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The 1975 Energy Production System in the States of the Rocky Mountain Region

by

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GLOSSARY

AGA	American Gas Association
API	American Petroleum Institute
AZ	Arizona
bbl	barrel (42 US gallons)
BIA	Bureau of Indian Affairs
BOM	Bureau of Mines
Btu	British Thermal Unit
cd	calendar day
CIF	cost, insurance, and freight
CO	Colorado
ERDA	US Energy Research and Development Administration
FEA	Federal Energy Administration
FOB	free on board
FPC	Federal Power Commission
g	gram
ID	Idaho
IPAA	Independent Petroleum Association of America
J	joule
kWh	kilowatt-hour
LASL	Los Alamos Scientific Laboratory
lb	pound
LP	Liquified Petroleum
LPG	Liquified Petroleum Gas
m^3	cubic metre
mcf	thousand cubic feet
MT	Montana
MW	megawatt
MWh	megawatt-hour
NGL	Natural Gas Liquids
NM	New Mexico
NURE	National Uranium Resource Evaluation
NV	Nevada
QJ	10^{15} joules (quadrillion joules)
quadrillion	10^{15}
Ref	reference
scf	standard cubic foot
sd	stream day
SIC	Standard Industrial Classification
SRI	Stanford Research Institute
TBTU	10^{12} Btu's (trillion Btu's)
ton	short ton (2000 pounds)
tonne	metric ton (1000 kilograms)

^{235}U	the isotope of uranium with atomic weight 235
^{238}U	the isotope of uranium with atomic weight 238
U_3O_8	uranium oxide (the primary constituent of yellowcake)
US	United States
USGS	United States Geological Survey
UT	Utah
WY	Wyoming
yellowcake	uranium mill output composed primarily of U_3O_8

THE 1975 ENERGY PRODUCTION SYSTEM IN THE STATES OF THE ROCKY MOUNTAIN REGION

by

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Abstract

This report presents statistics on the 1975 energy-supply system in the Rocky Mountain region. Detailed data on wood, fossil-fuel, electricity, and uranium production, transportation, exportation, conversion, and to a lesser degree consumption have been compiled for Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming, individually and as a region. Four types of information on the regional energy-production system are given: (1) quantities of energy produced, transported, exported, converted, and consumed; (2) employment in these activities; (3) contributions by these activities to final energy price; and (4) maps of the energy-supply system in each state. The data on energy quantities are presented in two forms: (1) in detail in the form of a reference energy system, and (2) in a simplified form enabling a quick overview of a state's energy-supply system. State-by-state resource data are given for coal, oil, gas, and uranium.

I. INTRODUCTION

Under the auspices of the US Energy Research and Development Administration, Assistant Administrator for Environment and Safety, the Los Alamos Scientific Laboratory is engaged in a program assessing alternative energy development strategies for the Rocky Mountain west (defined as Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming). The program's purpose is to identify and evaluate alternatives for utilization of the region's energy resources.

This report provides baseline data on the current energy-production system in the Rocky Mountain region. Although this report is similar to a published baseline for 1974,[1] it is not our intention to publish yearly data on energy in the region. Primarily because certain important data are not in the previous work, it was decided to correct these deficiencies and publish this report. This study presents a comprehensive picture of the current (1975) regional energy-production system. Fossil fuels and wood are discussed as well as uranium and electricity production and the transport of energy resources. Ancillary information important to citizens and decision makers, such as energy-related employment and data on the market value of energy, has also been included.

Because of the national decision to pursue metrication, metric units have been used throughout this report. Table 1 provides convenient conversion factors.[2] The energy unit commonly used in this report is a quadrillion (10^{15}) joules, abbreviated QJ. Conveniently, a QJ is approximately equal to a trillion Btu's (TBTU), the energy unit in Ref. 1 and in a number of other authors. Furthermore, one QJ is

TABLE I

SOME COMMON METRIC EQUIVALENTS[a]

Metric	Equivalent
1 joule	= 0.000948 Btu
1055.1 joules	= 1 Btu
1 tonne	= 1.1023 short tons
0.9072 tonnes	= 1 short ton
1 litre	= 0.2642 US gallons
3.7854 litres	= 1 US gallon
3 600 000 joules	= 1 kilowatt-hour
1 QJ (10^{15} joules)	= 0.948 TBTU (10^{12} Btu)
1.055 QJ	= 1 TBTU (10^{12} Btu)
1 cubic metre	= 0.03531 mcf (thousand cubic feet)
28.32 cubic metres	= 1 mcf (thousand cubic feet)
1 litre	= 0.00629 barrels
158.99 litres	= 1 barrel
1 joule/gram	= 0.4299 Btu/pound
2.3260 joules/gram	= 1 Btu/pound

[a]Source: "Metric Practice Guide."[2]

very approximately equal to 43 000 tonnes (47 000 short tons) of coal, 27 000 000 litres (170 000 barrels) of oil, 27 000 000 m^3 (950 000 mcf) of natural gas, or 280 000 000 kilowatt hours of electricity.

This report presents first a discussion of the conventions and techniques used in presenting energy system data, then an overview of the regional energy production system, and finally state-by-state detail. The appendixes provide energy resource information, along with some discussion of techniques and data sources.

Because of the large amount of data presented in this report, it is inevitable that some errors have occurred; the author would appreciate readers' bringing them to his attention.

II. METHODOLOGY

A. Reference Energy Systems

This analysis of the energy production system in the Rocky Mountain region assumes that in form the system is a directed graph. Energy extracted from the ground in a raw form is refined and then transported to the final consumer. Figure 1 pictorially depicts the regional energy supply system, which is then abstracted to Fig. 2. This type of energy-system representation (often referred to as a reference energy system) has been used by others, most notably by the Brookhaven National Laboratory.[3]

The diagram in Fig. 2 contains two basic items: links and nodes. The nodes are the circles joining the links (directed line segments). The links represent actual processes such as energy transport, energy conversion, or energy processing. When we refer to an energy flow through a link we mean the net energy *out of* the link. This concept is important because the process represented by the link often involves more primary energy* input than resulting output. For instance, when natural gas is transported by pipeline, the pipeline company may use some of the gas being transported as pipeline fuel. Thus input to the pipeline link is often greater than the link's output. Consequently, the reference energy system diagrams presented in this report have two numbers associated with each link: the net energy through the link (in quadrillion joules), and the "statistical efficiency" of the process (primary energy out of the link/primary energy into the link). The link's "statistical efficiency," constructed purely in terms of link input and output, may not be representative of the true physical efficiency of the process. For instance, coal cleaning involves some waste. Although this process is not 100% efficient in terms of coal, its statistical efficiency in this report is 1. So the losses incurred in coal cleaning are implicitly included in production. Because coal cleaning is often done at the mine, statistics are not usually available at the level of detail that would permit determination of a state-by-state coal-cleaning efficiency. Consequently, a "statistical efficiency" given in this report may not have a precise correspondence to physical efficiency.

In some cases, significant fluctuations occur over a year's time in inventories of energy resources. For instance, in anticipation of a coal strike, power plants often greatly increase their coal stocks. Such changes, as well as outright errors in reported

*The terms "primary energy" and "ancillary energy" are used throughout this report to distinguish between the energy form actually being "operated on" by a link (the primary energy) and other energy forms that may be used in a link. For instance, in the natural gas pipeline link, natural gas (whether shipped or used as fuel) is the primary energy form of the link. Diesel fuel, which may be used by the natural gas company to transport the gas, is termed ancillary energy.

statistics, often result in the total energy entering a node not being equal to the total energy leaving the node. In this report, a "statistical inventory increase" is associated with each node. The distinction between an actual inventory change and a "statistical change" is similar to that described above for efficiency. Essentially, in a "statistical change," statistical discrepancies are included with actual physical inventory changes. Using the net energy flow through a link, the "statistical efficiency" of that link, and the appropriate "statistical inventory increase," the reference energy system diagrams reported here should precisely balance; i.e., the sum of the energy flows in the links entering a node, less the node's inventory increase, should equal the sum of the energy flows in the links leaving the nodes, after division by the corresponding "statistical efficiencies."

The set of uranium links and nodes probably needs further explanation. Uranium is, of course, not utilized in the same manner as are fossil fuels or electricity; it is therefore difficult to measure in terms of QJ's. We have adopted a convention that allows the conversion of uranium (pounds of U_3O_8) into QJ equivalents. This conversion technique is described in detail in Appendix A.

Two other data items associated with each link are reported here: the employment generated by the process associated with a link, and the price increase of the primary energy form owing to the process associated with a link. These two items are reported in terms of employment or price increase *per unit energy* (QJ) through a link. For some links, employment and price data are not always available according to the categories of Fig. 2; for other links, total employment in the link may include people actually employed in other links. Consequently, the employment and price data should be used with caution.

Coal exports have been delineated in terms of destination (or origin for an import). For this purpose, the US has been divided into five regions (Fig. 3), corresponding to the five net coal-export regions of Fig. 2.

B. Overview Energy-Flow Diagrams

Because the reference energy system diagrams represented by Fig. 2 are somewhat detailed, it is difficult to gain a "feeling" for what a particular energy system really is like. For this reason, aggregated diagrams offering less information but more pedagogical appeal have been generated. These diagrams (Fig. 4, for example) are very similar to the more detailed diagrams (Fig. 2) except in their degree of aggregation. A somewhat artificial division of energy consumption into "used" and "lost" energy has been incorporated into the simplified diagrams.* Primary energy used in the energy industries has been allocated to the industrial sector, with the exception that primary energy used for transporting energy (as with pipeline fuel) has been allocated to the transportation sector. (This is in contrast to the convention used in reference energy systems of including such uses in "statistical efficiencies.") Hydroelectric energy has been converted to a "fossil-fuel equivalent" by multiplying the hydroelectric generation by three. This was thought desirable to give an indication of the amount of fossil fuels saved by the use of hydropower. But because this artificial increase is passed through to lost energy, the "Conversion and Line Loss" and "Lost Energy" boxes in the simplified diagram may seem somewhat inflated. Statistical inventory changes have been lumped together into one storage category in the flow diagrams.

C. 1974 Energy Flows

Although this report is similar to an earlier analysis of the regional energy system,[1] it was necessary to make some changes in statistical conventions here. The choice was between (a) adhering strictly to the conventions used in Ref. 1, and (b) correcting deficiencies in the conventions used in Ref. 1. Because our goal is to produce a useful baseline rather than generate time-series data, the latter course was chosen. The reader should be aware of conventional differences before comparing data in the two reports. These differences are discussed further in Appendix B.

---

*Of energy used for transportation, 75% has been assumed lost (after the Joint Committee on Atomic Energy[4]). Other end-use energy efficiencies are 1968 national averages from the Stanford Research Institute (SRI).[5] SRI's end-use efficiencies by end use and fuel were applied to 1968 US energy consumption by end use, fuel, and consumption sector (residential, commercial, and industrial) to determine an end-use efficiency by fuel and sector. These efficiencies may be found in Table II. The end-use efficiency for wood is assumed to be the same as for coal.

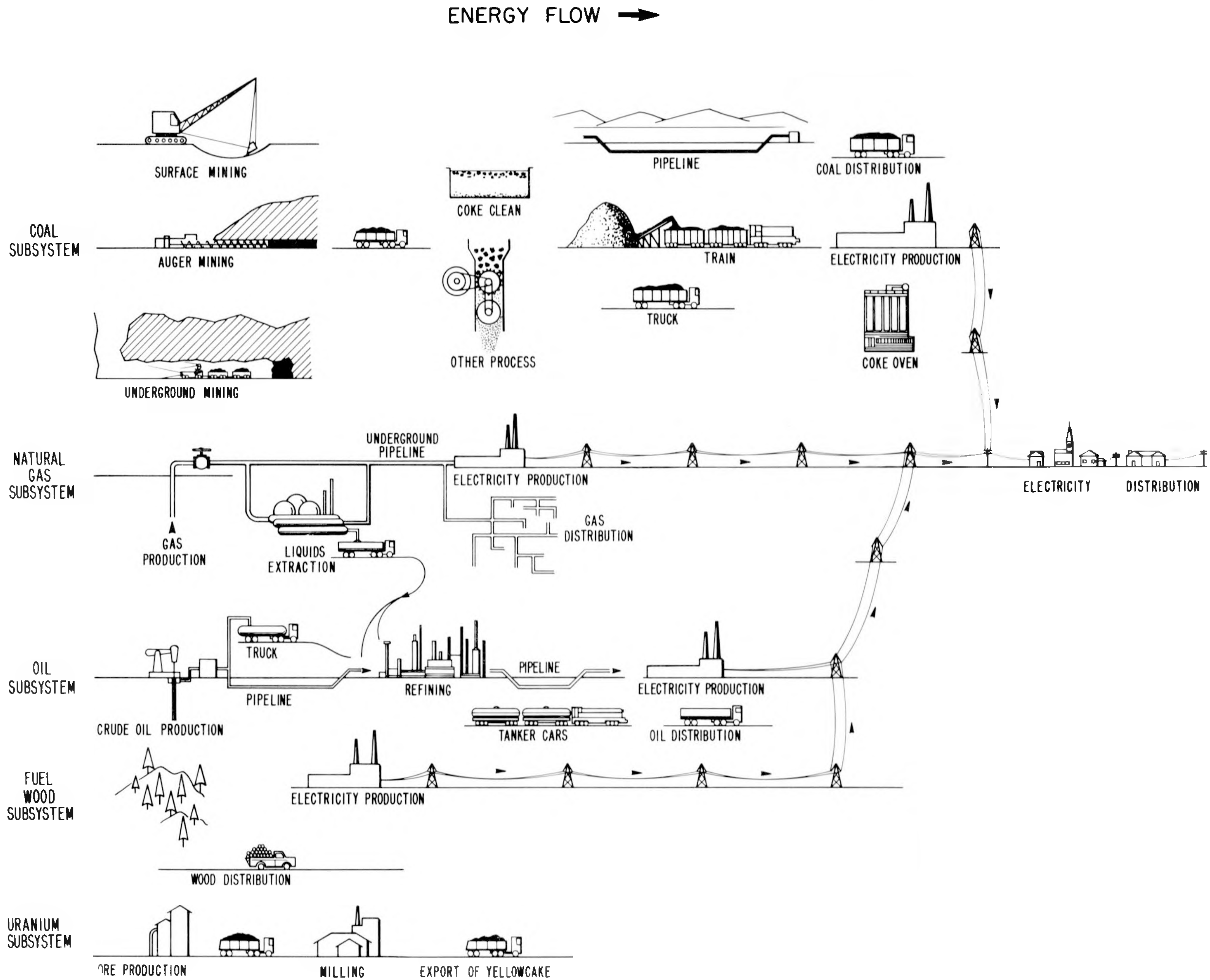

Fig. 1.
The regional energy-supply system.

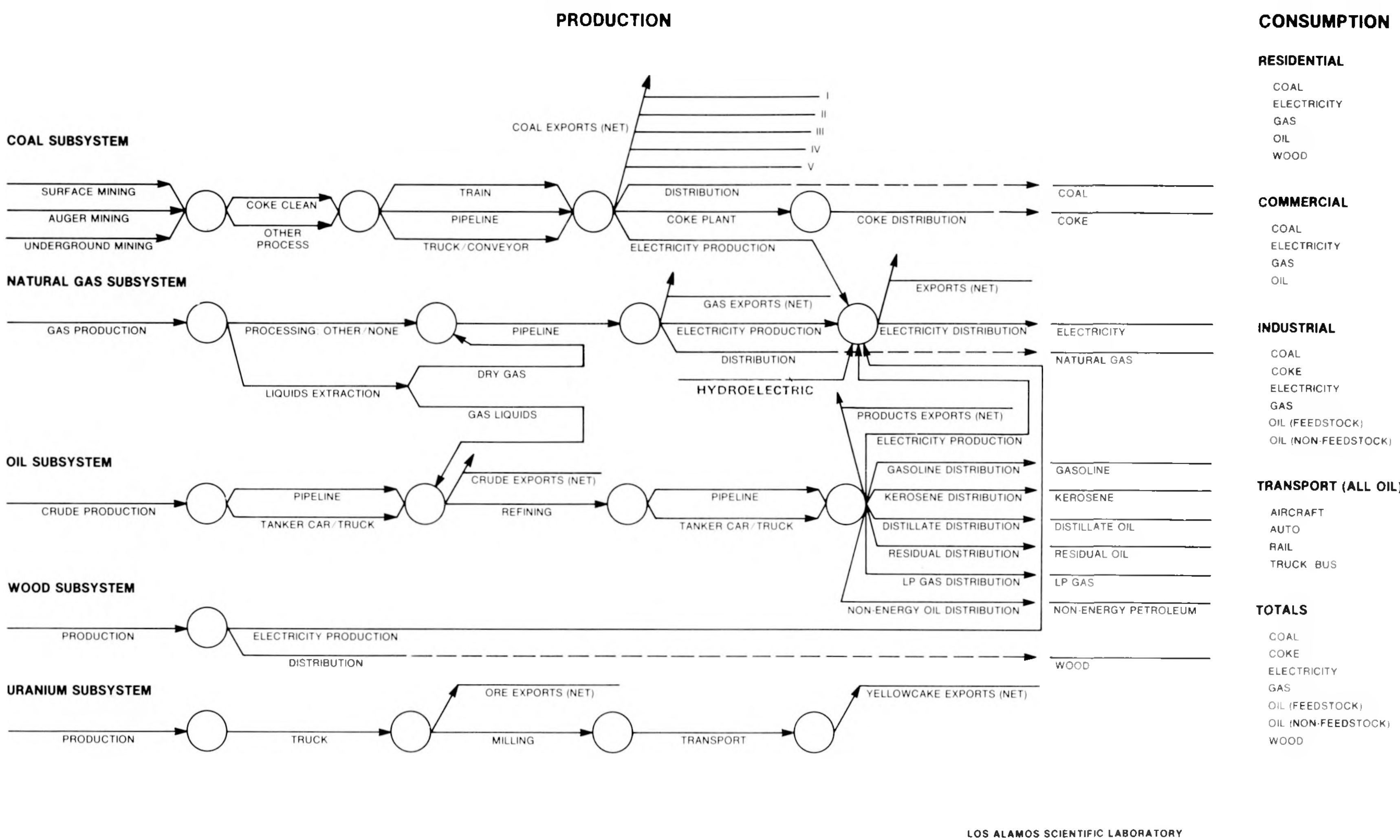

Fig. 2.
An abstraction of the regional energy-supply system.

TABLE II

AVERAGE 1968 US END-USE EFFICIENCIES[a]

	Coal[b]	Gas[b]	Oil[b]	Electricity
Residential	0.55	0.60	0.62	0.77
Commercial	0.70	0.69	0.76	0.67
Industrial	0.70	0.69	0.71	0.90

[a]Source: Adapted from SRI.[5]
[b]Excludes conversion to electricity.

Fig. 3.
Coal export-import regions.

D. Data Sources

A detailed accounting of data sources for this report is provided in Appendix C. In lieu of detailed data attribution in the body of this report, the reader is referred to Appendix C.

III. THE ROCKY MOUNTAIN REGION ENERGY-PRODUCTION SYSTEM

A. Regional Overview

The Rocky Mountain region is a significant producer and exporter of nearly every energy form, consuming 31% of its regional production within the region. If uranium is omitted from the analysis, 1975 regional consumption amounts to 57% of production (almost the same percentage as in 1971). Table III summarizes 1975 energy production, consumption, and exports for the region. New Mexico and Wyoming, the "energy baskets" of the region, are the major producers of coal, gas, oil, and uranium. Arizona and Colorado are the major consumers, although Colorado still manages to be a net energy exporter. Please note that Table III presents gross consumption of fuels including consumption for electricity generation. In most of this report, however, consumption for electricity generation is not generally considered as final consumption. Other conventions used in Table III are explained in the table footnotes and should be born in mind in making comparisons with other data presented in this report.

Fig. 5 characterizes the regional energy flows of Fig. 4 in some detail. Note that when a net export is negative, as in "Products Export (Net)" in Fig. 5, the implication is that the commodity is being imported. The reader is cautioned of the significant differences in conventions between Figs. 4 and 5, discussed in section II.B. Figure 6 presents coefficients for energy-related employment and energy price increases. Table IV gives oil prices (best estimates in some cases), Table V gives average coal heat content and coal prices, Table VI gives electricity prices, and Table VII gives natural gas prices for the region. A summary of all energy prices is presented in Table VIII. Per capita energy consumption by energy form and by end use is given in Tables IX and X. Maps showing the principal energy facilities of the region are shown in Figs. 7a and 7b. For clarity, two separate maps of the region's energy facilities were compiled. Details on these energy facilities may be found in the section on each state. Because of the extreme difficulty in establishing reliable information on gas-processing plants, that data may not be as reliable as other energy-facility data. Information on energy resources in the region is given in Appendixes D, E, and F. Details on wood consumption are presented in Appendix G.

B. Arizona

Although mining has been and still is a major industry in Arizona, production of energy minerals has not been significant. Uranium reserves have been productive in the past and will probably soon be

ROCKY MOUNTAIN REGION 1975

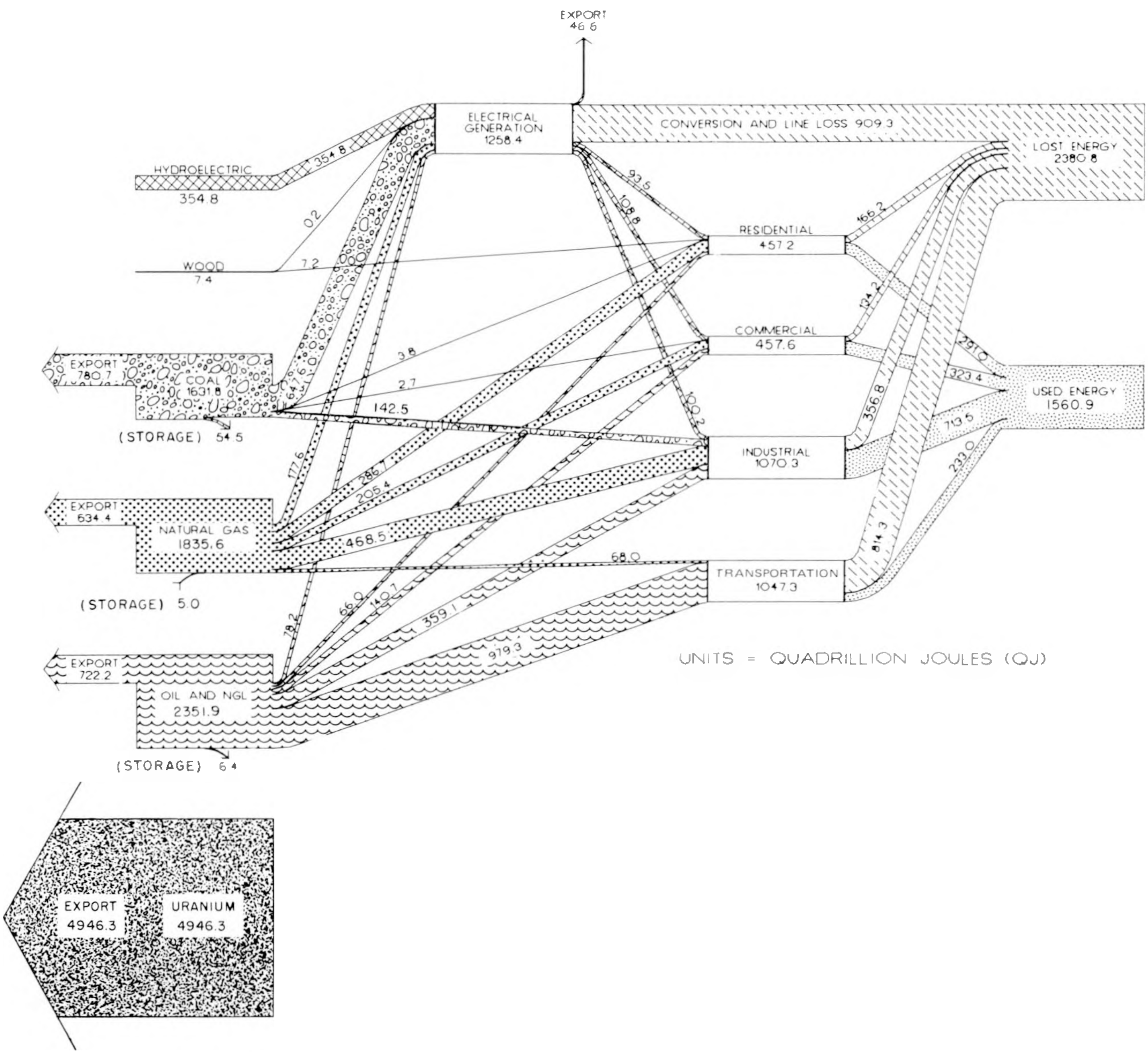

Fig. 4.
1975 energy flows, Rocky Mountain region.

TABLE III

1975 REGIONAL ENERGY BALANCE SHEET[a]
UNITS: QJ (10^{15} joules)

	Coal			Natural Gas			Oil And Natural Gas Liquids			Wood		Uranium[g]		Electricity			Total		
	Prod	Cons[b,c]	Exp[d]	Prod[e]	Cons[c]	Exp[d]	Prod[f]	Cons[c]	Exp[d]	Prod	Cons[c]	Prod	Exp[d]	Prod	Cons	Exp[d]	Prod[h]	Cons[j]	Exp[d,k]
AZ	158.9	97.1	78.4	0.24	151.1	−166.4	3.9	308.9	−309.1	0.8	0.8	—	—	78.3	73.1	−6.7	242.9	652.6	−417.4
CO	207.4	169.6	8.7	164.7	316.8	−156.6	262.4	333.1	−100.5	1.1	1.1	689.0	665.8	59.5	56.4	−6.1	1341.0	835.8	398.9
ID	—	11.2	−11.2	—	60.7	−63.7	—	126.4	−126.4	1.6	1.6	—	—	37.0	46.4	−17.0	113.7	363.4	−252.8
MT	419.0	19.0	398.7	48.4	81.5	−35.2	203.5	136.6	42.0	1.4	1.4	—	—	40.4	31.9	3.3	776.5	331.3	415.5
NV	—	106.2	−107.2	—	67.3	−66.4	0.70	108.0	−108.3	0.3	0.3	—	—	49.2	27.4	17.3	19.5	236.7	−229.5
NM	178.4	139.8	37.9	1238.0	186.4	984.8	752.1	197.4	545.9	1.6	1.6	2599.1	2453.1	70.3	24.1	42.2	4769.8	390.5	4149.6
UT	183.6	118.1	52.2	52.5	125.7	−81.4	256.9	203.3	35.5	0.4	0.4	221.2	198.5	20.7	27.3	−11.0	726.4	489.5	171.5
WY	484.6	135.8	323.7	331.7	72.2	219.2	872.5	111.2	743.0	0.2	0.2	1748.5	1629.0	43.1	15.9	24.6	3449.6	252.1	2989.5
REG	1631.9	796.6	780.7	1835.6	1061.6	634.4	2351.8	1524.8	722.2	7.4	7.4	5257.7	4946.3	398.4	302.5	46.6	11439.3	3551.7	7225.0

[a] Totals may not add because of losses and rounding errors; Prod=Production; Cons=Consumption; Exp=Exports.

[b] Coal input to coking plants included.

[c] Includes electricity fuel consumption.

[d] Exports may not be equal to production less consumption because of losses and fuel used in processing.

[e] Excludes Natural Gas Liquids.

[f] Includes Natural Gas Liquids.

[g] One tonne U_3O_8 = 0.521 QJ (see Appendix A)

[h] Total fossil fuel, wood, and uranium production plus the fossil fuel equivalent of hydro production. The fossil-fuel equivalent of hydro production is obtained by dividing total hydro production by 0.33.

[j] Total fossil fuel and wood consumption plus fossil-fuel equivalent of electricity consumption less fuels used for electricity production. The fossil-fuel equivalent of electricity consumption is obtained by dividing by the product of an average generation efficiency (0.33) and the transmission efficiency (0.86).

[k] Total fossil fuel and uranium exports plus the fossil equivalent of electricity exports. The fossil-fuel equivalent of electricity exports is obtained by dividing electricity exports by 0.33.

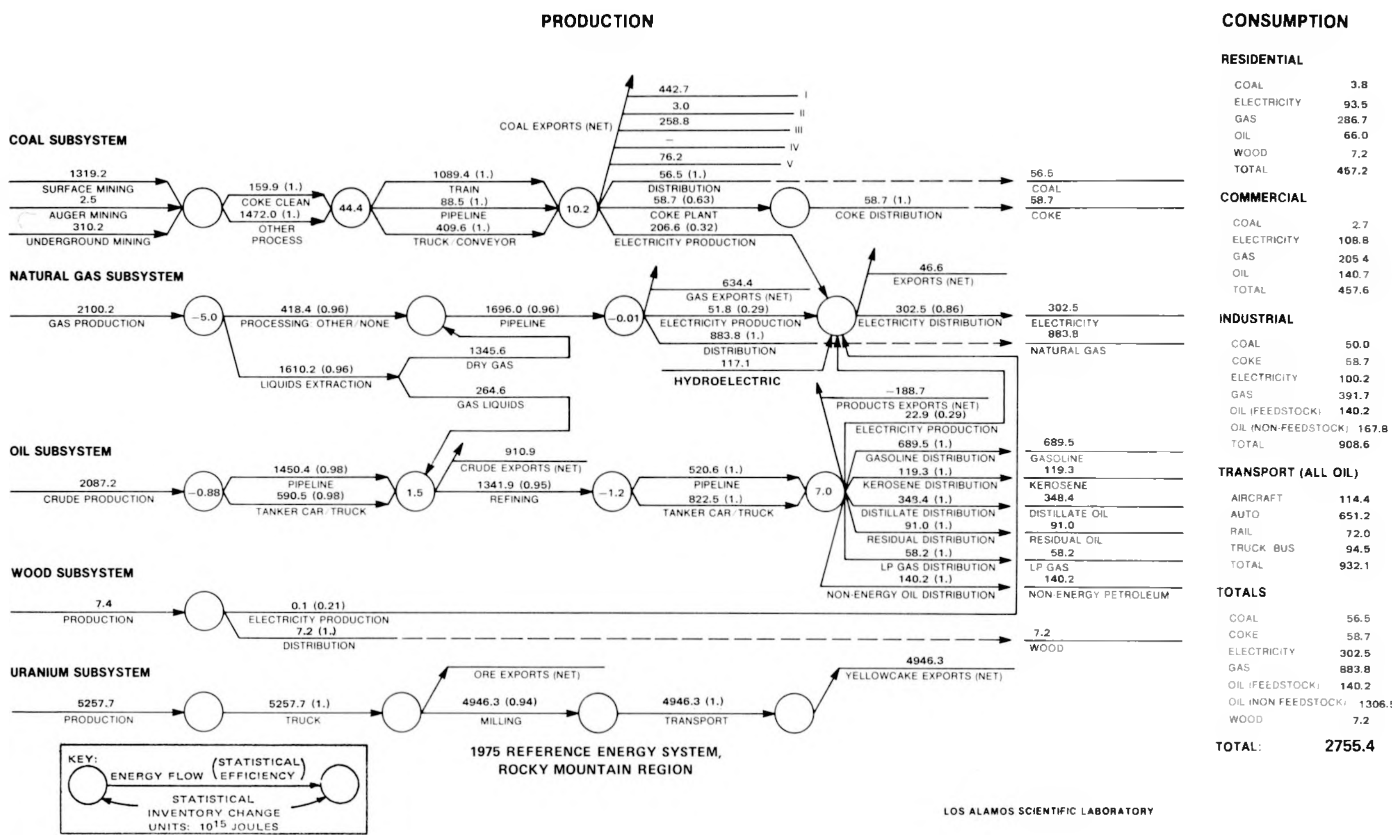

Fig. 5.
1975 reference energy system, Rocky Mountain region.

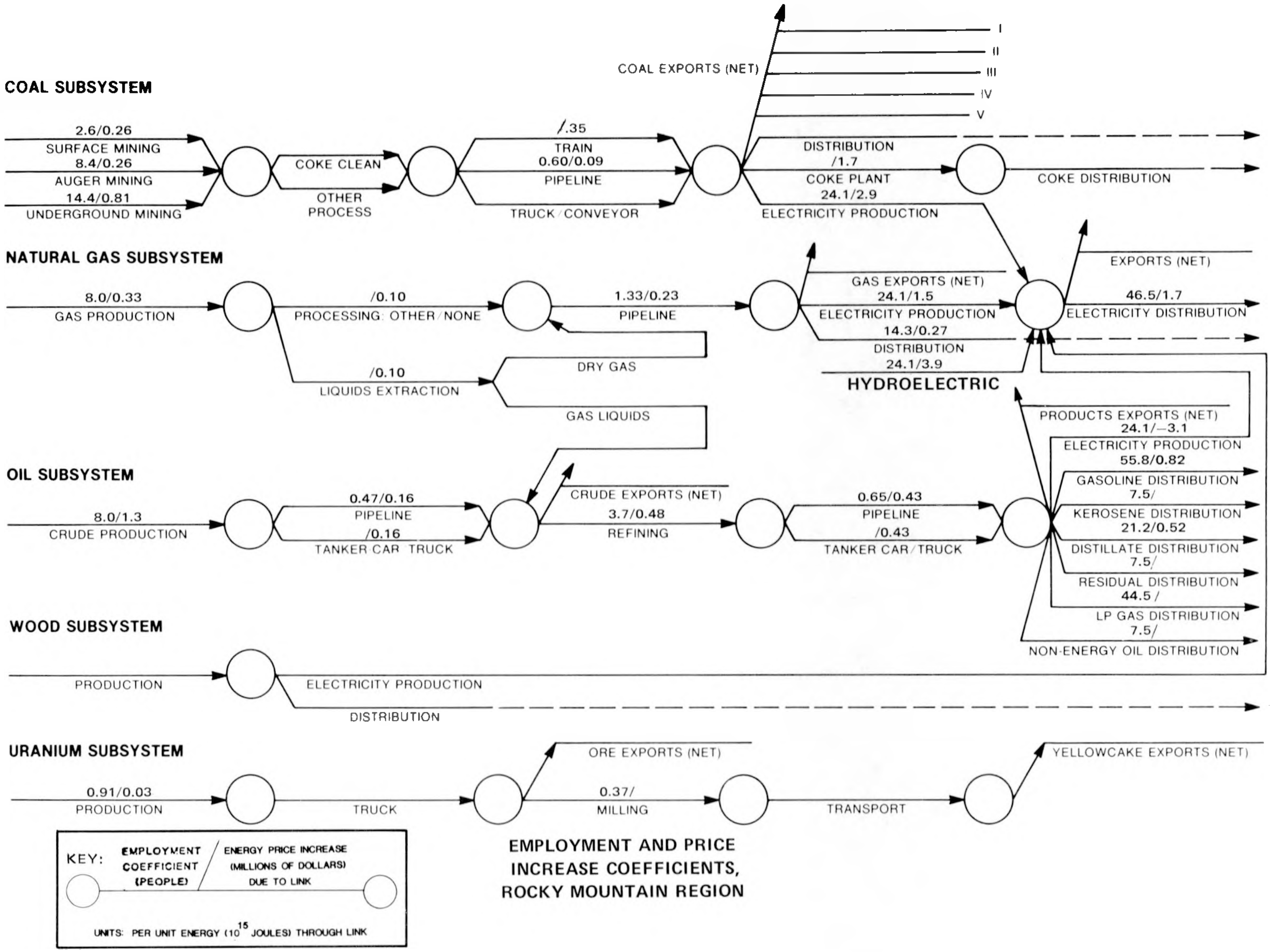

Fig. 6.
Employment and price increase coefficients, Rocky Mountain region.

TABLE IV

1975 PRICES OF CRUDE OIL AND PETROLEUM PRODUCTS (UNITS: $/barrel)

	Well Head Crude Oil[a]	Crude Oil at Refinery[b]	Oil Products at Refinery[c]	Price Paid by Distributor[d]	Consumer Price[e]
AZ	5.25	9.16	11.74	14.16	18.16
CO	9.60	9.16	12.08	14.63	19.32
ID	---	---	---	14.25	19.08
MT	7.83	8.97	12.08	14.35	19.34
NV	6.52	---	---	15.61	19.39
NM	8.30	9.56	11.74	14.41	19.50
UT	7.78	9.56	11.74	14.08	18.45
WY	7.41	8.97	12.08	14.25	19.07
Region	7.98	9.16	11.95	14.46	18.99

[a]Sources discussed in entry 62 of Appendix C.

[b]Averages of selected refiners [10] (see entry 65 of Appendix C).

[c]Estimated from regional and national figures[11,12] (see entry 72 of Appendix C).

[d]Estimated average price for distillate oil, gasoline, and oil for electricity generation (see entry 75 of Appendix C).

[e]Distributor prices increased by representative gasoline margins from Platt's.[13] For this reason, price may be high by as much as 10%.

TABLE V

COAL: 1974 AND 1975 AVERAGE PRICES, AVERAGE HEAT CONTENT, AND PRODUCTION[a]

	Average Heat Content[b]		Average Prices (FOB, mine)[c] ($/tonne)		Production (1000's of tonnes)	
State	1974	1975	1974	1975	1974	1975
AZ	25 560	25 070	3.40	3.53	5 850	6 337
CO	27 060	27 720	16.90[d]	17.58[d]	6 315	7 480
MT	20 980	20 910	3.50	5.58	12 781	20 037
NM	21 770	22 340	7.10	7.63	8 557	7 985
UT	30 280	29 170	19.50[d]	21.87[d]	5 150	6 294
WY	22 050	22 460	5.80	5.94	18 820	21 576
Region	23 410	23 410	7.70	8.50	57 463	69 709
National	27 590	e	16.50	20.67	545 000	580 595

[a]Sources: 1974 data from Ref. 1 with the exception of national average heat content.[14] See Appendix C for 1975 data sources.

[b]Weighted by production (in QJ's).

[c]Weighted by production (in tonnes).

[d]Very approximate owing to large amount of captive coking coal production.

[e]Not available.

TABLE VI

ELECTRICITY PRICE BREAKDOWN: 1000 kWh DELIVERED TO FINAL CONSUMPTION (1975)[a]

State	Fuel Mix Hydro: Coal: Oil: Nat. Gas[b]	Fuel Cost[b]	Wholesale Price[c]	Consumer Price
AZ	33:41:19:7	6.00	22.68	30.76
CO	9:62:3:26	6.20	17.58	25.43
ID	100:0:0:0	0.01	8.55	12.76
MT	85:14:0:1[d]	0.56	6.21	12.56
NV	12:65:5:18	5.84	13.39	21.89
NM	0:66:4:30	5.03	17.57	25.33
UT	19:77:1:3	4.56	17.07	22.55
WY	9:89:1:1	2.57	10.89	15.69
Region	29:52:6:13[d]	4.28	13.92	22.31

[a]Sources: See Appendix C.

[b]On the basis of total state generation.

[c]Price to largest industrial users: assumed equal to FOB generator price (see entry 30 in Appendix C).

[d]Negligible amount of generation from wood.

TABLE VII

1975 NATURAL GAS PRICES[a]

State	Wellhead Prices ($ per mcf)	Wholesale Price ($ per mcf)[b]	Consumer Price ($ per mcf)
AZ	0.280	0.757	1.066
CO	0.260	0.645	0.899
ID	—	1.171	1.506
MT	0.433	0.949	1.089
NV	---	1.134	1.426
NM	0.405	0.621	0.727
UT	0.480	0.693	1.003
WY	0.337	0.518	0.636
Region	0.382	0.738	0.969
National	0.445	0.964	1.193

[a]Source: Bureau of Mines.[15]

[b]Price paid by industrial users.

TABLE VIII

1975 ENERGY PRICE SUMMARY
UNITS: millions of dollars per quadrillion joules (QJ)

	Unit Price at Wellhead or Mine[a]				Unit Price to Consumer[a]			
State	Coal	Gas	Oil	Uranium[b]	Coal[c]	Gas[d]	Oil[e]	Electricity
AZ	0.15	0.24	0.86	---	0.20	1.03	3.16	8.54
CO	0.43	0.23	1.57	0.033	0.46	0.89	3.37	7.06
ID	---	---	---	---	---	1.39	3.33	3.54
MT	0.25	0.35	1.28	---	0.28	1.02	3.37	3.49
NV	---	---	1.07	---	0.33	1.44	3.37	6.08
NM	0.34	0.35	1.36	0.032	0.21	0.78	3.40	7.04
UT	0.52	0.41	1.27	0.033	0.45	0.94	3.22	6.26
WY	0.26	0.29	1.21	0.036	0.23	0.59	3.33	4.36
Region	0.31	0.33	1.30	0.034	0.32	0.95	3.31	6.20

[a]Sources: See Appendix C.

[b]Reported U_3O_8 price at mill.

[c]Price to electricity generation.

[d]Excluding electricity generation use.

[e]Products wholesale (price from Table III) plus the gasoline dealer margin.[13] For this reason, price may be high by as much as 0.3.

TABLE IX

SUMMARY OF 1975 PER CAPITA ENERGY
CONSUMPTION BY STATE AND ENERGY TYPE[a]
Units: billion (10^9) joules per person

State	Coal	Coke	Electricity	Gas	Oil	Wood	Total	Population Base[b]
AZ	1.1	---	32.9	59.0	117.2	0.36	210.5	2 224 000
CO	6.2	8.0	22.3	103.1	128.1	0.43	268.0	2 534 000
ID	13.7	---	56.6	74.0	154.0	2.0	300.2	820 000
MT	1.5	---	42.6	107.4	182.2	1.6	335.3	748 000
NV	2.4	---	46.3	65.9	167.7	0.51	282.8	592 000
NM	---	---	21.0	102.1	162.8	1.4	287.3	1 147 000
UT	11.4	30.4	22.6	102.0	167.7	0.33	334.4	1 206 000
WY	29.7	4.8	42.5	190.6	294.9	0.53	563.1	374 000
Region	5.9	6.1	31.4	91.6	150.0	0.75	285.7	9 645 000

[a]Final consumption only (fuel for electricity generation not included).

[b]Source: Bureau of Census.[16] Units: people.

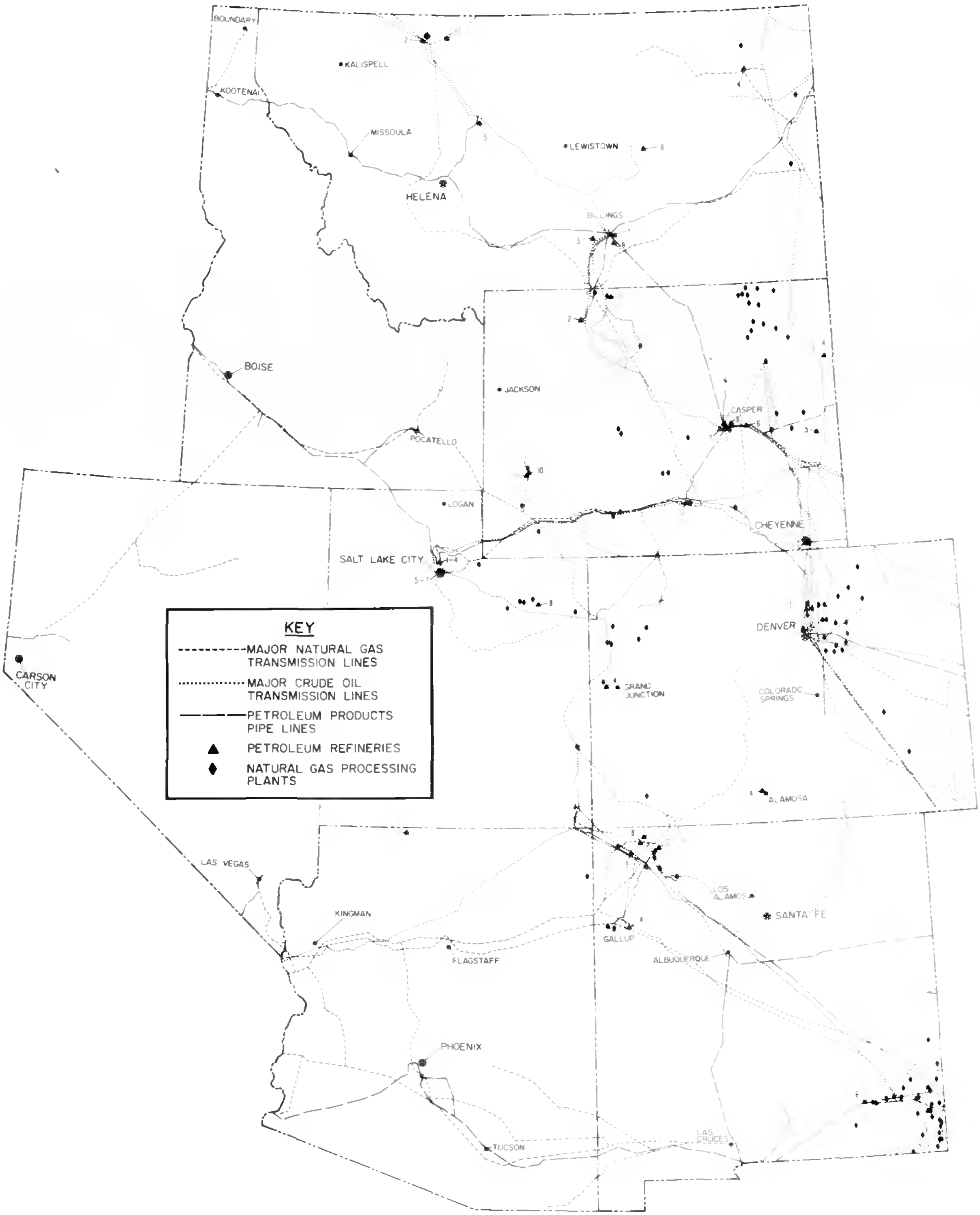

Fig. 7a.
Principal energy facilities of the Rocky Mountain region.

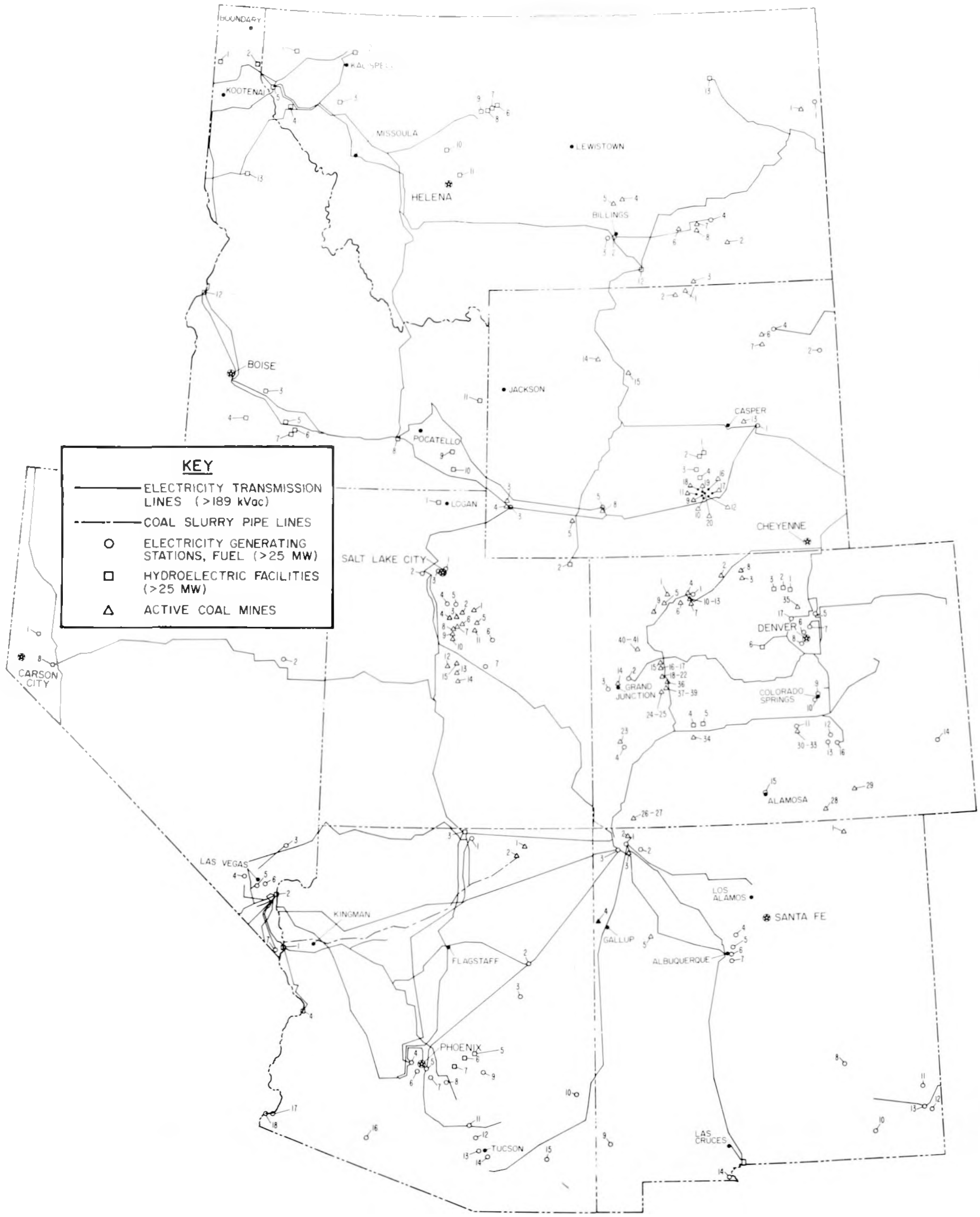

Fig. 7b.
Principal energy facilities of the Rocky Mountain region.

TABLE X

SUMMARY OF 1975 PER CAPITA ENERGY CONSUMPTION BY STATE AND END USE[a]
Units: billion (10^9) joules per person

State	Residential	Commercial	Industrial	Aircraft	Auto	Rail	Truck/ Bus	Transportation Total	Total	Population Base[b]
AZ	31.4	32.4	61.6	9.1	64.0	2.9	9.1	85.2	210.5	2 224 000
CO	55.4	53.9	70.3	14.3	64.7	3.6	5.8	88.4	268.0	2 534 000
ID	67.1	48.0	103.9	2.9	62.4	7.6	8.3	81.2	300.2	820 000
MT	57.9	54.0	121.9	7.5	63.4	16.7	14.0	101.6	335.3	748 000
NV	46.1	42.1	62.3	35.0	83.8	2.7	11.1	132.6	282.8	592 000
NM	38.9	37.5	101.3	11.9	76.5	7.6	13.6	109.6	287.3	1 147 000
UT	47.0	52.1	140.5	11.4	63.8	10.9	8.8	94.8	334.4	1 206 000
WY	53.5	103.7	252.4	4.8	85.6	38.0	25.4	153.7	563.1	374 000
Region	47.4	47.4	94.2	11.9	67.5	7.5	9.8	96.6	285.7	9 645 000

[a]Final consumption only (fuel for electricity not included).
[b]Source: Bureau of Census.[16] Units: people.

productive again, although no uranium is currently produced in the state. Coal is the only energy mineral produced in large quantities in Arizona. The Black Mesa coal field, located on the Hopi and Navajo Reservations in the northern part of the state, is the state's primary coal resource area and is the location of Peabody Coal's Black Mesa and Kayenta mines. The first of these mines services the Mohave power plant near Las Vegas, Nevada, through the only currently operating coal slurry pipeline in the country. The Kayenta mine serves the Navajo power plant in nearby Page, Arizona.

Electric-power production for consumption in Arizona is characterized by (a) an unusually high dependence (from a regional standpoint) on oil as a fuel, and (b) a heavy reliance on out-of-state electricity generation, notably the Four Corners power plant in New Mexico.* As Table IX indicates, however, per capita energy consumption in the state is the smallest in the region.

Figure 8 gives the 1975 Arizona reference energy system, shown in a simplified version in Fig. 9. Figure 10 contains available employment and price coefficients. Table XI is a list of the state's energy facilities, keyed to maps of those facilities in Figs. 11a and 11b.

*Approximately one-third of the state's utilities' generating capacity is located out-of-state.[6]

C. Colorado

Although Colorado, the most populous state in the region, consumes the most energy, the state still manages to be a net energy exporter. Colorado not only is endowed with significant mineral wealth that allows sizeable production of all of the commercial fuels (coal, oil, gas, and uranium), but also has rich deposits of oil shale in the western part of the state.

The coal industry is probably more varied in Colorado than in any other state in the region, with 41 mines operating in 1975, ranging from small to large, from underground to surface to auger, and from steam coal production to production of high-quality coking coal. Although coal resources are widely dispersed over Colorado, production is centered in the northwest quadrant of the state. The vast majority of the state's current surface mine production comes from Moffat and Routt counties in the extreme northwest portion of the state. With the exception of Colorado Fuel and Iron's captive Allen mine in the Raton Basin in the southeast (feeding

CF&I's Pueblo steel plant), all coking coal produced in the state comes from Pitkin and Gunnison counties.

Figure 12 gives the 1975 Colorado reference energy system, simplified in Fig. 13. Available employment and price coefficients are presented in Fig. 14. Table XII is a list of the state's energy facilities, keyed to Figs. 15a and 15b.

D. Idaho

Idaho is not rich in fossil fuels. Despite this, because of the abundance of hydroelectric power, Idaho consumes virtually no fossil fuels to satisfy its electricity requirement (at least in Idaho—some coal-fired generation in Wyoming serves Idaho[6]). With the exception of some heating for homes in Boise with geothermally derived hot water and some residential wood consumption, all of the state's non-electricity energy needs must be met with imported fossil fuels.

Figure 16 gives the 1975 Idaho reference energy system, simplified in Fig. 17. Available employment and price coefficients are presented in Fig. 18. Table XIII is a list of the state's energy facilities, keyed to Figs. 19a and 19b.

E. Montana

Montana is an energy-rich state, particularly with regard to coal resources. Although coal is found in a number of areas within the state, there are two primary coal areas. The northern Powder River Basin, located in eastern Montana, is rich in sub-bituminous coal. Further east and to the north are extensive but lower quality coal deposits. These lignite deposits are currently being viewed with some interest by energy companies. And because it is not generally economical to transport lignite over long distances, the resource will probably be useful only for on-site electricity generation or synthetic fuel production. Currently, most coal production is in the Powder River area where the largest strip coal mine in the US, the Decker mine, is located. Further north, the Colstrip Power Plant burns coal at the mouth of Western Energy's Rosebud mine.

Natural gas and oil (but not uranium) are also produced in sizeable quantities in Montana, although the state must still rely heavily on imports of gas, primarily from Canada.* Because of the nature of the gas supply, the state is particularly vulnerable to gas price increases and supply uncertainties. There is, in fact, current talk of a state-built, state-owned coal gasification plant to relieve the reliance on Canadian gas.

Figure 20 gives the 1975 Montana reference energy system, simplified in Fig. 21. Available employment and price coefficients are presented in Fig. 22. Table XIV is a list of the state's energy facilities, keyed to Figs. 23a and 23b.

F. Nevada

Nevada, like Idaho, is not energy-rich, although the state has uranium resources. Population is concentrated in the Las Vegas area and the Reno-Carson City area. In terms of energy supply, Las Vegas is characterized by two large generation facilities, the Mohave power plant fed by the coal slurry line from the Black Mesa mine on Navajo/Hopi land, and the generators associated with Hoover Dam on Lake Mead.

Mineral production in Nevada has been and is a major industry. Energy fuel production, however, has been confined to a small oil field in the eastern part of the state, the Eagle Springs field. The state does have geothermal potential, as yet untapped.

Figure 24 gives the 1975 Nevada reference energy system, simplified in Fig. 25. Available employment and price coefficients are presented in Fig. 26. Table XV is a list of the state's energy facilities, keyed to Figs. 27a and 27b.

G. New Mexico

New Mexico is the largest producer of energy in the region. The state is a significant producer of all energy forms (coal, uranium, oil, and gas). Geothermal energy as well shows potential, with two exploration projects underway in the Jemez volcanic complex in northern New Mexico.

Gas and oil production has been centered in the southeast and northwest corners of the state, the southeast Permian Basin being the richest. Uranium

*One reason for this is that major gas reserves in the state are contractually committed to out-of-state users.

production is centered in the Grants area of the west-central part of the state. That area is currently undergoing a tremendous boom from increased uranium exploration and production spurred by increased uranium demand. Also in that part of the state and to the north, there is considerable interest in coal development. Although coal reserves are small compared to those in Wyoming and Montana, the proximity of the area to the southern Arizona-California consuming region has resulted in considerable production in the recent past and possibly promises much greater production in the future. The Four Corners power plant, owned primarily by out-of-state utilities, has been operating in the area for over a decade.[7] The Western Gasification Company has been negotiating with the Navajo Tribe to build a coal gasification complex to produce an average of 1 000 000 cubic feet of synthetic natural gas per day for consumption in California and Oklahoma. El Paso Natural Gas and Consolidation Coal have recently been granted large coal leases (actually renegotiated old leases) by the Navajo Tribe that may also lead to coal gasification.

Figure 28 gives the 1975 New Mexico reference energy system, simplified in Fig. 29. Available employment and price coefficients are presented in Fig. 30. Table XVI is a list of the state's energy facilities, keyed to Figs. 31a and 31b.

H. Utah

Although not as well endowed with energy resources as New Mexico or Wyoming, Utah does produce significant quantities of all the energy resources we have been discussing. In terms of coal, Utah occupies a unique position in the region. There are two basic coal regions in the state, the Uinta Basin in the central part of the state, and the southern Utah fields that have sparked considerable interest recently. Despite the inaccessibility of these southern fields, they are close to the southern California energy market and have until recently been considered for mine-mouth power generation and are now being considered for coal gasification. All current state coal production is in the central Utah fields, and all mining is underground, which results in high FOB-mine prices for the coal. But because the coal has a fairly high heat content as well as a low sulfur content, it is nevertheless very attractive to midwest and eastern utilities. Because transportation costs constitute the major part of western coal prices delivered in the midwest, it is well worth midwest utilities' paying more at the mine for high-quality coal.

Figure 32 gives the 1975 Utah reference energy system, simplified in Fig. 33. Available employment and price coefficients are presented in Fig. 34. Table XVII is a list of the state's energy facilities, keyed to Figs. 35a and 35b.

I. Wyoming

Wyoming is the second largest state producer of energy in the region. Considering the small population of the state, energy production in Wyoming probably is of more importance, on a per capita basis, than in any other state of the region. In terms of current and near-term projected production, there are three main coal resource areas in Wyoming: the Powder River Basin in the east (by far the most important), the Hanna Basin, and the Green River Region.[8]

The Powder River Basin of eastern Wyoming has recently been suffering severe boom problems as coal production has skyrocketed in a traditionally rural, low-population-density area. Mine-mouth power plants owned by Utah, Idaho, and west coast utilities have begun to multiply. The vast coal resources of the state would indicate that the boom is by no means over. In fact, on the basis of already announced coal contracts, production is projected to more than quadruple in the next five years.[8] Although almost all of the coal currently mined is used for electricity production (mostly in the midwest), there is one small coking oven associated with Mid-Continent Coke and Coal's Rainbow #8 mine near Rock Springs.

Oil production is spread over much of the state, with Campbell and Park counties being the two largest producers. Although oil is often associated with natural gas, Campbell, Fremont, Sublette, and Sweetwater counties produce by far the bulk of the state's gas. Converse and Fremont counties are the major uranium producers in the state.[9]

Figure 36 gives the 1975 Wyoming reference energy system, simplified in Fig. 37. Available employment and price coefficients are presented in

Fig. 38. Table XVIII is a list of the state's energy facilities, keyed to Figs. 39a and 39b.

ACKNOWLEDGMENTS

The author wishes to thank the American Petroleum Institute (API) for permission to use its pipeline maps in this report. Because the API's maps have been redrafted for inclusion here, we accept full responsibility for any errors which may have occurred in the redrafting.

The author wishes to express his appreciation for the invaluable assistance of several individuals: C. M. Schneider and A. J. Martinez for assistance in condensing the large quantities of data necessary for this report; R. B. Kidman and D. R. Koenig for providing the computer-generated state and regional energy flow diagrams; R. Palmer for considerable assistance in determining the fossil fuel equivalent of U_3O_8 (appendix A); J. M. Dye and C. D. Markham for typing drafts of the report; and W. S. Bennett for critical review of the final draft. Lastly, the patient assistance of the LASL Illustrations Group has been appreciated.

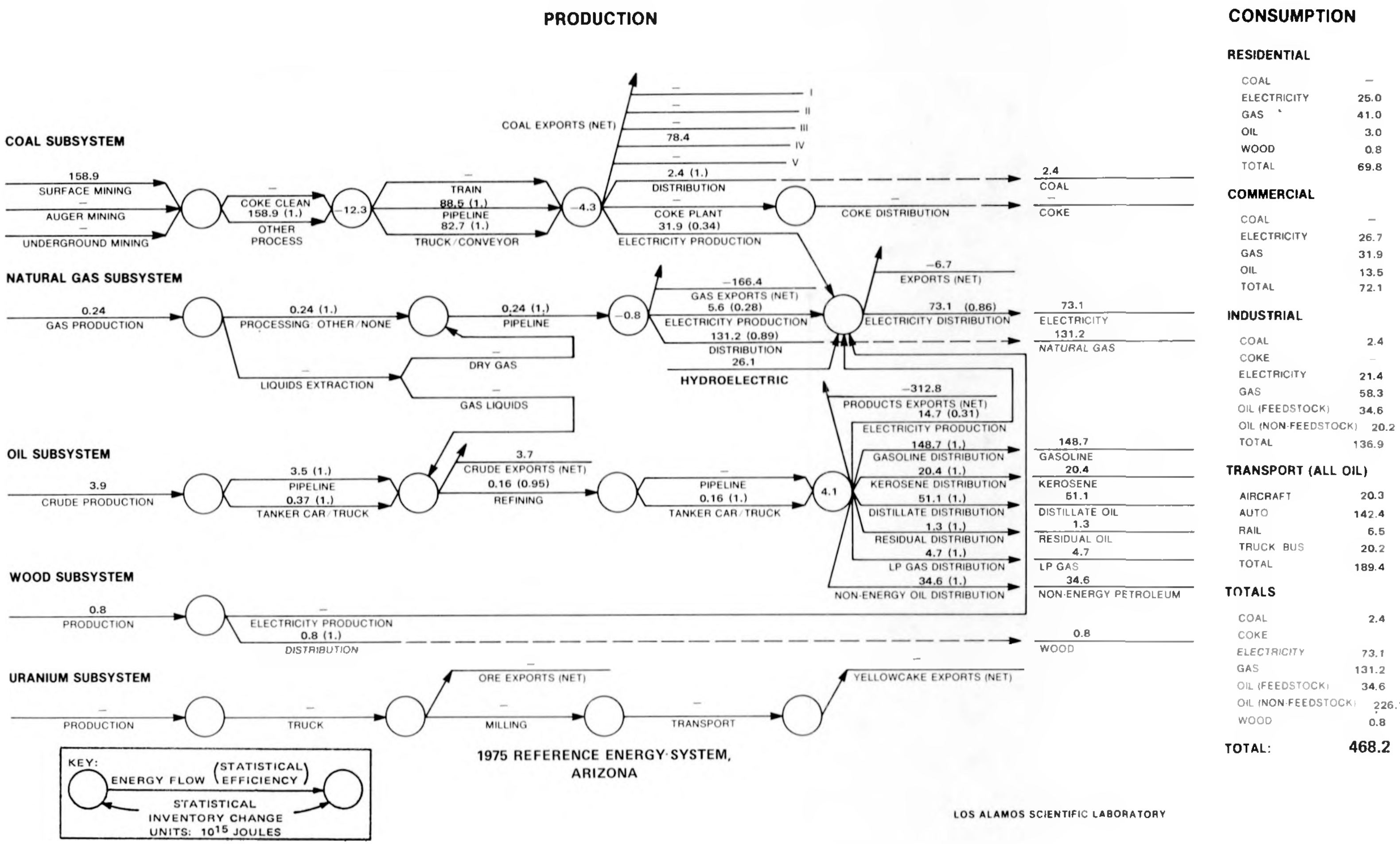

Fig. 8.
1975 reference energy system, Arizona.

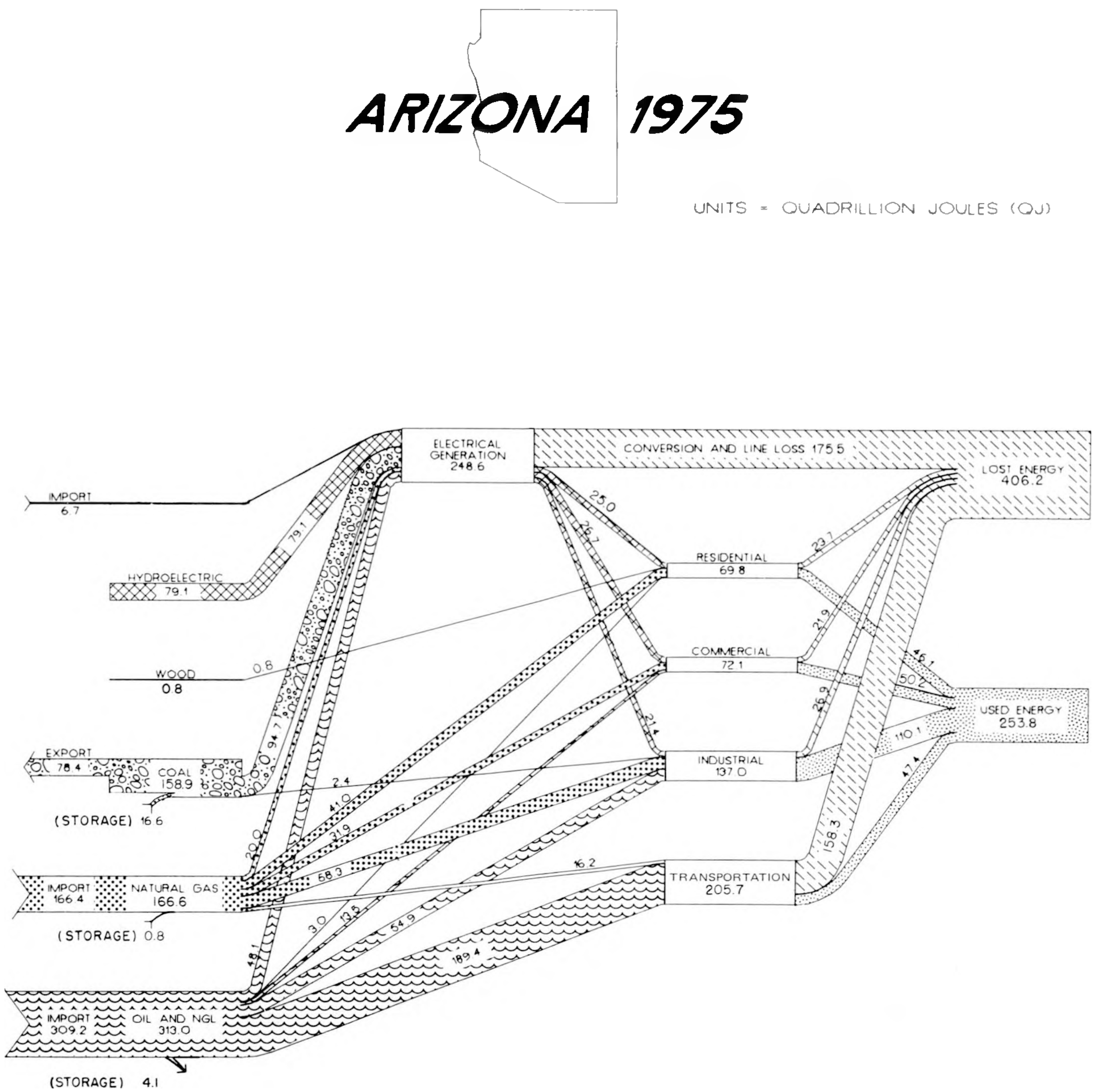

Fig. 9.
1975 energy flows, Arizona.

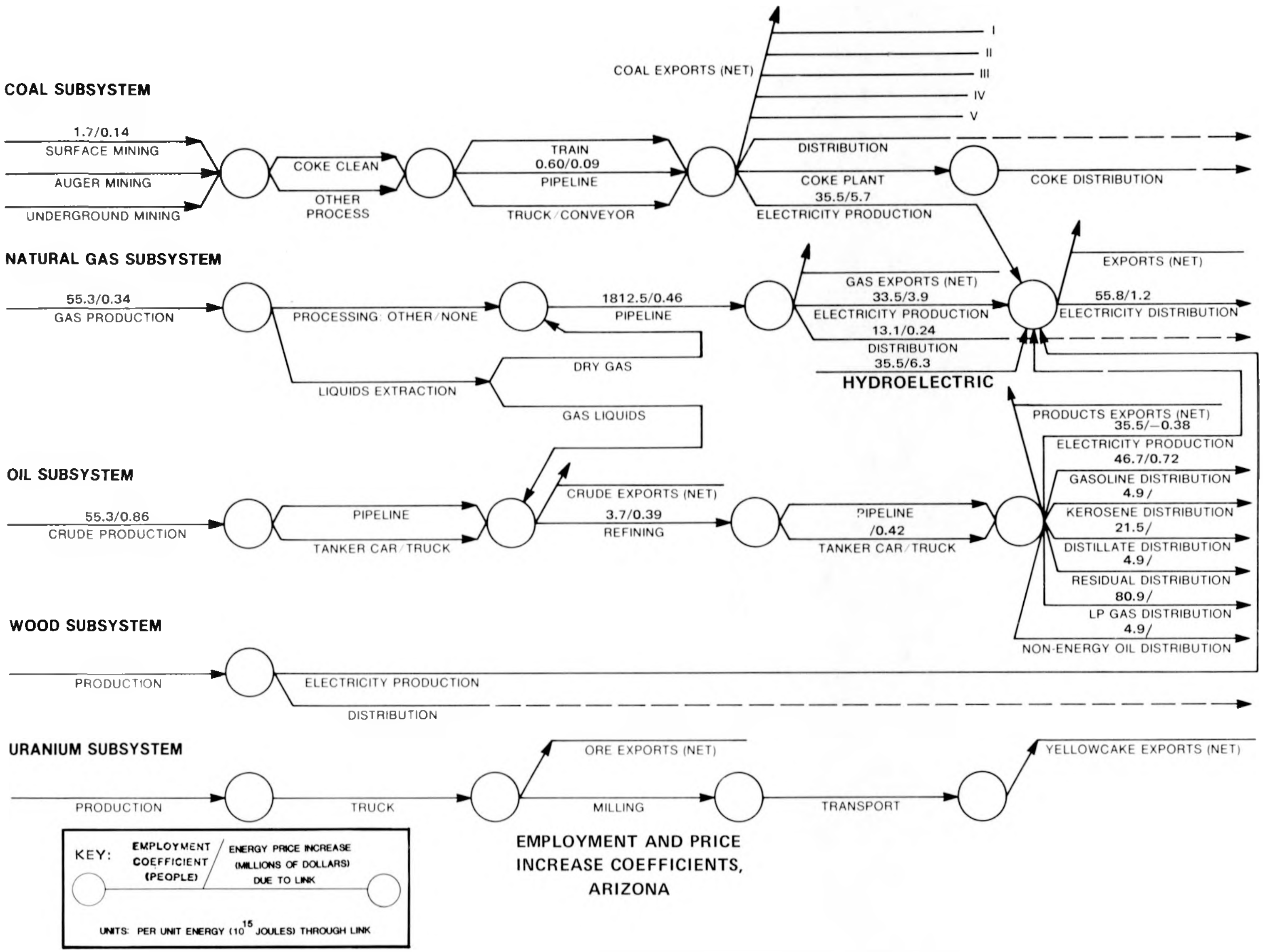

Fig. 10.
Employment and price increase coefficients, Arizona.

TABLE XI

ARIZONA ENERGY FACILITIES
(Keyed to Fig. 11)[a]

Electricity Generation (Capacity in MW)

Fuel:	Hydroelectric:[c]
1. Navajo (2409.0)	1. Davis (225.0)
2. Cholla (113.6)	2. Hoover (1 340.0–also in Nevada)
3. Snowflake (27.2)	3. Glen Canyon (950.0)
4. Agua Fria (594.5)	4. Parker (120.0)
5. Ocotillo (333.6)	5. Roosevelt (31.3)
6. Phoenix (468.3)	6. Horse Mesa (34.2)
7. Kyrene (334.9)	7. Mormon Flat (9.2)
8. Santan[b] (288.0)	
9. Inspiration (25.5)	
10. Morenci Branch (75.0)	
11. Saguaro (356.3)	
12. North Loop station[b] (108.0)	
13. DeMoss-Petrie (170.0)	
14. Irvington (585.5)	
15. Apache (105.0)	
16. New Cornelia (33.3)	
17. Yucca (179.6)	
18. Yuma Axis (75.0)	

Coal Mines (S = Strip)

1. Kayenta - S
2. Black Mesa - S

Oil Refineries (Capacity in bbl/cd)

1. Arizona Fuels Corp. (4000)

Gas Processing Plants (Capacity in mcf/day)

Company	Plant Name	County
Kerr-McGee	Navajo Plant (Helium; 2500)	Apache

---

[a]Sources for Fig. 11 and Table XI: FPC,[17,18] API,[19,20] BOM,[21] Western Oil Reporter,[22] Oil and Gas Journal.[23]

[b]Partly under construction.

[c]For hydroelectric installations located on a river boundary between two states, the hydro-capacity is considered to be on the generator side of the river.

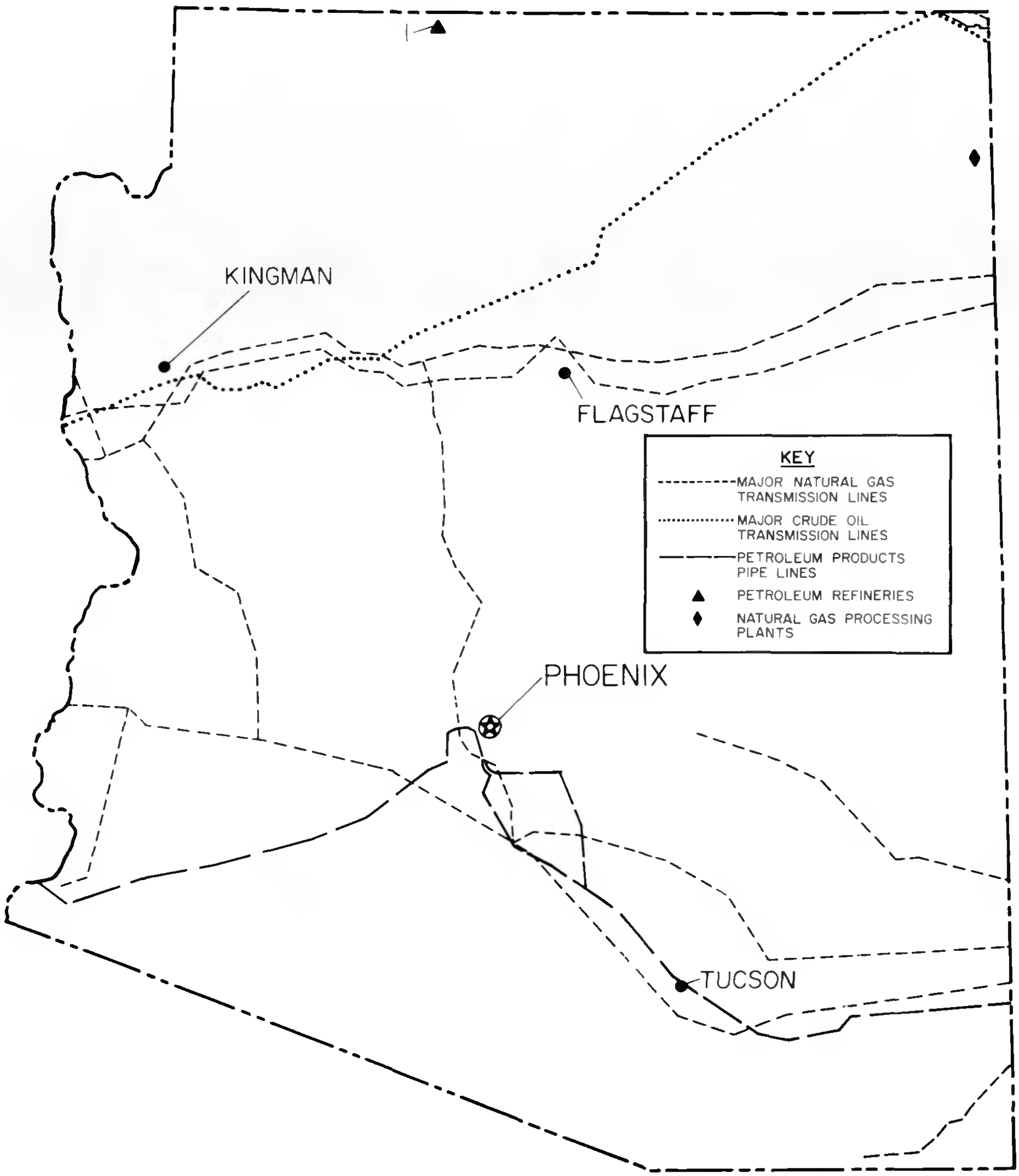

Fig. 11a.
Principal energy facilities of Arizona.

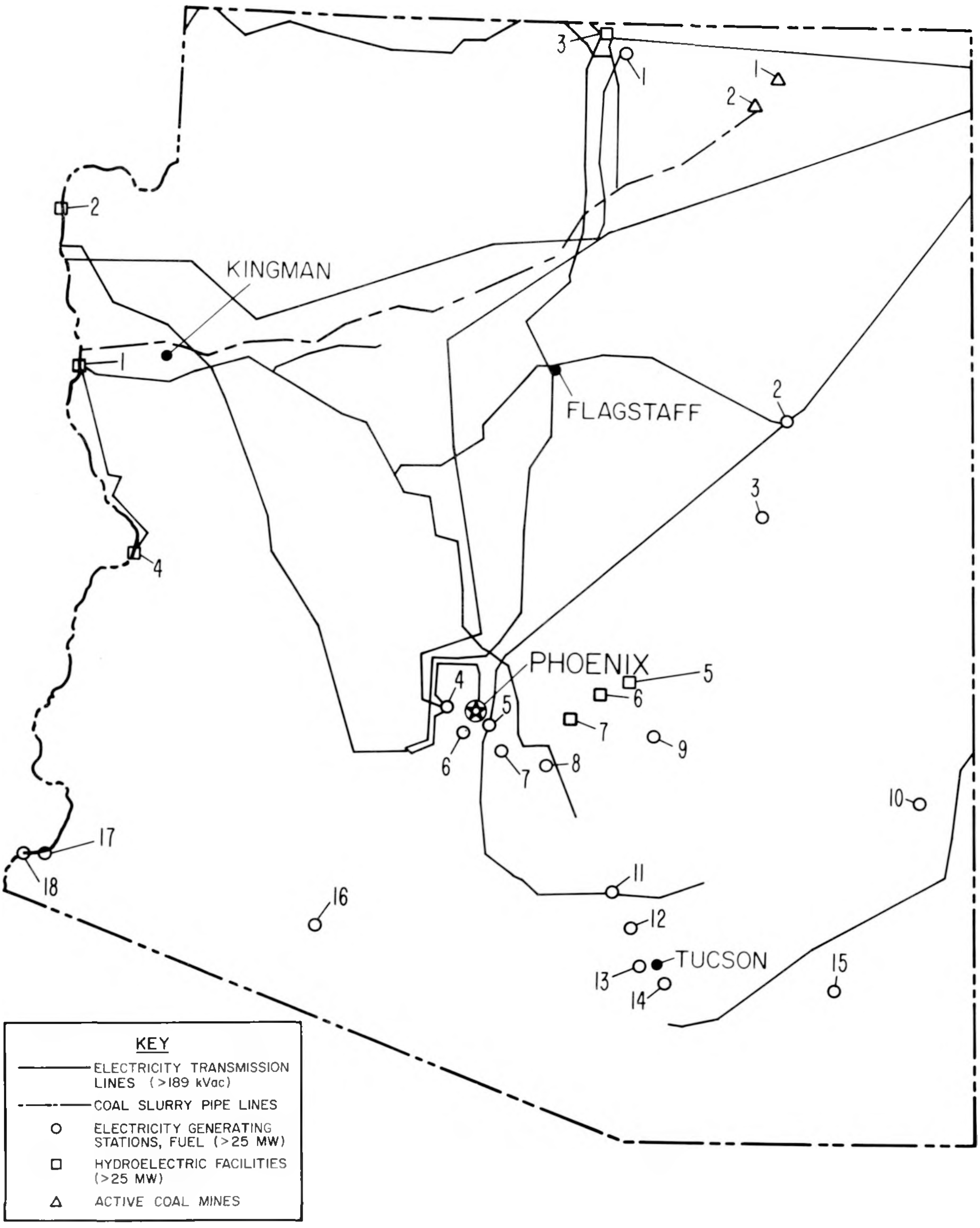

Fig. 11b.
Principal energy facilities of Arizona.

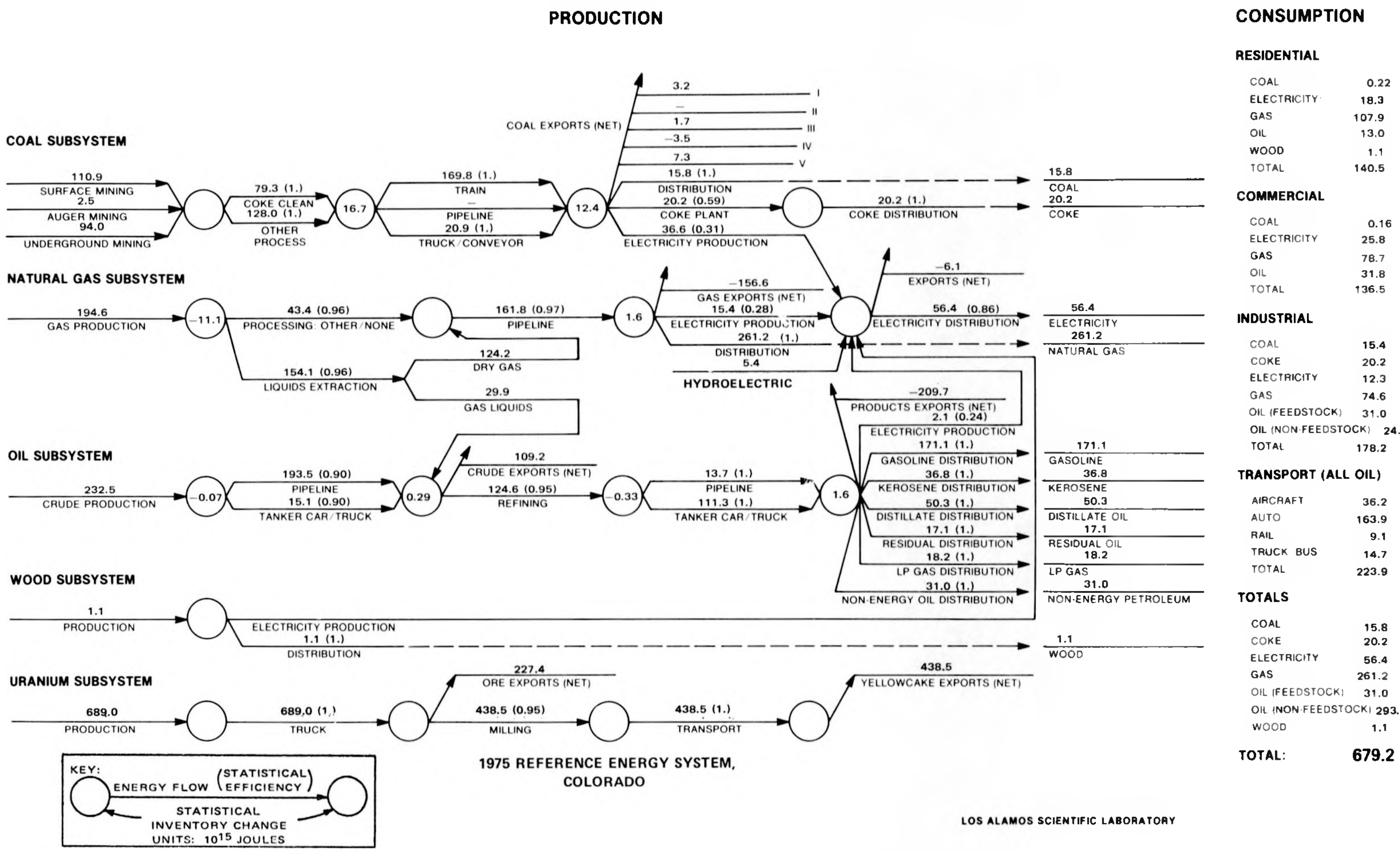

Fig. 12.
1975 reference energy system, Colorado.

COLORADO 1975

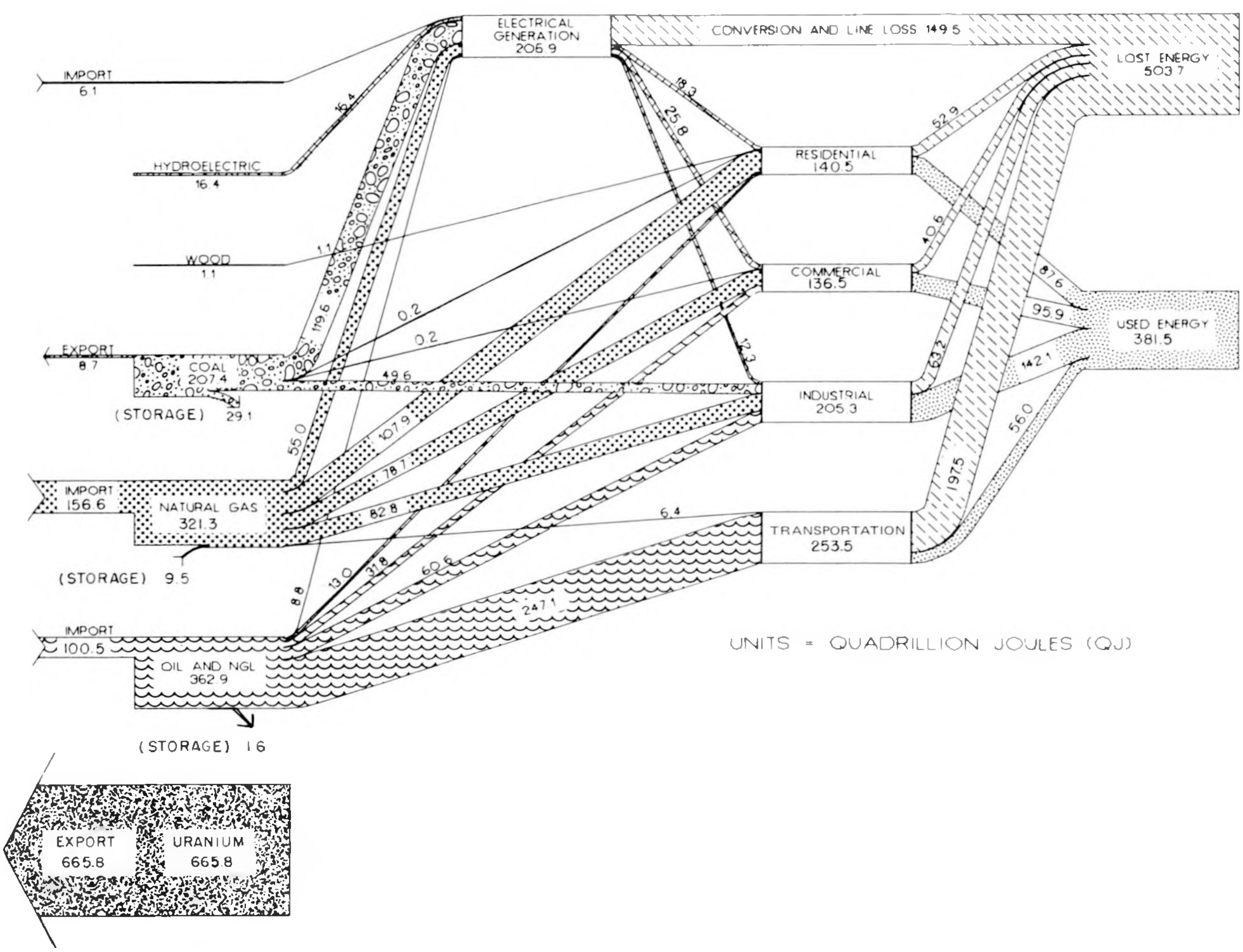

Fig. 13.
1975 energy flows, Colorado.

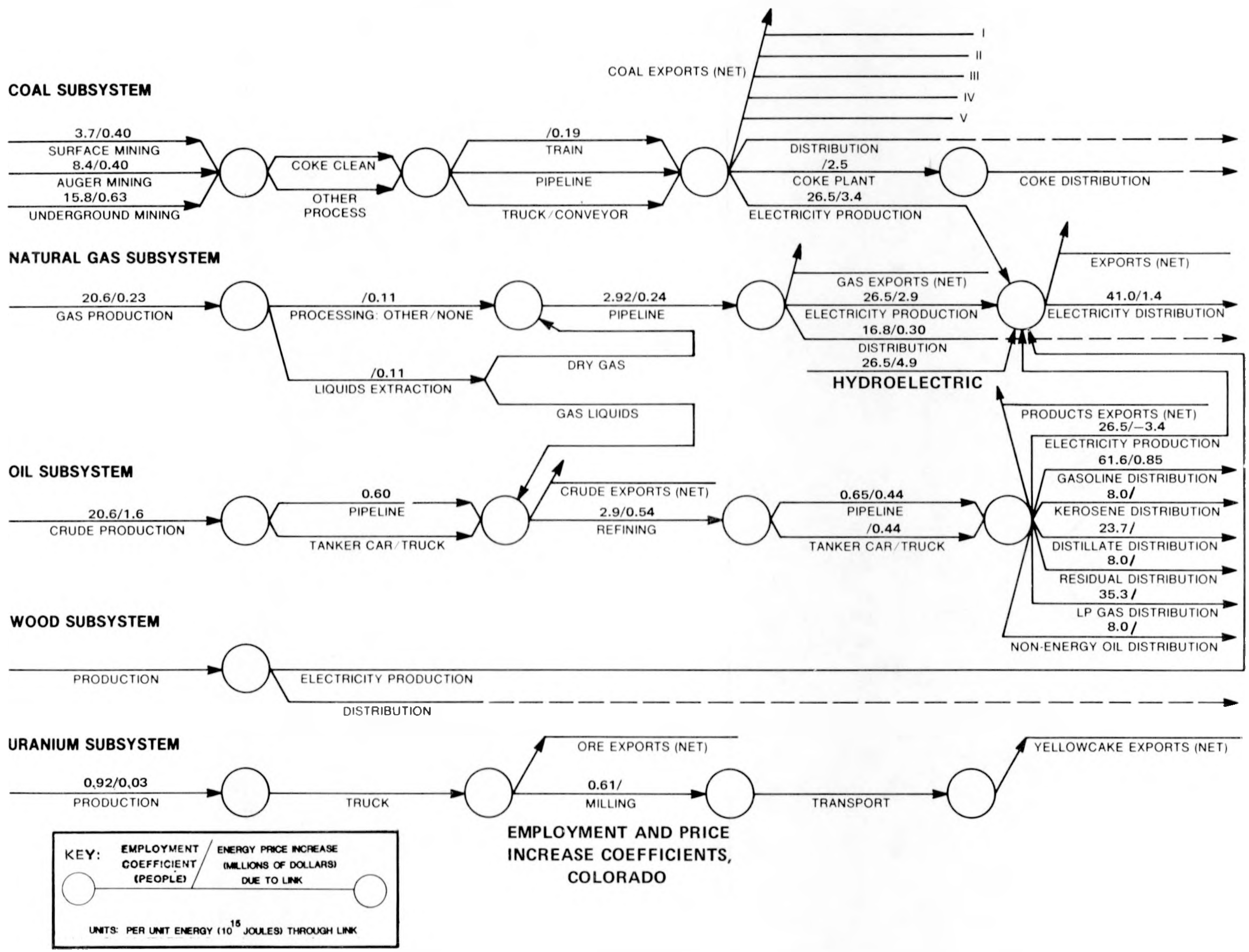

Fig. 14.
Employment and price increase coefficients, Colorado.

TABLE XII

COLORADO ENERGY FACILITIES
(Keyed to Fig. 15)[a]

Electricity Generation (Capacity in MW)

Fuel:	Hydroelectric:
1. Hayden (413.2)	1. Flatiron (71.5)
2. Cameo (75.0)	2. Pole Hill (33.3)
3. Fruita (28.8)	3. Estes (45.0)
4. Nucla Springs (34.5)	4. Morrow Point (120.0)
5. Fort Lupton (100.8)	5. Blue Mesa (60.0)
6. Zuni (115.3)	6. Cabin Creek (300.0)
7. Cherokee (806.8)	
8. Arapahoe (250.5)	
9. George Bridsell (62.5)	
10. Martin Drake (277.0)	
11. W. N. Clark (43.8)	
12. Pueblo (42.3)	
13. Minnequa (48.8)	
14. Lamar (36.7)	
15. Alamosa (48.3)	
16. Commanche (732.5)	
17. Valmont (346.8)	

Coal Mines (U = Underground, S = Strip, A = Auger)

1. Wise Hill #5 - U
2. Grizzly Creek - S
3. Canadian Strip - S
4. Seneca #2 - S
5. Williams Fork #1 - S
6. Denton - S
7. Apex #2 - U
8. Marr #1 - S
9. Rienau #2 - U
10. Energy #1 - S
11. Energy #2 - S
12. Energy #3 - S
13. Edna - S
14. CMC Mine - U
15. Four Mile - U
16. Thompson Creek #1 - U
17. Thompson Creek #3 - U
18. Coal Basin - U
19. L. S. Wood - U
20. Dutch Creek #1 - U
21. Dutch Creek #2 - U
22. Bear Creek - U
23. Nucla - U
24. Coalby #2 - U
25. Converse - U
26. King - U
27. Peacock - U
28. Allen - U
29. Jewel Strip - S
30. Cedar Canyon - U
31. Golden Quality #5 - U
32. Twin Pines - U
33. Corley S&A - S,A
34. O C Mine #2 - U
35. Eagle - U
36. Somerset - U
37. Sylvester Gulch - U
38. Bear - U
39. Hawk's Nest #3 - U
40. Eastside - U
41. Nu-Gap #3 - U

Oil Refineries (Capacity in bbl/cd)

1. Continental Oil Co. (30 000)
2. Refinery Corp. (21 500)
3. Asamera Oil Co. (12 000)
4. Gary Western Co. (5 400)

Gas Processing Plants (Capacity in mcf per day)

Company	Plant Name	County
Amoco Prod.	Peoria (16 000)	Arapahoe
	Spindle (16 000)	Weld
	Third Creek (8 000)	Adams
	Wattenburg (150 000)	Adams
	Watkins (150 000)	Arapahoe
Charter Gas Resources	Roggen (20 000)	Weld
Chevron Oil	Hagood (10 000)	Rio Blanco
Continental Oil	Fruita (20 000)	Mesa
Ecological Eng. Systems	Cabin Creek (1 500)	Adams
Excelsior Oil	Yenter (10 000)	Logan
Fleetwood Drilling	McClave (7 500)	Kiowa
Ginther Gas	Lowry (5 500)	Arapahoe
Industrial Gas Services	Latigo (6 000)	Arapahoe
KS-NB Natural Gas	Yenter (10 000)	Logan
Lamar Utilities	Barrel Springs (10 000)	Prowers
Koch Oil	Third Creek (30 000)	Adams
Chadbourne Corp.	Piceance Creek (40 000)	Rio Blanco
Northwest Pipeline	Ignacio (300 000)	La Plata
Rocky Mtn. Natural Gas	Piceance (15 000)	Rio Blanco
Sun Oil	Denver Central (12 000)	Arapahoe
	Dragon Trail (18 000)	Rio Blanco
	Dragoon (b)	Arapahoe
Texaco	Wilson Creek (10 500)	Rio Blanco
Union Oil	Adena (28 000)	Morgan
Valley Corp.	Ft. Morgan (3 000)	Morgan
Halliburton Resource Mgmt.	Bennett Plant (800)	Adams
	Irondale (15 130)	Adams
	Roundup (6 000)	Morgan
	Brighton (12 000)	Weld
	Irondale Cryogenics (10 000)	Adams
	Space City (2 200)	Weld
	West Douglas Creek (15 000)	Rio Blanco
	Baxter (8 000)	Garfield
Phillips Petroleum	Tampa (10 000)	Weld
Production Operators	Wattenburg (14 000)	Adams

[a]Sources for Fig. 15 and Table XII: FPC,[17,18] API,[19,20] Jones,[24–26] and Western Oil Reporter.[22]
[b]Not available.

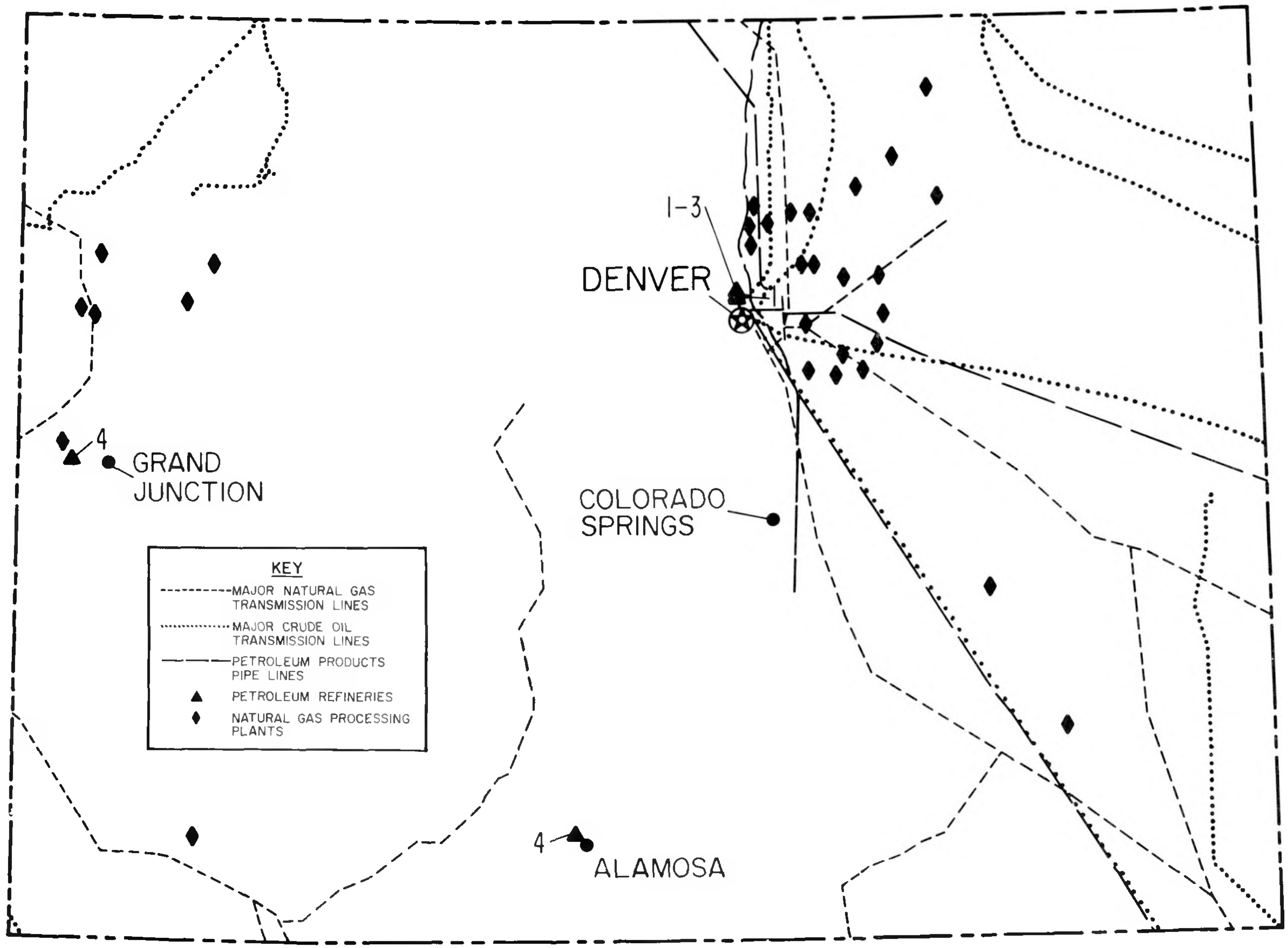

Fig. 15a.
Principal energy facilities of Colorado.

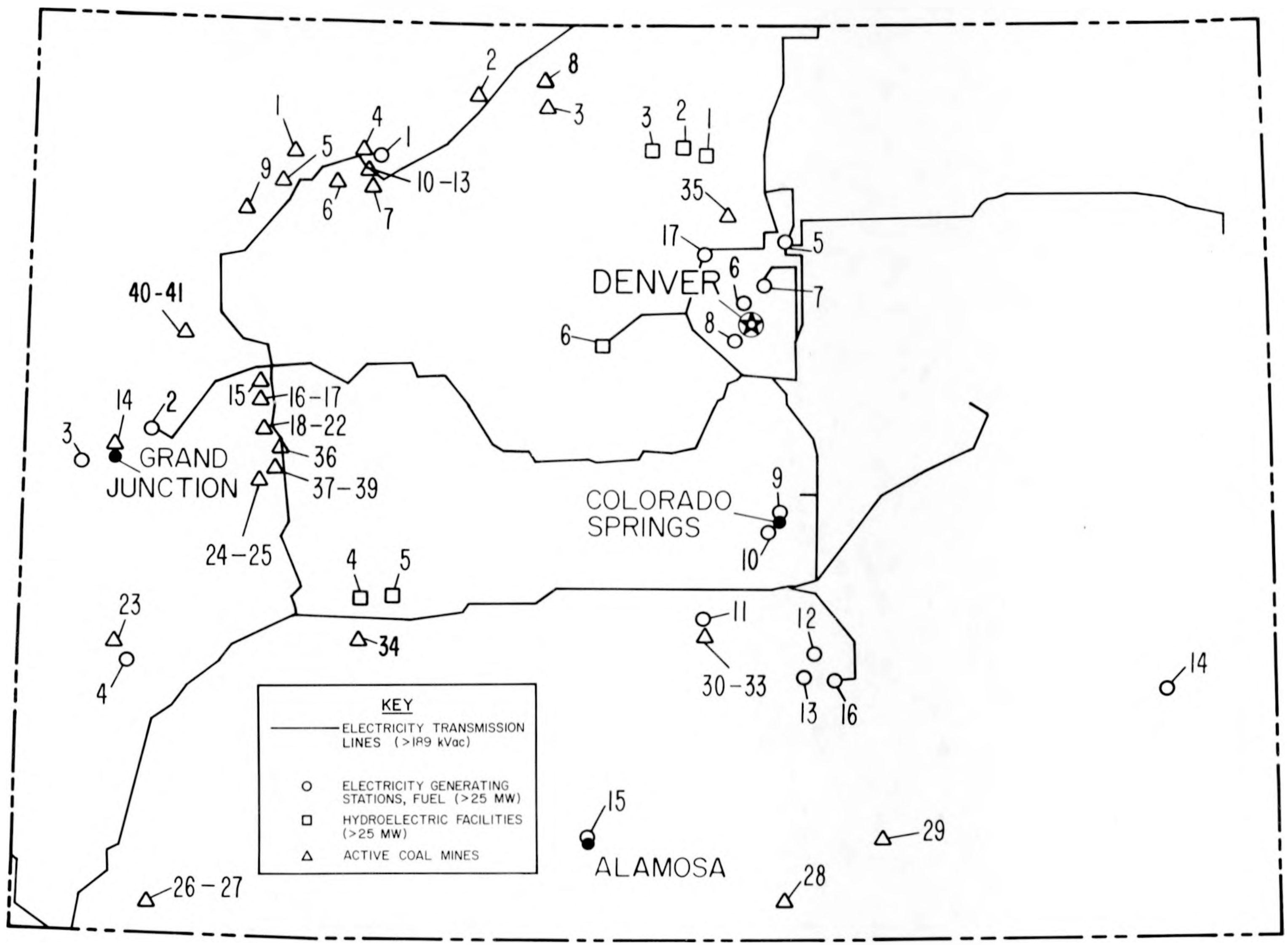

Fig. 15b.
Principal energy facilities of Colorado.

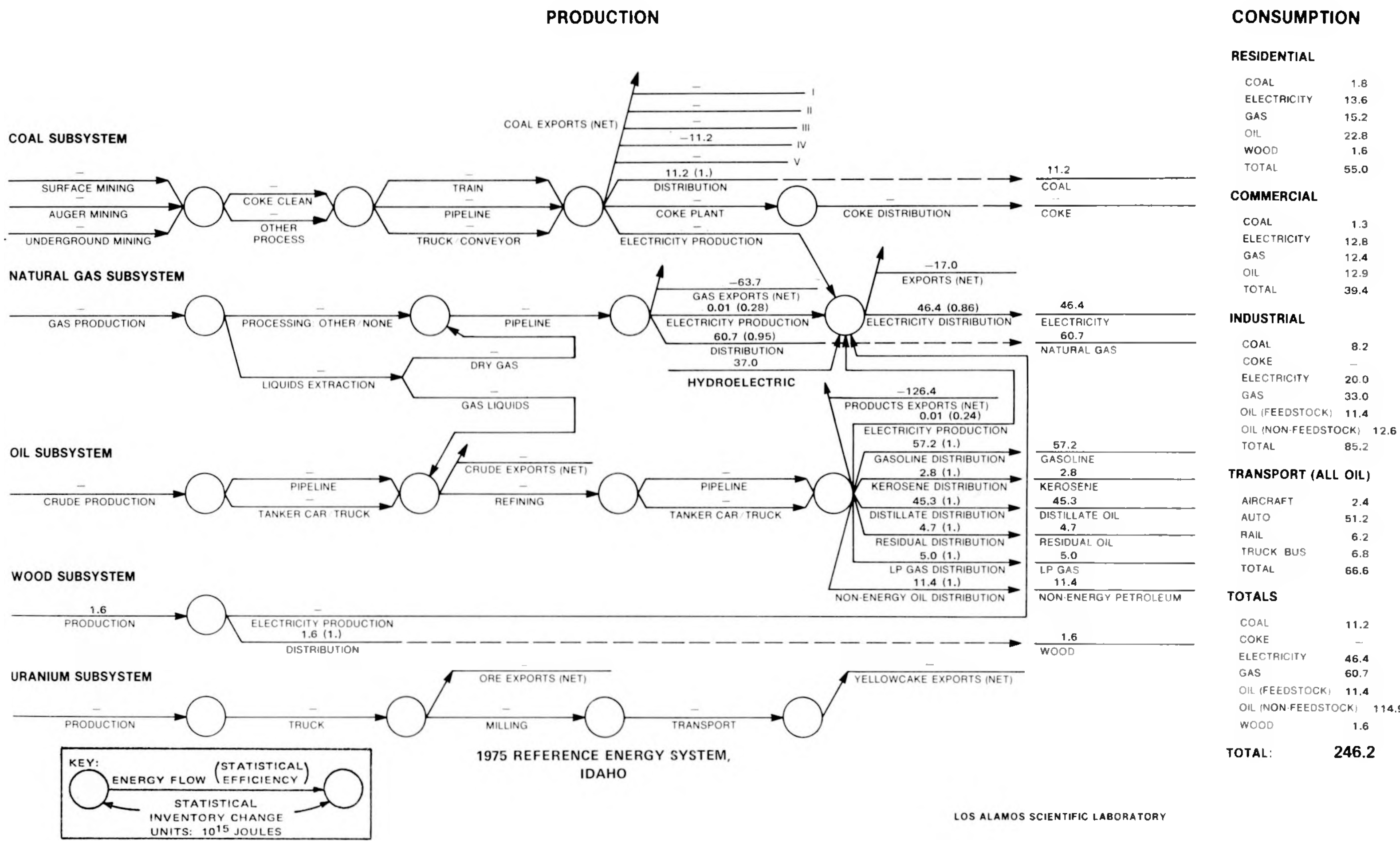

Fig. 16.
1975 reference energy system, Idaho.

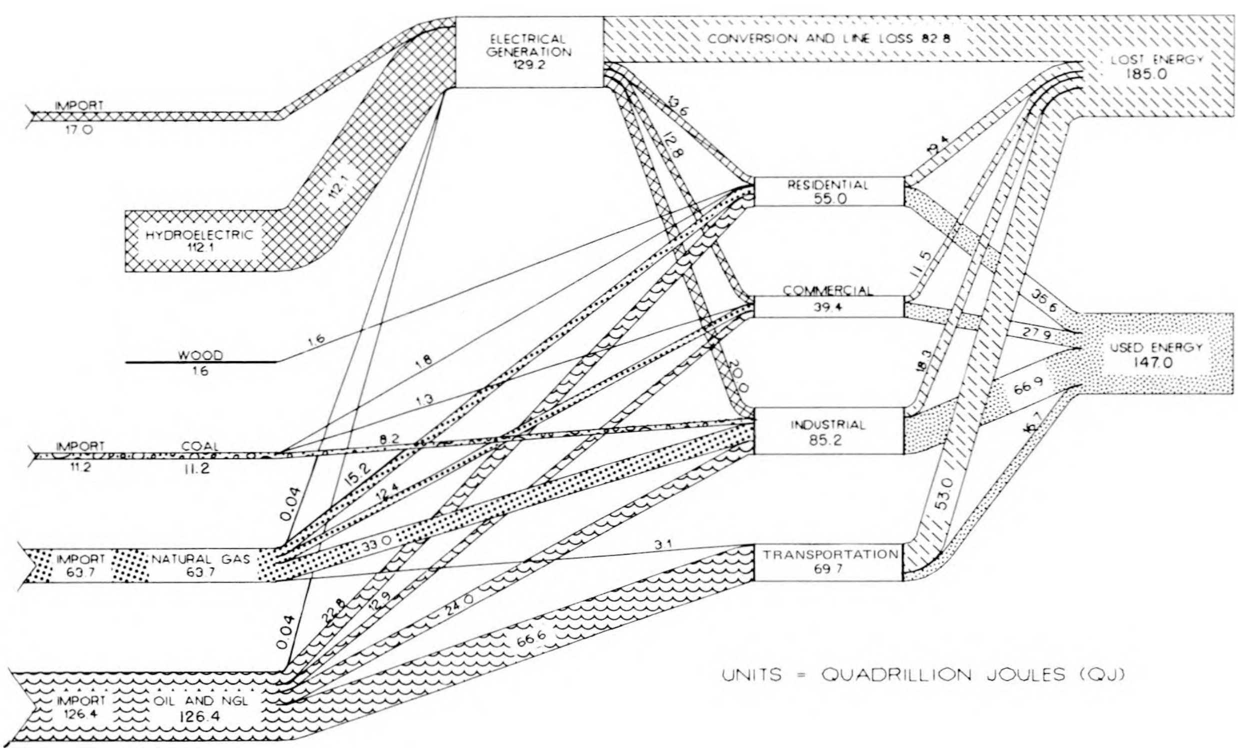

Fig. 17.
1975 energy flows, Idaho.

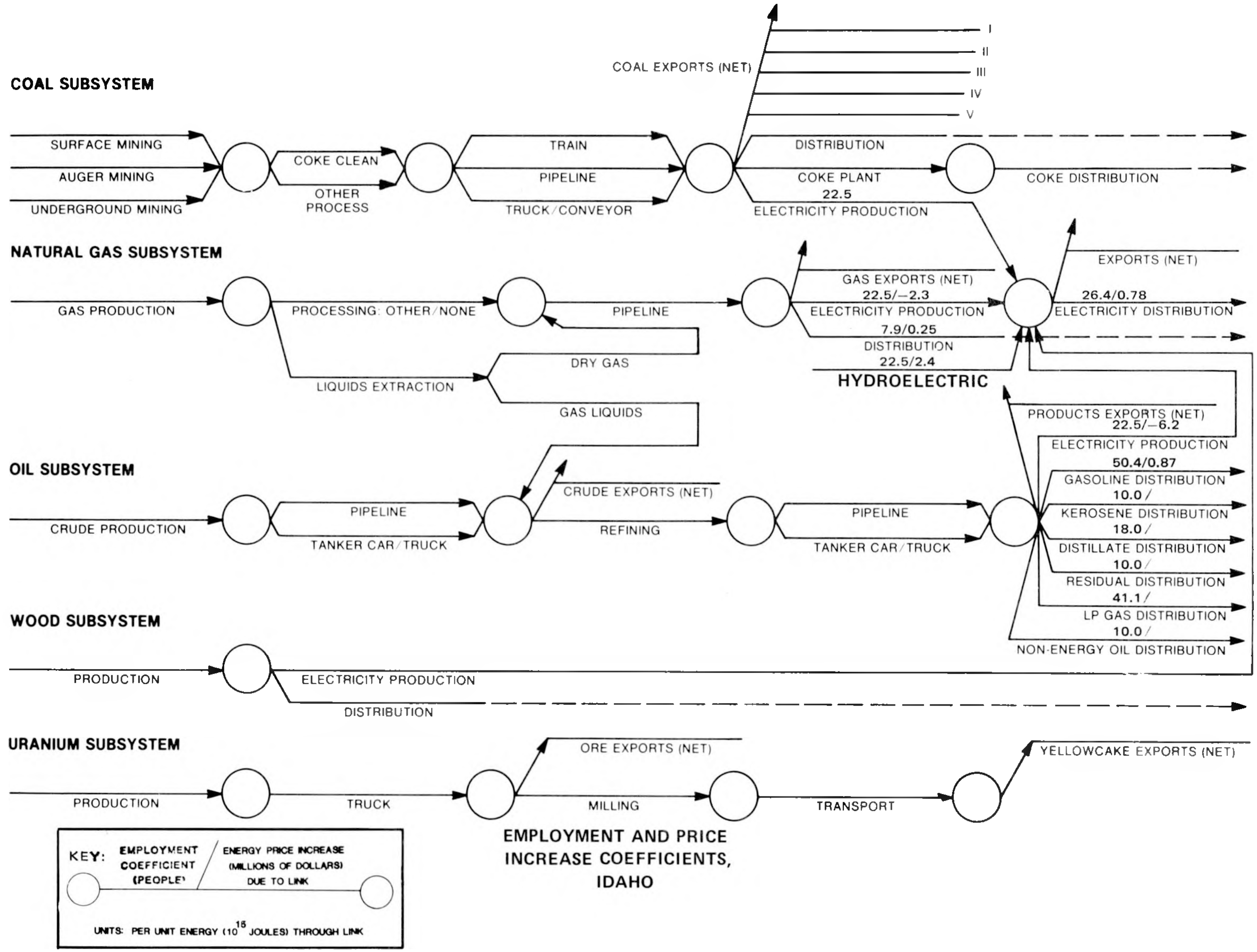

Fig. 18.
Employment and price increase coefficients, Idaho.

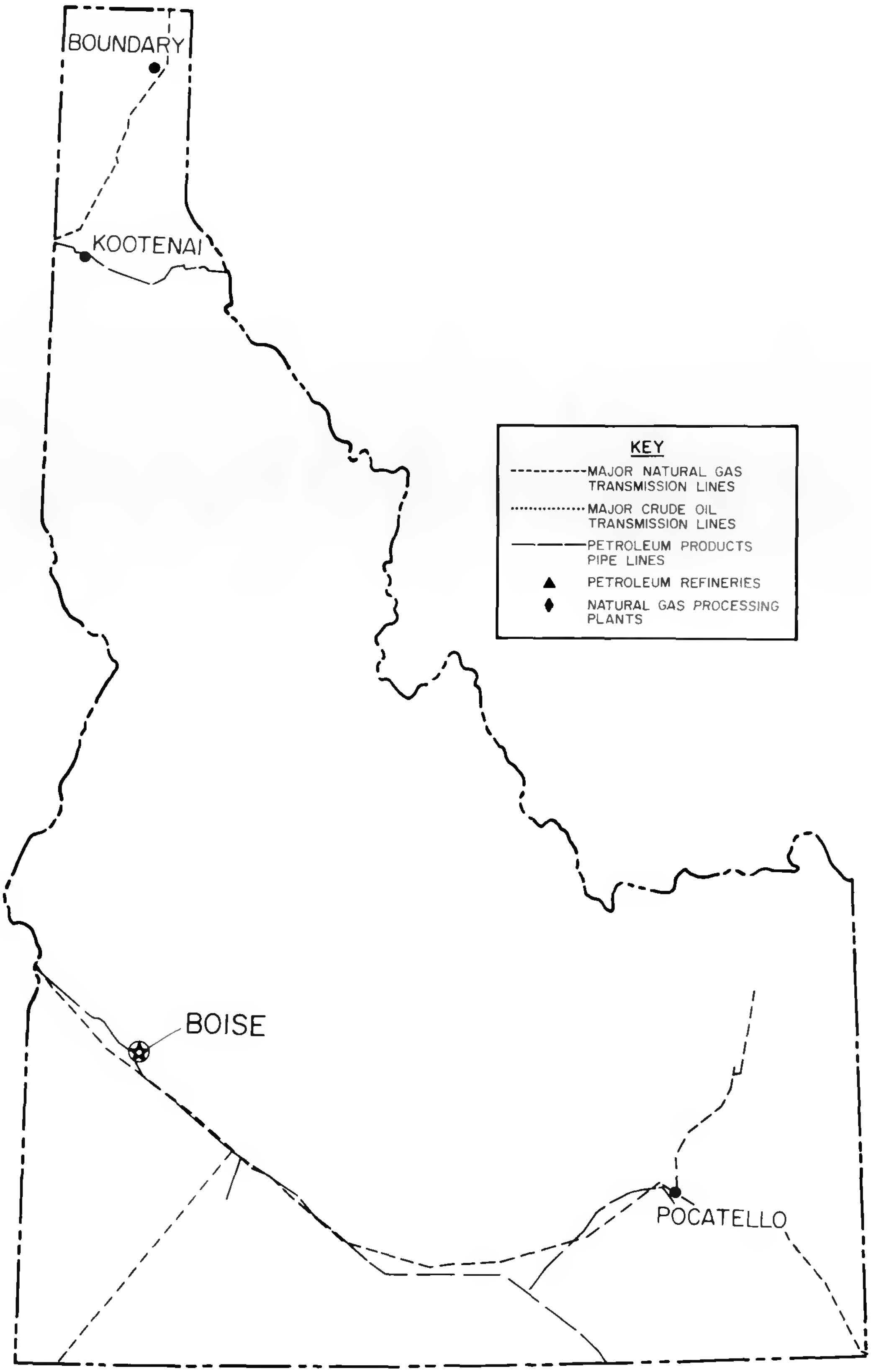

Fig. 19a.
Principal energy facilities of Idaho.

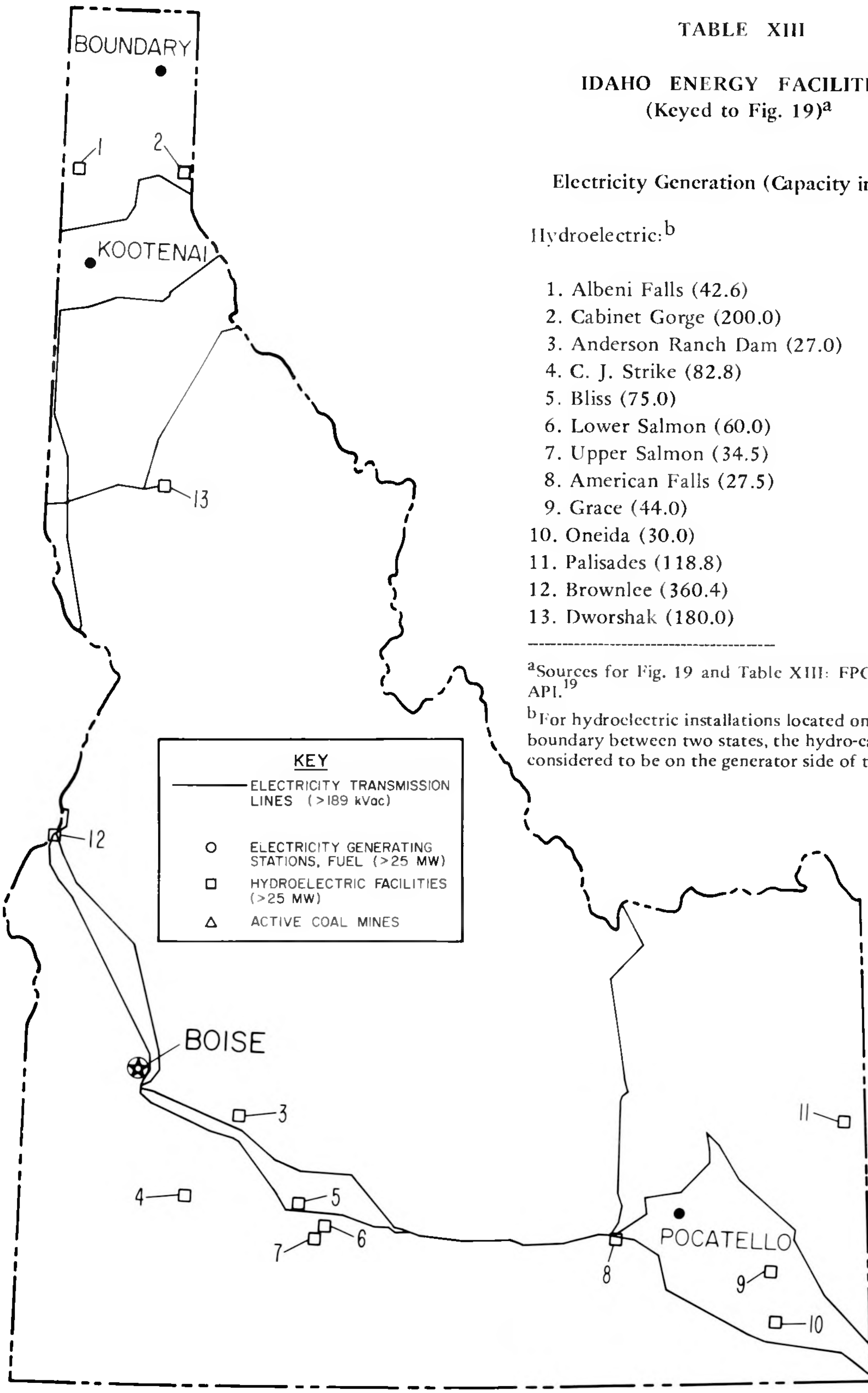

Fig. 19b.
Principal energy facilities of Idaho.

TABLE XIII

IDAHO ENERGY FACILITIES
(Keyed to Fig. 19)[a]

Electricity Generation (Capacity in MW)

Hydroelectric:[b]

1. Albeni Falls (42.6)
2. Cabinet Gorge (200.0)
3. Anderson Ranch Dam (27.0)
4. C. J. Strike (82.8)
5. Bliss (75.0)
6. Lower Salmon (60.0)
7. Upper Salmon (34.5)
8. American Falls (27.5)
9. Grace (44.0)
10. Oneida (30.0)
11. Palisades (118.8)
12. Brownlee (360.4)
13. Dworshak (180.0)

---

[a]Sources for Fig. 19 and Table XIII: FPC [18,27] and API.[19]

[b]For hydroelectric installations located on a river boundary between two states, the hydro-capacity is considered to be on the generator side of the river.

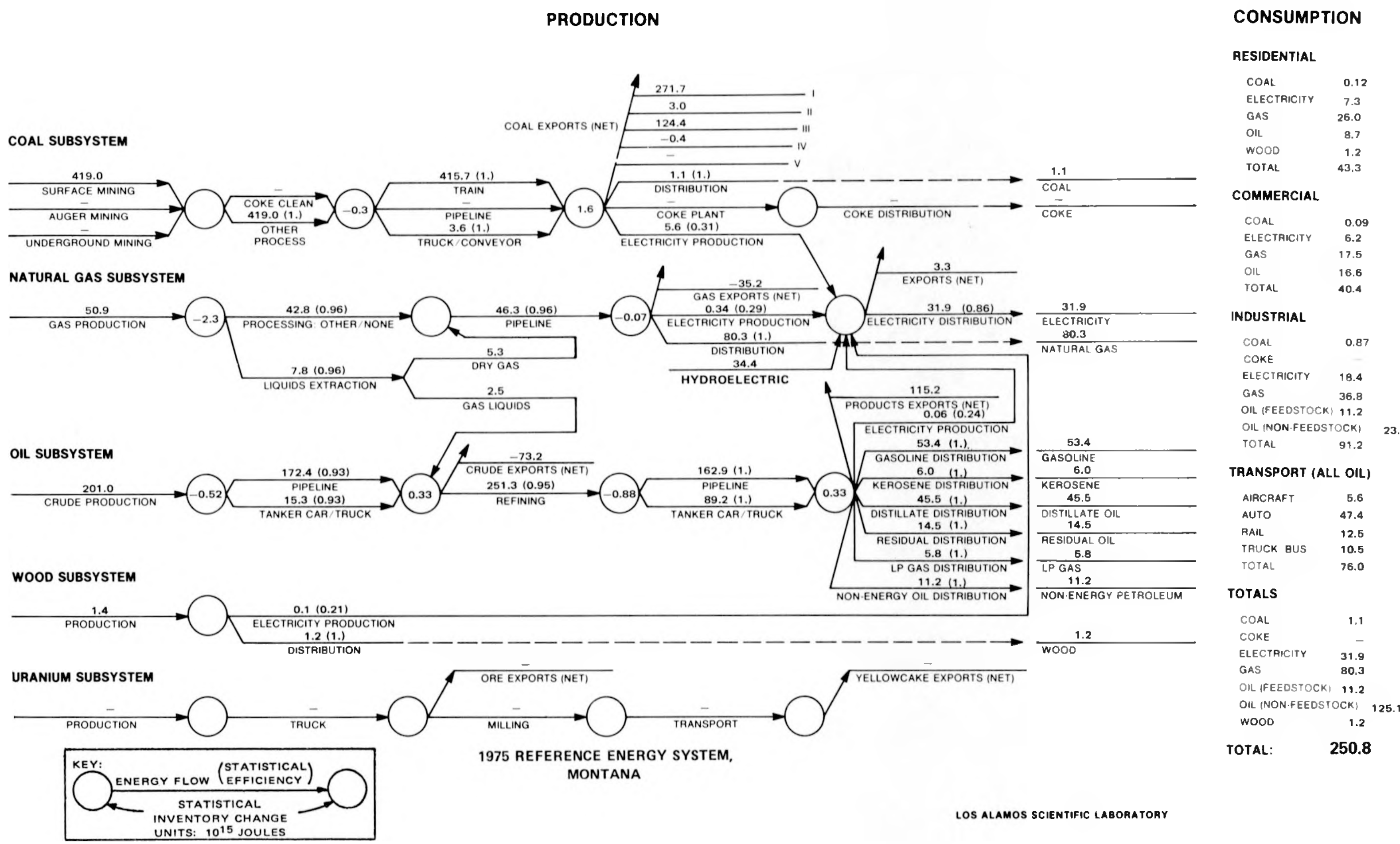

Fig. 20.
1975 reference energy system, Montana.

MONTANA 1975

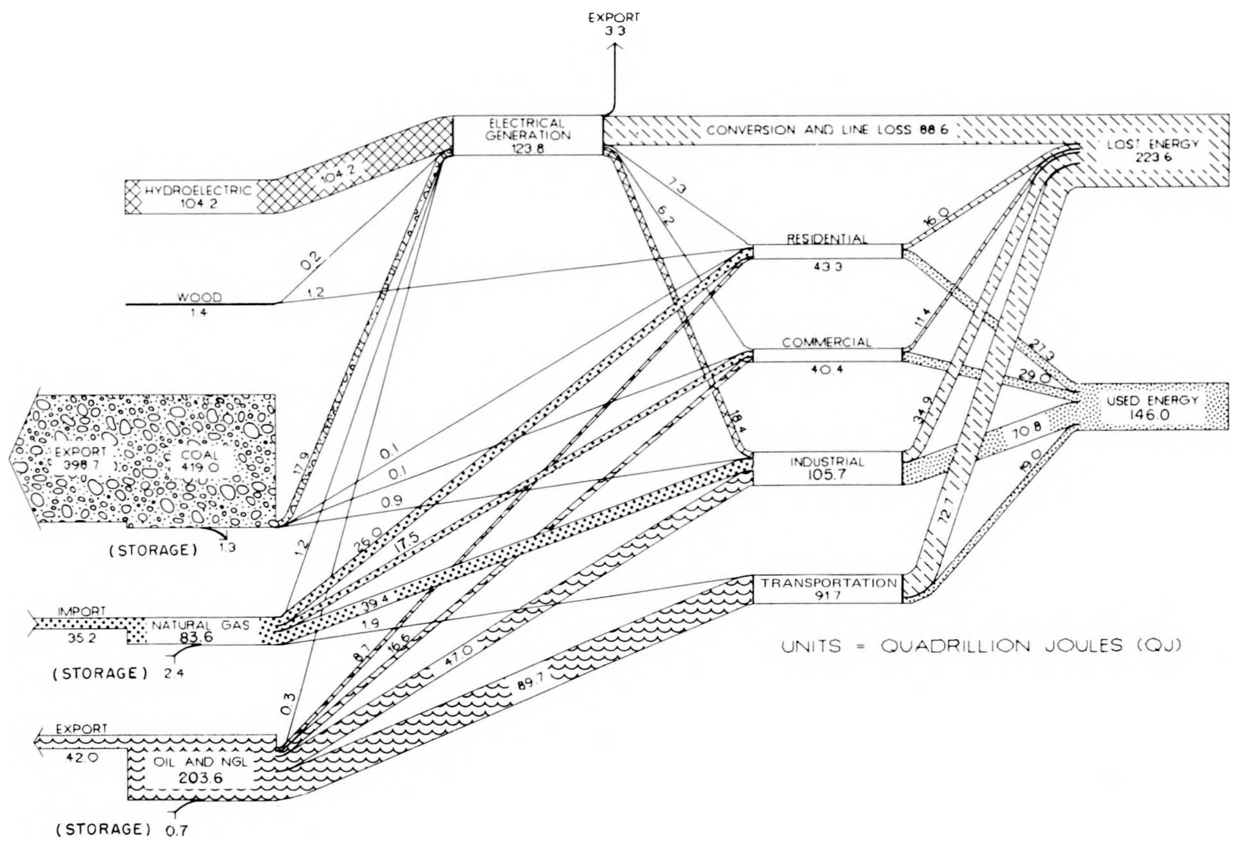

Fig. 21.
1975 energy flows, Montana.

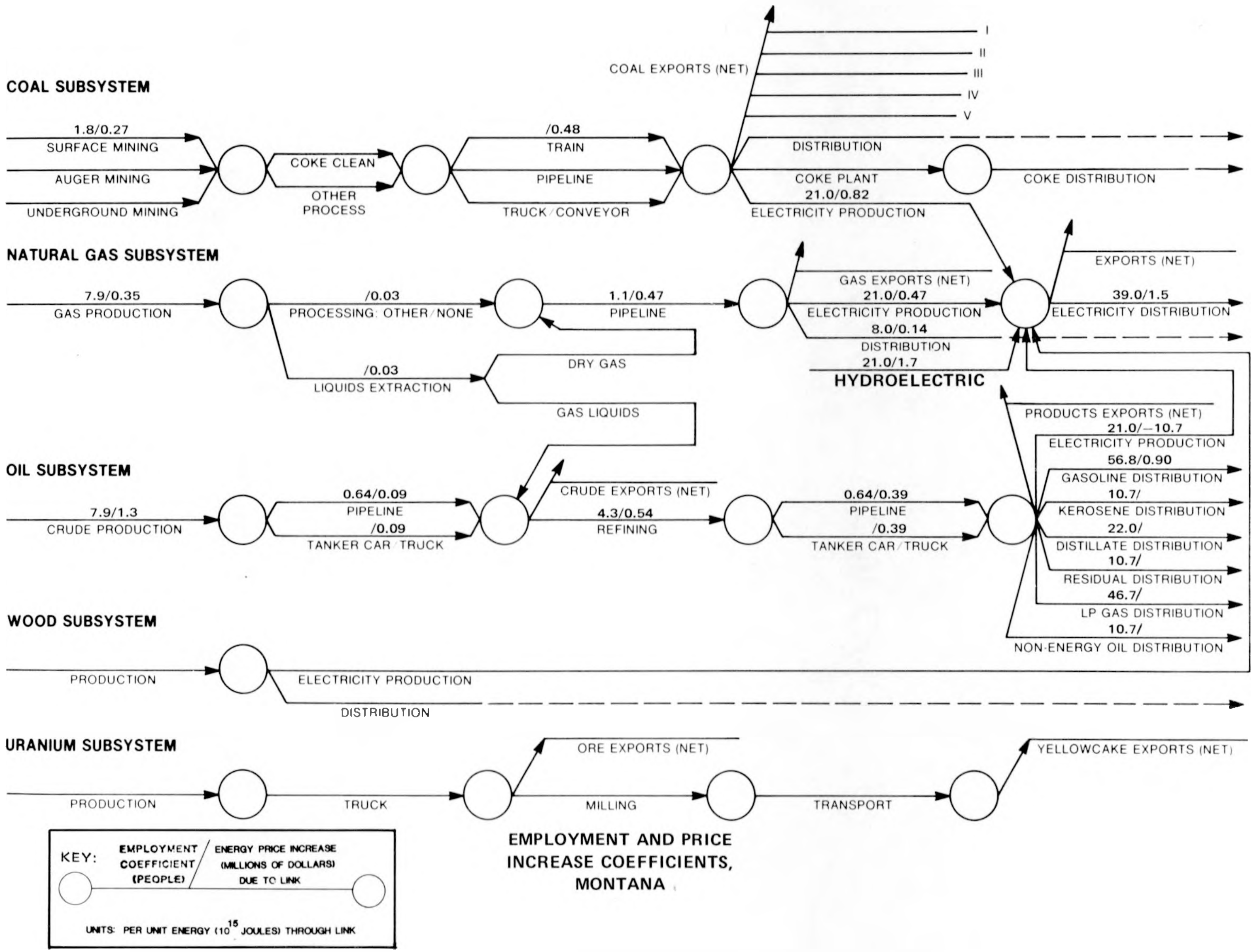

Fig. 22.
Employment and price increase coefficients, Montana.

TABLE XIV

MONTANA ENERGY FACILITIES
(Keyed to Fig. 23)[a]

Electricity Generation (Capacity in MW)

Fuel:	Hydroelectric:
1. Lewis & Clark (50.1)	1. Libby (420.0)
2. J. E. Corette (172.8)	2. Hungry Horse (285.0)
3. Frank Bird (69.0)	3. Kerr (168.0)
4. Colstrip[b] (660.0)	4. Thompson Falls (30.0)
	5. Noxon Rapids (282.9)
	6. Morony (45.0)
	7. Ryan (48.0)
	8. Cochrane (48.0)
	9. Rainbow (35.6)
	10. Holter (38.4)
	11. Canyon Ferry (50.0)
	12. Yellowtail (250.0)
	13. Fort Peck (165.0)

Coal Mines (S = Strip)

1. Savage - S	5. Stormking - S
2. Coal Creek - S	6. Sarpy Creek - S
3. Decker - S	7. Rosebud - S
4. P M Mine - S	8. Big Sky - S

Oil Refineries (Capacities in bbl/cd)

1. Big West (3 000)	5. Phillips Petroleum Co. (3 800)
2. Westco (5 500)	6. Jet Fuel Refinery (1 500)
3. Farmers Union (26 000)	7. Exxon Oil (40 000)
4. Spruce (3 000)	8. Continental Oil Co. (36 800)

Gas Processing Plants (Capacity in mcf per day)

Company	Plant Name	County
McCulloch Gas Processing	Fairview (6 000)	Richland
	Toole-Creek (2 500)	Roosevelt
Union Texas Petroleum	Glendive Plant (5 800)	Fallon
Thunderbird	Westco (31 000)	Glacier

[a]Sources for Fig. 23 and Table XIV: Montana Board of Oil and Gas Conservation,[28] FPC,[18,27] BOM,[21] API,[19,20] and Smith.[29]

[b]Partly under construction.

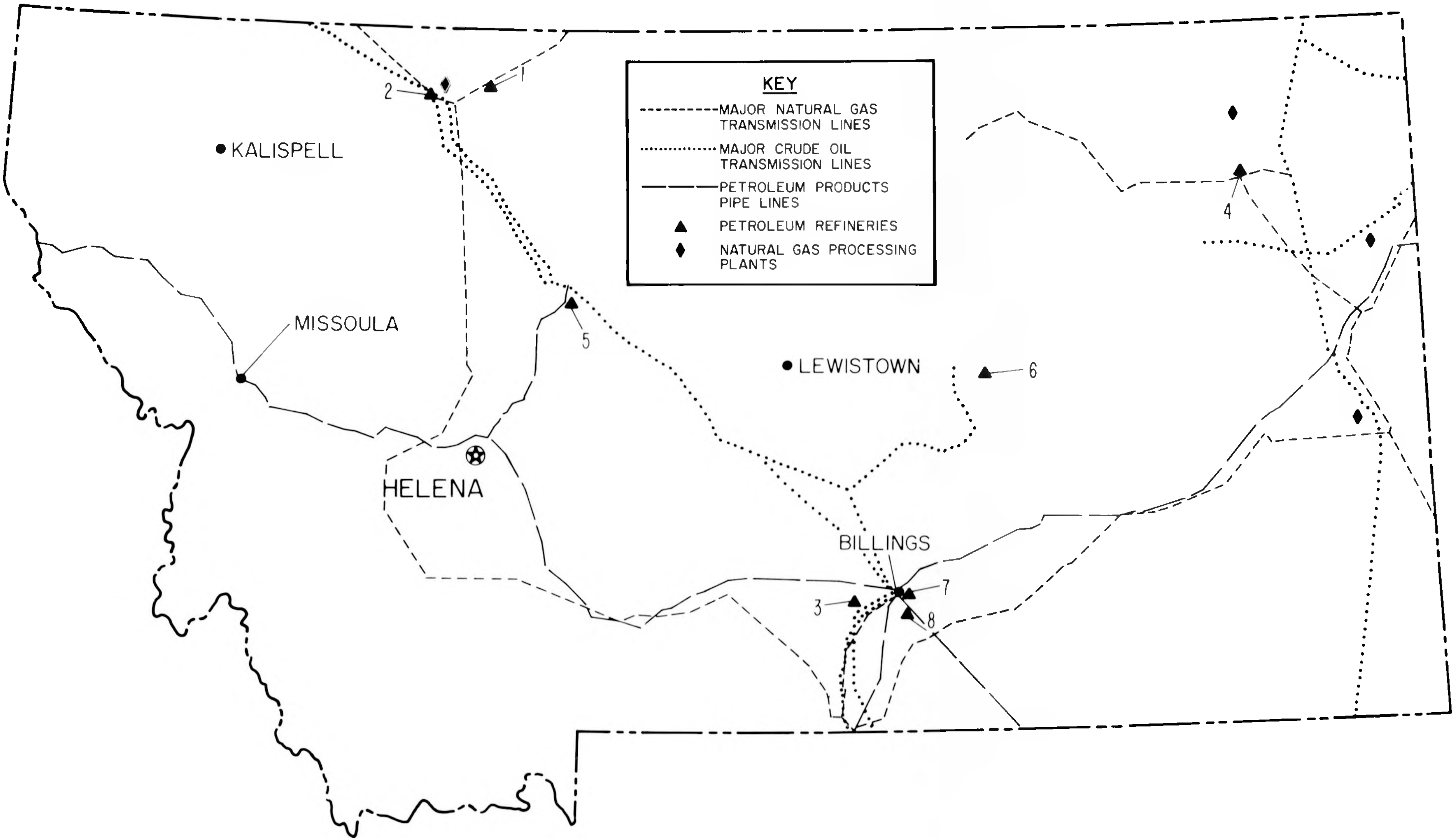

Fig. 23a.
Principal energy facilities of Montana.

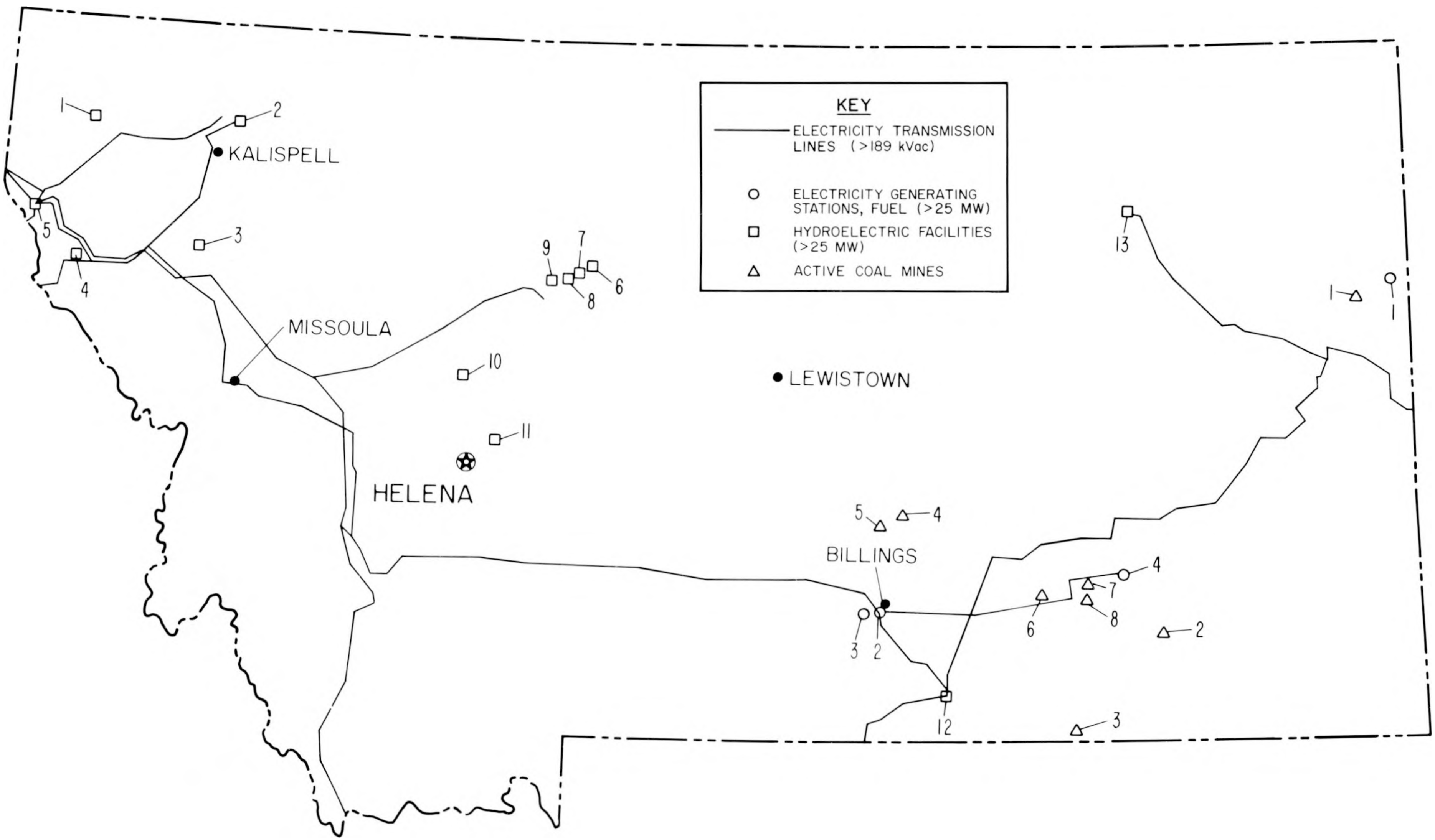

Fig. 23b.
Principal energy facilities of Montana.

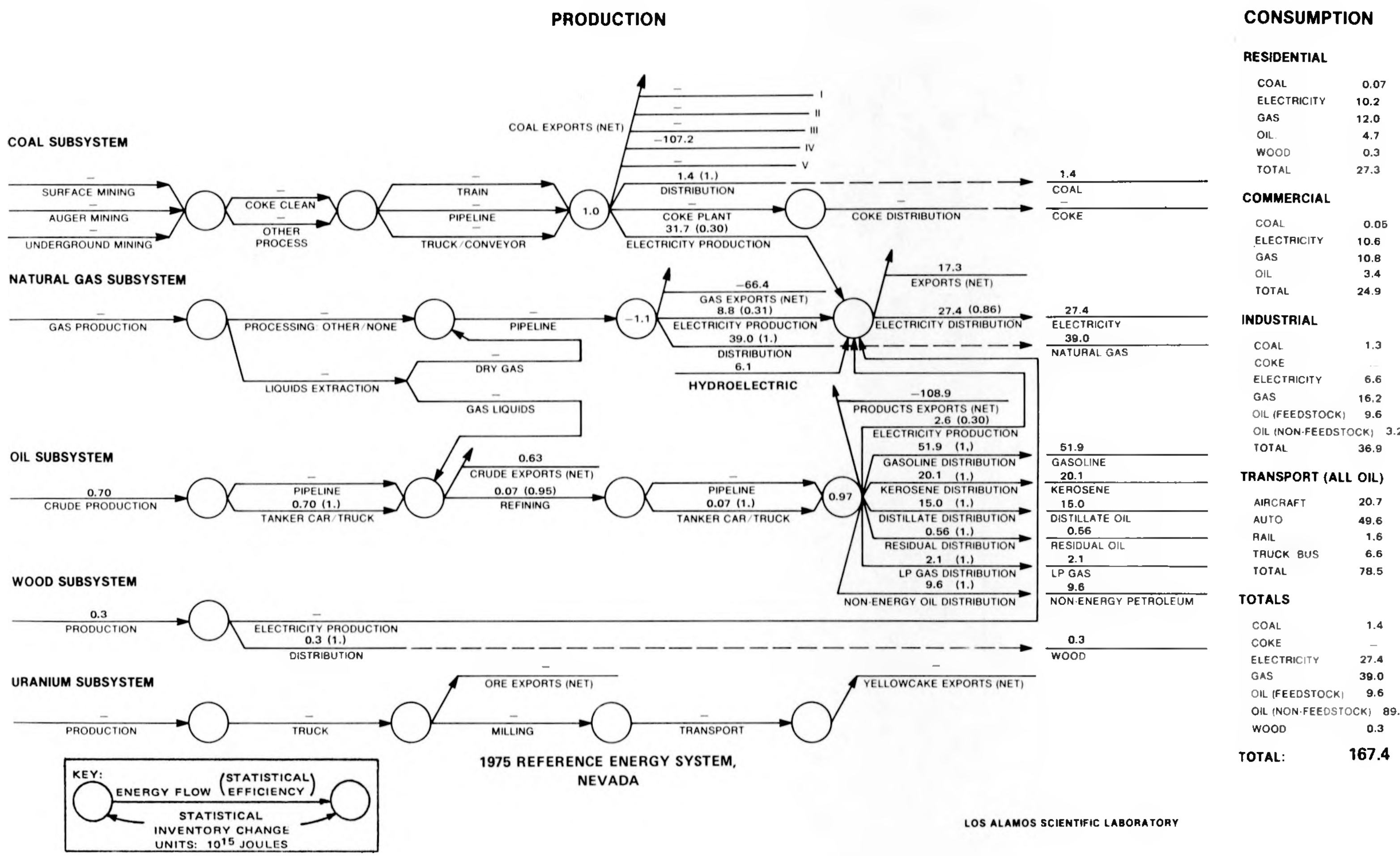

Fig. 24.
1975 reference energy system, Nevada.

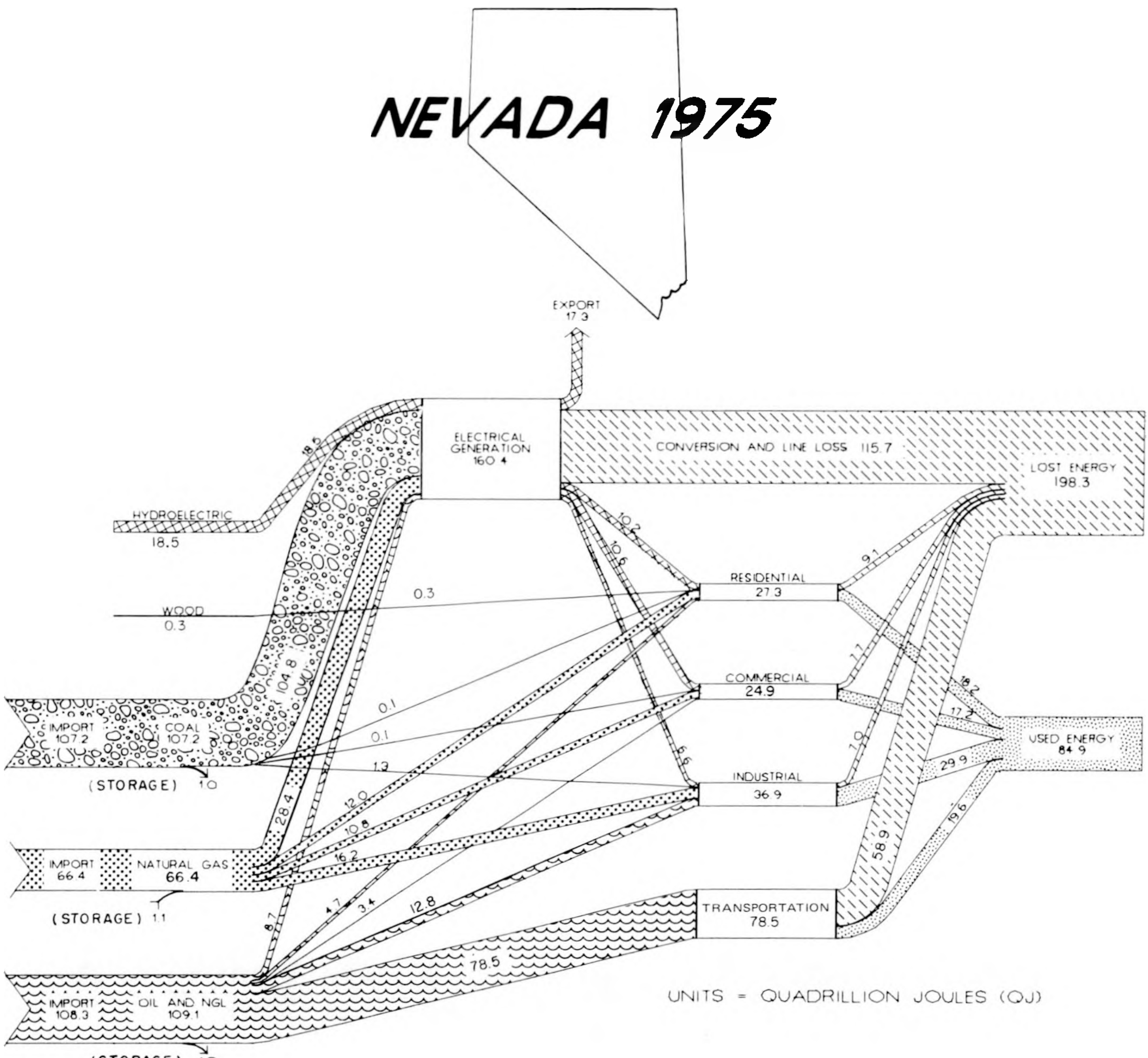

Fig. 25.
1975 energy flows, Nevada.

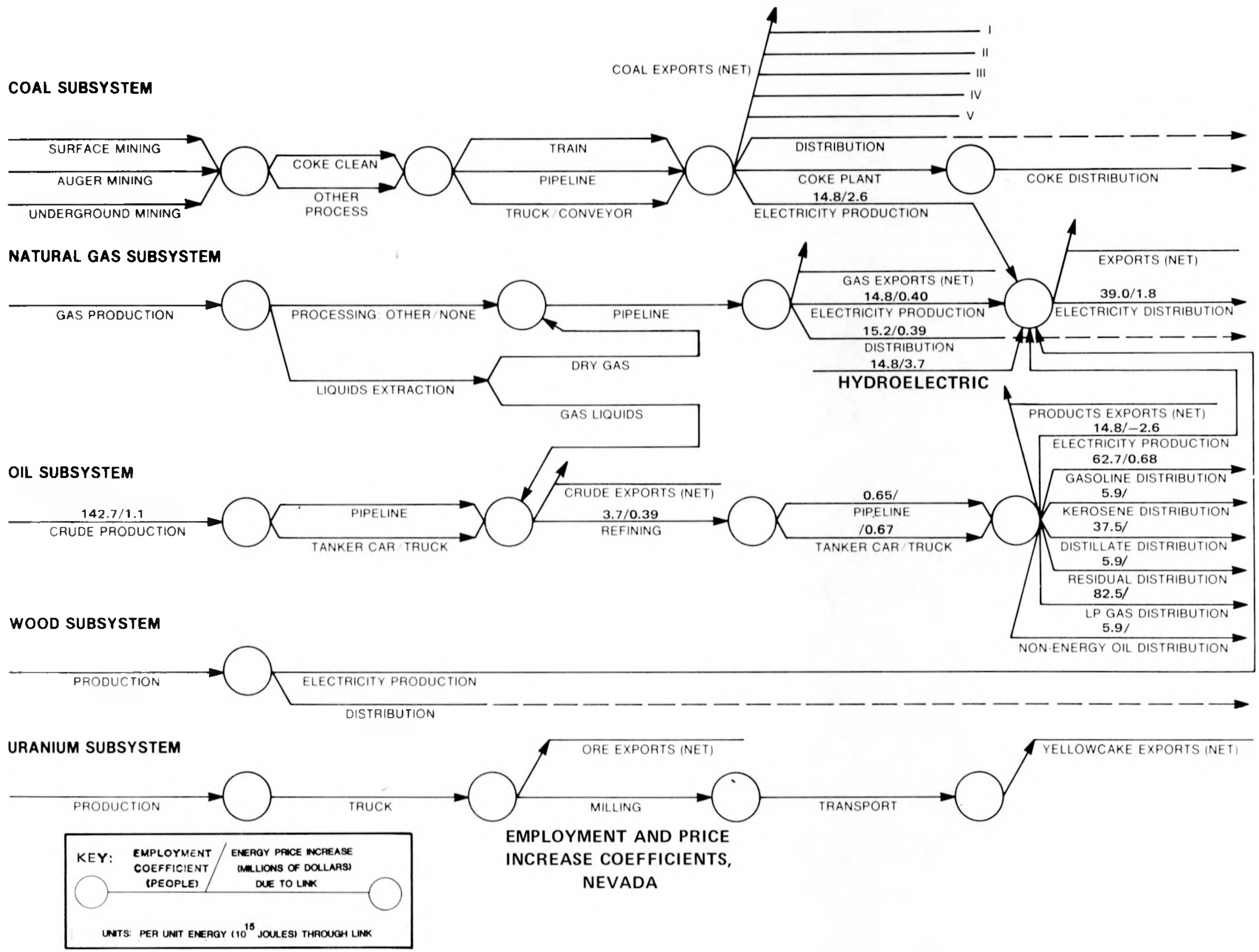

Fig. 26.
Employment and price increase coefficients, Nevada.

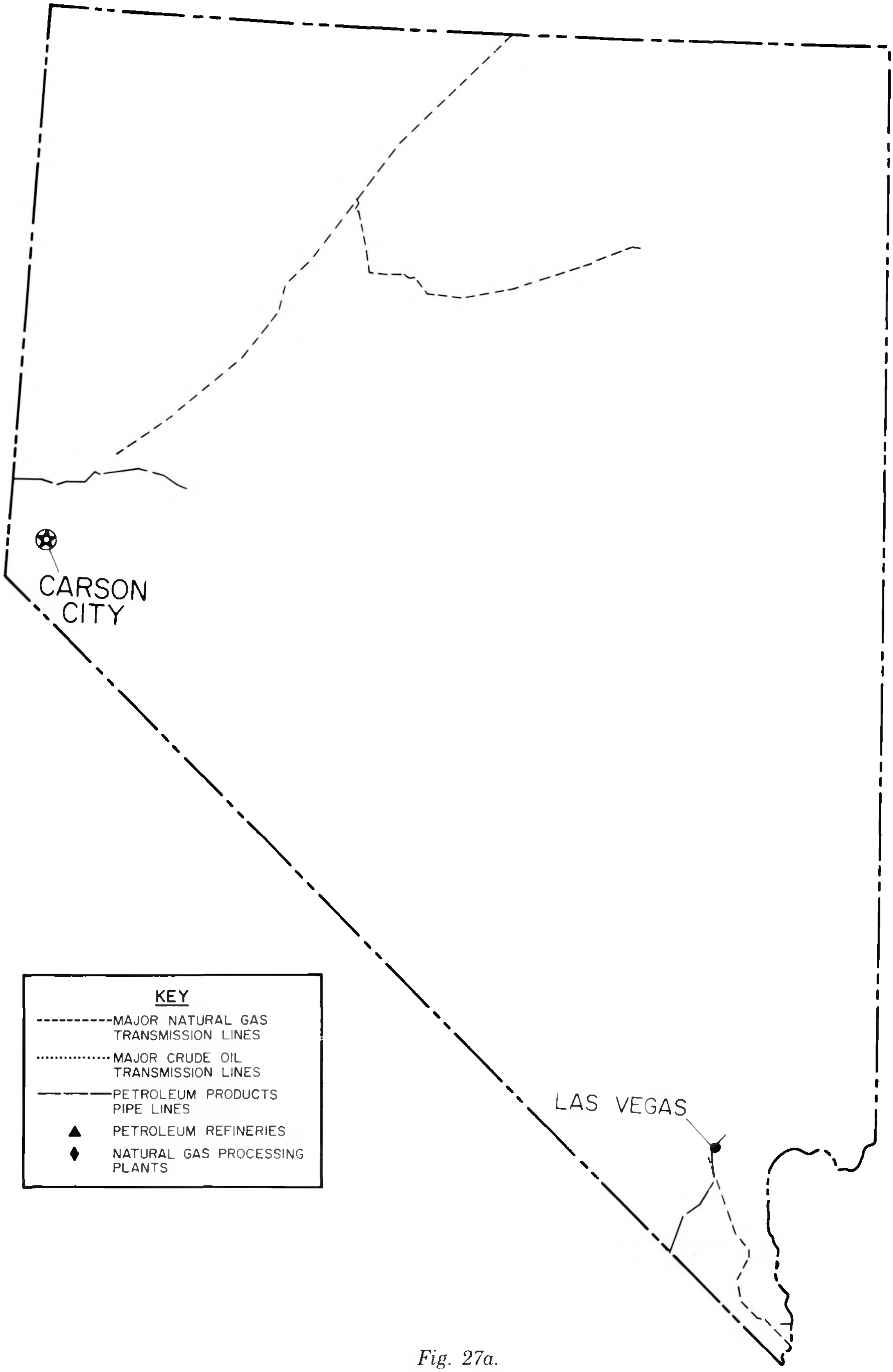

Fig. 27a.
Principal energy facilities of Nevada.

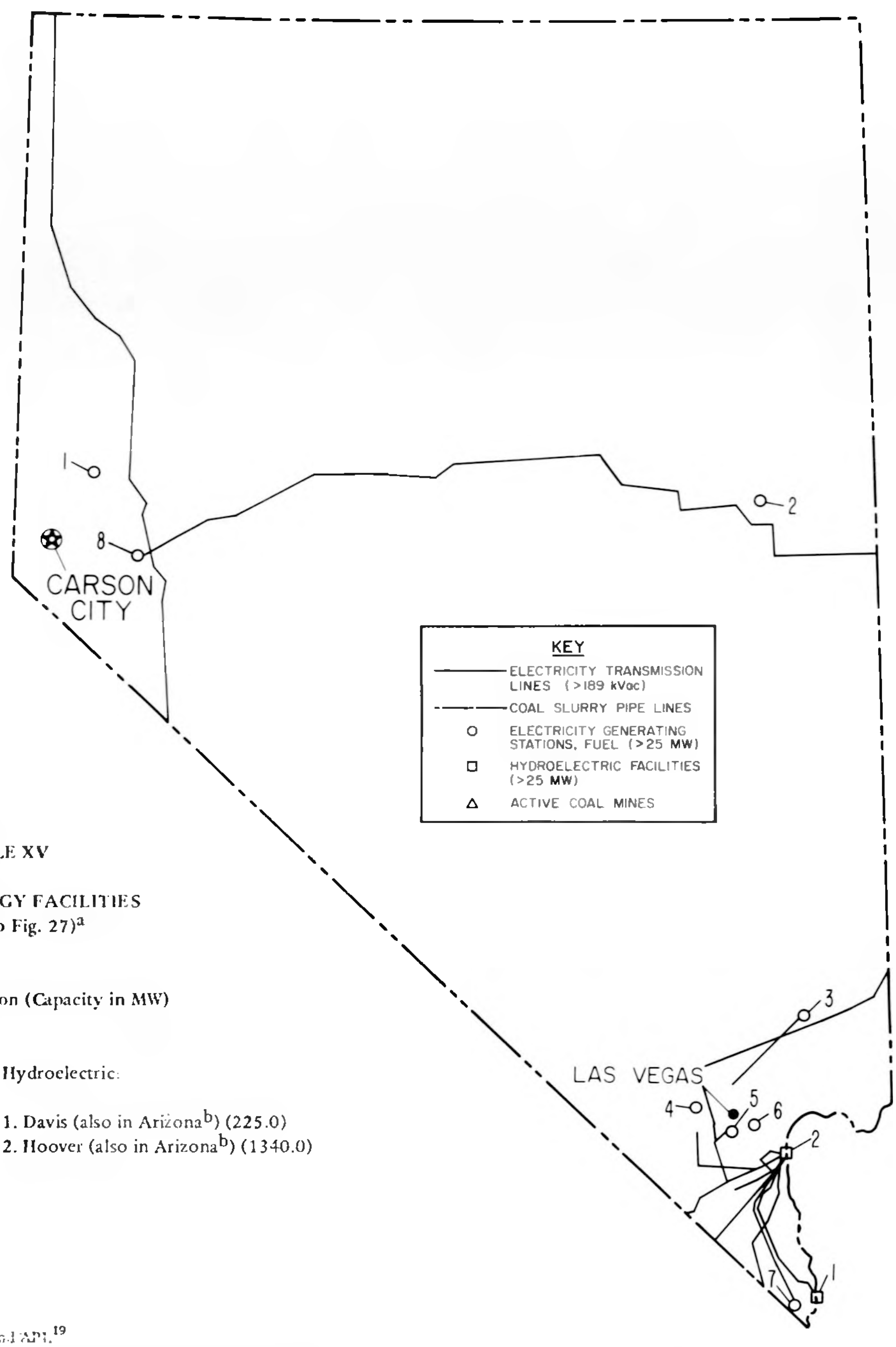

Fig. 27b.
Principal energy facilities of Nevada.

TABLE XV

NEVADA ENERGY FACILITIES
(Keyed to Fig. 27)[a]

Electricity Generation (Capacity in MW)

Fuel:

1. Tracy (158.0)
2. McGill (45.0)
3. Reid Gardner (227.3)
4. Westside (29.3)
5. Clark (262.7)
6. Sunrise (81.6)
7. Mohave (1636.2)
8. Ft. Churchill (220.0)

Hydroelectric:

1. Davis (also in Arizona[b]) (225.0)
2. Hoover (also in Arizona[b]) (1340.0)

---

[a]Sources for Fig. 27 and Table XV: FPC[17,18] and API.[19]

[b]When hydroelectric installations are located on a river forming the boundary between two states, the side of the river on which the generators are located determines the state in which the hydro-capacity is considered to exist.

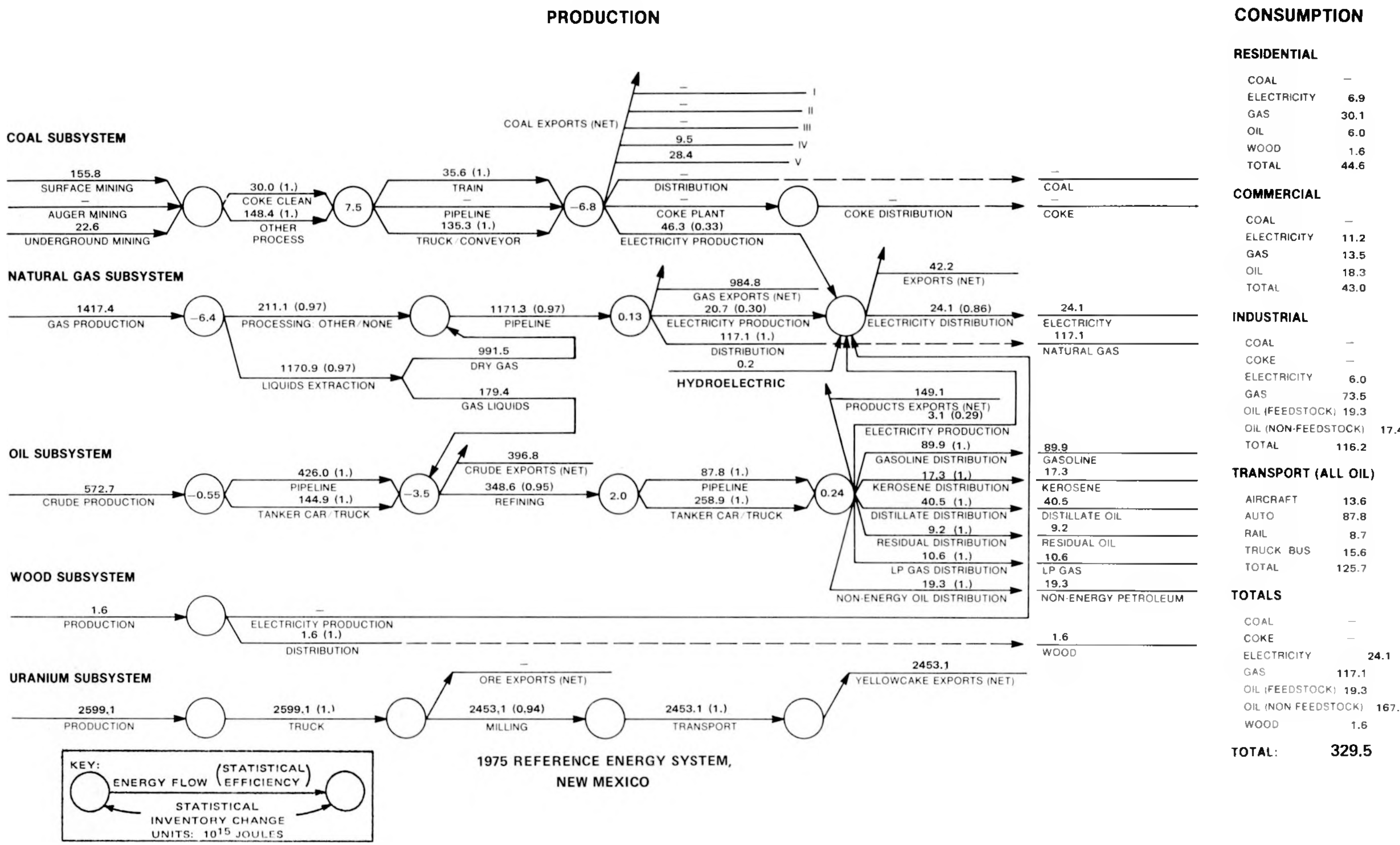

Fig. 28.
1975 reference energy system, New Mexico.

NEW MEXICO 1975

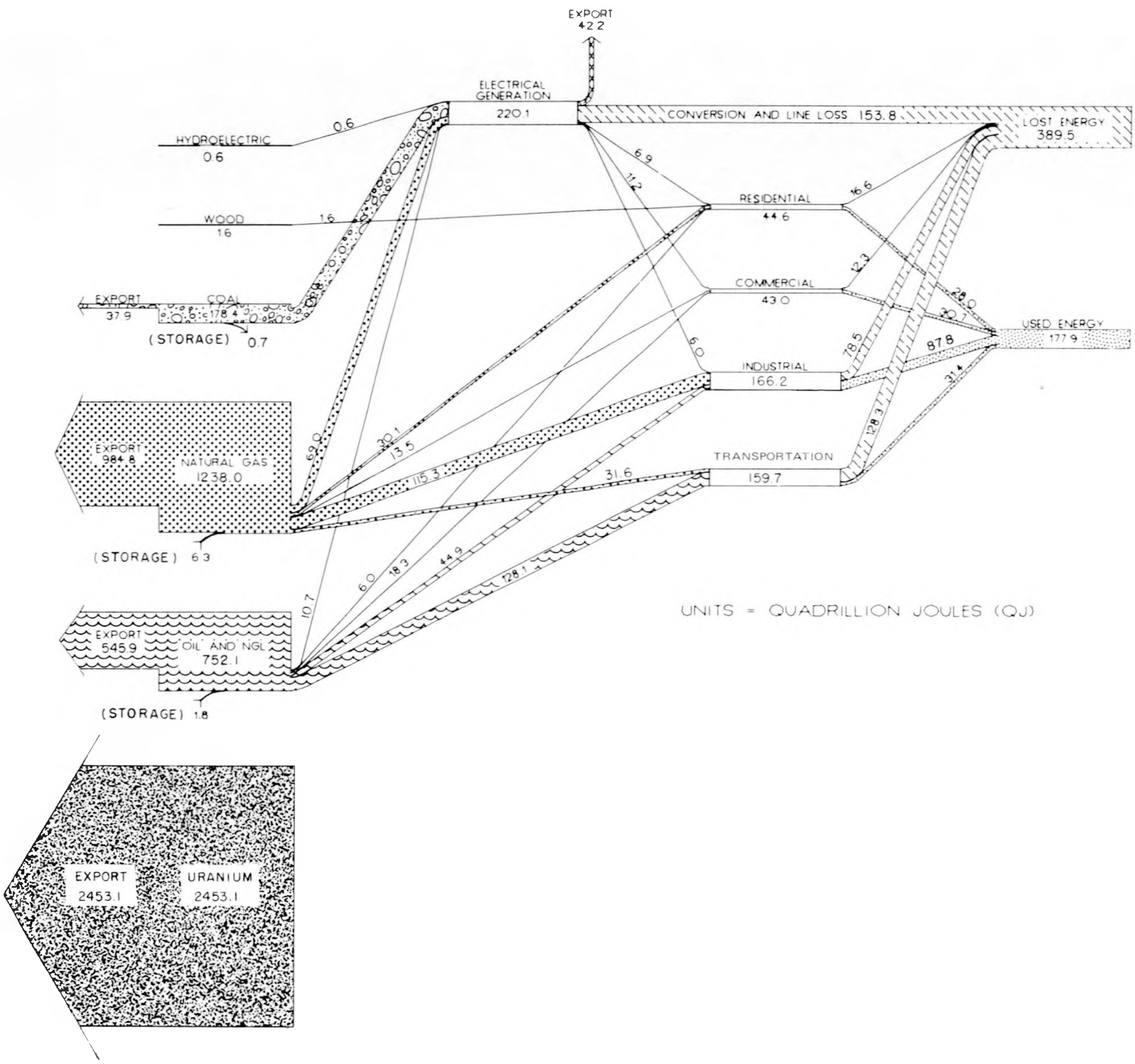

Fig. 29.
1975 energy flows, New Mexico.

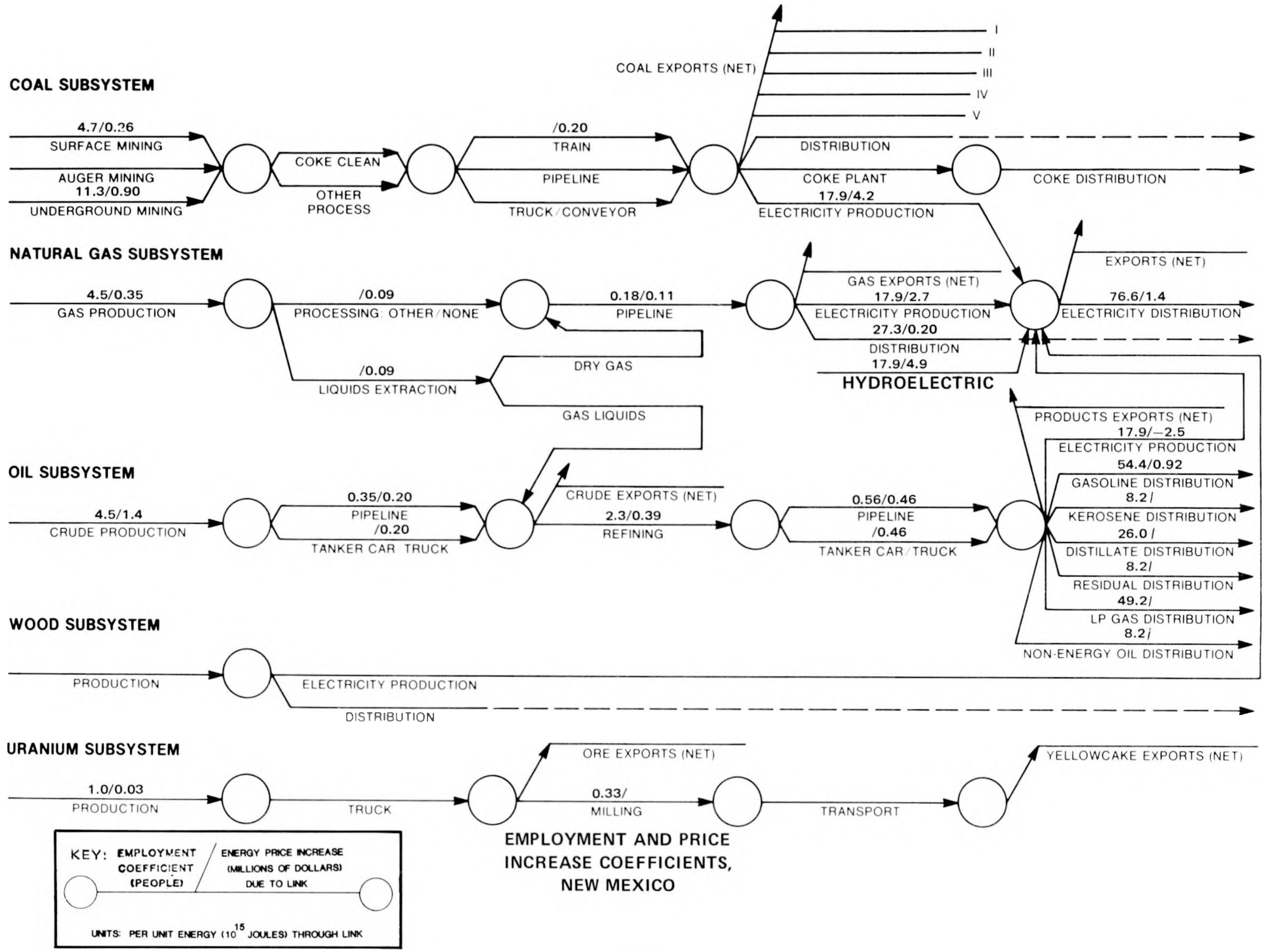

Fig. 30.
Employment and price increase coefficients, New Mexico.

TABLE XVI

NEW MEXICO ENERGY FACILITIES
(Keyed to Fig. 31)[a]

Electricity Generation (Capacity in MW)

Fuel:

1. San Juan (328.7)
2. Farmington (28.5)
3. Four Corners (2269.8)
4. Algodones (51.8)
5. Reeves (175.0)
6. Prager (35.0)
7. Person (125.0)
8. Roswell (35.7)
9. Lordsburg (54.5)
10. Carlsbad No. 2 (44.3)
11. North Lovington (133.6)
12. Maddox (113.6)
13. Cunningham (265.4)
14. Rio Grande (395.0)

Coal Mines (U = Underground, S = Strip)

1. York Canyon - U, S
2. San Juan - S
3. Navajo - S
4. McKinley - S
5. Sundance - S

Oil Refineries (Capacity in bbl/cd)

1. Thriftway Co. (4 020)
2. Plateau, Inc. (7 500)
3. Caribou Four Corners, Inc. (1 500)
4. Shell Oil Co. (20 000)
5. Southern Union (Monument) (5 000)
6. Navajo Refining Co. (29 930)
7. Southern Union (Lovington) (37 000)
8. Giant Industries (9 000)

Gas Processing Plants (Capacity in mcf per day)

Company	Plant Name	Location
Cities Service	Bluitt Gasoline Plant (40 000)	Milnesand
Continental Oil Co.	Maljamar (26 000)	Maljamar
El Paso Natural Gas Co.	Jal Complex (720 000)	Jal
	San Juan River (71 000)	Fruitland
	Wingate (40 000[b])	Gallup
	Blanco (558 000)	Bloomfield
	Chaco (594 000)	Farmington
Marathon Oil Co.	Indian Basin (220 000)	Artesia
Phillips Petroleum	Lovington (10 000)	Lovington
	Eunice (140 000)	Eunice
	Hobbs (38 000)	Hobbs
	Lee (70 000)	Buckeye
	Artesia (26 500)	Artesia
	Wilson (40 000)	Jal
	Lusk (c)	Lee County
	Winchestei (c)	Artesia
Skelly Oil Company	Eunice (135 000)	Eunice

Southern Union Production	Kutz (97 000)	Bloomfield
	Lybrook (82 000)	Lybrook
Southern Union Gas	Indian Hills (30 000)	Carlsbad
North Texas LPG Corp.	Lone Pine Plant (c)	McKinley County
Northern Natural	Hobbs (240 000)	Hobbs
Warren Petroleum	Monument (90 000)	Monument
	Saunders (42 000)	Lovington
	Eunice (60 500)	Eunice
	Vada (40 000)	Milnesand
Yates	Yates Gas Plant (c)	Artesia
Texaco, Inc.	Buckeye (22 500)	Buckeye
Amoco Production	Empire Abo (30 000)	Artesia
Tipperary	Denton Gasoline (12 500)	Lovington
Perry Gas Processing	Antelope Ridge (20 000)	Jal
Chala Cryogenics	Plant A (c)	Chavez County

[a] Sources for Fig. 31 and Table XVI: Grant,[30] FPC,[17,18] API,[19,20] BOM,[21] Stamets,[31] Bieberman and Weber,[32] Martinez,[33] Eichelman.[34]

[b] Gas liquids plant capacity in barrels per day.

[c] Not available.

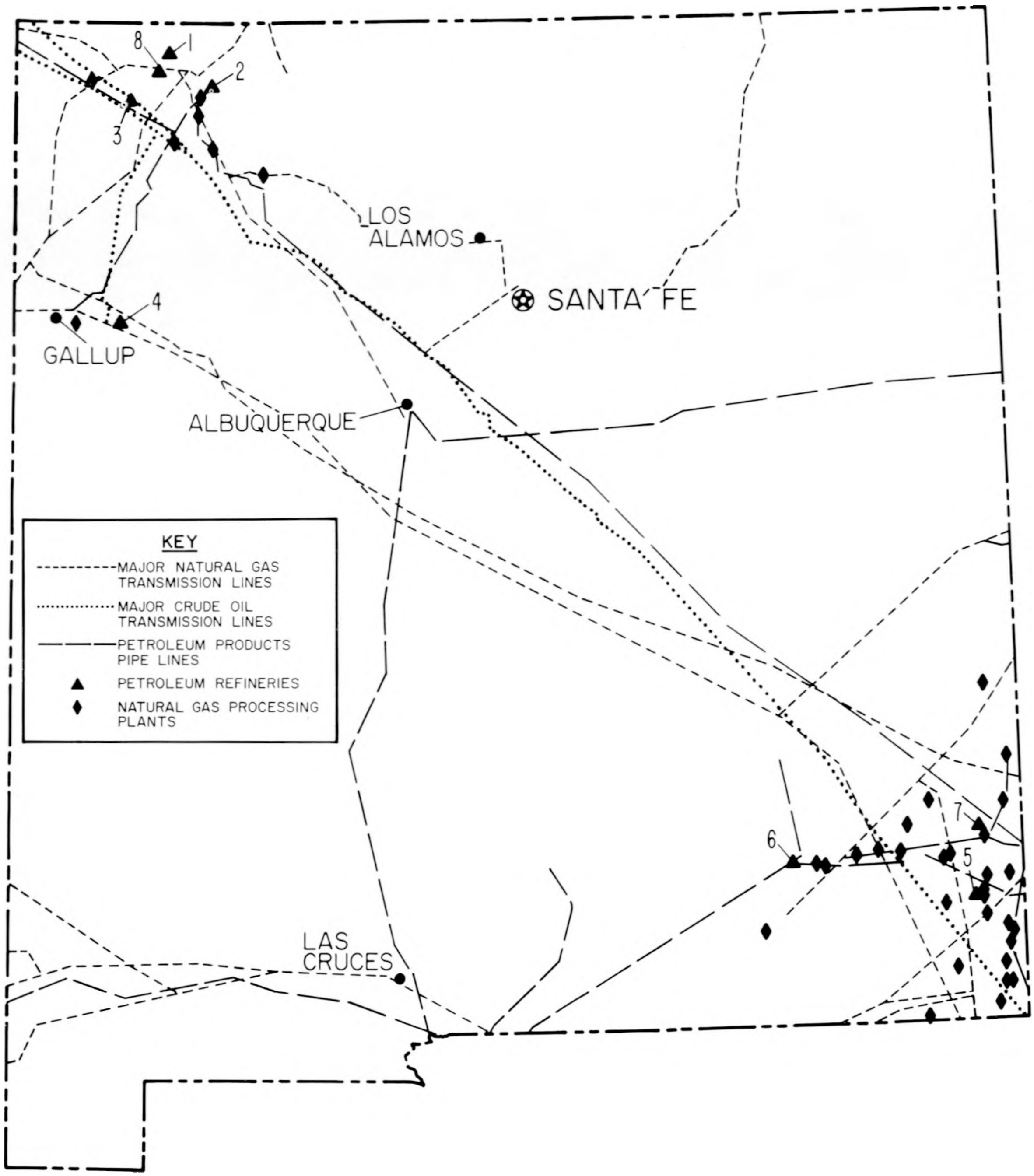

Fig. 31a.
Principal energy facilities of New Mexico.

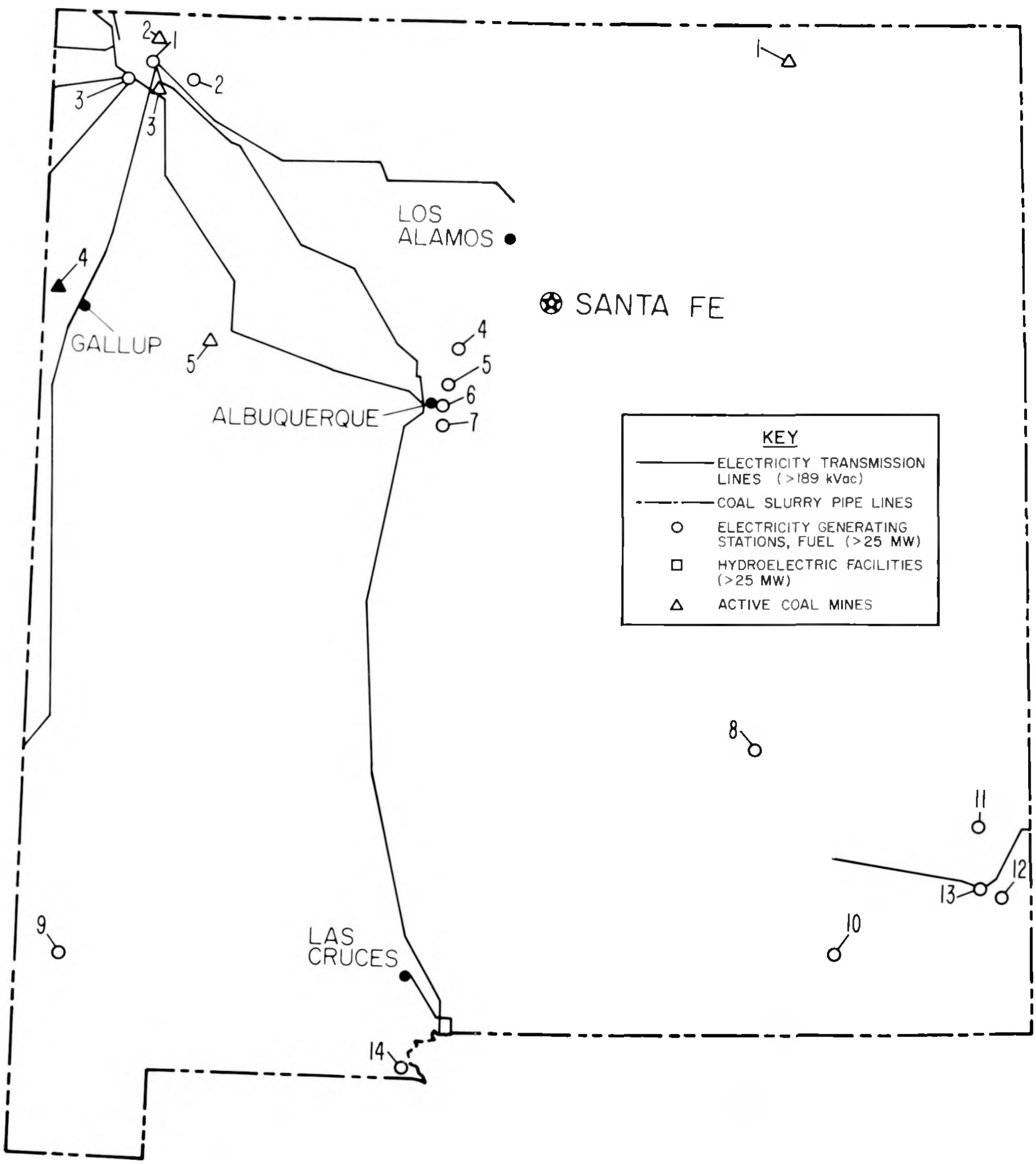

Fig. 31b.
Principal energy facilities of New Mexico.

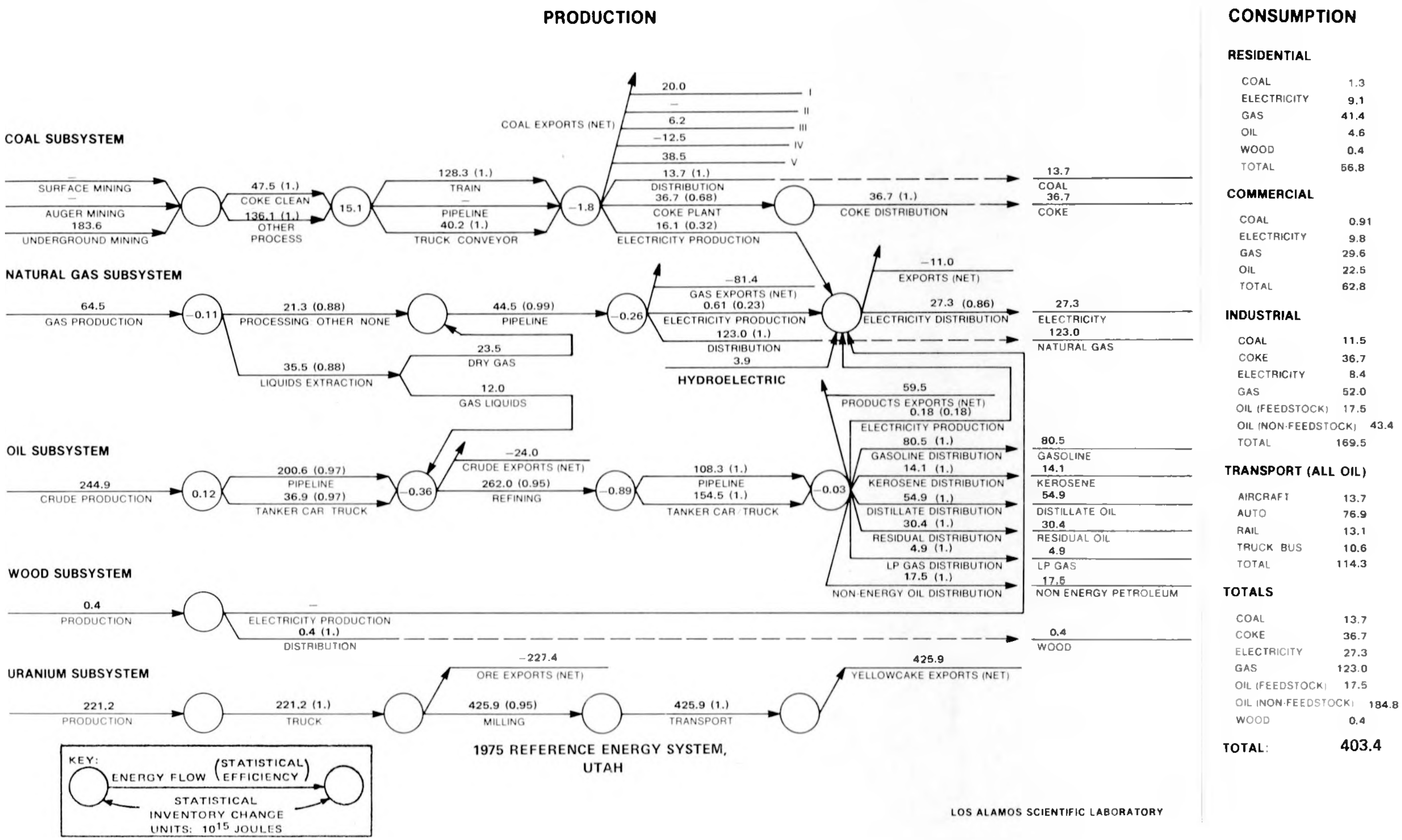

Fig. 32.
1975 reference energy system, Utah.

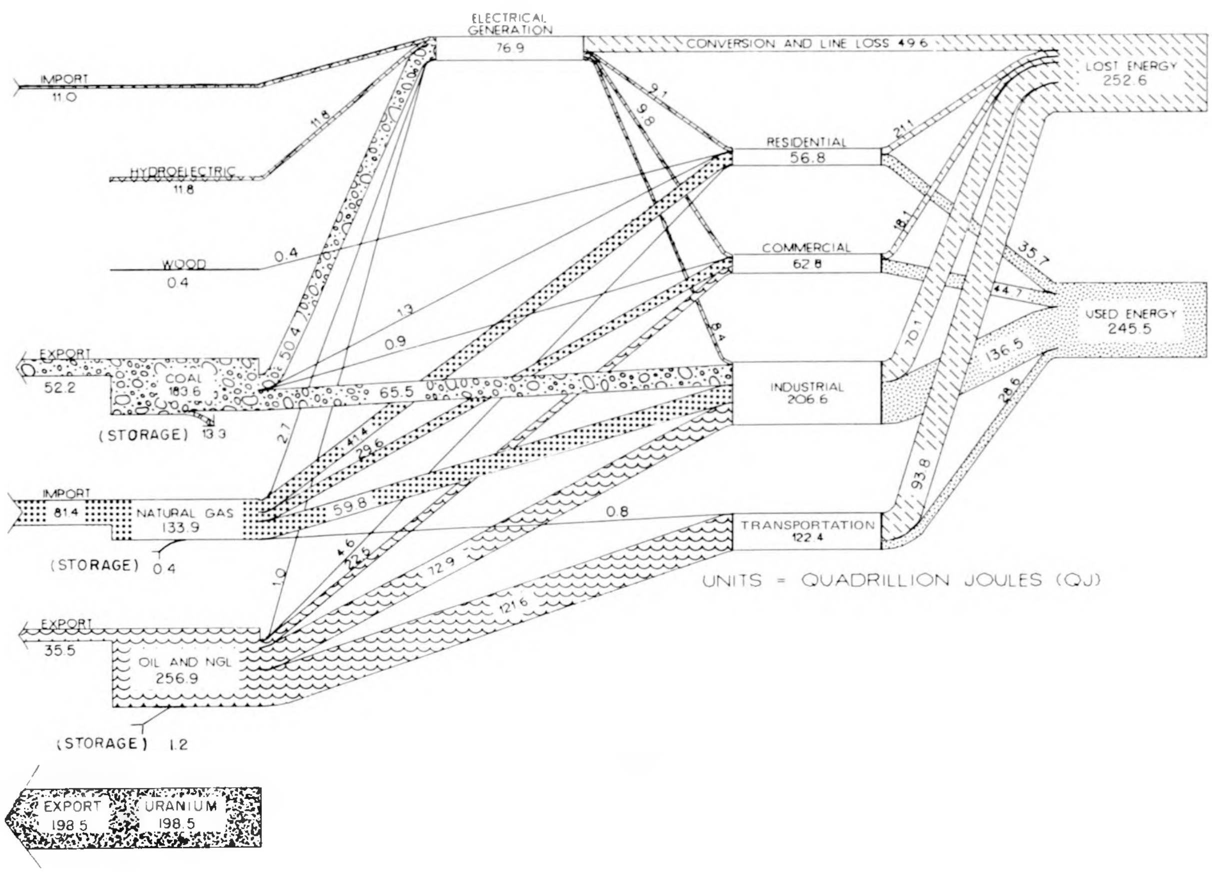

Fig. 33.
1975 energy flows, Utah.

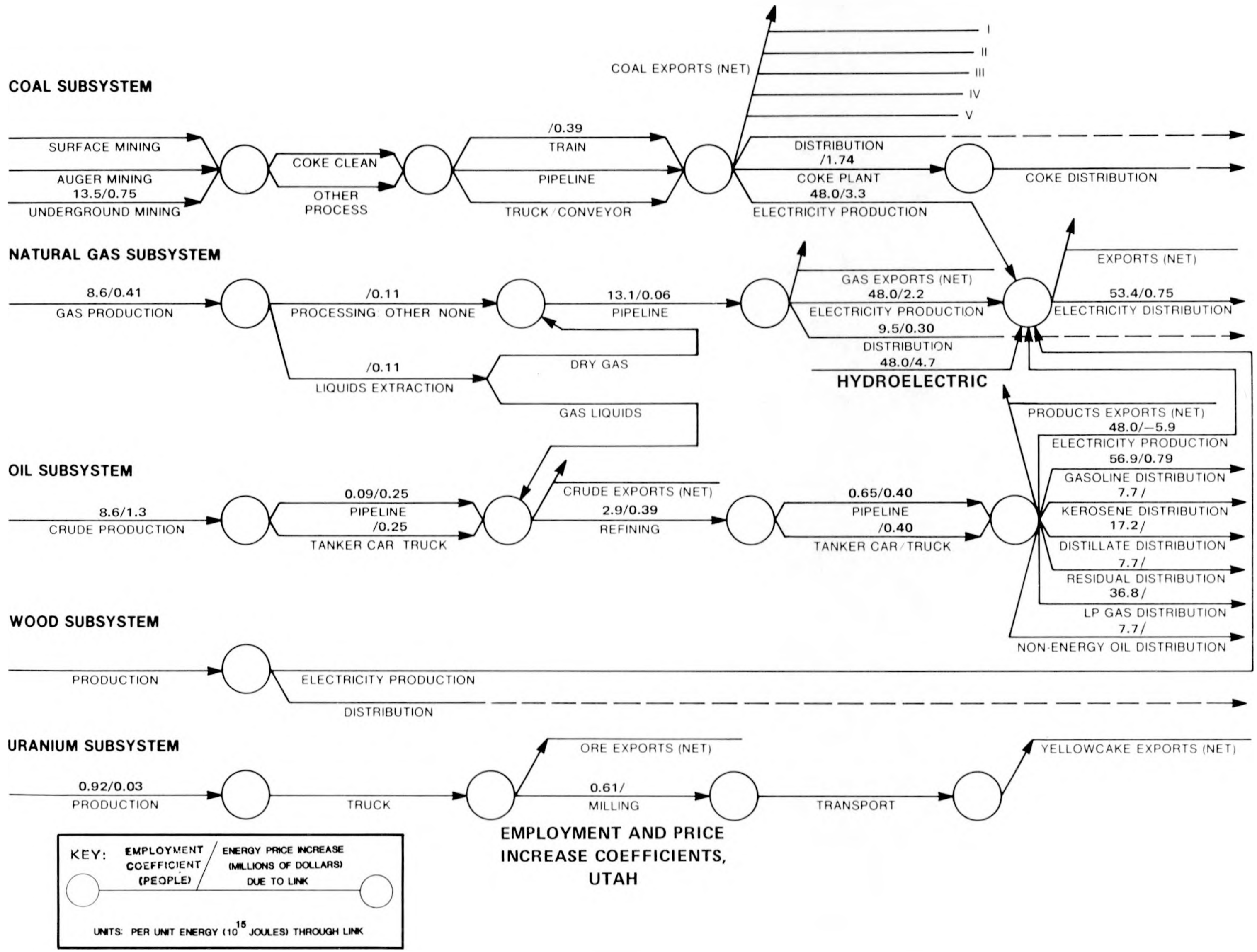

Fig. 34.
Employment and price increase coefficients, Utah.

TABLE XVII

UTAH ENERGY FACILITIES

(Keyed to Fig. 35)[a]

Electricity Generation (Capacity in MW)

Fuel:

1. Jordon (25.0)
2. Central (175.0)
3. Gadsby (251.6)
4. Geneva (50.0)
5. Hale (59.0)
6. Carbon (188.6)
7. Huntington (800.0)

Hydroelectric:

1. Cutler (30.0)
2. Flaming Gorge (108.0)

Coal Mines (U = Underground)

1. Soldier Canyon - U
2. Braztah - U
3. Gordon Creek #2 - U
4. Utah #2 - U
5. Sunnyside #1, 2, 3 - U
6. Star Point #1 and #2 - U
7. King - U
8. Co-op - U
9. Deer Creek - U
10. Beehive & Deseret - U
11. Geneva - U
12. Southern Utah Fuels - U
13. Browning (Emery) - U
14. Dog Valley - U
15. Wilberg - U

Oil Refineries (Capacity in bbl/day)

1. Phillips Petroleum Co. (24 000)
2. Caribou Four Corners (7 500)
3. Morrison Petroleum (1 500)
4. Western Refinery (10 000)
5. Amoco Oil Co. (39 000)
6. Chevron Oil Co. (45 000)
7. Husky Oil Co. (24 000)
8. Plateau, Inc. (7 500)

Gas Processing Plants (Capacity in mcf per day)

Company	Plant Name	County
Chevron Oil	Red Wash (38 000)	Uintah
El Paso	Aneth (100 000)	San Juan
Gary Operating	Altonah (15 000)	Duchesne
	Bluebell (20 000)	Duchesne
Koch Oil	Cedar Rim (7 500)	Duchesne
Quasar Energy	Pineview (3 500)	Summit
Shell Oil	Altamount (40 000)	Duchesne
Union Oil	Lisbon (80 000)	San Juan

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[a]Sources for Fig. 35 and Table XVII: FPC,[17,18] API,[19,20] BOM,[21] Utah Dept. of Natural Resources,[35] Utah Geologic and Mineral Survey.[36]

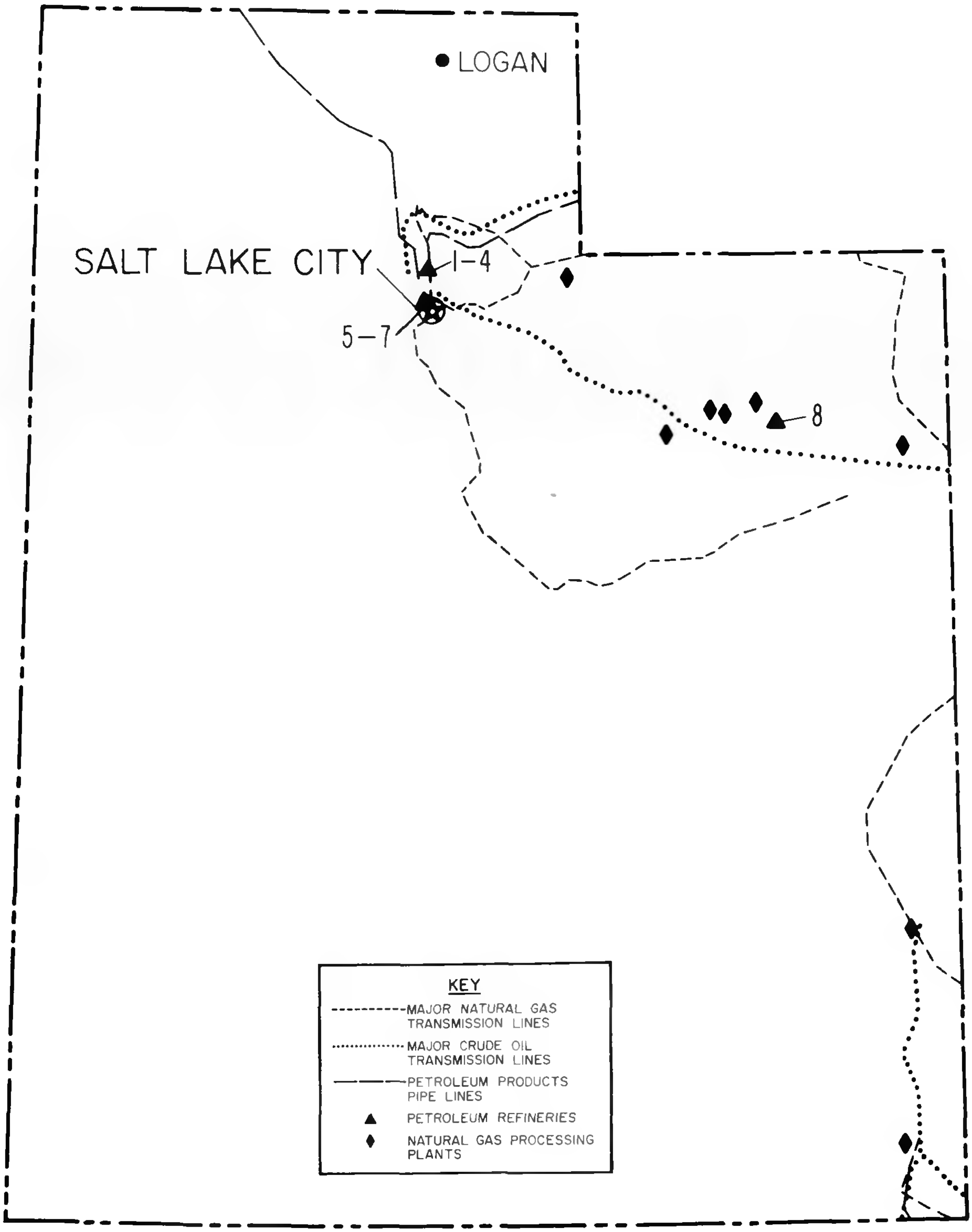

Fig. 35a.
Principal energy facilities of Utah.

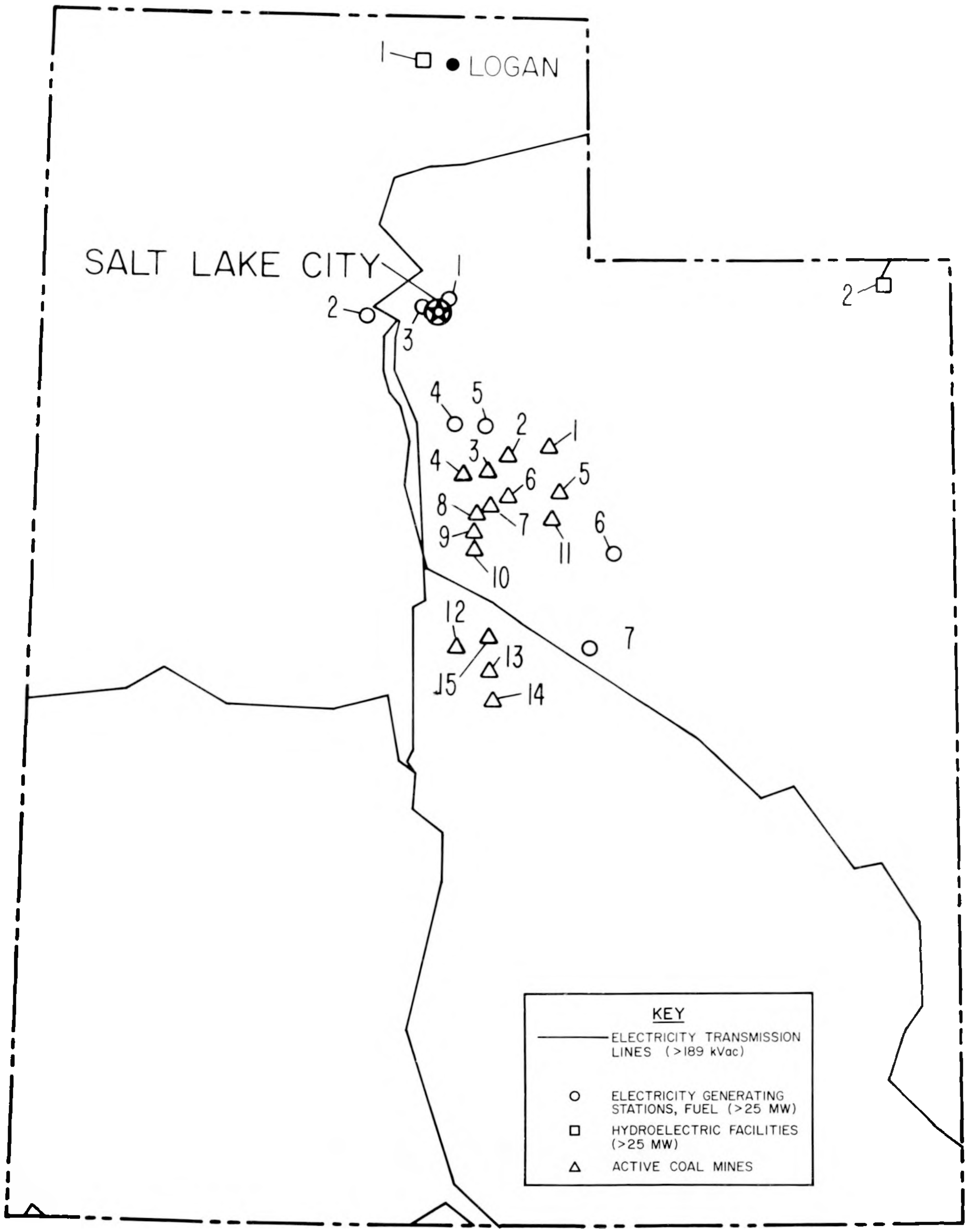

Fig. 35b.
Principal energy facilities of Utah.

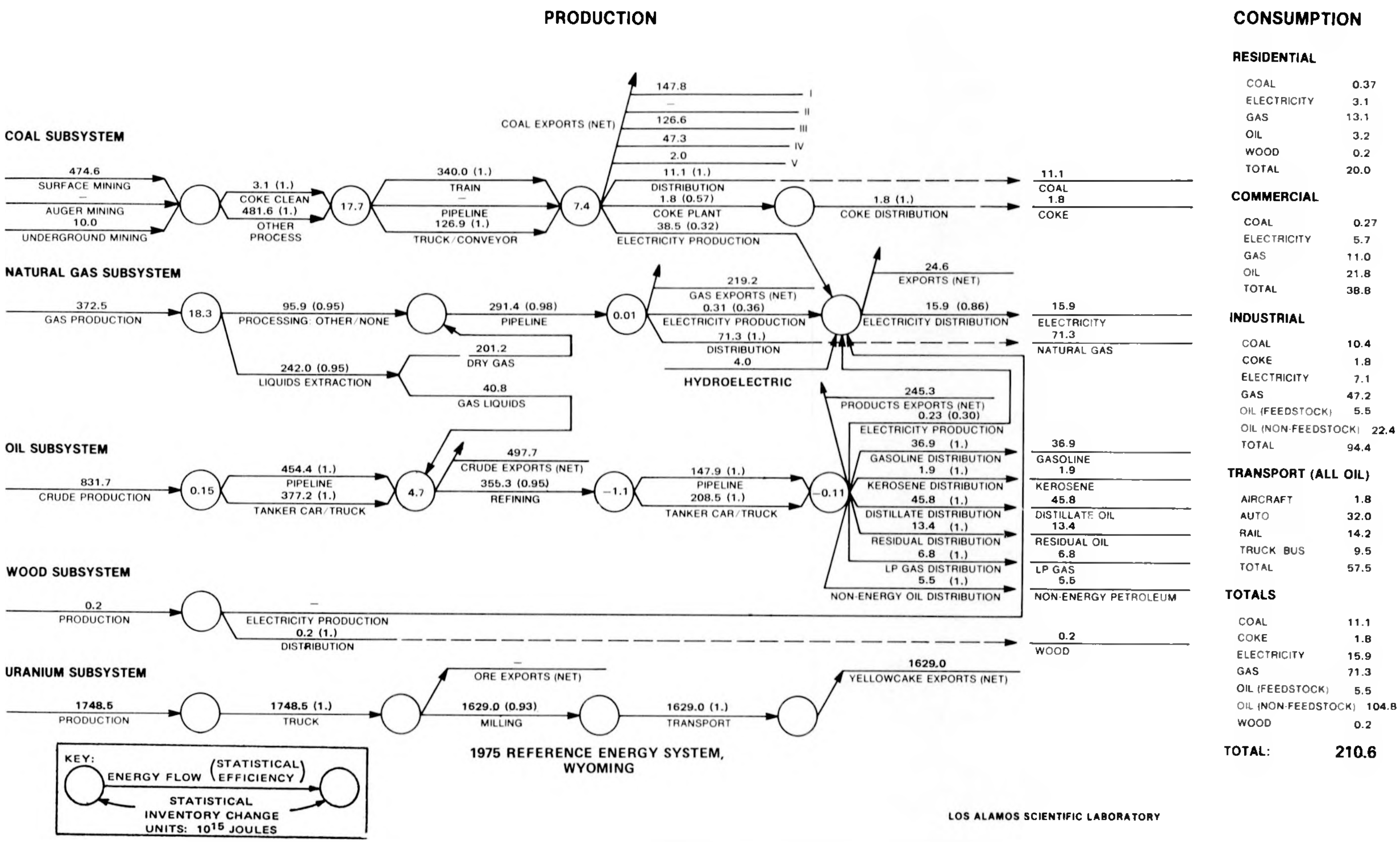

Fig. 36.
1975 reference energy system, Wyoming.

WYOMING 1975

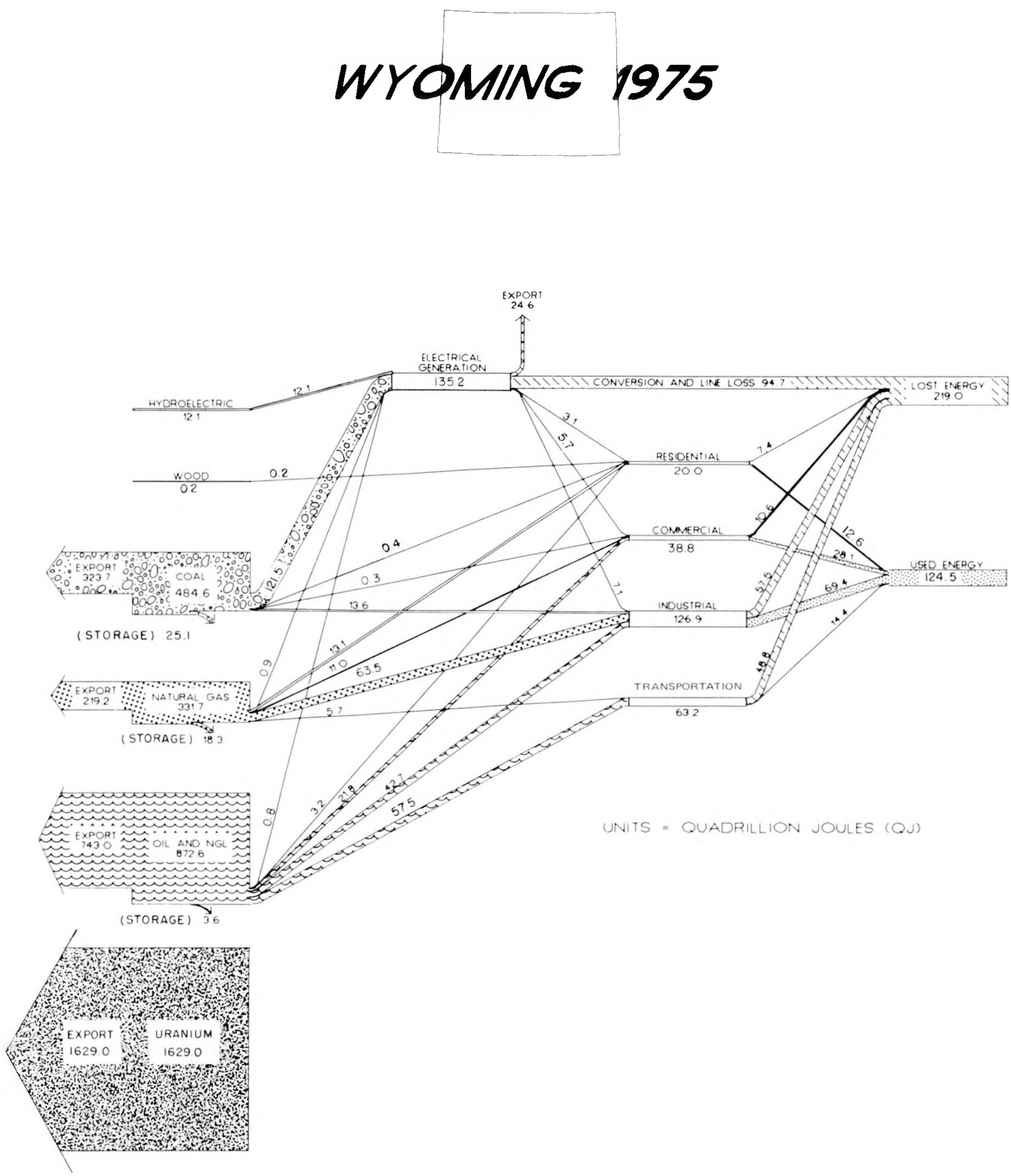

Fig. 37.
1975 energy flows, Wyoming.

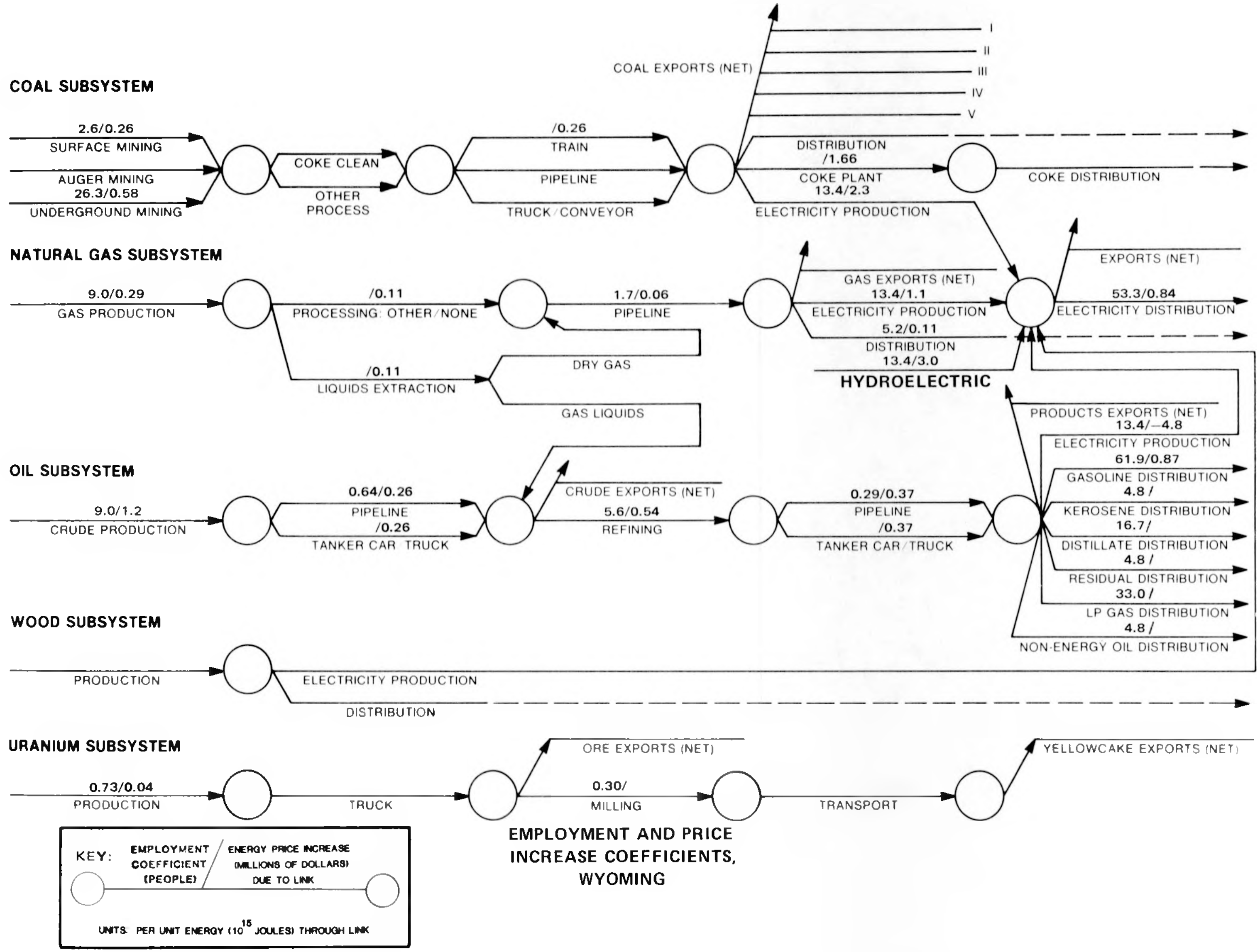

Fig. 38.
Employment and price increase coefficients, Wyoming.

TABLE XVIII

WYOMING ENERGY FACILITIES

(Keyed to Fig. 39)[a]

Electricity Generation (Capacity in MW)

Fuel:	Hydroelectric:
1. Dave Johnston (787.0)	1. Alcova (36.0)
2. Osage (35.5)	2. Fremont Canyon (48.0)
3. Naughton (707.2)	3. Kortes (36.0)
4. Neil Simpson (27.7)	4. Seminoe (32.4)
5. Jim Bridger[b] (2000.0)	

Coal Mines (U = Underground, S = Strip)

1. Bighorn #1 - S	11. Seminoe #2 - S
2. Welch - S	12. Rosebud #4 - S
3. Sorensen - S	13. Dave Johnston - S
4. Elkol - S	14. Grass Creek - S
5. Rainbow #8 - U	15. Roncco - U
6. Wyodak - S	16. Rosebud #5 - S
7. Belle Ayr - S	17. Seminoe #1 - S
8. Jim Bridger - S	18. Medicine Bow - S
9. Vanguard #3 - U	19. Vanguard # - U
10. Vanguard #2 - U	20. Rimrock - S

Oil Refineries (Capacity in bbl/day)

1. Sage Creek Refinery Co. (1 000)	7. Texaco Inc. (21 000)
2. Husky Oil Co. (10 800)	8. Amoco Oil Co. (43 000)
3. Husky Oil Co. (23 600)	9. Little America Refining Co. (24 500)
4. Tesoro Petroleum Corp. (10 000)	10. Mountaineer Refining Co., Inc. (700)
5. C & H (450)	11. Southwestern (500)
6. V-1 Oil Co. (1 000)	12. Pasco, Inc. (49 000)

Gas Processing Plants (Capacity in mcf per day)

Company	Plant Name	County
Amoco Production	Beaver Creek (65 000)	Fremont
	Elk Basin (17 000)	Park
Apex Co.	Recluse (13 000)	Campbell
Atlantic Richfield	Gillette (31 000)	Campbell
	Riverton Dome (30 000)	Fremont
	Joe Creek (2 000)	Campbell
CRA, Inc.	Lazy B (5 000)	Campbell
Champlin Petroleum	Brady (65 000)	Sweetwater
	Patrick Draw (30 000)	Sweetwater

Chevron Oil	Birch Creek (20 000)	Sublette
Cities Service	H. A. Creek (10 000)	Campbell
Colorado Interstate	Patrick Draw (10 000)	Sweetwater
	Rawlins (220 000)	Carbon
Continental Oil	Sussex (15 000)	Johnson
Energy West Ltd.	Manderson (2 000)	Big Horn
	Medicine Bow (2 000)	Albany
Ginther Gas Plants	Rozet (5 000)	Campbell
	Springen Ranch (8 000)	Campbell
Ginther-Inexco	Douglas (20 000)	Converse
Husky Oil Co.	Ralston (6 600)	Park
KS-NB Natural Gas	Flat Top (8 000)	Converse
	Casper Plant (80 000)	Natrona
Marathon Oil Co.	McFadden (3 000)	Carbon
McCulloch Gas Proc. Corp.	Hilight (60 000)	Campbell
	Jamison Prong (6 000)	Campbell
	Oedekoven (12 500)	Campbell
	Rocky Point (6 000)	Campbell
	Well Draw (3 000)	Converse
Montana-Dakota Utilities Co.	Riverton East (20 000)	Fremont
Mountain Fuel Supply	Church Buttes (100 000)	Uinta
Northwest Pipeline	Opal (250 000)	Lincoln
Amoco	Bairoil (4 000)	Sweetwater
	Wertz (5 000)	Carbon
Phillips Petroleum	Douglas (100 000)	Converse
Quasar Energy Co.	Spearhead Ranch (21 000)	Converse
Union Oil Co. Of California	Worland (50 000)	Washakie

[a]Sources for Fig. 39 and Table XVIII: FPC,[18,27] BOM,[21] API,[19,20] Oil and Gas Journal,[23] Glass,[8] Glass et al.,[37] Western Oil Reporter.[22]

[b]Partly under construction.

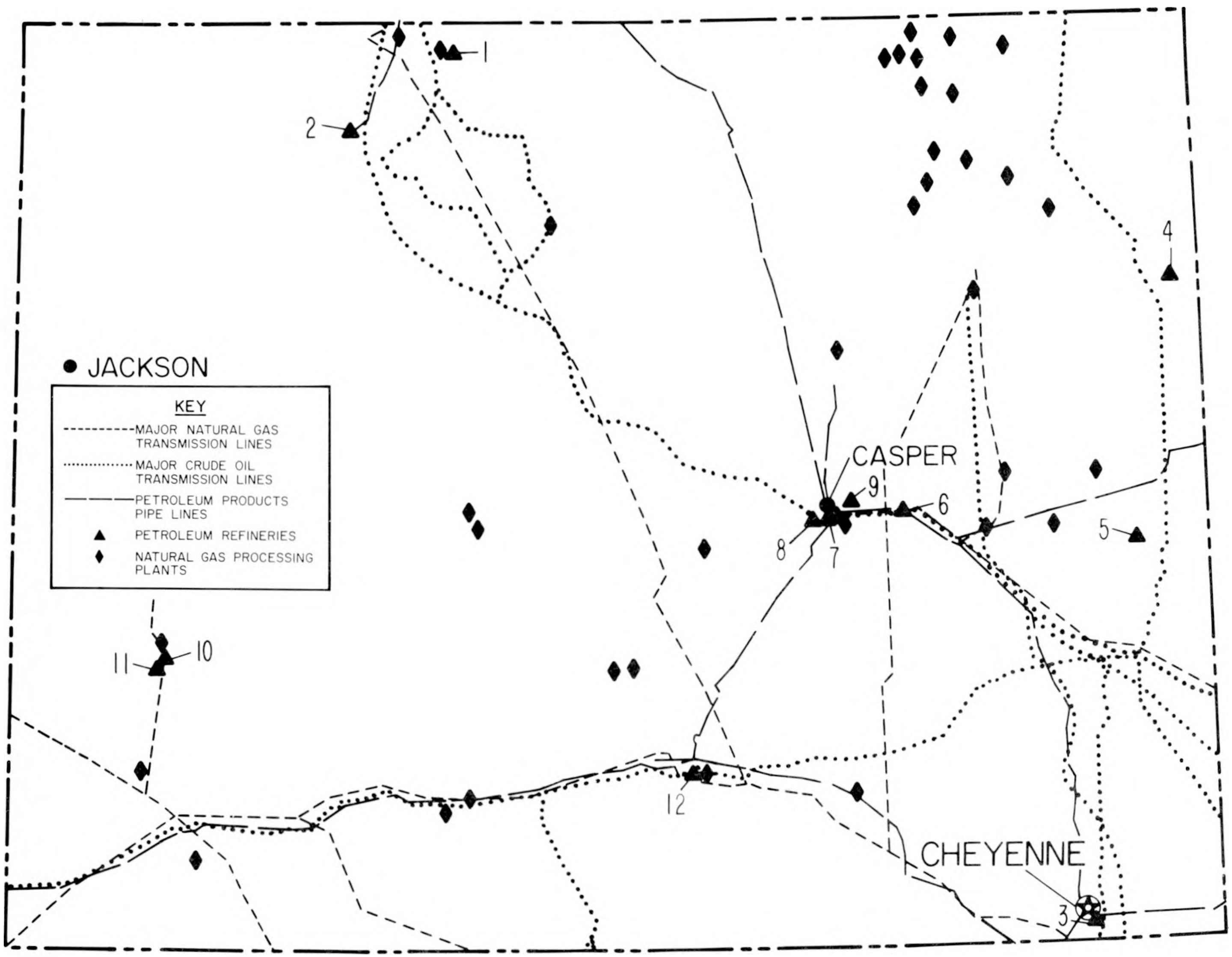

Fig. 39a.
Principal energy facilities of Wyoming.

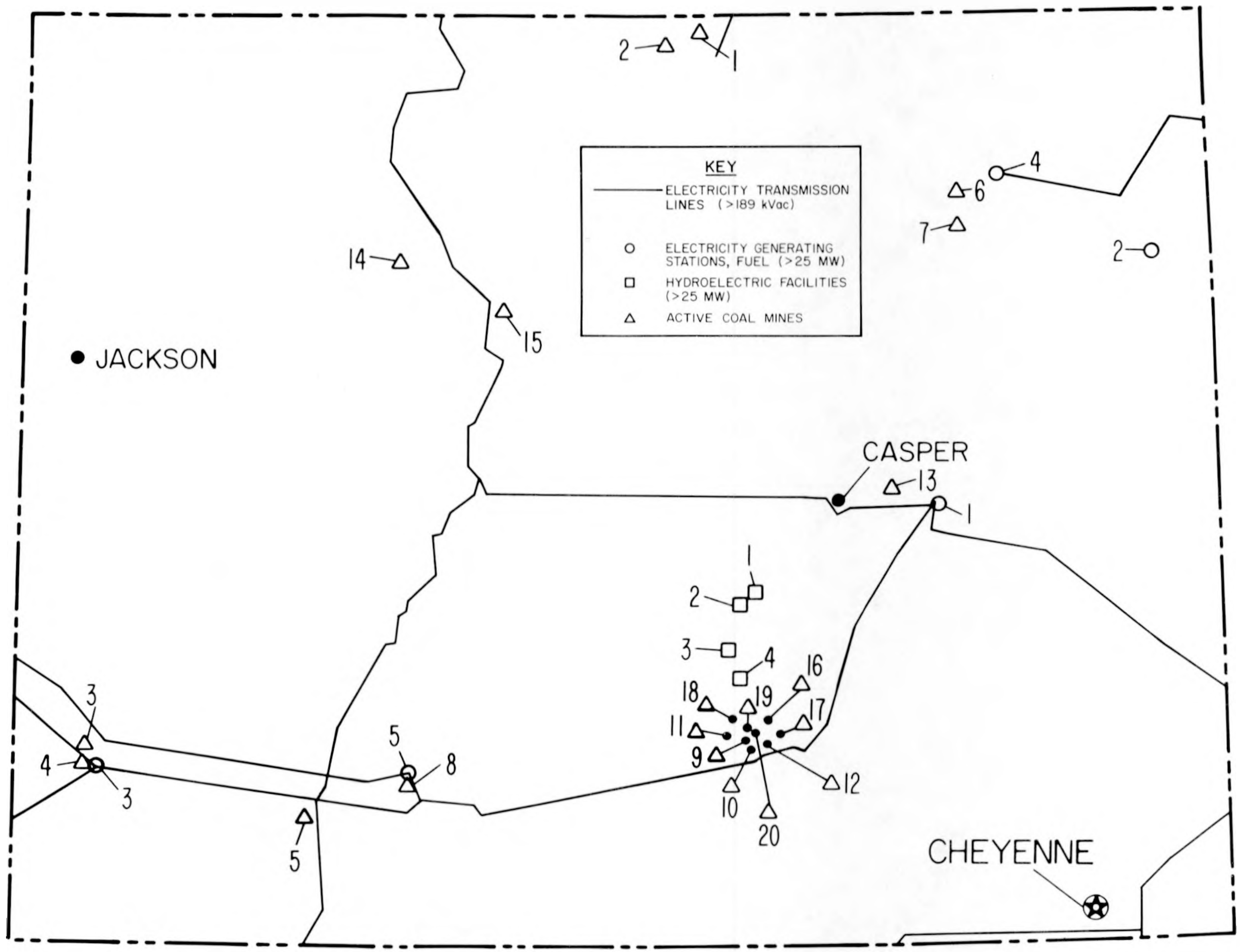

Fig. 39b.
Principal energy facilities of Wyoming.

APPENDIX A:

URANIUM "FUEL VALUE"

Comparing tonnes of U_3O_8 to joules of fossil fuels is like comparing apples to oranges. To facilitate the comparison of uranium to fossil fuels, an analysis was performed to assess the total *heat* energy resulting from the eventual use of a tonne of uranium in a conventional nuclear power reactor. Figure A-1 schematically depicts the current uranium fuel cycle from mining uranium ore, to milling into U_3O_8 or "yellowcake,"* to eventual processing into fuel elements for use in generating electricity.

A fairly detailed analysis of the uranium fuel cycle given in Ref. 38 has been adapted for this assessment. Natural uranium contains several different types, or isotopes, of uranium, the principal ones being ^{235}U and ^{238}U. Natural uranium usually contains 0.7115% ^{235}U; however, light-water reactors require a uranium fuel enriched to several per cent ^{235}U. As indicated in figure A-1, before enrichment is possible the U_3O_8 must be converted to UF_6. In this conversion, approximately 0.5% of the uranium is lost.[38] This UF_6 feed is then enriched to several per cent ^{235}U. A typical enrichment of 2.56% ^{235}U is used here, with tailings from the diffusion plants containing 0.2% ^{235}U.

Energy is used for all phases of uranium processing but is significant only in the enrichment process.[39] Typically, 8.665 MWh[39] of electricity are required for this enrichment to produce a kilogram of uranium fuel from natural uranium. This kilogram of enriched fuel typically produces 660 MWh of heat (not electricity) in a light-water reactor, yielding a spent fuel containing 96.25% of the original uranium but with only 0.643% of that as ^{235}U (once again, these are typical numbers from Ref. 38). After chemical reprocessing, which removes fission products and transuranium isotopes, this fuel can be converted into UF_6 feed, losing only 1.3% in the conversion process. And then, by expending 0.170 MWh[39] of electricity per kilogram uranium (as UF_6), this feed may be brought up to the ^{235}U enrichment of natural uranium. In actual practice, this last step is usually substituted by mixing the reprocessed UF_6 with natural feed and enriching the mixture to the desired end product.

The above analysis can be represented by the following equation:

1 kg U (in the form of UF_6, at 0.7115% enrichment) $\xrightarrow{-6.75 \times 10^9\ J}$

0.217 kg U (in the form of UO_2, at 2.56% enrichment) $\xrightarrow{+5.14 \times 10^{11}\ J}$

0.208 kg U ("burnt-up" fuel, at 0.643% enrichment) $\longrightarrow$

0.206 kg U (in the form of UF_6, at 0.643% enrichment) $\xrightarrow{-1.26 \times 10^8\ J}$

0.178 kg U (in the form of UF_6, at 0.7115% enrichment),

implying that 5.075×10^{11} J are liberated in the use of 0.822 kg U in the form of UF_6. But 1.185 kg U_3O_8 are required to produce 1 kg U in the form of UF_6. Therefore, a tonne of U_3O_8 results in the eventual liberation of 0.521 QJ of heat energy in a light-water reactor. This number is of course only typical, because exact values depend upon a particular reactor design and the specific use of the fuel cycle byproducts.

*The output of uranium mills, termed yellowcake (or concentrate), is generally only 75-85% U_3O_8.[38]

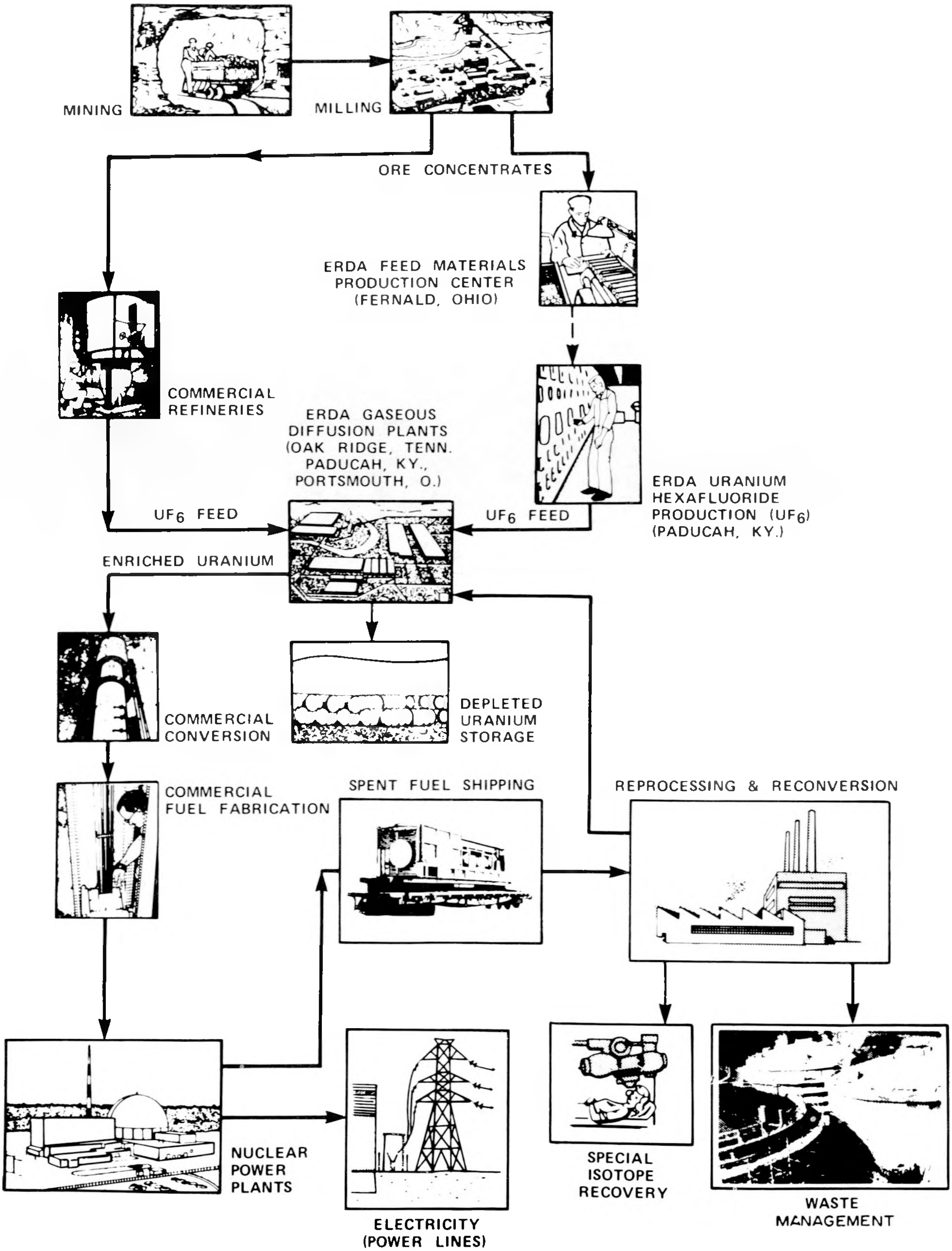

Fig. A-1.
The uranium fuel cycle (without plutonium recycle).

APPENDIX B

CONVENTIONAL DIFFERENCES BETWEEN 1974 AND 1975 REFERENCE ENERGY SYSTEMS

Substantial differences in conventional notation between a 1974 statistical analysis of the Rocky Mountain energy system[1] and this report make it instructive to discuss briefly some of the differences in the ways the regional energy system structure has been abstracted in these two analyses. Fig. B-1 is the 1975 reference energy system for the Rocky Mountain region, and Fig. B-2 is its 1974 counterpart, published in Ref. 1. Some basic differences between Fig. B-1 and Fig. B-2 are enumerated below.

- Units: Quadrillion joules (QJ) are used in Fig. B-1, as opposed to trillion Btu's (TBTU) in Fig. B-2.
- Exports: In Fig. B-1, *net* exports are used, whereas in Fig. B-2 either net exports are used or imports and exports are separately reported.
- Consumption: In Fig. B-2, consumption is broken down into more detail by end use than in Fig. B-1. Such a detailed breakdown was not used in this report because of the current difficulty in producing a reliable breakdown.
- Uranium and wood: Uranium and wood included as energy forms in Fig. B-1 were omitted in Fig. B-2.
- Inventory changes are implicit in Fig. B-2, whereas they have been explicitly represented in Fig. B-1.
- Coal transport: A different breakdown of coal transportation modes has been used in the two figures. It is felt that the breakdown in Fig. B-1 is more realistic.
- Natural gas processing: The reader will note that in this part of Fig. B-2 there should be an additional link for unprocessed gas. This has been combined with "Residual Gas Separation" into the category "Processing: Other/None" in Fig. B-1. Further, in Fig. B-1, more detail is provided in the liquids extraction process.
- Oil transport: In contrast to Fig. B-2, petroleum products and crude oil transport in Fig. B-1 are broken down by transport mode. Different data sources have been used for the breakdown, the 1975 data coming from annual reports of oil pipeline companies, and the 1974 data from the Bureau of Mines (refer to Appendix C).
- Oil Refining: All natural gas liquids were considered inputs to the refining link in Fig. B-1, whereas in Fig. B-2 they enter the oil subsystem after refining. Because some liquids are used as refinery inputs and some are not, neither approach is entirely correct.
- Petroleum products distribution: In Fig. B-1, products distribution has been broken down by individual products, as opposed to the aggregation in Fig. B-2. And Bureau of Mines data has been used in Fig. B-1 as opposed to primarily FEA data in Fig. B-2. In some cases there are considerable differences between these two sources.
- Oil consumption: Different techniques were used in Figs. B-1 and B-2 for breaking down Bureau of Mines data. Consequently, the data for the two years are not easily comparable. Refer to Appendix C of this report and the appendix of Ref. 1 for more details.

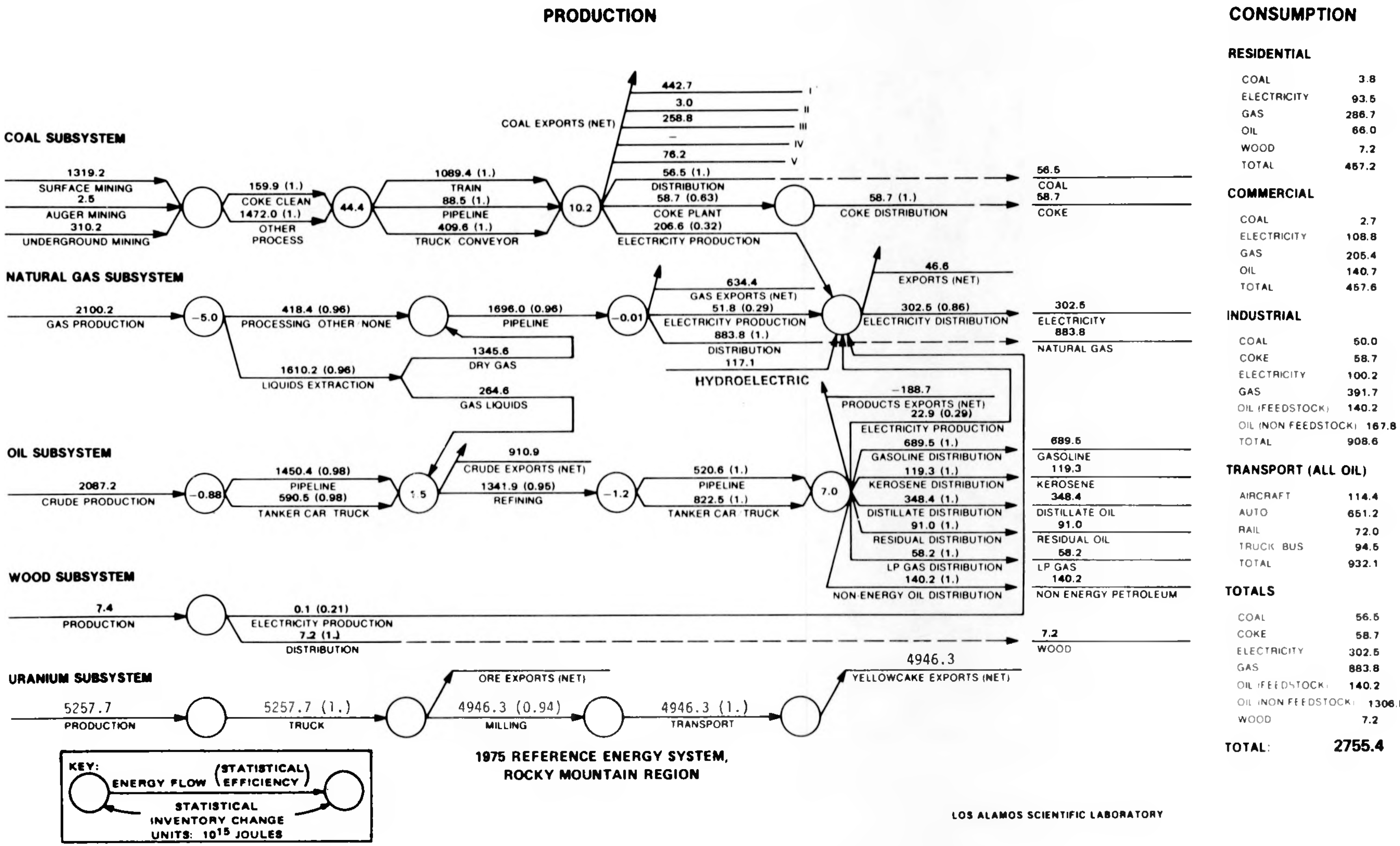

Fig. B-1.
1975 reference energy system, Rocky Mountain region.

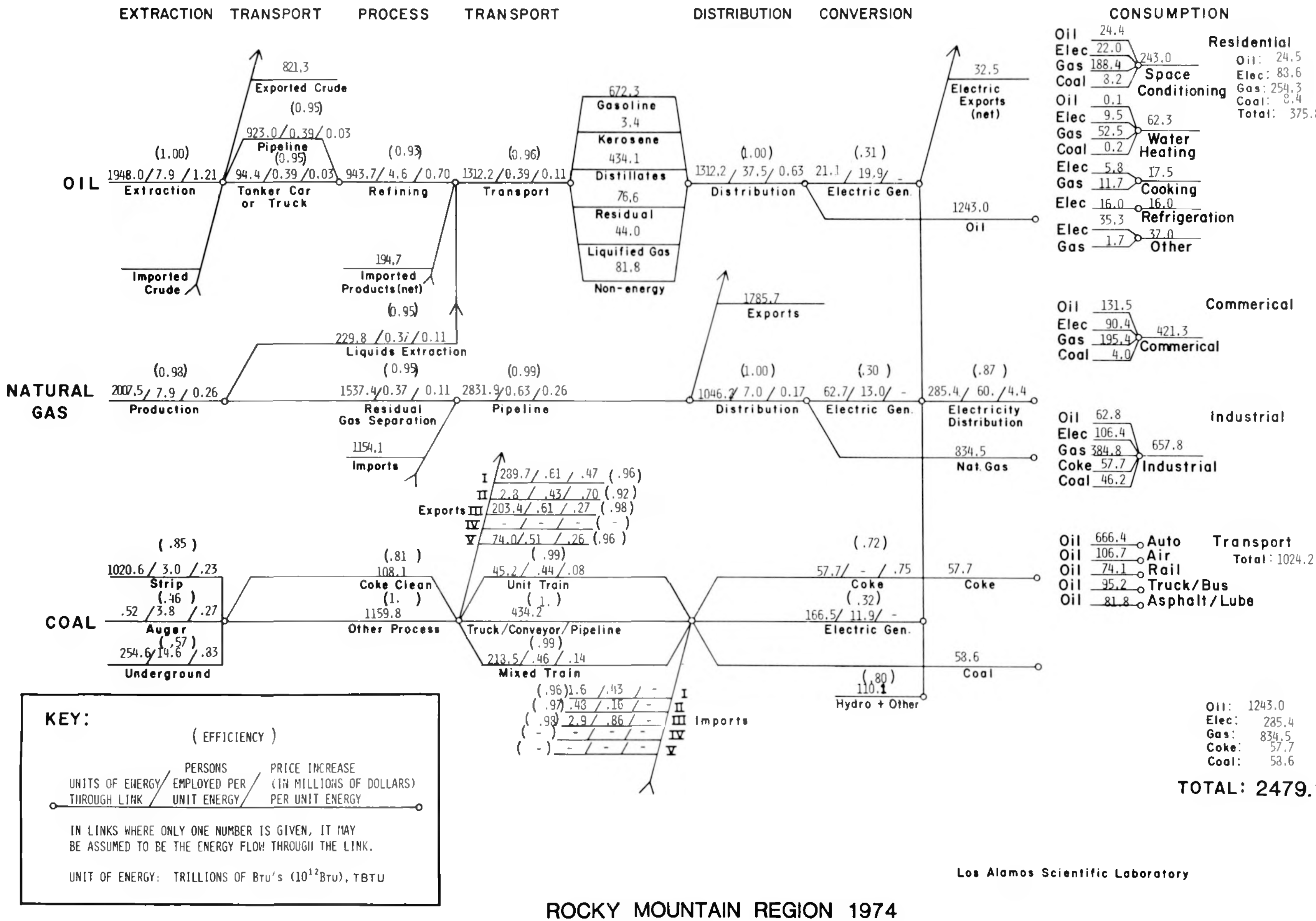

Fig. B-2.
1974 reference energy system, Rocky Mountain region. (Source: LASL[1])

APPENDIX C

REFERENCE ENERGY SYSTEM DATA SOURCE DOCUMENTATION

The purpose of this appendix is to document and explain the manner in which the energy-flow, employment, and price data on the state and regional reference energy system diagrams were obtained, what calculations were performed, and what sort of pitfalls one is likely to encounter in using the data. A sample reference energy system diagram is presented in Fig. C-1 with a code number assigned to each data slot. In the subsequent text, these code numbers are used to reference the relevant portion of the diagram

Data Entry (Fig. C-1)	Documentation
1,4,7	Coal production data were generally obtained by a three-step process: first, a detailed list of operating mines in each state was compiled; second, an average heat content for the coal from each mine was established; and finally, the 1975 production (in tons) from each mine was determined. This technique has permitted a fairly accurate determination (although the accuracy varies from state to state) of state coal production in terms of energy units. Heat content data for each coal mine was obtained from separate sources for each state: Arizona,[40] Colorado, [25,41,42] Montana,[21,43,44] New Mexico,[40,43,45] Utah,[43,46,47] and Wyoming.[43,48] Mine-by-mine production quantities were also obtained from different sources for each state: Arizona,[49] Colorado,[25] Montana,[50] New Mexico,[49,51] Utah,[52] and Wyoming.[53,54]
2,5,8	For the most part, coal-processing facilities are considered an integral part of a coal mine, at least for the purposes of statistical reporting. Consequently, employment in coal processing has been included in coal mining. Furthermore, when mines are associated with mine-mouth power plants, transport to the power plant has for the same reason been included with mining. Employment data were derived from different sources for the various states: Arizona,[55] Colorado,[25] Montana,[50] New Mexico,[56] Utah,[57] and Wyoming.[53,54]
3,6,9	For reasons similar to those described in entry (2) above, the value* increase for processing and for mine-mouth power plant transportation has been included with coal mining. Prices for steam coal are readily available because all FPC-regulated power plants must report the prices they pay for fuels. Coal produced by captive mines (i.e., a mine whose coal production is consumed almost entirely within the company, with very little being sold) is much more difficult to value. This is compounded by the fact that such coal almost invariably is coking coal, whose price varies considerably and is closely guarded. Nevertheless, the price of coking coal produced in New Mexico was deduced to be $29.36 per tonne in 1975.[40,58] Values for noncoking coal production in the state came from Ref. 40. The value of production in Colorado, Montana, and Utah was taken from Ref. 59. Colorado value was allocated to surface (including auger) and underground on the basis

*In this report, "value" is equivalent to market value (price times quantity).

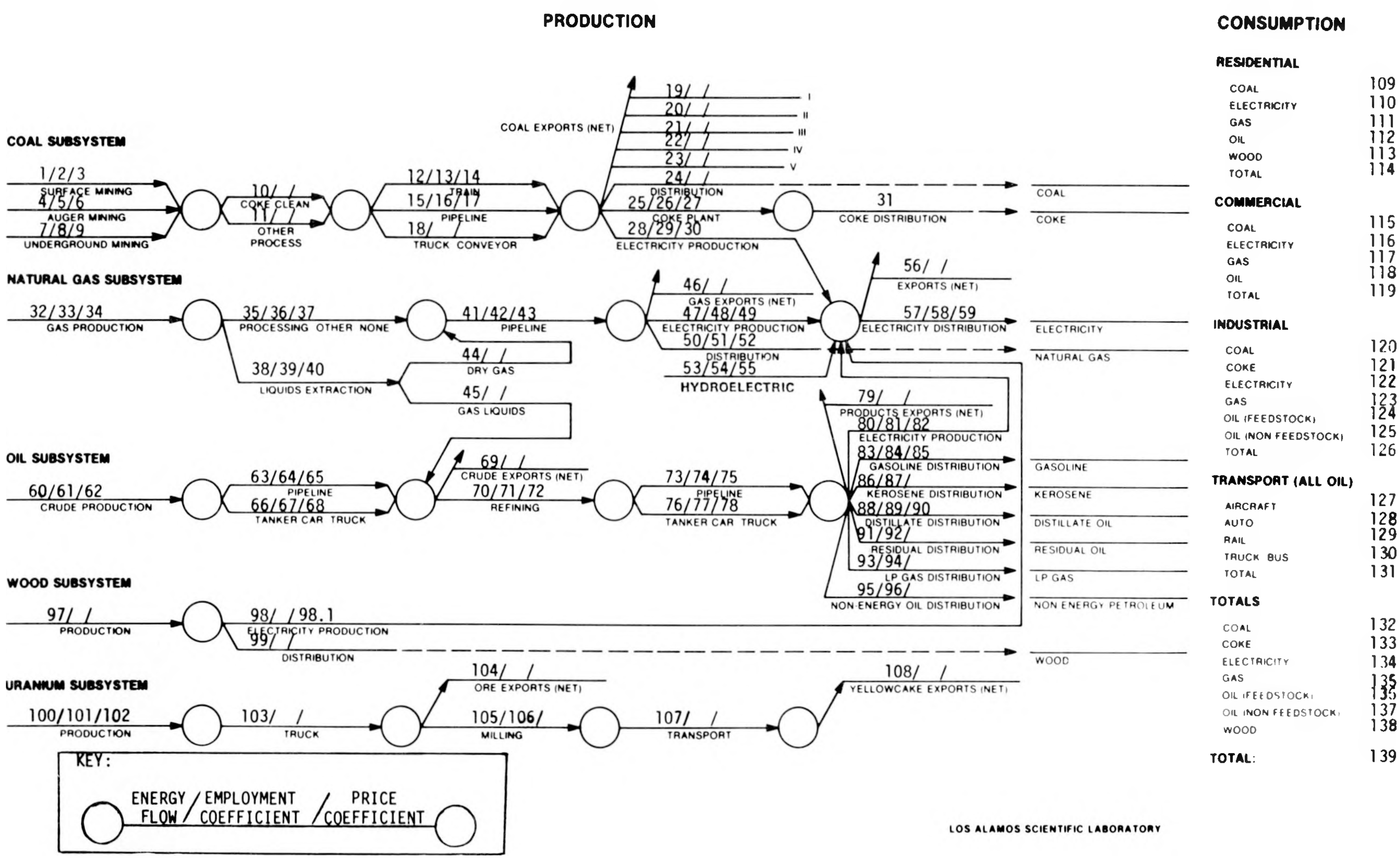

Fig. C-1.
Numerical key for data.

of 1974 prices.[13] The value of underground production in Wyoming was determined mine by mine using New Mexico coking coal prices, average state coal prices,[60] and data from Ref. 40. Surface coal value in Wyoming then follows from Ref. 60. CIF power-plant prices for all Arizona coal were available from Ref. 40. Adjusting this for transport value,[61] the total FOB mine value in Arizona was obtained.

4 Refer to entry (1).

5 Refer to entry (2).

6 Refer to entry (3).

7 Refer to entry (1).

8 Refer to entry (2).

9 Refer to entry (3).

10 This number refers to the actual amount of coking coal produced in a state. This is not quite the actual amount of coking coal processed, because some coal is shipped across state lines for processing. State totals represent the total production from mines known to produce coking-quality coal, with that information generally coming from the same source as the coal heat content discussed in entry (1).

11 Total coal production less entry (10).

12,15,18 Except for Arizona pipeline shipments, where data were obtained from Ref. 61, transport data were obtained from Refs. 40 and 62 and coal heat content data from Ref. 40, except in some cases where actual source mines were known—in which case actual mine heating values were used (refer to entry 1).

13,16 Employment data for train transport are not available because of the difficulty in allocating the railroad industry's employment to coal transport. Employment data for the Black Mesa Pipeline were available.[63]

14,17 In the case of the Black Mesa Pipeline Company, transport value was obtained from Ref. 61. For rail transport, coal movements were obtained as described in entry (12). In terms of these movements, published rail tariffs (in most cases) were used to determine coal transport value. In the cases of Montana and Wyoming, where almost all coal is consumed by steam-electric power plants, the difference between CIF power plant prices[40] and FOB mine prices (refer to entry 3) was assumed to be caused by transportation.

15 Refer to entry (12).

16 Refer to entry (13).

17 Refer to entry (14).

18 Refer to entry (12).

19,20,21, 22,23 These entries are *net* exports, with data sources the same as described in entry (12).

24 This entry comprises all coal in the "Retail Dealers" and "Other" categories in Ref. 62.

25 Input to coke plants was obtained from Ref. 62 with the exception of Wyoming, in which case all output from the Rainbow #8 mine was assumed to be coke oven input.[8] Coke production from Colorado, Utah, and California[64] was allocated to those states on the basis of coking

coal consumption. The heat value of pure carbon (33 700 joules/gram) was assumed for coke.[1]

26 Employment data for coke plants were not available.

27 Assuming a coking coal value (FOB mine) of $29.36/tonne (refer to entry 3), coal transport value as discussed in entry (14), and a coke price of $127.32/tonne, a value increase owing to coking was obtained. The value of coke ($127.32/tonne) was the average value in 1975 in St. Louis.[64,65]

28,47,53, 80,98 Deliveries of fuel to power plants[40] was used in conjunction with actual fuel consumption[66] to obtain a fuel inventory change. FPC power production data[66,67] was then used to determine efficiencies and net energy through the link. The FPC category "Other" was assumed to be wood[68] with a generation efficiency of 0.21 as described in appendix G.

29,48,54, 58,81 Employment in the electricity industry was assumed to be employment in the standard industrial classification (SIC)[69] category 491 and part of SIC 493. SIC 493 is combined electric and gas service (within the same company).[69] Data for various SIC categories were obtained from state Employment Security Commissions[70-76] except in the case of Montana. For Montana, in general, employment data from previous years[1] were extrapolated to 1975 and supplemented by some 1975 data, primarily at the two-digit SIC level.[77,78]

SIC 493 (combined gas and electric) was allocated to gas service and electric service differently for each of the states. For Arizona, the fractional breakdown for Arizona Public Service[79] and Tucson Gas and Electric[80] was applied to all of SIC 493 in the state. For Colorado, the Public Service Company of Colorado's breakdown[81] was similarly used. The Idaho and Nevada breakdowns were assumed to be the same as the SIC 491/SIC 492 allocation in the corresponding state. For Montana, Montana-Dakota Utilities and Montana Power were assumed to be the only companies in SIC 493, and employment was correspondingly allocated.[82,83] New Mexico and Utah have no industries in SIC category 493. Wyoming employment in SIC 493 was allocated equally to gas and electric. Total employment in the electricity industry was then computed for each state and this total allocated to production and distribution by the ratio 406:594. This ratio was determined by a survey, by no means comprehensive, of utilities operating in the region.* Employment per unit energy produced was assumed the same for all generation types.

30,49,55, 82,98 The Edison Electric Institute's "Large Industrial" category of electricity consumer[97] was considered to pay approximately the wholesale electricity price. This, coupled with fuel cost data[40] and electrical generation efficiencies (refer to entry 28), permitted the calculation of a value increase owing

*Lamar Utilities Board[84]; Mt. Wheeler Power[85]; City of Farmington[86]; Public Service Company of New Mexico[87]; City of Boulder City, Nevada[88]; US Dept. of the Interior, Bureau of Reclamation, Upper Missouri Region[89]; US Dept. of the Interior, Bureau of Reclamation, Upper Colorado Region[90]; US Dept. of the Interior, Bureau of Reclamation, Lower Colorado Region[91]; Arizona Public Service Co.[79]; Pinal County Electrical Dist. No. 5[92]; Tucson Gas and Electric Co.[80]; Public Service Co. of Colorado[81]; Sierra Pacific Power Co.[93]; Pacific Power and Light Co. (Idaho, Montana, and Wyoming operations)[94]; Platte River Power Authority[95]; and the Raton Public Service Co.[96]

to generation. Wood was assumed to have no cost as a fuel.

31 This was assumed to be equal to entry (25).

32 Data taken from Refs. 98 and 99, utilizing a heat value of 1.165 x 10^9 joules/mcf.[100]

33,61 Because oil and gas production are classified together in the standard industrial classification scheme,[69] total employment in oil and gas (SIC 13)[70,71,73-77] was allocated to oil and gas on the basis of state production in QJ's of those two fuels.

34 Total value was taken from Ref. 99 and divided by production (entry 32).

35 The total amount of energy processed, other than through processing plants, is the total amount into the pipeline less entry (44). Total input to the pipeline is entry (41) plus pipeline fuel.[99]

36,39 Included with entries (33), (42), and (51).

37,40 This is the value of the natural gas liquids produced (from Ref. 101, on the basis of state extraction loss) less the value of lease and plant fuel and extraction loss,[99] all divided by the total gas processed (sum of entries 35 and 38).

38 Sum of entries (44) and (45).

39 Refer to entry (36).

40 Refer to entry (37).

41 This entry is the sum of net exports[99] and total gas consumption.[99]

42 This is the total state employment in SIC 4922, divided by entry (41). Total employment was obtained from state employment security commissions[70-76] with the exception of Montana, where 1974 data were extrapolated from Ref. 1.

43 Prices paid by the category "Industrial" in Ref. 99 were assumed to represent approximate wholesale prices. This price, less the price contribution owing to gas production and processing (entries 34 and 37), was divided by entry (41) to produce a price increase per unit energy.

44 This represents the sum of the categories "Shipped to Transmission Companies" and "Direct Deliveries to Consumers" in Table 5 of Ref. 99 In Utah and Montana, the total was broken down on the basis of extraction loss in the two states.[99]

45 This entry is total natural gas liquids production from Ref. 101.

46 This entry is the negative of net interstate receipts from Ref. 99.

47 Refer to entry (28).

48 Refer to entry (29).

49 Refer to entry (30).

50 This represents total gas delivered to consumers less that delivered to electricity generation.[97]

51 This represents the total employment in SIC 492 less SIC 4922 plus the gas portion of SIC 493 (refer to entry 29), all divided by entry (50). Employment sources are enumerated in entry (29).

52 This represents the unit value of gas to final consumers (except electricity generation), less entries (34), (37), and (43), each adjusted by the appropriate statistical efficiency.

53 Refer to entry (28).

54 Refer to entry (29).

55 Refer to entry (30).

56 This represents the negative of entry (57) divided by the distribution efficiency, all plus total generation (the sum of entries 28, 47, 53, 80, and 98). A distribution efficiency (including transmission) has been obtained in a manner similar to that described in detail in Ref. 1, p. 43. A transmission/distribution efficiency of 0.86 was obtained from FPC power production[67] (adjusted for electricity imports from Canada[102]) and power consumption[97] in the states of the region plus California, Oregon, and Washington.

57 This represents total electricity consumption data from the Edison Electric Institute.[97]

58 Refer to entry (29).

59 This represents the average unit retail price of electricity to all consumers[97] less the unit wholesale price divided by the 0.86 distribution efficiency (refer to entry 56).

60 Assuming a crude oil heat content of 6.118 x 10^9 joules/barrel,[100] production was obtained from different sources for the various states: Arizona,[100] Colorado,[103] Montana,[104] Nevada,[105] New Mexico,[106] Utah,[35] and Wyoming.[107]

61 Refer to entry (33).

62 The unit value increase is based on production discussed in entry (60), with production values from different sources for each of the states: Arizona,[108] Colorado,[108] Montana,[104] Nevada,[109] New Mexico,[106] Utah,[110] and Wyoming.[60]

63,66 By adjusting production figures for lease inventory changes,[100,111] a figure for total lease shipments is obtained. The total of pipeline shipments is the total amount of crude oil originated by interstate pipelines* in each state (data from annual reports[112] to the Interstate Commerce Commission). The remainder of lease shipments were allocated to the "Tanker Car/Truck" category.

64 Total employment in crude pipelines is assumed to be the same as employment in SIC 4612.[67] Data sources: Refs. 1,70-76.

65,68 Using a 1975 average (weighted by volume) price paid[10] by the refiners Little America, Pasco, and Tesoro of \$8.972/bbl and by Famariss, Navajo, and Plateau of \$9.557/bbl, a regional weighted-average refiner crude price of \$9.164/bbl was obtained. The Famariss, Navajo, and Plateau average was used in New Mexico and Utah, along with state

*Arapahoe Pipe Line Co. (Colorado), Belle Fourche Pipe Line Co. (Wyoming), Butte Pipe Line Co. (Montana, Wyoming), Chevron Pipe Line Co. (Colorado, Utah), Cheyenne Pipe Line Co. (Colorado), Cities Service Pipe Line Co. (New Mexico), Continental Pipe Line Co. (Colorado, Montana, Wyoming), Exxon Pipe Line Co. (Montana), Four Corners Pipe Line Co. (Arizona, Colorado, New Mexico, Utah), Gulf Refining Co. (New Mexico), Kerr-McGee (Arizona), Phillips Pipe Line Co. (New Mexico, Utah), Platte Pipe Line Co. (Colorado, Montana, Wyoming), Portal Pipe Line Co. (Montana), Pure Transportation Co. (Utah, Wyoming), Shamrock Pipe Line Corp. (Colorado), Sohio Pipe Line Co. (New Mexico), Texas/New Mexico Pipe Line Co. (Colorado, New Mexico, Utah), Texas Pipe Line Co. (Montana, New Mexico, Utah), WESCO Pipe Line Co. (Montana), Western Oil Transportation Co. (Montana, New Mexico, Wyoming), Wyco Pipe Line Co. (Wyoming), Mobil Pipe Line Co. (Colorado, Montana, New Mexico, Wyoming), Amoco Pipe Line Co. (Colorado, New Mexico, Utah, Wyoming), Arco Pipe Line Co. (New Mexico), and Marathon Pipe Line Co. (Montana, Wyoming).

wellhead prices (refer to entry 60) to obtain a value increase in those states owing to crude transportation. The Little America, Pasco, and Tesoro averages were similarly used for Montana and Wyoming. The regional average refiner price, along with state wellhead prices, was used for other states in the region. A single number obtained for each state for the crude transport unit value increase has been assigned to entries (65) and (68).

66 Refer to entry (63).

67 Employment data in this category are not available.

68 Refer to entry (65).

69 The net export of crude is the total receipts of crude oil at refineries in the US from the state in question, less refinery receipts of crude (domestic and foreign) within the state.[113]

70 Utilizing refinery crude runs[113] adjusted for stock change,[100,111] a net crude throughput was obtained using a 1974 average regional refinery efficiency of 0.9546. This refining efficiency was obtained from the two tables in Ref. 114 detailing refinery throughput and fuel use. The net refinery crude throughput is then increased by entry (45) to give entry (70).

71 Refining employment was assumed equal to employment in SIC 291 (from Refs. 1, 70-76).

72 On the basis of regional price differences within the US for jobber gas,[11] the IPAA's wholesale products prices[12] were regionalized: \$0.2875/gal for the west (assumed CO, ID, MT, WY) and \$0.2795 for the southwest (assumed AZ, NV, NM, and UT), giving a regional average of \$0.2844 per gallon. These values, coupled with refinery crude prices (refer to entry 65) and refinery efficiencies (refer to entry 70) were used to determine a refinery value increase.

73,76 A petroleum stock change for each state was determined by breaking down the regional product stock change[100,111] by state crude runs.[113] Utilizing this change, an estimate of total input to products transportation was obtained. Total pipeline originations of petroleum products by state for all interstate pipeline companies* were then used to determine pipeline shipments.[112] The remaining shipments were assumed to be by "Tanker Car/Truck."

74 The employment in SIC 4613 was assumed to be all employment in products pipelines. This includes employment with pipelines that pass through a state. For example, the regional average for this entry includes some employment in Idaho, even though no petroleum products originate in Idaho. Data sources: Refs. 1, 70-76.

75,78 A state-by-state average products price after transportation was used by weighting the regional heating oil price of \$13.25/bbl[11] (assumed equal to the regional nonelectric distillate price), the state dealer gasoline price,[13] and prices paid by electric utilities for fuel[40] by, respectively, the state's consumption of distillate

*Chase Transportation Co. (Colorado), Chevron Pipe Line Co. (Utah), Continental Pipe Line Co. (Montana, New Mexico), Gulf Refining Co. (New Mexico), MAPCO, Inc. (New Mexico), Pioneer Pipe Line Co. (Wyoming), Powder River Corp. (Wyoming), Santa Fe Pipe Line Co. (New Mexico), Skelly Pipe Line Co. (Wyoming), WYCO Pipe Line Co. (Wyoming), Yellowstone Pipe Line Co. (Montana), and Amoco Pipe Line Co. (Colorado). See Ref. 112.

oil (other than for electricity generation), gasoline, and oil for electricity generation, obtained respectively from entries (88), (83), and (80). This state average products price was used in conjunction with refinery prices (refer to entry 72) to obtain a value increase owing to products transportation.

76 Refer to entry (73).

77 Employment data in this category were not available.

78 Refer to entry (75).

79 This is the difference between total products shipments (sum of entries 73 and 76) and total products consumption (sum of entries 83, 86, 88, 91, 93, and 95 plus entry 80, divided by the appropriate efficiency).

80 Refer to entry (28).

81 Refer to entry (29).

82 Refer to entry (30).

83 Total gasoline consumption was obtained from the Federal Highway Administration.[115-117]

84,87, 89,92, 94,96 Total employment in SIC 517 (petroleum products distribution[69]) was allocated to the various products on the basis of state consumption of the product (excluding electricity production). Employment in LP gas distribution was further increased by employment in SIC 5984 (natural gas liquids distribution.[69]) Employment in distillate distribution was increased by employment in SIC 5983 (distillate distribution.[69]) The category SIC 554 (service stations[69]) was broken down on the basis of gasoline and special fuels use on highways in the state,[115-117] and correspondingly allocated to gasoline distribution and distillate distribution. Employment data were obtained from Refs. 1, 70-77.

85 This represents the state's gasoline dealer margin.[13]

86 This is kerosene consumption as reported by the Bureau of Mines[118] plus consumption of kerosene jet fuels as reported by the Federal Energy Administration.[119]

87 Refer to entry (84).

88,91 This represents total state consumption of distillate or residual oil excepting consumption for electricity generation.[118]

89 Refer to entry (84).

90 This is a regional average and represents the difference between the heating oil price paid by dealers and retail consumers.[11]

91 Refer to entry (88).

92 Refer to entry (84).

93 This represents the total consumption of liquified petroleum gases excepting consumption for electricity generation. All data are from Ref. 120 except for Montana consumption of fuel for electricity consumption.[40]

94 Refer to entry (84).

95 Consumption of asphalt and road oil[121] was converted to QJ's using 37.4×10^9 joules/ton for asphalt and

38.5 x 10^9 joules/ton for road oil. Daily regional demand for other feedstocks[122] was annualized and allocated to states in the region on the basis of state population.[16] These commodities are considered to constitute total nonenergy oil distribution.

96 Refer to entry (84).

97 The entry is the estimated total wood removed for fuel in the National Forests of the region. Data were obtained by a survey with 91% response (100% response in ID, MT, NV, NM, WY), although many forests reported for fiscal year 1975 rather than calendar year 1975. Details may be found in Appendix G.

98 Refer to entry (28).

99 This was assumed to be entry (97), less entry (98), divided by the appropriate generation efficiency.

100 Refer to Appendix A for a discussion of a technique for converting pounds of U_3O_8 into a fossil fuel equivalent. Ore production in Colorado, New Mexico, Utah, and Wyoming was obtained from Refs. 123 and 124. Unfortunately, Colorado and Utah data were aggregated to protect private company data. The total was broken down on the basis of employment in uranium mining in the two states, which was estimated by subtracting state employment in uranium milling (refer to entry 106) from state employment in SIC 1094[71,75] (uranium mining and milling[69]), adjusting by totals in Ref. 123.

101 Refer to entry (100) for a discussion of the determination of mine employment in Colorado and Utah. Mine employment in New Mexico and Wyoming was obtained from Ref. 123.

102 The 1975 price of yellowcake was obtained for New Mexico from Ref. 125 and for Wyoming (approximate) from Ref. 126. The national average price[127] of $8.45/lb was then adjusted to exclude New Mexico and Wyoming, with a price of $8.20/lb obtained for the residual states. This average was used for Colorado and Utah.

103 This entry is assumed equal to entry (100).

104 Entry (103) less entry (105).

105 Mill production in Colorado, New Mexico, Utah, and Wyoming was obtained from Ref. 123, with the Colorado and Utah total broken down on the basis of milling capacity in the two states.[123]

106 Employment in milling in Colorado, New Mexico, Utah, and Wyoming was obtained from Ref. 123, with the Colorado and Utah total broken down on the basis of state milling capacity.[123]

107 Assumed equal to entry (105).

108 Assumed equal to entry (107).

109,115 In the region, the average ratio of residential gas consumption to commercial gas consumption is 1.4:1 (refer to entry 123). The category "Retail Dealers" in Ref. 62 was split according to this ratio to estimate residential and commercial coal consumption. In most cases, the average heat content of coal of the state of origin (refer to entry 1) was used to convert to QJ's.

110,116,
122 Data were taken from Ref. 97, with street lighting and public use allocated to the commercial sector and interdepartmental sales to the industrial sector.

111,117,
123 Gas consumption data were obtained from Ref. 99, with the category "other" assigned to industrial. The breakdown in Utah between residential and commercial seemed to be in error, apparently because one of the large utilities in that state does not distinguish between residential and commercial consumption in its statistics. The average ratio of residential to commercial gas use in the seven other states in the region is 1.4:1. This ratio was applied to the BOM total residential and commercial use in Utah[99] to obtain a breakdown.

112,118 Ascertaining the use of oil for the residential and commercial categories is not easy. Reference 118 gives a total for sales of distillate heating oil by state. This was assumed to be used entirely by the residential and commercial sectors. Additionally, the BOM[118] reports military oil use, off-highway distillate use, and kerosene use (excluding aviation). These were assumed to be entirely commercial uses. Additionally, nonhighway, nonaviation use of gasoline[116] (primarily agriculture) was considered commercial use. The use of LPG is broken down by the BOM[120] into residential and commercial use and internal combustion engine use. The use for internal combustion engines was considered a commercial use. All these data are broken down as to residential or commercial use except distillate heating oil and noninternal combustion engine LPG use. Residential use of distillate heating oil and LPG was obtained by determining the number of oil-powered water heaters, oil furnaces, LPG water heaters, LPG furnaces, and LPG stoves in each state in the region. These figures were obtained by extrapolating the 1970 Census of Housing[128] data to 1975 on the basis of state population.[16,129] Annual appliance energy consumption, with the exception of furnaces, was obtained from SRI.[6] State annual energy consumption by gas furnaces was assumed to be equal to consumption by oil and LPG furnaces after adjusting for furnace efficiencies.[5] Unit energy consumption in gas furnaces was obtained by subtracting nonfurnace gas appliance (water-heater, stove, and clothes-dryer) energy use from total residential gas use (entry 111). Nonfurnace gas appliance energy consumption was obtained by first determining an adjusted 1975 appliance population as described above and then applying average unit energy consumption given by SRI.[5] In this manner, total residential use of oil and LPG is estimated. Any remaining oil or LPG use, from the BOM categories described above, is assigned to the commercial sector.

113 All wood distributed was assumed to be used in the residential sector.

114 Sum of entries (109), (110), (111), (112), and (113).

115 Refer to entry (109).

116 Refer to entry (110).

117 Refer to entry (111).

118 Refer to entry (112).

119 Sum of entries (115), (116), (117), and (118).

120 This entry is from the category "Other" in Ref. 62. In most cases, an average heat content for the mines of the state of origin (refer to entry 1) was used to convert to QJ's.

121 All coke production was assumed used in the industrial sector.

122 Refer to entry (110).

123 Refer to entry (111).

124 The entry is the same as entry (95).

125 This entry includes all oil and LPG used in the industrial sector. LPG use is from the "industrial" and "miscellaneous" categories in Ref. 120. Oil use is the sum of the following categories from Ref. 118: "Industrial," "Oil Company," "Other," "#5 Residual Heating," "#6 Residual Heating."

126 Sum of entries (120), (121), (122), (123), (124), and (125).

127 This is the sum of kerosene-type jet fuel consumption reported by the FEA[119] and aviation gasoline reported by the Federal Highway Administration.[116]

128 This is the total highway use of gasoline as reported by the Federal Highway Administration.[115,117]

129 This entry is the total railroad consumption of distillate and residual as reported by the BOM.[118]

130 This entry is the total on-highway use of distillate as reported by the BOM.[118]

131 Sum of entries (127), (128), (129), and (130).

132 Sum of entries (109), (115), and (120).

133 Same as entry (121).

134 Sum of entries (110), (116), and (122).

135 Sum of entries (111), (117), and (123).

136 Same as entry (124).

137 Sum of entries (112), (118), (125), and (131).

138 Same as entry (113).

139 Sum of entries (132), (133), (134), (135), (136), (137), and (138).

APPENDIX D

COAL RESOURCES IN THE ROCKY MOUNTAIN REGION

Any mineral resource is generally categorized by the degree of knowledge as to its whereabouts, extent, and characteristics. The resources are further categorized as to their extraction economics. Those resources are considered reserves that have been identified and are considered economically extractable. These reserves are further delineated by the degree of certainty with which they have been identified. Figure D-1 indicates the various potential resources categories used by the Department of Interior.

Using this classification scheme, Averitt[132] has estimated the total US coal resources by state as of January 1, 1974. Appropriate data from this source for the Rocky Mountain region may be found in Table D-I. Note that total regional coal resources are significant, amounting to over half of total US resources and over 10% of total world coal resources. However, because a compilation of resources does not really address the economic recoverability of the mineral, resource estimates are not as significant for many applications as reserve estimates. The Bureau of Mines has applied recoverability formulas* to the measured and indicated reserves (i.e., excluding inferred coal) to define a coal reserve base in the western US. They estimate this to be approximately 22% of the total coal reserves in the west.[133] This reserve base is delineated by county and coal bed and is as of January 1, 1974. To determine the coal reserve base by coal region, the Rocky Mountain states have been divided into 25 areas mapped in Fig. D-2 and listed in Table D-II. Those coal resource areas of the region in which there is no coal reserve base have been omitted. Table D-III gives state summaries of the reserve base. The base is given in Tables D-IV through D-IX in detail by state, county, coal rank, mining type, and resource area, and in Table D-X by state, resource area, coal rank, and mining type for the region as a whole.

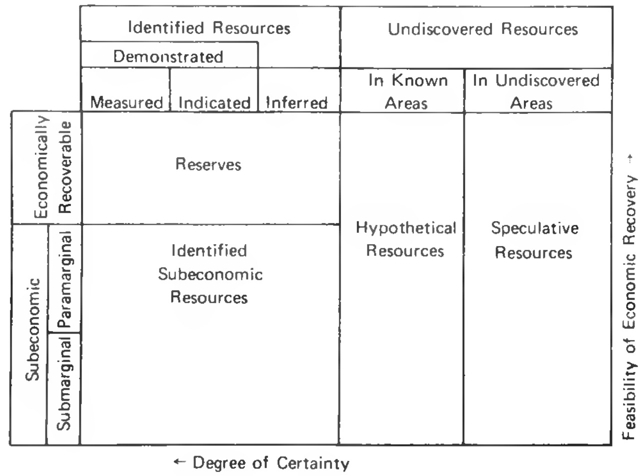

Fig. D-1.
US Department of the Interior classification scheme for mineral resources (Adapted from Matson et al.[130] and Elston[131])

*Recoverability formulas are very important. The formulas are of necessity almost always rule-of-thumb, which in some cases distorts considerably the actual reserves in an area.

TABLE D-I

ESTIMATED REMAINING COAL RESOURCES AS OF JANUARY 1, 1974[a]

	Identified Resources							
	Bituminous	Sub-Bituminous	Lignite	Anthracite and semi anthracite	Total Identified Resources	Hypo-thetical Resources	Specu-lative Resources[b]	Total Resources
Arizona	19 263	[c]	---	---	19 263	---	---	19 263
Colorado	98 989	17 901	18	71	116 979	276 900	---	393 908
Idaho	---	---	---	---	---	---	---	---
Montana	2 086	160 407	102 077	---	264 569	163 300	---	427 861
Nevada	---	---	---	---	---	---	---	---
New Mexico	9 750	45 939	---	4	55 693	126 600	---	182 295
Utah	21 034	157	---	---	21 191	51 700	---	72 900
Wyoming	11 524	111 801	---	---	123 325	725 700	---	849 069
Region	162 646	336 205	102 095	75	601 020	1 344 277	---	1 945 296
US	677 987	440 677	433 754	17 837	1 570 255	2 029 700	---	3 599 930
World[d]					5 800 000	9 300 000	---	15 100 000

Units: 10^6 tonnes.

[a]Source: Averitt.[132]

[b]Averitt assumes all coal areas are known.

[c]Included with bituminous.

[d]Original resources.

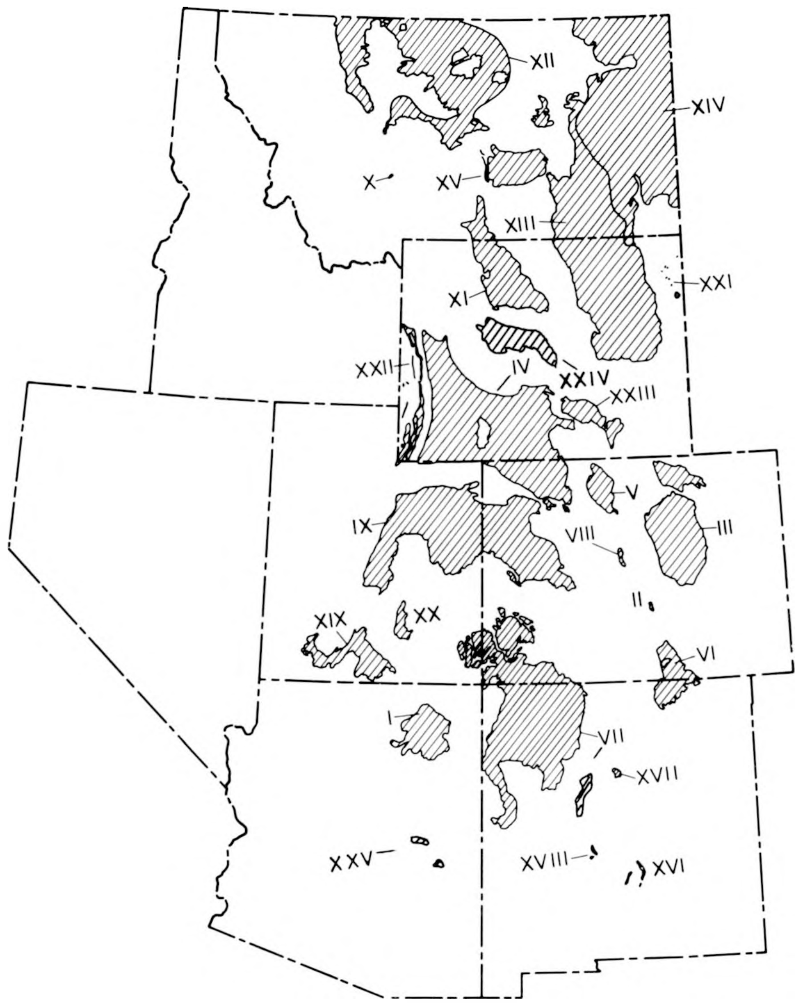

Fig. D-2.
Principal coal reserve areas of the Rocky Mountain region.

TABLE D-II

COAL RESOURCE AREAS[a]

Region	Region Name
I	Black Mesa (Arizona)
II	Canon City (Colorado)
III	Denver Basin (Colorado)
IV	Green River Region (Colorado, Wyoming)
V	North Park (Colorado)
VI	Raton Basin (Colorado, New Mexico)
VII	San Juan Basin (Arizona, Colorado, New Mexico, Utah)
VIII	South Park (Colorado)
IX	Uinta Region (Colorado, Utah)
X	Lombard Field (Montana)
XI	Bighorn Basin (Montana, Wyoming)
XII	North-Central Region (Montana)
XIII	Powder River Basin (Montana, Wyoming)
XIV	Fort Union Region (Montana)
XV	Bull Mountain Field (Montana)
XVI	Sierra Blanca Field (New Mexico)
XVII	Cerrillos Field (New Mexico)
XVIII	Jornada del Muerto Area (New Mexico)
XIX	Southwestern Utah (Utah)
XX	Henry Mountains Field (Utah)
XXI	Black Hills Region (Wyoming)
XXII	Hams Fork Region (Wyoming)
XXIII	Hanna/Rock Creek (Wyoming)
XXIV	Wind River Region (Wyoming)
XXV	Pinedale Field (Arizona)

[a]Source: *Keystone Coal Manual*[43] and Trumbeli.[134]

TABLE D-III

ROCKY MOUNTAIN REGION COAL RESERVE BASE BY STATE

(Source: BOM[130])

State	Rank	Deep: 10^6 Tonnes	Deep: QJ (10^{15} Joules)	Deep: Avg Heat Content (J/g)	Surface: 10^6 Tonnes	Surface: QJ (10^{15} Joules)	Surface: Avg Heat Content (J/g)
Arizona	Sub-bituminous				317.51	7 512.6	23 660
Colorado	Anthracite	25.17	744.2	29 567			
	Bituminous	8 369.79	228 935.1	27 353	789.25	20 431.3	25 887
	Sub-bituminous	4 304.87	104 129.8	24 189			
Total		12 699.83	333 809.1	26 285	789.25	20 431.3	25 887
Montana	Bituminous	1 248.36	29 467.3	23 605			
	Sub-bituminous	58 467.98	1 218 944.7	20 848	32 172.21	631 811.6	19 638
	Lignite				6 439.13	105 973.9	16 458
Total		59 716.34	1 248 412.0	20 906	38 611.34	737 785.5	19 256
New Mexico	Anthracite	2.09	61.3	29 330			
	Bituminous	1 385.46	39 481.8	28 497	226.80	5 975.4	26 347
	Sub-bituminous	550.65	14 425.5	26 197	1 821.91	48 087.1	26 394
Total		1 938.20	53 968.6	27 845	2 048.71	54 062.5	26 389
Utah	Bituminous	3 429.56	83 203.7	24 261	237.68	5 565.1	23 414
Wyoming	Bituminous	4 104.1	100 711.1	24 539			
	Sub-bituminous	22 643.93	452 043.0	19 963	21 631.98	421 631.8	19 491
Total		26 748.03	552 754.1	20 665	21 631.98	421 631.8	19 491
Region	Anthracite	27.26	805.5	29 549			
	Bituminous	18 537.27	481 799.0	25 991	1 253.73	31 971.8	25 501
	Sub-bituminous	85 967.43	1 789 543.0	20 817	55 943.61	1 109 043.1	19 824
	Lignite				6 439.13	105 973.9	16 458
Total		104 531.96	2 272 147.5	21 736	63 636.47	1 246 988.8	19 596

TABLE D-IV

ARIZONA COAL RESERVE BASE
(Source: BOM[130])

County	Coal Area	Rank	Deep			Surface		
			10^6 Tonnes	QJ (10^{15} Joules)	Avg Heat Content (J/g)	10^6 Tonnes	QJ (10^{15} Joules)	Avg Heat Content (J/g)
Apache	Black Mesa	Sub-bituminous				19.05	395.2	20 743
Coconine	Black Mesa	Sub-bituminous				31.75	753.9	23 743
Navajo	Black Mesa	Sub-bituminous				266.71	6 363.5	23 859
Total						317.51	7 512.6	23 660

TABLE D-V

COLORADO COAL RESERVE BASE
(Source: BOM[130])

County	Coal Area	Rank	Deep: 10^6 Tonnes	Deep: QJ (10^{15} Joules)	Deep: Avg Heat Content (J/g)	Surface: 10^6 Tonnes	Surface: QJ (10^{15} Joules)	Surface: Avg Heat Content (J/g)
Adams	Denver Basin	Sub-bituminous	111.26	2 243.1	20 161			
Arapahoe	Denver Basin	Sub-bituminous	63.61	1 650.8	25 952			
Archuleta	San Juan Basin	Bituminous	83.55	2 403.4	28 766			
Boulder	Denver Basin	Sub-bituminous	148.09	3 428.1	23 149			
Delta	Uinta Region	Bituminous	59.69	1 811.9	30 355			
		Sub-bituminous	185.94	5 243.8	28 202			
Douglas	Denver Basin	Sub-bituminous	4.60	119.4	25 957			
Elbert	Denver Basin	Sub-bituminous	225.72	3 322.6	14 720			
El Paso	Denver Basin	Sub-bituminous	112.39	2 276.4	20 254			
Fremont	Canon City	Bituminous	163.58	4 282.3	26 179			
Garfield	Uinta Region	Bituminous	501.66	14 138.4	28 183			
Gunnison	Uinta Region	Bituminous	631.91	18 582.9	29 408			
		Anthracite	25.17	744.2	29 567			
		Sub-bituminous	199.62	5 793.4	29 022			
Huerfano	Raton Basin	Bituminous	252.49	6 958.5	27 560			
Jackson	North Park	Bituminous				115.21	2 751.1	23 879
		Sub-bituminous	747.07	17 599.0	23 557			
Jefferson	Denver Basin	Sub-bituminous	159.58	3 655.3	22 906			
La Plata	San Juan Basin	Bituminous	292.17	8 914.0	30 510			
Las Animas	Raton Basin	Bituminous	754.74	21 861.7	28 966			
Mesa	Uinta Region	Bituminous	208.06	5 719.7	27 491			
		Sub-bituminous	8.16	223.6	27 402			
Moffat	Green River Basin	Sub-bituminous	522.37	13 583.4	26 003			
		Bituminous	1 809.61	48 302.03	26 692	244.94	6 066.2	24 766
Montezuma	San Juan Basin	Bituminous	17.34	514.0	29 642			
Montrose	San Juan Basin	Bituminous	38.85	1 119.2	28 810	54.43	1 568.3	28 810
	Uinta Region	Sub-bituminous	90.93	2 619.8	28 810			
Ouray	Uinta Region	Sub-bituminous	691.81	16 312.8	23 580			

Park	South Park	Bituminous	22.96	521.7	22 722			
Pitkin	Uinta Region	Bituminous	80.38	2 531.8	31 498			
Rio Blanco	Uinta Region	Bituminous	968.30	25 241.8	26 068			
Routt	Green River Basin	Bituminous	2 484.50	66 031.8	26 578	374.67	10 045.7	26 812
		Sub-bituminous	612.51	16 449.3	26 856			
Weld	Denver Basin	Sub-bituminous	421.21	9 609.0	22 813			
Total			12 699.83	333 809.13	26 285	789.25	20 431.3	25 887

TABLE D-VI

MONTANA COAL RESERVE BASE
(Source: BOM[130])

County	Coal Area	Rank	Deep			Surface		
			10^6 Tonnes	QJ (10^{15} Joules)	Avg Heat Content (J/g)	10^6 Tonnes	QJ (10^{15} Joules)	Avg Heat Content (J/g)
Big Horn	Powder River Basin	Sub-bituminous	25 159.03	558 147.5	22 185	9 635.75	213 766.9	22 185
Blaine	North-Central Region	Sub-bituminous	16.42	330.7	20 140			
Broadwater	Lombard Field	Bituminous	5.13	114.5	22 320			
Carbon	Bighorn Basin	Bituminous	666.85	16 081.0	24 115			
Cascade	North-Central Region	Bituminous	280.16	6 560.5	23 417			
Chouteau	North-Central Region	Sub-bituminous	0.53	11.3	21 321			
Custer	Fort Union Region	Lignite				1 060.16	18 983.1	17 906
	Powder River Basin	Sub-bituminous	1 238.45	22 175.7	17 906	1 043.36	18 682.3	17 906
Dawson	Fort Union Region	Lignite				999.62	16 550.9	16 557
Fallon	Fort Union Region	Lignite				136.08	1 870.2	13 743
Fergus	North-Central Region	Bituminous	190.63	4 335.4	22 742			
Garfield	Powder River Basin	Sub-bituminous	104.72	1 755.7	16 766	19.70	330.4	16 766
Glacier	North-Central Region	Bituminous	23.08	534.5	23 159			
Judith Basin	North-Central Region	Bituminous	82.03	1 833.1	22 347			
McCone	Fort Union Region	Lignite				421.29	7 445.7	17 673
	Powder River Basin	Sub-bituminous				637.09	11 259.6	17 673
Meagher	North-Central Region	Bituminous	0.48	8.3	17 292			
Musselshell	Bull Mountain Field	Sub-bituminous	3 045.74	76 989.0	25 278	99.79	2 522.5	25 278
Powder River	Fort Union Region	Lignite				1 136.09	20 157.8	17 743
	Powder River Basin	Sub-bituminous	10 290.22	182 581.2	17 743	13 805.02	244 944.8	17 743
Prairie	Fort Union Region	Lignite				181.44	3 307.9	18 231
Richland	Fort Union Region	Lignite				794.42	13 097.9	16 487
Roosevelt	Fort Union Region	Lignite				390.99	5 610.0	14 348
Rosebud	Powder River Basin	Sub-bituminous	17 191.96	348 217.2	20 255	6 634.33	134 376	20 255
Sheridan	Fort Union Region	Lignite				411.86	6 081.8	14 767
Treasure	(Not Available)	Sub-bituminous	885.49	17 667.6	19 952	297.16	5 929.1	19 952
Wibaux	Fort Union Region	Lignite				907.18	12 868.6	14 185
Yellowstone	Bull Mountain Field	Sub-bituminous	535.42	11 068.8	20 673			
Total			59 716.34	1 248 412	20 906	38 611.33	737 785.5	19 108

TABLE D-VII

NEW MEXICO COAL RESERVE BASE
(Source: BOM[130])

County	Coal Area	Rank	Deep: 10^6 Tonnes	Deep: QJ (10^{15} Joules)	Deep: Avg Heat Content (J/g)	Surface: 10^6 Tonnes	Surface: QJ (10^{15} Joules)	Surface: Avg Heat Content (J/g)
Colfax	Raton Basin	Bituminous	1 252.82	35 863.4	28 626			
Lincoln	Sierra Blanca Field	Bituminous	6.26	167.7	26 789			
McKinley	San Juan Basin	Bituminous				226.80	5 975.4	26 349
		Sub-bituminous	102.96	2 712.9	26 349			
Rio Arriba	San Juan Basin	Bituminous	4.08	124.7	30 557			
		Sub-bituminous	2.72	83.1	30 557			
Sandoval	San Juan Basin	Bituminous	3.18	75.5	23 764			
		Sub-bituminous	43.73	1 039.2	23 764			
San Juan	San Juan Basin	Bituminous	85.91	2 267.5	26 394			
		Sub-bituminous	401.15	10 588.0	26 394	1 821.91	48 087.1	26 394
Santa Fe	Cerillos Field	Bituminous	8.26	242.7	29 383			
		Anthracite	2.09	61.3	29 383			
Socorro	Jornado del Muerto Area	Bituminous	24.95	740.3	29 671			
Valencia	San Juan Basin	Sub-bituminous	0.09	2.3	25 556			
Total			1 938.20	53 968.6	27 845	2 048.71	54 062.5	26 389

TABLE D-VIII

UTAH COAL RESERVE BASE
(Source: BOM[130])

County	Coal Area	Rank	Deep			Surface		
			10^6 Tonnes	QJ (10^{15} Joules)	Avg Heat Content (J/g)	10^6 Tonnes	QJ (10^{15} Joules)	Avg Heat Content (J/g)
Carbon	Uinta Region	Bituminous	695.53	20 395.8	29 324			
Emery	Uinta Region	Bituminous	70.10	1 856.7	26 486	9.07	273.2	30 121
Garfield	(Not Available)	Bituminous	917.34	20 239.0	22 063	21.77	494.7	22 724
Iron	Southwestern Utah	Bituminous	4.90	122.0	24 898			
Kane	Southwestern Utah	Bituminous	1 555.36	35 593.1	22 884	181.44	4 130.6	22 766
Sevier	Uinta Region	Bituminous	129.15	3 552.8	27 509	9.07	255.3	28 148
Uinta	Uinta Region	Bituminous	36.54	924.5	25 301			
Wayne	Henry Mountains Field	Bituminous	20.64	519.8	25 185	16.33	411.3	25 185
Total			3 429.56	83 203.7	24 261	237.68	5 565.1	23 414

TABLE D-IX

WYOMING COAL RESERVE BASE
(Source: BOM[130])

County	Coal Area	Rank	Deep: 10^6 Tonnes	Deep: QJ (10^{15} Joules)	Deep: Avg Heat Content (J/g)	Surface: 10^6 Tonnes	Surface: QJ (10^{15} Joules)	Surface: Avg Heat Content (J/g)
Albany	Hanna/Rock Creek	Sub-bituminous	73.88	1 518.8	20 558			
Big Horn	Bighorn Basin	Sub-bituminous	2.49	57.8	23 123			
Campbell	Powder River Basin	Sub-bituminous	12 712.37	239 442.6	18 835	17 773.38	332 262.1	18 694
Carbon	(Not Available)	Bituminous	35.57	921.5	25 905			
		Sub-bituminous	1 560.59	40 427.7	25 905	420.84	10 902.1	25 905
Converse	Powder River Basin	Sub-bituminous	971.59	19 046.6	19 604	512.74	10 051.5	19 604
Crook	Black Hills Region	Bituminous	1.04	22.0	21 154			
Fremont	(Not Available)	Sub-bituminous	47.01	1 029.8	21 906			
Hot Springs	Bighorn Basin	Sub-bituminous	58.71	1 516.9	25 837	2.72	70.3	25 846
Johnson	Powder River Basin	Sub-bituminous	2 092.87	38 945.4	18 609	919.52	17 115.1	18 609
Lincoln	Hams Fork Region	Bituminous	504.29	13 966.9	27 696			
	(Not Available)	Sub-bituminous				907.18	25 125.3	27 696
Natrona	(Not Available)	Sub-bituminous	31.38	586.0	18 674			
Park	Big Horn Basin	Bituminous	7.49	172.9	23 058			
		Sub-bituminous	19.10	440.5	23 058			
Sheridan	Powder River Basin	Sub-bituminous	4 708.69	100 297.1	21 300	83.46	1 768.3	21 187
Sweetwater	Green River Region	Bituminous	3 086.95	74 226.2	24 045			
		Sub-bituminous	201.74	4 850.8	24 045	1 012.14	24 337.1	24 045
Uinta	Hams Fork Region	Bituminous	448.78	10 958	24 417			
	(Not Available)	Sub-bituminous	119.97	2 929.2	24 417			
Washakie	Big Horn Basin	Sub-bituminous	10.60	222.3	20 972			
Weston	Black Hills Region	Bituminous	19.98	443.6	22 205			
	Powder River Basin	Sub-bituminous	32.94	731.5	22 205			
Total			26 748.03	552 754.1	20 665	21 631.98	421 631.8	19 491

TABLE D-X

ROCKY MOUNTAIN REGION COAL RESERVE BASE BY RESOURCE AREA
(Source: BOM[130])

State	Coal Area	Rank	Deep: 10^6 Tonnes	Deep: QJ (10^{15} Joules)	Deep: Avg Heat Content (J/g)	Surface: 10^6 Tonnes	Surface: QJ (10^{15} Joules)	Surface: Avg Heat Content (J/g)
Arizona	Black Mesa	Sub-bituminous				317.51	7 512.6	23 661
Colorado	Canon City	Bituminous	163.58	4 282.3	26 179			
Colorado	Denver Basin	Sub-bituminous	1 246.46	26 304.7	21 104			
Colorado	Green River Region (CO)	Bituminous	4 294.11	114 333.8	26 626	619.61	16 111.9	26 003
		Sub-bituminous	1 134.88	30 032.7	26 463			
Wyoming	Green River Region (WY)	Bituminous	3 086.95	74 226.2	24 045			
		Sub-bituminous	201.74	4 850.8	24 045	1 012.14	24 337.1	24 045
Colorado	North Park	Bituminous				115.21	2 751.1	23 879
		Sub-bituminous	747.07	17 599.0	23 557			
Colorado	Raton Basin (CO)	Bituminous	1 007.23	28 820.2	28 613			
New Mexico	Raton Basin (NM)	Bituminous	1 252.82	35 863.4	28 626			
Colorado	San Juan Basin (CO)	Bituminous	431.91	12 950.6	29 984	54.43	1 568.3	28 813
New Mexico	San Juan Basin (NM)	Bituminous	93.17	2 467.7	26 486	226.80	5 975.4	26 347
		Sub-bituminous	550.65	14 425.5	26 197	1 821.91	48 087.1	26 394
Colorado	South Park	Bituminous	22.96	521.7	22 722			
Colorado	Uinta Region (CO)	Anthracite	25.17	744.2	29 567			
		Bituminous	2 450.0	68 026.5	27 766			
		Sub-bituminous	1 176.46	30 193.4	25 665			
Utah	Uinta Region (UT)	Bituminous	931.32	26 729.8	28 701	18.14	528.5	29 135
Montana	Lombard Field	Bituminous	5.13	114.5	22 320			
Montana	Bighorn Basin (MT)	Bituminous	666.85	16 081.0	24 115			
Wyoming	Bighorn Basin (WY)	Bituminous	7.49	172.9	23 084			
		Sub-bituminous	90.90	2 237.5	24 615	2.72	70.3	25 846
Montana	North-Central Region	Bituminous	576.38	13 271.8	23 026			
		Sub-bituminous	16.95	342.0	20 177			
Montana	Powder River Basin (MT)	Sub-bituminous	53 984.38	1 112 877.3	20 615	31 775.25	623 360.0	19 618
Wyoming	Powder River Basin (WY)	Sub-bituminous	20 518.46	398 463.2	19 420	19 289.1	361 197.0	18 725
Montana	Fort Union Region	Lignite				6 439.13	105 973.9	16 458
Montana	Bull Mountain Field	Sub-bituminous	3 581.16	88 057.8	24 589	99.79	2 522.5	25 278
New Mexico	Sierra Blanca Field	Bituminous	6.26	167.7	26 789			
New Mexico	Cerrilos Field	Anthracite	2.09	61.3	29 330			
		Bituminous	8.26	242.7	29 383			

New Mexico	Jornada del Muerta Area	Bituminous	24.95	740.3	29 671			
Utah	Southwestern Utah	Bituminous	1 560.26	35 715.1	22 890	181.44	4 130.6	22 766
Utah	Henry Mountains Field	Bituminous	20.64	519.8	25 184	16.33	411.3	25 187
Wyoming	Black Hills Region	Bituminous	21.02	465.6	22 150			
Wyoming	Hams Fork Region	Bituminous	953.07	24 924.9	26 152			
Wyoming	Hanna/Rock Creek	Sub-bituminous	73.88	1 518.8	20 558			
Montana	(Not Available)	Sub-bituminous	885.49	17 667.6	19 952	297.16	5 929.1	19 953
Utah	(Not Available)	Bituminous	917.34	20 239.0	22 063	21.77	494.7	22 724
Wyoming	(Not Available)	Bituminous	35.57	921.5	25 907			
		Sub-bituminous	1 758.95	44 972.7	25 568	1 328.02	36 027.4	27 129
Total			104 531.96	2 272 147.5	21 736	63 636.47	1 246 988.8	19 596

APPENDIX E

PETROLEUM AND NATURAL GAS RESERVES IN THE ROCKY MOUNTAIN REGION

Although oil and natural gas continue to be very important energy resources in the Rocky Mountain states, production has stabilized and is actually declining in many places. Figures E-1 and E-2 show the primary oil and gas fields of the region.

Following the same resource classification scheme discussed in Appendix D, state-by-state total resource estimates are not readily available. Resource estimates have been made by the USGS,[136] but because these estimates are by geologic region they do not follow political boundaries (except national boundaries). The USGS does estimate that for the lower 48 states, oil resources remaining to be discovered may amount to anywhere from 50% to 160% of current reserves (excluding offshore oil).[135] Similarly, undiscovered gas resources in the lower 48 states may range from 85% to 160% of current reserves.[135]

Although resource estimates may not be available state-by-state, oil and gas reserve estimates are available. Tables E-I and E-II give compilations of reserve estimates by the American Petroleum Institute (API) and the Federal Energy Administration (FEA) for oil, and by the American Gas Association (AGA) and the FEA for gas.

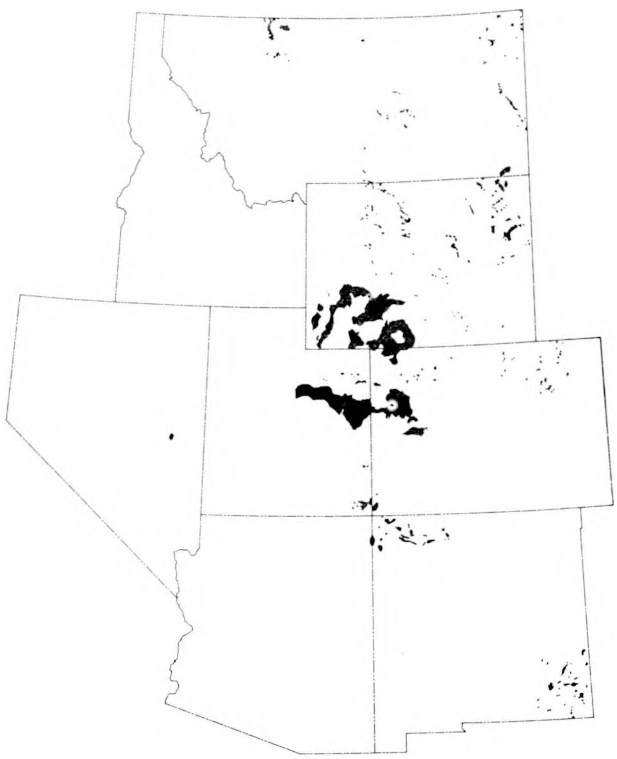

Fig. E-1.
Oil fields of the Rocky Mountain region. (Source: API[20])

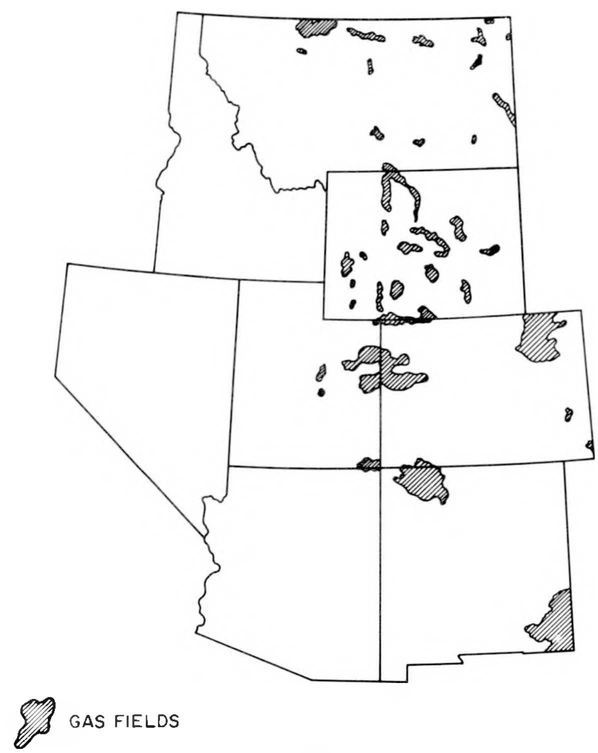

Fig. E-2.
Gas fields of the Rocky Mountain region. (Source: FPC[136])

TABLE E-I

CRUDE OIL RESERVES[a]
(as of December 31, 1974)

	API[137]	FEA[138]
Arizona	b	b
Colorado	46 000 (289 333)	46 184 (290 490)
Idaho	—	—
Montana	32 972 (207 389)	31 698 (199 380)
Nevada	b	b
New Mexico	99 362 (624 968)	103 747 (652 552)
Utah	39 850 (250 648)	58 197 (366 048)
Wyoming	143 623 (903 360)	164 727 (1 036 100)
Region	361 807 (2 275 698)	404 554 (2 544 570)
US	5 445 308 (34 249 956)	6 047 520 (38 037 757)

[a]Units: millions of litres (thousands of barrels).

[b]Sources aggregate with other states: total less than 1680 (10 567).

TABLE E-II

NATURAL GAS RESERVES[a]
(As of December 31, 1974)

	AGA[137]	FEA[138]
Arizona	b	b
Colorado	53 284 (1 881 695)	64 646 (2 282 947)
Idaho	—	—
Montana	25 521 (901 260)	20 760 (733 146)
Nevada	—	—
New Mexico	338 242 (11 944 902)	463 942 (16 383 957)
Utah	29 206 (1 031 409)	47 010 (1 660 157)
Wyoming	110 928 (3 917 387)	121 671 (4 296 781)
Region	557 181 (19 676 653)	718 030 (25 356 988)
US	6 714 845 (237 132 497)	6 802 585 (240 231 003)

[a]Units: millions of cubic metres (millions of standard cubic feet).

[b]Sources aggregate with other states: total less than 4760 (168 084).

APPENDIX F

URANIUM RESOURCES IN THE ROCKY MOUNTAIN REGION

Seventeen per cent of the world's uranium reserves (as of December 31, 1971) are in the US, and almost all of those reserves are in the Rocky Mountain region.[139] Fig. F-1 shows significant uranium reserve areas of the region as well as uranium mills. Conventions used for delineating uranium reserves and resources differ somewhat from those adopted by the USGS (discussed in Appendix D). Instead of speaking of economically recoverable and sub-economic resources, the resources are classified as to the cost of mining a specific ore deposit and milling the ore. Thus the reserve estimates, given in Table F-1 for states in the region, are categorized as to \$10, \$15, and \$30 reserves, referring to the cost of mining and milling per pound of concentrated ore (U_3O_8) produced. Be aware that estimates are cumulative; i.e., reserve estimates at a given price include all reserves extractable at a lower price. Because reserve estimates are derived by ERDA from private corporation data, Colorado and Utah reserves have been aggregated to avoid disclosing individual company data. On the basis of potential but probable resource estimates (discussed next), reserves could be assumed to be very roughly equally split between Colorado and Utah.

ERDA is currently undertaking a comprehensive National Uranium Resource Evaluation (NURE) to determine potential uranium resources in the US. Once again, in the NURE program, undiscovered resources are categorized using conventions different from those used by the USGS. The three categories "probable," "possible," and "speculative" are used as opposed to USGS's "hypothetical" and "speculative." Geological definitions used by ERDA may be found in the NURE Preliminary Report.[140] Table F-II lists \$30 resource estimates for each of the states of the Rocky Mountain region.

1- Exxon Corporation
2- Union Carbide Corporation
3- Utah International, Gas Hills, WY
4- Federal American Partners
5- Western Nuclear, Inc.
6- Utah International, Shirley Basin, WY
7- Atlas Corporation
8- Rio Algom Corporation
9- Union Carbide Corporation
10- Cotter Corporation
11- Kerr-McGee Nuclear Corporation
12- The Anaconda Co.
13- United Nuclear-Homestake Partners

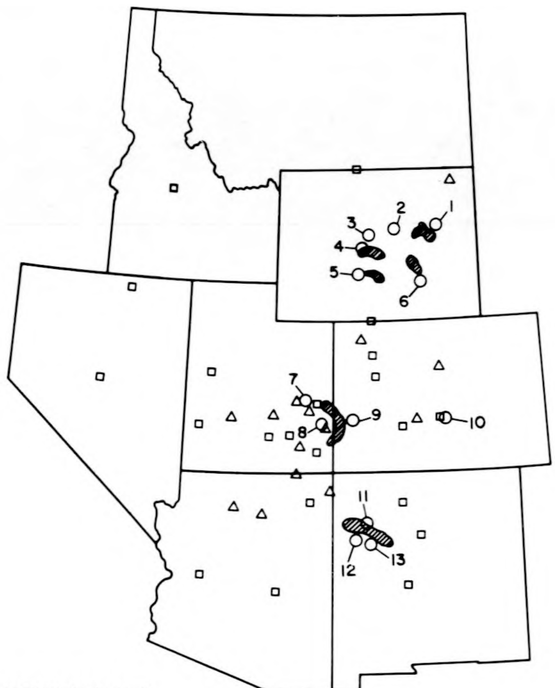

Fig. F-1.
Uranium mills and uranium reserve areas in the Rocky Mountain region. (Source: ERDA[123])

TABLE F-I

URANIUM RESERVES BY STATE AS OF JANUARY 1, 1976[a]

		New Mexico	Wyoming	Colorado and Utah	US
$10	Tonnes Ore	51 800 000	56 700 000	5 700 000	141 500 000
	$\%U_3O_8$	0.26	0.12	0.30	0.17
	Equiv. Tonnes U_3O_8	137 000	66 000	17 000	245 000
$15	Tonnes Ore	105 100 000	136 500 000	11 800 000	298 500 000
	$\%U_3O_8$	0.18	0.10	0.21	0.13
	Equiv. Tonnes U_3O_8	187 000	143 300	23 500	390 100
$30	Tonnes Ore	274 000 000	319 800 000	23 300 000	702 200 000
	$\%U_3O_8$	0.10	0.07	0.07	0.08
	Equiv. Tonnes U_3O_8	274 600	216 800	31 000	580 600

[a]Source: ERDA.[123]

TABLE F-II

POTENTIAL $30 URANIUM RESOURCES AS OF JANUARY 1, 1976[a] (10^3 Tonnes U_3O_8)

	Potential Resources [b]			
	Probable	Possible	Speculative	Total
Arizona	26	82	24	132
Colorado	102	98	26	226
Idaho	---	5	24	28
Montana	---	10	39	49
Nevada	9	48	44	102
New Mexico	266	406	69	741
Utah	101	224	5	330
Wyoming	287	87	25	399
Region	790	960	257	2 007
US	962	1 152	535	2 649

[a]Source: Meehan.[124]

[b]Some reports have indicated these estimates may be high by as much as a factor of 3.

APPENDIX G

WOOD AS A FUEL

Of the various fuels, wood has probably the longest history of use by man. It is currently being viewed with some interest as a fuel to relieve some of the present US dependence on foreign energy. Interestingly enough, this is not a new view of wood:

> Wood has always been of considerable importance as a fuel in this country, and the present [energy] emergency has greatly increased its comparative value for this purpose. Wood is now being cut for fuel in places where for many years it had practically gone out of use.[141]

This 1919 article goes on to enumerate some of the advantages of using wood for fuel, many of which are equally applicable today.

Although wood, particularly wood waste, is currently being viewed with some interest as a fuel, it has always played a significant role in many parts of the country, this region in particular. Some homes are heated by wood, and wood is still used for cooking. In many homes, wood is burned in fireplaces, and although this is not done primarily for providing heat, some home heating often results. And sawmills sometimes utilize their wood waste for generating process steam or electricity.

Assessing 1975 wood consumption in the Rocky Mountain region is not easy. Figure G-1 shows regional woodlands and National Forest boundaries. In this region, the woodlands lie mainly within National Forests. So it may be assumed that most of the wood used in homes in the region is removed from the National Forests. Each National Forest does generally estimate on an annual basis how much fuel wood is removed under either their free-use or fuel-wood sales systems. The National Forests in the region have been surveyed for this report to determine each Forest's estimate of wood removed for fuel use. In addition, one public electric utility in the region operates a wood-waste-fired power plant. The utility, a subsidiary of St. Regis Paper Corporation, operates a plant in Libby, Montana, and generated 13 943 MWh in 1975 from wood waste[66] from a St. Regis lumber complex in Libby.

In this study of fuel wood, we have considered only the Libby wood waste plant and fuel wood removed from the National Forests. Many other industrial plants undoubtedly utilize wood waste for their own heat and power requirements. In fact, a report discussing the Washington forest products industry[144] indicates that 58% of fuel used in that industry in 1971 came from wood waste. Unfortunately, statistics are not readily available on such energy users in the region. And sources of residential fuel wood besides the National Forests have similarly not been considered. This particular omission is probably less serious in this region than it would be elsewhere in the country because of the extent of regional forest land coming under the National Forest system.

Heat Content

Wood removed from the National Forests is generally categorized by species. The heat content of wood varies considerably from species to species and is highly dependent on moisture content. Wood used residentially is air-dried, with moisture content dependent on the ambient humidity of the air in the area. Heat content for air-dried wood for appropriate species taken from Ref. 141 has been adapted for Table G-I.

The heat content of wood used at the Libby power plant can be deduced from an estimated 65% boiler efficiency at that plant to produce 370°C steam and an average requirement of 1.3 kg of mixed coniferous waste to produce 1 kWh of electricity.[145] Assuming a turbine efficiency of 32%[146] results in an estimated wood-waste heat content of 13 600 J/g.

Consumption

In 1975, the Libby plant produced 13 943 MWh of electricity. Applying the above efficiency factors shows that 17 700 tonnes of wood waste were used in 1975 for a total heat value of 0.24 QJ.

Data on wood removed from the regional National Forests are given in Table G-II. Because species in Table G-II are as reported by the National Forests, in some cases it was impossible to determine exact species. An approximate heat content of 6.208 x 10^9 J/m^3 was then used.

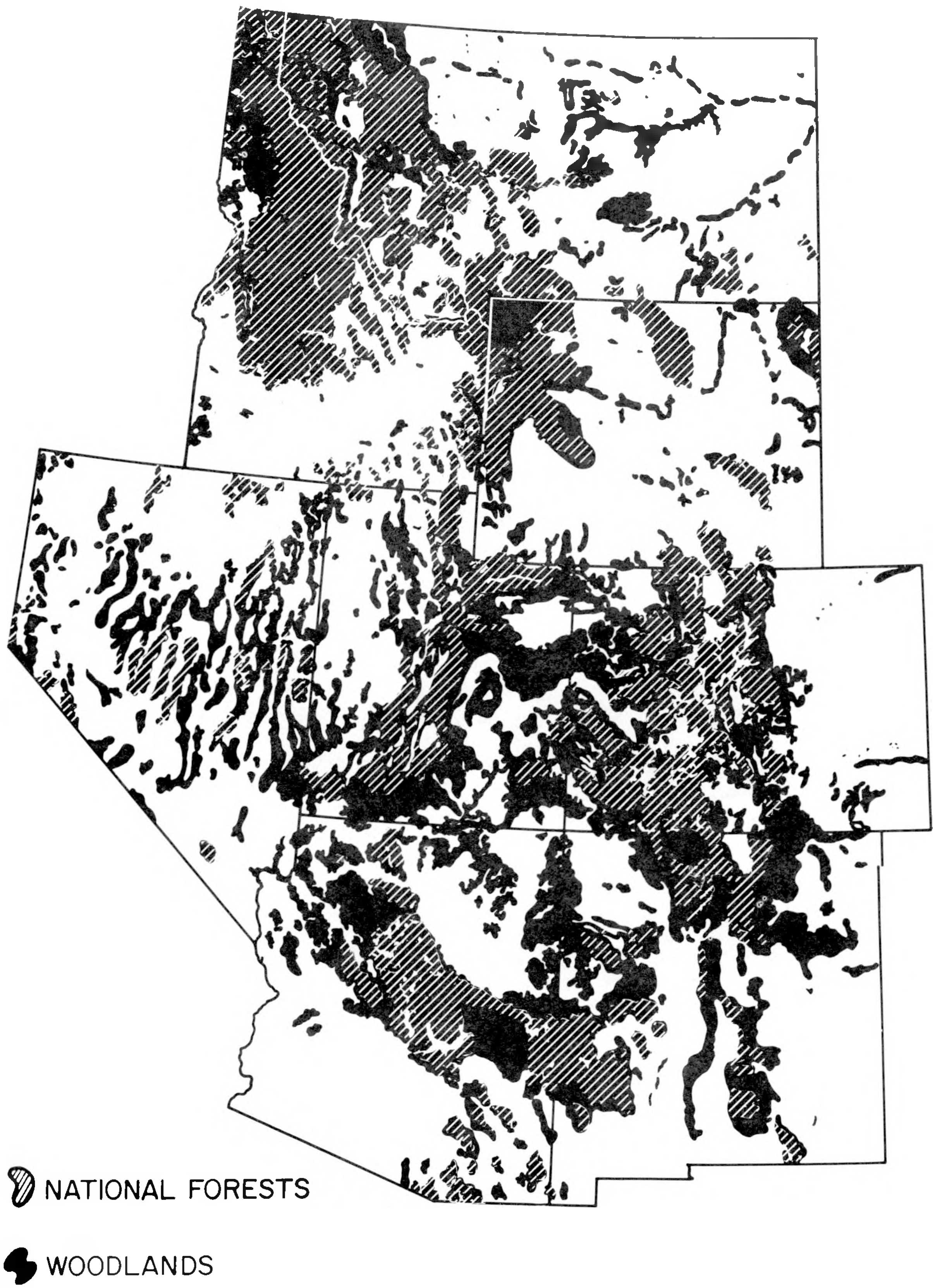

Fig. G-1.
Woodlands and National Forests. (Sources: BIA[142] and USGS[143])

TABLE G-I

AVERAGE SELECTED AIR-DRIED WOOD HEAT CONTENTS[a]

Species	Available Heat (10^6 Joules) Per Solid Cubic Meter
Aspen (F. tremuloides)	5 836
Oak (Average of 17 species)	9 478
Western Red Cedar (T. plicata)	5 008
Alpine Fir (A. lasiocarpa)	4 967
Lowland White Fir (A. grandis)	6 250
Douglas Fir, Rocky Mountains	6 457
Western Larch (L. occidentalis)	7 988
Jeffrey Pine (P. jeffreyi)	6 208
Lodgepole Pine (P. contorta)	6 208
Western White Pine (P. monticola)	6 498
Ponderosa or Western Yellow Pine (P. ponderosa)	6 208
Engelman Spruce (P. engelmanni)	4 925
White Spruce (P. canadensis)	5 836
Spruce (Average of 4 species)	5 629

[a]Adapted from Ref. 141.

TABLE G-II

1975 FUEL WOOD REMOVED FROM REGIONAL NATIONAL FORESTS, BY STATE AND SPECIES[a]

State	"Species" As Reported (% of State Total)		Total Heat Content[b] (QJ)
Arizona	Ponderosa Pine	(25%)	0.20
	Juniper	(34%)	0.27
	Gambel Oak	(2%)	0.01
	Pine	(7%)	0.05
	Oak	(1%)	0.01
	Combined Mesquite & Oak	(21%)	0.17
	Combined Juniper & Ponderosa	(11%)	0.09
	Total		0.80
Colorado	Pine	(3%)	0.03
	Spruce	(1%)	0.01
	Douglas Fir	(4%)	0.04
	Lodgepole Pine	(19%)	0.21
	Ponderosa Pine	(32%)	0.34
	Blue Spruce	(*)	**
	Engelmann Spruce	(2%)	0.02
	True Firs	(1%)	0.01
	Combined Spruce & Fir	(9%)	0.10
	Aspen	(4%)	0.05
	Combined Aspen & Gambel Oak	(1%)	0.01
	Other and Unspecified	(24%)	0.26
	Total		1.07
Idaho	Subalpine Fir	(*)	**
	Lodgepole Pine	(50%)	0.79
	Douglas Fir	(10%)	0.16
	Ponderosa Pine	(4%)	0.06
	Larch	(16%)	0.26
	White Pine	(4%)	0.06
	Aspen	(1%)	0.02
	Combined Lodgepole & Douglas Fir	(8%)	0.12
	Other and Unspecified	(7%)	0.12
	Total		1.59
Montana	Western Larch	(8%)	0.09
	Douglas Fir	(9%)	0.11
	Lodgepole Pine	(51%)	0.60
	Ponderosa Pine	(2%)	0.03
	Combined Ponderosa & White Pine	(1%)	0.02
	Combined Larch & Douglas Fir	(29%)	0.34
	Total		1.19

Nevada	Aspen	(*)	**
	Combined Piñon & Juniper	(14%)	0.04
	Combined Jeffrey Pine, White Fir & Piñon	(86%)	0.24
	Total		0.28
New Mexico	Piñon Pine	(51%)	0.84
	Ponderosa Pine	(11%)	0.18
	Aspen	(1%)	0.02
	Juniper	(14%)	0.22
	Douglas Fir	(2%)	0.04
	White Fir	(1%)	0.01
	Combined Douglas & White Fir	(5%)	0.08
	Combined Piñon & Juniper	(10%)	0.16
	Combined Ponderosa & White Pine	(5%)	0.08
	Total		1.63
Utah	Ponderosa Pine	(20%)	0.08
	Aspen	(14%)	0.06
	Piñon Pine	(11%)	0.05
	Gambel Oak	(2%)	0.01
	Lodgepole Pine	(36%)	0.15
	Combined Spruce & Fir	(4%)	0.02
	Combined Piñon & Juniper	(8%)	0.03
	Combined Engelmann, Spruce & Douglas Fir	(2%)	0.01
	Other and Unspecified	(3%)	0.01
	Total		0.42
Wyoming	Lodgepole Pine	(91%)	0.20
	Engelmann Spruce	(8%)	0.02
	Aspen	(1%)	**
	Total		0.22
Region Total			7.19

[a]Data is often for fiscal year 1975, i.e., July 1, 1974-June 30, 1975.

[b]On the basis that 1 cord of wood = 90 ft^3 solid wood = 2.55 m^3 solid wood.

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