Transportation Energy Demand Forecast Results

Demand Analysis Working Group (DAWG) Meeting

October 26, 2023

Acronyms, Initialisms, and Notes

AATE – Additional Achievable Transportation Electrification

ACC2 – Advanced Clean Cars II

BEV – Battery Electric Vehicle

CAISO – California Independent System Operator

CARB – California Air Resources Board

CEC – California Energy Commission

CED – California Energy Demand Forecast

CEDU – California Energy Demand Forecast Update

DCFC – Direct Current Fast Charging

EAD – Energy Assessments Division

FZ – Forecast Zone

GVWR - Gross Vehicle Weight Rating

ICE – Internal Combustion Engine

IEPR – Integrated Energy Policy Report

ICT 2022 – Innovative Clean Transit Bus Inventory Report 2022

LD – Light-Duty

MDHD – Medium- and Heavy-Duty

PEV – Plug-in Electric Vehicle (comprises BEV and PHEV)

PHEV – Plug-in Hybrid Electric Vehicle

ZEV – Zero-Emission Vehicle

TEDF – Transportation Energy Demand Forecast

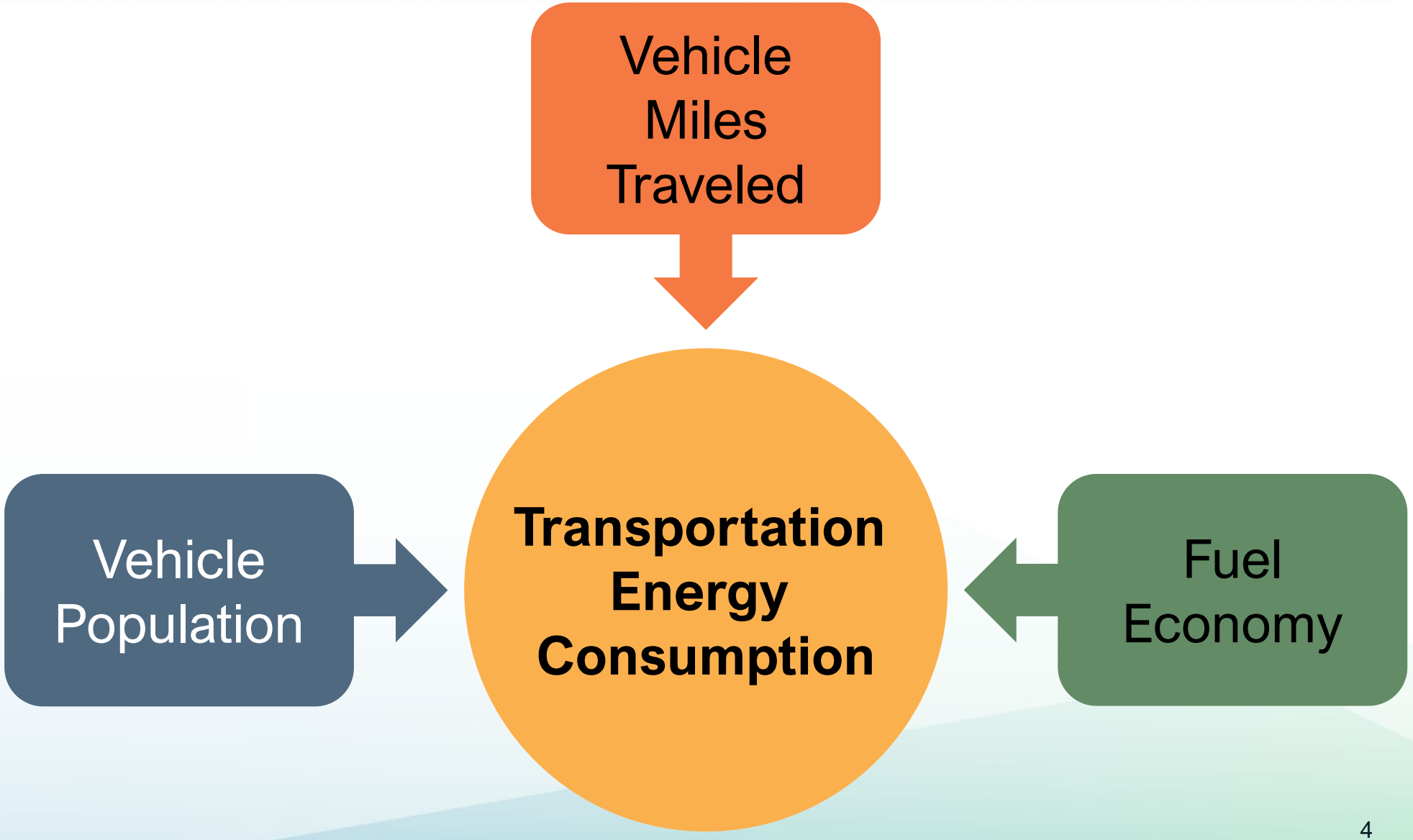
Note: Unless otherwise indicated, CEC staff developed all charts, data, and tables.

Statewide Electricity and LD Results

Quentin Gee, Transportation Energy Forecasting Unit Supervisor

October 26, 2023

Transportation Energy Consumption



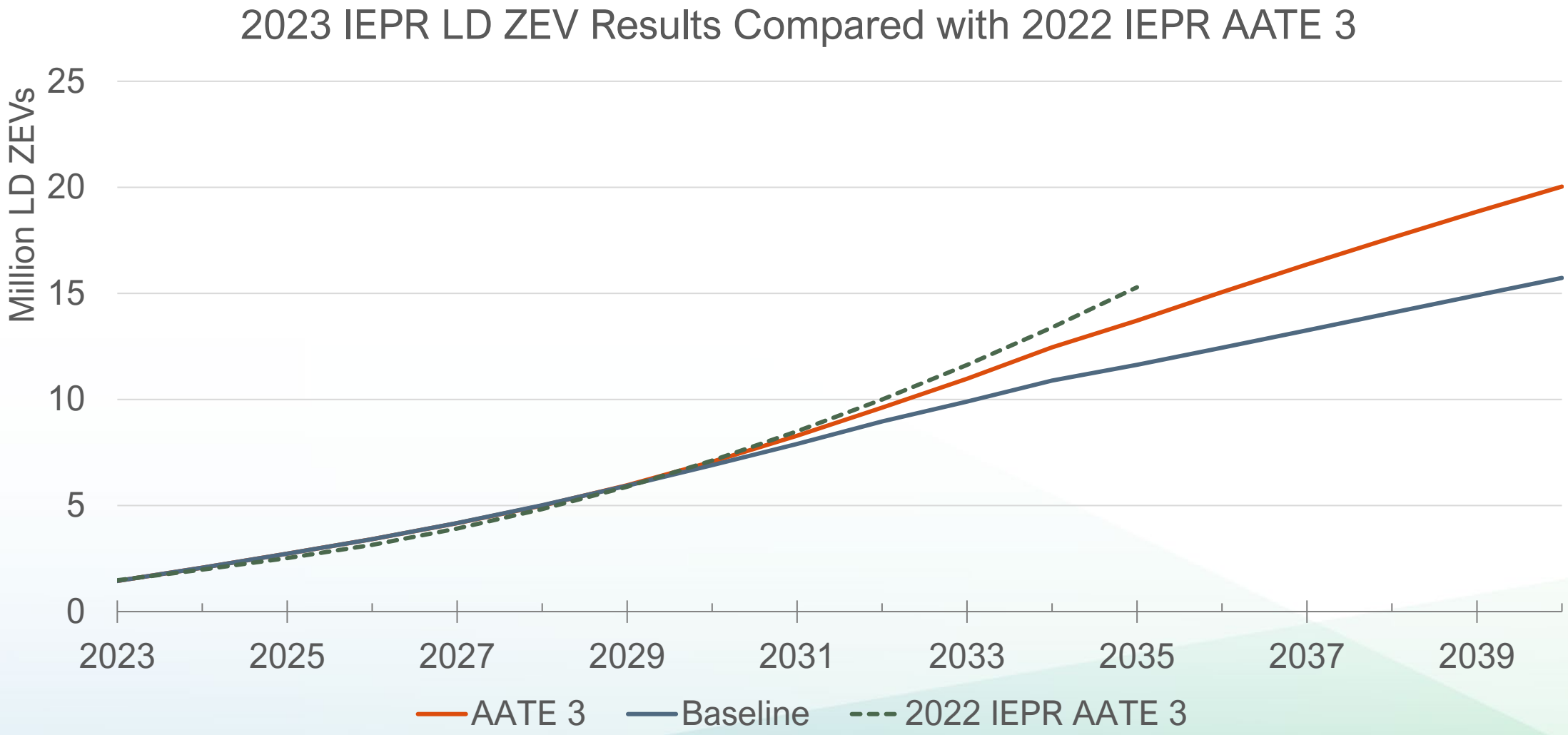
IEPR 2023 Updates to LD Models

Light-Duty Models	Baseline Forecast	AATE Scenario 3
Personal Vehicle Choice, Commercial Vehicle Choice, Government, and Rental Models	▪ Latest economic forecast from Moody's Analytics ▪ Revised fuel price forecast ▪ Revised vehicle ranges ▪ Updated vehicle prices ▪ Updated incentives ▪ Calibration to 2022 vehicle population	▪ ACC2 ▪ Clean Miles Standard

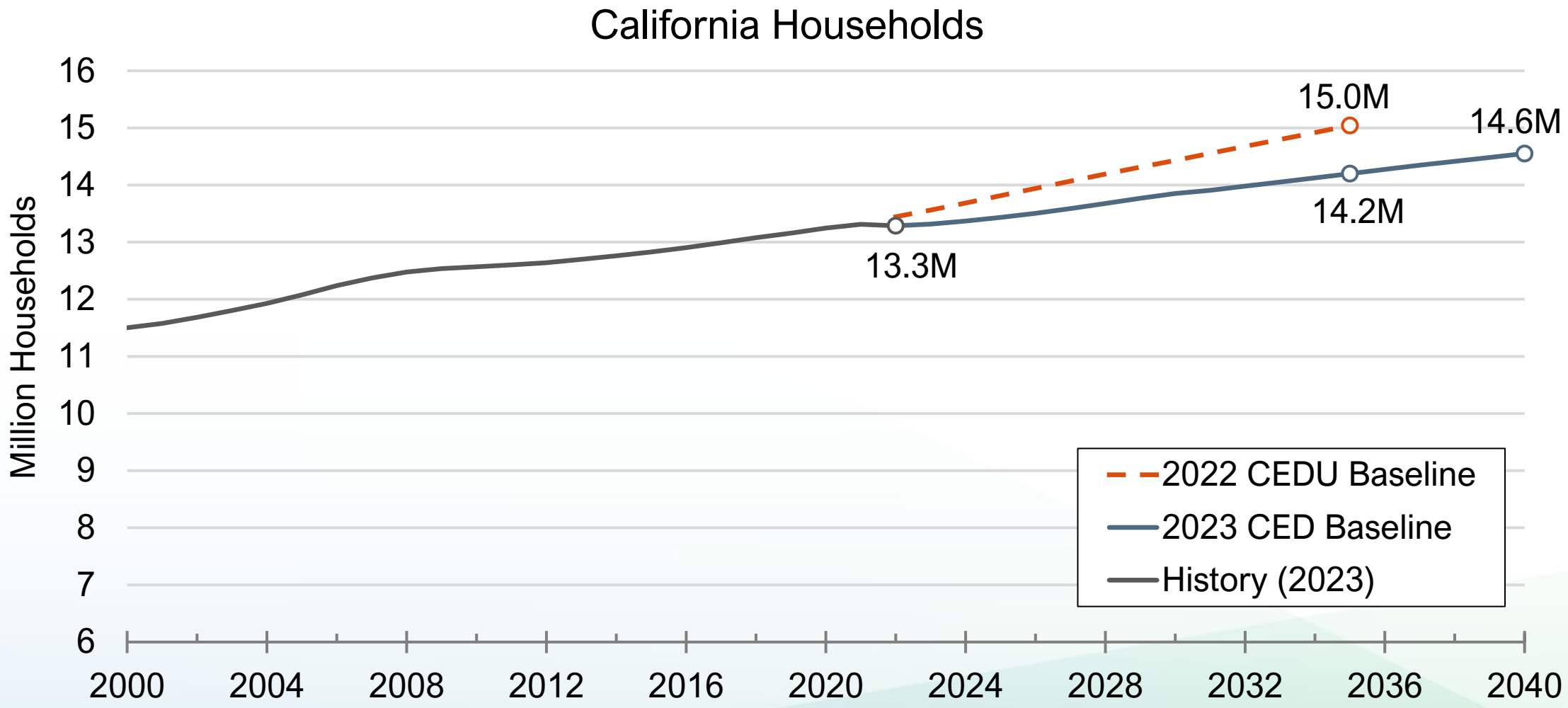
Class 2b vehicles count as LD in CEC* modeling (GVWR 8,500 lbs. - 10,000 lbs.) assumed to be superseded by ACC2, as opposed to captured in ACF.

* The Federal Highway Administration and U.S. Census Bureau assign Class 2b vehicles as "light-duty" in addition to CEC. The U.S. Environmental Protection Agency and California Air Resources Board classify Class 2b as "medium-duty passenger vehicles." See https://afdc.energy.gov/data/10380 for more information.

LD ZEVs
2023 IEPR Compared to 2022 IEPR

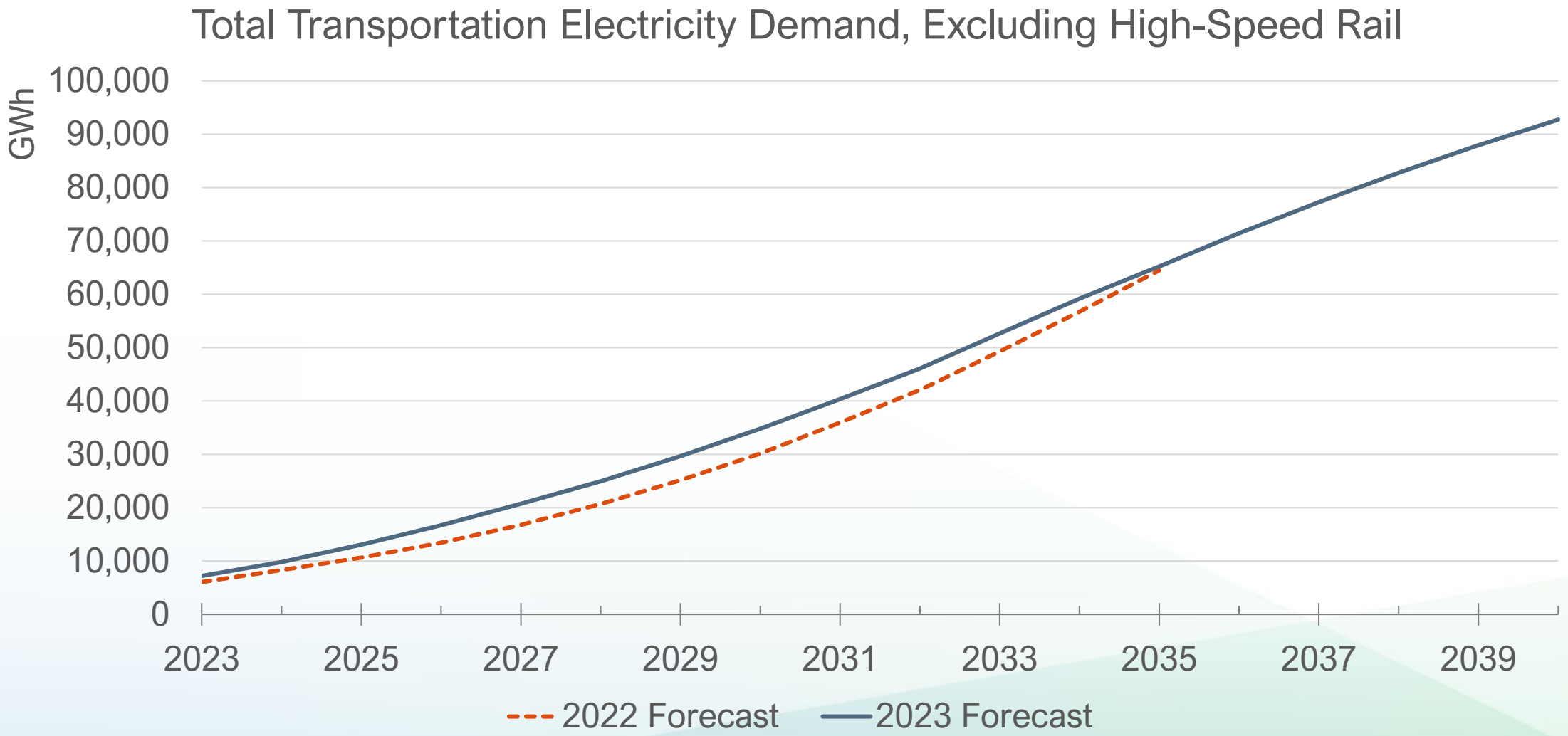


Leading Driver of LD ZEV Difference Between 2022 and 2023 TEDFs

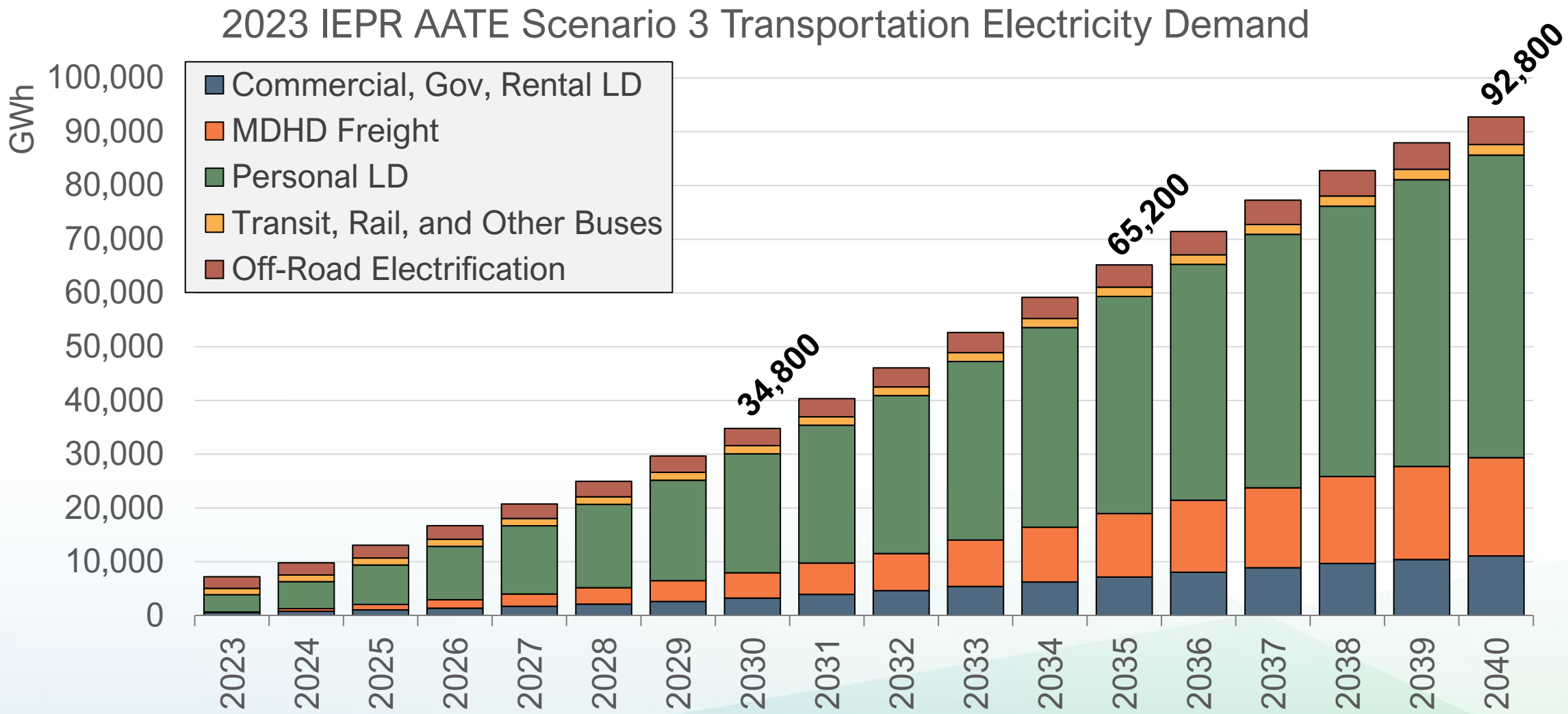


Source: CA Department of Finance

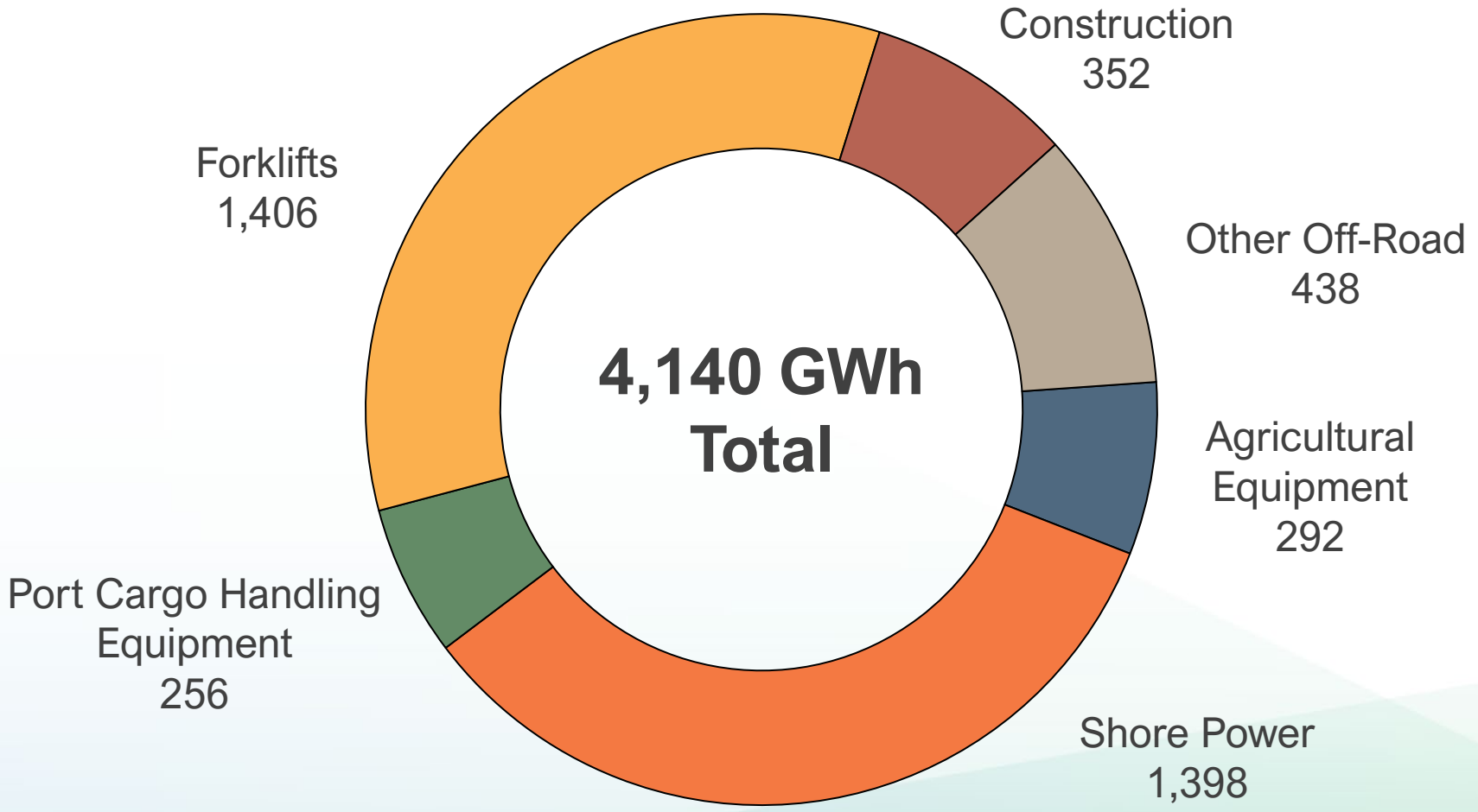
Electricity Demand
2023 and 2022 AATE 3 Scenario



Electricity Demand Across Vehicle Categories



Off-Road Electrification Forecast for 2035 (GWh)



MDHD Updates and Results

Maggie Deng, MDHD Forecasting Lead

October 26, 2023

MDHD Vehicle Classes

- **Class 3**
  - Pickups and Vans
  - Other Bus Cutaway (ICT 2022)
- **Single Unit / Straight**
  - Classes 4 and 5
  - Class 6
  - Class 7
  - Class 8
- **Single Unit Delivery**
  - Classes 4 and 5 Delivery
  - Class 6 Delivery
  - Class 7 Delivery
- **Tractor-Trailer Combinations**
  - California Instate Only
  - CA-based Interstate (EMFAC2021 & DMV)
  - Out-of-State-based Interstate (EMFAC2021)
- **Vocational**
  - Class 8 Refuse and Recycling
  - Class 8 Dump
- **Motorhomes**
  - Classes 3 to 5 (EMFAC2021)
  - Classes 6 to 8 (EMFAC2021)
- **Buses**
  - Urban Transit (ICT 2022)
  - School Bus (CARB 2022)
  - Intercity Motor Coach (EMFAC2021)
  - Other Bus Unspecified (EMFAC2021)
  - Other Bus Airport Shuttle (EMFAC2021)

IEPR 2023 Updates to MDHD Models

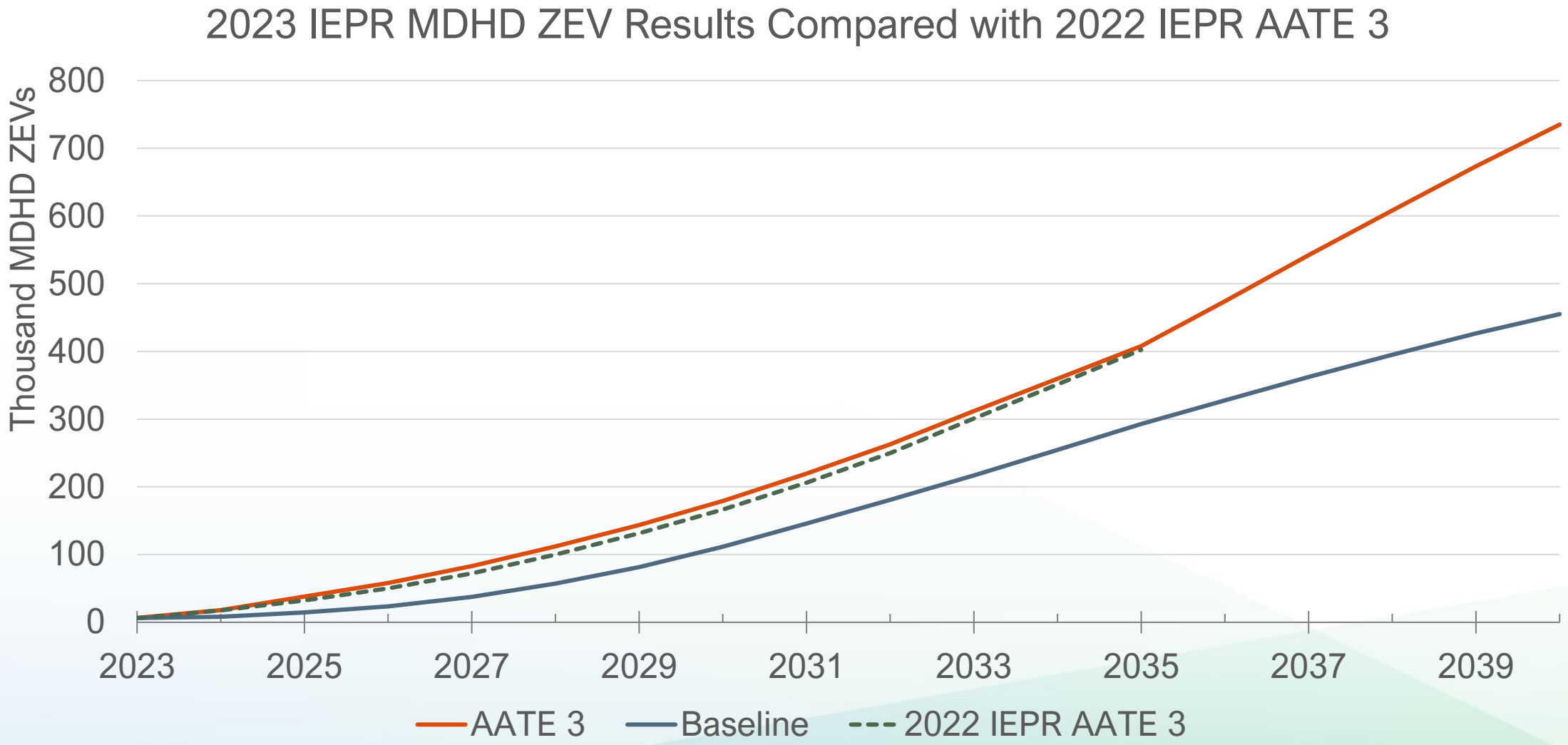
MDHD Models	Baseline Forecast	AATE Scenario 3
Freight and Truck Choice Model	▪ Latest economic forecast from Moody's Analytics ▪ Revised fuel price forecast ▪ Updated truck price forecast ▪ Updated incentives forecast ▪ Calibration to 2022 historical truck stock ▪ Calibration to 2022 historical diesel sales	▪ New CARB ACF ZEV requirements ▪ Implemented ICE cutoff beginning 2036 to reflect manufacturer sales mandate under ACF
OtherBus, Urban/Intercity Travel Choice Models (MDHD components)	▪ Calibration to 2022 fuel ▪ Econ/Demo forecast ▪ Revised fuel price forecast ▪ Updated public transit funding/ ridership (bus and rail) forecast ▪ Updated ICT bus rollout forecast ▪ New Zero-Emission School Bus purchase requirements	

Policies, Programs, Incentives, and Regulations for MDHD Vehicles

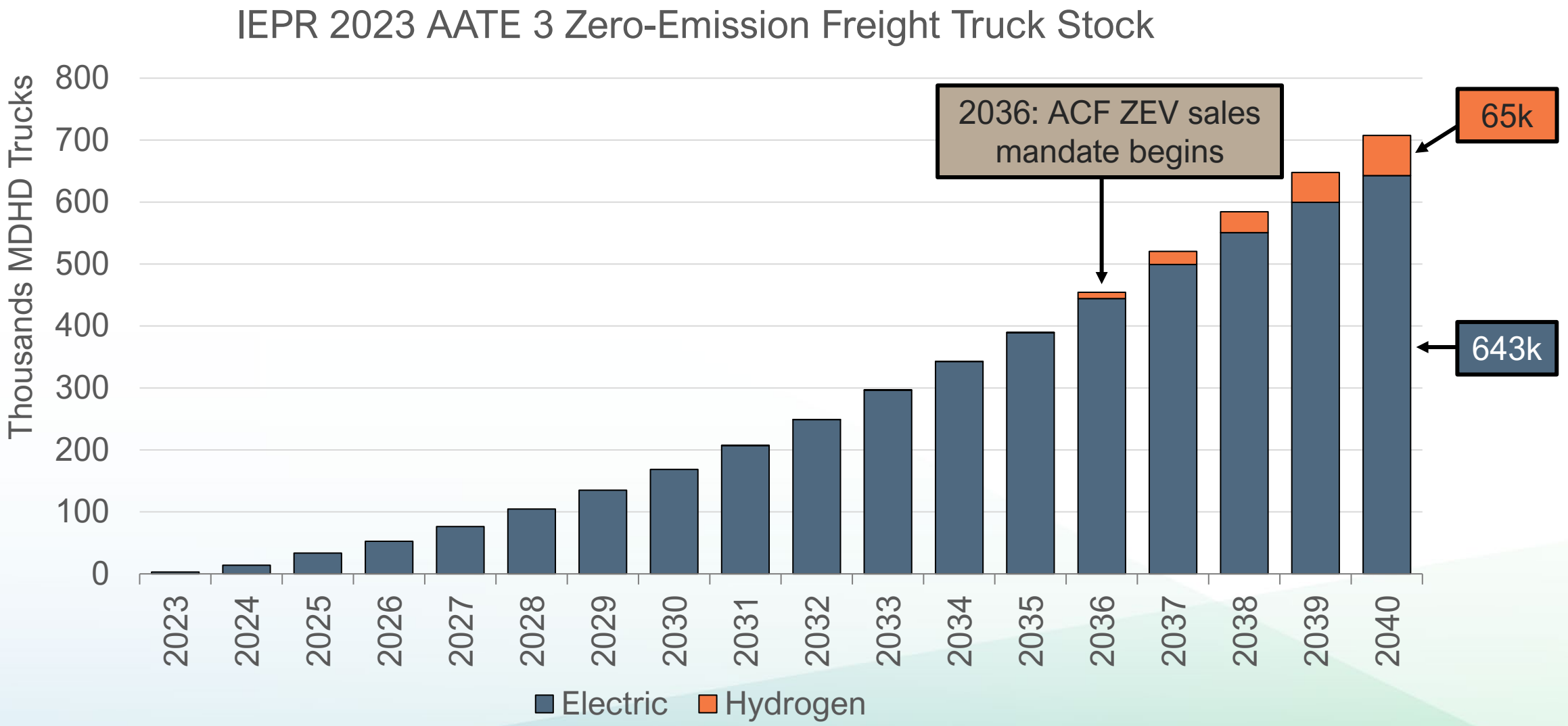
TEDF Baseline Forecast	TEDF AATE Scenario 3 (Policies in Addition to the Baseline Forecast)
▪ Advanced Clean Trucks (ACT) ▪ Commercial Clean Vehicle Tax Credit (IRS code 45W) ▪ California Hybrid and Zero-Emission Truck & Bus Voucher Incentive Project (HVIP) ▪ California Innovative Clean Transit (ICT) ▪ California Electric School Bus ▪ Commercial Harbor Craft (public transit ferryboats only) ▪ California In-Use Locomotives (passenger trains only)	▪ Advanced Clean Fleets (ACF) ➢ Fleet ZEV requirements ➢ 100 percent ZEV sales 2036+

Models for MDHD vehicles:
Freight and Truck Choice Model, OtherBus, and Urban/Intercity MDHD Travel Choice Models

MDHD ZEVs
2023 IEPR Compared to 2022 IEPR



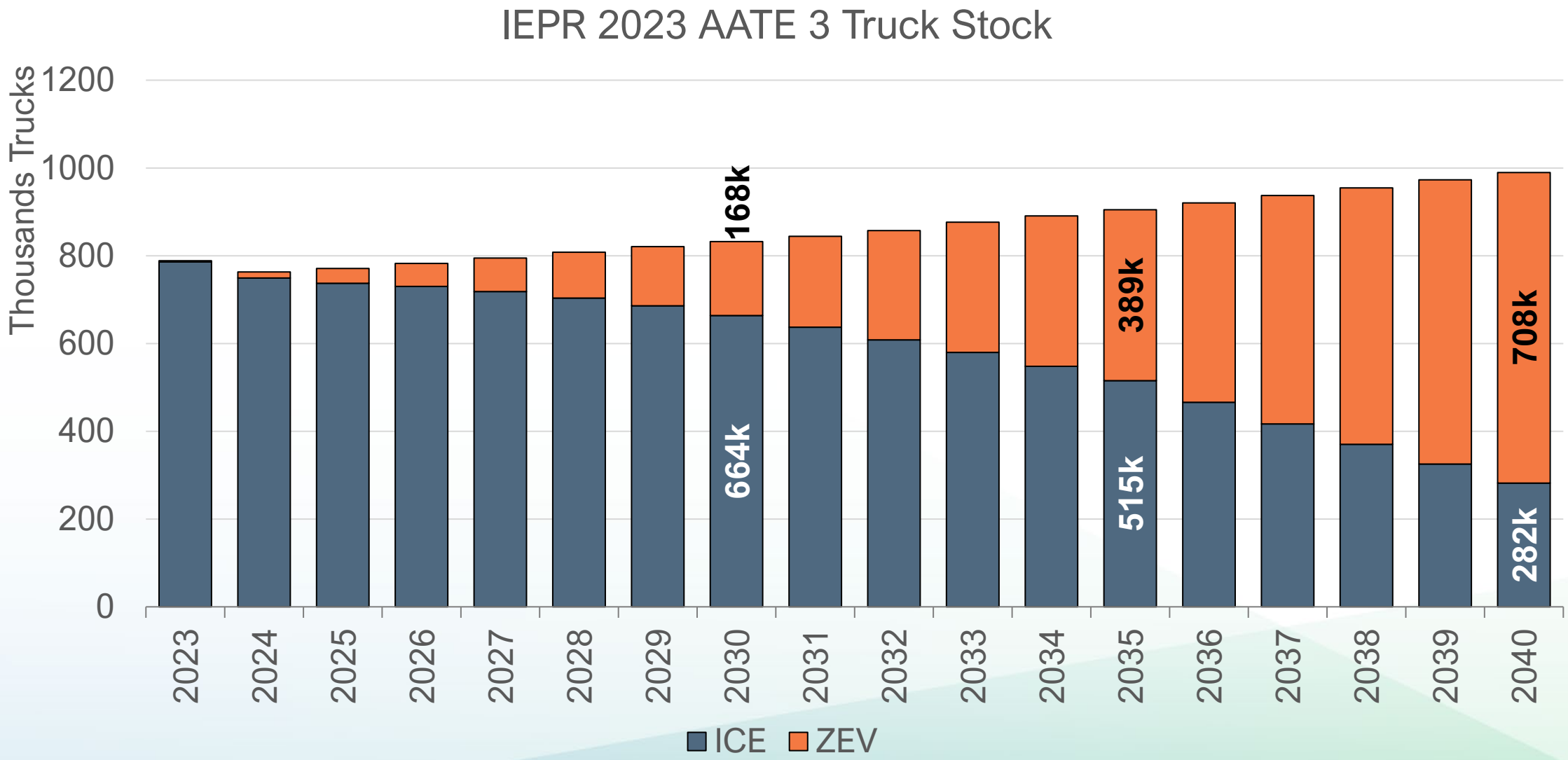
2023 IEPR AATE 3 Zero-Emission MDHD Trucks



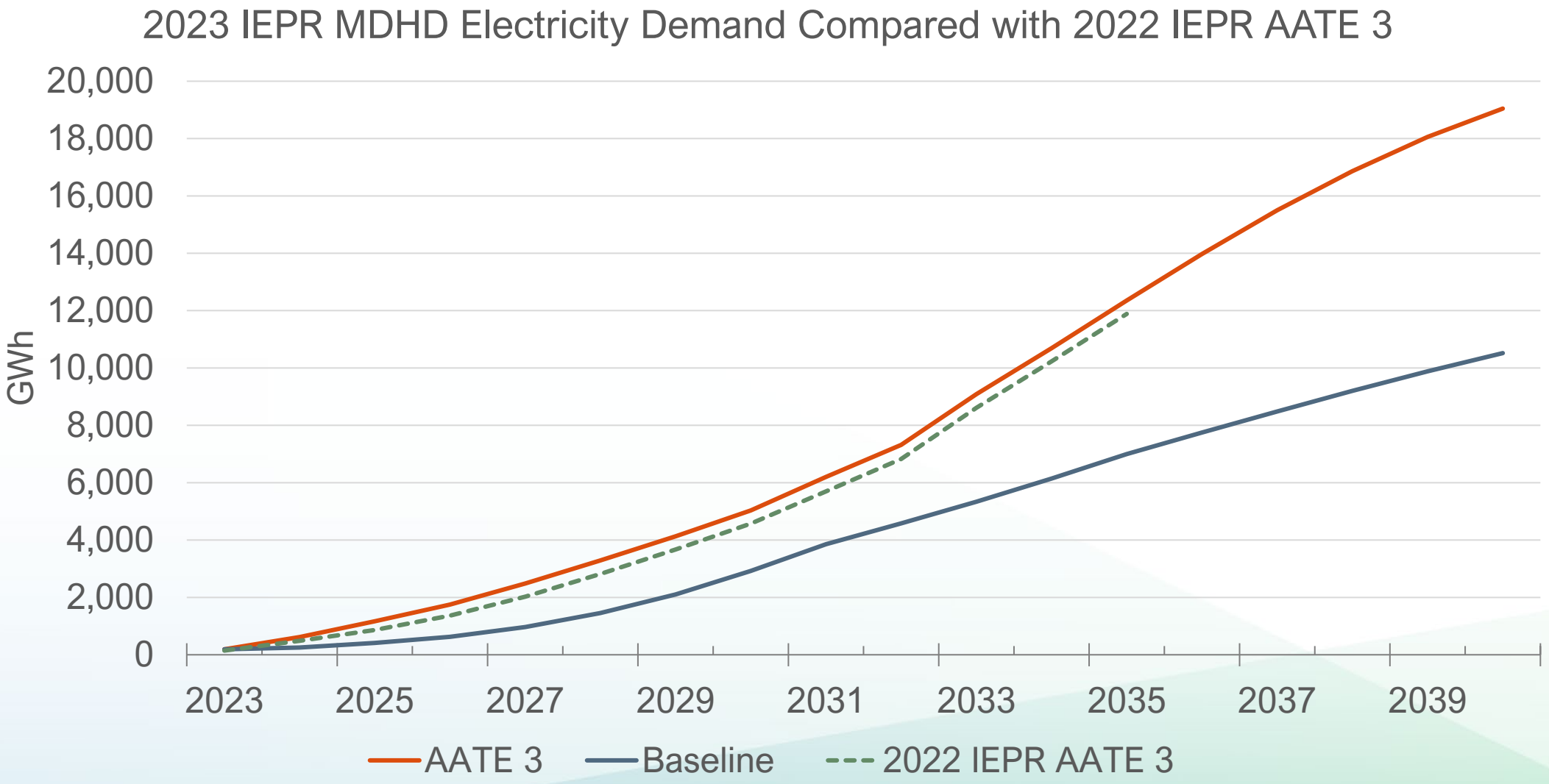
Hydrogen Trucks in 2023 IEPR AATE 3

- Notable increase in FCEVs for this year's AATE 3 compared to 2022 IEPR AATE 3, beginning in 2036.
  - Due to 100 percent MDHD ZEV sales requirement for 2036 and beyond, BEV and FCEV become the only options from 2036 onwards in the Freight and Truck Choice Model.
- Fuel price forecast updated to reflect recent trends in hydrogen prices.
- FCEVs only available for GVWR 6 and certain types of GVWR 8, based on market research.
- Model assumes hydrogen fueling infrastructure will be available.

2023 IEPR AATE 3 MDHD Trucks



MDHD Electricity Demand 2023 IEPR Compared to 2022 IEPR



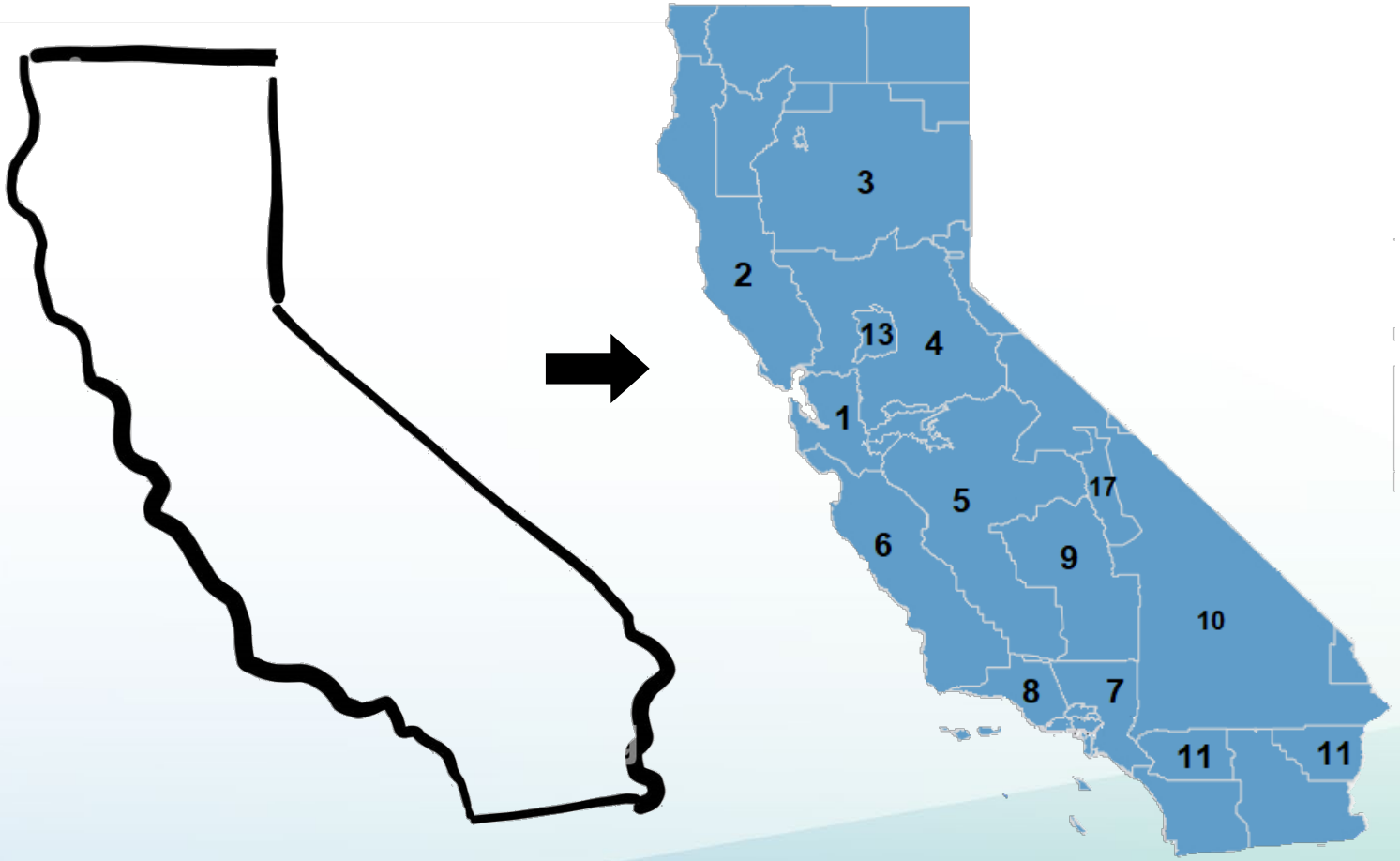
Regional Energy Allocation and Load Shapes

Liz Pham

October 26, 2023

Regional Energy Allocation

- Statewide energy consumption ➡ Forecast Zones level
- CEC Forecast Zone ArcGIS



Forecast Zone	Planning Area
1. Greater Bay Area 2. North Coast 3. North Valley 4. Central Valley 5. Southern Valley 6. Central Coast	1. PG&E
7. LA Metro 8. Big Creek West 9. Big Creek East 10. Northeast 11. Eastern	2. SCE
12. SDG&E	3. SDG&E
13. SMUD	4. SMUD
16. Coastal 17. Inland	5. LADWP

Regional Allocation LDV - Updates

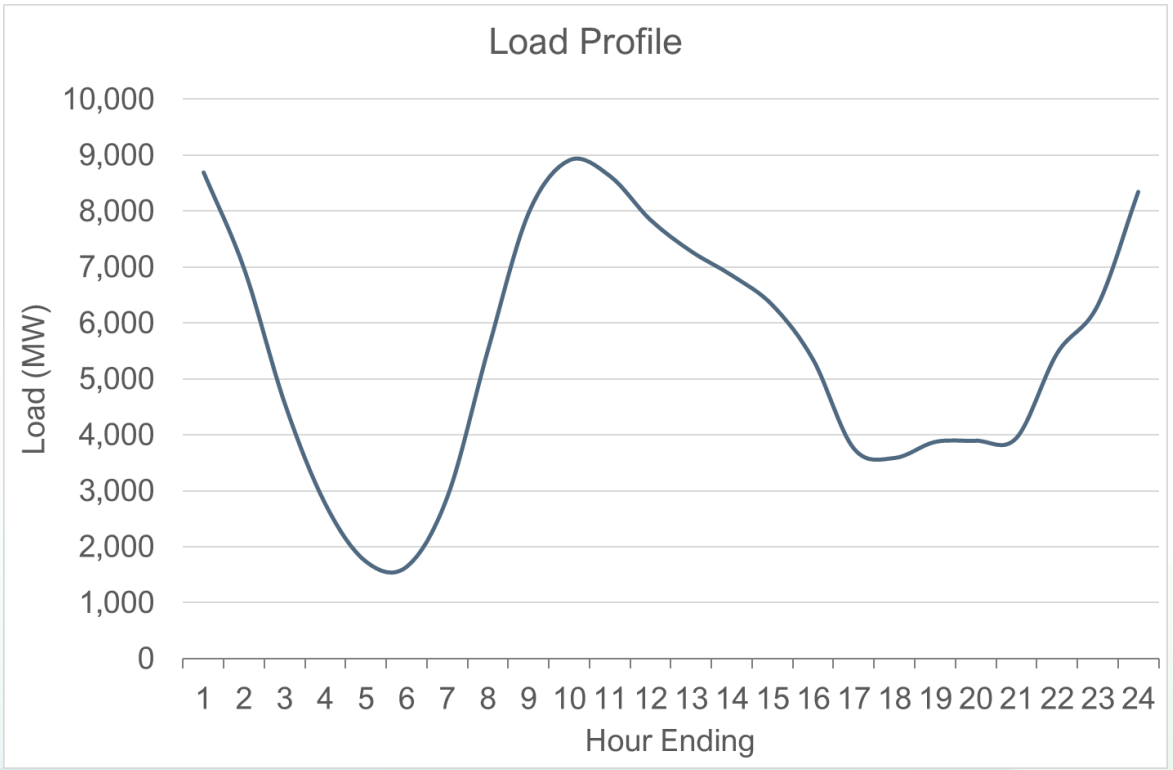
- **Inputs**:
  - EMFAC VMT (updated with EMFAC2021 v1.0.2)
  - DMV registration (updated with 2022 vehicle population)
  - Economic demographic:
    - Household (updated)
    - Income (update)
- **Improvements**: we assumed 12.5% of the statewide is allocated based on enroute charging to better distribute load for DCFC in more rural FZs.
  - We used population and traffic data from major highways.
- **Assumptions**:
  - 12.5% of statewide energy is from enroute charging and that it stays constant throughout the forecast years.
  - DMV - people are charging/using their vehicle where they are registered.

Regional Results: LD PEV Energy (GWh)

	Enroute allocation				Non-Enroute allocation
Utility Region	2025	2030	2035	2040	2040
LADWP	742	2,281	4,324	6,198	6,499
PG&E	3,290	10,017	18,820	26,738	25,912
SCE	2,988	8,917	16,443	23,048	23,986
SDG&E	839	2,588	4,861	6,870	7,188
SMUD	217	700	1,381	2,021	2,013
Others	243	812	1,638	2,433	1,710

EV Load Model – Load Profiles

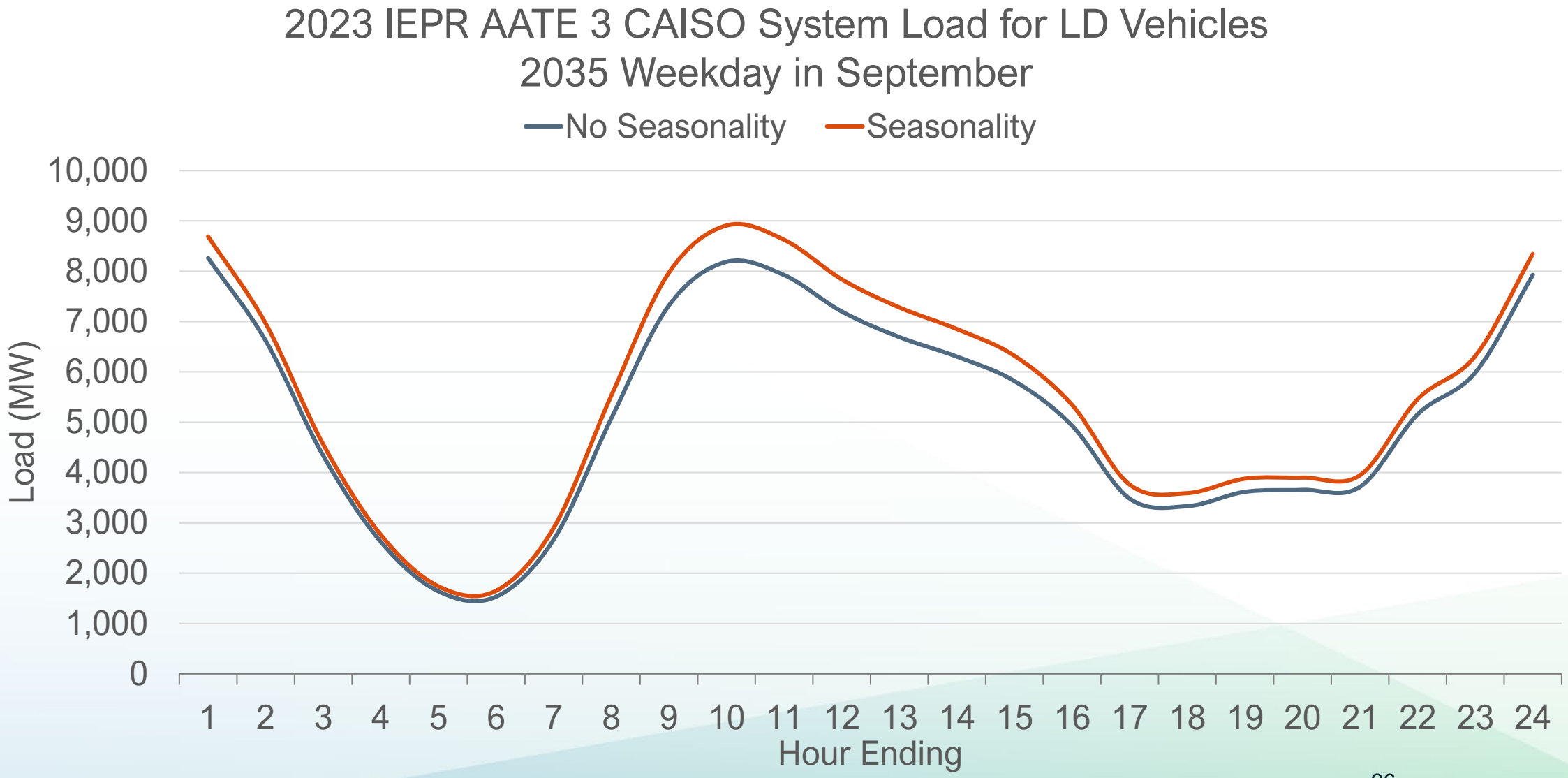
- Statewide energy consumption -> Forecast Zone
- Forecast Zone (geographical) -> 8760 hours load profile (temporal)



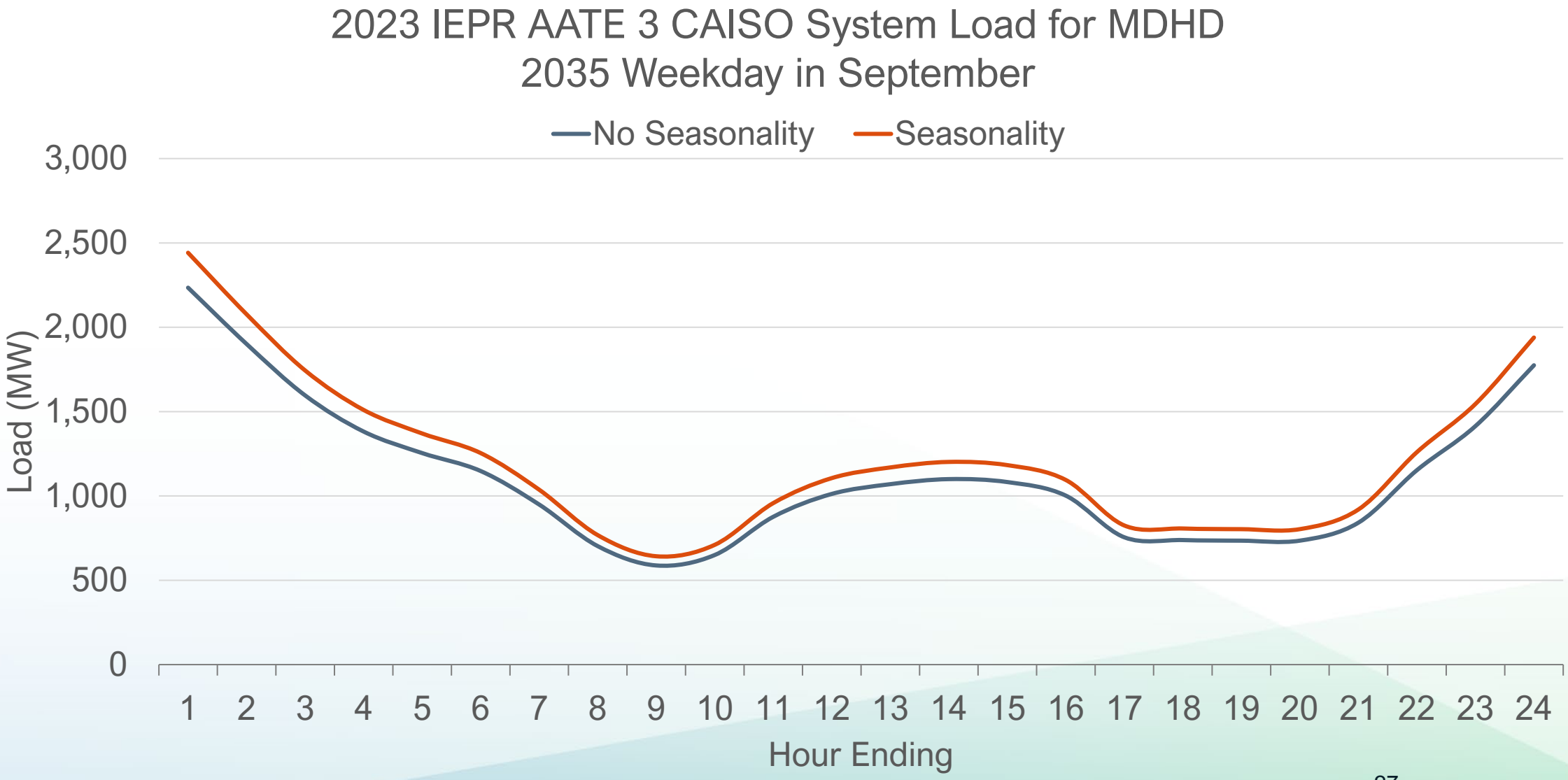
Load Profile - Updates

- Inputs:
  - EV TOU rates for each utilities (updated as of Sept 2023)
  - Load Shapes (LDV – 2017 Chargepoint, MDHD – LBNL) (same)
  - Elasticity factor (same)
  - TOU participations (same)
- Improvements:
  - Added seasonality: used monthly gasoline and diesel sales tax
- Assumptions:
  - Load shapes, elasticity factor, TOU participations is the same in all Forecast Zones
  - Gasoline sales tax informs LDV seasonal electricity demand
  - Diesel sales tax informs MDHD seasonal electricity demand

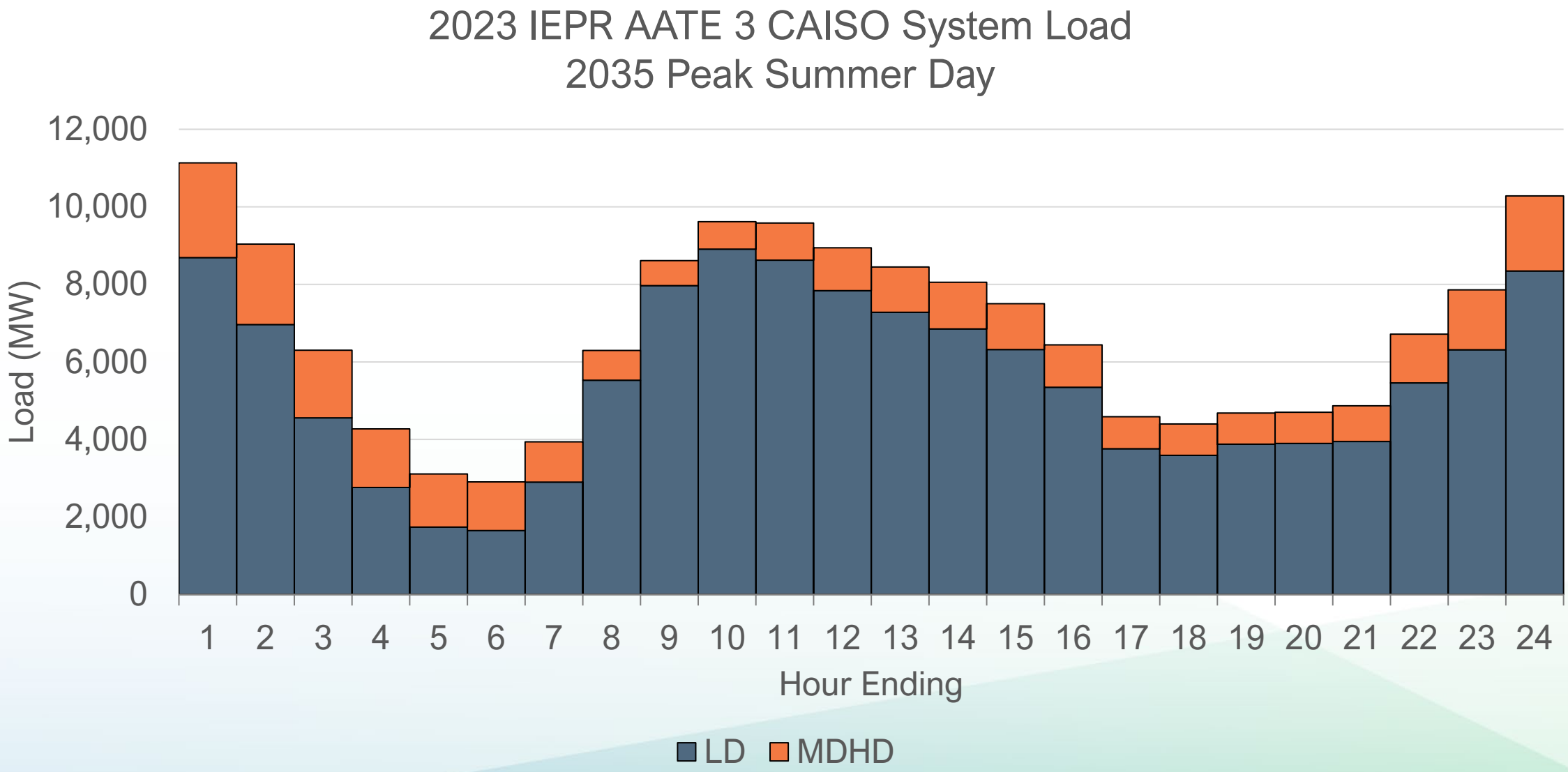
Load Profile – Seasonality Comparison for LD



Load Profile – Seasonality Comparison for MDHD



Load Profile



Transportation Energy Forecasting Team

Aniss Bahreinian
Jeffrey Chen (student)
Maggie Deng
Jesse Gage
Elena Giyenko
Farzana Kabir
Liz Pham
Namita Saxena
Ysbrand van der Werf (fuel prices)
Quentin Gee (Supervisor)

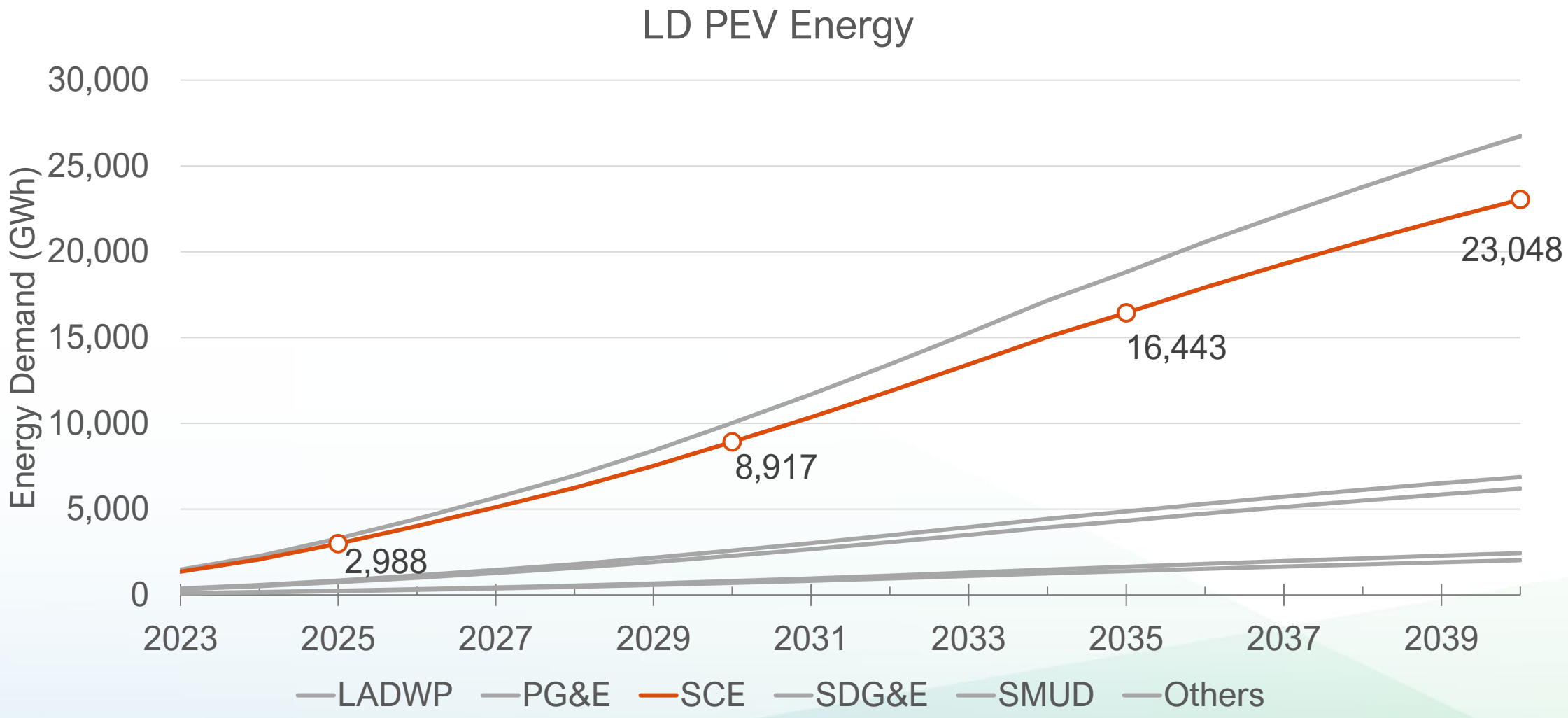
Thank You!

Questions Via Email

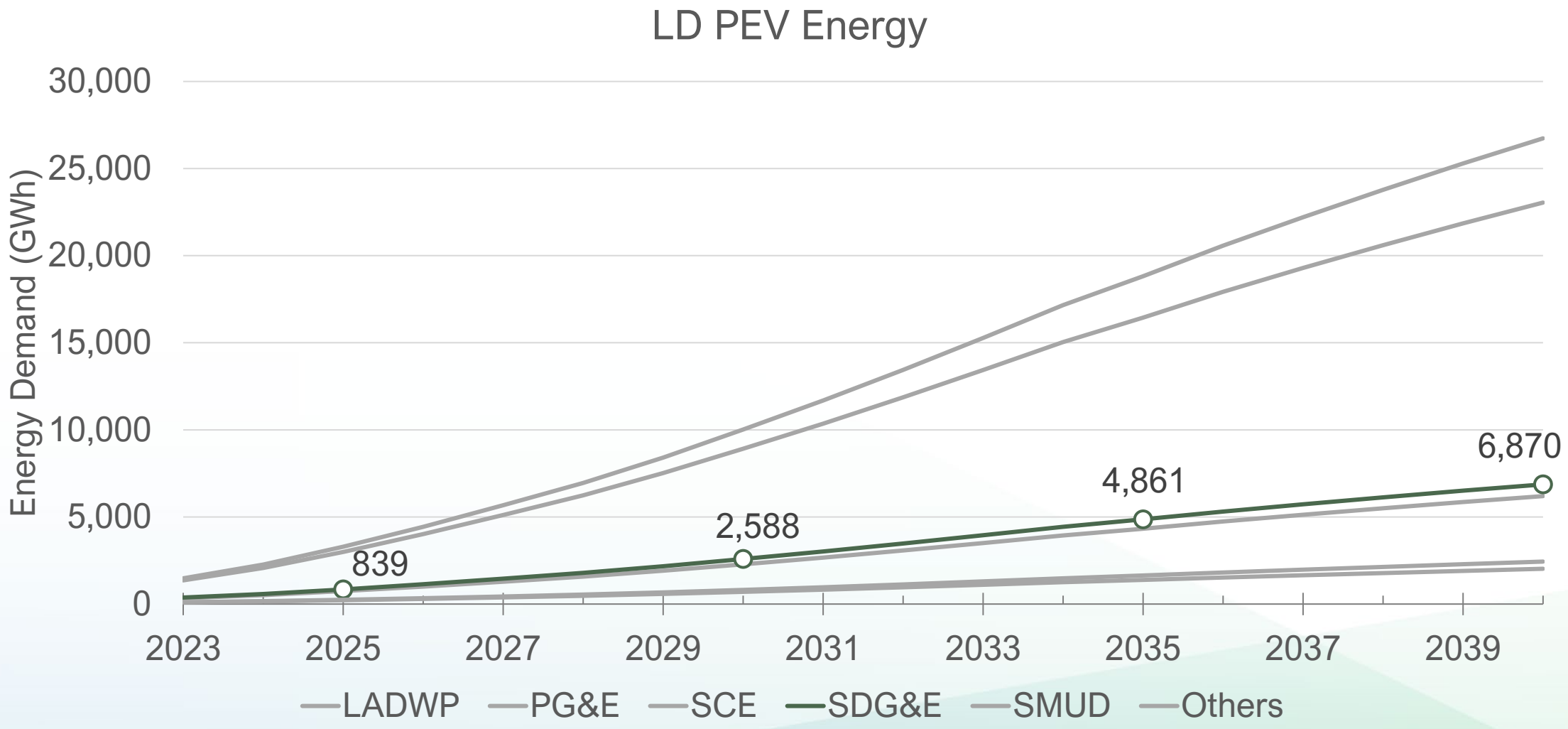
quentin.gee@energy.ca.gov

Appendix Slides

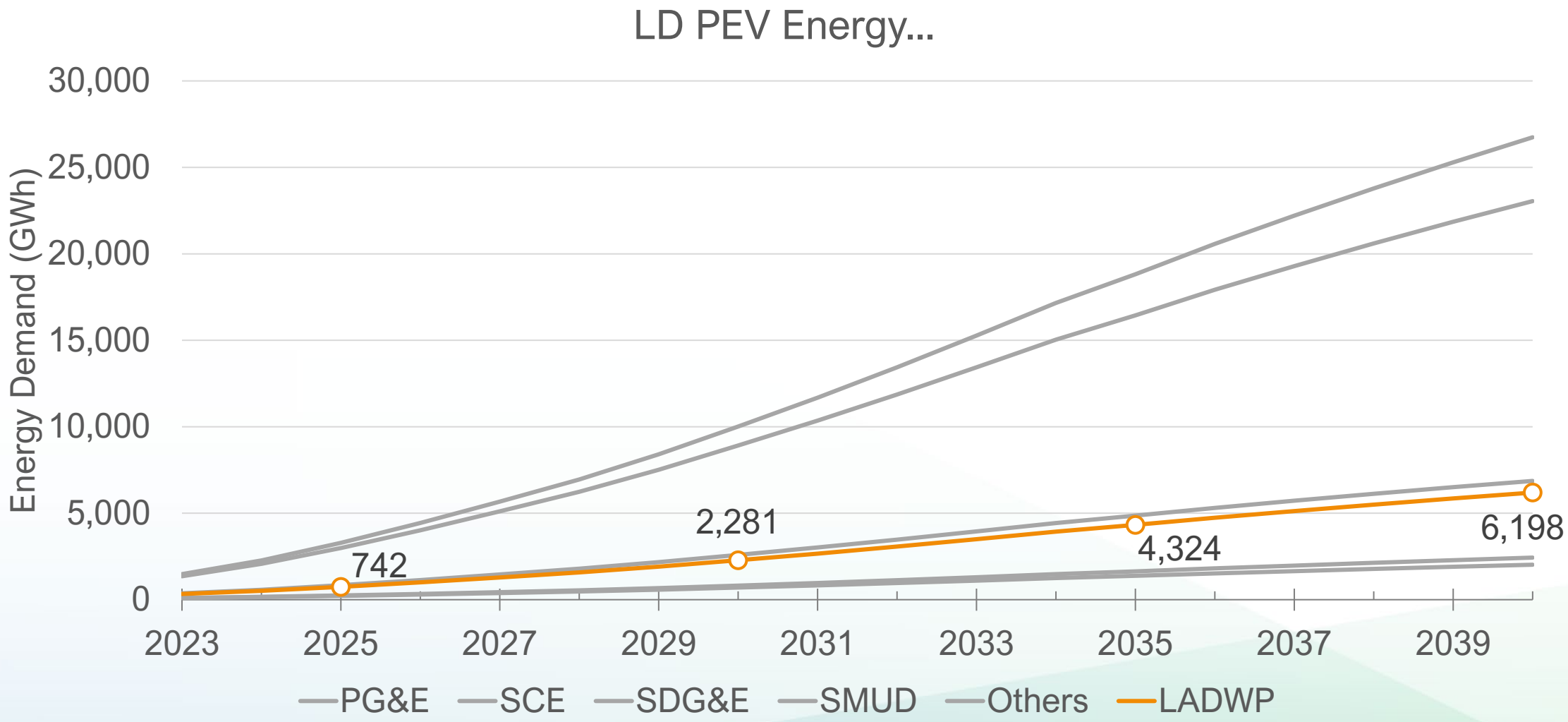
LD PEV Energy: SCE (GWh)



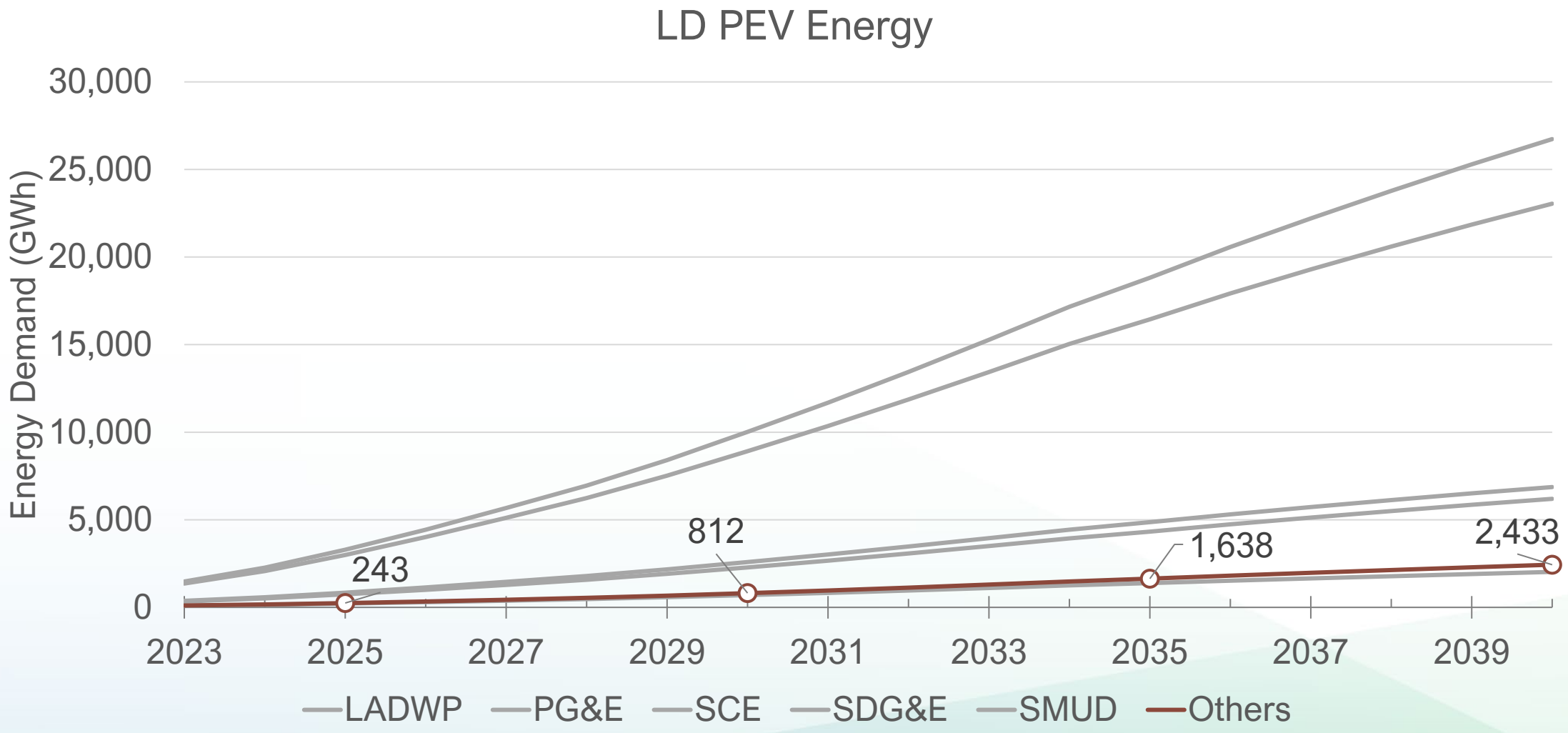
LD PEV Energy: SDG&E (GWh)



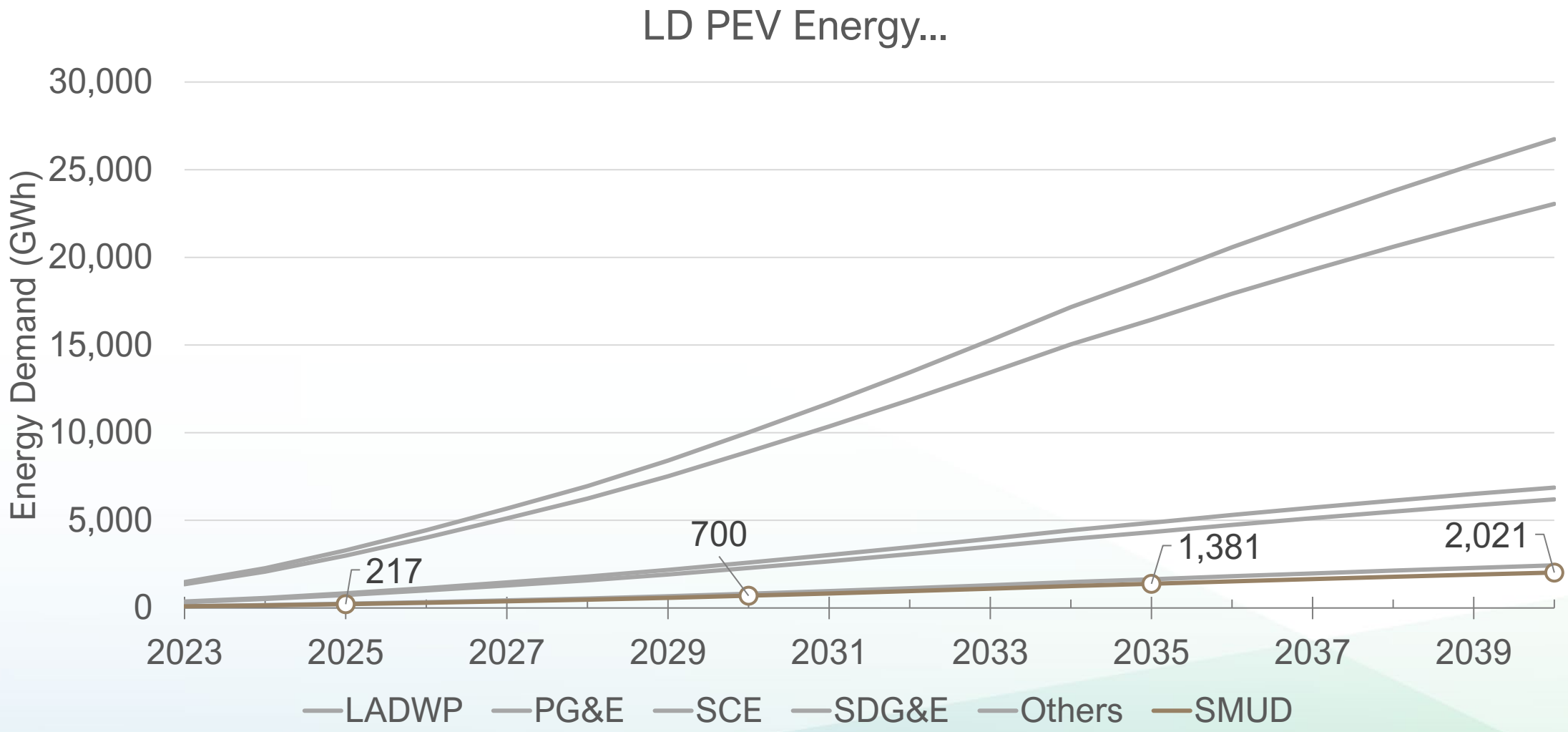
LD PEV Energy: LADWP (GWh)



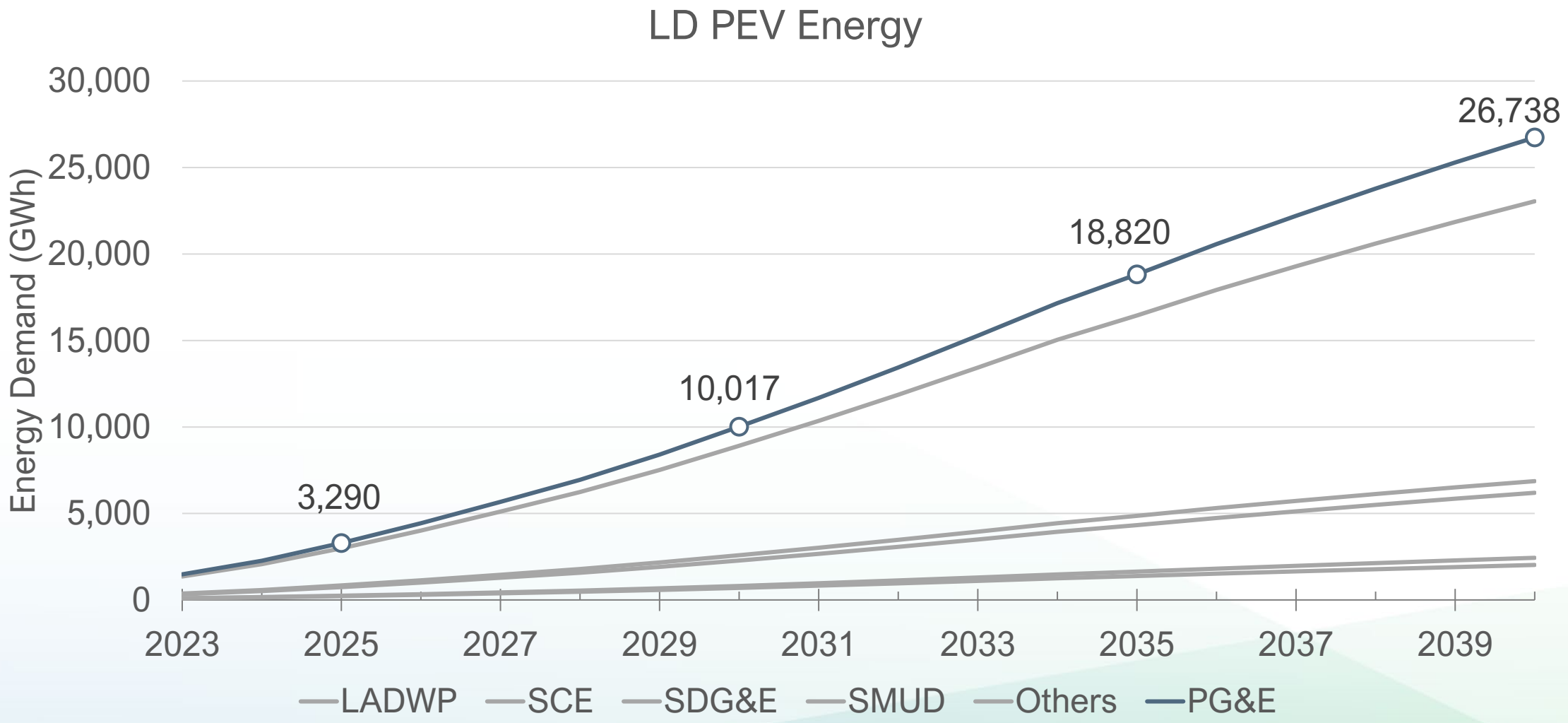
LD PEV Energy: Other Territories (GWh)



LD PEV Energy: SMUD (GWh)



LD PEV Energy: PG&E (GWh)



Regional Results: LD PEV Population (Thousand PEVs)

Utility Region	2025	2030	2035	2040
LADWP	247	654	1,300	1,939
PG&E	1,087	2,829	5,514	8,068
SCE	992	2,494	4,742	6,837
SDG&E	276	706	1,352	1,952
SMUD	75	204	418	633
Others	47	143	318	506