Board of Commissioners Regular Meeting Agenda
May 8, 2023 - 4:00 p.m.

Virtual Meeting Participation Information:
Dial: 1-253-215-8782 Meeting ID No. 82148732268
Webinar link: https://us02web.zoom.us/j/82148732268

Physical Meeting Location:
Pierce Transit Training Center
3720 96th Street SW
Lakewood, WA 98499

Call to Order

Roll Call

Flag Salute

Presentations

1. Honoring Joseph Rochon for Operator of the Month April 2023 — Scott Gaines, Transportation Assistant Manager

Public Comment

Citizens wishing to provide comment will be given up to three minutes to comment on transit-related matters regardless of whether it is an agenda item or not. The Chair, at his or her discretion, may reduce the comment time to allow sufficient time for the Board to conduct business.

*To request to speak virtually during public comment, please press the Raise Hand button near the bottom of your Zoom window or press *9 on your phone. If speaking in person, please sign in at the table at the back of the room. Your name or the last four digits of your phone number will be called out when it is your turn to speak. Written comments may also be emailed to Djacobson@piercetransit.org.*

1. Approval of Vouchers: April 1-30, 2023
2. Approval of Minutes: April 10, 2023, Regular Board Meeting
3. FS 2023-018, Authorize the Chief Executive Officer to execute Purchase Order 1708 to Pacific Power Group, LLC, in the amount of $475,660.02 for six (6) Energy Storage Systems (Battery Packs)

Action Agenda

1. FS 2023-019, Authorize the Chief Executive Officer to Enter into and Execute a Professional Services Agreement with Nelson Nygard (Contract No. 1618) to Assist the Planning Department with the 2023 Recovery and Restoration Fixed Route Services Plan — Lindsey Sehmel, Service Planning Assistant Manager
2. FS 2023-020, Authority to Increase the Recruitment Referral Incentive Amount and Add a New Hire Incentive Bonus Program for Bus Operators and Journey Level Mechanics — Amy Cleveland, Executive Director of Administration

Review and Discussion

1. Zero Emissions Bus (ZEB) Transition Strategy — Mark Eldridge, Senior Planner

Staff Updates

1. CEO's Report — Mike Griffus, Chief Executive Officer

Informational Items

1. Chair Report — Chair Campbell
2. Sound Transit Update — Vice Chair Walker
3. Puget Sound Regional Council Transportation Policy Board Update — Commissioner Ryan Mello
4. Commissioners' Comments

Executive Session – None Scheduled

Adjournment

Handouts: 2023 Q1 Financial Report

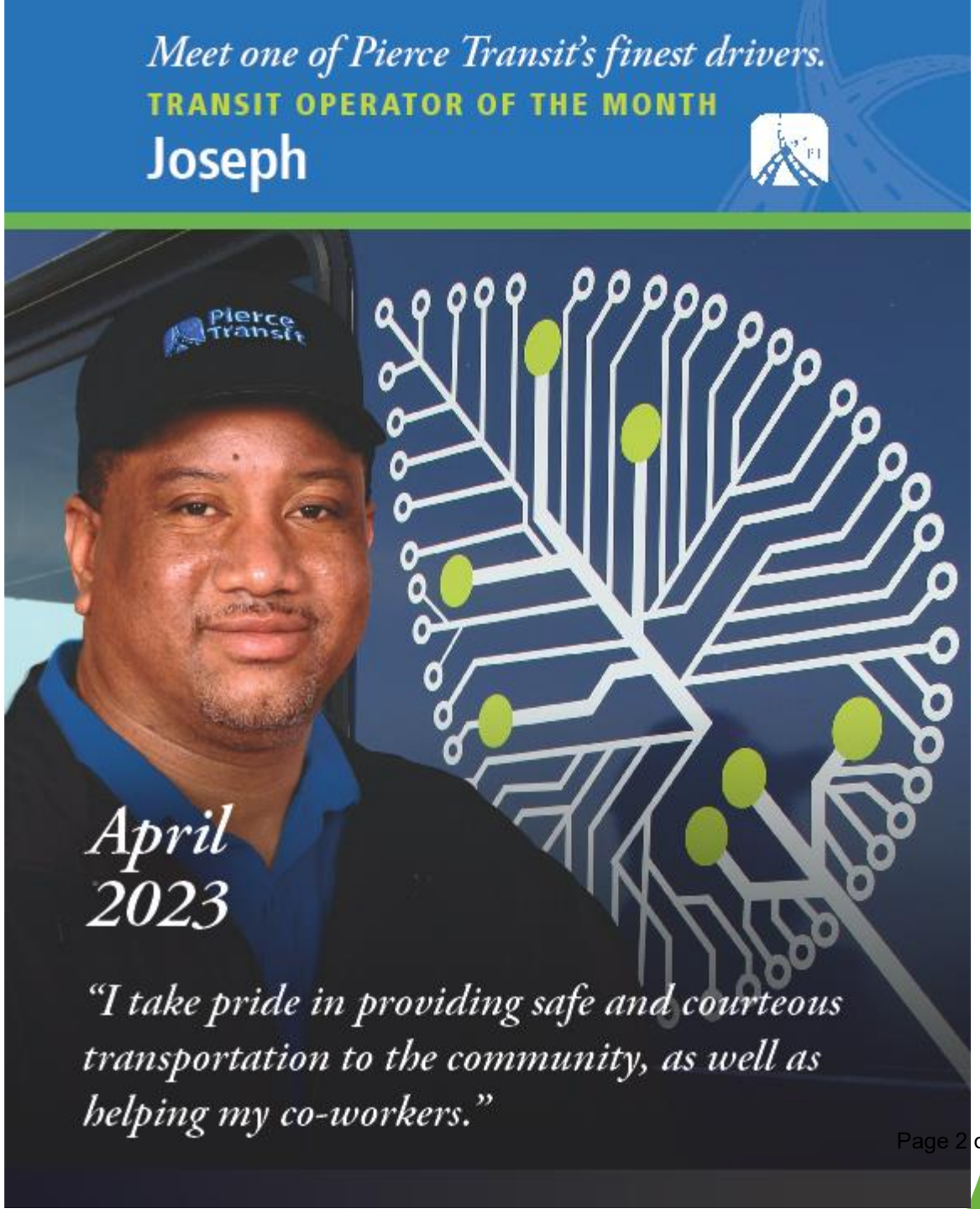
Pierce Transit does not discriminate on the basis of disability in any of its programs, activities, or services. To request this information in an alternative format or to request a reasonable accommodation, please contact the Clerk's Office at 253.581.8066, before 4:00 p.m., no later than the Thursday preceding the Board meeting.


Pierce Transit
Operator of the Month
April 2023

Joseph Rochon

April 2023

- Operator since 1990
- Outstanding Safety Record
- Excellent Customer Service
- Always helping Co-Workers



PIERCE TRANSIT
Board Payments Over $50,000
Payments From: Apr 1, 2023 to Apr 30, 2023
Cash and Investment Balance: $216,161,784.56

Payment Numbers CK 00380548 through CK 00380737
Wire Numbers EFT 00013400 through EFT 00013644
No Advance Travel Checks

Total $7,464,117.92
Payments in Excess of $50,000 are as follows:

Operating Fund

	Check	Vendor	Item/Service	Amount
CHK	00380610	UNIVERSAL PROTECTION SERVICE L	SEC SVC 2 SUPS 02/24-03/30/23	137,353.77
CHK	00380644	VOYAGER FLEET SYSTEMS INC	EXP VANPOOL CLOSE 04/01/23	76,921.30
CHK	00380655	ATU LOCAL 758 CORP	EE DED PP8 2023	50,838.65
CHK	00380696	UNIVERSAL PROTECTION SERVICE L	SEC SVC 2 SUPS 01/27-02/23/23	116,442.83
EFT	00013400	US BANK CORPORATE PAYMENT SYST	MISC BUSN EXPENSES	72,499.96
EFT	00013447	SHI INTERNATIONAL CORP	SUPP MICRO 04/22-03/23	204,737.10
EFT	00013448	SOUND TRANSIT	FARES COLLECTED 03/23	56,759.10
EFT	00013465	ASSOCIATED PETROLEUM	DIESEL USAGE	100,179.63
EFT	00013468	GREAT WEST RETIREMENT	DEF COMP CEO PP7 2023	82,046.21
EFT	00013469	ICMA RETIREMENT	DEF COMP LOAN PP7 2023	236,034.71
EFT	00013478	BRIDGESTONE AMERICA	TIRE MILES 03/23	59,722.63
EFT	00013483	FIRST TRANSIT	ADA PARATRANSIT SVCS 03/23	782,833.04
EFT	00013504	UNITED ENERGY TRADING LLC	CNG USAGE 03/23	107,946.45
EFT	00013510	US BANK CORPORATE PAYMENT SYST	MISC BUSN EXPENSES	64,282.36
EFT	00013518	GILLIG LLC	MISC BUS INVENTORY PARTS	62,745.91
EFT	00013537	ASSOCIATED PETROLEUM	DIESEL USAGE	66,288.66
EFT	00013585	ASSOCIATED PETROLEUM	DIESEL USAGE	71,527.57
EFT	00013588	AWC EMPLOYEE BENEFIT TRUST	ER BGLI 04.23	1,282,413.46
EFT	00013589	GREAT WEST RETIREMENT	DEF COMP CEO PP8 2023	75,944.07
EFT	00013590	ICMA RETIREMENT	DEF COMP LOAN PP8 2023	221,266.04
EFT	00013596	GIRO INC	SUPP HASTAS 04.20.23-04.19.24	233,312.00
EFT	00013608	GENFARE	MISC BUS INVENTORY PARTS	83,170.42
EFT	00013616	KROLL ASSOCIATES INC	NETWORK SUPP SVC 04/23-03/24	58,462.50
EFT	00013642	ASSOCIATED PETROLEUM	DIESEL USAGE	66,460.44
Payments for Fund 1 Total				**$ 4,370,188.81**

Self Insurance Fund

	Check	Vendor	Item/Service	Amount
EFT	00013404	ALLIANT INSURANCE SERVICES	PREM W/C 04/23-04/24	98,440.00
Payments for Fund 4 Total				**$ 98,440.00**

Capital Fund

	Check	Vendor	Item/Service	Amount
CHK	00380587	PEASE CONSTRUCTION, INC.	CONCRETE FORMING TDS 02/23	78,911.66
EFT	00013400	US BANK CORPORATE PAYMENT SYST	ADVERTISEMENT RFP 1430	12,366.29
EFT	00013466	WSP USA, INC.	DESIGN SVC BRT 01/01-02/03/23	609,494.70
EFT	00013479	CLEVER DEVICES	INSTALL CAD/AVL 100%	59,593.12
EFT	00013510	US BANK CORPORATE PAYMENT SYST	COMMERCE CHARGES	1,619.35
EFT	00013553	HUITT-ZOLLARS INC.	DESIGN MOBI BLDG 1 02/25/23	257,879.26
EFT	00013611	HUITT-ZOLLARS INC.	DESIGN SV MOBI BLDG 1 01/28/23	122,877.51
Payments for Fund 9 Total				**$ 1,142,741.89**
Total Payments in Excess of $50,000.00				**$ 5,611,370.70**

Pierce Transit
Payment Certification for Apr 30, 2023
Payments Apr 1, 2023 to Apr 30, 2023

Payment Numbers CK 00380548 through CK 00380737
Wire Numbers EFT 00013400 through EFT 00013644
No Advance Travel Checks

Bank ID		Check Number	Check Date	Amount	Vendor Name
01	CHK	00380548	04/06/2023	1,016.40	AAA FIRE PROTECTION INC
01	CHK	00380549	04/06/2023	333.33	AMPLIFIED WIRELESS SOLUTIONS I
01	CHK	00380550	04/06/2023	488.00	AT&T
01	CHK	00380551	04/06/2023	28.90	AT&T
01	CHK	00380552	04/06/2023	2,250.00	ATU LOCAL 758 CORP
01	CHK	00380553	04/06/2023	13,450.00	CABBROS CLEANING SERVICE LLC
01	CHK	00380554	04/06/2023	70.84	CENTURY LINK
01	CHK	00380555	04/06/2023	581.60	CHAPTER 13 TRUSTEE
01	CHK	00380556	04/06/2023	666.90	CITY TREASURER - TPU
01	CHK	00380557	04/06/2023	3,265.29	COLONIAL SUPPLEMENTAL LIFE
01	CHK	00380558	04/06/2023	158.91	COMCAST
01	CHK	00380559	04/06/2023	163.85	COMCAST
01	CHK	00380560	04/06/2023	158.91	COMCAST
01	CHK	00380561	04/06/2023	63.34	COMM ON POLITICAL EDUCATION
01	CHK	00380562	04/06/2023	243.44	CONSERVE
01	CHK	00380563	04/06/2023	10,569.60	CWA INC
01	CHK	00380564	04/06/2023	1,781.00	DM RECYCLING CO INC
01	CHK	00380565	04/06/2023	133.24	FRUITLAND MUTUAL WATER COMPANY
01	CHK	00380566	04/06/2023	629.64	GENES TOWING CORP
01	CHK	00380567	04/06/2023	420.00	GOVERNMENT FINANCE OFFICERS AS
01	CHK	00380568	04/06/2023	43.90	HARBOR FREIGHT TOOLS
01	CHK	00380569	04/06/2023	8,293.97	HAROLD LEMAY ENTERPRISES
01	CHK	00380570	04/06/2023	845.50	IAM & AW
01	CHK	00380571	04/06/2023	220.00	INTERNAL REVENUE SERVICE
01	CHK	00380572	04/06/2023	797.50	JAMES GUERRERO ARCHITECT
01	CHK	00380573	04/06/2023	3,959.87	KING COUNTY FINANCE
01	CHK	00380574	04/06/2023	842.05	L.N. CURTIS & SONS
01	CHK	00380575	04/06/2023	387.00	LEMAY MOBILE SHREDDING
01	CHK	00380576	04/06/2023	22,904.09	METRO GLASS CO INC
01	CHK	00380577	04/06/2023	293.08	MICHAEL G MALAIER
01	CHK	00380578	04/06/2023	447.00	ANOKA COUNTY HUMAN SERVICES
01	CHK	00380579	04/06/2023	419.50	NH DEPT OF H & HS
01	CHK	00380580	04/06/2023	185.90	NORTHWEST HANDLING SYSTEMS
01	CHK	00380581	04/06/2023	1,744.60	NORTHWEST IAM BENEFIT TRUST
01	CHK	00380582	04/06/2023	435.21	NYS CHILD SUPPORT PROCESSING
01	CHK	00380583	04/06/2023	581.00	OCCUPATIONAL HEALTH CENTERS OF
01	CHK	00380584	04/06/2023	1,509.49	OLYMPIC COLLECTION INC
01	CHK	00380585	04/06/2023	29.69	ORIN MULLEN
01	CHK	00380586	04/06/2023	777.87	PACIFIC TORQUE
01	**CHK**	**00380587**	**04/06/2023**	**78,911.66**	**PEASE CONSTRUCTION, INC.**
01	CHK	00380588	04/06/2023	1,993.09	PIERCE COUNTY BUDGET & FINANCE
01	CHK	00380589	04/06/2023	42,569.08	PIERCE COUNTY BUDGET & FINANCE
01	CHK	00380590	04/06/2023	2,395.00	PREMIER MEDIA GROUP
01	CHK	00380591	04/06/2023	402.93	PURCELL TIRE & RUBBER COMPANY
01	CHK	00380592	04/06/2023	2,500.00	QUEBEC INC
01	CHK	00380593	04/06/2023	67.32	RAINIER SUPPLY
01	CHK	00380594	04/06/2023	471.22	SAVED BY CASH
01	CHK	00380595	04/06/2023	1,192.00	SCHINDLER ELEVATOR CORPORATION
01	CHK	00380596	04/06/2023	248.56	SHERWIN-WILLIAMS (LKWD, CEDR)
01	CHK	00380597	04/06/2023	3,250.00	SIMON AND COMPANY INC
01	CHK	00380598	04/06/2023	891.86	SNIDER ENERGY
01	CHK	00380599	04/06/2023	500.00	SOURCE PANEL
01	CHK	00380600	04/06/2023	4,011.25	SM STEMPER ARCHITECTS PLLC
01	CHK	00380601	04/06/2023	420.00	T-MOBILE USA, INC
01	CHK	00380602	04/06/2023	3,000.00	TACOMA PIERCE COUNTY CHAMBER
01	CHK	00380603	04/06/2023	875.00	TARA DUNFORD CPA
01	CHK	00380604	04/06/2023	293.35	TX CHILD SUPPORT SDU
01	CHK	00380605	04/06/2023	239.62	SIJ HOLDINGS LLC
01	CHK	00380606	04/06/2023	182.13	TRANSOURCE
01	CHK	00380607	04/06/2023	2,709.60	UNITED SITE SERVICES (Everson)

01	CHK	00380608	04/06/2023	1,260.83	UNITED WAY OF PIERCE COUNTY
01	CHK	00380609	04/06/2023	1,071.73	WALTER E NELSON CO.
01	**CHK**	**00380610**	**04/13/2023**	**137,353.77**	**UNIVERSAL PROTECTION SERVICE L**
01	CHK	00380611	04/13/2023	22,754.83	AT&T
01	CHK	00380612	04/13/2023	77.38	BUNCE RENTALS INC
01	CHK	00380613	04/13/2023	917.70	CENTURY LINK
01	CHK	00380614	04/13/2023	84.73	CENTURY LINK
01	CHK	00380615	04/13/2023	8,852.84	CENTURY LINK
01	CHK	00380616	04/13/2023	485.29	CITY OF GIG HARBOR
01	CHK	00380617	04/13/2023	28,116.69	CITY OF PUYALLUP
01	CHK	00380618	04/13/2023	4,604.69	CITY TREASURER - TPU
01	CHK	00380619	04/13/2023	1,153.55	CITY TREASURER - TPU
01	CHK	00380620	04/13/2023	158.91	COMCAST
01	CHK	00380621	04/13/2023	204.54	COMCAST
01	CHK	00380622	04/13/2023	158.85	COMCAST
01	CHK	00380623	04/13/2023	288.00	CSCHED
01	CHK	00380624	04/13/2023	109.09	DISH
01	CHK	00380625	04/13/2023	42.59	FEDERAL EXPRESS CORP
01	CHK	00380626	04/13/2023	50.00	FORMFOX, INC.
01	CHK	00380627	04/13/2023	85.00	GOVERNMENT FINANCE OFFICERS AS
01	CHK	00380628	04/13/2023	880.00	HELM INC
01	CHK	00380629	04/13/2023	471.58	HULTZ BHU ENGINEERS INC.
01	CHK	00380630	04/13/2023	1,074.61	LEVEL 3 (CENTURY LINK)
01	CHK	00380631	04/13/2023	5,162.39	LEVEL 3 (CENTURY LINK)
01	CHK	00380632	04/13/2023	1,283.42	LOOMIS ARMORED US LLC
01	CHK	00380633	04/13/2023	1,763.00	MATERIALS TESTING & CONSULTING
01	CHK	00380634	04/13/2023	238.00	OCCUPATIONAL HEALTH CENTERS OF
01	CHK	00380635	04/13/2023	1,320.00	OLYMPIC SPORTS & SPINE PLLC
01	CHK	00380636	04/13/2023	615.53	PACIFIC TORQUE
01	CHK	00380637	04/13/2023	212.65	PENINSULA LIGHT
01	CHK	00380638	04/13/2023	5,017.50	PIERCE COUNTY BUDGET & FINANCE
01	CHK	00380639	04/13/2023	20,335.61	PUGET SOUND ENERGY
01	CHK	00380640	04/13/2023	100.04	TACOMA DAILY INDEX
01	CHK	00380641	04/13/2023	131.26	TERMINIX COMMERCIAL
01	CHK	00380642	04/13/2023	146.08	TERMINIX COMMERCIAL
01	CHK	00380643	04/13/2023	580.95	TRUVIEW BSI LLC
01	**CHK**	**00380644**	**04/13/2023**	**76,921.30**	**VOYAGER FLEET SYSTEMS INC**
01	CHK	00380645	04/13/2023	25.00	WA ST DEPT OF RETIREMENT SYSTE
01	CHK	00380646	04/14/2023	828.74	COMPLETE OFFICE
01	CHK	00380647	04/14/2023	559.68	GENES TOWING CORP
01	CHK	00380648	04/14/2023	185.64	GILCHRIST CHEVROLET
01	CHK	00380649	04/14/2023	8.78	HARBOR FREIGHT TOOLS
01	CHK	00380650	04/14/2023	6,768.54	SENSOR ELECTRONICS CORPS
01	CHK	00380651	04/14/2023	143.00	SNAP-ON TOOLS - Robert Mustain
01	CHK	00380652	04/14/2023	307.13	ULINE
01	CHK	00380653	04/14/2023	487.92	WURTH USA INC
01	CHK	00380654	04/20/2023	103.51	AT&T
01	**CHK**	**00380655**	**04/20/2023**	**50,838.65**	**ATU LOCAL 758 CORP**
01	CHK	00380656	04/20/2023	803.33	AUTOMATED ACCOUNTS INC
01	CHK	00380657	04/20/2023	581.60	CHAPTER 13 TRUSTEE
01	CHK	00380658	04/20/2023	26,649.43	CITY OF FEDERAL WAY
01	CHK	00380659	04/20/2023	4,948.84	CITY TREASURER - TPU
01	CHK	00380660	04/20/2023	4,257.00	CITY TREASURER - TPU
01	CHK	00380661	04/20/2023	472.88	CITY TREASURER - TPU
01	CHK	00380662	04/20/2023	40.00	CITY TREASURER - TPU
01	CHK	00380663	04/20/2023	158.85	COMCAST
01	CHK	00380664	04/20/2023	8,330.50	COMCAST
01	CHK	00380665	04/20/2023	238.47	CONSERVE
01	CHK	00380666	04/20/2023	1,731.24	CREDIT INTERNATIONAL CORP
01	CHK	00380667	04/20/2023	12,766.74	ENERGY SYSTEMS MANAGEMENT/TRS
01	CHK	00380668	04/20/2023	3,038.86	GENES TOWING CORP
01	CHK	00380669	04/20/2023	183.65	GENSCO INC
01	CHK	00380670	04/20/2023	701.64	GILCHRIST CHEVROLET
01	CHK	00380671	04/20/2023	65.95	HARBOR FREIGHT TOOLS
01	CHK	00380672	04/20/2023	220.00	INTERNAL REVENUE SERVICE
01	CHK	00380673	04/20/2023	3,649.06	LAKEWOOD WATER DISTRICT
01	CHK	00380674	04/20/2023	4,377.38	LEVEL 3 (CENTURY LINK)
01	CHK	00380675	04/20/2023	161.82	MCMASTER-CARR SUPPLY
01	CHK	00380676	04/20/2023	293.08	MICHAEL G MALAIER
01	CHK	00380677	04/20/2023	447.00	ANOKA COUNTY HUMAN SERVICES

01	CHK	00380678	04/20/2023	4,243.94	MULTICARE HEALTH SYSTEM
01	CHK	00380679	04/20/2023	419.50	NH DEPT OF H & HS
01	CHK	00380680	04/20/2023	961.40	NORBAR TORQUE TOOLS
01	CHK	00380681	04/20/2023	11,880.00	NOREGON SYSTEMS LLC
01	CHK	00380682	04/20/2023	435.21	NYS CHILD SUPPORT PROCESSING
01	CHK	00380683	04/20/2023	29.63	O'REILLY AUTO PARTS
01	CHK	00380684	04/20/2023	224.00	OCCUPATIONAL HEALTH CENTERS OF
01	CHK	00380685	04/20/2023	40.25	WASHINGTON STATE SCHOOL FOR TH
01	CHK	00380686	04/20/2023	360.00	OLYMPIC SPORTS & SPINE PLLC
01	CHK	00380687	04/20/2023	50.07	ORIN MULLEN
01	CHK	00380688	04/20/2023	655.28	PURCELL TIRE & RUBBER COMPANY
01	CHK	00380689	04/20/2023	1,151.31	QUADIENT LEASING USA INC
01	CHK	00380690	04/20/2023	346.98	SAVED BY CASH
01	CHK	00380691	04/20/2023	880.31	SNIDER ENERGY
01	CHK	00380692	04/20/2023	9,975.00	SOFTHQ INC.
01	CHK	00380693	04/20/2023	293.35	TX CHILD SUPPORT SDU
01	CHK	00380694	04/20/2023	1,218.83	UNITED WAY OF PIERCE COUNTY
01	CHK	00380695	04/20/2023	250.00	VICTORIA PEREZ
01	**CHK**	**00380696**	**04/27/2023**	**116,442.83**	**UNIVERSAL PROTECTION SERVICE L**
01	CHK	00380697	04/27/2023	333.33	AMPLIFIED WIRELESS SOLUTIONS I
01	CHK	00380698	04/27/2023	42,455.59	CITY OF LAKEWOOD
01	CHK	00380699	04/27/2023	1,070.41	CITY TREASURER - TPU
01	CHK	00380700	04/27/2023	10,569.60	CWA INC
01	CHK	00380701	04/27/2023	519.75	DAILY JOURNAL OF COMMERCE INC
01	CHK	00380702	04/27/2023	1,539.12	GENES TOWING CORP
01	CHK	00380703	04/27/2023	30.46	GILCHRIST CHEVROLET
01	CHK	00380704	04/27/2023	1,641.50	HAUGEN GRAPHICS
01	CHK	00380705	04/27/2023	949.14	RPAI US MANAGEMENT LLC
01	CHK	00380706	04/27/2023	29.00	KYLE FELLMAN
01	CHK	00380707	04/27/2023	127.00	MULTICARE HEALTH SYSTEM
01	CHK	00380708	04/27/2023	9,630.50	NORTHWEST PLAYGROUND EQUIPMENT
01	CHK	00380709	04/27/2023	232.40	ODP BUSINESS SOLUTIONS LLC
01	CHK	00380710	04/27/2023	877.87	PACIFIC TORQUE
01	CHK	00380711	04/27/2023	268.38	PARKLAND LIGHT & WATER CO
01	CHK	00380712	04/27/2023	411.13	PENINSULA LIGHT
01	CHK	00380713	04/27/2023	3,883.74	PUGET SOUND ENERGY
01	CHK	00380714	04/27/2023	1,038.70	PURCELL TIRE & RUBBER COMPANY
01	CHK	00380715	04/27/2023	3,190.74	SMITH FIRE SYSTEMS INC
01	CHK	00380716	04/27/2023	29.98	SNAP-ON TOOLS - Robert Mustain
01	CHK	00380717	04/27/2023	14,727.56	STANTEC
01	CHK	00380718	04/27/2023	3,464.08	SM STEMPER ARCHITECTS PLLC
01	CHK	00380719	04/27/2023	1,200.00	SUBTERRA INC
01	CHK	00380720	04/27/2023	163.92	TACOMA DAILY INDEX
01	CHK	00380721	04/27/2023	5,124.47	TACOMA MALL PARTNERSHIP
01	CHK	00380722	04/27/2023	682.37	ULINE
01	CHK	00380723	04/27/2023	556.25	UNITED SITE SERVICES (Everson)
01	CHK	00380724	04/27/2023	80.02	VERIZON WIRELESS
01	CHK	00380725	04/27/2023	23.02	VERIZON WIRELESS
01	CHK	00380726	04/27/2023	576.34	VERIZON WIRELESS
01	CHK	00380727	04/27/2023	955.55	VERIZON WIRELESS
01	CHK	00380728	04/27/2023	636.34	VERIZON WIRELESS
01	CHK	00380729	04/27/2023	1,378.13	VERIZON WIRELESS
01	CHK	00380730	04/27/2023	936.00	VERIZON WIRELESS
01	CHK	00380731	04/27/2023	556.00	VERIZON WIRELESS
01	CHK	00380732	04/27/2023	601.00	VERIZON WIRELESS
01	CHK	00380733	04/27/2023	293.28	VERIZON WIRELESS
01	CHK	00380734	04/27/2023	556.00	VERIZON WIRELESS
01	CHK	00380735	04/27/2023	596.68	VERIZON WIRELESS
01	CHK	00380736	04/27/2023	646.00	VERIZON WIRELESS
01	CHK	00380737	04/27/2023	502.51	WURTH USA INC
01	**EFT**	**00013400**	**04/04/2023**	**84,866.25**	**US BANK CORPORATE PAYMENT SYST**
01	EFT	00013401	04/06/2023	23,154.00	ACI CUSTODIAL INC
01	EFT	00013402	04/06/2023	84.00	ADRIAN T LEWIS
01	EFT	00013403	04/06/2023	7,098.44	ALL STARZ STAFFING AND CONSULT
01	**EFT**	**00013404**	**04/06/2023**	**98,440.00**	**ALLIANT INSURANCE SERVICES**
01	EFT	00013405	04/06/2023	4,142.44	AMAZON CAPITAL SERVICES INC
01	EFT	00013406	04/06/2023	10,204.36	ATWORK! COMMERCIAL ENTERPRISES
01	EFT	00013407	04/06/2023	84.00	AUSHA POTTS
01	EFT	00013408	04/06/2023	112.80	BRAUN CORPORATION
01	EFT	00013409	04/06/2023	3,072.32	BRAVO ENVIRONMENTAL NW INC

01	EFT	00013410	04/06/2023	8,693.83	COMMERCIAL BRAKE & CLUTCH
01	EFT	00013411	04/06/2023	36,850.60	CUMMINS INC
01	EFT	00013412	04/06/2023	522.50	CUSTOM EDGE, INC.
01	EFT	00013413	04/06/2023	250.00	CYBERSOURCE CORP.
01	EFT	00013414	04/06/2023	84.00	DEVORAH ZELLER
01	EFT	00013415	04/06/2023	2,696.68	DIAMOND PARKING SERVICES LLC
01	EFT	00013416	04/06/2023	11,441.50	DRUG FREE BUSINESS
01	EFT	00013417	04/06/2023	25,800.00	EMC RESEARCH INC
01	EFT	00013418	04/06/2023	2,182.89	ENGINEERED MACHINED PROD
01	EFT	00013419	04/06/2023	116.40	FINISHMASTER, INC
01	EFT	00013420	04/06/2023	20,000.00	FITCH RATINGS INC
01	EFT	00013421	04/06/2023	168.00	FRANCES L RANKOS
01	EFT	00013422	04/06/2023	8,662.50	FREIGHTLINER NORTHWEST PACIFIC
01	EFT	00013423	04/06/2023	47,182.41	GILLIG LLC
01	EFT	00013424	04/06/2023	5,750.00	GORDON THOMAS HONEYWELL
01	EFT	00013425	04/06/2023	1,773.46	GRAINGER
01	EFT	00013426	04/06/2023	18,025.00	LIBERTY MUTUAL GROUP INC
01	EFT	00013427	04/06/2023	1,981.32	HOLMES DISTRIBUTING
01	EFT	00013428	04/06/2023	84.00	JAZZMINE MARTINEZ
01	EFT	00013429	04/06/2023	2,758.53	WESTERN FLUID COMPONENTS
01	EFT	00013430	04/06/2023	339.61	KIM GRIMES
01	EFT	00013431	04/06/2023	496.32	MALLORY SAFETY & SUPPLY LLC
01	EFT	00013432	04/06/2023	736.61	MCGUIRE BEARING CO
01	EFT	00013433	04/06/2023	29,996.30	MEDSTAR CABULANCE INC
01	EFT	00013434	04/06/2023	1,271.03	MOHAWK MFG & SUPPLY
01	EFT	00013435	04/06/2023	655.96	MUNCIE RECLAMATION & SUPPLY CO
01	EFT	00013436	04/06/2023	1,440.00	NAVIA BENEFIT SOLUTIONS
01	EFT	00013437	04/06/2023	6,977.19	PACIFIC POWER PRODUCTS
01	EFT	00013438	04/06/2023	10,686.50	PAPE KENWORTH NORTHWEST
01	EFT	00013439	04/06/2023	5,190.01	THERMO KING NW INC
01	EFT	00013440	04/06/2023	1,652.18	PRINT NW
01	EFT	00013441	04/06/2023	7,348.11	QBSI-XEROX
01	EFT	00013442	04/06/2023	3,114.15	QUADIENT FINANCE USA INC
01	EFT	00013443	04/06/2023	129.36	R E AUTO ELECTRIC
01	EFT	00013444	04/06/2023	644.06	RED WING SHOE STORE
01	EFT	00013445	04/06/2023	49,236.97	RIGHT! SYSTEMS INC
01	EFT	00013446	04/06/2023	1,188.66	SEATTLE AUTOMOTIVE DIST.
01	**EFT**	**00013447**	**04/06/2023**	**204,737.10**	**SHI INTERNATIONAL CORP**
01	**EFT**	**00013448**	**04/06/2023**	**56,759.10**	**SOUND TRANSIT**
01	EFT	00013449	04/06/2023	10,853.36	SOUND TRANSIT
01	EFT	00013450	04/06/2023	334.59	SOUTH TACOMA GLASS
01	EFT	00013451	04/06/2023	566.29	STANDARD PARTS CORP
01	EFT	00013452	04/06/2023	1,202.51	STAPLES
01	EFT	00013453	04/06/2023	7,504.74	TACOMA DODGE CHRYSLER JEEP
01	EFT	00013454	04/06/2023	944.89	TACOMA SCREW
01	EFT	00013455	04/06/2023	279.19	TERI L BARTLE
01	EFT	00013456	04/06/2023	297.53	TERRY MILUS
01	EFT	00013457	04/06/2023	21,166.43	THE AFTERMARKET PARTS CO LLC
01	EFT	00013458	04/06/2023	761.40	TITUS WILL FORD INC
01	EFT	00013459	04/06/2023	84.00	TRISHA CANZLER
01	EFT	00013460	04/06/2023	215.90	UNIFIRST CORPORATION
01	EFT	00013461	04/06/2023	2,614.38	UNITED RENTALS GIG HARBOR
01	EFT	00013462	04/06/2023	973.26	VEHICLE MAINTENANCE PROGRAM
01	EFT	00013463	04/06/2023	15,633.51	WESTERN PETERBILT
01	EFT	00013464	04/06/2023	126.06	WILLIAMS OIL FILTER
01	**EFT**	**00013465**	**04/06/2023**	**100,179.63**	**ASSOCIATED PETROLEUM**
01	**EFT**	**00013466**	**04/06/2023**	**609,494.70**	**WSP USA, INC.**
01	EFT	00013467	04/06/2023	11,121.00	ZONAR SYSTEMS INC
01	**EFT**	**00013468**	**04/07/2023**	**82,046.21**	**GREAT WEST RETIREMENT**
01	**EFT**	**00013469**	**04/07/2023**	**236,034.71**	**ICMA RETIREMENT**
01	EFT	00013470	04/07/2023	15,979.55	NAVIA BENEFIT SOLUTIONS
01	EFT	00013471	04/07/2023	15,281.17	TACOMA EMPLOYEES RETIREMENT SY
01	EFT	00013472	04/07/2023	4,108.85	WA ST CHILD SUPPORT REGISTRY
01	EFT	00013473	04/13/2023	10,434.10	ABSHER CONSTRUCTION COMPANY
01	EFT	00013474	04/13/2023	110.00	ADAM DAVIS
01	EFT	00013475	04/13/2023	6,334.20	ALL STARZ STAFFING AND CONSULT
01	EFT	00013476	04/13/2023	5,024.83	AMAZON CAPITAL SERVICES INC
01	EFT	00013477	04/13/2023	5.79	TIMCO INC
01	**EFT**	**00013478**	**04/13/2023**	**59,722.63**	**BRIDGESTONE AMERICA**

01	**EFT**	**00013479**	**04/13/2023**	**59,593.12**	**CLEVER DEVICES**
01	EFT	00013480	04/13/2023	2,804.10	COGENT COMMUNICATIONS INC
01	EFT	00013481	04/13/2023	8,247.94	CUMMINS INC
01	EFT	00013482	04/13/2023	260.84	DANETTE ROGERS
01	**EFT**	**00013483**	**04/13/2023**	**782,833.04**	**FIRST TRANSIT**
01	EFT	00013484	04/13/2023	34,552.59	GILLIG LLC
01	EFT	00013485	04/13/2023	325.73	WESTERN FLUID COMPONENTS
01	EFT	00013486	04/13/2023	5,000.00	KROLL ASSOCIATES INC
01	EFT	00013487	04/13/2023	110.00	MARAH HARRIS
01	EFT	00013488	04/13/2023	717.00	MB ELECTRIC LLC
01	EFT	00013489	04/13/2023	941.94	MCGUIRE BEARING CO
01	EFT	00013490	04/13/2023	173.26	NORTHWEST PUMP & EQUIPMENT CO
01	EFT	00013491	04/13/2023	32,090.71	OPEN SQUARE
01	EFT	00013492	04/13/2023	1,660.23	PACIFIC POWER PRODUCTS
01	EFT	00013493	04/13/2023	21,193.91	PHOTOSHELTER
01	EFT	00013494	04/13/2023	1,482.25	R E AUTO ELECTRIC
01	EFT	00013495	04/13/2023	656.70	SAMBA HOLDINGS INC
01	EFT	00013496	04/13/2023	12.00	SHANE HALL
01	EFT	00013497	04/13/2023	17,624.68	SOUND TRANSIT
01	EFT	00013498	04/13/2023	1,750.75	SOUND UNIFORM SOLUTIONS INC
01	EFT	00013499	04/13/2023	16,545.00	SOUTH SOUND 911
01	EFT	00013500	04/13/2023	82.09	STANDARD PARTS CORP
01	EFT	00013501	04/13/2023	45.12	TACOMA SCREW
01	EFT	00013502	04/13/2023	194.98	THE AFTERMARKET PARTS CO LLC
01	EFT	00013503	04/13/2023	1,150.12	UNIFIRST CORPORATION
01	**EFT**	**00013504**	**04/13/2023**	**107,946.45**	**UNITED ENERGY TRADING LLC**
01	EFT	00013505	04/13/2023	6,400.00	WA ST AUDITOR
01	EFT	00013506	04/13/2023	1,892.46	WAXIE SANITARY SUPPLY
01	EFT	00013507	04/13/2023	5,279.63	WESTERN PETERBILT
01	EFT	00013508	04/13/2023	7,669.76	WOOD HARBINGER INC
01	EFT	00013509	04/13/2023	1,574.30	ALLSTREAM
01	**EFT**	**00013510**	**04/13/2023**	**65,901.71**	**US BANK CORPORATE PAYMENT SYST**
01	EFT	00013511	04/14/2023	537.04	AIRGAS-NOR PAC INC
01	EFT	00013512	04/14/2023	827.31	AMAZON CAPITAL SERVICES INC
01	EFT	00013513	04/14/2023	3,894.46	BATTERY SYSTEMS
01	EFT	00013513	04/14/2023	414.38	CONTINENTAL BATTERY COMPANY
01	EFT	00013514	04/14/2023	146.72	COMMERCIAL BRAKE & CLUTCH
01	EFT	00013515	04/14/2023	29,952.96	CUMMINS INC
01	EFT	00013516	04/14/2023	2,882.99	FINISHMASTER, INC
01	EFT	00013517	04/14/2023	27,488.62	GENFARE
01	**EFT**	**00013518**	**04/14/2023**	**62,745.91**	**GILLIG LLC**
01	EFT	00013519	04/14/2023	3,368.55	GRAINGER
01	EFT	00013520	04/14/2023	501.60	WESTERN FLUID COMPONENTS
01	EFT	00013521	04/14/2023	474.10	MALLORY SAFETY & SUPPLY LLC
01	EFT	00013522	04/14/2023	1,815.00	MILLER MOBILE & MECHANICAL LLC
01	EFT	00013523	04/14/2023	13,475.00	MINUTEMAN PRESS
01	EFT	00013524	04/14/2023	192.38	MOHAWK MFG & SUPPLY
01	EFT	00013525	04/14/2023	362.71	MUNCIE RECLAMATION & SUPPLY CO
01	EFT	00013526	04/14/2023	306.39	NEOPART TRANSIT LLC
01	EFT	00013527	04/14/2023	10,230.51	PACIFIC POWER PRODUCTS
01	EFT	00013528	04/14/2023	311.52	THERMO KING NW INC
01	EFT	00013529	04/14/2023	451.44	PROTERRA INC
01	EFT	00013530	04/14/2023	47.41	SEATTLE AUTOMOTIVE DIST.
01	EFT	00013531	04/14/2023	1,168.79	STAPLES
01	EFT	00013532	04/14/2023	1,516.38	TACOMA DODGE CHRYSLER JEEP
01	EFT	00013533	04/14/2023	1,327.82	TACOMA SCREW
01	EFT	00013534	04/14/2023	5,494.76	THE AFTERMARKET PARTS CO LLC
01	EFT	00013535	04/14/2023	4,474.31	WESTERN PETERBILT
01	EFT	00013536	04/14/2023	549.12	WHELEN ENGINEERING CO INC
01	**EFT**	**00013537**	**04/14/2023**	**66,288.66**	**ASSOCIATED PETROLEUM**
01	EFT	00013538	04/17/2023	13,902.85	JENCO DEVELOPMENT
01	EFT	00013539	04/19/2023	14,012.19	WA ST DEPT OF REVENUE
01	EFT	00013540	04/20/2023	6,306.66	ALL STARZ STAFFING AND CONSULT
01	EFT	00013541	04/20/2023	5,039.82	AMAZON CAPITAL SERVICES INC
01	EFT	00013542	04/20/2023	271.70	CONTINENTAL BATTERY COMPANY
01	EFT	00013543	04/20/2023	7,555.52	CHEVRON PRODUCTS CO.
01	EFT	00013544	04/20/2023	19,783.81	CUMMINS INC
01	EFT	00013545	04/20/2023	11,134.88	DKS ASSOCIATES
01	EFT	00013546	04/20/2023	4,752.00	COMPUTER SCIENCES CORPORATION

01	EFT	00013547	04/20/2023	308.00	DYNAMIC LANGUAGE
01	EFT	00013548	04/20/2023	720.00	EASTER SEALS WASHINGTON
01	EFT	00013549	04/20/2023	950.50	ENVIROISSUES
01	EFT	00013550	04/20/2023	16,416.23	GALLS LLC
01	EFT	00013551	04/20/2023	22,560.96	GILLIG LLC
01	EFT	00013552	04/20/2023	260.60	GRAINGER
01	**EFT**	**00013553**	**04/20/2023**	**257,879.26**	**HUITT-ZOLLARS INC.**
01	EFT	00013554	04/20/2023	1,997.16	K & L GATES
01	EFT	00013555	04/20/2023	404.53	KENDRA BROKMAN
01	EFT	00013556	04/20/2023	5,700.00	PEOPLEFLUENT INC
01	EFT	00013557	04/20/2023	1,735.94	LINDSEY SEHMEL
01	EFT	00013558	04/20/2023	11,870.07	LUMINATOR MASS TRANSIT LLC
01	EFT	00013559	04/20/2023	5,637.50	MALLORY SAFETY & SUPPLY LLC
01	EFT	00013560	04/20/2023	32,333.00	MEDSTAR CABULANCE INC
01	EFT	00013561	04/20/2023	1,815.00	MILLER MOBILE & MECHANICAL LLC
01	EFT	00013562	04/20/2023	796.92	MOHAWK MFG & SUPPLY
01	EFT	00013563	04/20/2023	121.47	MOOD MEDIA
01	EFT	00013564	04/20/2023	1,688.93	OPEN SQUARE
01	EFT	00013565	04/20/2023	97.98	OUTFITTER SATELLITE INC
01	EFT	00013566	04/20/2023	33,864.50	PACIFIC POWER PRODUCTS
01	EFT	00013567	04/20/2023	20.90	PACIFIC WELDING SUPPLY INC
01	EFT	00013568	04/20/2023	1,125.00	PACIFICA LAW GROUP
01	EFT	00013569	04/20/2023	110.33	PROTERRA INC
01	EFT	00013570	04/20/2023	109.95	SCHETKY NORTHWEST SALES INC
01	EFT	00013571	04/20/2023	993.37	SEATTLE AUTOMOTIVE DIST.
01	EFT	00013572	04/20/2023	669.18	SOUTH TACOMA GLASS
01	EFT	00013573	04/20/2023	394.64	STAPLES
01	EFT	00013574	04/20/2023	1.54	STERICYCLE
01	EFT	00013575	04/20/2023	5,218.12	TACOMA COMMUNITY COLLEGE
01	EFT	00013576	04/20/2023	3,700.90	TACOMA DODGE CHRYSLER JEEP
01	EFT	00013577	04/20/2023	577.61	TACOMA SCREW
01	EFT	00013578	04/20/2023	11,836.47	THE AFTERMARKET PARTS CO LLC
01	EFT	00013579	04/20/2023	1,701.13	TITUS WILL FORD INC
01	EFT	00013580	04/20/2023	13.15	TITUS-WILL TOYOTA
01	EFT	00013581	04/20/2023	215.90	UNIFIRST CORPORATION
01	EFT	00013582	04/20/2023	4,684.35	WA ST TRANSIT INSURANCE POOL
01	EFT	00013583	04/20/2023	3,202.85	WESTERN PETERBILT
01	EFT	00013584	04/20/2023	44.08	WILLIAMS OIL FILTER
01	**EFT**	**00013585**	**04/20/2023**	**71,527.57**	**ASSOCIATED PETROLEUM**
01	EFT	00013586	04/20/2023	984.22	ALLSTREAM
01	EFT	00013587	04/20/2023	1,252.24	ZONAR SYSTEMS INC
01	**EFT**	**00013588**	**04/21/2023**	**1,282,413.46**	**AWC EMPLOYEE BENEFIT TRUST**
01	**EFT**	**00013589**	**04/21/2023**	**75,944.07**	**GREAT WEST RETIREMENT**
01	**EFT**	**00013590**	**04/21/2023**	**221,266.04**	**ICMA RETIREMENT**
01	EFT	00013591	04/21/2023	15,493.03	NAVIA BENEFIT SOLUTIONS
01	EFT	00013592	04/21/2023	15,335.07	TACOMA EMPLOYEES RETIREMENT SY
01	EFT	00013593	04/21/2023	4,215.15	WA ST CHILD SUPPORT REGISTRY
01	EFT	00013594	04/24/2023	26,180.63	LAKEVIEW LIGHT & POWER CO
01	EFT	00013595	04/24/2023	19,909.09	LAKEVIEW LIGHT & POWER CO
01	**EFT**	**00013596**	**04/26/2023**	**233,312.00**	**GIRO INC**
01	EFT	00013597	04/27/2023	2,825.64	A & E IMAGING
01	EFT	00013598	04/27/2023	6,003.72	ALL STARZ STAFFING AND CONSULT
01	EFT	00013599	04/27/2023	4,194.48	AMAZON CAPITAL SERVICES INC
01	EFT	00013600	04/27/2023	4,114.68	BRIOTIX
01	EFT	00013601	04/27/2023	2,439.50	CENTRAL PUGET SOUND REGIONAL T
01	EFT	00013602	04/27/2023	550.00	CIVICPLUS LLC
01	EFT	00013603	04/27/2023	13,673.09	CUMMINS INC
01	EFT	00013604	04/27/2023	16,238.65	DELL USA LP
01	EFT	00013605	04/27/2023	554.68	FINISHMASTER, INC
01	EFT	00013606	04/27/2023	1,395.84	FIVE9 INC
01	EFT	00013607	04/27/2023	19,057.51	GALLUP INC
01	**EFT**	**00013608**	**04/27/2023**	**83,170.42**	**GENFARE**
01	EFT	00013609	04/27/2023	49,789.85	GILLIG LLC
01	EFT	00013610	04/27/2023	779.57	GRAINGER
01	**EFT**	**00013611**	**04/27/2023**	**122,877.51**	**HUITT-ZOLLARS INC.**
01	EFT	00013612	04/27/2023	3,037.00	JAJ ENTERPRISES, LLC
01	EFT	00013613	04/27/2023	15,868.50	JENCO DEVELOPMENT
01	EFT	00013614	04/27/2023	238.21	WESTERN FLUID COMPONENTS
01	EFT	00013615	04/27/2023	41.90	KENDRA BROKMAN

01	**EFT**	**00013616**	**04/27/2023**	**58,462.50**	**KROLL ASSOCIATES INC**
01	EFT	00013617	04/27/2023	447.03	LAKEVIEW LIGHT & POWER CO
01	EFT	00013618	04/27/2023	1,167.28	LARSCO INC
01	EFT	00013619	04/27/2023	1,980.00	LARSEN SIGN COMPANY
01	EFT	00013620	04/27/2023	3,080.00	LYTX INC
01	EFT	00013621	04/27/2023	506.88	MALLORY SAFETY & SUPPLY LLC
01	EFT	00013622	04/27/2023	320.67	MICHAEL GRIFFUS
01	EFT	00013623	04/27/2023	1,679.56	MOHAWK MFG & SUPPLY
01	EFT	00013624	04/27/2023	2,920.50	MUNCIE RECLAMATION & SUPPLY CO
01	EFT	00013625	04/27/2023	18,148.91	PACIFIC POWER PRODUCTS
01	EFT	00013626	04/27/2023	3,217.54	QUALITY PRESS
01	EFT	00013627	04/27/2023	148.50	RED WING SHOE STORE
01	EFT	00013628	04/27/2023	9,266.40	R.S. MEANS COMPANY LLC
01	EFT	00013629	04/27/2023	137.76	SCHETKY NORTHWEST SALES INC
01	EFT	00013630	04/27/2023	340.03	SEATTLE AUTOMOTIVE DIST.
01	EFT	00013631	04/27/2023	38.50	SOUND TRANSIT
01	EFT	00013632	04/27/2023	439.83	SOUTH TACOMA GLASS
01	EFT	00013633	04/27/2023	4,595.96	STAPLES
01	EFT	00013634	04/27/2023	2,370.50	SUMMIT LAW GROUP PLLC
01	EFT	00013635	04/27/2023	984.07	TACOMA DODGE CHRYSLER JEEP
01	EFT	00013636	04/27/2023	1,661.95	TACOMA SCREW
01	EFT	00013637	04/27/2023	21,637.52	THE AFTERMARKET PARTS CO LLC
01	EFT	00013638	04/27/2023	724.45	UNIFIRST CORPORATION
01	EFT	00013639	04/27/2023	400.00	WA ST TRANSIT INSURANCE POOL
01	EFT	00013640	04/27/2023	443.12	WAXIE SANITARY SUPPLY
01	EFT	00013641	04/27/2023	11,370.47	WESTERN PETERBILT
01	**EFT**	**00013642**	**04/27/2023**	**66,460.44**	**ASSOCIATED PETROLEUM**
01	EFT	00013643	04/27/2023	6,650.00	WSTA
01	EFT	00013644	04/27/2023	11,121.00	ZONAR SYSTEMS INC
Total Payments				**$7,465,932.92**	

PIERCE TRANSIT
BOARD OF COMMISSIONERS
REGULAR BOARD MEETING MINUTES

April 10, 2023

CALL TO ORDER

Chair Campbell called the regular board meeting to order at 4:11 p.m.

ROLL CALL

Commissioners present:
Marty Campbell, Chair of the Board, Pierce County Councilmember
John Hines, City of Tacoma Councilmember
Shannon Reynolds, City of Fircrest Councilmember (*representing Fircrest and University Place*)
Kim Roscoe, Mayor of Fife *(representing Fife/Milton/Pacific/Auburn/Gig Harbor Ruston/Steilacoom)*
Kristina Walker, Vice Chair of the Board, Deputy Mayor of City of Tacoma
John Hoheusle, President of ATU 758, Represents IAM and ATU

Commissioners excused:
Olgy Diaz, City of Tacoma Councilmember
Daryl Eidinger, Mayor of the City of Edgewood (*representing Edgewood and Puyallup*)
Ryan Mello, Pierce County Councilmember
Jason Whalen, City of Lakewood Mayor

Staff present:
Mike Griffus, Chief Executive Officer
Chris Schuler, Chief Financial Officer
Deanne Jacobson, Clerk of the Board
Brittany Carbullido, Assistant to the CEO/Deputy Clerk of the Board
Aaron Millstein, Counsel from K&L Gates
Abraham Weill, Counsel from K&L Gates

FLAG SALUTE

Chair Campbell stated that we gratefully honor and acknowledge that we rest on the traditional lands of the Puyallup People.

Chair Campbell led attendees in the Flag Salute, followed by a moment of silence.

OPENING REMARKS AND HOUSEKEEPING ITEMS

Chair Campbell welcomed board members, staff, and citizens to the meeting and provided attendees with instructions for meeting participation.

PRESENTATIONS

1. Honoring John Waterman for Operator of the Month for March 2023

Transportation Assistant Manager Scott Gaines honored Operator John Waterman for being selected Operator of the Month for March 2023. He reported that Mr. Waterman has been an operator since 2005 and has an outstanding safety record and provides excellent customer service.

Mr. Gaines read customer comments into the record from various customers to serve as a testament to the service that Mr. Waterman provides.

Mr. Waterman expressed his appreciation for the award and noted that he enjoys driving for Pierce Transit.

2. 2023 Q1 Community Transportation Advisory Group (CTAG)Update

CTAG member Linda Moran reported that she has served on the CTAG since 2021. She discussed her fondness for Pierce Transit services while going to law school and spoke at length how transit has been an important staple in her life.

She provided an overview of the work that the CTAG committee has conducted during Q1 of 2023, noting that the committee has received many updates from staff on current programs that the agency is in the process of implementing. She advised that things are going well and complimented staff for their support of the CTAG.

Ms. Moran advised that the CTAG is here to support the Board and encouraged members to attend their meetings if their schedules allow.

Vice Chair Walker thanked Ms. Moran for attending the meeting and serving on the CTAG and thanked the committee for their work.

Vice Chair Walker requested that the Board receive an update in the near future on the bus shelter design.

A short discussion ensued about whether Gig Harbor Trolley service would be offered this year. CEO Griffus advised that there will be a modified trolley service that will operator certain events such as the concert series, as an example.

3. WSTA Carbon Credit Aggregation Pool

Zero Emissions Fleet Coordinator Nathan Groh provided a PowerPoint presentation that explained the following information:

1) the substantive terms of the Member Services Agreement with WSTA that was established January 2023;
2) detailed the fuels that are eligible for credit;

3) reviewed the fee structure and provided an example on how credits would be calculated. He advised that credits are generated based on fuel consumption and carbon intensity and that credit value is a function of market forces that will fluctuate over time; and

4) Reviewed estimates of credits that Pierce Transit could realize from its current fleet inventory and also advised that gasoline and diesel vehicles are not eligible for credits.

Mr. Groh responded to questions relating to the amount of revenue the program will generate, noting that Pierce Transit does not expect to receive millions of dollars, but the monies received will supplement the budget. He advised that the program will provide valuable incentives for adopting low carbon fuels.

Chief Financial Officer Chris Schuler responded to questions about how Pierce Transit would invest the credit monies received, noting that the monies would be applied to the general fund and the agency could track it separately if need be.

PUBLIC COMMENT

Chair Campbell provided participation instructions to the public and opened public comment.

No written or public comments were received; public comment was closed.

CONSENT AGENDA

(*Items listed below were distributed to Commissioners in advance for reading and study and are enacted with one motion. Item(s) may be moved to the Action Agenda at the request of a commissioner.)*

Commissioners Walker and Roscoe **moved** and seconded to approve the consent agenda as amended.

Motion **carried,** 5-0.

1. Approval of Vouchers, March 1-31, 2023
   Operating Fund #10
   Self-Insurance Fund #40
   Capital Fund #90
   Payment Nos. 380283 through 380547
   Wire Nos. 13072 through 13399
   No Advance Travel Checks
   Total $9,493,895.30

2. Approval of Minutes: March 13, 2023, Special Study Session Meeting and Regular Board Meeting

3. 2023 First Quarter Sole Source and Contracts Executed Over $100,000

4. FS 2023-014, Authorized the Chief Executive Officer to enter into and execute a two-year contract with Trapeze, Inc., Contract No. 1587, to provide Maintenance and Support to the Enterprise Asset Management System, ATIS Trip Planner System, and Vanpool Ridepro Application System in the amount of $460,030.00.

5. ~~FS 2023-015, Authorized the Chief Executive Officer to enter into and execute a 10-year interlocal agreement with City of Tacoma Solid Waste Management Division (Contract No. 1652) allowing Pierce Transit access to the City's CNG fueling station during emergencies pursuant to the contractual terms in Exhibit A.~~ **This item was moved to the Action Agenda for consideration.**

ACTION AGENDA

1. **FS 2023-015, Authorize the Chief Executive Officer to Enter into and Execute a 10-year Interlocal Agreement with City of Tacoma Solid Waste Management Division (Contract No. 1652) Allowing Pierce Transit Access to the City's CNG Fueling Station During Emergencies Pursuant to the Contractual Terms in Exhibit A**

   Parts Procurement Manager Stephanie Prine presented on the item and reported that Pierce Transit already shares a mutual agreement with City of Tacoma Solid Waste Management Division that allows them to use to access Pierce Transit's CNG fueling station during emergencies and advised the proposed agreement would allow Pierce Transit to access the City of Tacoma's CNG fueling station during emergencies.

   Commissioners Roscoe and Walker **moved** and seconded to amend the proposed contract ending date to reflect April 30, 2033, instead of April 31, 2033.

   Motion **carried,** 5-0.

   Commissioners Roscoe and Walker **moved** and seconded to authorize the Chief Executive Officer to enter into and execute a 10-year interlocal agreement with City of Tacoma Solid Waste Management Division (Contract No. 1652) allowing Pierce Transit access to the City's CNG fueling station during emergencies pursuant to the contractual terms in Exhibit A.

   The motion **carried,** as amended, 5-0.

2. **FS 2023-016, Authorize the Chief Executive Officer to Execute a new Two-Year Interlocal Agreement with the Pierce County Sheriff's Department (Contract No. 1693) to Provide Law Enforcement Services Pursuant to the Terms and Conditions Described in Exhibit A, Retroactive January 1, 2023, Through December 31, 2024**

   Chief Operating Officer Grantley Martelly presented on the contract and advised that the proposed contract covers the costs for the Public Safety Chief and Investigator and estimated costs for extra duty patrol officers.

Mr. Martelly responded to questions about service levels and coverage.

Commissioners Walker and Hines **moved** and seconded to authorize the Chief Executive Officer to execute a new two-year Interlocal Agreement with the Pierce County Sheriff's Department (Contract No. 1693) to provide Law Enforcement Services pursuant to the terms and conditions described in Exhibit A, retroactive from January 1, 2023, through December 31, 2024, for a not to exceed amount of $2,549,730.

Motion **carried,** 5-0.

3. **FS 2023-017, Approval of Resolution No. 2023-003, Authorizing the Department of Retirement Systems as the Designated State Social Security Administrator to Conduct a Divided Vote Referendum for the Purpose of Allowing Eligible Employees the Option of Paying the Medicare-Only tax**

Human Resources Manager Tara Schaak presented on the item and reported that the proposal before the Board applies to just six employees. She explained the divided vote process and advised that Board approval is required to proceed with the Divided Vote process.

Ms. Schaak introduced Mark Veach, a veteran employee who will reach 43 years of service this year, who spoke in favor of the divided vote referendum.

ATU Representative John Hoheusle provided comments in support of the proposal.

Commissioners Walker and Hines **moved** and seconded to approve Resolution No. 2023-003, to 1) Extend the provisions of RCW 41.48.030 to provide Medicare coverage to eligible employees of Pierce Transit; 2) Authorize Department of Retirement Systems as the designated State Social Security Administrator to conduct a Divided Vote Referendum for the purpose of allowing eligible employees the option of paying the Medicare-only tax; 3) Authorize the Chief Executive Officer to execute an agreement with the State of Washington to secure Medicare coverage of eligible employees; and 4) Authorize staff to conduct the necessary administerial functions as described in Sections 4-7 of the proposed resolution.

Motion **carried,** 5-0.

DISCUSSION

Preliminary and Conceptual Design Changes to the Pacific Avenue/SR-7 Bus Rapid Transit Project. *[This item was not discussed due to the cancelation of the special study session meeting scheduled for 3:00 p.m.]*

STAFF UPDATES

1. **CEO'S Report**

CEO Griffus reported on the following items:

- Attended the APTA Legislative Conference in Washington DC last month, noting that it was a fruitful conference in that they had the opportunity to meet with the FTA and congressional delegation to update them on the BRT project, grant opportunities the agency is competing for, and other topics related to our federal partners.

- Pierce Transit held the first fare-free day of the year on Saturday, February 4, Transit Equity Day. Boardings that day were four percent higher than the next highest Saturday for the year. The next fare-free day will be April 22, Earth Day.

- The agency continues to promote the Free Youth Transit Pass. In the first two months of 2023, free youth rides represented 15 percent of all boardings for the agency, compared to 9 percent previously.

- An open house for the new Fuel and Wash Station will be held April 27 from 1-4 p.m. Requested that the Board Members inform staff by April 25 if they would like to attend.

- April 27 will also be Bring Your Child to Work Day and commissioners may bring their children to the Fuel and Wash Station open house.

INFORMATIONAL BOARD ITEMS

1. Chair's Report

Chair Campbell reported on the following:

- We have been unable to settle on a retreat date in April or May. We are now looking at repurposing the September 21 Executive Finance Committee meeting to hold the Board retreat in hopes that we can achieve a full complement, or close to full complement, of the Board in attendance.

- Expressed special thanks to Commissioner Mello and Vice Chair Walker for spearheading the recent efforts to ensure transit dollars coming from the federal government are allocated across the region in a more equitable way through the Puget Sound Regional Council.

2. Sound Transit Update

Vice Chair Walker provided an update on the Ballard/West Seattle Extension, noting that an additional study was approved and more options were added. Work will begin with the community to come up with the most financially sound path forward.

The next steps on the Tacoma Dome Link Extension have been approved. The project has seen some delays relating to the Fife Station. The public will be able to provide input over the next one to two years.

Commissioner Roscoe reported that the delay is related to station locations. There is a requirement that Sound Transit add additional station requirements.

3. **Puget Sound Regional Council Transportation Policy Board Update**

   Vice Chair Walker reported the work conducted by the FTA Working Group should yield $8 - $10 million annually to Pierce Transit. She reported that new criteria was developed so that dollars will be distributed in a more equitable way.

   She spoke about the WSDOT Review I-5 Plan, noting that this month they will look at a number of projects for funding that were not on the list.

   Chair Campbell thanked Vice Chair Walker and the FTA Funding Committee for their equity analysis work.

4. **Commissioners' Comments**

   No comments were provided.

EXECUTIVE SESSION

There was no Executive Session held.

ADJOURMENT

Commissioners Walker and Hines **moved** and seconded to adjourn the meeting at 5:08 p.m.

Motion **carried,** 5-0.

Deanne Jacobson	Marty Campbell, Chair
Clerk of the Board	Board of Commissioners

TITLE: Authority to Execute Purchase Order 1708 to Pacific Power Group, LLC, for six (6) Energy Storage Systems for Hybrid Electric Buses

DIVISION: Maintenance

SUBMITTED BY: Stephanie Prine, Parts Procurement Manager

RELATED ACTION: N/A

ATTACHMENTS: N/A

RELATION TO STRATEGIC PLAN: Customer

BUDGET INFORMATION

Is it Budgeted? ☒ Yes / ☐ No

Project Name or Number: N/A

☒Operating Budget ☐Capital Budget

FUNDING SOURCE:		EXPLANATION:
Local Amount	$ 475,660.02	The total expenditure amount of $475,660.02 including sales tax. Battery packs used on Sound Transit buses will be billed to Sound Transit via our standard work order system once they are installed.
Grant/Other Amounts	$ N/A	
Total Expenditure	$ 475,660.02	

BACKGROUND:

This item is being placed on the consent agenda as replacement of electric bus battery packs are essential and necessary to extend the life of a hybrid buses in order to provide service to the community without interruption. This is a planned expense to maintain continuity of operations.

Pierce Transit currently operates 12 hybrid electric buses for our local service and 18 hybrid electric buses for Sound Transit service. The energy storage systems (battery packs) need to be replaced after approximately 8-10 years to maintain the functionality and reliability of the bus. We currently have six buses in which the battery packs have reached the end of their useful life and are needing replacement.

Staff solicited quotes and received three responses. Pacific Power Group, LLC, provided the most competitive price at $72,069.70 each plus sales tax, for each battery pack.

STAFF RECOMMENDATION:

Staff recommends authorizing this purchase in order to properly maintain our hybrid electric buses and extend their useful life so that we can continue to provide reliable service to our customers.

ALTERNATIVES:

Do not authorize this purchase, therefore not replacing the battery packs. This could potentially jeopardize the functionality and reliability of 6 hybrid electric buses.

PROPOSED MOTION:

Move to: Authorize the Chief Executive Officer to execute Purchase Order 1708 to Pacific Power Group, LLC, in the amount of $475,660.02 for six (6) energy storage systems (battery packs).

TITLE: Authorize the Chief Executive Officer to Enter into and Execute a Professional Services Agreement with Nelson Nygard (Contract No. 1618) to Assist the Planning Department with the 2023 Recovery and Restoration Fixed Route Services Plan

DIVISION: Planning & Community Development

SUBMITTED BY: Lindsey Sehmel, Service Planning Assistant Manager

RELATED ACTION: N/A

ATTACHMENTS: N/A

RELATION TO STRATEGIC PLAN: Customer

BUDGET INFORMATION

Is it Budgeted? ☒ Yes / ☐ No

Project Name or Number: N/A

☒Operating Budget ☐Capital Budget

FUNDING SOURCE:		EXPLANATION:
Local Amount	$ 209,971.00	
Contingency	$ 41,994.20	
Grant/Other Amounts	$	
Total Expenditure	$ $251,965.20	

BACKGROUND:

During 2022 Pierce Transit identified that we would not be able to experience a recovery of our fixed route services as quickly as we had experienced reducing them at the peak of the pandemic. It was identified that it would be necessary to identify new ridership trends, look at reallocating resources and service hours throughout our service area to meet the needs of our riders to the best of our ability with the reduction of workforce in the Maintenance and Operator positions, which is experienced nationwide.

In early 2023 Pierce Transit advertised a Request for Proposal (RFP) to assist the Service Planning Department in the technical analysis, research, and community engagement to identify the best approach for the allocation of our fixed route service resources in conjunction with the operator and maintenance staff training/hiring.

We received two responses to the RFP. These were reviewed by a team of three, consisting of management staff from Operations, Human Resources, and Planning and Community Development. Scoring was based on response to scope of work, financial costs for services, and strength of interviews.

A draft of the plan will be presented to the Board in Fall of 2023 with a Public Hearing. The finalized Plan is expected to be completed at the end of 2023 and subsequently considered by the Board of Commissioners for approval.
The RFP included five major tasks as part of the work:

1. **Conduct Origin and Destination (O&D) Study for the time period of January 2021 through December 2022 for Pierce Transit Fixed Route services.**

2. **Community Engagement Support. Support Pierce Transit's Service Planning team in broad and meaningful community engagement outreach through our Public Transportation Benefit District, or service area, and with Pierce County jurisdictions.**
    a. Communication topics.
        i. Transit Education – resources, restrictions, opportunities
        ii. Impacts of Covid-19 Pandemic to Transit Service
    b. Outreach & engagement. Pierce Transit may assume a Technical Advisory Committee or utilize our Community Transportation Advocacy Group for this effort with internal staff leading. In addition, the project will engage with key community groups, commissions, neighborhood groups and business districts directly at their regularly scheduled meetings. Additionally, the agency will host a roundtable with jurisdictional representatives to share information about the alternatives and seek input.
        i. Consultant will work closely with Pierce Transit developing outreach and engagement plan. Consultant may be asked to schedule meetings, prepare agendas, and document meetings. Assumptions will need to be documented before scope of work is developed.
        ii. In person open houses (Approx. 4)
        Open houses will be located throughout Pierce Transit's service area to reach a broad mix of riders and the public with a focus of reaching equity communities. This will require having consultant staff available for the in-person outreach efforts and events onsite. Pierce Transit will lead this effort but requires support with graphics and data visualization, and key staff available at events to answer questions and support documenting findings.
        iii. Virtual online engagement (over 12-week period)
            1. "Plan your service" online interactive.
            2. Online open houses (assume 2).
            3. Executive team updates (assume 2).
    c. Board/Committee meetings: Assume updates at 50% and 90% project completion.

3. **Development of Draft Scenario Recovery Plan and graphics using community engagement tasks final reports.**
    a. Identify three (3) preferred scenarios on recovering projected fixed routes service hours up to 500k annual service hours and their associated timeline for successful implementation. Anticipated plan timeframe is six (6) years or less. Scenarios must be based on feedback, data trends findings, and fixed route performance.
    b. Identify prime regions or markets that may benefit from an alternative service, other than Fixed Route, due to low ridership or failing service performance in 2021 and 2022. Alternative services could be on-demand or other non-traditional services based on industry best practices.

   c. Close coordination of recovery planning with Pierce Transit Human Resources and Operations Divisions will be vital and conducted throughout this effort.
      i. The scenarios will need to include methods to weight proposals for recovery based on staffing availability and potential timelines for hiring and training additional Transit Operators.

4. **Analyze and re-evaluate the existing Pierce Transit Long Range Plan.**
   a. Analyze and reevaluate Pierce Transit's Destination 2040 Long Rang Plan Update with a focus on equity and service delivery to identify plan proposals that will need to change in the next update due to impacts of the COVID-19 Pandemic and recommendations of the Service Recovery Plan. Consider recently updated regional plans in this review.

5. **State Environmental Protection Act (SEPA) consideration. Analyze project against SEPA requirements to confirm no environmental analysis is required. If required, lead effectors to develop SEPA Checklist.**

Agency Staff will be working closely to ensure all tasks are conducted utilizing FTA Standards, Pierce Transit Policies and Procedures, financial accountability, Fixed Route Service Standards (adopted in Destination 2040), interim performance ratings for each fixed route, and our Title VI Plan. The staff involved will include a variety of divisions and departments due to the nature of the impact of recovering service and the balance of staff resources and available implementation timeline.

STAFF RECOMMENDATION:

Staff recommends the Board of Commissioners authorizes the Chief Executive Officer to enter into and execute a professional services agreement with Nelson Nygard not to exceed $251,965.20 which includes a 20% maximum contingency allowance.

ALTERNATIVES:

Conduct work in house with a longer timeframe for plan development and engagement. Due to internal staffing challenges this is not a preferred alternative as it would extend community education and engagement as well as the final plan deliverable to the Board.

PROPOSED MOTION:

Move to: Authorize the Chief Executive Officer to enter into and execute a professional services agreement with Nelson Nygard (contract No.1618) to assist the planning department with the 2023 Recovery and Restoration Fixed Route Services Plan in an amount not to exceed $251,965.20.

PierceTransit

Connecting you with life

2023 Fixed Route Recovery and Restoration Planning

BOC May 8th – Contract Authorization

2023 Fixed Route Recovery Planning

Consultant Selection and Project Overview

- The BOC adopted the 2023 Budget with an allocation of funds for work around planning and development of how Pierce Transit's Fixed Route Services can recover to pre-pandemic service levels.
- Staff published the RFP in February for the work, received two submittals in March and interviewed the respective firms in April.
- Submittals were scored based on the response to tasks identified in the Request for Proposals, financial assumptions of cost to complete, and consultant interviews.
- Review team consisted of management staff from Human Resources, Operations and Planning and Community Development.
- Nelson Nygard's proposal most closely meets the needs of the Agency, the ability to complete the work in the necessary timeframe.

Leading Principals

- Equity
- Route Performance
- Regional Access

Tasks and Project Timeline

Origin and Destination Study: May-June

Community Engagement: July-September

Three Preferred Alternatives: October-November

Final Plan Adoption and Destination 2040 Analysis Report: December

Questions

- Do Members of the Board have any questions on the fact sheet, project scope and/or tasks?

Proposed Motion

- Move to: Authorize the Chief Executive Officer to enter into and execute a professional services agreement with Nelson Nygard (contract No. 1618) to assist the Planning Department with the 2023 Recovery and Restoration Fixed Route Services Plan in an amount not to exceed $251,965.20.

TITLE: Authority to Increase the Recruitment Referral Incentive Amount and Add a New Hire Incentive Bonus for Bus Operators and Journey Level Mechanics

DIVISION: Administration

SUBMITTED BY: Amy Cleveland, Executive Director of Administration

RELATED ACTION: N/A

ATTACHMENTS:

Exhibit A, Recruitment Referral Incentive and Signing Bonus Program Guidelines

RELATION TO STRATEGIC PLAN: Employee

BUDGET INFORMATION

Is it Budgeted? ☒ Yes / ☐ No

Project Name or Number:

☒Operating Budget ☐Capital Budget

FUNDING SOURCE:		EXPLANATION:
Local Amount	$ 650,000	The incentives would be funded with existing personnel budget (unfilled positions).
Grant/Other Amounts	$	
Total Expenditure	$ 650,000	

BACKGROUND:

Pierce Transit is significantly affected, as are most employers, with a tightened labor market to compete for talent. Adequate staffing levels are necessary to increase service levels to meet community needs. One of the strategies to enhance the agency's ability to address our employee shortage has been a Recruitment Referral Incentive program to reward current employees who successfully recruit new employees to the agency. The program began as applicable only to Bus Operator positions and has since been expanded to all positions as the impact of a high vacancy rate has affected the entire organization. To date, 65 employees have been hired through this program.

The current program provides a $1,000 incentive to employees who refer a candidate to a posted job opportunity and the referral is hired, successfully completes probation and one year of service. While the Recruitment Referral Incentive combined with the many other actions taken have resulted in positive progress, the current vacancy rates are 15% for Bus Operators and 17% for Journey Level Mechanics. With the goal of full staffing for the difficult-to-fill Journey Level Mechanic classification and the ongoing challenge to recovering from an approximate 65 Bus Operator shortage, the proposed revision to the Recruitment Referral Incentive includes continuing the current program for most job openings and enhancing the program for Bus Operator and Journey Level Mechanic positions to provide for a $5,000 Recruitment

Referral Incentive for employees who successfully recruit Bus Operators and Journey Level Mechanics and adding a new hire incentive of $5,000 for Bus Operators and Journey Level Mechanics.

The enhanced incentive includes a provision that those who receive a New Hire Incentive payment would not also be eligible to also receive the Recruitment Referral Incentive payment. The program will be funded with existing 2023 budget amounts and is planned to end by December 31, 2023.

STAFF RECOMMENDATION:

Approve the proposed enhanced Recruitment Referral Incentive to provide for a $5,000 payment to eligible referring employees and the proposed New Hire Incentive to provide for a $5,000 payment for newly hired Bus Operators and Journey Level Mechanics.

ALTERNATIVES:

Do not approve changes to the Recruitment Referral Incentive or addition of New Hire Incentive of $5,000 for Bus Operators and Journey Level Mechanics. This will likely result in continued challenges to keep and fill staff shortages in positions that have a high impact to Agency ability to maintain and increase service.

PROPOSED MOTION:

Move to: Authorize the Chief Executive Officer to increase the current Recruitment Referral Incentive amount and add a New Hire Incentive bonus for Bus Operators and Journey Level Mechanics pursuant to the guidelines presented in Exhibit A.

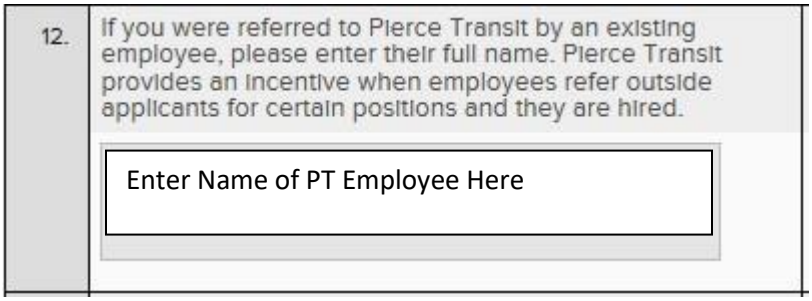
Recruitment Referral
& New Hire Incentive Program

Until 12/31/2023 includes the following:

Transit Operator & Journey Level Mechanic	$5,000[1]
All other Pierce Transit vacancies	$1,000
NEW HIRE Incentive (Signing Bonus[2]) for Transit Operator and JLM	$5,000

If you refer a candidate to any of our posted job opportunities, and if that person is hired, successfully completes probation and one year of service, Pierce Transit will pay you up to $1,000.00! **For Operators and Journey Level Mechanics, that amount has been increased to $5000[3].**

When you refer someone who you feel will make a great employee, **instruct them to enter your full name on their employment application**. Applicants should only list one Pierce Transit employee per application. Question found on online application:



New Transit Operator or Journey Level Mechanics hired on or after May 1, 2023 are eligible for the New Hire Incentive of $5000. Employees who receive the $5000 New Hire Incentive are not eligible for the Recruitment Referral Incentive.

[1] Payments after completion of probation ($2500) and completion of one year ($2500).
[2] Payments after completion of probation ($2500) and completion of one year ($2500).
[3] Applicants for JLM and Operator who apply starting May 1, 2023 shall be included in the $5000 RRI.

Program Guidelines

1. All current Pierce Transit employees hired prior to May 1, 2023 are eligible to refer applicants, and those hired after May 1st into jobs other than Transit Operator and JLM. **If you are the hiring manager or have influence/participation in the hiring process, you are excluded from receiving the incentive for that job.**

2. There is no limit on how many times you could be eligible for this incentive. You are eligible for the incentive for each referred applicant who provides your full name on their employment application indicating you referred them to the job opening, and the candidate is hired and meets the criteria.

3. The referral must be from a current employee for an external applicant. Existing, temporary, limited duration, summer, contract, and former employees of Pierce Transit are not eligible applicants for the Recruitment Referral Incentive or New Hire Incentive.

4. For you to be eligible to receive the incentive payment, the applicant must put your full name on the application as the referral source at the time of application.

5. Only one referring employee will be eligible for incentive payment per hire. Where an applicant has applied more than once, the application from which the employee was hired will be used.

6. All applicants will be evaluated for employment consistent with Pierce Transit's policies and procedures. Referrals do not guarantee employment to the candidate.

7. All information regarding the hiring decision will remain strictly need-to-know (confidential).

8. To qualify for the Recruitment Referral Incentive, the referring employee and the referred new hire must still be active employees at the time the referred new hire either passes probation or successfully completes one year of employment with Pierce Transit with neither having a resignation pending at the time of payment.

9. This incentive program may be discontinued at any time by the Chief Executive Officer, or designee.

For questions regarding the Recruitment Referral Incentive Program, please contact a member of the recruitment team at 253-581-8095, or email jobs@piercetransit.org.

Pierce Transit

Zero Emission Bus (ZEB) Strategy

Board Presentation
May 8, 2023

Presented by:

Tina Lee - Planning Manager

Nathan Groh – Zero Emissions Fleet Coordinator

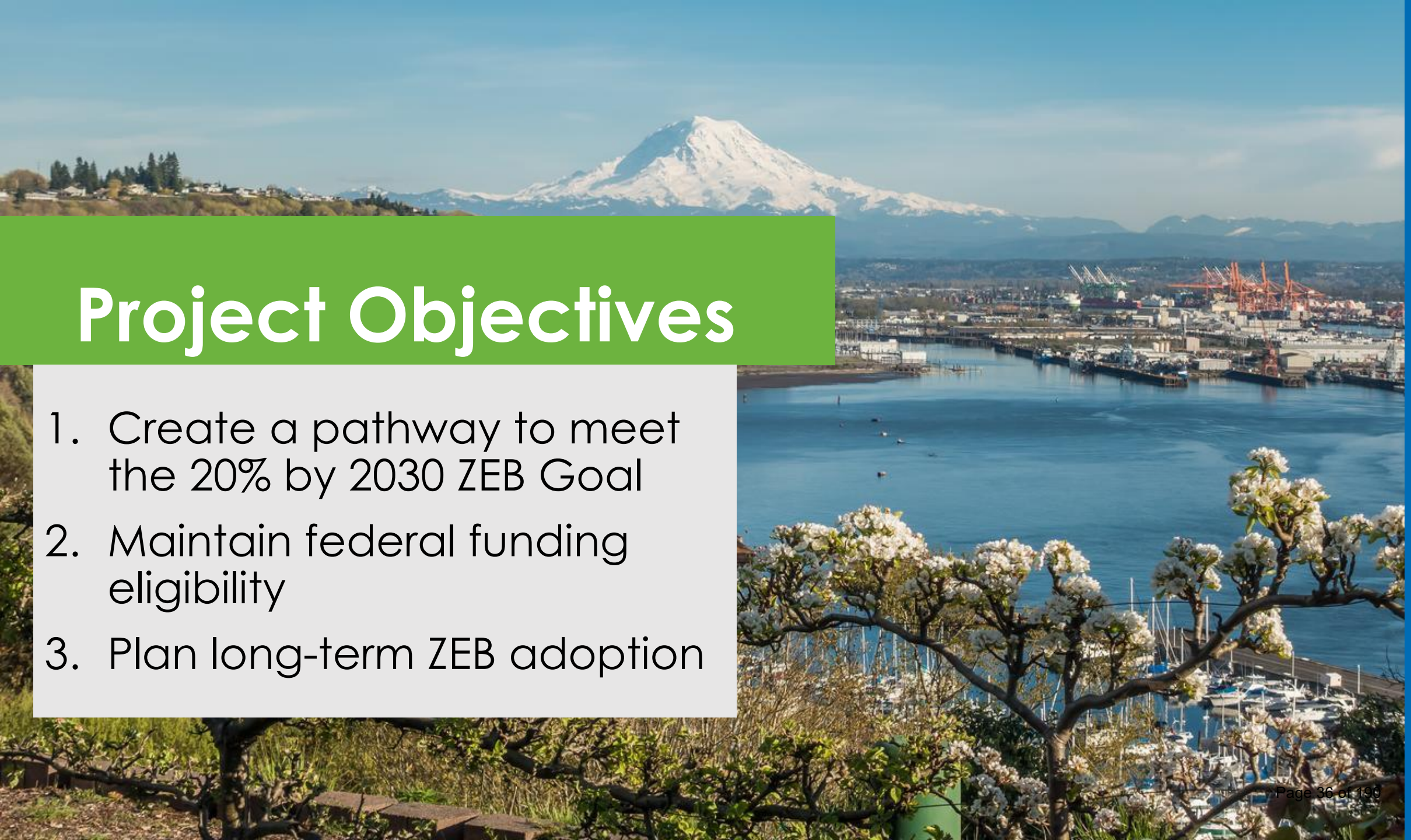
Mark Eldridge – Senior Planner

Agenda

1. Study Purpose & Analysis
2. Near-Term ZEB Strategies
3. Long-Term ZEB Strategies
4. Financial Analysis
5. Next Steps

Pierce Transit

01 Study Purpose & Analysis



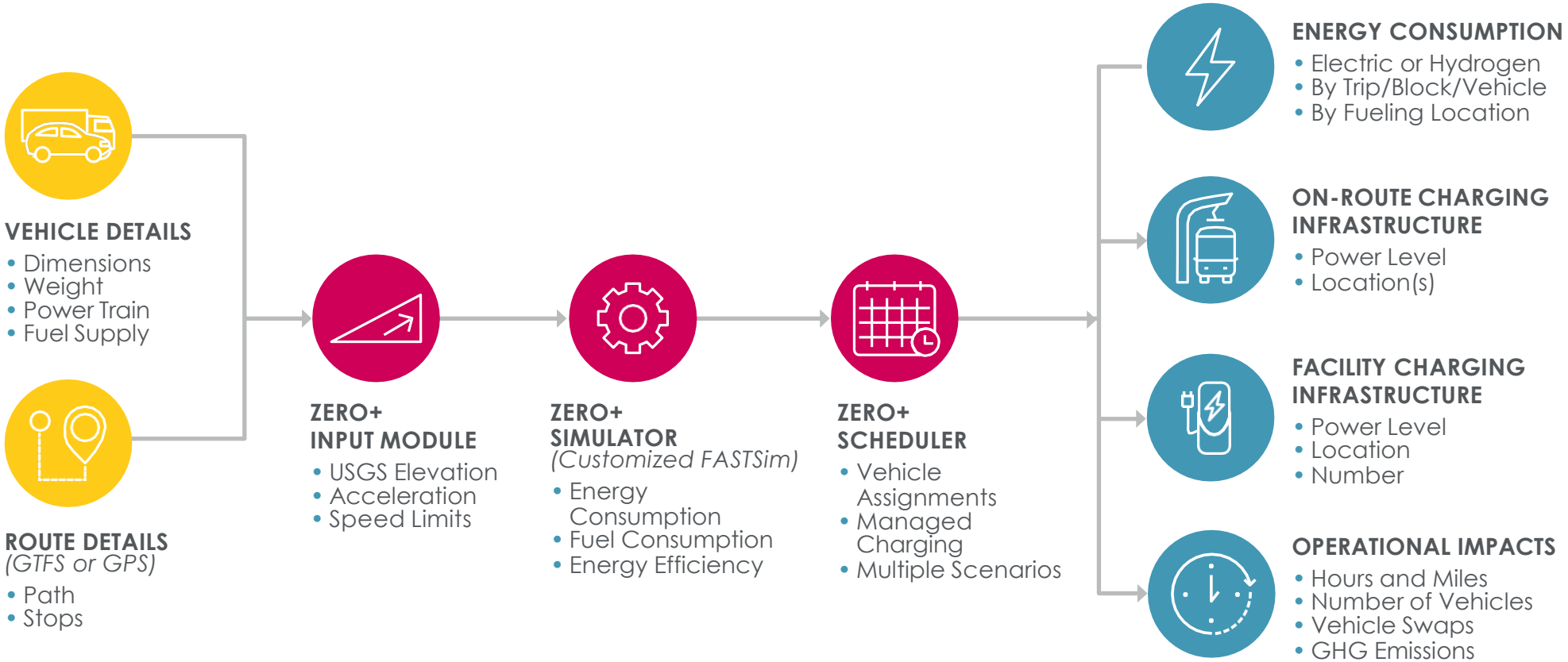
Project Objectives

1. Create a pathway to meet the 20% by 2030 ZEB Goal
2. Maintain federal funding eligibility
3. Plan long-term ZEB adoption

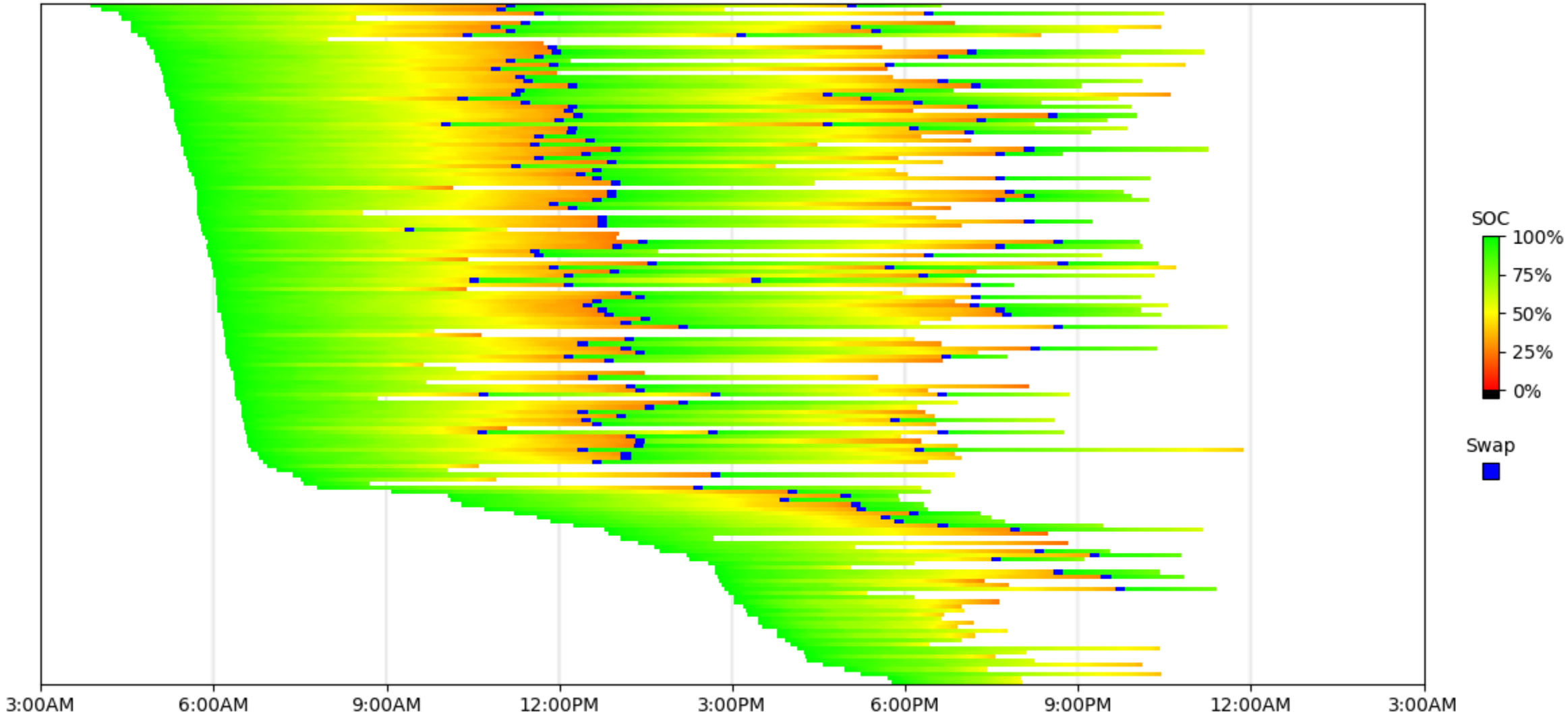
Methodology

- Policy & Legislative Impacts
- Route Modeling
- Stakeholder Engagement & Utility Coordination
- Workforce Development

Route Modeling

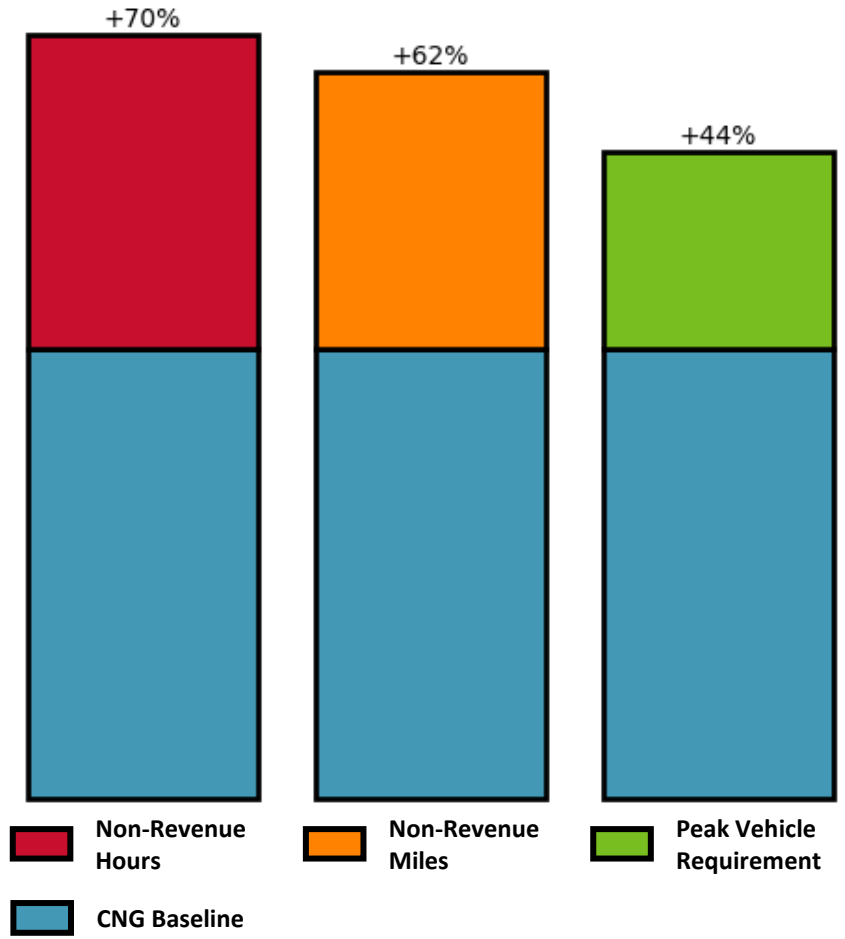


State of Charge – Depot Charging Only

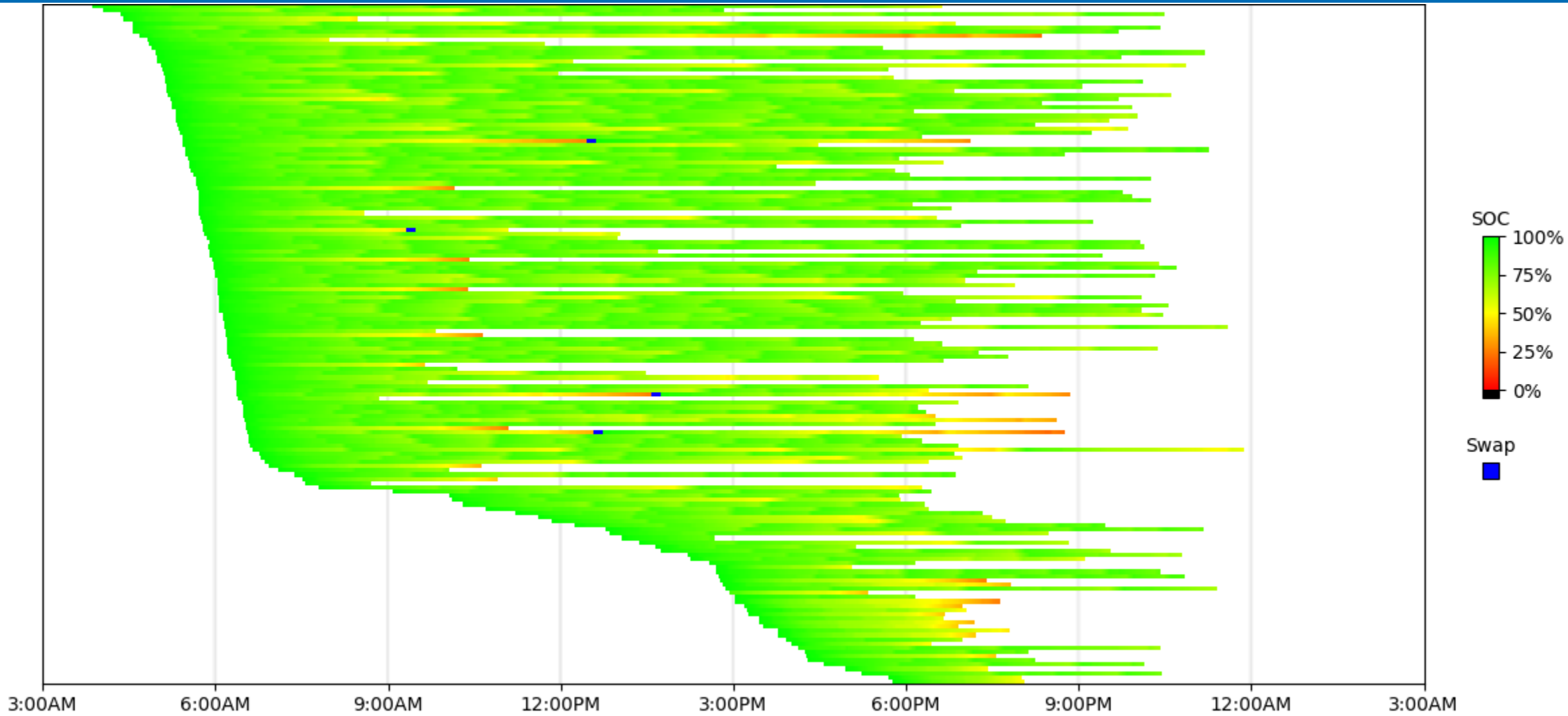


☑ Key Takeaways: BEB Depot Charging Only

- Revenue Hours & Miles remain the same
- Non-Revenue Hours: **70% increase**
- Non-Revenue Miles: **62% increase**
- Peak Vehicle Requirement: **44% increase**
  - ➢ Increase Fleet from 128 to 184 buses
  - ➢ 56 more vehicles required
- At least **77 Depot Chargers** will be required
- Pierce Transit can deploy **29 BEBs** before fleet increases will be required

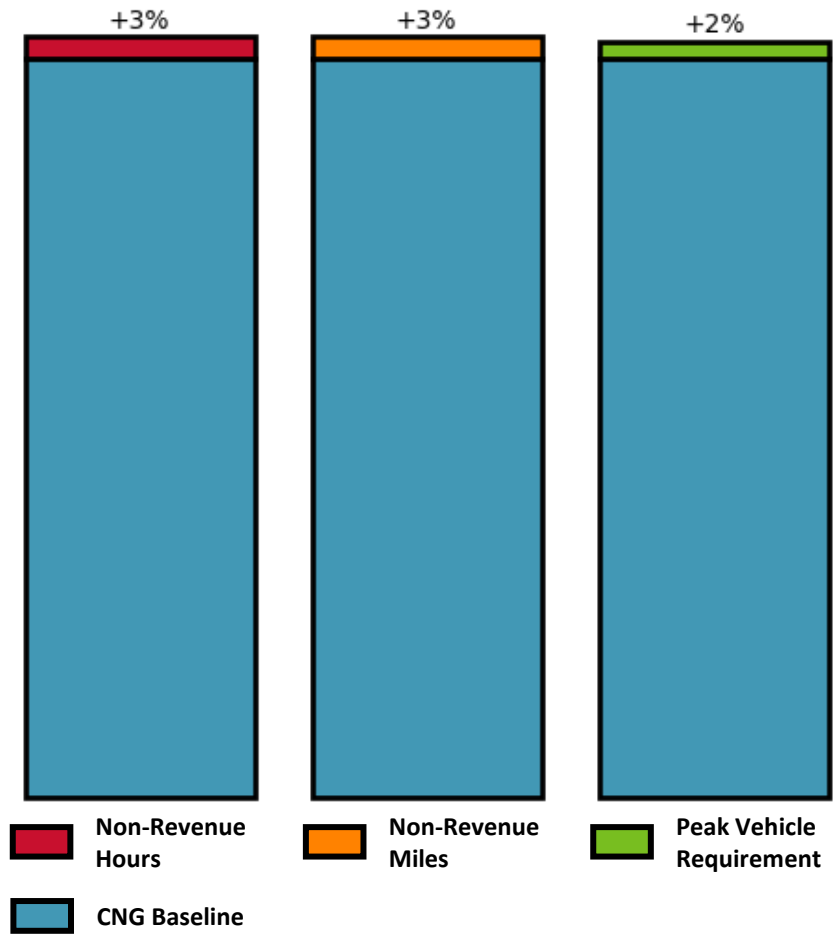


State of Charge – Depot + On-Route



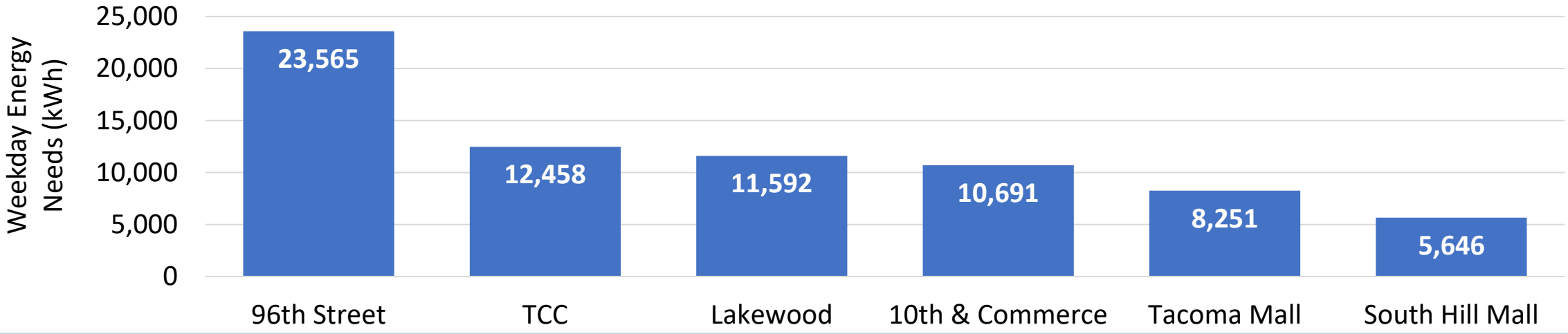
☑ Key Takeaways: BEB Depot + On-Route

- Revenue Hours & Miles remain the same
- Non-Revenue Hours: **3% increase**
- Non-Revenue Miles: **3% increase**
- Peak Vehicle Requirement: **2% increase**
  - ➢ Increase Fleet from 128 to 131 buses
  - ➢ 3 more vehicles required
- Up to **18 On-Route Chargers** will be required



Possible Charging Locations

Lakewood Base (96th St):	77 Depot Chargers
TCC Transit Center:	4 On-Route Chargers
Lakewood Transit Center:	4 On-Route Chargers
10th & Commerce Transit Center:	4 On-Route Chargers
Tacoma Mall Transit Center:	3 On-Route Chargers
South Hill Mall Transit Center:	3 On-Route Chargers



☑ Key Takeaways: Hydrogen Buses

- Hydrogen buses can replace current buses 1-to-1
  - Revenue Hours & Miles: **0% increase**
  - Non-Revenue Hours & Miles: **0% increase**
  - Non-Revenue Miles: **0% increase**
  - Peak Vehicle Requirement: **0% increase**
- Hydrogen Requirements
  - Weekly Hydrogen Requirement: 16,820 kg
  - 31 hours of refueling time needed per day
  - At least 2 dispensers are required (refueling would take all night with only 2 dispensers)
  - More dispensers may be needed to maintain current operations

Stakeholder Engagement

- Roundtable
- Social Media Survey
- Utilities Coordination
  - Lakeview Light and Power
  - Puget Sound Energy
  - Tacoma Power
  - Northwest Hydrogen Association

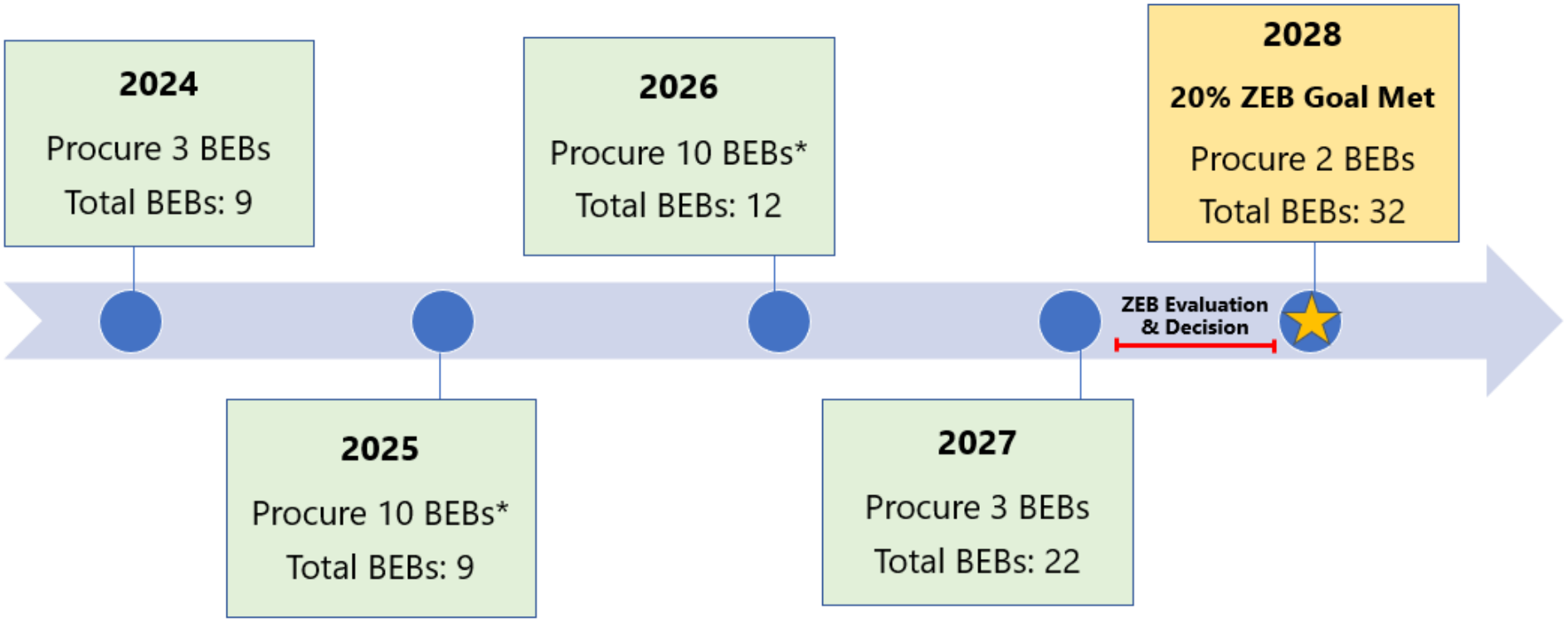
Workforce Development

- Identified additional training needs for ZEBs
- Developing mechanic training with 2022 Lo/No
- Recommending pre-apprenticeship, apprenticeship program, and operator training with 2023 Lo/No Application

02 Near-Term ZEB Strategy 2023-2028

Bus Deployment

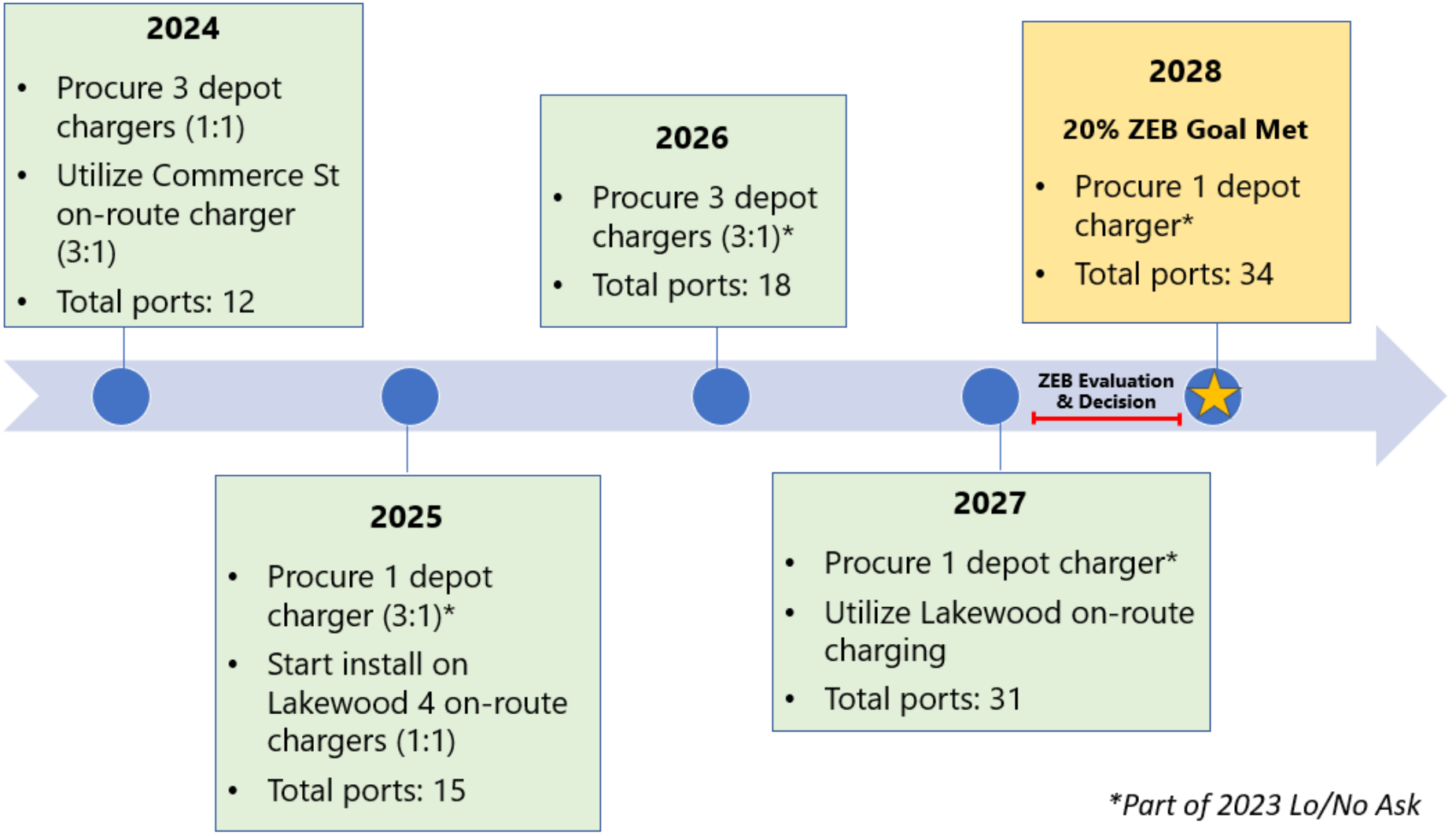
- 9 existing BEBs
- 28 BEBs procured from 2023-2028
- 20 BEB ask in 2023 Lo/No
- 32 buses in operation by 2028



*Part of 2023 Lo/No Ask

Charger Deployment

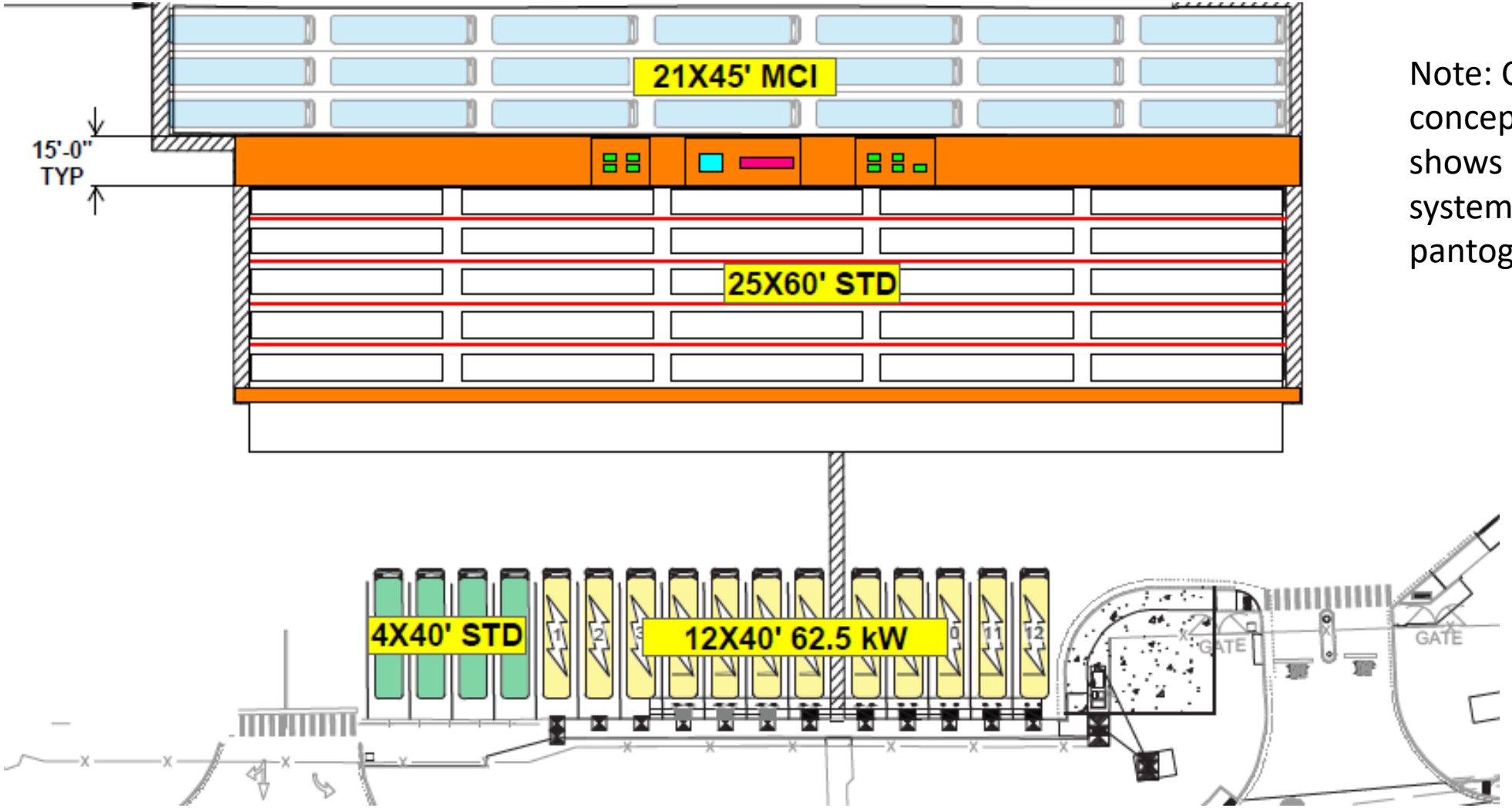
- 9 existing depot chargers
- 14 chargers procured from 2023-2028
- 7-charger-ask in 2023 Lo/No
- 23 chargers and 34 charging ports by 2028



*Part of 2023 Lo/No Ask

Pierce Transit

Lakewood Base Charging Layout



Note: Current conceptual design shows a gantry system and pantographs

Lakewood Transit Center Charger Layout

- Install four 450kW chargers at Lakewood Transit Center
- Start design in 2025 to have operational by 2027
- Would support fleet of up to 49 BEBs

03 Long-Term ZEB Strategy 2029-2042

2029-2042

Two Long-Term Scenarios

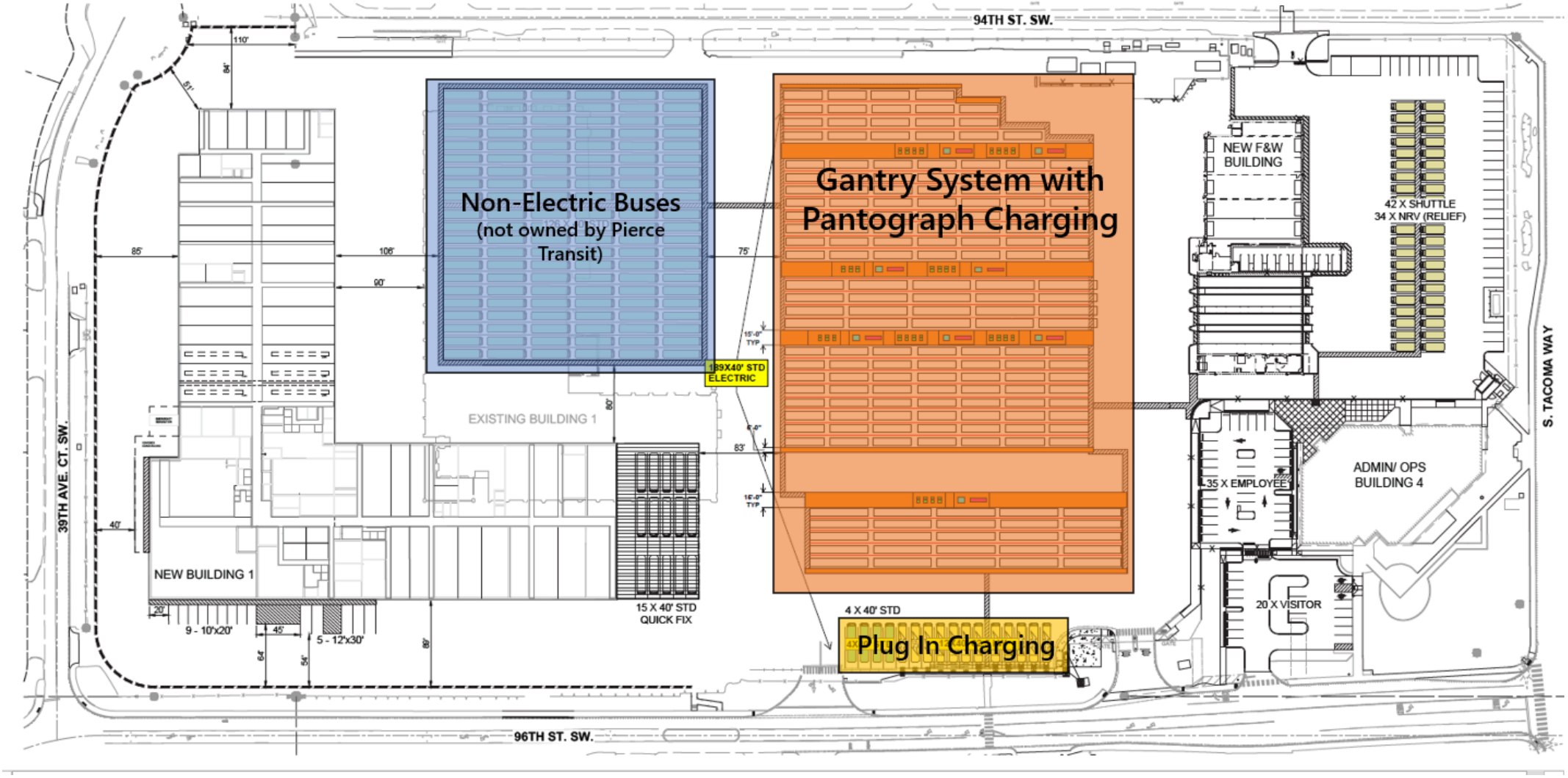
Option 1: Long-Term BEB

Option 2: Long-Term FCEB

Long-Term BEB

- 206 BEBs
- 77 Depot & 18 On-Route Chargers
  - Total 207 Charging Ports
- Created plan using this scenario
- Continue with regular procurement schedule but replace with BEBs
- Depot charging & on-route charging installed incrementally

Long-Term BEB: Depot Chargers



Long-Term BEB: On-Route Chargers

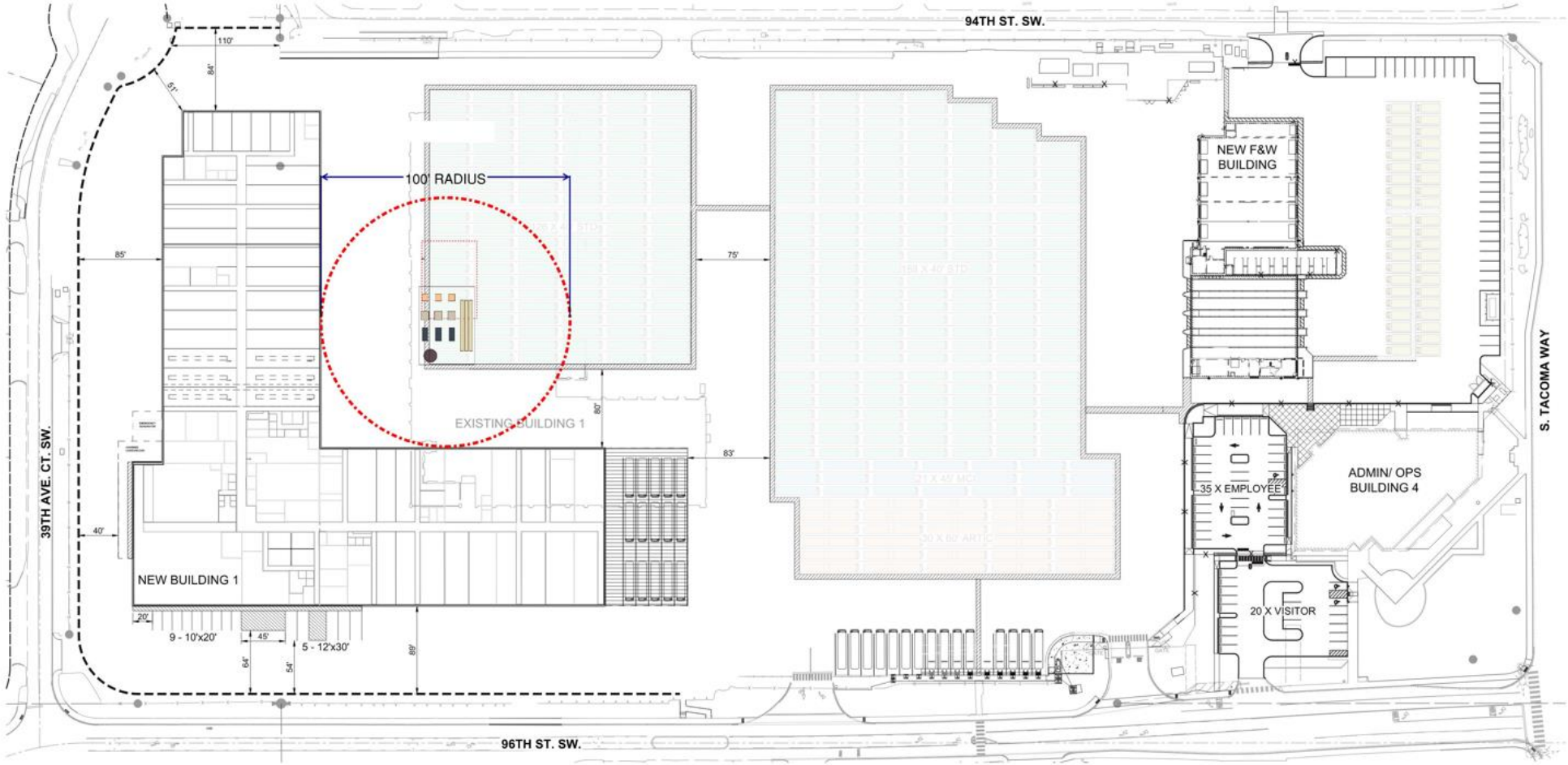
Transit Center	Number of Chargers	Design to Commissioning
Commerce Street	(4) 450kW (1) 180kW	2022-2023: (1) 180kW charger* 2033-2035: (4) 450kW chargers
Lakewood	(4) 450kW	2025-2027
TCC	(4) 450kW	2031-2033
Tacoma Mall	(3) 450kW	2034-2036
South Hill Mall	(3) 450kW	2034-2036

*Charger installation is part of existing efforts

Long-Term FCEB

- Alternative scenario if Pierce Transit wants to pivot to FCEBs
- Pivot would be triggered by decreased FCEB cost, decreased fuel cost, and/or increased fuel availability
- Begin purchasing FCEBs starting in 2029
- Infrastructure installation to begin in 2029

Hydrogen Fueling Infrastructure



- Truck in hydrogen
- 16,820 kg H2 per week
- At least two fuel dispensers

Pierce Transit

04 Financial Analysis

Capital Cost Estimates

- Estimated capital costs of three scenarios
  - **Baseline CNG**: no change, only procure CNG buses going forward
  - **Long-Term BEB**: adopt BEBs in near term and long term
  - **Long-Term FCEB**: adopt BEBs in near term and pivot to FCEBs in 2029
- Long-Term BEB: $210M more than baseline
- Long Term FCEBs: $296M more than baseline

Fleet Type	Total Capital Cost (2023-2042)
Baseline CNG	$364M
Long-Term BEB	$574M
Long-Term FCEB	$660M

05 Next Steps

ZEB Strategy

- Finalize **Financial Analysis**
- Receive **Board comments** on the **Zero Emission Bus Transition Plan**
- Applied for additional **FTA funding on April 13th & WA State Grant Funding** in 2023
- Continue Coordination & Grow **Partnerships with Utilities**

Zero-Emission Bus Transition Strategy

April 2023

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Acronyms and Abbreviations

APTA	American Public Transportation Association
ASE	Automotive Service Excellence
ATU	Amalgamated Transit Union
BEB	battery electric bus
BESS	battery energy storage systems
BRT	bus rapid transit
CDL	commercial driver's license
CES	Clean Energy Standard
CFS	Clean Fuel Standard
CHARGE	Consortium for Hydrogen and Renewably Generated E-fuels
CNG	compressed natural gas
CTE	Center for Transportation and the Environment
DER	distributed energy resource
ESS	energy storage systems
EV	electric vehicle
EVSE	electric vehicle supply equipment
FCEB	hydrogen fuel cell electric bus
FMCSA	Federal Motor Carrier Safety Administration

FTA	Federal Transit Administration
GEM	Grounds, Equipment, and Maintenance
GHG	greenhouse gas
GTFS	General Transit Feed Specifications
ICE	internal combustion engine
JLM	journey level mechanic
kW	kilowatt
kWh	kilowatt hour
LOTO	Lock-Out-Tag-Out
MW	megawatt
NFPA	National Fire Protection Agency
NTI	National Transit Institute
OEM	original equipment manufacturers
OTJ	On the job
PPE	personal protective equipment
PSRC	Puget Sound Regional Council
PV	photovoltaic
RCW	Revised Code of Washington
RNG	renewable natural gas
RSG	responsibly sourced gas
RSI	related/supplemental instruction
SME	subject matter expert
SOC	state of charge
TDP	Transit Development Plan
WAC	Washington Administrative Code
WSDOT	Washington State Department of Transportation
WSTA	Washington State Transit Association
WSTIP	Washington State Transit Insurance Pool
ZEB	zero-emission bus
ZEBRA	Zero Emissions Bus Resource Alliance
ZEV	zero emission vehicle
ZEVIP	Zero Emission Vehicle Infrastructure Partnership

Executive Summary

Analysis

HDR worked with Pierce Transit to create a Zero Emission Bus Strategy to further the agency's electrification efforts and align with Federal Transit Administration (FTA) Zero Emission Transition Plan guidelines by developing a pathway to operating a zero-emission bus (ZEB) fleet. This plan analyzed a variety of aspects of Pierce Transit's fleet, operations, facilities, and staff to create a recommended path forward for ZEBs. The following are high-level takeaways from each portion of the analysis.

- **Industry Research**: There are a wide variety of battery electric and hydrogen fuel cell vehicles that fit Pierce Transit's vehicle specifications.
- **Stakeholder Engagement**: The community, including public utilities, are generally supportive of Pierce Transit's decision to incorporate more ZEBs into the fleet.
- **Policy and Legislative Impacts**: There are a variety of programs at the local and state level that support vehicle electrification, in addition to competitive federal transit programs.
- **Route Modeling**: Detailed modeling of Pierce Transit's existing transit service showed how ZEBs could operate service in three scenarios (Scenario 1: fully battery electric bus fleet with depot-only charging; Scenario 2: fully battery electric bus [BEB] fleet with depot and on-route charging; and Scenario 3: fully hydrogen fuel cell bus [FCEB] fleet). Scenarios 2 and 3 showed operational viability and were explored further for the near term (2023–2028) and long term (2029–2042).
- **Workforce Development**: Pierce Transit staff would need to complete various types of training to prepare mechanics and operators to work with ZEBs. A training program would be adopted or developed by Pierce Transit to train existing staff in ZEBs and avoid workforce displacement from adopting a new technology. Additionally, Pierce Transit is creating a career pathways trainees program to recruit new workforce.
- **Utility Coordination**: Pierce Transit met with public utilities to discuss the ZEB transition and was able to confirm incentives and power availability at multiple proposed charging locations. The agency will continue coordinating with the utilities to ensure successful and cost-effective ZEB deployments.
- **Financial Analysis**: The project team estimated the capital costs associated with the long-term transition of the fleet to zero-emission vehicles. Additional funding needed for the purchase of ZEBs and charging stations, as well as utility upgrades and charger design/construction.

Transition Plan Overview

Transition Strategy: As a result of this analysis, HDR and Pierce Transit developed a phased transition schedule to transition the bus fleet to primarily battery electric buses using on-route and depot charging. This transition schedule allows Pierce Transit to meet their goal of a 20 percent electric fleet by 2030 and anticipates a fully zero emission bus fleet by 2042. This plan is

split into a near-term plan (2023–2028) and a long-term plan (2029–2042). The near-term plan is focused on BEB deployments and some previously planned internal combustion engine (ICE) deployments. The plan then provides two options when moving into the long-term plan: long-term BEB deployment and long-term FCEB deployment. At this time, Pierce Transit is anticipating the Long-Term BEB deployment, however the agency remains open to FCEBs in the future if costs come down and fuel availability increases. This transition plan is written under the assumption that Pierce Transit continues adopting BEBs in both the near-term and long-term and provides high level information on how Pierce Transit could pivot toward FCEBs if conditions changed. *(See **Fleet Transition Plan** for more information)*

Facility Plan: To support future BEBs, the Lakewood Base would need to undergo utility upgrades and charger installations for both the near-term and long-term BEB deployment. Pierce Transit would require 1.69 megawatts (MW) at peak load to satisfy the near-term BEB deployment (2023–2028) and 1.95 MW at peak load in the long term; Pierce Transit will need to coordinate with Lakeview Light and Power to ensure energy availability. The consultant team recommends a gantry system with overhead pantograph chargers to charge the buses overnight. *(**See Facilities and Infrastructure Plan** for more information)*

On-Route Charging: During the day, some buses would charge at on-route charging locations. The project team identified the need for 18 on-route chargers to provide midday charging at five different transit centers. In the near-term deployment, Pierce Transit would install one plug in charger at Commerce St Transit Center (charger was planned prior to making this strategy) and four pantograph or inductive chargers at the Lakewood Transit Center. In the long-term deployment Pierce Transit would install pantograph or inductive chargers at the following: four chargers at the Tacoma Community College Transit Center, four chargers at the Commerce Street Station, three chargers at the South Hill Mall Transit Center, and three chargers at the Tacoma Mall Transit Center. *(See **On-Route Charging** for more information)*

Financial Plan: Transitioning the fleet to BEBs or FCEBs will require a larger up-front cost compared to the baseline fleet. The vehicles themselves cost more in 2023; however, the bulk of this increased cost comes from the infrastructure needed to support a new propulsion type. The project team evaluated the capital costs of three scenarios: (1) a compressed natural gas (CNG) Baseline Scenario where Pierce Transit continued moving toward a fully CNG fleet, (2) a BEB Long-Term Scenario where Pierce Transit was fully BEB by 2042, and (3) a Long-Term FCEB Scenario where Pierce Transit adopted BEBs in the near-term then transitioned to FCEBs in the long-term. The CNG Baseline Scenario is the lowest cost at $364 million, the Long-Term BEB Scenario is $574 million, and the Long-Term FCEB Scenario is estimated to be the highest cost at $660 million. To transition to a fully BEB fleet, it is estimated to cost $210 million more than the baseline scenario and to transition to a fleet of FCEBs it is estimated to cost $296 million more than the baseline scenario. A ZEB transition will require Pierce Transit to secure additional funding, and the speed of the transition will be heavily dependent on funding. *(See **Financial Analysis** for more information)*

Introduction

Pierce Transit has long been committed to sustainability. The agency has a variety of initiatives including responsible fuel sourcing, recycling, participating in the American Public Transportation Association (APTA) Sustainability Commitment, having a dedicated green team, and prioritizing alternative fuels. Pierce Transit has been opting toward alternative fuels since the 1980s – the agency has operated compressed natural gas (CNG) buses for decades and introduced their first nine battery electric buses (BEBs) within the past few years.

The agency continues to explore other alternative fuel options in the coming years as they continually strive to become a cleaner, greener agency. In April 2008, the Agency's CEO issued Executive Order No. 1, which directs staff to continue the purchase of alternative-fuel vehicles, implement conservation strategies, and engage in other "green" practices. In June 2022, the Executive Order was amended by the new CEO to direct staff to explore and implement petroleum conservation and renewable fuel/energy. The executive order includes the following below.

- Committing to 20% electrification of revenue fleet by 2030
- Reducing vehicle idling time
- Implementing energy conservation strategies
- Implementing water conservation strategies
- Reducing toxic chemical use
- Sustainable procurement practices
- Pollution prevention, re-use, and recycling
- Green design in buildings and facilities
- Transit-oriented development

To further fleet efforts, in April 2022, Pierce Transit hired HDR to evaluate the feasibility of zero-emission vehicles and to develop a zero-emission bus (ZEB) transition plan that would lay out a roadmap for Pierce Transit to convert the existing bus fleet to 100 percent zero-emission vehicles (ZEVs). This study included route modeling and simulations, lifecycle cost analysis, infrastructure and facility needs, utility coordination and identification of hydrogen fuel providers, and a phased fleet transition strategy. This ZEB Transition Plan also meets the federal requirements to apply for Federal Transit Administration (FTA) funding.

FTA Zero Emission Bus Transition Plan

The Bipartisan Infrastructure Law has introduced a new requirement that any federal grant application for projects related to ZEVs must include a zero-emission transition plan. Therefore, the FTA requires a Zero Emission Bus Transition Plan from each transit agency that applies for the FTA Low or No Emission Grant Program and the FTA Bus and Bus Facilities Grant Program for zero emission bus projects.

The FTA Zero Emission Bus Transition Plan must include the following six elements:

1. **Policy & Legislative Impacts:** Consideration of policy and legislation impacting relevant technologies.
2. **Fleet Transition Plan:** Demonstration of a long-term fleet management plan with a strategy for how the applicant intends to use the current request for resources and future acquisitions.
3. **Facility & Infrastructure Plan:** Evaluation of existing and future facilities and their relationship to the technology transition.
4. **Utility & Fuel Partnerships:** Description of the partnership of the applicant with the utility or alternative fuel provider.
5. **Funding Plan:** Address the availability of current and future resources to meet costs for the transition and implementation.
6. **Workforce Transition Plan:** Examination of the impact of the transition on the applicant's current workforce by identifying skill gaps, training needs, and retraining needs of the existing workers. This focuses on supporting the applicant's short-term and long-term needs to operate and maintain ZEVs while avoiding displacement of the existing workforce.

The Pierce Transit Zero Emission Bus Transition Plan addresses each of these topics in the following report and the accompanying appendices.

Policy and Legislative Impacts

Local and regional climate action plans, in combination with nationwide alternative fuel initiatives, highlight supportive policy and legislation that encourages zero emission transit vehicle and infrastructure adoption. The following actions support Pierce Transit in zero-emission transitions at the local, regional, and state levels. As Pierce Transit begins transitioning its fleet into zero-emission vehicles with initial procurements of BEBs, it is also important to note that local utility partners are working to reduce emissions from the electric grid, from which the energy is pulled to power the bus fleet.

Pierce Transit Policies and Commitments

Pierce Transit believes sustainability practices must make good business, public, and environmental sense by balancing the community's economic, social, and environmental needs. At Pierce Transit, sustainability is a core value, addressed in terms of both the services provided and how the agency operates. Pierce Transit plays a key role in reducing the number of single-occupant vehicles on the road and the pollution they generate. In 2022, Pierce Transit customers skipped 5.5 million car trips, taking Pierce Transit buses, paratransit rides or vanpools instead. By seeking more efficient alternatives to existing practices, sustainability programs often lead to cost savings over time. Pierce Transit's commitment to sustainability is reflected throughout the conception, planning, design, construction, and operation of the system. Further, the following highlights demonstrate these commitments:

- **1986: CNG Demonstration Project.** In 1986, the Agency launched a four-year demonstration project to test the feasibility of using CNG as a fuel source for its bus fleet. Since 2004, the agency's entire fleet has been converted to alternative fuels. Smog-producing hydrocarbon emissions are 80 percent lower, and CNG buses produce very little black soot or other harmful particulates. Pierce Transit has nine BEBs. Electric vehicles emit no air pollutants directly. Pierce Transit's electricity source is 96 percent fossil-fuel free and produced within our region. Pierce Transit's clean-air efforts have garnered several awards from such groups as the American Lung Association, the Natural Gas Vehicle Coalition, American Gas Association, and the U.S. Department of Transportation. The U.S. Department of Energy honored Pierce Transit with a Clean Cities National Partner Award.

- **2008: Strategic Goals.** In 2008, the Board of Commissioners of Pierce Transit adopted Strategic Goals to provide Agency employees with a list of organizational values. Included in the list of values is a continued commitment to green technologies and strategies that respond to climate change and energy independence.

- **2016: APTA Sustainability Pledge.** In 2016, Pierce Transit pledged to adopt sustainable business practices and strategies by tracking, measuring, and reporting progress. Pierce Transit administers these practices on an ongoing basis to continually improve them

over time. As a signatory to the APTA Sustainability Commitment, Pierce Transit actively supports and responsibly serves the community.

- **2022: Executive Order No. 1, Establishing a Commitment to Utilize Green Technologies and Strategies.** This Executive Order reinforces the Agency's environmental commitment and responsibility, and sets the framework for a more ambitious, comprehensive approach for addressing sustainability throughout the agency. Section 1 includes sustainable business practices and strategies that will be integrated throughout the Pierce Transit organization over time, including planning, designing, constructing, and operating existing and new transit systems and facilities. Section 2 directs staff to explore and implement the following measures to the maximum extent viable: Petroleum Conservation and Renewable Fuel/Energy; Energy Efficiency; Water Conservation, Toxics Reduction, Procurement, Pollution Prevention, Re-Use, and Recycling; Building and Facility Performance (Green Design/Green Building); Land Use; and Equity. Section 3 directs staff to identify measurable targets and timeframes, and Section 4 focuses on finances and resources.

- **2022: Sustainability Report and FTA Sustainable Transit for a Healthy Planet Challenge.** Pierce Transit signed onto the FTA Sustainable Transit for a Healthy Planet Challenge initiative in 2022 and submitted the comprehensive Pierce Transit Sustainability Report.

- **2022: Phase 1 Battery Electric Bus Fleet Transition Plan.** Pierce Transit created the Phase 1 Plan to illustrate a path towards achieving a comprehensive and equitable rollout of a clean transit fleet and infrastructure.

In addition, the following actions and policies highlight additional keys to Pierce Transit actions in place:

- **Dedicated Green Team:** Pierce Transit's Green Team comprises representatives from a variety of departments including Data Analytics, Marketing, Communications, Maintenance, Safety & Training, Community Development, ADA Eligibility, and Planning. The goal of the Green Team is to establish sustainability outcomes for the agency and develop best practices, benchmarks, and data collection protocol to measure outcome attainment. The Green Team works to improve public awareness of agency sustainability efforts, emphasize modernization, increase community partnerships, and expand our community experience.

- **Idling Reduction:** In 2018, Pierce Transit approved a vehicle idling policy intended to protect the health of our employees, passengers, and communities; conserve fuel, reduce pollution and harmful effects to the environment; prevent premature engine wear; and minimize operating costs. This policy applies to every Pierce Transit-owned vehicle.

- **Sourcing Fuel:** Pierce Transit currently purchases its CNG through a distributor, United Energy Trading, on the open market. As the market fluctuates, so does the price of gas per therm (a unit of heat equivalent). By purchasing several years' worth of gas at a time, Pierce Transit was able to lock in a reduced rate at a third of what the market averages right now. As good stewards of public funds, Pierce Transit seeks such opportunities to reduce costs. Currently, market price of CNG is 90 cents per therm, and Pierce Transit pays 30 cents per therm, significantly saving the agency money.

- **Responsibly Sourced Natural Gas:** In late 2021, Pierce Transit began transitioning its vehicles that operate on CNG to responsibly sourced gas (RSG). This gas is mined, and during the mining process, there are greenhouse gas (GHG) emissions emitted. These emissions impact the air and therefore have a carbon footprint associated with them. RSG comes from mines that offset GHGs created during the mining process with other sustainable practices. While some would argue that using RSG is not a perfect process, it is far cleaner than running buses on diesel. In addition, each bus—regardless of its fuel source—takes potentially dozens of single-occupant vehicles off the road, which further reduces carbon output. Pierce Transit is also investigating using renewable natural gas (RNG). This gas comes from dairy farms or landfills that produce methane. This gas costs more, but the advantage is that it offsets exhaust emissions. By using this fuel, Pierce Transit would effectively operate with a neutral carbon footprint. Effective January 1, 2023, the Washington State will give companies carbon credits for using RNG. Moving to RSG and eventually RNG represents another step taken toward making Pierce Transit services sustainable.

- **Energy Efficiency:** Pierce Transit has installed LED lighting at Tacoma Dome Station parking garages, transit centers, and at headquarters on bus lot. This new lighting provides brighter illumination, movement- and daylight-sensitive fixtures to reduce time lit, and lower utility bills. With efficiency and sustainability in mind, Pierce Transit provides Toyota Prius and Ford Fusion Energi plug-in hybrid electric vehicles (EVs) to employees for use when travelling to meetings or running agency errands. There are charging stations set aside for these cars at headquarters. Pierce Transit also recently installed EV charging stations for employees to charge their personal vehicles; these are very popular and encourage employees to go electric. Hybrid electric vanpool vehicles are now part of the fleet, available for community use. Tacoma Public Utilities partnered with Pierce Transit to become the first recipient of eight plug-in Vanpool vans for their employees.

- **Carbon Footprint Monitoring:** There are different methods used to calculate the carbon footprint of a transit agency. A carbon footprint is the total amount of GHGs (including carbon dioxide and methane) that are generated by an entity's actions. Some agencies use the number of vehicles in their fleet, how much fuel is used for those vehicles, and the cost of utilities that support the vehicle operation. Pierce Transit has chosen to take a more comprehensive approach that includes not only fleet vehicles, but commute trips taken by employees in personal vehicles and in vanpools and carpools.

Considering the operations of the agency as well as the associated travel made by its employees gives a more holistic picture of resource use. Calculating the agency's true carbon footprint, and planning ways to reduce that footprint, captures all aspects of service. To that end, Pierce Transit is working with an industry expert to examine data on resource use and process to establish the carbon footprint baseline. Having a clear understanding of the starting point then empowers the agency to make smart decisions on what bus specifications, bus types, and other resources to procure. This is what has allowed the agency to reinvest fuel savings into other efforts.

City of Tacoma

2030 Climate Action Plan: In 2019, the Tacoma City Council declared a climate emergency in Tacoma and called for a new plan that would set climate strategies and actions that get us on a low carbon track by 2030 and works toward the goal of net zero emissions in 2050. While the 2030 Climate Action Plan contains numerous actions that are generally supportive of this transition effort, most specifically in support of Pierce Transit Zero Emissions is Action #19 by 2024, as part of the Better Breathing category (page 26, Community; and page 49, Section 2): *Provide support to Pierce Transit to develop a zero-emission transit plan and help Pierce Transit compete effectively for state and federal funding opportunities*.

Through the Phase II Community Input Summary, one of the top three strategies in the Top Draft Big Move Climate Strategies is: Zero emission transportation is affordable and available to all. Additionally, the action entitled Develop a zero-emission public transit plan with Pierce Transit was also strongly supported through this outreach. Finally, the plan also includes many actions related to transit including rail zero emissions, electrify city fleet, and expand transit mode share.

Pierce County

Transportation is the second largest contributor of GHG emissions in Pierce County, responsible for approximately 40 percent of all GHG emissions. Reducing GHG emissions in the transportation sector will reduce particulate matter pollution and improve air quality and human health. Communities living closest to busy roads will see the greatest improvement.

- **Sustainability 2030: Pierce County's Greenhouse Gas Reduction Plan (Sustainability 2030 Plan).** This plan builds on prior County sustainability efforts. In 2010, the County launched a Sustainability Initiative that met 7 of its 10 internal goals and saved millions of dollars. This initial effort evolved into a Sustainability 2020 Plan, which has resulted in more efficient internal operations and a reduction in GHG pollution. Washington State is calling for a 45 percent reduction of GHG emissions by 2030, a 70 percent reduction by

2040 and a 95 percent reduction by 2050. In alignment with the state mandates, the Sustainability 2030 Plan calls for Pierce County to reduce government operational and community wide GHG emissions by 45 percent by 2030. This plan establishes clear and actionable strategies to ensure Pierce Transit meets this goal through five areas of focus. The five areas of focus are: Energy and the Built Environment; Transportation; Consumption and Waste Reduction; Carbon Sequestration; and Education and Outreach. From within the Transportation area of focus, three Actions support Pierce Transit zero emission transition:

  - Action Identifier T-1: Support Pierce Transit's efforts to increase bus rapid transit with electric buses and to electrify their fleet.
  - Action Identifier T-5: Support and participate in regional and statewide efforts to accelerate transportation electrification.
  - Action Identifier T-8: Develop fleet electrification plan, including necessary charging infrastructure, and implement electric-first policy when purchasing replacement vehicles and other fuel burning equipment. When electric vehicles are inadequate, hybrid vehicles are preferred choice.

- **Climate Change Resilience Strategy for Pierce County:** Underway now, this strategy will soon develop recommendations with priority action steps that also support Pierce Transit zero emission transition. (Link: https://www.piercecountywa.gov/5558/Climate-Change-Resilience)

Puget Sound Regional Council

The region comes together at Puget Sound Regional Council (PSRC) to make decisions about transportation, growth management and economic development. PSRC develops policies and coordinates decisions about regional growth, transportation and economic development planning within King, Pierce, Snohomish and Kitsap counties. PSRC is composed of nearly 100 members, including the four counties, cities and towns, ports, state and local transportation agencies, and Tribal governments within the region. The mission is to ensure a thriving central Puget Sound, now and into the future, through planning for regional transportation, growth management. and economic development.

PSRC created Vision 2050 as the regional plan for sustainably managing growth over the coming decades. The plan prioritizes a comprehensive transportation system with all modes of travel and notes that two million people will be connected to the region's high-capacity transit system by 2050. The plan also highlights the need for GHG emissions reductions and aims to see an 80 percent decrease in GHGs by 2050 (compared to 1990 levels). While the plan does not explicitly call out electric vehicles, the plan promotes low-carbon travel choices and has overarching goals which electric vehicle adoption could help support.

Washington State

In Washington, the transportation sector is the largest source of GHG emissions and a major contributor to other types of air pollution. Under a 2020 law, Washington is required to reduce its overall GHG emissions 45 percent by 2030, 70 percent by 2040, and 95 percent by 2050. Since almost 45 percent of Washington's annual GHG emissions come from transportation, cleaner cars and trucks are essential to meeting these limits. Increasing the number of ZEVs on our roads will reduce total GHG emissions by the equivalent of 1 million metric tons of carbon dioxide a year by 2030.

Motor Vehicle Emission Standards – Zero Emission Vehicles Bill

Governor Jay Inslee signed the Motor Vehicle Emission Standards – Zero Emission Vehicles bill (Revised Code of Washington [RCW] 70A.30.010) on March 25, 2020. The result of this bill will be the adoption of California vehicle emission standards, including new requirements to increase the number of ZEVs sold in Washington. The law does not ban any gas or diesel vehicle currently on the road, but steadily replaces fossil fuel-powered vehicles with cleaner models for new vehicle sales.

Climate Commitment Act

Washington's comprehensive climate law is the Climate Commitment Act, signed by Governor Jay Inslee on May 17, 2021. The Climate Commitment Act establishes a "cap and invest" program that sets a limit on the amount of GHGs that can be emitted in Washington (the cap) and then auctions off allowances for companies and facilities that emit GHGs until that cap is reached. Over time, the cap will be reduced, allowing total emissions to fall to match the GHG emission limits set in state law. Auctioning allowances will raise money that will raise funds for investing in climate resiliency, reducing pollution in disproportionately affected communities and expanding clean transportation. Rulemaking for the Climate Commitment Act began in 2021, and the program's first compliance period will begin in 2023.

Clean Fuel Standard & Credit Generation Program

On May 17, 2021, Governor Jay Inslee signed the Clean Fuel Standard (HB 1091). The standard will cut statewide GHG emissions by 4.3 million metric tons a year by 2038 and will stimulate economic development in low carbon fuel production. The Clean Fuel Standard (CFS) will work beside the Climate Commitment Act to target the largest source of emissions in Washington. The CFS law requires fuel suppliers to gradually reduce the carbon intensity of transportation fuels to 20 percent below 2017 levels by 2038. There are several ways for fuel suppliers to achieve these reductions, including:

- Improving the efficiency of their fuel production processes
- Producing and/or blending low-carbon biofuels into the fuel they sell
- Purchasing credits generated by low-carbon fuel providers, including electric vehicle charging providers

The CFS creates the possibility of credit generation opportunities for public transit operators in Washington State, specifically those using alternative fuels, renewable fuels, electrification, and hydrogen. As a result of this legislation, the Washington State Transit Association (WSTA) is seeking consultant support in aggregating and marketing CFS credits on behalf of its membership. WSTA is seeking to act as an agent to aggregate the needs of its members under a single contract that would serve to assist members in education and generation of CFS credits and realizing the credits.

ZEV Infrastructure Partnership Program

The Washington State Alternative Fuel Vehicle Charging and Refueling Infrastructure Program (RCW 47.04.350) directs the Washington State Department of Transportation's (WSDOT's) Innovative Partnerships Office to develop and maintain a program to support the deployment of clean alternative fuel vehicle charging and refueling infrastructure supported by private financing. WSDOT refers to the program as The Zero Emission Vehicle Infrastructure Partnership (ZEVIP) program. ZEVIP consists solely of projects that provide a benefit to the public through development, demonstration, deployment, maintenance, and operation of clean energy technologies that save energy and reduce energy costs, reduce harmful air emissions, or otherwise increase energy independence for the state. Program funds are invested in the deployment of EV charging and hydrogen fueling stations at key intervals along state and federal highway corridors to support interurban, interstate, and interregional travel for clean alternative fuel vehicles.

Green Transportation Grant Program

The WSDOT Green Transportation Capital grant program provides funding to transit agencies for capital projects that reduce the carbon intensity of the Washington transportation system. This grant is supported by state funding through RCW 47.66.120. Project types include fleet electrification, including battery and fuel cell electric vehicles; modification or replacement of capital facilities to facilitate fleet electrification and/or hydrogen refueling; necessary upgrades to electrical transmission and distribution systems; and construction of charging and fueling stations. It is anticipated that there will be a minimum of $12 million and up to $50 million in state funding for Green Transportation Capital Grants in the 2023–2025 biennium. The Legislature will determine the funding level in the 2022–2023 legislative session.

Other State Policies

SB 5910: This legislation advances Washington's first statewide strategy to pursue a renewable hydrogen economy by authorizing financial support from the state for a public-private partnership, in efforts to apply for the Bipartisan Infrastructure Law's clean hydrogen hub funding. Existing renewable energy resources in the Pacific Northwest make Washington an ideal location for a hydrogen hub that is supported by both public and private partnerships. The bill passed on June 9, 2022, and now authorizes public utility districts to produce, sell, and own/operate pipelines to supply green electrolytic hydrogen. It also created an Office of Renewable Fuels within the Washington State Department of Commerce and allows the State to support a funding application for a public-private partnership to produce clean hydrogen.

HB 1988: This act establishes a retail sales and use tax deferral program for certain investment projects in clean technology manufacturing, clean alternative fuels production, and renewable energy storage. Permitted investments include renewable hydrogen production and ZEV refueling infrastructure. Investments in these areas will work to expand accessibility to clean hydrogen resources, while encouraging more robust deployment and use.

Federal Programs

The FTA has been a major influence on the progression to a ZEB fleet for transit agencies nationwide. The following are some of the national programs and policies that are pushing the fleets of the future towards zero emissions:

- **FTA 5339 (a): Buses and Bus Facilities Program:** Provides funding through a competitive allocation process to states and transit agencies to replace, rehabilitate, and purchase buses and related equipment. This includes the purchase of ZEVs and related infrastructure.
- **FTA 5339 (c): Low or No Emission Competitive Program:** Provides funding to state and local governmental authorities for the purchase or lease of zero-emission and low-emission transit buses as well as acquisition, construction, and leasing of required supporting facilities.
- **U.S. Department of Energy's Energy Earthshots Initiative:** Launched in 2021, the Hydrogen Shot program seeks to reduce the cost of clean hydrogen by 80 percent to $1 per 1 kilogram in 1 decade.
- **Clean Energy Standard (CES):** This initiative is still being developed. The CES is intended to set a national standard for emissions-free power with a goal of generating 80 percent clean electricity by 2030 and 100 percent by 2035.

Fleet Transition Plan

This section details the recommended near term and long-term deployment of ZEBs for Pierce Transit's revenue bus fleet. The near-term deployment is intended to be more detailed and provide a roadmap to meeting Pierce Transit's goal of 20 percent ZEBs by 2030. The long-term strategy provides a vision to operate ZEBs on all Pierce Transit bus routes by the 2042. While Pierce Transit is committed to fully transition the fleet, actual long-term deployments will depend on funding availability and future vehicle capabilities.

The consulting team and Pierce Transit utilized all parts of the ZEB analysis to develop this plan. Some major points of consideration when building the transition plan included the following: (1) route modeling and projected ZEB performance on Pierce Transit routes, (2) energy needs for ZEBs, (3) existing transit asset management plan, (4) existing bus facility conditions, (5) identifying possible on-route charging locations, (6) existing funding and additional funding needed for ZEB deployments, (7) utility coordination and incentives, and (8) environmental justice considerations and prioritizing Justice40 communities.

Pierce Transit Zero Emission Bus Goals

Near-Term Goal: Operate **20%** of bus fleet with zero emission buses **by 2030**

Long-Term Goal: Operate **100%** of bus fleet with zero emission buses **as soon as feasibly possible**

Zero Emission Vehicles and Fueling Options

Transit agencies across the globe seeking to reduce GHG emissions are adopting alternative vehicle technologies to replace conventional diesel and CNG buses as the vehicles reach the end of their useful life. The two alternatives taking the lead in the North American market are BEBs and FCEBs, both of which produce zero tailpipe emissions. **Figure 1** shows how each technology utilizes an energy source to power a battery, which in turn powers the rest of the vehicle while producing no tailpipe emissions.

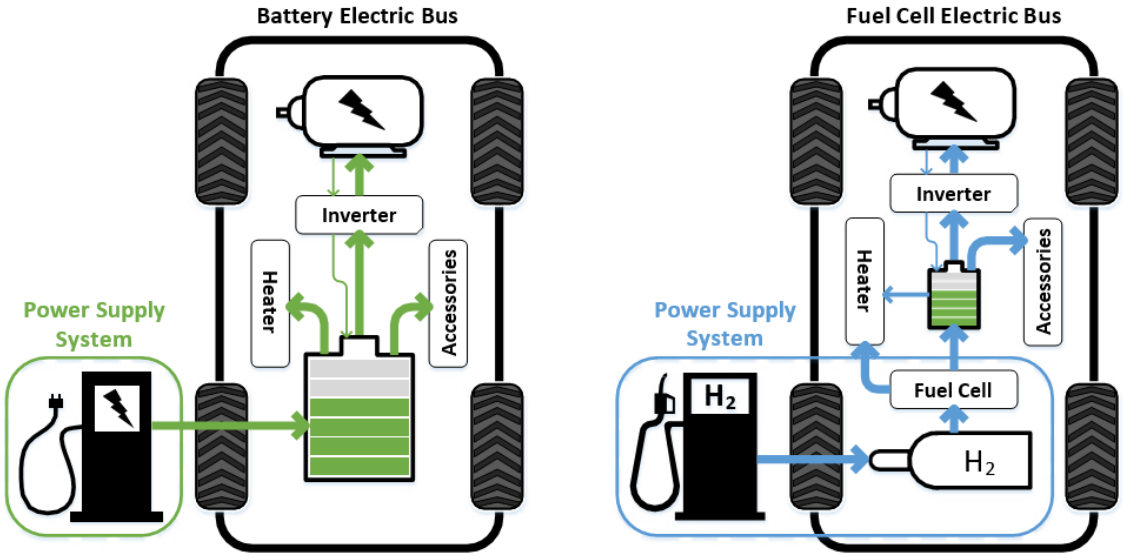


Figure 1: Battery Electric and Fuel Cell Bus Technologies

Battery Electric Buses: BEBs are currently the preferred alternative vehicle technology for North American agencies for a variety of reasons. Because there have been significantly more BEB deployments than FCEB deployments, there is a larger North American market for BEBs. Additionally, the fuel source for BEBs is delivered by the same extensive electric grid that powers the rest of North America's infrastructure. BEBs store power in battery packs that is converted to kinetic energy as a bus moves. BEBs also recuperate a percentage of battery life through regenerative braking – the preservation of kinetic energy that occurs when BEBs idle and/or decelerate. Charging infrastructure for BEBs can be located inside or outside of bus depots or maintenance facilities as well as in locations along established bus routes using either overhead or inductive (wireless) chargers. Charge time can vary from minutes to hours depending on the charging technology deployed. BEBs have a limited operational range compared to conventional buses, and the distance they can travel per charge is impacted by elevation, route profile, ambient temperature, and driver habits. While on-route charging infrastructure extends the operational range of BEBs, it is not always enough to provide BEBs with the same operational range as conventional buses.

Fuel Cell Electric Buses: FCEBs are not as prevalent as BEBs in North America but are quickly gaining traction with the increase of manufacturers entering the market and increased hydrogen supply reliability. FCEBs hydrogen storage tanks, fuel cells, and battery packs smaller than those located within BEBs. The hydrogen stored onboard an FCEB is used by its fuel cell to provide power to its battery packs as needed, and the energy residing in the battery packs is converted to kinetic energy as the bus moves. FCEBs also have regenerative braking, which preserves a percentage of energy that would otherwise be lost during idling and decelerating. Hydrogen refueling is practically identical to CNG refueling. Fueling infrastructure for FCEBs is typically limited to a designated location with specialized hydrogen storage tanks and dispensers. FCEBs refuel in a matter of minutes from empty; due the energy density of hydrogen, the operational range for FCEBs is similar to that of conventional diesel buses. The lack of need for supplemental refueling makes FCEBs a more attractive zero-emission option for transit agencies with longer routes.

While there are no emissions produced in the operation of BEBs or FCEBs, there are still well-to-wheel emissions – the total emissions related to the production, processing, distribution, and use of fuel[1] that power these alternative vehicle technologies. The amount of well-to-wheel emissions can vary for either form of technology depending on the source of electricity or hydrogen. The use of renewable power sources such as solar, wind, and hydropower can assist in mitigating well-to-wheel emissions, as the lack of emissions produced during energy production in addition to the lack of tailpipe emissions produced during operations yields zero well-to-wheel emissions. **Table 1** shows a high-level comparison of BEB and FCEB technologies.

[1] Alternative Fuels Data Center: Emissions from Electric Vehicles (energy.gov)

Table 1: Summary Comparison of BEB and FCEB Technology[2]

Consideration	Battery Electric Bus	Fuel Cell Electric Bus
Reliable Range	Likely less than 150 miles in transit service on a single charge (or indefinite range with on-route charging)	Between 200 and 320 miles in transit service before refueling
Fueling Technology	Depot or on-route charging • Plug-in charging • Overhead conductive charging • Wireless inductive charging	Hydrogen storage and fueling station • Purchase delivered gaseous or liquid hydrogen • Produce hydrogen on-site through electrolysis or natural gas reformation
Capital Costs	• BEBs are more expensive than diesel buses in 2023 • Charging infrastructure costs vary and may not scale easily depending on facility • Incremental costs or space requirements increase with fleet size	• FCEBs are more expensive than BEBs in 2023 • Fueling infrastructure costs vary and depend on the required fueling rate • Infrastructure is scalable; additional buses may not require additional infrastructure
Refueling Considerations	• Depot-charged buses may require hours to fully charge • Electricity rates will have a significant impact on operational costs • AC or DC charging options available depending on bus OEM	• Refueling procedure and time required are slower than diesel buses, but similar to CNG refueling • Electricity costs may be significant if producing hydrogen on site • Costs will vary based on production method or delivery distance

[2] TCRP Guidebook for Deploying Zero-Emission Transit Buses (2021)

Route Modeling

Transitioning to a zero-emissions fleet involves more than simply buying a vehicle and fueling system. The transition introduces new technology and requirements into day-to-day operations. Successful fleet transition plans take a holistic approach to consider operational requirements, market conditions, available power, infrastructure demands, and costs. The in-depth route modeling summarized below provides Pierce Transit with data to guide important decisions involving capital programs and operations necessary to transition the bus fleet to zero-emission vehicles. For complete details on the route modeling performed, see **Appendix A: Route Modeling Technical Memorandum**.

The first step in exploring ZEVs is use existing conditions to evaluate the current routes and fleet vehicles used to provide service. The evaluation began by collecting and reviewing all available background documents and data relevant to the study. All data collected and reviewed feeds into the modeling effort and analysis that follows. Key data inputs included:

- Operator blocks for weekdays and weekends
- Block- and bus-type assignments
- General Transit Feed Specifications (GTFS) data from pre-COVID service for transit blocks on weekdays and weekends
- Ridership data by route or block for typical weekdays and weekends
- Transit Service Plan and Transit Development Plan (TDP)
- Background policy documents
- Operations information including revenue and deadhead hours and miles
- Fleet replacement plan
- Drawings and as-built electronic drawings of the Pierce Transit operations and maintenance facility
- Maintenance costs required to develop the financial model baseline
- Scheduled maintenance and overhaul plan
- Financial plan

Battery Electric Bus Depot Charging Simulation

Depot charging only was modeled first to establish a baseline feasibility. This scenario allows the Zero+ Model to identify which existing service blocks can be electrified without an increase in peak vehicle requirements, the need for on-route charging, or the need for schedule modifications to achieve the same level of service. By electing a depot-only charging profile, the model calculates what staff, vehicle, and service modifications would be needed to maintain the current level of service.

Simulation Assumptions

To develop a model relevant for Pierce Transit's fleet and operations, a set of assumptions and variables were identified (**Table 2**). Depot charger power is assumed to be 150 kW as this is standard today, however manufacturers have recently started creating 180 kW depot chargers. Modeling assumes charging at a rate of 150kW but it should be noted that the buses could charge at a rate of 180 kW. 150 kW was used to create a more conservative model. While these attributes are typical of most vehicle original equipment manufacturers (OEMs), not every vehicle would meet this specification. When Pierce Transit procures vehicles for this transition, it is crucial to ensure that vehicle procurements meet or exceed this minimum specification to deploy BEBs that can match the operations simulated in this profile.

Table 2. BEB Depot-Charging Simulation Assumptions

Variable	Input
Battery Capacity 40-ft Buses	466 kWh
Battery Capacity 60-ft Buses	525 kWh
End-of-Life Battery State of Health	80% (Max Battery Degradation)
Energy Reserve	20% State of Charge (SOC)
Heating	Electric Heater
Ambient Temperature	Coldest Day (10th Percentile)
Passenger Capacity	Maximum Seated Capacity
Depot Charger Power	150 kW (95% Efficiency)

Model Results

Key Takeaways (**Figure 2**):

- Revenue Hours and Miles remain the same
- Non-Revenue Hours: **70% increase**
- Non-Revenue Miles: **62% increase**
- Peak Vehicle Requirement: **44% increase**
    - Increase Fleet from 128 to 184 buses
    - 56 more vehicles required
- At least 77 Depot Chargers will be required

Figure 2: BEB Depot-Only Model Outputs

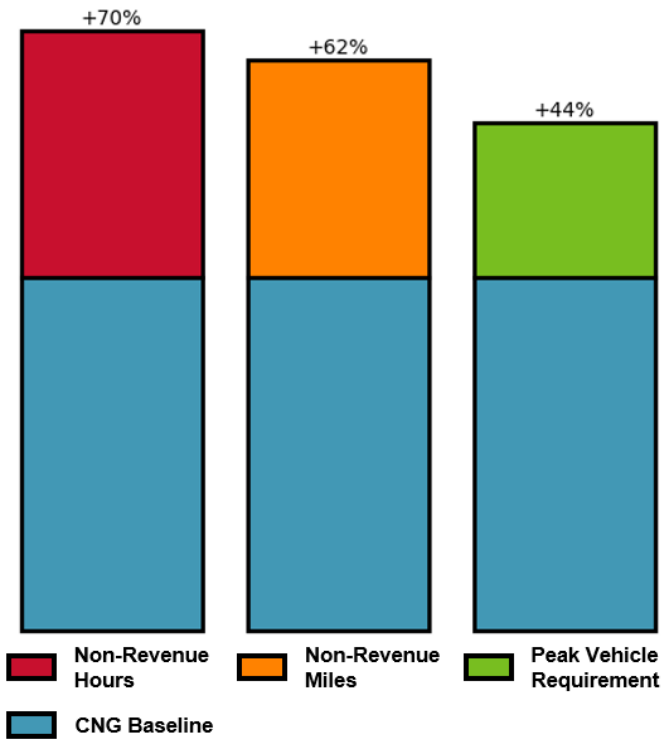
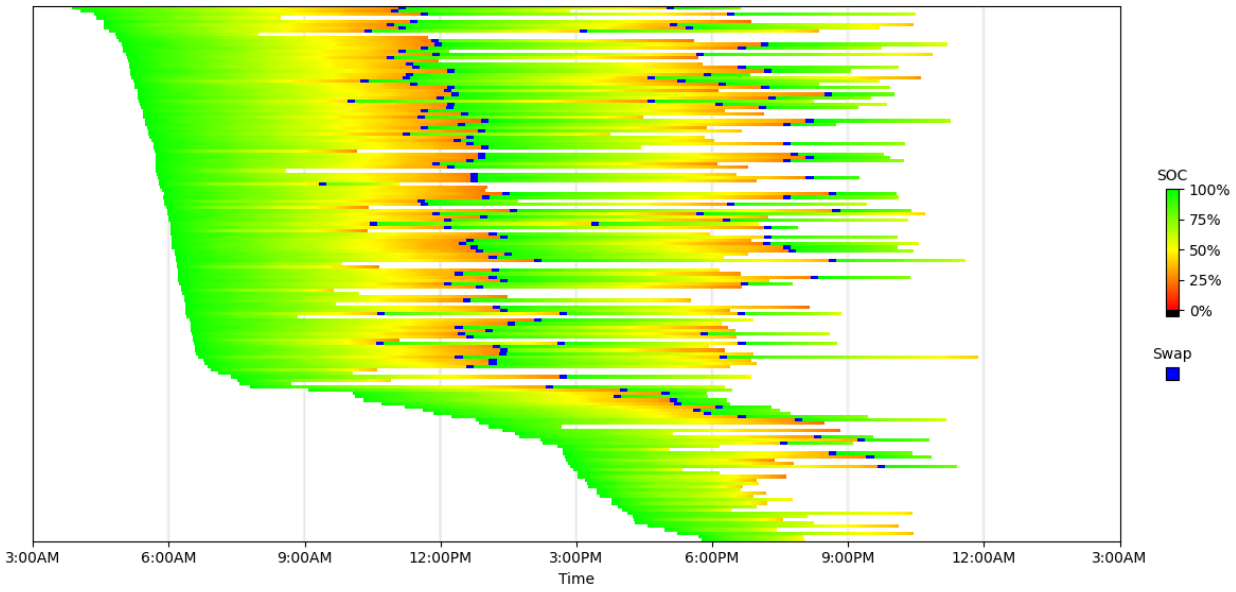


Figure 3 shows the vehicle battery SOC plot for each time block during for weekday service. Weekend service was also modeled, but fleet and charging requirements are driven by weekday service, which illustrates the most demanding operations for Pierce Transit. Each block is represented by a line on the chart with the color of the line corresponding to the SOC of the vehicle. The color changes from green to yellow to red as the SOC drops from 100 to 0 percent. Bus swaps (shown in blue) are introduced only between trips to minimize service impacts.

Figure 3: BEB Depot-Only Block State of Charge (Weekdays)



Bus swaps are also inserted in locations to guarantee the minimum SOC does not dip below the required 20 percent reserve capacity, including the energy needed to return the vehicle to the depot when a swap is needed. Whenever a vehicle is swapped out, it is replaced with a BEB that has a fully charged battery. Swapping buses is only helpful when the bus either stays near the depot all day or returns within a close distance to the depot at multiple points throughout the day. If a block is scheduled to travel a long distance one way away from the depot, then there is no opportunity for a swap. Pierce Transit could deploy 29 BEBs before fleet increases will be required.

Battery Electric Bus Depot + On-Route Charging

On-route charging is an enhancement that can greatly improve the feasibility of BEBs in many situations. This is particularly helpful with circulatory routes where the same on-route charger can be used by a vehicle multiple times throughout the day. On-route charging infrastructure is ideally located at places such as transit centers where buses operating on multiple routes all have scheduled layover time. On-route charging is capable of greatly extending the range of a BEB and facilitating one-to-one replacement of diesel vehicles when the routes are conducive to this charging strategy.

Simulation Assumptions

The simulation assumptions for the BEB Depot + On-Route Charging Scenario, as shown in **Table 3**, are similar to the assumptions for the BEB Depot Charging Scenario. The only difference is the assumption for on-route charger power and charging efficiency. Although there are on-route chargers on the market that offer more power (450 kW), there are currently no vehicles on the market that can accept this level of power. Route modeling assumed BEBs will be able to charge at 450kW in the future. OEMs have prioritized increasing the charge speed and it is expected that the vehicles will soon be able to charge at 450kW. When Pierce Transit procures vehicles for this transition, it is crucial to ensure that vehicle procurements meet or exceed this minimum specification to deploy BEBs that can match the operations simulated in this profile.

Table 3. BEB Depot + On-Route Charging Simulation Assumptions

Variable	Input
Battery Capacity 40-ft Buses	466 kWh
Battery Capacity 60-ft Buses	525 kWh
End-of-Life Battery State of Health	80% (Max Battery Degradation)
Energy Reserve	20% State of Charge (SOC)
Heating	Electric Heater
Ambient Temperature	Coldest Day (10th Percentile)
Passenger Capacity	Maximum Seated Capacity
Depot Charger Power	150 kW (95% Efficiency)
On-Route Charger Power	300 kW (95% Efficiency)

On-Route Charger Locations

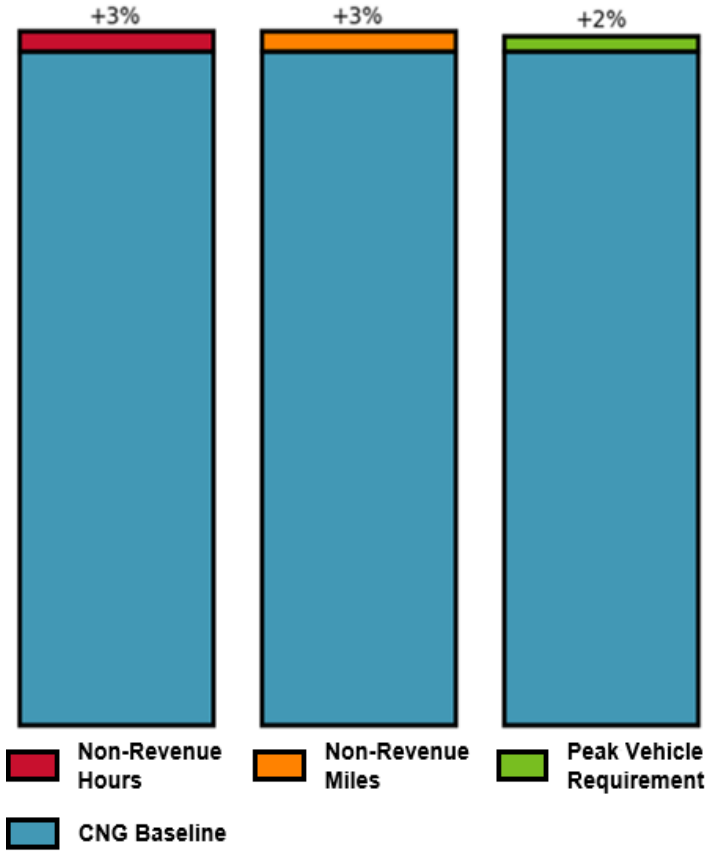
Layover times in the existing schedule were used to identify the most ideal locations for on-route chargers. There were twelve transit center, eight of which had good layover time and five of which were identified as good candidates for on-route charging. Most of these locations could make good use of a single charger, while some locations may require more chargers. The usefulness of an additional charger is dependent on how layover times overlap between vehicles. The **Facilities and Infrastructure Plan** section of this report will provide details on potential on-route charging locations.

Model Results

Key Takeaways (**Figure 4**):

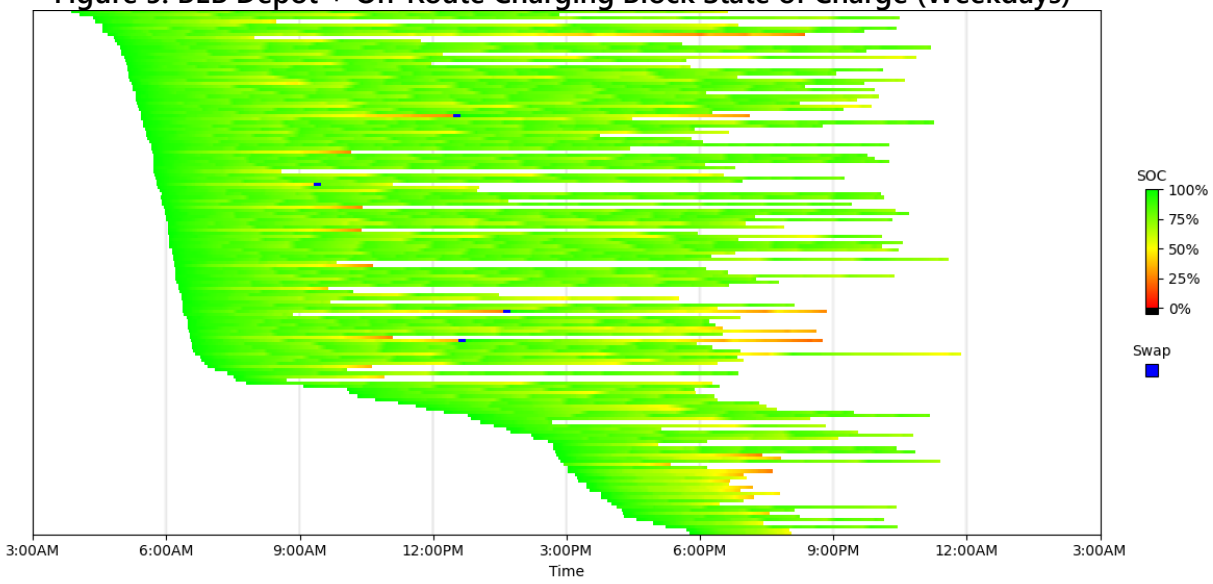
- Revenue Hours and Miles remain the same
- Non-Revenue Hours: **3% increase**
- Non-Revenue Miles: **3% increase**
- Peak Vehicle Requirement: **2% increase**
  - Increase Fleet from 128 to 131 buses
  - 3 more vehicles required
- At least **11 depot chargers** will be required
- Up to **18 on-route chargers** could be required

Figure 4. BEB Depot + On-Route Model Outputs



The vehicle battery SOC plot shown in **Figure 5** illustrates the SOC for each time block during weekday service for the BEB Depot + On-Route Charging Scenario. Weekend service was also modeled, but fleet and charging requirements are driven by weekday service, which illustrates the most demanding operations for Pierce Transit. Bus swaps are also inserted in locations to guarantee the minimum SOC does not dip below the required 20 percent reserve capacity, including the energy needed to return the vehicle to the depot when a swap is needed. By introducing on-route charging, the number of bus swaps required dropped significantly. For this scenario, 161 blocks can be operated without bus swaps while only 4 blocks require one or more swaps. Pierce Transit could operate up to 18 BEBs before on-route charging is needed. Because Pierce Transit is underway with an on-route charging station at Commerce Street Station, the agency can exceed the 18 BEBs modeled.

Figure 5: BEB Depot + On-Route Charging Block State of Charge (Weekdays)



Hydrogen Fuel Cell Bus Simulation

As transit agencies look for a zero-emission technology to replace diesel buses, there are two primary options, BEBs and FCEBs. Currently, BEBs are the most popular replacement choice because they use the electrical grid as their fuel source, which is universally available and relatively easy to connect into to get the required power. However, the vehicles have a limited range compared to diesel, which means they are not capable of directly replacing buses with long duty cycles or blocks. In some cases, it is not possible to re-cut the routes into pieces that are within the capability of a BEB, so an alternative zero-emission technology is needed. This portion of the route modeling assessed the use of FCEBs on Pierce Transit's fleet and **Table 4** explains the assumptions used to run the model.

Table 4. FCEB Simulation Assumptions

Variable	Input
Service Data	2020 (Pre-COVID)
Fuel Capacity	37.5 kg
Energy Density	33.6 kWh per kg of Hydrogen
Energy Reserve	5% or less remaining fuel
Heating	Electric Heater
Ambient Temperature	Coldest Day (10th Percentile)
Passenger Capacity	Maximum Seated Capacity

Model Results

Key Takeaways:

- Revenue Hours and Miles: **0% increase**
- Non-Revenue Hours and Miles: **0% increase**
- Non-Revenue Miles: **0% increase**
- Peak Vehicle Requirement: **0% increase**

All 161 existing service blocks are capable of being operated by FCEBs without an increase in peak vehicle requirements, revenue hours and miles, or non-revenue hours and miles. In addition, there would be no need for mid-block refueling or schedule modifications to achieve the same level of service as a diesel-operated service. An exact 1-to-1 replacement of diesel buses is possible because FCEBs typically have an operational range comparable to diesel buses and only require 7 to 10 minutes on average to refuel. There would be a large infrastructure cost in preparing to deploy FCEBs, but little operational impact to refueling, unlike the complex operations required to manage BEB charging.

Recommended Fleet Replacement Schedule

Through extensive discussion with Pierce Transit, it was determined that a primarily battery electric fleet with depot and limited on-route charging would best fit the needs of the agency. **Figure 6** shows the proposed fleet composition from 2022 to 2042 by fuel type. **Figure 7** shows the year-by-year procurement from 2022 to 2042. This schedule aligns with the current transit asset management plan bus replacement schedule. At the start of the ZEB transition, Pierce Transit would be procuring few BEBs. The 2023 procurement is already in motion and the 2024 procurement is already set due to a previous electric bus grant award. Pierce Transit is using previously secured grant funding to purchase three BEBs, three 62.5 kW depot chargers, and one on-route 180 kW charger with three dispensers. These plans were set in motion prior to creating the ZEB transition plan. Starting in 2025, Pierce Transit would start ordering larger quantities of BEBs, and by 2027 the agency would only be replacing retired buses with BEBs.

Figure 6: Proposed Fleet Composition from 2022-2042

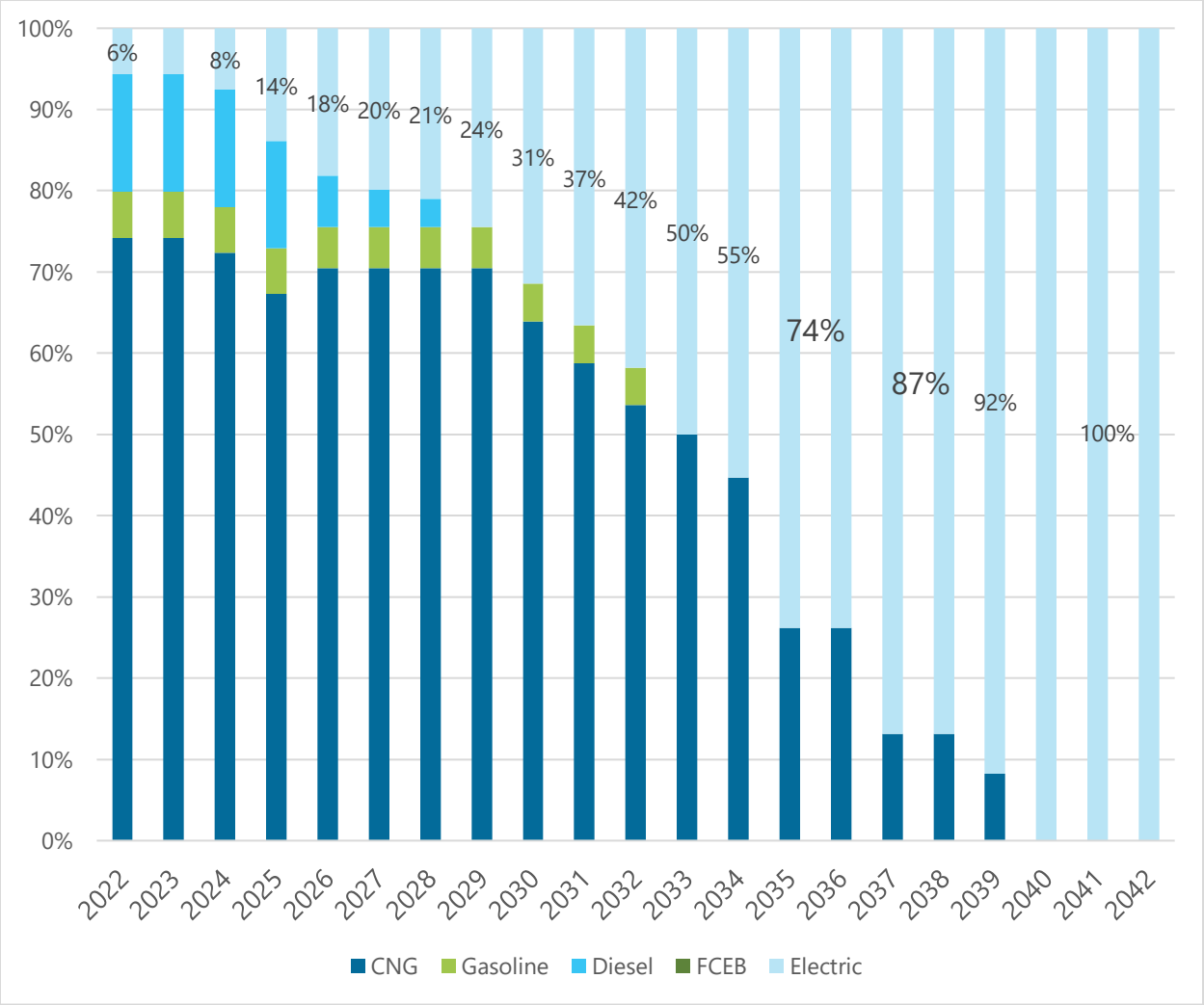
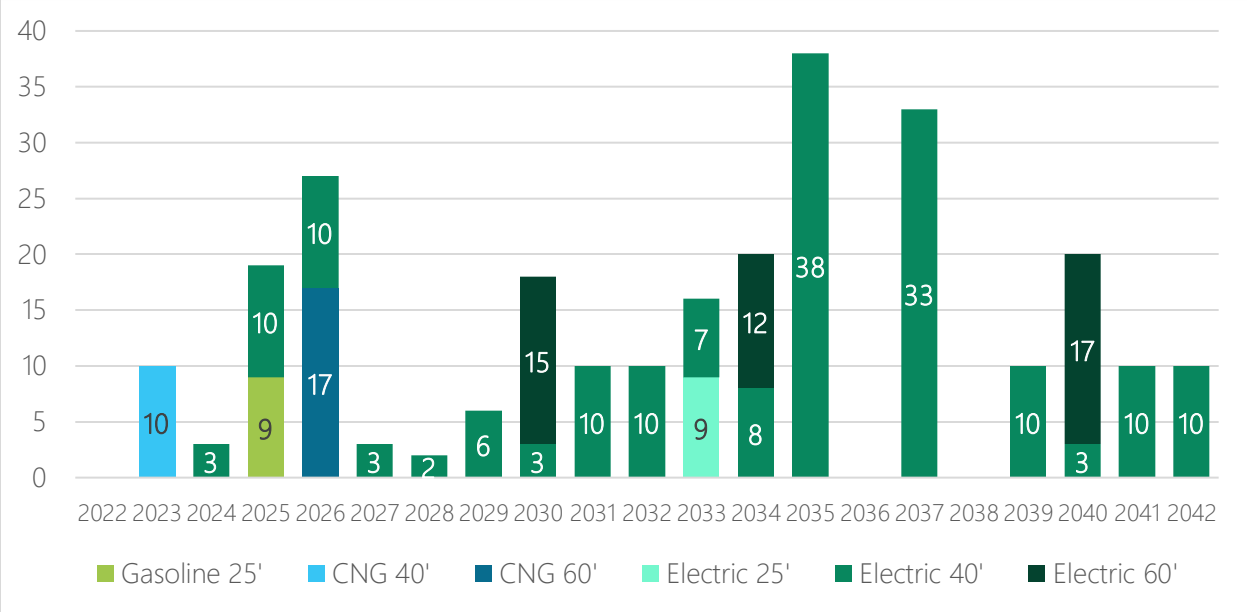


Figure 7: Vehicle Purchases by Year



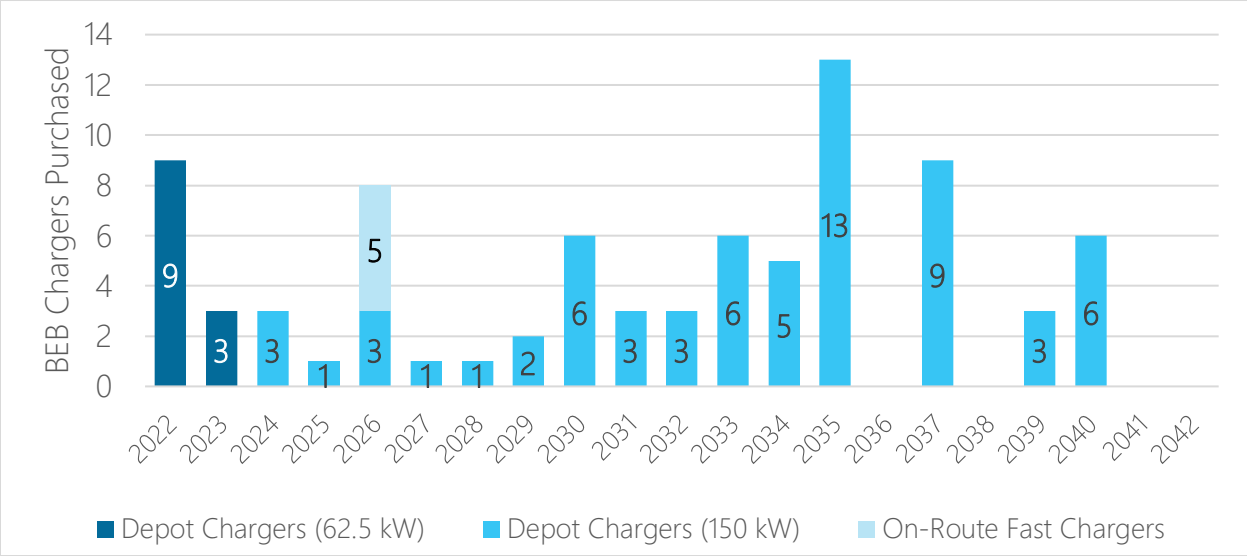
In order to operate BEBs, additional charging infrastructure will be required incrementally. Pierce Transit would primarily use 150 kW depot chargers to charge buses; however, a few on route chargers are needed once the fleet exceeds 18 BEBs. The charging infrastructure deployment will need to be completed by the time the buses arrive, so planning, design, and construction will need to occur prior to the deployment.

The infrastructure purchase schedule is indicated in **Figure 8**.

All 150 kW depot chargers are planned for a 3:1 dispenser-to-charger ratio. This report shows conceptual designs of depot charging with pantograph chargers and a gantry system, however Pierce Transit has yet to decide the charge dispense method so pantographs should be regarded as a conceptual design.

The 62.5 kW depot chargers will have a single dispenser. The on-route charging will be comprised of one 180 kW charger with three dispensers and four 450 kW chargers each hooked to one inductive charging pad.

Figure 8: BEB Chargers Purchased by Year



Near-Term Deployment: 2023–2028

37 Battery Electric Buses | 21 Depot Chargers | 5 On-Route Chargers

Bus Procurement

The near-term deployment is defined as 2023 to 2028. The consulting team is recommending a near term deployment schedule that will help Pierce Transit reach their 20 percent ZEB goal three years earlier than planned. The goal called for 20 percent ZEBs by 2030 and this transition schedule shows Pierce Transit operating 20 percent ZEBs by 2027. While this is sooner than the goal calls for, it appears feasible to purchase and operate this quantity of BEBs at Pierce Transit. To reach the 20 percent goal Pierce Transit would need to operate 26 BEBs. Pierce Transit plans to replace 26 buses by 2027.

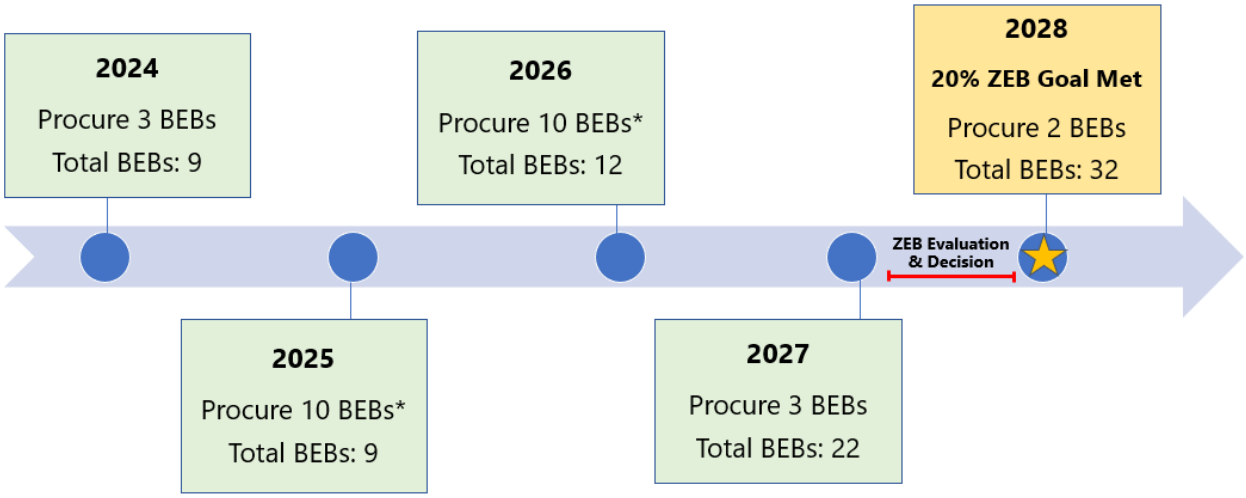
Table 5 shows the recommended bus purchases by fuel type from 2023 to 2028. Based on this schedule, Pierce Transit would proceed with their planned ten 40-foot CNG bus purchase in 2023 and utilize grant funds to purchase three 40-foot BEBs in 2024 to replace vehicles at the end-of-life. In 2025, the agency would purchase ten 40-foot BEBs and nine 25-foot gasoline cutaways to replace existing vehicles. In 2026, Pierce would purchase seventeen 60-foot CNG buses to operate the new bus rapid transit (BRT) line and ten 40-foot BEBs to replace vehicles at the end-of-life. From 2027 to 2028, the agency would continue purchasing BEBs to replace vehicles at the end of their useful lives.

Table 5: Bus Purchases by Year from 2023-2029

Fuel Type	Length	2023	2024	2025	2026	2027	2028
CNG	60'	-	-	-	17	-	-
CNG	40'	10	-	-	-	-	-
Electric	40'	-	3	10	10	3	2
Gasoline	25'	-	-	9	-	-	-

During 2027 and 2028, Pierce Transit should begin evaluating the status of the near-term deployment and the development of BEB and FCEB technology to confirm how to proceed in the long term. This plan assumes the continuation of BEBs with depot and on-route charging, however Pierce Transit could decide they want to integrate hydrogen fuel cell buses. See **Figure 9** for a BEB and charging infrastructure procurement timeline.

Figure 9: Near-Term Bus Procurement and Deployment Timeline



**Part of 2023 Lo/No Ask*

Depot Charging Strategy

To charge the BEBs in the near-term scenario, Pierce Transit would need to install 12 depot chargers and four on-route chargers. Pierce Transit currently has nine depot chargers. In total, Pierce Transit would have 21 depot chargers and four on-route chargers by 2028. Of the new depot chargers, nine would be 150 kW (charge delivery method proposed as pantograph but not yet confirmed) and three would be 62.5 kW plug-in chargers. In this conceptual design, each 150 kW charger would dispense power through pantograph chargers on a gantry system. The gantry system would be constructed in 2025 and built to accommodate chargers up to 2028. With three pantograph dispensers per one 150 kW charger, the facility would have 25 pantograph charging spots. This charging configuration could accommodate up to 27 pantograph charging spots; however, the parking layout only allows for 25. This brings the total number of charging ports for the near-term deployment to 37.

Figure 10 shows the conceptual charging layout for the new pantograph chargers. Note that this is a conceptual design rather than an approved charging plan; more discussion will occur internally at Pierce Transit before deciding on a charging delivery method.

Each 150 kW charger would have three pantograph dispensers and the gantry system would be sized to charge twenty-five 60-foot buses. Buses would be parked nose-to-tail. To the south of the gantry system would be the nine existing 62.5 kW plug-in chargers and three additional plug-in chargers used to power the BEBs purchased in 2024. Each charger has one dispenser and buses would be parked side-by-side. To the north of the gantry system would be existing parking for twenty-one 45-foot MCI buses.

Figure 10: Lakewood Base Charging Layout (2028)

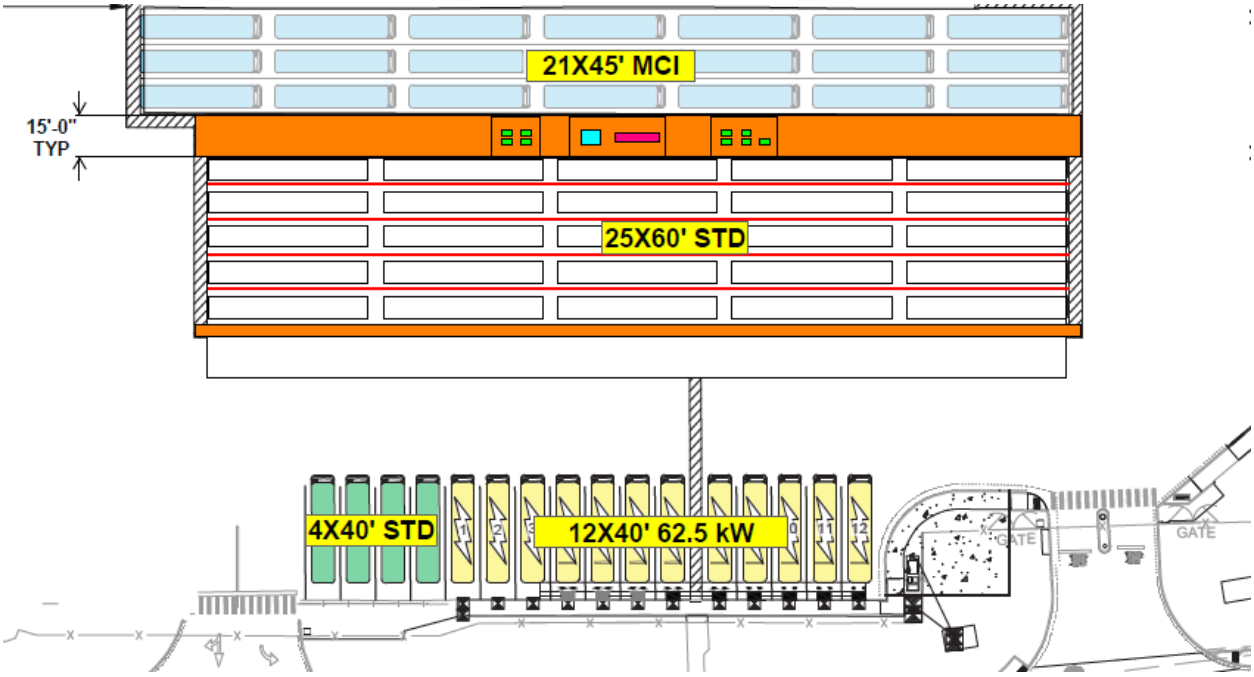
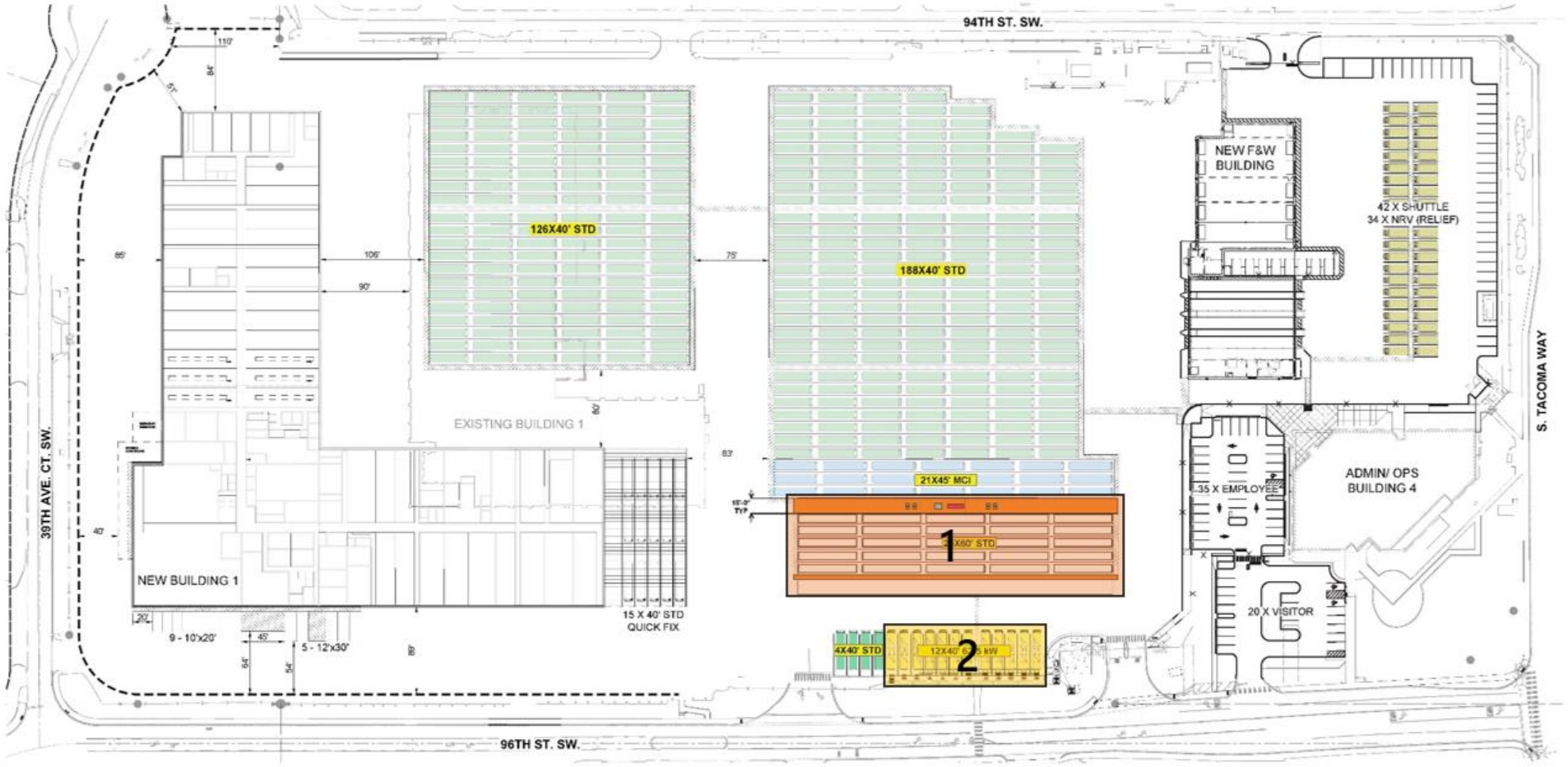


Figure 11 shows the entire Lakewood Base to provide context on the location of BEB charging in the near-term deployment.

Figure 11: Lakewood Base Charging Layout (2028)



1) New Pantograph Charging & Gantry System
2) Existing Plug In Charging

On-Route Charging

Prior to starting this study, Pierce Transit made plans to install one 180 kW charger with three dispensers at the Commerce Street Station. Route modeling showed that additional on-route charging is needed by 2027 to support the near-term deployment. When considering layover times, construction feasibility, and number of routes served, The Lakewood Transit Center was identified as the preferred location for BEB on-route charging for the near-term deployment. Installing four 450 kW chargers would accommodate a fleet of up to 49 BEBs. Each charger would be hooked to a pantograph dispenser. It is recommended that Pierce Transit begins construction on these charging stations in 2025 to provide ample time to have them ready for use in 2027. **Figure 12** shows a possible charging configuration for this transit center.

Figure 12: BEB Charging Layout at Lakewood Transit Center

Long-Term Deployment: 2029–2042

206 Battery Electric Buses | 77 Depot Chargers | 18 On-Route Chargers

Starting in 2029, it is planned that Pierce Transit would begin larger procurements of ZEBs. Pierce Transit should use the experience of operating the initial BEB fleet to inform decisions on how to further transition the fleet long term. If certain aspects of operating BEBs are presenting continual challenges for the agency, Pierce Transit could consider operating BEBs differently or incorporating another fuel type. For example, the agency could decide they have a preferred charging method and opt toward only using one type of charging. Another scenario could be that BEB ranges increase to a point where on-route charging is no longer needed. Lastly, FCEB costs could significantly decrease, clean hydrogen availability could increase, and FCEBs adoption could be much easier in the future.

Pierce Transit should evaluate the near-term transition and decide on how to proceed with ZEBs (BEBs or FCEBs) in 2027. The long-term deployment outlined in this memo assumes that a BEB

fleet with depot and on-route charging continues to meet Pierce Transit's needs. This deployment also assumes that the planned BRT route starts operating with BEBs starting in 2030. **Table 6** shows the recommended vehicle purchases from 2028 to 2042. By 2027, it is expected that BEB technology will have advanced enough that all routes could be operated with BEBs therefore ceasing the purchase of internal combustion engine (ICE) vehicles.

Table 6: Electric Bus Purchases by Year from 2028-2042

Size	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
60'	-	-	15	-	-	-	12	-	-	-	-	-	17	-	0
40'	2	6	3	10	10	7	8	38		33		10	3	10	10
25'	-	-	-	-	-	9	-	-	-	-	-	-	-	-	-

Depot Charging Strategy

Pierce Transit would need to purchase fifty-six 150 kW depot chargers from 2029 to 2042. Utility upgrades would be done in 2029 and would be sized to accommodate the full build out. The gantry system would be expanded in a few phases and chargers would be purchased incrementally.

Figure 13 shows the full build-out of electric bus charging at the Lakewood Base. The completed charging plan would have 195 charging ports available for the 206-vehicle fleet. Chargers would not be provided on a 1:1 ratio because the current parking layout only accommodates for 195 charging stalls. This should not present a problem because it is assumed that some buses will meet their charging needs on-route, some buses may not need to charge every night, some buses would come back during the day to charge while others would charge at night, and buses could be moved around to share dispensers if needed.

Phase 1 would be completed during the near-term deployment. Within the long-term deployment there would be five phases. Phase 2 includes the installation of twenty-two 150 kW chargers and 56 pantograph dispensers under a gantry designed to park 40-foot buses. This phase would be completed by 2033. Phase 3 includes fourteen 150 kW chargers and 20 pantograph dispensers under a gantry designed to park 60-foot buses. Phase 3 would be completed by 2034. Phase 4 includes sixteen 150 kW chargers and 56 pantograph dispensers under a gantry designed to park 40-foot buses. Phase 4 would be completed by 2036. Finally, Phase 5 includes the installation of 20 pantograph dispensers by 2039. These dispensers would be powered by the charging stations installed in Phase 4.

Figure 14 shows the Lakewood Base with all charging infrastructure in place in 2042.

Figure 13: Lakewood Base Charging Layout (2042)

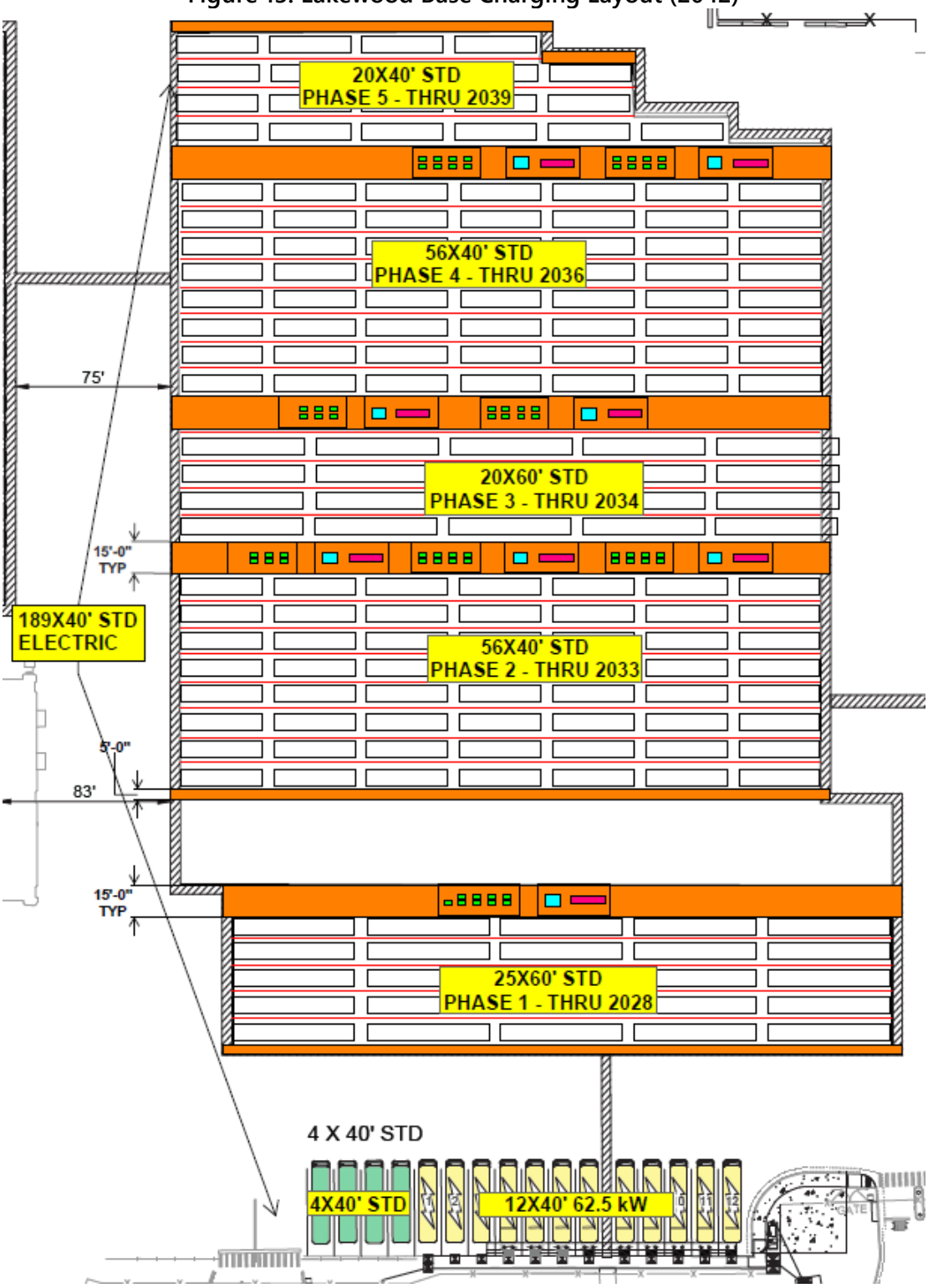
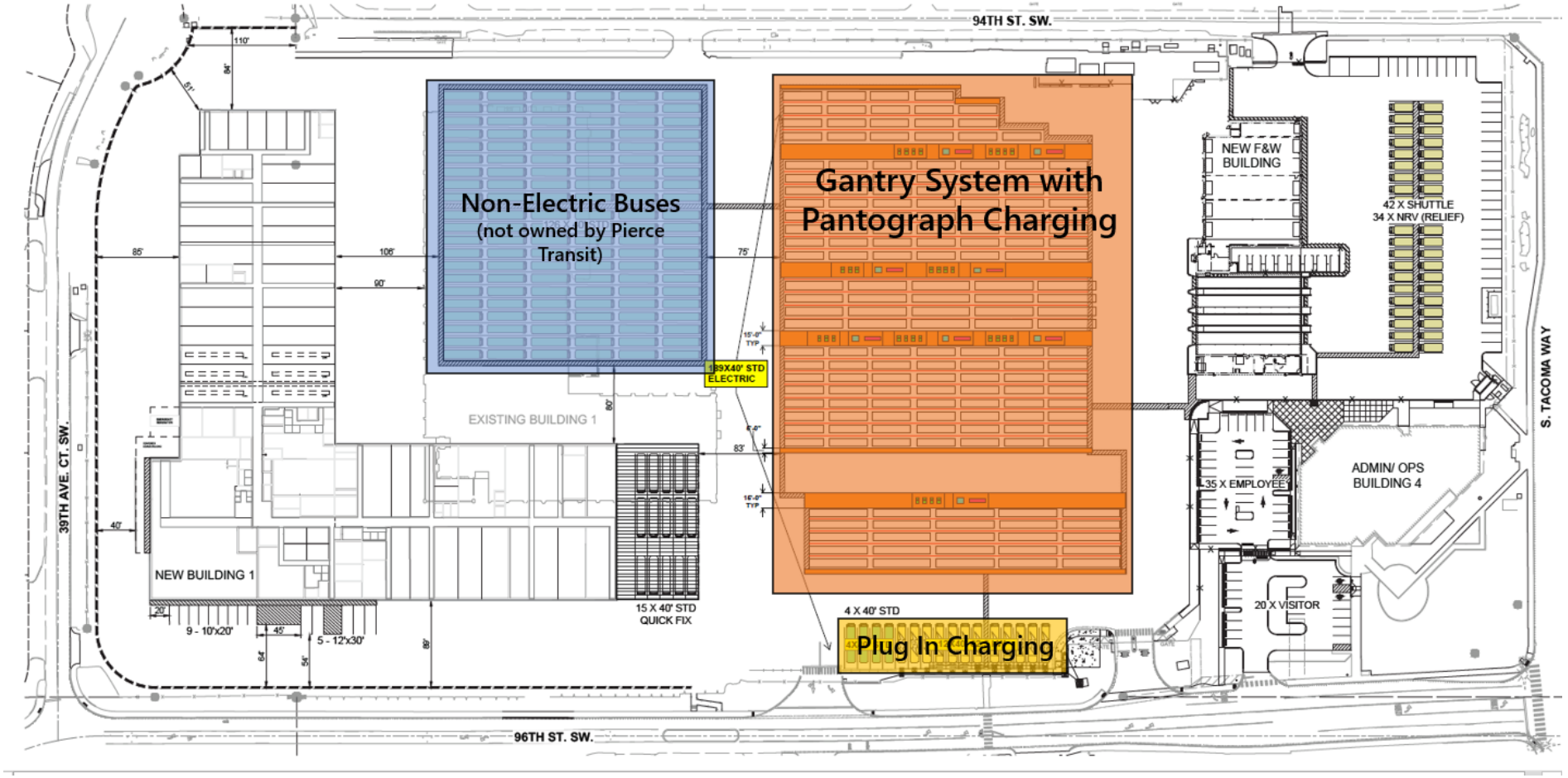


Figure 14: Lakewood Base Charging Layout (2042)



On-Route Charging Strategy

Pierce Transit would need 18 on-route chargers to operate a fully battery electric bus fleet. The near-term deployment would provide Pierce Transit with five on-route chargers, meaning that from 2029 to 2042 Pierce Transit would need to install 13 on-route chargers. This estimate does not include the previously planned 180 kW charger at the Commerce Street Station. Below is the suggested on-route charging plan based on route modeling outputs and conversations with the public utilities. More information on on-route charging plans can be found in the **Facilities and Infrastructure Plan** section.

- 2031: Begin construction of four 450kW chargers at the Tacoma Community College Transit Center (plan to have operational by 2033)
- 2033: Begin construction of four 450kW chargers at the Commerce St Transit Center (plan to have operational by 2035)
- 2034: Begin construction of three 450kW chargers at the South Hill Mall Transit Center and three 450kW chargers at the Tacoma Mall Transit Center (plan to have all chargers operational by 2035)

Facilities and Infrastructure Plan

Introduction

This facilities and infrastructure plan identifies infrastructure and energy needed to incorporate ZEB technology into Pierce Transit's fleet. This section is built around the recommended near-term and long-term fleet transition strategy while also considering results from Zero+ modeling. It will provide infrastructure requirements for the near term and long-term transition, including charging equipment, maintenance facility modifications, fuel storage, fuel pumping requirements, and power requirements including back-up power generation. After estimating the energy demands and facilities upgrades needed, this plan will detail resiliency considerations associated with each option.

Energy Needs

Lakewood Base Power Requirements

Pierce Transit would require 1.69 MW at peak load to satisfy the near-term BEB deployment (2023–2028) and 1.95 MW at peak load in the long term. The power requirement is very high for the initial build-out because most of the charging would happen at the depot. It is also expected the power profile has a higher peak in the near-term deployment because buses would be charged mid-day so they could be used on multiple blocks. The peak demand is high, but the total energy consumed would be lower in the near-term compared to the long term because Pierce Transit would have fewer buses to charge at the depot in the near-term than in the long-term deployment. For the long-term deployment there would be large additional power requirements at the on route locations (which would end up supplying a bulk of the required energy), and the power at the depot would be more continuous overnight. Overall, the peak load at the Lakewood base is expected to be significant at the start of the transition and level off over time.

This is an estimate that assumes the worst-case daily energy requirements, meaning the maximum energy that would be required during weekday service with cold weather (10th percentile temperatures) and 80 percent battery degradation. This places an upper limit on the energy requirements for beginning the conversation with the electrical utility or planning for backup power. The cost of energy depends not only on the amount of energy but also on the time of day when the energy is consumed.

Energy is only one component for determining the electric load and costs. In addition to energy costs, there is also a charge for the peak demand, or maximum power level seen over a billing period. Pierce Transit will need to coordinate with Lakeview Light and Power to determine the best rate plan for the facility, understand any energy incentives, and work together to reduce costs to charge the BEB fleet.

On-Route Power Requirements

In the recommended transition scenario, Pierce Transit would be installing on-route chargers starting in 2025. The fleet would rely primarily on depot charging and use on-route to supplement the longer routes. It is estimated that Pierce Transit would need 18 on-route chargers and 5.4 MW of energy to be available for these on-route chargers. The project team identified five different sites that could accommodate on-route chargers

Pierce Transit is already planning to deploy an on-route charger at the Commerce Street Station. This site is recommended for additional on-route charging because of the high amount of layover time and variety of routes that pass through this transit center. The Lakewood Transit Center, South Hill Mall Transit Center, Tacoma Mall Transit Center, and Tacoma Community College (TCC) Transit Center are also recommended sites for on-route chargers based on available space and power. Below is an overview of the proposed on-route charging:

- **Commerce Street Station:** 4 New Chargers at 450kW (1.2 MW), 1 Existing Charger at 180kW (0.2 MW), Total 1.4 MW
- **TCC Transit Center:** 4 New Chargers at 450kW (1.2 MW)
- **Tacoma Mall Transit Center:** 3 New Chargers at 450kW (0.9 MW)
- **Lakewood Transit Center:** 4 New Chargers at 450kW (1.2 MW)
- **South Hill Mall Transit Center:** 3 New Chargers at 450kW (0.9 MW)

Lakewood Base Hydrogen Fuel Requirements

Pierce Transit is committed to integrating ZEBs into the fleet, and while the agency is currently shifting toward BEBs, the consulting team is providing preliminary information on hydrogen in case the agency decides to have a mixed fleet later on. The most significant impact transitioning to FCEBs is the need for hydrogen instead of diesel. The Zero+ simulation results provide an estimate for the kilograms of hydrogen needed each day in the worst case (cold temperatures with a maximum passenger load).

It is expected that the hydrogen fueling infrastructure would require about 500–750 kW of power. If Pierce Transit were to shift toward a long-term FCEB scenario, the fleet would consume about 2,861 kg of hydrogen on weekdays, 1,474 on Saturdays, and 1,038 on Sundays.

Facilities and Infrastructure

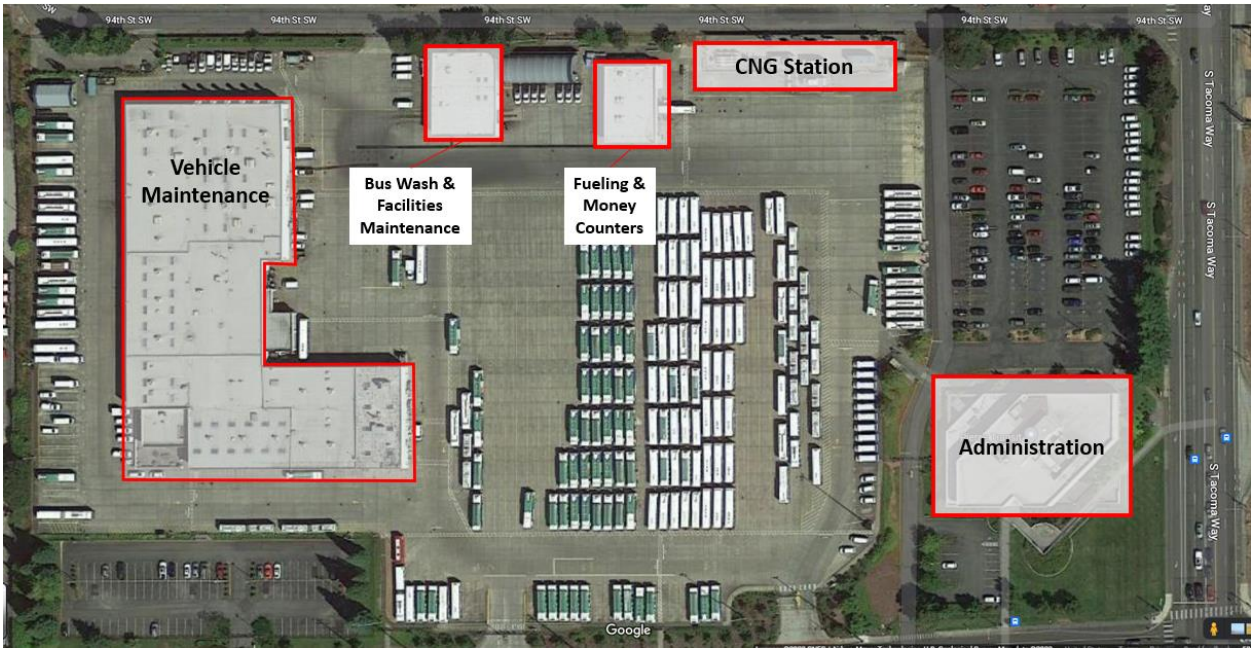
Existing Conditions

Pierce Transit's operations and maintenance facility, commonly referred to as the Lakewood Base, is located at 3701 96th Street SW in Lakewood, Washington. Pierce Transit's maintenance and operations facility was constructed in 1986 and designed to serve a fleet of 200 revenue vehicles. Today it supports a fleet of 300 buses, plus additional shuttles, vanpool, and support vehicles. Lakewood Base is undergoing expansion and modifications so that it can accommodate vehicle expansions through 2040. The expansion is detailed in the Pierce Transit

Base Master Plan (Source). This plan will only be looking at the Main Base area within this facility because this is the only space planned to house electric bus infrastructure. This plan will only cover upgrades occurring at the Main Base or upgrades relevant to the ZEB transition.

Figure 15 shows an aerial view of the Lakewood Base. The facility has four buildings each with the following functions: (1) vehicle maintenance, (2) bus wash and facilities maintenance, (3) fueling and money counters, and (4) administration. Through the planned renovations, the Lakewood Base will include new maintenance bays, bus washers, fueling bays, and bus parking, as well as renovate the administrative office. Pierce Transit removed the public CNG fueling station, which is no longer in use. The agency will also be constructing a training building at the South Base across the street (which would be used partially for electric bus trainings) and expanding their employee parking lot.

Figure 15: Lakewood Base Aerial View



Pierce Transit already operates nine battery electric buses and has nine plug-in charging stations at the Lakewood Base to charge the existing BEB fleet. Pierce Transit built this charging infrastructure to accommodate the initial nine BEBs with the intention of determining future charging station needs during this study.

The current route blocks require 128 routed buses for weekday service, not including vehicles for the planned BRT route or spare buses. Based on Pierce Transit's current fleet and operational use case, parking must be available for 150 40-foot transit buses and nine 25-foot cutaway vehicles.

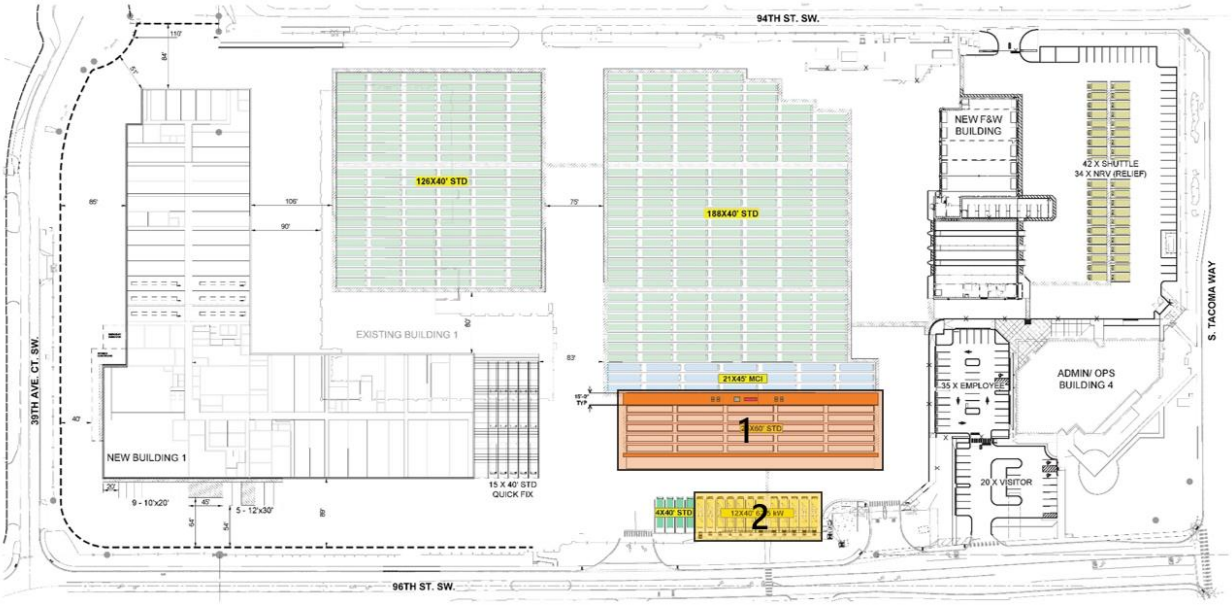
Lakewood Base Infrastructure Needs

Equipment and Layout

Figure 17 depicts the battery electric bus charging layout for the Lakewood Base in the recommended BEB transition scenario in the near term. The equipment and layout depicted in this section are recommendations put forth by the consulting team to provide a path for charging BEBs in the near-term deployment. More conversation and analysis is planned to occur on the Pierce Transit side before committing to this design, and for the time being this should be regarded as a concept rather than an official plan.

To charge the new BEBs, Pierce Transit would need to install 12 depot chargers. Nine of the depot chargers would be 150 kW and three would be 62.5 kW plug-in chargers. Each 150 kW charger would dispense power through pantograph chargers on a gantry system. The gantry system would be constructed in 2024 and built to accommodate chargers up to 2028. Each 150 kW charger would have three pantograph dispensers and the gantry system would be sized to charge twenty-five 60-foot buses. Buses would be parked nose-to-tail. To the south of the gantry system would be the nine existing 62.5 kW plug-in chargers and three additional plug-in chargers used to power the BEBs purchased in 2024. Each charger has one dispenser and buses would be parked side-by-side. To the north of the gantry system would be existing parking for twenty-one 45-foot MCI buses.

Figure 16: Aerial View of Lakewood Base Charging Layout (2028)



1) New Pantograph Charging & Gantry System
2) Existing Plug In Charging

Table 7 shows the recommended charger purchases from 2023 to 2028. The Lakewood Base already has nine 62.5 kW single-port chargers and plans to purchase three more in 2023. By 2028, Pierce Transit would have 20 chargers and 37 total charging ports.

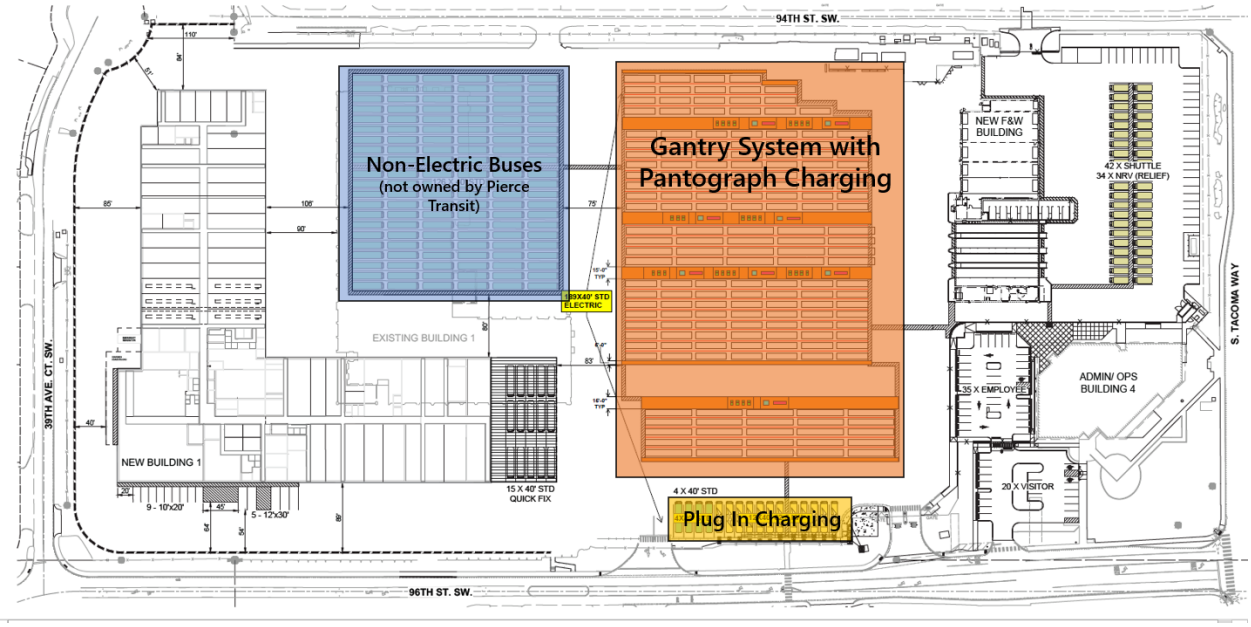
Table 7: Charger Purchases from 2023-2028

Charger Type	2022	2023	2024	2025	2026	2027	2028
Depot Chargers (62.5 kW)	9	3	-	-	-	-	-
Depot Chargers (150 kW)	-	-	3	1	3	1	1

In the long-term deployment, the facility would be equipped with a total of seventy-four 150 kW depot chargers (9 single port chargers and 54 triple port chargers). The long-term deployment assumes the use of pantograph chargers, however like stated previously, Pierce Transit has yet to determine the charge delivery method. Pantographs should be considered conceptual.

Conceptually, pantograph chargers would be installed under the gantry system and charge the fleet primarily overnight. The Lakewood Base would have 204 ports available to charge BEBs at the depot. **Figure 18** shows the proposed charging layout for the Lakewood Base in the long term.

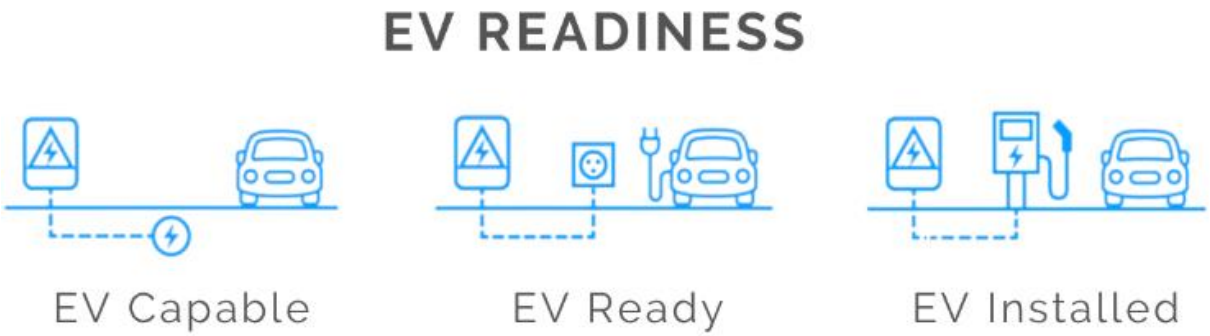
Figure 17: Aerial View of Lakewood Base Charging Layout (2042)



Construction Considerations

While chargers would be purchased and installed incrementally, it is recommended to perform electrical upgrades for the facility initially so that the facility is "EV Ready." Electric vehicle supply equipment (EVSE) readiness can be thought of in three categories.

1. **EV Capable**: Enough electrical capacity is installed at the panel to support future EV charging stalls. Additionally, there is a dedicated branch circuit to make sure enough power is available for future charging stations without overloading the system and conduit to future charging spots.
2. **EV Ready**: EV capable requirements are met, with the addition of wiring and junction box.
3. **EV Installed**: All of the above are met, plus installing the actual EV charging station.



It is recommended that Pierce Transit aims to be EV Ready with its near-term charging infrastructure if funding allows for these upgrades to be done at once. Sizing all electrical equipment for the near-term chargers up front will save time and money through the near-term deployment. Pierce Transit should also aim to construct as much of the gantry system as is feasible up front. Once Pierce Transit gets closer to 2030, the agency should reassess the ZEB fleet and determine what electrical upgrades make sense to do at the beginning of the long-term deployment.

The timeline from purchasing a charger to having it in operation is about one to two years in 2023. This time could expand or shrink depending on types of chargers constructed, supply chain conditions, and individual site conditions. It is generally best practice to have chargers purchased at the same time or before the BEB is purchased. Charger installation is typically faster than the time needed to build a BEB; however, it is critical that the charging infrastructure is ready prior to the delivery of the BEB to ensure the BEBs can operate. Each element of charger construction and installation has different timelines but can be done simultaneously. Pierce Transit should plan for about a year to make the Lakewood Base EV Ready, 1 to 1.5 years to construct a gantry system, and 6 months to a year for charger procurement and design.

On-Route Charging Infrastructure Needs

Route modeling showed that 18 on-route chargers are needed for a Long-Term BEB deployment. The project team identified 12 transit centers that serve Pierce Transit buses, and of those 12, five sites have enough layover time and space available to be considered for on-route charging. Route modeling showed that Pierce Transit could operate 18 BEBs before needing on-route charging. The following section details the conditions at each of these sites and includes a preliminary concept for installing on-route chargers.

Pierce Transit will have purchased 22 BEBs by 2025, and, assuming two-year lead times, the agency will surpass the 18 BEB threshold and require on-route charging in 2027. It is recommended that Pierce Transit install four on-route chargers at the Lakewood Transit Center and plan to utilize them starting in 2027. Four on-route chargers at Lakewood Transit Center could accommodate a fleet up of to 48 BEBs.

Another four on-route chargers at TCC Transit Center would accommodate a fleet of up to 76 BEBs. Pierce Transit plans to have 71 BEBs ordered by 2031, so again assuming two-year lead times, the agency would need to have four new on-route chargers operational by 2033.

The last phase of on-route charging installations would occur in 2033 and 2034. It is recommended to add four on-route chargers to Commerce Street Station in 2033 and six on-route chargers to the Tacoma Mall and South Hill Mall transit centers in 2034 (three chargers at each site).

Table 8 outlines each site's proposed chargers and installation year. The installation year is the year to begin constructing the on-route chargers. It is assumed that the design, construction,

and installation process will take two years. The year that the on-route chargers are needed is two years after the installation date listed below.

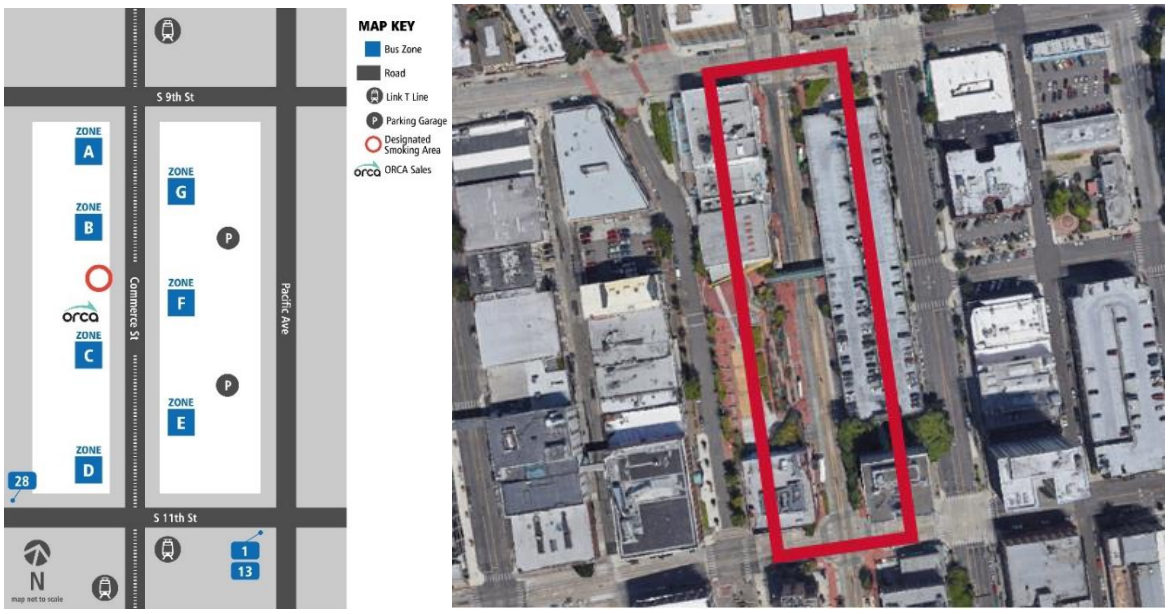
Table 8: On-Route Charging at Transit Centers

Transit Center	Number of Chargers	Number of Charging Ports	Energy Needed (in MW)	Design to Commissioning
Commerce Street Station	(4) 450 kW (1) 180 kW	**7 ports total** 1 port per 450 kW 3 ports per 180 kW	1.38	2022-2023: (1) 180kW charger 2033-2035: (4) 450kW chargers
Lakewood	(4) 450 kW	**4 ports total** 1 port per 450 kW	1.2	2025-2027
TCC	(4) 450 kW	**4 ports total** 1 port per 450 kW	1.2	2031-2033
Tacoma Mall	(3) 450kW	**3 ports total** 1 port per 450 kW	0.9	2034-2036
South Hill Mall	(3) 450 kW	**3 ports total** 1 port per 450 kW	0.9	2034-2036

Commerce Street Station

The Commerce Street Station is located in downtown Tacoma and has seven transit berths and four layover locations. An aerial photo of the Commerce Street Station is shown in **Figure 19**.

Figure 18: Commerce Street Station Aerial View

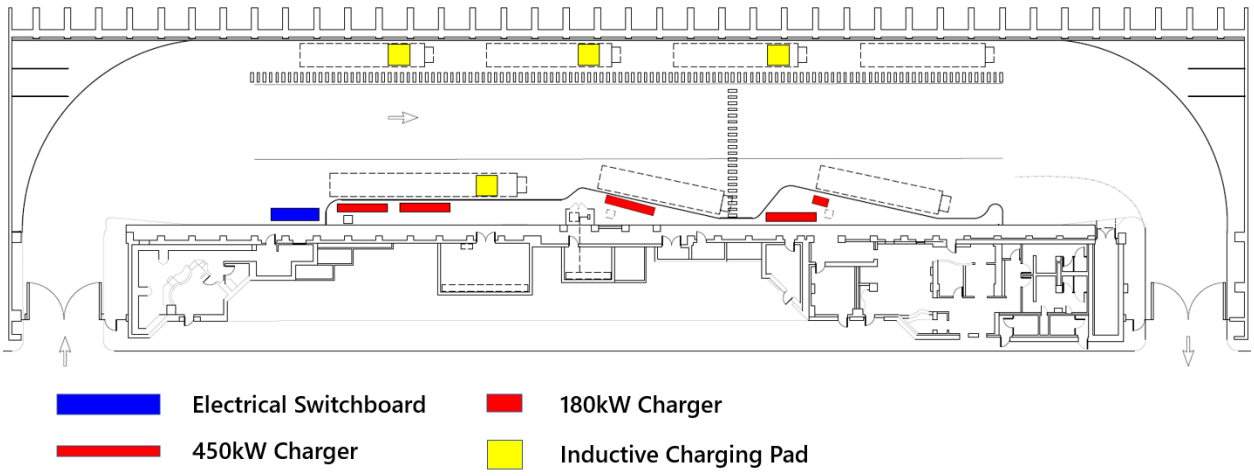


There are currently no charging stations at this transit center; however, there are existing plans to install one 180 kW plug in charger with three dispensers in the Commerce Street Station tunnel in 2023. In addition to this charger, this site could accommodate up to four pantograph or inductive chargers. This site is preferred for on-route charging because it offers the highest number of layover hours (229 per year) and serves the highest number of routes (16 routes) of all the transit centers assessed.

While this site offers the highest number of routes and longest layover times, Commerce Street Station also poses the most significant challenges because of limited space and expected disruption during construction. The Commerce Street Station operations facility is within a structure. The roof enclosing the tunnel is not a public park but Pierce Transit allows programming of the roof deck for public events such as farmers markets and concerts. Bus parking is constrained to the lower level. This site is constrained by available locations to install chargers, which could take up room on the deck since no room is available in the current layover area on the lower level. Construction would also temporarily reduce the use of the upper facility. Penetrating through the area above the enclosed parking area with conduit could cause potential concerns for water intrusion. Pierce Transit completed a major midlife renovation of the facility in 2022, which included repairs to the failing roof membrane. In addition the ceiling height above the buses needs to be considered prior to designing and installing pantographs over the buses. Despite these challenges, the site offers the largest on-route charging benefit.

Figure 20 shows the proposed on-route charging configuration on the lower level of the Commerce Street Station. The design includes four 450 kW chargers, each with one inductive charging pad and one plug in 180 kW charger. The site is estimated to require 1.38 MW at peak load for the five on-route chargers (1.2 MW for the proposed 450 kW chargers and 0.18 for the 180-kW charger). Note that while this design shows inductive charging pads, it should be studied more to determine if pantograph chargers will fit in this space.

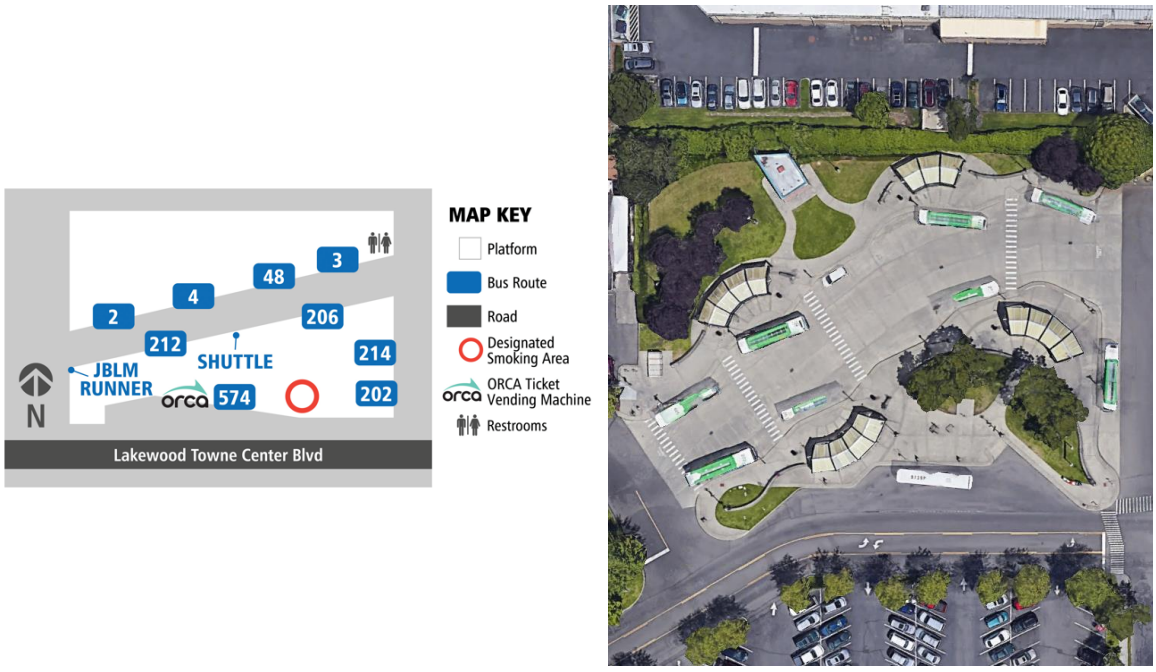
Figure 19: Commerce Street Station Electric Bus Charging Layout



Lakewood Transit Center

The Lakewood Transit Center has nine transit berths and four layover locations. It is located in a shopping plaza in Lakewood. An aerial photo of the Lakewood Transit Center is shown in **Figure 21**.

Figure 20: Lakewood Transit Center Aerial View



There are currently no charging stations at this transit center, however the Lakewood Transit Center was identified as one of the transit centers that could support on-route bus charging. **Figure 22** and **Figure 23** depict the battery electric bus charging layouts that were discussed with Pierce Transit. Figure 22 shows Option A, where the chargers are grouped together on the western side of the transit center and Figure 23 shows Option B, where the chargers are located in the middle of the transit center. For these layouts, four buses could charge simultaneously, and all four chargers would be constructed at the same time. The four on-route chargers would either be pantograph or inductive chargers and would require an estimated 1.2 MW at peak load.

This is a viable site for on-route charging because of power availability and no preliminary indication of conditions that would be prevent on-route charging. The utility confirmed that there is power available at this location and that there are no major constraints to installing on-route chargers. HDR anticipates a typical construction process to install on-route charging at this site.

Figure 21: Lakewood Electric Bus Charging Aerial View - **Option A**

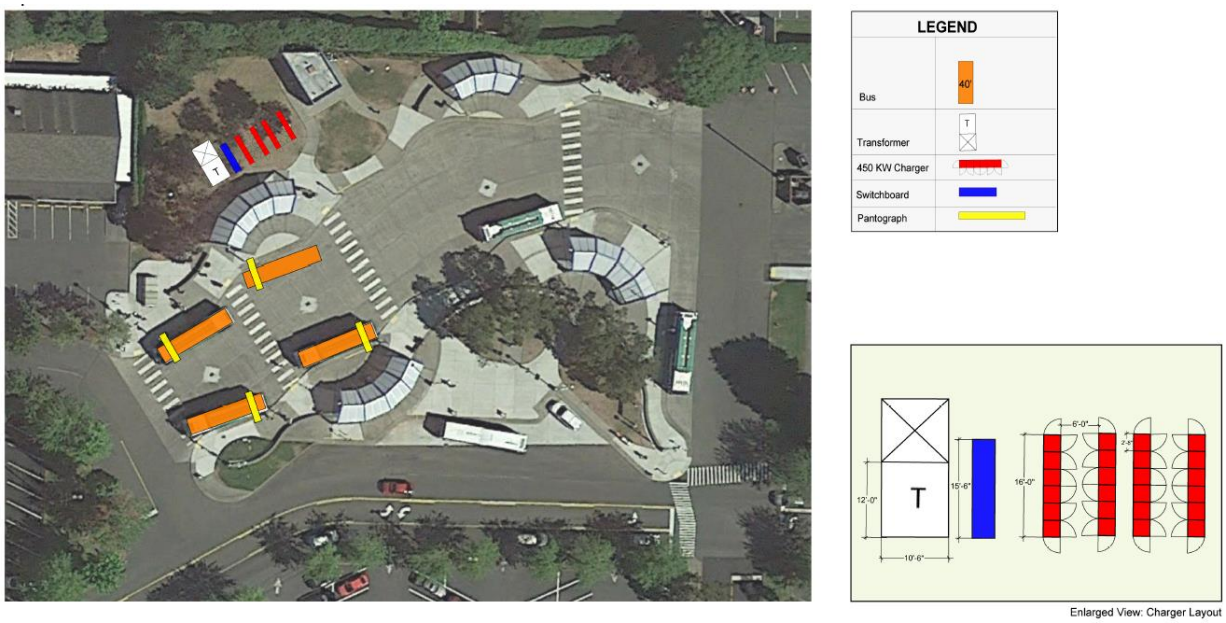
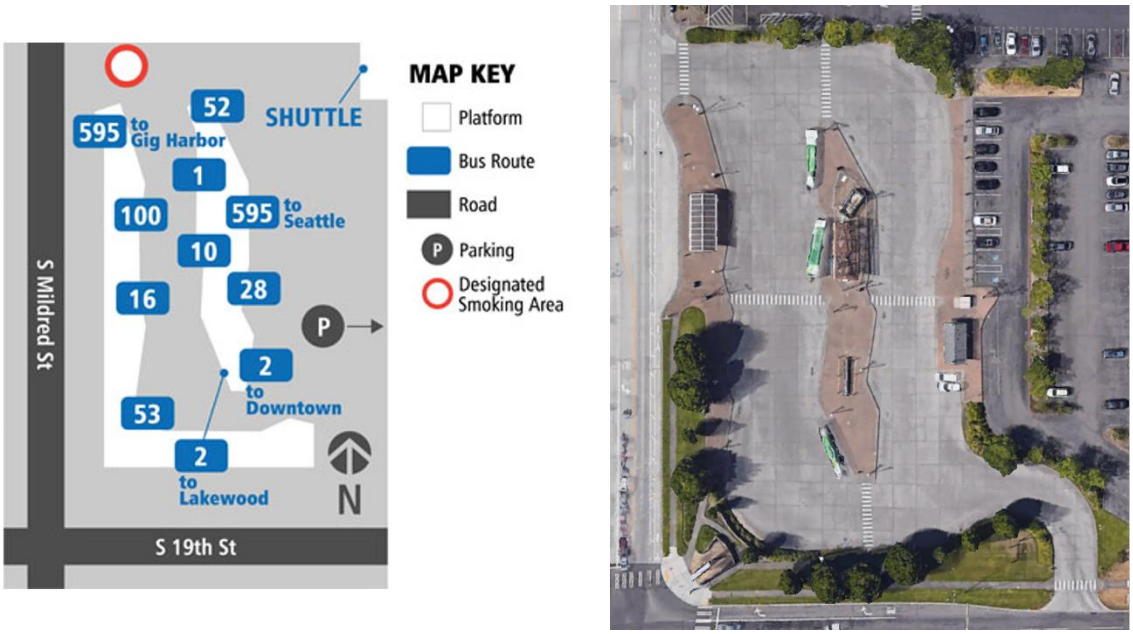


Figure 22: Lakewood Electric Bus Charging Aerial View - Option B

Tacoma Community College Transit Center

The TCC Transit Center is located in the southwestern corner of Tacoma Community College has 11 transit berths and four layover locations. An aerial photo of the TCC Transit Center is shown in **Figure 24**.

Figure 23: TCC Transit Center Aerial View



No chargers have yet been installed at this transit center. The TCC Transit Center was also identified as one of the transit centers that could support on-route bus charging. **Figure 25** and **Figure 26** depict the modified battery electric bus charging layouts that were discussed with Pierce Transit. Both options have pantographs or inductive chargers in the same place but chargers, switchboards, and transformer at different parts of the transit center. For this layout, four buses could charge simultaneously, and all four chargers would be constructed at the same time. It is estimated that the site would require 1.2 MW of power at peak load.

The TCC Transit Center is a small site that may not be suitable to add much electrical infrastructure without purchasing/leasing additional property. Aside from site size, there are no other major constraints other than the typical challenges of construction at an active site. This site is viable for on-route charging but would require more spatial analysis installing on-route charging.

Figure 24: Tacoma Community College Electric Bus Charging – Option A

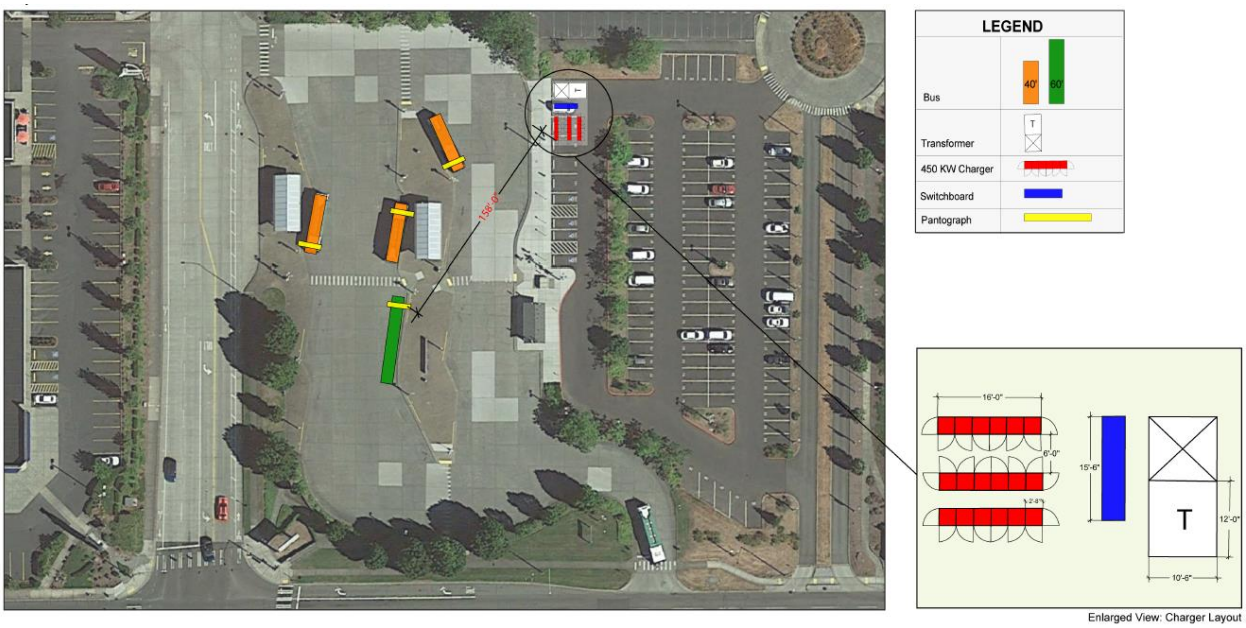
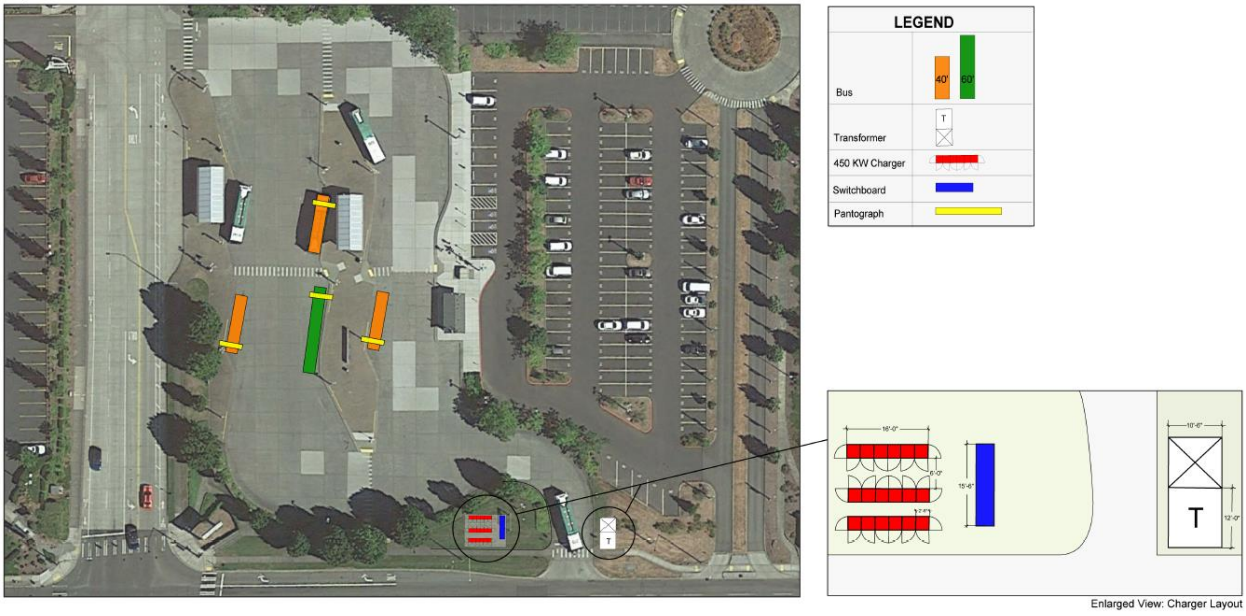


Figure 25: Tacoma Community College Electric Bus Charging – Option B



Tacoma Mall Transit Center

The Tacoma Mall Transit Center has eight transit berths and three layover locations. An aerial photo of the Tacoma Mall Transit Center is shown in **Figure 27.**

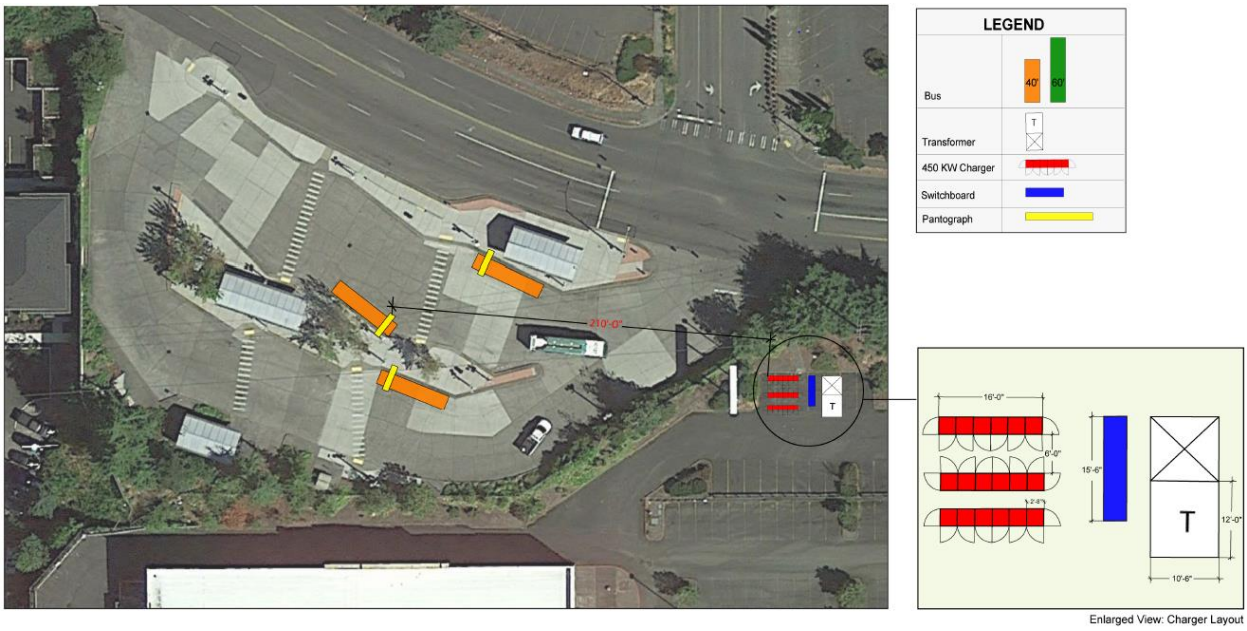
Figure 26: Tacoma Mall Transit Center Aerial View

No chargers have yet been installed at this transit center. The Tacoma Mall Transit Center was also identified as one of the transit centers that could support additional on-route bus charging. **Figure 28** and **Figure 29** depict the modified battery electric bus charging layout that was discussed with Pierce Transit. The primary difference between the two options is the location of the chargers, switchboards, and transformer. Both options would utilize either pantograph or inductive chargers. In Option A the buses would all charge toward the center of the site and for Option B the buses would charge toward the eastern side of the site. For this layout, three buses could charge simultaneously, and all three chargers could be constructed at the same time. The site is expected to require an estimated 0.9 MW of power at peak load.

Like the TCC Transit Center, this is a small site that may not be suitable to add much electrical infrastructure without purchasing/leasing additional property. Aside from site size, there are no other major constraints other than the typical challenges of construction at an active site. This site is viable for on-route charging but would require more spatial analysis installing on-route charging.

Figure 27: Tacoma Mall Electric Bus Charging – Option A

Figure 28: Tacoma Mall Electric Bus Charging – Option B



South Hill Mall Transit Center

The South Hill Mall Transit Center has six transit berths and three layover locations. An aerial photo of the South Hill Mall Transit Center is shown in **Figure 30**.

Figure 29: South Hill Mall Transit Center Aerial View

The South Hill Mall Transit Center was also identified as one of the transit centers that could support additional on-route bus charging. No chargers have yet been installed at this transit center. **Figure 31** and **Figure 32** depict the modified battery electric bus charging layout that was discussed during following discussions with Pierce Transit. For this layout, three buses could charge simultaneously, and all three chargers would be constructed at the same time. The three on-route chargers would either be pantograph or inductive charging. Options A and B show the pantograph/inductive charging in slightly different locations, but the primary difference is the location of the transformer, chargers, and switchboard. Option A shows the infrastructure at the center of the facility while Option B shows the infrastructure at the southeast corner. The site is expected to require an estimated 0.9 MW of power at peak load.

This is a viable site for on-route charging because of power availability and no preliminary indication of conditions that would be prevent on-route charging. The utility confirmed that there is power available at this location and that there are no major constraints to installing on-route chargers. HDR anticipates a typical construction process to install on-route charging at this site.

Figure 30: South Hill Mall Electric Bus Charging – Option A

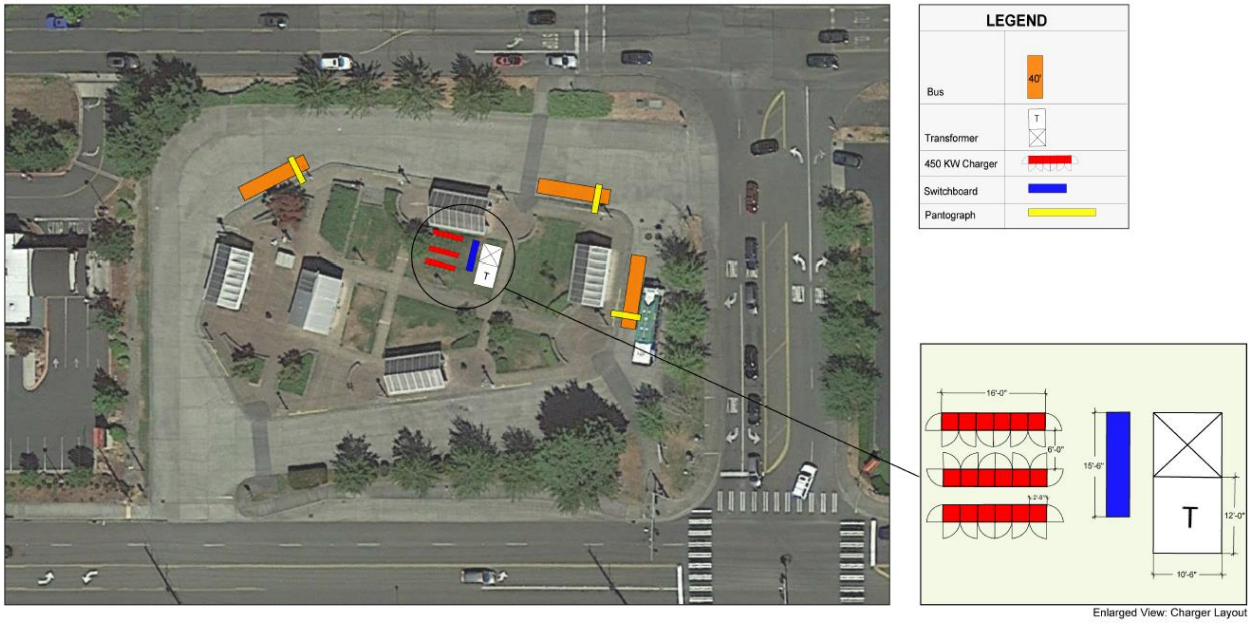
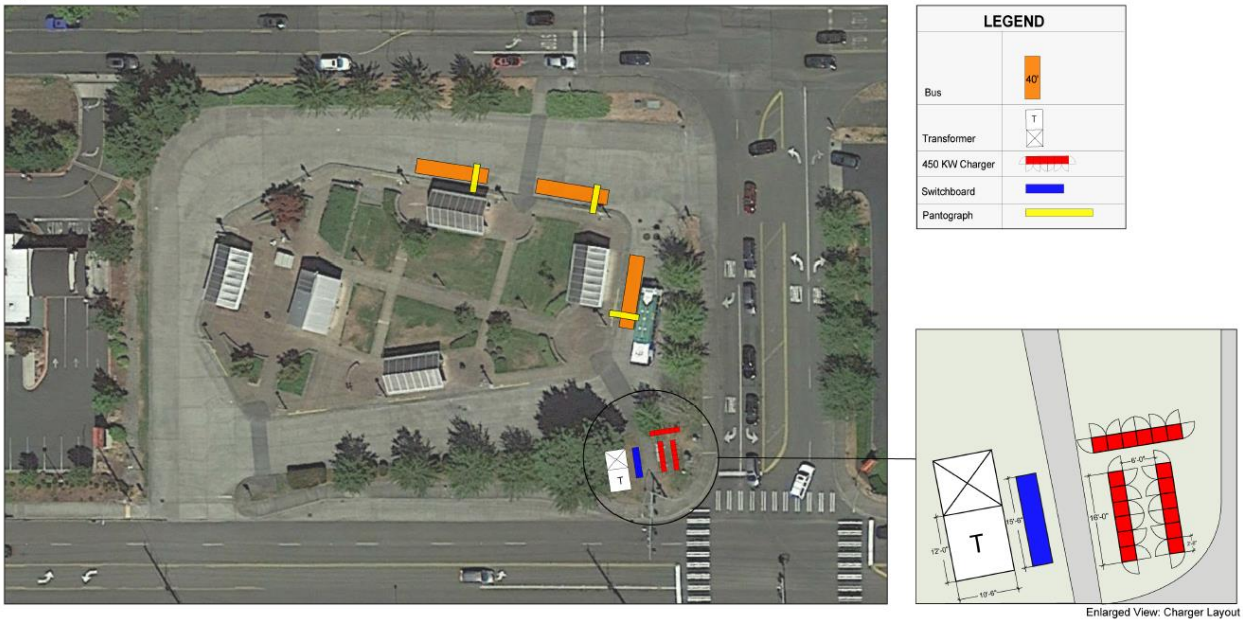


Figure 31: South Hill Mall Electric Bus Charging – Option B



Hydrogen Fueling Infrastructure

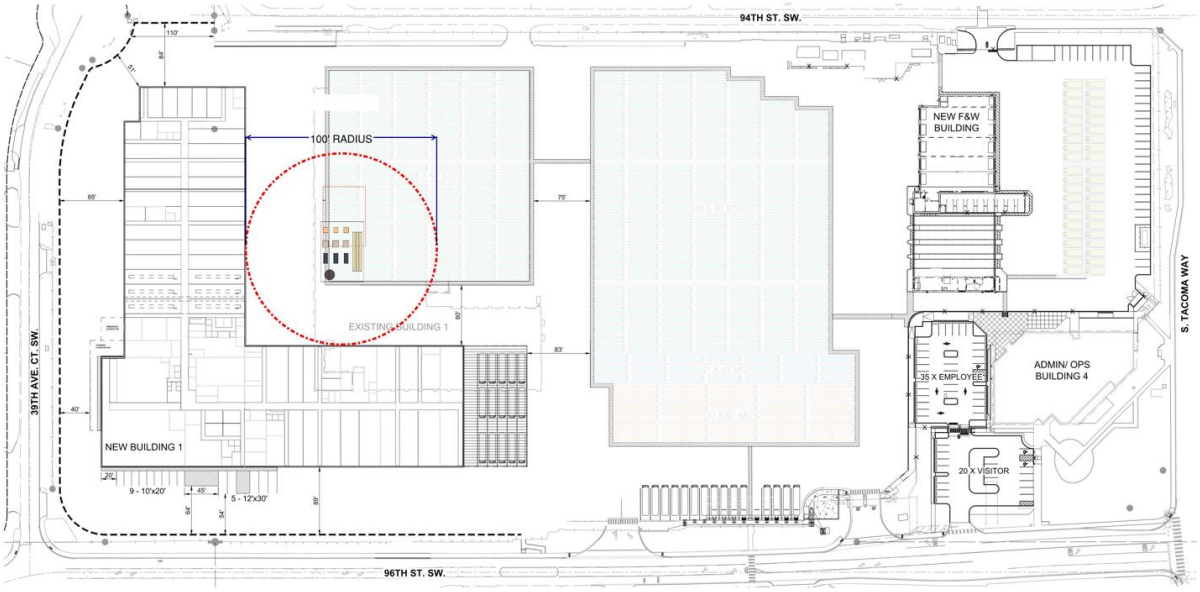
Equipment & Layout

While Pierce Transit is currently looking to procure BEBs, this section will provide high-level detail on operating hydrogen fuel cell buses. ZEB technology is evolving and it is possible that the agency could choose to adopt FCEBs in the future. This section aims to describe facility considerations for installing a hydrogen fueling system for trucking in liquid hydrogen.

Hydrogen buses operate similarly to diesel or hybrid buses and do not require additional buses to perform the same level of service as the current fleet. Hydrogen buses require fueling for the buses like a diesel pump, but do not require any other special attachments.

Figure 33 depicts the layout for hydrogen fueling located at the western side of the property. The hydrogen buses would park similar to the existing buses and undergo a daily refueling process that is almost identical to ICE fueling. With this conceptual design, it is estimated that the facility would lose 27 to 36 parking stalls to make room for hydrogen infrastructure and necessary setbacks.

Figure 32: Lakewood Base Layout to Accommodate Hydrogen Bus



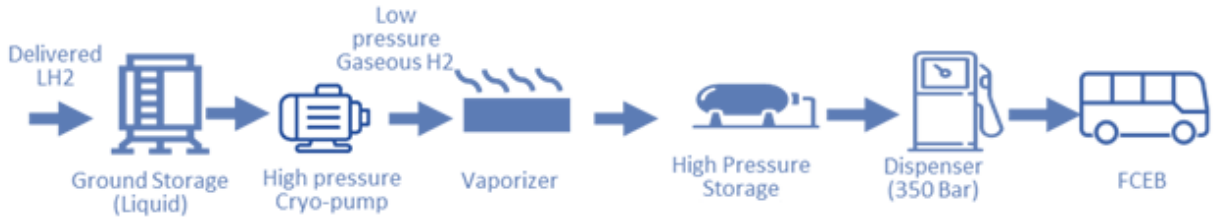
Hydrogen Fueling Station Components

Liquid hydrogen (LH_2) stations are composed of five main components: LH_2 tanks, LH_2 pumps, vaporizers, gaseous hydrogen (GH_2) tanks, and dispensers. The LH_2 tanks function as liquid storage; the hydrogen that is delivered via the trailers is unloaded into the liquid tanks and stored on-site. The LH_2 tanks are oversized for the amount of hydrogen to be dispensed on a daily basis to provide a buffer if a delivery is missed. LH_2 is pumped out of the liquid tanks by a cryogenic LH_2 pump. The LH_2 pumps used in this design are high-pressure cryopumps that allow

the GH_2 compression step to be omitted. These cryopumps are an emerging technology, and it should be noted that other station designs will include a gaseous compressor after the vaporization to bring the hydrogen up to desired pressure. The hydrogen is next pumped to a vaporizer, which converts the liquid hydrogen to gaseous hydrogen. The GH_2 is then transferred to gaseous storage tanks, where it is stored until buses are ready to fuel. GH_2 then travels from the GH_2 storage to the dispenser. The dispenser functions the same way as a diesel dispenser; operators simply insert the nozzle into the bus's fuel tank and hydrogen is dispensed. The hydrogen must be cooled before flowing through the dispenser in order to ensure safe and complete fueling. The temperature and flow rate are designed to comply with SAE standard J2601/2.

Figure 34 shows the major pieces of equipment typical of this type of station. The sizing and specifications of each component vary by equipment supplier, but most will follow this general process.

Figure 33: Key Components of a Delivered Liquid Hydrogen Station



Construction Considerations

A key consideration for hydrogen fueling infrastructure is the required distances from other equipment and other items. The defined setback requirements from various types. **Table 9** outlines the setback requirements for gaseous and liquid storage with relative to various types of exposure as defined by the Washington Administrative Codes (WACs).

Table 9: Setback Requirements by Exposure Type for Washington State[3] [4]

Type of Exposure	Distance from Gaseous Storage Under 3,000 CF (ft)	Distance from Liquid Storage Under 15,000 gal. (ft)	Distance from Liquid Storage Over 15,000 gal.(ft)
Fire resistive buildings and fire walls	0	5	5
Noncombustible buildings	0	50	75
Other Buildings	0	75	100
Flammable liquids*	10 - 25	75	100
Flammable Gas Storage	-	75	100
Open flames, smoking, welding	25	50	50
Concentrations of people**	25	75	75
Public ways, railroads, and property lines	5	50	75
Public sidewalk	15	50	75

* Distance to above ground storage or to nearest venting point from below ground storage

** In congested areas such as offices, lunchrooms, locker rooms, time-clock areas, and places of public assembly.

Major repairs and refurbishments to potential FCEBs would need to be performed in a facility compliant with established hydrogen safety standards. There are specific requirements for facilities which perform maintenance or refurbishment on hydrogen equipment. Pierce Transit's existing facilities will require upgrades to become compliant with all applicable safety codes and regulations.

Resiliency Considerations

BEBs rely on grid power, meaning that a power outage could have significant operational impacts within a BEB fleet. Short power outages may disrupt equipment while prolonged power outages jeopardize the ability to provide transit service. Multiple technologies can be utilized to create a more resilient and reliable system for Pierce Transit's ZEB fleet. Technologies and methods applicable to Pierce Transit include on-site generation, temporarily increasing on-route charging, redundant grid sources, utilizing spare buses, reducing service, installing solar, and utilizing battery energy storage. Each method provides different support for the fleet and its infrastructure. Multiple strategies can be used together. The sections below discuss each technology and method for providing increased system resiliency to Pierce Transit's ZEB fleet.

Internal Combustion Engine Generation

ICEs are the standard practice for powering vehicles and operating backup generators. Renewable and cleaner sources are starting to enter the market; however, the technology is still developing and more costly than its ICE counterpart. Pierce Transit could consider ICE generators as a backup to grid power in the event that there is a prolonged power outage.

[3] https://app.leg.wa.gov/wac/default.aspx?cite=296-24-31503

[4] https://app.leg.wa.gov/wac/default.aspx?cite=296-24-31505

While this is not clean energy, ICE generators can provide much needed power in an emergency and should be considered as a resiliency strategy especially as Pierce Transit adopts more BEBs.

Typically, combustion turbines have a larger power output (500 kW to 25 MW) but can still be utilized to meet larger distributed loads. These machines require hydrocarbon fuel input (i.e., natural gas, oil, or fuel mix) and typically have a lower power conversion efficiency. ICE generators come in a variety of sizes, making them highly scalable. These systems have a high degree of reliability and can operate on demand but require fuel input and maintenance. While they provide high degrees of reliability and some resilience, they fall short in terms of sustainability due to the utilization of fossil fuels.

ICE generation is normally not an ideal solution to offset BEB charging loads because the fuel input, high maintenance costs, and emissions are not suitable for consistent use. These generation methods can serve as backup generation to allow reduced transit operations to continue in the event of an electric service outage. The large ICE generator footprint is an important consideration. A typical stationary diesel ICE backup generator will require a footprint of approximately 75 ft^2/MW. Therefore, a 2 MW stationary backup generator would require approximately 150 ft^2, not including ancillary equipment such as transfer switches or noise reduction enclosures.

On-Route Charging

In the event of an outage localized to a transit base, on-route chargers could be utilized to keep transit routes in service. Pierce Transit could reroute buses to charge at on-route charging locations, assuming that the on-route location is not affected by the power outage. This strategy could be utilized for a short period of time to keep a single day's routes in service without major revision of the transit routes. This would be dependent on the final charging infrastructure design and the location of on-route chargers. It should also be noted that the total cost of charging may differ if on-route chargers are utilized as a method of sustaining services during an outage. Rerouting a large number of buses to charge on-route is not a long-term solution but could provide much needed battery power during a power outage.

Redundant Grid Sources

Another method to increase energy resiliency is to employ a redundant feeder from the utility grid to the Lakewood Base. Ideally, this secondary redundant source is served by a separate circuit than the primary feeder and could provide power to the Lakewood Base in the event the primary source experiences an outage or fault. Additional conversations with the public utility would be needed to determine if this is feasible. There are several main grid components that affect the grid source reliability.

Substation

The electric utility typically takes service from the generation and transmission grid at the utility's substation. The substation converts electricity from a high transmission voltage to the local medium voltage system. Due to land constraints and large load requirements, the local utilities generally operate multiple transformers within each substation and each transformer is

connected to multiple medium voltage, distribution feeders. Most outages at the substation level are localized to a single substation transformer. The presence of multiple substation transformers provides redundancy during most normal operations. The utility usually plans maintenance outages to avoid impacting the entire substation; however, when planning for redundant power to the transit base chargers, Pierce Transit should request redundant distribution feeders be fed from separate substations or at the least from separate substation transformers.

Distribution Feeders

Medium voltage distribution feeders are installed and operated by the utility to supply electricity to their customers. Utility planners work to ensure that the grid will operate as reliably and efficiently as possible. Utility planners consider how to add new loads to the grid and how to best operate the local grid when maintenance or other outages impact an area or customer. In most cases, impacts to the distribution feeders are seldom known or experienced by the utility customer.

Unexpected outages at the distribution level are often localized and able to be fed from a separate distribution feed. Underground distribution feeder outages are most commonly caused by digging into the line. Underground feeder outages do not happen frequently but occur for a longer duration. To avoid long-duration underground outages, utilities typically operate a loop system that can be switched from one source to another to avoid lengthy delays.

Overhead distribution feeders are installed nearer to the ground than transmission lines, so they are more likely to be impacted by tree branches and animals contacting the bare conductors and shorting the system. Overhead distribution feeders are also not built to the same strength as the transmission lines, so wind and downed trees can also impact these overhead feeders. Overhead feeder outages occur more frequently than underground outages but are repaired much quicker because they are more accessible. Overhead feeders are often configured to allow multiple sources to back feed the line in the event of outage or maintenance.

Some factors for consideration of the distribution feeders may include:

- Does the charging infrastructure require a 100 percent redundant backup source? If 100 percent redundancy is required, this will increase cost and on-site space required for the utility to provide this level of redundancy.
- Providing separate distribution sources from two separate substations is most desirable but also most costly. If redundant distribution feeds are installed, consider utilizing sources from a single substation but from separate transformers within that substation.

Spare Bus Utilization

Maintaining a fleet of spare buses (zero-emissions or conventional combustion engines) is a viable option to maintain a more operational transit routes in the event of an outage. Depending on the type and length of a potential outage, buses can be swapped with fully charged spares for a reserve fleet once they reach a low state of charge. Maintaining a reserve fleet of BEBs would allow for Pierce Transit to maintain their emissions goals while enabling a

greater sense of resiliency for transit operations. However, a reserve fleet of this style is still limited by the charging infrastructure which may be impacted by the potential outage.

A reserve fleet containing diesel buses can provide a greater amount of bus swaps as they are not limited by potential charging outages. While this method may be viable during a phased fleet conversion, this would no longer be viable once the entire fleet became battery electric. However, a mixed fleet of BEBs and FCEBs may be viable.

While a reserve bus fleet can provide a greater sense of resiliency and allow for increased transit operations during an outage, there are significant costs and space requirements associated with purchasing and maintaining a reserve fleet that should be weighed against the benefits of developing and storing one.

Reduced Bus Services

In the case of a power outage, service reductions could be considered for the duration of the outage. Services can be reduced to a maintainable level depending on the severity, type, and outage duration (utility, local, software, etc.) and then returned to baseline operation once an outage is restored and buses are fully charged for operation. Different plans can be developed to optimize services for different outage categories to streamline service reductions. It should be noted that in the event of a large-scale outage, such as those caused by a large natural disaster, the overall demand for different transit service will likely decrease as the disaster has larger regional impacts beyond transit services. This should be considered if reduced operations plans are developed in the future. Overall, service reduction plans are dependent on the type and scale of an outage and are a viable option as a primary or secondary method of operation resiliency.

Solar Photovoltaics

Solar photovoltaic (PV) energy provides a scalable choice for no emission energy generation. Over the past decade solar PV has become more reliable and requires little maintenance over its lifetime. Solar PV requires a large area/footprint to achieve large power output and is subject to fluctuations in solar irradiance. Given the use case for Pierce Transit, solar PV could be installed over gantry-mounted bus chargers or above existing buildings with some upgrades to the overall support structure. This helps alleviate some concern for a large footprint required by PV systems. The overall solar PV system can be scaled depending on the available space or module size but may be subject to fluctuations depending on module tilt and azimuth angles.

Solar PV is typically not capable of offsetting the entire bus charging energy demand. However, PV can offset a meaningful portion of overall demand resulting in a “net load” that is lower than scenarios without PV. Solar PV would not provide backup power unless designed to include battery energy storage; the primary benefit of a solar PV system would be offsetting the increasing energy consumption at the Lakewood Base. The overall impact of solar PV is also dependent on the bus charging schedule. A solar installation will have a greater impact if more of the charging occurs during peak solar generation hours. However, with the addition of energy

storage, a greater amount of solar energy can be utilized if the bus charging load is less than PV output during some daylight hours.

Battery Energy Storage

Battery energy storage can play a critical role within a microgrid or distributed energy resource (DER) system. Although energy storage systems (ESS) are not a generation method they can provide greater reliability and resiliency for a microgrid, along with potential energy bill reduction applications. ESS are especially useful when utilizing renewable generation methods, because it can help reduce some of the intermittency issues and extract more value out of those types of assets. Battery energy storage systems (BESS) are typically the most prominent and mature technology for distributed scale systems and microgrids. BESS systems are scalable and can help provide a greater sense of resiliency for a more renewable focused system but typically come at a relatively high installation cost and may experience degradation in energy capacity over the system's life.

For transit bases, BESS systems are typically utilized for shifting load and/or generation in a strategic way that may help reduce demand charges and total energy costs associated with large charging loads that occur during peak rate hours. The size and duration of a potential BESS is heavily dependent on the available space for installation because the size of the system will increase as the nameplate capacity and operational duration increases. BESS size will vary from vendor to vendor, but most solutions are typically of a containerized style. Systems of this nature are generally modular and flexible in terms of system size with footprints ranging from 8 feet by 12 feet upwards to 40 feet by 8 feet (40' ISO containers). Further analysis and optimization would help determine the optimum BESS size and configuration for Pierce Transit.

Utility Coordination

As part of this fleet transition planning process, Pierce Transit and HDR worked together to establish communication with all public utilities that serve Pierce Transit. Pierce Transit purchases power from three public utilities: Lakeview Light and Power, Puget Sound Energy (PSE), and Tacoma Power. Pierce Transit also met with the Northwest Hydrogen Association to discuss ZEB plans.

Lakeview Light and Power

Pierce Transit met with Lakeview Light and Power on January 18, 2022, to provide an overview of the ZEB study and begin high level utility coordination. Lakeview Light and Power provides energy for the Lakewood Base and Lakewood Transit Center, which is a potential on-route charging location. This public utility offered a few incentives for electric vehicles and was generally supportive of Pierce Transit's ZEB strategy. Lakeview was able to confirm power availability for Lakewood Transit Center and the Lakewood Base; however, upgrades would be needed to support the charging infrastructure installed at the Lakewood Base. Pierce Transit and Lakeview Light and Power will continue working together to coordinate the utility upgrades needed at this site.

Puget Sound Energy

Pierce Transit met with PSE on January 30, 2022, to provide an overview of the ZEB study and begin high level utility coordination. PSE offered a variety of electric vehicle incentives for fleets and charging stations that can be further explored for Pierce Transit's ZEB transition. PSE provides energy for the South Hill Mall Transit Center and was able to confirm power availability for the site. Overall, PSE was highly supportive of Pierce Transit's ZEB strategy.

Tacoma Power

Pierce Transit met with Tacoma Power on March 10, 2023, to provide an overview of the ZEB study and begin high level utility coordination. Tacoma Power did not yet offer EV incentives, but they are developing a program and plan to have a fleet program toward the end of 2023. Tacoma Power provides energy to the Commerce Street Station, TCC Transit Center, and Tacoma Mall Transit Center. The utility is working to confirm power availability at the three sites. Overall, the utility was supportive of Pierce Transit's ZEB strategy.

Northwest Hydrogen Association and Consortium for Hydrogen and Renewably Generated E-fuels

Pierce Transit is actively communicating with partners at the Pacific Northwest Hydrogen Association (PNWHA) and Consortium for Hydrogen and Renewably Generated E-fuels (CHARGE) to provide an overview of the ZEB plan. Increased coordination will continue to explore ways the association can partner with and support the ZEB study going forward. Pierce Transit met with CHARGE on March 31, 2023, to provide an overview of the ZEB study and talk about the interest in creating a hydrogen hub in the Pacific Northwest. At the time of this report,

the two hydrogen entities were still developing plans and did not have much public information that could be shared. Pierce Transit intends to maintain communication and stay up-to-date on hydrogen developments in the area.

Financial Analysis

When undertaking any major transit technology and infrastructure project, the first concern is typically how much it will cost to implement. This financial analysis explored the capital costs that would be expected for the implementation of the ZEB Transition Plan. More detailed lifecycle costs and long-term transition costs are being developed to provide a holistic picture of the funding needed for a ZEB transition. This section will only delve into initial costs to help inform funding gaps and potential grant applications; additional work needs to be done to create a fuller picture of the financial aspects of a ZEB transition for Pierce Transit.

ZEB Transition Costs

The costs evaluated in this section included capital (buses and infrastructure) over the entire transition plan (2023–2042).[5] See **Appendix B: Financial Assumptions** for assumptions used to estimate costs. The project team compared the capital costs of the CNG Baseline Scenario (procuring only CNG buses), a Long-Term BEB fleet, and a Long-Term FCEB fleet. The FCEB fleet assumes that Pierce Transit decides to pivot to FCEBs after the near-term deployment and starts procuring FCEBs starting in 2031. The Long-Term FCEB fleet would have both BEBs and FCEBs, but the long-term goal would be to integrate as many FCEBs as feasible.

Table 10 shows the total capital costs of each scenario from 2023 to 2042. The CNG Baseline Scenario is the lowest cost at $364 million, the Long-Term BEB Scenario is $574 million, and the Long-Term FCEB Scenario is estimated to be the highest cost at $660 million. To transition to fully BEBs it is estimated to cost $210 million more than the baseline scenario and to transition to a fleet of FCEBs it is estimated to cost $295 million more than the baseline scenario.

Table 10: Total Capital Costs for Fleet Scenarios (2023–2042)

Fleet Type	Total Capital Cost
Baseline CNG	$364,208,073
Long-Term BEB	$573,893,693
Long-Term FCEB	$660,162,945

Figure 35 shows a graphic representation of the costs associated with each scenario year-by-year. The tables following this figure show more detail on the year-by-year costs for each scenario. Overall, it is expected that the two long-term ZEB scenarios will incur more capital costs than the baseline scenario and additional funding will be needed to pursue either scenario.

[5] All estimates within this memo account for inflation. See Appendix A for details on how inflation was calculated.

Figure 34: Capital Costs for Each Scenario from 2023 to 2042 (in dollars)

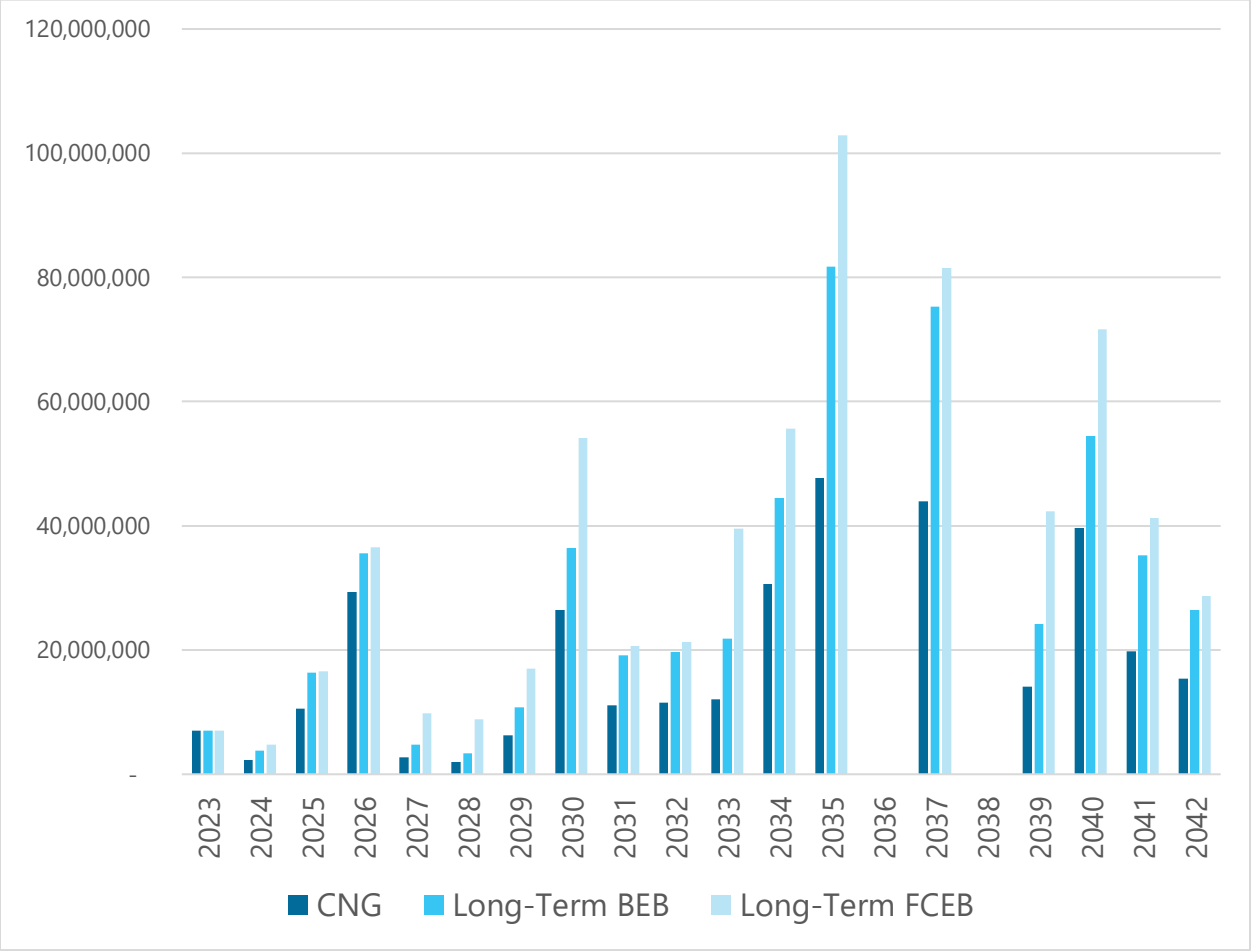


Table 11 shows a comparison between the three scenarios along with the total estimated capital costs for each scenario.

Table 11: Total Capital Costs for Each Bus Scenario in Dollars (2023-2042)

Year	Baseline CNG	Long-Term BEB	Long-Term FCEB
2023	8,000,000	7,000,000	7,000,000
2024	2,568,000	3,852,000	4,718,700
2025	11,735,225	16,314,825	16,623,948
2026	30,626,075	35,526,247	36,518,532
2027	3,145,910	4,718,866	9,791,646
2028	2,244,083	3,366,124	8,793,999
2029	7,203,506	10,805,259	17,018,282
2030	26,896,089	36,402,466	54,101,329
2031	12,736,999	19,105,498	20,697,623
2032	13,119,109	19,678,663	21,318,551
2033	13,259,319	21,789,199	39,524,594
2034	32,011,543	44,468,209	55,672,249
2035	54,475,296	81,712,944	102,857,960
2036	-	-	-
2037	50,188,520	75,282,780	81,556,345
2038	-	-	-
2039	16,134,849	24,202,273	42,353,978
2040	40,300,819	54,447,652	71,668,982
2041	21,931,747	35,304,764	41,295,875
2042	17,630,985	26,446,477	28,650,351
Total	364,208,073	520,424,246	660,162,945

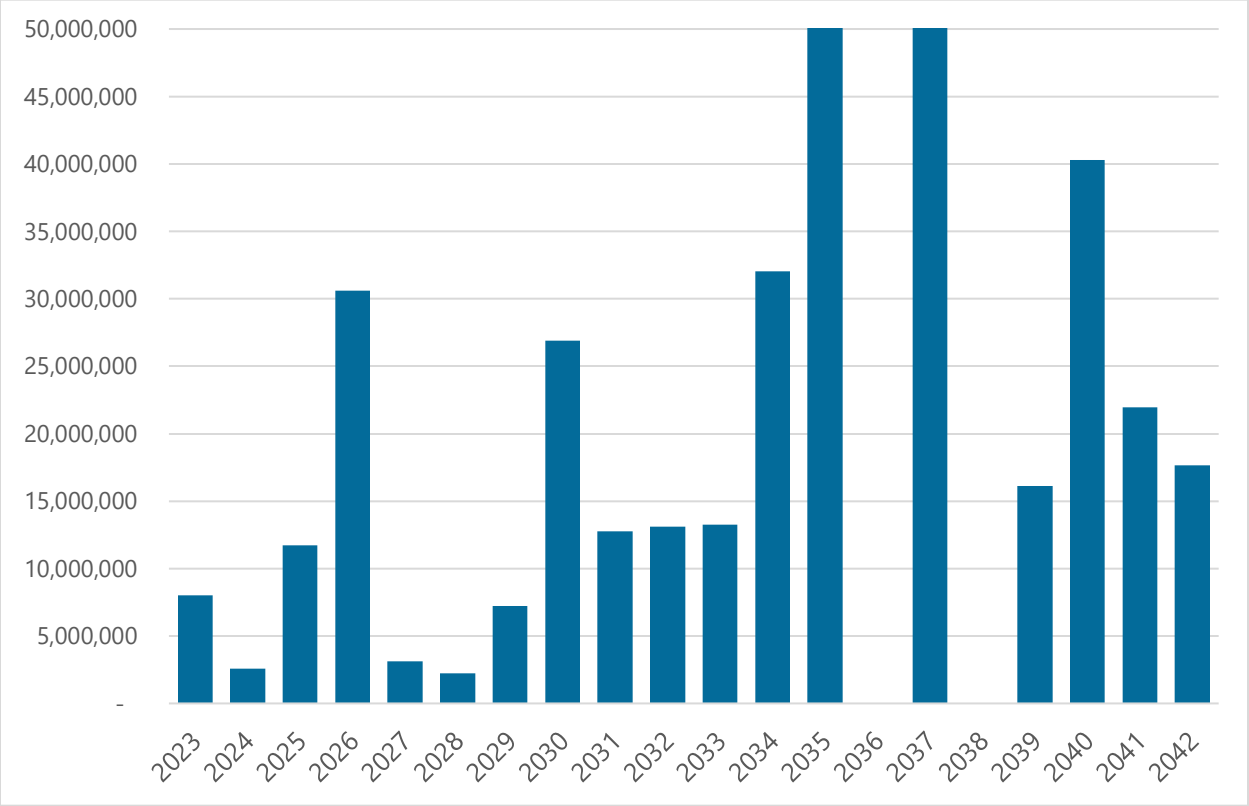
Baseline CNG Fleet Scenario

Table 12 shows the estimated capital costs for procuring a fully CNG fleet. There are no estimated infrastructure costs for this scenario because all CNG infrastructure is already in place. **Figure 36** shows a graphic representation of the capital costs estimated year-by-year.

Table 12: Total Capital Costs for Baseline CNG Fleet

Year	Vehicle Capital Cost (in dollars)
2023	8,000,000
2024	2,568,000
2025	11,735,225
2026	30,626,075
2027	3,145,910
2028	2,244,083
2029	7,203,506
2030	26,896,089
2031	12,736,999
2032	13,119,109
2033	13,259,319
2034	32,011,543
2035	54,475,296
2036	-
2037	50,188,520
2038	-
2039	16,134,849
2040	40,300,819
2041	21,931,747
2042	17,630,985

Figure 35: Total Capital Costs for Baseline CNG Fleet (in dollars)



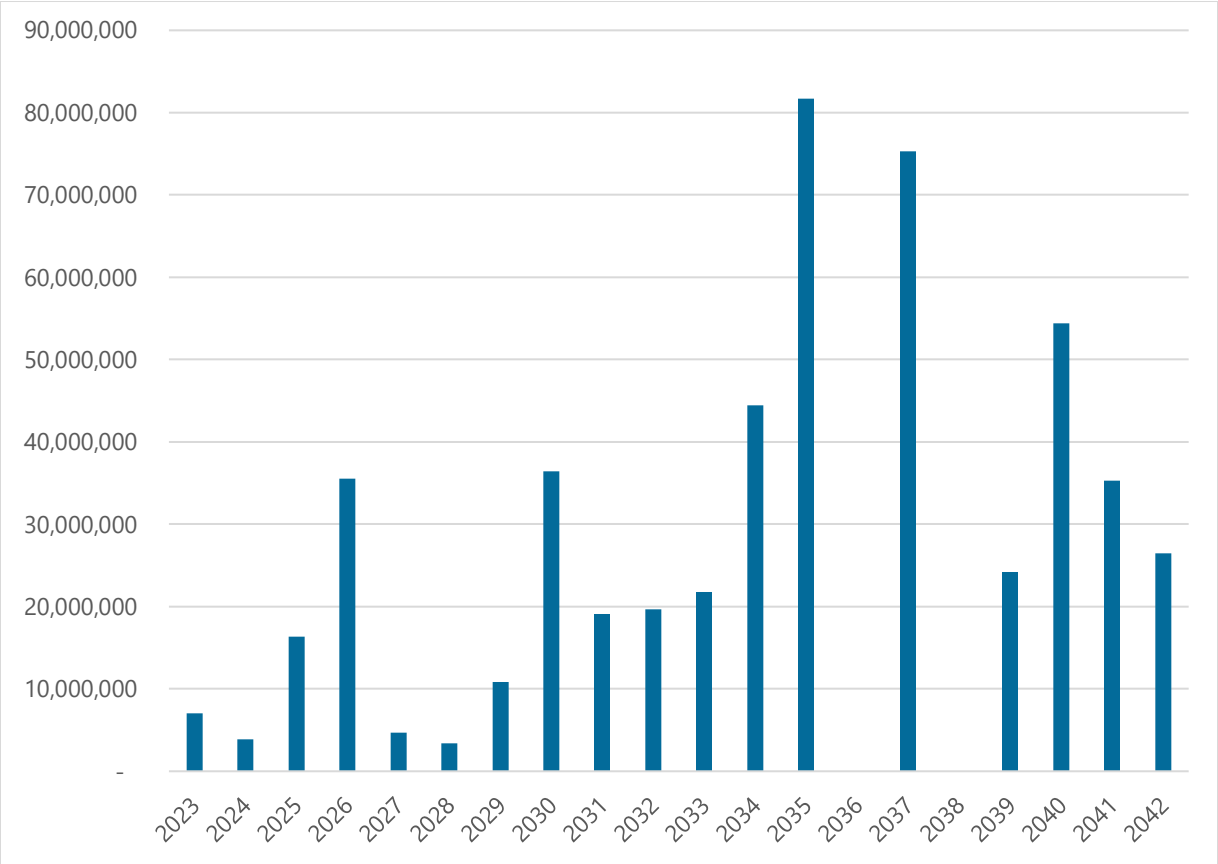
Long-Term Battery Electric Bus Fleet Scenario

Table 13 shows the estimated capital costs for a fully BEB fleet. Unlike the baseline scenario, this scenario requires additional infrastructure to support each bus procurement. This estimate does not account for design and construction costs of a gantry system. **Figure 37** depicts the year-by-year costs in a graphic.

Table 13: Total Capital Costs for Fully BEB Fleet

Year	Vehicle Capital Cost (in dollars)	Infrastructure Capital Cost (in dollars)	Total Capital Cost (in dollars)
2023	7,000,000	-	7,000,000
2024	3,852,000	866,700	4,718,700
2025	16,314,825	309,123	16,623,948
2026	35,526,247	992,285	36,518,532
2027	4,718,866	5,072,781	9,791,646
2028	3,366,124	5,427,875	8,793,999
2029	10,805,259	6,213,024	17,018,282
2030	36,402,466	6,677,650	43,080,116
2031	19,105,498	5,588,358	24,693,856
2032	19,678,663	1,328,310	21,006,973
2033	21,789,199	2,736,318	24,525,518
2034	44,468,209	2,348,673	46,816,882
2035	81,712,944	6,289,746	88,002,690
2036	-	-	-
2037	75,282,780	4,619,625	79,902,405
2038	-	-	-
2039	24,202,273	1,633,653	25,835,927
2040	54,447,652	3,365,326	57,812,978
2041	35,304,764	-	35,304,764
2042	26,446,477	-	26,446,477

Figure 36: Total Capital Costs for Long-Term BEB Fleet



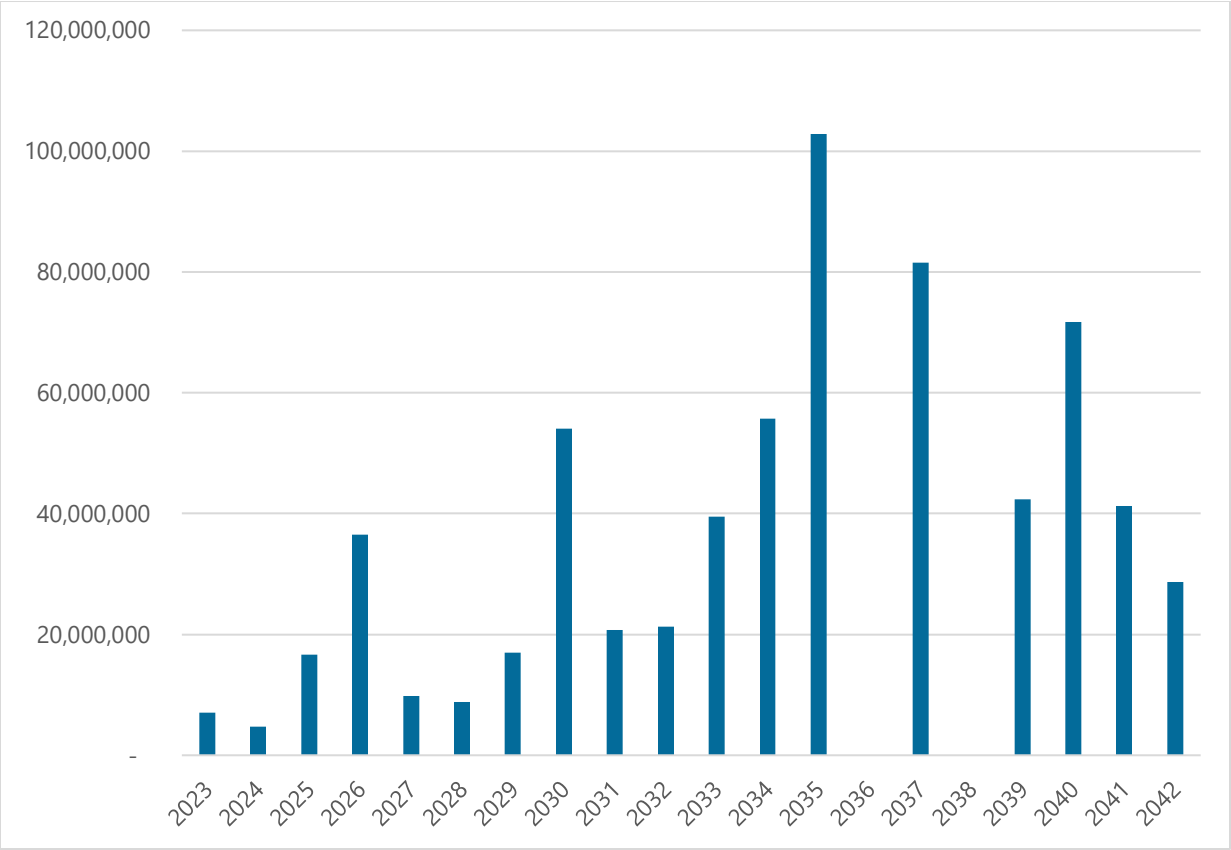
Long-Term Hydrogen Fuel Cell Bus Scenario

Table 14 depicts a scenario where Pierce Transit decides to pivot and procure a fully FCEB fleet starting in 2031. This scenario starts with BEBs from 2024 to 2030 then switches to FCEBs in 2031. This estimate includes infrastructure costs for BEB charging stations and hydrogen fueling infrastructure that would dispense hydrogen trucked in from an outside source rather than producing it on-site. This estimate does not include design and construction costs for BEB charging stations or the hydrogen fueling system. **Figure 38** shows the year-by-year costs for this scenario in a graph.

Table 14: Total Capital Costs for Long-Term FCEB Fleet

Year	Vehicle Capital Cost (in dollars)	Infrastructure Capital Cost (in dollars)	Total Capital Cost (in dollars)
2023	7,000,000	-	7,000,000
2024	3,852,000	866,700	4,718,700
2025	16,314,825	309,123	16,623,948
2026	35,526,247	992,285	36,518,532
2027	4,718,866	5,072,781	9,791,646
2028	3,366,124	5,427,875	8,793,999
2029	10,805,259	6,213,024	17,018,282
2030	41,735,311	12,366,018	54,101,329
2031	20,697,623	-	20,697,623
2032	21,318,551	-	21,318,551
2033	26,011,913	13,512,682	39,524,594
2034	55,672,249	-	55,672,249
2035	88,522,356	14,335,604	102,857,960
2036	-	-	-
2037	81,556,345	-	81,556,345
2038	-	-	-
2039	26,219,129	16,134,849	42,353,978
2040	71,668,982	-	71,668,982
2041	41,295,875	-	41,295,875
2042	28,650,351	-	28,650,351

Figure 37: Total Capital Costs for BEB+FCEB Fleet



Funding Plan

With a clear understanding of capital costs associated with a ZEB transition, Pierce Transit can begin to incorporate these costs into future operating and capital budgets. Grant funding will be essential in helping Pierce Transit meet their goal of reaching 20 percent zero emission by 2030 and achieving a long-term vision of a zero-emission fleet. Pierce Transit will utilize formula funding and previously awarded grant funding to continue transitioning the fleet in the near term. The agency will also apply for funding from any relevant competitive grant programs at the local, regional, state, and federal level including the WSDOT ZEVIP Program, the WSDOT Green Transportation Capital Grant Program, the FTA Low or No Emission Vehicle Grant Program, and the FTA Bus and Bus Facilities Grant Program. Pierce Transit will also explore innovative funding strategies like the Washington CFS Credit Generation Program, public-private partnerships, utility partnerships, and leasing opportunities.

Table shows the cost difference between the Baseline CNG and two ZEB scenarios year-by-year. It is assumed that all funding for the baseline scenario is secured and programmed so no additional funding would be needed for the baseline scenario. With each ZEB scenario, there would be funding needs each time the agency goes to procure the vehicles and infrastructure. Pierce Transit has planned for costs up until 2025. Starting in 2025, the agency will need to start looking for additional funding in order to keep integrating ZEBs into the bus fleet.

Table 15: Funding Needs for BEB and BEB+FCEB Fleets (2023–2042)

Year	Funding Needed for BEBs	Funding Needed for BEB+FCEBs	Year	Funding Needed for BEBs	Funding Needed for BEB+FCEBs
2023	-	-	**2033**	8,901,479	26,265,275
2024	1,508,700	1,508,700	**2034**	12,021,726	17,397,578
2025	2,598,923	2,598,923	**2035**	19,908,570	48,382,664
2026	3,442,371	3,442,371	**2036**	-	-
2027	5,859,258	5,859,258	**2037**	17,166,755	31,367,825
2028	5,988,896	5,988,896	**2038**	-	-
2029	8,013,900	8,013,900	**2039**	5,667,366	26,219,129
2030	15,256,575	20,713,080	**2040**	16,265,743	20,773,618
2031	8,772,608	7,960,624	**2041**	9,093,651	19,364,128
2032	4,608,087	8,199,443	**2042**	4,407,746	11,019,366

Workforce Development

Overview

With the introduction of zero emission technology to the Pierce Transit bus fleet, proper training on bus systems and subcomponents unique to ZEBs is critical to ensure safe, efficient operation and maintenance of the transitioned fleet. Pierce Transit will work with internal training departments in close coordination with OEMs to acclimate the existing workforce to the new technology, avoiding displacement of the existing workforce.

This section will address the necessary steps to evaluate the skills of the existing workforce, identify skill gaps on an individual basis, and develop a plan to build and implement an effective training program for both bus operators and bus maintenance personnel. In addition to the further development of the existing workforce, this document will also convey a workforce growth strategy for attracting new employees, retaining new and current employees, and funding opportunities to sponsor the growth.

Training Program Development

Pierce Transit intends to deploy ZEBs and provide an in-house comprehensive training curriculum to operate and maintain these vehicles. Training will focus on BEBs. While there are no immediate plans to adopt FCEBs, workforce development will include FCEBs because this technology could be incorporated at a later date. The development of a high-quality training program will entail coordination with internal and external resources. The following list identifies potential resources that may assist Pierce Transit with program development:

- Vehicle and charger OEM training curriculum purchased as part of new rolling stock procurements
- Technical and safety training curriculum developed and delivered by Pierce Transit's in-house Maintenance Training Program
- Vehicle subsystem/subcomponent OEM training curriculum
- Partnership with local first responding agencies
- Collaboration with transit agencies with operational zero emission fleets and in-house training programs such as King County Metro
- Washington State Transit Insurance Pool (WSTIP)
- GEM (Grounds, Equipment, and Maintenance), a Pacific Northwest Interagency Cooperative for all public agencies to the mutual benefit of all constituents
- Membership through training consortiums like National Transit Institute (NTI)
- Participation in transit associations like WSTA, APTA, Center for Transportation and the Environment (CTE), and Zero Emissions Bus Resource Alliance (ZEBRA)

Pierce Transit will work to develop a training program that integrates ZEB curriculum with its existing internal training program, including bus maintenance technical training and behind-the-wheel training. Technical training includes shop and system safety, system familiarization and operations, troubleshooting and diagnostics, rebuild, and preventative maintenance. All ZEB curricula will be jointly developed and reviewed by Pierce Transit and Amalgamated Transit Union (ATU) Local 758 prior to being approved by Pierce Transit's Bus Operations Training Assistant Manager, and Executive Director of Maintenance, and Maintenance Training Coordinator.

Training Curriculum

Pierce Transit's operator training program is a 28-day program built upon curriculum from WSTIP guided by the Federal Motor Carrier Safety Administration (FMCSA); the program includes 21 days of classroom training followed by 7 days of behind-the-wheel training. Pierce Transit works closely with Enterprise Asset Management, parts procurement, and bus OEMs to provide operator training. As the technology evolves and OEM training curriculum is updated, Pierce Transit will schedule operators to attend new training courses.

Both BEBs and FCEBs contain high voltage batteries, requiring all maintenance technicians to be certified to work on high voltage systems. Pierce Transit Bus Maintenance and Training Departments, with the inclusion of ATU, will work to supplement the existing electrical safety training curriculum with guidance from the National Fire Protection Agency (NFPA 70E), OSHA, OEMs, and industry best practices. The program will include the following curriculum:

- Proper use and inspection of personal protection equipment (PPE)
- CPR and first aid training
- High voltage onboard systems familiarization and identification
- Lock-Out-Tag-Out (LOTO) training and compliance
- FCEB workplace safety and hazard response protocol

Current entry level training for BEBs from OEMs is very thorough about LOTO and PPE and Pierce Transit goes above and beyond suggested safety standards wherever possible to create an extra buffer for personnel safety. Pierce Transit is currently working with Proterra on a four-day formal, in-house training course that will include both classroom and on the job modules. This training course will be offered in six-person classes at an estimated cost of $15,000 per class. Additionally, **Table 16** details the forecasted BEB training courses Pierce Transit identified in their Phase 1 Plan.

Table 16: Battery Electric Bus Driveline Training Transition Forecast

Course	Type	Units	Cost	Notes
Electric Drivelines	Cummins	Per Person	$4,000	Incl. Per Diem, Hotel
Door Training	Vapor	Class (4-6)	$3,400	1-day, in-house
BEB JLM Familiarization	GILLIG	Class (4-6)	$5,000	3-day, in-house (GILLIG)
Multiplex I/O	Dinex G5	Class (4-6)	$5,000	3-day, in-house (GILLIG)
HVAC	ThermoKing	Class (4-6)	$4,800	3-day, in-house (ThermoKing)
Charging Stations	ChargePoint	Class (4-6)	Free	ChargePoint Univ. Installers Course

Skills Assessment, Categorization, and Gap Identification

This section will outline the workplace hierarchy structure and authorized responsibilities of individuals based on qualifications, the skill level requirements for work needing to be performed, and initial, refresher, and proficiency guidelines and requirements for training and associated qualifications. Generally, operational staff can be grouped into four categories:

1. **Bus Operations Support:** Staff in this category would include those who are critical to bus operations but do not directly interact with the buses. Minimal training is required and typically only covers a high-level overview of the technology and its capabilities. For example, it's important for dispatchers and schedulers to understand the operational range of the vehicles to avoid assigning vehicles to unsuitable routes.
2. **Bus Operations:** Staff in this category would include operational staff who directly interact with the buses but do not perform any vehicle maintenance. Bus Operations will require more training than Bus Operations Support staff given their direct interaction with the vehicles. For example, bus operators must be familiar with all dash indicator lights, operation of doors and wheelchair access, and safety procedures.
3. **Bus Maintenance Support:** Staff in this category include operational specialists who directly interact with the buses, support, or lead bus maintenance training, and/or are responsible for the assignment and oversight of maintenance functions. Bus Maintenance Support will receive the same training as bus maintenance personnel as their roles require full familiarity with all vehicle systems and mechanical components.
4. **Bus Maintenance:** Staff in this category include operational specialists who directly interact with the buses and perform routine and unplanned maintenance functions. Bus Maintenance personnel require the most training as they have the most frequent and in-depth interaction with the vehicles. Within Bus Maintenance, personnel will be individually assessed on current skills and assigned to training modules as necessary, ensuring that all Bus Maintenance personnel receive all training required without

duplicating the effort. For example, maintenance personnel who can demonstrate proficient multiplexing skills would not be assigned to multiplexing courses.

Table 17 shows the composition of Pierce Transit's existing operations and maintenance staff, including the number of full-time equivalent employees (FTE), number of authorized positions, union affiliation, and role categorization with respect to the zero-emission transition.

Table 17: Pierce Transit Operations and Maintenance Job Titles & Staffing (2022)

Job Title	Role Category	# FTEs	Authorized Positions	Representation
Scheduler	Bus Operations Support	2	2	ATU Local 758
Service Impacts Supervisor	Bus Operations Support	1	1	ATU Local 758
Service Supervisor	Bus Operations Support	40	43	ATU Local 758
Service Supervisor - SHUTTLE	Bus Operations Support	2	2	ATU Local 758
Service Support Training Coordinator	Bus Operations Support	1	1	ATU Local 758
Specialized Transp. Dispatcher	Bus Operations Support	7	7	ATU Local 758
Transportation Assistant Manager	Bus Operations Support	7	7	Non-Represented
Transportation Manager	Bus Operations Support	2	2	Non-Represented
Transportation Manager, Specialized	Bus Operations Support	1	1	Non-Represented
Bus Training Assistant Manager	Bus Operations	1	1	Non-Represented
CSR Fixed Route	Bus Operations	8	10	ATU Local 758
CSR SHUTTLE	Bus Operations	9	9	ATU Local 758
Instructor	Bus Operations	12	13	ATU Local 758
Relief Transit Operator	Bus Operations	0	81	ATU Local 758
Transit Operator	Bus Operations	434	450	ATU Local 758
Transit Operator Trainee	Bus Operations	16	42	ATU Local 758
Executive Director of Maintenance	Bus Maintenance Support	1	1	Non-Represented
Fleet Assistant Manager	Bus Maintenance Support	4	4	Non-Represented
Fleet Care Attendant	Bus Maintenance Support	9	15	ATU Local 758
Fleet Manager	Bus Maintenance Support	1	1	Non-Represented
Labor Negotiator	Bus Maintenance Support	1	1	Non-Represented
Maintenance Training Coordinator	Bus Maintenance Support	1	1	Non-Represented

Training And Workforce Development Manager	Bus Maintenance Support	1	1	Non-Represented
Zero Emissions Fleet Coordinator	Bus Maintenance Support	1	1	Non-Represented
Travel Trainer	Bus Maintenance Support	1	2	ATU Local 758
Apprentice Diesel Mechanic	Bus Maintenance	1	3	ATU Local 758
Body Repair Technician	Bus Maintenance	6	8	ATU Local 758
Journey Level Mechanic	Bus Maintenance	40	48	ATU Local 758
Lead Maintenance Mechanic	Bus Maintenance	0	1	ATU Local 758
Lead Mechanic	Bus Maintenance	6	7	ATU Local 758
Maintenance Mechanic	Bus Maintenance	6	6	ATU Local 758
Mechanic I	Bus Maintenance	1	1	ATU Local 758
Preventative Maintenance Service Technician	Bus Maintenance	3	3	ATU Local 758
Transit Maintenance Worker	Bus Maintenance	3	3	ATU Local 758
Transit System Maintenance Worker	Bus Maintenance	6	9	ATU Local 758

Training Program Implementation

Pierce Transit's current technical training program is constantly evolving as old systems are retired and new systems are integrated; their in-house program will include a comprehensive curriculum on all vehicle systems and subsystems through internal training, peer-to-peer training, "Train the Trainer" through vendors and OEMs, and collaboration with local fire departments and vehicle towing companies. All maintenance department training will be specialized to provide employees with current information about new and existing equipment, including modern electronic and mechanical bus systems, OEM changes that impact maintenance practices, and refresher training if necessary. Additionally, Pierce Transit encourages all fleet maintenance personnel become Automotive Service Excellence (ASE) H-, S-, and T-series certified; these certifications are not mandatory, but technicians are awarded premium pay for achieving and maintaining ASE Master Transit Bus Technician Certification status per the ATU Local 758 Labor Agreement.

Initially, Pierce Transit plans to identify and develop a core group of subject matter experts (SME) to serve as BEB and FCEB fleet specialists. This approach will lend itself to the proactive development of qualified fleet specialists through hands-on experience and learning. In turn, this will influence the transition to an entirely zero-emission-certified workforce on a timeline that aligns with the integration of new ZEBs to the Pierce Transit fleet. The training effort is envisioned to be phased so that as the zero-emission fleet grows, more mechanics will complete zero-emission maintenance training. For example, if Pierce Transit is expecting delivery of 10

BEBs, transition training for five mechanics to become BEB- and FCEB-certified fleet specialists will begin one month prior to delivery. This ensures Pierce Transit is staffed appropriately when taking delivery of new buses in alignment with the identified fleet replacement schedule, with a 20 percent ZEB transition taking place by 2030.

In addition to the plans and training stated above Pierce Transit is currently under contract with Gillig for On-Call Training for maintenance through March 31, 2026. The training topics covered under the contract and relevant to Battery Electric Buses are:

- Gillig Battery Electric Bus Operator Training
- Maintenance Department General Vehicle Orientation
- Gillig Battery Electric Bus Service Personnel Training
- Basic Bus Electrical Systems
- Multiple Electrical Systems G3, G4, and G5

Workforce Right-Sizing

As Pierce Transit transitions to ZEBs, the agency will re-evaluate staffing needs on a rolling basis, based on overall fleet growth, and approve additional Apprentice Mechanic, Mechanic, and Lead Mechanic positions as determined by the Maintenance Department. A summary of Pierce Transit's current Operations and Maintenance staff by position category is shown in **Table 18**.

Table 18: Pierce Transit Operations and Maintenance Employees Summary

Role Category	Full Time Employees	Authorized Positions
Bus Operations Support	63	66
Bus Operations	480	606
Bus Maintenance Support	19	26
Bus Maintenance	72	89
Total	**634**	**787**

Pierce Transit jointly sponsors an apprenticeship program with ATU Local 758 and the Washington State Department of Labor and Industry. Apprenticeship occupational objectives under this program include Bus Body Repairer, Coach Heavy Duty Diesel Mechanic, and Facilities Maintenance Mechanic; all three programs establish on the job (OTJ) training that leads the apprentice to the status of State Certified Journey Level Heavy Duty Diesel Mechanic after completion of 8,000 hours of reasonably continuous employment and at least 144 hours per year of related/supplemental instruction (RSI) per the Washington State Apprenticeship and Training Council's Apprenticeship Program Standards. RSI hours can be satisfied through State Community/Technical Online College as approved by the Committee or through in-house training classes conducted at Pierce Transit under the maintenance training program.

Pierce Transit partners with local trade schools and educational institutions to promote careers in automotive technology and student applications to the apprenticeship program, as seen in

the Career Pathway Trainees Program. Specific to the apprenticeship program, Pierce Transit will give preference to internal over external applicants. By doing so, Pierce Transit is advancing the careers of current employees as the agency is contractually obligated to offer full-time employment into a Journey-Level Mechanic (JLM) position to all individuals who successfully complete their apprenticeship through the Apprenticeship Standards Revision.

To fill mechanic position vacancies, Pierce Transit will first evaluate whether any apprentices are nearing program completion, then post externally in partnership with local trade schools if the position cannot be backfilled internally. While a degree is preferred for JLM positions, it is not required provided the applicant has successfully completed his or her apprenticeship.

For Operators and all other positions requiring a commercial driver's license (CDL) (fleet maintenance positions), applicants are not required to have a CDL to be hired. However, prior to a final offer for any positions that require a CDL, candidates are required to obtain a Class B Commercial Learner's permit with Passenger endorsement. The hiring and training requirements and qualifications are shown below:

Required Qualifications:

- Must be at least 21 years of age at the time of hire.
- Must have been licensed for a minimum of five years to be considered.
  - Five years of continuous, recent driving history is required (i.e., no gaps in license status to include suspensions and withdrawals)
  - Must have an excellent driving record (no revocations or suspensions).
  - Applicants may apply with an out-of-state license but must possess a valid Washington State driver's license at the time of hire

Applicants that meet qualifications go through the following process:

- Interview
- Conditional offer
- Driving record review
- Criminal background check
- Reference checks
- Functional Assessment appointment to determine if they can perform the essential functions of the Operator position
- DOT Physical with a certified medical provider
- Pre-employment drug screening
- Verification of Class B CDL permit w/ passenger endorsement
- Final offer

Once hired, Operator trainees go through the six-week CDL training course and are tested onsite by third-party testers. If they complete the CDL training they then go into Mentorship training for a few weeks and then to route training. Once that is complete, they start their probationary period as an Operator.

Pierce Transit will continue to develop more creative recruitment strategies to combat the nationwide shortage of mechanics and bus operators. Properly marketing the Pierce Transit Zero Emission Fleet Transition, including the opportunity for a cutting-edge technical career, is critical to the attraction, development, and retention of the required workforce.

Funding Opportunities

The cost of workforce training will likely fluctuate in response to the adoption of ZEBs. Funding is anticipated to come from a number of sources, including procurement (where the cost of training is included in the budgeted cost of the vehicle or infrastructure procurement), existing funding sources used for training, and federal or local funding shares such as:

- FTA Low or No Emission Vehicle Program – 5339(c)
- FTA Bus and Bus Facilities Program – 5339(b)
- CMAQ Bipartisan Infrastructure Law Grant
- Washington State Bus and Bus Facilities Grant
- Washington State Green Transportation Capital Grant
- WSDOT Zero Emission Vehicle Infrastructure Partnerships (ZEVIPs) Grant

Historically, Pierce Transit allocated approximately $8,000 towards each bus purchased (80% Federal, 20% Local Match) to be utilized for training and specialized tooling and equipment needs. This allocation was sufficient to sustain and support tooling and critical training needs for maintenance staff. But since that funding has been removed, additional funding has been added to Pierce Transit's annual training budget.

While the cost of the training itself is one item to consider, the labor cost to train Bus Maintenance personnel is anticipated to be high. As highlighted by the International Transportation Learning Center, the following costs will be considered when budgeting for workforce training:

- Classroom training hours
- Instructor hours (instruction and prep)
- Instructor hourly wages and benefits
- Instructor costs per class
- Instructor cost per trainee
- OTJ training hours
- Mentor hours
- Mentor hourly cost
- Mentor cost per trainee
- Facilities cost
- Training materials/mock-ups/software/simulation cost

A sample curriculum of known training modules as detailed in **Table 19** will be used as a foundation for the larger training program. Bus Operations staff will be assigned to complete both Operations Support modules and Bus Operations modules; Bus Maintenance Support and Bus Maintenance staff will be required to complete all training modules. If the training module is marked with an "X", this means that the training is required for this fuel type. Shown at the bottom are the total estimated hours of training required for each fuel type.

Table 19: Sample ZEB Curriculum

Role Category	Training Module	Training Hours	Diesel	Battery Electric	Fuel Cell Electric
Operations Support	Vehicle Familiarization, Systems and Sub-Systems Overview	8	x	x	x
	Hydrogen Fuel Safety	8			x
	Advance Communication System	16	x	x	x
Bus Operations	Operator Orientation, including safety, charging procedures, onboard systems (includes behind the wheel training)	6.5		x	
Bus Maintenance	Shop Safety and Procedures	16	x	x	x
	Fundamentals of Troubleshooting	16	x	x	x
	Basic Repair Skills	16	x	x	x
	Heating, Ventilation, and Air Conditioning	16	x	x	x
	Air Brake Systems	24	x	x	x
	Hydraulic Brake Systems	8	x	x	x
	Steering and Suspension Systems	16	x	x	x
	Basic Electrical	24	x	x	x
	Multiplex Systems	24	x	x	x
	Low Voltage Systems Troubleshooting and Repair	16		x	x
	High Voltage Systems Troubleshooting and Repair	24		x	x
	Automatic Transmissions (phased out with 100% ZEB fleet)	24	x		
	Diesel Engine Tune-Up and Troubleshooting (phased out with 100% ZEB fleet)	24	x		
	Diesel Engine Electronic Control Systems (phased out with 100% ZEB fleet)	16	x		
	FCEB Propulsion Systems (Drive Motor and Gearbox)	24			x
	BEB Propulsion Systems (Drive Motor and Gearbox)	24		x	
	Total Hours of Training	**396**	**284**	**300**	**308**

Pierce Transit Career Pathway Trainees

The Pierce Transit Career Pathways program will design multiple pathways to employment in the transit industry including a pre-apprenticeship program (a first in Washington State) for young adults to earn a living wage without the time and expenses of a post-secondary education. This program provides options for underserved, minority, and first-generation college participants to train for and enter leadership and exempt positions in transit, and a direct pathway for women to employment as bus operators; a career that was historically dominated by men since the end of the second world war. These programs can only exist with discretionary grant funds and will strengthen connections between our organization and the communities we serve.

Pre-Apprenticeship Pilot

To better support those with systemic barriers to employment, Pierce Transit will seek grant funds to design the first Transit Pre-Apprenticeship Program in Washington. Partnering with the Labor and Industries, Washington State (L&I), local technical colleges, Consulting Experts, Staff, and workforce partners we will design a Transit Pre-Apprenticeship program to serve as a pathway to positions including facilities or vehicle custodians, service station attendants, and

maintenance mechanics. These entry-level positions provide a benefitted, labor-represented, living wage job to serve as a career step into other apprenticeship programs at Pierce Transit including Journey Level Mechanic and Communications Technicians (application in process with L&I).

Pierce Transit would complete an open competitive procurement process before entering contracts with supportive service partners. Pierce Transit has identified potential supportive services partners such as ANEW, and Palmer Scholars. Both organizations are non-profits and if selected will participate in recruitment efforts of minority, women, and underserved populations within Pierce and King counties. Future grant monies would be made available from Pierce Transit to partners. Services and supports would vary between partners but may include paid internships, emergency transportation funds, childcare stipends, relocation assistance, and emergency housing and utilities support. These funds would be disbursed by these agencies for Pierce Transit career pathway participants. Additional services provided by Palmer Scholars and ANEW include financial support for uniforms, union dues, Commercial Driver License (CDL) testing fees, one-on-one mentoring, relocation assistance and career readiness training. In addition, participants would receive a guaranteed interview for operator positions to anyone who meets minimum qualifications including hiring assessments.

ANEW was founded in 1980 by people dedicated to improving the access and advancement of women in non-traditional career pathways such as construction and manufacturing. This partnership will allow them to expand career pathways for transit to meet regional demands and provide a family wage for our community members.

Palmer Scholars offers the Palmer Pathways, serving young adults between 18 and 26 years old, who are neither enrolled in a postsecondary program nor gainfully employed and have an interest in pursuing a career in the trades. The Legacy Program serves young adults from the time they are juniors in high school through postsecondary program completion. Scholars may choose to attend any postsecondary program, whether that is an apprenticeship or two-year or four-year degree. Palmer Scholars would be eligible for paid internships/job shadowing for non-represented or hard to fill jobs at Pierce Transit. Additionally, Pierce Transit will host a 5-day career exploration week (summer session) for young adults (18-24 years of age).

These programs will:

- Serve as a career pathway for local underserved communities
- Support confirmed Workforce Innovation Opportunity Act (WIOA) recipients/partners
- Partner with Local Community Colleges
- Develop a new career pathway (transit pre-apprenticeship)
- Provide recruitment and career pathways into family-wage careers in areas of need for Pierce Transit (bus operations, maintenance-division)

Pierce Transit will use grant funds to develop and establish these programs. The necessary support positions to advance these pilot programs will be temporary/contract/grant limited:

- Two full time specialists focused on Workforce Development Apprenticeship and Internship Coordinating
- Contract – Labor and Industries developer
- Pierce Transit Workforce Development Manager overseeing and directing the development and operation of this program 10% time.

Pierce Transit Employee Retention Pilot

Operator Retention with Phased Route Training. Operator recruitment and retention continues to be a challenge for transit organizations across the country. Efforts to recruit additional operators are improving but the retention of new operators at the 6-month milestone is dropping. We seek to conduct pilot project to assess, improve, and expand the access to training and enhanced mentorships during an operator's first year. Three cohorts of participants (both trainer and new operators) will complete this pilot and results will be used for agency training recommendations for new operators.

Workforce Development Budget

Pierce Transit is anticipating additional costs in order to train existing operators and mechanics and to start the new Career Pathway Trainees Program. **Table 20** shows the estimated costs for ZEB workforce development activities outlined in the Career Pathway Trainees Program.

Table 20: Workforce Development Budget

Item	Description	Cost
Contracted Supportive Service Partner	Non-profit supporting women in nontraditional careers. 100 participants.	$125,000
Contracted Supportive Partner	Non-profit supporting underserved young adults. 10 paid internships.	$265,000
Conference of Minority Transportation Officials (COMTO)	Nine internships	$120,000
Technical College Lakewood Vicinity Program	Development and coordination of program	$100,000
Washington State Labor and Industries (LNI)	One developer	$40,000
Pierce Transit Positions	Two specialist positions 100% time over 4 years	$670,000
Workforce Development Manager	10% time over ten years	$180,000
Operator Training	Curriculum development for "Train the Trainer", instructional designers, and training for 550 operators	$275,000
Miscellaneous Workforce Development Support Budget	Costs projected over five years	$74,740
Human Resources	Outreach effort to under-represented populations	$50,000
Training Room Upgrades	To support full cohort of new operators (24 seats)	$195,000
Pilot Project	Operator retention with phased route training	$130,000
Additional Training Tools	Electrical and mechanical training software	$100,000

Zero Emissions Tooling and Equipment	For bus maintenance	$211,000
Knowledge Transfer Activities	Budget to present findings and share knowledge at conferences and other events	$32,000
Battery Electric Bus Retraining	Training for incumbent and new staff	$42,000
Total		**$2,610,240**

Stakeholder Engagement

Stakeholder engagement for this ZEB strategy focused on information sharing and gauging attitudes and awareness of ZEBs. Pierce Transit worked with a local community engagement organization to develop an engagement strategy for this plan. The team decided that the most effective outreach would include a virtual roundtable, community interviews, and social media polling. See **Appendix C: Stakeholder Engagement Supplemental Information** for additional information and documentation of outreach efforts.

Outreach Efforts:

1. A virtual roundtable on January 25, 2023, with local jurisdictions, agencies, and industry organizations to introduce Pierce Transit's zero emissions planning process and establish partnerships for future efforts.

2. Invitations for initial conversations with environmental justice focused organizations that serve Pierce County.

3. Social media polling on attitudes and awareness toward the zero-emissions fleet transition.

Key Takeaways:

- Partners are supportive of Pierce Transit's and are eager to get information.

- Partner emphasized that Pierce Transit's plan should prioritize safety, reliability, sustainability, and partnership.

- Community-focused organizations are overburdened at the time of the ask. While information sharing and attempts to establish a relationship are important, Pierce Transit should consider consulting these and other similar organizations with a less rigid timeline outside of legislative session, and perhaps with more specific asks.

- The social media polls revealed that Pierce Transit's audience is split on the value and need for a transition to a zero-emissions fleet. Pierce Transit could do more to talk through plans and phases of work with riders and the broader community.

Conclusion & Next Steps

This ZEB transition strategy is a roadmap for Pierce Transit to convert its existing bus fleet to 100 percent ZEBs by 2042. This study included route modeling of Pierce Transit's service, infrastructure and facility analysis, utility coordination and identification of hydrogen fuel providers, cost analysis, stakeholder outreach, and a phased fleet transition strategy. This ZEB Transition Strategy also meets the federal requirements to apply for FTA funding, including:

1. Policy & Legislative Impacts
2. Fleet Transition Plan
3. Facility & Infrastructure Plan
4. Utility & Fuel Partnerships
5. Funding Plan
6. Workforce Transition Plan

Pierce Transit will cease purchasing CNG and gasoline buses by 2027 and 100 percent of all future bus procurement will be zero emission. Pierce Transit will have 32 BEBs from by 2028 as part of the near-term transition plan. During this period, the market is expected to mature, technological advancements will occur, and Pierce Transit will continue to gain experience operating BEBs and learn how to scale their BEB fleet. By 2030, Pierce Transit would either continue purchasing BEBs or could look to incorporate FCEBs in addition to BEBs.

Grant funding will be essential in helping Pierce Transit meet the ambitious goal of reaching zero emission by 2042. Pierce Transit will utilize formula funding and apply for funding from any relevant competitive grant programs at the local, regional, state, and federal level including the WSDOT ZEVIP Program, the WSDOT Green Transportation Capital Grant Program, the FTA Low or No Emission Vehicle Grant Program, and the FTA Bus and Bus Facilities Grant Program.

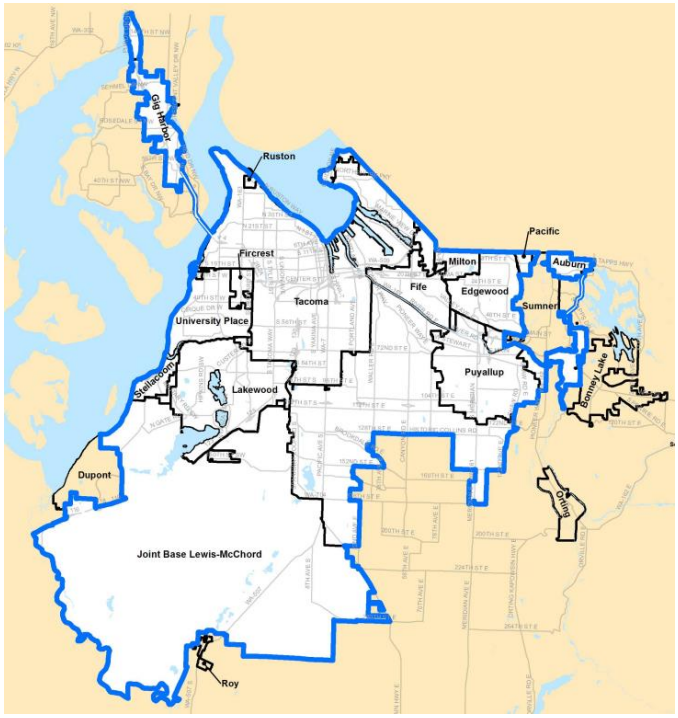
Sustainability is at the core of what Pierce Transit does as a public transportation provider. This Zero Emission Bus Transition Strategy will help Pierce Transit continue its commitment to sustainability by reducing emissions to improve air quality in the community and to protect the environment.

Appendix A: Route Modeling Technical Memorandum

Introduction

Transitioning to a zero-emissions fleet involves more than simply buying a vehicle and fueling system. The transition introduces new technology and requirements into day-to-day operations. Successful fleet transition plans take a holistic approach to consider operational requirements, market conditions, available power, infrastructure demands, and costs. The in-depth route modeling summarized below provides Pierce Transit with data to guide important decisions involving capital programs and operations necessary to transition the bus fleet to zero-emission vehicles.

Figure 38: Pierce Transit Service Area



Existing Conditions

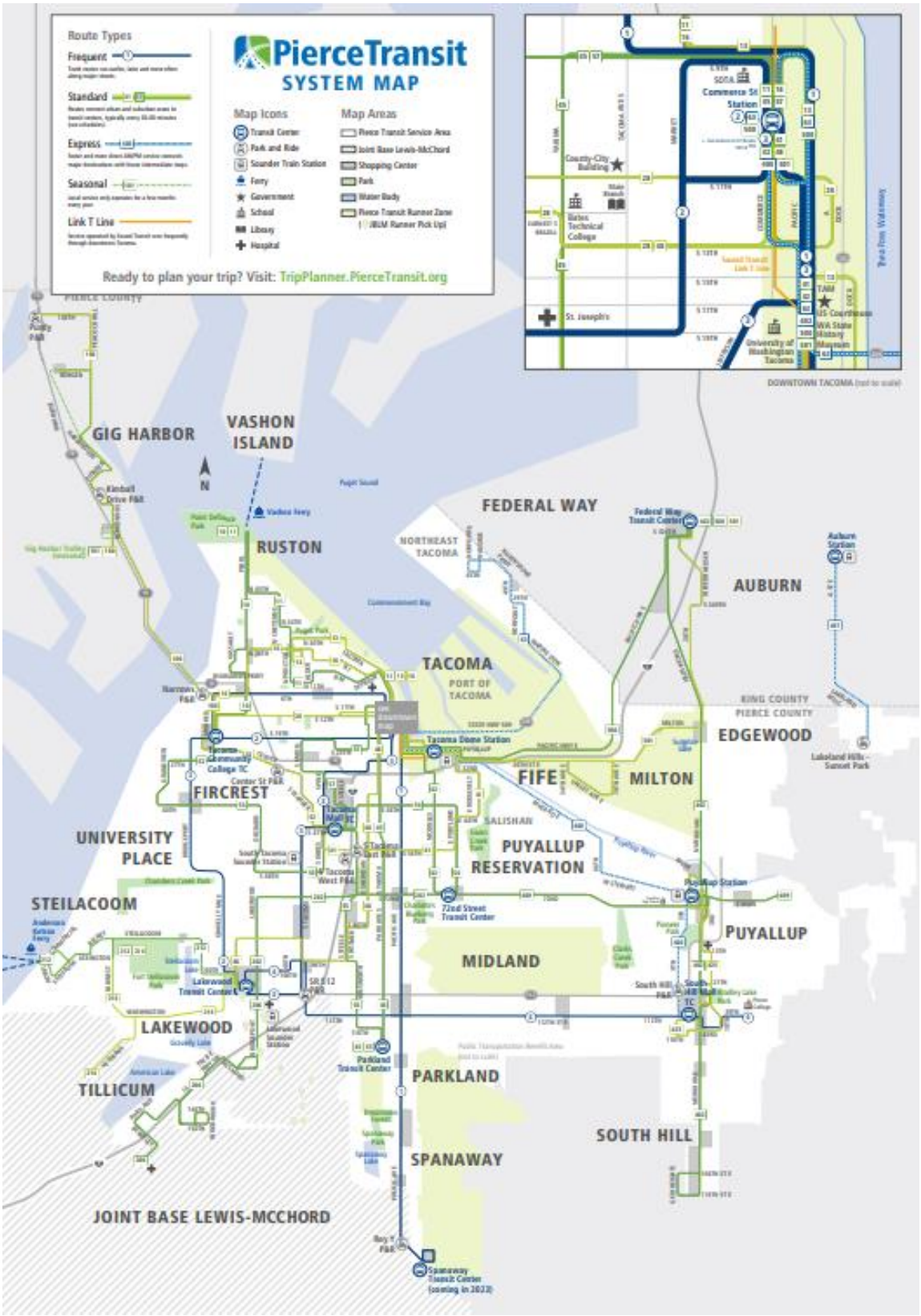
Serving Washington's second largest county, Pierce Transit provides three types of service—Fixed Route, SHUTTLE paratransit, and Vanpools—that help passengers meet their daily travel needs. Pierce Transit's service area covers 292 square miles of Pierce County with roughly 70 percent of the county population **Figure 39**).

Pierce Transit has been operating alternative fuel vehicles since the 1980s – the agency has operated CNG buses for decades, introduced their first three battery electric buses (BEBs) in 2018, then added six more BEBs in 2021. Pierce Transit's fleet currently consists of 118 CNG buses, 23 diesel buses, 9 gasoline buses, and 9 battery electric buses. All CNG, diesel, and electric buses are 40-foot and all gasoline buses are 25-foot cutaways. **Table 21** depicts the buses owned by Pierce Transit. The agency operates 31 fixed bus routes and is planning a 14.4-mile BRT route which would enhance Pierce Transit's highest ridership route – Route 1. **Figure 40** shows Pierce Transit's System.

Table 21: Pierce Transit Fixed Route Vehicles

Fleet Type	Fuel Type	# of Vehicles	Vehicle Make
40′ Transit Bus	CNG	21	New Flyer
		97	Gillig
	Diesel	23	Gillig
	Electric	3	Proterra
		6	Gillig
25′ Cutaway	Gasoline	9	Ford

Figure 39: Pierce Transit System Map



Fleet Data Evaluation

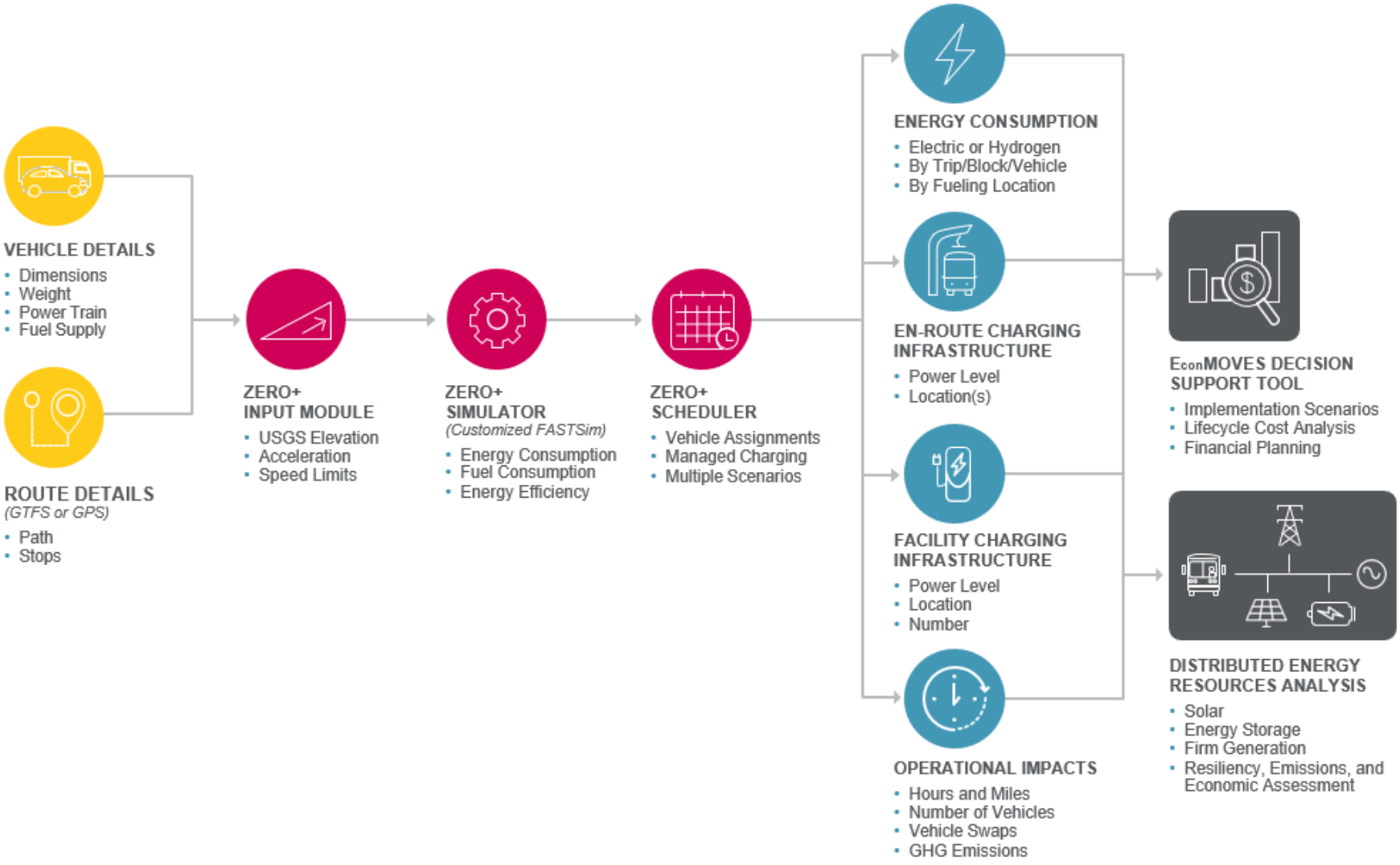
The first step in exploring zero-emission vehicles is to use existing conditions to evaluate the current routes and fleet vehicles used to provide service. The evaluation began by collecting and reviewing all available background documents and data relevant to the study. All data collected and reviewed feeds into the modeling effort and analysis that follows. Key data inputs included:

- Operator blocks for weekdays and weekends
- Block- and bus-type assignments
- General Transit Feed Specifications (GTFS) data from pre-COVID service for transit blocks on weekdays and weekends
- Ridership data by route or block for typical weekdays and weekends
- Transit Service Plan and Transit Development Plan (TDP)
- Background policy documents
- Operations information including revenue and deadhead hours and miles
- Fleet Replacement Plan
- Drawings and as-built electronic drawings of the Pierce Transit operations and maintenance facility
- Maintenance costs required to develop the financial model baseline
- Scheduled maintenance and overhaul plan
- Financial plan

Energy Consumption & Route Modeling Analysis

Understanding energy consumption is a key component of fleet transition planning, as it informs the choice of vehicle technology, infrastructure requirements, finances, and fleet replacement strategies. The energy consumption model, Zero+, provides a comprehensive understanding of the potential impacts zero emission bus (ZEB) technology may have on Pierce Transit's existing service. **Figure 41** shows the Zero+ Model inputs, outputs, and process. Energy consumption is impacted by several factors including slope and grade of the bus routes, number of vehicle stops, anticipated roadway traffic, and ambient temperature. The Zero+ model also analyzes variables known to impact lifetime vehicle performance, like energy density; battery degradation; operating environment; heating, air conditioning, and auxiliary power loads; as well as the lifecycle of bus batteries and hydrogen fuel cells. The model is fed by GTFS data, GIS data, and vehicle profile assumptions to create an accurate energy consumption profile unique to Pierce Transit's existing service. In sum, Zero+ results include many data variables, yielding the most accurate results possible to influence strong, effective decision making.

Figure 40: Zero+ Model Inputs, Outputs, and Process



The Zero+ model results, combined with discussions with Pierce Transit staff, provide the basis upon which the preferred ZEB technology (battery electric and/or hydrogen) for fleet conversion and the preferred refueling strategy will be determined. For a BEB scenario, this basis examines whether the optimal charging strategy is depot charging only, a mix of depot and on-route charging, or on-route charging only, and identifies potential strategies that best complement Pierce Transit's service and fleet plans. Simulations were performed at the granular level, so that the strategy can inform individual vehicles, routes, and blocks as well as the full Pierce Transit fleet. Examining each vehicle individually drives decisions for the right technology at the system, depot, route, and block levels. This analysis balances impacts to operations, overall fleet size, and infrastructure requirements. This ultimately provides Pierce Transit with the information to make a data-driven determination of the preferred ZEB transitional technologies and deployment pace.

By using this data and applying existing Pierce Transit service information, the Zero+ tool produced a heat map showing the vehicle state of charge (SOC) throughout the day on any given route block. This report details which blocks and routes could perform within currently available ZEB vehicle range capabilities, as well as forecasts at what point in each route ZEB range is exceeded. This insight provides clear data for planning operational adjustments and fleet demands to maintain service levels and maximize ZEB utilization while highlighting changes that may affect riders and recommending tactics to avoid or mitigate these impacts.

Scenarios Modeled

Based on the evaluation and collection of data described above, a baseline scenario is simulated of current Pierce Transit service to validate both the data provided and the functionality of the model by comparing simulation results to observed Pierce Transit existing operations. This validation provides confidence that the simulations of ZEB scenarios are not missing critical data points that influence the transition. ZEB scenarios simulated include three alternatives: BEBs with depot charging only, BEBs with depot and on-route charging combined, and fuel cell electric buses (FCEBs) with depot refueling only. Though Pierce Transit could implement a mixed fleet of both BEBs and FCEBs, each ZEB technology is kept separate during the initial modeling scenarios, so that the best applications of each technology can be understood within a single simulation.

Battery Electric Bus Depot Charging Simulation

Depot charging only was modeled first to establish a baseline feasibility. This scenario allows the Zero+ Model to identify which existing service blocks can be electrified without an increase in peak vehicle requirements, the need for on-route charging, or the need for schedule modifications to achieve the same level of service. By electing a depot-only charging profile, the model calculates what staff, vehicle, and service modifications would be needed to maintain the current level of service.

Simulation Assumptions

To develop a model relevant for Pierce Transit's fleet and operations, a set of assumptions and variables were identified (**Table 22)**. While these attributes are typical of most vehicle original equipment manufacturers (OEMs), not every vehicle would meet this specification. When Pierce Transit procures vehicles for this transition, it is crucial to ensure that vehicle procurements meet or exceed this minimum specification to deploy BEBs that can match the operations simulated in this profile.

Table 22. BEB Depot-Charging Simulation Assumptions

Variable	Input
Battery Capacity 40-ft Buses	466 kWh
Battery Capacity 60-ft Buses	525 kWh
End-of-Life Battery State of Health	80% (Max Battery Degradation)
Energy Reserve	20% State of Charge (SOC)
Heating	Electric Heater
Ambient Temperature	Coldest Day (10th Percentile)
Passenger Capacity	Maximum Seated Capacity
Depot Charger Power	150 kW (95% Efficiency)

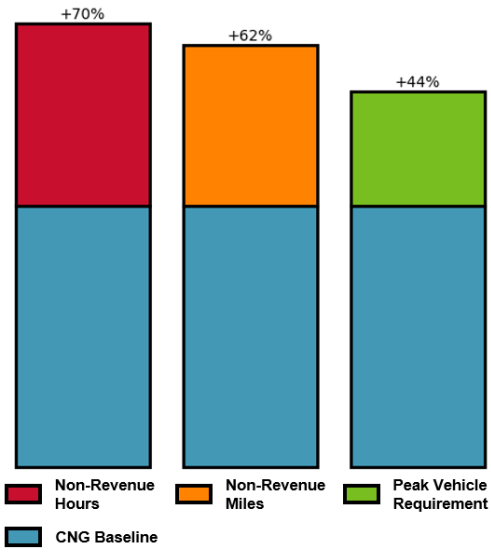
Model Results

Key Takeaways (**Figure 42**):

- Revenue Hours and Miles remain the same
- Non-Revenue Hours: **70% increase**
- Non-Revenue Miles: **62% increase**
- Peak vehicle requirement: **44% increase**
  - Increase fleet from 128 to 184 buses
  - 56 more vehicles required
- At least 44 Depot Chargers will be required

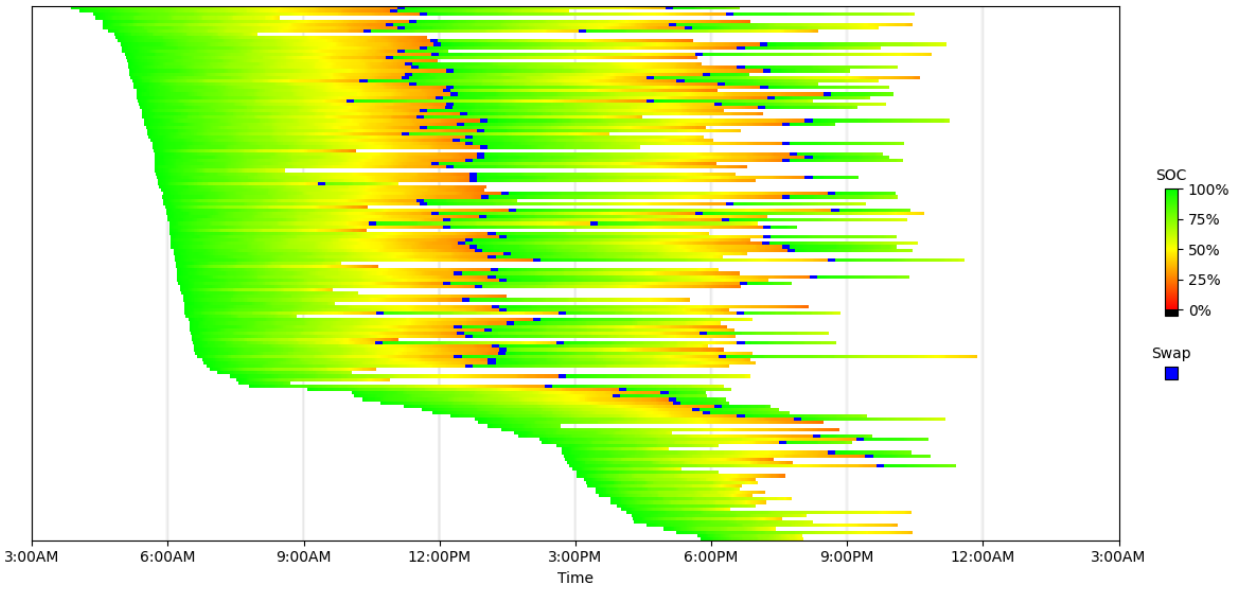
Figure 43 shows the vehicle battery SOC plot for each block during for weekday service. Weekend service was also modeled, but fleet and charging requirements are driven by weekday service which illustrates the most demanding operations for Pierce Transit. Each block is represented by a line on the chart with the color of the line corresponding to the SOC of the vehicle. The

Figure 41: BEB Depot-Only Model Outputs



color changes from green to yellow to red as the SOC drops from 100 to 0 percent. Bus swaps (shown in blue) are introduced only between trips to minimize service impacts.

Figure 42: BEB Depot-Only Block State of Charge (Weekdays)

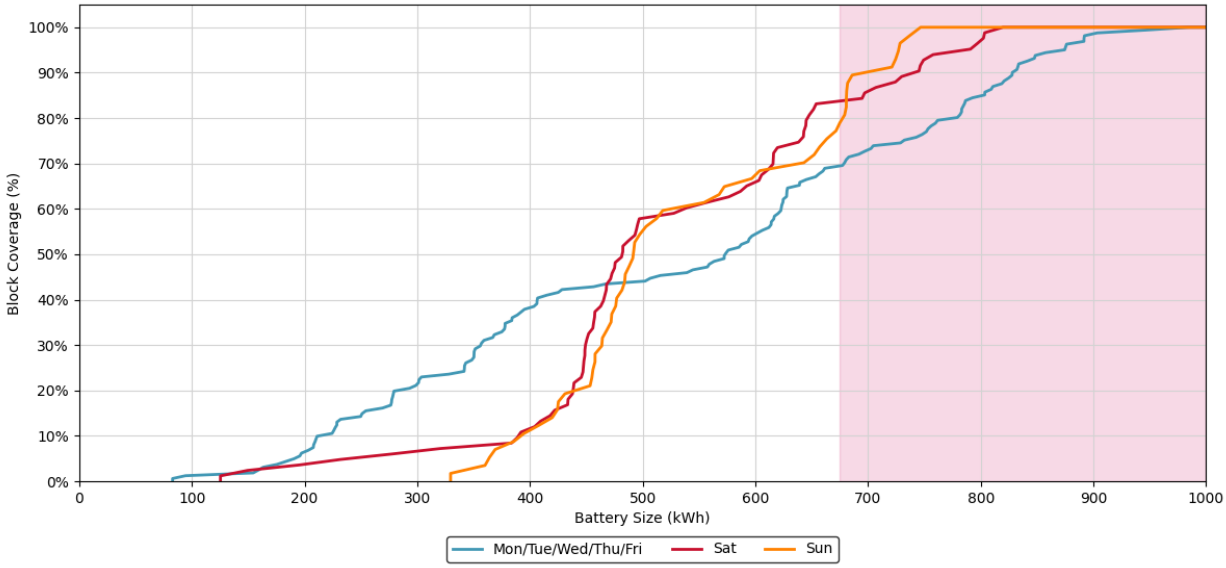


Bus swaps are also inserted in locations to guarantee the minimum SOC does not dip below the required 20 percent reserve capacity, including the energy needed to return the vehicle to the depot when a swap is needed. Whenever a vehicle is swapped out, it is replaced with a BEB that has a fully charged battery. Swapping buses is only helpful when the bus either stays near the depot all day or returns within a close distance to the depot at multiple points throughout the day. If a block is scheduled to travel a long distance one way away from the depot, then there is no opportunity for a swap. Pierce Transit could deploy 29 BEBs before fleet increases will be required.

Vehicle Battery Sizes

With technological advances expected in the coming years, it may be possible to improve the feasibility of a BEB Depot Charging Scenario by purchasing buses with larger battery sizes. **Figure 44** illustrates that Pierce Transit would be able to operate more blocks with a 466 kWh battery compared to a 525 kWh battery, and the greatest impacts would be seen during Saturday and Sunday service. Also, it is important to note that vehicles with larger batteries have higher capital costs and higher weights.

Figure 43: BEB Depot Charging Block Coverage vs. Battery Size



Battery Electric Bus Depot + On-Route Charging

On-route charging is an enhancement that can greatly improve the feasibility of BEBs in many situations. This is particularly helpful with circulatory routes where the same on-route charger can be used by a vehicle multiple times throughout the day. On-route charging infrastructure is ideally located at places such as transit centers where buses operating on multiple routes all have scheduled layover time. On-route charging is capable of greatly extending the range of a BEB and facilitating one-to-one replacement of diesel vehicles when the routes are conducive to this charging strategy.

Simulation Assumptions

The simulation assumptions for the BEB Depot + On-Route Charging Scenario, as shown in **Table 23**, are similar to the assumptions for the BEB Depot Charging Scenario. The only difference is the assumption for on-route charger power and charging efficiency. Although there are on-route chargers on the market that offer more power (450 kW), there are currently no vehicles on the market that can accept this level of power. When Pierce Transit procures vehicles for this transition, it is crucial to ensure that vehicle procurements meet or exceed this minimum specification to deploy BEBs that can match the operations simulated in this profile.

Table 23. BEB Depot + On-Route Charging Simulation Assumptions

Variable	Input
Battery Capacity 40-ft Buses	466 kWh
Battery Capacity 60-ft Buses	525 kWh
End-of-Life Battery State of Health	80% (Max Battery Degradation)
Energy Reserve	20% State of Charge (SOC)
Heating	Electric Heater
Ambient Temperature	Coldest Day (10th Percentile)
Passenger Capacity	Maximum Seated Capacity
Depot Charger Power	150 kW (95% Efficiency)
On-Route Charger Power	300 kW (95% Efficiency)

On-Route Charger Locations

Layover times in the existing schedule were used to identify the most ideal locations for on-route chargers. There were 12 transit center layovers, eight of which had good layover time and five of which were identified as good candidates for on-route charging. Most of these locations could make good use of a single charger, while some locations may require more chargers. The usefulness of an additional charger is dependent on how layover times overlap between vehicles.

Commerce Street Station

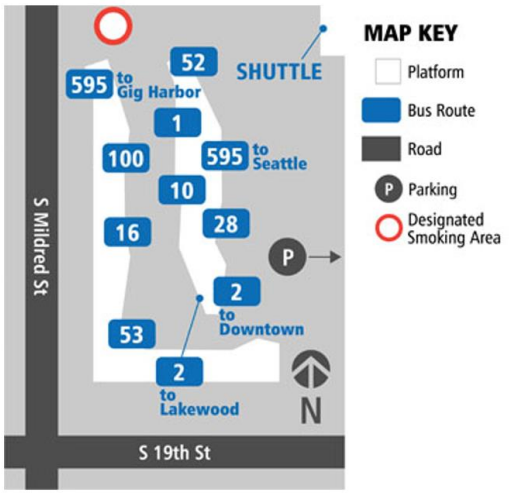
The Commerce Street Station is located at 1119 Commerce Street, Tacoma, Washington. Routes 2, 3, 11, 16, 41, 42, 45, 48, 57, 63, 102, 400, 500, 501, 590, and 594 serve this transit center. Commerce Street Station has about 229 hours of layover time on an average weekday.

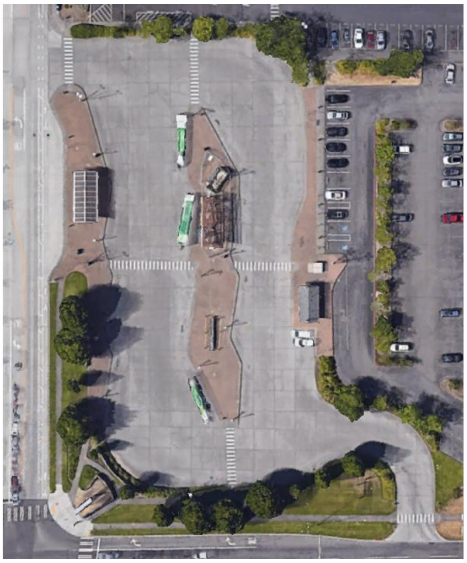
Lakewood Transit Center

The Lakewood Transit Center is located at 5719 Lakewood Towne Center Boulevard SW, Lakewood, Washington. Routes 2, 3, 4, 48, 202, 206, 212, 214, and JBLM Runner serve this transit center. Lakewood has about 196 hours of layover time on an average weekday.

Tacoma Community College Transit Center

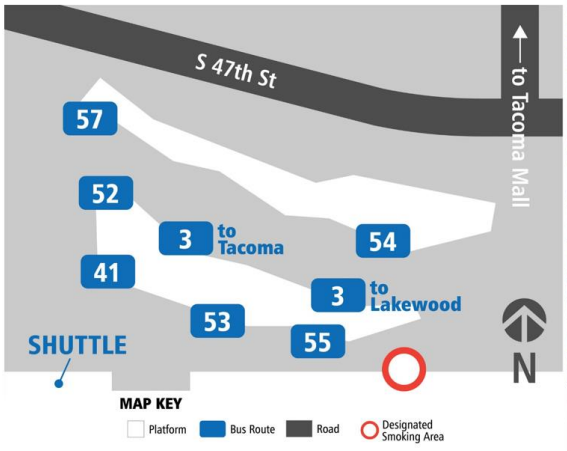
The Tacoma Community College Transit Center is located at 6615 S 19th Street, Tacoma, Washington. Routes 1, 2, 10, 16, 28, 52, 53, and 100 serve this transit center. The Tacoma Community College has about 172 hours of layover time on an average weekday.

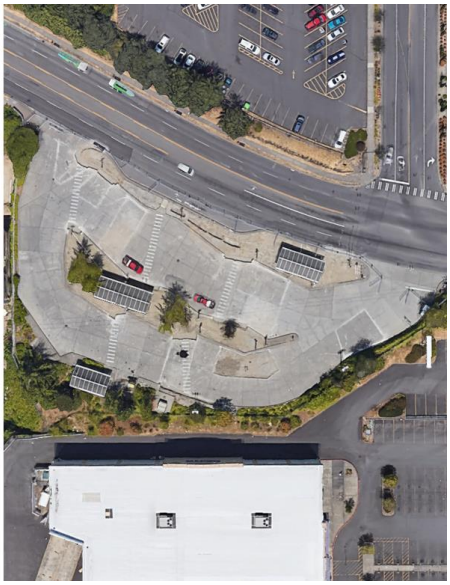




Tacoma Mall Transit Center

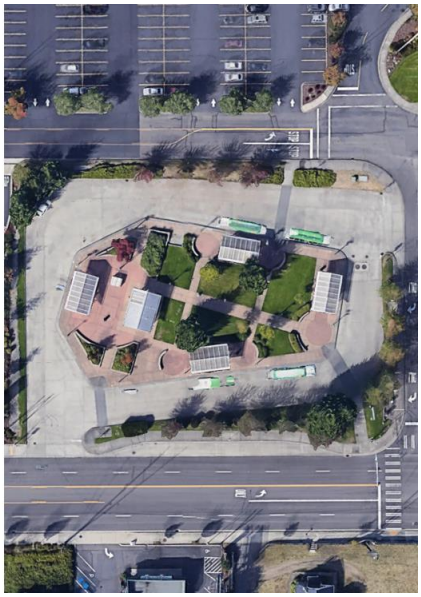
The Tacoma Mall Transit Center is located at 222 S 47th Street, Tacoma, Washington. Routes 3, 41, 52, 53, 54, 55, and 57 serve this transit center. The Tacoma Mall has about 108 hours of layover time on an average weekday.





South Hill Mall Transit Center

The South Hill Mall Transit Center is located at 503 39th Avenue SW, Puyallup, Washington. Routes 4, 400, 402, and 425 serve this transit center. The Tacoma Mall has about 65 hours of layover time on an average weekday.

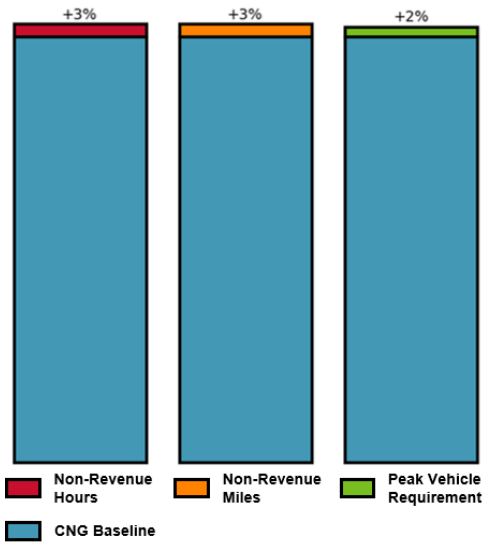


Model Results

Key Takeaways (**Figure 45**):

- Revenue Hours and Miles remain the same
- Non-Revenue Hours: **3% increase**
- Non-Revenue Miles: **3% increase**
- Peak Vehicle Requirement: **2% increase**
  - Increase Fleet from 128 to 131 buses
  - 3 more vehicles required
- At least **11 depot chargers** will be required
- Up to **18 on-route chargers** could be required

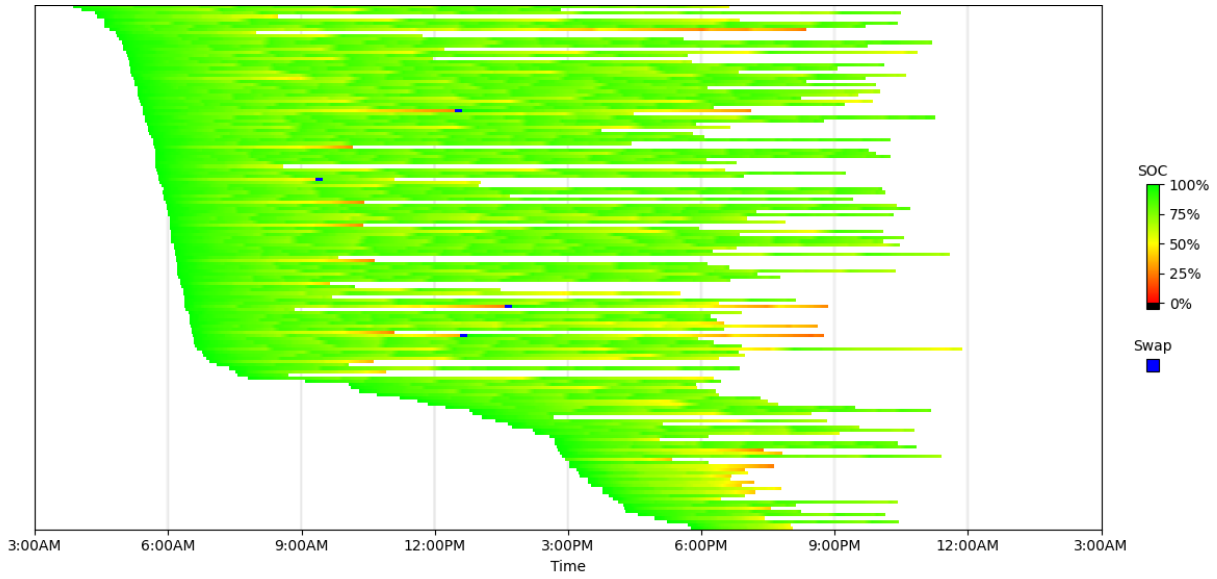
Figure 44: BEB Depot + On-Route Model Outputs



The vehicle battery SOC plot shown in **Figure 46** illustrates the SOC for each block during weekday service for the BEB Depot + On-Route Charging Scenario. Weekend service was also modeled, but fleet and charging requirements are driven by weekday service which illustrates the most demanding operations for Pierce Transit. Bus swaps

are also inserted in locations to guarantee the minimum SOC does not dip below the required 20 percent reserve capacity, including the energy needed to return the vehicle to the depot when a swap is needed. By introducing on-route charging, the number of bus swaps required dropped significantly. For this scenario, 161 blocks can be operated without bus swaps while only 4 blocks require one or more swaps.

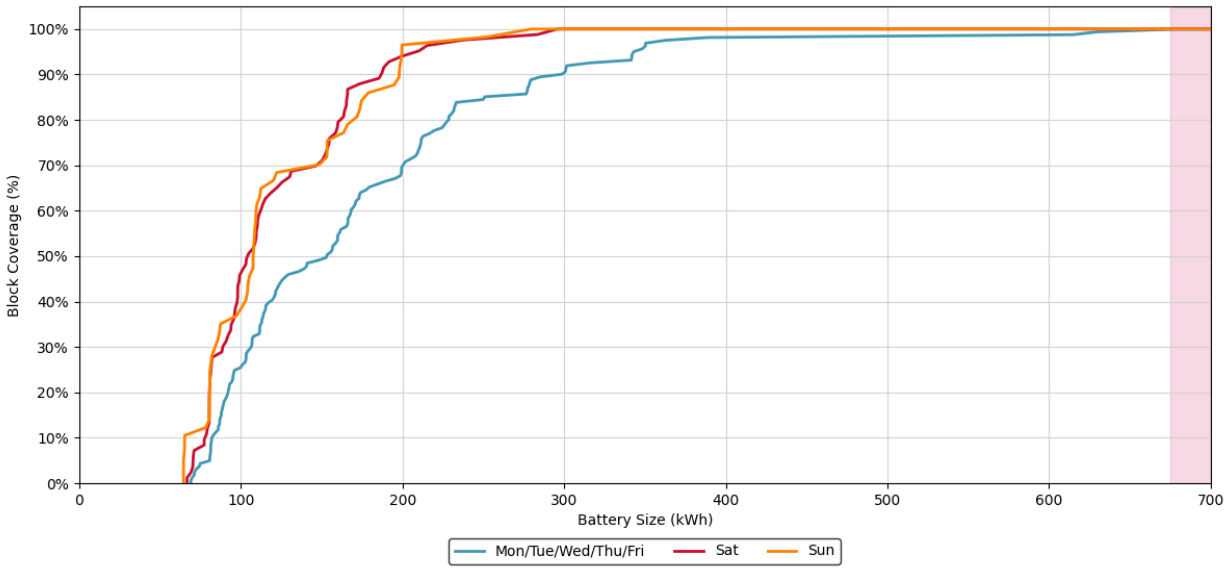
Figure 45: BEB Depot + On-Route Charging Block State of Charge (Weekdays)



Vehicle Battery Sizes

Increasing the vehicle battery size is less beneficial for the BEB Depot + On-Route Charging Scenario compared to the BEB Depot Charing Scenario. **Figure 47** illustrates minor block feasibility increases with increased battery size and shows there is almost no gain in block feasibility when comparing a 466 kWh battery with longer battery sizes.

Figure 46: BEB Depot + On-Route Charging Block Coverage vs. Battery Size



Hydrogen Fuel Cell Bus Simulation

As transit agencies look for a zero-emission technology to replace diesel buses, there are two primary options, BEBs and FCEBs. Currently, BEBs are the most popular replacement choice because they use the electrical grid as their fuel source, which is universally available and relatively easy to connect into to get the required power. However, the vehicles have a limited range compared to diesel, which means they are not capable of directly replacing buses with long duty cycles or blocks. In some cases, it is not possible to re-cut the routes into pieces that are within the capability of a BEB, so an alternative zero-emission technology is needed.

Hydrogen FCEBs are the other primary option as a propulsion type for a zero-emission transition. While hydrogen is not as readily available as electricity, FCEBs do not have the same range limitations as BEBs. FCEBs use a drivetrain similar to that of a BEB. However, they have a small battery on-board instead of a large battery. The small battery is recharged by an on-board fuel cell that generates electricity from hydrogen as the vehicle travels. The energy density of hydrogen is much higher than a battery, which allows for the range of these vehicles to closely match a conventional diesel bus.

Simulation Assumptions

To develop an FCEB model relevant for Pierce Transit's fleet and operations, a set of assumptions and variables were identified (**Table 24)**. While these attributes are typical of most vehicle OEMs, not every vehicle will meet this specification. When Pierce Transit procures vehicles for this transition, it is crucial to ensure that vehicle procurements meet or exceed this minimum specification to deploy FCEBs that can match the operations simulated in this profile.

Table 24: FCEB Simulation Assumptions

Variable	Input
Service Data	2020 (Pre-COVID)
Fuel Capacity	37.5 kg
Energy Density	33.6 kWh per kg of Hydrogen
Energy Reserve	5% or less remaining fuel
Heating	Electric Heater
Ambient Temperature	Coldest Day (10th Percentile)
Passenger Capacity	Maximum Seated Capacity

Model Results

Key Takeaways:

- Revenue Hours and Miles: **0% increase**
- Non-Revenue Hours and Miles: **0% increase**
- Non-Revenue Miles: **0% increase**
- Peak Vehicle Requirement: **0% increase**

All 161 existing service blocks are capable of being operated by FCEBs without an increase in peak vehicle requirements, revenue hours and miles, or non-revenue hours and miles. In addition, there would be no need for mid-block refueling or schedule modifications to achieve the same level of service as a diesel operated service. An exact 1-to-1 replacement of diesel buses is possible because FCEBs typically have an operational range comparable to diesel buses and only require 7 to 10 minutes on average to refuel. There would be a large infrastructure cost in preparing to deploy FCEBs, but little operational impact to refueling, unlike the complex operations required to manage BEB charging.

Conclusion

The project team modeled three scenarios: BEB depot-only charging, BEB on-route & depot charging, and Hydrogen FCEB only. If Pierce Transit were to shift toward a fully zero-emission fleet today, both BEB on-route & depot charging and Hydrogen FCEB scenarios proved to be operationally viable options that did not require drastically increasing fleet size or changing operating conditions.

There are many other factors that contribute to the feasibility of transitioning a fleet to zero-emission vehicles, so energy feasibility alone cannot be the basis in which an agency decides to transition to zero-emission vehicles. Additionally, this modeling looked at a hypothetical scenario where ZEBs would operate Pierce Transit's bus service today. In reality, transit routes

change to meet the needs of the community, a fleet would transition over time, and ZEBs are projected to be more efficient in the future.

This modeling should serve as an example of what is possible, and Pierce Transit can use this information in conjunction with other information from this project to determine ZEB transition strategy.

Appendix B: Financial Assumptions

The following assumptions were made when creating capital cost estimates. **Table 25** shows the estimated vehicle costs, **Table 26** shows the estimated ZEB infrastructure costs, and **Table 27** shows the estimated inflation costs and projections on when battery electric buses will be the same cost as an ICE bus. **Table 28** depicts the assumed growth rates and compound annual growth rates from 2023–2042.

Table 25: Estimated Vehicle Costs (2023)

Vehicle Type	Cost Estimate
40 ft CNG	$700,000
40 ft BEB	$1,200,000
40 ft FCEB	$1,300,000
60 ft CNG	$1,000,000
60 ft BEB	$1,330,000
60 ft FCEB	$1,500,000
25 ft Gasoline	$250,000
25 ft BEB	$500,000
25 ft FCEB	$700,000

Table 26: Estimated Infrastructure Costs (2023)

Infrastructure Type	Cost Estimate
150 kW Charger	$120,000
150 kW Charger Installation	$150,000
450 kW Charger	$450,000
450 kW Charger Installation	$450,000
Hydrogen Infrastructure (50 Buses)	$8,000,000

Table 27: Estimated Inflation Costs

Inflation	Estimate
Base Inflation (historical CPI)	3%
Current Economic Impact	4%
Annual Inflation Rate	7%
EV Vehicle Cost Decrease End Year	2029

Table 28: Assumed Growth Rates of Electric Vehicles from 2023–2042

Year	Annual Growth Rates	Compound Annual Growth Rate
2023	1	1
2024	7%	1.07
2025	7%	1.1449
2026	7%	1.225043
2027	7%	1.31079601
2028	7%	1.402551731
2029	7%	1.500730352
2030	3%	1.545752262
2031	3%	1.59212483
2032	3%	1.639888575
2033	3%	1.689085232
2034	3%	1.739757789
2035	3%	1.791950523
2036	3%	1.845709039
2037	3%	1.90108031
2038	3%	1.958112719
2039	3%	2.016856101
2040	3%	2.077361784
2041	3%	2.139682637
2042	3%	2.203873116

Appendix C: Stakeholder Engagement Supplemental Information

Pierce Transit Zero Emission Bus Roundtable Summary

Meeting purpose

Pierce Transit began the transition to a zero emission bus (ZEB) fleet with a grant award from the Federal Transit Administration (FTA) Low or No Emission Vehicle Grant Program in 2018. Currently, Pierce Transit has nine battery electric buses in operation. In order to successfully transition the rest of the fleet, Pierce Transit is in the process of developing a ZEB Transition Plan.

On Wednesday, January 15, 2023, from 2:30 to 4 p.m., Pierce Transit hosted a roundtable discussion with regional partners on the topic to:

- share information about the transition
- gather priorities and concerns, and
- explore opportunities for future partnerships

Attendees:
Jeffrey Arbuckle, King County Metro
Robert Barandon, Puyallup Tribe of Indians
Becca Book, Pierce County
Jamie Brinkley, Sound Transit
Emily Geralds, WSDOT
Kevin Kibet, King County Metro
Kurtis Kingsolver, City of Tacoma
Doug Lowman, King County Metro
Kristin Lynett, City of Tacoma
Ryan Medlen, Pierce County
Jeremy Metzler, City of Edgewood
Roxanne Miles, Pierce County
Tracy Oster, Downtown On the Go!
Wesley Rhodes, Pierce County
Angie Silva, Pierce County
Jen Tetatzin, Pierce County
Kourosh Vahdani, King County Metro
Kendall Wals, City of Puyallup
Kyla Wilson, Pierce County
LaTasha Wortham, Tacoma Public Utilities

Study team attendees
Katy Asher, PRR
Carly Macias, HDR
Mackenzie McGuffie, HDR
Jennifer Rash, PRR
Kelsey Rudd, HDR

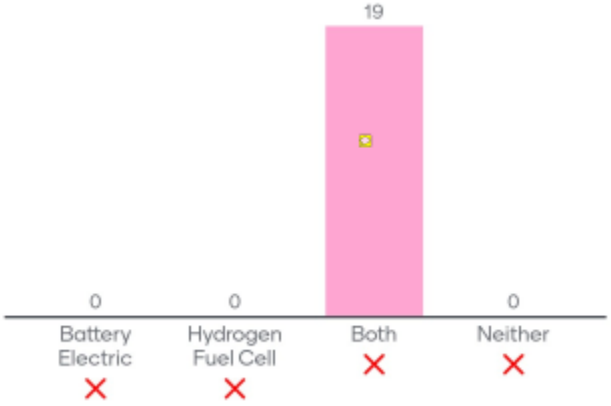
Pierce Transit attendees
Adam Davis
Mark Eldridge
Penny Grellier
Nathan Groh
Marah Harris
Tina Lee
Grantley Martelly
Alexandra Mather
Christopher Schuler

Welcome and Introductions

Tina Lee, Pierce Transit, welcomed attendees, asked them to add their name and organization in the chat, and reviewed the agenda. After a Mentimeter trivia icebreaker (results on pg. 2), Tina provided an overview of the purpose and goals of Pierce Transit's ZEB Study. A PDF of the presentation will be shared with the group.

Mentimeter Question 1: When did Pierce Transit transition from diesel buses? The correct answer is the 1980s, which most participants missed.

Mentimeter Question 2: Pierce Transit is considering what type of zero-emissions buses? The correct answer is both, which all participants selected.



Zero Emission Bus Technology Overview

Carly Macias, study team, provided an overview of the basics of ZEB Technology, reviewing the ZEB vehicle types, batter capacity, types of BEB Charging, Hydrogen Fuel Cell Bus (FCEB) basics, and potential hydrogen fuel sources.

Roundtable attendee comments and questions:

- What's the size difference between Pierce Transit's current fleet and proposed ZEB fleet?

- Goal is to have the buses be as similar in size as possible to current buses.
- Length and width of buses are intended to stay the same, but weight of vehicles will likely increase.
- Batteries will create more weight on the vehicle.

- How does inductive charging equipment hold up in rainy climates?
  - The chargers are built to withstand ice, snow, rain, and debris being on inductive chargers.
  - Chargers are installed to have proper drainage.
  - Jeff Arbuckle mentioned that Wenatchee has one.

Mentimeter Question 3: In your opinion, what is the top priority for Pierce Transit's ZEB transition? The words that appear largest are those with the most entries, including safety, funding, realiability, sustainabiliy, and partnership.

Pierce Transit ZEB activities and initiatives

Nathan Groh and Adam Davis, Pierce Transit, provided an overview of Pierce County's most recent ZEB activities and initiatives including a review of their current fleet, recent bus grants and purchases, and facility improvements. Chris Schuler, Pierce Transit, presented on Pierce County's Major Project Capital Expenditures.

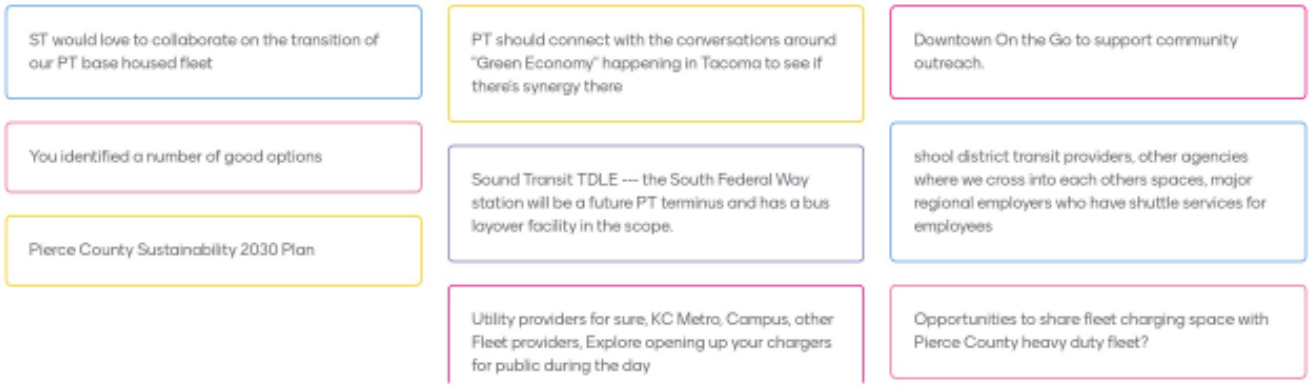
Zero Emission Bus Transition Planning

Carly reviewed some of the planning efforts performed so far for the study. The consultant team and Pierce transit are modeling and simulating various inputs and outputs to better understand infrastructure that is needed and operational impacts they might see. She gave a preview of models and key takeaways of depot charging only and depot plus on-route charging and hydrogen fuel cell buses, and a summary of route modeling results.

Roundtable attendee comments and questions:

- Can sales tax revenue be used for both capital and operating expenses? What is a likely or possible timeline for a vote to increase the sales tax?
  - Pierce Transit's board would have to provide direction on this, and the soonest anything would happen would be 2023-24.
- Ryan Medlen, Pierce County, suggested reaching out to Sound Transit to see if they would consider constructing (or providing space for future) charging facilities at the future TDLE stations, as some will have layover spaces. Jamie Brinkely, Sound Transit, offered to help connect Pierce Transit staff to the TDLE team.
- What is the charge rate for both Depot and On-Route?
  - This study looked at 300 kilowatts, but they can differ.
- How would on-route charging work? Is it a high-speed charge "top off" while the vehicle is in service?
  - Buses would layover at transit centers like they already do but be charged during layover.
  - The buses would regain some energy each time they layover.
    - Some buses on shorter routes would never fully deplete.
    - Other buses on more demanding routes deplete slowly until they can get to depot chargers at the end of the day.
- What is the impact to service by the need to charge throughout the day?
  - Ideally there would be little to no impact.
  - Conditions were modeled with existing schedules and layover times.
  - There is opportunity to make changes to schedules to make on-route charging more effective.
  - If depot-only were selected, there need to be extra planning and possible service impacts to swap buses midday.
- Would the board consider taking on debt if additional revenue is not available?
  - No.

Mentimeter Question 4: Do you have recommendations for partnerships and/or opportunities Pierce Transit should consider for the ZEB transition?



Roundtable attendee comments and questions:

- Jeff Arbuckle, King County Metro, hopes that Pierce Transit opts for pantograph chargers so that the two agencies can share infrastructure.
- If buses with a higher kilowatt charge were implemented, would it reduce the need for charging infrastructure?
    - A faster charge could slightly reduce the need, but it doesn't make a big enough difference to implement. However, this is something that would have to be reevaluated as technology advances.
- An attendee from Pierce Transit asked if HDR been instructed to plan for the first goal of 20 percent electrification; however, the virtual meeting ended as the question posted to chat.
    - Tina and team will follow up with him.

Conclusion and next steps

Tina shared next steps for Pierce Transit during their transition and thanked everyone for attending.

- Tina will send participants a copy of the presentation and Mentimeter results.
- Tina shared Pierce Transit's Zero Emissions Fleet Coordinator Nathan Groh's contact information and encouraged people to contact him for more information: ngroh@piercetransit.org
- Participants are encouraged to share any reports, plans, or studies that might help Pierce Transit with their ZEB transition.

Stakeholder Interviews

In the early stages of developing its ZEB plans, Pierce Transit sought to form relationships with environmental justice-focused and community-based organizations that serve Pierce County. A 30-minute virtual interview or phone call was offered to a select group of organizations, chosen based on

- Previous/current engagement with zero emissions policies
- Proximity to, and organizational interests in the service area
- Ability to represent public interests and provide input

Outreach to schedule these conversations took place from February 23 to March 10, 2023. It's important to note that the Washington State Legislative session was ongoing at this time, as well as several large transportation studies in Pierce County. One organization, Washington Physicians for Social Responsibility, emailed the following message: *At this time, WPSR is swamped with a few projects during this legislative session, and I cannot commit to taking on another project at this time. We won't be able to join the meetings, but we do hope that you will keep us informed of this as we are helping to support these efforts when we can.*

Table 29: Stakeholders Contacted

Organization	Contact	Email/phone	Website/additional info	Contact notes
350 Tacoma	No named contact	hello@350tacoma.org	https://www.350tacoma.org/	Contact page inquiries; no phone
The Black Collective	No named contact	tacomablackcollective@gmail.com	https://theblackcollective.org/	Contact page inquiries; no phone
Centro Latino	No named contact	reception@clatino.org; 253-348-1745		Voicemails and emails sent
Puget Sound Sage	Khristine Cancio, communications manager	khristine@pugetsoundsage.org	https://www.pugetsoundsage.org/	Voicemails and emails sent

Organization	Contact	Email/phone	Website/additional info	Contact notes
Transportation Choices	Matthew Sutherland, Advocacy Director	matthew@transportationchoices.org		Voicemails and emails sent
Washington Physicians for Social Responsibility	Riley Lynch Climate and Health Program Manager	wpsr@wpsr.org; riley@wpsr.org 206.547.2630	https://www.wpsr.org/ - they partner with 350 Tacoma	Per request, sent an emailed version of the interview questions; no response

Social media attitudes and awareness polling

Pierce Transit administered a two Facebook/Instagram poll ads and two organic tweets to get an early pulse on awareness of electric buses in the current fleet and to gauge attitudes toward a full zero-emissions transition. Content was posted on Thursday, March 8, through Sunday, March 12, 2023. Results shows differences in attitudes and awareness across platforms (Facebook, Instagram, Twitter), with a more supportive audience on Instagram and Twitter.

Facebook Poll Ad Results

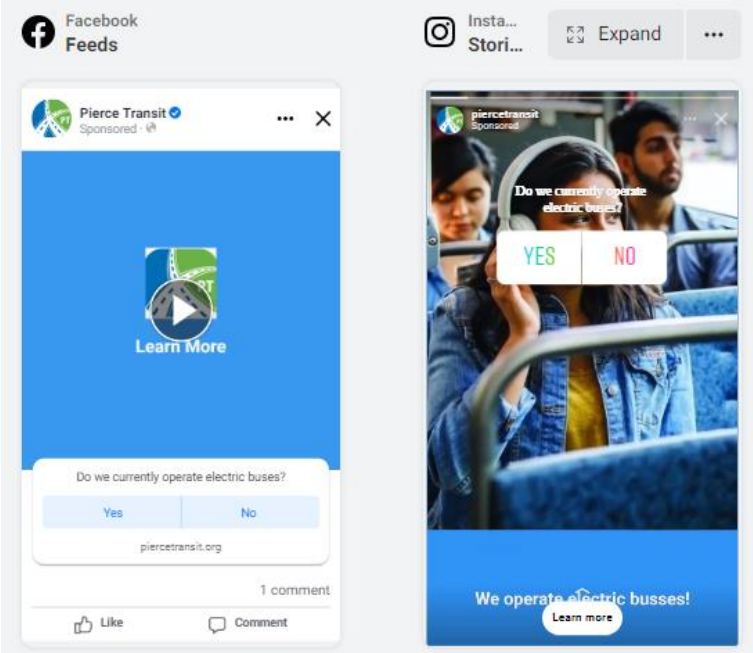
Overview:

Ad Set	Reach	Impressions	Spend	Clicks
Pierce Transit Poll Ad 1	20,061	20,473	$50.00	20
Pierce Transit Poll Ad 2	19,936	20,383	$50.00	33
TOTAL:	**27,289**	**40,856**	**$100.00**	**53**

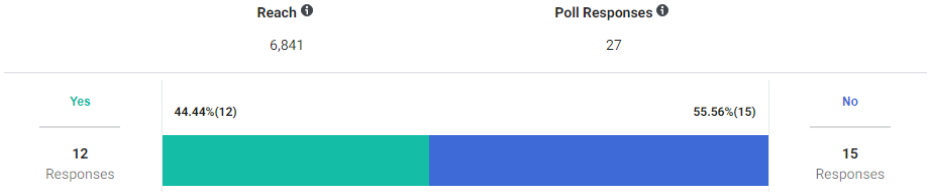
Poll Results:

Question	Yes	No	Total
Do we currently operate electric buses?	13	19	**32**
Is a zero-emissions bus fleet important to you?	11	23	**34**
Total	**24**	**42**	**66**

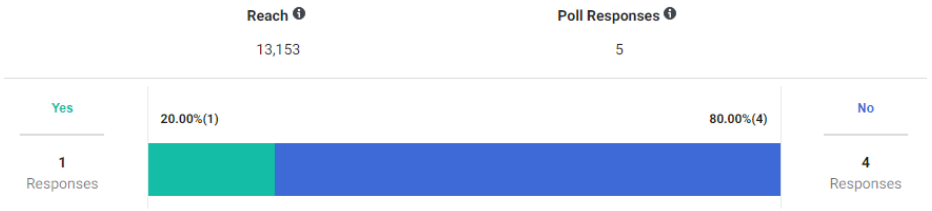
Poll 1: Do we currently operate electric buses?



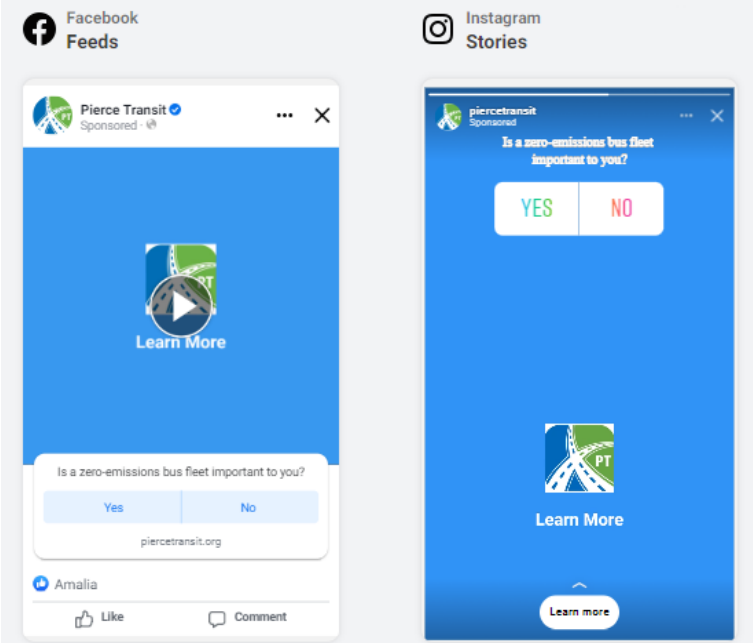
Instagram Stories results



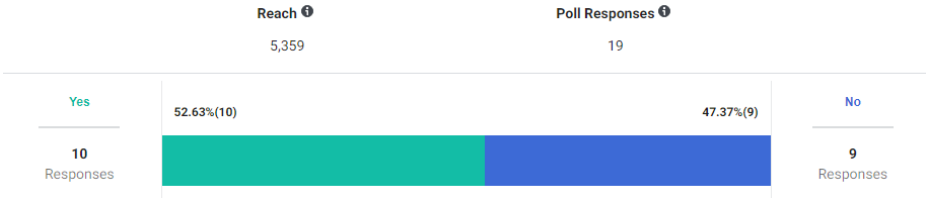
Facebook ad results



Poll 2: Is a zero-emissions bus fleet important to you? (yes/no)

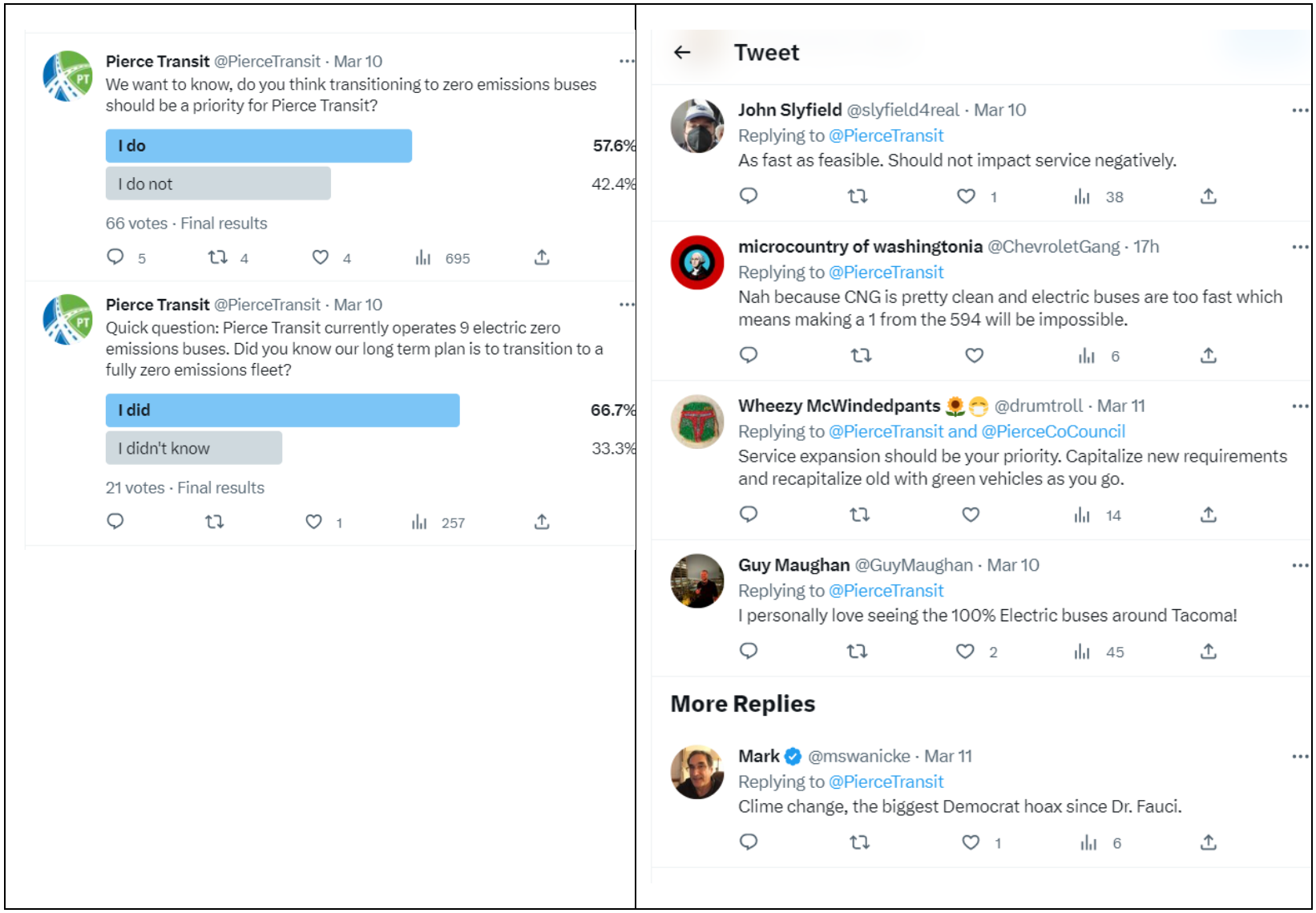


Instagram Stories results



Facebook ad results

Organic Twitter Engagement



Pierce Transit

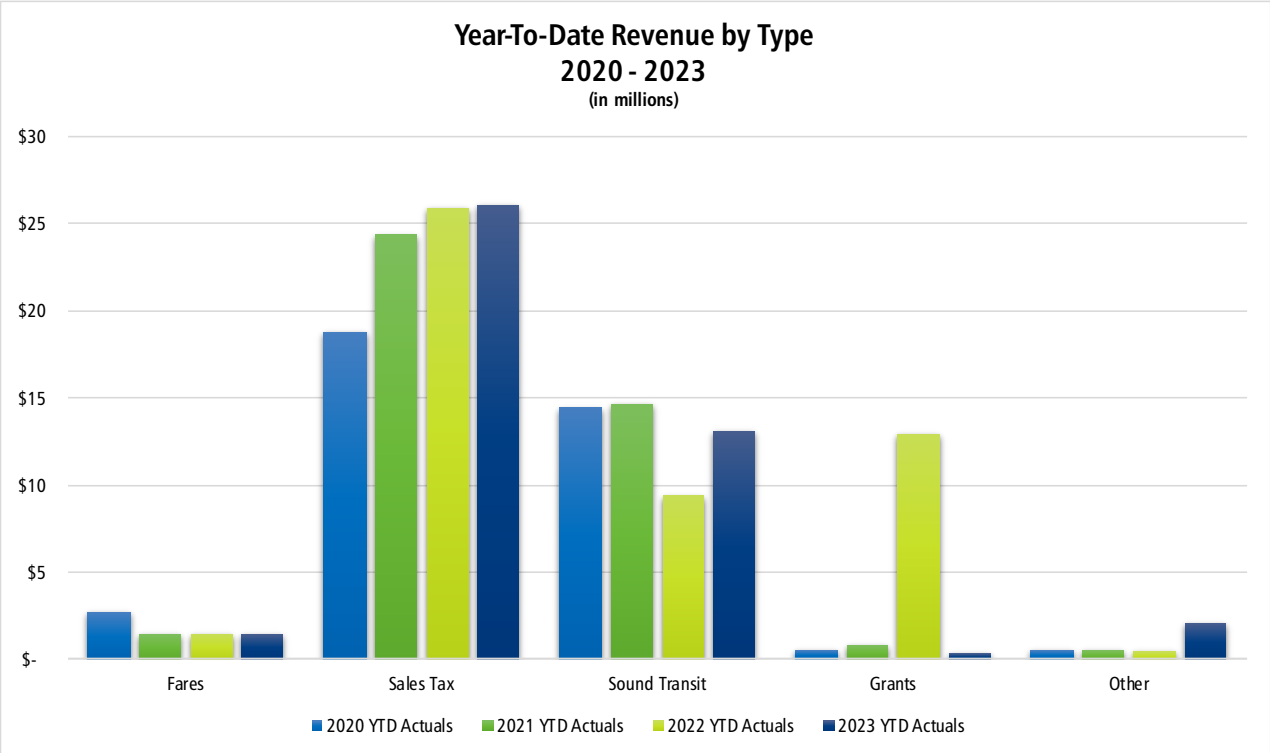
Quarterly Financial Report

01.01.2023 – 03.31.2023

Operating Revenues

As of March 31st, Pierce Transit has received 24.37% of the budgeted revenue. A comparison of operating revenue for three prior years and the 2023 Budget to Actuals are provided in the table below. The 2023 budget numbers are for the full year whereas actuals for each year reflect activity through March 31st.

	2020 YTD Actuals	2021 YTD Actuals	2022 YTD Actuals	2023 Budget	2023 YTD Actuals	% of Budget Received
Fares	$ 2,649,077	$ 1,437,687	$ 1,396,636	$ 5,446,210	$ 1,391,314	25.55%
Sales Tax	18,753,228	24,397,247	25,852,577	$ 110,557,130	26,056,694	23.57%
Sound Transit	14,453,171	14,570,957	9,364,066	$ 47,986,720	13,106,394	27.31%
Grants	557,761	773,842	12,877,067	$ 10,795,670	361,206	3.35%
Other	560,875	555,864	464,671	$ 1,623,270	2,077,308	127.97%
Total Operating Revenues	**$ 36,974,111**	**$ 41,735,598**	**$ 49,955,016**	**$ 176,409,000**	**$ 42,992,916**	**24.37%**



Highlights from 1st Quarter:

Other revenue has the largest gains over budget by 27.97%. The majority of this is earned interest from investments fueled by higher interest rates. Sales Tax, Sound Transit reimbursement, and Fares are performing at the expected budgeted amounts. Grants are lagging below the 25% mark and can be attributed to the timing of grant billings.

Revenue Definitions

Fares – Revenues for actual services provided and include fixed route, SHUTTLE and Vanpool services. The current average fare per boarding is $0.86. The last adult fare increase was in 2010.

Sales Tax – This revenue source provides most of our operating revenue and is based on taxable sales within the Pierce Transit Public Transportation Benefit Area. Currently, Pierce Transit only collects 0.6% of the 0.9% allowable sales tax rate.

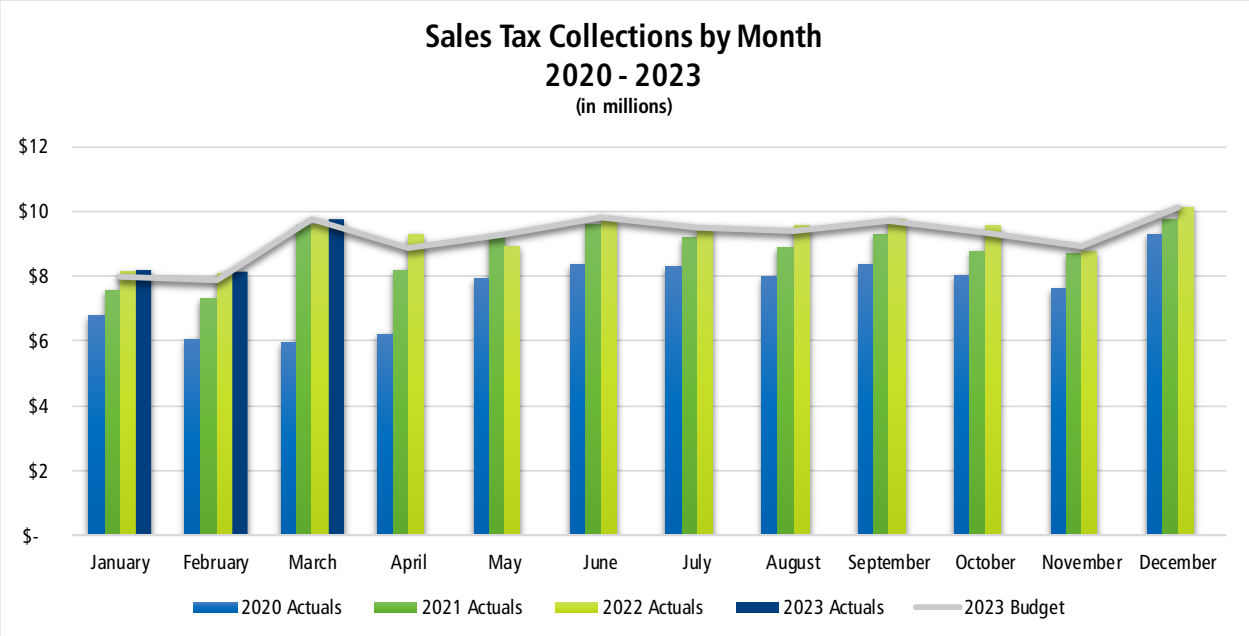
Sound Transit – Are reimbursable expenses for Pierce Transit providing regional transit service from Pierce to King County on behalf of Sound Transit. Reimbursements are based on the costs of services at an hourly rate for service hours required to provide the service.

Grants – Revenues to offset costs of running services. Included in grant revenues are Commute Trip Reduction and Special Needs Operations. These revenues are provided by Pierce County and Washington State.

Other – Other includes interest and advertising revenues that are received with more consistency as well as revenues that cannot be classified in one of the other revenue types.

Sales Tax Collections by Month

	2020 Actuals	2021 Actuals	2022 Actuals	2023 Budget	2023 Actuals		% of Budget Received
January	$ 6,787,065	$ 7,560,658	$ 8,126,107	$ 7,994,241	$ 8,177,567		102.29%
February	$ 6,031,190	$ 7,296,946	$ 8,108,303	7,850,776	8,115,984		103.38%
March	$ 5,934,973	$ 9,539,643	$ 9,618,167	9,763,144	9,763,144	*	100.00%
April	$ 6,228,837	$ 8,167,998	$ 9,280,481	8,892,040			
May	$ 7,939,384	$ 9,243,797	$ 8,936,817	9,265,148			
June	$ 8,371,592	$ 9,587,077	$ 9,684,670	9,821,208			
July	$ 8,297,927	$ 9,206,214	$ 9,421,412	9,492,953			
August	$ 7,963,120	$ 8,885,088	$ 9,526,356	9,382,783			
September	$ 8,326,834	$ 9,264,407	$ 9,765,463	9,697,943			
October	$ 8,023,707	$ 8,786,442	$ 9,529,305	9,334,014			
November	$ 7,633,747	$ 8,736,757	$ 8,784,403	8,929,080			
December	$ 9,289,086	$ 9,739,080	$ 10,146,049	10,133,798			
Total Sales Tax	**$ 90,827,462**	**$ 106,014,106**	**$ 110,927,532**	**$ 110,557,130**	**$ 26,056,694**		**23.57%**



*There is a two-month delay between when the sales tax is collected and remittance to Pierce Transit. The projection is based on the current year's monthly budgeted amount for this report until the remitted amount is finalized.

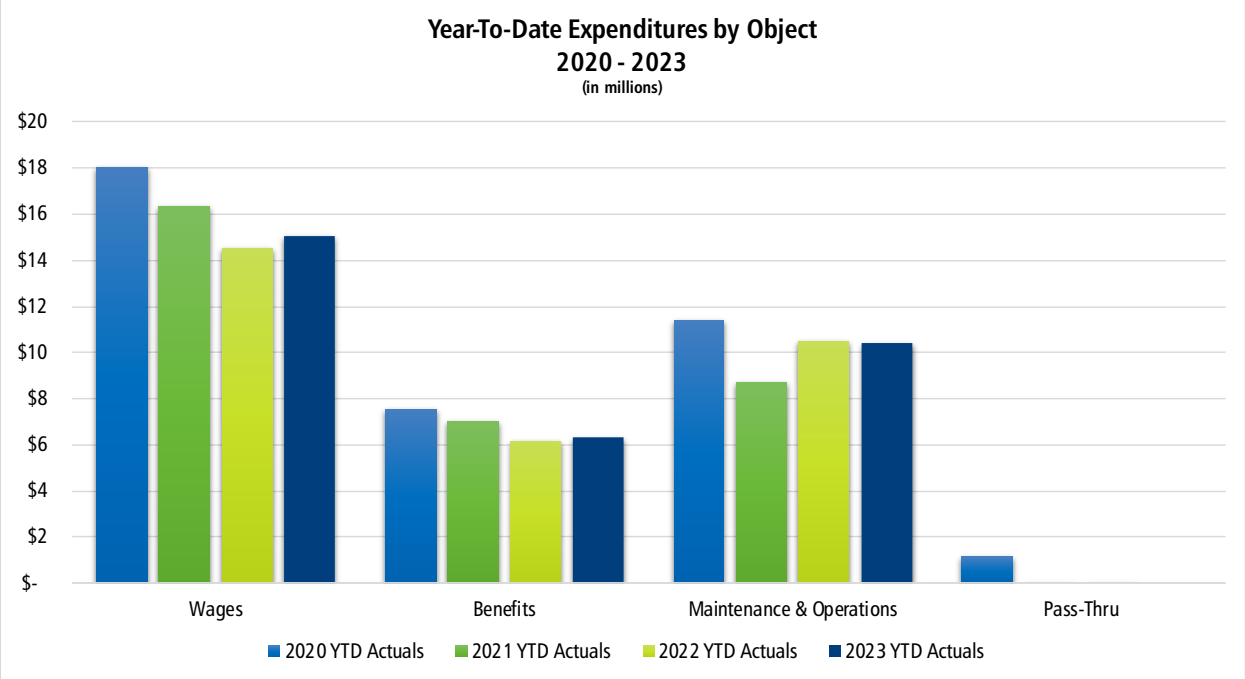
1st Quarter 2023 collections are 0.79%, or $204,118 over year-to-date 2022 actuals.

1st Quarter 2023 collections are 1.75%, or $448,534 over year-to-date 2023 budget.

Operating Expenditures by Object

As of March 31st, Pierce Transit has expended 19.43% of the budgeted expenditures. A comparison of operating expenditures for three prior years and the 2023 Budget and Actuals are provided in the table below. The 2023 budget numbers are for the full year whereas actuals for each year reflect activity through March 31st. Non-Departmental Pass-Thru funds are payments made to Pierce County as part of the 5307 agreement.

	2020 YTD Actuals	2021 YTD Actuals	2022 YTD Actuals	2023 Budget	2023 YTD Actuals	% of Budget Expended
Wages	$ 18,009,982	$ 16,345,062	$ 14,502,176	$ 81,402,050	$ 15,058,924	18.50%
Benefits	$ 7,538,511	$ 6,974,331	$ 6,146,235	31,237,330	6,331,471	20.27%
Total Personnel	$ 25,548,493	$ 23,319,393	$ 20,648,411	$ 112,639,380	$ 21,390,395	18.99%
Maintenance & Operations	$ 11,377,653	$ 8,712,028	$ 10,448,928	$ 49,970,850	$ 10,420,048	20.85%
Total Operating Expenditures	$ 36,926,146	$ 32,031,421	$ 31,097,339	$ 162,610,230	$ 31,810,443	19.56%
Pass-Thru	$ 1,143,054	$ -	$ -	$ 1,150,000	$ -	0.00%
Total Expenditures	**$ 38,069,200**	**$ 32,031,421**	**$ 31,097,339**	**$ 163,760,230**	**$ 31,810,443**	**19.43%**



Highlights from 1st Quarter:

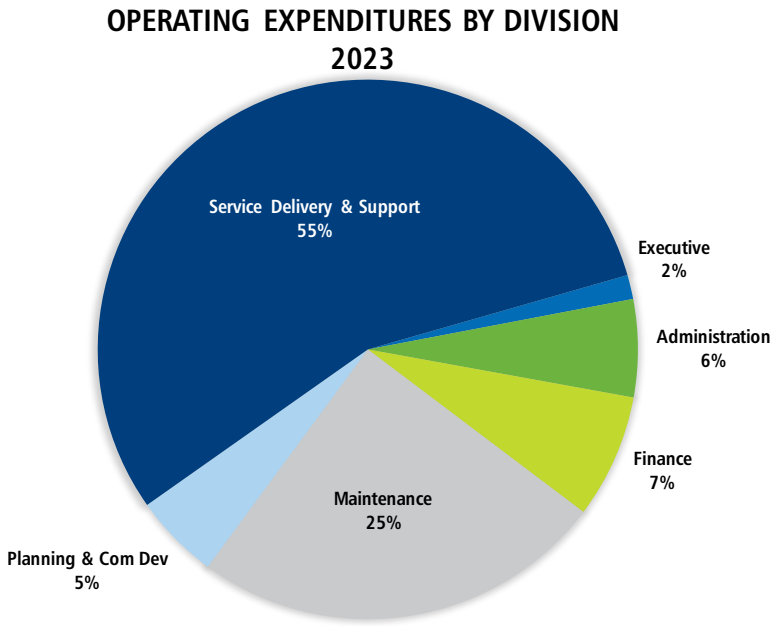
Overall operating expenditures are under budget by 5.57% when compared to 25% of the annual budget. All categories are under budgeted expectations. The main cause is vacant positions in Maintenance and Service Delivery. Our largest expense category is personnel costs, currently 67.2% of the overall expenditures.

No non-departmental pass-thru payments have been made to Piece County as part of the 5307 agreement in the first quarter of 2023. Historically payments have been made later in the year.

Operating Expenses by Division

Pierce Transit consists of six divisions: Executive, Administration, Finance, Maintenance, Planning & Community Development, and Service Delivery & Support. Approximately 70% of our budgeted operating expenditures are wages and benefits for personnel. 867 or 88% of our personnel is included in Maintenance and Service Delivery & Support.

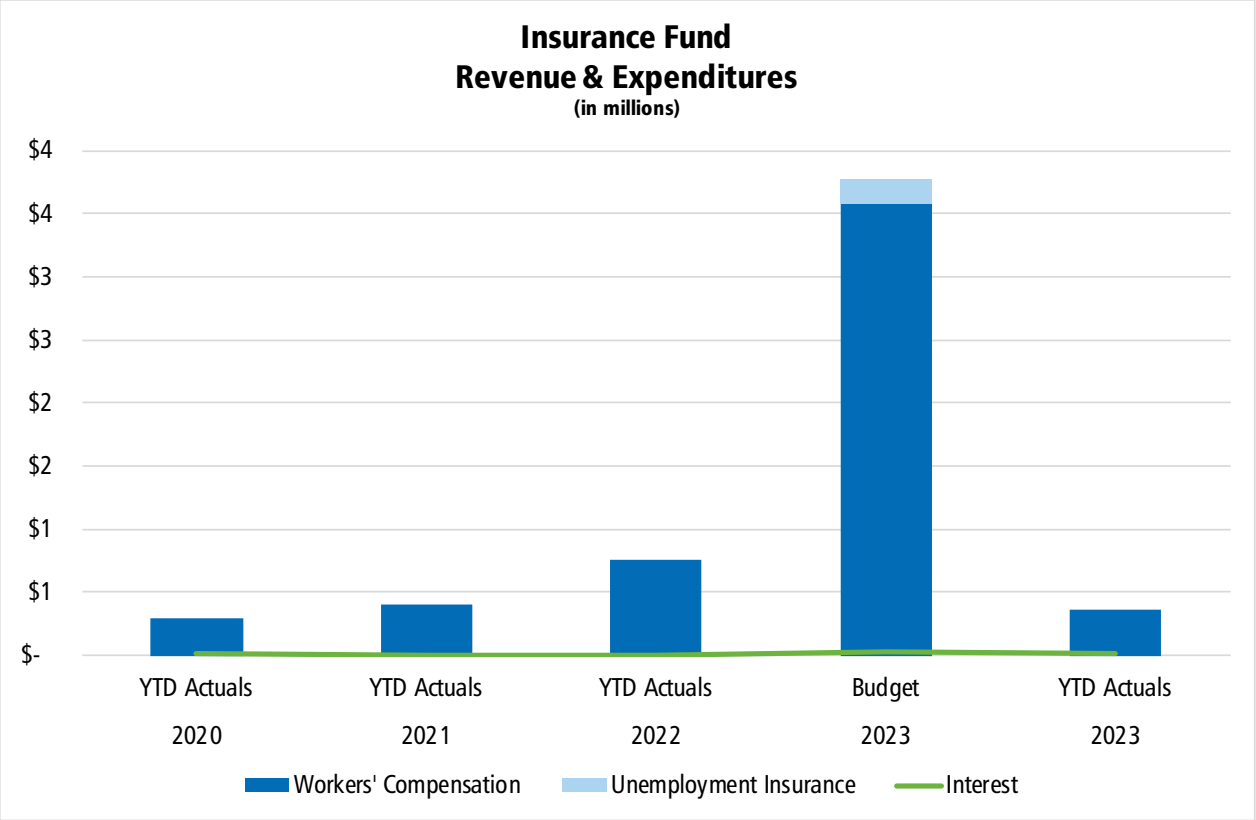
	2020	2021	2022	2023		% of Budget
	YTD Actuals	YTD Actuals	YTD Actuals	Budget	YTD Actuals	Expended
Executive	444,780	436,105	457,386	2,065,660	459,975	22.27%
Administration	1,901,974	1,768,934	1,890,817	9,597,520	1,862,504	19.41%
Finance	3,638,450	3,529,555	3,631,094	12,960,020	2,365,482	18.25%
Maintenance	8,414,822	7,445,093	7,303,737	37,020,200	7,889,696	21.31%
Planning & Com Dev	1,662,206	1,447,594	1,374,742	8,208,230	1,630,858	19.87%
Service Delivery & Support	20,863,914	17,404,139	16,439,563	92,758,600	17,601,928	18.98%
Subtotal Operating Expenditures	36,926,146	32,031,421	31,097,339	162,610,230	31,810,443	19.56%



Insurance Budget

Pierce Transit's Insurance Fund covers the expenses for Worker's Compensation and Unemployment Insurance. This fund receives minimal revenues from interest. Expenditures over revenue are covered using reserves and transfers from the Operating Fund.

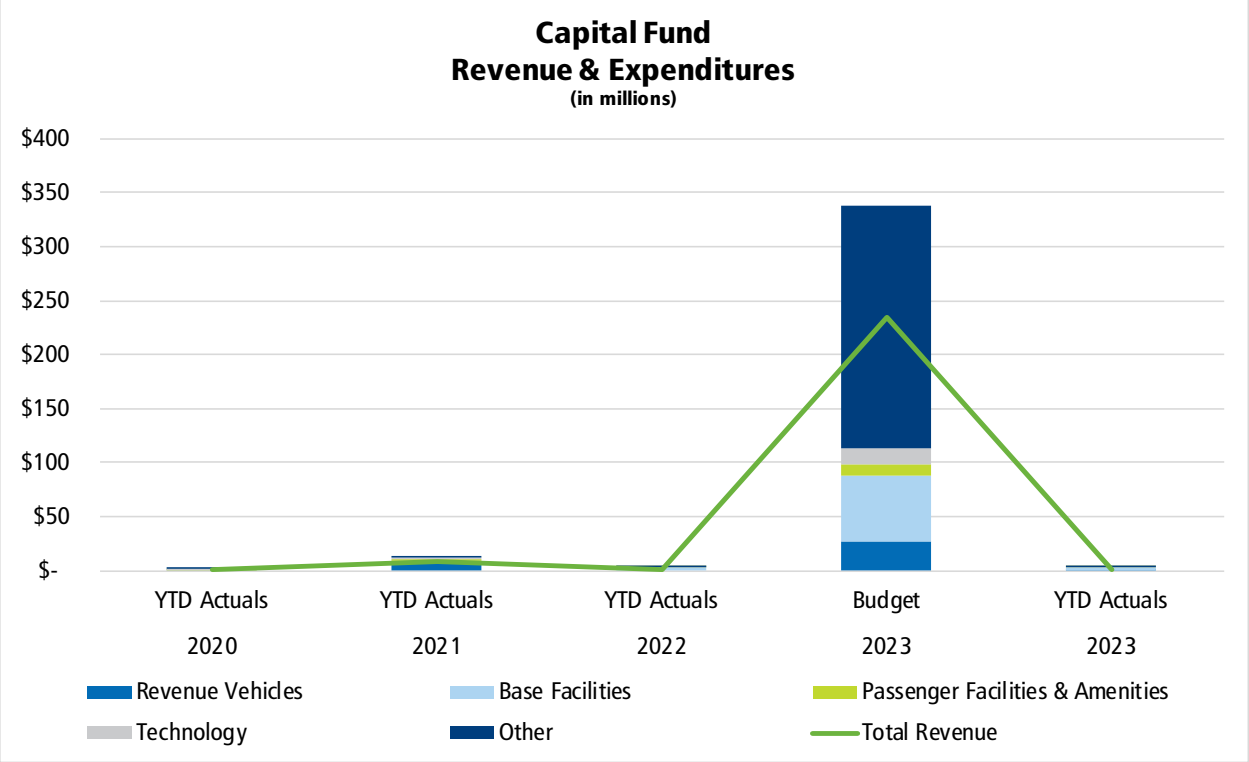
	2020 YTD Actuals	2021 YTD Actuals	2022 YTD Actuals	2023 Budget	2023 YTD Actuals	% of Budget
Revenue						
Interest	$ 17,912	$ 1,495	$ 1,639	$ 25,000	$ 16,660	66.64%
Expenditures						
Workers' Compensation	$ 293,485	$ 405,906	$ 764,845	$ 3,575,710	$ 356,789	9.98%
Unemployment Insurance	-	-	-	$ 200,000	$ -	0.00%
	$ 293,485	$ 405,906	$ 764,845	$ 3,775,710	$ 356,789	9.45%
Net Income (Loss)	$ (275,573)	$ (404,410)	$ (763,206)	$ (3,750,710)	$ (340,129)	



Capital Budget

Capital Fund is designated to provide funding and budgets for projects that meet the guidelines of capital, broadly defined as greater than $5,000, or aggregate purchases over $50,000, and useful life of more than one year. Capital projects are budgeted for the full amount in the year that they are added to the capital portfolio. Any unspent budgets are carried forward to the next budget year along with any remaining funding. Funding for projects is received from Federal, State, and other sources and is project specific. Expenditures over revenue are covered using reserves and transfers from the Operating Fund. Classifications of capital expenditures are defined by the National Transit Database (NTD).

	2020 YTD Actuals	2021 YTD Actuals	2022 YTD Actuals	2023 Budget	2023 YTD Actuals
Revenue					
Interest	$ 233,680	$ 17,710	$ 20,789	$ 175,000	$ 451,642
Grants	565,646	9,022,305	1,276,589	234,631,590	$ 938,466
Total Revenue	**$ 799,326**	**$ 9,040,014**	**$ 1,297,378**	**$ 234,806,590**	**$ 1,390,108**
Expenditures					
Revenue Vehicles	$ -	$ 8,374,593	$ -	$ 26,452,730	$ 8,018
Base Facilities	691,344	1,135,066	2,508,281	61,899,580	$ 2,488,807
Passenger Facilities & Amenities	146,921	1,528,416	328,091	9,831,360	$ 402,040
Technology	361,602	350,892	558,298	15,595,150	$ 645,979
Other	639,677	845,345	505,820	223,540,660	$ 1,465,980
Total Expenditures	**$ 1,839,544**	**$ 12,234,311**	**$ 3,900,490**	**$ 337,319,480**	**$ 5,010,825**
Net Income (Loss)	**$ (1,040,218)**	**$ (3,194,297)**	**$ (2,603,112)**	**$ (102,512,890)**	**$ (3,620,717)**
% Covered by Outside Funding	30.75%	73.75%	32.73%	69.56%	18.73%



Transfers

Transfers made from the Operating Fund to the Insurance and Capital Funds are to cover reserve requirements and expenditures. Transfers out from the Operating Fund and into the Insurance and Capital Funds net to zero and are not considered an actual revenue or expenditure in any fund. Below is a historical view of transfers made between funds.

	2020 Actuals	2021 Actual	2022 Actual	2023 Budget	2023 Actual	% of Budget
Operating Fund	(22,189,135)	(20,647,692)	(61,510,479)	(61,383,510)	-	0.00%
Insurance Fund	2,758,476	334,904	2,098,101	5,835,100	-	0.00%
Capital Fund	19,430,659	20,312,788	59,412,378	55,548,410	-	0.00%

Balances

Ending balances include the required reserves for the operating, insurance, and capital funds. The Board of Commissioner's reserve policy supports management decision-making by avoiding revenue-expenditure imbalances, supporting stable service delivery, and assuring funds are available for operations, self-insurance programs, and planned capital acquisition during economic downturns or other unanticipated events.

	Operating	Insurance	Capital
Beginning Balance	$ 123,185,702	$ 1,071,299	$ 87,148,759
Revenue	$ 42,992,916	16,660	1,390,108
Transfers-In	$ -	$ -	$ -
	$ 42,992,916	$ 16,660	$ 1,390,108
Expenditures	$ 31,810,443	356,789	5,010,825
Transfers-Out	$ -	$ -	$ -
	$ 31,810,443	$ 356,789	$ 5,010,825
Ending Balance	$ 134,368,175	$ 731,170	$ 83,528,042
Required Reserve	$ 27,101,710	$ 1,200,000	$ 8,500,000
Margin (Deficit)	$ 107,266,465	$ (468,830)	$ 75,028,042

Reserve Requirements

Operating: A minimum of two months of agency operating expenditures of the current year and is currently $27.1 million.

Insurance: An adequate level to protect the agency from self-insurance risk. The level is reviewed periodically and is currently $1.2 million.

Capital: A minimum of 50% of the previous three years average of annual asset depreciation at any point in the Six-Year Financial Plan; 100% in the final year of the Six-Year Financial Plan and is currently $8.5 million each year and $17.0 million in the final year.

Budget Revisions & Amendments

Budget revisions are done when the approved budget moves from one account to another. Revisions do not have a financial impact on the agency budget. Budget revisions do require the Board of Commissioners' approval when capital projects are increased by $50,000 or more cumulatively over the life of the project.

Budget amendments occur when unforeseen expenses are expected, and the agency budget is increased. Budget amendments require Board of Commissioner approval. Below is a list of changes made to the budget in the 1st quarter of 2023 and a table showing the new fund balances caused by the changes.

2023 Budget Summary

				Revenues & Other Sources			Expenditures & Other Uses				
Budget	Original Beginning Balance	Balance Adjustments	Adjusted Beginning Balance	Original Budget	Amendments	Revised Budget	Original Budget	Amendments	Revised Budget	Original Ending Balance	Revised Ending Balance
Operating	106,343,360	16,842,344	123,185,704	176,409,000	-	176,409,000	225,143,740	-	225,143,740	57,608,620	74,450,964
Insurance	(884,390)	1,955,691	1,071,301	5,860,100	-	5,860,100	3,775,710	-	3,775,710	1,200,000	3,155,691
Capital	55,464,480	31,684,280	87,148,760	290,355,000	-	290,355,000	337,319,480	-	337,319,480	8,500,000	40,184,280
Total	**160,923,450**	**50,482,315**	**211,405,765**	**472,624,100**	**-**	**472,624,100**	**566,238,930**	**-**	**566,238,930**	**67,308,620**	**117,790,935**

Fund	Item Description	Quarter	Beginning Fund Balance	Revenues	Transfers-In	Sources	Expenditures	Transfers-Out	Uses	Ending Fund Balance	Fact Sheet or Resolution #
Operating											
	Beginning Fund Balance Adjustment from Estimate to Actual	1	16,842,344			-			-	16,842,344	N/A
			16,842,344	-	-	-	-	-	-	16,842,344	
Insurance											
	Beginning Fund Balance Adjustment from Estimate to Actual	1	1,955,691			-			-	1,955,691	N/A
			1,955,691	-	-	-	-	-	-	1,955,691	
Capital											
	Beginning Fund Balance Adjustment from Estimate to Actual	1	31,684,280			-			-	31,684,280	N/A
	Closeout Project #544 - Virtual Reality Bus Driving Simulator	1				-			-	-	N/A
	Closeout Project #600 - Bldg 5 Office Moves	1				-			-	-	N/A
	Closeout Project #481 - HCT Feasibility Study	1				-			-	-	N/A
	Closeout Project #627 - Parts Washer Replacement	1				-			-	-	N/A
	Closeout Project #518 - Collision Avoidance System	1				-			-	-	N/A
	Closeout Project #618 - Bldg 4 Lobby Hardening	1				-			-	-	N/A
			31,684,280	-	-	-	-	-	-	31,684,280	
	Grand Total		**50,482,315**	-	-	-	-	-	-	**50,482,315**	

Budget Revision & Amendment Highlights:

2023 Beginning balances were up $50,482,315 compared to budget due to underspending the budgeted 2022 year-end estimates agency wide.

Projects Closed this Quarter

Project Name & Number	Budget	Actual
High-Capacity Transit Feasibility Study – 481	$1,716,625	$1,317,037
Collision Avoidance System – 518	$2,364,894	$2,294,087
Bus Driving Simulator – 544	$507,581	$506,919
Building 5 Office Moves – 600	$317,000	$177,148
Building 4 Lobby Hardening – 618	$150,523	$125,589
Parts Washer Replacement – 627	$46,525	$29,647