Mobility: Fleet Electrification

Building New Mexico's Clean Energy Future

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Power Systems Engineer, Austin Energy

08/05/2019

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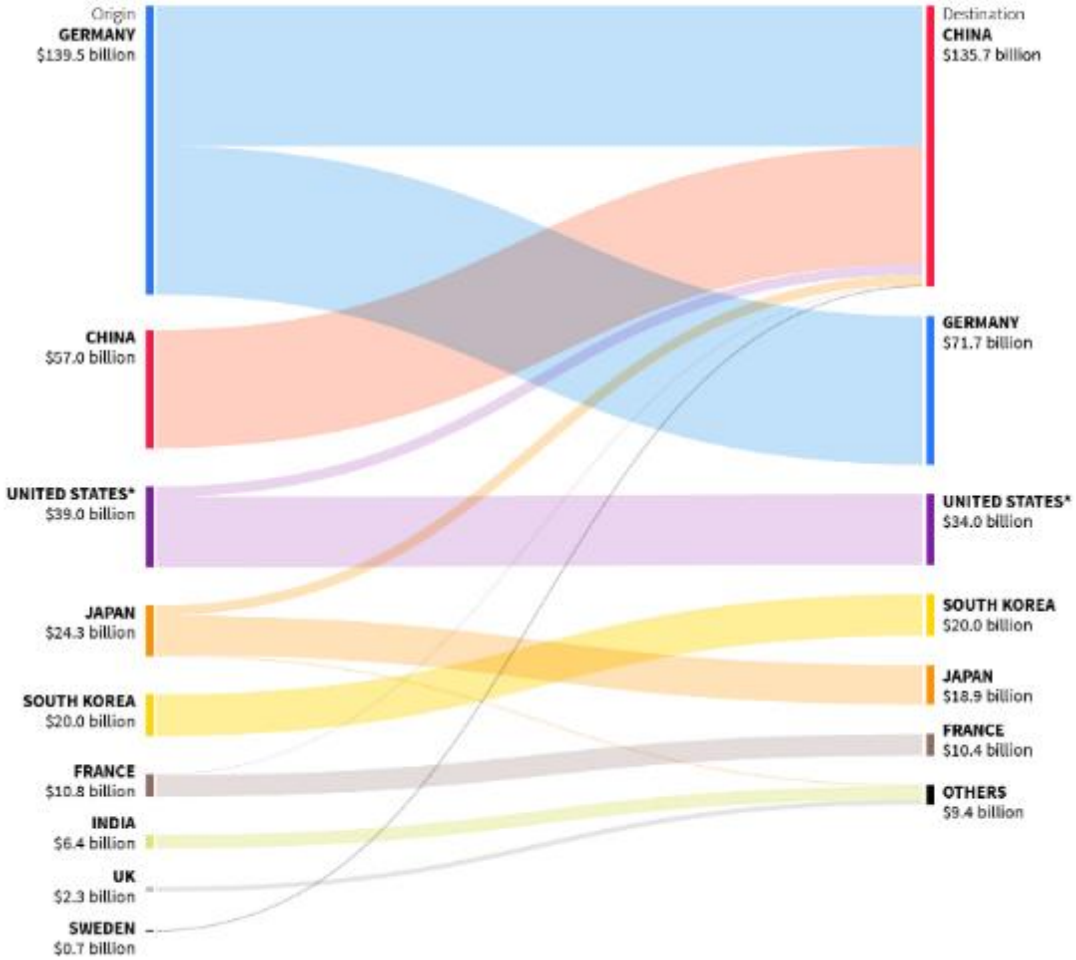
It’s a Global Market

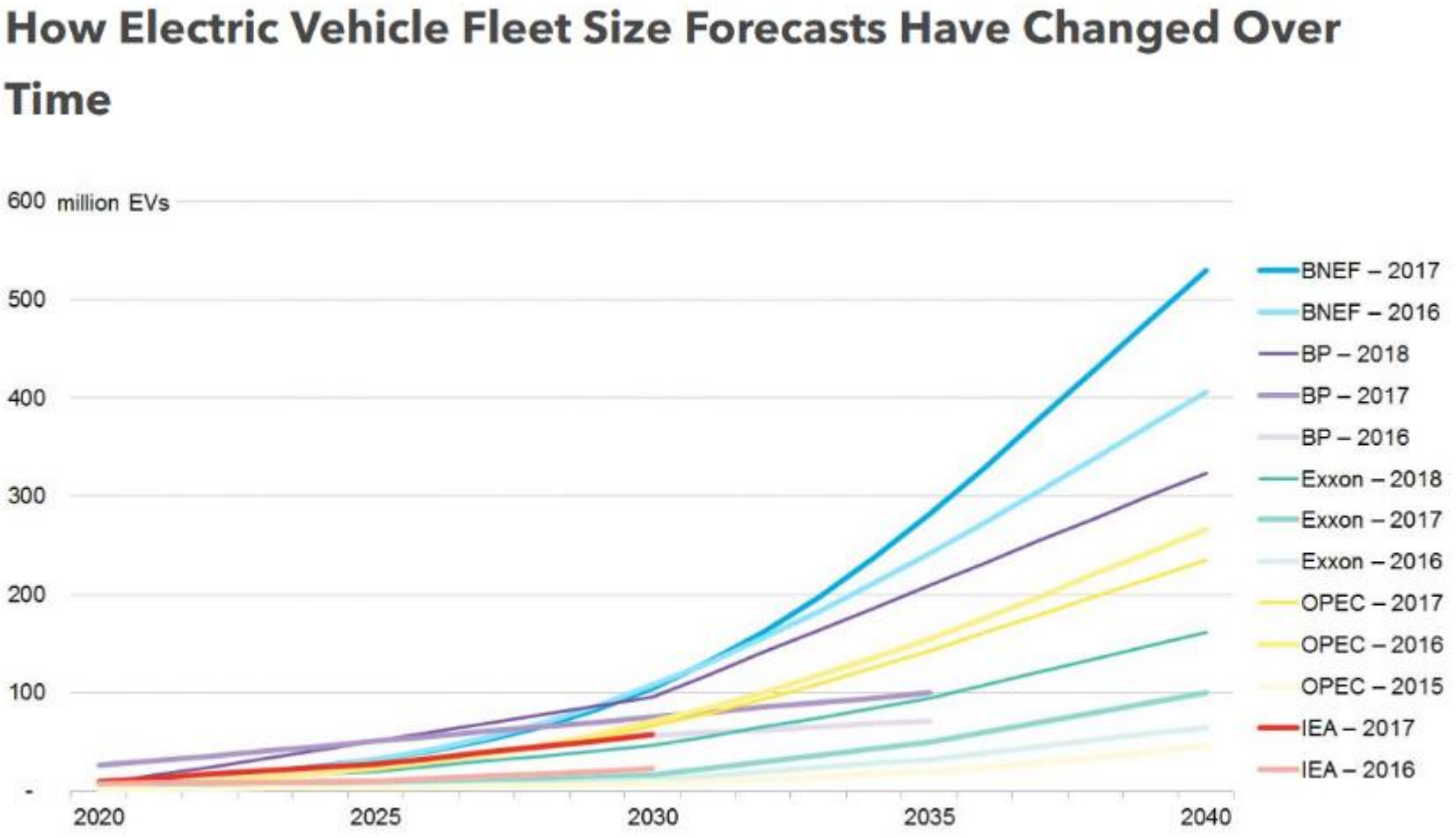
Investment in electric vehicles

Global automakers are planning to spend at least $300 billion on development and procurement of batteries and electric vehicles, with more than 45 percent of their budgets targeted at China, according to a Reuters analysis of public data released by those companies.

EV INVESTMENT FLOWS BY COUNTRY OF ORIGIN OF AUTOMAKER

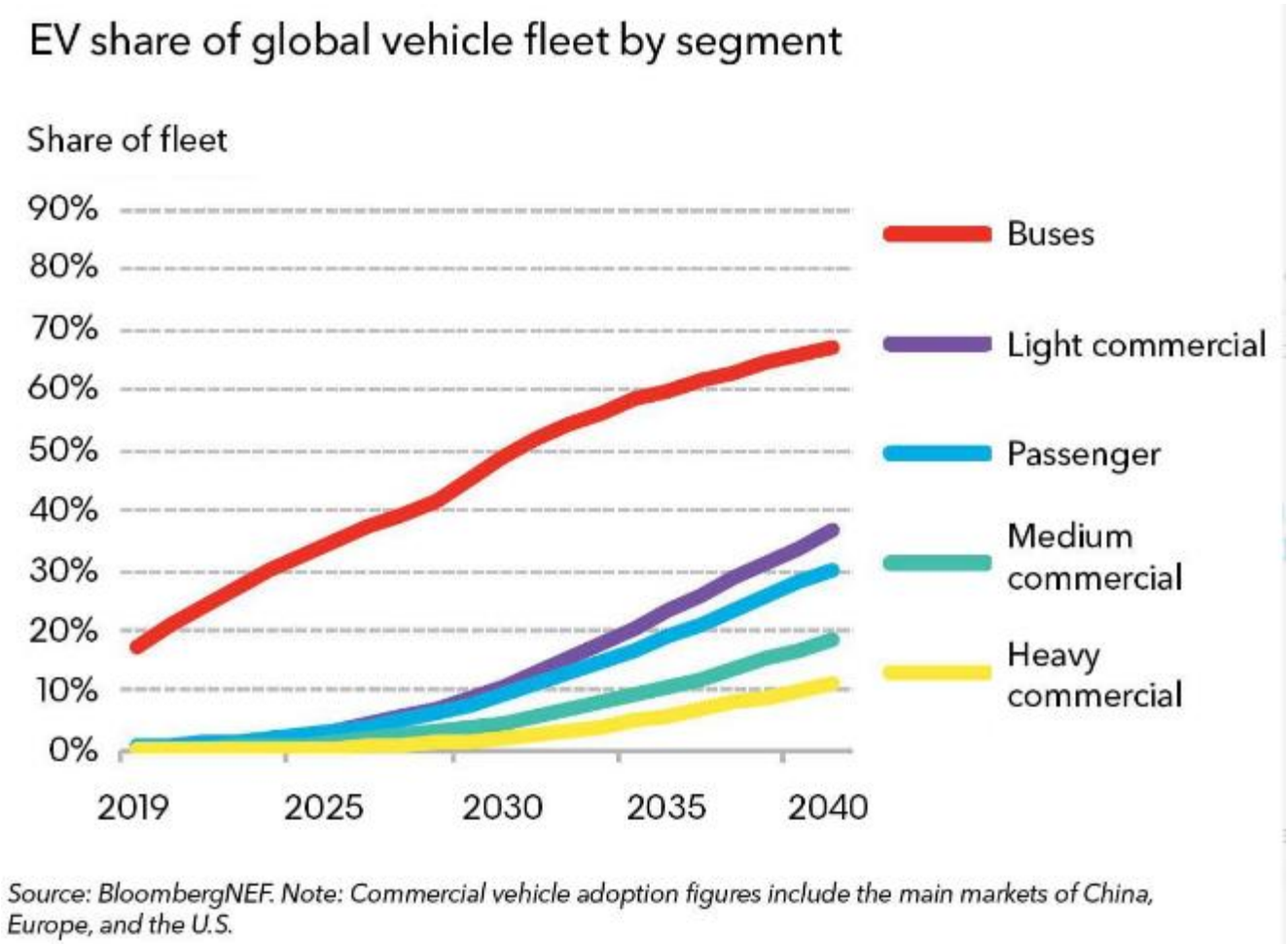


The EV conversation has shifted from “If” to When”



Source: Bloomberg New Energy Finance, BP, Exxon, OPEC, IEA.

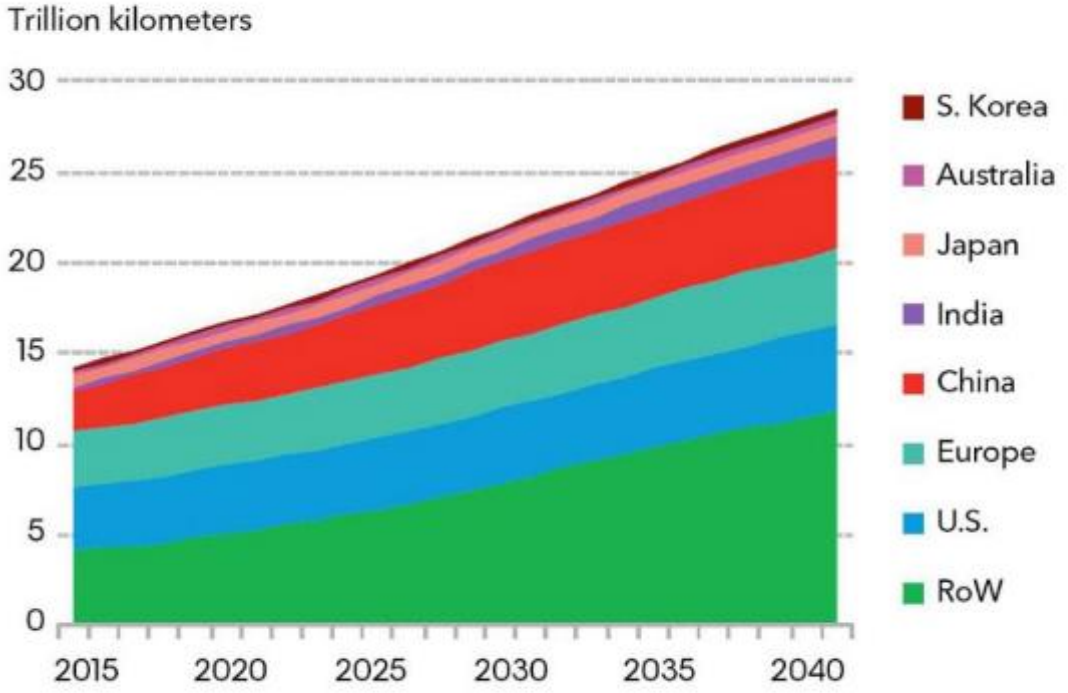
Where is the biggest opportunity?



Source: BloombergNEF. Note: Commercial vehicle adoption figures include the main markets of China, Europe, and the U.S.

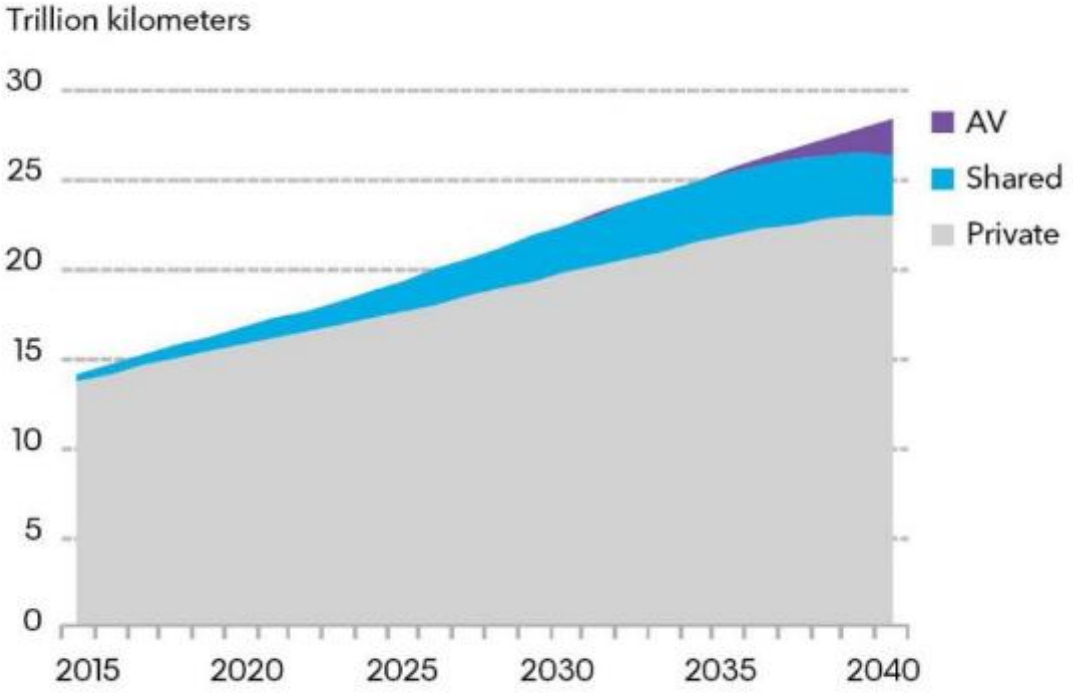
Distance traveled by Vehicle Fleets

Annual kilometers traveled by the passenger vehicle fleet by region



Source: BloombergNEF

Annual kilometers traveled by passenger vehicle fleet by type



Source: BloombergNEF

Kilometers to Miles

100 km ≈ 62 miles

4 Key Questions for Fleet Electrification

01 How to evaluate if fleet is ready to electrify?

02 What are the barriers to entry for fleet electrification?

03 Who are the critical partners needed to electrify?

04 Which policies will best accelerate this market?

*See Austin's Smart Mobility Roadmap as an example

Fleet Use Cases

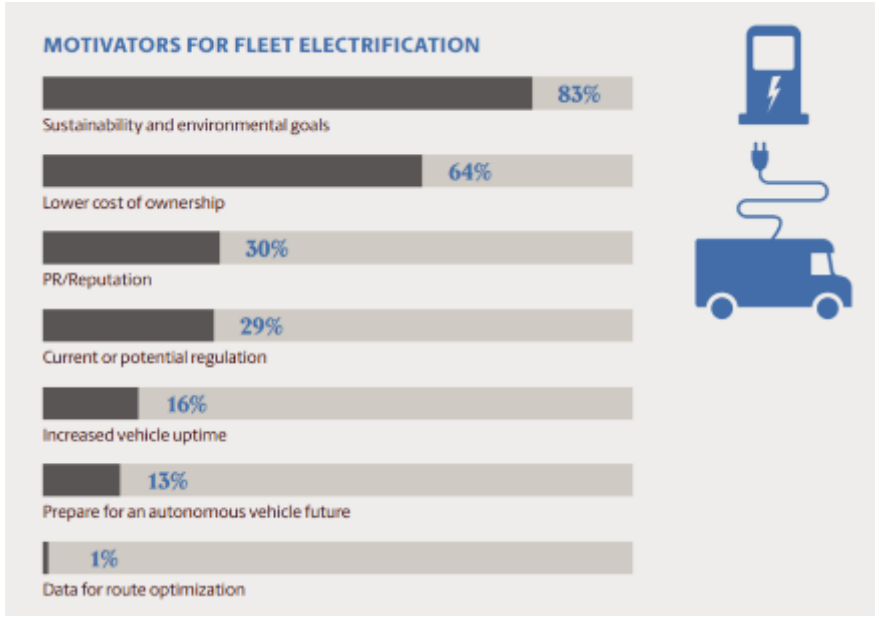
Source: PRTM Analysis

Classifying Fleets

Weight	Use	Public	Private
Light-duty	Services	Police cars, pickup trucks/utility vans for worksites	Pickup trucks/utility vans for worksites
	Goods Movement	-	Delivery cars/vans
	People Movement	Department cars	"Company cars" for sales/events
Medium-duty	Services	Bucket trucks	Utility or racked vans/trucks, food trucks
	Goods Movement	-	Delivery vans
	People Movement	School buses, mini buses	Mini buses, shuttles
Heavy-duty	Services	Refuse collection, fire trucks	Cement mixers, dump trucks, fuel carriers, tow trucks
	Goods Movement	-	Tractor trailers
	People Movement	Transit buses	Tour buses

Opportunities of Fleet Electrification

- Cost of EV/PHEV will continue to decrease
- Expansion into LD/MD/HD fleets
- Improved battery life
- Increased travel range on a single charge
- Lower total cost of ownership
- Route predictability
- Use of depots (charging hubs)



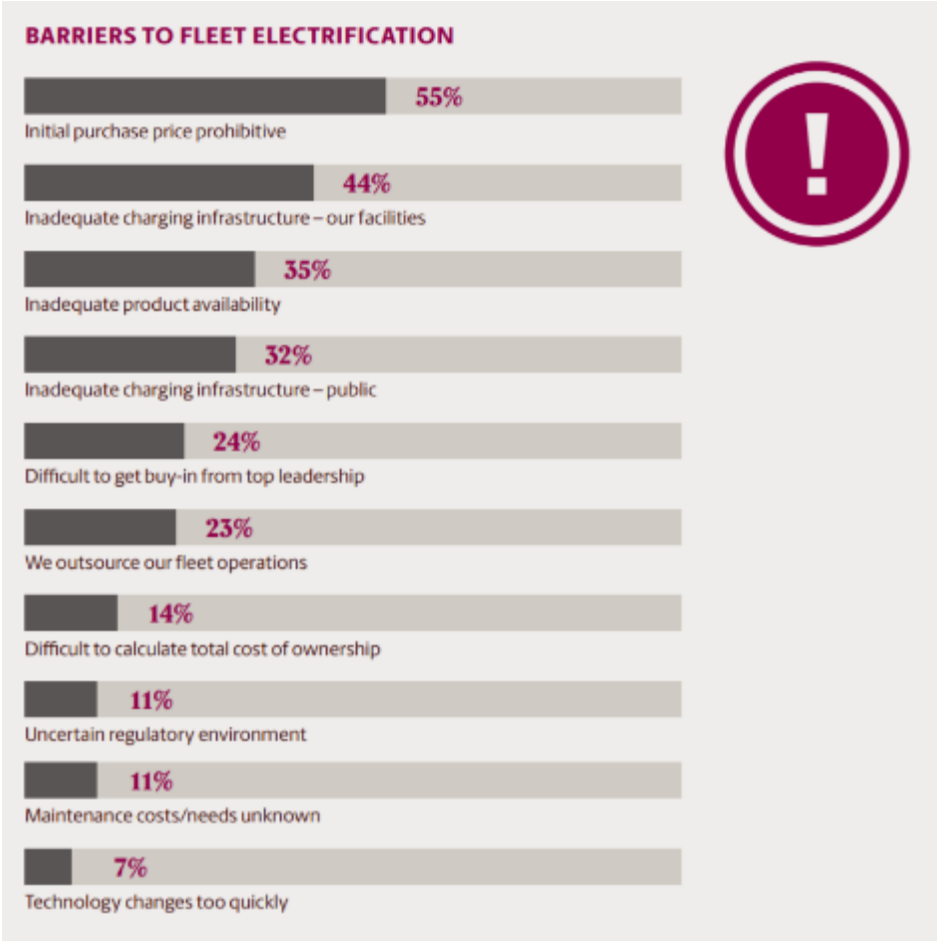
Motivators Drive Policy

Understand what motivates Fleet Electrification and cultivate policies to give companies the extra push to go electric.

Source: 2018 UPS/GreenBiz Study

Challenges of Fleet Electrification

- Culture change management
- Range anxiety
- OEM availability of MD/HD vehicles
- Maintenance technician training
- Capital costs vs. operating costs
- Infrastructure unavailability
- Education



Challenges are Opportunities

Government support of fleet electrification can make electric the new normal. Friendly economic policies for new technician trade schools and vehicle manufacturing can drive business to your community.

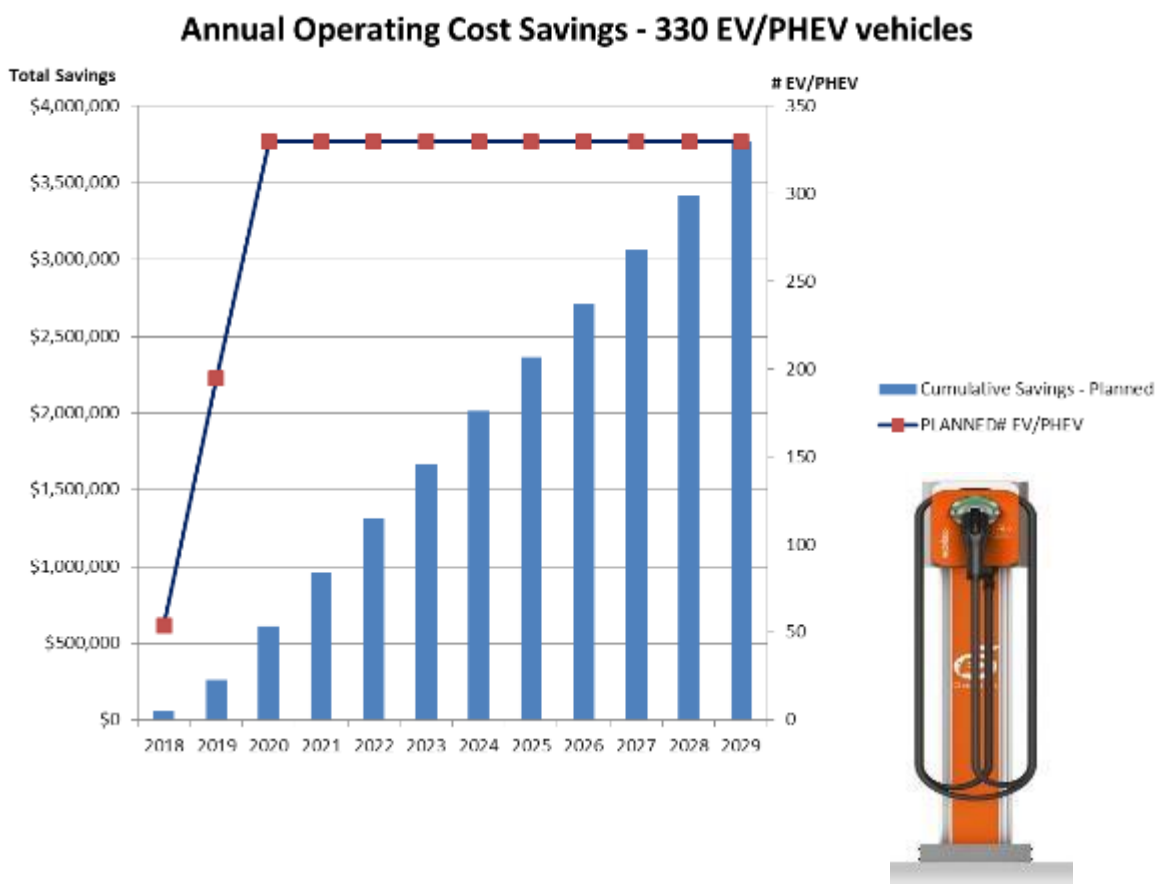
Source: 2018 UPS/GreenBiz Study

Fleet Services Electrification Plan

- 2016 Council Resolution in response to Smart Cities Challenge
- $3.5M Savings in Total Cost of Ownership
- Replace 330 vehicles with EV/PHEV
- Expand Charging Infrastructure
- Fund through interdepartmental fueling charging

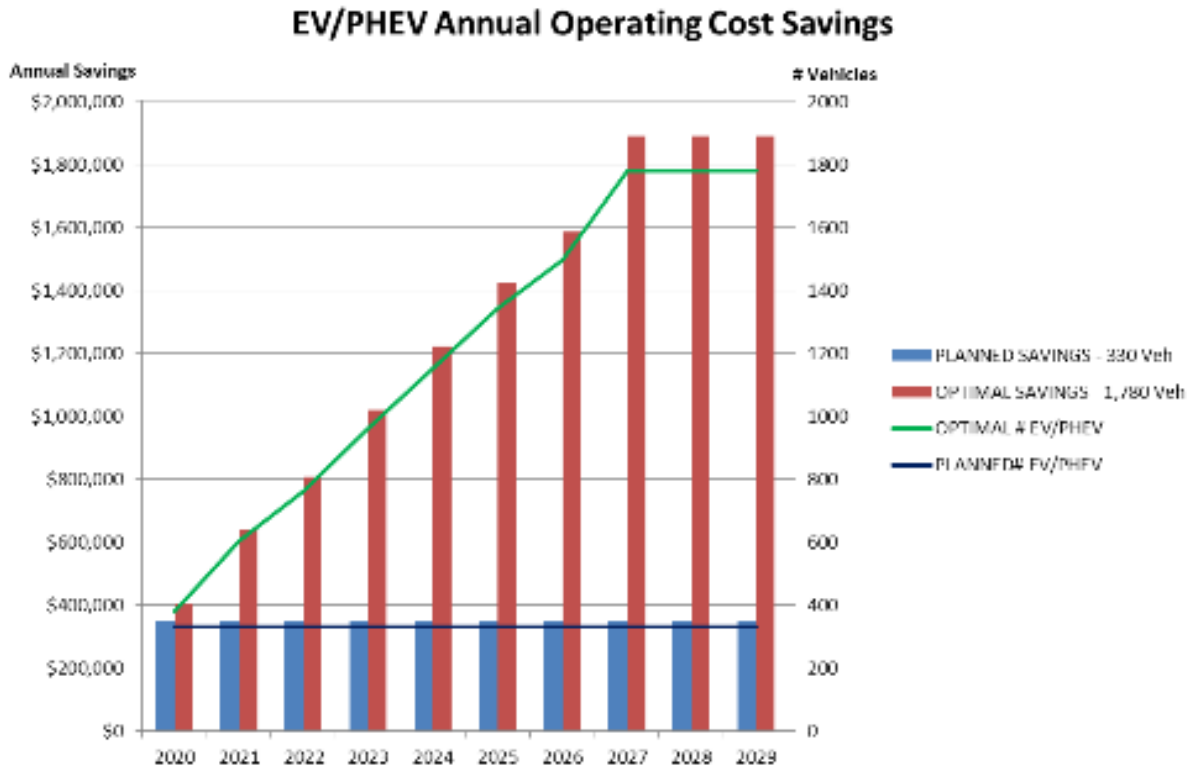
Policy Drives Change

City Council's resolution re-energized the fleet electrification plan. Cities need to lead by example.



Fleet Services Electrification Plan Ctn.

- Current fleet size is 6,652 with 33% light-duty
- Retirement eligibility of 1,780 more vehicles
- Up to 12.5M of Total Cost of Ownership Savings
- Expand on initial site designs

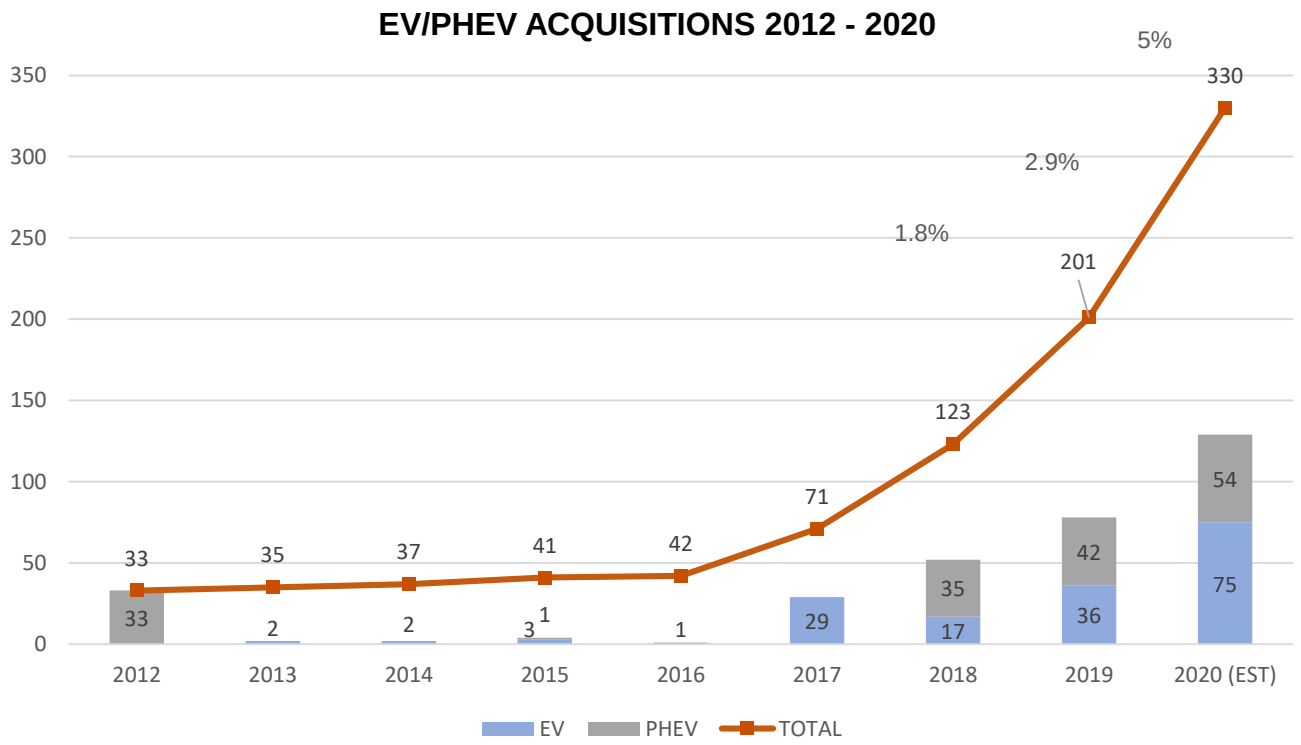


Big Picture

The goal should always be full conversion and have infrastructure to support a 100% electric fleet.

Fleet Procurement Strategies

- Evaluate Buy vs. Lease Options
- Use buy-boards
- Work directly with OEMs
- Impact of tax-credits (or lack of)
- CapX vs. OpX
- Lease to Own Models



Procurement & Policy

Governments are tax-exempt which plays a key-role in evaluating buying vs. leasing options. OEMs sometimes offer a discounted lease by "subtracting" a partial amount of the tax credits.

Fleet Services: Design Plan

- Design, construct, and energize charging stations at City-owned Sites

AE Distribution North (Kramer C) – Scope of Work

Plan for the Future

Don't just design for yesterday's needs but design for tomorrow's challenges.

Fleet Management Systems

ChargePoint EV Dashboard April 2019

Local Environmental Impact

4.31M

kWh

drivers consumed on the Plug-In EVerywhere Network since program inception

513,301

charging sessions

on the Plug-In EVerywhere Network since program inception

18.73M

petroleum miles

displaced, think of all those avoided oil changes!

100%

renewable

with GreenChoice® energy

540,905

gallons.

of gasoline savings from US average passenger car

4M

Lbs.

of GHG Savings using the EPA energy generation estimates

Metrics Indicate Success

Fleet Management Systems can provide additional value by providing metrics to the owner/operator.

The Power of Ride and Drive

AUSTIN CITY MANAGER SPENCER CRONK TOOK A 100% ELECTRIC CHEVY BOLT FOR A TEST DRIVE

Drives Change Policy

Use ride and drive events to get buy-in for fleet electrification.

Source: COA Fleet Services

City of Austin Fleet Services Vehicles

Source: COA Fleet Services

Lessons Learned

- Be wary of retrofits
- Temper expectations
- Time-intensiveness of operations
- Contract negotiations
- Logistical challenges
- Red tape
- Parking restrictions
- Lack of training and education

Policy Moment

Policy and planning need to go hand in hand. Cities often set lofty goals without considering the impact of implementation in terms of time, culture, and resources.

Source: Mexican-American Culture Center

gtm:

Electric Cars Could Save Ride-Sharing Drivers $5,200 a Year

Lyft, Uber and Ride Austin drivers are ideal candidates for electric vehicles, according to a Rocky Mountain Institute analysis.

GM expands Maven Gig into Austin with all-electric rental fleet

A Typical DC Fast Charging Hub

Example: 8 DCFast Stations is a new commercial customer that can generate high Demand (450+ kW) on small footprints (1,000sf).

ELECTRIC VEHICLES

Austin Energy sees third party EV charging as win-win

October 25, 2018 Peter Maloney

AMERICAN PUBLIC POWER ASSOCIATION

eGSE at Austin-Bergstrom International Airport

- Improve air quality by replacing aging gas and diesel ground support equipment (GSE)
- Currently 20 charging stations
- 12 plug-in baggage trucks and belt loaders
- Divert power to greatest need
- Tie to Jet Bridge Circuit

Public-Private Partnership

Delta, Southwest, and United Airlines took the charger partnered with ABIA to reduce their vehicle emissions by electrifying transportation.

Source: United Airlines eGSE

AUSTIN MONITOR
BETA

TRANSIT

Tuesday, April 23, 2019 by Ryan

Capital Metro to buy last wave of diesel, first electric buses

KUT 90.5 Austin's NPR Station

News Features Life & Arts Podcasts Support About Music

Cap Metro Says This Lot Will House The Electric Bus Facility 'Of The Future'

By MOSE BUCHELE, KUT • 16 HOURS AGO

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Cap Metro Fleet Electrification Project

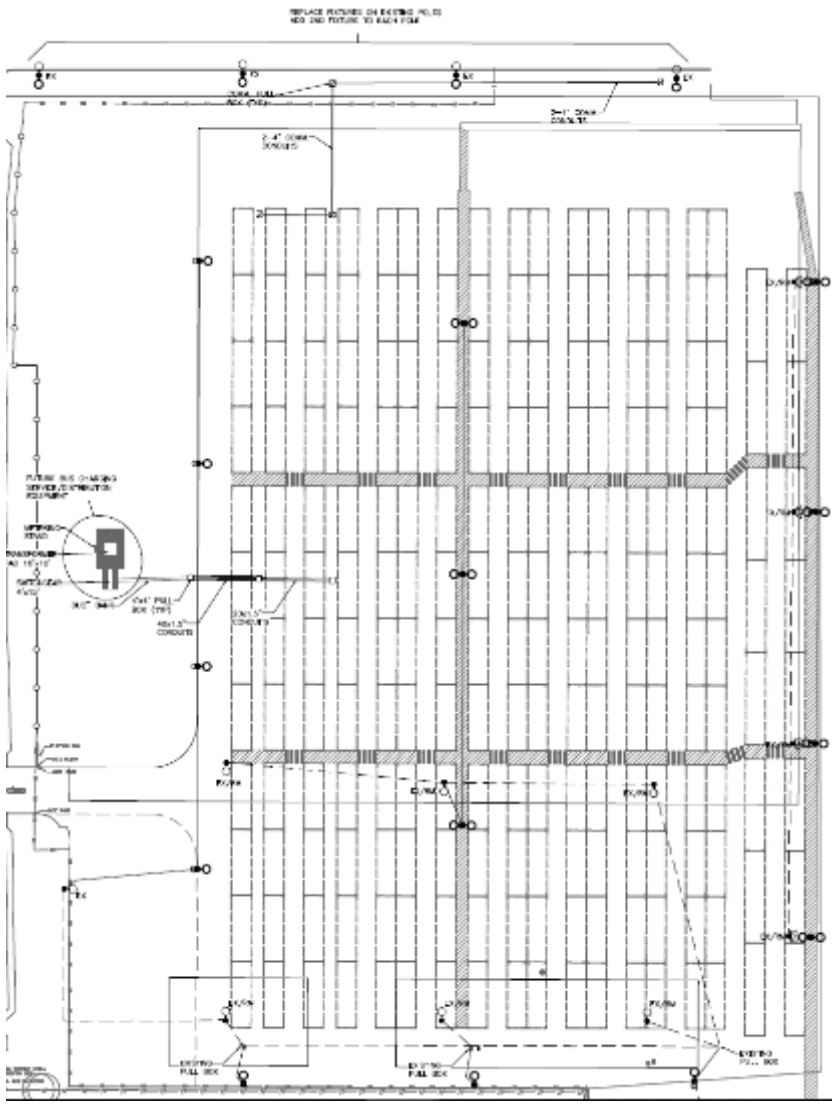
- Former Serta warehouse on McNeil to become Bus Charging Depot
- Support up to 200 electric buses
- Rate & Infrastructure Planning
- Role of the Transit Authority
- Vendor Beware
- Route Analysis

Impact with Infrastructure

Bus electrification has the opportunity to not only decarbonize transportation but educate the public on the benefits of electrification.

Source: Capital Metro

Bus Electrification – Charging Depot



Proposed Site Clearances

- Determine when to charge.
- Identify required clearances
- Estimate peak demand / load factor
- Size transformer
- Effect of terrain/temperature/use

Importance of the Utility

Get the electric utility involved in the discussion early for any bus electrification or large-scale depot charging project.

Electric Buses Around the World

Shenzhen, China

100% electric fleet of buses

- 16,359 buses in total
- $150k in subsidy per bus – more than half the cost of each one

Geneva, Switzerland

Emission-free public transit

- Airport to suburban route
- 10,000 passengers / day
- 20 second flash charging

Moscow, Russia

Capital Investment and Policy

- No more buses procured as of 2021
- Russian bus manufacturer is building local factory

The Climate Group: EV100

EV100

EV100 is a global initiative bringing together forward looking companies committed to accelerating the transition to electric vehicles and making electric transport the new normal by 2030.

Current Efforts

Companies

- **DHL:** 70% last-mile trips by 2025
- **UPS:** “Rolling lab;” 1000+ EVs now
- **FedEx:** ordered 1000 e-vans
- **Ryder:** sales/service partner of Chanje, Workhorse
- **Amazon:** “Shipment Zero:” 50% net zero deliveries by 2030
- **Ikea:** 100% last-mile by EV by 2025
- **Others:** Frito-Lay, Staples, USPS, Penske, J.B. Hunt

Vehicles

- 23 BEVs in use or development
- **BEV-focused:** Workhorse, Chanje, Arrival, Thor, Boulder, Motiv
- **Existing:** Daimler, Mercedes-Benz, Nissan, Volvo, VW, Ford, Isuzu, Navistar, Peterbilt

Utility Programs

- **Duke Energy & Workhorse partnership:** infrastructure design; vehicle financing; DERs
- **Oncor:** mapping out fleets in territory. Customer reached out to electrify new depot

Sources: see “Delivery Van Pilots, Vehicles, Announcements” spreadsheet, Appendix

Most segments already have an electric option

Top: Tesla Model S police car (City of Fremont), PG&E bucket truck, Lion school bus

Bottom: Boulder flatbed, Daimler semi, BYD garbage truck (Seattle)

Delivery Vehicle Electrification

Delivery Adoption Method

Surprisingly, corporate sustainability is more important to fleet electrification than total cost of ownership.

Left: UPS Electric Delivery Truck, Right: Ikea Electric Delivery Truck

Electric Delivery Trucks - Large



Top: Daimler Freightliner eM2 106, Volvo FL Electric, Daimler Mitsubishi FUSO eCanter

Bottom: Isuzu NPR-HD, Thor Trucks medium-duty, Peterbilt E220EV (medium-duty)

Electric Delivery Vans - Medium

Top: Mercedes-Benz eSprinter, Chanje V8100, Mercedes-Benz eVito

Bottom: Workhorse NGEN, Boulder DV-500, Nissan e-NV200

Electric Bucket Trucks?

Utility Adoption Method

Safety and reliability are more important to a utility than cost savings. The winning attribute is the “quietness” of the electric-version of the bucket truck. Eliminating noise pollution means happier customers and safer linemen.

Left: LADWP, Right: PG&E

More Utility Services

Repeated Routes

The pattern of the routes are predictable making this a great candidate for electrification.

Left: San Francisco Garbage Truck, Right: Seattle Garbage Truck

Austin American-Statesman

Charging stations at schools to power electric vehicles, student minds

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"EVs for Schools" Program

EV’s for Schools Curriculum Overview

EV Lessons for Schools Overview

This EV Lessons for Schools program introduces students to electric vehicles (EVs) and helps them understand why it is helpful to think about our transportation habits and their environmental impacts. Students build awareness of advancing electric vehicle technologies as they examine different types of EVs, consider the advantages and disadvantages of EVs, and compare EVs to traditional cars. They also think through important considerations related to an EV purchase, such as factors that might offset initial costs and how an EV owner plans a long-distance trip. They explore the issue of EV equity and think about ways they could help make sure EVs are accessible to everyone, including people in low-income communities that are often hardest hit by emissions pollution. Students also examine an EV charging station and its related app to see first-hand how the technology works and to gather data on electric vehicles. In the final lesson, students learn a design-thinking process to help them tackle a short-term or long-term capstone project related to EVs that could have long-lasting impacts for their community.

...

This program includes:

- 3 engaging lessons that encourage awareness, personal development, project-based learning, and design-thinking methods with a range of teaching strategies, including presentations, videos, activities, assessments, portfolio assignments, technology integration, and community extensions.
- 7 additional lessons from our Sustainable Intelligence program to provide additional instruction on foundational topics of energy, transportation, and sustainability.
- Student worksheets that engage students in real-world learning exercises.
- Standards alignment to the Texas Essential Knowledge and Skills (TEKS) for Environmental Systems, Integrated Physics and Chemistry, and Physics; Common Core State Standards (CCSS) for ELA/Literacy and Mathematics; Next Generation Science Standards (NGSS) for high school; and the Cloud Education for Sustainability (EFS) Standards & Performance Indicators.

Next ▸

EV's for Schools Sample Lessons

Next-Generation Leaders

Curriculum is developed at the Elementary, Middle, and High School levels. Teaching the next-generation about the transportation electrification will lead to more students engaging with the clean tech industry

EV Lessons for Schools

Transportation, Education, and Access

These lessons provide core instruction related to electric vehicles.

LESSON 1:
Why Electric Vehicles?

Photo: https://www.electricforall.org

Estimated time needed: One 55-minute session

This lesson provides students with an introduction to electric vehicles (EVs). Students learn about different types of EVs, the advantages and disadvantages of EVs, and how EVs compare to traditional cars. They explore their preconceptions about electric vehicles and begin to think about how they might go about promoting EVs to their school community. They also determine where their electricity comes from and why that matters for an electric vehicle.

LESSON 2:
EV Charge Forward

Photo courtesy of Austin Energy

Estimated time needed: Two 55-minute sessions

In this lesson, students investigate an actual EV charging station to see how it and its related smartphone app coordinate key information. If a charging station is not readily available, you can share the information via an EV Charging Storyboard. Then students suppose they are strongly considering purchasing an EV and investigate key factors that would influence that decision, such as incentives, rebates, where they would charge the vehicle, parking options and fees, driving style, etc. They also learn about EV etiquette in order to get a sense of the culture related to this new way of driving. Then they consolidate what they've learned by assuming they have purchased a vehicle they were interested in and are planning a long-distance trip. In Session 2, students take the conversation to another level by working in groups to simulate a city council that is concerned about equity and making sure this new technology is accessible to everyone, including people in low-income communities that are often hardest hit by emissions pollution.

Electric School Buses: “Go Yellow to Go Green”

- Typically 120 miles, 6 – 8 hours charging
- Route Analysis
- Operating Hours (7 – 9 am, 2 – 4pm)
- Higher capital $, lower O+M $

Public-Private Partnership Opportunity

Funding is the biggest challenge when it comes to school bus electrification. It takes a village of partners (OEMs, Charging Station Manufacturers, School Districts, Electric Utility, Transportation Department, and local government) to support a project like this.

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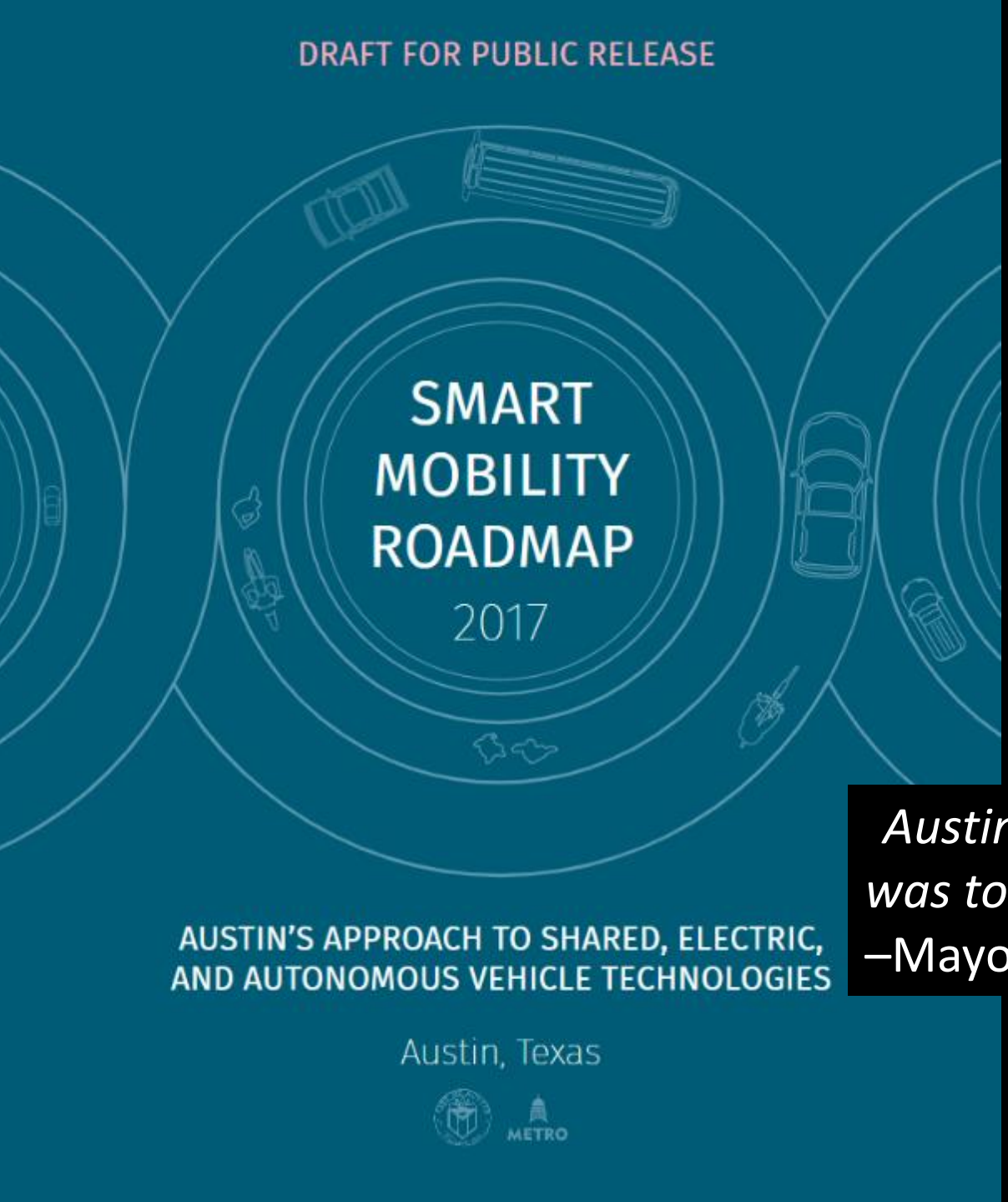
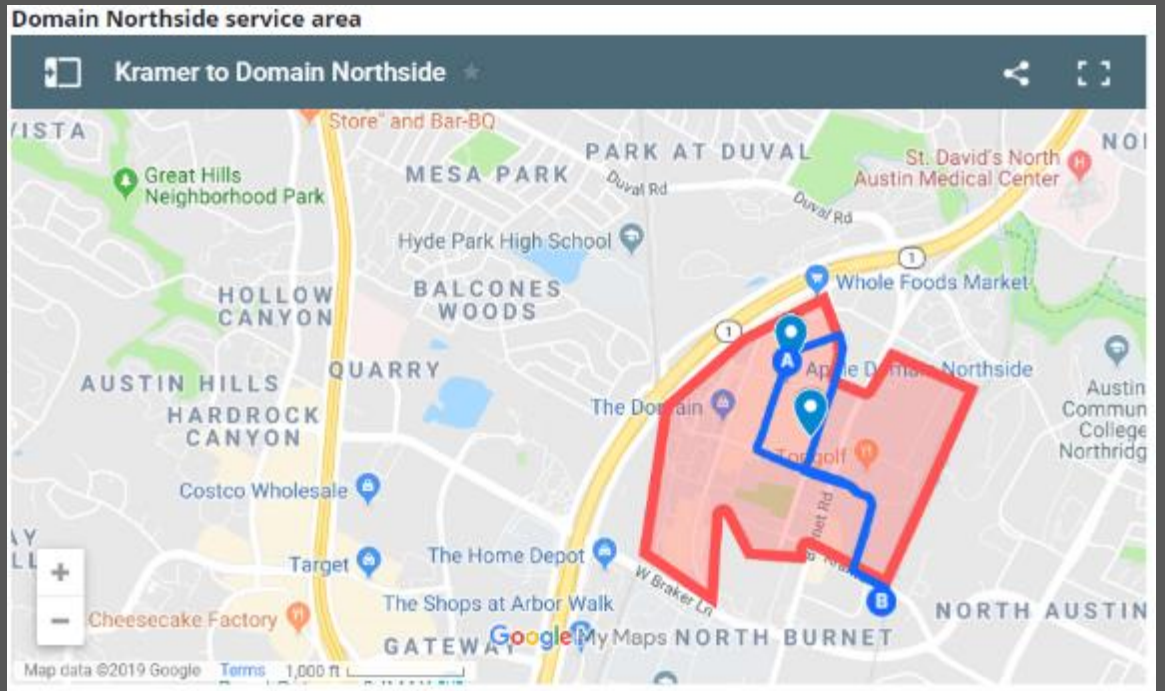
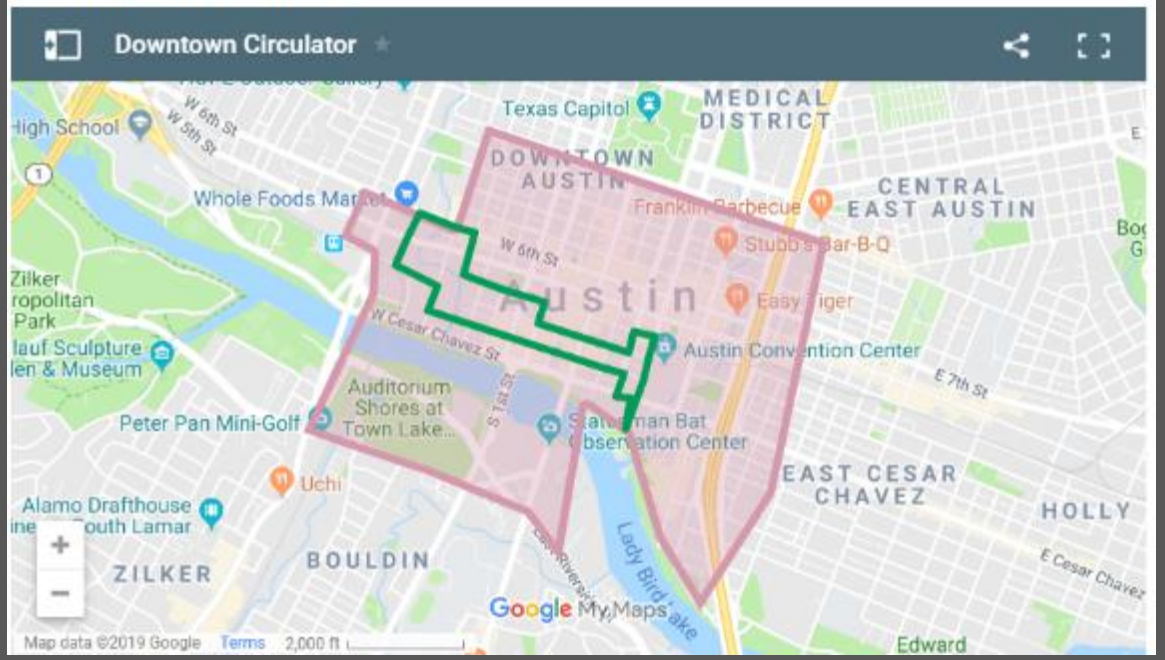


Austin, should be to automated vehicles what Detroit was to the last century of automakers."
–Mayor Steve Adler

Domain Northside service area



Downtown Austin service area



Bloomberg Businessweek

Your first ride on an e-scooter will be the most dangerous

The Washington Post

CDC study urges helmet use to prevent severe head injuries while riding scooters

AUSTIN MONITOR BETA

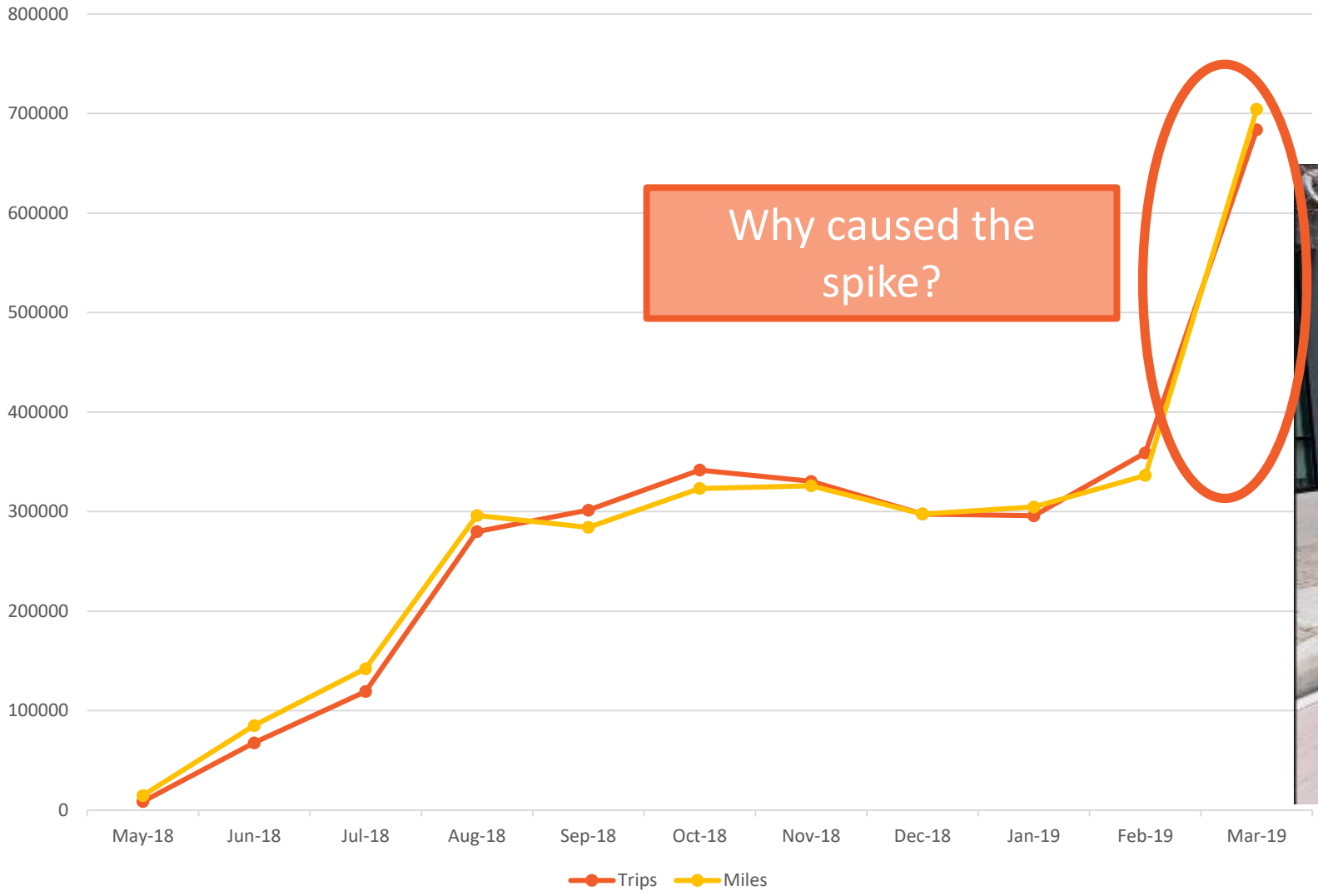
Figures show Austinites love and hate scooters

Bloomberg Businessweek

How Electric Scooters Are Reshaping Cities

eScooter Trips in Austin

700,000 miles = 28 trips around the globe



FOX 7 | News | Weather | Good Day | Sports | Traffic | Contests

Austin Energy employees learn the ways of the 'scooter'

By Casey Claiborne, FOX 7 Austin

THE AUSTIN
CHRONICLE

“EVs are for EVeryone” Program

30.2% of a low-income family’s income goes to transportation vs. 13% for middle-income families – TxETRA

Grant Funding Provided By:

11TH HOUR PROJECT
THE SCHMIDT FAMILY FOUNDATION

“ I can take my kids to school and then get to the store.”

“It's been so much fun biking around our neighborhood. We've even been getting to know more neighbors and everyone is always so curious (and jealous) of our bikes. **We are so happy there was a rebate! It definitely made the decision to get e bikes even sweeter.”**

Statesman

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Austin pedicabs get boost with electric motors just in time for SXSW

METRO-STATE

By Mary Huber - American-Statesman Staff

kxan

BikeTexas gets Austin rebate for fleet of new e-bikes

By: Andy Jechow

Posted: Aug 02, 2016 05:28 AM CDT
Updated: Aug 02, 2016 05:28 AM CDT

BikeTexas gets first of its kind rebate for fleet of new e-bikes (Mayor Adler Twitter Photo)

Hot off the Press

Policy Impacts
Supporting electric vehicle charging friendly policy is CRITICAL to the success of infrastructure expansion.

VW Settlement Funds

11 contracts awarded Aug. 2019

- 209 million allocated
- Repower or replace school buses, shuttle buses, or transit buses.

Autonomous Transit

Electric-powered shuttles

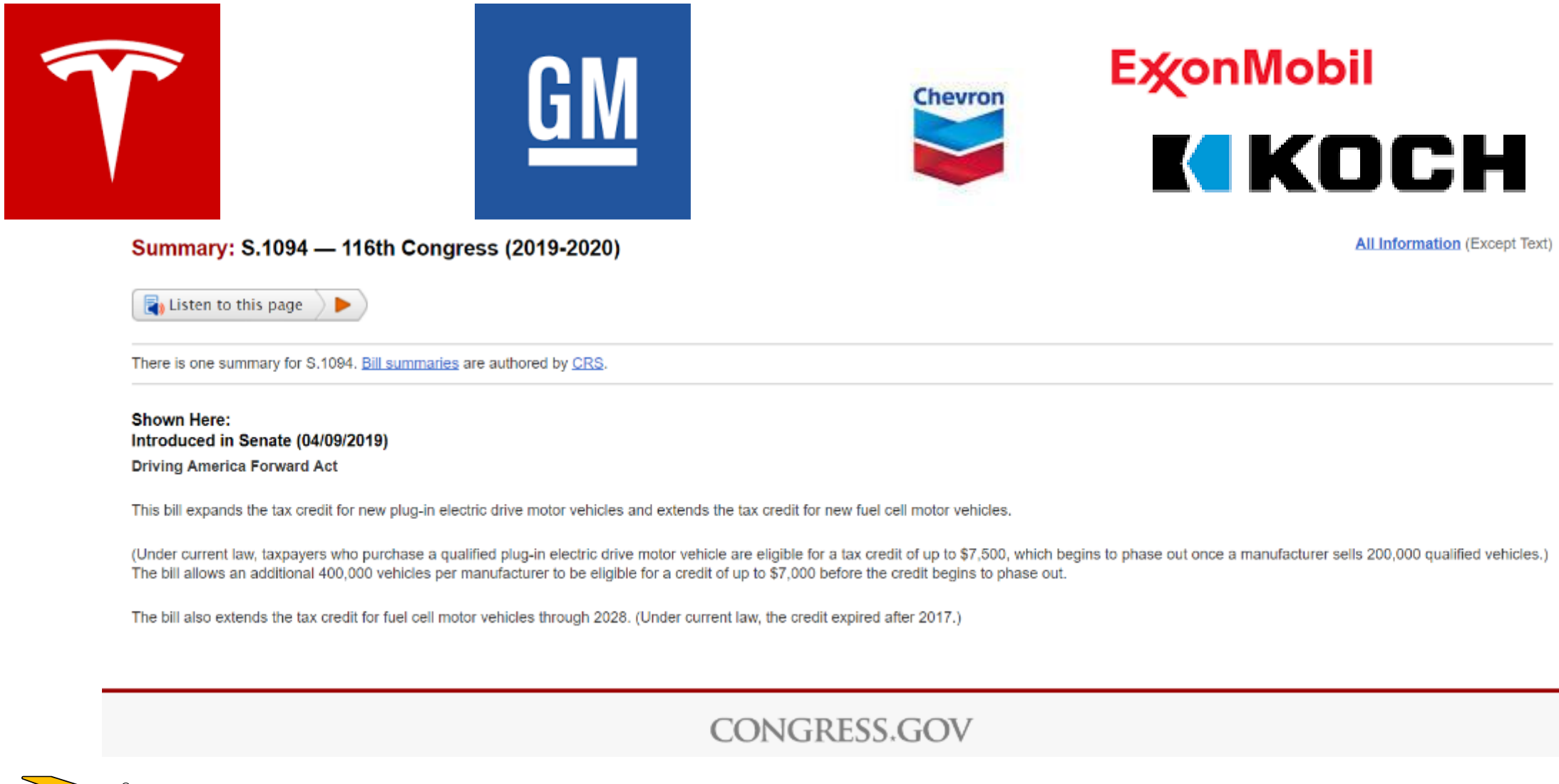
- CapMetro + RATPD DEV USA
- First mile, last mile solutions
- Shared, electric, autonomous

S.2302 America's Transportation Act

Senate Environment & Public Works Committee

- Transition vehicle fleets to electric, hybrid-electric, and alternative fuels
- Local support for carbon neutral fleet

Lobbying Battles: Car Makers vs. Big Oil



Summary: S.1094 — 116th Congress (2019-2020)

All Information (Except Text)

Listen to this page

There is one summary for S.1094. Bill summaries are authored by CRS.

Shown Here:
Introduced in Senate (04/09/2019)
Driving America Forward Act

This bill expands the tax credit for new plug-in electric drive motor vehicles and extends the tax credit for new fuel cell motor vehicles.

(Under current law, taxpayers who purchase a qualified plug-in electric drive motor vehicle are eligible for a tax credit of up to $7,500, which begins to phase out once a manufacturer sells 200,000 qualified vehicles.) The bill allows an additional 400,000 vehicles per manufacturer to be eligible for a credit of up to $7,000 before the credit begins to phase out.

The bill also extends the tax credit for fuel cell motor vehicles through 2028. (Under current law, the credit expired after 2017.)

CONGRESS.GOV

How can you support Fleets in your ____?

Operations

Identify the most applicable use cases of fleet electrification.

Acquisition

Point-of-purchase incentives and government mandates.

Declare Support

Proclamations, ordinances, or code changes show that cities are serious about supporting transportation electrification.

Build Relationships

Collaboration between OEMs, fleet owners, charging infrastructure, the local utility, and government is key.

Educate Fleet Operators

Educate on the business value of fleet electrification with lower total cost of ownership and meeting sustainability goals.

Funding Options

Grants, budget allocation, VW Settlement funds, and tax-credits.

State EV Policy Actions

Vehicle Rebate

Public Fleet Pilot Project – California Health and Safety Code 44274 and 44258, Maryland – business entities tax credit on up to ten vehicles, Sales tax exemption in NJ

HOV Lane Access

Arizona, Florida, Georgia, Hawaii, New Jersey, Tennessee

Government Fleet Mandates

Rhode Island – Executive Order 15 – 17, NY State Energy Research and Development Authority voucher for fleets operation, 5% AFV or HEV for state fleet vehicles in Massachusetts.

Transit Bus Fleet Upgrades

Seattle – King County Metro Transit, District Department of Transportation in D.C. LA County Metro – 2017 City Council Resolution

Vehicle Registration Fees

Lower vehicle registration fees in Connecticut, District of Columbia, Illinois, Iowa, Vermont. The opposite is states with an imposed EV fee such as Georgia.

Equity and Access

BlueLA, SB 1275, Charge Ahead California Initiative, Clean Cars 4 All

Source: Sierra Club Policy Toolkit

AUSTIN GREEN AWARDS

11TH HOUR PROJECT
THE SCHMIDT FAMILY FOUNDATION
Grant Award

TCEQ
Grant Award

1st Place
E SOURCE AD AWARDS 2017

greentechmedia: GRID EDGE innovation AWARDS

FAST COMPANY WORLD CHANGING IDEAS 2019

Electric Vehicles & Emerging Tech Team

Bloomberg Philanthropies
Grant Award

SMART 50 AWARDS RECIPIENT

SMART 50 AWARDS RECIPIENT

SMART AWARDS RECIPIENT

Smart Electric Power Alliance
Utility of the Year

U.S. DEPARTMENT OF ENERGY
Grant Award

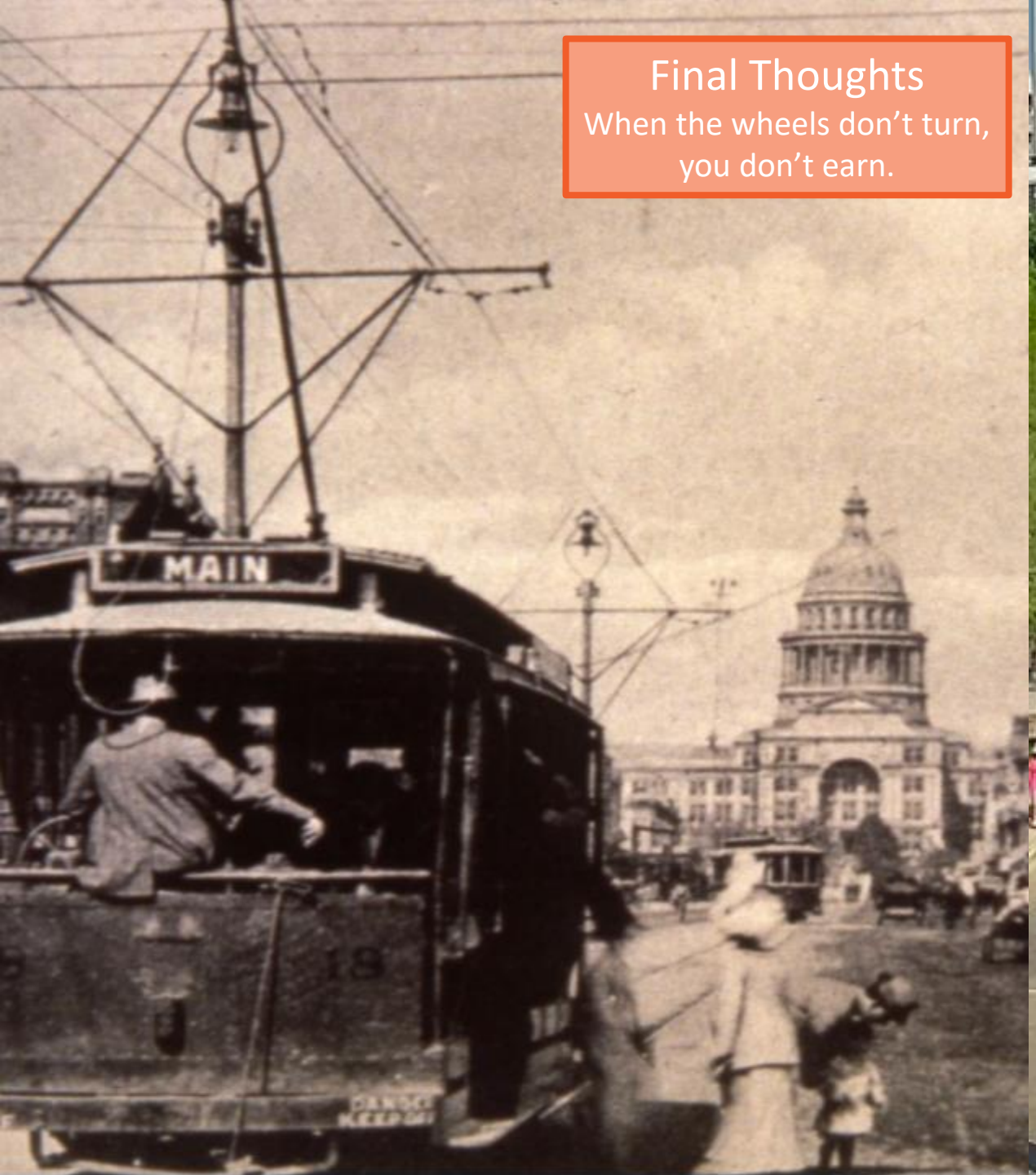
SMARTCITIESDIVE
Utility of the Year

DEED PUBLIC POWER RESEARCH & DEVELOPMENT
American Public Power Association

Special thanks to Allison Donnelly!

Final Thoughts

When the wheels don't turn, you don't earn.



Thank You!

Questions?

Kevin.Chandra@austinenergy.com

https://www.youtube.com/austinenergy