The Drive to Electrification

Tucson Electric Power

Agenda

- Benefits of Electrification
- EV and Charging Basics
- Current Efforts toward Electrification
- Current Key Projects
- Funding for EVs

Benefits of Electrification

Benefits

De-carbonizing the transportation sector will provide enhanced health benefits as a result of improved air quality

Electric vehicles can provide operational cost savings to fleets

Electric vehicles can empower customers to meet their sustainability goals

Increase grid utilization leading to lower costs for all customers

According to a Consumer Reports analysis of EVs, fuel savings alone can be more than $4,700 over the first seven years of ownership. With only 20 moving parts in an electric car, maintenance savings over the lifetime of the vehicle can range from $6,000 to $10,000.

Based on a national average price of $2.85 for a gallon of regular gasoline and $1.16 for an eGallon, the average fuel cost savings for an EV driver was about 60%.

EVs and Charging Basics

Vehicle Types

- **ICE** - Stands for Internal Combustion Engine which is powered by combustible fuel — this is what most vehicles are powered by today.

- **BEV** - Stands for Battery Electric vehicle, and is an all-electric vehicle that uses energy stored in rechargeable battery packs.

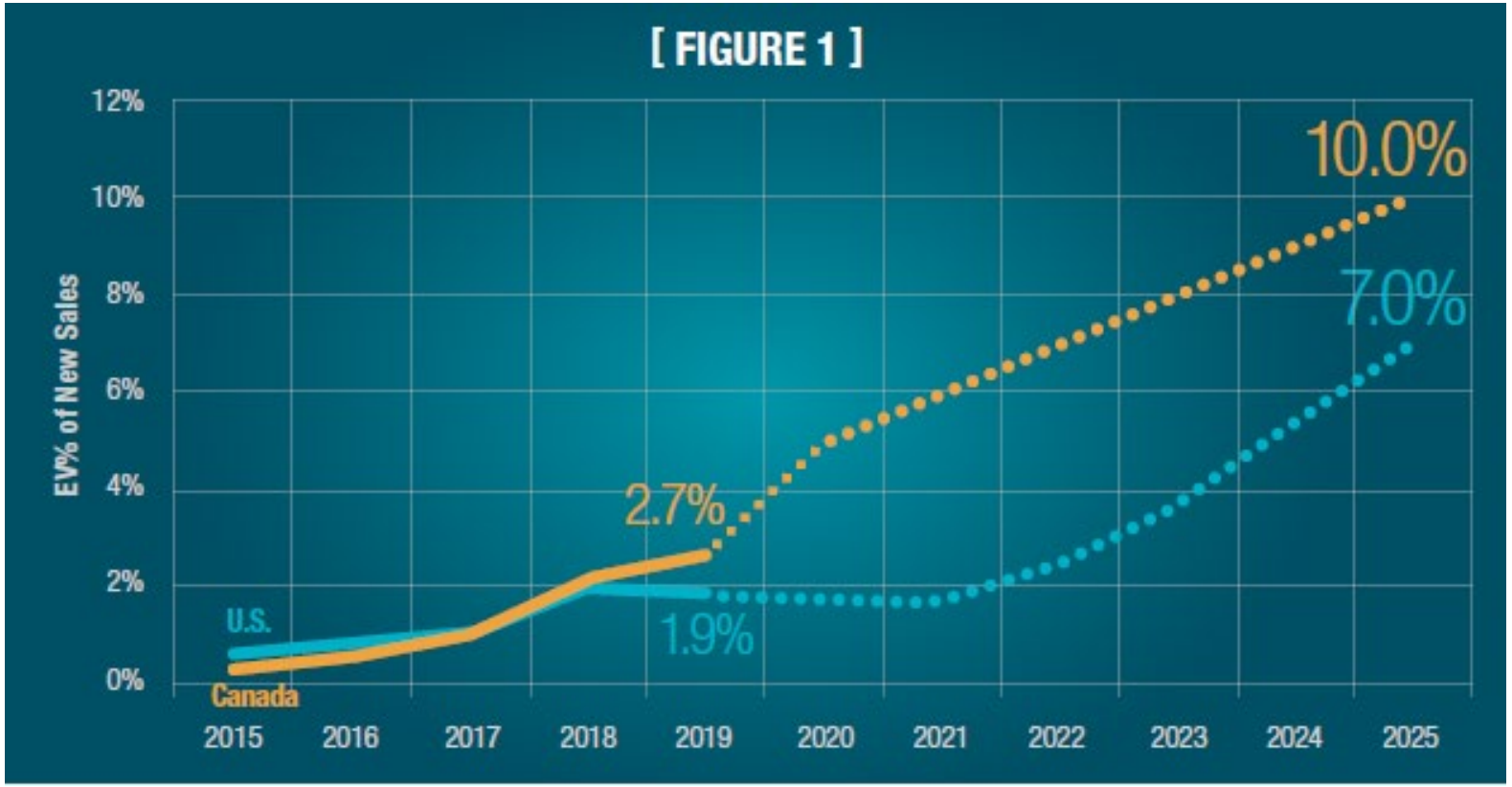
- **HEV** - Stands for Hybrid Electric Vehicles, a system that combines the EV system and an ICE system.

- **PHEV** - Stands for Plug-in Hybrid Electric Vehicles, which contain batteries that can be charged with an electric power source.

Common Perceived EV Misconceptions

EVs have limited range	Today's EVs can go on average 250 miles in a single charge
EVs are not cost effective	EVs may have a higher upfront cost today, but the operational savings can be significant
EV charging will increase my electrical costs	Align charging with off-peak hours (overnight and middle of the day) to minimize costs
EVs can't do the job of an ICE vehicle	EV sedans have been on a market for a few years, Light-duty pick-ups will be available in late 2021/early 2022

EV Sales - on the rise

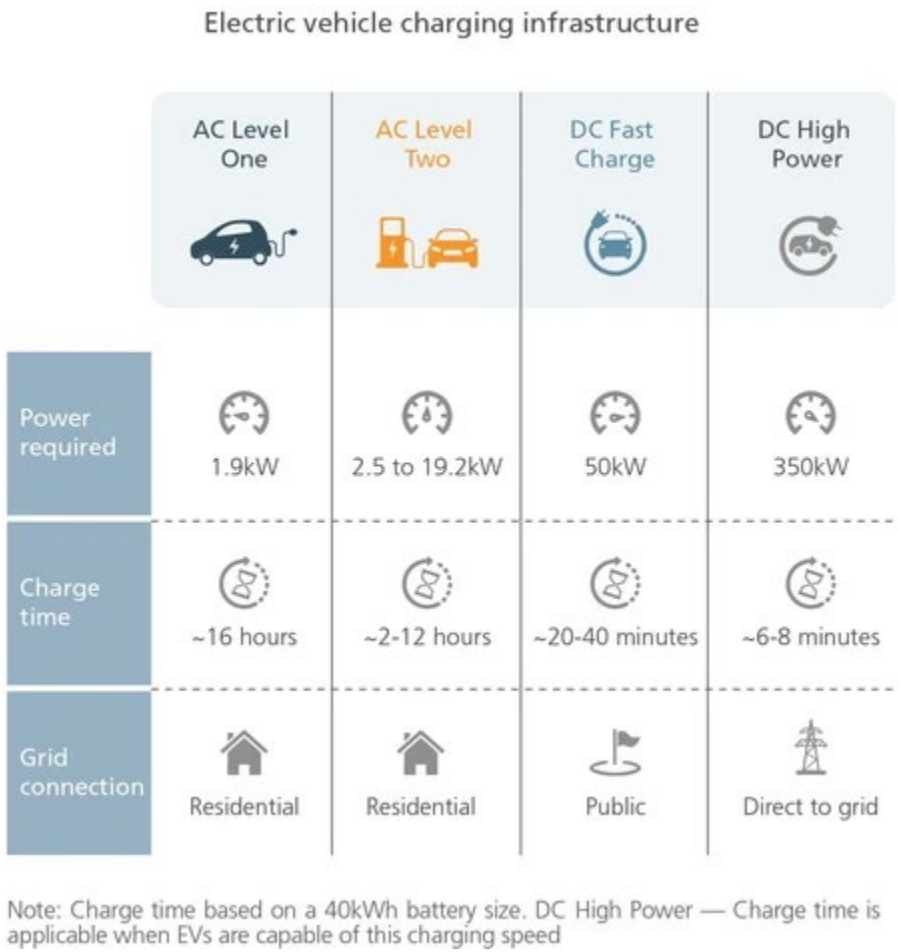


Vehicle Availability

EV Model Landscape

- Manufacturers are accelerating the release of new EV models
- Some are shifting away from internal combustion engines all together (e.g.. Audi)
- Range of an EVs is getting longer – Avg. is above 200 miles
  - Common fleet vehicles have a range closer to 250 miles
  - Electric light-duty trucks announced by Ford and GM

Charging Timeframes



Source: https://evelement.com/pages/info

AC - Stands for alternating current, or current that regular changes direction.
AC Level 1 - Can be charged with an ordinary household outlet. Gets 4.5 miles of range per hour of charging, or about 22 hours for a full charge.
AC Level 2 - Can be charged with an outlet that an electric dryer or oven uses. Gets around 26 miles of range per hour of charging.
DC Fast and High Power- Stands for direct current. Gets 40 miles of range for every 10 minutes of charging on average but can be as fast as 100 miles in 10 minutes, pending on charger output.

Charger Types

WALL BOX/PEDESTAL MOUNT

INTEGRATED DISPENSER

MODULAR SYSTEM
(POWER CABINET + DISPENSER)

Charging an EV –Types of Plugs

	AC	AC + DC	DC
LEVEL	Level 1 (120 V) Level 2 (240 V)	Level 2 Level 3	Level 3
SAE J1772	 **SAE J1772 AC** Charging rate: up to 20 kW Supply voltage: 120/240 V/208 V Supply amperage: up to 80 A	 **Combined Charging System (CCS Type 1)** Charging rate: up to 20 kW (AC) or 350 kW (DC) Supply voltage: 480V Supply amperage: up to 500A	 **Combined Charging System (CCS Type 1)** Charging rate: up to 350 kW (DC) Supply voltage: 480 V Supply amperage: up to 500 A
SAE J3068	 **SAE J3068 AC_6** Charging rate: up to 133 kW Supply voltage: 208-480V 3P Supply amperage: up to 160 A	 **SAE J3068 AC_6/DC_8** Charging rate: up to 133 kW (AC) or 200 kW (DC) Supply voltage: 208-480 V 3P Supply amperage: up to 160 A (AC) or 200 A (DC)	 **SAE J3068 DC_8** Charging rate: up to 200 kW (DC) Supply voltage: 480 V 3P Supply amperage: up to 200 A (DC)
CHAdeMO	N/A	N/A	 **CHAdeMO** Charging rate: up to 400 kW (DC) Supply voltage: 208-480 V 3P Supply amperage: up to 500 A
GB/T 20234	 **GB/T 20234 AC** Charging rate: up to 40 kW Supply voltage: 240 V/480 V Supply amperage: up to 63 A	N/A	 **GB/T 20234 DC** Charging rate: up to 238 kW Supply voltage: 480 V 3P Supply amperage: up to 300 A

Current Efforts Toward Transportation Electrification

Statewide Transportation Electrification Plan

- Goal of 1.076 million electric light duty vehicles (LDV) in AZ by 2030
- Economic and environmental benefits (2020-2040):
  - Lower cost of vehicle ownership
  - Downward pressure on electricity rates through greater system utilization
  - Benefits to Arizonan's through reduction in greenhouse gas emissions, local air pollutants, and gasoline consumption

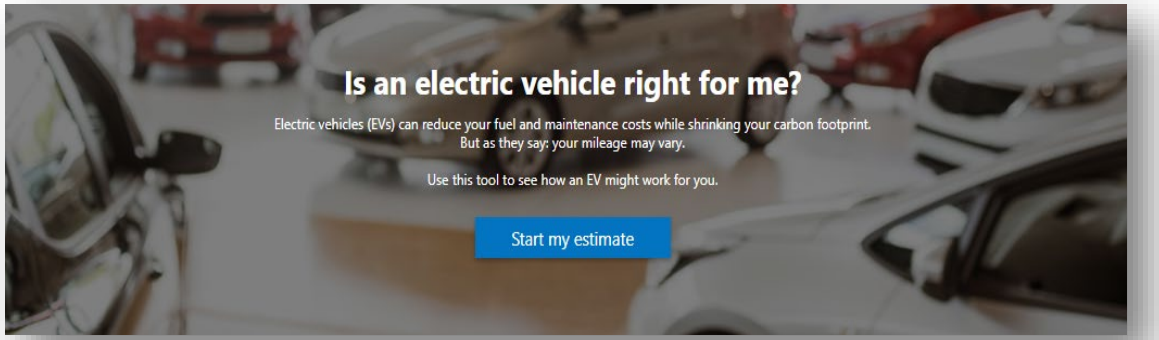
Tools and Infrastructure Deployment

Residential

Residential EV Calculator
- Estimate savings from ICE to EV Switch
- Customers enter electricity usage

Existing Homes
- Rebate covering 75% of the cost of installing Electric Vehicle Supply Equipment
- Up to $500

New Homes
- $100 rebate to homebuilders for pre-wiring for EVSE

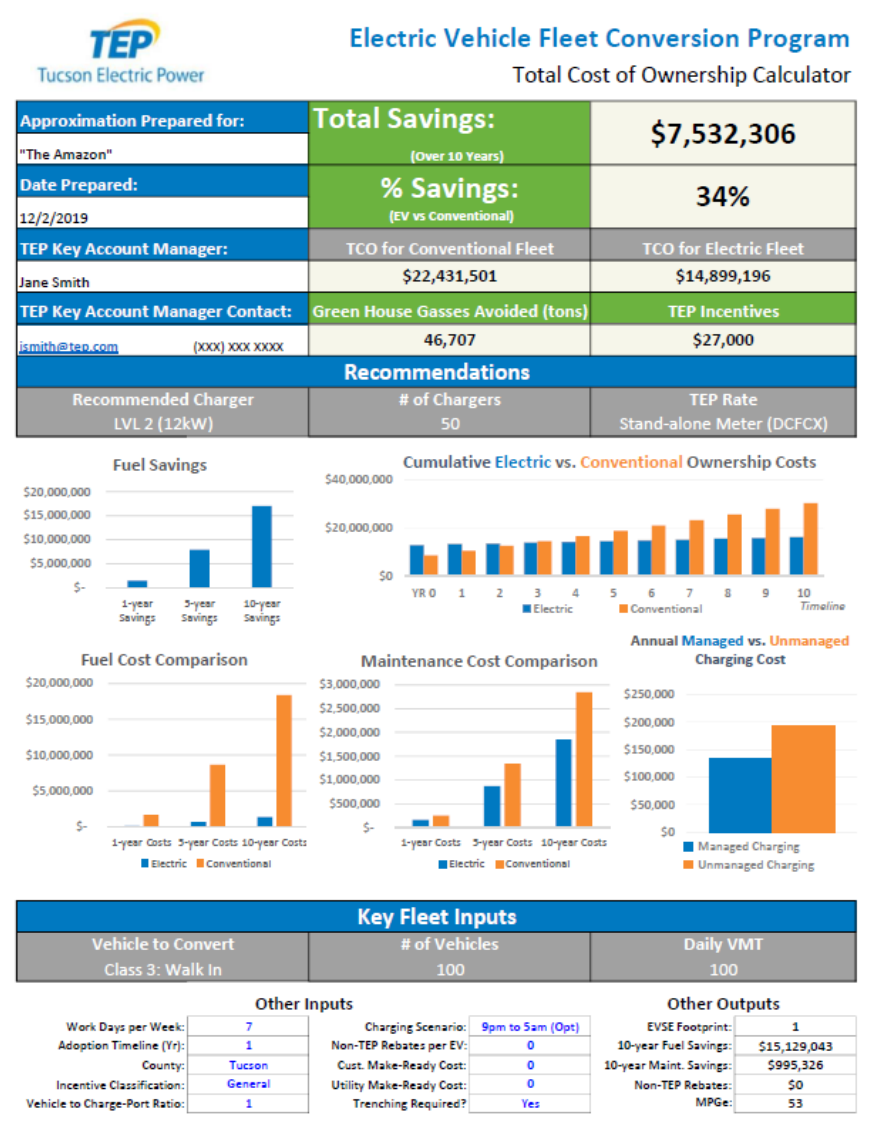


Commercial

Program Objectives:
- Engage early adopters
- Provide customers with trusted information
- Reduce barriers to adoption through technical and financial assistance

Incentive Levels:
- L2: $4,500/$6,000/$9,000
- DCFC: $24,000/ $40,000

Fleet Customers – Total Cost of Ownership



TEP Tucson Electric Power

Electric Vehicle Fleet Conversion Program

Total Cost of Ownership Calculator

Approximation Prepared for: "The Amazon"	**Total Savings:** (Over 10 Years)	$7,532,306
Date Prepared: 12/2/2019	**% Savings:** (EV vs Conventional)	34%
TEP Key Account Manager: Jane Smith	TCO for Conventional Fleet: $22,431,501	TCO for Electric Fleet: $14,899,196
TEP Key Account Manager Contact: jsmith@tep.com (XXX) XXX XXXX	Green House Gasses Avoided (tons): 46,707	TEP Incentives: $27,000

Recommendations

Recommended Charger	# of Chargers	TEP Rate
LVL 2 (12kW)	50	Stand-alone Meter (DCFCX)

Fuel Savings

Cumulative Electric vs. Conventional Ownership Costs

Fuel Cost Comparison

Maintenance Cost Comparison

Annual Managed vs. Unmanaged Charging Cost

Key Fleet Inputs

Vehicle to Convert	# of Vehicles	Daily VMT
Class 3: Walk In	100	100

Other Inputs

Work Days per Week:	7	Charging Scenario:	9pm to 5am (Opt)
Adoption Timeline (Yr):	1	Non-TEP Rebates per EV:	0
County:	Tucson	Cust. Make-Ready Cost:	0
Incentive Classification:	General	Utility Make-Ready Cost:	0
Vehicle to Charge-Port Ratio:	1	Trenching Required?	Yes

Other Outputs

EVSE Footprint:	1
10-year Fuel Savings:	$15,129,043
10-year Maint. Savings:	$995,326
Non-TEP Rebates:	$0
MPGe:	53

- Customer specific inputs
- Clear, easy-to-understand outputs
- Prioritization for deployment
- Recommendations on types of chargers that will meet needs
- Understanding key drivers of customer savings
- Ease of deployment
- Charging as a service

Current Key Projects

Strategic Electrification Partnerships

Sabino Canyon Tram

TUCSON POLICE ARIZONA 1871

SunTran

CITY OF FOUNDED 1775 TUCSON

Public Garages

PIMA COUNTY

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TEP

Transit Electrification

TEP and Sun Tran Partnership on low/no emission grants

- 2 successful Federal Transportation Administration awards
- Secured $6 million in Federal Grants
- One pilot bus + 10 Electric buses

How we partnered:

- TEP local match: $800,000
- Secured support from congressional delegation
- Technical support and advising
- Contract development
- Data sharing
- Monitoring for grid impacts

What's next?

- Round 3 of low/no emissions grant
  - 5 (40ft buses)
  - 8 (26 ft. buses)
- TEP participation: up to $950,000 match

Funding for EVs

Infrastructure & Investment Jobs Act

- **Section 11401**. Grants for Charging and Fueling Infrastructure. Authorizes the deployment of alternative fuel vehicle (electric, hydrogen, natural gas, propane) infrastructure along the national highway system.

- **Section 11403**. Carbon Reduction Program. Creates a new DOT carbon reduction program to incentivize states to reduce transportation emissions. Funds may be used for, among other things, truck stop electrification systems, installation of vehicle-to-infrastructure communication equipment

- **Section 30018.** Grants for Buses and Bus Facilities. Authorizes funding for the procurement of buses and upgrades to bus facilities, including purchase of low and no emission transit buses.

Electrification Journey

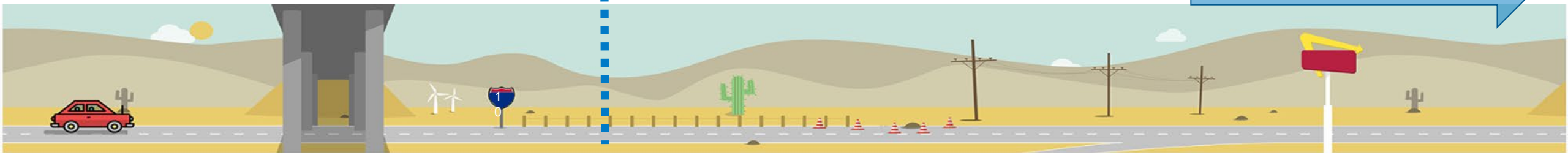
Previous and Ongoing EV Efforts

2021 and Beyond

Drive Technology Adoption

Encourage Proactive Policy

Empower Customers



- Support electrification market development
- Encourage local and state leadership
- Continue to foster public/private relationships
- Protect customers
- Prioritize LMI customers / financially displaced customers
- Prepare our grid for new load
- Efficiently electrify buildings
- Build public/private relationships
- Provide education and outreach

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Contact Us

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Visit our webpage:

TEP4EV.COM