

Perspective from the CURC/EPRI Roadmap

**U.S. Department of Energy
Office of Fossil Energy
and
National Energy Technology Laboratory**

**2014 Transformational Carbon Capture Technology
Workshop**

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Quick note about CURC and the CURC/EPRI Technology Roadmap

- **CURC is:**
 - Membership organization of 50 entities
 - An advocate for fossil energy RD&D
- **The CURC & EPRI Technology Roadmap**
 - Defined by CURC members & EPRI
 - Consultation with DOE and NETL
 - Issued June, 2012, updated August, 2012
 - Re-examination underway
 - R&D for existing units
 - Coal gasification
 - Power generation “transformational” technologies

**It's more complicated than just
"Plugging into an electrical outlet"**



What if They Are Wrong?

- **EPA said the impact of MATS**
 - Will result in ~8 GWs of coal retirement
 - Actually ~54- 56 GWs of retirements by 2016
- **Optimistic future for renewables**
 - ~8% of capacity now & ~9% by 2030 – 20% by 2020
 - “all in” for Germany and Spain
- **Abundant low-cost, plentiful natural gas**
 - Price volatility
- **Economy will grow w/o electricity growth**
 - History suggests otherwise

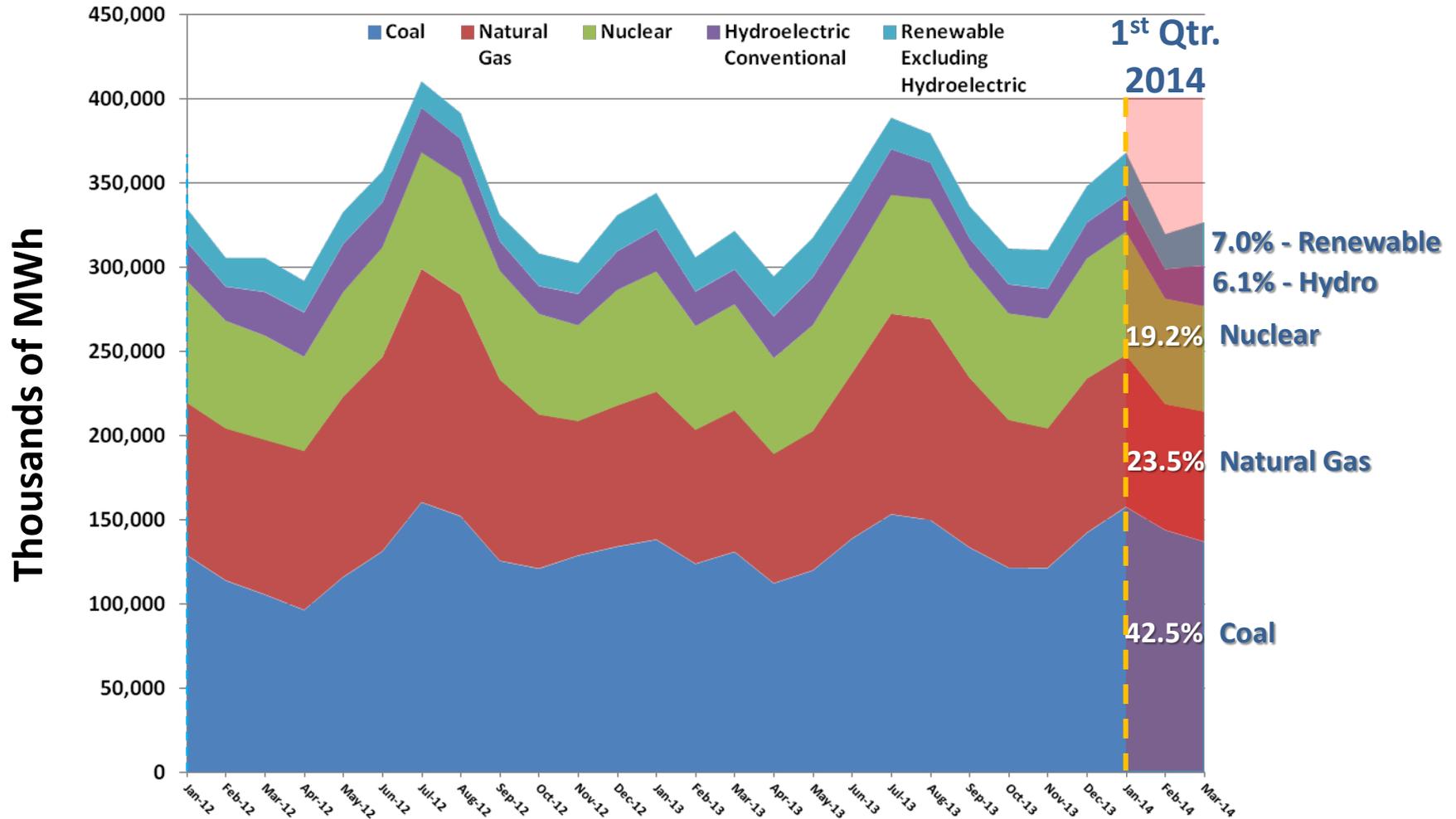
Two Topics to be Discussed

- **Why should we care about –**
 - the existing coal fleet  **Economic Security**
 - power generation options  **Energy Security**
 - CO₂ reductions  **Environmental Security**
- **What is the path forward -- *TECHNOLOGY***
 - National commitment to coal
 - Avoid regulations before there is technology to comply
 - Patience and substantial public \$\$\$ support
 - Specifically defined technology goals

The Value of the Existing Coal Fleet

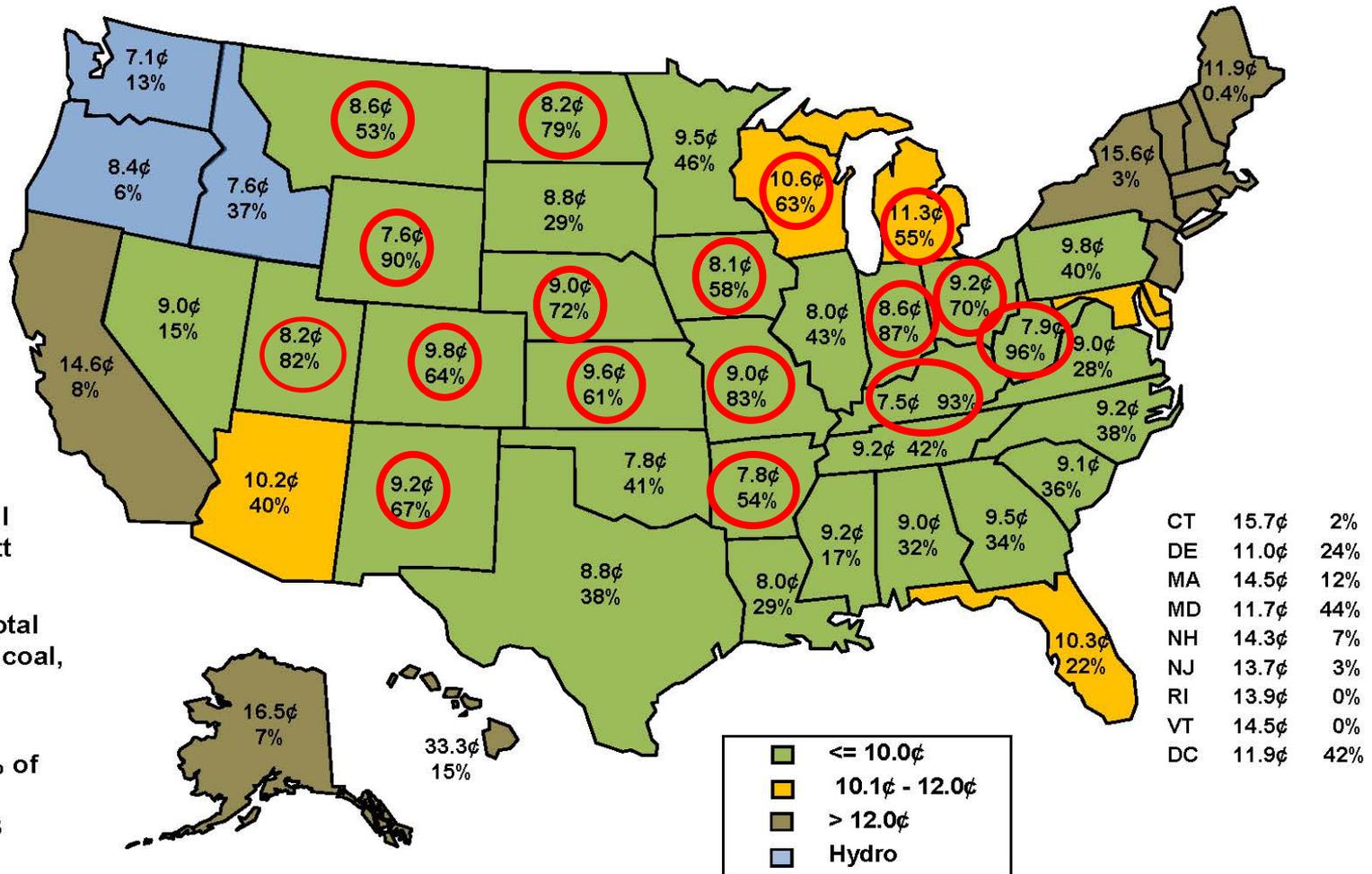
- **Polar Vortex (the winter of 2013 – 2014)**
- **10% increase in electricity costs leads to 1% decrease in GDP and loss of 1.5 million jobs**
- **Low cost electricity in the U.S. provides a competitive edge versus other free market nations**
- **Low cost coal has been a “buffer” to natural gas prices**

Monthly Electricity Supply



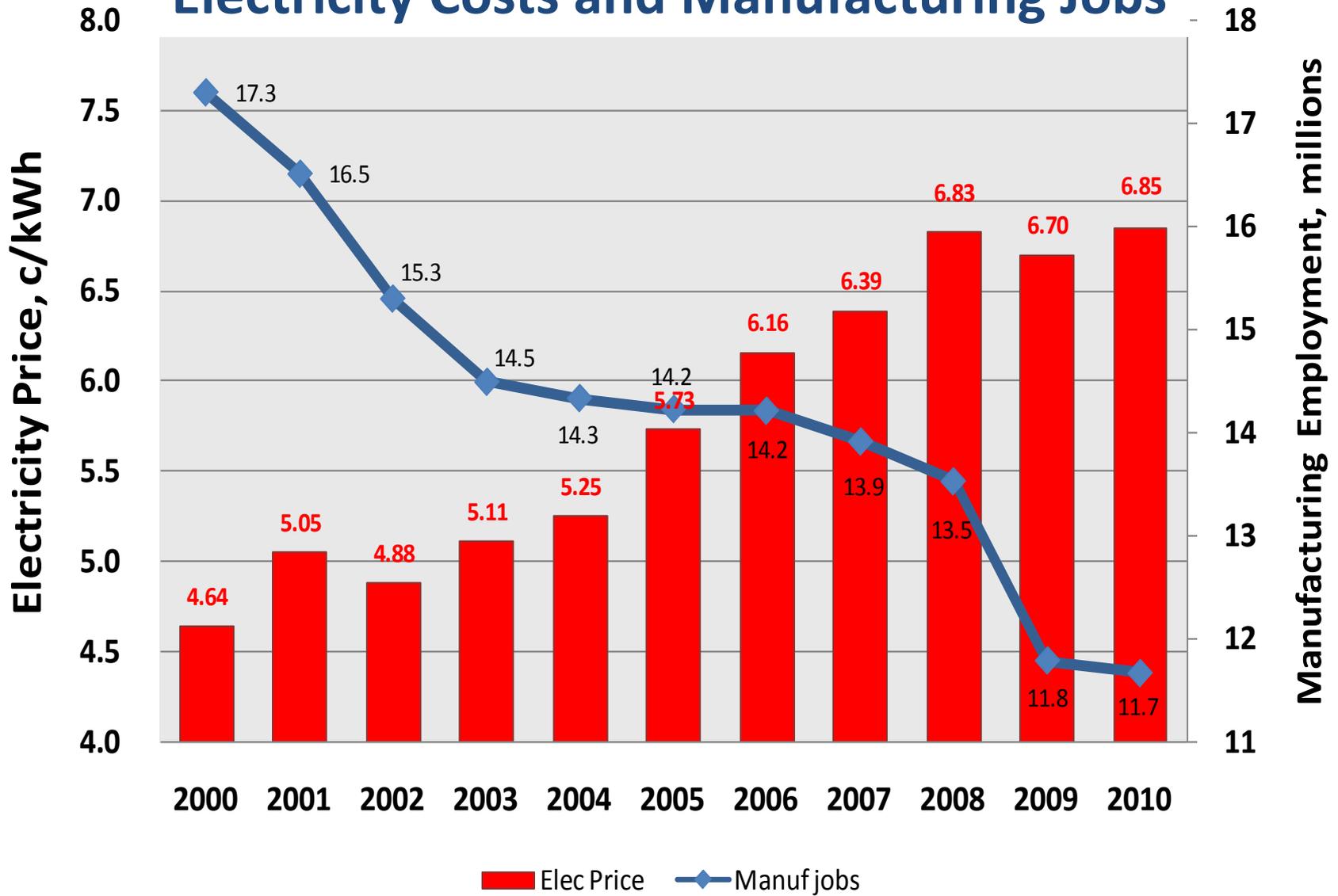
Coal Generation Equaled Total of Natural Gas Plus Nuclear In 1st Quarter 2014; Critical to Addressing the Polar Vortex Demand

Cost Per kWh & Percent of Coal Power Sector Generation



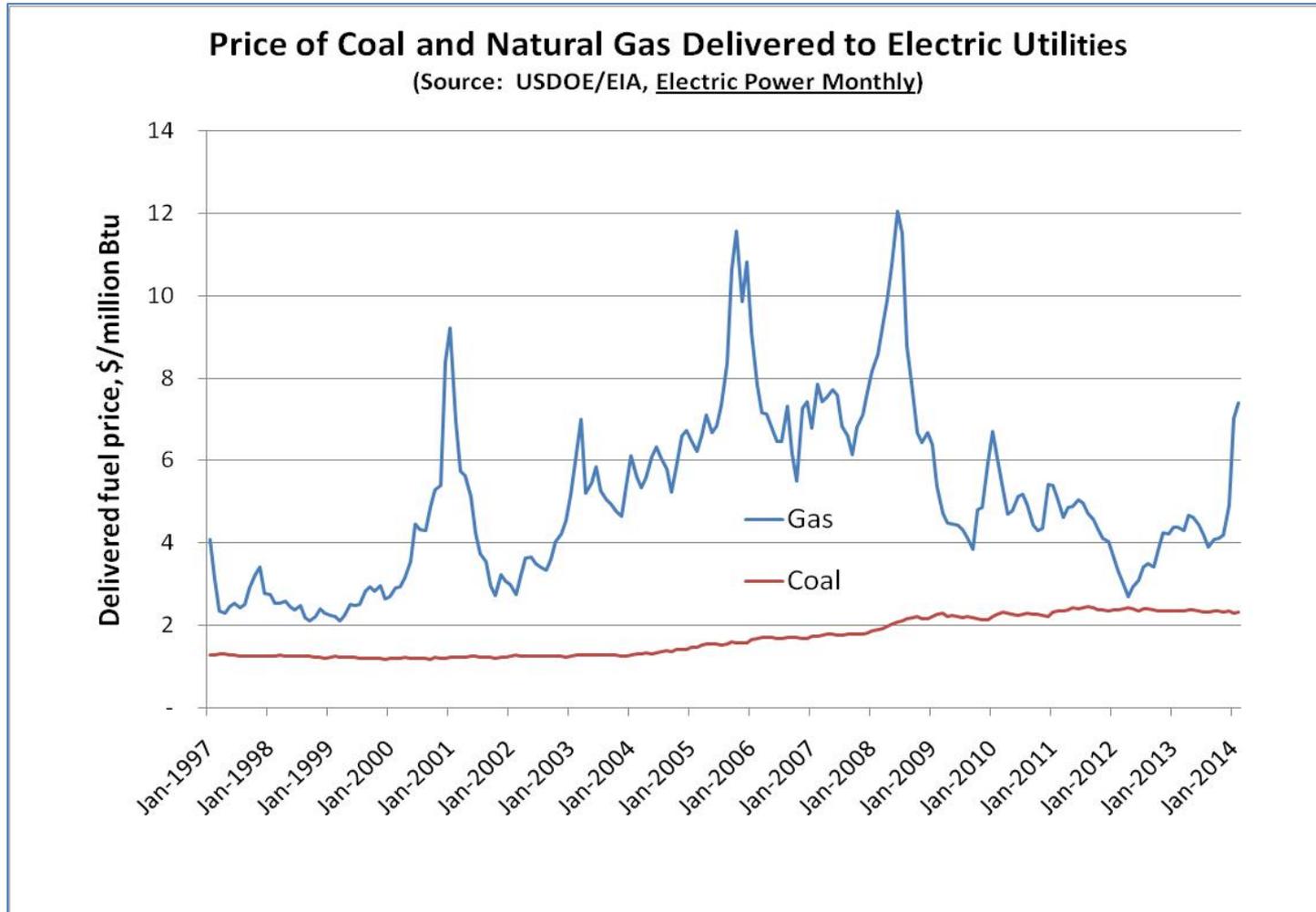
Sources: Energy Information Administration, *Electric Power Monthly*, March 2014 (2013 data); Public Service Commission of the District of Columbia (2012); California Energy Commission (2012 latest available); Washington State Department of Commerce (2012 latest available); Idaho Power (2013 estimate). 2013 data are preliminary.

Electricity Costs and Manufacturing Jobs



*The National Coal Council: Reliable and Resilient The Value of Our Existing Coal Fleet, May 2014, pp. 24

Fuel Price Volatility



*The National Coal Council: Reliable and Resilient The Value of Our Existing Coal Fleet, May 2014, p.

Energy Options are Important

- **All options have challenges**
 - **Nuclear** -- significant costs to construct; public perceptions post Fukushima
 - **Renewables** -- intermittent resource, requires backup capacity, limited by geography
 - **Natural gas** -- price volatility; delivery infrastructure
 - **Coal** -- environmental challenges; public perceptions of “dirty coal”, current costs of CCS

Impacts of Over-Reliance

Japan & Fukushima



- Spending extra \$35 B/year on fossil fuels
- Trade deficit of \$112 billion in '13, quadruple deficit in '11
- Residential energy bills >20%
- Industrial energy bills >30%

Germany & Renewables



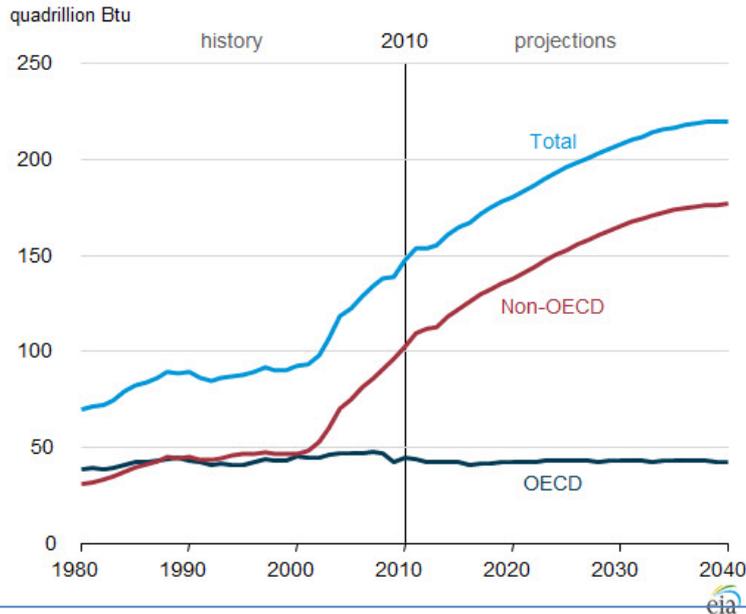
Leads Europe & much of the world in total renewable generating capacity (71 GWs)
Average residential electric rate in 2013 (U.S. \$) ~ \$0.40/kWh
Subsidies for renewables totaled €120.4 billion since 2002
Plan to add 7,400 MW of coal-fueled generation by 2015

CO₂ Reductions

- Coal is fastest growing fossil fuel used worldwide – soon to surpass oil
- 3.6 Billion People Have No or Only Partial Access to Electricity
- The issue will not be successfully addressed by transferring wealth to developing countries
- President Obama's Climate Action Plan will not be successful without CCUS

Developing Countries will Use Majority of Coal and Emit Majority of CO₂

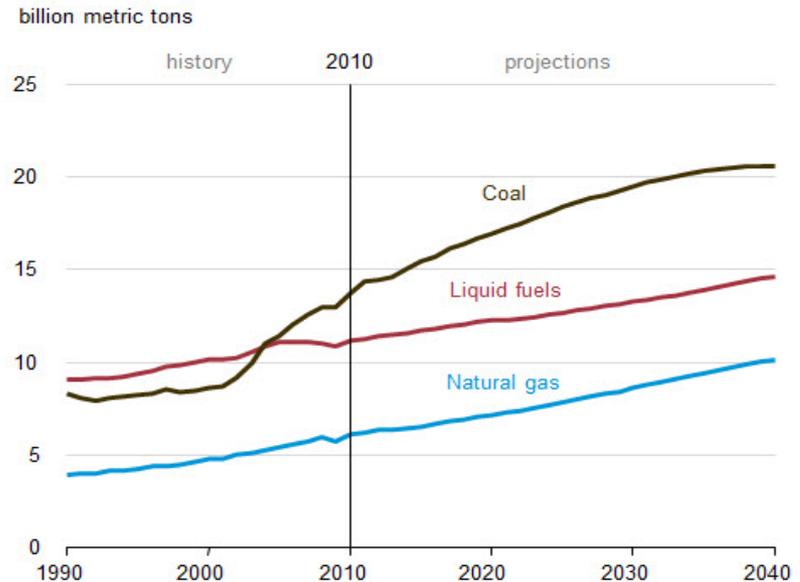
Figure 70. World coal consumption by region, 1980-2040



According to EIA, world energy-related **CO₂ emissions** are projected to increase nearly 46% between 2010 and 2040. In 2040, the developing **non-OECD nations** account for **69%** of the world total. Today, the **U.S.** coal fleet only accounts for roughly **3%** of total global GHG emissions.

According to EIA, **China's** share of global coal consumption will increase from 47% in 2010 to 55% in 2040. **India** will surpass the United States as the second-largest coal-consuming country after 2030.

Figure 141. World energy-related carbon dioxide emissions by fuel type, 1990-2040

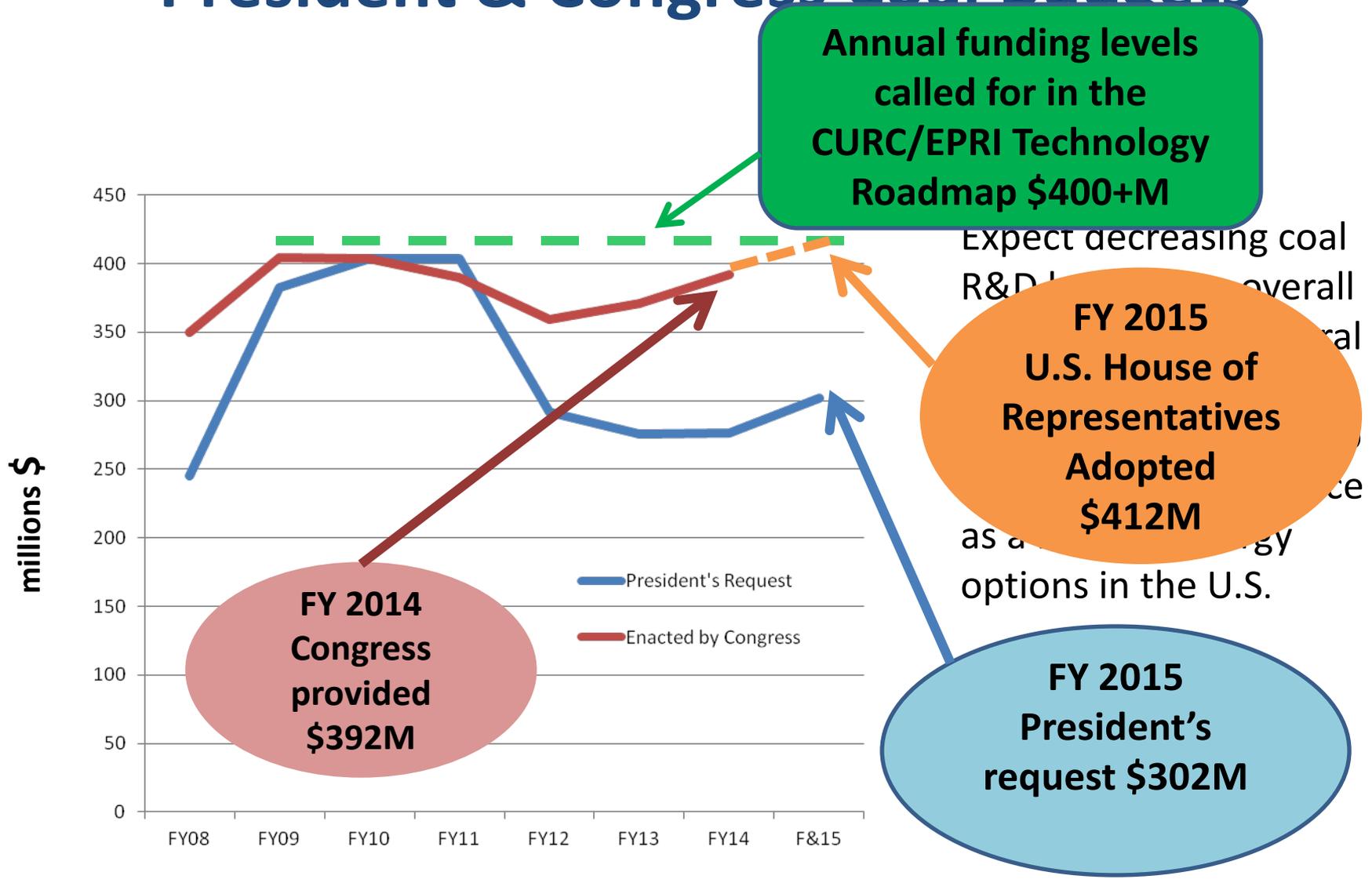


EPA's Proposed NSPS Does Not Promote CCS

- **CCS is not ready for “prime time”**
 - Technology is still too expensive
 - No operating large-scale electricity generation projects w/ CCS in the world
 - Entire generating plant is at risk if CCS does not work
- **The Congressional Research Service says:**
 - “If the standards [EPA’s proposed standards for NSPS] won’t have any cost or impact, because no new coal-fired capacity subject to them will be built, then they will do little to stimulate the development of CCS technology.”*
- **The EPA argues that “no harm” will be done because no plants will be built anyway. Problems with this argument:**
 - Time is not a friend when there are other cost-competitive alternatives (natural gas) and coal plants will not be built
 - Without near-term market demand and diminishing government RD&D support, the technology pipeline (to bring down costs) dries up and expertise disappears
- **In short: EPA’s proposed NSPS is a barrier to CCS development**
 - The goal to address global climate change is not encouraged with the proposed rule

* Nov. 15, 2013 CRS Study: EPA Standards for Greenhouse Gas Emissions from Power Plants: Many Questions, Some Answers by James E. McCarthy, Specialist in Environmental Policy

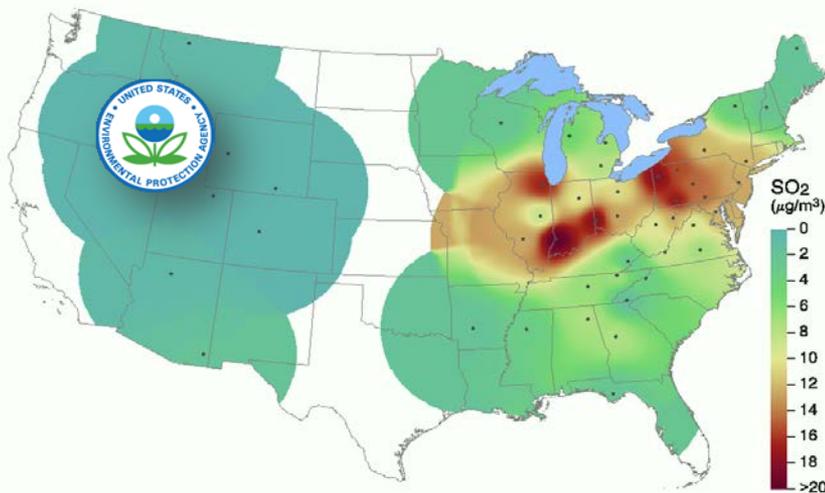
President & Congress Coal Budgets



We Have Developed Technology to Address other Environmental Concerns

With the application of new technologies developed in partnership between DOE and the private sector, the U.S. is significantly reducing criteria emissions (particulate matter, sulfur dioxide, carbon monoxide, lead, ozone, and nitrogen oxides)

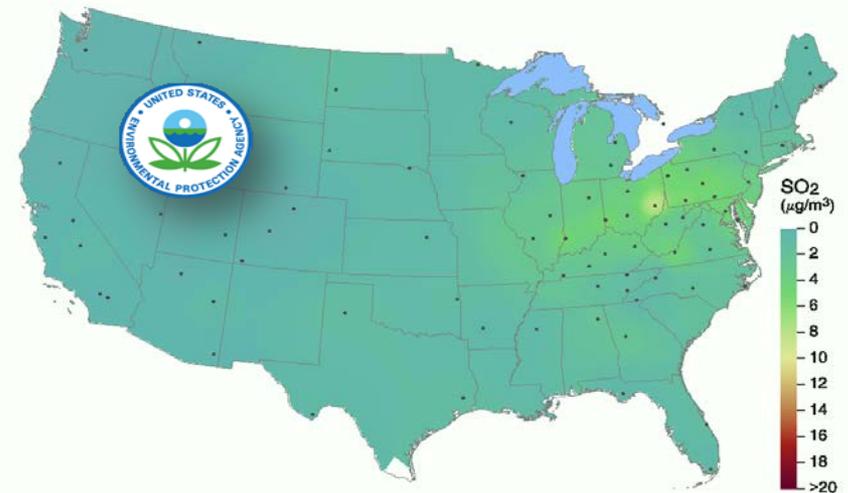
1990 SO₂ Concentrations



Source: CASTNET

USEPA/CAMD 08/09/06
file:///c:/network/gis/1990a/c_1990.gif

2009 SO₂ concentrations



Source: CASTNET

USEPA/CAMD 07/26/10
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The Path Forward -- Key Points

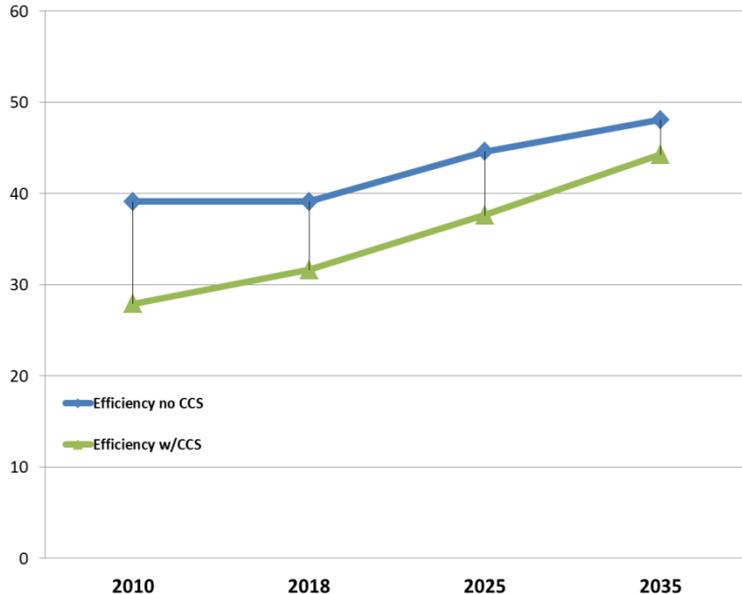
- Rely upon American ingenuity
- Neither China nor India will develop CCS technology
- Patience -- a realistic transition time and substantial public financial incentives
- Export potential of CCS-related technology

Adequate Time and Funding can Produce New and Better Technologies

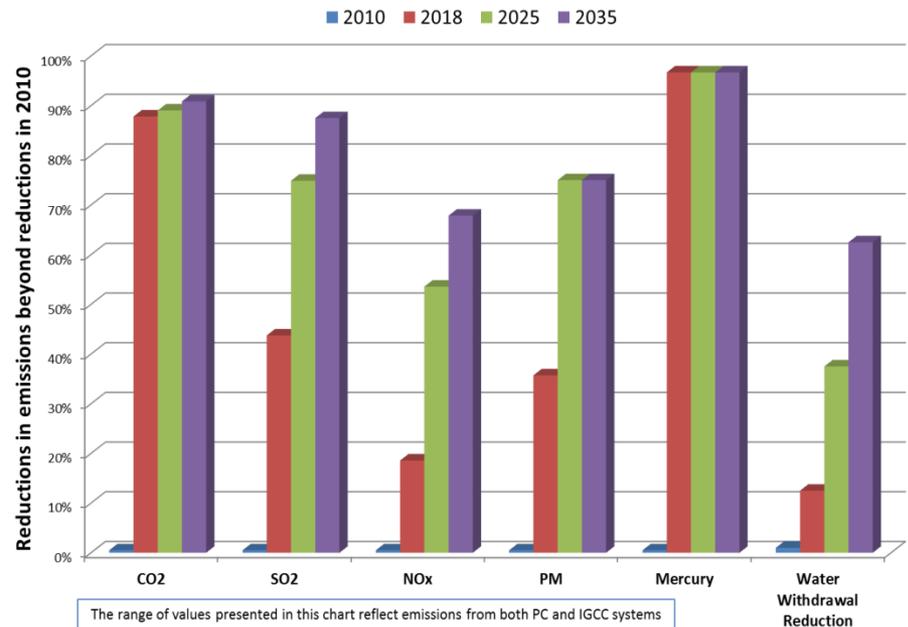
Independent of a climate driver, less CO₂ is emitted as a result of increased power generation efficiency, and less coal is used for the same unit of power output

Reduced emissions of traditional air pollutants, reduced water use and consumption, and reduced CO₂ emissions

Efficiency with and without CCS



Environmental Improvements Relative To A New Unit In 2010



2010 "State of the Art" Baseline Data

Reductions reflect a range of values for both PC and IGCC technology changes after 2010, but the reductions in 2010 are very significant:

CO₂: 0% (no carbon controls in use)

NO_x and SO₂: 90 - 99% reduction

PM: 99.6% reduction

Mercury: 90% reduction

Water Withdrawal Reduction (as a result of cooling towers): 98%

3-Part Technology Program Coal from 2013 to 2050 & Beyond

CURC's Three Part Technology Program

Efficiency, reliability, and flexibility of the existing

Near Term Program
Existing Coal Fleet

S. 2152
“Advanced Clean Coal Technology Investment in Our Nation (ACCTION) Act”
Introduced by:
Senator Heidi Heitkamp (D-ND)
March 25, 2014

CCS

Support Investments in RD&D Today.

- Improve today's coal-use technologies (target costs & performance)
- Develop “transformational” technologies and create new ways to use coal

Long-Term Program
Transformational technologies for the future

2013

2025

2050

Thank You

CURC

COAL UTILIZATION
RESEARCH COUNCIL

www.coal.org