MINING IN KENTUCKY : Past, Present & Future

Presented at the
Kentucky Geological Survey Annual Seminar
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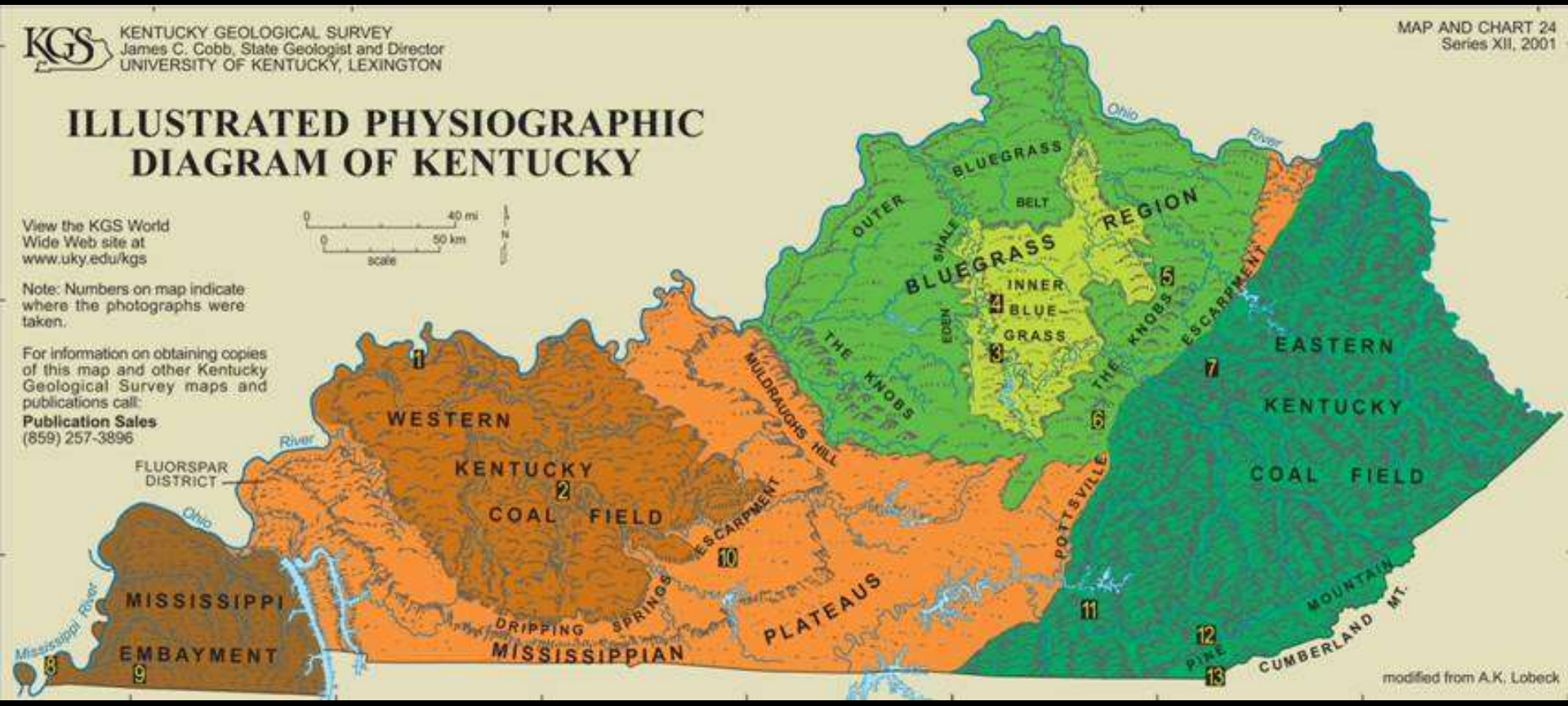
ECSI LLC
ENGINEERS • CONSULTANTS • SCIENTISTS

ecology and environment, inc.
International Specialists in the Environment

MINING IN KENTUCKY : Past, Present & Future



Kentucky can be defined by its mineral resources;
Coal fields, Fluorspar District, Limestone

Kentucky's Historic Mining Resources

To look forward, sometimes we need to take a look back.

Saltpeter

Iron Ore

Fluorspar

Clay / Shale

Sandstone

Limestone / Dolomite

Sand / Gravel

Lead

Phosphates

Zinc

Headframe from abandoned Zinc mine, WKY

Kentucky Mineral Resources

Limestone / Dolomite

KY has the most Underground Quarries in the U.S.

Kentucky Mineral Resources

Fluorspar / Barite / Calcite / Lead / Zinc

FLUORSPAR

Kentucky led the nation in production until World War II. Presently there is none mined in the US.

Coal: The Public Perception -

Death, Despair & Destruction

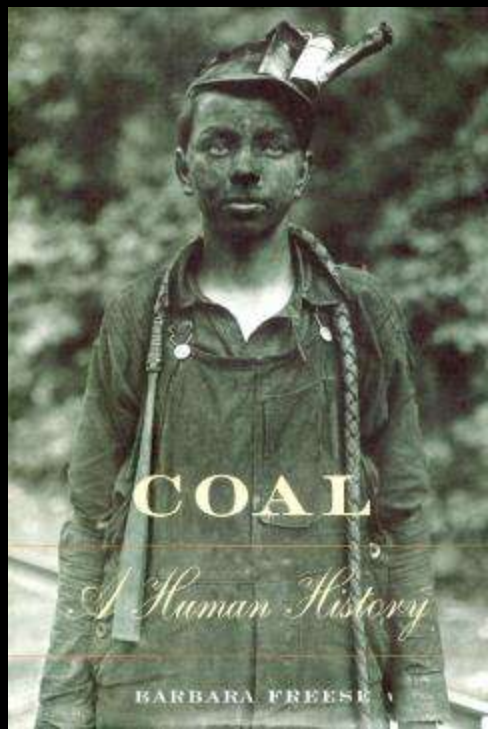
COAL'S HERITAGE

"… Britain, the first nation to be thoroughly transformed by releasing the genie of coal. …became the most powerful force on the planet, and created an industrial society the like of which the world had never seen."

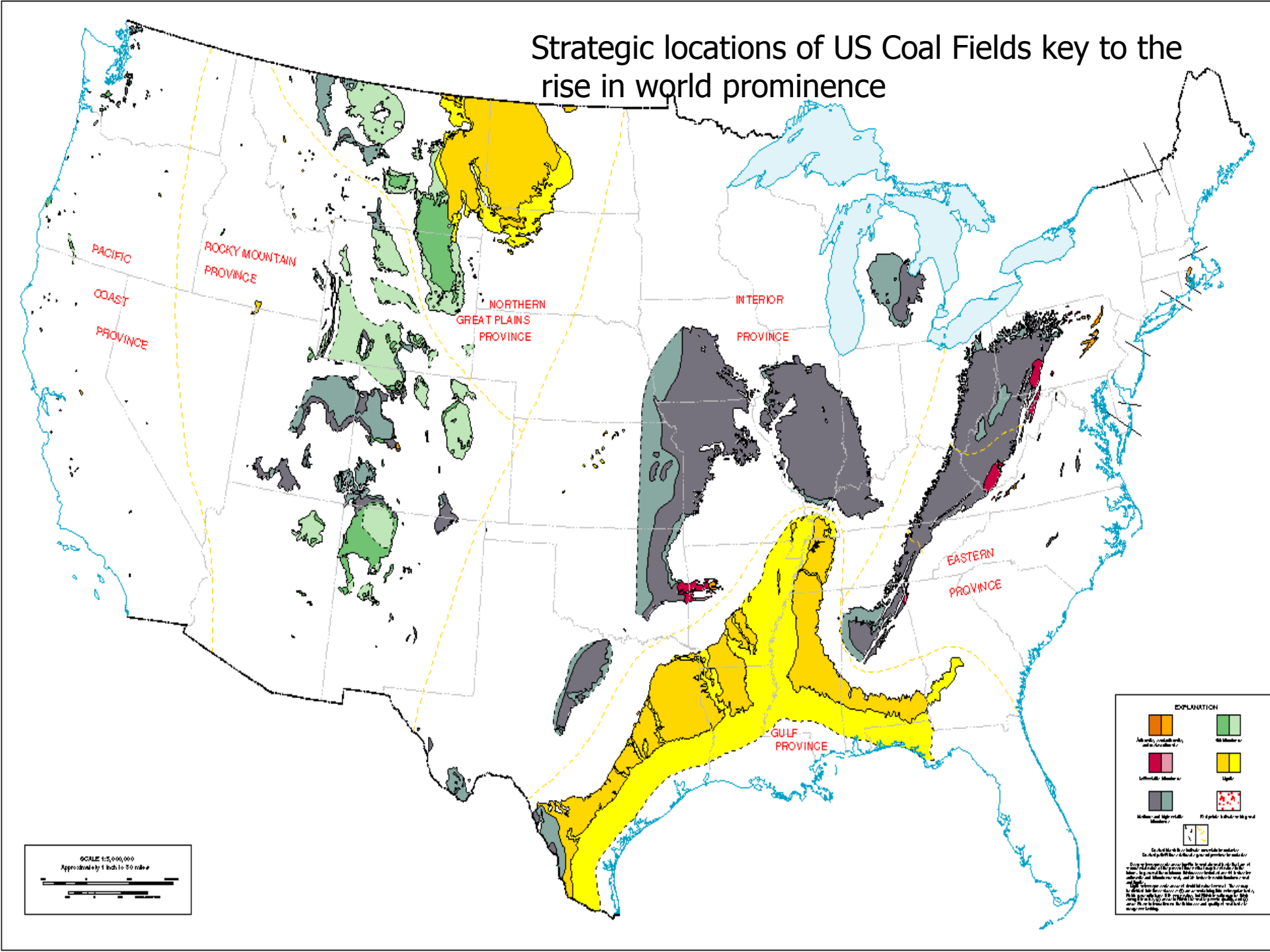
"… the United States,… Coal transformed a virtual wilderness into an industrial super power with astonishing speed."

-Powerful observations from Barbara Freese,

"Coal – A Human History"



Strategic locations of US Coal Fields key to the rise in world prominence



Take a Look Forward by Looking Back

Brief History of KENTUCKY COAL Formative Events By The Decades

1750 Dr. Thomas Walker, an early KY explorer records his discovery of coal.

1820 1st Commercial Mine – the "Mclean Drift Bank" Muhlenberg County – 328 Tons

1850 Coal exported back to Great Britain "The King's Coal"

1879 1 Million Tons Produced – primarily from W. KY

COAL

1880 Mechanical Stokers

1st Coke Ovens Western Kentucky

Coal Mining Machines Come into General Use

COMMUNITY OF COAL

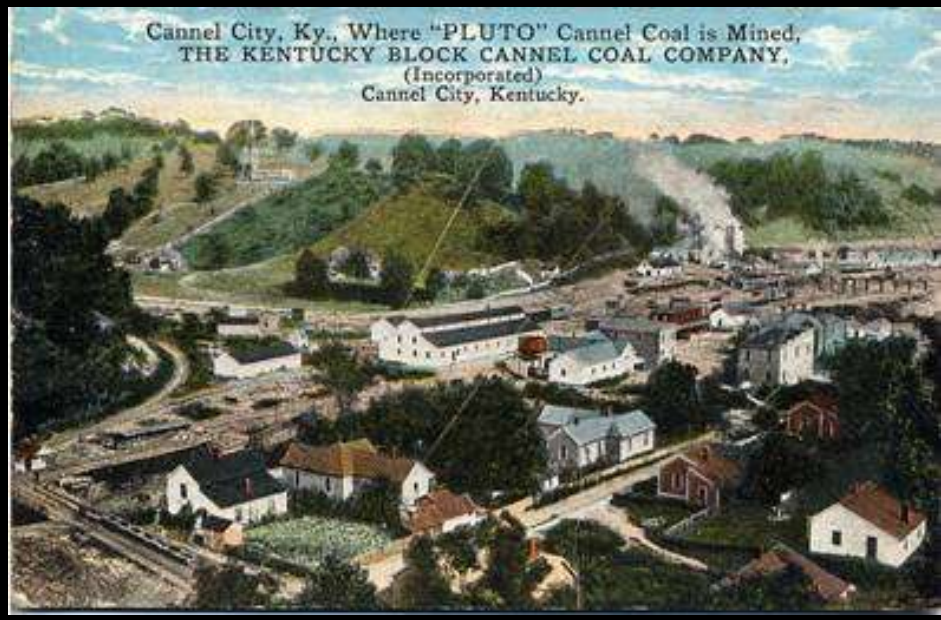
1900s

"The Golden Age of Coal Mining.

Coal Camp's Contrasting Life Styles, many are model communities

Kentuckians have strong sense of Place

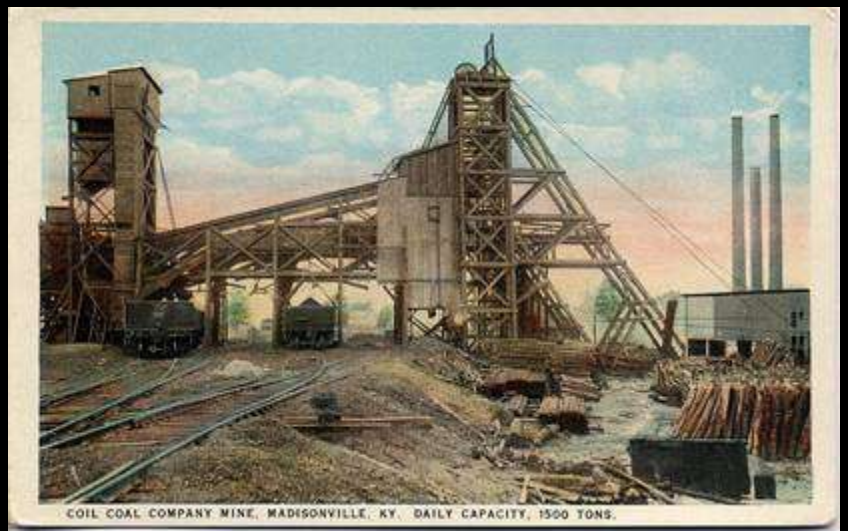
Miners are fiercely proud of their Heritage

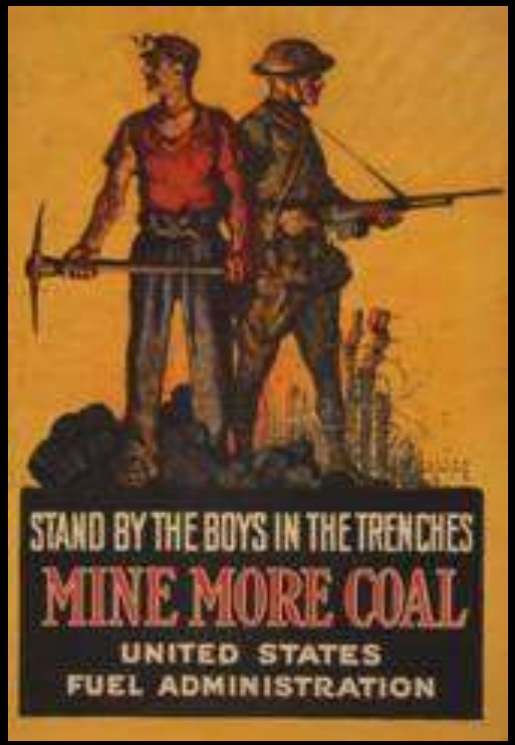


COAL – Western KY Coalfield

Led the state in production until 1912

1914 World War I increases demand in KY - 20 Million Tons in production





COAL

1920 42.1 Million Ton production

1923 1st Large scale excavators in Mining

1930 Union wars "Bloody Harlan" - Depression

Shovel moved from Panama Canal construction

COAL

1940 World War II KY Production 72.4 Million tons

1942 Continuous Miners Developed

Auger Mining introduced

More Mechanization necessary due to miners In service

Development of mobile equipment for war led to adaptation in small scale surface mining

COAL

1950 82.2 Million Tons
Roof Bolting Introduced
Another Down Cycle in Coal

1960s RR's begin using Unit Trains
First Longwall Mining

1963 100 Million Tons Production

COAL

1970s marked by new Regulatory initiatives

1969 Federal Coal Mine Health & Safety Act forms MESA - Now MSHA

1970 Federal Clean Air Act

1972 Clean Water Act

the first women coal miners in US Pike County

1973 OPEC Oil Embargo
Coal Production & Price Skyrockets

1976 Scotia Mine Disaster – Letcher Co.

1977 Federal Surface Mining Control & Reclamation Act (SMCRA)

COAL

1988 Wyoming Becomes Leading U.S. Producer

1989 PYRO Mine Disaster – First woman killed underground

1990 KY Record Production 179.4 Million Tons U.S. Coal Production Exceeds 1 Billion Tons

1998 Mountaintop Mining Controversy begins

COAL – THE PRESENT

Issues for Kentucky Coal

- Environment
- Miner Health & Safety
- Community Health

EPA ?- Which Law Applies?

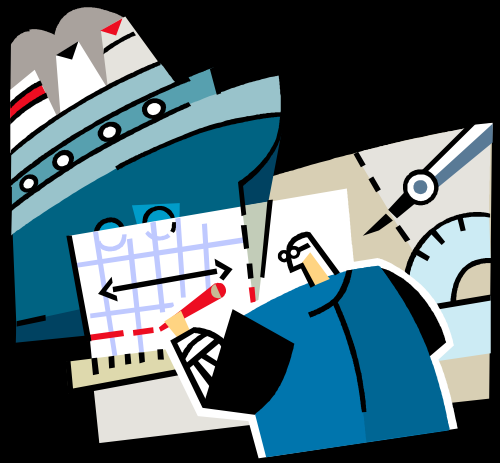
New interpretations of long standing programs

STATE PROGRAMS?

SMCRA - 1977

CWA -1972

Corps of Engineers



The mining tragedies of 2006 – 2007 & then 2010 - Upper Big Branch

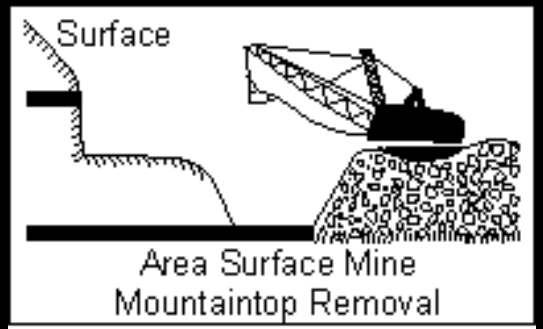
Is Coal Mining Bad for Your Health?

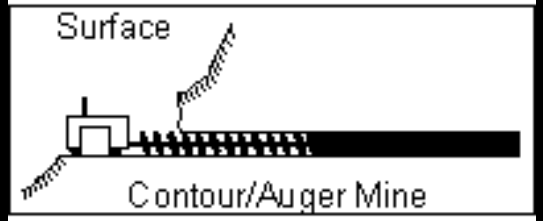
Whose science do you believe?

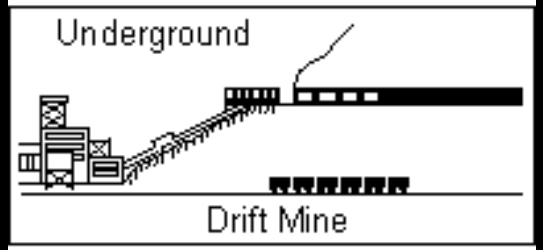
“The problem is that the theory that this is due to coal and coal pollution is politically attractive but scientifically not defensible,” says Jonathan Borak, a physician and epidemiologist at Yale.

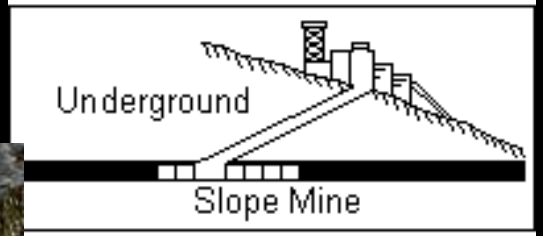
Modern Mining Methods

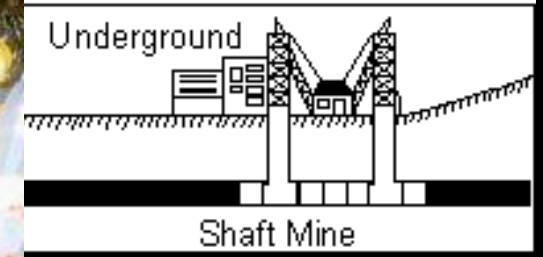
- Surface
  - Area & MTR
  - Contour- Highwall/Auger
- Underground Mining
  - Room & Pillar and Longwall



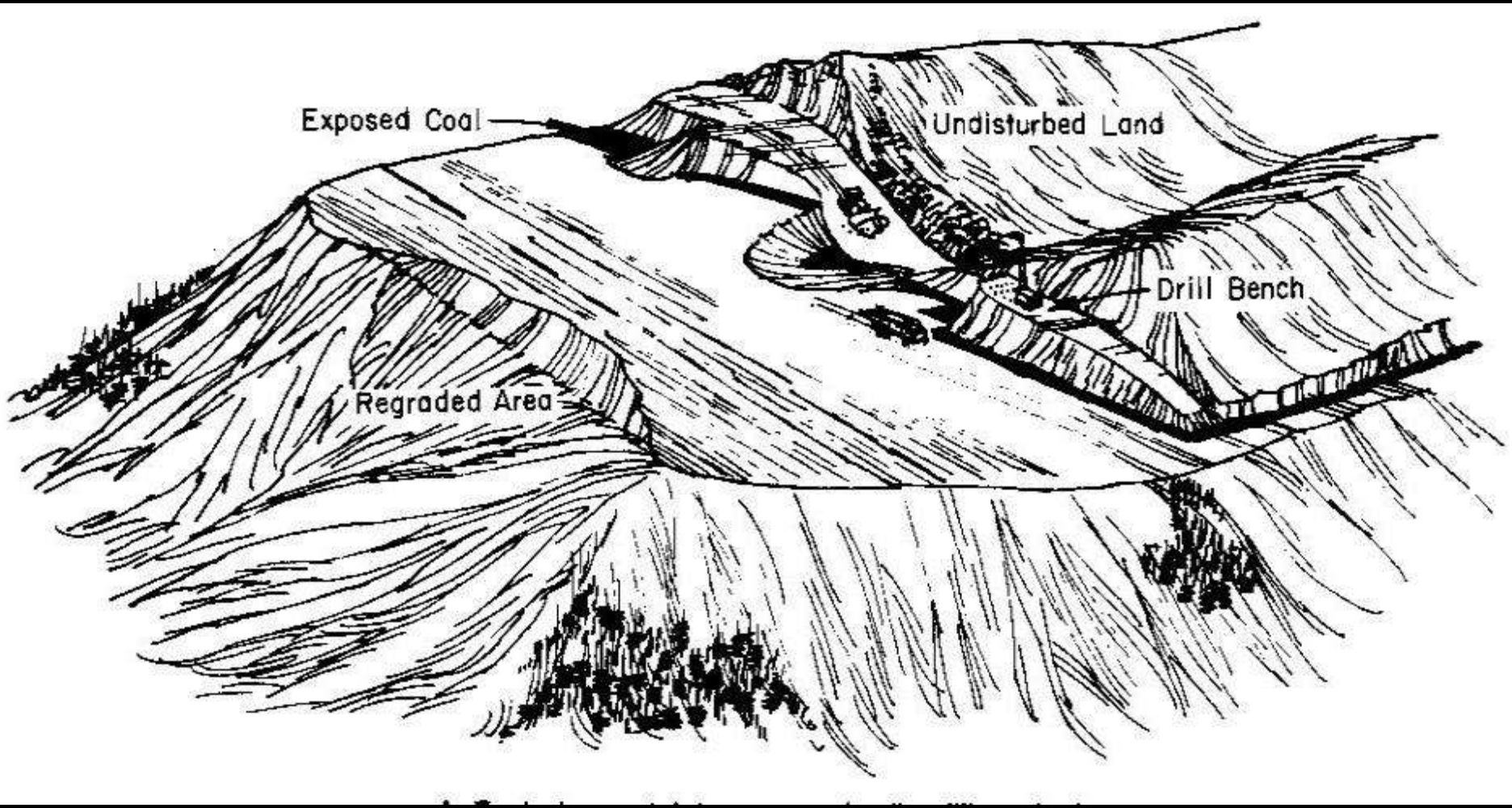








Mountaintop Removal or Mountaintop Mining



- Fig. 1 Mountaintop Mining, Skelley and Loy, 1975

EPA 2005 EIS Definition "Mountaintop mining"

- was defined in the FPEIS as coal mining by …***surface methods (e.g., contour mining, area mining, and mountaintop removal mining) in the steep terrain of the central Appalachian coalfields.***

- **This definition by its very nature includes virtually all surface mining.**

Coal Preparation Plants & Refuse Disposal

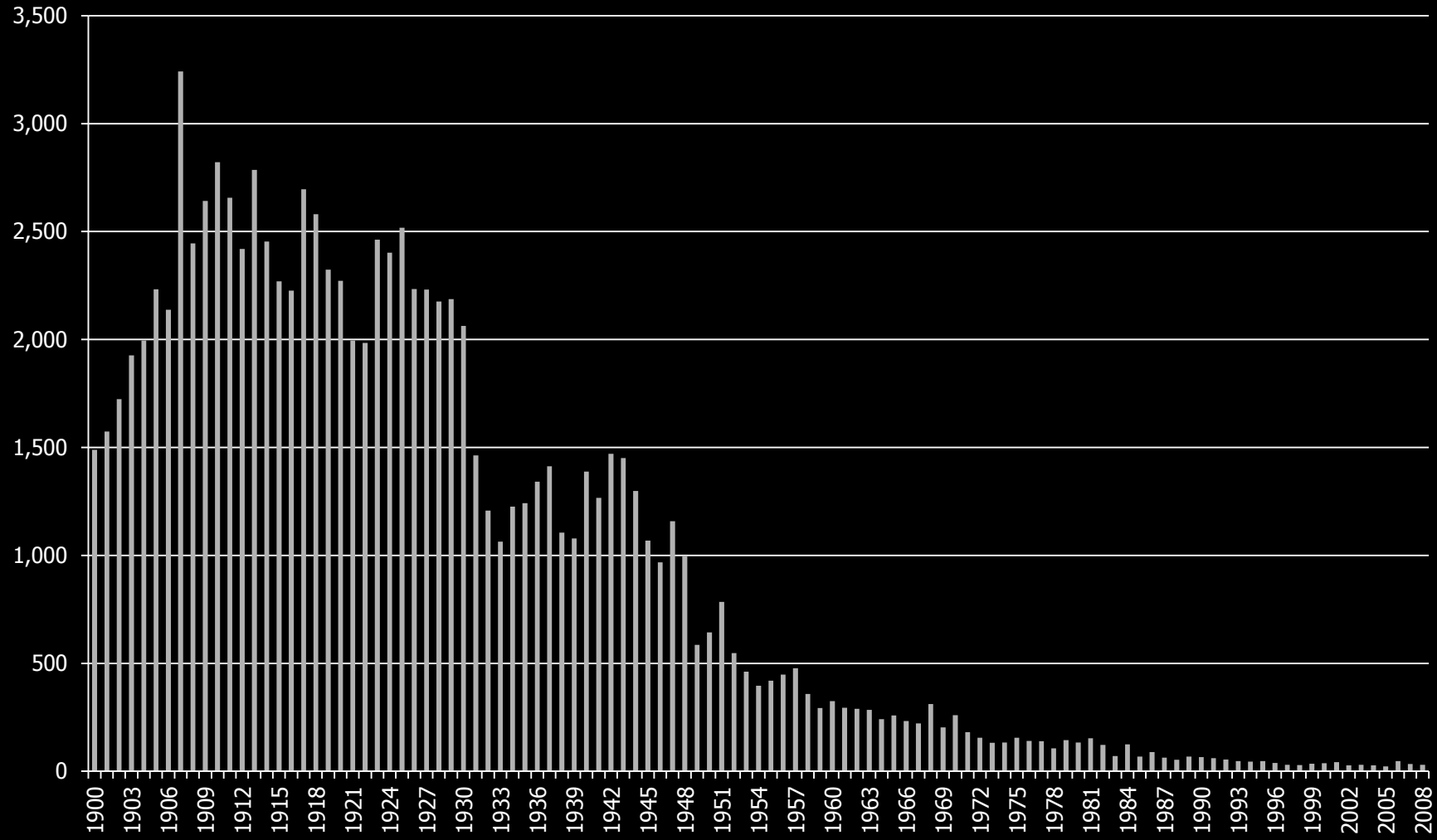
Refuse areas have mistakenly been directly associated with Mountaintop Removal by many activist groups

Underground mined coal has to be processed. In many mines 50% of material mined is rock that must be placed in refuse areas.

Mine Health & Safety

- What has changed in mine safety law?
- But first, historical perspective on mine safety

U. S. Coal Mining Fatalities per Year

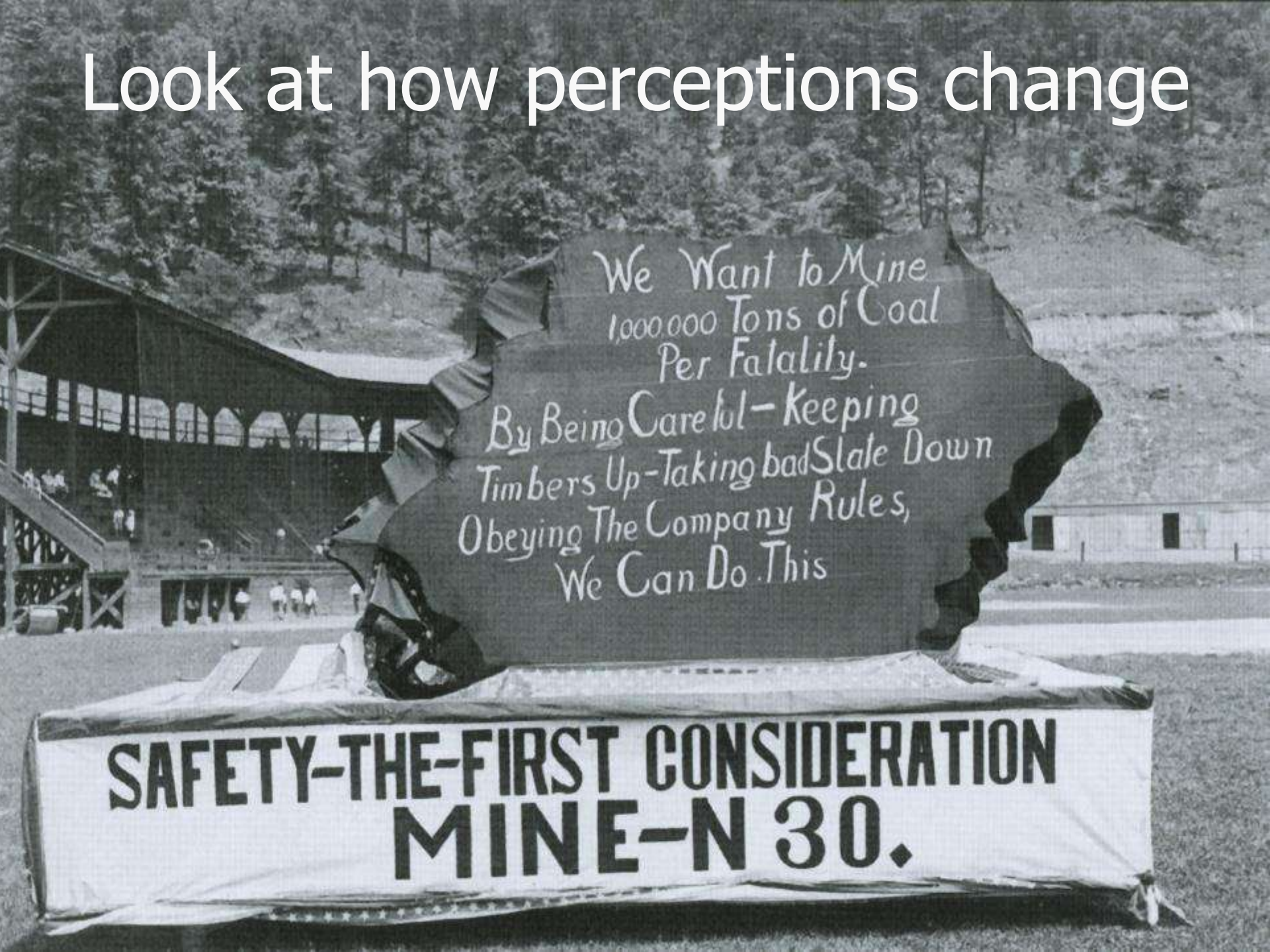


MSHA says 2012 safest year on record in US mines

Primary Causes of Mine Accidents

- Roof Falls
- Equipment Accidents
- Fires and Explosions
- Human Errors !

Look at how perceptions change



- *MINER Act designed to prevent a repeat of Sago*
- Phased in over three years
- Has spurred new technologies
  - Shelters
  - Communications
  - Seal design


Tracking Devices
ICCL
INTEGRATED COMMUNICATIONS CAP LAMP


Refuge Chambers
Allow 20 ft. clearance
ENTRY
FRESH AIR BAY
3 ft. clearance
INSPECTION DOOR


Refuge Chambers

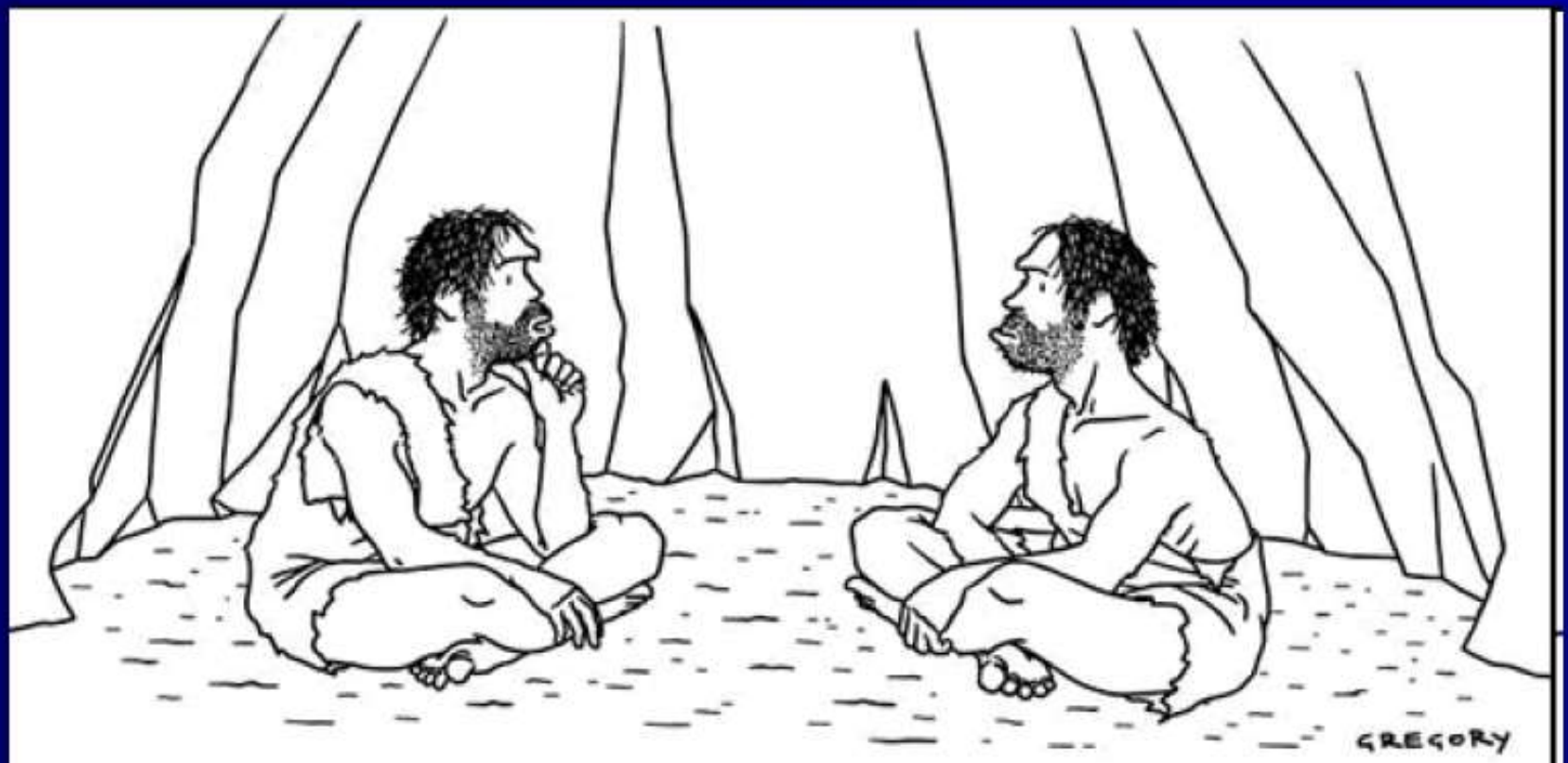

Strata Plug Seal without Concrete

Everyone's Goal-Come home safe!

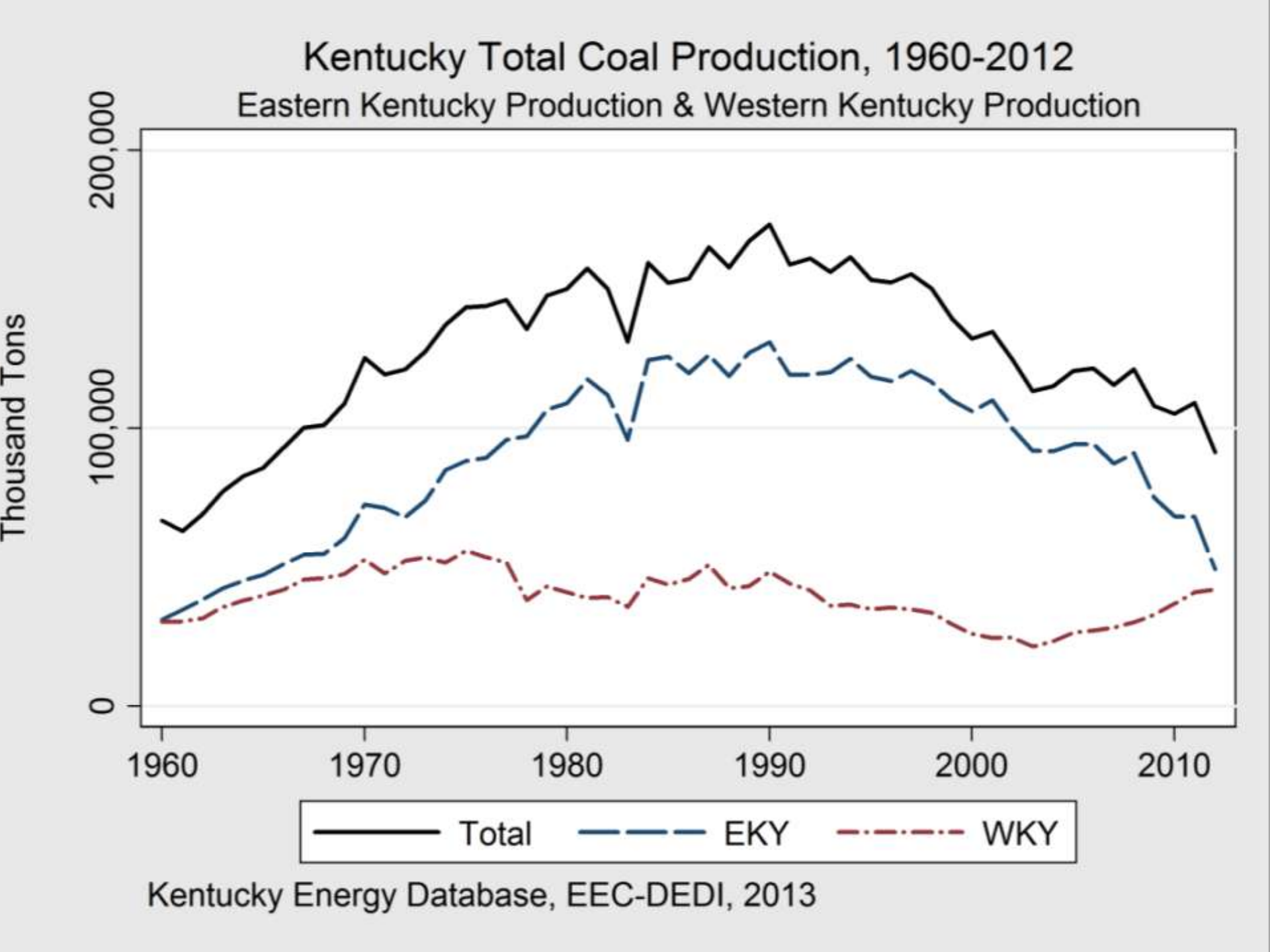

THE FUTURE OF COAL?

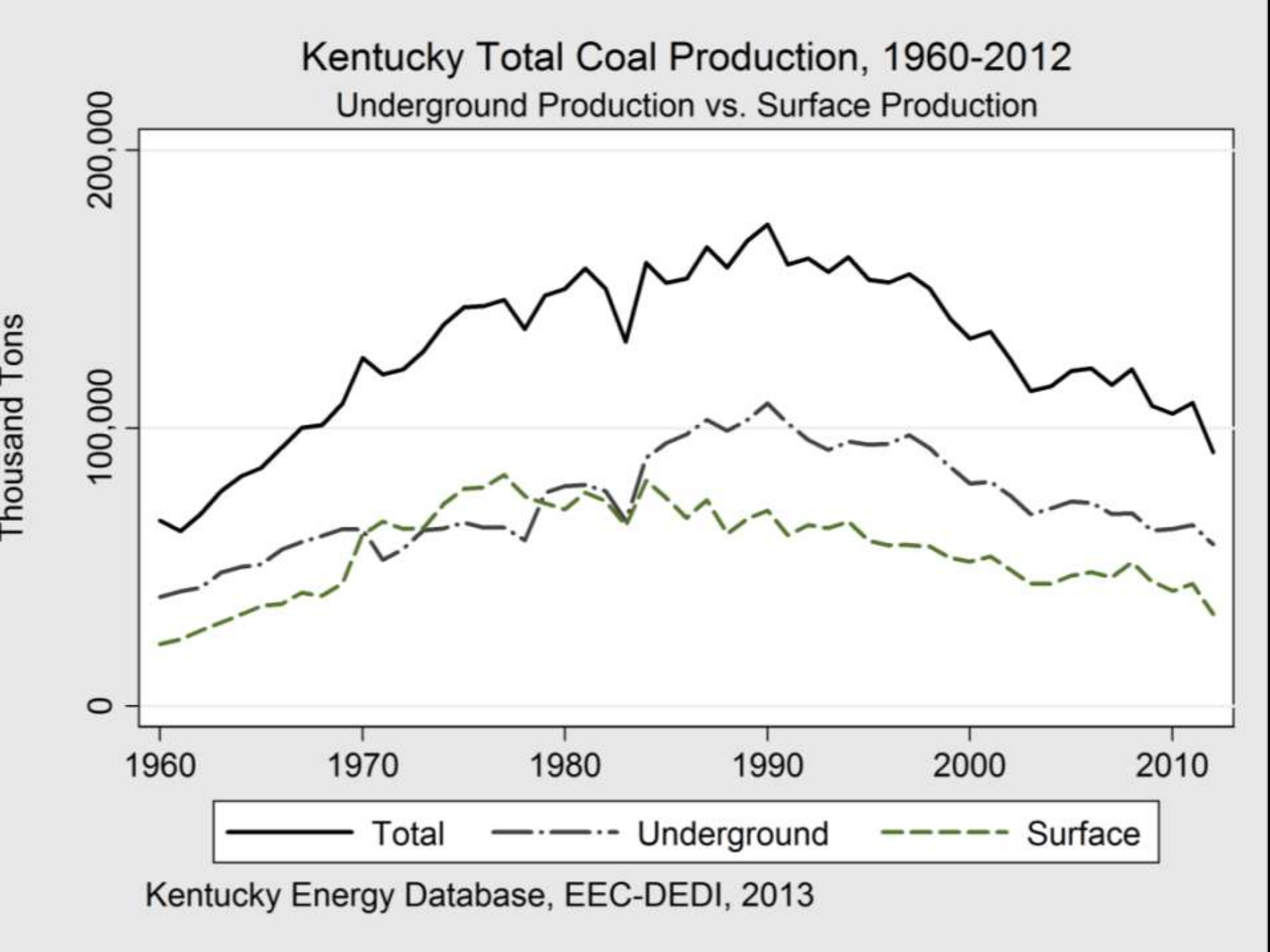
"WE USED TO THINK THIS WAS THE CASE UNTIL THERE ACTUALLY WAS A REALISTIC, AFFORDABLE ALTERNATIVE TO COAL"

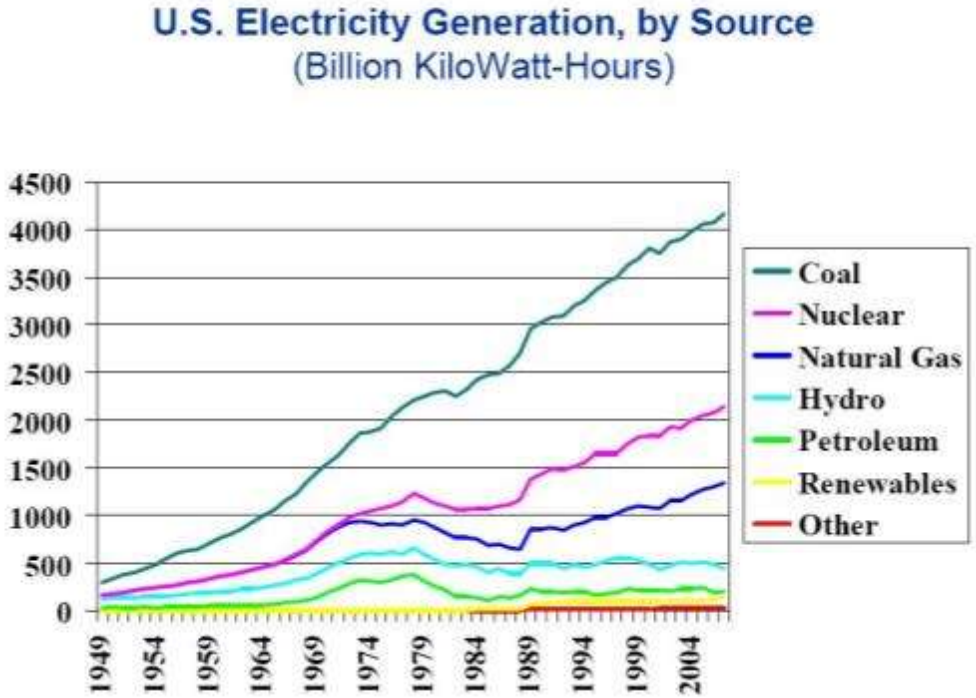
A Coal-Free World?



"Something's just not right—our air is clean, our water is pure, we all get plenty of exercise, everything we eat is organic and free-range, and yet nobody lives past thirty."

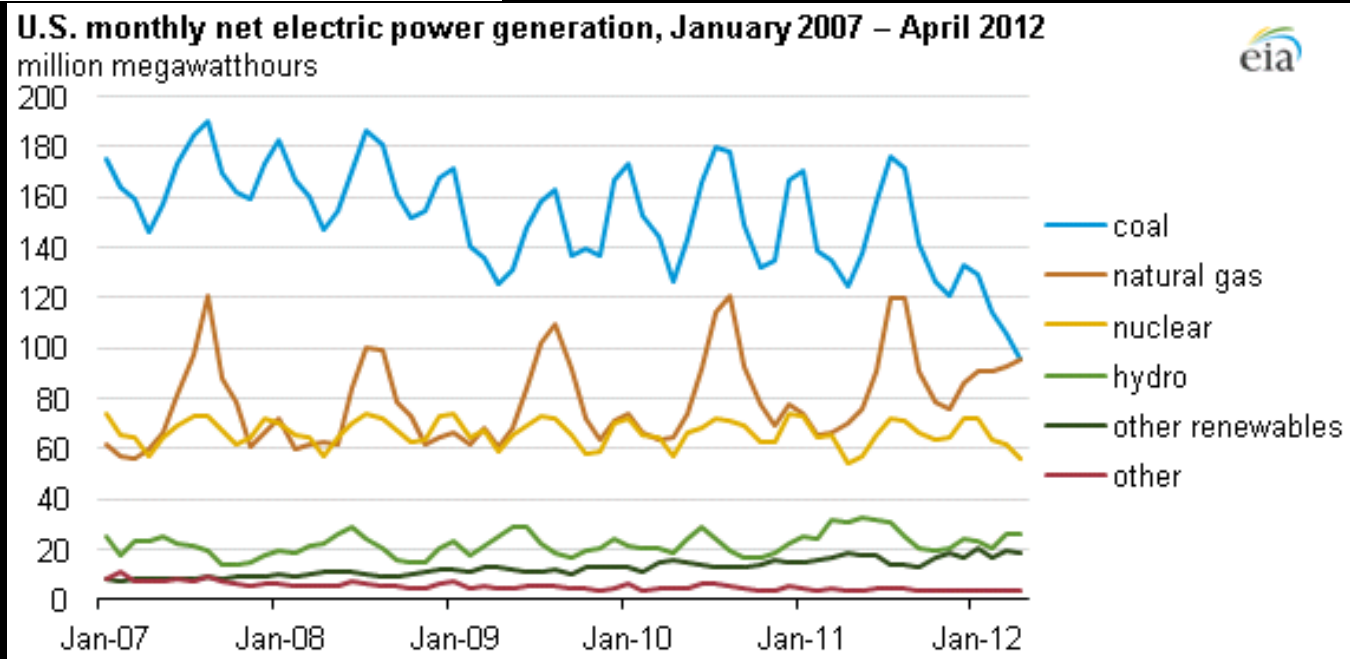

Kentucky Total Coal Production, 1960-2012
Eastern Kentucky Production & Western Kentucky Production
Thousand Tons
200,000
100,000
0
1960
1970
1980
1990
2000
2010
Total
EKY
WKY
Kentucky Energy Database, EEC-DEDI, 2013


Kentucky Total Coal Production, 1960-2012
Underground Production vs. Surface Production
Thousand Tons
0
100,000
200,000
1960
1970
1980
1990
2000
2010
Total
Underground
Surface
Kentucky Energy Database, EEC-DEDI, 2013



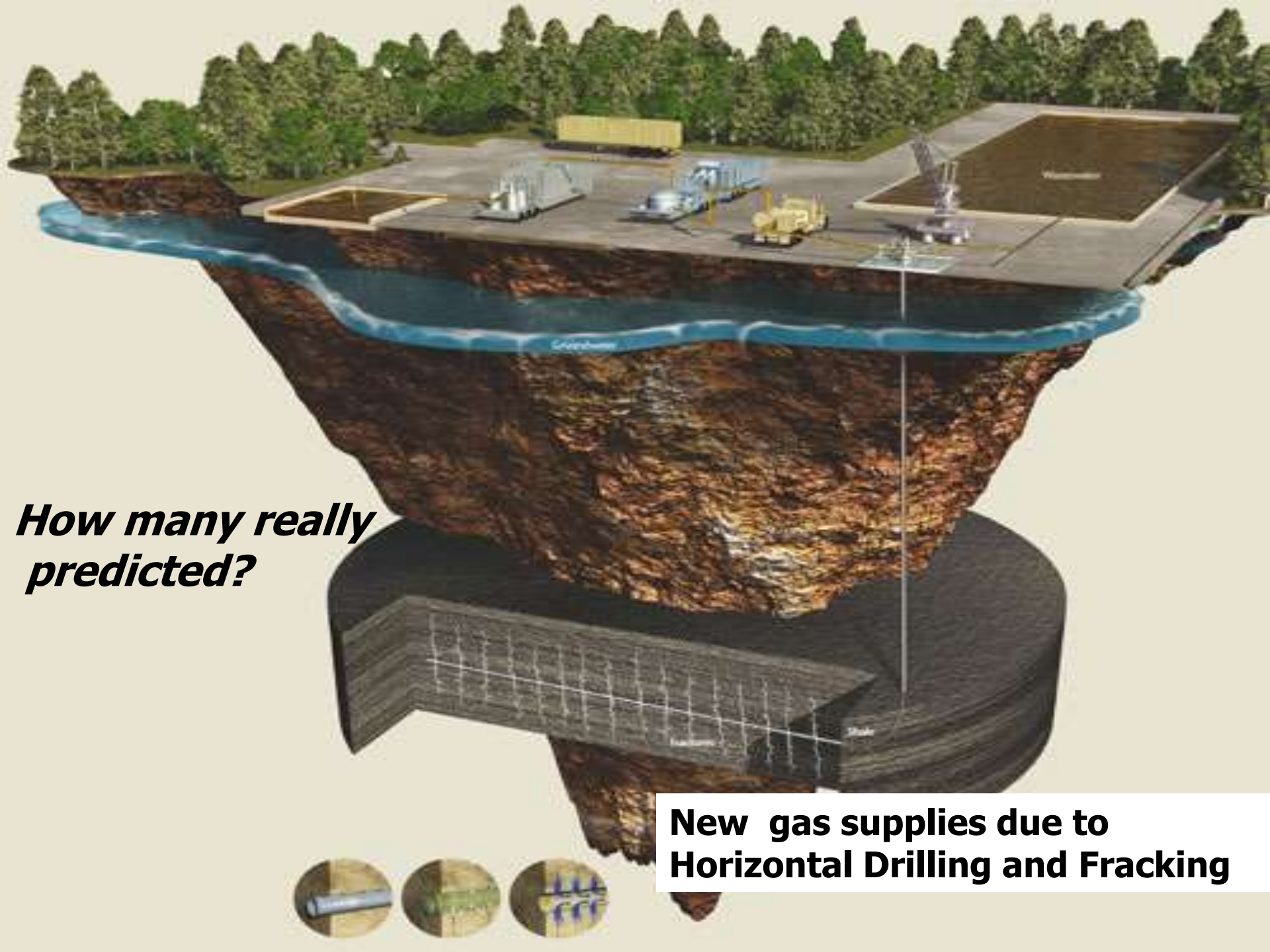
2004

2012
Gas =Coal



WHAT CHANGED FOR COAL?

The Economy


How many really predicted?
New gas supplies due to Horizontal Drilling and Fracking

EPA

Reinterpretation of regulatory programs

Building a Stream Protection Rule

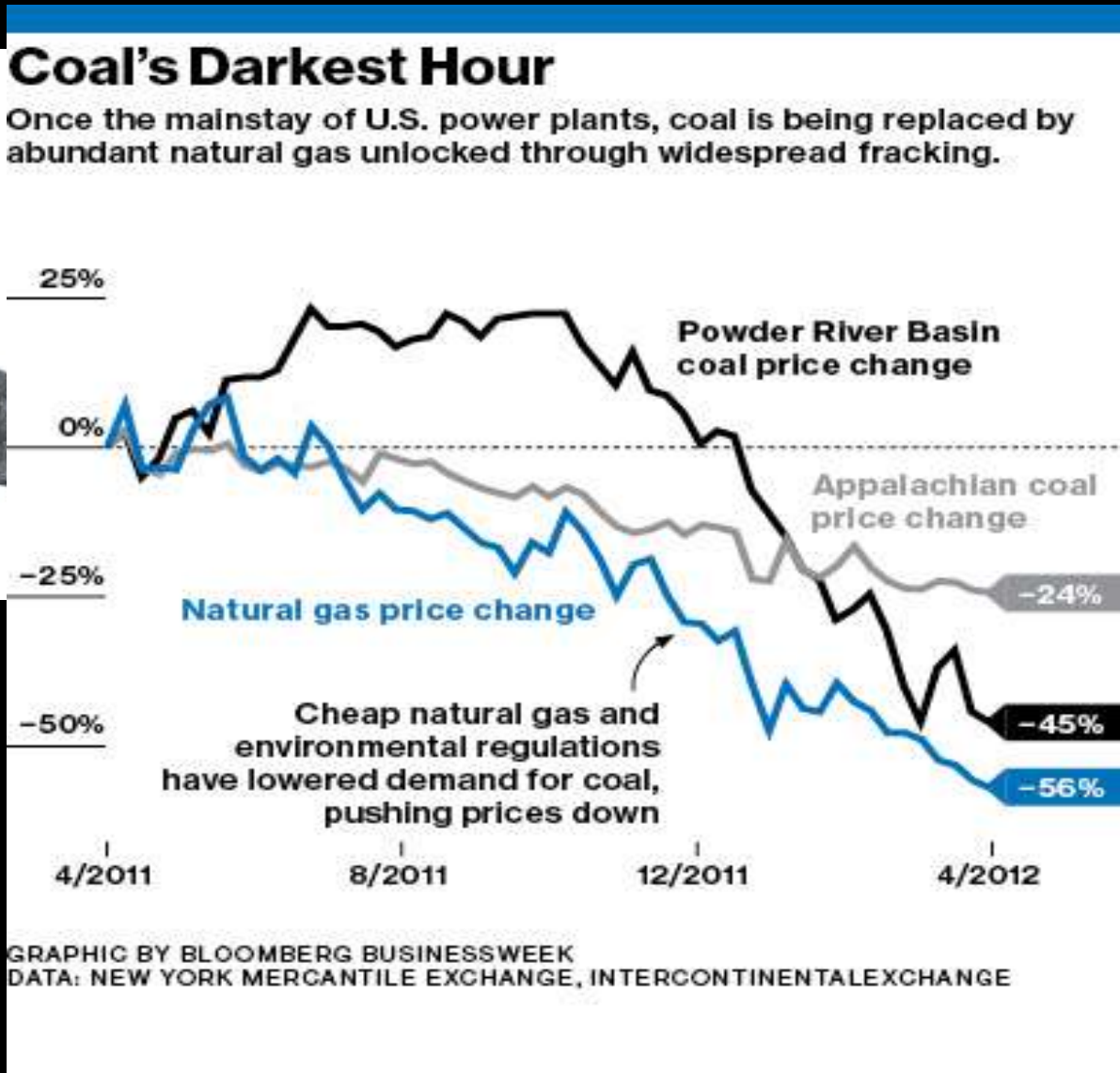
Study: The coal industry is in far more trouble than anyone realizes

That's according to a new peer-reviewed study by three researchers at Duke's Nicholas School of the Environment

- **Cheap natural gas is crowding out coal**
- **And new pollution rules could accelerate that shift**

PLUS THE EPA REINTERPRETATION OF CWA PRIMARILY IMPACTING APPALACHIAN MINING

BusinessWeek - Coal's Future Is Rocky at Best



WHAT HAPPENS IN KENTUCKY?

- Less Coal Production in EKY

- Electricity gets more expensive??

- Manufacturing moves out of KY?

The end of Appalachia? Illinois Basin coal makes comeback

- Illinois Basin region most affected by the Clean Air Act and subsequent amendments

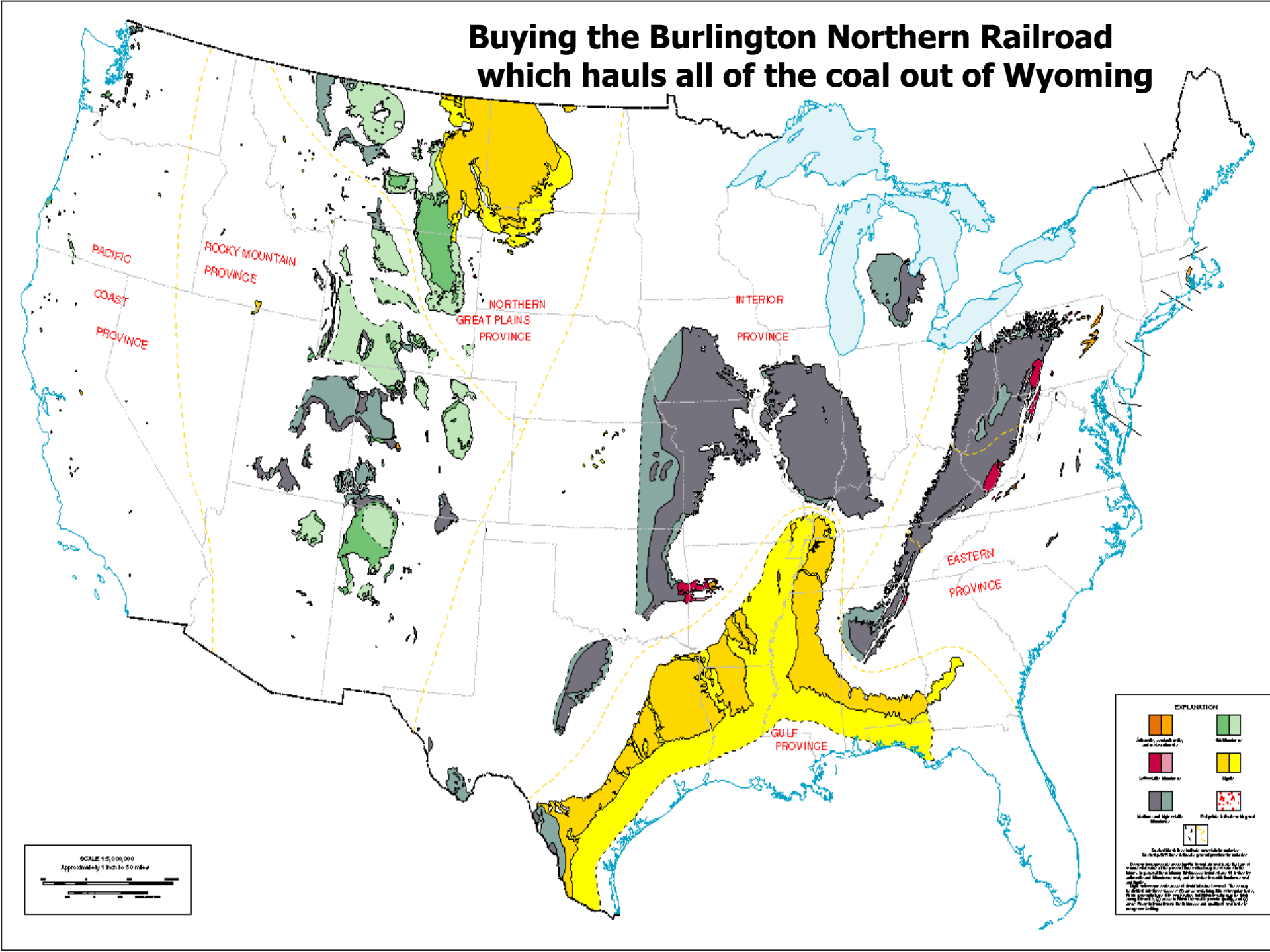
- advance of technology now allows burning of high-sulphur coal

Chris Cline: The New King of Coal?

Illinois' recoverable reserves of coal are larger than those of any state east of the Mississippi River and the third largest in the country, behind only Montana and Wyoming. IL Geological Survey

Why were Bill Gates & Warren Buffett in Gillette Wyoming?

Buying the Burlington Northern Railroad which hauls all of the coal out of Wyoming

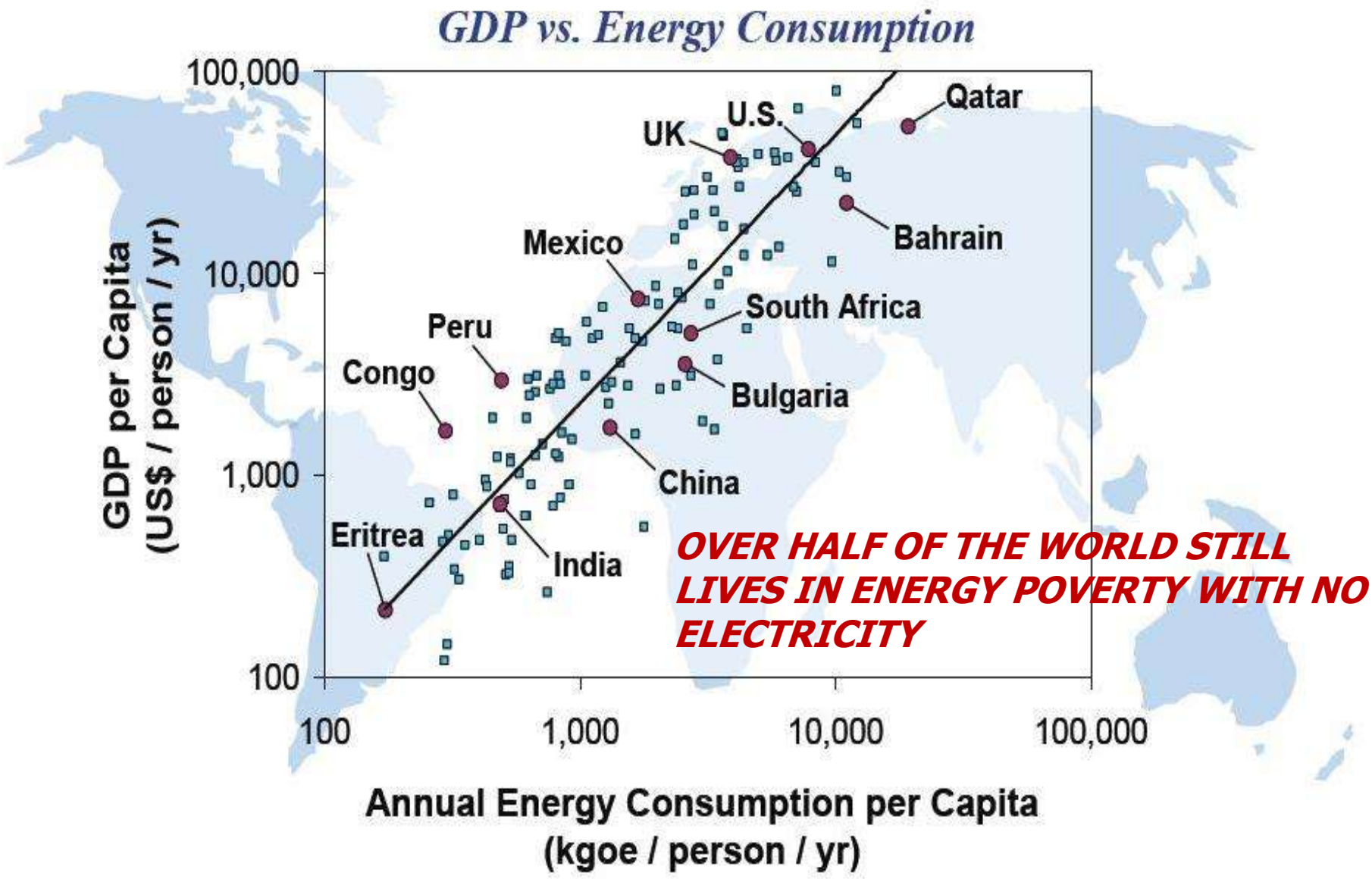


WHAT ABOUT THE REST OF THE WORLD?

BRICSI COUNTRIES
Brazil, Russia, India, China, S. Africa, Indonesia

COAL PRODUCTION IN THE REST OF THE WORLD RISING DRAMATICALLY

Energy Contributes to Quality of Life



Future Hope for Kentucky Coal?

Metallurgical Coal & Exports

- **Exports have increased – Nationally approximately 100,000,000 tons**

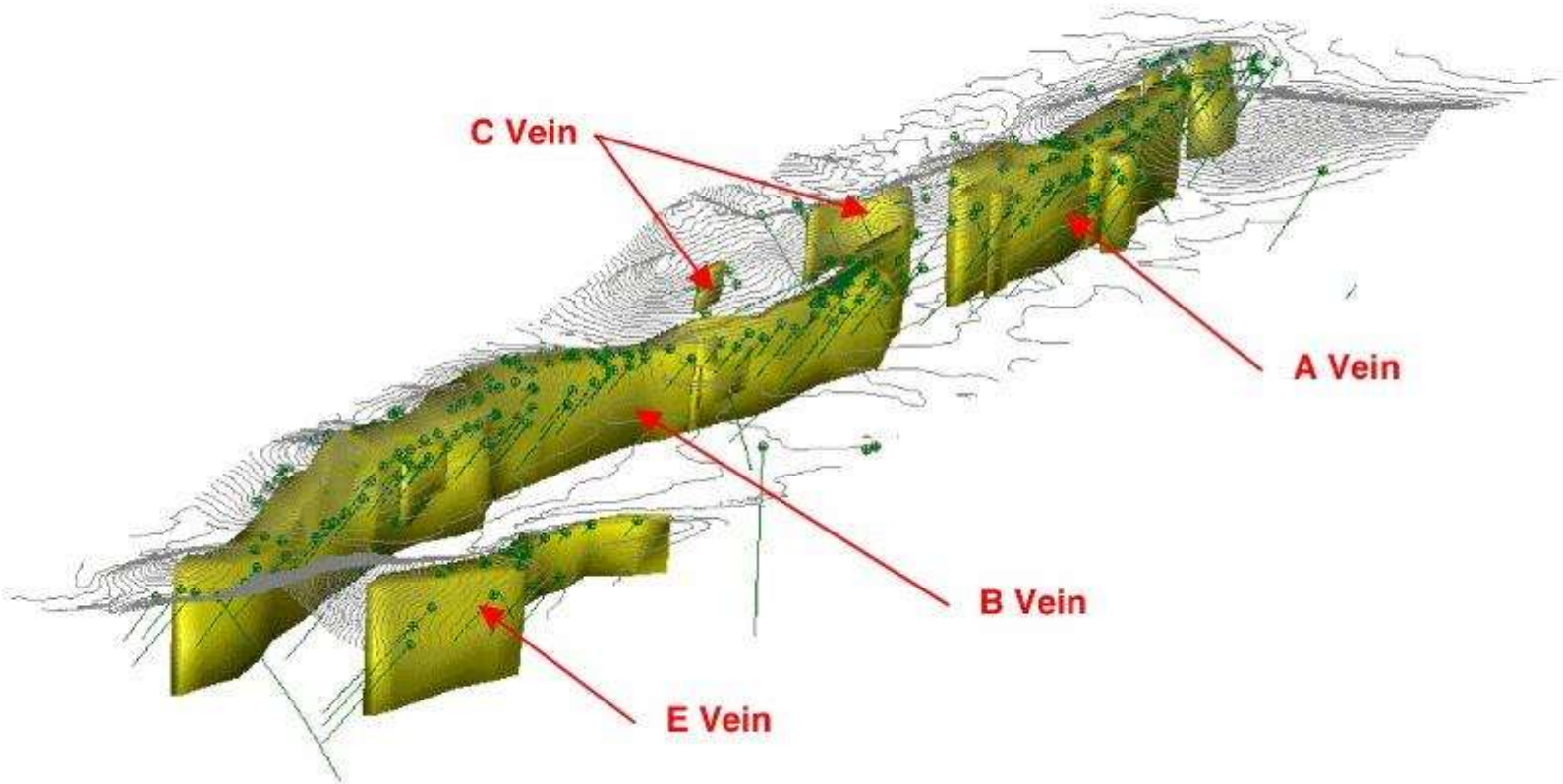
Recent Headlines:

- **Kentucky, W.Va., To Ship Coal To India For 25 Years**
  August 16, 2012 (still hasn't happened almost a year later)

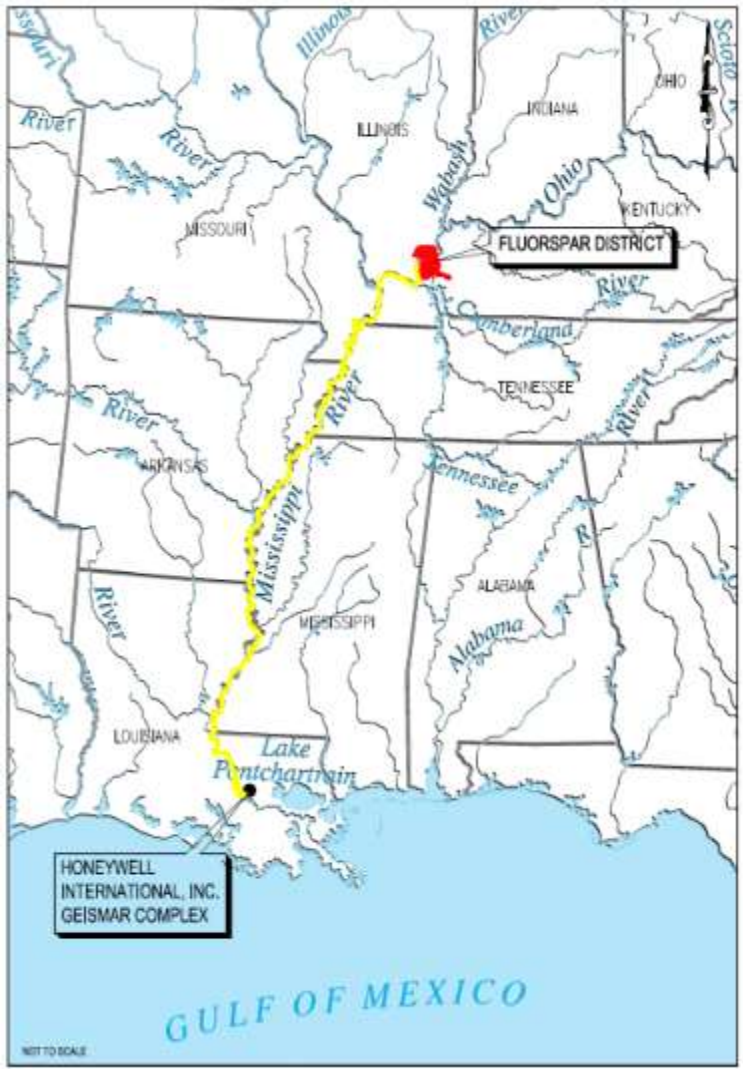
Predictions:

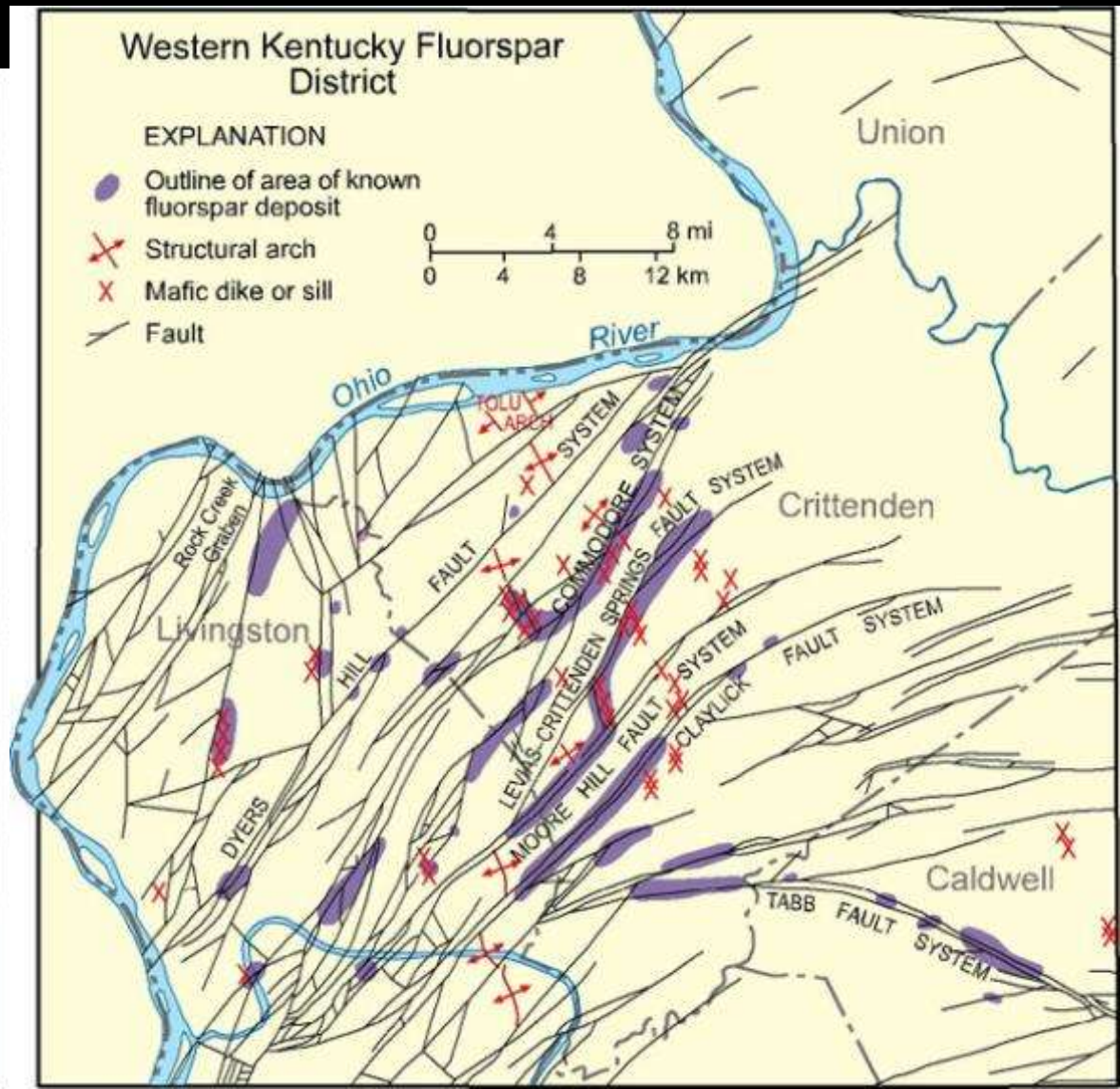
- WKY production will increase
- Exports will increase, but will not make up EKY production losses
- EKY production will continue to decline
- Surface mining in EKY will decline more dramatically
- Underground mining will increase somewhat

NEW OPPORTUNITIES FOR MINING IN KENTUCKY?



Western KY-Illinois Fluorspar District





WE MAY SEE THIS TYPE OF MINING AGAIN IN A FEW YEARS

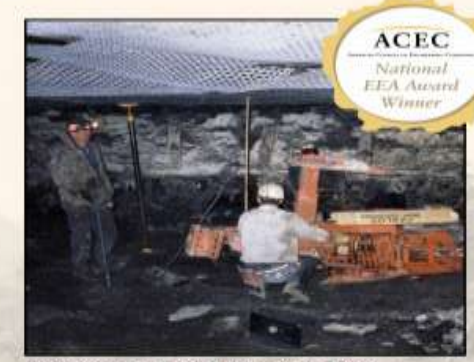
Kentucky's Rich Mining Heritage

2010 ACEC Kentucky "Grand Conceptor Award" Winner
2010 National ACEC "Honor Award" Winner

One exhibit showing history of mining

Information exhibits at No. 4 Entry

Mantrip used for tourist transportation



Installation of high-strength fiber mesh/resin roof bolting system for stability and safety

ACEC National EEA Award Winner

Portal 31 – Kentucky's First Exhibition Coal Mine

Lynch, Harlan County, Kentucky

Client:
Southeast Education Foundation, Inc.
Cumberland, Kentucky

Firm:
Engineering Consulting Services, Inc.
Lexington, Kentucky

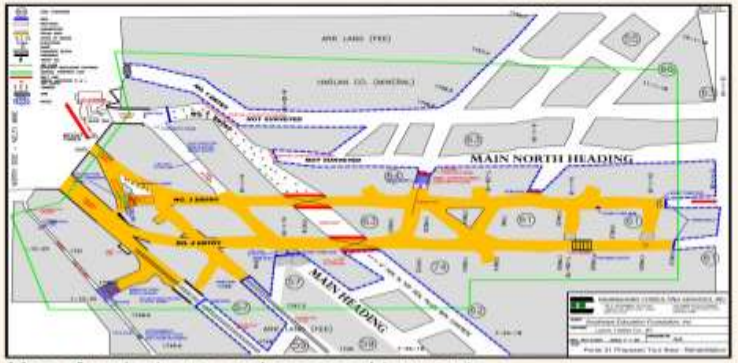
Innovative Engineering Techniques:
All potential hazards of taking the public into an underground mine were considered for this project. A system of sump pumps was designed to drain water outside the mine. New seals were constructed throughout utilizing Omega Blocks (lightweight foam/fly ash blocks). The mine fan was rehabilitated for circulation of fresh air. Multiple roof control measures were utilized including installation of high-strength fiber mesh on the roof and ribs of the tunnels, resin roof bolts, concrete cribs, and application of an experimental high-tensile sealant (Tekflex).

Future Value to Engineering Practice:
Portal 31 preserves the heritage and historical value for future generations. It serves as a classroom for engineering and mining students and a public education tool on energy and the environment.

Social, Economic, Sustainable Design:
ECSI and the client applied adaptive reuse to Portal 31 which will provide an income stream to the local community and provide jobs for local residents.

Complexity:
The complexity of this project began with obtaining the necessary permits for the mine portal to remain open for rehabilitation and continued throughout the design process. Funding issues and political considerations also complicated the project.

Exceeding Client Needs:
ECSI worked with the client over a 10 year period. We provided a feasibility analysis and engineering design, offered our expert opinions, and represented client interests and public safety. ECSI ensured accuracy of underground exhibits, obtained mining equipment, helped secure state and federal funding, negotiated contractor cost overruns, provided C/A services, and established a project website.



Map of project area and proposed tour route

ACEC

ON A POSITIVE NOTE - KENTUCKY DID WIN ONE NATIONAL CHAMPIONSHIP IN 2013 -UK Norwood Chapter Named SME Outstanding Student Chapter

Kentucky's Team at the International Intercollegiate Mining Competition 2012