Summary of MRN-NEEM Results for EIPC BAU Sensitivity 3: Alternative EPA Regulations

April 20, 2011

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Overview

- Using the EIPC stakeholder-approved input assumptions, CRA has completed MRN-NEEM modeling of the Business-as-Usual ("BAU") Future, Sensitivity 3 ("F1S3").
- BAU Sensitivity 3 changes in comparison to the BAU Base Case ("F1B"):
  - *EPA regulations modified to be more consistent with recently proposed regulations*
  - *Other changes:*
    - Landfill gas capacity limits updated
    - Coal Creek unit relocated to MISO_W region
    - Nebraska (NE) wind given 6% value for reserves (same as SPP_S and SPP_N)
    - Future NE, SPP_S and SPP_N wind units all counted 100% to regional RPS.
    - Existing/planned retrofits updated for the Columbia coal unit in MISO_WUMS.
    - Capacity of the new Oak Creek 2 unit in MISO_WUMS updated.
    - $0.01/MWh added to $0 friction charges so output report will show flows in one direction.

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Detailed Summary Reports

- As before, a detailed summary of modeling results in excel-readable format was created for stakeholders to review, including a Generation Report, Capacity Report and Transmission Report.
- Several improvements were made to the output reports:
  - *The Capacity Report includes nuclear uprates in new builds, and includes nuclear plants reaching their end of license in retirements.*
  - *Off-shore wind, pulverized coal, IGCC, and IGCC w/CCS are separately identified in the Generation and Capacity Reports.*
  - *The Transmission Report lists prices by NEEM region by load block by year (as well as flows, transfer limits, and hurdles).*
- No more changes to the output reports are planned at this time. The format should remain the same hereafter.

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Summary of Results – BAU Base Case (March 20 Results)

- For the BAU Base Case completed on March 20, the Eastern Interconnection new capacity and retirements by capacity type were as shown below:
  - *Minor revisions were made to this summary table from the March 20 version.*

BAU Base Case: New Builds and Retirements by Capacity Type for the Eastern Interconnection
2015, 2020 and 2030 (GW)

	2010 In-service	---------- Additions ----------			-------- Retirements --------			2030 In-service
		2015	2020	2030	2015	2020	2030	
Coal	271.9	8.4	0.0	3.3	69.7	47.6	0.0	166.4
Nuclear	99.8	2.7	4.5	0.0	0.0	0.6	1.5	105.0
CC	132.7	30.4	45.3	23.2	5.7	0.0	0.0	225.8
CT	120.3	4.9	10.2	3.3	0.9	0.0	0.0	137.8
Steam Oil/Gas	74.5	0.0	0.0	0.0	35.2	0.6	0.4	38.3
Hydro	44.6	0.0	0.0	0.0	0.0	0.0	0.0	44.6
On-shore Wind	18.7	22.2	12.7	13.0	0.0	0.0	0.0	66.6
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	3.3	5.9	0.0	0.0	0.0	14.3
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	69.8	75.9	49.8	111.5	48.2	1.9	818.2
DR	33.1	-1.3	16.8	22.1				70.7

In practice, the model is run for the year 2010 as well, for reporting purposes retirements/additions for 2010/2015 have been cumulated in 2015. 2030 includes additions and retirements for both the 2025 and 2030 model year results.

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Summary of Results – BAU Sensitivity 3 (New Results)

- For the just-completed BAU Sensitivity 3, the EI capacity expansion results are shown below.
  - *In comparison to the BAU Base Case, 2015 results are similar, but coal retirements in 2020 are significantly reduced. As of 2030, there are 32 GW more of coal capacity in service.*

BAU Sensitivity 3: New Builds and Retirements by Capacity Type for the Eastern Interconnection
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	66.9	14.8	0.0	198.7
Nuclear	99.8	2.7	4.5	0.0	0.0	0.6	1.5	105.0
CC	132.7	30.7	18.1	26.2	5.7	0.0	0.0	202.0
CT	120.3	4.7	4.4	4.5	2.0	0.0	0.0	131.9
Steam Oil/Gas	74.5	0.0	0.0	0.0	37.1	0.6	0.4	36.4
Hydro	44.6	0.0	0.0	0.0	0.0	0.0	0.0	44.6
On-shore Wind	18.7	22.2	12.1	14.8	0.0	0.0	0.0	67.8
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	3.3	4.5	0.0	0.0	0.0	13.7
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	71.6	42.5	51.0	111.7	16.0	1.9	818.8
DR	33.1	-1.3	16.8	22.1				70.7

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Key Drivers of Near-term Retirements

- Stakeholder assumptions for forced builds, demand response ("DR"), and load growth are summarized below assuming no economic builds or retirements take place.
  - *With no economic builds or retirements, the EI is long capacity through 2030.*
    - 96 GW long in 2015 and 48 GW long in 2030
    - Forced builds add 37 GW of capacity by 2020, and DR grows by 39 GW from 2015 to 2030.
  - *New economic builds to meet RPS requirements will yield an even longer capacity situation.*

Existing Eastern Interconnection Capacity and Forced Builds/Retirements in Comparison to Demand *(GW)*

Capacity is after adjustment for reserve value of renewables and fixed interchange.

	2015	2020	2025	2030
Starting Capacity	769.3	801.7	806.6	806.9
- Forced Builds	47.5	5.9	0.3	0.0
- Forced Retirements	(15.1)	(1.0)	0.0	(1.5)
Capacity this Year	801.7	806.6	806.9	805.4
- DR	31.8	48.6	68.2	70.7
Capacity with DR	833.5	855.2	875.1	876.1
Peak Load w/Reserves	737.6	770.6	798.9	828.3
Capacity above Reserves	95.8	84.6	76.3	47.8

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Key Drivers of Near-term Retirements (cont.)

- Future EPA regulations are less stringent/costly in BAU Sensitivity 3, however:
  - 95% of large coal plants still require at least one retrofit, and many require multiple retrofits
    - Retrofits include scrubbers, SCRs, cooling water upgrades, baghouses, upgraded ESPs, and activated carbon injection (ACI).

- Low load growth, high DR, and high forced builds combine to make both coal and oil/gas steam units economically retire in significant numbers.
  - *55 GW of coal and 35 GW of steam oil/gas units economically retire in the EI by 2015.*
    - *In addition, there are forced retirements of 12 GW of coal and 2 GW of steam oil/gas.*
  - *Another 15 GW of coal fired capacity retires by 2020 as the EPA regulations come into place.*

- It is anticipated that the mix of retirements will shift more toward steam oil/gas in higher gas price and delayed EPA regulation sensitivities.

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Summary of Results – Coal Retirements by NEEM Region

- BAU Sensitivity 3 coal retirements are similar in 2015 and lower in 2020.

Coal Retirements by EI NEEM Region (MW)

		BAU Base		BAU Sensitivity 3	
	Existing 2010	Retired by 2015	Retired by 2020	Retired by 2015	Retired by 2020
ENT	8,309	953	1,128	893	893
FRCC	9,463	1,134	4,055	466	1,335
IESO	6,416	6,416	6,416	6,416	6,416
MAPP_CA	1,746	1,010	1,010	1,009	1,009
MAPP_US	4,661	1,788	2,087	716	896
MISO_IN	14,747	395	2,742	1,361	1,361
MISO_MI	10,792	3,203	5,462	2,326	3,513
MISO_MO-IL	13,964	2,039	5,184	1,025	2,057
MISO_W	12,820	339	6,293	1,926	2,928
MISO_WUMS	7,545	1,857	4,404	2,411	2,672
NE	3,878	-	1,643	0	0
NEISO	2,571	2,251	2,571	2,250	2,570
NonRTO_Midwest	10,630	1,300	2,013	1,101	1,101
NYISO_A-F	2,252	2,252	2,252	2,252	2,252
NYISO_G-I	368	368	368	368	368
NYISO_J-K	-	-	-	0	0
PJM_E	3,853	3,285	3,853	3,223	3,791
PJM_ROM	16,381	8,045	8,566	8,045	8,045
PJM_ROR	59,868	13,312	25,656	13,374	19,510
SOCO	25,335	9,693	9,693	8,556	8,556
SPP_N	7,883	-	2,620	0	375
SPP_S	13,140	2,181	3,377	1,580	1,580
TVA	15,159	3,803	8,179	3,803	4,544
VACAR	20,136	4,079	7,687	3,758	5,936
Total	271,916	69,702	117,258	66,858	81,708
		26%	43%	25%	30%

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Summary of Results – Wind Builds by NEEM Region

- Wind builds are similar to the BAU Base Case. However, new wind in SPP is now mostly in SPP_S.

Cumulative New Wind Capacity by EI NEEM Region (MW)

NEEM Region	Future 1 BAU: Base Case			Future 1 BAU, Sensitivity 3		
	2015	2020	2030	2015	2020	2030
ENT	0	0	0	0	0	0
FRCC	0	0	0	0	0	0
IESO	2,106	2,106	2,106	2,106	2,106	2,106
MAPP_CA	302	302	302	302	302	302
MAPP_US	421	778	1,224	421	942	1,224
MISO_IN	0	0	0	0	0	0
MISO_MI	2,000	2,000	2,718	2,000	2,000	2,600
MISO_MO-IL	300	300	300	300	300	300
MISO_W	2,801	4,935	8,871	2,801	4,787	8,770
MISO_WUMS	969	969	969	969	969	969
NE	202	2,628	2,628	202	202	202
NEISO	231	2,903	4,385	231	3,132	5,280
NonRTO_Midwest	0	0	0	0	0	0
NYISO_A-F	2,476	3,186	3,186	2,476	3,186	3,547
NYISO_G-I	0	60	60	0	60	60
NYISO_J-K	0	0	0	0	0	0
PJM_E	1,150	1,150	1,150	1,150	1,150	1,150
PJM_ROM	480	902	7,040	480	480	7,040
PJM_ROR	8,326	8,326	8,517	8,326	8,326	8,517
SOCO	0	0	0	0	0	0
SPP_N	0	257	370	0	0	210
SPP_S	430	580	580	430	2,893	3,347
TVA	0	0	0	0	0	0
VACAR	1	3,500	3,500	1	3,500	3,500
Total	22,195	34,882	47,907	22,195	34,336	49,125

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Summary of Results – New CCs by NEEM Region

- In BAU Sensitivity 3, CC builds are reduced given the reduced amount of coal retirements.

Cumulative New CCs by EI NEEM Region (MW)

NEEM Region	Future 1 BAU: Base Case			Future 1 BAU, Sensitivity 3		
	2015	2020	2030	2015	2020	2030
ENT	184	1,366	2,273	831	1,780	2,743
FRCC	1,517	8,984	15,078	1,517	6,855	12,949
IESO	1,263	1,263	1,263	1,263	1,263	1,263
MAPP_CA	913	1,424	2,007	913	1,424	2,007
MAPP_US	0	0	0	0	0	0
MISO_IN	0	7,239	8,947	0	1,428	3,543
MISO_MI	0	0	802	0	0	0
MISO_MO-IL	0	0	0	0	0	0
MISO_W	0	0	0	0	0	0
MISO_WUMS	0	4,368	5,093	0	3,245	3,652
NE	0	0	0	0	0	0
NEISO	2,050	2,050	2,050	2,050	2,050	2,050
NonRTO_Midwest	0	1,460	1,744	0	556	786
NYISO_A-F	639	639	639	639	639	639
NYISO_G-I	0	0	1,150	0	0	1,310
NYISO_J-K	1,175	1,175	1,175	1,175	1,175	1,175
PJM_E	4,634	4,634	4,634	4,634	4,634	4,634
PJM_ROM	1,679	1,679	1,679	1,679	1,679	1,679
PJM_ROR	3,077	9,871	15,319	3,077	3,197	8,387
SOCO	5,027	5,426	7,143	5,027	5,214	7,964
SPP_N	0	3,708	3,708	0	1,835	2,203
SPP_S	0	3,548	4,573	0	406	2,393
TVA	1,418	6,924	6,924	1,418	3,292	4,428
VACAR	6,777	9,889	12,632	6,455	8,139	11,238
Total	30,352	75,647	98,831	30,678	48,810	75,043

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