Electric Vehicles: Opportunities and Challenges

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Petroleum Dominates Transportation Fuel Use

- Petroleum: 91.6%
- Natural Gas: 3.1%
- Renewables*: 5.0%
- Electricity: 0.3%

Source: Transportation Energy Data Book, edition 37 (January 2019), Table 2.03
*“Renewables” include hydro-electric, geothermal, wind, solar, and bio-mass energy.
Mission: Decarbonize transportation across all modes

- Net-zero by 2050 requires dramatic energy efficiency and emissions improvements in vehicle and the overall transportation system.
- 100% clean electricity and dramatic technology cost reductions enable deep transportation decarbonization.
- On-Road Vehicles (Light, Medium, Heavy) account for 83% of energy use, and can be electrified leveraging cheap and abundant clean electricity.
- Long Haul freight movement and Air, Marine, Rail likely require Hydrogen and Biofuels.

Source: EIA AEO

2019 U.S. Transportation Energy Use (26.8 Quads)
Vehicle Technologies Office (VTO)

ON-ROAD
Light-, Medium-, Heavy Duty Vehicles

Batteries & Electrification

Materials Technology

Mobility Systems

Demonstration and Deployment

Air, Marine, Rail

Some R&D for On/Off-Road MD/HD Vehicles
Electric Vehicle Battery R&D

BY 2025, reduce the cost of EV battery packs to less than $100/kWh, and increase range to 300 miles, and decrease charge time to 15 minutes or less.

Developing multiple pathways to reduce costs and reduce material needs

• Next generation lithium ion
  – higher capacity Cathodes (no cobalt/no nickel)
  – silicon-based anodes (no or low graphite)

• Lithium metal batteries including solid-state & lithium-sulfur (no cobalt/no nickel, no graphite)

• Establish profitable lithium battery recycling ecosystem
Accelerate Nationwide Adoption and Deployment of EVs and Infrastructure

- Significantly expand EV community partner demonstration activities
- Demonstrate innovative charging/infrastructure technology for various types of EV owners. Improve equitable access to the benefits of electrified transportation,
- Support Administration’s goal to deploy 500,000 charging stations across the Nation.
- Demonstrate innovations to enhance community resilience (especially underserved communities) to physical hazards using distributed solar, energy storage, EVs, and other DERs (joint EERE-OE effort).
- Support education and workforce training.
Technology Integration Program (TI)

Provide objective/unbiased data and real-world lessons learned that inform future research needs and support local decision-making.

- Clean Cities Coalitions
- Information and Tools
- Technical Assistance
- Training, Outreach, Partnerships
- Financial Assistance
- Regulatory Activities / State and Alt Fuel Provider Fleets
- Advanced Vehicle Technology Competitions
Technology Integration Focus Areas

Light, medium and heavy-duty vehicles

Alternative Fuel Infrastructure

Energy Efficient Mobility Systems and Technologies
Alternative Fuels Data Center (AFDC)

afdc.energy.gov
Alternative Fueling Station Locator

Locate alternative fueling stations and get maps and driving directions.

afdc.energy.gov/stations/
Alternative Fueling Corridor Tool

Use this tool to measure the driving distance along Interstate Highways between stations that meet the criteria under the Federal Highway Administration's Alternative Fuel Corridors Program.

afdc.energy.gov/stations/#/corridors

fhwa.dot.gov/environment/alternative_fuel_corridors/
Electricity Pages

Basics, benefits and considerations, stations, infrastructure development, vehicles, and more!

afdc.energy.gov/fuels/electricity
Charging Infrastructure Procurement & Installation

Link to EVTIP resources

Charging Infrastructure Procurement and Installation

A variety of options for plug-in electric vehicle (PEV) charging infrastructure exist, thereby creating a multifaceted infrastructure procurement process. In addition to typical infrastructure considerations like cost, regulations, safety, siting, and type of equipment, installing charging infrastructure can involve complex payment structures, data collection, ownership models, parking, and signage requirements. Some organizations may also need to issue a formal solicitation, such as a request for proposal (RFP). See the Infrastructure Development Checklist for important factors to consider when selecting and procuring charging infrastructure.

For examples of how other organizations have completed the charging infrastructure procurement process, see the following cases studies:

- Public Charging Procurement Case Study: Colorado Energy Office, EV Fast-Charging Corridor Grant Program
- Multi-Unit Dwelling Charging Procurement Case Study: Green Rock Apartments

Identify the Need

An initial action in the charging infrastructure procurement process is to identify potential users (i.e., plug-in electric vehicle (PEV) drivers). It is important to understand their expected charging needs based on travel patterns, PEV ownership, amount of time it may take to charge the vehicle battery, and the number and type of PEVs expected to be served at each location. This type of information can help better determine the number and type of charging infrastructure required for the project.

The EVI-Pro Lite tool can also provide an informed estimate of the quantity and type of charging infrastructure necessary to support regional adoption of electric vehicles by state or city/urban area.

Cost Considerations

Another important consideration is to determine the cost associated with the required charging needs. This includes equipment, installation, and operation and maintenance (including electricity, demand charges, and any annual charging network fees).

Equipment

Equipment costs may vary based on factors such as application, location, charging level, and type. Single connector unit costs range from $300 to $1,500 for Level 1, $400 to $6,500 for Level 2, and $10,000 to $40,000 for DC fast charging. When choosing charging infrastructure,
Highlight: Electricity Handbooks

- Fleet Managers
- Workplace Charging Hosts
- Public Charging Hosts
- Consumers

afdc.energy.gov/publications/
Fuel Economy
FuelEconomy.gov
Training, Outreach & Partnerships

- Propane Education & Research Council
- NGVAmerica
- National Biodiesel Board
- Renewable Fuels Association
- California Fuel Cell Partnership
- NTEA

Clean Cities University Workforce Development (Intern) Program
Technical & Problem Solving Assistance

Technical Response Service
• **First-level** resource for stakeholders, consumers, and others
• Research and response to general inquiries
• Help with challenging questions
• Education for legislators and government officials.

*TechnicalResponse@icf.com, 800-254-6735*

Tiger Teams
• **Second-level** resource for coordinators, stakeholders, and others
• Expert technical problem-solving to overcome obstacles
• Assistance on barriers that challenge local resources
• Help at any point in the project/product life cycle (concept, development, execution, operation/maintenance, closure)
More than 75 Clean Cities coalitions with thousands of stakeholders, representing ~80% of U.S. population

Clean City Coalition Results

- Since 1993, the cumulative energy impact of Clean Cities coalition activities has surpassed 9.8 billion GGEs through alternative fuel use, fuel economy improvements, idle-reduction measures, and other strategies.
- In 2019, nearly 1 million of the AFVs in operation were a result of Clean Cities coalition efforts.
VTO Technology Integration Competitive Project Funding

VTO has funded over 600 Technology Integration projects and distributed nearly $500 million since 1993

- Living Labs for Energy Efficient Transportation
- AFV Adoption Through Partnerships
- AFV Safety Training
- Rural New Mobility Solutions
- EV Community Partner Projects
- AFV Data Collection and Analysis
FY20 TI Awards: $37M for 18 Projects

Topic Areas and # of Projects

- Gaseous Fuels Technology Demonstration (2)
- Alt. Fuel Proof-of-Concept in New Communities and Fleets (8)
- EV and Charging Community Partner (3)
- TI Open Topic Projects (5)
Clean Cities Coalitions will play a key role in the success of these awards.

- 32 Clean Cities Coalitions involved in projects*
- Representing 26 States

*Based on pre-negotiated project information. Project partners may change.
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afdc.energy.gov
cleancities.energy.gov
fueleconomy.energy.gov