



FLEET ELECTRIFICATION

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CITY OF SEATTLE FLEET



FLEET OPERATIONS

- 4,000 vehicles maintained
- 11 garages & 5 warehouses
- All city departments: Police, Fire, Utilities, Parks, SDOT, etc.



ALT FUEL FLEET

- 100 Battery electric (BEV)
- 65 Plug-in hybrids (PHEV)
- 500+ conventional hybrids



EVSE INFRASTRUCTURE

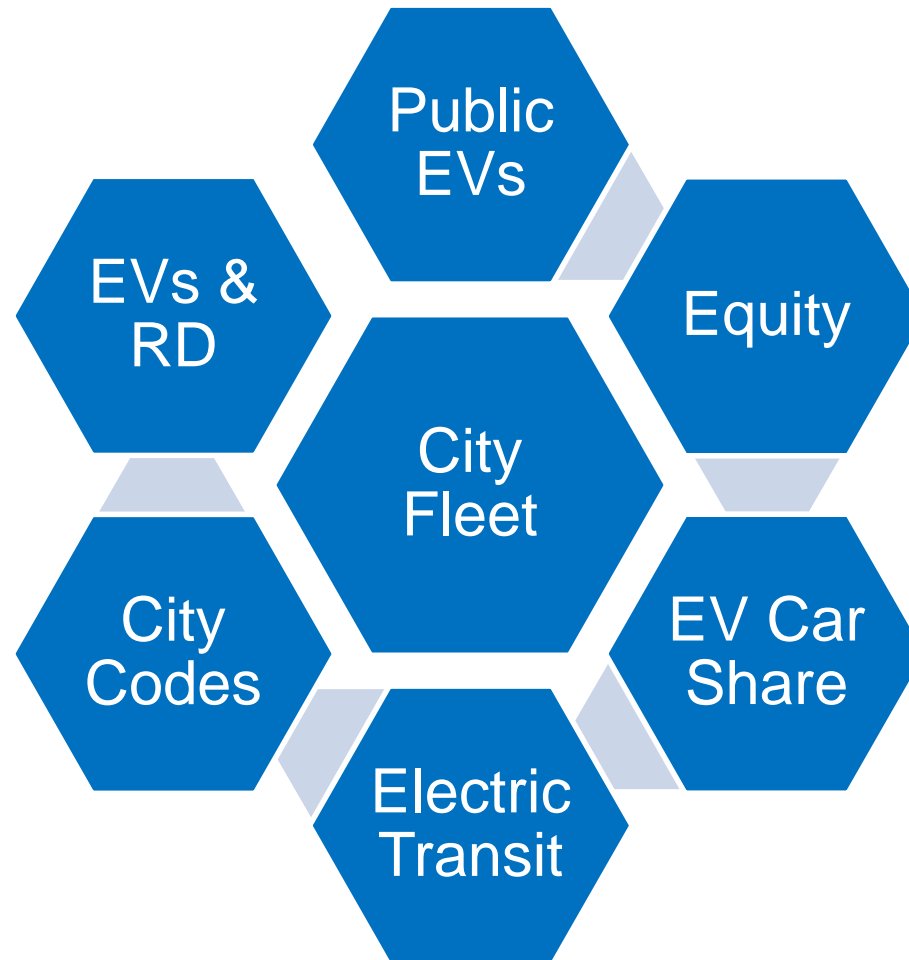
- 250 Fleet EVSE over 11 locations
- 1 DCFC for fleet use (480v)
- Large EVSE expansion project underway – 400 EVSE installed by 2023





DRIVE CLEAN SEATTLE

Powering a new generation of clean cars with carbon neutral electricity.





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Action #1: Transform the City Fleet

50% GHG
Reduction by
2025

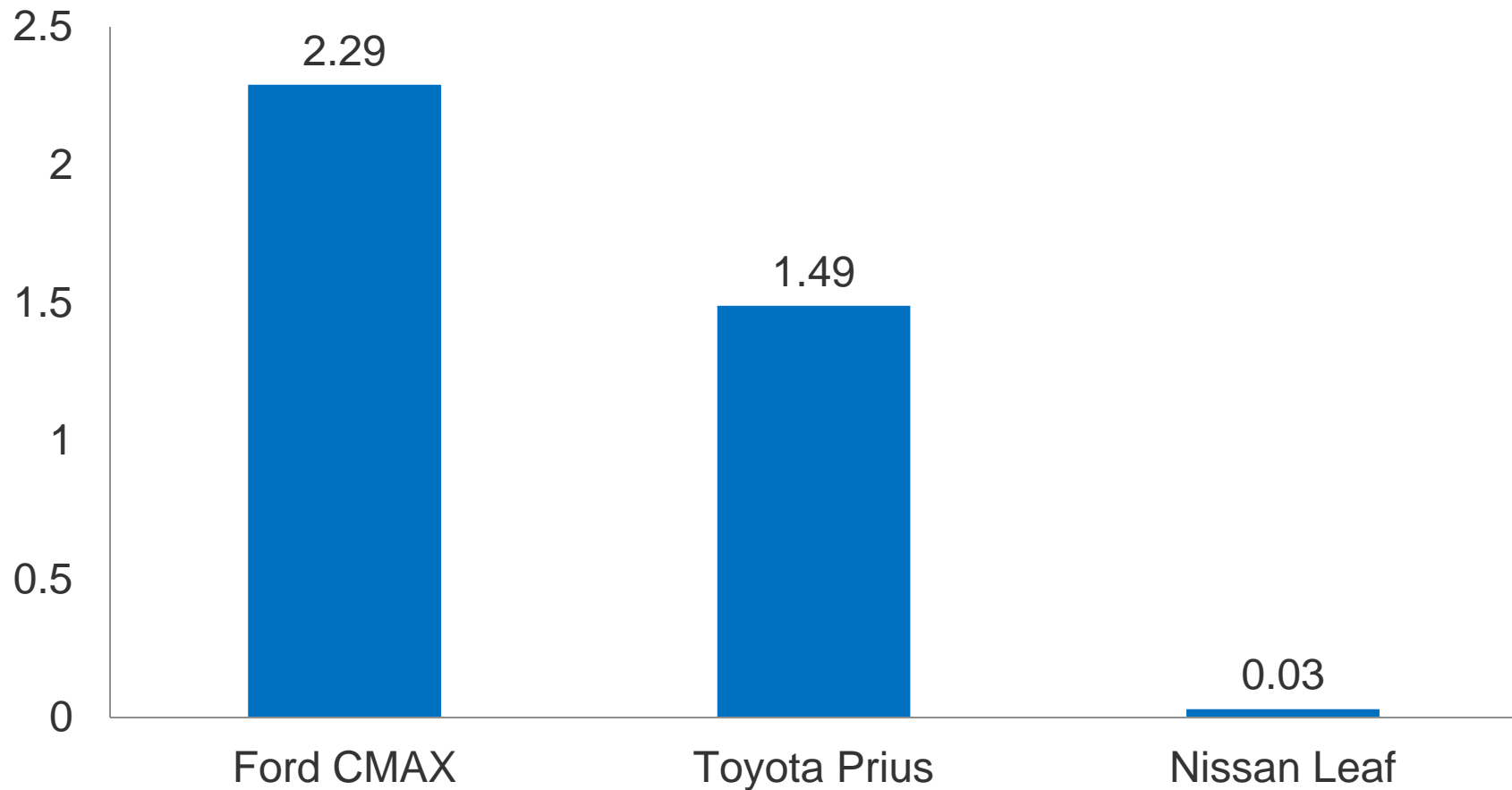
Install 400
EVSE to
support
electrification

Advance
EVs &
renewable
diesel for
med/hvy duty



REDUCED GHG EMISSIONS

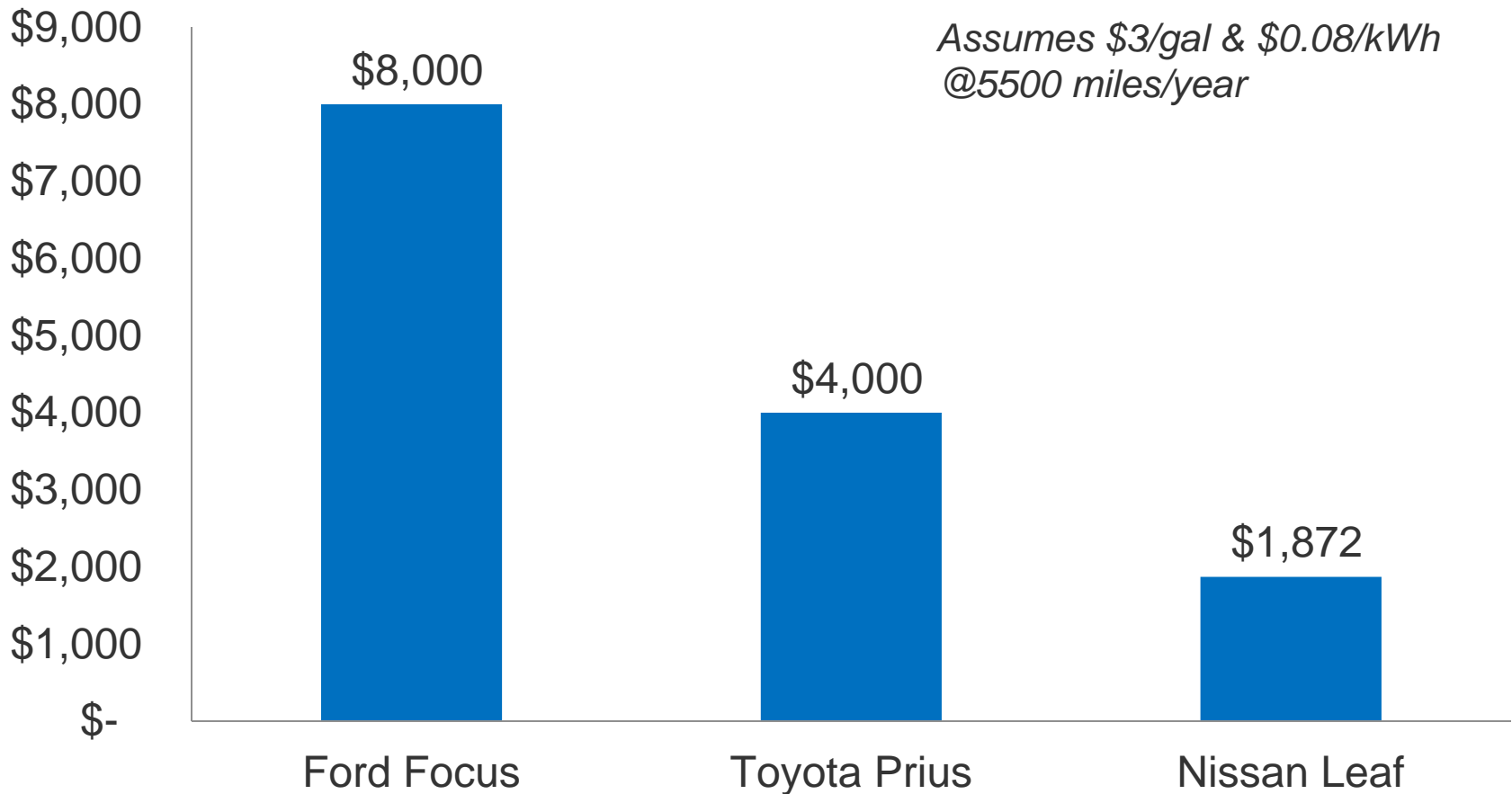
Replacing hybrids with BEVs = 98-99% GHG reduction/vehicle



GHG based on Carb LCFS CI values and Seattle City Light retail power emissions factor



REDUCED LIFETIME FUEL COST



REDUCED OPERATING COSTS

$$\text{TCO} = \text{Acquisition} + \text{Life Fuel} + \text{Life Maint.} - \text{Salvage}$$

| Type | Description | Life | Acq. | Fuel | Maint. | Salvage | TCO |
|--------|-------------|--------|----------|---------|----------|---------|----------|
| Gas | Ford Focus | 10 yrs | \$21,284 | \$8,000 | \$11,790 | \$2,128 | \$38,946 |
| Hybrid | Ford CMAX | 10 yrs | \$25,028 | \$5,830 | \$6,481 | \$2,503 | \$34,836 |
| BEV | Nissan Leaf | 10 yrs | \$22,638 | \$1,980 | \$5,553 | \$2,264 | \$27,907 |

Fleet operating cost for 300 passenger sedans:

| | |
|----------------|---------------------------|
| | Hybrids: \$10,450,860 |
| | BEVs: <u>\$ 8,372,160</u> |
| Savings | \$ 2,078,700 |



EVSE STRATEGY & CONSIDERATIONS

Intent – design efficient and cost effective EVSE systems to facilitate on-going fleet electrification

Considerations:

- Start small but plan big – work on smaller installations while planning larger projects to maintain progress
- ID vehicle location and existing electrical capacity
- Secured facility (*behind the fence*)? “Dumb vs. Smart”
- Battery size + dwell time = EVSE amperage
- Every facility is different – no one size fits all and costs are not linear



Budget \$

Big Projects

Small

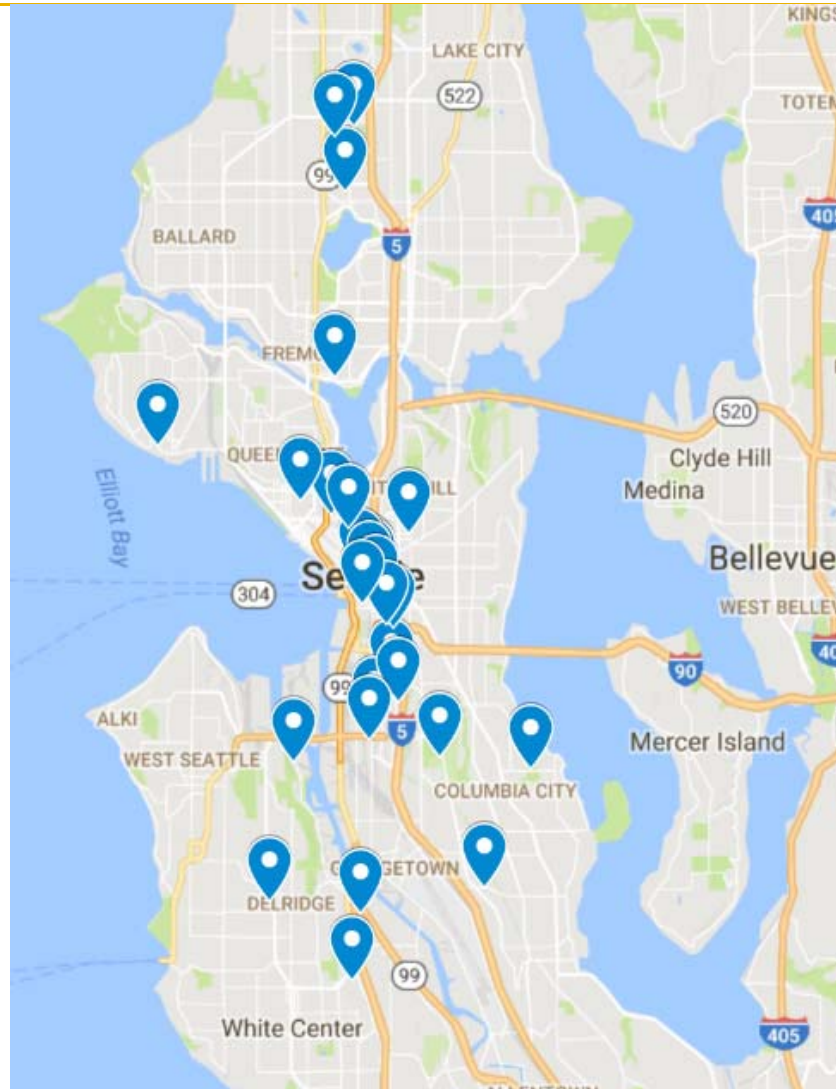
~\$10K/ea
(no svc upgrades)

Service
upgrades?

~\$3-7K/ea



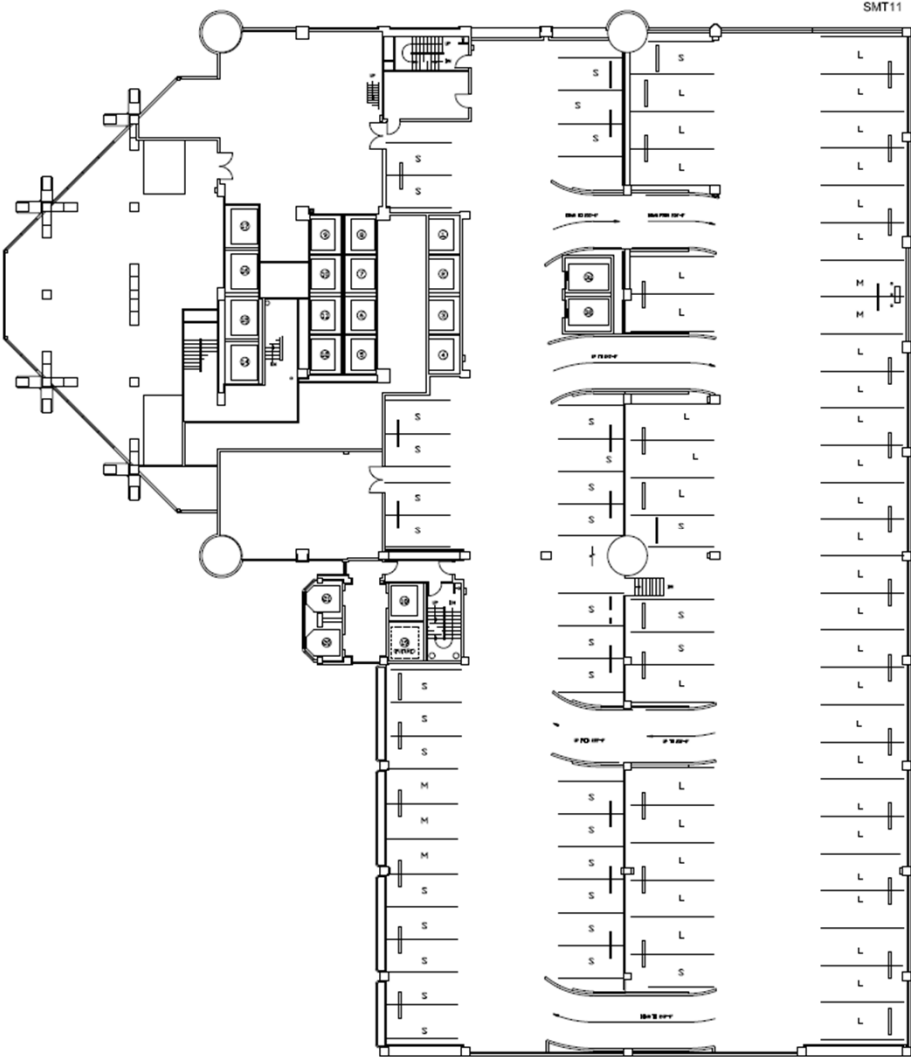
EVSE PROJECT MAP – SATELLITES & HUBS



SEATTLE MUNICIPAL TOWER (SMT)






SMT PROJECT



LOAD MGMT EVSE VS. BASIC “DUMB” EVSE

L2 Options Overview & Cost Comp.

| | Basic | Powershare | Panelshare |
|--------------------------------------|--|---|---|
| |  |  |  |
| Equipment Price | \$600 | \$7,500 | \$1,650 |
| Annual Network Fees | NA | \$616 | \$308 |
| Equipment Cost for 150 vehicles | \$90,000 | \$562,500 | \$247,500 |
| Annual Network Fees for 150 vehicles | 0 | \$46,200 | \$46,200 |
| 10 Year Equip + Network Cost* | \$90,000 | \$1,024,500 | \$709,500 |

**cost does not include staff time for administration of networked charger system (~0.25-0.5 FTE), additional construction cost related to IT system set up, troubleshooting, commissioning or cost related to repeaters or cell service reception (equipment on floor 10 could impact cell reception). Also maintenance of units is not included, which is historically more for networked EVSE units.*



LESSONS LEARNED – EVSE RIGHTSIZING

- **Battery size**
- **Fleet dwell time**
- **Amperage needed**
- *May not need a full 40amp L2 for small vehicles with long dwell times*

Average Fleet Dwell Time = 14 hours

(assumes one shift, no overtime)

- **Nissan Leaf** - Battery size = 24kWh = 90 miles of range



L2 charge time: 4 – 6 hrs

Charge time assumes 32amp continuous load

- **Chevy Bolt** – Battery size = 60 kWh = 240 miles of range



L2 charge time: 9 hrs

- **Tesla Model X** – Battery size = 100 kWh = 290 miles of range

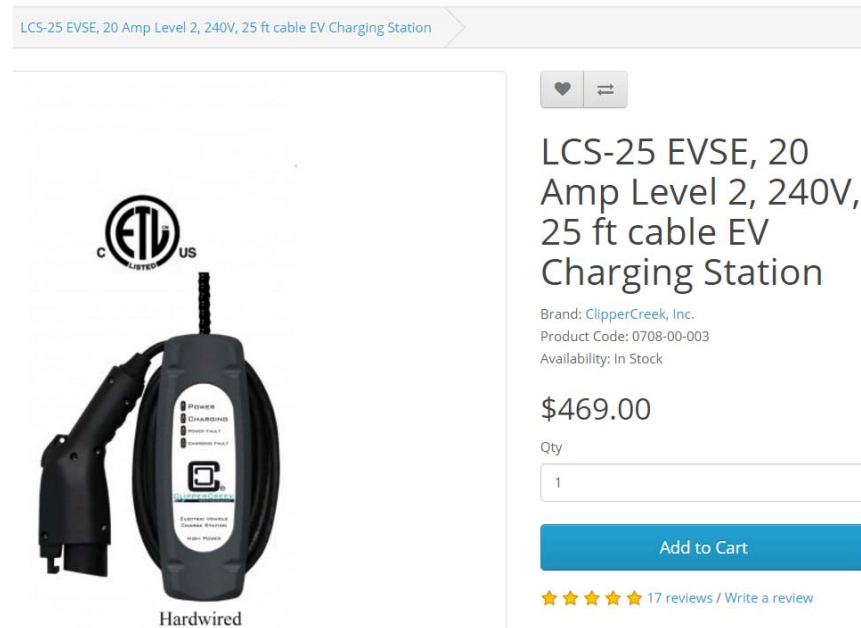


L2 charge time: 14.5 hrs



SMT SOLUTION? DECREASE AMPS.

- Project design team confirmed that a 25amp charger will charge a 60kWh battery from empty to 99% full in 14 hours
- This will decrease power needs by ~40%, provide appropriate cost controls and future proof for larger battery sizes



SEAPARK GARAGE PROJECT

- Install 100+ EVSE at SeaPark Garage
- Fleets is partnering with Seattle City Light and EPRI to turn into R&D load mgmt. study
- Up to 3 technologies will be studied and contrasted
- ROIs & user surveys included



EVSE INSTALLATION CONSIDERATIONS

- Infrastructure lead time \neq vehicle lead time
 - Could be 18-24 months vs. 3 months so start planning early
- Installation guidelines – create them
 - Install as close to service /panel as possible to reduce costs
 - (ie- rearrange parking! *gasp*)
 - Provisions to separately meter load
 - Verify cell service prior to smart EVSE install
 - Install larger conduit to allow for future expansions
 - Commission units per manufacturer specs and a vehicle /simulator
- Capacity /Grid Constraints
 - Load mgmt. may make sense
 - Solar panel or LED offsets /Decentralize EVs
 - Partner with local utility



12"



24"



FUNDING & FORECASTING

Funding Strategies

- Capital Improvement Program (CIP)
 - REET funding, debt service, etc.
 - Combine w/ efficiency projects
- Extend vehicle lifecycle and use capital dollars for EVSE
- Fuel mark up or vehicle rates
- Grant funding

Future Planning

- Incorporate into remodels and new construction
- Timing of vehicles coming to market is key
- Medium/heavy duty will require more power and may come to market as PHEVs first
- Consider industry trends and talk to OEMs



THANK YOU!

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