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Patterns of Energy Production in the Southwest*

by

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Abstract

The southwest states of Arizona and New Mexico are energy rich, particularly New Mexico. Data is presented establishing the regions position with respect to coal, oil, gas and uranium resources. Further, this status is reflected in current patterns of energy production, data on which are presented. Additionally, price information is presented which explains, in part, current energy production patterns in the region.

I. Introduction

In this talk I will present information on the energy production system during 1975 in the states of the southwest, namely Arizona and New Mexico. The information presented here has been culled from a detailed analysis of the energy production system in the Rocky Mountain West, available from the Los Alamos Scientific Laboratory.[1]

II. Resources

The Rocky Mountain Region of the U.S. is well known as the most energy rich part of the country. All energy resources are plentiful in this region although coal and uranium are the major resources in terms of projected production. A breakdown of U.S. coal reserves is shown in Fig. 1 and indicates the extent of U.S. coal reserves and resources in the west. Here the terms reserves and resources are as used by the USGS.[2] Reserves are known deposits, economically extractable. Resources cover a broader base, including speculative deposits which may not yet be economically extractable. Although New Mexico and Arizona are not in the same league as Montana or Wyoming, the southwest's coal remains vitally important primarily because of its proximity to the energy consuming areas of California and Arizona. With coal transport costing approximately 1¢/ton-mile, closeness to markets can be very significant. Almost all of the coal resources of this area are found on Navajo and Hopi lands in Arizona and New Mexico.

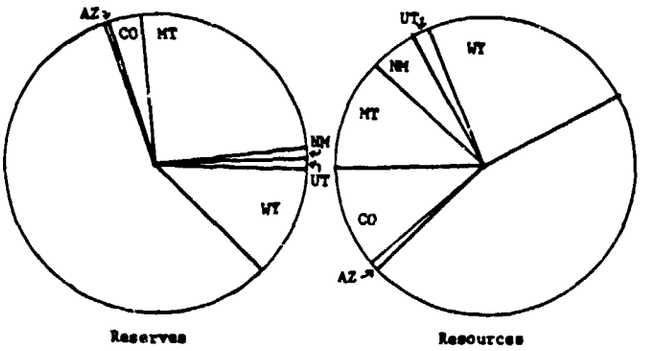

Figure 1. U.S. Coal Reserves and Resources, January 1, 1974.

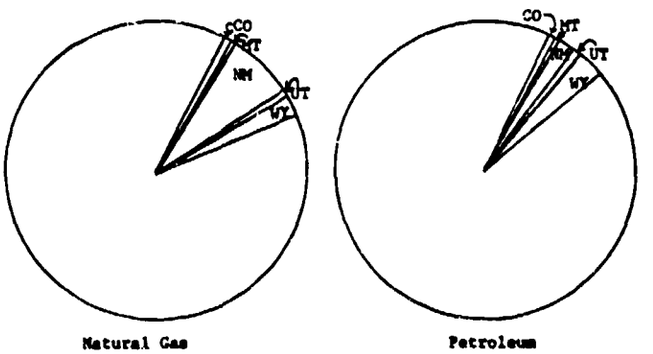

Figure 2. U.S. Natural Gas and Petroleum Reserves, December 31, 1974.

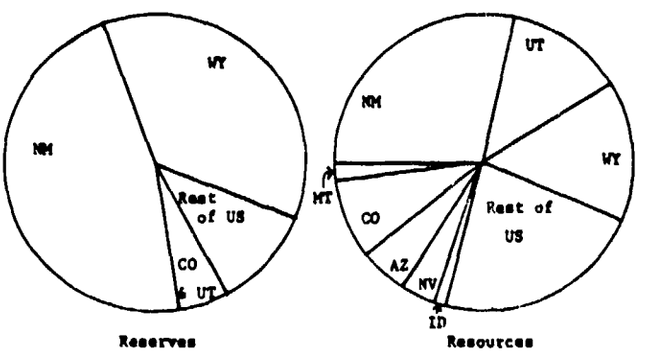

Figure 3. U.S. $30 Uranium Reserves and Resources, January 1, 1976.

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[1] C. D. Kolstad, "The 1975 Energy Production System in the States of the Rocky Mountain Region," LA-6624, Los Alamos Scientific Laboratory, Los Alamos, NM, 1977

[2] United States Geological Survey, "Principles of the Mineral Resource Classification System of the U.S. Bureau of Mines and U.S. Geological Survey," Geological Survey Bulletin 1450-A, Washington, DC (1976).

In Figure 2, U.S. natural gas and petroleum reserves are presented. Although on a national basis regional shares are much lower than in the case of coal, New Mexico stands out because of its significant gas reserves.

Uranium is quite a different story. As Fig. 3 indicates, the southwest, namely New Mexico, is by far the most significant uranium resource region in the entire country. As all here are aware, I am sure, uranium deposits in the southwest are concentrated in the northwest corner of the state of New Mexico.

III. Production

These resource distributions are reflected somewhat in the 1975 baseline energy production statistics. In Fig. 4, the mix of energy production among the Rocky Mountain States is presented. Note that although Montana and Wyoming are often touted as major energy producers, which they are, New Mexico leads the entire west in energy production by a sizeable margin. And the reserves estimates we have just seen would lead one to expect New Mexico and the southwest to continue to be significant energy producers.

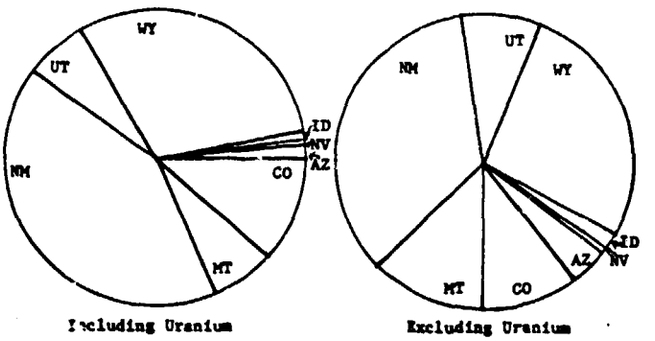

Figure 4. Rocky Mountain Regional Energy Production, 1975.

Fig. 5 depicts Arizona's energy production system in 1975. In reading these diagrams, the left-most boxes represent energy production activities. Arrows pointed from these boxes to the left represent energy exports from the state and arrows pointing from the left into the boxes represent energy imports. Energy then "moves" to the right where it is converted to electricity or consumed in one of several sectors. This use is broken down, somewhat arbitrarily, into used and lost energy. Note that Arizona imports most of its energy, the exceptions being some hydro production and coal production from the Black Mesa, on Indian lands, in the northern part of the state. This coal production is split roughly evenly between the Navajo Power Plant at Page and the Mohave power plant at Las Vegas which is fed by a coal slurry pipeline from Black Mesa. These two power plants as well as the Four Corners plant in New Mexico are used primarily to supply the energy needs of southern California and southern Arizona.

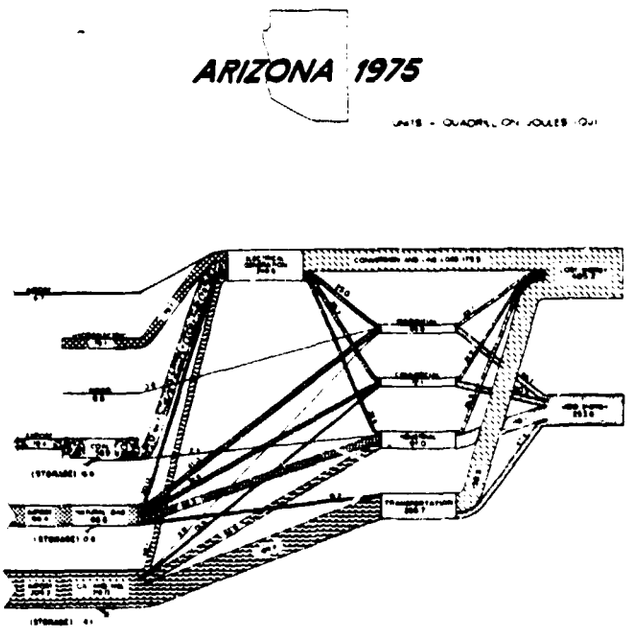

Figure 5. 1975 Arizona Energy Flow Patterns.

Figure 6 presents a similar snapshot of New Mexico's 1975 energy production system. The figure leaves no doubt regarding the state's role as an energy supplier. Although the coal production in Four Corners is quite visible politically, as can be seen here, coal is currently dwarfed by oil, gas and uranium production in the state.

Turning to some more specific statistics on energy in the southwest, in Table I energy prices are given for different energy forms; first as the energy is extracted and secondly as it is delivered to consumers. In examining these consumer prices, be aware that consumer prices encompass all consumers whether residential or industrial. Note the extremely low price of gas relative to the competition. At the wellhead, gas in some states is cheaper than coal. Unquestionably gas is easier and cheaper (aside from the gas cost) to utilize so it is no wonder that gas is wasted in some uses where other less desirable fuels such as coal could be used. Gas is far cheaper for the consumer than either oil or electricity which is a major reason for its popularity for home heating.

The reasons for the spread in electricity prices can be seen in Table II. The consumer's prices seem to be due to a very large degree to the mix of fuels used to produce a state's electricity. For instance, Arizona has the highest fraction of electricity production from expensive oil, 19%, than any other state in the region, and consequently has the highest consumer electricity prices in the region. Arizona's electricity prices average over twice those in Idaho where hydropower dominates.

In Table III natural gas prices at various stages of the production process are presented. It has often been said that New Mexico consumers pay more for New Mexico gas than out-of-state consumers pay for the state's gas. While this may be true and might seem to be reasonable based on past and current regulatory policies, it does not seem to be supported by this data. Gas for consumers in Wyoming is cheaper than in any other state of the Region with New Mexico following with the next cheapest gas. New Mexico and Wyoming happen to be the largest gas producers in the Region.

Statistical analyses can be carried to any length. Unquestionably, the nature of the energy supply system in the southwest will change in the future but it would seem that, particularly in the case of New Mexico, the region will continue to be a major national source of energy.

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] Source: Ref. 1
[b] Reported U_3O_8 price at mill.
[c] Price to electricity generation.
[d] Excluding electricity generation use.
[e] Products wholesale plus the gasoline dealer margin. For this reason, price may be high by as much as 0.3.

Table I.

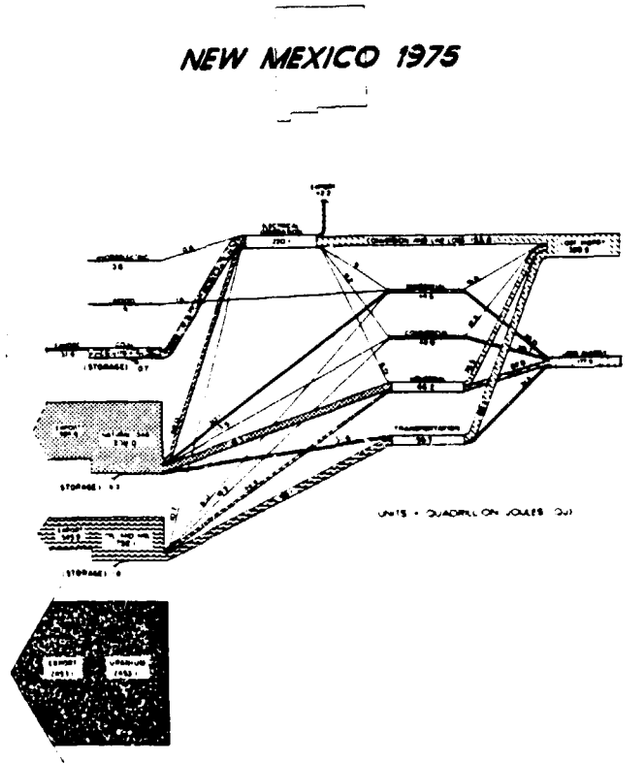

Figure 6. 1975 New Mexico Energy Flow Patterns.

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

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] Source: Ref. 1
[b] On the basis of total state generation.
[c] Price to largest industrial users: assumed equal to FOB generator price
[d] Negligible amount of generation from wood.

Table II.

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: Ref. 1
[b]Price paid by industrial users.

Table III.