

**MEMORANDUM**

To:	Caroline Garber, Chief, Environmental Studies Section, WI DNR Kris Krause, Co-Chair, GWTF Technical Advisory Committee George Edgar, Co-Chair, GWTF Technical Advisory Committee
From:	Glen Wood, ICF International (ICF), and Jeff Amlin, Systematic Solutions Inc. (SSI)
Date:	May 26, 2008
Re:	<b><u>Cap and Trade Scenarios 3 and 4</u></b>

The following memorandum compares the ENERGY 2020 model outputs for the Reference Case with the outputs for all policies including Cap and Trade Scenarios 3 and 4. A number of changes have been made to the policies based on feedback and direction from the TAG. The most significant among these changes was a decision to allow the model to build new generation on an economic basis rather than simply to meet the required reserve margin. This, combined with other adjustments, allowed more wind and renewable generation to be added in the Reference Case as well as in response to the Cap and Trade policy.

The following memorandum compares the ENERGY 2020 model outputs for all policies including Cap and Trade Scenarios 3 and 4.

The *Reference Case* used for comparison purposes is the Reference Case based on the high energy price scenario, adjusted to include the impacts of the Energy Independence and Security Act. The comparisons shown below are based on the Reference Case and respective Cap and Trade Policy Cases, including the impacts of feedback with the REMI model.

The two Cap and Trade Scenarios modeled to-date are both based on a 100% auction of permits.

- Cap and Trade Scenario 3 (CT03) assumes that there is no cap on the use of offsets.
- Cap and Trade Scenario 4 (CT04) assumes that offsets are capped at 10% of the allowances needed in any given year.

The trading system is modeled to include the neighbouring states which signed the MWGA Accord and were originally included in the modeled region (WI, IA, IL, MN, and MI). The results for the Region includes these states as well as the other states included as the Region in prior policy cases (i.e. Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, and Ohio).

The comparisons shown below compare the results for CT04, which resulted in higher trading costs, to the Reference Case. In both cases these results include feedback from the REMI macro-economic model. The results of CT03 do not include this economic feedback. After describing the results for CT04, the memo will then briefly describe differences between these results and those for CT03.

## 1. Introduction

The data is presented for a set of milestone years established after discussion with the TAG. ENERGY 2020 provides data for all years in the modeled period should that be required.

ENERGY 2020 outputs typically display the data for about 70 economic sectors and other categories. The data presented below has been consolidated by sector based on the following sectors as agreed to with the TAG:

- Residential
- Commercial
- Pulp and Paper
- Other Energy Intensive Industries (*these include Smelting and Refining, Iron and Steel, Chemicals, Cement, Petroleum Refining, & mining*)
- Other Industry (including construction)
- Passenger Transportation
- Freight Transportation (including off-road)
- Agricultural
- Forestry
- Waste and Wastewater
- Power Sector

## 2. Economic Data:

To be added when run with REMI

## 3. Power Sector Data:

Electricity consumption declines by 22% relative to Reference Case levels by 2024 under the Cap and Trade 4 scenario. This reduction is greater than in CT02 as a result of additional energy efficiency programs funded by auction revenues.

### Change in Wisconsin: CT04

Sales (GWh)	2010	2015	2020	2024
Residential	(1,199)	(3,479)	(5,437)	(6,686)
Commercial	(1,106)	(3,295)	(5,266)	(6,443)
Industrial	(1,289)	(4,025)	(7,157)	(9,149)
Street Lights/Misc.	-	-	-	-
Resale	-	-	-	-
<b>Total Sales</b>	<b>(3,594)</b>	<b>(10,799)</b>	<b>(17,860)</b>	<b>(22,278)</b>
Imports	(3,565)	7,486	17,942	13,710

Generation Output (GWh/year)	2010	2015	2020	2024
Gas/Oil	(29)	(132)	(934)	(2,432)
Coal	-	(18,078)	(37,449)	(36,449)
Nuclear	-	-	-	-
Hydro	-	-	-	0
Landfill Gas/EFW	-	(24)	(24)	(24)
Wind	-	10	2,760	2,755
Other	-	(61)	(154)	162
<b>Total</b>	<b>(29)</b>	<b>(18,285)</b>	<b>(35,802)</b>	<b>(35,988)</b>

Generation Capacity (MW)	2010	2015	2020	2024
Gas/Oil Combustn. Turbine	-	-	-	(160)
Gas/Oil Combined Cycle	-	-	-	(800)
Gas/Oil Steam	-	-	-	-
Coal	-	-	-	-
Nuclear	-	-	-	-
Hydro	-	-	-	-
Landfill Gas/EFW	-	(3)	(3)	(3)
Wind	-	3	852	851
Other	-	(10)	(25)	26
<b>Total</b>	<b>-</b>	<b>(10)</b>	<b>824</b>	<b>(86)</b>

Notes: 1. EFW = Energy from Waste

2. Other generation is primarily comprised of renewable generation sources.

- Fossil generation declines significantly (44%), with almost the entire decline coming from coal generation.
- Net imports rise significantly relative to the Reference Case as a result of decreasing fossil generation, lower electricity sales and increased renewable production.
- Wind production rises from almost 5,000 GWh per year in the Reference Case to almost 7,600 GWh/year in CT04 by 2024. Wind generation supplies over 16% of total generation in 2024 within Wisconsin and a similar level within the Cap and Trade market. Landfill gas and other renewable generation also increase to

the point where renewable forms of generation account for 23% of in-state generation.

**Absolute Values for Wisconsin:**

<b>Sales (GWh)</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
Residential	20,586	19,457	19,336	19,721
Commercial	22,578	22,707	23,668	25,050
Industrial	31,794	31,228	33,777	35,986
Street Lights/Misc.	400	400	400	400
Resale	-	-	-	-
<b>Total Sales</b>	<b>75,358</b>	<b>73,792</b>	<b>77,181</b>	<b>81,157</b>
Imports	1,037	15,305	35,284	35,218

<b>Generation Output (GWh/year)</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
Gas/Oil	4,601	4,077	3,504	3,508
Coal	54,909	36,148	16,777	17,777
Nuclear	12,115	12,802	12,802	12,802
Hydro	1,184	1,184	1,184	1,184
Landfill Gas/EFW	137	2,483	2,483	2,483
Wind	1,288	1,580	4,843	7,564
Other	88	212	303	619
<b>Total</b>	<b>74,321</b>	<b>58,487</b>	<b>41,897</b>	<b>45,939</b>

<b>Generation Capacity (MW)</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
Gas/Oil Combustn. Turbine	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	8,560	8,441	8,441	8,441
Nuclear	1,586	1,676	1,676	1,676
Hydro	435	435	435	435
Landfill Gas/EFW	52	349	349	349
Wind	486	595	1,601	2,428
Other	15	35	50	101
<b>Total</b>	<b>18,691</b>	<b>19,110</b>	<b>20,131</b>	<b>21,009</b>

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

<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>	6%	10%	13%

Note – The model results represent in-state generation only. Approximately half of the generation to meet the RPS is expected to come from outside of Wisconsin.

**Change in Market:**

<b>Sales (GWh)</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
Residential	1	34	(41)	(1,091)
Commercial	1	122	708	512
Industrial	6	214	574	(1,945)
Street Lights/Misc.	-	-	-	-
Resale	-	-	-	-
<b>Total Sales</b>	<b>8</b>	<b>370</b>	<b>1,241</b>	<b>(2,524)</b>

<b>Generation Output (GWh/year)</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
Gas/Oil	(34)	(5,033)	(102)	(1,014)
Coal	-	(66,977)	(146,029)	(155,846)
Nuclear	-	-	-	-
Hydro	-	(0)	(0)	198
Landfill Gas/EFW	-	(0)	0	802
Wind	-	(38)	1,795	1,979
Other	-	8	8	20
<b>Total</b>	<b>(34)</b>	<b>(72,041)</b>	<b>(144,327)</b>	<b>(153,861)</b>

<b>Generation Capacity (MW)</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
Gas/Oil Combustn. Turbine	-	-	-	-
Gas/Oil Combined Cycle	-	155	(446)	(246)
Gas/Oil Steam	-	-	-	-
Coal	-	-	-	-
Nuclear	-	-	-	-
Hydro	-	-	-	50
Landfill Gas/EFW	-	-	-	131
Wind	-	4	583	567
Other	-	-	-	(0)
<b>Total</b>	<b>-</b>	<b>159</b>	<b>138</b>	<b>502</b>

- Sales in the Cap and Trade market outside of Wisconsin decrease slightly (1%) by 2024.
- Generation within the Cap and Trade market area decreases by 15% by 2015 and 31% by 2024 relative to the Reference Case. Coal generation declines by over 60% by the end of the period.

**Change in Rest of Region:**

<b>Sales (GWh)</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
Residential	-	4	(77)	(572)
Commercial	-	1	(135)	(908)
Industrial	-	3	(694)	(4,143)
Street Lights/Misc.	-	-	-	-
Resale	-	-	-	-
<b>Total Sales</b>	<b>-</b>	<b>8</b>	<b>(906)</b>	<b>(5,623)</b>
Imports	251	(331)	(12,550)	(18,265)

<b>Generation Output (GWh/year)</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
Gas/Oil	(251)	(557)	11,653	12,638
Coal	-	903	-	16
Nuclear	-	-	-	-
Hydro	-	-	-	-
Landfill Gas/EFW	-	(9)	(9)	(9)
Wind	-	-	-	-
Other	-	3	0	(3)
<b>Total</b>	<b>(251)</b>	<b>339</b>	<b>11,644</b>	<b>12,642</b>

<b>Generation Capacity (MW)</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
Gas/Oil Combustn. Turbine	-	-	-	(160)
Gas/Oil Combined Cycle	-	-	-	-
Gas/Oil Steam	-	-	-	-
Coal	-	-	-	-
Nuclear	-	-	-	-
Hydro	-	-	-	-
Landfill Gas/EFW	-	(2)	(2)	(2)
Wind	-	-	-	-
Other	-	-	-	(3)
<b>Total</b>	<b>-</b>	<b>(2)</b>	<b>(2)</b>	<b>(165)</b>

- Sales in the Region outside of the market decrease slightly (1% by 2024).
- Generation in the Region increases by about 2% by 2024 from Reference Case levels with the increased generation coming from gas and oil generation.

### Change in Rest of US and Canada:

Sales (GWh)	2010	2015	2020	2024
Residential	1	6	(105)	(653)
Commercial	-	4	9	16
Industrial	1	17	3,954	905
Street Lights/Misc.	-	-	-	-
Resale	-	-	-	-
<b>Total Sales</b>	<b>2</b>	<b>27</b>	<b>3,858</b>	<b>268</b>

Generation Output (GWh/year)	2010	2015	2020	2024
Gas/Oil	(1,362)	(128)	18,291	14,139
Coal	(1,742)	78,572	134,355	128,881
Nuclear	-	-	-	-
Hydro	-	-	0	(0)
Landfill Gas/EFW	-	(0)	0	92
Wind	(8)	(8)	(24)	16
Other	(0)	0	0	0
<b>Total</b>	<b>(3,112)</b>	<b>78,436</b>	<b>152,622</b>	<b>143,128</b>

Generation Capacity (MW)	2010	2015	2020	2024
Gas/Oil Combustn. Turbine	-	-	-	-
Gas/Oil Combined Cycle	-	-	-	-
Gas/Oil Steam	-	-	-	-
Coal	-	-	-	-
Nuclear	-	-	-	-
Hydro	-	-	-	-
Landfill Gas/EFW	-	-	-	15
Wind	(3)	(3)	(9)	6
Other	-	-	-	-
<b>Total</b>	<b>(3)</b>	<b>(3)</b>	<b>(9)</b>	<b>21</b>

- Electricity sales in the rest of the US and Canada show no change from Reference Case levels.
- Generation increases by about 4% with the bulk of the additional GWh coming from increased coal generation (a 6% increase).
- Overall, the net change in sales and generation within Wisconsin and the Cap and Trade market results in the need to import about 164,000 GWh into the Region. Approximately 7,000 GWh of this production comes from other states in the region while the balance comes from the rest of the US. The additional generation within the region comes almost exclusively from gas-fired generation while about 90% of the power from outside the region comes from coal.

**Transportation Data:**

<b>Average Passenger Vehicle Efficiency (mpg)</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
Light Gas Vehicles	0.6	3.0	5.1	6.9
Medium Gas Vehicles	0.5	2.6	4.5	6.1
Heavy Gas Vehicles	0.6	2.6	4.1	4.9
Heavy Gas Vehicles	0.6	2.6	4.1	4.9
Ethanol as a Percentage of Passenger Gasoline Use	0.3%	1.9%	4.4%	6.5%

- Passenger vehicle efficiency improvements decrease very slightly from levels reached in Policy Case 1 (difference of 0.2 mpg).
- Ethanol use decreases very slightly as a percentage of gasoline relative to Policy Case 1 (0.1% change in 2024).

<b>Distance Travelled (millions of VMT)</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
Passenger	(82)	(8,701)	(14,486)	(17,447)
Freight	(24)	(100)	(522)	(855)
Passenger (miles per person)	(10)	(1,467)	(2,319)	(2,640)

- Passenger VMT declines slightly more than in Policy Case 01; dropping by almost 27% from the Reference Case.
- Freight VMT per year decreases by 7.5% relative to the Reference Case.

**Fuel Use data:**

**Change in Wisconsin:**

<b>Total Energy Use (TBtu)</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
Residential	(10)	(34)	(55)	(69)
Commercial	(7)	(20)	(32)	(39)
Paper	(3)	(8)	(17)	(24)
Other Energy Intensive Industry	(3)	(8)	(15)	(20)
Other Industry	(6)	(16)	(27)	(35)
Agriculture / Forestry	(0)	(2)	(6)	(6)
Passenger Transport	(8)	(72)	(103)	(117)
Freight Transport	(1)	(3)	(13)	(18)
Power Sector	(0)	(196)	(396)	(393)
<b>Total</b>	<b>(37)</b>	<b>(360)</b>	<b>(663)</b>	<b>(722)</b>

<b>Total Energy Use (TBtu)</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
Aviation Fuel	(0)	(3)	(5)	(6)
Biomass	(0)	(2)	(3)	(3)
Coal	(1)	(199)	(401)	(402)
Diesel	(1)	(5)	(14)	(20)
Ethanol	1	(0)	0	1
Electric	(12)	(37)	(61)	(76)
Landfill Gas	-	(0)	(0)	(0)
LPG	(0)	(0)	(1)	(1)
Gasoline	(8)	(68)	(96)	(110)
Natural Gas	(13)	(39)	(68)	(91)
Nuclear	-	-	-	-
Oil, Unspecified	(1)	(5)	(10)	(13)
Solar	(0)	(1)	(2)	(3)
Other	(0)	(1)	(1)	2
<b>Total</b>	<b>(37)</b>	<b>(360)</b>	<b>(663)</b>	<b>(722)</b>

- Energy use decreases by over 32% relative to the Reference Case by 2024.
- All sectors experience reduced energy use compared to the Reference,
- The largest change occurs in the power sector where fuel use drops by 51%.
- Energy use for passenger transportation drops by 36% while freight energy use decreases by 9% relative to the Reference.
- All fuels except ethanol and “other” (primarily renewables) decrease relative to the Reference Case.
- Coal shows the greatest change, declining by almost 66%.

## Change in Market

Total Energy Use (TBtu)	2010	2015	2020	2024
Residential	0	(2)	(14)	(30)
Commercial	0	(1)	(5)	(10)
Paper	(0)	(2)	(10)	(18)
Other Energy Intensive Industry	(0)	(8)	(39)	(71)
Other Industry	0	(3)	(17)	(33)
Agriculture / Forestry	-	-	-	-
Passenger Transport	-	(1)	(6)	(12)
Freight Transport	-	(2)	(12)	(23)
Power Sector	(0)	(762)	(1,551)	(1,655)
<b>Total</b>	<b>(0)</b>	<b>(781)</b>	<b>(1,654)</b>	<b>(1,851)</b>

Total Energy Use (TBtu)	2010	2015	2020	2024
Aviation Fuel	-	(0)	(3)	(6)
Biomass	(0)	1	5	11
Coal	(0)	(720)	(1,567)	(1,715)
Diesel	-	(1)	(10)	(20)
Ethanol	-	0	1	3
Electric	0	1	4	(9)
Landfill Gas	-	(0)	(0)	(0)
LPG	(0)	(1)	(4)	(7)
Gasoline	-	(1)	(6)	(12)
Natural Gas	(0)	(59)	(74)	(112)
Nuclear	-	-	-	-
Oil, Unspecified	(0)	(0)	(1)	(0)
Solar	-	-	-	-
Other	0	(0)	0	15
<b>Total</b>	<b>(0)</b>	<b>(781)</b>	<b>(1,654)</b>	<b>(1,851)</b>

- Fuel use within the Cap and Trade market states shows a similar pattern, with fuel use in the power sector declining by 36% and coal use declining by 61%.
- Energy use declines across most sectors of the economy; however, without the impact of “other policies” fuel use in other sectors show a much smaller rate of decrease than in Wisconsin.

## Change in Region

Total Energy Use (TBtu)	2010	2015	2020	2024
Residential	-	0	(0)	(0)
Commercial	-	(0)	0	1
Paper	-	(0)	(0)	(0)
Other Energy Intensive Industry	-	(0)	(1)	(2)
Other Industry	-	(0)	(1)	(3)
Agriculture / Forestry	-	-	-	-
Passenger Transport	-	-	0	0
Freight Transport	-	-	-	-
Power Sector	(3)	6	89	100
<b>Total</b>	<b>(3)</b>	<b>6</b>	<b>88</b>	<b>96</b>

Total Energy Use (TBtu)	2010	2015	2020	2024
Aviation Fuel	-	-	0	0
Biomass	-	0	0	0
Coal	-	10	0	4
Diesel	-	(0)	0	0
Ethanol	-	-	0	0
Electric	-	0	(3)	(19)
Landfill Gas	-	0	(0)	(0)
LPG	(0)	(0)	0	1
Gasoline	-	-	0	0
Natural Gas	(3)	(5)	87	104
Nuclear	-	-	-	-
Oil, Unspecified	(0)	(0)	0	0
Solar	-	-	-	-
Other	(0)	(0)	3	6
<b>Total</b>	<b>(3)</b>	<b>6</b>	<b>88</b>	<b>96</b>

- Energy use in the rest of the Region increases by 0.9% from Reference Case levels; driven almost exclusively by changes in the power sector.
- Natural gas usage increases by 6.5% from Reference Case levels.

## Change in the Rest of US:

- Energy use in the rest of the US increases by 1,430 tBtu (1.3%) from the Reference Case by 2024 with the only significant change occurring in the power sector.
- Coal use increases by 6% from Reference case levels.

### Energy Price Data:

Prices for oil, gas, biomass and coal are specified exogenously. The model assumes that national and world prices are unaffected by changes within Wisconsin; however, the Cap and Trade system and other policies do impact delivered energy costs.

#### Wisconsin Cap and Trade4 – Change from Reference

Electricity Prices	2010	2015	2020	2024
Residential	-0.9%	1.4%	16.6%	28.2%
Commercial	-1.2%	1.9%	20.9%	34.6%
Industrial	-1.2%	3.3%	27.0%	42.8%
Average Retail	-1.2%	1.9%	20.9%	34.6%

Residential Energy Prices	2010	2015	2020	2024
Electricity	-0.9%	1.4%	16.6%	28.2%
Natural Gas	0.0%	0.0%	0.0%	0.0%
Gasoline	0.0%	0.0%	0.0%	0.0%

Change in Energy Costs	2010	2015	2020	2024
Residential Electricity	-6.3%	-14.0%	-9.0%	-4.3%
Commercial Electricity	-6.6%	-13.6%	-5.6%	0.5%
Industrial Electricity	-6.7%	-12.4%	-0.9%	6.6%
Gasoline Passenger	-2.0%	-21.8%	-32.1%	-36.6%

- Electricity prices rise significantly (30-40%) compared to the Reference Case for all sectors.
- Reductions to overall energy use due to efficiency and conservation compensate for most or all of these price increases; resulting in a net decrease in energy costs in the residential sector and modest increases in overall energy costs in the commercial and industrial sectors..
- The overall energy costs associated with passenger transportation decline due to efficiency increases and reduced vehicle miles travelled.

### Emissions Data:

Emissions rise slightly by 2010, but drop consistently from that level until the end of the period.

#### Absolute Values - Wisconsin:

GHG Emissions (Mt)	2010	2015	2020	2024
Residential	12.9	12.0	11.5	11.4
Commercial	5.0	4.1	3.6	3.5
Pulp & Paper	5.5	5.0	5.0	4.9
Other Energy Intensive Industry	2.3	2.1	2.0	2.0
Other Industry	9.5	9.7	10.2	10.7
Agriculture	12.9	10.9	6.6	7.8
Passenger Transport	21.3	16.2	13.3	12.4
Freight Transport	12.3	12.5	12.7	13.1
Power Sector	56.7	36.8	18.1	18.9
Waste & Wastewater	3.9	4.6	5.2	5.7
<b>Total Gross Emissions</b>	<b>142.1</b>	<b>113.9</b>	<b>88.3</b>	<b>90.5</b>
Land Use - Forestry	(8.2)	(13.3)	(13.3)	(13.3)
<b>Total Net Emissions</b>	<b>133.9</b>	<b>100.7</b>	<b>75.1</b>	<b>77.2</b>

#### Change from Reference Case: Wisconsin

GHG Emissions (Mt)	2010	2015	2020	2024
Residential	(0.3)	(1.3)	(2.1)	(2.6)
Commercial	(0.2)	(0.6)	(0.9)	(1.1)
Pulp & Paper	(0.1)	(0.4)	(1.1)	(1.6)
Other Energy Intensive Industry	(0.1)	(0.3)	(0.6)	(0.8)
Other Industry	(0.2)	(0.7)	(1.4)	(2.0)
Agriculture	(0.0)	(2.7)	(8.4)	(8.3)
Passenger Transport	(0.5)	(4.8)	(6.8)	(7.7)
Freight Transport	(0.1)	(0.2)	(0.9)	(1.3)
Power Sector	(0.0)	(18.6)	(37.4)	(37.2)
Waste & Wastewater	(0.0)	(0.0)	(0.1)	(0.2)
<b>Total Gross Emissions</b>	<b>(1.6)</b>	<b>(29.6)</b>	<b>(59.7)</b>	<b>(62.9)</b>
Land Use - Forestry	-	(5.1)	(5.1)	(5.1)
<b>Total Net Emissions</b>	<b>(1.6)</b>	<b>(34.7)</b>	<b>(64.8)</b>	<b>(67.9)</b>

- Gross emissions decline by 41% relative to the Reference Case by 2024.
- Net emissions decline by slightly over 5Mt as a result of additional sequestration purchased using auction revenues resulting in a 47% decrease from Reference Case levels.

**Change from Reference: Rest of Market**

<b>GHG Emissions (Mt)</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
Residential	(0)	(0)	(1)	(1)
Commercial	(0)	(0)	(1)	(1)
Pulp & Paper	(0)	(0)	(1)	(2)
Other Energy Intensive Industr	(0)	(1)	(4)	(6)
Other Industry	(0)	(1)	(2)	(4)
Agriculture	-	-	-	-
Passenger Transport	-	(0)	(0)	(1)
Freight Transport	-	(0)	(1)	(2)
Power Sector	(0)	(71)	(147)	(158)
Waste & Wastewater	-	-	-	-
<b>Total Gross Emissions</b>	<b>(0)</b>	<b>(73)</b>	<b>(157)</b>	<b>(175)</b>
Land Use - Forestry	-	-	-	-
<b>Total Net Emissions</b>	<b>(0)</b>	<b>(73)</b>	<b>(157)</b>	<b>(175)</b>

**Change from Reference: Rest of Region**

<b>GHG Emissions (Mt)</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
Residential	(0)	(0)	0	0
Commercial	-	(0)	0	0
Pulp & Paper	-	(0)	0	0
Other Energy Intensive Industr	-	0	0	0
Other Industry	(0)	(0)	0	0
Agriculture	-	-	-	-
Passenger Transport	-	-	0	0
Freight Transport	-	-	-	-
Power Sector	(0)	1	5	6
Waste & Wastewater	-	-	-	-
<b>Total Gross Emissions</b>	<b>(0)</b>	<b>1</b>	<b>5</b>	<b>6</b>
Land Use - Forestry	-	-	-	-
<b>Total Net Emissions</b>	<b>(0)</b>	<b>1</b>	<b>5</b>	<b>6</b>

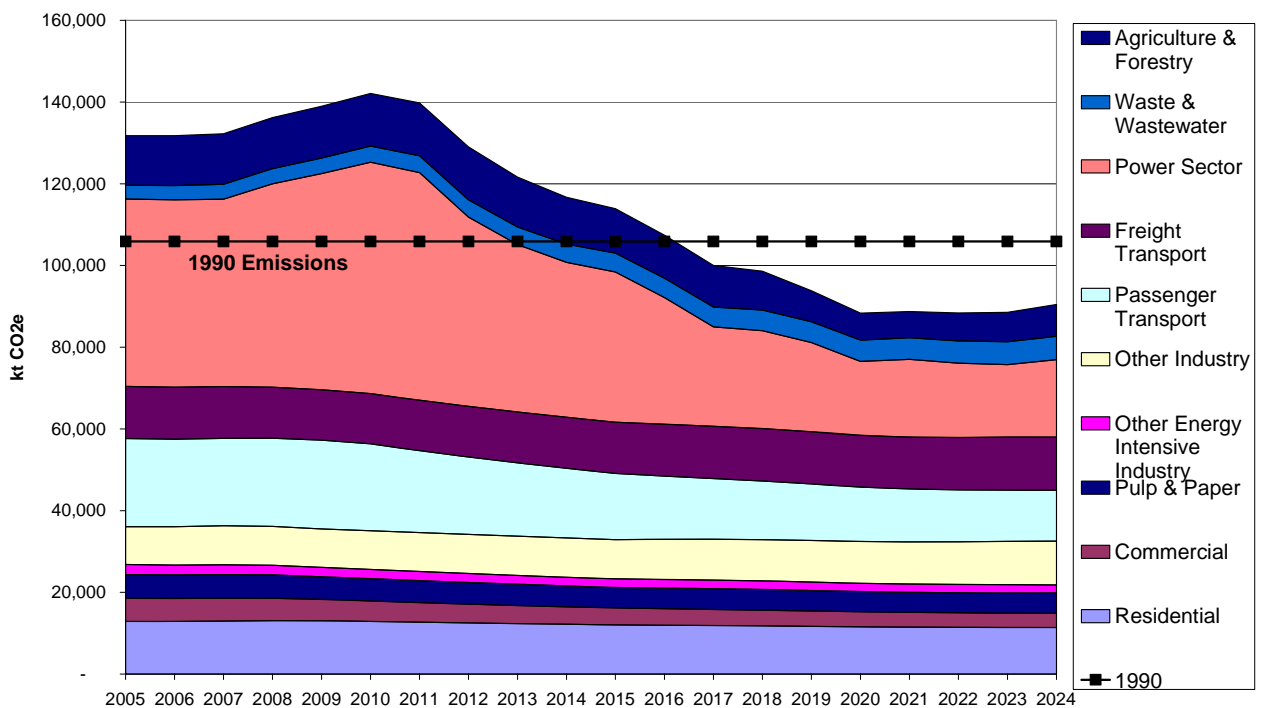
**Change from Reference: Rest of US and Canada**

<b>GHG Emissions (Mt)</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
Residential	-	-	-	0
Commercial	-	0	0	0
Pulp & Paper	-	-	-	-
Other Energy Intensive Industr	-	-	0	0
Other Industry	-	0	0	0
Agriculture	-	-	-	-
Passenger Transport	-	-	-	-
Freight Transport	-	-	-	-
Power Sector	(2)	79	139	134
Waste & Wastewater	-	-	-	-
<b>Total Gross Emissions</b>	<b>(2)</b>	<b>79</b>	<b>139</b>	<b>134</b>
Land Use - Forestry	-	-	-	-
<b>Total Net Emissions</b>	<b>(2)</b>	<b>79</b>	<b>139</b>	<b>134</b>

**Change from Reference:**

- Emissions in Wisconsin and the rest of the Market decline by 68Mt and 175Mt respectively. Changes in generation outside of the market partially offset this reduction as emissions increase by 6Mt in the rest of the Region and by 134Mt outside of the region; all relative to Reference Case levels. The overall reduction in emissions resulting from the policies proposed for Wisconsin and the Cap and Trade system net to about 134Mt CO<sub>2</sub>e after taking these changes into account.
- Gross emissions in Wisconsin fall below 1990 levels after 2016 dropping below 90Mt by 2019 and reaching 90 Mt by 2024. Emissions in the state overshoot the state target as the Cap and Trade policy works to achieve its targets across the multi-state market

**Wisconsin GHG Emissions - Cap and Trade 04**



*Note – Graph shows Gross emissions and does not include sequestration or offsets.*

**Cap and Trade Case 03 – 10% Offset Limit:**

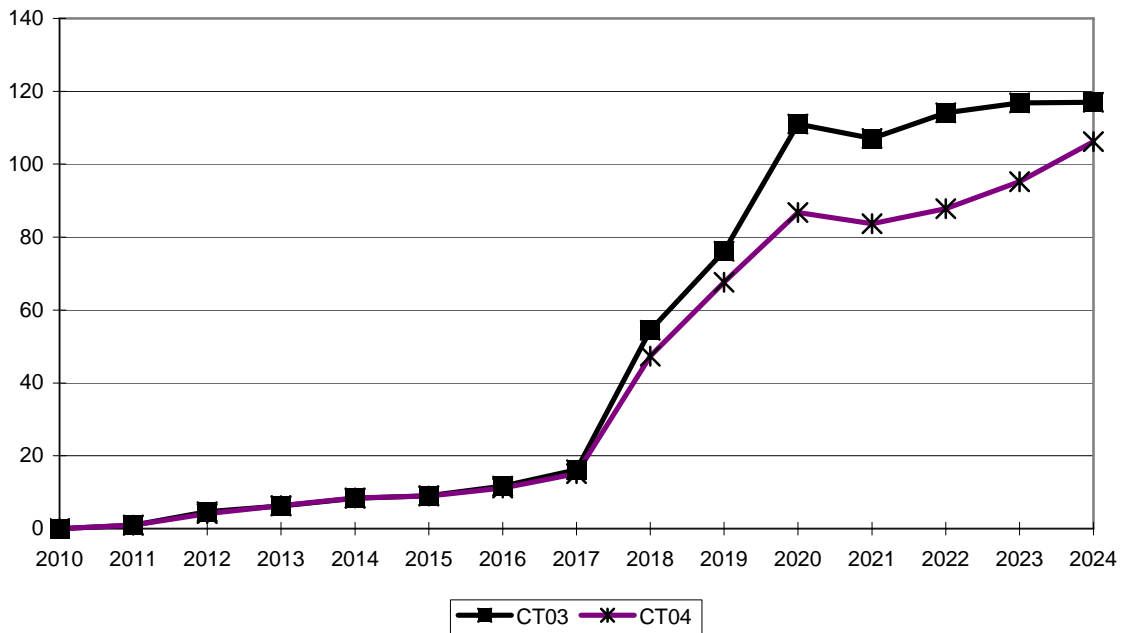
- As will be discussed below, carbon prices under cap and trade case 04 decrease relative to those in CT03. As a result, while results for CT03 and CT04 are broadly similar there are some differences between the cases.

- It should also be noted that the results for CT04 include the effects of feedback from the REMI macroeconomic model; while those for CT03 do not.
- Electricity sales decrease by only 18% under CT03 compared to a 22% increase in CT04 while generation declines slightly more in CT03.
- In 2024 GHG emissions in Wisconsin are almost 8 Mt lower in CT04 than in CT03.
- The graphs on the following page show the marginal cost of permits in the Cap and Trade market and the resulting costs by sector.

### Carbon Trading:

The following chart shows trading costs for Cap and Trade cases 3 and 4:

### Marginal Cost of Trading Allowances (2008 \$/Tonne)



- In both cases, carbon costs rise to just below \$20/tonne by 2017 and then increase rapidly to \$80 per tonne by 2019. Under CT03, costs then rise to near \$120/tonne after 2020. In CT04, costs rise more gradually eventually passing \$100/tonne in 2024.

### Cost of Permits - Cap and Trade Case 02:

<b>Permits Required (Mt)</b> (negative value indicates sector is selling permits).				
	<b>2011</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
Residential	12.7	12.1	11.7	11.5
Commercial	4.8	4.2	3.7	3.5
Pulp and Paper	5.4	5.0	5.0	5.1
Other Energy Intensive	2.4	2.2	2.2	2.2
Other Industry	9.4	9.6	10.2	10.7
Transportation Fuels	32.5	29.0	26.7	26.3
Agricultural	13.0	13.7	15.0	16.1
Forestry	0.0	0.0	0.0	0.0
Waste and Waste Water	4.1	4.6	5.3	5.9
Power Sector	55.3	35.5	20.1	18.8
<b>Total (Gross)</b>	<b>139.5</b>	<b>115.8</b>	<b>100.0</b>	<b>100.1</b>

<b>Cost of Permits (millions of 2008 \$)</b>				
	<b>2011</b>	<b>2015</b>	<b>2020</b>	<b>2024</b>
Residential	13	102	939	945
Commercial	5	35	297	289
Pulp and Paper	5	43	405	420
Other Energy Intensive	2	19	178	183
Other Industry	9	81	818	879
Transportation Fuels	32	245	2,145	2,165
Agricultural & Forestry	13	115	1,205	1,321
Forestry	0	0	1	1
Waste and Waste Water	4	39	427	484
Power Sector	55	300	1,617	1,544
<b>Total -</b>	<b>139</b>	<b>978</b>	<b>8,031</b>	<b>8,231</b>

Note: Negative values indicate the sector is selling permits and earning revenues.

- Permit costs reflect the level of energy use and emissions associated with each sector and their ability to respond.
- The permit costs reflected above represent the net number of permits required with no gratis permits.
- The C&T policy is implemented after all of the “other policies” described in Policy Case 01. Due to these policies, emissions are reduced in Wisconsin relative to other states in the Cap and Trade market however all sectors must purchase permits under the auction scheme.

**Economic Impacts:**

We are awaiting final results from the REMI model for the most recent run of CT04. ***The results below are illustrative – based on prior results and are intended ONLY to represent the type of data that may be presented.***

***REMI does provide employment and output by economic sector, however, we do not have a file of that information for the Reference Case. I have asked Bob if he can provide a copy. This will allow us to present information on the change in employment by sector resulting from the policy.***

Cap and Trade 04 Change from Reference Case	2010	2015	2020	2024
Total Employment (Thous)	(6.4)	(14.7)	(112.5)	(116.6)
Total GRP (Bil Fixed 2000\$)	(0.5)	(1.0)	(8.5)	(10.1)
Real Disp Pers Inc per Cap (Thous Fixed 2000\$)	(0.0)	(0.0)	(0.4)	(0.3)

Cap and Trade 04 Change from Reference Case	2010	2015	2020	2024
Total Employment (Thous)	-0.2%	-0.4%	-2.9%	-3.0%
Total GRP (Bil Fixed 2000\$)	-0.2%	-0.4%	-2.7%	-2.9%
Real Disp Pers Inc per Cap (Thous Fixed 2000\$)	0.0%	-0.1%	-1.4%	-0.8%

- Employment, GRP and Personal Income all decline relative to levels that would otherwise be achieved in the Reference Case. In all cases this reflects a reduction in the level of growth represented in the Reference Case, not a decline in real terms.
- The change in employment represents a 3% change relative to the Reference Case in 2024 as presented in the graphs below.

