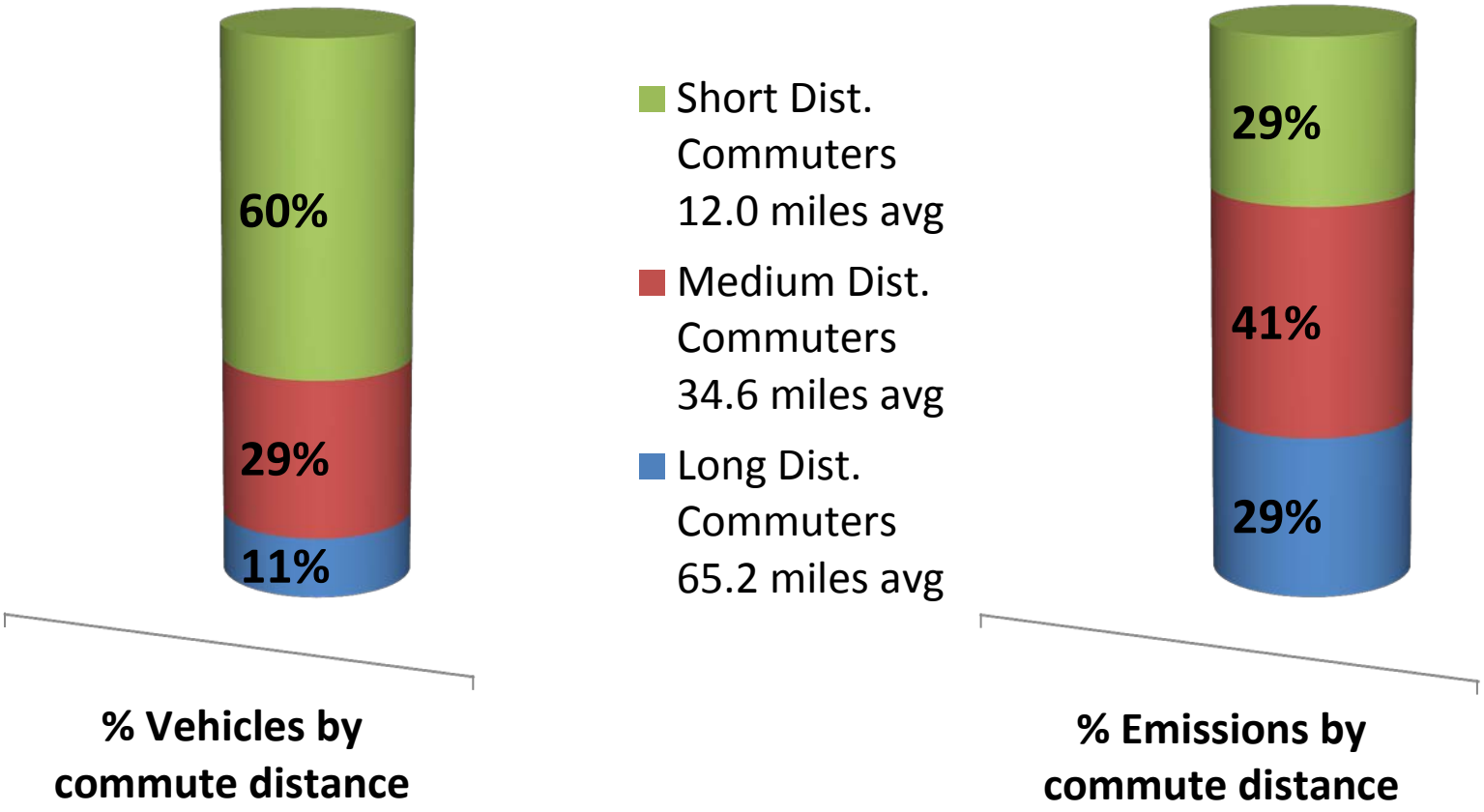
Getting Government Plug-in Ready: Workplace Charging Strategies

Electro Mobility Solutions
Consulting

The key to least cost highest convenience workplace charging

WHICH PEV COMMUTERS COULD BENEFIT FROM RELIABLE WORKPLACE CHARGING?

Distribution of round trip commute distance & emissions for Seattle CBD commuter vehicles



Source: Puget Sound Regional Council 2006 Activity Survey

Which PEV commuters can make it home easily on electricity without charging at work?

	Round Trip Commute Distance		
Make/Model (PEV type) EPA rated electric driving range	**Short** **<22 miles** **12.0 miles avg**	**Medium** **24-48 miles** **34.6 miles avg**	**Long** **>50 miles** **65.2 miles avg**
Nissan LEAF (all-electric) 84 miles	Yes	Yes	No
Chevy Volt (PHEV) 38 miles	Yes	Maybe	No
Ford C-Max Energi (PHEV) 21 miles	Yes	No	No**
Toyota Plug-in Prius (PHEV) 11 miles*	Maybe	No**	No**

* Depending on how it is driven, may use both gas & electricity.

** Not sufficient range to complete trip on electricity alone.

WHAT ARE THE ELEMENTS OF EFFECTIVE WORKPLACE CHARGING?

Elements of effective workplace charging

Plan for success!

1. Uses EVSE (aka charging station) types that are cost-effective and inexpensive to scale.
2. Doesn’t reduce number of general parking stalls.
3. Convenient to use and creates certainty around reliably obtaining a charge.
4. Fees for charging.

Elements of effective workplace charging

1. EVSE TYPES THAT ARE COST-EFFECTIVE AND INEXPENSIVE TO SCALE.

Types of EVSE: power (kW) vs. time to charge

<u>L1 (1.6 kW)</u>
25 miles range in 4 hours

120V 16 Amp

<u>L2 (4.1 kW)</u>
25 miles range in 1.5 - 2 hours

208-240V 20 Amps

<u>L2 (6.6 kW)</u>
25 miles range in 1-2 hours

208-240V 32 Amps

<u>DC Fast Charger (20 – 50 kW)</u>
25 miles range in 10 - 20 minutes

208V or 480V
3-phase power
CHAdeMO Connector

Types of EVSE: Basic vs. Networked

Basic EVSE

Driver just plugs in.

Networked EVSE

Driver uses RFID, app or credit card to turn on EVSE.

Cell or Ethernet connectivity required.

Third party network operator used to assess fees and monitor usage.

Basic vs. Networked EVSE capital costs

<u>Standard Outlet</u>

- **$20 per outlet**

<u>Basic L1 or L2</u>

- **$500 – $700 per connector**

<u>Networked L2</u>

- **$2,000 – $5,000 per connector**
- Cell amplifier required if low/no signal or Ethernet connectivity not available

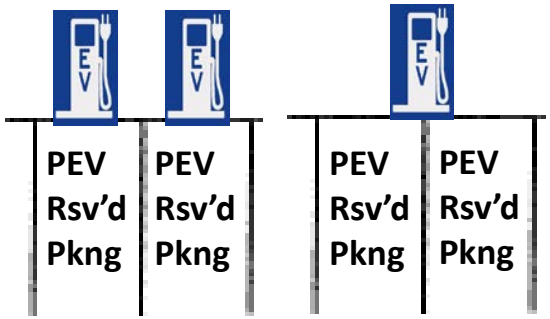
Low → Cost → **High**

Elements of effective workplace charging

2. MINIMIZING IMPACT ON GENERAL PARKING

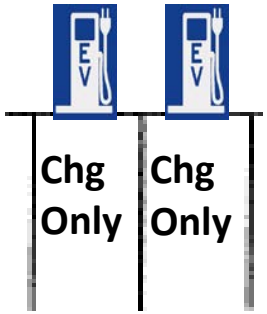
PEV parking strategies impact on general parking

Dedicated PEV Parking – No impact on general parking



- No reparking required.
- PEV parks like general parker except stall has EVSE.

Parking While Charging Only – High impact on general parking



- "Fueling Station" model: driver reparks after charge is complete.
- Stalls removed from general parking.
- Each PEV will still need a general parking stall.

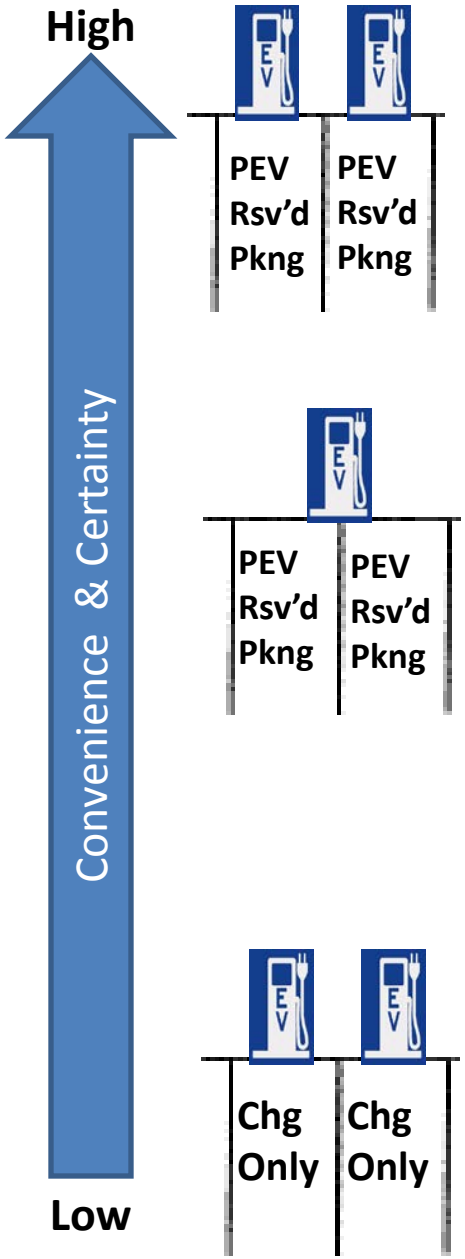
“Parking While Charging Only” can limit scalability

- Each PEV still needs a general parking stall in addition to stalls withdrawn for Parking While Charging Only stalls.

- If general parking is constrained, Parking While Charging Only stalls will limit expansion of system.

Elements of effective workplace charging

3. CREATING CONVENIENCE & CERTAINTY FOR DRIVERS



Dedicated PEV Parking – 1 stall 1 EVSE

- Park, connect charger to PEV and go to work
- No reparking required

Dedicated PEV Parking – Shared EVSE

- 1st driver parks, connects to charger and goes to work
- 2nd driver parks and goes to work
- 2nd driver switches connector at lunchtime to charge their PEV; no reparking of either vehicle required.

Parking While Charging Only

- Repark to general parking after charge completed
- 1-3 reparking moves every day for PEV driver
- Hourly fees used to incent turnover

Elements of effective workplace charging

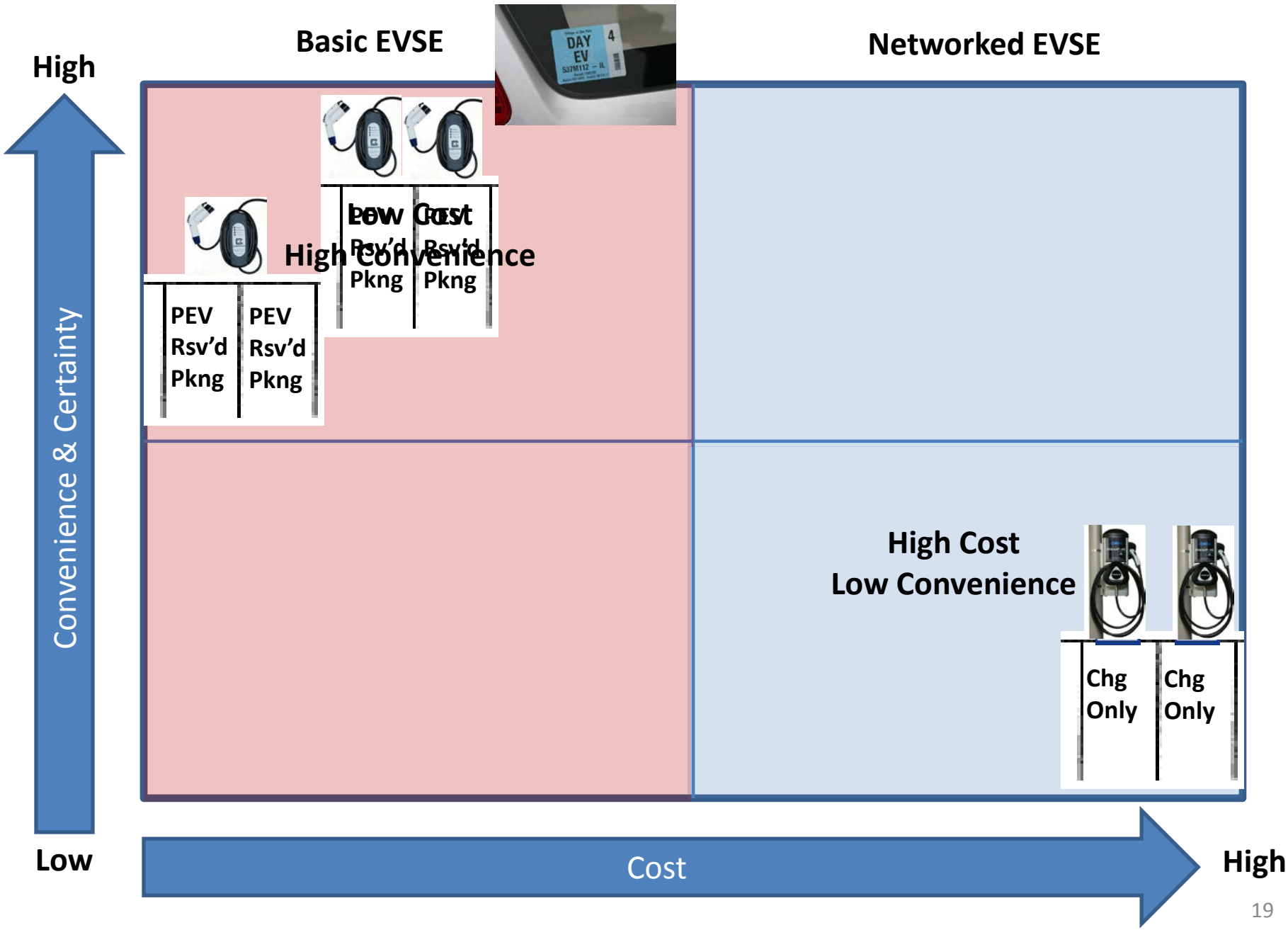
4. FEES FOR WORKPLACE CHARGING

Fees for workplace charging are recommended

- **Taxable benefit** concerns avoided.
- **Prevents shift from home charging to free charging at work.**
- **Workplace equity** – not providing free transportation fuel for certain employees.

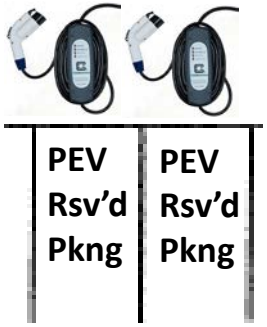
- **Fee structure drives basic vs. networked EVSE deployment:**
  - Monthly flat fee assessed by employer/parking manger <u>enables use of basic EVSE.</u>

Workplace Charging Strategies



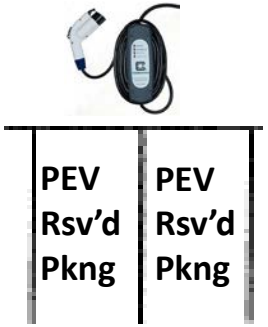
CONCLUSIONS

Effective strategy for regular PEV commuters: Basic EVSE plus monthly flat fee & no reparking required



<u>Basic L1 or L2</u>
Dedicated PEV Parking stalls.
Monthly flat fee.

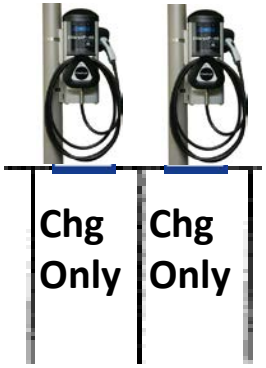
- **Low cost & scalable for property managers.**
- **Most convenient & certain for drivers; no reparking required.**
- **Dedicated L2 works for very long distance commuter.**
- **No impact on general parking**



<u>Basic L2</u>
EVSE shared between Dedicated PEV Parking stalls.
Monthly flat fee.

- **Lowest cost & scalable for property managers.**
- **Convenient & certain for drivers; connector switched at lunch; no reparking required.**
- **No impact on general parking.**

Effective strategy for visitors and intermittent commuter use: Networked EVSE



<u>Networked L2</u>
"Parking While Charging Only" stalls.
Fee per minute or kWh using RFID, app or credit card.

- **Reparking required after charge is complete.**
- **Stalls removed from general parking.**

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WHY ARE THE ECONOMICS OF PEV COMMUTING SO FAVORABLE?

Significant PEV savings:
Medium Distance Commuter – w/out workplace charging

- Mileage: 35 miles per weekday; 20 miles per weekend day; **11,218 miles per year**.
- Gas Cost: $4/gallon average over period.
- Efficiency: MPG = EPA Combined City/Highway; Watts/mile = EPA rating.
- Electricity: $0.11 per kWh average over period.
- Maintenance: Not included. Lower for PEV.
- Home Charging Station Costs: Not included. L2 plus installation would add ~$1,000 initial.

Vehicle	**Stnd Prius**	**C-Max Energi**	**Volt**	**LEAF S**
Monthly Lease Payment	$358	$306	$269	$199
Due at signing	$1,008	$951	$2,399	$1,999
Lease Term (years)	3	3	3	3
Fuel $/Month	$125	$85	$60	$59
Total Monthly Cost	$461	$384	$372	$289
Monthly Savings vs. Prius	$0	$76	$89	$171
Total Savings vs. Prius	$0	$2,753	$3,210	$6,167

Source: Based on Tom Saxton, Plug In America
http://www.pluginamerica.org/drivers-seat/leasing-plug-vehicle-total-cost-ownership

Significant PEV savings:
Long Distance Commuter w/ workplace charging

- Mileage: 66 miles per weekday; 20 miles per weekend day; **19,306 miles per year**.
- Gas Cost: $4/gallon average over period.
- Efficiency: MPG = EPA Combined City/Highway; Watts/mile = EPA rating.
- Electricity: $0.11 per kWh average over period.
- $0.15 per mile over 12,000 miles per year additional lease cost.
- Maintenance: Not included. Lower for PEV.
- Home Charging Station Costs: Not included. L2 plus installation would add ~$1,000 initial.

Vehicle	**Stnd Prius**	**C-Max Energi**	**Volt**	**LEAF S**
Monthly Lease Payment	$358	$306	$269	$199
Due at signing	$1,008	$951	$2,399	$1,999
Lease Term (years)	3	3	3	3
Fuel $/Month	$125	$85	$60	$59
Total Monthly Cost	$606	$513	$489	$406
Monthly Savings vs. Prius	$0	$93	$117	$200
Total Savings vs. Prius	$0	$3,351	$4,217	$7,200

Source: Based on Tom Saxton, Plug In America
http://www.pluginamerica.org/drivers-seat/leasing-plug-vehicle-total-cost-ownership