Fast Falling Battery Prices Boost Economic Benefits Expected from HDV Electrification

California Energy Commission

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Sacramento, California

ENERGY INNOVATION
POLICY & TECHNOLOGY LLC®

Methodology

WORKING PAPER 2023-10

Purchase costs of zero-emission trucks in the United States to meet future Phase 3 GHG standards

Author: Yihao Xie, Hussein Basma, Felipe Rodríguez

Keywords: Zero-emission truck purchase costs, zero-emission propulsion systems, battery-electric trucks, hydrogen fuel cell trucks

Table A6. Component cost breakdown for battery-electric trucks in 2022, 2030, and 2040

BET	2022	2030	2040
	Rigid truck, Class 4–5		
Base glider	19k	19k	19k
Auxiliaries	21k	21k	21k
E-drive	15k	6k	5k
Battery	31k	15k	11k
Indirect costs	38k	18k	17k

BET	2022	2030	2040
	Tractor truck, short-haul		
Base glider	36k	36k	36k
Auxiliaries	34k	34k	34k
E-drive	21k	8k	6k
Battery	105k	51k	37k
Indirect costs	84k	38k	34k

	Rigid truck, Class 6–7		
Base glider	23k	23k	23k
Auxiliaries	23k	23k	23k
E-drive	18k	7k	5k
Battery	47k	23k	17k
Indirect costs	49k	23k	21k

	Tractor truck, long-haul		
Base glider	42k	42k	42k
Auxiliaries	34k	34k	34k
E-drive	21k	8k	6k
Battery	266k	122k	85k
Indirect costs	152k	58k	48k

	Rigid truck, Class 8		
Base glider	44k	44k	44k
Auxiliaries	32k	32k	32k
E-drive	21k	8k	6k
Battery	92k	44k	33k
Indirect costs	81k	38k	34k

Prior HDV Battery Pack Price Forecast

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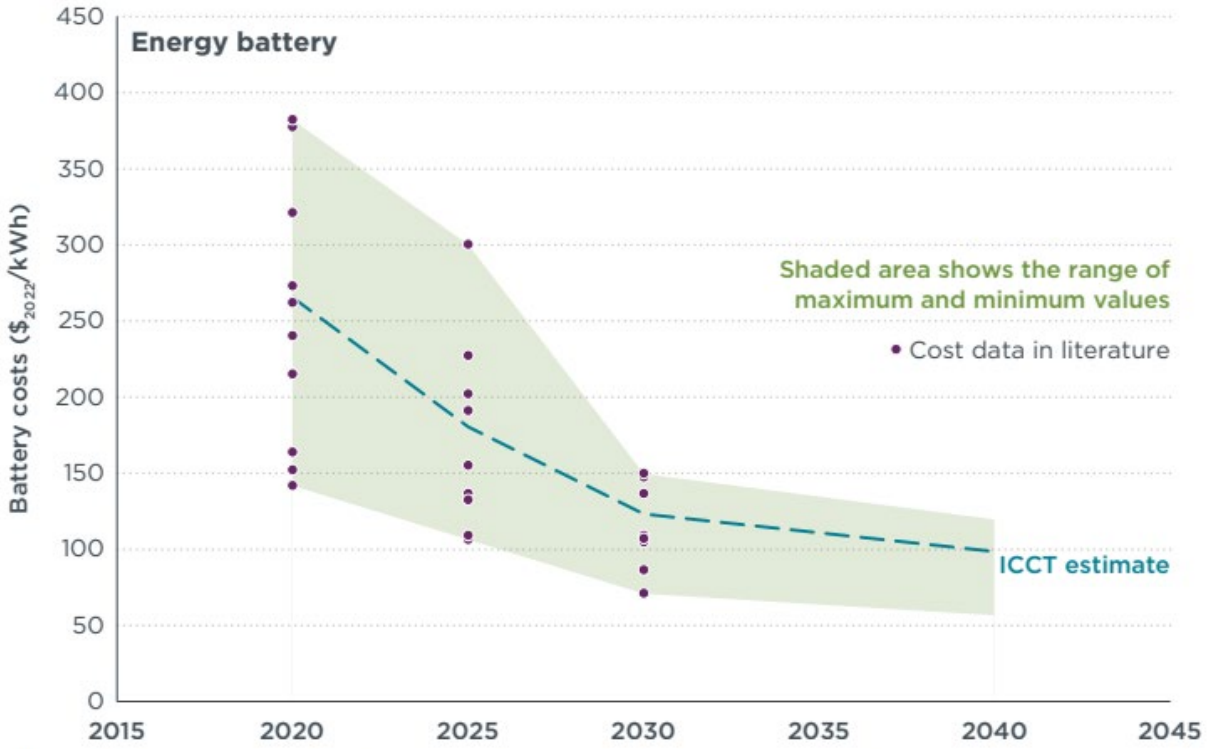


Figure 3. Estimates for the direct manufacturing cost of energy batteries

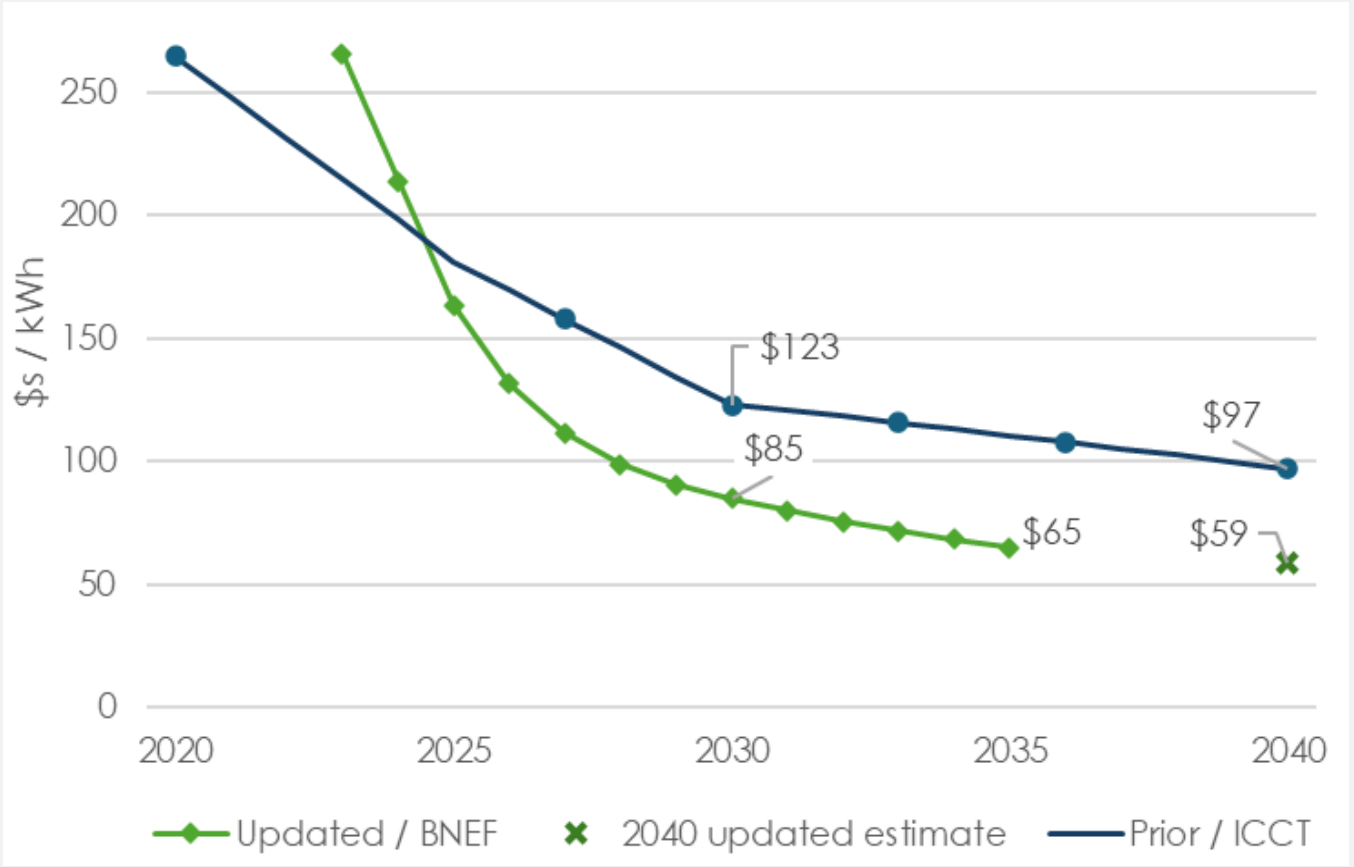
Two HDV Battery Pack Forecasts

Updated forecast from Bloomberg New Energy Finance (BNEF) 2023 EV Outlook

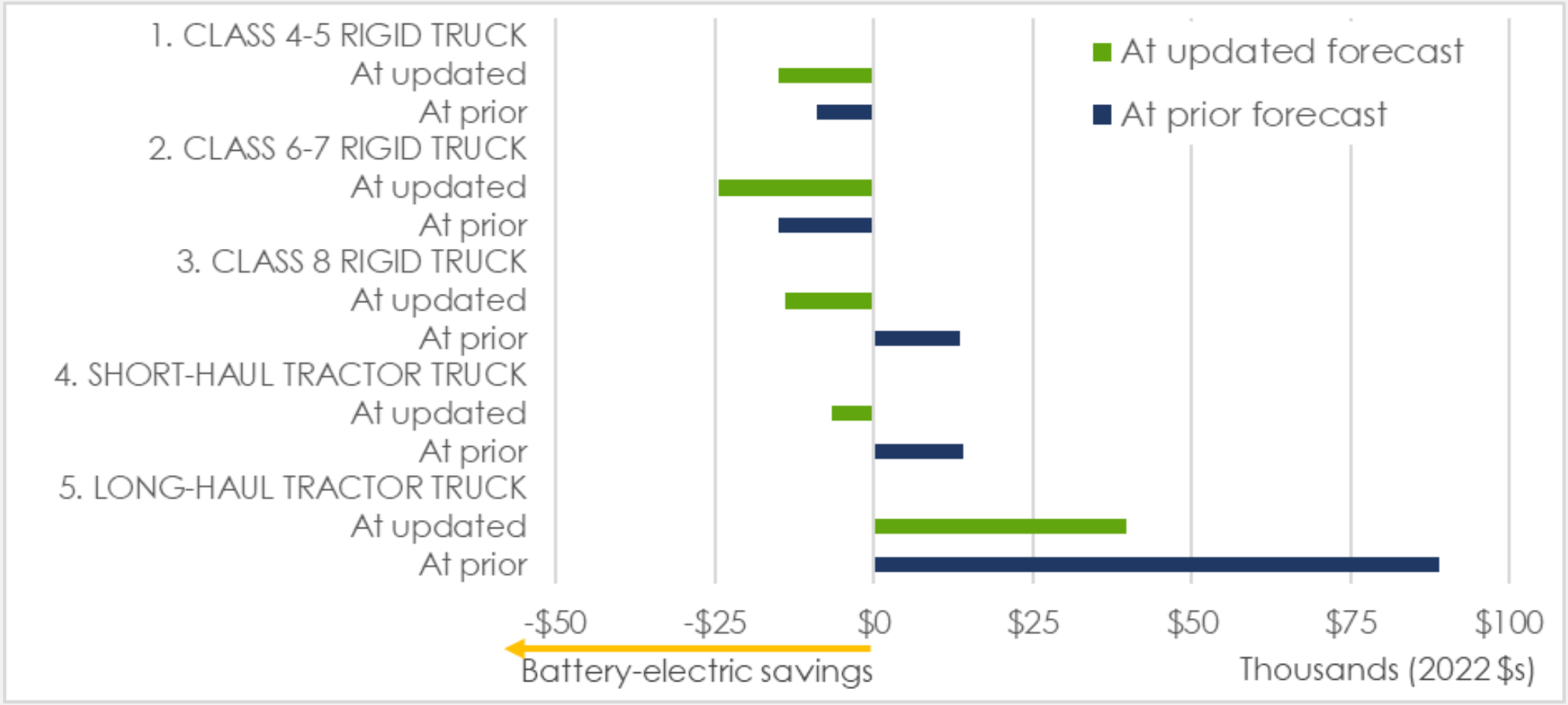
	2030	2040
Updated (BNEF)	$85 / kWh	$59 / kWh [+]
Prior (ICCT)	$123 / kWh	$97 / kWh

* In constant 2022 dollars

[+]2040 estimate based on BNEF's forecast through 2035 and 17% learning rate

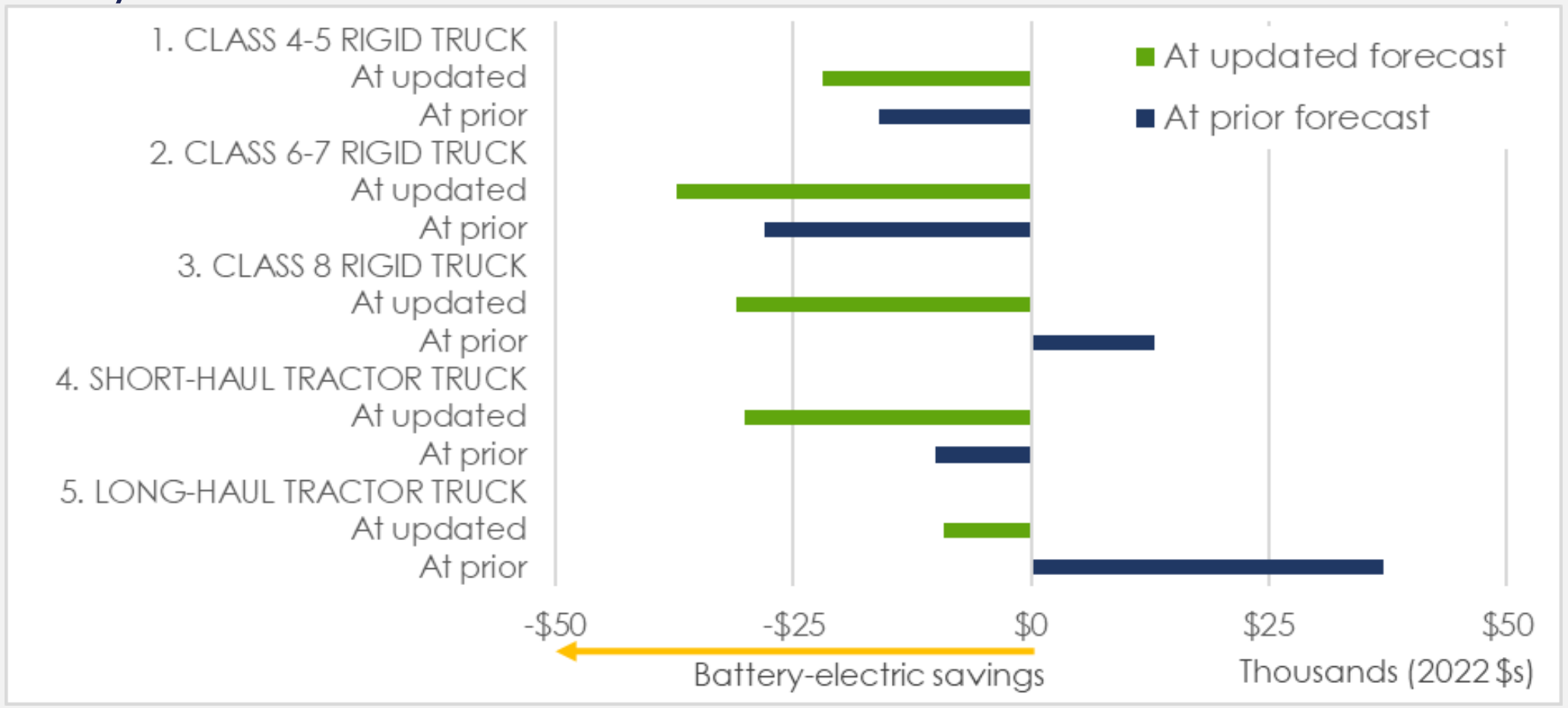


Battery-Electric vs. Diesel Vehicle Purchase Cost in 2030



Sources: BNEF, ICCT, and EI calculations

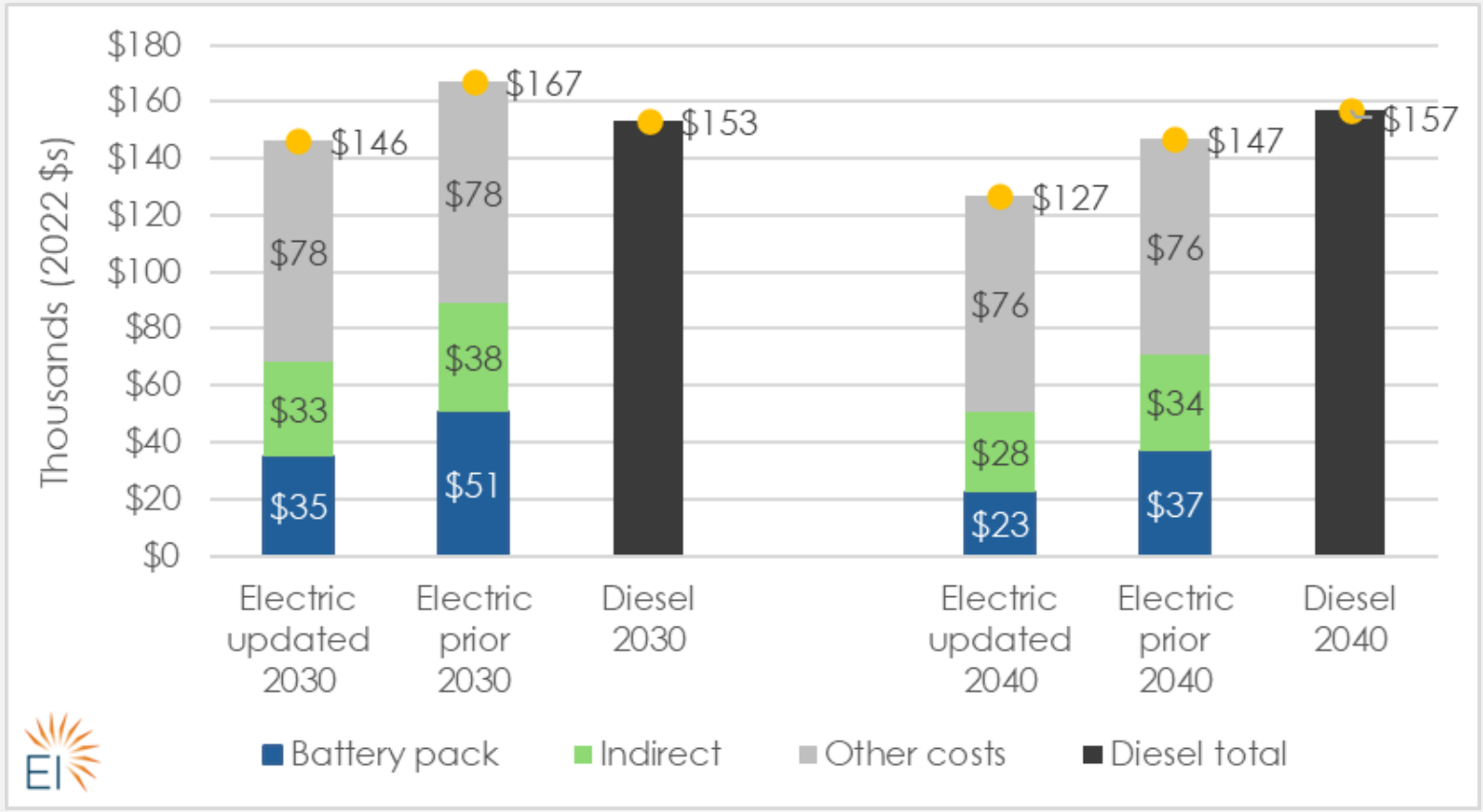
Battery-Electric vs. Diesel Vehicle Purchase Cost in 2040



Sources: BNEF, ICCT, and EI calculations

Short-Haul Tractor Truck Cost Comparison

Purchase cost difference	2030	2040
BEV @ updated vs. BEV @ prior	-$21K	-$20K
BEV @ updated vs. Diesel	-$7K	-$30K

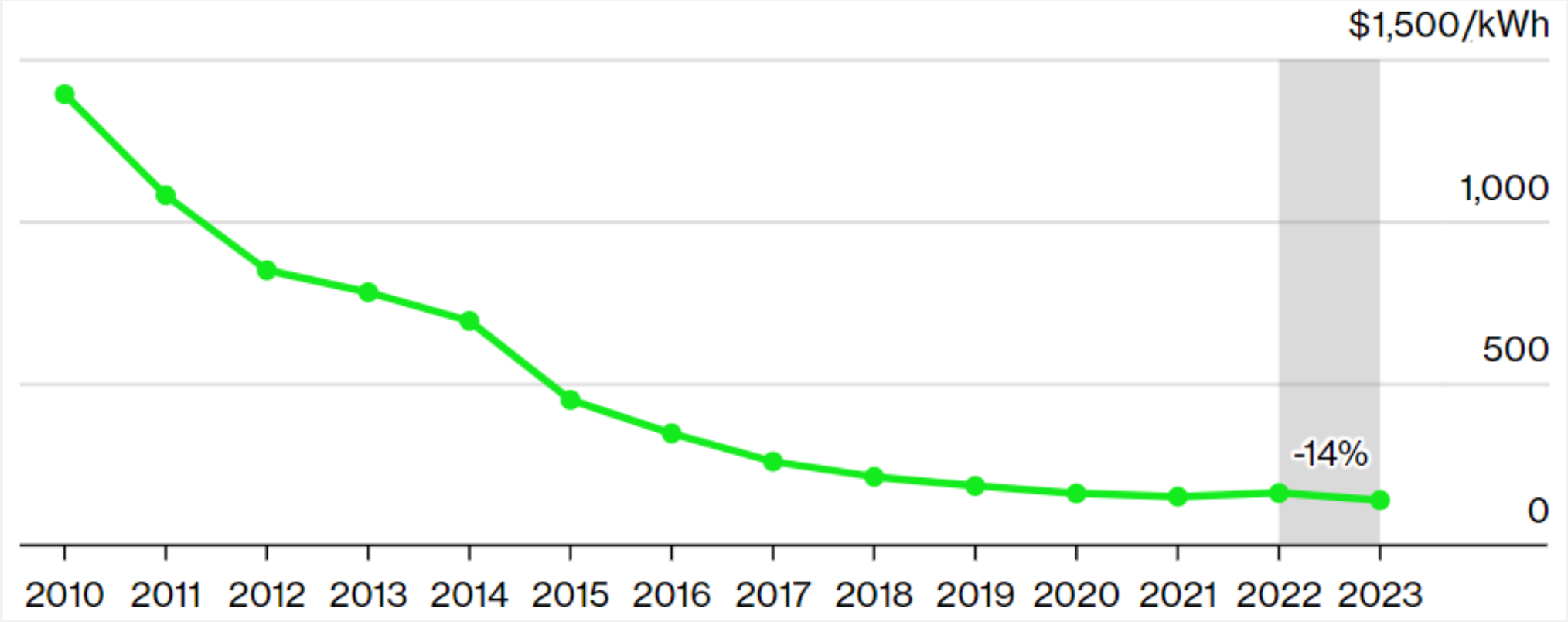


Sources: BNEF, ICCT, and EI calculations

Battery price fell 14% on average in 2023

Updated forecast published mid-year, not fully capturing 2023 trends

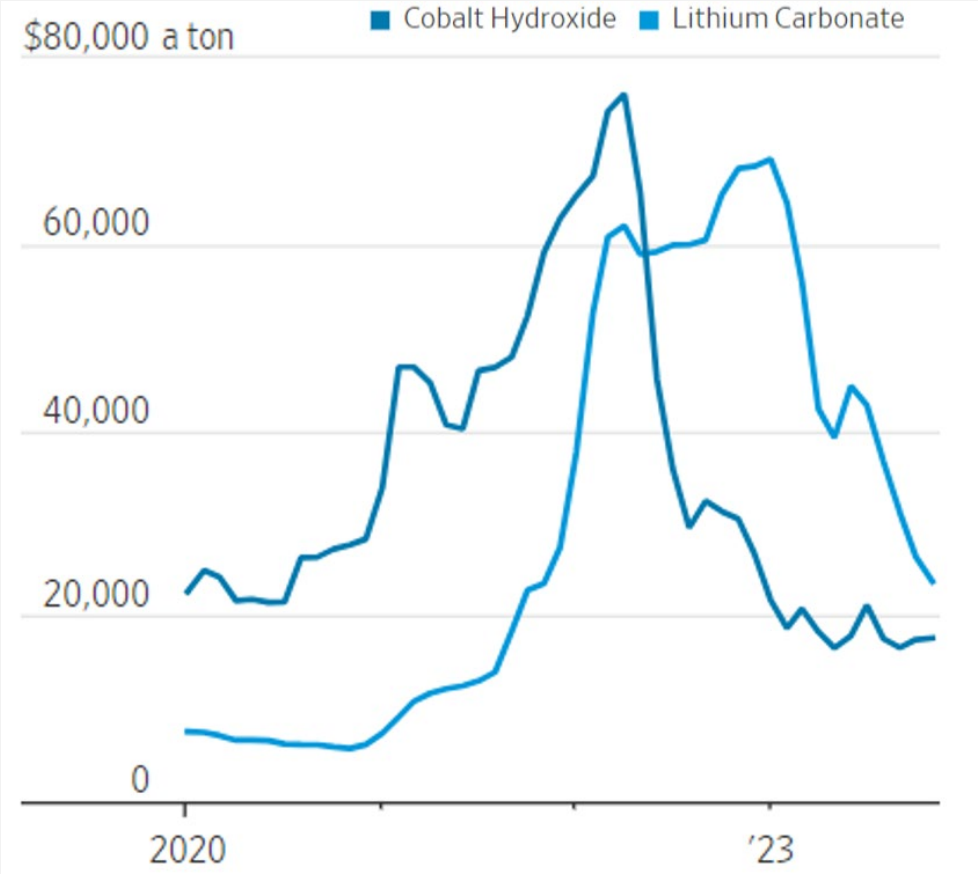
Sales weighted average price for battery packs



Source: BNEF via Bloomberg

Battery Mineral Prices Fall from the Stratosphere

- **Lithium prices dropping 70%**
- **Cobalt prices reverting to pre-pandemic levels**

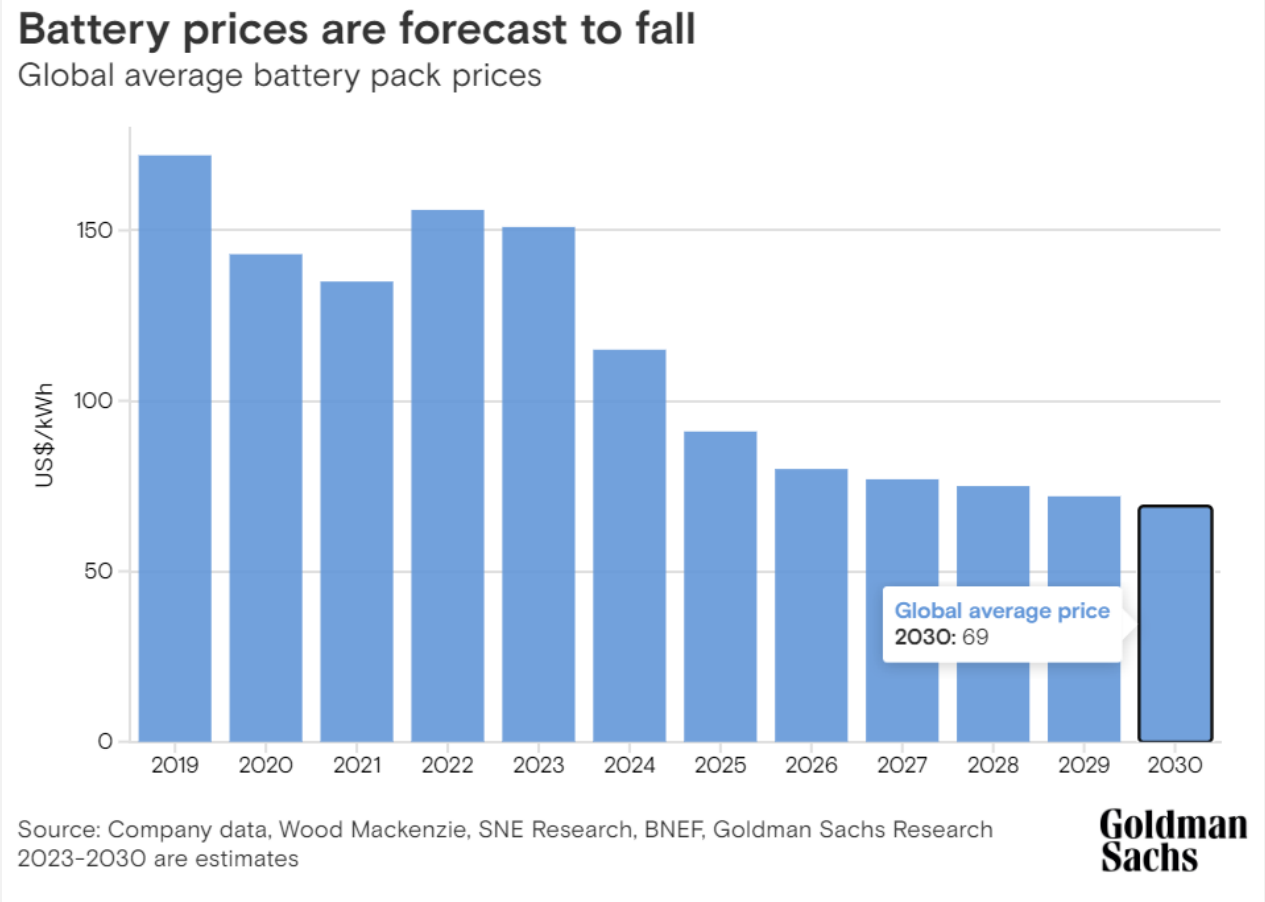


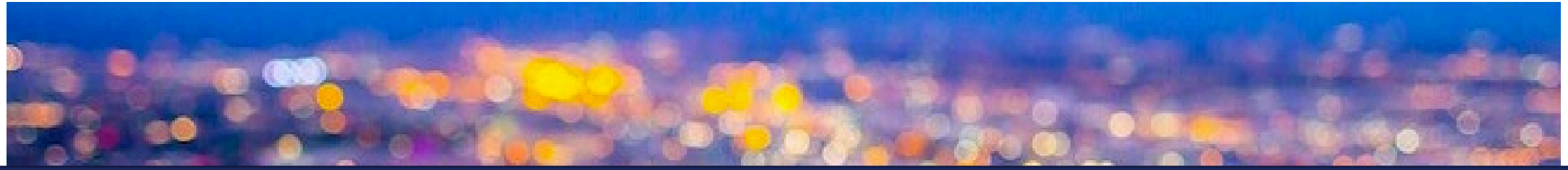
Source: Wall Street Journal

Goldman Sach's Greater Optimism

- "Battery prices are now falling rapidly."
- Expect, "a nearly 40% decline in battery prices between 2023 and 2025."

Quotes from Goldman Sach's "Lower battery prices are expected to eventually boost EV demand," February 29, 2024.





Thank you

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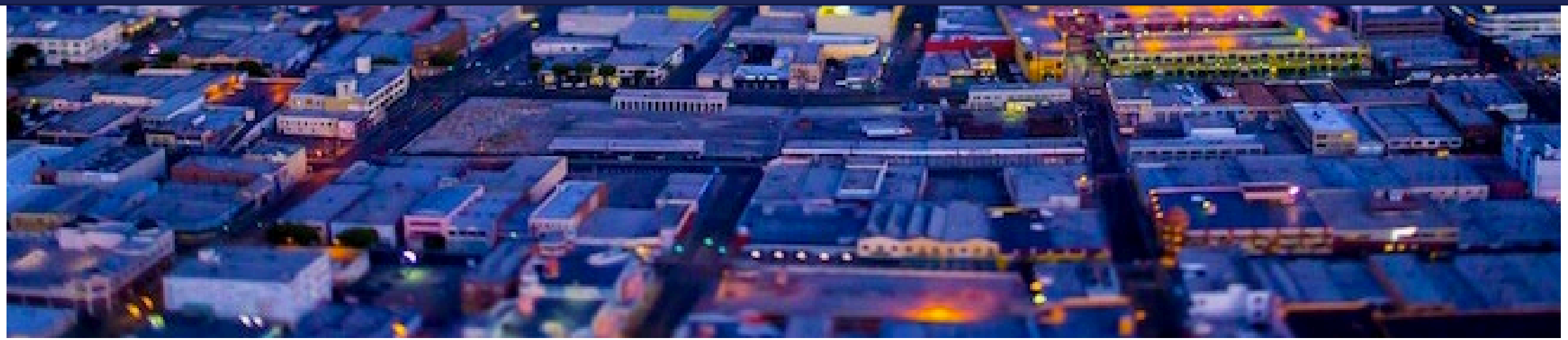
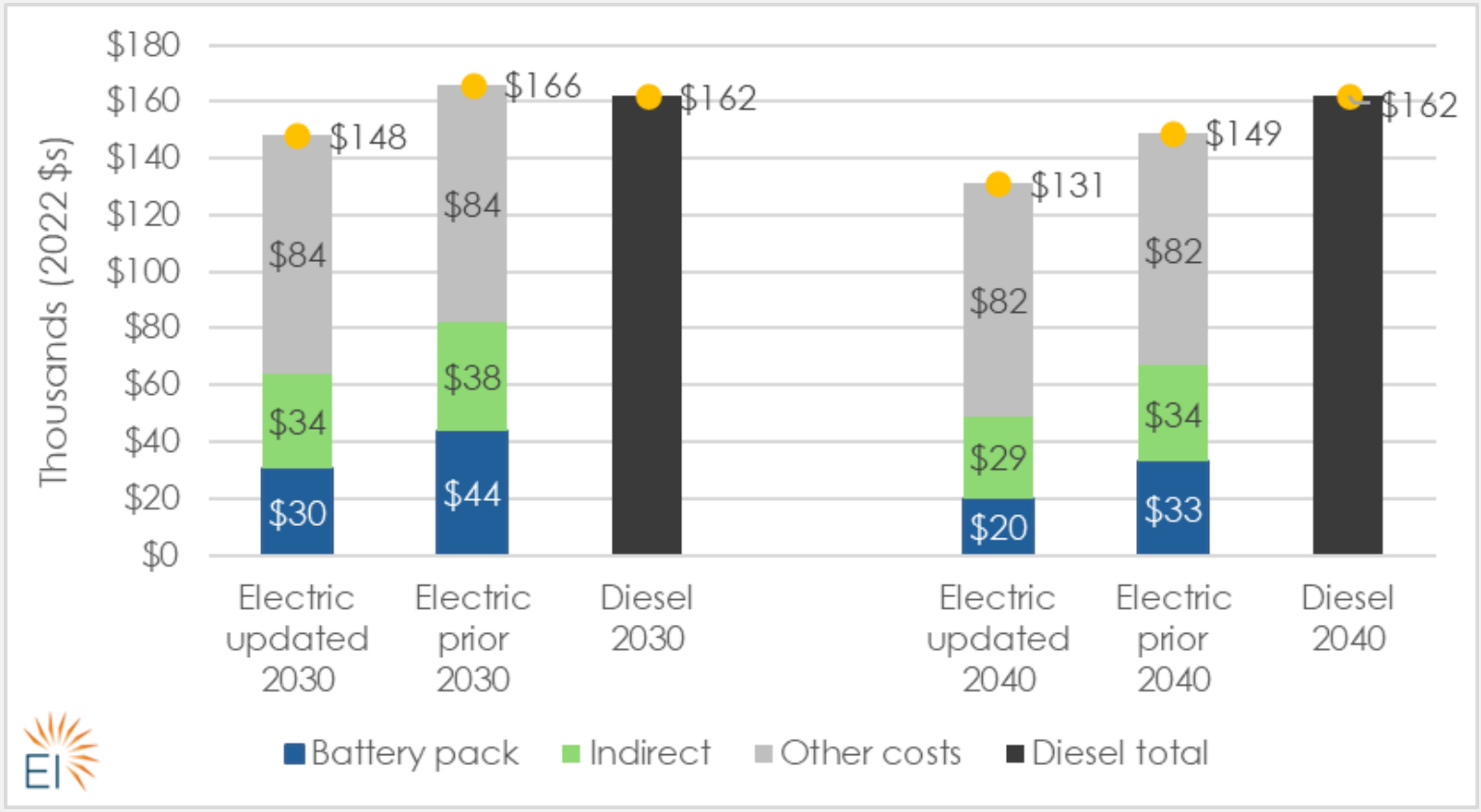


Class 8 Rigid Truck Cost Comparison

Purchase cost difference	2030	2040
BEV @ updated vs. BEV @ prior	-$18K	-$18K
BEV @ updated vs. Diesel	-$14K	-$31K



Sources: BNEF, ICCT, and EI calculations

Vehicle segmentation

The segmentation of commercial vehicles according to Gross Vehicle Weight Rating (GVWR) differs between countries and follows the classification used by statistics agencies in every country or region.

Table 41: Commercial vehicle segmentation according to Gross Vehicle Weight Rating (GVWR)

Country	LCV	MCV	HCV
US	<4.5t	4.5-12t	>12t
Europe	<3.5t	3.5-12t	>12t
China	<6t	6-14t	>14t
India	<3.5t	3.5-16t	>16t
Japan	<5t	5-9t	>9t
South Korea	<5t	5-12t	>12t

Source: BloombergNEF. Note: 't' denotes metric tons; LCV, MCV and HCV denote light-, medium- and heavy-duty commercial vehicles, respectively.