



**2020 Long-term System Assessment  
Kickoff, Initial Input Assumptions and  
Capacity Expansion Preliminary  
Results for Current Trends Scenario**

May, 2019  
RPG Meeting

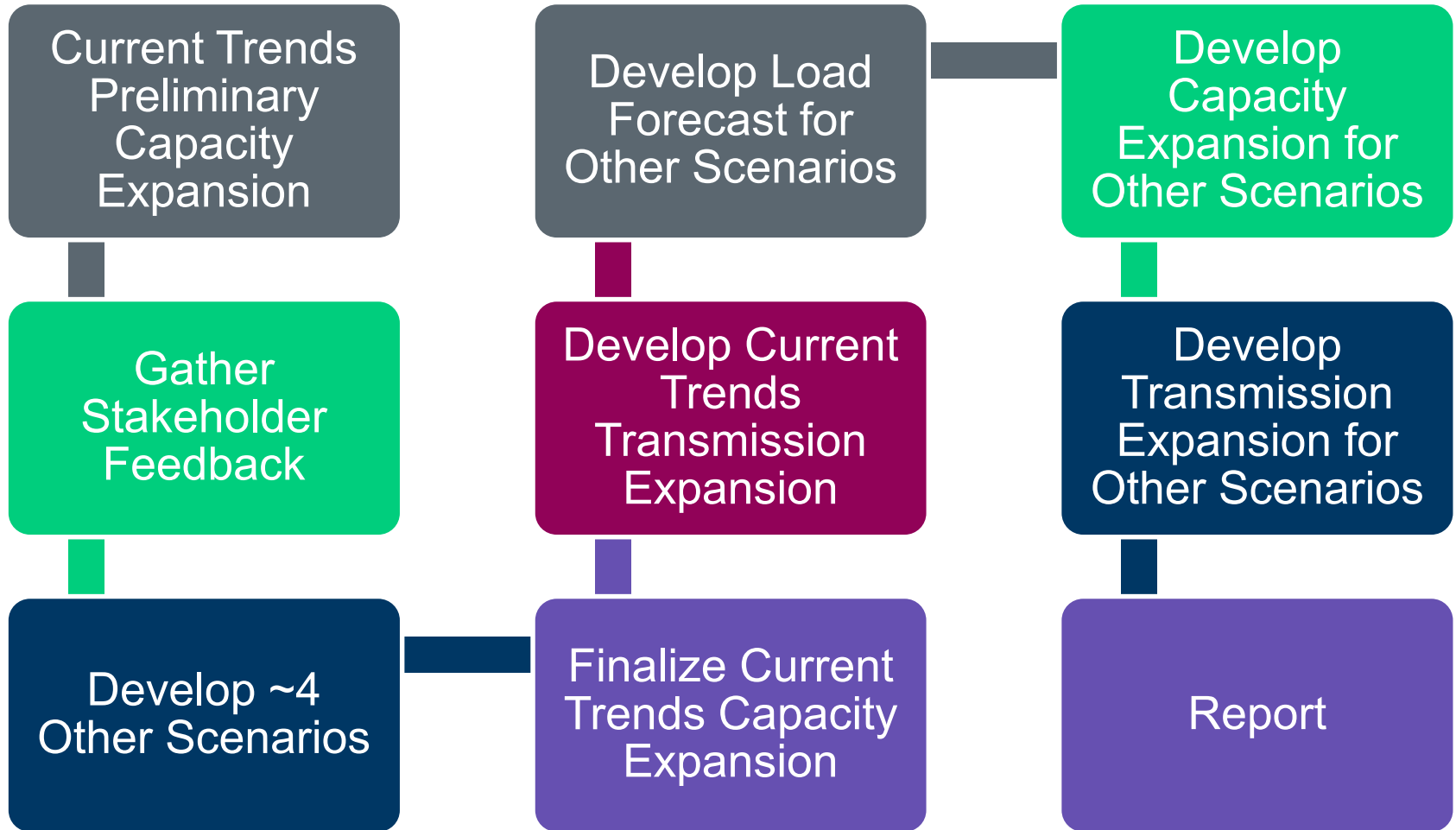
# Outline

- LTSA Overview
- LTSA Methodology Improvement
- Input Assumptions for Current Trends scenario
  - Load Forecast
    - Distributed Generation
    - Electric Vehicle Adoption
  - Fuel Pricing
  - New Unit Capital Costs
  - Emission Costs
- Preliminary Results for Current Trends scenario
- LTSA Survey
- LTSA Schedule

# LTSA Overview

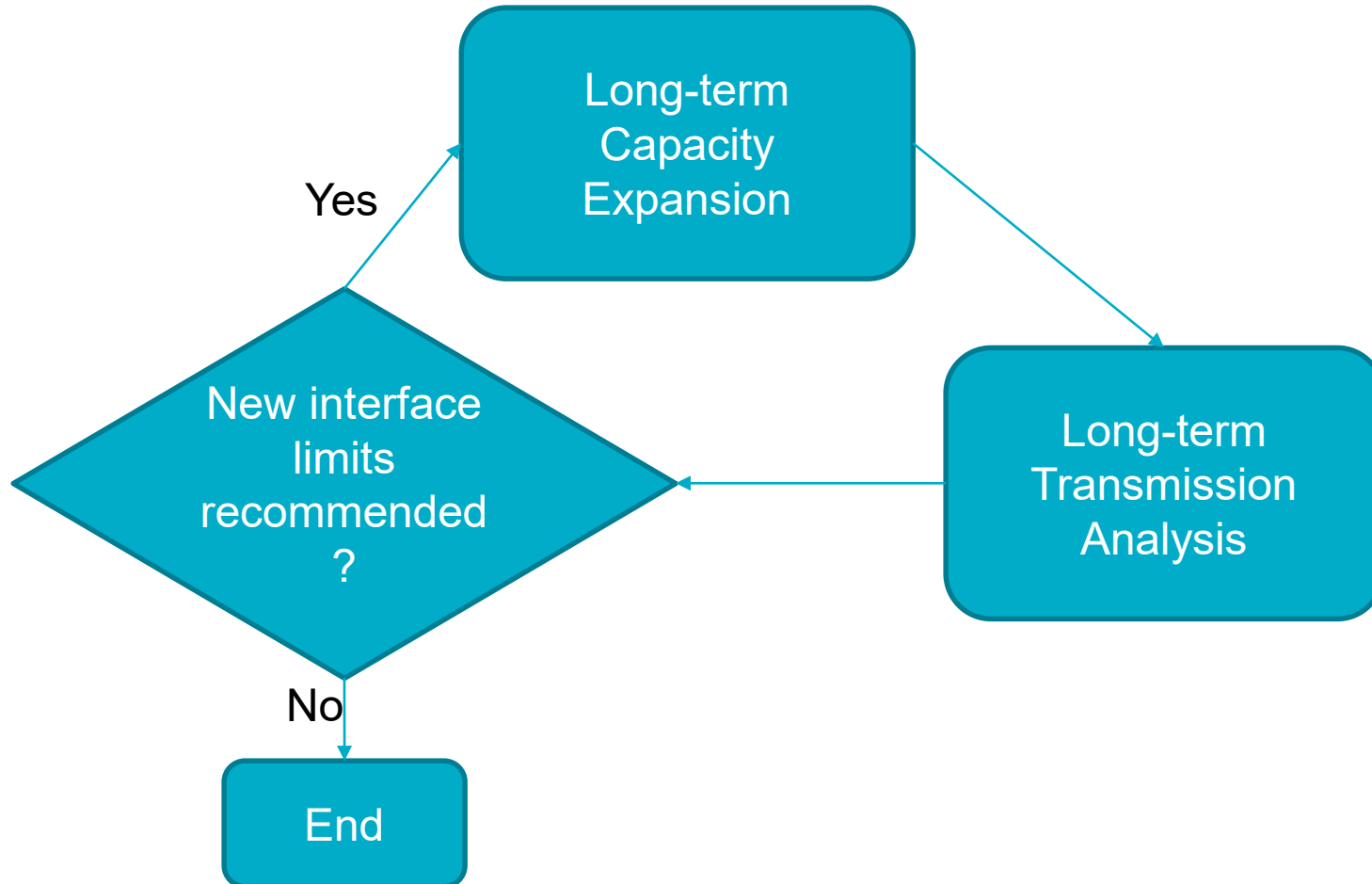
- The LTSA provides an evaluation of the potential needs of ERCOT's extra-high voltage (345-kV) system in the 10- to 15-year planning horizon.
- The LTSA guides the six-year planning process by providing a longer-term view of system reliability and economic needs.
- ERCOT studies different scenarios in its long-term planning process to account for the inherent uncertainty of planning the system beyond six-years.

# 2020 LTSA Process



# LTSA Methodology Improvement

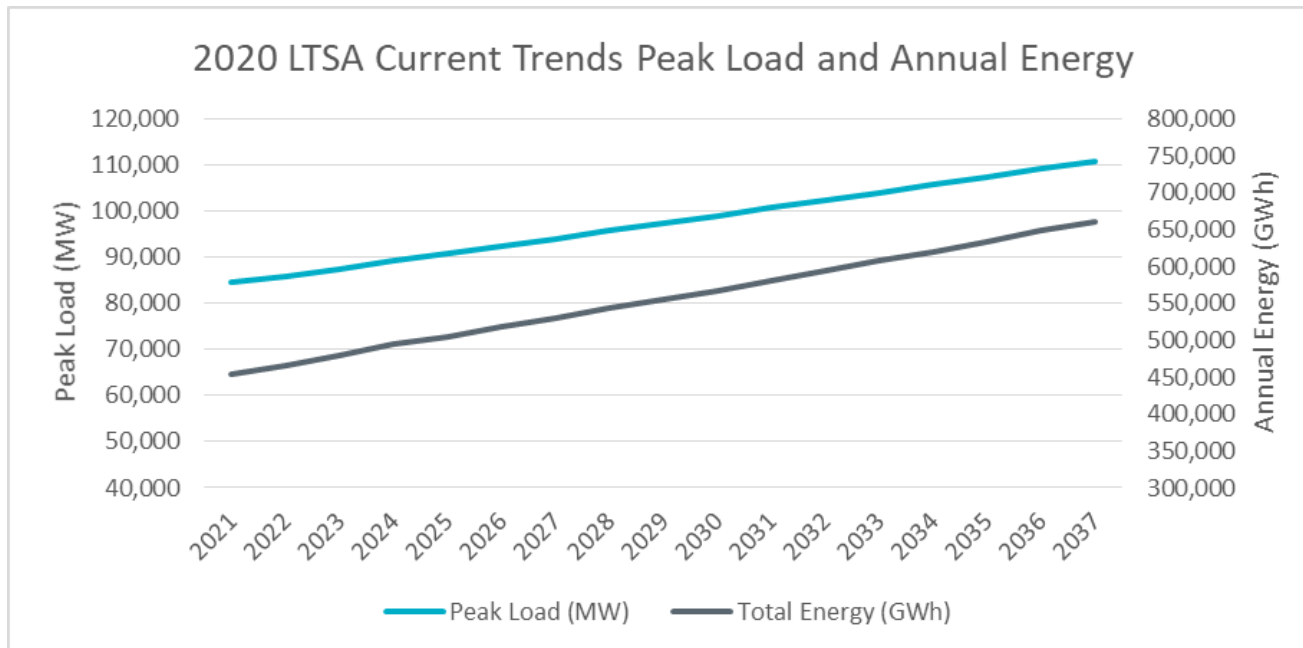
- Co-optimize capacity expansion and transmission planning through iterative process



# Current Trends Initial Data and Study Period

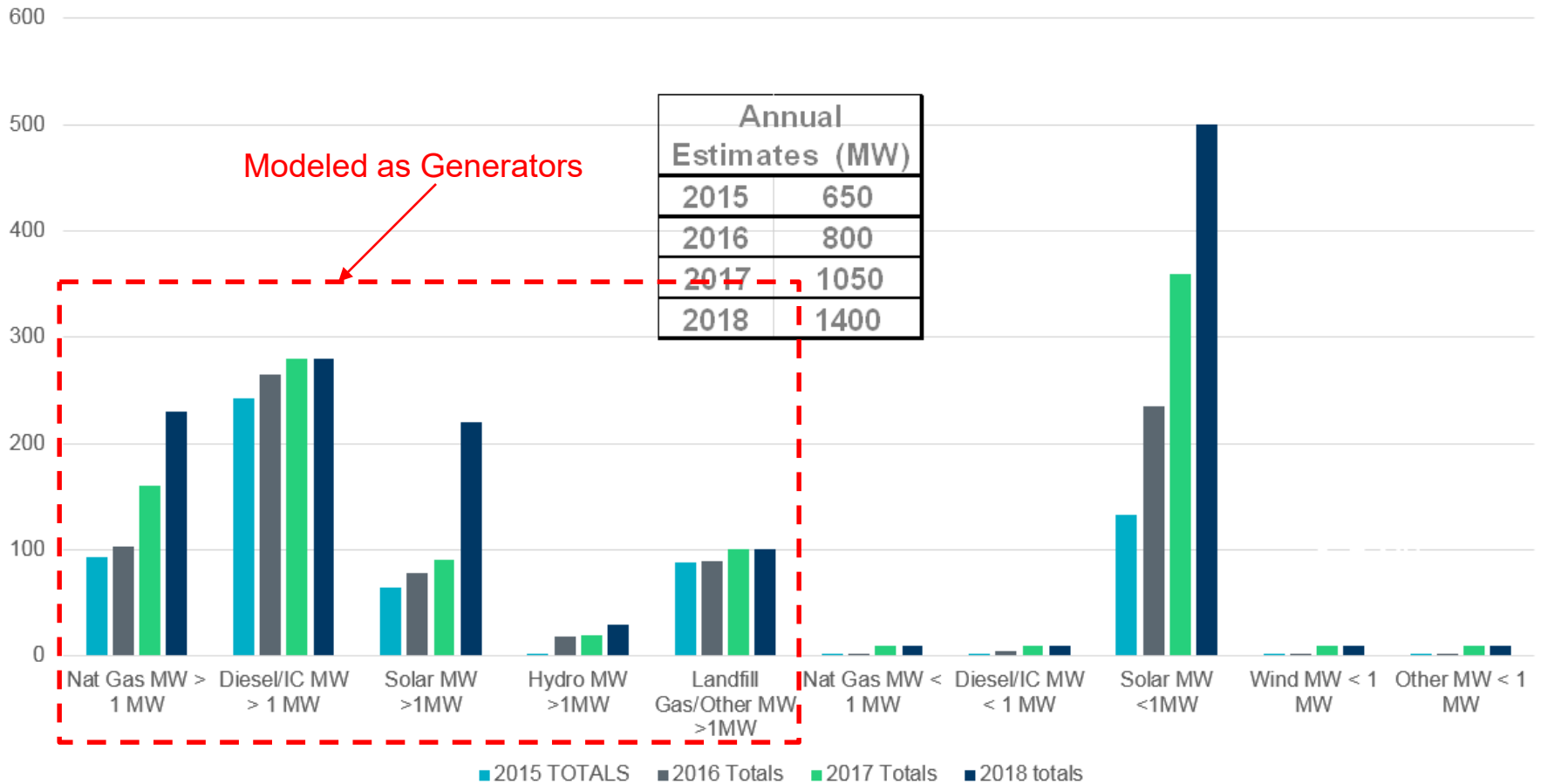
- The following slides show preliminary numbers for Current Trends scenario and are subject to change based on survey results (at end of presentation) and any comments from this meeting.
- Some of the assumptions could have a significant impact on scenario results. Your feedback is greatly appreciated.
- The study period for 2020 LTSA is 2021 through 2035.
  - The focus is on 2030 to 2035

# Current Trends Load Forecast



- Forecast includes:
  - Electric vehicle adoption assumption
  - Distributed PV solar adoption assumption
  - Existing Private Use Network (PUN) load

# Distributed Generation



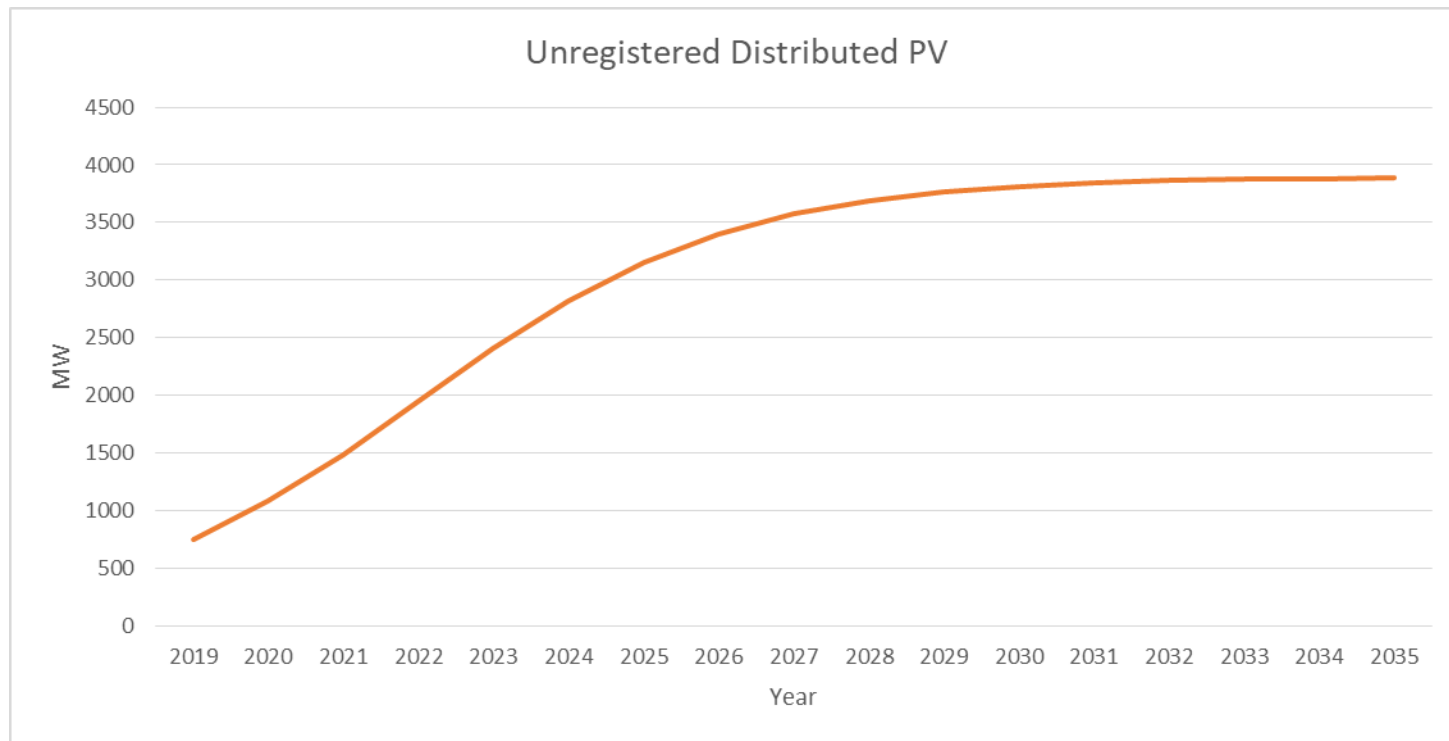
Note: This estimate includes *informal* data reporting by many NOIEs and excludes generation data *informally* reported by investor-owned utilities for generation that would typically be considered backup or emergency generation.





# Unregistered Distributed PV

- Projection for unregistered distributed PV



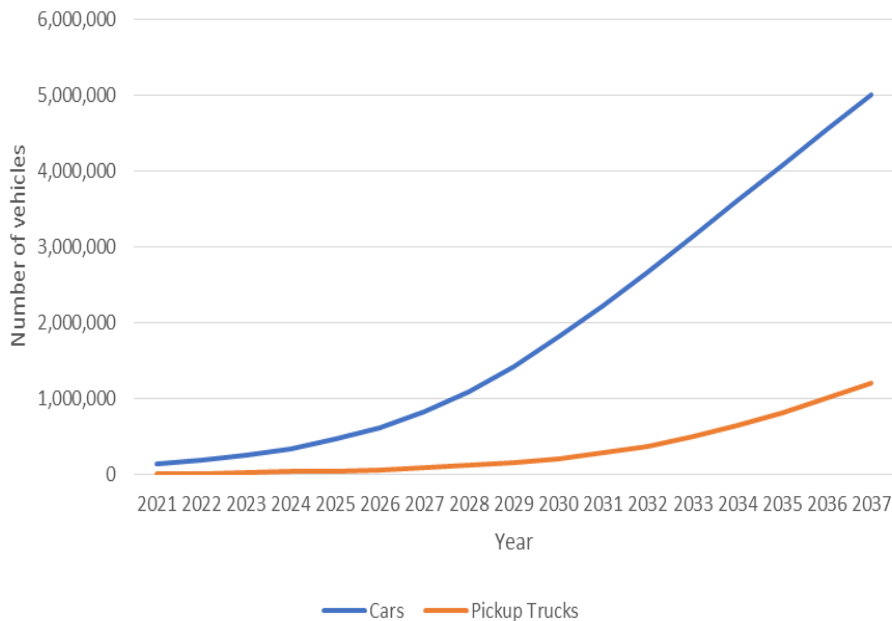
# Electric Vehicle Adoption

- Electric car and light truck adoption based on Bloomberg New Energy Finance (BNEF) 2017 projection

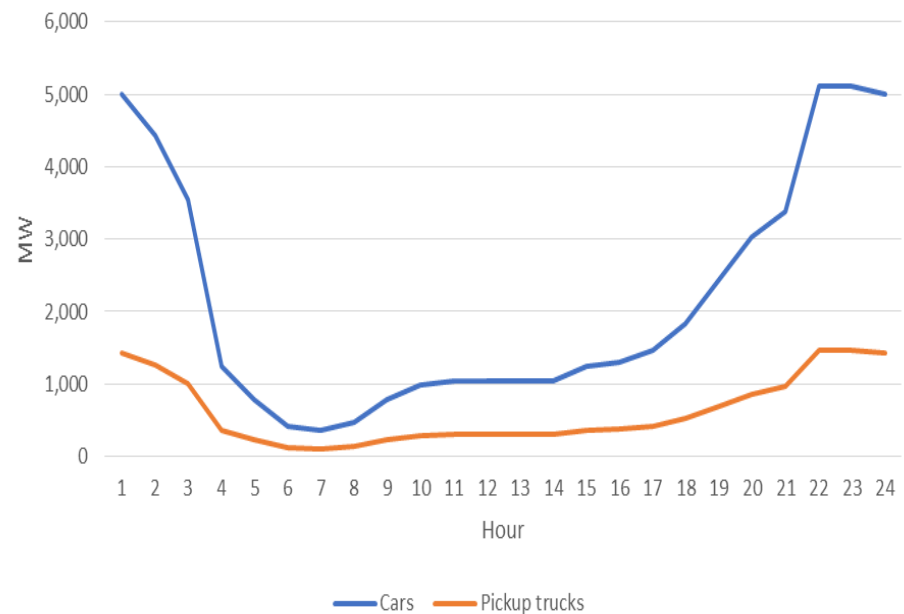
## EV penetration and charging demand estimation for 2035

Type	Number of Vehicles	Average miles per vehicle per day	Miles/kWh	Total Capacity Increases (MW)
Cars	4,090,000	34	2.6	5,109
Light trucks	816,000	34	2.0	1,457

Electric car and light-duty pickup truck adoption

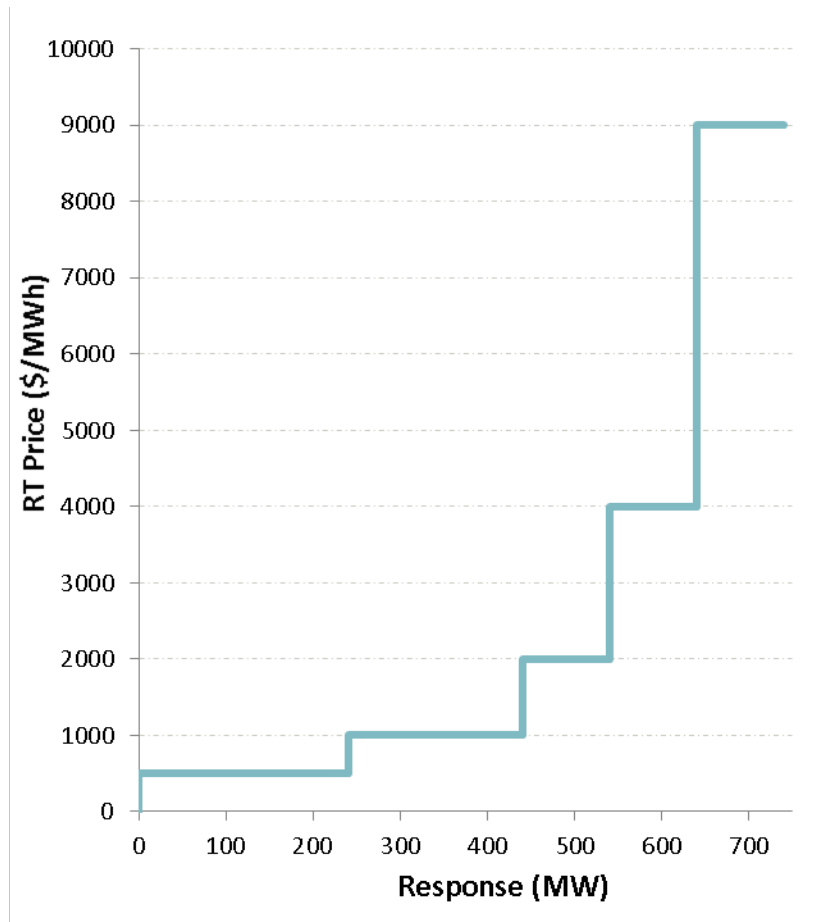


Cars and light-duty pickup truck hourly charging load in 2035



# Price Responsive Demand

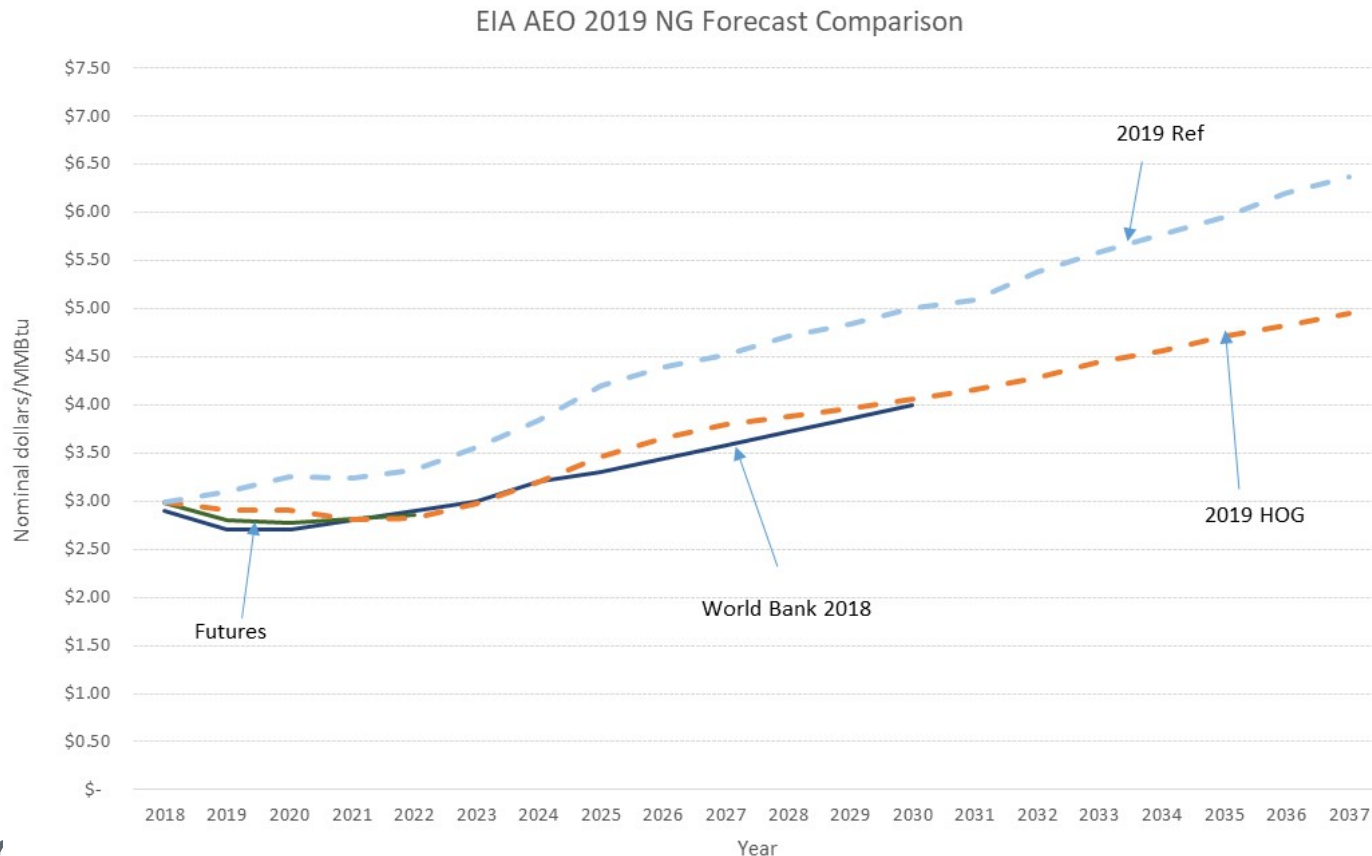
- 741 MW PRD in 2017 modeled as resources with striking prices
- 2% growth rate is assumed for PRD
- Load has been grossed up to reflect the load without PRD response.



Source: <http://www.ercot.com/calendar/2018/4/20/141901-DSWG>

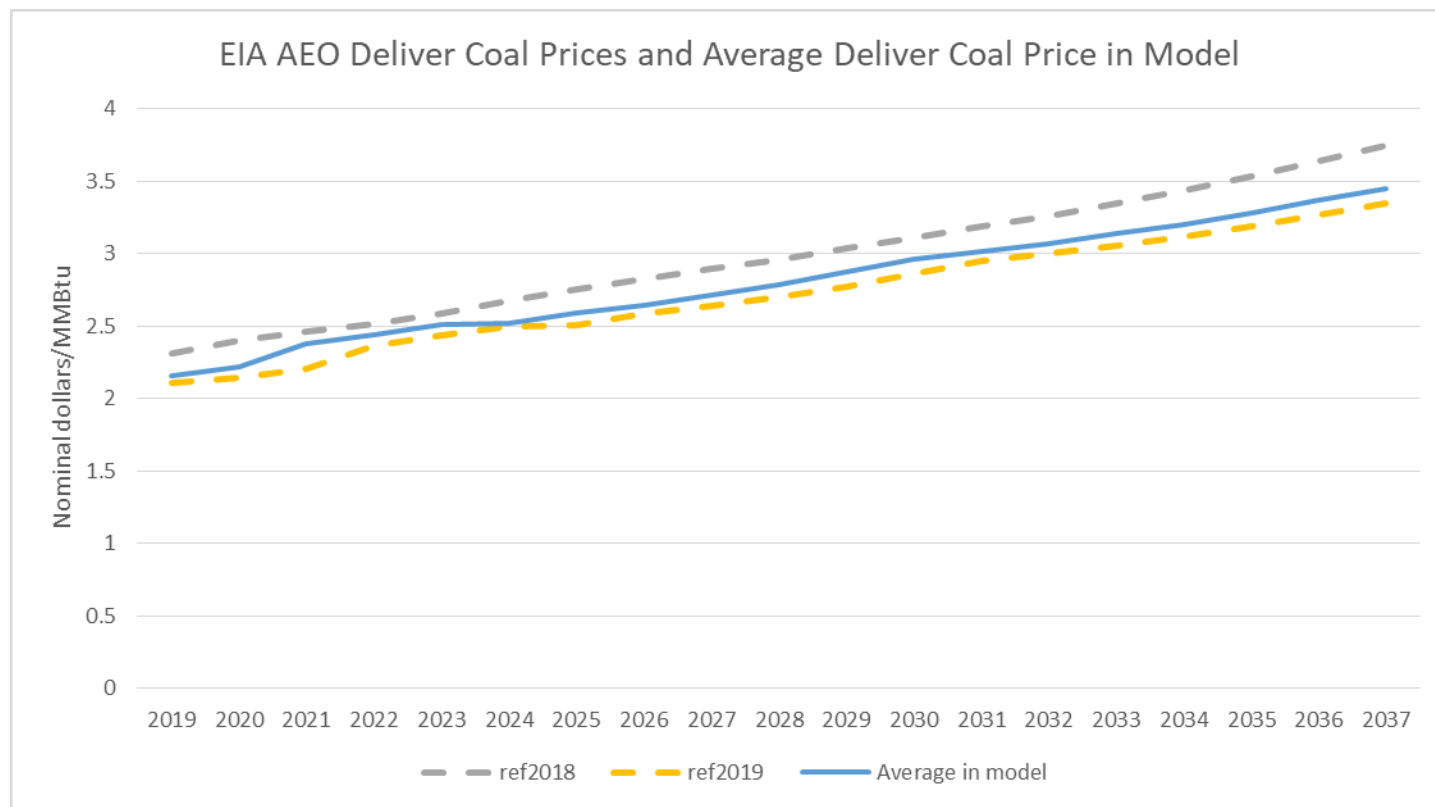
# Natural Gas Price Assumptions

- Ref is the EIA Annual Energy Outlook (AEO) Reference Case and HOG is the High Oil and Gas Resource and Technology Case
- Futures from Nymex and World Bank forecast are from 2018



# Coal Price

- Plant specific deliver coal prices are used in the model. The average of the plant specific prices is shown in the chart.
- Ref is the EIA AEO Reference Case



# New Unit Capital Costs

- Sources of capital cost assumptions,
  - Lazard’s Levelized Cost of Energy Analysis, November 2018
  - EIA AEO 2019
  - Cost examples from national labs and utility IRP assumptions
- Costs are \$/kW in nominal dollars

Year	Combined Cycle	Advanced Combined Cycle	Combustion Turbine	Advanced Combustion Turbine	Conventional Coal	Nuclear	Solar	Wind	Biomass	Geothermal	Battery Storage
2018	925	1075	680	800	3900	6200	1100	1350	3600	4290	1140
2019	944	1097	694	816	3978	6324	1012	1337	3672	4376	912
2020	962	1118	707	832	4058	6450	931	1323	3745	4463	730
2021	982	1141	722	849	4139	6579	875	1310	3820	4553	584
2022	1001	1164	736	866	4221	6711	858	1303	3897	4644	467
2023	1021	1187	751	883	4306	6845	847	1297	3975	4737	444
2024	1042	1211	766	901	4392	6982	838	1290	4054	4831	421
2025	1063	1235	781	919	4480	7122	830	1284	4135	4928	400
2026	1084	1260	797	937	4569	7264	826	1277	4218	5026	392
2027	1105	1285	813	956	4661	7410	822	1271	4302	5127	384
2028	1128	1310	829	975	4754	7558	818	1265	4388	5229	388
2029	1150	1337	845	995	4849	7709	814	1258	4476	5334	392
2030	1173	1363	862	1015	4946	7863	810	1252	4566	5441	396
2031	1197	1391	880	1035	5045	8020	806	1255	4657	5550	400
2032	1221	1418	897	1056	5146	8181	801	1258	4750	5661	404
2033	1245	1447	915	1077	5249	8344	804	1262	4845	5774	408
2034	1270	1476	933	1098	5354	8511	806	1265	4942	5889	412
2035	1295	1505	952	1120	5461	8681	809	1268	5041	6007	416
2036	1321	1535	971	1143	5570	8855	811	1271	5142	6127	421
2037	1348	1566	991	1165	5682	9032	814	1274	5245	6250	425

# Environmental Issues and Emission Costs

- Current Trends Scenario doesn't include any new environmental regulations.

Emission Prices for Current Trends

Emission	\$/ton
NO <sub>x</sub> (Seasonal)	150
NO <sub>x</sub> (Annual)	2.75
SO <sub>2</sub>	0.00
CO <sub>2</sub>	0.00

<https://www.rggi.org/Auction/42>

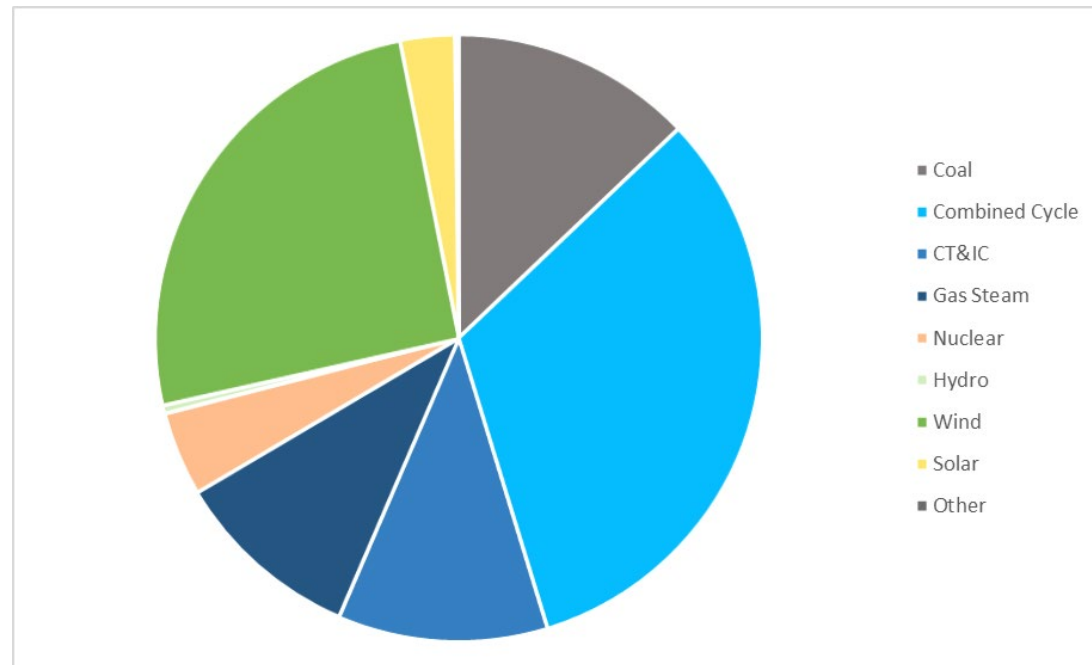
<https://www.epa.gov/airmarkets/2018-so2-allowance-auction>

<https://www.spglobal.com/platts/en/market-insights/latest-news/electric-power/012518-seasonal-nox-prices-hold-steady-on-more-small-trades>

# Starting Capacity Mix

- Included planned resources which meet Planning Guide 6.9 based on December 2018 CDR and January 2019 GIS released on February 1<sup>st</sup> 2019.

Technology	Capacity (MW)
Coal	14,722
Combined Cycle	37,025
CT&IC	12,782
Gas Steam	11,492
Nuclear	5,140
Hydro	535
Wind	29,075
Solar	3,323
Other	210





# Preliminary Current Trends Results

- Reserve margin in final year: 5%
- Built 16,100 MW gas generation
- Built 6,400 MW solar
- Built 5,500 MW wind
- No retirements
- Unserved energy in year 2035. Shortages are mainly concentrated in evening hours in summer months with maximum magnitude over 4,000 MW

Description	Units	2021	2025	2030	2035
CC Adds	MW	2,000	3,000	7,000	4,000
CT Adds	MW	-	-	100	-
Coal Adds	MW	-	-	-	-
Nuclear Adds	MW	-	-	-	-
Storage Adds	MW	-	-	-	-
Solar Adds	MW	1,500	4,900	-	-
Wind Adds	MW	2,400	3,100	-	-
Annual Capacity Additions	MW	5,900	11,000	7,100	4,000
Cumulative Capacity Additions	MW	5,900	16,900	24,000	28,000
Economic Retirements	MW	-	-	-	-
Cumulative Economic Retirements	MW	-	-	-	-
Reserve Margin	%	12	12	10	5
Coincident Peak	MW	84,433	90,826	98,967	107,416
Annual Energy	GWhs	454,308	505,265	567,484	633,595
Average LMP	\$/MWh	34.22	39.12	44.47	74.09
Natural Gas Price	\$/mmbtu	2.81	3.47	4.05	4.71
Average Market Heat Rate	MMbtu/MWh	12.17	11.28	10.97	15.73
Natural Gas Generation	%	60.99	57.24	61.34	63.57
Coal Generation	%	1.98	3.03	3.51	5.37
Wind Generation	%	23.88	24.52	21.84	19.74
Solar Generation	%	3.38	6.20	5.52	4.18
Scarcity Hours	HRS	-	1	-	16
Unserved Energy	GWhs	-	0.00	-	17.27

# Ancillary Service Prices

- Simulated AS prices are generally lower than AS prices in market.
- Ancillary service is co-optimized with energy in the model. High AS prices show up during scarcity hours, so the AS prices are much higher in 2035.

Average AS Prices for the past five years vs simulated average AS prices (\$/MW per hour)

AS Type	2021	2025	2030	2035	Modeled Average	2014-2018 AS Price Average
Regulation Up	1.87	1.56	1.21	17.30	5.48	10.38
Regulation Down	0.01	0.01	0.00	0.00	0.00	6.29
Responsive Reserve	1.86	1.50	0.43	2.69	1.62	12.96
Non-Spin	0.01	0.00	0.02	13.89	3.48	5.24

# LTSA Survey

- Stakeholders are encouraged to participate in the 2020 LTSA Survey (link below). The survey will remain open until May 28
- The survey has questions regarding assumptions in the Current Trends Scenario and drivers that may lead to other scenarios to be studied
- Survey link:  
[https://www.surveymonkey.com/r/ERCOT2020LTSA\\_StakeholderSurvey](https://www.surveymonkey.com/r/ERCOT2020LTSA_StakeholderSurvey)

# 2020 LTSA Schedule

Task	Date
Current Trends Preliminary Results	May 2019 RPG Meeting
Stakeholder Feedback	May 2019
Finalize Scenarios	Q3 2019
Finalize Current Trends Capacity Expansion	Q3 2019
Current Trends Transmission Expansion	Q4 2019
Other Scenarios Capacity Expansion	Q1 2020
Other Scenarios Transmission Expansion	Q2 2020

# Questions

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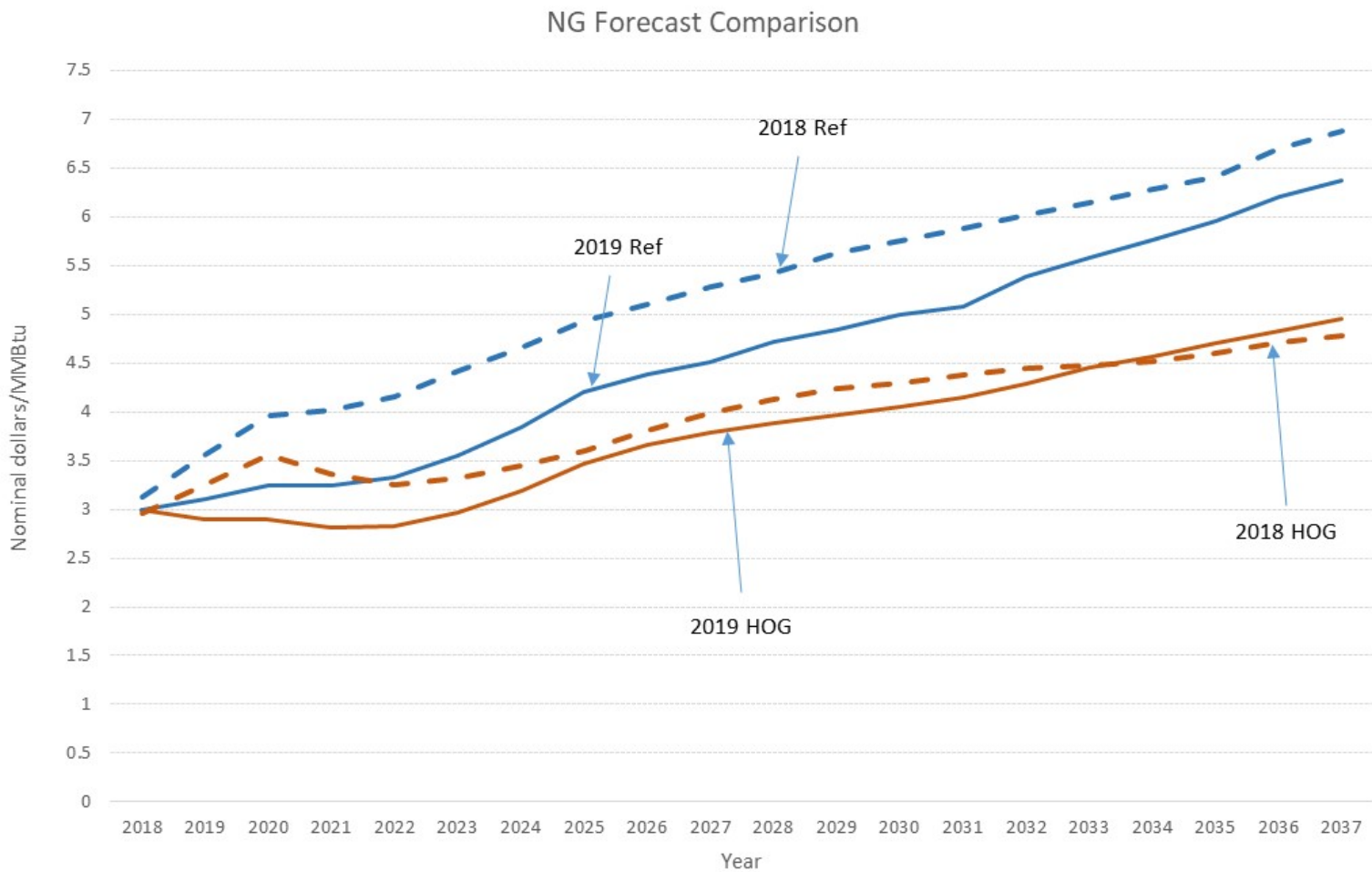
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# Gas Price comparison, 2019AEO vs 2018AEO



# New Unit Capital Costs for 2018 LTSA

- Sources of capital cost assumptions,
  - EIA 2017 Annual Energy Outlook
  - Lazard's Levelized Cost of Energy Analysis, December 2016
  - Solar Energy Industries Association, 4<sup>th</sup> QTR 2016 Solar Market Insights
- Costs are \$/kW in nominal dollars

Year	Combined Cycle	Advanced Combined Cycle	Combustion Turbine	Advanced Combustion Turbine	Conventional Coal	Nuclear	Solar	Wind	Biomass	Geothermal
2017	900	1,050	800	675	3,800	6,086	1,534	1,500	3,500	4,200
2018	918	1,071	816	689	3,876	6,208	1,411	1,485	3,570	4,284
2019	936	1,092	832	702	3,954	6,332	1,298	1,470	3,641	4,370
2020	955	1,114	849	716	4,033	6,459	1,195	1,455	3,714	4,457
2021	974	1,137	866	731	4,113	6,588	1,123	1,441	3,789	4,546
2022	994	1,159	883	745	4,196	6,719	1,100	1,434	3,864	4,637
2023	1,014	1,182	901	760	4,279	6,854	1,087	1,427	3,942	4,730
2024	1,034	1,206	919	775	4,365	6,991	1,076	1,419	4,020	4,824
2025	1,054	1,230	937	791	4,452	7,131	1,065	1,412	4,101	4,921
2026	1,076	1,255	956	807	4,541	7,273	1,060	1,405	4,183	5,019
2027	1,097	1,280	975	823	4,632	7,419	1,063	1,398	4,266	5,120
2028	1,119	1,306	995	839	4,725	7,567	1,068	1,402	4,352	5,222
2029	1,141	1,332	1,015	856	4,819	7,719	1,074	1,405	4,439	5,327
2030	1,164	1,358	1,035	873	4,916	7,873	1,079	1,409	4,528	5,433
2031	1,188	1,385	1,056	891	5,014	8,030	1,084	1,412	4,618	5,542
2032	1,211	1,413	1,077	908	5,114	8,191	1,090	1,416	4,711	5,653
2033	1,236	1,441	1,098	927	5,217	8,355	1,095	1,419	4,805	5,766