
32436864.	33386160.	949296.	1.	0.001	0.991	0.000
33386160.	34335456.	949296.	1.	0.001	0.990	0.000

1000

PROBABILITY

DEMAND GT	DEMAND LE	0 10 20 30 40 50 60 70 80 90 100
23890200	24842496	*
24842496	25791792	***
25791792	26741088	**********
26741088	27690384	**********
27690384	28639680	**********
28639680	29588976	**********
29588976	30538272	**********
30538272	31487568	****
31487568	32436864	**
32436864	33386160	*
33386160	34335456	



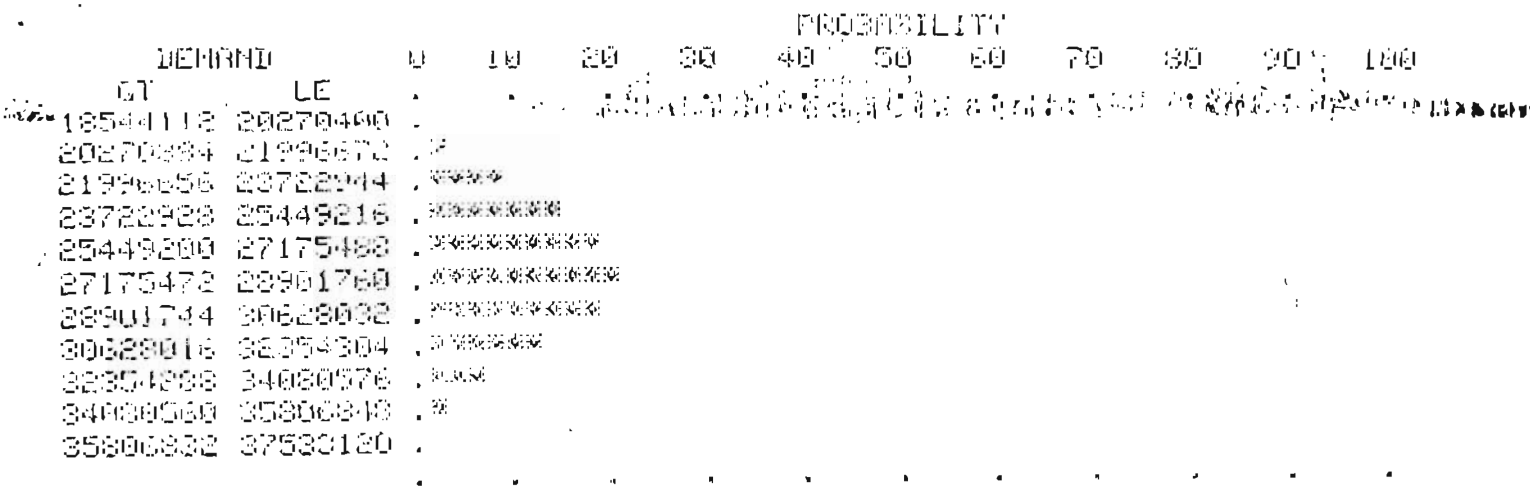


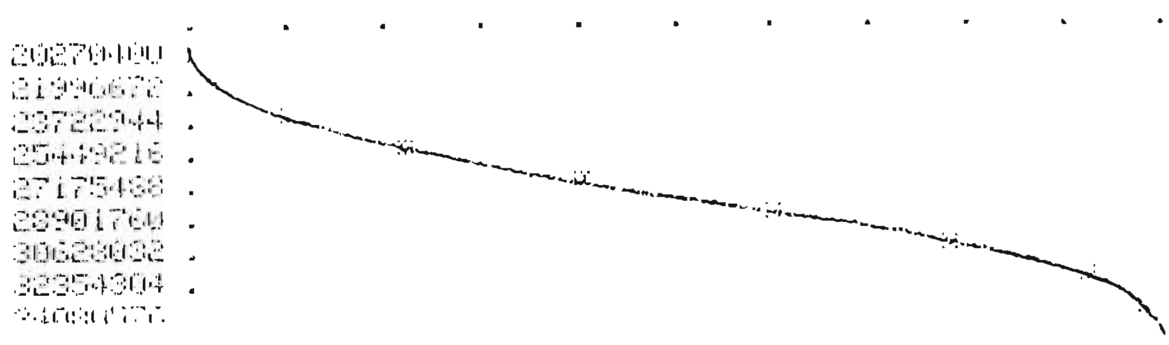
OIL #5 1985

```
 1
ENTER MIN,ML,AND MAX VALS OF CONS,PS,CONV,POP,NO,ALT
>3954.23 .137 .194 .368 390. .495E6 .5363E6 .5800E6 390.
>3.9E6 5.1E6 8.8E6
ENTER % MIN, % ML, % MAX PROBS
>6%.05 6%.7 6%.95
ENTER VAL OF N - LE 1000
>1000
ENTER 1 STD, 2 SPECIAL OUTPUT
>1
```

GT	LE	MEAN	FREQ	PROB	LPROB	1-LPROB
18544112.	20270400.	19760320.	6.	0.006	0.006	0.994
20270384.	21996672.	21363344.	15.	0.015	0.021	0.979
21996656.	23722944.	22952736.	71.	0.071	0.092	0.908
23722928.	25449216.	24641728.	131.	0.131	0.223	0.777
25449200.	27175488.	26323664.	176.	0.176	0.399	0.601
27175472.	28901760.	27995856.	208.	0.208	0.607	0.393
28901744.	30628032.	29744048.	179.	0.179	0.786	0.214
30628016.	32354304.	31424736.	125.	0.125	0.911	0.089
32354288.	34080576.	33059920.	69.	0.069	0.980	0.020
34080560.	35806848.	34839392.	16.	0.016	0.996	0.004
35806832.	37533120.	36382288.	4.	0.004	1.000	0.000

1000



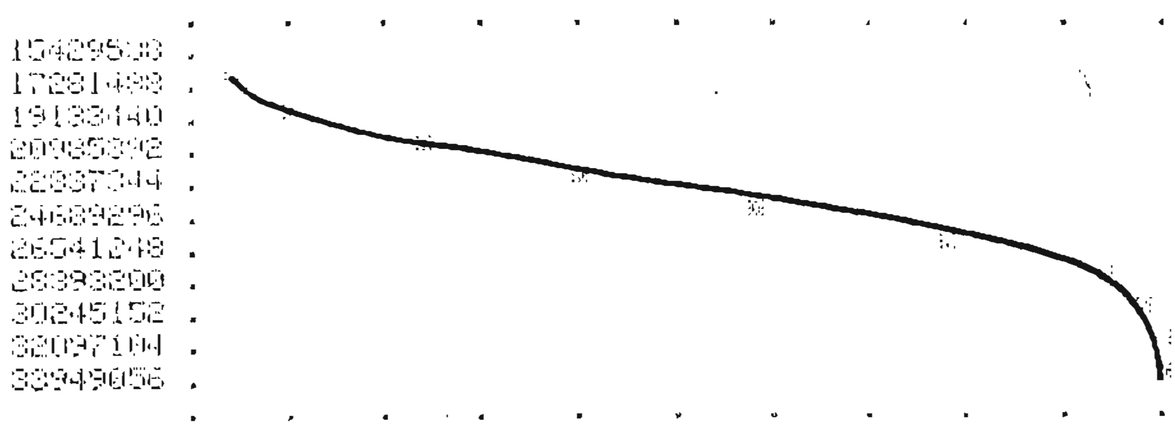


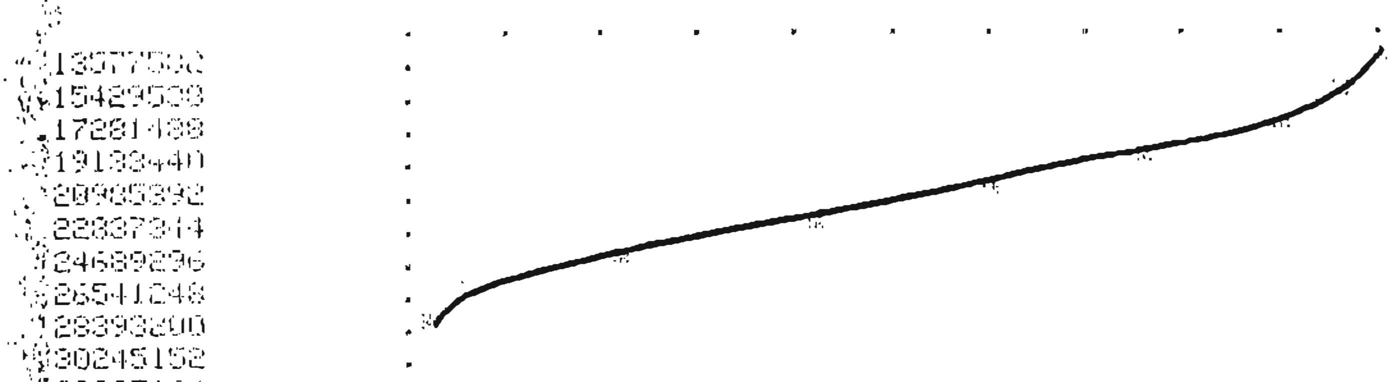
OIL SCENARIO: 1990

13577582.	15429533.	[illegible]	[illegible]	0.005	[illegible]	[illegible]
15429533.	17281488.	[illegible]	[illegible]	0.055	0.062	[illegible]
17281488.	19133440.	[illegible]	75.	0.075	0.107	0.893
19133440.	20985392.	[illegible]	[illegible]	0.131	0.238	0.762
20985392.	22837344.	[illegible]	[illegible]	0.153	0.391	0.609
22837344.	24689296.	[illegible]	[illegible]	0.191	0.582	0.418
24689296.	26541248.	[illegible]	[illegible]	0.194	0.776	0.224
26541248.	28393200.	27375904.	164.	0.164	0.940	0.060
28393200.	30245152.	29155760.	46.	0.046	0.986	0.014
30245152.	32097104.	30777536.	13.	0.013	0.999	0.001
32097104.	33949056.	33023136.	1.	0.001	1.000	0.000

1000

```
                                             PROBABILITY
         DEMAND          0    10    20    30    40    50    60    70    80    90   100
     GT         LE       .     .     .     .     .     .     .     .     .     .     .
 13577582 15429533 .
 15429533 17281488 .*
 17281488 19133440 .****
 19133440 20985392 .*******
 20985392 22837344 .********
 22837344 24689296 .**********
 24689296 26541248 .**********
 26541248 28393200 .********
 28393200 30245152 .**
 30245152 32097104 .*
 32097104 33949056 .
                     .     .     .     .     .     .     .     .     .     .     .
```





```
 1
ENTER 1 INPUT DATA, 2 STORED
>1
ENTER MIN,ML,AND MAX VALS OF CONS,PS,CONV,POP,IND,ALT
>3*54.23 .184 .263 .461 .05 .10 .15 .636596E6 .721625E6 .988066E6
>3*0. 1.2E6 2.0E6 5.0E6
ENTER 6 MIN, 6 ML, 6 MAX PROBS
>6*.05 6*.7 6*.95
ENTER VAL OF N - LE 1000
>1000
ENTER 1 STD, 2 SPECIAL OUTPUT
>1
```

O

GT	LE	MEAN	FREQ	PROB	CPROB	1-CPROB
12100779.	14540289.	14084134.	7.	0.007	0.007	0.993
14540289.	16979792.	15958988.	30.	0.030	0.037	0.963
16979792.	19419296.	18559456.	73.	0.073	0.110	0.890
19419296.	21858800.	20828592.	122.	0.122	0.232	0.768
21858800.	24298304.	23128032.	174.	0.174	0.406	0.594
24298304.	26737808.	25515568.	204.	0.204	0.610	0.390
26737808.	29177312.	27866640.	187.	0.187	0.797	0.203
29177312.	31616816.	30270400.	133.	0.133	0.930	0.070
31616816.	34056320.	32573984.	54.	0.054	0.984	0.016
34056320.	36495824.	35153744.	15.	0.015	0.999	0.001
36495824.	38935328.	37715648.	1.	0.001	1.000	0.000

1000

Oil #5
1995

```
                                                    PROBABILITY
       DEMAND            0    10    20    30    40    50    60    70    80    90   100
    GT        LE         .     .     .     .     .     .     .     .     .     .     .
 12100779 14540289 .
 14540289 16979792 .*
 16979792 19419296 .******
 19419296 21858800 .*********
 21858800 24298304 .************
 24298304 26737808 .**************
 26737808 29177312 .************
 29177312 31616816 .*********
 31616816 34056320 .****
 34056320 36495824 .*
 36495824 38935328 .
                         .     .     .     .     .     .     .     .     .     .     .
```

```
                         .     .     .     .     .     .     .     .     .     .     .
           14540289 .
           16979792 .
           19419296 .
           21858800 .
           24298304 .
           26737808 .
```

19761440.	22497728.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22497728.	25234016.	23754160.	208.	0.208	0.661	0.339
25234016.	27970304.	26472912.	172.	0.172	0.833	0.167
27970304.	30706592.	[illegible]327632.	114.	0.114	0.947	0.053
30706592.	33442880.	[illegible]94112.	39.	0.039	0.986	0.014
33442880.	36179168.	[illegible]77344.	12.	0.012	0.998	0.002
36179168.	38915456.	36970480.	2.	0.002	1.000	0.000

OIL SCENARIO 2000

1000

```
                                           PROBABILITY
     DEMAND          0    10    20    30    40    50    60    70    80    90   100
   GT        LE      .     .     .     .     .     .     .     .     .     .     .
 8816269  11552567   .
11552568  14288866   .*
14288867  17025152   .****
17025152  19761440   .*******
19761440  22497728   .***********
22497728  25234016   .***********
25234016  27970304   .**********
27970304  30706592   .******
30706592  33442880   .**
33442880  36179168   .*
36179168  38915456   .
                     .     .     .     .     .     .     .     .     .     .     .
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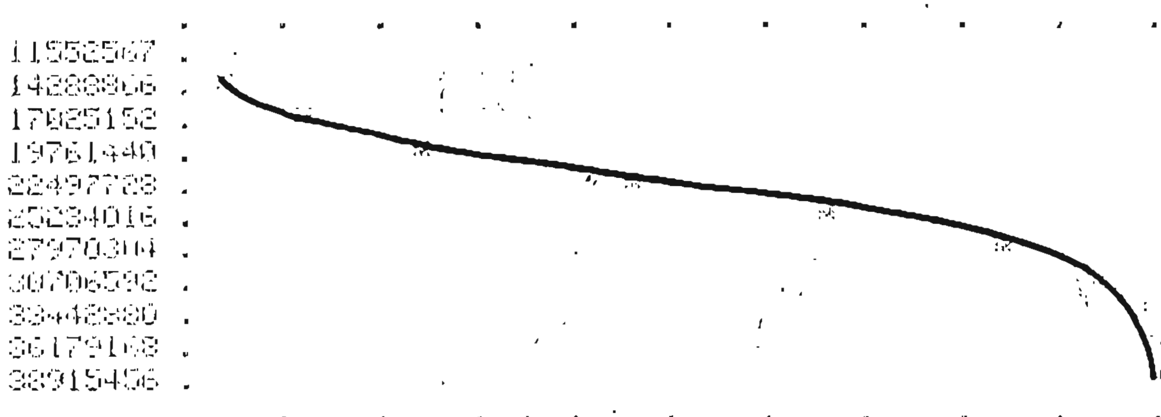
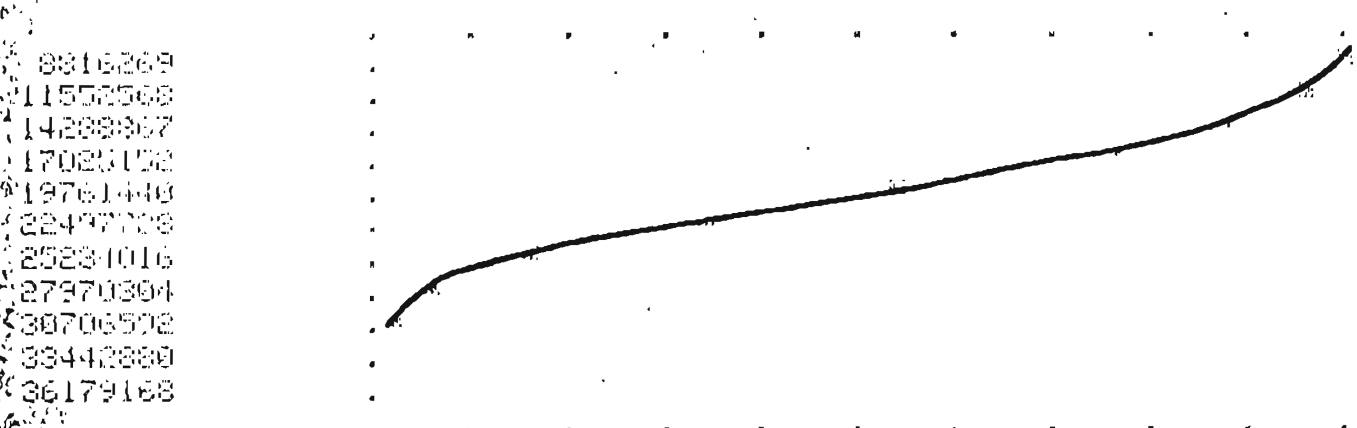
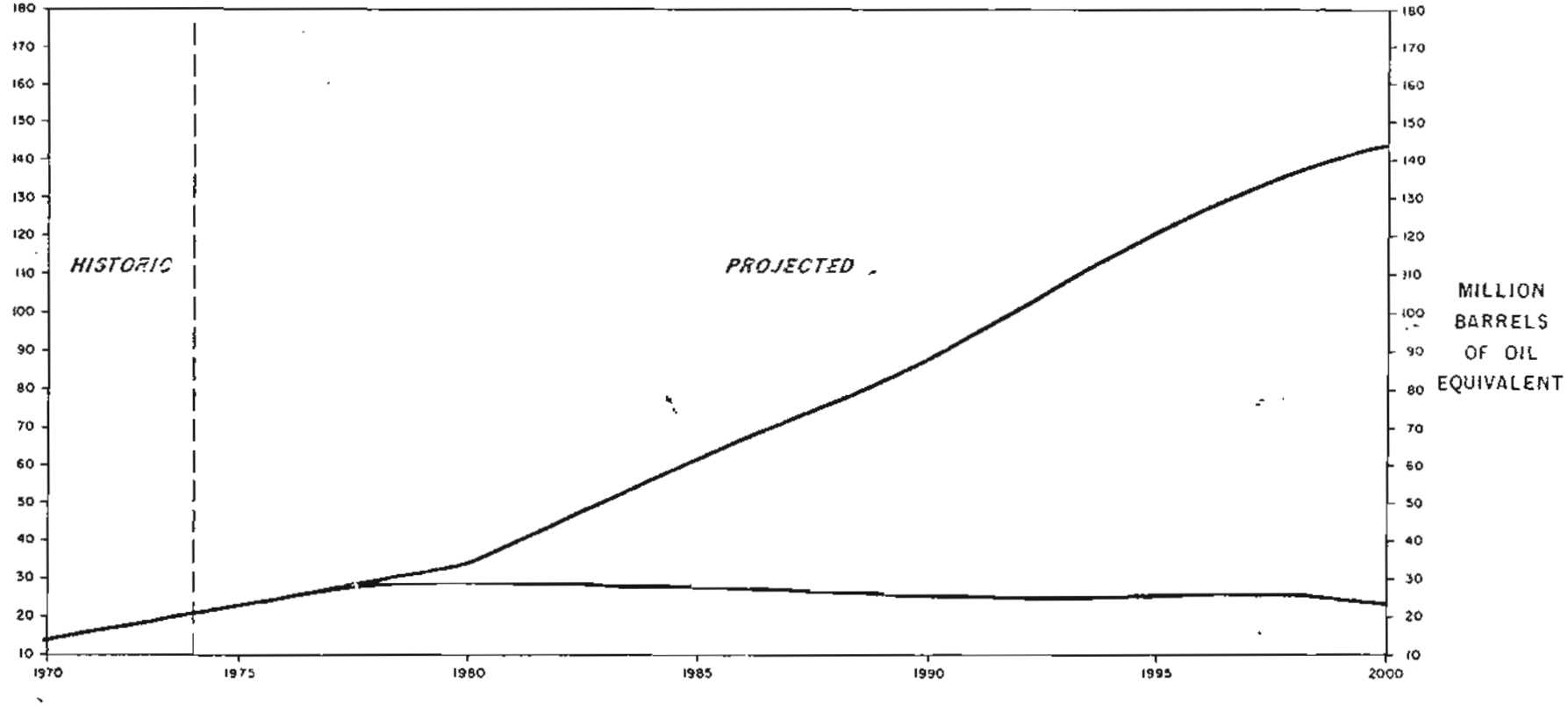
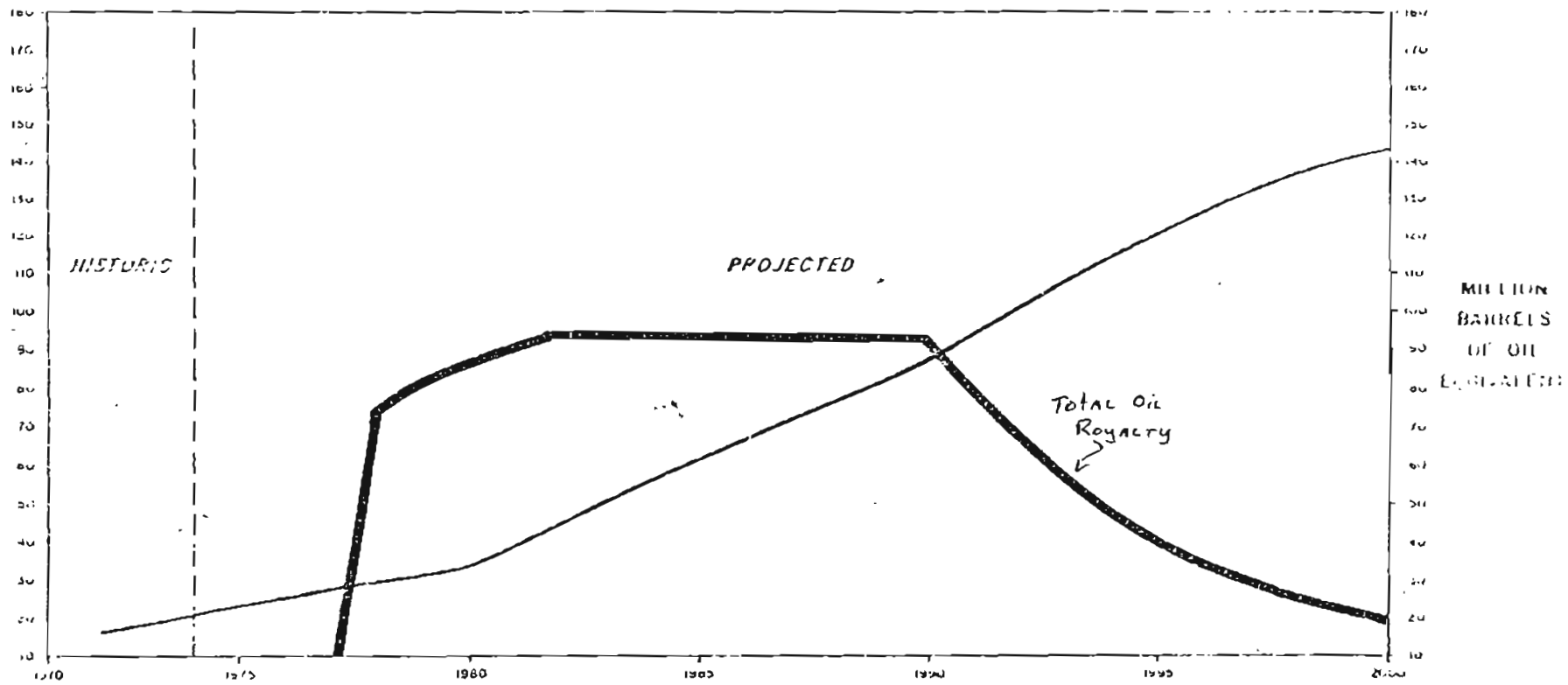






DEMAND DECISION RANGE

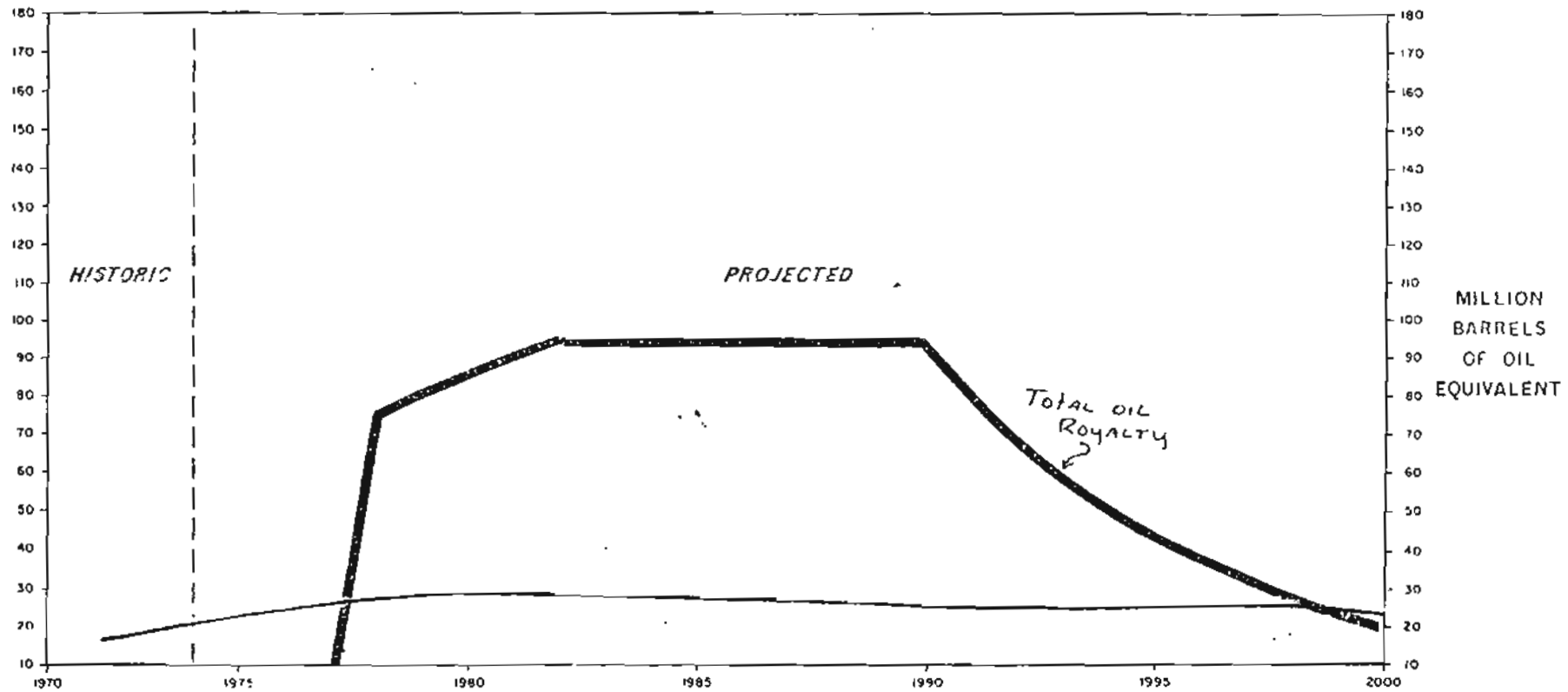
FIGURE



SPECULATIVE MINIMUM ROYALTY OIL SURPLUS

NO ECONOMICS

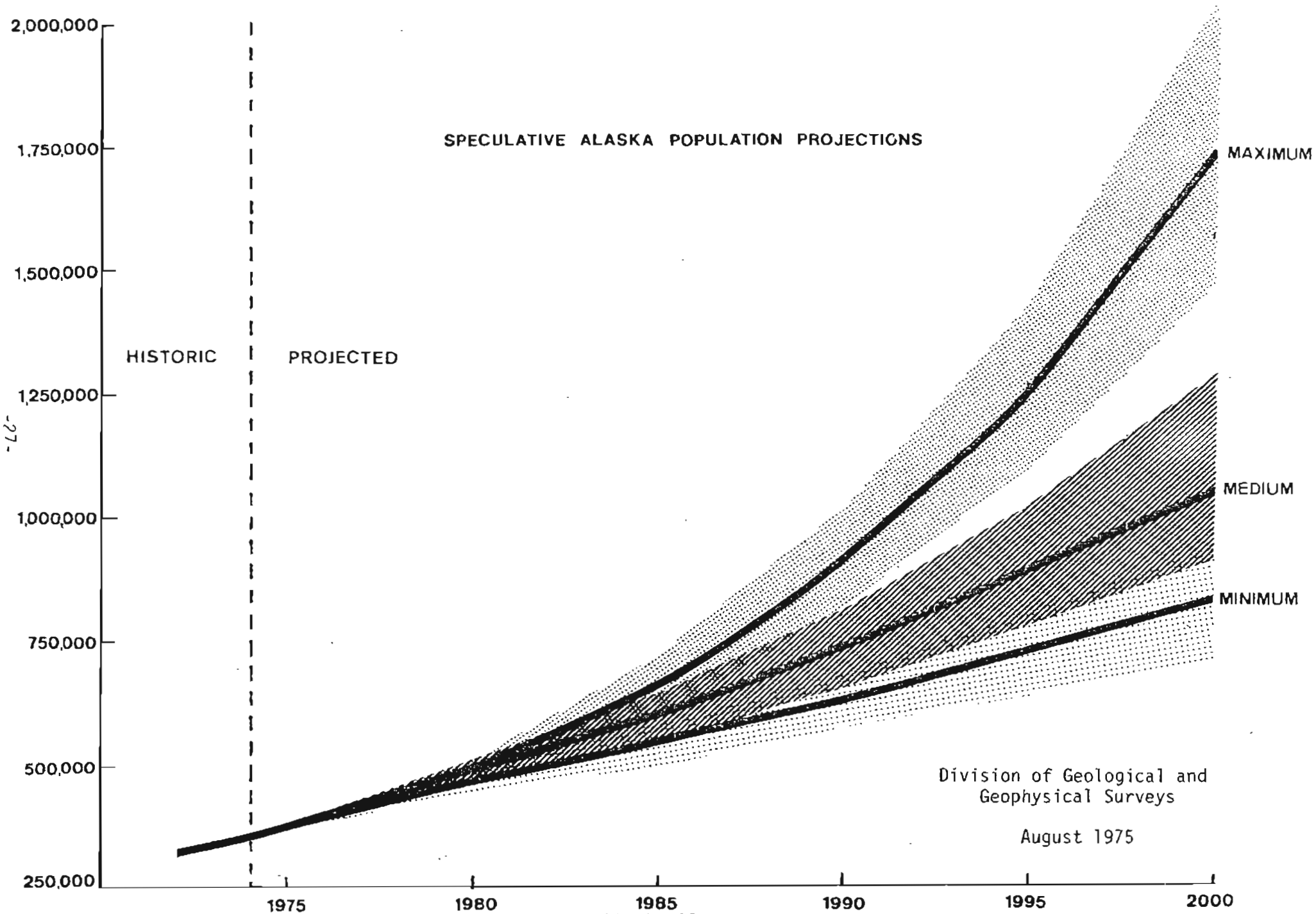
FIGURE



SPECULATIVE MAXIMUM ROYALTY OIL SURPLUS

NO ECONOMICS

FIGURE



1995 and 2000 projected by DGGS Staff, other data supplied by I.S.E.G.R.

SPECULATIVE ALASKA POPULATION PROJECTIONS

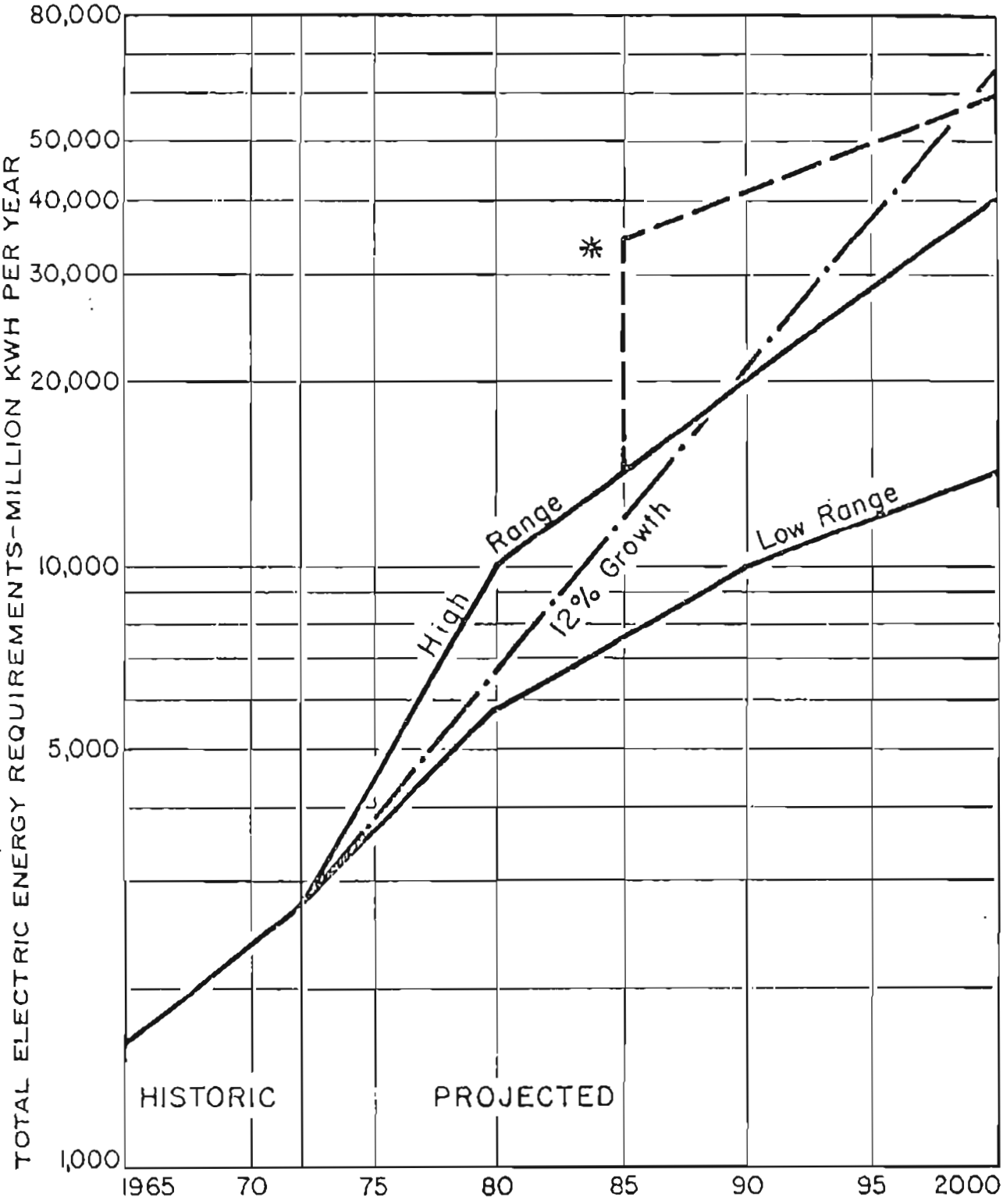
	Minimum	Medium	Maximum
	490,300	510,000	510,000
1980	468,600	487,700	487,700
	446,600	465,600	465,600
	580,900	649,600	714,600
1985	536,300	595,500	657,400
	493,000	542,900	602,100
	682,000	810,500	1,013,700
1990	627,500	729,600	908,300
	573,600	653,600	810,900
	800,668	1,022,040	1,438,440
1995*	721,625	892,301	1,255,270
	636,696	774,516	1,092,282
	939,984	1,288,793	2,041,146
2000*	829,869	1,091,284	1,734,784
	706,733	917,801	1,471,304

*1995 and 2000 projected by DGGS Staff, other data supplied by I.S.E.G.R.

Division of Geological and
Geophysical Surveys

August 1975

TOTAL ALASKA POWER REQUIREMENTS 1965-2000



*SHOWS EFFECT OF LARGE INDUSTRIAL LOAD, SUCH AS A NUCLEAR FUEL ENRICHMENT PLANT OR OTHER VERY LARGE ENERGY INTENSIVE FACILITY.

POWER REQUIREMENTS

Alaska Electric Power Installed Capacity
(Nameplate Ratings in Kilowatts)

	1972	1973	1974
Hydroelectric	74,275	121,000	122,260
Steam	68,250	68,250	68,000
Diesel	144,975	147,700	148,054
Gas Turbine	246,139	313,100	385,324

Statewide Power Requirements 1972-2000
(million kilowatt hours / year)

Actual Requirements	Estimated Future Requirements		
1972	1980	1990	2000
2,669	9,660*	41,810*	58,090*
	7,130**	13,290**	27,510**
	5,790***	9,660***	14,900***

* Higher Rate of Growth
** Likely Mid-Range Growth Rate
*** Lower Rate of Growth

Estimated Fuel Requirements for Power
Based on Mid-Range Load Estimates

	1972	1980	1990	2000
I. Continued reliance on oil and natural gas:				
Oil (million bbl/yr)	1.4	6.4	11.9	26.5
Natural Gas (billion cubic feet/yr)	16.1	37.6	63.4	133.9
II. Emphasis on alternative energy sources:				
Oil (million bbl/yr)		6.4	7.5	12.4
Natural Gas (billion cubic feet/yr)		37.6	15.0	15.0