FLEET ELECTRIFICATION
Andrea Pratt, Green Fleet Program Manager
Fleet Management Division, City of Seattle
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.
**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 |

**DRIVE CLEAN SEATTLE**

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

Assumes $3/gal & $0.08/kWh @5500 miles/year

- Ford Focus: $8,000
- Toyota Prius: $4,000
- Nissan Leaf: $1,872
## REDUCED OPERATING COSTS

TCO = Acquisition + Life Fuel + Life Maint. – Salvage

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

Fleet operating cost for 300 passenger sedans:

- Hybrids: $10,450,860
- BEVs: $8,372,160

**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

~$10K/ea
(no svc upgrades)

Service upgrades?

Small

~$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.

<table>
<thead>
<tr>
<th></th>
<th>Basic</th>
<th>Powershare</th>
<th>Panelshare</th>
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</thead>
<tbody>
<tr>
<td><strong>Equipment Price</strong></td>
<td>$600</td>
<td>$7,500</td>
<td>$1,650</td>
</tr>
<tr>
<td><strong>Annual Network Fees</strong></td>
<td>NA</td>
<td>$616</td>
<td>$308</td>
</tr>
<tr>
<td><strong>Equipment Cost for 150 vehicles</strong></td>
<td>$90,000</td>
<td>$562,500</td>
<td>$247,500</td>
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<tr>
<td><strong>Annual Network Fees for 150 vehicles</strong></td>
<td>0</td>
<td>$46,200</td>
<td>$46,200</td>
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<tr>
<td><strong>10 Year Equip + Network Cost</strong></td>
<td>$90,000</td>
<td>$1,024,500</td>
<td>$709,500</td>
</tr>
</tbody>
</table>

*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

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Battery Size</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nissan Leaf</td>
<td>24kWh</td>
<td>90 miles</td>
</tr>
<tr>
<td>Chevy Bolt</td>
<td>60 kWh</td>
<td>240 miles</td>
</tr>
<tr>
<td>Tesla Model X</td>
<td>100 kWh</td>
<td>290 miles</td>
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</table>

Charge time assumes 32amp continuous load

L2 charge time: 4 – 6 hrs

L2 charge time: 9 hrs

L2 charge time: 14.5 hrs

(assumes one shift, no overtime)
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 ≠ 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
CITY OWNED VEHICLES ONLY

EXCEPT FOR ELECTRIC VEHICLE CHARGING
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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