

# Insights from EIA Analyses of Climate Change Policy Options

## **NREL Energy Analysis Forum**

Howard Gruenspecht  
Deputy Administrator  
U.S. Energy Information Administration  
([howard.gruenspecht@eia.doe.gov](mailto:howard.gruenspecht@eia.doe.gov))

November 27, 2007



# EIA

- Energy Data: 80-85 percent of EIA's mission
  - Weekly, monthly, annual surveys covering oil, natural gas, electricity, coal, and renewable energy. Quadrennial surveys of energy consumption.
  - Statistical agency independence (pretty standard)
- Projections/ Other Analysis: 15-20 percent of EIA's mission
  - Analysis products are not subject to Administration clearance (pretty unusual)
  - Often respond directly to requests from Congress
  - Analytical support for Administration/DOE offices when requested
- EIA does not promote, formulate, or take positions on policy issues, and our views should not be construed as representing those of the Department or the Administration

# Advantages of Economic Instruments for GHG Mitigation

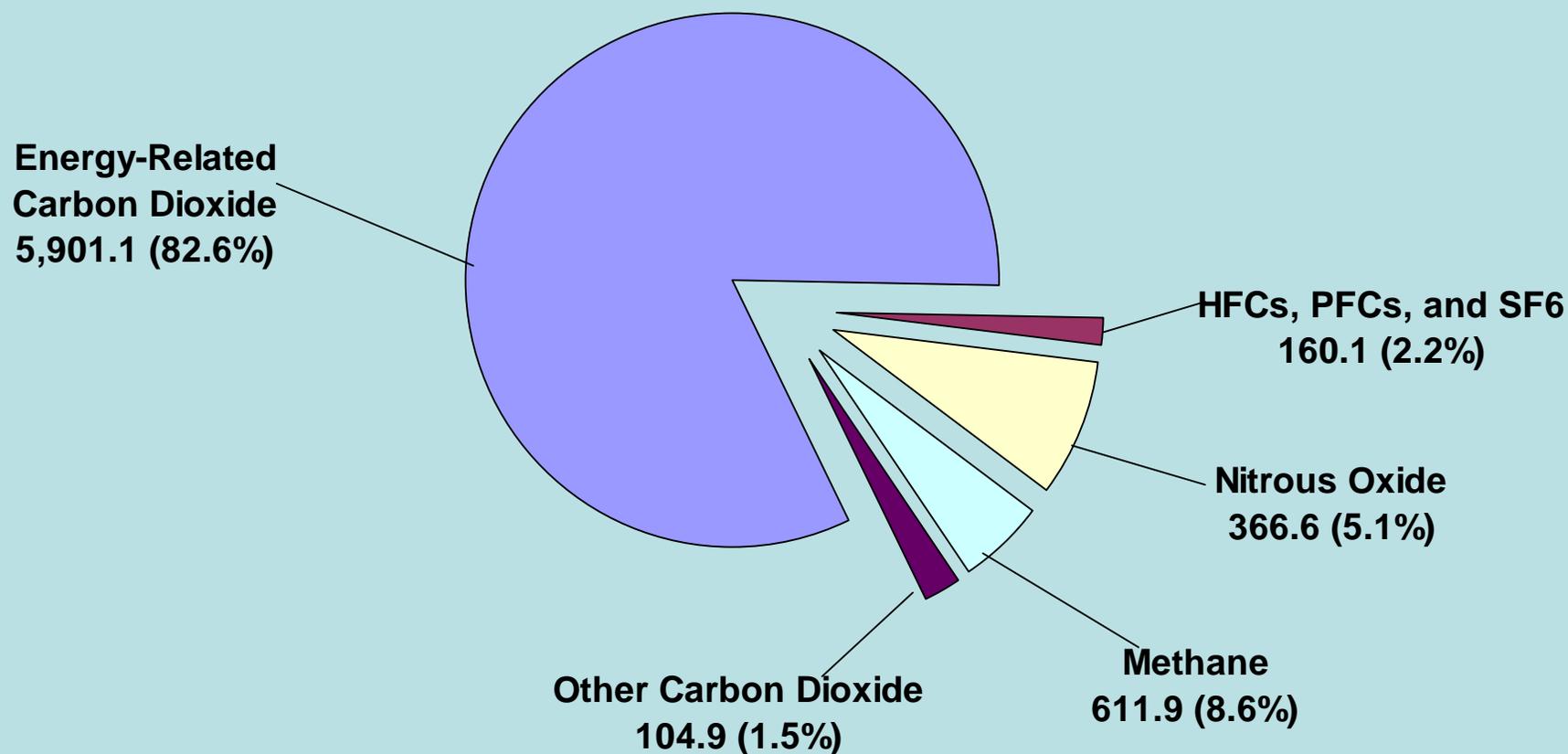
## **CHARACTERISTICS OF EMISSIONS SOURCES**

- GHG emissions come from a wide variety of sources – command and control regulation is unlikely to provide emissions reductions at the lowest cost.
- Both supply and demand-side decisions contribute to GHG emissions.

## **MECHANISMS OF CLIMATE CHANGE PROCESSES**

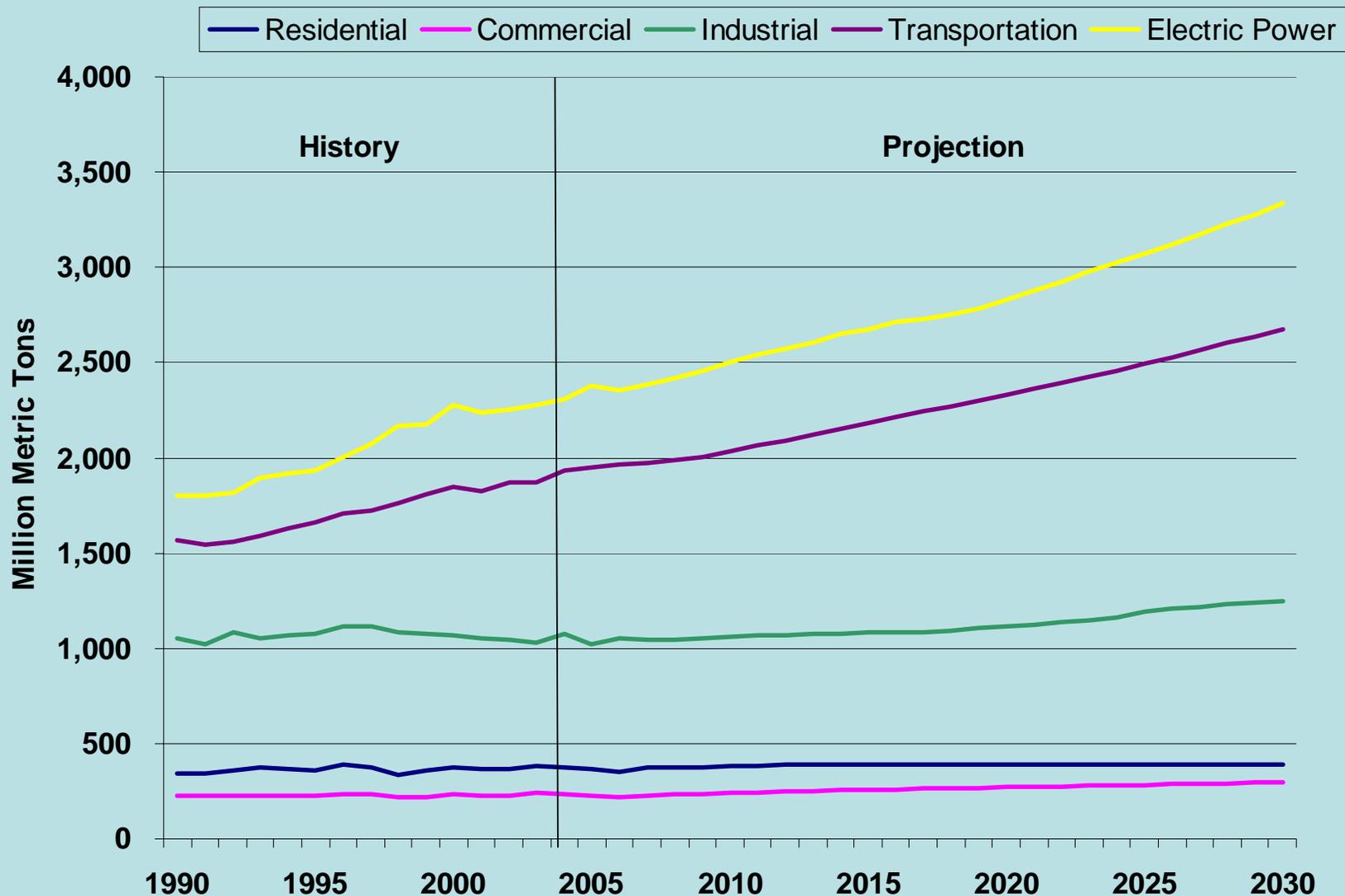
- The location of emissions are not a concern – climate impacts are the same whether or not emissions are concentrated at particular locations
- Year-to-year emissions variation is also not a concern -- what matters is the total stock of GHGs in the atmosphere, which depends on long-term emissions trends.

# US GHG Emissions in 2005 (million metric tons of CO<sub>2</sub>-equivalent)



Source: *Emissions of Greenhouse Gases in the United States 2005*. DOE/EIA-0573(2005), Washington, DC, November 2006

# Energy-related CO<sub>2</sub> emissions by sector AEO2007 Reference Case



## Policy to Reduce GHGs Could Significantly Affect the Energy Outlook

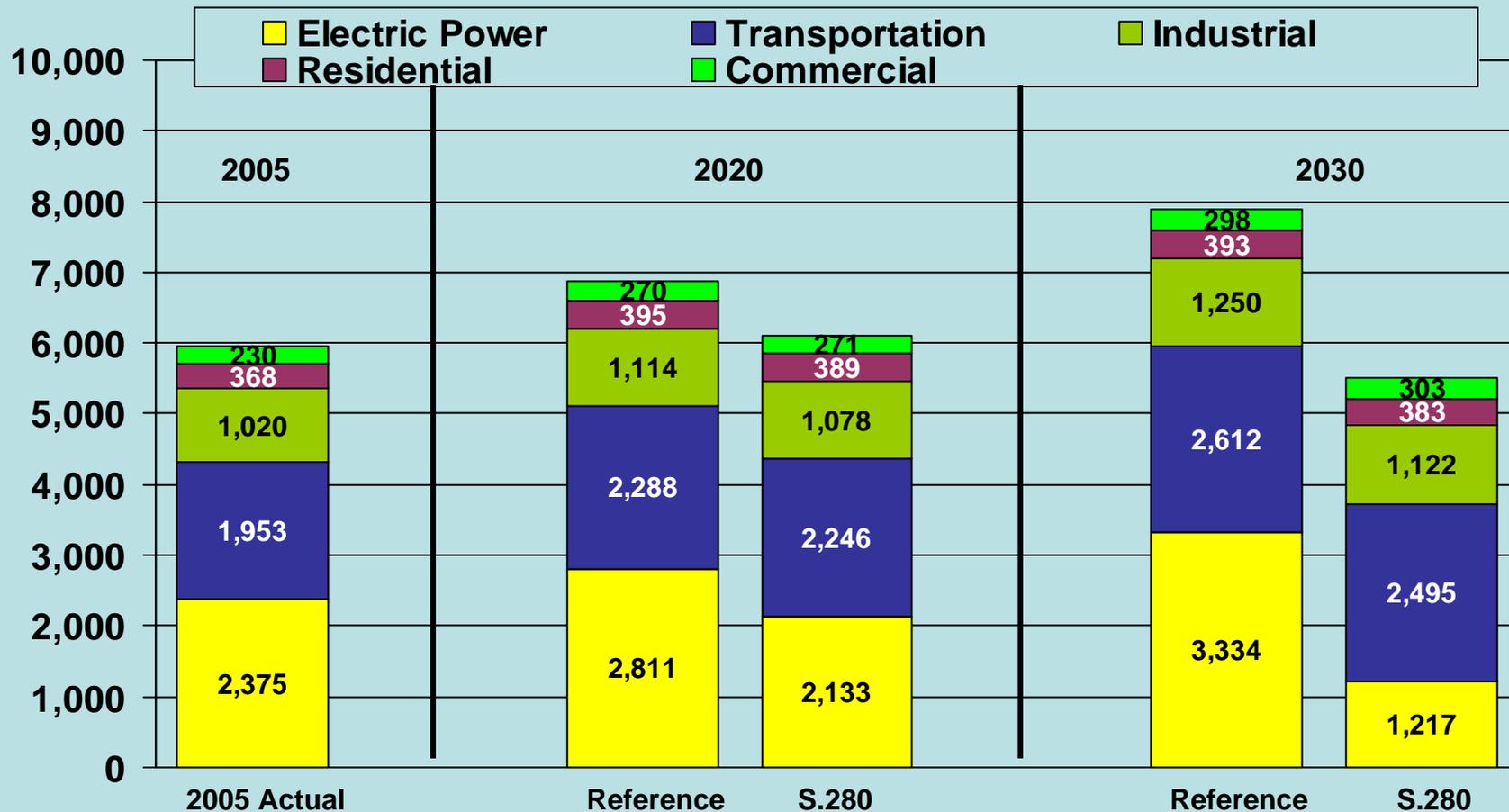
- EIA Reference Case projections are generally based on existing laws and policies.
- In several recent reports, EIA has examined the energy implications of alternative cap and trade programs for greenhouse gas (GHG) emissions. Further analyses are in progress.
- The analyses suggest that reductions outside the energy sector are an important first step, but that reductions from energy necessarily play an increasing role as the emissions target is tightened.
- Within energy, the electricity sector, particularly projected coal use, is most significantly affected.

## Impact of a CO<sub>2</sub> Value on Fossil Fuel Prices

Fuel	CO <sub>2</sub> content per million Btu	Delivered Price (2005, all sectors, per million Btu)	Impact of \$10 per ton CO <sub>2</sub> value		Impact of \$50 per ton CO <sub>2</sub> value	
			\$	percent	\$	percent
Coal	0.094	1.57	0.94	59.9	4.70	299
Oil	0.074	18.60	0.74	4.0	3.70	19.9
Nat. Gas	0.053	9.65	0.53	5.5	2.65	27.5

- As shown above, placing a value on GHGs through either a tax or a cap-and-trade program has a relatively large impact on the delivered price of coal.
- This reflects both the substantially lower price of coal relative to other fossil fuels under baseline conditions and its higher emission of CO<sub>2</sub> per unit of energy
- A \$25/ton value on CO<sub>2</sub> raises gasoline prices by about 23 cents per gallon.

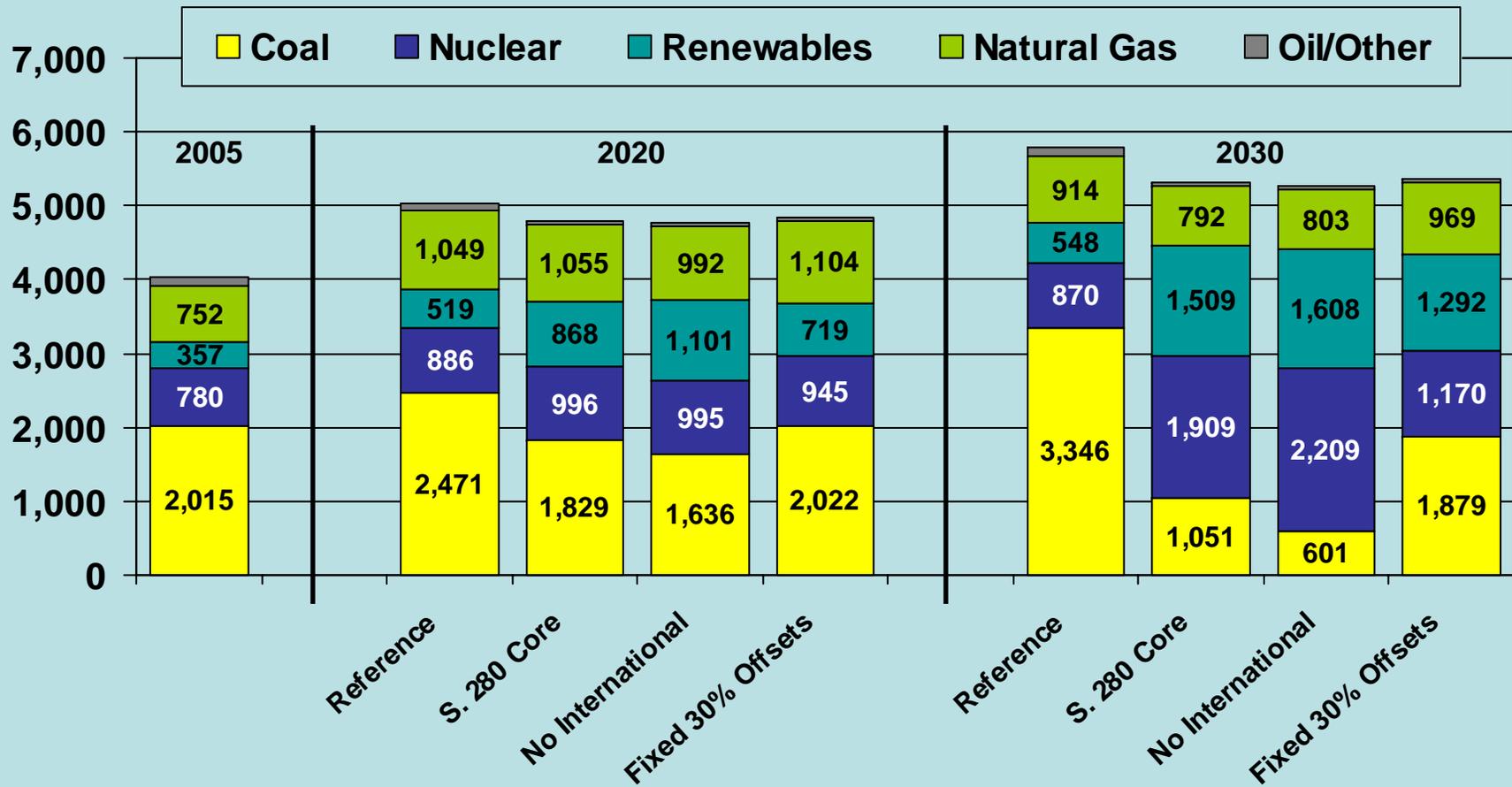
# Energy-Related CO<sub>2</sub> Emissions: EIA Analysis of S.280 (million metric tons)



- The electric power sector dominates energy-related CO<sub>2</sub> emission reductions.
- Although the S.280 GHG target for covered entity emissions in 2030 is 18 percent below the 1990 level (equivalent to 34 percent below the 2005 level), total energy-related CO<sub>2</sub> emissions in the S.280 Core Case are only about 7% below the 2005 level in 2030 due to the use of offsets and banked allowances, partial coverage and greater reduction of other GHGs. If more (less) international offsets were available, projected 2030 energy-related emissions under S.280 would be higher (lower).

# Electricity Generation by Fuel

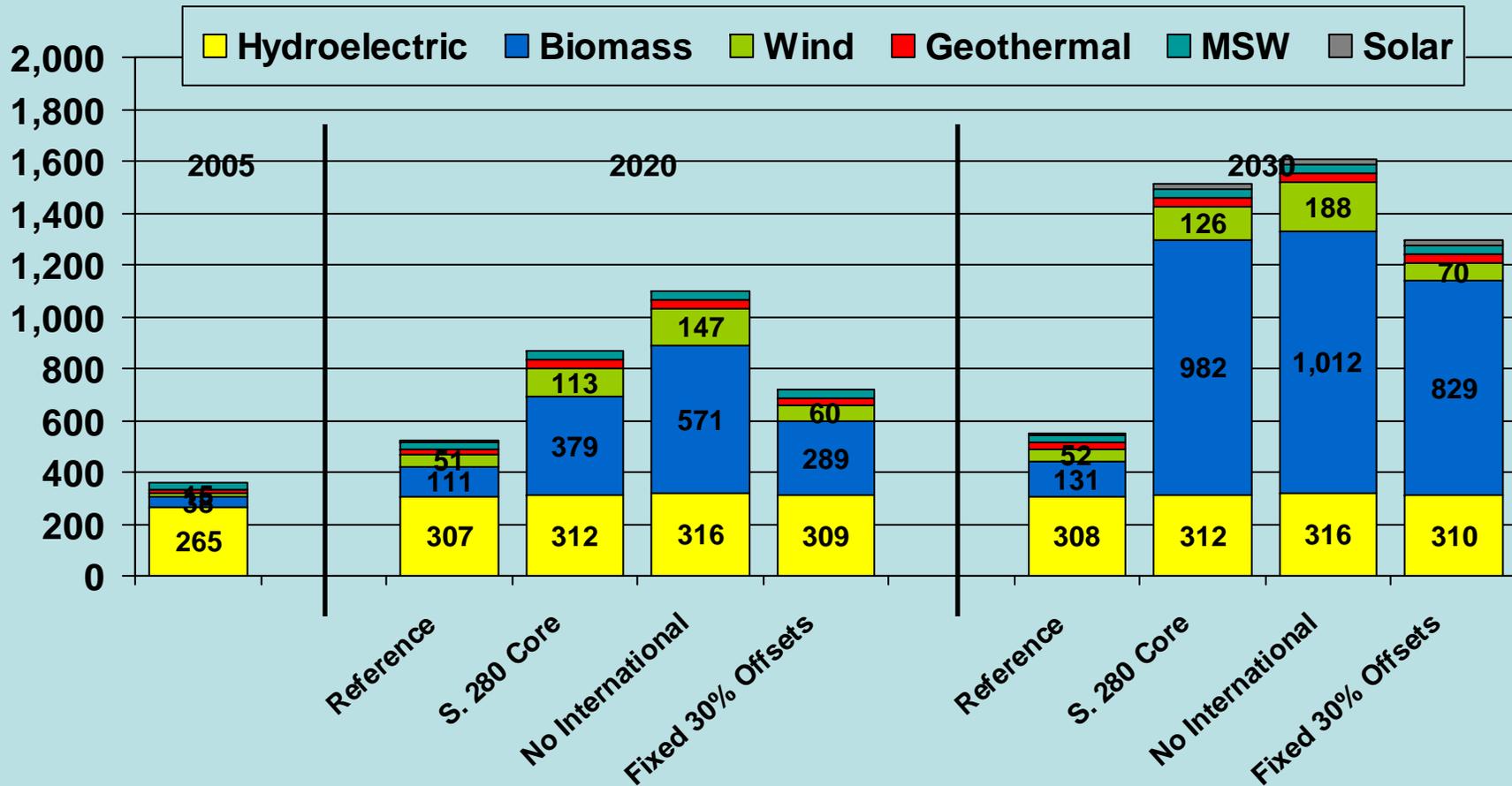
(billion kilowatthours)



Higher fossil fuel prices encourage increased nuclear and renewable generation in place of coal-fired generation. Gas generation holds steady in lowest allowance price scenario, but falls in others.

# Renewable Electricity Generation by Fuel

(billion kilowatthours)



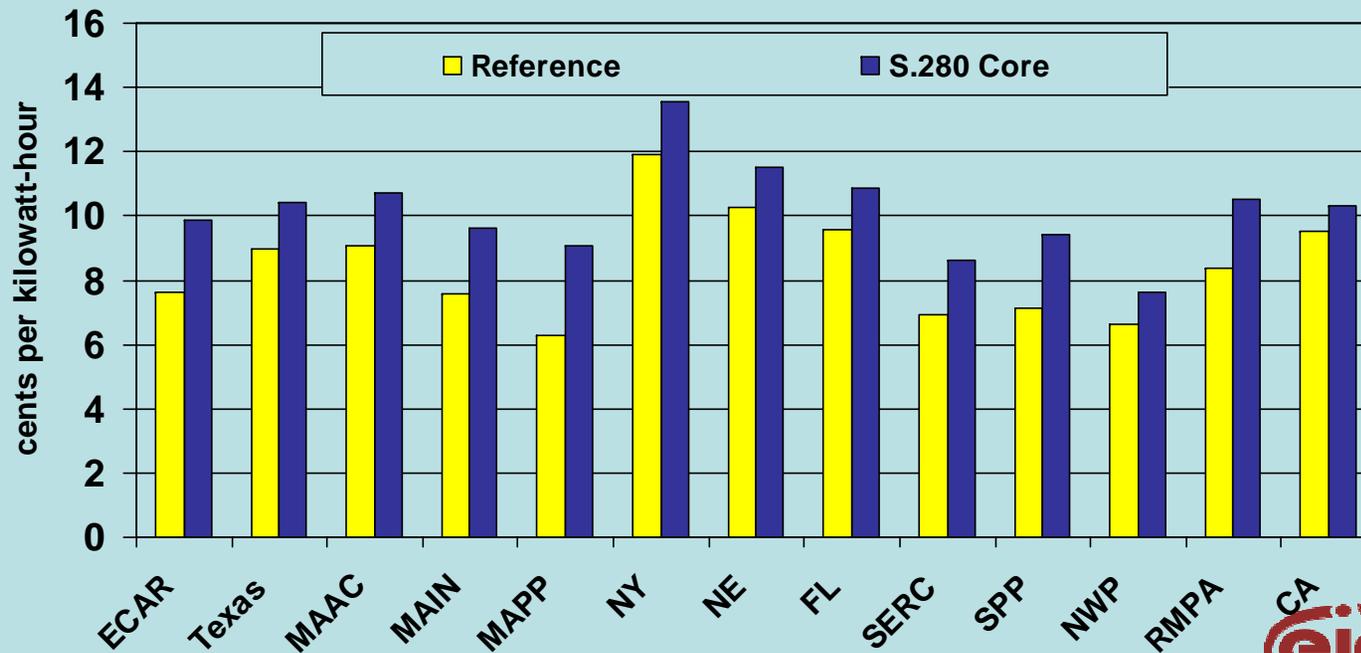
In EIA's recent S.280 analysis, biomass generation increases significantly under the cap-and-trade program. The dispatchability of biomass makes it a good substitute for coal-fired baseload capacity.

# 2030 Regional Electricity Price Impacts: EIA S.280 Analysis

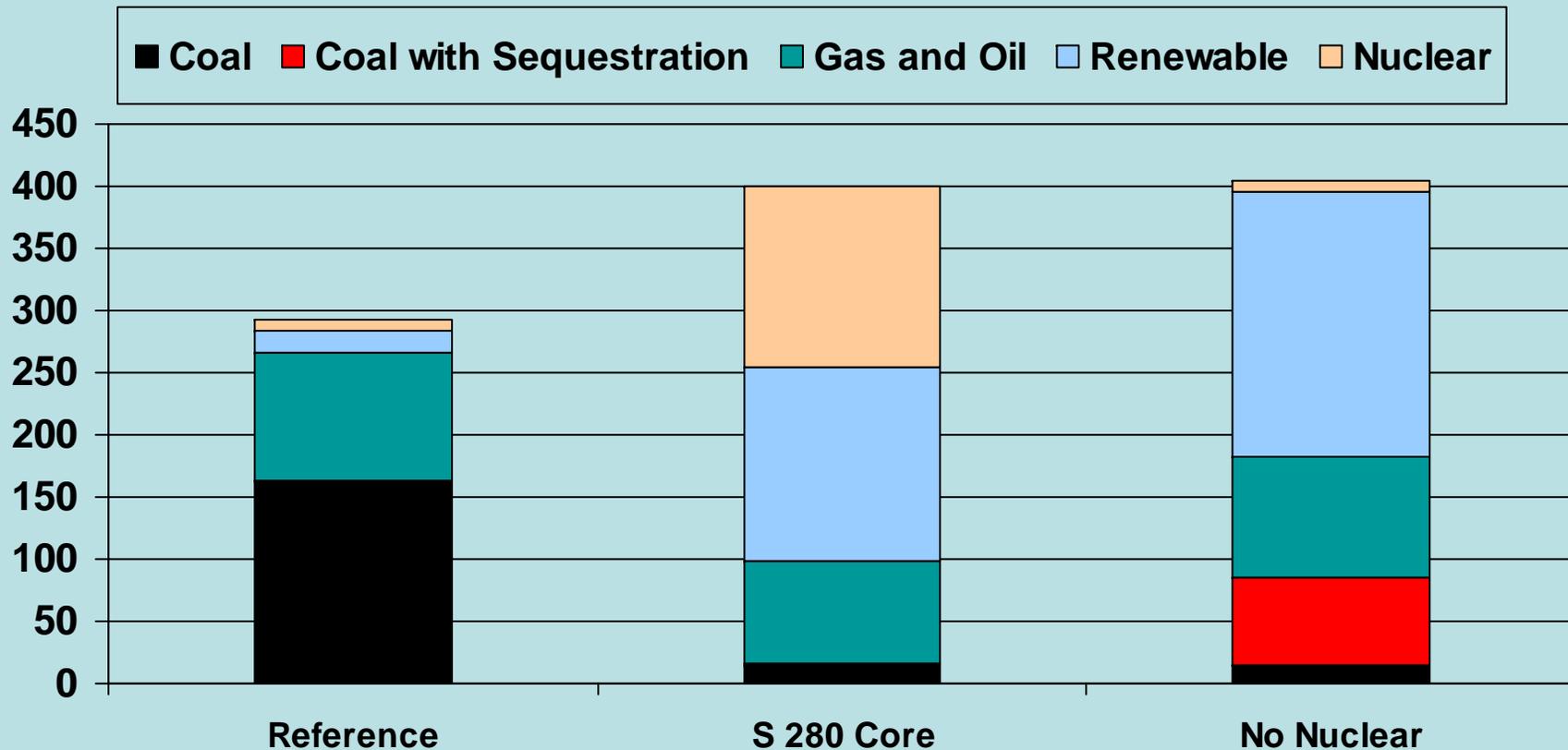


- 1 East Central Area Reliability Coordination Agreement (ECAR)
- 2 Electric Reliability Council of Texas (ERCOT)
- 3 Mid-Atlantic Area Council (MAAC)
- 4 Mid-America Interconnected Network (MAIN)
- 5 Mid-Central Area Power Pool (MAPP)
- 6 New York (NY)
- 7 New England (NE)

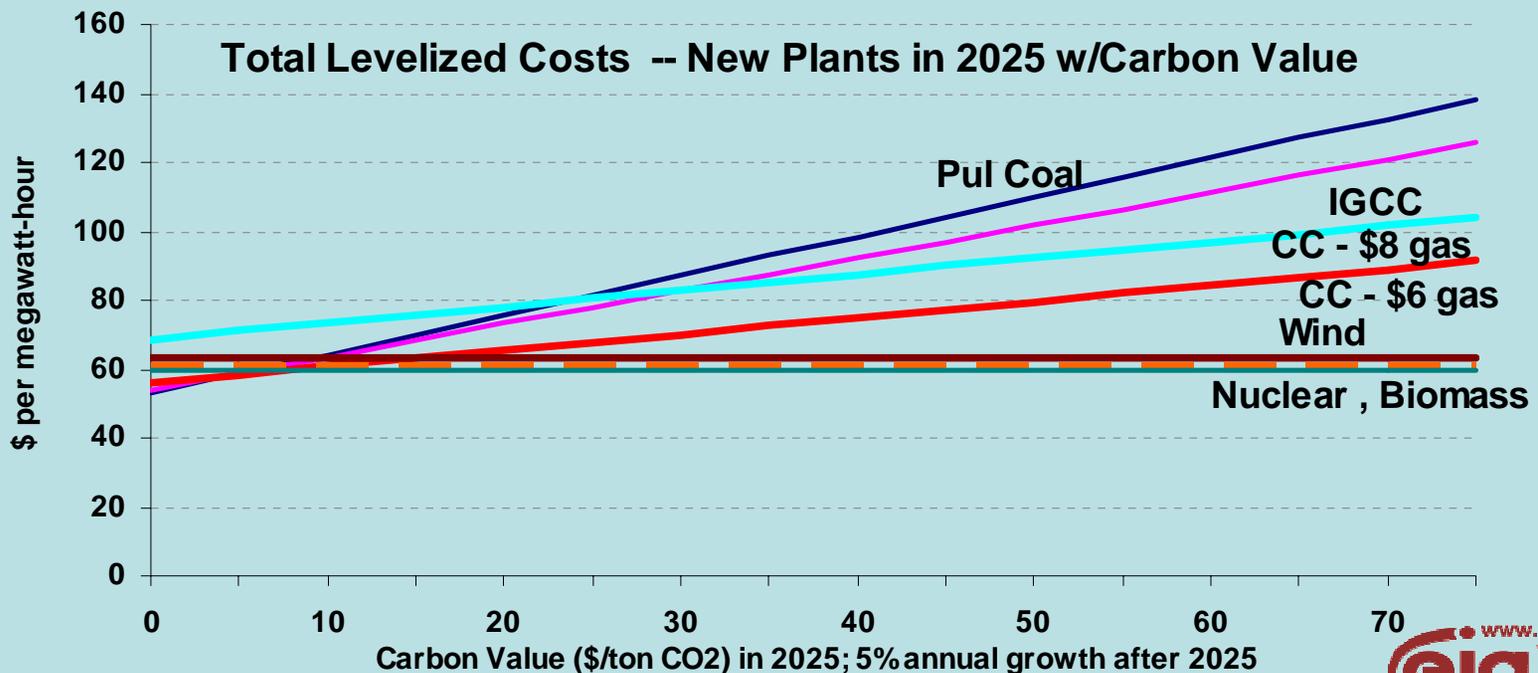
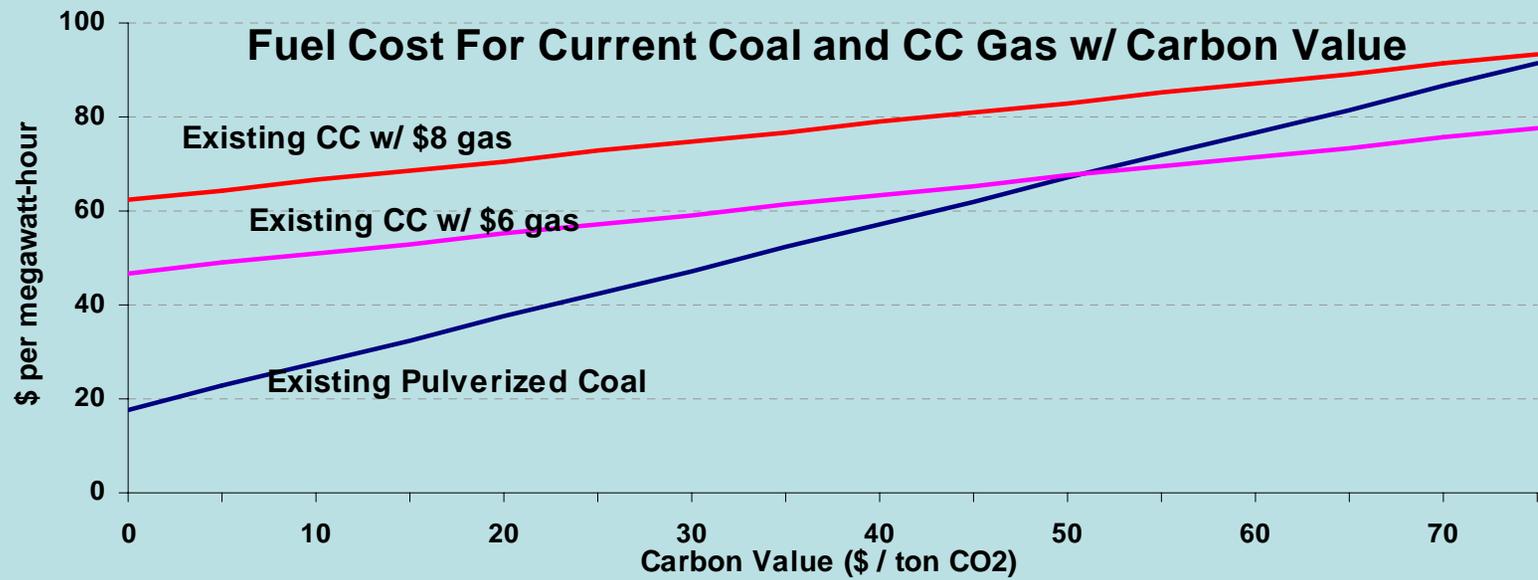
- 8 Florida Reliability Coordinating Council (FL)
- 9 Southeastern Electric Reliability Council (SERC)
- 10 Southwest Power Pool (SPP)
- 11 Northwest Power Pool (NWP)
- 12 Rocky Mountain Power Area, Arizona, New Mexico, and Southern Nevada (RA)
- 13 California (CA)



# Capacity Additions by Type to 2030 (gigawatts)



- Emission reduction CHANGES THE MIX of capacity additions.
- Emission reduction also INCREASES CAPACITY TOTAL ADDITIONS, since there is a need to retire existing coal units that continue to operate in the reference case. This is a major challenge given NIMBY and BANANA problems and resource constraints.
- Without nuclear as an option, the power sector turns to coal with sequestration and even greater use of renewable fuels.

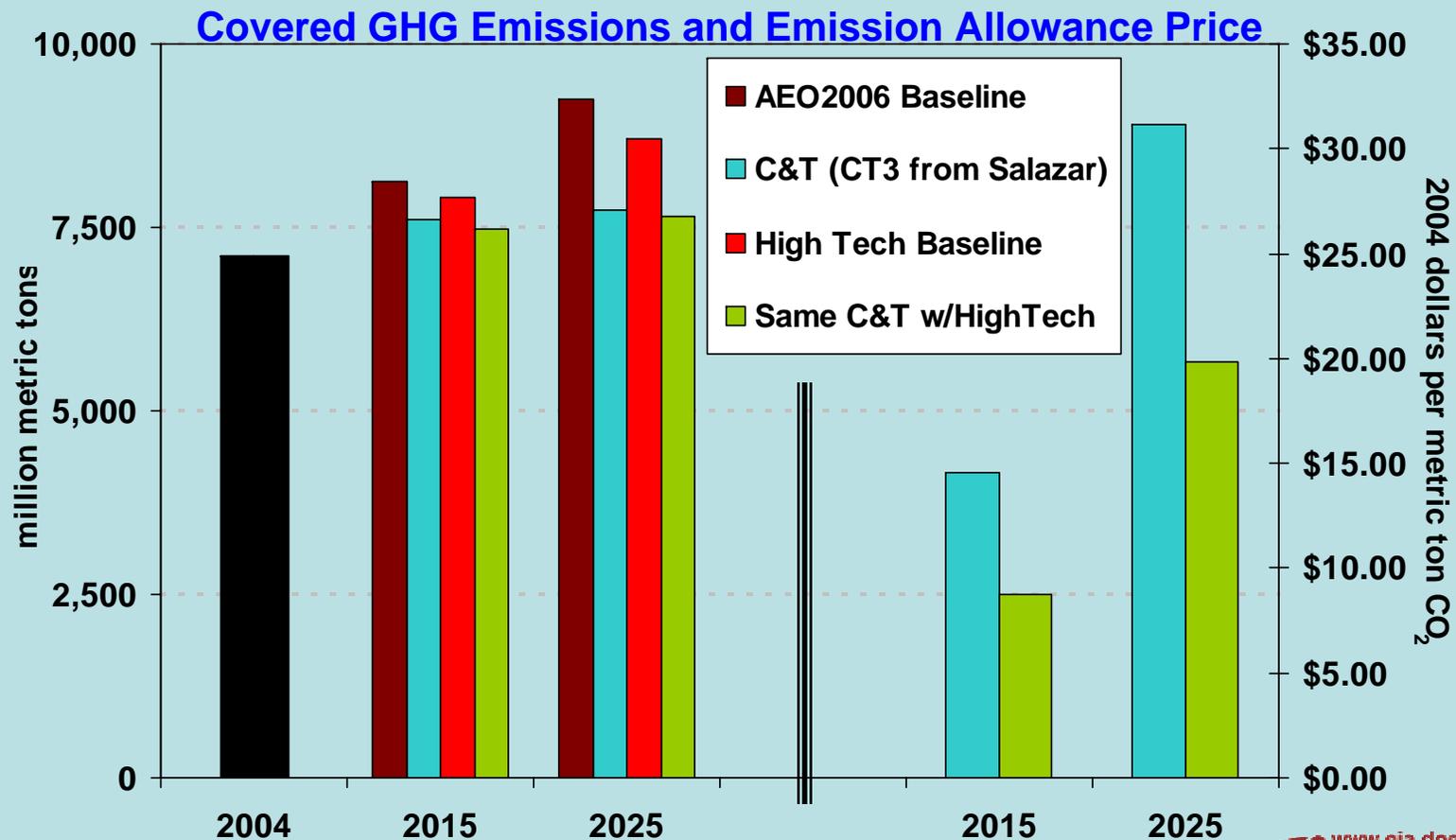


## Energy Security and GHG Emission Reduction: some synergies (S), some conflicts (C)

- (S) Improved vehicle efficiency: lowers GHG emissions and oil demand/imports (=more energy security?)
- (S/C) Biomass: should it back out coal used in electricity generation or oil used in transport fuels?
- (C) Coal to liquids: reduces oil import dependence, but not helpful on GHGs
- (S/C) CO2 sequestration requirements: helpful on GHGs, hurts coal, but can reduce oil imports via enhanced production from aging fields.

# The State of Energy Technology Matters

- With lower cost and earlier availability of advanced energy technology, it is both easier and cheaper to reach any given GHG emissions target. Advanced technology lowers baseline GHG emissions and also makes it cheaper to further reduce emissions.
- The graph below summarizes emissions and delivered price results for the same cap-and-trade program under two alternative characterizations of the state of energy technology.
- EIA is not able to relate the state of future technology to specific government initiatives.



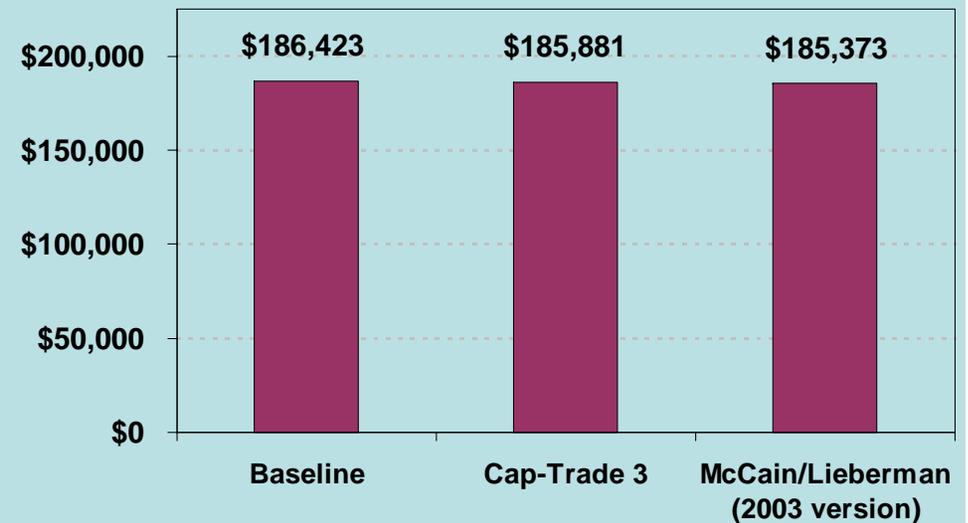
# Economic Impacts of GHG Reduction: small % changes = big \$

Given the overall size and expected growth of the U.S. economy, small changes in growth rates of consumption or output translate into large absolute dollar changes. The same estimated impacts can be “framed” to sound either large or small.

Sum of Discounted (@4%) Change in Real Gross Domestic Product, 2010 - 2025, (billion 2000 dollars)



Sum of Discounted (@4%) Real Gross Domestic Product, 2010 - 2025, (billion 2000 dollars)



# The Devil is in the Details

- Efforts to hide costs or pick winners (or prevent particular technologies from coming to market) can affect the realized costs of mitigation
  - Experience with the Public Utility Regulatory Policies Act
  - Prospects for new nuclear and biomass power are a critical issue
- Policymakers need to consider how policy design affects incentives for *ex post* behavior
  - Analyses generally reflect “efficient” responses without regard to public (or private) concerns other than GHG mitigation.
  - Different policy approaches that are analytically similar can have very different implications for post-implementation behavior.

## Additional Observations

- All long-run energy projections are highly uncertain. Differences between scenarios and general trends are more important than specific model results.
- Distributional effects as well as overall impacts matter. The rules for handing out or auctioning emissions allowances are very important in this regard.



[www.eia.doe.gov](http://www.eia.doe.gov)