TRANSPORTATION

Emissions from the transportation sector are the largest source of greenhouse gas (GHG) emissions in the U.S., accounting for 27% of total U.S. GHG emissions in 2020.[1] The consensus solution for addressing transportation greenhouse gas (GHG) emissions is electrifying as much of transportation sector as technically feasible. For heavy duty trucks, maritime, aviation that cannot be electrified, the goal is to substitute carbon beneficial biofuels and hydrogen for existing fossil fuels.

Key Technologies

Electric vehicle charging including **Charging Stations** with **smart metering systems.**

Vehicle electrification components include **Batteries** and **battery management software.**

Integration of EV's requires smart chargers, vehicle to grid capabilities, energy management software and other components to link EV into load shifting, demand reduction and other grid programs.

Rail Electrification requires capacitators, insulators, smart meters, switchgear, and transformers.

Potential Market Size & Timing

The U.S. has passed legislation providing significant support to transportation electrification in the Infrastructure Investment and Jobs Act (IIJA) ($7.5 billion to support EV's) and Inflation Reduction Act (IRA) ($369 billion in total climate funding). In addition, there is $2 billion in funding for semiconductors used in EV's in the CHIPS and Science Act.

- After the IIJA investments, there could be 1.2 million charging stations by 2030 (46,000 today).
- The EV market is projected to be $53 trillion by 2050.[2]
- EV's are rapidly expanding, with battery, hybrid, and plug-in hybrid vehicles comprising over 10 percent of cars/SUV's sold in the US.[3] Globally, EV purchases are increasing by 50% per year.
- By 2030, 48 million electric vehicles could be on the road if federal EV target sales are met.[4]

Barriers

- **Battery reliability and charging capacity** are consumer's top concerns with buying EV's.[5]
- **Lack of EV charging stations** for highways, rural areas, and even parts of urban areas.
- **Costs of EV's** remain higher than traditional cars due to battery and other components.
- **Grid reliability:** Increase in EV charging could overwhelm grid during certain hours.
- **Grid carbon intensity:** Without decarbonization of the grid, EV's are still running on fossil fuels.
- **Lack of alternatives for heavy duty engines** including trucks, trains, and maritime.
- **Decarbonized aviation** requires low carbon fuels and zero carbon alternatives to the jet engine.

Accelerators

- **Aggressive implementation of the IIJA and IRA** to support:
  - EV purchases by individuals, fleets and federal government.
  - EV charging infrastructure deployment
  - Domestic battery and critical component manufacturing and recycling.
  - New clean generation resources to meet increased transportation electrification.
- **Additional federal policies** to drive sector decarbonization such as a Low Carbon Fuel Standard.
- **State policies** supporting transportation electrification such as strengthening tail-pipe emissions regulations, future bans on fossil-fuel cars, and state Low Carbon Fuel Standards.
- **Funding for Development of solutions for large engine applications** including carbon beneficial biofuels and hydrogen, and matching engine technology to utilize the new fuels.
- **Extension of the Smart Grid to transportation system** so that EV's contribute to load shifting, demand response, emergency power and other necessary grid capabilities.

1 https://www.epa.gov/greenvehicles/fast-facts-transportation-greenhouse-gas-emissions
2 https://about.bnef.com/electric-vehicle-outlook/
3 https://www.eia.gov/todayinenergy/detail.php?id=51218
4 https://www.mckinsey.com/industries/public-and-social-sector/our-insights/building-the-electric-vehicle-charging-infrastructure-america-needs
5 Thomas Gersdorf, Russell Hensley, Patrick Hertzke, Patrick Schaufuss, and Andreas Tschiesner, The road ahead for e-mobility, McKinsey, January 27, 2020.