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ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

# The Energy Scene: Update on a Few Key Issues

**Sue Tierney**

Ozone Transport Commission
May 24, 2012

# Looking ahead in energy:

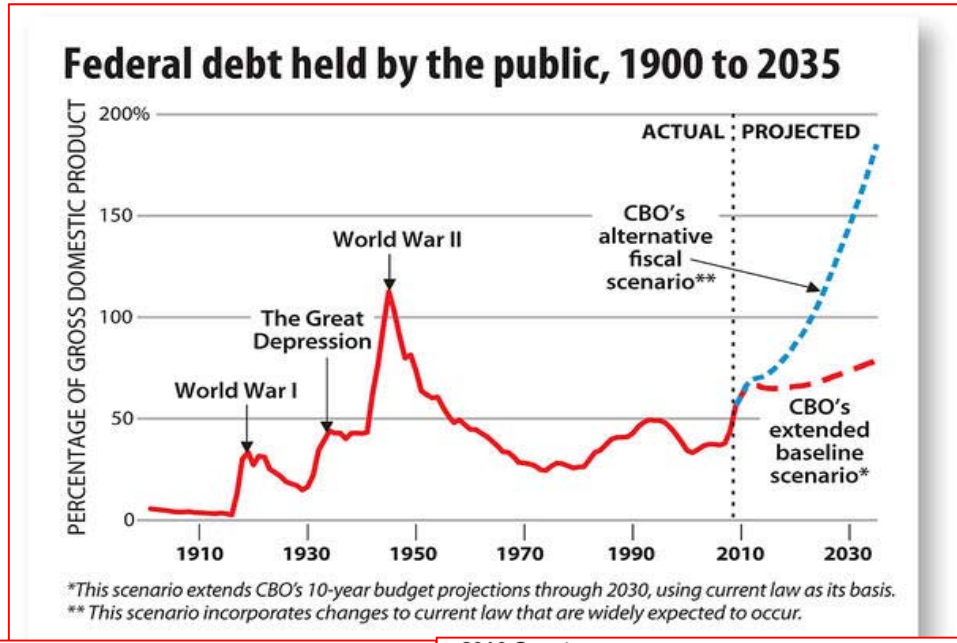
## Some boundary conditions….

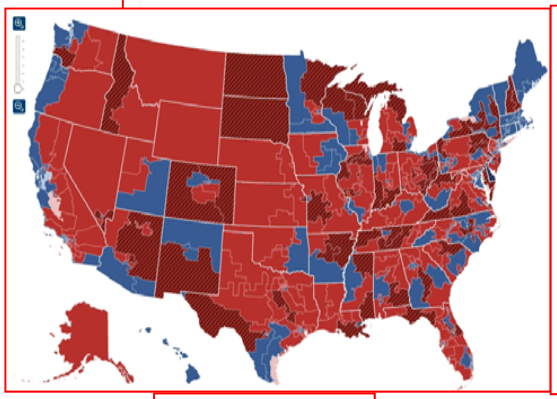
## Outlook and some implications for:

- **Natural gas**
- **Existing coal fleet**
- **Renewables**
- **Energy ‘productivity’ (energy efficiency)**

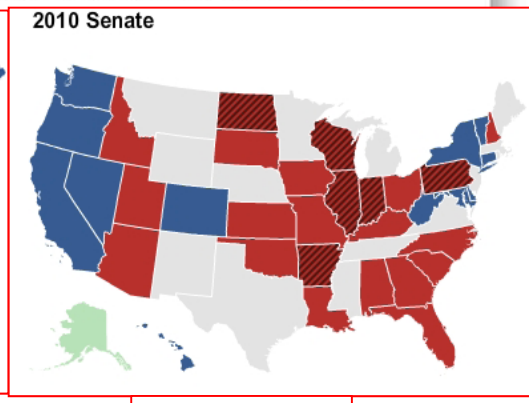
# Energy policy is overshadowed by:

- **Big gorilla challenges:**
  - The federal deficit looms large
  - Poor prospects for funding energy programs, or much R&D
- **Partisan rancor**
  - Stalemate on legislation generally
  - New energy bill(s) unlikely
  - Scrutiny on energy subsidies of all sorts



House

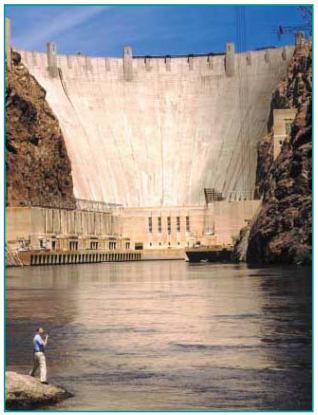



Senate

# Every fuel and technology has attributes someone doesn't like

Nuclear

Wind



Hydro

Transmission

Oil

Solar PV

Natural Gas

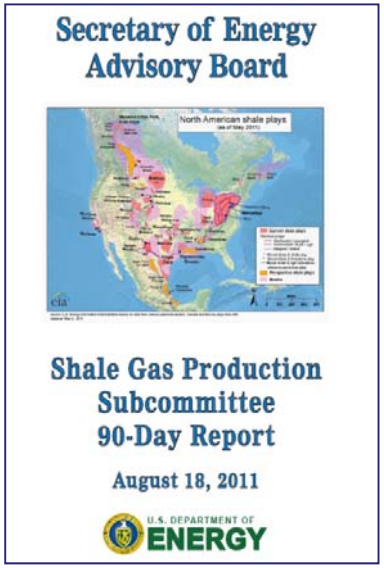
Coal

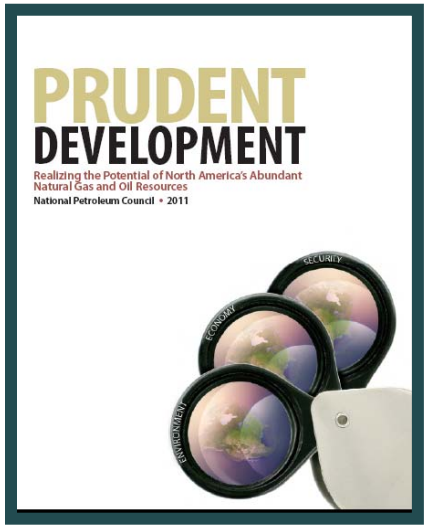
Efficiency

CCS

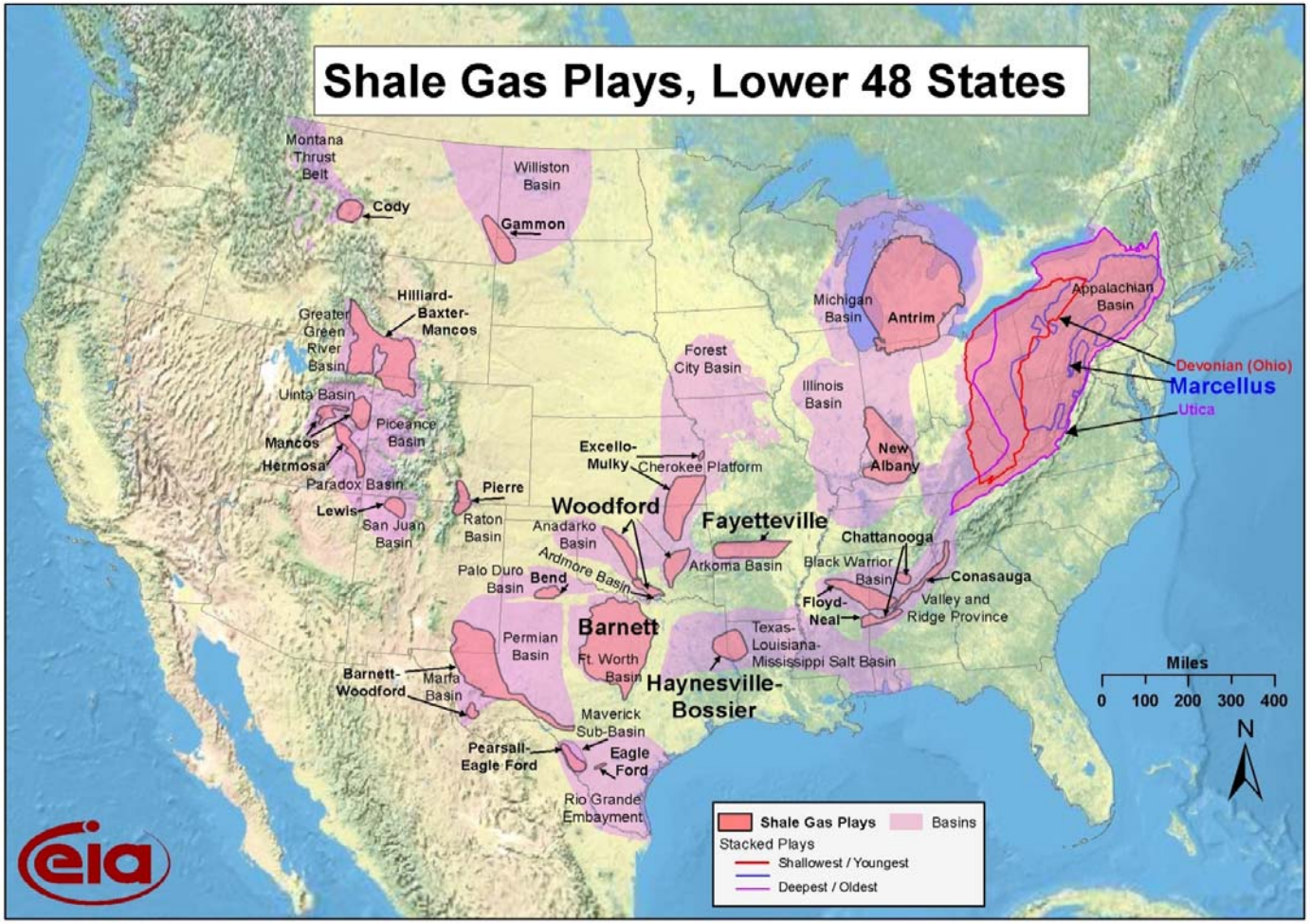
# Overview – Natural Gas isks and Opportunities:

## Shale Gas:
## Game changer or something else?



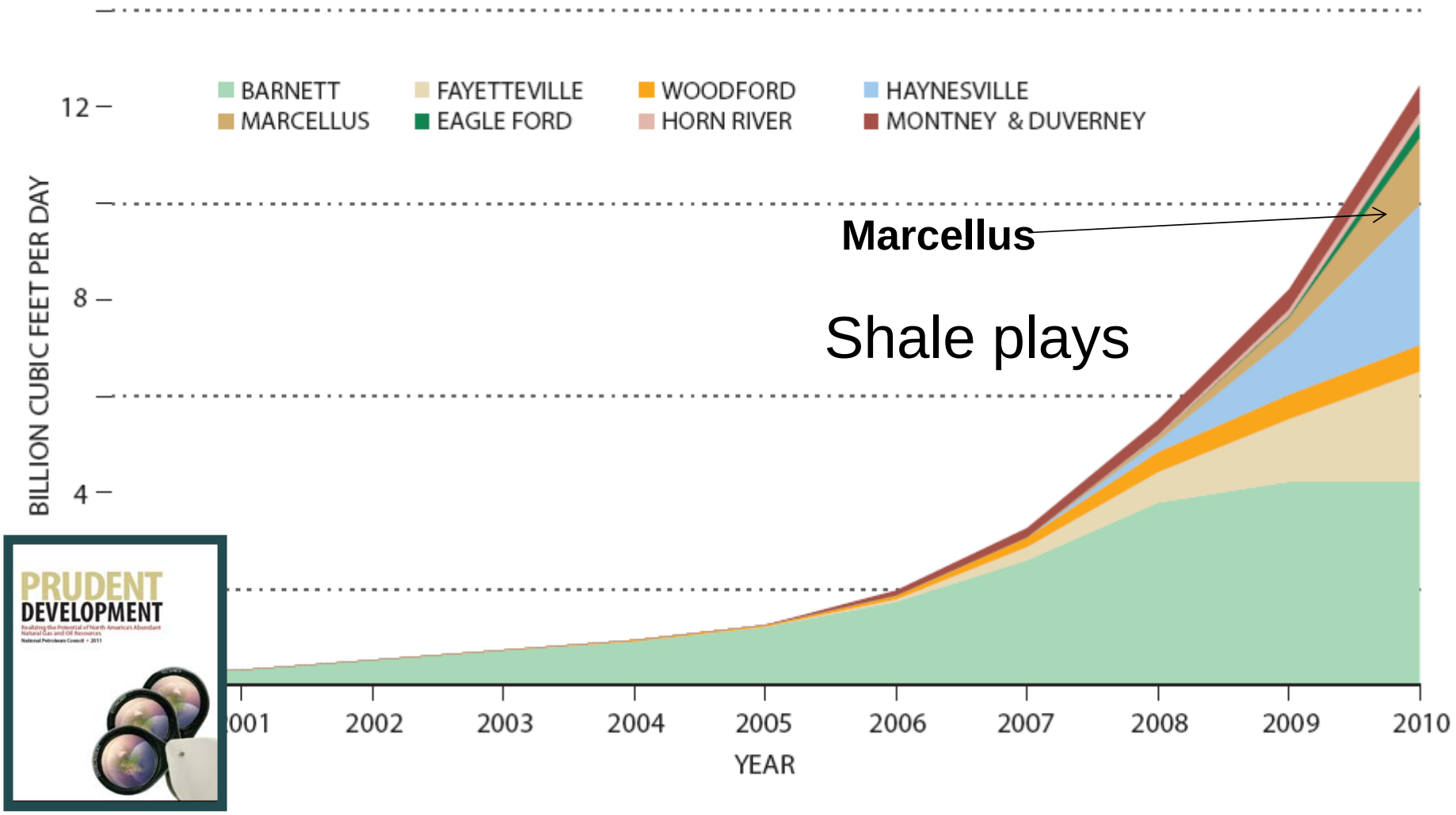



# The geography of shale gas




Source: Energy Information Administration based on data from various published studies.
Updated: March 10, 2010

# Shale gas production growth: the past decade…..



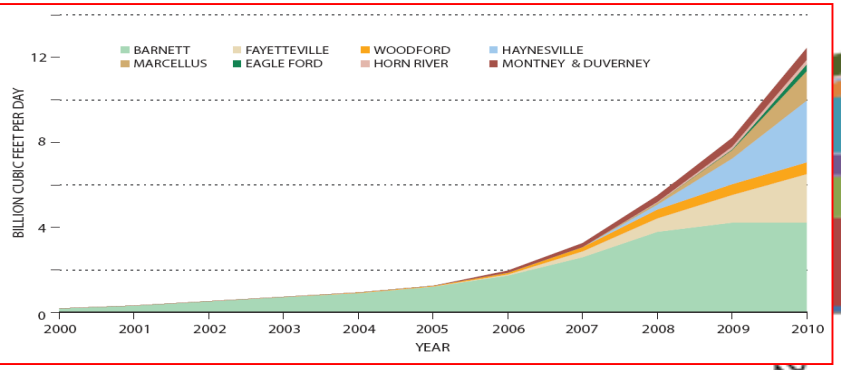


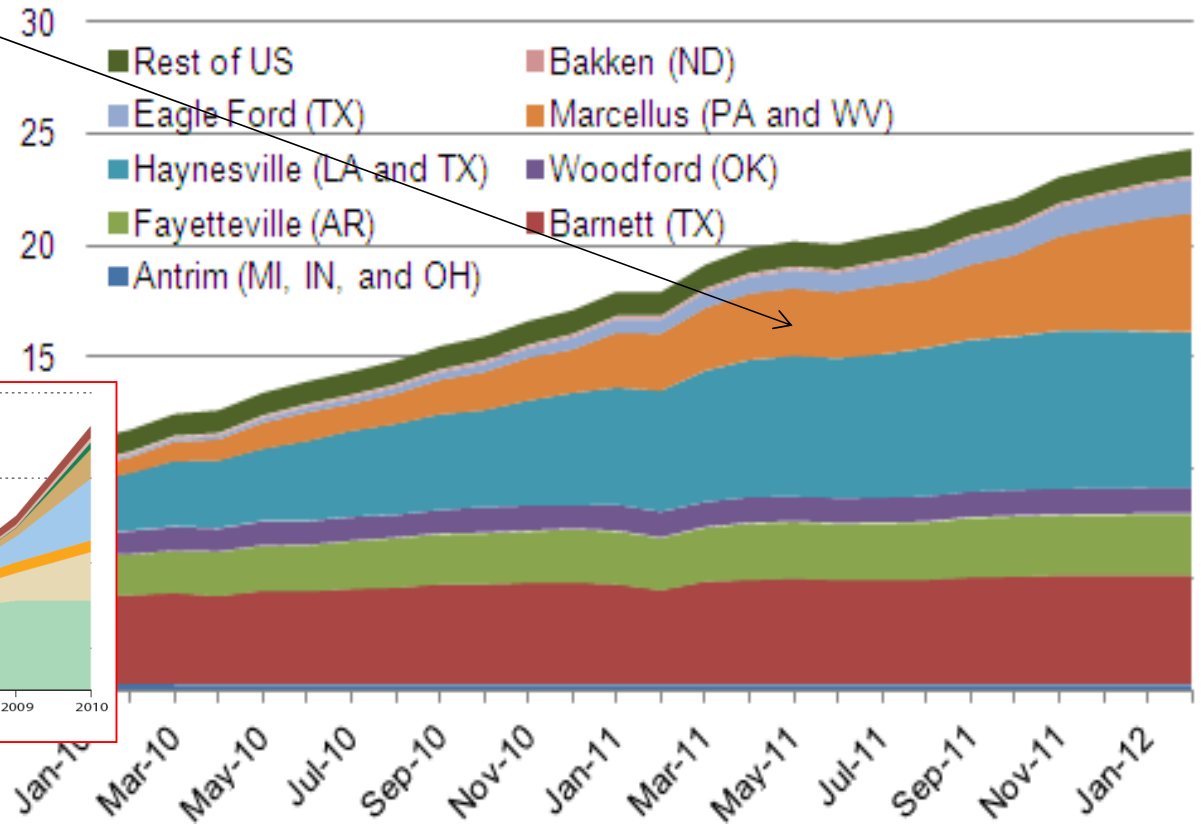


NPC, Prudent Development, 2011

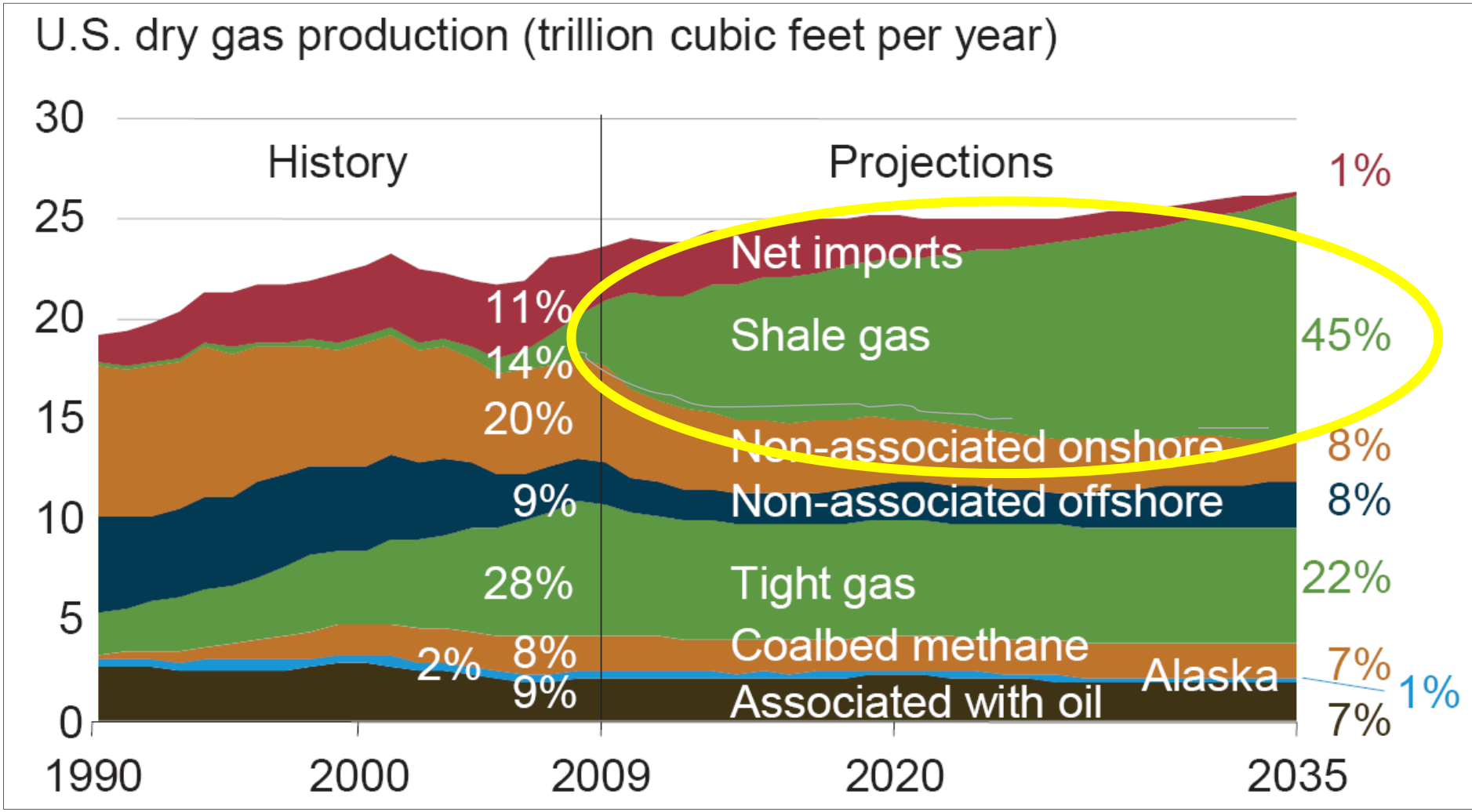
# Shale gas production: last decade + 2 years

**Marcellus: biggest piece**



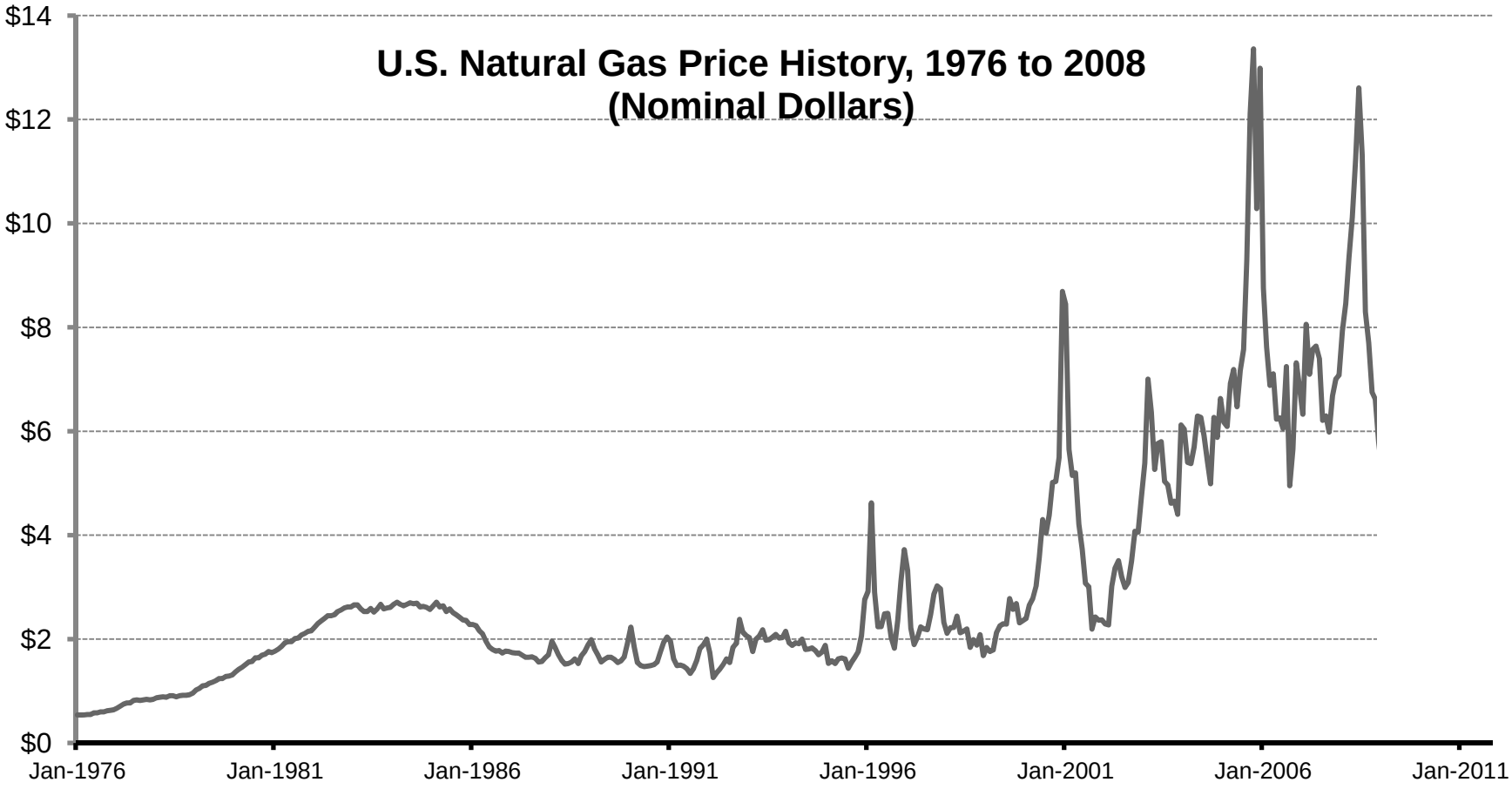
# Outlook for the next two decades: cont'd growing production






Source: EIA, Annual Energy Outlook, Early Release Overview,

# Natural gas prices – before shale gas……




Source: EIA, Wellhead prices through 1994. Henry Hub prices from 1995 – 2011

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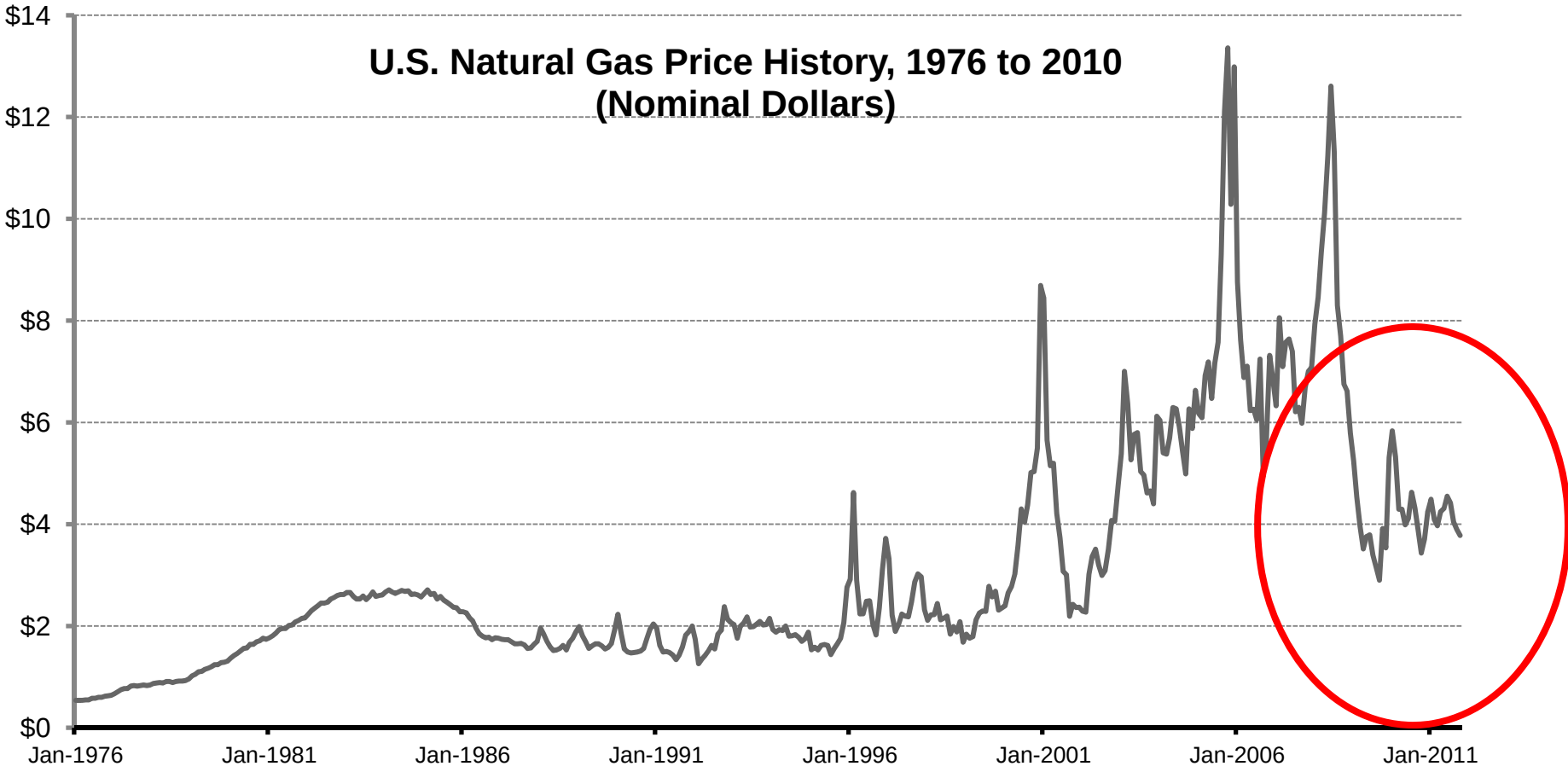
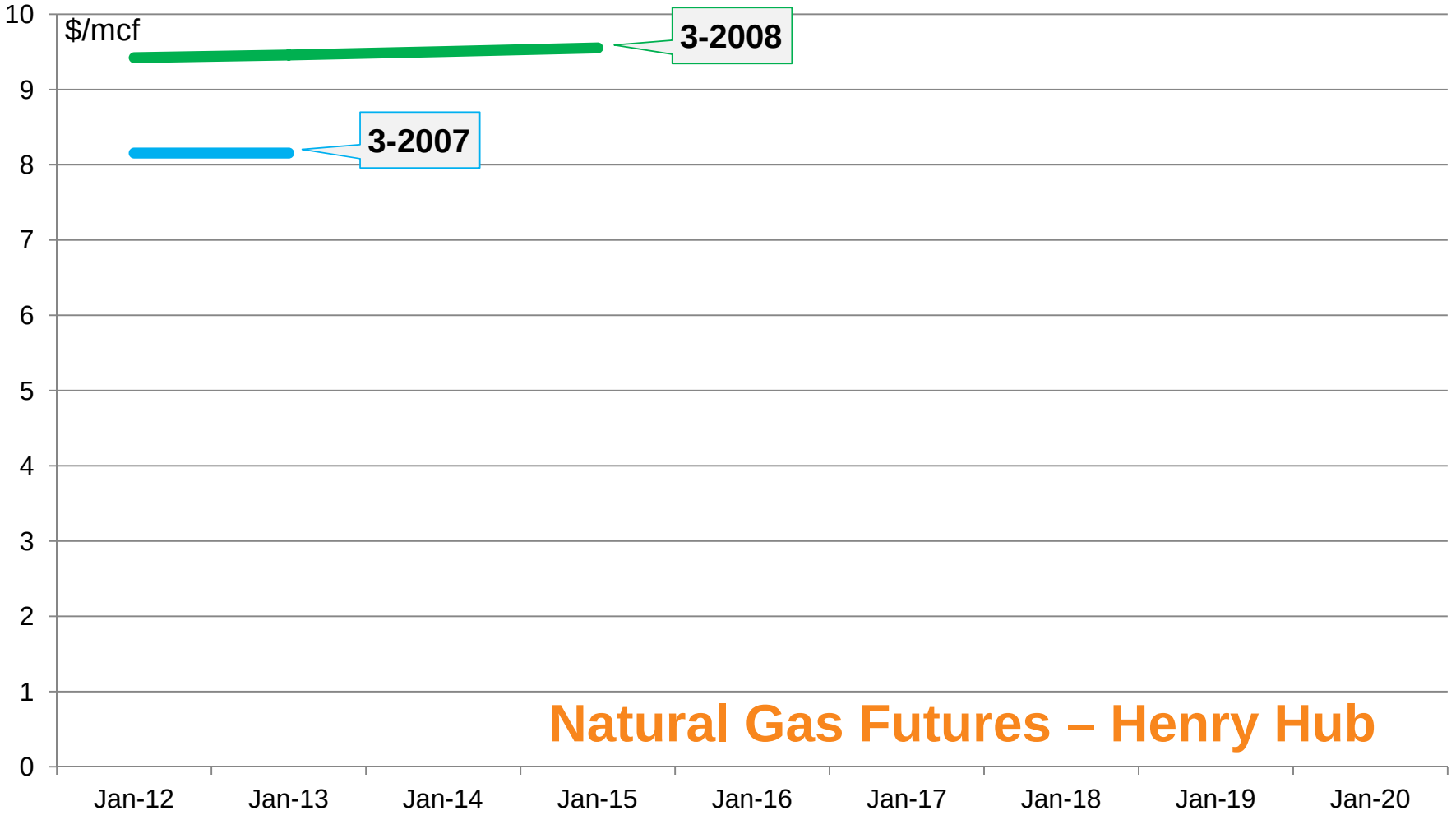



Source: EIA, Wellhead prices through 1994. Henry Hub prices from 1995 – 2011

# Price outlook for natural gas



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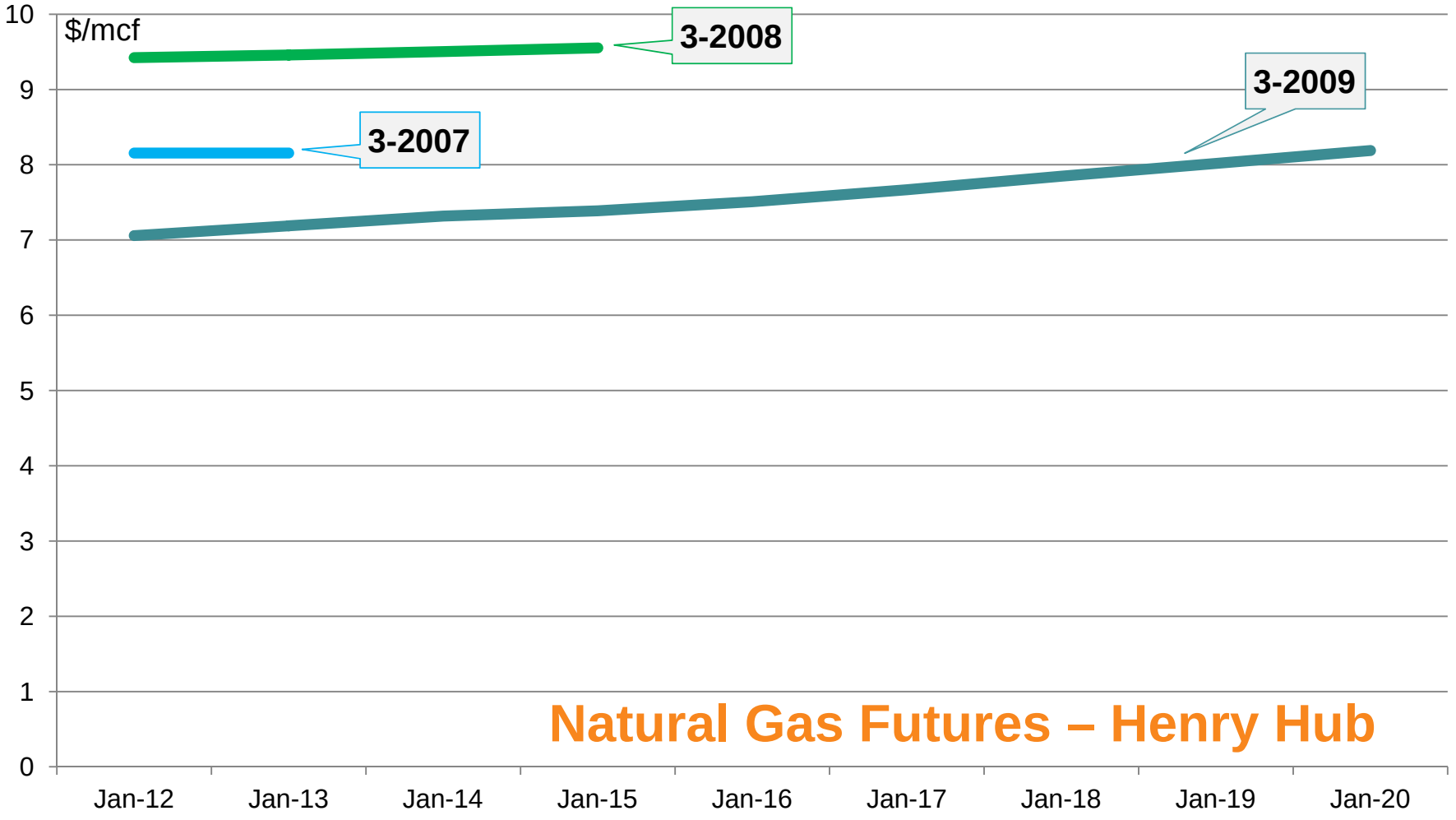

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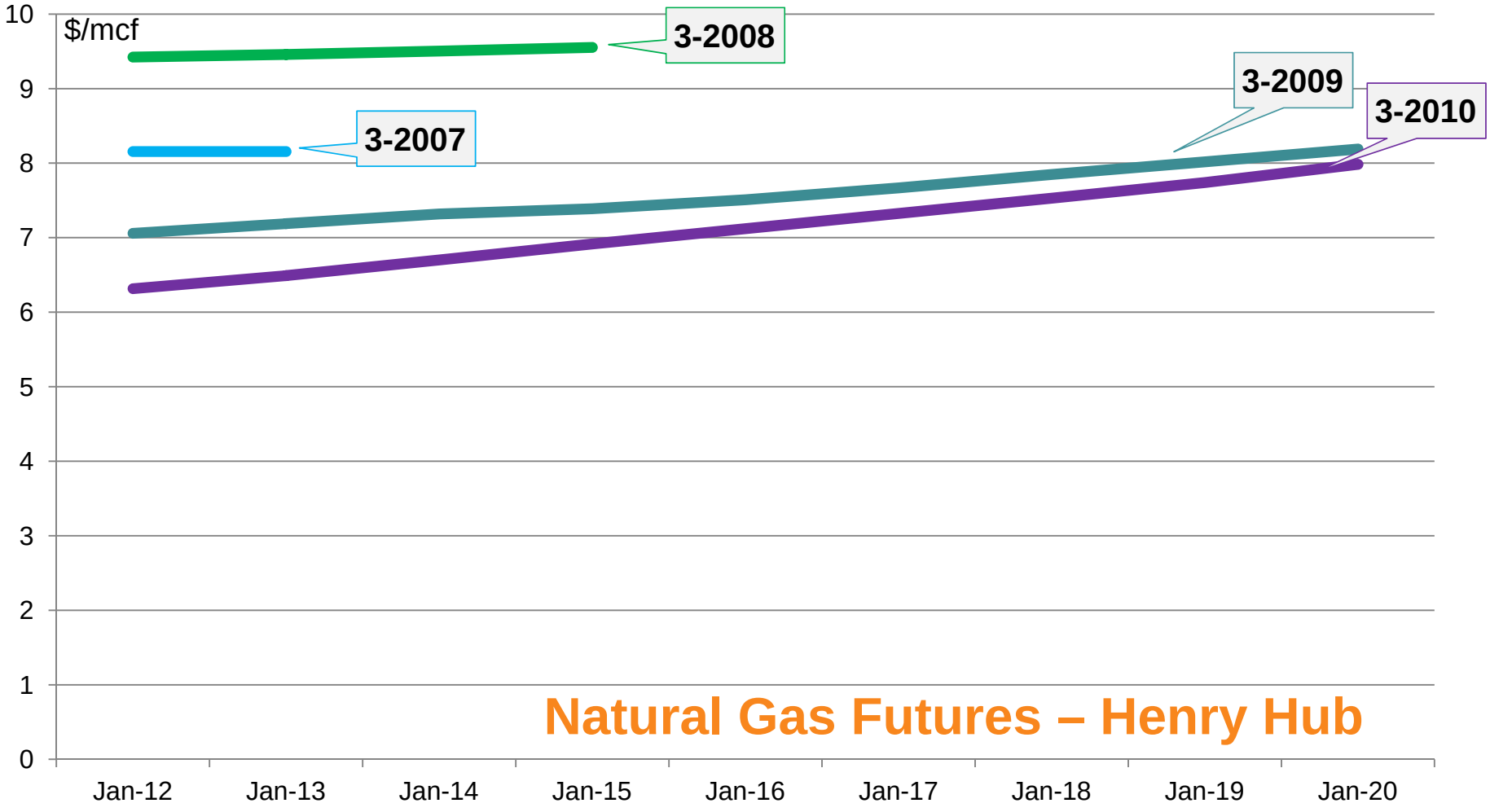

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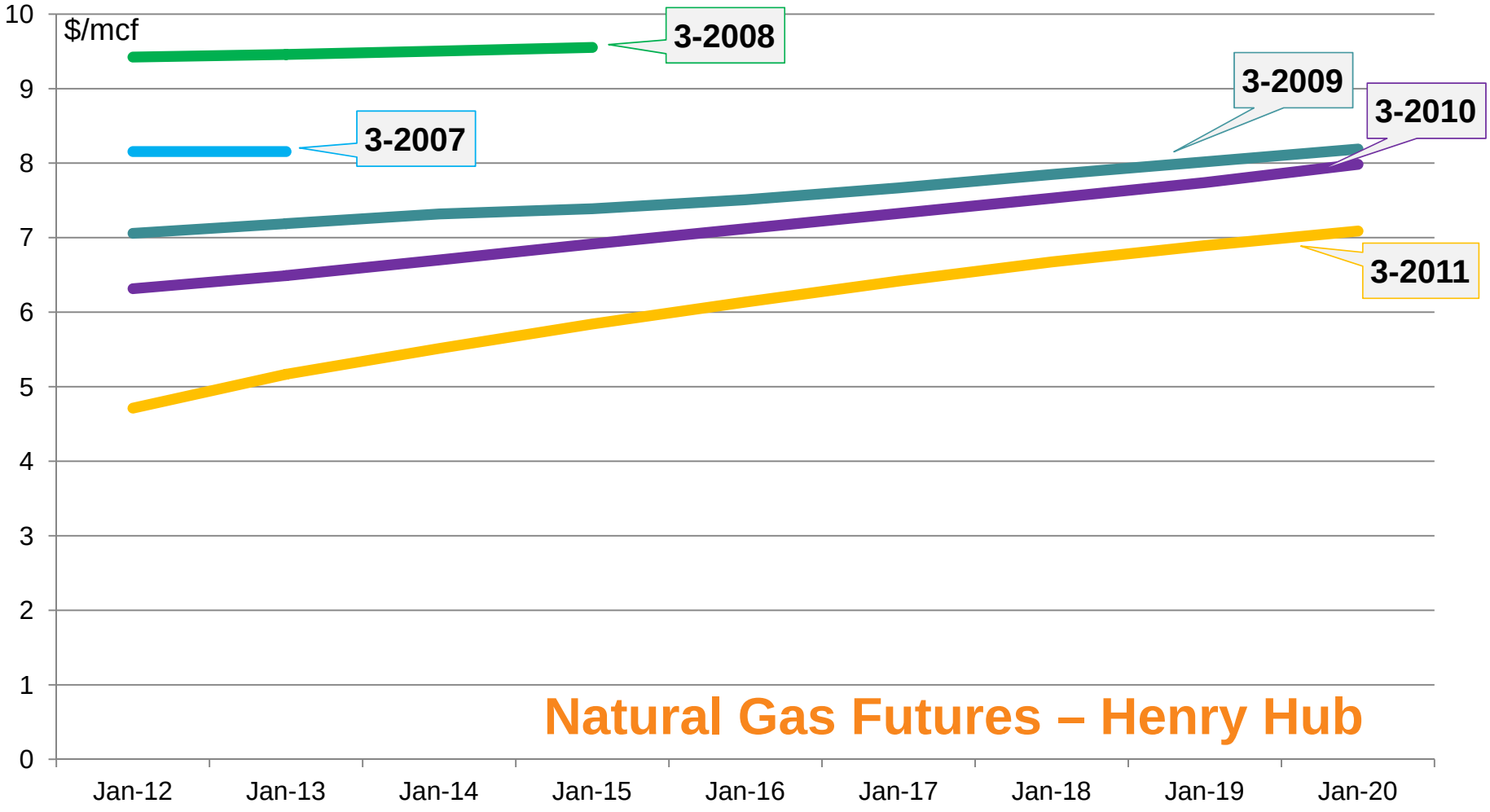
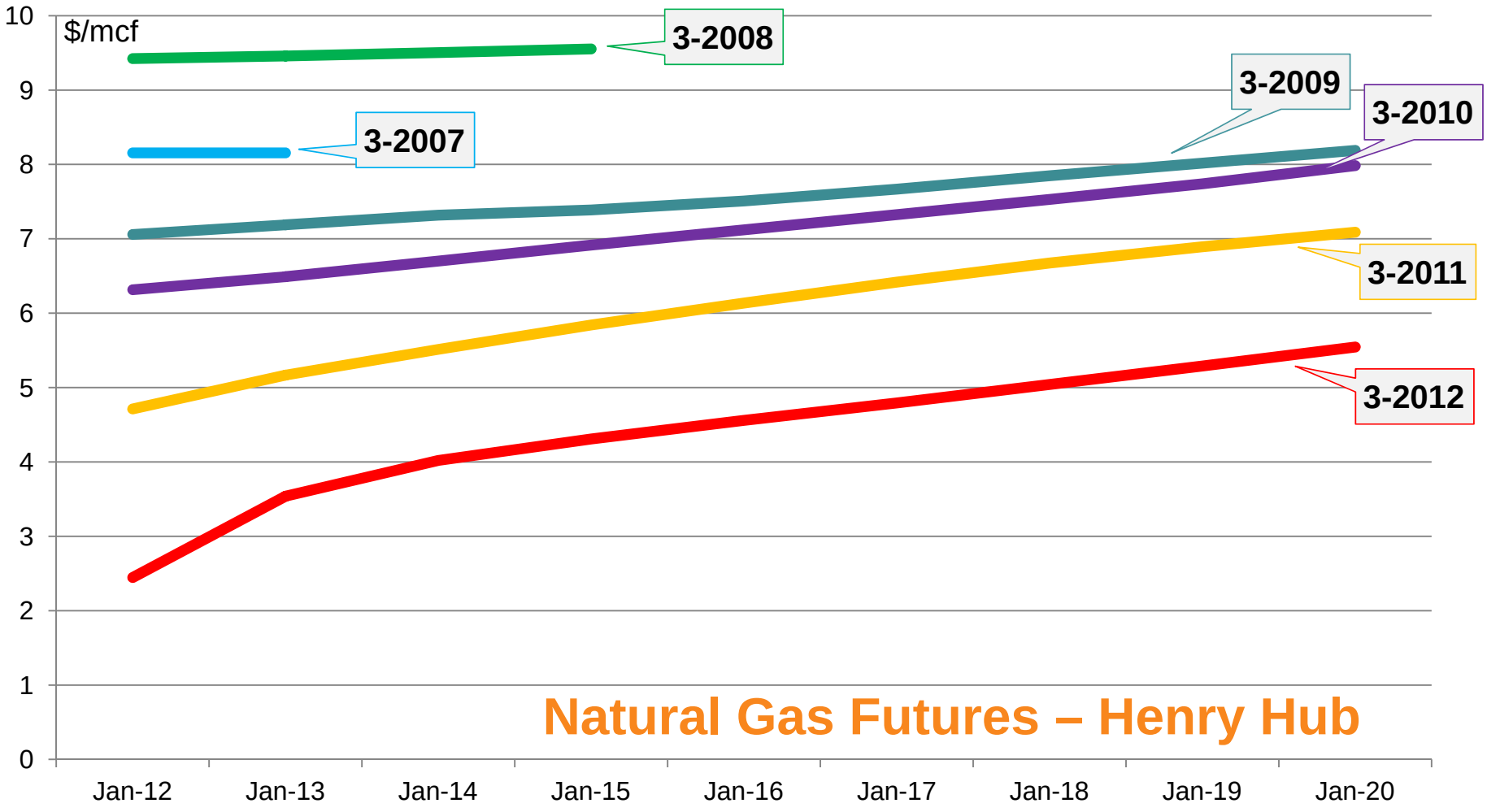
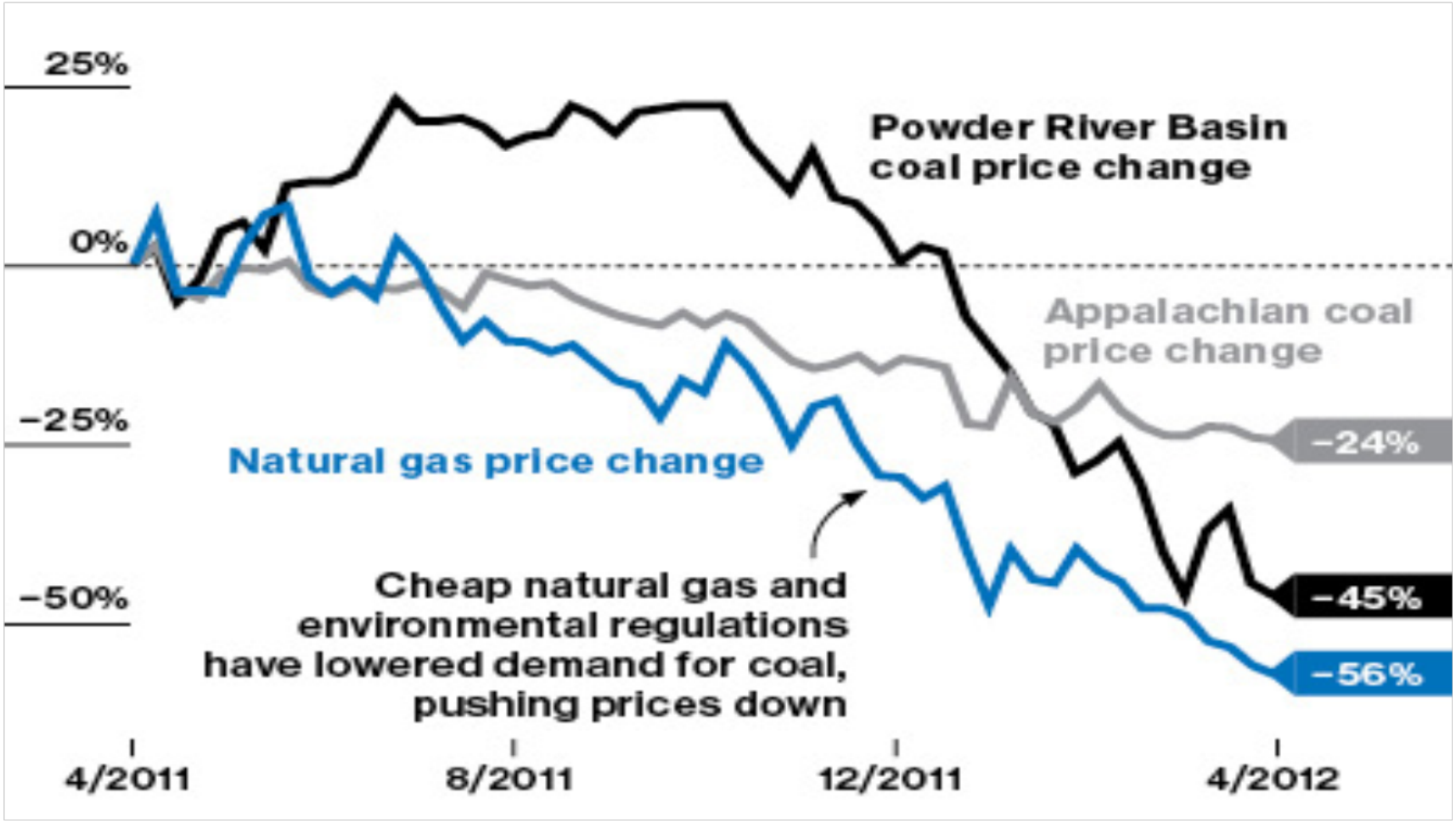


# Price outlook for natural gas

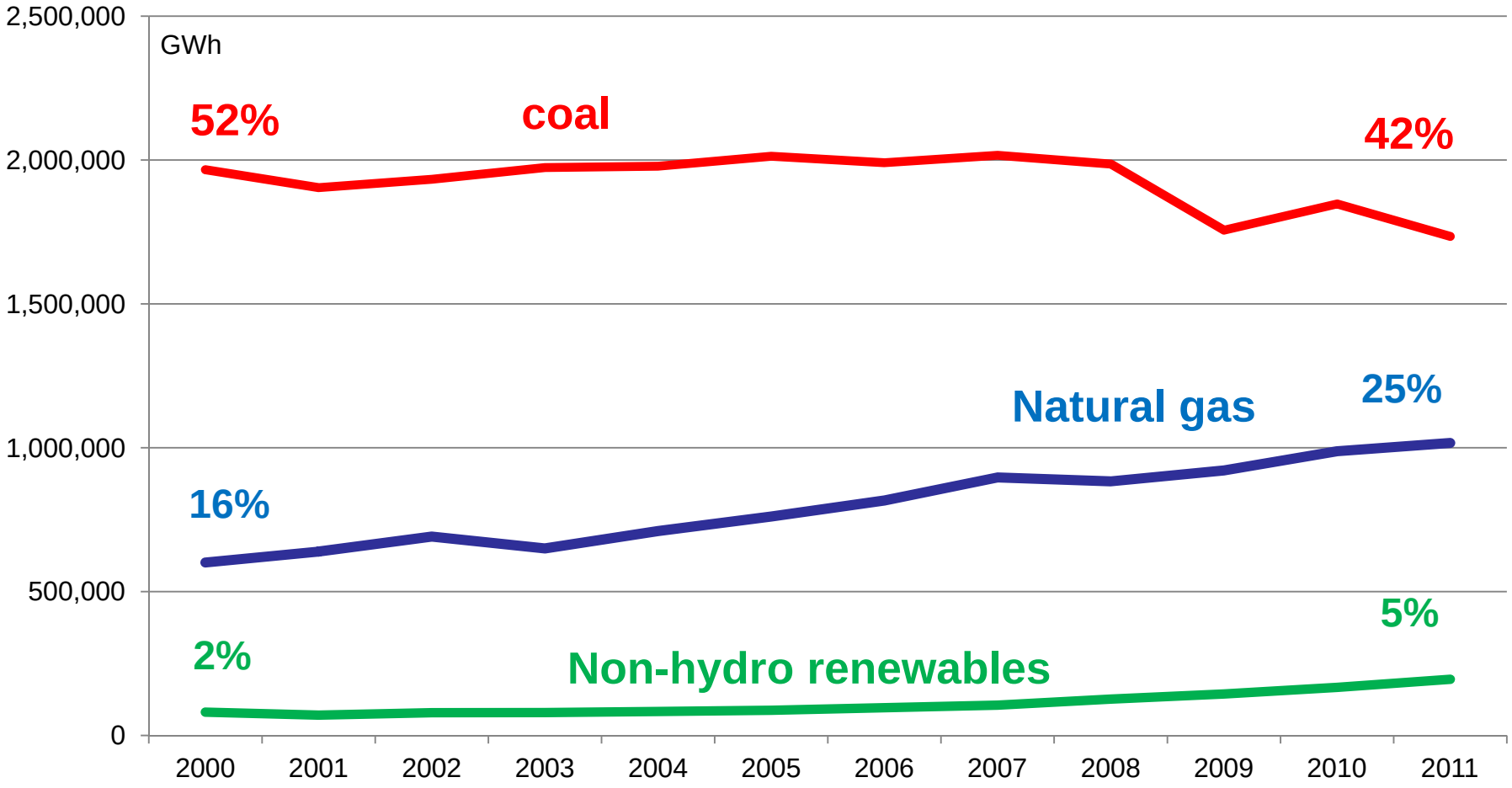


# Gas price pressure on coal (in the last year)



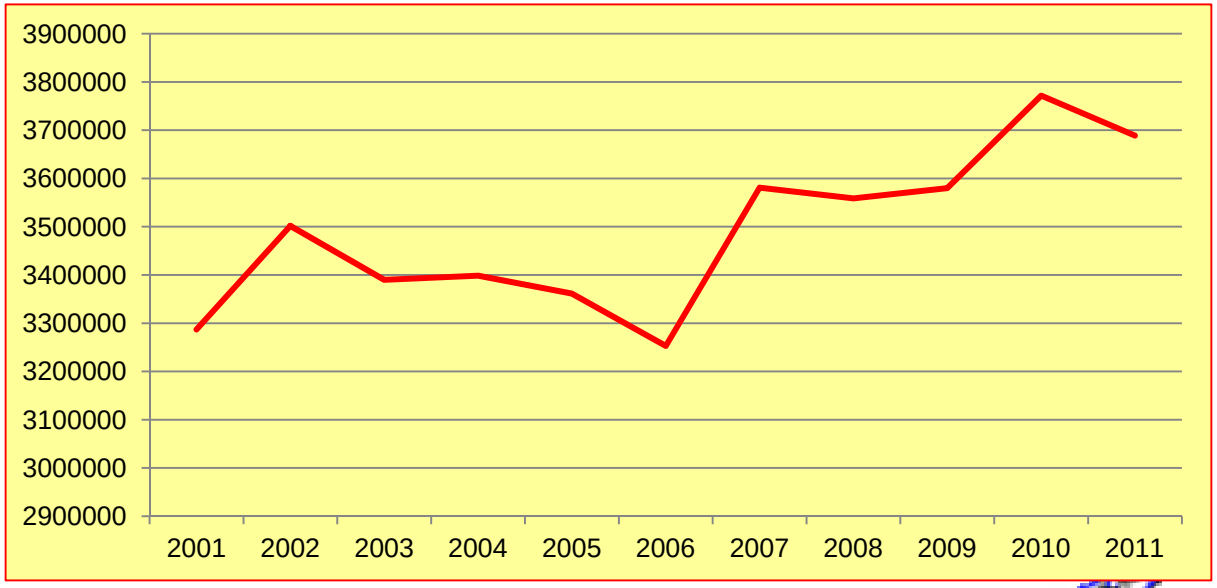

Bloomberg Business Week, http://www.businessweek.com/articles/2012-04-26/coals-future-is-rocky-at-best; data from the New York Mercantile Exchange and the Intercontinental Exchange

# US Generation Output: coal, natural gas, renewables (2000-2011)



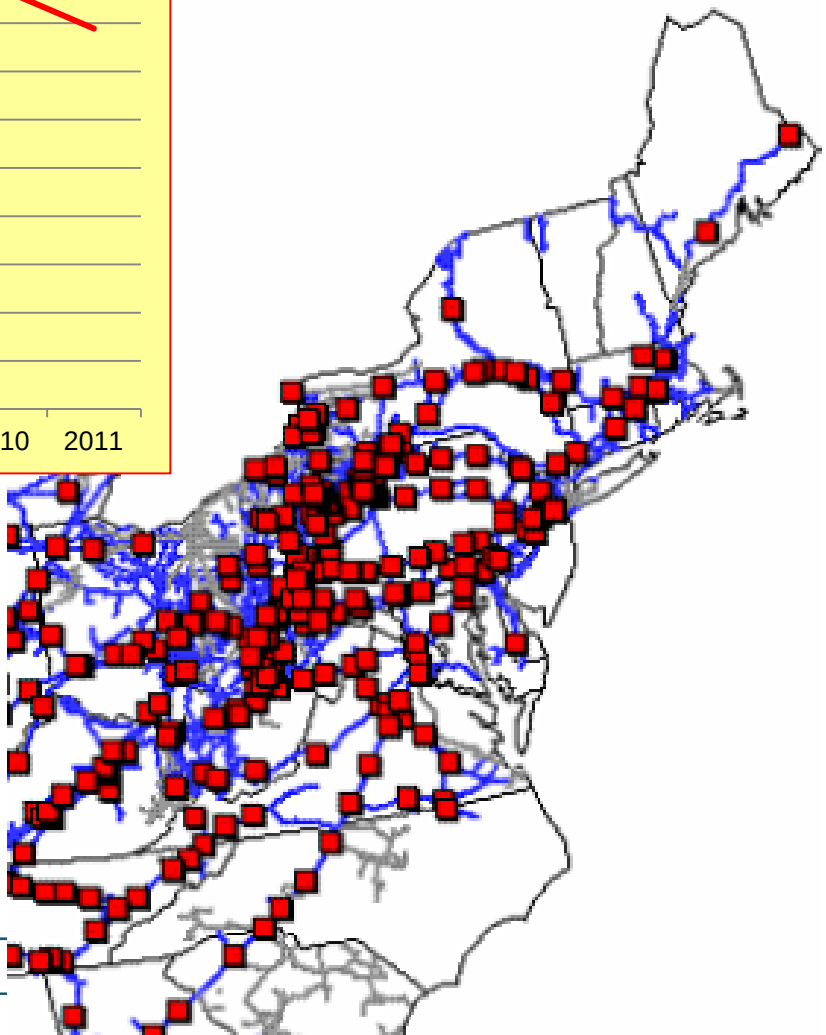

EIA data

# Significant gas consumption (OTR)



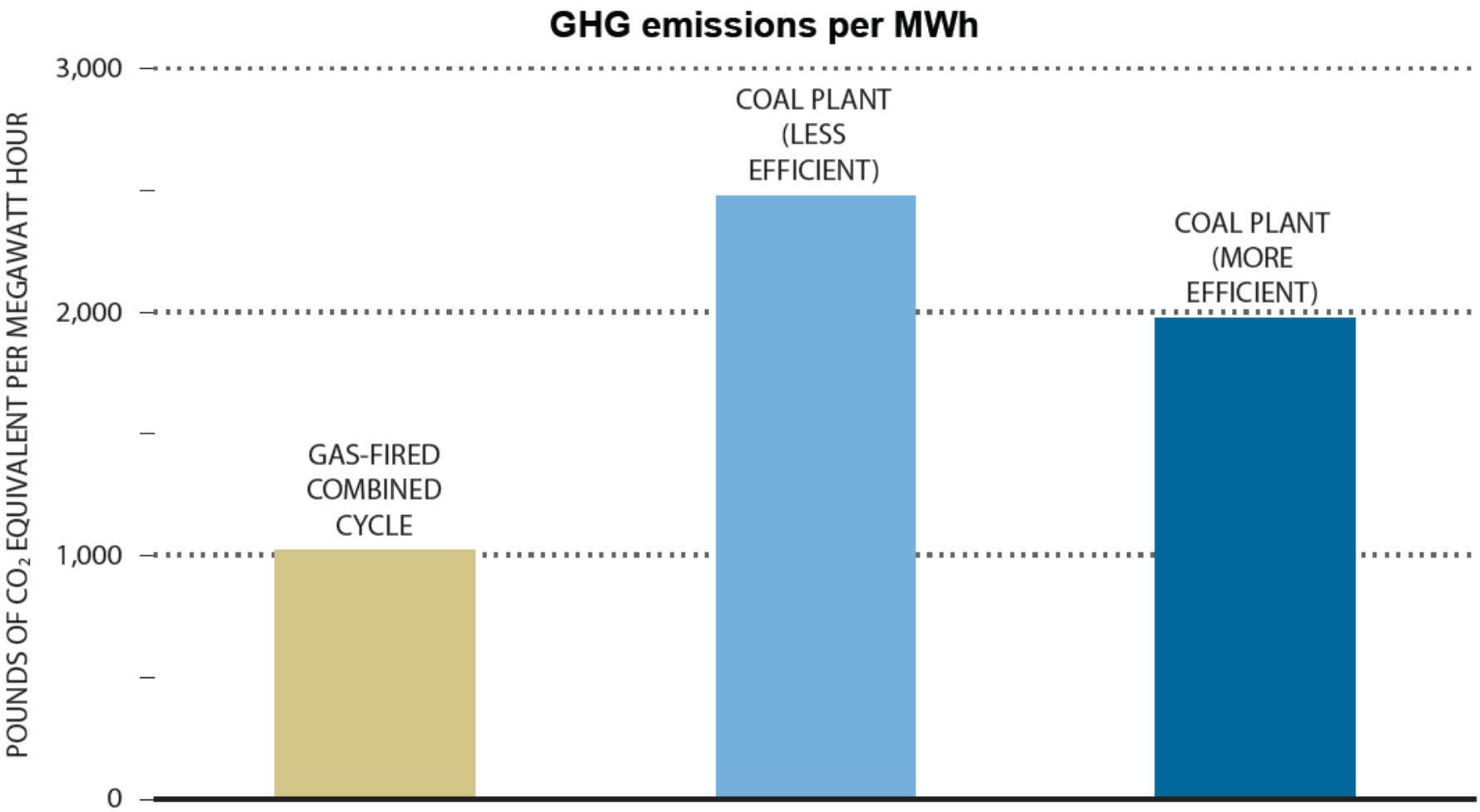

EIA, data for OTC states not including VA

# The interstate pipeline system (and compressor stations)

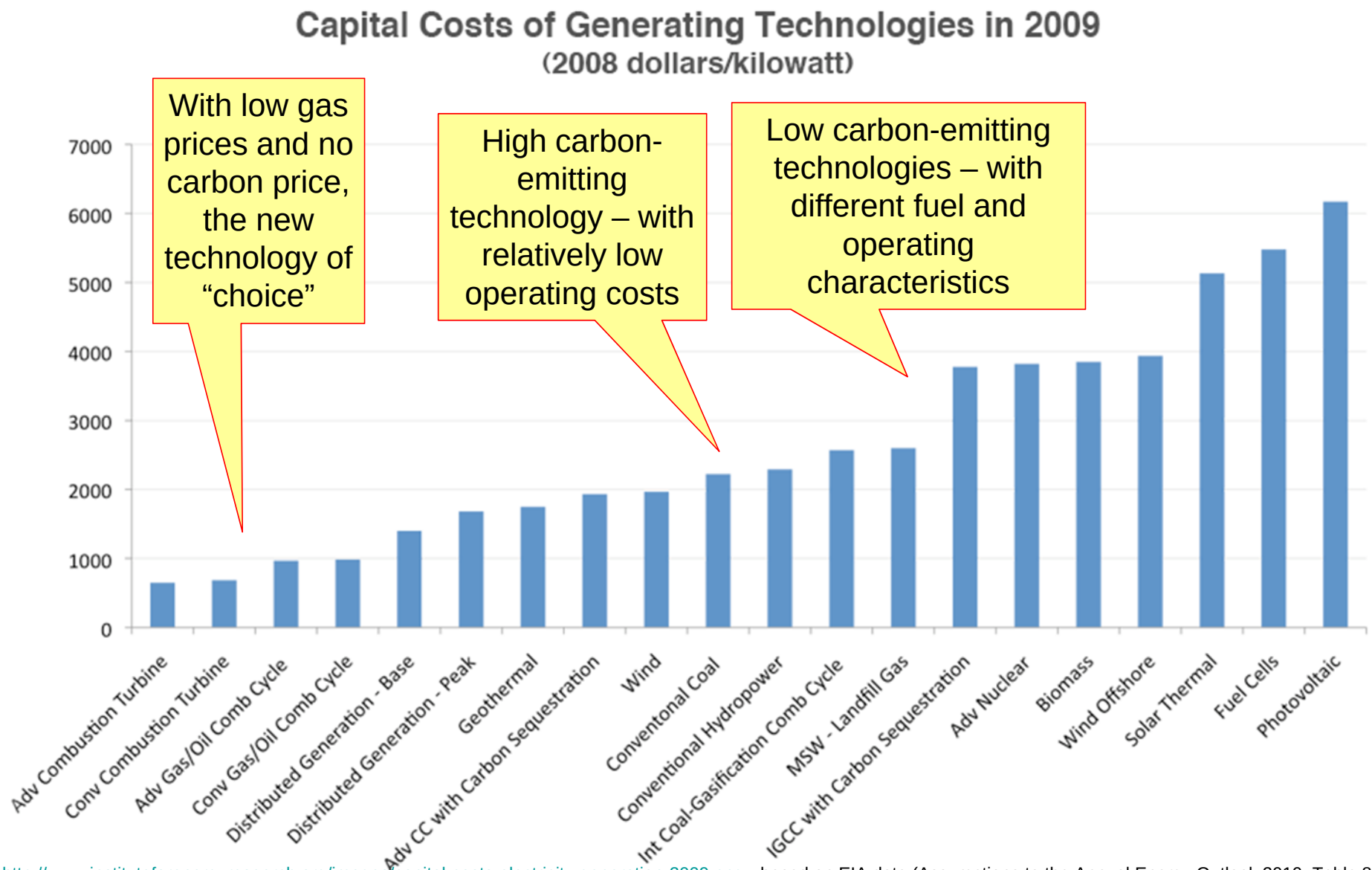


Source: EIA

# Relative GHG per MWh at the stack: natural gas v. coal




NPC, Prudent Development, 2011

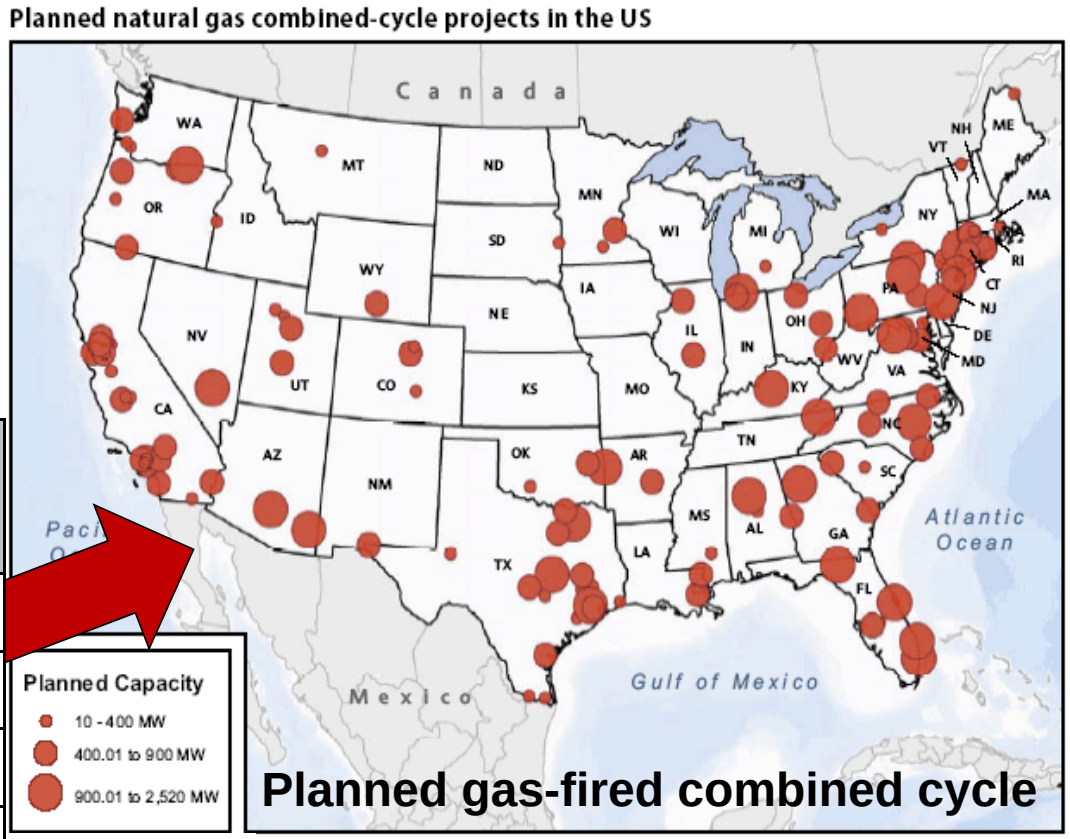



http://www.instituteforenergyresearch.org/images/capital-costs-electricity-generation-2009.png - based on EIA data (Assumptions to the Annual Energy Outlook 2010, Table 8.2

# New gas plants are relatively economical investments

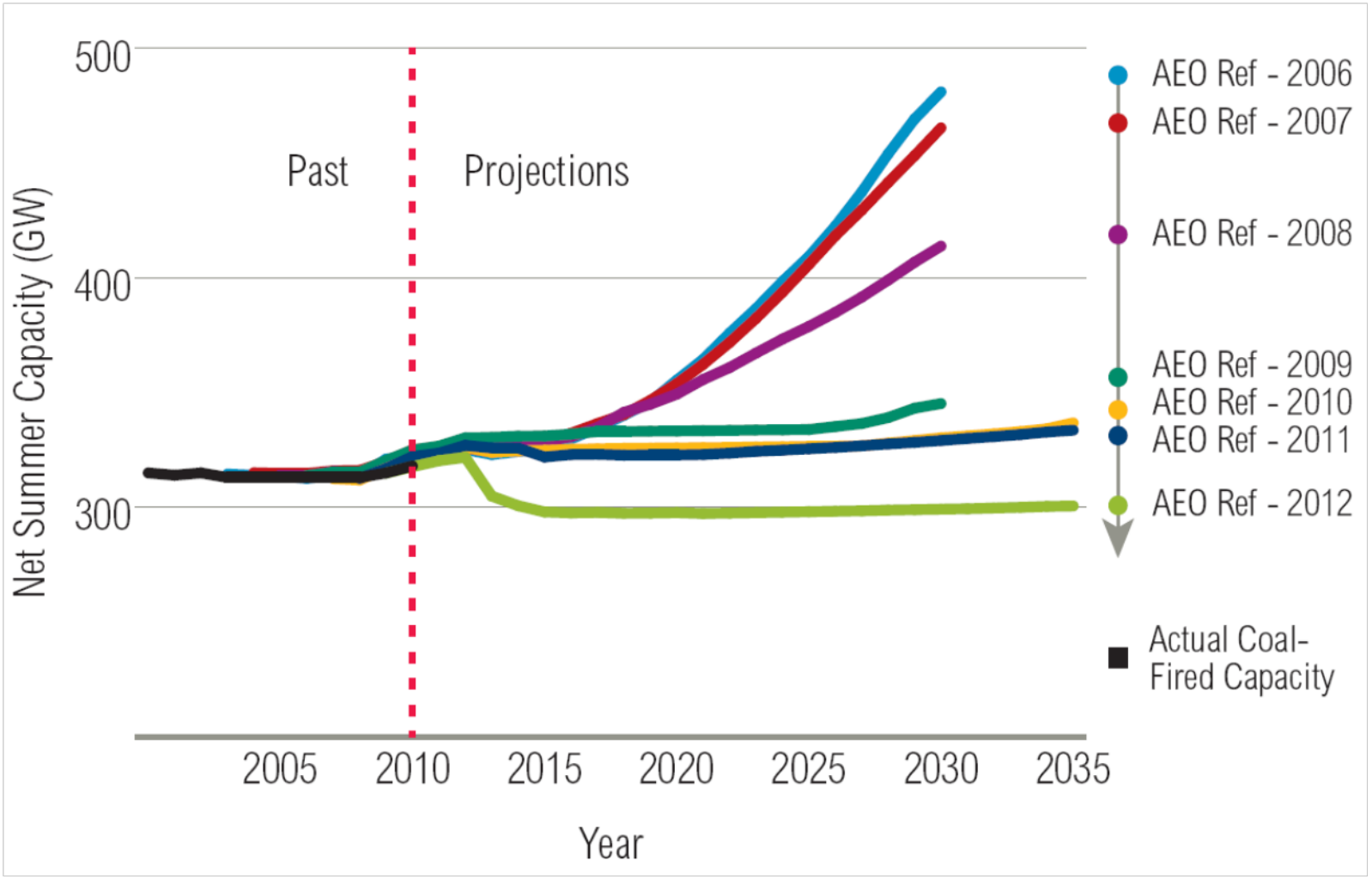
Gas-fired combined cycle and peaking plants are the fuel/ technology of choice for new plants (except renewables)

| | Under Const. (GW) | Adv'd Dev (GW) | Annc'd (GW) | Total (GW) |
|---|---|---|---|---|
| 2012 | 5.2 | 0.2 | 2.1 | 7.5 |
| 2013 | 7.4 | 0.6 | 4.8 | 12.8 |
| 2014 | 2.0 | 3.5 | 7.2 | 12.7 |
| 2015 | 0.0 | 4.0 | 12.3 | 16.3 |
| 2016+ | 0.7 | 2.8 | 29.5 | 33.0 |



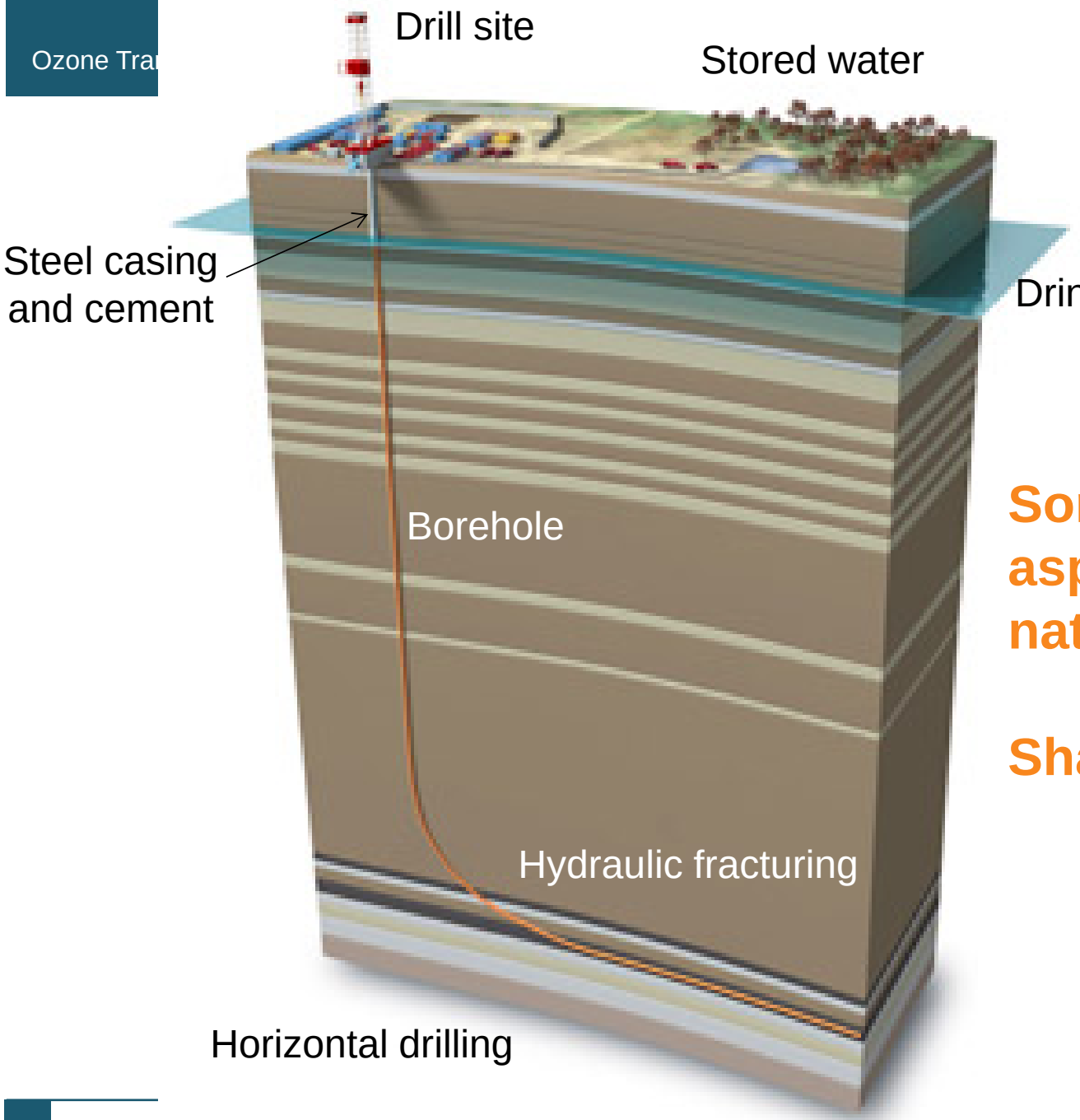

SNL Energy (data as of 3-2012)

# Past and projected coal-fired generating capacity






Source: James Bradbury, "U.S. Electricity Markets Increasingly Favor Alternatives to Coal," WRI, 2012, based on EIA Annual Energy ("AEO") Outlooks

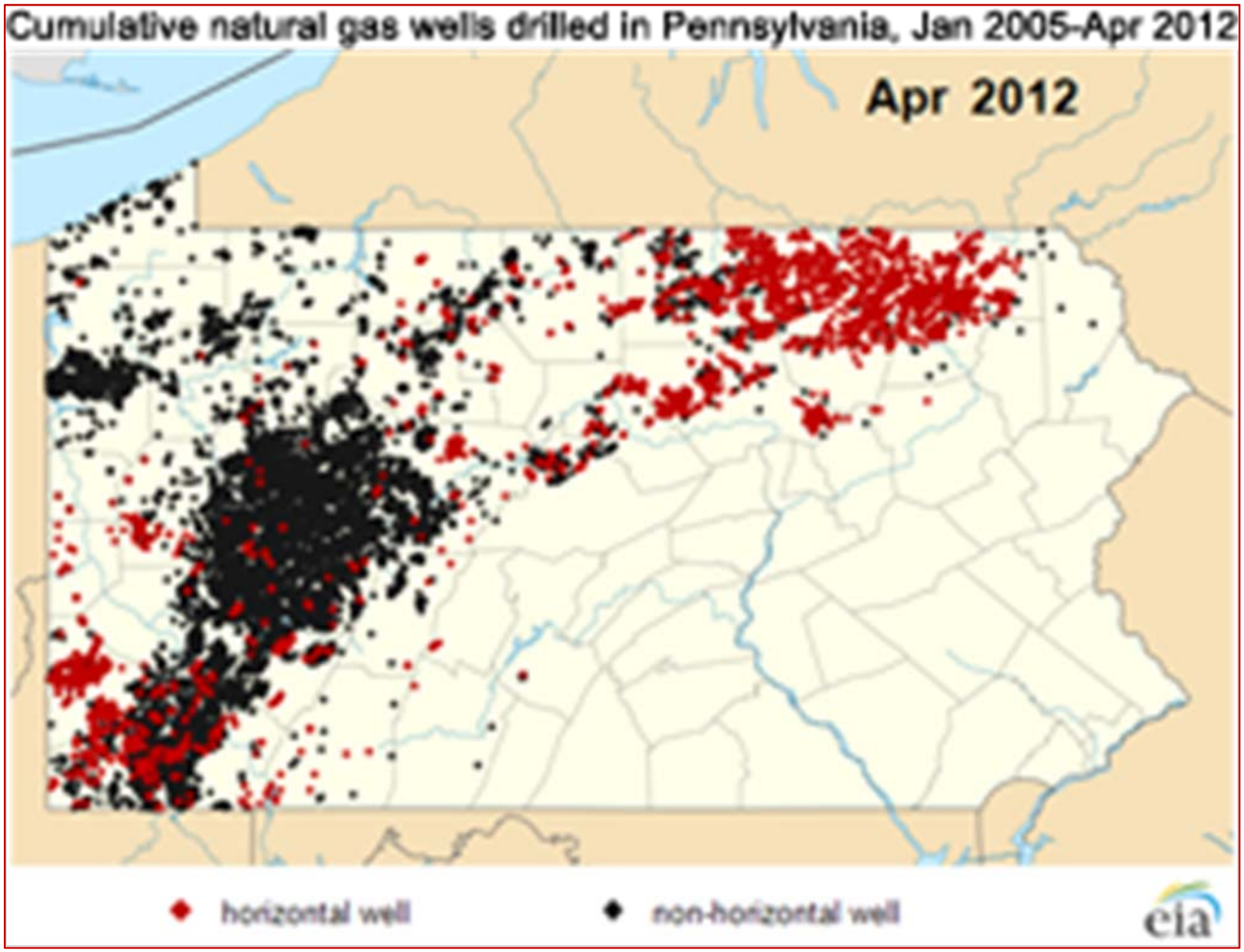



**Some other aspects of the natural gas issues:**

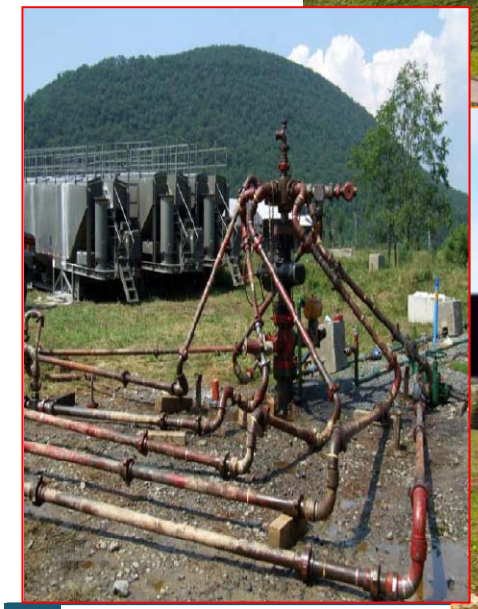
**Shale gas profile**

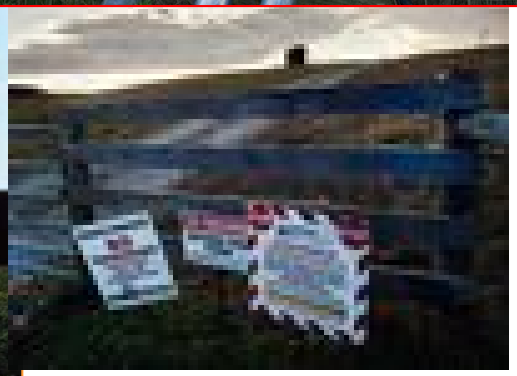
http://news.nationalgeographic.com/news/energy/2010/10/101022-energy-marcellus-shale-gas-rush/

# The development footprint in Pennsylvania: in 7 years



# Sources of potential push-back on development







http://news.nationalgeographic.com/news/2010/10/photogalleries/101022-energy-shale-gas-drilling-pictures/#/energy-marcellus-shale-environment03-hallowich-dinner_27065_600x450.jpg

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# Shale gas development: "environmental urgency

## Areas of concern (Sec. of Energy Adv Bd Report)

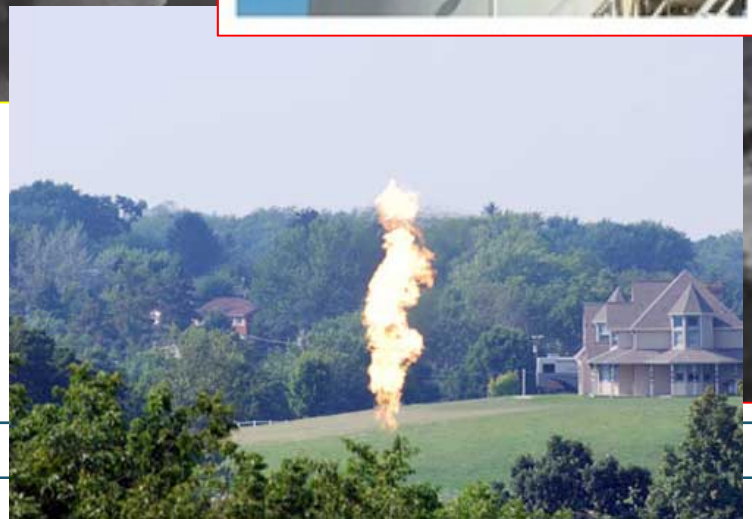
- **Water – possible pollution of drinking water (methane, chemicals), water consumption, disposition/management of used water**
- **Air pollution – GHG (methane), VOCs/ozone precursors**
- **Community disruption**
- **Preservation of unique/sensitive areas**
- **Cumulative adverse impacts (traffic, noise, visual, odors, land-use intensity) on communities, ecosystems, wildlife**

Sec of Energy Advisory Board, Shale Gas Production, 90-Day Report, August, 2001:
Phil Nguyen, Regulatory Options and Challenges in Hydraulic Fracturing, WISE, 2010

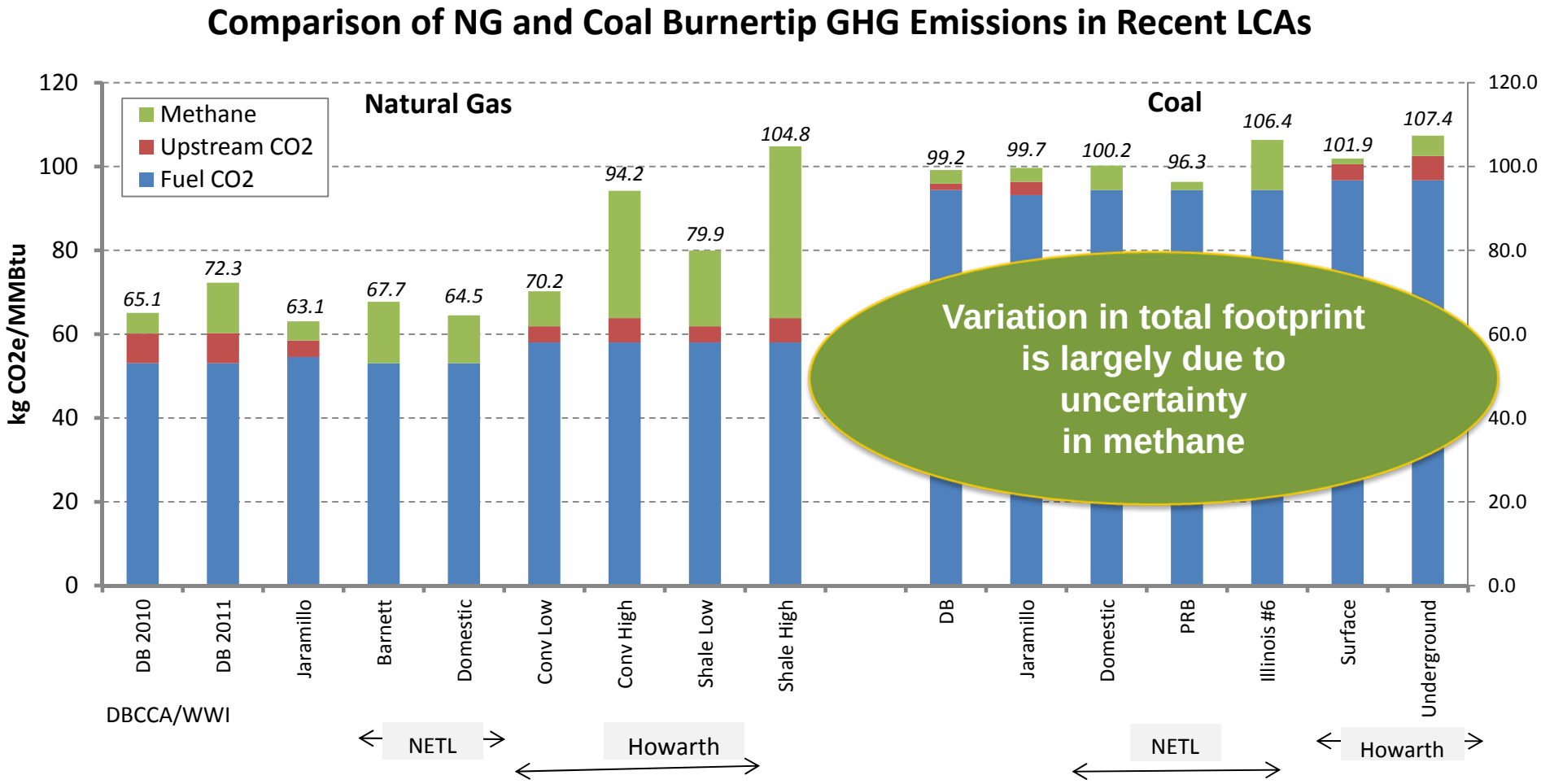
# What if gas' life-cycle emissions are worse that we know?

* On a full fuel life cycle basis



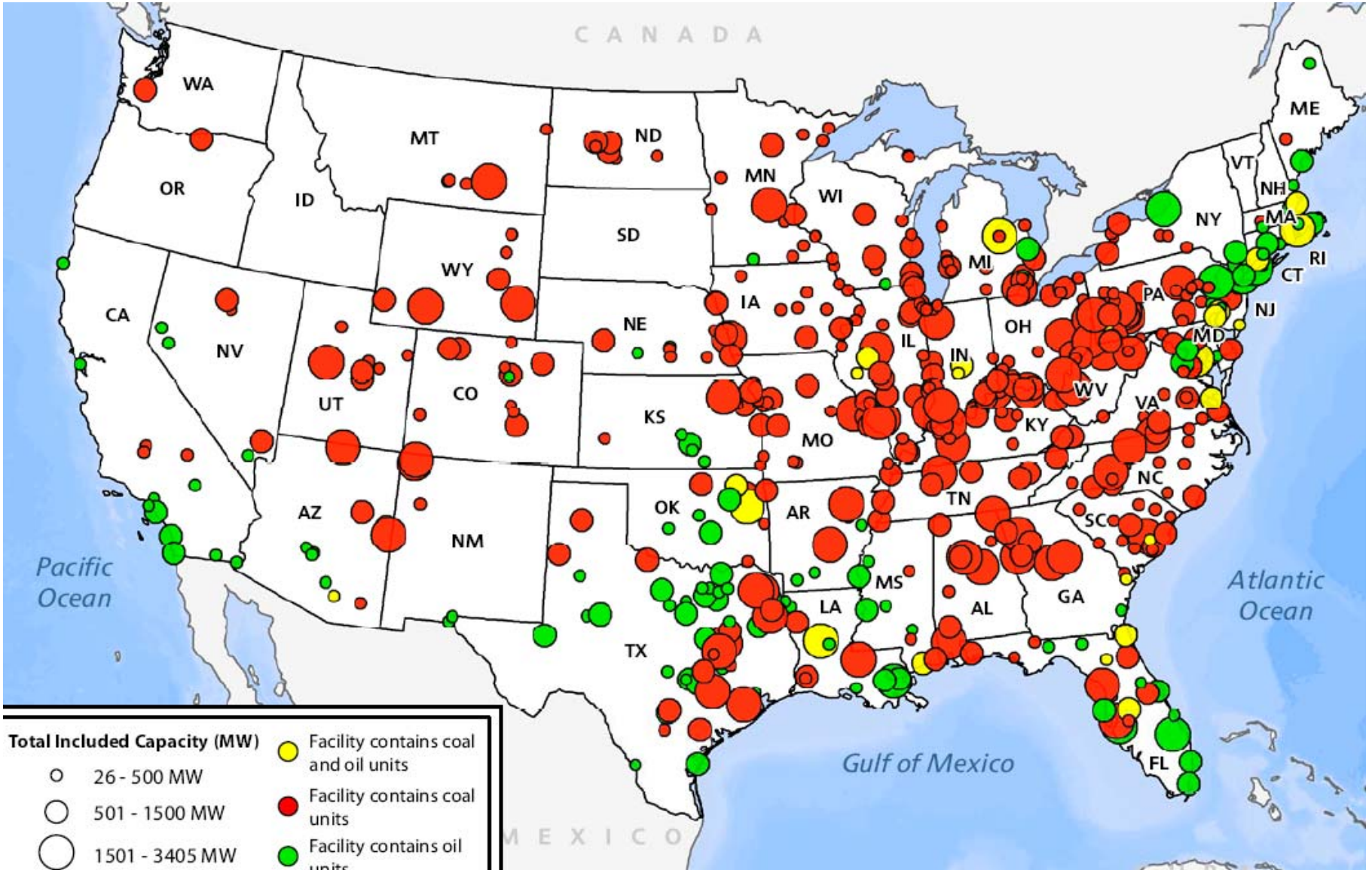



# Lower GHG reductions depend on addressing methane emissions from gas….




Source: Armond Cohen, Clean Air Task Force, "Natural Gas and Climate Bridge, Highway, or Destination?" EUEC presentation, 1-30-2012

# Turning to coal: Power plants affected by EPA MATS Rule



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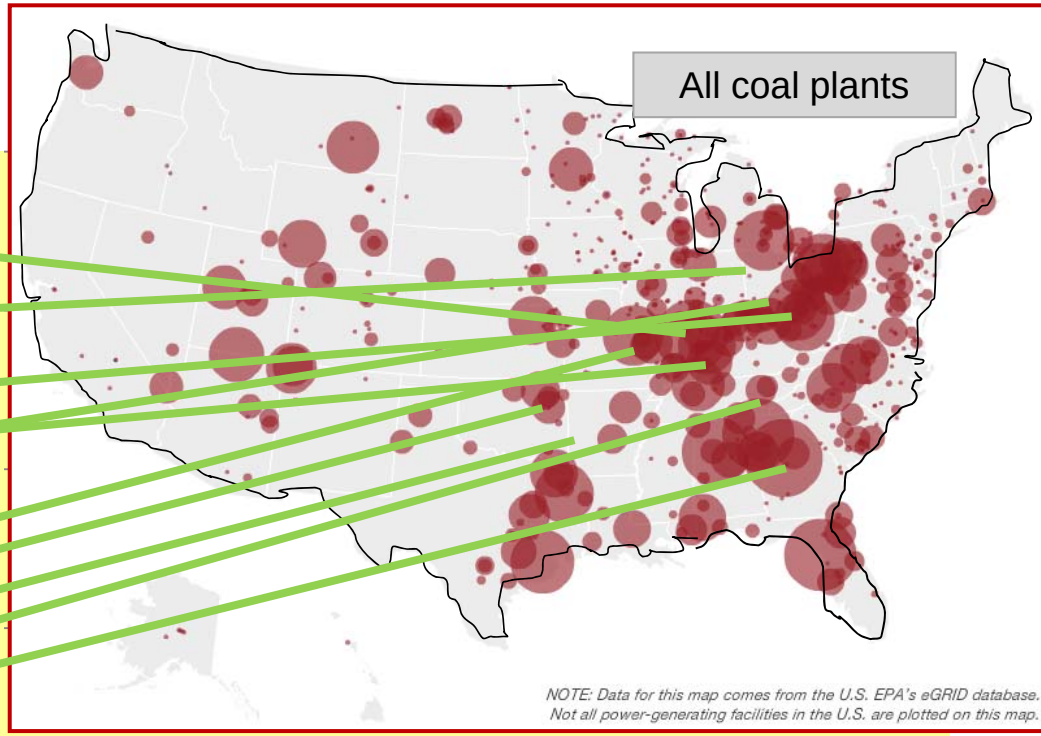
# Current coal plant capacity: Without emission controls







Notes:
[1] Totals do not include Alaska or Hawaii.
[2] Units without emissions are those units without SCR or FGD systems.

Source: SNL data.

# Coal plant retirement announcements to date

## The starting point is approximately 320 GW of coal:

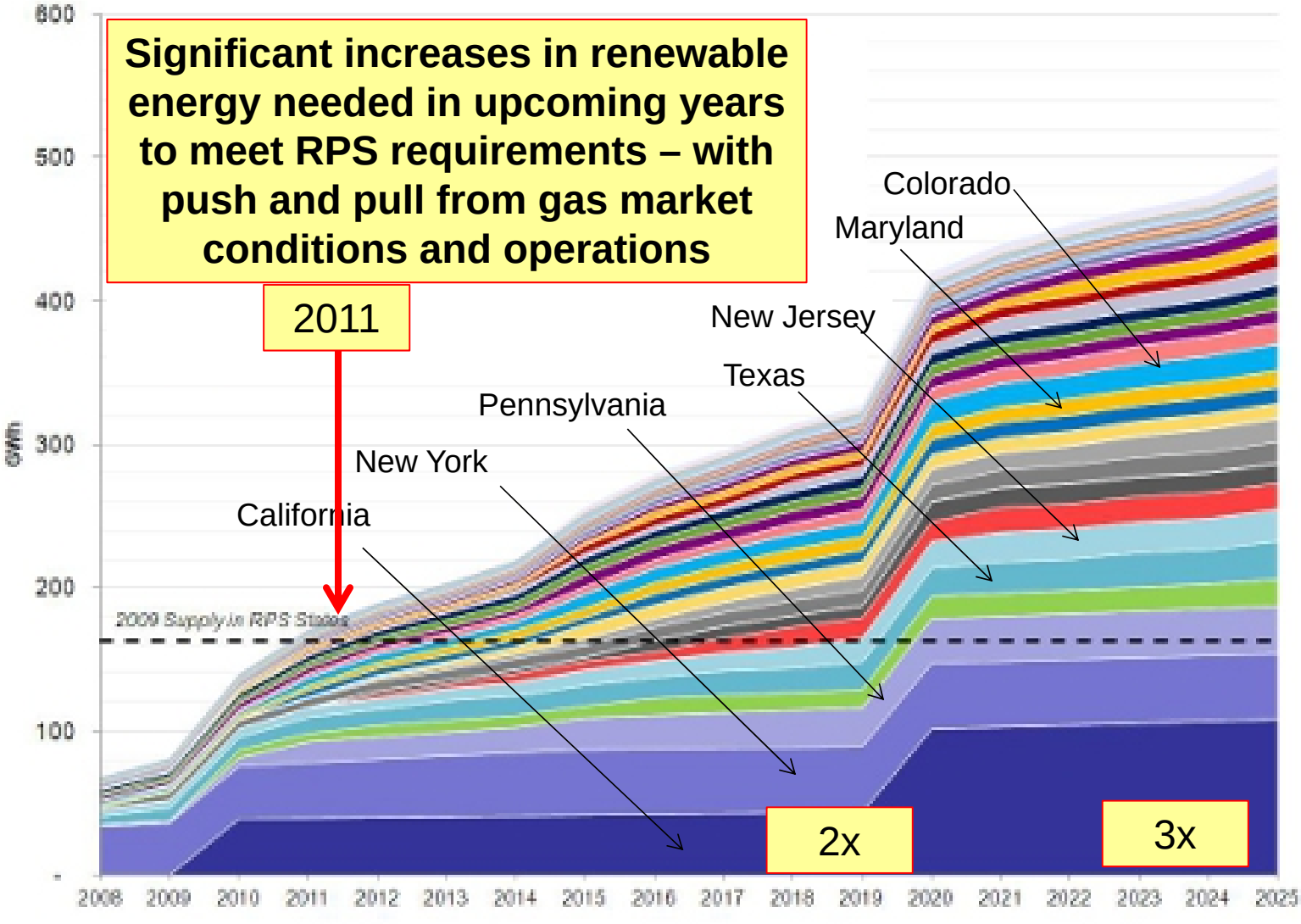
| Date of Tracking of Announced Retirements | Coal Unit Retirements Expected to Occur in the Following Time Period (GW) | | | | |
|---|---|---|---|---|---|
| | 2011 | 2011-2012 cumulative | 2011-2013 cumulative | 2011-2014 cumulative | 2011-2015 cumulative |
| **June 2011** | **3.4 (estimated)** | **6.1** | **8.7** | **17.2** | **20.0** |
| **March 2012** | **4.0 (actual)** | **10.9** | **12.8** | **17.4** | **25.0** |

Source: SNL Financial database of coal unit retirements.

# Turning to renewables

- Cost / Competitiveness of renewables in a world of low gas prices and federal budget deficits
- Challenges with transmission to join resources with markets
- Scaling up to tap sufficient renewables to meet GHG reduction targets

# Gas will be needed even more as renewables ramp up






http://www.emerging-energy.com/content/press-details/State-RPS-Policies-Will-Drive-250-Increase-in-Renewable-Energy-Generation-by-2025/32.aspx

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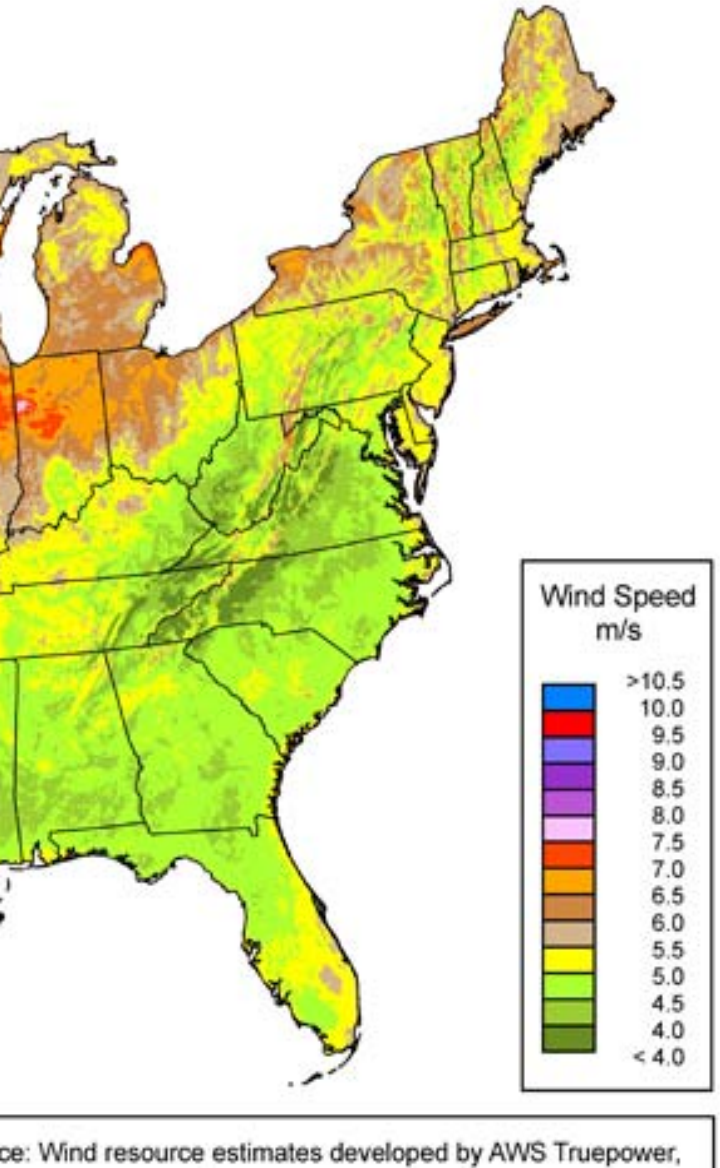
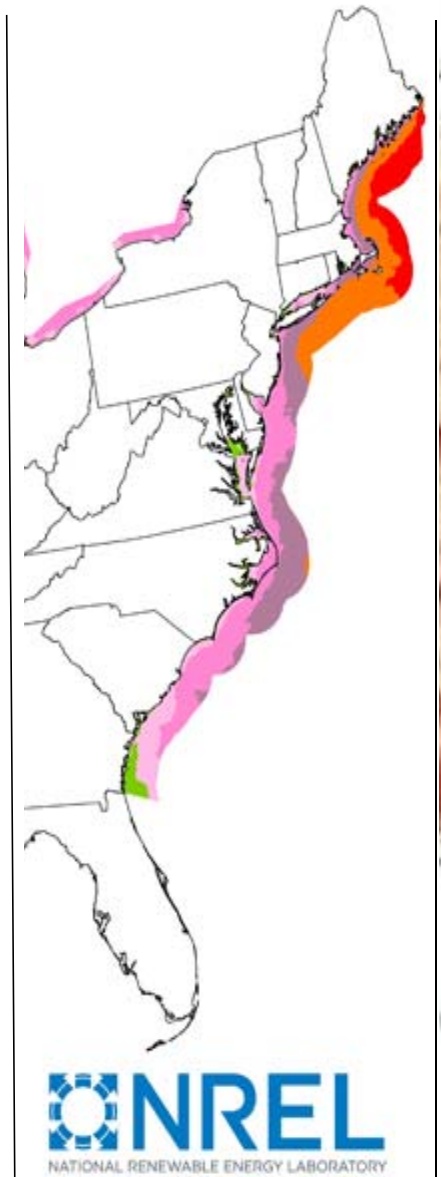
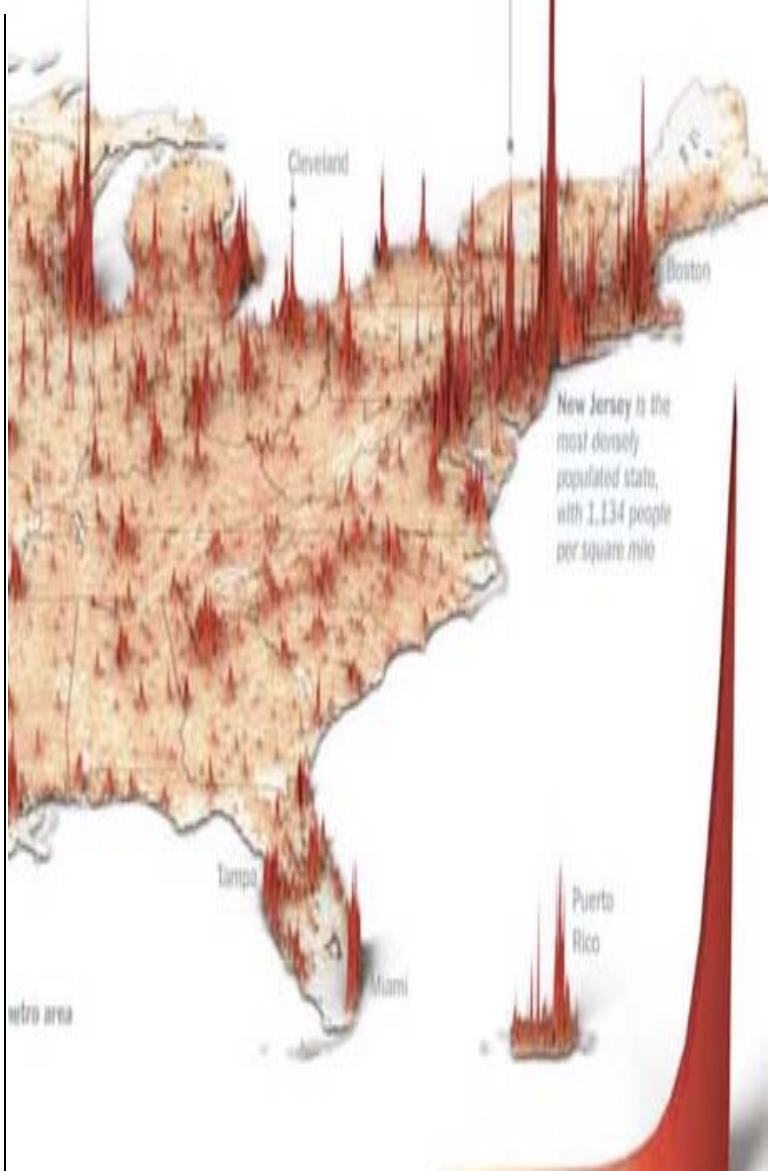
# Northeast/Mid/Atlantic wind resources and load centers



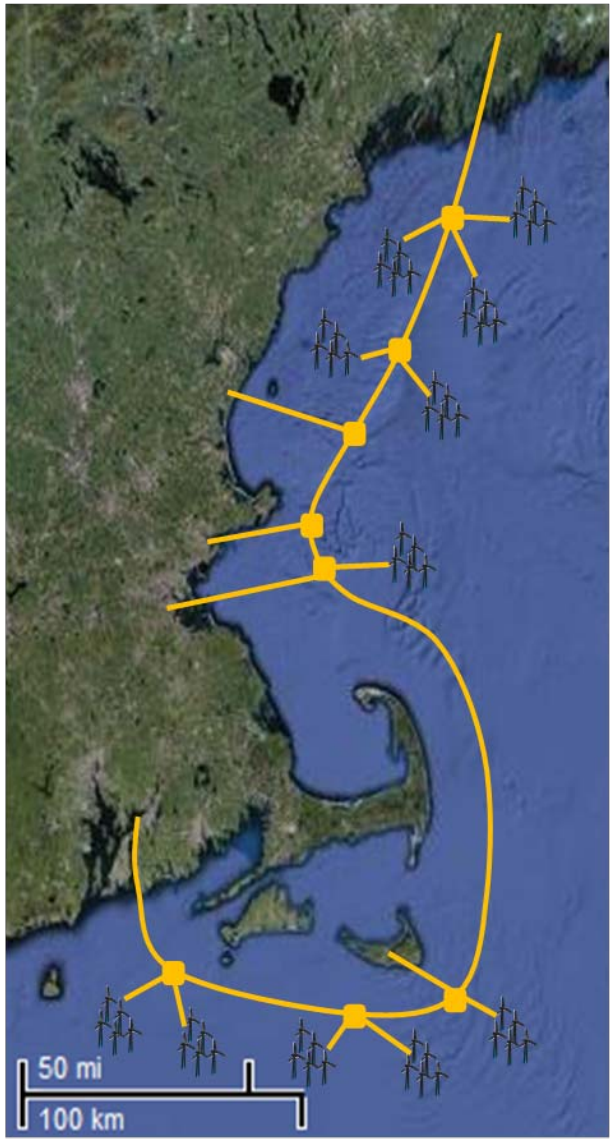

ce: Wind resource estimates developed by AWS Truepower,



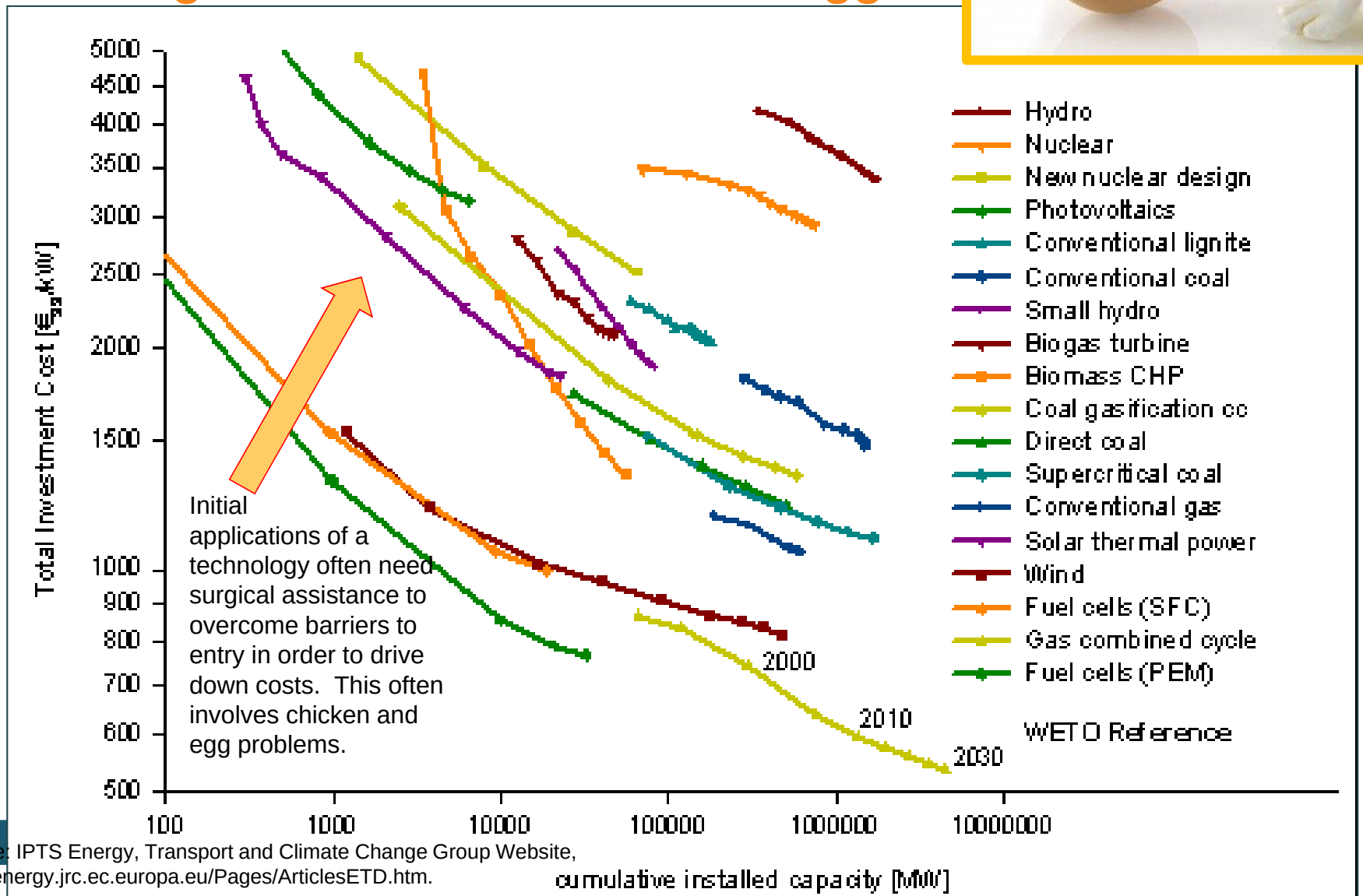
NREL
NATIONAL RENEWABLE ENERGY LABORATORY



# Connecting offshore wind to the grid

# Bringing down the cost
# Learning curves and chicken and eggs




Source: IPTS Energy, Transport and Climate Change Group Website, http://energy.jrc.ec.europa.eu/Pages/ArticlesETD.htm.

# Getting more economic productivity out of energy

- **Energy efficiency –**
  - increasing usefulness out of energy consumptions
- **Implications**
  - States with big opportunities
  - The multiplier benefits of energy efficiency (RGGI)

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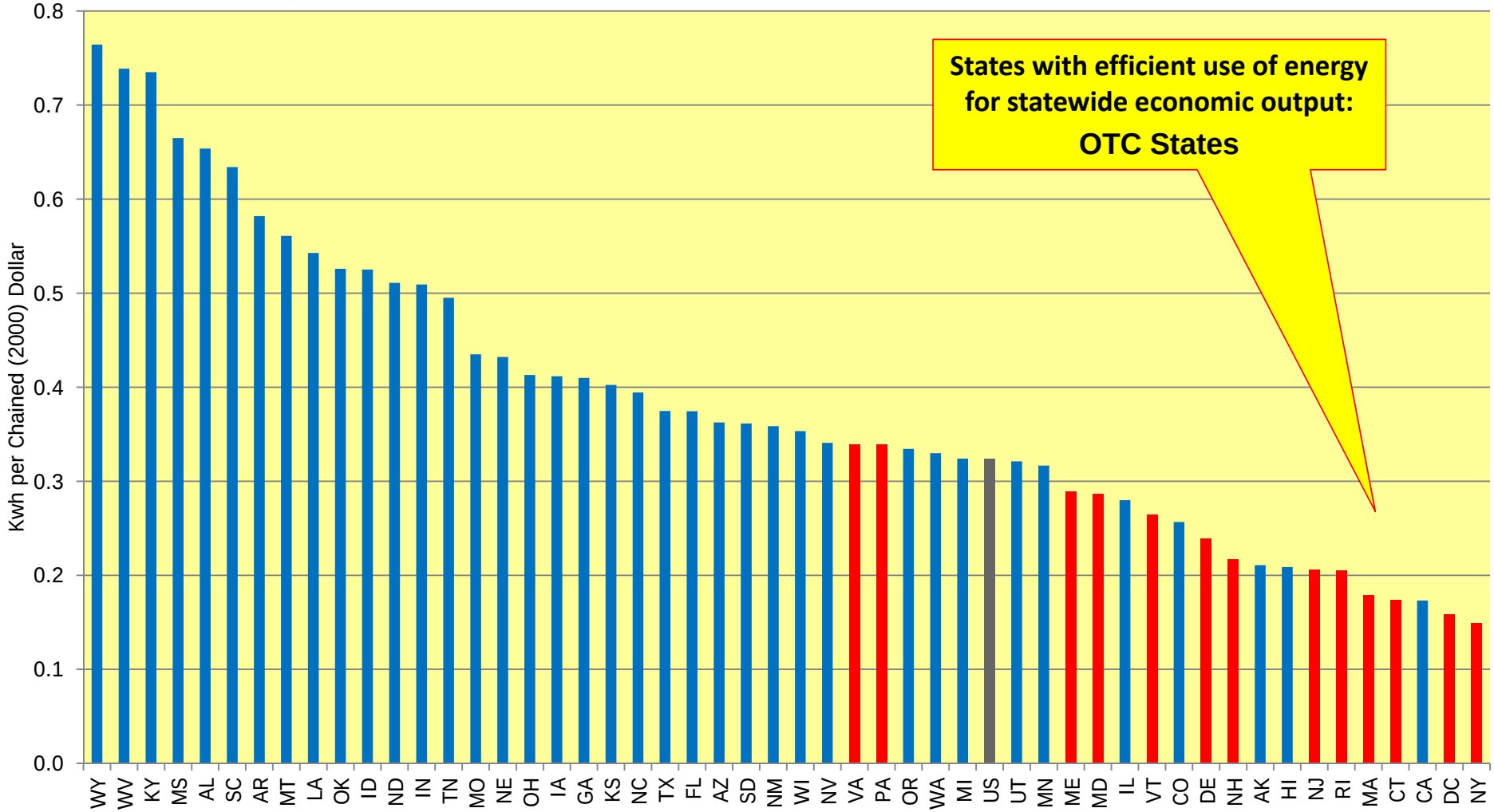
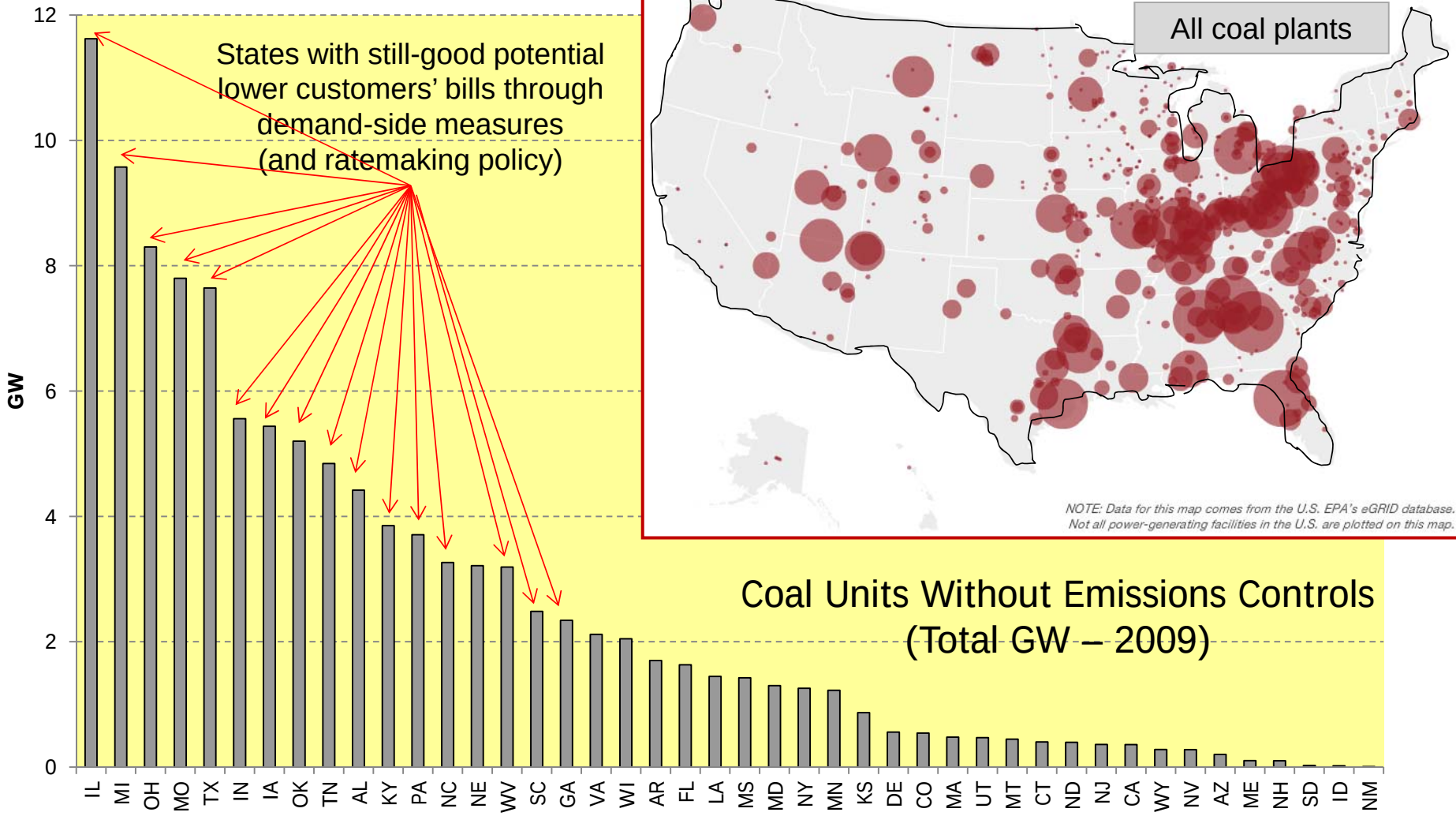
# Comparison of States: Electricity per Dollar of Gross State Product



# Once again: Coal plant capacity (no emission controls)

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Source: SNL data.

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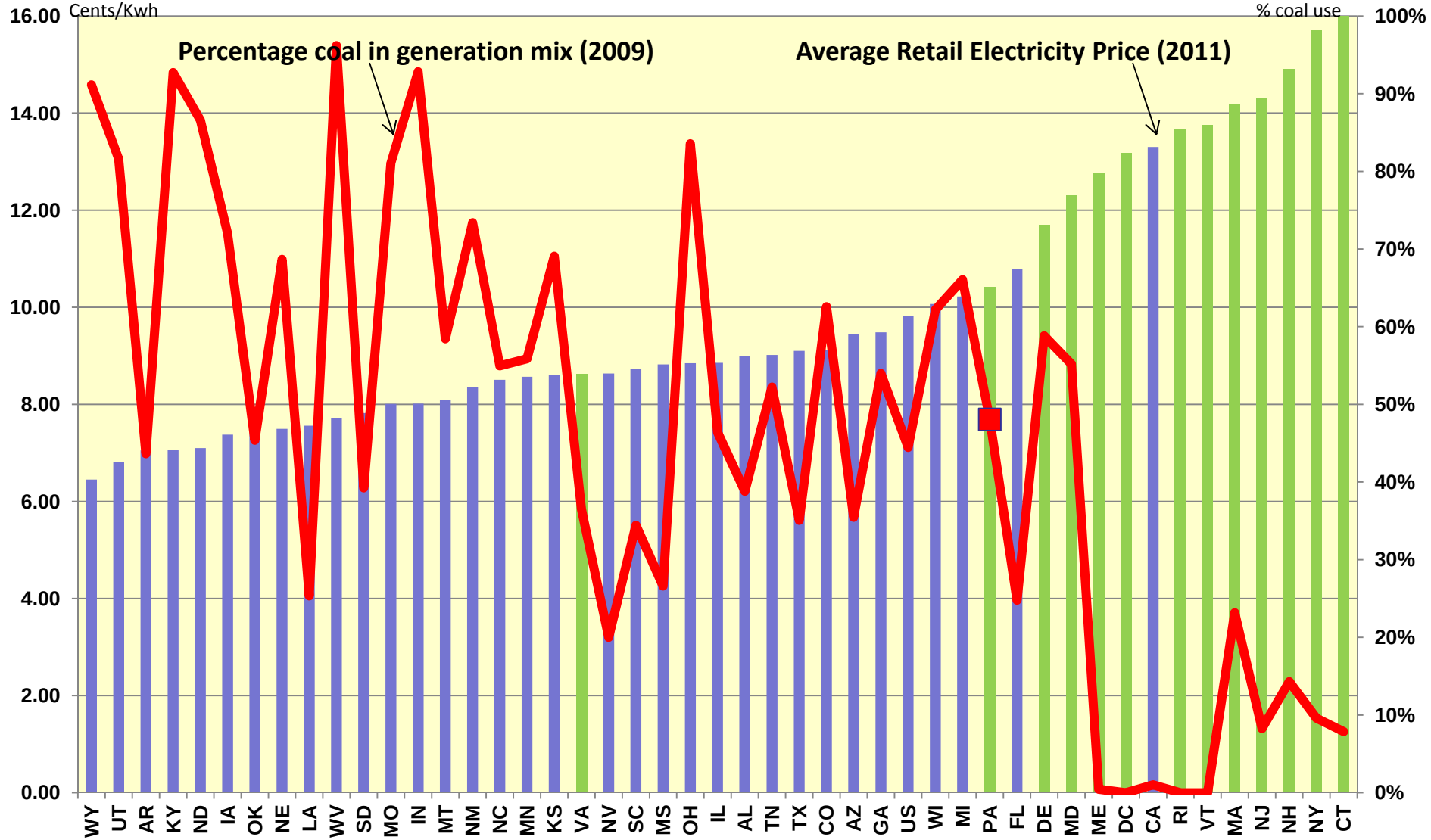
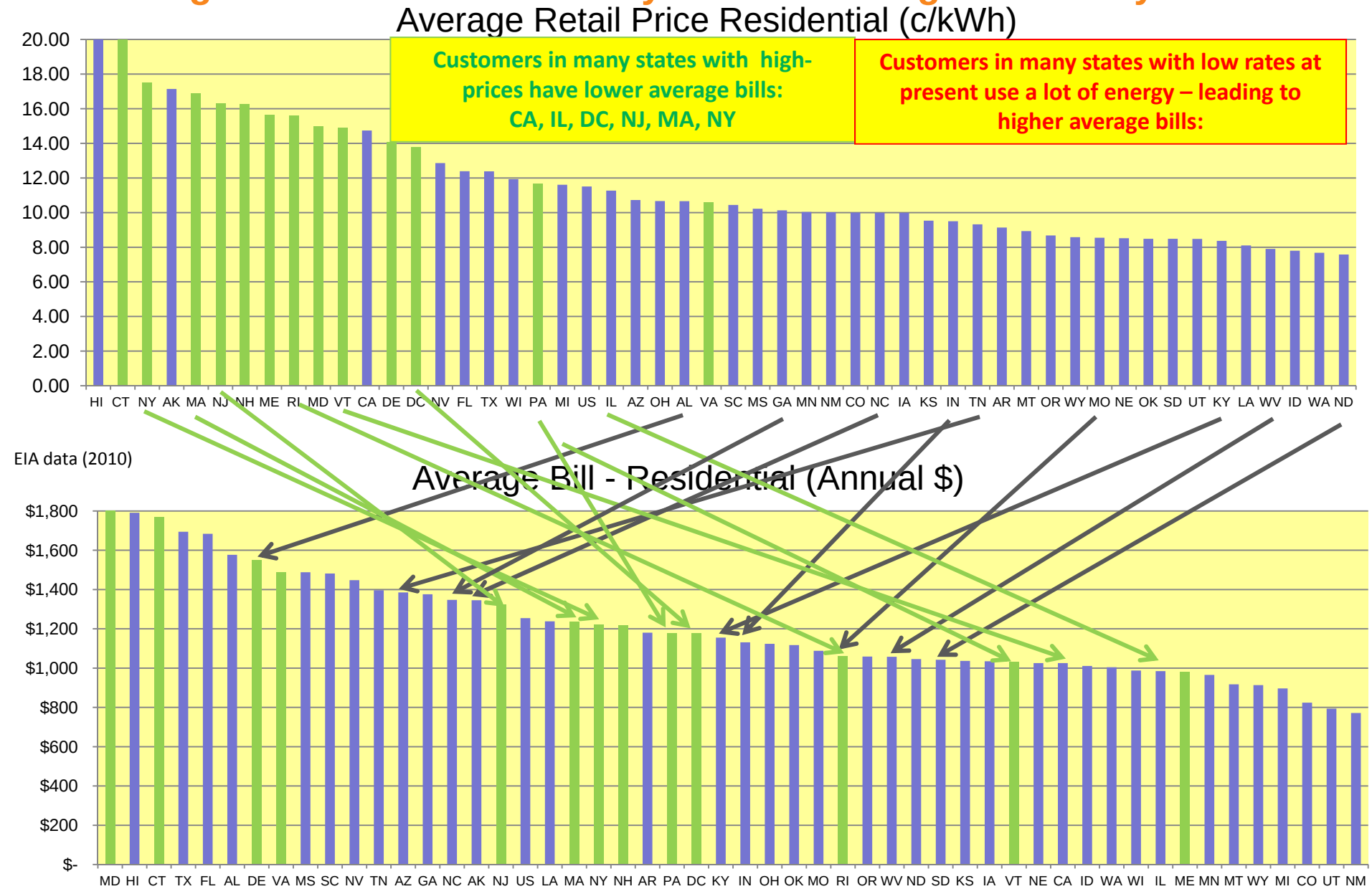
# Comparison of States' Reliance on Coal and Change in Retail Electricity Price






Source: Energy Information Administration data. The chart does not include two states (HI, AK) within the lower 48 , and removes 3 states in the Pacific Northwest (WA, OR, ID) that have ,ore than 80% of their generation produced at hydroelectric power plants.

# Average Unit Price of Electricity Versus Average Electricity Bill



# Study of the Economic Impacts of RGGI

## Foundation- Funded Study (11-2011):

- **Only requirement from the funders: independent, with full editorial control by Analysis Group team**
- **Team: Paul Hibbard, Sue Tierney, Andrea Okie, Pavel Darling**

## Electricity Journal Article (12-2011)

ANALYSIS GROUP

The Economic Impacts of the Regional Greenhouse Gas Initiative on Ten Northeast and Mid-Atlantic States

*Review of the Use of RGGI Auction Proceeds from the First Three-Year Compliance Period*

Paul J. Hibbard
Susan F. Tierney
Andrea M. Okie
Pavel G. Darling

November 15, 2011

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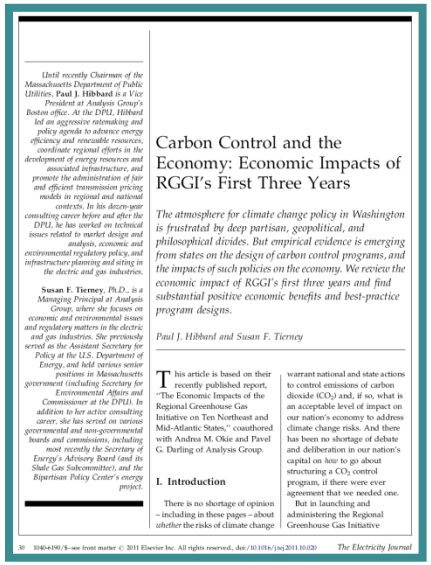


*Until recently Chairman of the Massachusetts Department of Public Utilities,* **Paul J. Hibbard** *is a Vice President at Analysis Group's Boston office. At the DPU, Hibbard led an aggressive ratemaking and policy agenda to advance energy efficiency and renewable resources, coordinate regional efforts in the development of energy resources and associated infrastructure, and promote the administration of fair and efficient transmission pricing models in regional and national contexts. In his dozen-year consulting career before and after the DPU, he has worked on technical issues related to market design and analysis, economic and environmental regulatory policy, and infrastructure planning and siting in the electric and gas industries.*

**Susan F. Tierney**, *Ph.D., is a Managing Principal at Analysis Group, where she focuses on economic and environmental issues and regulatory matters in the electric and gas industries. She previously served as the Assistant Secretary for Policy at the U.S. Department of Energy, and held various senior positions in Massachusetts government (including Secretary for Environmental Affairs and Commissioner at the DPU). In addition to her active consulting career, she has served on various governmental and non-governmental boards and commissions, including most recently the Secretary of Energy's Advisory Board (and its Shale Gas Subcommittee), and the Bipartisan Policy Center's energy project.*

Carbon Control and the Economy: Economic Impacts of RGGI's First Three Years

*The atmosphere for climate change policy in Washington is frustrated by deep partisan, geopolitical, and philosophical divides. But empirical evidence is emerging from states on the design of carbon control programs, and the impacts of such policies on the economy. We review the economic impact of RGGI's first three years and find substantial positive economic benefits and best-practice program designs.*

*Paul J. Hibbard and Susan F. Tierney*

This article is based on their recently published report, "The Economic Impacts of the Regional Greenhouse Gas Initiative on Ten Northeast and Mid-Atlantic States," coauthored with Andrea M. Okie and Pavel G. Darling of Analysis Group.

**I. Introduction**

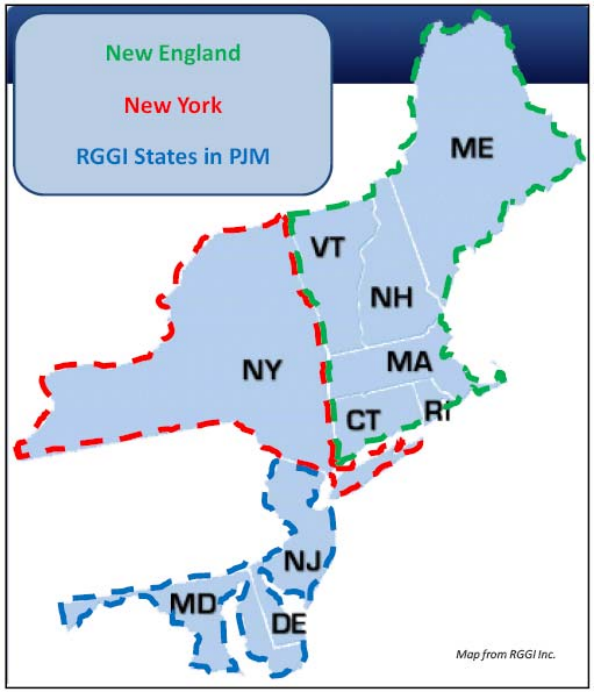
There is no shortage of opinion – including in these pages – about *whether* the risks of climate change warrant national and state actions to control emissions of carbon dioxide ($CO_2$) and, if so, what is an acceptable level of impact on our nation's economy to address climate change risks. And there has been no shortage of debate and deliberation in our nation's capital on *how* to go about structuring a $CO_2$ control program, if there were ever agreement that we needed one. But in launching and administering the Regional Greenhouse Gas Initiative

- **Economic study**
  - **…actual revenues, actual programs, actual impacts**
- **Following the money**
  - **…through the electric sector**
  - **…and through the macro economy**
- **Measuring results**

- **Not a study of:**
- **carbon reduction benefits**
- **environmental impacts**
- **need for a carbon control program**
- **forecast of future program cap, participation, effectiveness, results**

# Bottom line results:

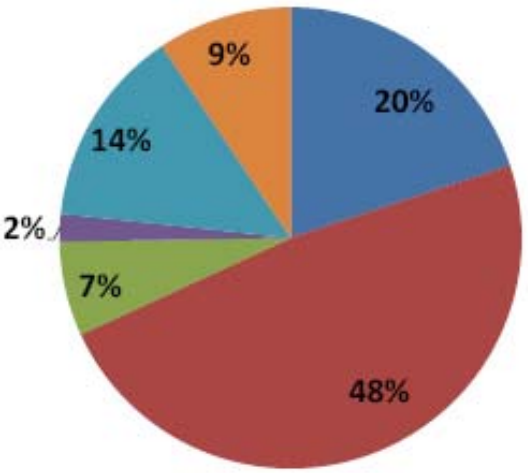



- **Net positive economic impacts for:**
  - the 10 RGGI states together, and for each state participating in RGGI
  - Across the region, the initial $0.9 billion in CO2 allowance auction proceeds translates to $1.6 billion in net economic value added
- **Economic value results from the various ways states spent auction proceeds:**
  - Biggest economic bang for buck: energy efficiency program support
  - Economic value also created by other ways money recirculates in local economies (e.g., customer bill rebates, general fund contributions)

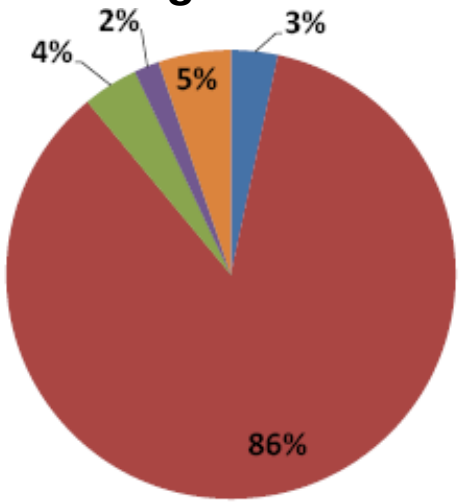
# Use of RGGI auction proceeds ($912 million) across the 10 states and in the 3 electric regions

- General Fund/State Government Funding
- Renewable Investment
- Direct Bill Assistance
- EE and other Utility Programs and Audits & Benchmarking
- Education & Outreach and Job Training
- GHG Programs and Program Administration

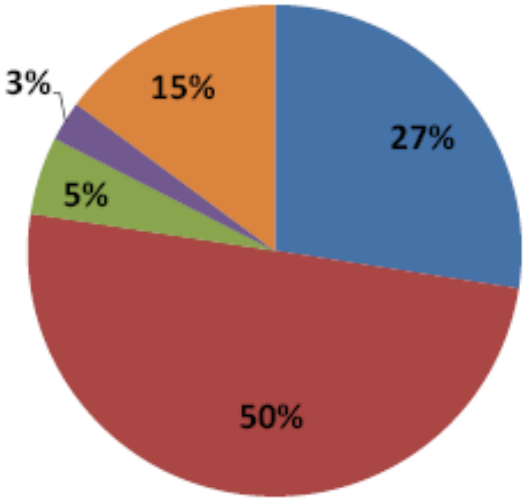
## 10 RGGI states



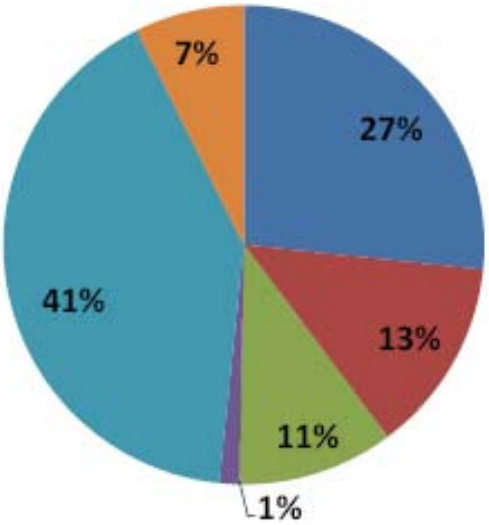

## 6 New England States




## New York (NYISO)




## DE, MD, NJ (PJM)




**Source:** Individual state reports and interviews.
**Note:** Certain grant programs may include multiple components, and are categorized in the figure above based on the largest share of spending.

# Overall economic impacts – 10 states

| | |
|---|---|
| $1.6 billion | – economic value added in the region (NPV*) |
| $0.9 billion | – auction proceeds (mid-2008 through Q3 2011) |
| $1.1 billion | – consumer savings (electricity customers) (NPV*) |
| $0.17 billion | – consumer savings (natural gas & oil heat customers) (NPV*) |
| $1.6 billion | – lower revenues to power plant owners (NPV*) |
| $0.77 billion | – fewer dollars spent on out-of-region fossil fuel (NPV*) |
| 16,000 jobs | – jobs created |
| 0.7 percent | – average electricity bill increases during 3-year RGGI period [with savings over time given energy efficiency implemented with RGGI funds] |

* Using a 3% social discount rate

# Total Economic Impact – Value Added and Job-Years

| | Value Added[1] (millions of $) | Employment[2] |
|---|---|---|
| Connecticut | $ 189 | 1,309 |
| Maine | 92 | 918 |
| Massachusetts | 498 | 3,791 |
| New Hampshire | 17 | 458 |
| Rhode Island | 69 | 567 |
| Vermont | 22 | 195 |
| **New England Subtotal** | **$ 888** | **7,237** |
| New York | $ 326 | 4,620 |
| **New York Subtotal** | **$ 326** | **4,620** |
| Delaware | $ 63 | 535 |
| Maryland | 127 | 1,370 |
| New Jersey | 151 | 1,772 |
| **RGGI States in PJM Subtotal** | **$ 341** | **3,676** |
| Regional Impact[3] | $ 57 | 601 |
| **Grand Total** | **$ 1,612** | **16,135** |

Notes:
[1] Value Added reflects the actual economic value added to the state and regional economies, and therefore does not include the costs of goods purchased from or manufactured outside of the state or region.
[2] Employment represents job-years as outputted from IMPLAN.
[3] Regional Impact reflects the indirect and induced impacts resulting within the RGGI region as a result of state dollar impacts.
[4] Results are discounted to 2011 dollars using a 3% social discount rate.

## Shale gas – and energy markets

**Shale gas development provides opportunities for:**

- **lower building heating costs than previously expected**
- **lower power prices than previously expected – and less differential than in traditional coal regions**
- **lower emissions profile of power plants in upwind regions**

**But ….**

- **challenges to address emissions from gas production**
- **challenges with meeting renewables' targets**
- **continued need for energy productivity improvements**

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