

Session 6: Energy Infrastructure

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RESEARCH CENTER



Energy Infrastructure Session

1. Introduction – future infrastructure themes
2. Framing talk: Prof. Joan Ogden – UC Davis
3. Panel discussants:
 - Michael Berube, Director – U.S. DOE Vehicle Tech. Office
 - Janea Scott, Commissioner – CA Energy Commission
 - Matthew Tipper, Vice President of New Fuels – Shell Int'l
 - Peter Kosak, Executive Director of Urban Mobility – GM
4. Panel and audience Q&A

Future Infrastructure - Some Themes

1. New and improved vehicle technologies
 2. New mobility and travel patterns
 3. Innovative new EV and FCV infrastructure programs
 4. Vehicle-grid integration opportunities
- Critical Challenge – attracting private sector investments given market and policy uncertainties to further enable the *transition to low-carbon fuels*

Improved Vehicle Techs. and Opps.

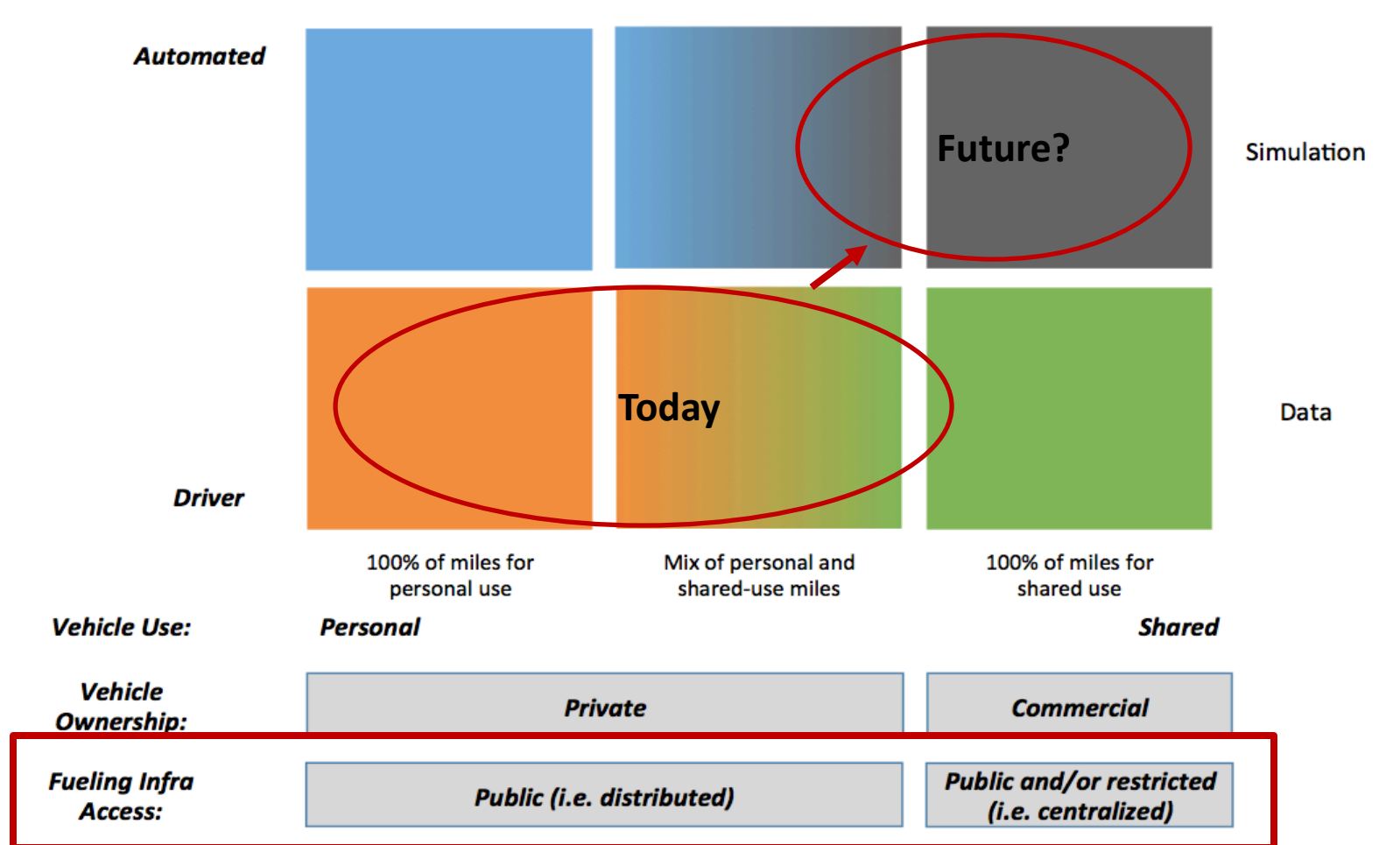
- Batteries improving steadily and 200+ mile real world EVs at reasonable prices are now emerging
 - **A game changer! (but battery costs remain an issue)**
- Hydrogen fuel cell vehicles now commercial and proliferating around initial infr. corridors
- Electrification of medium and heavy-duty vehicles is progressing as well (short/medium haul)
- Biofuels use also increasing, but with scale-up issues for adv. cellulosic but promising developments including renewable diesel



New Mobility and Travel Patterns

- New paradigms of ride sharing / hailing are changing our thinking about future personal mobility
 - Uber has over 40 million active users and has now delivered over 2 billion rides! (since 2011)
- CAVs offer a potentially ‘game changing’ overlay with many infrastructure implications
- Many agree we need better public transportation – but challenging esp. in relatively low density areas
- Important infrastructure implications of new mobility – where to locate fueling stations and charging depots and with what capacities?

Multi-National Lab Smart Mobility Study



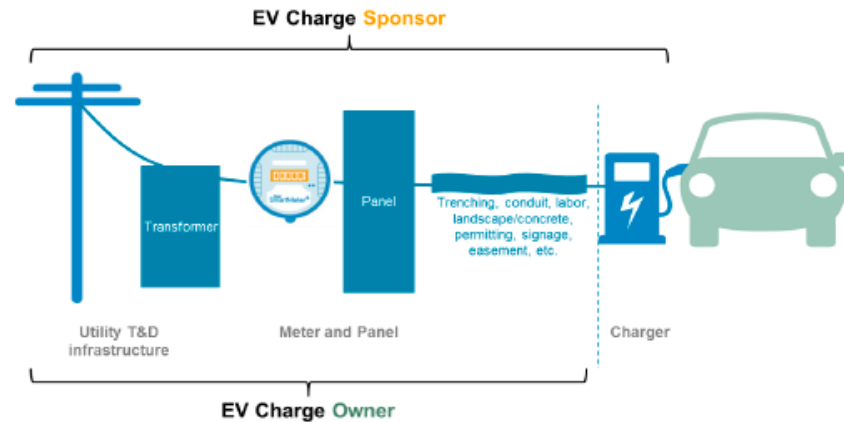
Innovative Infrastructure Programs

- Volkswagen Settlement Agreement
 - Settlement agreement calls for \$2B investment for ZEV infrastructure and increased awareness of ZEVs
 - 10-year program where 40% (\$800 million) to be spent in California
- California investor-owned utility programs
 - Utilities now being allowed to “rate base” investments in EV charging infrastructure
- Local air district programs (incl. CEC funding)
- California support for hydrogen infrastructure, now spreading to the Northeast

PG&E EV Charge Network: 7,500 charge points in pilot program



Two charging infrastructure ownership models for sites



EV Charge Sponsor: PG&E owns charging station

- Option for MUDs and any site in disadvantaged community – up to 35% of total program ports
- PG&E owns and is responsible for all infrastructure, including charger units
- Site host pays “participation payment” based on site type, equipment choice, and number of chargers

EV Charge Owner: Site host owns charging station

- Option for all site types/locations
- PG&E owns and is responsible for “make-ready” infrastructure (up to charger stub-out)
- Site host purchases, owns, and operates qualified charger equipment
- PG&E provides a rebate based on site type, equipment choice, and number of chargers

Source: PG&E

Hydrogen Stations Progress



Mill Valley



Hollywood



Anaheim



Riverside

Starting to Go Nationwide

H2stationmap.com



MAP HYDROGEN STATIONS DEPLOYMENT COSTS & FINANCING STATE SUPPORT ABOUT US

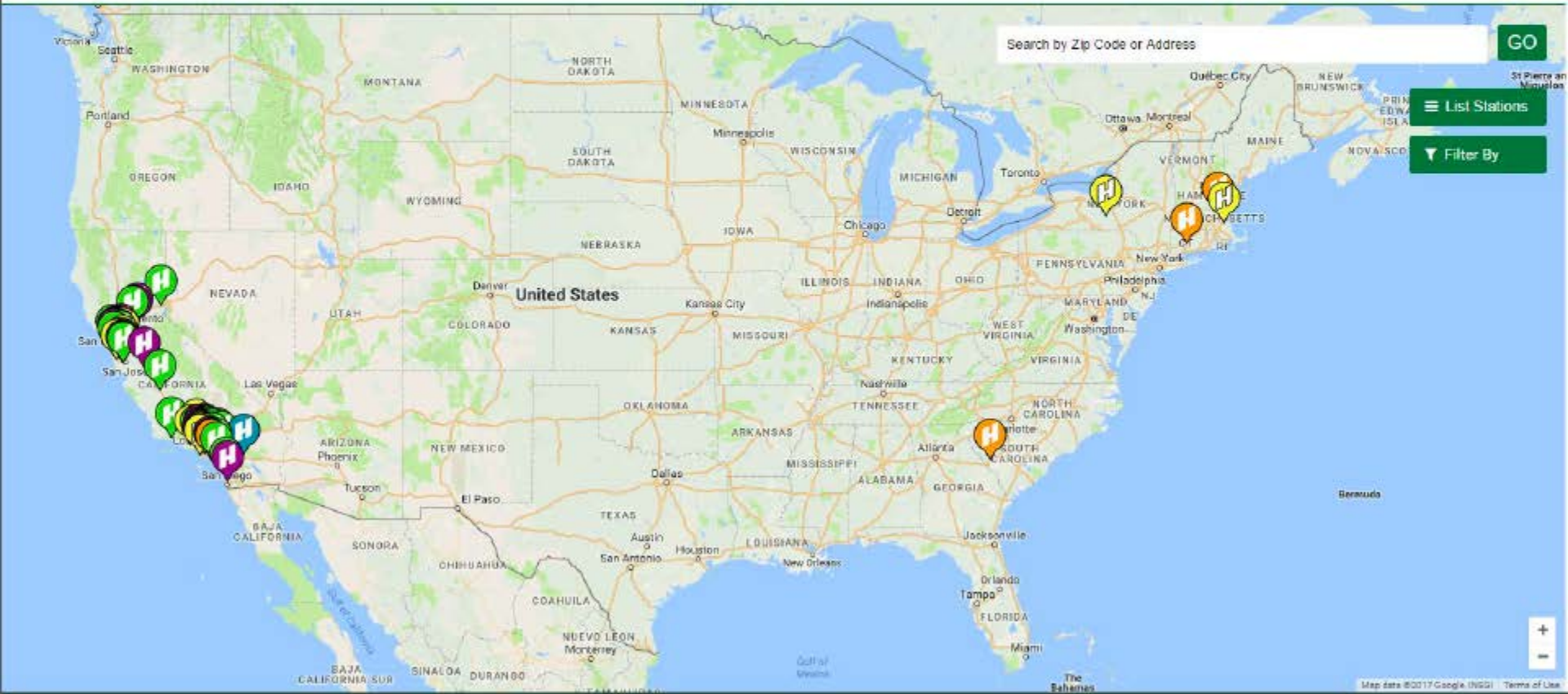


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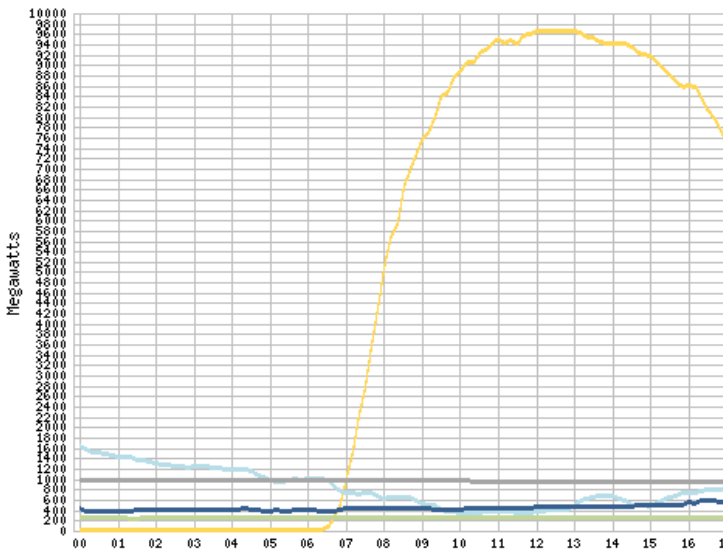
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Vehicle-Grid Integration – Recent Findings

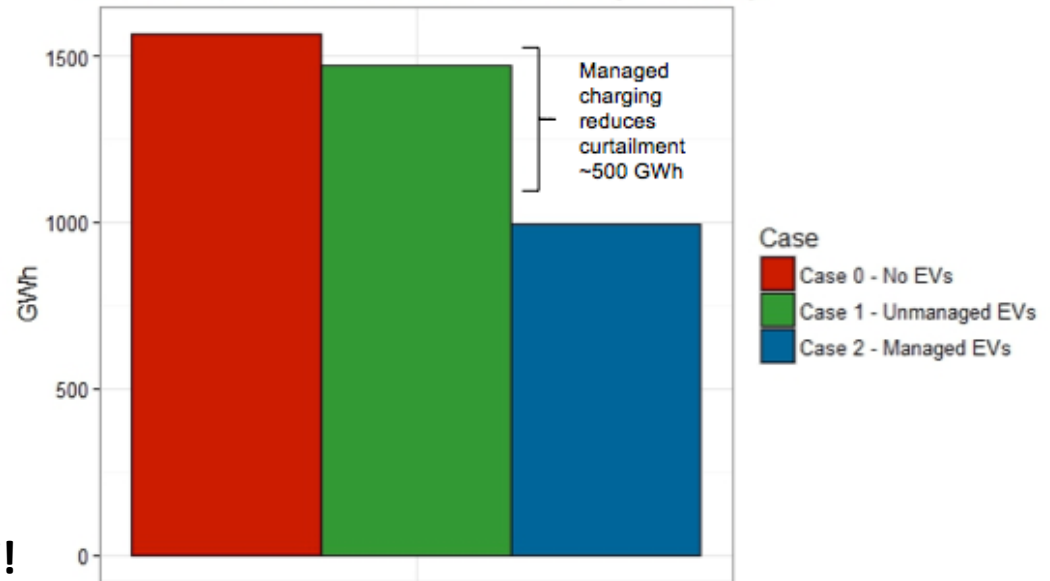
Future California Grid and EV Scenario Using PLEXOS Modeling

Important Implications for Where and When EVs Should be Enabled to Charge



Solar peak in CA is now almost 10 GW!

2024 Annual CA Renewable Curtailment (All Cases)



Source: Julia Szinai, UC Berkeley/LBNL, 2017
(CEC EPIC 15-013 project)

The Transition Continues...

Innovation is the market introduction of a technical or organisational novelty, not just its invention.

- Joseph A. Schumpeter