



MINNESOTA
Climate Change
Advisory Group



Minnesota Climate Change Advisory Group

ES Technical Work Group Teleconference
#9

November 16, 2007

Minnesota Department of Commerce
Minnesota Pollution Control Agency
The Center for Climate Strategies

Today's Agenda

- Call to order
- Roll Call of TWG members and public
- Review and approval of summary of TWG Meeting #8 (October 25, 2007)
- Review of MN CCAG Process and Expected Next Steps
- Discussion of the assumptions used in the initial analytical results of priority energy supply options
- Discussion of revised GHG forecast for energy supply
- Proposed agenda, time and date for NEXT meeting
- Public input and announcements

Roll Call

- Call to order
- Roll Call of TWG members
- Roll Call of MN State Agency Staff
- Roll Call of Members of the Public

Prior Call Summary

- Review and Approval of the ES meeting #8 Summary (October 25, 2007)

Stepwise Planning Process

1. Develop inventory and forecast of emissions
2. Identify a full range of possible actions
3. Identify initial priorities for analysis
4. Develop straw proposals
5. Quantify GHG reductions and costs/savings
6. Evaluate externalities, feasibility issues
7. Develop alternatives to address barriers
8. Aggregate results
9. Iterate to final agreements
10. Finalize and report recommendations

Assumptions used in the initial analytical results

1. Planned addition assumptions
2. Planned retirement assumptions
3. Cost & performance assumptions
4. Avoided costs

Planned Capacity Additions (MW)

Fuel type	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Coal	0	7	0	0	0	0	0	0	1,183	0	0	0	0	0	0	0	0	0	0	0	0
Hydroelectric	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas	0	531	290	1,108	300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nuclear	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Renewab	0	99	64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pumped Stora	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
All Sources	0	642	354	1,108	300	0	0	0	1,183	0	0	0	0	0	0	0	0	0	0	0	0

Planned Capacity Retirements (MW)

Fuel type	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Coal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydroelectric	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nuclear	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Renewab	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pumped Storage	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
All Sources	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Default Cost & performance assumptions

	Capacity installed between 2005 and 2012							Capacity installed after 2012						
	Overnight Capital	Trans	Fixed O&M	Variable O&M	Cap factor	Heat rate	Lifetime	Overnight Capital	Trans	Fixed O&M	Variable O&M	Cap factor	Heat rate	Lifetime
	2005 \$/kW	2005 \$/kW	2005 \$/kW-yr	2005 mills/kWh	%	btu/kWh	years	2005 \$/kW	2005 \$/kW	2005 \$/kW-yr	2005 mills/kWh	%	btu/kWh	years
Coal (EIA)	1,290	0	25.91	4.32	75%	8,844	40	1,492	80	36.4	2.8	75%	8,309	40
Hydroelectric	1,500	80	13.13	3.30	47%	10,107	40	1,500	80	13.13	3.30	47%	10,107	40
Natural Gas CT (EIA)	420	0	3.36	11.40	50%	10,807	40	420	0	3.36	11.40	47%	10,107	40
Natural Gas CC (EIA)	603	0	11.75	1.94	75%	7,163	40	603	0	11.75	1.94	75%	7,163	40
Nuclear	1,982	0	63.88	0.47	84%	10,400	40	1,982	0	63.88	0.47	84%	10,400	40
Other	0	0	0.00	0.00	0%	0	40	0	0	0.00	0.00	0%	0	40
Other Gas	0	0	0.00	0.00	0%	0	40	0	0	0.00	0.00	0%	0	40
Geothermal	1,880	0	154.92	0.00	50%	36,025	40	1,880	0	154.92	0.00	50%	36,025	40
MSW	1,595	0	107.50	0.01	75%	13,648	40	1,595	0	107.50	0.01	75%	13,648	40
Landfill gas	1,595	0	107.50	0.01	75%	13,648	40	1,595	0	107.50	0.01	75%	13,648	40
Biomass	1,834	0	50.18	2.96	75%	8,911	40	1,834	0	50.18	2.96	75%	8,911	40
Solar	4,320	80	10.99	0.00	35%	10,280	40	4,320	80	10.99	0.00	35%	10,280	40
Wind (EIA)	1,206	80	28.51	0	35%	10,280	40	1,206	80	28.51	0.00	35%	10,280	40
Petroleum	420	0	11.40	3.36	10%	10,807	40	420	0	11.40	3.36	10%	10,807	40
Pumped Storage	0	0	0.00	0.00	0%	0	40	0	0	0.00	0.00	0%	0	40

Avoided Costs

- In the absence of available avoided costs, an estimate was prepared using the assumed capacity addition plans with/without the RES (2005 \$/MWh):

Component	Without RPS	With RPS
Energy	39.9	26.3
Capacity	16.5	26.3
Total	56.3	52.6

Key Assumptions and Initial analytical results

- ES-1
- ES-3
- ES-4
- ES-5
- ES-6
- ES-7
- ES-8
- ES-9
- ES-10
- ES-11
- ES-12

Initial Quantification Assumptions: ES-1 (GPS; Scenario #1)

Start year for GPS

2013

CO2e emission intensity threshold assumptions

	lbs CO2 per MWh	tonnes CO2e/MWh
MN power stations	1,100	0.50
contracts with out-of-state power stations	1,100	0.50
MN CHP stations	1,300	0.59
contracts with out-of-state CHP stations	1,300	0.59

Sensitivity regarding the effect of the GPS on planned additions in MN that are already in the pipeline

1

- 1 GPS has **no** effect on MN planned capacity already in the pipeline (default)
- 2 GPS **affects** MN planned capacity already in the pipeline

Sensitivity regarding the effect of the GPS on imports that are already in the pipeline

1

- 1 GPS has **no** effect on out-of-state imports already in the pipeline (default)
- 2 GPS **affects** out-of-state imports already in the pipeline

Sensitivities for replacement power from new utility/NUG capacity in MN to meet GPS

1

- 1 50% natural gas; 50% wind (default)
- 2 user-defined

Sensitivities for replacement power from new CHP capacity in MN to meet GPS

1

- 1 100% natural gas (default)
- 2 user-defined

Sensitivities for replacement power from imports to meet GPS

1

- 1 100% natural gas (default)
- 2 user-defined
- 3 GPS not applicable to imports

Initial Quantification Results: ES-1 (GPS; Scenario #1)

Results assume the following assumptions:

Effect of the GPS on planned additions in MN that are already in the pipeline
 Effect of the GPS on imports that are already in the pipeline
 Replacement power from new utility/NUG capacity in MN to meet GPS
 Replacement power from new CHP capacity in MN to meet GPS
 Replacement power from imports to meet GPS

GPS has no effect on MN planned capacity already in the pipeline (default)
 GPS has no effect on out-of-state imports already in the pipeline (default)
 50% natural gas; 50% wind (default)
 100% natural gas (default)
 100% natural gas (default)

Summary - No RPS

New MN power stations
 New MN CHP stations
 contracts with out-of-state power suppliers
 Total

GHG Reductions (million tonnes CO2e)			NPV of Costs (E6 2005\$)	Cost of Saved Carbon (2005\$/tCO2e avoided)
Annual		Cumulative		
2015	2025			
0.0	0.0	0.0	\$0	0.0
0.0	0.0	0.0	\$0	0.0
0.0	0.0	0.0	\$0	0.0
0.0	0.0	0.0	\$0	0.0

Summary - With RPS

New MN power stations
 New MN CHP stations
 contracts with out-of-state power suppliers
 Total

GHG Reductions (million tonnes CO2e)			NPV of Costs (E6 2005\$)	Cost of Saved Carbon (2005\$/tCO2e avoided)
Annual		Cumulative		
2015	2025			
0.0	0.0	0.0	\$0	0.0
0.0	0.0	0.0	\$0	0.0
0.0	0.0	0.0	\$0	0.0
0.0	0.0	0.0	\$0	0.0

Initial Quantification Assumptions: ES-1 (GPS; Scenario #2)

Start year for GPS

2013

CO2e emission intensity threshold assumptions

	lbs CO2 per MWh	tonnes CO2e/MWh
MN power stations	1,100	0.50
contracts with out-of-state power stations	1,100	0.50
MN CHP stations	1,300	0.59
contracts with out-of-state CHP stations	1,300	0.59

Sensitivity regarding the effect of the GPS on planned additions in MN that are already in the pipeline

2

- 1 GPS has **no** effect on MN planned capacity already in the pipeline (default)
- 2 GPS **affects** MN planned capacity already in the pipeline

Sensitivity regarding the effect of the GPS on imports that are already in the pipeline

2

- 1 GPS has **no** effect on out-of-state imports already in the pipeline (default)
- 2 GPS **affects** out-of-state imports already in the pipeline

Sensitivities for replacement power from new utility/NUG capacity in MN to meet GPS

1

- 1 50% natural gas; 50% wind (default)
- 2 user-defined

Sensitivities for replacement power from new CHP capacity in MN to meet GPS

1

- 1 100% natural gas (default)
- 2 user-defined

Sensitivities for replacement power from imports to meet GPS

1

- 1 100% natural gas (default)
- 2 user-defined
- 3 GPS not applicable to imports

Initial Quantification Results: ES-1 (GPS; Scenario #2)

Results assume the following assumptions:

Effect of the GPS on planned additions in MN that are already in the pipeline
 Effect of the GPS on imports that are already in the pipeline
 Replacement power from new utility/NUG capacity in MN to meet GPS
 Replacement power from new CHP capacity in MN to meet GPS
 Replacement power from imports to meet GPS

GPS affects MN planned capacity already in the pipeline
 GPS affects out-of-state imports already in the pipeline
 50% natural gas; 50% wind (default)
 100% natural gas (default)
 100% natural gas (default)

Summary - No RPS

New MN power stations
 New MN CHP stations
 contracts with out-of-state power suppliers
 Total

GHG Reductions (million tonnes CO2e)			NPV of Costs (E6 2005\$)	Cost of Saved Carbon (2005\$/tCO2e avoided)
Annual		Cumulative		
2015	2025			
4.7	61.4	61.4	\$1,642	26.7
0.0	0.0	0.3	\$39	142.4
0.0	1.1	5.8	\$116	19.9
4.7	5.9	67.6	\$1,797	26.6

Summary - With RPS

New MN power stations
 New MN CHP stations
 contracts with out-of-state power suppliers
 Total

GHG Reductions (million tonnes CO2e)			NPV of Costs (E6 2005\$)	Cost of Saved Carbon (2005\$/tCO2e avoided)
Annual		Cumulative		
2015	2025			
4.7	61.4	61.4	\$1,642	26.7
0.0	0.0	0.3	\$39	142.4
0.0	0.0	0.0	\$0	0.0
4.7	4.8	61.7	\$1,681	27.2

Initial Quantification Assumptions: ES-3 (Plant improvements)

Co-firing amount 8%

Start year for option 2013

Ramp-up period (years) 5

Phase-in for co-firing portion

Start year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	
2008				0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2009					0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010						0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2011							0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2012								0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013									2%	3%	5%	6%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%
2014										0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2015											0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2016												0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	0%	0%	0%	0%	0%	0%	0%	0%	2%	3%	5%	6%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%

Initial Quantification Results: ES-3 (Plant improvements)

Summary - No RPS

Plant improvements

GHG Reductions (million tonnes CO2e)			NPV of Costs (E6 2005\$)	Cost of Saved Carbon (2005\$/tCO2e avoided)
Annual		Cumulative		
2015	2025			
1.60	3.00	31.08	\$216	6.95

Summary - With RPS

Plant improvements

GHG Reductions (million tonnes CO2e)			NPV of Costs (E6 2005\$)	Cost of Saved Carbon (2005\$/tCO2e avoided)
Annual		Cumulative		
2015	2025			
1.43	2.19	25.54	\$180	7.04

Initial Quantification Assumptions: ES-4 (Transmission System Upgrading)

Start year for option 2008

T&D system loss reduction (%) 1%

Phase-in for T&D upgrading

2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
0%	0%	0%	0%	0%	0.6%	0.8%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%

Reference Case T&D losses in MN (with/without RPS)

2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
2.5%	7.3%	7.2%	7.1%	7.1%	7.0%	6.9%	6.9%	6.8%	6.7%	6.6%	6.6%	6.6%	6.6%	6.7%	6.7%	6.7%	6.7%	6.7%	6.9%	6.6%

Reference Case T&D losses in MN (with/without RPS) after T&D upgrades

2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
2.5%	7.3%	7.2%	6.9%	6.7%	6.4%	6.1%	5.9%	5.8%	5.7%	5.6%	5.6%	5.6%	5.6%	5.7%	5.7%	5.7%	5.7%	5.7%	5.9%	5.6%

Transmission expansion cost \$4,000,000,000 based on 2006-2011 investments as reported in MTEP06: Growing the Grid, 2/07, Midwest ISO expansion plan

Assumed reduction in losses 0.10% placeholder!

Cost of T&D upgrades \$40,000,000,000 per each 1% improvement

Initial Quantification Results: ES-4 (Transmission System Upgrading)

Summary - No RPS

T&D system improvements

GHG Reductions (million tonnes CO2e)			NPV of Costs (E6 2005\$)	Cost of Saved Carbon (2005\$/tCO2e avoided)
Annual		Cumulative		
2015	2025			
0.53	0.58	8.74	\$93	57.10

Summary - With RPS

T&D system improvements

GHG Reductions (million tonnes CO2e)			NPV of Costs (E6 2005\$)	Cost of Saved Carbon (2005\$/tCO2e avoided)
Annual		Cumulative		
2015	2025			
0.53	0.57	8.65	\$83	56.50

Initial Quantification Assumptions: ES-5 (RES)

Start year for RPS

2011

RPS targets

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
RPS targets (%)	0%	0%	0%	0%	0%	0%	3%	6%	9%	13%	16%	16%	17%	18%	19%	19%	21%	22%	23%	24%	25%
Retail electricity sales in MN (GWh)	66,019	66,346	66,675	67,005	67,337	67,671	68,006	68,343	68,681	69,022	69,364	69,707	70,053	70,400	70,748	71,099	71,451	71,805	72,161	72,518	72,878
Required renewable energy generation (GWh)	0	0	0	0	0	0	2,142	4,306	6,490	8,697	10,925	11,488	12,056	12,630	13,209	13,793	14,662	15,539	16,424	17,317	18,219

Initial Quantification Results: ES-5 (RES)

Summary

RPS

GHG Reductions (million tonnes CO2e)			NPV of Costs (E6 2005\$)	Cost of Saved Carbon (2005\$/tCO2 avoided)
Annual		Cumulative		
2015	2025			
6.15	13.67	110.96	\$2,750	24.8

Initial Quantification Assumptions: ES-6 (Nuclear power)

Online year for new nuclear power

2020

Upstream fuel stages considered?

1

- 1 Upstream fuel stages **are** considered for coal and nuclear generation (default)
2 Upstream fuel stages are **not** considered for coal and nuclear generation

Cost & performance characteristics of new nuclear power stations

	Units	Value	Source
Size	MW	1,100	Assumption
Contingency factor	dimensionless	1.00	Assumption
Capital	2005 \$/kW	1,802	Assumption
Transmission	2005 \$/kW	80	Assumption
Fixed O&M	2005 \$/kW-yr	63.88	Assumption
Variable O&M	2005 mills/kWh	0.47	Assumption
Fuel	2005 \$/mmbtu	2.0	Assumption
Capacity factor	%	85%	Assumption
Heat rate	btu/kWh	10,400	Assumption
Annual gross generation	GWh/yr	8,191	Assumption

Resource displaced

100%	coal
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Initial Quantification Results: ES-6 (Nuclear power)

Results assume the following assumptions:

Online year for new nuclear power: **2020**
 Upstream fuel stages considered: **Yes**
 Resource displaced: **100% coal**

Summary - No RPS

Total

GHG Reductions (million tonnes CO2e)			NPV of Costs (E6 2005\$)	Cost of Saved Carbon (2005\$/tCO2e avoided)
Annual		Cumulative		
2015	2025			
0.0	7.8	47.0	\$744	15.8

Summary - With RPS

Total

GHG Reductions (million tonnes CO2e)			NPV of Costs (E6 2005\$)	Cost of Saved Carbon (2005\$/tCO2e avoided)
Annual		Cumulative		
2015	2025			
0.0	7.7	46.2	\$744	16.1

Initial Quantification Assumptions: ES-7 (Advanced fossil fuel w/o CCR)

Number of new IGCC units 1

Online year for new IGCC unit(s) 2013

Carbon capture & storage? No

Cost & performance characteristics of new IGCC power stations

	Units	Value	Source
Size	MW	600	EIA Assumption
Contingency factor	dimensionless	0.07	EIA Assumption
Capital	2005 \$/kW	1,492	EIA Assumption
Transmission	2005 \$/kW	80	EIA Assumption
Fixed O&M	2005 \$/kW-yr	38.93	EIA Assumption
Variable O&M	2005 mills/kWh	2.94	EIA Assumption
Fuel	2005 \$/mmbtu		EIA Assumption
Capacity factor	%	75%	EIA Assumption
Heat rate	btu/kWh	8,309	EIA Assumption
Annual gross generation	GWh/yr	3,942	EIA Assumption

Resource displaced

100%	existing coal
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Initial Quantification Results: ES-6 ES-7 (Advanced fossil fuel w/o CCR)

Results assume the following assumptions:

Online year for new IGCC unit(s): **2013**
 Resource displaced: **100% existing coal**
 Carbon capture & storage? **No**

Summary - No RPS

Total

GHG Reductions (million tonnes CO2e)			NPV of Costs (E6 2005\$)	Cost of Saved Carbon (2005\$/tCO2e avoided)
Annual		Cumulative		
2015	2025			
1.0	1.0	13.0	\$686	52.9

Summary - With RPS

Total

GHG Reductions (million tonnes CO2e)			NPV of Costs (E6 2005\$)	Cost of Saved Carbon (2005\$/tCO2e avoided)
Annual		Cumulative		
2015	2025			
1.0	1.0	13.0	\$686	52.9

Initial Quantification Assumptions: ES-8 (Advanced fossil fuel w/CCR)

<u>Number of new IGCC/CCR units</u>	1
<u>Online year for new IGCC/CCR unit(s)</u>	2013
<u>Carbon capture & storage?</u>	Yes
<u>Coal CO₂e emission factor (tCO₂e/mmbtu)</u>	0.0959
<u>Sensitivities for CCR technology</u>	1

1 Central value (default)
2 High value
3 Low value

Cost & performance characteristics of new IGCC power stations

	Units	Value	Source
Size	MW	600	EIA Assumption
Contingency factor	dimensionless	0.07	EIA Assumption
Capital	2005 \$/kW	1,492	EIA Assumption
Transmission	2005 \$/kW	80	EIA Assumption
Fixed O&M	2005 \$/kW-yr	38.93	EIA Assumption
Variable O&M	2005 mills/kWh	2.94	EIA Assumption
Fuel	2005 \$/mmbtu		EIA Assumption
Capacity factor	%	75%	EIA Assumption
Heat rate	btu/kWh	8,309	EIA Assumption
Annual gross generation	GWh/yr	3,942	EIA Assumption

Cost & performance characteristics of new carbon capture & storage technology

		Range			Source
		Low	High	Central	
Capture from IGCC	2005\$/tCO ₂ captured	15.0	75.0	45.0	see note 3
Transportation	2005\$/tCO ₂ transported	1.0	8.0	4.5	see note 3
Geologic storage	2005\$/tCO ₂ injected	0.5	8.0	4.3	see note 3
Monitoring/verification	2005\$/tCO ₂ injected	0.1	0.3	0.2	see note 3
Incremental capital cost	2005 \$/kW	245	705	499	see note 3
Incremental fixed O&M	2005 \$/kW-yr	0	0	0	see note 3
Incremental variable O&M	2005 mills/kWh	0	0	0	see note 3
Unit size	MW	0	0	0	see note 1
Fuel	2004 \$/mmbtu				NA
Heat rate penalty	btu/kWh	2,697	221	1,440	see note 3
CO ₂ emission reduction	%	81%	91%	86%	see note 3
Capacity factor	%	75%	75%	75%	see note 1

Resource displaced

100%	existing coal
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Initial Quantification Results: ES-8 (Advanced fossil fuel w/CCR)

Results assume the following assumptions:

Online year for new IGCC unit(s): **2013**
 Resource displaced: **100% existing coal**
 Carbon capture & storage? **Yes**
 Carbon capture & storage technology estimate **Central value (default)**

Summary - No RPS

Total

GHG Reductions (million tonnes CO2e)			NPV of Costs (E6 2005\$)	Cost of Saved Carbon (2005\$/tCO2e avoided)
Annual		Cumulative		
2015	2025			
3.6	3.6	47.1	\$2,894	61.4

Summary - With RPS

Total

GHG Reductions (million tonnes CO2e)			NPV of Costs (E6 2005\$)	Cost of Saved Carbon (2005\$/tCO2e avoided)
Annual		Cumulative		
2015	2025			
3.6	3.6	47.1	\$2,894	61.4

Initial Quantification Assumptions/Results: ES-9 (CHP)

- Being analyzed by RCI TWG

Initial Quantification Assumptions/Results: ES-10 (Voluntary targets)

- Not quantified

Initial Quantification Assumptions/Results: ES-11 (Carbon tax)

- Being analyzed by C&T TWG

Initial Quantification

Assumptions/Results: ES-12

(Distributed renewable generation)

- Under preparation

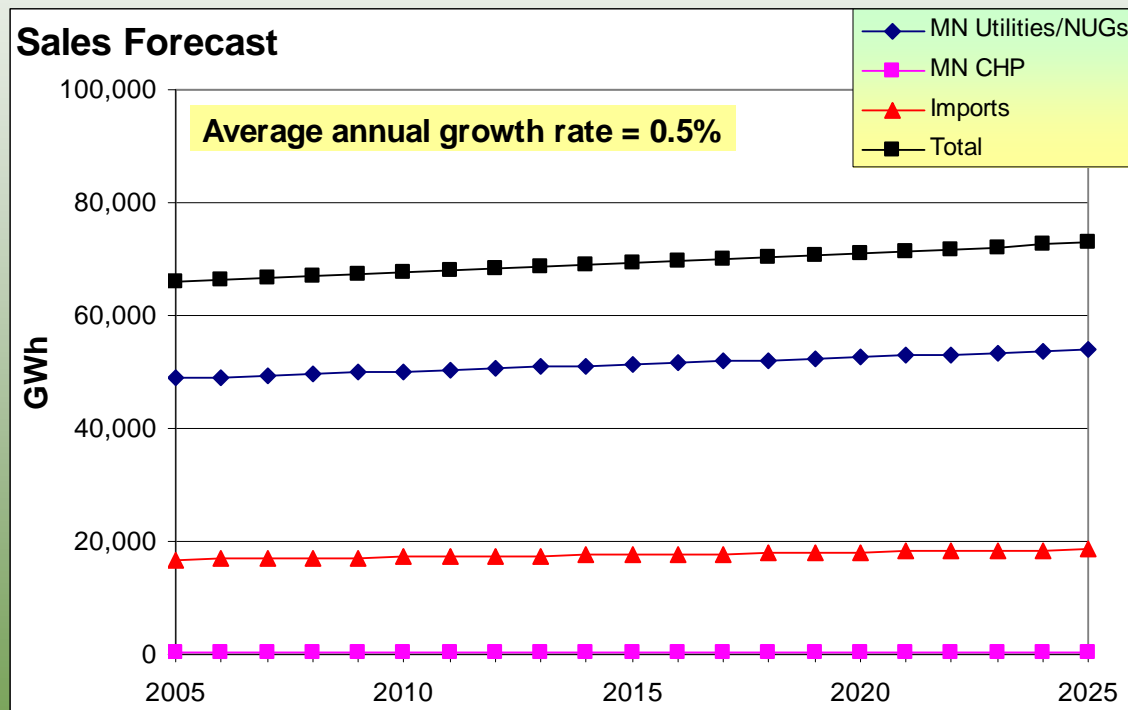
Initial Quantification

Assumptions/Results: ES-13

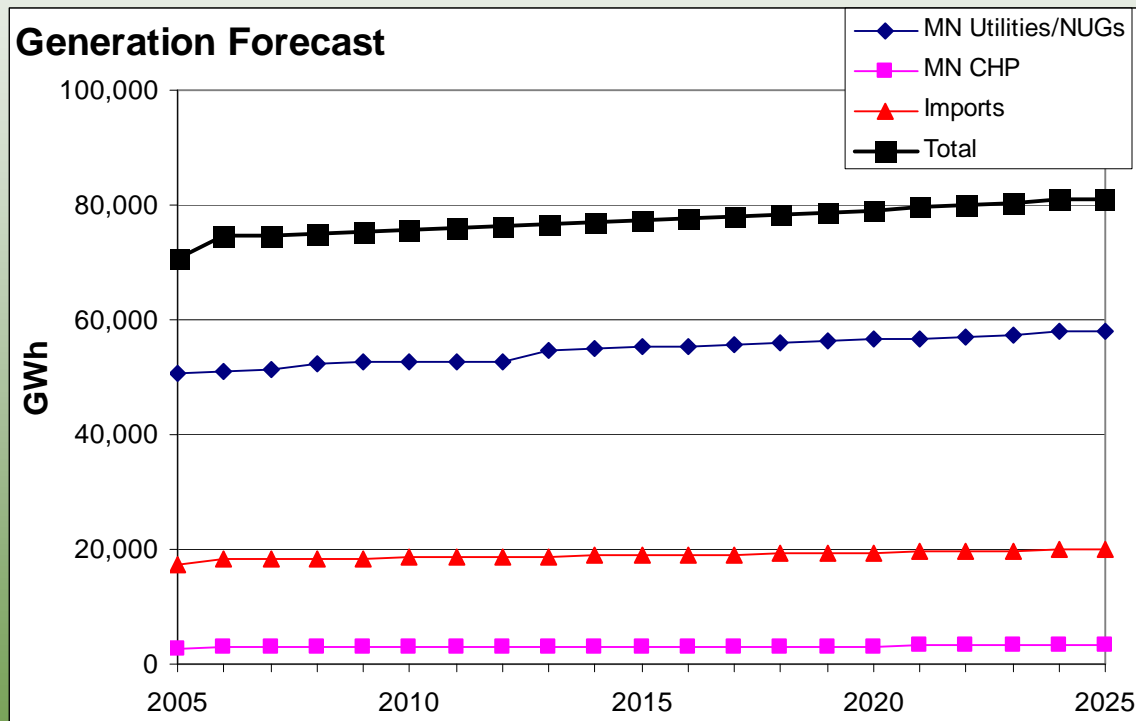
(Technology-Based Approaches)

- Not quantified

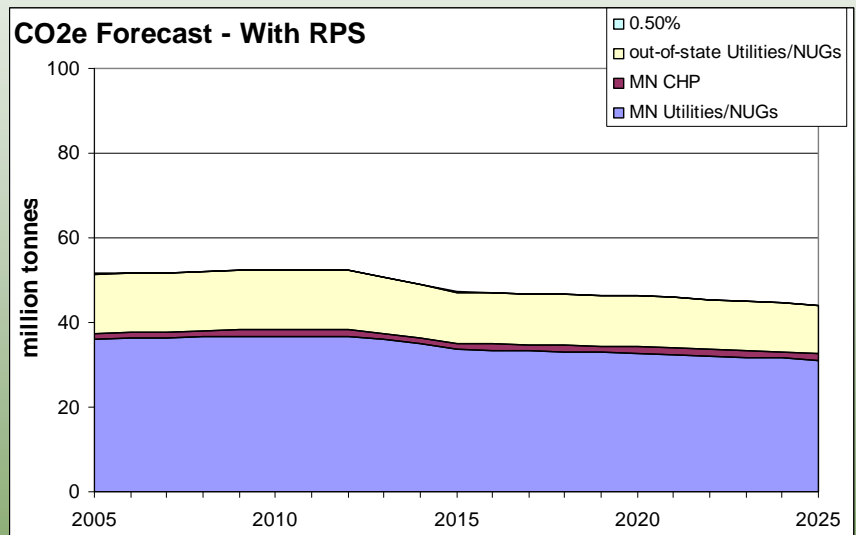
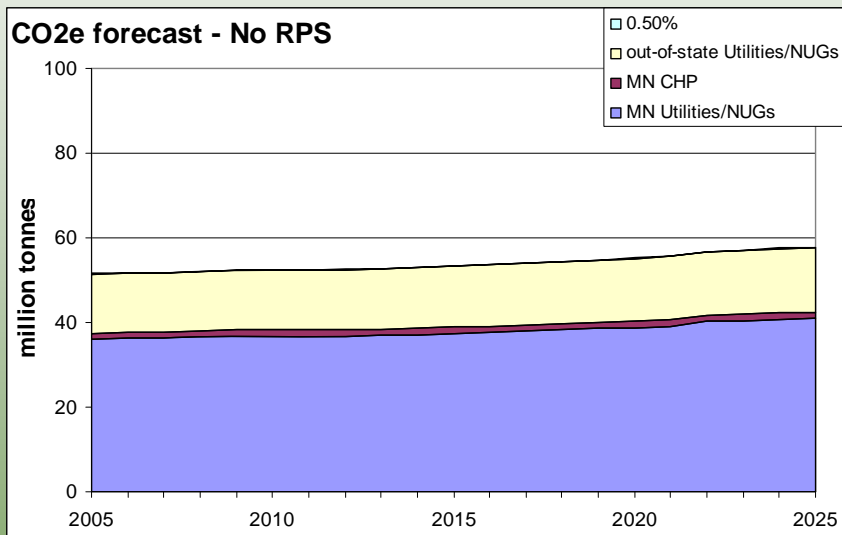
Revised GHG Forecast (Sales)



Revised GHG Forecast (Gross Generation)

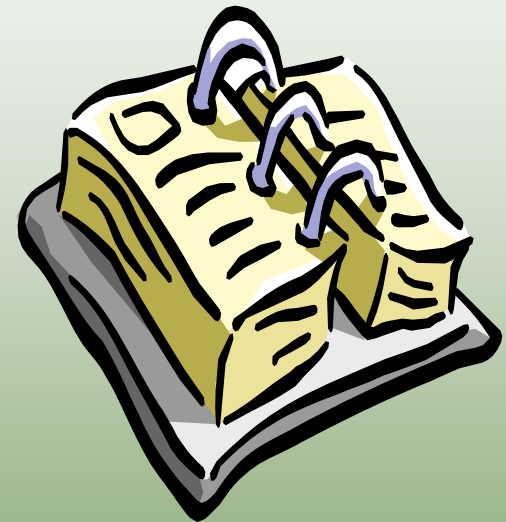


Revised GHG Forecast (CO₂e emissions)



Next TWG Meeting

- Teleconference #10
- Agenda:
 - Quantification of priority options
- **November 28 from 9:00 to 11:00 AM**
- Future Teleconferences:
 - December 6th from 10 am to 12 pm



Public Input, Announcements