

TRANSPORTATION-TO-GRID

ELECTRIC VEHICLE ROADMAP WORKSHOP
EVOLVE HOUSTON

MAY 15, 2019

NAVIGANT

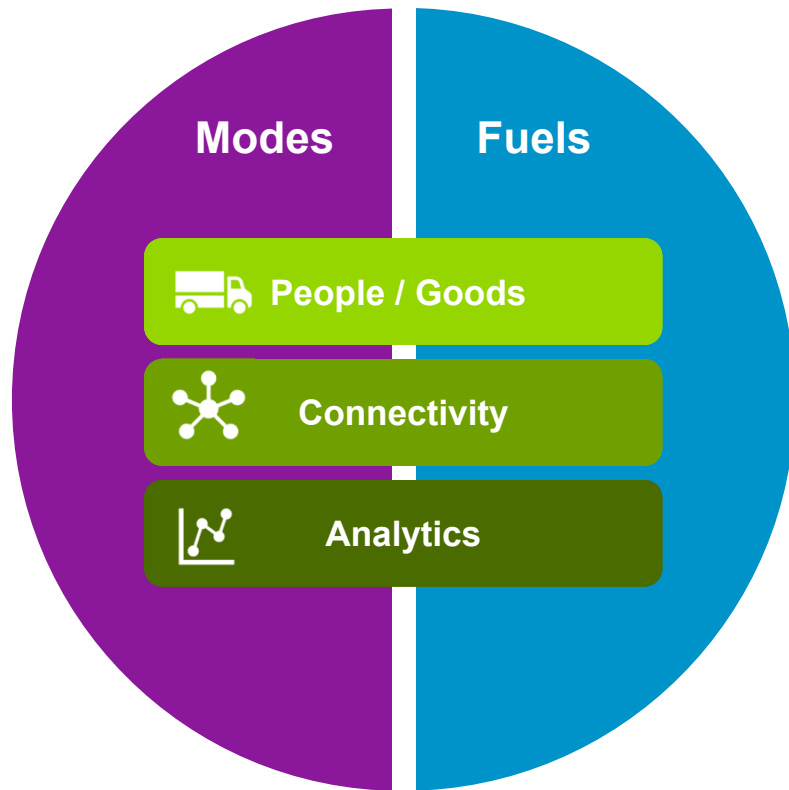
DISCLAIMER

Notice Regarding Presentation

This presentation was prepared by Navigant Consulting, Inc. (Navigant) for informational purposes only. Navigant makes no claim to any government data and other data obtained from public sources found in this publication (whether or not the owners of such data are noted in this publication).

Navigant does not make any express or implied warranty or representation concerning the information contained in this presentation, or as to merchantability or fitness for a particular purpose or function. This presentation is incomplete without reference to, and should be viewed solely in conjunction with the oral briefing provided by Navigant. No part of it may be circulated, quoted, or reproduced for distribution without prior written approval from Navigant.

THE TRANSPORTATION-TO-GRID VISION



Today, the Transportation-to-Grid ecosystem is an ever-evolving collection of increasingly complex transportation *modes* and diversifying *fueling* options.

Combinations of modes and fuels are moving *people and goods* further, faster, and more sustainably using increasingly sophisticated configurations of *connected* hardware and software systems.

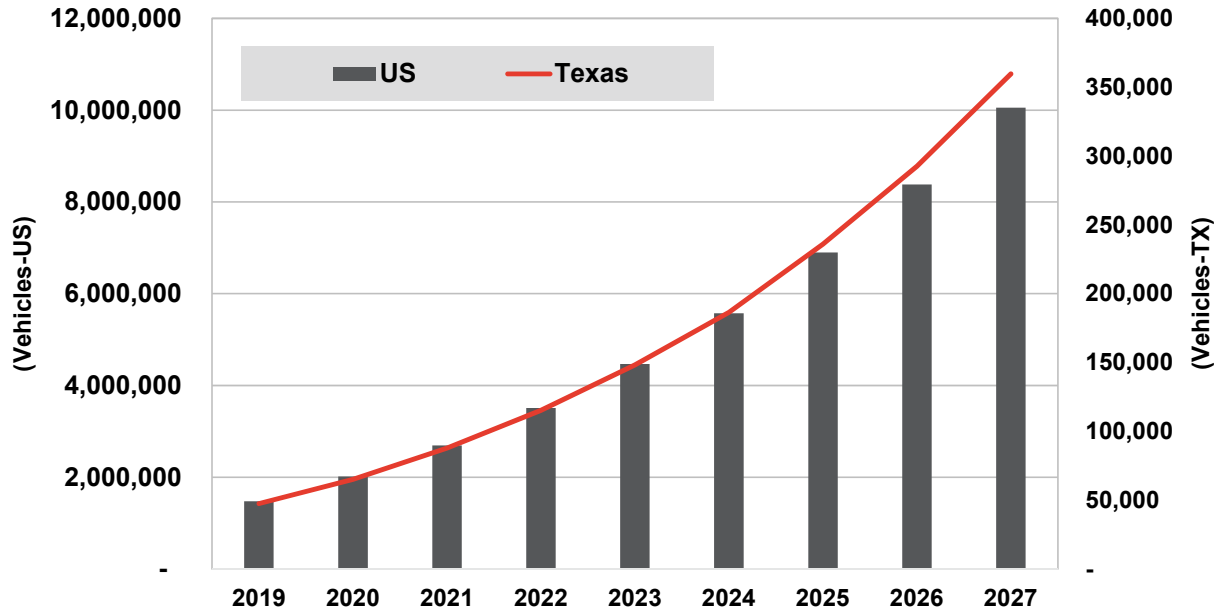
These connected systems provide limitless opportunities for continuous improvement through *analytics* and evolutions in artificial intelligence. The boundaries of this ecosystem will be pushed in new ways that haven't yet been imagined.

TRANSPORTATION-TO-GRID

WHAT DOES THE ELECTRIC VEHICLE TRANSFORMATION LOOK LIKE?

LIGHT DUTY PEVs: Navigant estimates there will be over 10,000,000 plug-in electric vehicles* (PEV) on the road nationally, of which over 350,000 will be located in Texas by 2027.

LD PEV Population, US & Texas: 2019-2027



(Source: Navigant Research)

Houston's PEV population is expected to grow from roughly 12,000 in 2019 to nearly 100,000 by 2027

TRANSPORTATION-TO-GRID

HOW IS THE ELECTRIC VEHICLE TRANSFORMATION DIFFERENT?

Electric vehicles (EV) are *not your typical* distributed energy resource (DER) – plan for rapid change and *complexity*.



DERs



EVs



Navigant EV Insights

	DERs	EVs	Navigant EV Insights
Technology Examples	<ul style="list-style-type: none"> • Energy efficiency measures • Solar photovoltaics • Battery storage 	<ul style="list-style-type: none"> • <i>Plug-in hybrids</i> • <i>Battery electric</i> • <i>Off-road</i> 	Global auto industry <i>bigger scale</i> and <i>longer history</i> with more <i>complex set</i> of components
Priority	<ul style="list-style-type: none"> • Serve load 	<ul style="list-style-type: none"> • <i>Serve road</i> 	EVs are <i>grid agnostic...</i>
Location	<ul style="list-style-type: none"> • Fixed 	<ul style="list-style-type: none"> • <i>Mobile</i> 	...and <i>grid connectedness varies</i> over many EV use cases and usage patterns...
Impact	<ul style="list-style-type: none"> • Downward load pressure 	<ul style="list-style-type: none"> • <i>Upward load pressure</i> 	...but <i>light-duty load</i> size of a house...
Predictability	<ul style="list-style-type: none"> • Data rich • Tested methodologies 	<ul style="list-style-type: none"> • <i>Data scarce</i> • <i>New methodologies</i> 	...so, data scarcity and market nascence requires strategic <i>planning for complexity</i> to pursue EV opportunities <i>wisely</i>

TRANSPORTATION-TO-GRID

HOW WILL CHARGING INFRASTRUCTURE SUPPORT THIS TRANSFORMATION?

We see *policy strategies for charging infrastructure* in the transportation sector generally falling into *three approaches*: Public Good, Nascent Market, and Ratepayer Protection.

Public Good



Fast Charge Corridors

Backbone public charging infrastructure supports policy goals and establishes market readiness

Nascent Market



Fleet Vehicle Charging

Supports embedded system cost reductions for ratepayers and utilizes excess energy supply

Ratepayer Protection



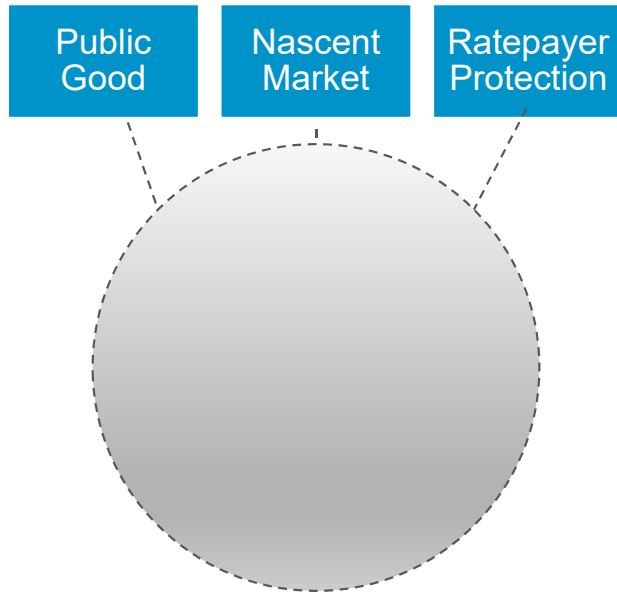
Public Charging

Protect ratepayers by avoiding inefficient or stranded utility investments to accommodate suboptimal siting

TRANSPORTATION-TO-GRID

‘SEEDS TO SOW’ IN BREAK OUT DISCUSSIONS

Which policy strategies should Houston stakeholders leverage, to *demystify* the complexities of your evolving Transportation-to-Grid future?



Market Need	Example Electrification Challenge for Houston	Policy Opportunities for Discussion
Availability	EV models <i>don't yet align</i> with customer preferences for light-duty <i>pickups</i> and SUVs	How can stakeholders <i>“right-size solutions”</i> for market conditions and customer preferences?
Affordability	Purpose of <i>demand charges</i> to recover utility costs for peak users complicates total cost of ownership calculation for commercial adopters	How can each stakeholder group <i>“make it easy”</i> when commercial customers are ready to adopt?
Access for All	Public <i>charging infrastructure</i> for passenger vehicles currently only benefits those that can pay >\$35,000 for an EV	How can stakeholders <i>“model the way”</i> with multimodal public options for all demographics (mass transit, rideshare, scooters)?

CONTACTS

DEREK JONES

Director
1.415.356.7187
derek.jones@navigant.com

ANDREW JOHNSTON

Associate Director
512.493.5490
andrew.johnston@navigant.com