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Should Electric Vehicles Pay a Mileage Tax?

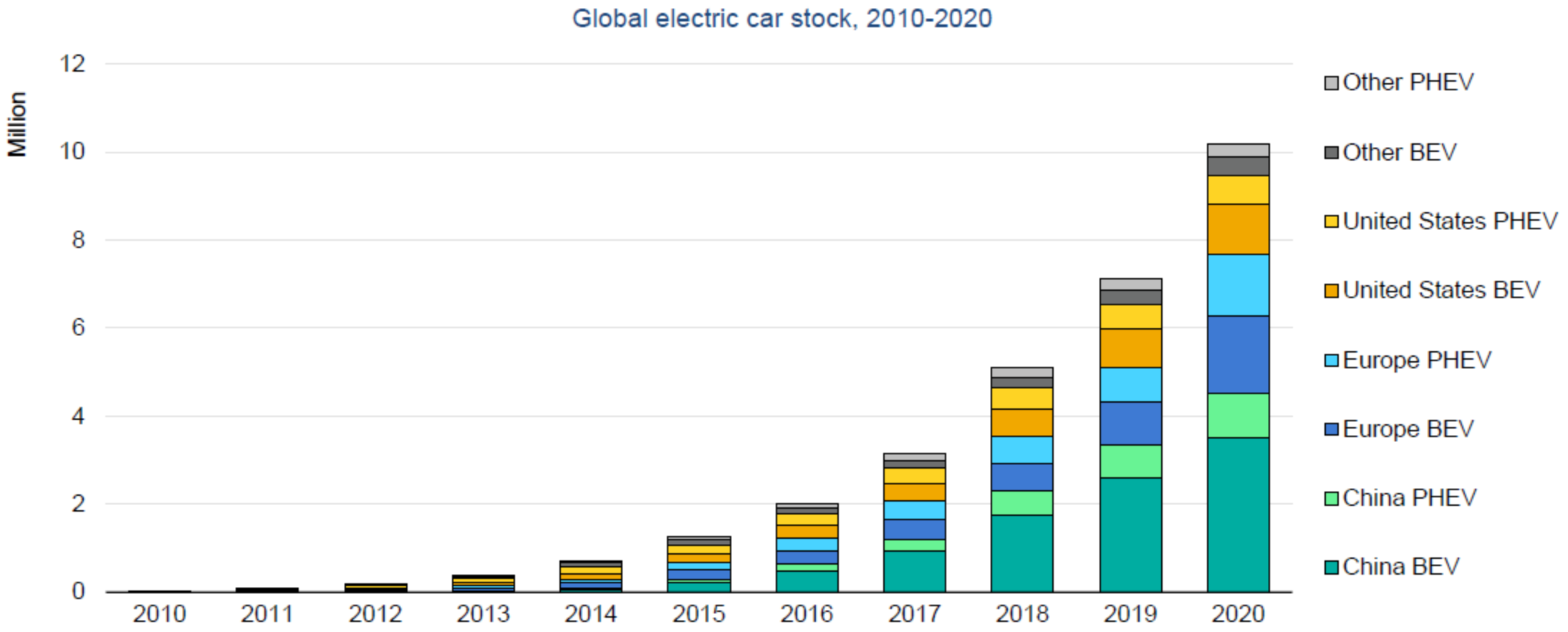
NBER New Directions in Transportation Economics
June 17, 2021

Lucas Davis and James Sallee

Paying For Roads

In many countries the revenue from gasoline taxes is used to pay for roads.

EV Drivers Don’t Pay the Gas Tax



Source: International Energy Agency, “Global EV Outlook 2021”.

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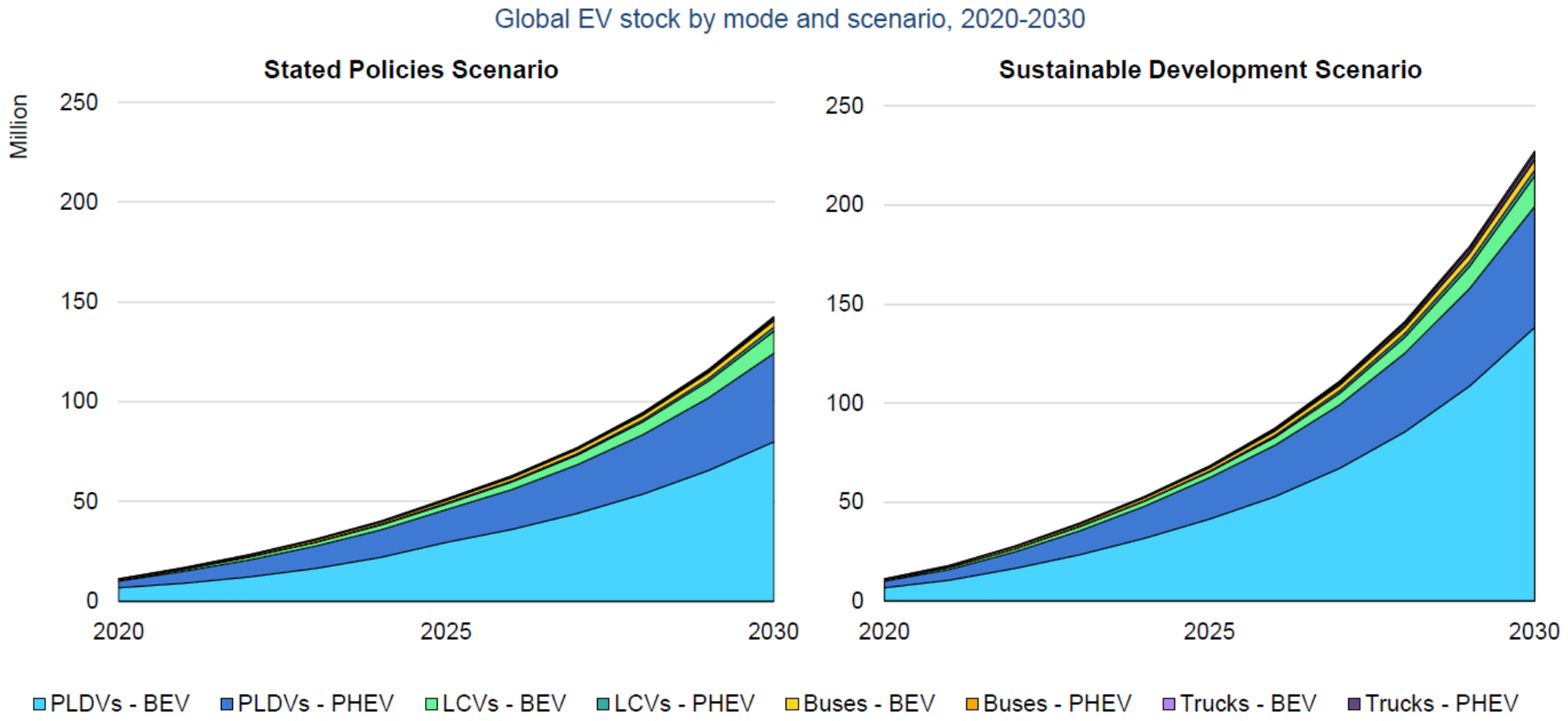
Trickle Could Turn into Flood



Source: International Energy Agency, “Global EV Outlook 2021”.

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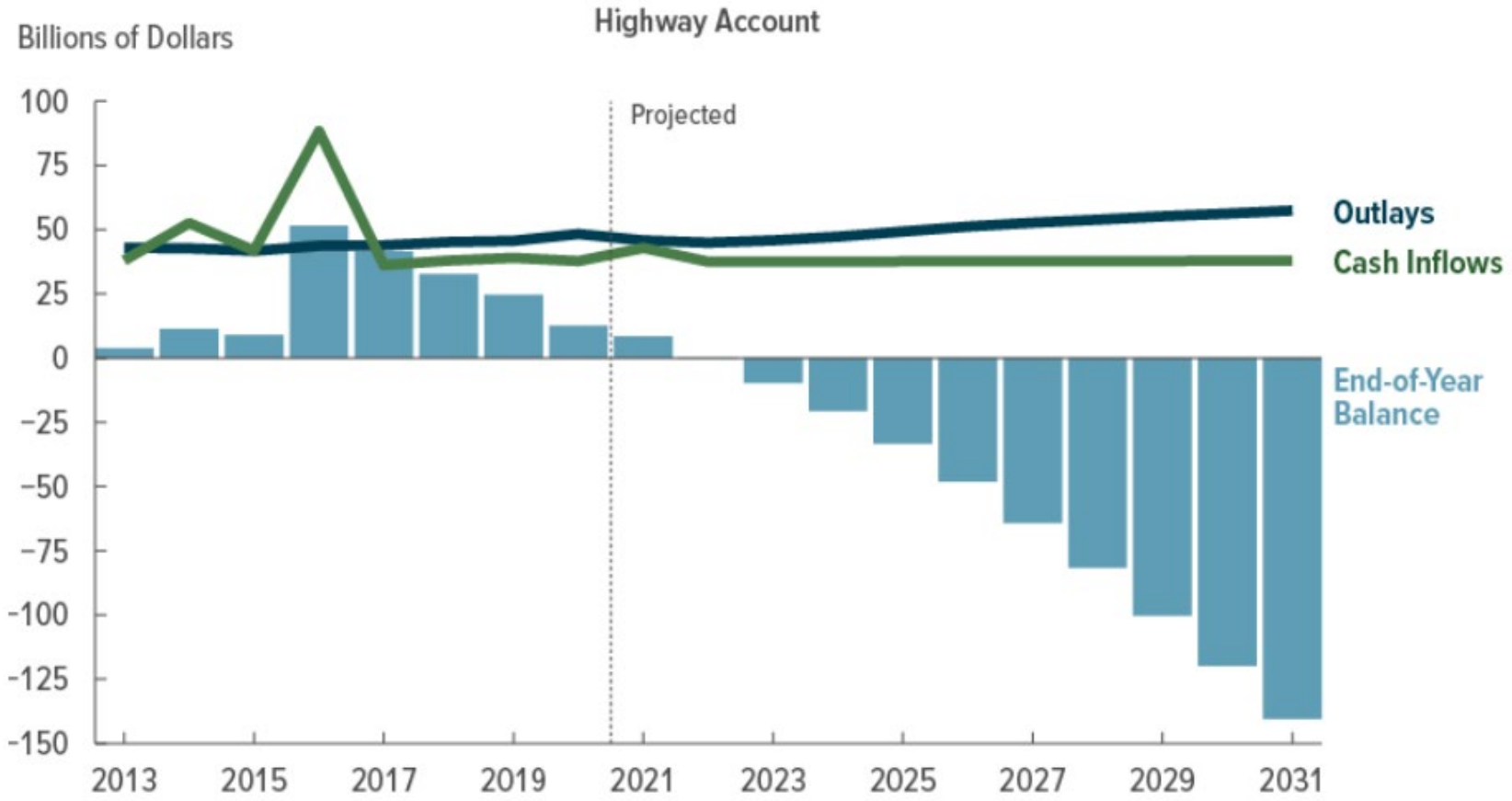
Could Exacerbate Existing Shortfalls with HTF



Source: Joseph Kile, U.S. Highway Trust Fund, “Statement to Congress on the Long-Term Solvency of HTF”, April 2021.

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Several States Piloting Mileage Tax

For example, with Oregon's opt-in program, drivers pay 1.8 cents/mile in lieu of paying state gas tax.

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Related Discussion in D.C.

The New York Times

Bipartisan Group of Senators Say Tentative Infrastructure Deal Reached

Last Updated June 16, 2021

The bipartisan group of senators hashing out an infrastructure deal includes, from left, Senators Mitt Romney, Republican of Utah; Jeanne Shaheen, Democrat of New Hampshire; Susan Collins, Republican of Maine; and Kyrsten Sinema, Democrat from Arizona.
Stefani Reynolds for The New York Times

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Research Questions

Should Electric Vehicle Drivers Pay a Mileage Tax?

- How would an economist think about this?
- What are the key tradeoffs?

- How much have U.S. EVs reduced gas tax revenue?
- How is this split between federal and state impacts?

Very Brief History of the Gasoline Tax

Originated as a benefits tax.

When introduced in the U.S. in 1932, a mileage tax was infeasible.

So the gasoline tax was implemented instead.

The gasoline tax has always been an imperfect proxy for road usage.

Economic Perspective

Economic efficiency means setting prices equal to social marginal cost, i.e. pricing externalities.

- GHGs ($.49/gallon)*
- Local air pollution ($.11/gallon)*
- Traffic congestion ($1.14/gallon)*
- Accidents ($.49/gallon)*

*Source: Coady, Parry, and Shang “Energy Price Reform: A Guide for Policymakers”, 2018, REEP.

First-Best

Tax all externalities per mile using time-varying, location-varying dynamic prices.

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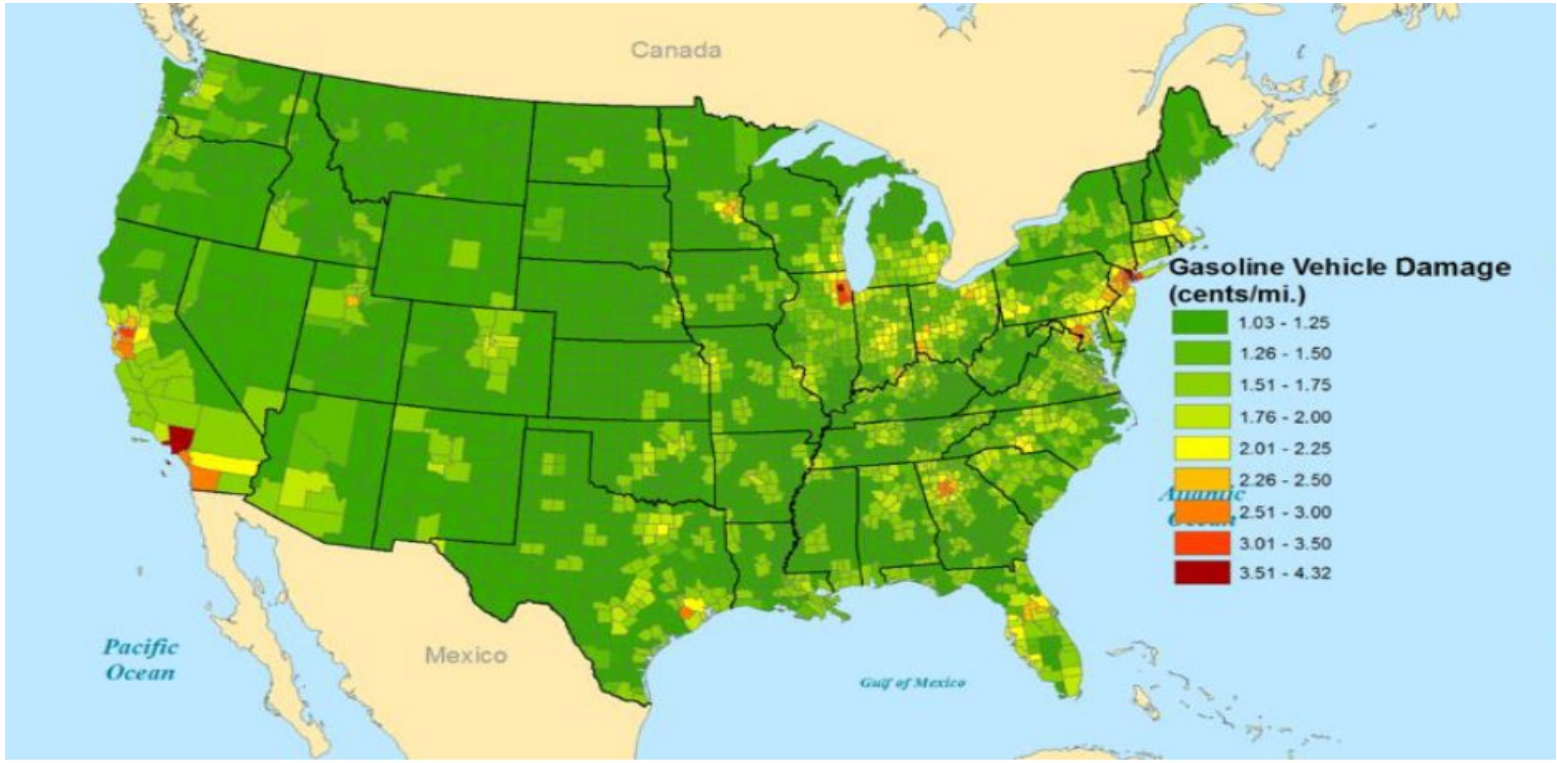

Source: Holland, Mansur, Muller and Yates, *American Economic Review* "Are the Environmental Benefits from Driving EVs?".

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Our Model

- "Tax all externalities dynamically" is off the table.
- We have migrated to a mileage tax.
- Drivers choose miles driven in electric vehicles (e) and gas vehicles (g).
- Externalities denoted ϕ_e and ϕ_g, respectively.
- Taxes denoted t_e and t_g.

- In this case, the efficient solution would be: $t_e = \phi_e$ and $t_g = \phi_g$.

Main Result

- But in general, $t_g \neq \phi_g$.

- Then the optimal second-best tax on electric vehicles can be written as:

$$t_e^{SB} = \phi_e + \left(t_g - \phi_g\right) * \frac{-\partial g/\partial t_e}{\partial e/\partial t_e}$$

$$\text{-} \qquad\qquad +$$

- Reflects the interaction between the electric and gasoline markets.

Model Takeaways

Our stylized model highlights a key tradeoff between mileage externalities and the pre-existing distortion for gasoline vehicles.

When gasoline vehicles are taxed at ϕ_g, then the optimal tax on EVs is ϕ_e.

However, when $t_g < \phi_g$, then the optimal tax on EVs is below ϕ_e.

In this case, a low tax on EVs has efficiency benefits by encouraging substitution away from gasoline-powered vehicles.

Knowledge Spillovers

Also, we largely ignore knowledge spillovers, which provide an additional rationale for EV subsidies.

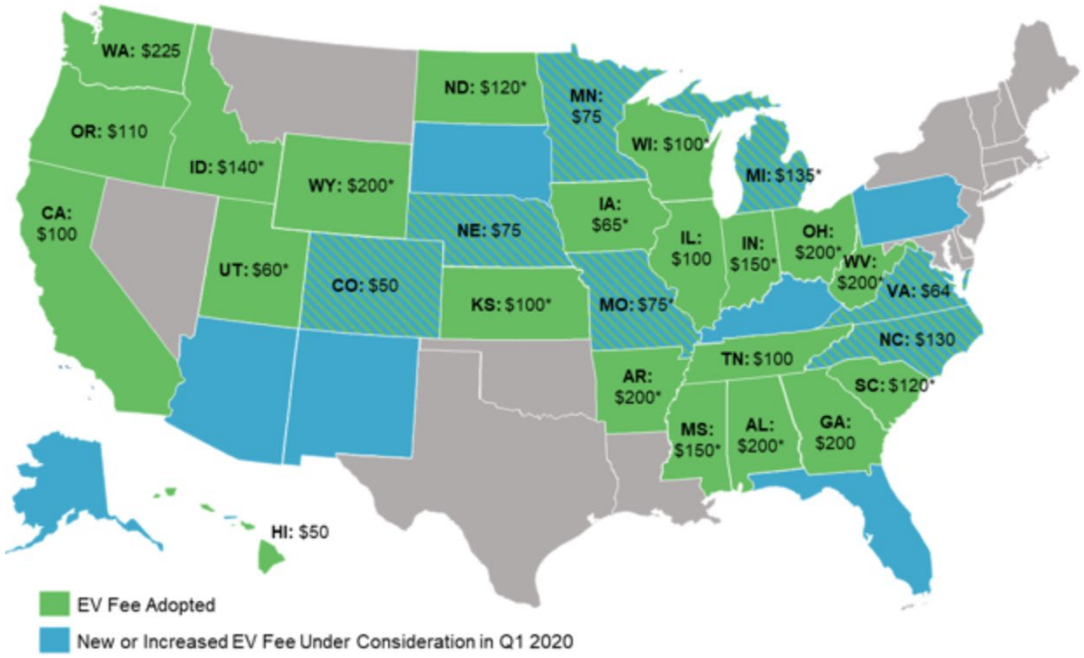
While you could incentivize knowledge spillovers by exempting EVs from the mileage tax, it will tend to be more efficient to use an adoption subsidy, like the $7,500 federal income tax credit.

Annual Fees

Seventeen states charge additional annual fees for EVs.

We don't allow for this explicitly in our model, but our intuition is that this is inferior to a mileage tax.

- Discourages adoption of EVs, and thus doesn't address knowledge spillovers or encourage substitution away from gas
- Doesn't address the mileage margin



Source: NC Clean Energy Technology Center

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Conclusion

EVs provide an opportunity to think hard about our current approach for financing roads.

Our work highlights the importance of pricing externalities, in addition to addressing revenue concerns.

Gasoline taxes are a very limited tool.

THANK YOU

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BONUS SLIDES

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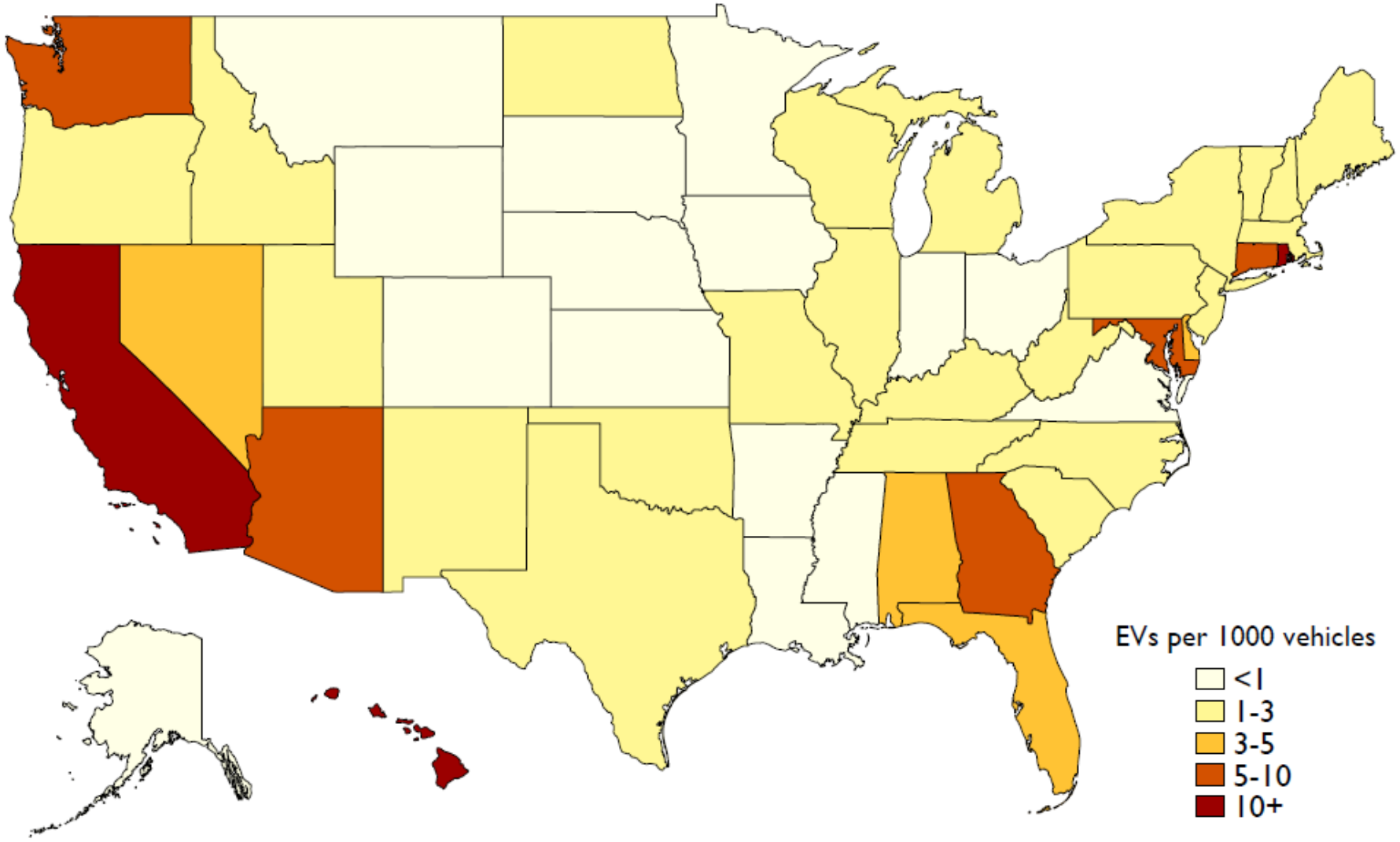
Empirical Analysis

- Turn to the empirical analysis, and introduce policy landscape for EVs in the United States

- Primary dataset is the 2017 *National Household Travel Survey*, from U.S. Department of Transportation.
  - Large scale (130,000 households!), nationally-representative household survey
  - First NHTS with non-negligible number of EVs

- We also incorporate state-level gasoline taxes from the *American Petroleum Institute*

EVs By State



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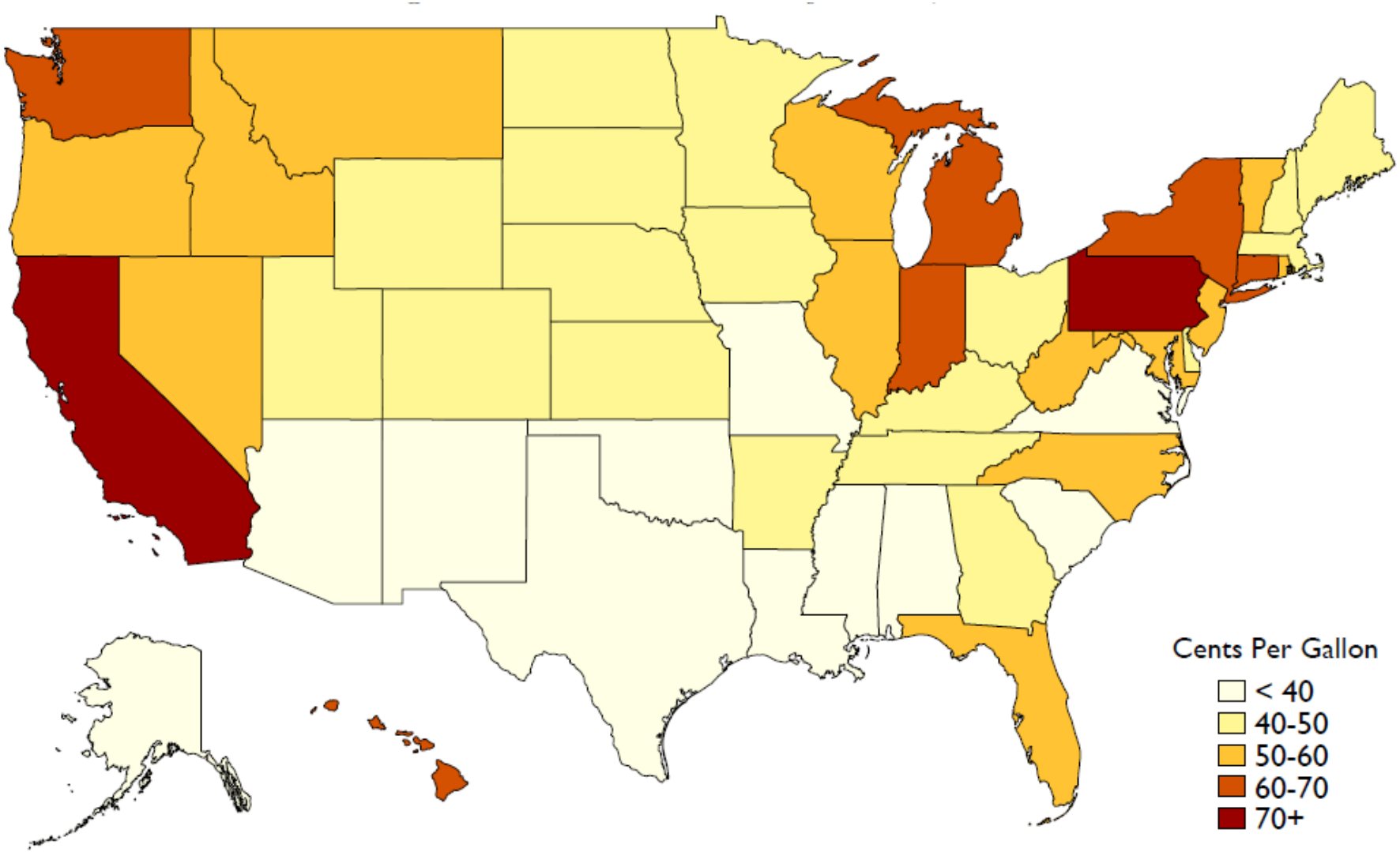
Gas Tax



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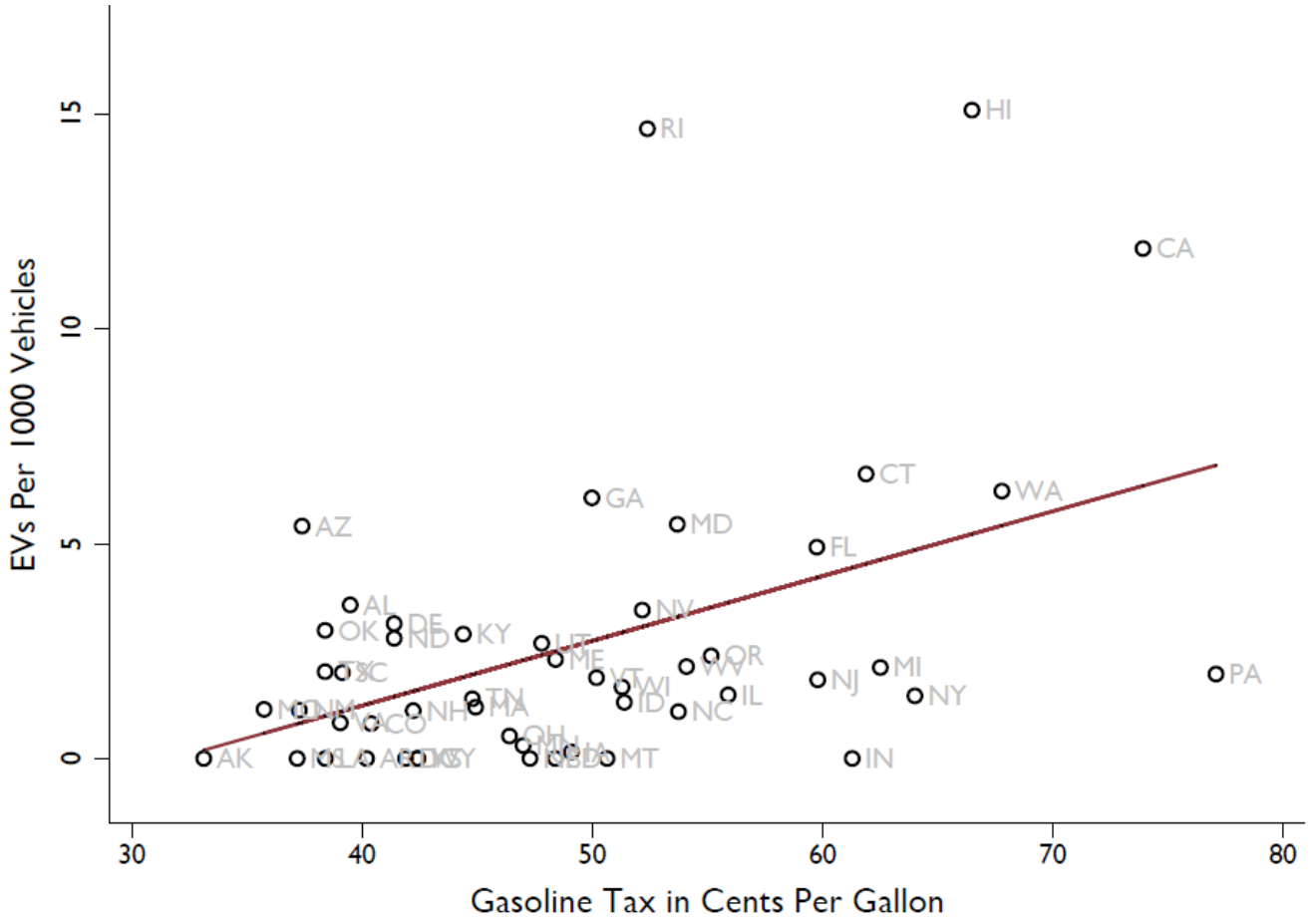
Positive Correlation (0.46)



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Growing Hole in Road Budgets

Table 2: Foregone Gasoline Tax Revenue

Federal	$ 75 million
State and Local	$ 174 million
Total	**$ 249 million**

30% foregone federal tax, 70% foregone state tax

$90 million per year in CA alone

Key Assumptions

Foregone gas tax per EV is calculated to be $318.

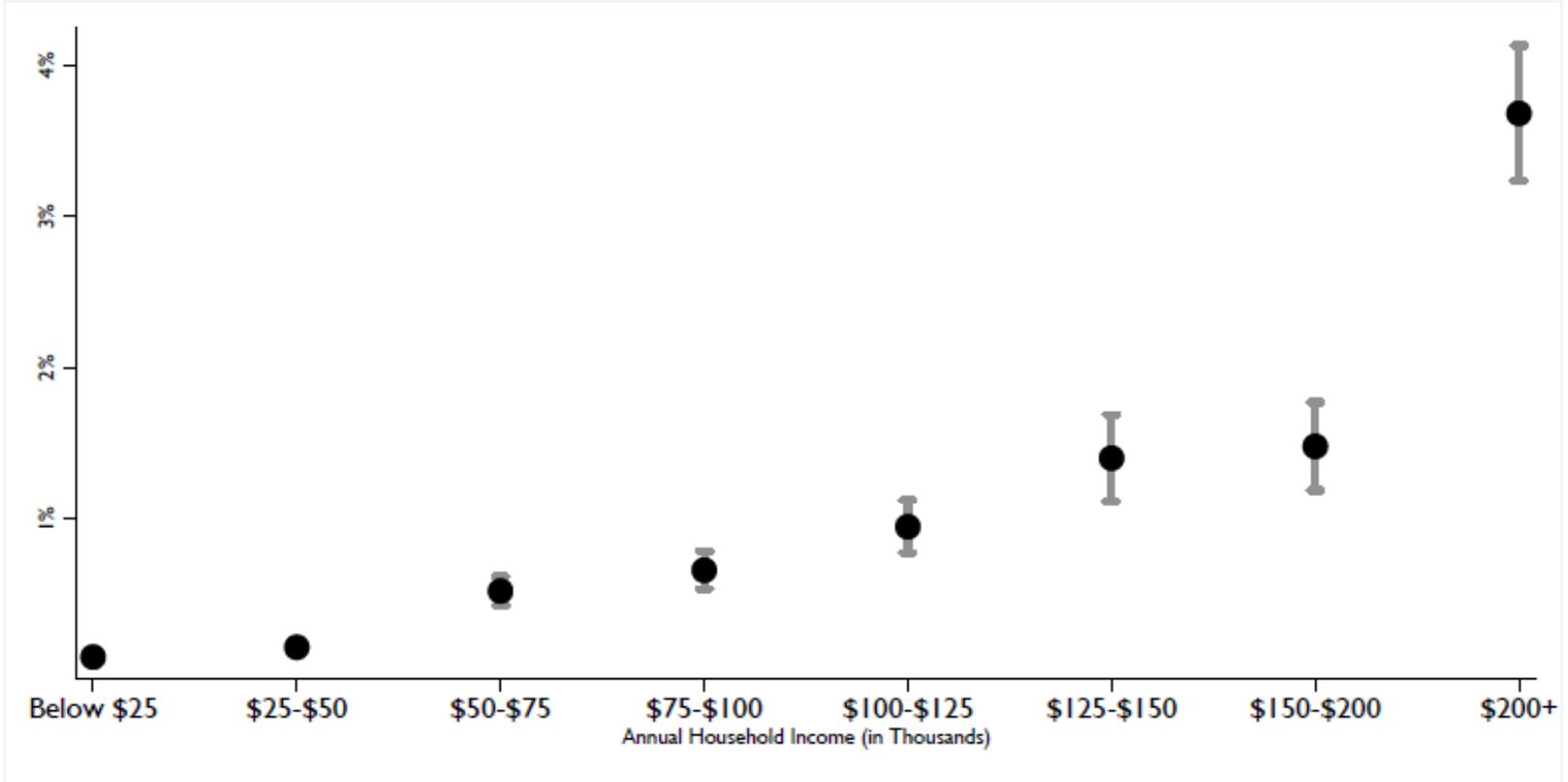
Assumes EV drivers *otherwise* would have driven:

- 15,000 miles per year (following Holland et al., 2016)
- in a 28.9 mpg gasoline vehicle (following Xing, et al, 2019)

We also report estimates for alternative assumptions.

Missing Revenue Highly Regressive

Figure 5: Electric Vehicles By Income Category



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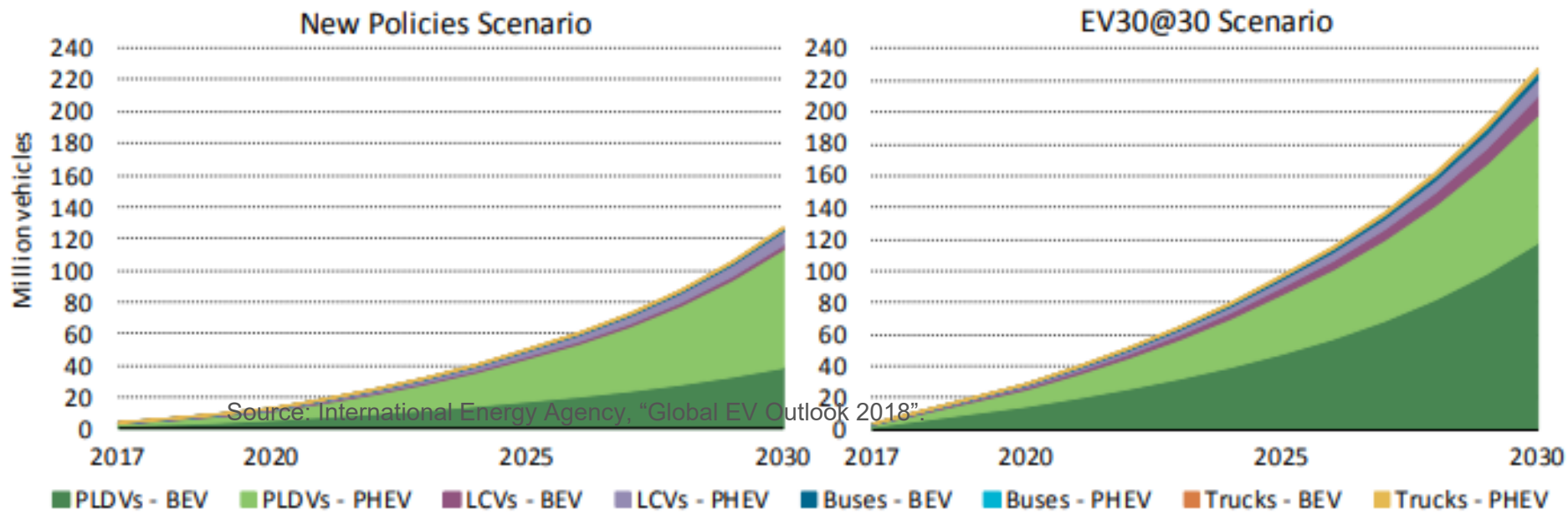
Scenarios Revisited

Figure 6.1 • Global EV stock by scenario, 2017-30



Source: International Energy Agency, "Global EV Outlook 2018".

Implies $6 billion in foregone U.S. gas tax revenue by 2030

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