LOWER WHITE RIVER FIELD

GREEN RIVER REGION

DANFORTH HILLS

HOGBACK

HINSDALE

MINERAL

J'SAN JUAN

MOFFAT

UINTA REGION

CLIFFS

COAL PRODUCTION AND DISTRIBUTION AND ELECTRICAL POWER GENERATION

COMPILED BY WILLIAM R. TAYLOR\* AND L. R. LADWIG\*\*

ARAPAHOE

STEAM COAL FROM WYOMING

ILLINOIS [Amount compared to total Colorado production]

LARIMER

BOULDER

NORTH PARK

REGION

S A G U A C H E

RIOGRANDE

CONEJOS

#### COAL RESOURCES

The eight coalbearing regions of Colorado encompass approximately 26,000 sq. mi., or 28 percent of the total area of Colorado. Over 434 billion tons of in-place coal resources are believed to remain in Colorado (Averitt, 1975, p. 14) above an overburden thickness of 6,000 ft, with nearly 129 billion tons to a depth of 3,000 ft. In terms of remaining identified bituminous coal resources, Colorado ranks second behind Illinois, but is first in terms of low-sulfur bituminous coal (Averitt, 1975, p. 22). The demonstrated reserve base of coal in Colorado on January 1, 1979 is estimated at 16.2 billion tons (DOE/EIA-0280(79).

Colorado coals range in age from early Late Cretaceous to Eocene and ranks range from lignite to anthracite. Over 70 percent of Colorado's coal resources are bituminous, approximately 23 percent subbituminous, 5 percent lignite, and less than 1 percent anthracite.

Steam quality and metallurgical grade coal comprises nearly all current production. The Green River and Uinta Regions furnish most of the bituminous steam coal, while the southeastern portion of the Uinta Region and the Raton Mesa Region furnish most of the metallurgical grade coal.

#### REFERENCES

PHILLIPS

Y U M A

KIT CARSON

FROM OKLAHOMA

(Amount compared

to total Colorado

vary due to operator reports

and withdrawal from stocks.

WASHINGTON

ROWLEY

ANIMAS

Averitt, Paul, 1975, Coal resources of the United States, January 1, 1974: U.S. Geol. Survey Bull. 412, 131 p.

Demonstrated Reserve Base of Coal in the United States on January 1, 1979, DOE/EIA-0280(79).

#### 1981 COAL STATISTICS

				pped	Total
County	No.	Mine	In-State	Out-of-State	Produc
Archuleta	1	Chimney Rock	7,435 7,435	247,576 247,576	255 255
Delta			44,500	1,267,838	1,353
	2	Blue Ribbon		111,113	129
	3 4	Orchard Valley Red Canyon		976,7961	976
	5	Tomahawk	44,500	114,429 65,500	137 110
El Paso					3
-	6	Bacon (C)	-	-	3
Fremont			124,864	153,163	350
	7	Dorchester #1	59,552	114,190	173
	8 9	GEC Strip Newlin Creek	36,932	38,973	75
	10	Twin Pines	28,380		72,
Garfield			22,721	31,677	55,
Garriora	11	McClain Canyon	20,721	31,677	53,
	12	Munger Canyon			
	13	Sunlight	2,000		2,
Gunnison			263,208	703,333	1,633,
	14 15	Bear Hawk's Nest E.	260,653	34,776	260,
	16	Hawk's Nest W.			617, 84,
	17	O.C. Mine (I)	2,490		2,
	18	Somerset	65	668,557	668,
Huerfano			35,493	506	37,
	19	Viking Strip (Prior)	35,493	506	37,
Jackson			14,436	492,446	523,
	20	Bourg Strip	236	94,398	94,
	21	Canadian Strip Marr Strip	14,200	124,248 273,800	140, 288,
La Plata	23	National King	9,310 9,310	133,450 133,450	135, 135,
	24	Peacock (I)	0,0.0	100,400	100,
Las Animas			643,889	65,038	734,
Edo Allillas	25	Allen	468,705	03,038	486,
	26	Helen			7,
	27 28	Maxwell Trinidad Basin	175,184	65,038	175, 65,
		The state of the s	170,104	00,000	00,
Mesa	29	Cameo #1	0.416	947,499	949,
	30	Fruita (I)	2,416	283,072	283,
	31	Roadside	2,416	664,427	664,
Moffat			3,683,232	2,929,125	6,027,
	32	Colowyo Strip	1,162,102	2,400,945	3,170,
	33 34	Eagle #5 Eagle #9	272,800	457,326 70,854	693,
	35	Trapper	2,248,330	70,034	70, 2,093,
Montrose			74 694		
Worthose	36	Nucla	74,684 74,684	-	74,
Dittel			1051	705.004	
Pitkin	37	Coal Basin	4,851 1,213	735,324 91,786	740, 92,
	38	Dutch Creek #1	1,212	44,173	45,
	39	Dutch Creek #2	1,213	256,280	257,
	40	L.S. Wood #3 Thompson Creek #1	1,213	223,431 116,049	224, 116,
	42	Thompson Creek #3		3,605	3,
Rio Blanco			34,842	161,940	121,
	43	Northern #1	18,697		5,
	44	Rienau #2	16,145	161,940	115,
Routt	4-	A 110	4,715,949	2,025,223	6,727,
	45 46	Apex #2 Edna Strip	16,658 561,178	1,996 439,591	1 000
	47	Energy Strip	2,618,668	792,787	1,000, 3,351,
	48	Grassy Creek #1	191,981	44,026	229,
	49 50	Hayden Gulch Meadows Strip	99,519	746,823	885,
	51	Seneca Strip	1,227,945		9, <sup>1</sup>
Weld			7,293		
TTOIG	52	Keenesburg Strip	7,293		7,5 7,5
TOTALS			9 689 122	9,894,138	19,732,
			0,000,120	,004,100	19,732,
1-Orchard Vall	ey repor	ted production less Blue	Ribbon and Red	Canyon shipme	ents.

1-Orchard Valley reported production less Blue Ribbon and Red Canyon shipments.
\*-Estimated (C)-Closed (I)-Idle
\*\*Total production may differ from amount shipped due to stock change.

Source: Colorado Div. of Mines, Coal Mine Operator's Annual Reports, 1981

# 1981 INDUSTRIAL COAL CONSUMPTION

#### Major Consumers (In Tons)

Colorado Fuel and Iron Corp.  Pueblo, Colorado		(Allen and Maxwell) (Cold
r debio, Colorado		(Bokoshe, Oklahoma) (Co
	961,000	
Martin Marietta Cement Lyons, Colorado	64,548	(Northern Coal Co.) (Cold
Ideal Basic Industries Florence and Fort Collins		(Edna Strip) (Colo.) (Wyoming)
	234,000	
Coors	151,845	(Grassy Creek) (Colo.)
Golden, Colorado	39,873	(Hayden Gulch) (Colo.)
	31,714	(Empire Strip) (Colo.)
	15,527	(Viking Strip) (Colo.)
	2,699	(Keenesburg) (Colo.)
	241,658	

TOTAL INDUSTRIAL CONSUMPTION IMPORTS IN-STATE

1,501,206 235,000 1,266,206 PLATE 1 OF 3

#### ELECTRICAL GENERATION

In 1981, Colorado consumed 22,976,000 kwh\* of electricity in all sectors of the economy. A total of 25,669,374 kwh of electricity was produced within the state. This is gross generation and does not account for line and other losses. Of this, an estimated 21,016,131 kwh was produced by coal fired steam generation plants, 2,131,553 kwh using oil and/or gas in major coal fired plants and assorted gas-oil fired plants, 1,771,273 kwh by hydroelectric plants and 750,480 kwh by the nuclear fueled plant.

Coal is the predominant fuel (81.9% of total generation), and of the total coal used, 77% is mined in-state while 23% is imported from out-of-state (mainly Wyoming). The building of large coal fired plants in recent years have caused the shut down or placing on standby of numerous small city owned generation facilities, mainly located throughout eastern Colorado.

\*Source: University of Colorado, Business Research Division, Graduate School of Business Administration.

#### 1981 STEAM ELECTRIC GENERATION

	(MW)	(x1000)	(TNS)	(MCF)	(bbl)
Central Telephone & Util. Corp.					
or o					
Canon City	38.5	253,513	156,857		
Pueblo	30.0	93,383		1,525,401	334
Pueblo (IC)	10.0	695			1,141
Rocky Ford	7.5	33,043		542,208	
Rocky Ford (IC)	10.0	871			1,525
	96.0	381,505	156,857	2,067,609	3,000
City of Colo. Spgs.					
Geo. Birdsall	63.0	5,609		91,958	
Martin Drake	282.0	1,565,649	835,294	74,147	
Ray D. Nixon	200.0	1,141,737	584,721	74,147	3,345
, a, s, t,				100.105	-
	545.0	2,712,995	1,420,015	166,105	3,345
Colo. Ute Electric					
Assoc., Inc.					
Hayden #1	190.0	1,083,385	538,350	1	3,184
Hayden #2	275.4	1,595,906	770,948		5,121
Nucla	37.8	78,891	55,314		
Bullock	10.0	23,644	17,785		386
Craig #1	447.0	2,571,429	1,304,614		28,476
Craig #2	447.0	2,817,154	1,437,323		21,630
	1407.2	8,170,409	4,124,334	0	58,797
Public Service Co. of Colorado					
Arapahoe	251.0	1 001 517	700 007	70.040	
Valmont	282.0	1,261,517	730,207	73,212	
Cherokee (IC)	802.0	1,078,483	529,798	787,550	
Zuni	115.0	4,357,427 328,960	2,045,844	2,337,664	4.057
Cameo	75.0	396,723	201,976	4,849,817	4,257
Comanche	778.5	4,066,037	2,404,671	259,457 9,695	15.649
Valmont (CT)	66.0	20,080	2,404,071	277,009	15,648 458
Fruita (CT)	29.0	13,647		192,117	351
Alamosa (CT)	58.0	14,113		196,659	5,101
Alamosa	18.0	14,370			813
Ft. Lupton (CT)	110.0	71,671		261,159 822,593	651
Pawnee	552.0	259,747	161,579	022,090	60,030
Sub Total	3,118.5	11,882,712	6,074,075	10,066,932	87,336
Ft. St. Vrain (NU)	342.0	750,480			
Total	3,460.5	12,633,192	6,074,075	10,066,932	87,336
	5,508.7	23,898,101	11,775,281	12,300,646	152,478

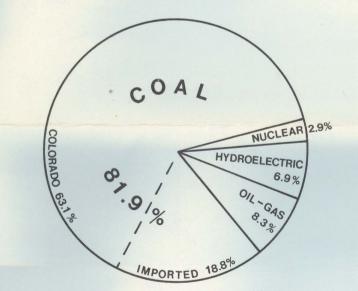
Source: Federal Energy Regulatory Commission, Municipal Electric Utilities, Annual Reports

DOE/EIA-0095(80) Inventory of Power Plants in the United States.

#### 1981 ELECTRIC UTILITY COAL CONSUMPTION

otal Utility Consumption	11,775,781 Tons
nports	2,708,430 Tons
-State	9.067.351 Tons

#### 1981 ELECTRICAL OUTPUT BY ENERGY SOURCE



#### 1981 HYDROELECTRIC POWER GENERATION

Namepiate kwH Generated

Owner	Plant	Rating (MW)	(x 1000)
City of Colorado	Manitou	5.0	15
Springs	Ruxton	1.0	2
Colorado Ute	Ames	4.0	10,027
Elec. Assn., Inc.	Tacoma	7.5	7,704
City of Denver	Williams Fork	3.0	7,149
City of Estes Park	Fall River	1.0	900
City of Longmont	Longmont	2.0	4,186
Public Service Company	Boulder Hydro.	20.0	16,995
of Colorado	Georgetown Hydro.	2.0	3,257
	Palisade Hydro.	4.0	12,142
	Salida Hydro.	2.0	6,094
	Shoshone Hydro.	16.0	96,769
	Cabin Creek	300.0	157,691*
Redlands Water & Power Co.	Redlands	1.4	10,643
Bureau of Reclamation	Big Thompson	4.5	12,558
-aroua of ricolalilation	Blue Mesa	60.0	247,005
	Crystal	29.0	170,184
	Estes	45.0	115,252
	Flatiron	74.0	251,286
	Green Mountain	22.0	28,747
	Lower Molina	5.0	17,502
	Upper Molina	9.0	29,485
	Mary's Lake	8.0	44,457
	Morrow Point	120.0	316,417
	Pole Hill	33.0	204,806
Total		778.4	1,771,273

\*Pump storage facility used 398,464 mw for pumping

# ACKNOWLEDGEMENTS

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Base from U.S. Geological Survey

DRAFTED BY CHERYL BRCHAN

SAN ARD PART JUAN RIVER REGION

FOREIGN EXPORT

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#### EXPLANATION

10 10 20 30 40 50 Kilometers

Scale 1:1,000,000

Lambert conformal conic projection based on standard parallels 33° and 45°

CUSTER

COSTILLA

MESA

TRINIDAD

F Standby (oil/gas)

TO TEXAS, NEW MEXICO

Approximate coal region boundary **ELECTRICAL GENERATION** FACILITIES DENVER Coal region name REGION DURANGO Coal field name Coal/oil/gas fired FIELD (major facilities) Surface mine and number (keyed to Coal Statistics Table) Coal fired - mine mouth Underground mine and number (keyed to Coal Statistics Hydroelectric Nuclear Generalized coal movement direction

Scale: O Percent of total Colorado production

# 1981 COAL PRODUCTION DESTINATION\* 0 10 20 30 40 50 60 70 80 90 100 PERCENT IN-STATE OUT-OF-STATE \*C.G.S. estimations. Actual amounts

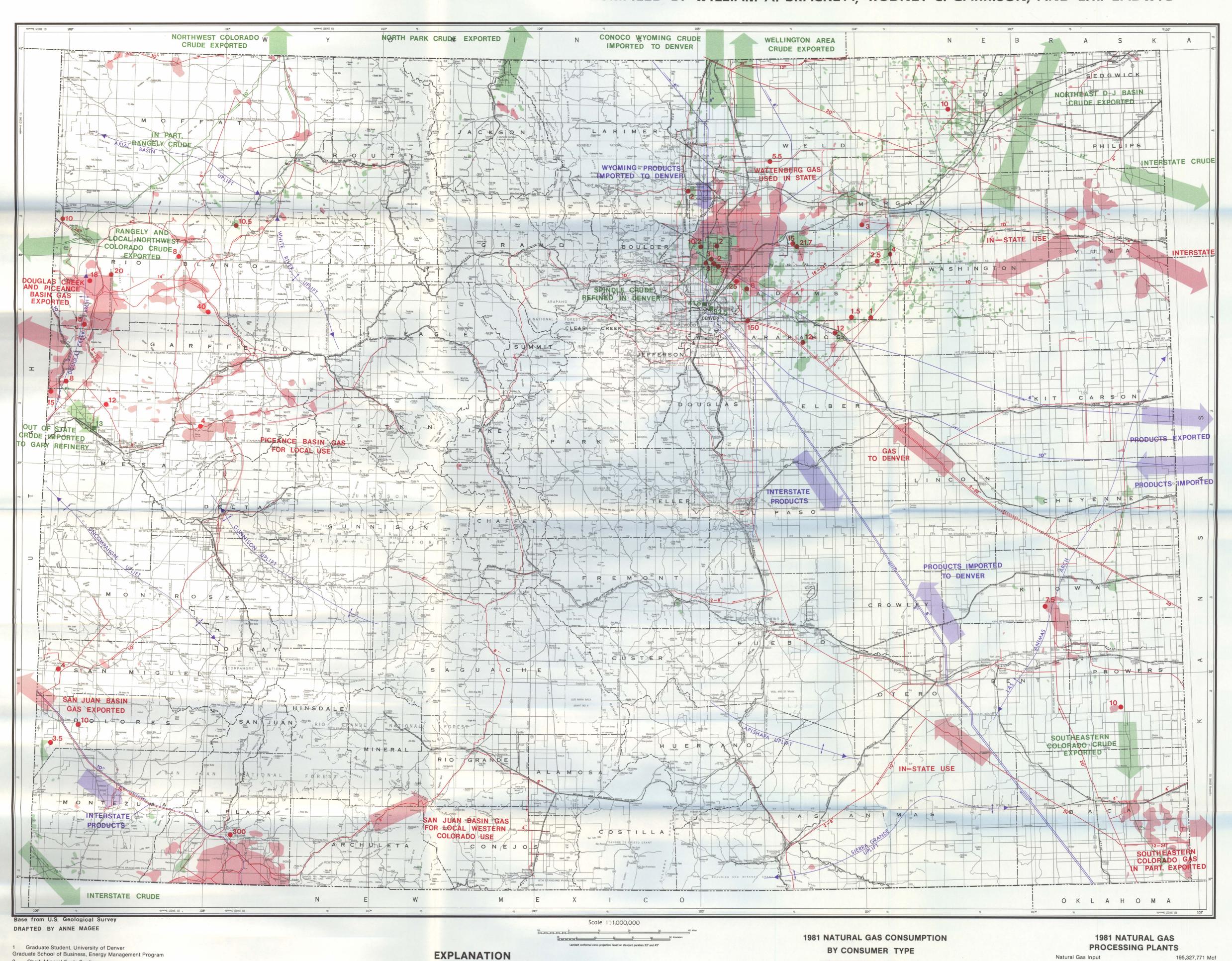
OKLAHOMA

\*Graduate Student, University of Denver Graduate School of Business, Energy Management Program

\*\*Chief, Mineral Fuels Section, Colorado Geological Survey

# COLORADO ENERGY BALANCE-1981, Plate 2

OIL AND GAS PRODUCTION, MOVEMENT, AND CONSUMPTION COMPILED BY WILLIAM A. BRACKETT, RODNEY C. GARRISON, AND L.R. LADWIG<sup>2</sup>



Oil movement direction

Gas movement direction

Product movement direction

During 1981, a total of 200.4 Bcf of natural gas was produced in 30 Colorado counties. Of this, 197.0 Bcf was hydrocarbon gas, and 3.4 Bcf was CO<sub>2</sub>. This raw gas was processed by 38 gas plants located in 15 counties, mainly separating produced gas (wet) into dry gas and various products such as propane, butane, natural gasolines, and other hydrocarbon mixes. Dry gas and products are transported in- and out-of-state via pipeline, tank car, and truck.

**COLORADO NATURAL GAS-1981** 

Due to the location of the wells that produce this gas and existing pipelines, not all of this gas was consumed within Colorado, but part was exported into interstate commerce. This amounts to 143.0 Bcf imported and 81.2 Bcf exported for a net import into Colorado of 61.8 Bcf. Added to Colorado production of 197.0 Bcf is this 61.8 Bcf of imported gas and 2.4 Bcf of gas withindrawn from storage. Natural gas converted to other products amounted to 26.9 Bcf and an additional 13.7 Bcf was used as lease and pipeline fuel.

Of the 220.5 Bcf of natural gas available to consumers, 37.2% (81.9 Bcf) was used in the residential sector, 30.7% (67.7 Bcf) industrial, 26.7% (58.9 Bcf) commercial and 5.4% (12.0 Bcf) for utility fuel. Total value of this gas was in excess of \$788

At the end of 1981, Colorado's natural gas reserves were estimated at 3.2 Tcf.

Commission, Annual Report (1981).

Source: Colorado Oil and Gas Conservation

Colorado Public Utilities Commission.

Interstate Transmission and Pipeline Companies personal communication.

Statistics of Interstate Natural Gas Pipeline Companies, 1980: DOE/EIA-0145(80).

U.S. Crude Oil, Natural Gas, and Liquid Reserves, 1981 Annual Report, DOE/EIA-0216(81).

#### 1981 NATURAL GAS PRODUCTION BY COUNTIES

			CUMULATIVE
		GAS	TO 1-1-82
	GAS	SALES	GAS
COUNTY	(Mcf)	(Mcf)	(Mcf)
DAMS	18,142,889	16,924,227	200,070,797
RAPAHOE	3,633,593	3,351,010	52,253,314
RCHULETA	10,781	10,781	396,078
BACA	5,929,224	5,903,077	85,443,667
BENT	1,016,598	1,015,856	14,605,366
BOULDER	548,870	528,534	656,847
CHEYENNE	297,409	32,950	1,572,037
OOLORES	1,055,462	892,923	13,200,861
LBERT	1,954,142	1,844,125	11,757,516
SARFIELD	8,878,977	8,835,183	57,532,567
HUERFANO	127	0	2,502
ACKSON	2,910,484	191,764	666,091,699
EFFERSON	0	0	3,820
AWOI	2,030,688	2,011,419	33,985,676
(IT CARSON	14,674	14,674	54,351
A PLATA	28,161,329	28,004,026	825,106,456
ARIMER	465,509	403,192	24,414,436
AS ANIMAS	0	0	2,390,121
OGAN .	1,544,757	1,203,840	196,059,877
MESA	4,684,431	4,662,231	74,857,695
MOFFAT	17,723,655	17,123,976	564,826,930
MONTEZUMA	1,041,010	889,699	24,402,280
MONTROSE	0	0	58,092
MORGAN	1,443,224	1,233,851	184,166,205
HILLIPS	4,819	4,819	67,562
PITKIN	0	0	12,629,822
ROWERS	1,299,527	1,124,792	9,070,912
IO BLANCO	29,184,539	25,999,123	1,193,729,867
OUTT	122,993	23,085	872,435
AN MIGUEL	1,200,713	1,128,672	26,357,698
EDGWICK	103,020	103,020	6,116,862
VASHINGTON	2,293,286	2,050,316	63,778,045
VELD	59,877,680	58,609,481	483,441,198
UMA	4,920,264	4,891,504	13,348,139

200,494,674 189,012,150 4,843,321,724 Condensate production is included as oil production. A tabulation

showing Hydrocarbon Gas, Carbon Dioxide, and Helium production

is as follows:

	1981	CUMULATIVE
YDROCARBON GAS (Mcf)	197,054,674	4,178,308,663
ARBON DIOXIDE (Mcf)	3,440,000	664,960,061
ELIUM (Mcf) (Las Animas County)		53,000

Source: Colorado Oil and Gas Conservation Commission

"Oil & Gas Statistics, 1981."

Total Natural Gas Production

C0<sub>2</sub> Production

Total Consumed

195,327,771 Mcf

26,996,488 Mcf

168,331,283

439,927 Bbls

2,025,947

2,773,841

1,763,802

945,000

101,424

286,016

1,315

10,914,272 Bbls

Natural Gas Input

Natural Gas Output

Gas Products Produced

Condensate

Butane

Propane

Gasoline

NGL Mix

Crude Oil

LPG

Other

Converted to Other Products

(18.6%)

(25.4%)

(16.2%)

(8.7%)

(0.9%)

(26.2%)

#### 1981 COLORADO NATURAL GAS STATISTICS

200,494,674

220,563,744

3,440,000

		0,110,000
Net Hydrocarbon Gas Produ	ction	197,054,674
Imported Natural Gas		143,082,815
Colorado Production Exporte	ed	81,279,864
Net Imported		61,802,951
Natural Gas Placed in Storag		33,973,029
Gas Withdrawn from Storage		36,457,636
Net gain (+) or loss (-)		- 2,484,607
Natural Gas Available for Co	nsumption	
Colorado Production		197,054,674
Net Import		61,802,951
Gas from Storage		2,484,607
		261,342,232
Natural Gas Converted in Ga To other Products (Butane,		
etc.)	Propane, NGL,	26,996,488
Natural Gas Used as Lease	and Pipeline	
Fuel		13,782,000
Total Natural Gas Available to	o Consumer	220,563,744
Total Natural Gas Used by C	onsumers	
Residential	(37.2%)	81,968,532
Industrial	(30.7%)	67,666,271
Commercial	(26.7%)	58,889,453
Electric Utility Fuel	(5.4%)	12,039,487

(100.0%)

#### 1981 - COLORADO NATURAL GAS **PROCESSING PLANTS**

h Coors Co.,			Courses Colo	rada Oil and Oa	. 0
tenberg Gas Plant, Weld Co. o Production,	8.0.	RF	Commission.	rado Oil and Gas	s Conser
ria Plant, Arapahoe Co.	10.0		Commission.		
idle Plant, Weld Co.	12.0	TE			
tenberg Plant, Adams Co.	37.0	TE	Rold,	John W., "Cold	rado's E
Land Co.	150.0	TE	Resou	urces", June 16, 1980	0.
ance Creek Plant,					
Blanco Co.	40.0	RA			
on Oil Co.,					
ood Plant, Rio Blanco Co.	10.0	RF	1981 OIL P	RODUCTION B'	Y COUN
o Inc.					
ta Plant, Mesa Co.	21.0	AD			CUMU
on Oil Corp.,					PRODU
gen Plant, Weld Co.	21.7	RA			TO
ey Plant, Morgan Co.	3.0	RA		OIL	
gical Engineering Systems, Inc.			COUNTY	(Bbls)	
hton Plant, Weld Co.	2.0	RF			
in Creek Plant, Adams Co.	1.5	RF	ADAMS	3,111,509	37
son Farms Plant, Weld Co.	2.0	RF	ARAPAHOE	804,482	19
ior Oil Corp., subsidiary of			ARCHULETA	108,603	6
sas-Nebraska Natural Gas,			BACA	66,285	1
ter Plant, Logan Co.	10.0	RA	BENT	6,840	
nergy Processing Co.,			BOULDER	23,576	
yo Plant, Adams Co.	1.0	RF	CHEYENNE	1,343,446	7
oose Canyon Plant, Dolores Co.	5.5	RF	DELTA	175	
Hydrocarbon Co.,			DOLORES	113,025	1
th Boxer Plant, Morgan Co.	2.5	JE	ELBERT	498,149	2
d Creek Plant, Adams Co.	25.0	RA	FREMONT	27,933	14
Utilities Board,		110	GARFIELD	9,033	
el Spring Plant, Prowers Co.	10.0	AD	HUERFANO	281	
and Gas Processing Co. Ltd.,		AD	JACKSON	224,512	13.
eland Plant, Larimer Co.	2.0	RF	JEFFERSON	0	10
Production Co., subsidiary	2.0	nr	KIOWA	319,148	10
orthwest Energy Co., Founda-			KIT CARSON	1,007	10
Creek Plant, Rio Blanco Co.	15.0	DE	LA PLATA	71,941	
th Douglas Creek Plant,	13.0	RF	LARIMER	238,548	15.
Blanco Co.	20.0	D.F.	LINCOLN	773	13,
west Pipeline	20.0	RF	LOGAN	719,272	102
icio Plant, La Plata Co.	300.0	4.5	MESA	10,389	102
a Energy Corp.,	300.0	AB	MOFFAT	470,040	55,
tennial Plant, Weld Co.	5.5		MONTEZUMA	143,330	7.
Engineers Inc.	5.5	RF	MORGAN	399,211	25,
Clave Plant, Kiowa Co.	7.5		PROWERS	24,136	25,
Mountain Natural Gas.	7.5	RA	RIO BLANCO	15,947,577	712
bran Plant, Mesa Co.	4.0		ROUTT	171,059	713,
ance Plant, Rio Blanco Co.	4.0	RF	SAN MIGUEL		5,
th Canyon Plant, Garfield Co.	8.0	RF		7,931	100
	15.0	RF	WASHINGTON	1,506,326	130,
ias Co.,			WELD	4,040,101	77,
ver Central Plant, Arapahoe Co.	12.0	RA	YUMA	0	
gon Trail Plant, Rio Blanco Co.	18.0	RA			
o Inc.,					
on Creek Plant, Rio Blanco Co.	10.5	RF	CTATE		
merican Gas Products,			STATE	00 100 000	
tenberg Plant, Weld Co.	14.0	RA	TOTAL:	30,408,638	1,327,
-Colorado Pipeline Co.,			0 0 1		
k Rock Plant,				Dil & Gas Conservation C	ommission, '
Miguel Co.	4.0	RA	Gas Statist	ics, 1981."	

Process methods: D--dehydration. AB--absorption, RF-refrigeration, AD--adsorption, JE--J-T expansion, S--sweetening RA--refrigeration-absorption, TE--turbo expander (cryogenic), F-

Buck Peak Plant, Moffat Co.

Adena Plant, Morgan Co.

Western Slope

Vessels Gas Processors, Ltd., Brighton Plant, Weld Co.

Baxter Plant, Garfield Co.

West Douglas Plant, Rio Blanco Co.

Dove Creek Plant, Dolores Co.

1981 NATURAL GAS PRODUCTION -		
MOVEMENT USE Product F	Pipelines	
COLORADO Capacity I	Bbls/day	Size
PRODUCTION Amoco	20,000±	6"
Chase	50,000	10"
Medicine Bow	20,000	6"
197.0 Medicine Bow Mid-America Phillips	65,000	6"
Phillips	36,000	8"
	14,000	6"
Medicine Bow Mid-America Phillips  Wyco	50,000	8"-6"
Crude P	ipelines	
Company Capacity	Bbls/day	Size
Amoco	145,000	20"-
	12,000	10"
PIDEASE	6,000	6"
PIPELINE AND COMPARIED  CONTROL  CONTRO	20,000±	6"
Cheyenne	4,000	8"
Conoco	55,000	10"
Diamond Shamrock	7,000	6"
TO CONSUMERS Matador	3,000	4"-
Natadol Natadol	1,000	4"
Permian Corporation	5,300	6"
	1,200	4"
Pure Transportation Company	60,000	12"
	60,000-40,000	12"-
	25,000	6"-

#### COLORADO CRUDE OIL AND REFINED PRODUCTS - 1981

Production of crude oil in Colorado in 1981 totaled 30,408,638 barrels. This was a 2% increase over 1980 production. Of this total production, over one-half came from Rio Blanco County (Rangely Field), with Adams, Cheyenne, Washington, and Weld Counties adding over 10 million more barrels and the remainder produced from 25 other Colorado counties.

Colorado, though producing a significant amount of crude oil, refined considerably less than it consumed. Due to historic patterns of oil field locations and pipelines, most of Colorado's crude production is channeled to out-of-state refineries, while the bulk of refined petroleum products consumed in the state are refined out of state.

Actual movements over specific pipelines constitutes proprietary information. However, existing pipeline capacities give an idea of the potential movements within the state. The capacities, directions, and products carried may be changed with relatively minor alternations. Pipelines account for about 65% of the crude oil movement in Colorado, 33% by tank-truck, and 2% cannot be accurately determined. In 1977 Colorado had more pipelines carrying crude and refined products than in 1981. One major line was converted to natural gas liquids.

Petroleum products consumption in Colorado during 1981 was 62,548,757 barrels. This figure represents the actual consumption + 5%. Variations are due to changes in stocks at refineries, pipelines, terminals, and distributors.

Refining capacity in Colorado is currently at Source: Oil Deposition and Refining, Petroleum Information, 1981

In 1980 the proven reserves of oil in Colorado were 260 million barrels. Estimated undiscovered resource was approximately 1.975 billion barrels. These figures are based upon existing technology and do not include oil from oil shale.

RF	1981 OIL PI	RODUCTION BY	COUNTIE
AD			CUMULATI
RA		0.11	TO 1-1
RA	COUNTY	OIL (Bbls)	(B
RF			
RF	ADAMS	3,111,509	37,528,
RF	ARAPAHOE	804,482	19,839,
	ARCHULETA	108,603	6,318,
	BACA	66,285	1,801,
RA	BENT	6,840	178,
	BOULDER	23,576	819,
RF	CHEYENNE	1,343,446	7,356,
RF	DELTA	175	
	DOLORES	113,025	1,720,
JE	ELBERT	498,149	2,434,
RA	FREMONT	27,933	14,821,
	GARFIELD	9,033	17,
AD	HUERFANO	281	2,
	JACKSON	224,512	13,228,
RF	JEFFERSON	0	15,
	KIOWA	319,148	10,727,
	KIT CARSON	1,007	45,
RF	LA PLATA	71,941	947,
	LARIMER	238,548	15,095,
RF	LINCOLN	773	
	LOGAN	719,272	102,490,
AB	MESA	10,389	31,
,,,,	MOFFAT	470,040	55,618,
RF	MONTEZUMA	143,330	7,259,
	MORGAN	399,211	25,292,
RA	PROWERS	24,136	165,
107	RIO BLANCO	15,947,577	713,263,
RF	ROUTT	171,059	5,207,
RF	SAN MIGUEL	7,931	150,
RF	WASHINGTON	1,506,326	130,320,
	WELD	4,040,101	77,185,
RA	YUMA	0	13,
RA			10,
nA			
RF	OTATE		
	STATE	00 100 000	
RA	TOTAL:	30,408,638	1,327,902,

# 1981 COLORADO REFINERY CAPACITIES

npany	Capacity Bbls
mara (Denver)	41,800
noco (Denver)	32,500
y (Fruita)	13,000
	87,300*

\*Expanded in 1982 by 17,000 Bbls/Day.

#### 1981 COLORADO PIPELINE CAPACITIES

	Product Pipelines	
Company	Capacity Bbls/day	Size
Amoco	20,000 <u>±</u>	6"
Chase	50,000	10"
Medicine Bow	20,000	6"
Mid-America	65,000	6"
Phillips	36,000	8"
	14,000	6"
Wyco	50,000	8"-6"
	Crude Pipelines	
Company	Capacity Bbls/day	Size
Amoco	145,000	20"-22"
	12,000	10"
	6,000	6"
Bonanza	20,000±	6"
Cheyenne	4,000	8"
Conoco	55,000	10"
Diamond Shamrock	7,000	6"
Matador	3,000	4"-3"
	1,000	4"
Permian Corporation	5,300	6"
	1,200	4"
Pure Transportation C	ompany 60,000	12"
	60,000-40,000	
	25,000	6"-8"

#### 1981 COLORADO PETROLEUM PRODUCTS DISTRIBUTION

oduct	Bbls*	% Total	
soline (regular)	32,366,964	51.75	
soline (unleaded)	12,327,547	19.71	
esel	8,256,921	13.20	
rosene-based jet fuel	4,439,328	7.10	
ppane	2,041,555	3.26	
Heating Oil	1,253,754	2.00	
n-utility #5, #6, fuel oil	643,855	1.03	
rosene	346,807	.55	
ner residual fuel oil	317,094	.51	
ner mid-distilates	284,375	.45	
ation Gasoline	231,015	.37	
ptha-based jet fuel	36,005	.06	
lity Use #5, #6 fuel oil	3,537	.01	

62,548,757 100.00%

\*One barrel equals 42 U.S. gallons

Source: Colorado Office of Energy Conservation

#### 1981 COLORADO CRUDE OIL MOVEMENT BY METHOD

	%	Amount/Bbls	
Pipeline	64.70	19,074,389	
Truck	32.65	9,928,420	
Misc.	2.65	805,829	
	100.00	30,408,638	

87,300 barrels per day.

#### John P. Byrden-Coordinator of the Energy Management Program, Graduate School of Business and Public Management, University of Denver, who set up this intern program. Also the following people and organizations who supplied valuable information: Ron Cattany, formerly with the Colorado Office of Energy Conservation; Colorado Oil and Gas Conservation Commission; Colorado Public Utilities Commission, and the Interstate Transmission and Pipeline

**ACKNOWLEDGMENTS** 

The authors wish to give special thanks to Dr.

Oil field

Showing capacity in thousand barrels/day.

Showing capacity in million cubic feet/day.

Gas processing plant

Crude oil pipeline,

Natural gas pipeline

Products pipeline

direction of flow & diameter

direction of flow & diameter

direction of flow & diameter

2 Cheif, Mineral Fuels Section

Colorado Geological Survey

Companies.

PROPOSED LA SALLE

PIPELINE CORRIDOR

FOR CRUDE SHALE OIL

TO BE REFINED

OUT OF-STATE

YELLOWCAKE EXPORTED EAST

HINSDALE

RIOGRAND

**RESOURCE SERIES 26** PLATE 3 OF 3

1981 COLORADO URANIUM MINES AND MILLS

GEOTHERMAL

The geothermal resources of Colorado, are

represented by the 61 thermal springs and wells found

throughout the western one-half of the State. These

resources, which can be properly classified as

hydrothermal resources, range in temperature from a

low of 70°F to a high of 181°F. Due to the geologic

complexity of western Colorado no generalized

comment can be made regarding the geological

conditions surrounding these areas. To some degree

all the areas appear to be fault controlled, and are

associated with rocks ranging in age from

Preliminary evaluation of each thermal area has shown

that the 61 thermal areas may contain from

4,880,000,000,000,000 to 13,240,000,000,000

B.T.U.'s of heat energy (4.8 to 13.2 Quads).

Exploration work by major energy companies has

failed to locate any area in Colorado having reservoir

characteristics suitable for the generation of

While the hydrothermal resource areas are widely scattered throughout western Colorado some of the areas are found in close proximity to urban areas and the thermal waters could be used for a wide range of direct application uses. For example, they could be used for district heating systems such as was recently

developed in Pagosa Springs, or for a variety of such

Development of Colorado's hydrothermal resources has slowed recently due to the downturn in the economy and prices of energy. Development efforts in the late 1970's showed that the geothermal resources

of Colorado could play an important part in supplying

Source: Colorado's Hydrothermal Resource Base-

**COLORADO GEOTHERMAL** 

SITE CHARACTERISTICS

An Assessment, by Richard H. Pearl, 1979,

Resource Series 6, Colorado Geological

Site Surface Discharge Quality

No. Temp. gal./min. (TDS)\*\*

Algae growing

Agriculture

Source: Colorado Division of Mines.

Precambrian to Recent.

other uses as:

Space heating

Fish farming

the energy needs of local areas.

Recreation

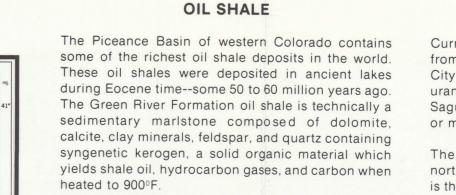
URANIUM, OIL SHALE, AND GEOTHERMAL PRODUCTION, MOVEMENT AND CONSUMPTION

CROWLEY

IMPORTED FROM OUT-OF-STATE

WASHINGTON

COMPILED BY WILLIAM A. BRACKETT\*, RODNEY C. GARRISON\*, AND L.R. LADWIG\*\*



Colorado oil shale resources are placed at a total of 1200 billion barrels in beds at least 100 feet thick that contain over 30 gal/ton and 840 billion barrels in lesser deposits 15 feet thick and at least 15 gals/ton. This makes the Piceance Basin, slightly more than 1500 sq. miles, one of the richest single hydrocarbon deposits

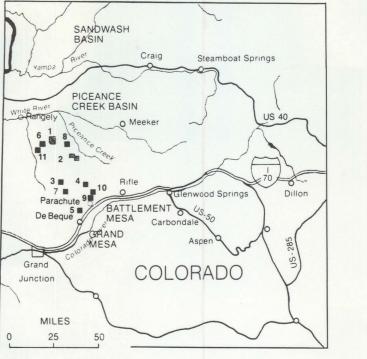
Associated with the Green River Formation are elongate, podlike masses and irregular bodies called sodium-carbonate minerals. In Colorado these are nacholite (NaHCO<sub>3</sub>), a potential source of dry industrial stack gas sulfur scrubbing agent, and dawsonite (NaAlCOH3CO2), a potential source of alumina. Estimated resources of these minerals in tons of dawsonite.

commercial production by mid 80s to late 80s, but recent changes in world oil prices and demand have generally set back most of these schedules.

During 1981 approximately 196,000 bbls of oil was produced by Occidental at Logan Wash, and 26,320 bbls by Rio Blanco Oil Shale Company.

Source: U.S. Geological Survey

#### 1982 COLORADO OIL SHALE ACTIVITY



- 1. C-a Rio Blanco (Gulf, Std. Indiana) 2. C-b Cathedral Bluffs (Occidental, Tenneco)
- 3. Clear Creek Shale Oil Project (Chevron, Conoco) 4. Colony Shale Oil Project (Exxon) 5. Logan Wash (Occidental) 6. Mahogany Shale Project (Phillips)
- 7. Pacific Shale Project (Sohio. Cleveland-Cliffs. Superior) 8. Horse Draw (Mult. Minerals) 9. Parachute Project (Mobil Oil)

ALL YELLOWCAKE IN U.S

Oakridge, Tenn.

Paducah, Ky.

OKLAHOMA

\*Graduate Student, University of Denver Graduate School of Business, Energy Management Program

\*\*Chief, Mineral Fuels Section, Colorado Geological Survey

OCESSED BY A D.O.E. FACILITY

10. Parachute Creek Shale Oil Program, (Union Oil) 11. BX In-Situ Oil Shale Project (Equity Oil)

Source: Shale Country, 1983

Parachute Creek

Shale Oil Program

Union Oil

BX In-Situ Oil

Shale Project

Current uranium ore production in Colorado comes from two major, geologically distinct areas, the Central City area and the Uravan Mineral Belt. Other areas of uranium mineralization include protions of Moffat, Saguache, and Weld Counties, which have produced or may produce in the future.

The Schwartzwalder Mine, about eight miles northwest of Golden, in the Central City uranium area. is the largest uranium mine in Colorado and is a prime example of vein-type uranium deposits in North America. Uranium from this mine occurs as veins of pitchblende associated with sulfide minerals.

The Uravan mineral belt is an arcuate belt extending from western Montrose and San Miguel Counties through southwestern Mesa County and into eastern "rolls." Numerous small mines produce ore in this

After the uranium ore is mined, it is shipped to either the Cotter Corporation mill in Canon City or the Union ore is purchased by General Electric at its buying station in Naturita and shipped to Blanding, Utah. Development of these resources during 1981 indicated Also, one company ships ore from another state to be milled in Colorado and two mines export ore to be milled in another state. At these mills uranium concentrate called "Yellowcake" is produced from uranium ore. Concentrate is also produced using the heap-leaching process, extracting uranium from old uranium tailings. Two plants in Colorado use this method and produce a very small amount of concentrate. From both types of plants, the uranium is

> After the ore is processed into enriched uranium, most is used as fuel for nuclear power plants. Colorado has one such plant at Plattville (Fort St. Vrain), a high temperature helium cooled reactor, utilizing thorium as well as uranium as feed stock. During 1981 this plant generated 750,480 kwh of electricity.

#### 1981 COLORADO URANIUM STATISTICS

ORE PRODUCTION-FROM 67 MINES 480,000 TONS\* NET EXPORT (YELLOWCAKE)

### **COLORADO URANIUM RESOURCES (1977)**

**Potential Resource** PROBABLE POSSIBLE SPECULATIVE TOTAL

At forward cost of \$30/lb U308 An estimated 3,750 tons of U308 reserves were delineated along the Front Range of Colorado since this estimate.

Source: Colorado Energy Resource Handbook, Volume 3-Uranium. Colorado Energy Research Institute, December

#### 

1982 - COLORADO OIL SHALE PROJECTS					
Project	Index No.	Technology	Estimated Production	Current Update (April 1983)	
Ca Tract Blanco Oil Shale Co. Gulf Oil, Standard Indiana	1	Original plan was modified- in-situ. Presently developing plans for an open pit with surface retorting.	No estimate of future production. Produced 26,300 Bbls oil from in-situ burn.	Completing a Lurgi pilot plant in Hannaville. PA and trying to obtain 6400 acres for off-tract disposal.	
Cb Tract Cathedral Bluffs Oil Shale Co. Occidental, Tenneco	2	Original plan was modified in-situ. Present plans for modified in-situ and aboveground retorting.	Projected 13,500 Bbls/day by 1988 if funding is approved.	Applied to U.S. Synthetic Fuel Corp. for loan guarantee. Continuation of project dependent upon this funding.	
Clear Creek Shale Oil Project nevron Shale Oil Co. Standard California), Conoco	3	Underground and open-pit mining with surface retorting and upgrading. Staged turbulent bed retort.	Ultimate 100,000 Bbls/day. Phased development of 10,000 Bbls/day (25,000 Tons-shale/ day)	Plan first phase construction to start in 1985, production by mid-1990s. Currently building a 350 ton/day semiworks at Salt Lake City.	
Colony Shale Oil Project Exxon	4	Underground mining, surface retorting using TOSCO II RETORT.	Between 1965-72 produced 180,000 Bbls oil at a semiworks retort and demonstration mine. Proposed 450,000 Bbls/day by mid-1980s	May 1983. Exxon phased out entire project. Retaining a worl force for maintenance and reclamation.	
<b>Logan Wash</b> Occidental	5	Location of modified in-situ experiments.	During early 1982 retorts 7 and 8 were burned producing 196,000 Bbls oil.	Research winding down, with only retort monitoring and reclamation work continuing.	
hogany Shale Project Phillips	6	No specifics as to process type.	No announced plans.	Site exploration and offsite studies being conducted.	
acific Shale Project hio, Cleveland-Cliffs, Superior	7	12.600 acres private land, room and pillar mine, above ground Superior Circular Grate Retort	100,000 Bbls/day by late 1990s, start-up by 1990. Uses 164,760 TPD raw shale.	In planning stage, with a Draft EIS due in late 1983.	
Horse Draw ti-Mineral Corporation	8	Underground mine, for recovery of shale oil, nacholite and dawsonite.	Research in conjunction with USBM. Company research facility 85% complete in Grand Junction. No specific plans for production.	Project on hold.	
Parachute Project Mobil Oil	9	Hold 10,000 acres. Underground room and pillar mine, surface retort.	Projected 100,000 Bbls/day (160,000 TPD raw shale) by late 1990s.	In planning stage, with a Draft EIS due in late 1983.	
_					

10,000 acres valley land.

the shale, DOE joint project.

11 Super heated steam injected into No future plans

10 Underground mine with surface Phase I-10.000 Bbls/day in Construction proceeding with

retort. 20,000 acres oil shale. late 1983, the first commercial start-up late in 1983. Ten-year

shale oil project in U.S. contract with DOD for 33 million

Phase II - 90,000 Bbls/day by barrels military diesel and jet

fuel. Seeking Synthetic Fuels

Corp. assistance for Phase II.

Project being evaluated.

Utah. Ore bodies are contained in continental sandstones with the mineralized rock forming

shipped to a federal enrichment plant.

CONCENTRATE PRODUCTION (YELLOWCAKE) 900 TONS CONSUMPTION (EQUIVALENT TO YELLOWCAKE) 20 TONS

\*Equal to 1200 tons of yellowcake at .25 U<sub>3</sub>0<sub>8</sub> Source: U.S. Department of Energy

# Tons U3O8 Yellowcake\*

101,000 82,000 37,000

Donna Collins. Colorado Geological Survey

Antelope Warm Springs Birdsie Warm Springs Brand's Ranch Well Brown's Canyon Warm Spgs. Canon City Warm Springs Canon City Warm Spgs. Canon City Warm Springs Cebolla Hot Springs Cement Creek Warm Spg. Clement Creek Warm Spg. Colonel Chinn Well Colonel Chinn Well Colonel Chinn Well Conundrum Hot Springs Craig Warm Water Well Cotonwood Hot Springs Craig Warm Water Well Doster Warm Spring Don K. Ranch Well Dotton Hot Spring Dutch Crowley Well Splashand Well Penrose Artesian Well Cegser Warm Spring Brown Spring Cegser Warm Spring Cegnod Hot Springs C	
Dexter Warm Spring	1 1 1 2 1
Don K. Ranch Well         29         82         25           Dotsero Warm Spring         10         90         1500           Dunton Hot Spring         51         108         25           Dutch Crowley Well         39         158         75           Eldorado Springs         8         79         200           Eoff Well         40         102         50           Penrose Artesian Well         28         82         130           *Fremont Natatorium Spg.         27         95         18           Fullinwider Warm Spring         58         62         11           Geyser Warm Spring         52         82         100           *Glenwood Hot Springs         11         124         2678           Hartsel Hot Springs         19         126         50           Haystack Butte Well         7         82         4           Hortense Hot Springs         19         126         50           Haystack Butte Well         7         82         4           Hortense Hot Springs         9         115         52           *Juniper Hot Springs         9         115         52           *Juniper Hot Springs         1	
Haystack Butte Well 7 82 4 Hortense Hot Spring 59 181 18 'Hot Sulphur Springs 6 111 55 'Idaho Hot Springs 9 115 52 'Juniper Hot Springs 1 100 18 'Lemon Hot Springs 50 91 10 Mapco State Well 1-32 61 34 'McIntyre Warm Springs 37 57 5 'Mineral Hot Springs 31 140 100 'Mt. Princeton Hot Spgs. 21 162 60  'Orvis Hot Springs 48 126 20 'Ouray Hot Springs 49 156 200 'Pagosa Springs 49 156 200 'Pagosa Springs 41 136 300 Paradise Hot Springs 53 115 30 'Penny Hot Springs 53 115 30 'Penny Hot Springs 53 12 'Piedra River Warm Spgs. 58 'Pinkerton Hot Springs 23 160 235 Rainbow Hot Springs 42 104 45 'Ranger Warm Springs 17 81 150 'Rhodes Warm Spring 18 75 200 Rico 54 111 60 Routt Hot Springs 3 147 65  'Sand Dunes Well 34 111 50 'Shaws Warm Spring 33 86 40 South Canyon Hot Spg. 12 120 18 'Splashland Well 35 104	1 10. 1 1 1, 1, 1, 21,
Hortense Hot Spring	23
*Ouray Hot Springs	12 12 2 1 28 28
*Shaws Warm Spring 33 86 40 South Canyon Hot Spg. 12 120 18 *Splashland Well 35 104 50	22 16 33 6 29 39 6
*Steamboat Springs 4 102 200 Stinking Springs 38 81 24 Stratton Warm Spring 57 Swissvale Warm Spring 25 82 145 *Tripp/Trimble Hot Spgs. 56 111 1 *Valley View Hot Springs 32 99 135 *Wagon Wheel Gap Spgs. 43 135 60 *Lower and Upper Waunita	6 8 33
Hot Springs 46 176 40 Wellsville Warm Spg. 24 91 200	5

#### \*Currently developed for beneficial use. \*\*Total dissolved solids.

Source: R.H. Pearl, Colorado Geological Survey

#### Program, Graduate School of Business and Public Management, University of Denver, who set up this intern program. Also the following people and organizations who supplied valuable information: Richard H. Pearl, Colorado Geological Survey (C.G.S.), geothermal; Donna Collins, C.G.S., uranium; and Bill Chenoweth, Department of Energy, Grand

ACKNOWLEDGMENTS

The authors wish to give special thanks to Dr. John P. Byrden - Coordinator of the Energy Management

Base from U.S. Geological Survey

Drafted by Anne Magee

Junction, uranium.

ANT. SCHOOL D. O. L. Chair Min. O. R. E. S.

#### OIL SHALE GEOTHERMAL URANIUM Oil shale occurrence area • 38 Geothermal spring or well and 🕺 Uranium mine Uranium processing mill Product movement Vanadium processing plant Uranium heap leach recovery operation

Scale 1:1,000,000

Lambert conformal conic projection based on standard parallels 33° and 45°

10 0 10 20 30 40 50 Kilometers

# **EXPLANATION**

Nuclear power plant Uranium occurrence area Product movement