

Shared, Autonomous, Electric EVs and How to Charge Them

John Smart
Idaho National Laboratory

June 8, 2017

EV Roadmap 10

www.inl.gov



INL/MIS-17-42389

Palm Pilot vs. iPhone: What made the difference for consumer adoption?



Faster

Sleeker

More capable

Intuitive

Flexible – apps!

Fully connected – voice, text, and www

Are we there yet with EVs?



en.wikipedia.org/wiki/General_Motors_EV1



media.chevrolet.com

- Will next-gen EVs like the Chevrolet Bolt have iPhone-like mass appeal?
- If not, what are they missing to become the “gotta have” product?

Automation may be “it”

- Many automakers are developing automated EVs



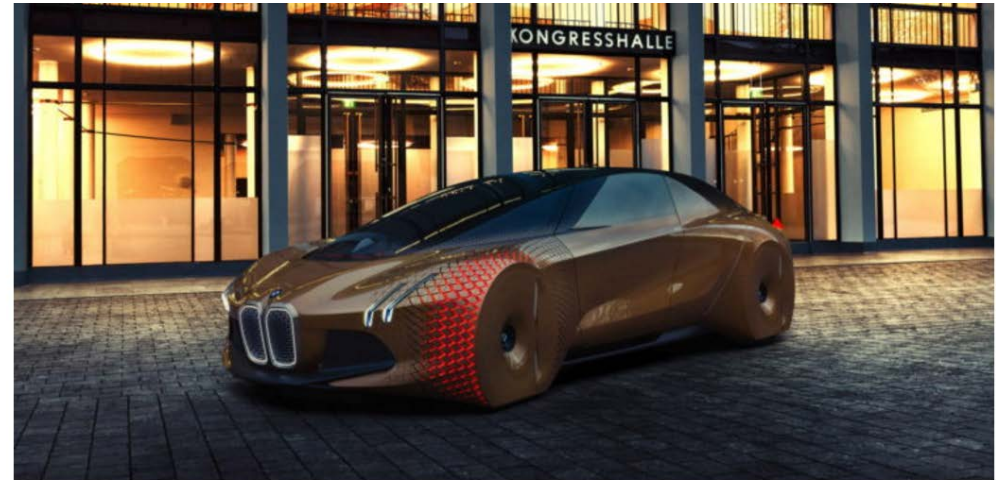
Tesla Model 3 Concept

Source: tesla.com



Volkswagen ID Concept

Source: media.vw.com



Future BMW iNEXT will be an electric crossover, feature Level 3 autonomy

BMW i News | May 5th, 2017 by Nico DeMattia

When BMW displayed its concept for the BMW Vision NEXT 100, it looks like something plucked straight from the future. With a flexible skin-like body ...

Source: www.bmwblog.com

Expectations are also high for shared-automated vehicles



Source: localmotors.com



GM May Soon Have 'Thousands' Of Self-Driving Electric Bolts In A Lyft Test Fleet

Forbes

The future car is driverless, shared and electric

March 16, 2017 by Mollie D'agostino

PHYS ORG

Self-driving electric vehicles to make car ownership vanish

Marco della Cava , USA TODAY Published 12:02 a.m. ET May 4, 2017 | Updated 1:33 p.m. ET May 4, 2017

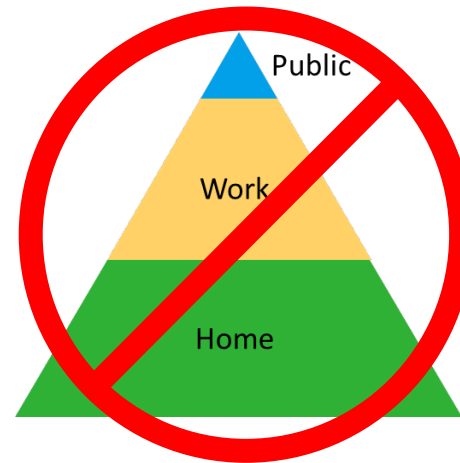
We will need to rethink charging infrastructure

Shared mobility and shared-automated vehicles have different operating patterns and fueling infrastructure requirements than personal-use vehicles

“San Diego’s leading car sharing company [replaced] its all-electric vehicle fleet with gas-powered cars *due to a lack of charging stations*, a symbolic setback for the emission-reduction aspirations of the city’s ballyhooed climate action plan.”¹



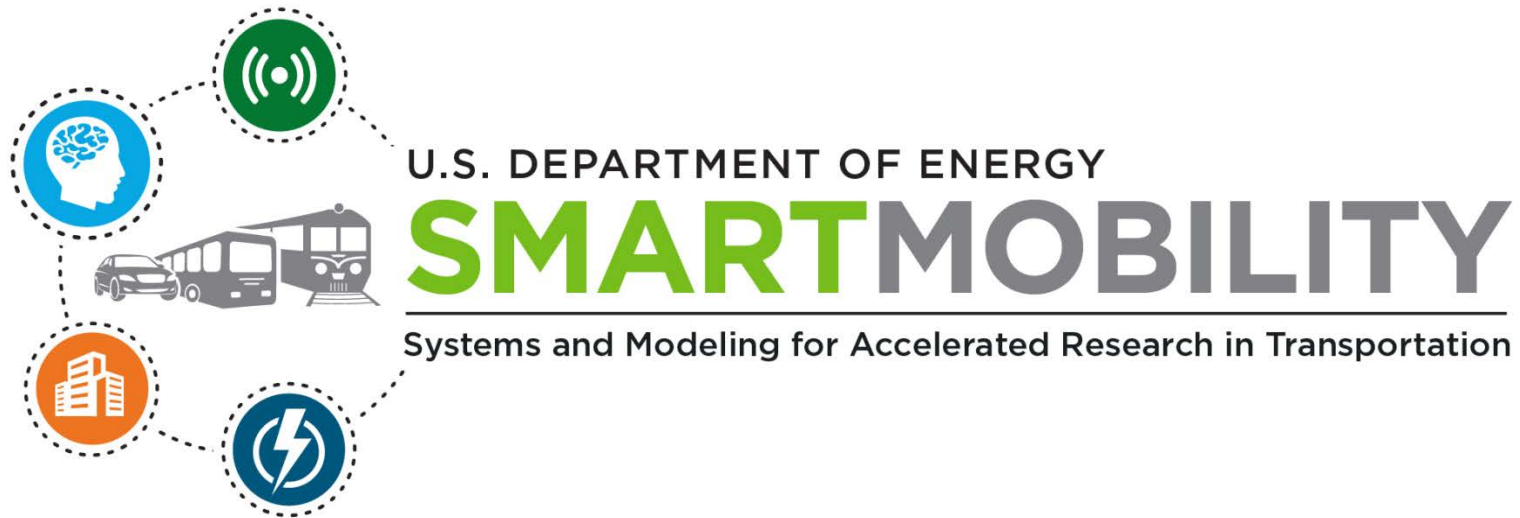
Source: INL



1. Garrick, D., “[Car2Go switching electric cars to gas](#),” San Diego Union-Tribune, Mar 16, 2016, italics added

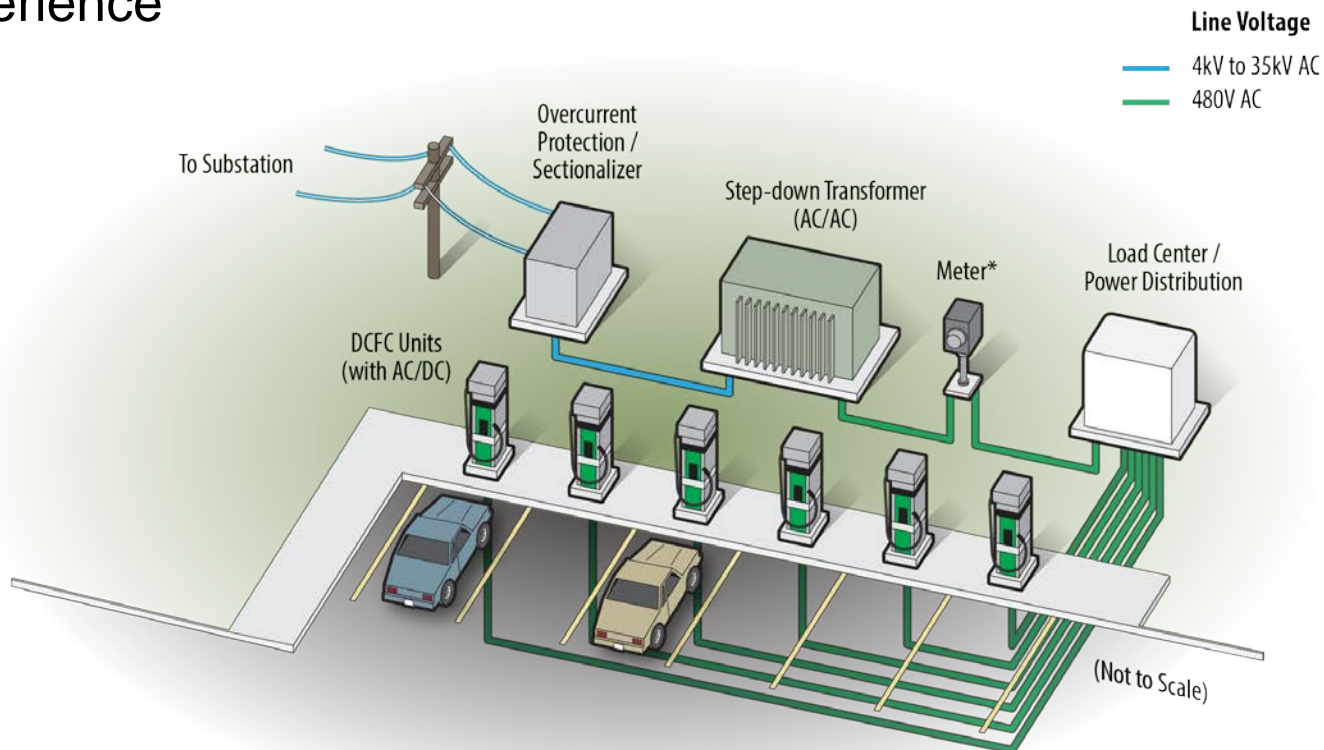
Research is underway at the National Labs

- The Advanced Fueling Infrastructure Pillar of DOE's SMART Mobility initiative has begun researching the unique charging infrastructure requirements of shared mobility



DC fast charging design study completed

- Larger batteries, longer range mean BEVs need faster charging infrastructure
- A study was completed to examine the design and costs of high-power, multi-port DC fast charging complexes that provide a gas station-like experience



*Meter may be located on the other side of the transformer

Scope and key conclusions

The study included:

- Summary of lessons learned from previous fast charging projects
- Design considerations for multi-port DCFC complexes
- A design case study with rough-order-of-magnitude cost estimate and business case analysis

Findings include:

- Significant cost savings can be realized with a well planned strategy for upgrading to higher power levels
- Under multiple scenarios, the break-even cost to charge is very high – \$5-\$9/gas gallon equivalent
- On-site energy storage will likely play a role in some scenarios to balance operating cost vs. higher upfront capital cost
- A follow-on project has been started to refine analysis

Full report entitled “Considerations for Corridor and Community DC Fast Charging Complex System Design” available at:

avt.inl.gov/project-type/charging-infrastructure-studies

John Smart – INL Advanced Vehicles Group

john.smart@inl.gov

(208) 526-5922