# Economics: The Intersection of Regulations And Policy: The Role of the Private Sector

The U.S. China Clean Energy Research Center

Advanced Coal Technology Consortium

Jim Wood

Director

WestVirginiaUniversity.

# Clean Air Act of 1970

## 42 U.S.C. § 7401 et seq. (1970)

- 1955 Air Pollution Control Act (first federal legislation on air pollution *research $*)
- 1963 Clean Air Act (first federal legislation on air pollution *control*)
- 1967 Air Quality Act (expanded government actions into *monitoring-inspection*)
- 1970 Clean Air Act (comprehensive state and federal emissions *limits)*

# Criteria Emissions Technology Moved Back and Forth Across Atlantic (and Pacific)

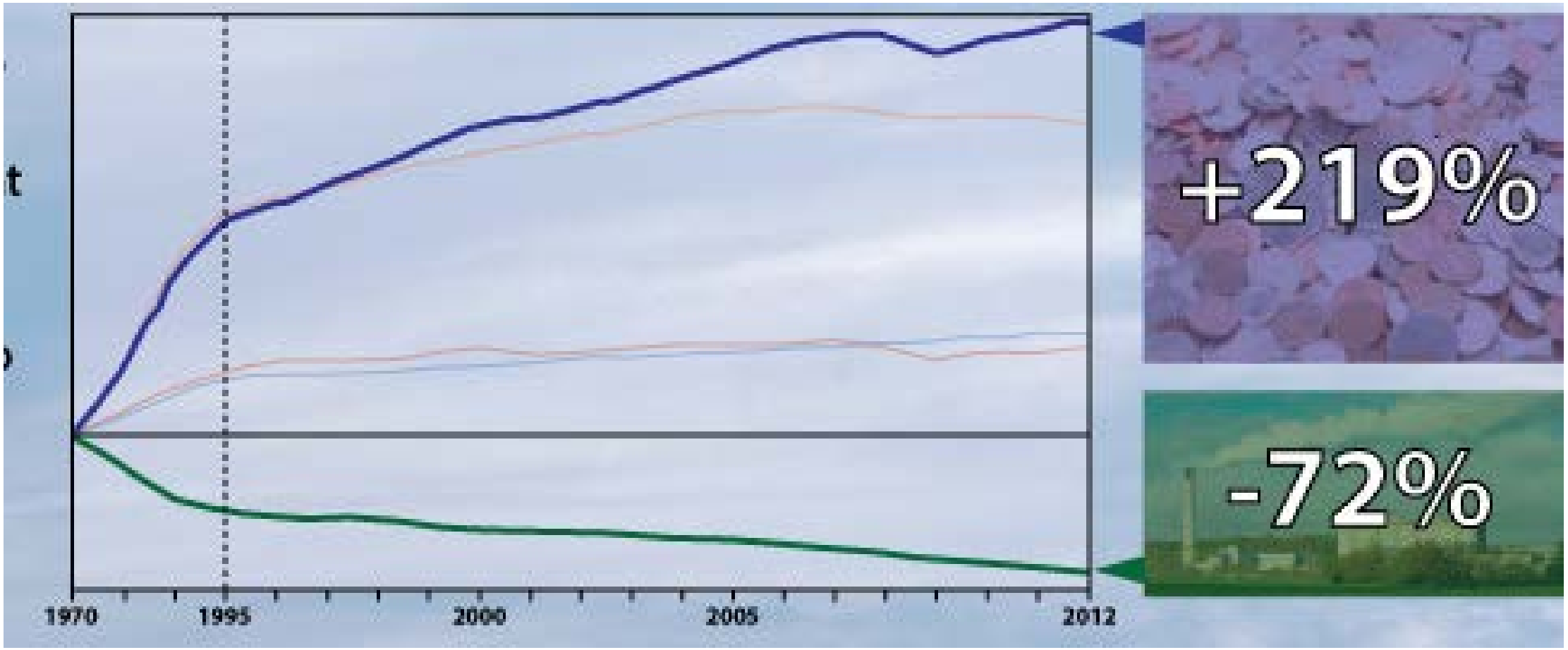
**USA**

- 1955 Air Pollution Control Act
- Japan (MHI) already had NOx catalyst
- 1967 Air Quality Act
- 1970 Clean Air Act & EPA (1977, provisions for PSD, and NAAQS non-attainment)
- 1990 CAAA (acid deposition, control of 189 toxic pollutants, expanded enforcement, Ozone layer

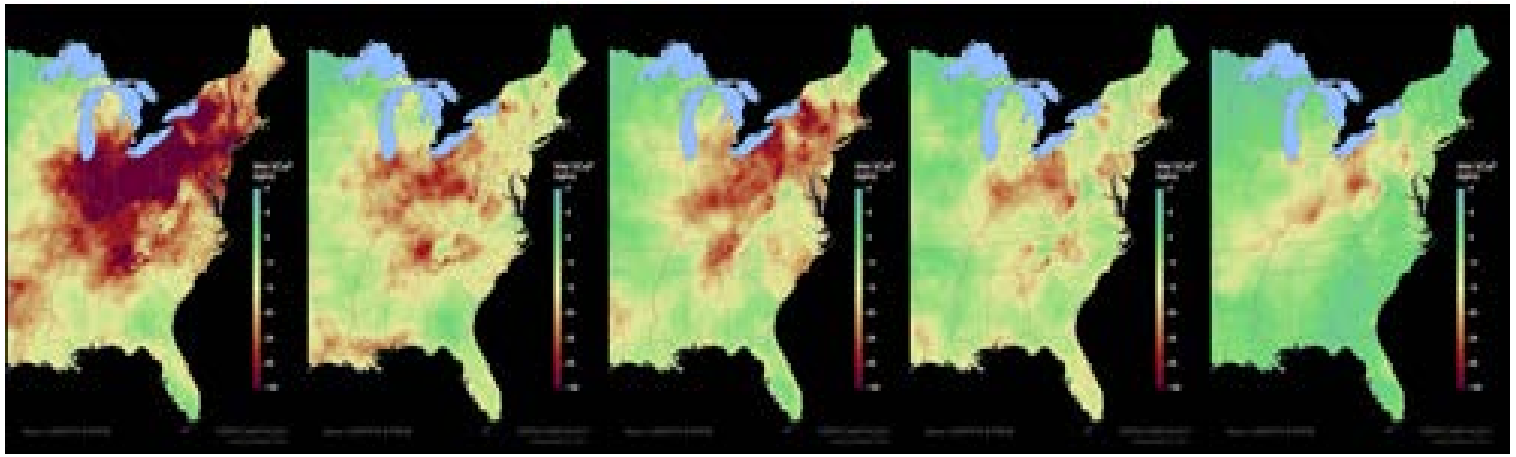
**Germany**

- 1964 TA *Luft* enacted
- 1974 Federal Pollution Control Act
- 1986 **Federal Ministry for Environment (more responsibilities than USEPA)**
- 2002 TA *Luft* last amended

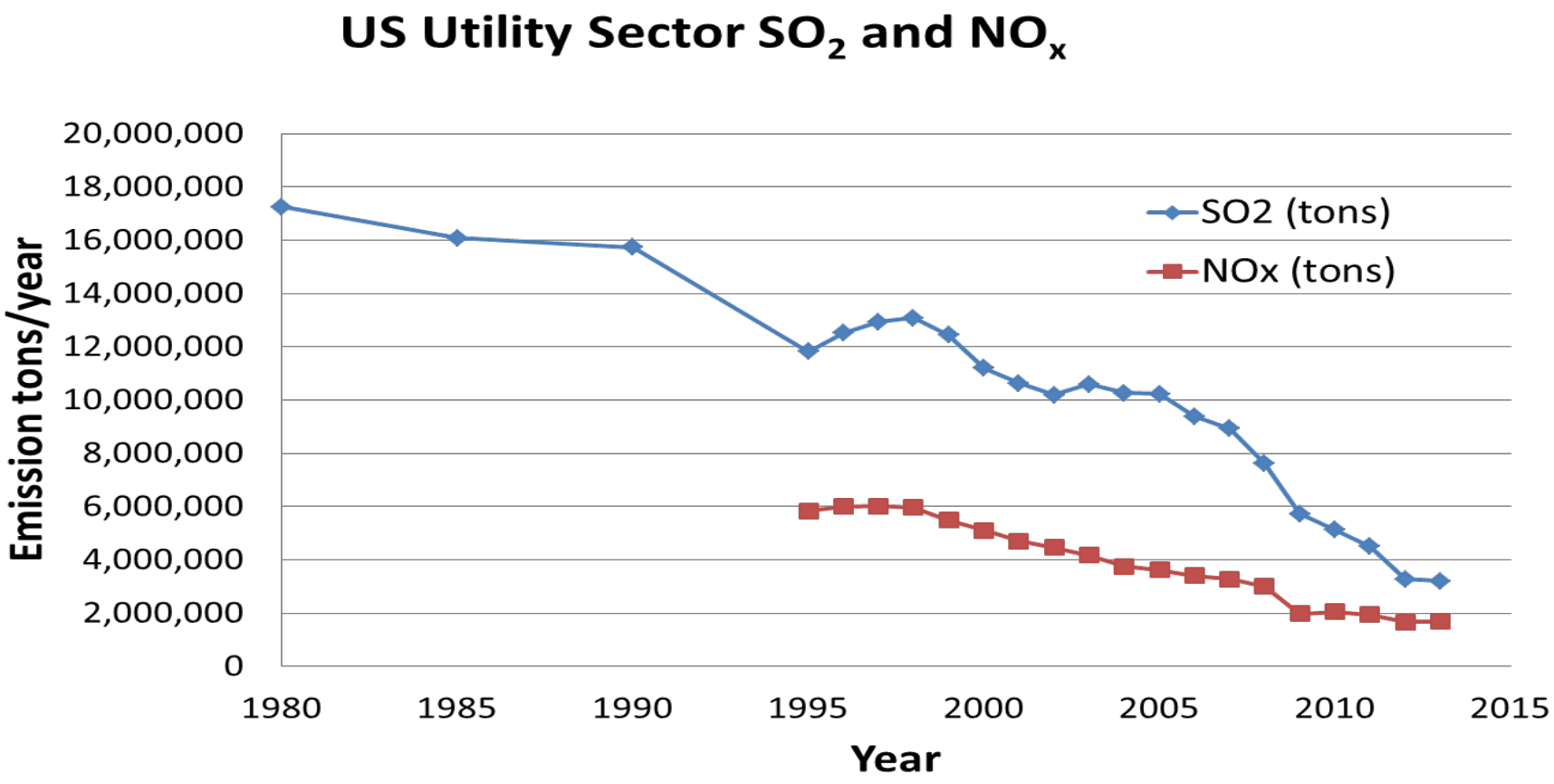
# Economic Growth Up 219%. Emissions Down 72%



# Decreased Acid Rain Damage



# Electric Generation Sector




Source: EPA Air Markets Program data ampd.epa.gov

# Carbon

- By 2001, academic research and the national laboratories in the US began focusing on $CO_2$ capture and storage. Private sector interest waxed and waned as cap and trade discussions moved forward.

- On August 5, 2015, CPP announced (partial reaction to December 2015 Paris Meeting) SIP requirements and a federal plan if states fail to comply-- all under 111(d), and a new carbon emissions standard under 111(b)

# May 6, 2004
# 3rd Annual Conference on Carbon Sequestration

- 60 projects
- $140 MM total value
- 36% industry cost share

# July 2014
# NETL $CO_2$ Capture Technology Meeting

- > 150 Projects
- 2012- $69 MM; 2013- $66 MM; 2014 $92 MM [Pre and Post Combustion Research]
- 12 candidate pilots progressing toward large pilot (25-50 MW)

# Criteria Emissions vs. Climate Change

**1955-1970**

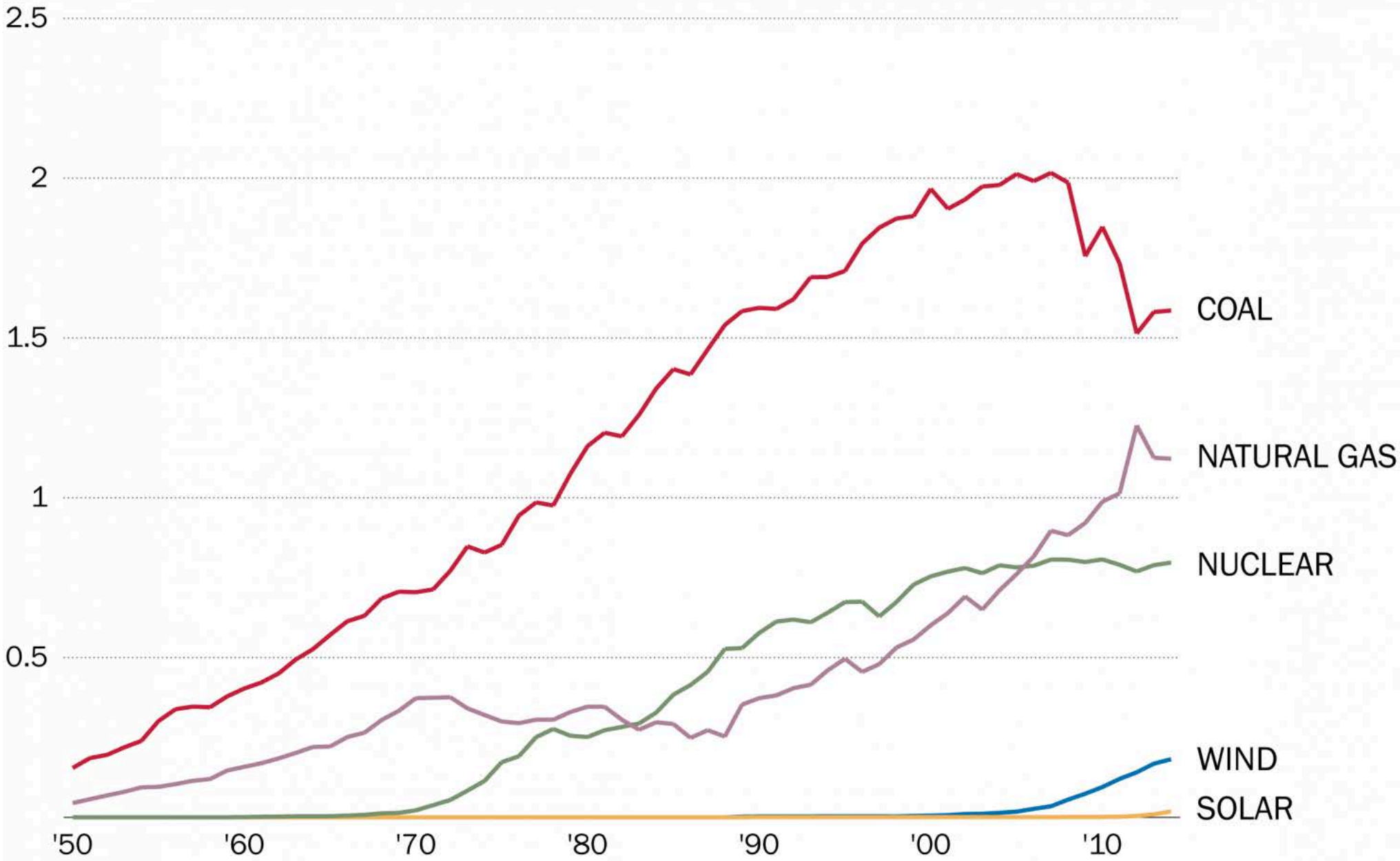
- 15 years of data; reasonable consensus
- technology developed in private sector
- cost effective innovative solutions
- lower limits with concurrent technical and reliability improvements
- vendor-customer- consumer shared risk

**2001-2015**

- 14 years; conflicting consensus
- technology has multiple “owners”
- no cost effective solutions, reliability unknown
- regulations without demonstrated solutions
- since 2001, ~$2 B in R&D, plus ARRA ($2.4 B) plus cost share ~30% = $4 B
- CURC (2015 Road Map) estimates an additional $15.6 B required through 2035

# Electricity generation by source

Data from the EIA. Trillions of kilowatt-hours.



# Outcomes-Based Research and The Private Sector

- Congressional appropriations develop constituencies over time;
- Constituencies tend to plan and organize around federal funding;
- There is a need to protect IP.

- Provide a means to disrupt constituency formation;
- Link multiple sources of IP to commercialize products;
- Integrate system components more rapidly;
- De-risk large demonstrations including via rate recovery.

# Many Thanks!
# 谢谢!

jfwood@mail.wvu.edu