Zero Emission Vehicles – Clearing the Air

New Jersey Clean Air Council

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Agenda

- Advanced ICE and Hybrids – GHG and emissions
- Zero Emission Vehicles
- Recommendations
  - Affordability
  - Infrastructure
  - Awareness
  - Equity
  - Heavy Duty Vehicles

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Advanced ICE and Hybrids

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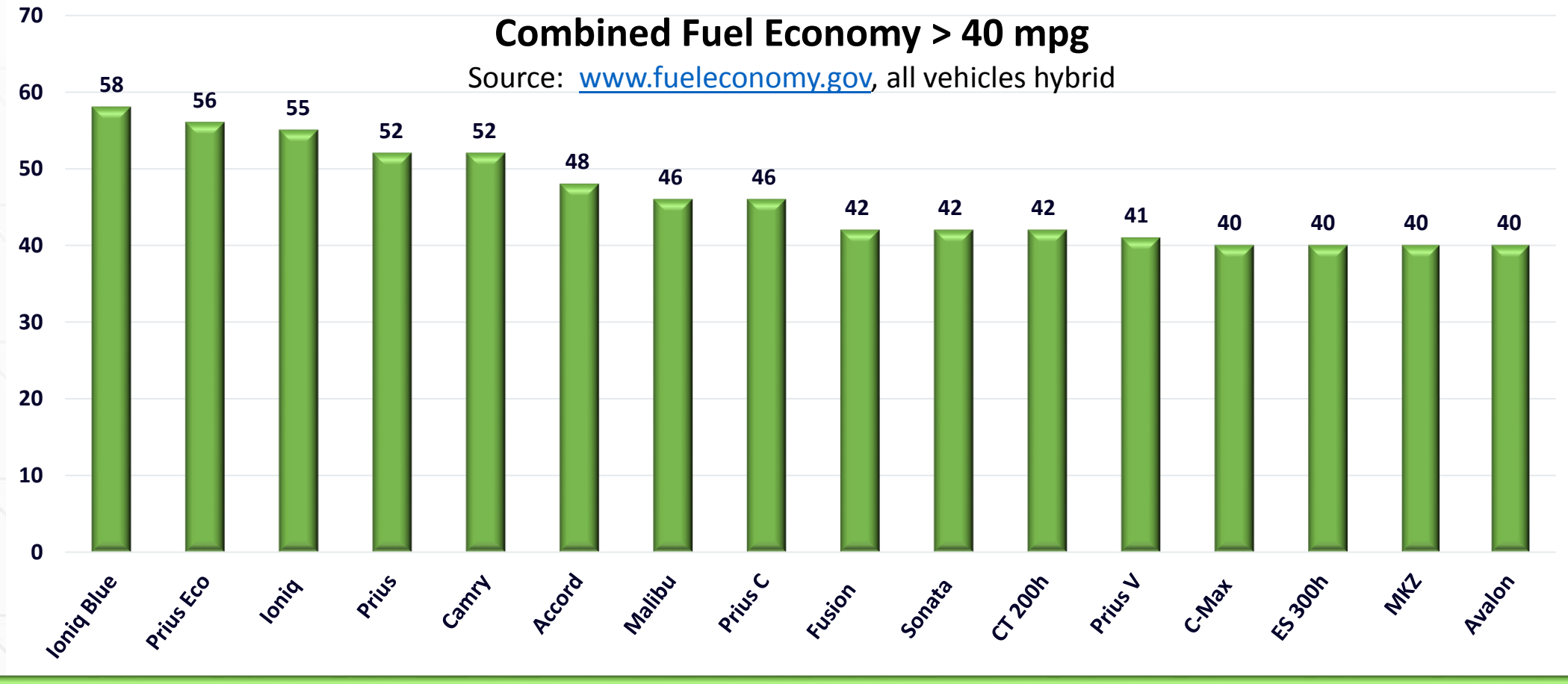
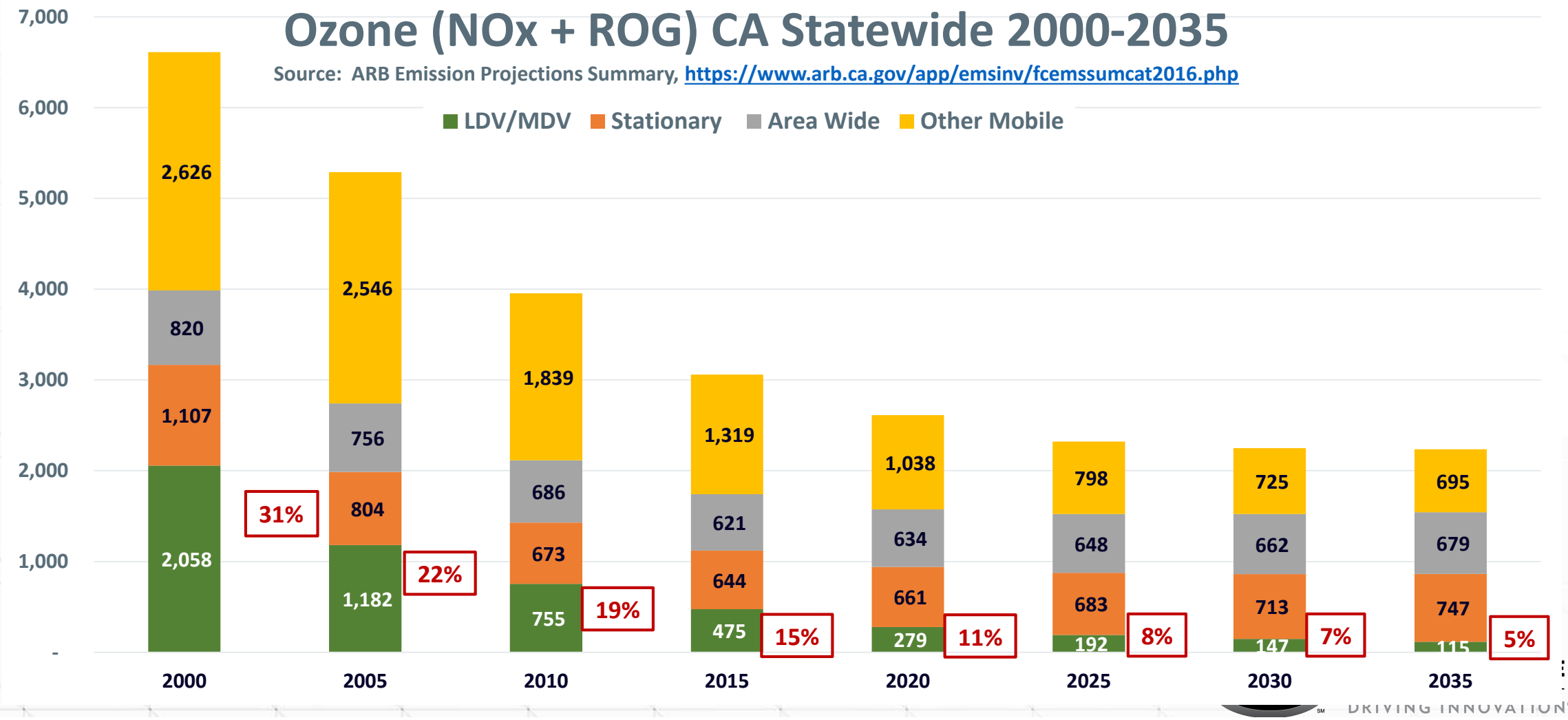
Internal Combustion Engines and Hybrid Fuel Economy



8 gallons of gas: Trenton to Washington, DC…and back!

Cars, Trucks, SUVs, and Minivans SMOG Contribution*



* Projected emissions not available for NJ, but 2010 CA values consistent with NJ 2011 emissions, http://www.state.nj.us/dep/baqp/ozoneco2011inv/app-ii-2011-inventory-report-final.pdf

Cars vs Leaf Blowers

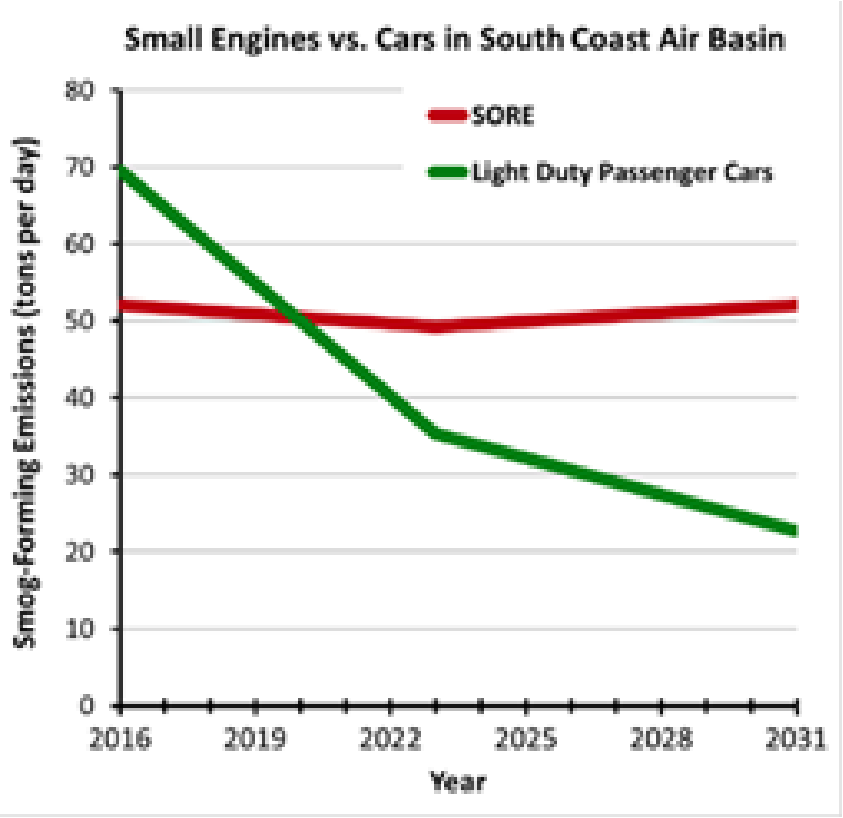
"In the early 2020s, however, total smog-forming emissions from small engines are projected to exceed those from passenger cars in the South Coast Air Basin because passenger car emissions will continue to decrease. **By 2031, small engine emissions will be more than twice those from passenger cars.**"

ARB Small Engine Fact Sheet, June 2017

https://www.arb.ca.gov/msprog/offroad/sm_en_fs.pdf


SCIENCE NOW SCIENCE LA TIMES

Mad about L.A.'s air quality? Blame common products like hairspray and paint, not just cars



SORE = Small Off Road Engines

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Zero Emission Vehicles

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What is a “ZEV” (Zero Emission Vehicle)?

1. **PHEV**: Plug-in Hybrid Electric Vehicle = Gas + Electric (Chevy Volt)
2. **BEV**: Battery Electric Vehicle = Electric Only (BMW i3)
3. **FCEV**: Fuel Cell Electric Vehicle = Hydrogen Only (Toyota Mirai)

Automaker ZEV Efforts

- Aggressive vehicle prices
- More Models
- More variety
- Longer Range
- Better Performance
- More options

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41 ZEVs Available Now*

BEV (12)
BMW I3 BEV
Chevy Bolt
Ford Focus Electric
Honda Clarity Electric
Kia Soul EV
Mercedes B250e
Nissan LEAF
Smart Electric Drive
✧Tesla Model S
Tesla Model 3
✧Tesla Model X
Volkswagen eGolf

PHEV (29)	
Audi A3 e-tron	Kia Niro Plug-in
BMW 330e	Kia Optima Plug-in
✧BMW 530e	Mercedes C350e
✧BMW 740e	✧Mercedes GLE-550e
BMW i3 REX	✧Mercedes GLC-350e
BMW i8	Mercedes S550 Plug-in
✧BMW X5 xDrive40e	✧Mini Countryman S E ALL4
Cadillac CT6	✧Mitsubishi Outlander
Chevy Volt	✧Porsche Cayenne S-E
Chrysler Pacifica Hybrid	Porsche Panamera S-E
Ford C-Max Energi	Toyota Prius Prime
Ford Fusion Energi	✧Volvo S90 T8
Honda Clarity Plug-in	✧Volvo XC90 T8
Hyundai Ioniq Plug-in	✧Volvo XC60 T8
Hyundai Sonata Plug-in	

* ZEVs with Feb-2018 sales http://www.hybridcars.com/february-2018-dashboard/ retrieved 15-Jan-2018
✧ AWD available

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Then…
In 2016, ARB Predicted 70 ZEV Models by 2021

- BEV – 37 different models (24 with > 200 mile range)
- PHEV – 36 different models
- FCEV – 6 different models

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* ARB ACC Mid-Term Review, Zero Emission Vehicle and Plug-in Hybrid Electric Vehicle Technology Assessment, 18-Jan-2017, Page C-15

Now…Even More ZEV models Coming
2017-18 OEM Announcements*

- Mercedes, Jan 29, 2018[6]: 10 BEVs by 2022, 50 total electrified** models
- Ford, Jan 14,2018[1]: 16 BEVs (40 total electrified models) by 2022, $11 billion investment by 2022
- Toyota, Dec 18, 2017[2]: 10 BEVs by early 2020s. By around 2025, every model in the Toyota and Lexus line-up around the world will be available either as an electrified option.
- General Motors, Nov 15, 2017[3]: 20 total BEV or FCEV by 2023, 2 long-range BEVs in 18 months
- Mitsubishi, Sep 15, 2017[4]: Part of Alliance (Renault, Nissan, Mitsubishi), 12 new BEVs by 2022
- Volkswagen, Sep 11, 2017[5]: 80 new electric vehicles by 2025
- BMW, Sep 7, 2017[7]: 12 BEVs, 25 total electrified models by 2025
- Jaguar Land Rover, Sep 7, 2017[8]: Every new model from 2020 will be electrified
- Volvo, July 4, 2017[9]: 5 BEVs by 2021. Every new model launch from 2019 will have an electric motor (HEV, PHEV, and BEV)

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* See Sources Slide;
** "Electrified" typically means conventional hybrid electric vehicle, PHEV, BEV, or FCEV.

ZEVs are here…MANY MANY MORE ARE COMING!

- 2WD/AWD
- Small car, large car, SUV, Minivan
- BEVs, PHEVs, FCEVs
- Long range/short range
- Luxury/economy
- Everything in between
- Automaker investment likely to reach $100 billion by 2025

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The problem is NOT a lack of vehicles…

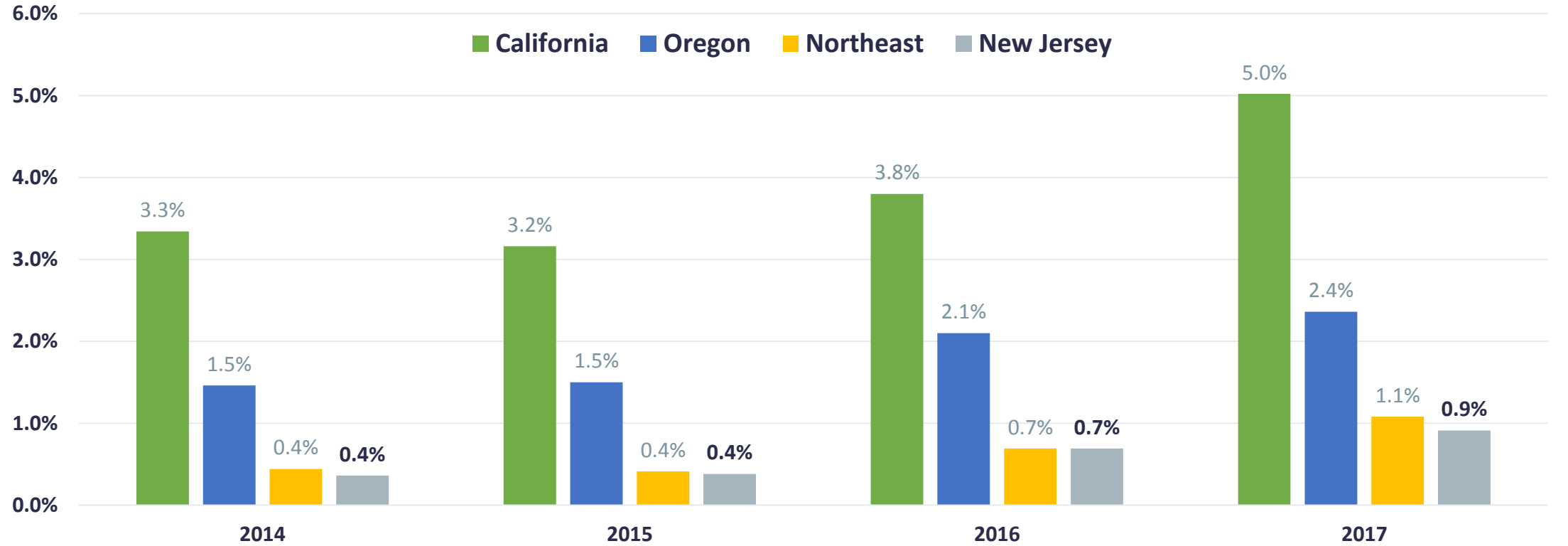
THE PROBLEM IS A LACK OF CUSTOMERS!

Automakers and Policymakers May Be on a Path to Electric Vehicles; Consumers Aren't

By Ken Kurani (https://itspeople.ucdavis.edu/fac-proresearch/kurani-ken/) and Scott Hardman (https://itspeople.ucdavis.edu/postdoc-research/hardman-scott/)

UC Davis, ITS GreenLight Blog, 18-Jan-2018 retrieved from https://its.ucdavis.edu/blog-post/automakers-policymakers-on-path-to-electric-vehicles-consumers-are-not/

Context – Nascent ZEV Market*



* Advanced Technology Vehicle Sales Dashboard. Data compiled by the Alliance of Automobile Manufacturers using information provided by IHS Markit. Data last updated 2/16/2018. Retrieved 22-Mar-2018 from https://autoalliance.org/energy-environment/advanced-technology-vehicle-sales-dashboard/

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Recommendation – Develop a Plan

Develop a detailed, comprehensive, governor-signed ZEV Action Plan. The Action plan should include specific actions, the timeframe for each action, the agencies involved, and the agency responsible for ensuring completion.

Examples: 2016 California ZEV Action Plan, NESCAUM

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Customers and the Market

- Incentives
- Infrastructure
- Simple, low-cost fuel pricing
- Consumer education & awareness

❖ Equity

❖ Heavy Duty Vehicles

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Incentives & Affordability (Financial Incentives)

- Federal: Up to $7,500 tax credit
- State:
  - Rebates or tax credits
  - Sales tax exemption
  - Reduced registration fees
- Local:
  - Rebates
  - Free or reduced parking rates
- Free or reduced tolls

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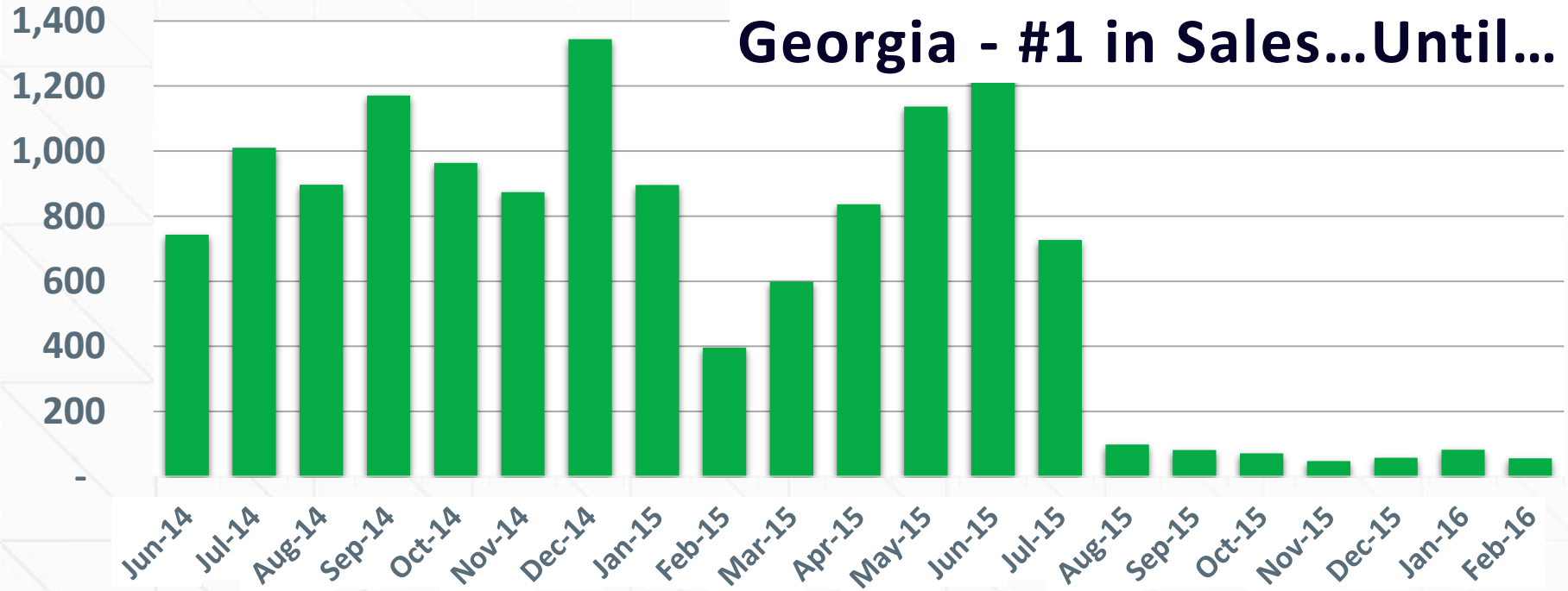
Do Financial Incentives Matter?

SUPPORT
ZEV Incentives



Non-Financial Incentives

- HOV lane access
- Preferential parking
- Free public charging
- Free workplace charging

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Infrastructure Benefits

- Technology acceptance
- Range confidence
- Maximize electric miles
- Build consumer awareness

- 41 Plug-in electric vehicle (PHEVs and BEVs) models
- 3 Fuel cell electric vehicle (FCEV) models

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Fuel Cell EVs Available Where Hydrogen Available

Fuel cell electric vehicles
and hydrogen fuel

OVER 3,000
Mirai sold
or leased in
California

Retrieved 31-Jan-2018 from https://cafcp.org/

State's Role - Hydrogen

- Public-private partnership to share up-front and operating costs. For example, California:
  - Allocates $20 million annually
  - Goal of 200 stations state-wide by 2025
- Streamline siting, permitting, installation of H2 stations
- Eliminate barriers to use of FCEVs

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Infrastructure Locations

- Home (single family home, MUDs, and DCFC clusters)
- Workplace
- Public
- Highway corridors
- High-Utilization Urban Transportation “Hubs”

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Consumer Awareness

- Integrate into every part of the program – incentives, infrastructure, fuel prices
- Direct consumer awareness campaigns. For example,
  - Drive Change. Drive Electric.
  - DMV
  - Utilities
- Ride and drive events

State Fleet Purchases

- Drives consumer awareness
- State infrastructure can be used by public (particularly H2 fueling)
- Provides states experience in operation of ZEVs
- Highlights issues with state fleet purchase (e.g., lease vs purchase)
- State should set
  - Long-term goals – e.g., 50% ZEVs by 2025
  - Intermediate, annual goals – e.g., 10% ZEVs by 2020, 20% by 2021, etc.
  - Report and track vehicle purchases/leases
- Incorporate local government fleets where possible

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Drive Change. Drive Electric.

- Launched at New York Auto Show
- 7 states + 16 car companies
- Focus on benefits of electric cars, advance consumer understanding, consideration and adoption of electric cars
- https://driveelectricus.com/

Equity

- Integrated into all aspects of electrification
- Incentives
- Infrastructure
- Simple, low cost fuel

Utility and BPU Engagement in Electric Vehicle Charging Infrastructure

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Why Utilities and Regulators *Should* Engage

- Good for all ratepayers
  - Introduces flexible load that can flatten load curve and improve grid utilization
  - Better integration of renewable resources
  - Downward pressure on rates over the long term
- Good for EV drivers
  - Stable, typically lower-cost fuel
  - Convenient home fueling
- Good for the environment
- Potential solution for declining load, distributed generation, and other problems facing utilities

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Why Utilities and Regulators *Must* Engage

- EVs represent potentially the largest load to hit the grid since kitchen appliances and air conditioning – waiting to see "what happens" is not responsible. Early engagement allows utilities and regulators to capture benefits and avoid unintended consequences or potential cost
- The market has not sufficiently invested in EV infrastructure and so utility investment is required to close the infrastructure gap
- Utilities have:
  - Experience at siting, installing, operating electrical equipment long term
  - Ability to shoulder projects with high installation cost and low profit
  - Knowledge of grid impacts for EVSEs at all power levels
  - Ability to ensure access to underserved communities (rural, low income)
  - Strong existing relationships with all ratepayers

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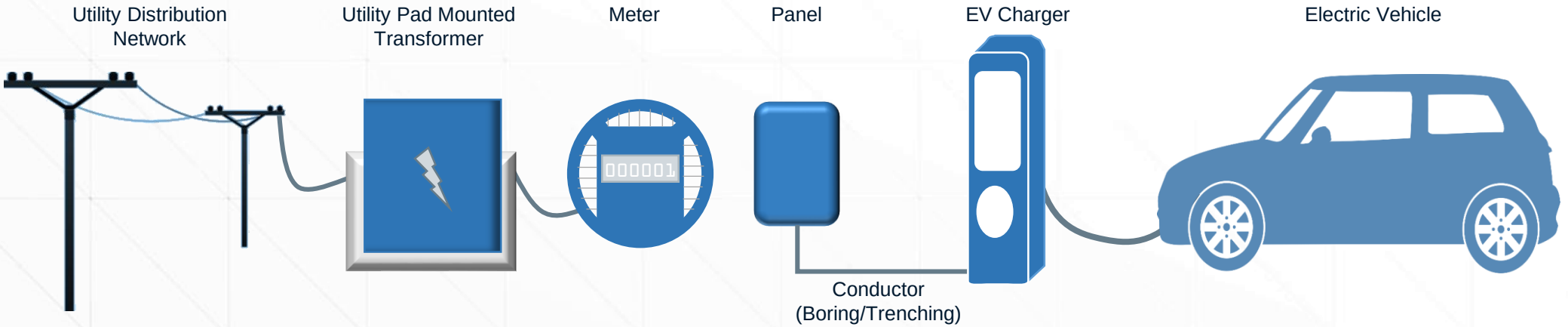
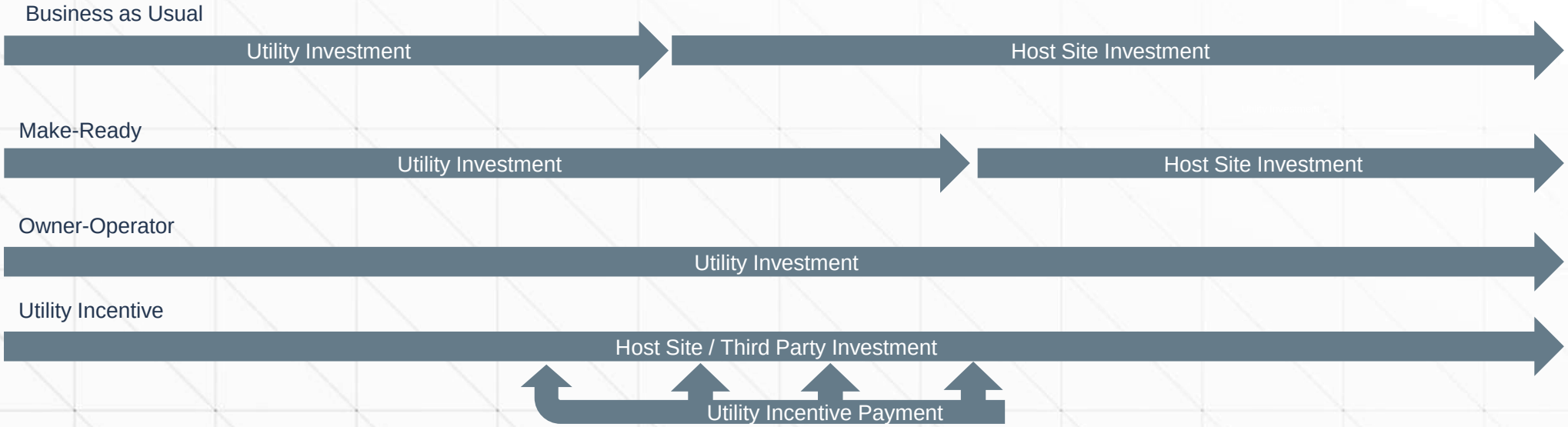
Utility Investment Options in EV Charging Infrastructure

All options should be on the table during the early market before a positive business case is established.





Utility Engagement – Fuel Pricing

- Residential
  - Time of use rates
  - Special rates for EV drivers
  - EVSE use as submeters
- Commercial (fleet operators, public DCFC, etc.)
  - Special rates to reduce demand charges
  - Assistance with EV charger installation (e.g. transformer upgrades)
  - Steer charging toward grid beneficial periods
- Other Options –
  - Energy storage (V1G, H2 generation)
  - Special pilots to identify alternatives to demand charges (e.g. temporary demand charge waivers)

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Utility Engagement
Consumer Education & Awareness

- Residential
  - Technology promotion
  - Assist customers with rate selection
  - Charger installation – recommended chargers, electricians, permitting requirements, panel upgrades, etc.
- Commercial (fleet operators, public DCFC, etc.)
  - Special rates to reduce demand charges
  - Analysis of infrastructure and operating costs
  - Business case development (parking lots, retail site host, etc.)

Utilities are uniquely qualified to deliver EV Education/Awareness: they are trusted 3rd party experts on all things related to electricity and they already have a direct relationship with every residential and commercial customer.

Utility Engagement – Incentives

- Incentives for chargers (home, public, workplace)
- Incentives for installation (home, public, workplace)

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BMW Group · FCA FIAT CHRYSLER AUTOMOBILES · Ford · GM · JAGUAR · LAND ROVER · mazda

Mercedes-Benz · MITSUBISHI MOTORS · PORSCHE · TOYOTA · VOLKSWAGEN GROUP OF AMERICA · VOLVO

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