Planning, Policy, and Economic Impacts of Expanding EV Infrastructure in the United States

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Overview

- Federal Framework
- State Planning
  - EV Planning
  - Scenario Planning
  - Equity Considerations
- Economic Impacts of EV Infrastructure Expansion on Texas Metros
  - Overview
  - Methodology
  - Economic Benefit Tool
  - Scenario Analysis
  - Recommendations
  - Future Research
- Stakeholder Engagement
- State of Texas EV Planning

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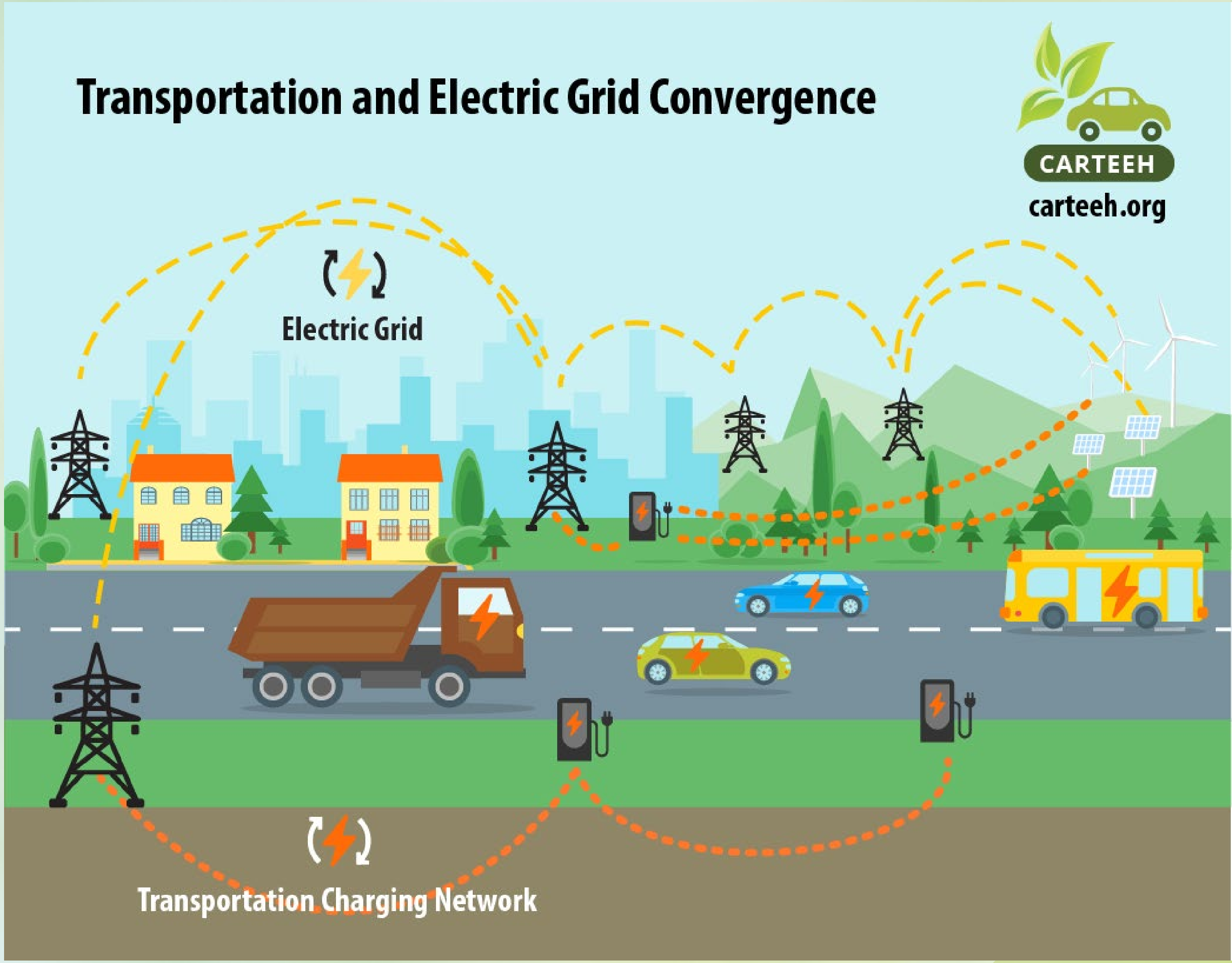
EV Ecosystem

Transportation + Energy + Land Use

<u>Executive Branch Oversight</u>

- DOT-DOE Joint Office (JOET) Established
- JOET Priorities:
  - **Support Electric Vehicles:** 50% new vehicle sales by 2030 to be EV
  - **Fewer Emissions:** Net zero by 2050
  - **Job Creation**
  - **A Network for everyone:** Equity in mobility and energy

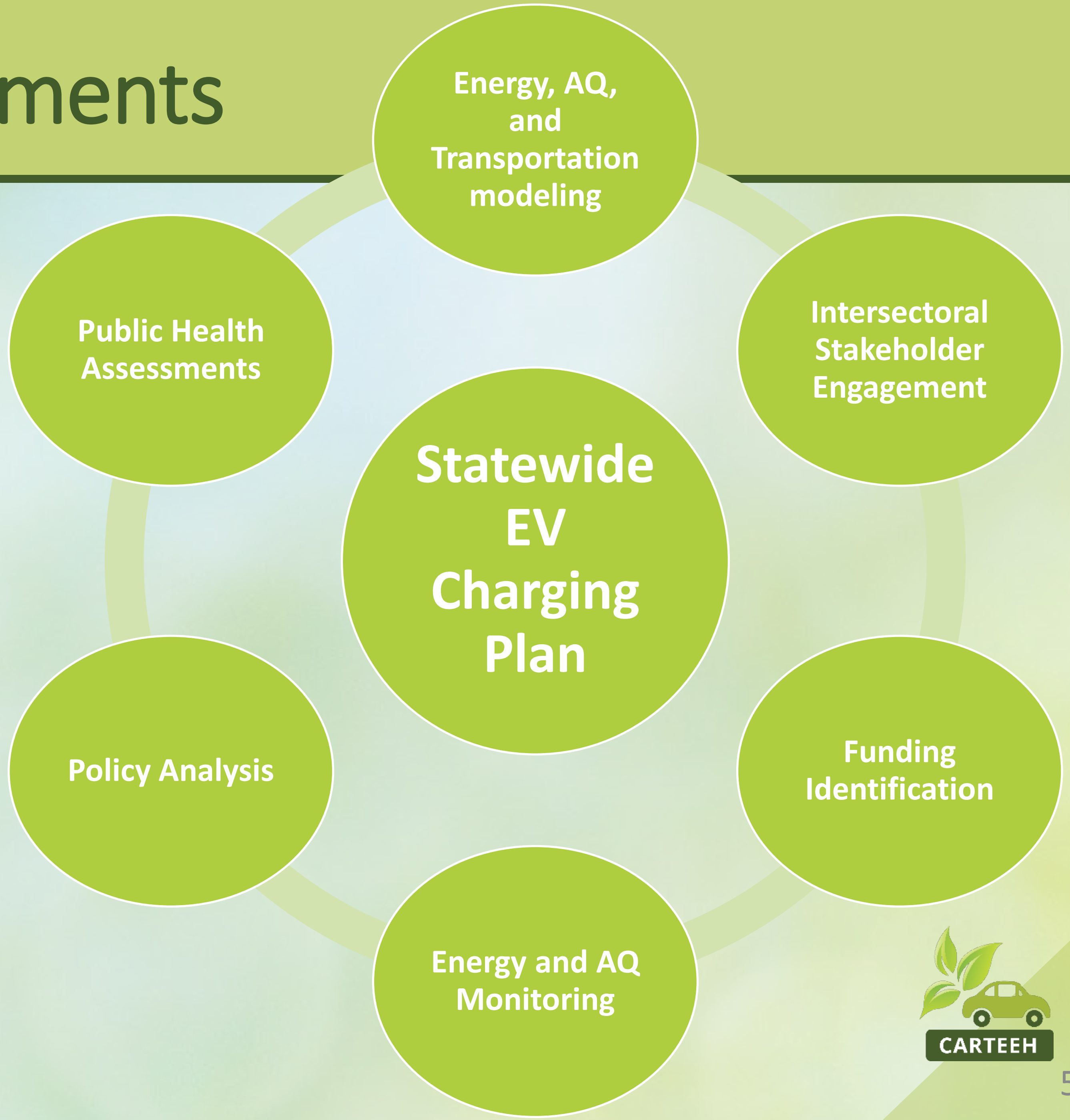


New EV-Relevant IIJA Programs

Program	Overview
National Electric Vehicle Infrastructure	Formula funds up to $5B for electric vehicle charging infrastructure
Charging and Fueling Infrastructure	Competitive grants for up to $2.5B for publicly accessible alternative fuel charging/fueling stations
Carbon Reduction	$6.4B in formula funds to reduce emissions from transportation
Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation	$8.7 billion over five years ($1.4 billion competitive) in formula and competitive funds to increase resilience
Electric or Low Emitting Ferry	Competitive grants for cleaner ferries
Clean School Bus	$6.4B in formula funds to states supporting reductions in transportation emissions

State EV Planning Elements

States have unique charging planning needs to cover urban, suburban and rural areas as well as coordinate across state lines



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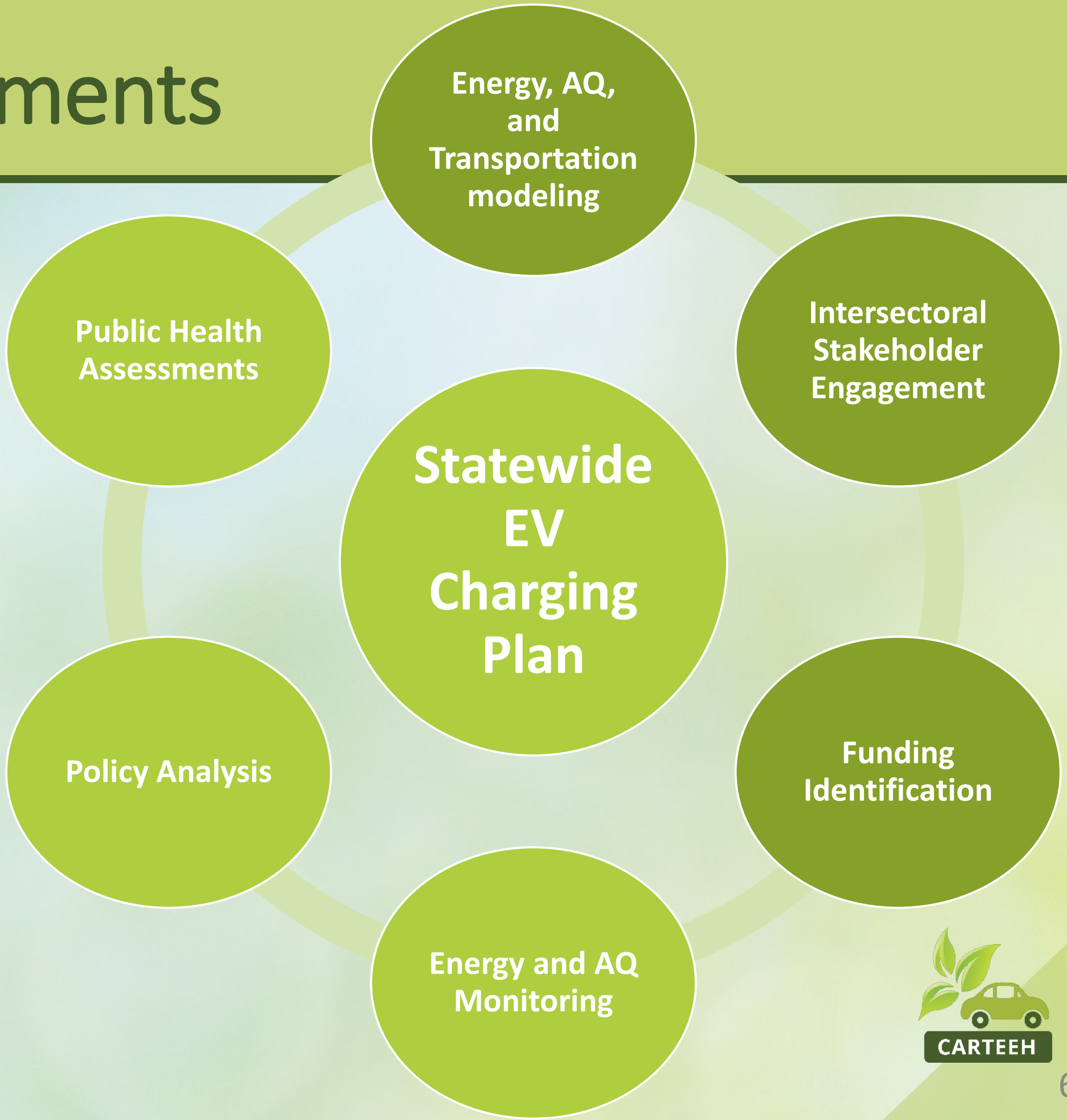

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Scenario Planning Process Framework

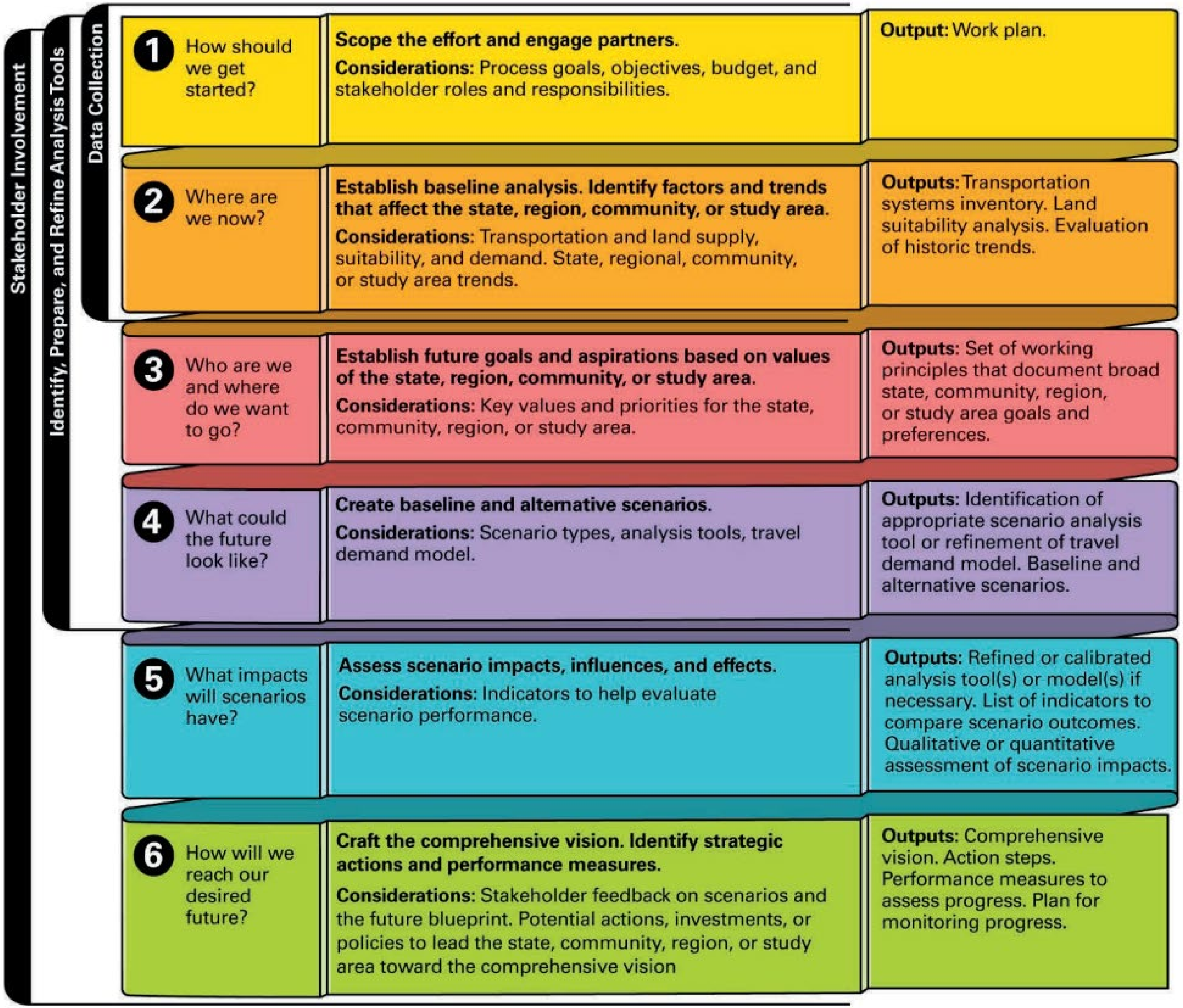

Figure from Volpe Center and FHWA, 2011 "FHWA Scenario Planning Guidebook"

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Scenario Planning

Scenario Planning…

- Is a tool for visioning and identifying land use, energy, and transportation scenarios for future growth
- Supports use of data, models, and metrics to examine multiple possible outcomes
- Can be used to maximize system performance and support achievement of project and community goals and targets
- Increases in usefulness as certainty of the future decreases

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Considering Equity

Equity theory in the fields of behavioral science and in economics does not refer to some moral or ethical standard of equity.

It reflects what a society regards an appropriate, fair or just distribution of goods and outcomes for its members based on needs and contributions.

- Step 1: identification of the population and study area that will be impacted
- Step 2: determination of the impacts resulting from the transportation improvement
- Step 3: an analysis of the distributive effects for disproportionality

Source: Brodie, 2015

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Economic Impacts of EV Infrastructure Expansion on Texas Metros

Jacqueline Kuzio, Brianne Glover, Bill Prieto, Nishita Sinha, and Britt Rhome.

Outline

- Overview
- Methodology
- Economic Benefit Tool
- Scenario Analysis
- Recommendations
- Future Research

Overview

- Increased EV sales will require a more robust charging network.
- Public investment is key to ensuring charging infrastructure is available to all.
- Research has focused on environmental and social benefits – highlighting economic benefits can spur public investment.

Methodology

- Literature review guided assumptions, data sources, and calculations within the tool.

Key Components:

- Benefit-Cost Analysis
  - Travel time savings (better access to charging)
  - Environmental cost savings (switch from ICE to electric)
  - Safety cost savings (related to reduced travel times).
- Economic Impact
  - Direct, indirect, and induced impacts of the investment in charging infrastructure.

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Economic Benefit Tool Overview

Inputs

- Region/MSA
- EV Adoption Rate
- Distance to Charging Infrastructure
- Charging Facility Type and Size

Outputs

- Benefits related to reduced travel time
- Installation costs
- Benefit-Cost Ratio
- Economic Impacts

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INPUTS	
Where would you like to examine charging infrastructure needs?	
Abilene	MSA
Please choose an electric vehicle adoption scenario:	
Average Adoption	Scenario
Baseline number of chargers:	
Level 2 Public Chargers:	6
DCFC Public Chargers:	0
Proposed number of chargers:	
Level 2 Chargers Needed (2025):	14
DCFC Chargers Needed (2025):	1
Baseline average travel distance (miles) to charging infrastructure:	
7.3	Miles
Proposed average travel distance (miles) to charging infrastructure:	
3.0	Miles

Note: Default of 3 miles used.

Infrastructure Costs	
Number and type of Charger to Install:	DC Fast (150kW) (6 Chargers per Site)
Installation Cost:	$18,577
Infrastructure Cost (Low):	$493,265
Infrastructure Cost (Average):	$577,833
Infrastructure Cost (High):	$662,400
Cost to Use for Analysis:	Average

OUTPUTS	
Benefits and Costs	Value (2019$)
Vehicle Operating Cost Savings	$748,218
Value of Time Savings	$2,908,483
Safety Savings	$1,340,851
Environmental Benefits	$75,802
Total Benefits	$5,073,353
Installation Cost	$18,577
Infrastructure Cost	$577,833
Total Cost	$596,410
Net Present Value	$4,476,944
Benefit/ Cost Ratio	8.5

Discounted at 3%

Economic Impact	
Economic Output	$920,591
Labor Income	$774,654
Employment	684,715

Slow Adoption Scenario

- Not all metro areas will see the same rate of EV growth – preparing for different scenarios can ensure that investments are targeted and justified.

- This scenario presents a comparison for the Tyler, TX metro area on the different infrastructure needs and costs between slow and average adoption.

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Slow Adoption Scenario: Results

	Slow Adoption	Average Adoption
No. Level 2 Chargers Required	14	35
Add'l. Level 2 Chargers Needed	2	23
No. of DCFCs Required	1	1
Add'l. DCFCs Needed	N/A	N/A
Total Benefits	$1,698,000	$19,523,000
Total Installation Cost	$3,000	$8,800
Total Infrastructure Cost	$9,700	$112,100
Benefit-Cost Ratio	23.3	14.0
Total Economic Impact	$20,600	$195,900

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Policy Scenario: Evaluating Austin's CCP

Forecast	Number of Battery Electric Vehicles
Low Adoption	300,000
Mid Adoption	600,000
High Adoption	1,200,000

- Austin's Community Climate Plan details strategies to meet the city's climate goals.
- EV adoption is one strategy under transportation.
- This scenario models the infrastructure costs and benefits for the forecasted adoption levels.

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Policy Scenario Results

	Low Adoption	Mid Adoption	High Adoption
No. Level 2 Chargers Required	10,800	21,600	43,200
Add'l. Level 2 Chargers Needed	9,728	20,528	42,128
No. DCFCs Required	450	900	1,800
Add'l. DCFCs Needed	345	795	1,695
Total Benefits (millions)	$16,700	$19,900	$26,200
Total Installation Cost (millions)	$30	$64	$131
Total Infrastructure Cost (millions)	$940	$1,980	$4,070
Benefit-Cost Ratio	17.3	9.7	6.3
Total Economic Impact (millions)	$1,750	$3,700	$7,590

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Equity Scenario: Charger Locations

- Scenario focuses on equitable deployment of charging infrastructure in the Houston metro area.
- Three neighborhoods were selected to compare the impact relative to current environmental conditions.
- Data from EJScreen and the GREET Model were used to determine potential reduction in emissions.

	Third Ward	North Shore	Friendswood
Percent POC	90	85	27
Percent Low-Income	48	55	4
EJ Index for Traffic Proximity & Volume (%ile in State)	90	91	23
EJ Index for Particulate Matter ($PM_{2.5}$) (%ile in State)	65	69	9
EJ Index for Ozone (%ile in State)	61	64	12

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Equity Scenario Results

	Average Adoption
Additional Level 2 Chargers	2
Additional DCFCs	1
Total Benefits	$4,340,000
Total Installation Cost	$48,500
Total Infrastructure Cost	$93,400
Benefit-Cost Ratio	30.6
Total Economic Impact	$265,600

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Equity Scenario Results

Neighborhood	Health Benefits ($)
Third Ward	$8,005,000,000
North Shore	$8,004,700,000
Friendswood	$7,999,700,000

- Benefits are related to the reduced exposure to pollutants from transportation.
- The cost savings reflect reduced mortality risks.
- Full health impact would need to consider other risk factors, other health outcomes, and incorporate more granular data.

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Recommendations

- An economic benefit tool can help to justify public investments in charging stations and related infrastructure.

- In addition to considering economic benefits, equity as well as demand be considered for charging station sites.

- Increased investment at the federal level provides an opportunity to develop a public charging network that complements and expands on the existing infrastructure.

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Conclusion & Future Research

- Understanding economic benefits are critical to supporting public investment in EV charging infrastructure.
- Ensuring an equitable charging network will require consideration of access to EVs as well as the accessibility of EV infrastructure.
- However, further research is needed in terms of both charger siting and the cost savings associated with environmental and health benefits.

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Stakeholder Engagement

New connections, avenues for communication, and collaboration needed for data input, policy and planning, and implementation

- Cross Sector
  - Public
  - Private
  - Non-profit
- Cross Disciplinary
  - Transportation
  - Energy
  - Land use

<u>Shared and Unique Goals</u>

- Cleaner air
- Better public health
- Efficient use of public and private space
- Equitable access

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Clean Transportation Collaborative Overview

The intent of the collaborative is to **facilitate thought leadership in the transition to a low-emissions transportation system**.

CTC members come together to reach common goals of:

- Stakeholder collaboration between the Transportation and Energy sectors
- Use of scientific and objective information to inform researchers and policy makers
- Emission, economic, and technology assessments regarding vehicle technologies
- Development of effective approaches to maximize emission reductions
- Advance equity and health outcomes
- Outreach and dissemination of outputs

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E-Mobility Ecosystem Key Stakeholder Overview

Government & Regulatory Bodies

Equipment Providers & Supply Chain

Vehicle Manufacturers
OEMs

Component Suppliers
- Auto-part suppliers
- Battery Manufacturers
- Operational Software vendors
- Etc.

Infrastructure Developers
Installers

Component Suppliers
- Charging station components
- Operational Software vendors
- Etc.

Electricity Providers & Supply Chain

Utilities
Grid Operators

Suppliers & Service Providers
- Grid Components (e.g., transformers, wires, etc.)
- Software developers
- Etc.

Off-Grid Power Supply
System Integrators

Suppliers & Service Providers
- Battey Suppliers
- Solar Panel Suppliers
- Power Electronics Suppliers
- Etc.

Customers

Fleet Operators
Fleet managers/operators

Suppliers & Service Providers
- OEMs
- Infrastructure Manufacturers
- Utilities
- Off-grid power supply
- Software Providers

Individual EV Owners
Private citizens

Suppliers & Service Providers
- OEMs
- Infrastructure Manufacturers
- Utilities
- Off-grid power supply
- Software Providers

Research to Practice: TxDOT EV Adoption and Planning

- 125,418 EVs registered in the state of Texas as of May 3, 2022
- Over a quarter of registered EVs are 2021 models
- Since 2020, the total number of electric vehicles across Texas has nearly tripled

- TxDOT developed NEVI plan as a framework to:
  - Enable passenger EV travel across the state
  - Spur economic development
- Conducted stakeholder listening sessions
- Focus on interstate routes then transition to off interstate routes and urban areas

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Questions?

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