



AWAY FROM HOME CHARGING

MICHAEL NICHOLAS

GIL TAL

THOMAS TURRENTINE

UC DAVIS PH&EV RESEARCH CENTER

ARB 5/27/2014

BEYOND HOME CHARGING, WHAT DO CUSTOMERS WANT?

- Customers really want it everywhere but if you make them choose only 5, what do they choose?

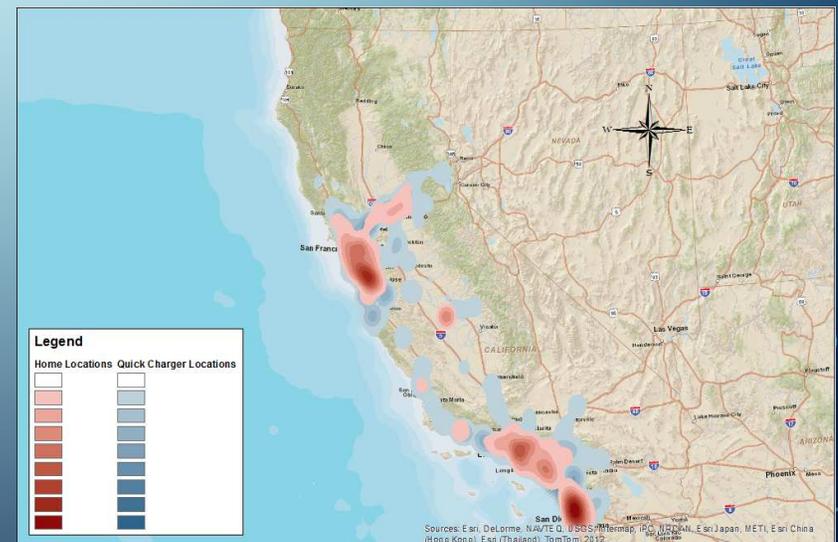
Count of desired chargers by charger type and response number
(n=1140 survey respondents; up to 5 desired chargers each)

	Desired Charger Choice # (1 - 5)					
	1	2	3	4	5	Total by Charger Type
DC Fast	479	464	426	374	327	2070
Level 2	262	189	152	110	87	800
Total by Choice	741	653	578	484	414	2870
Percent of n=1140	65%	57%	51%	42%	36%	

- Frequency of usage is not represented. i.e. Work L2 may be the most useful and used, but DC fast is for access. Also DC fast can represent a “basket” of L2 locations.

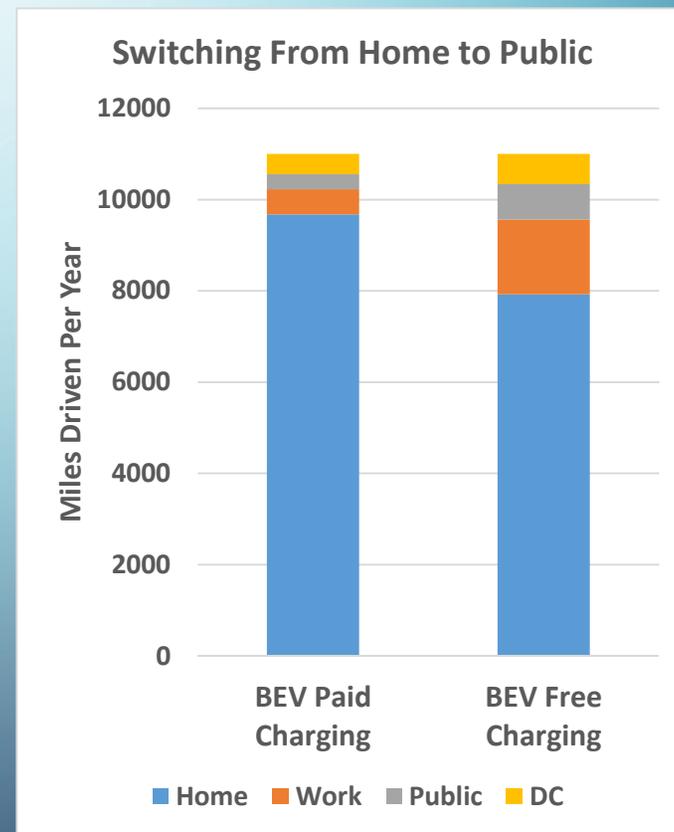
FOR THOSE ON THE FENCE ABOUT A PEV, WHAT INFRASTRUCTURE WOULD TRIGGER A PURCHASE?

- Free charging at work
- Fast charging access network. Destination Chargers. Corridor chargers.
- Subsidized home level 2 or level 2 “community charger” within walking distance of home



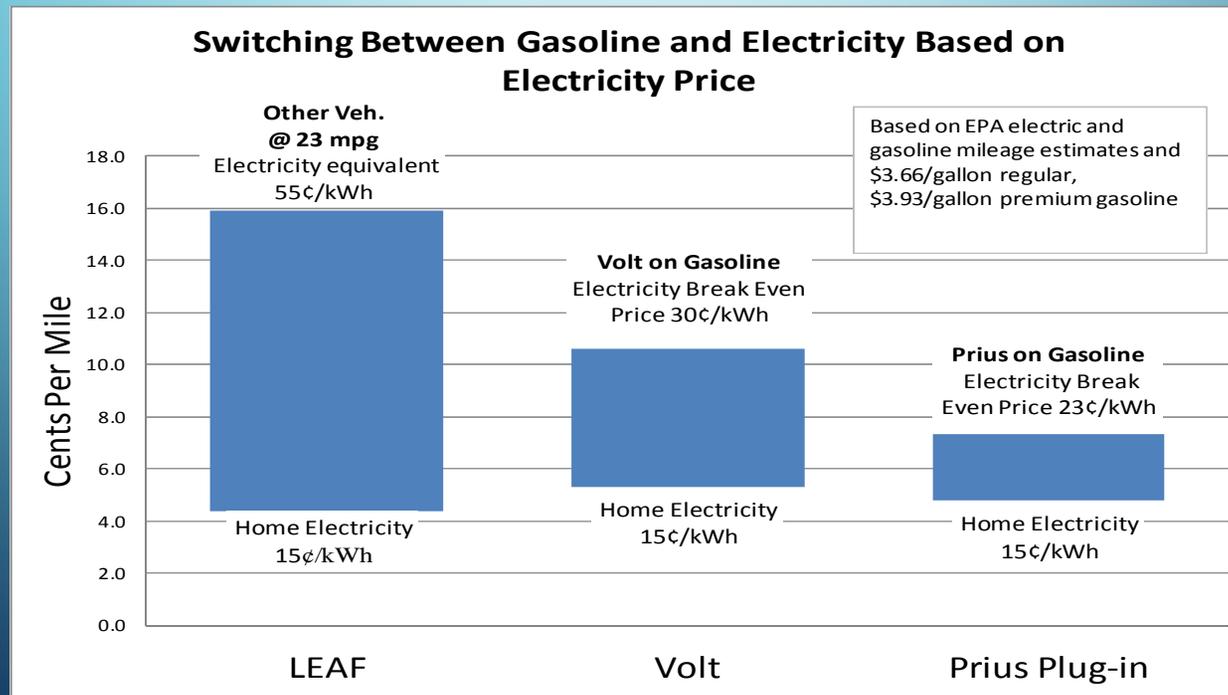
WHAT TYPES OF CHARGING DO DRIVERS NEED TO IMPROVE THE UTILITY/USEFULNESS OF THEIR PEVS?

- Increasing public charger use does not equal increased miles
- Is switching charging from home to public with no increase in miles an increase in utility?



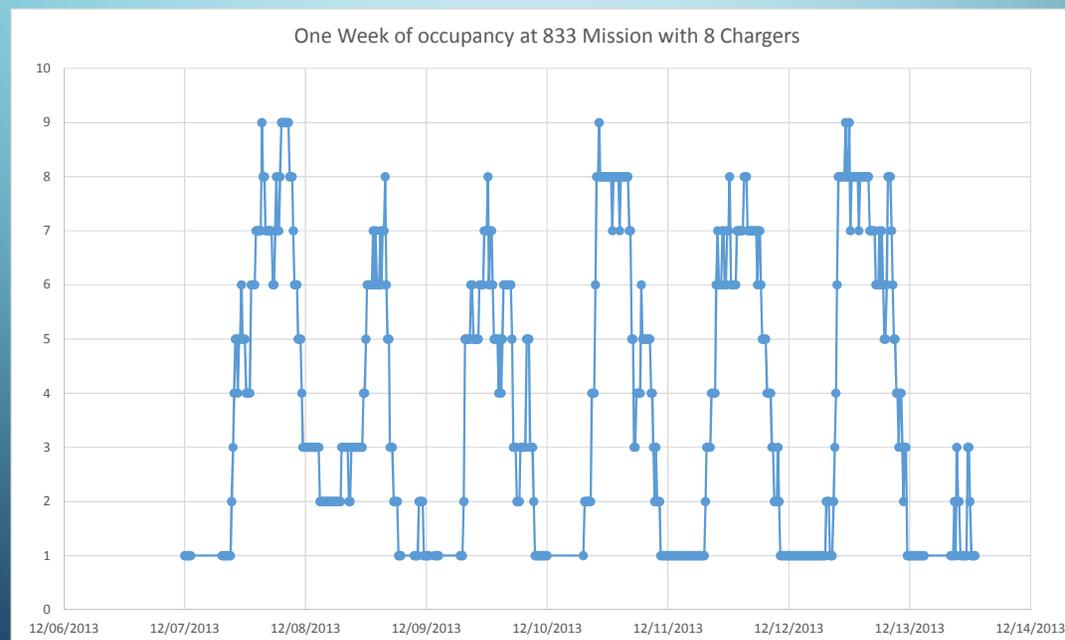
WHAT TYPES OF CHARGING DO DRIVERS NEED TO IMPROVE THE UTILITY/USEFULNESS OF THEIR PEVS?

- Paid Charging < gasoline. Ensures that every charge could not be completed with home electricity. 4 times fewer chargers.



WHAT TYPES OF CHARGING DO DRIVERS NEED TO IMPROVE THE UTILITY/USEFULNESS OF THEIR PEVS?

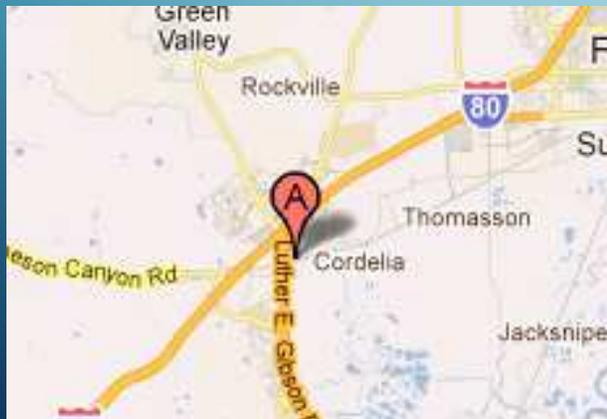
- **Reliable Charging.** If chargers are congested, then BEVs are less likely to attempt a trip. Only those who don't need it are plugging in.



WHAT TYPES OF CHARGING DO DRIVERS NEED TO IMPROVE THE UTILITY/USEFULNESS OF THEIR PEVS?



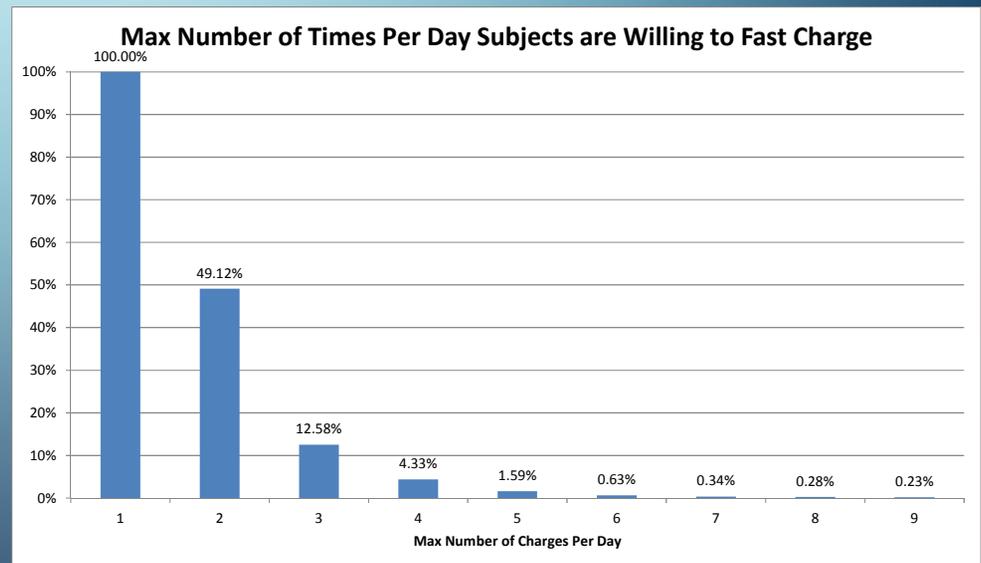
Destination



Corridor

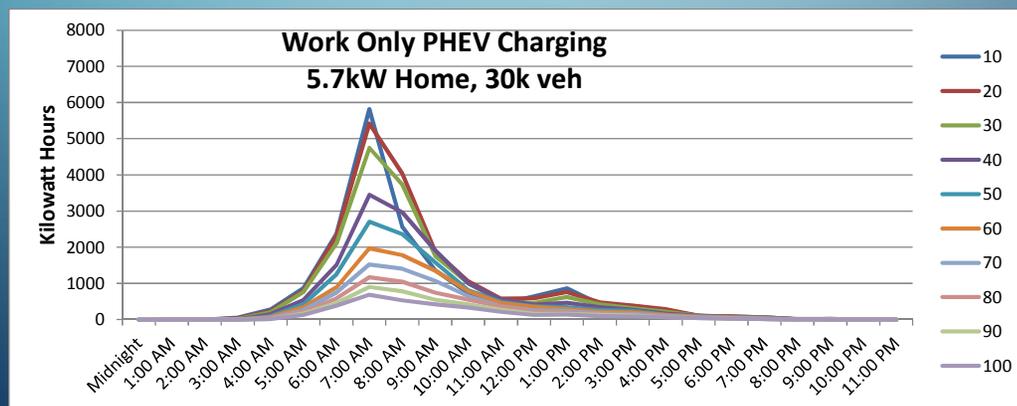
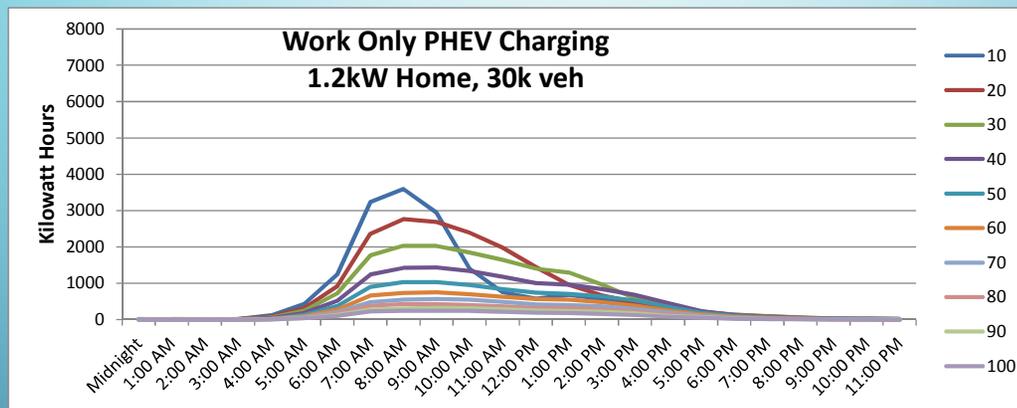
Fast charging

- Destination. Corridor.
- Within 2 charges round-trip



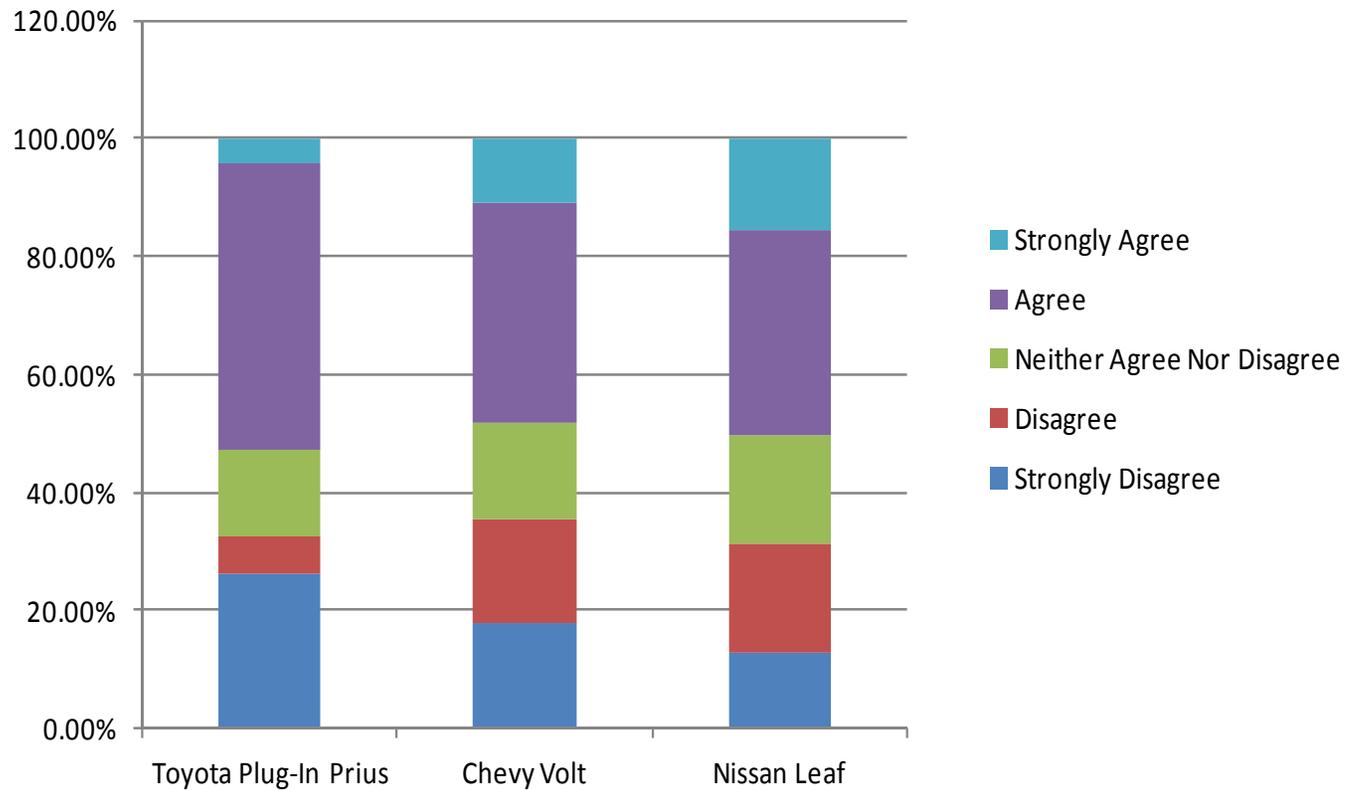
HOW DOES L1 COMPARE TO L2 IN TERMS OF 4-PLUS HOUR PARKING SETTINGS?

- PHEV Simulation on Caltrans data shows potential power profiles on L1 vs L2 at work. 1% difference max in eVMT.



WHAT DO USERS THINK ABOUT LEVEL 1?

Is Level 1 Sufficient for Workplace Charging?



WHAT RETURN DO WE GET FOR INFRASTRUCTURE INVESTMENT? (VMT/GHG)

- Home Charging VMT

- 60 Mile Veh. = 59%

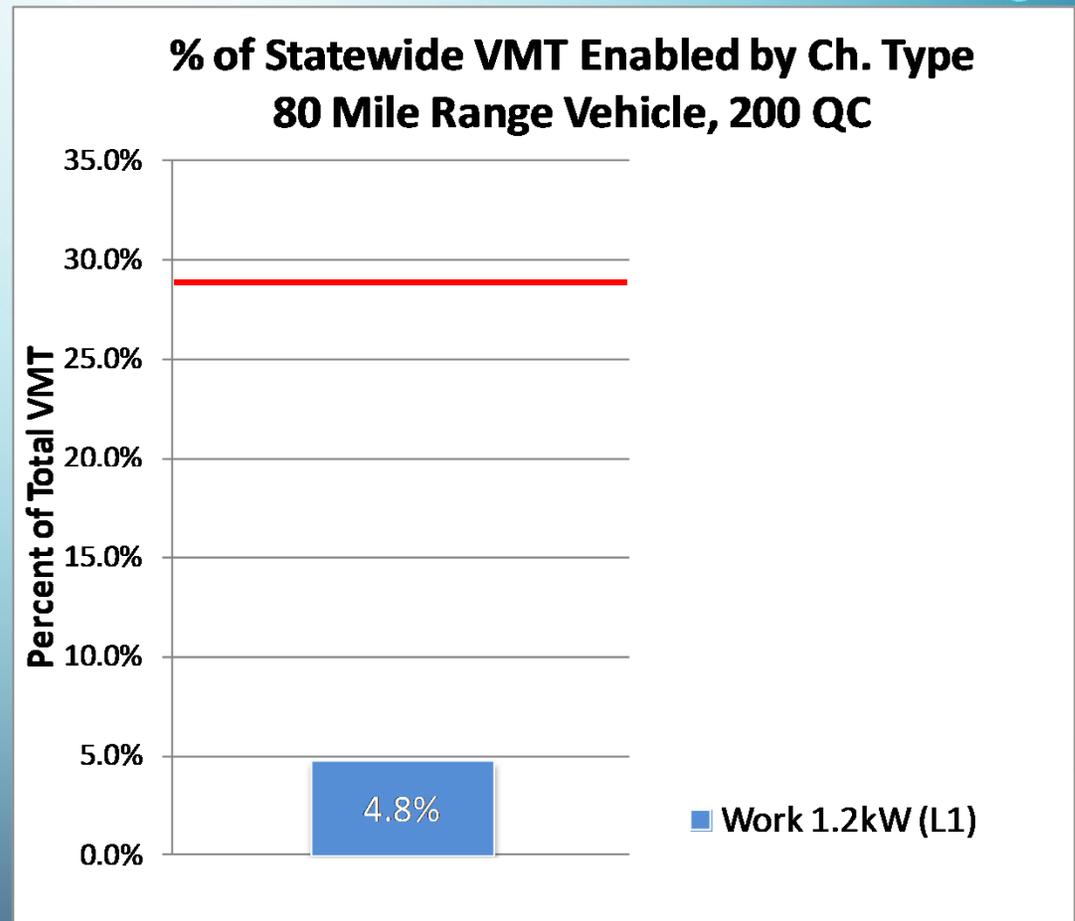
- 80 Mile Veh. = 71%

- 100 Mile Veh. = 79%

WHAT RETURN DO WE GET FOR INFRASTRUCTURE INVESTMENT? (VMT/GHG) (UC DAVIS MODEL)

- Home Charging VMT

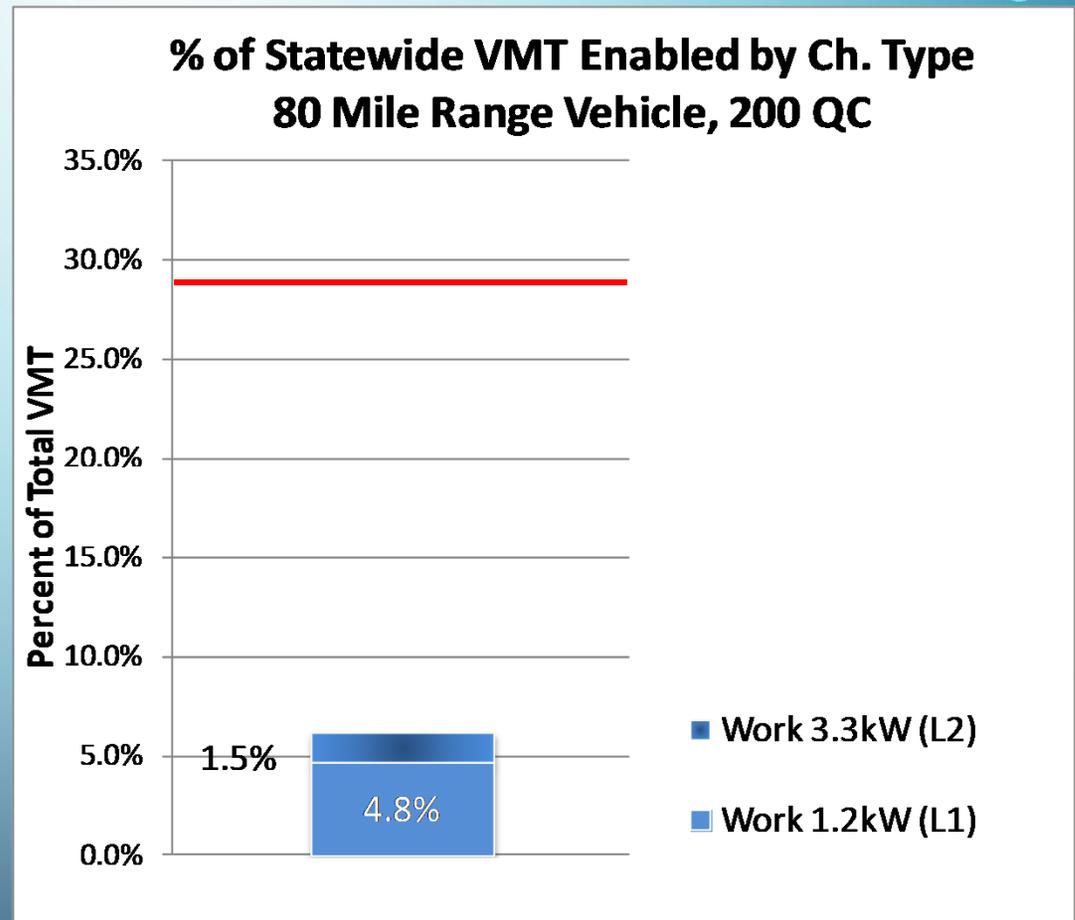
- 60 Mile Veh. = 59%
- 80 Mile Veh. = 71%
- 100 Mile Veh. = 79%



WHAT RETURN DO WE GET FOR INFRASTRUCTURE INVESTMENT? (VMT/GHG) (UC DAVIS MODEL)

- Home Charging VMT

- 60 Mile Veh. = 59%
- 80 Mile Veh. = 71%
- 100 Mile Veh. = 79%



WHAT RETURN DO WE GET FOR INFRASTRUCTURE INVESTMENT? (VMT/GHG) (UC DAVIS MODEL)

- Home Charging VMT

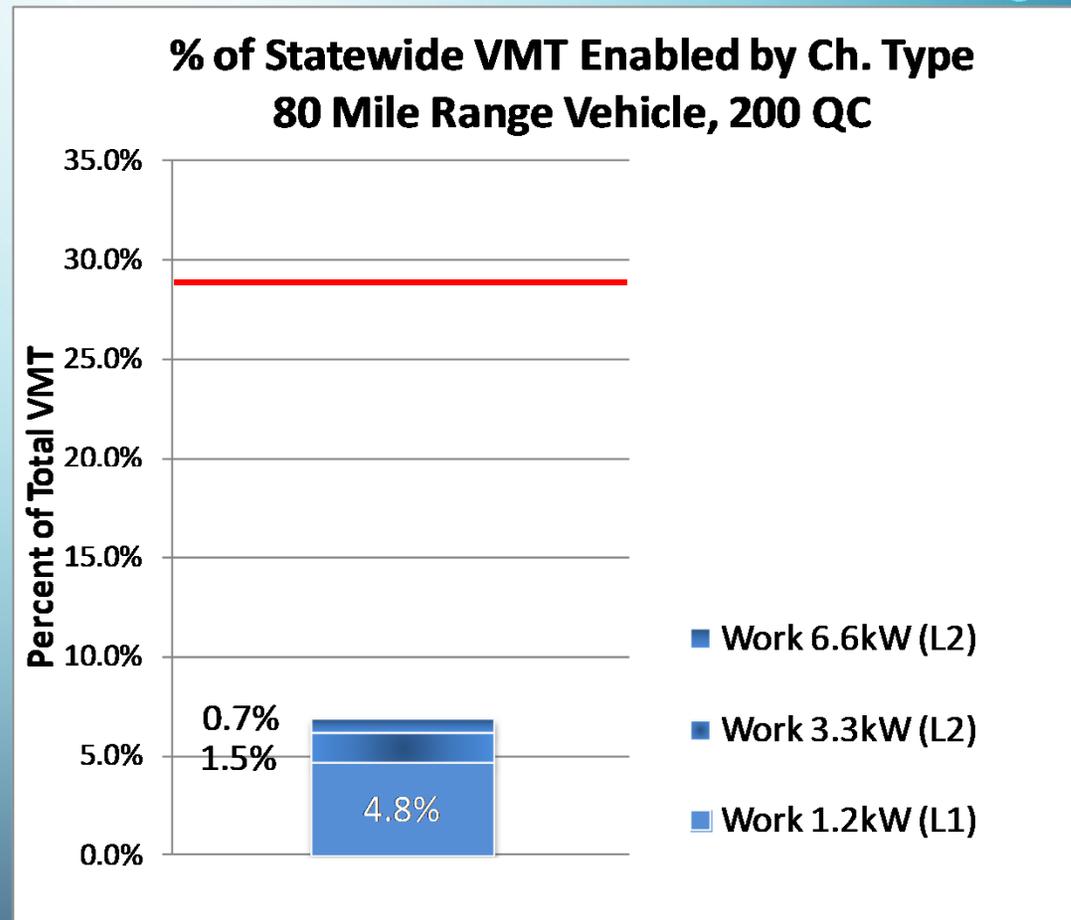
- 60 Mile Veh. = 59%

- 80 Mile Veh. = 71%

- 100 Mile Veh. = 79%

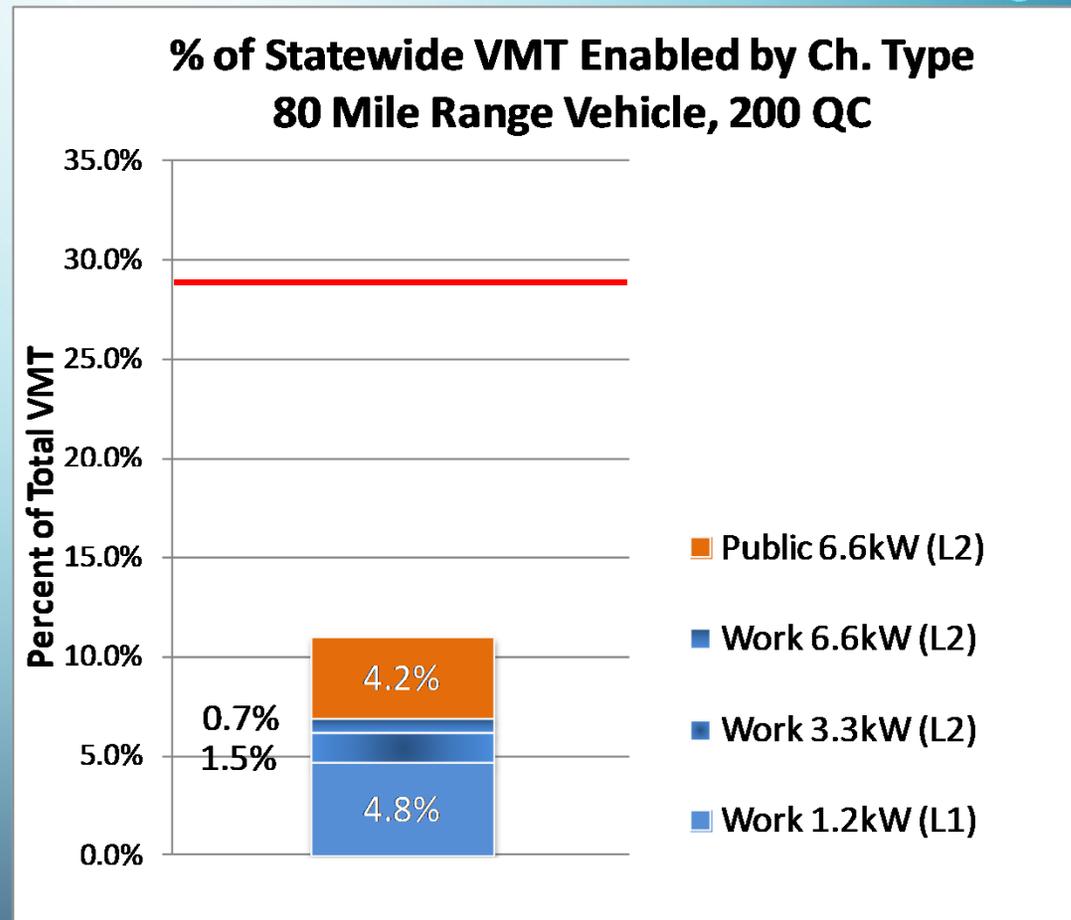
- L1 Work Charging is sufficient for ~5%

- L2 Work Charging is needed for ~2%



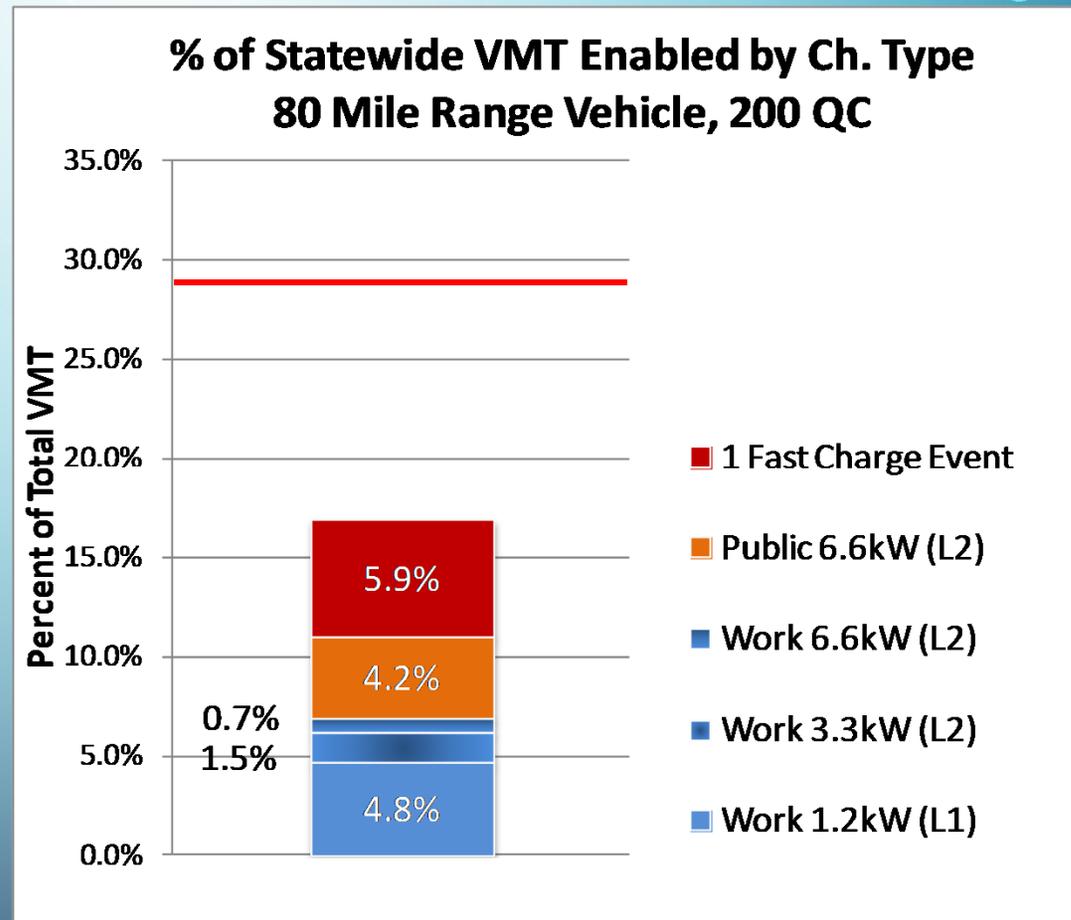
WHAT RETURN DO WE GET FOR INFRASTRUCTURE INVESTMENT? (VMT/GHG) (UC DAVIS MODEL)

- Home Charging VMT
 - 60 Mile Veh. = 59%
 - 80 Mile Veh. = 71%
 - 100 Mile Veh. = 79%
- L1 Work Charging is sufficient for ~5%
- L2 Work Charging is needed for ~2%



WHAT RETURN DO WE GET FOR INFRASTRUCTURE INVESTMENT? (VMT/GHG) (UC DAVIS MODEL)

- Home Charging VMT
 - 60 Mile Veh. = 59%
 - 80 Mile Veh. = 71%
 - 100 Mile Veh. = 79%
- L1 Work Charging is sufficient for ~5%
- L2 Work Charging is needed for ~2%



WHAT RETURN DO WE GET FOR INFRASTRUCTURE INVESTMENT? (VMT/GHG) (UC DAVIS MODEL)

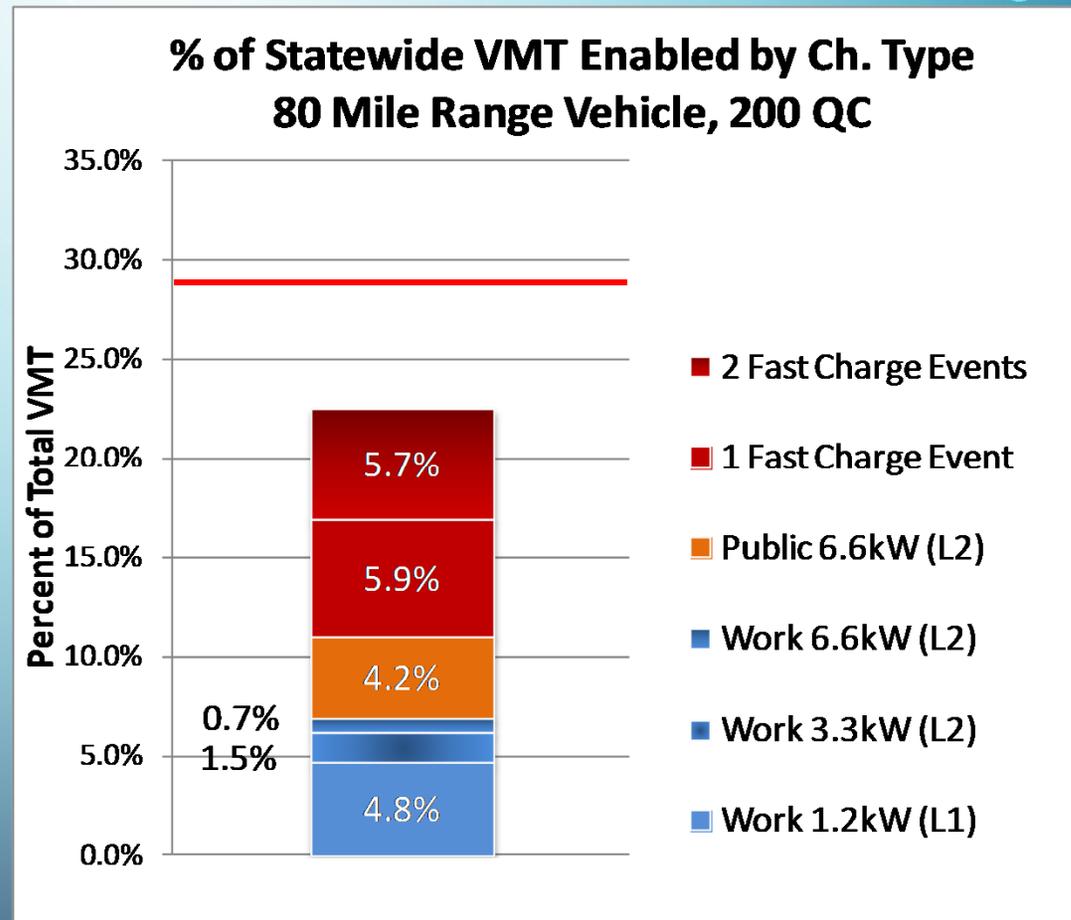
- Home Charging VMT

- 60 Mile Veh. = 59%
- 80 Mile Veh. = 71%
- 100 Mile Veh. = 79%

- L1 Work Charging is sufficient for ~5%

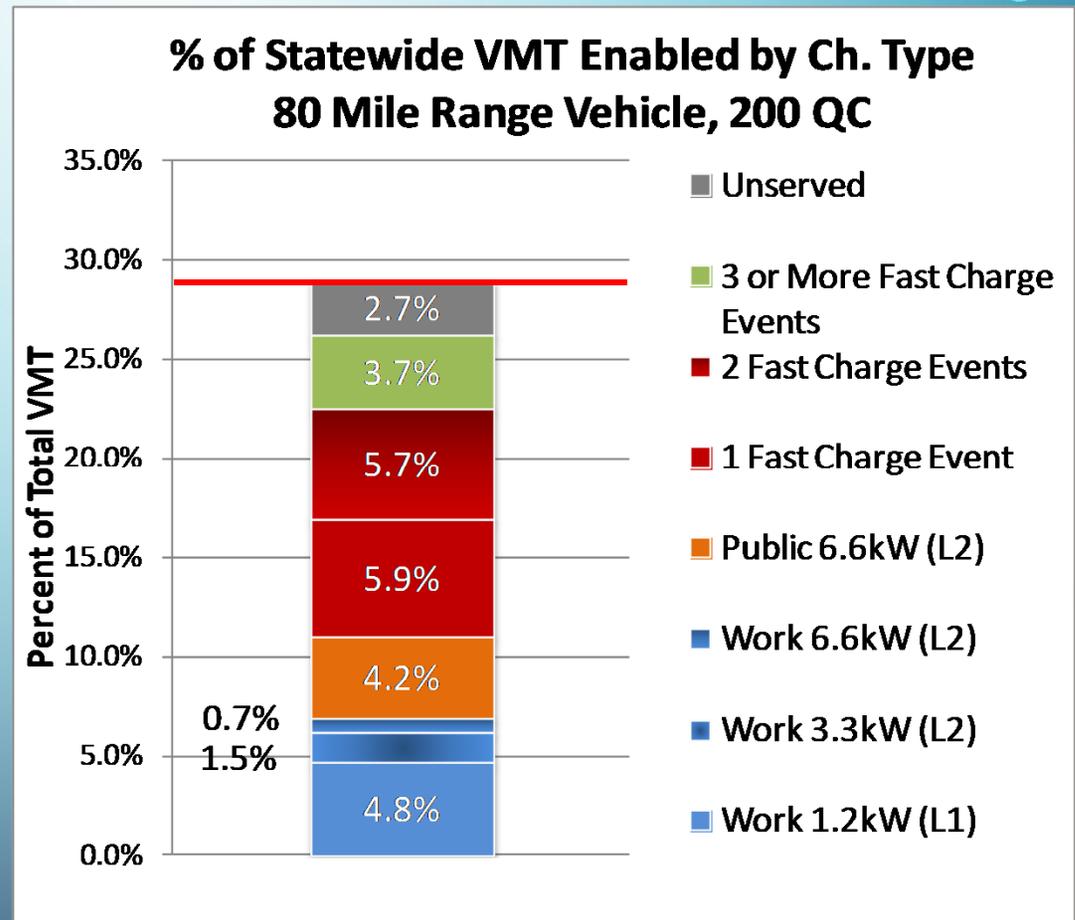
- L2 Work Charging is needed for ~2%

- QC accommodates up to 10% additional



WHAT RETURN DO WE GET FOR INFRASTRUCTURE INVESTMENT? (VMT/GHG) (UC DAVIS MODEL)

- Home Charging VMT
 - 60 Mile Veh. = 59%
 - 80 Mile Veh. = 71%
 - 100 Mile Veh. = 79%
- L1 Work Charging is sufficient for ~5%
- L2 Work Charging is needed for ~2%
- QC accommodates up to an additional 10% EV miles



CONCLUSIONS

- Congestion is detrimental and has a negative feedback.
- Separate want from need with price
- 2 chargers for every 10 PEVs at work if priced
- Free charging increases market for EVs, but we don't know how much. Is it a sustainable model?
- L1 or other low power charger can handle 80% of workplace demand based on dwell times
- DC Fast charging can be bridge to ubiquitous level 2. Useful at destinations (airports, city centers) and along route