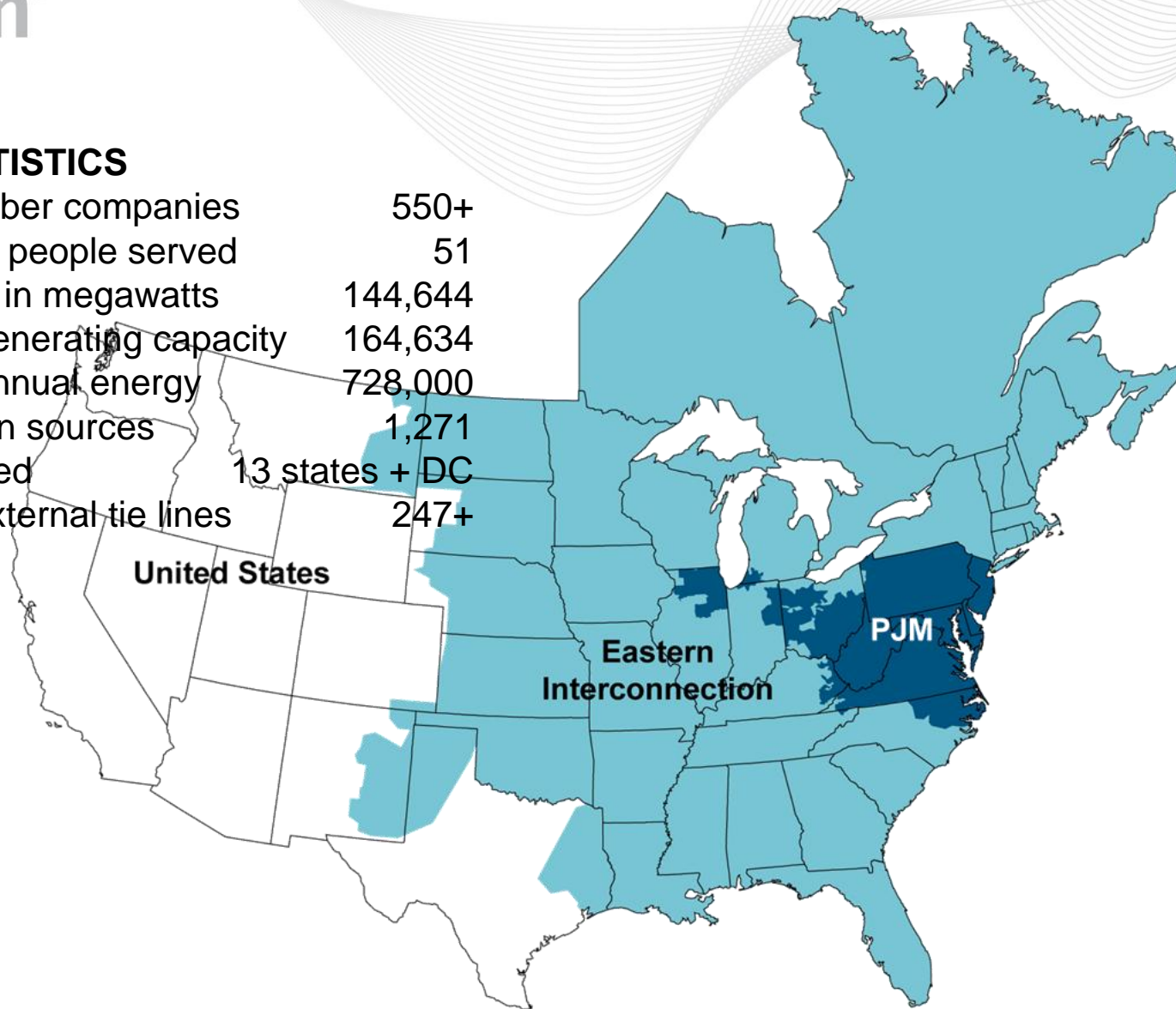


Potential Effects of Proposed Climate Change Legislation on PJM's Energy Market

Michael E. Nix
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December 10, 2009

KEY STATISTICS

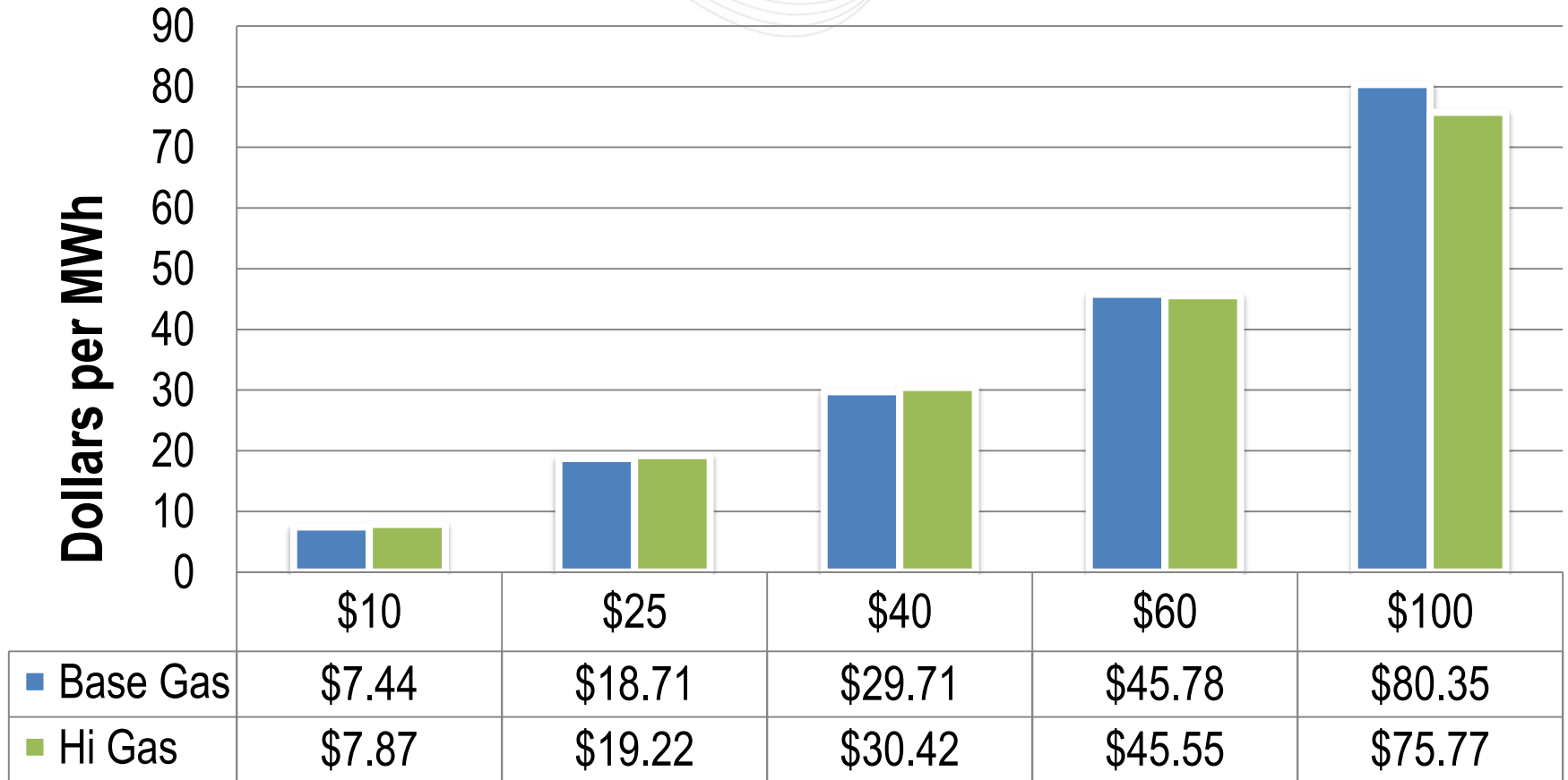
PJM member companies	550+
millions of people served	51
peak load in megawatts	144,644
MWs of generating capacity	164,634
GWh of annual energy	728,000
Generation sources	1,271
Area served	13 states + DC
Internal/external tie lines	247+



Marginal Cost of Abatement (\$/short ton)
 Re-dispatch from Coal (10 mmBtu/MWh)
 to Gas Combined Cycle (7 mmBtu/MWh)

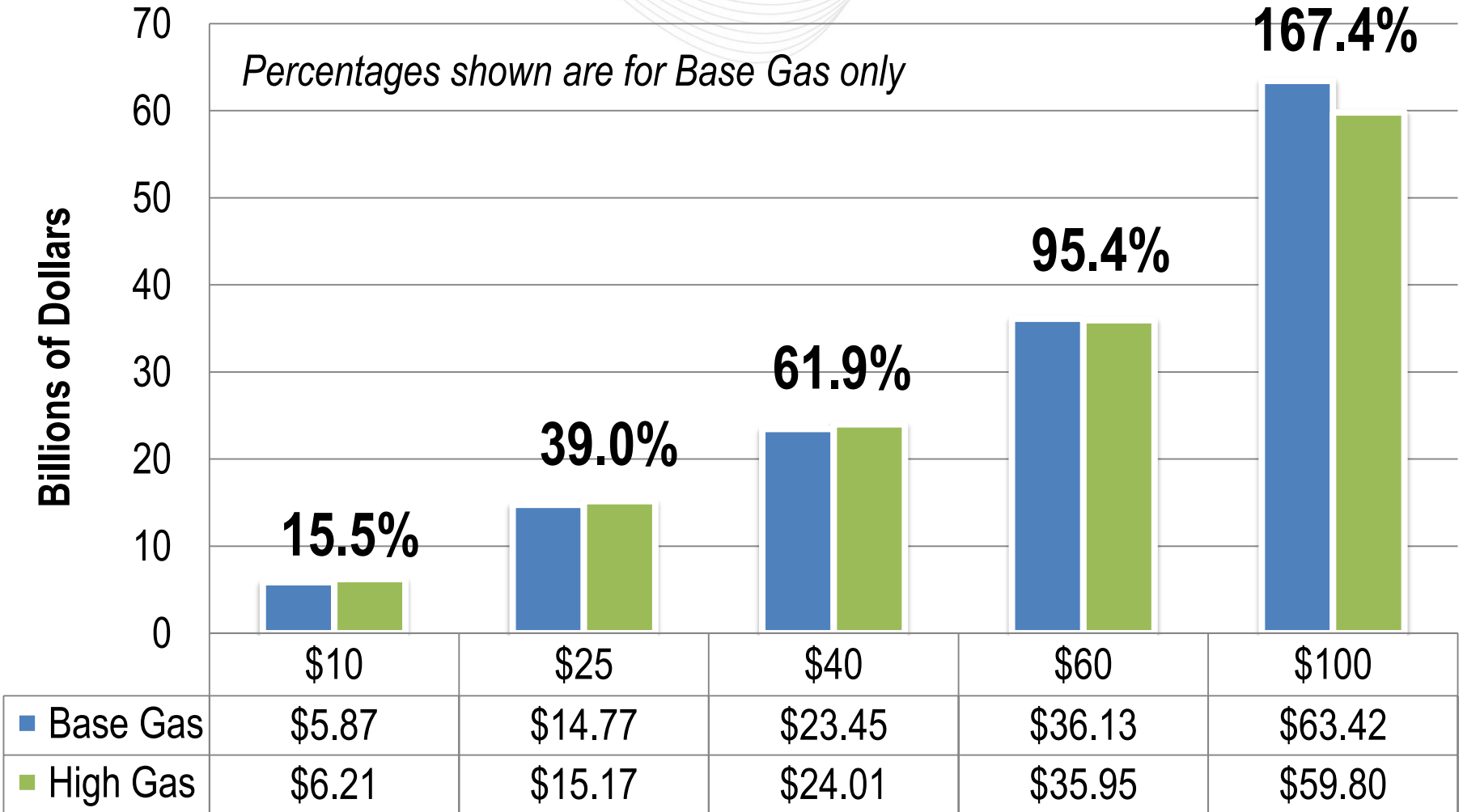
Region	Coal Price (\$/mmBtu)	Gas price (\$/mmBtu)		
		\$3.60 (9-25-09)	\$6.44 (Base)	\$10.00 (High)
Mid-Atl	\$2.30	\$3.57	\$35.80	\$76.21
ComEd	\$1.54	\$15.89	\$48.13	\$88.53
West	\$1.97	\$8.92	\$41.15	\$81.56
South	\$2.43	\$1.46	\$33.69	\$74.10

LMP Increase by CO₂ Price and Gas Price



Approximately 75-80% of CO₂ price is transmitted to load-weighted Average LMP.

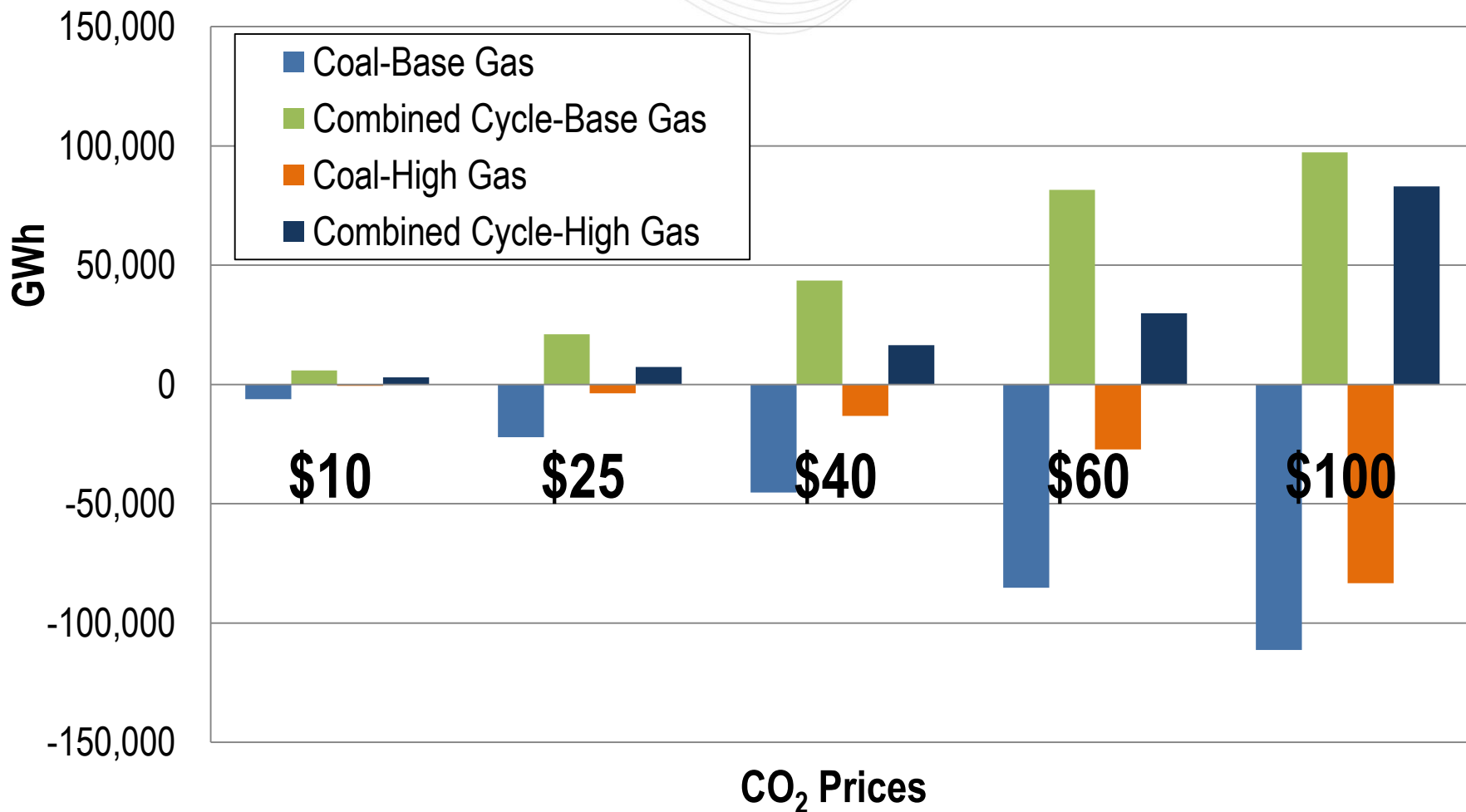
Increase in Wholesale Power Costs by Gas Price and CO₂ Price



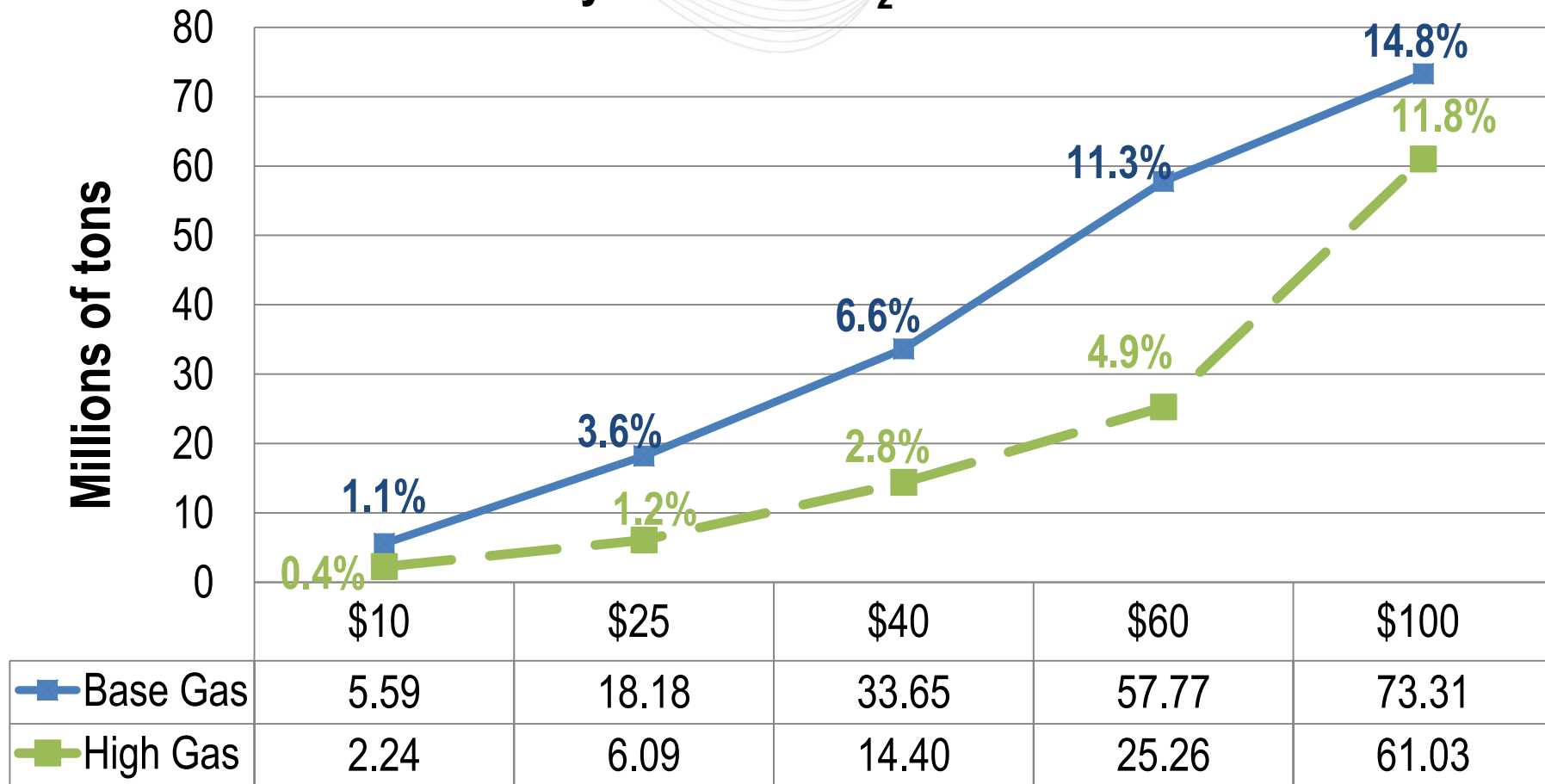
Increase in Monthly Bill of a Residential Customer Using 750 kWh



Change in Coal and Combined Cycle Generation by CO₂ Price



Emissions Reductions by Gas and CO₂ Price



Reductions are from the baseline 2013 emissions

Price and Cost Increases Mitigated				
	Load Reduction Percentage			15 GW Wind
	2%	5%	10%	
LMP (\$/MWh)	\$2 - \$4	\$5 - \$9	\$11 - \$17	\$5 - \$5.50
Wholesale Power Cost	\$3 - \$4 billion	\$6-\$11 billion	\$10-\$18 billion	\$4 - \$4.5 billion
Consumer Bill (monthly)	\$1 - \$3	\$4 - \$6.50	\$7 - \$12.50	\$3.50 - \$4

- 15 GW of wind has same impact as somewhere between a 2% and 5% load reduction
- Displaced generation is at a \$0 CO₂ price in the base gas case only.

Generation Displacement and Emissions Reductions Achieved

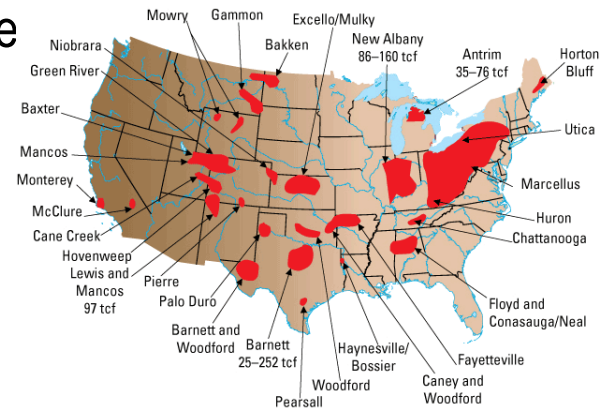
	Load Reduction Percentage			15 GW Wind
	2%	5%	10%	
Coal	6,741 GWh	18,376 GWh	41,972 GWh	26,303 GWh
Combined Cycle Gas	6,555 GWh	15,685 GWh	28,587 GWh	13,009 GWh
Additional CO ₂ Reductions (tons)	10-14 million	29-34 million	58-64 million	34-37 million

- Approximately the same effect as a 5% reduction in load with regard to emissions impacts gas displaced
- Displaced generation is at a \$0 CO₂ price in the base gas case only.

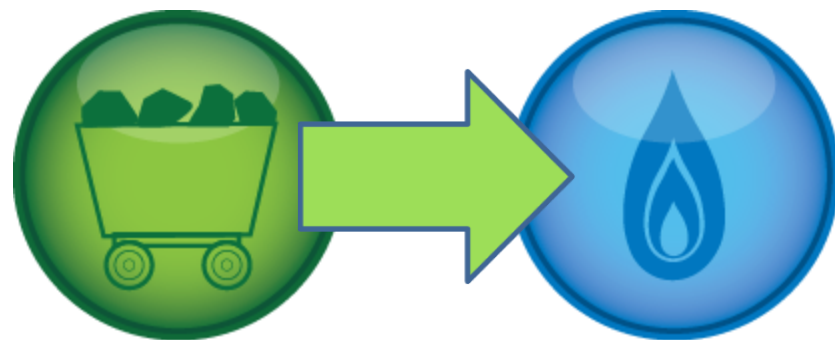
- LMP increases by 75-80% of CO₂ price
 - results in increase in customer bills
- Dispatch of gas ahead of coal for large-scale emissions reductions occurs only at
 - Approximately \$40/ton in the base gas case (\$6.44/mmBtu)
 - Approximately \$80/ton in the high gas case (\$10/mmBtu)
- Demand reduction and wind power can reduce emissions and offset increases in LMP, wholesale power costs, and customer bills.

- A tight range of CO₂ prices in 2013:
 - \$15-\$20/ton in most likely scenarios
 - ≈ \$11/ton without any banking or with high availability of offsets
 - \$28/ton if no international offsets
 - ≈ \$51/ton with no international offsets and high hurdles for new nuclear and renewable resources
- National average gas prices \$6.20-\$7.30/mmBtu
 - Availability of shale gas production help to drive price
 - Gas demand not appreciably higher either
- National average coal prices \$2/mmBtu
 - Increases in coal transportation costs offset by declining coal demand

Marcellus Shale



- CO₂ prices that cause widespread re-dispatch from coal to gas:
 - National average prices: \$20-\$30/ton
 - Less than \$15/ton east of the Alleghenies
 - \$15-\$20/ton in the West (not including ComEd)
 - Greater emissions reductions at lower CO₂ prices than in PJM whitepaper
- \$11-\$15/MWh increases in LMP on average **IF** CO₂ price – LMP relationship same as in whitepaper
 - includes only increase due directly to CO₂ prices, not increased fuel costs
 - can separate out effects from direct CO₂ price and impact on fuel prices
- Whitepaper update in progress



- Policy Changes from federal legislation
 - Waxman-Markey (ACES)
 - Bingaman (ACELA)
 - Kerry-Boxer emissions caps
- Technology
 - Determined partially by policy and legislation
 - Carbon capture and storage
 - AEP, Wall Street Journal, 12/9/09
 - Nuclear
- Markets
 - CO2/GHG
 - RTO/ISO

- Offsets
 - Energy Information Administration analysis
 - ICF analysis
- Renewable Portfolio Standards/Electricity Standards
 - Federal v. State
 - Production Tax Credits
 - Renewable Energy Credits
 - Wholesale electricity prices
 - Cap and trade
 - Allowance allocation