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# The Impact of ZEV Adoption on California Transportation Revenue

Project WP 1850
July 2019

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## INTRODUCTION

Former California Governor Jerry Brown set an ambitious target for the state to reach five million zero-emission vehicles (ZEVs) by 2030. The policy is intended to reduce greenhouse gas emissions, but progress toward this target will also affect future state-generated transportation revenues collected from vehicle owners and operators. A central concern for policymakers is to estimate the magnitude of the revenue impact.

We used a simple spreadsheet model to project future transportation revenue in California through 2040 under two scenarios. The first scenario assumes that ZEV ownership continues at its historical rate of net increase, approximately 26,000 vehicles per year (the "low-adoption scenario"). The second scenario assumes that California reaches its goal of five million ZEVs by 2030 (the "high-adoption scenario"). The projections are for light duty vehicles and do not address the possibility that heavy trucks may over time also adopt alternative fuels.

## METHODS

We projected revenues from taxes and fees collected by the State of California that meet three criteria: they are collected from vehicle owners and users; the state dedicates the proceeds for transportation programs; and the amount of revenue collected corresponds at least in part on the vehicle's fuel source (ICE or ZEV). The relevant taxes are gasoline excise taxes, diesel excise taxes, diesel sales taxes, the state's Transportation Improvement Fee (TIF), and the state's Road Improvement Fee (RIF) charged annually on ZEVs.[1] Table 1 shows the rate for each tax or fee.

The projections were made using a spreadsheet model that estimates annual revenue by applying tax and fee rates to projected fuel sales and numbers of vehicles of particular types. Key independent variables include state population size, the number of vehicles and vehicle miles traveled (VMT), gasoline and diesel fuel prices, and adoption rates for ICE vehicles and ZEVs. The projections use inputs derived from authoritative sources, such as a widely used set of national projections of transportation energy prepared by the US Energy Information Administration (EIA) of the US Department of Energy.[2] Complete methodological details are available in a companion report to this piece.[3] Results are reported in constant 2019 dollars.

For each scenario we estimated an upper bound, a lower bound, and a mean between them which we consider the most like future values. The range between the upper and lower bounds represents a set of plausible outcomes under different economic conditions. The high and low estimates result from numerous assumptions about reasonable ranges of the independent variables.

**Table 1: State of California Transportation Taxes and Fees Projected for This Study**

| Tax/Fee | Rate [a] |
|---|---|
| Gasoline taxes | |
| Base excise tax | 30¢ per gallon |
| Swapb excise tax | 17.3¢ per gallon (effective 7/1/2019) |
| Diesel taxes | |
| Excise tax | 36¢ per gallon |
| Swap[b] sales tax | 5.75% on purchase price |
| Vehicle fees | |
| Transportation Improvement Fee | $25 to $175 per vehicle annually, with rate depending on the vehicle's value |
| Road Improvement Fee | $100 per ZEV, annually (effective 7/1/2020) |

*Source:* Adapted from California Legislative Analyst's Office, *Overview of 2017 Transportation Funding Package (2017)*, http://www.lao.ca.gov/Publications/Report/3688 (accessed July 25, 2018).

[a] Rates will be adjusted for inflation starting July 1, 2020 for the gasoline and diesel excise taxes, January 1, 2020 for the Transportation Improvement Fee, and January 1, 2021 for the Road Improvement Fee on ZEVs. The diesel sales taxes are not adjusted for inflation.

[b] For details about the gas tax swap, including tax and fee rates prior to the swap, see Anne Brown, Mark Garrett, and Martin Wachs, "Assessing the California Fuel Tax Swap of 2010," *Transportation Research Record: The Journal of the Transportation Research Board*, no. 2670 (2017), pp. 16–23.

The estimates result from combinations of various factors that cannot be individually associated with probabilities of occurrence, such as vehicle fleet fuel efficiency, the market price of gasoline, and the amount of driving. For that reason, the bands do not indicate a particular level of statistical significance.

As with any projections, readers should keep in mind that these rely on numerous assumptions about future trends—gasoline prices, inflation rates, fleet changes, and so on. With the horizon year of 2040 over 20 years away, many unforeseen changes in conditions can—and undoubtedly will—intervene. For example, if population were to drop markedly due to some unanticipated economic change, then actual revenues could fall outside the projection bands. Of particular relevance to this analysis is the price for ZEVs in the future. If purchase prices fall much faster than assumed, then revenues may fall outside the values projected in this report.

## TOTAL PROJECTED TRANSPORTATION REVENUES

Figure 1 shows projected total state revenues for the two scenarios. In both, annual revenue will start at around $8 billion in 2018 and increase to a maximum of $11 billion by 2020. After 2020, revenues fall under both scenarios, but the projections begin to diverge. By 2040, as the scenarios diverge, we project revenue to be approximately $9 billion under the low-adoption scenario and $11 billion under the high-adoption scenario.

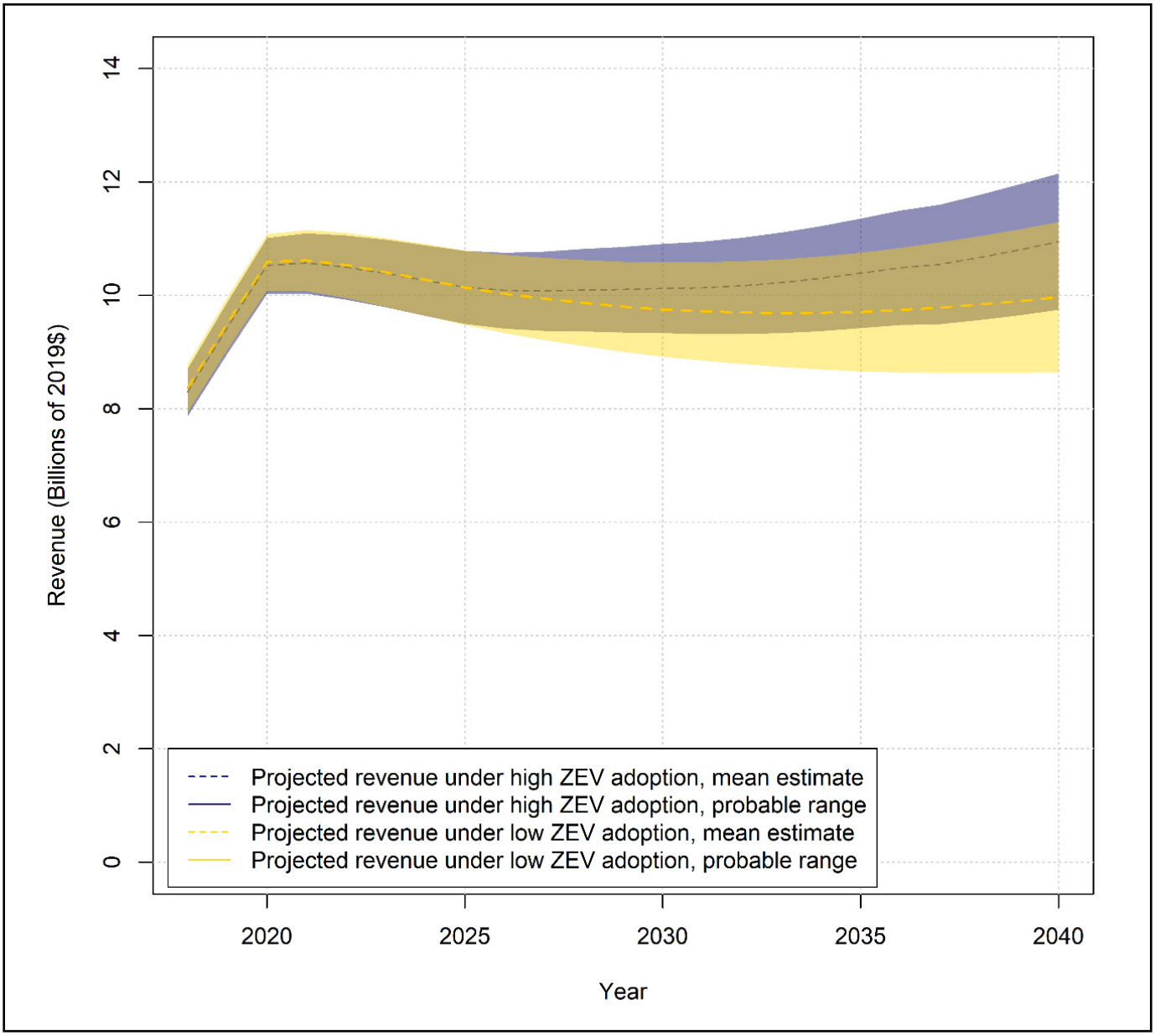


**Figure 1: Total State Revenue under Both Scenarios, 2018–2040**

The finding that revenues are *higher* under the high-adoption scenario will surprise some readers, as the public discourse in California has focused on EVs as a threat to transportation funding because ZEVs pay no fuel tax. And indeed, gasoline excise, diesel excise, and diesel sales tax revenues are all greater under the low-adoption scenario. However, TIF and RIF revenues are higher under the high-adoption scenario and more than replace lost fuel tax proceeds. TIF revenue will be higher under the high-adoption scenario because TIF fees are calculated based on vehicle value, and ZEVs tend to have higher values than ICE vehicles.

Figure 2 shows how the composition of revenues will change over time under each scenario. In the low ZEV adoption scenario shown in Figure 2 (left), the share of all revenue from the gasoline excise tax will increase until 2021 and then decline. Nevertheless, the share of all

revenue coming from gasoline excise receipts will remain over 50 percent of total state revenue through 2040. The share of total state revenue coming from diesel sales and excise taxes will stay constant over time. Finally, the share of all revenue coming from TIF and RIF receipts will generally increase. However, TIF revenue will remain a larger portion of all revenue (around 20 percent) than will RIF revenue.

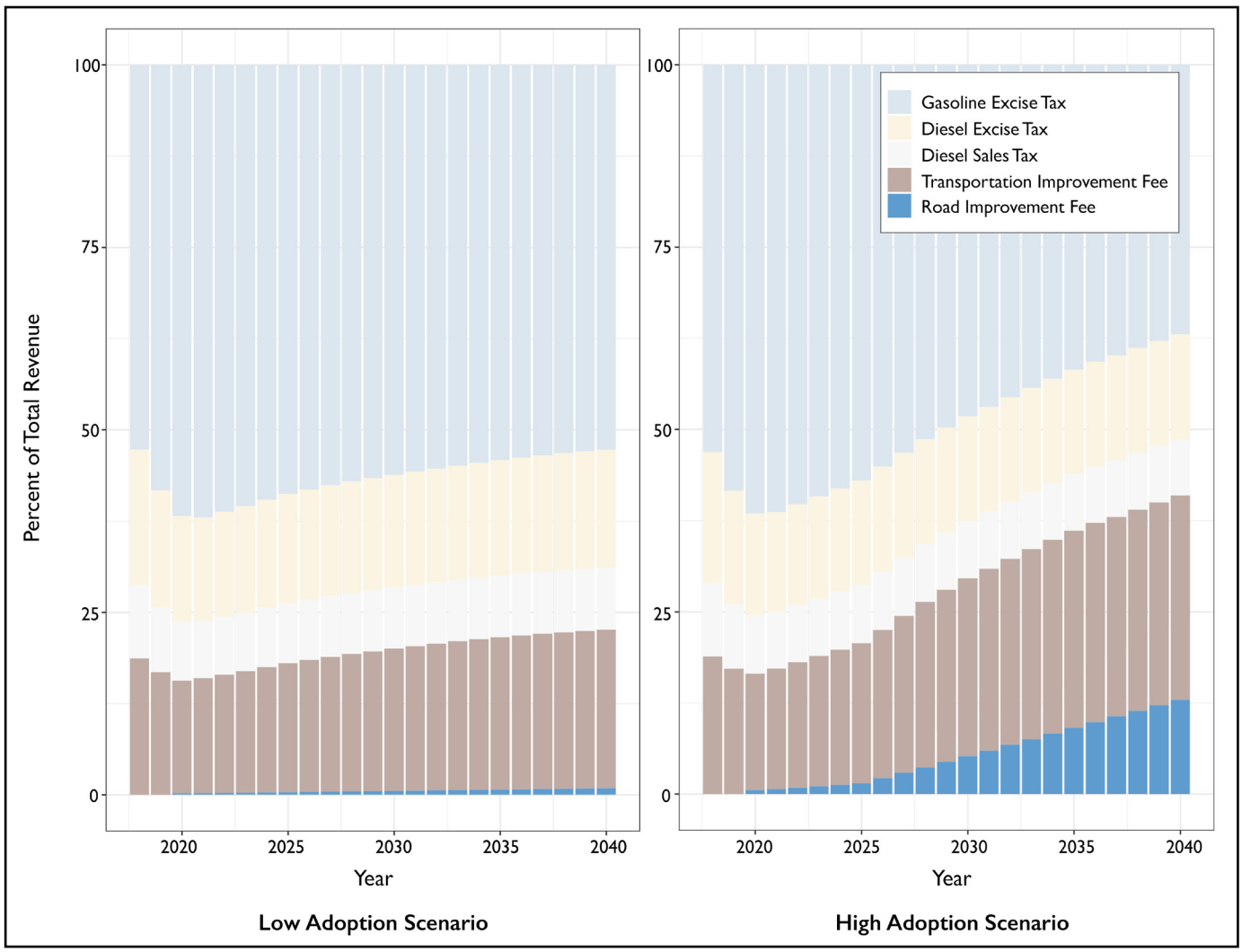


**Figure 2: Revenue by Source under the Low Adoption (left) and High Adoption Scenarios (right), 2018–2040**

For the high-adoption scenario shown in Figure 2 (right), the same general trends hold, but the magnitude of those trends is larger. Gasoline excise revenue will constitute a growing portion of all revenues for the next few years but then will decline. By 2040, gasoline excise revenues will constitute less than 45 percent of all revenues. Also, the share of total revenue coming from diesel fuel sales and excise receipts will stay flat across the projection period, and TIF and RIF revenue under high ZEV adoption will over time become an increasingly large share of all revenue. Notably, though, under high ZEV adoption, RIF revenues will constitute a significant portion (10 percent) of all revenues by 2040.

Readers should note that the TIF revenue estimates assume no major fall in the purchase price for new ZEVs. Should new ZEVs become comparatively much cheaper than they are today, TIF revenues—and overall state revenues—could fall below the bands projected in this report.

## PROJECTED TRANSPORTATION REVENUES BY TAX/FEE

This section compares projections for each tax and fee type under the two scenarios.

### Gasoline Excise Tax Revenue

Figure 3 shows that under both scenarios, gasoline excise revenue will increase until 2021 and decline afterward, with the decline being more significant under high ZEV adoption because a larger percentage of the fleet will no longer need to purchase gasoline.

Foregone gasoline excise revenue under the high ZEV adoption scenario is proportional to the percent of the vehicle fleet composed of ZEVs.

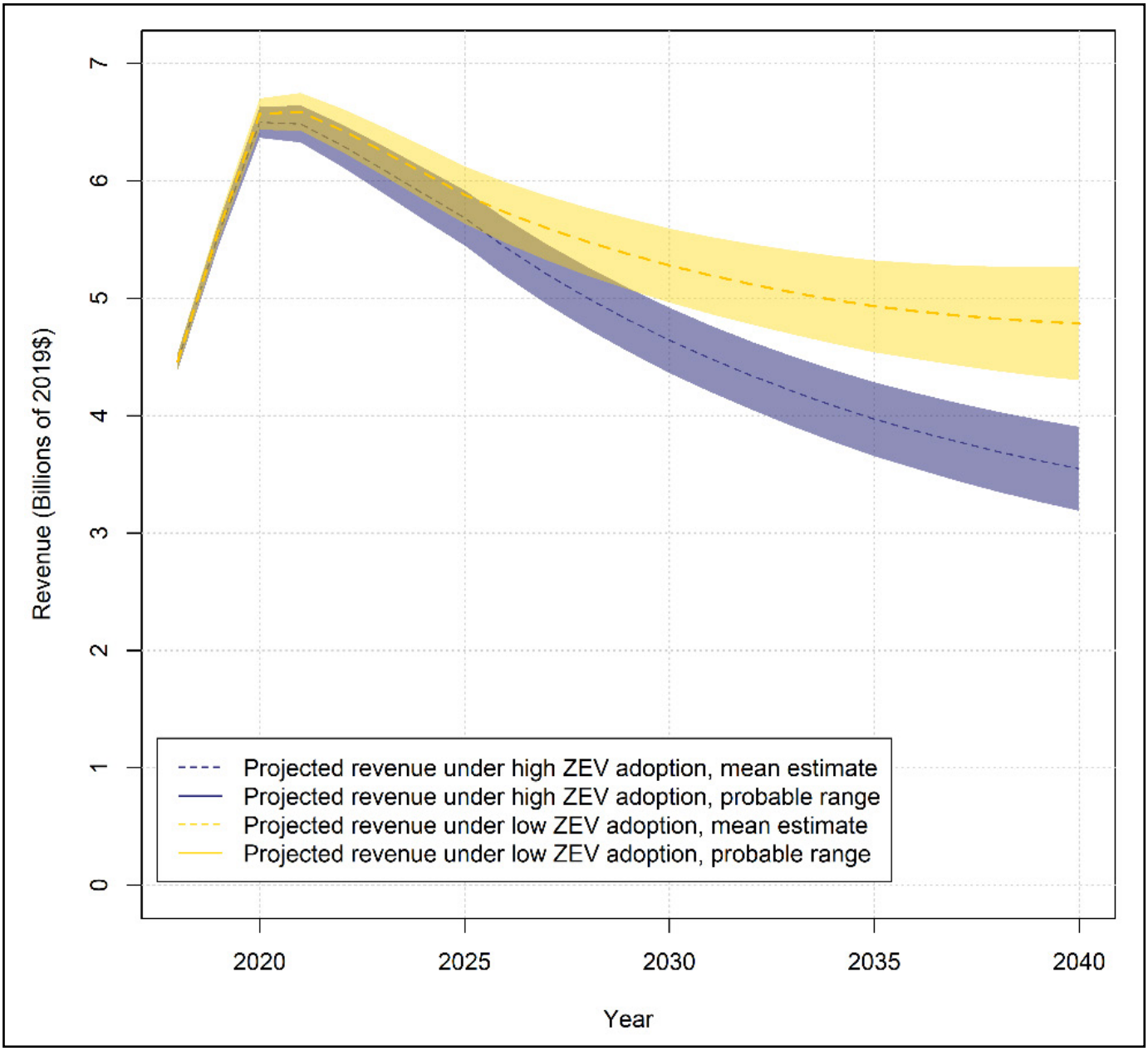


**Figure 3: Gasoline Excise Tax Revenue under Both Scenarios, 2018–2040**

### Diesel Excise Tax Revenue

The low ZEV adoption scenario assumes that no light-duty diesel vehicles will be replaced with ZEVs, while the high ZEV adoption scenario assumes that all light-duty diesel vehicles are replaced with ZEVs. Under both scenarios, Figure 4 shows that diesel excise tax revenues from light duty vehicles will decline over time, although the rate of decline may level off or even reverse close to 2040. Diesel excise tax revenue under high ZEV adoption will be slightly lower than diesel excise tax revenue under low ZEV adoption for the entire projection period.

The overall impact to the state of foregone diesel excise tax revenue under the high ZEV adoption scenario is small, however, because fewer than five percent of California's light-duty vehicles run on diesel fuel.

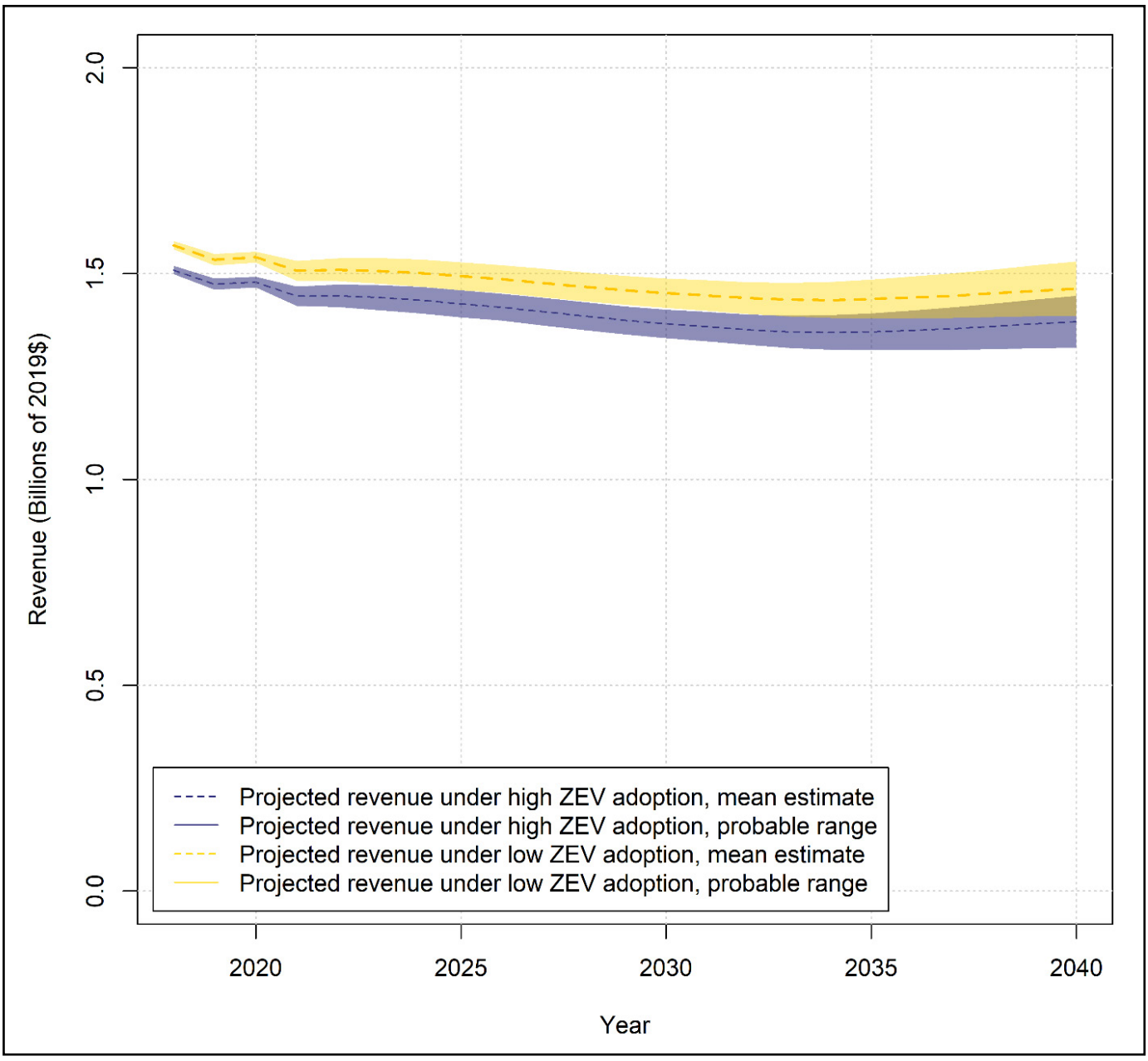


**Figure 4: Diesel Excise Tax Revenue under Both Scenarios, 2018–2040**

### Diesel Sales Tax Revenue

Again, the low ZEV adoption scenario assumes that no light-duty diesel vehicles will be replaced with ZEVs, while the high ZEV adoption scenario assumes that all light-duty diesel vehicles are replaced with ZEVs. Under both scenarios, diesel sales tax revenues, shown in Figure 5, will decline modestly over time. Diesel sales tax revenue under high ZEV adoption will be slightly lower than diesel excise tax revenue under low ZEV adoption for the entire projection period.

Foregone diesel sales tax revenue under the high ZEV adoption scenario is proportional to the small percentage—less than five percent—of light-duty vehicles that run on diesel fuel.

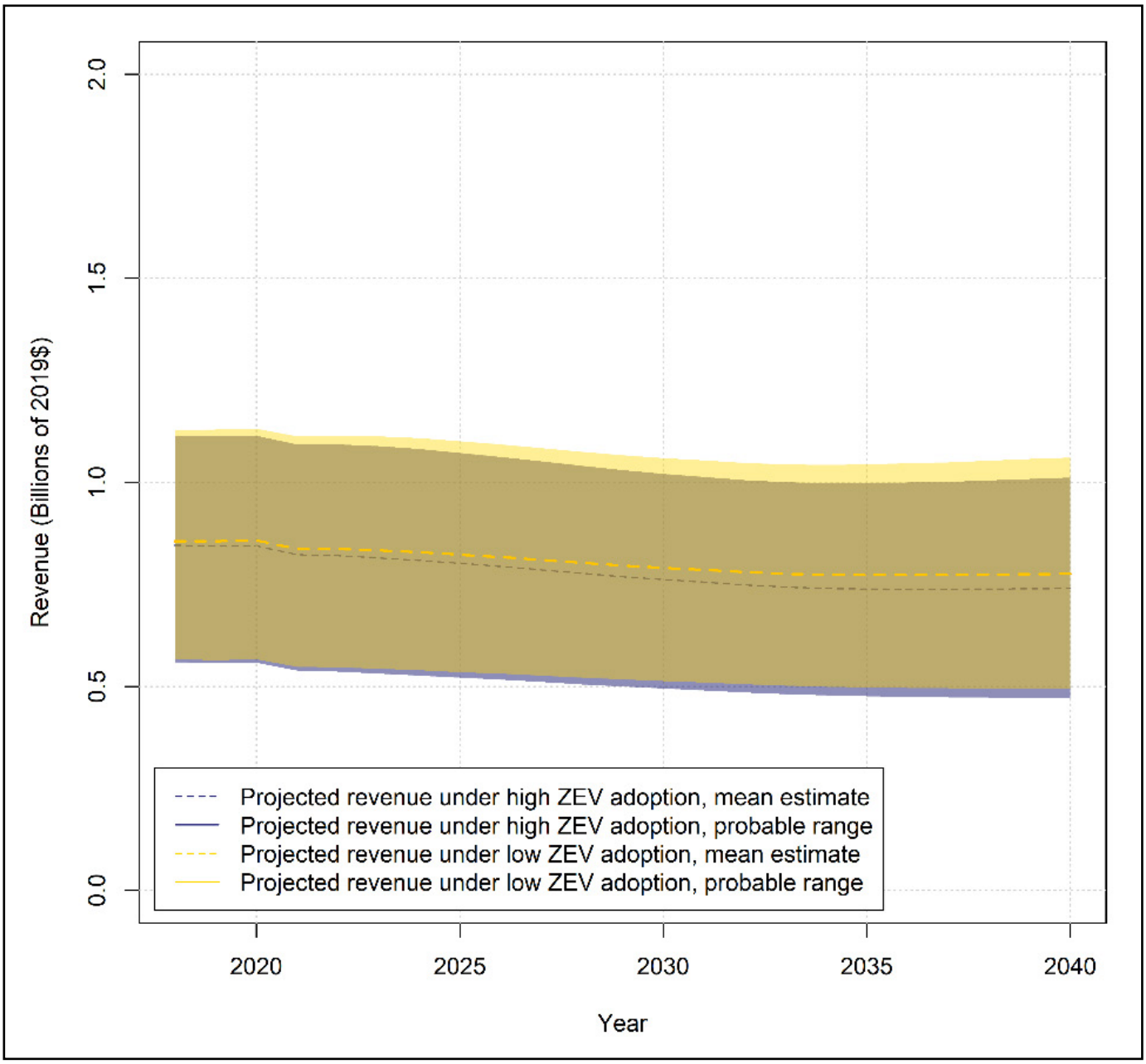


**Figure 5: Diesel Sales Tax Revenue under Both Scenarios, 2018–2040**

### TIF Revenue

As Figure 6 shows, TIF revenue will increase over time under both scenarios. Under low ZEV adoption, TIF revenue will increase from around $1.5 billion in 2018 to around $2 billion in 2040. Under high ZEV adoption, TIF revenue will increase from around $1.5 billion in 2018 to around $2.5 million in 2040. TIF revenue will be higher under the high ZEV adoption scenario because TIF fees are calculated based on vehicle value, and ZEVs generally have higher values than ICE vehicles.

Readers should note that the TIF projections are highly dependent on vehicle values. Should ZEV purchase prices drop faster than expected, TIF revenues could fall outside the band projected here. (The text box below presents details on how we estimated TIF revenues.)

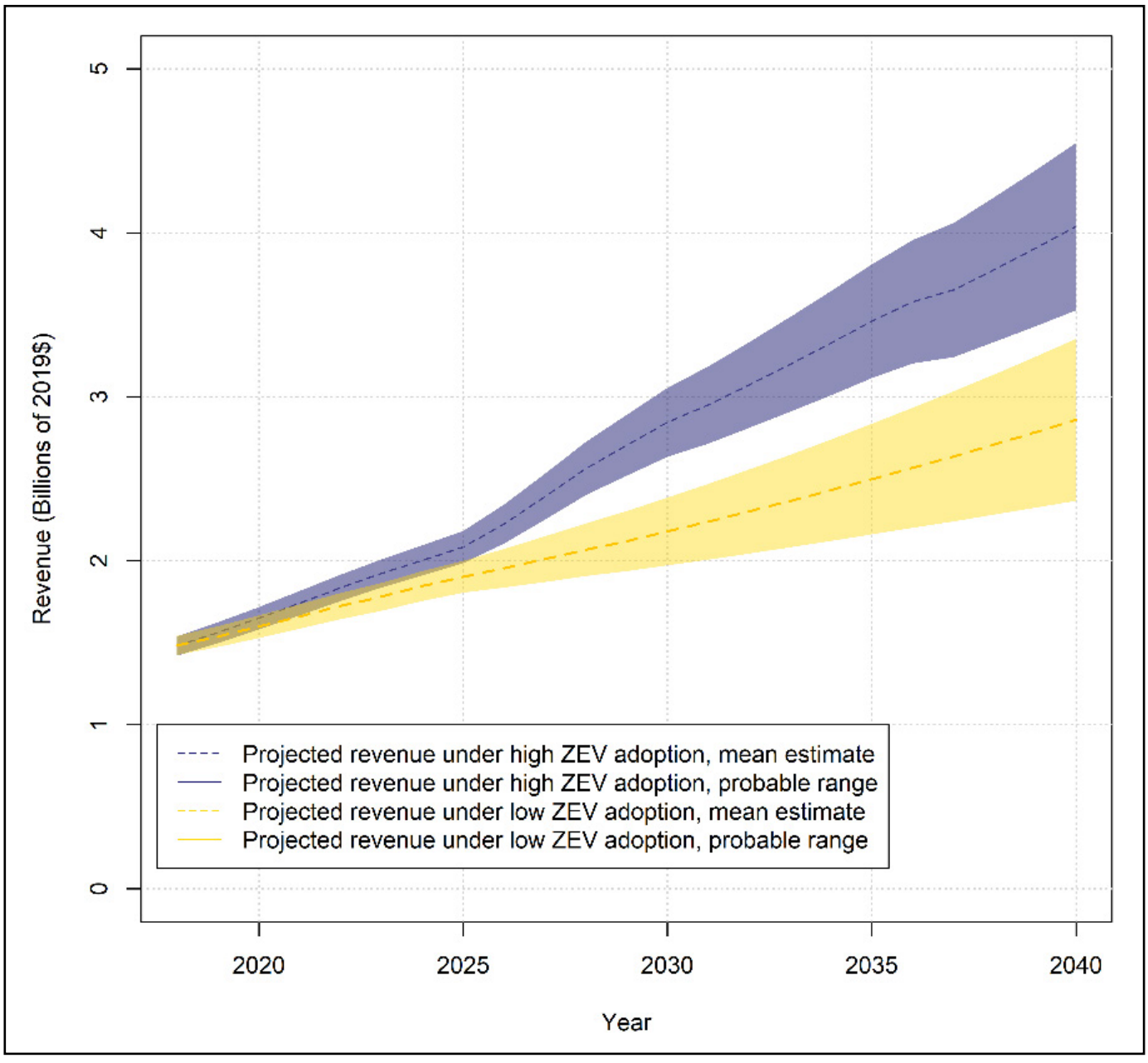


**Figure 6: Transportation Improvement Fee (TIF) Revenue under Both Scenarios, 2018–2040**

**Key Assumptions Used to Project TIF Revenues**

The models used to project TIF revenue incorporate the following assumptions about vehicle depreciation, purchasing, and turnover:

- Vehicle values depreciate in a straight line over 11 years, and after 11 years the value is $0 (no salvage value).
- All ZEVs are bought new, and the real purchase price (2019$) of a new ZEV declines over time. In other words, over time ZEVs become cheaper to buy new. This assumption is significant for our analysis because the TIF assessed on ZEV owners is sensitive to the value of the ZEV. All else being equal, less expensive ZEVs may translate into less TIF revenue per vehicle.
- The age of ICE vehicles in the fleet remains constant: 17% of ICE vehicles are less than 2 years old; 38% of ICE vehicles are 3 to 9 years; and 45% of ICE vehicles are older than 9 years.
    - To keep the fleet composition of ICE vehicles constant, the model assumes that older vehicles are retired at the same rate that new vehicles are purchased.
    - TIF revenues were calculated by projecting the average purchase price of a new ICE vehicle for each year through 2040. The EIA projects that average ICE vehicle purchase prices will increase slightly in real terms, with values ranging from $34,050 to $34,590 (in 2019$).
    - The value of each vehicle was depreciated each year over 11 years, from 2018 to 2040. In other words, vehicles were assumed to lose one-eleventh (approximately 9%) of their value each year. We assume that all vehicles depreciate to a value of $0 (i.e., that vehicles have no salvage value).
    - ICE vehicles that were already in the vehicle fleet prior to 2018 were depreciated over a total of 11 years, *accounting for the vehicle's age as of 2018*. Thus, an ICE vehicle that was 5 years old in 2018 was depreciated a further 6 years to a value of $0.
    - We used the California Department of Motor Vehicles' fee schedule to assign TIF rates to the "average" ICE and "average" ZEV vehicle in each year. TIF rates are assigned categorically rather than absolutely, so the same TIF rate is applied to all vehicles whose value falls within certain ranges.
        - Vehicle age categories were constructed so that for each year, vehicles in each age range pay a constant rate. For example, a new car in 2018 is going to pay the same rate (in 2019$) as a new car in 2040.
- The projected number of ICE vehicles and TIF rate were multiplied to calculate TIF revenue from ICE vehicles.

### RIF Revenue

RIF revenue, shown in Figure 7, will increase over time as the number of ZEVs increases. The range of possible RIF revenues each year will widen as the range of possible ZEV adoption rates increases.

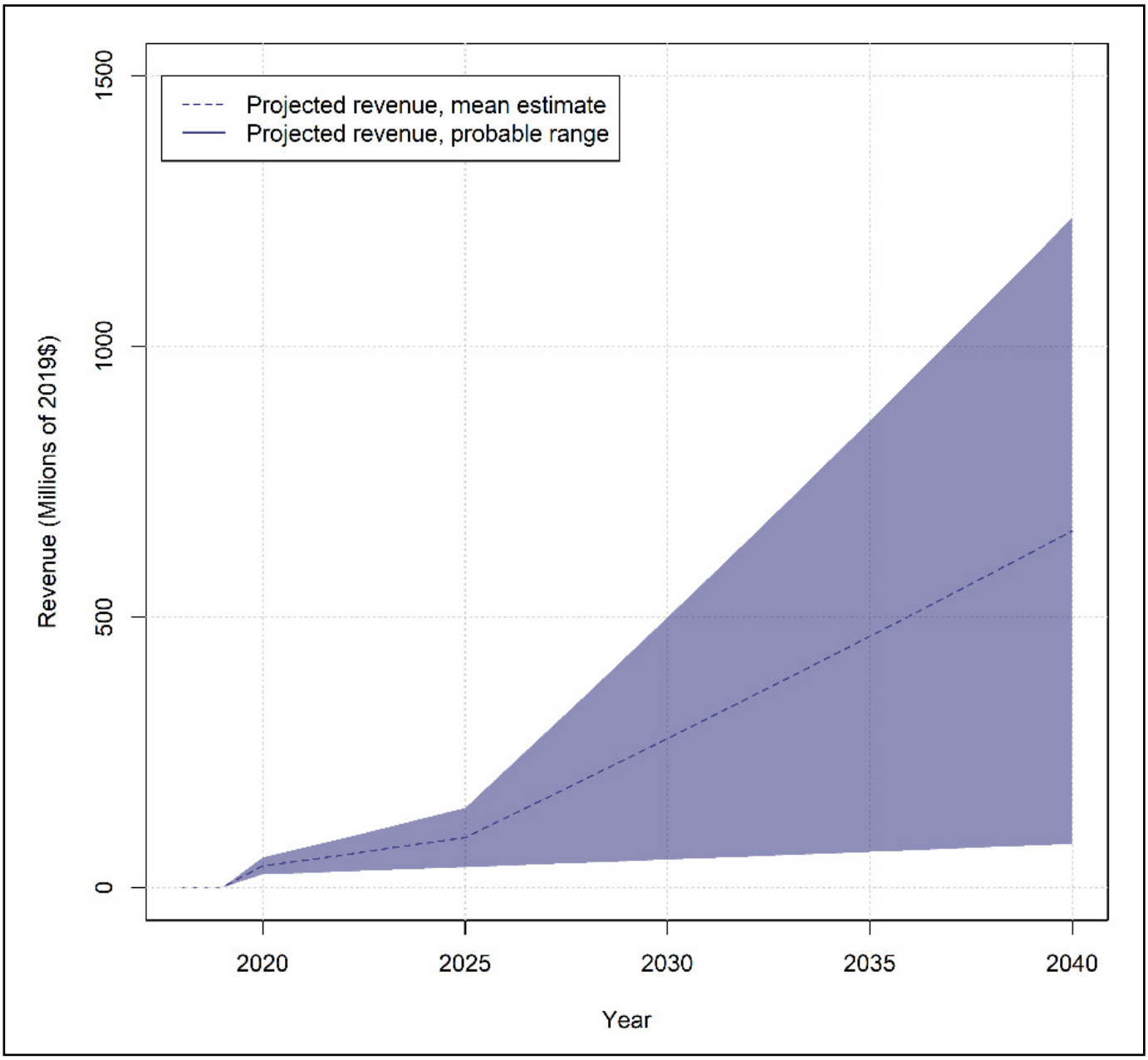


**Figure 7: Roadway Improvement Fee (RIF) Revenue under Both Scenarios, 2018–2040**

## IMPLICATIONS FOR POLICY MAKERS

It has been widely recognized that widespread adoption of EVs will have important revenue consequences for California's transportation programs because a large proportion of the state's transportation revenue is produced by user fees in the form of motor fuel taxes. Using common projection methods and widely-used sources of data, this analysis showed that the user fees levied on EVs under the provisions of SB1 can replace and potentially even exceed the revenue to the state that will be lost because of declining gasoline sales tax revenue. However, these estimates assume that ZEV purchase prices remain higher than purchase prices for comparable ICE vehicles. Should ZEV purchase prices fall considerably, then TIF revenue—and overall state revenues—could fall considerably below the values projected in this report.

## ENDNOTES

1. Revenues from the state's base vehicle registration fee and vehicle license fee are not projected because the proceeds are not dedicated for transportation programs.

2. US Energy Information Administration, *Alternative Fuel Infrastructure Expansion: Costs, Resources, Production Capacity, and Retail Availability for Low-Carbon Scenarios*, https://www.nrel.gov/docs/fy13osti/55640.pdf (accessed September 30, 2018).

3. Martin Wachs, Hannah King, and Asha Weinstein Agrawal, *The Future of California Transportation Revenue* (San Jose: Mineta Transportation Institute, October 2018).

## ACKNOWLEDGEMENTS

The authors gratefully acknowledge the many people who helped us during the course of researching and writing this report. Anne Brown, Assistant Professor in the School of Planning, Public Policy, and Management at the University of Oregon, permitted us to adapt for this study a spreadsheet projection model she developed to project implications of the California Gas Tax Swap. Dr. Mark Garrett shared his insights from historical research into California transportation finance. Steven Keck and Athena Glidden, both of the California Department of Transportation (Caltrans), answered questions about the collection and distribution of transportation revenues in California. Brock Wells of the California Department of Motor Vehicles forecasting unit provided us with detailed vehicle registration information. Paul Golaszewski at the California Legislative Analyst's Office answered questions about the availability of data from that agency. Lastly, the authors thank Editing Press for editorial services, the Mineta Transportation Institute (MTI) for funding the project, and MTI staff for their support, including Executive Director Karen Philbrick, PhD, Deputy Executive Director Hilary Nixon, PhD; Research Support Assistant Joseph Mercado; Graphic Designer Alverina Weinardy; and Executive Administrative Assistant Jill Carter.



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