

# New Car Buyers' Valuation of Zero-Emission Vehicles

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# Goals and Regulatory Context

- What are consumers' awareness, knowledge, experience, and valuation of plug-in hybrid electric vehicles (PHEVs), battery electric vehicles (BEVs), and fuel cell electric vehicles (FCEVs)?
- Regulatory Context
  - Air quality standards: Section 177 of Federal Clean Air Act
  - Greenhouse gas emissions reductions: AB 32,...
- Supporting Programs: federal, state, and local
  - Zero-emission vehicle (ZEV) sales requirements
  - Vehicle purchase and use incentives
  - Charging and fueling infrastructure deployment



# Executive Summary

“Californians are generally unfamiliar with most advanced technologies and alternative fuel vehicles, or have misperceptions about the vehicles and their capabilities, believing them to be small and lacking in power and style.

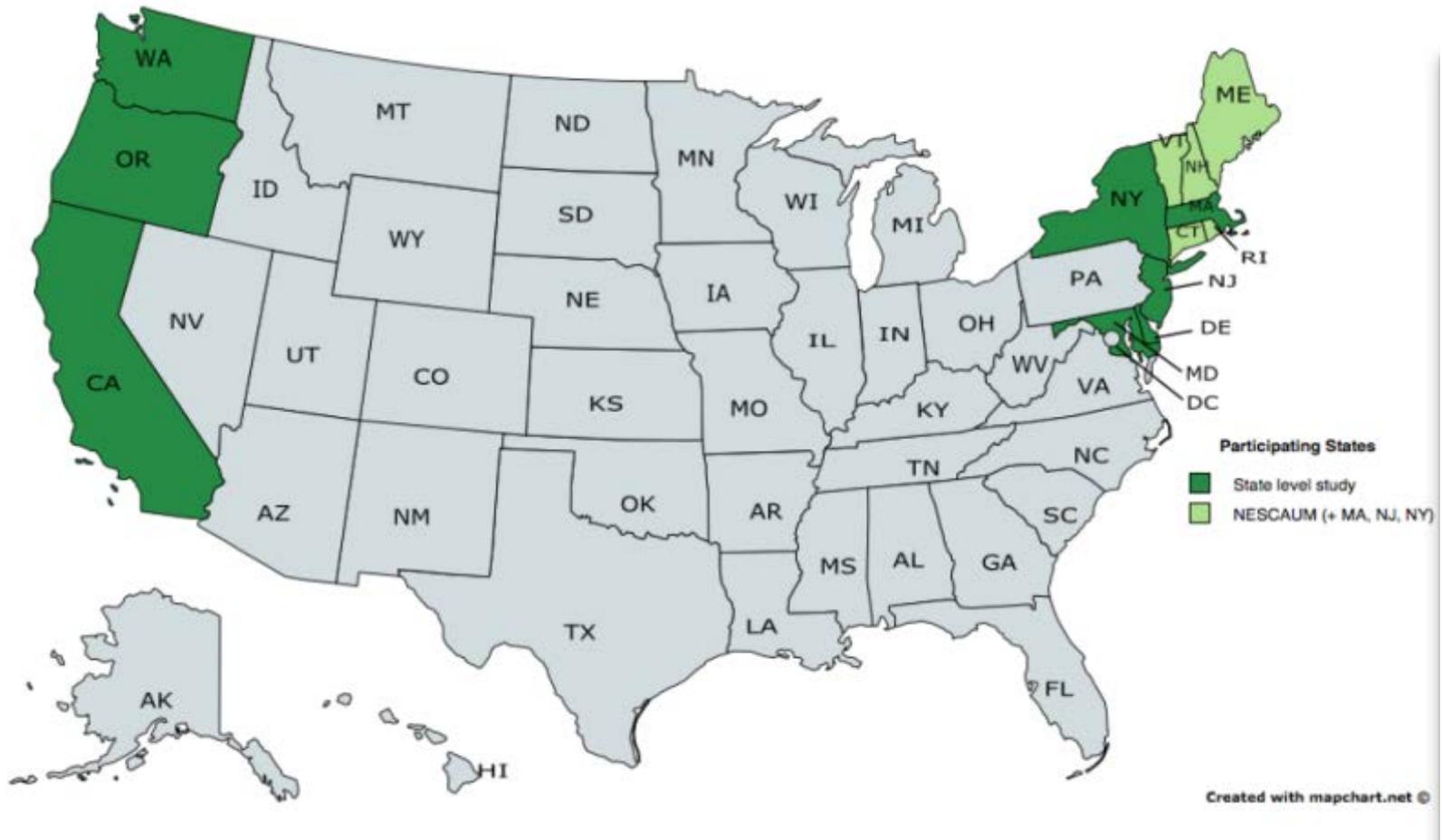
“Consumers have little trust in new, “untested” technologies, but they tend to trust those they consider to be their peers with personal experience for vehicle validation.”

Plax, Kearney, and Jolly (2006)

- Consumers, everywhere we looked, are generally unfamiliar with plug-in electric and fuel-cell vehicle technology.
    - The first hurdle to growing markets is so few households have yet to ask themselves whether a PEV or FCEV is right for them.
  - Consumers are not monolithic in their response to “ZEV” or “new” technology, and policy goals and tools.
    - The differences across states and regions may be less important than the similarities.
    - Differences within states and regions are correlated with respondents’ ZEV valuations.
- Kurani, Caperello, and TyreeHageman (2016)

# Multiple States

What they have in common may turn out to be more important than their differences



# Multiple methods

- Survey: December 2014 to January 2015
  - Multi-state sample of new car buyer households
    - Total, n = 5,654
    - CA, n = 1,671
- Interviews: January to March 2015
  - Selected from survey respondents
    - Pro- and Con-ZEV respondents from survey
    - Three States
      - Oregon (Portland)
      - Washington (Puget Sound)
      - California (Sacramento, San Francisco Bay Area, San Diego, Los Angeles)

# Valuation

- Will new vehicle buyers design a plausible next new vehicle for their household that is a PHEV, BEV or FCEV?
  - Yes = positive valuation
  - No = negative valuation

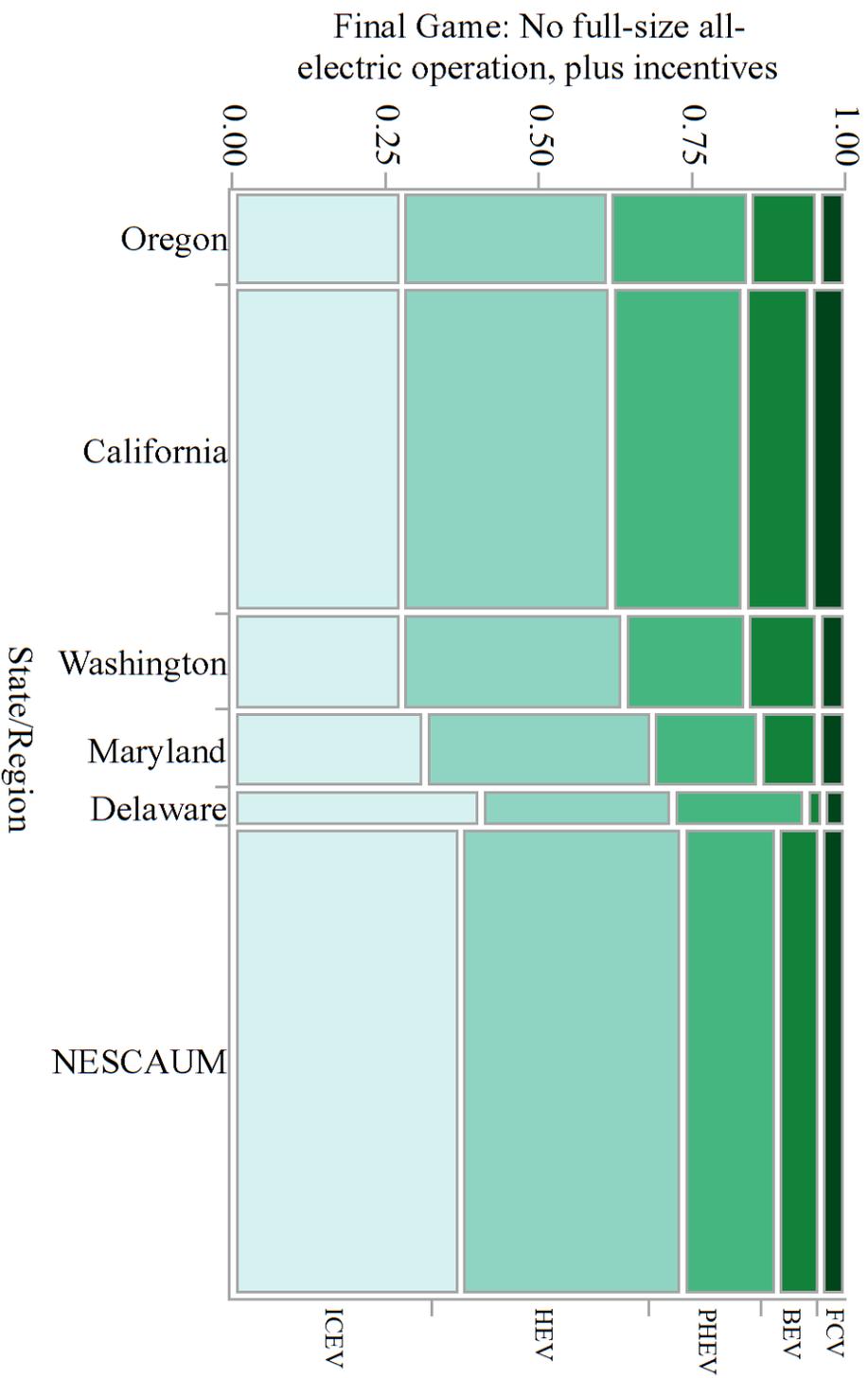
# Design Game Parameters

- Establish Starting Vehicle
- Drivetrain Design: More electric costs more
  - HEV
    - Fuel economy and purchase price increments
  - PHEV
    - Charge Sustaining (CS) mode: fuel economy equivalent to HEV
    - Charge Depleting (CD) mode: assist or all-electric; range
    - Charging: duration, home and away
  - BEV
    - Range
    - Charging: duration, home and away
  - FCEV
    - Range
    - Home hydrogen fueling

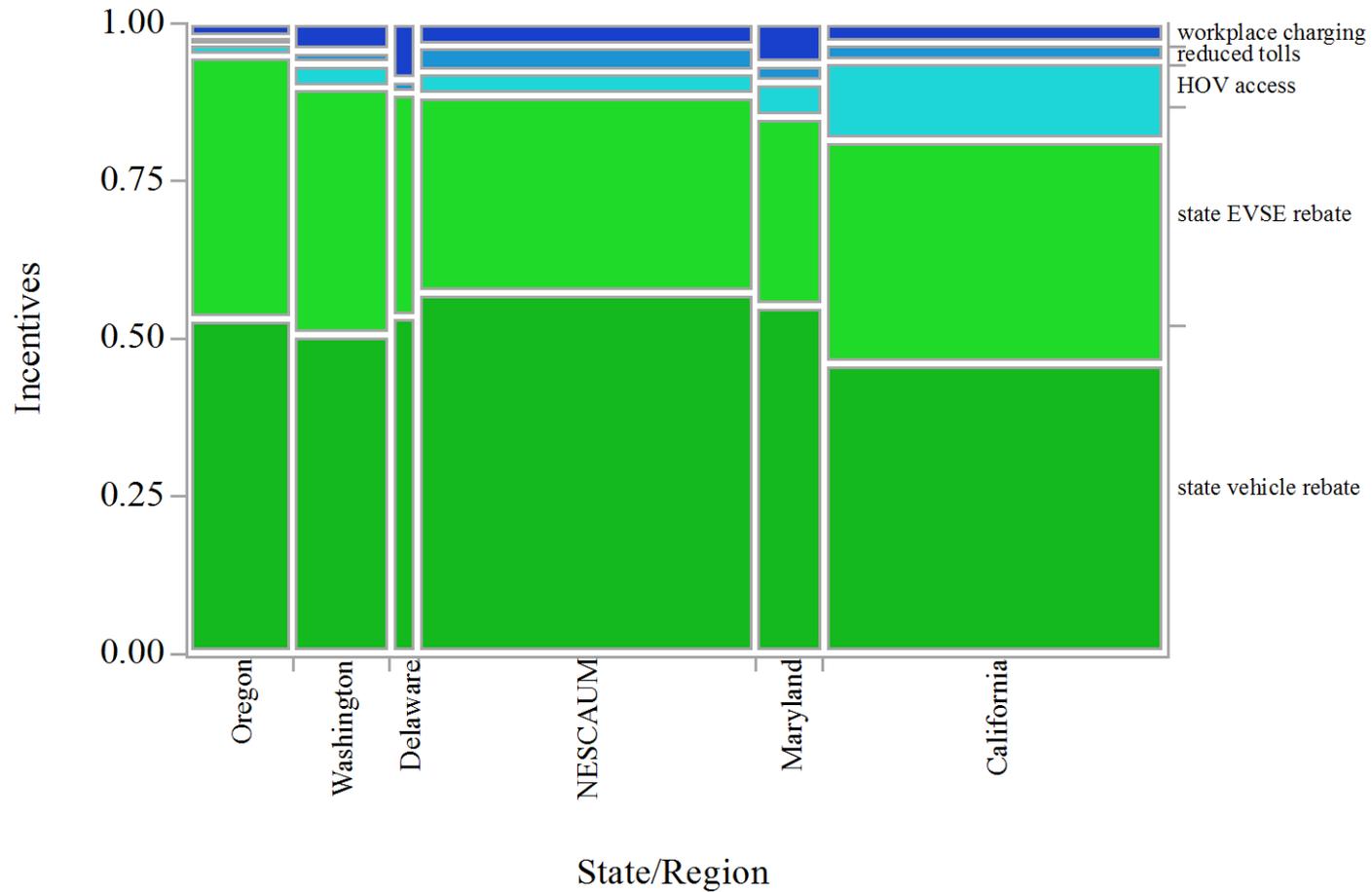
# Design Game Parameters

- Incentives
  - Offered in final game only
  - PHEVs, BEVs, and FCEVs assigned a federal incentive
    - Equivalent to schedule of federal tax credit at time of survey
      - FCEVs given same credit as BEVs
  - Plus respondent's choice of **one** of the following
    - State vehicle incentive equal to CVR at time of survey
    - State home charger/H2 fueling incentive equal to State vehicle incentive
    - Single occupant HOV access (until Jan. 2019)
    - Reduced bridge and road tolls (until Jan. 2019)
    - If workplace charging isn't available, assume it is made available
      - Workplace fueling not offered for FCEVs

# 27 to 39 percent of respondents design their next new vehicle to be a PHEV, BEV, or FCEV.



# Incentives by State/Region



# Why do people design PEVs and FCEVs, or not?

1. Modeling design game results
  - Models for states and NESCAUM
2. Post-game motivations

# What is correlated with drivetrain designs?

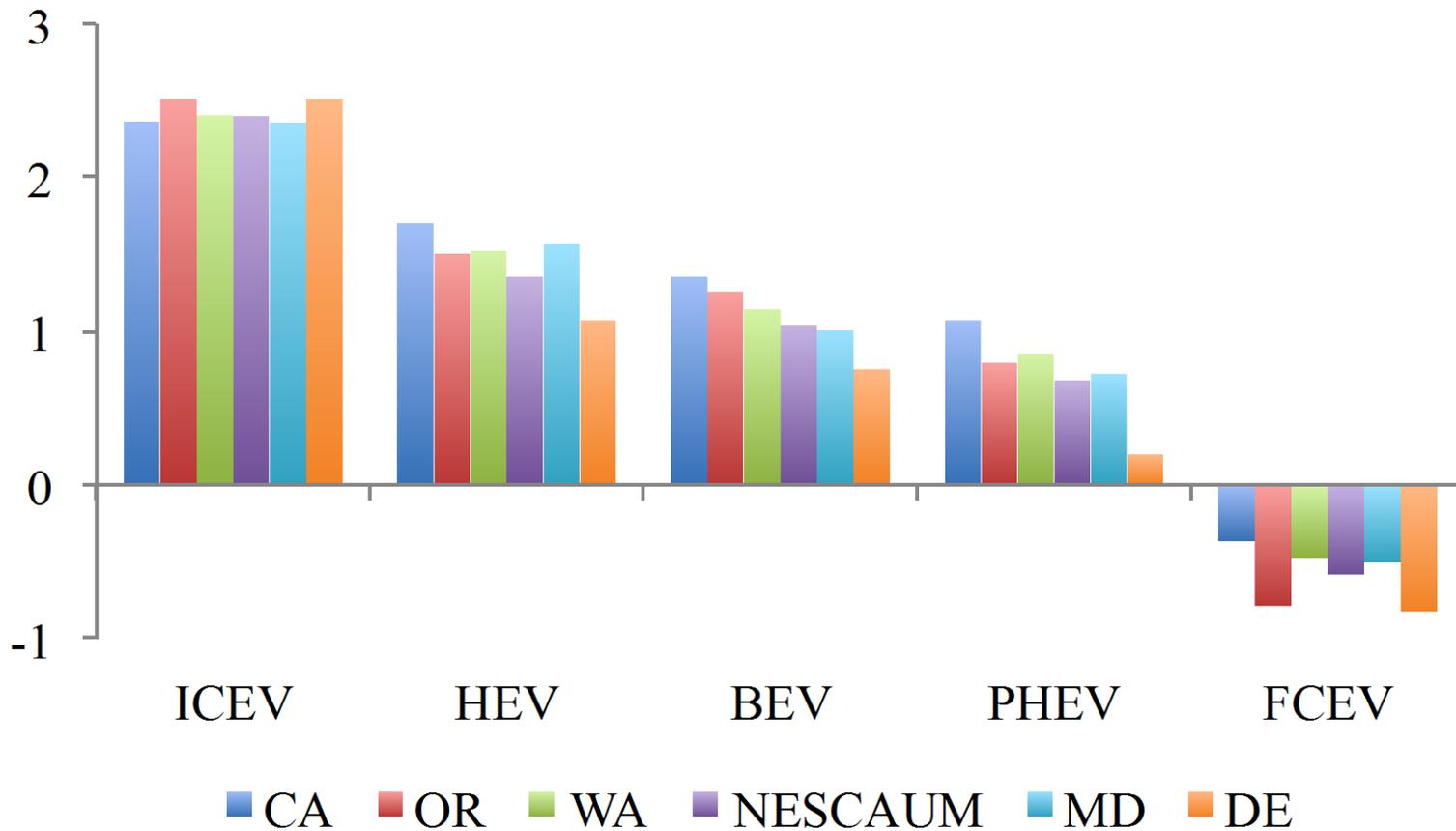
- Respondents' Contexts
  - Can they charge a PEV at home?
  - Do they commute by private vehicle to work?
- Respondents' attitudes toward policy goals and tools
  - Air quality is motivating across most states
    - Regional risk, personal threat
  - Incentives
    - Awareness of federal incentives or support for incentives

# What is correlated with drivetrain designs?

- Specific assessments of PEVs and FCEVs
  - Whether electricity and/or hydrogen is a likely replacement for gasoline and diesel;
  - Extent to which respondents have already considered acquiring a PEV or FCEV.
  - Whether respondents have already seen PEV charging in the parking facilities they use
  - Personal interest in ZEV technology;
  - Familiarity with drivetrain types in the design games: ICEVs, HEVs, PHEVs, EVs, and FCEVs;
  - Prior assessments of EVs and FCEVs on six dimensions including charging/fueling, purchase price, safety, and reliability;
  - Experience driving vehicles of the different drivetrain types;

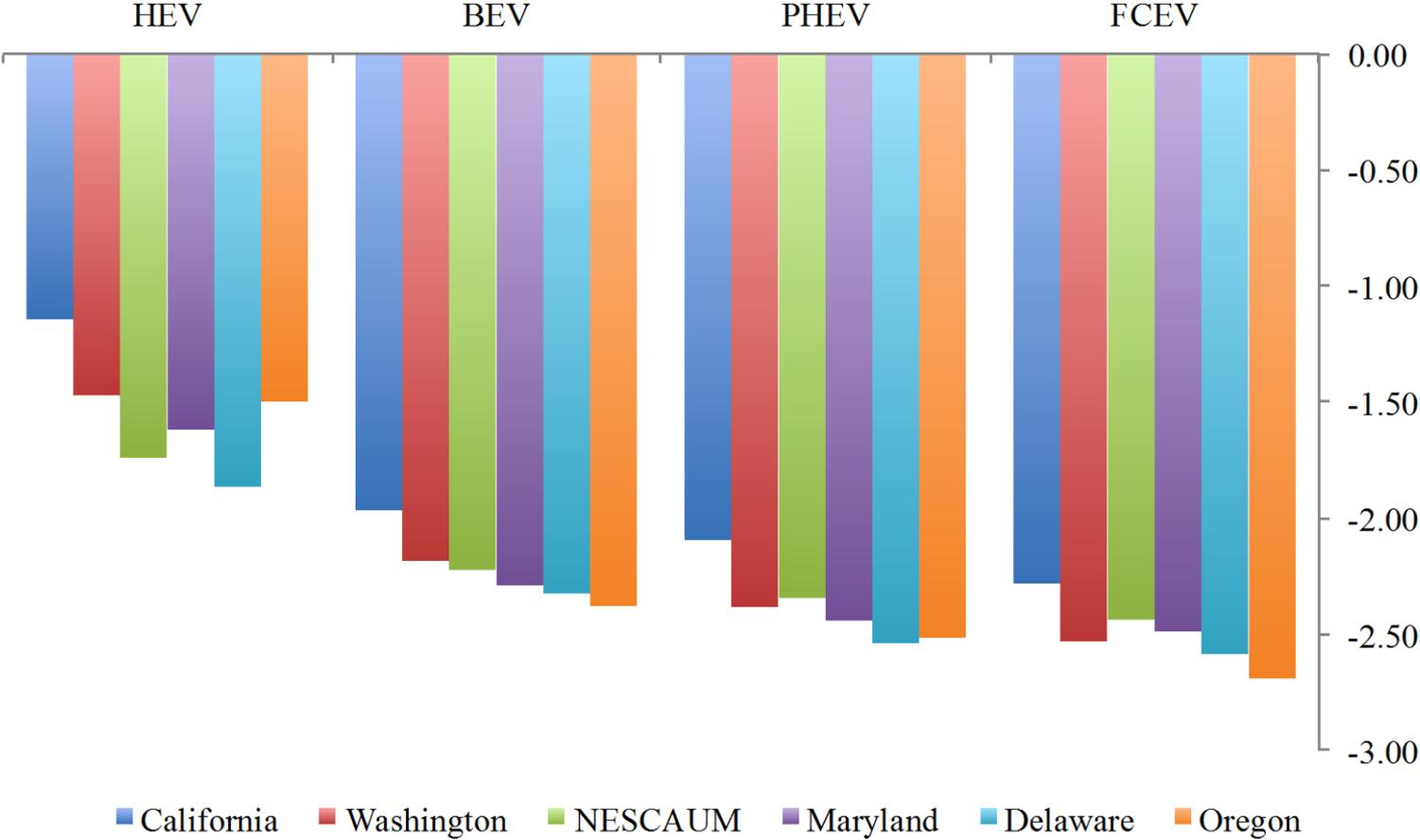
Are you familiar enough with these types of vehicles to make a decision about whether one would be right for your household?

Mean scores; -3 = no, 3 = yes

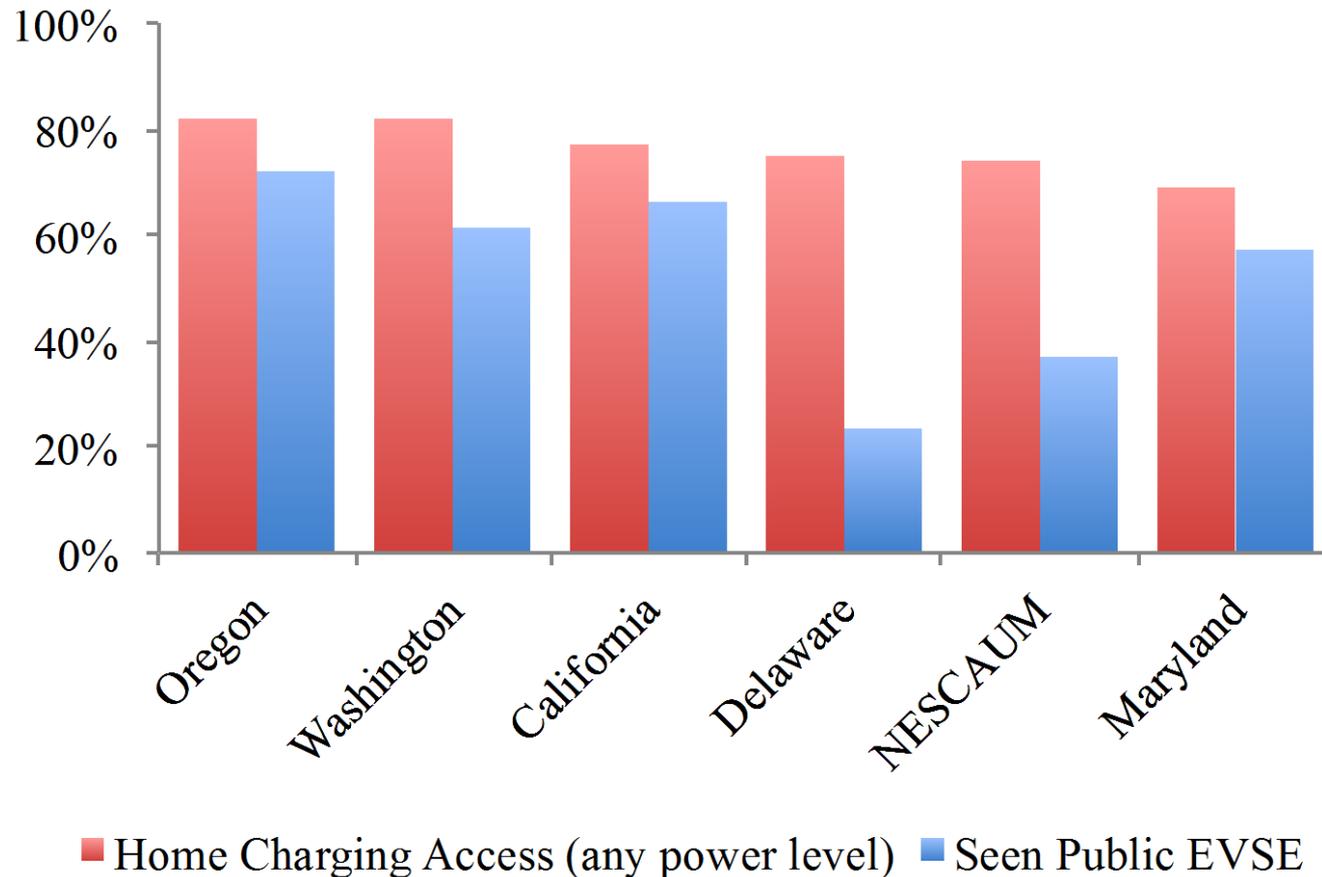


# How much driving experience do you have in these types of vehicles?

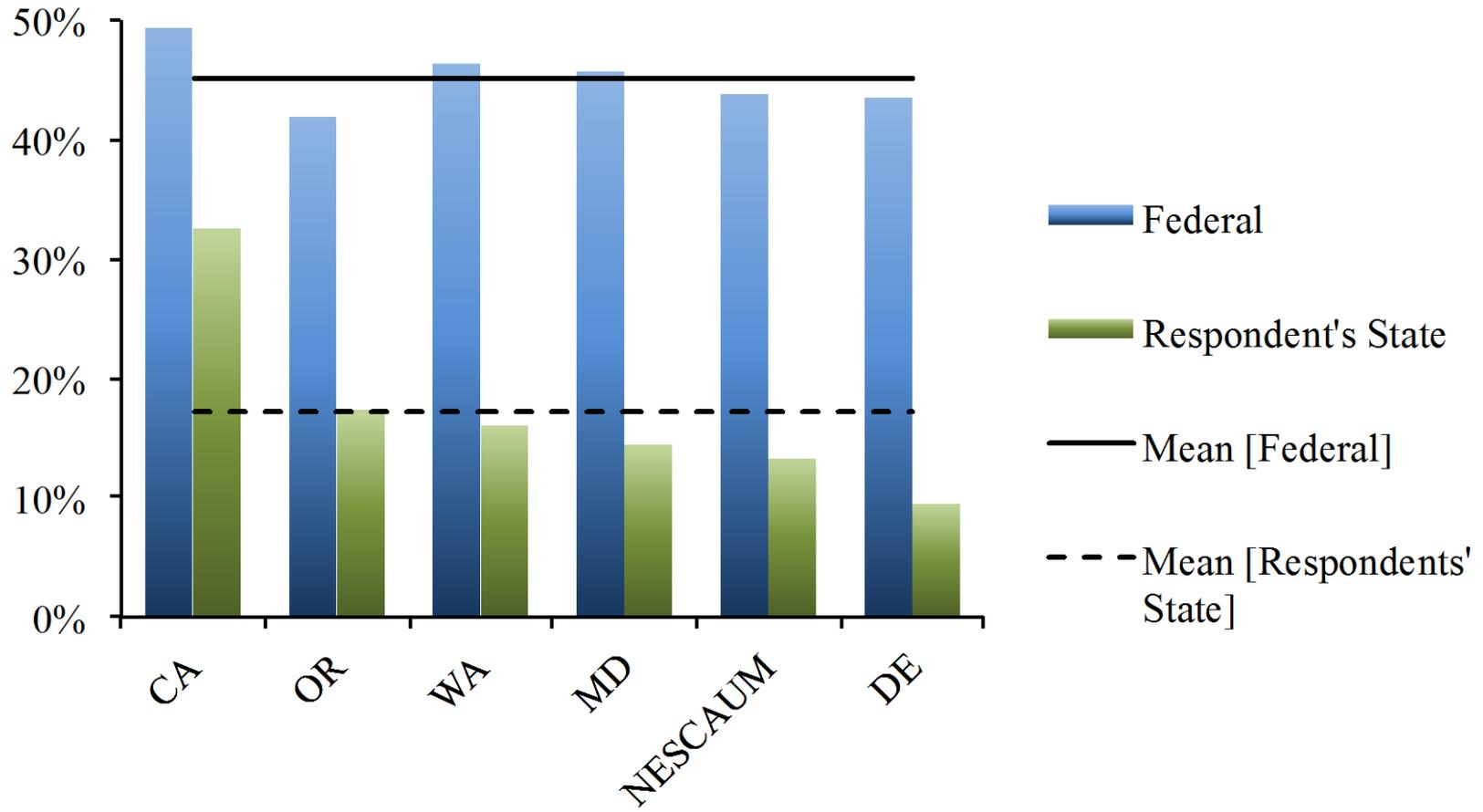
Mean Scores; -3 = none at all; 3 = extensive



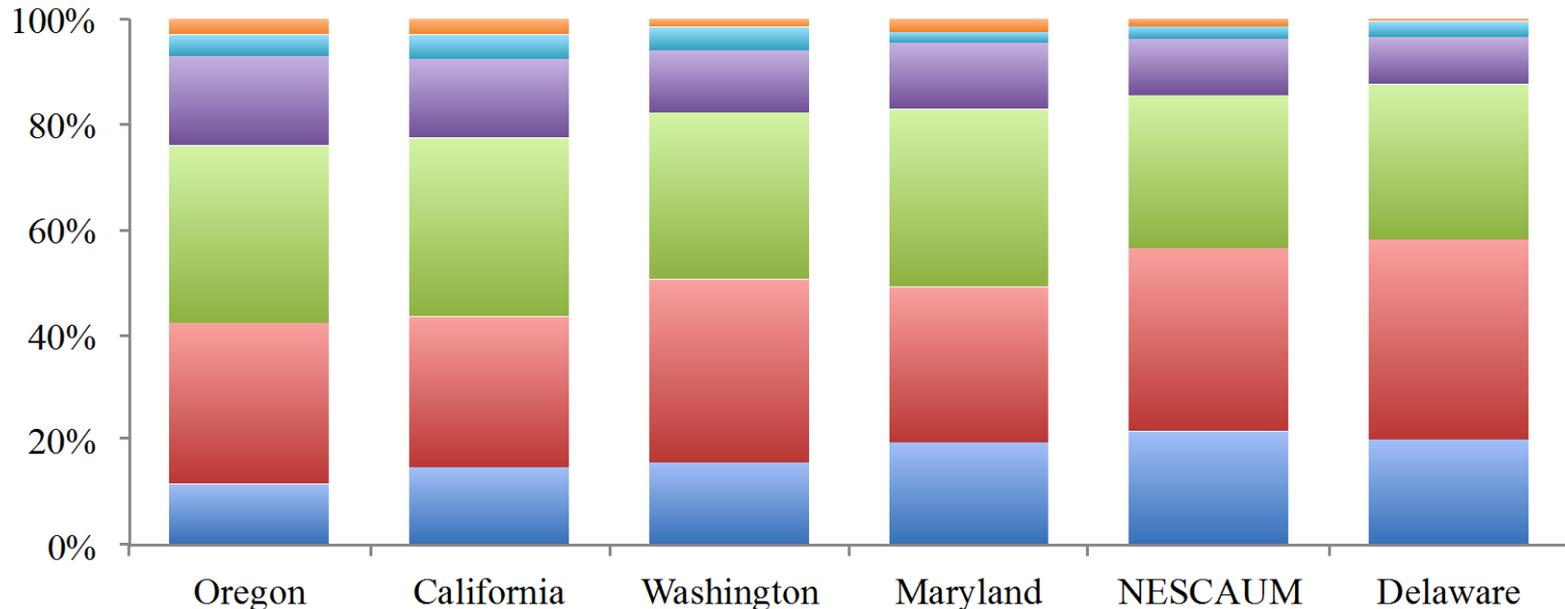
Self described access to charging at home parking location and whether they have seen electric vehicle charging in the parking garages and lots they use. Percent “yes.”



As far as you are aware, is each of the following offering incentives to consumers to buy and drive vehicles powered by alternatives to gasoline and diesel? Percent “yes.”



# Have you considered a vehicle that runs on electricity for your household?

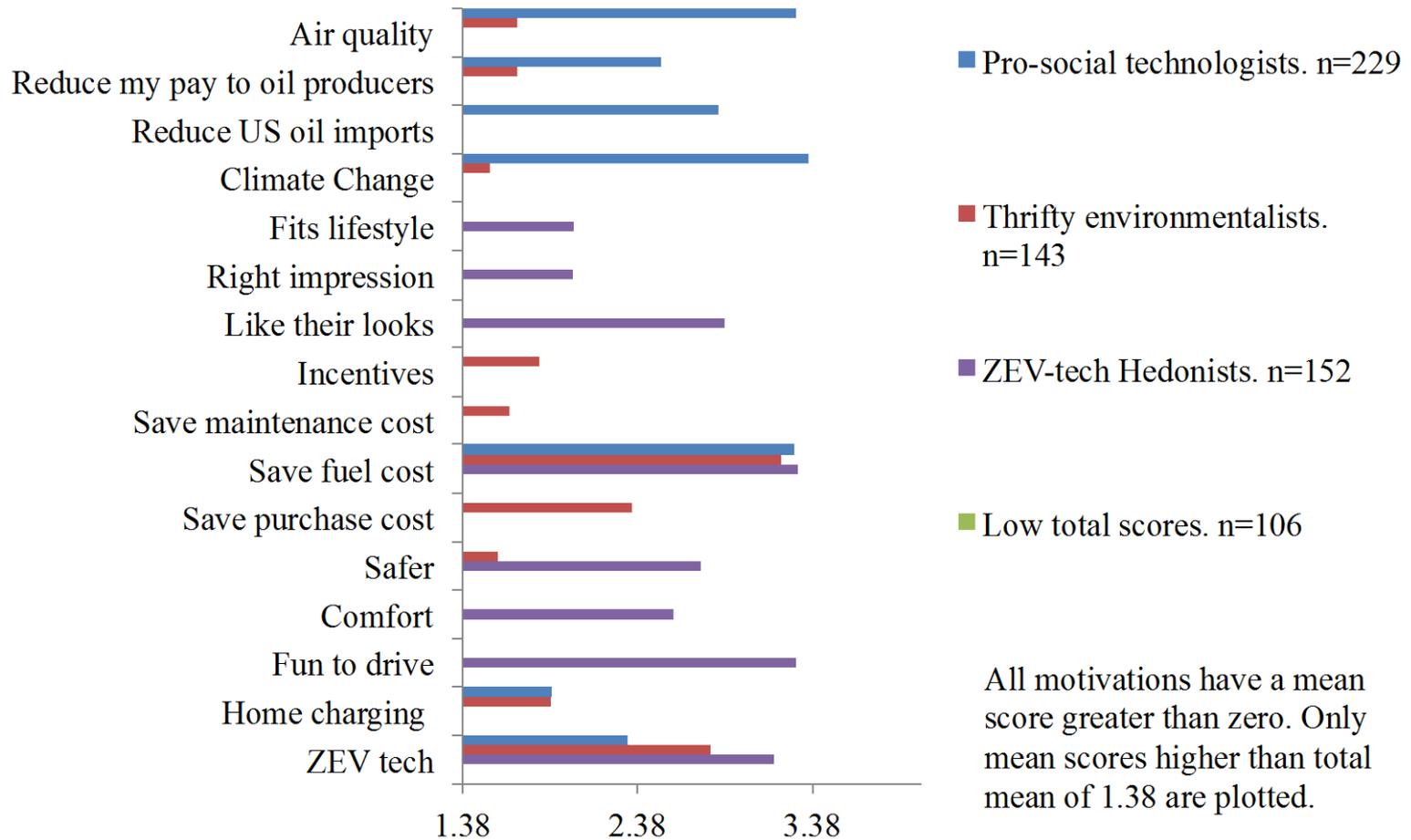


- I (we) already have a vehicle powered by electricity
- Shopped for an electric vehicle, including a visit to at least one dealership to test drive
- Started to gather some information, but haven't really gotten serious yet
- The idea has occurred, but no real steps have been taken to shop for one
- I (we) have not considered buying a vehicle that runs on electricity but maybe some day we will
- I (we) have not and would not consider buying a vehicle that runs on electricity

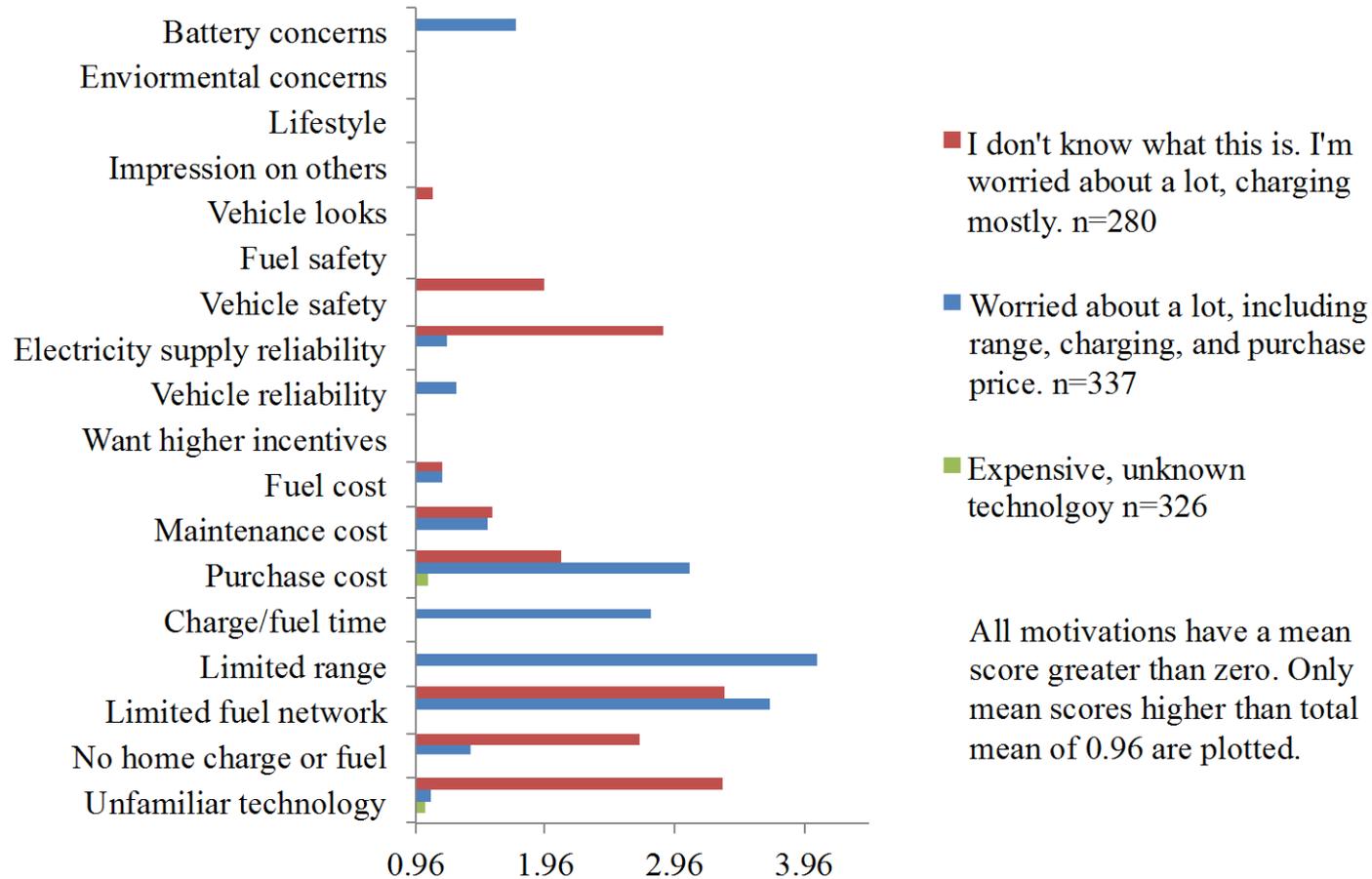
# Why do people design PEVs and FCEVs, or not?

1. Modeling design game results
2. Post-game motivations

# Why do people design PHEVs, BEVs, or FCEVs?: California



# Why *don't* people design PHEVs, BEVs, or FCEVs?: California

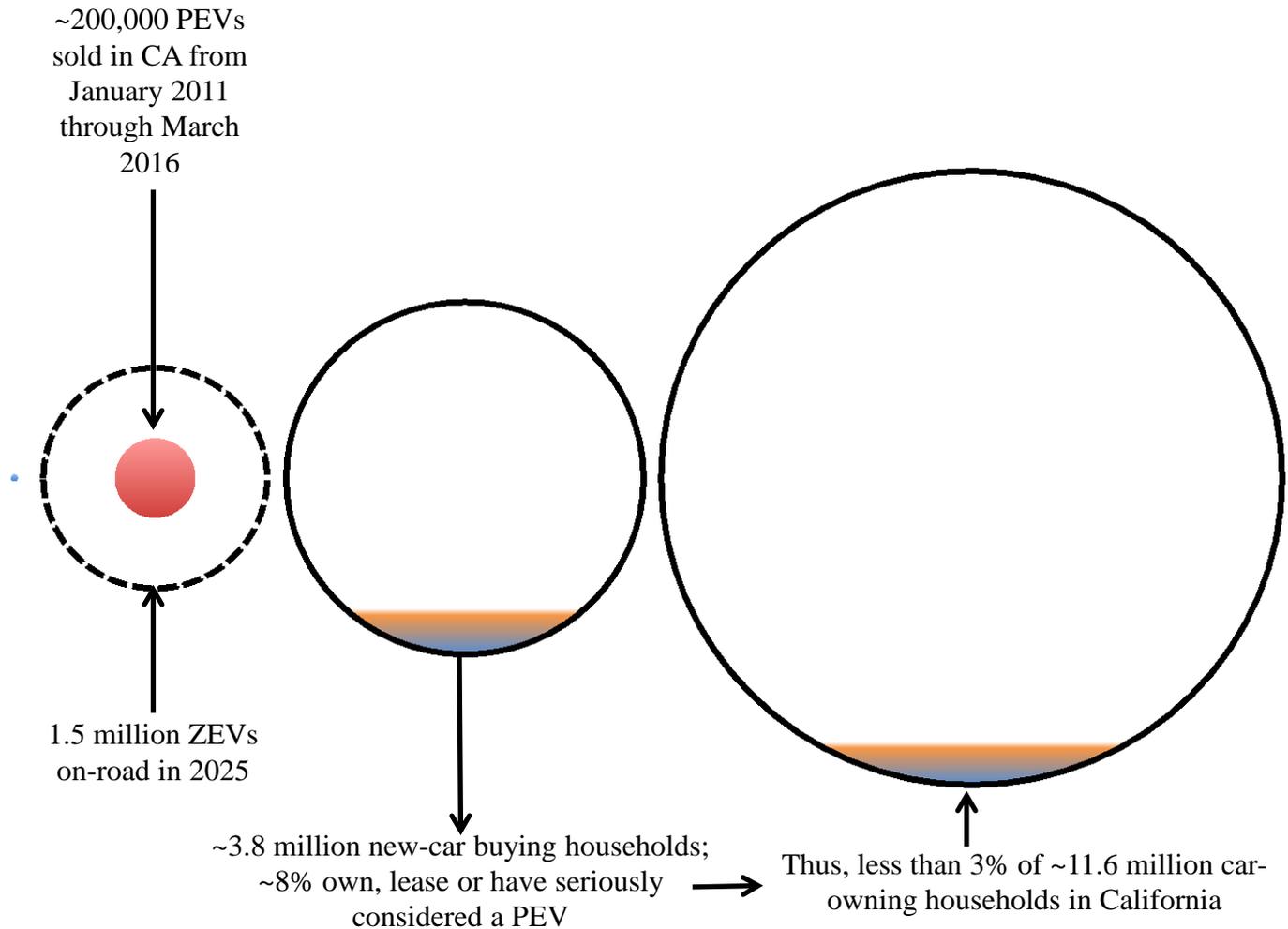


# Progress toward ZEV goals

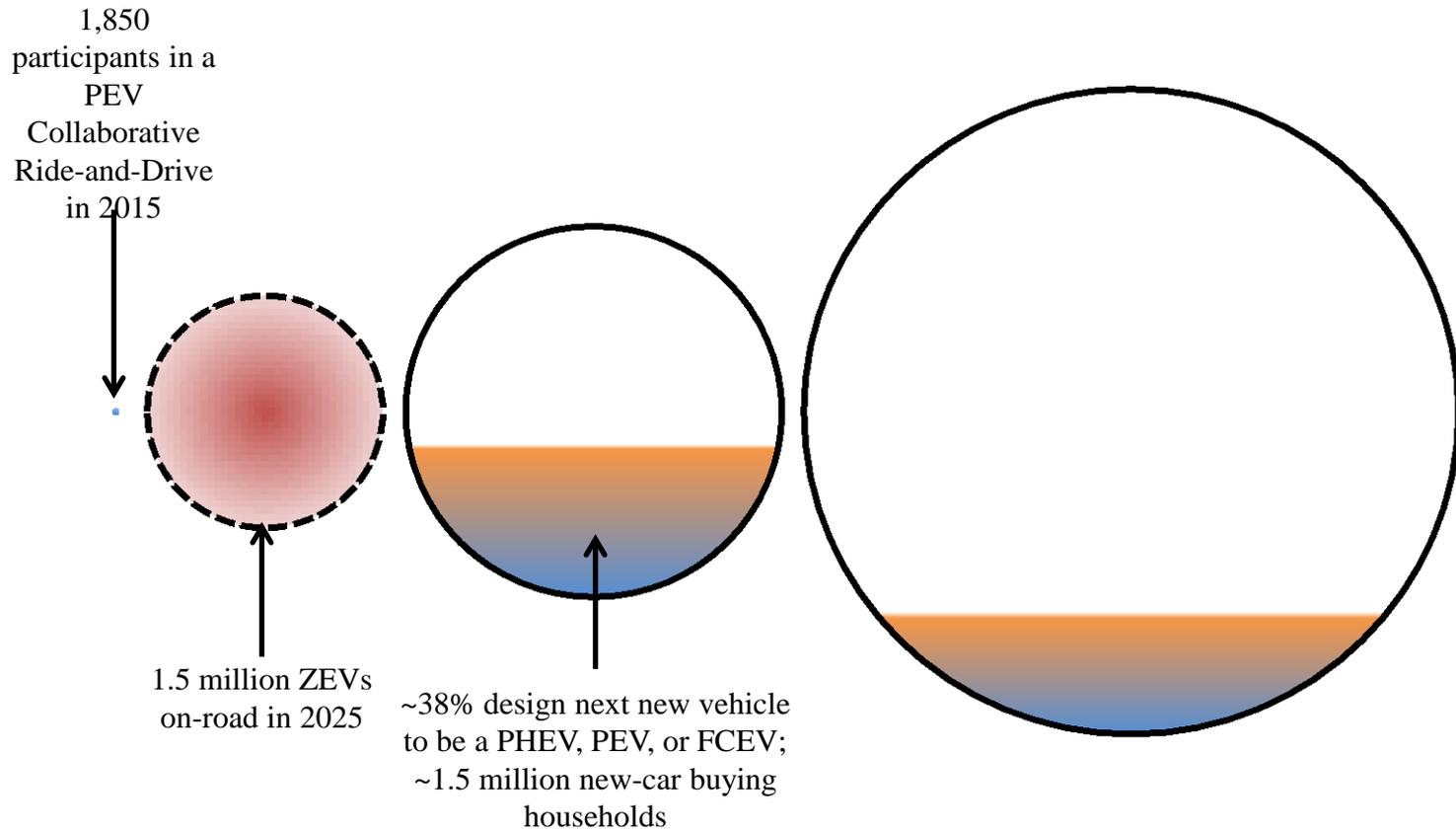
# Population estimates of new car buyers with positive PHEV, BEV, or FCEV valuation

	<b>Occupied housing units x 1,000 (US Census)</b>	<b>Vehicle available (ACS)</b>	<b>% buy new (est. from past UCD surveys)</b>	<b>% Design PEV or FCEV Game 3</b>	<b>Population Estimate x 1,000</b>
Oregon	1,523	92%	33%	38.7%	181
<b>California</b>	<b>12,617</b>	<b>92%</b>	<b>33%</b>	<b>38.1%</b>	<b>1,476</b>
Washington	2,645	93%	33%	35.9%	295
Maryland	2,156	91%	33%	31.4%	204
Delaware	339	94%	33%	28.0%	30
NESCAUM	16,078	81%	33%	26.6%	1,151
Total					3,337

# Households and PEVs in CA



# Households and PEVs in CA



# Conclusions

1. Despite low awareness, knowledge, experience, and prior consideration, across the states and regions in this study 24% to 39% of respondents design a PEV or FCEV as their next new vehicle.
    - CA: 38%
- ~3.34 million new car-buying households
- CA: ~1.48 million

# Conclusions

2. The effects of incentives (as offered):
  - Among those who designed a PEV or FCEV:
    - ~20% more PEV and FCEVs
  - Among those who did not design a PEV or FCEV:
    - (Increased) incentives may have had little effect
      - 2.5% to 5% say higher incentives would have “tempted” them to design a PHEV, BEV, or FCEV

# Conclusions

3. Most households with negative ZEV valuation have yet to ask themselves, “Is a PEV or FCEV right for my household?”
  - The litany of motivations against designing a PEV or FCEV may be as or more important than any single motivation.
    - Highlighted by the high scores pervasively given to “unfamiliar technology”

# Conclusions

4. The importance of awareness, knowledge, experience, and prior consideration
  - ~38% positive ZEV valuations because ZEV technology
  - ~62% negative ZEV valuations because new technology
    - If you aren't aware of passing generations of improving ZEV technology, you always think you're being asked to be a risk-taker.
  - Promotional policies that mitigate up-front costs still leave the “new-technology averse” with an expensive unknown.
  - Promotional policies to prompt awareness and provide knowledge and experience address that unknown.

# Conclusions

5. Those with positive ZEV valuations have multiple motivations suggesting multiple media and messages to reach them.
  - Everyone highly motivated by fuel cost savings is highly motivated by something else, too.

# Acknowledgements

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- Oregon Department of Environmental Quality
- Washington State Department of Ecology