

State & Local Action to Build Clean Transportation Tech Industry



CALSTART Headquarters



What I want to talk about today

- The urgency of why we are here
- Wayne Gretsky and the jobs topic
- Reasons for optimism
- Specific suggestions for joint action



CALSTART's 185 Member Companies

(PARTIAL LISTING)

SOUTHERN CALIFORNIA EDISON
 South Coast AQMD
 WELLS FARGO
 BAY AREA AIR QUALITY MANAGEMENT DISTRICT
 Southern California Gas Company
 Sempra Energy utility
 SAN JOAQUIN RTD
 Time Warner Cable
 NEW FLYER
 ups
Westport
BAE SYSTEMS
 Union of Concerned Scientists
 -chargepoint-
 Southern Company
 Sandia National Laboratories
 VOLVO
 AMERICAN POWER GROUP
 VALLEY PACIFIC
EATON
Attec
BYD
 GENTHERM
 HINO TRUCKS
 HOIST LIFTRUCK
SEVCON
CATERPILLAR
 MERITOR
FedEx
TOYOTA
 FPL
 Ford
GM
 PG&E
 Cummins
Allison Transmission
BLACK & VEATCH
 SIEMENS
plug power
SDGE
 HOLLYWOOD TRUCKS
FUSO
FedEx
TESLA
DAYLIGHT TRANSIT
TOSHIBA
 GOLDEN GATE PETROLEUM
ARC
 PHOENIX MOTORCYCLES
 SDGE
 Audi
 US Hybrid
ENC
AxleTech
INTERNATIONAL
UQM
KW
LONG BEACH
HARRIS
TEREX
ODYNE
pace
MANHATTAN BEER DISTRIBUTORS
 HUMMINGBIRD ELECTRIC VEHICLE
BBW
BALLARD
AMERESCO
ADVANCED VEHICLE MANUFACTURING
Parker
MOTIV
 Los Angeles Department of Water & Power
UNICELL
 greencommuter
ZENITH MOTORS
ENVERA
Pi Innovo
achatesPOWER
TransPower
ANTEATER EXPRESS
Lightning Systems
MALICO INC
REALPOWER
WAVE
ESW America
TRANSIT
PROTERRA
ADOMANI
Purolator
EFFICIENT DRIVETRAINS, Inc.
HYDROGENICS
BOLLINGER MOTORS
EMERALD
Schneider Electric
WAVE
ESW America
TRANSIT
PROTERRA
ADOMANI
NUVERA
emerald automotive
oberon FUELS
Schneider Electric
WAVE
ESW America
TRANSIT
PROTERRA
ADOMANI
e-Traction
SARTA
UTS
 Cerritos College
 Foothill Transit
EBG RESISTORS
ART
HYLIION
TORRANCE TRANSIT
ebus
TULA
ORANGE EV
TRI DELTA TRANSIT
SPGP GreenPower Bus
STURMAN
effenco
AVTA
Clean Cities
CITY OF GARDENA
ace parking
 SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT
Cal State LA
VTA
CIVIC PROJECTS
 UNITED STATES POSTAL SERVICE
 COUNTY OF LOS ANGELES PUBLIC WORKS
P&T'S
LADOT
FIRST PRIORITY GREEN FLEET

CALSTART Offices



CALSTART Investor Council (CIC)



WELLS
FARGO

The Wells Fargo logo consists of the words "WELLS" and "FARGO" stacked vertically in a bold, yellow, serif font, centered within a solid red square.



CALSTART Overarching Goal:
Clean air for all; prevent climate change; clean transportation tech industry dominates
Speed commercialization of clean transportation technologies

These are our focus areas:



Initiatives Areas

This is the work we do:



Activities Areas

	CARS	BUSES	TRUCKS & Non- Road	FUELS
Tech. Development & Demonstration				
Tech. Assessment & Validation				
Market Acceleration				
Policy_Development & Support				
Industry Services				

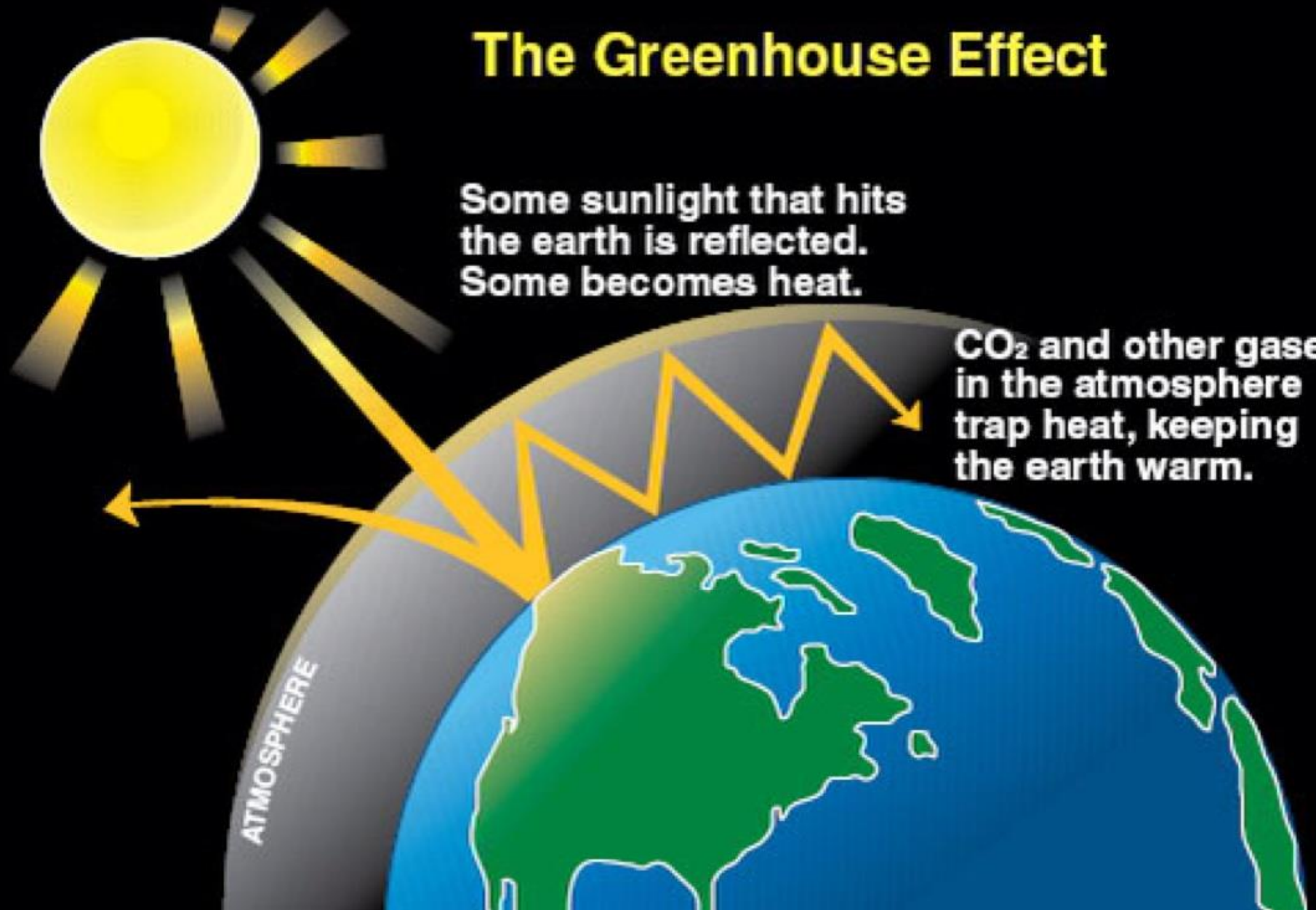


The Greenhouse Effect

Some sunlight that hits the earth is reflected. Some becomes heat.

CO₂ and other gases in the atmosphere trap heat, keeping the earth warm.

ATMOSPHERE



BEFORE



AFTER



Nations Unies

Conférence sur les Changements Climatiques 2015

COP21/CMP11

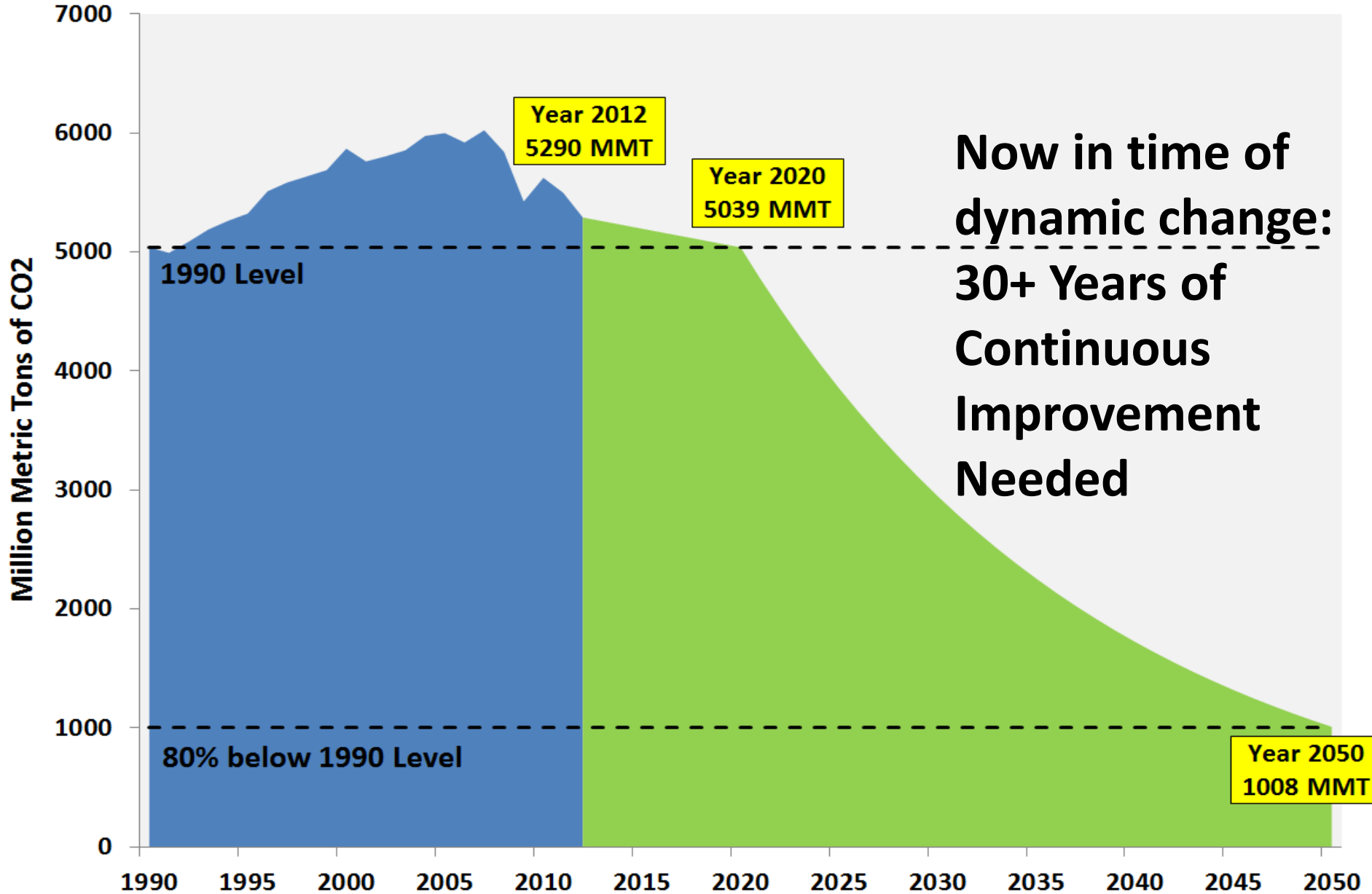
Paris France



USA – What % of World's Population and What % of Daily GHG Generation?

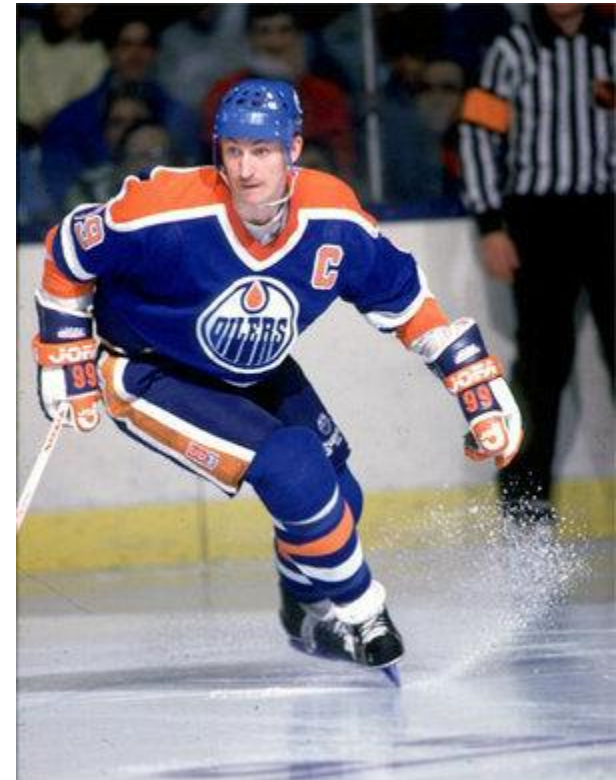


US Energy Related Total CO2 Emissions



If It Was Only About Jobs What Would We Do?

- Wayne Gretzky: I skate not to where the puck is but where it will be – high efficiency, low carbon transportation is where puck will be Be global technology leaders in vehicle technology, low carbon fuels, and new mobility systems
- Use renewable domestic fuels – keep our transportation energy \$'s at home

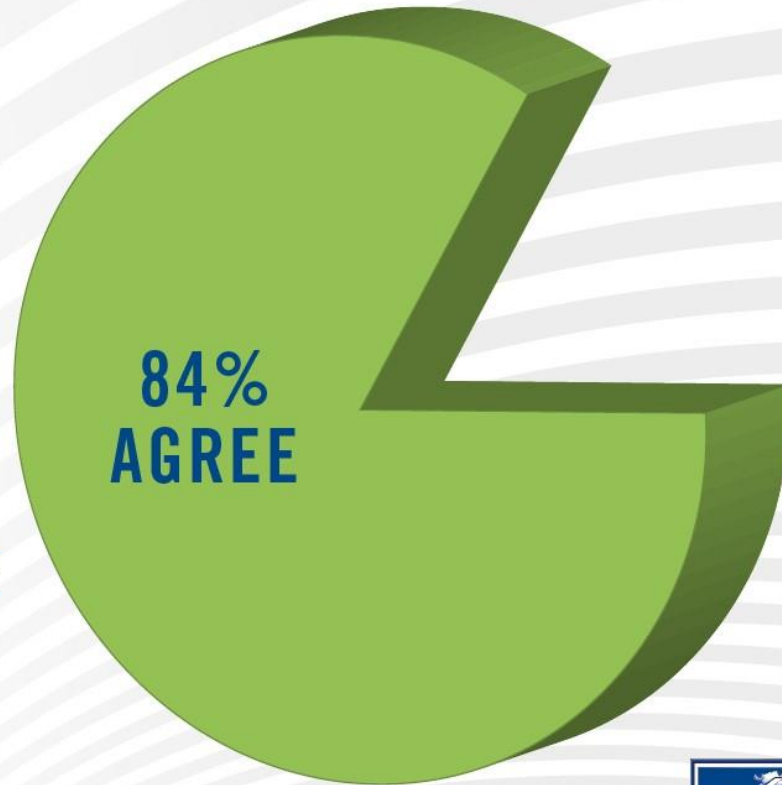


Suppliers Continue to Back 2025 Federal Standard – No Change Needed

ACCORDING TO A
RECENT SURVEY

**84% OF AUTO
SUPPLIERS
AGREE**

THAT THE 2025
STANDARDS ENCOURAGE
JOB GROWTH AT THEIR
COMPANIES.



www.CALSTART.org

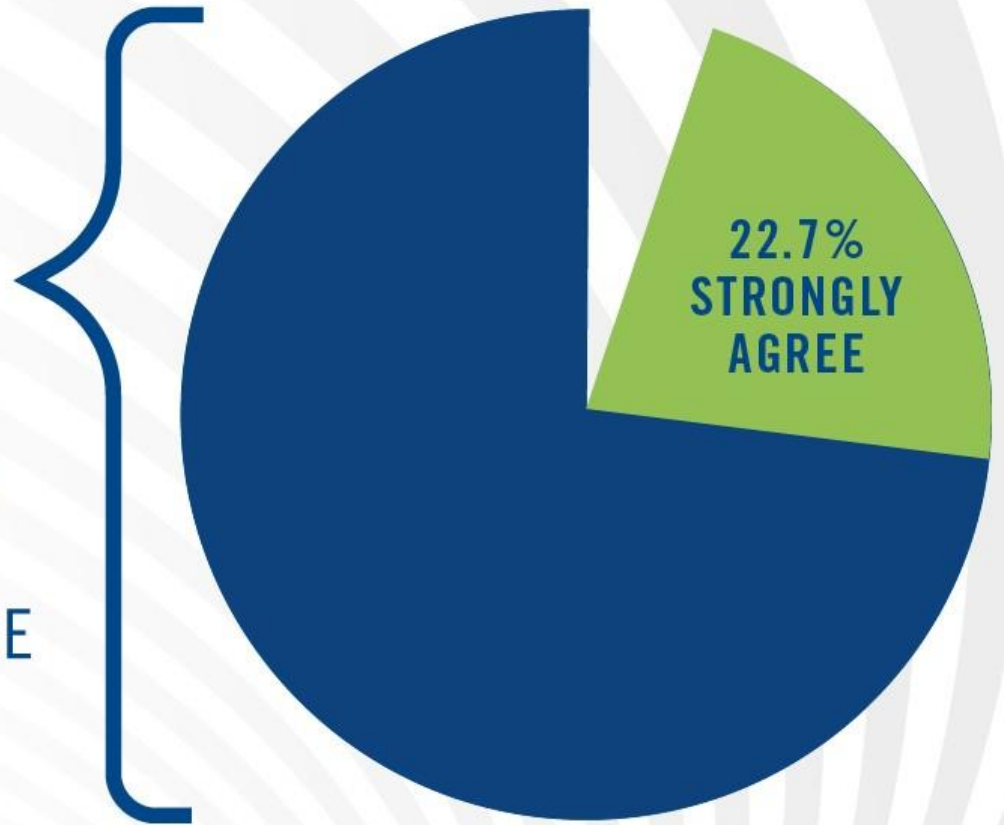
Source: CALSTART commissioned survey by Ricardo Energy & Environment



ACCORDING TO A RECENT SURVEY

95%

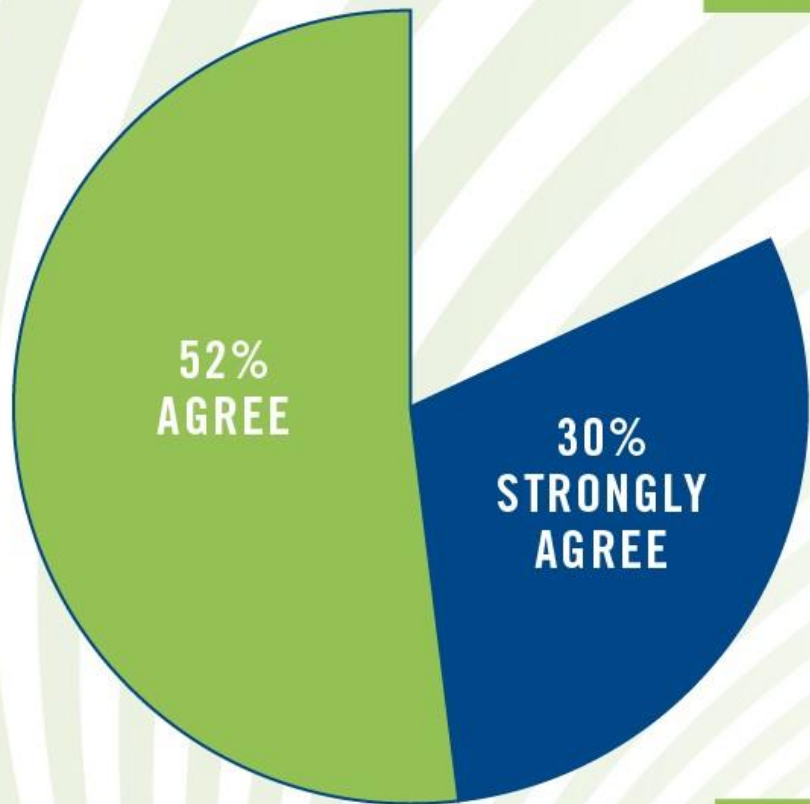
OF AUTO SUPPLIERS AGREE
THAT **MORE** AMBITIOUS
MPG STANDARDS ENCOURAGE
MORE INNOVATION
& **INVESTMENT** IN THE U.S



www.CALSTART.org

Source: CALSTART commissioned survey by Ricardo Energy & Environment





ACCORDING TO A RECENT SURVEY

82%

OF AUTO SUPPLIERS AGREE
THAT COMPANIES THAT ARE
LEADERS IN VEHICLE
EFFICIENCY TECHNOLOGIES
WILL BE **MORE SUCCESSFUL**
OVER THE NEXT 10–15 YEARS.

www.CALSTART.org

Source: CALSTART commissioned survey by Ricardo Energy & Environment



Leadership at State and City Level Extremely Important Right Now

- Indianapolis has the nation's largest fleet of electric buses
- Stark Area Regional Transit Authority (NE Ohio) is developing a fleet of fuel cell buses to provide service
- Texas is the nation's leading producer of wind power

Global Climate Action Summit – September 12-14, 2018

San Francisco

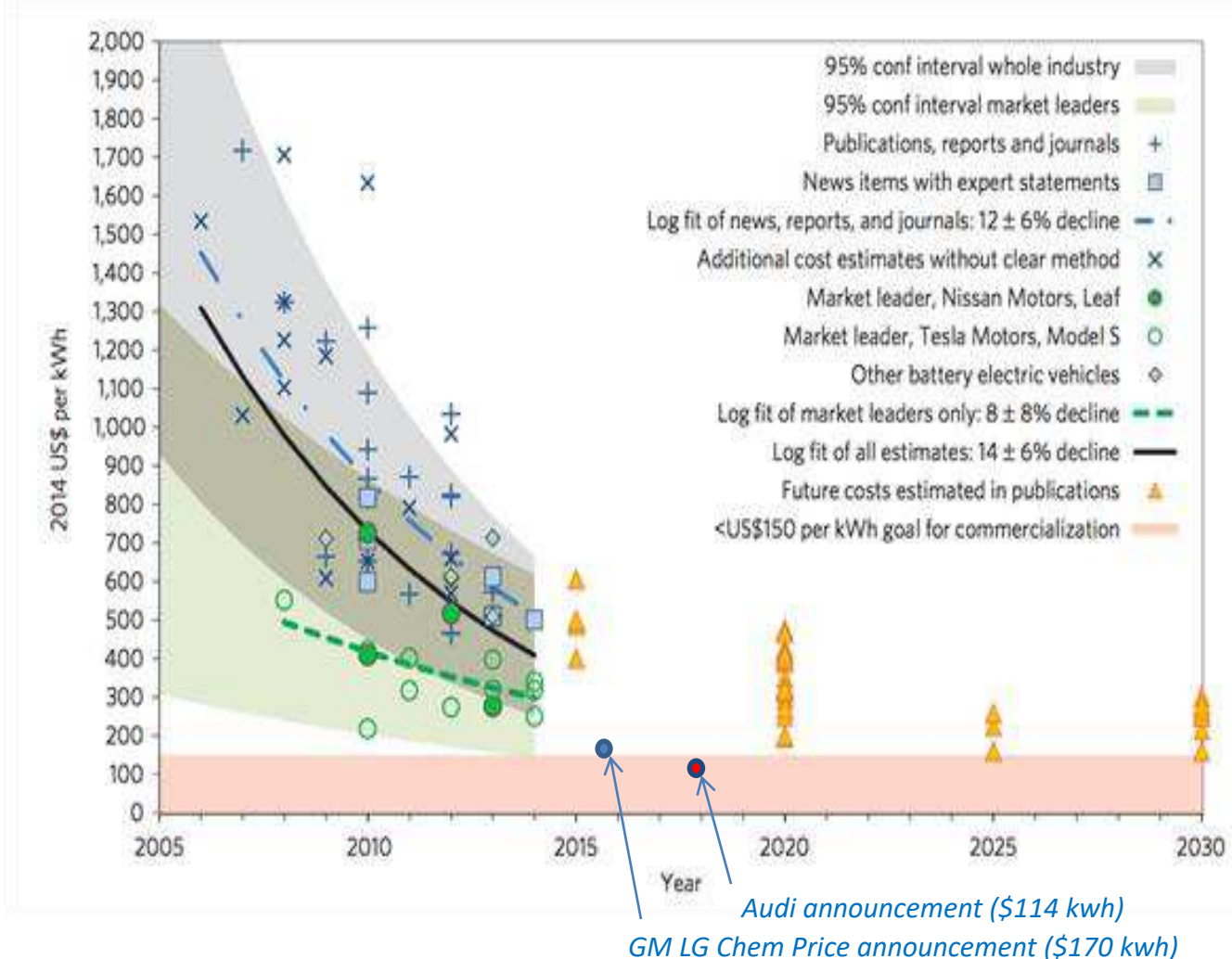
CALSTART Global Beachhead Workshop

**GLOBAL
CLIMATE
ACTION SUMMIT**



Battery Costs Below 2020 Expectations

- Old forecast: \$300/kwh by 2020
- 2014 findings: Industry \$410/kwh; leaders at \$300/kwh
- New data: leaders <\$200/kwh



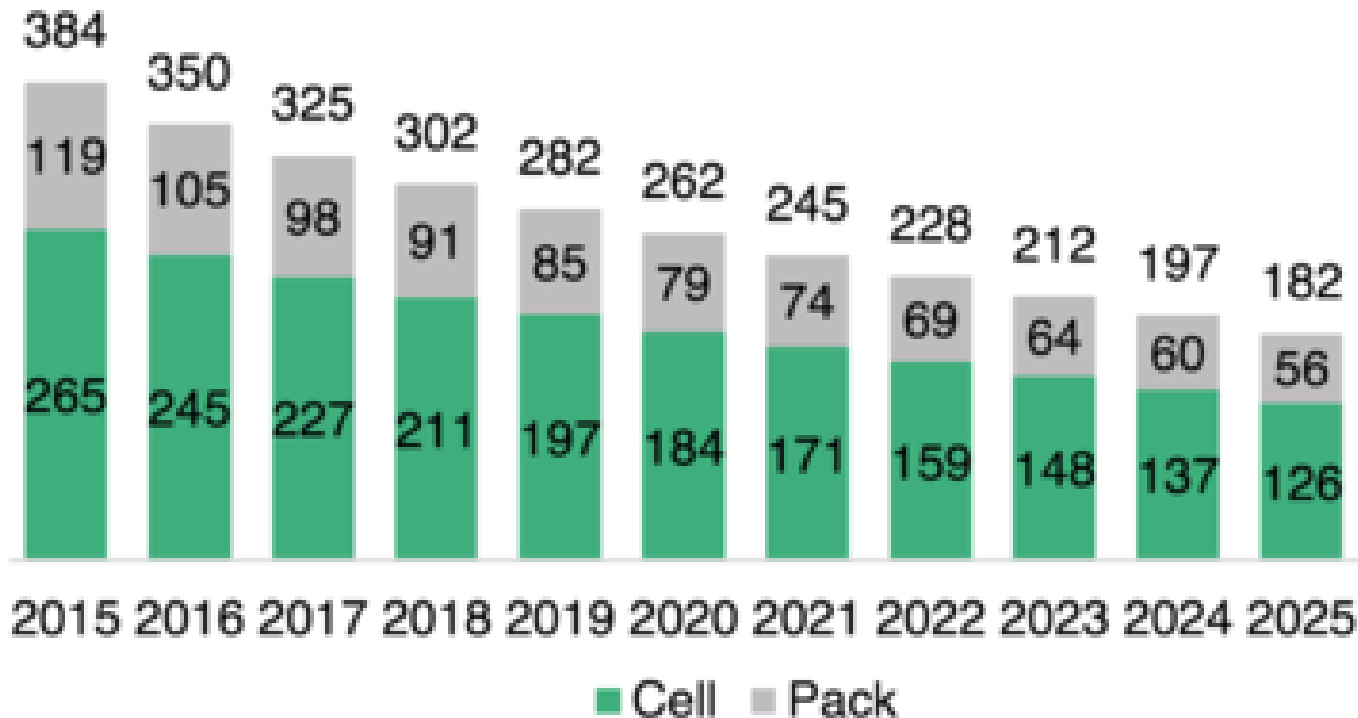
Nature Climate Change report:

<http://www.carbonbrief.org/blog/2015/03/electric-vehicle-batteries-already-cheaper-than-2020-projections/>

Moore's Law for Batteries – 30-40% Cost Reduction Every 5 Years?

Battery Prices Keep Tumbling

Lithium Ion Forecast (\$/kWh)



- Source: Bloomberg New Energy Finance, 10/31/16

5X in 6 Years



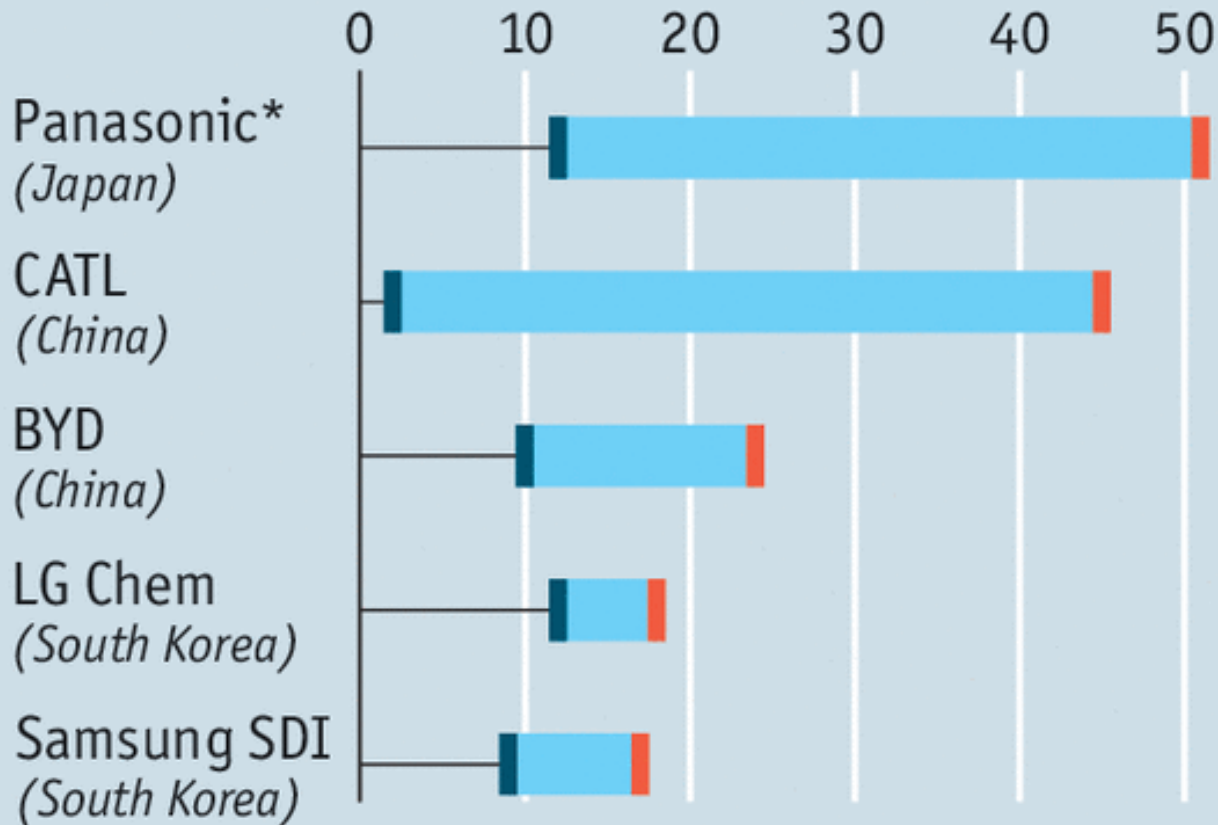
Chevy Bolt EV has a real world range of 240 miles on a charge (2017) vs. 50 miles for Gen1 Nissan Leaf in 2011

Electric dreams

Manufacturing capacity forecasts

Gigawatt-hours per year

■ 2017 ■ 2020



Source: Cairn ERA

*Includes Tesla gigafactory

Major
Growth in
Global
Battery
Production
Capacity

CALSTART Launches Nation's First Pilot Training Program Using ZE aircraft



In 2017 – EV 2.0 - 200 Mile Range for
\$30,000 (USD)/240SK

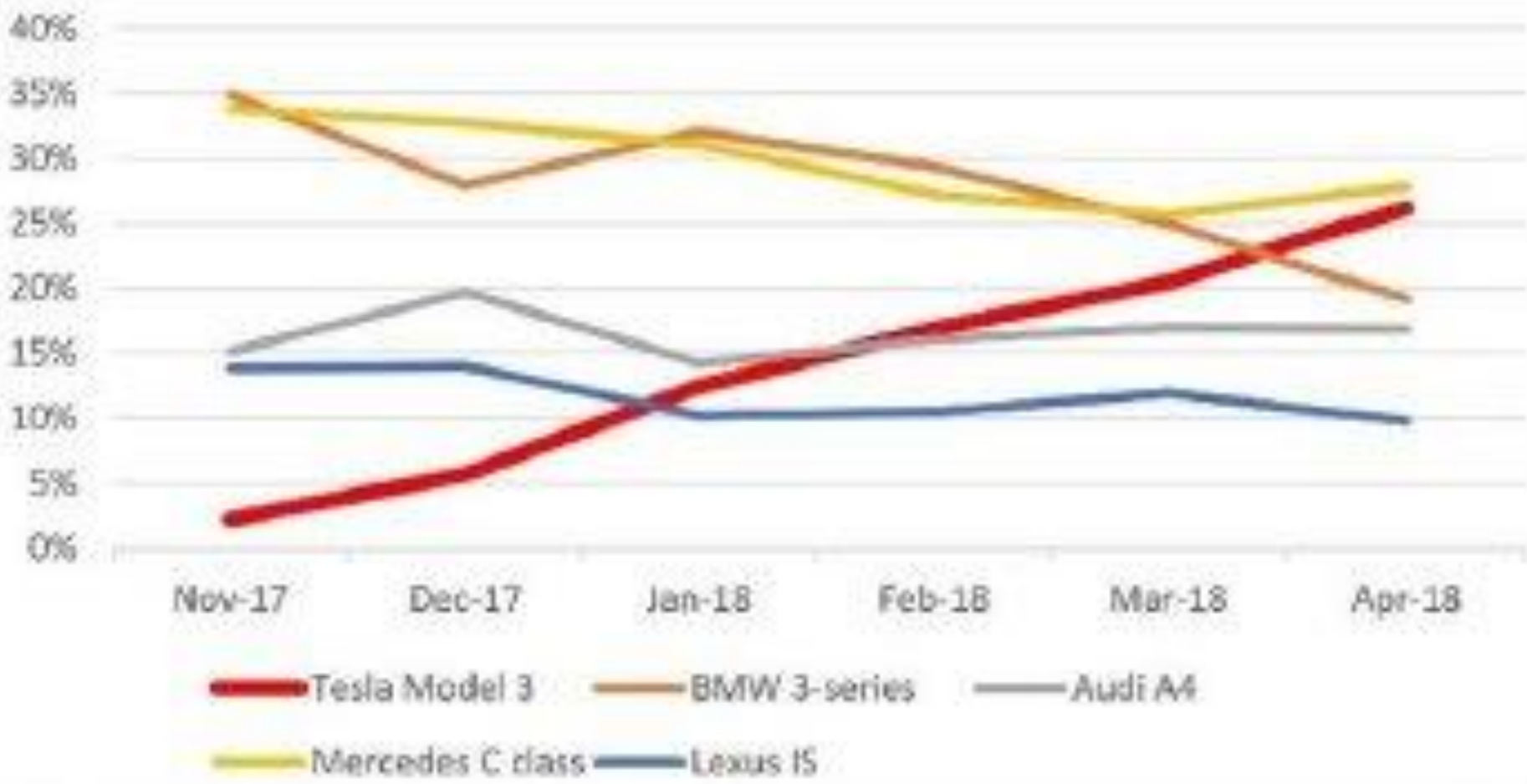


EV 2.0: Tesla Model 3



Tesla Model 3 – Winning Its Category

Mid sized premium sedans - US market share



EV's Compete Well When They Compete

- BoltEV best selling sub-compact in CA
- Tesla Model 3 2nd best selling luxury/high-end sports cars
- OEM's still not providing full suite of EV's in all states
- Lack of EV options in most segments
 - Dearth of EV options in SUV/Mini-Van/Pick-up truck segments

Getting Employers to Power Cars



States Can Give Awards to Top 5 Employers Who Provide EV Charging for Employees

Natural Gas Engine 90% Fewer NOx Emissions – Trucks and Buses with “Near Zero Emissions” (NZE)

Get Closer to Zero

INTRODUCING

ISL G **NEAR ZERO**



Cummins **Westport**

Dairy Methane Emissions = Big Climate Change Contributor = Opportunity

Goal: Closed Loop System – Ag Trucks Running on Renewable Methane



CA Company – Using Dairy Waste as Feedstock – Will Begin Producing Renewable Natural Gas Next Year – 70 cents/diesel gallon equivalent

Biorem Energy has created a cooperative to



Reduce Fuel costs to less than 10% of operating costs



Increase company profits by an estimated 25%

The logo for Biorem Energy features the word "biorem" in blue lowercase letters with a stylized flame icon inside the letter 'o', followed by the word "energy" in green lowercase letters.

Low Carbon Fuel Standard

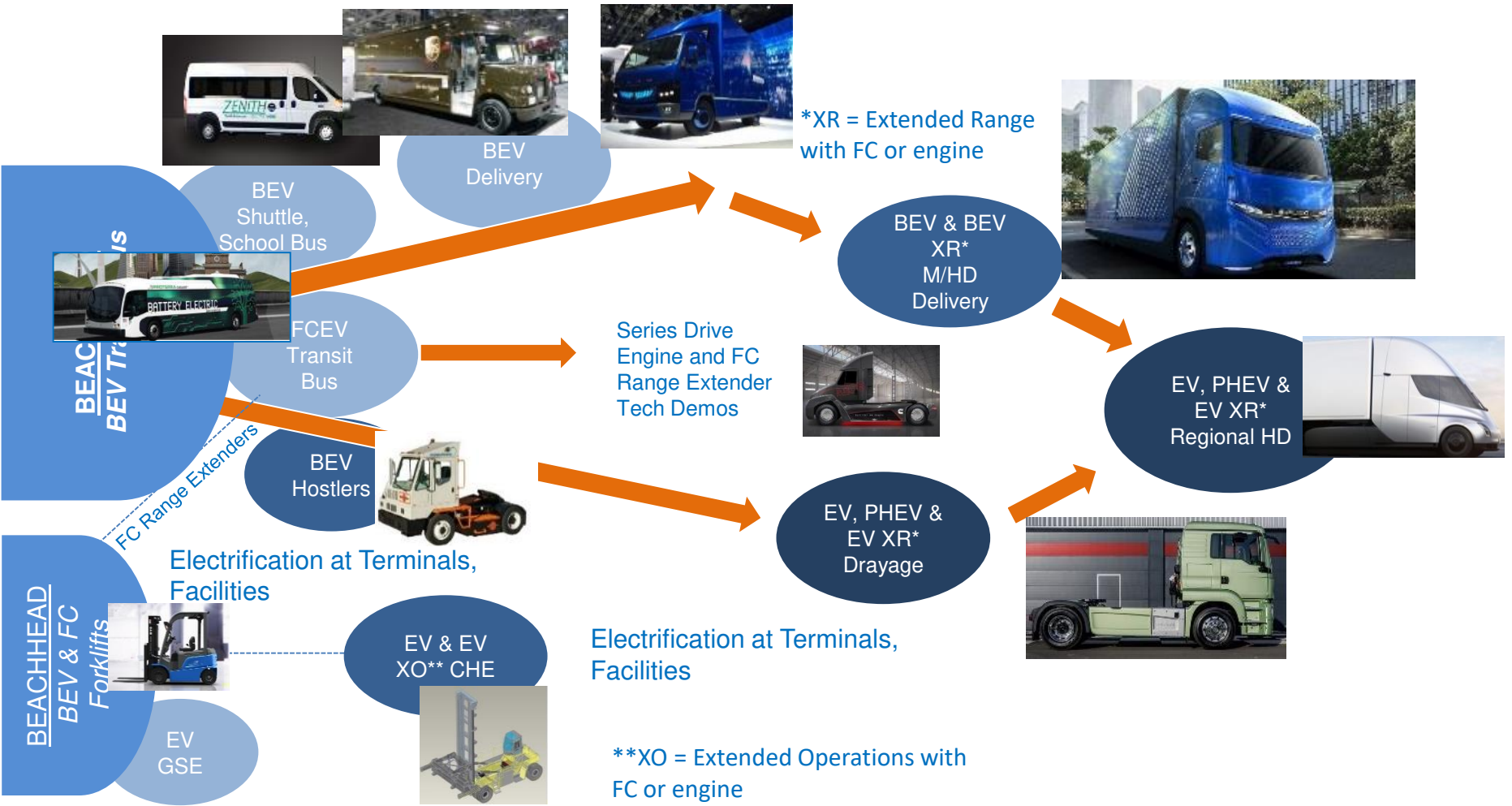
- » State level policy
- » Sets target for carbon intensity of all fuels sold
- » Refiners point of regulation
- » Carbon values established for each fuel allows for efficient market trading and outcomes
- » Complimentary to federal Renewable Fuel Standard
- » Opportunity for Midwest States with major agricultural sectors – new revenue stream for farmers

Strategic Transformation

“Beach Head” Framework

- » Identify and leverage key early markets where technology can be successful; use as launching point to then support additional applications
- » Success comes from growth of core supply chain, transferring similar powertrain and components
- » Beachheads help establish first success cases
 - » As technologies mature, they can expand in application and get more affordable
- » Each succeeding market builds greater volume

M-HDV Zero Emission Beachhead, Pathways



2017

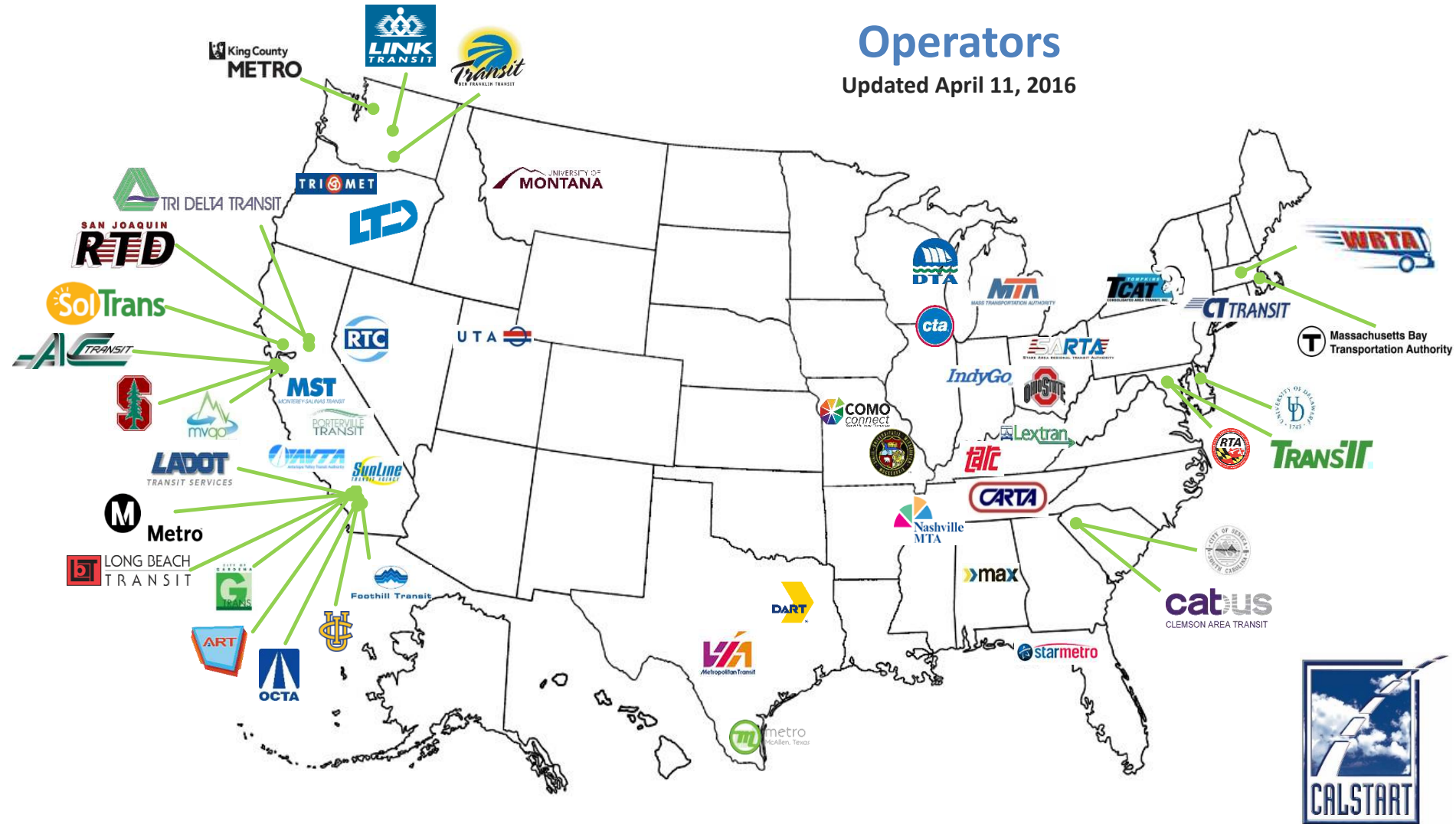
Steadily Expanding Climate 'Wedges' of Increasing Volume, Impact

More Than Twenty Three ZEB Products Across Ten Bus Makers



U.S. Zero Emission Transit Bus Operators

Updated April 11, 2016



CALSTART Ohio Fuel CellBus Activities

The Midwest Office is also responsible for supporting the Ohio Fuel Cell activities in conjunction with Ohio State University and GTI; testing, evaluating and demonstrating fuel cell buses.

- » OSU is leading a new FTA Low or No Emissions Component Testing Center; testing components, systems and vehicles
- » The team brings together world class experts in power electronics, gaseous fuel systems and the largest test track in the nation
- » CALSTART is identifying potential technologies and leading 'Voice of Customer' activities to keep focus on the needs of the end-users



THE OHIO STATE
UNIVERSITY

CENTER FOR
AUTOMOTIVE RESEARCH



GAS
TECHNOLOGY
INSTITUTE



Federal Transit
Administration

Federal LoNo Funding Available Now

- » Federal Transit Administration is accepting applications now for its Low & No Emission (aka LoNo) bus program
- » Approximately \$85 million available
- » Incentives for deploying in buses in rural areas
- » Contact CALSTART's Fred Silver – fsilver@calstart.org or (626) 744-5687



Federal Transit Administration

Volvo Group Announces 2 Electric Truck Products This Year



VOLVO

Volvo Group



Cummins Electrified Powertrain

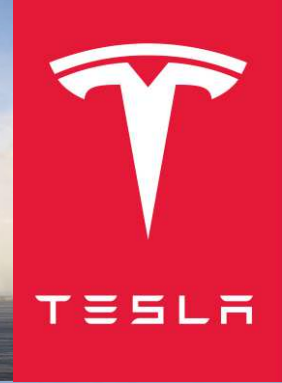


- Class 6-8 delivery, transit bus
- All-electric, downsized engines PHEV and range-extender architecture



Meritor Electric Axle

- Multiple components built around electric drive integrated into axles – no drive shaft
- Range of size and application designs including low floor bus and line haul
- Also electric suspensions, new air brakes
- \$26 million investment in TransPower – e-truck start-up
- CEO Jay Craig: “You’re seeing part of the Renaissance of Meritor”



Chanje



- Electric Delivery & Shuttle, Class 4 –more to come
- Ryder to provide service network

Toyota Fuel Cell Truck Demo



What Can States Do To Support ZE Truck and Bus Markets?

VW Settlement Funds Can Play Key Role in Supporting Beachhead Markets

- States should invest funds so they get 3:1 benefits – reductions in smog forming and greenhouse gas emissions and reduced dependence on oil
- Voucher Incentive most efficient way to distribute funds
 - Applications can be completed in 15 minutes
 - Avoid lengthy proposal development/review processes
 - Market driven

CALSTART is Managing Clean Vehicle Purchase Incentive Programs in 3 States



Scaling of Fleets – Solar/Storage/Microgrids



Infrastructure Challenge & Opportunity

Challenges:

- Fleets need help addressing high costs
- More EV charging needed

Solution:

- Utilities need to be in the game
- Use ratepayer funds to under-write % of cost of infrastructure
- Favorable rates

Regulatory proceedings underway in several states

CALSTART Utility Change Model

- Pre-application to utility regulatory body – important to bring key stakeholders together
 - National trucks fleets, truck and bus OEM's, transit fleets, EVSP's and utilities
 - Identify real world issues and solutions
 - Seek consensus prior to application & organize support for proposal
 - Reach consensus on rates and investments needed
 - Contact: Ryan Schuchard rschuchard@calstart.org



**ENERGY®
STORAGE**
NORTH AMERICA



CALSTART at ESNA

November 7-8, 2018 at the Pasadena Convention Center

- Co-locate with Energy Storage North America 2018
- Clean Technology Exhibit Vehicle Showcase and Expo Hall
- CALSTART will lead development of mobility track
- 2,000+ Attendees from Around the Globe

www.esnaexp.com

Please join us at ESNA 2018

ESNA 2018 Keynote Speakers



Penni McLean-Conner
Chief Customer Officer, SVP
Evensource Energy



Mary Powell
President & CEO
Green Mountain Power



Maria Rigiattii
EVP & CEO
Edison International

What Does a Win Look Like in 2030 or 2050?

- US companies and manufacturing sector strong and healthy because of global technological leadership in vehicle efficiency
- Economy benefitting from elimination of imported oil – all transportation energy produced and used in US
- Clean and health air; emissions related respiratory issues virtually eliminated
- Climate threat has subsided and rest of world appreciates our leadership and role – much like WWII and Marshall Plan

Summary

- Technology is improving and becoming commercially viable
- We are in a race against time
- Policy is an essential driver
- Leadership from US states and cities is critical

Regional CALSTART Contacts

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