

# Natural Gas End Use and Power Generation

Interstate Oil and Gas Compact  
Commission

March 29, 2011



# U.S. Natural Gas Resources

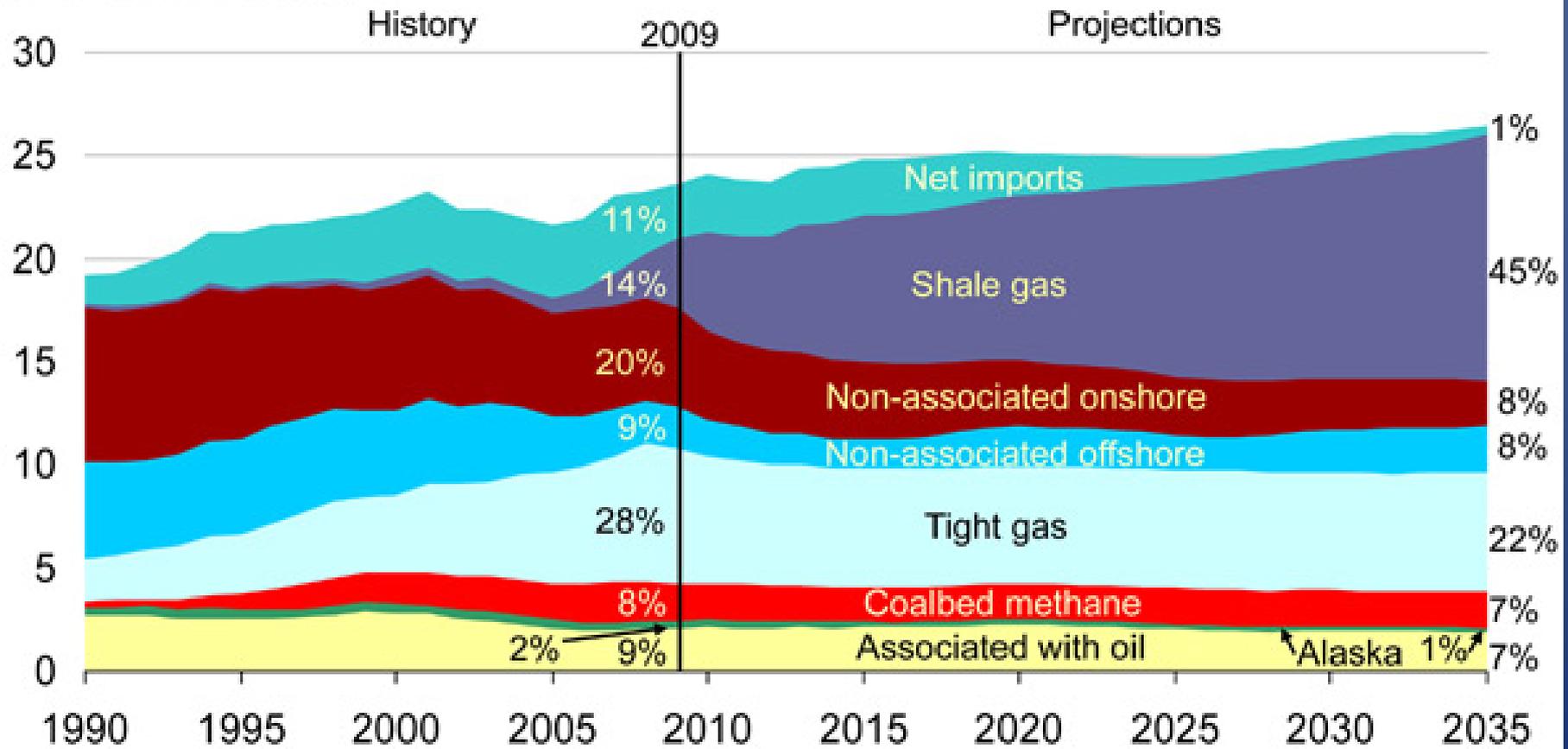
# Shale Gas Plays, Lower 48 States



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

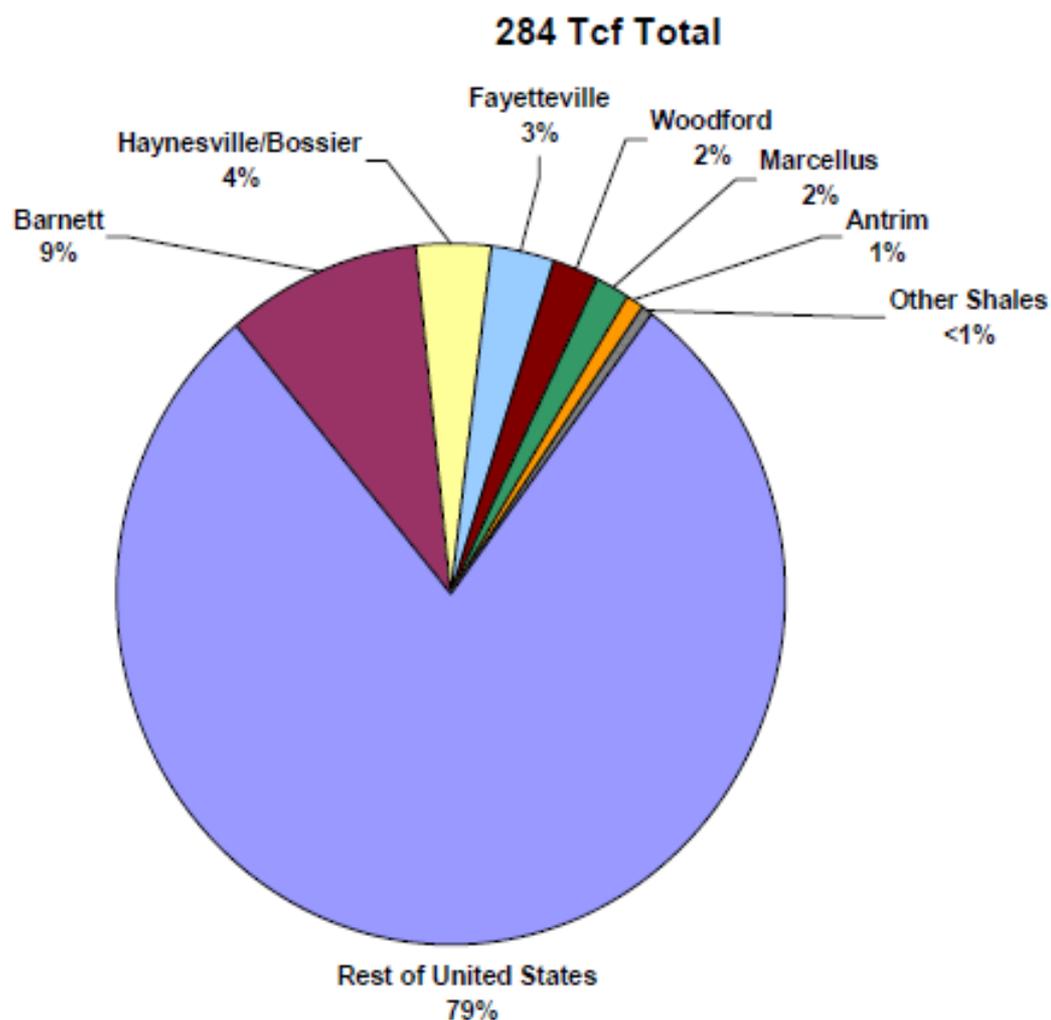


U.S. dry gas  
trillion cubic feet per year



Source: EIA, Annual Energy Outlook 2011

**Figure 2. Shares of U.S. Natural Gas Proved Reserves from Shale Plays and Other Sources, 2009**



Source: U.S. Energy Information Administration

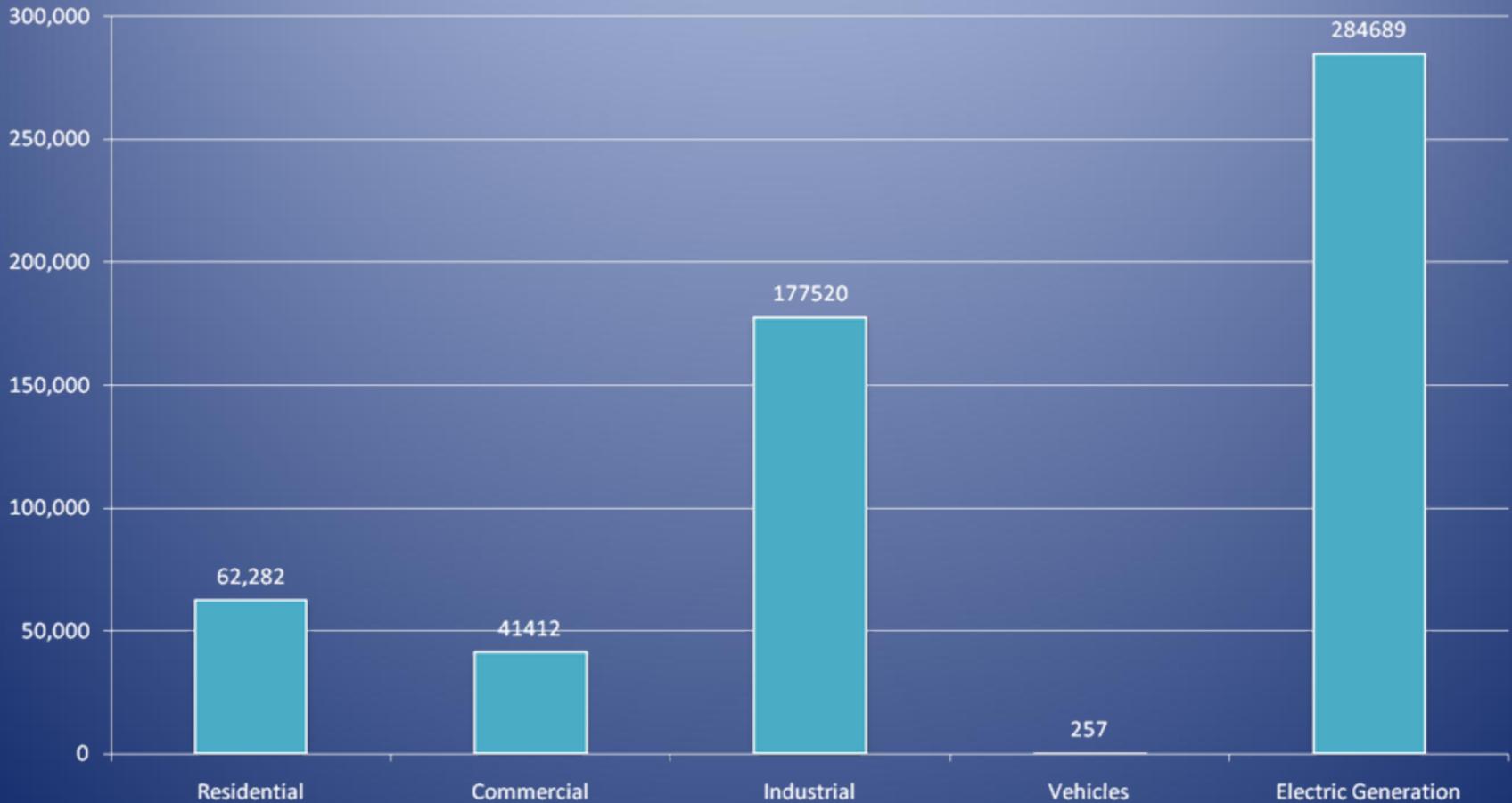
Note: The volumes of shale gas represent only data reported by operators on Form EIA-23; estimates for all non-surveyed operators are included in "Rest of United States".

**Table 3. Principal Shale Gas Plays: Natural Gas Production and Proved Reserves, 2008-2009**  
(billion cubic feet)

Shale Play	2008		2009		Change 2009-2008	
	Production	Reserves	Production	Reserves	Production	Reserves
Barnett	1,501	22,492	1,745	26,493	318	4,001
Haynesville/Bossier	25	1,031	321	10,468	296	9,437
Fayetteville	279	3,833	527	9,070	248	5,237
Woodford	168	3,845	249	6,389	81	2,544
Marcellus	2	102	76	4,478	74	4,376
Antrim	122	2,894	132	2,499	14	-395
<b>Sub-total</b>	<b>2,097</b>	<b>34,197</b>	<b>3,050</b>	<b>59,397</b>	<b>953</b>	<b>25,200</b>
Other Shale Plays	19	231	60	1,247	41	1,016
<b>All U.S. Shale Plays</b>	<b>2,116</b>	<b>34,428</b>	<b>3,110</b>	<b>60,644</b>	<b>994</b>	<b>26,216</b>

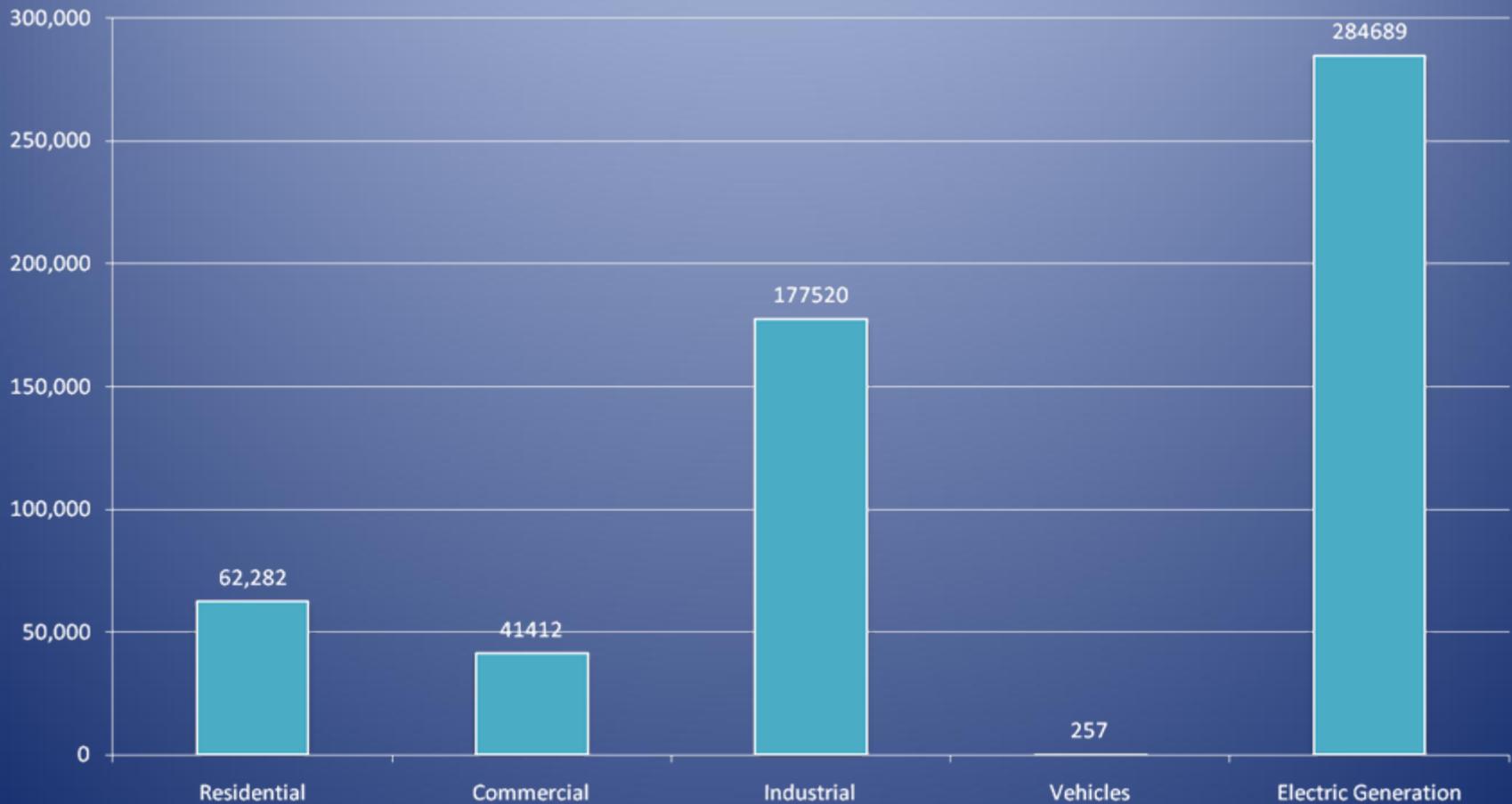
Natural Gas--  
Where does it go?

# U.S. 2010 Natural Gas Consumption by End Use (mcf)



Source: EIA

# Oklahoma 2009 Natural Gas Consumption by End Use (mcf)



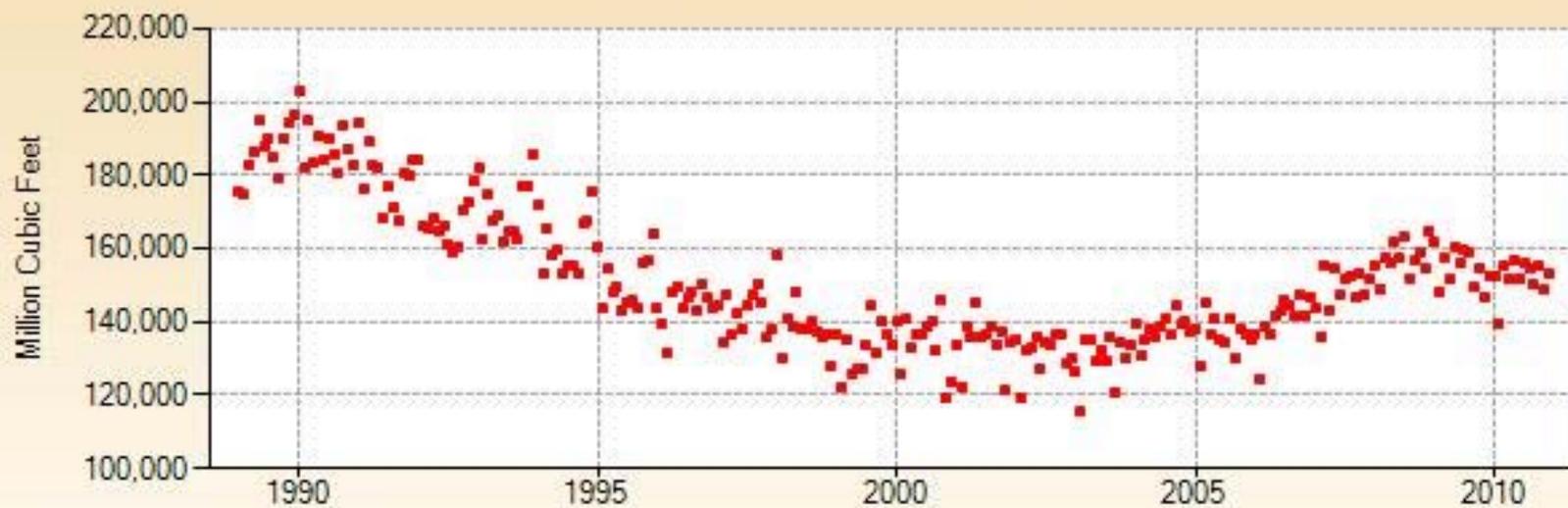
Source: EIA

# Oklahoma's Natural Gas Production

# Oklahoma is a leader in natural gas production

- The US produced 22,562,633 mcf marketed production in 2010
  - Oklahoma produced 1,825,513 mcf (8%) in 2010 (trailing only Texas, Wyoming, and Louisiana, and leading Alaska and New Mexico)
  - All other states produced 5,549,309 mcf marketed production combined in 2010

### Monthly Oklahoma Natural Gas Marketed Production



Source: U.S. Energy Information Administration

# Oklahoma's 2009 Nat Gas Production by Source (mcf)

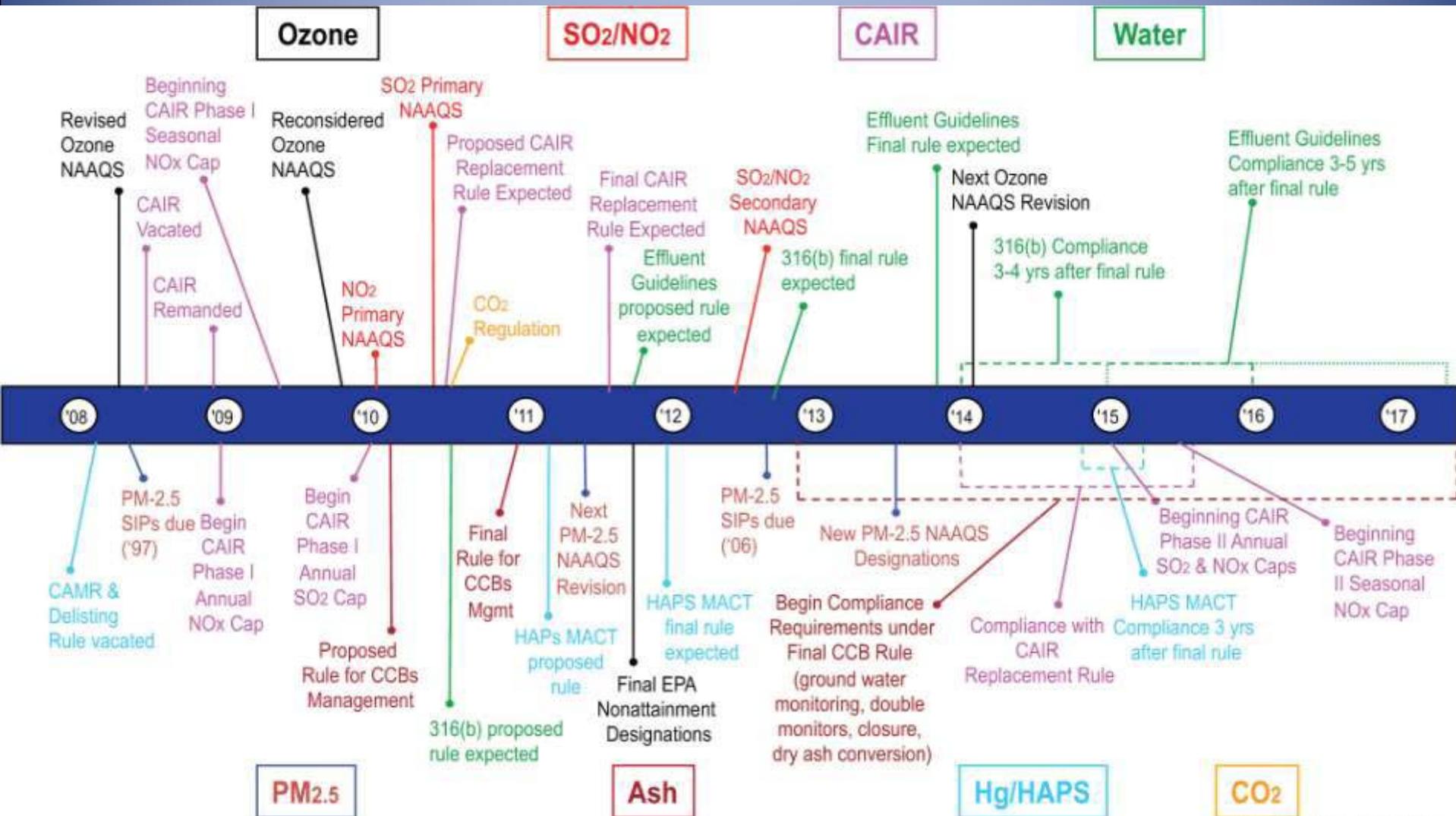
Gas Wells	1,387,543
Oil Wells	94,070
Coalbed Wells	75,137
<u>Shale Gas Wells</u>	<u>301,028 (16%)</u>
<b>TOTAL</b>	<b>1,857,777</b>

Note: 2010 data not yet available from EIA

# Regulatory Barriers and Opportunities for Natural Gas in the Power Sector

- Clean Air Act compliance
  - Regional Haze
    - Environmental retrofit v. natural gas generation
  - Utility MACT
    - Focuses on mercury and air toxics
- Other considerations
  - Lack of a GHG price inherently incentivizes cheaper, dirtier fuels
  - Coal currently accounts for over 50% of current generation
- However, the market may continue to push for lower carbon options...

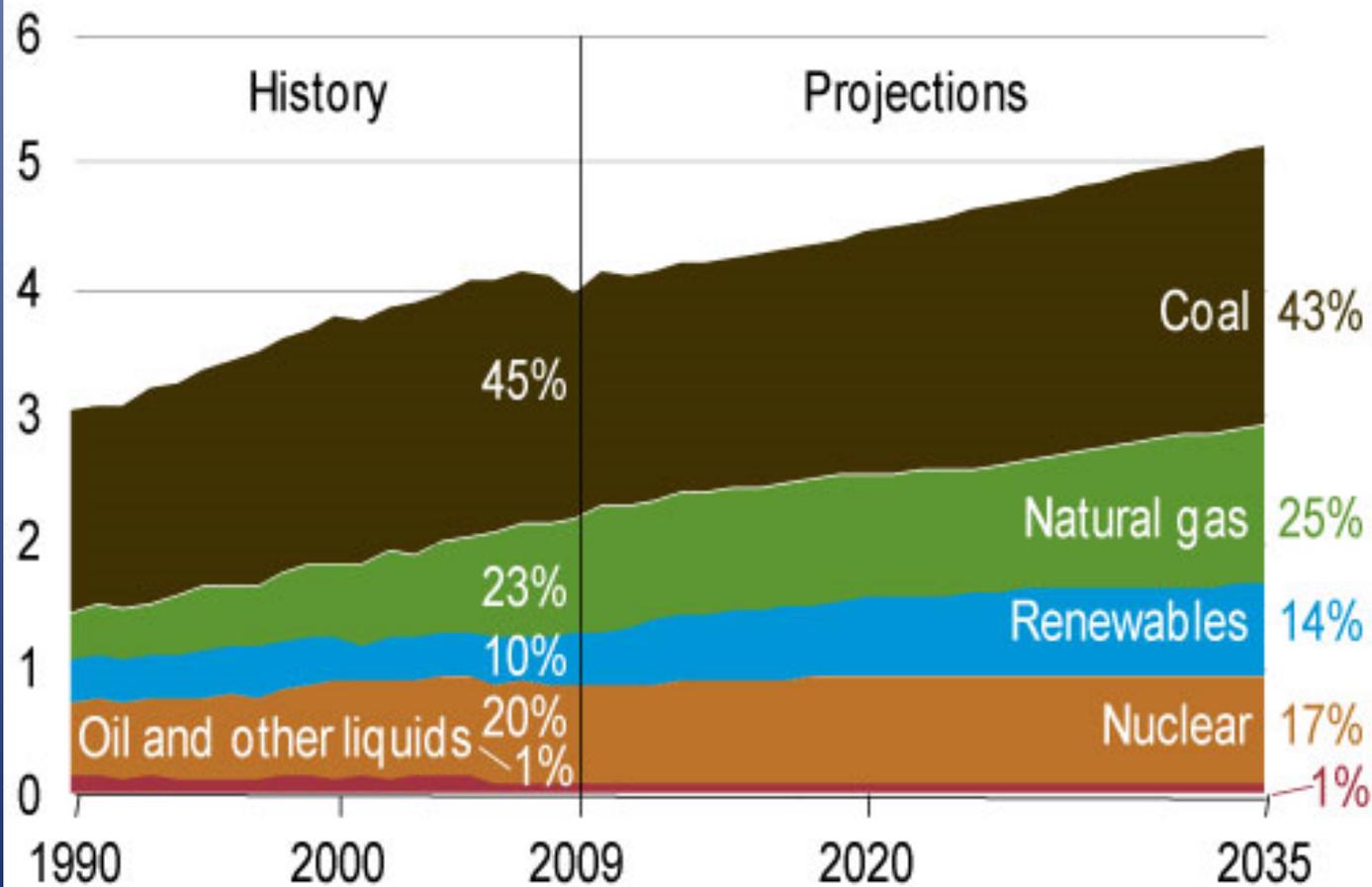
# Possible Timeline for Environmental Regulatory Requirements for Electric Utilities



-- adapted from Wegman (EPA 2003)

Figure 2. The projected fuel mix for electricity generation gradually shifts to lower carbon options

Net electricity generation (trillion kilowatthours per year)



Case Study

# The Colorado Clean Air Clean Jobs Act

HB 1365 (2010)

# What was the goal?

- Modernize Colorado's electrical generation resources to benefit the state's public health, environment, and economy.
- Maximize the use of natural gas through a statewide policy preference.
- Achieve public health and environmental goals through systematic closure of aging coal-fired power plants.

# Stakeholders/Interested Parties/The Players

- Xcel Energy-Colorado's primary IOU
- Colorado Public Utilities Commission
- Colorado Department of Public Health and Environment
- Natural Gas Alliance
- Coal Producers
- Colorado Governor's Office
- Colorado Legislature

# Policy Barriers/Considerations

- Need for a cost recovery mechanism
- Need for consumer protections; requirement that CPUC approve any emissions-reduction plan based on consumer costs and environmental improvement
- Need for long-term utility natural gas contracts to prevent future “look backs” and hedge against fuel price volatility
- Need to develop an emissions reduction plan to meet current and “reasonably foreseeable” federal and state Clean Air Act requirements (SIP)

# Substantive Reasons For the Effort/Support

- Administrative: 2009-Colorado approaching SIP deadline; federal implementation plan looming
- Legislative: Need for a state-level solution to address electric generation environmental and public health concerns in absence of federal legislative action

# Xcel Energy

recognized that change would need to be comprehensive and long-term; a piecemeal approach would be too costly to implement.

# Policy Profile

- The Colorado Clean Air-Clean Jobs Act
  - Created a process for IOU's to work with CDPHE to develop and submit a plan to achieve 70-80% reduction in NOx from Colorado's aging coal-fired electricity generation fleet. Goals:
    - Ultimately create a viable path to EPA Regional Haze Program compliance
    - Address public health concerns such as summer ozone, particulate matter (the "brown cloud"), mercury levels

# Policy Profile (cont'd)

- Required IOU's to conduct re-powering studies that evaluate various retirements, replacement, or retrofit scenarios. Requirements:
  - Address at least 900 MW of coal-fired generation by December 31, 2017
  - Evaluate potential for a more aggressive schedule as determined by CDPHE and CPUC.
  - Incorporate a focus on natural gas and other low or non-emitting resources, including energy efficiency.
- Ensure replacement power generation in Colorado will lead the nation in emissions reductions and meet current and anticipated clean air standards

## Policy Profile (cont'd)

- Protect consumers through the use of long-term fuel-supply contracts and similar mechanisms
- Provide for a fully transparent review of utility plans by both the CDPHE and the CPUC

# Timeline/Process

- CACJ Act Passed-April 19,2010
- CPUC issues initial notice of rulemaking-April 21, 2010
  - Period for intervention open
  - All interested parties permitted to intervene and submit compliance plans
- Xcel files initial compliance plan-August 13, 2010
  - Plan to cover lesser of 900 MW or 50% of existing coal-fired generation
  - Projects \$1.3 billion over 12 years; estimated 2% annual rate impact
  - Estimated no job loss to coal industry; yet the coal industry claimed loss of 30,000-120,000 jobs

# Timeline/Process (cont'd)

- CPUC issues final order re: Xcel's emission reduction plan—December 15, 2010
  - Approved a plan for Xcel to retire 500 MW of coal-fired generation by closing 3 units and replacing with a combined cycle natural gas plant (\$500 million) by 2018.
  - Approved converting another two coal-fired plants to natural gas (Arapahoe 4 (2013) and Cherokee 4(2017))
  - CPUC will explore other options for re-powering Xcel's Cherokee 4 plant in 2011 electric resource plan.
  - Implementation costs: likely in excess of \$1.3 billion.
  - Annual rate impact: 2.5% by 2020

# Timeline/Process (cont'd)

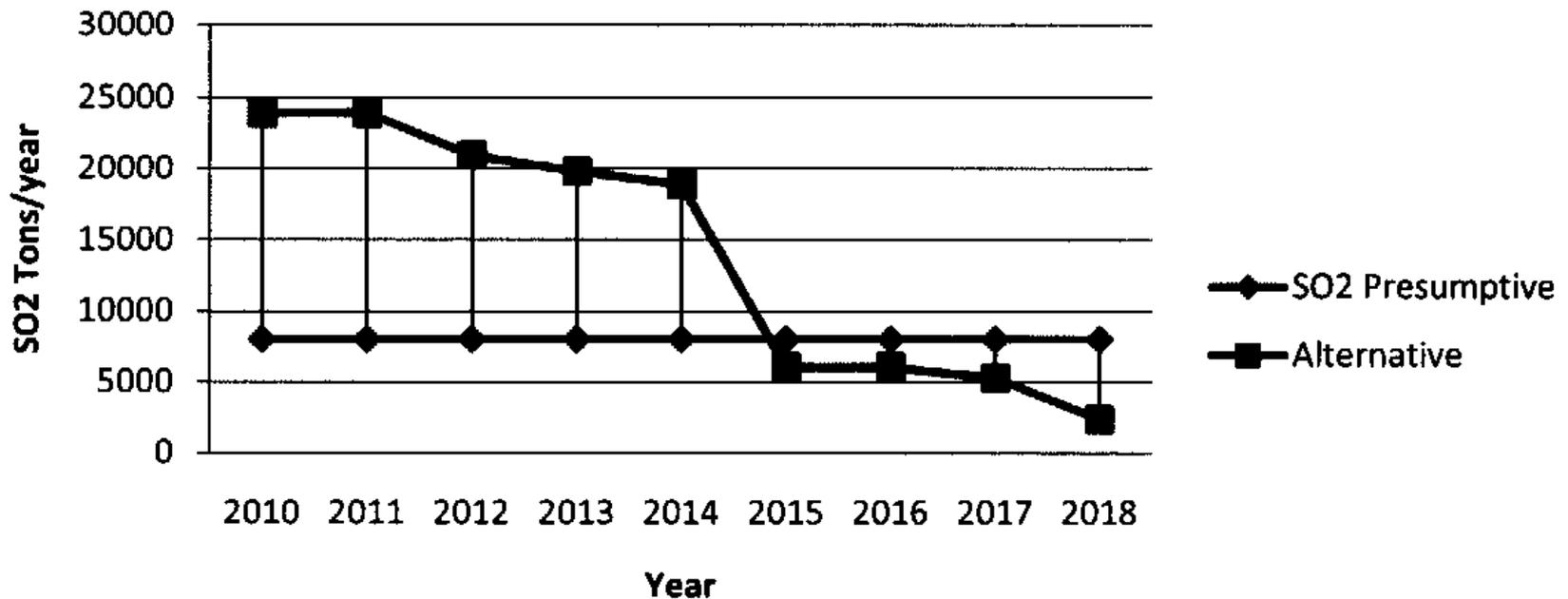
- Regional Haze SIP due to Colorado Legislature and US E.P.A.—January 2011
- Colorado Air Quality Control Commission hears report on applicability of emissions reduction plan to the SIP and impacts on Denver area—January 2011.

# CPUC Considerations

- Cost comparisons (\$/MMBtu)
  - Gas Price Forecasts
    - Xcel--\$4.22(2011), \$7.81 (2020)
    - Peabody--~\$5.93(2011), ~ \$22(2045)
    - Gas Intervenors—~\$5.54+(2011), ~\$11.30+(2030)
  - Coal Price Forecasts
    - Xcel--\$1.77(2011), \$2.07(2020)
    - Peabody—PSCo Benchmark 1.0 scenario prices
    - Gas Intervenors--escalation of 2% or more per year over PSCo forecasted prices

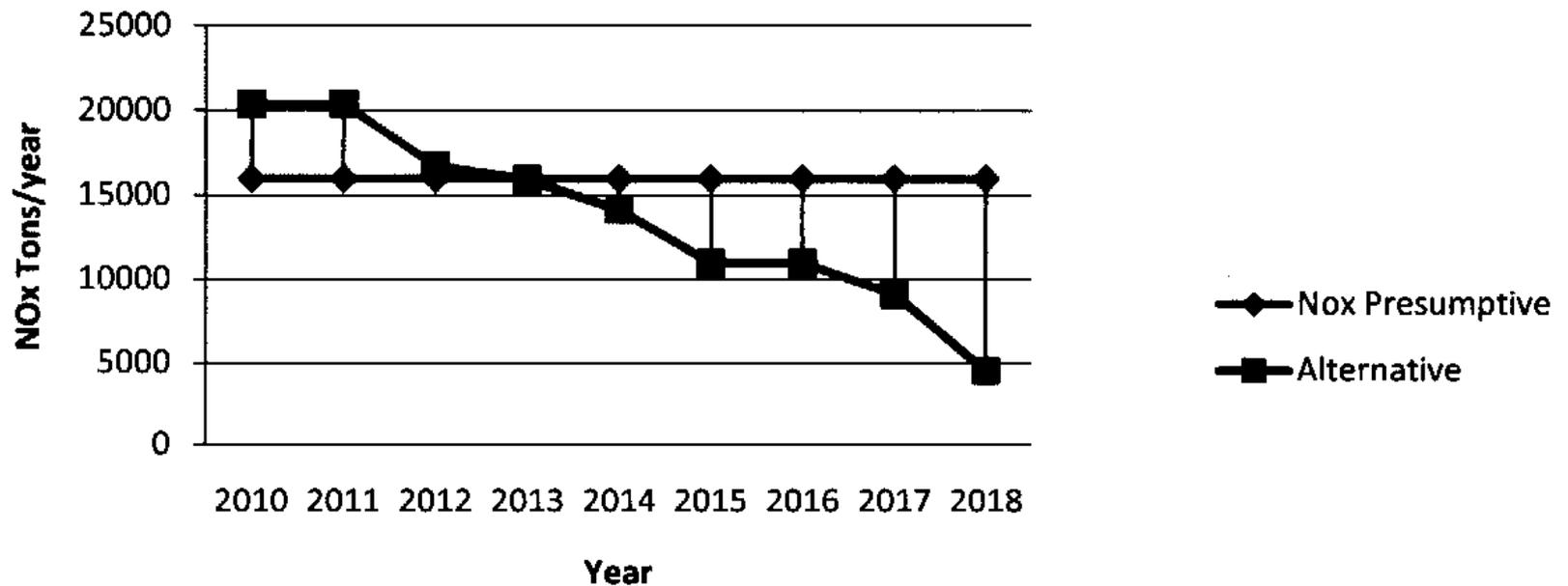
# Colorado Air Quality Control Commission (CDPHE)

## SO2 Reductions



# Colorado Air Quality Control Commission (CDPHE)

## NOx Reductions



# What did we learn?

- State-level solution (such as Co. CACJ Act) may be more palatable to state-level stakeholders:
  - Other states are nearing FIP implementation: Arizona, Arkansas, Florida, Idaho, Kansas, Oklahoma, Oregon, Texas, Wyoming
  - “Oklahoma First” – an idea to allow Incentives to transition the Utilities from unscrubbed coal to greater use of natural gas

# Questions?

Jim Roth, Senior Advisor  
Regulatory & Environmental Policy  
American Clean Skies Foundation

ACSF  
750 1st Street N.E., Suite 1100  
Washington, DC 20002  
Cell: 405.514.7684  
[www.cleanskies.org](http://www.cleanskies.org)

PHILLIPS MURRAH P.C.  
101 N. Robinson Avenue  
Oklahoma City, OK 73102  
Office: 405.235.4100  
[www.phillipsmurrah.com](http://www.phillipsmurrah.com)  
[jaroath@phillipsmurrah.com](mailto:jaroath@phillipsmurrah.com)