



MnDOT's Use of Electric Vehicles

Jed Falgren, PE | State Maintenance Engineer

Mike Joyce | State Fleet Manager

June 22, 2023

MnDOT's current EV Fleet

Row Labels	ELECVEH	HYBRID	PHEV
CHEVROLET	8	6	
BOLT	8		
MALIBU HYBRID		6	
CHRYSLER			2
PACIFICA HYBRID			2
FORD	2	24	6
ESCAPE HYBRID		9	
E-TRANSIT T-350	1		
F-150 HYBRID		1	
F-150 LIGHTNING	1		
FUSION ENERGI PHEV			6
FUSION HYBRID		14	
HYUNDAI		6	
SONATA HYBRID		6	
MITSUBISHI			28
OUTLANDER PHEV			28
TOYOTA		13	
CAMRY HYBRID		6	
RAV4 HYBRID		7	
Grand Total	10	49	36

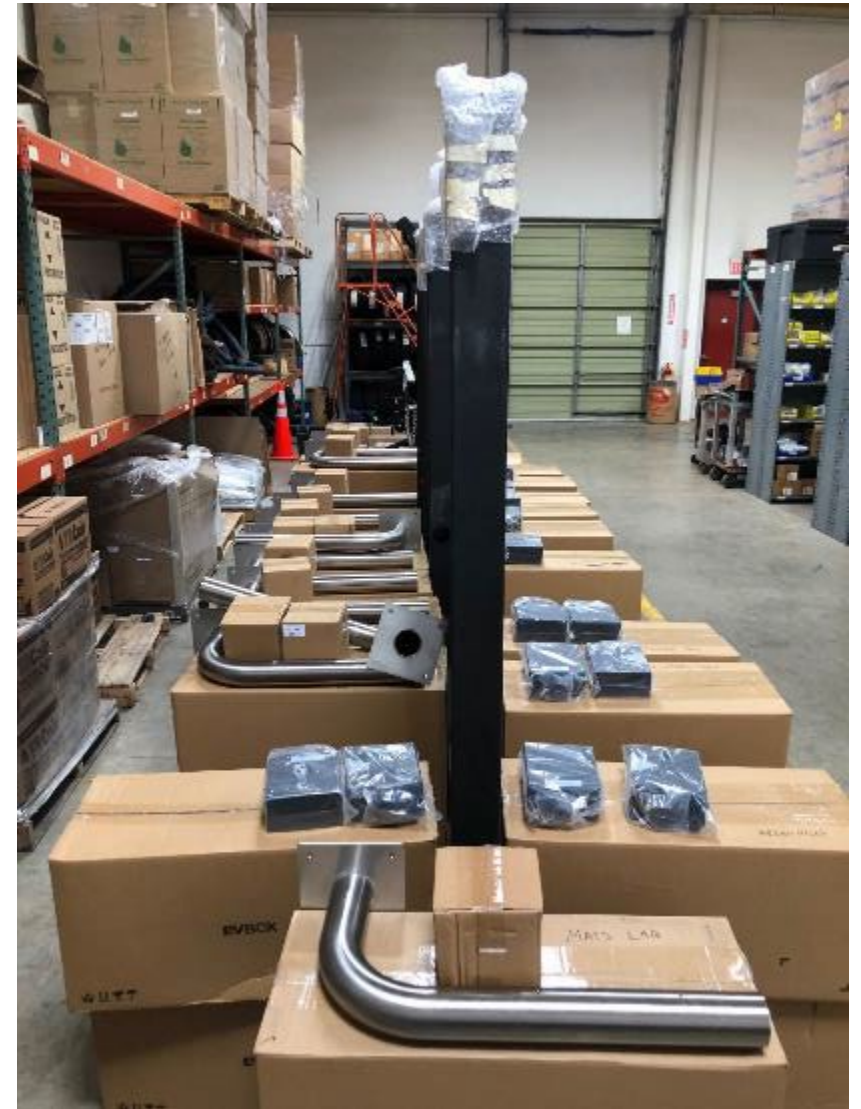
Where are we using them

- Primary motor pool use
 - Mix of users
 - Maximize utilization
 - Easiest initial purchasing evaluation
- Piloting full electric vehicles in Rural Districts
 - D2 Crookston – Chevy Bolt
 - D6 Owatonna – Ford F150 Lightning

- Generally favorable
- “Fun” to drive
- Great traction in snow – HEAVY and good traction control
- Some frustration of not getting enough “electric miles” out of Hybrids
- Range anxiety is REAL
 - We have not completed trips as expected
 - Cold weather range and charging is a SIGNIFICANT challenge

MnDOT EV Chargers – Feb 2023

- Last order received end of **July 2022** and shipped to Districts
- 43 ports for Level 2 charging (mix of single and dual ports) sent to facilities in Districts 1-4, 7, 8 and the Materials Lab
- Based on responses to request for info in early 2023 - total number of ports is **70**
- Mix of staff only and accessible for visitors
- As of February 2023 - there are **49 installed and operational**



D2 Example – Chevy Bolt (250 mi range)

- Commuter car between Crookston and Bemidji – 170 Mi round trip
 - Easy in summer, questionable spring and fall, not possible in Winter
 - Just added level 2 charger in Bemidji to support winter trip if layover is > 3 hrs
- Have done a Case Lake round trip (210 miles)
- Limited charging infrastructure makes some destinations harder
- Unable to service at local dealers (Grand Forks for software update)

D6 Example – Ford Lightning (230 mi range)

- Max winter range has been around 130.
 - Slower recharge
- EV showcase trip to the Capital this spring... Great weather day - 70's
 - Drove 141 mi round trip had 46 mi remaining when arriving at Owatonna
- Best day has been 200 miles
- I-90 guardrail project between Albert Lea and Austin was just a little out of range for inspector to use all day.
- I-35 Unbonded overlay near Faribault starting soon - hopeful

Purchasing Challenges

- Availability
 - Ordered 5 Lightnings – 4 were cancelled by manufacturer
- Long lead-times
 - Well over 1 year from order to delivery
- Reduced options
 - Wanted long range battery in Lightning but could only get regular
- What current vehicles make sense to consider???

How to grow MnDOT's EV fleet in the future

- Move to Data based selection
- EV Suitability Assessment
- Using telematics data to model likelihood of success
- Xcel Energy funded grant utilizing Sawatch Analytics
- Modeled full EV's as well as hybrid alternatives

Scope and Timeline

Phase 1 Scope

- Dec 2019 – Mar 2020
- Sept 2021 – Nov 2021
- Dec 2021 – Mar 2022
- June 2022 – Oct 2022
- Mix of sedans and SUVs, primarily in the Metro District
- Some vehicles in multiple study periods – 238 suggestions
- 80 vehicles with data confidence
- Some had telematics issues

Phase 2 Scope

- Study of 17 existing MnDOT EVs (most are PHEVs)
- Operational Savings
- GHG reduction
- Fuel costs
- Gas/Electric usage – Missed charging opportunities
- Through April 2023

ez ev Suitability Assessment All Vehicles



Home

Annual projected figures based on tracked period

Click on a header to sort by that metric. Click on a vehicle to see specifics for that vehicle

Download

Asset ID	Year	Make	Model	Recommendation*	Annual Est. VMT	Overall Score	Economics Score	TCO (Lifetime)	GHG Reduction (%)	Energy Score
1023077	2019	FORD	F-150	2022 Ford F-150 Lightning Pro BEV	7,310	98	98	▼ -\$3,000-6,000	56%	100
1086083	2019	FORD	F-150	2022 Ford F-150 Lightning Pro BEV	7,800	97	93	Cost parity	46%	100
1102638	2014	DODGE	GRAND CARAVAN	2022 Chevy Bolt EUV BEV	7,070	96	100	▼ -\$3,000-6,000	77%	100
1024739	2018	FORD	F-150	2022 Ford F-150 Lightning Pro BEV	17,100	95	103	▼ -\$18,000-21,000	52%	97
1022291	2018	FORD	F-150	2022 Ford F-150 Lightning Pro BEV	6,740	95	98	▼ -\$3,000-6,000	69%	100

Previous Page 1 of 4 Next

*Each vehicle is first compared against all electric models within the same vehicle class. If there is an EV within the same class that is a good operational and economic fit, the recommended EV model is provided. If none of the EV models within the same class are a good fit, the vehicle is then compared against all other EV models included in the analysis. The vehicle is then scored against the best fit EV and can receive a recommendation of: Possible Sedan Fit, Optimization Candidate, or No Change. Please see the results page for each vehicle for additional information.

Recommended Replacement: 2022 Ford F-150 Lightning Pro BEV

Select Vehicle To Compare:

2022 Ford F-150 Lightning Pro BEV



Observation Period: 12/14/2021 - 3/8/2022

Days tracked: 85 days

Trips tracked: 99

Last trip: 3/9/2022

Model: 2019 FORD F-150

VIN: 1FTEX1CB1KKC54697

Total Miles: 1,703

Temperature range: 11°F-24°F

Midday Charging Needs:
Not needed

- Economics & Environment
- Parking & Charging
- Assumptions

Estimated Operational Metrics in a 2022 Ford F-150 Lightning Pro BEV

These metrics estimate what the usage numbers would be if the miles driven by your 2019 FORD F-150 had been driven in a 2022 Ford F-150 Lightning Pro BEV.

Vehicle Miles Traveled	GHG Reduction	Operational Cost Difference*	TCO* (Lifetime)	TCO** (%)	Average Daily Idling Hours
7,310	56%	▼ -\$12,000-15,000	▼ -\$3,000-6,000	▼ -7%	1.4

* Total Cost of Ownership (TCO) Change and Operational Savings reflect the financial savings over the lifetime of the vehicle.
 ** TCO Change takes into account the purchase price of the recommended vehicle, Operational Savings does not.

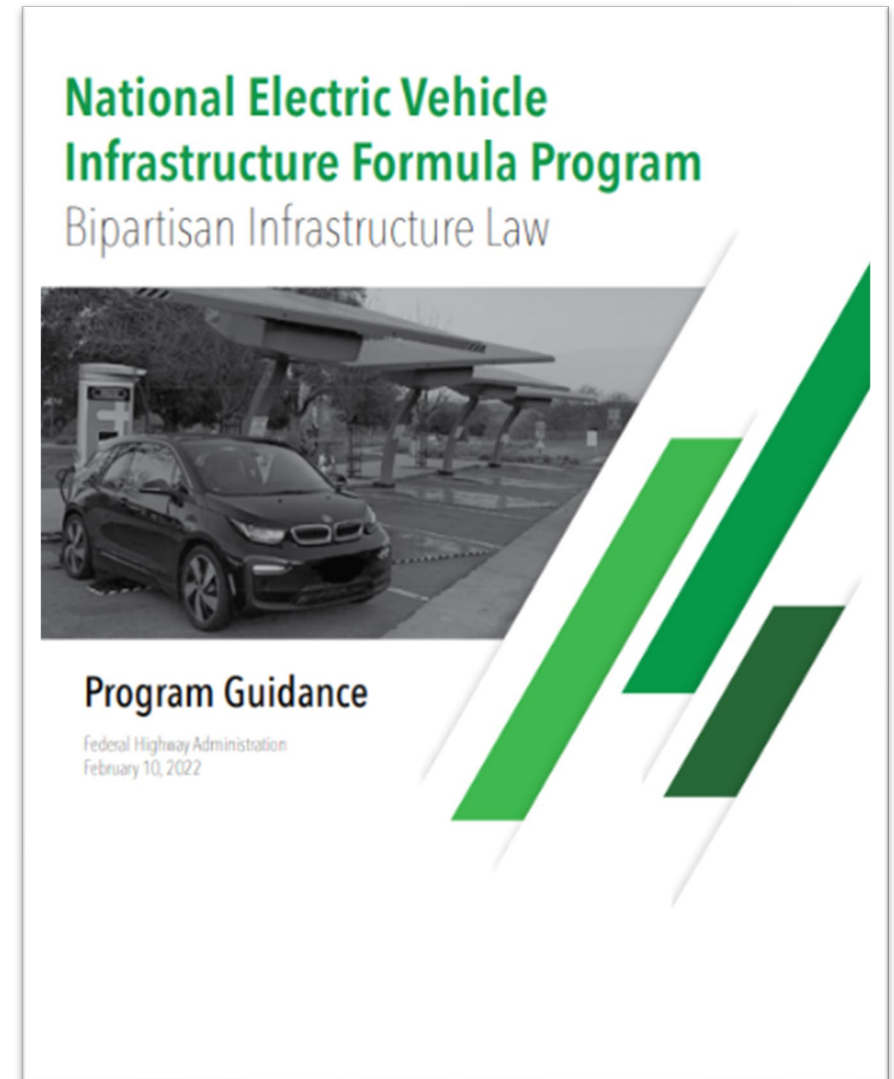
Menu

- Shift
- ez ev
- ez io
- ion ev
- emit

NEVI

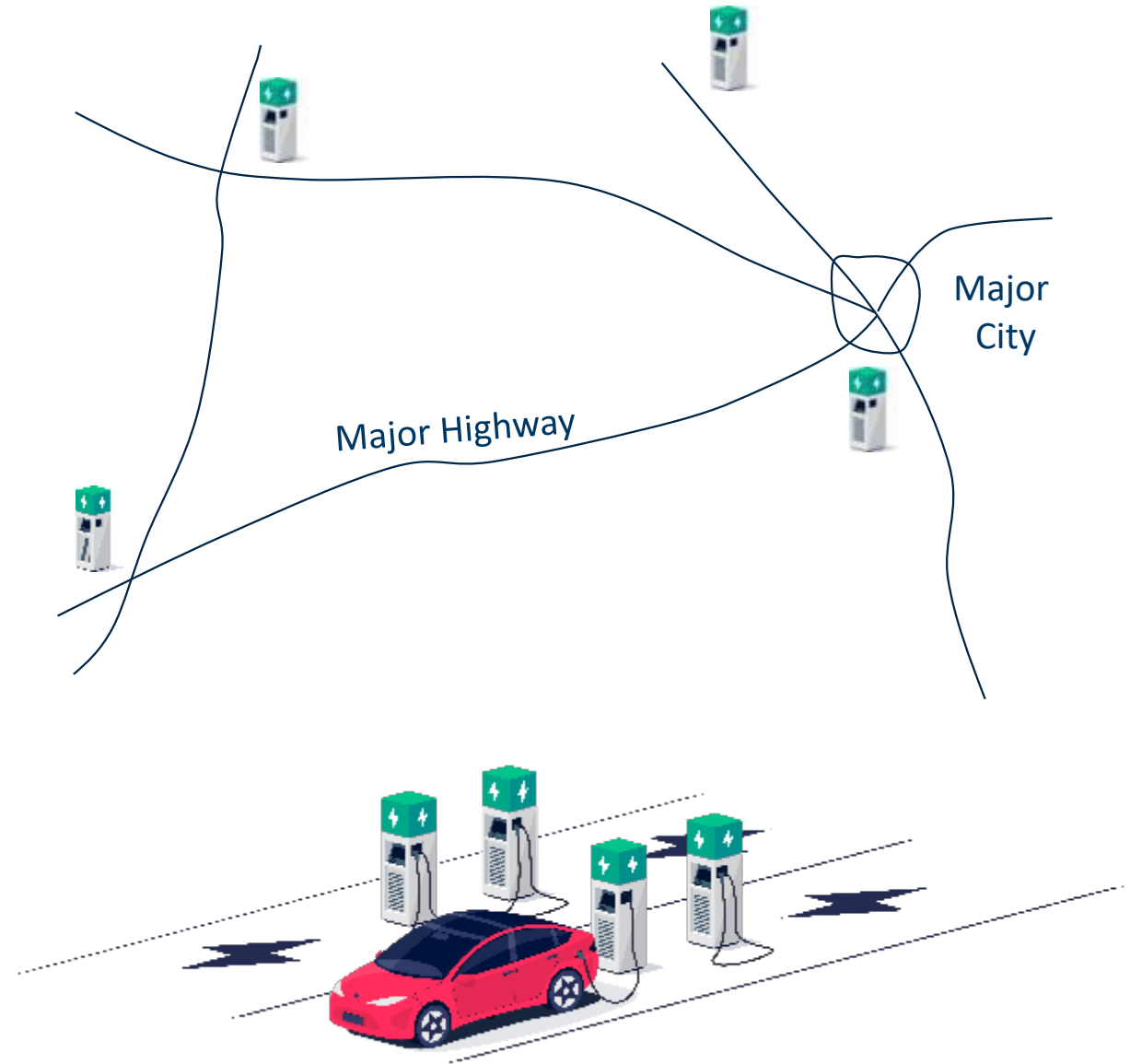
What is NEVI?

- New federal program authorized under the Bipartisan Infrastructure Law - November 2021
- Provides funds to states to install DC fast chargers along designated corridors
- Convenient, affordable, reliable and equitable public charging network
- Federal appropriation for Minnesota is \$68 million for federal FY 22 – 26
- 20% non-federal match and state legislative spending authorization required
- MN Plan approved September 14, 2022



So how does the NEVI program work?

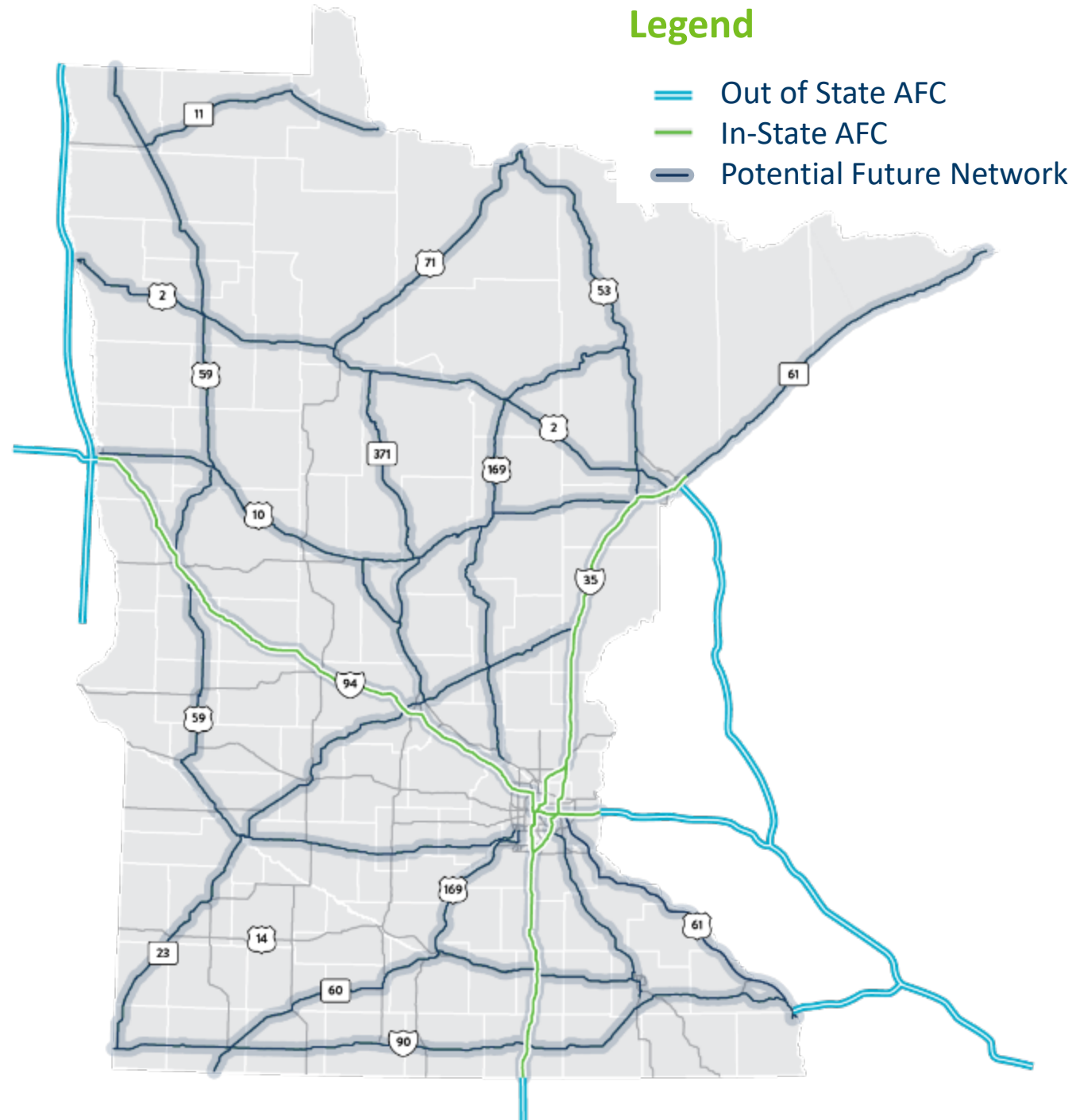
- Funding must be used to build out Alternative Fuel Corridors (AFCs) first before spent on non-AFC corridors
- MnDOT's first round of funding will focus on the build-out of NEVI compliant chargers along the existing AFCs in Minnesota: I-94 and I-35
- Charger requirements for full build out
 - DC Fast Charging
 - Located every 50 miles
 - Located <1-mile driving distance from AFCs
 - 4 -150 kW fast charging ports at each site
- **Third-parties will own, operate and maintain the stations.**



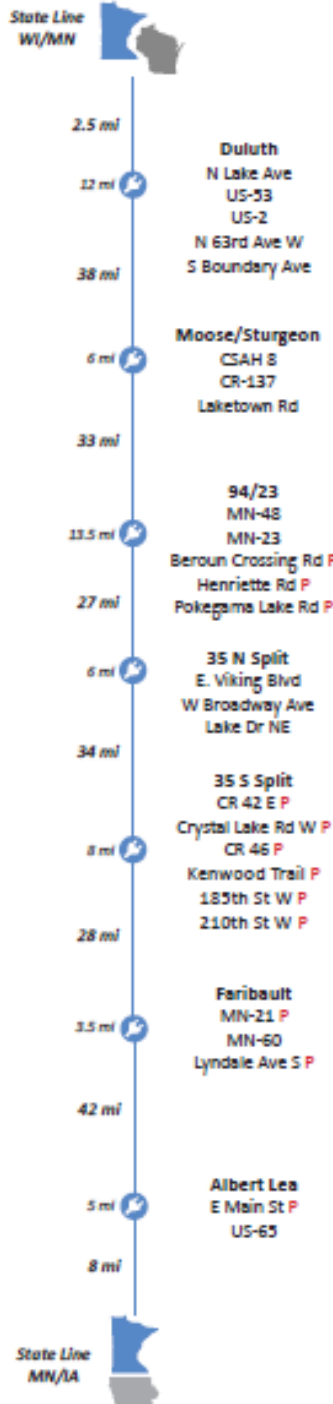
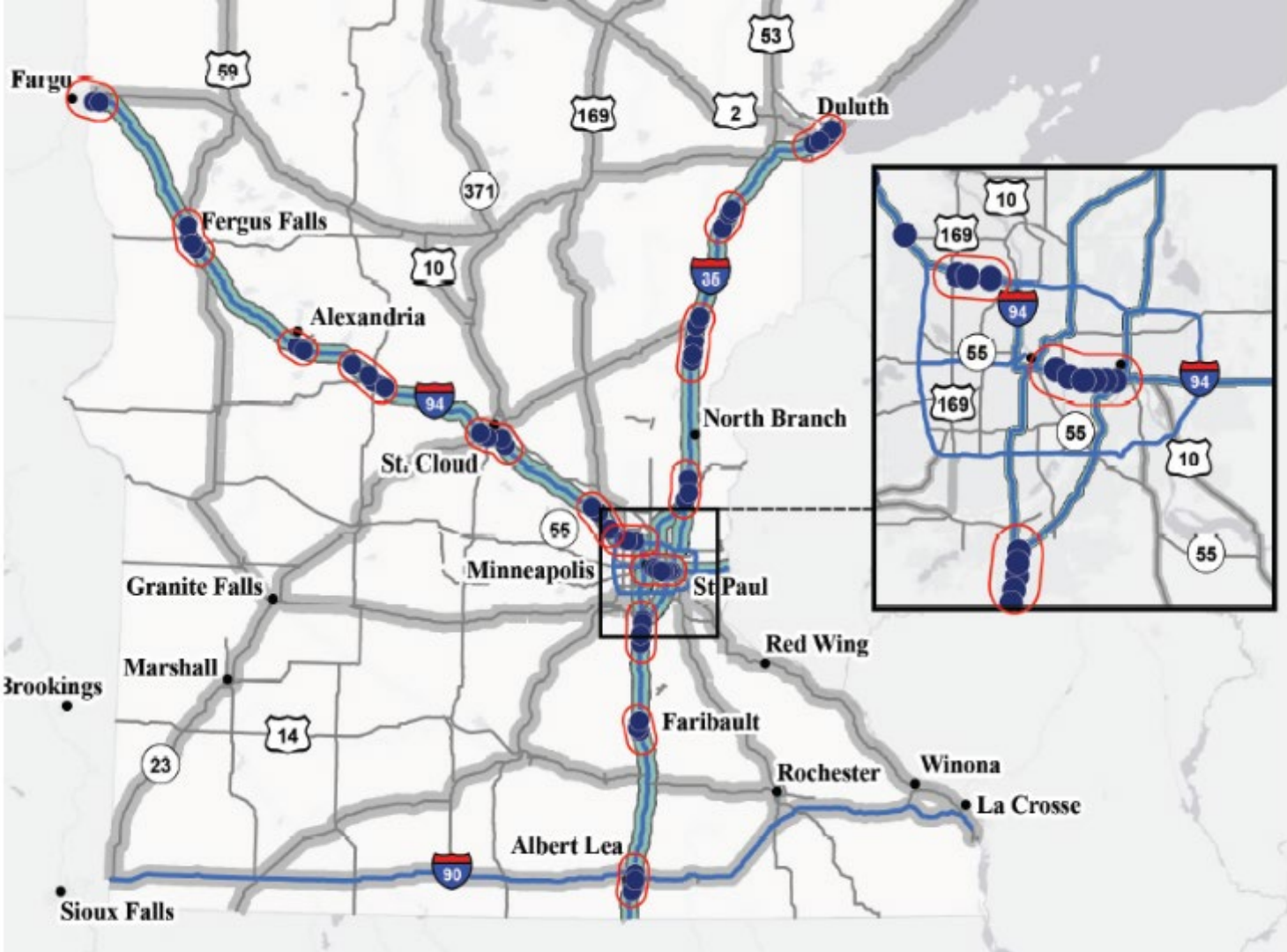
Minnesota EV Fast Charging Network Vision

Includes all potential corridors for investment with the \$68 million of NEVI funds (FY 2022-2026)

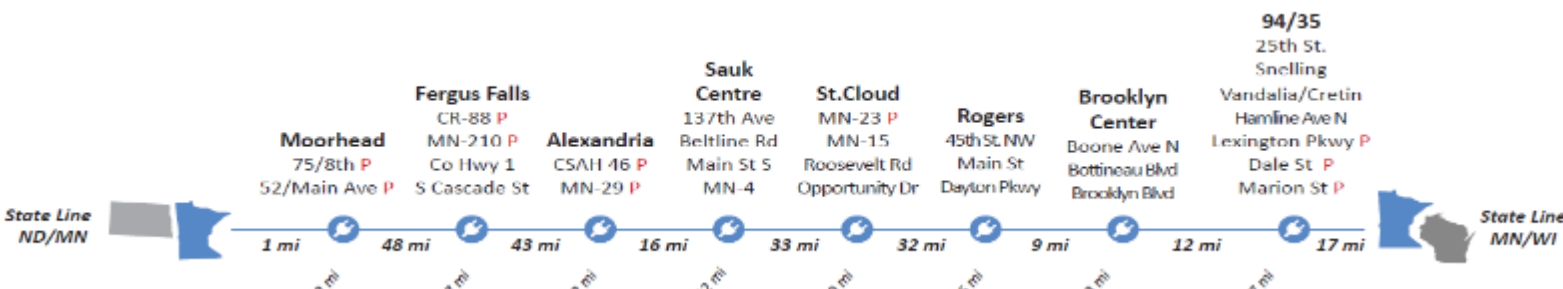
- Promotes coverage across the state
- Prioritizes roadways that serve long distance travel
- Creates a network that connects to other networks
- Recognizes both rural and urban communities
- Serves current and future EV drivers



Fast Charger Locations: I-94 and I-35 in 2022 plan

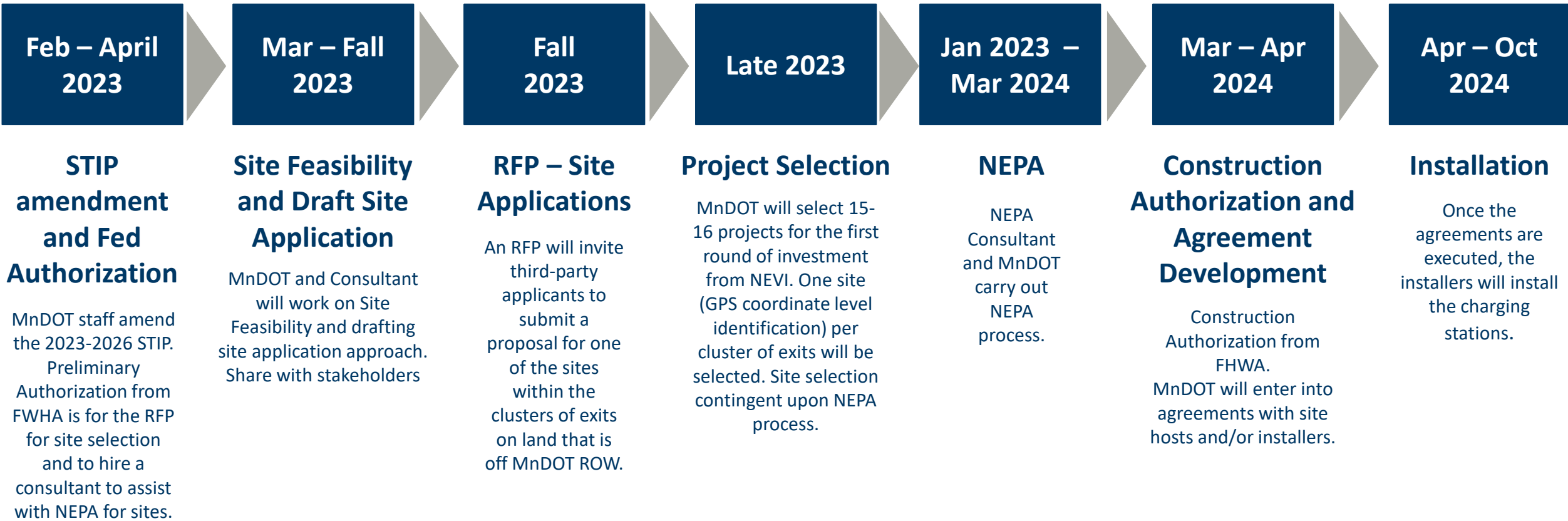


P – 600kW load verified available per utility input



Moorhead 75/8th P 52/Main Ave P	Fergus Falls CR-88 P MN-210 P Co Hwy 1 S Cascade St	Alexandria CSAH 46 P MN-29 P	Sauk Centre 137th Ave Beltline Rd Main St S MN-4	St. Cloud MN-23 P MN-15 Roosevelt Rd Opportunity Dr	Rogers 45th St NW Main St Dayton Pkwy	Brooklyn Center Boone Ave N Bottineau Blvd Brooklyn Blvd	94/35 25th St. Snelling Vandalia/Cretin Hamline Ave N Lexington Pkwy P Dale St P Marion St P	Albert Lea E Main St P US-65
--	--	---	---	--	---	--	--	---

Installing chargers along I-94 and I-35 (dates may shift)





10





C-Line Characteristics and Infrastructure

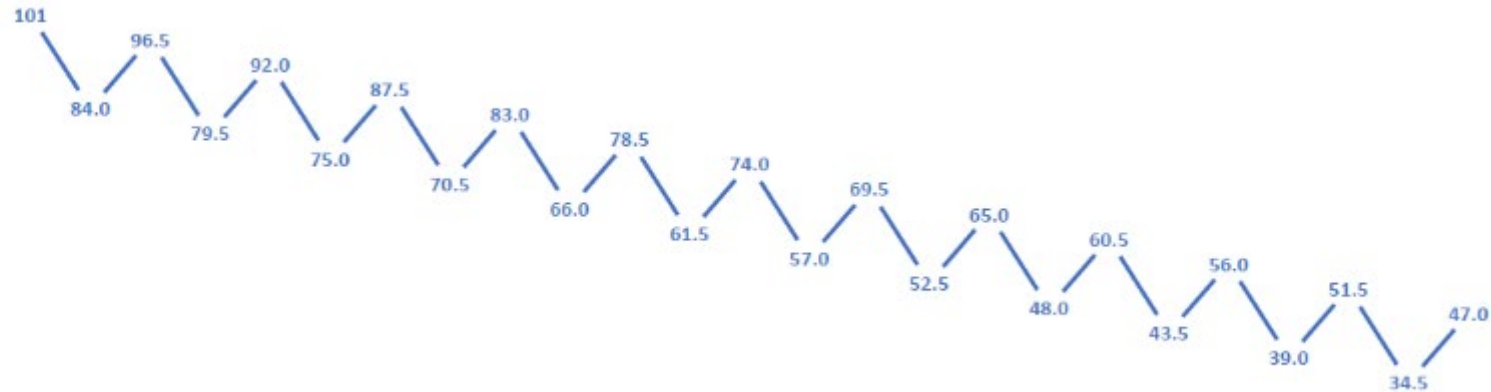
- Operate 7 days/week in one of Metro Transit's highest ridership corridors
- 17 mile round trip
- 8 Electric and 6 Diesel BRT 60' Buses
- 3 door boarding
- 8 Garage chargers at FTH
- 2 On-route chargers at BCTC





On-Route Charging Characteristics

ESTIMATED RANGE (W/12 MIN FAST CHARGE EACH TRIP)



	Start		1		2		3		4		5		6		7		8		9		10		11		12
— Est. Range	101	84.0	96.5	79.5	92.0	75.0	87.5	70.5	83.0	66.0	78.5	61.5	74.0	57.0	69.5	52.5	65.0	48.0	60.5	43.5	56.0	39.0	51.5	34.5	47.0



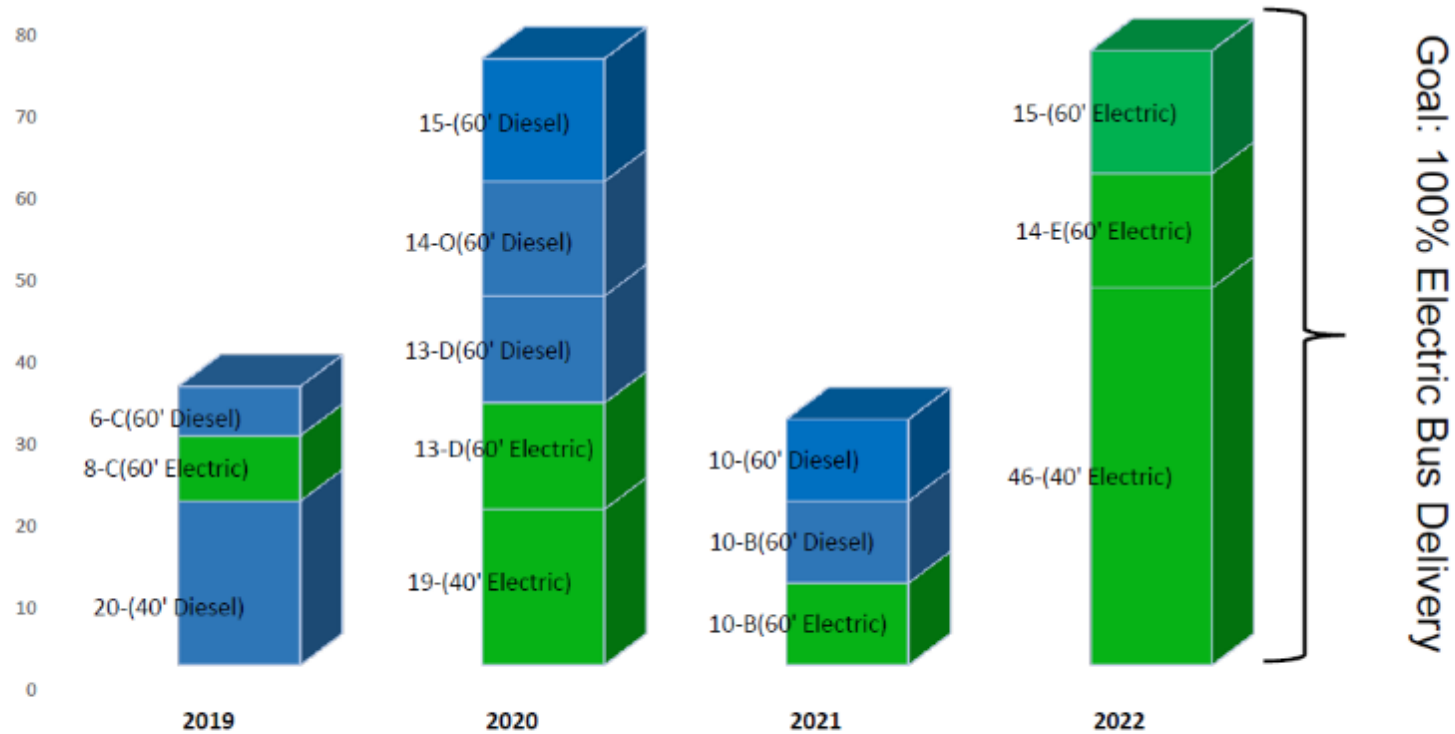
Electric Bus Evaluation

- Metro Transit is in a unique operational position of not having an immediate need for 40' buses and is positioned to gain a better understanding of fleet electrification
 - Procure and Test 19 electric 40' buses
 - Take a measured approach and thoroughly test in Metro Transit's local route service environment
 - Gain a better understanding of operating, infrastructure and training needs
- Metro Transit is implementing all future ABRT routes with a fleet of at least 50% electric buses
 - Procure and Test 30 electric 60' BRT buses
 - Learn the operational characteristics of on-route charging
 - The impact of 3 door bus operations in various weather conditions



Procurements 2019 - 2022

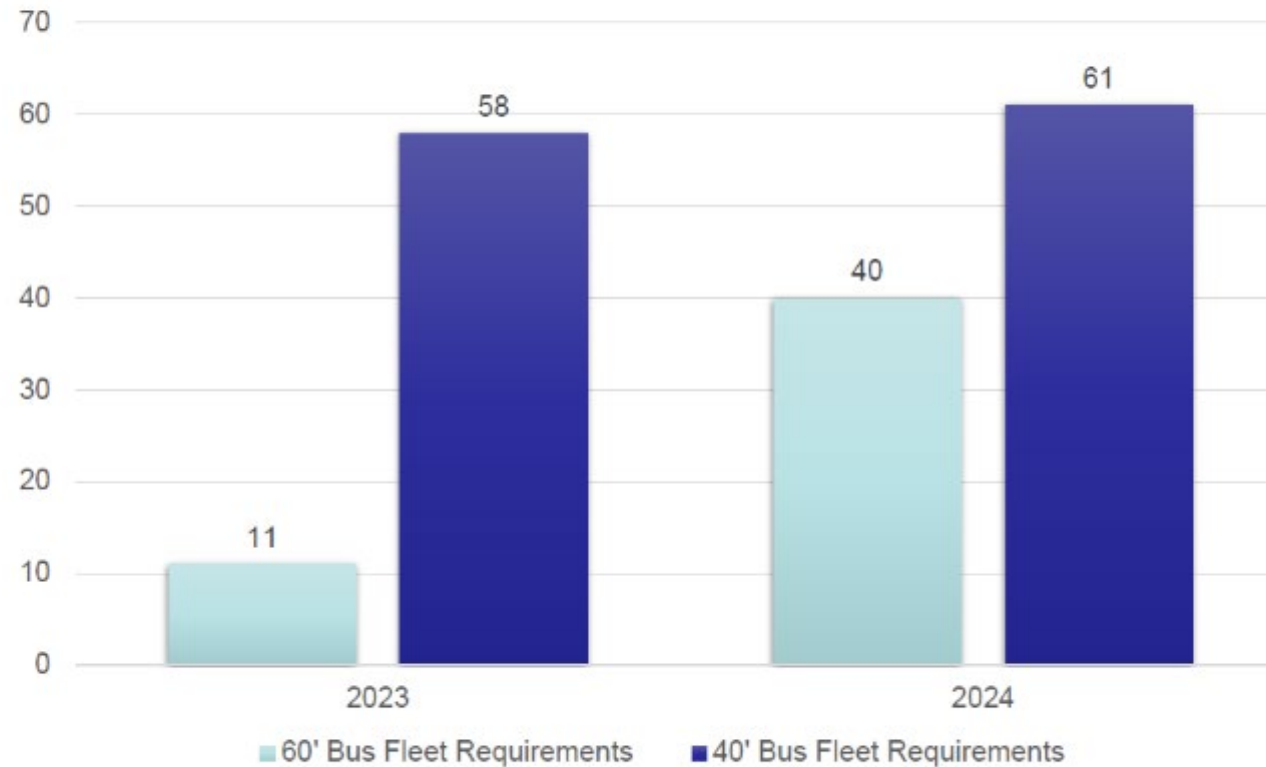
➔ Receive - Test - Evaluate - Decide ➔



Goal: 100% Electric Bus Delivery



2023 and 2024 Fleet Requirements



Questions?

Jed.Falgren@state.mn.us

507-720-8707

Michael.Joyce@state.mn.us

651-233-0518