

Overview of Results for EIPC Additional Future 1 and 8 Sensitivities

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Overview

- Using the EIPC stakeholder-approved input assumptions, CRA has completed modeling of:
 - Future 8 “Combined Federal Climate and Energy Policy”:
 - F8S7: Hardened limits from F8S1 (75%), with Flat CO₂ prices after 2030, intra-MISO CC adjustments, and on-shore wind adjustments in MISO, SPP, MAPP_US, and NYISO_A-F.
 - Future 1: Business as Usual
 - F1S17: Prior Base Case (F1S3) with intra-MISO CT adjustments and a higher reserve value for SPP intermittent capacity.
- Of the 80 total runs, all 80 have now been completed.

Future 8 (Combined Federal Climate and Energy Policy) Results

- Total EI capacity in 2030 is shown below by type for Future 8 in comparison to the BAU.
 - F8S1 (OL75) was used as the basis for the hard limits used in F8S3, F8S4 and F8S7.
 - In comparison to F8S1, F8S7 has higher CC builds (like F8S6), but a similar amount of wind builds.

Installed 2030 EI Capacity by Type: BAU vs. Future 8 (GW)

	Total 2010	Installed Capacity in 2030								
		F1S3	F8B	F8S1	F8S2	F8S3	F8S4	F8S5*	F8S6*	F8S7*
		BAU	CO2+	75%	25%	Low	Hi	75%w	75%w	Flat
		Base	RPS	Soft	Soft	Rnw\$	RPS	FltCO2	FltCO2	CO2
Coal	272	199	17	17	18	18	18	10	10	10
Nuclear	100	105	137	135	133	139	136	134	134	134
CC	133	202	210	199	186	181	190	215	213	208
CT	120	132	61	64	71	75	69	56	59	66
Steam Oil/Gas	75	36	9	4	4	4	4	5	5	4
Hydro	45	45	49	49	52	51	50	49	49	50
On-Shore Wind	19	68	245	263	287	294	303	259	259	261
Off-Shore Wind	0	2	2	2	2	3	2	2	2	2
Other Renewable	4	14	12	12	13	12	12	12	12	12
New HQ/Maritimes	0	0	0	0	3	5	5	0	0	5
Other	17	17	17	17	17	17	17	17	17	17
Total w/o DR	783	819	759	762	786	799	805	759	759	770
DR	33	71	152	152	152	152	152	152	152	152
Total w/DR	816	890	912	915	938	951	958	912	912	923

* F8S5 and F8S6 include intra-MISO CC and on-shore wind build adjustments. F8S6 and F8S7 also include on-shore wind build adjustments for SPP, MISO_W, MAPP_US and NYISO_A-F.

Future 8 Results (cont.)

- El new capacity thru 2030 is shown below by region for Future 8. For F8S7, in comparison to F8S1:
 - *F8S7 has more wind in MISO_W , and the MISO CCs and MISO eastern wind are dispersed throughout the MISO regions.*

2030 New El Capacity by Region: Future 8 (GW)

	Cum New CCs in 2030										Cum New On-Sh Wind in 2030									
	F1S3	F8B	F8S1	F8S2	F8S3	F8S4	F8S5*	F8S6*	F8S7*		F1S3	F8B	F8S1	F8S2	F8S3	F8S4	F8S5*	F8S6*	F8S7*	
	BAU	CO2+	75%	25%	Low	Hi	75%FI	75%FI	Flat		BAU	CO2+	75%	25%	Low	Hi	75%FI	75%FI	Flat	
	Base	RPS	Soft	Soft	Rnw\$	RPS	CO2	CO2	CO2		Base	RPS	Soft	Soft	Rnw\$	RPS	CO2	CO2	CO2	
ENT	3	6	4	2	2	3	5	5	3	0	0	0	0	2	0	0	0	0	0	
FRCC	13	11	10	10	11	11	11	11	11	0	0	0	0	0	0	0	0	0	0	
IESO	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	
MAPP_CA	2	1	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	
MAPP_US	0	0	0	0	0	0	0	0	0	1	6	10	11	5	8	8	9	9	9	
MISO_IN	4	15	17	11	10	14	6	8	8	0	39	29	0	31	43	26	21	11	11	
MISO_MI	0	3	1	0	0	1	5	5	5	3	3	3	2	3	3	9	9	9	9	
MISO_MO-IL	0	0	0	0	0	0	5	5	5	0	26	6	6	11	19	27	18	13	13	
MISO_W	0	0	0	0	0	0	4	4	4	9	27	61	96	71	69	45	55	68	68	
MISO_WUMS	4	4	5	10	5	5	4	4	4	1	9	1	1	1	8	3	3	3	3	
NE	0	0	0	0	0	0	0	0	0	0	12	15	18	19	16	14	13	16	16	
NEISO	2	2	2	2	2	2	2	2	2	5	5	5	5	5	5	5	5	5	5	
NonRTO_Mid	1	4	5	4	3	4	6	6	6	0	0	0	0	0	0	0	0	0	0	
NYISO_A-F	1	1	1	1	1	1	1	1	1	4	5	6	3	8	3	4	6	6	6	
NYISO_G-I	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
NYISO_J-K	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	
PJM_E	5	5	5	5	5	5	5	5	5	1	1	1	1	1	1	1	1	1	1	
PJM_ROM	2	2	2	2	2	2	2	2	2	7	1	1	1	1	1	1	1	1	1	
PJM_ROR	8	26	21	13	13	16	31	28	22	9	26	13	9	13	19	13	13	12	12	
SOCO	8	10	10	10	11	10	12	12	12	0	0	0	0	0	0	0	0	0	0	
SPP_N	2	0	0	0	0	0	0	0	0	0	26	41	66	52	42	37	37	42	42	
SPP_S	2	0	0	0	0	0	0	0	0	3	33	46	43	45	40	40	41	41	41	
TVA	4	6	6	4	4	6	7	7	6	0	0	0	0	0	0	0	0	0	0	
VACAR	11	12	11	9	11	11	11	11	11	4	4	4	4	4	4	4	4	4	4	
	75	109	101	86	81	92	117	115	108	49	226	244	268	275	284	240	240	243	243	

* F8S5 and F8S6 include intra-MISO CC and on-shore wind build adjustments. F8S6&F8S7 also include on-shore wind adjustments for SPP, MISO_W, MAPP_US and NYISO_A-F.

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Future 1 (Business as Usual) Results

- Total EI capacity in 2030 is shown below by type for F1S3 (old base case) and F1S17.
 - As shown, the results are essentially identical from a total EI standpoint.

Installed 2030 EI Capacity by Type: BAU F1S3 v F1S17 (GW)

		Installed Capacity in 2030	
		F1S3	F1S17*
	Total	BAU	BAU
	2010	Base	Base
Coal	272	199	199
Nuclear	100	105	105
CC	133	202	202
CT	120	132	132
Steam Oil/Gas	75	36	36
Hydro	45	45	45
On-Shore Wind	19	68	68
Off-Shore Wind	0	2	2
Other Renewable	4	14	14
New HQ/Maritimes	0	0	0
Other	17	17	17
Total w/o DR	783	819	818
DR	33	71	71
Total w/DR	816	890	889

* F8S17 include intra-MISO CT adjustments and increased SPP intermittent resource reserve value.

Future 1 Results (cont.)

- El new capacity through 2030 is shown below by region for F1S3 v F1S17:
 - *As shown, results are essentially identical, except MISO CTs are dispersed throughout MISO in F1S17.*

2030 New El Capacity by Region: BAU F1S3 v F1S17 (GW)

	New Builds		New CCs		New OnS Wind		Coal Retire		New CTs	
	F1S3	F1S17*	F1S3	F1S17*	F1S3	F1S17*	F1S3	F1S17*	F1S3	F1S17*
	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU
	Base	Base	Base	Base	Base	Base	Base	Base	Base	Base
ENT	4	4	3	3	0	0	1	1	0	0
FRCC	16	16	13	13	0	0	1	1	2	2
IESO	5	5	1	1	2	2	6	6	0	0
MAPP_CA	2	2	2	2	0	0	1	1	0	0
MAPP_US	2	2	0	0	1	1	1	1	1	1
MISO_IN	5	5	4	3	0	0	1	1	0	1
MISO_MI	3	4	0	0	3	3	4	4	0	1
MISO_MO-IL	2	3	0	0	0	0	2	2	0	1
MISO_W	9	10	0	0	9	9	3	3	0	1
MISO_WUMS	10	6	4	4	1	1	3	3	5	1
NE	1	1	0	0	0	0	0	0	0	0
NEISO	9	9	2	2	5	5	3	3	0	0
NonRTO_Mid	1	1	1	1	0	0	1	1	0	0
NYISO_A-F	4	4	1	1	4	4	2	2	0	0
NYISO_G-I	1	1	1	1	0	0	0	0	0	0
NYISO_J-K	3	3	1	1	0	0	0	0	1	1
PJM_E	7	7	5	5	1	1	4	3	0	0
PJM_ROM	12	12	2	2	7	7	8	8	0	0
PJM_ROR	20	20	8	8	9	9	20	20	0	0
SOCO	10	10	8	8	0	0	9	9	0	0
SPP_N	3	3	2	2	0	0	0	0	0	0
SPP_S	8	7	2	2	3	3	2	2	1	1
TVA	8	8	4	4	0	0	5	5	2	2
VACAR	20	20	11	11	4	4	6	6	1	1
	165	165	75	75	49	49	82	82	13	13

* F1S17 includes intra-MISO CT build adjustments and increased SPP intermittent resource reserve value

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Proposed Three Selected Scenario Results

- Total EI capacity in 2030 is shown below by the proposed three selected “build-out” scenarios.
 - Regional RPS in F6S10 leads to fewer CCs and more on-shore and off-wind shore wind and other renewables than in the BAU.
 - CO₂ pricing in F8S7 leads to reduced coal and steam oil/gas and increased nuclear and on-shore wind.

Installed 2030 EI Capacity by Type: Three Selected Scenarios (GW)

		Installed Capacity in 2030		
		F1S17	F6S10	F8S7
	Total	BAU	Hard	Flat
	2010	Base	Limit	CO2
Coal	272	199	178	10
Nuclear	100	105	105	134
CC	133	202	157	208
CT	120	132	134	66
Steam Oil/Gas	75	36	38	4
Hydro	45	45	52	50
On-Shore Wind	19	68	159	261
Off-Shore Wind	0	2	38	2
Other Renewable	4	14	37	12
New HQ/Maritimes	0	0	1	5
Other	17	17	17	17
Total w/o DR	783	818	916	770
DR	33	71	71	152
Total w/DR	816	889	987	923

Proposed Three Selected Scenarios Results (cont.)

- EI new capacity thru 2030 by region is shown below for the proposed three selected scenarios:
 - *The regional RPS in F6S10 results in significant on-shore wind builds in PJM; these move to MISO and SPP in F8S7.*

2030 New EI Capacity by Region: Three Selected Scenarios (GW)

	New Builds			New CCs			New On-Sh Wind			Coal Retire		
	F1S17	F6S10	F8S7	F1S17	F6S10	F8S7	F1S17	F6S10	F8S7	F1S17	F6S10	F8S7
	BAU	Hard	Flat	BAU	Hard	Flat	BAU	Hard	Flat	BAU	Hard	Flat
	Base	Limit	CO2	Base	Limit	CO2	Base	Limit	CO2	Base	Limit	CO2
ENT	4	2	4	3	1	3	0	0	0	1	1	8
FRCC	16	9	31	13	4	11	0	0	0	1	1	9
IESO	5	5	5	1	1	1	2	2	2	6	6	6
MAPP_CA	2	5	4	2	0	0	0	0	0	1	2	2
MAPP_US	2	7	9	0	0	0	1	6	9	1	1	4
MISO_IN	5	1	20	3	0	8	0	0	11	1	1	15
MISO_MI	4	3	14	0	0	5	3	2	9	4	4	11
MISO_MO-IL	3	3	20	0	0	5	0	0	13	2	2	14
MISO_W	10	18	71	0	0	4	9	18	68	3	3	13
MISO_WUMS	6	14	8	4	0	4	1	1	3	3	3	8
NE	1	3	16	0	0	0	0	2	16	0	0	3
NEISO	9	8	9	2	2	2	5	4	5	3	3	3
NonRTO_Mid	1	1	6	1	0	6	0	0	0	1	2	10
NYISO_A-F	4	4	7	1	1	1	4	3	6	2	2	2
NYISO_G-I	1	0	0	1	0	0	0	0	0	0	0	0
NYISO_J-K	3	3	1	1	1	1	0	0	0	0	0	0
PJM_E	7	16	7	5	5	5	1	1	1	3	4	4
PJM_ROM	12	14	6	2	2	2	7	7	1	8	11	16
PJM_ROR	20	61	37	8	3	22	9	54	12	20	25	60
SOCO	10	14	21	8	5	12	0	0	0	9	11	25
SPP_N	3	11	42	2	0	0	0	11	42	0	1	8
SPP_S	7	26	43	2	0	0	3	24	41	2	2	13
TVA	8	10	8	4	1	6	0	0	0	5	6	15
VACAR	20	48	25	11	3	11	4	4	4	6	11	20
	165	286	416	75	30	108	49	141	243	82	102	270

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2030 Energy Source by Future (Hard Limits, if Run)

- El generation as a percent of demand, El energy demand , and El CO₂ emissions are shown below for 2030 for each Future.
 - Results for the Base transfer limits are shown for F1 (BAU), F4 and F7
 - Hard transfer limit results are shown for F2, F3, F5, F6 and F8.
 - BAU is F1S17. Hard limits cases are F2S11, F3S12, F5S10, F6S10, and F8S7
 - Proposed selected scenarios are highlighted.

2030 El Generation as Percent of El Demand for Six Key Capacity Types, El Demand, and El CO₂ Emissions

	BAU S17	F2 Hard	F3 Hard	F4B	F5 Hard	F6 Hard	F7B	F8 Hard
CC	25%	26%	37%	16%	15%	13%	19%	26%
Coal	38%	1%	2%	41%	32%	33%	39%	0%
Nuclear	22%	31%	32%	27%	23%	23%	27%	35%
On-Shore Wind	5%	30%	18%	5%	20%	13%	5%	27%
Off-Shore Wind	0%	0%	0%	0%	0%	4%	0%	0%
Hydro	5%	7%	7%	7%	6%	6%	6%	8%
Total	96%	96%	96%	96%	96%	91%	96%	96%
Demand (TWh)	3702	3248	3248	3008	3609	3609	3700	3008
<i>Change from BAU</i>		-12%	-12%	-19%	-3%	-3%	0%	-19%
CO2 (MilMetricTons)	1716	296	408	1367	1310	1316	1650	264
<i>Change from BAU</i>		-83%	-76%	-20%	-24%	-23%	-4%	-85%