APPENDIX

DETAILS ON FUNDING SOURCES FOR REACHING FULL CHARGE: HOW CALIFORNIA'S CHARGING INFRASTRUCTURE INVESTMENTS CAN ENABLE 100 PERCENT LIGHT-DUTY ELECTRIC VEHICLE SALES BY 2035

SUMMARY OF THE SOURCES OF FUNDING CONSIDERED IN THE FACT SHEET

Low Carbon Fuel Standard (LCFS) credits for owners of charging stations:

- Credits for owners of charging stations: Figure 1 conservatively assumes $100 per metric ton for LCFS credits going forward. However, for the last three years LCFS credit prices have been almost $200 per metric ton.[1] Based on an LCFS model from Dean Taylor Consulting, at LCFS credit prices of $100 per credit (and per metric ton of carbon reduced), the value of LCFS is about $82 for every 1,000 kWh. The model assumes that kWh per year per charging station for light-duty EVs can vary widely, from 1,000 to 100,000 kWh, depending on many variables including location, whether the charger is Level 2 or DC, and the kW size of the charger.
- Credits for owners of DC fast-charging stations: Currently, 2,402 DC (direct current) fast chargers at 366 sites have been approved for the LCFS program's Zero-Emission Vehicle (ZEV) infrastructure capacity credits, and high potential exists for more (such as the 10,000 DC fast chargers by 2025 mandated in Executive Order B-48-18).[2] Assuming the California Air Resources Board (CARB) extends this program out to 2035, there potentially could be another 10,000 or more DC fast chargers.[3]
- We assume that 20 percent of all LCFS credits (residential and nonresidential) will go to fund away-from-home charging including workplace and public Level 2 and DCFC. We also assume that 25 percent of all LCFS credits that go to publicly owned utilities (base residential credits) will fund shared public charging stations at multiunit dwellings starting in 2024.[4]

Utility programs:

- Currently the California Public Utilities Commission (CPUC) has approved or is considering approval of more than $1.2 billion in allocations from investor-owned utilities to partially pay for more than 100,000 chargers at multi-unit dwellings or public charging stations (2021 to 2026), with another $154 million estimated for multiunit dwelling related chargers (2027 to 2029).[5] In addition, an estimated $340 million, or 34 percent of funds, will be directed to disadvantaged communities.[6] The costs on the utility side of the meter are not included in this analysis but can typically represent 30 percent of total costs.[7] With the AB 841 law (enacted 2020), these costs will be treated in the future like other investor-owned utility costs: They will no longer be assigned to the site and will not need to be requested in special filings as in the past.[8] Publicly owned utilities are also investing tens of millions per year utilizing LCFS credit proceeds to support nonresidential light-duty EV charging programs as well as medium- and heavy-duty truck charging infrastructure.[9]

State incentives:

- The California Energy Commission (CEC) has spent about $200 million to date on public and shared private chargers, with almost 50 percent going to disadvantaged communities.[10] Out of the $10 billion state budget for ZEVs (FY 2021–22 and proposed FY 2022–23), up to $900 million could benefit public and shared private charging for passenger EVs.[11]
- State ballot initiative: A potential ballot measure (the Clean Cars and Clean Air Act) that could be voted on in November 2022 would provide funds for many types of EV charging infrastructure, with half of the funding reserved for projects in low-income and disadvantaged communities.[12] These potential funds are not included in this analysis.

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Federal funding:

- The Infrastructure Investment and Jobs Act (enacted in 2021) provided $5 billion in formula funding for corridors called the National EV Formula Program and an additional $2.5 billion for other community charging and fueling infrastructure through a competitive program.[13] California will receive at least $348 million and potentially as much as $940 million over the next five years for community and corridor charging.[14]

Sources of funding not included in Figure I: Private investments (from automakers, retailers, third-party service providers, and transportation network companies):15

- Private companies (e.g., Tesla, Electrify America, EVgo, ChargePoint, Rivian) are playing an increasing role in EV charging, which suggests that incentives can come down over time. In addition, a growing number of companies are entering the public charging station business, and some evidence exists that prices paid by drivers for away-from-home charging are coming down a little.[16]

Trends:

Public investment from state and federal budgets and from utility programs will likely continue. The LCFS program does not expire, and the residential LCFS credits (which increase with the number of EVs) could become a new source of funds, if needed.

The specific assumptions for the development of Figure I include the following:

- **Federal incentives:** We show the low case scenario, in which $384 million from National EV Charging Infrastructure formula funding will come to California.[17] This analysis is conservative compared with the high case scenario, in which $4.5 billion of the $5 billion in formula funds for corridor charging reaches the states. California receives 12 percent, proportional to its share of the U.S. population, and receives 16 percent of the competitive charging and fueling infrastructure for public and shared private charging out of $2.5 billion nationally by providing higher matching funds in competitive bids.[18]
- **State incentives:** See above section on state incentives.
- **LCFS proceeds:** We assume $100 per credit (or metric ton), which is much lower than historic electricity credits and LCFS credit prices.[19] The analysis assumes that 20 percent of total electricity credits will go to public and shared private charging (not including multiunit dwellings, single-family homes, or fleets). LCFS increases with the number of EVs registered in the state. For future years, estimates of the number of EVs on the road are based on a vehicle stock model produced by Shulock Consulting and a scenario evaluating the requirements from CARB's proposed Advanced Clean Cars II program.[20] Our estimate that 6.4 million plug-in electric vehicles will be on the road in 2030 is based on Shulock Consulting's stock model.
- **LCFS capacity credit proceeds:** We assume that developers will reach full potential, which is 2.5 percent of LCFS deficits.[21]
- **Utility incentives:** These include approved light-duty EV programs by SCE, PG&E, SDG&E, Liberty, Bear Valley, and NRG from SB 350, settlements, AB 1082, and AB 1083 (e.g., Charge Ready 1 and 2 Light-Duty, Power Your Drive 1 and 2, EV Charge Network, PG&E DC Fast Charge, Priority Review projects) for 2021 to 2026.[22] We assume that all pending or staff-proposed projects will move forward for light-duty EV public and shared charging (2023–2026), including approval of LCFS holdback funds ($21 million), upcoming filings for near-term priorities projects ($75 million), and extension of PG&E's EV Charge Network ($276 million).[23] In addition, the analysis by Dean Taylor Consulting assumes funding for two years of the $270 million for customer-side charging rebates in multiunit dwellings from 2025–2029 (or $54 million per year), based on directional information in the CPUC's staff proposal.[24] For public electric distribution utilities, the analysis by Dean Taylor Consulting assumes half of $50 million per year for the Los Angeles Department of Water and Power and smaller publicly owned utilities will go to public and shared private light-duty charging.[25]
- The above assumptions for Figure 1 are conservative and reasonable. For example, LCFS prices are assumed to be $100 per credit (MT), which is low compared with prices for the last three years. Federal funds are estimated at the lowest number in the literature. Regarding the proposed state budget for FY 21/22, the analysis assumes that $300 million for home charging is not included. The investor-owned utility funds do not include funds for utility-side costs. The publicly owned utility LCFS funds are reduced by 50 percent to account for spending on charging for medium- and heavy-duty EVs. Many potential sources of funds (e.g., private, future state funding sources, future utility applications to the CPUC and future ballot measures) are excluded. The analysis does not assume any funds from community choice aggregators.

The assessment of EV charging infrastructure and investment needs conducted by Atlas Public Policy and Dean Taylor Consulting utilized the following methodology:

- The consultancies used the U.S. Department of Energy's Electric Vehicle Infrastructure Project Tool (EVI-Pro) Lite model to assess the charging infrastructure needed.
- The consultancies used CARB's adoption curves for battery EVs and plug-in hybrid EVs (PHEVs) sourced from Shulock Consulting to determine the need for shared private charging at multiunit dwellings and workplaces, public Level 2 charging, and public DC fast charging out to 2050.
- Estimates of need did not include DCFC for long trips or transportation network company charging, or for private assigned parking spaces at homes, condos, apartments, and fleets.
- For PHEVs, estimates of need assume that PHEVs will use away-from-home Level 2 charging for 50 percent of trips rather than 100 percent used in CEC reports.
- Cost per port is derived for Level 2 charging from CPUC decisions and is a weighted average of PG&E's EV Charge Network's average costs ($17,956), SDG&E's Power Your Drive ($21,605), and SCE's Charge Ready ($13,731), reduced by 30 percent in order to exclude utility make-ready costs (based on utility estimates) due to these utility-side costs being covered by AB 841's requirements.[26]
- Atlas Public Policy further assumes PHEVs have a 50-mile electric range and battery EVs have a 250-mile range (the longest vehicle ranges available in EVI-Pro Lite), that 71 percent of drivers have access to home charging, that two EVs share multiunit dwelling chargers, that chargers are in place two years prior to associated battery electric vehicle adoption levels, and that needed charging infrastructure is net of existing ports (taken from the CEC).[27]

Comparison of Expected Funding to Expected Need for Public and Shared Private Light-Duty EV Chargers

The $3.2 billion in expected public and shared private EV infrastructure investments (Figure 1 in the fact sheet), when compared with the modeling by Atlas Public Policy and Dean Taylor Consulting on the needed amount of public and shared private light-duty EV chargers, shows that in approximately 2027 additional funds from utility, state, or federal sources will be needed.[28] While LCFS credit proceeds and limited rebates from utilities are projected to continue, that will not be enough to meet the need for public and shared private charging of light duty EVs, and by 2027 other sources of funding will be needed.

ENDNOTES

1 California Air Resources Board (hereinafter CARB), Transportation Fuels Branch, "Monthly LCFS Credit Price and Transaction Volume," Figure 4 on LCFS Data Dashboard, accessed June 6, 2022, https://ww2.arb.ca.gov/resources/documents/lcfs-data-dashboard.

2 CARB, Transportation Fuels Branch, "LCFS ZEV Infrastructure Crediting: Approved HRI and FCI Applications," accessed June 6, 2022, https://ww2.arb.ca.gov/resources/documents/lcfs-zev-infrastructure-crediting. The LCFS regulation limits these credits to 2.5 percent of total deficits. CARB, Transportation Fuels Branch, "Zero-Emission Vehicle (ZEV) Infrastructure Crediting Within the LCFS: How Does It Work?", Slide 4, August 2021, https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/guidance/zev_infra_crediting_overview.pdf.

3 CARB, "ZEV Infrastructure Crediting Within the LCFS," Slide 3.

4 We additionally assume 20% of all base residential credit proceeds generated by utilities go to publicly owned utilities.

5 Estimates of chargers and total funding are based on a model by Dean Taylor Consulting that only counts public and shared private charging for light-duty EVs. See endnotes 21 to 24. Also see California Public Utilities Commission (hereinafter CPUC), *Energy Division Staff Proposal to Establish Transportation Electrification Funding Cycles and Statewide Behind-the-Meter Program*, February 25, 2022, 12 (Figure 1) and 20–26, https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M453/K952/453952700.PDF.

6 Estimate of disadvantaged community chargers and expenditures are based on a model by Dean Taylor Consulting with 34 percent of $1.03B in approved or expected funds for public and shared private charging stations from 2022 to 2026 . Also, see CPUC, "Energy Division Staff Proposal," at 19, regarding a new state law requiring 35 percent of utility EV spending to be in disadvantaged communities and regarding recent CPUC decisions and staff proposals on disadvantaged community spending.

7 CPUC, *Decision Authorizing Southern California Edison Company's Charge Ready 2 Infrastructure and Market Education Programs,* D-20-08-045, September 2, 2020, Table 1, https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M346/K230/346230115.PDF. Applied 30 percent of total funds estimate by Southern California Edison to other utilities.

8 For the CPUC's description of implementing AB 841, see Commissioner Clifford Rechtschaffen, CPUC, "Assigned Commissioner's Ruling Adding Staff Report to the Record and Inviting Public Comment," February 25, 2022, 5–10, https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M453/K953/453953154.PDF.

9 Thanh Lopez and Madison Jarvis, *Draft Zero-Emission Vehicle Infrastructure Plan (ZIP*), California Energy Commission (hereinafter CEC), April 2022, 11, https://www.energy.ca.gov/sites/default/files/2022-04/CEC-600-2022-054.pdf.

10 Patrick Brecht, *2021–2023 Investment Plan Update for the Clean Transportation* Program, Commission Final Report CEC, December 17, 2021, Table 1 and Figure 2, https://efiling.energy.ca.gov/GetDocument.aspx?tn=240977

11 Combines $314M for FY 2021/2022 state budget and $600M for proposed FY 2023/2023 state budget for light-duty public and shared private charging and excluding equitable home charging. See CEC, "CEC Approves $1.4 Billion Plan for Zero-Emission Transportation Infrastructure and Manufacturing," press release, November 15, 2021, https://www.energy.ca.gov/news/2021-11/cec-approves-14-billion-plan-zero-emission-transportation-infrastructure-and. Also see Lopez and Jarvis, *Draft Zero-Emission Vehicle Infrastructure Plan*, at 13; and Legislative Analyst's Office, "The 2022–2023 Budget: Zero-Emission Vehicle Package," February 23, 2022, Table 3, https://lao.ca.gov/Publications/Report/4561.

12 Martin Wisckol, "California Ballot Proposal Would Raise Billions for Electric Cars, Charging Stations," *Mercury News*, January 17, 2022, https://www.mercurynews.com/2022/01/17/ballot-proposal-would-raise-billions-for-electric-cars-charging-stations/. NRDC staff and Dean Taylor Consulting estimate that up to $1 billion per year could go to public and shared private charging infrastructure.

13 Infrastructure Investment and Jobs Act of 2021, Public Law 117-58, Sections 11401 for the grants for charging and fueling infrastructure. The National Electric Vehicle Formula Program is authorized under Pub. L. 117-58, division J, tit. VIII, para. (2) (Nov. 15, 2021), https://www.congress.gov/117/bills/hr3684/BILLS-117hr3684enr.pdf.

14 Lopez and Jarvis, *Draft Zero-Emission Vehicle Infrastructure Plan*, at 41. Also see federal incentives section on top of page 3 in the Appendix.

15 The analysis assumes 100 percent of the cost of charging stations would be paid for by public investments. However, private funds can likely cover 20 to 50 percent of the cost. See Lopez and Jarvis, *Draft Zero-Emission Vehicle Infrastructure Plan*, at 6.

16 Jamie Dunckley and Chanakya Valluri, "National Charging Costs," Electric Power Research Institute, Fall Advisory, December 31, 2017, https://www.epri.com/#/pages/product/3002011098/. Also see David Trinko et al., "Combining Ad Hoc Text Mining and Descriptive Analytics to Investigate Public EV Charging Prices in the United States," *Energies* 14, no. 17 (August 24, 2021), https://www.mdpi.com/1996-1073/14/17/5240/htm.

17 Lopez and Jarvis, *Draft Zero-Emission Vehicle Infrastructure Plan*, at 41.

18 Infrastructure Investment and Jobs Act of 2021, Public Law 117-58, Sections 11401 https://www.congress.gov/117/bills/hr3684/BILLS-117hr3684enr.pdf.

19 CARB, "Monthly LCFS Credit Price and Transaction Volume."

20 CARB, "*Public Hearing to Consider the Proposed Advanced Clean Cars II Regulations—Staff Report: Initial Statement of Reasons*, April 12, 2022, https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2022/accii/isor.pdf.

21 CARB, "ZEV Infrastructure Crediting Within the LCFS," Slide 4.

22 CPUC, "Transportation Electrification," accessed March 31, 2022, https://www.cpuc.ca.gov/zev/.

23 Edward Randolph, CPUC Deputy Executive Director for Energy and Climate Policy, "PG&E's 2021 Low Carbon Fuel Standard Implementation Plan," letter to Sidney Bob Dietz II, Director of Regulatory Relations, PG&E, December 24, 2021, https://www.pge.com/tariffs/assets/pdf/adviceletter/ELEC_6226-E-A.pdf (estimate by Dean Taylor Consulting based on subtracting funding to small businesses from the MUD/Small Business Direct Install Pilot in Attachment 1, Table 8); CPUC, *Pacific Gas and Electric Company Electric Vehicle Charge 2 Prepared Testimony*, October 26, 2021, https://docs.cpuc.ca.gov/PublishedDocs/SupDoc/A2110010/4240/417398449.pdf.

24 CPUC, *Energy Division Staff Proposal*, at 12 (Figure 1) and 20–26. Estimate on page 20 is reduced by 10 percent to account for other programs such as administration, marketing, education, outreach, and evaluation.

25 Lopez and Jarvis, *Draft Zero-Emission Vehicle Infrastructure Plan*, at 11.

26 Source for cost per port for DCFC: Michael Nicholas, "Estimating Electric Vehicle Charging Infrastructure Costs Across Major U.S. Metropolitan Areas," International Council on Clean Transportation, August 12, 2019, https://theicct.org/publication/estimating-electric-vehicle-charging-infrastructure-costs-across-major-u-s-metropolitan-areas/. Also see endnotes 8 and 9.

27 Matt Alexander, *Staff Report: Home Charging Access in California*, CEC, January 2022, 5, https://www.energy.ca.gov/sites/default/files/2022-01/CEC-600-2022-021.pdf.

28 Based on assumptions in the Appendix. For example, we assume no private funds will be used, that 50 percent of PHEVs will need away-from-home charging, and that two BEVs and/or PHEVs will use each charger, on average.