

TRANSPORTATION RESEARCH BOARD

**Programs to Support the Deployment of the
Electric Vehicle Infrastructure**

**Wednesday, April 3, 2019
2:00-3:30 PM ET**

The Transportation Research Board has met the standards and requirements of the Registered Continuing Education Providers Program. Credit earned on completion of this program will be reported to RCEP. A certificate of completion will be issued to participants that have registered and attended the entire session. As such, it does not include content that may be deemed or construed to be an approval or endorsement by RCEP.



REGISTERED CONTINUING EDUCATION PROGRAM

Purpose

Discuss the development of the electric vehicle network. Electrification of the vehicle fleet will be a major change to the transportation sector. This may have a significant effect on the environment with the reduction in vehicle emissions.

Learning Objectives

At the end of this webinar, you will be able to:

- Describe the origin and development of programs supporting the transition from conventional fueled vehicles to electric vehicles
- Discuss the organization structure developed to promote the transition
- Explain how states, counties, cities, local agencies, and other organizations are using funds to further the deployment of electric vehicle fleets

Programs and Funding Sources Supporting the Deployment of the Electric Vehicle Infrastructure

Sponsored by TRB ADC20 Committee

Transportation and Air Quality

Wednesday, April 3, 2019

Programs and Funding Sources Supporting the Deployment of the Electric Vehicle Infrastructure

- This webinar is one in a series that is being presented on the transformation of the vehicle fleet and its impact on emissions
- Previous webinars have included:
 - "Technology Changes Influencing the Decline of Vehicle Emissions"
 - "The Alternative Fuels Corridor Program"
- The purpose of these webinars is to describe the changes in societal conditions, personal preferences and technological improvements and advancements which are likely to be permanent and lead to reductions in emissions from vehicles that are a concern in many areas

Programs and Funding Sources Supporting the Deployment of the Electric Vehicle Infrastructure

- Today's speakers will present their discussion on the evolving vehicle infrastructure from three perspectives:
 - Global/national
 - State
 - Local
- The talks will focus on the programs that have been initiated by various governments and the private sector in support of the evolution of the energy system used by highway vehicles
- Speakers for today's webinar will include:
 - Francisco Posada Sanchez (International Council on Clean Transportation, ICCT)
 - Christian Willis (State of Colorado Energy Office)
 - Jennifer Venema (City of Sacramento)
 - Kevin Black (Federal Highway Administration, FHWA, moderator)

Programs and Funding Sources Supporting the Deployment of the Electric Vehicle Infrastructure

- Our first speaker who will provide a global and national perspective on the electrical vehicle evolution is Francisco Posada Sanchez with the International Council on Clean Transportation (ICCT)
- Our second speaker who will provide a State perspective on the electrical vehicle transition is Christian Willis with the State of Colorado Energy Office
- Our Third Speaker who will provide the local perspective on the evolving electrical infrastructure is Jennifer Venema with the City of Sacramento

Programs and Funding Sources Supporting the Deployment of the Electric Vehicle Infrastructure

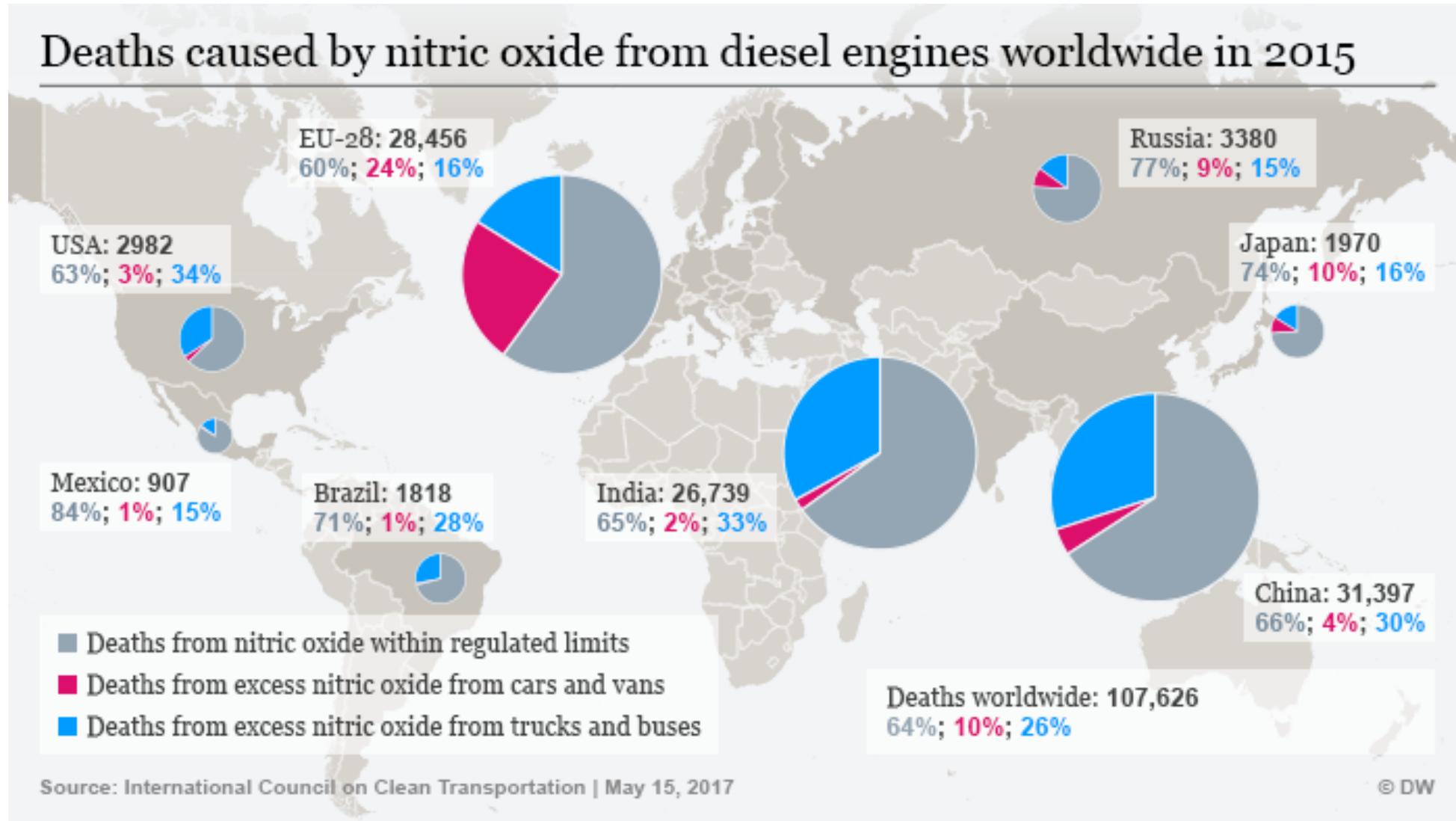
- The TRB ADC20 Committee on Transportation and Air Quality hopes that this webinar helps the viewers understand the transformation occurring with highway vehicles and the infrastructure supporting them
- The Committee would also like to thank TRB for sponsoring this webinar and the others noted early which have been examining the evolution occurring in vehicle transportation systems

Transitioning from the internal combustion engine to the zero emission vehicle

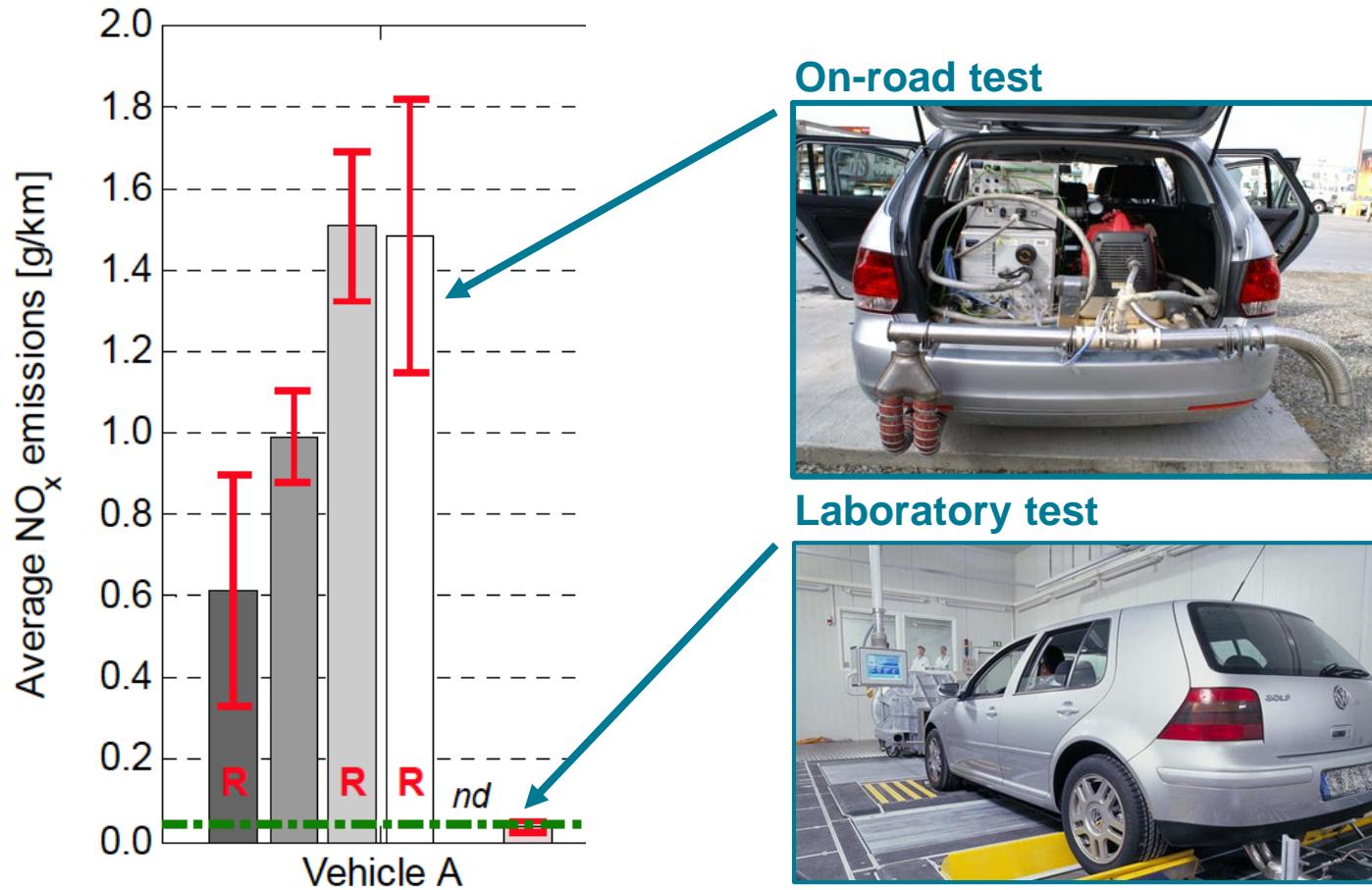
*Francisco Posada
Senior Researcher*

TRB Webinar series
Washington DC
April 3rd, 2019

Globally, more than 38,000 people die early because of excess diesel NO_x emissions, every year. More than 69,000 early deaths due to regulated NOx.



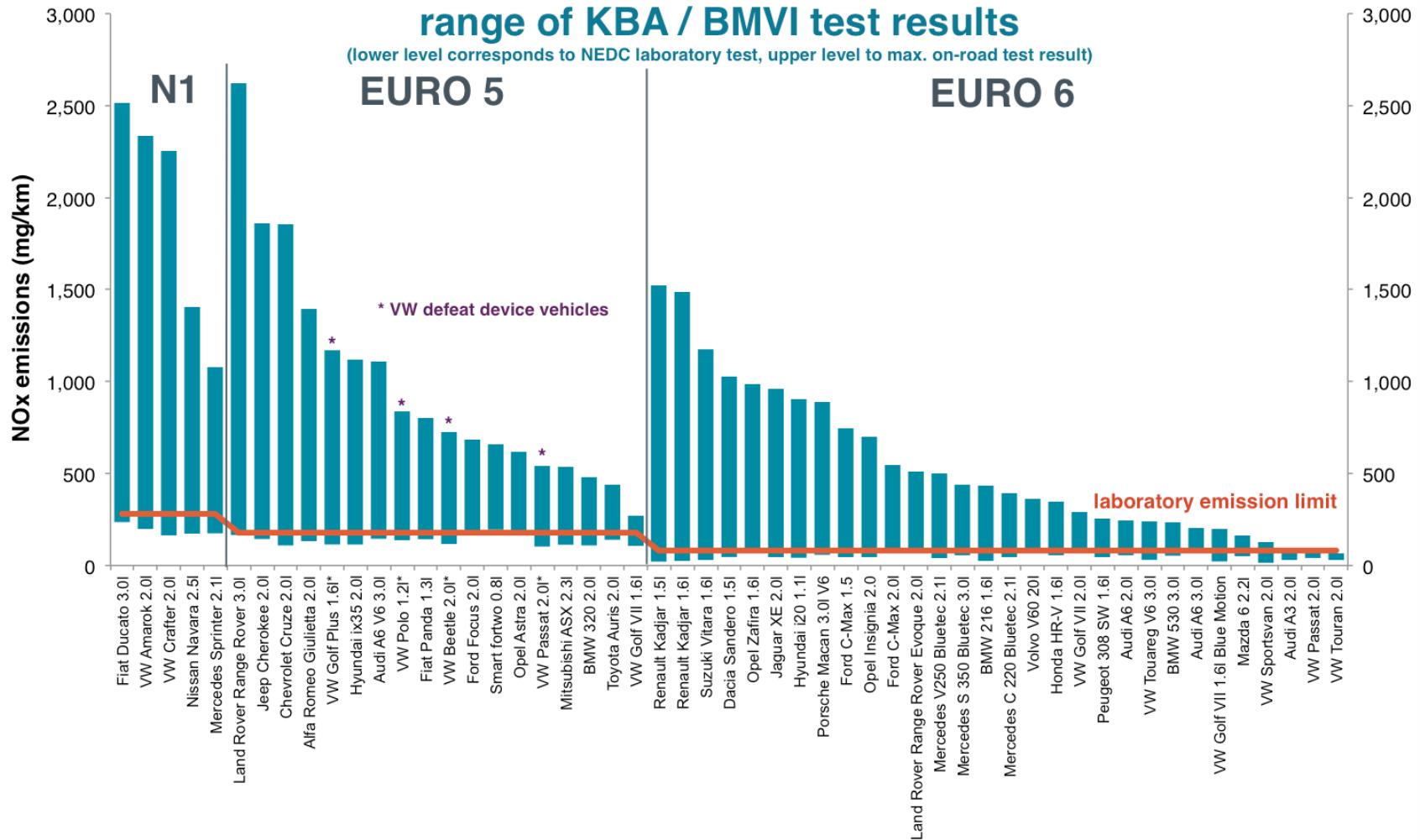
A comparison of laboratory vs. on-road test results for 3 diesel cars in the US triggered 'Dieselgate'



Source: <http://www.theicct.org/use-emissions-testing-light-duty-diesel-vehicles-us>

Source for photos: WVU / ICCT, AVL / ERMES
Vehicles shown on photos are not related to test results shown

Government testing has confirmed earlier findings and points to numerous other defeat devices



Summary of results from 1243 PEMS test on 541 diesel models

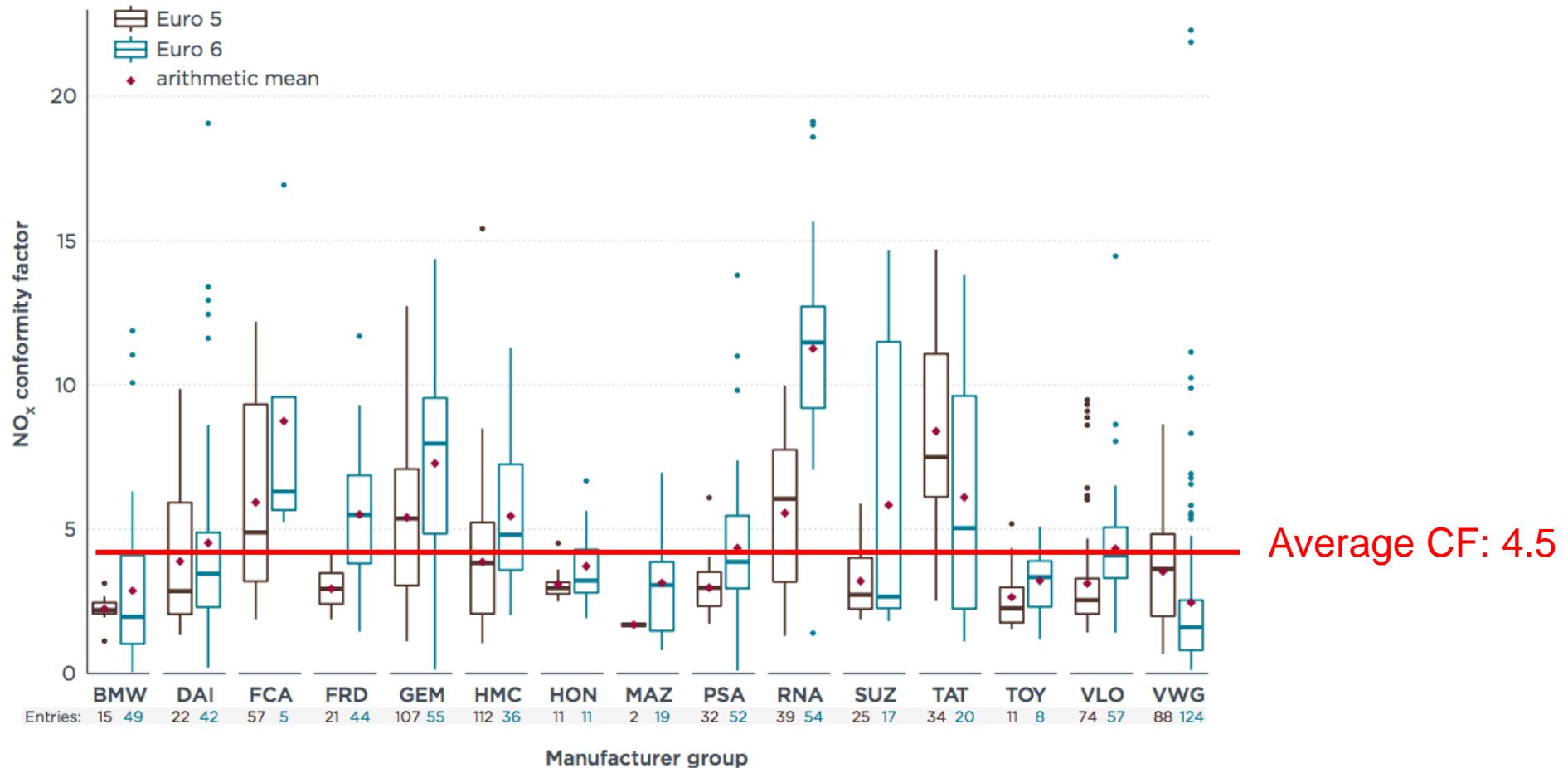
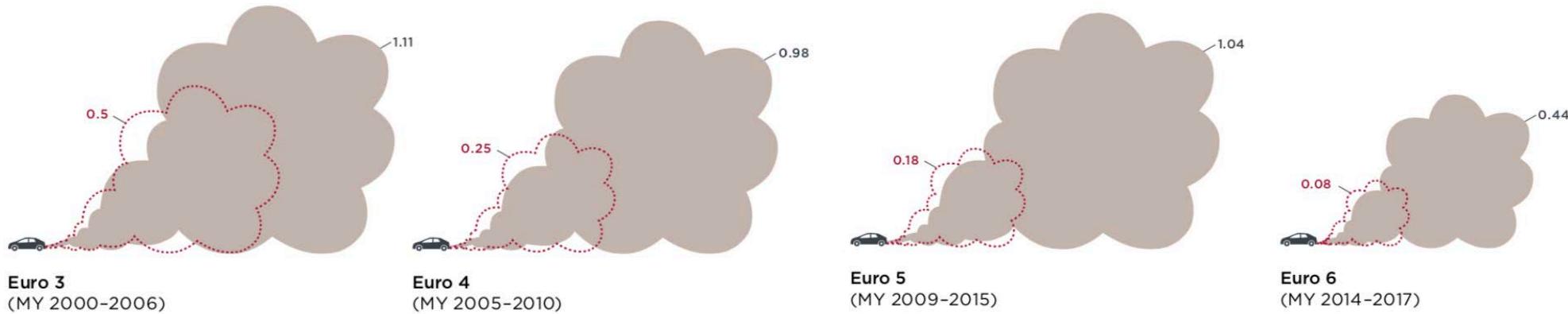


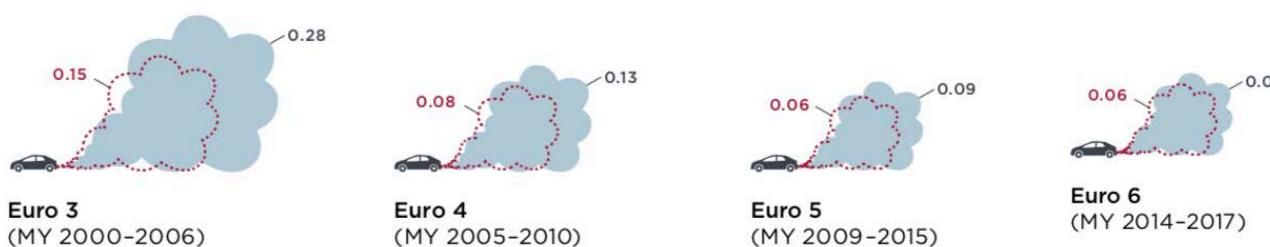
Figure 1: Boxplots of on-road NO_x conformity factors of individual vehicle tests by manufacturer group and emissions standard.¹²

Nitrogen oxides emissions from diesel cars in Europe have not decreased as expected

Diesel cars: Nitrogen oxide (NO_x) emissions (in g/km)



Gasoline cars: Nitrogen oxide (NO_x) emissions (in g/km)

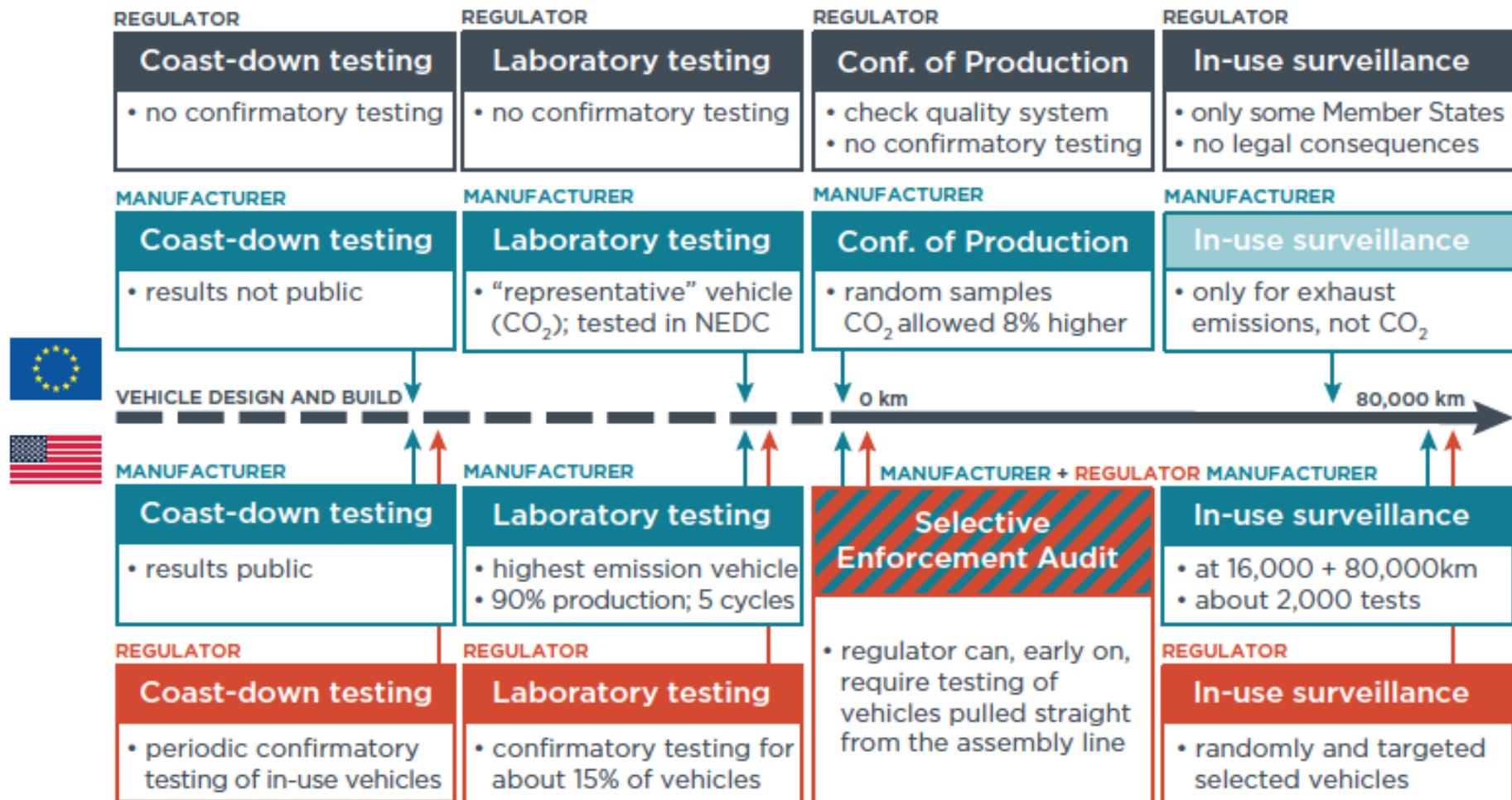


■ On-road measured value,
measurements taken between
2011 and 2017

… Euro emission limit

US: Self-certification + strict compliance testing

EU: Strict approval process but little enforcement



Air pollution and public health concerns caused by elevated NOx emissions from diesel cars drove city officials to take desperate actions. Sales of diesel passenger cars are coming down in Europe

Pollution

Four of world's biggest cities to ban diesel cars from their centres

Paris, Madrid, Athens and Mexico City will ban the most polluting cars and vans by 2025 to tackle air pollution



Cars sit in traffic in Mexico City, Mexico. Photograph: Brett Gundlock/Getty Images



Italy has a relatively high percentage of diesel-engined cars, with diesel car sales in recent years approaching 60 percent.

PHOTO BY WOODY HIBBARD

ROME TO BAN DIESEL CARS FROM CITY CENTER BY 2024

High levels of traffic congestion and prevalence of diesel cars is taking a toll

MARCH 2, 2018

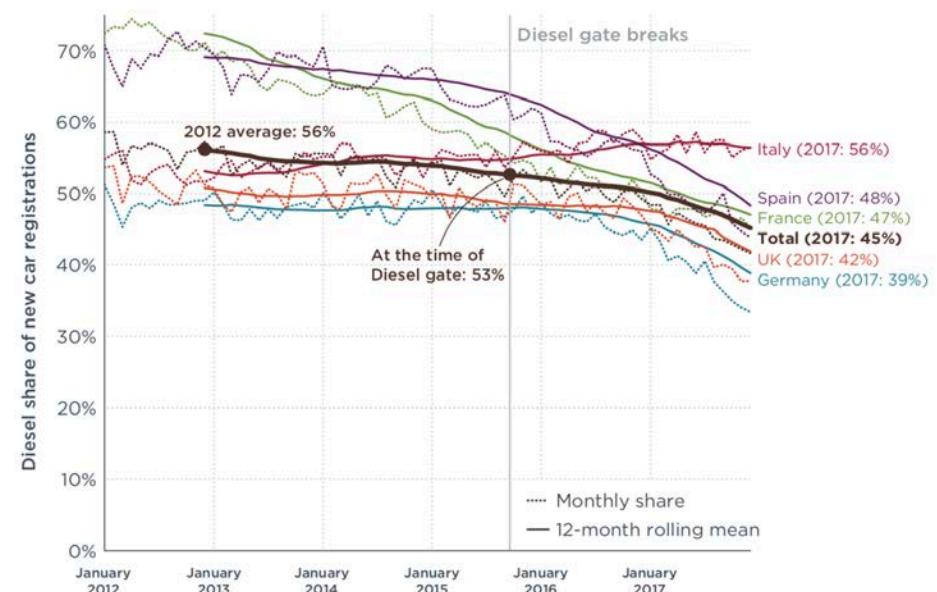
Greenhouse gas emissions

Oslo temporarily bans diesel cars to combat pollution

Norway's two-day city centre ban angers motorists who were encouraged to buy diesel vehicles in 2006



Traffic enters and exits the Flølefjord tunnel, a major intersection in Oslo, Norway. Photograph: Grethe



Remote sensing as an ideal complementary measurement tool for detecting high on-road emissions

TRUE: the real urban emissions initiative

ENVIRONMENT | Wed Mar 29, 2017 | 10:44am EDT

Paris and London mayors announce scheme to gauge car emissions



London Mayor Sadiq Khan (L) and Paris Mayor Anne Hidalgo attend a meeting on air pollution in Paris, France, March 29, 2017. REUTERS/Gonzalo Fuentes

1/2

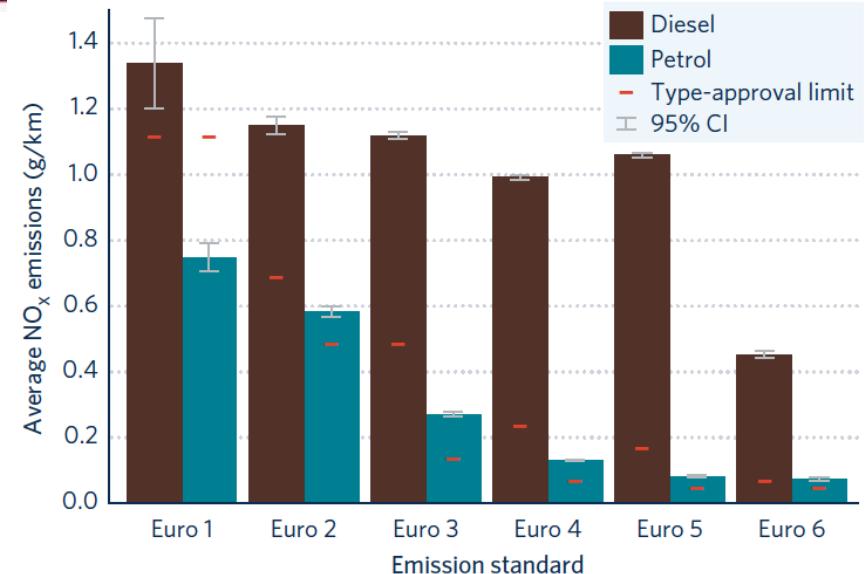
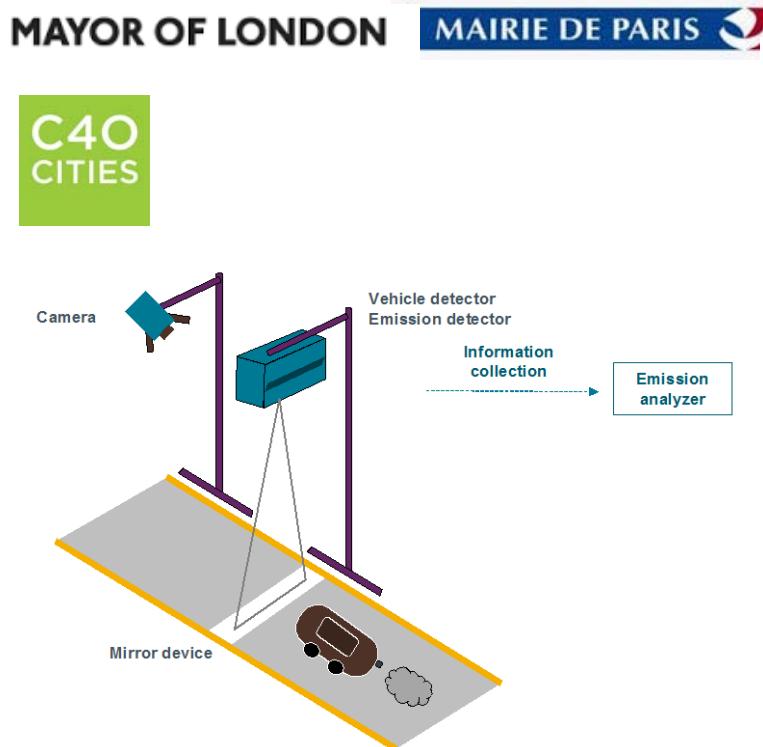


Figure 10: Overview of NO_x emissions (g/km) of the on-road fleet, from Euro 1 to Euro 6, for petrol and diesel passenger vehicles.³³

London: Ultra Low Emission Zone, Clean Car Checker, diesel Taxi expedited retirement, scrappage

Paris: Low Emission Zone

Brussels: Low Emission Zone and Vehicle Ban

Scotland: Remote sensing network and Low Emissions Zones in major cities

Mexico City: Scrappage, Low Emission Zones

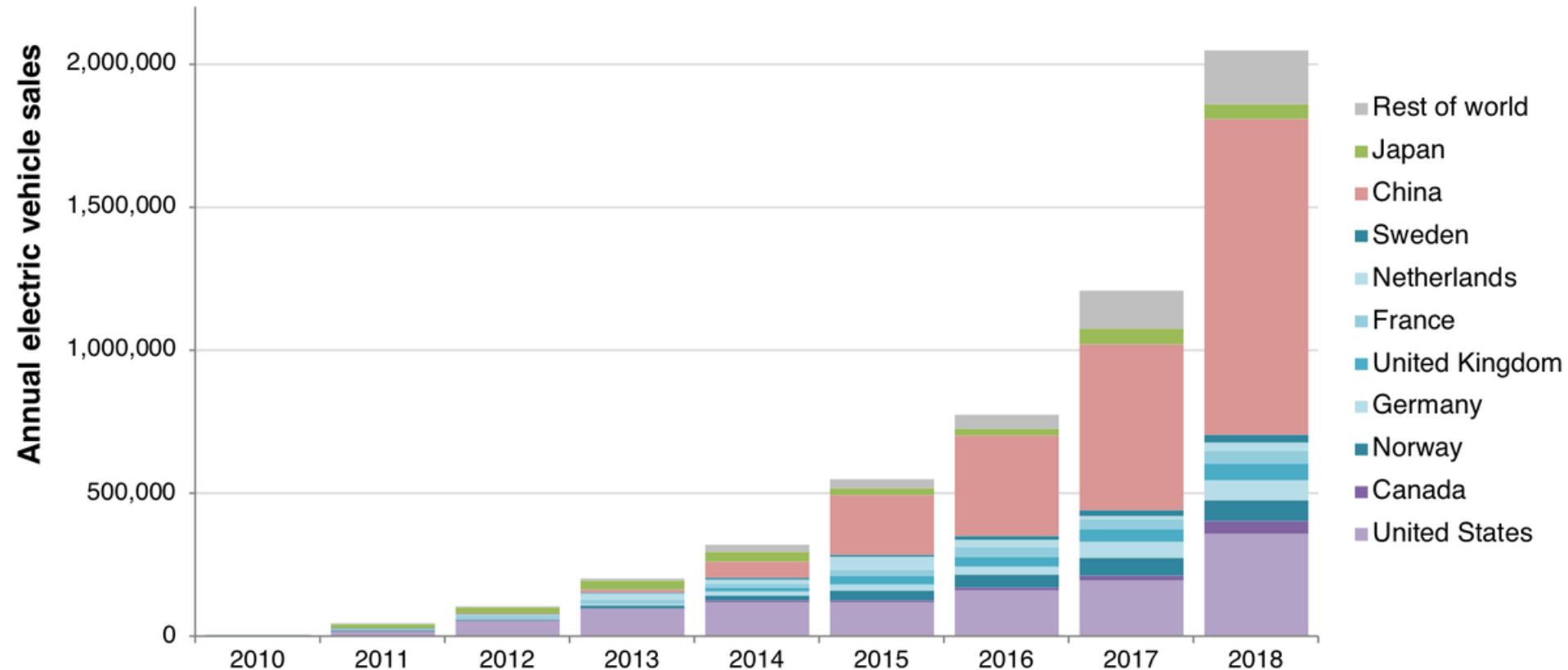
Source: <https://www.trueinitiative.org/>

Source: <http://www.theicct.org/China-diesel-remote-sensing-regulation>

A shift to electromobility

Addressing local air quality and global climate challenges

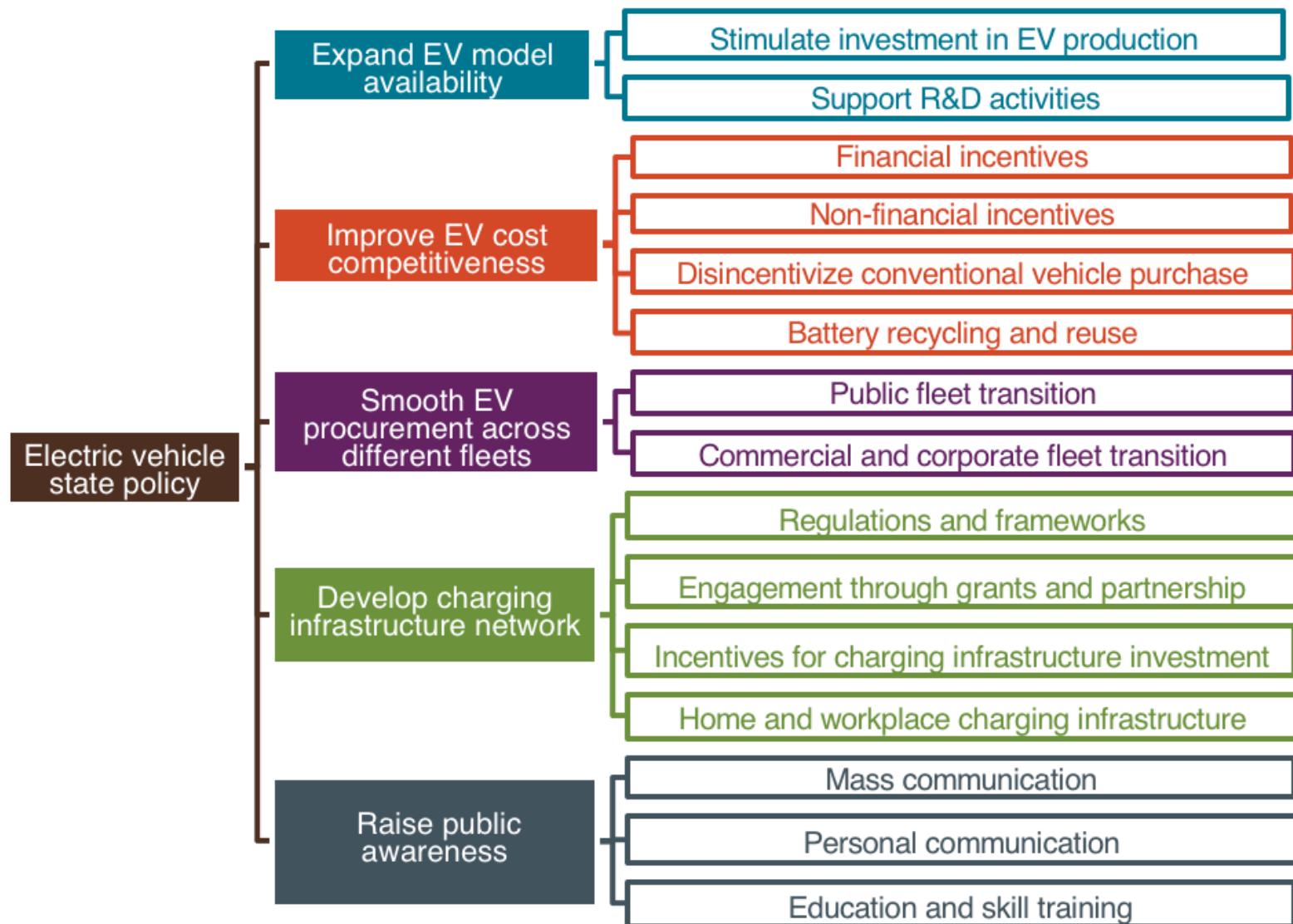
Annual electric vehicle sales jumped ~70% in 2018. Cumulative EV sales are now above 5 million.



Top 30 cities account for half of all passenger EV sales

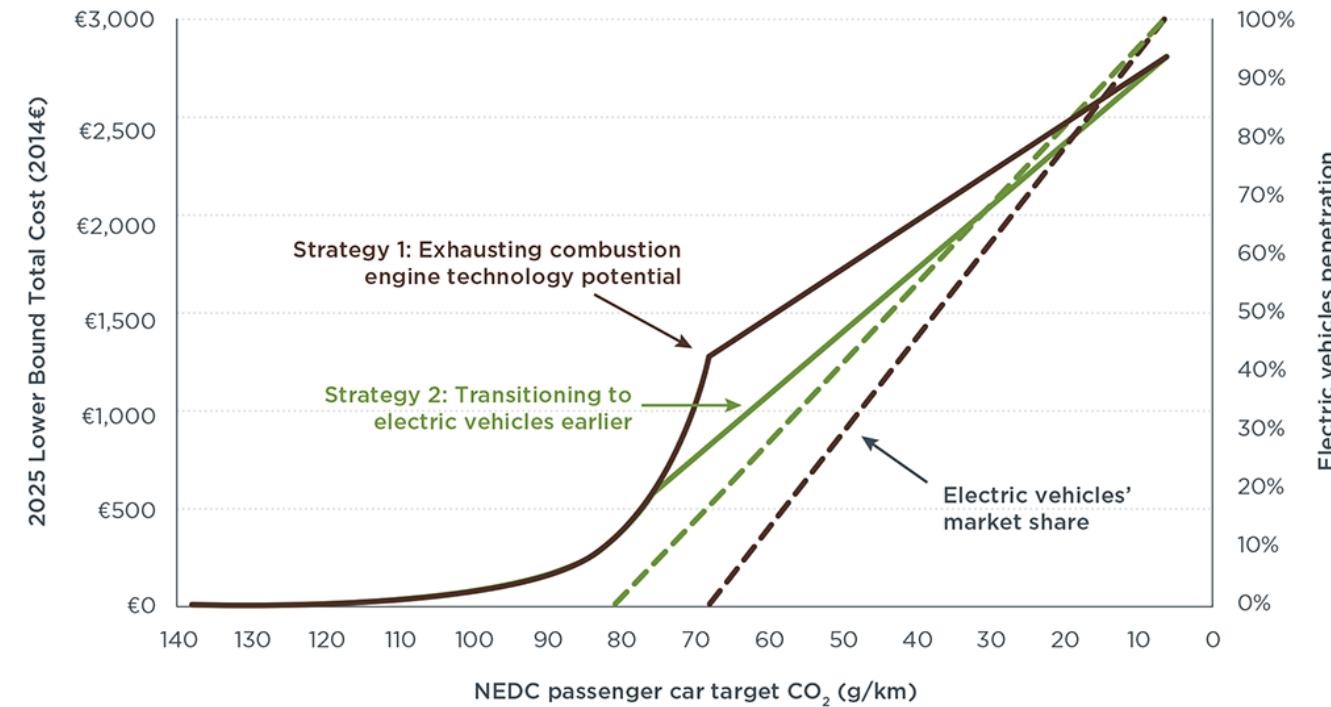
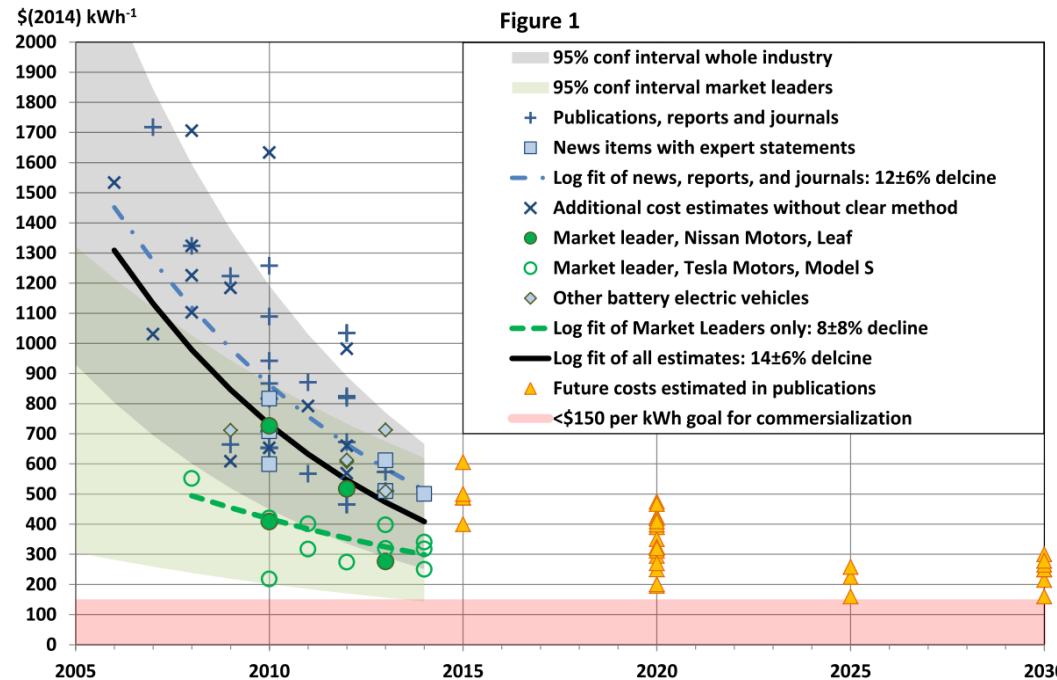


A variety of national-level actions needed to promote electrification



Future (2025/30) CO₂ target values can be achieved cheaper if transitioning to electric vehicles earlier

Battery cost reductions enable EVs to reach cost parity with conventional cars



Source: Nykvist, B., & Nilsson, M. (2015). Rapidly falling costs of battery packs for electric vehicles. *Nature Climate Change*, 5(4), 329–332. <https://doi.org/10.1038/nclimate2564>

Source: <http://www.theicct.org/2020-2030-co2-standards-cars-lcvs-eu-briefing-nov2016>

Passenger vehicle ZEV mandates spread around the world

Government	Target year	Percentage of EV credits	ICCT estimate of percent EV sales
China	2020	12%	3 – 4%
California (+ Sec. 177 states)	2025	22%	8%
Quebec	2025	22%	10%
Europe	2025	15%	5 – 10%
	2030	30%	15 – 20%

- China's New Energy Vehicle mandate is integrated into its existing fuel economy standards,
- California forecasts only 8% EV penetration in 2025 due to credit multipliers
- Quebec's policy is nearly identical to California's but with fewer credits
- Europe's policy – currently only a proposal – includes incentives for achieving substantial EV penetration levels but no penalties

Top EV CITIES adopted a complete policy package in pushing for vehicle electrification

CHARGING INFRASTRUCTURE		FLEETS AND NEW MOBILITY		SUPPORTING ACTIONS	
LEADING CITY	PROGRAM	LEADING CITY	PROGRAM	LEADING CITY	PROGRAM
Beijing	City charging strategy	Shenzhen	Taxis	Zhengzhou	Purchase incentives
Amsterdam	On-demand public charging	London	Electric ride-hailing	Shanghai	Preferential registration
Tokyo	Charging infrastructure incentives	San Francisco	Electric autonomous testing	San Jose	Parking benefits
Beijing	Building and parking requirements	Stockholm	City fleet	Oslo	Toll exemptions
Guangzhou	Utility partnerships	Shenzhen	Buses	Bergen	Lane access
		Shanghai	Car-sharing fleet	Shanghai	Consumer awareness programs
				London	Planned zero-emission zones
Chinese		European		American	
Other Asia		American		Other Asia	

ICCT: EV Capitals: Accelerating the global transition to electric drive:
<https://www.theicct.org/publications/ev-capitals-of-the-world-2018>

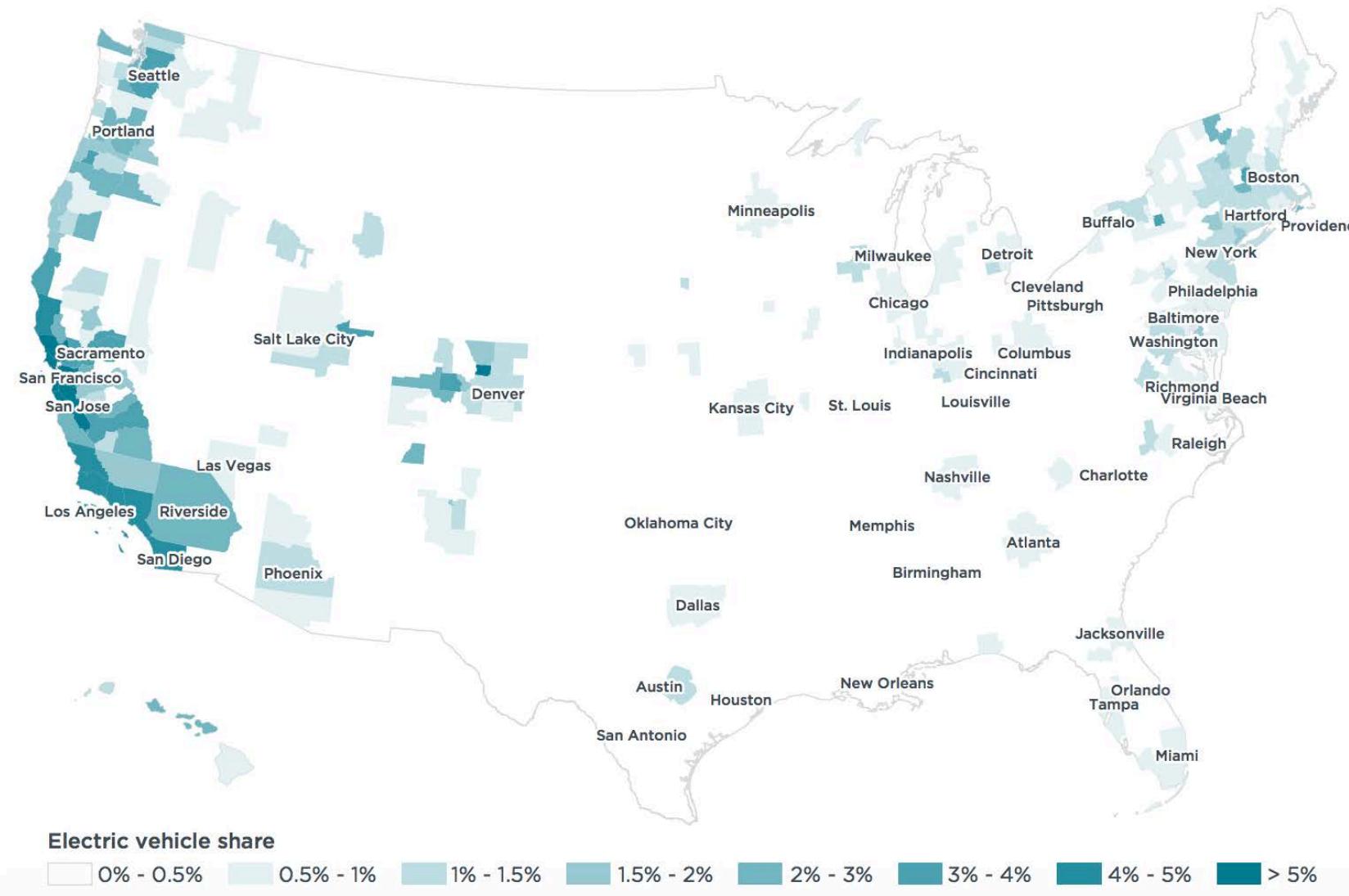
Leading markets tend to have more public charging, more available electric vehicle models, consumer incentives, and local promotion actions



See: <http://www.theicct.org/leading-us-city-electric-vehicle-2016>

https://www.theicct.org/sites/default/files/publications/Transition_EV_US_Cities_20180724.pdf

EV market is concentrated in the west coast and the northeast, with some high shares in Colorado and other key areas



Source: https://www.theicct.org/sites/default/files/publications/Transition_EV_US_Cities_20180724.pdf

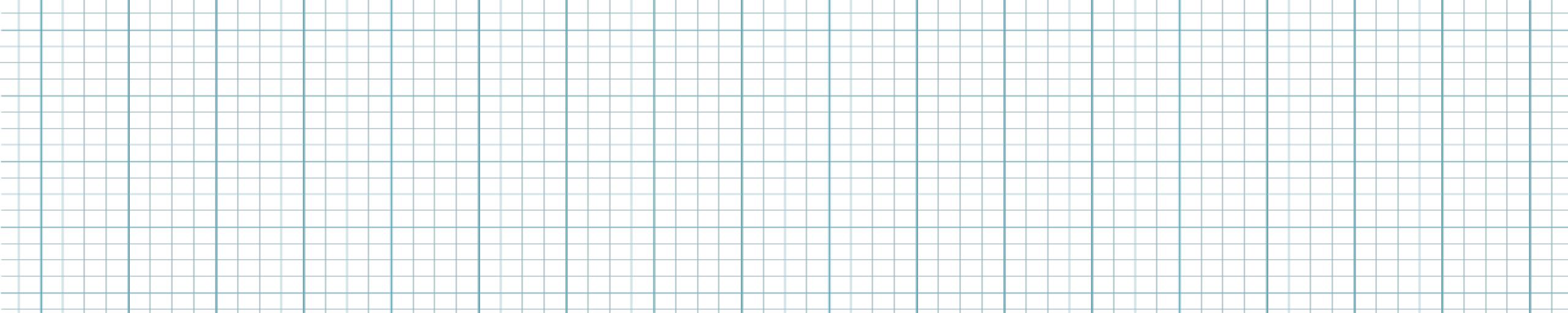
For more detail, please visit our ICCT website



Programs Where We Work About the ICCT Info & Tools



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www.theicct.org



Extra slides

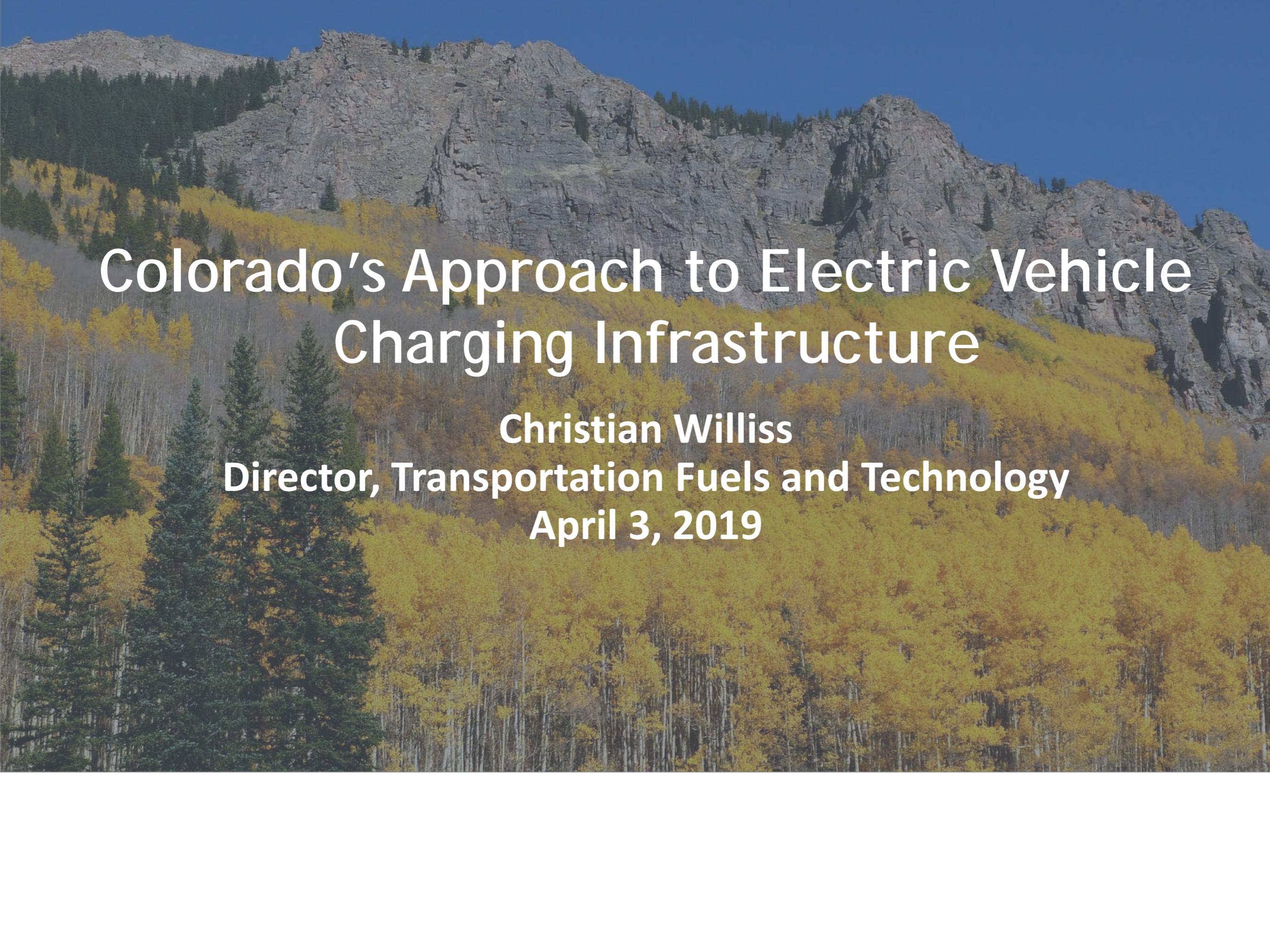
California Zero emission bus mandate

Calendar year	Zero Emission Bus percentage of new bus purchases	
	Large transit agency	Small transit agency
2023*	25%	
2024*	25%	
2025	25%	
2026	50%	25%
2027	50%	25%
2028	50%	25%
2029 and after	100%	100%

* Potential waiver for early action (more than 1000 ZEBs by December 2020; 1150 by December 2021)

Zero Emission Bus (ZEB) Rollout Plan

- Each transit agency is required to submit a transit board approved ZEB purchase and deployment plan
 - June 30, 2020 for large transit agencies
 - June 30, 2023 for a small transit agencies.
- Goal of full transition to zero-emission technologies by 2040 or earlier.
 - Identify the type of zero-emission technology a transit agency is planning to deploy
 - Describe build out of charging and fueling infrastructure
 - Identify the planned schedule for bus purchases
 - Describe the training schedule for zero-emission bus operators and technicians
 - Identify potential funding sources

The background of the slide features a wide-angle photograph of a rugged mountain range. The upper slopes are covered in dark, craggy rock, while the lower slopes are densely forested with aspen trees whose leaves have turned a vibrant yellow-orange color, characteristic of autumn. Evergreen trees are also visible throughout the scene. The sky is a clear, bright blue.

Colorado's Approach to Electric Vehicle Charging Infrastructure

Christian Williss
Director, Transportation Fuels and Technology
April 3, 2019

Agenda

1. Policy environment in Colorado
2. Funding sources
3. Infrastructure grant programs

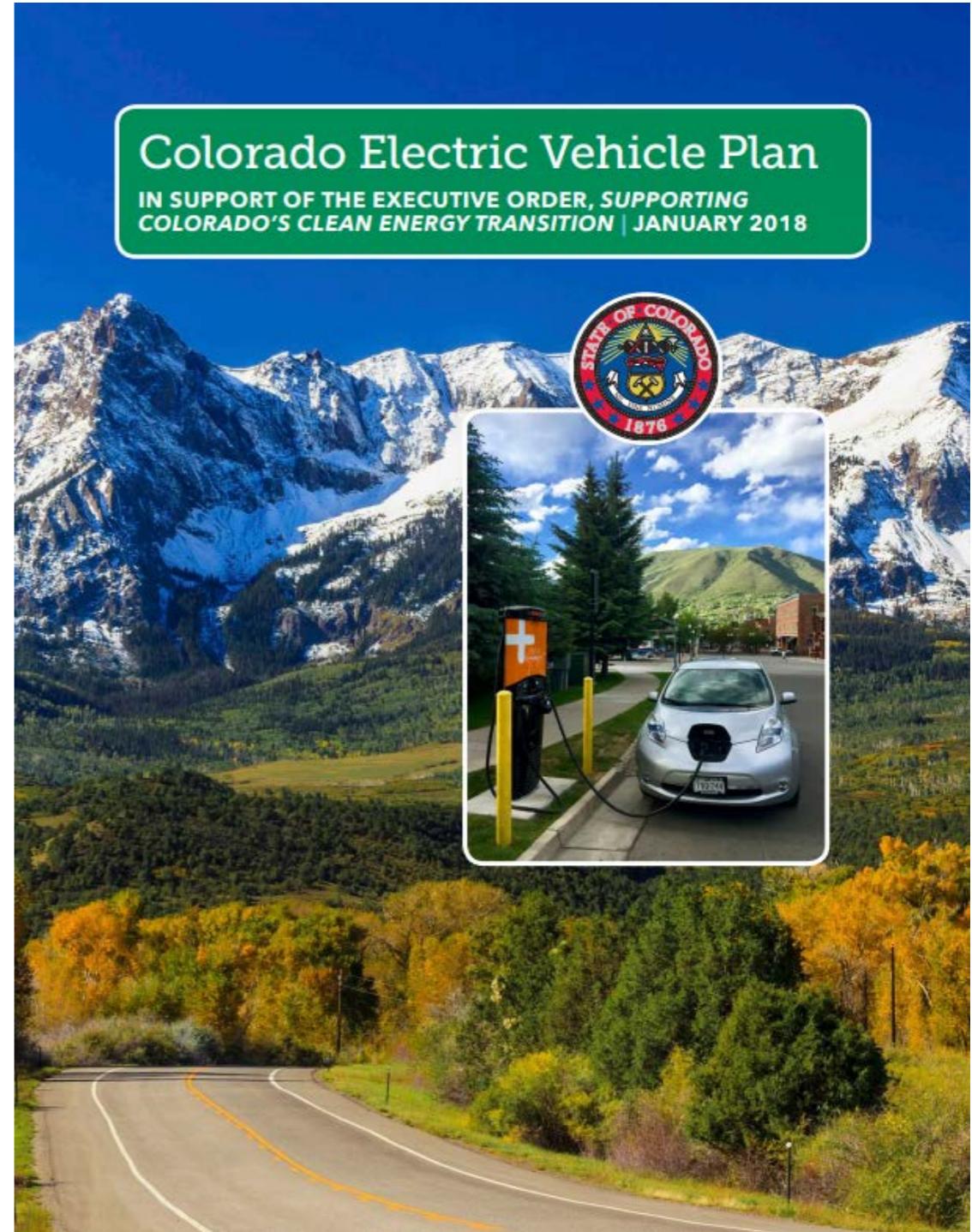
Transportation Fuels and Technology

CEO's Transportation Fuels and Technology Team works to accelerate adoption of zero emission vehicles through:

1. Program Management – administer grant programs that reduce the upfront cost of installing charging infrastructure.
2. Policy and Planning – make Colorado an attractive place to own and operate an electric vehicle (EV) and make investments in EV charging infrastructure.
3. Outreach and Education – provide information and technical support to fleets and consumers on the costs and benefits of owning and operating EVs.

Colorado Electric Vehicle Plan

- Build out key charging corridors that facilitate economic development, boost tourism, and reduce harmful air pollution.
- Accelerate adoption of EVs and ensure Colorado remains a leader in the EV market.
- Serve as a living document.



Regional Electric Vehicle West

- REV West MOU signed by 8 Western Governors.
- Establishes a framework for collaboration on an Intermountain West Electric Corridor.
- Develop best practices/voluntary minimum standards for stations, expand access to EVs, and create a consistent charging experience.

Intermountain West EV Corridor



Executive Order B 2019 002

Supporting a Transition to Zero Emission Vehicles

1. Creates an interdepartmental electrification workgroup to support widespread electrification across the state.
2. Directs CO Dept. of Public Health and Environment (CDPHE) to develop a rule to establish a Colorado Zero Emission Vehicle program and propose to the Air Quality Control Commission no later than May 2019 for possible adoption before October 30, 2019.
3. Directs CDPHE to revise the VW Beneficiary Mitigation Plan to focus all remaining eligible investments on supporting electrification of transit and school buses and trucks.
4. Directs CO Dept. of Transportation to develop a zero emission vehicle and clean transportation plan.

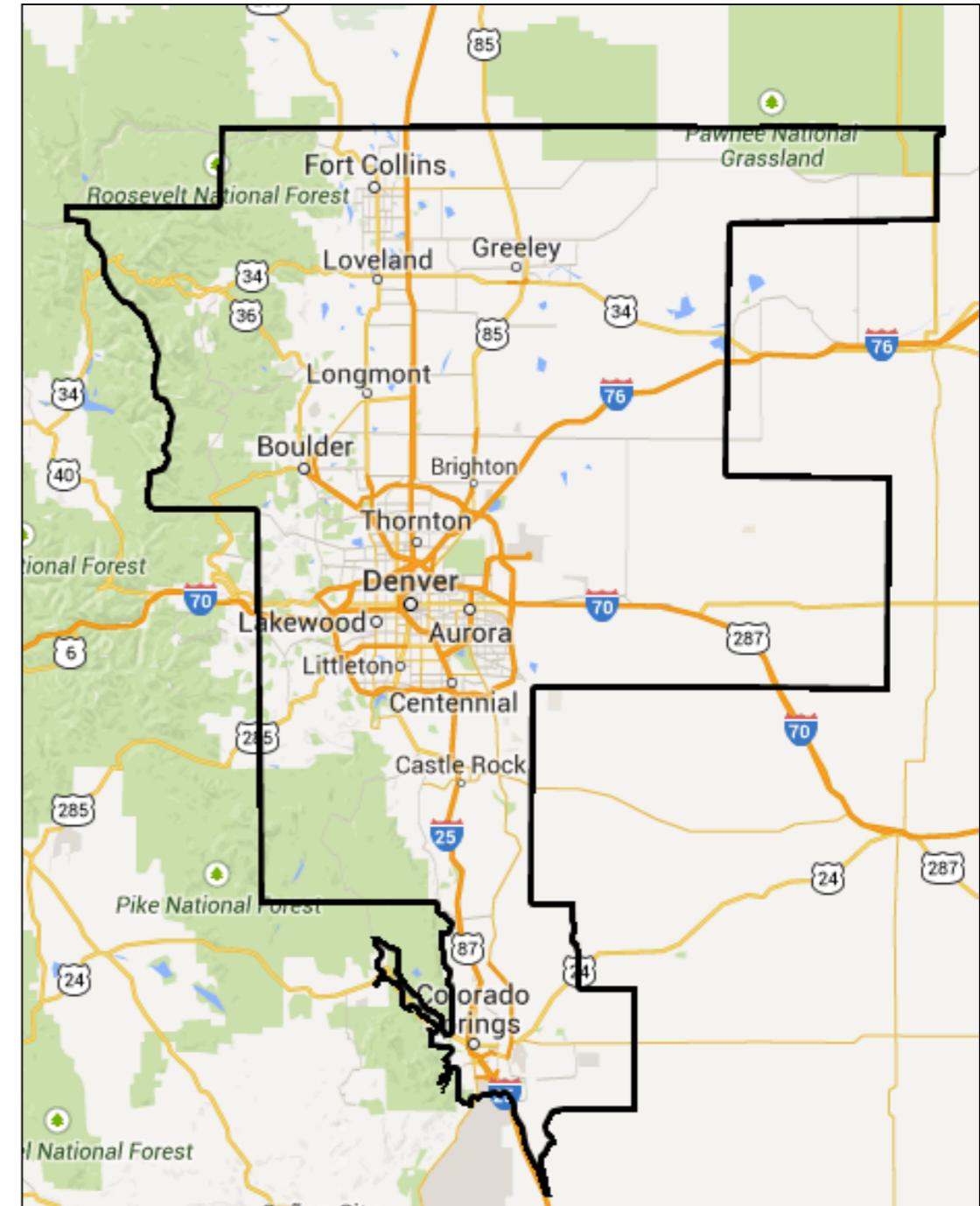
Colorado Electric Vehicle Grant Fund

The Colorado Electric Vehicle Fund was created by statute in 2009.

- Collects \$50 from EV owners at time of registration
- \$30 goes to highway users trust fund/\$20 to EV Fund
- Funds may be used to provide grants for installation of EV charging stations
- Eligible entities include government, private businesses, workplaces, HOAs, etc.
- Pending legislation would allow for more flexibility in how funds are allocated.

ALT Fuels Colorado (AFC)

- Partnership between CEO and Regional Air Quality Council.
- Funded through Congestion Mitigation and Air Quality program.
- Grants for AFVs, fueling and charging infrastructure.
- \$30 million over 6 years, split between vehicles and infrastructure.



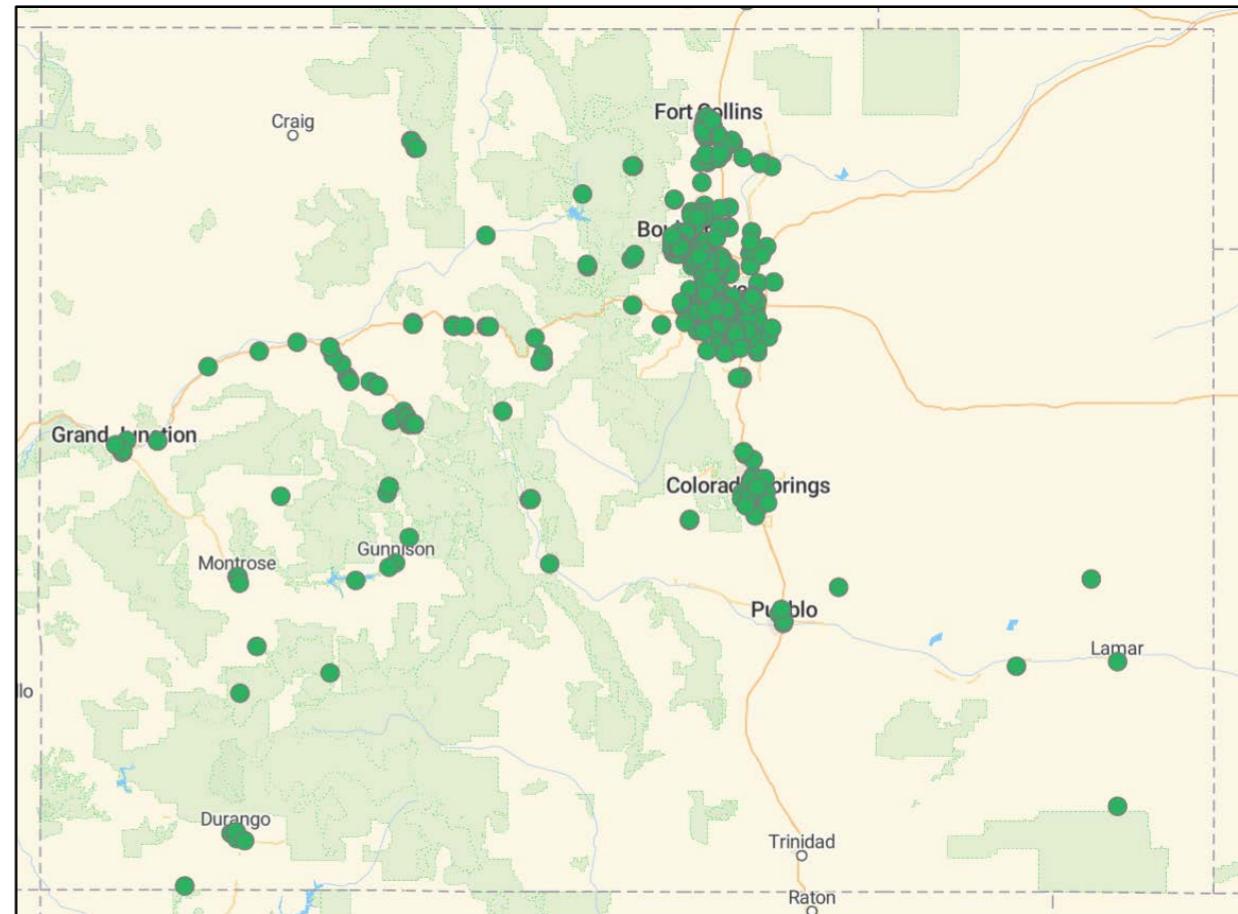
Colorado Beneficiary Mitigation Plan

- Proposes 15%, maximum allowed, for Zero Emission Supply Equipment Program – \$10.3 million.
- Distributed through existing grant programs – Charge Ahead Colorado and ALT Fuels Colorado.
- \$3.5 million for community-based Level II and DC fast-charging stations.
- \$6.8 million for DC fast-charging stations along Colorado's major transportation corridors.



Charge Ahead Colorado

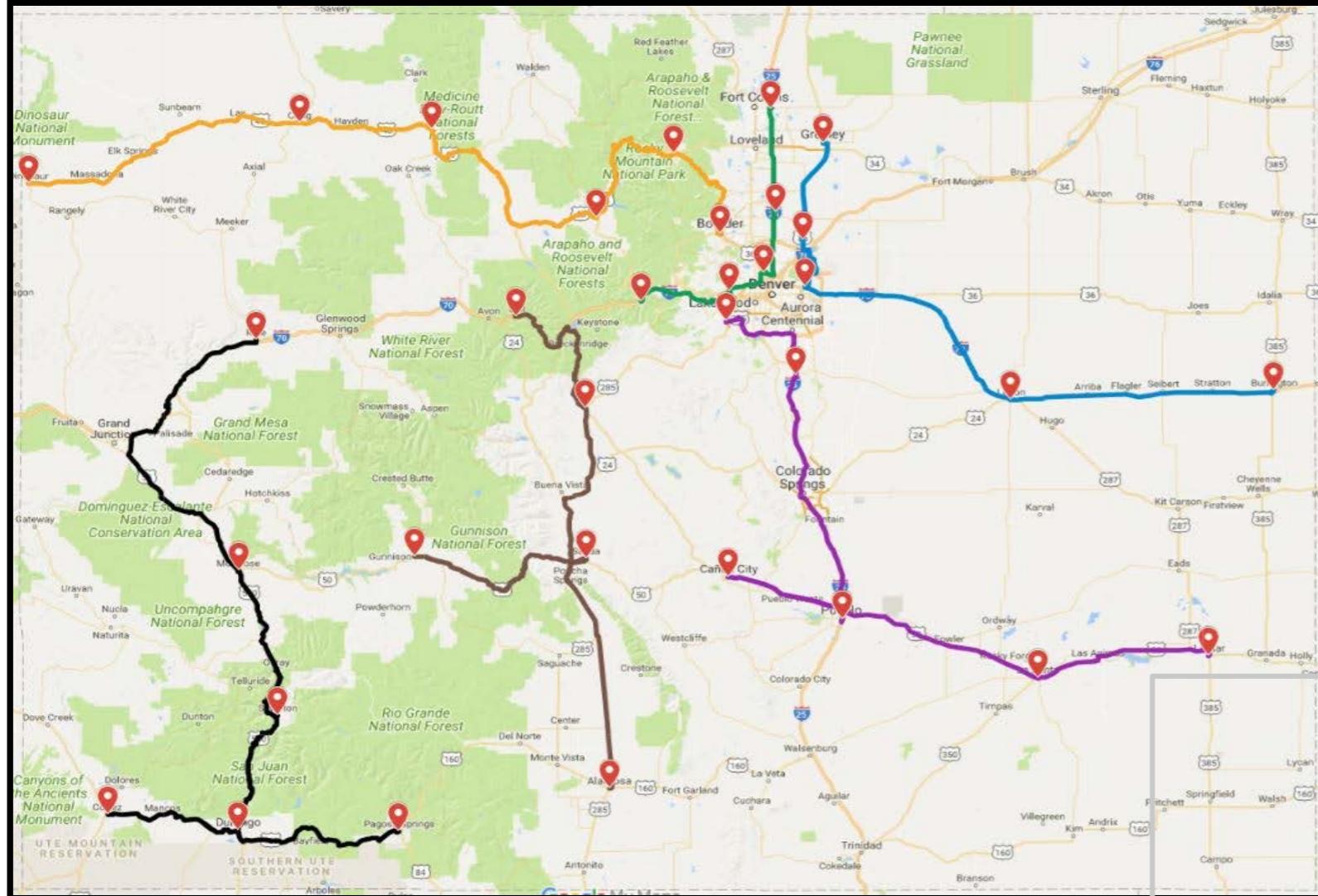
- Partnership between CEO and Regional Air Quality Council.
- Grants for community-based Level II and DC fast-charging stations across the state.
- Grants for EVs in 7-county metro area – public/non-profit fleet owners.
- Grants for more than 780 stations awarded to date.



Source: Alternative Fuels Data Center

AFC: EV Fast-Charging Corridors

Colorado Electric Vehicle DCFC Corridor Program



Electrify America

AFC: EV Fast-Charging Corridors

- \$10.3 million award made to ChargePoint to build 33 DCFC across six corridors.
- 2-4 chargers at each site; capable of providing at least 50 kW and up to 150 kW charging.
- Statewide network ensures a consistent driver experience at every station.
- Committed site hosts: retail, grocery, c-store, and local governments.
- State-of-the-art modular technology allows for expansion.



Electric Vehicle (EV) Initiatives in Sacramento

Jennifer Venema, Department of Public Works

April 3, 2019



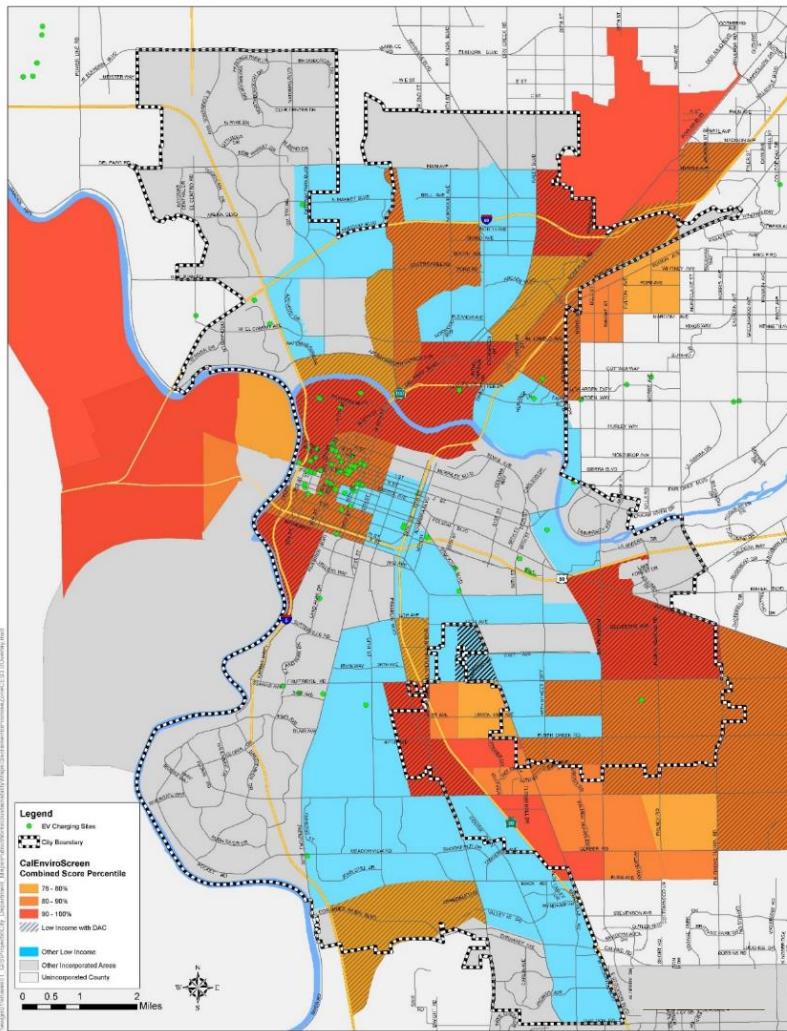
Summary

- Sacramento context
- EV efforts
- Policy framework
- Project example
- Take-aways



Setting

- Capital of California
- Top 10 most diverse cities in US
- Confluence of major interstate routes
- Poor air quality



EV CHARGERS AND LOW-INCOME OR DISADVANTAGED COMMUNITIES

Context

3.3% EV share

5th in EV uptake

Top 3 for EV promotion actions

ICCT 2018



Context

City leadership

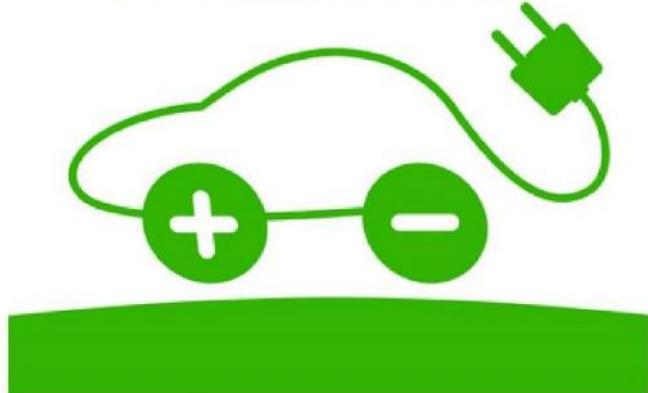
- “ZEV First” commitment
- 50% ZEV target for light-duty vehicle replacements

Regional partnerships



Electric Vehicle Readiness and Infrastructure Plan

Prepared for Sacramento County and the Cities Within by the
Sacramento Area PEV Collaborative



EV Efforts

PUBLIC EV
CHARGING &
PARKING
PROGRAM



CAR SHARE

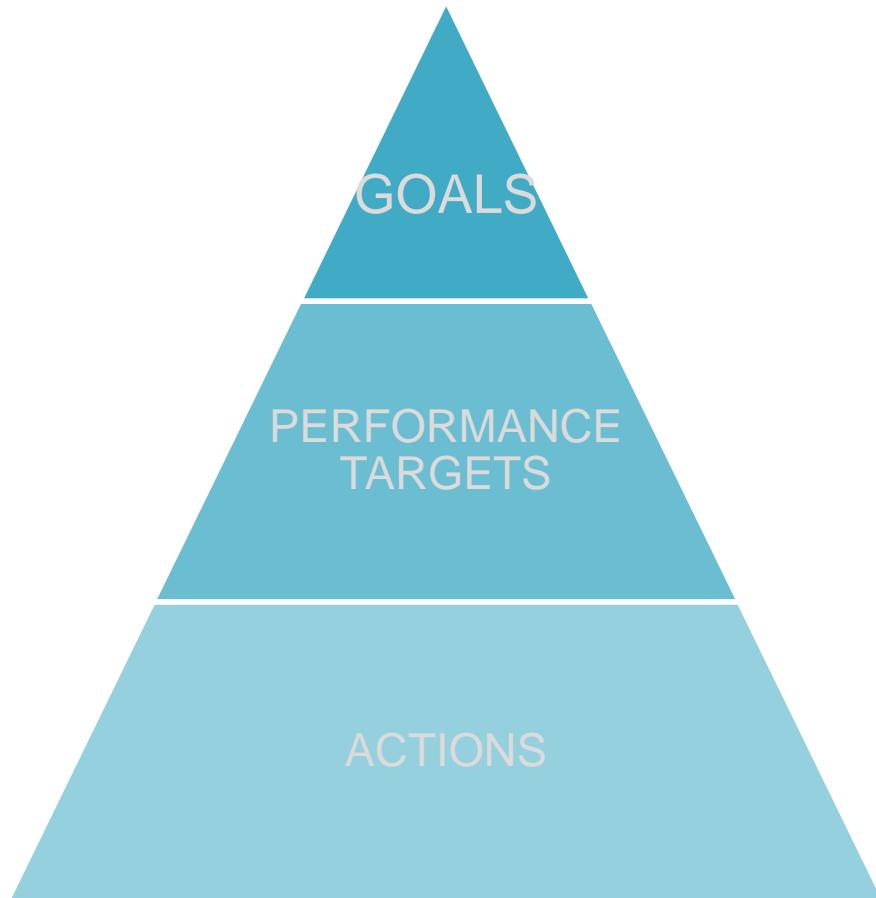


CURBSIDE EV CHARGING

Policy Framework

EV Strategy adopted 12/2017

75,000 ZEVs in Sacramento by 2025



Action categories:

1. Community Charging and Infrastructure
2. Heavy-Duty and New ZEV Applications
3. Electrify America Green City Initiative
4. City Facility Charging Infrastructure
5. Fleets
6. Economic Development and Innovation
7. Programs, Partnerships, and Engagement
8. ZEV Access

Green City “Sac-to-Zero”

\$44 million investment
commitment from Electrify
America



ZEV Car Share

- GIG Car Share: Free float ZEV car share
- Envoy: Round trip ZEV car share



Charging Infrastructure

- 10+ Sacramento regional charging sites
- Ultra-fast 50 kW—350 kW charging speeds



ZEV Bus/Shuttle

- UC Davis to Sacramento bus service
- Franklin Blvd. Corridor shuttle service

<http://www.cityofsacramento.org/Green-City>

Take-aways

Leadership and partnerships

ZEVs as a means, not an end



Thank you

www.cityofsacramento.org/ev

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Sustainability Manager
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City of Sacramento

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Today's Speakers

- Kevin Black, *Federal Highway Administration*,
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- Francisco Posada, *The International Council on Clean Transportation*, francisco@theicct.org
- Christian Williss, *Colorado Energy Office*,
christian.williss@state.co.us
- Jennifer Venema, *City of Sacramento*,
JVenema@cityofsacramento.org



Panelists Presentations

<http://onlinepubs.trb.org/onlinepubs/webinars/190403.pdf>

After the webinar, you will receive a follow-up email containing a link to the recording

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 - Networking opportunities
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