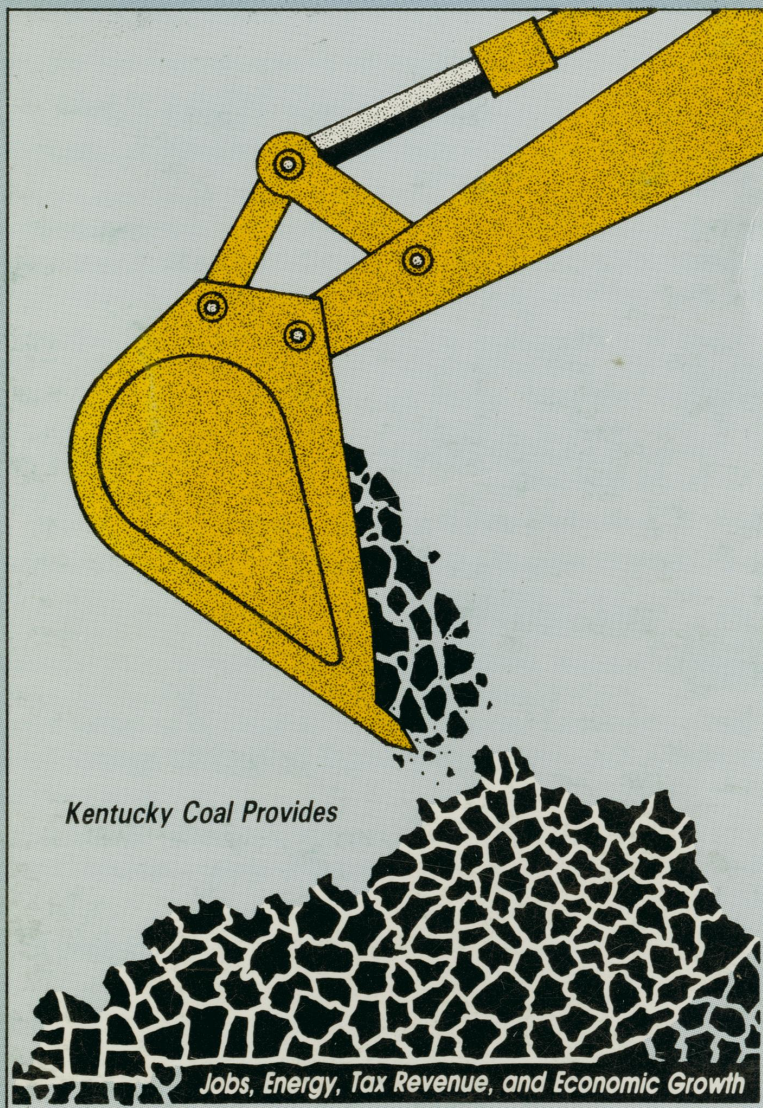


1991 - 92 POCKET GUIDE

# KENTUCKY COAL FACTS



Prepared by the  
**Governor's Office For Coal  
and Energy Policy**  
and the  
**Kentucky Coal Association**

# Highlights

## Production

Kentucky produced a record 179.4 million tons of coal in 1990, compared to the old record of 177.3 million tons set in 1987.

Kentucky was the nation's number one coal producer from 1973 to 1987, was number two in 1990, behind Wyoming, and has been one of the top 3 producers in the United States for the last 45 years.

## Employment

The Kentucky coal industry directly employed 30,498 persons and indirectly provided an additional 85,000 jobs in 1990.

The Kentucky coal industry paid over \$1.1 billion in direct wages in 1990.

## Economy

The Kentucky coal industry brought \$3.7 billion into Kentucky from out-of-state during fiscal year 1990-1991 through coal sales to customers in 25 other states and foreign countries.

Kentucky coal companies paid over \$190 million in coal severance taxes in Fiscal Year 1990-1991 and induced economic activity leading to \$570 million in General Fund revenues.

Many Kentucky communities are dependent on the coal industry.

## Coal Markets

Electric utilities are the major market for Kentucky coal, accounting for 77% of the Kentucky coal sold.

Over 80% of Kentucky's coal is sold in other states or exported.

Almost all (94%) of Kentucky's electricity is generated from coal.

There are 20 major coal-burning electric utility plants in Kentucky.

## Environment

All surface-mined land today is reclaimed equal to or better than it was, prior to mining. Kentucky received two of ten national reclamation awards in 1991 for surface mining.

Coal mining creates valuable lands, such as wetlands, wildlife habitats, flat mountaintops and industrial sites where only steep unproductive hillsides had once existed.

Kentucky operators have paid over \$440 million into a federal fund since 1977 to reclaim abandoned unreclaimed coal mines.

From the mining to the burning of coal, our environment is protected by stringent environmental performance standards.

## Coal Resources

Kentucky has two distinct coal fields, one in Western Kentucky and one in Eastern Kentucky.

Kentucky's 91.7 billion tons of coal resources remaining represent 87% of the original resource.

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December 1991

This publication is for informational use only. It includes some extrapolative second and third party data as well as some broad estimates, and should not necessarily be construed as official source data or be construed as advocating or necessarily reflecting any policy position of the Governor's Office for Coal and Energy Policy or the Kentucky Coal Association.

The Kentucky coal industry is vital to the economy of the Commonwealth. Kentucky coal means thousands of jobs and millions of dollars in tax revenues. It generates billions of dollars for Kentucky's economy.

In addition, Kentucky coal is an important energy source. It fuels the generation of almost all of Kentucky's electricity and is shipped to electric utilities and industries in many other states.

Coal has played an important role in the history of Kentucky and the United States and will play an important role in the future. As a reasonably-priced, reliable source of electricity, coal should become a key player in a national energy policy that would reduce dependence on foreign energy.

The industry has high standards for reclaiming mined land and for workers' safety. It has greatly reduced its impact upon the environment.

New challenges face the Kentucky coal industry today – fewer mining jobs, higher costs and lower prices, increased competition from other states and countries. In addition, unbalanced national and international policies concerning energy and environment continue to hamper the quest for energy independence for our country.

**Kentucky Coal Facts** was prepared to provide ready reference information about coal to government officials, legislators, regulatory personnel, media representatives, community leaders, educators, students, and other citizens. Each major section of information provides references for those requiring more detailed information.

This booklet was a joint project between the Governor's Office for Coal and Energy Policy and the Kentucky Coal Association, a non-profit organization of coal producers. Initial copies are available free from either of the offices or from members of the Kentucky Coal Association. Additional multiple copies may be purchased from the Kentucky Coal Association.

We welcome your feedback, comments, and suggestions concerning **Kentucky Coal Facts**.

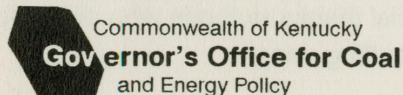
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## Kentucky Government Agencies

Governor's Office

Department of Local Government

Cabinet for Human Resources

Department for Employment Services

Natural Resources and Environmental Protection Cabinet

Department for Surface Mining Reclamation and Enforcement

Public Protection and Regulation Cabinet

Department of Mines and Minerals

Revenue Cabinet

Transportation Cabinet

Coal Haul Highway Section

## U.S. Government Agencies

U.S. Department of Energy

Energy Information Administration

U.S. Army Corps of Engineers

## Railroad Companies

CSX Transportation, Inc.

Norfolk Southern Corporation

Paducah and Louisville Railway

TransKentucky Transportation Railroad, Inc.

Tradewater Railway Company

## Kentucky Coal Association Officers

### 1991

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Robert Anderson, Jr.

Raymond A. Bradbury

Mike Musulin, II

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Chairman

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Vice President

### 1992

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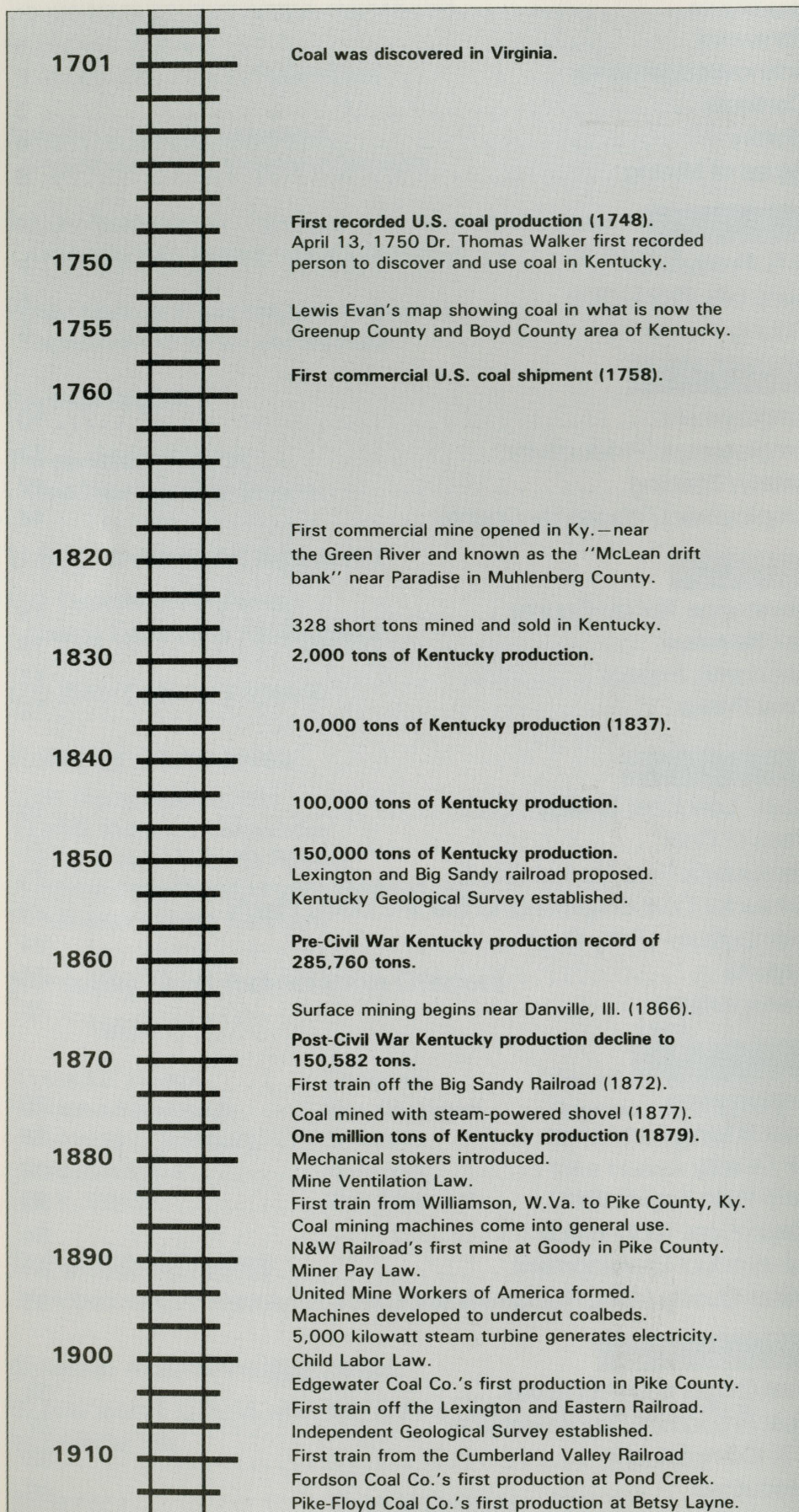
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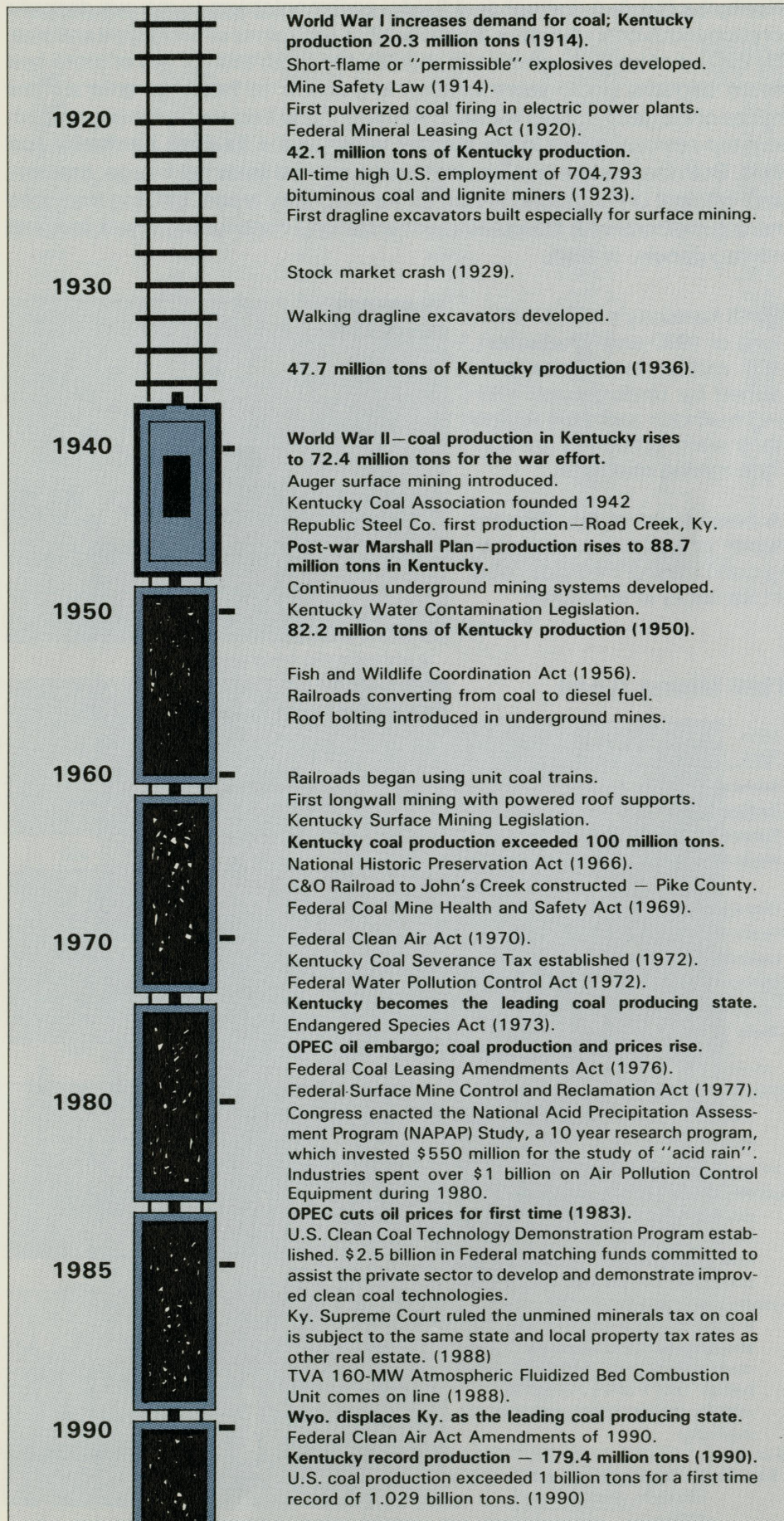
Typing

Computer Compositions

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Sources: Energy Information Administration, Coal Data: A Reference, 1989.  
Ky. Dept. of Mines and Minerals, Annual Report.  
Willard Rouse Jillson, Coal Industry in Ky., 1922.



**Kentucky has two distinct coal fields**, each containing numerous deposits of bituminous coal of various characteristics and mines of every type and size. By the use of large draglines and shovels, the excavation of two or more coal seam deposits (multi-seam mining) is possible in the large *area surface mines* of the gently rolling **Western Kentucky** coal field and in the large *mountain top removal mines* in the steeper terrain of the **Eastern Kentucky** coal field. Both the Eastern and Western Kentucky coal fields have large, modern, and efficient underground mines (of various entry types) utilizing improved mining methods with increased mechanization - continuous miners, longwall mining panels, or both.

■ Of Kentucky's 179.4 million tons of 1990 coal production, 109 million tons were produced by underground mining methods and 70.4 million tons were produced by surface mining methods.

A breakdown of the different types of surface and underground mining methods used in Kentucky is as follows:

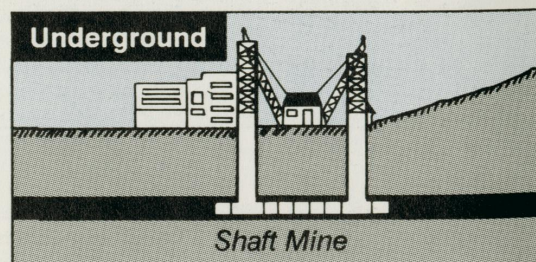
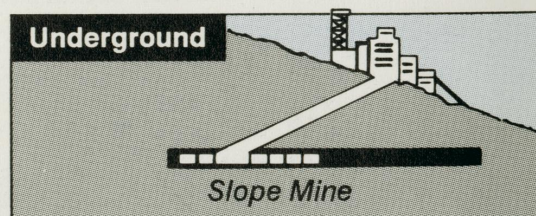
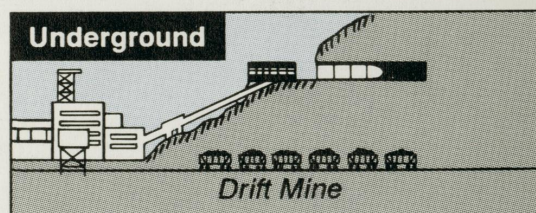
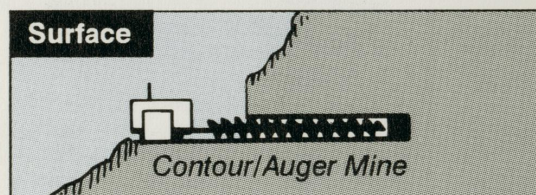
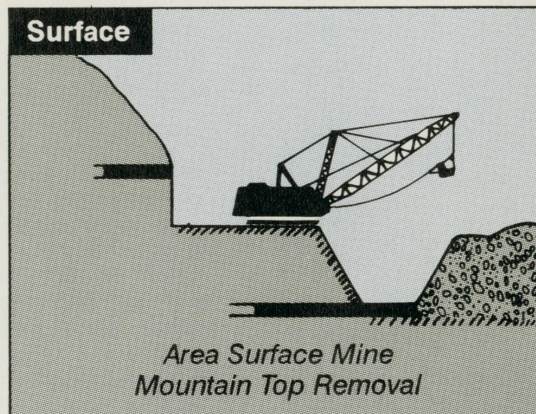
### 1990 Mining Types

Mine Type	No. of Mines	Prod. Million Tons
<b>Surface</b>		
Surface Mining	316	25.4
Surface & Auger	544	44.1
Auger Mining	83	.9
<b>Underground</b>		
Room and Pillar *	826	109.0
Longwall Mining **	(7)	(6.6)
<b>State Totals *</b>	<b>1,769</b>	<b>179.4</b>

\* Underground *Room and Pillar* values include the *Longwall mining* estimates.

\*\* Longwall mining figures are not reported separately and values are estimates from phone surveys by the Governor's Office for Coal and Energy Policy. The longwall production (6.6 million) and employee estimates (600) usually include 2 conventional mining sections used to support the development of the longwall panels. Only 4 of the 7 longwall mines were active during 1990 in Kentucky.

Sources: Ky. Dept. of Mines and Minerals, *Annual Report*, 1990.  
 Governor's Office for Coal and Energy Policy.



Source: Energy Information Administration, *Coal Data: A Reference*, 1989.

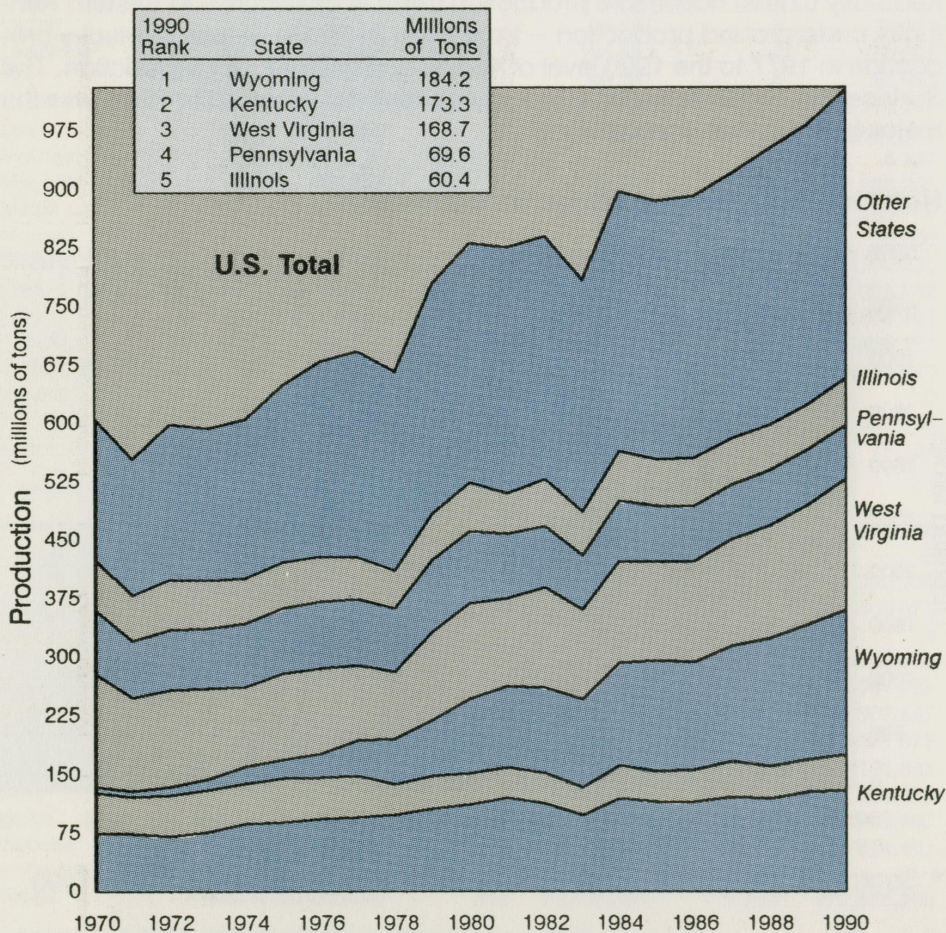


## Kentucky and U.S. Coal Production,\* 1970-1990 (millions of tons)

Year	Kentucky			United States	Kentucky as % of U.S.
	Eastern	Western	Total		
1970	72.5	52.8	125.3	602.9	20.8
1971	71.6	47.8	119.4	552.2	21.6
1972	68.9	52.3	121.2	595.4	20.4
1973	74.0	53.7	127.6	591.7	21.6
1974	85.4	51.8	137.2	603.4	22.7
1975	87.3	56.4	143.6	648.4	22.1
1976	91.1	52.8	144.0	678.7	21.2
1977	94.0	52.3	146.3	691.3	21.2
1978	96.2	39.5	135.7	665.1	20.4
1979	104.1	42.5	146.5	777.9	18.8
1980	109.2	41.0	150.1	829.7	18.1
1981	117.9	39.7	157.6	823.8	19.1
1982	111.2	39.0	150.2	838.1	17.9
1983	95.6	35.6	131.2	782.1	16.8
1984	117.3	42.3	159.5	895.9	17.8
1985	113.3	39.0	152.3	883.6	17.2
1986	112.7	41.2	153.9	890.3	17.3
1987	119.9	45.3	165.2	918.8	18.0
1988	117.5	40.3	157.9	950.3	16.6
1989	125.7	41.6	167.4	980.7	17.1
1990	128.4	44.9	173.3	1,029.1	16.8

\* This is the official U.S. DOE number for Kentucky. State and federal numbers will differ, please see page 8 for details.

## United States Leading Coal Producers\*\*

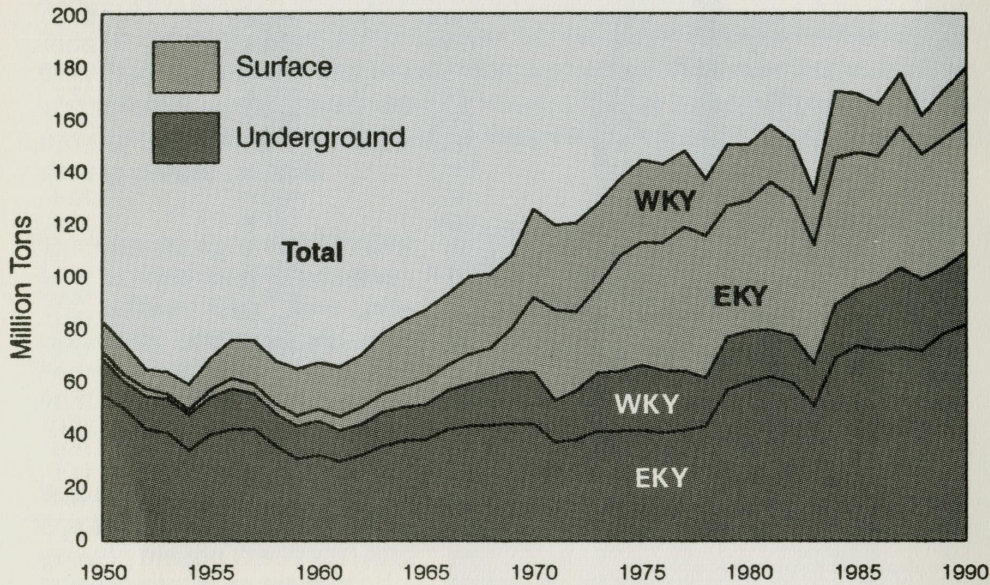


\*\* Wyoming was not one of the top five coal producers until 1978, when it surpassed Virginia and Ohio, but is included before 1978 to show its rise to the leading coal-production state.

Sources: U.S. DOE - Energy Information Administration, Coal Production, 1977 - 1990.  
U.S. Bureau of Mines, Minerals Yearbook, 1970 - 1976.

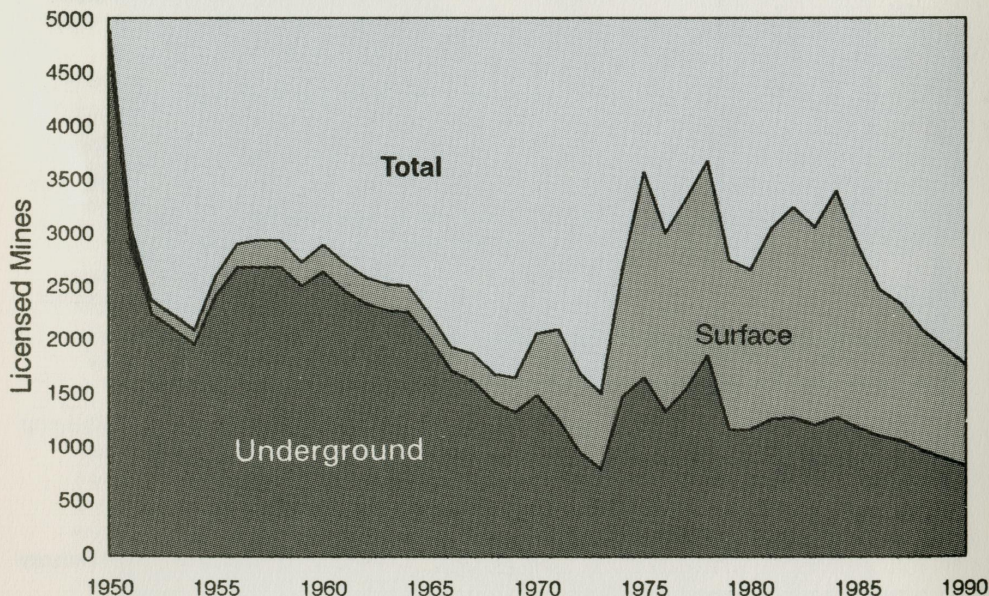
Kentucky produced a record 179.4\* million tons of bituminous coal in 1990, breaking the old record of 177.3 million tons set in 1987.

## Kentucky Production



Kentucky's most noticeable production trend is its increase in Eastern Kentucky underground production – from a low of 28.1% of total Kentucky production in 1977 to the 1990 level of 45.5% of total Kentucky production. The Surface Mining Reclamation and Enforcement Act, enacted in 1977, was the major factor in this change.

## Number of Licensed Mines in Kentucky



\* Source: Ky. Dept. of Mines and Minerals, Annual Reports, 1950 - 1990.

Note: State production numbers differ slightly each year from Federal U.S. DOE - Energy Information Administration (EIA) production numbers, due to minor differences in their methodology (i.e., clean coal versus raw coal). Please note whether Federal or State numbers are referenced when using a value in this publication.

## 1990 Tons Produced and Number of Mines

Coal Field	Production In Tons			Number of Licensed Mines		
	Surface	Underground	Total	Surface	Underground	Total
Eastern Ky.	49,393,390	81,577,417	130,970,807	860	799	1,659
Western Ky.	21,026,997	27,375,465	48,402,462	83	27	110
<b>Ky. Total</b>	<b>70,420,387</b>	<b>108,952,882</b>	<b>179,373,269</b>	<b>943</b>	<b>826</b>	<b>1,769</b>

## 1990 Production By County and Type of Mine

County	Underground		Surface		Total	
	Mines	Tonnage	Mines	Tonnage	Mines	Tonnage
<b>Eastern Kentucky</b>						
Bell	28	2,756,152	38	1,727,478	66	4,483,630
Boyd	—	—	3	401,537	3	401,537
Breathitt	—	—	49	5,425,181	49	5,425,181
Carter	1	10,000	2	21,007	3	31,007
Clay	4	211,473	24	1,455,357	28	1,666,830
Cllnton	0	0	0	0	0	0
Elliott	2	100	10	133,854	12	133,954
Floyd	90	6,122,603	62	5,680,966	152	11,803,569
Greenup	—	—	3	719,936	3	719,936
Harlan	131	13,224,107	39	1,114,809	170	14,338,916
Jackson	—	—	5	99,735	5	99,735
Johnson	9	816,817	12	73,077	21	889,894
Knott	53	4,470,693	73	4,059,289	126	8,529,982
Knox	68	582,242	30	564,886	98	1,147,128
Laurel	—	—	7	94,137	7	94,137
Lawrence	2	14,202	2	168,893	4	183,095
Lee	—	—	5	96,961	5	96,961
Leslie	20	6,628,734	21	1,545,015	41	8,173,749
Letcher	59	6,771,269	81	3,895,950	140	10,667,219
McCreary	—	—	2	5,557	2	5,557
Magoffin	6	550,322	24	1,407,913	30	1,958,235
Martin	39	8,628,393	34	4,302,369	73	12,930,762
Morgan	—	—	1	10,000	1	10,000
Owsley	—	—	16	300,535	16	300,535
Perry	24	3,963,269	98	8,042,293	122	12,005,562
Pike	233	26,029,253	141	6,528,944	374	32,558,197
Pulaski	—	—	4	266,161	4	266,161
Rockcastle	—	—	3	19,046	3	19,046
Wayne	0	0	0	0	0	0
Whitley	30	797,788	68	1,157,377	98	1,955,165
Wolfe	—	—	3	75,127	3	75,127
<b>Western Kentucky</b>						
Butler	—	—	10	1,226,708	10	1,226,708
Caldwell	—	—	1	0	1	0
Christian	1	0	3	998,329	4	998,329
Davless	—	—	12	1,509,673	12	1,509,673
Edmonson	0	0	0	0	0	0
Hancock	—	—	1	42,096	1	42,096
Henderson	1	1,136,696	2	1,564,339	3	2,701,035
Hopkins	7	3,766,861	21	6,895,726	28	10,662,587
McLean	—	—	4	221,072	4	221,072
Muhlenberg	4	3,419,827	12	3,715,816	16	7,135,643
Ohio	1	390,835	10	2,291,504	11	2,682,339
Union	8	11,563,717	1	34,772	9	11,598,489
Webster	5	7,097,529	6	2,526,962	11	9,624,491
<b>Totals</b>	<b>826</b>	<b>108,952,882</b>	<b>943</b>	<b>70,420,387</b>	<b>1,769</b>	<b>179,373,269</b>

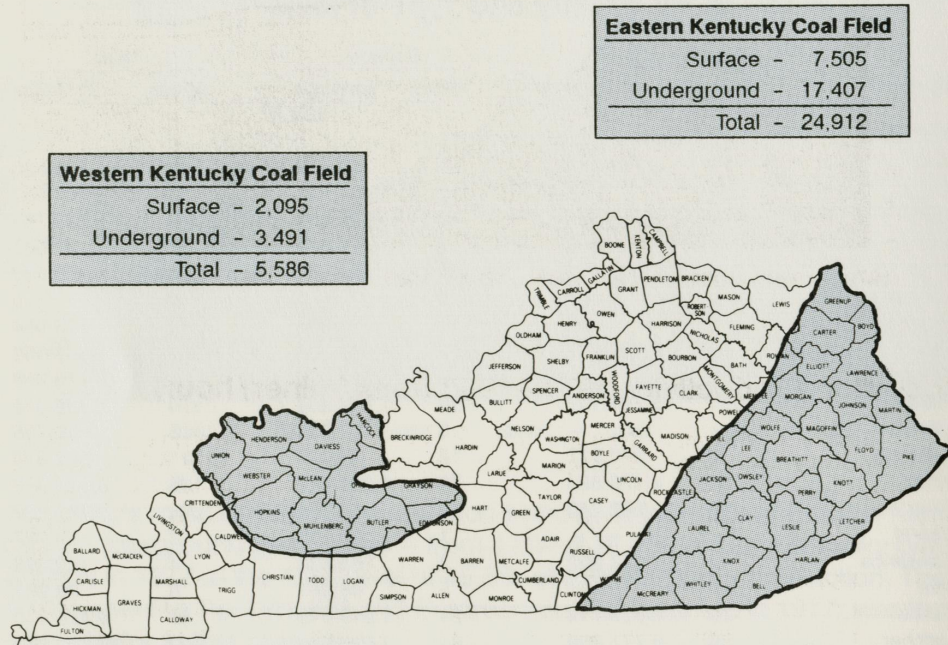
Source: Ky. Dept. of Mines and Minerals, Annual Report, 1990.

█ Pike County was the leading coal producing county in Kentucky with over 32.5 million tons of production in 1990.

█ Union County lead the production in Western Kentucky with 11.6 million tons.

The Kentucky coal mining industry has a current work force of approximately 30,498 people directly employed in coal mining jobs. The Western Kentucky coal field employs approximately 5,586 persons, while the Eastern Kentucky coal field provides 24,912 direct mining jobs.

## Kentucky's Coal Mining Work Force, 1990



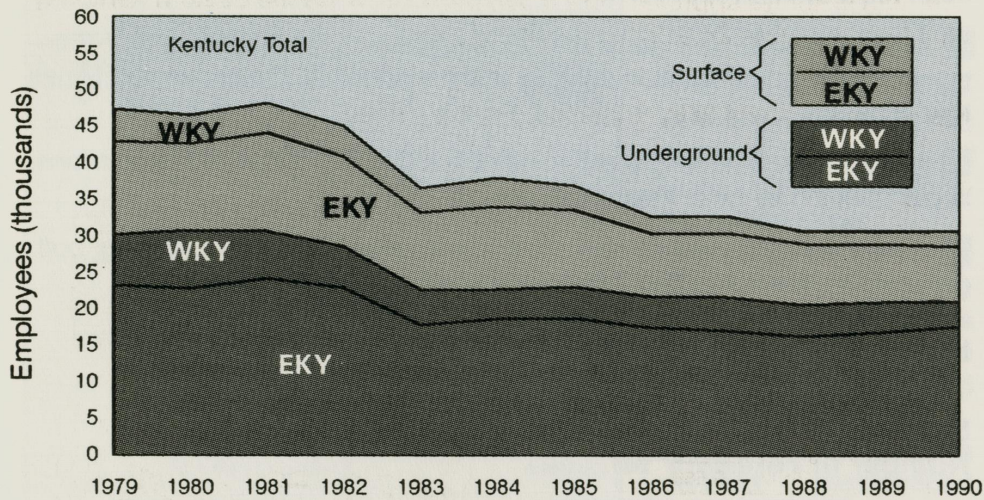
- Eastern Kentucky averaged 82% of Kentucky's coal mining work force and accounted for about 74% of Kentucky's total coal production in 1990.
- Western Kentucky averaged 18% of Kentucky's coal mining work force and accounted for about 26% of Kentucky's total coal production in 1990.
- Due to continued productivity gains, Kentucky achieved a record production during 1990 while maintaining nearly level employment.

## Kentucky Coal Mining Employment, 1979 - 1990

Year	Western Kentucky			Eastern Kentucky			Kentucky Totals
	Surface	Underground	Total	Surface	Underground	Total	
1979	4,343	6,945	11,288	12,838	23,064	35,902	47,190
1980	3,995	7,879	11,874	11,819	22,702	34,521	46,395
1981	4,056	6,489	10,545	13,473	24,032	37,505	48,050
1982	4,120	5,639	9,759	12,319	22,782	35,101	44,860
1983	3,415	4,918	8,333	10,485	17,615	28,100	36,433
1984	4,022	4,053	8,075	11,327	18,474	29,801	37,876
1985	3,421	4,294	7,715	10,516	18,583	29,099	36,814
1986	2,327	4,297	6,624	8,718	17,312	26,030	32,654
1987	2,345	4,605	6,950	8,740	16,900	25,640	32,590
1988	1,825	4,388	6,213	8,261	16,085	24,346	30,559
1989	1,870	4,166	6,036	8,034	16,586	24,620	30,656
1990	2,095	3,491	5,586	7,505	17,407	24,912	30,498

Source: U.S. DOE - Energy Information Administration; Coal Production, 1979 - 1990.

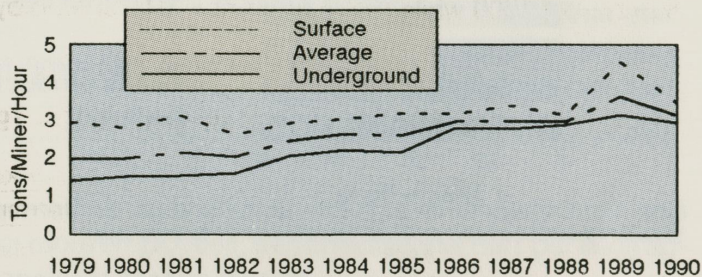
## Kentucky Coal Mine Employment, 1979 - 1990



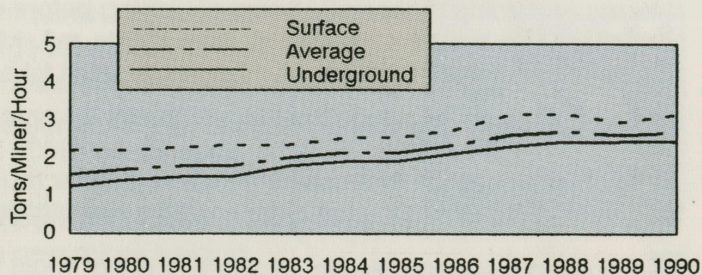
## Coal Mine Productivity, 1977 - 1990 (tons/miner/hour)

Year	Eastern Kentucky	Western Kentucky	Kentucky Average	Appalachian Coal Field	Interior Coal Field	Western U.S. Coal Field	U.S. Average
1977	1.71	2.22	1.86	1.36	2.42	5.85	1.82
1978	1.62	1.97	1.71	-	-	-	1.79
1979	1.54	1.94	1.64	1.33	2.21	5.47	1.81
1980	1.67	1.96	1.74	1.39	2.30	5.64	1.93
1981	1.76	2.12	1.84	1.51	2.35	6.15	2.10
1982	1.79	2.01	1.84	1.51	2.38	6.26	2.11
1983	1.98	2.43	2.08	1.75	2.69	7.60	2.50
1984	2.13	2.61	2.24	1.86	2.80	8.30	2.64
1985	2.13	2.57	2.23	1.90	2.81	8.55	2.74
1986	2.31	2.94	2.45	2.09	3.14	9.27	3.01
1987	2.59	2.98	2.69	2.30	3.33	10.42	3.30
1988	2.68	2.95	2.74	2.44	3.45	11.01	3.55
1989	2.58	3.62	2.78	2.49	3.84	11.63	3.70
1990	2.66	3.46	2.83	2.60	3.88	11.82	3.83

### Western Kentucky Coal Mine Productivity, 1979 - 1990



### Eastern Kentucky Coal Mine Productivity, 1979 - 1990



Source: U.S. DOE - Energy Information Administration; Coal Production, 1977 - 1990.

Safety and health conditions in U.S. coal mines have steadily improved; bituminous coal mining was twelfth on a recent National Safety Council list of the most hazardous occupations.

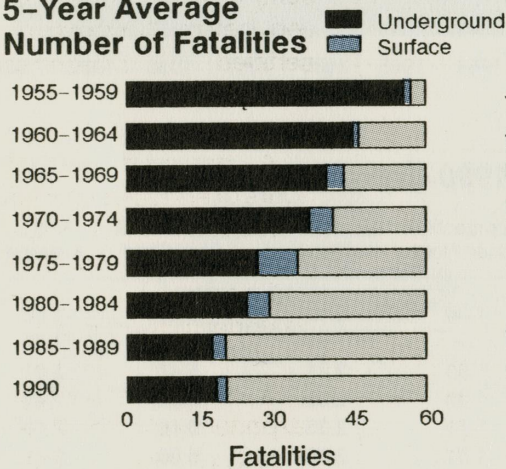
- Safety and health standards are highly regulated by the national Mine Safety and Health Administration (MSHA) and the Kentucky Department of Mines and Minerals.

- All surface and underground mines are inspected regularly for violations; larger mines may have inspectors present daily.

- Miners are highly skilled technicians who receive extensive training, both general safety training and job-specific training.

## Kentucky Gains in Productivity and Safety

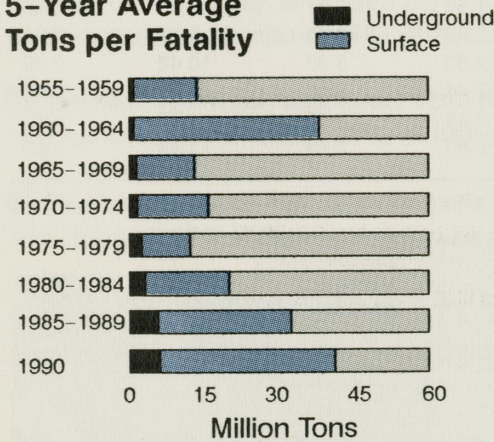
**5-Year Average Number of Fatalities**



The bar chart shows the overall trend in mine safety improvements by averaging out somewhat erratic yearly data.

1990 ended with 20 mine fatalities, the same as the preceding 5 year average.

**5-Year Average Tons per Fatality**



The productivity bar chart indicates safety improvements both in underground and surface mines, with steady improvement in underground mines.

1990's production was a record for Kentucky.

Source: Developed from Ky. Dept. of Mines and Minerals data.

## Training for Surface Miners

New miner training requires 24 hours of training before employment at a surface mine. This includes workers at prep plants, rail sidings, and river terminals, and all contract workers on a mine site must take the training.

- Each surface mine employee must receive 8 hours of annual retraining.

- To obtain a surface foreman certification, a miner must have 2 years of surface mining experience, plus pass a written examination.

- To obtain a surface blaster's license, a miner must have 2 years of work experience under an experienced blaster, plus pass a written examination.

### Underground Miner Classifications

Years* Experience Required	Underground Mining Position	Current No. of Miners Certified
10 Yrs.	Electrical Inspector*	11
	Mine Inspector / Mine Safety Analyst*	571
5 Yrs.	Mine Foreman**	9,081
	Electrical Instructor*	65
3 Yrs.	Asst. Mine Foreman**	2,938
	Fire Boss	21
	Instructor	74
	Belt Examiner	2,436
1 Yr.	Electrical Worker*	6,946
	Shot Firer / Solid Blasting*	4,039
	Drill Oper. / Solid Blasting*	3,603
	Holsting Engineer*	1,058
90 days	Mine Rescue	171
	Conventional Shot Firer*	12,639
	Gas Detection	15,307
	Certified Miners	20,428
<u>Special Training</u>		
	EMT - Emergency Medical Technician	1,228
	First Aid	1,817

\* Tests are required in addition to years of experience.  
\*\* Includes fire boss and first aid.

Source: Ky. Dept. of Mines and Minerals.

### Training for Underground Miners

New miner training requires a minimum of 48 hours of training to start work as a certified inexperienced miner.

■ A certified inexperienced miner must work a minimum of 90 days in an underground mine and pass a written examination before becoming a certified experienced miner.

■ A minimum of 16 hours of annual retraining is required to maintain the miner certification and continue to work at an underground mine.

■ A newly hired miner (experienced or inexperienced) receives 8 hours of minesite-specific new miners training.

Each miner receives new work assignment training of 20 hours minimum to become certified for each new job classification.

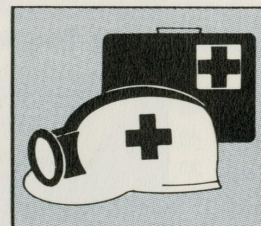
■ To maintain certification and qualifications, satisfactory completion of an electrical retraining class for certified workers is required annually.

■ Only certified shot-firers can detonate explosives within a mine.

EMT - An emergency medical technician is required at underground coal mines employing 12 or more employees, with an additional EMT per each additional 50 miners or majority fraction thereof.

■ EMT certification requires 110 hours of instruction and 10 hours of emergency room intern observations and training (4 written tests) plus 24 hours of retraining every 2 years, in addition to maintaining a cardiopulmonary resuscitation (CPR) certification.

■ A minimum of 10 hours of First Aid training is required as part of the new miner training.



## Coal County Wages and Employment, 1990

County*	Direct Mining Employment	% of Labor Force	Miners as % of Total Employed	Mining Wages	% of Total County Wages	Avg. Weekly Mining Earnings***
<b>Eastern Kentucky</b>						
Bell	1,270	12.2%	13.5%	39,240,858	24.1%	\$594.20
Breathitt	856	17.4%	19.2%	34,489,226	45.8%	774.83
Carter	48	.5%	.6%	1,026,348	1.7%	411.20
Clay	167	3.2%	3.5%	4,001,545	7.0%	460.80
Floyd	1,675	10.6%	11.4%	45,210,896	21.3%	519.07
Harlan	3,323	27.8%	30.1%	111,141,047	52.2%	643.19
Johnson	354	4.2%	4.5%	9,112,420	10.0%	495.02
Knott	1,065	20.9%	22.8%	29,895,983	50.8%	539.83
Knox	197	2.0%	2.1%	3,636,798	4.1%	355.02
Laurel	279	1.5%	1.6%	8,475,565	3.3%	584.20
Lawrence	103	2.2%	2.5%	2,068,285	5.3%	386.16
Lee	73	2.5%	2.7%	1,380,707	6.8%	363.73
Leslie	1,195	22.4%	23.8%	39,539,657	61.7%	636.30
Letcher	2,051	21.8%	23.6%	61,894,503	49.0%	580.34
McCreary	5	.1%	.1%	126,163	0.5%	485.24
Magoffin	121	3.2%	3.8%	3,820,460	12.9%	607.19
Martin	1,450	47.5%	51.6%	72,736,800	73.0%	964.68
Owsley	13	.9%	1.0%	258,720	4.0%	382.72
Perry	2,239	20.6%	22.2%	79,426,173	37.4%	682.19
Pike	5,794	23.1%	24.8%	188,231,201	42.7%	624.76
Pulaski	60	.3%	.3%	2,044,492	0.7%	655.29
Whitley	784	6.9%	7.4%	21,814,405	13.4%	535.09
<b>Sub Total</b>	<b>23,122</b>	-	-	<b>759,572,252</b>	-	<b>631.75</b>
<b>EKY Total**</b>	<b>24,045</b>	-	-	<b>790,534,392</b>	-	<b>632.26</b>

Fayette Note: The direct mining employment classification does not include most of the administrative or professional employees of the coal companies located in Kentucky's two major metropolitan areas and does not include any private services or indirect employment 909.43  
 Jefferson 1,261.93

### Western Kentucky

Butler	256	3.3%	3.6%	8,613,129	16.8%	647.02
Davless	261	.6%	.6%	7,891,320	1.2%	581.44
Henderson	526	2.4%	2.6%	27,136,392	7.6%	992.12
Hopkins	1,319	6.6%	7.1%	54,311,695	15.4%	791.85
Muhlenberg	888	8.5%	9.4%	41,993,306	27.9%	909.42
Ohio	431	6.3%	6.9%	15,771,315	19.7%	703.70
Union	1,883	31.0%	32.9%	84,668,863	53.7%	864.71
Webster	1,038	16.9%	18.1%	50,930,125	50.0%	943.57
<b>Sub Total</b>	<b>6,602</b>	-	-	<b>291,316,145</b>	-	<b>848.57</b>
<b>WKY Total**</b>	<b>6,724</b>	-	-	<b>294,882,785</b>	-	<b>843.37</b>

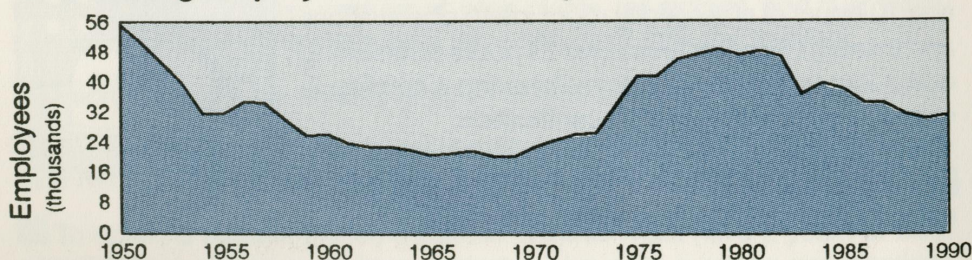
**State Total\*\* 30,949 - - 1,095,295,932 - 680.58**

\* Counties with less than three employers or one employer with 80% of the total county miner work force were withheld to avoid disclosure of individual company data. The counties are as follows: Boyd, Breckinridge, Caldwell, Carroll, Christian, Estill, Grant, Greenup, Jackson, McLean, Menfee, Metcalfe, Morgan, Nelson, Powell, Rockcastle, Warren, Wolfe. It is suspected that multcounty mining employment attributes to some counties being "under reported" and others being over reported.

\*\* Columns do not add to the totals due to withheld data.

\*\*\* Variation in average weekly mining income affected greatly by hours worked per week as well as hourly wage rate.

## Coal Mining Employment in Kentucky, 1950 - 1990



Source: Kentucky Cabinet for Human Resources.



## Severance Tax by County

## Coal Severance Tax Revenue by County, Fiscal Year 1990-1991

County	Gross Value of Severed Coal	Tax on Severed Coal	Gross Value of Processing	Total Tax Receipts
Bell	\$ 107,629,502	\$ 4,819,310	\$ 17,230,534	\$ 5,594,701
Boyd	904,563	36,673	17,328,203	821,191
Breathitt	104,293,021	4,522,857	6,396,309	4,808,465
Butler	21,139,146	940,599	1,629,082	1,005,111
Carter	W	W	W	W
Christian	W	W	W	W
Clay	54,170,774	2,436,979	3,441,517	2,591,334
Davless	29,687,852	1,332,051	2,196,045	1,428,350
Edmonson	W	W	W	W
Elliott	7,117,542	324,002	-	324,002
Estill	W	W	W	W
Floyd	217,520,902	9,328,423	21,212,190	10,265,877
Greenup	18,825,444	847,145	107,662	851,991
Hancock	W	W	W	W
Harlan	343,122,982	15,200,138	31,467,671	16,591,880
Henderson	64,685,432	2,909,252	3,521,998	3,067,446
Hopkins	217,760,988	9,399,273	19,634,464	10,275,629
Jackson	1,460,691	64,864	-	64,864
Johnson	18,146,166	797,612	1,611,573	872,714
Knott	113,870,896	4,950,510	14,719,482	5,607,715
Knox	29,385,359	1,181,529	4,486,296	1,382,014
Laurel	2,149,070	97,612	488,887	118,622
Lawrence	1,955,681	88,006	758,228	121,952
Lee	3,901,639	175,578	146,801	182,184
Leslie	181,566,908	8,167,791	17,335,327	8,947,568
Letcher	204,854,274	8,686,827	34,152,327	10,155,178
McCreary	W	W	W	W
McLean	W	W	W	W
Magoffin	25,692,570	1,152,135	3,908,430	1,317,366
Martin	344,452,338	14,867,000	40,404,839	16,671,934
Morgan	353,441	15,905	45,180	17,938
Muhlenberg	114,718,596	5,168,757	6,876,848	5,478,215
Ohio	45,959,317	2,068,097	3,217,098	2,212,866
Owsley	6,230,321	280,097	122,903	285,628
Perry	344,485,411	15,354,400	25,846,546	16,491,779
Pike	776,833,288	34,057,283	102,724,845	38,616,897
Pulaski	3,574,644	160,859	185,626	169,213
Rockcastle	270,085	1,377	12,835	1,955
Union	198,519,278	8,525,370	24,320,576	9,619,796
Wayne	W	W	W	W
Webster	203,691,029	8,730,346	19,824,631	9,622,448
Whitley	58,847,348	2,550,923	14,346,028	3,194,468
Wolfe	3,316,843	145,258	224,225	156,200
<b>State Totals*</b>	<b>\$3,890,963,607</b>	<b>\$170,272,428</b>	<b>\$451,776,263</b>	<b>\$190,285,779</b>

<sup>W</sup> Withheld to avoid disclosure of individual company data.

\* Columns do not add to State Totals because of counties in which information was withheld to avoid disclosure of individual company data.

Source: Kentucky Revenue Cabinet.

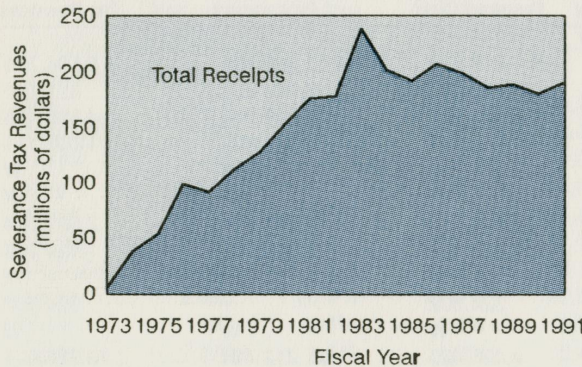
### Eastern and Western Kentucky Severance Tax Contribution, Fiscal Year 1990-1991

Eastern Kentucky	\$146,674,037
Western Kentucky	\$ 43,611,742

■ Pike County was the leading Eastern Kentucky county, accounting for over \$38 million in coal severance taxes during Fiscal Year 1990-1991.

■ Hopkins County was the leading Western Kentucky county, accounting for over \$10 million in coal severance taxes during Fiscal Year 1990-1991.

The Kentucky coal industry paid over \$190 million in coal severance taxes in Fiscal Year 1990 - 1991.



While the gross value of coal per ton has decreased, increasing production has helped curb the decline in coal severance tax receipts.

In addition to the \$22.8 million of the severance tax returned directly to the counties, \$167.5 million went to Kentucky's General Fund.

Source: Kentucky Revenue Cabinet, Annual Reports, 1973 - 91.

## Coal Severance Tax - Local Government Economic Assistance Fund returned directly to Coal Producing and Impacted Counties.

County and Municipal Totals for Fiscal Year 1990 - 1991

### Coal Producing Counties

Bell	\$ 542,231
Boyd	263,330
Breathitt	707,088
Butler	177,685
Carter	134,005
Christian	249,791
Clay	330,629
Davless	375,975
Edmonson	103,607
Elliott	117,303
Floyd	1,199,693
Greenup	200,752
Hancock	61,620
Harlan	1,498,287
Henderson	362,265
Hopkins	938,057
Jackson	116,737
Johnson	341,598
Knott	610,412
<b>Sub-Total</b>	

Knox	\$ 236,403
Laurel	160,199
Lawrence	430,964
Lee	108,368
Leslie	821,248
Letcher	879,870
McLean	88,582
Magoffin	243,280
Martin	1,314,208
Muhlenberg	587,057
Ohio	280,689
Owsley	125,299
Perry	1,489,470
Pike	3,168,614
Pulaski	185,779
Union	797,576
Webster	800,155
Whitley	389,223
Wolfe	114,906
<b>Sub-Total</b>	<b>\$ 20,552,958</b>

### Coal Impacted Counties

Anderson	\$ 38,819
Bath	47,748
Boone	39,334
Bourbon	73,939
Boyle	33,505
Bracken	47,016
Bullitt	37,821
Caldwell	51,481
Calloway	43,925
Campbell	63,754
Clark	138,366
Crittenden	41,754
Estill	39,285
Fayette	74,380
Fleming	55,254
Grant	43,641
Harrison	75,159
Jefferson	72,491
Kenton	25,672
Lincoln	52,979
Livingston	35,626
<b>Sub-Total</b>	

Logan	\$ 61,226
Lyon	44,249
McCreary	59,554
Madison	46,345
Marshall	42,807
Mason	57,063
Mercer	43,164
Montgomery	45,513
Morgan	48,097
Nelson	68,511
Nicholas	31,356
Pendleton	76,258
Powell	184,313
Rockcastle	56,824
Scott	41,820
Simpson	34,018
Spencer	30,384
Todd	42,186
Warren	63,734
Washington	38,744
Woodford	35,546
<b>Sub-Total</b>	<b>\$ 2,283,660</b>

**State Total**

**\$ 22,836,618**

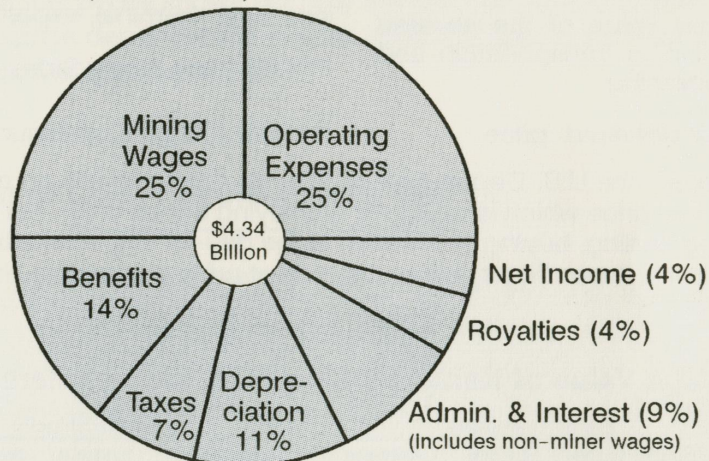
Source: Governor's Office, Department of Local Government.

**The production and sale of Kentucky coal:**

- brought \$3.7 billion into Kentucky from out-of-state
- provided over 115,000 jobs directly or indirectly
- generated about \$570 million in revenues to the state's General Fund

**The gross value of the coal mined and processed in Kentucky during Fiscal Year 1990 - 1991 was \$4.34 billion.**

An estimated \$3.7 billion (or 84% of the total) was brought into Kentucky from 25 other states and from foreign countries. The five largest include: Tennessee (\$420 million), Georgia (\$400 million), Florida (\$400 million), Ohio (\$300 million), North Carolina (\$300 million). An estimated distribution of these monies follows:



**The Kentucky coal industry paid over 1.1 billion dollars in total covered wages in 1990.**

Miners' wages accounted for about 25% of the total, and miners' benefits accounted for 14%.

Economic ripple effects from the mining industry induced employment of an additional 85,000 persons with earnings of \$1.6 billion.

**The Kentucky coal industry resulted in over 9.1 billion dollars of total economic output in 1990.**

Much of the remainder was spent on Kentucky's economy through expenditures on equipment repair and maintenance, fuel, office supplies, interest on loans, royalties to mineral owners, and so on.

An estimated 4% was net income which was either re-invested or distributed to stockholders. These expenditures result in production of an additional \$4.7 billion worth of other products and services, for a total of over \$9 billion of total economic output.

**Coal accounts for 13% of Kentucky's General Fund Revenues.**

(This percentage has historically been between 19 and 24%. The dollar amount of coal's contribution has remained fairly constant but General Fund revenues have increased significantly.)

The Kentucky coal industry and its employees paid state taxes including:

Severance Tax	\$190 million
Other Company Taxes	88 million
Personal Income Tax	40 million
Personal Sales Tax	28 million

The additional manufacturing, purchasing, and jobs induced by the coal industry provided additional state revenues including:

Business Taxes	\$130 million
Personal Income Tax	57 million
Personal Sales Tax	40 million

Sources: Governor's Office for Coal and Energy Policy.

U.S. Department of Commerce, Bureau of Economic Analysis.

Seth Schwartz, *Coal and the Kentucky Economy*, 1985.

Dr. Charles F. Haywood, *Estimating the Economic Impact of Reduced Production of Western Kentucky Coal*, 1991.

There is no such thing as an average coal price as "average" coal price is an ambiguous term. There are as many coal price averages as there are coal qualities (i.e., sulfur, Btu), market types (i.e., steam coal, metallurgical or coking, industrial, export), sales conditions (i.e., spot market, extended spot market; short-term contract, long-term contract), sales location and included costs (i.e., FOB\* mine, FAS\*\*, CIF\*\*\*, total delivered). Within each of these ways to sell coal, there are wide ranges of price. A further review of the major points at which coal is sold and the different cost included during the mine-to-market process of coal in Kentucky are as follows:

Coal sold in place (reserves)	Gross value of the severed coal plus transportation
Coal sold in the pit	
Gross value severed coal	*FOB (Free on Board) the mine, rail-car, river terminal, export terminal
Gross value of the severed coal plus transportation and processing	**FAS (Free Along Side)
Total delivered price	***CIF (Cargo Cost/Insurance/Freight)

However, the U.S. Department of Energy does provide an average annual coal cost price which is useful for identifying trends only! For individuals not pricing, selling, buying or involved in the day-to-day marketing of Kentucky coal but just needing to follow the market price and trends, these values are helpful.

#### Average Value of Kentucky Coal FOB Mine (dollars per ton)

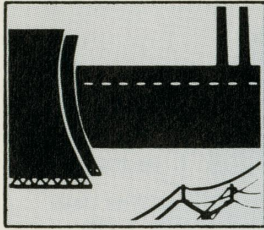
Year	Eastern Kentucky			Western Kentucky			Kentucky
	Underground	Surface	Average	Underground	Surface	Average	Average
1976	\$26.37	\$20.36	\$23.03	\$15.12	\$13.41	\$14.18	\$19.79
1977	\$25.98	\$18.71	\$21.67	\$19.88	\$14.80	\$17.07	\$20.02
1978	\$28.86	\$22.58	\$25.30	\$22.78	\$18.35	\$20.36	\$23.86
1979	\$30.18	\$24.85	\$27.62	\$26.26	\$18.79	\$22.17	\$26.04
1980	\$30.98	\$26.23	\$28.73	\$27.40	\$22.28	\$24.72	\$27.62
1981	\$32.47	\$28.86	\$30.72	\$30.92	\$25.03	\$27.66	\$29.95
1982	\$32.71	\$28.85	\$30.87	\$32.50	\$26.53	\$29.25	\$30.44
1983	\$30.71	\$28.43	\$29.63	\$30.72	\$25.97	\$28.09	\$29.20
1984	\$29.29	\$27.84	\$28.61	\$28.68	\$25.50	\$26.81	\$28.13
1985	\$29.83	\$27.41	\$28.77	\$26.79	\$26.68	\$26.73	\$28.24
1986	\$26.89	\$25.67	\$26.38	\$24.25	\$26.56	\$25.31	\$26.09
1987	\$27.48	\$25.74	\$26.71	\$25.06	\$24.16	\$24.68	\$26.15
1988	\$27.72	\$25.92	\$26.97	\$24.89	\$22.32	\$23.96	\$26.20
1989	\$25.69	\$25.96	\$25.80	\$23.03	\$21.79	\$22.48	\$24.97
1990	\$25.49	\$26.44	\$25.84	\$24.42	\$22.01	\$23.32	\$25.19

Sources: U.S. Bureau of Mines, Minerals Yearbook, 1976; U.S. DOE, Bituminous Coal and Lignite Production and Mine Operations, 1977-1978, and Coal Production, 1979-1990, DOE - EIA, Coal Data: A Reference, May, 1989.

For an indication of month-to-month trends, the spot sales data (steam coal and metallurgical coal) published in monthly trade publications are useful. These monthly spot coal prices are usually presented in 3 or 4 different incremental ranges of percent sulfur (i.e., 0-0.75, 0.76-1.5, 1.6-3.0, 3.1-4.0) for at least 4 different average Btu/lb values (i.e., 11,000, 11,500, 12,000, 12,500). The monthly trade publications sometimes list nine to twelve average prices for each mine region such as the Appalachian and the Interior Basin. It must be kept in mind though that spot sales are only *one part* of total coal sales transactions.

A good source of average "total delivered price" of electric utility coal is the values reported by the utilities on U.S. DOE Energy Information Administration Form 423 data. This is a good source for market prices, since the electric utility industry is a major market source for Kentucky coal. However, when using these "total delivered prices" for trend comparisons, it should be remembered that "total delivered price" is affected greatly by *transportation costs* and only consistent origins and destinations must be utilized in yearly trend comparisons.

**Coal is the lowest cost fossil fuel and its price is the most stable.**

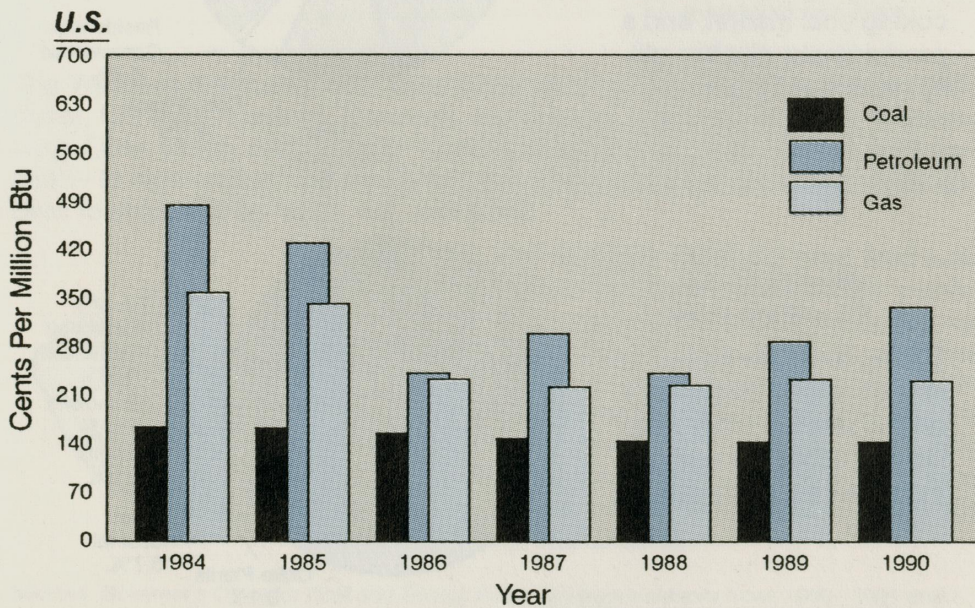
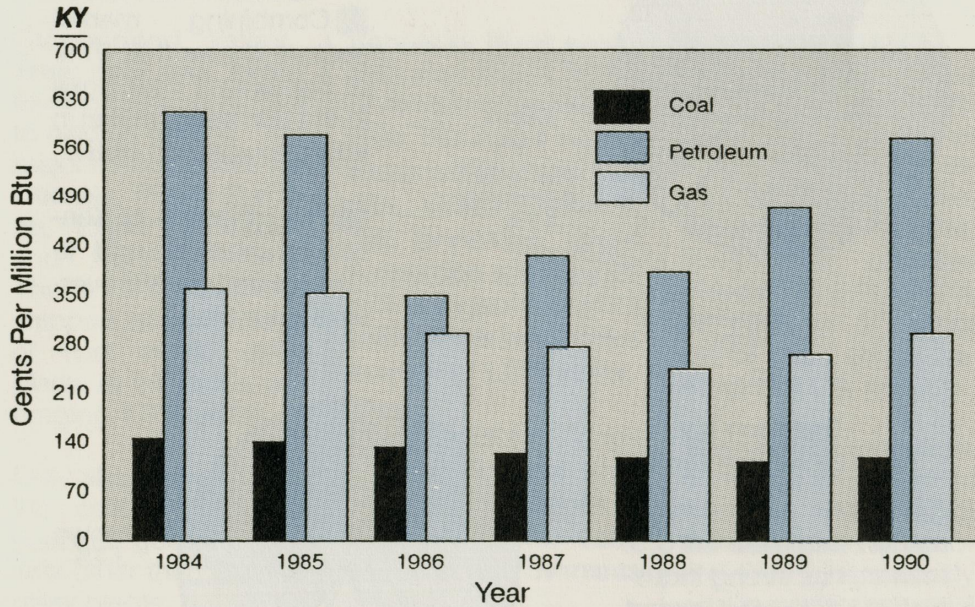


Almost 96% of Kentucky's electricity was generated from coal in 1990. (Hydro provided 4%; oil and gas together provided less than 0.5%.)

Utilities in Kentucky generated about 74 billion kilowatt-hours of electricity in 1990. Kentucky typically exports around 20% to 40% of the electricity produced in the state.

A comparison of fuel prices shows not only the fuel cost saving of coal but the more stable price dependability of coal. *Note that coal is the least cost energy source on the chart below.*

### Average Cost of Coal, Petroleum, and Gas



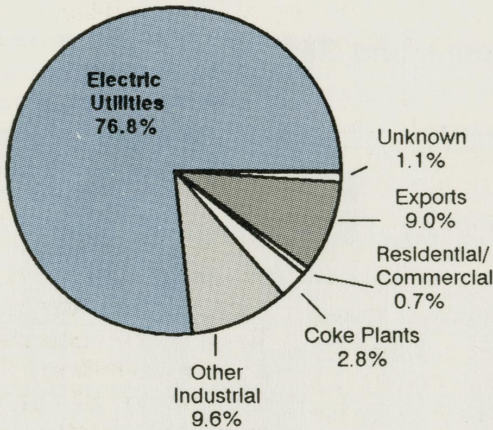
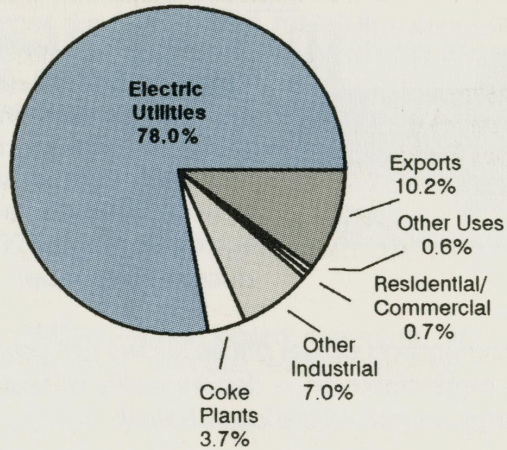
Source: Energy Information Administration, Cost and Quality of Fuels for Electric Utility Plants.

## Distribution of Coal by Consuming Sector, 1990

### U.S. Total 1.02 billion tons

■ Electric utilities represent the largest market for U.S. and Kentucky coal.

■ The three major markets for coal are electric utilities, industry, and the export market.



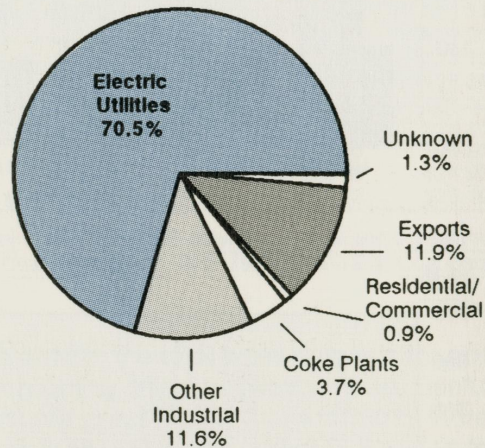
### Kentucky 173 million tons

■ Combining market sectors shows that 91% of Kentucky's coal goes to the domestic market in approximately 26 states.

■ The other 9% of Kentucky's coal is sold to Canada and several overseas countries.

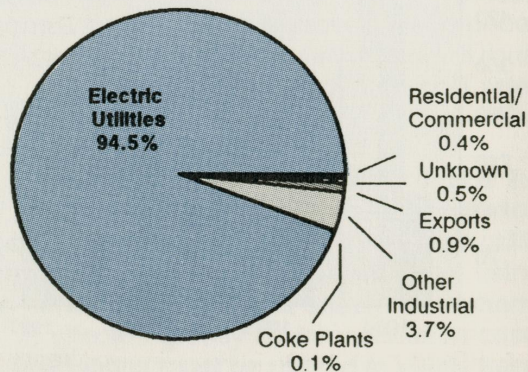
### Eastern Ky. 128 million tons

■ Eastern Kentucky's market, much like the U.S. market, has strong industrial (11.6%) and export (11.9%) sectors, a small coking coal market, and a predominate electric utility market at 70.5%.



### Western Ky. 45 million tons

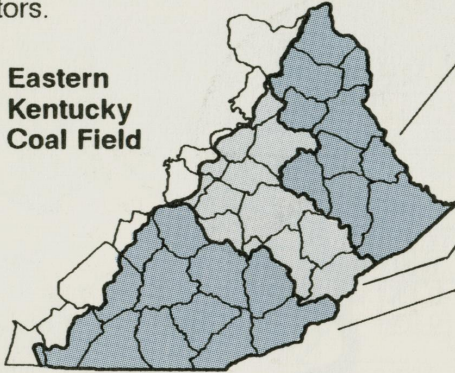
■ Western Kentucky is almost totally dependent on the electric utility market with 95% of its coal going to electric utility plants.



# Kentucky's Four Market Sheds

The Eastern Kentucky coal field has been divided into three areas based on their different coal markets, transportation access, coal quality and other factors.

## Eastern Kentucky Coal Field



**Big Sandy River Counties:** Boyd, Carter, Elliott, Floyd, Greenup, Johnson, Lawrence, Magoffin, Martin, and Pike.

**Kentucky River Counties:** Breathitt, Estill, Knott, Lee, Letcher, Morgan, Owsley, Perry, and Wolfe

**Cumberland Valley Counties:** Bell, Clay, Clinton, Harlan, Jackson, Knox, Laurel, Leslie, McCreary, Pulaski, Rockcastle, Wayne, and Whitley.

As one considers these three "transportation/market sheds" in the following order - the Cumberland Valley, the Kentucky River, and the Big Sandy - there is: (1) an increase in market diversity as indicated by decreased reliance on the electric utility market, and (2) a shift from primarily southern markets to more northern markets.

**Cumberland Valley area:** sells over three-fourths (80%) of its coal to electric utilities. The major market states are Georgia, South Carolina, Florida, Tennessee, and North Carolina. These 13 counties shipped 26 million tons of coal to 60 utility plants in 14 states, averaging 1.3% sulfur.

Only about one-fifth of the coal from these counties goes to markets other than electric utility plants.

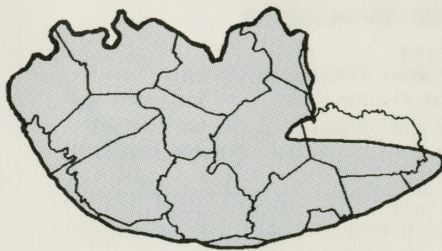
**Kentucky River area:** sells two-thirds (67%) of its coal to electric utilities. The major market states are Georgia, Florida, Ohio, Kentucky, and Tennessee. These 9 counties shipped 25 million tons of coal to 73 utility plants in 18 states averaging 1.0% sulfur.

Approximately one-third of the coal from these counties goes to industrial users, coke plants and overseas markets.

**Big Sandy area:** sells about half (53%) of its coal to electric utilities. The major market states are North Carolina, Michigan, Ohio, Kentucky and Virginia. These 10 counties shipped 33 million tons of coal to 87 utility plants in 24 states, averaging 1.0% sulfur.

The non-utility markets consume almost half of the coal (47%) from these counties. In general the highest quality coal is sold to industrial users, coke plants and overseas markets.

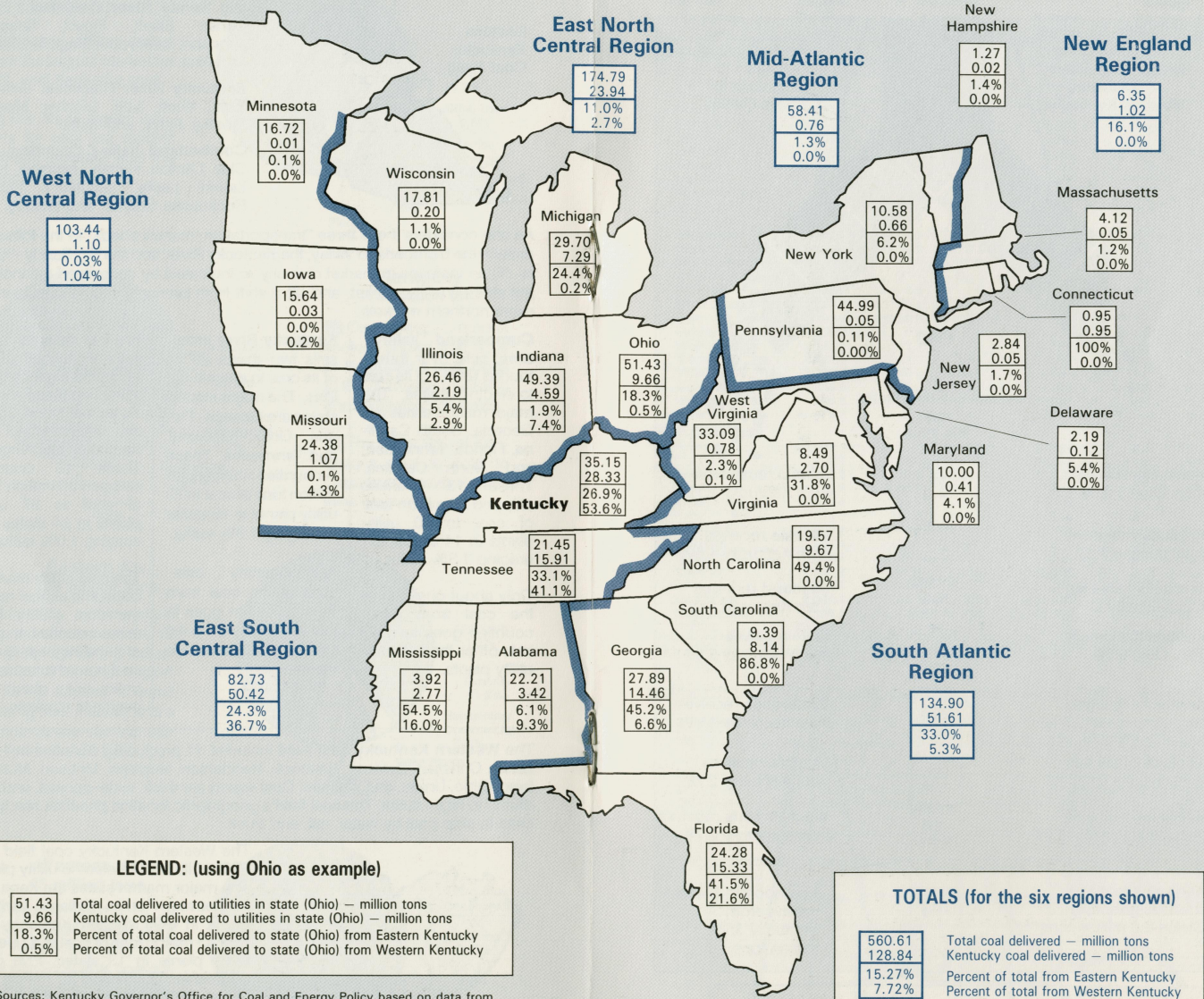
The **Western Kentucky coal field** includes 11 producing counties in 1990: Butler, Christian, Daviess, Hancock, Henderson, Hopkins, McLean, Muhlenberg, Ohio, Union, and Webster. Coal seams are thick, wide-spread, and medium- to high-sulfur. The coal field's geographic location provides ready access to ship coal by water, rail, and truck.



The Western Kentucky coal field sells 95% of its coal to electric utility plants. The major market states are Kentucky, Tennessee, Florida, Indiana, and Alabama. In 1990, Western Kentucky sold over 43 million tons of coal to 42 electric utility plants in 13 states. Five utility companies purchased 33 million tons or over 75% of Western Kentucky's utility coal market.

# Kentucky Coal Shipments to Electric Utility Plants by State in 1990

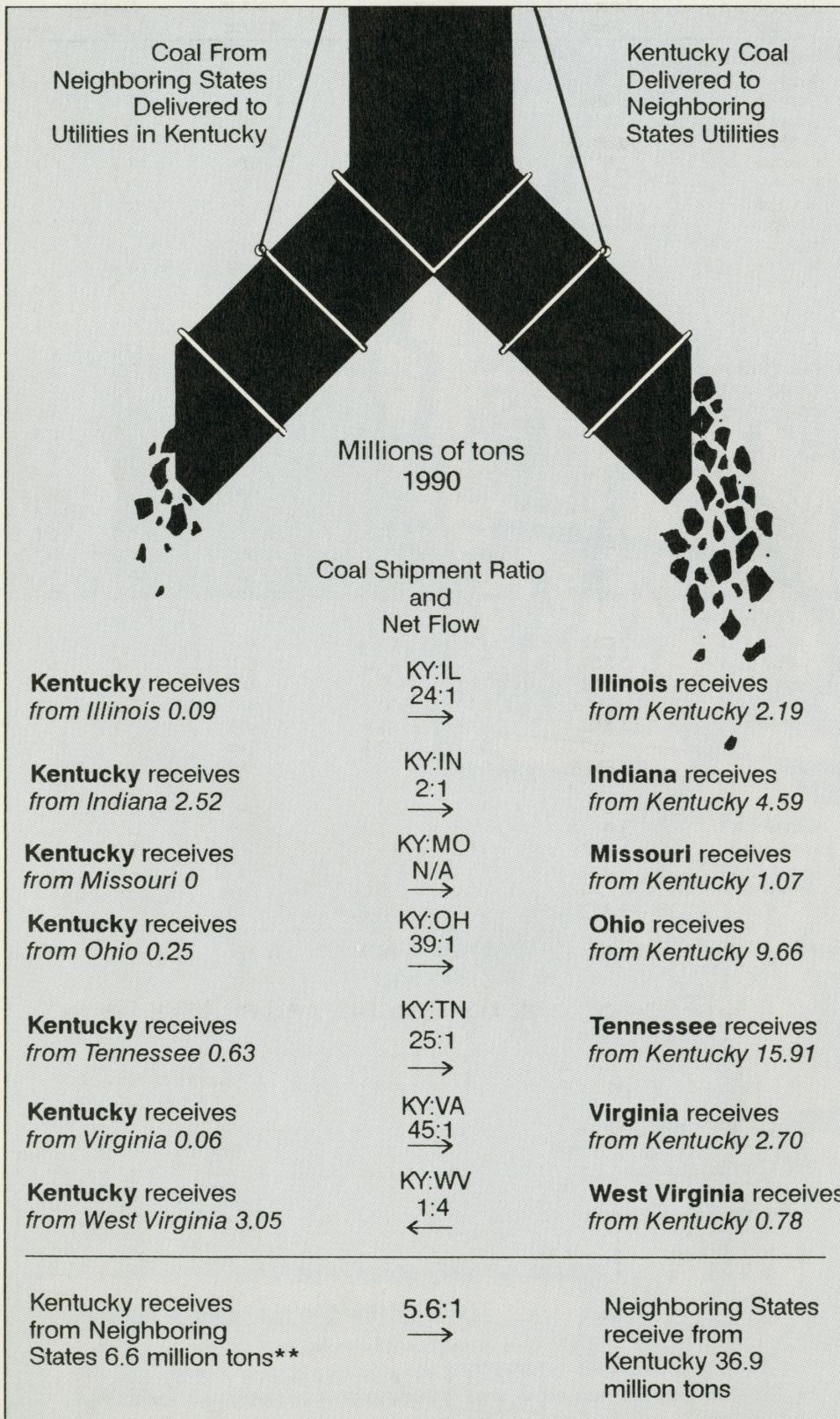
Kentucky coal is shipped to electric utilities in 26 states.



Sources: Kentucky Governor's Office for Coal and Energy Policy based on data from U.S. Department of Energy.  
Energy Information Administration, Cost and Quality of Fuels for Electric Utility Plants, 1990 Annual Report.



Kentucky exports over 5 tons of utility coal to neighboring states for every ton imported. The chart below shows the *Interstate Imports and Exports* of utility coal between Kentucky and its neighboring states.\*



\* Does not include metallurgical or industrial coal shipments.

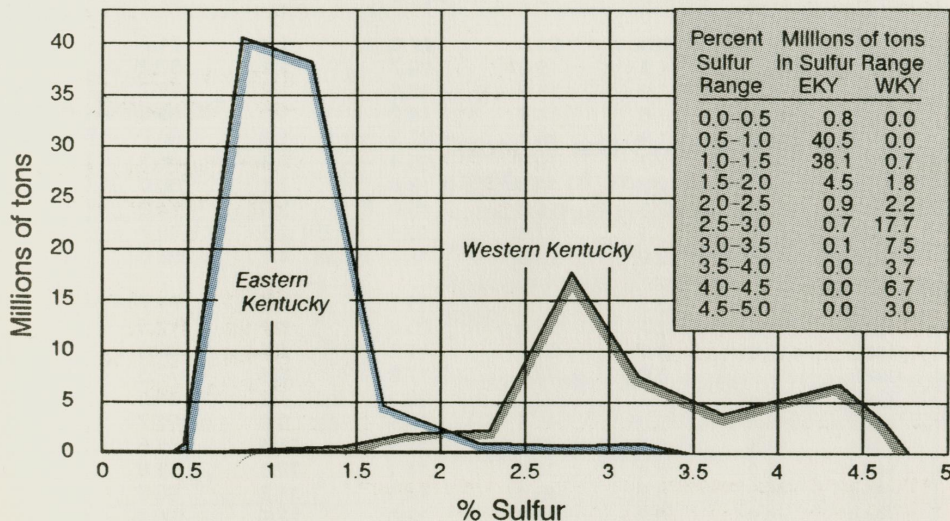
\*\* Does not include 0.21 million tons from Wyoming.

Source: U.S. DOE – Energy Information Administration, *Cost and Quality of Fuels*, 1990.

Kentucky coal was shipped to electric utility plants in 26 states in 1990.

Coal Field Destination State	Receipts Thousand Tons	Percentage of Receipts		Average Btu / lb	Average Percentage	
		Surface	Spot		Sulfur	Ash
<b>Eastern Kentucky</b>						
Alabama	1,351.4	31.3	52.2	12,535	1.0	9.1
Connecticut	954.0	0.0	11.0	13,233	0.5	6.4
Delaware	117.1	2.4	85.8	12,837	0.7	7.2
Florida	10,083.8	39.8	12.5	12,718	1.0	8.2
Georgia	12,615.8	61.5	28.0	12,268	1.4	10.7
Illinois	1,435.8	16.0	36.0	13,202	0.7	6.2
Indiana	945.3	41.5	17.0	12,588	0.7	8.5
Kentucky	9,470.9	73.5	41.2	12,187	1.0	10.8
Maryland	407.0	90.2	20.3	12,942	0.7	7.9
Massachusetts	49.0	85.5	100.0	12,599	0.9	8.7
Michigan	7,242.2	49.7	28.4	12,681	0.9	8.4
Minnesota	8.3	6.8	43.4	12,105	1.1	9.8
Mississippi	2,137.7	0.0	6.6	12,765	0.8	7.8
Missouri	22.8	0.0	100.0	14,128	0.6	5.6
New Hampshire	17.2	17.0	100.0	12,969	0.9	6.6
New Jersey	47.4	37.1	100.0	13,050	0.8	7.6
New York	659.0	0.0	5.6	13,290	0.5	6.9
North Carolina	9,669.9	45.4	20.2	12,551	1.0	8.8
Ohio	9,396.4	73.0	52.8	11,859	1.1	12.7
Pennsylvania	50.0	0.0	0.0	12,710	1.3	8.7
South Carolina	8,144.7	11.1	27.5	12,596	1.2	9.3
Tennessee	7,102.5	43.5	20.4	12,088	1.3	11.0
Virginia	2,700.7	49.3	36.8	12,697	1.0	8.5
West Virginia	753.4	81.2	19.0	12,357	0.9	9.1
Wisconsin	196.0	66.1	79.9	12,894	0.8	8.1
<i>Subtotal</i>	<i>85,578.3</i>	<i>48.1</i>	<i>28.8</i>	<i>12,426</i>	<i>1.1</i>	<i>9.7</i>
<b>Western Kentucky</b>						
Alabama	2,064.3	21.2	59.9	11,759	3.0	10.4
Florida	5,249.1	34.2	41.3	12,277	2.9	8.6
Georgia	1,842.3	78.5	22.8	11,827	2.9	10.3
Illinois	757.4	94.7	100.0	11,576	1.7	8.2
Indiana	3,646.8	67.4	6.4	11,494	3.4	11.2
Iowa	29.5	100.0	100.0	11,218	3.1	11.2
Kentucky	18,856.2	50.0	14.0	11,186	3.7	13.4
Michigan	50.4	100.0	100.0	11,678	3.0	10.1
Mississippi	628.7	16.7	100.0	11,890	2.6	6.9
Missouri	1,042.8	71.0	0.0	11,316	3.0	10.7
Ohio	266.1	91.8	29.9	11,373	2.4	9.8
Tennessee	8,804.1	61.2	6.7	11,729	2.6	8.7
West Virginia	24.6	0.0	0.0	11,935	3.5	12.7
<i>Subtotal</i>	<i>43,262.4</i>	<i>52.8</i>	<i>20.4</i>	<i>11,532</i>	<i>3.2</i>	<i>11.1</i>
<b>Total</b>	<b>128,840.8</b>	<b>49.6</b>	<b>26.0</b>	<b>12,126</b>	<b>1.8</b>	<b>10.2</b>

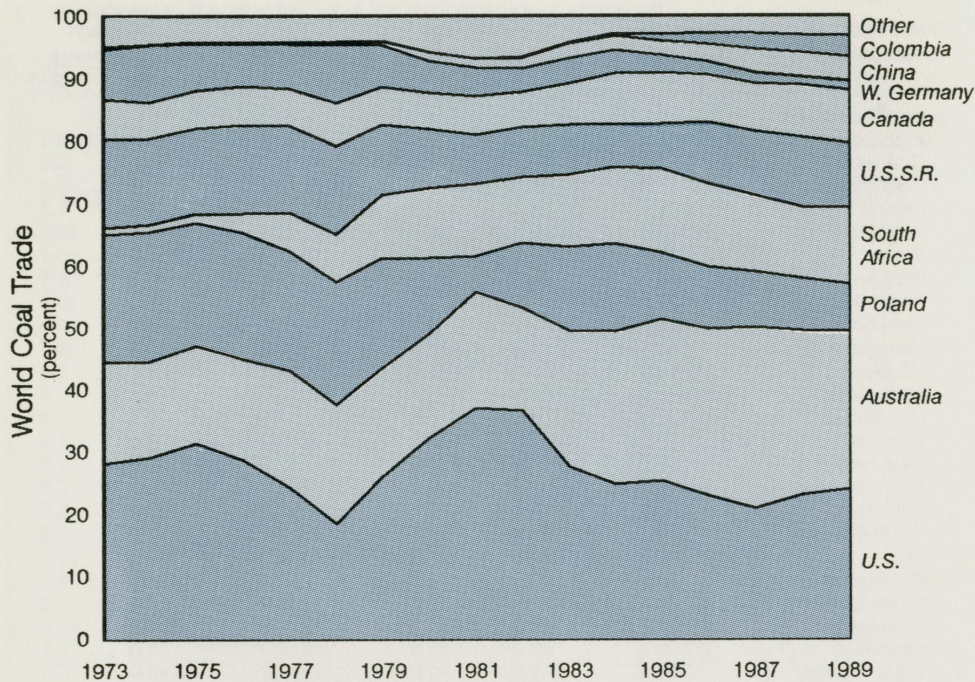
### Sulfur Distribution of Kentucky Coal Shipped to Utility Plants\*



\* 1990 values plotted at weighted average sulfur content within each sulfur range.

Source: U.S. DOE - Energy Information Administration, Form 423 data.

The U.S. Plays a Major Role in World Coal Trade



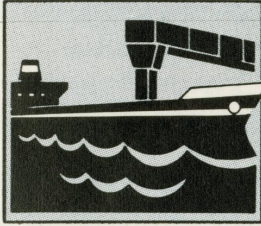
■ The United States continued to be of worldwide importance as a source of coal ranking second to Australia in the amount exported.

■ The United States exports coal to over 30 countries with three countries – Canada, Japan, and Italy – accounting for more than one-third of the total.

Destination of U.S. Coal Exports (million tons)

Year	Canada	Brazil	Europe	Japan	Other	Total
1960	12.8	1.1	17.1	5.6	1.3	38.0
1961	12.1	1.0	15.7	6.6	1.0	36.4
1962	12.3	1.3	19.1	6.5	1.0	40.2
1963	14.6	1.2	27.7	6.1	.9	50.4
1964	14.8	1.1	26.0	6.5	1.1	49.5
1965	16.3	1.2	25.1	7.5	.9	51.0
1966	16.5	1.7	23.1	7.8	1.0	50.1
1967	15.8	1.7	19.4	12.2	1.0	50.1
1968	17.1	1.8	15.5	15.8	.9	51.2
1969	17.3	1.8	15.2	21.4	1.2	56.9
1970	19.1	2.0	21.8	27.6	1.2	71.7
1971	18.0	1.9	16.6	19.7	1.1	57.3
1972	18.7	1.9	16.9	18.0	1.2	56.7
1973	16.7	1.6	14.4	19.2	1.6	53.6
1974	14.2	1.3	16.1	27.3	1.8	60.7
1975	17.3	2.0	19.0	25.4	2.6	66.3
1976	16.9	2.2	19.9	18.8	2.1	60.0
1977	17.7	2.3	15.0	15.9	3.5	54.3
1978	15.7	1.5	11.0	10.1	2.5	40.7
1979	19.5	2.8	23.9	15.7	4.1	66.0
1980	17.5	3.3	41.9	23.1	6.0	91.7
1981	18.2	2.7	57.0	25.9	8.7	112.5
1982	18.6	3.1	51.3	25.8	7.5	106.3
1983	17.2	3.6	33.1	17.9	6.1	77.8
1984	20.4	4.7	32.8	16.3	7.2	81.5
1985	16.4	5.9	45.1	15.4	9.9	92.7
1986	14.5	5.7	42.6	11.4	11.4	85.5
1987	16.2	5.8	34.2	11.1	12.3	79.6
1988	19.2	5.3	45.1	14.1	11.3	95.0
1989	16.8	5.7	51.6	13.8	12.9	100.8
1990	15.5	5.8	58.4	13.3	12.8	105.8

Sources: Energy Information Administration, Coal Data: A Reference, 1989 Quarterly Coal Report, October – December, 1990, Annual Prospects for World Coal Trade, 1991.



The U.S. exported 105.8 million tons of coal in 1990, while importing only 2.7 million tons.

■ Kentucky's 1990 exports of 15.7 million tons were 15% of total U.S. exports in that year.

#### Kentucky Coal Exports, 1990 (thousands of tons)

Region	Canada	Overseas*	Total
Eastern Kentucky	1,679	13,590	15,269
Western Kentucky	48	373	421
Kentucky Total	1,727	13,963	15,690

Source: Energy Information Administration, *Coal Distribution*, 1990.

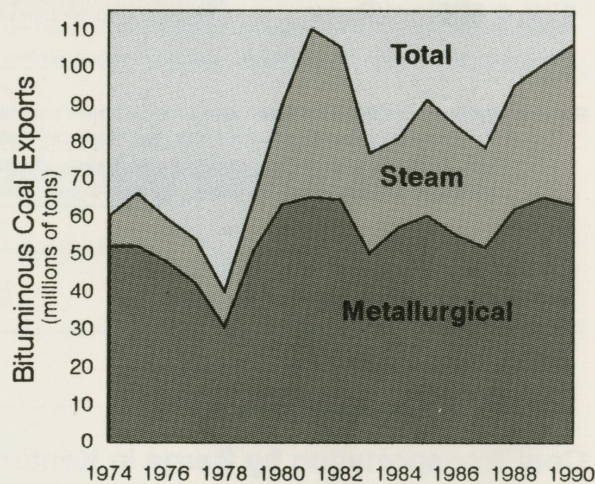
\* Includes Mexico.

#### U.S. Bituminous Coal Exports, Steam and Metallurgical

Metallurgical coal has historically dominated U.S. bituminous exports, and is expected to continue to do so through the remainder of the century.

In 1990 the U.S. exported 105.8 million tons of coal (42.3 million of steam coal and 63.5 million of metallurgical coal).

Metallurgical coal remained the mainstay of U.S. exports, although its share of the total dropped to 60% in 1990.



Sources: Energy Information Administration, *Coal Data: A Reference, 1989*; *Annual Prospects for World Coal Trade, 1991*.

#### U.S. Imports\*

Year	U.S. Total	
	Quantity (millions)	Average Price / Ton
1981	1.043	\$28.47
1982	0.742	30.40
1983	1.271	33.59
1984	1.286	35.37
1985	1.952	36.04
1986	2.212	36.02
1987	1.747	32.04
1988	2.134	29.96
1989	2.851	34.14
1990	2.699	34.45

\* Includes Puerto Rico and Virgin Islands.

Source: Energy Information Administration, *Quarterly Coal Report*, Oct.-Dec., 1990.

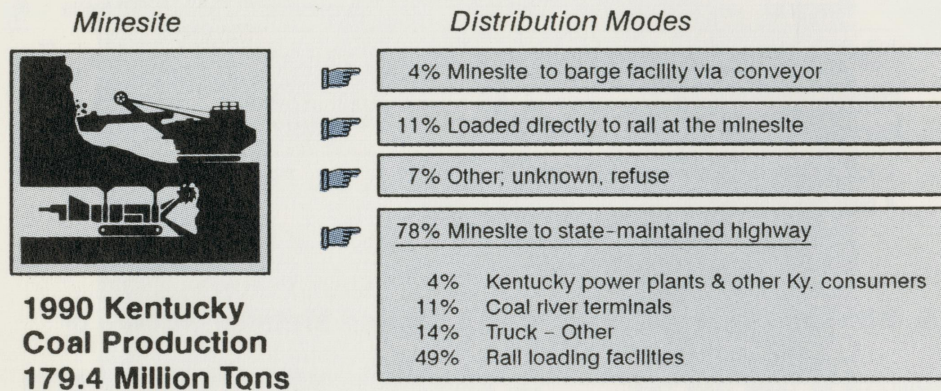
Colombia and Canada were the largest suppliers of imported coal in 1990, increasing their share to 1.4 million and 1.0 million short tons, respectively. Venezuela decreased its share to 10% of total imports.

Four electric utility plants received about 1.2 million short tons of imported coal mostly from Colombia.

Most Kentucky coal is transported by more than one mode of transportation because of cost considerations, the location of the minesite, and/or the customer.

- Kentucky coal is transported by rail, truck, and/or barge.
- Transportation is often more than one third of the cost of delivered coal.

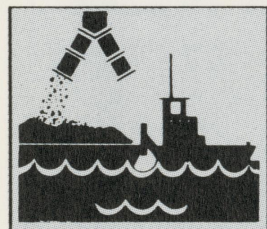
## Kentucky Coal Transportation System Distribution Estimate



Sources: Governor's Office for Coal and Energy Policy estimates based on data from:  
 Ky. Transportation Cabinet's Coal Haul Highway System, 1991 Report.  
 U.S. DOE - Energy Information Administration, Coal Distribution, 1990.  
 Ky. Dept. of Mines and Minerals, Annual Report, 1990.

## Coal Transportation by Barge in Kentucky

Kentucky has more than 1,000 miles of navigable rivers over which 36.4 million tons of coal are shipped each year.



- Statewide, 68 coal river terminals on the Ohio River and its tributaries serve Kentucky coal shippers. Approximately 47 are within Kentucky's borders and 21 on opposite banks.
- In total, 27 coal river terminals are located near Eastern Kentucky, 9 in Central Kentucky, and 32 near Western Kentucky.
- Of these, 27 of the coal river terminals have rail access, 57 have truck access, 29 have barge off-loading access, and 5 have conveyor access.
- Automated blending is found in 42 of the coal river terminals with 34 having automatic sampling, 38 having some coal crushing equipment, and 18 having stoker preparation equipment.

Sources: Governor's Office for Coal and Energy Policy, Western Kentucky Coal, 1990 - 1991 and Eastern Kentucky Coal, 1990 - 1991; Big Sandy River Counties, Cumberland Valley Counties, Kentucky River Counties.

### Coal Transportation by Rail in Kentucky

Kentucky has over 2,700 miles of railroad lines, over which 121.7 million tons of Kentucky coal were transported in 1990.

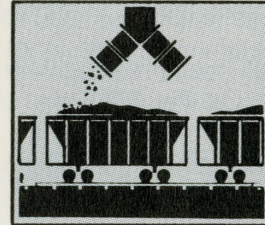
■ There are 2 Class I railroads, 1 Class II railroad, originating coal and 2 short line railroads that operate totally in Kentucky or originate coal in Kentucky.

■ These railroads have in excess of 95,000 hopper cars dedicated to the transport of coal.

■ Kentucky has approximately 244 coal rail loading facilities, with 71% of the more efficient and modern facilities being active during 1990. Many of the older, less efficient facilities are temporarily inactive as excess capacity.

■ There are 125 coal loading rail facilities with unit train service ( 70 provide 4 hour service, and 55 provide 24 hour service). Over 95 million tons of Kentucky coal moved by unit train service during 1990.

■ Coal is the main commodity of Kentucky's rail industry which employs over 7,400 Kentuckians and has a combined annual payroll of over 250 million dollars.



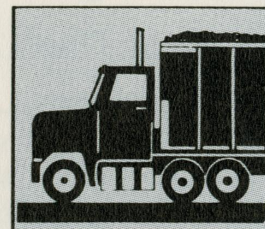
Sources: Governor's Office for Coal and Energy Policy estimates based on data from:  
 CSX Transportation, Inc.  
 Paducah and Louisville Railway  
 TransKentucky Transportation Railroad, Inc.  
 Norfolk Southern Corporation  
 Tradewater Railway Corporation

### Coal Transportation by Truck in Kentucky

Approximately 22% of Kentucky's 27,000 miles of state-maintained highways are used for transporting coal.

■ In 1990 over 140 million tons of coal were shipped by coal truck (78% of 1990 Kentucky production).

■ Truck shipments are a very important mode of coal transportation in Kentucky. Approximately 80% of Kentucky's coal uses trucks in at least one leg of the many different types of multimodal coal transportation market routes.



■ Over 2.6 billion ton miles of coal transportation by truck were reported during 1990.

■ Over 3,300 coal trucks were registered during 1990 in Kentucky; indicating that over 3,300 coal truck drivers were employed in Kentucky.

Mined land must be returned to its approximate original contours, with the exception of mountaintop removal operations, in accordance with the Federal Surface Mining Control and Reclamation Act of 1977.

■ The 1977 law allows mountaintops to be reclaimed as flat land, which leaves the land more valuable for development.

■ Reclaimed land must be as useful as the land was before mining, according to the 1977 law; often it is more useful.

■ Stringent regulations govern the design, operations, and environmental impact of every mine.

■ Mining and reclamation sites are inspected on a regular basis by state inspectors with random oversight inspections by federal inspectors.

■ Kentucky coal operators have paid over \$440 million to date into a federal program to reclaim land that was mined prior to August 3, 1977.

■ Before surface mining begins Kentucky coal operators must post bonds to ensure proper reclamation.

■ Under Kentucky's 1984 Permanent Program or "Primacy Program," bonds are not fully released until a coal operator has demonstrated five years of consecutive successful reclamation. (See chart.)

**The Kentucky coal mining industry currently has over \$824 million of reclamation bonds outstanding to assure timely and successful reclamation.**

Bond Release Phase	Reclamation Release Type	% of Bond Released	Time/Phase Requirement
Phase I	Backfilling, Grading and Drainage	60%	Complete Landscaping
Phase II	Vegetation	25%	Approximately 2 Yrs. of Successful Reclamation
Phase III	Final	15%	5 Years of Consecutive Successful Reclamation

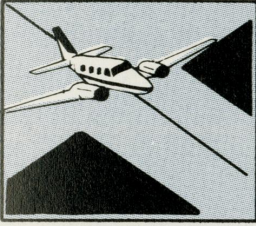
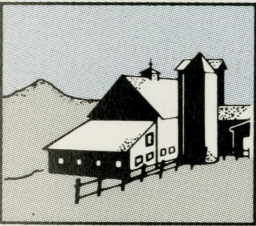
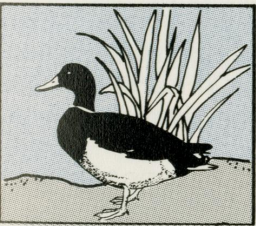
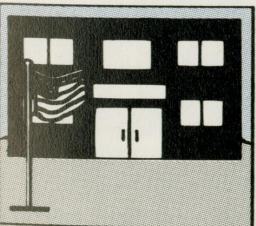
### Successful Mining Reclamation - Primacy Bond Releases (1984 through 1990)

Year	Phase I			Phase II			Phase III		
	# of Releases	Acres*	Bond	# of Releases	Acres*	Bond	# of Releases	Acres*	Bond
1984	4	123	\$277,886	—	—	—	—	—	—
1985	40	767	\$1,946,323	2	84	\$79,841	1	8	\$11,600
1986	248	6,361	\$16,781,470	—	—	—	1	14	\$16,800
1987	332	8,379	\$21,390,109	11	253	\$289,767	4	155	\$284,300
1988	561	15,583	\$38,194,394	57	1,303	\$1,261,810	—	—	—
1989	446	16,777	\$32,058,350	60	1,632	\$1,967,811	3	21	\$38,500
1990	533	15,383	\$28,108,146	260	7,298	\$6,221,870	51	1,697	\$1,569,147
<b>Total</b>	<b>2,164</b>	<b>63,373</b>	<b>\$138,756,678</b>	<b>390</b>	<b>10,570</b>	<b>\$9,821,099</b>	<b>60</b>	<b>1,895</b>	<b>\$1,920,347</b>

\* Includes surface acreage over underground mines.

Kentucky is deriving many benefits from post mining land use in the form of wildlife refuges, airports, mountaintop farms, duck sanctuaries, parks, playgrounds, and level land for schools, hospitals, homes, businesses and churches.

■ Post mining land use changes go hand-in-hand with economic development in Kentucky, especially in many parts of Eastern Kentucky where much needed level land for development is still a premium.

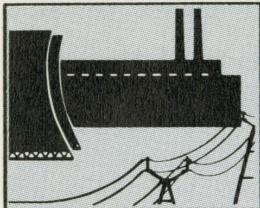
Post Mining Land Uses	Samples of Post Mining Land Use	County
 <p>Industrial / Commercial</p>	<p><b>Regional Airports</b></p> <p>Big Sandy Regional Airport            Pike County / Hatcher Field Airport            East Kentucky Regional Airport / Carroll Field            Ohio County Airport            Manchester Airport</p>	<p>Martin            Pike            Perry            Ohio            Clay</p>
	<p><b>Correctional Facilities</b></p> <p>Federal Correctional Institute            East Kentucky Correctional Complex            Medium Security Prison</p>	<p>Clay            Morgan            Muhlenberg</p>
 <p>Cropland / Pasture Land</p>	<p><b>Government Facilities</b></p> <p>Earle C. Clements Job Corp Center            Kentucky Army National Guard Training Center            U.S. Postal Service            Ohio County Park            Madisonville South By-pass            Municipal Solid Waste Landfills</p>	<p>Muhlenberg            Muhlenberg            Laurel            Ohio            Hopkins            Hopkins, Muhlenberg, Webster</p>
	<p><b>Mountaintop Farms</b></p> <p>Starfire Project            MAPCO / Morehead Agriculture Center            Martin County Coal Farm            D &amp; R Brangus Farm            Avlan Farms</p>	<p>Perry            Martin            Martin            Perry            Wayne</p>
 <p>Developed Water Resources            Fish &amp; Wildlife Habitat*</p>	<p><b>Duck Refuge Areas</b></p> <p>Muhlenberg, Ohio, Perry, Breathitt, Knott, and Martin Counties</p>	
	<p><b>Goose Down Production and Fish Farming</b></p> <p>Greenup County</p>	
 <p>Residential / Industrial / Commercial</p>	<p><b>Wetland Development</b></p> <p>Muhlenberg County</p>	
	<p><b>Sites for Homes, Schools, Churches, and Businesses</b></p> <p>Harlan County High School            Pike Central High School            Bell County High School            Bell County Middle School            Athletic Complex            Athletic Complex            Athletic Complex            Hazard Appalachian Regional Hospital            Housing Development            Clay County Golf Course            Faith Assembly of God Church, School, Daycare            Humfleet Mobile Home Sales            Hazard Shopping Center            Jackson Shopping Center            London Shopping Center            Whitesburg Shopping Center            South Williamson Shopping Center            Manchester Shopping Center            Barbourville Shopping Center            Numerous other Small Businesses in East Kentucky</p>	<p>Harlan            Pike            Bell            Bell            Perry            Letcher            Bell            Perry            Letcher            Clay            Laurel            Laurel            Perry            Breathitt            Laurel            Letcher            Pike            Clay            Knox</p>

\* Almost half of today's surface permits issued for East Kentucky have Wildlife Habitats as their approved post mining land use.



## Coal is being burned more cleanly today than ever before.

Air pollution from coal is decreasing, while coal use is increasing.



The major source of air pollution from coal is electric utility plants, because they are the major users of coal.

Electric utilities are using less polluting coal and their use of pollution control equipment has increased dramatically.

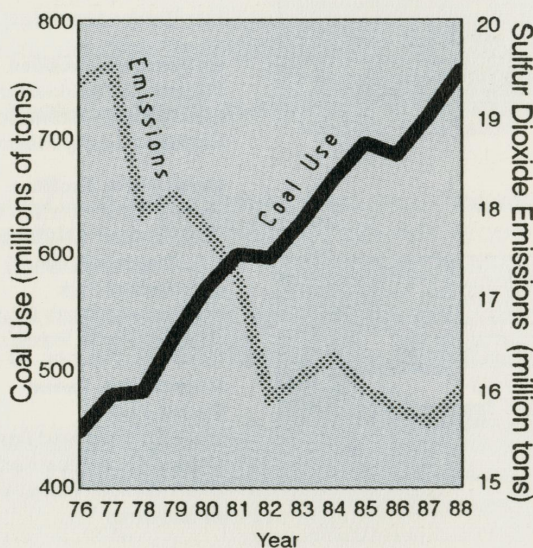
The pollution most often associated with coal has historically been smoke and soot - called particulates. Virtually all power plants have now installed pollution control equipment which captures over 99% of the smoke and soot. Sulfur dioxide is also of concern as one of the several causes of acid rain.

### Coal Use and Sulfur Dioxide Emissions from Electric Utility Plants

Coal-fired power plants in the U.S. have reduced their sulfur dioxide emission rate (the amount of pollution produced for each ton of coal burned) by nearly 50% since 1977.

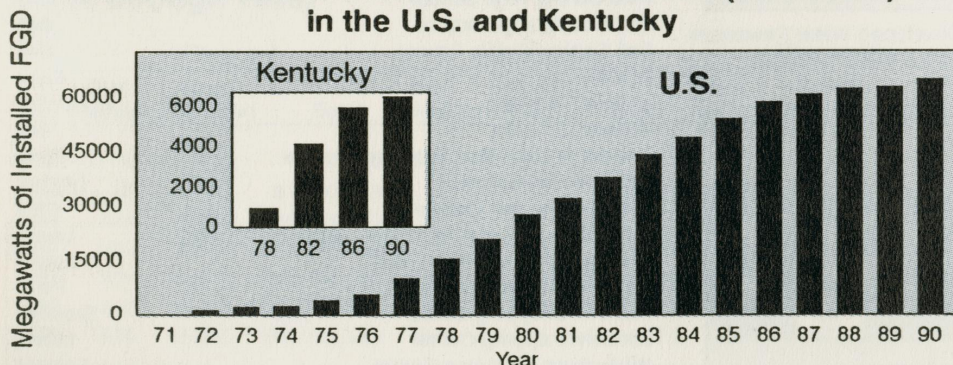
■ U.S. sulfur dioxide emissions have decreased by 28% since 1977, even though power plants increased their coal use by 60%.

■ In Kentucky, sulfur dioxide emissions have been reduced by 46% since 1976.



These achievements are the result of using lower sulfur coal and using pollution control equipment, like scrubbers. Bituminous coal sold to electric utilities is now 24% lower in sulfur than in 1977. The use of flue gas desulfurization equipment (FGD or scrubbers) has increased dramatically. Kentucky is second in the nation in installed scrubber capacity. Utilities in Kentucky have scrubbers on 39% of their coal-fired generating capacity, compared to the national average of 22%.

### Increased Use of Flue Gas Desulfurization (scrubbers) in the U.S. and Kentucky



■ Every new coal-fired power plant is required to install pollution control equipment which captures over 99% of the particulates (smoke and soot) and between 70% and 90% of the sulfur (depending on the sulfur in the coal).

Sources: National Acid Precipitation Assessment Program, *Acid Deposition: State of Science and Technology, Summary Report, 1991 and Interim Assessment, 1987*; Oak Ridge National Laboratory, *Utility FGD Survey, 1991*; Argonne National Laboratory, *Current Emission Trends (ANL/EAIS/TM-25)*; Kentucky Division of Air Pollution Control; USDOE/EIA, *Electric Power Annual, 1989*

### Acid Rain Legislation

"Acid Deposition Control", enacted as Title IV of the Clean Air Amendments of 1990, will have a significant impact on coal markets. The following is a simplified summary of the major provisions.

Each year, EPA gives utilities a calculated number of allowances<sup>a</sup>. At the end of the year, utilities turn in the number of allowances that they actually emitted.

#### Phase I: 1995 - 2000

##### Requirements and allowances given by EPA

Affects 261 electric utility units, at 109 plants in 21 states.

Allowances: Baseline Btu<sup>b</sup> x 2.5 lb/mmBtu<sup>c</sup>  
200,000 additional allowances for Ohio, Illinois, Indiana (given only once)

Result is approximately 3.5 million tons/year reduction in sulfur dioxide emissions

##### Compliance Options

Fuel switch (to low sulfur coal, gas, etc.)

Scrubbers (Flue Gas Desulfurization FGD)

Reduce use of plant

Postpone Compliance until 1997

If selected to share 3.5 million ton special bonus allowances and install scrubbers

Overcontrol at one unit and transfer spare allowances to another unit

Buy needed emission Allowances

##### Affected units in KY

Big Rivers

Coleman, units 1 - 3

East Kentucky Power

Cooper, units 1 - 2

Spurlock, unit 1

Henderson Municipal

Station II, units 1 - 2

Kentucky Utilities

Brown, units 1 - 3

Ghent, unit 1

Green River, unit 4

Owensboro Municipal

Smith, units 1 - 2

Tennessee Valley Authority

Paradise, unit 3

Shawnee, unit 10

##### Effect on KY coal

60% of Western KY coal and 2% of Eastern KY coal is sold to Phase I units.

#### Phase II: year 2000 and beyond

Requirements and allowances - Affects all electric utility units.

1985 rate (lb/mmBtu)	Basic Allowances	Bonus Allowances (2000 - 2009)
> 1.2 <sup>c</sup>	Baseline Btu <sup>b</sup> x 1.2 <sup>c</sup>	if < 2.5 <sup>c</sup> & < 60% CF <sup>d</sup> , then 1/2 x (Btu at 60% CF minus Baseline Btu)
< 1.2 <sup>c</sup>	120% x Baseline Btu <sup>b</sup> x lessor of '85 actual or allowable emission rate	can opt for Btu at 60% CF <sup>d</sup> system-wide instead of 120% x Baseline Btu <sup>b</sup> ; could lose allowances at some units

##### Special Emission Allowance Reserves & Other Provisions

300,000 allowances for conservation and renewable energy use

125,000 allowances for "Clean States" (< 0.8 lb/mmBtu)

50,000 allowances for Phase I units in 10 states (including Kentucky)

40,000 allowances for "High Growth" states

*Auctions (EPA will withhold 2.8% of each utility's allowances for auction):*

Direct Sales (50,000 allowances sold each year at \$1,500 per ton)

Auctions to highest bidder: 150,000 allowances/yr between 1995 - 2000;  
250,000 allowances/yr auctioned after 2000

##### Often-used terms:

<sup>a</sup>Allowance: an entitlement (permission) to emit one ton of sulfur dioxide.

<sup>b</sup>Baseline Btu: the average fuel used during 1985, 1986, and 1987.

<sup>c</sup>lb/mmBtu: pounds of sulfur dioxide (SO<sub>2</sub>) emitted per million Btu of fuel.

<sup>d</sup>CF: capacity factor (what percentage of its potential a plant uses).

Note: It is incorrect that utilities are required to meet 2.5 lb/mmBtu in Phase I and 1.2 lb/mmBtu in Phase II. As a utility increases the amount of coal it uses, it must meet lower emission rates. Example: if coal use increases at 2% per year, a utility unit whose allowances are calculated using 1.2 lb/mmBtu would have to meet around a 0.9 lb/mmBtu limit in the year 2000 rather than 1.2 lb/mmBtu. This equates to about 0.6% sulfur coal, instead of 0.8% sulfur.

## Future coal use will be even cleaner.

In 1990, Congress enacted *acid rain control legislation* to limit sulfur dioxide emissions to about half their current level and reduce nitrogen oxide emissions (see previous page).

Joint efforts by industry and governments are developing and demonstrating *Clean Coal Technologies* that will use coal with less emissions and greater efficiency.

One of the most promising is Fluidized Bed Combustion. The largest atmospheric fluidized bed combustion unit in the world is a 160 MW unit in Paducah, Kentucky, at the Tennessee Valley Authority's (TVA) Shawnee Steam Plant. This demonstration plant is a joint project of TVA, the Commonwealth of Kentucky, coal companies, electric utilities, railroads, and others. It began generating electricity in October, 1988 and will soon be operated as a commercial plant.

Following a recommendation by Special Acid Rain Envoys from the U.S. and Canada, the U.S. has embarked on an unprecedented Clean Coal Technology Program. Under this program, \$4.6 billion has been committed to 42 demonstration projects (60% of this by industries and state governments).

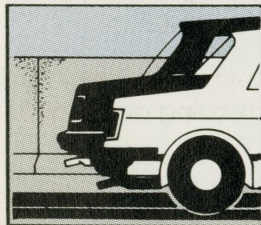
Some of these technologies are expected to reduce sulfur dioxide emissions by more than 99%, reduce nitrogen oxide emissions by 95%, and increase the amount of electricity that can be generated per ton of coal.

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## By-product Development

The generation and disposal of nuclear waste proposes huge environmental and financial burdens. However, coal-burning electric utility plants have developed many uses for their by-product waste material. Coal utilization by-products have a long useful history. Many people can recall using coal ashes to coat icy steps and walkways or to fill in a muddy driveway hole. Local road crews used ashes and cinders to coat slick roads in the winter in past years.

Some of the major by-products produced by today's coal-fired power plants are **scrubber sludge**, **spent bed material**, **bottom ash**, and **fly ash**. The following are just a few of the many current uses for coal-burning electric generation plant by-products in Kentucky.



### Scrubber Sludge Use:

Highway By-pass in Webster County

### Fluidized Bed Combustion Bed Material Use:

Service Roads in McCracken Co.

**Bottom Ash Use:** Farm Lanes, Driveways, and Road Shoulder Maintenance on the Pennyryle and Green River Parkways



### Bottom Ash Use:

Sand Blasting Materials and Asphalt Shingle Aggregate Factory in Muhlenberg County

There are also several new innovative uses of coal-burning electric utility plant waste currently in various stages of development. Some of the more widely publicized ones are: Building Brick, Cement Additives, Wallboard Manufacturing, Aggregate Pellets, and others.

### Water Quality

The effects of mining on water sources are much less than the effects from other sources. For example, soil loss from agriculture accounts for 62% of Kentucky's sediment while natural geologic erosion accounts for 26%.

■ Strict state and federal regulations deal with water during and after mining, on the minesite and on nearby streams and rivers.

■ Before obtaining mining permits, the coal operator must determine the probable effects mining will have on the quality of surface and ground water.

■ Surface and underground water is monitored during all phases of mining to protect the quality of the water, limit erosion, and prevent destructive flooding.

■ Regulations require the interception of water, detention of water in sedimentation ponds, water quality monitoring at certain locations or special wells, and treatment of the water if necessary before releasing to streams and rivers.

■ Some of the main water quality control permit and monitoring processes used in Kentucky by the mining industry are as follows:

- 4,700 coal related KY Pollution Discharge Elimination System Permits
- 4,884 coal related surface water monitoring points
- 4,522 coal related groundwater monitoring points/wells

Sources: Resource Papers. Kentucky's Environmental Future - At What Cost. Governor's Ninth Annual Conference on the Environment. 1984.  
Kentucky Natural Resources and Environmental Protection Cabinet.

### Abandoned Mine Land (AML) Reclamation

The Federal Surface Mining Control and Reclamation Act of 1977 establishes authority for the AML Fund. Contributions to this fund are made by each mining company at the rate of \$0.35 per ton for surface mined coal and \$0.15 per ton for deep-mined coal. These funds are used to reclaim pre-law (1977) sites left abandoned, unreclaimed, or insufficiently reclaimed.

■ The Kentucky's coal industry has contributed \$443.1 million to this fund since 1977.

#### AML Reclamation Accomplishments in Kentucky to Date

<i>Kentucky AML Projects</i>	<i>OSM* Emergency Projects</i>
321 State AML Projects.	284 Federal AML Projects
\$196.3 million in expenditures.	\$35 million in expenditures
8,271.9 acres reclaimed.	536.88 acres reclaimed

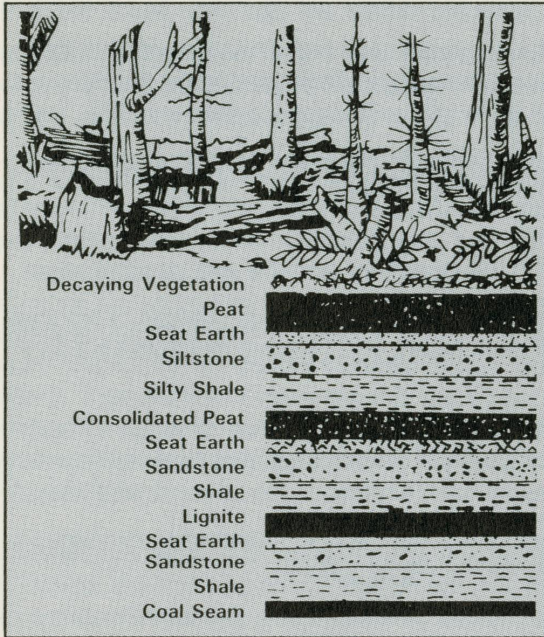
Approximately 605 total AML projects have been undertaken in Kentucky by both the state of Kentucky and OSM from 1982 - 1990 reclaiming over 8,800 acres and expending \$231 million in AML reclamation.

Some accomplishments to date of the state's AML Projects in Kentucky are:

- 18 public facilities enhanced (water replacement) - \$24 million.
- Over 47 miles of stream restoration projects.
- Over 8,000 feet of highwall eliminated.
- 80 hazardous structures removed.
- 437 mine portal closures.
- 18 vertical shafts sealed.
- 18 mine fires controlled.
- 95 landslides stabilized.

■ Today's coal industry in Kentucky is reclaiming the land to uses as good or better than before mining. Through contributions to the AML fund of over \$443 million since 1977, the industry is also helping to restore lands mined prior to today's reclamation standards.

\* Office of Surface Mining.



It is generally accepted that coal originated from plant debris including ferns, trees, bark, leaves, and seeds that accumulated and settled in swamps.

■ This unconsolidated accumulation of plant remains is called peat. Peat is being formed today in marshes and bogs.

■ Layers of peat, covered by sediment receiving heat and pressure from the subsidence of the swamps, went through a metamorphic process called coalification to form coal.

■ The metamorphic process is thought to have occurred in several stages over millions of years. The conditions of the metamorphic process and the swamps and bogs greatly affect the formation of the coal.

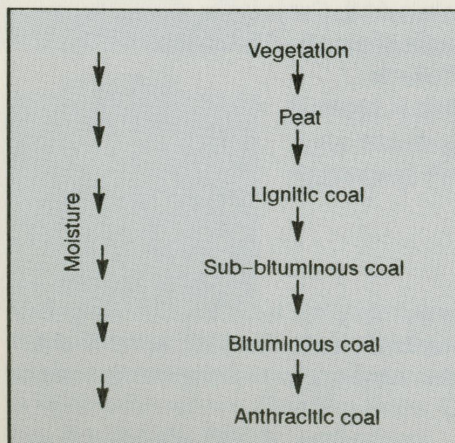
■ Several factors which greatly affected the content, makeup, quality, and rank of the coal were:

- |                  |                         |
|------------------|-------------------------|
| Temperature      | Fresh water/sea water   |
| Pressure         | Swamp acidity           |
| Time             | Types of plant debris   |
| Layering process | Types of sediment cover |

■ Coal first formed from peat has a high moisture content and a relatively low heating value.

## Coal Rank

Coal usually is divided into two main classes – anthracite (hard coal) and bituminous (soft coal). When anthracite was formed, it was squeezed under greater pressure than was bituminous. As a result anthracite contains the highest percentage of carbon and the lowest percentage of moisture. Anthracite makes up only a small part of the world's supply of coal. About half of the world's coal reserve is bituminous coal. (See U.S. Coal Reserves map). Remaining coal reserves are even softer (lignite and sub-bituminous).

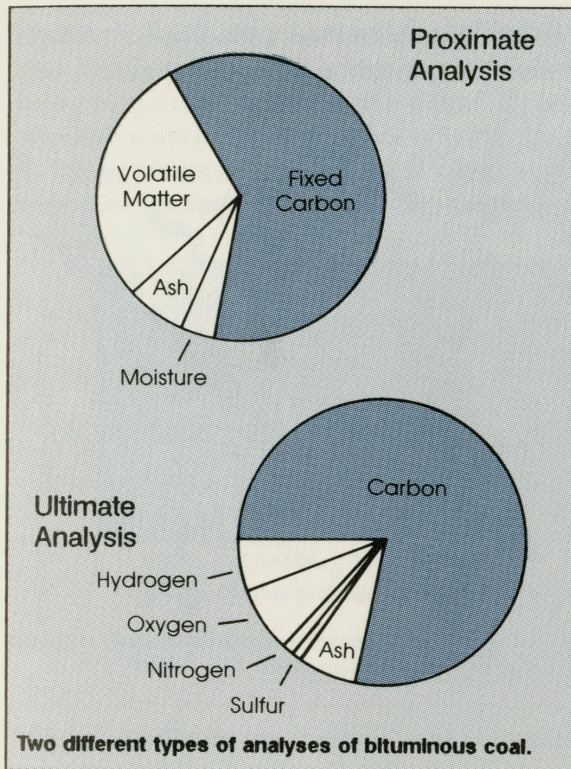


■ Moisture decreases, rank increases.

■ Rank increases, fixed carbon increases.

■ Rank increases, volatile matter decreases.

■ Rank increases, heating value increases. (optimum Btu at low-volatile bituminous)



Proximate analysis determines (on an as-received basis)

**–Moisture content**

**–Volatile matter** (gases released when coal is heated).

**–Fixed carbon** (solid fuel left after the volatile matter is driven off).

**–Ash** (impurities consisting of silica, iron, alumina, and other incombustible matter).

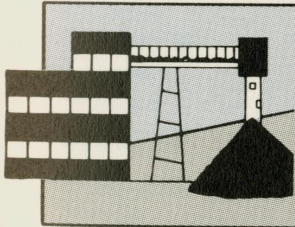
■ Ultimate analysis determines the amount of carbon, hydrogen, oxygen, nitrogen, and sulfur.

■ Heating value is determined in terms of BTU both on an as-received basis (including moisture) and on a dry basis.

Source: U.S. DOE – Energy Information Administration, *Coal Data: A Reference*, 1989.

### Improving the Properties of Mined Coal

Kentucky coal is improved by the partial removal of the impurities sulfur and ash. The cleaning process to remove impurities from the coal is often called *beneficiation*, *coal preparation*, or *coal washing*.



■ In general, coal cleaning is accomplished by separating and removing inorganic impurities from organic coal particles. The inorganic ash impurities are predominantly more dense than the coal particles. This property is generally the basis for separating the coal particles from the ash impurities.

■ Kentucky has over 70,000 tons per hour of coal preparation design capacity at approximately 136 coal preparation plants (105 in Eastern Kentucky and 31 in Western Kentucky).

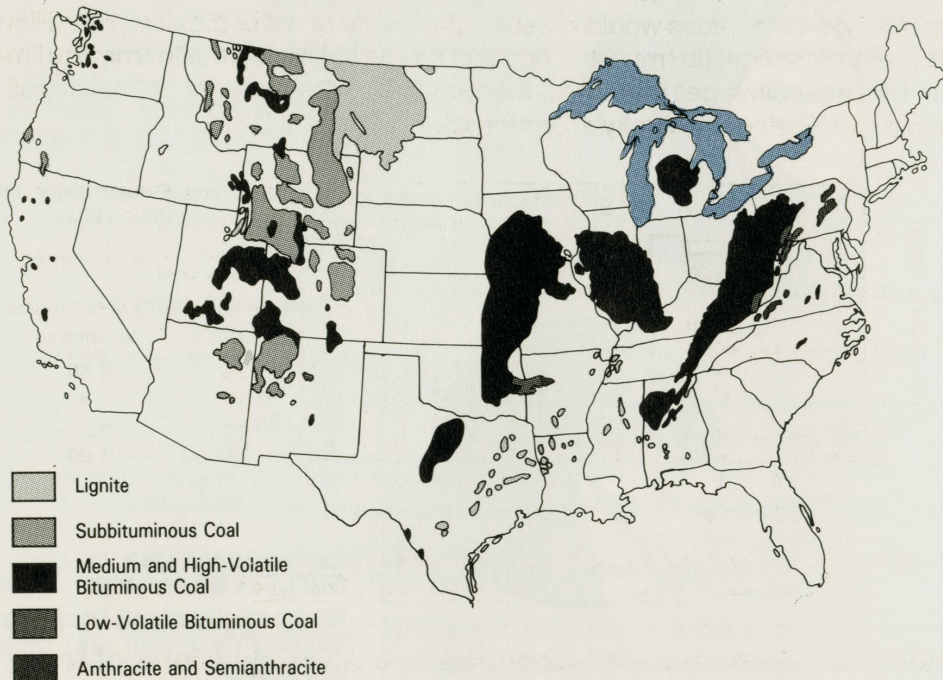
■ Each coal seam has a different washability characteristic. The range of improvement to a particular seam by mechanical washing varies from plant to plant and location to location.

■ In Western Kentucky, the sulfur (inorganic sulfur) and ash are the two main impurities removed. Considering the 7 principal mined seams in W. Ky. the average sulfur content reduction ranges from 0.5% to 2.5% and the reduction in the ash content ranges from 9% to 13% after the coal washing process.

■ In Eastern Kentucky, coals with very high ash contents are washed. High ash content results from seam impurities, splits or partings in the seam, or ash accumulating mining methods. In these seams the ash is the main impurity removed, with an average ash content reduction of 10 to 15% during the coal washing process and with only a slight reduction in the sulfur content.

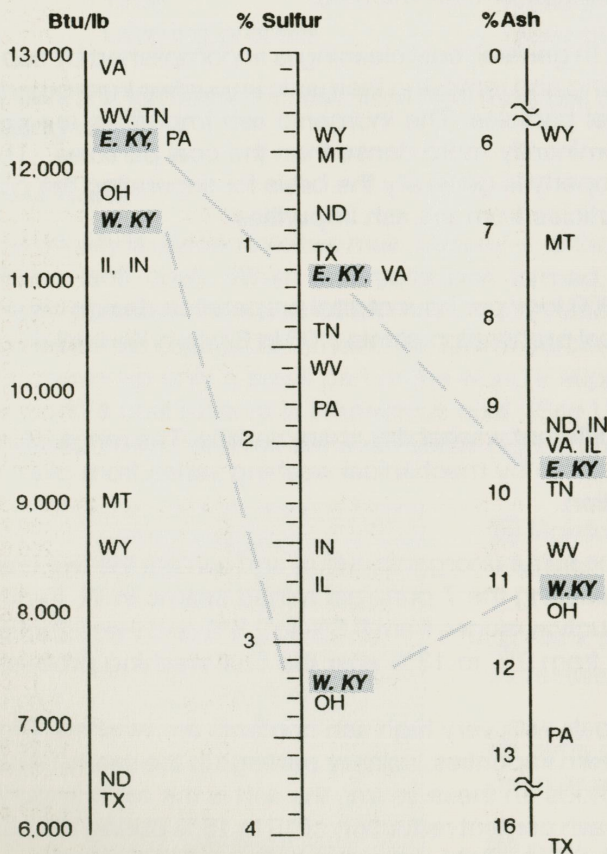
Source: Developed from the Governor's Office for Coal and Energy Policy's Kentucky Coal Marketing Information System.

## U.S. Coal Fields and Coal Producing Areas



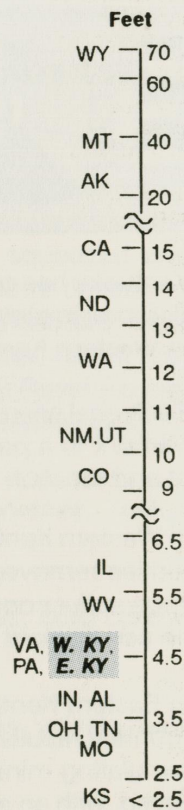
Source: Developed from the U.S. Geological Survey

## Average Quality of Coal Produced for Power Plants by Selected Producing States, 1990



Source: Energy Information Administration, Cost and Quality of Fuels for Electric Utility Plants, 1990.

## Average\* Coalbed Thickness Mined in 1987

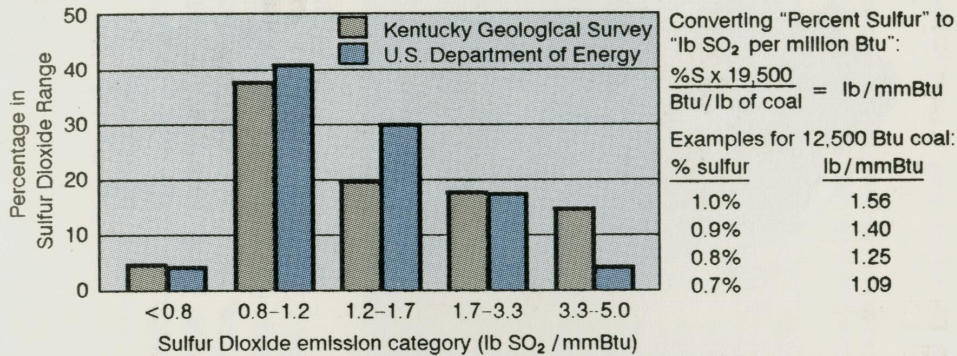


\* Weighted average.

Source: Energy Information Administration, Coal Data: A Reference, 1989.

### Eastern Kentucky Low-sulfur Coal

The Kentucky Geological Survey has estimated that 43% of Eastern Kentucky's coal resources would meet a 1.2 pounds of sulfur dioxide per million Btu emissions limit (lb/mmBtu), and that 5% would meet a 0.8 lb/mmBtu limit. These percentages are almost identical to U.S. Department of Energy estimates for Eastern Kentucky's Demonstrated Reserve Base.



Sources: Kentucky Geological Survey, *Compliance Coal Resources In Kentucky*, 1982;  
 U.S. DOE - EIA, *Estimation of U.S. Coal Reserves by Coal Type* (DOE/EIA-0529)

### 1990 U.S. Demonstrated Coal Reserve Base\* (millions of tons)

The U.S. Demonstrated Coal Reserve Base is an estimate of the tonnage that can be economically mined with today's technology.\*

Coal Producing Region and State	Anthracite	Bituminous	Sub-bituminous	Lignite	Total**
<b>Appalachian Total</b> ...	<b>6.9%</b> .....	<b>92.0%</b> .....		<b>1.0%</b> .....	<b>103,566.4</b>
Alabama .....		77.5%		22.5%	4,857.8
Georgia .....		100.0%			3.2
Kentucky, Eastern .....		100.0%			9,225.1*
Maryland .....		100.0%			762.4
North Carolina .....		100.0%			10.7
Ohio .....		100.0%			18,515.3
Pennsylvania .....	24.1%	75.9%			29,234.8
Tennessee .....		100.0%			855.9
Virginia .....	4.6%	95.4%			2,711.9
West Virginia .....		100.0%			37,389.2
<b>Interior Total</b> .....	<b>0.1%</b> .....	<b>89.5%</b> .....		<b>10.4%</b> .....	<b>134,154.3</b>
Arkansas .....	25.0%	69.0%		6.0%	417.1
Illinois .....		100.0%			78,331.3
Indiana .....		100.0%			10,199.2
Iowa .....		100.0%			2,191.0
Kansas .....		100.0%			978.3
Kentucky, Western .....		100.0%			20,417.9
Louisiana .....				100.0%	491.6
Michigan .....		100.0%			127.7
Missouri .....		100.0%			6,007.3
Oklahoma .....		100.0%			1,591.1
Texas .....				100.0%	13,402.1
<b>Western Total</b> .....	<b>0.1%</b> .....	<b>10.3%</b> .....	<b>76.8%</b> .....	<b>12.8%</b> .....	<b>233,816.3</b>
Alaska .....		11.4%	88.4%	0.2%	6,139.7
Arizona .....		100.0%			266.6
Colorado .....	0.1%	52.3%	22.9%	24.6%	17,017.4
Idaho .....		100.0%			4.4
Montana .....		1.2%	85.7%	13.1%	120,013.5
New Mexico .....	0.1%	43.7%	56.2%		4,487.2
North Dakota .....				100.0%	9,663.4
Oregon .....			100.0%		17.5
South Dakota .....				100.0%	366.1
Utah .....		99.9%	0.1%		6,177.8
Washington .....		21.3%	78.1%	0.6%	1,424.8
Wyoming .....		6.5%	93.5%		68,237.8
<b>U.S. Total</b> .....	<b>1.6%</b> .....	<b>50.8%</b> .....	<b>38.1%</b> .....	<b>9.5%</b> .....	<b>471,537.0</b>

\* Kentucky coal resource values are considered by some to be too high of a value; while the Eastern Kentucky "Demonstrated Coal Reserve Base" value is openly rejected by many others as being too low.

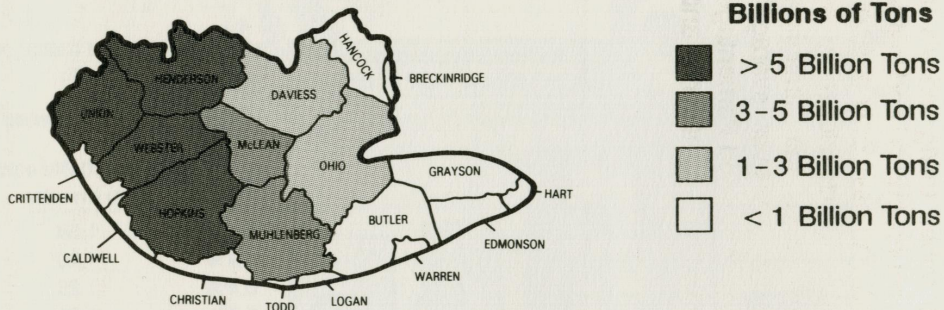
\*\* Millions of tons.

Source: U.S. DOE - Energy Information Administration, *Coal Production*, 1990.



## Western Kentucky Coal Field

The Western Kentucky coal field covers 6,400 square miles and contains over 36 billion tons of remaining resources. (Part of this cannot be mined using today's technology.)

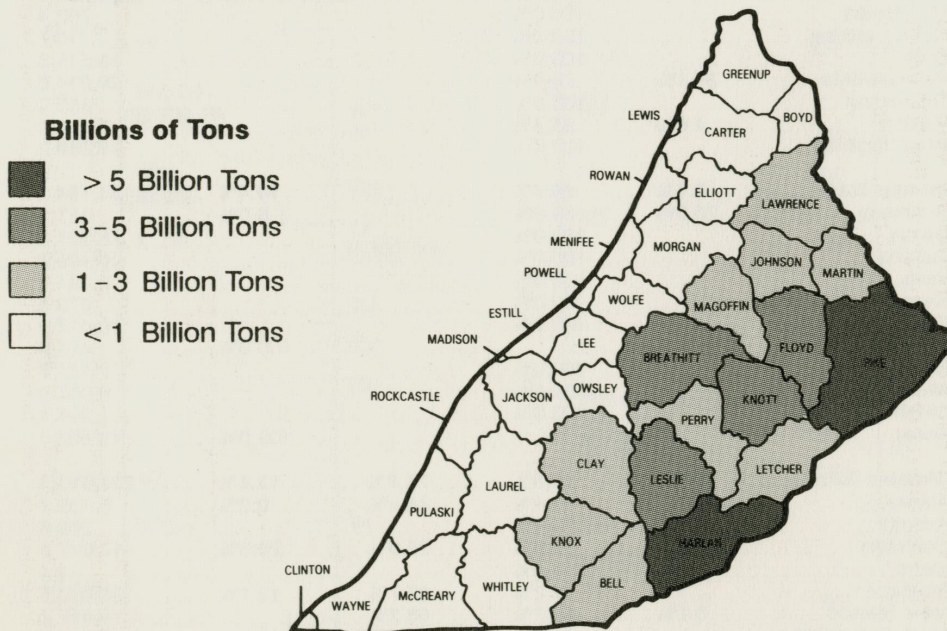


There are 35 named coal beds, of which 7 principal coal beds contain about 94% of the resources in Western Kentucky.

Over 4 billion tons of coal have been mined or lost due to mining, amounting to only about 11% of total Western Kentucky coal resources.

## Eastern Kentucky Coal Field

The Eastern Kentucky coal field covers 10,500 square miles and contains over 55 billion tons of remaining resources. (Part of this cannot be mined using today's technology.)



There are more than 80 named coal beds in the Eastern Kentucky coal field which covers parts of 37 counties.

Over 8 billion tons of coal have been mined or lost due to mining, amounting to only about 14% of total Eastern Kentucky coal resources.

Source: Updated from Brant and Other, Coal Resource Series, 1980-1983.

Original resource estimates for Western and Eastern Kentucky were 41 and 64 billion tons respectively. The resources currently remaining after 200 years of mining are estimated to be 36.6 billion tons in Western Kentucky and 55.1 billion tons in Eastern Kentucky. As shown in the tables below, assumptions on the percentage available for development reduce this value even further. These values and percentages available for development are now carefully being determined. However, they will be a much debated subject for several more years to come. The table also calculates some values for years of remaining production at current levels of production, at given percentage availabilities, and at current levels of recovery technology.

Part of these resources cannot be mined using today's technology, and should be used mainly as original resource/mined and lost estimates. Some quadrangle areas have been estimated to have only 40% of the "remaining estimated original resource" available for development due to land-use restrictions, geological conditions, and the limitations of today's technologies. Other quadrangle areas, however, average 60% or more availability for development. Thus, the "Assumed Percentage" portion of the table is useful for estimating resources remaining and available for development in a given county.

County	Estimated Original Resource (mm tons)	Mined 1790-1990 (mm tons)	Estimated Resources Lost Due to Mining 1790-1990 (mm tons)	Western Kentucky Coal Resources										Current Year Production 1990 (mm tons)
				Assumed Percentage of Remaining Original Resource Available for Development										
				100% mm Tons/Yrs.*	90% mm Tons/Yrs.*	80% mm Tons/Yrs.*	70% mm Tons/Yrs.*	60% mm Tons/Yrs.*	50% mm Tons/Yrs.*	40% mm Tons/Yrs.*				
Butler	413.69	29.10	29.10	355/>200	320/>200	284/>200	249/177	213/151	178/126	142/101	1.23			
Davless	1,330.32	50.32	50.32	1,230/>200	1,107/>200	984/>200	861/>200	738/>200	615/>200	492/>200	1.51			
Henderson	6,852.78	38.36	38.36	6,776/>200	6,098/>200	5,421/>200	4,743/>200	4,066/>200	3,388/>200	2,710/>200	2.70			
Hopkins	8,814.80	663.00	663.00	7,489/>200	6,740/>200	5,991/>200	5,242/>200	4,493/>200	3,744/>200	2,996/194	10.66			
McLean	3,576.41	14.29	14.29	3,548/>200	3,193/>200	2,838/>200	2,483/>200	2,129/>200	1,774/>200	1,419/>200	.22			
Muhlenberg	4,723.84	697.90	697.90	3,328/>200	2,995/>200	2,662/>200	2,330/>200	1,997/180	1,664/150	1,331/120	7.14			
Ohio	1,824.55	243.71	243.71	1,337/>200	1,203/>200	1,070/>200	936/>200	802/>200	668/196	535/156	2.68			
Union	6,506.98	249.76	249.76	6,007/>200	5,407/>200	4,806/>200	4,205/182	3,605/156	3,004/130	2,403/104	11.60			
Webster	6,322.95	174.49	174.49	5,974/>200	5,377/>200	4,779/>200	4,182/>200	3,584/>200	2,987/175	2,390/140	9.62			
Other**	623.08	18.70	18.70	586/>200	527/>200	469/>200	410/>200	351/>200	293/>200	234/195	1.04			
WKY Totals	40,989.30	2,179.63	2,179.63	36,630/464	32,967/418	29,304/371	25,641/325	21,978/278	18,315/232	14,652/186	48.40			

\* The years remaining are calculated based on 1990 production (county's 1990 underground production (x) times a mined and lost factor of 2 plus a county's 1990 surface production (x) times a mined and lost factor of 1.15 equals (=) the counties 1990 mined and lost value, divided into the assumed percentage (%) recovery columns value in tons equals (=) estimated years of production remaining at current levels of production).

\*\* "Other" includes Breckenridge, Caldwell, Christian, Crittenden, Edmonson, Grayson, Hancock, and Warren Counties. Source: Smith and Brant (1980), "Mined and Lost" and "Remaining Resources" updated by the Governor's Office for Coal and Energy Policy from the Kentucky Dept. of Mines and Minerals Annual Reports.

County	Estimated Original Resource (mm tons)	Mined 1790-1990 (mm tons)	Estimated Resources Lost Due to Mining 1790-1990 (mm tons)	Eastern Kentucky Coal Resources										Current Year Production 1990 (mm tons)
				Assumed Percentage of Remaining Original Resource Available for Development										
				100% mm Tons/Yrs.*	90% mm Tons/Yrs.*	80% mm Tons/Yrs.*	70% mm Tons/Yrs.*	60% mm Tons/Yrs.*	50% mm Tons/Yrs.*	40% mm Tons/Yrs.*				
Bell	3,194.70	242.10	242.10	2,710/>200	2,439/>200	2,168/>200	1,997/>200	1,826/>200	1,626/>200	1,355/181	1,084/145	4.48		
Boyd	630.68	19.93	19.93	590/>200	532/>200	473/>200	414/>200	354/>200	295/>200	236/>200	186/>200	0.40		
Breathitt	4,112.20	156.10	156.10	3,800/>200	3,420/>200	3,040/>200	2,660/>200	2,280/>200	1,900/>200	1,520/>200	1,140/>200	5.43		
Carter	501.96	18.57	18.57	465/>200	419/>200	372/>200	326/>200	279/>200	233/>200	186/>200	139/>200	0.03		
Clay	1,536.11	55.02	55.02	1,426/>200	1,283/>200	1,141/>200	998/>200	856/>200	713/>200	570/>200	428/>200	1.67		
Elliott	316.32	9.60	9.60	297/>200	267/>200	237/>200	208/>200	178/>200	148/>200	119/>200	90/>200	0.13		
Floyd	4,168.08	380.90	380.90	3,406/181	3,066/163	2,725/145	2,384/127	2,044/109	1,703/91	1,363/73	1,022/55	11.80		
Greenup	204.87	8.54	8.54	188/>200	169/>200	150/181	132/159	113/136	94/113	75/91	56/73	0.72		
Harlan	7,881.12	758.40	758.40	6,364/>200	5,728/>200	5,091/183	4,455/161	3,818/138	3,182/115	2,546/92	1,910/70	14.34		
Jackson	375.87	10.84	10.84	354/>200	319/>200	283/>200	248/>200	213/>200	177/>200	142/>200	107/>200	0.10		
Johnson	1,419.44	76.47	76.47	1,267/>200	1,140/>200	1,013/>200	887/>200	760/>200	633/>200	507/>200	380/>200	0.89		
Knott	4,385.10	177.90	177.90	4,029/>200	3,626/>200	3,223/>200	2,821/>200	2,418/178	2,015/148	1,612/118	1,210/88	8.55		
Knox	1,381.93	65.65	65.65	1,251/>200	1,126/>200	1,001/>200	875/>200	750/>200	625/>200	500/>200	375/>200	1.15		
Laurel	408.04	35.30	35.30	337/>200	304/>200	270/>200	236/>200	202/>200	169/>200	135/>200	100/>200	0.09		
Lawrence	2,071.68	193.32	193.32	1,986/>200	1,787/>200	1,589/>200	1,390/>200	1,192/>200	993/>200	794/>200	595/>200	0.18		
Lee	353.98	7.87	7.87	348/>200	313/>200	279/>200	244/>200	209/>200	174/>200	139/>200	104/>200	0.10		
Leslie	3,554.65	152.93	152.93	3,249/>200	2,924/194	2,599/173	2,274/151	1,949/130	1,625/108	1,300/86	1,000/64	8.17		
Letcher	3,692.80	418.10	418.10	2,857/158	2,571/143	2,286/127	2,000/111	1,714/95	1,429/79	1,143/63	860/54	10.70		
McCreary	444.97	55.14	55.14	335/>200	301/>200	268/>200	234/>200	201/>200	167/>200	134/>200	101/>200	0.01		
Magoffin	1,969.10	47.98	47.98	1,873/>200	1,686/>200	1,499/>200	1,311/>200	1,124/>200	937/>200	749/>200	550/>200	1.96		
Martin	3,319.97	236.40	236.40	2,847/128	2,562/115	2,278/103	1,993/90	1,708/77	1,424/64	1,139/51	888/46	12.93		
Morgan	849.40	15.03	15.03	819/>200	737/>200	655/>200	573/>200	492/>200	410/>200	328/>200	246/>200	0.01		
Owsley	574.14	8.32	8.32	558/>200	502/>200	446/>200	390/>200	335/>200	279/>200	223/>200	170/>200	0.30		
Perry	3,596.70	423.30	423.30	2,750/160	2,475/144	2,200/128	1,925/112	1,650/96	1,375/80	1,100/64	825/54	12.01		
Pike	11,391.70	954.00	954.00	9,484/159	8,535/143	7,587/127	6,639/111	5,690/96	4,742/80	3,793/64	2,844/48	32.56		
Whitley	987.44	81.09	81.09	825/>200	743/>200	660/>200	578/197	495/169	413/141	330/113	247/>200	1.96		
Wolfe	443.92	4.94	4.94	434/>200	391/>200	347/>200	304/>200	260/>200	217/>200	174/>200	131/>200	0.08		
Other**	334.89	33.07	33.07	269/>200	242/>200	215/>200	188/>200	161/>200	134/>200	108/>200	81/>200	0.29		
EKY Totals	64,064.76	4,472.81	4,472.81	55,118/251	49,607/226	44,095/201	38,583/176	33,071/151	27,561/126	22,049/101	17,537/66	130.97		

\* The years remaining are calculated based on 1990 production (county's 1990 underground production (x) times a mined and lost factor of 2 plus a county's 1990 surface production (x) times a mined and lost factor of 1.15 equals (=) the counties 1990 mined and lost value, divided into the assumed percentage (%) recovery columns value in tons equals (=) estimated years of production remaining at current levels of production).

\*\* "Other" includes Clinton, Pulaski, Rockcastle, and Wayne Counties. Source: Smith and Brant (1980), "Mined and Lost" and "Remaining Resources" updated by the Governor's Office for Coal and Energy Policy from the Kentucky Dept. of Mines and Minerals Annual Reports.

One **Btu** equals approximately:

- 1 blue-tip kitchen match

One **million Btu** equals approximately:

- 90 pounds of U.S. coal  
 120 pounds of oven-dried hardwood  
 8 gallons of motor gasoline or the amount it took in 1987 to move the average passenger car in the United States about 154 miles  
 10 therms of dry natural gas  
 11 gallons of propane

One **million Btu of fossil fuels burned** at electric utilities can generate about 100 kilowatt-hours of electricity, while about 300 kilowatt-hours of electricity generated at electric utilities can produce about 1 million Btu of heat.

One **short ton of coal** equals approximately:

- 106 days of coal consumption per person (U.S. - 1988)  
 3.8 barrels of crude oil  
 21 thousand cubic feet of dry natural gas  
 6,500 kilowatt-hours of electricity consumed

One **thousand kilowatt-hours (kwh) of electricity** equals approximately:

- 35 days of electricity use per person (U.S. - 1988)  
 0.59 barrels of crude oil (although it takes about 1.8 barrels of oil to produce 1,000 kwh)  
 0.15 short tons (or 310 pounds) of coal (although it takes about 0.47 short tons to produce 1,000 kwh)  
 3,300 cubic feet of dry natural gas (although it takes about 10,000 cubic feet to produce 1,000 kwh)

Source: U.S. DOE - Energy Information Administration, Energy Facts, 1988.

### Handy Calorific Value Conversion\* for Coal

kcal/kg	Btu/lb	kcal/kg	mj/kg	Btu/lb	Btu/lb	kcal/kg
7500	13500	7403	31	13227	13500	7500
	13050	7264	30	12897	13000	7222
7000	12600	6925	29	12467	12500	6944
	12150	6686	28	12037	12000	6667
6500	11700	6448	27	11607	11500	6389
	11250	6209	26	11177	11000	6111
6000	10800	5970	25	10748	10500	5833
	10350	5731	24	10318	10000	5556
5500	9900	5492	23	9888	9500	5278
	9450	5254	22	9458	9000	5000
5000	9000	5015	21	9028		

\* Conversion chart alignment is approximate and values are rounded to the nearest whole number.

Btu/lb British thermal units per pound.

mj/kg Megajoules (a unit of work) per kilogram.

kcal/kg Kilocalorie per kilogram.

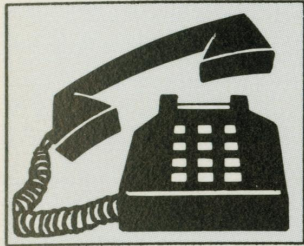
For more precise conversion between units:

kcal/kg = 238.8 x mj/kg

Btu/lb = 1.800 x kcal/kg = 429.9 x mj/kg

Source: Developed from source Ideas by: BP Coal Limited, Coal Handbooks.

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(606) 233-4743

Kentucky coal data, information, and referral assistance to government, private organizations, and individuals are available from the following. Initial copies of **Kentucky Coal Facts** are available free of charge directly from the following offices or directly from the member companies of the Kentucky Coal Association. Additional multiple copies can be purchased from the Kentucky Coal Association.

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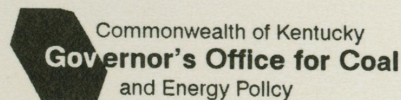
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