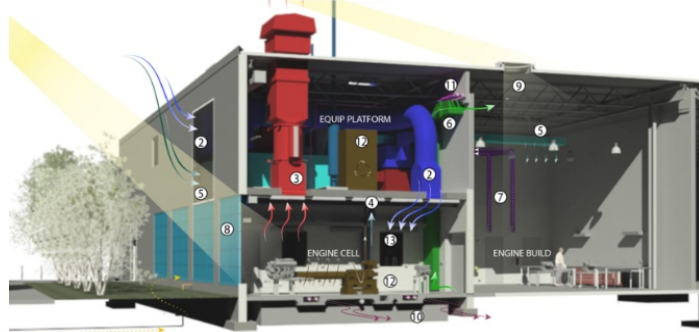


Post-Pandemic Transportation Trends: Vehicle Technology

Will Northrop, Associate Professor, Mechanical Engineering
Presentation to MN House Transportation Finance & Policy Committee

January 19, 2021

TE Murphy Engine Research Laboratory



Research Areas

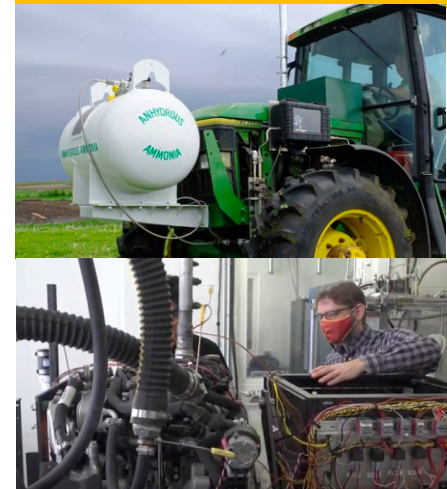
Combustion Nanoparticle Emissions



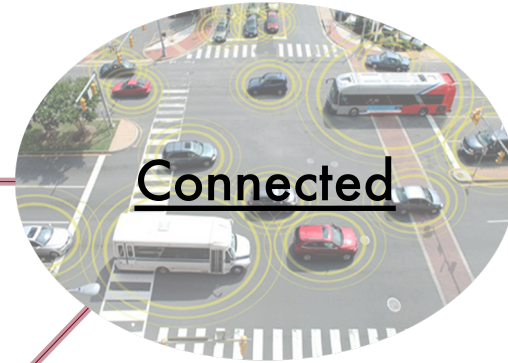
Connected & Electrified Vehicles



Alternative Fuels and Biofuels



Current Vehicle Trends

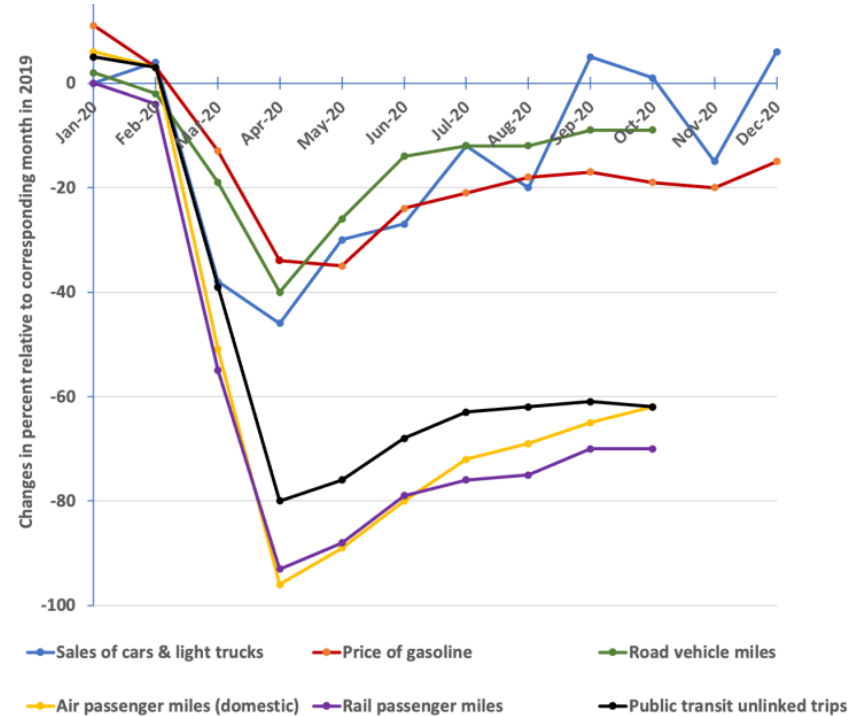


Transportation Post Pandemic

- Private vehicle sales resilient
- Transit will be slow to recover
- Shared mobility - larger role
- Fuel prices remain historically low



Monthly Change in Transportation Indexes

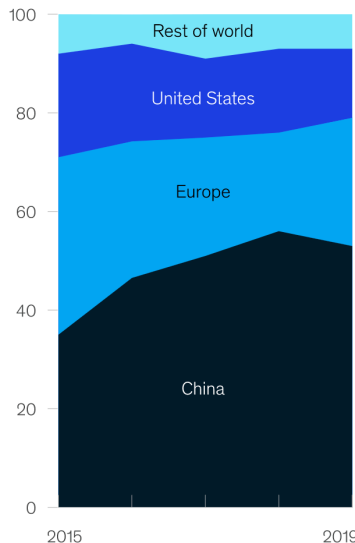


<https://www.greencarcongress.com/2020/10/20200923-sivakindex.html>

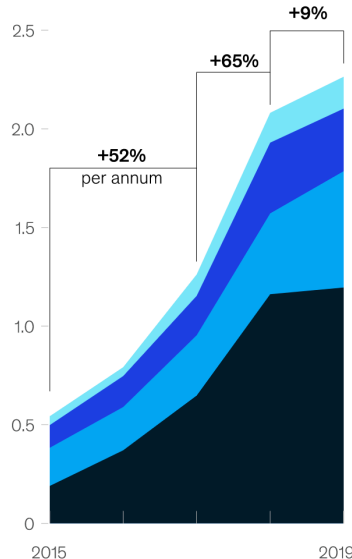
Electric Vehicles

- Electric vehicles appear to be stagnating

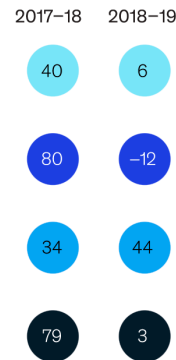
Global electric-light-vehicle sales by region, % share



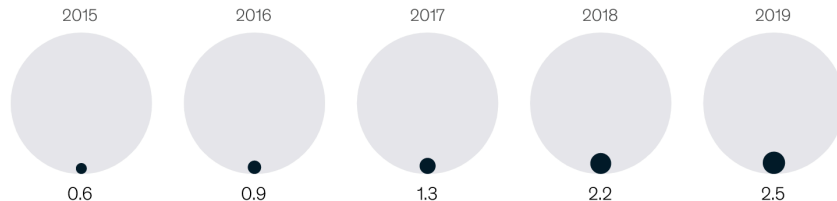
Global electric-light-vehicle sales by region, million units



Electric-vehicle growth, %



Global electric-light-vehicle sales, % of total sales



<https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/mckinsey-electric-vehicle-index-europe-cushions-a-global-plunge-in-ev-sales>

Electric Vehicles

- Electric vehicles appear to be stagnating

however...

1. EV technology advancing rapidly



Toyota's Solid-State Battery Prototype Could Be an EV Game Changer

New technology brings electric cars closer to the convenience of their gas-powered counterparts.



Solid State Batteries:

- Safer
- Fast charging
- Cheaper
- Better in cold weather
- Longer range

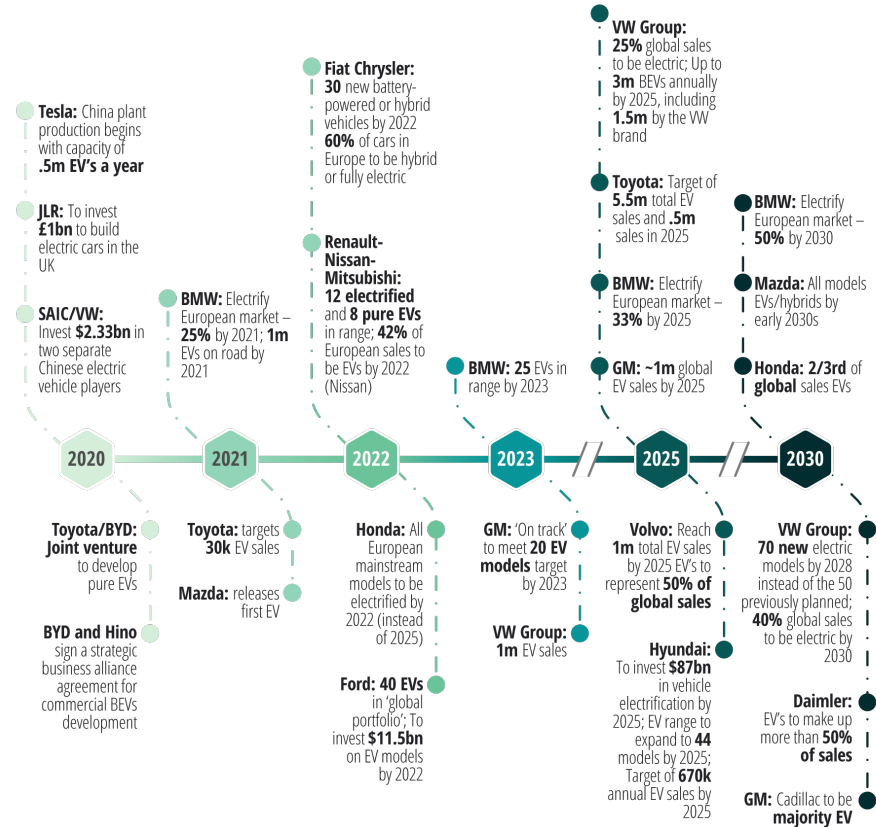
<https://www.motortrend.com/news/toyota-solid-state-battery-ev-2021/>

Electric Vehicles

- Electric vehicles appear to be stagnating

however...

1. EV technology advancing rapidly
2. Significant investment in EVs by market, OEMs



<https://www2.deloitte.com/us/en/insights/focus/future-of-mobility/electric-vehicle-trends-2030.html>

Electric Vehicles

- Electric vehicles appear to be stagnating

however...

1. EV technology advancing rapidly
2. Significant investment in EVs by market, OEMs
3. Substantial infrastructure investment

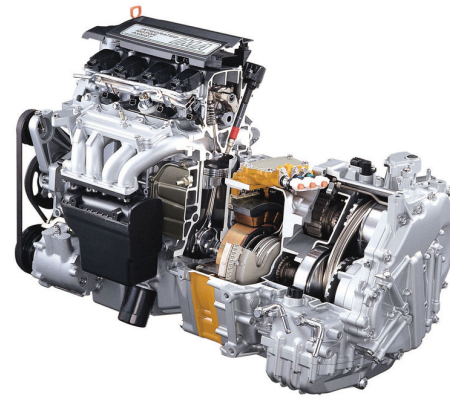
Xcel Energy is charging ahead with \$110M electric vehicle plan

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<https://www.bizjournals.com/denver/news/2020/12/24/xcel-energy-electric-vehicle-plan-colorado.html>

Engines still have a role

- Interim electrification strategies involve hybridization (they use engines)
- Engines can reduce GHG emissions
 - Hybridization schemes
 - Higher efficiency
 - Increased use of E-fuels and biofuels
 - Ethanol production more renewable than in the past (43% reduction from gasoline)
 - MN produces 1.2 billion gallons of ethanol/yr



Hybrid powertrain



Flexible fuel hybrid



Ethanol Blends

Summary Points

- Post-pandemic transportation environment will see increased personal vehicle sales (light-med. duty)
- Connectivity, automation, and electrification are major technological trends
- Electric vehicles appear stagnant, but significant investment and technological advances will accelerate consumer acceptance
- Efficient engines with E-fuels and biofuels (including ethanol) will play a role in future electrified vehicles

Thank You!

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