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Docket Number:	16-BSTD-06
Project Title:	Updates to the 2019 Time Dependent Valuation of Energy
TN #:	211453
Document Title:	Presentation - 2020-2026 Production Cost Simulation Assumptions and Selected Results
Description:	N/A
Filer:	Hilary Fiese
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	5/12/2016 1:21:38 PM
Docketed Date:	5/12/2016

California Energy Commission

2020-2026 Production Cost Simulation Assumptions and Selected Results

2019 Time Dependent Value of Energy

Imbrecht Hearing Room

May 12, 2016

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Scope of Presentation

- TDV scenarios
- Key drivers and assumptions
- SB 350 friendly AAEE
- SB 350 friendly RPS portfolio
- Selected simulation results

PLEXOS® for Power System

- Production cost model that produces a marginal price forecast.
- Determines the least cost dispatch of generating resources to meet a given power demand subject to predefined constraints.
- Does not include costs for ancillary services or fixed operation and maintenance.

TDV Scenarios

1. Base Case: SB 350 Friendly
   - Achieves SB 350-Friendly RPS and AAEE
2. Sensitivity – 1xAAEE
   - SB 350-Friendly RPS Portfolio (50% by 2030)
   - 2015 IEPR Mid Case AAEE
3. SB 350 Friendly - High CO2 Prices
   - Achieves SB 350-Friendly RPS and AAEE
   - High CO2e price projections

Key Drivers
Additional Achievable Energy Efficiency

- CED 2015 Adopted Demand and Additional Achievable Energy Efficiency
  - Adopted 01/27/2016.
  - CED 2015 Mid AAEE extrapolated from 2026 to 2030 assuming 3% annual growth.
- SB 350 Friendly AAEE.
  - Based on CED 2015 adopted Mid AAEE extrapolated to 2030.
  - Annual values were increased linearly from 2018 to 2030.

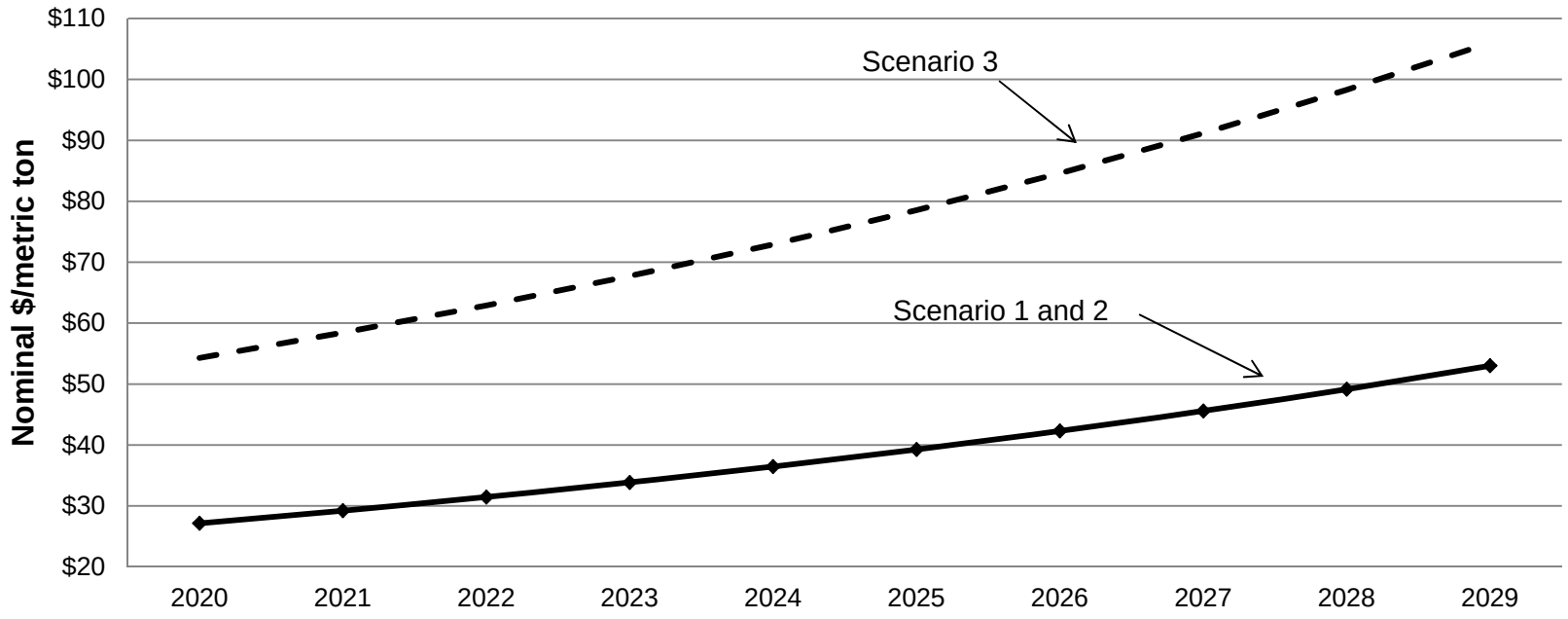
Key Drivers
Additional Achievable Energy Efficiency

Statewide Annual Aggregate AAEE Assumptions (GWh)				
	2015 IEPR		SB 350 Friendly	
Year	Mid AAEE	Extrapolated	Conversion Factor	Amount
2016	1,750	1,750	1	1,750
2017	3,581	3,581	1	3,581
2018	5,789	5,789	1.077	6,234
2019	7,385	7,385	1.154	8,521
2020	8,838	8,838	1.231	10,877
2021	10,432	10,432	1.308	13,642
2022	11,966	11,966	1.385	16,568
2023	13,554	13,554	1.462	19,809
2024	15,076	15,076	1.538	23,194
2025	16,600	16,600	1.615	26,815
2026	18,128	18,128	1.692	30,678
2027	n/a	18,672	1.769	33,034
2028	n/a	19,232	1.846	35,505
2029	n/a	19,809	1.923	38,094
2030	n/a	20,403	2	40,806

Key Drivers
Greenhouse Gas Prices

IEPR 2015 Mid and High price projections

posted 01/25/2016



Key Drivers
Load and Sales Forecast

- CED 2015 Adopted Mid Demand Forecast
  - Load forecast for production cost modeling: Form 1.5a (net energy for load) and 1.5b (1-in-2 peak demand)
  - RPS Targets: Form 1.1c - retail sales

Mid Demand Baseline Case, No AAEE Savings							
	2020	2021	2022	2023	2024	2025	2026
Net Energy for Load (GWh)	292,401	293,805	296,009	297,692	299,030	300,413	301,480
1 in 2 Net Peak Demand (MW)	60,230	60,478	60,902	61,231	61,456	61,456	61,769
Total Statewide Retail Deliveries	261,742	263,052	265,095	266,657	267,657	267,908	270,194

Key Drivers
Renewable Portfolio Standard (RPS)

- Statewide existing RPS capacity was estimated by CEC staff.
- E3 Used RPS Calculator to develop an ISO-only portfolio through 2030.
- CEC staff developed a statewide portfolio.
  - Assumed development statewide was proportional to RPS Calculator results.
  - Existing facilities that were not picked by the RPS Calculator were assumed to contract with a utility outside ISO territory.
  - Contracts for out-of-state renewables expiring during the forecast period were not renewed.

	Operational – In-state*	1. SB 350 Friendly	2. 1xAAEE	3. High GHG Price
	Nameplate Capacity (MWac)			
Biomass	1,092	0	0	0
Geothermal	2,460	0	0	0
RPS-Hydro	1,679	0	0	0
Solar PV	5,932	8,995	11,267	8,995
Solar Thermal	1,300	0	0	0
Wind	6,043	3,619	5,497	3,619
Total	**18,506**	**12,614**	**16,764**	**12,614**

* As of 3/1/2016. Does not include contracts for out-of-state generation.

Other Key Drivers

- Fuel Price Forecasts
  - IEPR Burner-tip Mid Demand Natural Gas Price Projections (posted 02/22/2016)
  - 2015 Annual Energy Outlook (EIA) Coal price projections
- CA Hydro-electric Generation
  - Average hydro plant generation was assumed to be 30,888 GWh throughout the forecast period. Based on 2000-2014 actual California hydro generation.

General Modeling Assumptions

- SB 350 Annual RPS statewide targets are achieved
- Diablo Canyon Retires
- CA Net Exports are not constrained in production cost modeling
  - Current LTPP planning assumptions recommend constraining net exports to 2,000 MW or 5,000 MW maximums in all hours of the year.
  - CEC staff plans to gather data and analysis to support, from an analytic standpoint, a recommendation for this assumption over the forecast period.

Scenario-Specific Assumptions

Scenario	Key Assumptions
1. Base	SB 350-Friendly AAEE Mid GHG Prices
2. Sensitivity – 1xAAEE	CED 2015 AAEE* Mid GHG Prices
3. Sensitivity – High GHG Prices	SB 350-Friendly AAEE High GHG Prices

*This lower AAEE assumption results in a higher RPS energy target.

RPS Targets	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Percent	33	34.75	36.5	38.25	40	41.7	43.3	45	46.7	48.3	50
Scenario 1 and 3 (TWh)	81.3	84.9	88.7	92.1	95.3	98.1	100.6	103.7	106.8	109.7	112.5
Scenario 2 (TWh)	82.1	86.3	90.8	95.0	99.2	103.2	107.1	111.5	115.8	120.3	124.7

PLEXOS Simulation Results