The Lieberman-Warner Climate Security Act—S. 2191 Modeling Results from the National Energy Modeling System *--Preliminary Results--*

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Clean Air Task Force
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Background

- CATF, working through its consultant OnLocation, has modeled several scenarios of S 2191.
- This is a summary of the results of our latest run which looks at the committee passed bill and includes the new corporate average fuel economy standards that were enacted in December 2007.
- The model runs simulate most but not all of the provisions of S. 2191.
- Some of the data in this presentation is based on calculations done after the model run, but using modeled outputs.

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About NEMS

- The National Energy Modeling System (NEMS) is a detailed computer-based, energy-economic modeling system of U.S. energy markets. NEMS projects energy supply, demand, imports, conversion, and prices to the year 2030, subject to market assumptions such as macroeconomic and investment factors, world energy markets, fuel availability, technology cost and performance characteristics of energy technologies, and more.

- The model was developed and is maintained by the Energy Information Administration (EIA) for use in developing annual projections (in particular the "Annual Energy Outlook") and for evaluating energy policies.

About OnLocation

- **OnLocation, Inc./Energy Systems Consulting, founded in 1984, is a consulting firm specializing in energy and environmental policy analysis. Their analysis supports government, non-governmental organizations, and corporate decision makers. OnLocation has been involved in the development and maintenance of NEMS since its inception and assists multiple clients by using the tool to examine proposed government policies and their associated impacts on the energy system.**

How we modeled S. 2191

- Covered sector emissions include: coal fired electrical and industrial boilers, transportation (upstream), residential, commercial and industrial natural gas and petroleum use (upstream).
- Offsets are allowed up to 30% (the 15-15 split is not possible in NEMS, but the resulting output is close).
- Unlimited banking.
- We did not change any technology assumptions in NEMS, except to constrain the deployment of biomass power.
- To partially simulate the use of auction revenue and direct allocation of allowances for low and no carbon power technologies, we used a production tax credit for CCS power and extended the wind production tax credit to 2030.
- To simulate S. 2191's technology and efficiency provisions and the money dedicated to deploying efficiency and new technologies, we used EIA's "Best Available Technology" case.
- We have not yet analyzed the impact of the 5% allowance allocation to agricultural sequestration nor the 1% to methane reductions from landfills and coal mines.

How We Didn't Model S. 2191

- In our modeling we chose to adhere as closely as possible to the way EIA would model the bill.
- As such, we did not try to produce a "plausible" generation mix or generation expansion schedule.
- We think that that work is necessary and we are exploring putting that case together.
- We did not model the low carbon fuel standard that was added in the committee passed bill.
- We did not model the Carbon Market Efficiency Board.

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EIA's Best Available Technology Case and Why We Used It

- **EIA's Best Available Technology (BAT) case assumes that consumers choose the most efficient equipment (from light bulbs to boilers) available, regardless of costs within residential and commercial buildings, when replacing end-use energy equipment in residential and commercial buildings.**

- **EIA's BAT scenario was used as a *useful proxy* for S. 2191's massive energy efficiency investment provisions, as well as S. 2191's new building and energy equipment efficiency regulations.**

- **Through 2030, S. 2191 directs approximately $265 billion to energy efficiency and new product development, and sets efficiency standards for buildings and residential boilers.**

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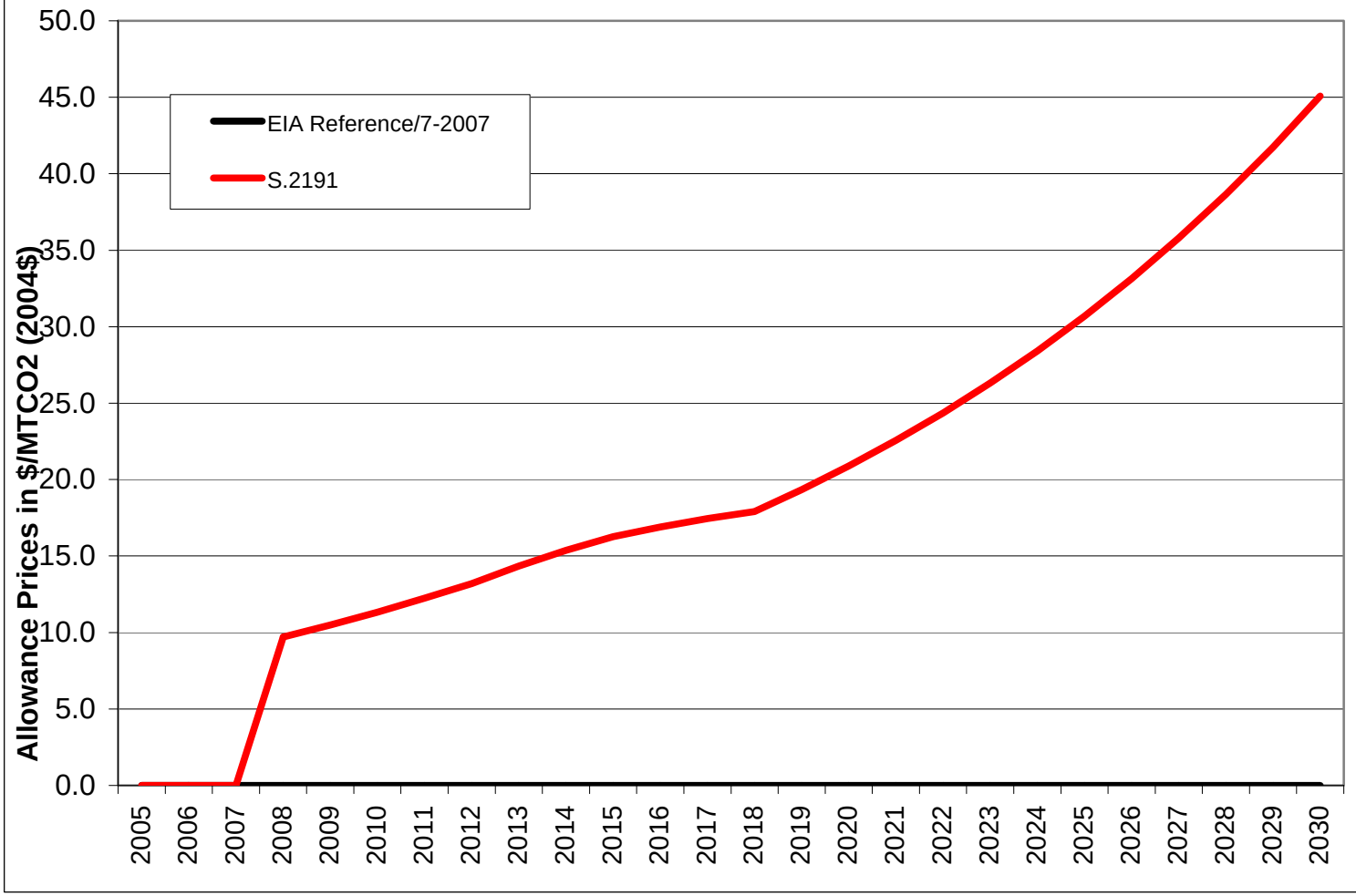
CO2 Allowance Prices



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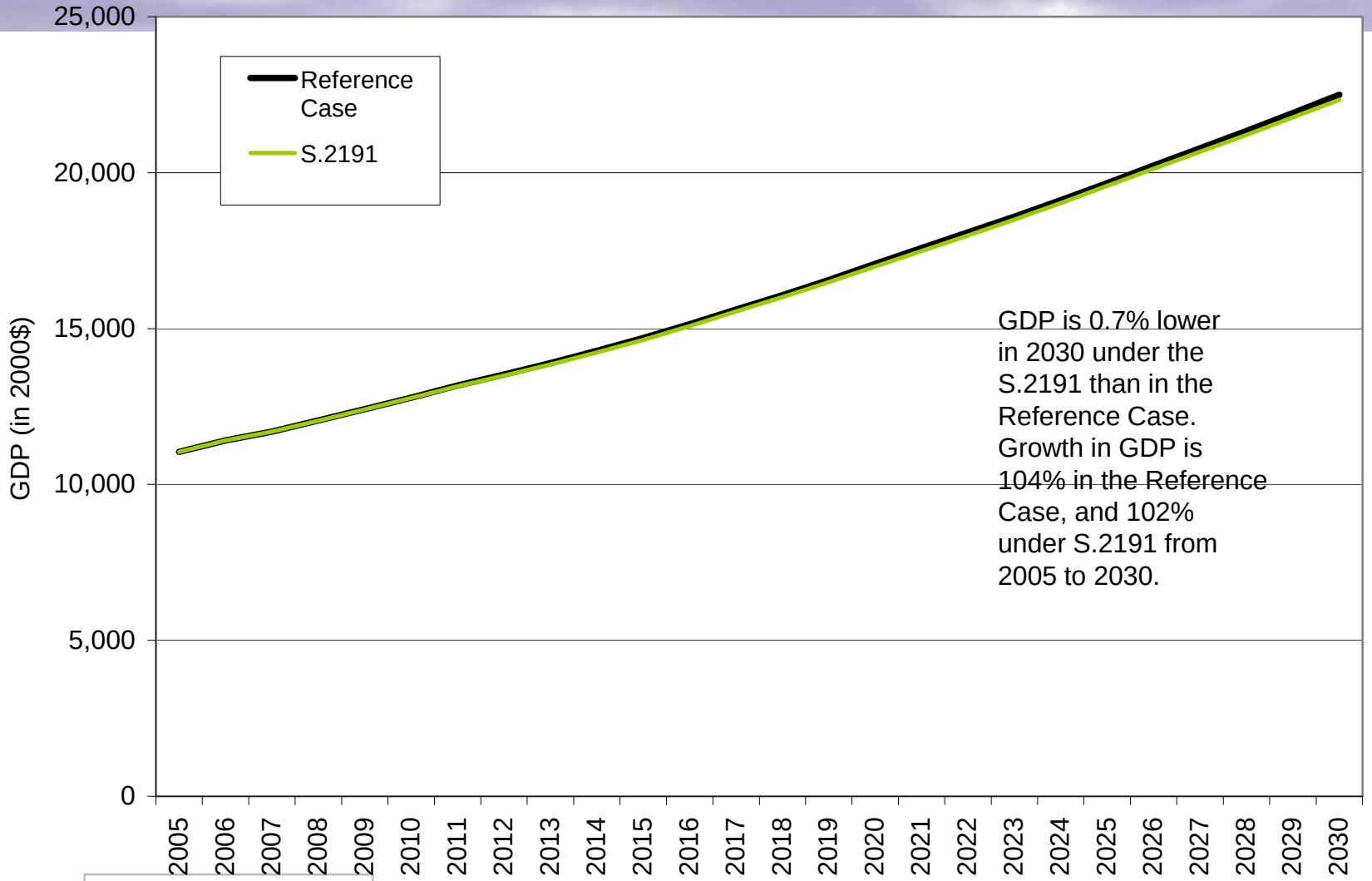
Gross Domestic Product



GDP is 0.7% lower in 2030 under the S.2191 than in the Reference Case. Growth in GDP is 104% in the Reference Case, and 102% under S.2191 from 2005 to 2030.

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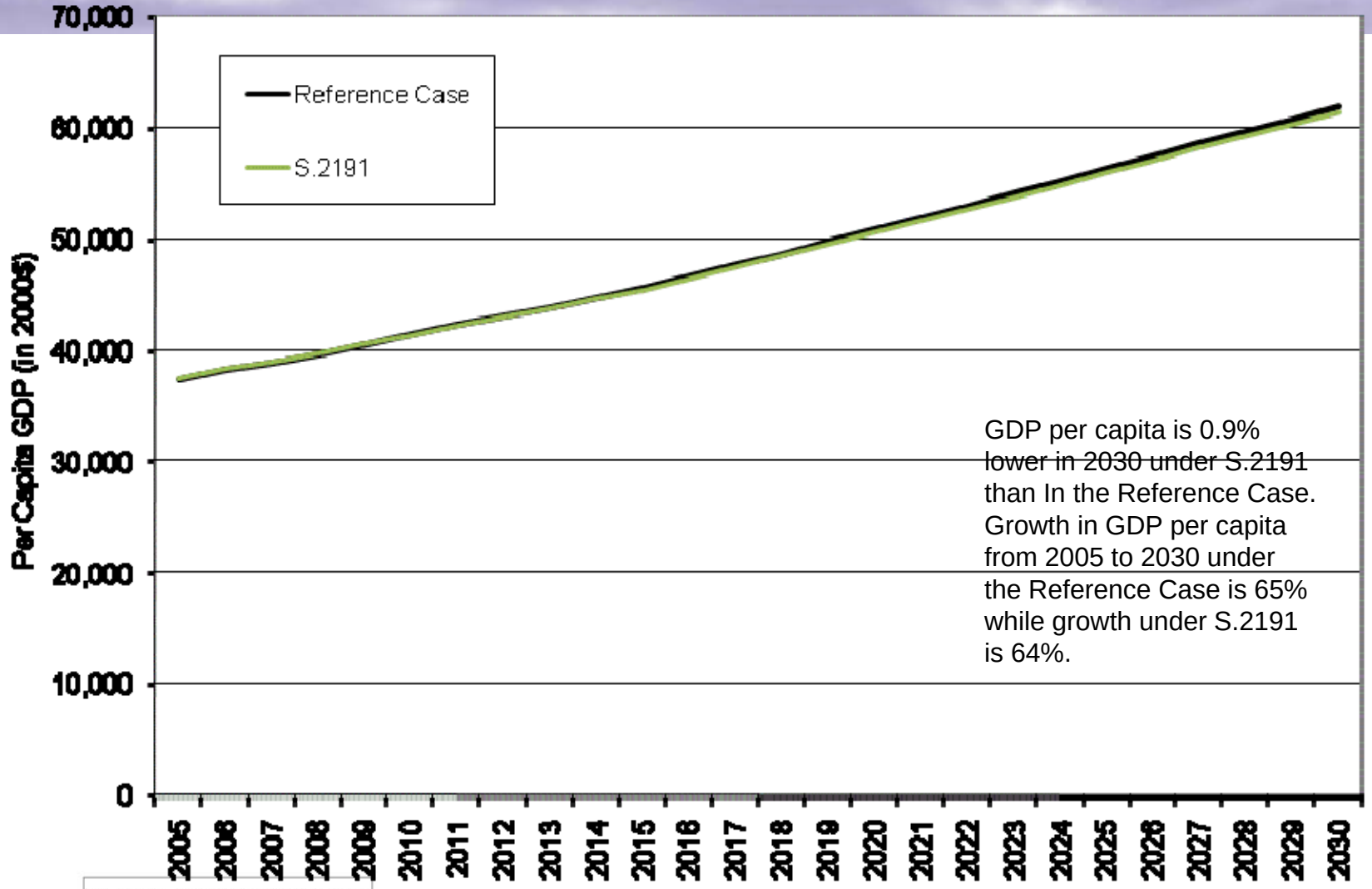
Per Capita Gross Domestic Product



GDP per capita is 0.9% lower in 2030 under S.2191 than In the Reference Case. Growth in GDP per capita from 2005 to 2030 under the Reference Case is 65% while growth under S.2191 is 64%.

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Electricity Prices

- The average price per KWh of electricity increases from 8.2 cents per KWh in 2006 to 9.5 cents per KWh in 2030.
- However energy usage drops considerably, due to S. 2191's energy efficiency provisions and price response.
- This drop in energy consumption results in lower monthly electrical bills for residential and commercial customers relative to the reference case.
- Roughly similar impacts on industrial energy bills would likely occur due to S. 2191's energy efficiency investment provisions – but these reductions do not show up in our analysis, as EIA's BAT scenario does not include industrial energy equipment efficiency.

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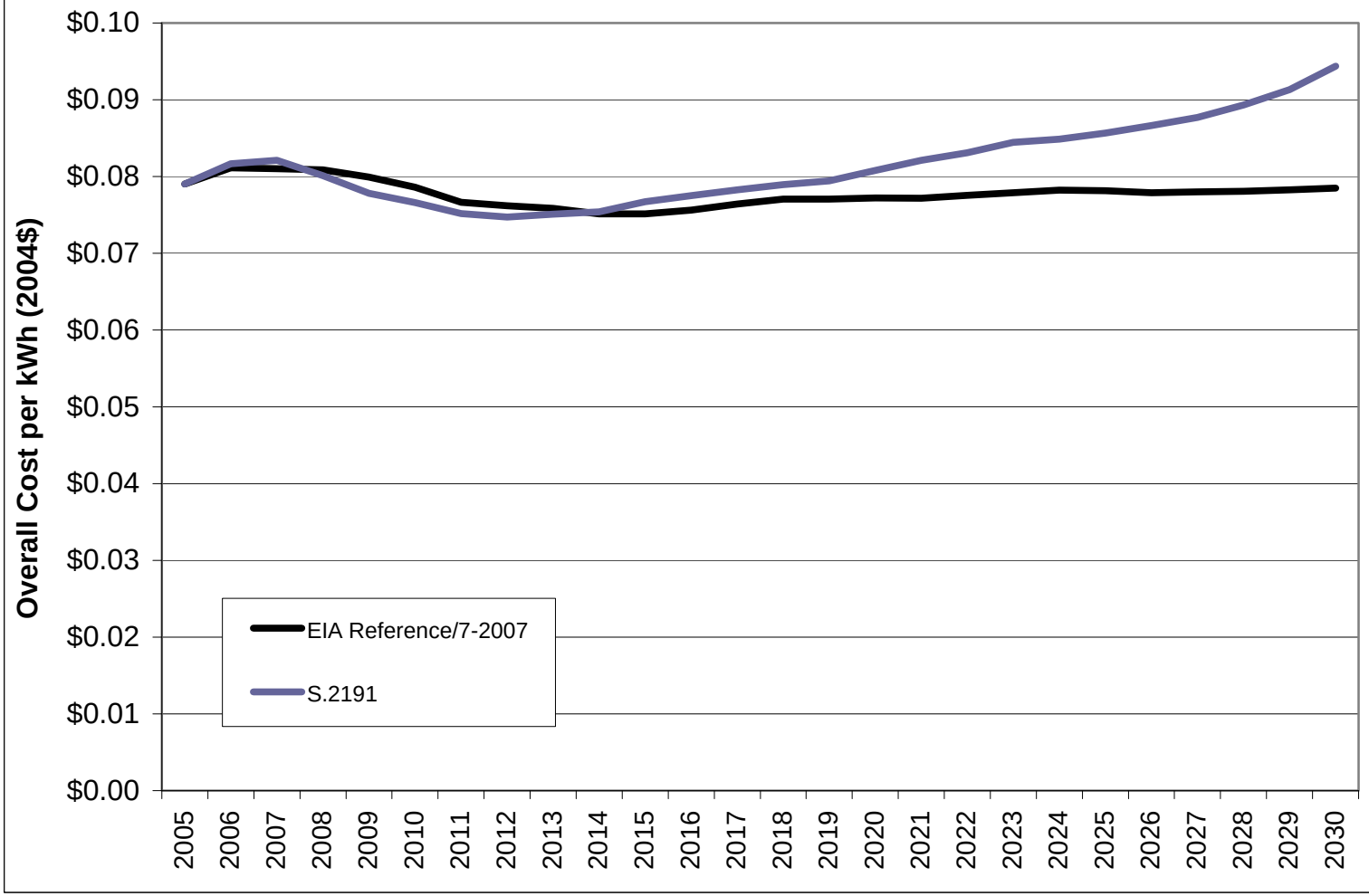
Electricity Prices



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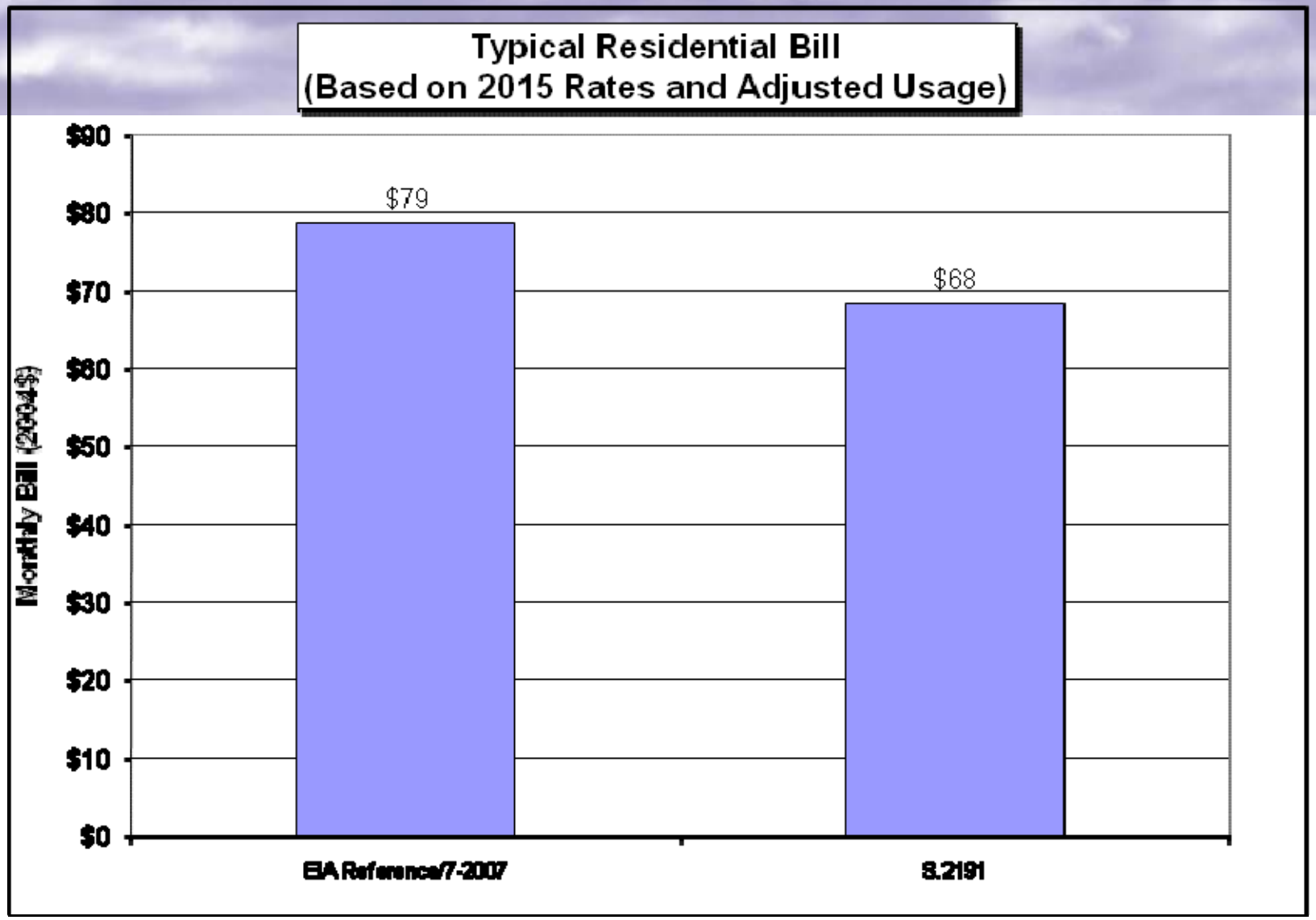

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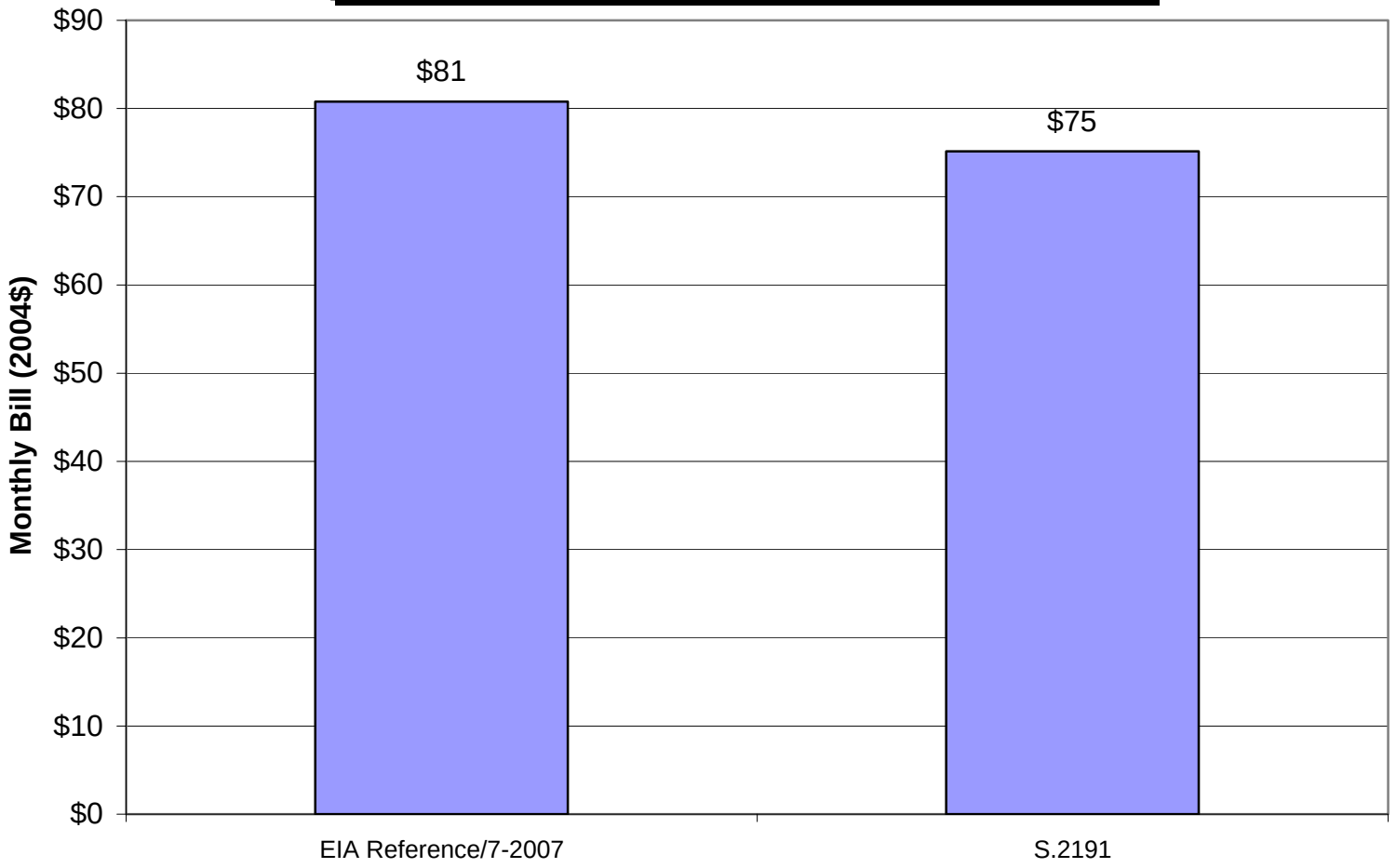
Typical Residential Bill
(Based on 2030 Rates and Adjusted Usage)



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A Safety Net for Electricity Price Increases

- Even though monthly energy bill impacts are expected to be less than BAU for residential customers, S. 2191 creates a safety net to protect low and middle income consumers.

- Sec. 3401 sets aside 9% of the total allowance pool to be used as rebates to low and middle income energy consumers and to promote energy efficiency.

  By 2030, this fund will contain nearly $213 billion.

- Sec. 4101, 4501and 4502 establish the Energy Assistance Fund that provides additional funding to LIHEAP, the Weatherization Assistance Program, and a new Rural Energy Assistance Program.

  By 2030, this fund will contain over $193 billion.

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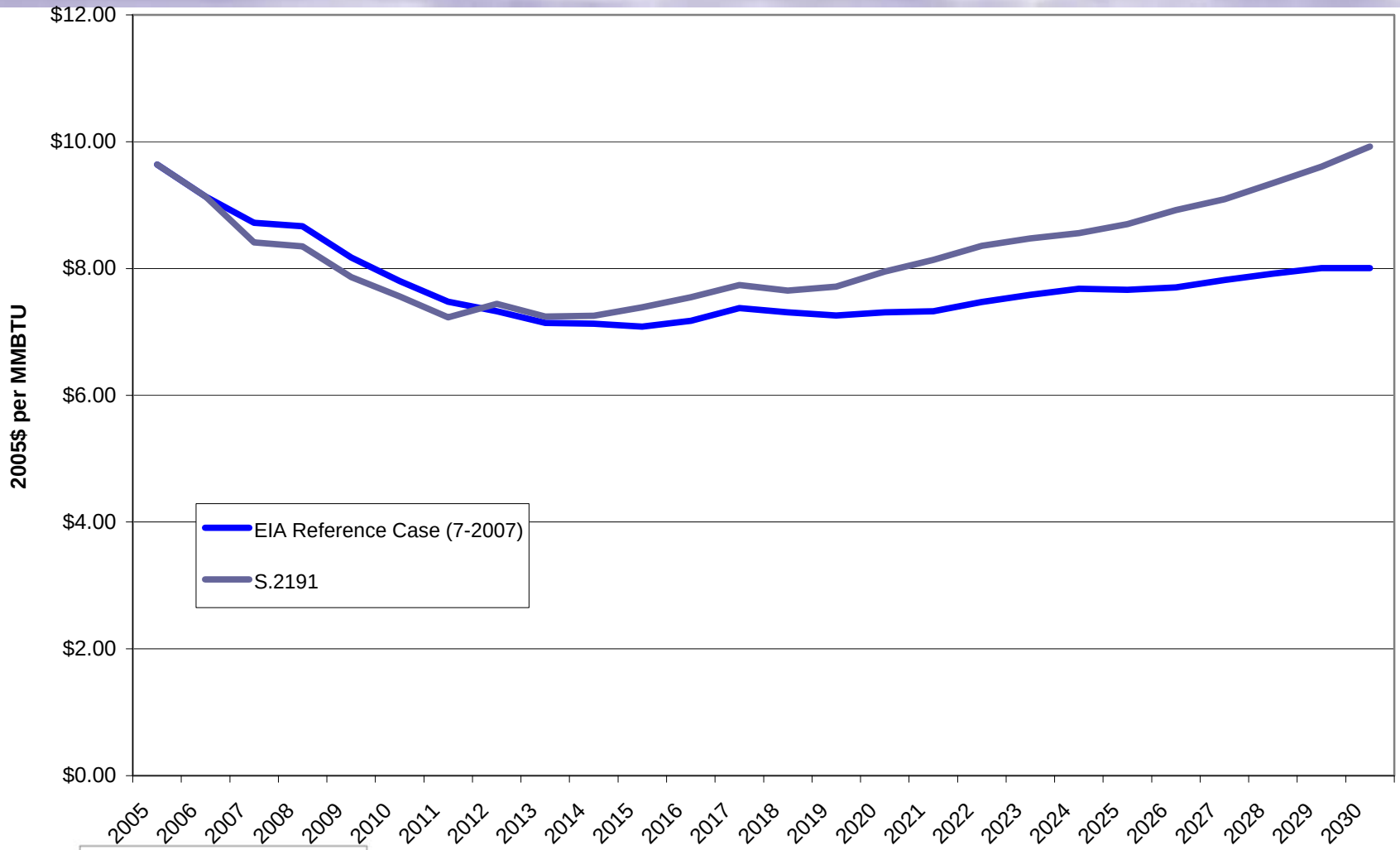
Natural Gas Prices

- The average price per MMBTU of natural gas increases from $9.64 per MMBTU in 2005 to $9.92 per MMBTU in 2030.
- However, due to S. 2191's energy efficiency provisions measures in the bill and price response, energy usage drops considerably.
- This drop in actual energy needed, reduces price impacts on monthly natural gas bills for residential and commercial customers.
- Roughly similar impacts on industrial energy bills would likely occur due to S. 2191's energy efficiency investment provisions – but these reductions do not show up in our analysis, as EIA's BAT scenario does not include industrial energy equipment efficiency.

Natural Gas Prices
Overall End Users



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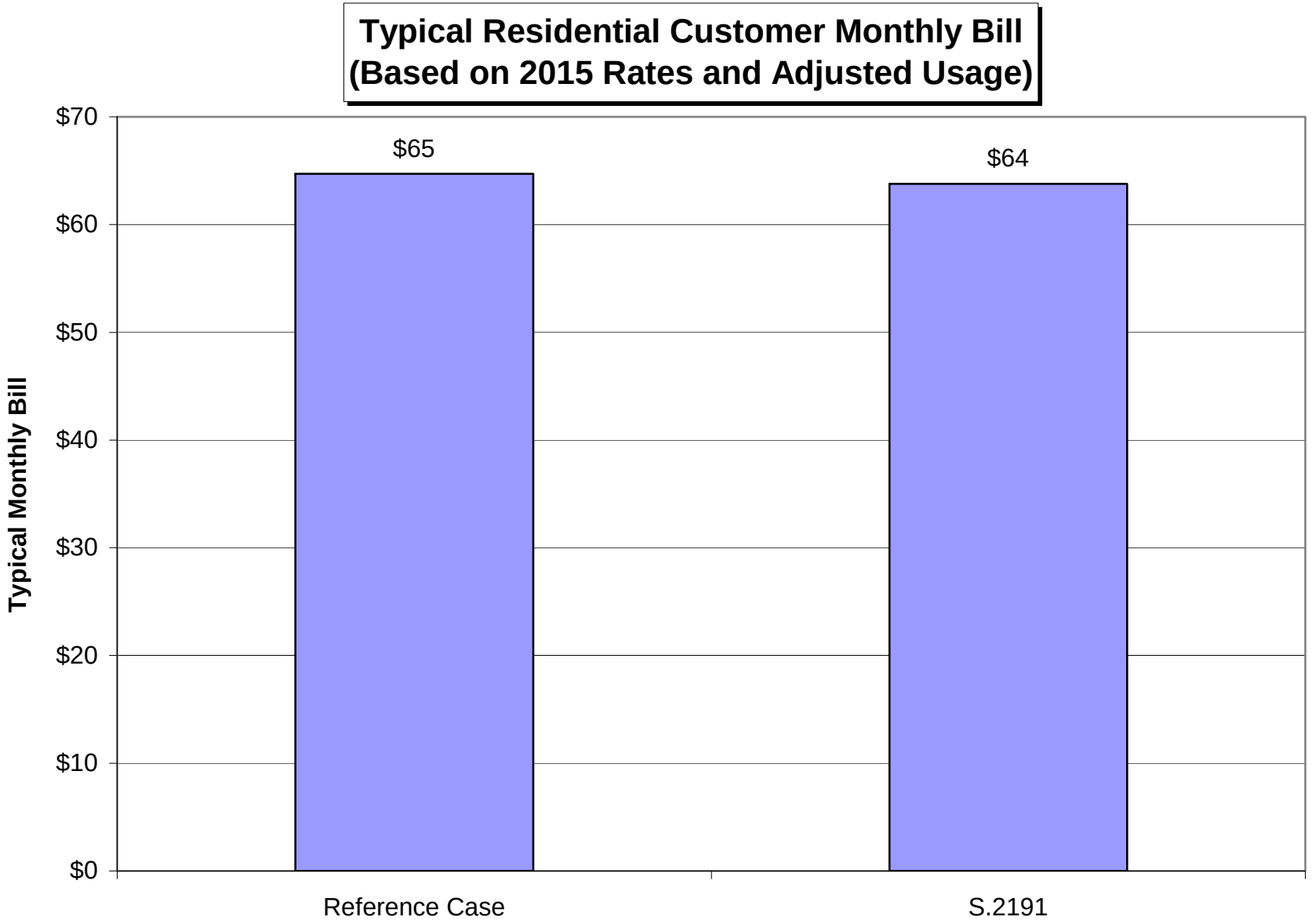
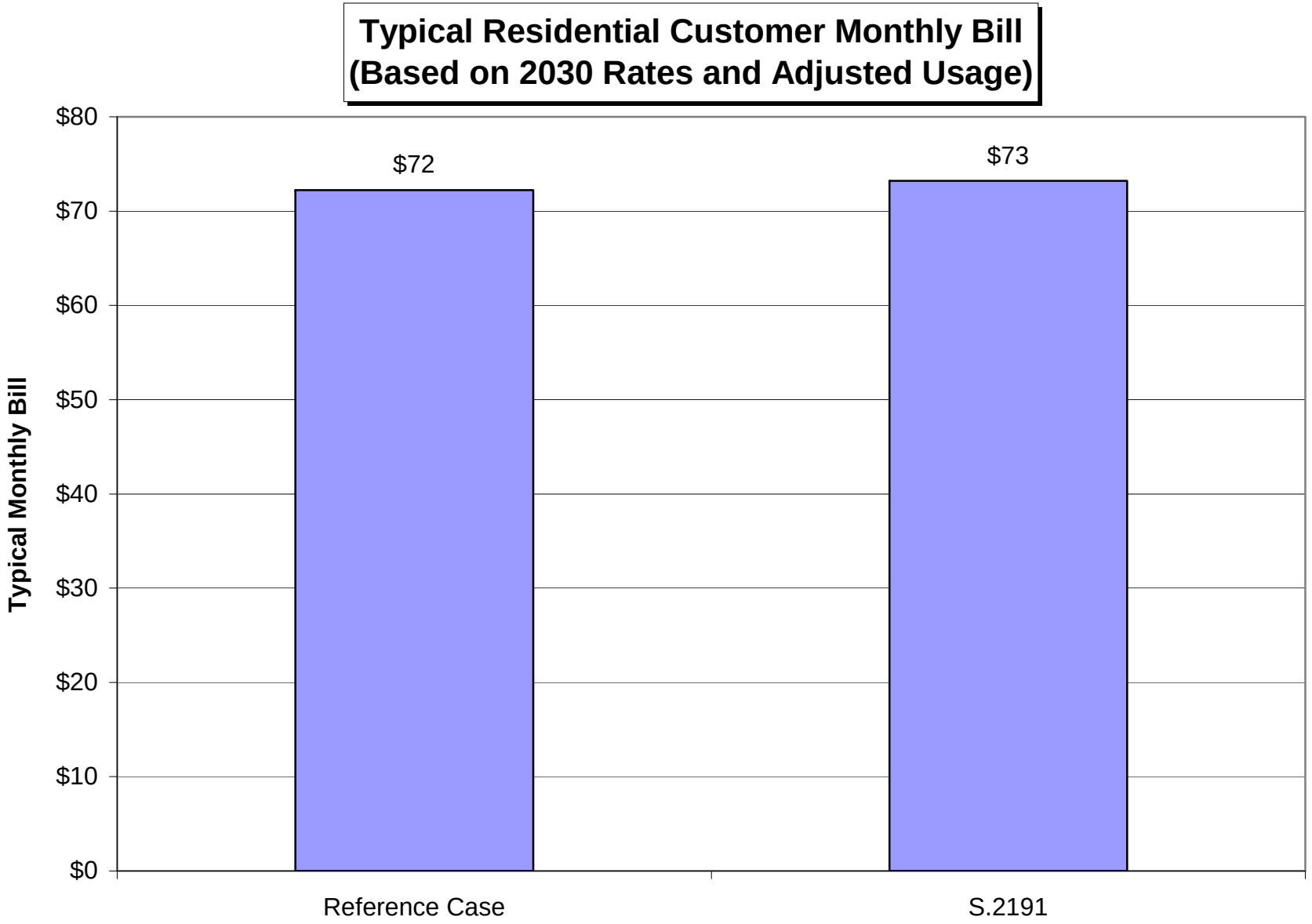

Typical Residential Customer Monthly Bill
(Based on 2015 Rates and Adjusted Usage)
Typical Monthly Bill
$70
$60
$50
$40
$30
$20
$10
$0
$65
$64
Reference Case
S.2191


Typical Residential Customer Monthly Bill
(Based on 2030 Rates and Adjusted Usage)
Typical Monthly Bill
$80
$70
$60
$50
$40
$30
$20
$10
$0
$72
$73
Reference Case
S.2191

A Safety Net for Natural Gas Price Increases

- Even though monthly natural gas bill impacts for residential customers are expected to be quite small when compared to BAU, S. 2191 creates a safety net to protect low and middle income consumers.
- Sec. 3501 sets aside 2% of the total allowance pool to be used as rebates to low and middle income energy consumers and to promote energy efficiency.
  By 2030, this fund will contain nearly $47 billion.
- Sec. 4302, 4501 and 4502 establish the Energy Assistance Fund that provides additional funding to LIHEAP, the Weatherization Assistance Program, and a new Rural Energy Assistance Program.
  By 2030, this fund will contain over $193 billion.
- LIHEAP funds, as well as the Rural Energy Assistance Funds could be used to offset any price impacts that low and middle income natural gas customers might see.

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Gasoline Prices

- **Gasoline prices gradually go up under S. 2191, closely tracking the CO2 allowance price (i.e. 10$ a ton CO2= @ 10 cents on a gallon).**
- **While EIA's projection for gas prices, even for the AEO 2007 case may look optimistic, the *incremental impact* that S. 2191 will have on actual future gasoline prices would be similar to that projected in this analysis.**
- **Gasoline prices under S. 2191, reflect almost 100% pass-through cost of the CO2 allowance price.**

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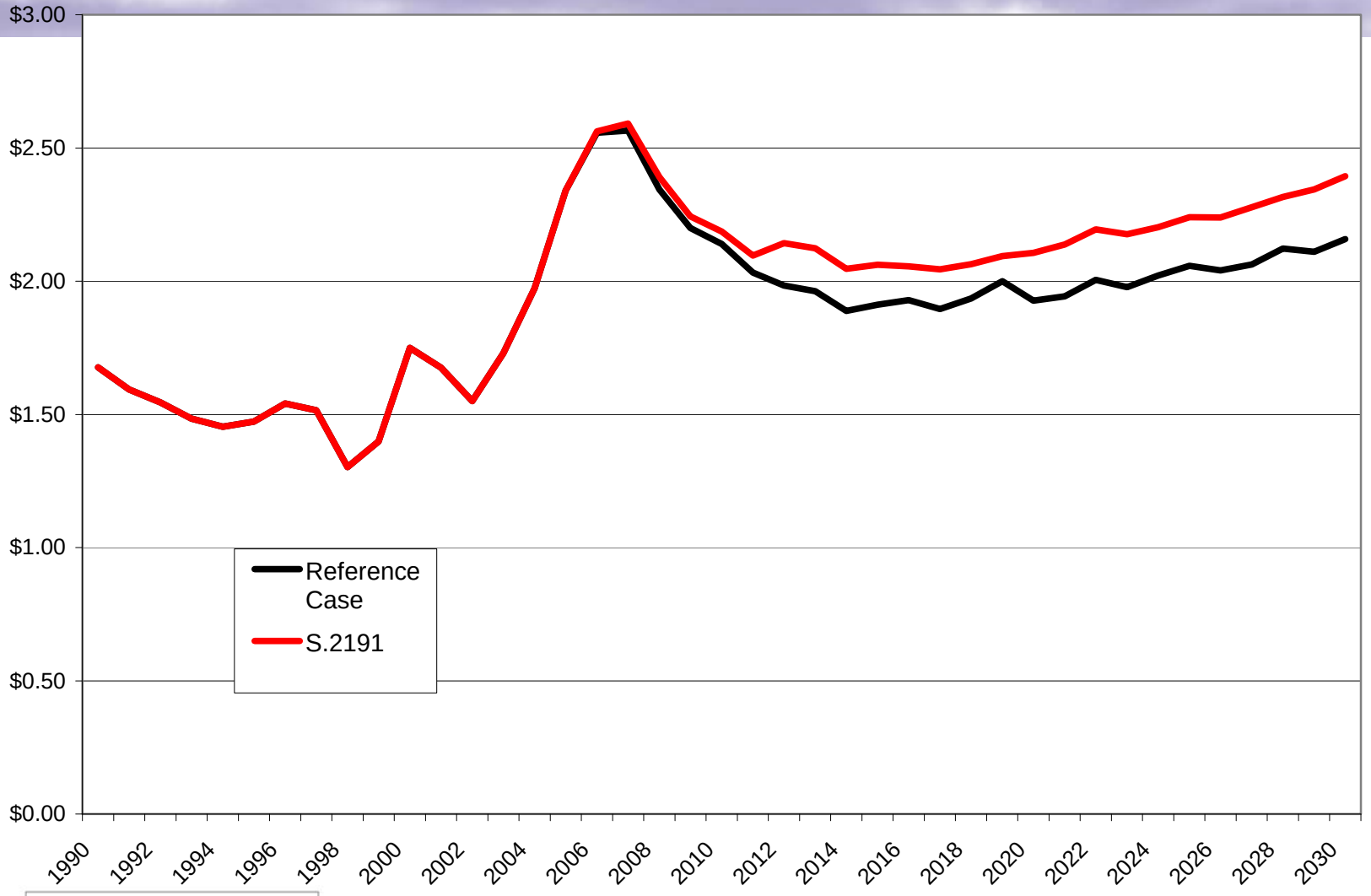
Retail Gasoline Prices -- Historic and Projected



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Electricity Generation

- Due to the technology and efficiency incentives and the standards in the bill, overall electricity generation declines by 20% as compared to projected 2030 growth in BAU generation.
- This is equivalent to not building 170 1000Mw power plants.
- This combined with the GHG cap reduces the role that traditional fossil fuels play in the power sector.
- However, new low carbon fossil technologies and renewable technologies, spurred by the incentives in S. 2191, along with nuclear increase dramatically.

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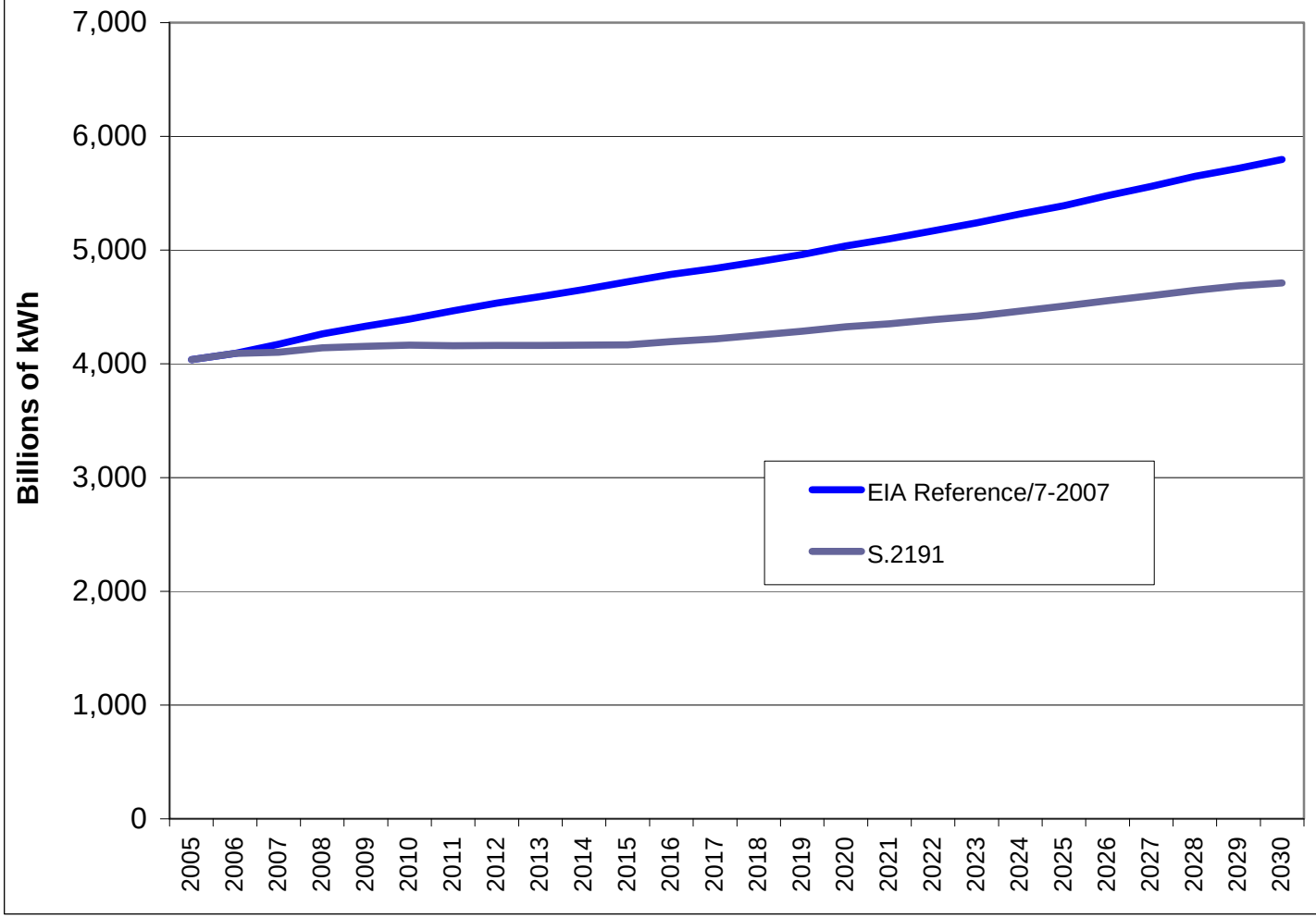
Total Power Generation



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Gas Generation

- In most climate policies, gas generation is relied on as an interim power source prior to CO2 allowance prices reaching the point where carbon capture and sequestration becomes economic.
- Because of the incentives for CCS, and the reduction in overall energy use, natural gas generation does not show up as a “bridge” fuel.
- If CCS or nuclear is constrained below projected expansion levels in the real world, gas generation would likely fill the gap.

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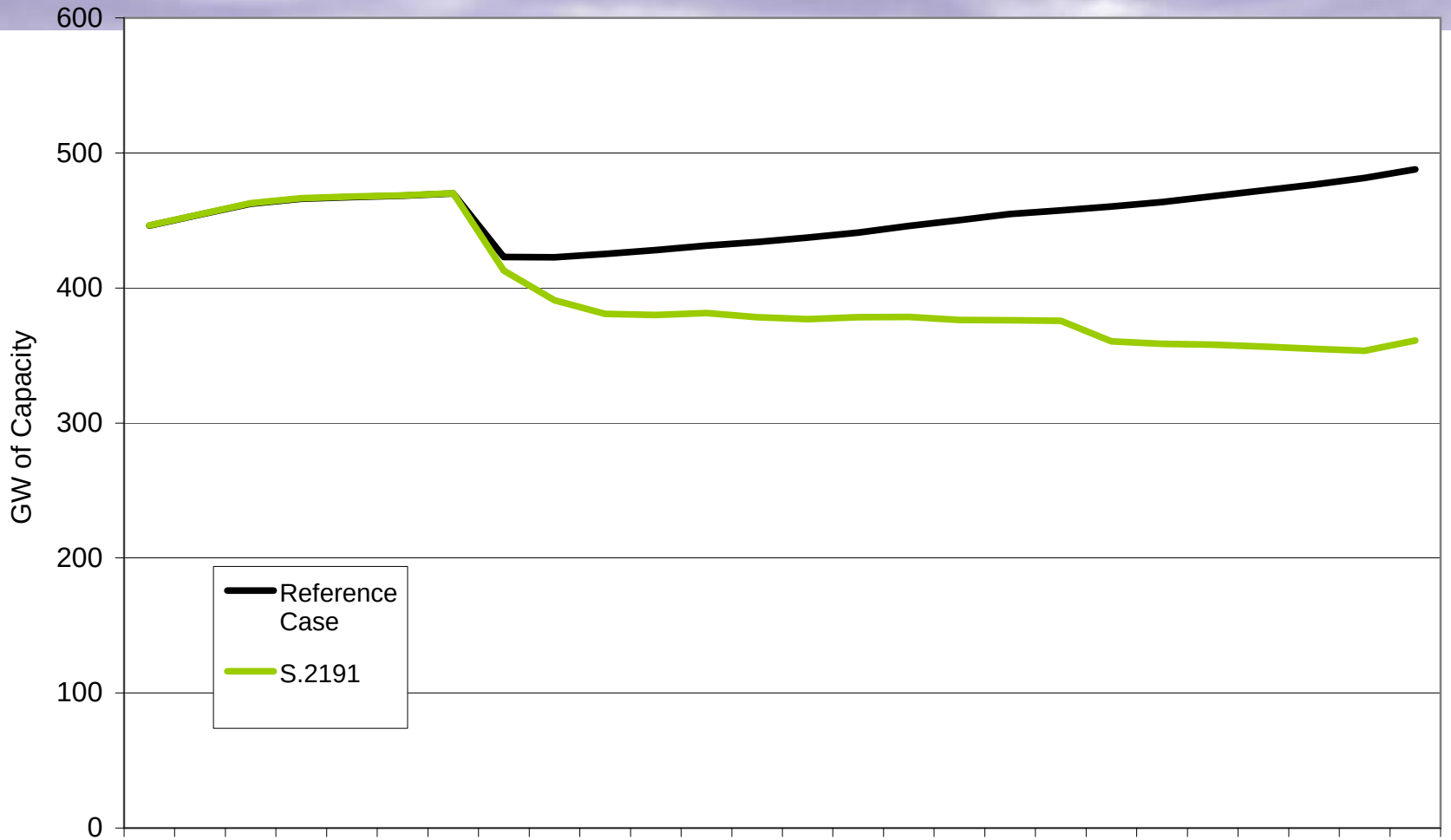
Oil and Gas-Fired Generating Capacity



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Nuclear Generation

- Nuclear power in a carbon constrained world will have an economic advantage that it does not currently have.
- NEMS sees nuclear as a low cost, no carbon power generation choice, and thus builds large amounts of new nuclear generation- 104 GWs by 2030.
- We chose not to artificially constrain nuclear power within the model.

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Nuclear Generation, Contd.

- As of *late 2006*, 27 GW of new plants were on order or proposed in the US, according to the World Nuclear Association.
- While building a further 77GWs would be an aggressive build rate, it is entirely plausible.
- Between 1971-1990, the US built approximately 5GWs a year.

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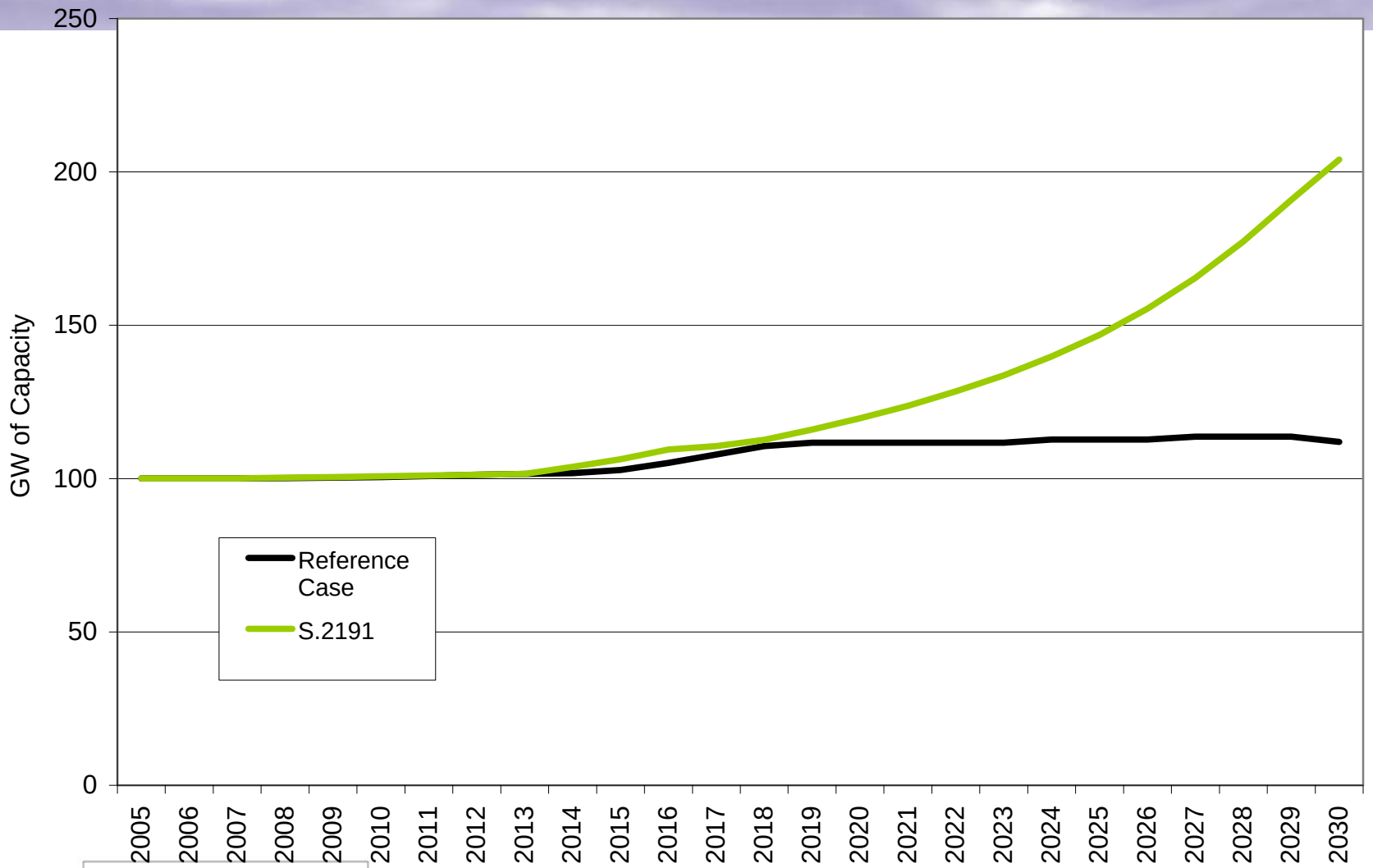
Nuclear Generating Capacity



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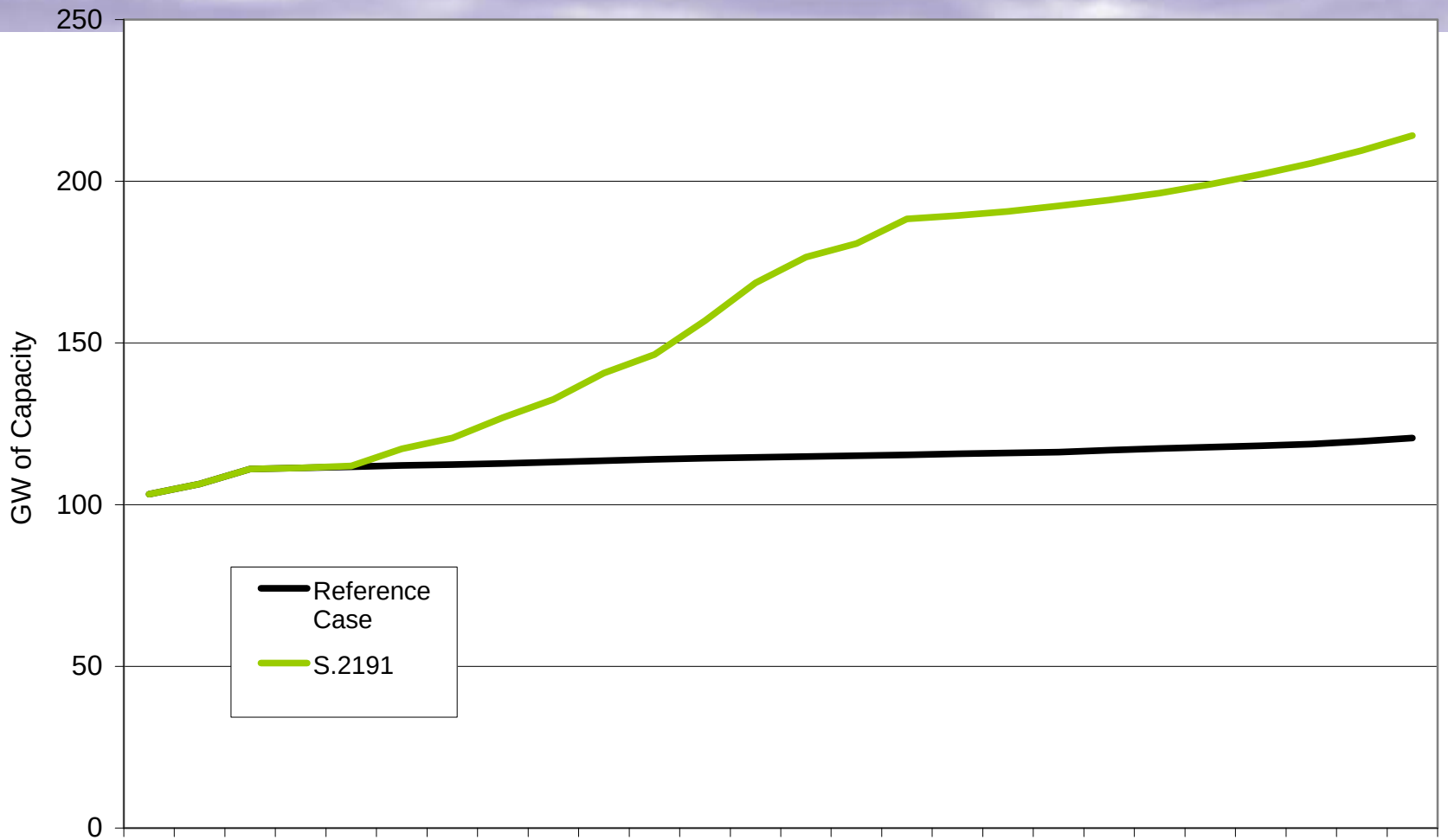
Renewable Generation

- The large expansion of renewable generation is due to both the GHG cap as well as the incentives in S. 2191 for low and no carbon technologies.
- Sec. 4401 and 4402 dedicate approximately $125 billion to zero and low carbon power generation.
- We extended the production tax credit for wind power to 2030 within the model to mimic the benefit of these funds.
- In addition, we suppressed the amount of biomass power due to the many competing uses that biomass faces (i.e. ethanol and other biofuels), as well as questions about net climate impacts and costs.
- Renewable generation expands by about 77% (not including conventional hydro power).
- Between 2012-2030, nearly 54 GWs of new wind generation is deployed.

Renewable Generating Capacity



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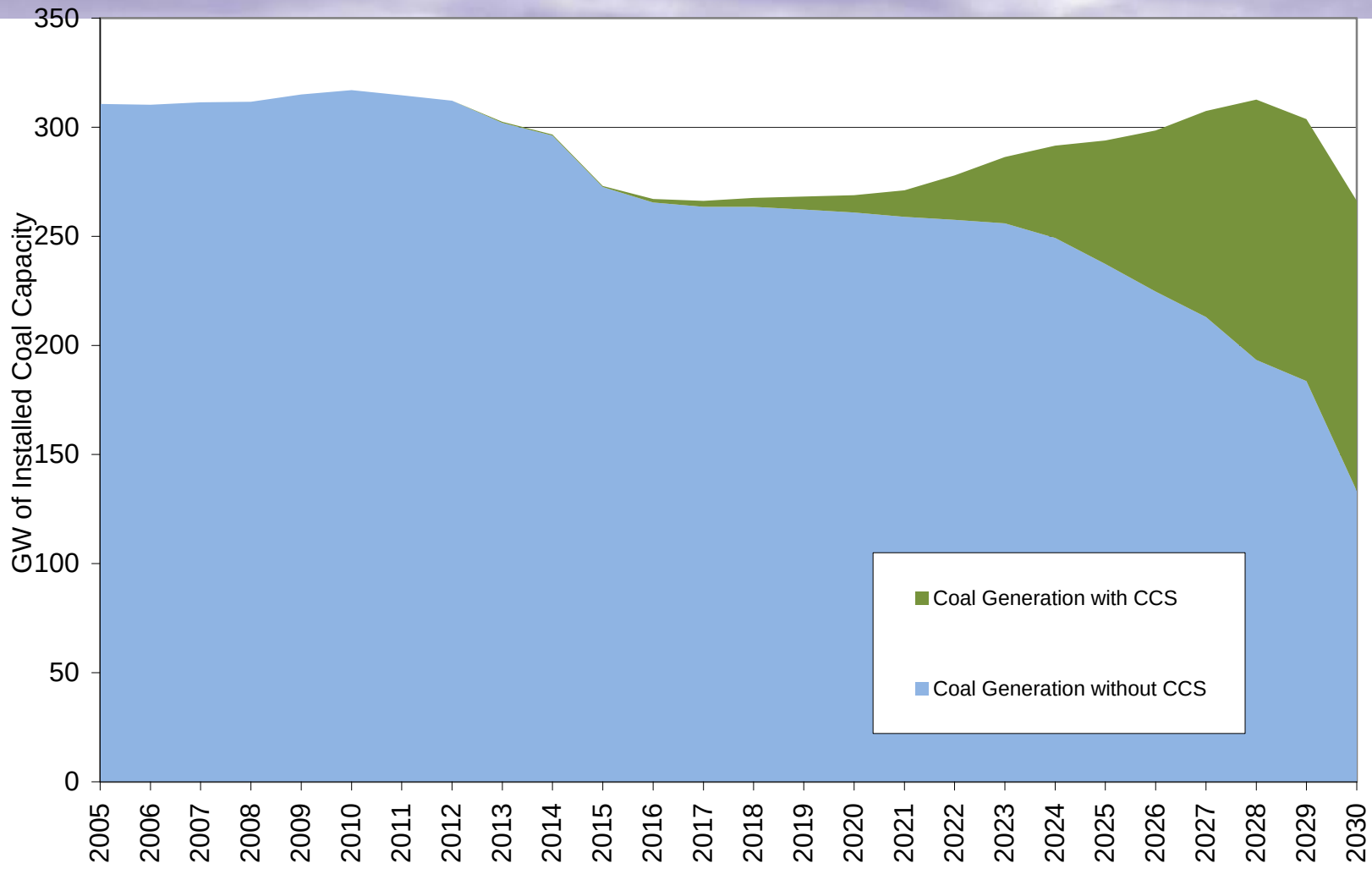
Coal Generation

- In modeling S. 2191, we used a production tax credit of 1.25 cents/KWh for coal generation with carbon capture and storage.
- This was used to mimic in part the many incentives for promoting CCS technologies in the bill.
- ACSA contains a 4% bonus allowance for CCS (the production tax credit most closely resembles this), a fund for deploying 20GWs of new IGCC/CCS, a fund for deploying new fossil and retrofit technologies with CCS, a fund for demonstrating geologic carbon storage, and the zero and low carbon generation fund which CCS power plants could qualify for.
- Overall coal generation capacity drops by 14% from today's levels.
- 177 GWs of traditional coal retires, while 133 GWs of IGCC/CCS is built by 2030.

Coal Capacity by Type Under S.2191



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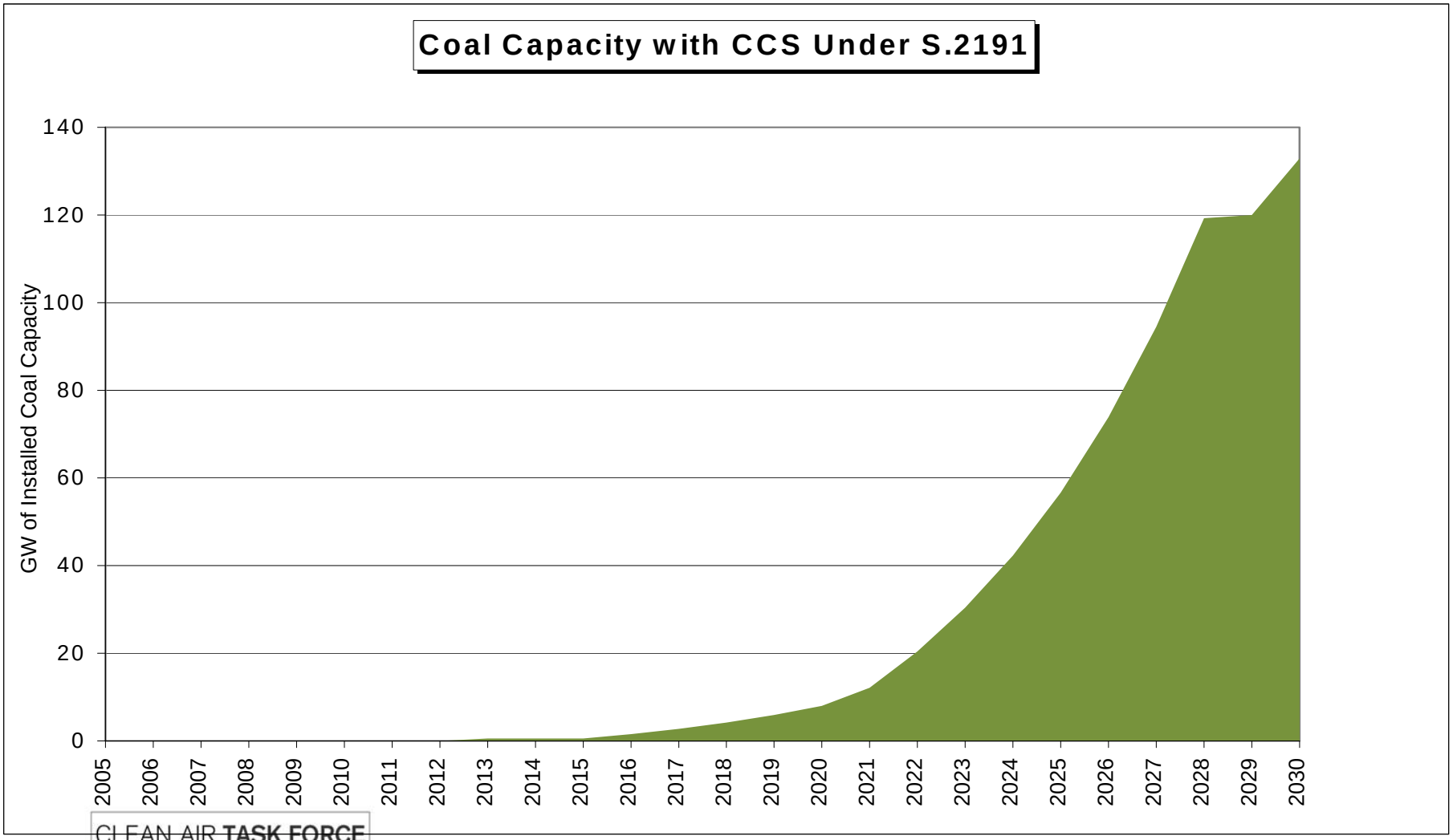
CCS Expands Dramatically



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Greenhouse Gas Emissions

- **Total greenhouse gas emissions (including reductions through offsets) fall by 23% from their 2005 levels by 2020, and by 26% by 2030.**
- **This figure is not yet adjusted to show the impact of S. 2191's allowance auction revenue investments in agricultural carbon storage nor the provisions for methane reduction from landfills and coal mines.**
- **The power sector makes up the majority of the energy system reductions (because reductions are the most economical in this sector), with small reductions coming from the residential sector, and reduction in growth only coming from industrial, commercial and transportation.**

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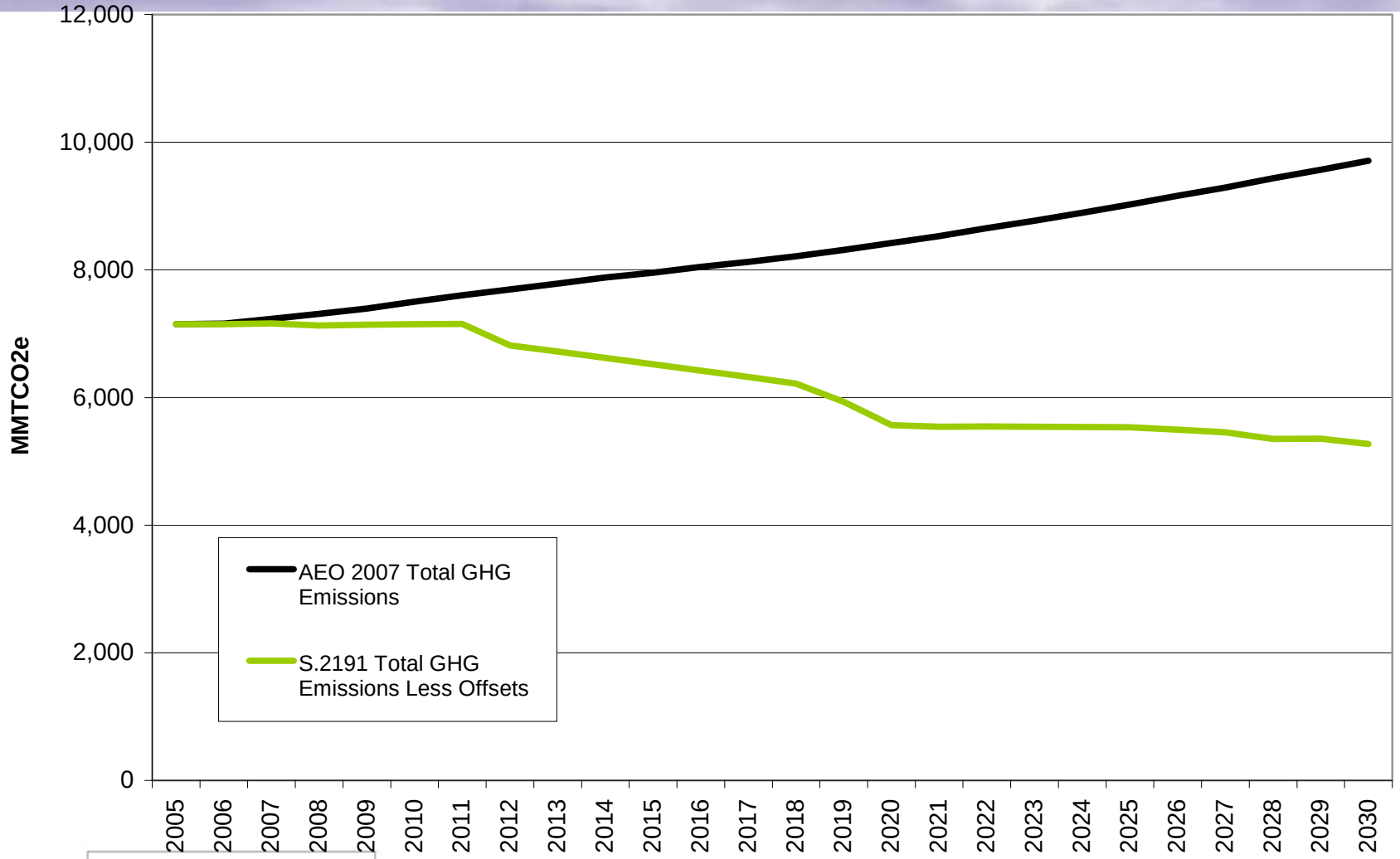
Total GHG Emissions Less Offsets



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