Title: *Dedicated Parking/Charging for Alternative Fueled Vehicles*

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Purpose: *To incentivize the transition from fossil fueled personal vehicles to alternative fueled vehicles*

Description: Human behavior is notoriously difficult to alter and we face an uphill battle when it comes to influencing mode choice in a rural context. We therefore expect that a complete transition to sustainable transportation for HSU will include mixed modes (i.e. transit, walking/biking, ***and*** personal vehicle use with zero-carbon or low carbon fuels). This strategy is intended to incentivize the adoption of alternative fuels in the personal vehicle fleet by providing exclusive access to on-campus parking to drivers of alternative fuel vehicles. There has been discussion of installing EV charging on the HSU campus but to date there are still no chargers and there has not been any concerted discussion of dedicated parking spaces.

Recommendation: Humboldt State University should incentivize the adoption of alternative fueled vehicles by reserving some number of campus parking spaces for vehicles fueled by electricity, hydrogen, or biofuels. In addition, HSU should remove a key barrier to adoption of EVs by installing EV chargers on campus.

Background
Based on statewide emissions estimates from the CA Air Resources Board, electric vehicles emit ~31% of the greenhouse gases per mile traveled as conventional vehicles. The benefit of incentivizing one driver to commute to campus in an EV has an equivalent environmental impact as convincing 3 commuters to carpool instead of driving alone. Similarly, hydrogen fuel cell vehicles driving on hydrogen from reformed natural gas emit ~61% of the GHGs as conventional vehicles. Biofuels can also significantly reduce emissions, though the amounts are highly dependent on the fuel feedstock and blend ratios.

The following recommendations and analysis focus on electric vehicles because they offer high potential for emissions savings, are widely available for purchase (in contrast to hydrogen vehicles), and are easier to manage than biofuel vehicles from a parking enforcement perspective (because they are more easily identified and verified).

The three most prominent barriers to adoption of EVs are:
1. Vehicle cost
2. Range anxiety
3. Lack of access to public charging infrastructure

There are state and federal incentives that continue to help overcome the vehicle cost barrier. Car manufacturers are responding to the range anxiety barrier by bringing longer range vehicle

to the market (e.g. the Chevrolet Bolt will have ~200 miles of range). But charging infrastructure is a barrier than can only be removed through concerted local action.

- **Scale and Scope:** This is a campus-wide policy that would impact all car commuters to campus. At a minimum, we recommend four EV chargers be installed on campus as soon as possible and at least 4 parking stalls be dedicated for alternative fueled vehicles. Through the process of installing the first bank of chargers, action should be taken to ease future installations (e.g. through installing adequate conduit, charger stubs, and upgrading electrical panels if necessary).
- **Timing:** This is a long-term strategy that would need to be adapted and updated as EVs become more common in the overall personal vehicle fleet. The short-term time horizon is ~1 year between planning for the first bank of EV chargers and full implementation.
- **Key Participants** This strategy would require active engagement and support from the HSU Parking and Transportation Committee in addition to Facilities Management which would be responsible for implementation.

Summary of Estimated Costs, Benefits and other Impacts:

- *Costs*
    - Based on a 2014 cost estimate for installing four chargers on the HSU campus in addition to actual costs incurred by installing chargers in other locations in Humboldt County, we estimate that 4 chargers (2 pedestals with 2 cords each) could be installed at HSU for $40-60k.
    - The majority of the cost to install charging infrastructure is from the balance of system (e.g. trenching cables through concrete, ADA code compliance, construction management & overhead, etc.). The project costs can therefore be significantly reduced if combined with a parking lot construction or retrofit project already underway.
    - The marginal cost of adding new dual-plug charging pedestals to existing stubs (assuming no further trenching or electrical upgrades are necessary) is on the order of $10k per pedestal or $5k per plug.
    - Depending on the chargers selected, there can be network subscription fees on the order of $300 per year per plug.. For the four charger installation recommended here, this would be $1200/year. Given sufficient demand, the subscription feeds could be paid for through revenues generated by the chargers themselves.
- *Funding Availability*
    - The California Energy Commission has made EV charging infrastructure deployment an important focus of its current funding strategy. The Redwood Coast Energy Authority (RCEA) with the support of the Schatz Energy Research Center has already successfully secured funds to install over 10 EV charging stations throughout Humboldt County. In future funding rounds, RCEA could include HSU as a site host and partially or fully fund the installation of chargers at low or no cost to the University. Alternatively, HSU could self-fund the chargers through parking permit or parking violation fees.

- *Benefits*
    - We estimate the *direct impact* of installing EV chargers to be 94 metric tons of CO_{2e} per charger per year. This is based on directly replacing conventional miles traveled with electric miles traveled by virtue of electricity delivered at the on-campus charger.
    - We estimate the *indirect impact* of install EV chargers to be 311 metric tons of CO_{2e} per charger per year. This is based on taking credit for "converting" conventional drivers to EVs simply by providing access to charging infrastructure at work/school and then claiming the cumulative emissions reductions over the lifetime of the charger.
    - The direct impact estimate was determined by converting the electricity delivered to the EVs into electric miles traveled and then taking the difference in emissions between traveling those miles in a conventional vehicle and an EV. The following assumptions were made:
        - Chargers are used 4 hours per weekday at 7kW for 48 weeks per year (unused on the weekend)
        - Average fuel economy of conventional vehicle is 36 MPG (this is U.S. average for new passenger vehicles)
        - 23.5 pounds of CO_{2e} are emitted per gallon of gasoline (wells to wheels estimate from GREET)
        - 0.379 metric tons of CO_{2e} are emitted per 1000 kWh of electricity consumed (CA ARB LCFS Estimate)
        - EVs have plug-to-wheel efficiency of 80%
    - The indirect impact estimate was determined by assuming that each plug "converts" one conventional vehicle driver to an EV each year over a 10 year lifetime for the charger.
        - Drivers are assumed to drive 10,000 miles per year
        - Emissions factors are identical to the above assumptions.
- *Other Impacts*
    - EV charging on campus could be attractive to prospective students and employees.
    - Dedicating parking stalls to EV owners could cause pushback from other personal vehicle commuters.

Dollar Spent/GHG Reduction: $1.53/ton per plug for direct *and* indirect benefits; $8.75/ton per plug for *only* direct benefits.