

# The electric bus revolution

The advantages and challenges faced by cities adopting electric, low emission buses, vans and more, in Brampton, Edmonton, Guelph, Halifax, Montreal, Oakville, Toronto, Vancouver, Victoria and beyond.

Thurs Dec 10, 2020 | 1:30 AM - 2:30 PM ET



CLIMATE SOLUTIONS WEBINAR SERIES



## **BRUCE (BF) NAGY CLIMATE SOLUTIONS**

- Columnist & features
- Consultant
- Author 200+ articles on climate solutions
- Author The Clean Energy Age, Rowman & Littlefield





#### SOLUTIONS, PRIORITIES, CASE EXAMPLES



#### **BUILDINGS**

**NEW & RETROFIT TECHNOLOGY & PROGRAMS** 



#### **TRANSPORTATION**

**ELECTRIC FLEETS, INFRASTRUCTURE & TRANSIT VEHICLES** 



#### POWER GENERATION & STORAGE

TECHNOLOGY, PLANNING & ECONOMICS

#### **TODAY**

1. MOSTLY ELECTRIC BUSES ADVANTAGES & CHALLENGES

2. MOSTLY CANADIAN CITIES

3. MYSTERY GUEST FOR A FEW MINUTES

4. WILL TOUCH ON INTERNATIONAL & USA SCENE, OTHER CITY FLEET VEHICLES, HYBRID BUSES, HYDROGEN BUSES.

5. QUESTIONS

40 [1]: [1]: 59.50

#### THE ELECTRIC BUS REVOLUTION

ACCORDING TO BLOOMBERG
NEW ENERGY FINANCE, AT
THE BEGINNING OF 2018
THERE WERE 3 MILLION
CITY BUSES IN OPERATION
WORLDWIDE.

IN MAY 2019 BLOOMBERG
SAID THE SHARE OF ELECTRIC

BUSES WAS ABOUT 18% OF THE TOTAL MUNICIPAL BUS FLEET.



ACCORDING TO THE INTERNATIONAL ENERGY AGENCY *GLOBAL EV OUTLOOK 2019,*THE NUMBER OF ELECTRIC BUSES IN 2018 WAS EVEN HIGHER, APPROXIMATELY 460,000 ELECTRIC BUSES GLOBALLY.

NOW IT IS QUICKLY RAMPING HIGHER AGAIN.

#### CANADA'S ELECTRIC BUS REVOLUTION

**TORONTO** 





MONTREAL

**BRAMPTON** 





**VANCOUVER** 

**VICTORIA** 

GUELPH







#### **USA**



LOS ANGELES **NEW YORK** CHICAGO, ILLINOIS **MASSACHUSETTS ALLEGHENY COUNTY (PITTSBURGH)** MINNEAPOLIS METRO TRANSIT **PENNSYLVANIA WASHINGTON D.C. NEW JERSEY COLORADO** SENECA, SOUTH CAROLINA KING COUNTY, WASHINGTON ALBUQUERQUE, NEW MEXICO

#### INTERNATIONAL

**MOSCOW** 

**SHENZHEN** 

LONDON

**BERLIN** 

**PARIS** 

**AMSTERDAM** 

**CAPE TOWN** 

CHILE

AND MANY OTHERS











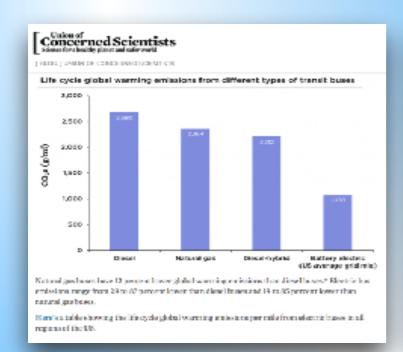




#### ADVANTAGES - ELECTRIC VS DIESEL BUS

- GREENHOUSE GAS EMISSIONS REDUCED
   FOR HEALTHIER PLANET
- DIESEL FUMES ELIMINATED HEALTHIER PEOPLE: DRIVERS, PASSENGERS, CHILDREN, PASSERSBY, TRANSIT WORKERS
- COST SAVINGS ON FUEL
- COST SAVINGS ON MAINTENANCE
- RELIABILITY INCREASED BY ABOUT 10%
- COLD WEATHER STARTUP ADVANTAGES
- SNOWY WEATHER ADVANTAGE
  - -TORQUE, MULTIPLE ENGINES
- LIFECYCLE COST REDUCTION DISCUSSION

- PUBLIC HEALTH COST SAVINGS
- NOISE POLLUTION REDUCTION
- PASSENGER COMFORT INCREASED GRIDLOCK MAY BE REDUCED
- REDUCTION OF LEAKED TOXIC FLUIDS FROM COMBUSTION ENGINES
- INTO SOIL & POTENTIALLY AS RUNOFF INTO FRESHWATER BODIES
- REDUCTION OF VENTILATION EQUIPMENT INSIDE GARAGES
- AUTONOMOUS TECH EXPECTED TO ENHANCE SAFETY
- DATA COLLECTION ADVANTAGES & DISADVANTAGES
- GRANT FUNDING MORE AVAILABLE







#### **CHALLENGES - ELECTRIC VS DIESEL BUS**

- UPFRONT COST PREMIUM FOR BUS
- UPFRONT COST OF CHARGING INFRASTRUCTURE
- CHARGING INFRASTRUCTURE COMPLEXITY
- LONGER REFUELLING TIME
- ROUTING CHANGES DISCUSSION

- TRAINING REQUIREMENTS, DRIVING, CHARGING, MAINTENANCE
- INDUSTRY STANDARDS & INTEROPERABILITY
- DATA COLLECTION ADVANTAGES & DISADVANTAGES
- GRANT FUNDING INADEQUACIES











#### **TORONTO**

#### TORONTO TRANSIT COMMISSION

- 525,470,000 PASSENGER TRIPS IN 2019
- 174 BUS & STREETCAR ROUTES TOTAL 7000+ KM
- DOES NOT INCLUDE SUBWAY, LRT & WHEELTRANS
- 2096 BUSES 40' & 60' DIESEL, NATGAS, HYBRID, ELECTRIC

#### **CURRENT EVALUATION PROJECT**

- 60 FULLY ELECTRIC BUSES
- 20 FROM NEW FLYER AT ARROW RD GARAGE
- 20 FROM BYD AT EGLINTON GARAGE (AC POWER)
- 20 FROM PROTERRA AT MOUNT DENNIS GARAGE
- HEAD-TO HEAD TECHNOLOGY/VENDOR EVALUATION
- EXTENSIVE DOCUMENTATION, DATA COLLECTION & ANALYTICS





BEM CASE, TTC HEAD OF VEHICLE PROGRAMS, HAS INFORMALLY AGREED
TO JOIN CLEAN AIR PARTNERSHIP AS A GUEST PRESENTER DURING 2021
TO REPORT ON CONCLUSIONS & PROGRESS





#### 60 ELECTRIC BUSES & CHARGING GEAR

THE 60 ALL-ELECTRIC BUSES REQUIRED AN INVESTMENT
OF \$140 MILLION BY THE CITY OF TORONTO AND
THE GOVERNMENT OF CANADA THROUGH THE
FEDERAL PUBLIC TRANSIT INFRASTRUCTURE FUND.

TRUDEAU/MCKENNA: "TARGET OF 5000 ELECTRIC
BUSES IN CANADA'S FLEETS OVER THE NEXT FIVE YEARS."

ALSO \$20 MILLION FOR 70 NEW WHEEL-TRANS BUSES DELIVERED BETWEEN 2022 AND 2023.

UNDER TRANSFORM**TO**, 100% OF VEHICLES
IN TORONTO MUST TRANSITION TO LOW-CARBON
ENERGY BY 2050.

"ELECTRIFICATION IS THE FUTURE OF PUBLIC TRANSIT

AND I'M PROUD THAT THE TTC HAS BEEN ESTABLISHED AS

AN INDUSTRY LEADER." -TTC CHAIR JAYE ROBINSON.







#### **TORONTO**



#### TransformTO Target:

Reduce greenhouse gas (GHG) emissions 80% by 2050



#### TTC Target:

Steady-state procurement of zero-emissions buses by 2025 in line with the C40 Fossil-Fuel-Free Streets Declaration, and an all zero-emissions bus fleet by 2040.

HOLD FLESH STEELS SAIL ASES

ELECTRIC BUSES ELIMINATE 150 TONS OF GREENHOUSE GAS PER YEAR PER BUS.

26 BUSES CAN CHARGE AT A TIME AT TWO
GARAGES 10 AT A TIME AT THE THIRD GARAGE

ALL THREE HAVE 4 MEGAWATTS OF BATTERY
STORAGE. ONE HAS A 6 MEGAWATT BACKUP
NATURAL GAS GENERATOR IN CASE THE GRID
GOES DOWN.

ELECTRIC BUSES ARE PUT ON A LONG ROUTE ALL DAY UP TO 250 KILOMETRES.

THEN THEY ARE CHARGED FOR ABOUT AN HOUR AND PUT BACK OUT AGAIN FOR ABOUT ANOTHER 80 KILOMETRES. TOTAL 10–15 HOURS.

ALL 60 BUSES ARE IN REGULAR OPERATION

#### **TORONTO**

#### **BEM CASE:**



THE MORE YOU RUN AN ELECTRIC BUS THE FASTER IT PAYS BACK, MEASURED AS COST PER KILOMETRE PER PASSENGER.

TRAINING FOR DRIVERS, CHARGING AND MAINTENANCE IS NOT AS BIG A LEAP FOR US BECAUSE OUR OLDER HYBRIDS ARE ESSENTIALLY ELECTRIC VEHICLES.

INTEROPERABILITY IS A MUST. SOME INFRASTRUCTURE AT SOME POINT WILL BE SHARED BY TTC, MYWAY (MISSISSAUGA), AND ONROUTE (ONTARIO).

OUR IMPACT STUDY IDENTIFIES NOISE REDUCTION AS A SIGNIFICANT BENEFIT.



WE THINK THE TOTAL COST OF DIESEL IS UNDER-APPRECIATED...LIFECYCLE COMPARISONS SHOULD INCLUDE DIESEL FUEL ISLANDS, PUMPING STATIONS, OTHER FLUIDS LIKE ENGINE OIL & COOLANT...WE ARE STARTING TO TRY TO QUANTIFY THE COST OF DIESEL LEAKS OVER 70 YEARS, UNBURNED FUEL, TRANSMISSION FLUID, ENGINE OIL, COOLANT.

THERE WILL BE BIG FUEL SAVINGS, AND EVEN IF WE INCLUDE THE UP-FRONT CAPITAL COSTS, AT SOME POINT ELECTRIC BUSES WILL LIKELY HAVE A LOWER LIFE CYCLE COST THAN HYBRIDS, DIESELS, AND NATURAL GAS VEHICLES.

TRANSIT AGENCIES WITH THE LONGEST ELECTRIC BUS HISTORIES ARE SAYING 25% LESS MAINTENANCE COST (SAVINGS ARE HIGHER WITH SMALLER ELECTRIC VEHICLES BECAUSE BRAKES & ENGINES ARE PROPORTIONALLY MORE SIGNIFICANT).



# DESI, PLEASE SWITCH AUDIO ONLY TO TYLER SEED FROM OPG

## **Tyler Seed**Business Development Analyst



#### **Ontario Power Generation**

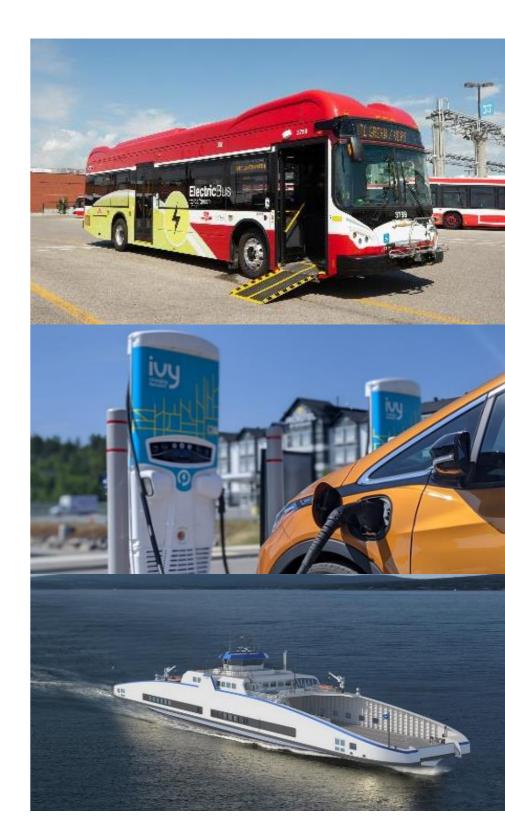
At OPG we design, build, operate and maintain high-power charging infrastructure that not only reduces costs, but also emissions.

As a global climate change leader and energy innovation company, OPG's electrification expertise is unparalleled.

From growing what will be Ontario's largest electric vehicle public charging network, to the electrification of one of the province's largest bus fleets, we are helping change the way we travel.

#### **Current OPG Electrification Projects**

- TTC eBus charging infrastructure
- Ivy EV Fast Charger Network (in partnership with Hydro One)
- Amherst and Wolfe Island electric ferry charging infrastructure



# A province-wide approach to electrify transit

Ontario Power Generation is working with agencies to efficiently, reliably, and cost-effectively provide the charging infrastructure that Ontario's transit agencies require as they move to electrify.

As the largest utility in Ontario we're best positioned to coordinate a provincewide procurement and construction program to provide the best possible value to Ontarian riders and ratepayers ,while decarbonizing transit. ~15%

in infrastructure cost savings through aggregated procurement

5-15%

in infrastructure costs offset by energy market revenue

~40%

time savings in procurement

# DESI, PLEASE SWITCH AUDIO BACK TO BRUCE

#### **VANCOUVER**

IN FEBRUARY 2020 TRANSLINK MAYORS IN GREATER VANCOUVER VOTED FOR AN AGGRESSIVE LOW CARBON STRATEGY.

TRANSLINK WILL CONVERT MORE THAN HALF OF ITS ENTIRE DIESEL BUS FLEET TO BATTERY ELECTRIC BUSES IN 10 YEARS. GREENHOUSE GAS EMISSIONS WILL BE CUT BY 44% BY 2030.

TRANSLNK WILL ADD 635 ELECTRIC BUSES, MULTIPLE CHARGERS ACROSS METRO VANCOUVER. 64% OF THE TOTAL TRANSIT BUS FLEET WILL BECOME ELECTRIC IN THOSE FIRST10 YEARS, DIESEL BUSES REPLACED BY ELECTRICS.

THE REMAINDER WILL THEN BE REPLACED BY 2050 OR SOONER.

MARPOLE TRANSIT CENTRE WILL BE A 100% ELECTRIC BUS DEPOT WITH 280 CHARGES.

UP-FRONT PREMIUM: \$447 MILLION INCLUDING VEHICLES AND INFRASTRUCTURE. DESPITE THE UPFRONT COSTS, SAVINGS ARE EXPECTED IN THE LONG RUN.





#### **BRAMPTON**

IN JULY 2019 BRAMPTON PURCHASED EIGHT ELECTRIC BUSES & FOUR CHARGING SYSTEMS, EACH OF WHICH IS EXPECTED TO CUT GREENHOUSE GAS EMISSIONS 235 TONES EVERY YEAR, ACCORDING TO MAYOR PATRICK BROWN.



A YEAR LATER THE CITY ANNOUNCED

PLANS TO BUILD A NEW TRANSIT GARAGE,

DESIGNED TO HELP SUPPORT A FULLY

ELECTRIC ZERO-EMISSION BUS FLEET.

ITS NOT CLEAR IF THE CITY IS

COMMITTED TO PHASING OUT OTHER

KINDS OF BUSES.

BRAMPTON'S GREENHOUSE GAS
REDUCTION TARGET IS 80% BY 2050.

#### YORK REGION

IN JUNE 2019 YORK REGION PURCHASED SIX ELECTRIC BUSES FROM CANADIAN MANUFACTURERS NEW FLYER AND NOVA BUS.

AN OVERHEAD CHARGING STATION IS LOCATED AT NEWMARKET TERMINAL. THE BUS WILL CHARGE UNDERNEATH THE OVERHEAD STATION BEFORE PICKING UP PASSENGERS AT THE PLATFORM.



THE REGION EXPECTS THE PILOT TEST WILL SHOW THAT ELECTRIC BUSES CAN:

- REDUCE FUEL AND MAINTENANCE COSTS
- REDUCE NOISE
- REDUCE EMISSIONS

YORK REGION'S GOAL IS TO REACH ZERO GREENHOUSE GAS EMISSIONS BY 2051.

#### **CUTRIC**

GOVERNMENTS FROM THE THREE PREVIOUS SCREENS, VANCOUVER
TRANSLINK, BRAMPTON AND YORK REGION WERE ALL SUPPORTED IN
THEIR PILOT TESTS BY THE CANADIAN URBAN TRANSIT RESEARCH &
INNOVATION CONSORTIUM (CUTRIC). CUTRIC IS A NON-PROFIT THAT
HELPS CITIES WITH GROUP PROCUREMENT, SECURING FUNDING,
DATA ANALYSIS AND TECHNOLOGY INTEGRATION RELATED TO
ZERO EMISSIONS TRANSIT.



IN ADDITION TO HELPING WITH SMALLER PILOT TESTS CUTRIC COLLECTS AND ANALYZES LARGE QUANTITIES OF DATA FROM TORONTO TRANSIT AUTHORITY, SOCIÉTÉ DE TRANSPORT DE MONTRÉAL, EDMONTON TRANSIT SERVICE AND OTHERS. IT THEN PROVIDES NATIONAL REAL-TIME ANALYSIS OF E-BUS PERFORMANCE, CHARGING PATTERNS, ENERGY AND ELECTRICITY LOADS, AND ENERGY INTENSITY, TO HELP CITIES AND TRANSIT AGENCIES MAKE EMPIRICALLY-SOUND DEPLOYMENT CHOICES, UNDER THE BANNER THE ACES BIG DATA TRUST.

WHILE WORKING WITH CITIES AND BUS MANUFACTURERS ON PILOT TESTS CUTRIC HAS ESTABLISHED BEST PRACTICES RELATING TO STANDARD TECHNICAL PROTOCOLS AND INTEROPERABILITY BETWEEN VENDOR TECHNOLOGIES THROUGH THE PAN-CANADIAN ELECTRIC BUS DEMONSTRATION AND INTEGRATION TRIAL.

#### **ELECTRIC EDMONTON - 40 BUSES**

IN 2018 EDMONTON DECIDED TO PURCHASE 40 ELECTRIC BUSES WITH FUNDING HELP OF \$21.5 MILLION FROM THE FEDERAL GOVERNMENT THROUGH ITS PUBLIC TRANSIT INFRASTRUCTURE FUND. THE PROVINCE IS CONTRIBUTING \$10.8 MILLION THROUGH ITS GREENTRIP PROGRAM. THE CITY IS PROVIDING \$10.8 MILLION.

MAYOR DON IVESON SAID IF IT GOES WELL HE'D LIKETO SEE THE ENTIRE FLEET CONVERTED TO ELECTRIC WITHIN 10 OR 20 YEARS.

ALL 40 BUSES ARE NOW IN SERVICE AND EDMONTON USES

OVERHEAD CHARGERS INSIDE THE GARAGE, WHICH HELPS SAVE
FLOOR SPACE.

THE 40 BUSES ARE ALL FROM PROTERRA, WHICH CLAIMS THEY
ARE WINTER COMPATIBLE, HAVE A RANGE UP TO 350
KILOMETRES ON A SINGLE CHARGE, AND COST ROUGHLY 30%
LESS TO SERVICE AND MAINTAIN THAN CURRENT DIESEL BUSES.





#### MONTREAL

#### MONTREAL WILL HAVE MORE THAN 40 ELECTRIC BUSES BY THE END OF NEXT YEAR:

- 7 FAST-CHARGING NEW FLYER ELECTRIC BUSES.
- 30 LONG-RANGE ELECTRIC BUSES.
- 4 MIDIBUSES (30 FEET), A MID-SIZE VEHICLE BIGGER
   THAN A MINIBUS YET SMALLER THAN A STANDARD BUS.
- 2 PARA-TRANSIT ELECTRIC MINIBUSES.

## BY 2025, ALL NEW BUS ORDERS WILL BE ELECTRIC.

#### **EXPECTED BENEFITS:**

- REDUCE GHG EMISSIONS
- SUPPORT GROWTH OF QUÉBEC INDUSTRIES
- REDUCE DEPENDENCE ON OIL
- USE CLEAN (NON-POLLUTING) QUEBEC ENERGY





#### MONTREAL

A FEW ARE IN SERVICE BUT MOST OF THE ACTION CURRENTLY IS PREPARING THE STINSON BUS GARAGE.

MORE THAN 50 KILOMETRES OF ELECTRICITY, FIBRE OPTIC AND NETWORK CABLES.

53 JUNCTION BOXES CONNECT THE BUSES TO THE CHARGERS. CONNECTION CABLES RUN BETWEEN THE UNITS AND THE BUSES.

EIGHT PANTOGRAPHS HAVE BEEN INSTALLED.

FOR BUS DRIVERS AND MAINTENANCE EMPLOYEES, IT IS A NEW KIND OF VEHICLE. THEY ARE BEING TRAINED ON DRIVING AND RECHARGING.

THE SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) SYSTEM, MEANS CHARGE STATUS CAN BE MONITORED AND CONTROLLED REMOTELY.







A CHARGE INDICATOR
SHOWS THE BUS IS
LESS THAN 50%
CHARGED



#### MONTREAL

THERE ARE THE 12 CHARGERS THAT RECHARGE BUSES IN THE FOUR MAIN ELECTRICALLY EQUIPPED AISLES.

BUS CHARGERS CONVERT ALTERNATING CURRENT (AC) TO DIRECT CURRENT (DC) AND ADJUST THE VOLTAGE.

AN ENHANCED AIR CONDITIONING SYSTEM IS NEEDED AS THE CHARGERS EMIT QUITE A BIT OF HEAT.

THE DASHBOARD DISPLAY SCREENS SHOW CHARGE STATUS, LOW-VOLTAGE (24V) BATTERY VOLTAGE, 12V CIRCUIT VOLTAGE, OPERATIONAL STATE OF DIFFERENT BATTERY GROUPS, AND REAL-TIME CONSUMPTION.

A SIGNAL CONCENTRATOR COLLECTS INFORMATION SUCH AS ALARM DATA, ELECTRICAL DATA AND CHARGE DATES FROM THE CHARGERS AND SENDS THEM TO THE SCADA SYSTEM.



#### **OAKVILLE**

BATTERY-ELECTRIC BUSES WILL REPLACE 57 OF THE TOWN'S DIESEL BUSES OVER THE NEXT SIX YEARS, AND 16 ADDITIONAL NEW ELECTRIC BUSES WILL BE ADDED TO THE FLEET.

THE FEDERAL GOVERNMENT CONTRIBUTED \$26.5 MILLION, THE PROVINCE \$22.1 MILLION, CITY OF OAKVILLE \$17.6 MILLION.

WILL ALSO FUND PROJECTS TO MODERNIZE THE TRANSIT EXPERIENCE:

- WIFI ON ALL BUSES
- A SMART PHONE APP THAT WILL GIVE RIDERS ACCESS TO A BUS LOCATION, ARRIVAL, DEPARTURE TIMES. WILL ALSO INTEGRATE WITH THE METROLINX TRIPLINX PLANNER
- FOR RIDERS USING SPECIALIZED TRANSIT SERVICES, THERE WILL BE ON-DEMAND SCHEDULING SOFTWARE AND A REAL-TIME TRIP MANAGEMENT MOBILE APP.
- SAFETY AND ACCESSIBILITY IMPROVEMENTS TO 249 BUS STOPS.





REPORT: AS WELL AS
ELIMINATING EMISSIONS,
ELECTRIC BUSES TRAVEL MORE
QUIETLY, HAVE REDUCED
MAINTENANCE COSTS AND
WILL SAVE THE TOWN ABOUT
\$120,000 PER BUS OVER
A 14-YEAR LIFE SPAN.

#### **HALIFAX**

IN MAY HALIFAX COUNCIL VOTED TO ADD 210 ELECTRIC BUSES TO ITS FLEET AS PART OF THE BUS RAPID TRANSIT STRATEGY AT A COST OF \$780 MILLION BY 2028. IT WILL RESULT IN 50% OF HALIFAX BUSES BEING ELECTRIFIED BY 2028.

BUSES WILL ARRIVE IN TWO TO THREE YEARS, IN STEP WITH THE EXPANSION AND ADDITION OF CHARGING STATIONS AT THE RAGGED LAKE TRANSIT CENTRE.

THE FOUR DESIGNATED ROUTES ARE PART OF A RAPID-TRANSIT STRATEGY WITH DEDICATED ROUTE LANES.

EACH ELECTRIC BUS WILL PROVIDE SIGNIFICANT FUEL SAVINGS AND \$24,000 IN SAVINGS PER YEAR DUE TO REDUCED MAINTENANCE COSTS.

FUNDING IS BEING SOUGHT THROUGH THE FEDERAL
GOVERNMENT PUBLIC TRANSIT INFRASTRUCTURE FUND AND
THE GREEN INFRASTRUCTURE FUND, AND ALSO FROM THE
PROVINCE.





#### **ELECTRIC VANS & LIGHT TRUCKS**



We Delive Fix You



#### **ELECTRIC 3 WHEEL DELIVERIES**



#### **ELECTRIC VANS & LIGHT TRUCKS**



#### **TESLA CYBERTRUCK - PLANT IN TEXAS**



## FORD F-150 - PLANT IN MICHIGAN



#### **ELECTRIC VANS & LIGHT TRUCKS**









#### **ELECTRIC FLEETS**







UPS 300
FRITO LAY 280
LA POLICE 100
VANCOUVER 100+

DHL 45
PACIFIC GAS & ELECTRIC HUNDREDS





### **BIG ELECTRIC VEHICLES**

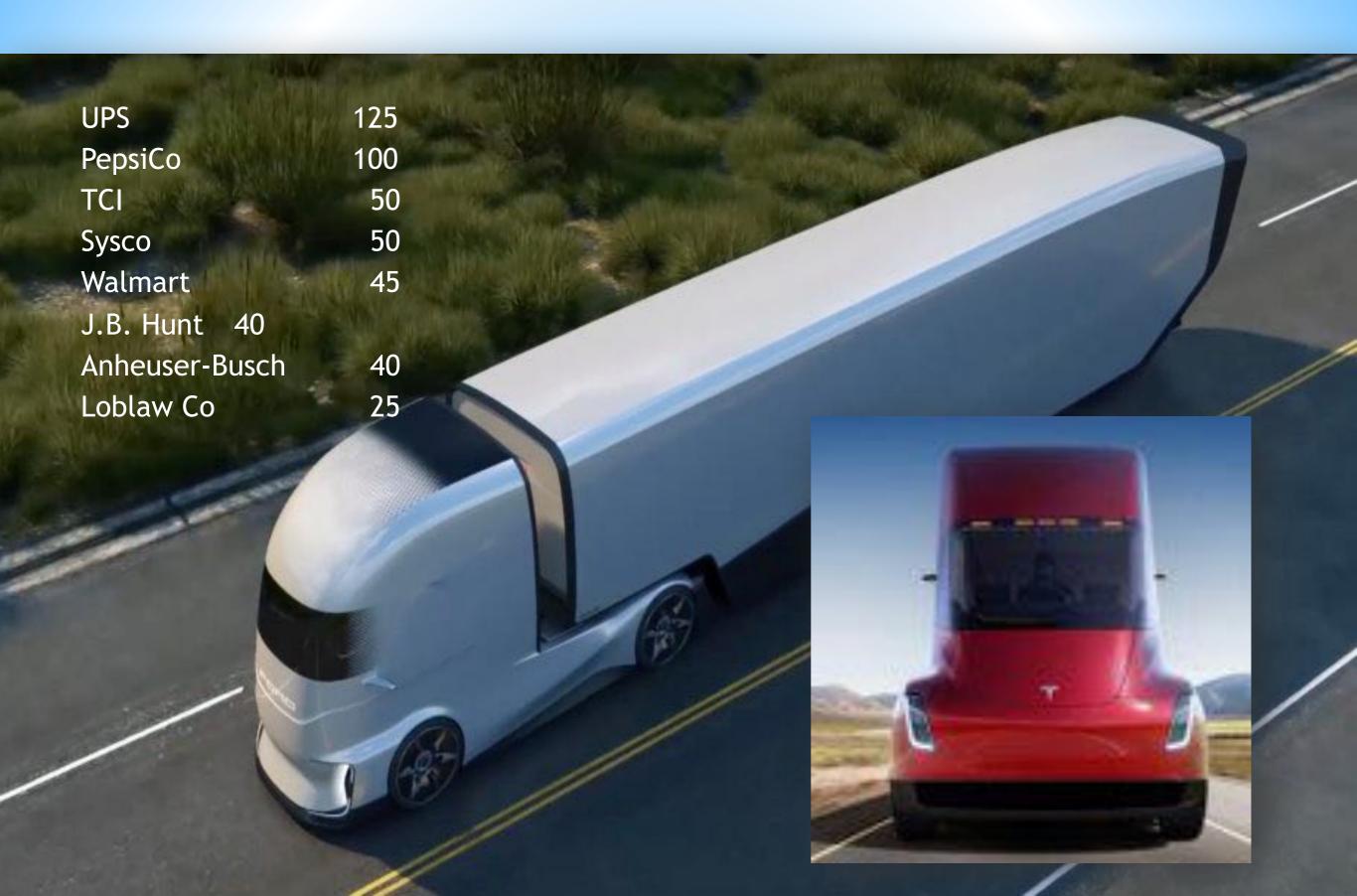








## FREIGHT TRUCKS



### FLEET VEHICLES - NY CITY UPDATE



591 FULLY ELECTRIC VEHICLES (WITH HYBRIDS 1919)
690 CHARGE STATIONS, 86 SOLAR CARPORTS
GHG OF ENTIRE FLEET CUT BY 50% BY 2025 (2000 FULLY ELECTRIC)
SAVING 80% ON FUEL, 65% ON MAINTENANCE

#### FLEET VEHICLES - CANADIAN CITIES?







CANADA'S CITY VEHICLE FLEETS - WEBINAR IN 2021 ?
DESI WILL BE SURVEYING YOU.

## It's time for an action plan.



This year, ask for your personal Top 10 List.

# Energy Age

A GVIDE TO BEATING CLUANTE GLANGE

BE NOSY

solutions priorities success stories

Top 10 lists of climate actions

## lt's time for an action plan.



TOP 10 LISTS

Home Owners

Government People & Political Leaders

Business Managers & Executives

Investors & Entrepreneurs

Media, Teachers, Speakers & Entertainers

Salespeople, Servers, Retail & Customer Service

**Urban Planners** 

Engineers, Architects & Tradespeople

Builders & Developers

Medical Professionals

Transportation People

Manufacturing & Agricultural Teams

This year, ask for your personal Top 10 List.



## **QUESTIONS?**

# The electric bus revolution

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CLIMATE SOLUTIONS WEBINAR SERIES



# THANK YOU & HAPPY HOLIDAYS!

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CLIMATE SOLUTIONS WEBINAR SERIES

