

# Feasibility Analysis of Electric Vehicles in Pennsylvania



## DRAWDOWN

Corey Scamman<sup>a</sup>, Elizabeth Traut<sup>b</sup>

<sup>a</sup>Bucknell University, Computer Science and Economics

<sup>b</sup>Penn State, Larson Transportation Institute

### Significance

- ▶ Electric Vehicles are the future of clean transportation
- ▶ Fully electrifying passenger vehicles will reduce yearly carbon emissions by an estimated 55 million metric tons a year in PA alone<sup>1,2</sup>
- ▶ One of the pillars needed to establish a sustainable society

### Objectives and Methodology

- ▶ Developed framework for EV state level feasibility analysis
- ▶ Pennsylvania Case Study
- ▶ Literature Review of relevant written works
- ▶ Identify Government Policy and Incentives
- ▶ Analyze solutions to facilitate EV adoption
- ▶ Financial Cost Benefit Analysis

### Barriers to Adoption

- ▶ Underdeveloped Charging Infrastructure
- ▶ Range Anxiety
- ▶ Limited Battery Technology
- ▶ Expensive
- ▶ Public Misconceptions
- ▶ Limited Production
- ▶ Limited Variety
- ▶ Consumer Behavior

### Solutions

- ▶ Government Policy and Incentives
  - ▶ Taxes, Rebates, Subsidies, and Funding
- ▶ Investment in Charging Infrastructure<sup>T1</sup>
- ▶ Complimentary and Residence Charging Stations
- ▶ Market Competition
- ▶ Economies of Scale
- ▶ Education
- ▶ Research and Development

Charging Level	Voltage	Charging Time	Installation Cost	Location
Level 1	120 V AC	8 – 12 Hours	\$300 - \$4500	Home, Workplace
Level 2	208 – 240 V AC	4 – 6 Hours	\$1,000 - \$19,200	Home, Workplace, Public
DC Fast Charger	400 – 1000 V DC	20 – 30 Minutes	\$14,000 - \$91,000	Public, Charging Stations

(T1) Table 1: Types of EV chargers and relevant information<sup>3-5</sup>

### What Can You Do?

- ▶ Consider whether an Electric Vehicle is right for you
  - ▶ Consider the added (in)convenience of EVs
  - ▶ Consider the financial implications of an EV
- ▶ Educate yourself and others about government incentives
- ▶ Is your workplace EV friendly?
- ▶ Is your residency EV friendly?
- ▶ Is your local and state government promoting EVs?

### Electric Vehicles<sup>T2</sup>

- ▶ Zero Tailpipe Emissions
- ▶ Higher Performance
- ▶ Range Anxiety
- ▶ Recharge Time
- ▶ Underdeveloped Charging Infrastructure
- ▶ Cheaper Operating Costs
- ▶ Simpler Engineering
- ▶ Regenerative Braking

### Conventional Vehicles<sup>T2</sup>

- ▶ Lower Upfront Cost
- ▶ Faster Refuel Time
- ▶ Longer Driving Range
- ▶ Maintenance
- ▶ Fossil Fuel Dependent
- ▶ Not Sustainable
- ▶ Developed Refueling Infrastructure
- ▶ Complicated Internal Combustion Engine

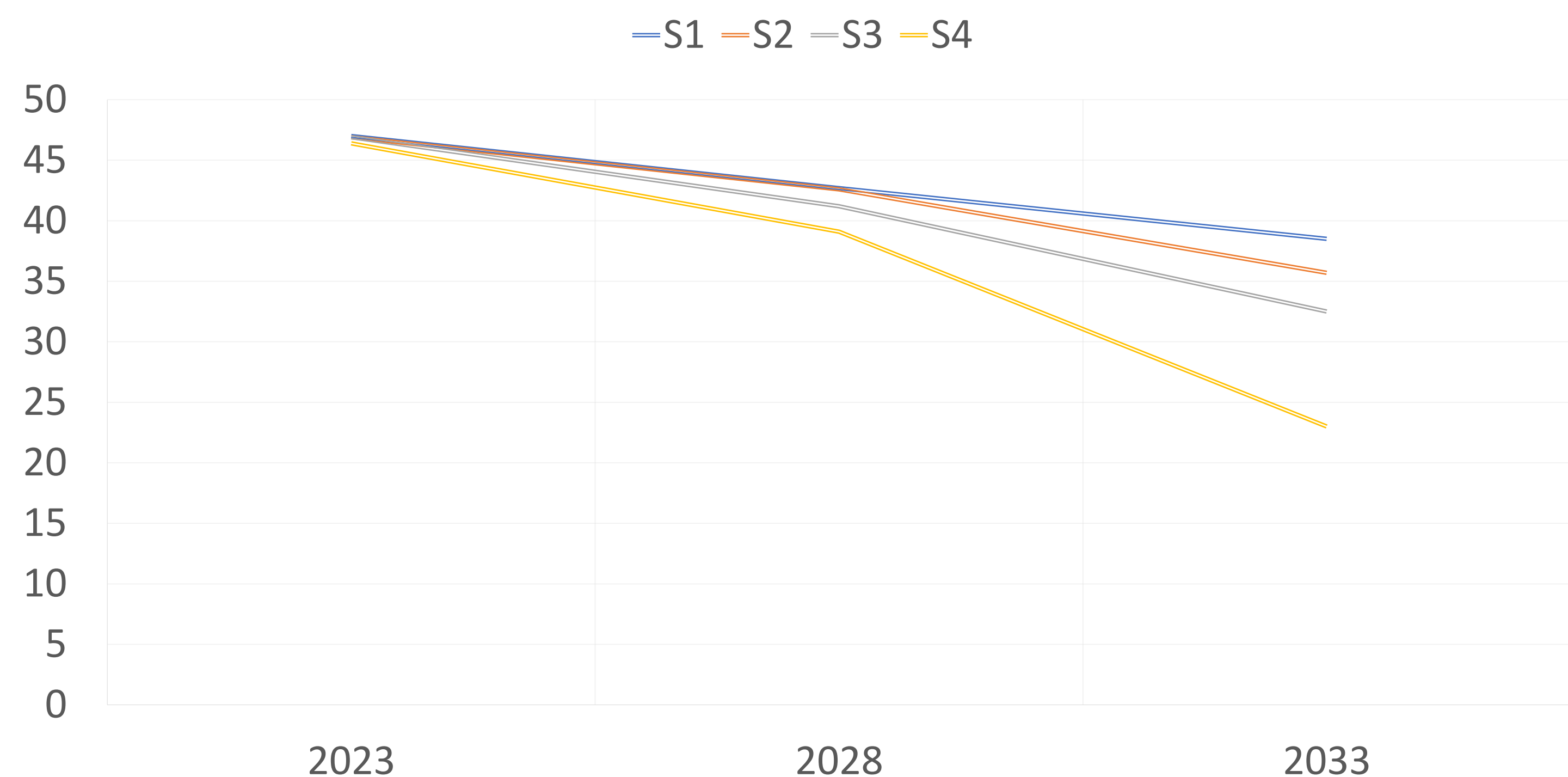
Model	Price (W/O Incentives)	Yearly OPC*	Performance (0 – 60 mph)	Range
Nissan Leaf	\$29,990	\$600 - \$650	7.4 seconds	150 miles
Tesla Model 3	\$38,990	\$500 - \$550	5.3 seconds	240 miles
Honda Civic	\$19,550	\$1150 - \$1250	6.7 seconds	430 miles

(T2) Table 2: Provides price, operating costs, range, and performance of 2 EVs and 1 ICE car for comparison<sup>6-13</sup>. OPC = Operating Cost

### Pennsylvania RoadMap

- ▶ There are 4 possible future adoption scenarios<sup>F1</sup>
  - ▶ (S1) Scenario 1: Low policy, low technology
  - ▶ (S2) Scenario 2: Low policy, high technology
  - ▶ (S3) Scenario 3: High policy, low technology
  - ▶ (S4) Scenario 4: High policy, high technology

### PROJECTED GHG EMISSIONS



(F1) Figure 1: Graph of the four implementation scenarios. X Axis is GHG Emissions in Million Metric Tons. Y Axis is Time. From PA roadmap<sup>14</sup>

### Key Findings

- ▶ As done by Norway, a carbon-based emission tax can be effective to reduce upfront price difference between EVs and ICE cars
- ▶ Public, private, work, and residential investment in charging stations is needed to establish the charging infrastructure
- ▶ Providing clear information and education is key to fixing the misconceptions surrounding EVs
- ▶ Market competitiveness will provide more EV variety, reduce cost, and increase range and performance
- ▶ Savings accumulate overtime due to lower operating costs

\*See handout for references and acknowledgments