

ELECTRIC VEHICLE CHARGING DESIGNED FOR THE REAL WORLD



A presentation by Philip Skoog & Jeff Finn for the
American Institute of Architects – Seattle
Committee on the Environment: July 13, 2016

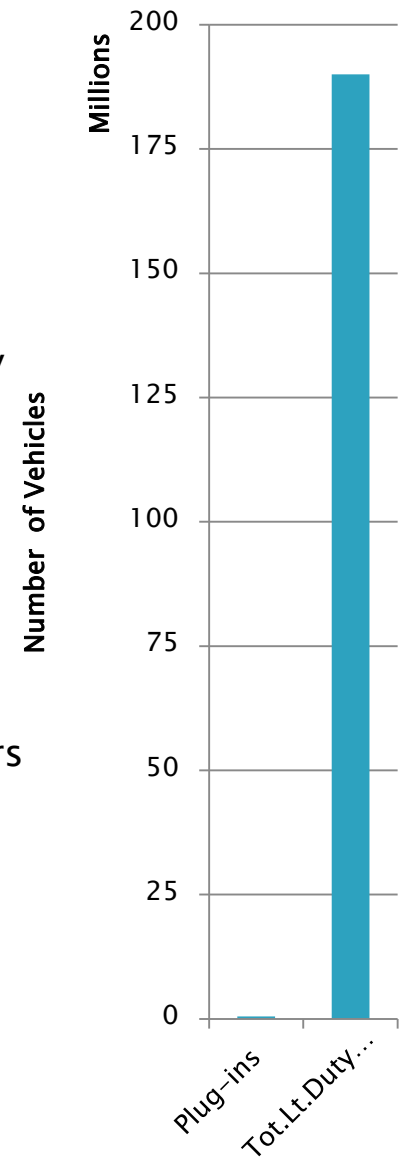
Today's EV Charging Topics

- ▶ **EV adoption, usage and capabilities**
- ▶ **EV charging/infrastructure**
- ▶ **EV infrastructure considerations during the Schematic Design, Design Development, Construction Document phases for**
 - Single family dwellings
 - Multi-family dwelling units
 - Workplaces (Business properties)
- ▶ **EV infrastructure incentives/requirements**
- ▶ **Resources for EV infrastructure**

EV Adoption, Usage & Capabilities

- ▶ Currently ~½ million EVs out of ~190 million light duty vehicles registered in the U.S.
- ▶ 80% (~152M) of our automobiles & light duty trucks are driven less than 40 miles/day
 - i.e., all battery only EVs currently on the market have a minimum EPA range which is at least 1½ times the 40 miles/day of documented actual light duty vehicle usage
- ▶ **40 miles/day = 10–15kWh of EV energy usage**
 - This is true regardless of an EV's maximum battery only range
 - Typically costs <\$1.25 at WA electricity rates
- ▶ **Charging space usage characteristics will be significantly affected by autonomous driving vehicles**
 - Possibly becoming a profit center for EVSE space owners by:
 - Renting existing charging spaces to commercial EV fleet operators
 - Selling excess electricity back to grid
- ▶ **Still in the early adoption phase of EV technology**
 - e.g., current plug-in replaced by inductive park-over charging?
 - We will make mistakes due to unexpected technology changes!

Plug-in EVs vs.
Total
July, 2016






Infrastructure



Electric Vehicle Supply Equipment

(EVSE = Charging Stations)

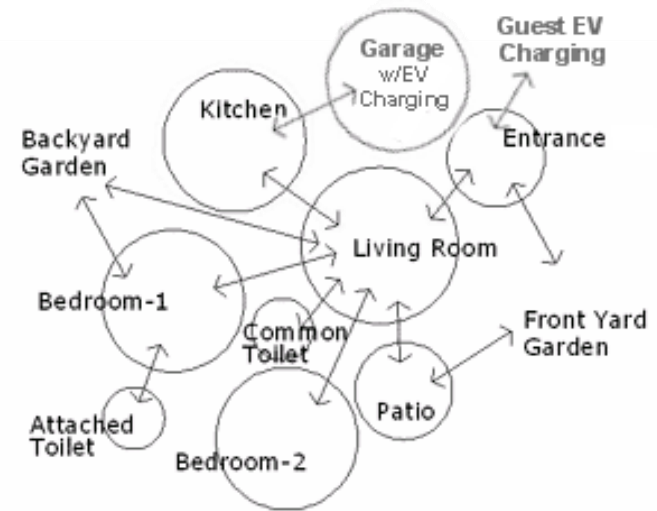
| THE BASIC LEVELS OF EV CHARGING | | | |
|--|--|---|---|
| Charger Type | Power (typical Configuration) | Typical Rates of Charging | Found At |
| AC - Level 1  | 120V 12 amps, standard U.S. outlet | \approx 3 - 5 miles of range per hour | EVERYWHERE! Think: same as charging cell phone. |
| AC - Level 2  | 208-240V 30 amps, standard U.S. EV plug (J-1772) | \approx 12 - 26 miles of range per hour | Homes, apartment buildings and public charging stations. |
| DC - Fast Charge  | 480V CHAdeMO and SAE Combo EV plugs | \approx 2 - 5 miles of range per <u>minute</u> | Public charging stations at shopping malls, fueling stations and travel centers. |

Architects' involvement with EV charging infrastructure

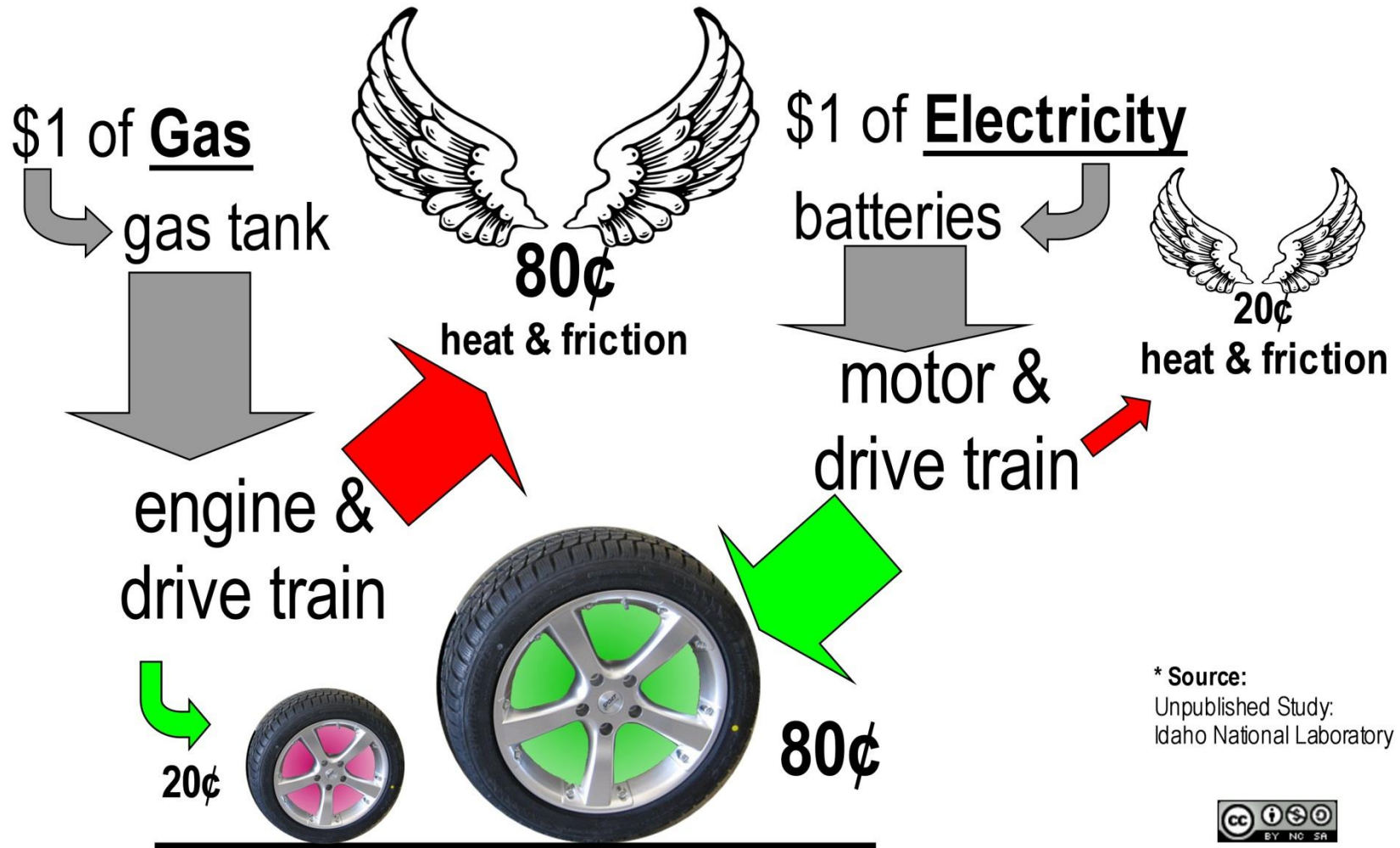


Schematic Design Phase

- ▶ **Include provisions for EV Charging?** (y/n)
 - Also available for guests? (y/n)
 - On-site, sustainable electricity generation? (y/n)
- ▶ **Single Family Dwellings**
 - Think an extra electric clothes dryer or electric range circuit
- ▶ **Multi-family Dwelling Units (Apartments/Condos)**
 - Building Code now requires new construction to be *EV Ready* based on a % of total parking spaces
 - LED upgrade of existing lighting system creates excess panel capacity which could be available for EV charging
- ▶ **Workplaces (Business properties)**
 - Similar to multi-family with emphasis on employee EV charging opportunities



Automobile Fuel Usage Efficiency *



* Source:
Unpublished Study:
Idaho National Laboratory



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Jeffrey Finn; Bellevue, WA; 2009

Design Development Phase

- ▶ **Site suitable for solar electricity generation?** (y/n)
- ▶ **Location(s) of EVSE(s)?**
 - Charging port location is not standardized on EVs
 - Not too distant from electrical service panel
- ▶ **Number & Charging Level(s) of EVSE(s)**
- ▶ **Single Family Dwellings**
 - L1 or L2 or just conduit w/panel capacity for future L2
 - Long cable for sharing Level 2 w/guests
- ▶ **Multi-family Dwelling Units**
 - L1 for residents?, L2 for guests?
 - Share a single Level 2 between a **public charging space** and an accessible parking space or among as many as 4 charging spaces
 - L2 w/networking capability for online status, maintenance, fee collection and/or usage restriction purposes?
 - New construction requires *EV Readiness* based on total # of parking spaces
 - Affects number of required EVSEs installed or roughed-in & size of electrical room
- ▶ **Workplaces (Business properties)**
 - Similar to multi-family dwelling units
- ▶ **General rule of thumb: *Locate EVSEs away from prime parking spots***



Construction Documents Phase

- ▶ **Sizing of Electrical Service Panel**
 - Number, Charging Level(s) & Amperage of EVSE(s)
 - Distance from service panel
- ▶ **Interior/Exterior grade EVSE(s)?**
- ▶ **Single Family Dwellings**
 - EVSE conduit rough-in & service panel capacity specs (90amp EVSE)
 - L2 Recommendation: 240VAC 40a or 50a circuit in garage w/NEMA 6-50r (electric dryer) or NEMA 14-50r (RV hookup) receptacle in garage
- ▶ **Multi-family Dwelling Units**
 - EVSE conduit rough-in & service panel capacity specs
 - Optional: wire pull & EVSE specs
 - L1 w/lockbox?, resettable NEMA 15-15r directly to 20a circuit breaker
- ▶ **Workplaces (Business properties)**
 - The “Goldilocks” Approach
- ▶ **Required signage for EVSEs made available to the public**
 - Applies to those both on public and private property



Incentives / Requirements in WA

- ▶ **\$7,500 EV Federal Income Tax Credit to promote EV adoption**
- ▶ ***Appropriate* (Alternative) Fuels' EV Sales Tax Exemption**
 - Exemption also applicable to EVSEs
- ▶ **PSE's \$500 rebate pilot for residential customers to install L2 EVSEs**
- ▶ **Avista's \$3million EVSE pilot**
 - Install 265 L2 and 7 DC Quick Charge stations at residential, workplace & additional public locations in Avista's service area
- ▶ **State's EV Charging Infrastructure Bank (Public Private Partnership Office)**
 - Applications only accepted from governmental units and 501(c)(3) nonprofits
- ▶ **All State & Local jurisdictions must include EVs in total cost of ownership analyses for fleet vehicle acquisitions**
- ▶ **RCW 43.01.250 No charge for EV charging electricity at state offices**
 - *"authorizes the purchase of power at state expense to recharge privately and publicly owned plug-in EVs"*
- ▶ **WA State Building Code (WAC 51-50-0427 (BCA 15-044): effective July 1)**
 - requires 5% of parking spaces in apartments, condominiums, and some commercial buildings to comply with "EV Readiness" specifications
- ▶ **Keep current @ DOE's *Appropriate* (Alternative) Fuels Data Center**
 - <http://www.afdc.energy.gov/laws/all?state=WA>

EVSEs Available to the Public

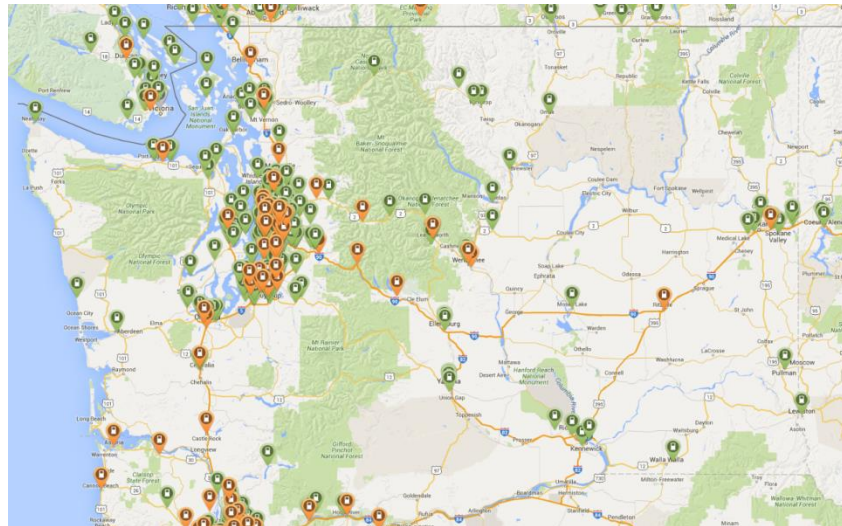
- ▶ State Law Requires De-ICEing Signage

RCW 46.08.185



- ▶ Wayfinding signs recommended!

- ▶ Electronic Billboard to draw customers



EV Resources

- ▶ pskoog4@gmail.com (Philip Skoog)
- ▶ jfinn@PlugInAmerica.com (Jeff Finn)
- ▶ <http://SeattleEVA.org> (Seattle EV Association)
- ▶ <http://pluginamerica.org/> (“Goldilocks”)
- ▶ <http://ElectricAuto.org> (Electric Auto Association)
- ▶ <http://AFDC.Energy.gov> (DOE Alternative Fuels)
(should stand for “**Appropriate Fuels**”)
- ▶ <http://FuelEconomy.gov> (DOE)

As an automobile EVs are

► Fun to drive!



»» Q & A