Overview of MRN-NEEM Results for the EIPC Future 3 Sensitivities, Future 4, and the Future 5 Base and Soft Constraint Cases

June 28, 2011

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The results presented herein use modeling assumptions developed by EIPC, EIPC stakeholders and CRA for purposes of EIPC capacity expansion modeling. As such, these results do not necessarily reflect the opinions or views of CRA or any individual EIPC stakeholder.

Overview

- Using the EIPC stakeholder-approved input assumptions, CRA has completed modeling of:
  - Future 3 "Federal Carbon Constraint – State/Regional Implementation" for:
    - *F3 Sensitivities: F3S3 through F3S12 (F3S2 and F3S7 are reserved)*
      - The F3 "Hard Limits" selected by the SSC are applied in each of these sensitivities
  - *Future 4 "Aggressive EE/DR/DG/Smart Grid" for:*
    - *Future 4 Base (F4B) and Future 4 Sensitivities (F4S1-F4S3)*
  - *Future 5 "National RPS – Top Down Implementation" for:*
    - *Future 5 Base and 75% and 25% Soft Constraint Sensitivities (F5B, F5S1and F5S2)*

- Of the 80 total runs, 46 have now been completed.

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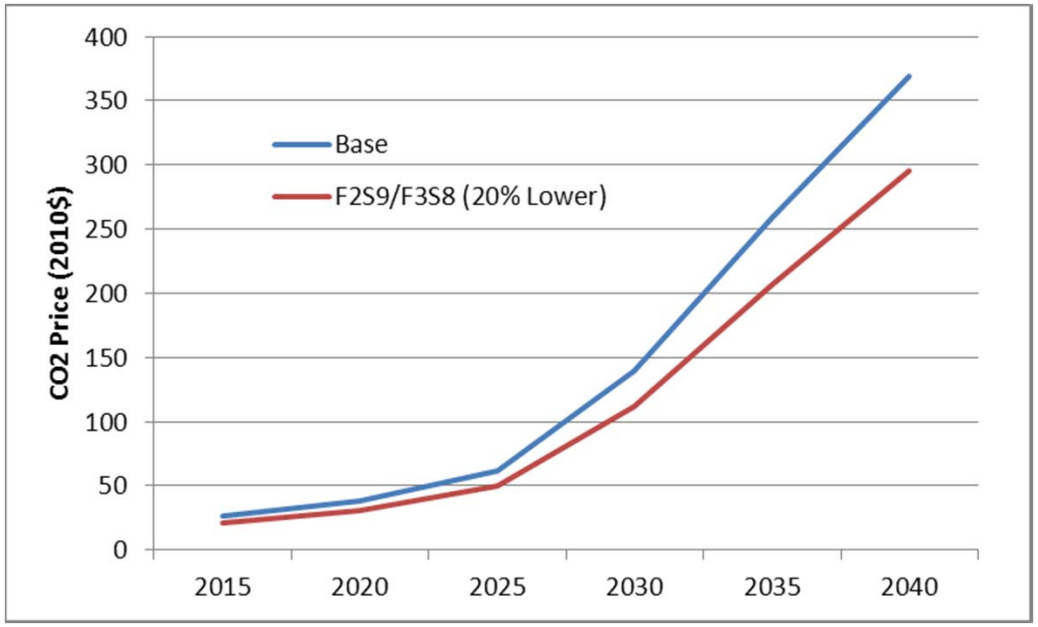
Future 2 and Future 3 Carbon Prices

- The same carbon prices derived in Future 2 were applied in NEEM in Future 3 (20% lower in F2S9 and F3S8).

Economy-wide CO_2 Price
(2010$/metric ton)



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Future 2 Results (from June 13)

- Total EI capacity in 2030 is shown below by type for Future 2 (Federal Carbon – National Implementation) in comparison to the BAU.

Installed 2030 EI Capacity by Type: BAU vs. Future 2 (GW)

		Installed Capacity in 2030											
		F1S3	F2B	F2S1	F2S2	F2S3	F2S4	F2S5	F2S6	F2S7	F2S9	F2S10	F2S11
	Total 2010	BAU Base	Fed CO2	75% Soft	25% Soft	50% Frict	High Load	Low Load	ExHi Gas	Low Gas	Low CO2	ExLo Rnw$	Hard Limit
Coal	272	199	29	30	30	30	69	16	83	22	34	33	31
Nuclear	100	105	133	130	129	132	136	127	135	105	114	134	131
CC	133	202	246	230	224	226	306	166	170	265	240	213	226
CT	120	132	106	115	116	112	128	100	113	120	119	113	112
Steam Oil/Gas	75	36	22	27	28	29	35	9	21	27	28	29	29
Hydro	45	45	50	51	52	51	52	47	51	49	51	52	51
On-Shore Wind	19	68	282	313	315	320	385	232	348	243	279	357	317
Off-Shore Wind	0	2	2	2	2	2	2	2	2	2	2	3	2
Other Renewable	4	14	13	13	14	13	14	12	21	13	13	12	13
New HQ/Maritimes	0	0	0	0	3	3	3	3	3	3	3	3	3
Other	17	17	17	17	17	17	17	17	17	17	17	17	17
Total w/o DR	783	819	901	927	930	934	1,147	731	965	866	898	967	932
DR	33	71	71	71	71	71	85	58	71	71	71	71	71
Total w/DR	816	890	971	998	1,000	1,005	1,232	789	1,035	937	969	1,037	1,003

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Future 3 Results

- Total EI capacity in 2030 is shown below by type for Future 3 (Federal Carbon – Regional/State Implementation) in comparison to the BAU.
  - F3S12 (Hard limits) builds are close to F3S1 (75%). Hard limits are used in F3S3 through F3S12.
  - Low gas/low CO_2 increase CC builds and reduce wind builds. High nuclear cost swaps CCs for nukes. High Canadian hydro imports do not change the overall EI results materially.
  - Additional "Other Renewables" are constructed in extra-low renewable costs in F3 (unlike F2).

Installed 2030 EI Capacity by Type: BAU vs. Future 3 (GW)

		Installed Capacity in 2030											
		F1S3	F3B	F3S1	F3S3	F3S4	F3S5	F3S6	F3S8	F3S9	F3S10	F3S11	F3S12
	Total 2010	BAU Base	Reg CO2	75% Soft	High Load	Low Load	ExHi Gas	Low Gas	Low CO2	Hi $ Nuke	HiCN Impt	ExLo Rnw$	Hard Limit
Coal	272	199	40	35	66	18	82	24	33	39	38	34	39
Nuclear	100	105	134	134	137	132	134	105	112	105	134	128	134
CC	133	202	256	256	335	185	190	287	267	269	253	229	252
CT	120	132	104	105	128	84	104	118	115	116	105	107	105
Steam Oil/Gas	75	36	18	18	30	11	17	19	24	18	18	25	18
Hydro	45	45	52	52	52	49	53	50	51	52	51	53	52
On-Shore Wind	19	68	199	195	233	156	213	151	170	198	193	215	197
Off-Shore Wind	0	2	2	2	2	2	10	2	2	2	2	59	2
Other Renewable	4	14	13	13	14	12	33	13	13	13	13	26	13
New HQ/Maritimes	0	0	0	3	5	3	5	3	3	5	4	4	5
Other	17	17	17	17	17	17	17	17	17	17	17	17	17
Total w/o DR	783	819	833	829	1,019	668	857	789	807	833	829	897	833
DR	33	71	71	71	85	58	71	71	71	71	71	71	71
Total w/DR	816	890	904	900	1,105	726	927	860	878	904	900	968	903

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Future 3 Results (cont.)

- EI new capacity in 2030 is shown below by NEEM region for Future 3 in comparison to the BAU.

2030 EI New Builds by Region: BAU vs. Future 3 (GW)

	Cum New Builds in 2030											
	F1S3 BAU Base	F3B Reg CO2	F3S1 75% Soft	F3S3 High Load	F3S4 Low Load	F3S5 ExHi Gas	F3S6 Low Gas	F3S8 Low CO2	F3S9 Hi $ Nuke	F3S10 HiCN Impt	F3S11 ExLo Rnw$	F3S12 Hard Limit
ENT	4	9	9	13	6	9	9	9	9	9	9	9
FRCC	16	29	29	32	26	25	18	20	18	29	37	29
IESO	5	5	5	5	5	5	5	5	5	5	5	5
MAPP_CA	2	5	5	6	2	5	5	5	5	5	5	5
MAPP_US	2	12	12	9	11	13	12	12	12	12	10	12
MISO_IN	5	21	24	22	19	13	23	22	22	22	21	22
MISO_MI	3	6	3	10	2	8	3	4	4	5	5	5
MISO_MO-IL	2	11	8	16	3	8	11	10	10	10	8	10
MISO_W	9	40	41	61	29	41	42	40	40	40	44	40
MISO_WUMS	10	9	11	18	8	8	11	10	11	10	9	10
NE	1	3	3	3	4	1	3	3	3	3	2	3
NEISO	9	9	9	9	9	11	9	9	9	9	13	9
NonRTO_Mid	1	7	7	8	6	7	7	7	7	7	7	7
NYISO_A-F	4	10	7	14	4	14	4	4	9	5	14	9
NYISO_G-I	1	1	0	2	0	0	0	0	0	0	0	0
NYISO_J-K	3	1	1	3	1	2	1	1	1	1	2	1
PJM_E	7	7	7	7	7	7	7	7	7	7	16	7
PJM_ROM	12	6	6	12	6	12	10	6	6	6	22	6
PJM_ROR	20	82	84	94	62	68	48	61	82	82	76	82
SOCO	10	23	23	29	17	20	16	16	17	23	22	23
SPP_N	3	17	17	24	15	17	23	23	17	17	20	17
SPP_S	8	38	38	50	24	36	33	33	38	37	34	37
TVA	8	11	11	16	7	11	12	11	11	11	13	11
VACAR	20	28	28	38	22	33	27	28	27	28	60	28
	165	392	389	502	296	373	339	346	371	385	456	390

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Future 3 Results (cont.)

- EI new CC builds through 2030 are shown below by NEEM region for Future 3.

2030 EI New CC Builds by Region: BAU vs. Future 3 (GW)

	Cum New CCs in 2030											
	F1S3 BAU Base	F3B Reg CO2	F3S1 75% Soft	F3S3 High Load	F3S4 Low Load	F3S5 ExHi Gas	F3S6 Low Gas	F3S8 Low CO2	F3S9 Hi $ Nuke	F3S10 HiCN Impt	F3S11 ExLo Rnw$	F3S12 Hard Limit
ENT	3	8	8	12	5	7	8	8	8	8	7	8
FRCC	13	12	13	18	9	9	15	13	15	12	12	12
IESO	1	1	1	1	1	1	1	1	1	1	1	1
MAPP_CA	2	0	0	1	0	0	0	0	0	0	0	0
MAPP_US	0	0	0	0	0	0	0	0	0	0	0	0
MISO_IN	4	20	23	21	18	12	22	21	21	21	21	21
MISO_MI	0	3	1	6	0	0	1	2	1	1	0	1
MISO_MO-IL	0	3	0	6	0	0	2	2	2	2	0	2
MISO_W	0	0	0	1	0	0	1	0	0	0	0	0
MISO_WUMS	4	7	8	9	6	6	9	8	8	8	6	8
NE	0	2	2	3	0	0	3	2	2	2	2	2
NEISO	2	2	2	2	2	2	2	2	2	2	2	2
NonRTO_Mid	1	6	6	6	3	1	7	6	6	6	5	6
NYISO_A-F	1	1	1	1	1	1	1	1	1	1	1	1
NYISO_G-I	1	0	0	1	0	0	0	0	0	0	0	0
NYISO_J-K	1	1	1	3	1	1	1	1	1	1	1	1
PJM_E	5	5	5	5	5	5	5	5	5	5	5	5
PJM_ROM	2	2	2	5	2	2	2	2	2	2	2	2
PJM_ROR	8	25	26	37	13	4	35	25	25	25	18	25
SOCO	8	12	12	19	7	10	13	13	14	12	12	12
SPP_N	2	4	2	8	2	3	6	5	5	4	3	4
SPP_S	2	5	7	12	5	4	6	6	6	5	6	5
TVA	4	9	9	13	5	5	10	9	9	9	9	9
VACAR	11	16	16	21	12	9	19	18	18	16	13	16
	75	144	145	208	96	82	169	149	152	143	125	143

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Future 3 Results (cont.)

- New EI on-shore wind capacity through 2030 is shown below by NEEM region for Future 3.

2030 EI New On-Shore Wind Builds by Region: BAU vs. Future 3 (GW)

	Cum New On-Sh Wind in 2030											
	F1S3	F3B	F3S1	F3S3	F3S4	F3S5	F3S6	F3S8	F3S9	F3S10	F3S11	F3S12
	BAU Base	Reg CO2	75% Soft	High Load	Low Load	ExHi Gas	Low Gas	Low CO2	Hi $ Nuke	HiCN Impt	ExLo Rnw$	Hard Limit
ENT	0	0	0	0	0	0	0	0	0	0	0	0
FRCC	0	0	0	0	0	0	0	0	0	0	0	0
IESO	2	2	2	2	2	2	2	2	2	2	2	2
MAPP_CA	0	0	0	0	0	0	0	0	0	0	0	0
MAPP_US	1	12	11	8	10	12	11	12	12	12	10	12
MISO_IN	0	0	0	0	0	0	0	0	0	0	0	0
MISO_MI	3	2	2	3	2	2	2	2	2	2	2	2
MISO_MO-IL	0	6	6	8	1	6	6	6	6	6	6	6
MISO_W	9	40	40	60	29	41	41	40	40	40	44	40
MISO_WUMS	1	1	1	1	1	1	1	1	1	1	1	1
NE	0	0	0	0	3	0	0	0	0	0	0	0
NEISO	5	5	5	5	5	7	5	5	5	5	9	5
NonRTO_Mid	0	0	0	0	0	0	0	0	0	0	0	0
NYISO_A-F	4	9	6	13	3	13	3	3	9	4	13	8
NYISO_G-I	0	0	0	0	0	0	0	0	0	0	0	0
NYISO_J-K	0	0	0	0	0	0	0	0	0	0	0	0
PJM_E	1	1	1	1	1	1	1	1	1	1	1	1
PJM_ROM	7	1	1	2	1	7	5	1	1	1	7	1
PJM_ROR	9	54	54	54	45	54	9	32	54	54	54	54
SOCO	0	0	0	0	0	0	0	0	0	0	0	0
SPP_N	0	12	14	16	12	12	17	17	12	12	16	13
SPP_S	3	29	27	37	17	30	25	25	30	29	26	29
TVA	0	0	0	0	0	0	0	0	0	0	0	0
VACAR	4	4	4	4	4	4	4	4	4	4	4	4
	49	180	176	214	138	194	133	152	179	175	196	179

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Future 4 Results

- Total EI capacity in 2030 is shown below by type for Future 4 (Aggressive EE/DR/DG/Smart Grid) in comparison to the BAU.
  - *Compared to the BAU, total EI demand is 17% to 33% lower by 2030 in these Future 4 cases.*
    - This yields less total capacity installed than in 2010. Most of the reduction from the BAU is in new CCs and CTs, along with more coal and steam oil/gas retirements.

Installed 2030 EI Capacity by Type: Future 4 vs. BAU (GW)

		Installed Capacity in 2030				
		F1S3	F4B	F4S1	F4S2	F4S3
	Total	BAU	Aggr	High	HiEV	XtrHi
	2010	Base	EE/DR	PHEV	OnPk	EE/DR
Coal	272	199	172	174	174	143
Nuclear	100	105	105	105	105	105
CC	133	202	138	139	142	94
CT	120	132	69	65	75	38
Steam Oil/Gas	75	36	3	3	3	1
Hydro	45	45	45	45	45	45
On-Shore Wind	19	68	54	56	56	48
Off-Shore Wind	0	2	2	2	2	2
Other Renewable	4	14	12	13	13	11
New HQ/Maritimes	0	0	0	0	0	0
Other	17	17	17	17	17	17
Total w/o DR	783	819	617	617	631	504
DR	33	71	152	153	158	186
Total w/DR	816	890	769	771	789	690
EI Demand 2030 (TWh)		3702	3008	3084	3086	2471
Change from F1S3			-19%	-17%	-17%	-33%

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Future 4 Results

- Total new EI capacity in 2030 is shown below by region for Future 4.
  - *Most of the new builds are the "forced builds" included in the Baseline Infrastructure.*

2030 EI Builds by Region: Future 4 vs. BAU (GW)

	Cum New Builds in 2030					Cum New CCs in 2030					Cum New On-Sh Wind 2030				
	F1S3	F4B	F4S1	F4S2	F4S3	F1S3	F4B	F4S1	F4S2	F4S3	F1S3	F4B	F4S1	F4S2	F4S3
	BAU	Aggr	High	HiEV	XtrHi	BAU	Aggr	High	HiEV	XtrHi	BAU	Aggr	High	HiEV	XtrHi
	Base	EE/DR	PHEV	OnPk	EE/DR	Base	EE/DR	PHEV	OnPk	EE/DR	Base	EE/DR	PHEV	OnPk	EE/DR
ENT	4	1	1	1	1	3	0	0	0	0	0	0	0	0	0
FRCC	16	5	5	5	5	13	2	2	2	2	0	0	0	0	0
IESO	5	5	5	5	5	1	1	1	1	1	2	2	2	2	2
MAPP_CA	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0
MAPP_US	2	1	1	1	1	0	0	0	0	0	1	1	1	1	0
MISO_IN	5	1	1	1	1	4	0	0	0	0	0	0	0	0	0
MISO_MI	3	2	2	2	2	0	0	0	0	0	3	2	2	2	2
MISO_MO-IL	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0
MISO_W	9	6	6	6	3	0	0	0	0	0	9	6	6	6	3
MISO_WUMS	10	2	2	2	2	4	0	0	0	0	1	1	1	1	1
NE	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
NEISO	9	7	8	8	5	2	2	2	2	2	5	3	4	4	2
NonRTO_Mid	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
NYISO_A-F	4	4	4	4	4	1	1	1	1	1	4	3	3	3	3
NYISO_G-I	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
NYISO_J-K	3	1	1	1	1	1	1	1	1	1	0	0	0	0	0
PJM_E	7	7	7	7	7	5	5	5	5	5	1	1	1	1	1
PJM_ROM	12	5	5	5	4	2	2	2	2	2	7	1	1	1	0
PJM_ROR	20	15	15	15	15	8	3	3	3	3	9	9	9	9	8
SOCO	10	8	8	8	8	8	5	5	5	5	0	0	0	0	0
SPP_N	3	1	1	1	1	2	0	0	0	0	0	0	0	0	0
SPP_S	8	4	4	4	3	2	0	0	0	0	3	2	2	2	2
TVA	8	3	3	3	3	4	1	1	1	1	0	0	0	0	0
VACAR	20	11	11	11	10	11	3	3	3	2	4	4	4	4	4
	165	93	95	95	85	75	26	26	26	25	49	36	37	37	29

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Future 5 Base Case Results

- Future 5 has a national RPS target starting at 7.5% in 2015 and reaching 30% in 2030 (MWh basis), with hydro, wind, biomass, solar, geothermal and landfill gas energy counting toward the RPS.
- The inclusion of the National RPS and the feedbacks between MRN and NEEM result in changes in GDP, gas prices and electricity demand between the BAU (F1S3) and Future 5 Base Case (F5B).
  - *U.S. GDP is about 0.3% lower in F5B than in the BAU in 2030.*
  - *Higher electricity prices and lower GDP reduce electricity demand in the EI as shown below.*

EI Electricity Demand (TWh)

	2015	2020	2025	2030	2035	2040
BAU (F1S3)	3,317	3,446	3,572	3,702	3,838	3,979
Future 5 Base (F5B)	3,310	3,389	3,512	3,609	3,757	3,895
% Reduction from BAU	0.2%	1.7%	1.7%	2.5%	2.1%	2.1%

  - *Beginning in 2020, gas prices decrease somewhat in F5B relative to the BAU (F1S3) as more renewables are installed in place of CCs.*

Gas Prices (2010 $/mmBtu Henry Hub)

	2015	2020	2025	2030	2035	2040
BAU (F1S3)	4.84	5.22	6.07	6.56	7.25	8.02
Future 5 Base (F5B)	4.87	5.10	5.71	5.84	6.46	7.26

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Summary of Results – Future 5 Base Case

- For Future 5 Base Case, additional on-shore wind is constructed to meet the national RPS.
  - Relative to the BAU (F1S3), the additional wind replaces new CCs and coal.
  - On-shore wind continues to dominate the renewable options, as its economics tend to be more favorable than other renewable types in a "national RPS".

Future 5 Base Case: New Builds/Retirements by Type for the EI in 2015, 2020 and 2030 *(GW)*

	2010 In-service	---------- Additions ----------			-------- Retirements --------			2030 In-service
		2015	2020	2030	2015	2020	2030	
Coal	271.9	8.5	0.0	0.0	69.4	25.8	8.5	176.7
Nuclear	99.8	2.7	4.5	0.0	0.0	0.6	1.5	105.0
CC	132.7	28.1	8.3	2.8	4.8	0.0	0.5	166.6
CT	120.3	4.7	8.7	4.4	2.4	0.0	0.0	135.7
Steam Oil/Gas	74.5	0.0	0.0	0.0	34.9	0.9	1.2	37.6
Hydro	44.6	0.0	2.2	5.7	0.0	0.0	0.0	52.4
On-shore Wind	18.7	22.2	38.0	157.4	0.0	0.0	0.0	236.3
Off-shore Wind	0.0	0.5	0.0	1.1	0.0	0.0	0.0	1.6
Other Renewables	3.6	2.3	3.2	4.3	0.0	0.0	0.0	13.4
New HQ/Maritimes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other	17.1	0.0	0.0	0.0	0.0	0.0	0.0	17.1
Total	783.3	69.0	64.9	175.6	111.5	27.3	11.7	942.5
DR	33.1	-1.3	16.8	22.1	0.0	0.0	0.0	70.7

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Future 5 Results

- Total EI capacity in 2030 is shown below by type for Future 5 in comparison to prior Futures.
  - *Compared to the BAU, additional on-shore wind replaces coal and CCs by 2030.*
  - *In F5S1 and F5S2, the overall builds do not change significantly from F5B, except less total wind capacity can be built to meet the same RPS as "better wind" locations can be reached.*

Installed 2030 EI Capacity by Type: Future 5 vs. BAU and Future 2 (GW)

	Installed Capacity in 2030								
		F1S3	F2B	F2S11	F3B	F3S12	F5B	F5S1	F5S2
	Total 2010	BAU Base	Fed CO2	Hard Limit	Reg CO2	Hard Limit	Nat RPS	75% Soft	25% Soft
Coal	272	199	29	31	40	39	177	175	174
Nuclear	100	105	133	131	134	134	105	105	105
CC	133	202	246	226	256	252	167	167	167
CT	120	132	106	112	104	105	136	136	143
Steam Oil/Gas	75	36	22	29	18	18	38	39	39
Hydro	45	45	50	51	52	52	52	51	51
On-Shore Wind	19	68	282	317	199	197	236	220	216
Off-Shore Wind	0	2	2	2	2	2	2	2	2
Other Renewable	4	14	13	13	13	13	13	13	13
New HQ/Maritimes	0	0	0	3	0	5	0	6	6
Other	17	17	17	17	17	17	17	17	17
Total w/o DR	783	819	901	932	833	833	942	931	933
DR	33	71	71	71	71	71	71	71	71
Total w/DR	816	890	971	1003	904	903	1013	1002	1004
EI Demand 2030 (TWh)		3702	3248	3248	3248	3248	3609	3609	3609
Change from F1S3			-12%	-12%	-12%	-12%	-3%	-3%	-3%

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Future 5 Results (cont.)

- EI new capacity builds through 2030 are shown below by NEEM region for Future 5 vs. the BAU.
  - *In F5S1 & F5S2, wind moves toward the "better" locations in SPP to meet the same RPS targets.*
    - In F5S2, NE (SPP-Nebraska) sees a large increase and MISO_W a large decrease. PJM_ROM sees an increase back to BAU levels, as the MISO and PJM_ROR wind decreases.

2030 EI Capacity by Region: Future 5 vs. BAU (GW)

	Cum New Builds in 2030					Cum New CCs in 2030					Cum New On-Sh Wind 2030				
	F1S3	F2B	F5B	F5S1	F5S2	F1S3	F2B	F5B	F5S1	F5S2	F1S3	F2B	F5B	F5S1	F5S2
	BAU Base	Fed CO2	Nat RPS	75% Soft	25% Soft	BAU Base	Fed CO2	Nat RPS	75% Soft	25% Soft	BAU Base	Fed CO2	Nat RPS	75% Soft	25% Soft
ENT	4	9	4	3	1	3	8	0	0	0	0	0	2	2	0
FRCC	16	30	10	10	10	13	12	7	7	7	0	0	0	0	0
IESO	5	5	5	5	5	1	1	1	1	1	2	2	2	2	2
MAPP_CA	2	4	5	5	5	2	0	0	0	0	0	0	0	0	0
MAPP_US	2	6	7	7	6	0	0	0	0	0	1	5	7	7	6
MISO_IN	5	57	20	1	1	4	14	0	0	0	0	42	19	0	0
MISO_MI	3	8	3	3	3	0	5	0	0	0	3	3	3	2	2
MISO_MO-IL	2	30	20	8	3	0	1	0	0	0	0	27	18	6	0
MISO_W	9	34	40	41	7	0	1	0	0	0	9	33	40	41	7
MISO_WUMS	10	18	13	12	19	4	6	0	0	0	1	11	5	1	1
NE	1	13	15	17	64	0	0	0	0	0	0	13	15	16	64
NEISO	9	9	9	9	8	2	2	2	2	2	5	5	5	5	4
NonRTO_Mid	1	6	1	1	1	1	5	0	0	0	0	0	0	0	0
NYISO_A-F	4	10	7	4	4	1	1	1	1	1	4	10	6	3	3
NYISO_G-I	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0
NYISO_J-K	3	1	2	2	2	1	1	1	1	1	0	0	0	0	0
PJM_E	7	7	7	7	7	5	5	5	5	5	1	1	1	1	1
PJM_ROM	12	6	6	6	12	2	2	2	2	2	7	1	1	1	7
PJM_ROR	20	71	27	27	17	8	28	3	3	3	9	40	20	20	10
SOCO	10	23	8	8	8	8	12	5	5	5	0	0	0	0	0
SPP_N	3	31	28	39	30	2	1	0	0	0	0	28	28	38	29
SPP_S	8	45	43	53	58	2	4	0	0	0	3	38	41	51	56
TVA	8	11	8	8	8	4	9	2	4	4	0	0	0	0	0
VACAR	20	28	19	19	19	11	15	10	9	9	4	4	4	4	4
	165	465	310	294	298	75	135	39	40	40	49	263	218	201	197

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Future 5 Results (cont.)

- F5B has more generation from wind than the BAU, but less than F2B. On-shore wind and hydro are the key capacity types meeting the national RPS requirements.

EI Generation as Percent of EI Energy Demand for Six Key Capacity Types

	BAU F1S3		F2B		F3B		F4B		F5B	
	2020	2030	2020	2030	2020	2030	2020	2030	2020	2030
CC	26%	25%	44%	31%	46%	37%	21%	16%	22%	16%
Coal	37%	38%	9%	1%	9%	2%	38%	41%	37%	31%
Nuclear	24%	22%	26%	32%	26%	32%	27%	27%	24%	23%
On-Shore Wind	4%	5%	12%	25%	10%	18%	5%	5%	7%	20%
Off-Shore Wind	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Hydro	6%	5%	6%	7%	6%	7%	6%	7%	6%	7%
Total	97%	96%	97%	97%	97%	96%	97%	96%	97%	96%

- F5B has lower U.S. electric sector CO_2 emissions than the BAU, but not as low as the national carbon futures.

U.S. Electric Sector CO2 Emissions *(Millions of metric tons)*

	2020	2025	2030	2035
F1S3 (BAU)	2,041	2,159	2,239	2,424
F2B	1,086	718	487	277
F3B	1,105	747	556	320
F4B	1,858	1,838	1,823	1,883
F5B	1,976	1,874	1,769	1,960

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Next Steps

1. Hardened Future 5 transfer limits are calculated by the MWG to use in the remaining Future 5 sensitivities using the F5S2 (25%) soft constraint results.
2. The remaining Future 5 sensitivities are run in NEEM.
3. Future 6 Base Case (F6B) and soft-constraint sensitivity (F6S1) are run, and a soft constraint report is created for the MWG to calculate the hardened limits to use for the remaining F6 sensitivities using the F6S1 (25%) soft constraint results.
4. As time permits, F7B (nuclear resurgence) and F7S1 will be completed, and a soft constraint report created. Similarly, as time permits, F8B, F8S1 and F8S2 and an F8 soft constraint report.
5. Based on the last SSC call:
   – The F2S8 and F3S7 “high carbon” sensitivities are reserved, and the F3S2 and F6S8 friction/hurdles sensitivities are eliminated.