IEEE-USA

POSITION STATEMENT

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ELECTRIFIED TRANSPORTATION

Adopted by the IEEE-USA
Board of Directors (3 November 2021)

Transportation consumes most of the petroleum used in the United States. Dependence of a critical economic sector on a single fuel represents a serious threat to national security.

Ninety (90) percent of the energy used in transportation comes from oil. The transportation sector consumes more than 70 percent of all petroleum used in the United States.[1] Oil will continue to be a major fuel for decades, but our ability to reduce petroleum use substantially will be essential to mitigating the national security risks inherent in dependence on a single energy source for transportation. An efficient way to curtail dependence on petroleum is to expand electrification of mass transit, passenger and commercial vehicles, buses and rail.

Electrifying transportation increases energy efficiency and reduces pollution.

Electric motors are inherently more efficient than internal combustion engines and can be used in mass transit, passenger and commercial vehicles, buses and rail. Electric vehicles (EV) (which convert about 59-62 percent of the grid's electrical energy to power at the wheels) are more efficient than conventional gasoline-powered vehicles (which convert only about 17–21 percent of the energy stored in gasoline to power at the wheels).[2] Conservatively, these percentages translate to a well-to-wheels efficiency of about 20–21 percent for electrics, and about 15–19 percent for conventional cars.[3] Conventional hybrid vehicles have already demonstrated the capability to substantially increase fuel economy by adding a small electric motor. The plug-in feature adds an

[1] *EIA Monthly Energy Review*, February 2018, www.eia.gov/totalenergy/data/monthly/index.php#petroleum
[2] USDOE, *Energy Efficiency and Renewable Energy*, www.fueleconomy.gov
[3] Using 34% well-to-plug efficiency for electricity (see, e.g., *LLNL Energy Flow*, April 2018); and 10% loss for petroleum refining and transport.

option to substitute electricity for some, or all, of the gasoline used in the vehicles.

We need a radical transformation of the transportation sector, not only to reduce its complete dependency on oil, but also to reduce emissions, particularly in large cities. Because transportation emissions are widely dispersed, it is impractical and uneconomical to capture and store transportation emissions once they are emitted.

Even with the current generation mix, electrifying the transportation sector has the potential to increase transportation energy efficiency and reduce both greenhouse gas and criteria pollutants.[4] Such factors take into account on-road performance, battery manufacture and battery disposal, recycle and reuse.[5]

Appropriate market signals would accelerate progress.

The U.S. electric infrastructure already in place is sufficient to permit a significant reduction in dependence on liquid fuels through greater penetration of plug-in electric vehicles (PEVs), including all-electric and plug-in hybrid electric vehicles (HEVs). Technology advances could make inductive (wireless) charging an attractive alternative (or complement) to plug-in charging. Electrified roadways, relying on similar technologies to provide on-road charging while the vehicle is moving, have also been demonstrated. Vehicle electrification would produce a direct and immediate domestically produced substitute for oil, along with commensurate benefits for energy efficiency, national security, and the environment.

Automobile, bus, ship, train and truck vehicle manufacturers are now rapidly developing and commercializing more efficient electric drivetrain technologies. In the United States Tesla, Chevrolet, Toyota, and other manufacturers have released all-electric or plug-in hybrid designs for the mass market. Outside the United States, manufacturers like Volvo, Mercedes, BMW, Hyundai, and others have entered this market as well.

India has announced a target to sell only electric vehicles by 2030.

As part of their national strategic plan[6], China is positioning itself to drive the future of electric vehicles by dominating the EV supply chain through battery and motor production. This will include heavily subsidizes of its EV industries.[7]

Much of the world is moving toward electric vehicles. The United States should position itself to do likewise through strategies that reduce the total costs of ownership of electric

[4] The six **criteria pollutants** are carbon monoxide, ground-level ozone, lead, nitrogen dioxide, particulate matter, and sulfur dioxide.
[5] See e.g., "Electrifying Transportation Reduces Greenhouse Gases and Improves Air Quality'" EPRI-NRDC, September 2015
[6] "Made in China 2025" Industrial Policies: Issues for Congress, Congressional Research Service, August 2020.
[7] China Announced 2020 – 2022 Subsidies for New Energy Vehicles, The International Council on Clean Transportation, July 2020.

vehicles.

RECOMMENDATIONS

IEEE-USA recommends an increased focus on electrifying transportation, focusing on plug-in electric and hybrid technologies to include market support and tax incentives to EV industries and consumers that are designed to encourage industry investment in the U.S.

Domestically produced electricity would give the United States the ability to maintain its economy and transportation system, regardless of what happens in the rest of the world.

Continuing stable and predictable incentives for the electric vehicle market in the near-term is necessary. It is essential that the United States combine these market development measures with further technological advances (particularly in battery systems) and developing economies of scale to improve cost competitiveness with conventional internal combustion technology.

Government and the private sector should develop and pursue a strategy to address transportation systems as follows:

- **Efficiency and Deployment:** Increase transportation efficiency and promote the rapid deployment of PEVs and HEVs through federal, state and city incentives for personal transportation electric vehicle purchase and use.
- **Battery Charging Infrastructure:** Promote the development of battery charging infrastructure and its deployment by cities, states and private companies.
- **Battery R&D:** Increase federal and private sector R&D aimed at improving automobile battery technology and battery disposal, recycle and reuse through improved energy storage density, increasing battery life, use of recyclable materials, and implementing rapid battery recharge or change-out strategies.
- **Charger Technology R&D:** Increase research and development to advance the technology of chargers for faster charging times of automobile batteries used in PEVs. This research should not be limited to plug-in chargers; U.S. should continue to pursue inductive (wireless) charging both in place and on-road.
- **Grid Integration R&D:** Continue federal and industry research of PEV integration on the electric grid. Develop and implement industry consensus standards to achieve integration.
- **Power Electronics and Electric Machine R&D:** Accelerate federal and industry R&D aimed at reducing weight and volume and increasing power electronics reliability and capability, coupled with electric machines for electric vehicles.

- **Electrify Vehicle Fleet:** Reduce U.S. exposure to disruption of oil supplies and price volatility in oil markets through electrification of the vehicle fleet.

This statement was developed by the IEEE-USA Energy Policy Committee and represents the considered judgment of a group of U.S. IEEE members with expertise in the subject field. IEEE-USA advances the public good and promotes the careers and public policy interests of the over 150,000 engineering, computing and allied professionals who are U.S. members of the IEEE. The positions taken by IEEE-USA do not necessarily reflect the views of IEEE, or its other organizational units.