

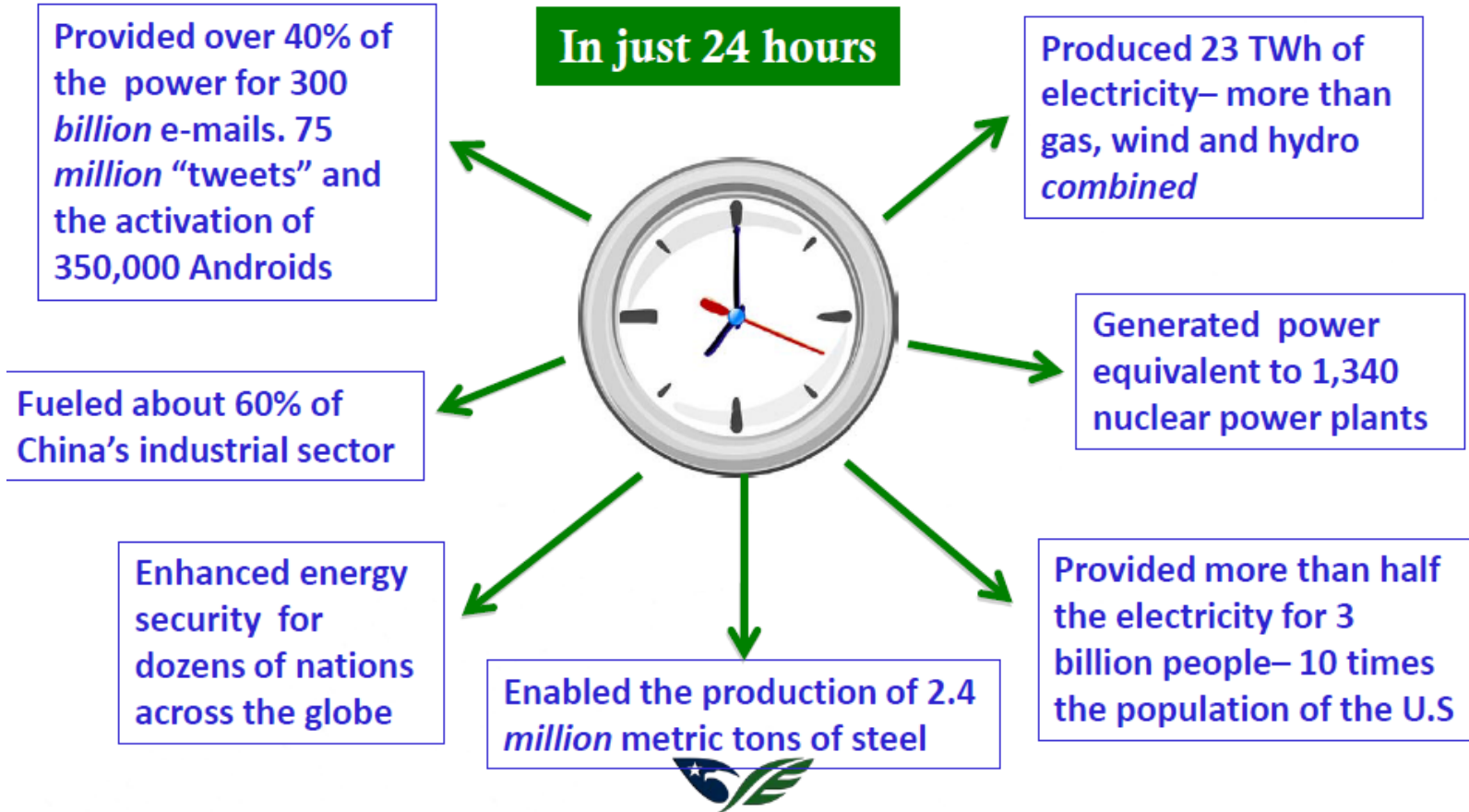


**Society of Mining Professors  
Societät der Bergbaukunde**

# **Research on Environmental Impacts of Coal Operations: Developing Science- Based Regulations in the USA**

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# What Coal Did Today



Source: IEA (2010), EIA (2010), Business insider (2011) and Science News Today (2011)

Figure 2. World marketed energy use by fuel type

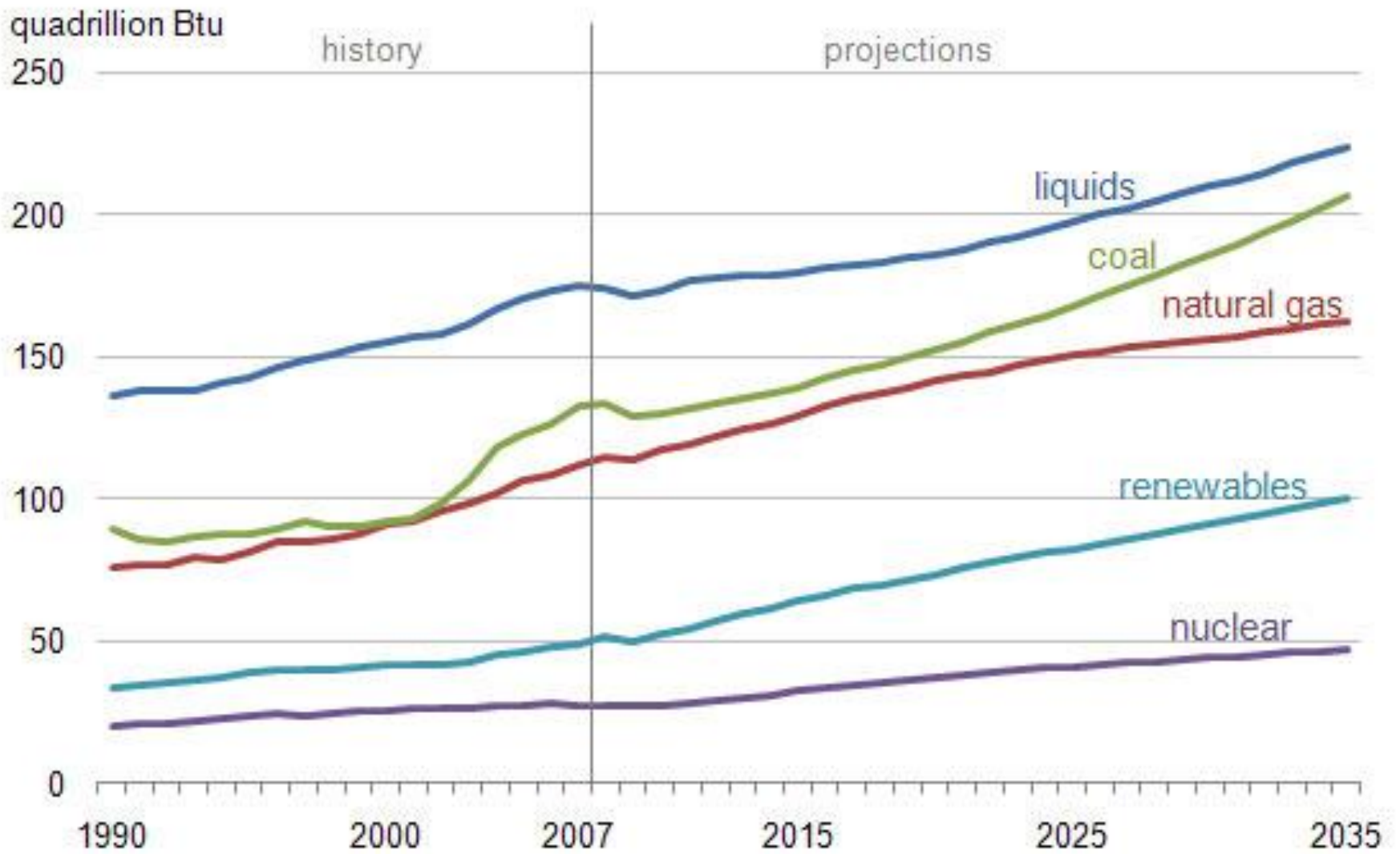
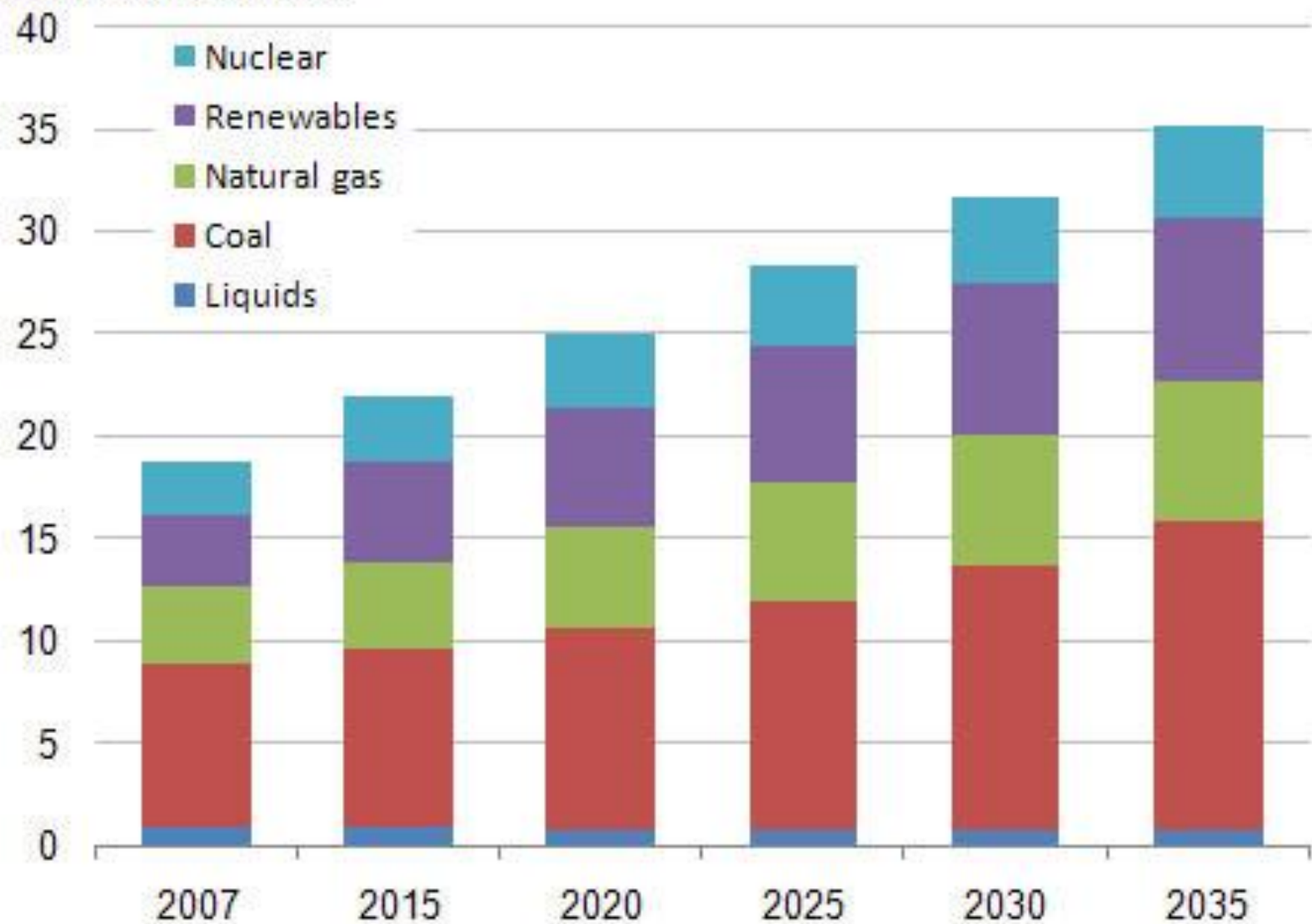


Figure 6. World net electricity generation by fuel

trillion kilowatthours



# Renewables grow rapidly, but under current policies fossil fuels still provide 78% of U.S. energy use in 2035

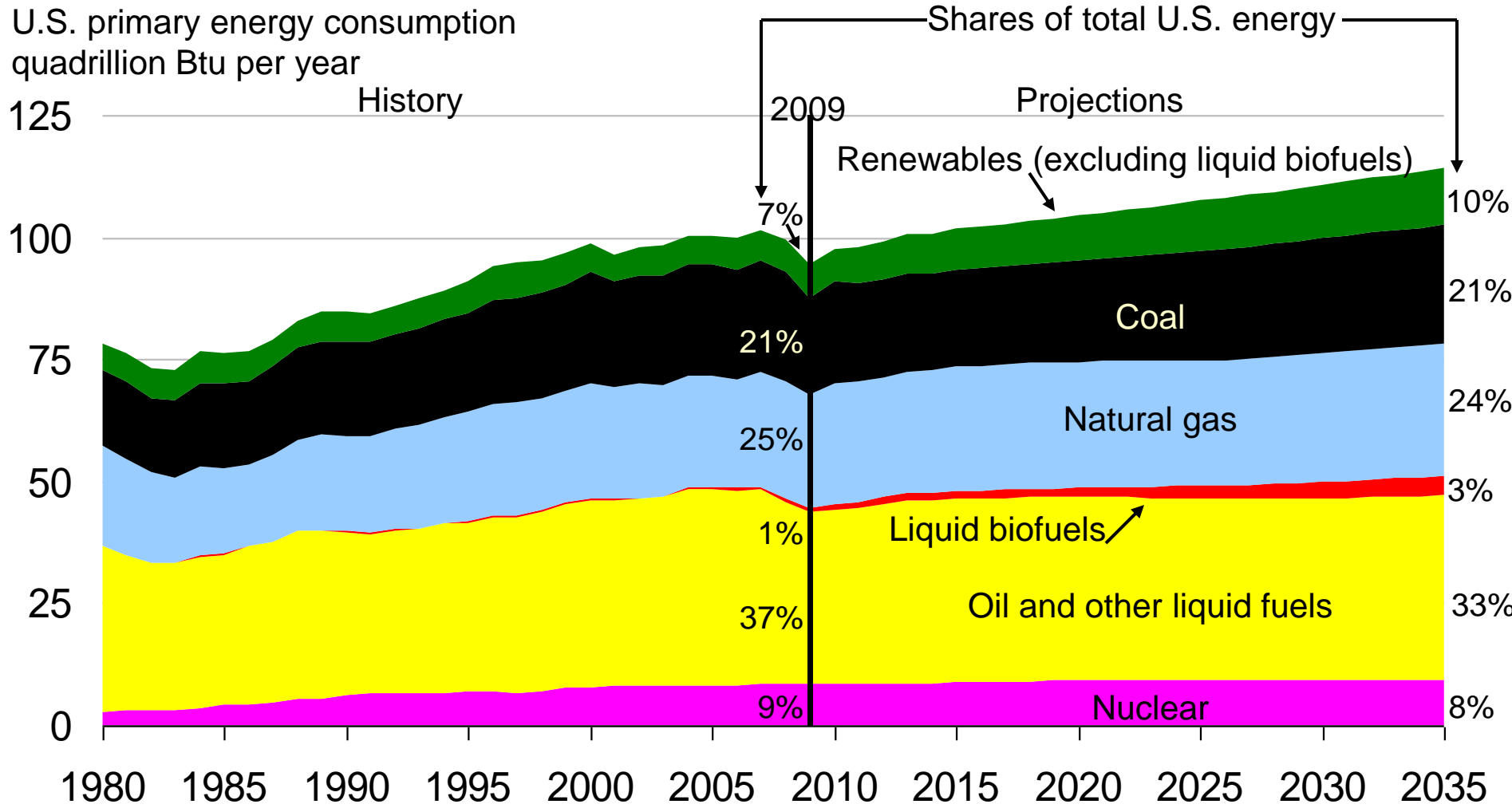
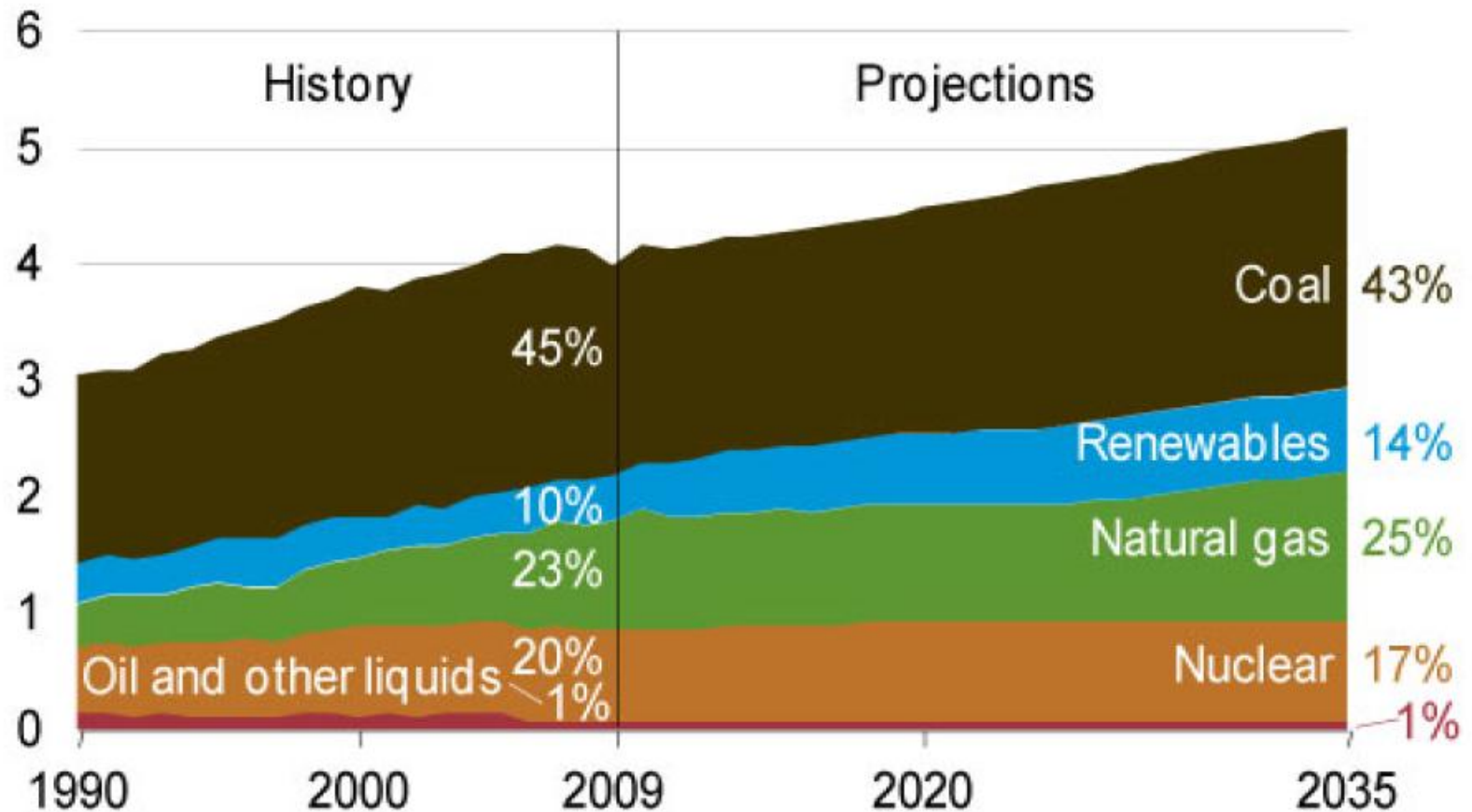
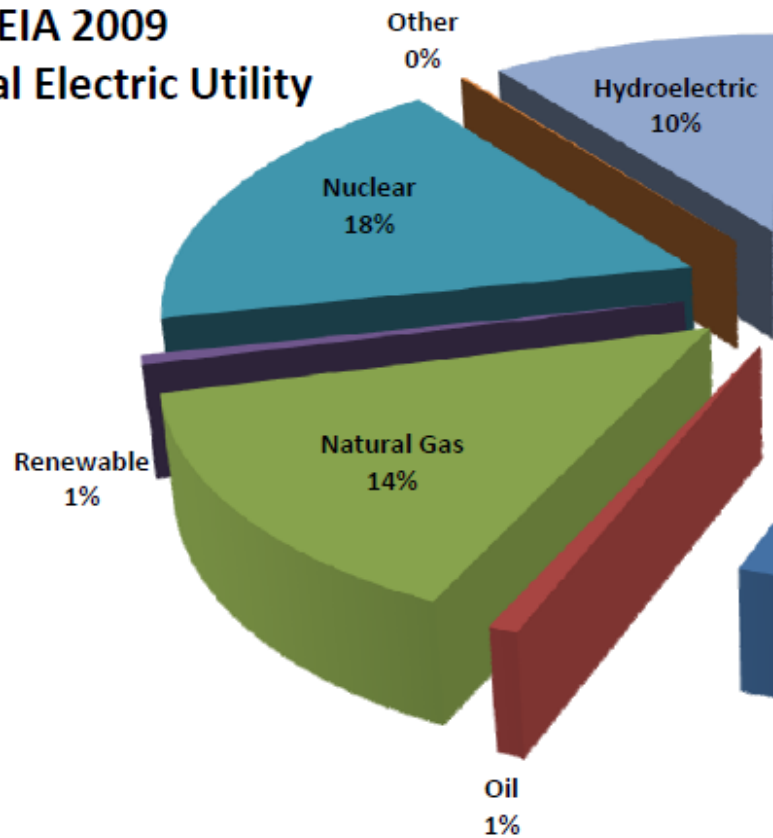


Figure 12. Electricity generation by fuel, 1990-2035)

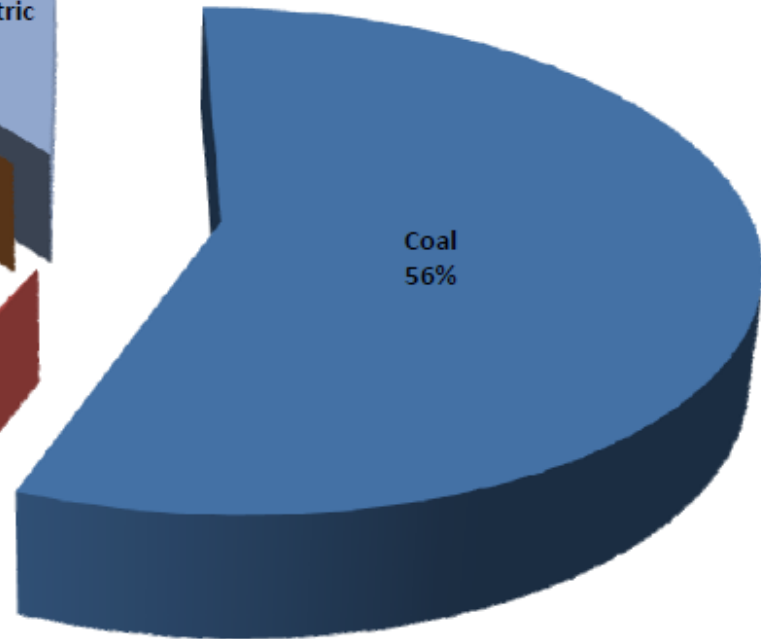
Net electricity generation (trillion kilowatthours per year)



**EIA 2009  
National Electric Utility**

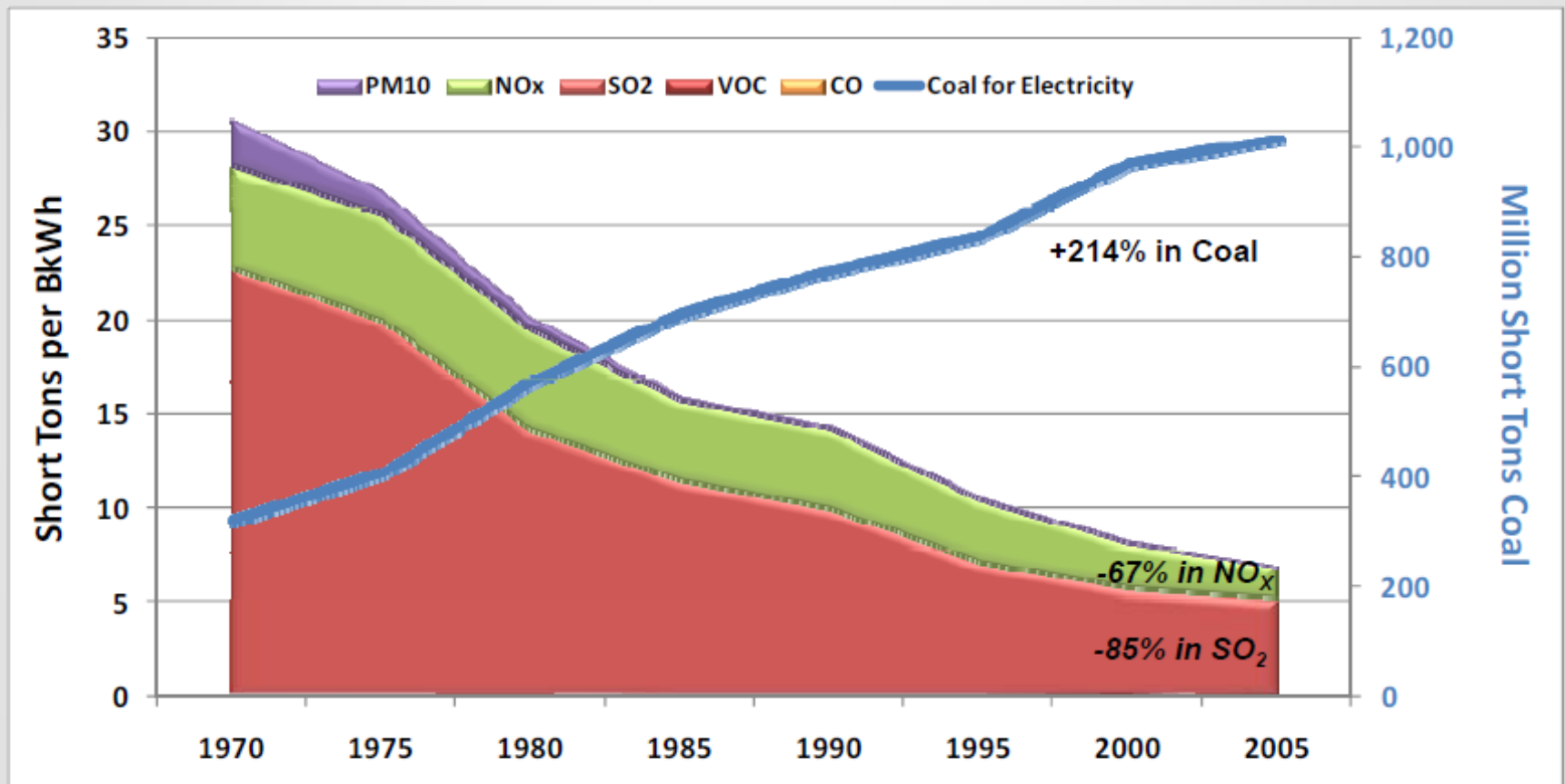


**Coal ≈ 70 % Baseload Generation**



- Renewable generation represents wind, solar, biomass, MSW, and geothermal.
- Source: U.S. Energy Information Administration (EIA): Net Generation by Energy Source: Electric Utilities 2009

# Total Emissions Have Declined 77% While Coal-Fueled Electricity Generation Has Increased



# Yet, the Coal Industry, at least in the USA, is Under a Major Attack!

- From Government
- From Media
- From NGOs

## Attacks often based on:

- Questionable Science
- False Assertions
- Self-serving Interests

## Using as a major instrument:

- Unreasonable Regulation

# U.S. Environmental Protection Agency

Regulation	Target Pollutants or Practices	Target Industry	Control Options
<b>Utility MACT</b>	Hazardous Air Pollutants – e.g. mercury, other metallic particles, acid gases, and hazardous organics	Coal- and oil-fired power plants	“Maximum achievable control technology” – e.g. Sorbent injection; Baghouses; co-benefit controls such as scrubbers, SCRs.
<b>Ambient Air Standards (NAAQS)</b>	Backbone of the Clean Air Act that drives stringency of local/federal controls – new standards for SO <sub>2</sub> , NO <sub>x</sub> , PM <sub>2.5</sub> , and ozone expected.	Power plants and other stationary sources	Controls for limits SO <sub>x</sub> , NO <sub>x</sub> , VOCs and PM.
<b>Transport Rule I</b>	Reduce downwind contribution to ozone and PM <sub>2.5</sub> non-attainment via control of precursor SO <sub>2</sub> and NO <sub>x</sub> emissions	Power plants larger than 25 MW in 31 Midwestern/Eastern states	Scrubbers; SCRs, SNCRs; Low NO <sub>x</sub> Burners; Fuel Switching; Minimal Allowance Trading
<b>Transport Rule II</b>	Reduce downwind contributions to ozone non-attainment in accordance with upcoming 2011 ozone NAAQS thru seasonal NO <sub>x</sub> controls	Power plants and possibly other large stationary sources of NO <sub>x</sub>	SCRs, other NO <sub>x</sub> control technologies, and fuel switching
<b>Transport Rule III</b>	Reduce downwind contributions to PM non-attainment in accordance with upcoming 2011 PM NAAQS thru annual SO <sub>2</sub> and NO <sub>x</sub> controls	Power plants and possibly other large stationary sources of SO <sub>2</sub> and NO <sub>x</sub>	Scrubbers, SCRs, other SO <sub>2</sub> and NO <sub>x</sub> control technologies, and fuel switching
<b>Regional Haze BART</b>	SO <sub>2</sub> , NO <sub>x</sub> and PM <sub>2.5</sub> to improve visibility in Class I national parks	Power plants and other large stationary sources contributing to visibility impairment in national parks	“Best Available Retrofit Technology”– scrubbers; SCRs; SNCRs; low NO <sub>x</sub> burners; emissions trading
<b>Coal Combustion Residuals</b>	Fly ash, bottom ash, boiler slag, and scrubber byproducts	Coal-fired power plants	Surface impoundment liners (to separate ash from soil); leachate collection; groundwater monitoring systems; dispose ash in offsite dry landfills
<b>Cooling Water Intake Design</b>	Mitigate the adverse impacts resulting from entrainment/impingement of aquatic species during water intake	Thermal power plants (coal, nuclear, oil and gas) that use cooling water from U.S. surface waters	“Best technology available” for minimizing adverse impacts—e.g. screening and other retrofits to single loop intake structures to minimize environmental impacts; closed-loop water intake systems that require cooling towers
<b>Waste Water Toxic Metals</b>	Mercury, arsenic, chromium and other heavy metals and toxins most prevalent in coal combustion residuals.	Thermal power plants (coal, oil and gas)	“Best technology available” for wastewater discharge treatment.
<b>Greenhouse Gases</b>	Performances standards for GHGs from new and existing sources.	Power plants and oil refineries first; other large stationary sources next	Energy efficiency, fuel switching.
	PSD and Title V permits for GHGs from new or major modifications to large stationary sources.	Large stationary sources exceeding “Tailoring Rule” applicability thresholds for GHG emissions	“Best available control technology” (BACT) determined on case-by-case basis by state permitting authorities.

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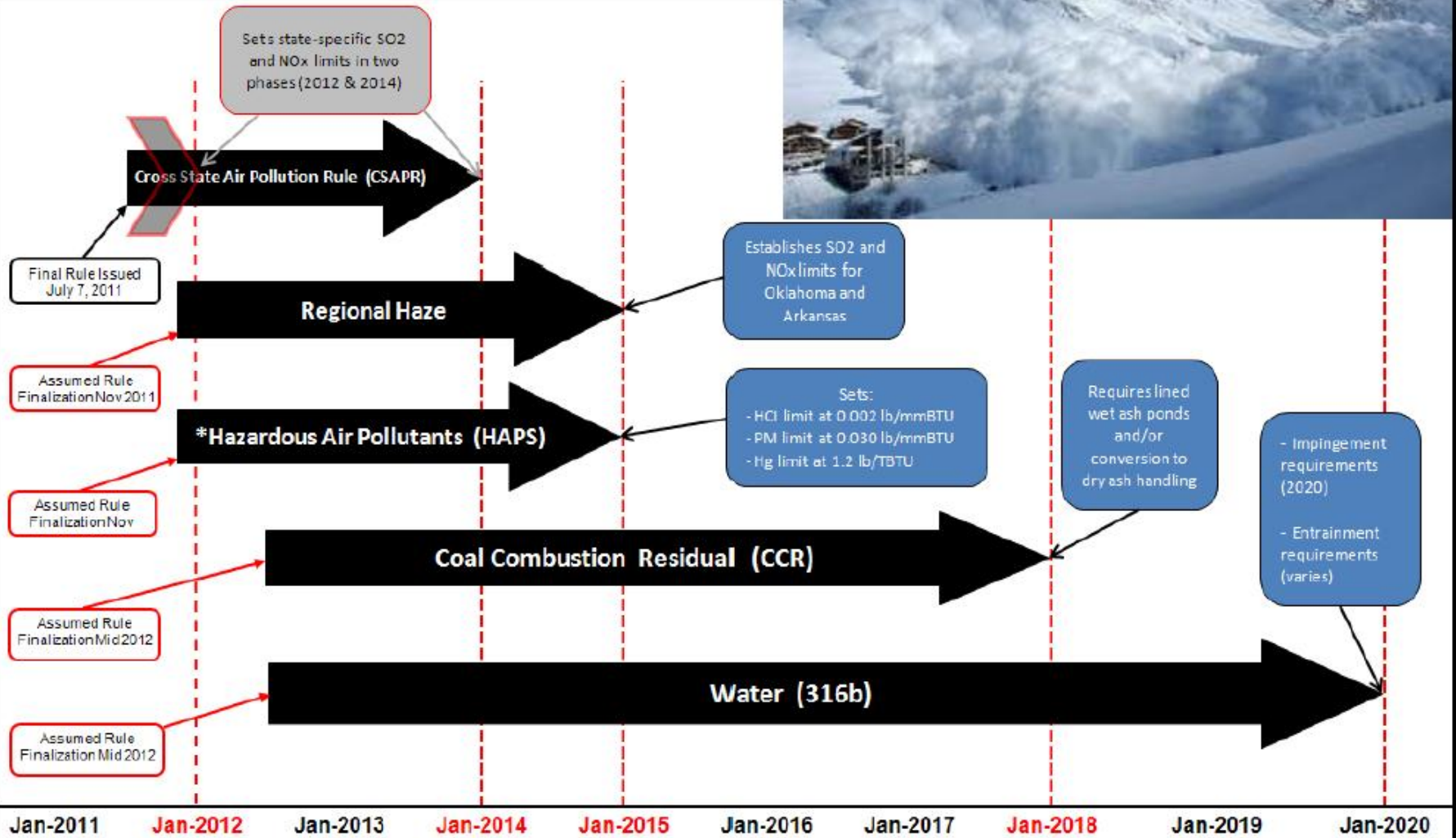
# Why Science-Based Approaches?

- Most issues and problems have scientific and engineering components
  - Scientific-based discussions allow for communication, cooperation and collaboration with all stakeholders
  - Optimum planning, operation and post-mining use of mining projects relies on science-based approaches
  - Government policies and regulations must be based on science-based solutions and practices NOT on politics or self-serving agendas
-

# Are we Practicing Sustainable Development?

- Economic, environmental and social impacts and values must be considered in any project
- Regulatory framework must be consistent with SD principles and should promote the integration and consideration of SD Principles in assessing net contribution and eventual permitting of a project
- The regulatory structures in the USA do not foster or even consider an SD integrated approach
- Decisions, particularly in the case of coal mining and coal utilization, are increasingly based on single media approaches that focus on limits on specific emissions or discharge of concern while ignoring all other SD components
- Worst, some of the decisions are political, targeting a specific industry, a specific practice or even, a specific region. In fact, if a particular limit is imposed on coal in Appalachia, then it should also be applied for all industries, irrespective of location!!!!

# The EPA Avalanche



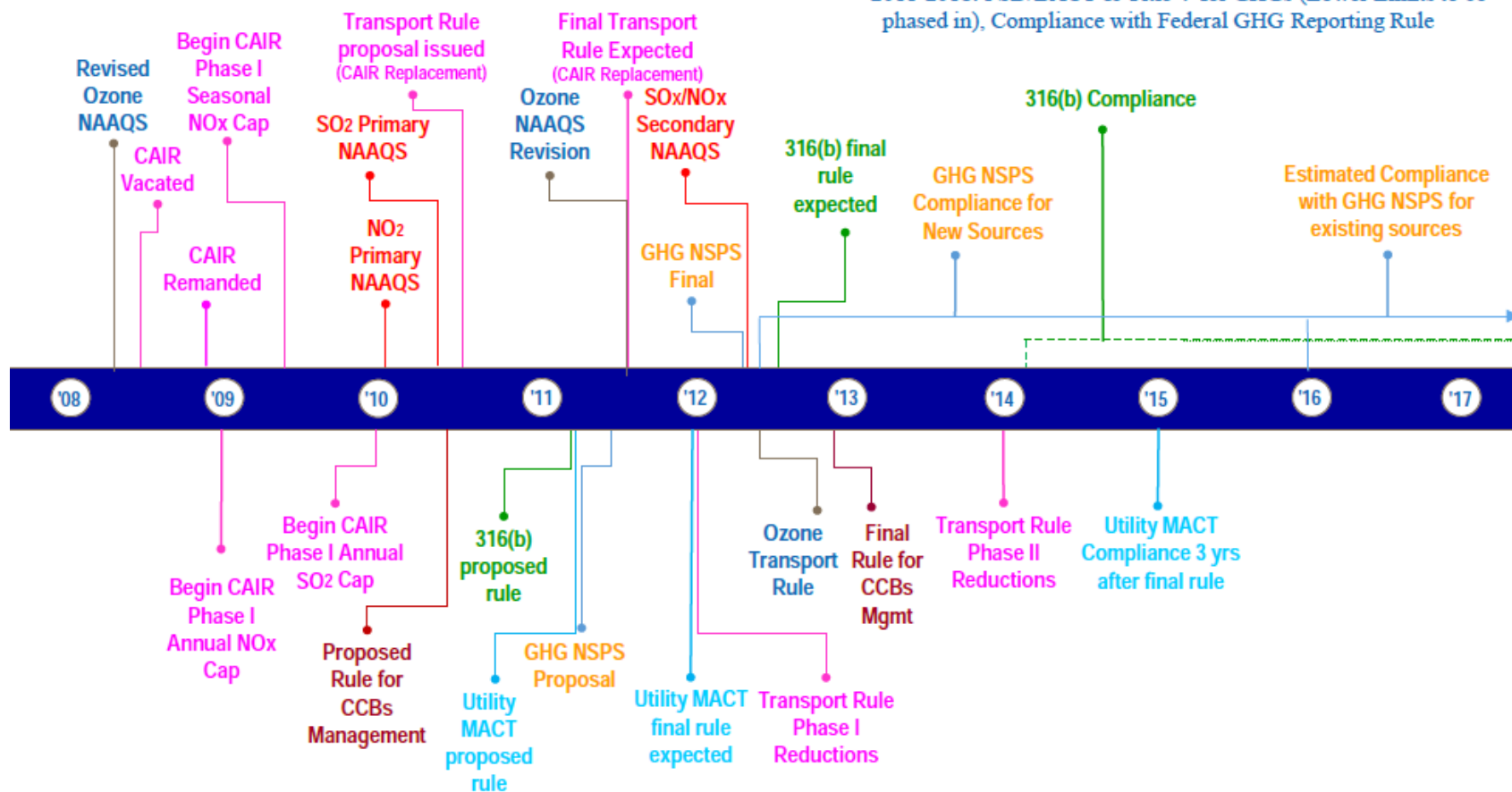
\* Units that will be retrofit are eligible for a one year compliance extension from the EPA

# The Great EPA Train Wreck!

## Challenges Generators Face: Major EPA Rules



\*\*\* 2011-2018: PSD/BACT & Title V for GHGs (Lower Limits to be phased in), Compliance with Federal GHG Reporting Rule



# At the Power Plant Level:

## Major impacts for AEP

To meet compliance deadlines for new environmental regulations, AEP expects it will need to invest \$6 billion to \$8 billion to:

- Retire nearly 6,000 MW of existing coal-fired generation by Dec. 31, 2014.
- Refuel, retrofit with new or upgrade existing environmental controls on another 11,000 MW. (\*see appendix)
- Temporarily (1 – 4 years) idle / curtail 1,500 MW – 5,200 MW.
- Build approximately 1,700 MW of new generation. (\*see appendix)

This will create:

- Abrupt rate increases ranging from 10% to 35%.
- Significant reliability concerns, particularly in the 2014 – 2016 time frame.
- The need to install additional equipment to address impacts on the transmission system due to the reduction in generating capacity.
- Net loss of 600 Jobs
- Annual lost wages of \$40 million
- \$20 million decline in payroll taxes
- \$12 million decline in property tax payments

# A View From The U.S. Supreme Court



Source: April 19, 2011 Transcript of Oral Argument before the U.S. Supreme Court in *AEP v. Connecticut*, No. 10-174, p. 60 (draft transcript subject to final review) (emphasis added)

Justice Alito: “[If you regulate GHG emissions from coal-fired utilities,] it will increase the cost of electricity ... and that will produce certain effects. It will result in the loss of a certain number of jobs, it will mean that consumers will have less money to spend on other ... things. Some people will not be able to have air conditioning in the summer. That will have health effects.”

# At the Mine Level:

## First Line of Attack on Coal is the Appalachian Mountaintop Practice

- **June 11, 2009 Action:**
  - MOU between CoE, OSM & EPA to “*take coordinated action to strengthen the oversight and regulation, and minimize adverse environmental consequences of **mountaintop coal mining***”
- Targeted six states –KY, OH, PA, TN, VA & WV
- Aimed to drastically curtail or even revoke mining permits

# Mine Permits Impacted

## ■ 404 Permit

- ❑ Federal permit that must be certified by the state with Core of Engineers (CoE) with EPA oversight
- ❑ No federal permit can be issued without certification of Section 401 of Clean Water Act (CWA)
- ❑ **No timeline:** Timelines do exist, but they are not respected.
- ❑ **No answers / feedback / specific comments:** Forced to resubmit without identifying what the specific concern is...

## ■ 402 Permit

- ❑ State permit that is subject to federal oversight
  - General
  - Individual

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# Spruce Mine Veto—January 13, 2011

- Located in Logan County, WV
  - Ten (10+) years to develop application
  - Approved by all involved agencies
  - In operation for more than three (3) years employing nearly 300 people
  - 1/13/11-EPA vetoes permit **RETROACTIVELY**
  - Concerns from every industry that depends on a federal permit to work
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## April 1, 2010:

- EPA announces “**Final Interim Guidance**” (Fool’s Day memo!!!!!!)
  - Considered a “new interpretation of existing law”
  - In KY, OH, PA, TN, VA & WV, new requirements for:
    - 404s (Federal Permits)
    - 402s (State Permits)
    - SMCRA
-

# April 1, 2010 Guidance:

- Establishes a water Conductivity level of 300 to 500  $\mu\text{S}/\text{cm}$
- *“The scientific literature is increasingly recognizing the relationship between conductivity levels in Appalachian streams and impacts to aquatic biota in streams below surface coal mining operations. Based on field measurements comparing unmined and mined watersheds in Appalachia, the peer-reviewed 2008 "Pond-Passmore" study concluded that aquatic life at sites with specific conductance greater than 500  $\mu\text{S}/\text{cm}$  were determined to have been adversely impacted based on a genus-level multi-metric biological index”*
- Other studies who do not support this conclusion are ignored!!

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## In fact:

- *“This concentration is essentially unachievable using current coal mining practices and treatment, and may not be achievable even with yet to be determined modified coal mining practices and treatment.”* –Kentucky DEP Commissioner Bruce Scott
  - This Conductivity level applies only to coal mining in Appalachia!!!!!!!!!!!!
-

# Result: Permits are not Issued, Lawsuits against EPA are Next!!

- Impossible to approve new permits
- NMA sues July 20, 2010
- WV Coal Assoc / State of WV sues Oct 6, 2010
- KY Coal Assoc sues Oct 19, 2010
- Commonwealth of KY sues Oct 22, 2010
- **All the above litigation has been moved to DC where they have been consolidated together**
- Other litigation exists as well

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# “Final Guidance”

- EPA issues “Final Guidance” on July 21, 2011.
  - 500 limit for Conductivity had been the guidance, now set at 300, BUT...
    - Optional approaches now exist and will be evaluated on a “case by case” basis
    - Concepts, not standards, which are arbitrary and may not be enforced in an equitable manner
-

# Attacks on Coal Mining (primarily Appalachian Mountaintop mining) are intense not only by regulators but also in the court of public opinion!

- “Studies” (!) claim severe health impacts of mountaintop mining in the community, ranging from cancer to baby/infant disease and mortality
- It is alleged, that coalmining perpetuates poverty in the mining regions and communities
- It is suggested that social and community fabric and character suffers irrecoverably is by the coal operations in that area

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**The Coal Industry needs Help!**

***The Appalachian Research  
Initiative for Environmental  
Science (ARIES)***

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# The Road to ARIES

- **Concept Kick off**: Advisory Board Meeting of the VCCER of VT, December 2009.
  - Vital for the industry to develop and support a research initiative addressing potential upstream (mining, drilling and processing) and downstream (water, land, air) environmental impacts of the mining, gas and energy sectors in Appalachia
  - The focus should be on conducting scientific inquiry and research, fostering publication and contributing to the relevant literature, and engaging in outreach efforts to share and disseminate research results
  - The concept of establishing “**The Appalachian Research Initiative for Environmental Science (ARIES)**” was approved by the VCCER Advisory Board
  - First priority was the coal industry in Appalachia

# The Realization of ARIES

- A number of meetings and strategic sessions were held in 2010 and early 2011, with participation of the major Appalachian coal producers, coal associations and essential coal infrastructure companies
- A vision statement was created and the participating companies were asked to decide on funding and level of support
- Sustainability of such an initiative requires multi-year commitment and financial support (5-Years)
- A core university group, with expertise in the ARIES areas of interest, was identified and established to implement the goals and vision of this initiative

# ARIES Funding

- Industrial Affiliate Partners committed to fund ARIES with a grant of \$15 million, over the next five years
- A research strategy was chartered and approved for 2011-2016
- ARIES committed to an “open door” policy, encouraging other companies to join in the future

**ARIES Announced March 31, 2011**

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# ARIES Partner Universities

- Virginia Tech
  - VCCER at VT is the leading entity of ARIES
- West Virginia University
- University of Kentucky
- Ohio State University
- Pennsylvania State University
- University of Pittsburgh
- University of Pennsylvania
- Marshall University\*

\* Joined later

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- **Charles Steger**, Virginia Tech President:
    - *“The innovative researchers involved in ARIES bring together vast knowledge and experience from multiple disciplines. Multi-institution collaboration will provide the perspective needed to address such critical environmental and energy issues as protecting human health and quality of life and improving mining practices.”*
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# Original ARIES Member Companies (Industrial Affiliates), as of May, 2011

- Alpha Natural Resources
  - International Coal Group
  - Massey Energy
  - Natural Resource Partners
  - TECO Coal Corporation
  - Patriot Coal Corporation
  - Cliffs Natural Resources
  - Mepco
  - Norfolk Southern Corporation
  - CSX Corporation
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# ARIES Member Companies , as of September 2011 (after Mergers!!!)

- Alpha Natural Resources
- Arch Coal
- Natural Resource Partners
- TECO Coal Corporation
- Patriot Coal Corporation
- Cliffs Natural Resources
- Mepco
- Norfolk Southern Corporation
- CSX Corporation

In discussions with other companies interested to join

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# Kevin Crutchfield, CEO, Alpha Natural Resources:

- *"We believe that good scientific research on natural resources, safety, and environmental issues is a key way to sustain the viability of the industry. Only by knowing what the facts are about the impacts of mining can elected officials then make sound policy decisions that support jobs and energy security while maintaining the health and well-being of the environment and communities of Appalachia. ARIES will provide the needed research to make that happen."*
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# ARIES Status



- Research plans have been developed
- Work at participating institutions has commence
  - First year is fully funded at \$3million
- Emphasis is in multi-institutional and interdisciplinary approach for each focus area
- Organization is set up to foster communication among researchers
- Outreach is an important component of ARIES
- Plans to organize a major international meeting under SME sponsorship (Spring 2013)

# Specific Research Areas under ARIES

- **Area 1:** Assessment of Mining Impacts on Ecosystem Health and Diversity (WVU, VT, MU)
- **Area 2:** Treatment and Minimization of Constituent Discharges (VT, WVU, UK, PSU)
- **Area 3:** Prediction of Constituent Releases by Overburden and Refuse (VT, UK, WVU)
- **Area 4:** Overburden Handling and Fill Design (UK, VT, WVU, PSU)
- **Area 5:** Next-generation Eco-friendly Mining Systems (VT/WVU, UK, PSU, UPIT)
- **Area 6:** Evaluating impacts and optimizing contributions of mining on community well-being (VT, UPIT, PSU, OSU)

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# ARIES Participants

- In total, 33 Academic Researchers, Numerous Graduate Students, 23 Academic Departments representing Colleges (Faculties) of Engineering, Science, Agriculture, Forestry, Public Health, Business and Medicine
-



**STEVEN L. BESHEAR**  
GOVERNOR



**JOHN R. KASICH**  
GOVERNOR



**TOM CORBETT**  
GOVERNOR



**ROBERT F. McDONNELL**  
GOVERNOR



**EARL RAY TOMBLIN**  
GOVERNOR

With this in mind, we applaud the establishment of the Appalachian Research Initiative for Environmental Science (ARIES) and look forward to its support and advancement of critical research in these areas. We are pleased that seven major research universities within our states – Ohio State University, Pennsylvania State University, University of Kentucky, University of Pennsylvania, University of Pittsburgh, Virginia Tech, and West Virginia University – have all joined together in this important endeavor.

The scientific inquiry and research findings supported and made possible by ARIES will help identify the challenges we face in balancing multiple societal goals. We eagerly anticipate the contribution ARIES will thus make to the development of public policies that will collectively and simultaneously promote economic opportunity, energy security, and environmental stewardship.

Sound public policies based on sound science will be a benefit to the citizens of not only our own states, but of the nation as a whole. For that, we thank you and commend you for the work to which ARIES is committed.