

# One Way Tolling Might Become a “Bridge to VMT Charging”

*Or... “I can Dream Can’t I?”*

Ed Regan



**CDM  
Smith**

Presented at the IBTTA  
SUMMIT ON ALL-ELECTRONIC TOLLING, MANAGED LANES AND INTEROPERABILITY

July 25, 2016

# VMT Charging is Eventually Coming

- Or at least some form of road user charging
- The declining sustainability of the gas tax makes it almost inevitable
  - At least in some form
- Don't be surprised if the transition into direct road charging starts with electronic tolling on our nation's interstate system
  - Probably state by state
- But what if it happened all at once
  - Perhaps coordinated through AASHTO
  - Perhaps as a replacement for the federal gas tax
- Tolling the whole system may be a long shot
  - But the idea does create some interesting possibilities
- First, let's take a hard look at the gas tax
  - Its not a new story, but I'll try to put some magnitude and timing on the coming crisis

# The Gas Tax: A System at Risk

- The motor fuel tax has been the primary source of funding for transportation for close to 100 years
  - It has served us well
  - It is nearly invisible and widely accepted by the public
  - It's probably doomed to fail in the future!
- What's the problem?
  - It's a tax on fuel consumed; not miles driven
  - With continuing increases in fuel efficiency, and a coming shift to all electric vehicles, tax revenue will be decreasing while travel is increasing
- A notable policy contradiction: Transportation Funding is based on the taxation of a commodity that our nation is aggressively trying to discourage the use of
  - Dramatically higher CAFE standards – 54.3 MPG by 2025
  - Rapid emergence of PHEV and full battery electric vehicles
- It's great for climate change and reduced dependence on foreign oil, but...
- It's an impending disaster for transportation funding if we stick to our current funding systems

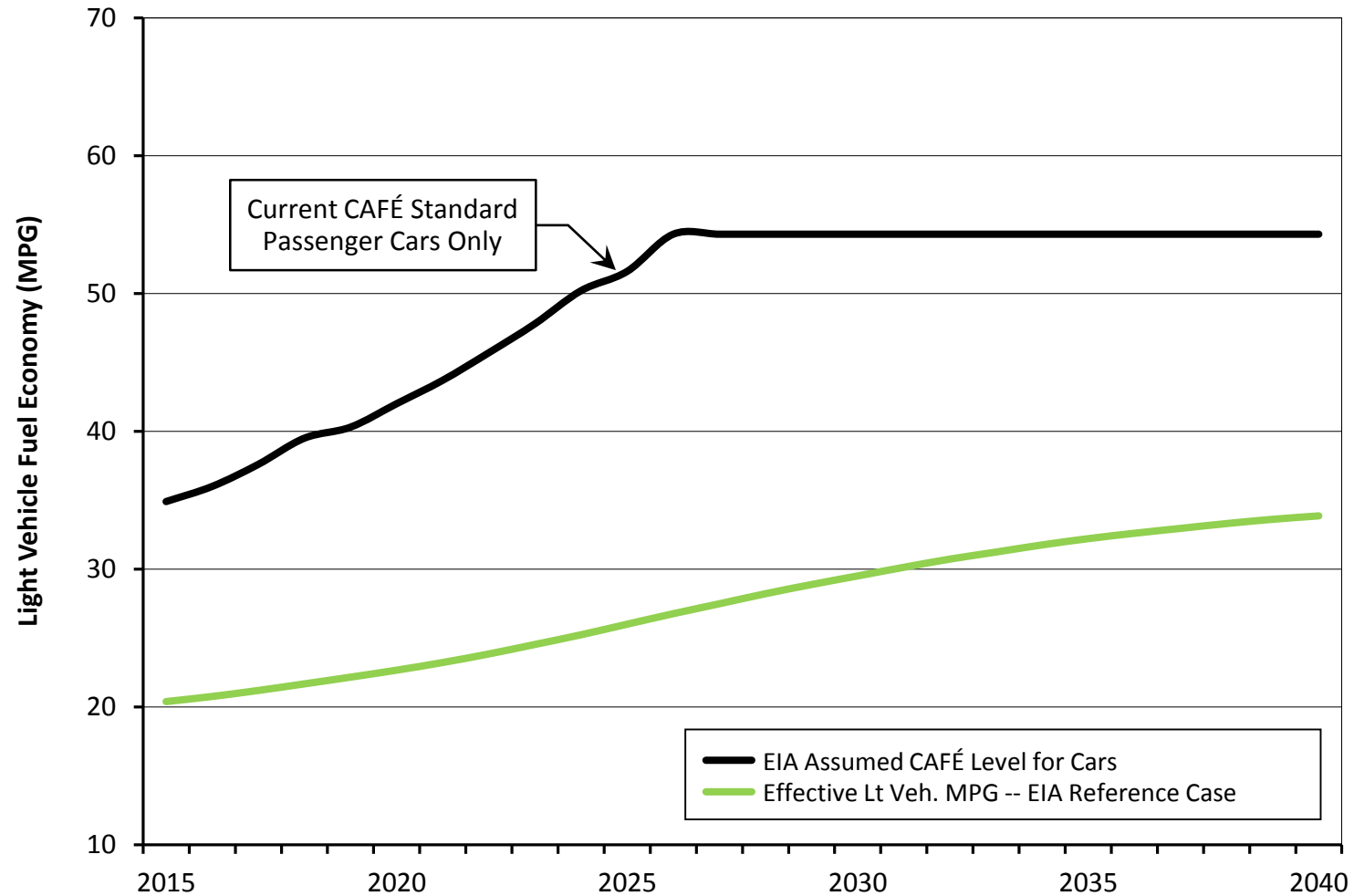
# The Trend Has Already Begun

- Average new car fuel efficiency increased 22% between 2008 and 2014
  - Has held relatively steady over the last year or so with lower gas prices
- The trend will accelerate as automakers try to achieve compliance with aggressive CAFE standards by 2025
- Perhaps the biggest impacts will come when fully electric vehicles become more viable and less costly
  - Bloomberg Energy says this is expected to occur around 2023
  - Recent unprecedented “pre-order” of Tesla 3 suggests it may be sooner

# U.S. Energy Information Administration (EIA) Forecasting

- EIA Produces Annual 25-year forecasts of future energy consumption, including all forms of motor fuel
  - Most recent estimates – May 2016
  - Projections extend from 2016-2040
  - Forecasts developed by vehicle and fuel categories
- Most recent EIA national estimates used as benchmark in this analysis
  - Official national VMT growth forecast
  - Baseline “reference case” assumptions on changing average fuel efficiency by vehicle category
  - Actual estimates of motor fuel consumption
- Key Point: EIA Assumes no further change in CAFE standards after 2025

# Estimated Light Vehicle Fuel Efficiency (MPG)

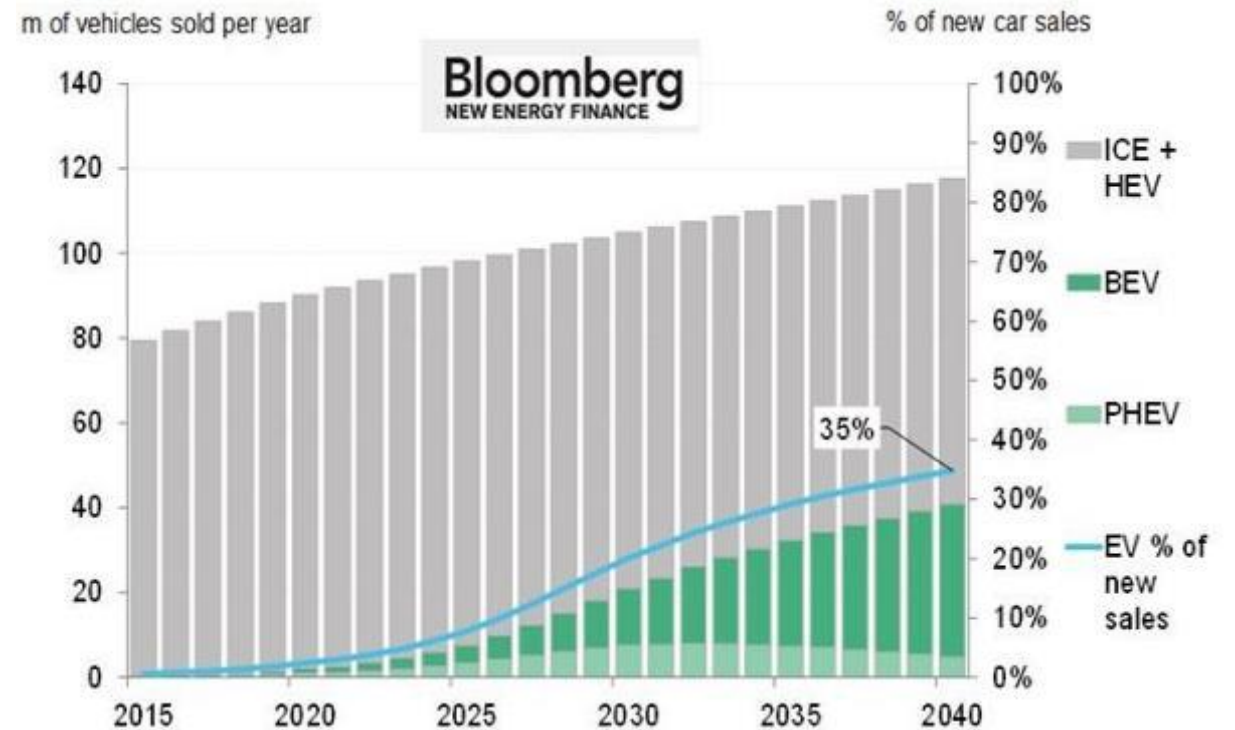


Source: Adapted from Energy Information Agency 2016 "early" Forecast. Also, Bloomberg New Energy Finance.

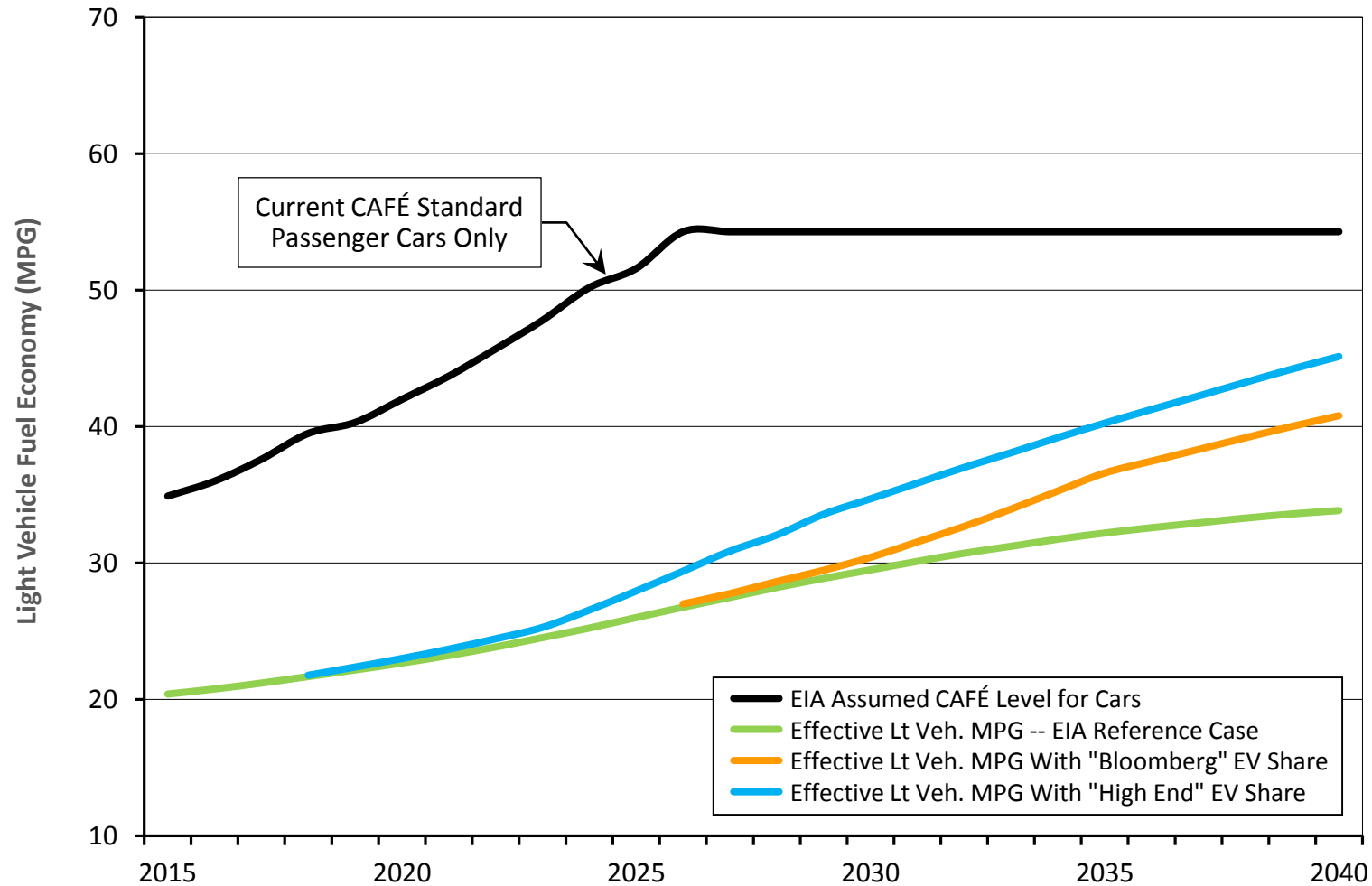
Note: CAFÉ standards apply only to passenger cars. Light vehicles include cars, SUV's and pickup trucks.

# The Future Emergence of Electric Vehicles

- Battery performance increases and prices are coming down
- Bloomberg Energy estimates EV performance and price point will be comparable with ICE vehicles by around 2023
  - Estimates 35% of worldwide new auto sales will be fully electric vehicles by 2040
  - Higher than assumed by EIA
- Tesla 3 reaches this pivot point by end of 2017
  - 225 miles between charges
  - \$35,000 price
  - Over 400,00 people have already pre-ordered; won't get delivery until early 2018
- Two alternative EV Scenarios also developed



# Estimated Light Vehicle Fuel Efficiency (MPG)



Source: Adapted from Energy Information Agency 2016 "early" Forecast. Also, Bloomberg New Energy Finance.

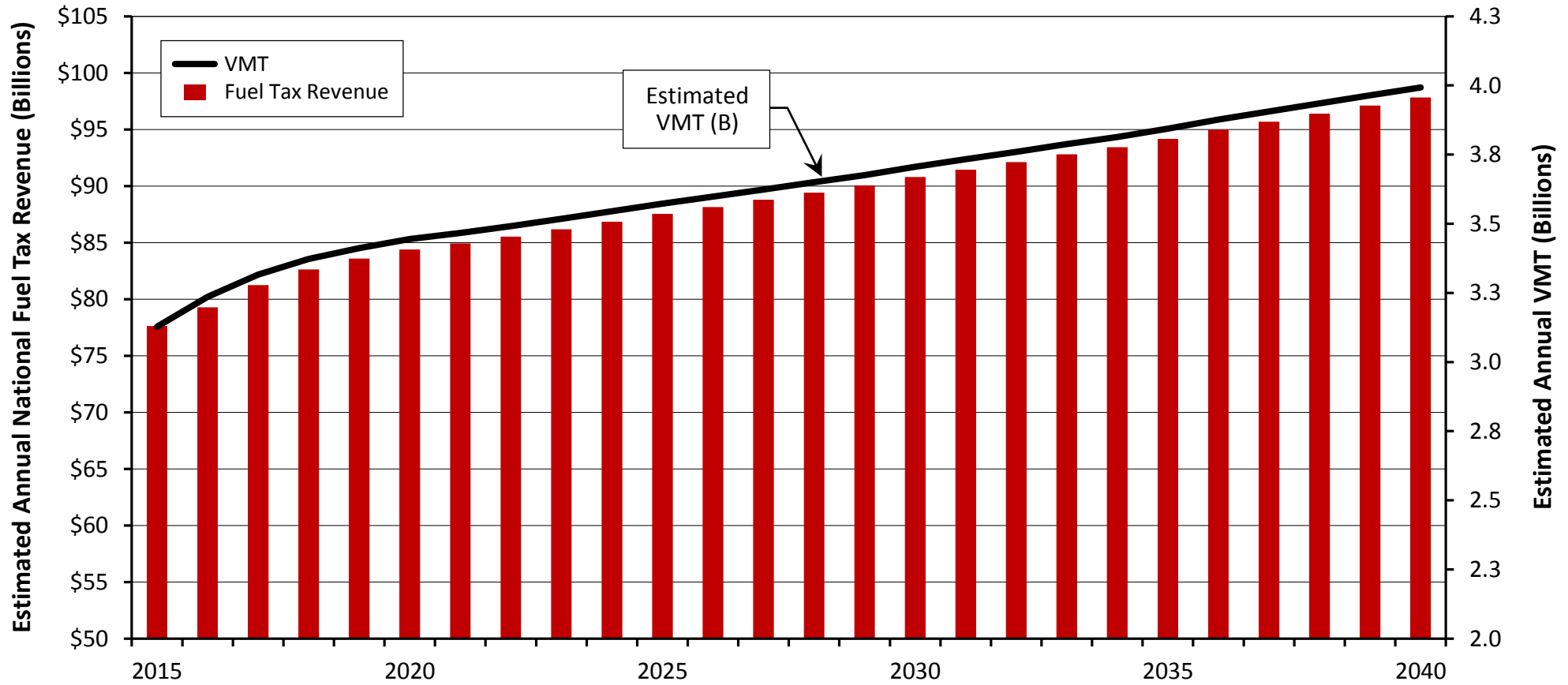
Note: CAFÉ standards apply only to passenger cars. Light vehicles include cars, SUV's and pickup trucks.



# Estimated National Annual Fuel Tax Revenue

## State and Federal Levels (2016 Dollars)

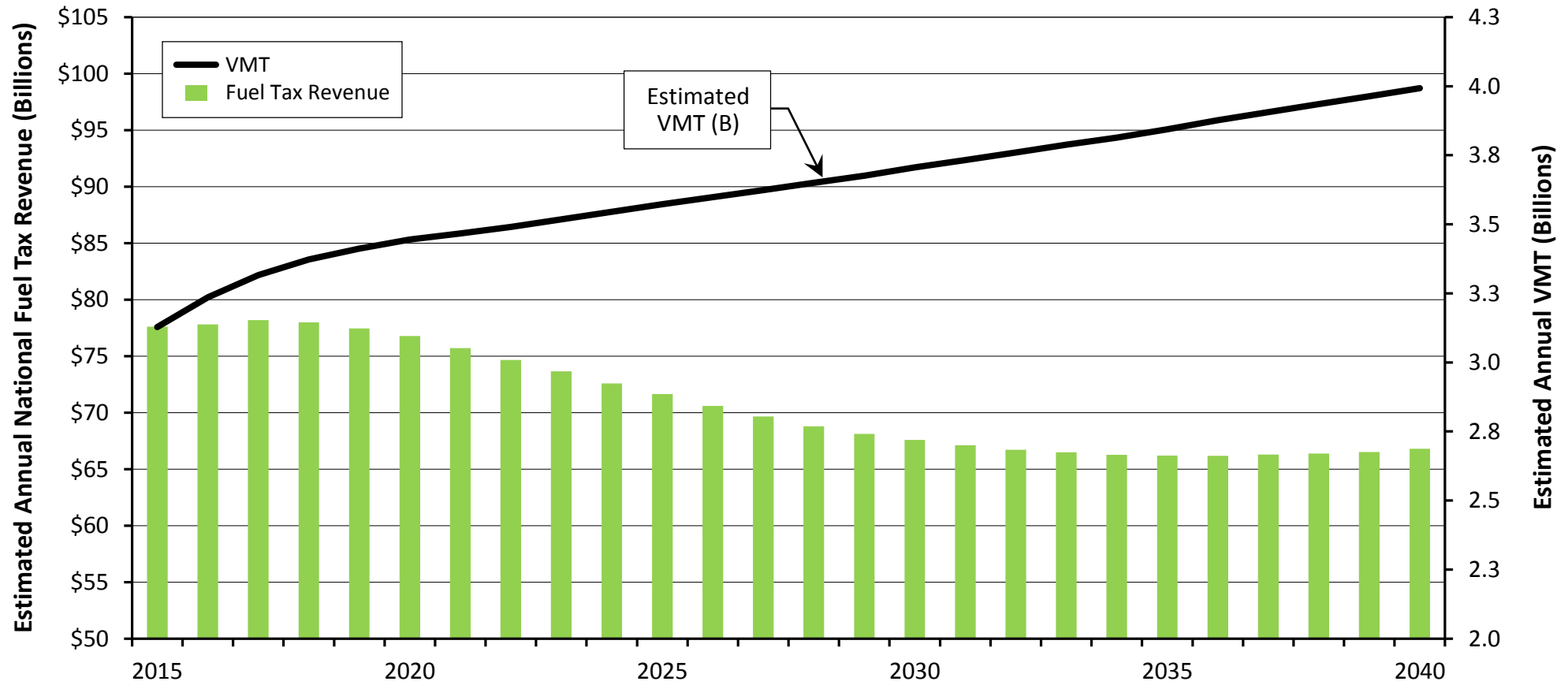
### Assuming No Change in MPG from 2016



# Estimated National Annual Fuel Tax Revenue

## State and Federal Levels (2016 Dollars)

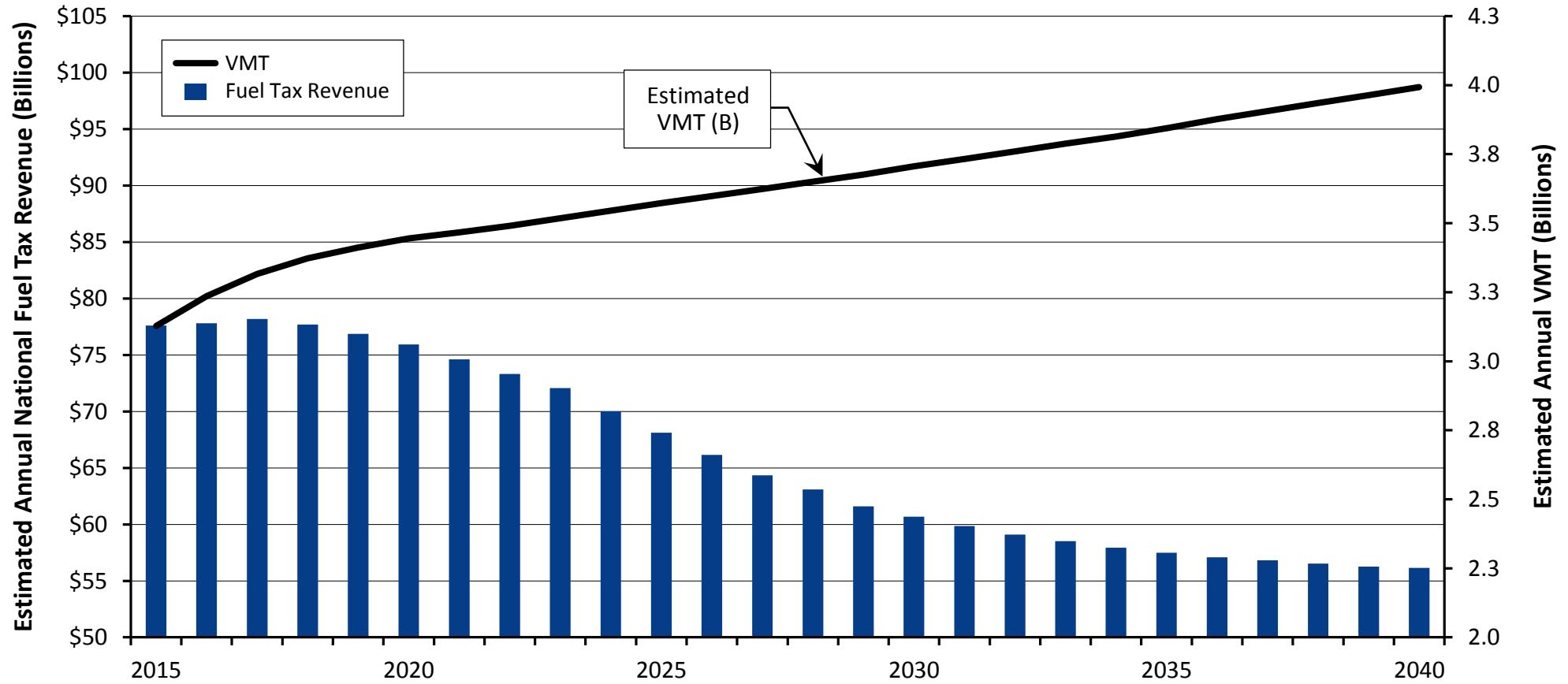
### Assuming EIA Reference Case MPG Forecast



# Estimated National Annual Fuel Tax Revenue

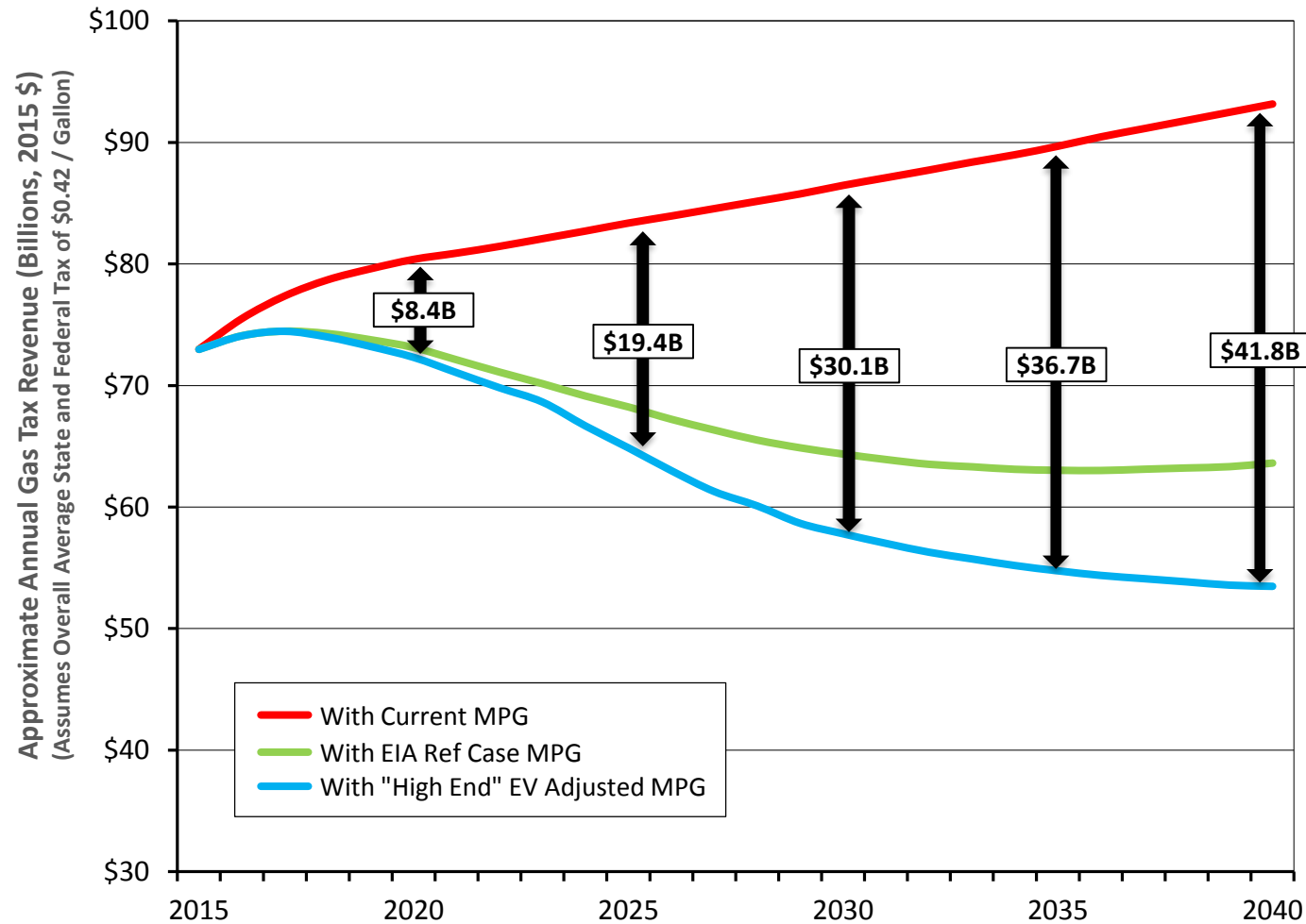
## State and Federal Levels (2016 Dollars)

### Assuming High EV Penetration Scenario



# Approximate State and Federal Fuel Tax Revenue

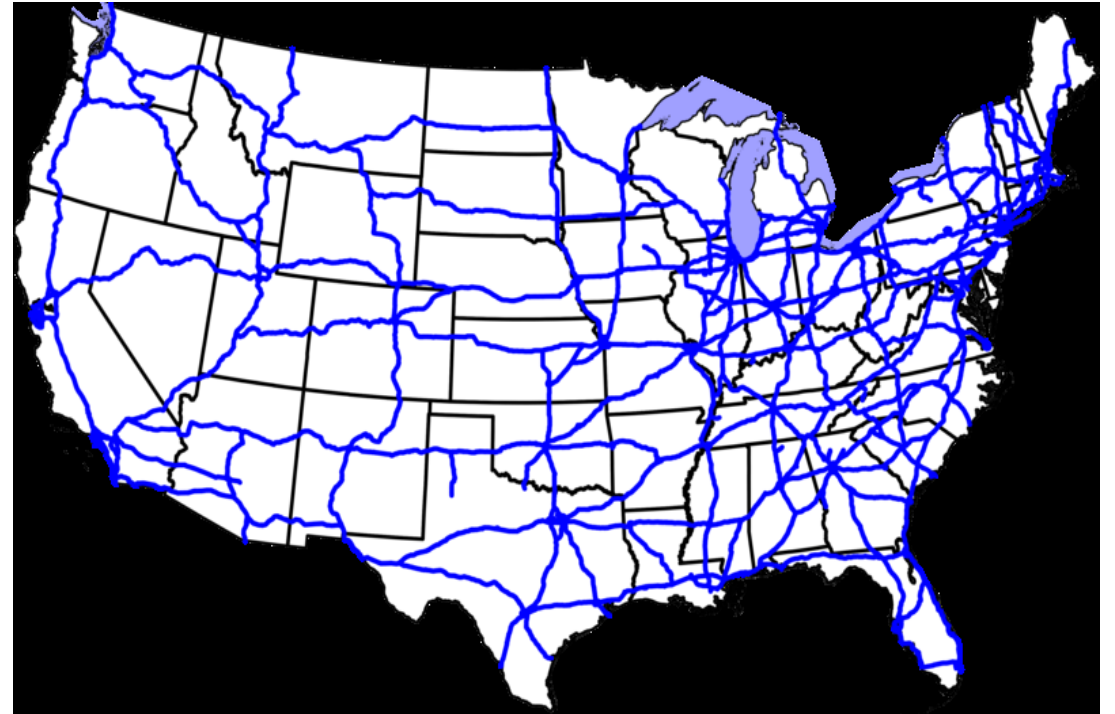
2015 Dollars; Assumes Nominal \$0.42/Gal. Combined Average Tax



# One Way to Fill the Impending Gap

- Toll the interstates
- Not just some of them; all of them
- Leave reality aside for a few minutes; assume all the states and the feds see the problem coming and they collectively decide to do it!
- OK, remember it's only a dream

- What if we tolled the whole 47,000 mile system at once??



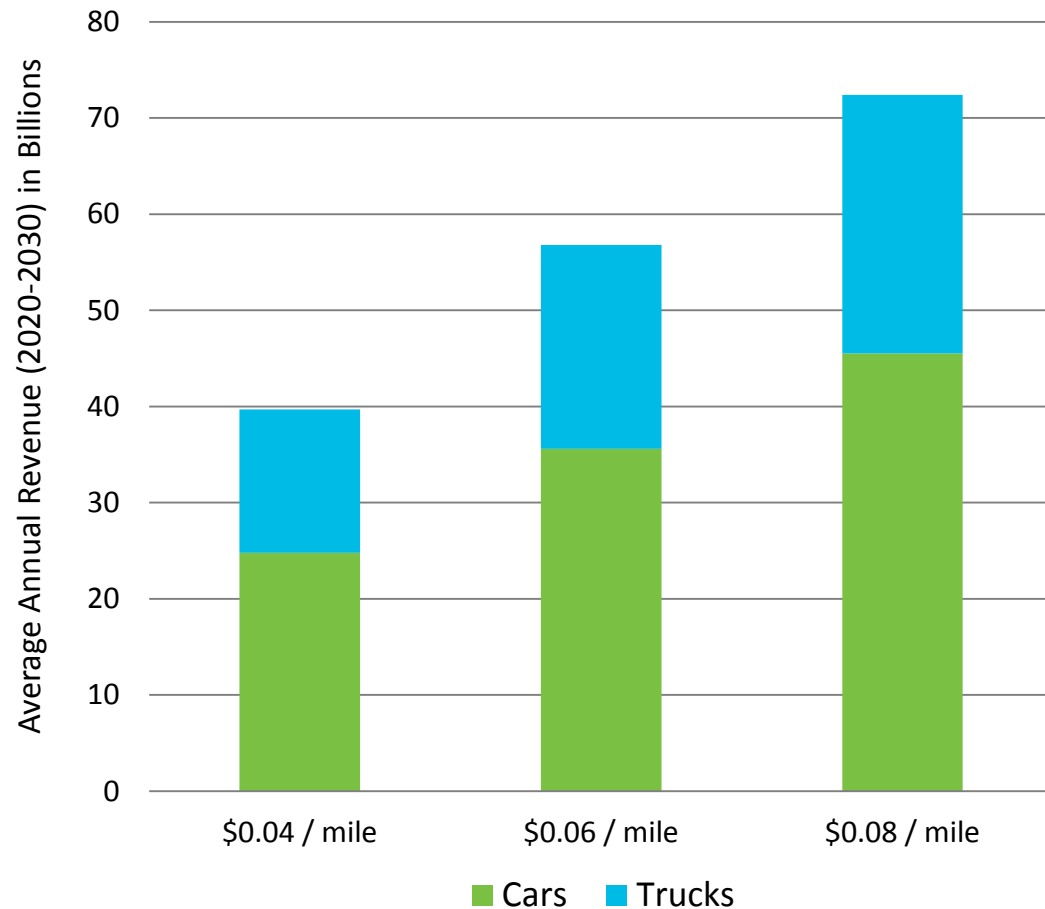
# Suppose the Entire “Toll Free” Interstate Became Tolled

- FHWA Interstate System Tolling Analysis Tool
  - Sketch planning tool developed by CDM Smith as part of FHWA study
  - National model, includes over 25,000 miles of highways and 7500 traffic zones
  - Passenger Car and Truck travel patterns calibrated to entire interstate system
  - Designed to test a range of impacts for various types of interstate tolling
- Our FHWA study considered several scenarios, including tolling the entire 45,000 mile toll free interstate system
  - Existing toll portions excluded
- It tested alternative toll rates and looked at capital and operating costs
  - National scenario assumed all user paid (closed systems)
  - Assumed AET gantries every five miles on rural portions and every two miles on urban portions

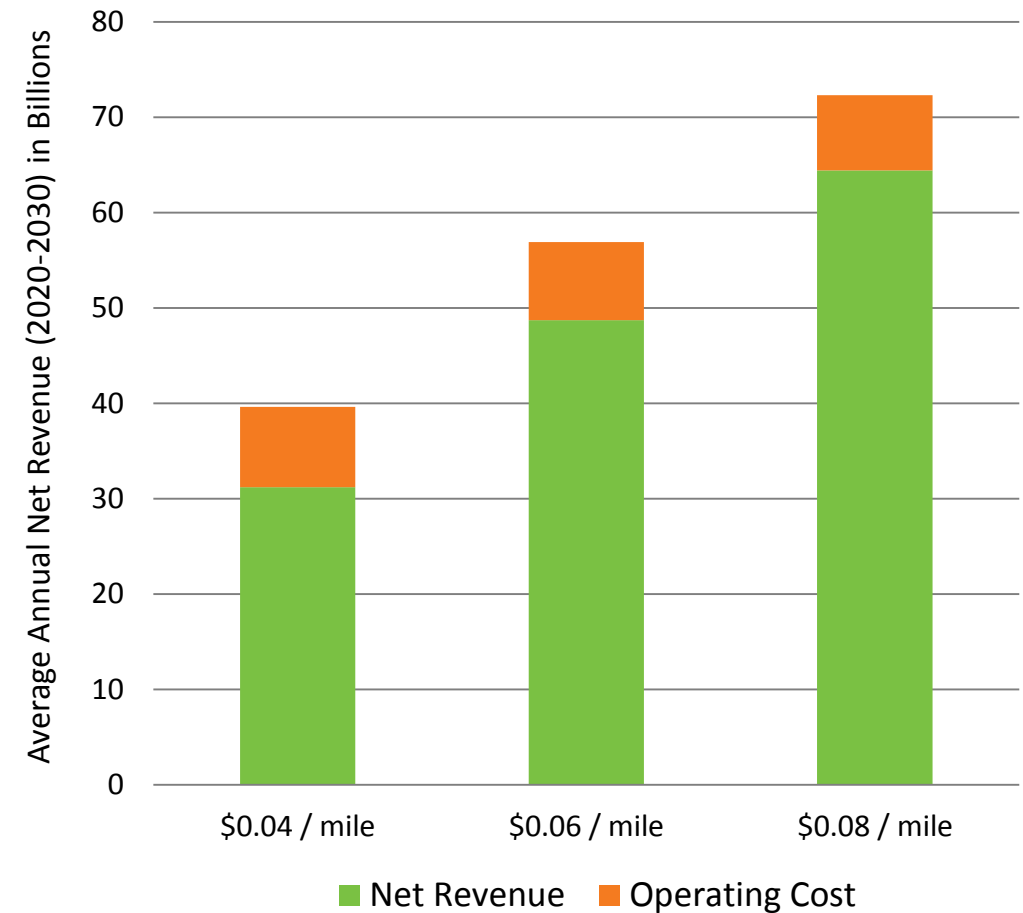
# Interstate Tolling Revenue Potential

(in 2011 Dollars)

### Average Annual Revenue (2020-2030)



### Estimated Annual Net Revenue



## Interesting Possibility

- A toll of \$0.05 per mile for cars and \$0.125 per mile for trucks would generate more net revenue than the \$0.184 per gallon current federal gas tax
- And it would be collected as a user fee on a system that is just 2 % of our highway miles but carries about 25% of all VMT
  - A system that demands about 30% of all state expenditures on highways



# What It Might Cost to Deploy

- Assuming AET, with ETC and Video Tolling over 45,000 miles
- Capital Cost: At least \$50 billion (sketch model estimates)
  - Over 13,000 two-directional gantries plus equipment
  - Over 400 customer services centers
- If we equipped every car and truck with transponders: Maybe \$3.0-\$5.0 billion more
- Figure **\$55 billion** “all in” capital cost (2011 \$)
  - Perhaps \$65 billion in 2020 \$



# There Might be Another Way

- If the whole system were tolled at once
- Should we spend over \$50 billion to erect a massive roadside system? Or
- Should we equip every vehicle in America with GPS based tolling technology?
- Interesting opportunity:
  - Assuming 270 million vehicles and about \$200 per vehicle for intelligent OBU: **\$54 billion**
  - We could equip every vehicle in the nation with GPS/ GSM OBU's for about what it would cost for 13-14000 gantries using today's technology
  - At a quantity of over 250 million, OBU cost would likely be much lower, even with installation
- We would not need an extensive roadside system, or video tolling and billing, since every vehicle would have OBU technology that could assess user charge for miles driven on the interstate system

# The “Pipe Dream” Continued

- While only the Interstate System would be tolled, a national framework and account payment system would be established
- It could be used for tolling other existing toll facilities, since every vehicle would be part of the system
  - Significantly reduce capital and operating costs associated with future conversions to AET
  - Toll facilities use the same national GPS based pricing framework as the interstate system
- But the biggest benefit: Nationwide Interstate tolling via intelligent OBUs would also establish the very framework that states and regional agencies can later tap into as we gradually move off the gas tax
  - The interstates carry 25% percent of US VMT every day... not a bad way to phase in VMT fees
- Interstate tolling will emerge as a way to plug the funding gap created by electric vehicles and increasing fuel efficiency...
  - But if it is done this way it could provide the framework for other agencies to cross the “bridge to VMT fees”
  - But that bridge should definitely have a toll!!

# Epilogue

- It's an obvious solution; and an obvious way to phase in MBUF
- So should our current technology providers and operators be worried?
  - Probably not
- Let's keep in mind, this dream depends on three critical things happening:
  - Congress removing all prohibitions on tolling existing free interstates;
  - All states and other levels of government coming together to agree on interstate tolling; and
  - Having the political courage to put GPS based pricing technology in every car and truck in America
- A pretty high bar if you ask me
- But it never hurts to dream