

Brett Williams, PhD – Principal Advisor, EV Programs

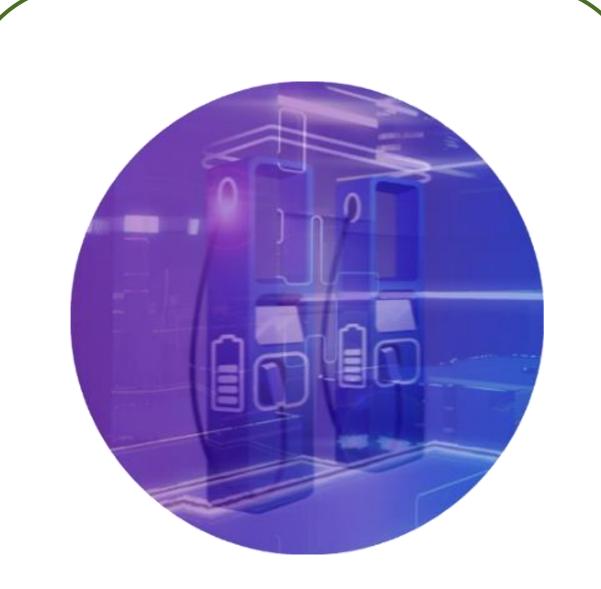
with thanks to Jennifer Boughton, Michelle Jones, Eric Fullenkamp, and others at CSE

Image: https://www.revermont.org/our-work/





CSE Areas of Expertise



Clean **Transportation**

Adoption of electric vehicles and deployment of charging infrastructure



Advancing energy efficiency and renewable resources



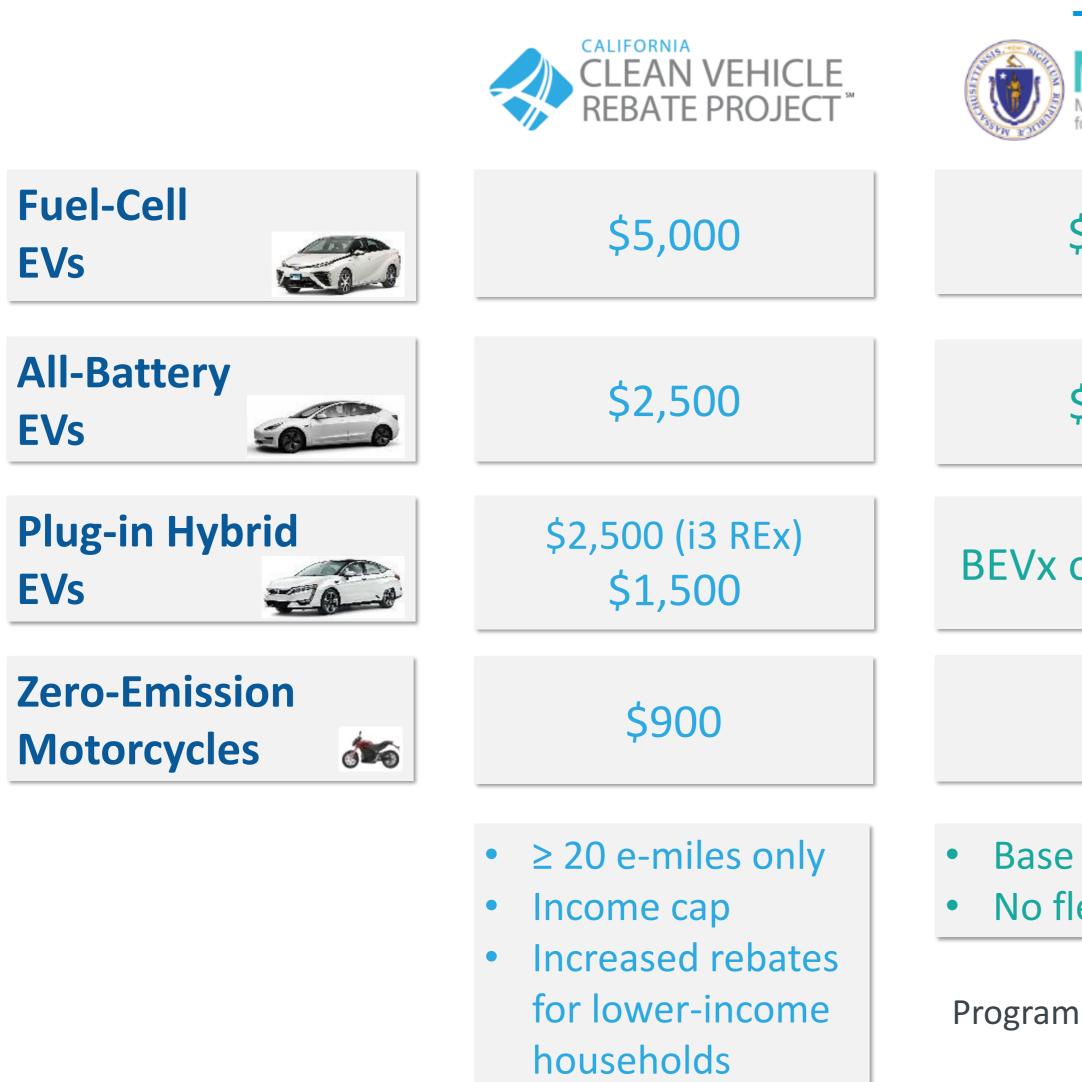
Built Environment

Technology Convergence

Interconnecting systems to achieve decarbonization



State EV Rebate Programs Administered by CSE

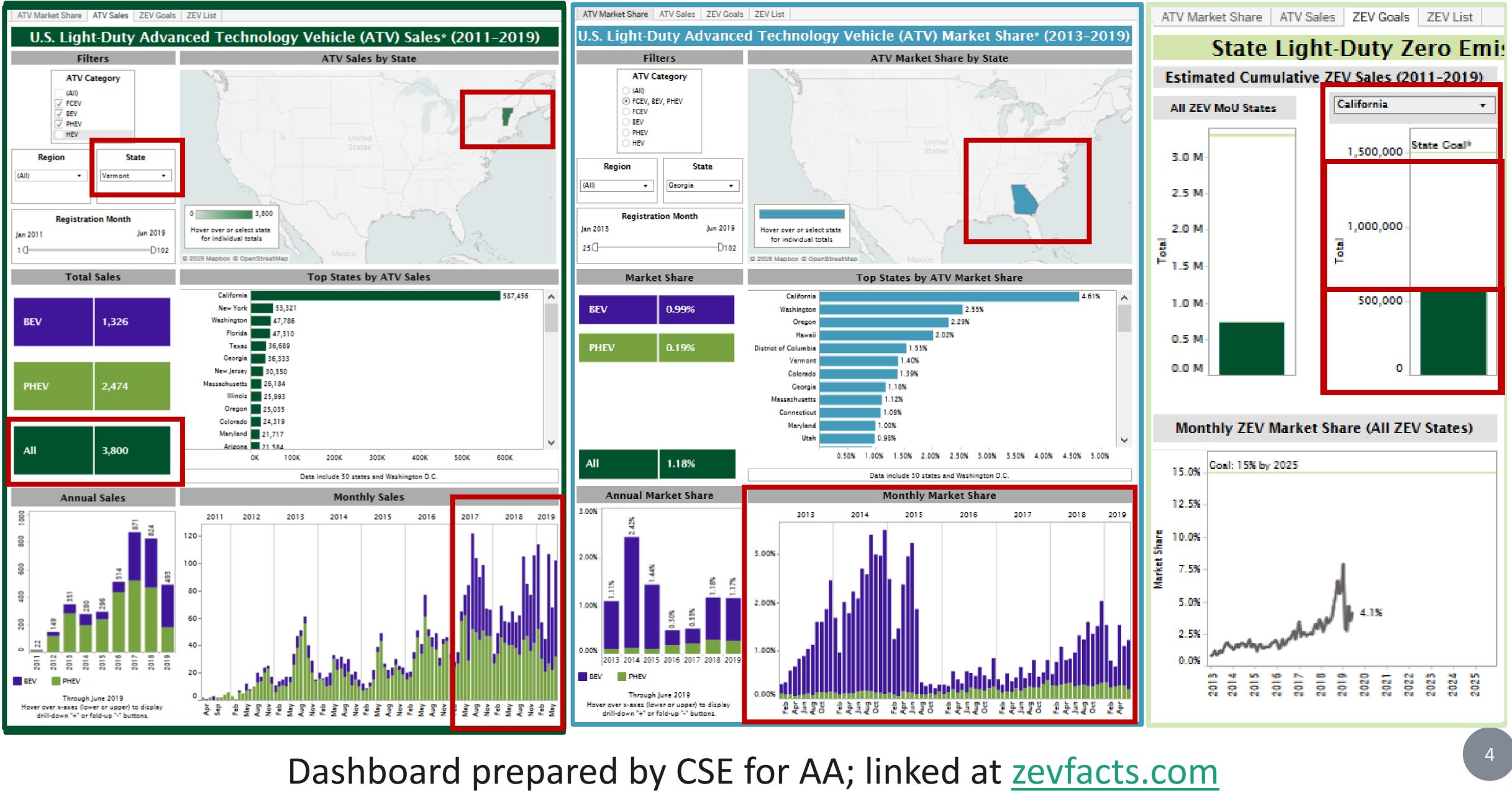


(as of Jan. 2019; Oregon pending)

MOR-EV Massachusetts Offers Rebates for Electric Vehicles	Connecticut Hydrogen and Electric Aut	tomobile Purchase Rebate	2	
\$1,500	\$5,0	00	<u>e-mile</u>	<u>S</u>
	<u>e-miles</u>		≥ 120	\$2,000
\$1,500	≥ 200	\$2,000	≥ 40	\$1,700
	≥ 120 < 120	\$1,500 \$500	≥ 20	\$1,100
only: \$1,500	≥ 45 < 45	\$1,000 \$500	< 20	\$500
\$450				
e MSRP ≤ \$50k Fleet rebates n ended 9/30/19	 BEVs & PH \$50k base FCEVs ≤ \$6 Point-of-sa \$150 deale incentive 	MSRP, 50k ale option	\$60 max	e MSRP > k = \$500 <.; nt-of-sale



AA 50-State EV Sales, Market Share, and Goals Dashboard



- Statewide EV Rebate Program Update
 - Outputs: Vehicles & Consumers Rebated – Outcomes: Behaviors Influenced

 - Impacts: Emission & Market
- Additional Design Considerations
 - Rebate Effectiveness
- Dealer Incentives
- Wrap Up, Additional Info

* EVs = light-duty plug-in hybrid, battery, and fuel-cell electric vehicles (PHEVs, BEVx vehicles, BEVs, and FCEVs)

Outline

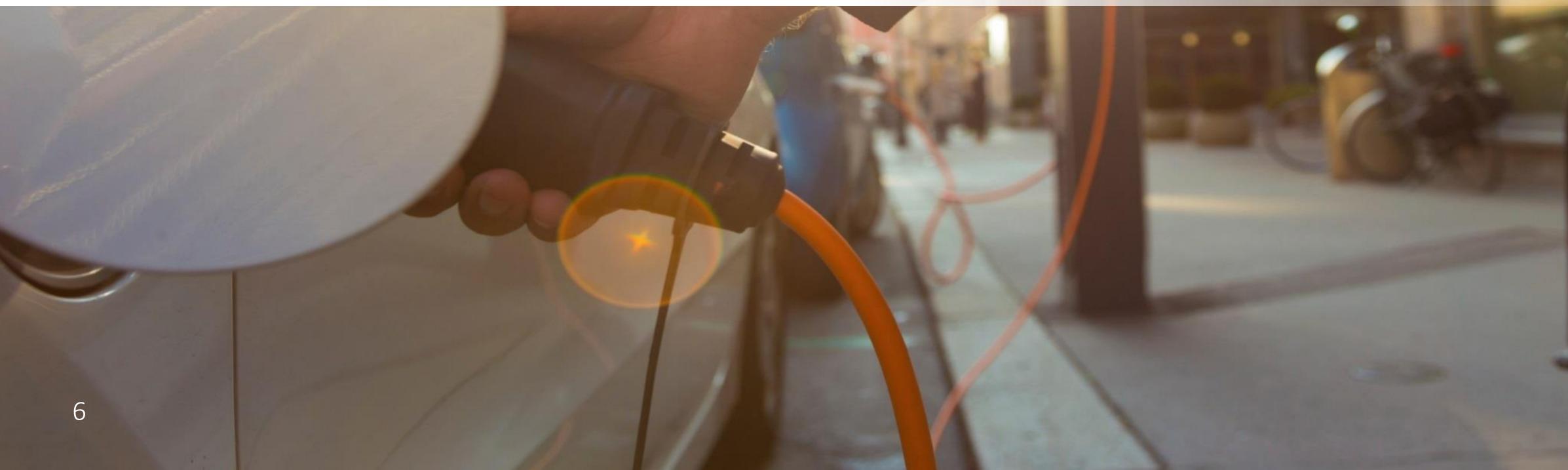
– Equity: Income caps compared to MSRP caps





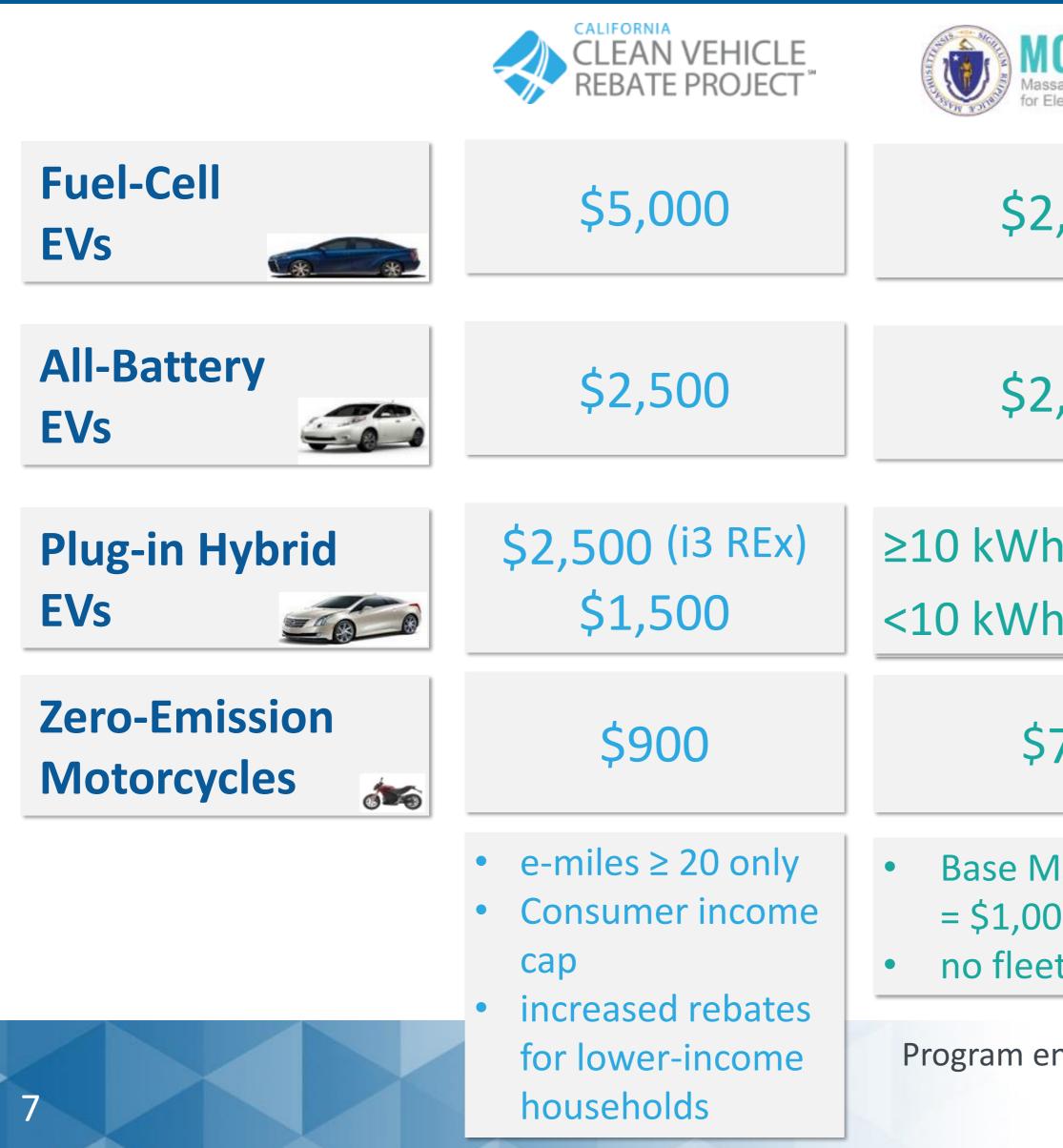
Statewide EV Rebate Program Update

Outputs, Outcomes, and Impacts

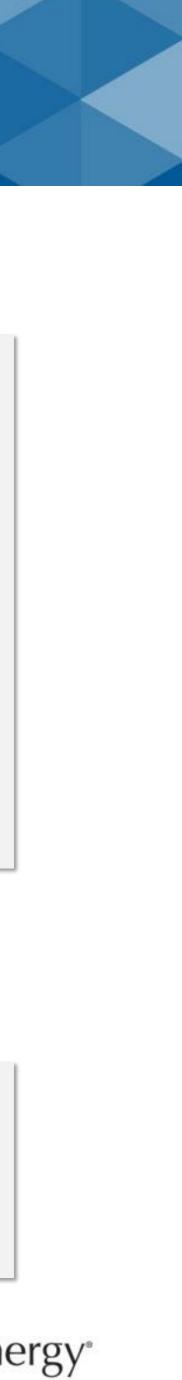




EV Rebate Designs (As of Sept. 2018; Reflective of Most of the Data Gathered)

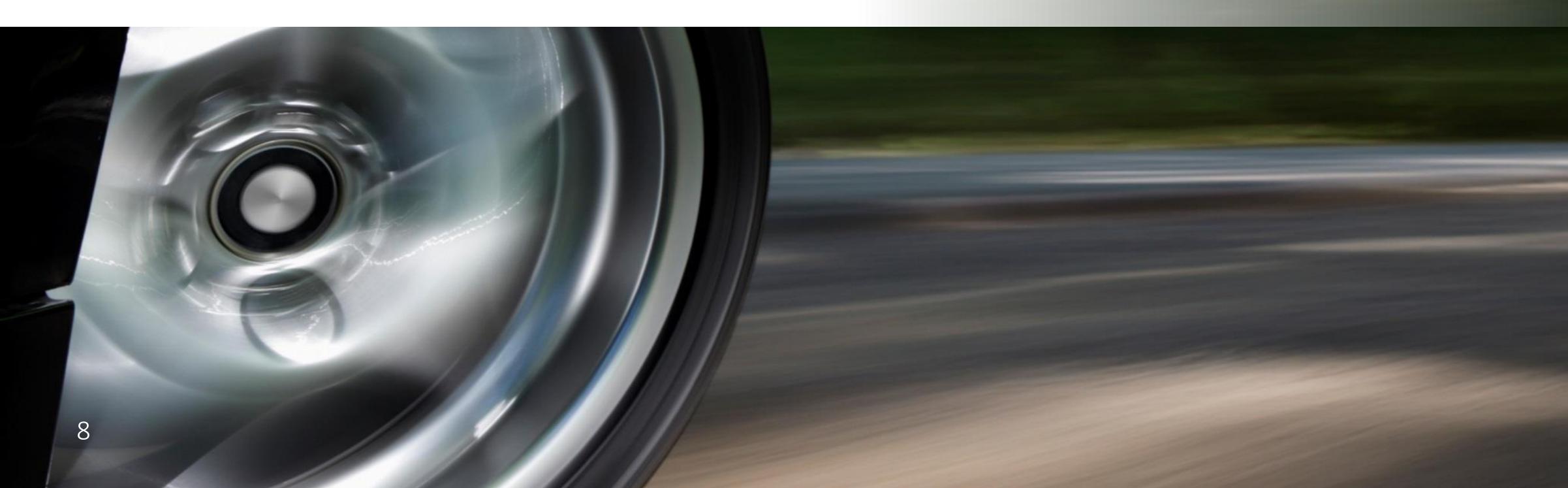


OR-EV ssachusetts Offers Rebates Electric Vehicles	Connecticut Hydrogen and Electric	Automobile Purchase Rebate		NEW YORK STATE	
2,500	\$5,000		<u>e-miles</u>		
2,500	<u>e-miles</u> ≥ 175 ≥ 100	\$3,000 \$2,000	≥ 120 ≥ 40	\$2,000 \$1,700	
h \$2,500 h \$1,500	< 100 ≥ 40 < 40	\$500 \$2,000 \$500	≥ 20 < 20	\$1,100 \$500	
750					
ASRP ≥ \$60k 00 max. et rebates		ignment er incentive	 Base MS \$500 m point-of dealer 		
ended 9/30/19	(\$300 prev	vious)	Center for Sustainable En		





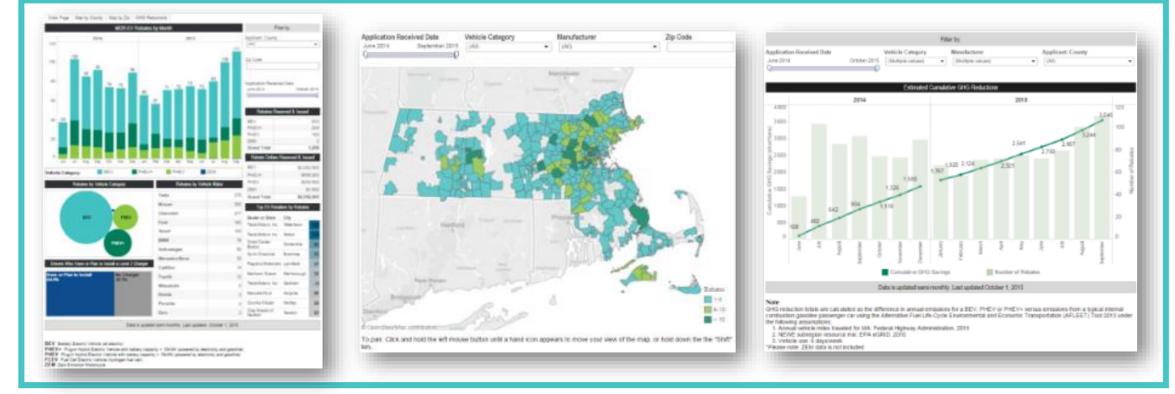
Outputs: Vehicles Rebated



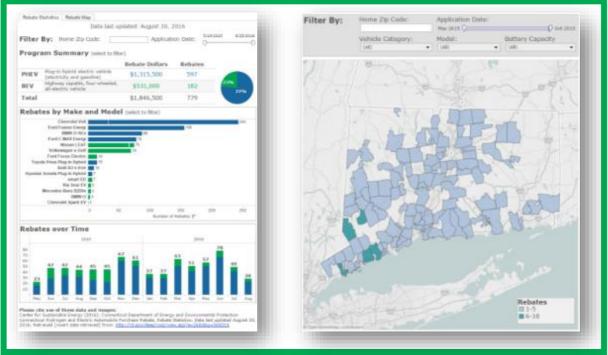
Where Are EV Rebates Going? Public Dashboards and Data Facilitate Informed Action



cleanvehiclerebate.org



mor-ev.org



ct.gov/deep

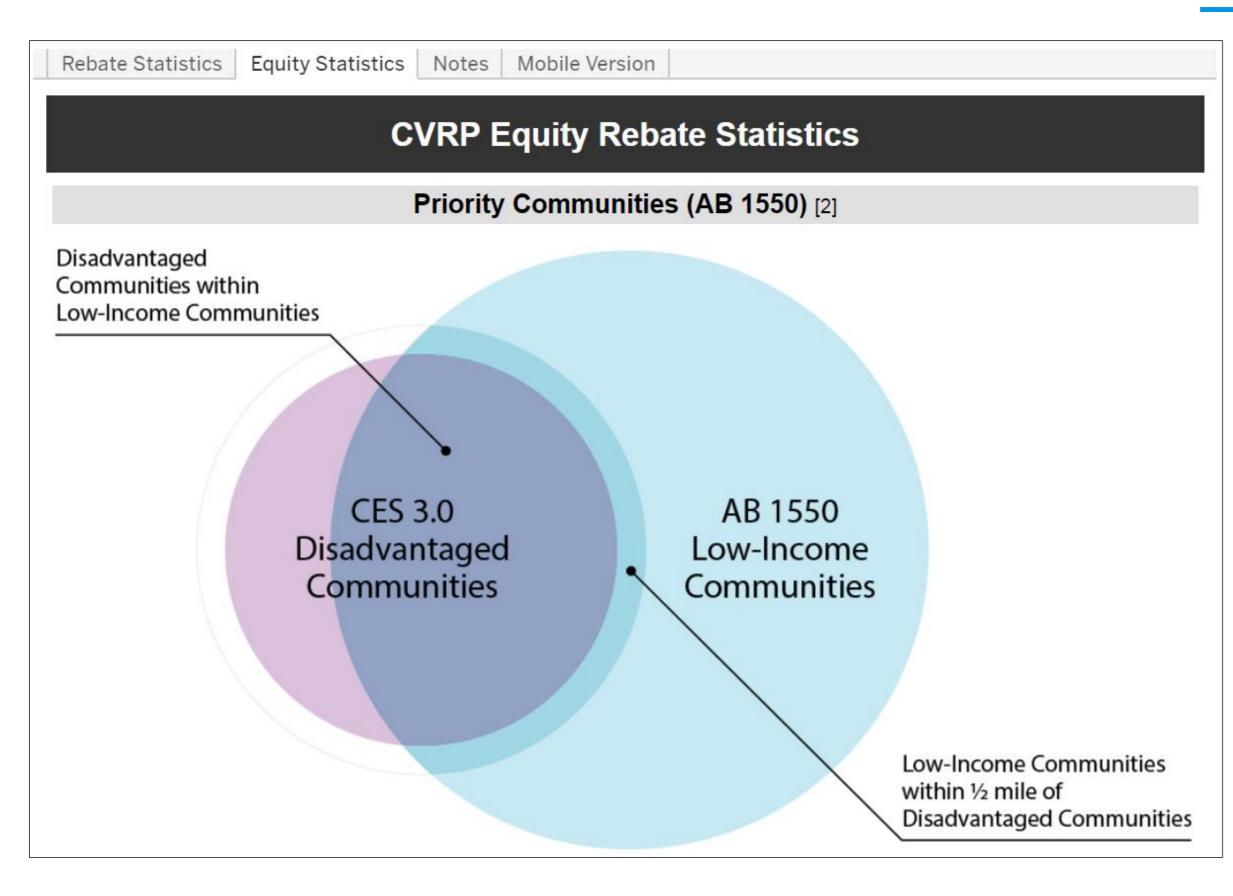
1040	6,580	NOW- POIT	\$8,473,80		17,344	6,580	\$8,473,800	17,344
-	Mitt	1	989	BEV.				Filter by
1	22	-		adulas tur	filtechy: Cours	to She	Al	acter ranges 30
				thile Tigst			5	Stational -
- C - E - E - E - E - E - E - E - E - E								Prove 10 10 10 10 10 10 10 10 10 10 10 10 10
12 L L			PET				5.00 - 10	A CONTRACT OF
2.00			726	-	And includes the second state	5 6 2	A. 19	
2.1			726 Mit auto		Sector Sec	5 P. 3	AL ST	All aller
2.1			726 Mit auto		And includes the second state		A A A	
2.1		11	726 Mit auto		Sector Sec	3		
: . 1	1 7 7 7 7 7 7 7 7		726 Mit auto	per et an canada	An open from the second			in in interest in the second s
2	Triation	181.	1756 Wet Holder 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	ph Harcania 2ku	Sector Sec			
2	Name and Minder		1956 197 Dealer	per et an constantes		-		in in interest in the second s
2 J	Trias Free Disc Press Disc Van Forenting	1455 - Ni 151 141	176 IN Content IN Content I	and an amount of the second se	And			in in interest in the second s
2 J	Main and Michel Price Prime One Viet Ferromotiong 1-9/Prime p	1455 - 30 31 34 34	176 Whit is not be recently included by Dealer Transformed by Dealer Statistic type 1 Statistic type 1 Stati	20-1 20-1 20-1 20-1 20-1 20-1 20-1 20-1	An operation of the second sec			in in interest in the second s
2 g	Trias Free Disc Press Disc Van Forenting	1455 - Ni 151 141	176 IN Content IN Content I	20-1 20-1 20-1 20-1 20-1 20-1 20-1 20-1	And			
2 J	Man and Michael PristPrint UR Ver Forening 1-Monorg Print Spain Epite Print Epite Print	185 - 10 11 14 14 14 14 14 14 14	Told With automatic sector and sector and sector and sector and sector and sector and devices types that which sector and devices types that which sector and sector and sector and devices types that which sector and phases types that and sector and phases types		An operation of the second sec			in in interest in the second s
2 J Theorem has Theorem Decoded Theorem Sec	Alter Hold Backer Triat Freq Ell Van Ferenseng Hold Anno Factor	1851 - Ni 22 84 99 7 1 1 1 1 1 1 1 1	Total Mitti and Mitti and Totalita d'America Instance Social Carlos de America Instance Social Carlos de America Nationa de Ame	and the classic and th	An operation of the second sec			in in interest in the second s
2 J There is a second there is a second time	Millio de 2 Million Presi Prine Dil Vali Forenciere Pare Seator Maio 20	101 - 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Told With make With make With make Second Second Second Second Second Second Second Second Second Second Second Second Se		An operation of the second sec			in in interest in the second s
2 J Theorem has Theorem Decoded Theorem Sec	Alter Hold Backer Triat Freq Ell Van Ferenseng Hold Anno Factor	1851 - Ni 22 84 99 7 1 1 1 1 1 1 1 1	Total Mitti and Mitti and Totalita d'America Instance Social Carlos de America Instance Social Carlos de America Nationa de Ame		An open series of the series o			in in interest in the second s
2 J Theorem has Theorem Decoded Theorem Sec	Main and Michael Price Press Unit Van Forenering Lagranding Reset Reset Sale 201 201 201 201 201 201 201 201 201 201	185 - 121 - 121 - 14 - 121 - 14 - 121 - 14 - 121 - 14 - 121 - 14 - 121 - 221 -	Tota white south the south south of the south of the south of the south south of the		And			in in interest in the second s
2 . J	Non dia Water Processor Da We Forming	1855 + N: 212 341 917 344 214 214 214 214 214 214 214 214 214 2	Tota With make With make With make Second Se		An open series of the series o			in in interest in the second s
2 J Transmitter Transmitter Transmitter Transmitter Transmitter	Minis doc 2000er / Pray Tray Vie Concentrary Frances Frances March	185 - 121 - 121 - 14 - 121 - 14 - 121 - 14 - 121 - 14 - 121 - 14 - 121 - 221 -	Tobe with a solution with a solution of the solution of bornarestee the solution of bornarestee the solution of bornarestee the solution of bornarestee the solution of the solution the solution of the solution of the solution of the solution of the solution of the solution of the solution of the solution of the solution of the solution of the solution of the solution of the solution of the solution of the solution of the solution of the solution of the solution of the solution of the solut		An experimentation for the second sec			in in interest in the second s
2 J Transition Transition Transition Transition Transition	Non dia Water Processor Da We Forming	185 - 121 - 121 - 14 - 121 - 14 - 121 - 14 - 121 - 14 - 121 - 14 - 121 - 221 -	Tota With make With make With make Second Se		An experimentation for the second sec			in in interest in the second s

nyserda.ny.gov (dashboards done by NYSERDA)

- > 350,000 EVs and consumers have received
 > \$720 M in rebates
- > 70,000 survey
 responses being analyzed
 so far, statistically
 represent > 300,000
 consumers
- Reports, presentations, and analysis growing



Equity Statistics Dashboard (partial)



8/5/19 images from <u>https://cleanvehiclerebate.org/eng/rebate-statistics</u>

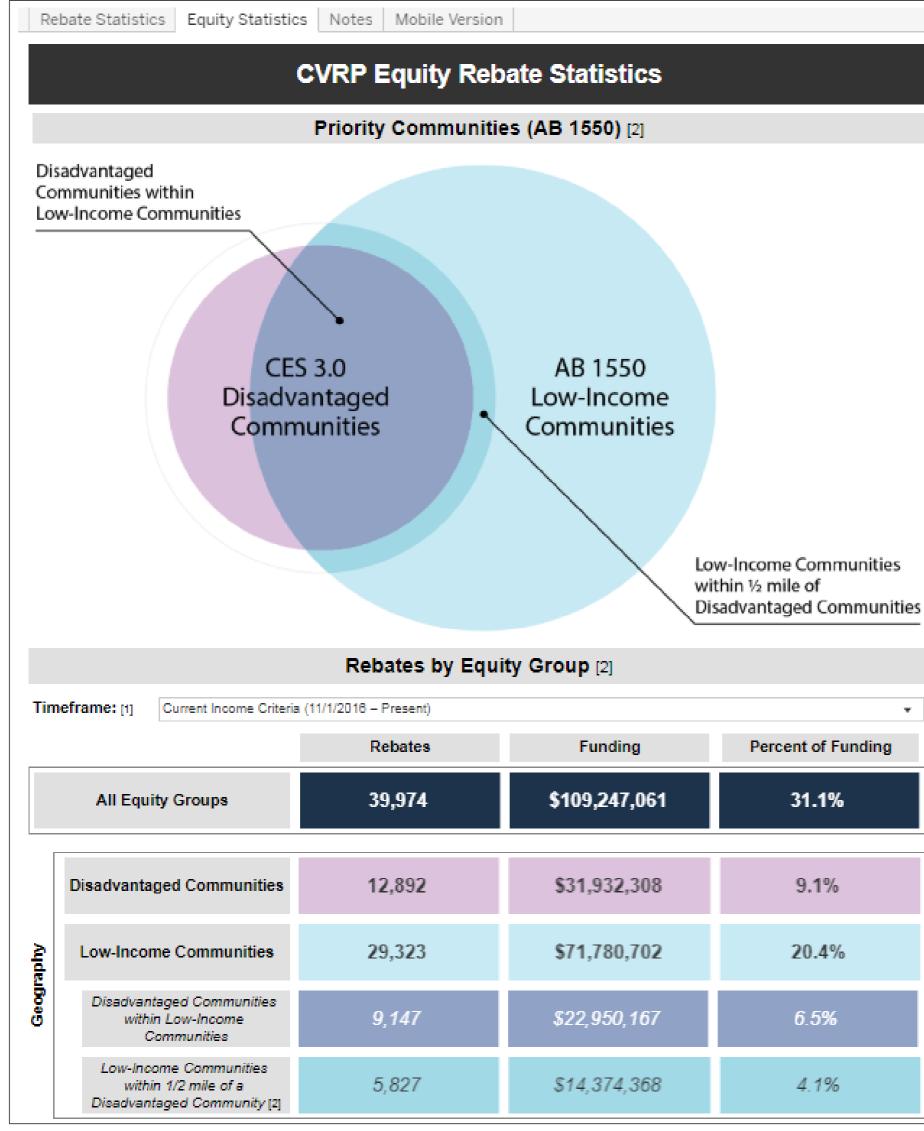


	Rebates by Equity Group [2]										
Tin	Timeframe: [1] Current Income Criteria (11/1/2016 – Present)										
		Rebates	Funding	Percent of Fun							
	All Equity Groups	39,974	\$109,247,061	31.1%							
	Disadvantaged Communities	12,892	\$31,932,308	9.1%							
aphy	Low-Income Communities	29,323	\$71,780,702	20.4%							
Geography	Disadvantaged Communities within Low-Income Communities	9,147	\$22,950,167	6.5%							
	Low-Income Communities within 1/2 mile of a Disadvantaged Community [2]	5,827	\$14,374,368	4.1%							
Type											
Rebate Ty	Increased Rebates for Low-/Moderate-Income Consumers [1]	11,405	\$46,553,152	13.3%							
ľ Ř											

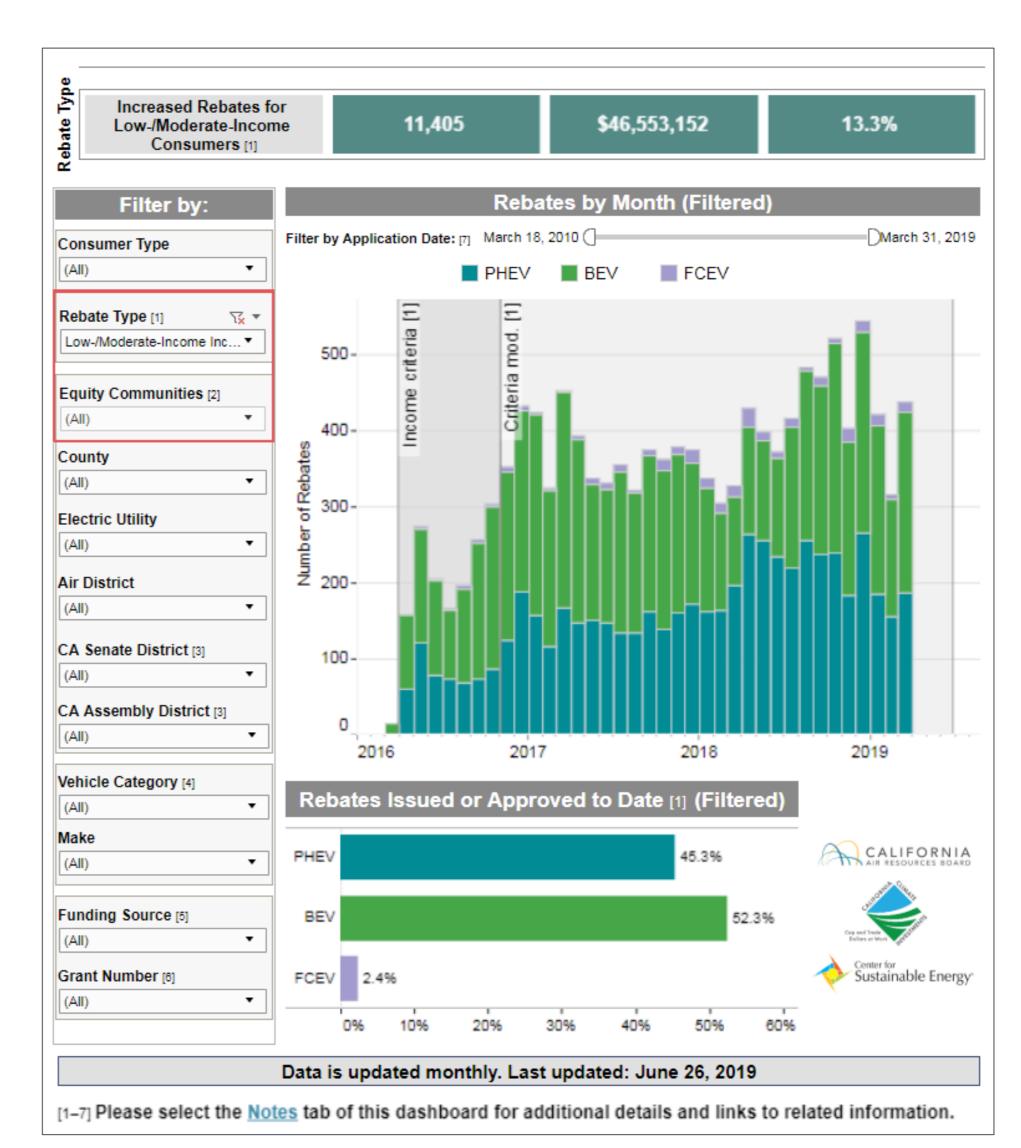




Equity Statistics Dashboard





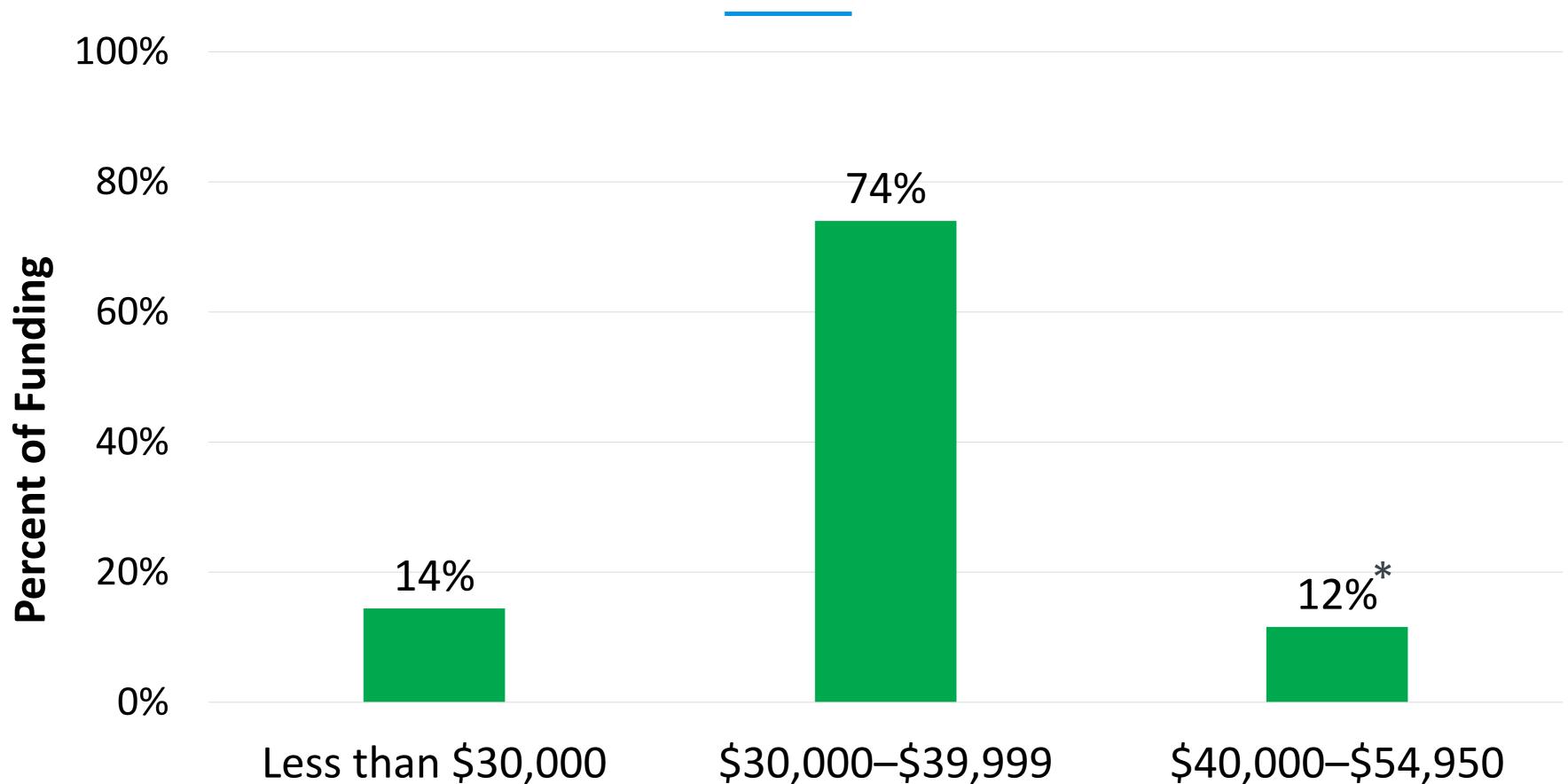


8/5/19 images from <u>https://cleanvehiclerebate.org/eng/rebate-statistics</u>





Moderately Priced Vehicles Received Most Funding (thru April 2018, pre-"Model 3 effect")



*\$44,000 MSRP used for all rebated Model 3 vehicles. N=2,709 total CHEAPR rebates through April 2018; includes fleet rebates

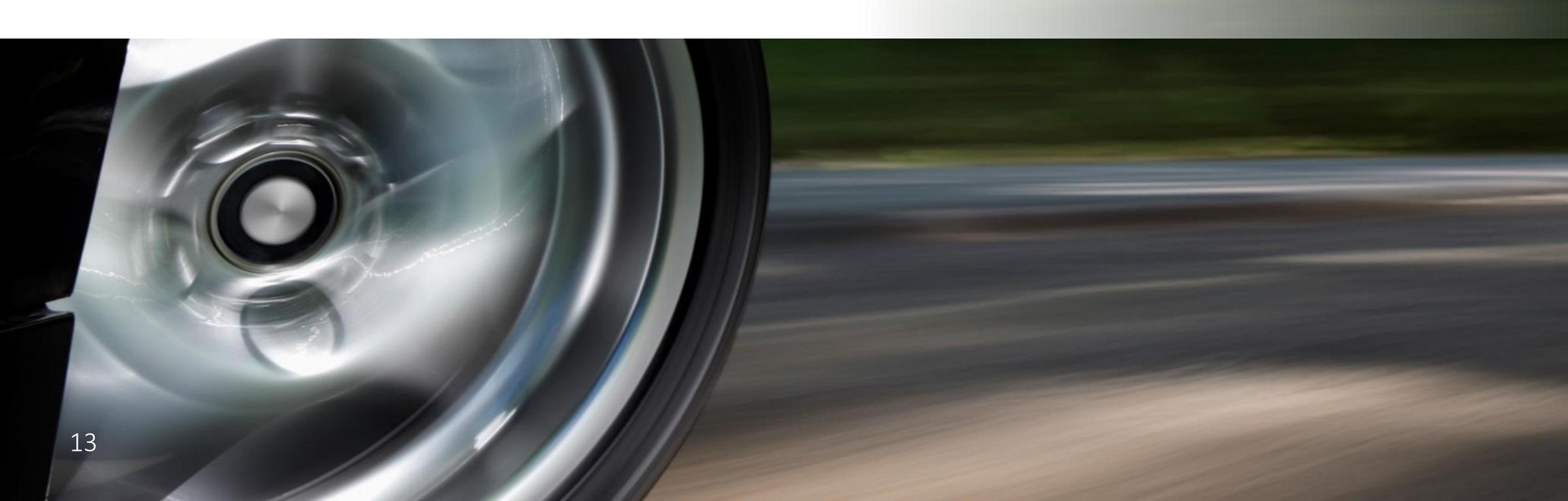


\$30,000–\$39,999 \$40,000–\$54,950 **Base MSRP**





Outputs: Consumers Rebated



Consumer Survey Data (Shows Rebates to Individuals Only)

	CALIFORNIA CLEAN VEHICLE REBATE PROJECT	Massachusetts Offers Rebates for Electric Vehicles	Connecticut Hydrogen and Electric Automobile Purchase Rebate		Total
Vehicle Purchase/ Lease Dates	Dec. 2010 – Dec. 2018	Jun. 2014 – Oct. 2018	May 2015 – Sep. 2018	Mar. 2017 – Jul. 2018	Dec. 2010 – Dec. 2018
Survey Responses (total n)*	62,092	4,555	1,565	1,808	70,020
Program Population (N)	278,538	10,920	3,510	8,651	301,619

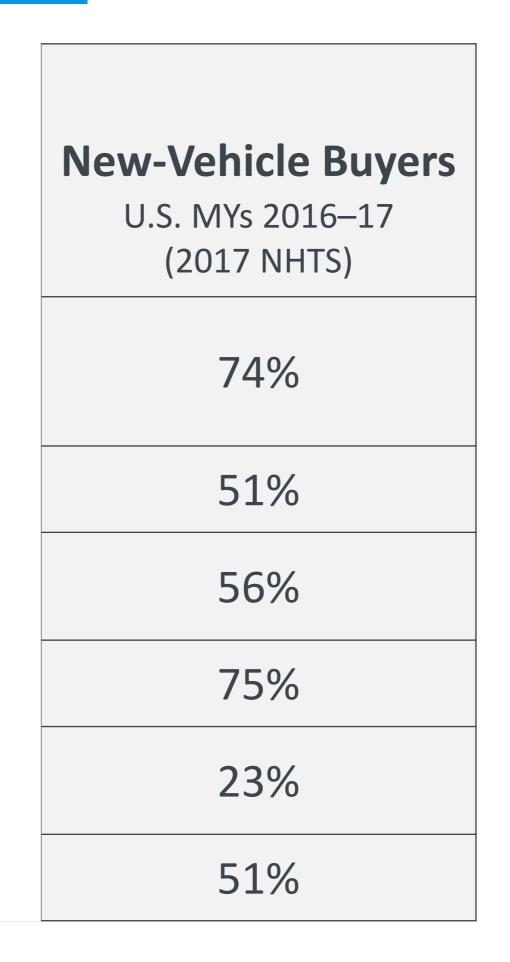
* Weighted to represent the program population along the dimensions of vehicle category, vehicle model, buy vs. lease, and county (using raking method)



Setting an Appropriate Baseline: Car Buyers Are Different Than the Population

	All	
	U.S. Population (Census 2017)	
Selected solely White/Caucasian	61%	
≥ 50 Years Old	34%	<
≥ Bachelor's Degree*	23%	<<<<
Own Residence	63%	<<
≥ \$150k HH Income	12%	<<
Selected Male	49%	\approx

"Prefer not to answer," "I don't know," and similar responses are excluded throughout. Census 2017: 2013–2017 American Community Survey, <u>http://factfinder2.census.gov</u>. 2017 NHTS weighted to represent population, not new-vehicle subset. New-vehicle buyers identified based on within-100-mile match between odometer and miles driven while owned. * Census & NHTS data characterize individual educational attainment.



- New-car buyers are different on almost every dimension.
- More frequently:
 - White
 - Older _
 - Degree holders
 - Residence owners
 - Higher income
- Some differences explained by driving age...







Setting an Appropriate Baseline: Car Buyers Are Different Than the Population

	All U.S. Population (Census 2017)	Driving Age <i>16+ Years Old</i> U.S. Population (Census 2017)	"Buying Age" 21+ Years Old U.S. Population (Census 2017)	New-Vehicle Buyers U.S. MYs 2016–17 (2017 NHTS)
Selected solely White/Caucasian	61%	64%	65% <	74%
≥ 50 Years Old	34%	43%	47% <	51%
≥ Bachelor's Degree*	23%	27%	30% <<	< 56%
Own Residence	63%	63%	64% <	< 75%
≥ \$150k HH Income	12%	12%	12% <	< 23%
Selected Male	49%	49%	49% 🗙	= 51%

"Prefer not to answer," "I don't know," and similar responses are excluded throughout.

Census 2017: 2013–2017 American Community Survey, <u>http://factfinder2.census.gov</u>.

2017 NHTS weighted to represent population, not new-vehicle subset. New-vehicle buyers identified based on within-100-mile match between odometer and miles driven while owned. * Census & NHTS data characterize individual educational attainment.

- *Some* of the difference explained by driving or buying age
- The rest may be due in part to social inequities



16

Rebated EV Consumer Characteristics

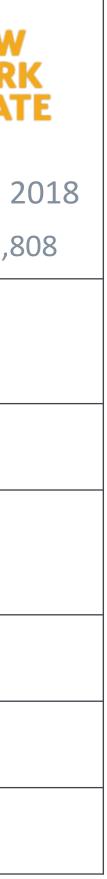
	"Buying Age" 21+ Years Old U.S. Population (Census 2017)	New-Vehicle Buyers U.S. MYs 2016–17 (2017 NHTS)	CALIFORNIA CLEAN VEHICLE REBATE PROJECT Dec. 2010 – Dec. 2018 weighted n = 62,092	Massachusetts Offers Rebates for Electric Vehicles Jun. 2014 – Oct. 2018 weighted n = 4,555	May 2015 – Sep. 2018 weighted n =1,565	Mar. 2017 – Jul. 2 weighted n = 1,8
Selected solely White/Caucasian	65%	74%	59%	85%	87%	86%
≥ 50 Years Old	47%	51%	50%	58%	54%	59%
≥ Bachelor's Degree in HH	30%*	56%*	83%	90%	83%	76%
Own Residence	64%	75%	83%	92%	89%	90%
≥ \$150k HH Income	12%	23%	47%	58%	43%	39%
Selected Male	49%	51%	74%**	78%	74%	70%

"Prefer not to answer," "I don't know," and similar responses are excluded throughout.

Census 2017: 2013–2017 American Community Survey, <u>http://factfinder2.census.gov</u>.

NHTS weighted to represent population, not new-vehicle subset. New-vehicle buyers identified based on within-100-mile match between odometer and miles driven while owned.

* Census & NHTS data characterize individual educational attainment, whereas other data characterize highest household attainment.





Rebated EV Consumer Characteristics (CVRP "current program" only)

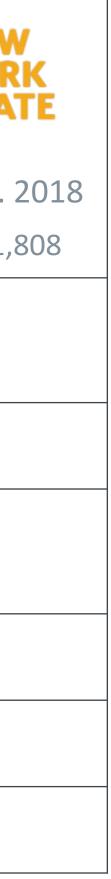
		New-Vehicle Buyers	CALIFORNIA CLEAN VEHICLE REBATE PROJECT	for Electric Vehicles	Connecticut Hydrogen and Electric Automobile Purchase Rebate	YORI STAT
	U.S. Population (Census 2017)	U.S. MYs 2016–17 (2017 NHTS)	<i>Nov. 2016</i> – Dec. 2018 weighted n = 23,478	Jun. 2014 – Oct. 2018 weighted n = 4,555	May 2015 – Sep. 2018 weighted n =1,565	Mar. 2017 – Jul. 2 weighted n = 1,8
Selected solely White/Caucasian	61%	74%	54%	85%	87%	86%
≥ 50 Years Old	34%	51%	52%	58%	54%	59%
≥ Bachelor's Degree in HH	23%*	56%*	83%	90%	83%	76%
Own Residence	63%	75%	82%	92%	89%	90%
≥ \$150k HH Income	12%	23%	42%	58%	43%	39%
Selected Male	49%	51%	73%**	78%	74%	70%

"Prefer not to answer," "I don't know," and similar responses are excluded throughout.

Census 2017: 2013–2017 American Community Survey, <u>http://factfinder2.census.gov</u>.

NHTS weighted to represent population, not new-vehicle subset. New-vehicle buyers identified based on within-100-mile match between odometer and miles driven while owned.

* Census & NHTS data characterize individual educational attainment, whereas other data characterize highest household attainment.





Rebated EV Consumer Characteristics (CVRP "current program" only)

	"Buying Age" 21+ Years Old U.S. Population (Census 2017)	New-Vehicle Buyers U.S. MYs 2016–17 (2017 NHTS)	CALIFORNIA CLEAN VEHICLE REBATE PROJECT Nov. 2016 – Dec. 2018 weighted n = 23,478	Massachusetts Offers Rebates for Electric Vehicles Jun. 2014 – Oct. 2018 weighted n = 4,555	May 2015 – Sep. 2018 weighted n =1,565	Mar. 2017 – Jul. 2 weighted n = 1,8
Selected solely White/Caucasian	65%	74%	54%	85%	87%	86%
≥ 50 Years Old	47%	51%	52%	58%	54%	59%
≥ Bachelor's Degree in HH	30%*	56%*	83%	90%	83%	76%
Own Residence	64%	75%	82%	92%	89%	90%
≥ \$150k HH Income	12%	23%	42%	58%	43%	39%
Selected Male	49%	51%	73%**	78%	74%	70%

"Prefer not to answer," "I don't know," and similar responses are excluded throughout.

Census 2017: 2013–2017 American Community Survey, <u>http://factfinder2.census.gov</u>.

NHTS weighted to represent population, not new-vehicle subset. New-vehicle buyers identified based on within-100-mile match between odometer and miles driven while owned.

* Census & NHTS data characterize individual educational attainment, whereas other data characterize highest household attainment.





Rebated EV Consumer Characteristics: 2017

	All U.S. Population	New-Vehicle Buyers U.S. MYs 2016–17	CALIFORNIA CLEAN VEHICLE REBATE PROJECT CY 2017	for Electric Vehicles CY 2017	CY 2017	Mar.–Dec. 201
	(Census 2017)	(2017 NHTS)	weighted n = 9,539	weighted n = 1,285	weighted n = 501	weighted n = 1,0
Selected solely White/Caucasian	61%	74%	58%	85%	88%	86%
≥ 50 Years Old	34%	51%	52%	61%	59%	60%
≥ Bachelor's Degree in HH	23%*	56%*	82%	90%	85%	73%
Own Residence	63%	75%	79%	92%	89%	90%
≥ \$150k HH Income	12%	23%	40%	58%	41%	34%
Selected Male	49%	51%	72%**	74%	71%	68%

"Prefer not to answer," "I don't know," and similar responses are excluded throughout.

Census 2017: 2013–2017 American Community Survey, <u>http://factfinder2.census.gov</u>.

NHTS weighted to represent population, not new-vehicle subset. New-vehicle buyers identified based on within-100-mile match between odometer and miles driven while owned.

* Census & NHTS data characterize individual educational attainment, whereas other data characterize highest household attainment.





Rebated EV Consumer Characteristics: 2017

				1	
"Buying Age"	New-Vehicle Buvers	CLEAN VEHICLE REBATE PROJECT	MOR-EV Massachusetts Offers Rebates for Electric Vehicles	Connecticut Hydrogen and Electric Automobile Purchase Rebate	
U.S. Population	U.S. MYs 2016–17	CY 2017	CY 2017	CY 2017	Mar.–Dec. 201
(Census 2017)	(2017 NHTS)	weighted n = 9,539	weighted n = 1,285	weighted n = 501	weighted n = 1,02
65%	74%	58%	85%	88%	86%
47%	51%	52%	61%	59%	60%
30%*	56%*	82%	90%	85%	73%
64%	75%	79%	92%	89%	90%
12%	23%	40%	58%	41%	34%
49%	51%	72%**	74%	71%	68%
	21+ Years Old U.S. Population (Census 2017) 65% 47% 30%* 64% 12%	Daty flig Age Buyers 21+ Years Old U.S. MYs 2016–17 U.S. Population U.S. MYs 2016–17 (2017 NHTS) 74% 65% 74% 47% 51% 30%* 56%* 64% 75% 12% 23%	"Buying Age" 21+ Years Old U.S. Population (Census 2017) New-Vehicle Buyers U.S. MYS 2016–17 (2017 NHTS) CY 2017 CY 2017 weighted n = 9,539 655% 74% 58% 47% 51% 52% 30%* 56%* 82% 64% 75% 79% 12% 23% 40%	"Buying Age" 21+ Years Old U.S. Population (Census 2017) INEW-Venicle Buyers U.S. MYs 2016–17 (2017 NHTS) REBATE PROJECT CY 2017 weighted n = 9,539 Massachusetts Offers Rebates CY 2017 weighted n = 1,285 65% 74% 58% 85% 47% 51% 52% 61% 30%* 56%* 82% 90% 64% 75% 79% 92% 12% 23% 40% 58%	"Buying Age" 21+ Years Old U.S. Population (Census 2017) New Venicle Buyers U.S. MYs 2016–17 (2017 NHTS) REBATE PROJECT CY 2017 weighted n = 9,539 Massachusette Offers Rebates CY 2017 weighted n = 1,285 CY 2017 weighted n = 501 65% 74% 58% 85% 88% 47% 51% 52% 61% 59% 30%* 56%* 82% 90% 85% 64% 75% 79% 92% 89% 12% 23% 40% 58% 41%

"Prefer not to answer," "I don't know," and similar responses are excluded throughout.

Census 2017: 2013–2017 American Community Survey, <u>http://factfinder2.census.gov</u>.

NHTS weighted to represent population, not new-vehicle subset. New-vehicle buyers identified based on within-100-mile match between odometer and miles driven while owned.

* Census & NHTS data characterize individual educational attainment, whereas other data characterize highest household attainment.





Differing Approaches, Similar Metrics...

	"Buying Age" 21+ Years Old	New-Vehicle Buyers	CV 2017	MOR-EV Massachusetts Offers Rebates for Electric Vehicles CY 2017	CY 2017	NEW YORI STAT MarDec. 201
	U.S. Population (Census 2017)	U.S. MYs 2016–17 (2017 NHTS)	CY 2017 weighted n = 9,539	weighted $n = 1,285$	weighted n = 501	weighted n = 1,0
Selected solely White/Caucasian	65%	74%	58%	85%	88%	86%
≥ 50 Years Old	47%	51%	52%	61%	59%	60%
≥ Bachelor's Degree in HH	30%*	56%*	82%	90%	85%	73%
Own Residence	64%	75%	79%	92%	89%	90%
≥ \$150k HH Income	12%	23%	40%	58%	41%	34%
Selected Male	49%	51%	72%**	74%	71%	68%

"Prefer not to answer," "I don't know," and similar responses are excluded throughout.

Census 2017: 2013–2017 American Community Survey, <u>http://factfinder2.census.gov</u>.

NHTS weighted to represent population, not new-vehicle subset. New-vehicle buyers identified based on within-100-mile match between odometer and miles driven while owned.

* Census & NHTS data characterize individual educational attainment, whereas other data characterize highest household attainment.





EV Consumer Characteristics—NY

	NY Population 21+ Years Old (Census 2017)	NY New-Vehicle Buyers (2017 NHTS)	NY EV Consumers, (rebated for Mar. 2017 – Jul. 2018 adoption)
Selected solely White/Caucasian	58%	74%	86%
Male	48%	49%	70%
≥ Bachelor's degree in HH	35%*	64%*	76%
Own Residence	54%	73%	90%
≥ 50 years old	47%	43%	59%
≥ \$150k HH Income	16%	23%	39%

Census 2017: 2013–2017 American Community Survey, <u>http://factfinder2.census.gov</u>. National Household Travel Survey, 2017 calendar year: filtered for model year 2016/2017, state = NY, weighted n = 414,721. NYSERDA Adoption Survey, 2017–18 edition: filtered to purchase/lease dates Mar 2017–Jul 2018, weighted n = 1,808. *Census & NHTS data characterize individual educational attainment, whereas other data characterize highest household attainment.





EV Consumer Characteristics—MA

			Massachusetts Offers Rebates for Electric Vehicles			
	MA Population	New England New-	MA EV consumers,			
	21+ Years Old	Vehicle Buyers	(rebated for Jun. 2014 –			
	(Census 2017)	(2017 NHTS)	Oct. 2018 adoption)			
Selected solely White/Caucasian	76%	88%	85%			
Male	48%	49% <<	< 78%			
≥ Bachelor's degree in HH	41%*	61%*	90%			
Own Residence	62%	82%	92%			
≥ 50 years old	48%	49% <	58%			
≥ \$150k HH Income	20%	37% <	< 58%			

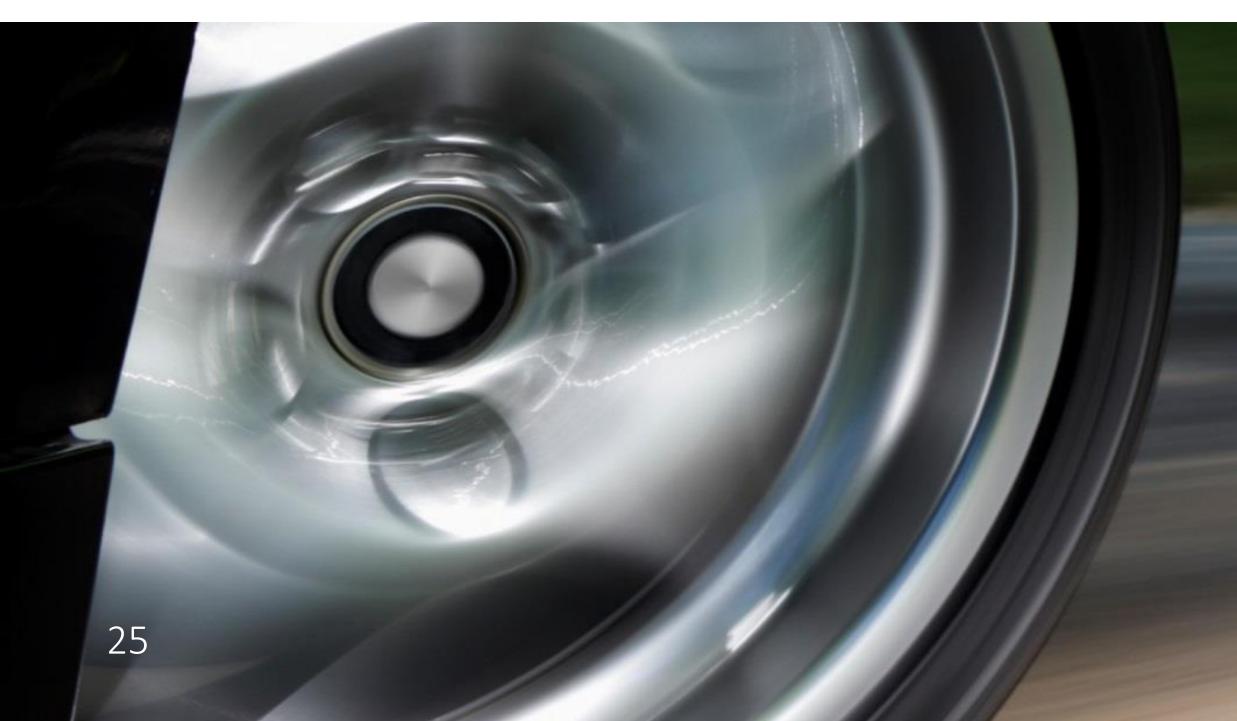
Census 2017: 2013–2017 American Community Survey, <u>http://factfinder2.census.gov</u>. National Household Travel Survey, 2017 calendar year: filtered for model year 2016/2017, state = CT, MA, ME, RI, VT, NH, weighted n = 330,437. MOR-EV Survey 2016 – 17 & 2017–18 edition: filtered to purchase/lease dates June 2014–Oct 2018, weighted n = 4,555. *Census & NHTS data characterize individual educational attainment, whereas other data characterize highest household attainment.



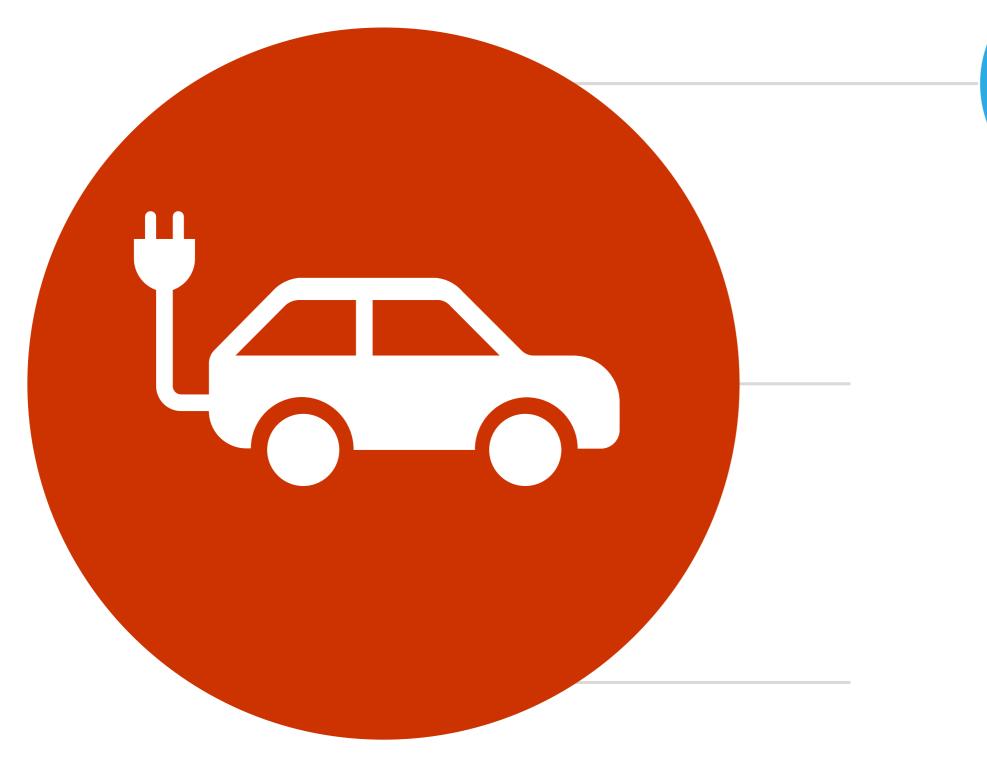


What is the path forward?

Strategies for Program Design and Outreach



How Can Research Help Us Grow Markets for Electric Vehicles?



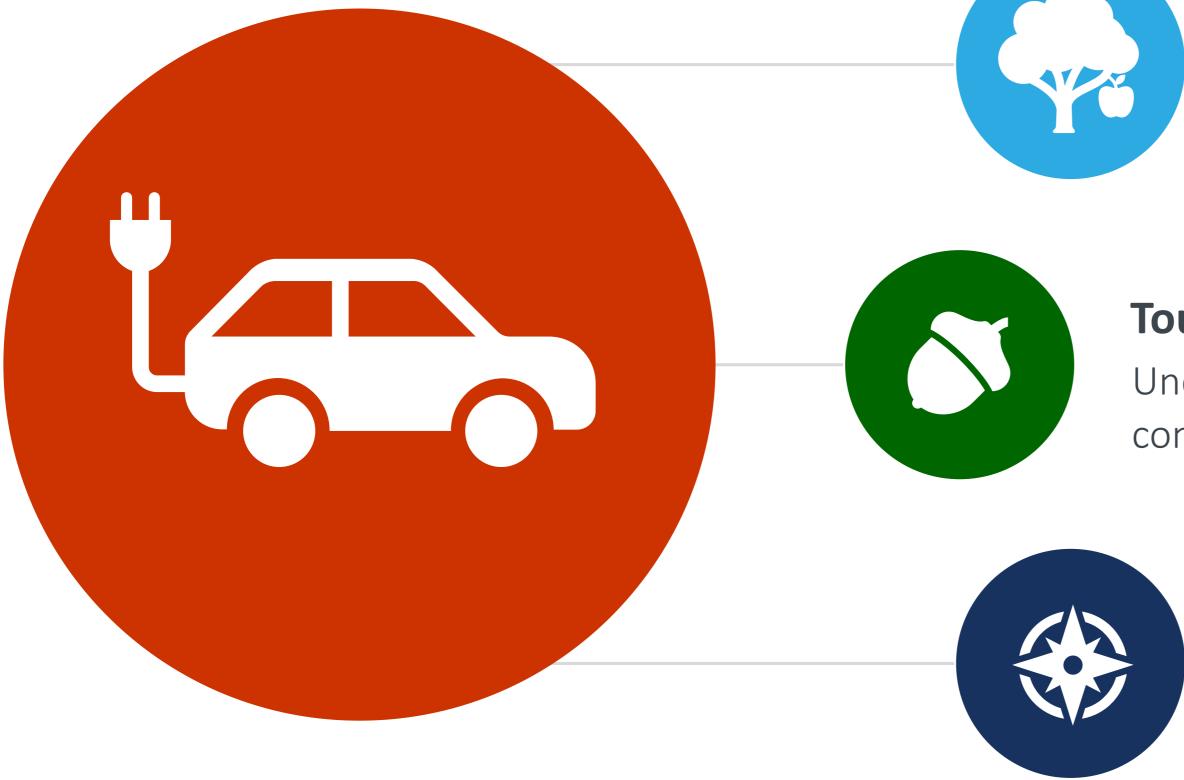


Low-Hanging Fruit

Understand existing adopters to reinforce and scale what is already working



How Can Research Help Us Grow Markets for Electric Vehicles?





Low-Hanging Fruit

Understand existing adopters to reinforce and scale what is already working

Tough Nuts to Crack

Understand and break down barriers faced by consumers targeted based on policy priorities

Expanding Market Frontiers

Go beyond the enthusiastic core of EV markets in order to expand further into the mainstream



Expanding Market Frontiers Through Strategic Segmentation



Existing Adopters: Market Acceleration

Characterize existing, generally enthusiastic and pre-adapted consumers, to target similar consumers who have the highest likelihood of adoption



"Rebate Essential" Consumers: Minimizing Free Ridership

Characterize adopters most highly influenced by supportive resources to join the EV market, to improve the cost-effectiveness of outreach and program design

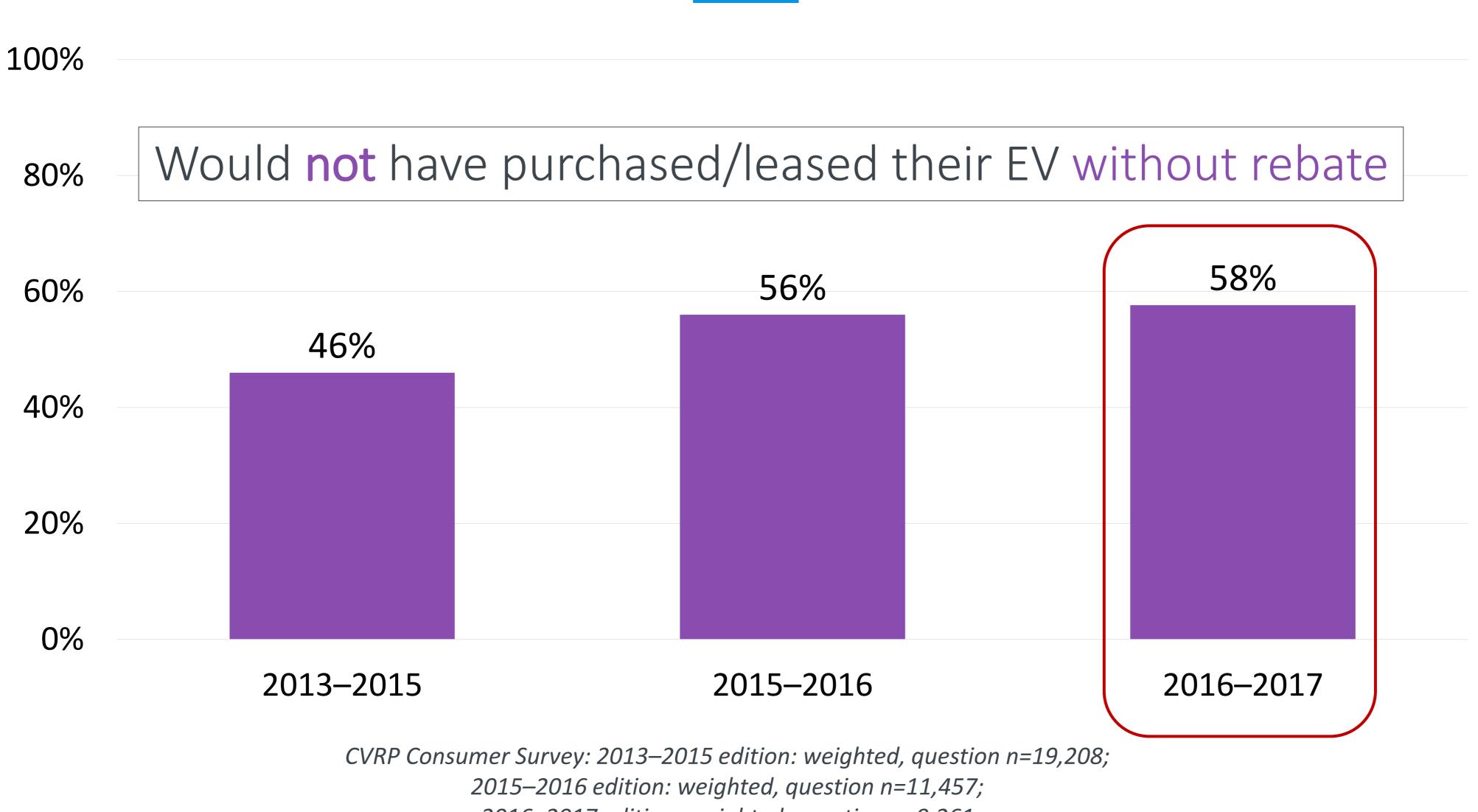


"EV Converts": Moving Mainstream

Characterize EV consumers with low initial interest in EVs, to look for additional opportunities to expand into the mainstream



"Rebate Essentials": Highly Influenced

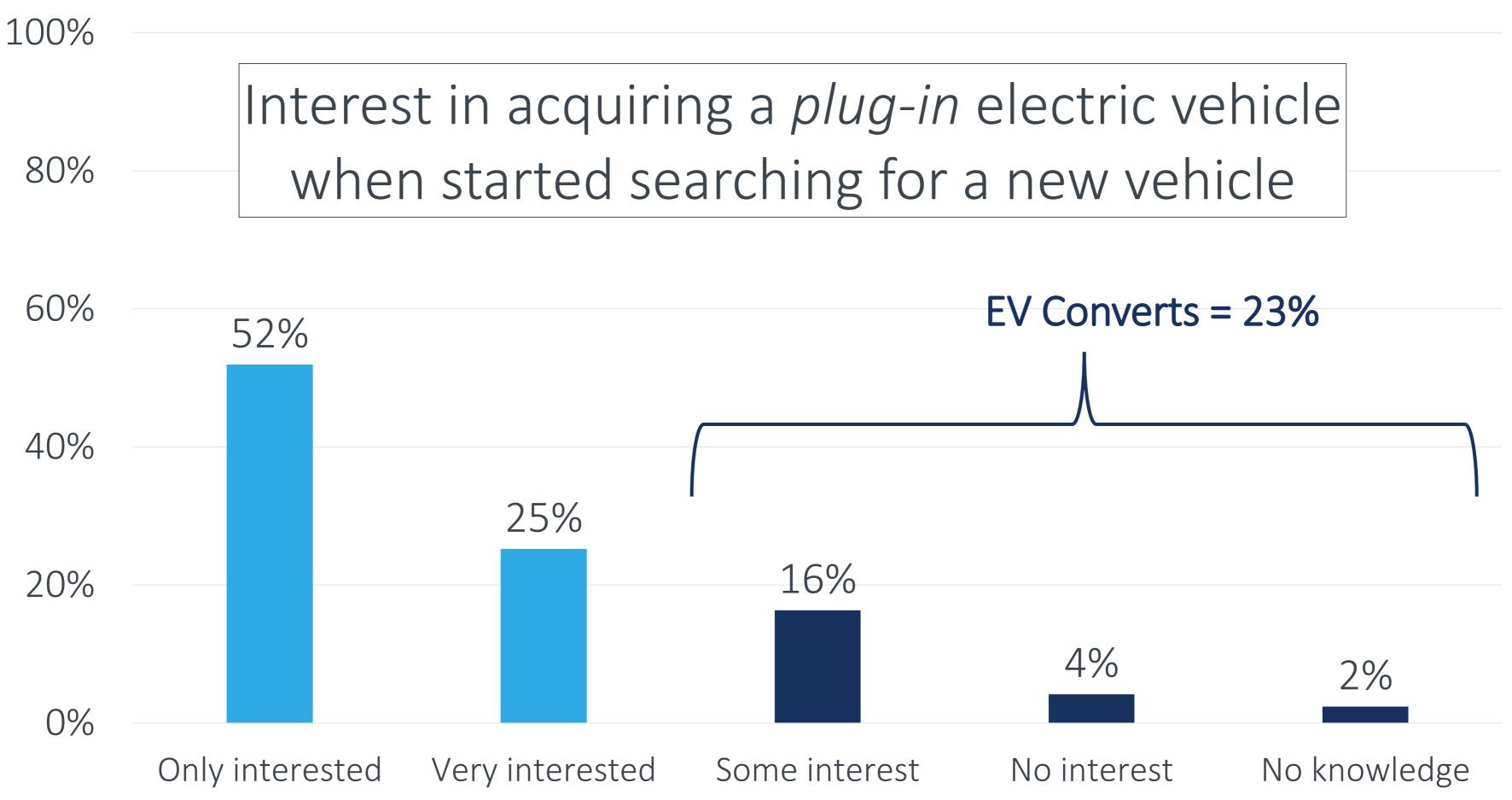


2016–2017 edition: weighted, question n=9,261



29

"EV Converts": Low Initial Interest



CVRP Consumer Survey, 2016–17 edition: filtered to purchase/lease dates Nov 2016–May 2017, weighted n = 5,327



Paths Forward: CA

	Low-Hanging Fruit Nov. 2016 – Dec. 2018 weighted n = 23,478	Rebate Essentials	EV Converts	CA New-Vehicle Buyers, MYs '16–'17 (2017 NHTS)	Priority Populations	
Selected solely White/Caucasian	<u>54%</u> ↑	T	1	51%		
≥ 50 Years Old	52%	\downarrow	\downarrow	46%	For example, CalEnviroScreen	
≥ Bachelor's Degree in HH*	83%	$\uparrow\uparrow$	\uparrow	58%*	 Disadvantaged Communities or 	
≥ \$150k HH Income	42% 1	\uparrow	~	32%	AB 1550 Priority Communities	
Selected Male	73%** 111	$\uparrow \uparrow \uparrow$	$\uparrow\uparrow$	50%		

"Prefer not to answer," "I don't know," and similar responses are excluded throughout. NHTS weighted to represent population, not new-vehicle subset. New-vehicle buyers identified based on within-100-mile match between odometer and miles driven while owned. * NHTS data characterize individual educational attainment, whereas other data characterize highest household attainment. ** 100% includes non-binary options.





Strategic Segments: Explanation

Factors that Increase the Odds of Being an EV Convert* (Relative to Other Plug-in EV Adopters)

Plug-in EV consumers (both PHEV and BEV) are more likely converts if they:

- are *younger*, do *not* have *solar*
- are not highly motivated by reducing environmental impacts or HOV lane access
- do *not* spend time *researching EVs online*

Additionally:

- **PHEV** consumers are more likely converts if they chose PHEVs other than the Volt
- **BEV** consumers are more likely converts if they:
 - have *lower income*
 - are *moderately motivated by energy independence*
 - Have *no workplace charging*
 - choose BEVs other than Bolt or Tesla (long-range BEVs?)
 - find the *rebate essential* to purchase/lease

* Significantly associated factors in binary logistic regression



- are women, do not identify as white/Caucasian, live in the Central Valley or LA/SoCal area, or



33

Strategic Segments: Prioritization

Comparison to Other Plug-in EV Adopters: **Rebate Essential Explanatory Factors***



For more info, see:

- 2016 BECC talk
- 2017 TRR paper and TRB poster
- 2018 EVS 31 talk...

Central (vs. Bay Area)

Central (vs. South)

Lower-income Increased Rebate

Difficulty finding information online

More importance: carpool

Younger age

Did not hear about CVRP from the dealer

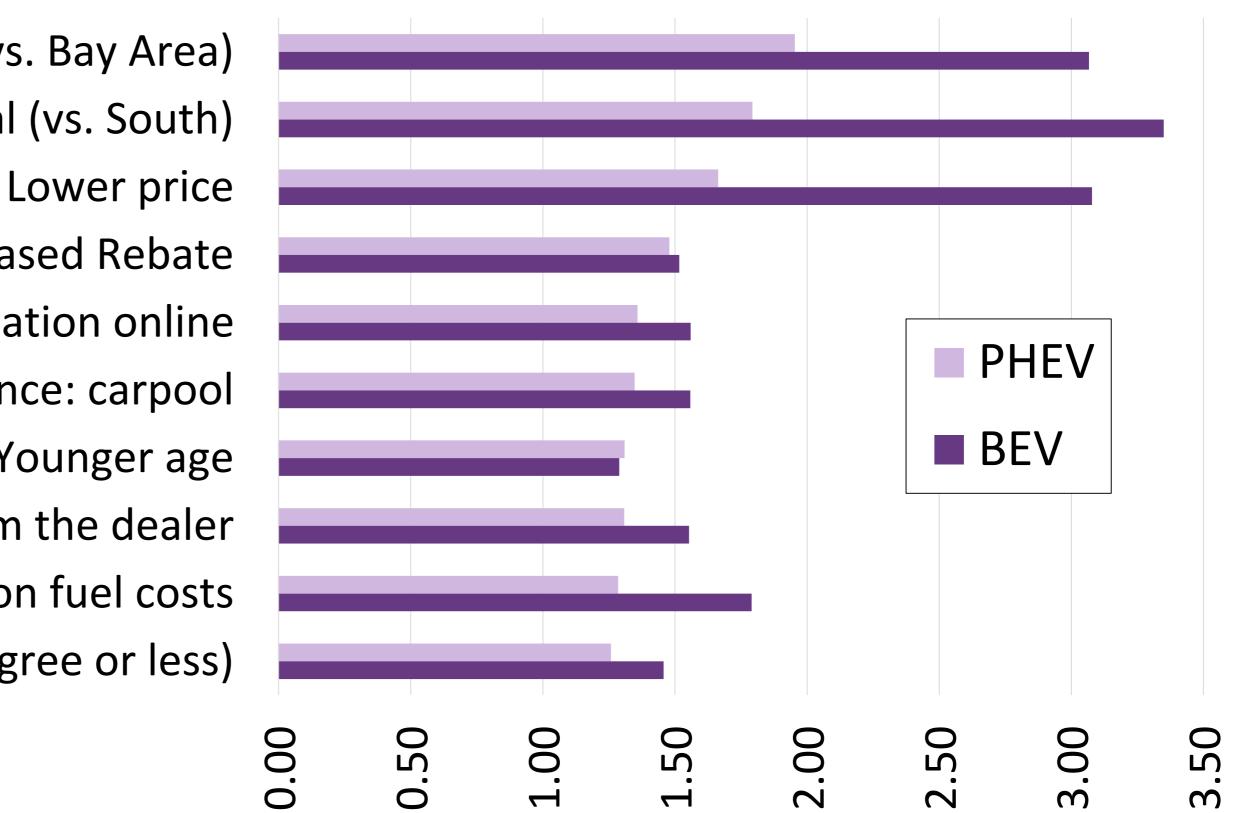
More importance: save on fuel costs

Postgraduate degree (vs. Associate degree or less)

* Significantly associated factors in binary logistic regression of data characterizing CA rebate recipients who bought/leased EVs Nov. 2016 thru May 2017

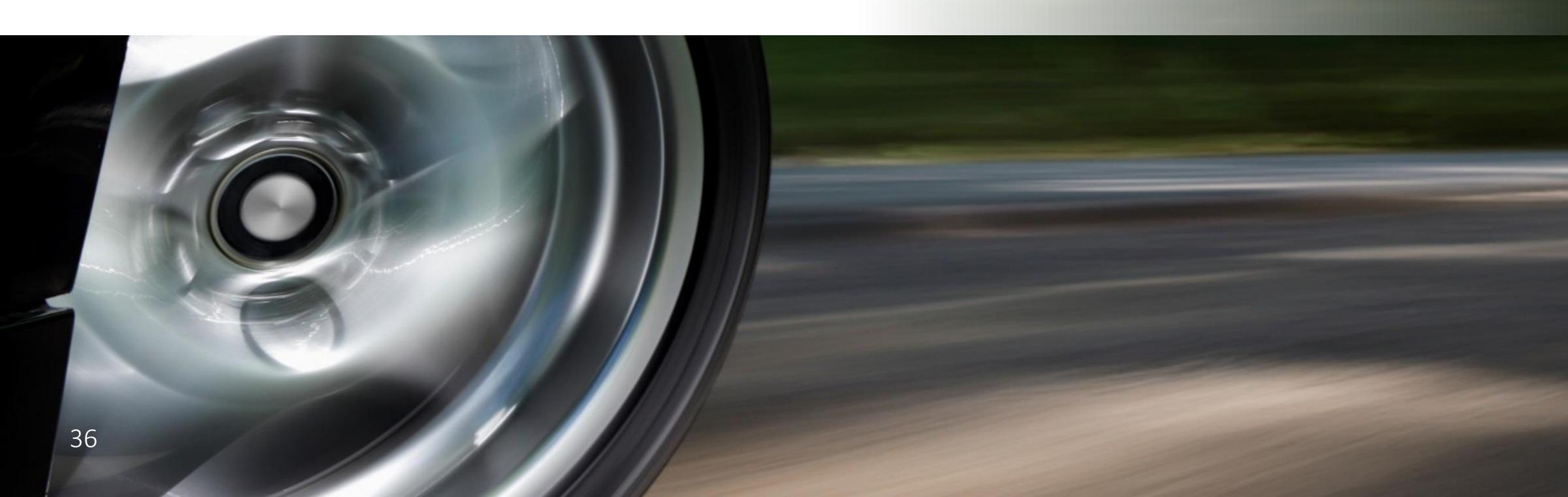


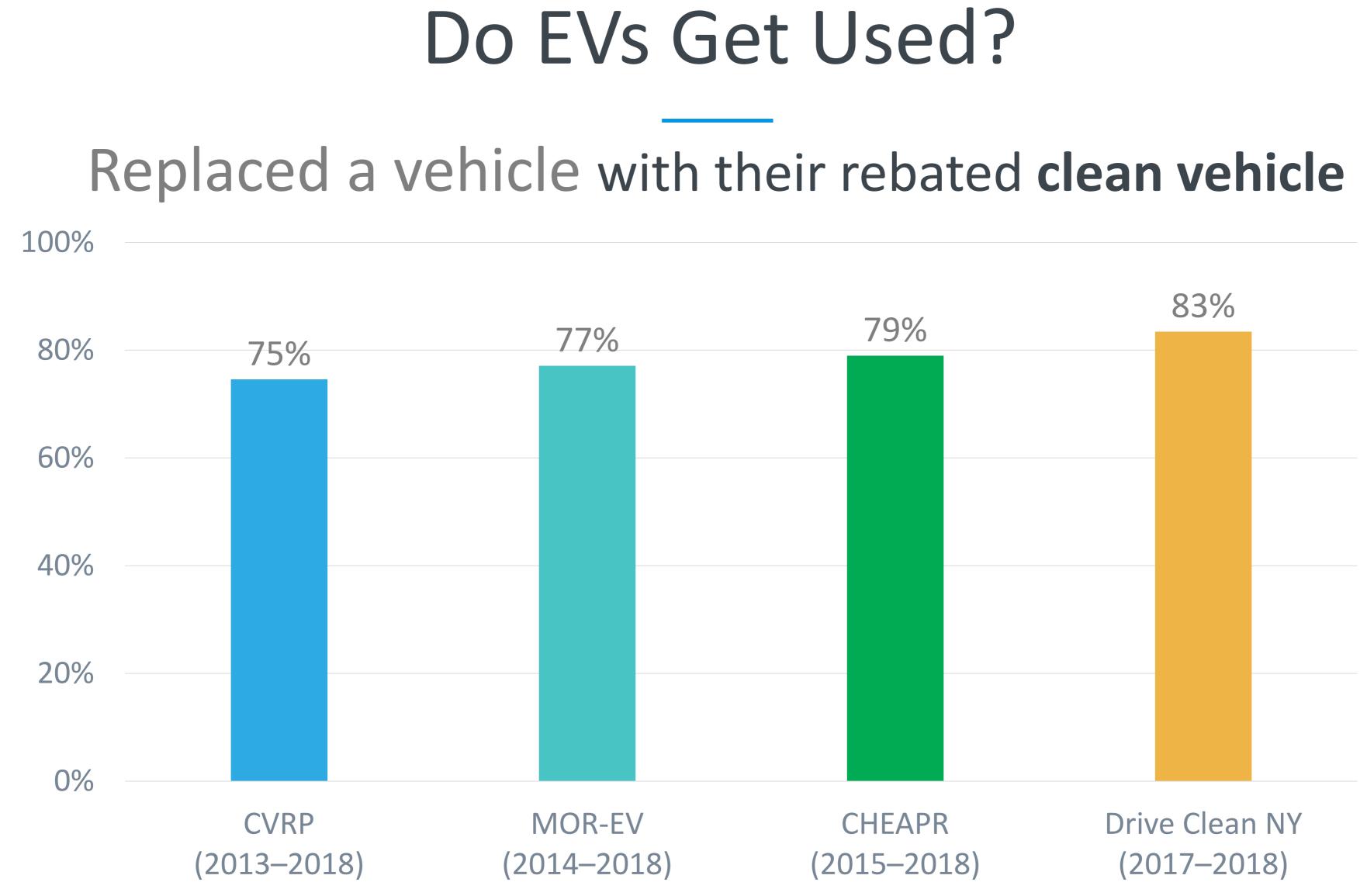
X-Standardized Rebate Essentiality **Odds Ratios**



35

Outcomes: Behaviors Influenced

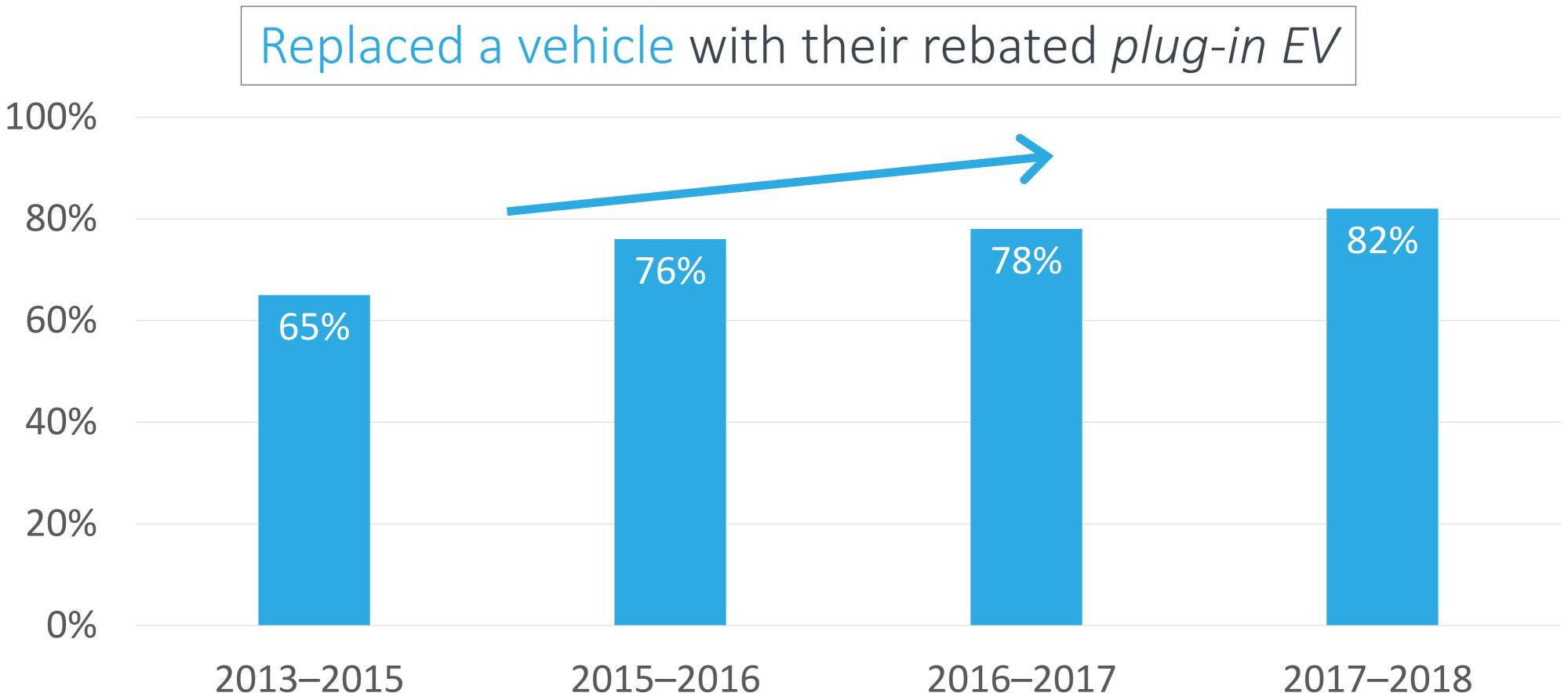




Overall datasets: 70,020 total survey respondents weighted to represent 301,619 rebate recipients



Vehicle Replacement is Increasing



CVRP Consumer Survey: 2013–2015 edition: weighted, question n=19,247; 2015–2016 edition: weighted, question n= 11,583; 2016–2017 edition: weighted, question n= 9,006; 2017–2018 edition: weighted, question n= 20,847



2016-2017

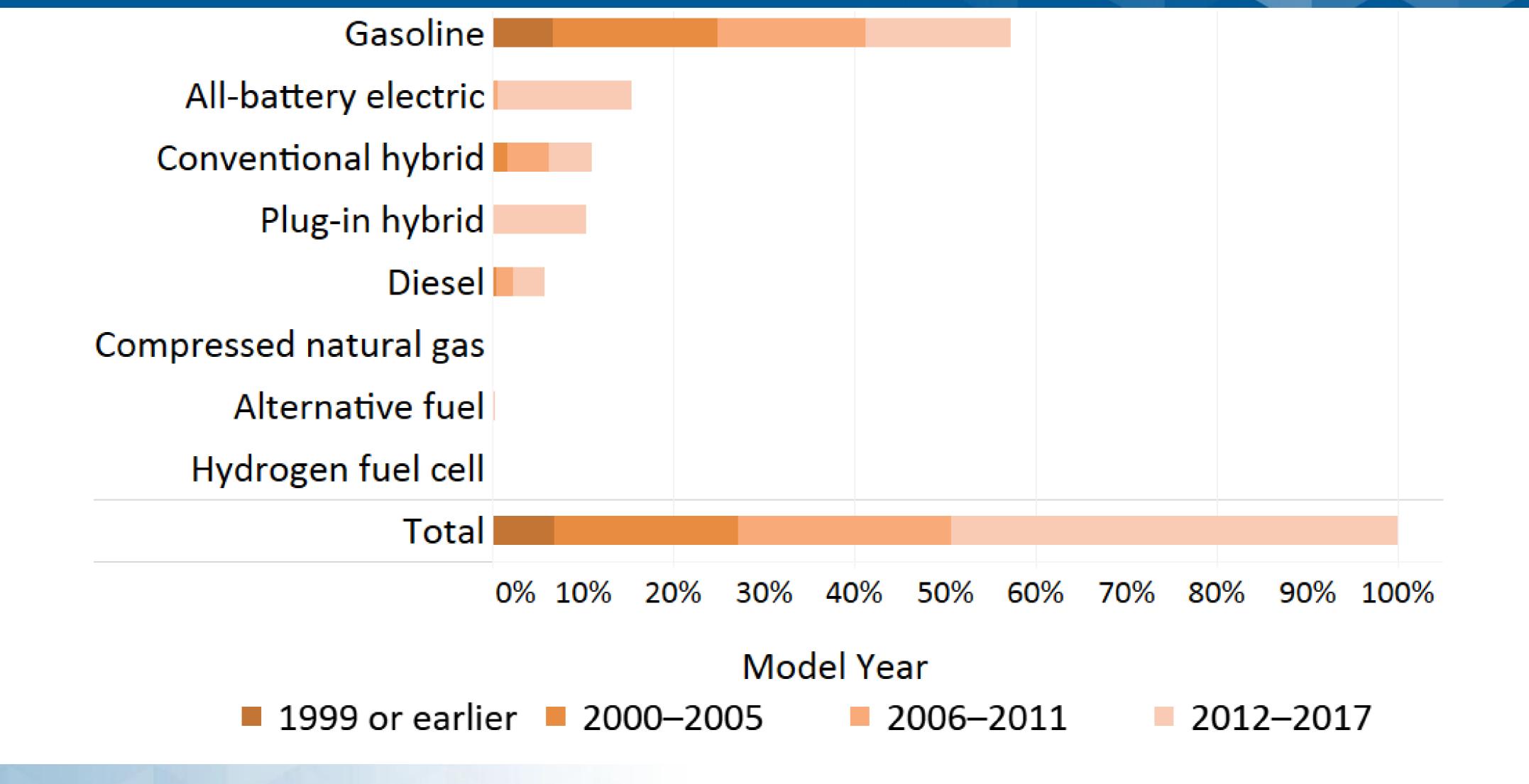
2017-2018







What Vehicles Types Have Rebates Helped Replace?



CVRP Consumer Survey. 2016–2017 edition, trimmed to start November 2016, PEV respondents only, weighted, n=4,695



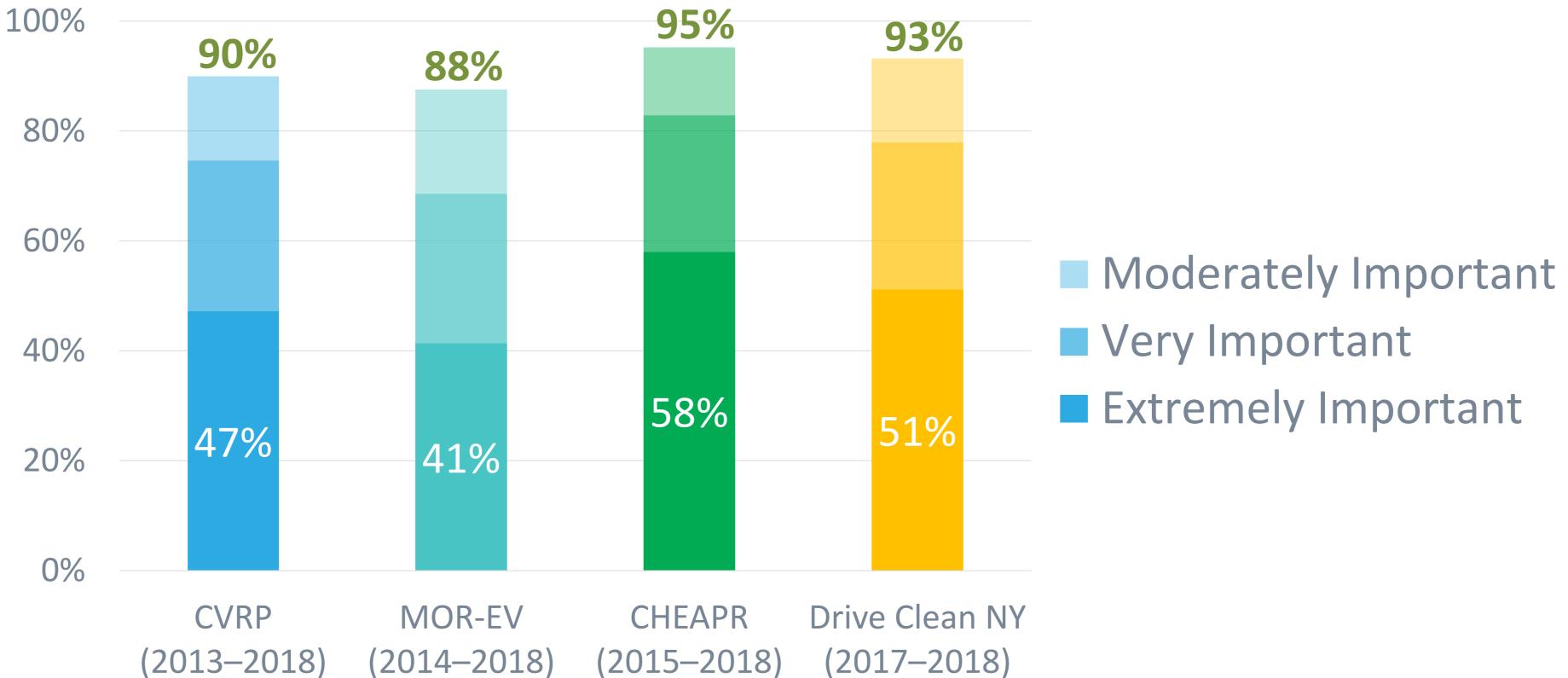






Rebate Influence: Importance

How important was the state rebate in making it possible for you to acquire your clean vehicle?

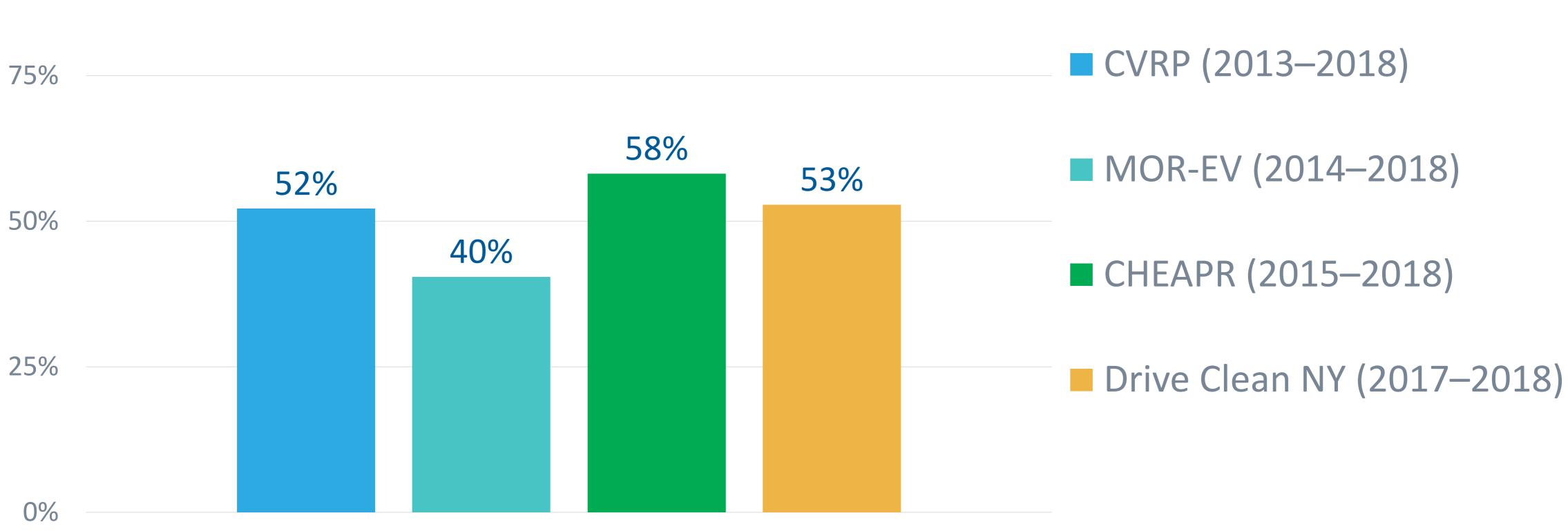


Overall datasets: 70,020 total survey respondents weighted to represent 301,619 rebate recipients



Rebate Influence: Essentiality

100%



Overall datasets: 70,020 total survey respondents weighted to represent 301,619 rebate recipients

Would not have purchased/leased their clean vehicle without rebate



Federal Tax Credit: Background

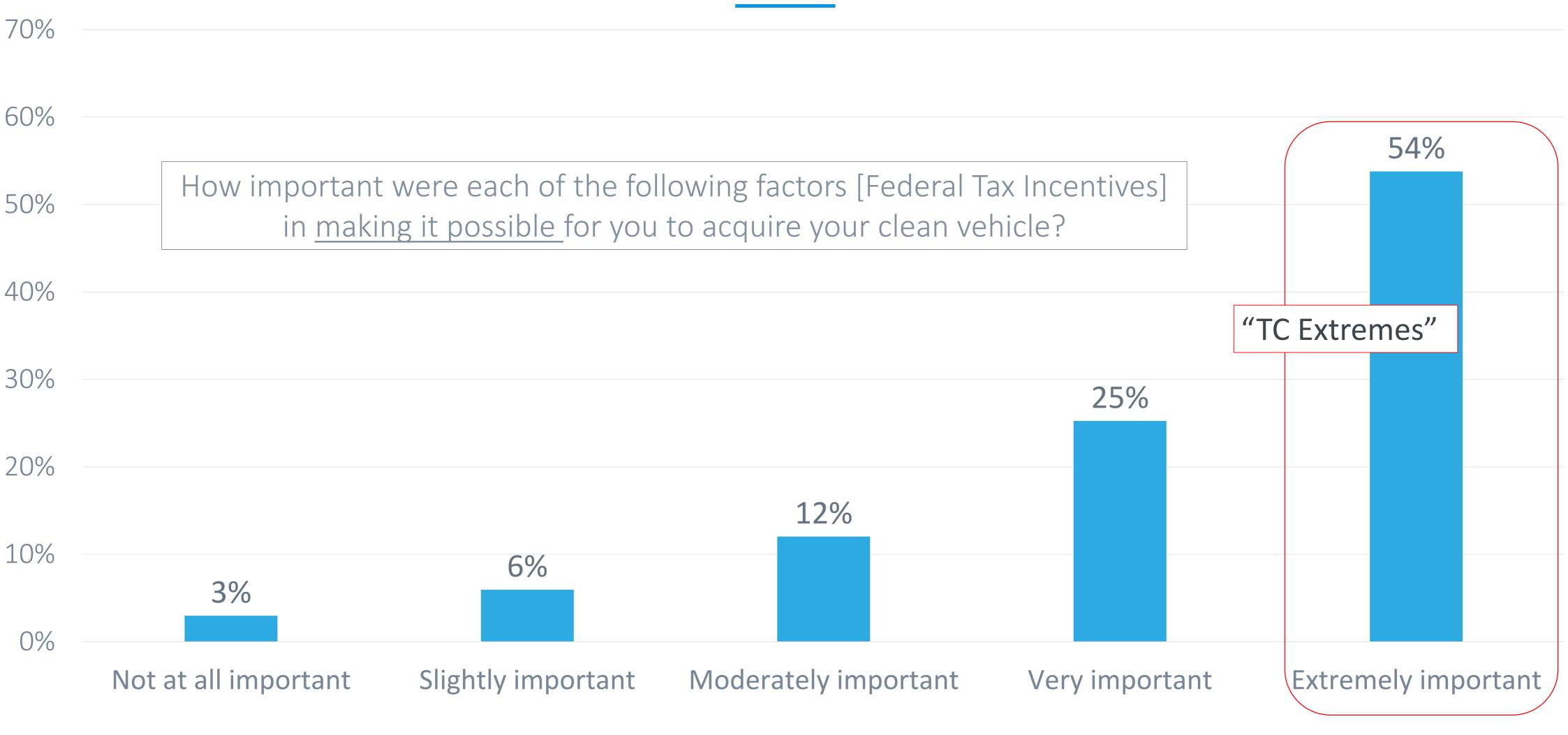
- Up to \$7,500 for the purchase or lease of a plug-in electric vehicle (PEV)*
 - Credit amount decreases on the second calendar quarter after a manufacturer has sold 200,000...

Tesla Motors		1/1/10 to 12/31/18	1/1/19 to 6/30/19	7/1/19 to 12/31/19
2012–19 Model S	EV	\$7,500	\$3,750	\$1,875
2016–19 Model X	EV	\$7,500	\$3,750	\$1,875
Model 3 Standard Range Plus	EV	\$7,500	\$3,750	\$1,875
2017–19 Model 3 Long Range	EV	\$7,500	\$3,750	\$1,875
2019 Model 3 Long Range AWD and AWD Performance	EV	\$7,500	\$3,750	\$1,875
2018–19 Model 3 Mid Range	EV	\$7,500	\$3,750	\$1,875
2008–11 Roadster	EV	\$7,500	\$3,750	\$1,875
Chevrolet		1/1/10 to 3/31/19	4/1/19 to 9/30/19	10/1/19 to 3/31/20
2017–19 Chevrolet Bolt EV	EV	\$7,500	\$3,750	\$1,875
2011–19 Chevrolet Volt	PHEV	\$7,500	\$3,750	\$1,875
2014–16 Chevrolet Spark EV	EV	\$7,500	\$3,750	\$1,875

* Light-duty plug-in electric vehicles, including both plug-in hybrid EVs (PHEVs) and battery EVs (BEVs) Images taken 8/16/19 from https://www.fueleconomy.gov/feg/taxevb.shtml



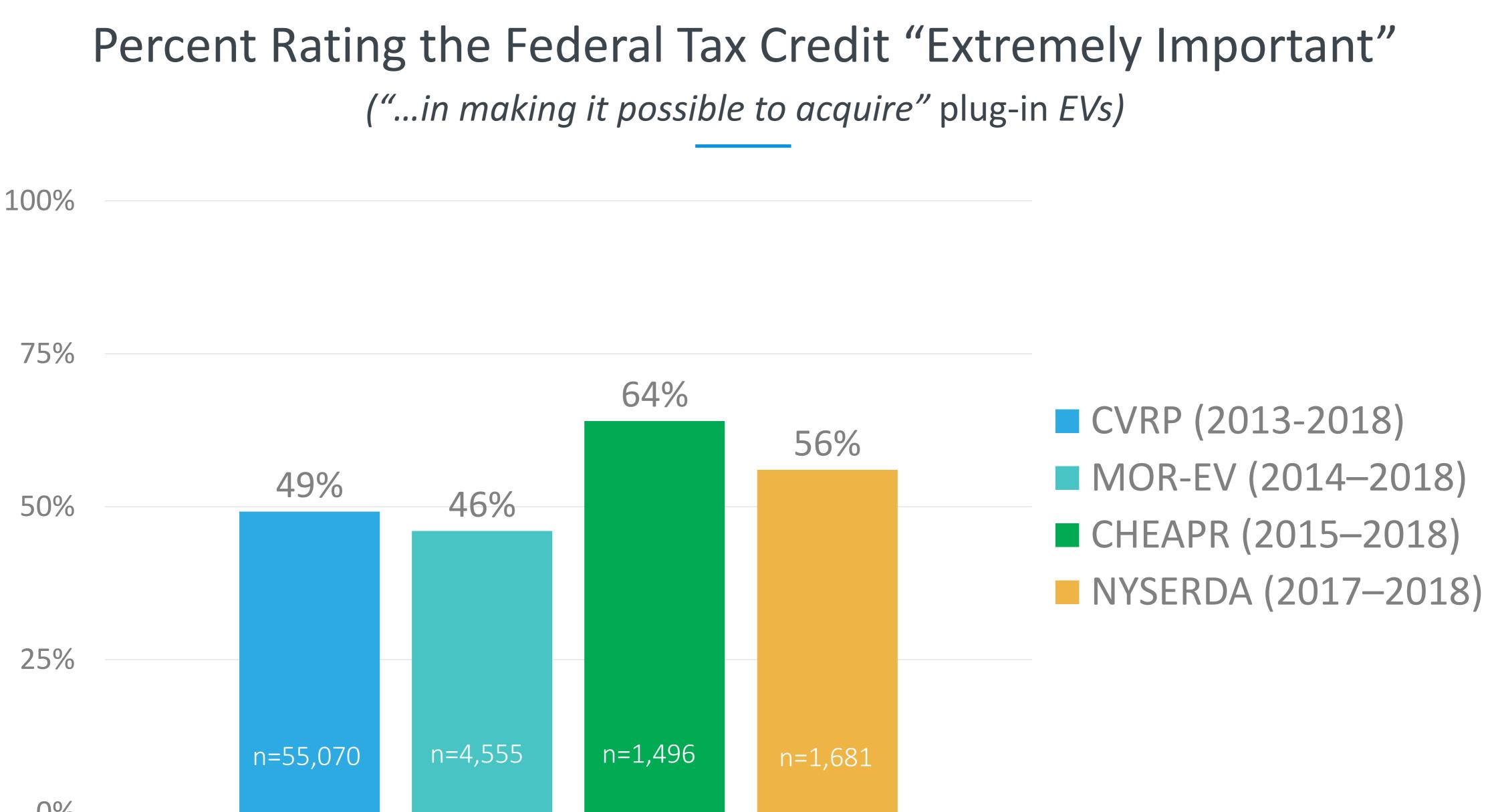
Importance of Federal Tax Credit (2017–18 survey edition)





CVRP Consumer Survey, 2017–18 edition (6/17–12/18), weighted n = 17,101



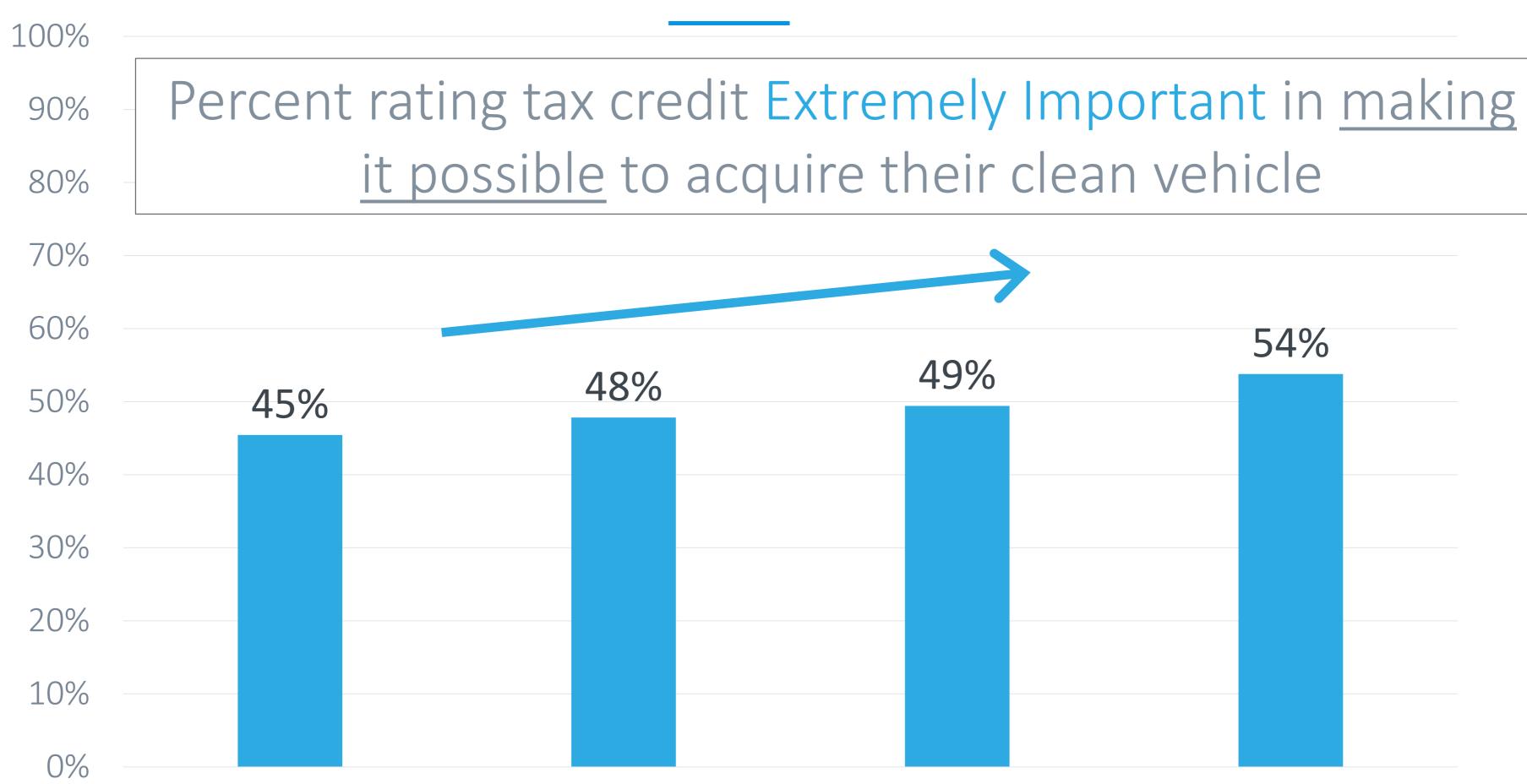


0%

Overall datasets: 70,020 total survey respondents weighted to represent 301,619 rebate recipients



Extreme Importance of Federal Tax Credit is Increasing



2015 - 2016 2016 - 2017 2017 - 20182013 - 2015

CVRP Consumer Survey: 2013–15 edition weighted n = 18,967, 2015–16 edition weighted n = 10,724, 2016–17 edition weighted n = 8,278; 2017–18 edition weighted n = 17,101









Assessment of Individual Measures

Ranked from most cost-effective to least cost-effective [\$ saved/vehicles lost]

/liddle (baseline)		(excl. waitlist)	vehicles lost	vehicle lost
	0% (baseline)	\$264 M	0% (baseline)	(baseline
\$60k MSRP	-6%	\$246 M	2%	-\$4,453
\$50k MSRP	-7%	\$244 M	2%	-\$4,219
imit one per person (not retroactive)	0%	\$263 M	0%	-\$4,085
\$40k MSRP	-37%	\$156 M	13%	-\$3,973
ncome cap—single filers: ≤ \$150k, other filers: ≤ \$250k	-6%	\$248 M	2%	-\$3,712
ncome cap—single filers: ≤ \$150k, other filers: ≤ \$204k	-13%	\$227 M	5%	-\$3,616
educe standard rebate \$500 (\$150 for ZEM)	-13%	\$226 M	5%	-\$3,538
40-mi UDDS all-electric range	-6%	\$246 M	3%	-\$3,147
HEV/BEVx: > 50-mi BEV/FCEV/ZEM: > 100 UDDS all-electric range	-7%	\$242 M	3%	-\$3,136
50-mi UDDS all-electric range	-7%	\$243 M	3%	-\$3,119
HEV/BEVx: > 25-mi BEV/FCEV/ZEM: > 100 UDDS all-electric range	-1%	\$260 M	1%	-\$3,004
HEV/BEVx: > 30-mi BEV/FCEV/ZEM: > 100 UDDS all-electric range	-2%	\$260 M	1%	-\$2,994
30-mi UDDS all-electric range	-1%	\$260 M	1%	-\$2,894
25-mi UDDS all-electric range	-1%	\$261 M	1%	-\$2,886
imit 3 months between purchase and application*				
	mit one per person (not retroactive) \$40k MSRP come cap—single filers: < \$150k, other filers: < \$250k come cap—single filers: < \$150k, other filers: < \$204k educe standard rebate \$500 (\$150 for ZEM) 40-mi UDDS all-electric range HEV/BEVx: > 50-mi BEV/FCEV/ZEM: > 100 UDDS all-electric range 50-mi UDDS all-electric range HEV/BEVx: > 25-mi BEV/FCEV/ZEM: > 100 UDDS all-electric range HEV/BEVx: > 30-mi BEV/FCEV/ZEM: > 100 UDDS all-electric range 30-mi UDDS all-electric range 25-mi UDDS all-electric range	mit one per person (not retroactive)0%\$40k MSRP-37%acome cap—single filers: ≤ \$150k, other filers: ≤ \$250k-6%acome cap—single filers: ≤ \$150k, other filers: ≤ \$204k-13%educe standard rebate \$500 (\$150 for ZEM)-13%40-mi UDDS all-electric range-6%HEV/BEVx: > 50-mi BEV/FCEV/ZEM: > 100 UDDS all-electric range-7%50-mi UDDS all-electric range-7%HEV/BEVx: > 25-mi BEV/FCEV/ZEM: > 100 UDDS all-electric range-1%HEV/BEVx: > 30-mi BEV/FCEV/ZEM: > 100 UDDS all-electric range-1%25-mi UDDS all-electric range-1%25-mi UDDS all-electric range-1%	mit one per person (not retroactive)0%\$263 M\$40k MSRP-37%\$156 Mcome cap—single filers: ≤ \$150k, other filers: ≤ \$250k-6%\$248 Mcome cap—single filers: ≤ \$150k, other filers: ≤ \$204k-13%\$227 Meduce standard rebate \$500 (\$150 for ZEM)-13%\$226 M40-mi UDDS all-electric range-6%\$246 MHEV/BEVx: > 50-mi BEV/FCEV/ZEM: > 100 UDDS all-electric range-7%\$242 M50-mi UDDS all-electric range-7%\$243 MHEV/BEVx: > 25-mi BEV/FCEV/ZEM: > 100 UDDS all-electric range-1%\$260 M40-mi UDDS all-electric range-1%\$260 M50-mi UDDS all-electric range-1%\$260 M40-mi UDDS all-electric range-1%\$260 M	mit one per person (not retroactive) 0% \$263 M 0% \$40k MSRP-37%\$156 M13%come cap—single filers: \leq \$150k, other filers: \leq \$250k-6%\$248 M2%come cap—single filers: \leq \$150k, other filers: \leq \$204k-13%\$227 M5%educe standard rebate \$500 (\$150 for ZEM)-13%\$226 M5%40-mi UDDS all-electric range-6%\$246 M3%HEV/BEVx: > 50-mi BEV/FCEV/ZEM: > 100 UDDS all-electric range-7%\$242 M3%50-mi UDDS all-electric range-7%\$243 M3%HEV/BEVx: > 25-mi BEV/FCEV/ZEM: > 100 UDDS all-electric range-1%\$260 M1%30-mi UDDS all-electric range-1%\$260 M1%25-mi UDDS all-electric range-1%\$260 M1%

Assumes changes effective 1 December 2019. Note, first-cycle costs do not include an estimated \$29 M waitlist.

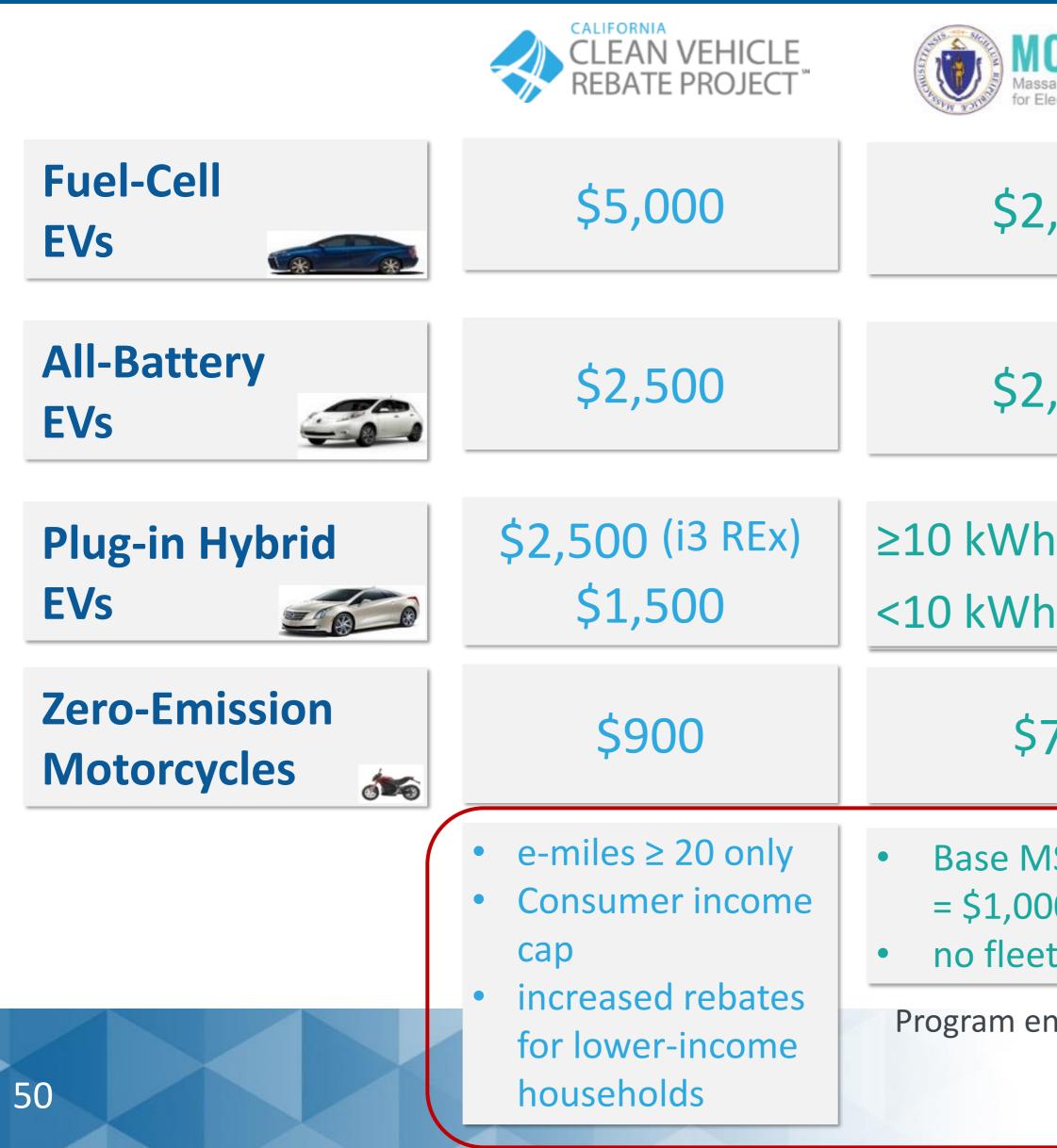
* 3-month time limit assumed to produce no long-term savings or market losses (based on implementation of similar time limits in other states)







EV Rebate Designs (as of Sept. 2018), Reflective of most of the data gathered



OR-EV ssachusetts Offers Rebates Electric Vehicles	Connecticut Hydrogen and Ele	APR ectric Automobile Purchase Rebate	ئے	NEW YORK STATE
2,500	\$5,	,000	<u>e-miles</u>	
	<u>e-miles</u>	¢2.000	≥ 120	\$2,000
2,500	≥ 175 ≥ 100	\$3,000 \$2,000	≥ 40	\$1,700
	< 100	\$500	≥ 20	\$1,100
h \$2,500 h \$1,500	≥ 40 < 40	\$2,000 \$500	< 20	\$500
750				
ASRP \geq \$60k 00 max. et rebates ended 9/30/19	 Base MSRP ≤ \$60k only dealer assignment \$150 dealer incentive 		 Base MSRP > \$60k = \$500 max. point-of-sale via dealer 	
	(\$300 pr	evious)	Cer Su	nter for Istainable Ene



CVRP	Ε	ligibility		Rebate	Amount	
	Filing Status	Gross Annual Income	FCEV	BEV	PHEV	ZEM
	Individual	> \$150,000	\$5,000			
Income Cap	Head of Household	> \$204,000	(unless received an		Not Eligible	
	Joint	> \$300,000	HOV sticker)			
	Individual	300% FPL to \$150,000				
Standard Rebate	Head of Household	300% FPL to \$204,000	\$5,000	\$2,500	\$1,500	
	Joint	300% FPL to \$300,000				\$900
Increased Rebate for Low-Income Applicants*		me ≤ 300 percent of the overty level (FPL)	\$7,000	\$4,500	\$3,500	
51 * Application	ns are also prioritized.			Cap and Trade Dollars at Work 1995	CAL AIR RES	IFORNIA Sources board



Income-Based Eligibility: Implementation Considerations

- **Dealer reluctance**, fears about liability
- Outreach complexity, consumer confusion
- Application complexity, affects all applicants
- Intrusiveness, tax forms
- Wait times, even for priority applicants
- Investment in processing systems, labor
- Fraud
- Loopholes

Point-of sale rebates with MSRP caps may better support equity goals... Supplemented with Increased Rebates based upon income criteria

• Precludes a point-of-sale rebate, which would benefit those that need the rebate most





Differing Approaches, Similar Metrics...

	"Buying Age" 21+ Years Old	New-Vehicle Buyers	CALIFORNIA CLEAN VEHICLE REBATE PROJECT ^{**} CY 2017	MOR-EV Massachusetts Offers Rebates for Electric Vehicles CY 2017	CY 2017	Mar. – Dec. 202
	U.S. Population (Census 2017)	U.S. MYs 2016–17 (2017 NHTS)	weighted n = 9,539	weighted n = 1,285	weighted n = 501	weighted $n = 1,0$
Selected solely White/Caucasian	65%	74%	58%	85%	88%	86%
≥ 50 Years Old	47%	51%	52%	61%	59%	60%
≥ Bachelor's Degree	30%*	56%*	82%	90%	85%	73%
Own Residence	64%	75%	79%	92%	89%	90%
≥ \$150k HH Income	12%	23%	40%	58%	41%	34%
Selected Male	49%	51%	72%**	74%	71%	68%

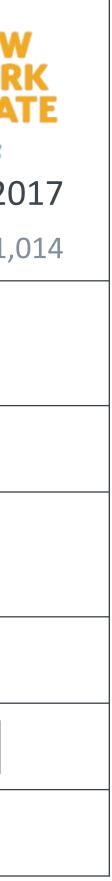
"Prefer not to answer," "I don't know," and similar responses are excluded throughout.

Census 2017: 2013–2017 American Community Survey, <u>http://factfinder2.census.gov</u>.

NHTS weighted to represent population, not new-vehicle subset. New-vehicle buyers identified based on within-100-mile match between odometer and miles driven while owned.

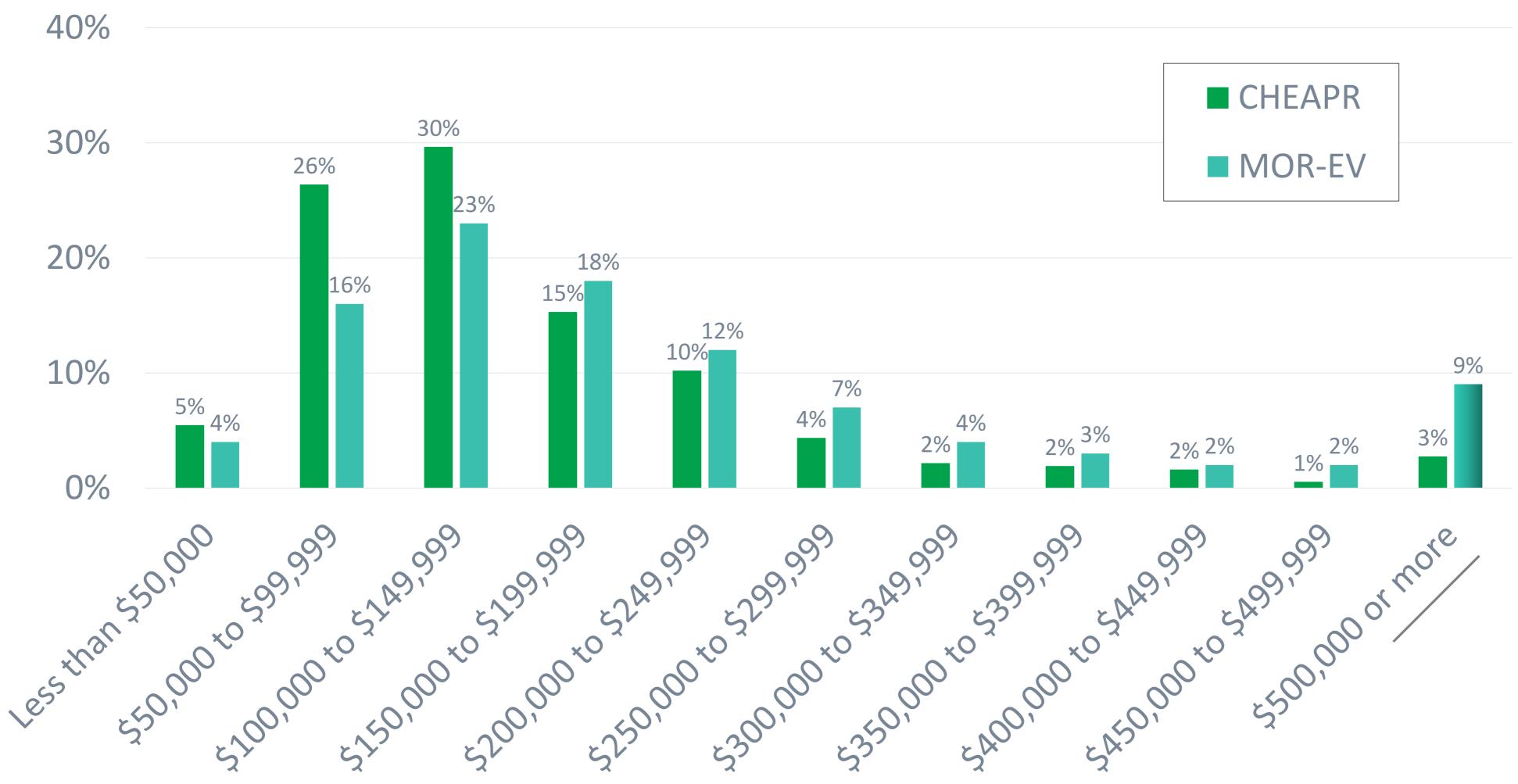
* Census & NHTS data characterize individual educational attainment, whereas other data characterize highest household attainment.

*** 100% includes non-binary options.*





CHEAPR and MOR-EV Respondents by Household Income



CHEAPR Survey (2015–17): n=819 total respondents, weighted to represent N=1,583 participants MOR-EV Survey (2014–17): n=2,549 total respondents, weighted to represent N=5,754





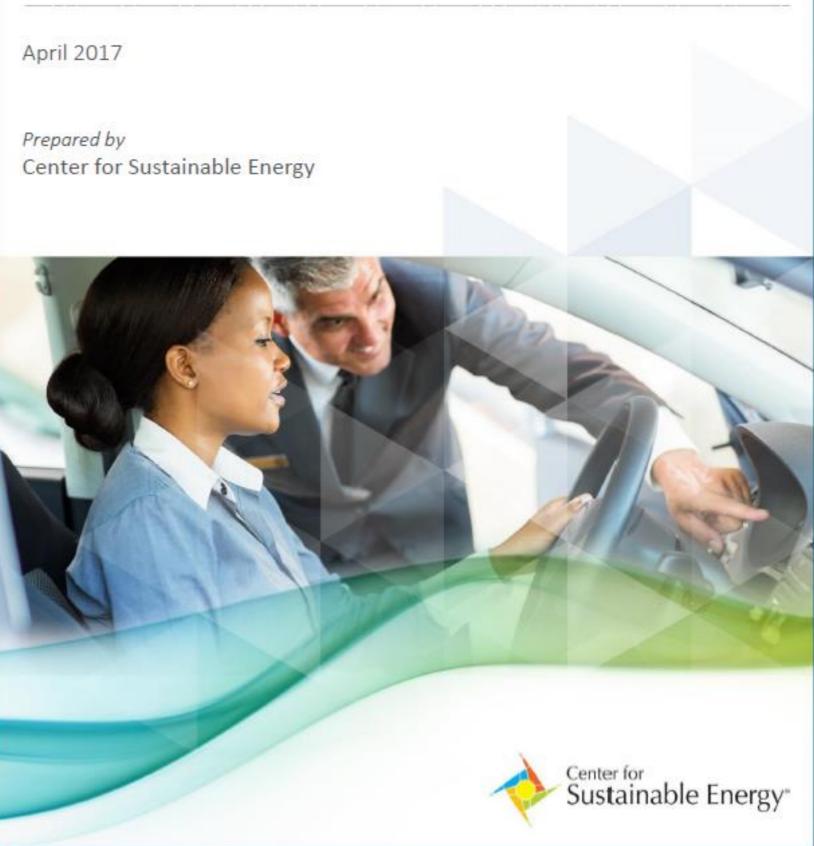






How is the Dealer Incentive Working?

Evaluating the Connecticut Dealer Incentive for Electric Vehicle Sales



Johnson, Clair, Williams, Brett, Anderson, John & Appenzeller, Nicole (2017), Evaluating the *Connecticut Dealer Incentive for Electric Vehicle Sales, Center for Sustainable Energy.*





"To what extent are you motivated by the current dealer incentive to do each of the following?"

Have Never Owned an EV

Have Owned an EV

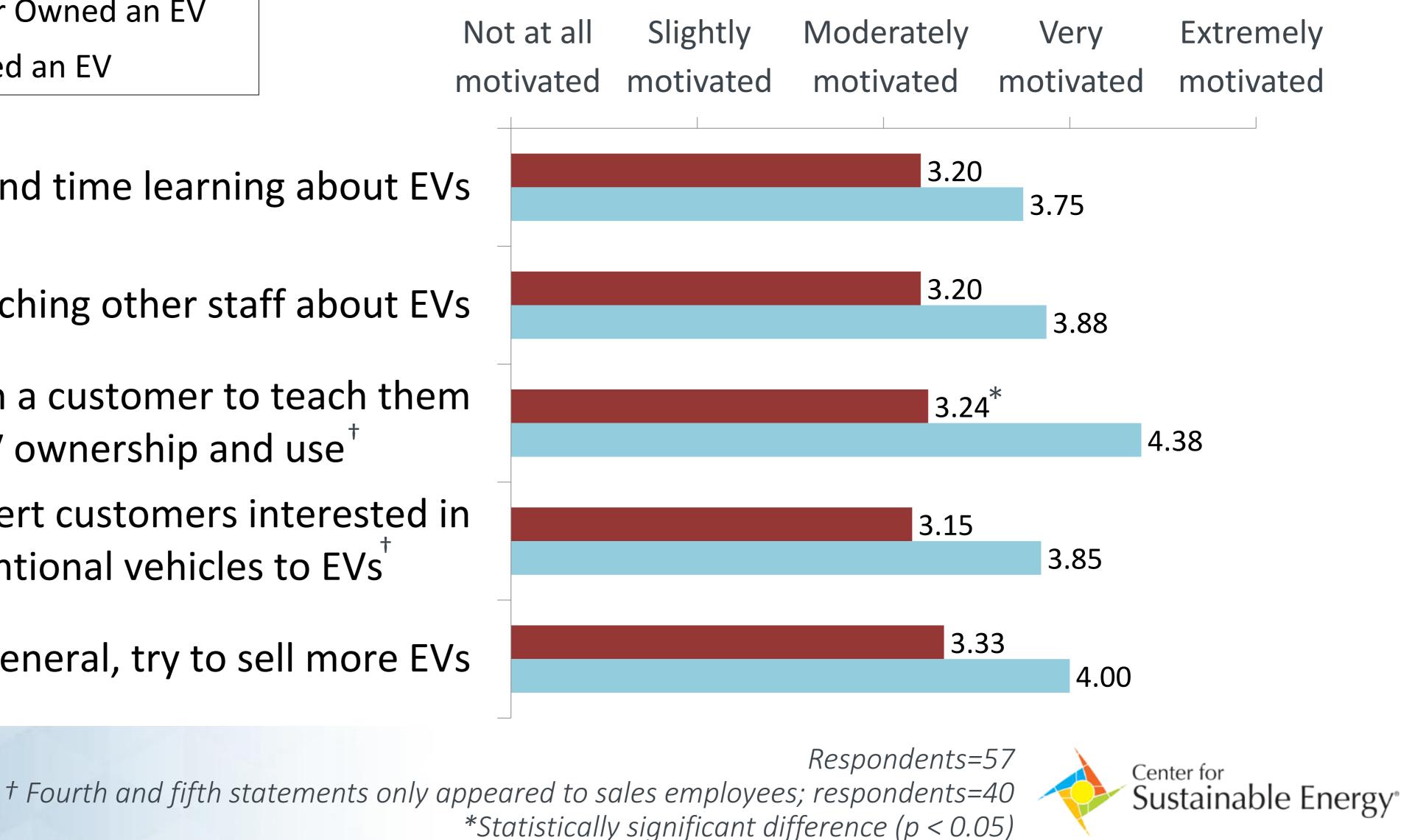
Spend time learning about EVs

Spend time teaching other staff about EVs

Spend time with a customer to teach them about EV ownership and use^{\dagger}

> Try to convert customers interested in conventional vehicles to EVs⁺

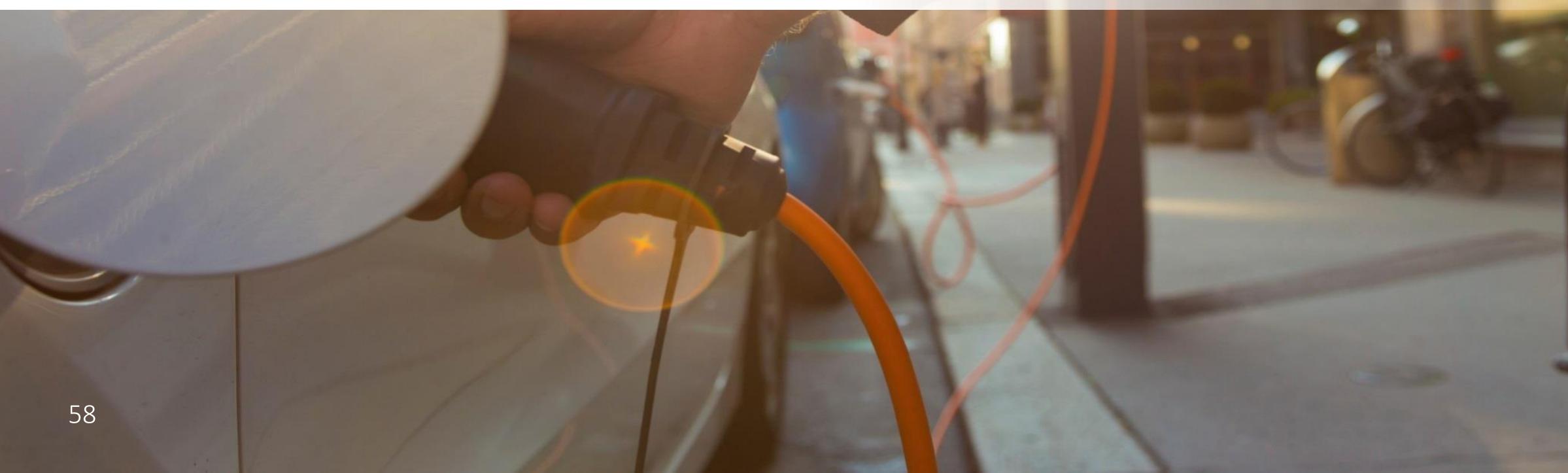
> > In general, try to sell more EVs







Wrap Up, Additional Resources & Details





Select Findings: Program Impacts

- Some consumer differences, particularly gender, remain
 - Trending in the right direction
 - Segmentation can support market-acceleration, cost-effectiveness, or mainstreaming, or equity goals
- ~ 4/5^{ths} of rebated EVs replace older, more polluting vehicles
- Rebate influence on purchase/lease:
 - moderately to extremely important to 9/10^{ths}
 - essential to > 1/2
- Indicators of impact are increasing over time
- income, as needed.
- ownership experience

Avoiding > 30 tons of GHG emissions per vehicle (12-year life) at costs <\$100/ton

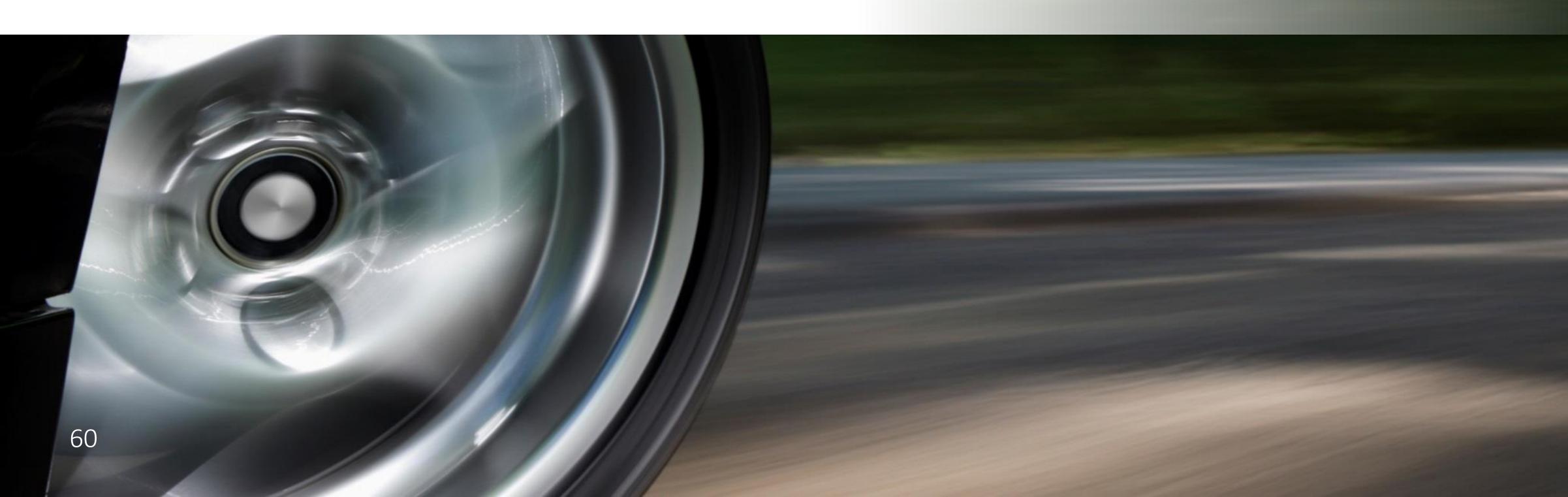
• Programs with MSRP caps and cash on the hood may support equity as well as, or better than, programs with income caps. *Supplement* with Increased Rebates based on

Dealer sales incentives motivate EV salespeople, particularly those with prior EV





Additional Resources & Details





CSE Clean Transportation Resources



Reports, analysis, infographics, presentations, ...

Search Term
Presentation: "EV
Provides equity metr
webinar "Expanding
Summary of CVF
A fact sheet which d

		Expertise	Core Values	Thought Leadership	о <i>и</i>
Т	HOUGHT LEAD	ERSHIP			
	_		nort	C	
	ch and	d Re	port	S	
	_	d Re	port	S	
	_	d Re	port	S	
	_	d Re	port	S	
	_	d Re		S	

Presentation: "EV Rebates: Demographic Update, Program Design Features, and Paths Forward for Broadening Participation"

Provides equity metrics, demographics, program-design features, and outreach strategies from four state-wide incentive programs. Given to the ZEV Alliance webinar "Expanding Access Listening Series."

(Aug, 2019

Summary of CVRP Rebate Eligibility and Funding Availability Over Time (Updated)

A fact sheet which details changes in Clean Vehicle Rebate Project rebate amounts, consumer-income eligibility criteria, and program funding availability over time





Evaluation: CVRP Analysis



Program reports, fact sheets, infographics & presentations











Image: Summary Documentation of the Electric Vehicle Consumer Survey, 2013-2015 Edition Image: Summary Documentation of the Electric Vehicle Consumer Segments - TRB Poster Infographic: Characterizing California Electric Vehicle Consumer Segments - TRB Image: Image: Summary 16, 2017 Infographic: Plug-in Electric Vehicle Owners in California's Disadvantaged Image: CVRP Final Report 2014-2015 Image: Summary 11, 2017 Image: Summary 11, 2017 Image	
Poster January 16, 2017 Infographic: Plug-in Electric Vehicle Owners in California's Disadvantaged Communities January 11, 2017 CVRP Final Report 2014-2015 November 21, 2016 Characterizing Plug-In Hybrid Electric Vehicle Consumers Most Influenced by CVRP November 15, 2016 Presentation: "Electric Vehicle Rebates in Disadvantaged Communities: Evaluating Progress with Appropriate Comparisons"	Edition
Communities January 11, 2017 CVRP Final Report 2014-2015 November 21, 2016 Characterizing Plug-In Hybrid Electric Vehicle Consumers Most Influenced by CVRP November 15, 2016 Presentation: "Electric Vehicle Rebates in Disadvantaged Communities: Evaluating Progress with Appropriate Comparisons"	Poster
November 21, 2016 Characterizing Plug-In Hybrid Electric Vehicle Consumers Most Influenced by CVRP November 15, 2016 Presentation: "Electric Vehicle Rebates in Disadvantaged Communities: Evaluating Progress with Appropriate Comparisons"	Communities
Presentation: "Electric Vehicle Rebates in Disadvantaged Communities: Evaluating Progress with Appropriate Comparisons"	
Progress with Appropriate Comparisons"	
	Progress with Appropriate Comparisons"



Select Pertinent Highlights (Reverse Chronological)

- predecessors linked on last slide)
- "CVRP: Data and Analysis Update"
- Consumers
- Consumers in 2016–2017" (update)
- "Electric Vehicle Rebates: Exploring Indicators of Impact in Four States"
- Targeting EV Consumer Segments & Incentivizing Dealers

Additional Analysis of CVRP Funding Need and Program-Change Scenarios (and

• Cost-Effectively Targeting EV Outreach and Incentives to "Rebate-Essential"

• Peer-Reviewed Conference Paper: "Strategically Targeting Plug-in Electric Vehicle Rebates and Outreach Using Characteristics of 'Rebate-Essential'





Select Pertinent Highlights, Cont. (Reverse Chronological)

- <u>Report: Evaluating the Connecticut Dealer Incentive for Electric Vehicle Sales</u>
- <u>Supporting EV Commercialization with Rebates: Statewide Programs, Vehicle & Consumer Data, and Select Findings</u>
- Yale Webinar: Supporting EV Commercialization with Rebates: Statewide Programs, Vehicle & Consumer Data, and Select Findings
- "CVRP Income Cap Analysis: Informing Policy Discussions"





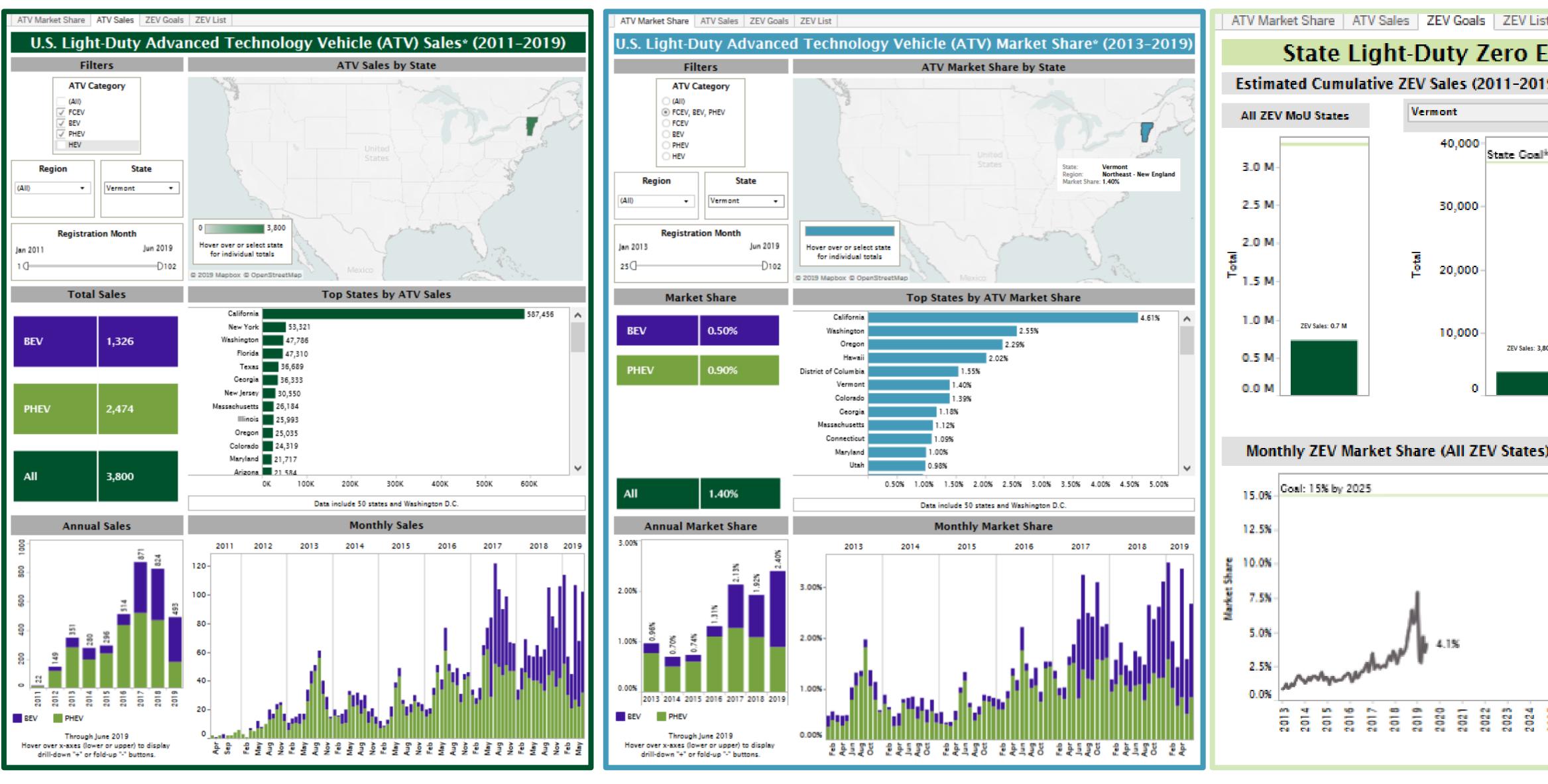
Consumer Survey Data (Shows Rebates to Individuals Only, CVRP "Current Program" Only)

	CLEAN VEHICLE REBATE PROJECT	Massachusetts Offers Rebates for Electric Vehicles	Connecticut Hydrogen and Electric Automobile Purchase Rebate		Total
Vehicle Purchase/ Lease Dates	<u>Nov. 2016</u> * – Dec. 2018	Jun. 2014 – Oct. 2018	May 2015 – Sep. 2018	Mar. 2017 – Jul. 2018	Jun. 2014 – Dec. 2018
Survey Responses (total n)**	23,478	4,555	1,565	1,808	31,406
Program Population (N)	135,897	10,920	3,510	8,651	158,978

* After the most recent change in the program's income criteria, to reflect the "current program era" ** Weighted to represent the program population along the dimensions of vehicle category, vehicle model, buy vs. lease, and county (using raking method)



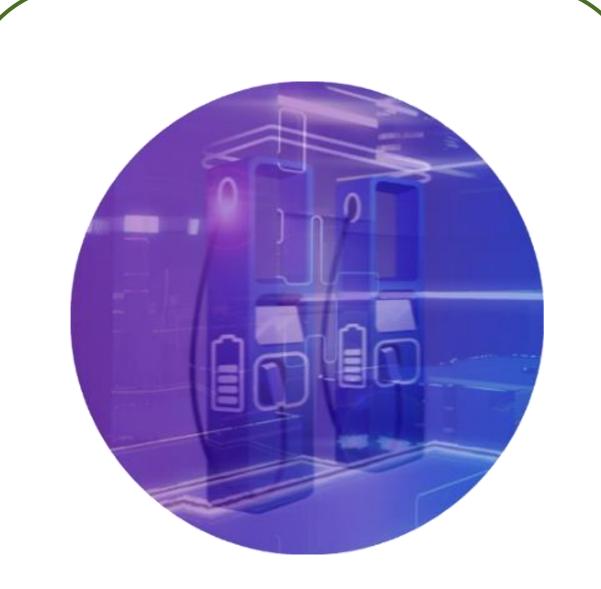
AA 50-State EV Sales, Market Share, and Goals Dashboard



Linked at <u>zevfacts.com</u>

st	
Emis	
9)	
Ŧ	
*	
800	
5)	
2025	
66	

CSE Areas of Expertise



Clean **Transportation**

Adoption of electric vehicles and deployment of charging infrastructure



Advancing energy efficiency and renewable resources



Built Environment

Technology Convergence

Interconnecting systems to achieve decarbonization



CSE: A Nonprofit With Billion-Dollar Program Management Experience

- Five Statewide Electric Vehicle Rebate Programs
 - > \$720 million
 - > 350,000 rebated vehicles
 - > 300,000 consumers characterized
- Statewide EV Charging Incentives
 - > \$100 million
 - 367 DC fast chargers, 211 Level 2 chargers and growing
 - Diverse: urban, rural, mountains, deserts, plains
- Solar On Multifamily Affordable Housing Program \$1 billion
 - 300 MW + virtual net energy metering



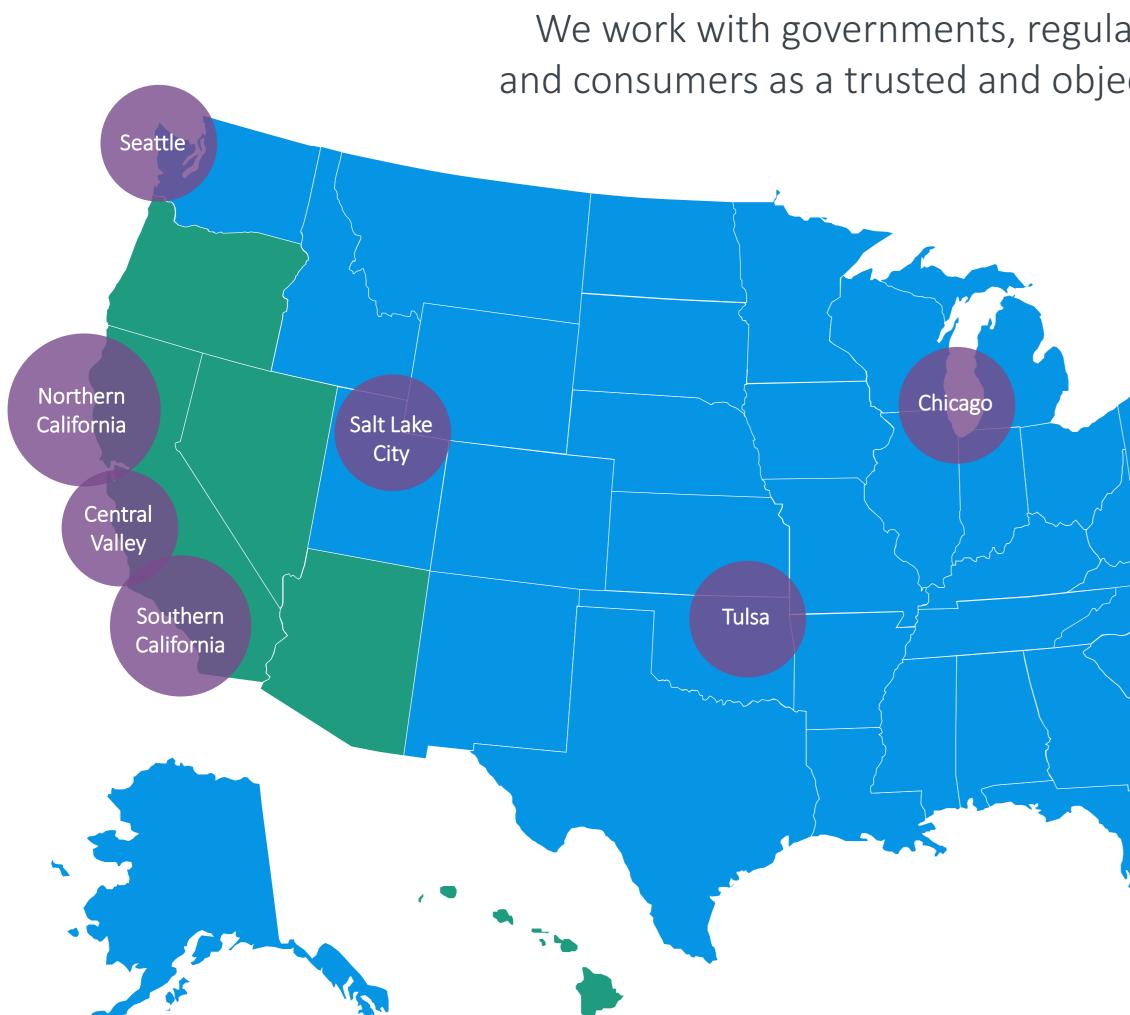




How Can We Help?

Baltimore/

DC



We work with governments, regulators, utilities, CCAs, businesses, property owners, and consumers as a trusted and objective implementation partner and technical advisor.

For more information:

https://cleanvehiclerebate.org/eng/program-reports

https://energycenter.org/thought-leadership/research-and-reports

brett.williams@energycenter.org

Statewide incentive programs

Region-specific solutions

Tackling issues of national importance





Contact Us



HEADQUARTERS

3980 Sherman Street, Suite 170 San Diego, CA 92110

REGIONAL OFFICES

EnergyCenter.org



Boston MA • Brooklyn NY

Los Angeles CA • Oakland CA

Sacramento CA • Stony Brook NY



TELEPHONE

858-244-1177

Topics for Discussion

- EV market dynamics: models, product types, state statistics
- EV incentive design, for
 - Volume benefits
 - Cost effectiveness
 - Emissions reductions
 - Equity
- EV consumer demographics / incentive beneficiaries
- Implementation perspectives
- Pillars of program administration
- Mechanisms for increasing EV demand infrastructure
- Comprehensive and effective EV policy frameworks Vehicle supply, demand, fuel carbon intensity, vehicle use

– Awareness, dealer sales incentives, consumer purchase incentives,

