

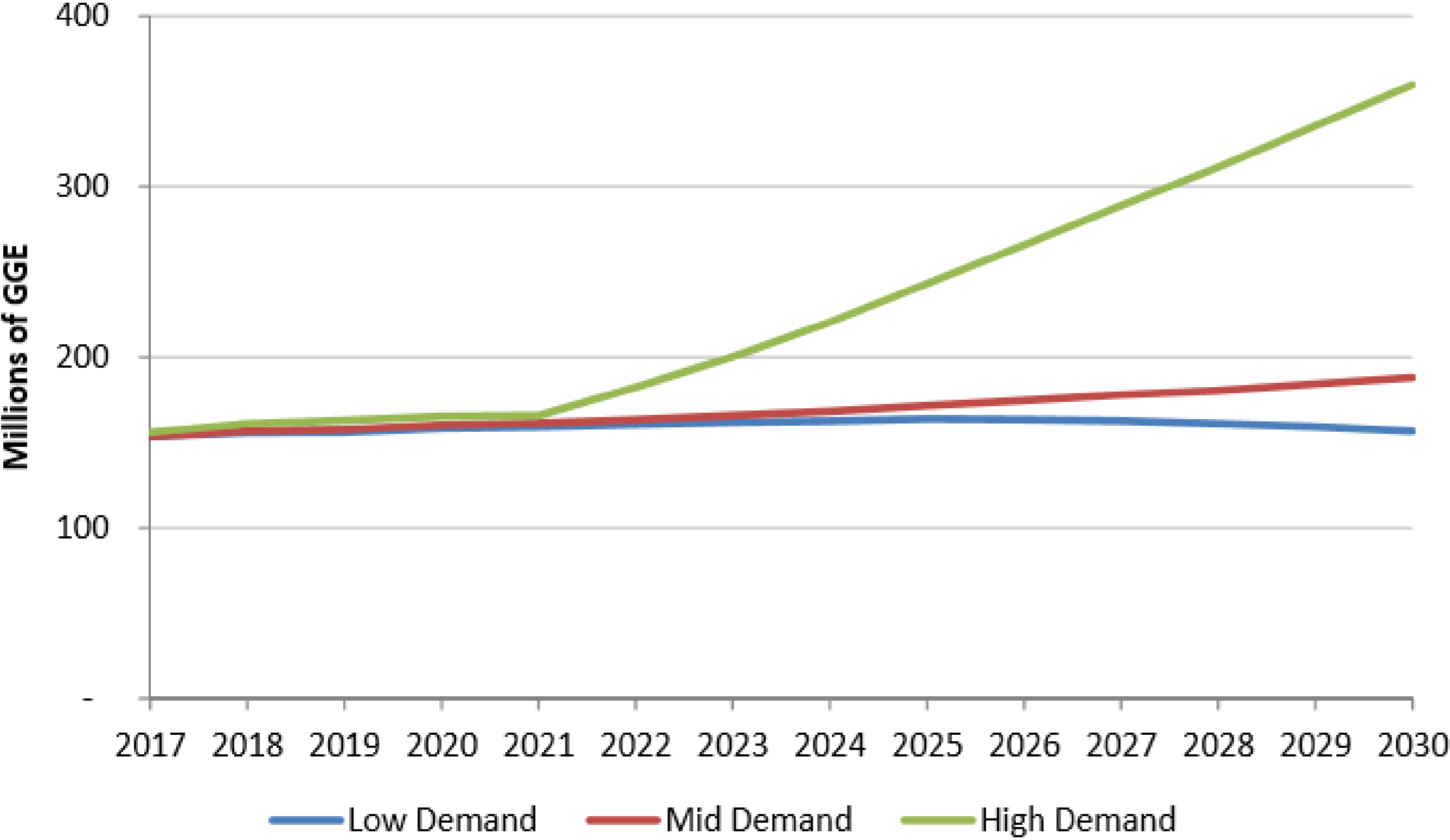
Potential RNG Supply from SB 1383 Methane Reduction Goals and Forecasted Vehicle Fuel Demand

For Discussion Purposes Only

Dairy and Livestock Working Group
Subgroup 2: Fostering Markets for Dairy Digester Projects
April 9, 2018

Transportation Natural Gas Demand Forecast

Figure 5-18: Transportation Natural Gas Demand Forecast



Source: California Energy Commission

Natural Gas Demand

- Most future growth expected to remain in heavy-duty truck segment, where alternative fuel truck rules, cheaper per-mile costs, voucher incentives, and higher annual mileage lead to a faster payoff on natural gas engines

Low Demand Case (Blue)

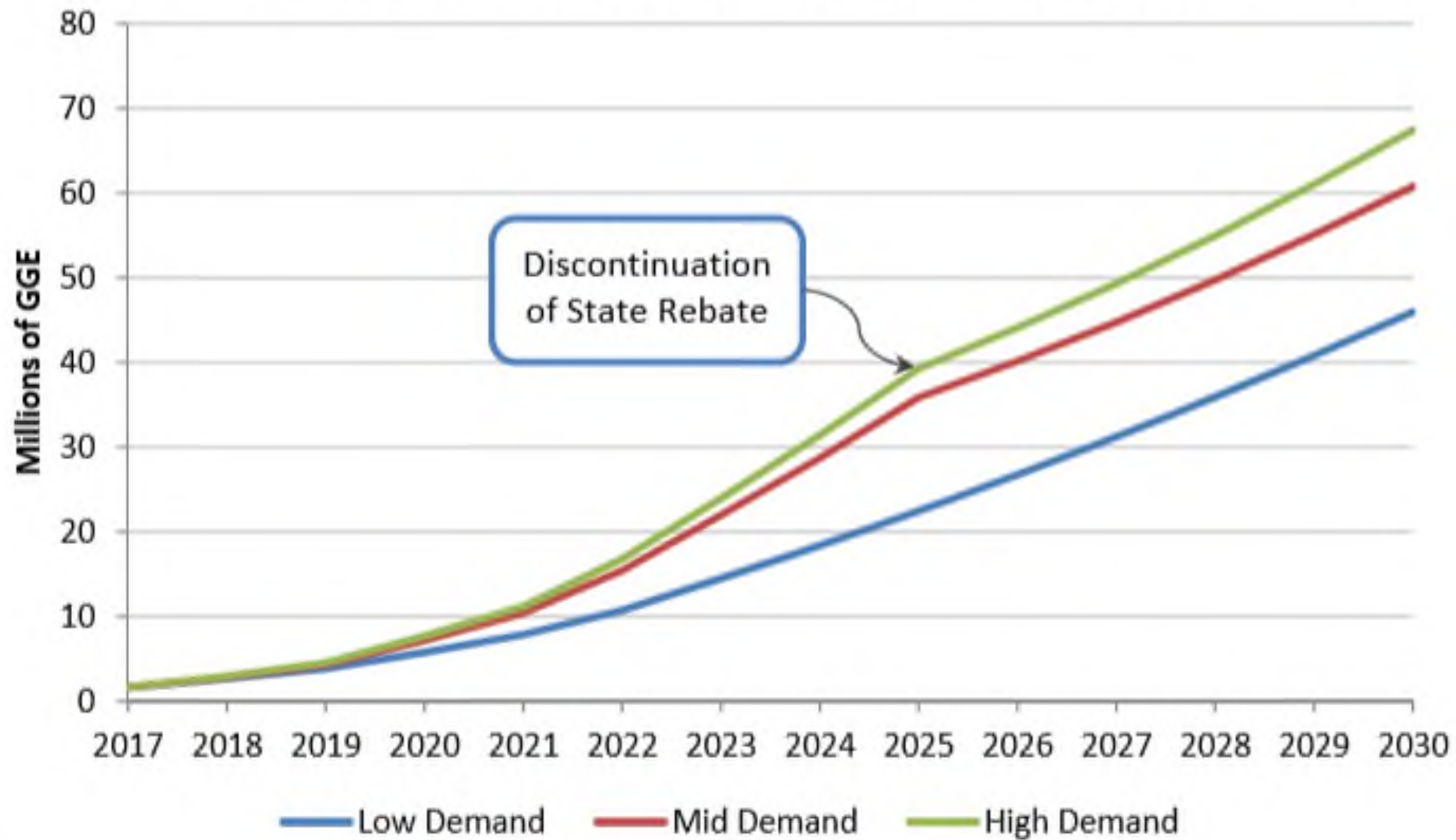
- There is no assumption of incentives for heavy-duty trucks
- Electric buses replace natural gas buses in urban transit
- These two factors lead to a decline in natural gas demand in the low case.

High Demand Case (Green)

- Incentives and the combination of high diesel price and low natural gas price create a demand for natural gas trucks
- Rise in natural gas demand in 2022 from the introduction of low-NOx engines in the heaviest truck classes

Transportation Hydrogen Demand Forecast

Figure 5-19: Transportation Hydrogen Demand Forecast



Hydrogen Demand

- Continuous increase over the forecast period, due to the predicted increase in light-duty fuel cell electric vehicles (FCEVs)
 - Predicted increase in FCEVs based on CARB’s automaker surveys of anticipated FCEV deployment, and CEC forecasts
- Change in the growth rate of hydrogen demand follows the change in FCEV demand caused by the discontinuation of the state rebate for zero emission vehicles (ZEVs), including FCEVs.

Source: California Energy Commission

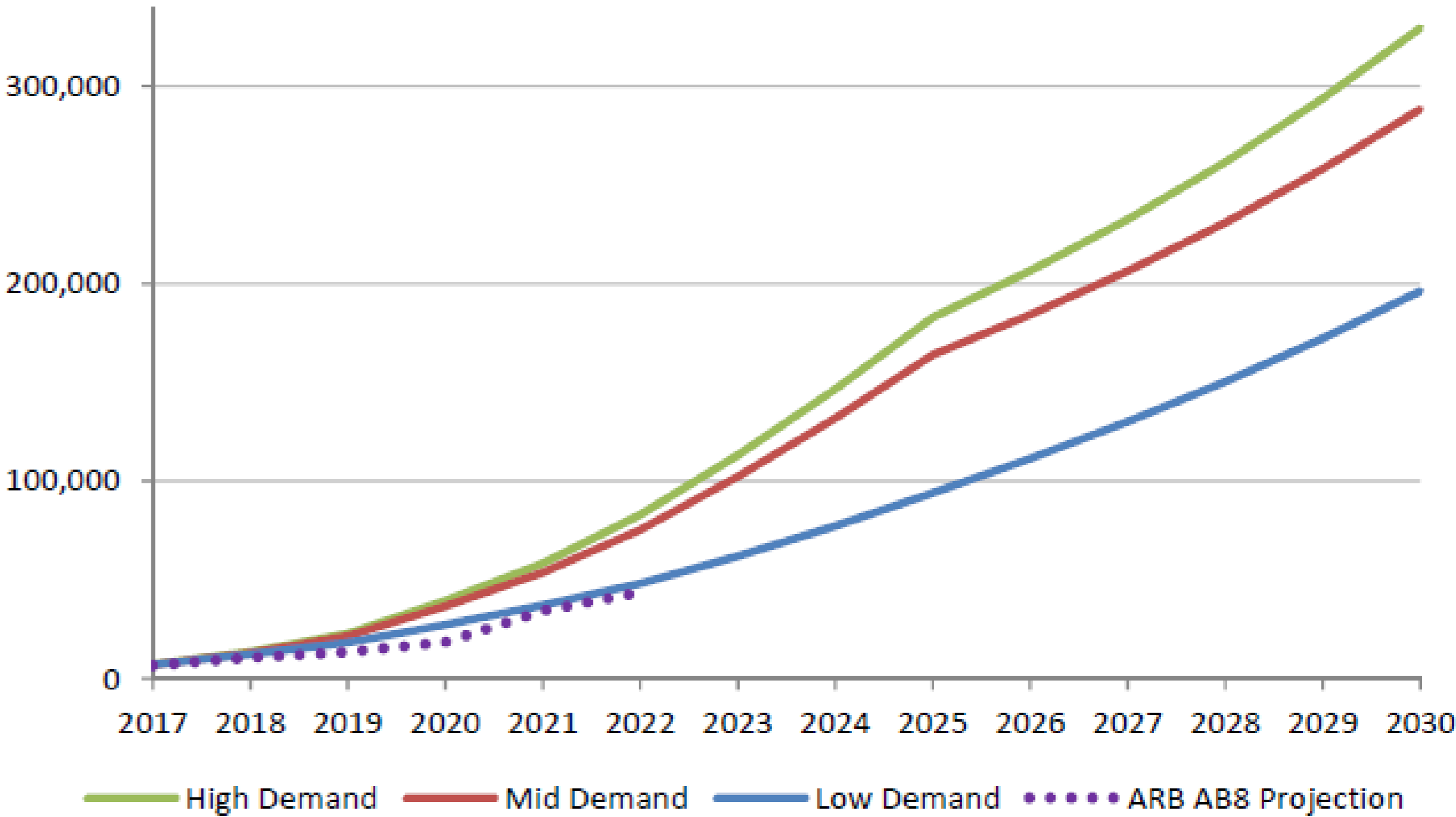
Truck Stock Forecast

Table 5-1: Truck Stock Forecast by Fuel Type and Case

		2017	2020	2025	2030
High case	Diesel	748,041	852,973	886,491	887,741
	Diesel-Electric Hybrid	2,802	10,449	21,169	41,715
	Electric	1,166	6,690	19,851	42,580
	Ethanol		756	2,639	16,085
	Gasoline	233,183	243,272	245,682	231,347
	Gasoline Hybrid		112	694	5,045
	Natural Gas	9,939	13,164	33,307	61,117
	Propane	1,996	3,156	4,785	5,829
Mid case	Diesel	710,322	757,938	827,310	866,487
	Diesel-Electric Hybrid	1,919	6,665	18,244	32,233
	Electric	1,020	4,207	16,562	29,722
	Ethanol		441	2,707	16,582
	Gasoline	229,129	229,248	235,893	237,505
	Gasoline Hybrid		54	597	3,826
	Natural Gas	9,642	11,919	17,938	29,653
	Propane	1,626	2,349	3,616	4,622
Low case	Diesel	712,314	754,492	823,344	877,244
	Diesel-Electric Hybrid	1,999	6,490	16,707	29,683
	Electric	830	819	1,099	5,085
	Ethanol		323	1,775	10,459
	Gasoline	229,485	231,473	241,053	242,483
	Gasoline Hybrid		99	679	4,429
	Natural Gas	9,658	11,562	15,090	18,664
	Propane	1,672	2,451	3,460	4,174

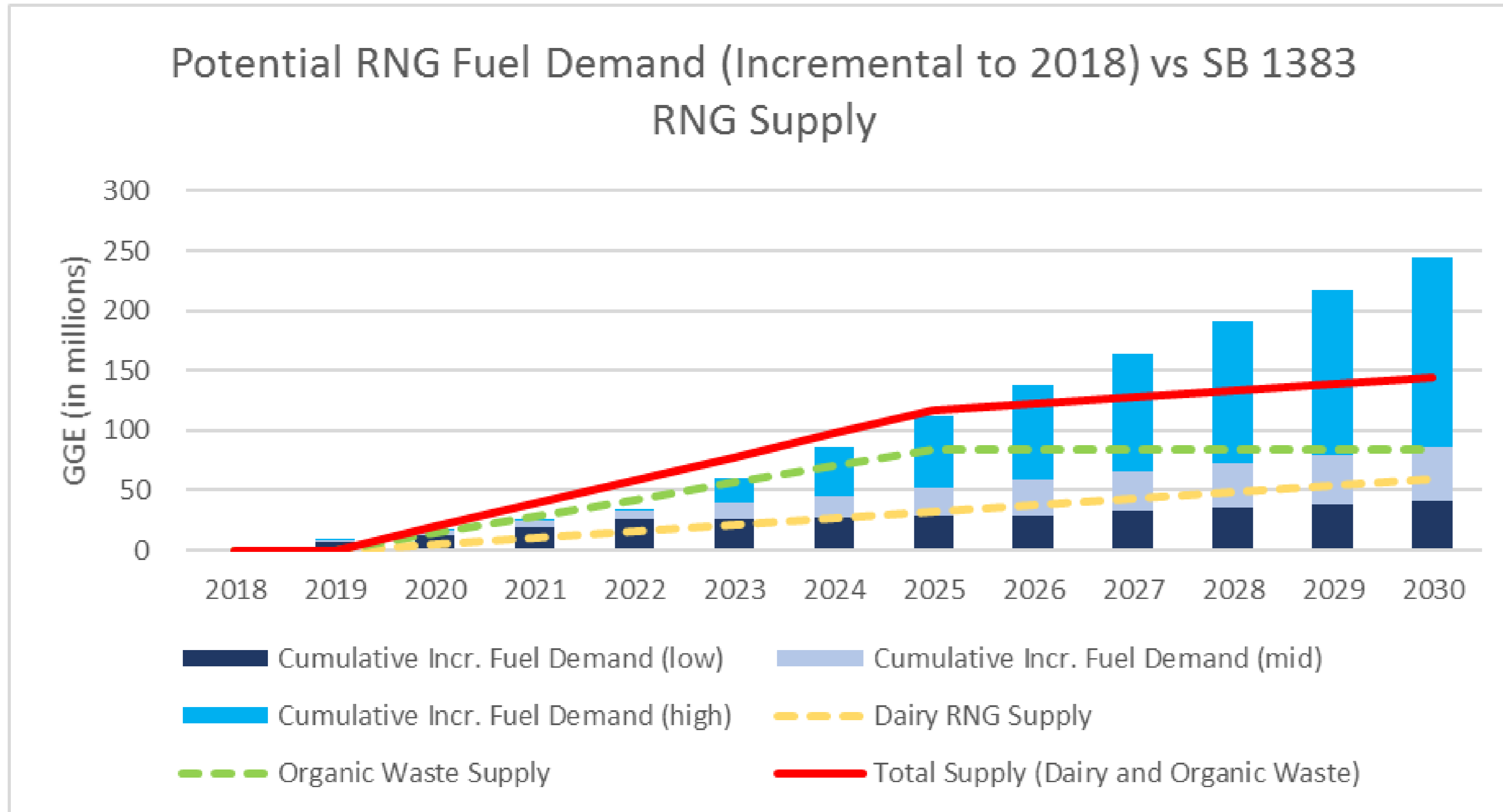
Source: California Energy Commission analysis

Figure 5-6: FCEV and Plug-In Hybrid FCEV Forecast Stock and CARB Automaker Survey Projections



Source: CEC Staff Report, Transportation Energy Demand Forecast 2018-2030, November 2017, Pages 65 and 70

Potential RNG Fuel Demand and SB 1383 RNG Supply



Incremental Fuel Demand from Natural Gas and Hydrogen Vehicles Only

Overview

- **Fuel Demand** – for natural gas and hydrogen only¹
- **Dairy RNG Supply**
 - 1.77 million milking cows in CA in 2013 (CDFA stats)
 - 1 cow can produce 100 DGE/year²
 - 2013 methane emission level = 118 MMTCO₂e, 25% is from dairy manure³
 - SB 1383 40% reduction in methane emissions from dairy manure management by 2030 - equates to 11.8 MMTCO₂e
 - **Assumption:** 75% of the reduction in methane emissions will be used for vehicle fuel, 25% will be used/managed in other ways
- **Food/Green Waste Supply**
 - Amount of organics disposed in landfills in 2014 = 22.8 million tons⁴
 - SB 1383 goal of 75% diversion of organic waste by 2025 (diverting 17.2 million tons/year from landfills)
 - **Assumption:** 50% of the organics are anaerobically digested and the renewable gas is used for vehicle fuel

¹ Source: CEC Staff Report, Transportation Energy Demand Forecast 2018-2030, November 2017, Pages 77-79

² http://kerncountyenergysummit.com/assets/neil-black-calbio_kern-energy-summit---11-8-17_final.pdf

³ https://arb.ca.gov/cc/dairy/documents/mainwkickoff/arb_presentation.pdf

⁴ <http://www.calrecycle.ca.gov/Actions/PublicNoticeDetail.aspx?id=2178&aiid=1987>