PLANNING EV INFRASTRUCTURE FOR YOUR FLEET:

Don’t Overbuild.
Don’t Underbuild.

Fleet Planning for the ZEV Transition
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SHAPING A SMARTER TRANSPORTATION EXPERIENCE™
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AN EMPLOYEE-OWNED COMPANY

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AGENDA

1 / INTRODUCTION

- DKS Electromobility
- Why Electrify?

2 / LESSONS LEARNED

- Project resource needs
- Data collection and analysis
- Project implementation/strategy

3 / FLEET ELECTRIFICATION PLANNING PROCESS

- Evaluate Existing Fleet for Vehicle Electrification
- Evaluate Facility Electrical Capacity
- Determine Future Facility Electrical Upgrade Needs
- Charging Station Options and Budget Estimates
- Project Implementation and Phasing

INTRODUCTION

DKS' ELECTROMOBILITY SERVICES

Fleet Electrification

Comprehensive vehicle and charging infrastructure planning to convert light, medium, and heavy-duty vehicles to electric propulsion.

Transit Electrification

Bus electrification planning including battery charging infrastructure alternatives, electrical substation feasibility, technology planning, operations and environmental review.

EV Charging Infrastructure Planning

Strategic selection of sites for fleet, workplace, residential, public right-of-way, destination, and shared mobility EV charging based on travel demand expertise.

EV Charging Infrastructure Installation Design

Infrastructure design for Level 2, DC Fast, and high-power chargers including cost estimation, construction documentation, coordination with local utilities and EV charging networks.

TRANSPORTATION ELECTRIFICATION SERVICES

DKS Associates, an employee-owned transportation planning and engineering firm, provides a range of smart mobility services for Municipal Governments, Transit Agencies, Utilities & Community Choice Aggregators, Universities, Developers, Property Owners and Managers, and EV Charging Networks.

- **FLEET ELECTRIFICATION**
- **TRANSIT ELECTRIFICATION**
- **EV CHARGING INFRASTRUCTURE PLANNING**
- **EVSE INSTALLATION DESIGN**

WHY ELECTRIFY?

ENVIRONMENTAL BENEFITS

- ✓ Decarbonize Fleet Operations
- ✓ Reduce Criteria Air Pollutants

LOWER VEHICLE TOTAL COST OF OWNERSHIP

- ✓ Light Duty Vehicles
- ✓ Excluding Charging Infrastructure

WHY ELECTRIFY NOW?

ENVIRONMENTAL BENEFITS

- ✓ Decarbonize Fleet Operations
- ✓ Reduce Criteria Air Pollutants

LOWER VEHICLE TOTAL COST OF OWNERSHIP

- ✓ Light Duty Vehicles
- ✓ Excluding Charging Infrastructure

COMPLIANCE WITH CARBON NUTRALITY TARGETS

- ✓ Strategic Climate Action Plan Mandates
- ✓ ZEV Fleet by 2030?

INFRASTUCTURE DEPLOYMENT TIMEFRAMES

- ✓ Project Planning
- ✓ Capital Budgeting
- ✓ Procurement
- ✓ Construction

PREPARE FOR NEW EV OPTIONS AND FUNDING

- ✓ Examples: Ford F-150 Lightning and E-Transit: 2022
- ✓ State, Federal, and Utility Grants and Rebate

LESSONS FROM EXPERIENCE

PLANNING FLEET ELECTRIFICATION:

Lessons from recent projects

Cities:
- S. San Francisco, CA
- Seattle, WA
- Fremont, CA
- Berkeley, CA
- Dublin, CA
- Albany, CA
- Hayward, CA
- Oakland, CA
- Walla Walla, WA
- Bellevue, WA
- Spokane, WA
- Tacoma, WA

Counties:
- King County, WA
- Alameda County, CA

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PLANNING FLEET ELECTRIFICATION:

Lessons from recent projects

1. Engage the correct project stakeholders
2. Scope the project carefully
3. Budget sufficient resources for projects
4. Compile the correct data the first time
5. Engage your local utility early
6. Evaluate alternative charging strategies
7. Consider both operating and capital costs
8. Seek potential revenue opportunities
9. Implement project phasing strategically
10. Be open to new ideas and technologies

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Lesson 1: Engage the correct project stakeholders

Project Team:

1. Resource Conservation Manager, ES OEPS
2. Sustainability Officer, ES Office of Environmental Policy and Sustainability
3. Fleet Manager for General Government Public Works
4. Energy Research & Development lead, Electrical Utility
5. Electrical Vehicle Charging services, Electrical Utility
6. Parking Services Manager, Public Works

Stakeholders:

1. City Manager Office representative
2. Local Public Utilities, Fleet Manager
3. GG Facility Management (PW)
4. Public Venue Event, Operational Management
5. Environmental Services, Solid Waste Operations
6. Environmental Svcs. Wastewater Treatment, Operations & Maintenance Division Manager
7. Environmental Svcs. Facility Management, Center for Urban Waters
8. Finance, Office of Budget and Management
9. Public Works, Street Operations
10. Fire Department, Finance & Planning
11. Police Department, Finance & Planning
12. Planning & Development Services, Code Inspections Supervisor
13. Local Public Utilities, Sustainable Action Team & Facilities Conservation
14. Local Public, Facility Management
15. Local Public, New Services
16. Environmental Svcs. Recovery & Transfer Center, Capital Projects Engineer
17. Environmental Svcs. Central Treatment Plant, Capital Projects Engineer

Lesson 2: Scope the project carefully

Typical fleet client questions:

- How do I replace my fleet with electric vehicles?
- What's the most cost-effective way to charge an EV fleet?
- What are the best locations to install chargers?
- How much will it cost to install charging infrastructure?
- How much will it cost to operate charging infrastructure?
- How do I ensure that my EV fleet keeps charged?
- How do I implement fleet electrification?
- How do I pay for electrification?

Lesson 2: Scope the project carefully

Task 1 Project Management
1.1 Prepare project workplan and Earned Value Analysis
1.2 Meetings and provide meeting minutes
1.3 Provide monthly invoices and progress reports
Task 2 Evaluate Vehicle Fleet for Electrification
2.1 Right-sizing analysis
2.2 Review existing fleet utilization policy and vehicle replacement criteria and timeframe
2.3 Align recommendations with State mandates for consistency
2.4 Evaluate existing fleet inventory
2.5 Identify market-ready Evs
2.6 Evaluate fuel consumption, duty cycle, dwell time and other data
2.7 Provide case studies or recommendations
2.8 Prepare Conceptual Vehicle Replacement Timeframe
Task 3 Evaluate Facility Electrical Capacity
3.1 Review fleet garage electrical drawings
3.2 Review inventory of existing charging stations
3.3 Interview Fleet and Facility staff for vehicle usage, needs and plans for fleet and facility changes
3.4 Review utility bills
3.5 Recommend process for isolating EV electrical consumption from building energy use
3.6 Calculate available electrical capacity and estimate costs to upgrade
3.7 Assess reliability of grid and need for backup power
3.8 Identify potential alternative charging strategies
Task 4 Charging Station Options and Budget Estimates
4.1 Prepare recommendations addressing the most suitable alternative charging strategies
4.2 Identify quantity of EV chargers
4.3 Determine the most optimum locations for installing charging stations
4.4 Conduct field visits to inspect fleet facilities and vet conceptual recommendations
4.5 Estimate costs for multiple EV charging project components
4.6 Develop phasing strategy(s) for implementation of charging infrastructure
4.7 Estimate cost of infrastructure maintenance, replacement costs, and management of stations
Task 5 Prepare Report
5.1 Prepare Draft Report
5.2 Conduct presentation of preliminary findings
5.3 Prepare Final Report
5.4 Conduct presentation of final report and recommendations to agency management

SOURCE: City of Bellevue/DKS

Lesson 3: Budget sufficient resources for projects

	Principal-in-Charge	Electromobility Lead	Project Manager	Senior Project Engineer	Project Engineer	Total DKS Hours by Task	DKS Labor Cost by Task
DKS Standard Billing Rates	$$$$$	$$$$$	$$$$$	$$$$$	$ 155.00		
Task 1 Project Management						41	$8,720.00
1.1 Prepare project workplan and Earned Value Analysis	1	2	6			9	$2,055.00
1.2 Meetings and provide meeting minutes	2	6	12	6	3	29	$6,895.00
1.3 Provide monthly invoices and progress reports			3			3	$630.00
Task 2 Evaluate Vehicle Fleet for Electrification						143	$25,170.00
2.1 Right-sizing analysis		3	8	8	16	35	$6,130.00
2.2 Review existing fleet utilization policy and vehicle replacement criteria and timeframe		2	4		12	18	$3,280.00
2.3 Align recommendations with State mandates for consistency		2	4		6	12	$2,270.00
2.4 Evaluate existing fleet inventory			2	4	8	14	$2,380.00
2.5 Identify market-ready EVs		1	2	4	4	11	$1,930.00
2.6 Evaluate fuel consumption, duty cycle, dwell time and other data		1	2	4	16	23	$3,730.00
2.7 Provide case studies or recommendations		2	4		6	12	$2,270.00
2.8 Prepare Conceptual Vehicle Replacement Timeframe		2	4	4	8	18	$3,220.00
Task 3 Evaluate Facility Electrical Capacity						124	$22,280.00
3.1 Review fleet garage electrical drawings			2	12		14	$2,340.00
3.2 Review inventory of existing charging stations		1	2		8	11	$1,910.00
3.3 Interview Fleet and Facility staff for vehicle usage, needs and plans for fleet and facility changes		6	12	18	16	44	$8,100.00
3.4 Review utility bills			4	6		10	$1,880.00
3.5 Recommend process for installing EV electrical consumption from building energy use		2	2	6		10	$1,880.00
3.6 Calculate available electrical capacity and estimate costs to upgrade			2	8	4	14	$2,320.00
3.7 Assess reliability of grid and need for backup power		1	2	8		11	$1,850.00
3.8 Identify potential alternative charging strategies		2	4	4		10	$1,380.00
Task 4 Charging Station Options and Budget Estimates						133	$25,025.00
4.1 Prepare recommendations addressing the most suitable alternative charging strategies			4	4		12	$2,460.00
4.2 Identify quantity of EV chargers			2	4	12	18	$2,320.00
4.3 Determine the most optimum locations for installing charging stations		2	4		8	14	$2,580.00
4.4 Conduct field visits to inspect fleet facilities and set conceptual recommendations		6	12		18	36	$6,840.00
4.5 Estimate costs for multiple EV charging project components	1	2	8	2	8	21	$4,035.00
4.6 Develop phasing strategy(s) for implementation of charging infrastructure		2	4		8	14	$2,580.00
4.7 Estimate cost of infrastructure maintenance, replacement costs, and management of stations		2	12		4	18	$3,540.00
Task 5 Prepare Report						109	$21,585.00
5.1 Prepare Draft Report	2	16	12	4	28	54	$10,850.00
5.2 Conduct presentation of preliminary findings	1	2	6	4	4	17	$3,345.00
5.3 Prepare Final Report	1	4	8	2	12	27	$5,155.00
5.4 Conduct presentation of final report and recommendations to agency management	1	2	4	2	2	11	$2,265.00
Sub-Total						550	$102,780.00
Expenses							
Mileage, lodging & Per diem (88 miles for 438-mile round trips at $0.55/mile)							$44.80
Grand Total							$102,824.80

SOURCE: City of Bellevue/DKS

Lesson 4: Compile the correct vehicle data the first time

Fleet vehicle inventory questions:

- Inventory of vehicles by year, make, model, fuel type, VIN
- Current odometer readings
- Vehicle fuel consumption records
- Duty cycle data
- Planned vehicle replacement schedule and expected service life (miles and/or or years)
- Recent and anticipated fleet acquisitions by make & model
- Daily hours of use/Nightly vehicle dwell times
- Special travel behavior (Long trips, heavy or parasitic load) not shown in the fleet data spreadsheet.
- Existing and planned auxiliary equipment (parasitic electrical loads)
- Loaded hourly rate for parking facility (if available) to move vehicles for shared chargers

Lesson 4: Compile the correct vehicle data the first time

More fleet vehicle inventory questions:

- Vehicle O&M cost data
- Specialized vehicle needs (eg. AWD or other special equipment)
- Seasonality (eg. Snow plows?) If so, provide data on usage.
- Operating days/year - (Assume 260?)
- Idling time of frequently or long-idling vehicles
- Any preferred EV makes (e.g Ford, Nissan, GM, Tesla)?
- Preferred purchasing contract (e.g. state contract, Sourcewell, other?)
- Assigned parking location name and address
- Relevant City fleet policies, plans, or studies
- Plans for phasing out/decommissioning/replacement of vehicles, including per site, current and potential (next 5 years).

Lesson 4: Compile the correct facilities data the first time

Fleet facilities inventory questions:

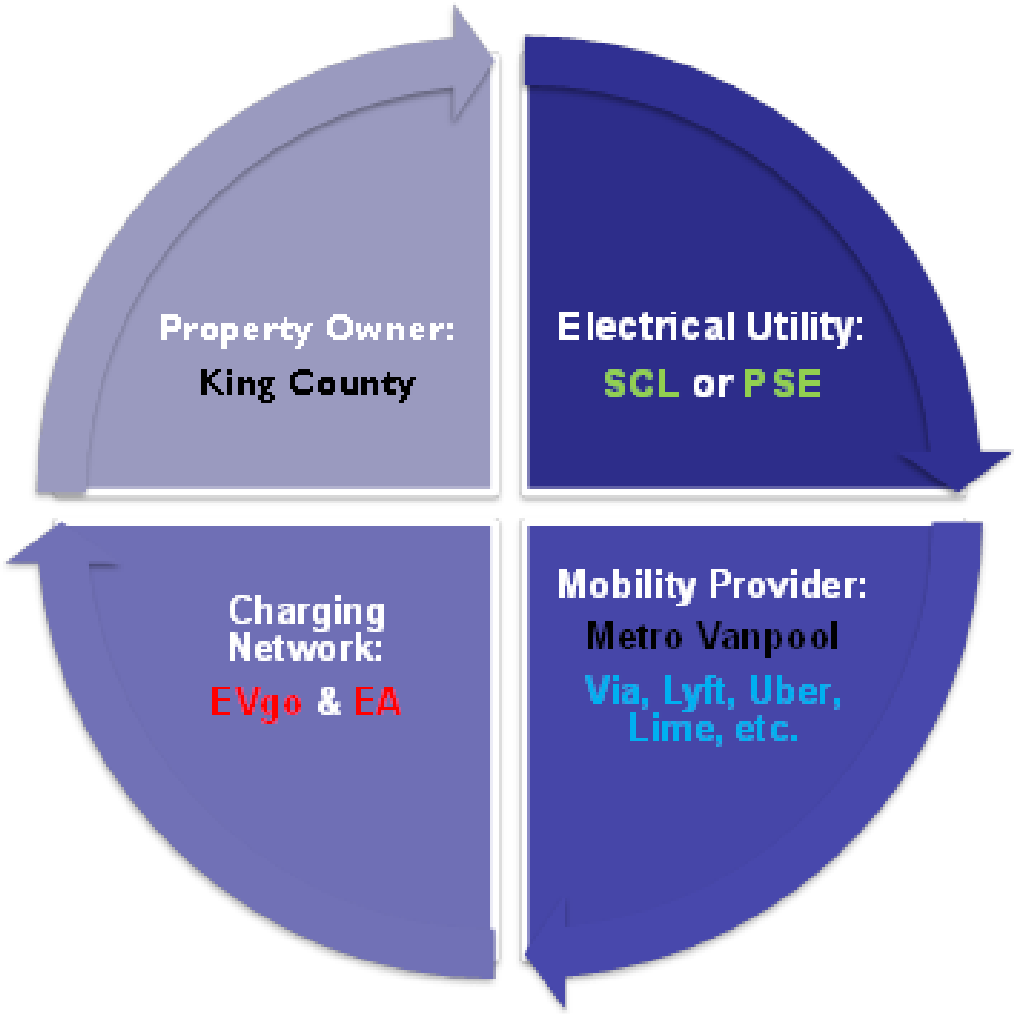
- Number of parking stalls by fleet domicile parking lot or garage
- Existing electrical service: load data (data logging) and/or electric bills to determine available electrical capacity and peak load demand
- Relevant parking facility as-built drawings (electrical, civil, signing and architectural)
- Status of facility ownership: owned or leased (and duration of lease)
- Plans for major facility upgrades, closures or replacement that would impact electrical service
- Contacts, phone, and email for facility managers
- List of Electric Vehicle Supply Equipment (EVSE) installed or planned for near-term installation at each site. Include itemization of connector types, and user interfaces for payment.
- Any preferred charger Vendors? (Eg. ChargePoint, Greenlots and Siemens)

Lesson 4: Compile the correct facilities data the first time

More fleet facilities inventory questions:

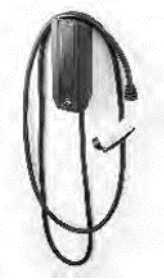
- Preferred purchasing contract for charger pricing (State contract or Sourcewell)
- Utility bills that show both kWh and kW consumption for both facilities
- Insurance (eg. Does fleet have or need insurance policy that covers the potential vandalism of the charging equipment?)
- Quanity, makes and models of existing and/or planned EV chargers
- Parking/charging access (limited to fleet vehicles, employers, members of the public)
- Fee structure of expanding electrical service per kWh
- Known fixed costs in supplying additional electrical service if projected loads from new chargers exceed capacity.
- Contacts, phone, and email for utility

Lesson 5: Engage your local utility early

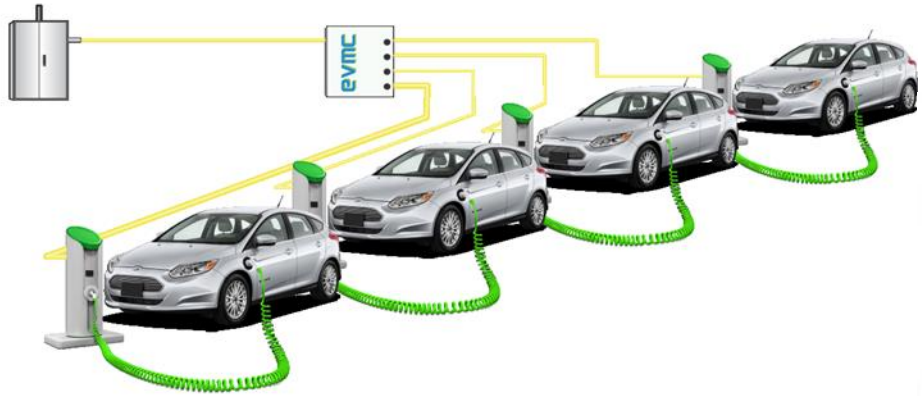


SOURCE: KC Metro Transit/DKS

Lesson 6: Evaluate alternative charging strategies



1. Dedicated Level 1 & Level 2 chargers
2. Dedicated & Level 2 chargers with load management
3. Shared Level 2 chargers with load management
4. Shared DC Fast Chargers
5. Mobile chargers



Lesson 7: Consider both operating and capital costs

Scenario 2. Dedicated L2 chargers with load management

INPUT | OUTPUT

Facility	Incremental Electricity Expenses												
	Electricity Rate						Daily EV Consumption		Monthly Expense				Annual Estimate (12 months)
	Utility Provider	Approximate Current Max Demand (kW) (1)	Current Rate Tier	Expected Rate Tier with EV Chargers	Energy Charge (per kWh) (4)	Demand Charge (per kW)	Energy (kWh)	Max Demand Increase (kW) (7)	Energy Charge (8)	Demand Charge	Power Factor Charge (9)	Monthly Subtotal	
Black River	PSE	~400	Large demand general service (>350kW)	same	0.0656	10.48 (5)	133.7	33.0	$ 192.8	$ 345.8	$ 69.2	$ 608	$ 7,294
Chinook	SCL (Downtown)	360	Medium (50-999kW)	same	0.0987	8.63	568.4	72.6	$ 1,234.3	$ 626.5	$ 125.3	$ 1,986	$ 23,834
Goat Hill	SCL (Downtown)	60	Medium (50-999kW) (2)	same	0.0987	8.63	1114.0	224.4	$ 2,418.9	$ 1,936.6	$ 387.3	$ 4,743	$ 56,914
KCCF	SCL (Downtown)	~400	Medium (50-999kW)	same	0.0987	8.63	386.2	39.6	$ 838.7	$ 341.7	$ 68.3	$ 1,249	$ 14,985
MRJC	PSE	<150	Small demand general service (50-350kW)	same	0.0719	8.68 (5)	1041.3	116.4	$ 1,647.0	$ 1,010.4	$ 202.1	$ 2,859	$ 34,313
King Street Center	SCL (Seattle)	910	Medium (50-999kW) (3)	Large (1,000 - 9,999 kW)	0.0756 (6)	2.06 (6)	1839.5	316.8	$ 3,059.5	$ 652.6	$ 130.5	$ 3,843	$ 46,112

1. Historical electricity bills available at Chinook, Goat Hill & King Street Center facilities; current maximum demand at other locations inferred from current connected loads
2. Occasional Small Demand (<50 kW)
3. Occasional Large Demand (1,000 - 9,999 kW)
4. Seattle City Light Electricity Rates. https://www.seattle.gov/city-light/business-solutions/business-billing-and-account-information/business-rates#seattlebusinesses
   Puget Sound Energy Electricity Rates. https://www.pse.com/-/media/Project/PSE/Portal/Rate-documents/summ_elec_prices_2021_01_01.pdf
5. Assume the average of winter and summer rates
6. Assume the average of peak and off-peak rates
7. Assume electrical demand (kW) is 80% of kVA consumption due to efficiency loss
8. Assume 22 working days per month
9. Assume 20% power factor surcharge based on the demand charge

Facility	Annual Depreciation, Maintenance, Labor and Other Expenses														
	Chargers					Additional Load Management Equipment (3)			Preventive maintenance, wear & tear, and repair (4)	Vandalism and insurance (5)	Staffing (6)			Miscellaneous		Total
	Types	Quantity (charging ports)	Charging Ports per Station (2)	Average Charging Station Cost (2)	Annual Depreciation (2)	Required Number of Units	Average Equipment Unit Cost	Annual Depreciation			Loaded Hourly Rate	Annual Labor Hour Estimate	Annual Cost	Network Fee (7)	Parking Revenue Loss (8)	
Black River	6.6 kW	17	2	$ 1,500	$ 1,400	3	$ 4,100	$ 1,900	$ 1,100	$ -	$ 67.81	20	$ 1,400	$ 1,000	$ -	$ 6,800
Chinook	6.6 kW	35	2	$ 1,500	$ 2,700	5	$ 4,100	$ 3,100	$ 2,000	$ -	$ 67.81	20	$ 1,400	$ 1,000	$ -	$ 10,200
Goat Hill	6.6 kW	134	2	$ 1,500	$ 10,100	17	$ 4,100	$ 10,500	$ 6,900	$ -	$ 67.81	40	$ 2,800	$ 1,000	$ -	$ 31,300
KCCF	6.6 kW	15	2	$ 1,500	$ 1,200	2	$ 4,100	$ 1,300	$ 900	$ -	$ 67.81	20	$ 1,400	$ 1,000	$ -	$ 5,800
MRJC	6.6 - 19.2 kW (1)	14	1	$ 3,500	$ 4,900	0	$ -	$ -	$ 1,700	$ -	$ 67.81	20	$ 1,400	$ 1,000	$ -	$ 9,000
King Street Center	6.6 kW	189	2	$ 1,500	$ 14,300	24	$ 4,100	$ 14,800	$ 9,700	$ -	$ 67.81	40	$ 2,800	$ 1,000	$ -	$ 42,600

1. Assume ten 6.6 kW and four 19.2 kW Blink chargers at MRJC (scenario 2 only).
2. Each charging station may include one or multiple charging ports. Assume $1,500 per station for 6.6 kW Clipper Creek chargers (dual-port) and $3,500 per station for 6.6 - 19.2 kW Blink chargers (single port) and 10 year lifespan.
3. Additional load management equipment and/or software may or may not be required depending on charger type (required for Clipper Creek chargers but not required for Blink chargers under Scenario 2). Assume $4,100 per unit (Cyber Switching), each unit supports up to 8 chargers, and 5-7 years lifespan.
4. Assume maintenance and repair annual expenses to be around 1/3 of annual depreciation or about 3-5% of charger and EVMC costs; it factors in 2-3 years of warranty; consistent with low maintenance expectation of Level 2 EVSE (https://afdc.energy.gov/files/u/publication/evse_cost_report_2015.pdf)
5. Assume vandalism insurance covered by King County insurance policy
6. Staff hourly rate provided by King County; labor includes general management of chargers, training, maintenance coordination, billings, as well as vehicle rotation if applicable.
7. Assume $1,000 per year per site. https://afdc.energy.gov/files/u/publication/evse_cost_report_2015.pdf

SOURCE: King County Facilities Management Division/DKS

Lesson 7: Consider both operating and capital costs

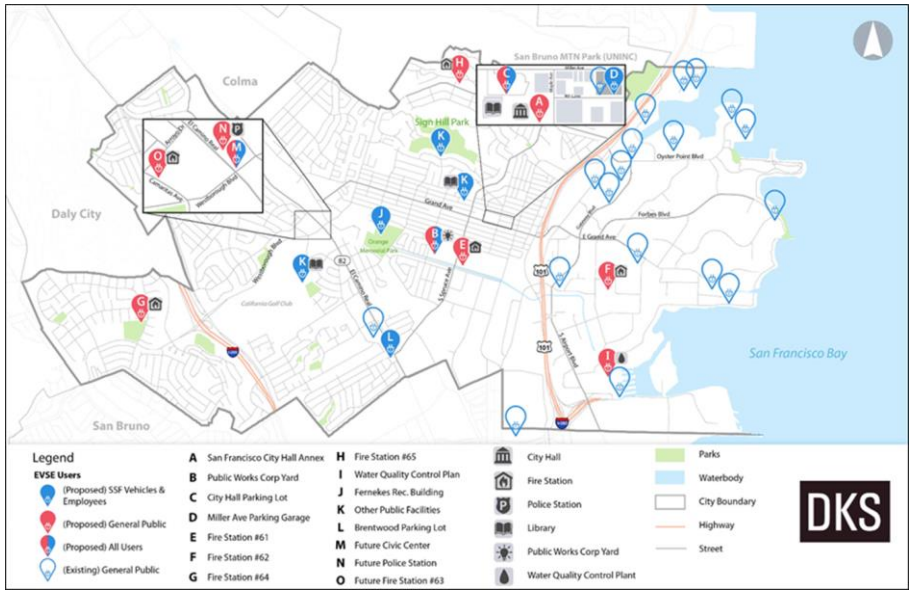
Hub	Facility Type	Parking Location	Total # of Vehicles to be Electrified	Ownership	Daily Required EV Energy (kWh/day)	Dwell Time (hrs)		Total Existing Chargers		Existing Chargers Available		Scenario 1				Scenario 2			Scenario 3 # of Chargers using Charger Sharing			Supplemental Charging	Proposed Connected Load (kVA)			
						Minimum	Maximum	# of L2 Chargers	# of DCFC	For Fleet	For Public	# of Level 1 Chargers (1.4k W	# of Level 2 Low Output Chargers (6.6 kW	# of Level 2 Medium Output Chargers (12.0 kW	# of Level 2 High Output Chargers (19.2 kW	# of Low Output L2 Chargers using Load Management	# of Medium Output L2 Chargers using Load Management	# of High Output L2 Chargers using Load Manageme	# of Low Output L2 (6.6 kW)	# of Medium Output L2 (12 kW	# of High Output L2 (19.2 kW)	# of DC Chargers	Scenario 1	Scenario 2	Scenario 3	DCFC
Alameda	Large	1141 Harbor Bay Pkwy, Alameda	67	Alameda	669.4	12.0	22.2	12	-	9	3	62	5	-	-	67	-	-	20	-	-	-	147.3	119.6	90.8	-
Oakland	Large	1111 Jackson St, Oakland	48	Alameda	848.6	12.0	22.6	-	-	-	-	32	16	-	-	48	-	-	28	-	-	-	208.0	99.0	231.0	-
	Small	1401 Lakeside Dr, Oakland	13	Alameda	225.6	8.0	8.0	-	-	-	-	3	10	-	-	13	-	-	5	-	-	-	89.6	76.3	41.3	-
	Hub	165 13th St, Oakland	221	Alameda	3512.0	12.0	16.4	41	1	12	29, 1 DCFC	125	96	-	-	221	-	-	127	-	-	3	989.9	1823.3	948.8	187.50
	Small	2000 San Pablo Ave, Oakland	1	Leased	8.9	17.0	17.0	-	-	-	-	1	-	-	-	1	-	-	1	-	-	-	2.4	8.3	8.3	-
	Small	400 Broadway, Oakland	1	Leased	3.2	17.5	17.5	-	-	-	-	1	-	-	-	1	-	-	1	-	-	-	2.4	8.3	8.3	-
	Small	585 7th St, Oakland	20	Alameda	284.2	12.0	19.6	18	-	9	9	13	7	-	-	20	-	-	10	-	-	-	30.9	22.7	8.3	-
	Small	7200 Bancroft Ave, Oakland	16	Leased	172.8	12.0	21.9	-	-	-	-	15	1	-	-	16	-	-	6	-	-	-	43.9	33.0	49.5	-
	Large	2425 E 12th St, Oakland	104	Leased	2320.88	8.0	8.0	-	-	-	-	33	54	13	4	84	16	4	43	12	3	-	814.9	257.3	606.8	-
	Small	8000 Capwell Dr, Oakland	1	Leased	10.8	13.3	13.3	-	-	-	-	-	1	-	-	1	-	-	1	-	-	-	8.3	8.3	8.3	-
San Leandro	Small	15200 Foothill Blvd, San Leandr	1	Alameda	5.6	20.9	20.9	-	-	-	-	1	-	-	-	1	-	-	1	-	-	-	2.4	8.3	8.3	-
	Small/Hub	15800 Foothill Blvd, San Leandr	9	Alameda	364.8	12.0	19.6	-	-	-	-	2	-	-	7	2	-	7		-	3	1	172.8	51.5	72.0	62.50
	Small	2000-2020 150th Ave, San Leand	5	Alameda	43.7	12.0	20.0	-	-	-	-	4	1	-	-	5	-	-	2	-	-	-	17.8	16.5	16.5	-
	Small	2050 Fairmont Dr, San Leandro	10	Alameda	133.8	12.0	17.1	2	-	1	1	7	3	-	-	10	-	-	4	-	-	-	33.1	24.8	24.8	-
	Hub	2054 Fairmont Dr, San Leandro	74	Alameda	836.4	12.0	23.9	-	-	-	-	57	17	-	-	74	-	-	27	-	-	1	275.6	156.8	222.8	62.50
	Small	2100-2500 Fairmont Dr, San Lea	14	Alameda	171.6	12.0	20.5	9	-	6	3	12	2	-	-	14	-	-	6	-	-	-	28.5	33.0	0.0	-
	Large	2150-2500 Fairmont Dr, San Lea	26	Alameda	313.43	12.0	21.5	-	-	-	-	20	6	-	-	26	-	-	12	-	-	-	97.0	57.8	99.0	-
Fremont	Small	2400 Stevenson Blvd, Fremont	7	Leased	190.9	12.0	19.7	-	-	-	-	3	4	-	-	7	-	-	3	-	-	-	40.1	16.5	24.8	-
Hayward	Small	22225 Foothill Blvd, Hayward	3	Leased	46.0	12.0	19.0	-	-	-	-	2	1	-	-	3	-	-	2	-	-	-	13.0	8.3	16.5	-
	Small	24085 Amador St, Hayward	9	Alameda	75.0	10.0	23.2	-	-	-	-	9	-	-	-	9	-	-	2	-	-	-	21.4	24.8	16.5	-
	Hub	24360 Amador St Parking Lot, Ha	79	Alameda	854.7	12.0	16.8	12	-	9	3	69	10	-	-	79	-	-	30	-	-	2	172.1	148.5	173.3	125.00
	Small	159 W Winton Ave, Hayward	5	Alameda	30.8	12.0	12.0	-	-	-	-	4	1	-	-	5	-	-	2	-	-	-	17.8	16.5	16.5	-

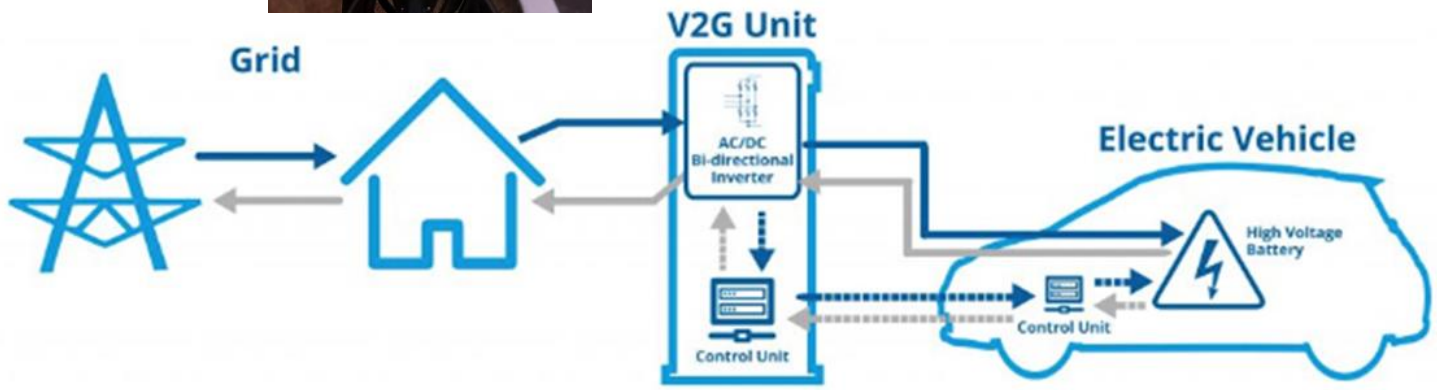
Total Connected Load (kVA)			CONSTRUCTION COSTS																				
			Scenario 1							Scenario 2						Scenario 3							
Scenario 1 + DCFC	Scenario 2 + DCFC	Scenario 3 + DCFC	Level 1 Chargers	Level 2 Low Output Chargers		Level 2 Medium Output Chargers		Level 2 High Output Chargers		Level 2 Low Output Chargers		Level 2 Medium Output Chargers		Level 2 High Output Chargers		Level 2 Low Output Chargers		Level 2 Medium Output Chargers		Level 2 High Output Chargers		DCFC
				Chargepoint	Mobi	Chargepoint	Mobi	Nuvve	Mobi	Chargepoint	Mobi	Chargepoint	Mobi	Nuvve	Mobi	Chargepoint	Mobi	Chargepoint	Mobi	Nuvve	Mobi	
147.3	119.6	90.8	$260,400	-	-	-	-	-	-	$2,863,600	-	-	-		-	$535,700	-	-	-	-	-	-
208.0	99.0	231.0	$134,400	$779,200	-	-	-	-	-	$2,368,800	-	-	-			$1,363,600	-	-	-	-	-	-
89.6	76.3	41.3	$12,600	$368,000	-	-	-			$488,800	-	-	-	-			-	$36,805	-	-	-	-
1177.375	2010.75	1136.25	$525,000	$4,090,800	-	-	-			$10,316,100	-	-	-			$5,600,500	-		-	-	-	$234,000
2.4	8.3	8.3	$4,200	-	-	-	-	-	-	-	$118,900	-	-	-	-	-	$118,900	-	-	-	-	-
2.4	8.3	8.3	$4,200	-	-	-	-	-	-	-	$118,900	-	-	-	-	-	$118,900	-	-	-	-	-
30.9	22.7	8.3	$54,600	-	-	-	-	-		$412,600	-	-	-	-			-	$36,810	-	-	-	-
43.9	33.0	49.5	$63,000	-	$118,900	-	-	-	-	-	$1,902,400	-	-	-	-	-	$713,400	-	-	-	-	-
814.9	257.3	606.8	$138,600	-	$6,420,600	-	$1,545,700	-	$475,600	-	$9,987,600	-	$1,902,400		$475,600	-	$5,112,700	-	$1,426,800	-	$475,600	-
8.3	8.3	8.3	-	-	$118,900	-	-	-	-	-	$118,900	-	-	-	-	-	$118,900	-	-	-	-	-
2.4	8.3	8.3	$4,200	-	-	-	-	-	-	$39,400	-	-	-	-	-		-	$36,801	-	-	-	-
235.25	113.95	134.5	$8,400	-	-	-	-	$260,400	-	$76,200	-	-	-	$260,400	-		-	$36,800	-	$111,600	-	$78,000

SOURCE: Alameda County/DKS

Lesson 8: Seek potential revenue opportunities

- Grants and rebates
- Charging fees from other charger users
- LCFS credit sales
- Grid services





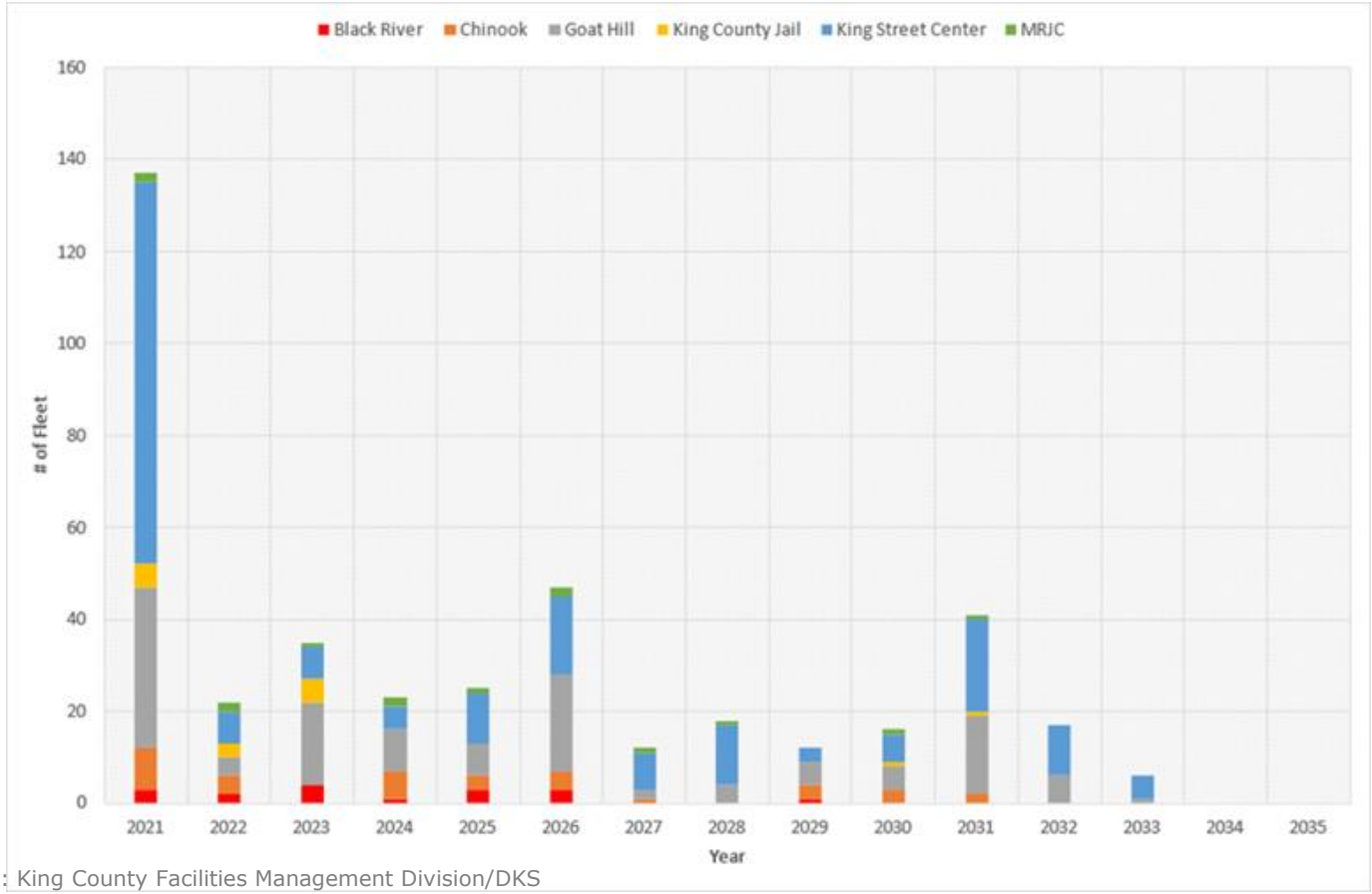
Lesson 9: Implement project phasing strategically

- Delay replacement of M-D & H-D vehicles

Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8
	Envirotech Urban Truck 		GreenPower EV Star CarGOVan		Kenworth K370E	
Ford Transit		Lightning Systems Ford E-450		BYD 6D Step Van		Freightliner eCascadia116/ 126
						

Lesson 9: Implement project phasing strategically

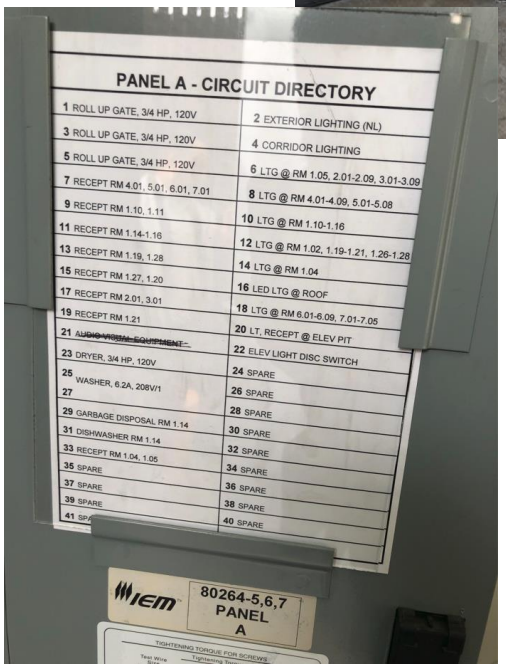
- Phase-in charging infrastructure over time and if possible as part of other electrification projects



SOURCE: King County Facilities Management Division/DKS

Lesson 9: Implement project phasing strategically

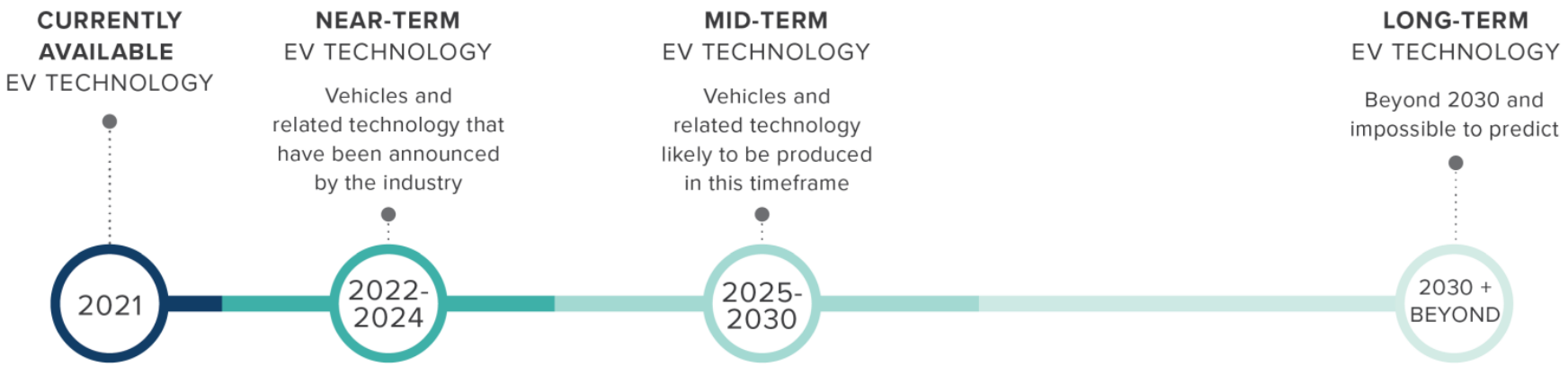
- Plan for flexibility and capacity expansion



SOURCE: City of Berkeley/DKS

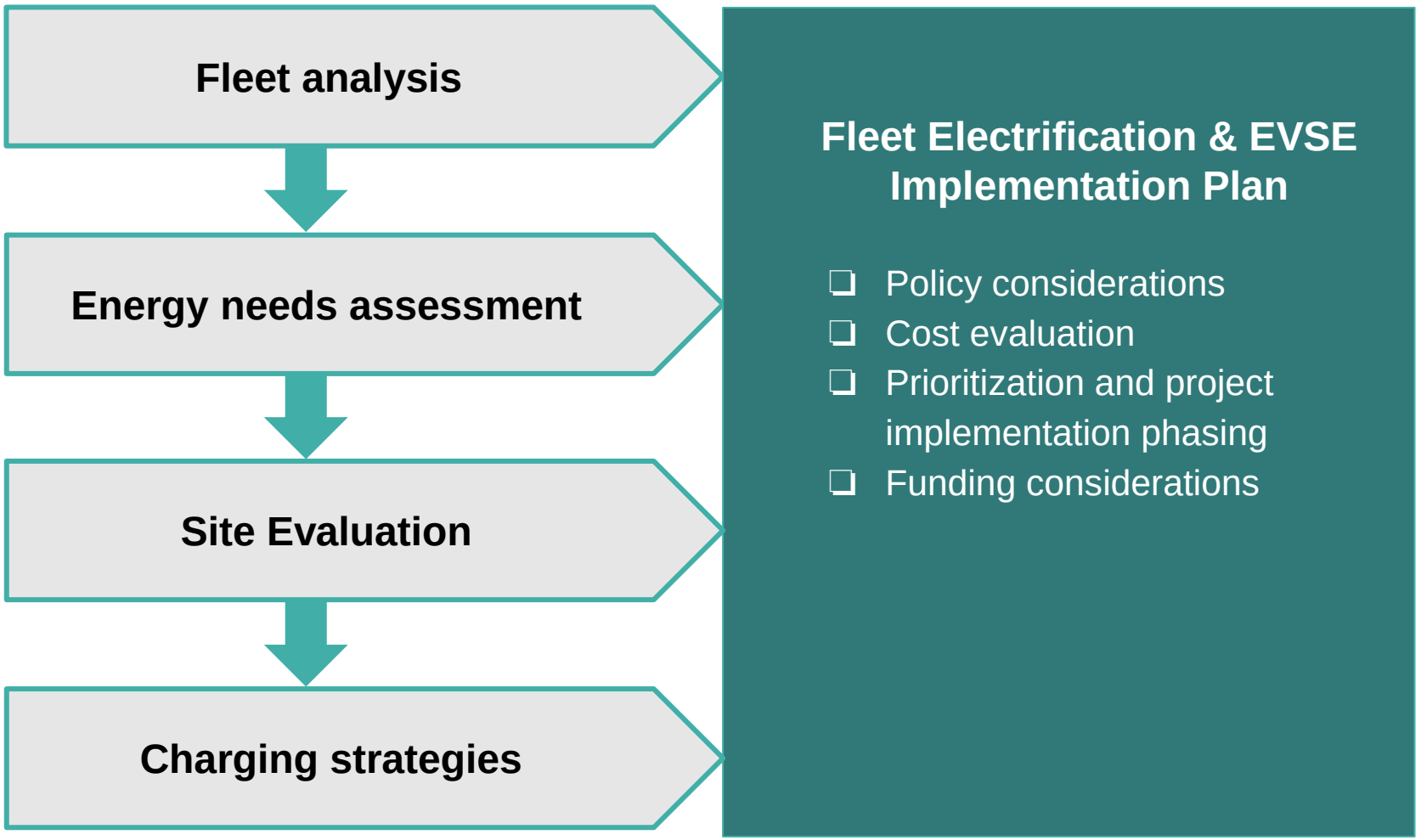
Lesson 10: Be open to new ideas and technologies

- Fleet right-sizing
- Shared chargers
- Infrastructure-as-a-Service
- Bidirectional charging
- Automated charging



FLEET ELECTRIFICATION PLANNING

EVSE INFRASTRUCTURE PLANNING PROCESS



CONCEPTUAL SCOPE OF WORK

Roadmap for planning electrified fleet and charging facilities:

Task 1 / Project Management

Task 2 / Evaluate Existing Fleet for Vehicle Electrification

Task 3 / Evaluate Facility Electrical Capacity

Task 4 / Charging Station Options and Budget Estimates

Task 5 / Compile Recommendations & Prepare Report

Task 1 / Project Management

Keep the project focused, on-schedule, within budget and high quality

1.1 Prepare project workplan and Earned Value Analysis

1.2 Meetings and provide meeting minutes

1.3 Provide monthly invoices and progress reports

Task 2/
Evaluate Vehicle Fleet for Electrification

Estimate EV fleet's peak energy requirements during charging

2.1 Perform fleet right-sizing analysis

2.2 Review existing fleet utilization policy and vehicle replacement criteria and timeframe

2.3 Align recommendations with regulatory mandates for consistency

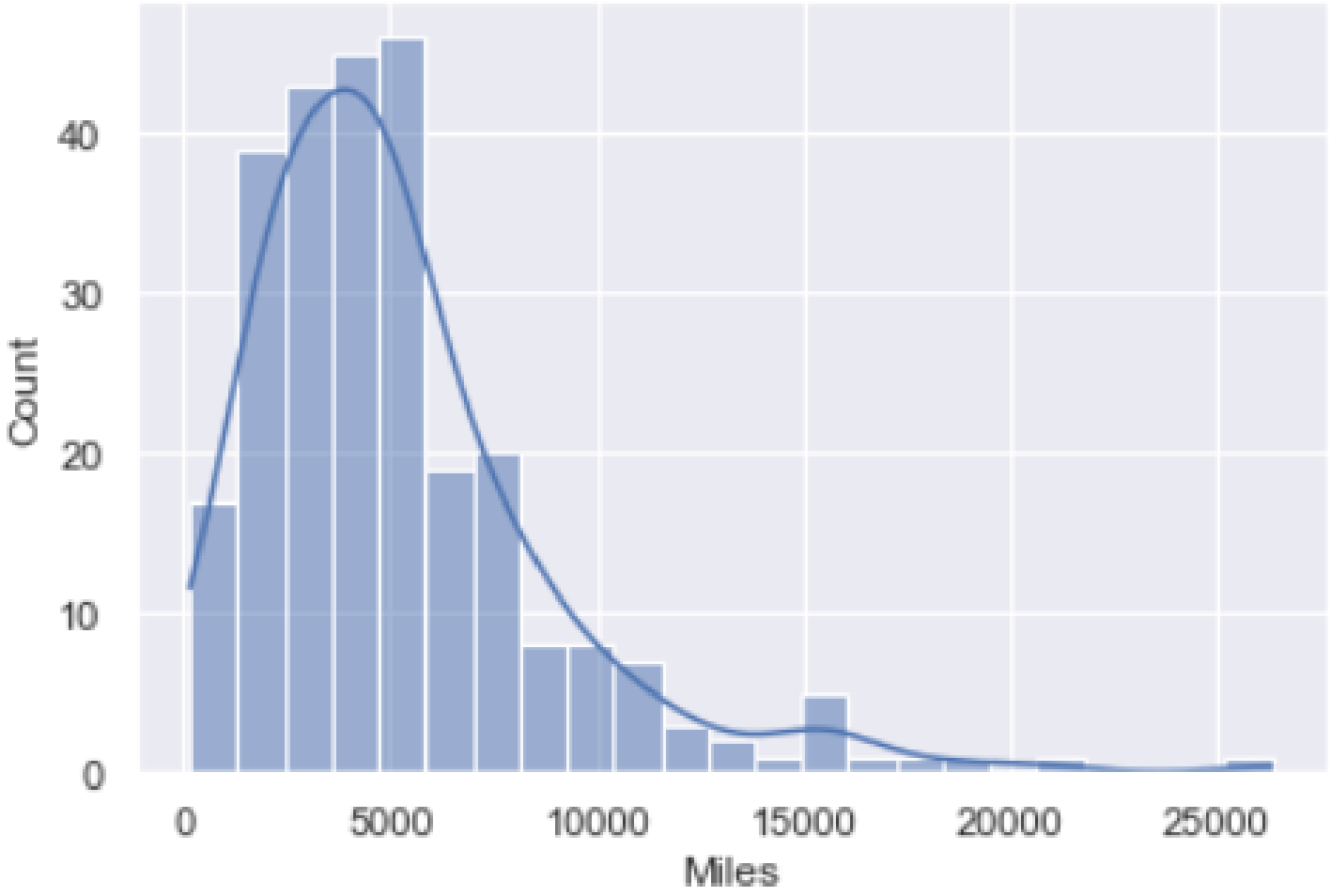
2.4 Evaluate existing fleet inventory

2.5 Identify market-ready EVs

2.6 Evaluate fuel consumption, duty cycle, dwell time and other data

FLEET RIGHT SIZING ANALYSIS

Optimize fleet by vehicle utilization



SOURCE: City of Bellevue/DKS

POLICY & FUNDING CONSIDERATIONS

- Advanced Clean Truck Rule increases ZEV sales by vehicle class through 2035.
- City of Seattle - 100% fossil free by 2030.
- City of Berkeley - Council directive to prepare electrification Action Plan by June 2020.
- City of Dublin - Climate Action Plan and Green Fleet Policy.
- Major EVSE infrastructure incentives likely from California Energy Commission for FY 2021-2024.

MANY JURISDICTIONS ARE ADOPTING CLIMATE ACTION PLANS AND/OR POLICIES TO REDUCE GHG EMISSIONS

AVAILABILITY OF FUNDING ALSO DRIVES STAGING AND IMPLEMENTATION

FLEET VEHICLE ANALYSIS: DATA SOURCES

- Main Data Sources
  - Fuel records
  - Maintenance records
  - Fleet asset inventory
  - Interviews with fleet managers

- Supplementary Data Sources
  - Auxiliary equipment data
  - Fuel purchase reports
  - Cost and quantity reports
  - Telematics data
  - Vehicle Purchase incentives
  - Interviews with fleet and facilities staff

SAMPLE VEHICLE DATABASE

B	C	D	E	F	G	H	I	J
Equipment ID	VIN	Make	Model	Model Year	Purchase Year	Purchase Pice	Aux. Eq. Cost	Total Price
213011	JTDKN3DP4D3039813	TOYOTA	PRIUSPLUGIN	2013	2013	$ 43,075	$ -	$ 43,075
27025	JTNBB46K673041028	TOYOTA	CAMRY	2007	2007	$ 27,074	$ 500	$ 27,574
219049	1FMCU0F76KUC35113	FORD	ESCAPE FWD	2019	2019	$ 21,026	$ -	$ 21,026
29027	1FMNE11L59DA68897	FORD	E150 8 PASS VAN	2009	2009	$ 21,630	$ 500	$ 22,130
212005	NM0KS9CN6CT091628	FORD	TC WAGON	2012	2012	$ 24,580	$ -	$ 24,580
216025	1FTYR2CM2GKB25096	FORD	TRANSIT250MRCRG	2016	2016	$ 25,973	$ 8,481	$ 34,454
219046	2T3LWRFV5KW010623	TOYOTA	RAV 4 HYBRID LE	2019	2019	$ 29,990	$ -	$ 29,990
210001	3FAHPOHG4AR127695	FORD	FUSION	2010	2009	$ 19,577	$ -	$ 19,577
210531	2FABP7BV8AX143955	FORD	CROWN VICTORIA	2010	2010	$ 27,217	$ -	$ 27,217
211005	1FMCU4K3XBKA50651	FORD	ESCAPE HYBRID	2011	2010	$ 33,263	$ -	$ 33,263
211006	1FMCU4K31BKA50652	FORD	ESCAPE HYBRID	2011	2010	$ 33,263	$ -	$ 33,263
211007	1FMCU4K3XBKA56837	FORD	ESCAPE HYBRID	2011	2010	$ 33,263	$ -	$ 33,263
211008	1FMCU4K31BKA56838	FORD	ESCAPE HYBRID	2011	2010	$ 33,263	$ -	$ 33,263
211009	1FMCU4K33BKA56839	FORD	ESCAPE HYBRID	2011	2010	$ 33,263	$ -	$ 33,263
211010	1FMCU4K3XBKA56840	FORD	ESCAPE HYBRID	2011	2010	$ 33,263	$ -	$ 33,263
211011	1FMCU4K31BKA56841	FORD	ESCAPE HYBRID	2011	2010	$ 33,263	$ -	$ 33,263
211012	1FMCU4K33BKA56842	FORD	ESCAPE HYBRID	2011	2010	$ 33,263	$ -	$ 33,263
211013	1FMCU4K35BKA56843	FORD	ESCAPE HYBRID	2011	2010	$ 33,263	$ -	$ 33,263
211014	2FABP7BVXBX112918	FORD	CROWN VICTORIA	2011	2011	$ 24,444	$ -	$ 24,444
211015	2FABP7BV1BX112919	FORD	CROWN VICTORIA	2011	2011	$ 24,444	$ 290	$ 24,734
211016	2FABP7BV8BX112920	FORD	CROWN VICTORIA	2011	2011	$ 24,444	$ -	$ 24,444
211018	3FAHPOHG4BR173593	FORD	FUSION	2011	2011	$ 20,415	$ -	$ 20,415
211019	3FAHPOHG6BR173594	FORD	FUSION	2011	2011	$ 20,415	$ -	$ 20,415
211020	3FAHPOHG8BR173595	FORD	FUSION	2011	2011	$ 20,415	$ -	$ 20,415
211502	2FABP7BV7BX167956	FORD	CROWN VICTORIA	2011	2012	$ 26,977	$ -	$ 26,977
211506	2FABP7BV2BX167959	FORD	CROWN VICTORIA	2011	2012	$ 26,977	$ -	$ 26,977

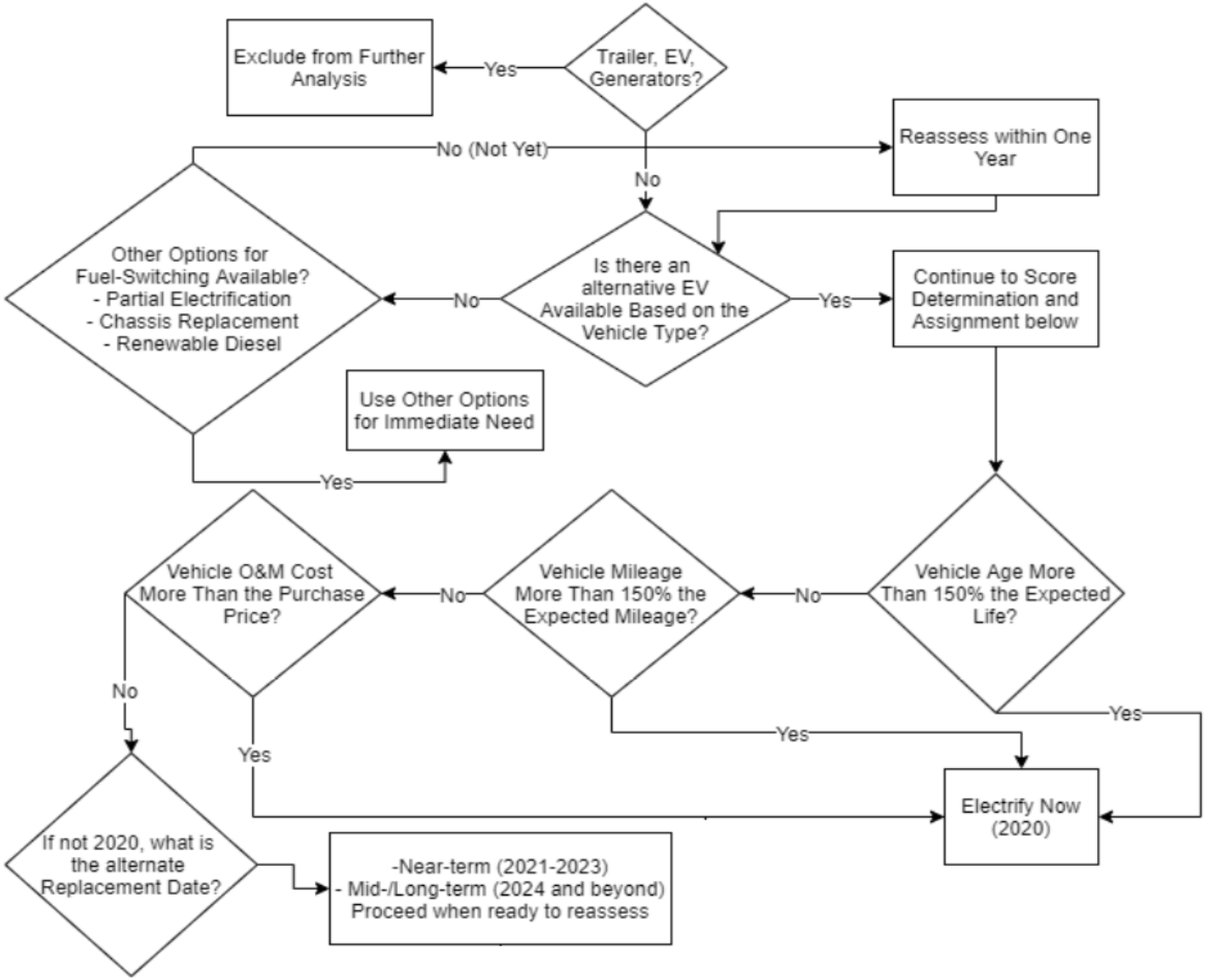
SOURCE: City of Fremont/DKS

FLEET VEHICLE CHARGING ANALYSIS

Division	Domiciled	EER	Baseline Fuel	Fuel Use (GGE or DGE/day)	EV Energy Requirement (kWh/day)	Dwell Time (hours/day)	Minimum Charging Rate (kW)	Likely Charging Standard
Police Patrol	2100 Martin Luther King Jr Way,	3.4	Gasoline	0.1	0.7	14	0.05	L2
Aids Program	830 Unitversity Ave	3.4	Gasoline			12		
Police Services	2100 Martin Luther King Jr Way,	3.4	Gasoline	0.5	5.3	12	0.45	L2
Parks Facilites	1326 Allston Way, Corp Yard	3.4	Gasoline	2.1	20.6	12	1.72	L2
ENGINEERING	2025 Center St. Parking Garage	3.4	Gasoline	0.3	2.9	14	0.21	L2
Marina Maint.	201 University Ave	3.4	Gasoline	1.2	12.2	14	0.87	L2
Marina Maint.	201 University Ave	3.4	Gasoline	1.3	13.1	14	0.94	L2
Equip Maint Corpyrd	1326 Allston Way, Corp Yard	3.4	Gasoline	1.9	18.9	14	1.35	L2
Parks Facilites	1326 Allston Way, Corp Yard	3.4	Gasoline	2.6	25.9	14	1.85	L2
Forestry	1326 Allston Way, Corp Yard	3.4	Gasoline	2.6	25.1	14	1.79	L2
Abandoned Vehicles	2025 Center St. Parking Garage	3.4	Gasoline	1.2	11.8	14	0.84	L2
Sanitary Sewer	2025 Center St. Parking Garage	3.4	Gasoline	0.7	7.3	14	0.52	L2
Equip Maint Pool	1326 Allston Way, Corp Yard	3.4	Gasoline	0.4	3.6	14	0.26	L2
Equip Maint Pool	1521 University Ave	3.4	Gasoline	0.7	6.6	14	0.47	L2
Fire/Supp/Rescue/Haz	2680 Shattuck Ave - Sta 5	3.4	Gasoline	0.6	6.1	8	0.76	L2
Fire/Supp/Rescue/Haz	1101 Folger Fire Warehouse	5	Diesel			8		
Marina Gardeners	201 University Ave	3.4	Gasoline	1.3	12.9	14	0.92	L2
Police Patrol	2100 Martin Luther King Jr Way,	3.4	Gasoline	0.3	3.3	12	0.27	L2
Police Patrol	2100 Martin Luther King Jr Way,		Diesel			12		
ENGINEERING	2025 Center St. Parking Garage	3.4	Gasoline	0.3	2.7	14	0.19	L2
ENGINEERING	2025 Center St. Parking Garage	3.4	Gasoline	0.1	0.8	14	0.06	L2
Equip Maint Pool	1326 Allston Way, Corp Yard	3.4	Gasoline	3.1	29.9	14	2.14	L2
Parking Enforcement	125/127 University Ave.	3.4	Gasoline	1.4	14.0	12	1.16	L2
Parking Enforcement	125/127 University Ave.	3.4	Gasoline	1.1	10.7	12	0.89	L2
Parking Enforcement	125/127 University Ave.	3.4	Gasoline	0.6	6.1	12	0.51	L2

SOURCE: City of Berkeley/DKS

VEHICLE DATA ANALYSIS



Task 3/
Evaluate Facility Electrical Capacity

Determine facility upgrades needed for fleet charging

3.1 Review fleet facility electrical drawings

3.2 Review inventory of existing charging stations

3.3 Interview Fleet and Facility staff for vehicle usage, needs and plans for fleet and facility changes

3.4 Review utility bills

3.5 Recommend process for isolating EV electrical consumption from building energy use

3.6 Calculate available electrical capacity and estimate costs to upgrade

3.7 Assess reliability of grid and need for backup power

3.8 Identify potential alternative charging strategies

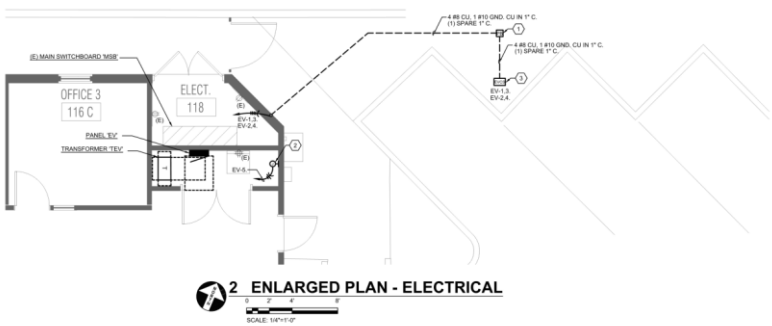
CHARGING FACILITIES PLANNING: DATA SOURCES

- Main Data Sources
  - As-built drawings
  - Utility (electric) bills
  - Data logging
  - Interviews with facilities managers

- Supplementary Data Sources
  - Google Earth
  - Local utilities
  - Purchase records
  - Vendors

CHARGING FACILITIES PLANNING: DATA SOURCES

- As-built drawings

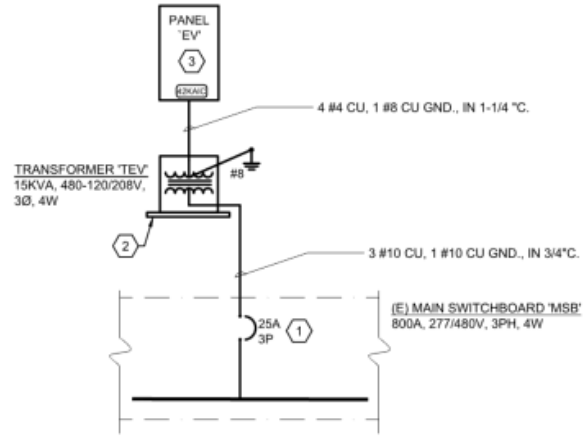


Panel 'EV' 120/208V, 3 Ph., 4 W.; 100A Bus with 60A Main Circuit Breaker Surface Mounted Panelboard

2019-0684

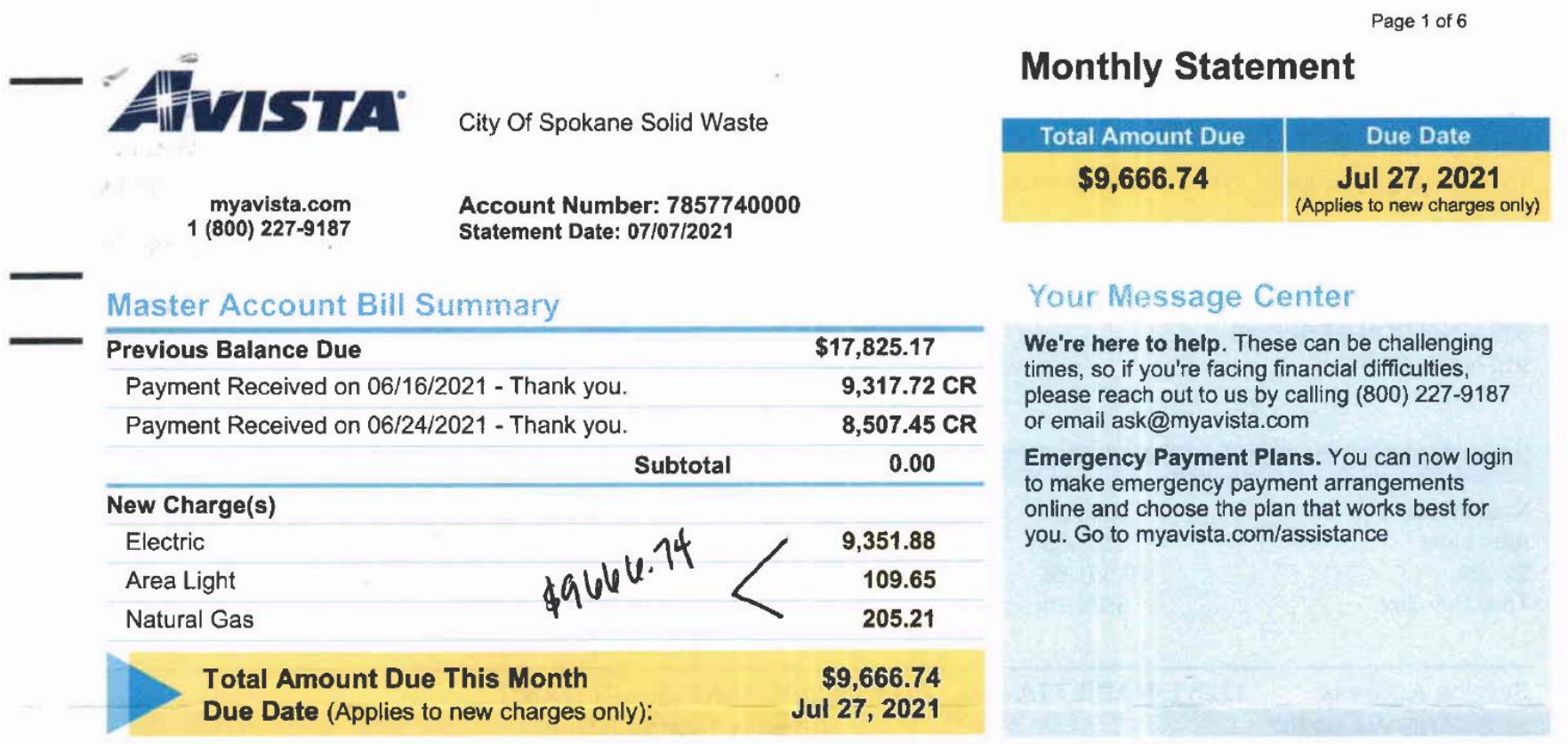
Ckt. No.	Description / Location	Load (VA)	Type	C.B. A/Pole	Note	Ph.	Note	C.B. A/Pole	Load (VA)	Type	Description / Location	Ckt. No.
1	EVCS	3,328	G	40/2		A		40/2	3,328	G	EVCS	2
3	-	3,328	G	-		B		-	3,328	G	-	4
5	CHARGEPOINT GATEWAY	50	G	20/1		C		20/1			SPARE	6
7	SPACE					A		20/1			SPARE	8
9	SPACE					B					SPACE	10
11	SPACE					C					SPACE	12
13	SPACE					A					SPACE	14
15	SPACE					B					SPACE	16

Total Connected Load:	Ph. A	6,656 VA	55 Amps	Panel Connected Load:	13.4 KVA	37.1 Amps	
Total Connected Load:	Ph. B	6,656 VA	55 Amps	Sub-Fed Connected Load:	0.0 KVA	0.0 Amps	
Total Connected Load:	Ph. C	50 VA	0 Amps	**Total Demand Load:**	13.4 **KVA**	37.1 **Amps**	



CHARGING FACILITIES PLANNING: DATA SOURCES

- Utility (electric) bills



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AVISTA

City Of Spokane Solid Waste

myavista.com
1 (800) 227-9187

Account Number: 7857740000
Statement Date: 07/07/2021

Monthly Statement

Total Amount Due	Due Date
$9,666.74	Jul 27, 2021 (Applies to new charges only)

Master Account Bill Summary

Previous Balance Due	$17,825.17
Payment Received on 06/16/2021 - Thank you.	9,317.72 CR
Payment Received on 06/24/2021 - Thank you.	8,507.45 CR
Subtotal	0.00
New Charge(s)	
Electric	9,351.88
Area Light	109.65
Natural Gas	205.21
Total Amount Due This Month	$9,666.74
Due Date (Applies to new charges only):	Jul 27, 2021

$9666.74

Your Message Center

We're here to help. These can be challenging times, so if you're facing financial difficulties, please reach out to us by calling (800) 227-9187 or email ask@myavista.com

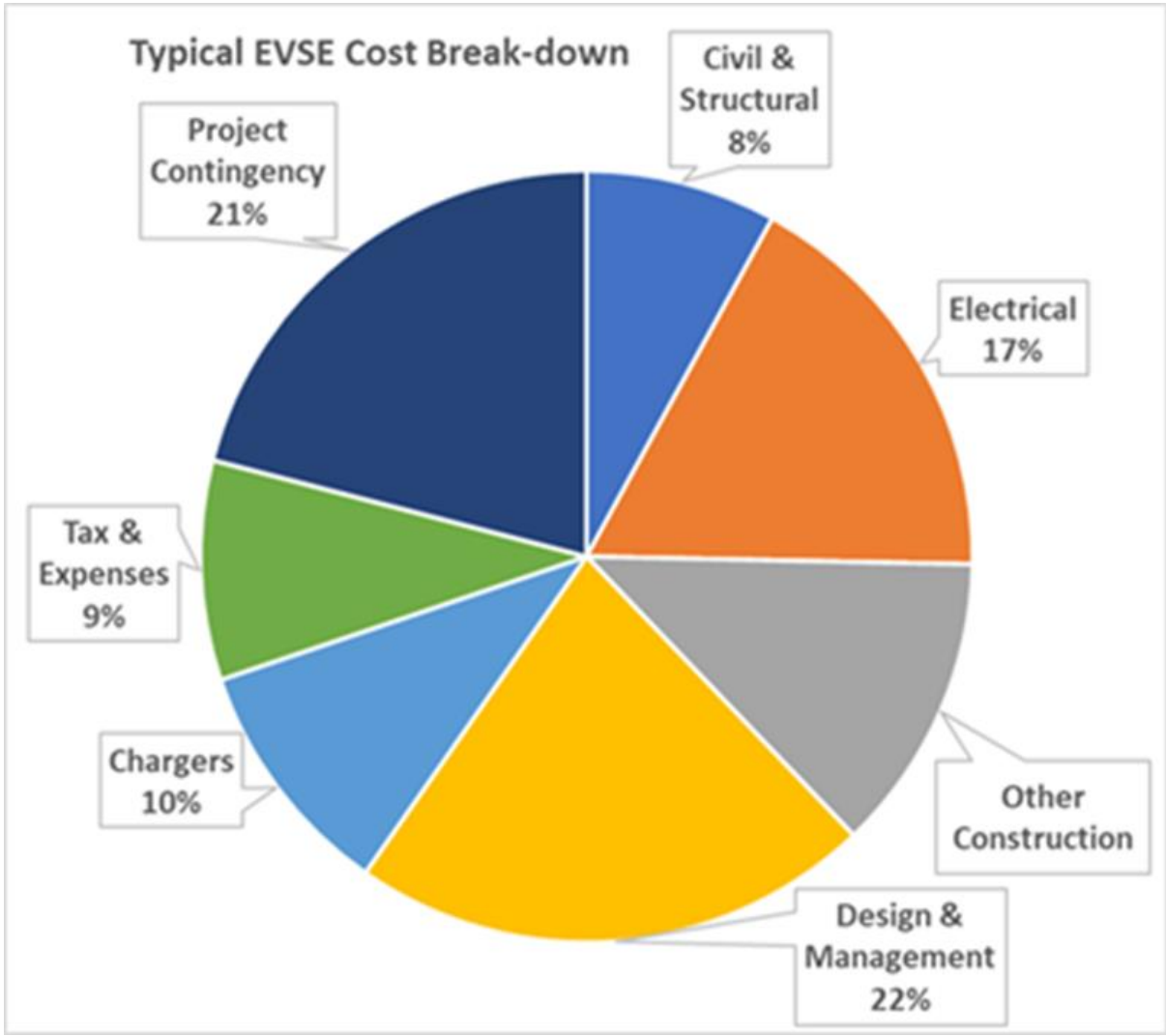
Emergency Payment Plans. You can now login to make emergency payment arrangements online and choose the plan that works best for you. Go to myavista.com/assistance

SOURCE: City of Spokane/DKS

CHARGING ANALYSIS

Cost Drivers for charger installation:

- Charger installation design, soft costs, and contingency
- Electrical service upgrades
- Charger purchase



SOURCE: City of Seattle/DKS

CHARGING ANALYSIS

Resiliency options:

- DER (Solar Panels & Storage Batteries)
- Generators

Battery Energy Storage

On-site Distributed Energy Resources

Solar-Powered chargers

On-Site Generators

FRONTIER energy

CHARGING INFRASTRUCTURE COST ANALYSIS

			Input (Values to Be Updated)				UPDATED:	12/16/19
DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL MATERIAL COST	CONTRACTOR'S PROFIT (15%)	LABOR HOURS PER UNIT	LABOR COST $70 PER HOUR	TOTAL COST
ELECTRICAL SERVICE								
Electric Service, 101-1000 kva	LS	1	$100,000	$100,000			$0.00	$100,000
Electric Service, 1001-2000 kva	LS	1	$200,000	$200,000			$0.00	$200,000
Electric Service, 2001-3000 kva	LS	1	$300,000	$300,000			$0.00	$300,000
Electric Service, 3001-4000 kva	EA	1	$400,000	$400,000			$0.00	$400,000
Electric Service, 4001-5000 kva	EA	1	$500,000	$500,000			$0.00	$500,000
Transformer	EA	1	$0	$0			$0.00	$0
Service Panel	EA	1	$1,000	$1,000	$150	4.0	$280.00	$1,430
ELECTRIC VEHICLE CHARGING EQUIPMENT								
Level 2 Charger (9.6 kva)	EA	1	$4,050	$4,050	$608	16.0	$1,120.00	$5,778
Level 2 Charger (16.7 kva)	EA	1	$4,900	$4,900	$735	16.0	$1,120.00	$6,755
Level 2 Charger (33 kva)	EA	1	$5,750	$5,750	$863	16.0	$1,120.00	$7,733
DC Fast Charger (200 kva)	EA	1	$106,736	$106,736	$16,010	16.0	$1,120.00	$123,866
DC Fast Charger (350 kva)	EA	1	$202,400	$202,400	$30,360	16.0	$1,120.00	$233,880
Cyberswitching Power Management System	EA	1	$8,799	$8,799	$1,320	16.0	$1,120.00	$11,239
1000 KW Generator	EA	1	$416,280	$416,280	$62,442	8.0	$560.00	$479,282
DC Fast Charger (200 kva)	EA	1	$91,840	$91,840	$13,776	16.0	$1,120.00	$106,736
457 kW Generator	EA	1	$280,874	$280,874	$42,131	8.0	$560.00	$323,565
MISCELLANEOUS ITEMS								
Bollard	EA	1	$500	$500	$75	2.0	$140.00	$715
Pavement Marking	LF	31	$2	$62	$9		$0.00	$71
Drainage	LS	1	$10,000	$10,000			$0.00	$10,000
Permits	EA	1	$5,000	$5,000			$0.00	$5,000
SCL Infrastructure 101-1000 kva	LS	1	$100,000	$600,000			$0.00	$600,000
SCL Infrastructure 1001-2000 kva	LS	1	$200,000	$950,000			$0.00	$950,000
SCL Infrastructure 2001-3000 kva	LS	1	$300,000	$1,300,000			$0.00	$1,300,000
SCL Infrastructure 3001-4000 kva	LS	1	$400,000	$1,700,000			$0.00	$1,700,000
SCL Infrastructure 4001-5000 kva	LS	1	$500,000	$2,000,000			$0.00	$2,000,000
Removals	LS	1	$5,000	$5,000			$0.00	$5,000

SOURCE: City of Seattle/DKS

Task 4/
Charging Station Options and Budget Estimates

Finalize analysis and prepare recommendations

4.1 Prepare recommendations addressing the most suitable alternative charging strategies

4.2 Identify quantity of EV chargers

4.3 Determine the most optimum locations for installing charging stations

4.4 Conduct field visits to inspect fleet facilities and vet conceptual recommendations

4.5 Estimate costs for multiple EV charging project components

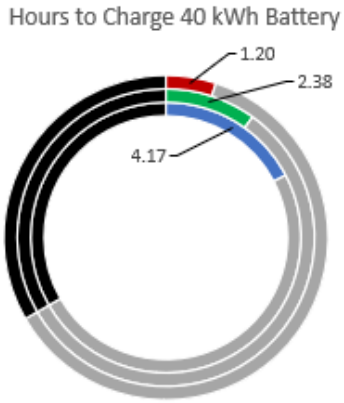
4.6 Develop phasing strategy(s) for implementation of charging infrastructure

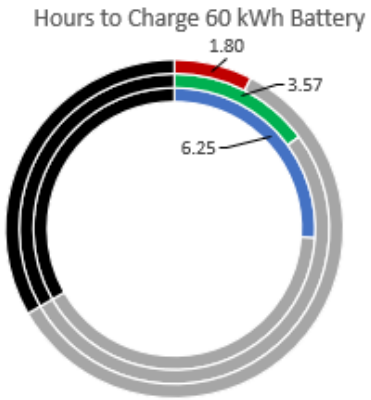
4.7 Estimate cost of infrastructure maintenance, replacement costs, and management of stations

CHARGING ANALYSIS

Calculating power consumption:

- Vehicle dwell time
- EV energy requirement based on fuel usage (kWh/day)
- Miles driven (daily)
- Operational realities





Week	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
0		⚡					
1				⚡			
2						⚡	
3							
4			⚡				
5					⚡		

60 kWh Battery (225mi range) ⚡

Week	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
0		⚡				⚡	
1					⚡		
2				⚡			
3			⚡				
4		⚡				⚡	
5					⚡		

40 kWh Battery (125mi range) ⚡

SOURCE: City of Seattle/DKS

EV CHARGING SPEEDS

EV Battery Charging Times

Electric Vehicles (EV)	Battery Capacity in kWh	Acceptance Rate in kW		Time Required for Optimum (80%) Battery Charged Based on Charger Loads in Hours											
				Level 1 Chargers		Level 2 Chargers						DC Fast Chargers			
		AC	DC	1.4[1]	1.9[1]	3.6	6.6	7.2	9.6	12	19.2	50	100	150	175
Nissan Leaf	40	6.6	150	22.9	16.9	8.9	4.9	4.9	4.9	4.9	4.9	0.7	0.4	0.3	N/A
Chevrolet Bolt	66	7.2	50	37.8	27.8	14.7	10.9	7.4	7.4	7.4	7.4	1.1	N/A	N/A	N/A
Lordstown Endurance	109	11	150	62.3	45.9	24.2	13.2	12.1	9.1	9.1	9.1	1.8	0.9	0.6	N/A
Tesla Model X/S	100	11.5-17.5	200	57.2	42.2	22.3	12.2	11.2	8.4	6.7	4.7	1.6	0.8	0.6	0.5
Ford Mach-E	98.8	10.5	150	56.5	41.6	22.0	5.1	11.0	8.3	8.3	8.3	1.6	0.8	0.6[2]	N/A
Ford E-Transit	67	11	100	38.3	28.3	14.9	8.2	7.5	5.6	4.9	4.9	1.1	0.6	N/A	N/A
Nissan Ariya	65	7.2	130	37.2	27.4	14.5	7.9	7.3	7.3	7.3	7.3	1.1	0.6	N/A	N/A

Note 1: Level 1 chargers include 16A (1.4kW) and 20A (1.9kW) breaker ampacity.

00.0 = kW

Note 2: The base Select Ford Mustang Mach-E modal is capable of up to 115 kW of fast-charging capability, while all other Mustang Mach-E models will go to 150 kW.

SOURCE: Nissan, Ford, Tesla, GM/DKS

FLEET CHARGING STRATEGY OPTIONS

	Dedicated L1 & L2 chargers	Dedicated L2 chargers with load management	Shared L2 chargers	Shared DC Fast Chargers
Convenience and simplicity	⏫	⏫	⏬	🔽
Capacity for future fleet expansion	⏫	⏫	➖	🔽
Reduces peak demand and resulting service upgrades	⏬	⏫	🔼	🔽
Costs for hardware purchase, installation and load upgrades.	🔽	⏬	🔼	⏫
Requires active parking/charging management	⏫	⏫	⏬	⏬
Risk of vehicles not being charged	⏫	🔼	⏬	⏬
Flexibility for different vehicles and users	⏫	🔽	⏬	⏫

SOURCE: DKS

FLEET FACILITIES CHARGING ALTERNATIVES

Facility Name	Facility Location	Energy Needs (kWh/day)	Light-duty Vehicles		Chargers	New Service Req'd	Preliminary Build-Out Costs		
			LDV	C1	L2 (Dual Head)/DCFC		*Option 1* Level 2 Only	*Option 2* Mobi Only*	Backup Generator
Corporation Yard	1326 Allston Way	112.74	7	9	4 and 1 DCFC	Yes	$354,000 (includes 1 DCFC)	-	$487,000
Berkeley Transfer Station	1201 Second St	49.64	2	3	2	No	$87,000	-	$34,000
125/127 University Ave	125/127 University Ave	296.07	33		4	Yes	$290,000	-	$204,000
Adult Mental Health Clinic	1521 University Ave	156.74	13		3 or 3 Mobi	Yes	Not recommended	$135,000	-
Mental Health Clinic	1890 Alcatraz Ave/ 3282 Adeline St	33.29	6		1 or 1 Mobi	Yes	$147,000	$45,000	$34,000
Center Street Garage	2025 Center St	247.81	27	9	28 Dual, 1 Single	NA	Currently installed/Public access	-	-
Central Library Parking Lot	2031 Bancroft Way	3.38	1		1	Yes	$149,000	-	$34,000

SOURCE: City of Berkeley/DKS

SITE ASSESSMENT

CHINOOK BUILDING

EXISTING CONDITIONS

ADDRESS

401 Fifth Avenue Seattle, WA

SITE DESCRIPTION

Ally-accessed 2-level garage in lower 1.5 floors of downtown mid-rise office building.

ELECTRICAL CAPACITY

Total Capacity: 1.66 MVA

Available Capacity: 332.5 kVA

LOCATION OF POWER SUPPLY

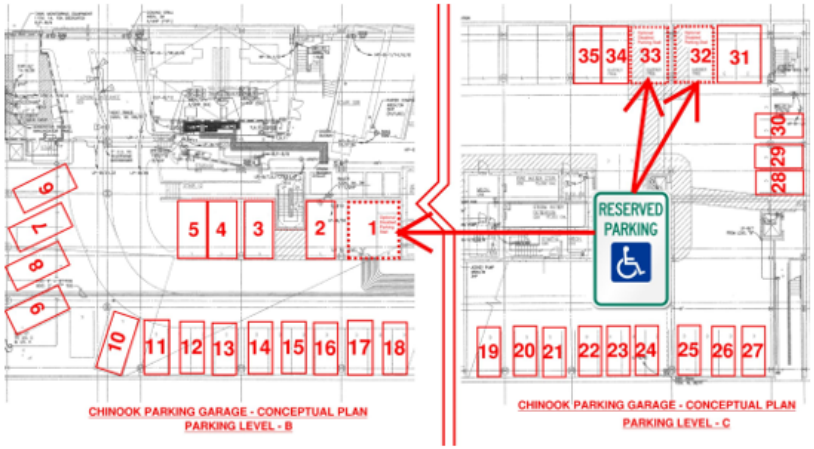
The main switchboard (MSB-A) which operates at 480V service is in the electrical room on parking level B. Two breaker spaces are available. The main breaker in MSB-A is 2500A.

ANALYSIS

A total of 16 medium duty ICE vans and trucks and 19 ICE cars needs to be replaced by comparable class EVs. The daily required EV energy was calculated by comparing existing vehicle duty cycle with replacement EV battery range.

REQUIRED ELECTRICAL LOAD AND COSTS PER CHARGING SCENARIO

CHARGING SCENARIO	ELECTRIC LOAD	COST
DEDICATED L1 & L2	145.75 kVA	$455,200
DEDICATED L2 WITH LOAD MANAGEMENT	90.75 kVA	$538,400 (Blink) $384,100 (Grizzl-E) $449,200 (Power-Flex) $591,700 (ChargePoint) $419,500 (Cyber-Switching)
SHARED L2	115.50 kVA	$277,100
SHARED DCFC	187.50 kVA	$271,600



DESIGN RECOMMENDATIONS

POWER

To power EVSE, a 150A breaker needs to be installed in one of the two available spaces in MSB-A. Ceiling mounted conduit to be punched through the sheetrock wall separating electrical room from parking level B.

Install a floor-mounted transformer (to step down from 480/277V to 120/208V), and a wall mounted sub-panel in parking level B. See attached exhibit for more details.

COMMUNICATION

The cellular reception in the parking garage is poor. An additional antenna on the outside or GPS sim-card may need to be installed in the sub panel during the construction phase. Coordination will be needed with the EV charger vendor on the options on how to increase the strength of the antenna in the parking garage.

CHARGING EQUIPMENT

The following quantities of 7.2 kW smart L2 chargers are recommended:

1 x Single-cord pedestal mounted charger

1 x Dual-cord pedestal mounted charger

12 x Single-cord wall-mounted chargers

10 x Dual-cord wall-mounted chargers

CHARGING STALL LOCATIONS

The parking stalls to be upgraded for EV charging should be located close to the electrical room. 18 of these including 1 potential ADA stall should be on parking level B and 17 on level C (2 existing and 1 potential ADA stall). See attached exhibit for more details.

LIGHTING

Adequate lighting is available in the parking garage. No additional lighting required.

SECURITY AND ACCESS

Protective bollards should be erected around the step-down transformer and wall-mounted electrical sub-panel for protection against vehicular damage.

CONDUIT INSTALLATION APPROACH

A combination of wall-mounted and ceiling-mounted conduit installation will be required including punching through sheetrock to connect the electrical panel in the electrical room to the chargers on both floors of the garage.

CHALLENGES AND RISKS

CHALLENGES/ RISKS	DESCRIPTION
ELECTRICAL	None. Spare capacity and breaker slots available.
CIVIL	None
OPERATIONAL	None. Garage accessed by King County staff only.
OTHERS	None

SOURCE: King County Facilities Management Division/DKS

IMPLEMENTATION PRIORITIZATION

	SSF Facility	# of chargers		Potential Primary Funding Source	Priority	Phase
		SSF Vehicles & Employees	General Public			
A.	SSF City Hall Annex, 400 Grand Ave	1		SSF	High	1
B.	Public Works Corp Yard, 550 N Canal St.	1		SSF	High	1
		23	8	PG&E	High	2
C.	City Hall Parking lot, 400 Grand Ave	12		PG&E	High	2
D.	Miller Ave Parking Garage, 329 Miller Ave		10 4 HPC	PG&E and EVgo	High	2
E.	Fire Station #61, 480 N Canal St.	4		SSF or EA	Medium	3
F.	Fire Station #62, 249 Harbor Way	2		SSF	Low	3
G.	Fire Station #64, 2350 Galway Dr.	2		SSF	Low	3
H.	Fire Station #65, 1151 South San Francisco Dr.	2		SSF	Low	3
I.	Water Quality Control Plant, 195 Belle Aire Rd	2		SSF	Low	3
J.	Fernekes Recreation Building at Orange Park, 781 Tennis Dr.		3-6	BAAQMD or EA	Low	3
K.	Other City facilities: libraries; parks; senior & community centers.		1-2 per	BAAQMD	Low	3
L.	Brentwood Parking Lot on El Camino Real at Hazelwood Ave		2-6	BAAQMD	Low	3
	Planned Future SSF Facility (2022 implementation)					
M.	Future Community Civic Center Campus at Antoinette Ln at Chestnut Ave	10	10 2-4 DCFC?	PG&E, SSF and/or EA	Medium	3
N.	Future Police Station at Antoinette Ln at Chestnut Ave	4 + 2 DCFC?		SSF	Medium	3
O.	Future Fire Station #63 at Arroyo and Camaritas	2-4?		SSF	Medium	3
P.	Future Garage #2 (location to be determined)		50 50 DCFC	BAAQMD or EA and EVgo	Medium	3

SOURCE: City of S. San Francisco/DKS

IMPLEMENTATION STRATEGY

Baseline Scenario

- One L2 charger per vehicle
- One DCFC + generator at fuel tank sites
- Hub of fast chargers at key sites

$227M

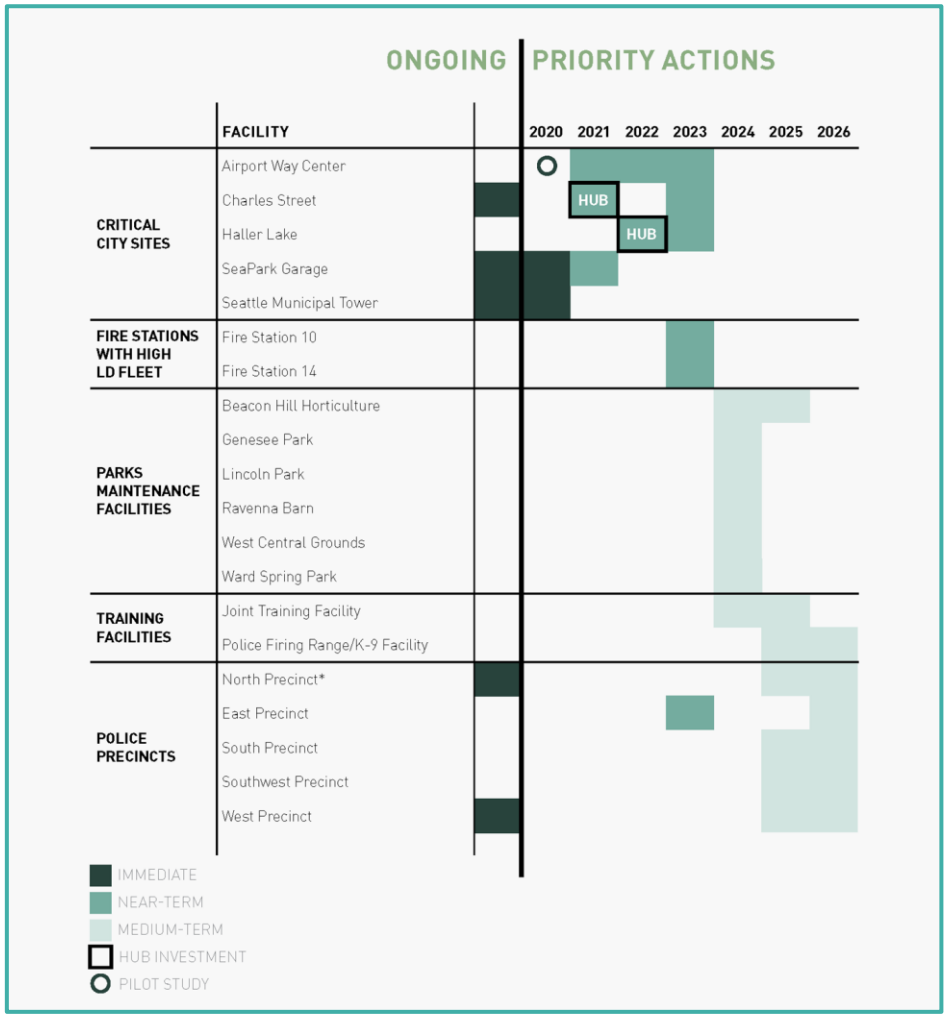
Recommended Approach

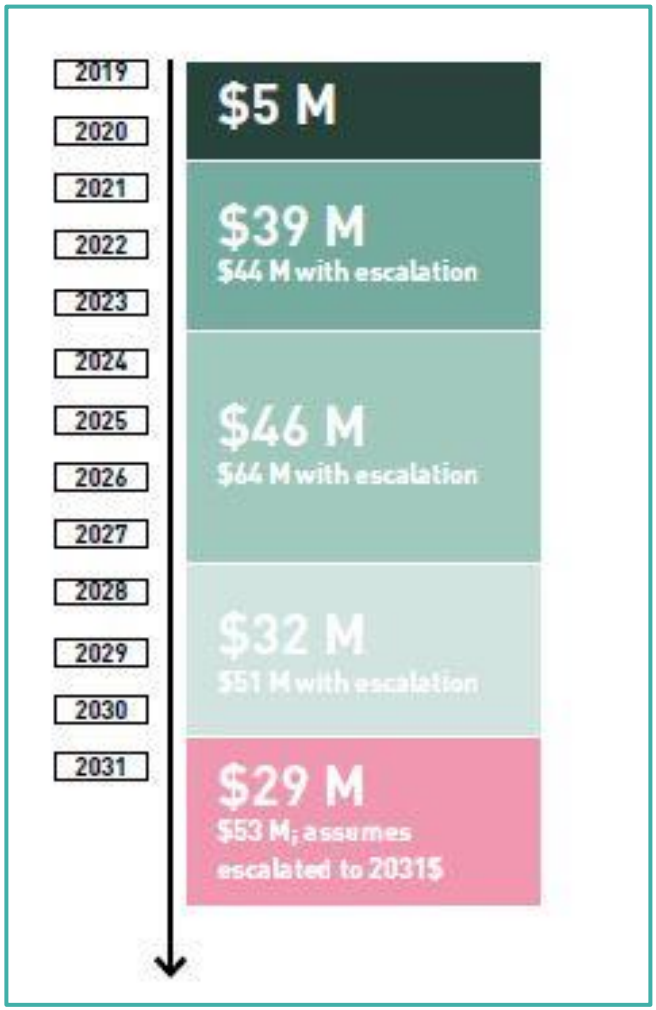
- Strategic load management
- Charger sharing
- Align fire station infrastructure with fleet behavior

$151M

SOURCE: City of Seattle/DKS

IMPLEMENTATION PHASING





SOURCE: City of Seattle/DKS

Task 5/
Prepare Report

Finalize analysis and prepare recommendations

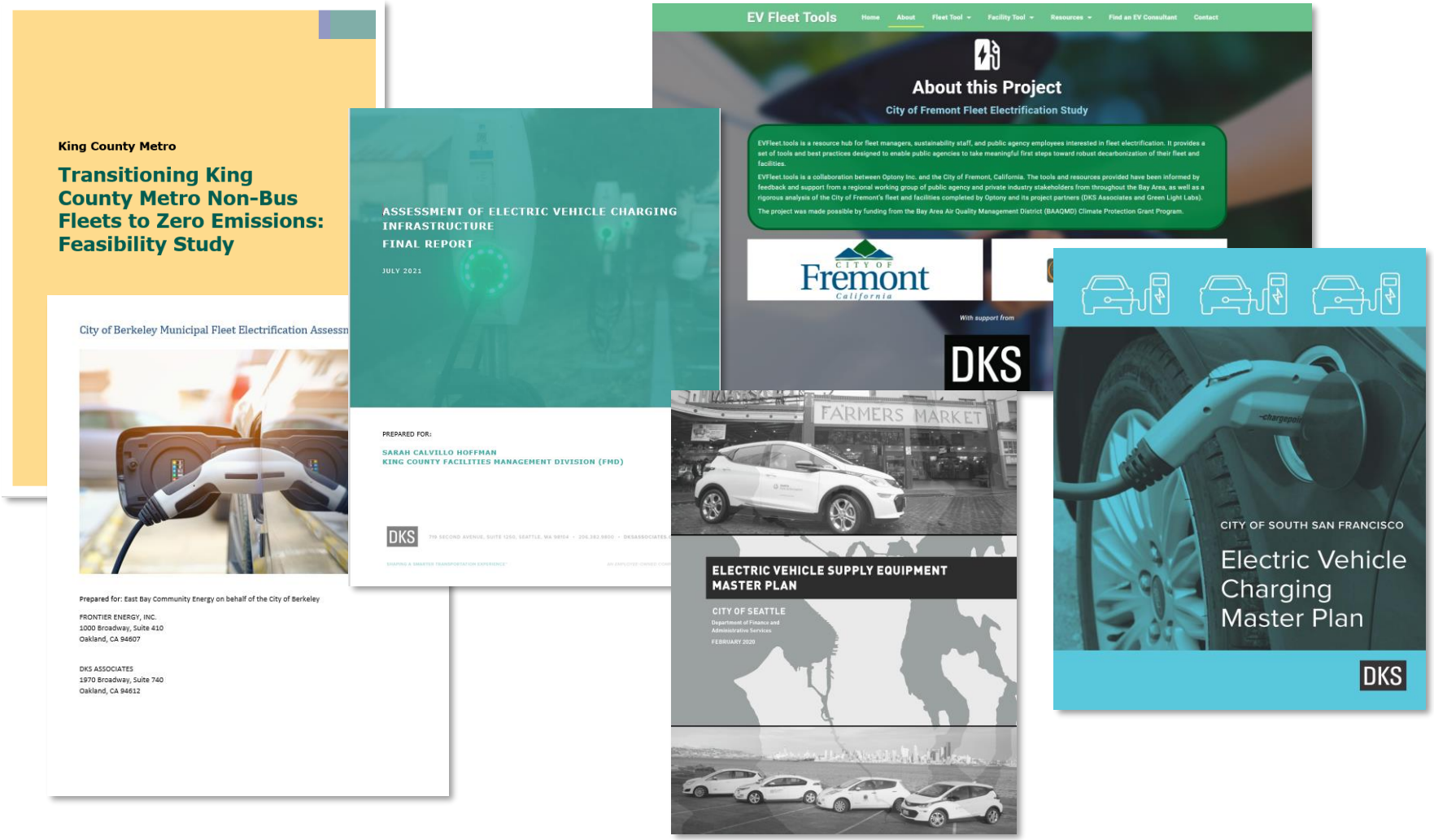
5.1 Prepare Draft Report

5.2 Conduct presentation of preliminary findings & client review

5.3 Prepare Final Report

5.4 Conduct presentation of final report and recommendations to agency management

Compile recommendations into report



SOURCE: DKS Associates, Makers Architecture, Frontier Energy, Optony, Center for Transportation and the Environment

PLANNING FLEET ELECTRIFICATION:

Questions?

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