



Next Generation Integrated Mobility:

Driving Smart Cities

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Idaho National Laboratory

**Energy Efficient Mobility Systems: The US DOE's Research on
SMART Mobility – Advanced Fueling Infrastructure Pillar**

INL/CON-17-43727

New Transportation Paradigms

Shared, electric, connected, automated



Source: www.mavendrive.com



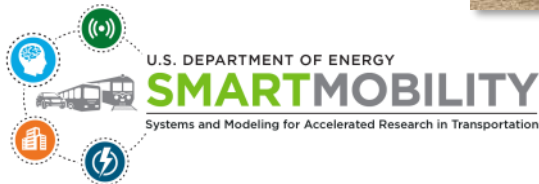
Source: www.uber.com



Source: www.reachnow.com

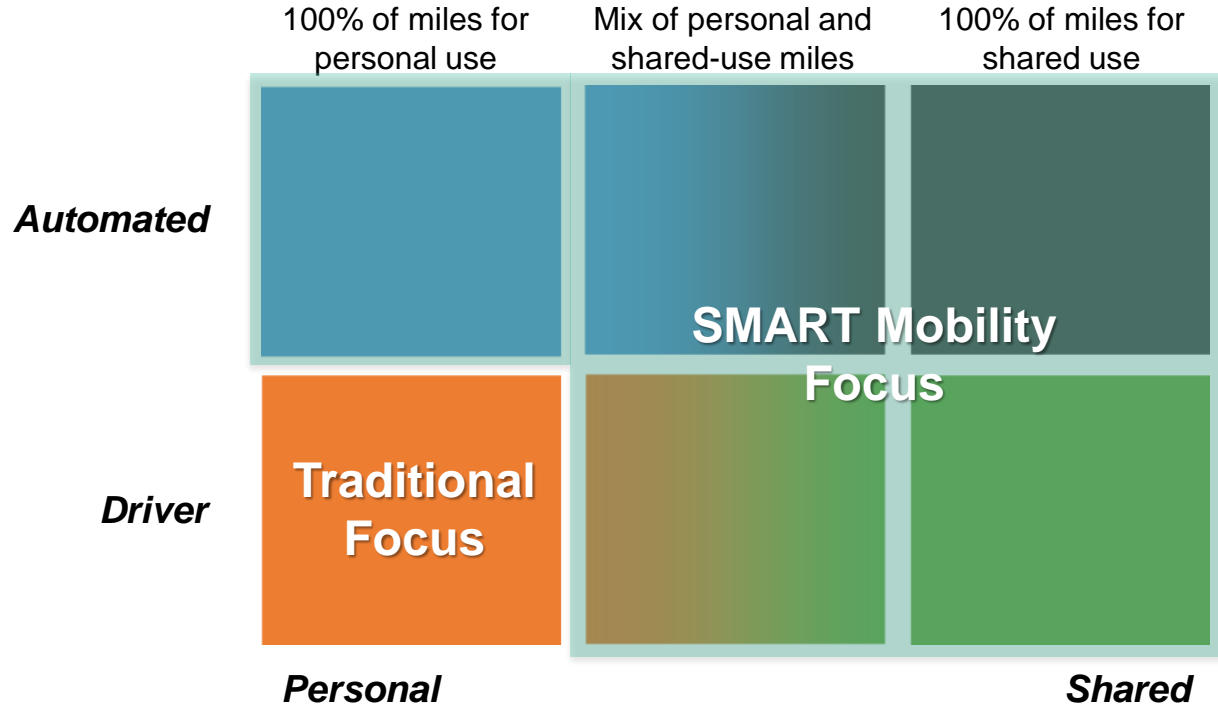


Source: localmotors.com



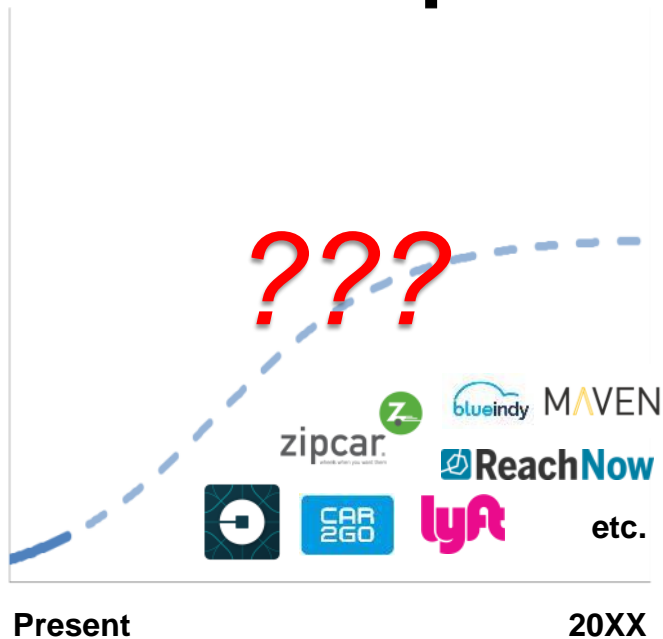
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New Approach to Fuel Selection



Transportation Energy Impact

Percent of VMT
by Shared Vehicles



What percent of travel will be in shared vehicles?

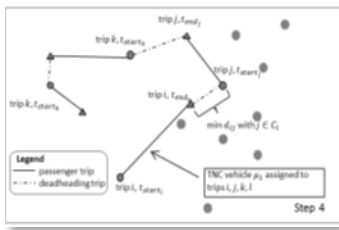
What percent of travel will be powered by petroleum, electricity, hydrogen, and other fuels?

Ride Hailing in Columbus, OH

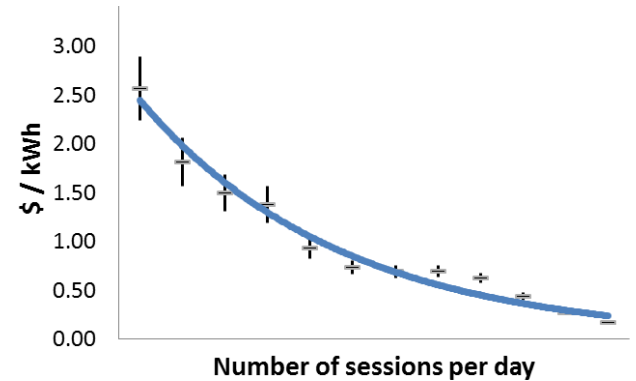
Compared travel in 5,000 real personal-use vehicles vs. same travel in simulated shared vehicles

Shared vehicles had:

- **29% higher** DVMT (37 mi)
- **24% lower** average trip distance (5.9 mi)
- Need **2x more** fast chargers
- Use fast chargers **3.5x more**



High fast charger utilization helps EV charger economics



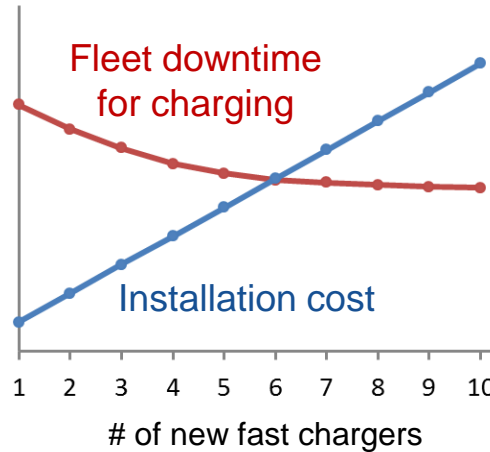
Car Sharing in Seattle, WA



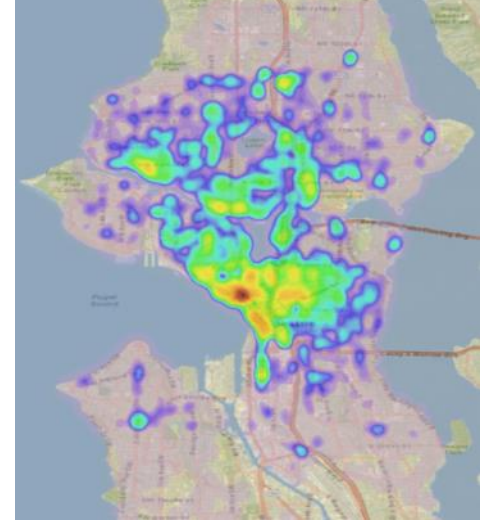
Source: www.reachnow.com



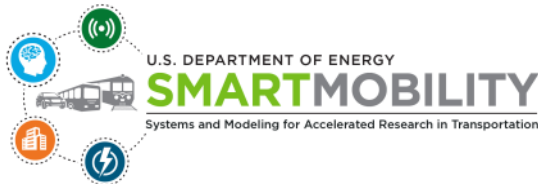
Free-floating model relies on fast charging network for BEVs



BEV parking density in Seattle



Source: INL



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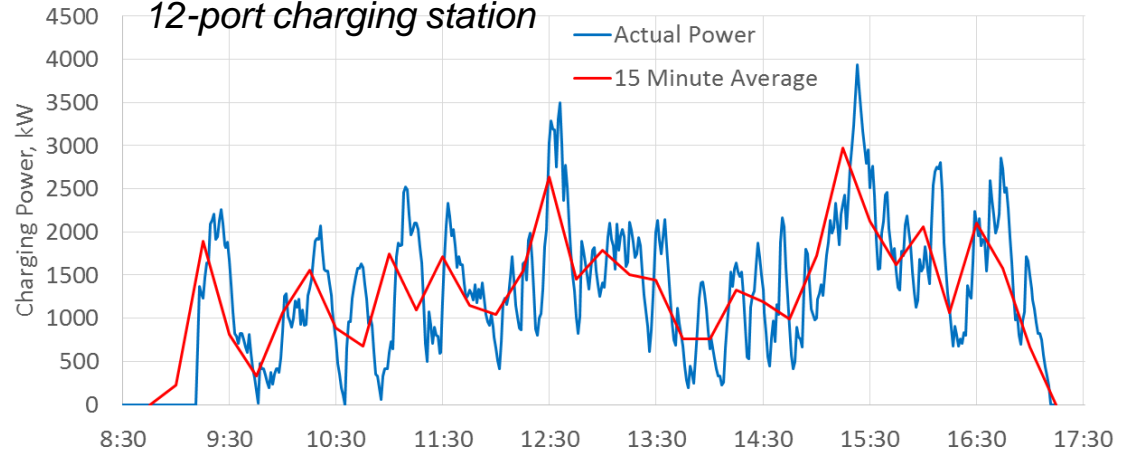
Faster EV Fast Charging

50-kW DC fast charger avg time at charger: 25 min¹

Gas station avg time at the pump: 6 min²

Fast charging may reach
400 kW in the future to
charge 100+ kWh
batteries in 5 – 15 min

*Simulated high-power charging demand on electric grid at
12-port charging station*



¹ from 100+ Blink DCFs nationwide in 2015

² from observations at 7 gas stations in urban and corridor locations in CA, ID, NC, SC in 2017

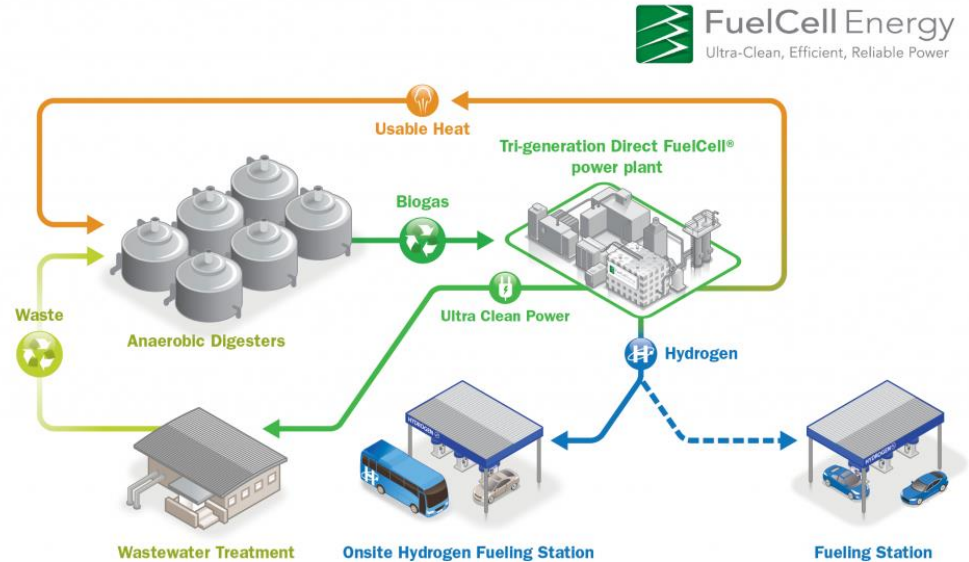
Systems Integration

Energy storage for peak shaving

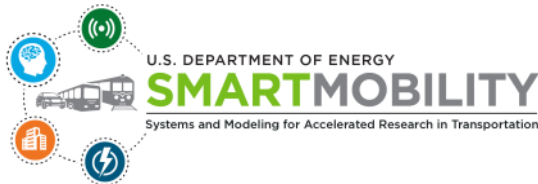


Source: NRG EVgo

Hydrogen production for valley filling



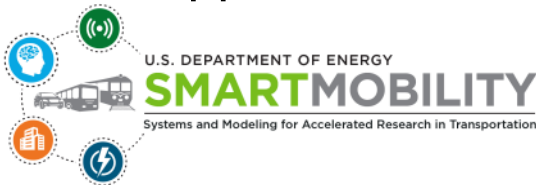
Source: www.fuelcellenergy.com



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Conclusion

- Advanced Fueling Infrastructure Pillar is focused on fuel selection and fueling infrastructure requirements for shared and shared-automated mobility
- First step in predicting future impacts is to understand differences in vehicle use patterns
- Preliminary findings show potential for high utilization of fueling infrastructure by shared mobility vehicles
- Sophisticated, system-wide analysis is required to understand opportunities for alternative fuel vehicles and fueling infrastructure



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