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# **Process Overview and Interim Results Discussion**

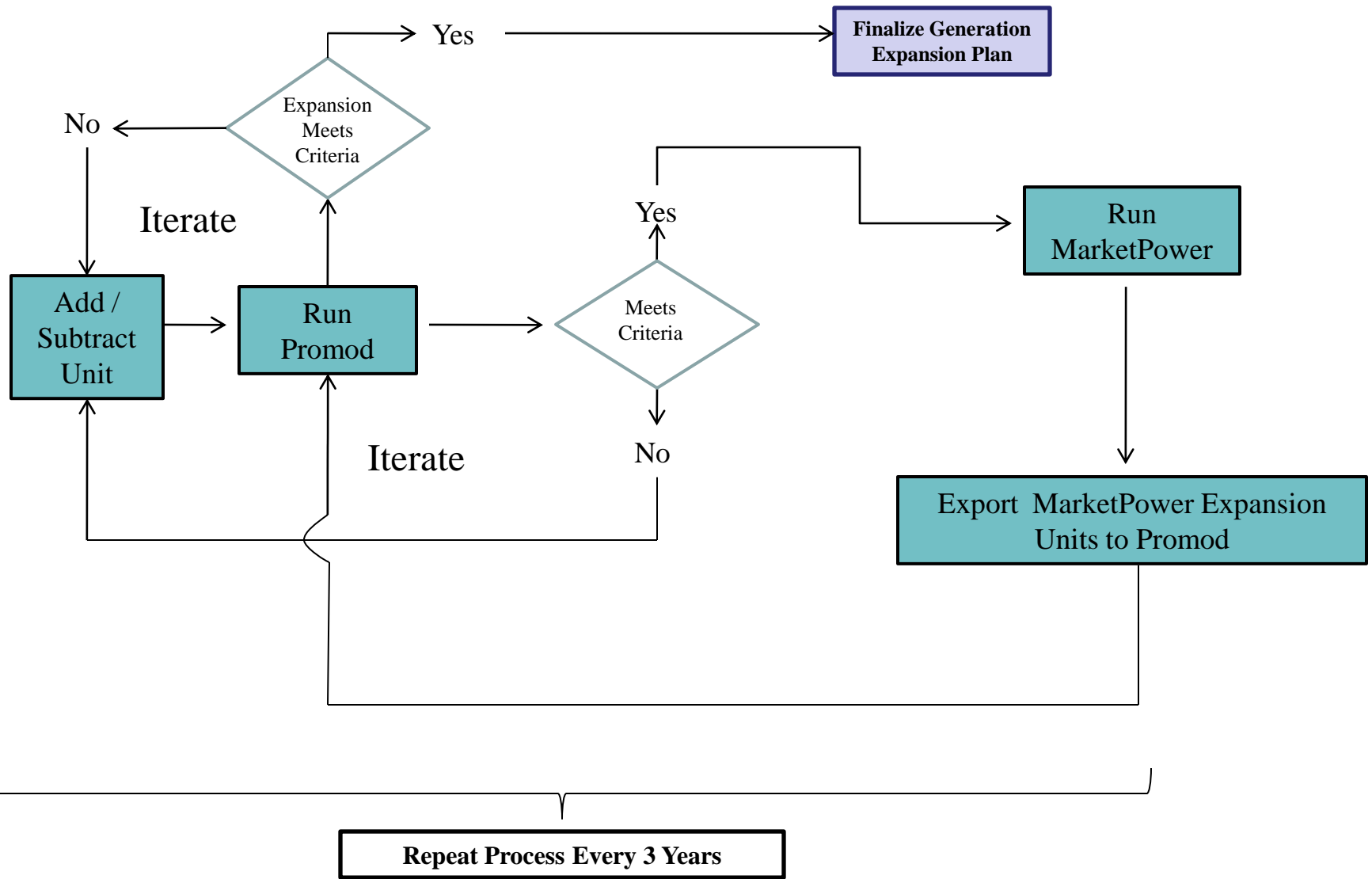
**May 2011**

# Agenda

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- **Process Overview**
- **BAU Scenario**
  - Interim Generation Expansion Results
    - No PTC
    - With PTC
  - Sensitivities
    - High Natural Gas Price (EIA plus \$5/mmbtu)
    - High Natural Gas Price with PTC

# Flowchart of Process



# Financial Criteria

- **Start with input assumptions (from Generic Database Characteristics spreadsheet)**
- **Model uses financial accounting metrics to calculate net cash flows**
- **Revenue for year 1 results from Promod run**
  - Promod captures hourly LMP's against hourly generation of the unit
  - Revenue from 1 year Promod run is then escalated for future years by respective change in natural gas price
    - Assumption: natural gas remains the marginal fuel
    - This is to develop a forecasted stream of revenues over the life of the project
      - Annual Revenue: natural gas price x market heat rate x generation of unit
- **Determined a Net Present Value (NPV) of the project from the net cash flows**
- **Calculated the Internal Rate of Return from the NPV**
  - The project had to meet a 16% threshold

# Model / Process Considerations

- **These results are intended to show how directional changes in the model inputs affect the generation development results.**
- **Several items/model updates could have significant impact on results:**
  - Inclusion of incremental ancillary service requirements and revenues (where applicable due to differences in resource characteristics)
  - Enforcing reserve margin of 13.75%
  - Inclusion of scarcity pricing during spinning reserves use



# Expansion Results

# BAU Expansion Plan Results

Additions in 2014 are units with I/As:

- Coal: Sandy Creek (925 MW)
- Wind: Archer-Young, Gunsight Mtn., Penascal, Senate, Sherbino Mesa (872 MW)

Total economic expansion builds in 2030:

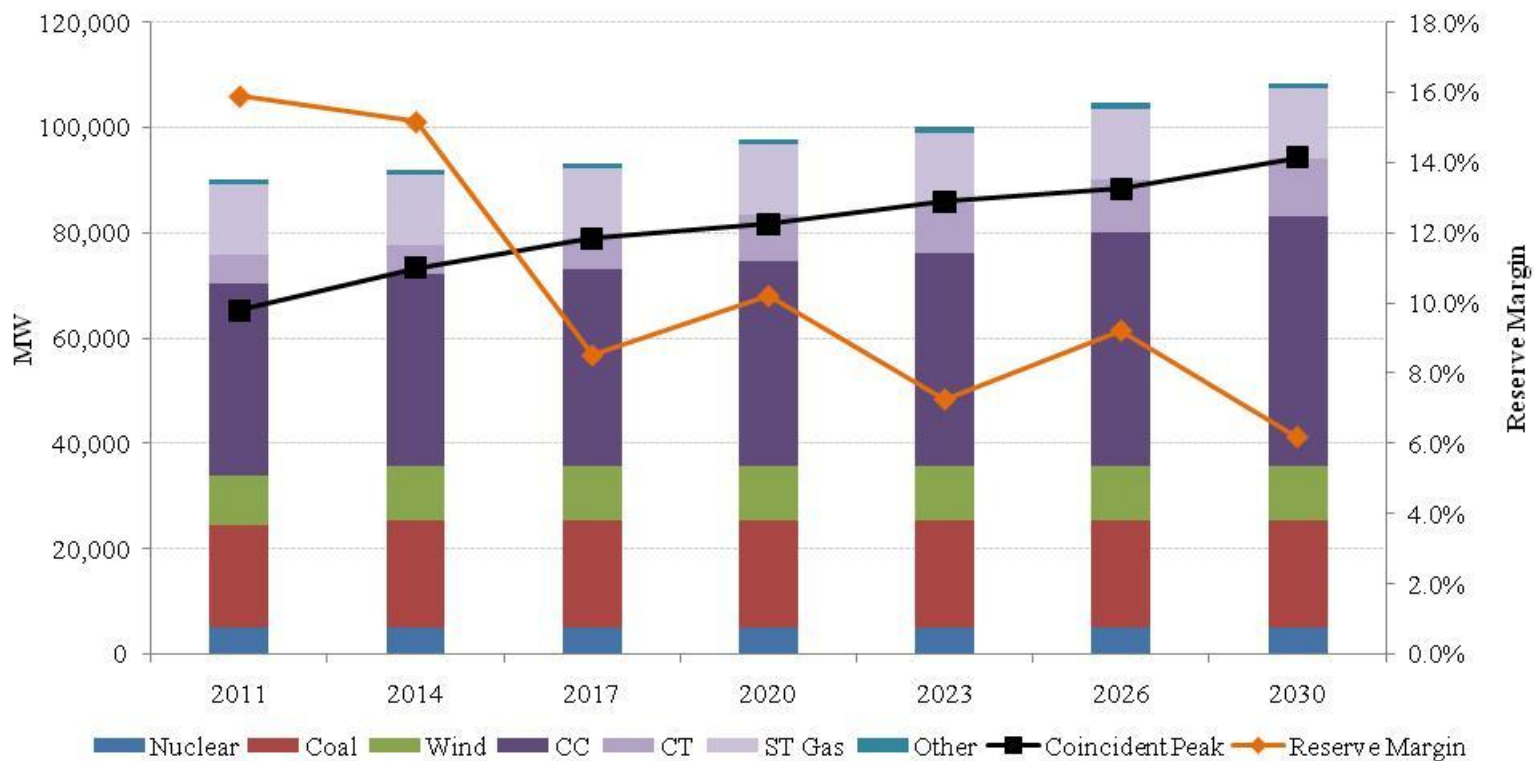
- 27 combined cycles – 10,800 MWs
- 57 combustion turbines – 5,700 MWs
- Total thermal additions – 16,500 MWs

Description	Units	2010 Actual	2011	2014	2017	2020	2023	2026	2030
CC Adds	MW			-	800	1,600	1,600	4,000	2,800
CT Adds	MW			-	400	3,000	700	500	1,100
Coal Adds	MW			925	-	-	-	-	-
Nuclear Adds	MW			-	-	-	-	-	-
Other Adds	MW			-	-	-	-	-	-
Wind Adds	MW			872	-	-	-	-	-
Annual Capacity Additions	MW			1,797	1,200	4,600	2,300	4,500	3,900
Cumulative Capacity Additions	MW			1,797	2,997	7,597	9,897	14,397	18,297
Reserve Margin	%	21.4	15.9	15.2	8.5	10.2	7.2	9.2	6.2
Coincident Peak	MW	65,776	65,206	73,375	78,869	81,665	85,928	88,318	94,318
Average LMP	\$/MWh	34.41	37.42	42.51	56.76	63.23	73.69	81.50	87.75
Natural Gas Price	\$/mmbtu	4.38	4.50	4.63	5.10	5.68	6.47	7.35	8.39
Average Market Heat Rate	MMbtu/MWh	7.86	8.32	9.18	11.14	11.14	11.38	11.09	10.46
Natural Gas Generation	%	38.2	41.3	45.8	47.0	49.3	51.0	53.0	59.3
Coal Generation	%	39.5	37.8	36.5	34.3	33.0	31.7	30.6	31.4
Wind Generation	%	7.8	9.2	7.3	8.4	8.0	7.7	7.4	7.6
Scarcity Hours	HRS	-	-	-	29	33	42	49	56
Unserved Energy	GWhs	-	-	-	24.1	39.9	63.9	60.1	68.8

# Capacity and Coincident Peak Changes: BAU

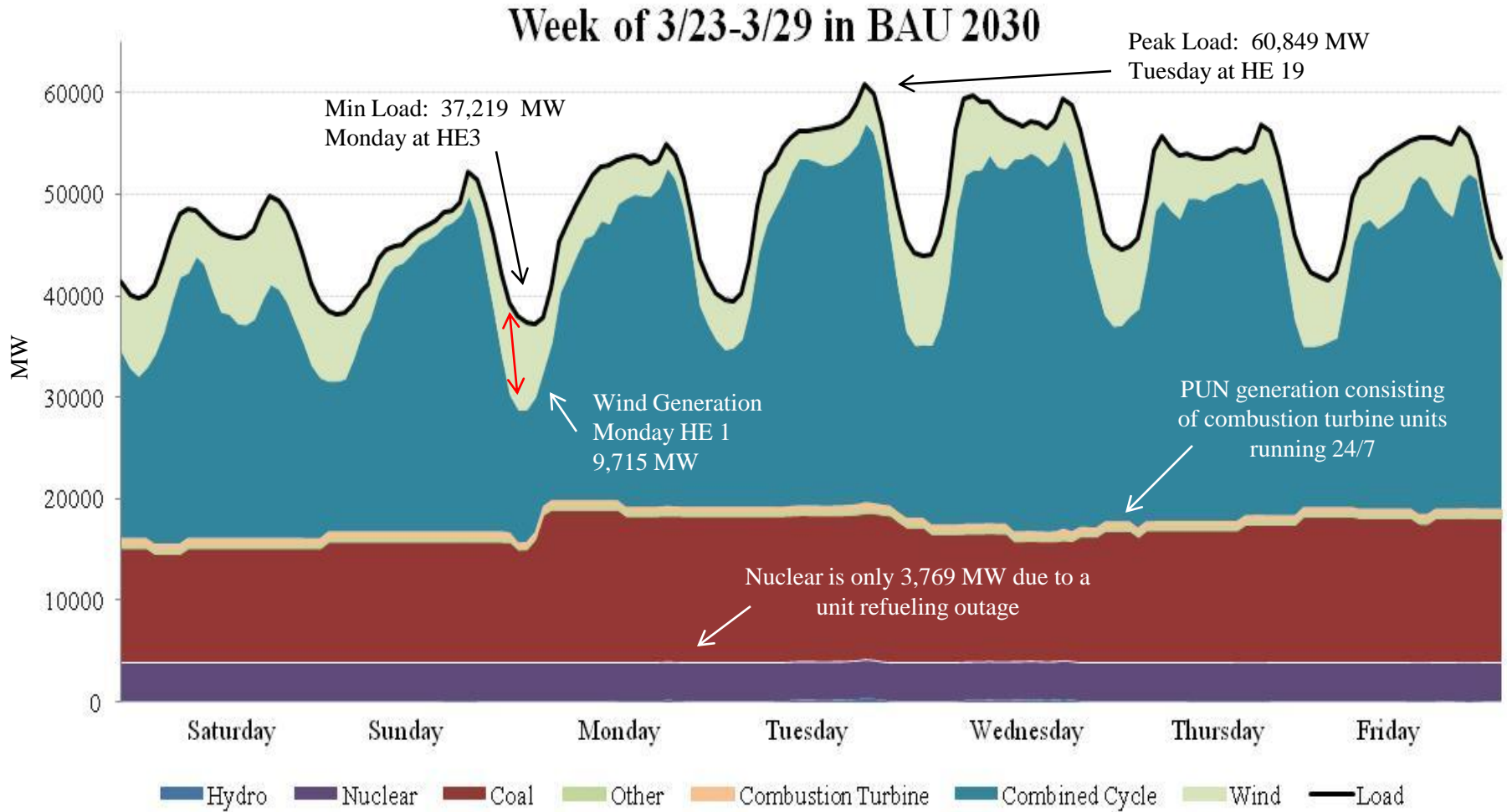
2030 capacity by fuel type:

- 65% Natural gas
- 19% Coal
- 5% Nuclear
- 10% Wind
- 1% Other – Hydro, Biomass, and LFG

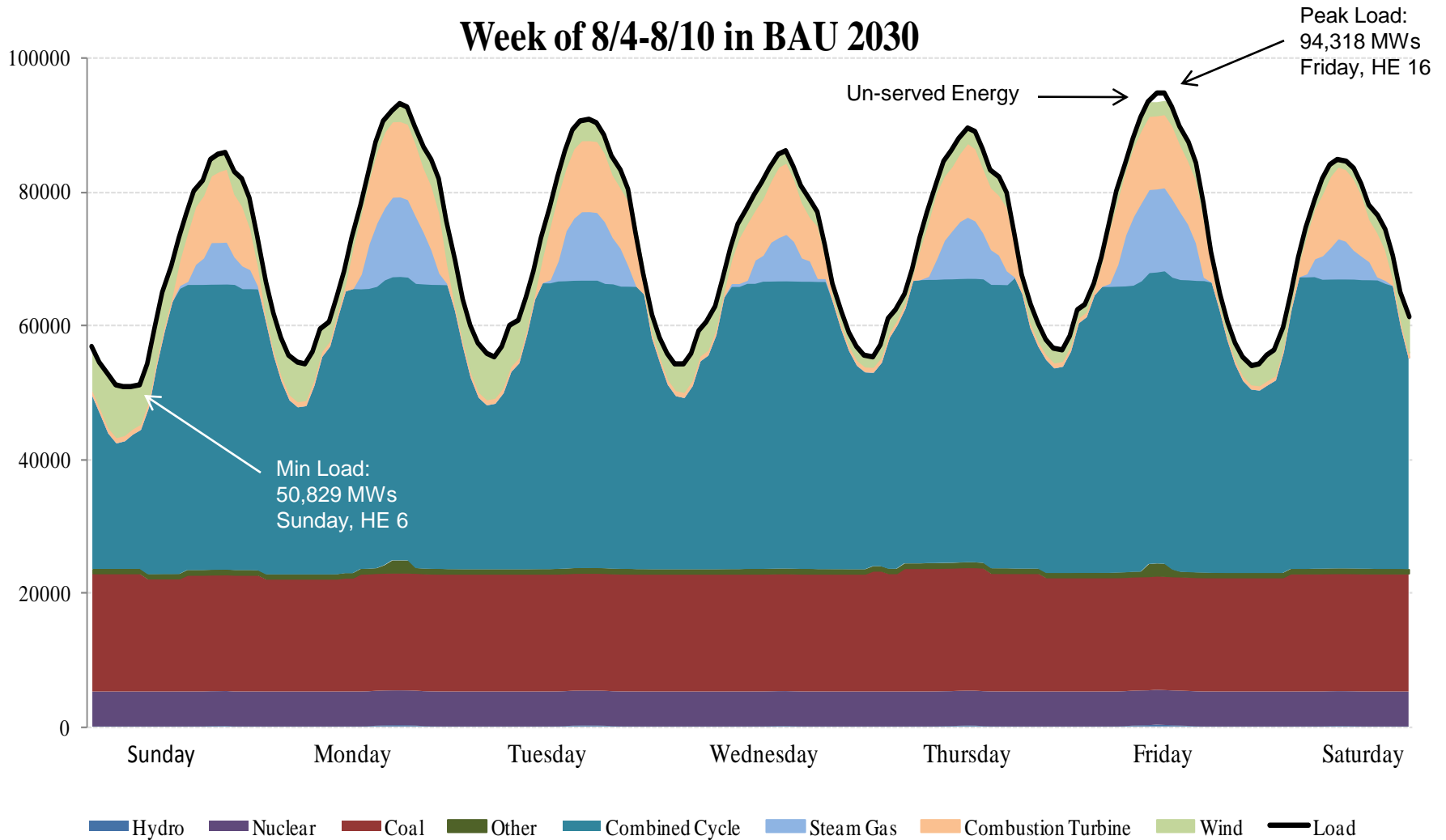




# Weekly Generation Pattern



# Weekly Generation Pattern



# BAU with PTC Expansion Plan Results

Total economic wind expansion MWs by 2030:

- 25,250 MWs; total wind on entire system – 35,600 MWs

Total economic thermal expansion builds in 2030:

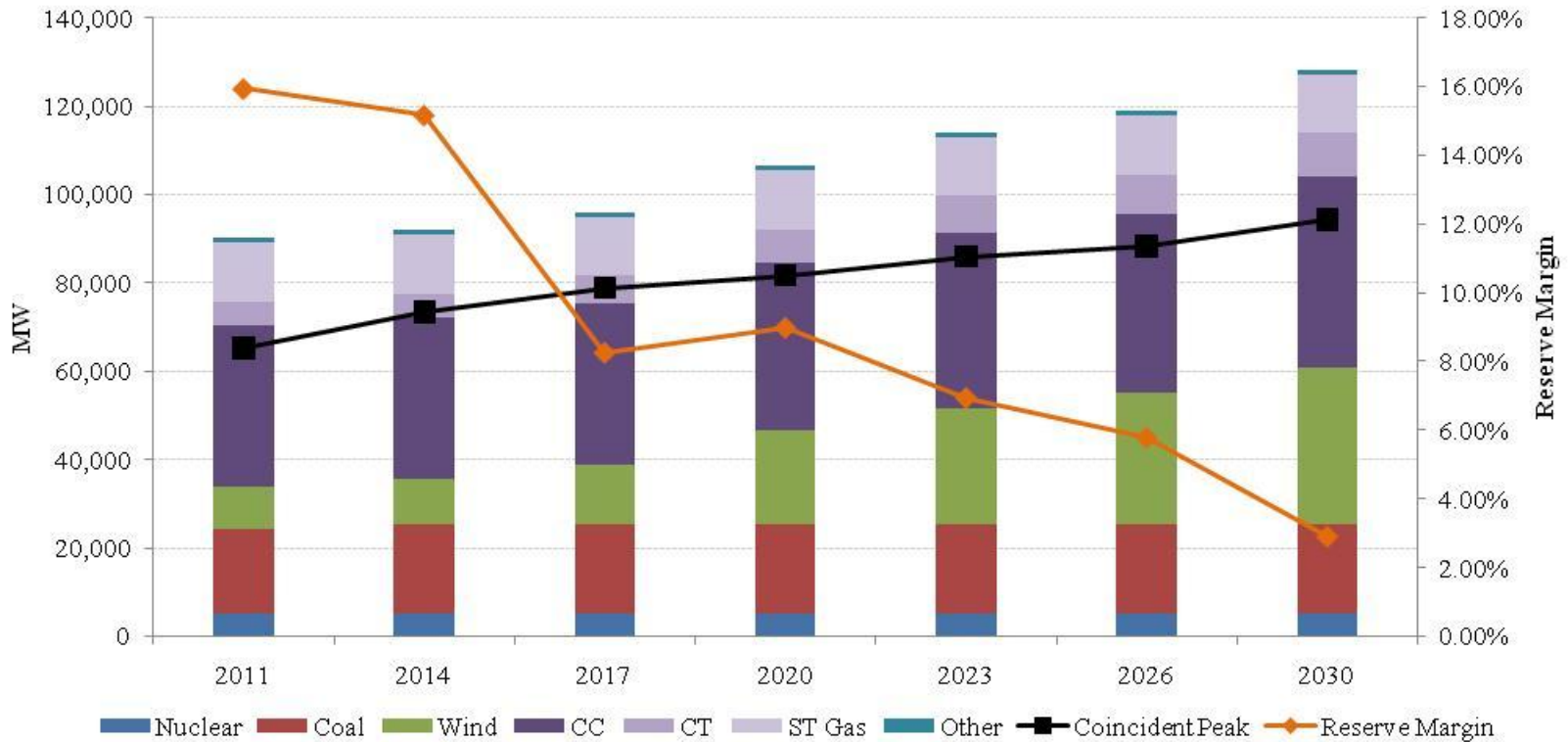
- 17 combined cycles – 6,800 MWs
- 42 combustion turbines – 4,200 MWs
- Total thermal additions – 11,000 MWs

Description	Units	2010 Actual	2011	2014	2017	2020	2023	2026	2030
CC Adds	MW			-	-	1,600	1,600	800	2,800
CT Adds	MW			-	700	1,500	1,000	500	500
Coal Adds	MW			925	-	-	-	-	-
Nuclear Adds	MW			-	-	-	-	-	-
Other Adds	MW			-	-	-	-	-	-
Wind Adds	MW			872	3,250	7,500	5,000	3,500	6,000
Annual Capacity Additions	MW			1,797	3,950	10,600	7,600	4,800	9,300
Cumulative Capacity Additions	MW			1,797	5,747	16,347	23,947	28,747	38,047
Reserve Margin	%	21.4	15.9	15.2	8.3	9.0	6.9	5.8	2.9
Coincident Peak	MW	65,776	65,206	73,375	78,869	81,665	85,928	88,318	94,318
Average LMP	\$/MWh	34.41	37.42	42.51	57.86	66.85	67.00	73.68	78.55
Natural Gas Price	\$/mmbtu	4.38	4.50	4.63	5.10	5.68	6.47	7.35	8.39
Average Market Heat Rate	MMbtu/MWh	7.86	8.32	9.18	11.35	11.77	10.36	10.02	9.36
Natural Gas Generation	%	38.2	41.3	45.8	40.7	41.6	40.4	40.3	39.3
Coal Generation	%	39.5	37.8	36.5	34.2	32.3	30.6	29.2	27.3
Wind Generation	%	7.8	9.2	7.3	11.0	16.5	19.7	21.5	24.6
Scarcity Hours	HRS	-	-	-	32	52	37	40	37
Unserved Energy	GWhs	-	-	-	36.2	88.3	60.7	75.9	92.8

# Capacity and Coincident Peak Changes: BAU with PTC

2030 capacity by fuel type:

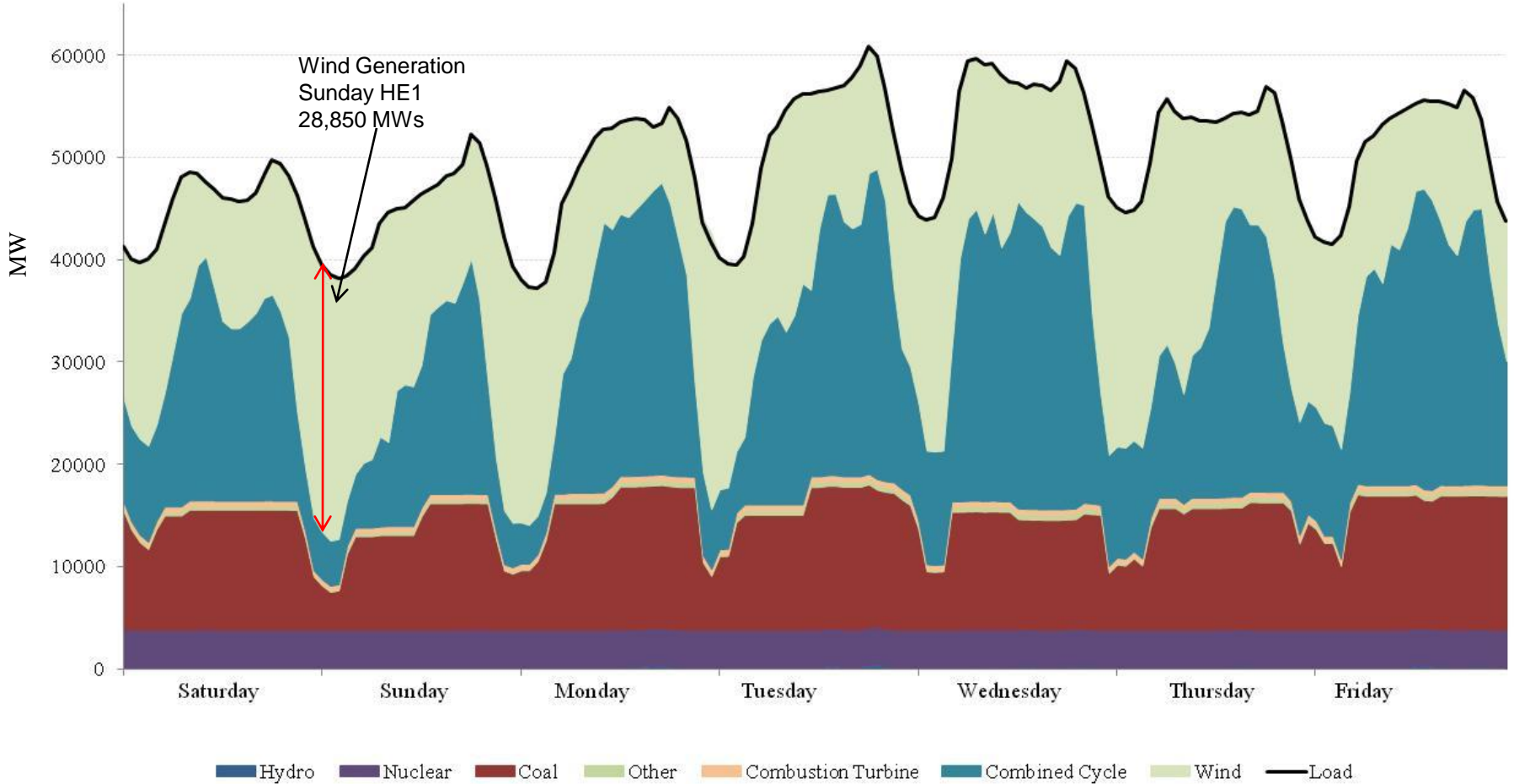
- 51% Natural gas
- 16% Coal
- 4% Nuclear
- 28% Wind
- 1% Other – Hydro, Biomass, and LFG



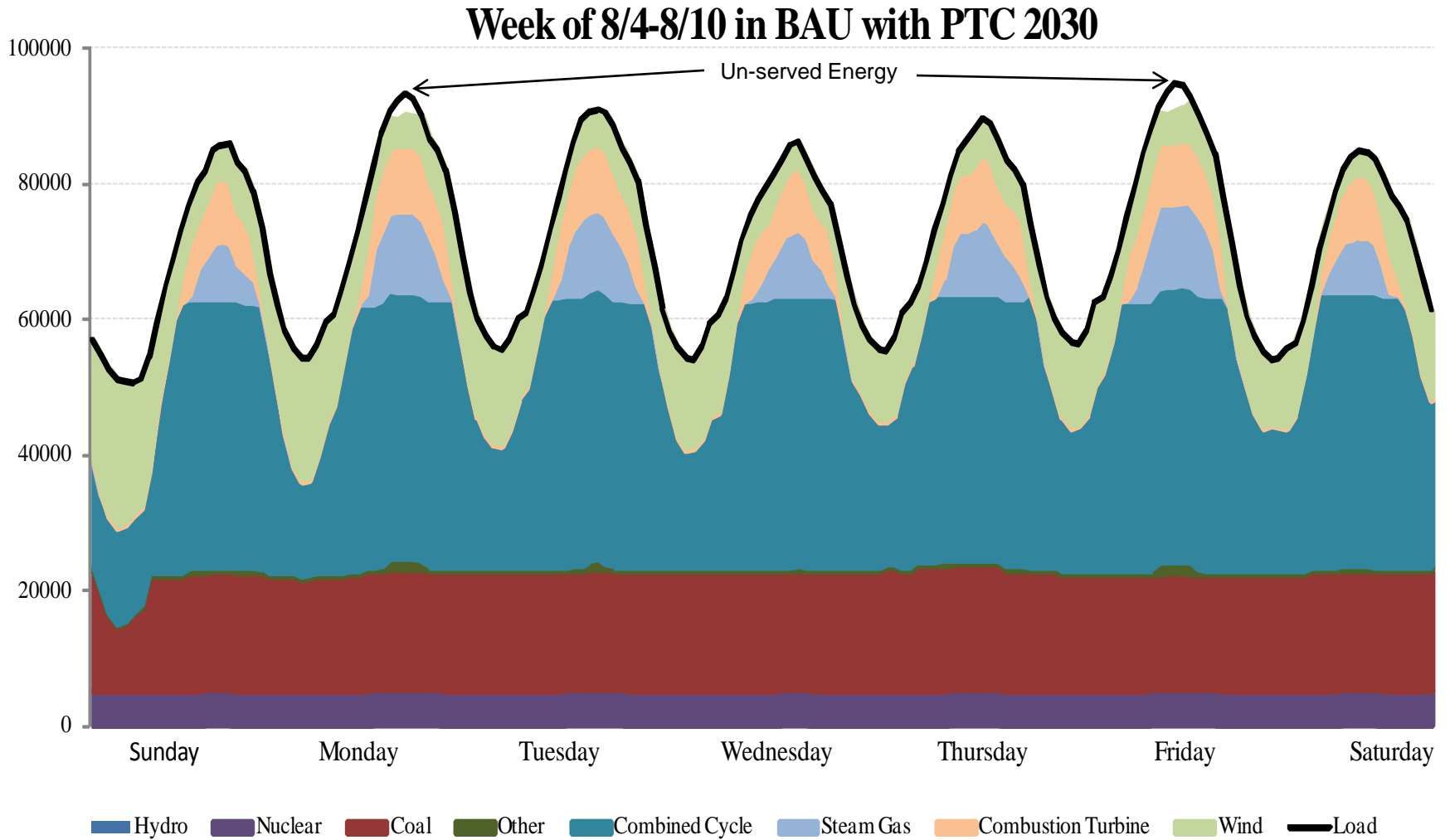
# Weekly Generation Pattern

Will require further  
A/S analysis

### Week of 3/23-3/29 in BAU with PTC 2030



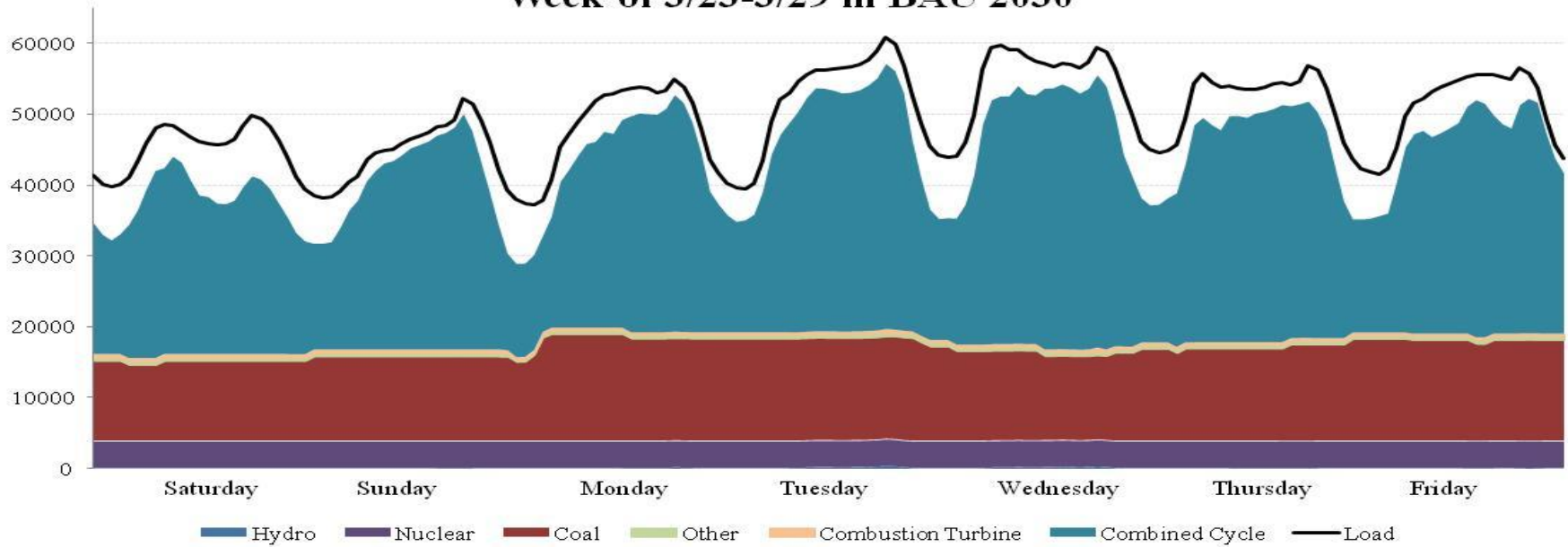
# Weekly Generation Pattern



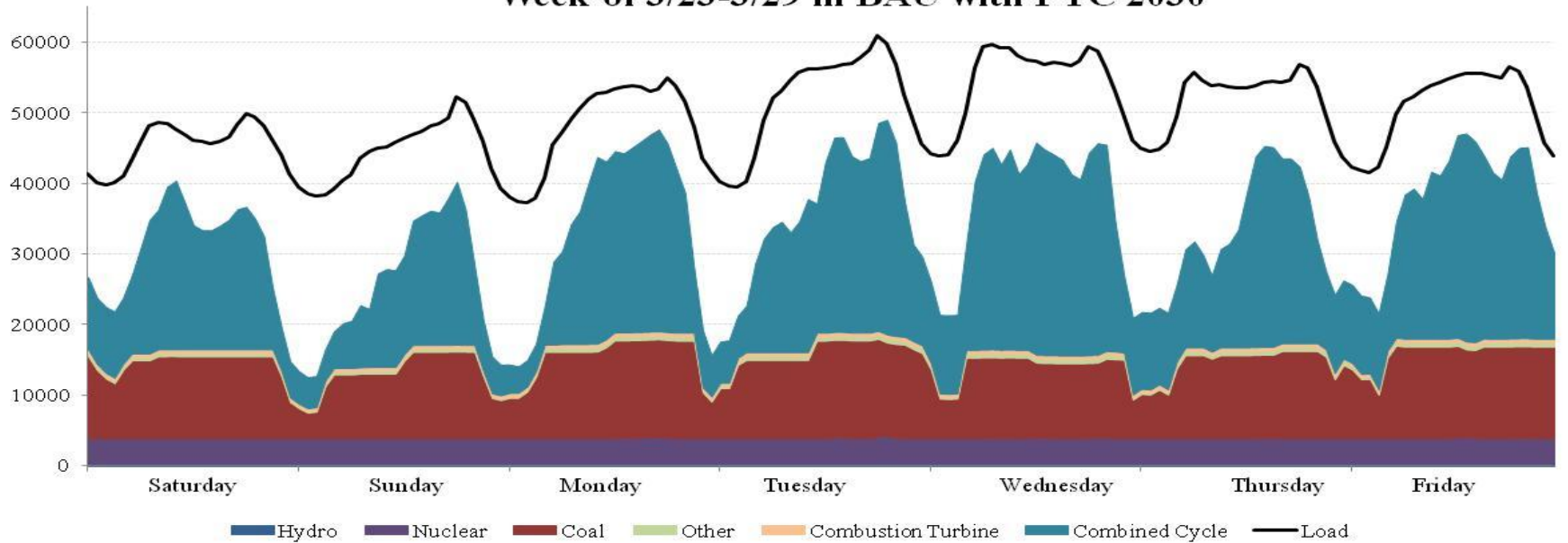
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## **BAU 2030 With and Without PTC Comparisons**

### Week of 3/23-3/29 in BAU 2030

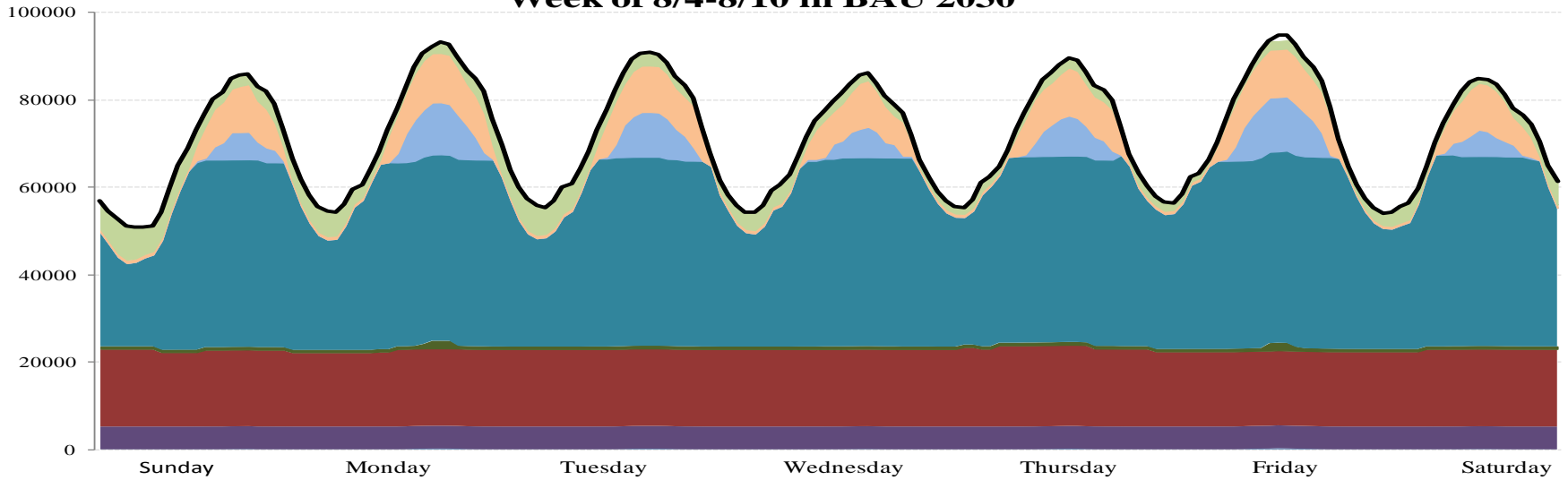


### Week of 3/23-3/29 in BAU with PTC 2030



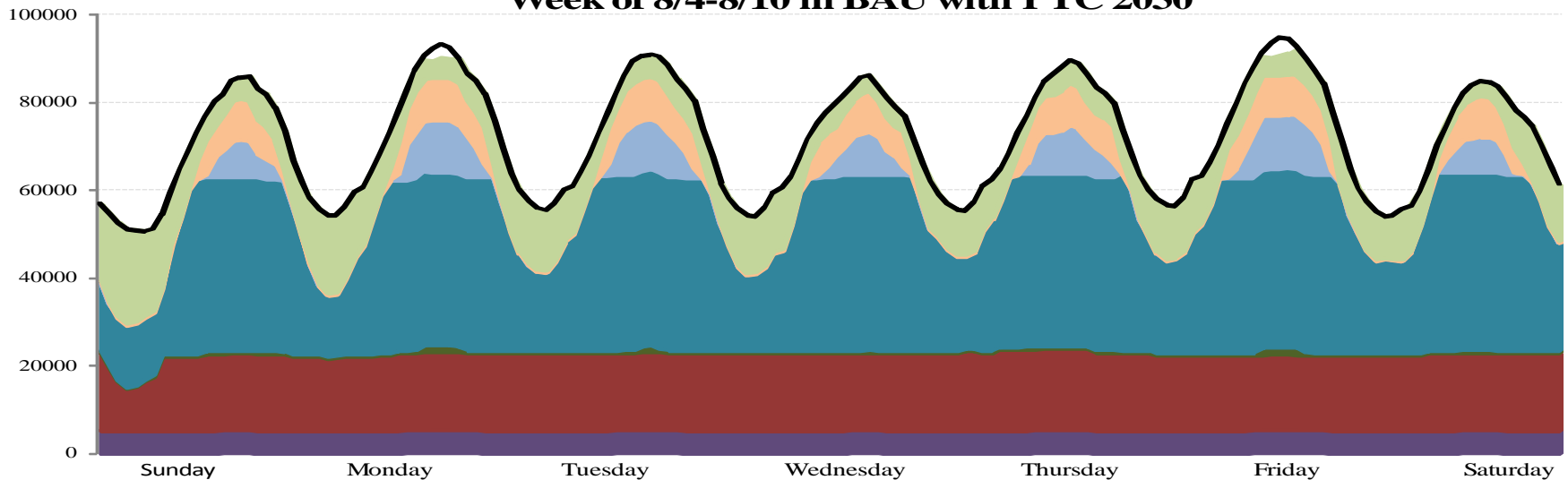


**Week of 8/4-8/10 in BAU 2030**



Hydro Nuclear Coal Other Combined Cycle Steam Gas Combustion Turbine Wind Load

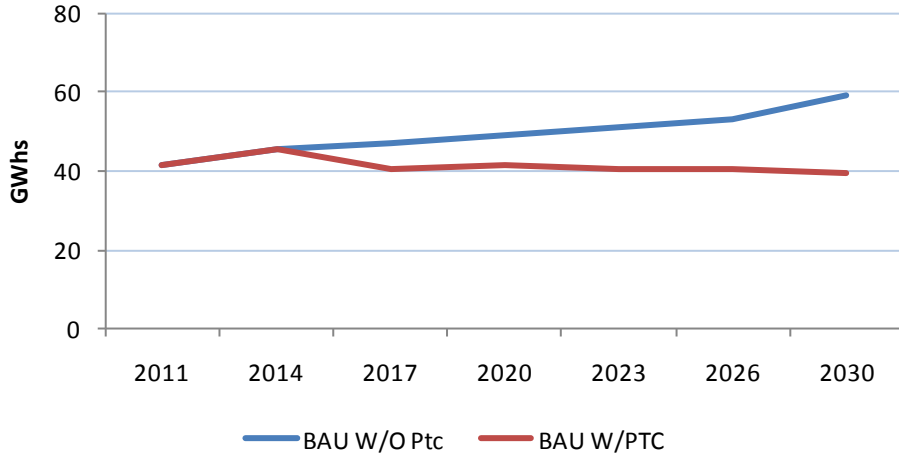
**Week of 8/4-8/10 in BAU with PTC 2030**



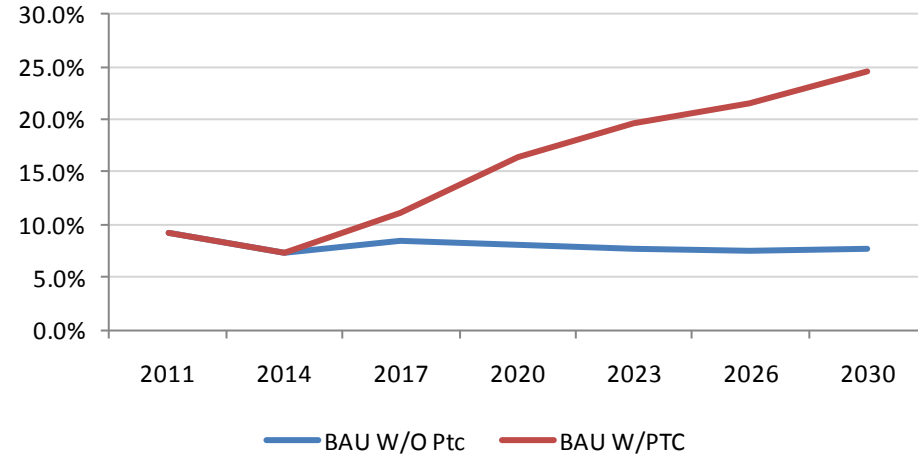
Hydro Nuclear Coal Other Combined Cycle Steam Gas Combustion Turbine Wind Load

# BAU With and Without PTC Comparisons

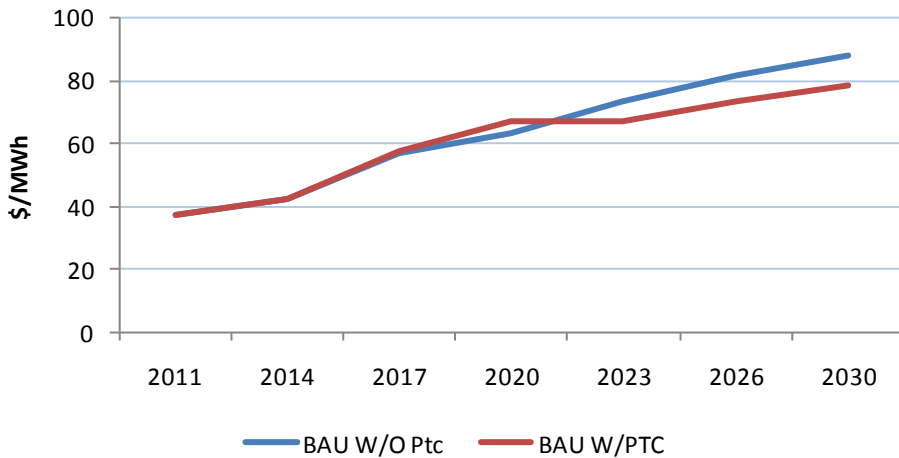
## Natural Gas Generation



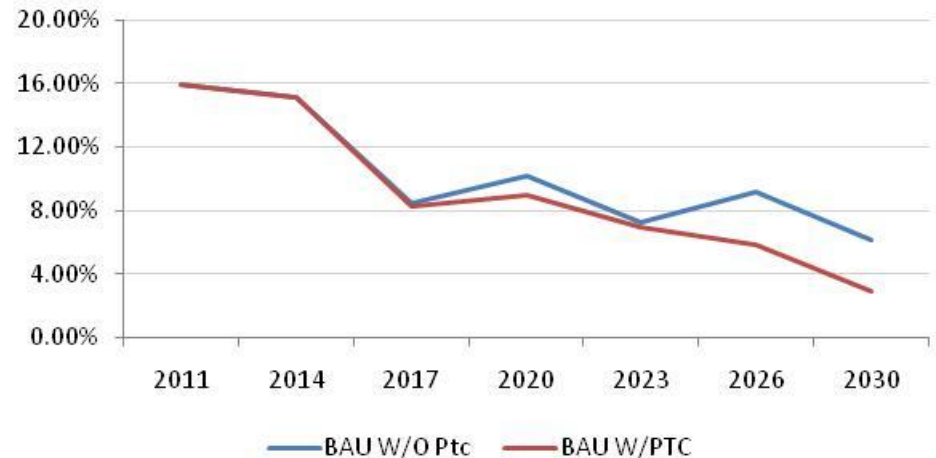
## Wind Generation



## LMPs

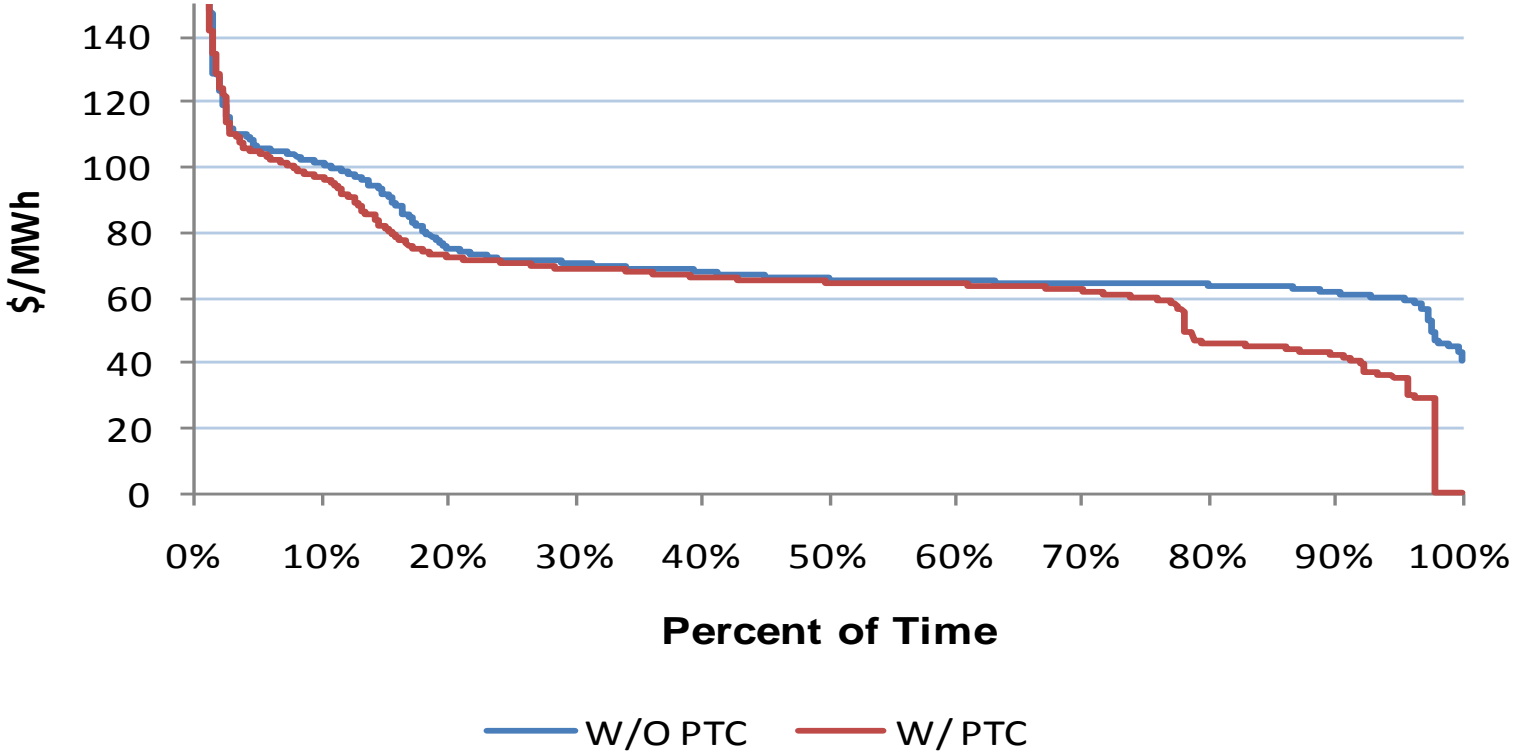


## Reserve Margin



# BAU With and Without PTC Comparisons For 2030

Price duration curve shows significant impact during the off peak hours of wind generation



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## **BAU With High Natural Gas Price Sensitivity**

# BAU High Natural Gas (EIA plus \$5/mmbtu) Expansion Plan Results

Total economic wind expansion MWs by 2030:

- 6,000 MWs; total wind on entire system – 16,350 MWs

Total economic thermal expansion builds in 2030:

- 29 coal plants – 17,400 MWs
- Total thermal additions – 17,400 MWs

Description	Units	2010 Actual	2011	2014	2017	2020	2023	2026	2030
CC Adds	MW			-	-	-	-	-	-
CT Adds	MW			-	-	-	-	-	-
Coal Adds	MW			925	3,000	3,000	3,600	3,000	4,800
Nuclear Adds	MW			-	-	-	-	-	-
Other Adds	MW			-	-	-	-	-	-
Wind Adds	MW			6,872	-	-	-	-	-
Annual Capacity Additions	MW			7,797	3,000	3,000	3,600	3,000	4,800
Cumulative Capacity Additions	MW			7,797	10,797	13,797	17,397	20,397	25,197
Reserve Margin	%	21.4	16.4	12.0	9.7	7.8	8.3	7.0	7.6
Coincident Peak	MW	65,776	65,206	73,375	78,869	81,665	85,928	88,318	94,318
Average LMP	\$/MWh	34.41	37.42	77.12	84.54	91.90	98.00	107.28	114.68
Natural Gas Price	\$/mmbtu	4.38	4.50	9.63	10.10	10.68	11.47	12.35	13.39
Average Market Heat Rate	MMbtu/MWh	7.86	8.32	8.01	8.37	8.61	8.54	8.69	8.57
Natural Gas Generation	%	38.2	41.3	39.7	36.8	34.7	31.8	29.8	26.3
Coal Generation	%	39.5	37.8	35.5	38.3	41.6	45.3	48.2	52.5
Wind Generation	%	7.8	9.2	12.5	13.2	12.6	12.2	11.7	11.2
Scarcity Hours	HRS	-	-	1	12	22	26	39	46
Unserved Energy	GWhs	-	-	0	7.6	29.0	36.9	44.5	92.5

# BAU High Natural Gas with PTC Expansion Plan Results

Total economic wind expansion MWs by 2030:

- 25,000 MWs; total wind on entire system – 35,350 MWs

Total economic thermal expansion builds in 2030:

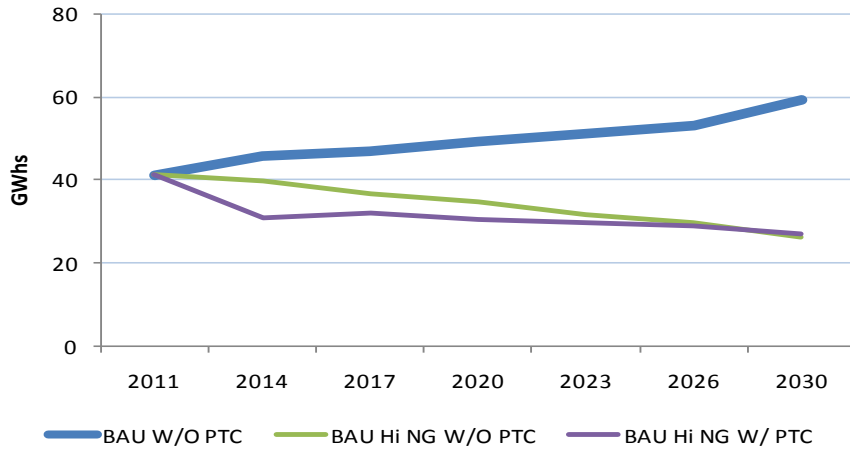
- 17 coal plants – 10,200 MWs
- 46 combustion turbines – 4,600 MWs
- Total thermal additions – 14,800 MWs

Question: Should we limit the potential annual build-out of specific types of resources?

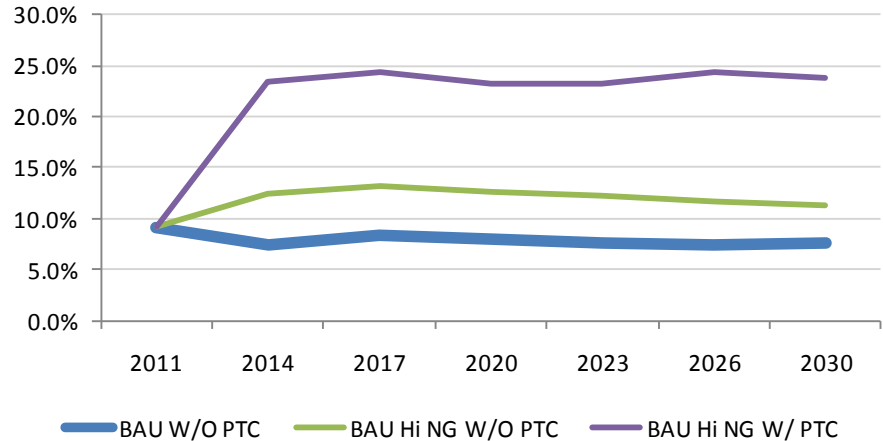
Description	Units	2010 Actual	2011	2014	2017	2020	2023	2026	2030
CC Adds	MW			-	-	-	-	-	-
CT Adds	MW			-	-	1,000	600	2,000	1,000
Coal Adds	MW			925	600	3,000	1,800	1,200	3,600
Nuclear Adds	MW			-	-	-	-	-	-
Other Adds	MW			-	-	-	-	-	-
Wind Adds	MW			19,872	1,000	-	1,000	3,000	1,000
Annual Capacity Additions	MW			20,797	1,600	4,000	3,400	6,200	5,600
Cumulative Capacity Additions	MW			20,797	22,397	26,397	29,797	35,997	41,597
Reserve Margin	%	21.4	16.4	13.5	8.3	7.6	6.9	6.1	6.6
Coincident Peak	MW	65,776	65,206	73,375	78,869	81,665	85,928	88,318	94,318
Average LMP	\$/MWh	34.41	37.42	66.98	81.71	88.98	96.85	102.21	109.16
Natural Gas Price	\$/mmbtu	4.38	4.50	9.63	10.10	10.68	11.47	12.35	13.39
Average Market Heat Rate	MMbtu/MWh	7.86	8.32	6.96	8.09	8.34	8.44	8.28	8.16
Natural Gas Generation	%	38.2	41.3	30.7	32.1	30.4	29.7	28.9	26.9
Coal Generation	%	39.5	37.8	33.5	32.1	35.4	36.5	36.5	39.3
Wind Generation	%	7.8	9.2	23.5	24.3	23.2	23.2	24.4	23.9
Scarcity Hours	HRS	-	-	1	30	45	52	55	59
Unserved Energy	GWhs	-	-	0	35.7	77.4	90.2	117.1	129.6

# BAU to BAU High Natural Gas Comparisons

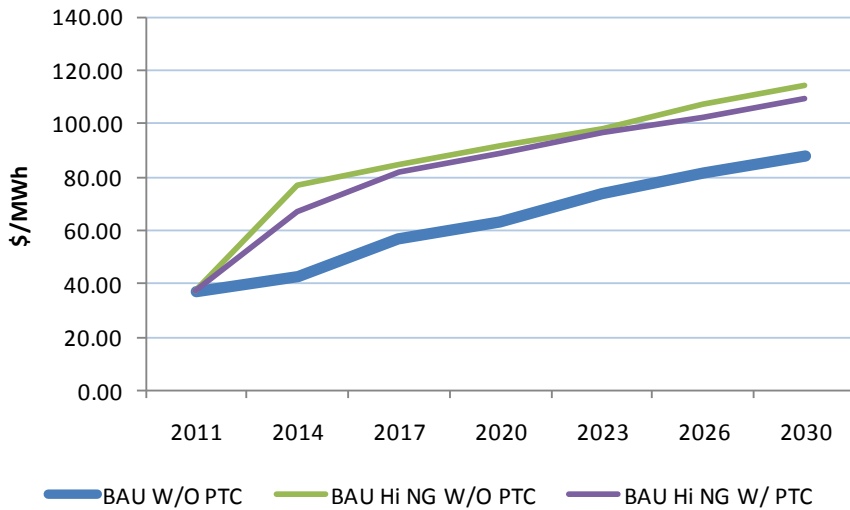
## Natural Gas Generation



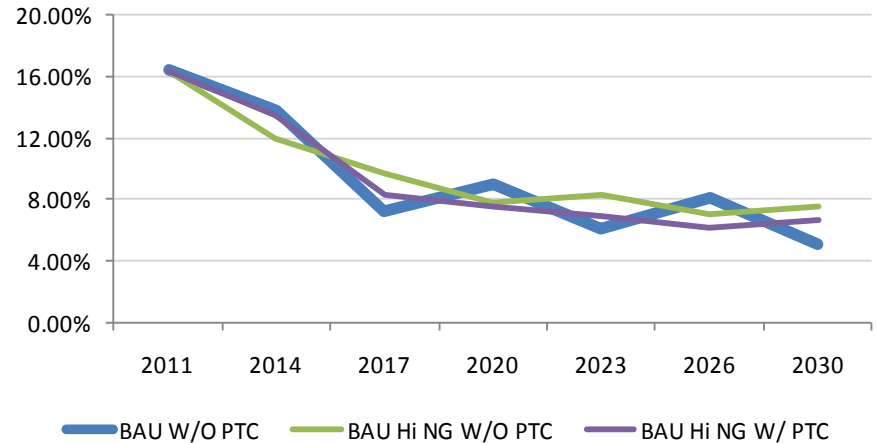
## Wind Generation



## LMPs



## Reserve Margin





**Questions?**