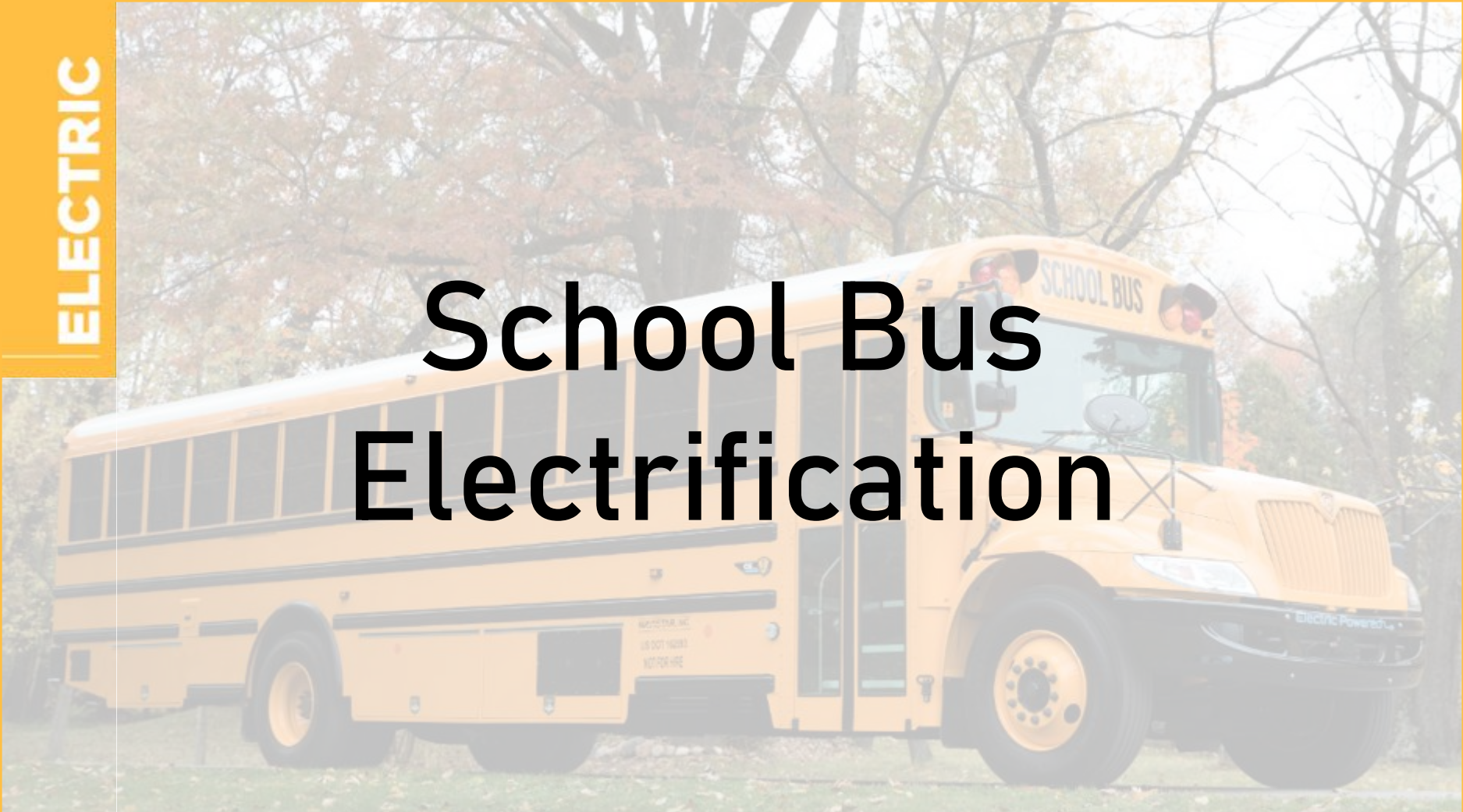


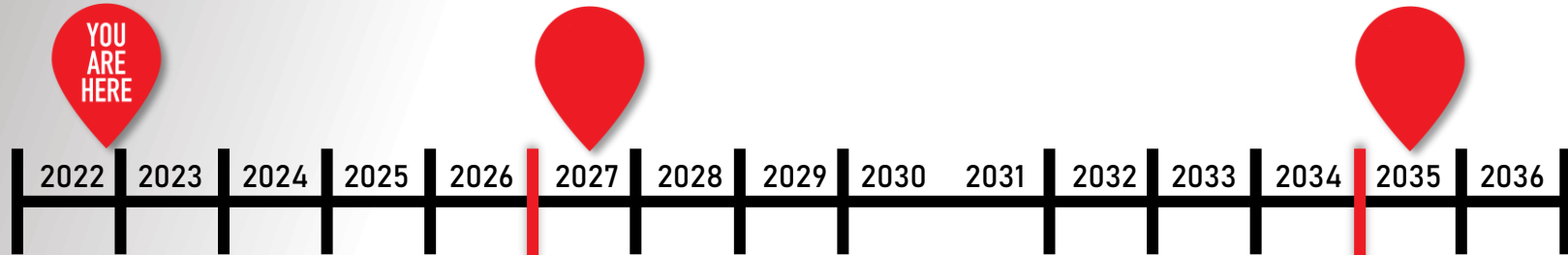
**ELECTRIC**

# School Bus Electrification



# Legislation

➤ Ruling has been made by New York State:

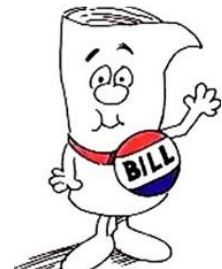


All New NY School bus purchases are to be zero-emission by July 1<sup>st</sup>, 2027

This includes all vehicles used to transport students:

- Minivans (Type O)
- Small Buses (Type A)
- Large Buses (Type C & D)

All NY school buses are to be zero-emission by July 1<sup>st</sup>, 2035



# Before the Bus - Planning



## Year 1 – Exploration and Preparation

Interest in Electric Bus

Route Consultation

Charging Infrastructure Consultation

Grant and Incentive Procurement

Complete Financing Package

*Not necessarily in this order\**

## Year 2 – Construction and Preparation

Maintain Rotation on Existing Fleet

Launch Fleet Management Software

Construction Begins

May Budget Vote

Prepare for Budget Vote

## Year 3 – Implementation and Preparation

Construction Wraps Up

Order Buses

Technician and Driver Education

Receive New Buses

Deploy Electric Buses

# Maintenance

- Maintenance savings – fewer unpredictable expenses

Diesel	Electric
Oil Maintenance	No Engine Oil
Fuel System	No Fuel System
Transmission	No Transmission
Exhaust System	No Turbo, EGR, or Injectors
Air Filter	No Air Filter
DPF and DEF Systems	No Aftertreatment

# Maintenance

- Maintenance – What stays the same?
  - Tire and Suspension Maintenance
  - Bus Body Maintenance
  - Brake Replacement and Maintenance
  - Air System Maintenance
  - Lubrication/Greasing Practices
  - Interior



# The Hold Ups

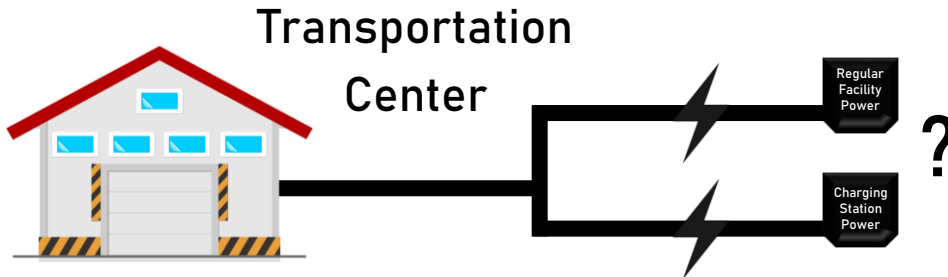
- 25-30% decreased range in cold climates
- May not work on all routes
  - May need to redesign existing routes from scratch
  - May require additional fuel types until technology evolves
- Limited public charging network
  - Not suitable for all sports and/or field trips at this time
- Power grid capabilities
- Higher purchase price
  - \$400,000+ vs. \$150,000 for diesel
- Grants often geared toward older fleets
  - Typically, 2009 and older



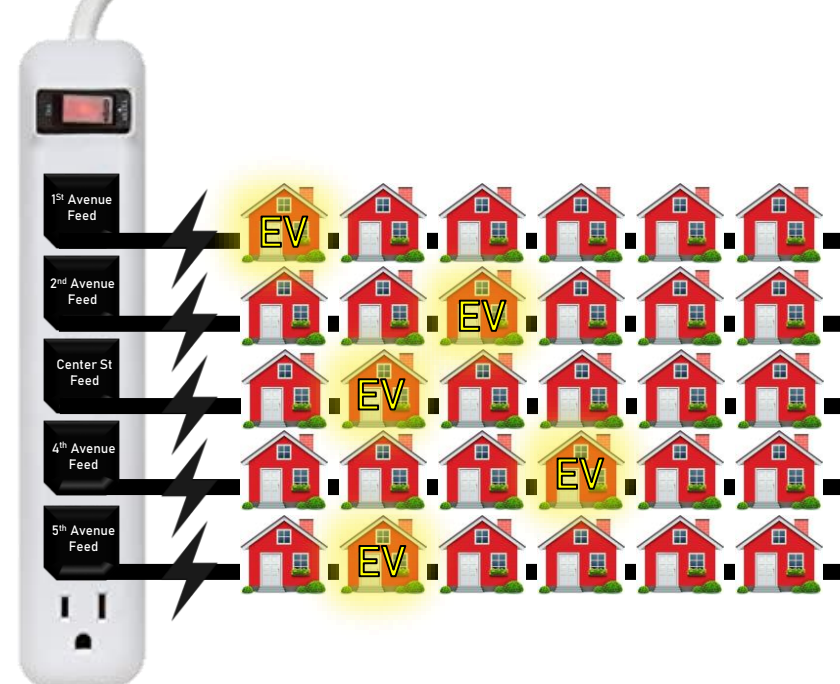
# Before the Bus - Planning

## FACILITY & GRID CAPACITY

- The substation feeding your area does not have an unlimited capacity
- Upgrades will be required in almost every case
- Costs will vary greatly, depending on current capacity and distance to the substation



Distribution Substation

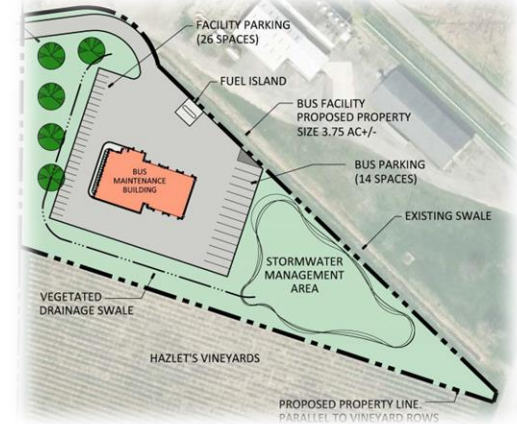


# Before the Bus - Planning

## FUTURE FACILITY CONSIDERATIONS



- Future-proof your district during the planning phase:
  - Expect electric to be part of your future in some capacity
  - Create provisions for future infrastructure
    - i.e., Conduit, sidewalks, islands, etc.





# Before the Bus - Planning

## FUTURE FACILITY CONSIDERATIONS



- Future-proof your district during the planning phase:
- Remember to include other locations within your district:
  - Athletic fields
  - Event centers



# Vehicle-to-Grid

## CHARGING FUNDAMENTALS



### Vehicle-to-Grid (V2G)

- Allows stored power in vehicle batteries to be sold back to the grid in times of increased demand.
- Use Caution:
  - Most batteries will come with a maximum throughput associated with the warranty.
  - Throughput is any power put into and taken out of the battery.
  - Selling power back to the grid will count as throughput and could decrease your warranty period significantly if not managed properly.
  - Selling power back to the grid will discharge the battery and require a new charge cycle to replenish.

# Charging Systems

## CHARGING FUNDAMENTALS



### Level 1

- Provides charging through a 120V AC plug and does not require installation of additional charging equipment.
- **Not suitable for commercial vehicles such as buses.**



### Level 2



- Provides charging through a 240V (Residential) or 208V (Commercial) plug and requires installation of additional charging equipment.
- Commercial Charger
- 3kW – 19.2kW
- Typically, 19.2kW for Commercial
- Suitable for Overnight and Mid-Day Charging in Many Cases.
- Will Charge an electric school bus.

# Charging Systems

## CHARGING FUNDAMENTALS

Level 3



- DC Fast Charge: Provides charging through 208-600V AC input and requires specialized equipment to be installed at your vehicle location.
- Commercial Charger
- Multiple Power Options
- 24kW to 350 kW
- Full Charge in Less Than one Hour
- Will Charge an Electric CE

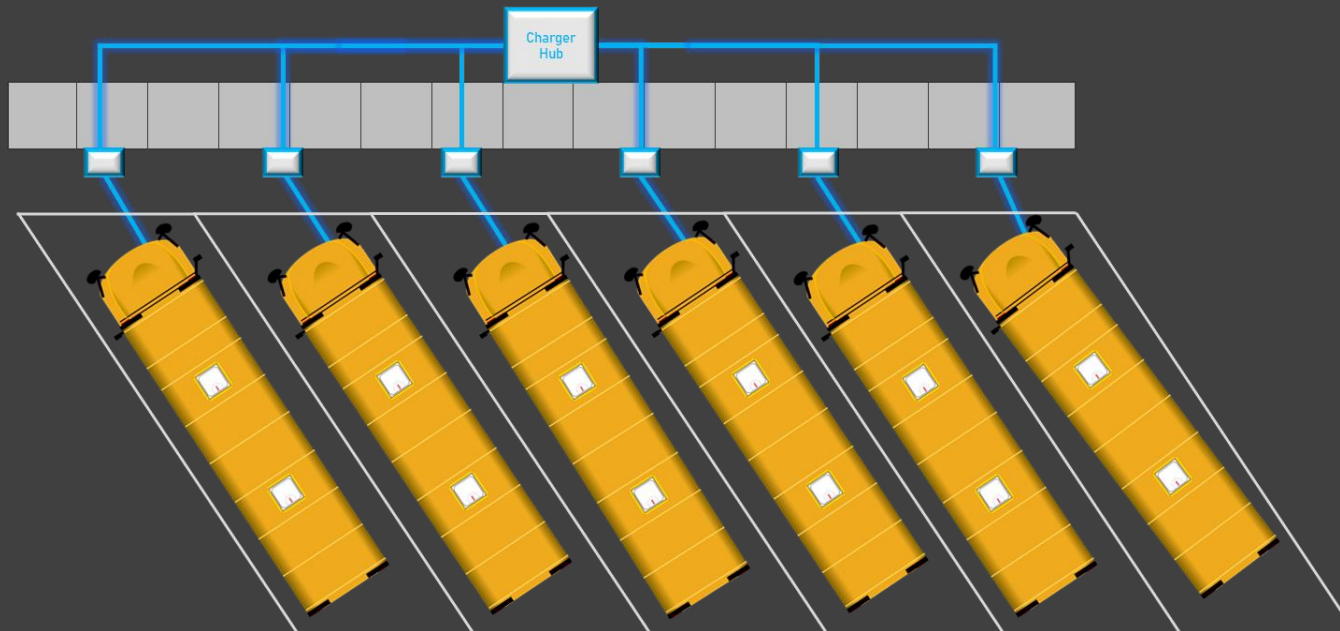


This is the most expensive charger but will be needed in many cases.

# Charging Systems

## CHARGING FUNDAMENTALS

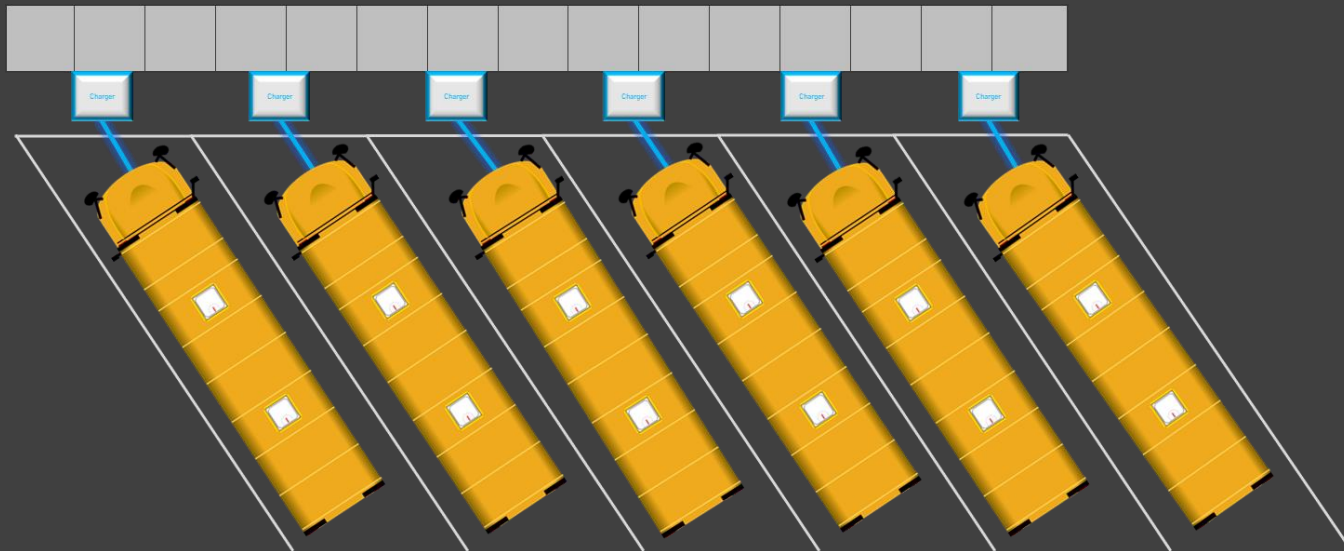
- 2+ to 1 Charging
- Not recommended
- If the base station goes down, it is possible that all associated buses will not charge



# Charging Systems

## CHARGING FUNDAMENTALS

- 1 to 1 Charging
  - Ideal scenario
  - If one charger goes down, only one bus goes down



# Before the Bus - Planning

NYAPT WEBINAR SERIES



➤ For more information about planning for an EV Fleet, please visit the links below to view the three-part NYAPT Webinar Series presented by Cornice Technologies.

➤ Part 1: Planning for an Electric Bus Fleet

➤ <https://vimeo.com/638629580>



➤ Part 2: Understanding Electric Vehicles and Charging Infrastructure

➤ <https://vimeo.com/641929212>



➤ Part 3: Understanding Electricity as a Fuel

➤ <https://vimeo.com/646044340>



# Before the Bus – Funding

YEAR 1 EPA CLEAN SCHOOL BUS PROGRAM



[www.epa.gov/cleanschoolbus](http://www.epa.gov/cleanschoolbus)

## Round 1 Program Rewards:

- Total Awards Nationwide: \$913,132,000
  - Funding for 2,468 buses
  
- New York State Total Awards: \$69,620,000
  - Funding for 184 buses
  
- Total Awards for Customers of Leonard Bus Sales: \$24,005,000
  - Funding for 61 buses



# Before the Bus – Funding

## EPA CLEAN SCHOOL BUS PROGRAM



- What can you do now to prepare for round 2?
  - Manage your fleet as usual until more information is available regarding scrappage requirements for round 2 of funding.
  - Update, renew, or apply for SAM (System Award Management) and UIE (Unique Entity ID / DUNS number). Both registrations can be completed through the SAM website - <https://sam.gov/content/home>
  - Visit the EPA website - [www.epa.gov/cleanschoolbus](http://www.epa.gov/cleanschoolbus) to access all available program information.
  - Sign up to receive the “Clean School Bus Program Newsletter” to receive information as it is released by the EPA for this program.  
<https://lp.constantcontactpages.com/su/dgrhRed/cleanschoolbus>

# Electric Bus Acquisition



- Through Leonard Bus Sales and our partnership with Cornice Technology, the bus quote provided by your Transportation Advisor can include the following to simplify the ordering and launch process:
  - The bus/buses
  - Charging hardware (Not including sitework to feed power to the hardware)
  - Charging software and plans (For battery charging management, all EVSB's require software)
  - Charger maintenance plans (Serviced by Leonard Bus Sales Technicians)
- To assist in a smooth implementation after the bus quote, Leonard Bus Sales and Cornice Technology can help steer initial discussions toward the appropriate next steps.
- Construction may be required as electric vehicles are added to your fleet. Note that all construction related expenses must be managed separately and cannot be included on a quote as part of the bus purchase.
  - Utility coordination and consultation
  - Electrical upgrades and associated expenses
  - Facility/Civil upgrades
  - Contractor bids and award amounts

# Comparison

	IC Bus	Thomas Built Buses	Blue Bird Bus
<b>Model Name</b>	eCE	Jouley C2	Electric Vision
<b>Estimated Range</b>	Up to 200 Miles	Up to 138 Miles	Up to 120 Miles
<b>Capacity Options</b>	Up to 77	Up to 81	Up to 77
<b>Tire Size</b>	11R22.5	11R22.5	11R22.5
<b>Horsepower</b>	Up to 342 HP	Up to 295 HP	Up to 315 HP
<b>Electric Motor</b>	Dana TM4 Sumo	Proterra ProDrive	Dana TM4 Sumo
<b>Transmission</b>	None - Direct Drive	Eaton - 2 Speed	None - Direct Drive
<b>Regenerative Braking</b>	Yes - 3 Levels	Yes - 1 Level	Yes - 1 Level
<b>Battery Type</b>	Lithium Ion	Lithium Ion	Lithium Ion
<b>Charging Ability</b>	AC Level 2	No Level 2	AC Level 2
	DC Level 3 (Fast Charge)	DC Level 3 (Fast Charge)	DC Level 3 (Fast Charge)
<b>Braking</b>	Air Disc Only	Air Disc	Air Disc Optional
<b>Service At</b>	IC Bus Dealer	Thomas Bus Dealer	Cummins

# CE Bus

## IC eCE SPEC SHEET



Capacity

**29-70 Passengers**

*Floorplan configurations vary based on seat spacing and wheelchair positions.*

Wheelbase Options

**217" - 276"** (Configuration May Vary)

*Capacity and battery configuration options are closely related.*

GWR

**31,000 - 33,000 lbs.**

*Electric buses are comparable in weight to a standard bus.*

Safety

**Standard Electronic Stability Control**

*Collision Mitigation is not available at this time but is expected to be in the future*

Rear Axle Ratio

**5:57 or 6:83**

*Diesel buses typically run a 6:17 or 6:50 gear ratio*

Comfort

**Standard Electric Convection Heating**

*Optional fuel-fired heater not currently available in NYS*

Comfort

**Optional Air Conditioning**

*Not available if the bus has a fuel-fired heater*

Charging

**Charging ports in either the front or rear**

Safety

**Sound Generator**

*Below 20MPH to indicate bus movement.*

Front Axle

**Meritor: 10,000 lbs.**

Power

**Direct Drive Dana Motor**

Braking

**Air Disc Brakes Only**

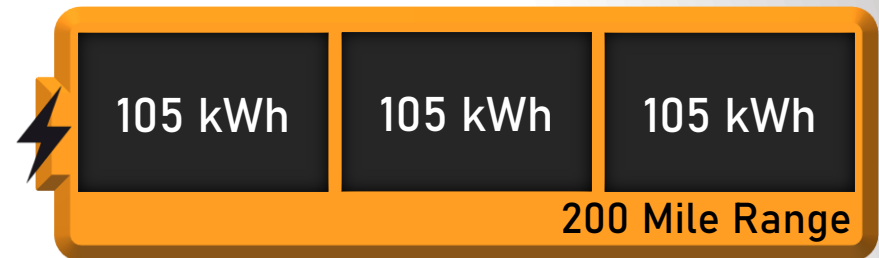
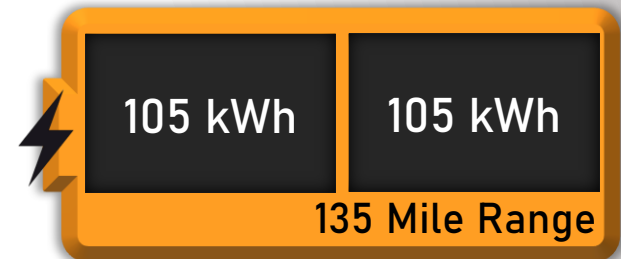
The standard electric CE bus is equipped with all the comforts and conveniences you are used to seeing.

# eCE Spec Sheet



- Battery Thermal Management System (BTMS) maintains optimal temperature for range and charging
- 650 volt, 6-phase permanent magnet motor
- State-of-the-art instrument cluster
- Three levels of regenerative braking
- Level II AC and DCFC charging ready
- Peak Power: 335HP
- Continuous Power: 255HP
- Vehicle to grid (V2G) ready

Two battery options offer the longest single-charge range in the industry



*Range is approximate and will vary based on the driver, terrain, temperature, and a variety of other factors.*

# IC eCE

## BUS WARRANTY

- Drive Charger, Charging Cables, and Inverters
  - 5 Years/100,000 Miles
- HV Steering Pump, Air Compressor
  - 1 Year/Unlimited
- Standard IC Chassis Warranty
- Drive Battery
  - 8 Years/175,000 Miles
- Drive Motor
  - 5 Years/100,000 Miles

**LEONARD**  
Bus Sales Inc



# Summary



- Designate an EV Implementation Team
  - Superintendent, Business Office, Buildings & Grounds, Transportation Department, Bus Distributor
- Watch the 3-Part Webinar series
- Be aware of “pop-up” companies making offers that sound too simple
- Begin researching architectural firms for EV understanding and capabilities
  - Interview your architects – very few are experienced in this area
- Contact your utility provider to determine facility capabilities
- Understand what funding options are available
  - How do we present this to voters?
- Look long term – do not hyperfocus on the immediate future

**ELECTRIC**



**eCE**