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Hedging Future Carbon Risk with Wind Power



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UWIG Spring Meeting
A Capital View of Wind Integration
April 6, 2006





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What is now obvious

- 1. The scientific debate is on global warming is over.**
- 2. Limits on greenhouse gas emissions are coming -- soon.**
- 3. These limits pose significant financial risks to utilities and consumers and will change the economics of power generation options.**
- 4. We need to factor these future costs into investment decisions today.**



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A changing political climate

- **Global response: Kyoto ratification, EU Trading, G8 Summit**
- **State/regional response: CA, NM, MA, NH, WA, OR; Northeast Regional Greenhouse Gas Initiative (RGGI), West Coast Governors Initiative; Renewable Electricity Standards in 20 states & DC**
- **Local response: 174 cities have agreed to reduce emissions by at least 7 percent below 1990 levels (Kyoto)**



Sense of the Senate Resolution

- **“It is the sense of the Senate that Congress should enact a comprehensive and effective national program of mandatory, market-based limits and incentives on emissions of greenhouse gases...”**
 - adopted June 22, 2005, supported by 54 Senators
 - co-sponsored by: Bingaman (D-NM), Specter (R-PA), Byrd (D-WV), Domenici (R-NM)
 - Bingaman & Domenici released white paper on design elements for a mandatory system on Feb. 2, 2006; 29 panelists presented proposals at Energy Committee’s Climate Conference on April 4
- **Federal proposals: Climate Stewardship Act, National Commission on Energy Policy, power plant multi-pollutant caps.**



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Industry leaders recognize inevitability of carbon limits

- **GE, BP, British Airways, Ford**
- **Financial institutions and insurance companies**
 - JP Morgan Chase, Merrill Lynch, Swiss Re
- **Utilities & Power Suppliers**
 - Duke Energy—CEO called for economy-wide carbon tax
 - Exelon
 - American Electric Power
 - Cinergy
 - Xcel Energy
 - PacifiCorp
 - Idaho Power
 - Pacific Gas & Electric
 - PSE
 - Avista
 - Entergy
 - Sempra
 - PNM Resources
 - Calpine

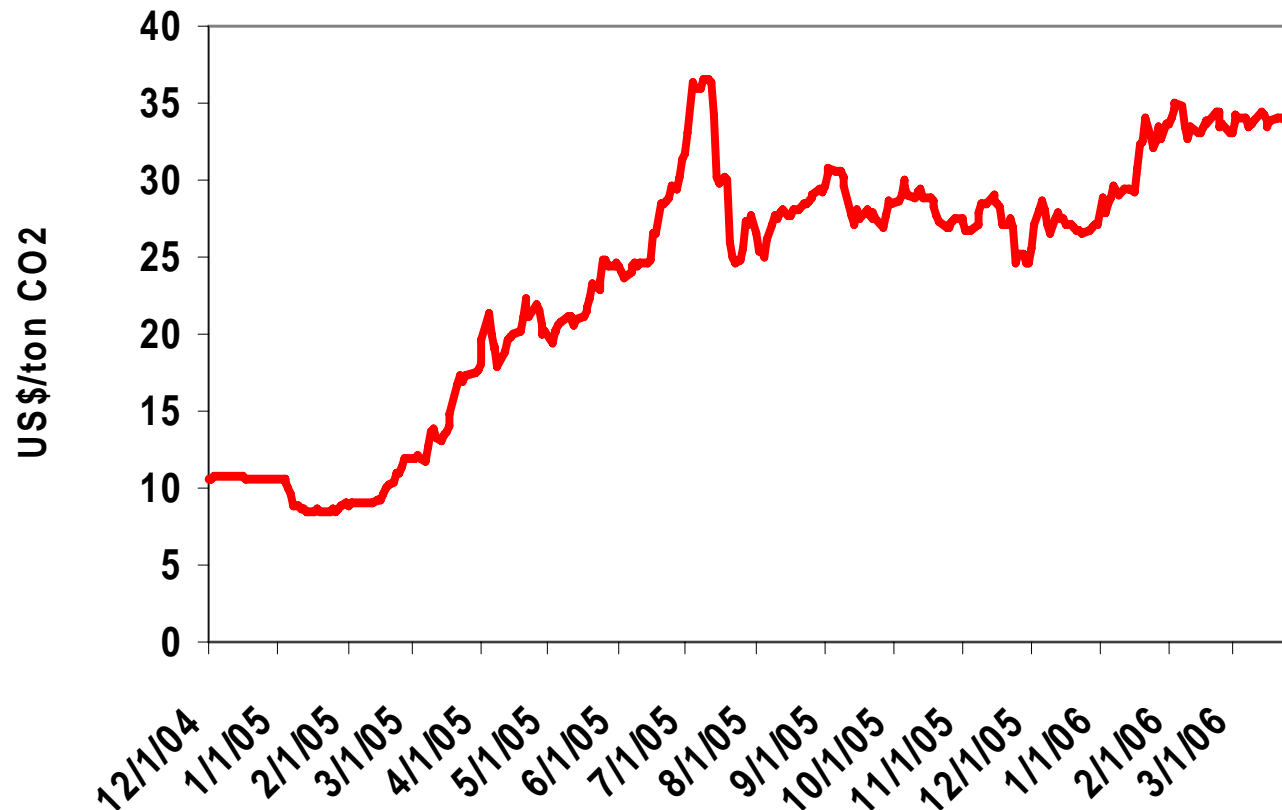


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What is the cost of CO₂ limits?

Current Market Prices

EU Carbon Allowance Closing Price



- **EU: \$9-35/ton**
- **Chicago Climate Exchange (voluntary): \$1.50-\$3.25/ton**
- **Climate Trust: \$3-6/ton for offsets**

Sources: EU: PointCarbon.com using an average exchange rate for 2005 of 1.25 US dollars per euro; Chicago Climate Exchange Market Data, www.chicago.com/trading/stats/monthly/index.html; Bokenkamp et. al. "Hedging Carbon Risk" Electricity Journal, July 2005.



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What is the cost of future CO₂ limits in the US?

➤ **Top-down studies**

- **Climate Stewardship Act: \$15-\$34/ton (EIA); \$14-\$36/ton (MIT)**
 - » 2000 levels by 2010 and 1990 levels by 2016.
- **Clean Power Act: \$14-\$33/ton in 2020 (EIA)**
 - » reduces power plant CO₂ to 1990 levels

➤ **Bottom-up studies**

- **Climate Stewardship Act: \$9/ton in 2010, \$21/ton in 2020 (Tellus, using EIA model)**
 - » \$30 billion in net benefits to consumers by 2020 with efficiency and renewable energy policies.
- **DOE Clean Energy Future Study: \$13.64/ton to achieve 1990 levels by 2020**

➤ **Cost ultimately depends on the level of reductions and availability of affordable low/no carbon solutions**



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Utilities are increasingly evaluating carbon risk

- **7 of 12 western utilities considered carbon risk in latest resource plans, representing 30% of western electricity supply**
 - 10 of 12 plans will consider in next round: 42% of western electricity

- **CA PUC requires utilities to include “adder”**
 - \$8/ton initially rising at 5% year
 - Required to include in long-term planning and evaluating bids

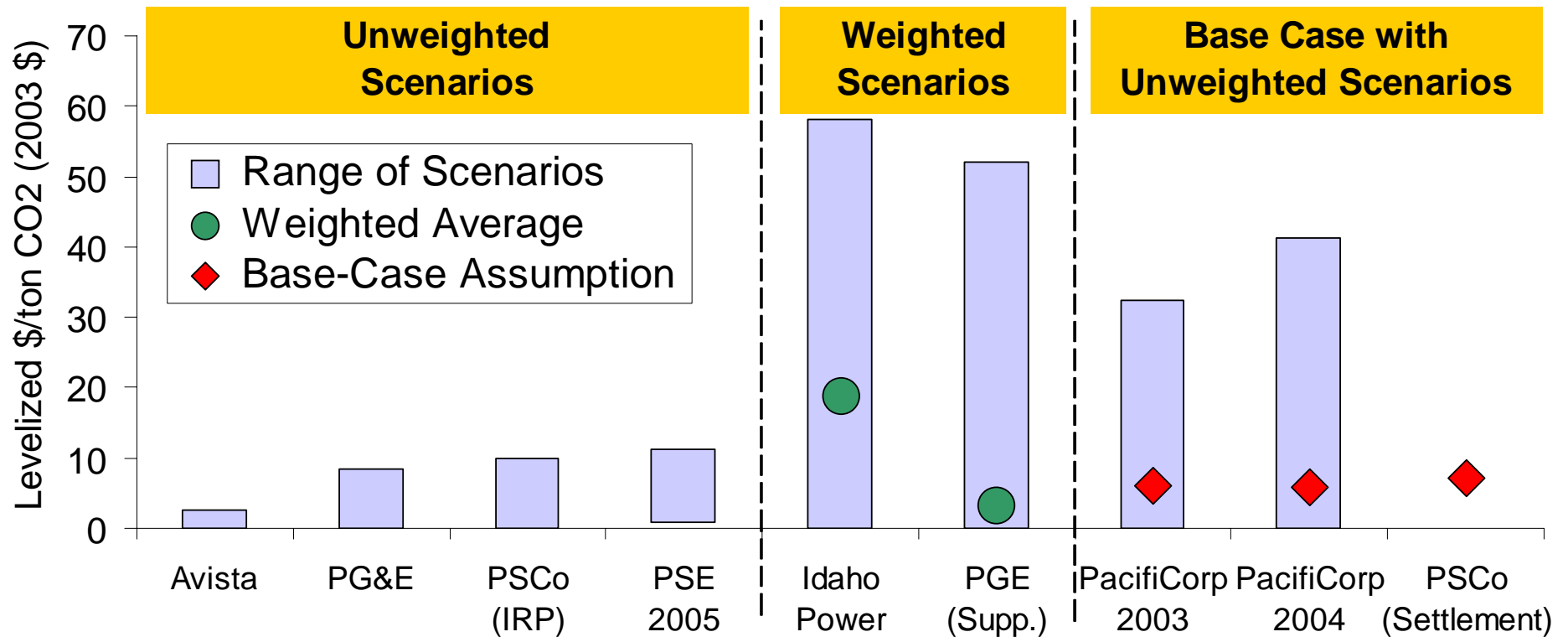
Sources: LBL, *Balancing Cost and Risk: The Treatment of Renewable Energy in Western Utility Resource Plans*, August 2005;

CA PUC Decision No. 04-12-048 December 2004, and revised decision in April 2005..



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Methods and Approach to Carbon Risk Evaluation Vary



Lawrence Berkeley Lab recommends that...

- all utilities evaluate carbon risk
- a greater level of consistency in evaluation approaches be sought
- a broad range of possible regulatory environments be considered

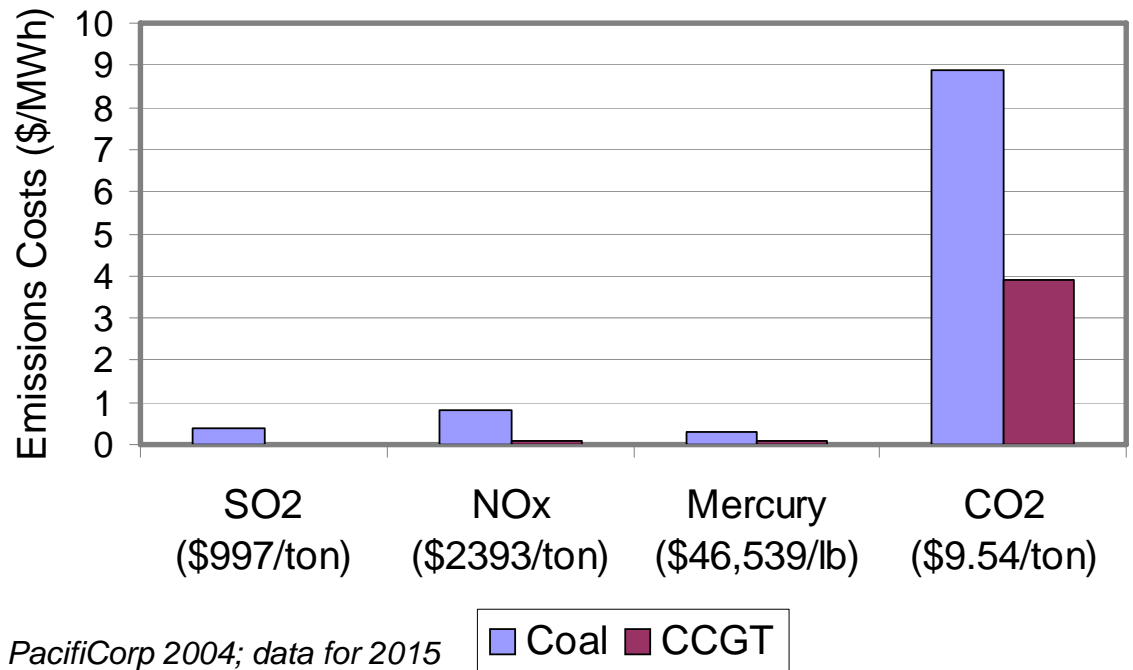
Source: LBL, *Balancing Cost and Risk: The Treatment of Renewable Energy in Western Utility Resource Plans*, August 2005.



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CO₂ is important component of environmental regulatory risk

Environmental regulations are likely to change over the lifetime of electric supply investments, and utility planning should evaluate these risks, and mitigate them if cost-effective to do so



Risk of carbon regulation – at the state or federal level – is likely the most important to consider, but risk of strengthened regulations of SO₂, NO_x and mercury also deserve note

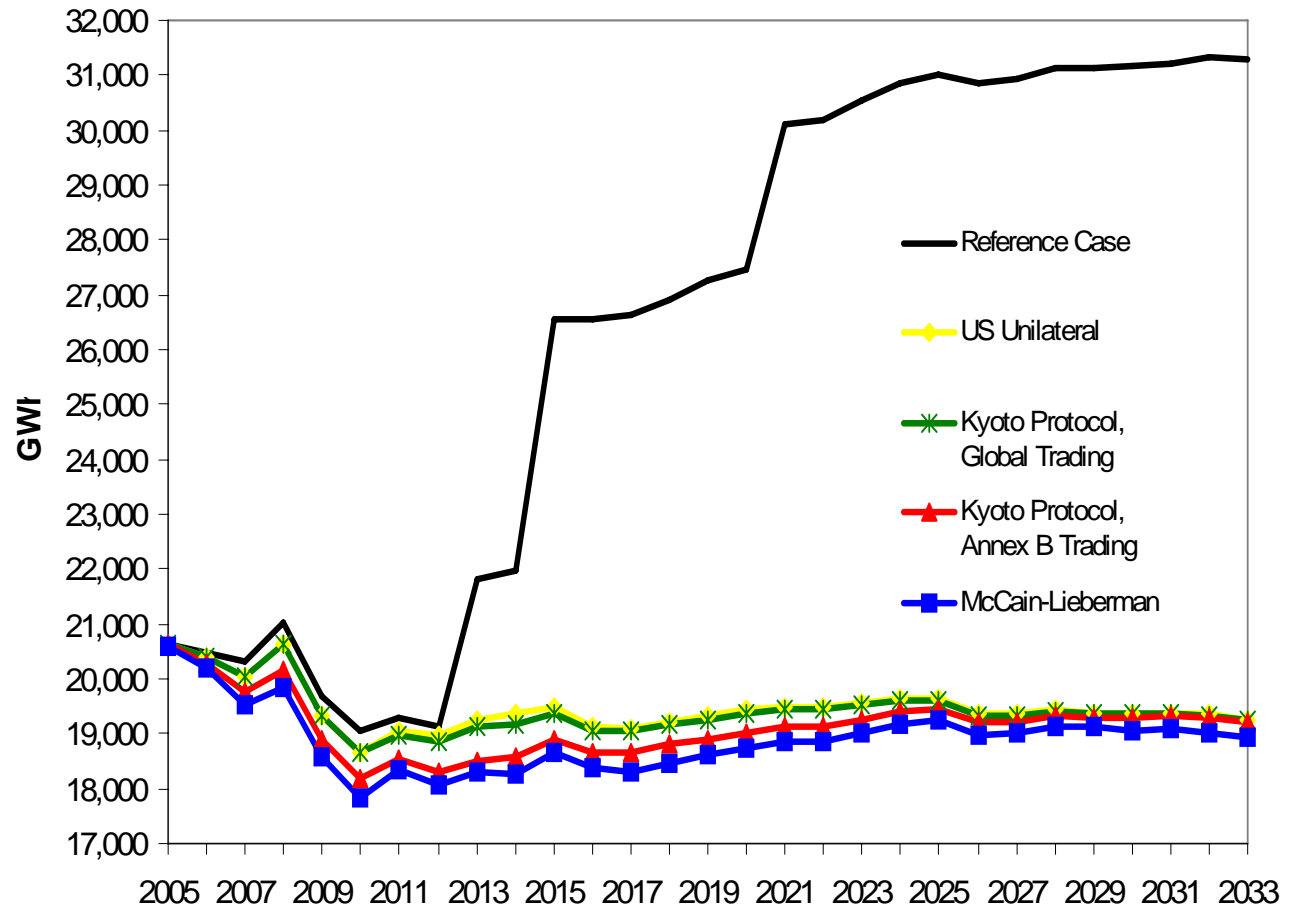


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Economics of electricity generation options will change

- **Xcel Energy's 2004 IRP in MN included 1125 MW of new coal in its "Preferred Plan."**
- **When future CO₂ costs were included in Xcel's model, ALL THE NEW COAL GENERATION DISAPPEARED, even using CO₂ costs lower than current prices in the EU.**
- **New coal plants become uneconomic when CO₂ regulations are included.**

Coal Generation under Xcel's Preferred Plan (Reference Case) and Carbon Reduction Regulatory Scenarios (GWh)



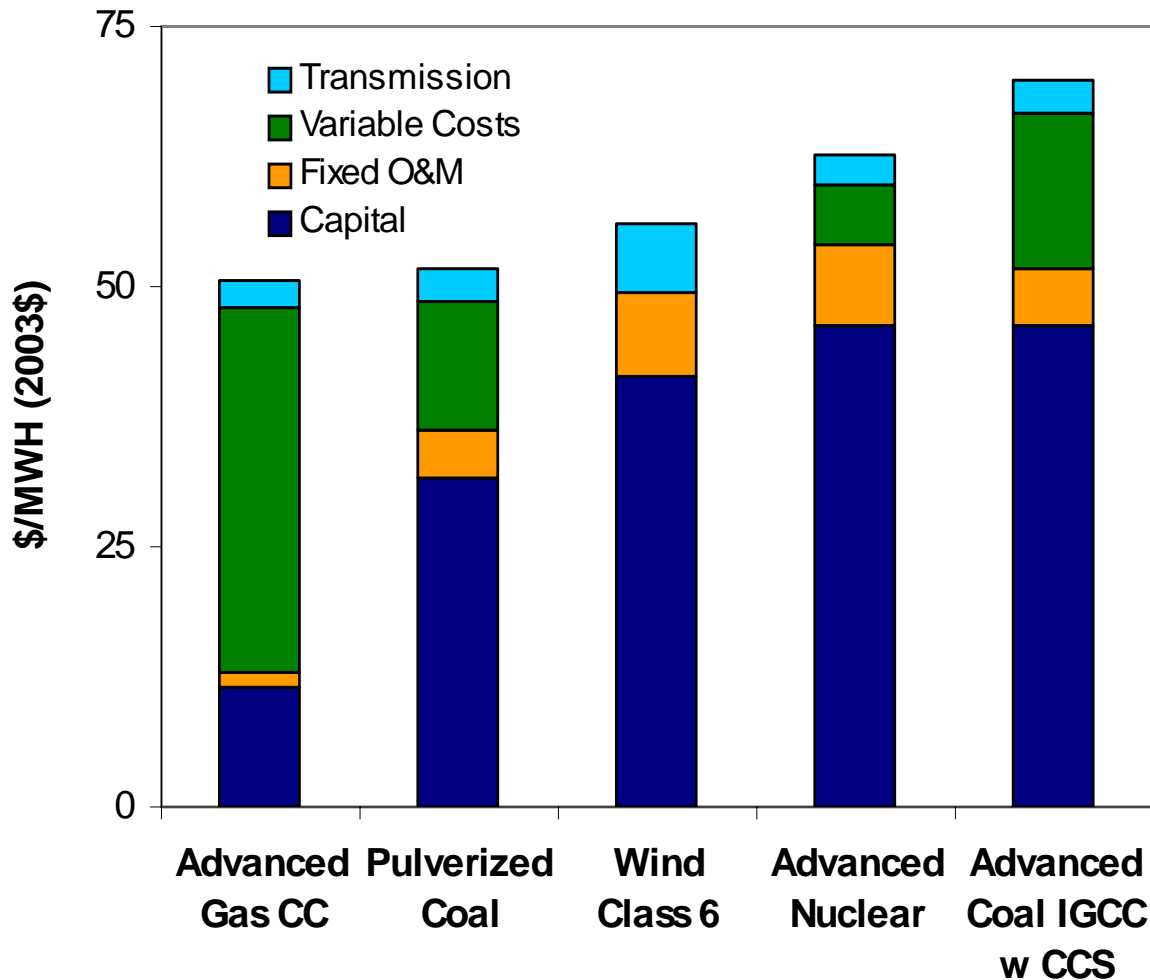
Source: Xcel responses to IWLA/ME3/UCS/MCEA Information Requests 7d and 19b.



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EIA: New Wind Cheaper than Advanced Coal and Nuclear

Levelized Cost of Electricity from New Power Plants, 2015



➤ Pessimistic wind assumptions:

- no PTC
- wind pays 100% of transmission
- no reduction in capital cost
- modest increase in performance
- NREL projects costs to decline to under \$30/MWH w/o PTC
- would offset additional wind integration costs

➤ Optimistic fossil & nuclear assumptions:

- low natural gas and coal prices
- advanced nuclear: unproven; unresolved safety, waste disposal & proliferation issues
- coal IGCC with CCS: few demonstrations; potential CO₂ leakage; permanence

Source: EIA, AEO 2005, Figure 71. Coal IGCC based on data from EIA.



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How low do emissions need to go?

- **EU target (below 1990 levels):**
 - **60-80% by 2050**
- **California target (below 1990 levels):**
 - **80% by 2050**
- **New Mexico target (below 2000 levels):**
 - **75% by 2050**



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New coal plants would lead to higher carbon emissions

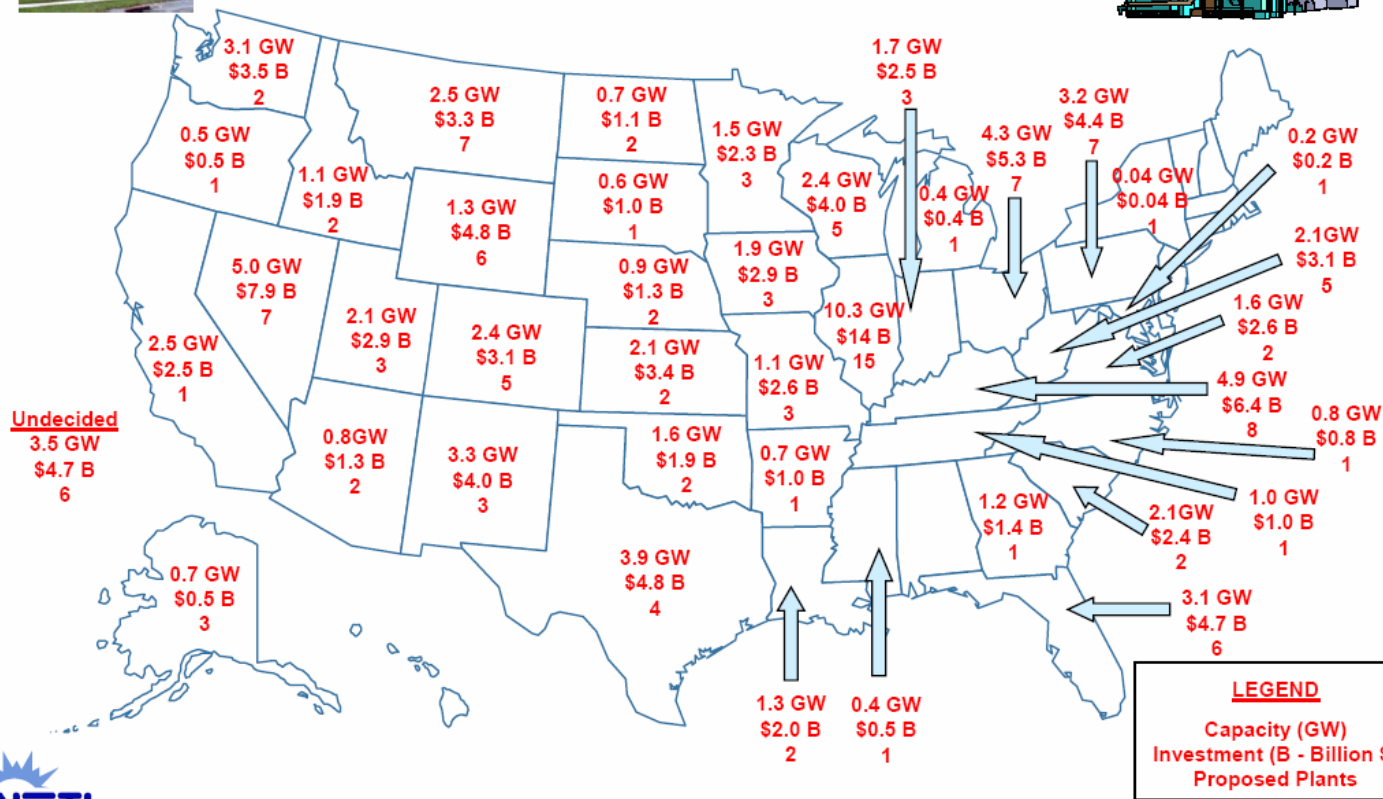
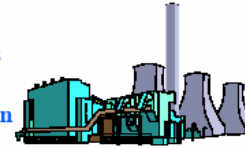
Coal's Resurgence in Electric Power Generation



Equivalent Power for 85 Million Homes

Proposed New Plants

140 Plants
85GW
\$ 119 Billion



140 new plants (85 GW)

No plans to capture and store CO²

Locks us in for decades to highest-carbon energy, with huge environmental AND financial risk

Ratepayers shouldn't bear the risk of these imprudently incurred costs

LEGEND
 Capacity (GW)
 Investment (B - Billion \$)
 Proposed Plants



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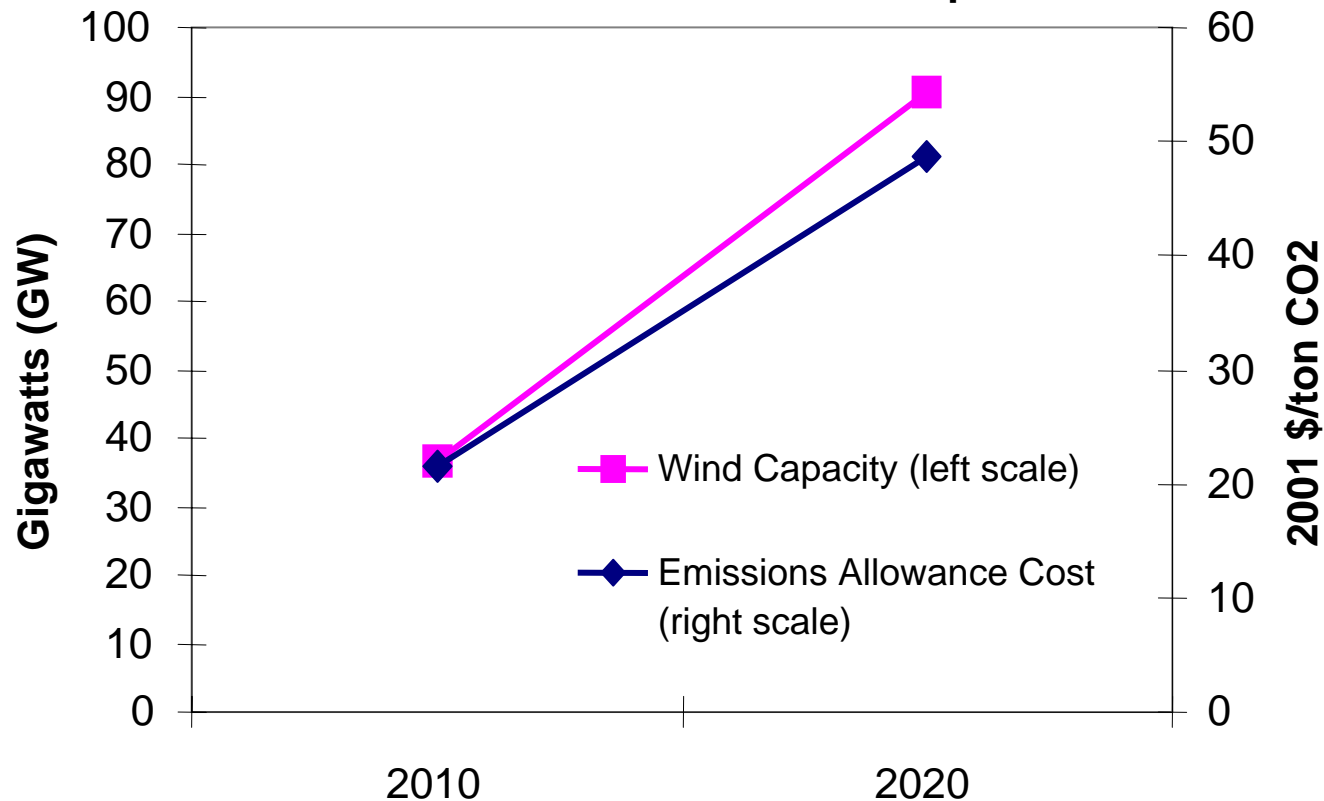
OCES 3/20/2006



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EIA: Huge increase in wind capacity under Climate Stewardship Act

US Wind Capacity and CO2 Emissions Allowance Cost
under the Climate Stewardship Act



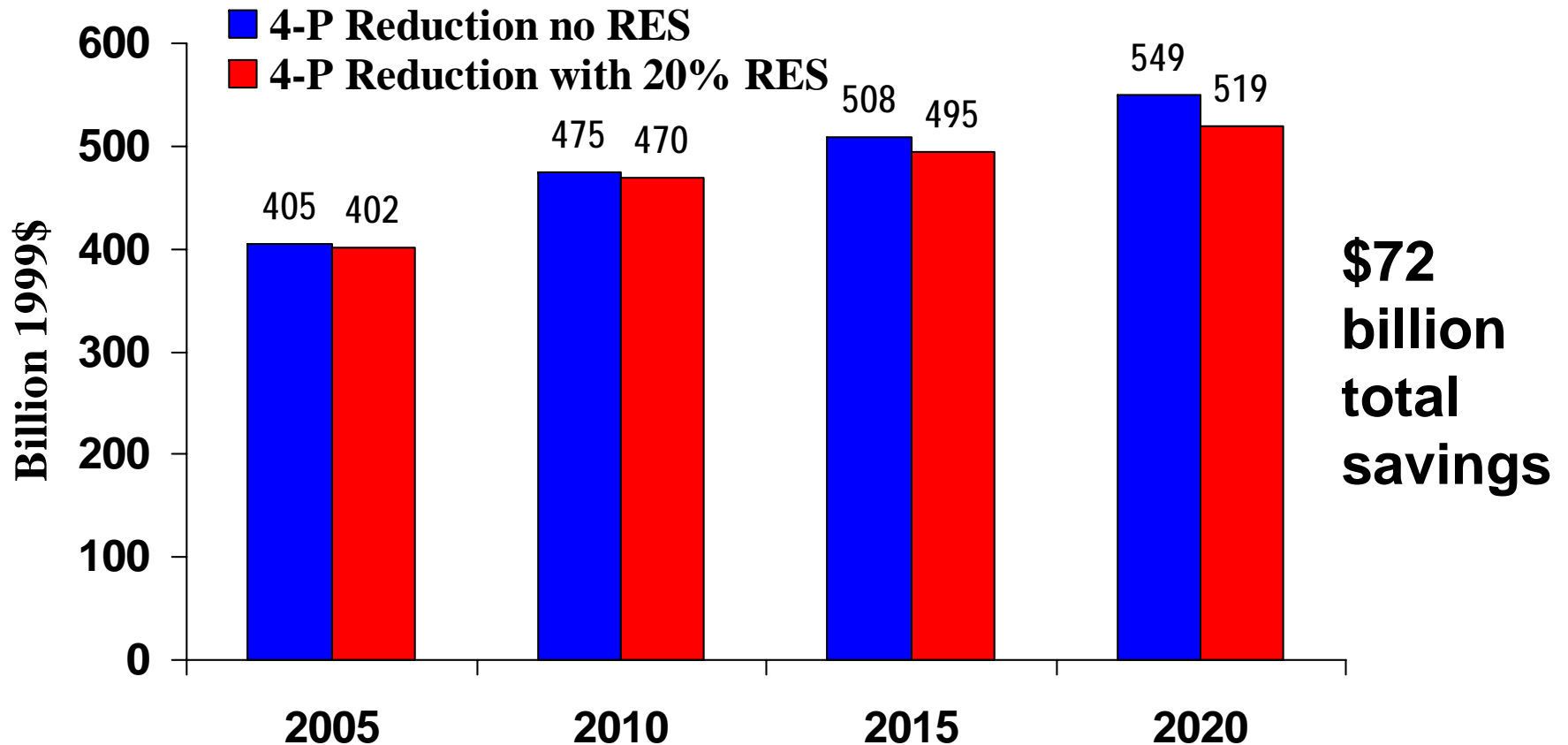
Source: EIA, 2003. *Analysis of S.139, the Climate Stewardship Act of 2003*. SR/OIAF/2003-02. Washington, DC.



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EIA: 20% national RES lowers cost of power plant 4-pollutant caps

Total Consumer Energy Bills (not including
transportation)

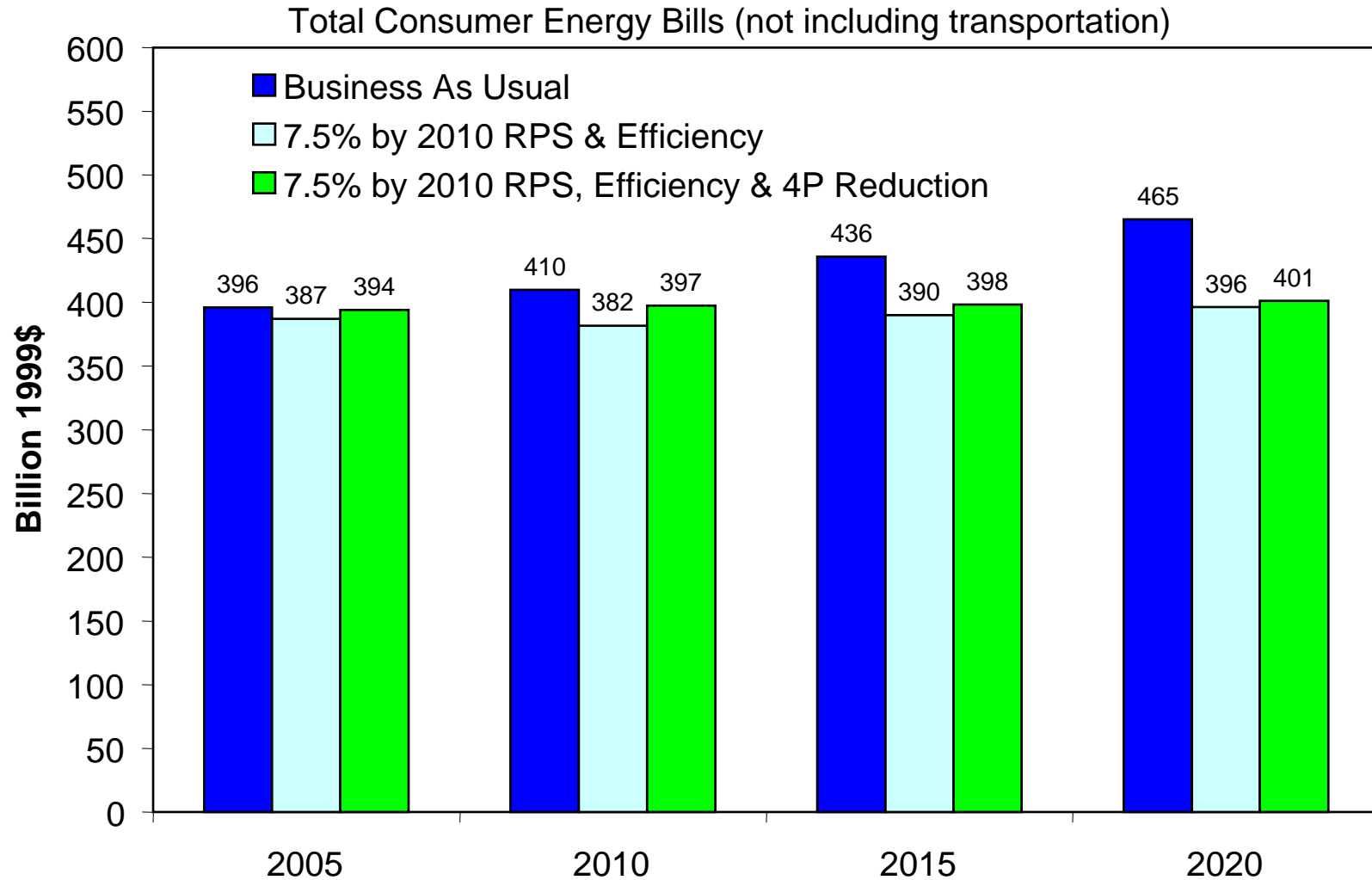


Source: EIA, *Strategies for Reducing Multiple Emissions from Electric Power Plants*, July 2001, Table H3.



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Combining 4 Pollutant Reductions with RES and Efficiency Saves Money

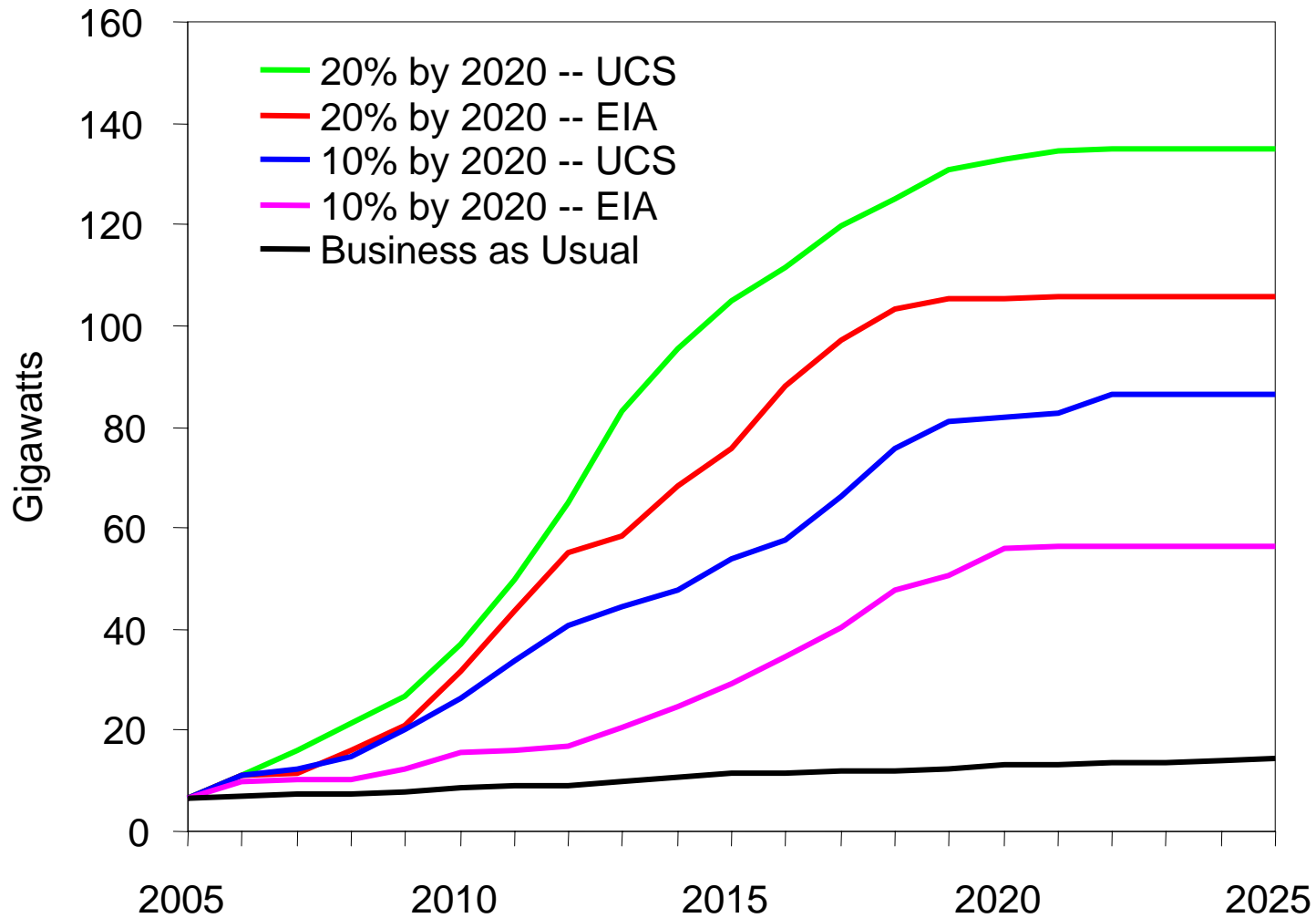


Source: EIA, *Analysis of Strategies for Reducing Multiple Emissions from Electric Power Plants with Advanced Technology Scenarios*, Oct. 2001, Table D3.



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US wind capacity under a national renewable standard



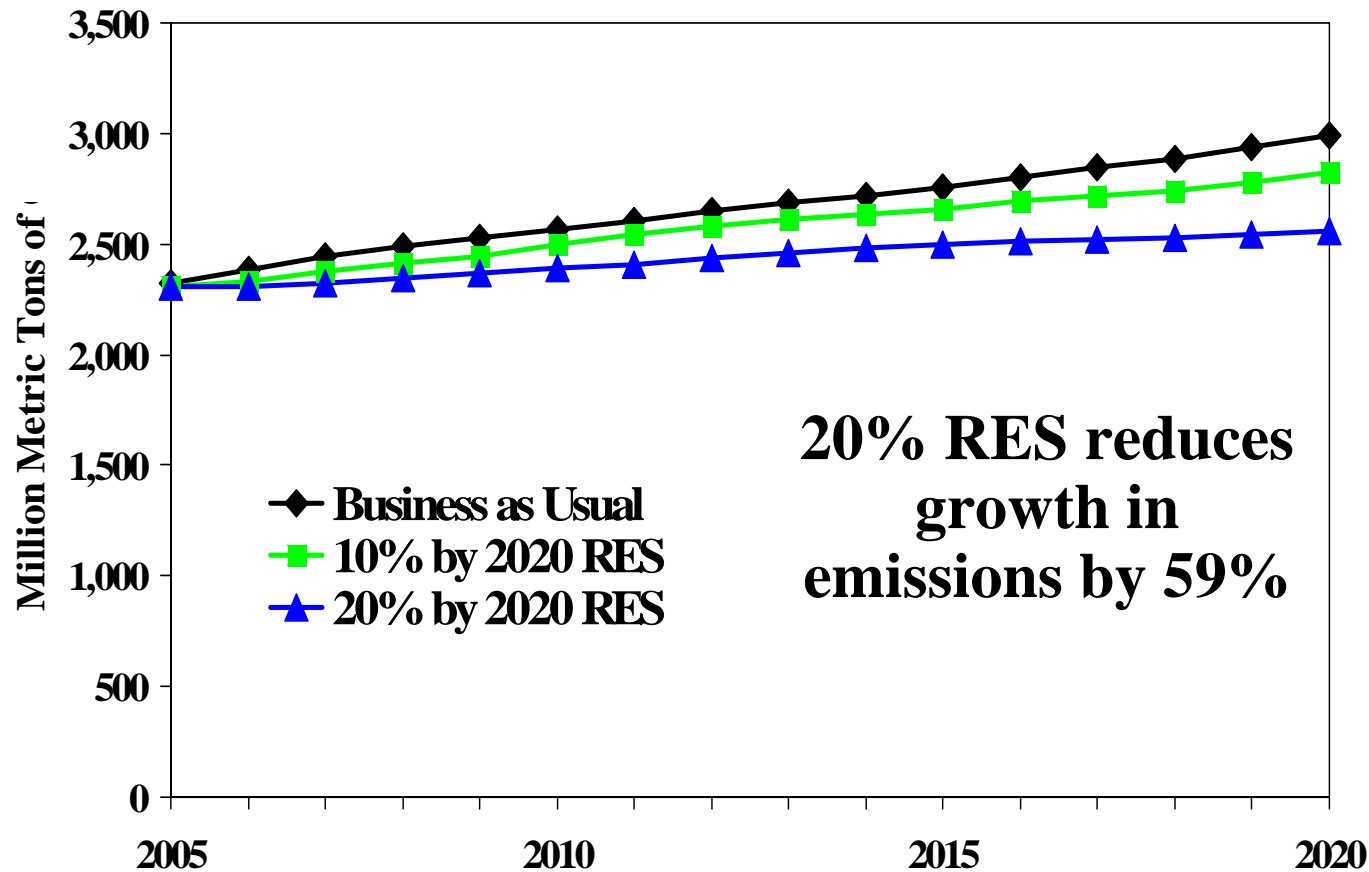
Source: UCS, *Renewing America's Economy*, 2004, using EIA model



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A national standard reduces emissions and compliance costs

Carbon Dioxide Emissions, U.S. Power Plants

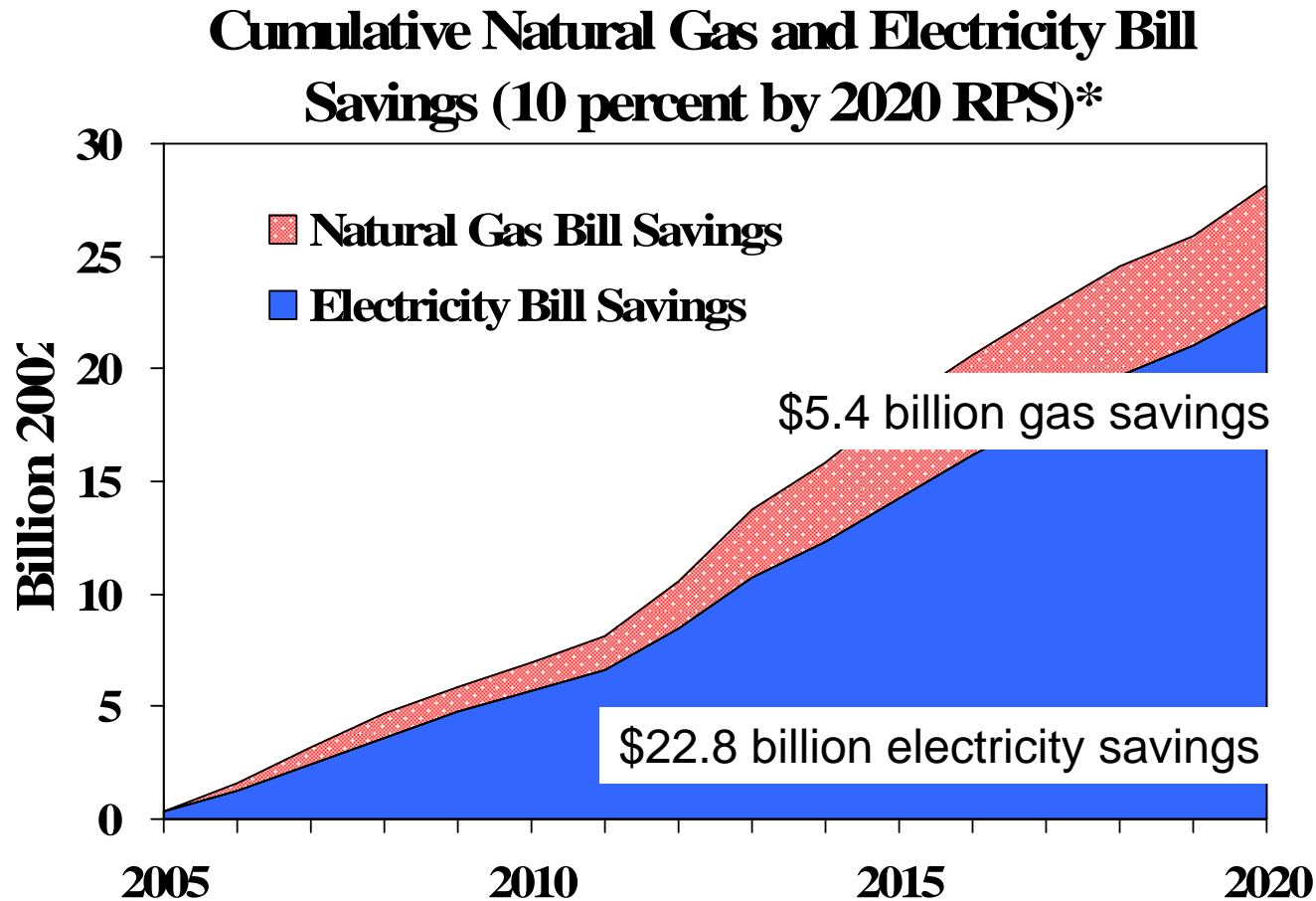


Source: UCS, using EIA model



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Renewable energy saves electric & natural gas consumers money



Savings in all customer classes:

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

- **EIA: 10% RES saves \$23 billion**
- **20% RES saves \$49 billion by 2020**

Source: UCS, 2004; EIA, Analysis for Sen. Bingaman, 2005.

*Excludes Transportation.

Renewable Electricity Standards

NV: 20% by 2015,
solar 5% of annual

MN: 19% by 2015 (Xcel Energy)*

NY: 24%
by 2013

ME: 30%
by 2000

IA: 2% by 1999*

WI: 10% by 2015

IL: 8%
by 2013**

MA: 4%
by 2009

MT: 15%
by 2015

RI: 16%
by 2019

CT: 10% by 2010

NJ: 22.5% by 2020

DE: 10% by 2019

MD: 7.5% by 2019

D.C.: 11% by 2022

PA: 8% by 2020

CO: 10%
by 2015

NM: 10%
by 2011




CA: 20%
by 2017

AZ: 15% by 2025

TX: 5,880 MW
(~5.5%) by 2015

HI: 20% by 2020

20 States
+ D.C.

-  RES
-  RES and Goal
-  RE Goal

*MN has a requirement for one utility, Xcel Energy, and a 10% by 2015 renewable energy goal for all other utilities. In addition to its requirement, IA has a 1,000 MW (~10%) by 2010 goal.

**Renewable energy goal, with no specific enforcement measures.



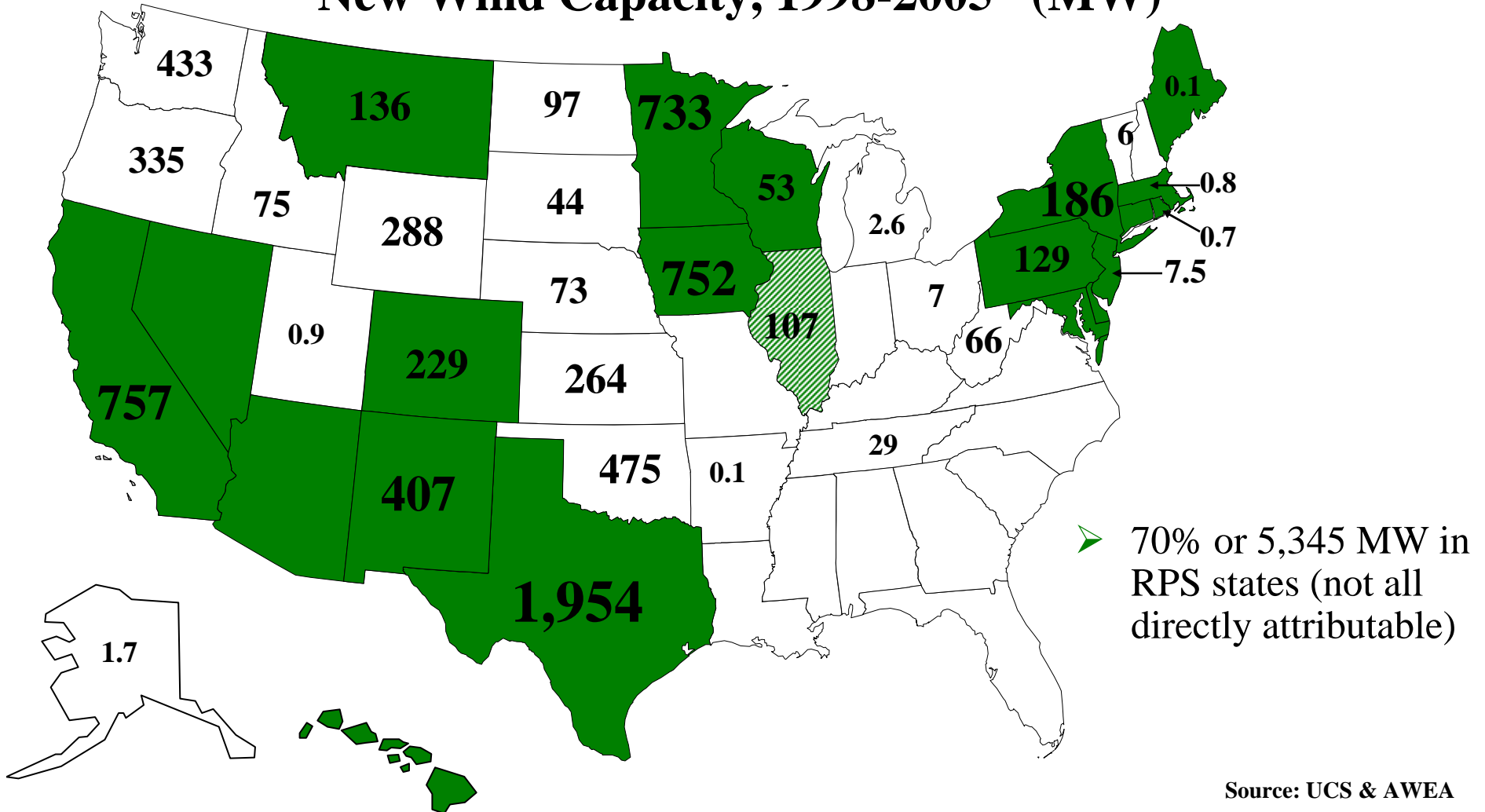
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Most new wind capacity installed in states with renewable standards

New Wind Capacity, 1998-2005* (MW)



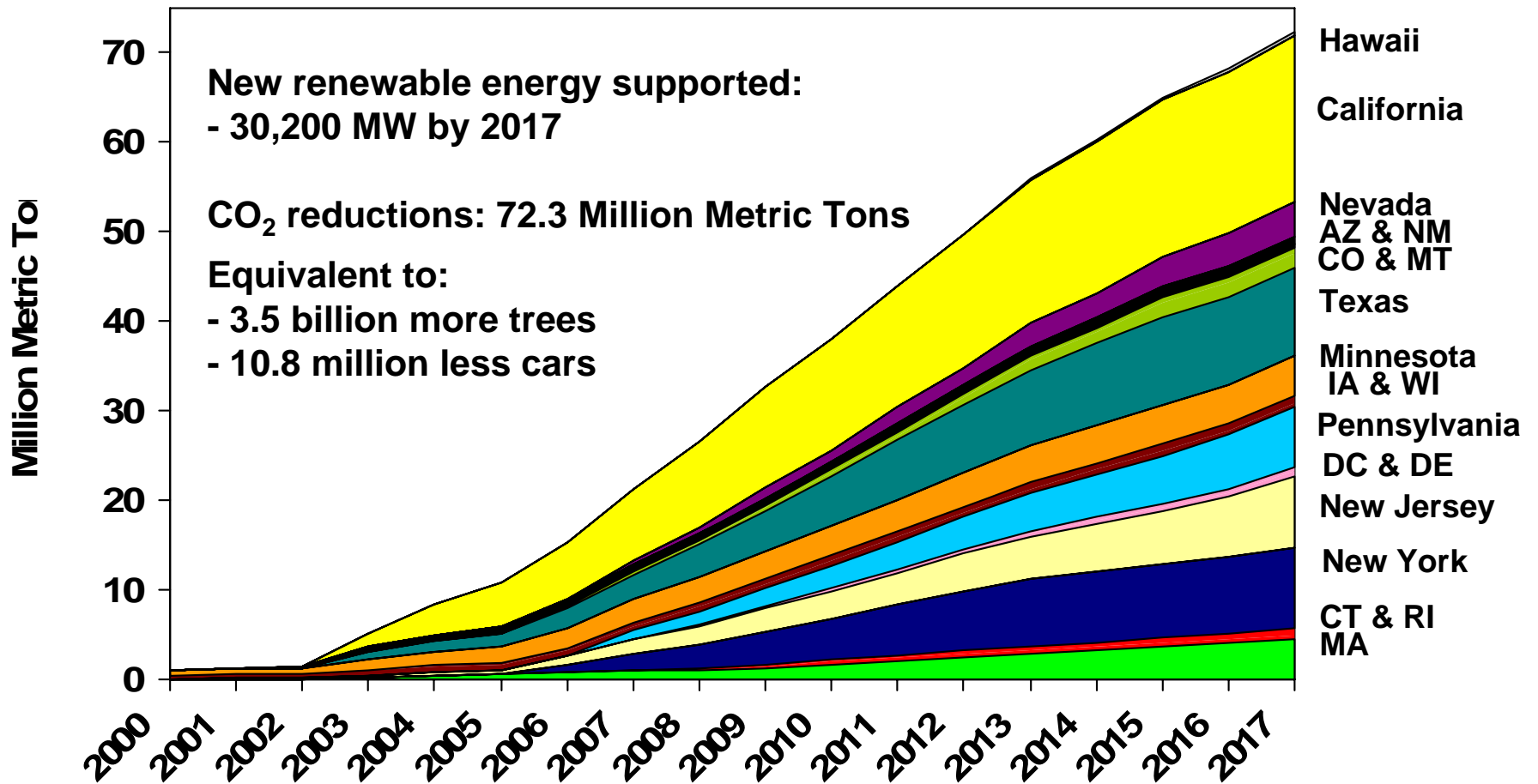
Source: UCS & AWEA



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Projected CO₂ reductions from state renewable standards

CO₂ Reduction from State Renewable Electricity Standards*



*Projected development assuming states achieve annual RPS targets.

Source: UCS, 2006.



Conclusions

- **Future limits on greenhouse gas emissions are coming soon**
- **These limits pose a significant financial risk to utilities and ratepayers and will raise the cost of using fossil fuels to generate electricity**
- **Wind power can provide an affordable hedge against this financial risk**
- **Mandatory market based limits on CO₂ with complementary policies for efficiency and renewable energy is the approach with the lowest costs and greatest benefits**