



Overview of Reference Case

*State of Wisconsin
Department of Natural Resources and the
Governor's Global Warming Task Force*

February 5, 2008

Agenda:

1. Changes from January 4th, 2008 results
2. Inputs & Assumptions
3. Power Sector
4. Transportation Sector
5. Total Fuel Use
6. Energy Prices
7. GHG Emissions

Changes from January 4th, 2008 Results

- “Reference Case Inputs & Assumptions” document presented to GWTF at the December 20th meeting.
- Feedback from Task Force members reviewed by TAG and included in model and “Assumptions Book”.
- Changes from January 4th, 2008 results:
- TAG agreed to proceed with Reference Case based on the “high price scenario” developed by TAG.
- The Reference Case includes the projected impacts of the recent federal Energy Independence and Security Act 2007 (EISA 2007).
- RPS has been added to the Reference Case.

Inputs & Assumptions: Prices

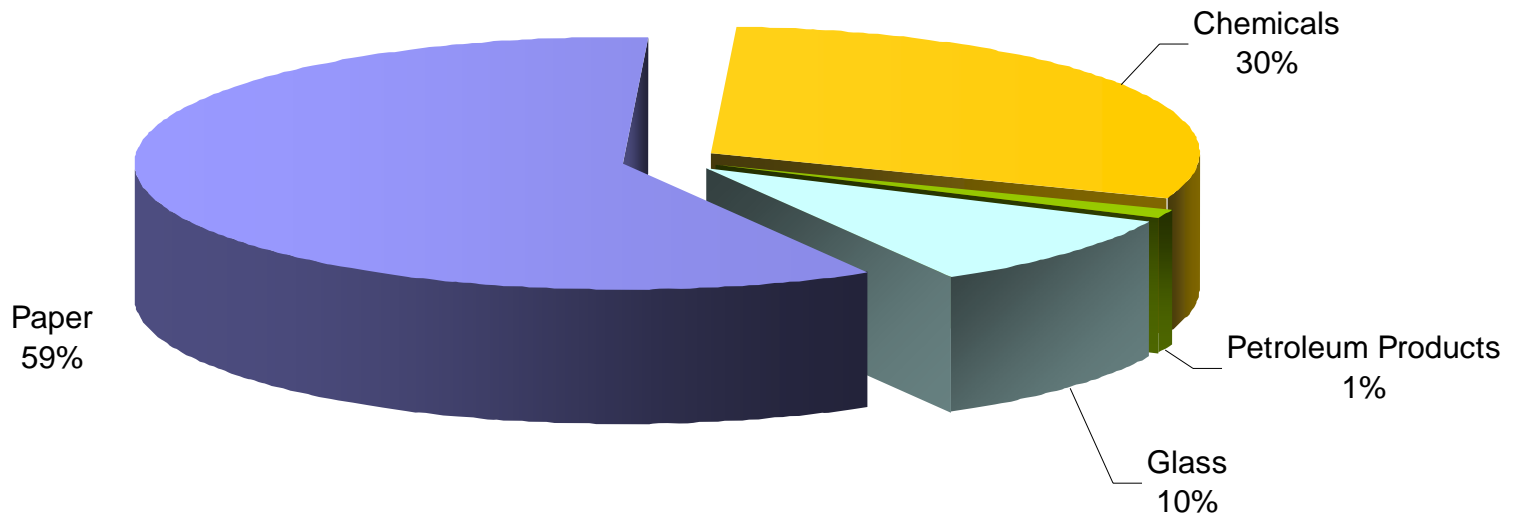
- Oil prices from US EIA Annual Energy Outlook High Price Case
- Natural gas based on NYMEX futures price for 2008 held constant in real terms
- Coal price based on the AEO High Price Case
- Historic electricity prices from Energy Information Administration (EIA)
- Model calculates future power prices based on generation costs.

Inputs & Assumptions: Outputs

- ENERGY 2020 outputs include data for 70 economic sectors and other categories. The data 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

Inputs & Assumptions: Energy Intensive Industries

Energy Intensive Industries
2004 Energy Use



Inputs & Assumptions: Economic Data

- Population
- Households by housing type (single family, multi-family, other)
- Personal income (provided by REMI)
- Passenger transportation demand (Vehicle miles travelled)
- Employment and Gross Output by economic sector
- National Deflator (inflation rate) per REMI

Power Sector

Comparison with Reported Values:

For 2004	Model Results	WI Stats ^{1,2}	WI Stat Description
Total Generation Capacity (MW)	14,259	12,573 (a) 15,056 (b)	a) Owned generation used for Wisconsin loads, b) Total including owned & merchant
Total Generation Output (GWh)	60,445	57,987	Utility gen. inc. IPP, but excluding imports and losses.
Sales (GWh)	69,861	67,976	Sales to ultimate customers
Peak Load (MW)	12,958	13,001 - Peak 12,149 - Adjusted	Adjusted value is net of Interruptible and DR, capacity sales/purchases, etc..
For 2006	Model Results	WI Stats ^{1,2}	WI Stat Description
Total Generation Capacity (MW)	15,983	12,762 (a) 16,238 (b)	a) Owned generation used for Wisconsin loads, b) Total including owned & merchant
Total Generation Output (GWh)	61,644	58,822	Utility gen. inc. IPP, but excluding imports and losses.
Sales (GWh)	74,289	69,809	Sales to ultimate customers
Peak Load (MW)	13,648	15,166 – Peak 14,022 - Adjusted	Adjusted value is net of Interruptible and DR, capacity sales/purchases, etc..

- Significant differences between various reported data sources
- Modeled sales slightly above reported sales.
- Total generating capacity close to owned plus merchant generation.
- Out of state generation devoted to WI needs, interruptible loads and DR addressed in reserve margin calculation for new generation requirements).

Electricity Sales

Electricity Sales (GWh)						
Sector	2004	2006	2010	2015	2020	2024
Residential	19,203	20,292	22,015	23,188	25,023	26,648
Commercial	21,800	22,322	24,347	28,201	32,083	35,217
Industrial	28,438	31,275	33,162	35,549	41,273	45,470
Street Lights/Misc.	400	400	400	400	400	400
Resale	20	-	-	-	-	-
Total Sales	69,861	74,289	79,924	87,338	98,779	107,735
Net Imports to State	9,416	12,645	421	5,191	12,249	15,031

Growth in Electricity Sales		
Sector	Reference	AE08
Residential	1.9%	1.6%
Commercial	2.4%	2.4%
Industrial	2.3%	2.3%
Total Sales	2.2%	2.1%

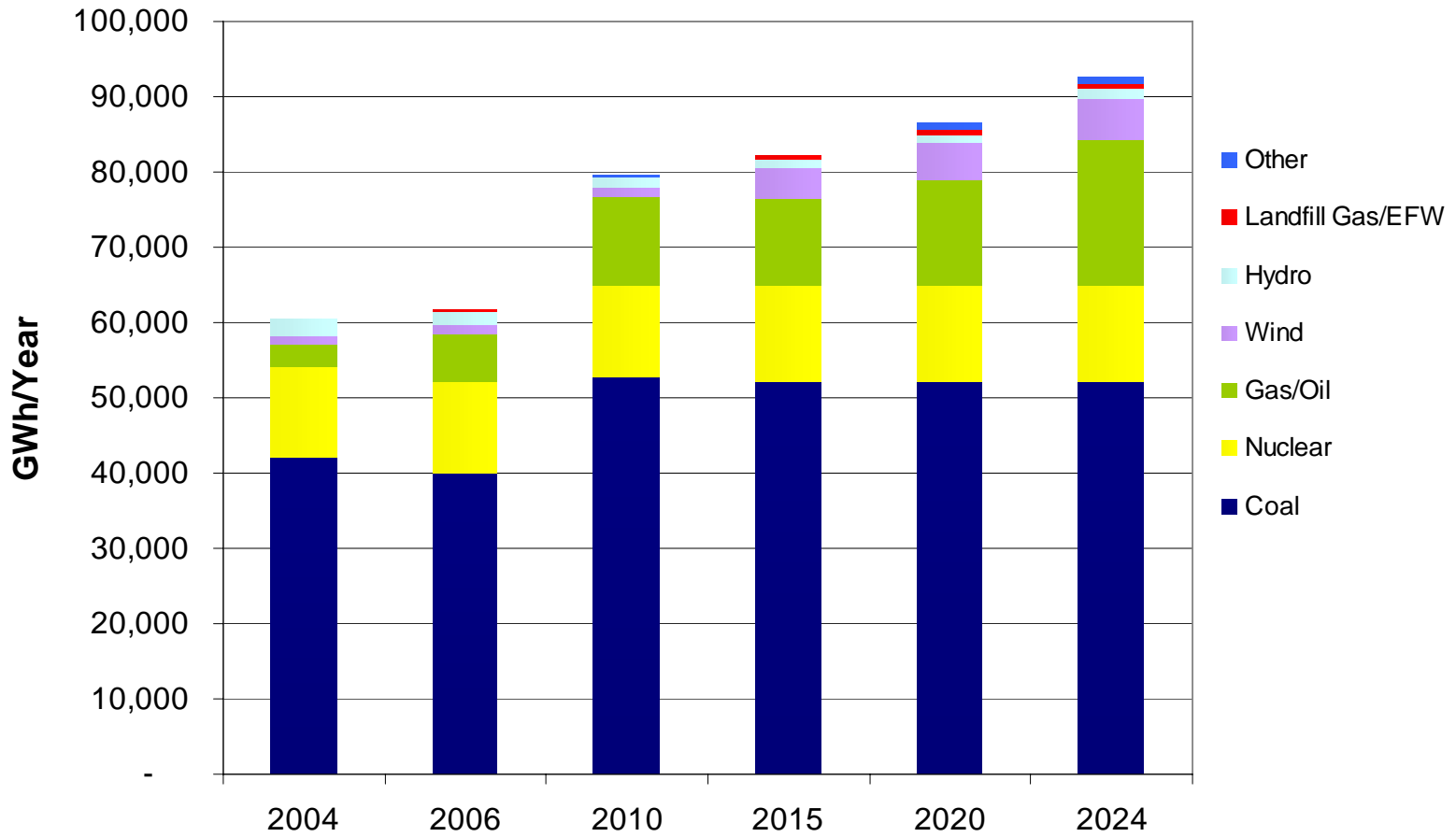
Electricity Generation & Capacity

Generation Output						
Plant Type	2004	2006	2010	2015	2020	2024
Gas/Oil	3,146	6,226	11,765	11,526	14,088	19,341
Coal	42,141	40,043	52,782	52,099	52,099	52,099
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	312	610	794
Wind	1,175	1,349	1,453	4,151	4,863	5,600
Other	-	4	72	72	883	884
Total	60,445	61,644	79,503	82,147	86,530	92,704

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	2,680	3,283	4,884
Gas/Oil Steam			281	305	305	305
Coal	6,882	6,984	8,639	8,519	8,519	8,519
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	83	267	300
Wind	39	121	561	1,688	1,989	2,300
Other	-	-	12	12	12	12
Total	14,259	15,983	18,774	19,927	21,015	22,958

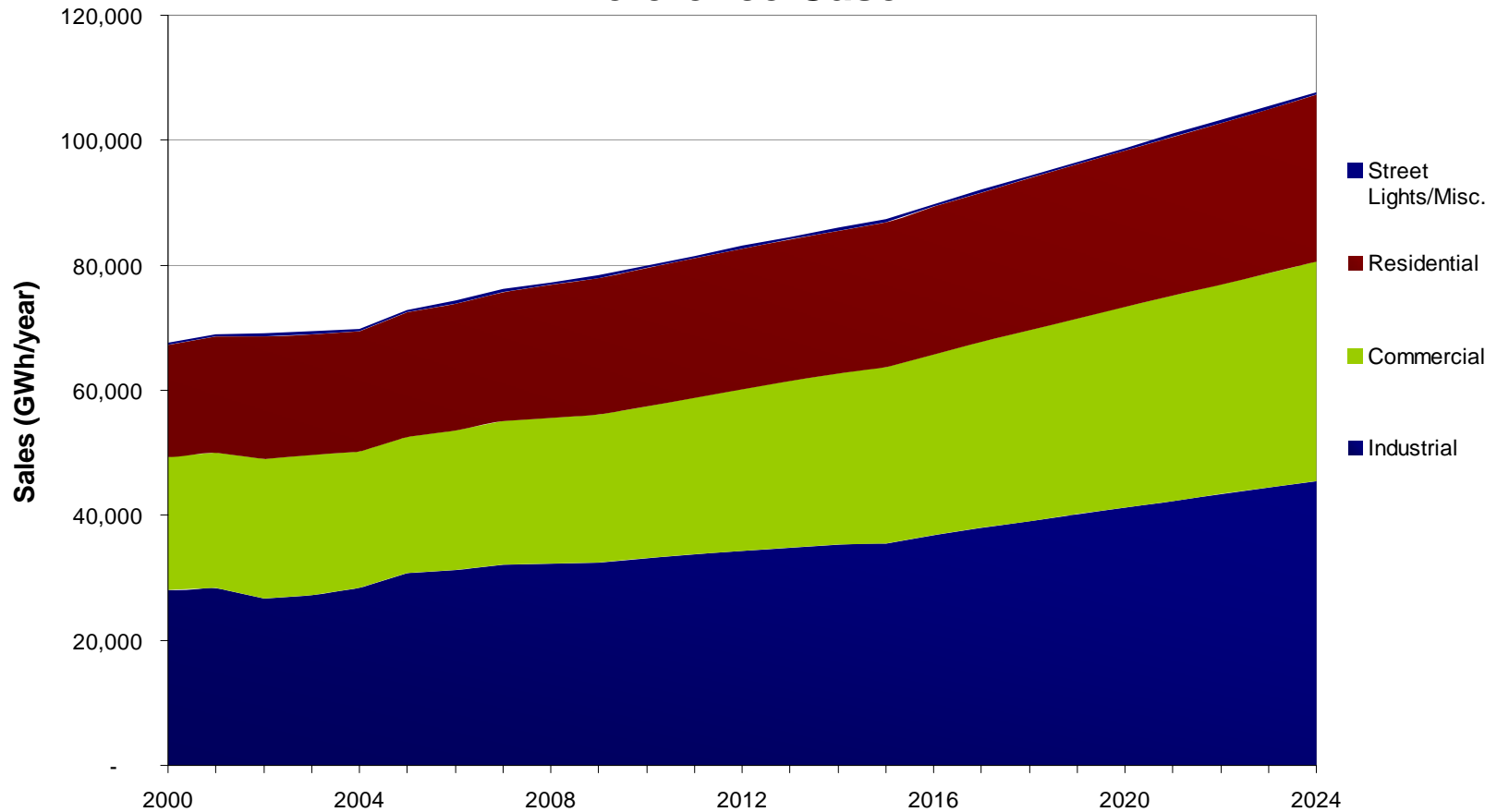
Electricity Generation

Generation Output



Electricity Sales

Electricity Sales Reference Case



Peak Loads and In-State Renewable Sales

Peak Loads (MW)	2004	2006	2010	2015	2020	2024
Annual Peak Load	12,958	13,648	14,650	16,081	18,144	19,768
Reserve Margin Calculation						
Adjusted Peak Load (<i>net of Demand Reduction and Interruptible Load</i>)	12,190	12,880	13,882	15,313	17,376	19,000
Adjusted Generation Capacity (<i>Including out-of-state generation devoted to WI & 15% of wind capacity</i>)	15,062	16,716	19,133	19,581	20,459	22,185
Estimated Reserve Margin -	22%	28%	36%	27%	17%	16%

In-State Renewables	2015	2020	2024
- as % of Total Sales	5.2	5.6	6.0
* Renewables defined as wind, solar, EFW, LFG and biomass.			

- Electricity demand may vary, but changes in peak demand do not significantly effect GHG emissions

Transportation

Transportation Sector: Demand

Distance Traveled (millions VMT)	2004	2006	2010	2015	2020	2024	Avg. % Change per Year
Passenger	43,395	50,105	53,187	56,269	60,713	64,728	2.0%
Freight	7,653	8,317	8,588	9,423	10,474	11,369	2.0%
Passenger Miles per Person	7,930	9,036	9,352	9,625	10,010	10,304	1.3%

- No change from January 4th results.

Transportation Sector: Vehicle Efficiency

Marginal Vehicle Efficiency (miles/gallon)						
	2004	2006	2010	2015	2020	2024
Light Gas Vehicles	30.9	32.1	33.7	36.9	41.9	45.4
Medium Vehicles	26.8	28.2	30.0	33.0	37.7	41.0
Heavy Vehicles	20.7	21.1	21.6	23.3	25.2	25.9
Heavy Diesel	20.7	21.2	21.8	23.6	25.5	26.3
	2004	2006	2010	2015	2020	2024
Ethanol as a % of Gasoline Used for Passenger Transportation*	2.8%	2.8%	4.2%	6.5%	9.0%	10.7%

**This represents total statewide use of ethanol.*

- Increase in marginal vehicle efficiency and consumption of ethanol in Reference Case due to the effect of the EISA 2007.

Total Fuel Use

Total Energy Use: Sector

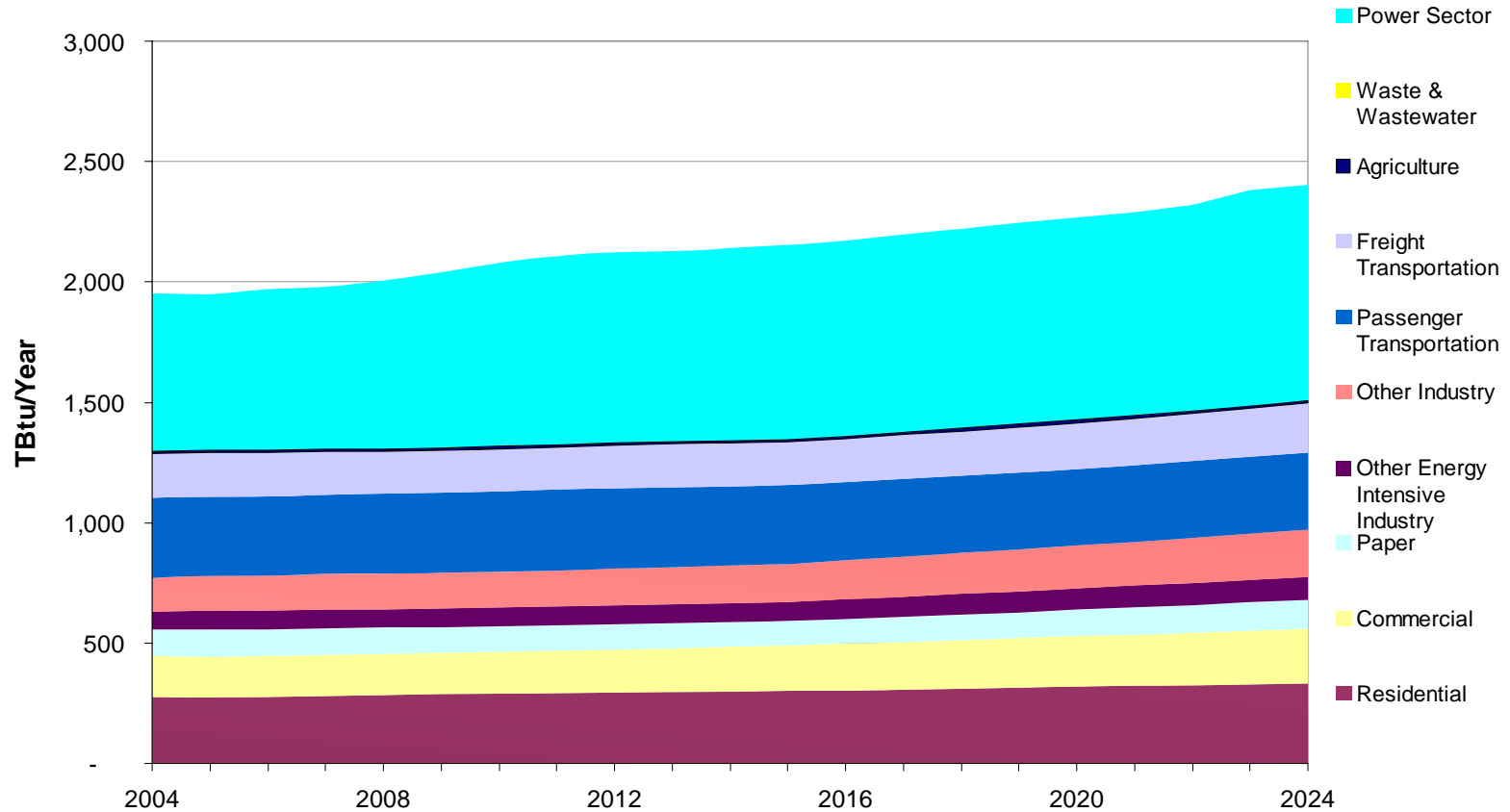
Total Energy Use (TBtu/year)						
Sector	2004	2006	2010	2015	2020	2024
Residential	275	277	290	300	318	335
Commercial	174	170	174	190	210	228
Paper	108	109	104	100	110	118
Other Energy Intensive Industry	75	78	78	80	89	96
Other Industry	138	147	151	158	179	194
Passenger Transportation	332	329	335	326	319	322
Freight Transportation	185	181	175	181	192	203
Agriculture	9	9	9	10	10	11
Power Sector	656	670	764	811	843	895
Total -	1,952	1,969	2,080	2,156	2,269	2,403

Total Energy Use: Fuel Type

Total Energy Use (TBtu/year)						
Fuel Type	2004	2006	2010	2015	2020	2024
Aviation Fuel	12.9	13.3	14.1	14.9	16.2	17.3
Biomass	45.9	47.4	48.8	49.7	52.7	54.4
Coal	510.2	510.1	592.5	584.0	589.1	627.4
Diesel	176.7	172.2	166.7	170.5	180.0	190.0
Ethanol	8.6	8.6	12.9	19.5	26.4	31.4
Electric	236.9	252.2	270.8	296.0	338.7	374.0
Landfill Gas	-	1.8	1.8	19.3	19.3	19.3
LPG	2.3	2.2	2.2	2.2	2.4	2.5
Gasoline	316.2	312.4	312.9	297.7	283.7	282.4
Natural Gas	415.3	428.8	439.4	466.1	522.2	562.4
Nuclear	121.9	122.4	122.4	129.4	129.4	129.4
Oil, Unspecified	85.6	72.3	71.1	70.2	70.9	72.1
Solar	7.8	9.1	10.5	12.0	13.9	15.6
Other	11.2	16.1	14.2	24.1	24.3	24.3
Total -	1,952	1,969	2,080	2,156	2,269	2,403

Total Energy Use

Total Energy Use



Energy Prices

Energy Prices: Electricity & Natural Gas

Energy Prices (2007 \$'s)		2004	2006	2010	2015	2020	2024
Electricity	Units						
Residential	MWh	\$76.34	\$84.04	\$83.39	\$80.98	\$83.49	\$84.40
Commercial	MWh	\$68.33	\$70.01	\$69.73	\$67.79	\$70.40	\$71.44
Industrial	MWh	\$57.00	\$57.61	\$57.39	\$55.74	\$58.82	\$60.08
Average Retail	MWh	\$68.33	\$70.01	\$69.73	\$67.79	\$70.40	\$71.44
Natural Gas							
Residential	Mcf	\$13.44	\$16.73	\$15.84	\$15.84	\$15.84	\$15.84
Commercial	Mcf	\$11.91	\$14.85	\$14.21	\$14.21	\$14.21	\$14.21
Industrial	Mcf	\$11.08	\$12.83	\$13.33	\$13.33	\$13.33	\$13.33

Energy Prices: Fuel Oil, Transportation and Coal

Energy Prices (2007 \$'s)		2004	2006	2010	2015	2020	2024
Fuel Oil							
Residential	gallons	\$2.03	\$2.83	\$2.95	\$3.23	\$3.45	\$3.55
Commercial	gallons	\$1.71	\$2.51	\$2.62	\$2.90	\$3.12	\$3.22
Industrial	gallons	\$1.73	\$2.81	\$3.29	\$3.57	\$3.79	\$3.89
Transportation Fuels							
Gasoline	gallons	\$2.34	\$3.29	\$3.29	\$3.55	\$3.74	\$3.83
Diesel	gallons	\$2.37	\$3.55	\$3.56	\$3.84	\$4.06	\$4.16
Biomass							
Residential	mBtu	\$10.79	\$11.53	\$11.50	\$13.53	\$15.10	\$15.84
Commercial	mBtu	\$9.45	\$10.09	\$10.06	\$12.09	\$13.66	\$14.40
Industrial	mBtu	\$9.45	\$10.09	\$10.06	\$12.09	\$13.66	\$14.40
Coal							
Coal - Utility	mBtu	\$1.68	\$2.03	\$2.07	\$2.02	\$2.04	\$2.09
Coal - Industry	mBtu	\$2.68	\$3.27	\$3.33	\$3.28	\$3.30	\$3.35

GHG Emissions

GHG Emissions:

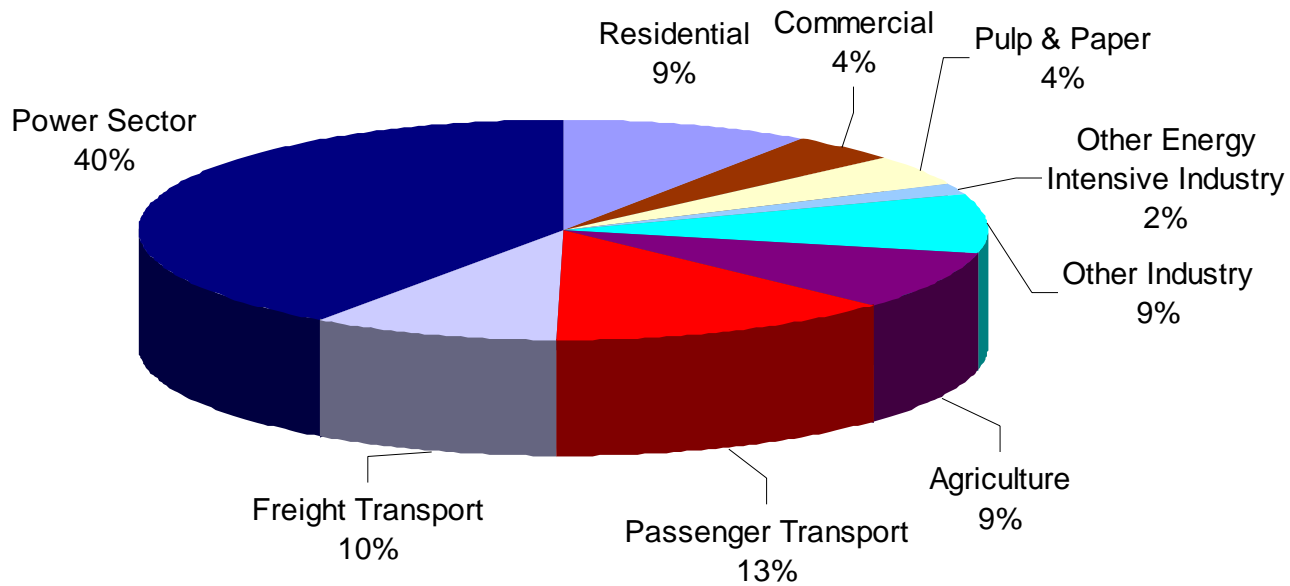
GHG Emissions (Mt)	2004	2006	2010	2015	2020	2024	Average Annual % Change
Residential	13.1	12.8	13.1	13.3	13.7	14.1	0.4%
Commercial	5.9	5.6	5.5	5.6	5.9	6.3	0.3%
Pulp & Paper	5.6	5.9	5.8	5.6	6.2	6.8	0.9%
Other Energy Intensive Industry	2.3	2.4	2.3	2.4	2.6	2.8	0.9%
Other Industry	8.9	9.5	9.8	10.4	11.8	12.8	1.8%
Agriculture	11.4	9.7	10.6	11.6	12.4	13.0	0.7%
Passenger Transport	21.6	21.4	21.8	20.9	20.1	20.1	-0.4%
Freight Transport	13.1	12.7	12.4	12.8	13.6	14.4	0.5%
Power Sector	45.6	50.6	58.8	57.5	58.7	60.6	1.4%
Waste & Wastewater	3.2	3.5	3.9	4.6	5.3	5.9	3.0%
Total Gross Emissions	130.7	134.1	143.9	144.8	150.3	156.8	0.90%
Land Use - Forestry	(8.2)	(8.2)	(8.2)	(8.2)	(8.2)	(8.2)	0.0%
Total Net Emissions	122.5	125.9	135.7	136.6	142.1	148.6	0.96%

- Level of sequestration due to land use changes based on draft Winrock International report.
- WRI inventory showed 2003 emissions of 123 Mt. Emissions from model results, excluding estimated sinks, equals 134 Mt in 2006.

Greenhouse Gas Emissions

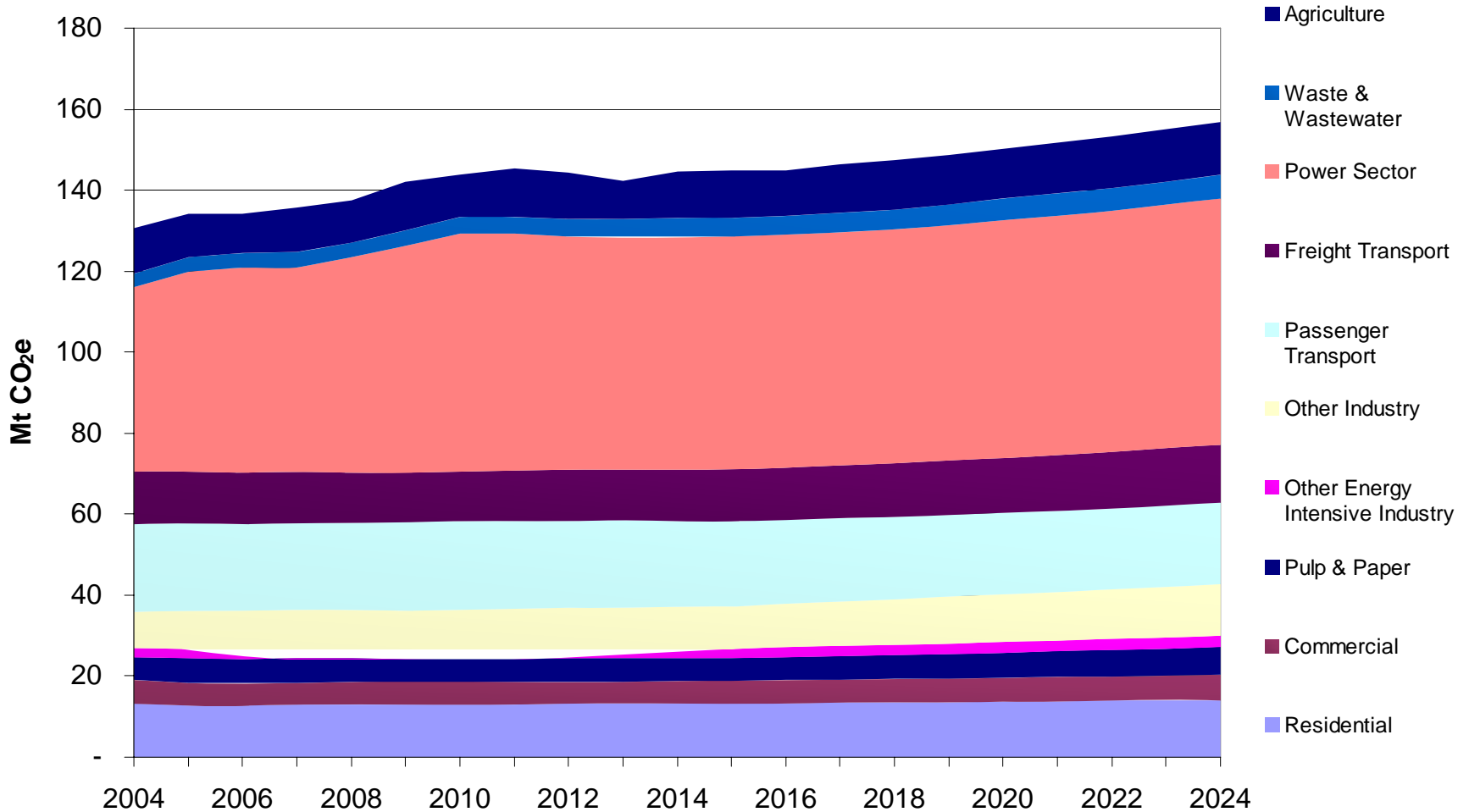
GHG Reference Case Emissions 2024

Total GHG Emissions 2004: 156.8 Mt



GHG Emissions

GHG Emissions - Reference Case



Questions?

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