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If Not Nuclear, Shale Gas?

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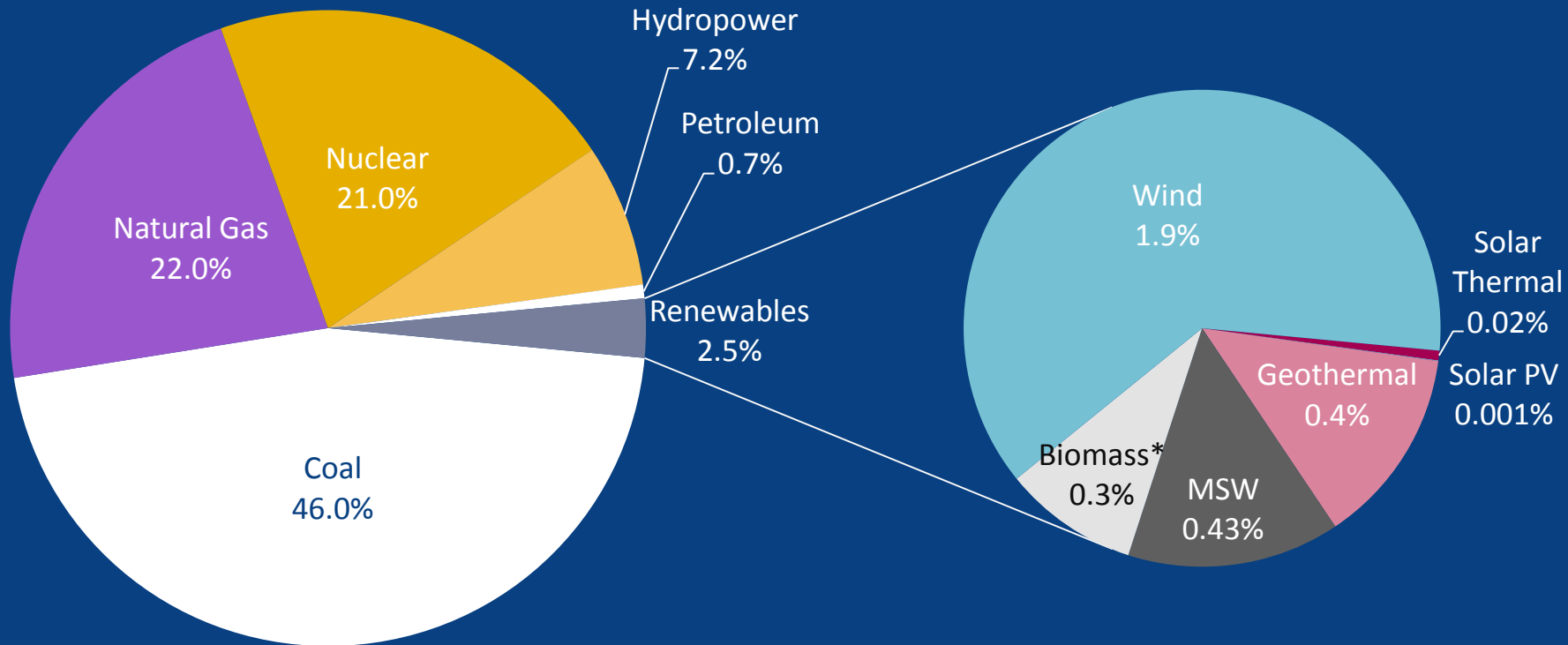
Harvard Electricity Policy
Group, Washington, DC
June 2, 2011.

Toward a New National Energy Policy: Assessing the Options

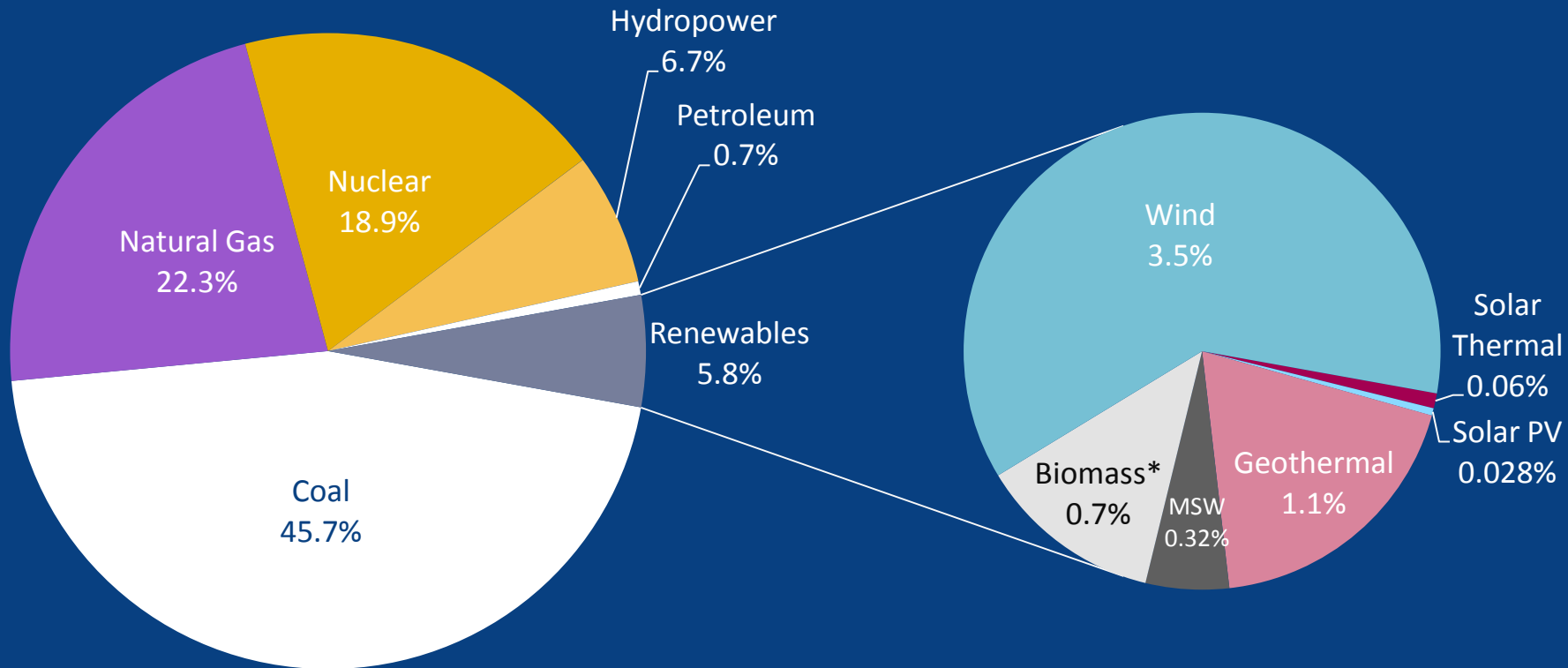
EXECUTIVE SUMMARY



Generation by Fuel Type in 2009 from the AEO 2011 Reference Case 3799 GWh



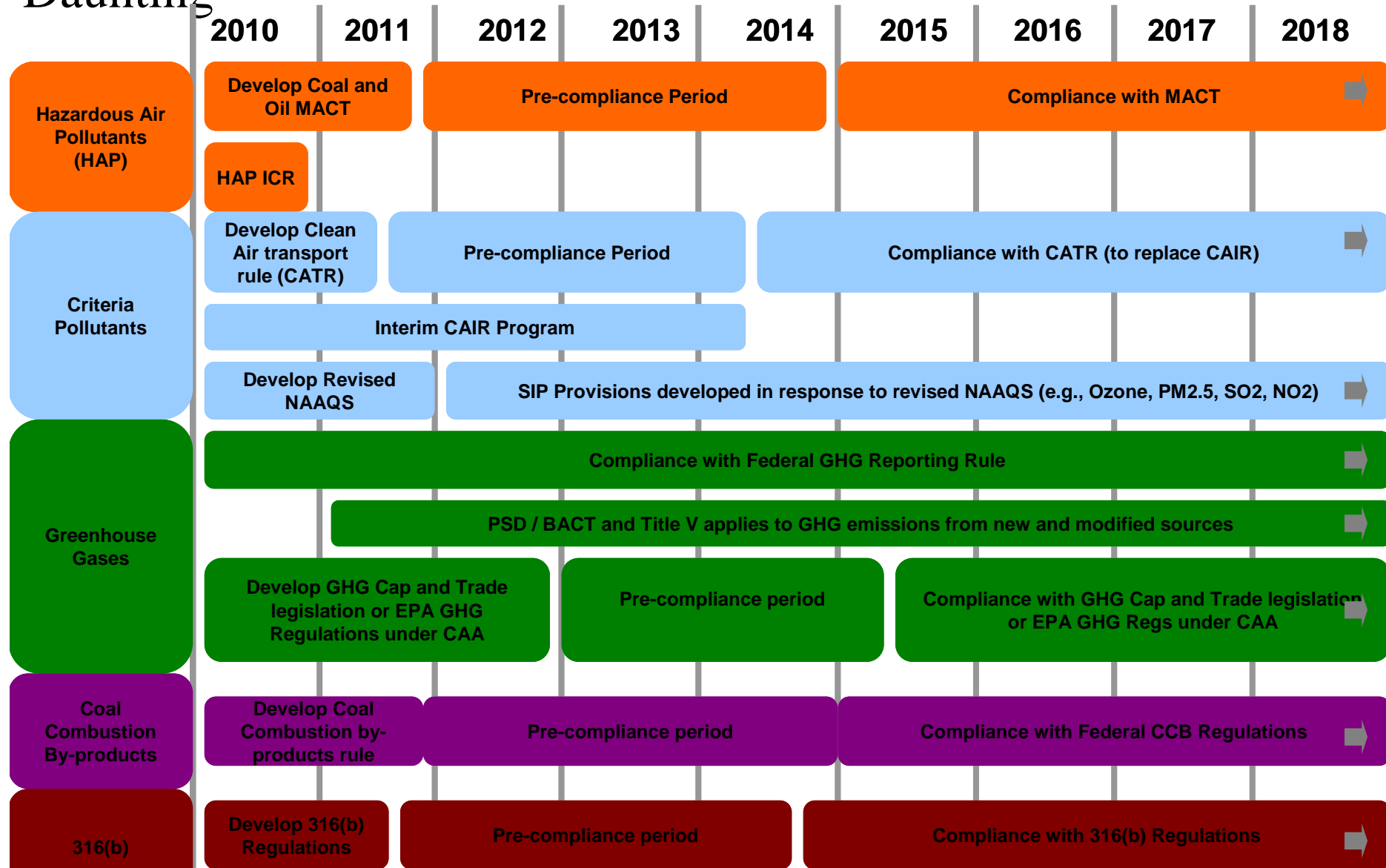
Generation by Fuel Type in 2035 from the AEO 2011 Reference Case 4619 GWh



Generation Fuel Review

- Coal: coal mining disasters, high conventional pollutants, recent concerns about ability to sequester large quantities CO₂
- Hydro and Oil: not factors
- Nuclear: Not any time soon
- Wind and solar: intermittent, cost, NIMBY, grid

DB: The Timeline of Pending EPA Regulatory Action is Daunting



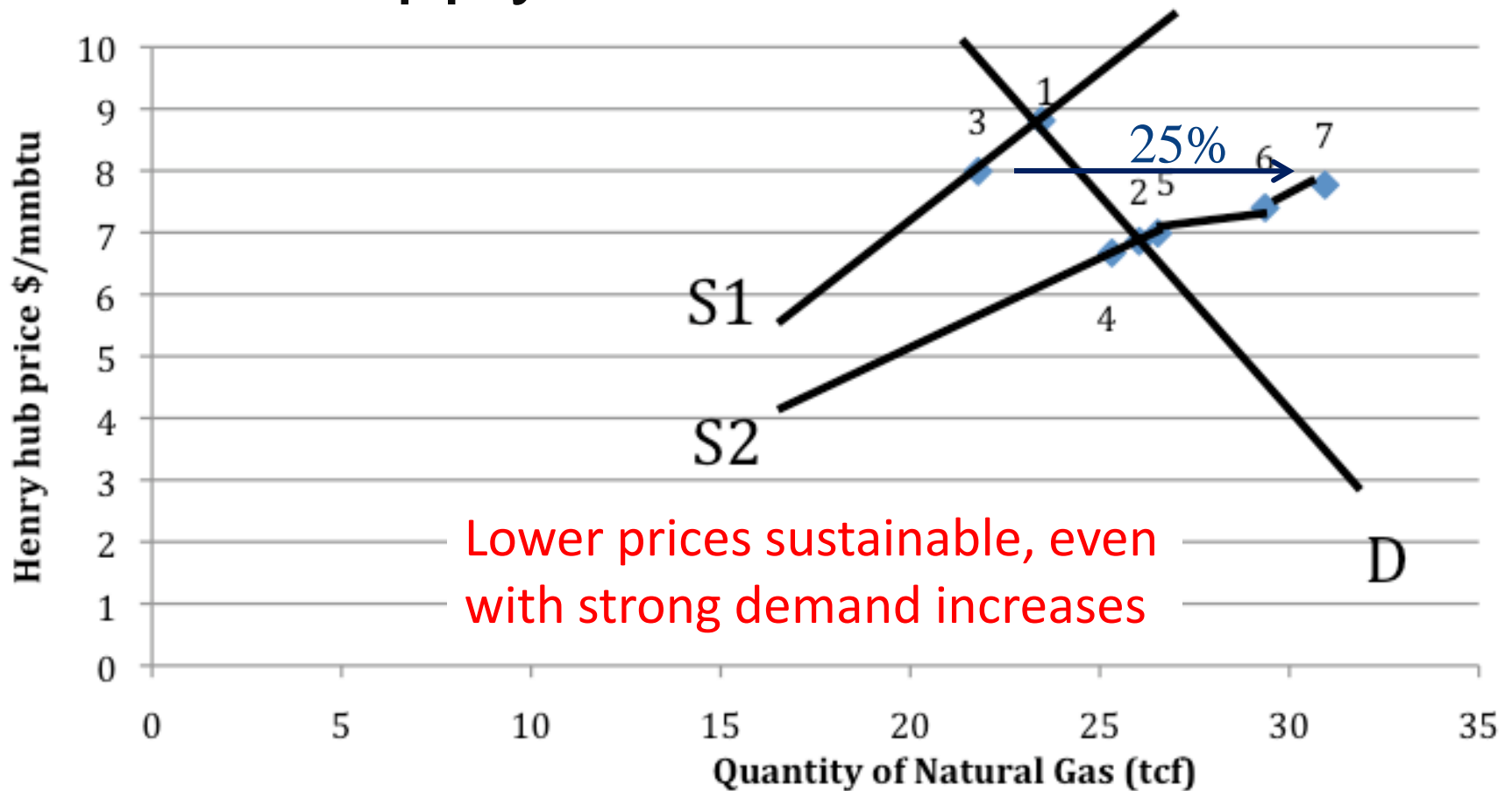
Source: Exelon Corp

Can shale gas fill the bill?

Can shale gas lead to long-run price stability and low prices?

- Modeled replacing NEMS gas resource estimates with those of Potential Gas Committee
 - Scenario 1: 269.3 tcf shale gas resources (EIA 2007)
 - Scenario 2: 615.9 tcf shale gas resources (PGC 2009)
 - AEO2011 is at 827 tcf, so scenario 2 is underestimate
- Can keep natural gas prices low—even with big gains in natural gas demand

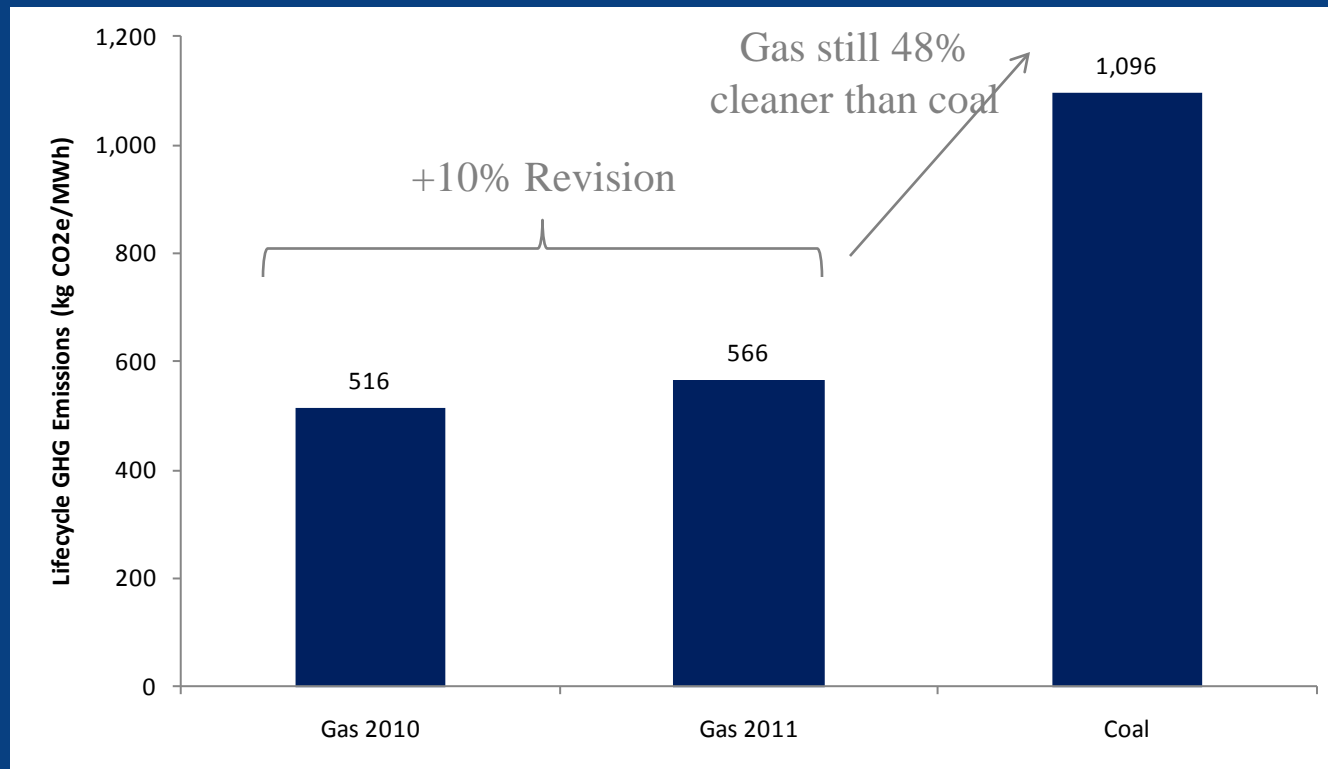
Scenario Analysis: Supply and Demand, 2030



Can natural gas be a bridge to low-carbon future?

- Is natural gas a low carbon fuel (compared to coal)?
- How much does natural gas (post-shale gas) substitute for coal without policy intervention? With it?

Lifecycle CO₂e Analysis (DB, 3/11) Shows Gas (with fracking) Superior to Coal

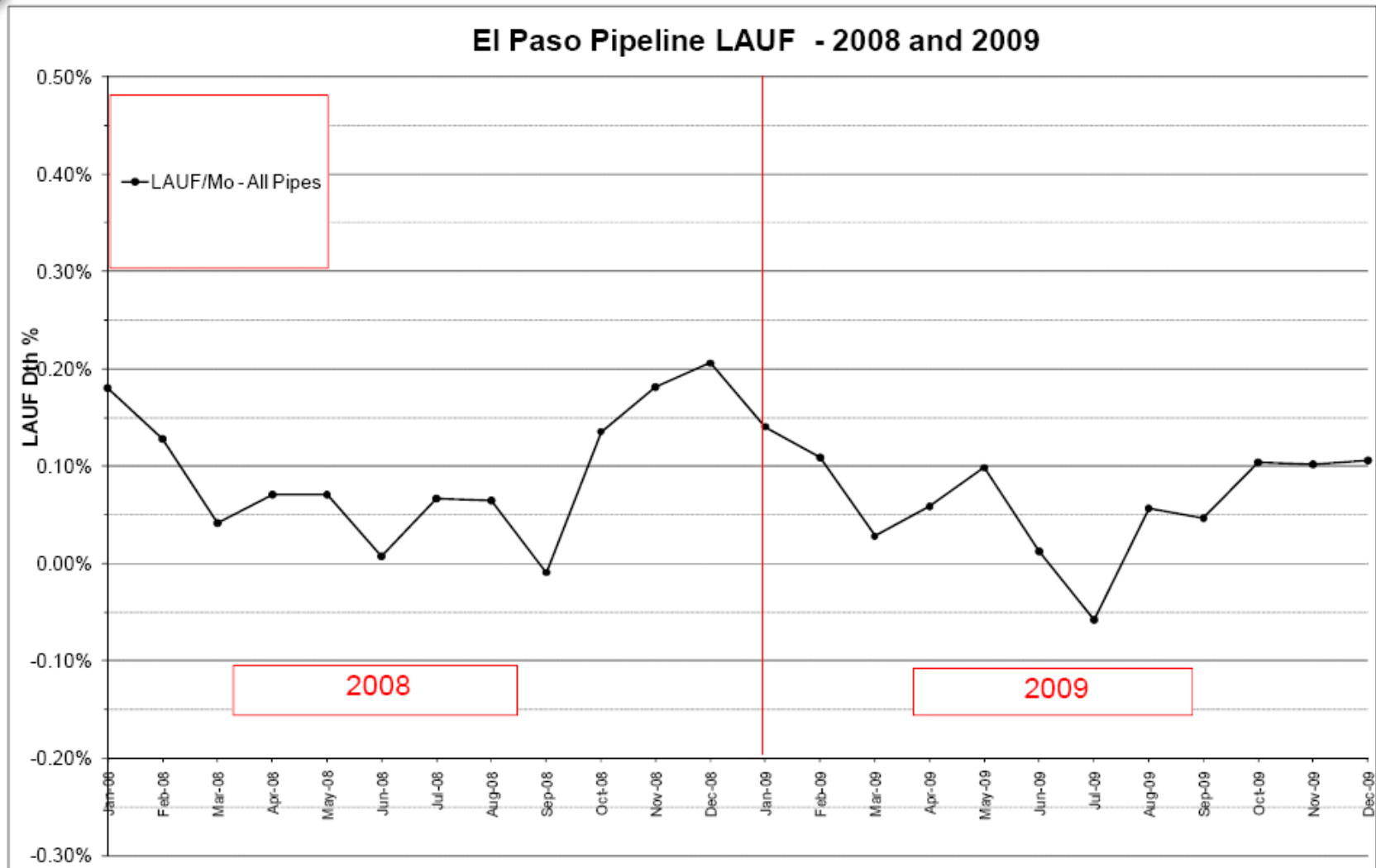


Note: 100 year global warming potential
Source: EIA, ICF International, DBCCA analysis 2011

Cornell Study and Critique

- Fugitive methane*GWP + other fuel cycle elements <> Coal emissions (CO2e)
- Fugitive methane:
 - Amount of fugitive emissions: Not necessarily in industry's interest to cut.
 - Cornell study: For key data point (Haynesville fugitive emissions) documentation "missing."
- GWP => 20 vs. 100 years; IPCC or revised estimates
→ should stimulate further study

And Why LAUF Should Not Be Used as Proxy for GHG Emissions



LAUF ≠ Emissions. A significant portion of the LAUF is associated with metering errors, not emissions

NEMS Simulations (AEO2009 vs. PGC)

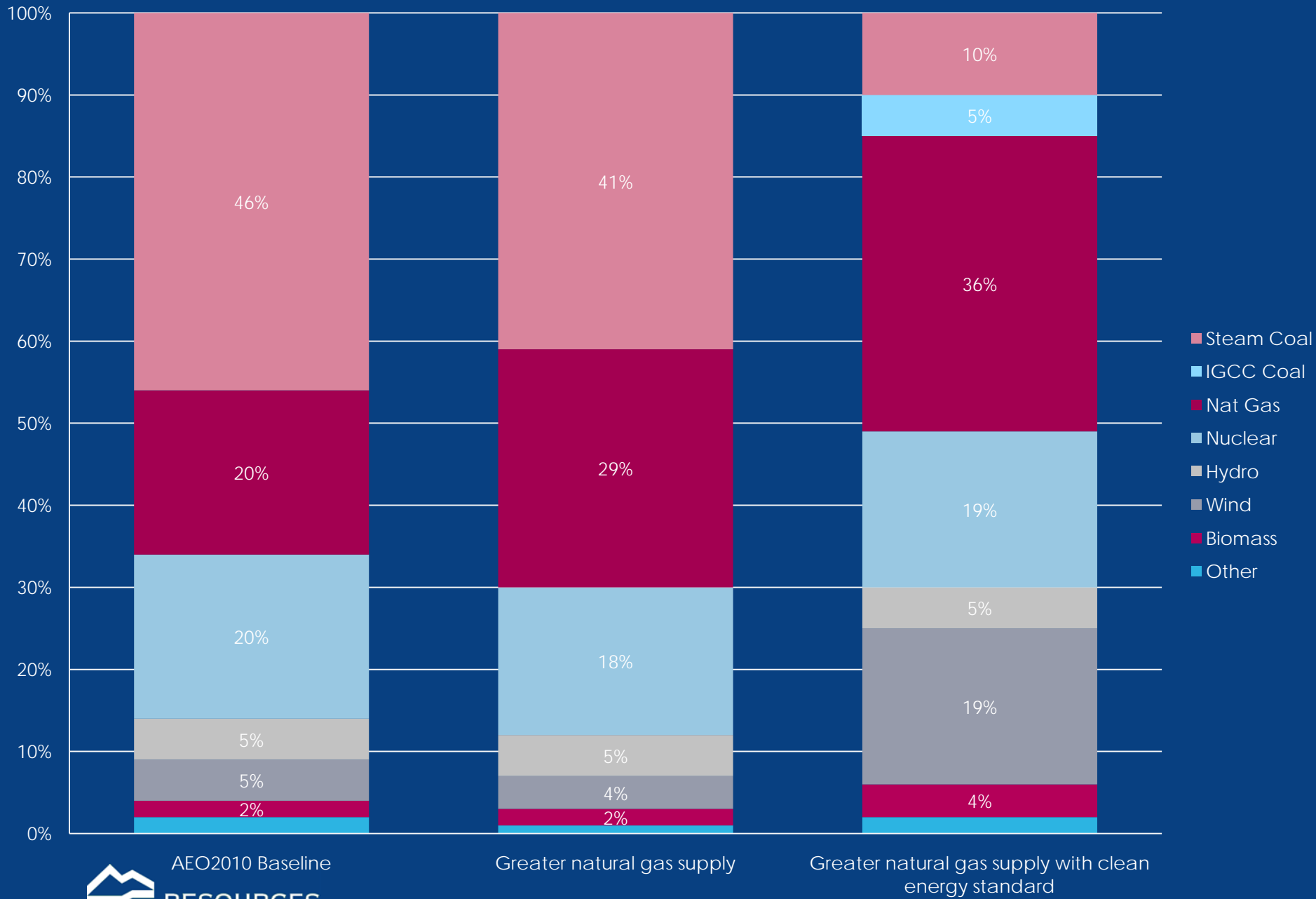
- Without climate policy, abundant natural gas *increases* energy use and CO₂ emissions
 - With climate policy (C&T), abundant natural gas increases natural gas use and electricity use falls
 - Abundant natural gas *moderately reduces* cost of reducing CO₂ emissions
 - Emissions allowance price falls about 1 percent
 - PV cost of carbon policy reduced about 1 percent (\$1 billion)
- ➔ A “narrow” (flimsy?) bridge to a low carbon future?
- ➔ Gets stronger with larger and less expensive resources

HAIKU Simulations with AEO2010 and with AEO2011 NG prices in 2035

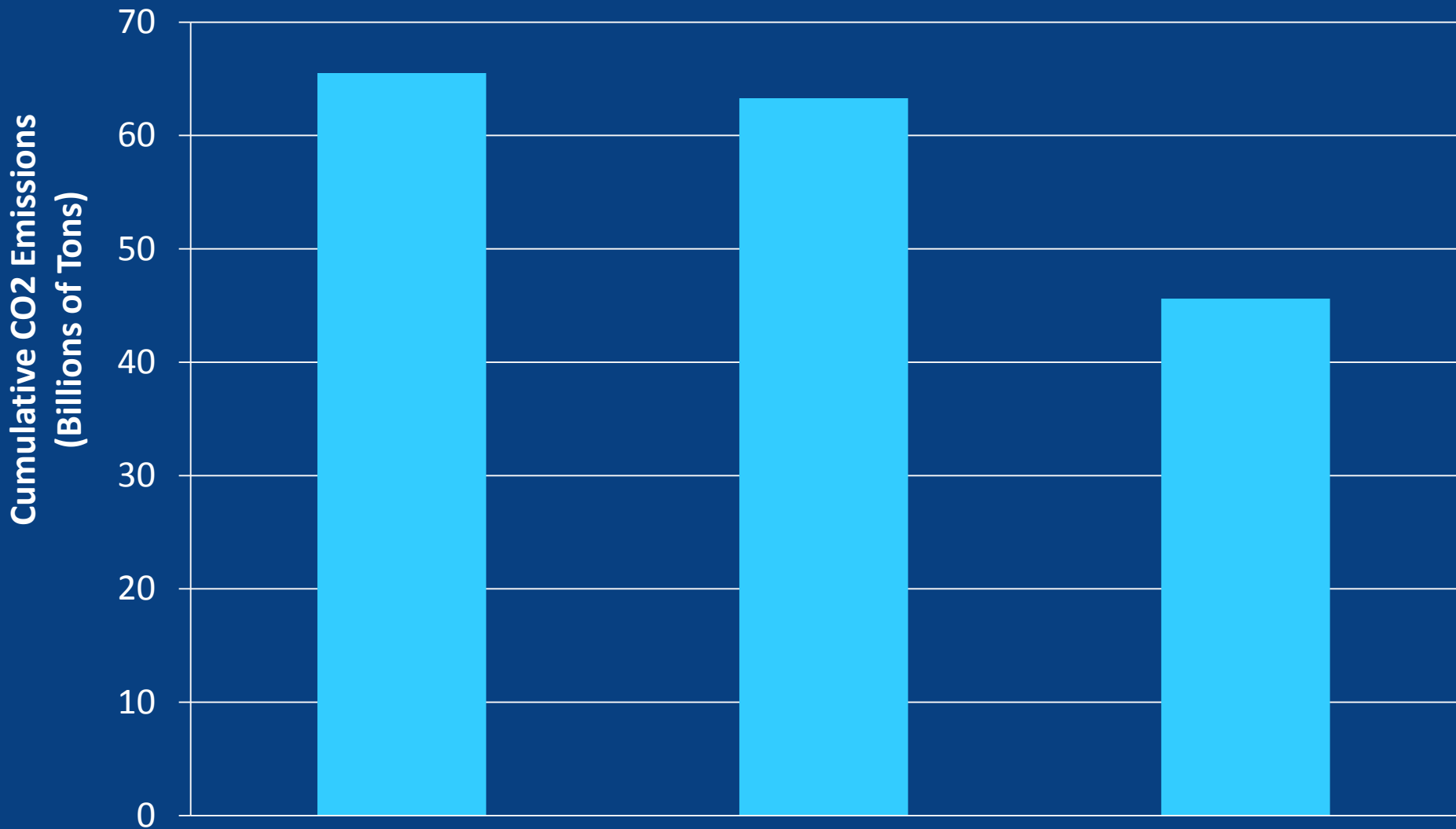
- Baseline (AEO2010)
- Cheap Natural Gas (AEO2011)
- Cheap Natural Gas + Clean energy standard

- Take Homes:
 - A weak bridge to a low carbon future
 - But a more important part of the electrical energy mix

Share of Electricity Generation in 2035 for Alternative Futures



Cumulative (2010-2035) CO2 Emissions from Alternative Futures



AEO2010 Baseline

Greater natural gas supply

Greater natural gas supply with clean energy standard



RESOURCES
FOR THE FUTURE

Shale gas risks

- Duke Study: Methane found in water wells <1km from drilling site, not in wells farther away. Fluids migration ruled out
 - Issues
 - No baseline readings
 - Depth of methane not identified
 - Lots of water wells <1km with low methane
- Need baseline data. Let industry get it before they drill. Third party audits.

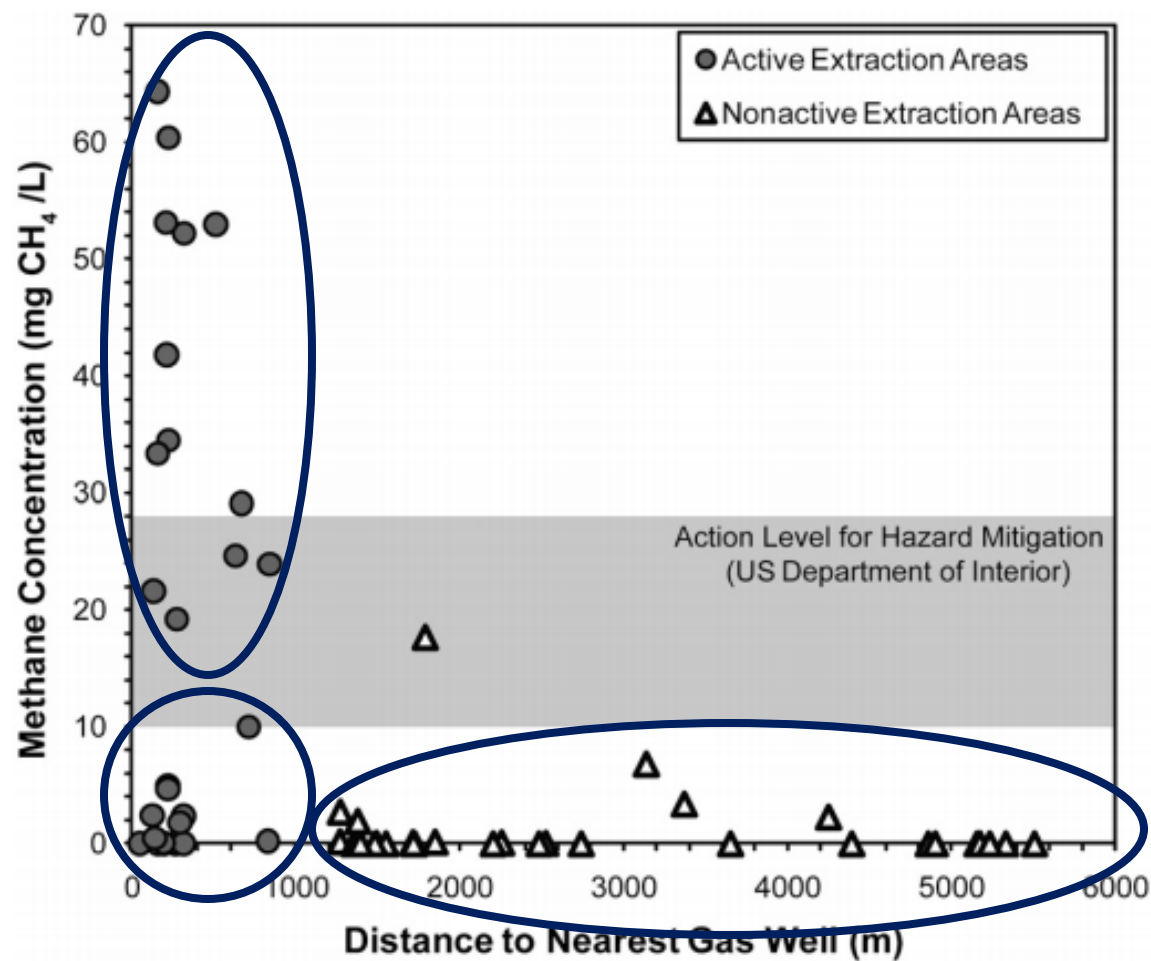


Fig. 3. Methane concentrations (milligrams of CH₄ L⁻¹) as a function of distance to the nearest gas well from active (closed circles) and nonactive (open triangles) drilling areas. Note that the distance estimate is an upper limit and does not take into account the direction or extent of horizontal drilling underground, which would decrease the estimated distances to some extraction activities. The precise locations of natural-gas wells were obtained from the Pennsylvania Department of Environmental Protection and Pennsylvania Spatial Data Access databases (ref. 35; accessed Sept. 24, 2010).



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Conclusion

- We are lucky to be able to obtain cheap shale gas
- But need to get on top of “expert” and perceived risks
 - Industry behind the arc of public opinion; some big mistakes in controlling risks
 - Regulators behind regulating
 - Scientists behind on research