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Project Title:	Electricity and Natural Gas Demand Forecast
TN #:	239170
Document Title:	Presentation - Historic Zero-Emission Vehicle (ZEV) Trends
Description:	S2.01 Gage, Bahreinian, McBride, Aragon, Deaver, Marshall_CEC
Filer:	Raquel Kravitz
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	8/3/2021 12:47:51 PM
Docketed Date:	8/3/2021

Historic Zero-Emission Vehicle (ZEV) Trends

IEPR Workshop on Electricity and Natural Gas Demand Forecast:
Inputs and Assumptions
August 5, 2021

Jesse Gage
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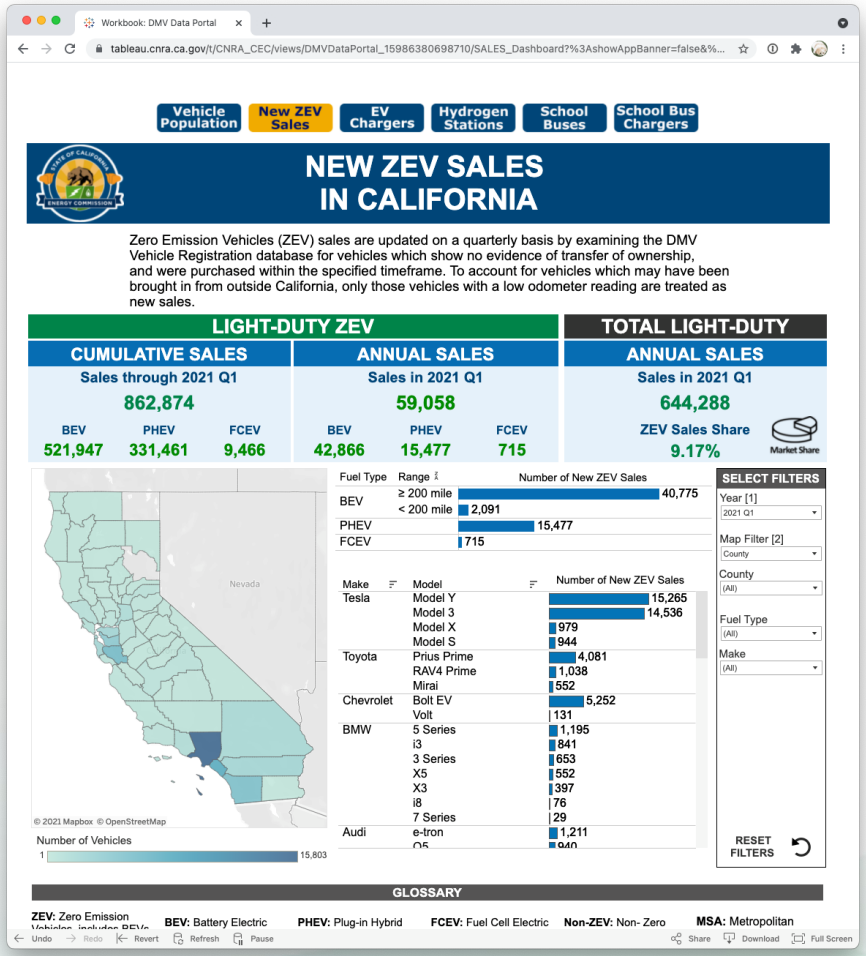
ZEVStats is Your Official Source for… ZEV Stats

- Historical on-road ZEV population
- Sales of new ZEVs, updated quarterly
- Infrastructure data such as EV chargers and H2 stations
- Medium/Heavy-Duty ZEV data in the works
- Just type “ZEVStats” in Google, Bing, or DuckDuckGo

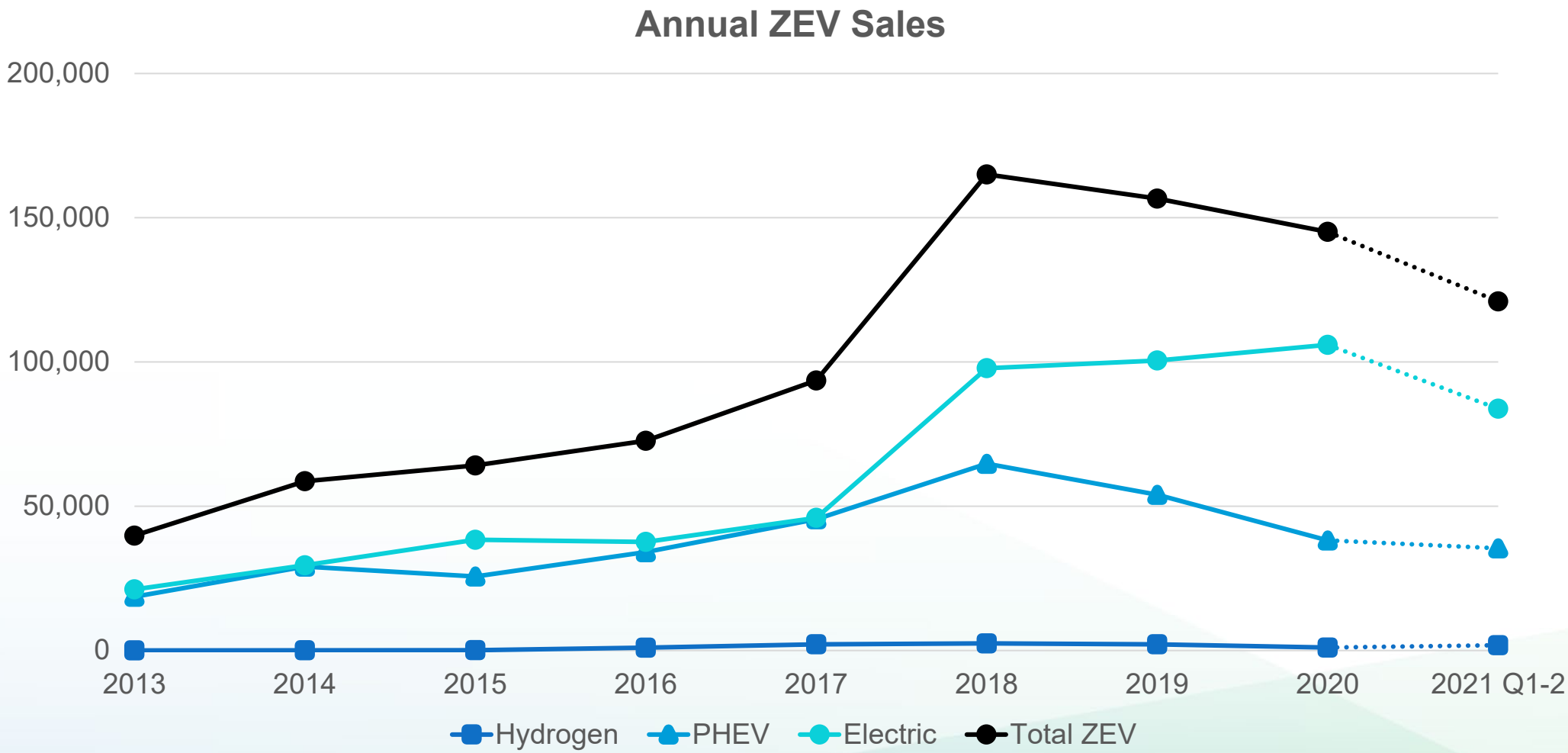


https://www.energy.ca.gov/data-reports/energy-insights/zero-emission-vehicle-and-charger-statistics

Overview

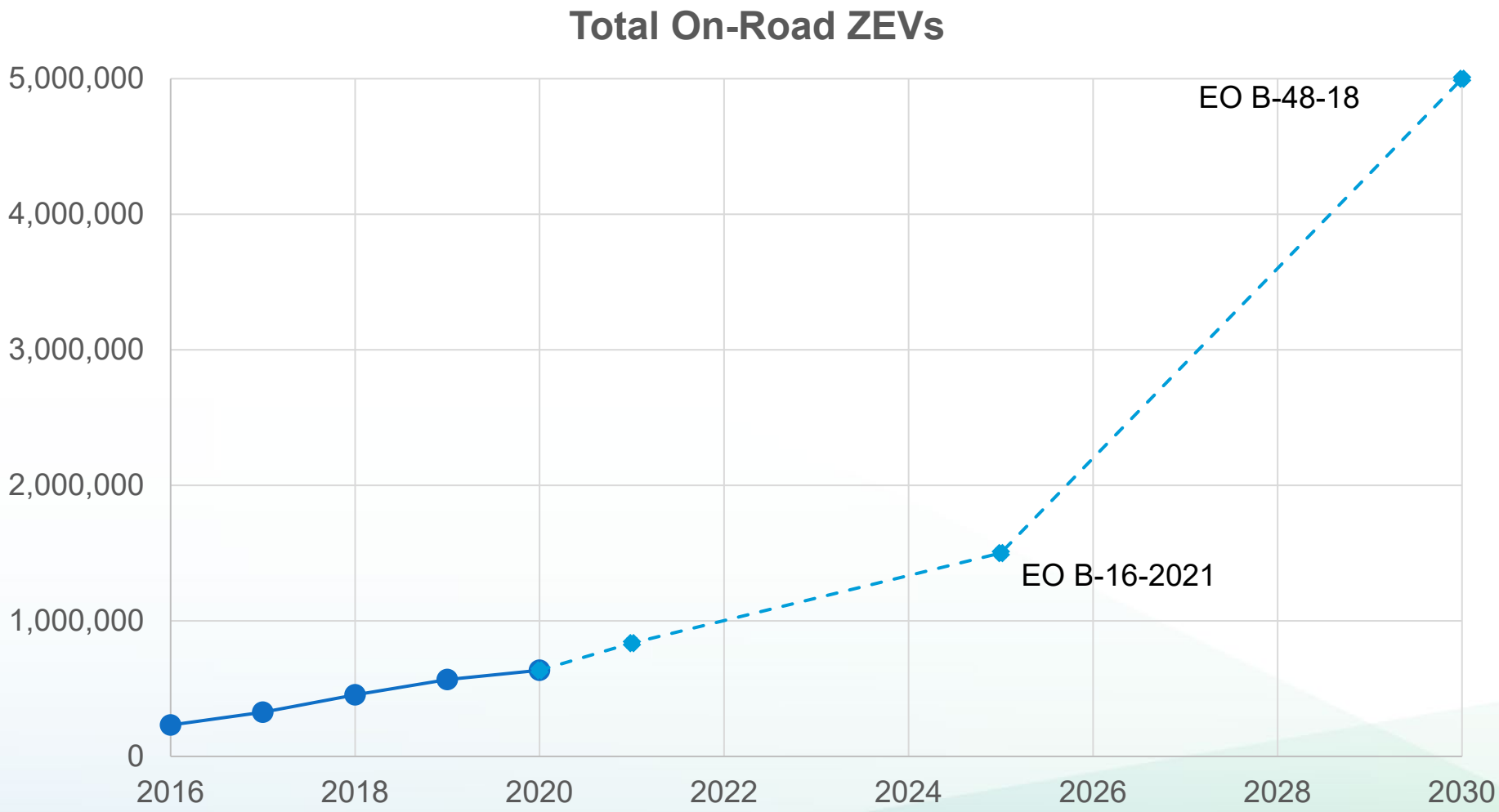
- Record ZEV sales in 2021 and 10% sales share look likely
- 1.5 million on-road ZEV by 2025 looks within reach; 5 million by 2030 may need help
- Tesla is the largest ZEV maker, but not a majority
- ZEV models are diversifying and will soon be offered for nearly all light-duty market segments

ZEV Sales on Pace for a Record in 2021…



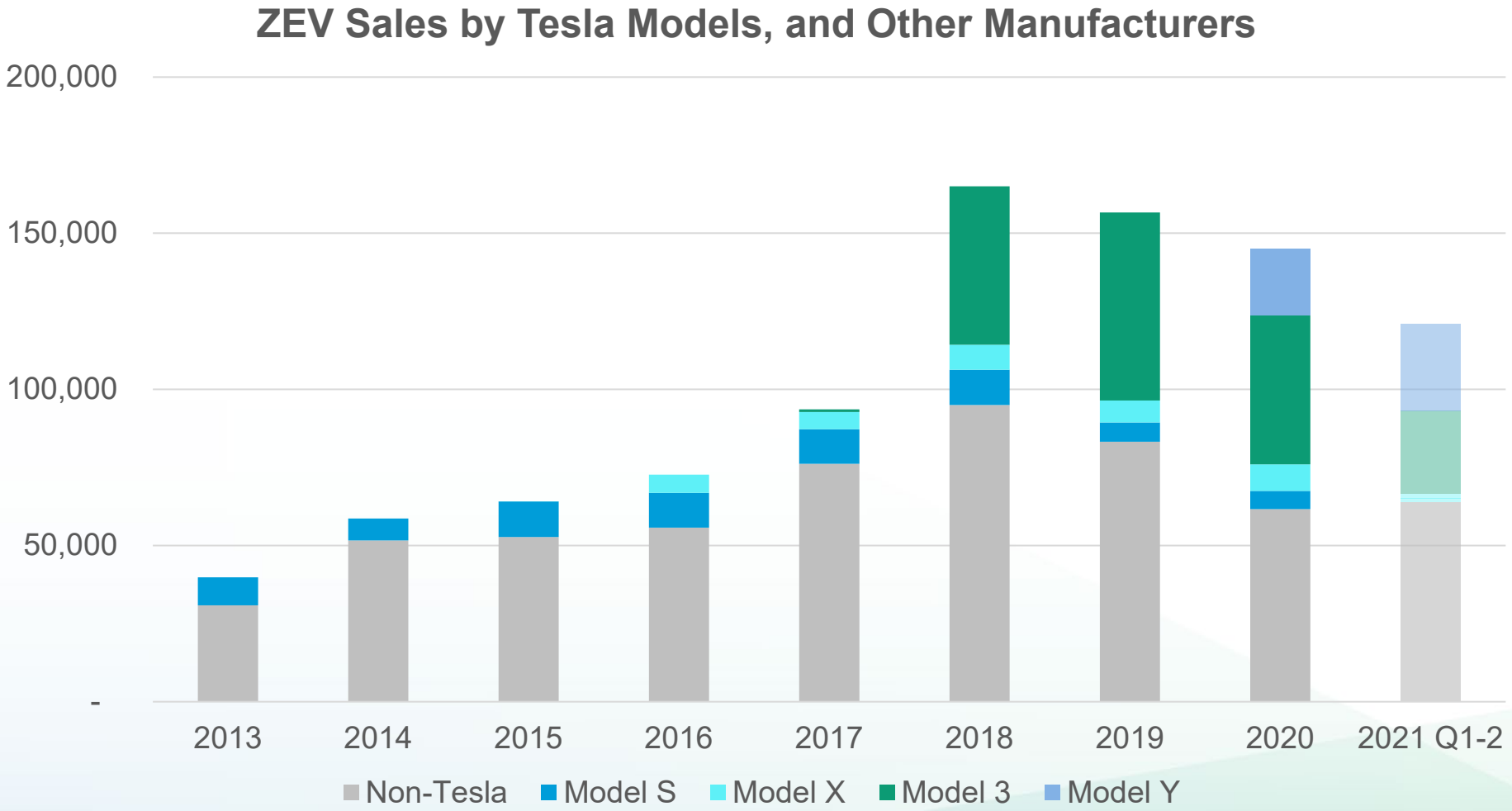
2021 Q1-2 sales data is through June 2021 and is approximate. Source: Zevstats.

… but There's a Long Way to Go



Source: Zevstats.

Tesla's Sales Share is Dominant, but not Absolute



Source: Zevstats.

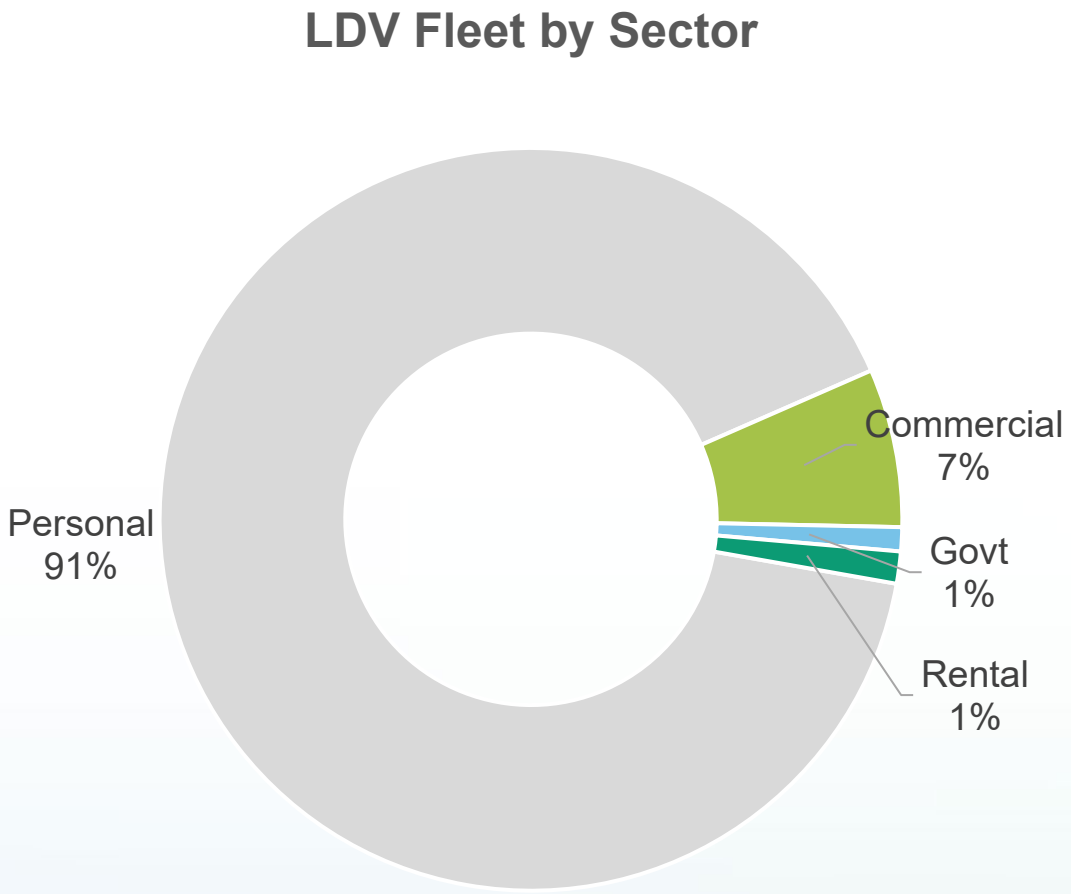
ZEV Sales Charts: The Top Ten

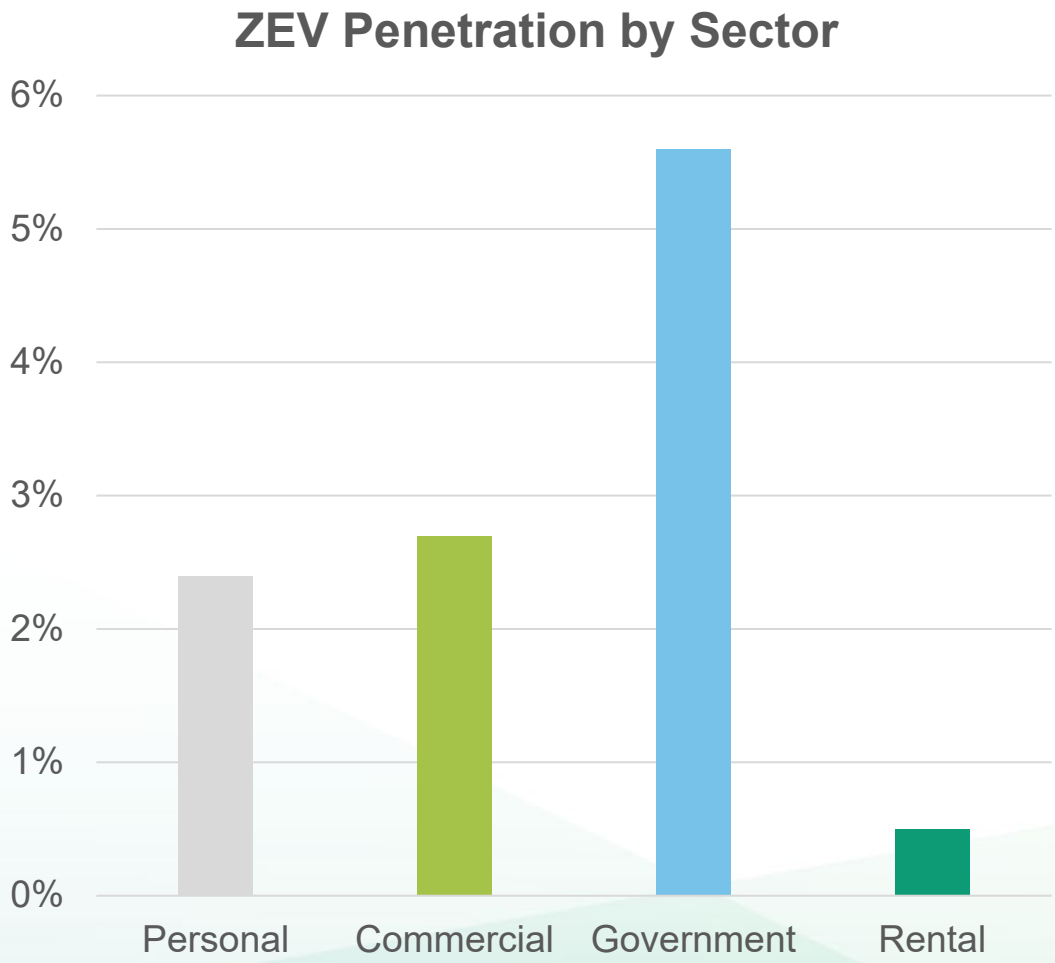
Rank	Make	Model	Fuel	2021 Q1-2 Sales
1	Tesla	Model Y	Electric	27,924
2	Tesla	Model 3	Electric	26,671
3	Chevrolet	Bolt EV	Electric	10,983
4	Toyota	Prius Prime	PHEV	10,535
5	Toyota	RAV4 Prime	PHEV	2,841
6	BMW	5 Series	PHEV	2,504
7	Ford	Mustang Mach-E	Electric	2,466
8	Nissan	LEAF	Electric	2,401
9	Audi	e-tron	Electric	2,247
10	Honda	Clarity PHEV	PHEV	2,236

Rank	Make	Model	Fuel	All-Time Sales
1	Tesla	Model 3	Electric	186,145
2	Chevrolet	Volt	PHEV	79,717
3	Tesla	Model S	Electric	74,719
4	Nissan	LEAF	Electric	56,036
5	Chevrolet	Bolt EV	Electric	55,949
6	Toyota	Prius Prime	PHEV	55,486
7	Tesla	Model Y	Electric	49,303
8	Tesla	Model X	Electric	36,227
9	Ford	Fusion Energi	PHEV	30,361
10	FIAT	500e	Electric	29,824

Source: Zevstats and staff analysis of DMV Vehicle Registration Database.

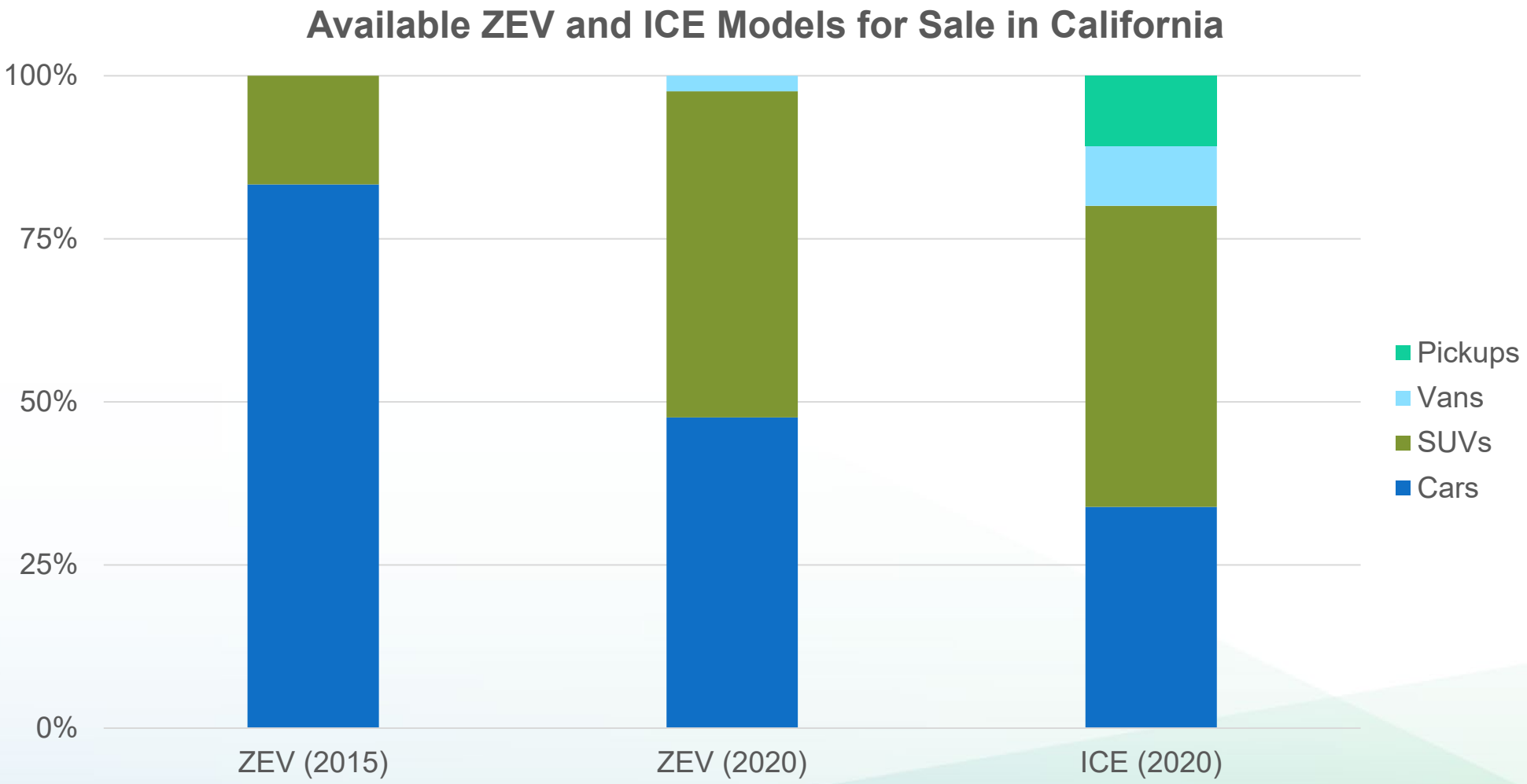
Govt/Rental sectors small, but have anomalous ZEV penetration





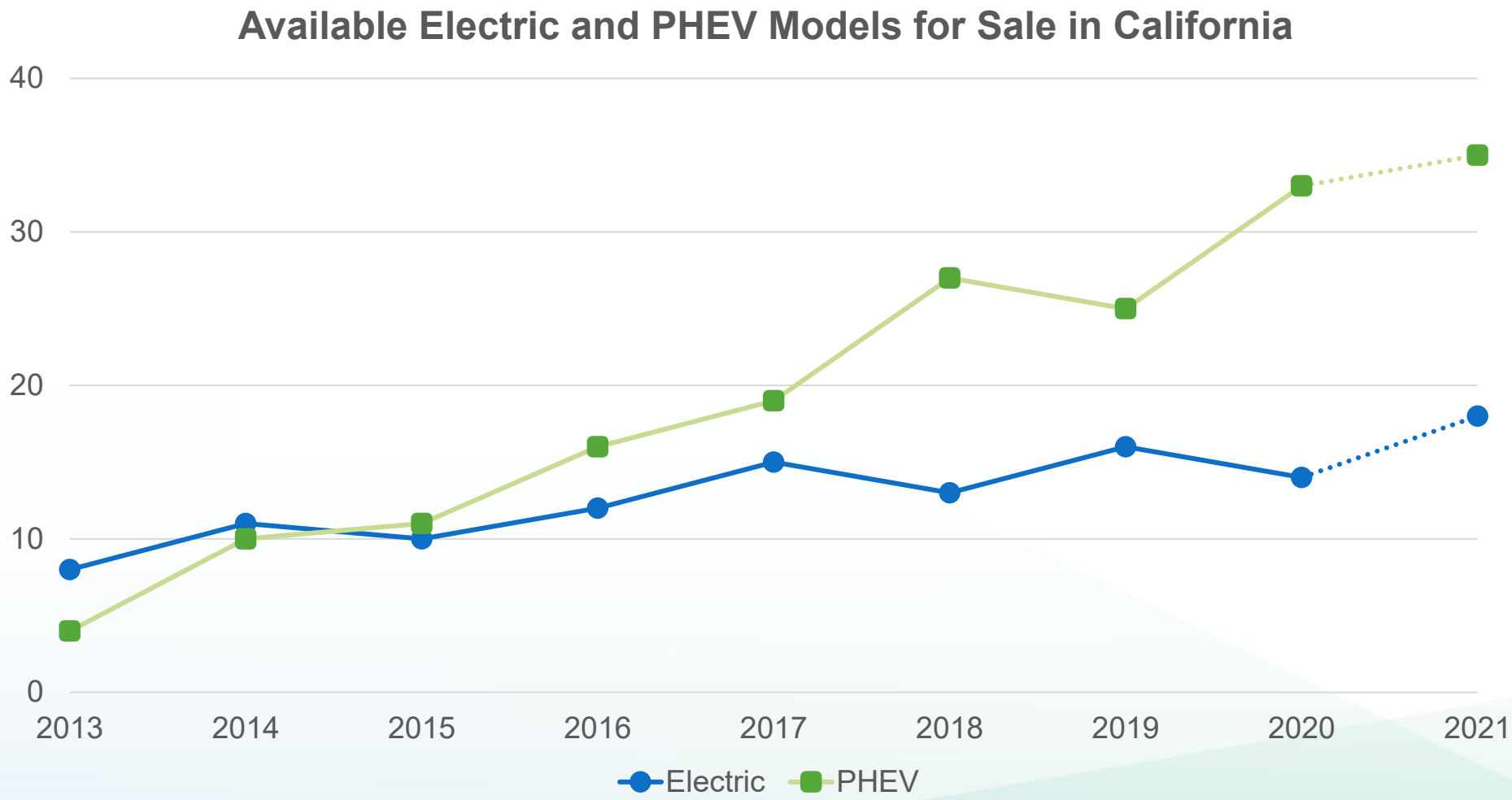
Includes all light-duty vehicles model year 2000 and later. Source: Staff analysis of DMV Vehicle Registration Database.

ZEV Model Availability Beginning to Look Like ICE



Source: Staff analysis of DMV Vehicle Registration Database.

Still More PHEV Models than Electric



Source: Zevstats and staff analysis of DMV Vehicle Registration Database.

Hydrogen Models

Toyota Mirai

Image source: Toyota

Honda Clarity FCV

Image source: Honda

Hyundai Nexo

Image source: CEC Staff. Dog not included.

Thank You!

Transportation Forecasting: Light Duty Vehicle Model Updates

IEPR Workshop on Electricity and Natural Gas Demand Forecast: Inputs and Assumptions
August 5, 2021

Aniss Bahreinian
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Overview of Updates

- Forecasting Inputs
- Model Updates
- Light Duty Vehicle Classes

Input Updates

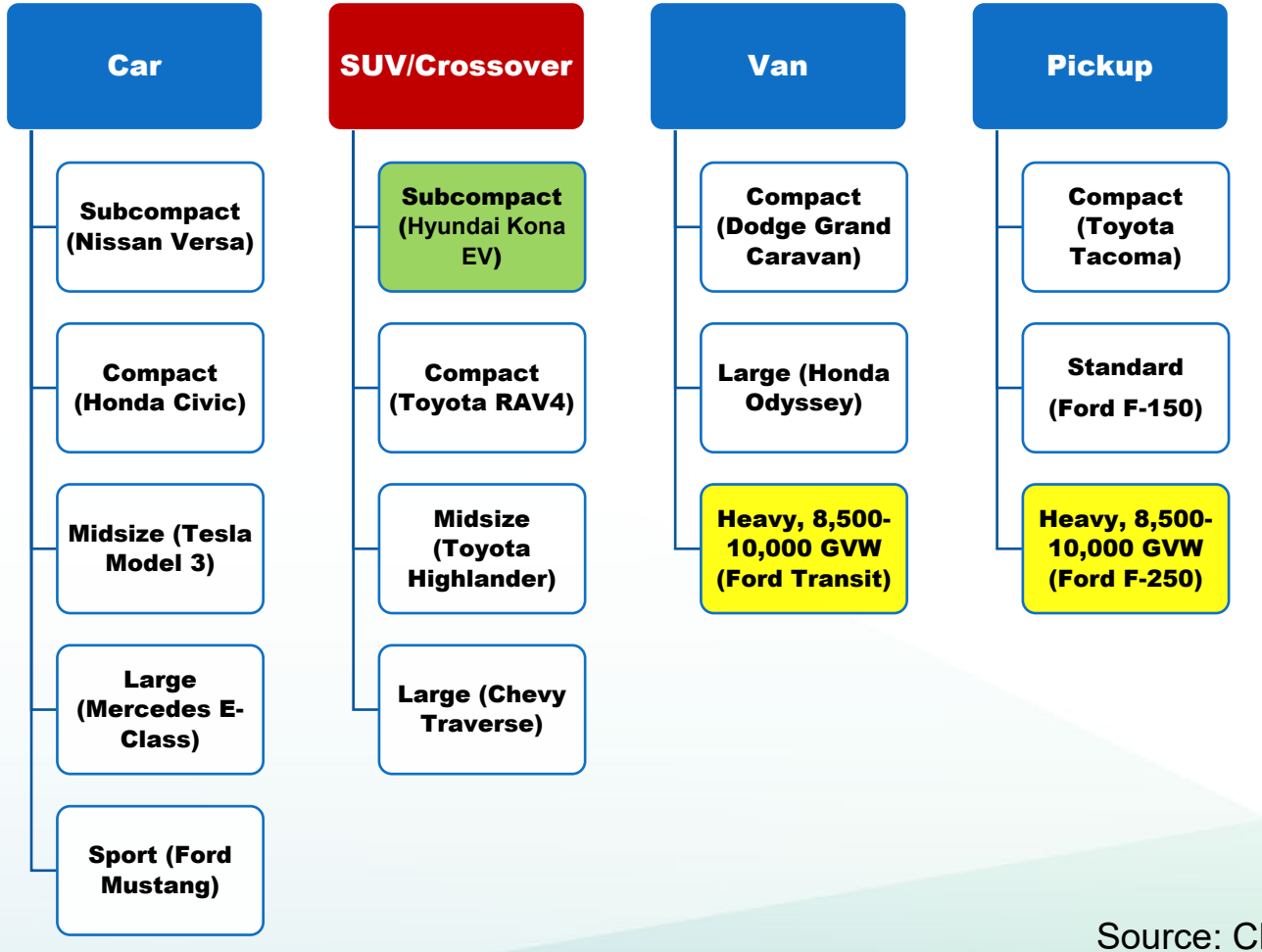
- Economic & Demographic Data,
- Energy Prices,
- Vehicle attribute (price, range, MPG …etc) forecasts **updating**:
  - All attribute values,
  - Technology introduction & elimination schedules,
  - Differentiating between luxury and standard vehicle attributes,
  - Light duty vehicle attribute forecast scenarios includes one on the 2035 ICE sales ban for a potential ZEV demand forecast scenario.

Forecasting Horizon: 2021-2035

Model Updates

- Consumer preferences in the **newly estimated models** reflect the snapshot of consumer preferences, in the residential and commercial market segments, captured in the **2019 California Vehicle Survey data**,
- Differentiating between **luxury and standard** vehicle preferences,
- Higher resolution of income category; **10 income categories** vs 7 in prior forecasts,
- **514 household types** vs 362 household types in prior forecasts,
- Rebate incentives **by threshold income category**, more consistent with current CVRP practice.

New Vehicle Classes: 15 New Classes vs 18 Legacy Classes



Source: CEC staff

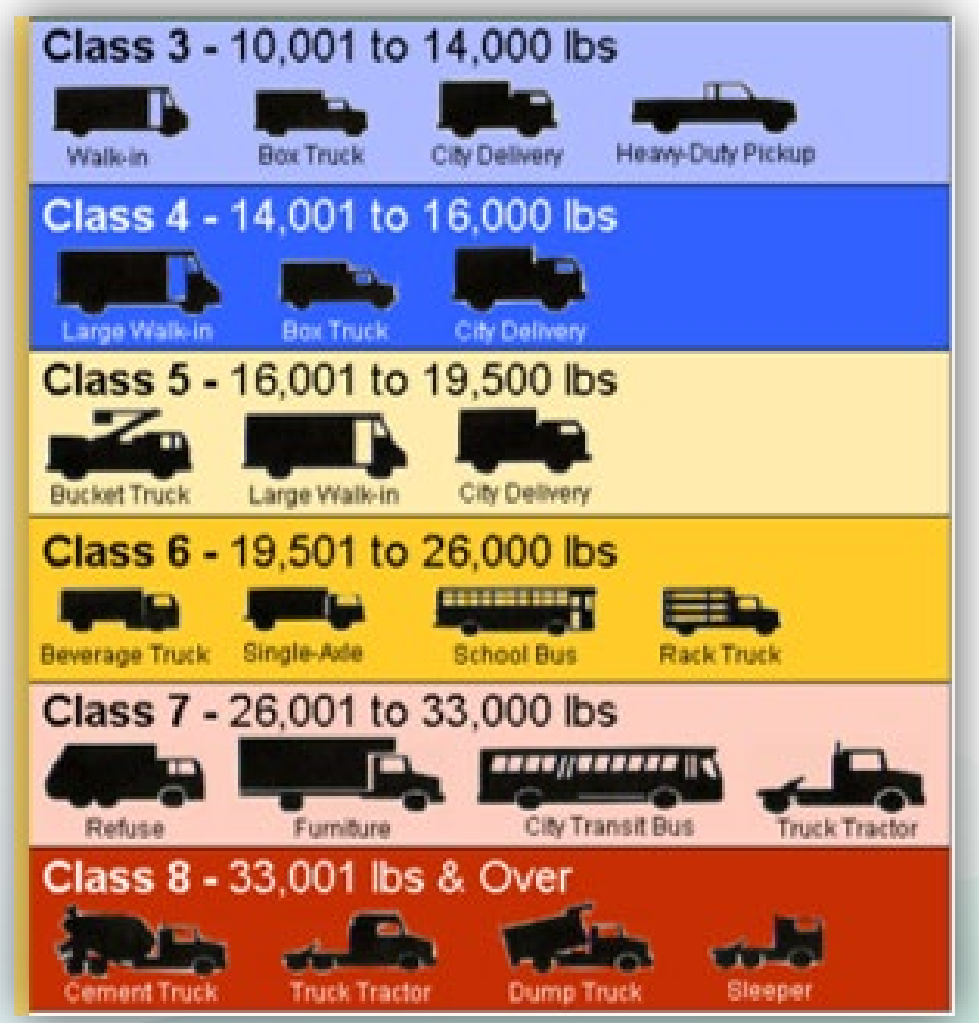
Thank You!

Truck Choice and Freight Model Inputs and Assumptions – 2021 IEPR

Presenter: Bob McBride, Energy Commission Specialist

Date: August 5, 2021

Medium- and Heavy-duty Vehicle Classes



MD-HD Truck Model and Data Changes since IEPR 2020

- Update commodity growth and service growth based on economic projections
- Reclassify trucks to stay comparable to CARB's EMFAC 2021
- Allocate freight-tons to new truck classes for Classes 4 to 8
- Update truck prices and fuel economy
- Update the availability matrix of fuel types and truck classes
  - Dropped dedicated ethanol and catenary electric
  - Added Class 6 hydrogen
- Removed the restriction on daily movement of battery-electric trucks to their nominal range
- Update the distribution of intermodal rail and truck freight tons

Powertrain Availability Matrix (draft)

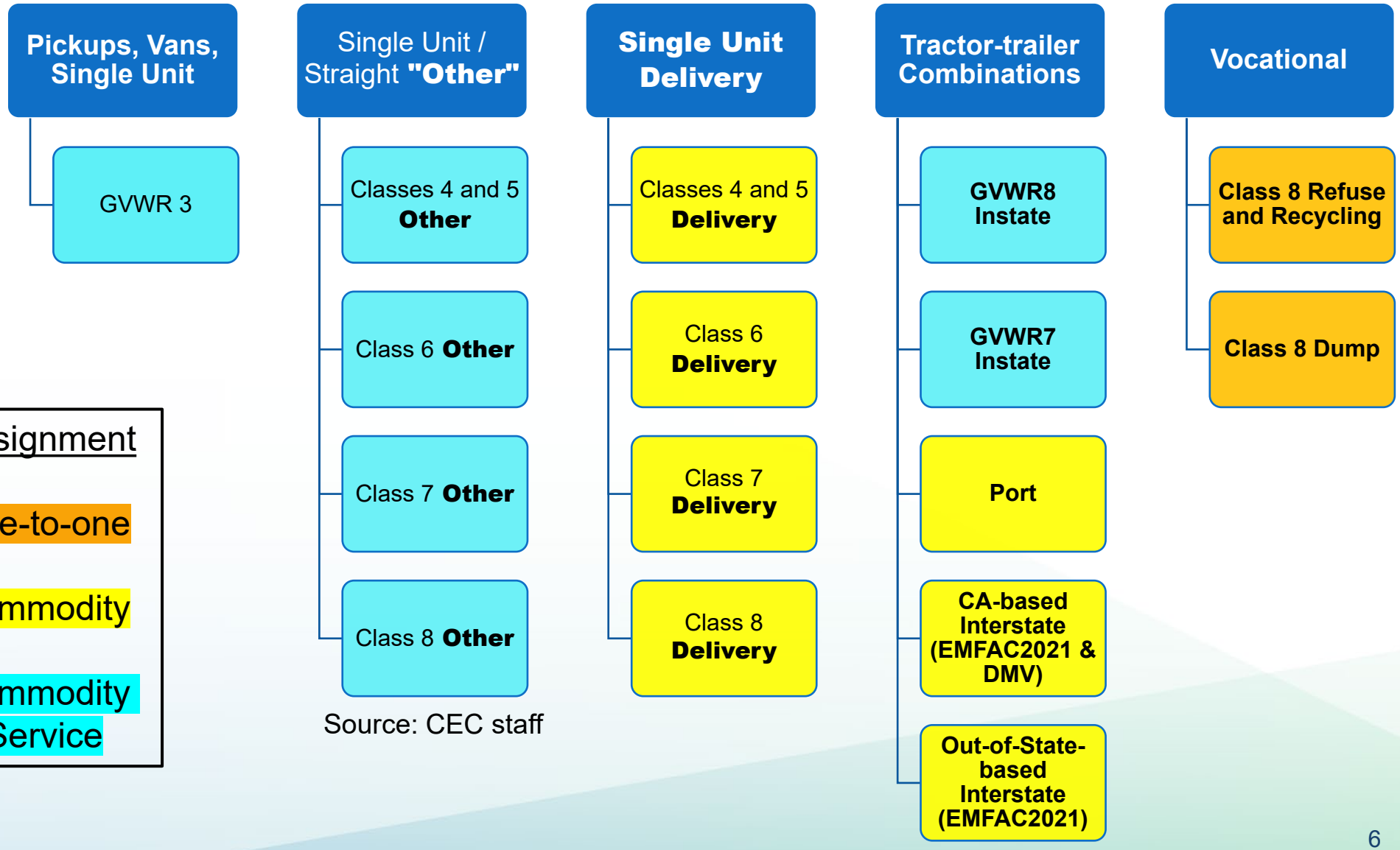
	Diesel-Electric Hybrid	Battery electric	Gasoline	hydrogen fuel cell	natural gas	propane	diesel	Diesel PHEV	gasoline hybrid
GVWR3	Null	2016	1995	Null	Null	2000	1995	Null	2020
GVWR4and5	2010	2016	1995	Null	2000	2000	1995	Null	2020
GVWR4and5 Delivery	2010	2016	1995	Null	2000	2000	1995	Null	2020
GVWR6	2010	2016	1995	2027	2000	2000	1995	Null	Null
GVWR6 Delivery	2010	2016	1995	2027	2000	2000	1995	Null	Null
GVWR7	2010	2024	Null	Null	2003	Null	1995	Null	Null
GVWR7 Delivery	2010	2024	Null	Null	2003	Null	1995	Null	Null
GVWR7 COMBO	Null	2021	Null	Null	2003	Null	1995	Null	Null
GVWR8_SU	Null	2024	Null	Null	2000	Null	1995	2025	Null
GVWR8 REFUSE AND RECYCLING	2020	2023	Null	Null	2000	Null	1995	Null	Null
GVWR8 COMBO	Null	2021	Null	2022	2007	Null	1995	2025	Null
GVWR8 IRP	Null	Null	Null	TBD	2000	Null	1995	Null	Null
GVWR8 PORT	Null	2021	Null	2022	2007	Null	1995	2025	Null
GVWR8_SU DUMP	Null	2024	Null	Null	2000	Null	1995	TBD	Null
GVWR8 CAIRP	Null	Null	Null	TBD	2000	Null	1995	Null	Null
GVWR8 PUBLIC AND UTILITY	Null	2024	Null	Null	2000	Null	1995	TBD	Null

Source: CEC staff

Uses of CARB's EMFAC 2021 Data

- Annual miles per truck estimated using a fitted equation from EMFAC 2021 miles per truck by class and vintage
- Survival rates by model year are a statewide average of EMFAC 2021 stock proportions through time (to represent retirements, imports, and sales of used trucks)
- Truck fuel economy values from EMFAC 2021 where they exist. Supplemented with ICF's research for additional fuels using GREET and HD Systems data

Commodity Assignment to Truck Class (Remainder Becomes Service Trucks)



Source: CEC staff

Questions?

Production Cost Model Preliminary Inputs, Assumptions, and Results

2021 Integrated Energy Policy Report (IEPR)

Presenters: Hazel Aragon, Electric Generation System Specialist I
Paul Deaver, Electric Generation System Program Specialist I

Date: August 5, 2021

Topics

- IEPR Preliminary Common Case Overview
- Inputs and Assumptions
  - Load forecast
  - Renewable portfolio build
  - Hydro updates
  - Thermal fuel and price updates
- Selected Simulation Results
  - Natural gas demand for electric generation
  - Greenhouse gas emission projections
  - California generation

IEPR Preliminary Common Case Overview

Common Case	2020 CA Energy Demand Update	Price	Energy Efficiency	2030 RPS Target
High Energy Consumption	High	Low	Low AAEE	60%
Mid Energy Consumption	Mid	Mid	Mid AAEE	60%
Low Energy Consumption	Low	High	High AAEE	60%

*AAEE = Additional Achievable Energy Efficiency

*RPS = Renewable Portfolio Standard

Preliminary Inputs and Assumptions

CA Energy Demand for PLEXOS Simulations

- Preliminary IEPR simulations used 2020 CA Energy Demand Update
  - Hourly load and modifiers for Investor-Owned Utilities (IOUs)
    - Add “Leap Day” – only modification
  - Annual load and modifiers for Publicly Owned Utilities
    - Loads shaped using CEC-developed shape from historical data
    - Modifiers calculated and shaped using nearest IOU profile
- Mid-Mid / High-Low / Low-High Cases used
- https://www.energy.ca.gov/data-reports/reports/integrated-energy-policy-report/2020-integrated-energy-policy-report-update-0

Rest of WECC Loads

- Data obtained from various sources
  - Western Electricity Coordinating Council (WECC) Loads and Resources - Peak and Energy for 2024 through 2030 only
  - Federal Energy Regulatory Commission 714 filings
  - Utility Integrated Resource Plans (IRPs)
- High and Low Cases developed using U.S. Energy Information Administration (EIA) 861 regional electricity sales forecast data by category (Residential, Industrial, Commercial)
- Adjustments made in certain areas to smooth / control growth

Rest of WECC Loads (cont.)

- For out of state (OOS) loads, for the mid case:
  - Use historical data (2014-2018) by Balancing Authority Area or state to create average monthly load duration curves (LDC)
  - Create a base year LDC (2018) to order average monthly LDCs
  - Re-order average LDCs based on 2018 chronology
- For the low and high cases use 2020 EIA Annual Energy Outlook:
  - Percent difference between mid/low and mid/high to get multipliers
  - Use multipliers on mid case to get low/high cases

Retirements and Additions

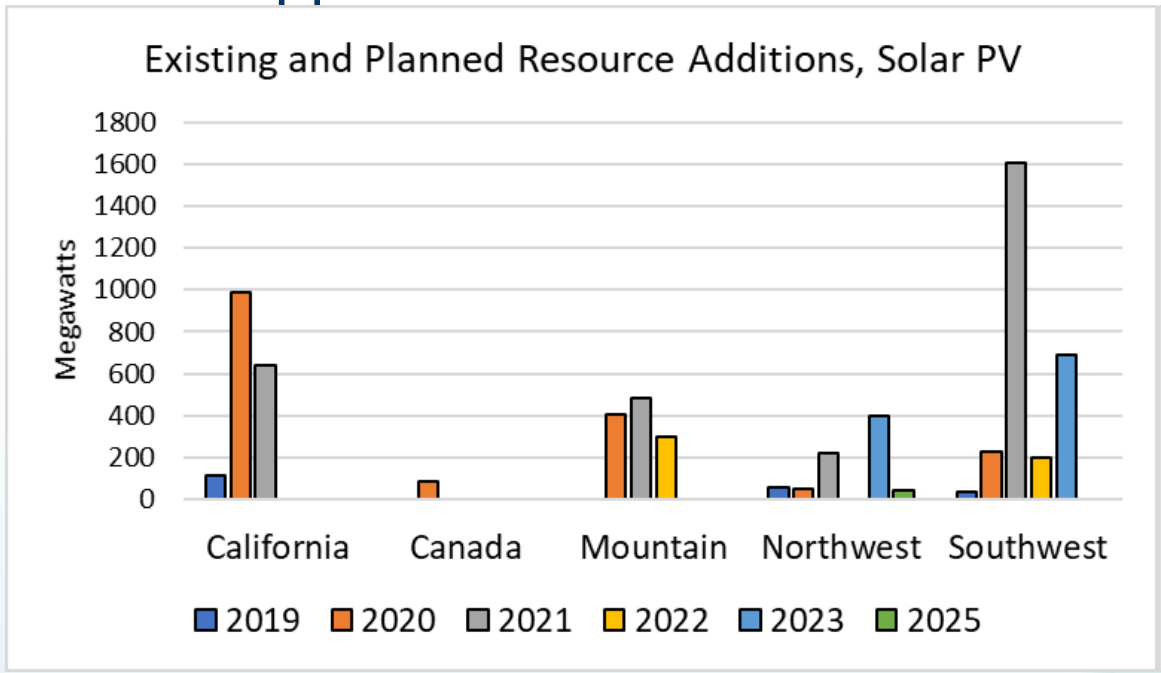
- Hitachi ABB Energy Velocity Suite subscription database / WECC Anchor Dataset (ADS) / Trade Press / IRPs
- Once Through Cooling compliance dates
- “Generic” renewable additions for RPS Requirements
- Updates captured through January 2021

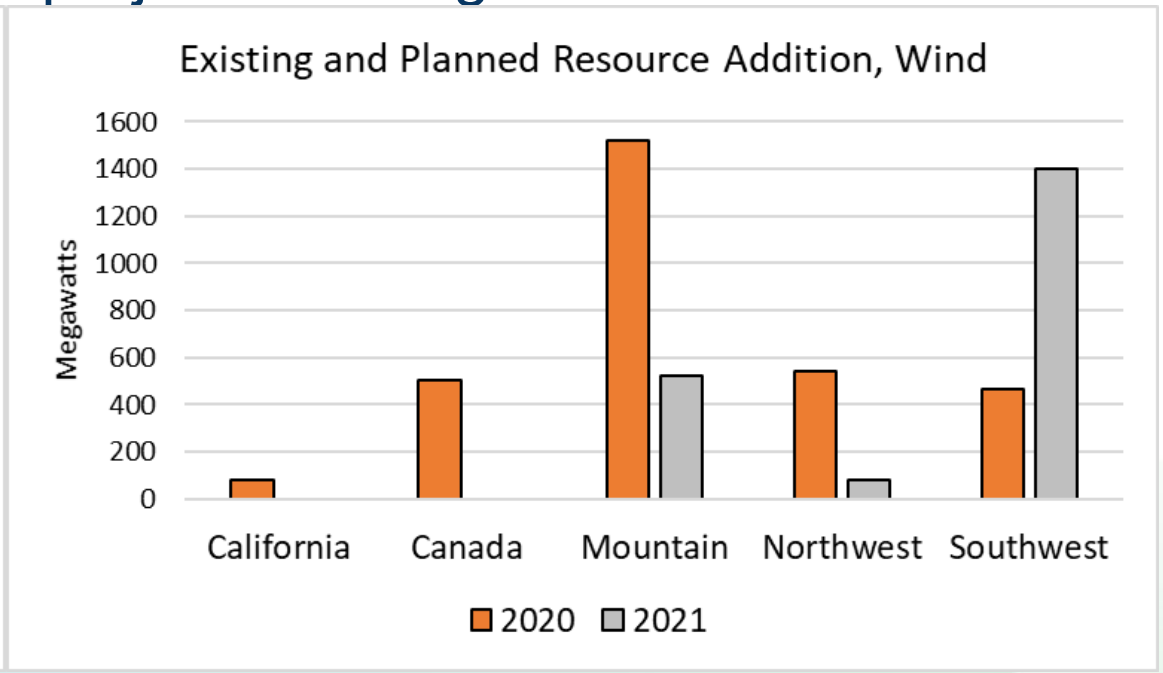
Retirements

- Additional 5,450 megawatt (MW) in WECC-wide retirements by 2030 not captured in the previous IEPR cycle:
  - 3,360 MW in coal capacity retiring
  - 1,740 MW in gas capacity retiring
  - Remaining 340 MW in biomass, landfill gas, hydro resources

Additions

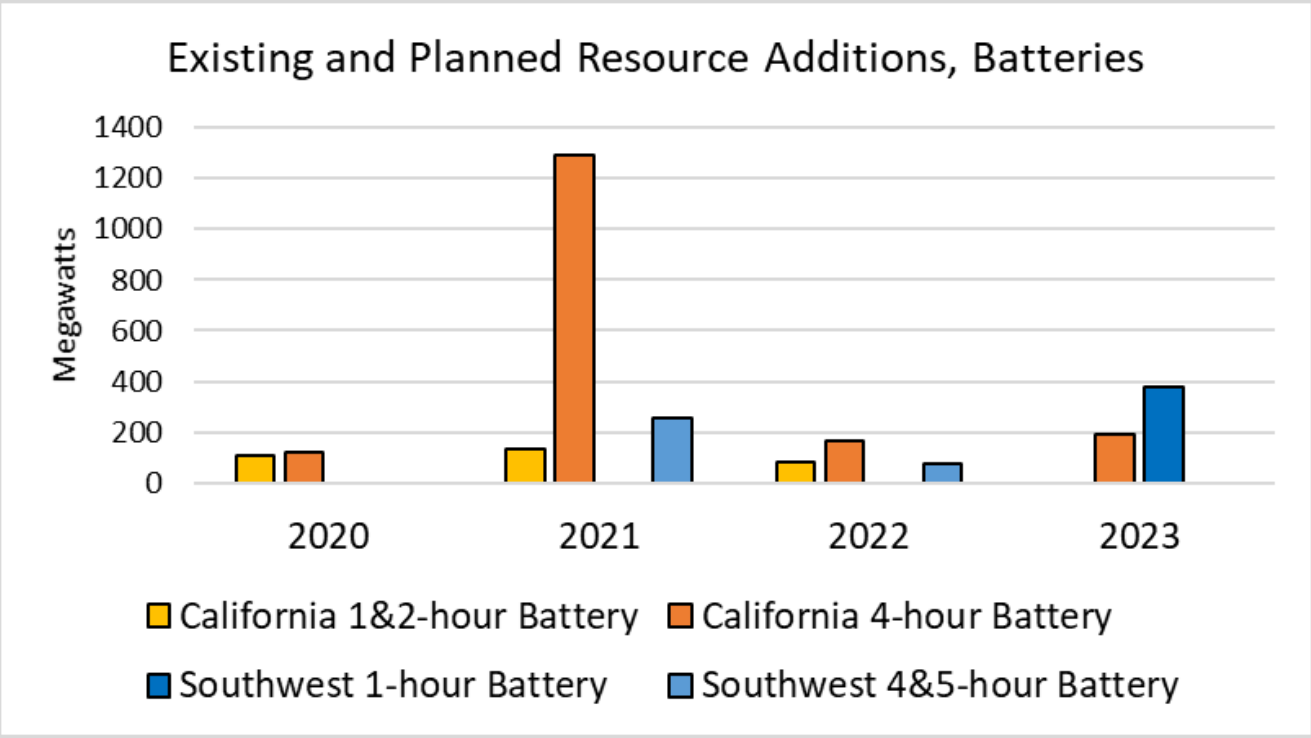
- Solar photovoltaic (PV) and wind additions to the Preliminary IEPR 2021 cycle
- Planned resources include those under construction, some regulatory approval or level of confidence in projects coming online





Additions (cont.)

- 1, 2, 4, or 5-hour battery storage additions to the Preliminary IEPR 2021 cycle
- Planned resources include those under construction, some regulatory approval or level of confidence in projects coming online



Renewable Profiles

- Wind/Solar original source:
  - California: Use California Independent System Operator data and aggregate
  - Rest of WECC: National Renewable Energy Laboratory data
- For this update: changed all times to Pacific Standard Time, and do not adjust for daylight savings
  - Provides consistent estimates as solar PV generation can change greatly in an hour or two

Renewable Portfolio Build for the RPS

- Estimated RPS energy targets in the mid demand

Estimated Mid Demand Annual RPS Targets (GWh)			
State	**2022**	**2026**	**2030**
Arizona	7,384	13,574	20,112
California	**89,812**	**117,393**	**143,384**
Colorado	10,387	10,629	11,194
Montana	1,239	1,264	1,296
New Mexico	3,144	7,247	9,510
Nevada	8,374	9,296	13,826
Oregon	7,013	11,209	14,256
Utah	4,210	5,094	5,239
Washington	11,834	11,901	12,149
Total	**143,397**	**187,607**	**230,966**

Renewable Portfolio Build for the RPS (cont.)

- Additional capacity is added to the model as “generic” to meet the RPS target

Mid Demand Installed Generic Capacity to Meet California's RPS (MW)			
	2022	2026	2030
RPS Biomass	**0**	**248**	**429**
RPS In-State	0	248	429
RPS Out-of-State	0	0	0
RPS Geothermal	**0**	**55**	**109**
RPS In-State	0	55	96
RPS Out-of-State	0	0	13
RPS Solar PV	**0**	**7,939**	**14,702**
RPS In-State	0	7,939	13,773
RPS Out-of-State	0	0	929
RPS Wind	**0**	**1,418**	**4,967**
In-State	0	1,418	2,461
RPS Out-of-State	0	0	2,506
Total MW	**0**	**9,660**	**20,208**

"Generic" Battery Storage

- Additional 4-hour capacity is added to the model as “generic” to meet zero unserved energy

High Demand Case Generic 4-Hour Battery Capacity (MW)			
Region	**2022**	**2026**	**2030**
California	1,445	3,099	4,499
Northwest	140	140	140
Southwest	319	2,300	2,300
Mountain	88	88	88
Grand Total	**1,992**	**5,627**	**7,027**

Hydro Generation Input Data

- 2005 to 2019 average monthly generation by plant
  - Quarterly Fuel and Energy Report (QFER) data for CA
  - EIA data (via Hitachi ABB Energy Velocity) for rest of WECC
  - Conventional hydro only

- California annual total generation ~ 27 terawatt-hours (TWh)
- Rest of WECC annual total generation ~ 211 TWh
- Constraints added to CAISO and PNW to ensure minimum generation

Nuclear Refueling Schedule

- Diablo Canyon / Palo Verde / Columbia Generating Station
- Use historical patterns for refuel outages from EIA data
- Outage duration ~ 5 weeks every 18 months
- Unit outages staggered – no overlap at Diablo Canyon and Palo Verde
- Diablo Canyon units retires in 2024, 2025

Heat Rate Update

- Use public data to update natural gas plant operating attributes
  - Environmental Protection Agency (EPA) Continuous Emissions Monitoring System (CEMS)
  - Index of /DMDnLoad/emissions/hourly/monthly/ (epa.gov)

- For this update, used 2014-2018 hourly data to create a relationship between fuel use and output, and remove outliers
  - Staff white paper describes the method in detail:
  - Updating Thermal Power Plant Efficiency Measures and Operational Characteristics for Production Cost Modeling | California Energy Commission

Price Updates

- Deflator series – U.S. Bureau of Economic Analysis, Mood's Analytics Forecasted
- Greenhouse gas (GHG) prices – CEC, Alberta Government, British Columbia Carbon Tax
- Updates to coal and gas cold start costs and thermal variable operations and maintenance costs – WECC ADS, EIA
- June 2021 natural gas burner tip price* – CEC North American Gas-Trade (NAMGas) team

Thermal Price Updates

- Except for super critical coal, all other thermal technologies saw a decrease in start costs

		Cold Start Data - 2019$	Baseload Variable Cost - 2019$	$ Difference (2019$)	
WECC - Unit Type	PLEXOS - Unit Type	C&M Cost ($/MW cap.)	($/MWh)	Cold Start	Baseload Variable Cost
Coal - Small Sub Critical	COAL_SML	$ 142.25	$ 1.77	$ (22.90)	$ (1.40)
Coal - Large Sub Critical	COAL_LRG_SUB	$ 112.61	$ 2.37	$ (5.35)	$ (0.64)
Coal - Super Critical	COAL_LRG_SUP	$ 124.47	$ 3.71	$ 7.63	$ 0.39
Gas - Steam	GAS_ST	$ 66.19	$ 0.29	$ (18.07)	$ (0.75)
Gas - Large Frame CT	GAS_SC_LRG	$ 56.31	$ 0.55	$ (59.41)	$ (0.09)
Gas - Aero Derivative CT	GAS_SC_AERO	$ 27.66	$ 0.44	$ (8.29)	$ (0.30)
Typical CC [GT+HRSG+ST]	GAS_CC	$ 74.09	$ 2.07	$ (14.67)	$ 0.93

EIA - Unit Type	Plexos Child Name	VO&M Cost - 2019$
50-MW Biomass Plant	Biomass	$ 4.83
50-MW Biomass Plant	Wood	$ 4.83
Internal Combustion Engines - Landfill Gas	Landfill Gas	$ 6.20
Geothermal	Geothermal	$ 1.16

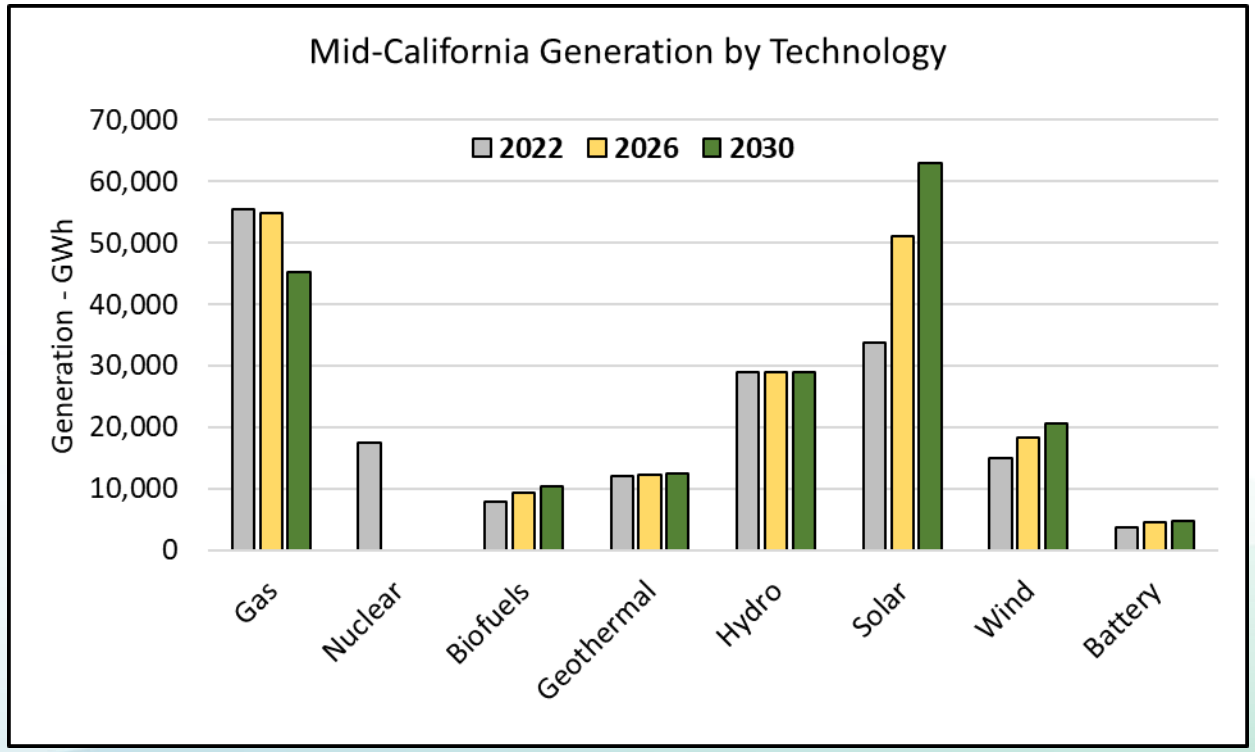
Ongoing Work

- Items we would like to address permitting the time:
  - Finalize iterations with the NAMGas team on the burner tip prices
  - Update the renewable and battery portfolio to account for the recent CPUC Proposal Decision, which adds 11,500 MW of NQC capacity
  - Apply more emphasis on system reliability not only in the summer but also in the winter

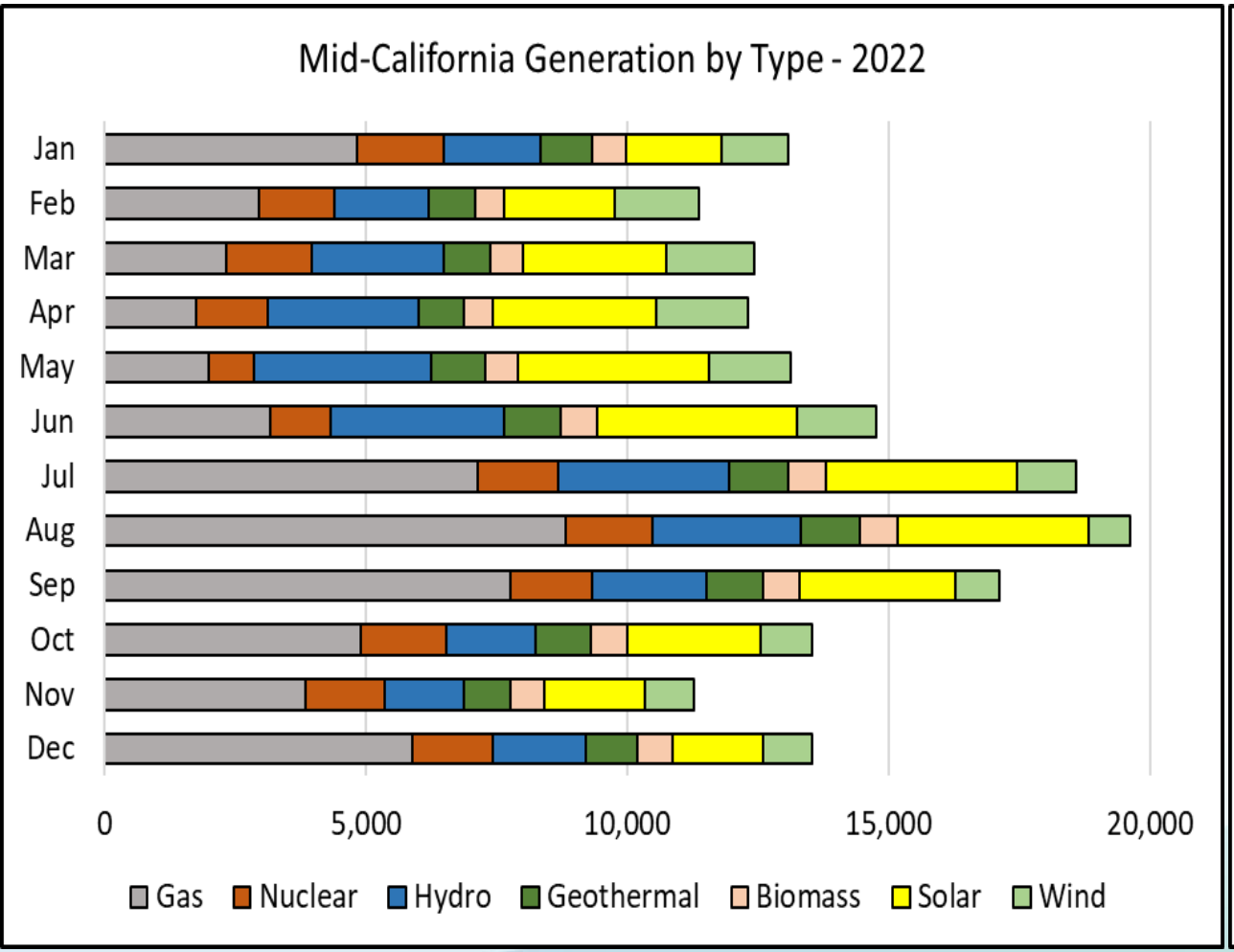
Preliminary Results

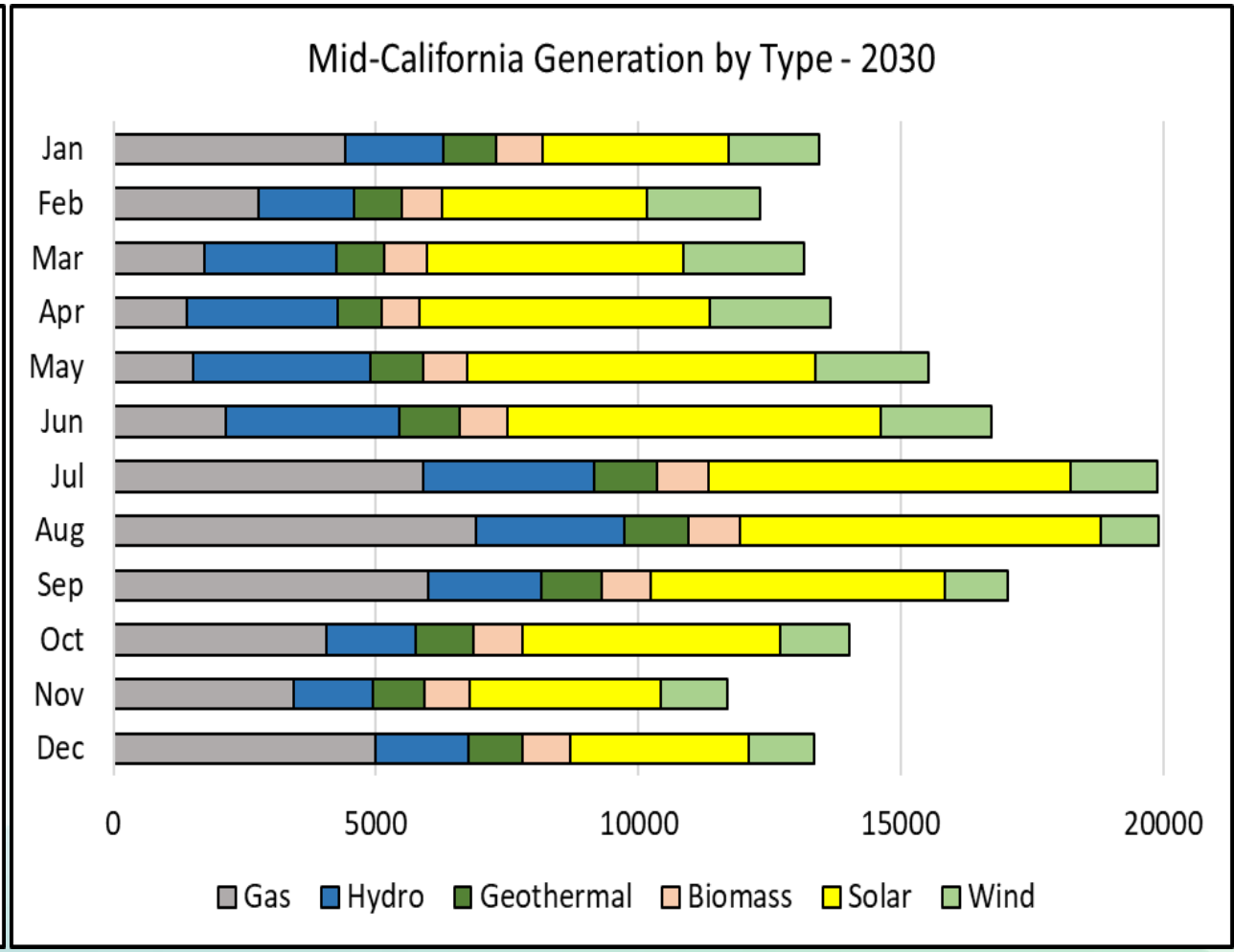
CA Generation Results (Annual)

- In California, gas use decreases as solar and wind increase
  - Decrease from 2022-2026 is smaller than from 2026-2030
    - Diablo retirement cause short term need for some gas
- Biofuels, geothermal, and hydro remain constant

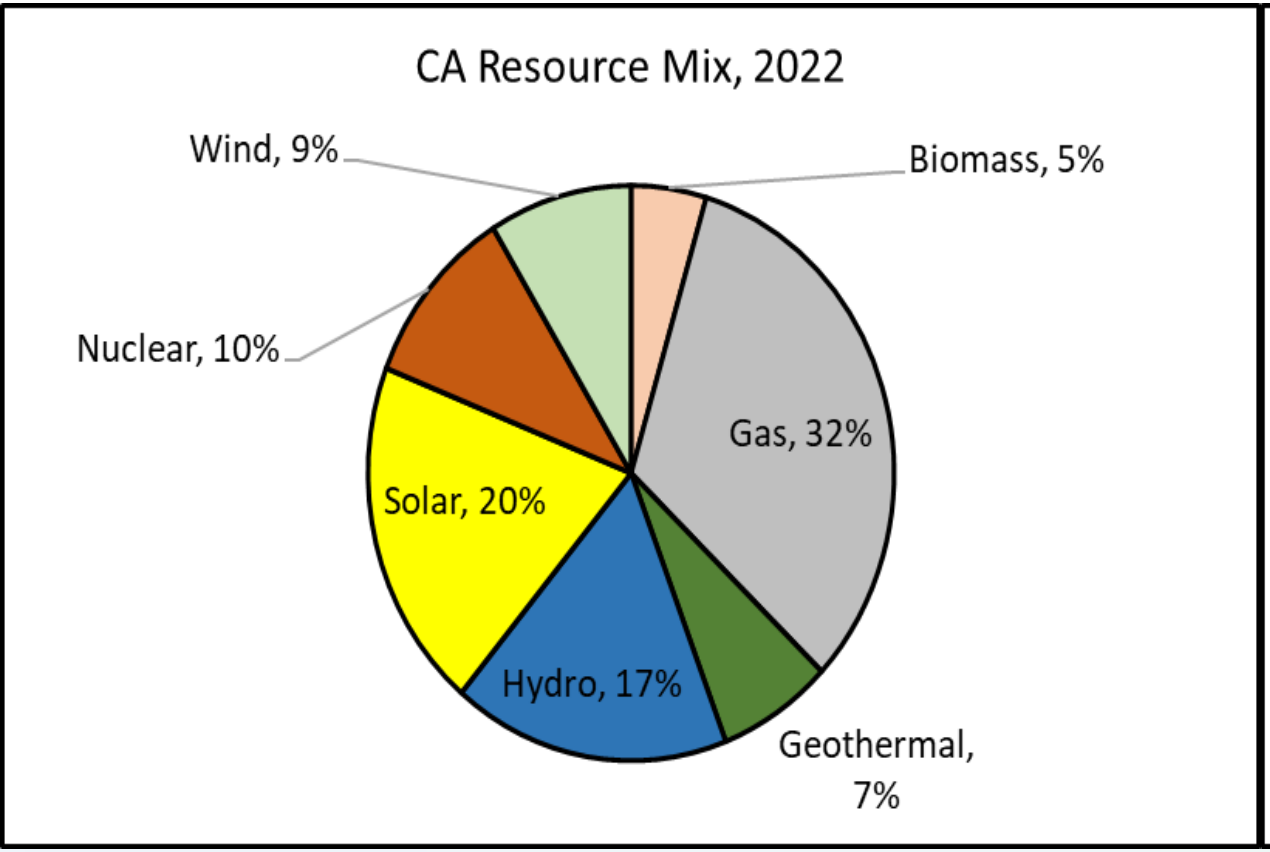


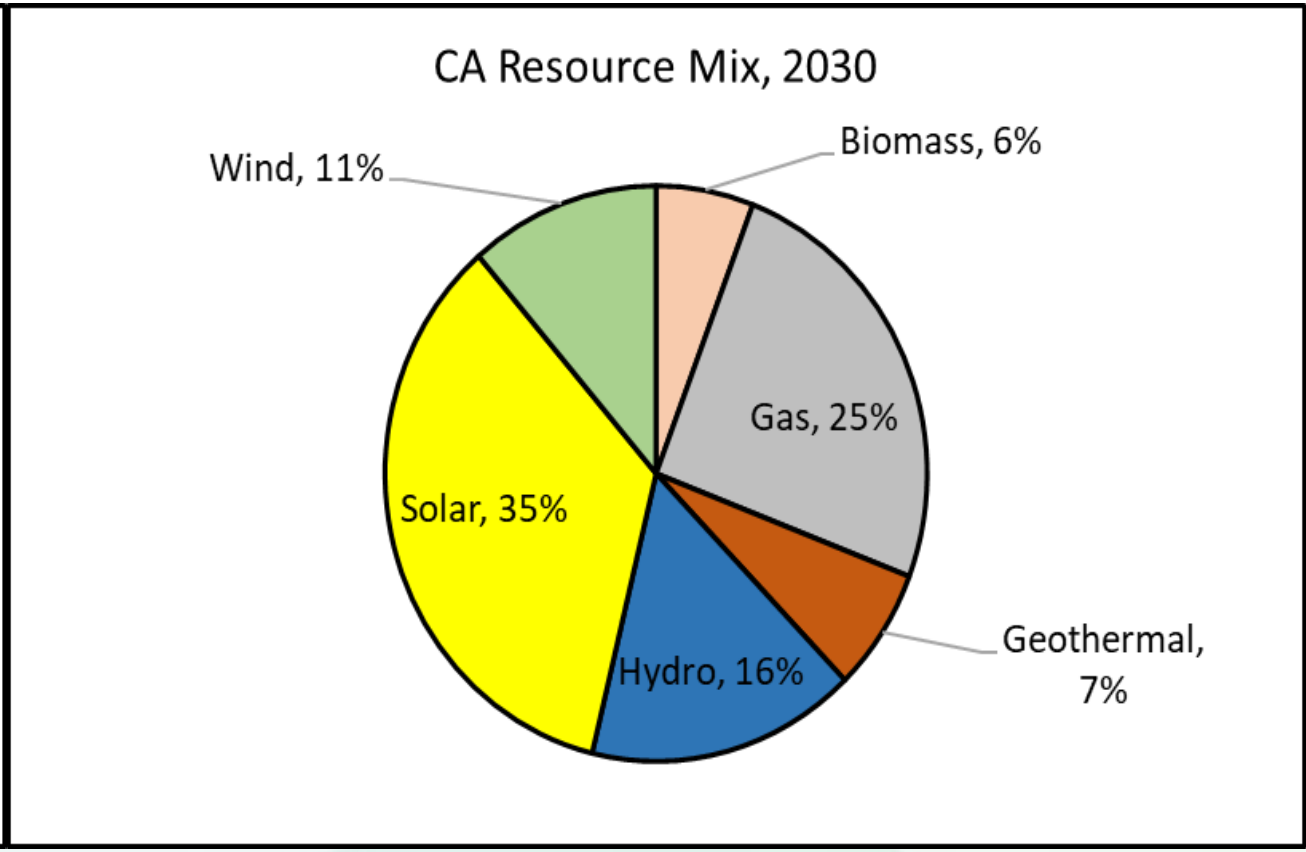
CA Generation Results (Monthly)





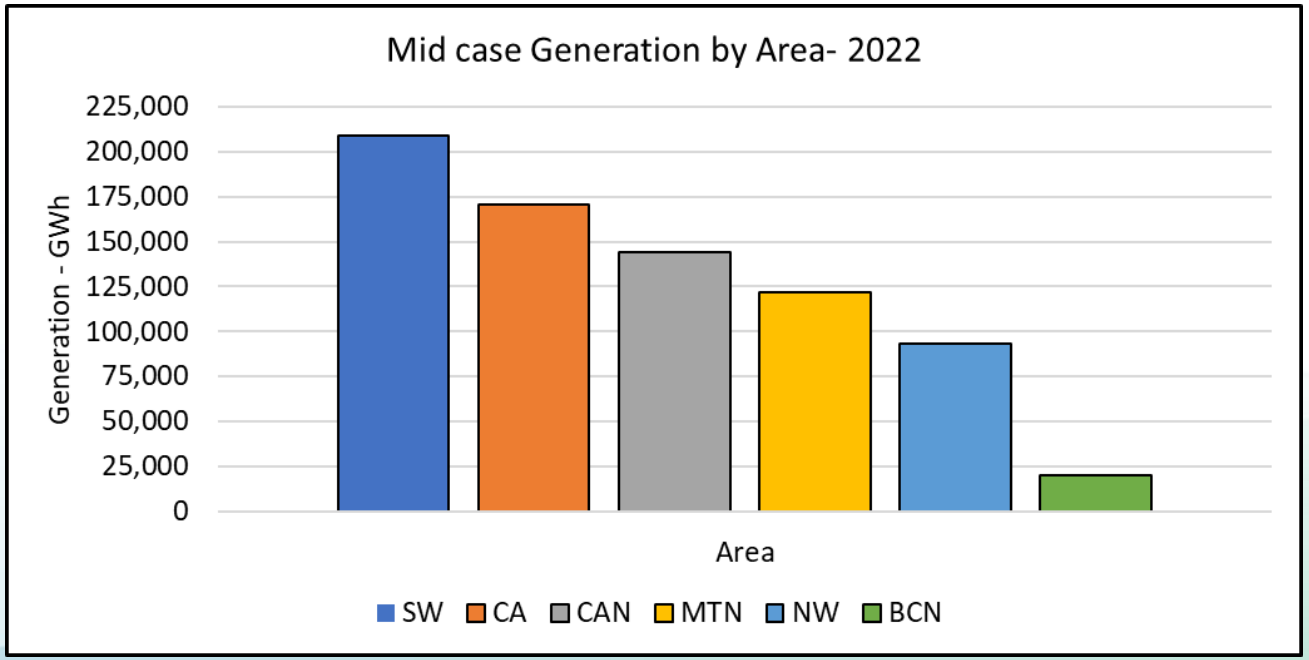
California Generation Mix-Mid Case



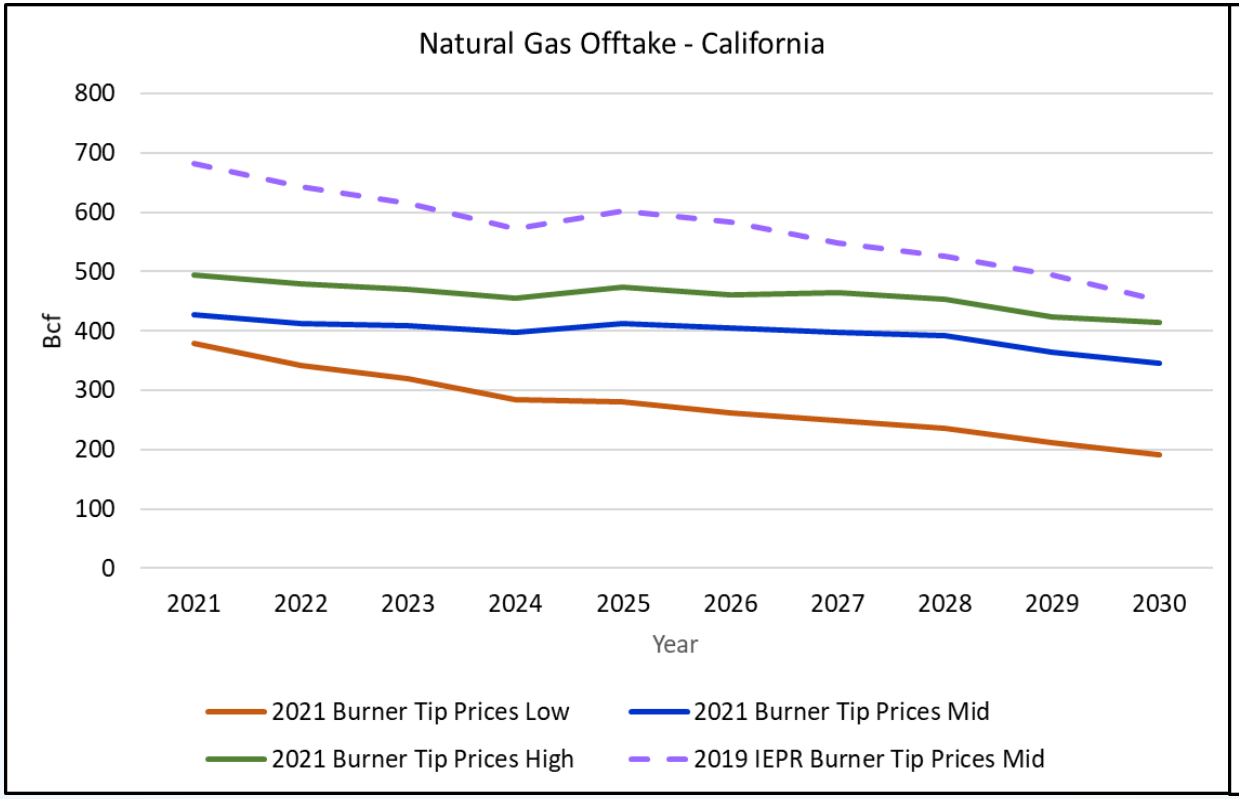


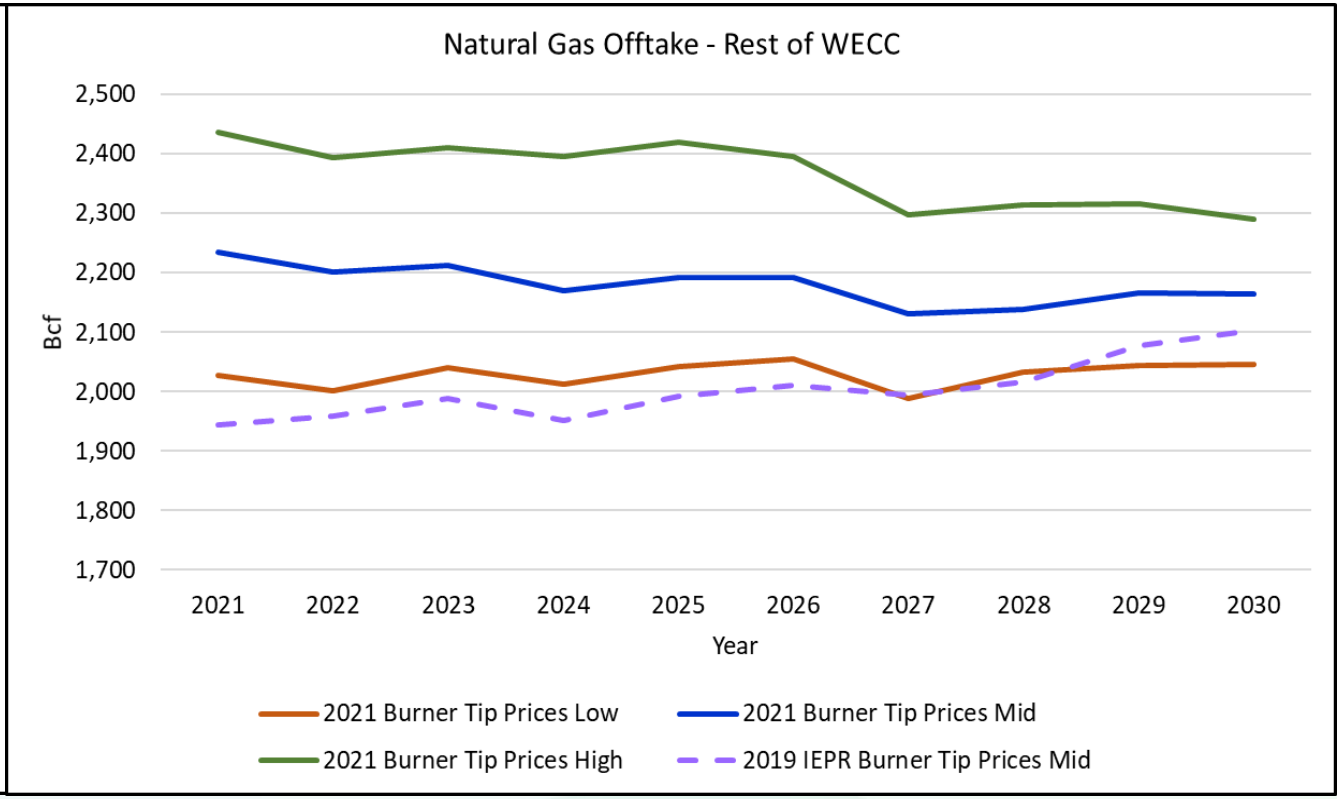
Generation by Area

- Southwest states generate the most, followed by CA
  - Pattern persists through 2030
- SW: Arizona, New Mexico, & Nevada
- NW: Oregon, Idaho, and Montana
- MTN: Utah, Colorado, Wyoming, and South Dakota
- CAN: Alberta and British Columbia
- BCN: Baja California North (CFE)

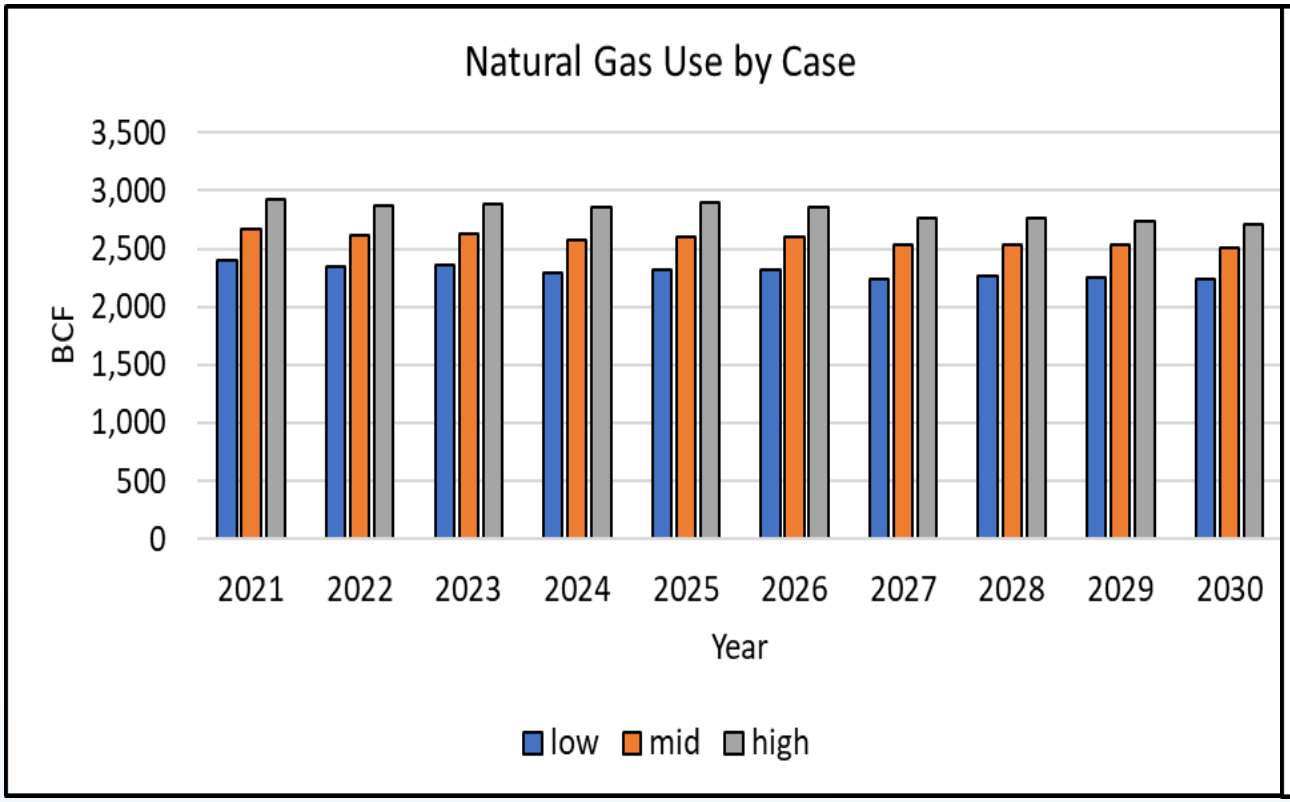


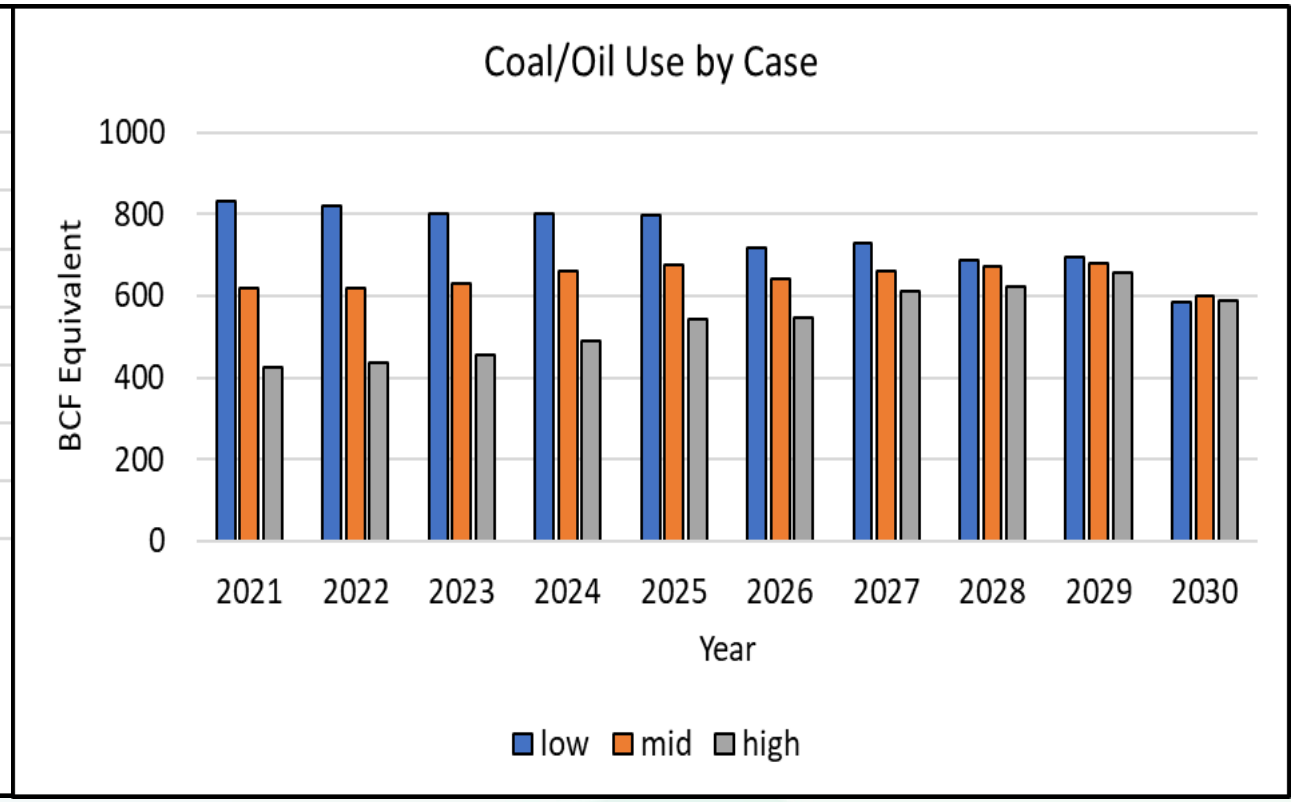
Natural Gas Use (CA and rest of WECC)



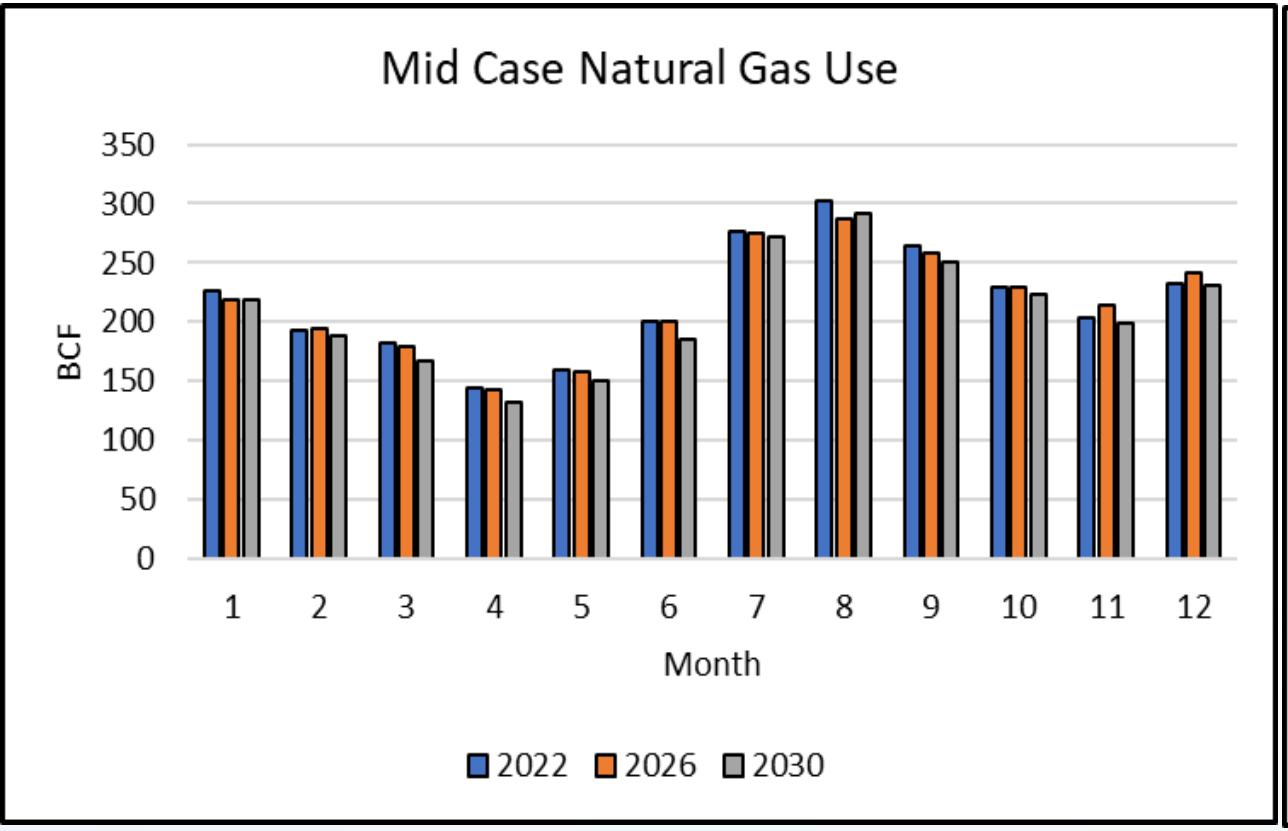


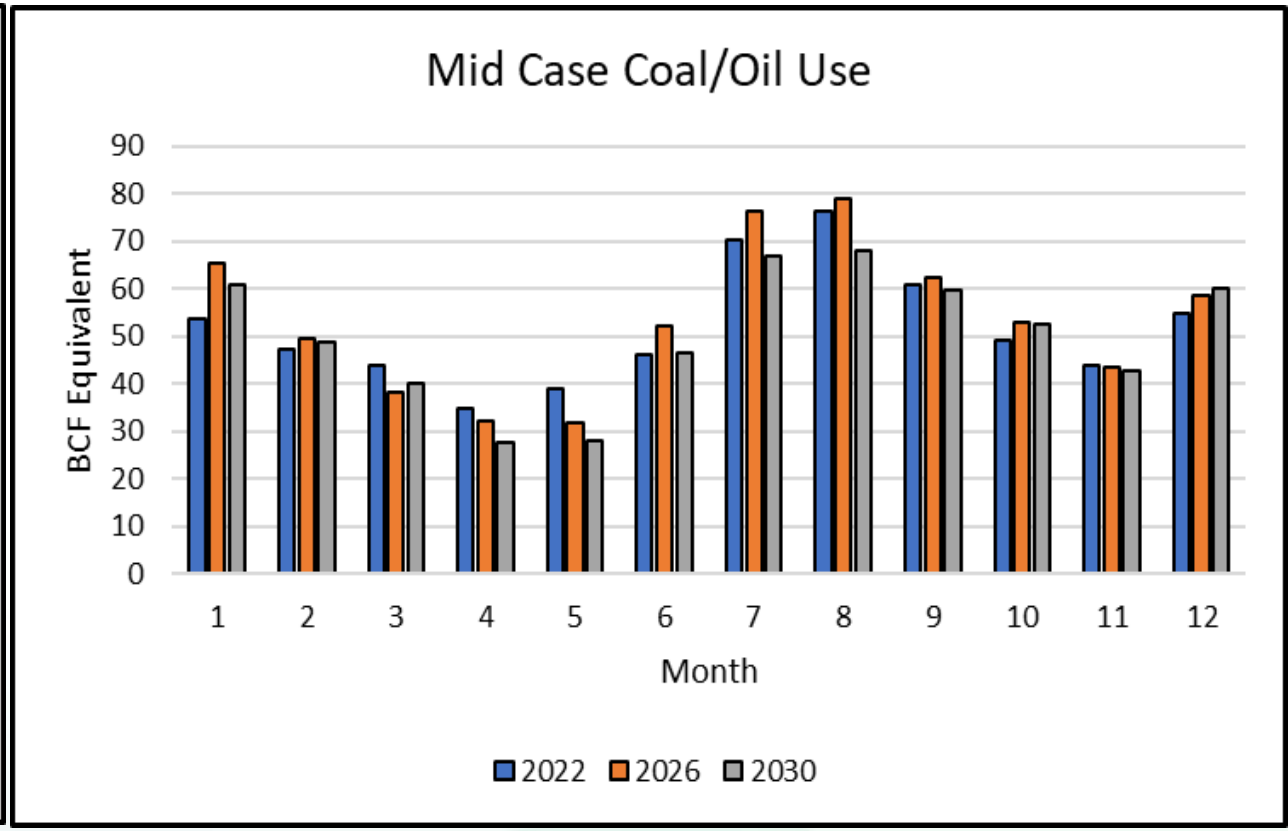
Natural Gas and Coal Use- WECC



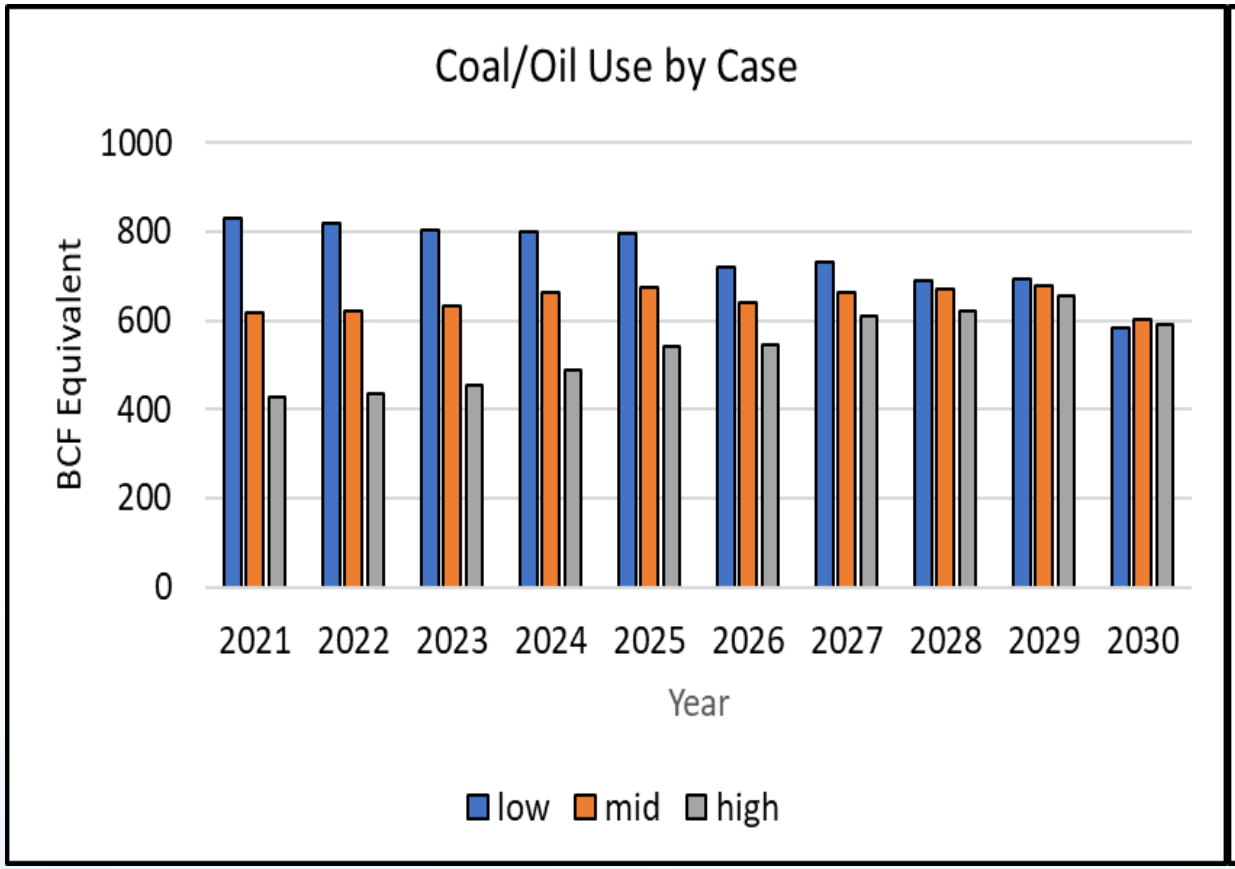


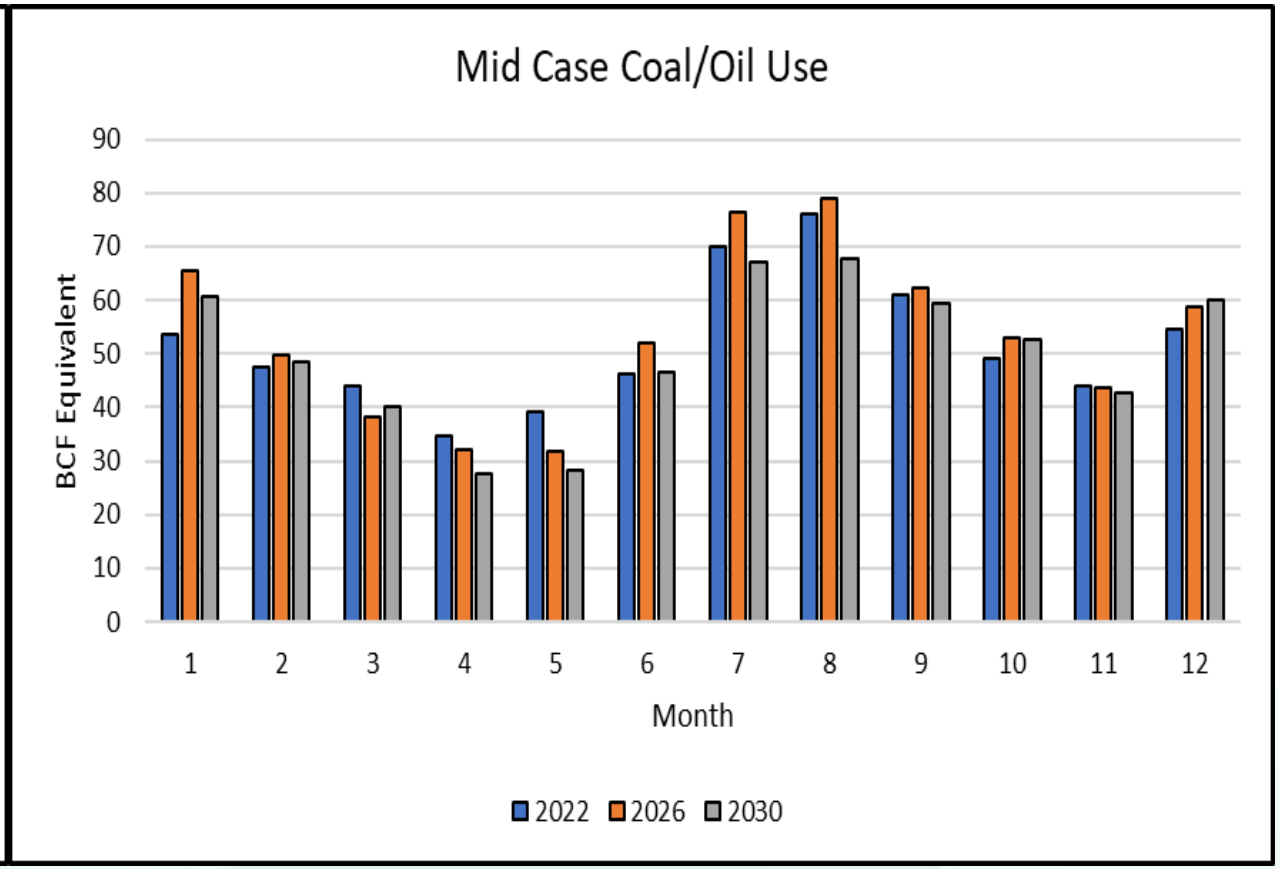
Natural Gas and Coal Use-WECC



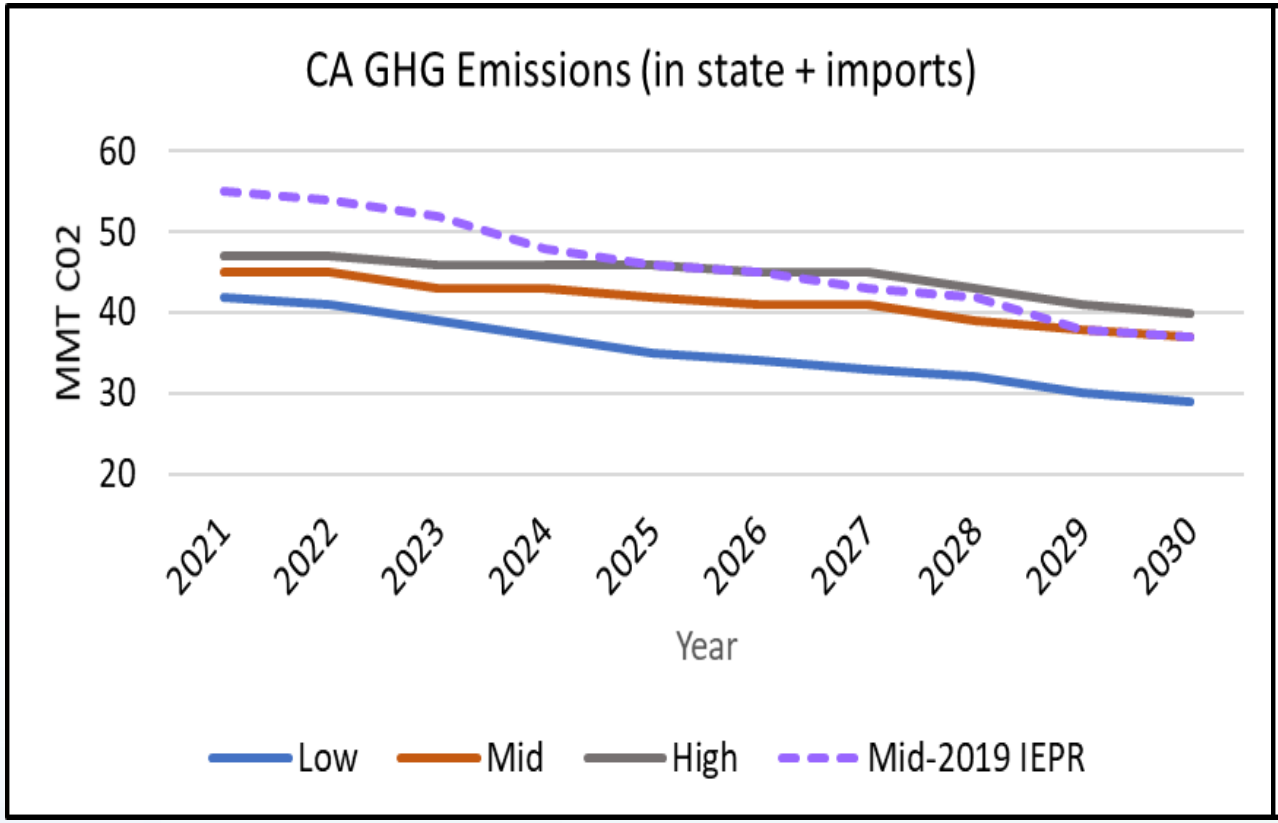


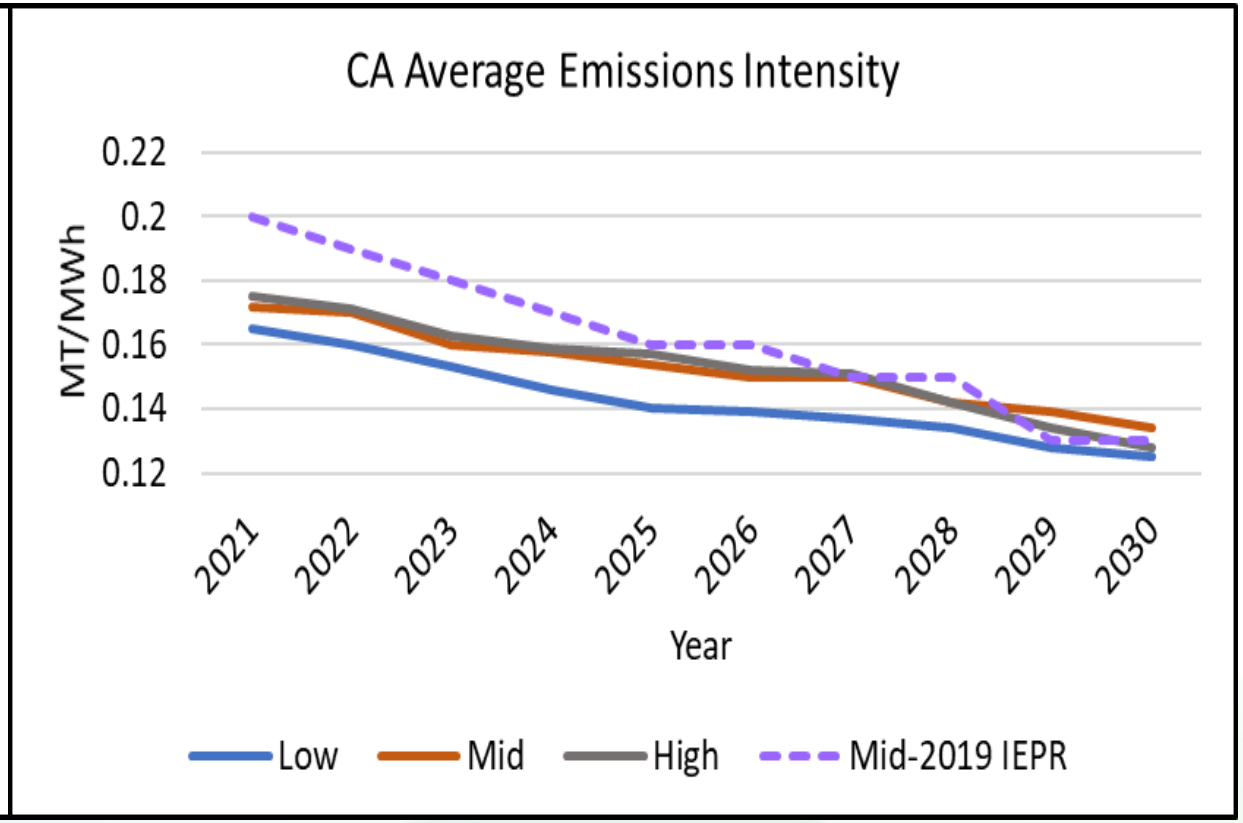
Coal Use (WECC)





California GHG Emissions





California GHG Emissions Cont.

2022	Month											
Hour	1	2	3	4	5	6	7	8	9	10	11	12
0	0.23	0.22	0.18	0.13	0.13	0.15	0.21	0.25	0.25	0.25	0.24	0.25
1	0.24	0.22	0.19	0.13	0.14	0.16	0.22	0.26	0.26	0.25	0.24	0.25
2	0.24	0.22	0.19	0.14	0.15	0.17	0.22	0.26	0.26	0.25	0.24	0.25
3	0.23	0.22	0.19	0.14	0.15	0.17	0.23	0.26	0.26	0.25	0.24	0.25
4	0.23	0.22	0.18	0.13	0.15	0.16	0.22	0.26	0.26	0.25	0.24	0.25
5	0.23	0.21	0.17	0.13	0.14	0.16	0.22	0.26	0.25	0.24	0.23	0.25
6	0.21	0.20	0.17	0.13	0.14	0.15	0.21	0.25	0.25	0.23	0.22	0.23
7	0.21	0.18	0.14	0.11	0.11	0.13	0.18	0.20	0.21	0.20	0.21	0.22
8	0.18	0.16	0.10	0.09	0.10	0.12	0.16	0.18	0.18	0.16	0.17	0.19
9	0.16	0.12	0.09	0.08	0.09	0.11	0.15	0.17	0.17	0.15	0.15	0.16
10	0.15	0.11	0.09	0.08	0.09	0.10	0.15	0.16	0.16	0.14	0.14	0.15
11	0.14	0.10	0.08	0.08	0.09	0.10	0.15	0.16	0.16	0.14	0.13	0.15
12	0.14	0.11	0.09	0.08	0.09	0.09	0.15	0.16	0.16	0.14	0.14	0.15
13	0.15	0.11	0.09	0.08	0.09	0.09	0.15	0.17	0.17	0.14	0.14	0.16
14	0.16	0.12	0.10	0.08	0.09	0.09	0.15	0.16	0.18	0.16	0.16	0.17
15	0.19	0.15	0.12	0.09	0.09	0.09	0.14	0.16	0.18	0.19	0.20	0.22
16	0.21	0.19	0.16	0.10	0.09	0.09	0.13	0.16	0.18	0.19	0.19	0.22
17	0.19	0.18	0.15	0.10	0.10	0.10	0.13	0.16	0.18	0.18	0.18	0.20
18	0.18	0.17	0.14	0.10	0.10	0.12	0.15	0.17	0.18	0.18	0.18	0.19
19	0.18	0.16	0.13	0.10	0.11	0.13	0.16	0.18	0.19	0.18	0.18	0.19
20	0.18	0.17	0.13	0.10	0.11	0.13	0.17	0.19	0.20	0.19	0.19	0.19
21	0.19	0.18	0.14	0.10	0.10	0.13	0.18	0.21	0.22	0.21	0.20	0.20
22	0.21	0.19	0.16	0.11	0.11	0.13	0.19	0.22	0.23	0.23	0.21	0.22
23	0.22	0.21	0.17	0.12	0.13	0.14	0.20	0.24	0.25	0.24	0.23	0.24

2030	Month											
Hour	1	2	3	4	5	6	7	8	9	10	11	12
0	0.22	0.20	0.16	0.11	0.10	0.12	0.19	0.22	0.23	0.23	0.22	0.23
1	0.23	0.21	0.16	0.11	0.11	0.12	0.19	0.23	0.24	0.24	0.22	0.24
2	0.23	0.21	0.16	0.12	0.11	0.13	0.19	0.24	0.24	0.24	0.23	0.24
3	0.23	0.21	0.16	0.12	0.11	0.13	0.20	0.24	0.24	0.24	0.23	0.24
4	0.23	0.21	0.16	0.12	0.11	0.14	0.20	0.24	0.24	0.24	0.23	0.24
5	0.22	0.20	0.15	0.11	0.11	0.13	0.19	0.23	0.23	0.22	0.22	0.24
6	0.20	0.19	0.15	0.11	0.10	0.11	0.18	0.22	0.22	0.22	0.21	0.22
7	0.19	0.16	0.10	0.05	0.04	0.04	0.09	0.12	0.16	0.17	0.19	0.21
8	0.13	0.09	0.04	0.03	0.03	0.03	0.05	0.06	0.07	0.07	0.08	0.14
9	0.08	0.05	0.03	0.03	0.03	0.03	0.05	0.05	0.05	0.05	0.05	0.08
10	0.06	0.04	0.03	0.03	0.03	0.03	0.05	0.05	0.05	0.04	0.05	0.07
11	0.06	0.04	0.03	0.03	0.03	0.03	0.05	0.05	0.05	0.04	0.05	0.07
12	0.06	0.04	0.03	0.03	0.03	0.03	0.05	0.05	0.05	0.04	0.05	0.07
13	0.06	0.04	0.03	0.03	0.03	0.03	0.05	0.05	0.06	0.05	0.05	0.07
14	0.07	0.04	0.03	0.03	0.03	0.04	0.06	0.07	0.08	0.06	0.06	0.08
15	0.14	0.06	0.04	0.04	0.04	0.04	0.09	0.10	0.13	0.13	0.15	0.18
16	0.20	0.16	0.11	0.05	0.05	0.05	0.11	0.13	0.16	0.18	0.19	0.21
17	0.18	0.17	0.13	0.09	0.08	0.08	0.13	0.14	0.16	0.17	0.18	0.19
18	0.18	0.16	0.13	0.10	0.09	0.11	0.15	0.16	0.18	0.17	0.17	0.18
19	0.17	0.16	0.13	0.11	0.11	0.13	0.16	0.18	0.18	0.17	0.17	0.18
20	0.18	0.16	0.12	0.10	0.11	0.13	0.16	0.18	0.18	0.18	0.18	0.19
21	0.18	0.17	0.13	0.10	0.09	0.12	0.16	0.18	0.20	0.20	0.19	0.20
22	0.20	0.18	0.13	0.10	0.09	0.11	0.17	0.20	0.21	0.21	0.20	0.21
23	0.21	0.19	0.14	0.11	0.10	0.11	0.18	0.21	0.22	0.22	0.21	0.23

Thank You!

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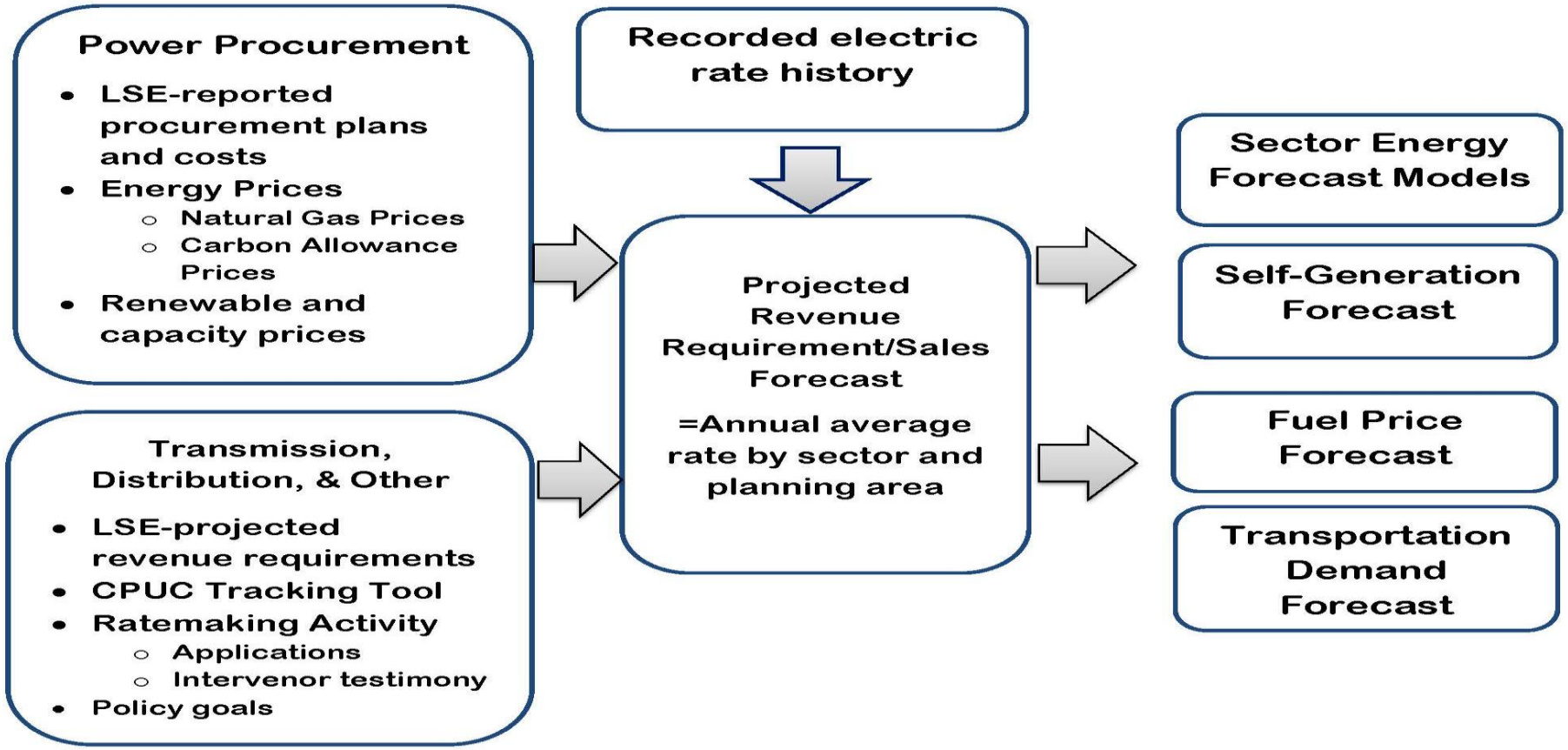
Electricity Rate Scenarios Inputs and Assumptions

August 5, 2021

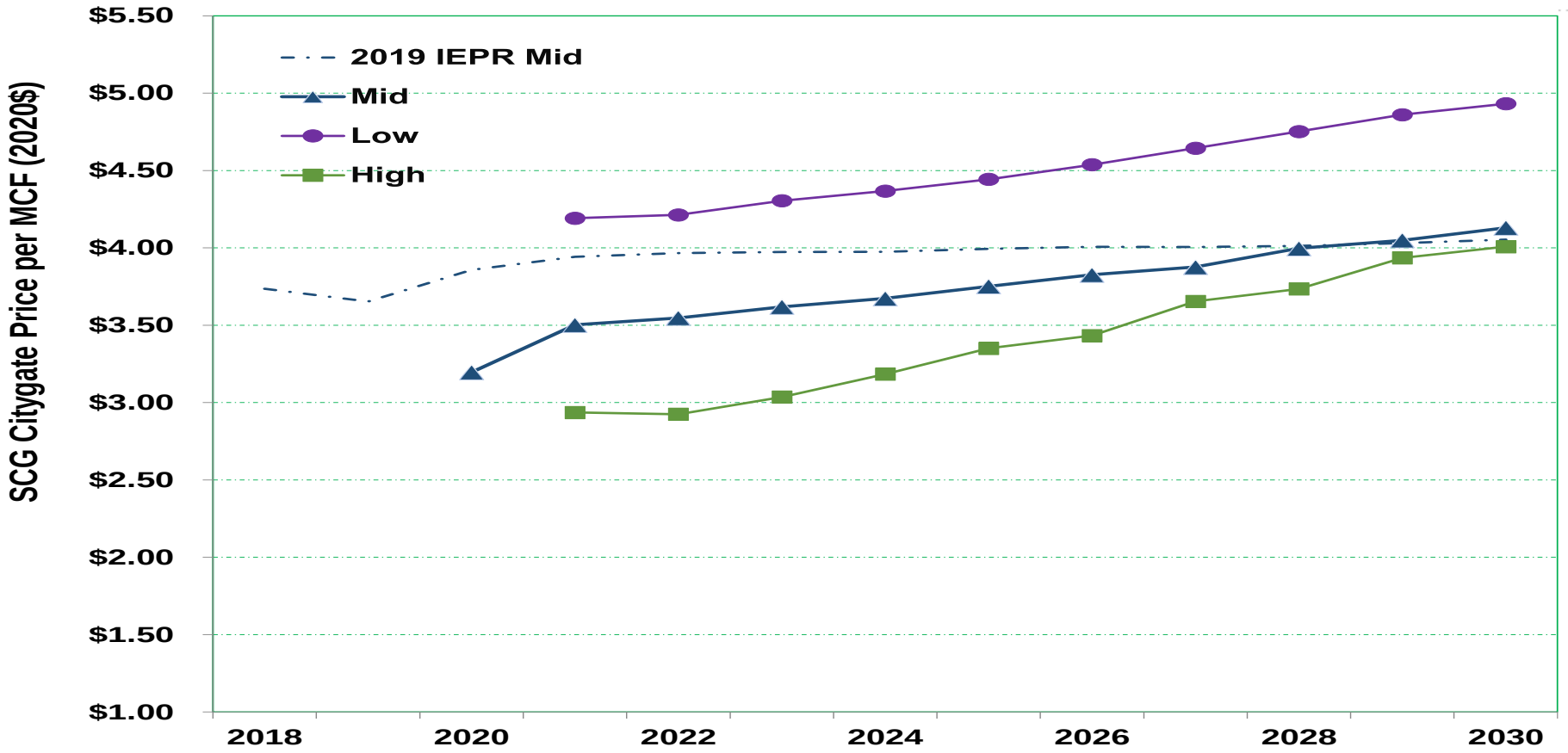
Lynn Marshall

Energy Assessments Division

Overview of Rate Forecast



Natural Gas Price Scenarios



- While current prices are lower than previously projected, costs to maintain aging natural gas pipeline infrastructure are projected to increase transportation rates, so citygate prices rise at faster pace.
- Complete natural gas price forecast will be presented at the August 30th IEPR workshop

Cap and Trade Program Background

Electric generation is covered by the ARB cap and trade program, so allowance prices are included in PLEXOS model and are reflected in resulting prices.

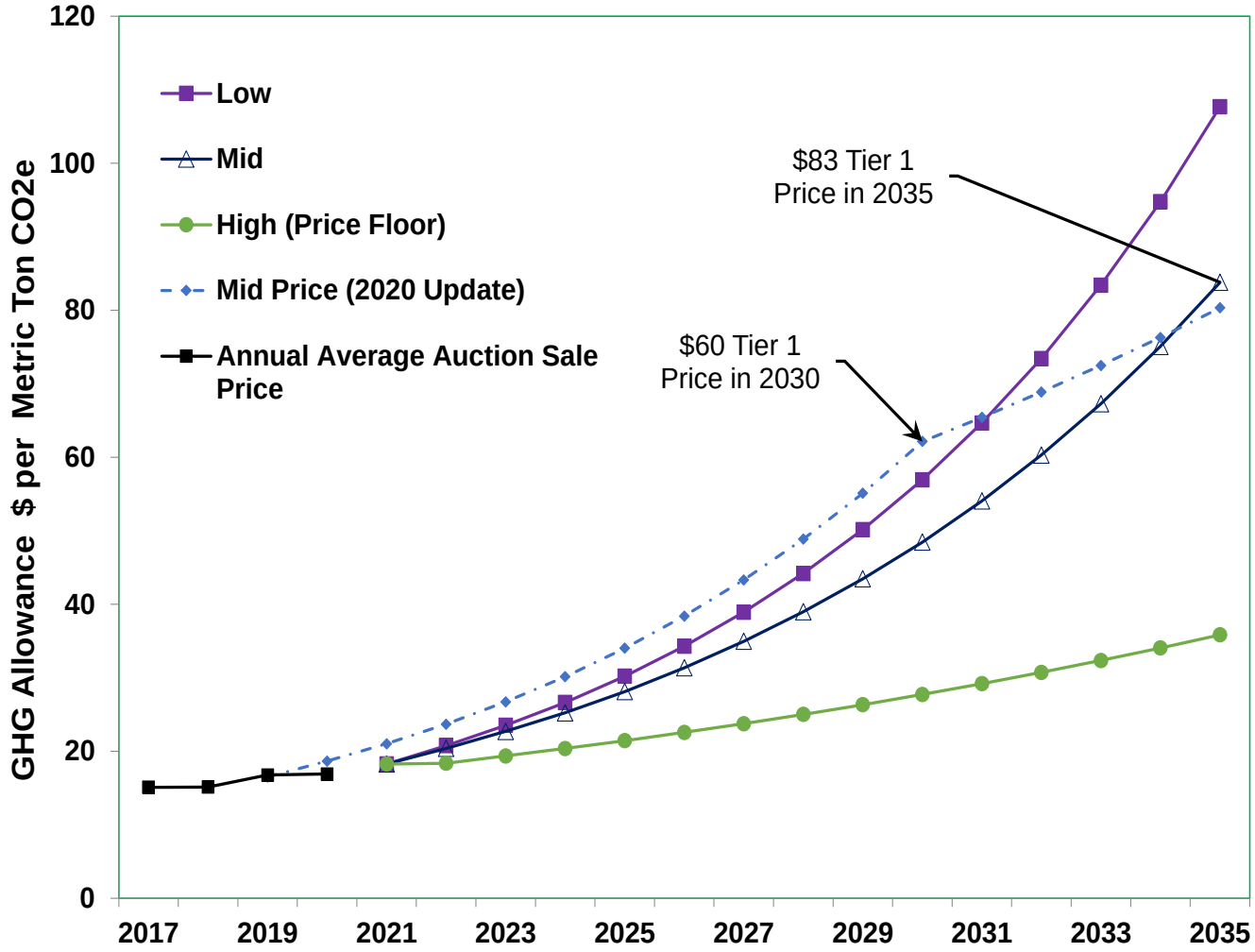
The current cap and trade regulation has the following features:

- A $65 (nominal) price ceiling value in 2021.
- A post-2020 Reserve Tier 1 price fixed at the halfway point of the Auction Reserve Price (floor price) and price ceiling in all years ($41.40 in 2021).
- A post-2020 Reserve Tier 2 price fixed at the three-quarter point of the Auction Reserve Price and the price ceiling in all years ($53.2 in 2021).
- After 2021, tier prices and the price ceiling escalate annually at 5 percent plus inflation. The Auction Reserve Price at the same rate.

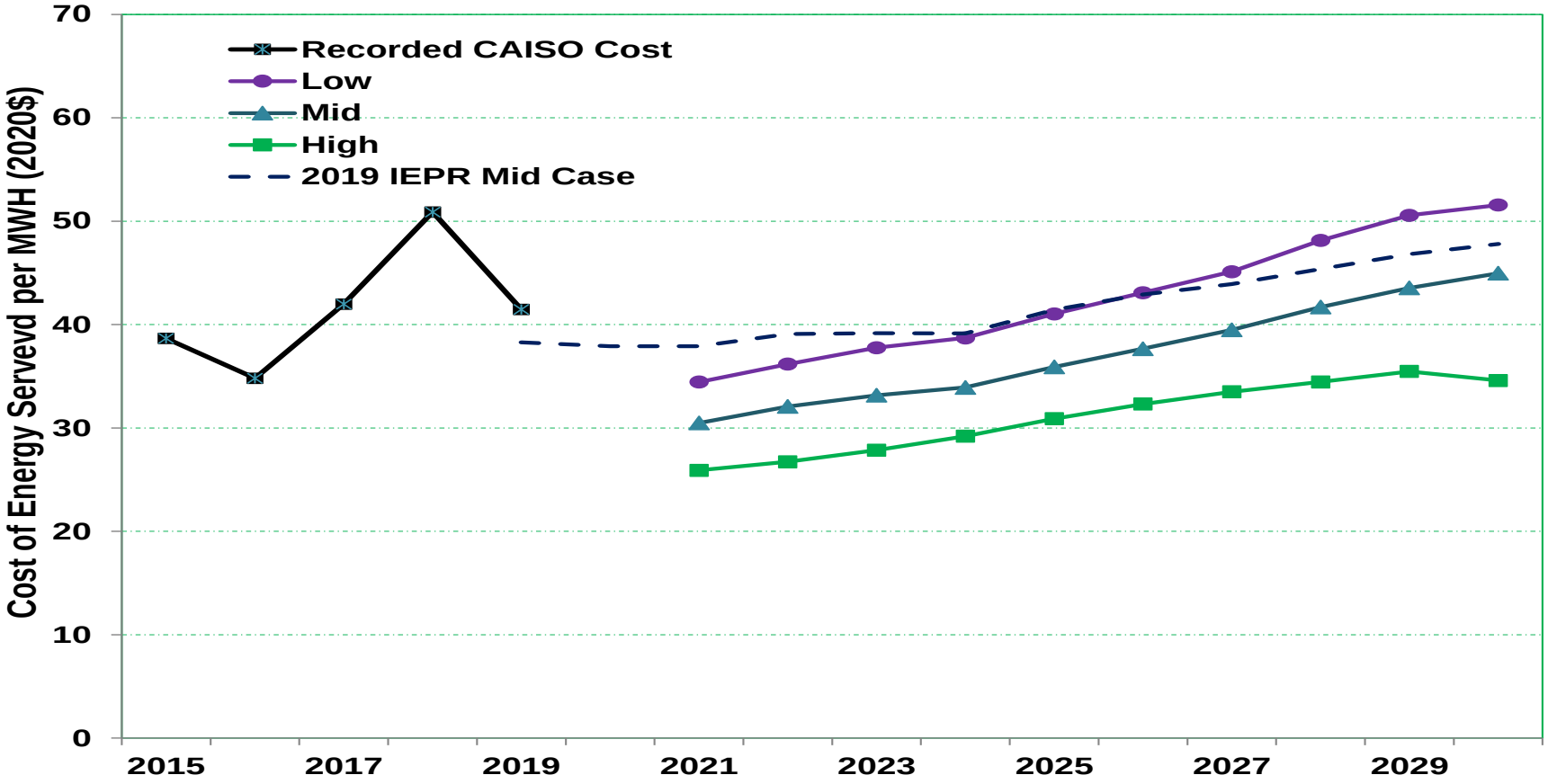
- In analysis of this structure, Borenstein, Bushell and Wolak (2017) found probability-weighted expected prices in 2030 in the $40-$60 range, but with high probabilities of being either at the cap or floor price.
- Previously staff used the 2030 Tier 1 price ($60) for the mid case 2030 price, the Tier 2 price for the low demand (high price) case, and the Auction Reserve Price in the high demand (low price) case.

GHG Allowance Price Scenarios

- Prices to date have been slightly above the floor price.
- Complementary programs, such as the Low Carbon Fuel Standard, provide a strong incentive to reduce emissions and reduce allowance demand, dampening cap and trade prices.
- Eventual regulation changes will likely seek to incent more GHG reductions.
- The new mid-case 2035 price assumes prices will increase more slowly, but still eventually reach the Tier 1 price.



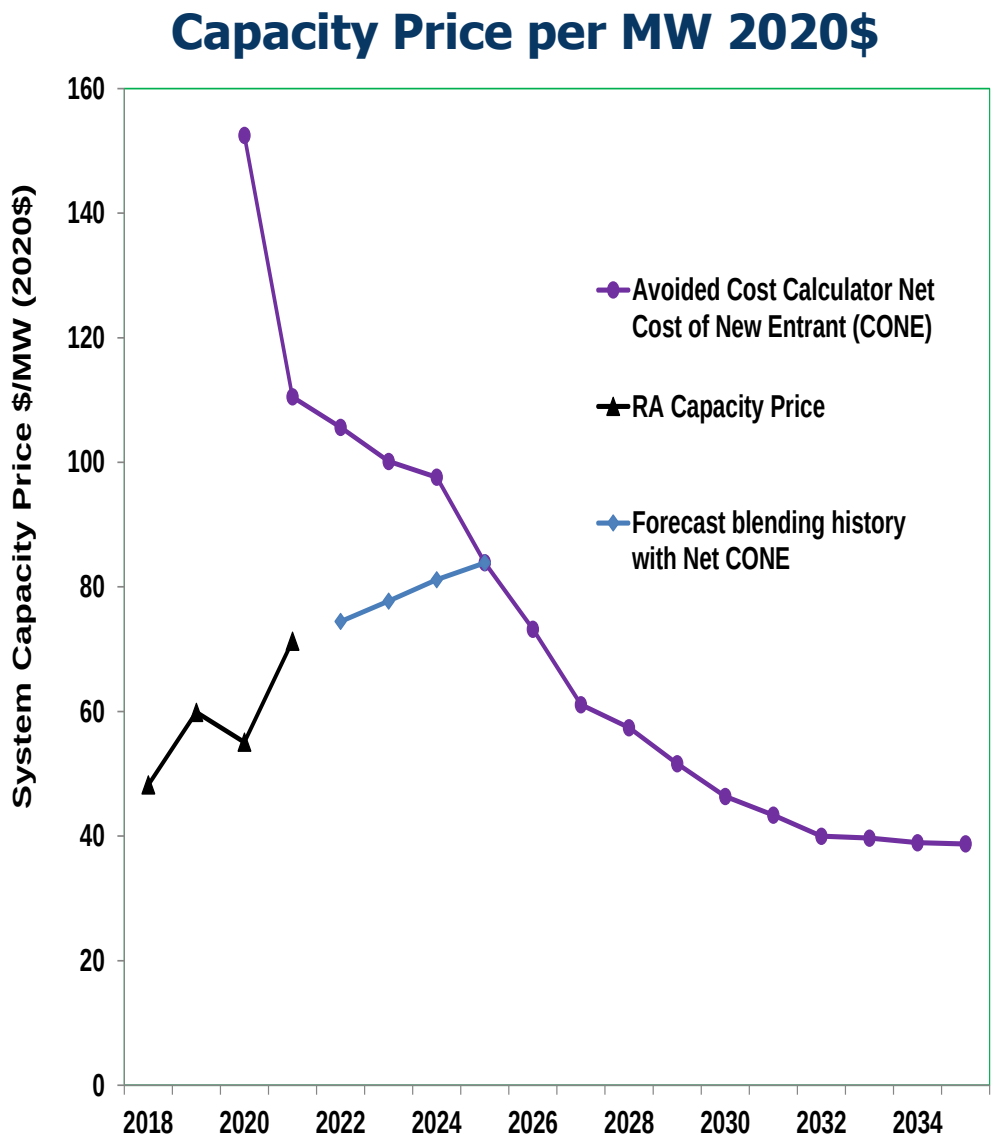
Wholesale Energy Costs



- Lower natural gas and GHG allowance prices, and increased additions of renewable and storage resources, lower energy prices compared to 2019 IEPR mid case.
- Incremental renewable procurement costs will be valued using NREL 2021 Annual Technology Baseline levelized costs.

Capacity Costs

- The CPUC 2021 Avoided Cost Calculator (ACC) estimates the avoided cost of generation capacity based on 4-hour battery storage, assumed to be the marginal resource.
- Near term, the ACC cost per MW is much higher than recent reported capacity prices compiled by the CPUC.
- Staff is blending the 2021 capacity price with the ACC forecast for purposes of valuing incremental capacity needs.
- Prices reach $84/MW in 2025 then decline with lower capital costs and increasing energy market revenue.



Non-Procurement Costs

- LSEs over 200 MW report current and projected revenue requirements on IEPR demand forms:
  - Distribution
  - Transmission
  - Customer Costs
  - Energy efficiency, demand response, electrification, and other programs
- Rate case proceedings and publicly owned utility rate actions and plans
- CPUC Energy Division Utility Cost & Rate Tracking Tool compiles current and pending IOU revenue requirements, in support of Affordability OIR R.18-07-006.
  - CPUC Affordability Report scenarios use the CEC bundled rate forecast as input, but are designed for a different purpose:

	CPUC Affordability Analysis	CEC Forecast
Objective	Assess potential cumulative rate and bill impacts of all pending applications	Project expected outcome of final decisions
Scope	Bundled IOU customers	Bundled, Community choice, direct access, and public utility customers
Method	Near term: full application request; Long term: escalation based on CEC bundled rate forecast	Short term: Pending applications discounted based on intervenor positions; Long term: scenarios based on historic trends and policy and cost drivers

Distribution Revenue Requirement Scenarios

- Pending applications are adjusted based on expected outcomes.
- Wildfire mitigation costs are the largest component of recent requested increases.
  - Proposed decision on SCE 2021 GRC reduces their request from a 19% increase to 7.4%. The largest reduction is to wildfire mitigation capital.
- Staff will develop scenarios to 2035 will reflect a range of potential wildfire mitigation and infrastructure costs.

PG&E General Rate Case Distribution Revenue Requirements
CPUC Authorized v. Utility Application

	Authorized		Requested	
	Million $	% Increase	Million $	% Increase
2019	4,364			
2020	4,800	10%	5,057	16%
2021	5,011	4%	5,310	5%
2022	5,287	6%	5,644	6%
2023			8,171	45%
2024			8,621	6%