

Renewable Energy and Natural Gas: *From Crisis to Opportunity*



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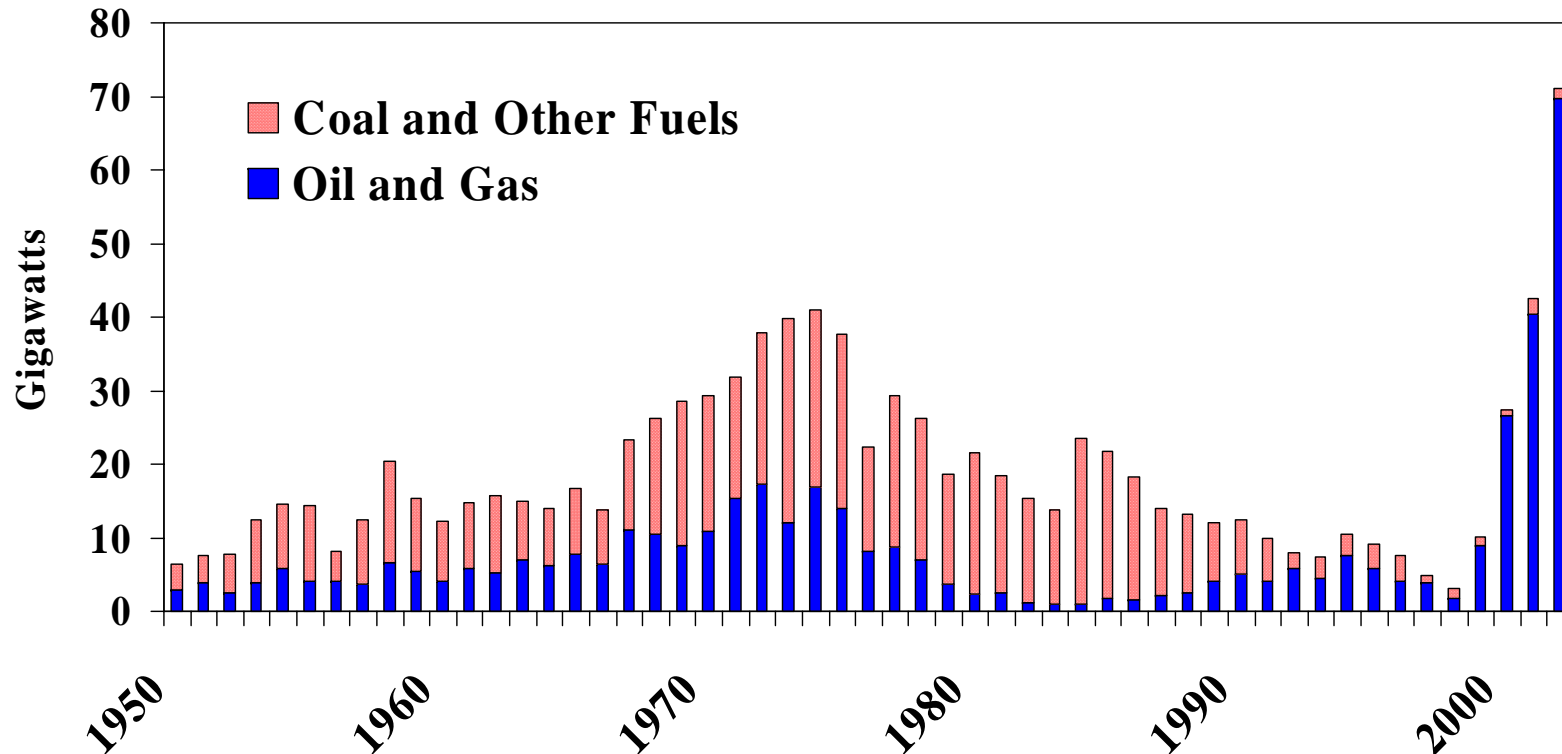
Union of Concerned Scientists
Citizens and Scientists for Environmental Solutions



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The problem: Surge of new natural gas plants...

Annual Additions to Electric Generation Capacity
by Fuel, 1950-2002

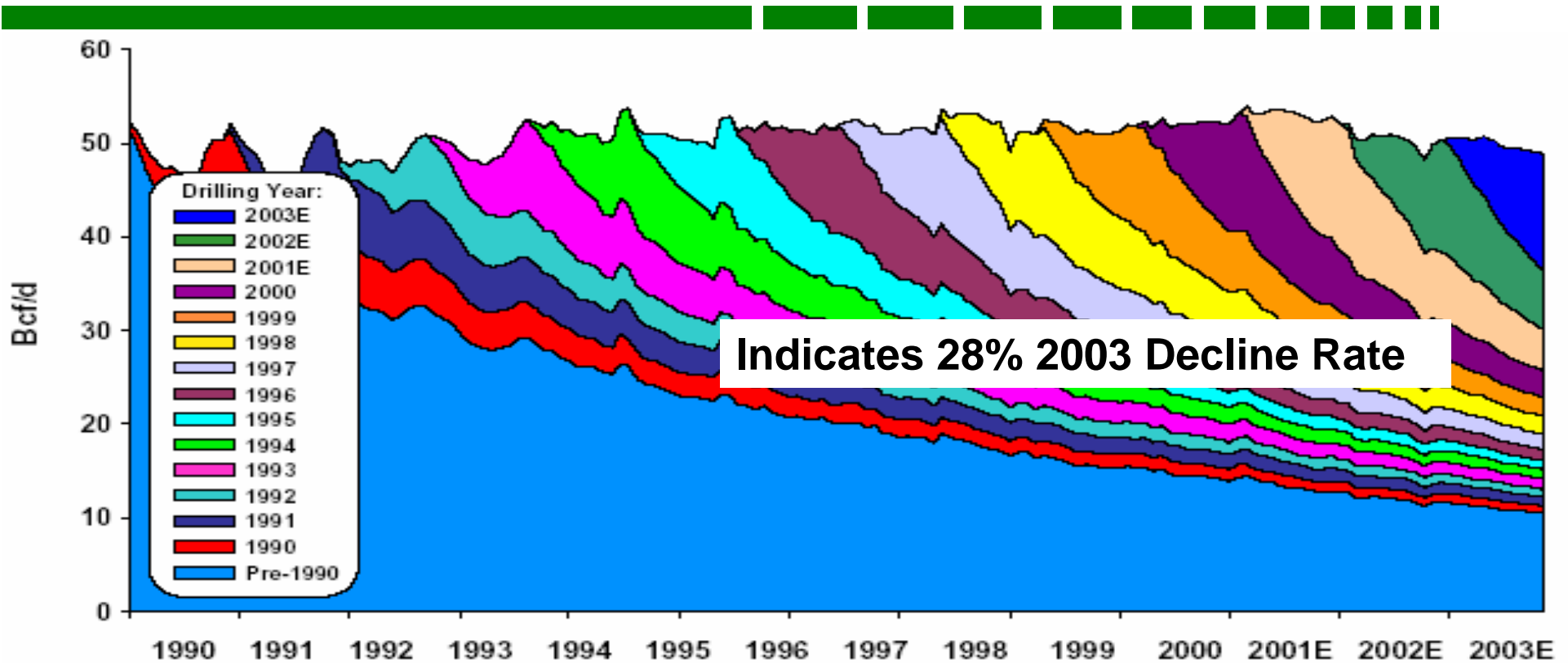


Source: EIA, *Annual Energy Outlook 2004*



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While US gas productivity declines...



Production Decline Rate of Base:

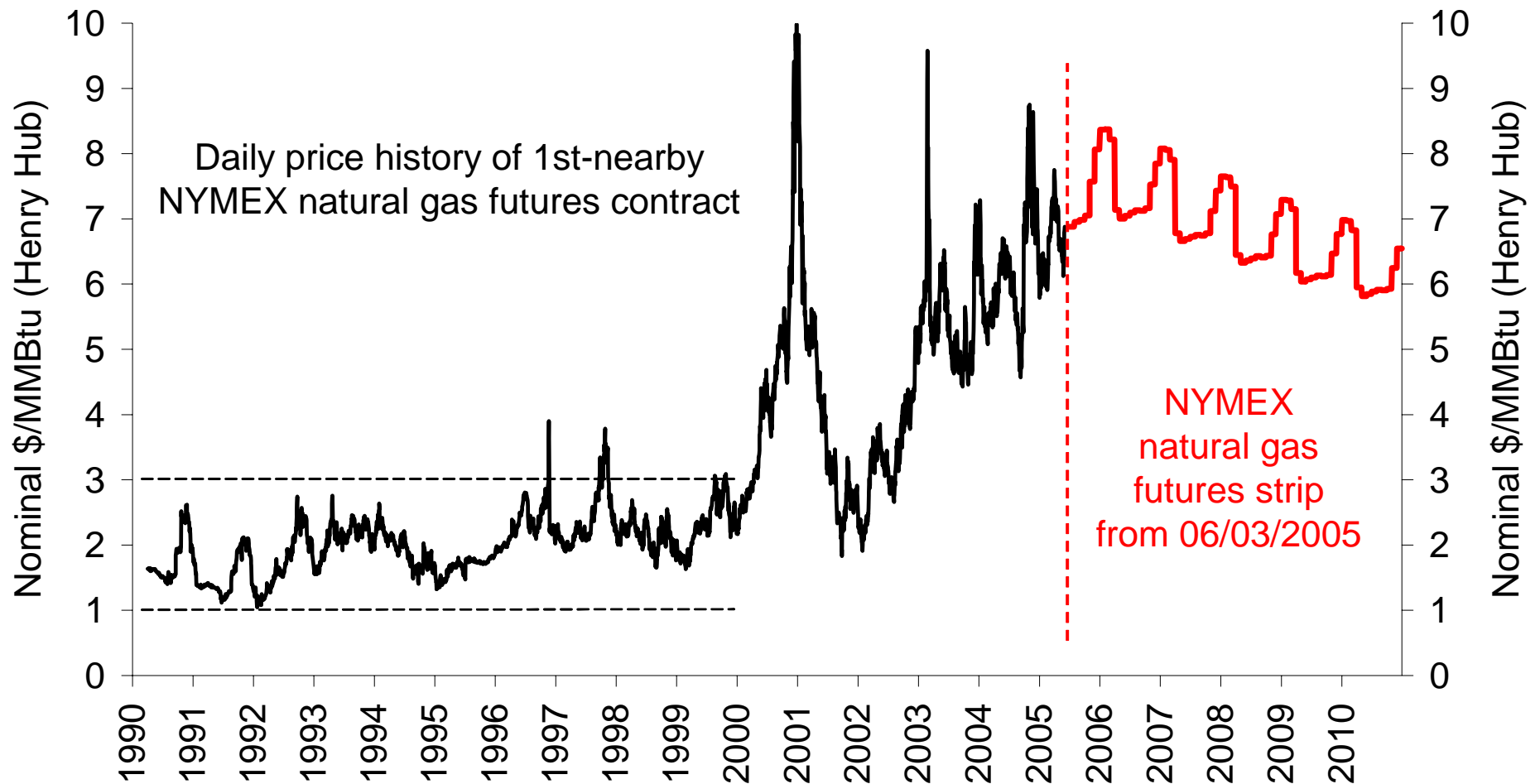
17% 17% 16% 18% 19% 19% 20% 21% 23% 23% 25% 24% 27% 28%

Source: Richard Levitan: IHS Energy, Petroleum Information Corp., EOG Resources



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...Helping to drive gas higher & higher



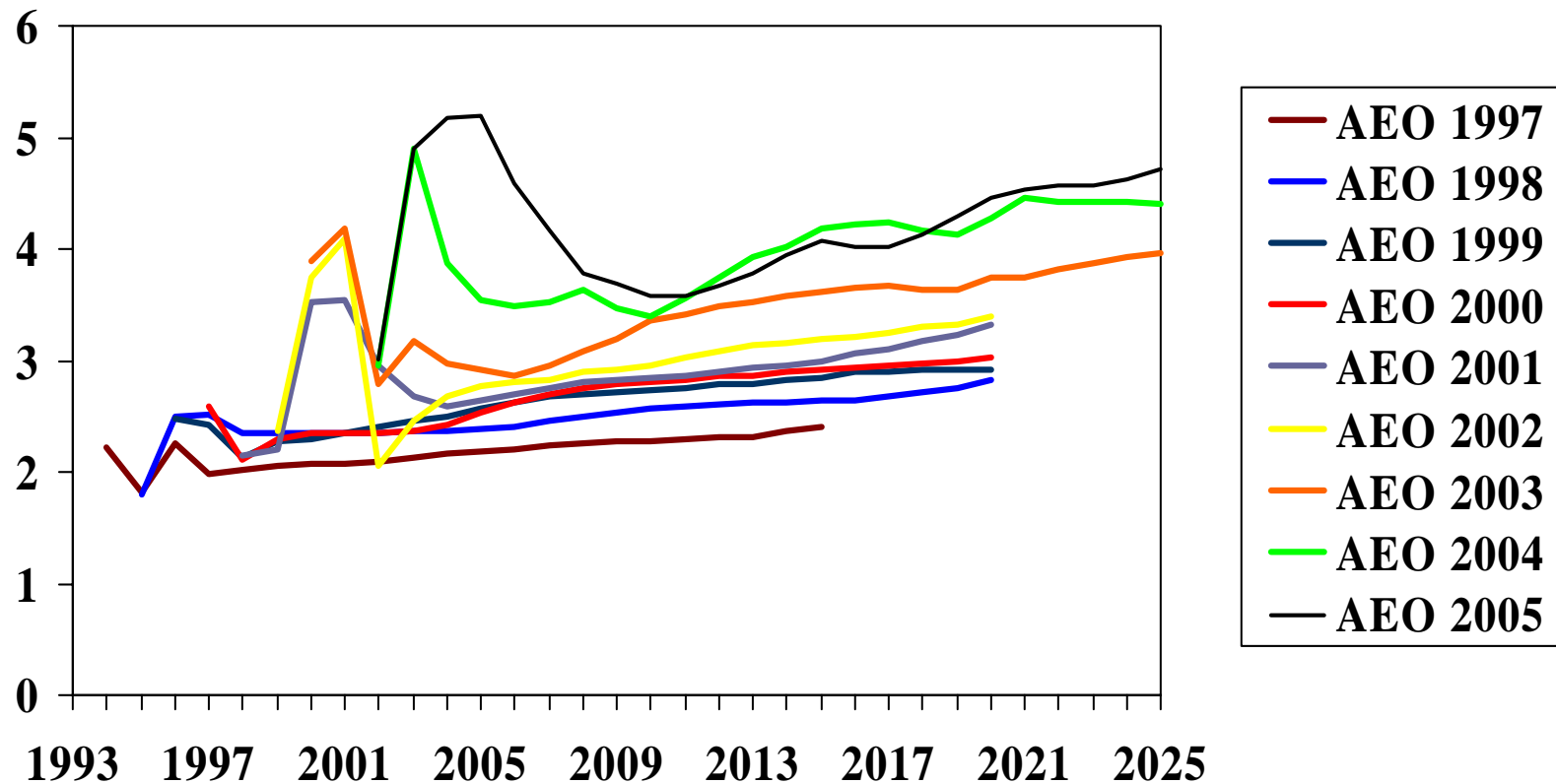
Source: NYMEX



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EIA annual long-term gas price forecasts also continue to rise

Wellhead Natural Gas Prices (2002\$/Mcf)



Source: EIA, *Annual Energy Outlook*



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Renewable energy can help...

Renewable energy provides a hedge against volatile and escalating gas prices in two ways:

- **RE Reduces Gas Prices:** By displacing gas-fired generation, incremental renewable generation reduces demand for natural gas, and consequently puts downward pressure on natural gas prices
- **RE Reduces Exposure to Gas Price Risk:** Incremental renewable generation (usually fixed-price) displaces gas-fired generation (usually variable-priced)

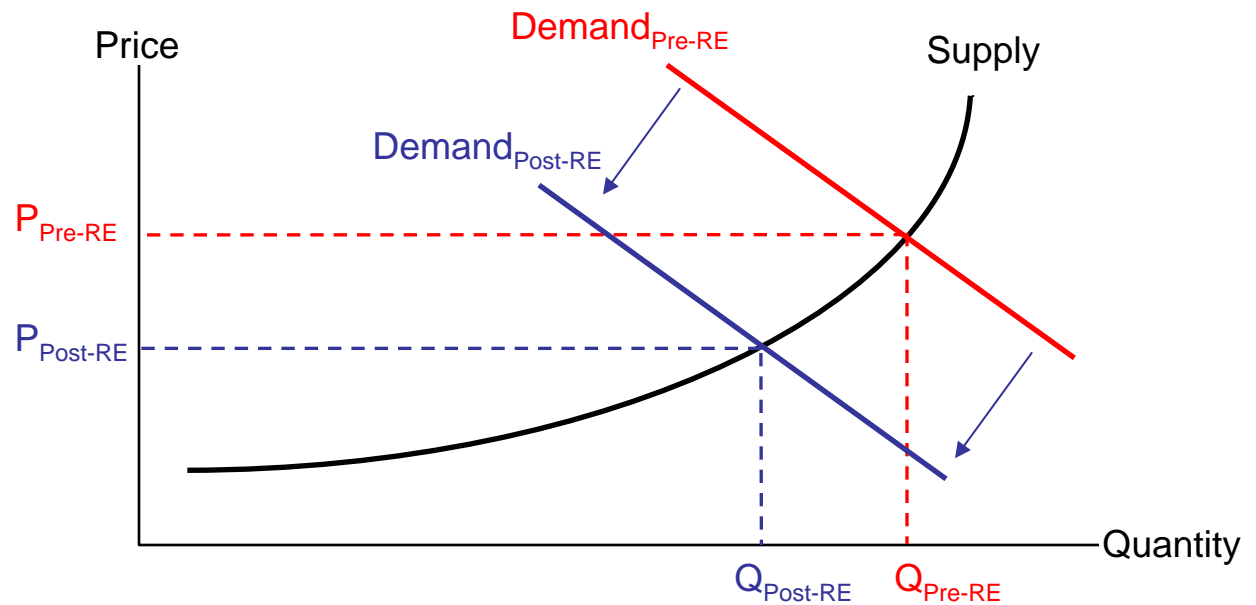
*****This presentation only covers the first benefit**



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Increased RE deployment puts downward pressure on gas prices

Theory: Increased renewable generation displaces gas-fired generation, reducing demand for natural gas and placing downward pressure on natural gas prices



Magnitude of price reduction depends on the shape of the gas supply curve: impact expected to be larger in the short-term than in the long-term due to short-term supply constraints

Source: U.S. DOE, LBNL



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Renewable energy & natural gas studies

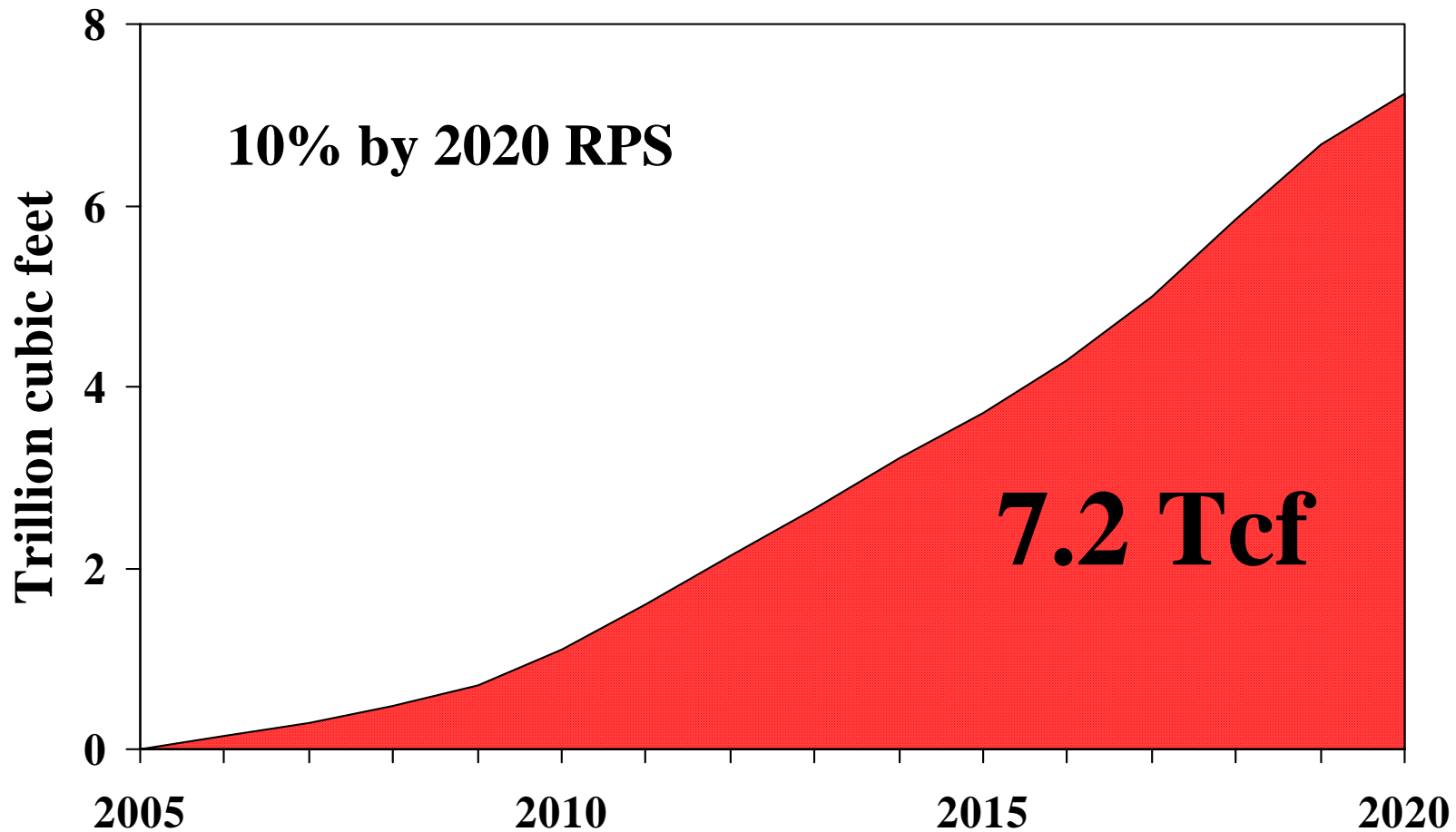
- **Series of scenarios examined by U.S. Energy Information (EIA) and Union of Concerned Scientists**
- **Renewable electricity (portfolio) standards—10% or 20% by 2020**
 - **Different penetrations based on target level, exclusions (e.g., munis, coops, small utilities, baseline deductions (e.g., hydro, MSW))**
- **As important for what they say about the penetration of renewables as the policies to get there**
- **Similarities**
 - **National Energy Modeling System (NEMS)**
 - **Same demand forecasts, fossil technology costs, fuel price assumptions**
 - **Examine wind, geothermal, solar, biomass technologies**
 - **No ocean, incremental hydro**
- **Differences**
 - **EIA: pessimistic renewable energy costs, performance**
 - **UCS: renewable energy costs and performance assumptions more in line with recent experience and U.S. DOE national laboratories**
- **Renewable electricity displaces ~50% gas, 50% coal – balance tilts more towards coal displacement as gas prices rise**



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Renewable energy conserves natural gas supplies

Cumulative Natural Gas Savings



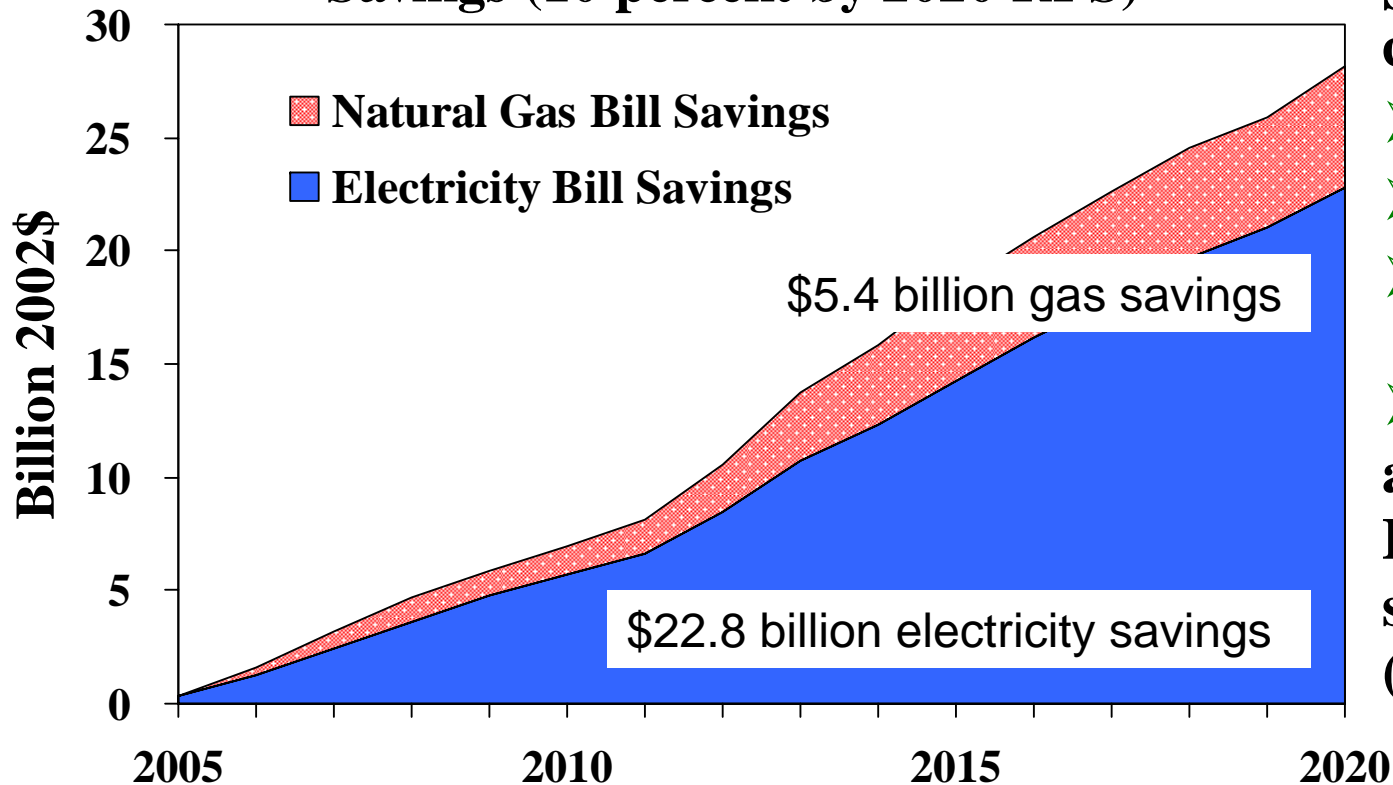
Source: UCS, 2004.



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Renewable energy saves electric & natural gas consumers money

Cumulative Natural Gas and Electricity Bill Savings (10 percent by 2020 RPS)*



Savings in all customer classes:

- Res.: \$7.9 bil
- Comm.: \$11.3 bil
- Ind.: \$9 bil

➤ June 2005 EIA analysis for Sen. Bingaman shows similar savings (\$22.6 billion)

Source: UCS, 2004.

*Excludes Transportation.

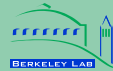


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Renewable energy can help...

- LBNL report released in January 2005
- Analyzes results from 13 modeling studies that have evaluated the impact of increased RE and EE deployment on gas prices
 - 5 EIA studies of the impact of a national RPS, two of which model multiple RPS scenarios
 - 6 UCS studies of the impact of a national RPS, three of which model multiple RPS scenarios and one of which includes aggressive EE
 - 1 Tellus study of the impact of New England RPS (focus on RI)
 - 1 ACEEE study of the impact of national RE/EE deployment
- All use NEMS (from various years), except ACEEE, which uses a model from EEA
- <http://eetd.lbl.gov/ea/ems/re-pubs.html>

LBNL-56756



**ERNEST ORLANDO LAWRENCE
BERKELEY NATIONAL LABORATORY**

**Easing the Natural Gas Crisis:
Reducing Natural Gas Prices through
Increased Deployment of Renewable
Energy and Energy Efficiency**

Ryan Wisser, Mark Bolinger, Matt St. Clair

**Environmental Energy
Technologies Division**

January 2005

Download from <http://eetd.lbl.gov/EA/EMP>

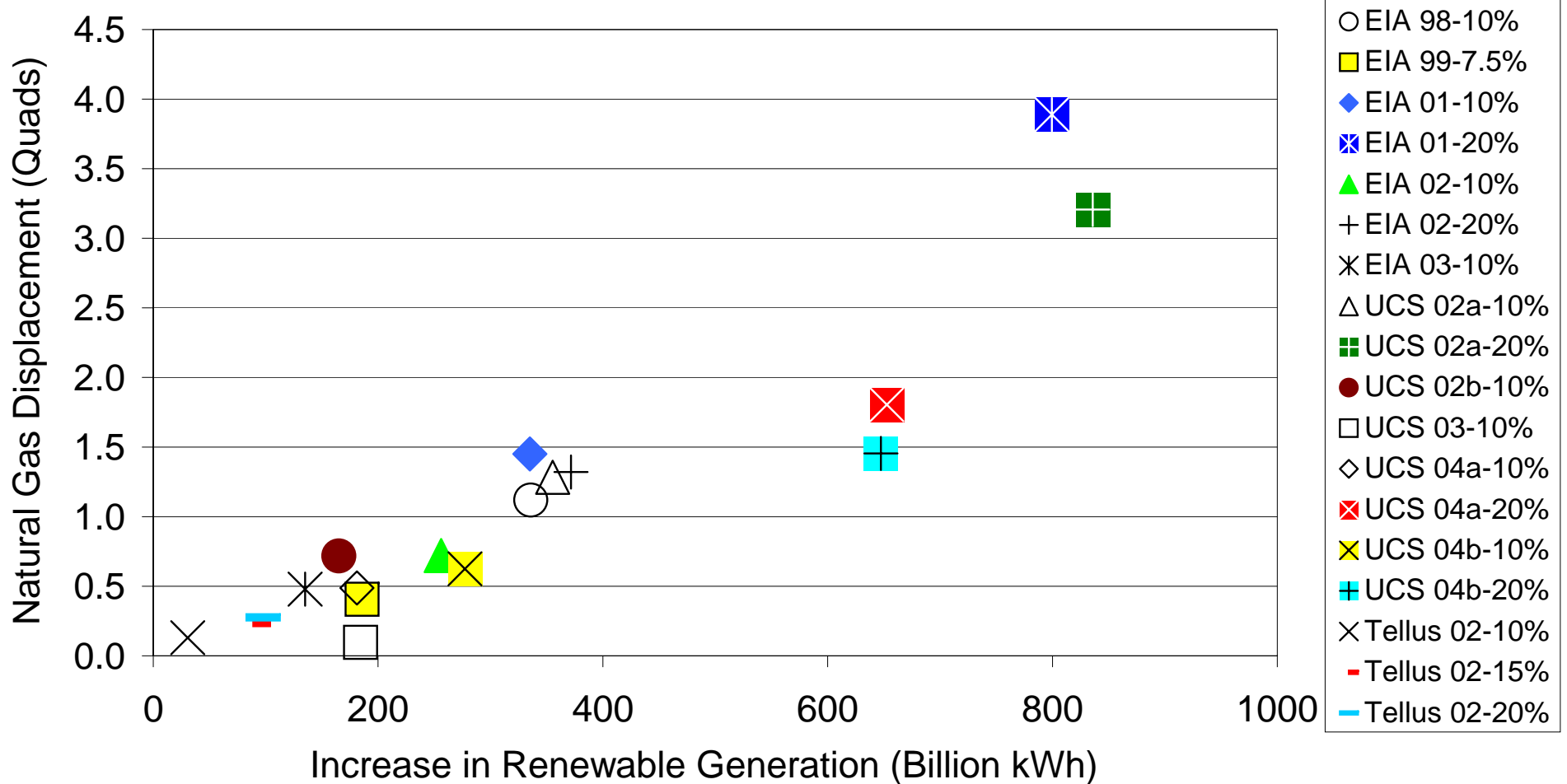
The work described in this paper was funded by the Assistant Secretary of Energy Efficiency and Renewable Energy, Office of Planning, Budget & Analysis and Wind & Hydropower Technologies Program, of the U.S. Department of Energy under Contract No. DE-AC03-76SF00098.



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More renewables = more gas savings

Projected Gas Displacement in 2020 Under RPS Studies



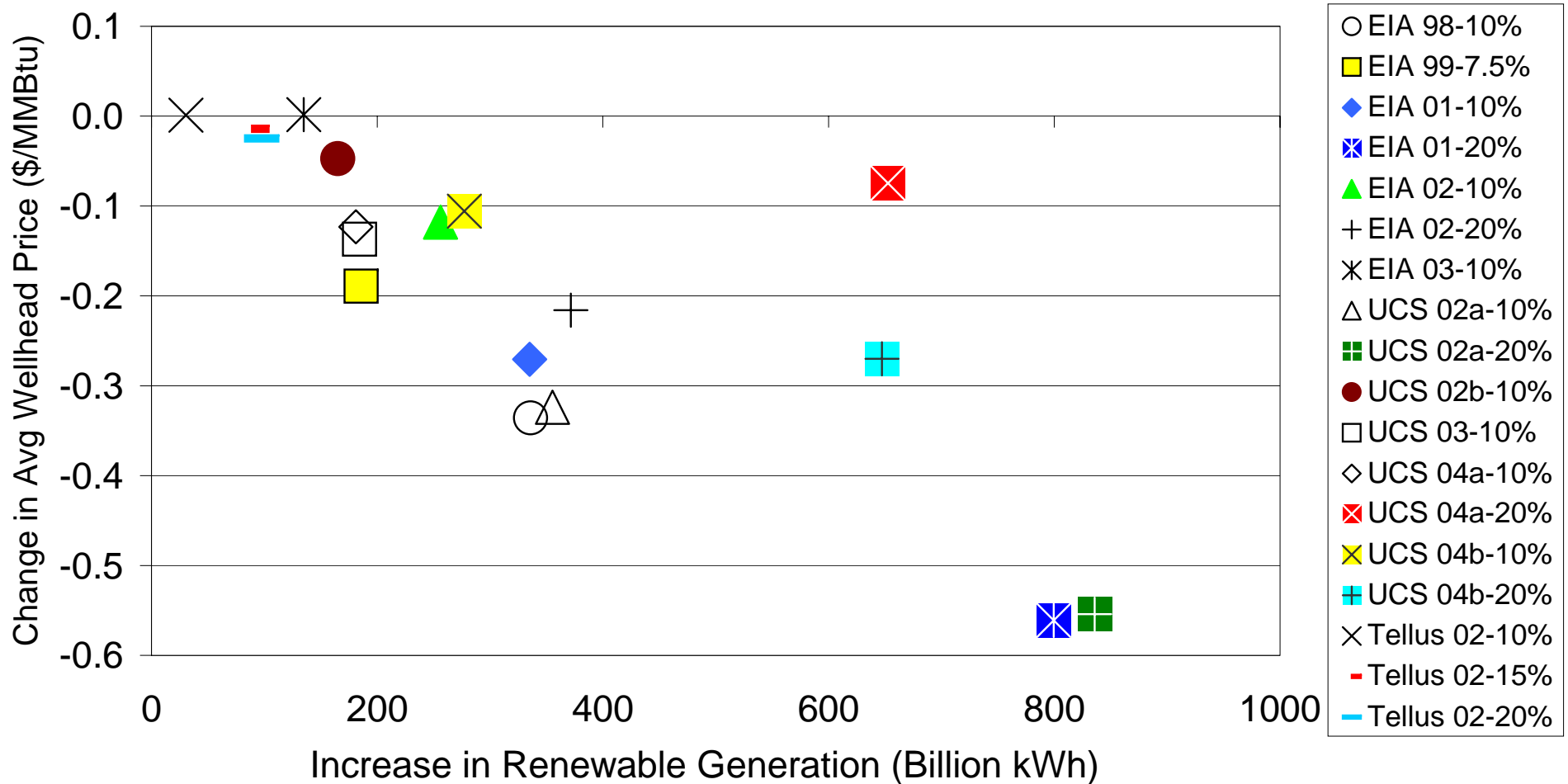
Source: U.S. DOE, LBNL



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More gas savings = Lower Gas Prices

Projected Gas Price Change in 2020 Under RPS Studies

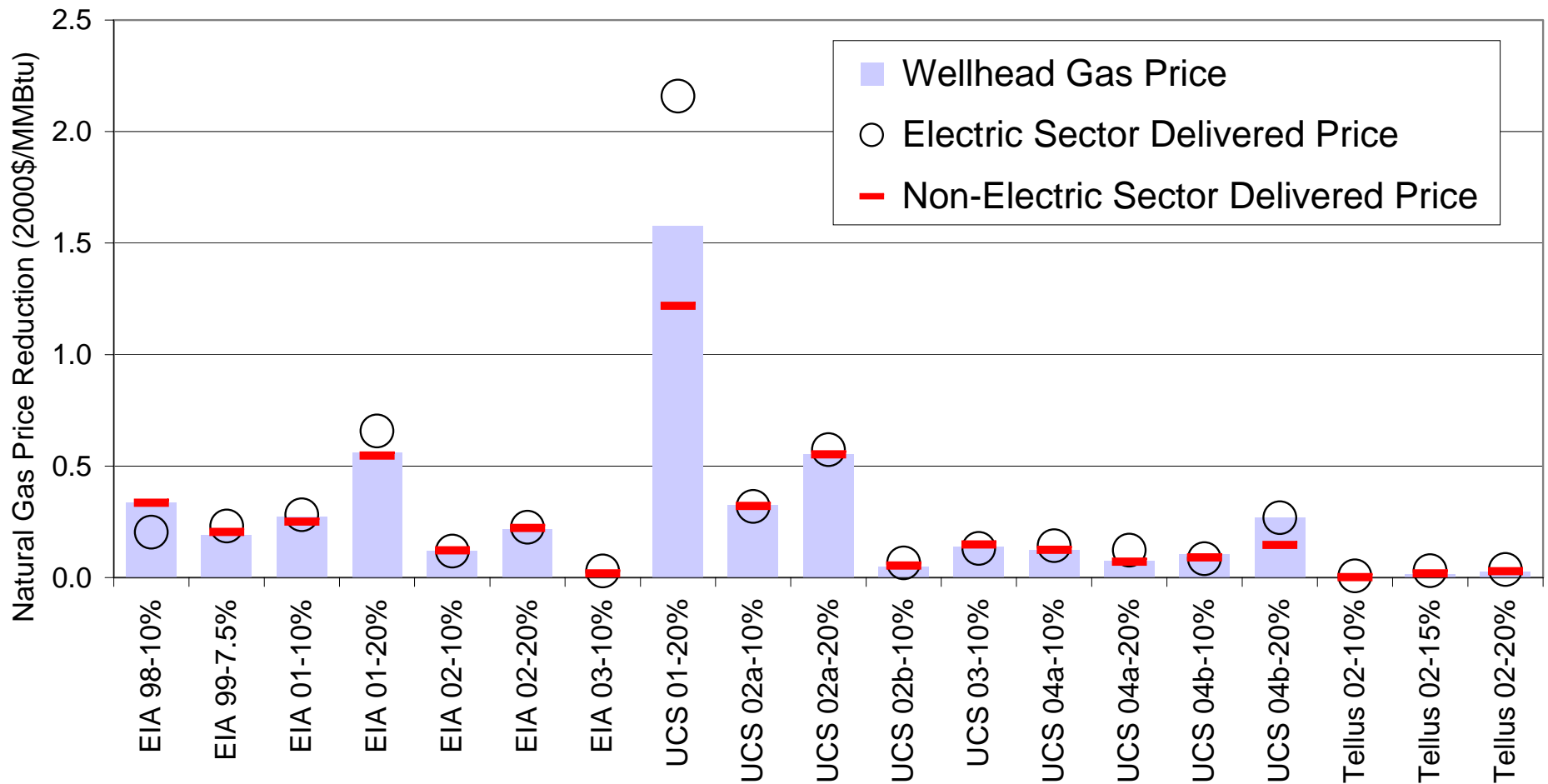


Source: U.S. DOE, LBNL



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LBNL: Wellhead price reductions flow through to delivered prices roughly 1:1

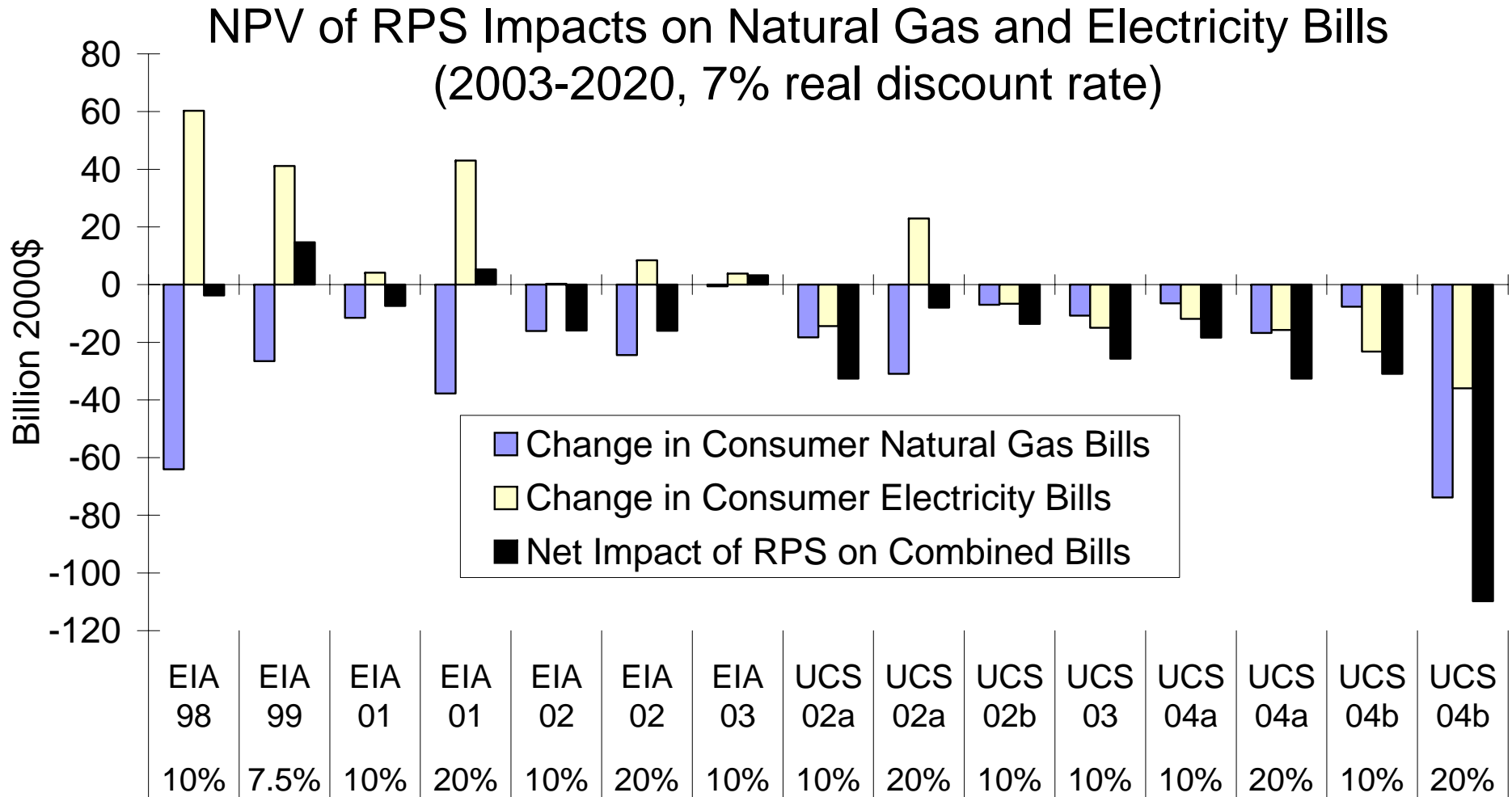


Source: U.S. DOE, LBNL



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LBNL: Gas bill reductions substantially offset any increase in electricity bills



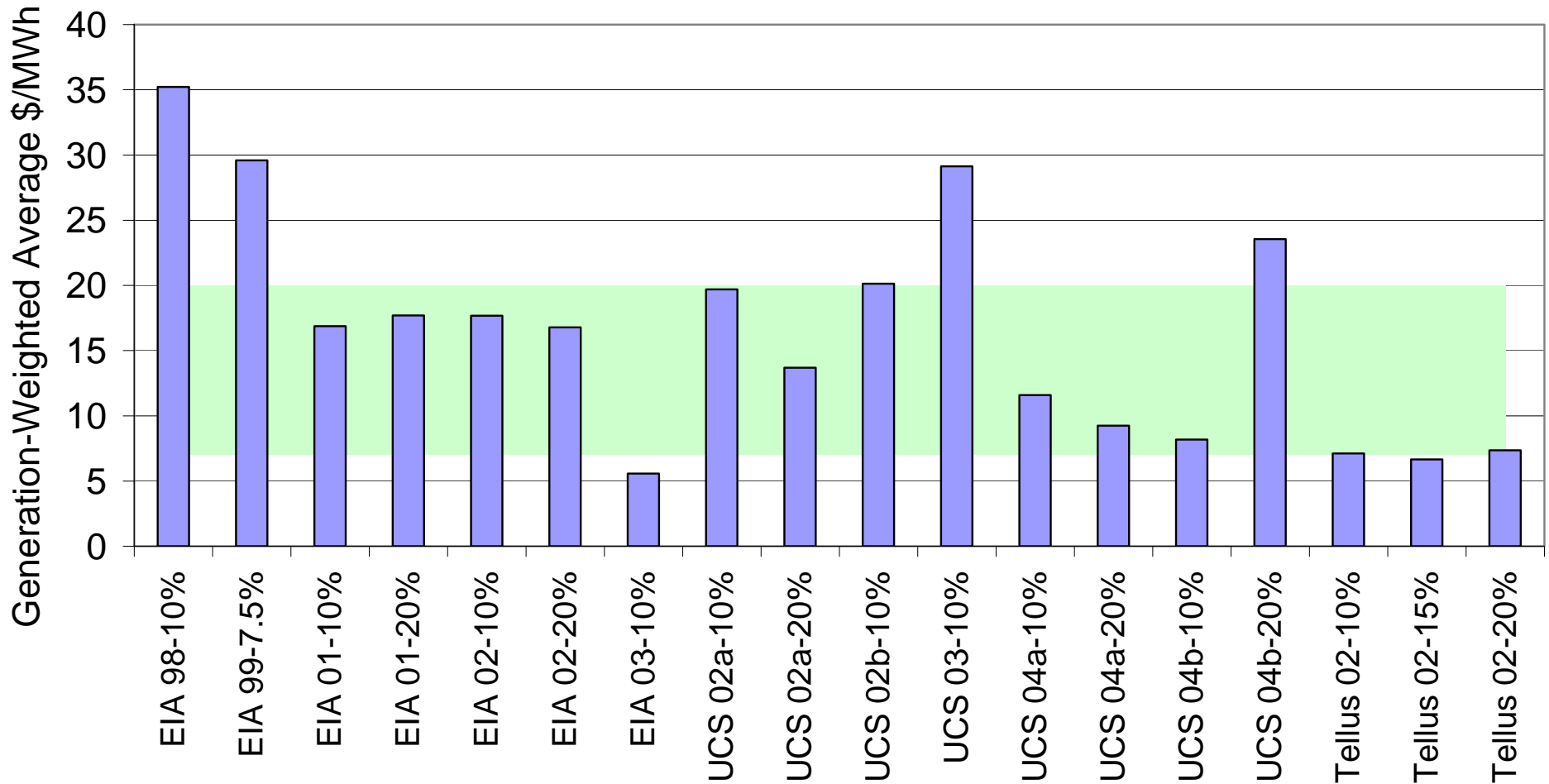
Source: U.S. DOE, LBNL



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LBNL: Expressed as \$/MWh of incremental RE, national gas bill savings are substantial

Range of \$7-\$20/MWh captures most studies (some larger)



Source: U.S. DOE, LBNL

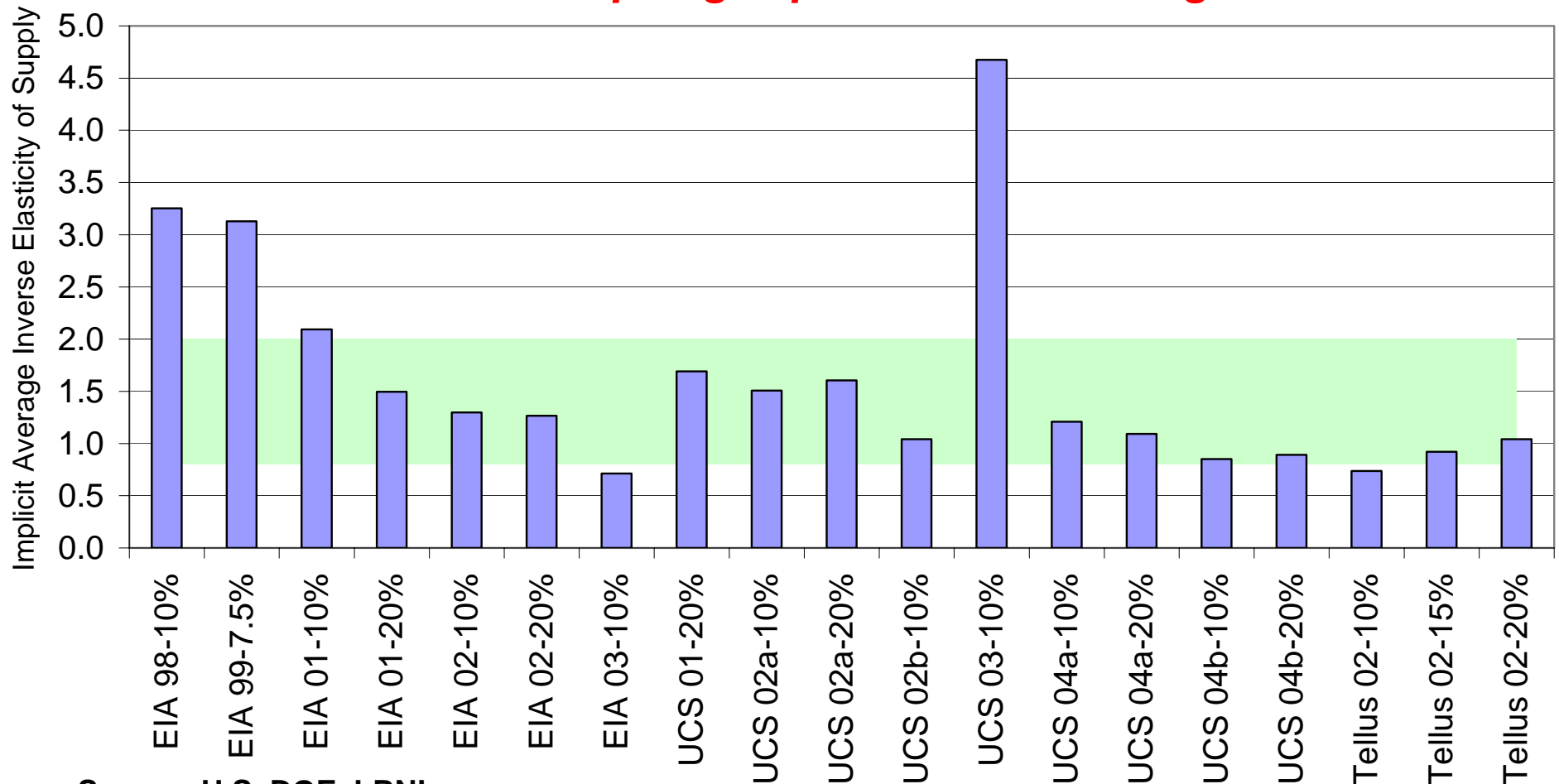


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Implied ‘Inverse Elasticity of Supply’

(Defined as $\% \Delta P / \% \Delta Q$, measures shape of long-term supply curve)

Central tendency of 0.8-2.0 suggests that **a 1% drop in gas demand causes a 0.8%-2.0% drop in gas prices over the long term**



Source: U.S. DOE, LBNL



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LBNL: NEMS Fairly Consistent with Other Models and Empirical Estimates

➤ Four of six models used in a recent study by Stanford's Energy Modeling Forum exhibit inverse elasticities that are consistent with those in NEMS

Energy Model	2010 Inv. Elast.	2020 Inv. Elast.
POEMS	1.75	1.81
CRA	2.33	0.93
NANGAS	6.67	4.76
E2020	1.03	0.76
MARKAL	2.04	2.13
NARG	-3.57	-50.00

- Results from EEA model (used in ACEEE and NPC studies) imply *higher* inverse elasticities (>15 short-term, ~4-6 long-term)
- LBNL only found one published empirical estimate of the inverse elasticity of gas supply: **3.57 from 1918-1973, 1.25 from 1973-1999**
- Empirical and modeling estimates from other markets (oil, coal, copper) instill some confidence in these gas numbers
- More work is needed in this area

Source: U.S. DOE, LBNL



Conclusions

- **Natural gas prices are high, volatile, unpredictable**
- **Cost of renewables is competitive, steady, predictable**
- **Renewables reduce gas consumption and prices**
 - **Modeling studies imply that a 1% drop in gas demand leads to a long-term 0.8% - 2.0% drop in gas prices on average (and possibly a larger near-term drop)**
 - **Consumer gas bill savings from increased RE/EE conservatively estimated to be ~\$10-20/MWh on a national basis**
- **Efficiency AND renewables = best combination. UCS *Clean Energy Blueprint*: up to 31% less natural gas; 27% reduction in gas price**
- **Any policy evaluation of RE should extend beyond the power sector, to include gas sector impacts as well**



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several slides and other info.**

Thank you!

For more information...

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