



# Review of Policy Cases 1 & 2

*State of Wisconsin  
Governor's Global Warming Task Force*

May 1, 2008

# Agenda:

1. Listing of Policies/Scenarios Modeled
2. Power Sector results
3. Energy Prices and Costs
4. Transportation Sector
5. Total Fuel Use
6. GHG Emissions

# Policies Modeled:

The following policies were included in the “All Policies except Cap and Trade” scenarios.

Policy No.	Policy Title
C&EE 01	Enhanced Energy Efficiency Program
C&EE 02	Residential & Commercial Energy Efficiency & Green Building Codes
C&EE 03	State Appliance Efficiency Standard
C&EE04	Residential Rental Lighting Standard
F&A 01	Urban Forestry (stand alone policy)
Trans 01	CO2 Emission Standards, Commonly Called “California Car” Standards
Trans 02	Low Carbon Fuel Standard
Trans 03	Reform Planning and Funding Policies to Reduce VMT
EG 01	Enhanced Renewable Portfolio Standard

# Policy Scenarios :

- Two policy scenarios are presented below:
  - Policy Case 1: All Policies Except Cap & Trade
  - Policy Case 2: All Policies Except Cap & Trade and California Cars
- Changes resulting from this policy are described relative to the Reference Case.
- There are no differences in the impact of these two policies on the residential, commercial, industrial or electricity sector.
- Changes to the transportation sector, fuel use and emissions are first described for Policy Case 1.
- Differences for Policy Case 2, which excludes the California Cars policy, will then be noted.

## Introduction:

- Several changes have been made based on Task Force/Working Group feedback following 4April08 meeting:
  - Enhanced EEPS achieves an 18% reduction in electricity use and 10% reduction in natural gas use below Reference by 2024
  - Sequestration levels for urban forestry have been reduced.
  - Based on discussion with the TWG policies achieved the following changes by 2024 on a stand-alone basis:
    - VMT Reductions reach 26% below Reference
    - California Cars reduce emissions by 2.9Mt below Reference

# Power Sector

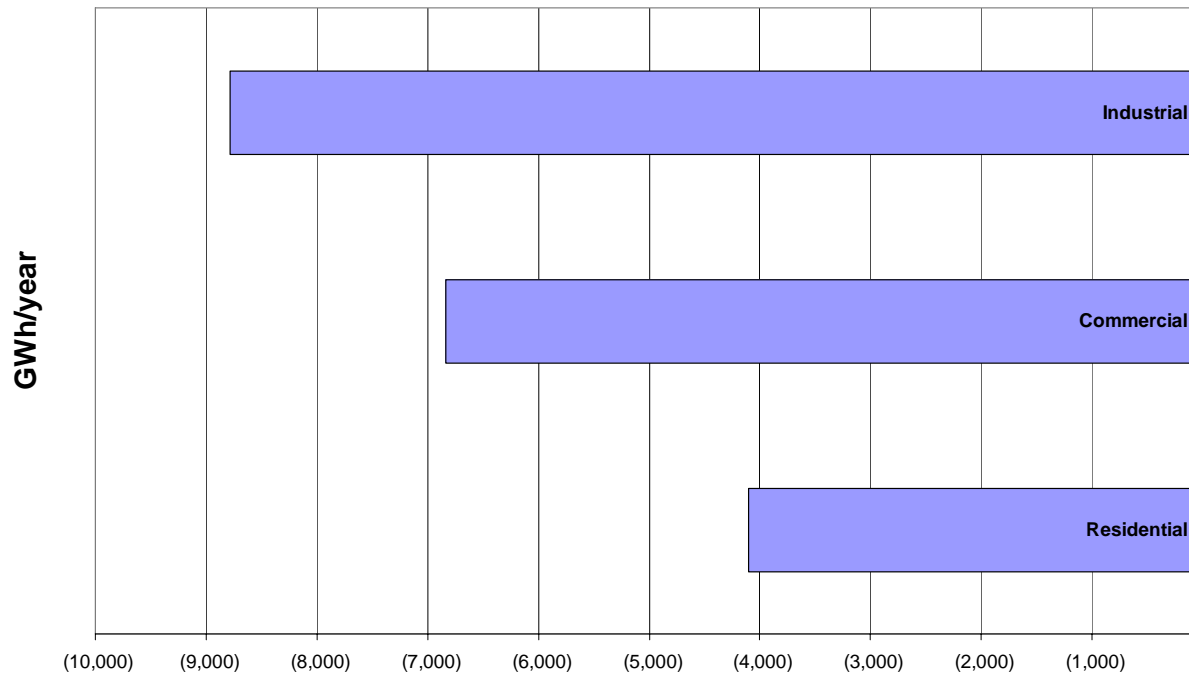
# Electricity Sales (Policy Case 01)

Growth in Electricity Sales 2004 to 2024		
Sector	Reference	Policy
Residential	1.70%	0.80%
Commercial	1.90%	0.80%
Industrial	2.40%	1.40%
<b>Total Sales</b>	<b>2.00%</b>	<b>1.00%</b>

- By 2024, electricity sales drop by approximately 18% and Natural Gas sales by about 10% relative to the Reference Case.
- Electricity growth over the period from 2004 to 2008 remains at same levels as in Reference Case, but drops from an average 2.0% per year to 0.8% per year from 2009 to 2024 as the Enhanced Energy Efficiency Portfolio Standard (EEPS) comes into effect.
- The average annual increase in electricity sales over the full period from 2004 to 2024 drops to 1% per year.

# Electricity Sales – Wisconsin (Policy Case 01)

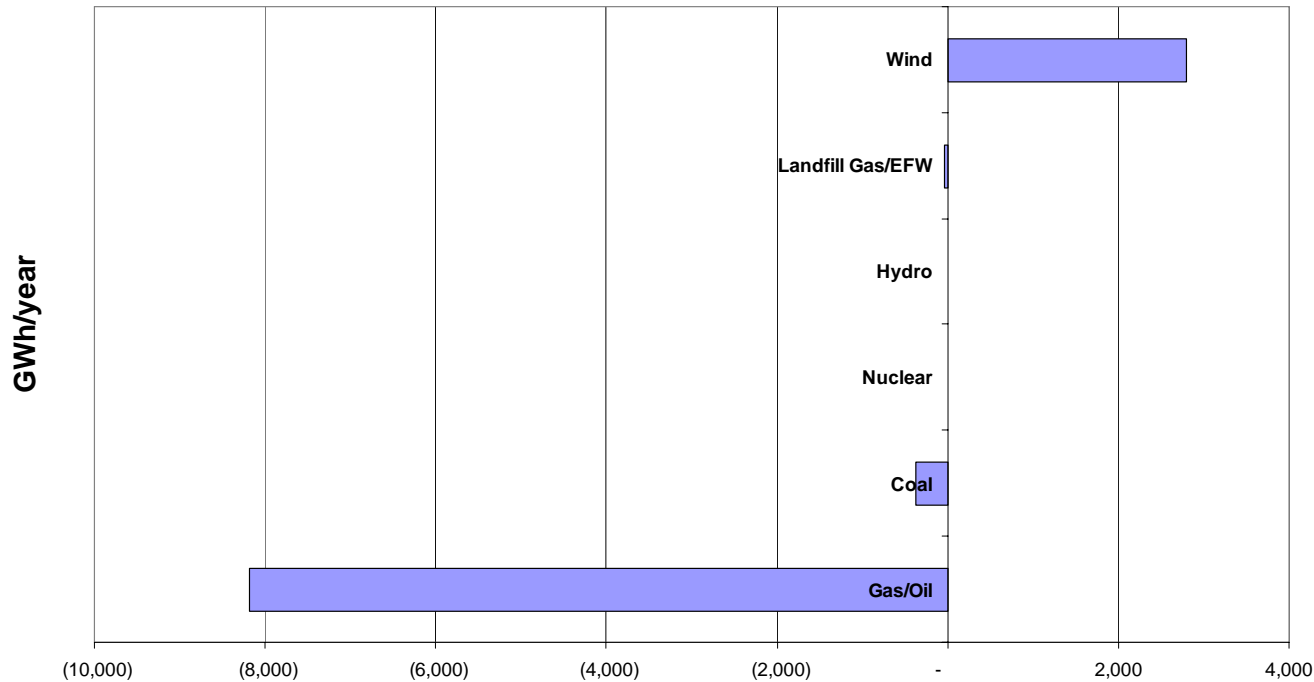
**Change in Electricity Sales by 2024**  
Relative to Reference Case



- Increased efficiency reduces electricity use across all sectors.

# Electricity Generation – Wisconsin (Policy Case 01)

**Change in Generation Output by 2024**  
Relative to Reference Case



- The bulk of the increase in renewable generation is supplied by wind power; offset by a reduction in gas and oil and to a much lesser extent coal generation.

# Electricity Sales and Generation

## Absolute Values for Wisconsin – Policy Case 1

Electricity Sales (GWh)						
Sector	2004	2006	2010	2015	2020	2024
Residential	19,203	20,148	21,184	21,149	21,818	22,707
Commercial	21,800	22,272	22,593	22,703	23,907	25,501
Industrial	28,438	31,226	31,739	31,271	34,434	37,352
Street Lights/Misc.	400	400	400	400	400	400
Resale	20	-	-	-	-	-
<b>Total Sales</b>	<b>69,861</b>	<b>74,046</b>	<b>75,916</b>	<b>75,523</b>	<b>80,559</b>	<b>85,960</b>
Net Out-Flows	9,416	12,402	(4,048)	(4,598)	(861)	2,442

Generation Output (GWh/year)						
Plant Type	2004	2006	2010	2015	2020	2024
Gas/Oil	3,146	6,226	10,269	8,514	6,113	5,595
Coal	42,141	40,043	54,909	53,816	53,971	53,857
Nuclear	11,888	12,234	12,115	12,802	12,802	12,802
Hydro	1,981	1,679	1,184	1,184	1,184	1,184
Landfill Gas/EFW	114	110	133	402	886	1,240
Wind	1,175	1,349	1,283	3,066	5,684	7,765
Other	-	4	72	338	780	1,075
<b>Total</b>	<b>60,445</b>	<b>61,644</b>	<b>79,964</b>	<b>80,121</b>	<b>81,420</b>	<b>83,518</b>

- Notes:
1. EFW = Energy from Waste
  2. Other generation is primarily comprised of renewable generation sources.

# Electricity Sales and Generation

## Absolute Values for Wisconsin – Policy Case 1

Generation Capacity (MW)						
Plant Type	2004	2006	2010	2015	2020	2024
Gas/Oil Combustn. Turbine	5,248	6,793	4,517	4,517	4,517	4,517
Gas/Oil Combined Cycle			2,679	2,679	2,679	2,679
Gas/Oil Steam			360	383	383	383
Coal	6,785	7,464	8,560	8,441	8,441	8,441
Nuclear	1,583	1,586	1,586	1,676	1,676	1,676
Hydro	447	447	447	447	447	447
Landfill Gas/EFW	60	52	52	86	147	192
Wind	39	121	484	1,069	1,877	2,509
Other	-	-	12	55	129	179
<b>Total</b>	<b>12,445</b>	<b>16,020</b>	<b>18,697</b>	<b>19,353</b>	<b>20,296</b>	<b>21,023</b>

- Notes:
1. EFW = Energy from Waste
  2. Other generation is primarily comprised of renewable generation sources.

# Electricity Sales and Generation

## Change from Reference Case: Wisconsin – Policy Case 1

Electricity Sales (GWh) Change from Reference (Policy minus Reference)				
Sector	2010	2015	2020	2024
Residential	(621)	(1,937)	(3,245)	(4,099)
Commercial	(1,129)	(3,668)	(5,685)	(6,832)
Industrial	(1,398)	(4,354)	(7,282)	(8,781)
Street Lights/Misc.	-	-	-	-
Resale	-	-	-	-
<b>Total Sales</b>	<b>(3,148)</b>	<b>(9,959)</b>	<b>(16,212)</b>	<b>(19,712)</b>
Net Imports	(2,908)	(8,464)	(13,581)	(13,727)

Generation Output (GWh/year) Change from Reference (GWh/year) Change from Reference (Policy minus Reference)				
Plant Type	2010	2015	2020	2024
Gas/Oil	(240)	(917)	(3,854)	(8,181)
Coal	-	(205)	(255)	(369)
Nuclear	-	-	-	-
Hydro	-	-	0	(0)
Landfill Gas/EFW	-	(16)	(58)	(43)
Wind	-	(308)	1,670	2,798
Other	-	(48)	(134)	(190)
<b>Total</b>	<b>(240)</b>	<b>(1,495)</b>	<b>(2,631)</b>	<b>(5,985)</b>

# Electricity Sales and Generation

## Change from Reference Case: Region – Policy Case 1

<b>Electricity Sales (GWh) Change from Reference (Policy minus Reference)</b>				
<b>Sector</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
Residential	16	84	255	420
Commercial	10	89	365	630
Industrial	(15)	(13)	651	1,599
Street Lights/Misc.	-	-	-	-
<b>Total Sales</b>	<b>11</b>	<b>160</b>	<b>1,271</b>	<b>2,649</b>

<b>Generation Output (GWh/year) Change from Reference (GWh/year) Change from Reference (Policy minus Reference)</b>				
<b>Plant Type</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
Gas/Oil	(487)	(2,058)	(2,442)	(1,583)
Coal	-	(948)	(2,305)	(3,418)
Nuclear	-	-	-	-
Hydro	-	-	-	-
Landfill Gas/EFW	-	-	6	140
Wind	-	33	2,843	4,868
Other	-	(3)	(25)	(185)
<b>Total</b>	<b>(487)</b>	<b>(2,976)</b>	<b>(1,923)</b>	<b>(178)</b>

# Electricity Sales and Generation

- Sales outside of Wisconsin increase very slightly (0.3% by 2024).
- Total generation decreases very slightly by 2024 relative to Reference Case (as imports into Wisconsin decrease the generation that had been used to supply these imports is used outside the Region).
- Fossil generation decreases in the Region both as a result of the change in sales and the increase in wind generation needed to meet RPS requirements.
- Generation outside the Region declines as generation formerly imported to Wisconsin is used elsewhere.

Note – Region includes Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, and Ohio.

# Electricity Generation

## Enhanced Renewable Portfolio Standard

<b>Renewable Generation as % of Sales:</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
<b>Target</b>	10%	20%	24%
<b>Model Results</b>	5.0%	9%	12%

- For modeling purposes we allowed the model to build up to half of the renewable generation requirement outside of Wisconsin.
- The RPS provisions are met by wind, energy-from-waste, landfill gas and biomass; with the majority of the new supply from wind.

# Energy Prices and Costs

# Electricity Prices and Costs:

- Electricity prices rise as a result of EEPS and RPS, etc.
- Other fuel prices assumed to be unaffected by Wisconsin policies.

Energy Prices (% Change from Reference)		2010	2015	2020	2024
<b>Electricity</b>	Units				
Residential	MWh	9.4%	18.1%	10.9%	6.7%
Commercial	MWh	11.3%	22.0%	13.5%	8.5%
Industrial	MWh	13.4%	26.0%	15.9%	10.0%
Average Retail	MWh	11.3%	22.0%	13.5%	8.5%

Change in Energy Cost (million 2005 \$)				
	2010	2015	2020	2024
Residential	-2%	1%	-10%	-15%
Commercial	4%	5%	-7%	-13%
Industrial	6%	8%	-5%	-12%

- Electricity rates rise across all sectors with the largest increases occurring in the period prior to 2015 as new capacity is added.
- Increased energy efficiency/reduced use result in lower energy costs for residential sector through most of period and for all sectors by 2020.

# Transportation

# Transportation Sector

## Policy Case 1 Change from the Reference Case:

<b>Marginal Passenger Vehicle Efficiency (miles/gallon)</b>				
	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
Light Gas Vehicles	0.6	3.0	5.3	7.1
Medium Gas Vehicles	0.6	2.6	4.7	6.3
Large Gas Vehicles	0.6	2.6	4.1	4.9
Large Diesel	0.6	2.6	4.2	5.0

<b>Ethanol as a % of Gasoline for Passenger Transportation</b>				
	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
Reference Case	4%	7%	9%	11%
Policy Case 1	5%	8%	13%	17%

- Vehicle efficiencies improve relative to the Reference Case reflecting the more stringent standards under the California Cars standard.
- Ethanol use increases to approximately 17% of total gasoline use, meeting the requirements of the Low Carbon Fuel Standard.
- For Policy Case 2 (Excluding California Cars) there was minimal change to vehicle efficiency relative to the Reference Case.

# Transportation Sector

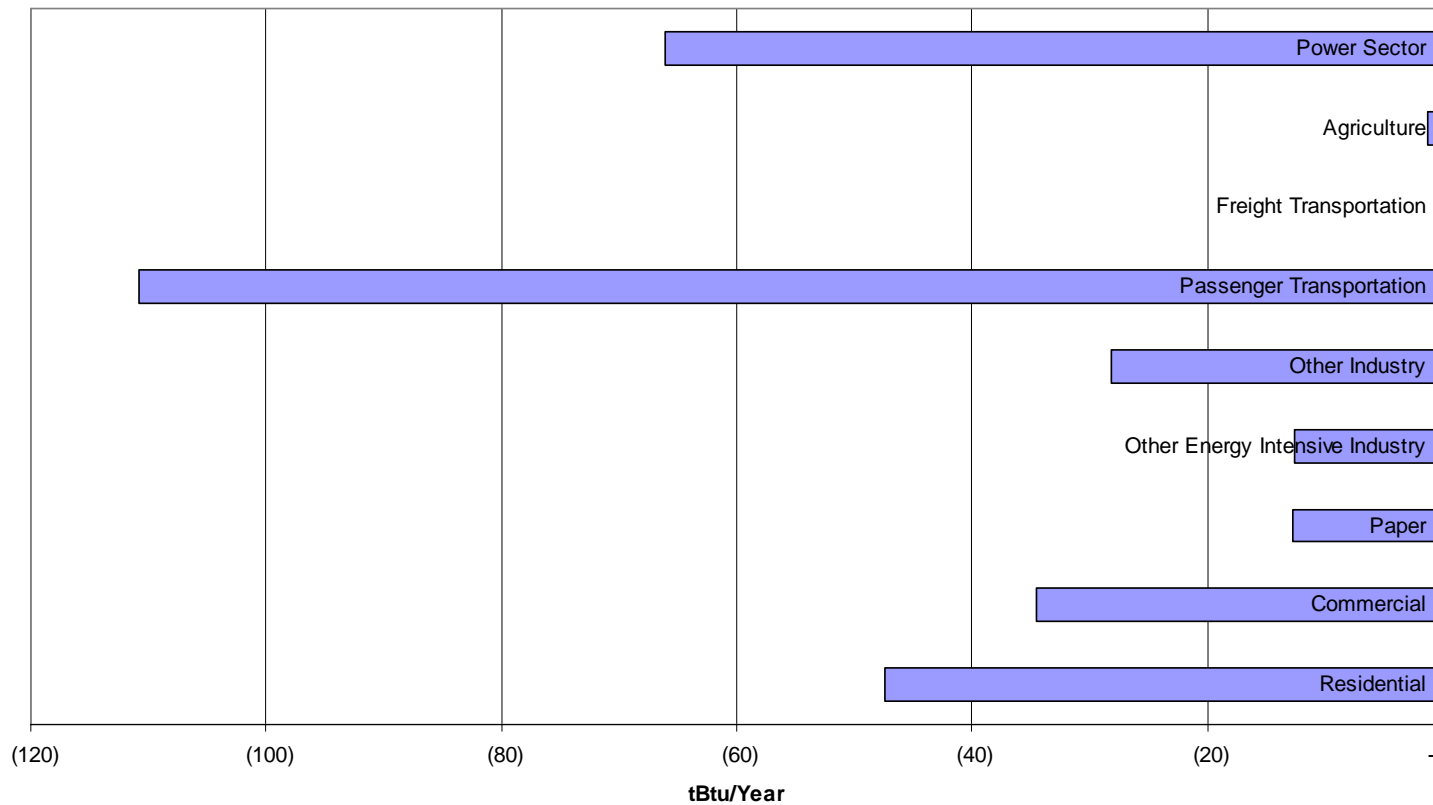
Distance Travelled (millions of vehicle miles travelled)					
<i>Change from Reference</i>	2010	2015	2020	2024	Change in Growth Rate
<b>Passenger</b>	31	(8,456)	(13,408)	(16,077)	-1.4%
<b>Freight</b>	9	13	19	14	0.0%
<b>Passenger Miles/person</b>	4	(1,450)	(2,217)	(2,562)	-1.4%

- Passenger VMT declines by about 24% relative to the Reference Case, growing at about 0.6% per year over the period rather than almost 2% per year over the period to 2024
- Freight VMT remains unchanged from the Reference Case
- The change in VMT was unchanged in Policy Case 2 (No CA Cars)

# Total Fuel Use

# Fuel Use: (Policy Case 01)

## Change in Fuel Use by Sector Policy Case minus Reference Case



### Policy Case 1 – Including CA Cars

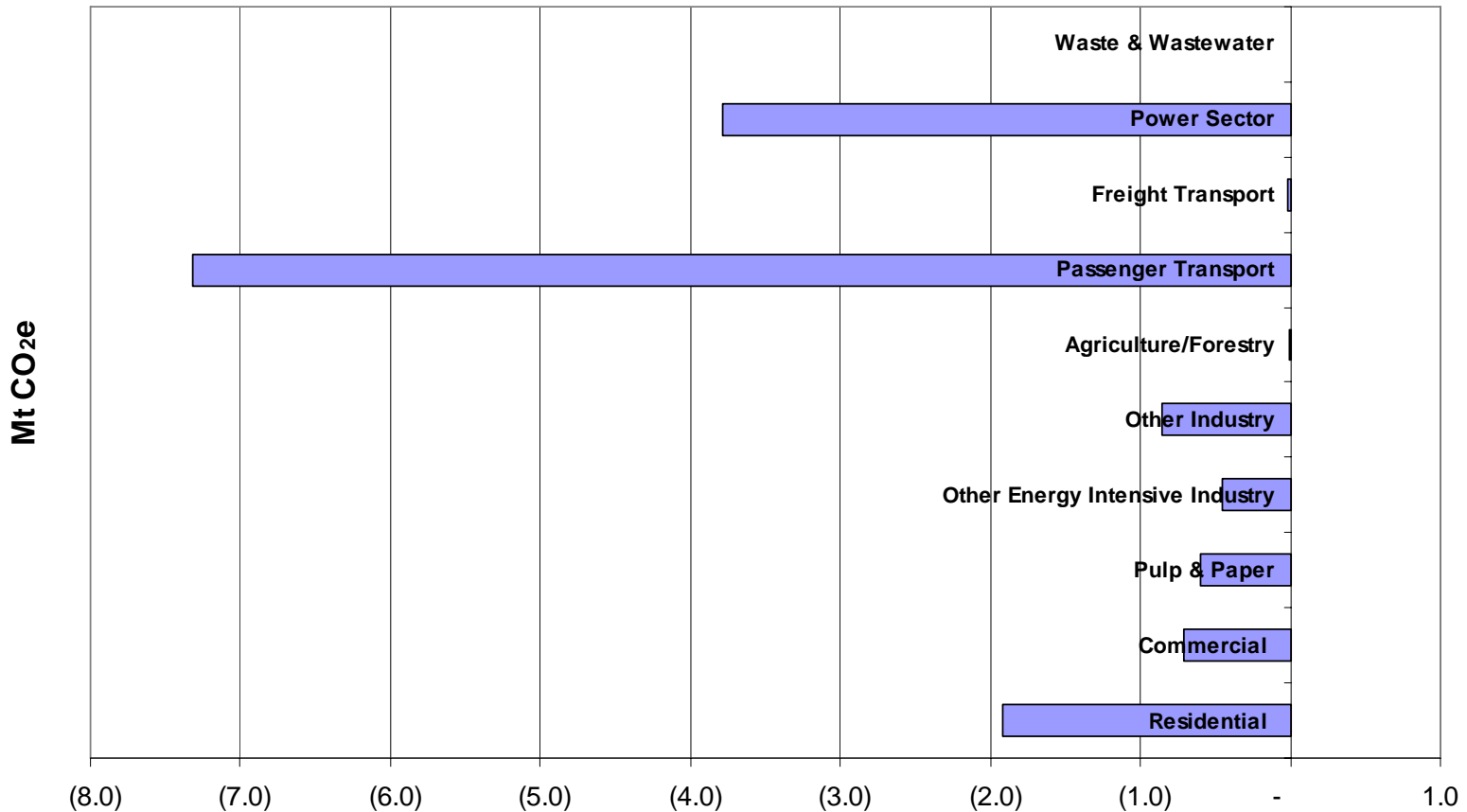
## Fuel Use:

- Energy requirements decrease from Reference levels across all sectors and across all fuels except ethanol.
- Ethanol use more than doubles as it replaces gasoline to meet Low Carbon Fuel Standard.
- Gasoline requirements decrease by 37% and natural gas use declines 22% by 2024 vs. the Reference Case.
- Regionally fuel use is unchanged except in the power sector where fuel use declines by less than 1%.
- Passenger transportation energy use is approximately 39 tBtu lower with the California Cars policy. All other sectors show the same change vs. the Reference Case under Policy Case 01 and Policy Case 02.

# GHG Emissions

# GHG Emissions: Policy Case 01

## Change in GHG Emissions in 2024 Relative to the Reference Case



# GHG Emissions: Wisconsin Absolute Values

## (Policy Case 01)

GHG Emissions (Mt)	2004	2006	2010	2015	2020	2024	Average Annual % Change
Residential	13.1	12.9	12.9	12.5	12.1	12.0	-0.4%
Commercial	5.9	5.6	5.0	4.2	3.9	3.8	-2.2%
Pulp & Paper	5.6	5.8	5.5	5.1	5.5	5.9	0.3%
Other Energy Intensive Industry	2.3	2.4	2.3	2.1	2.2	2.3	0.0%
Other Industry	8.9	9.4	9.5	9.8	10.9	11.7	1.4%
Agriculture/ Forestry	11.9	12.2	12.8	13.7	15.0	16.1	1.5%
Passenger Transport	21.6	21.4	21.3	16.3	13.6	12.8	-2.7%
Freight Transport	13.1	12.7	12.4	12.8	13.5	14.3	0.4%
Power Sector	45.6	49.9	59.2	56.8	55.9	55.5	1.0%
Waste & Wastewater	3.2	3.5	3.9	4.6	5.3	5.9	3.0%
<b>Total Gross Emissions</b>	<b>131.3</b>	<b>135.8</b>	<b>144.7</b>	<b>137.8</b>	<b>137.9</b>	<b>140.4</b>	<b>0.3%</b>
Land Use - Forestry	(8.2)	(8.2)	(8.20)	(8.21)	(8.21)	(8.22)	0.0%
<b>Total Net Emissions</b>	<b>123.1</b>	<b>127.6</b>	<b>136.5</b>	<b>129.5</b>	<b>129.7</b>	<b>132.2</b>	<b>0.4%</b>

# GHG Emissions: Wisconsin (Policy Case 01)

GHG Emissions (Mt) - Change (Policy minus Reference)				
	2010	2015	2020	2024
Residential	(0.3)	(0.8)	(1.5)	(1.9)
Commercial	(0.2)	(0.5)	(0.6)	(0.7)
Pulp & Paper	(0.1)	(0.3)	(0.5)	(0.6)
Other Energy Intensive Industry	(0.1)	(0.3)	(0.4)	(0.4)
Other Industry	(0.2)	(0.5)	(0.7)	(0.9)
Agriculture/Forestry	(0.1)	(0.0)	(0.0)	(0.0)
Passenger Transport	(0.5)	(4.7)	(6.5)	(7.3)
Freight Transport	0.0	0.0	(0.0)	(0.0)
Power Sector	(0.1)	(0.6)	(2.0)	(3.8)
Waste & Wastewater	0.0	0.0	(0.0)	0.0
<b>Total Gross Emissions</b>	(1.5)	(7.6)	(12.2)	(15.7)
Land Use - Forestry	<b>(0.00)</b>	<b>(0.01)</b>	<b>(0.01)</b>	<b>(0.02)</b>
<b>Total Net Emissions</b>	<b>(1.5)</b>	<b>(7.6)</b>	<b>(12.2)</b>	<b>(15.7)</b>

- Emissions within Wisconsin drop by just under 16 Mt from Reference Case levels.

*(Note - Urban forestry sequestration contributes <0.1 Mt by 2024.)*

# GHG Emissions: Region (Policy Case 01)

GHG Emissions (Mt) - Change (Policy minus Reference)				
	2010	2015	2020	2024
Residential	(0.0)	(0.0)	(0.0)	(0.1)
Commercial	(0.0)	(0.0)	(0.1)	(0.1)
Pulp & Paper	0.0	0.0	0.0	0.0
Other Energy Intensive Indu	(0.0)	(0.0)	(0.1)	(0.1)
Other Industry	0.0	0.0	(0.0)	(0.1)
Agriculture/Forestry	-	-	-	-
Passenger Transport	(0.0)	(0.0)	(0.0)	(0.0)
Freight Transport	-	-	-	-
Power Sector	(0.3)	(2.3)	(3.9)	(4.9)
Waste & Wastewater	-	-	-	-
<b>Total Gross Emissions</b>	<b>(0.3)</b>	<b>(2.3)</b>	<b>(4.1)</b>	<b>(5.2)</b>
Land Use - Forestry	-	-	-	-
<b>Total Net Emissions</b>	<b>(0.3)</b>	<b>(2.3)</b>	<b>(4.1)</b>	<b>(5.2)</b>

- Emissions decline by just over 5Mt in the Region and a further 6Mt in the rest of the U.S. as a result of changes in the power sector.

# GHG Emissions: Changes in Policy Case 02

- In the Policy Case without California Cars (PC02) GHG emissions were approximately 2.2 Mt higher.
- *Note: When modeled on a “stand-alone” basis this policy resulted in a 2.9 Mt emission reduction. This reduction is decreased by the VMT reduction policy and the introduction of the low carbon fuel standard.*

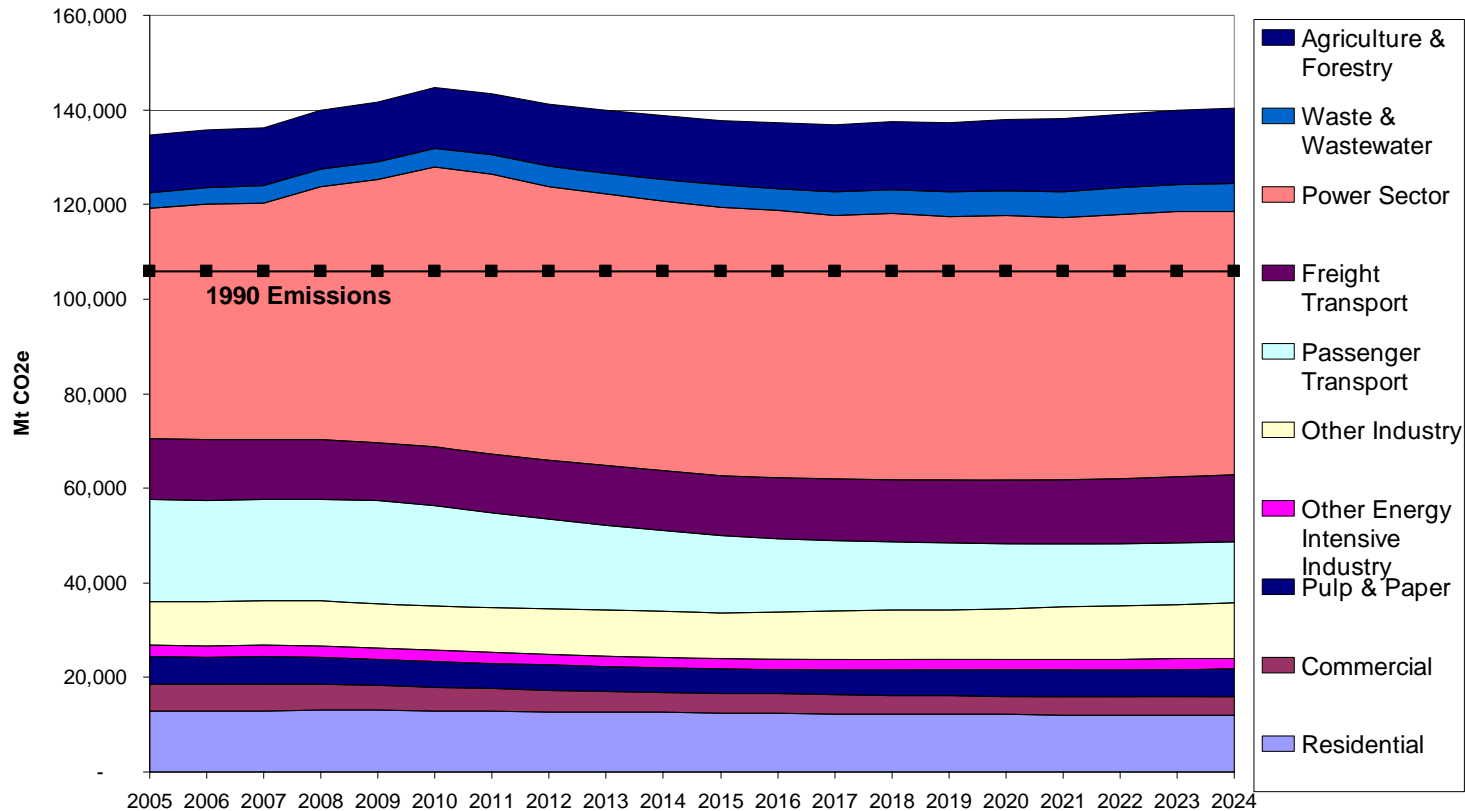
# Summary of Differences

## Policy Case 01 vs. Policy Case 02

<b>Summary of Differences – Policy Cases 1 &amp; 2</b>		
	<b>Policy Case 1 (Including California Cars)</b>	<b>Policy Case 2 (Excluding California Cars)</b>
<b>Vehicle Efficiency</b>	4.9 to 7.1 mpg increase from Reference.	Decreased 0.1 to 0.5 mpg from Reference.
<b>Ethanol</b>	6.4% increase vs. Reference.	Increased 6.6% from Reference.
<b>Passenger VMT</b>	1.4% decrease from Reference.	1.4% decrease from Reference.
<b>Total Energy Use</b>	111 tBtu decrease from Reference.	73 tBtu decrease from Reference.
<b>GHG Emissions from Passenger Transportation</b>	7.3 Mt decrease from Reference.	5.2 Mt decrease from Reference.

# GHG Emissions (Policy Case 01)

## GHG Emissions - Policy Case 01



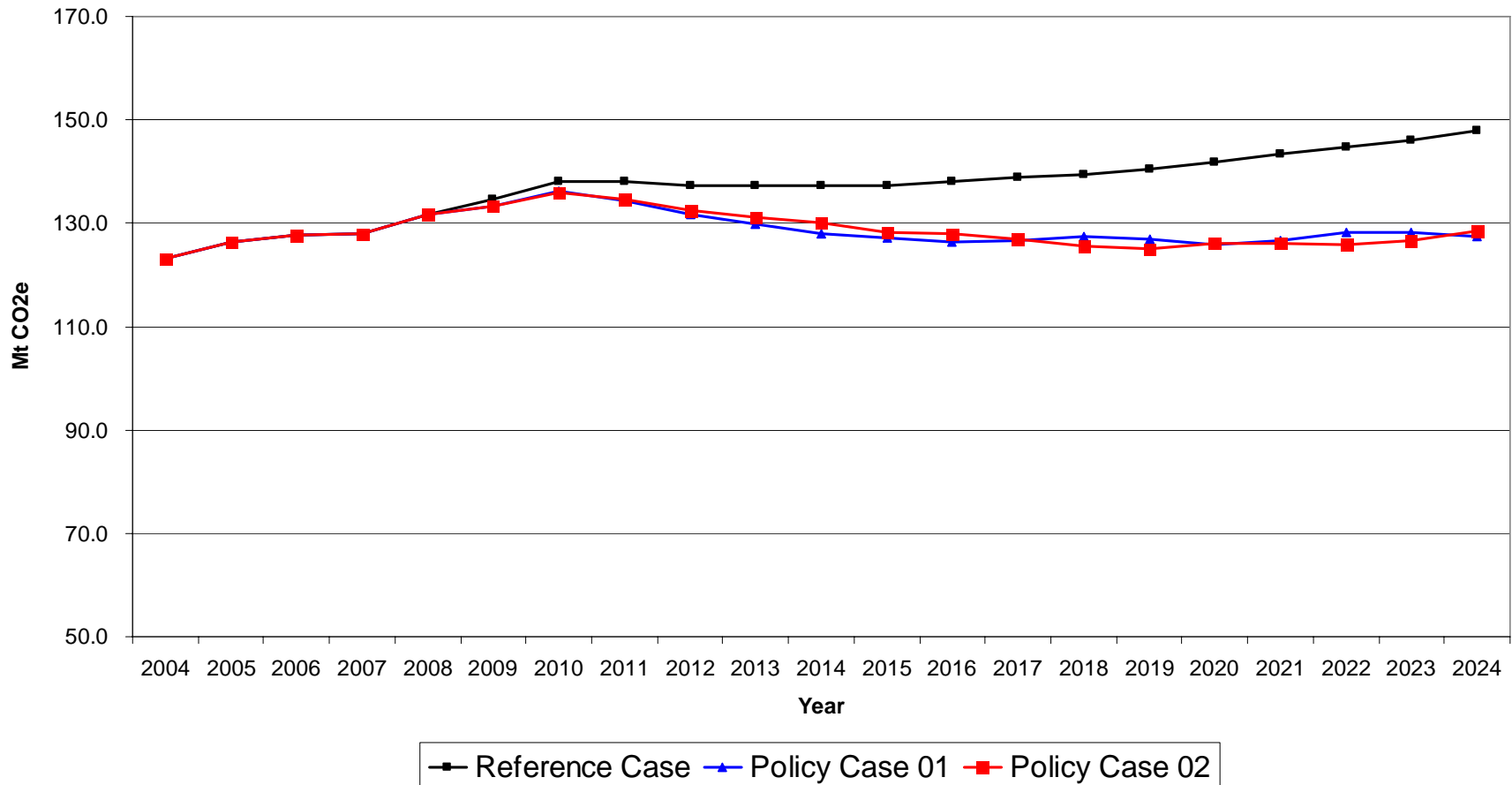
Note – Graph does not include sequestration.

- GHG emissions decline after 2010 and remain below 2010 levels until the end of the period .

# GHG Emissions:

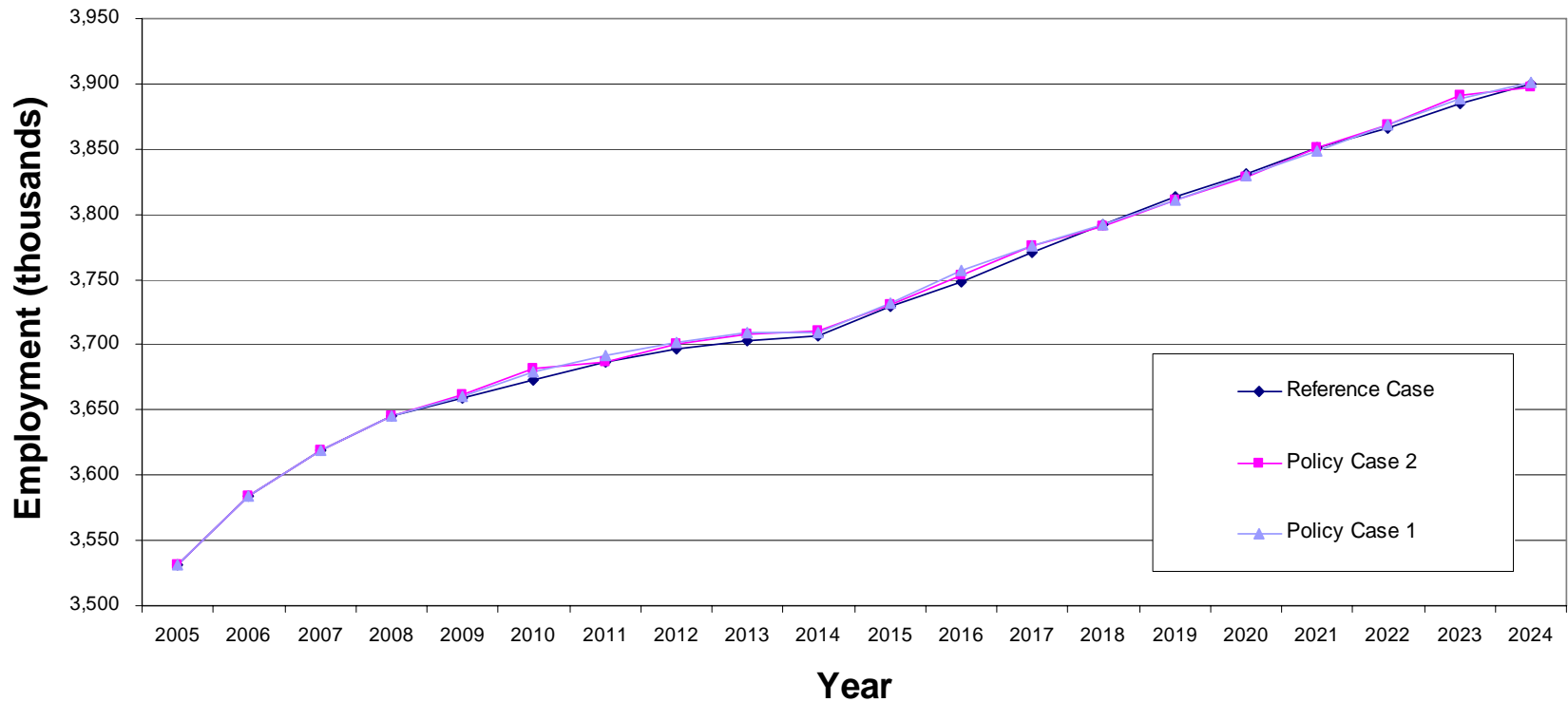
## Policy Cases 01 and 02 vs. Reference

### Change in Net GHG Emissions (Including Out-of-State Reductions)



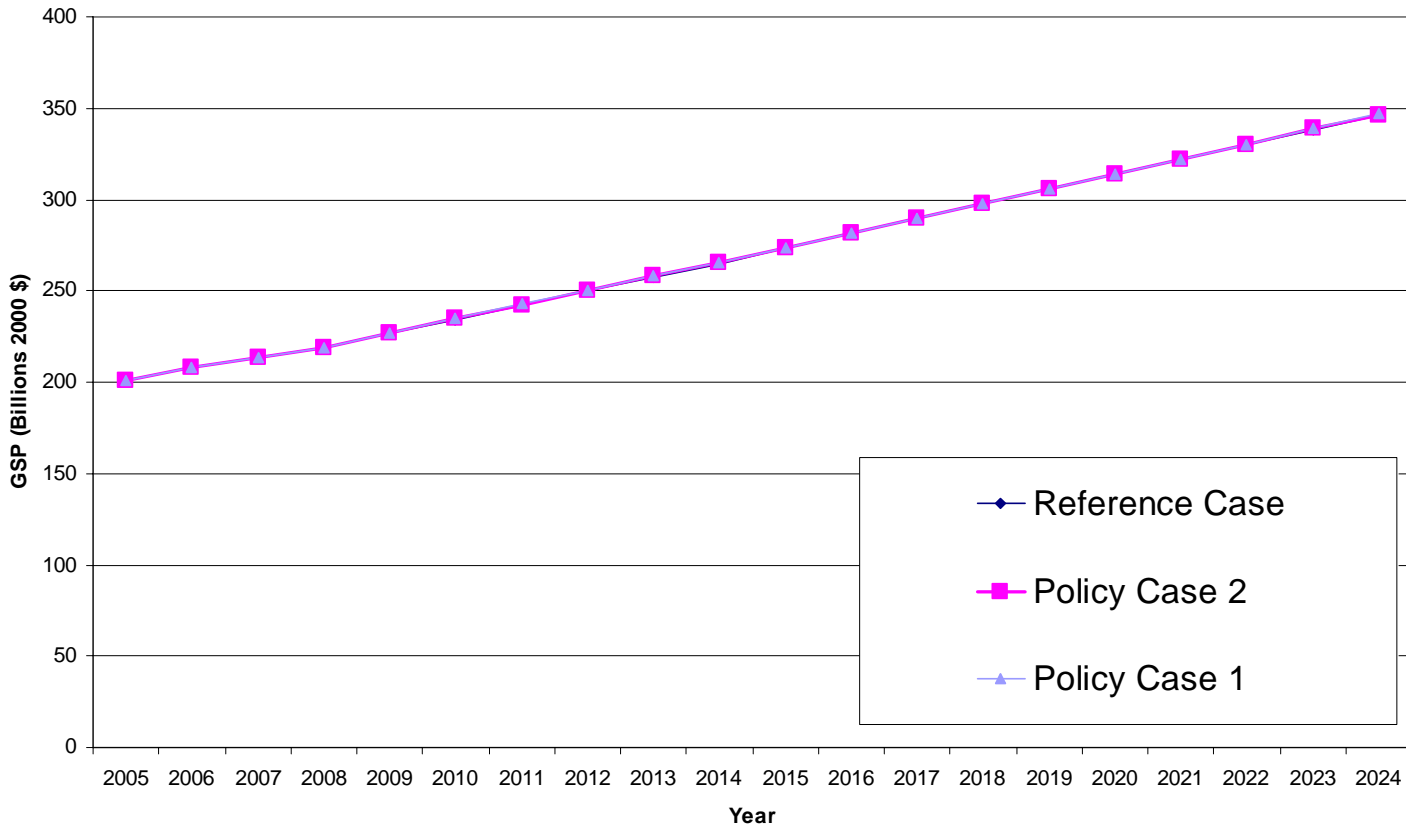
# Economic Effects: Policy Cases 01 and 02 vs. Reference

## Total Employment



# Economic Effects: Policy Cases 01 and 02 vs. Reference

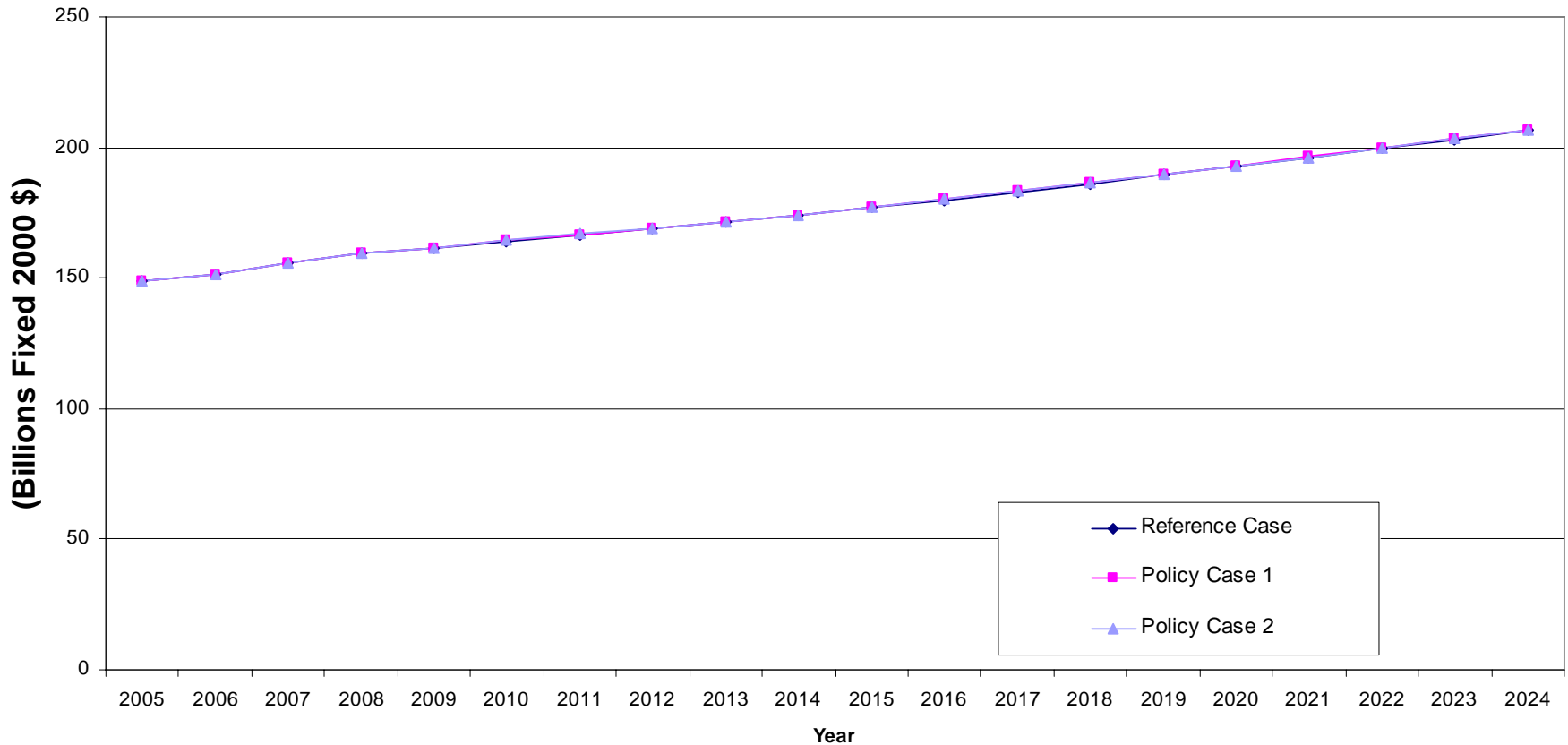
## Gross State Product



- Differences between Reference and Policy Cases are extremely small.

# Economic Effects: Policy Cases 01 and 02 vs. Reference

## Real Disposable Income (Billions Fixed 2000 \$)



- Differences between Reference and Policy Cases are extremely small.

# Economic Effects

*(in Absolute and Percentage terms)*

<b>Policy Case 1 Change from Reference:</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
Employment (thousands)	(6.5)	(4.4)	(8.7)	0.6
Gross State Product (Billions 2000 \$)	(0.5)	(0.4)	(0.7)	(0.0)
Real Personal Disposable Income (Billions 2000 \$)	(0.1)	(0.1)	(0.3)	(0.1)
<b>Policy Case 1 Change from Reference:</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
Employment (%)	-0.2%	-0.1%	-0.2%	0.0%
Gross State Product (%)	-0.2%	-0.2%	-0.2%	0.0%
Real Personal Disposable Income (%)	-0.1%	-0.1%	-0.2%	-0.1%
<b>Policy Case 2 Change from Reference:</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
Employment (thousands)	(8.3)	0.3	(5.4)	1.5
Gross State Product (Billions 2000 \$)	(0.6)	(0.1)	(0.5)	0.1
Real Personal Disposable Income (Billions 2000 \$)	(0.2)	0.0	(0.2)	(0.1)
<b>Policy Case 2 Change from Reference:</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
Employment (%)	-0.2%	0.0%	-0.1%	0.0%
Gross State Product (%)	-0.3%	0.0%	-0.2%	0.0%
Real Personal Disposable Income (%)	-0.1%	0.0%	-0.1%	-0.1%

- Policies have a very minor negative economic impact.
- Impacts are all quite small across the overall economy
- For example, Real Disposable income increases by over 26% between 2006 and 2024. Policy impact would reduce incomes by 0.1% in 2024.

# Questions?

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