



Fleet Futures: Gas vs. Electric

Get AMPED Webinar
February 15th, 2024 - 12:00-1:00 pm

Agenda

- Introductions & webinar goals
- AMPED campaign overview
- Cost and emissions analysis of EV
- Maintaining EVs within a municipal fleet
- Q&A

Presenters



Andy Burnham
Principal Environmental
Scientist
Argonne National
Laboratory



Joseph A. Saurini, Sr.
Fleet Manager
Monroe County
Department of
Environmental Services



Madison M. Quinn
Sustainability Coordinator
Monroe County
Department of
Environmental Services

Webinar Goals

- See how to crunch the numbers and use the Total Cost of Ownership (TCO) to compare electric vs. internal combustion engine fleets.
- Understand the full cradle-to-grave emissions of electric vehicle compared to gas, including the impact of lithium ion batteries
- Dig into the impact of fuel type on operating and maintaining your vehicles



Our purpose is to help make the Genesee-Finger Lakes region healthier, more efficient, and more resilient by supporting our community's transition to vehicles and buildings powered by carbon-free electricity.

Funders



Climate Solutions Accelerator
of the Genesee-Finger Lakes Region



Steering Committee Members

Causewave Community
Partners
City of Rochester
Climate Solutions Accelerator of
the Genesee-Finger Lakes
Region
Dutton Properties
EMCOR Betlem
Empire State Development
Excellus BCBS
Genesee/Finger Lakes Regional
Planning Council
Genesee Transportation Council
Greater Rochester Chamber of
Commerce
Greater Rochester Clean Cities

Monroe County
PathStone Corporation
Rochester Gas and Electric
Corporation
Rochester Institute of
Technology
Rochester Regional Health
Regional Transit Service
Sustainable Comfort, Inc
SWBR
Turner Engineering

Creative Partners



Lautner Marketing

**Lauren
Petracca**

Andy Burnham
Principal Environmental Scientist
Argonne National Laboratory

“AFLEET TOOL” TO ANALYZE THE COSTS AND BENEFITS OF CHARGING AND USING ELECTRIC VEHICLES



ANDY BURNHAM

Principal Environmental Scientist
aburnham@anl.gov

February 15, 2024



Argonne National Laboratory is a
U.S. Department of Energy laboratory
managed by UChicago Argonne, LLC.

OUTLINE OF PRESENTATION

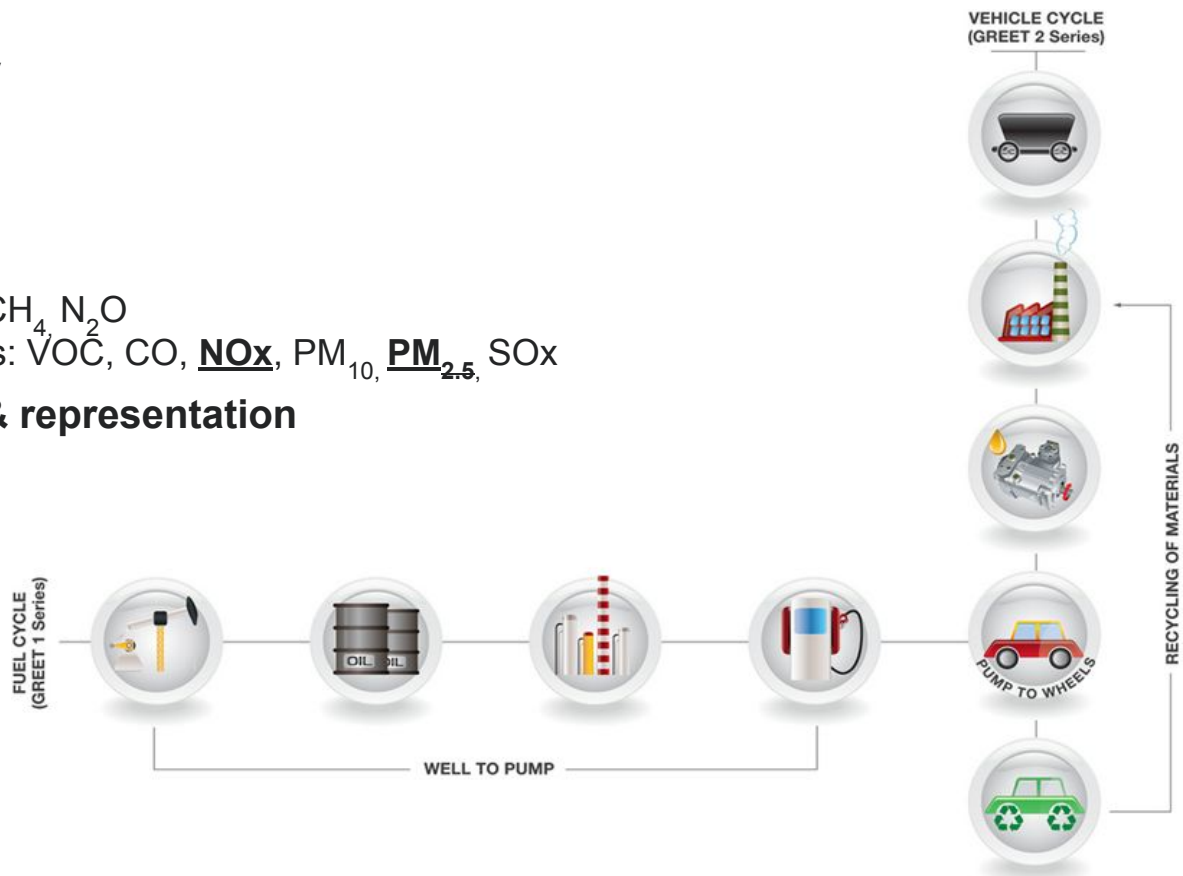
- **Life-Cycle Analysis Introduction**
- **AFLEET Introduction**
- **AFLEET Online Demo**

Life-Cycle Analysis (LCA) Introduction



GREET LCA MODELING AT ARGONNE

- **System boundary**
- **Metrics**
 - Energy
 - Water use
 - **Emissions**
 - **GHG**: CO₂, CH₄, N₂O
 - Air pollutants: VOC, CO, **NO_x**, PM₁₀, **PM_{2.5}**, SO_x
- **Data availability & representation**



See details at <https://greet.es.anl.gov>

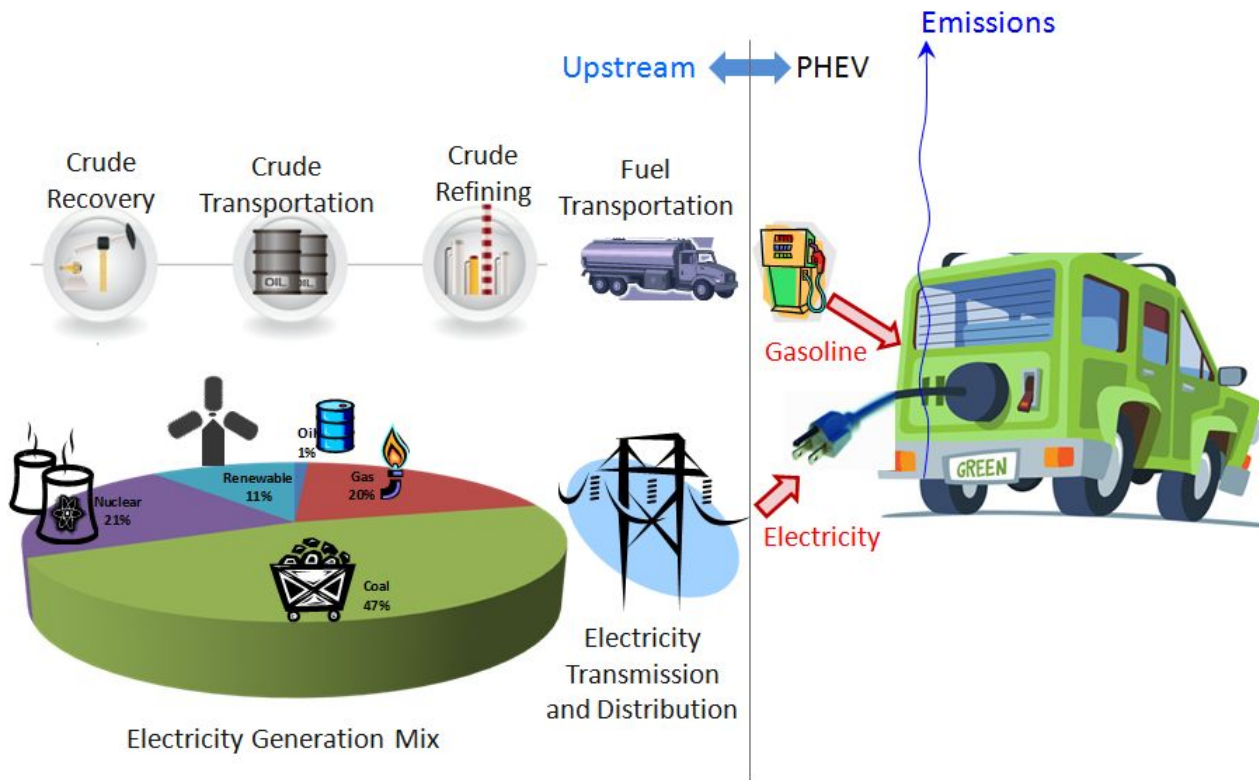
LCA FOR GHG AND AIR POLLUTANT ANALYSIS

▪ GHGs

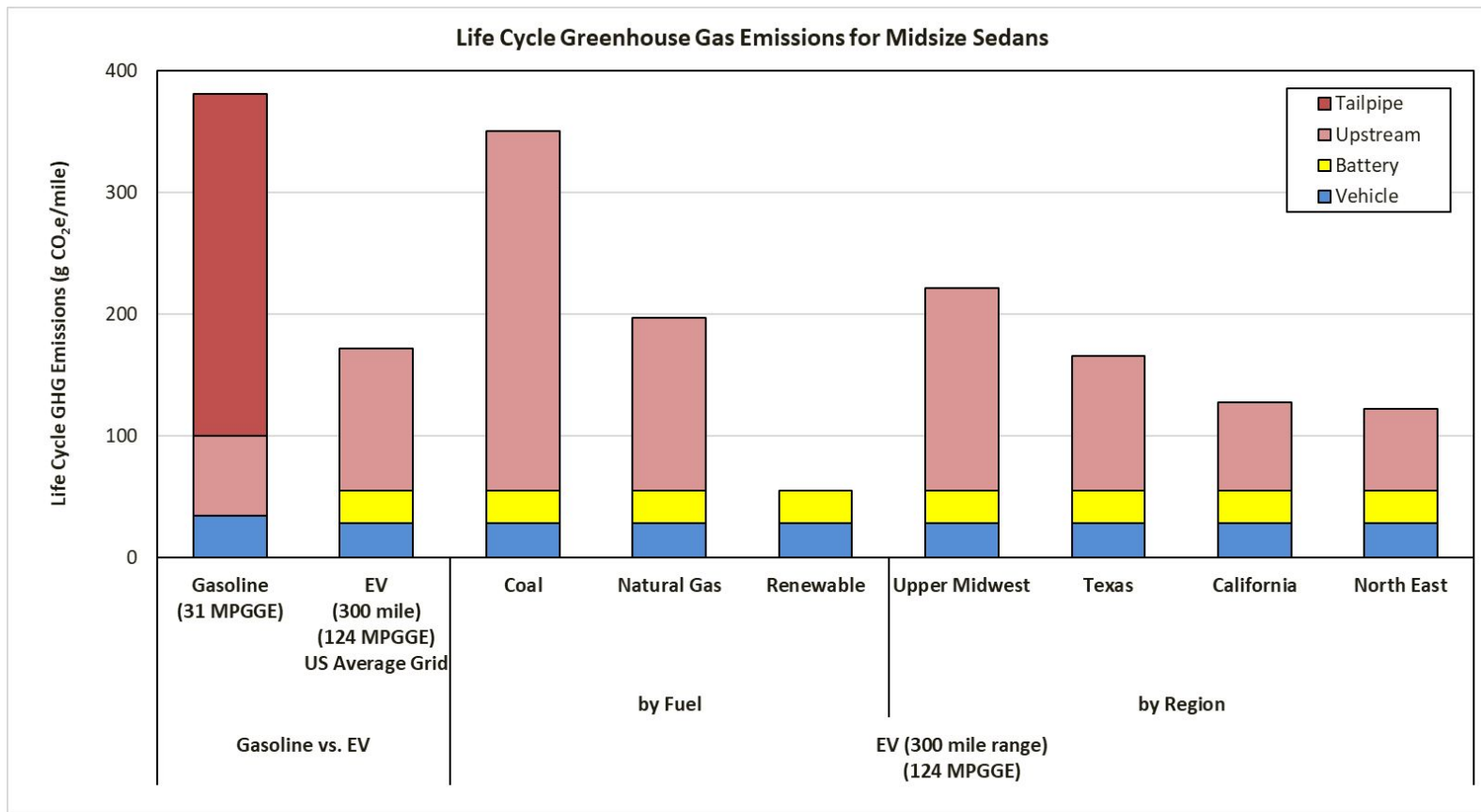
- LCA needed for proper analysis
 - Quantity matters; location doesn't

▪ Air pollutants

- Vehicle operation often focus for analysis
- LCA = fuller picture when analyzing AFVs
 - Air quality/health impacts require detailed modeling
 - Quantity & location matters



GEOGRAPHIC IMPACT OF GRID MIX

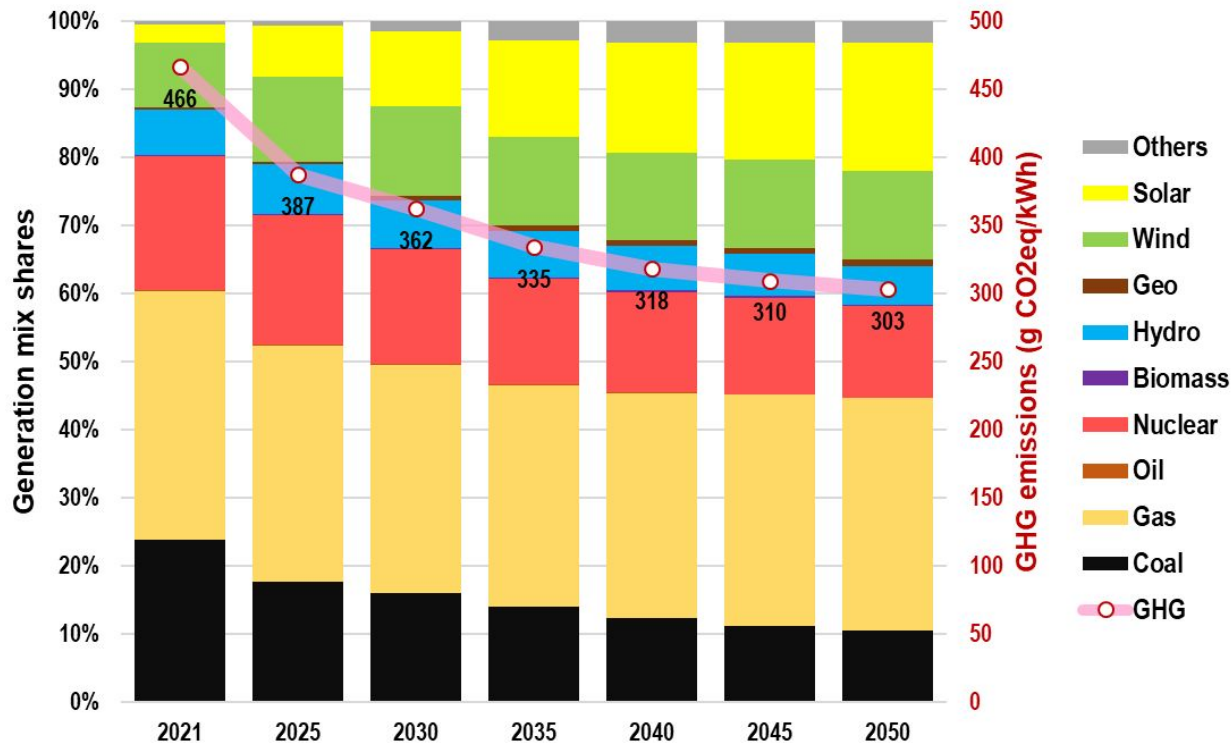


TEMPORAL IMPACT OF GRID MIX

U.S. 2021 vs 2050 (EIA AEO BAU projected)

- GHG intensity (g GHG/kWh at the plug)
 - 466 vs 303
- Generation mix
 - Gas 36% vs 34%
 - Coal 24% vs 11%
 - Nuclear 20% vs 19%
 - Renewable 19% vs 36%

U.S. set goal of 100% carbon pollution-free electricity by 2035



AFLEET INTRODUCTION

EXAMINES ON-ROAD AND OFF-ROAD FLEET

- ✓ Environmental footprint
- ✓ Cost of ownership
- ✓ Refueling infrastructure
- ✓ Idle reduction

CURRENT FLEET



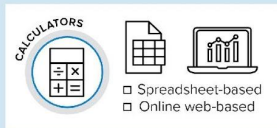
AFLEET

Helps identify vehicle replacement

10,000+
USERS



18 ALTERNATIVE FUEL/TECHNOLOGY COMBINATIONS



OPTIMIZED FLEET



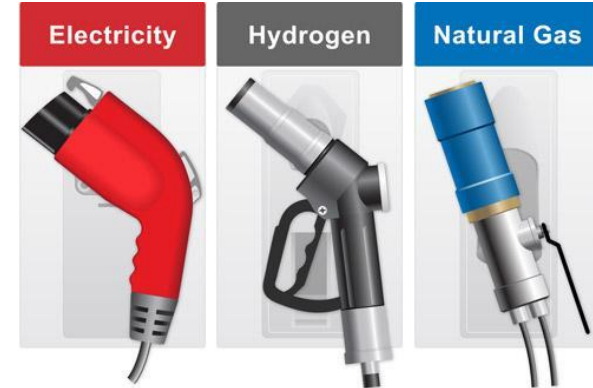
BENEFITS OF NEW TECHNOLOGIES

- ✓ Save on cost of ownership
- ✓ Reduce carbon footprint
- ✓ Contribute to cleaner air
- ✓ Reduce petroleum use

To learn more, visit afleet.es.anl.gov

AFLEET TOOL

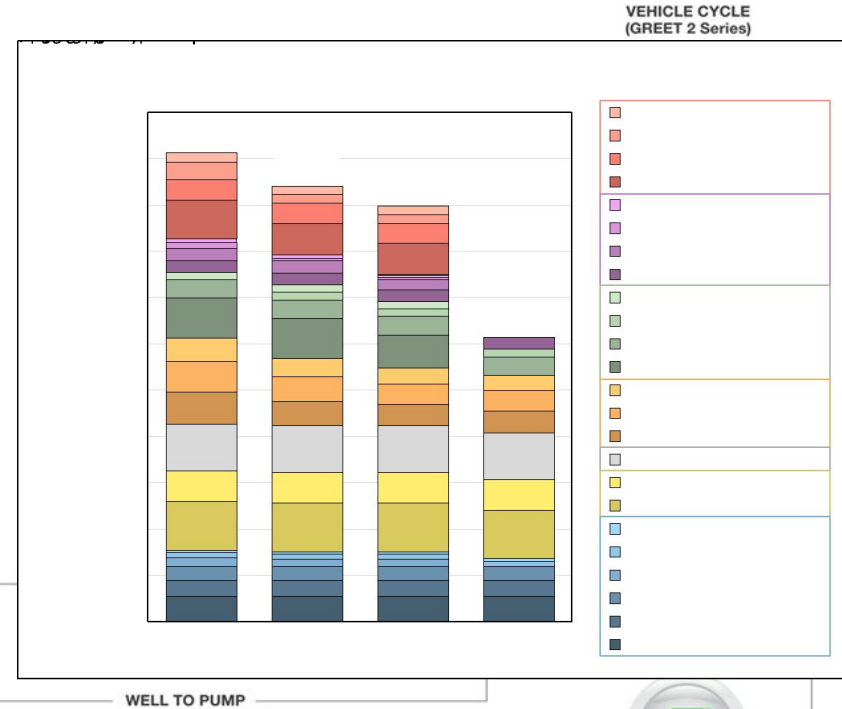
- **Designed for Clean Cities stakeholder fleet cost and emission analysis**
- **Examines light-duty, heavy-duty, and off-road vehicle:**
 - Petroleum use
 - GHGs
 - Air pollutants
 - Cost of ownership
- **Contains 18 fuel/vehicle technologies**
 - Conventional
 - Hybrids
 - Plug-in electrics
 - Alternative fuels: CNG, LNG, LPG, H₂, ethanol, biodiesel, renewable diesel
- **AFLEET Spreadsheet and Online; HDVEC: afleet.es.anl.gov**
 - AFLEET Online and HDVEC updated as well



KEY DATA SOURCES

- **Petroleum use, GHGs, air pollutants factors from Argonne's GREET Model**
 - Light-duty and heavy-duty fuel economy data
- **Vehicle air pollutant emission factors from EPA's MOVES3**
- **Fuel prices using Clean Cities Alternative Fuel Price Reports**
- **Depreciation, maintenance & repair, and insurance using multi-lab DOE TC study**

FUEL CYCLE
(GREET 1 Series)



AFLEET CALCULATION METHODS (SPREADSHEET)

1. **Simple Payback Calculator**
 - On-Road
 - Off-Road
2. **Total Cost of Ownership Calculator**
3. **Idle Reduction Calculator**
4. **On-Road Fleet Footprint Calculator**
5. **Off-Road Fleet Footprint Calculator**
6. **EV Utility Rate Calculator**
7. **EV Charging Cost Calculator**
8. **Charging and Fueling Infrastructure Calculator**



AFLEET ONLINE

- **User friendly, web-based version replicates:**

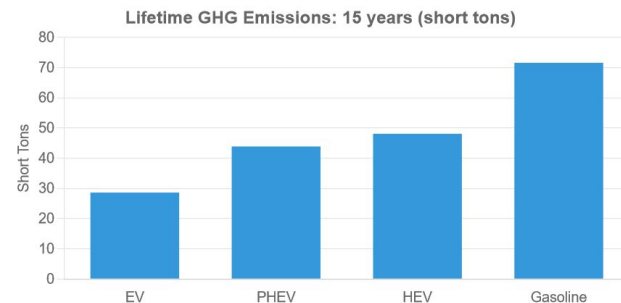
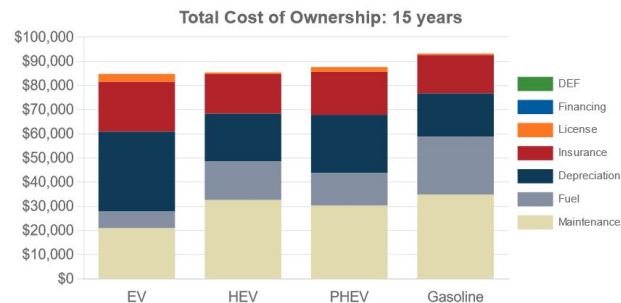
- Simple Payback Calculator
 - On-Road
 - Off-Road
- Total Cost of Ownership Calculator

- **Under development**

- EV Utility Rate Calculator
- EV Charging Cost Calculator

- **AFLEET Online:** afleet.es.anl.gov/afleet/

Sort by Low to High



AFLEET ONLINE DEMO

AFLEET ONLINE

The Department of Energy has enlisted the expertise at Argonne to develop the Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) Tool for Clean Cities Coalition stakeholders. This online version of AFLEET compares new alternative fuel vehicles to gasoline (light-duty) and diesel (heavy-duty) vehicles.

Below are the calculators implemented by the online version from the AFLEET Tool 2020 spreadsheet. Select one of the options below to get started:

SELECT A TOOL TO GET STARTED

PAYBACK ON-ROAD CALCULATOR

- Annual petroleum use
- Annual greenhouse gas emissions
- Annual air pollutant emissions
- Simple payback on-road

PAYBACK OFF-ROAD CALCULATOR

- Annual petroleum use
- Annual greenhouse gas emissions
- Annual air pollutant emissions
- Simple payback off-road

TCO CALCULATOR

- Lifetime petroleum use
- Lifetime greenhouse gas emissions
- Lifetime air pollutant emissions
- Total cost of ownership

For any questions please contact: greet@anl.gov

[Copyright Statement](#)

THANK YOU!!!

**Argonne National Laboratory's work is supported by the
U.S. Department of Energy, Office of Energy Efficiency and
Renewable Energy**

This work has been supported and assisted by:

Margaret Smith: U.S. DOE

Marcy Rood: Argonne

Joann Zhou: Argonne

Eric Pfister, Noah Song, David Sandoval, Arijus Trakymas,
Andy Ayers

AFLEET ONLINE TUTORIAL - START PAGE

- About, Tool Selection

AFLEET ONLINE

The Department of Energy has enlisted the expertise at Argonne to develop the Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) Tool for Clean Cities Coalition stakeholders. This online version of AFLEET compares new alternative fuel vehicles to gasoline (light-duty) and diesel (heavy-duty) vehicles.

Below are the calculators implemented by the online version from the AFLEET Tool 2020 spreadsheet. Select one of the options below to get started:

SELECT A TOOL TO GET STARTED

PAYBACK ON-ROAD CALCULATOR

- Annual petroleum use
- Annual greenhouse gas emissions
- Annual air pollutant emissions
- Simple payback on-road

PAYBACK OFF-ROAD CALCULATOR

- Annual petroleum use
- Annual greenhouse gas emissions
- Annual air pollutant emissions
- Simple payback off-road

TCO CALCULATOR

- Lifetime petroleum use
- Lifetime greenhouse gas emissions
- Lifetime air pollutant emissions
- Total cost of ownership

For any questions please contact: afleet@anl.gov

[Copyright Statement](#)

AFLEET ONLINE TUTORIAL - TCO

- **1st step: select vehicle type**
 - LDV (compare to gasoline)
 - HDV (compare to diesel)

AFLEET Online

Home Payback On-road Payback Off-road TCO

Vehicle Info Fuel Prices Other Costs Fuel Options

Vehicle Type School Bus

State

Quantity

Vehicle Mileage

Planned Ownership

Powertrains to Compare

Powertrain	Fuel (MPG)	Cost	TCO
<input type="checkbox"/> Gasoline			
<input checked="" type="checkbox"/> Diesel			
<input checked="" type="checkbox"/> EV			
<input type="checkbox"/> FCV	11.28	\$0	\$0.56
<input type="checkbox"/> Diesel HEV	11.03	\$160,000	\$0.81
<input type="checkbox"/> Diesel HHV	10.54	\$0	\$0.81
<input checked="" type="checkbox"/> B20	8.17	\$100,000	\$0.93
<input type="checkbox"/> B100	8.17	\$100,000	\$0.93
<input type="checkbox"/> RD20	8.17	\$100,000	\$0.93
<input type="checkbox"/> RD100	8.17	\$100,000	\$0.93
<input type="checkbox"/> E85	6.81	\$0	\$0.61
<input checked="" type="checkbox"/> LPG	6.81	\$108,000	\$0.61
<input checked="" type="checkbox"/> CNG	6.94	\$130,000	\$0.93
<input type="checkbox"/> LNG	6.94	\$120,000	\$0.93
<input type="checkbox"/> LNG/D	7.76	\$0	\$0.97

Save Load

AFLEET ONLINE TUTORIAL - TCO

- **2nd step:**
 - state
 - # of vehicles
 - mileage
 - years of ownership
- **3rd step: select alternative fuels/powertrains**
- **4th step:**
 - fuel economy
 - purchase price
 - maintenance

AFLEET Online

Home Payback On-road Payback Off-road TCO

Vehicle Info Fuel Prices Other Costs Fuel Options

Vehicle Type School Bus

State Illinois

Quantity 1 vehicle(s)

Vehicle Mileage 15,000 mi/year

Planned Ownership 15 years

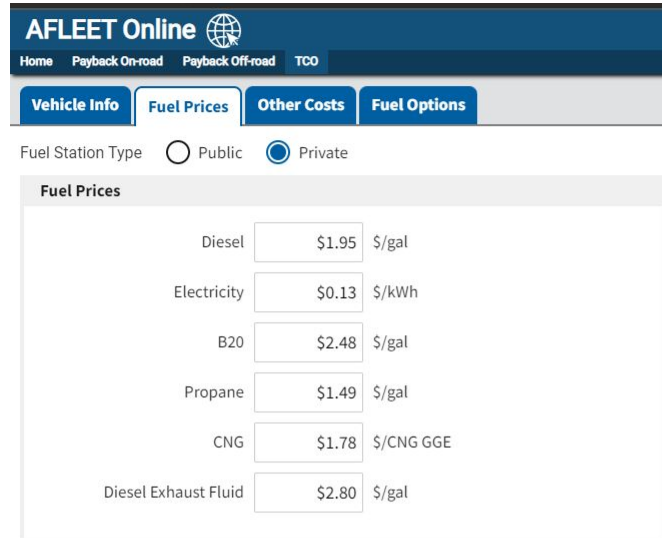
Powertrains to Compare

<input type="checkbox"/>	Powertrain	Fuel Economy (MPDGE)	Purchase Price (\$/vehicle)	Maintenance (\$/mi)
<input type="checkbox"/>	Gasoline	6.81	\$0	\$0.61
<input checked="" type="checkbox"/>	Diesel	8.17	\$100,000	\$0.93
<input checked="" type="checkbox"/>	EV	23.96	\$300,000	\$0.56
<input type="checkbox"/>	FCV	11.28	\$0	\$0.56
<input type="checkbox"/>	Diesel HEV	11.03	\$160,000	\$0.81
<input type="checkbox"/>	Diesel HHV	10.54	\$0	\$0.81
<input checked="" type="checkbox"/>	B20	8.17	\$100,000	\$0.93
<input type="checkbox"/>	B100	8.17	\$100,000	\$0.93
<input type="checkbox"/>	RD20	8.17	\$100,000	\$0.93
<input type="checkbox"/>	RD100	8.17	\$100,000	\$0.93
<input type="checkbox"/>	E85	6.81	\$0	\$0.61
<input checked="" type="checkbox"/>	LPG	6.81	\$108,000	\$0.61
<input checked="" type="checkbox"/>	CNG	6.94	\$130,000	\$0.93
<input type="checkbox"/>	LNG	6.94	\$120,000	\$0.93
<input type="checkbox"/>	LNG/D	7.76	\$0	\$0.97

Save Load

AFLEET ONLINE TUTORIAL - TCO

- 5th step: fuel prices



The screenshot shows the AFLEET Online interface for the TCO (Total Cost of Ownership) section. The 'Fuel Prices' tab is selected, and the 'Private' radio button is chosen for the fuel station type. The form contains input fields for various fuel types with their respective units and current values.

Fuel Type	Unit	Value
Diesel	\$/gal	\$1.95
Electricity	\$/kWh	\$0.13
B20	\$/gal	\$2.48
Propane	\$/gal	\$1.49
CNG	\$/CNG GGE	\$1.78
Diesel Exhaust Fluid	\$/gal	\$2.80

AFLEET ONLINE TUTORIAL - TCO

- **6th step:**
 - fuel production sources
 - petroleum use, GHGs, and air pollutants options

The screenshot shows the AFLEET Online interface for the TCO (Total Cost of Ownership) calculation. The top navigation bar includes links for Home, Payback On-road, Payback Off-road, and TCO. Below the navigation bar are tabs for Vehicle Info, Fuel Prices, Other Costs, and Fuel Options. The main content area is divided into two sections: Fuel Production Sources and Calculation Options.

Fuel Production Sources

Biodiesel Feedstock	Soy
CNG Feedstock	North American NG
North American NG Feedstock Source	Conventional: 66% Shale: 34%
LPG Feedstock Source	NG: 69% Petroleum: 31%
Electricity	Average U.S. Mix

[View Electricity Source Map](#)

Calculation Options

GHG Calculations

Well-to-Wheels Petroleum Use and GHGs & Vehicle Operation Air Pollutants

Use Diesel-In-Use Multiplier?

Use Low NOx Engines?

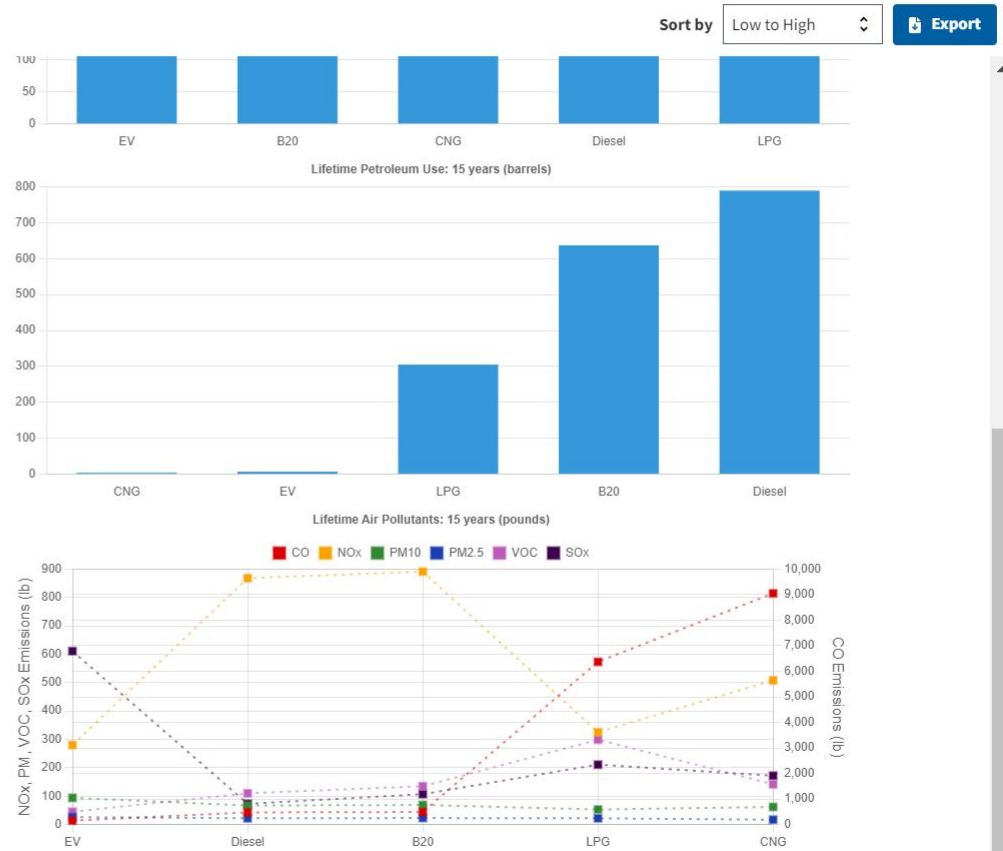
AFLEET ONLINE TUTORIAL - TCO

- 7th step: view TCO, GHG, petroleum, air pollutant results



AFLEET ONLINE TUTORIAL - TCO

- 7th step: view TCO, GHG, petroleum, air pollutant results



Joseph A. Saurini, Sr.
Fleet Manager

Madison Quinn
Sustainability Coordinator

**Monroe County Department of
Environmental Services**

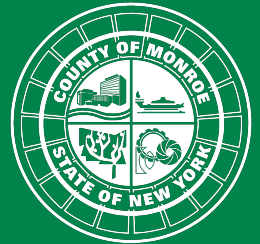
Maintaining Electric Vehicles within a Municipal Fleet – Monroe County, NY

Joseph A. Saurini, Sr.
Fleet Manager

Madison Quinn
Sustainability Coordinator

Monroe County Department of
Environmental Services

MONROE COUNTY



ADAM J. BELLO
COUNTY EXECUTIVE

February 15, 2024



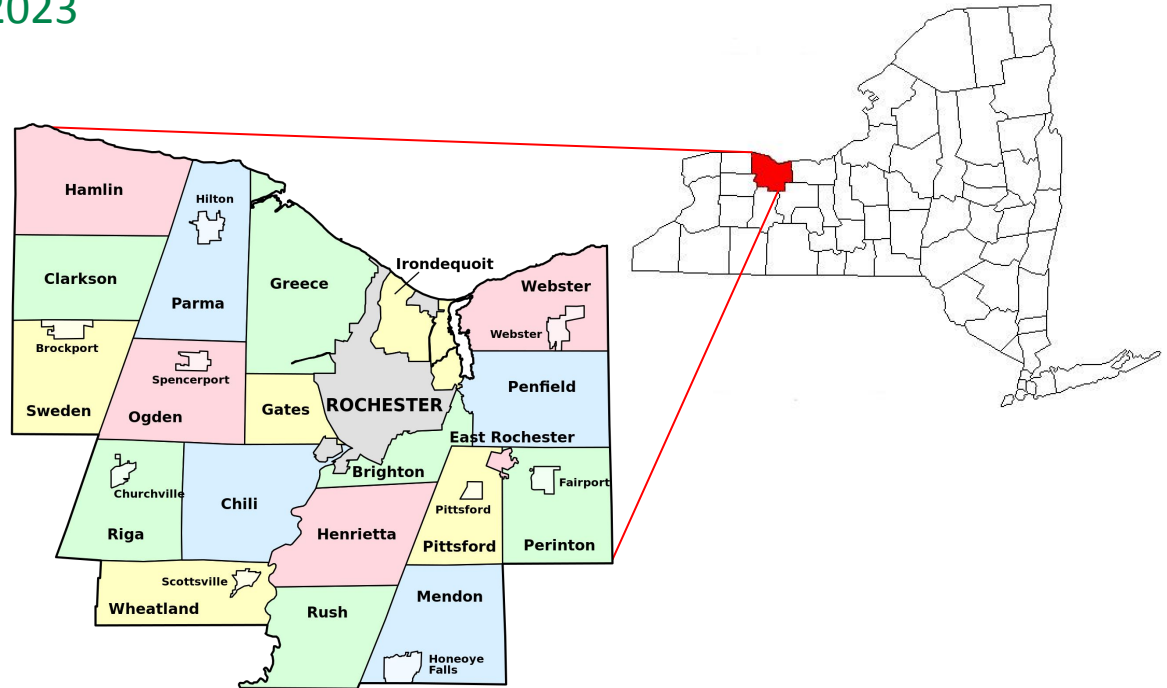
Agenda

- About Monroe County
- Monroe County Fleet
- Electric vs Gas Comparing Costs
 - Purchase Prices
 - Operations & Maintenance
- Maintenance & Warranty Coverage
- Grounds Maintenance Goes Electric
- Climate Action Plan
- What's Next



About Monroe County

- Population 747,523 as of 2023
- 1,367 square miles
- 1 County Executive, 29 Legislators
- 31 municipalities: 1 city, 20 towns, & 10 villages*
- Urban, suburban, and rural communities



*Village of East Rochester is coterminous with Town of East Rochester

About Monroe County Fleet

- Nearly 1000 vehicles
- Alternative fuel & EV equipment:
 - 360 alternative fuel – including Biodiesel, E85, Propane, CNG
 - 10 electric zero-turn lawnmowers
 - 22 Hybrid Passenger Vehicles
 - 1 Plugin Hybrid Car
 - 1 Fully Electric Car



Electric Vehicles

- Chevy Volt – Plugin Hybrid & Chevy Bolt – Fully Electric



Comparing Purchase Costs

- 2017 Chevy Bolt – Fully Electric

\$35,154 Purchase Cost

- \$9,000 Grant to purchase EV Bolt

\$26,154 Purchase Cost after Grant



- 2017 Chevy Impala – V6 Gas

\$24,000 Purchase Cost



Comparing Maintenance Costs



2017 Chevy Bolt (Full EV)

- \$1,800 Repairs/maintenance
 - \$0 Fuel*
-
- \$1,800 Total cost of “ownership”

2019 Ford Escape

- \$2,700 Repairs/maintenance
 - \$6,500 (Fuel \$3.00/gal avg.)
-
- \$9,200 Total cost of “ownership”

*Cannot quantify actual electric charging usage, not metered



Maintenance & Warranty Coverage

- Simplified maintenance – EVs do not need oil changes, transmission flushes, engine belt and air filter replacements or spark plugs
- Warranty coverage includes battery
- Repairs needed outside of warranty coverage:
 - Tires, brakes – expected maintenance costs for all vehicles, electric or gas-powered



Electric Grounds Maintenance Equipment

- 10 Zero Turn Electric Mowers purchased in late 2023
- Replacing 10 traditional mowers used by MC Parks Dept.
- Will evaluate performance when seasonal maintenance resumes in the spring



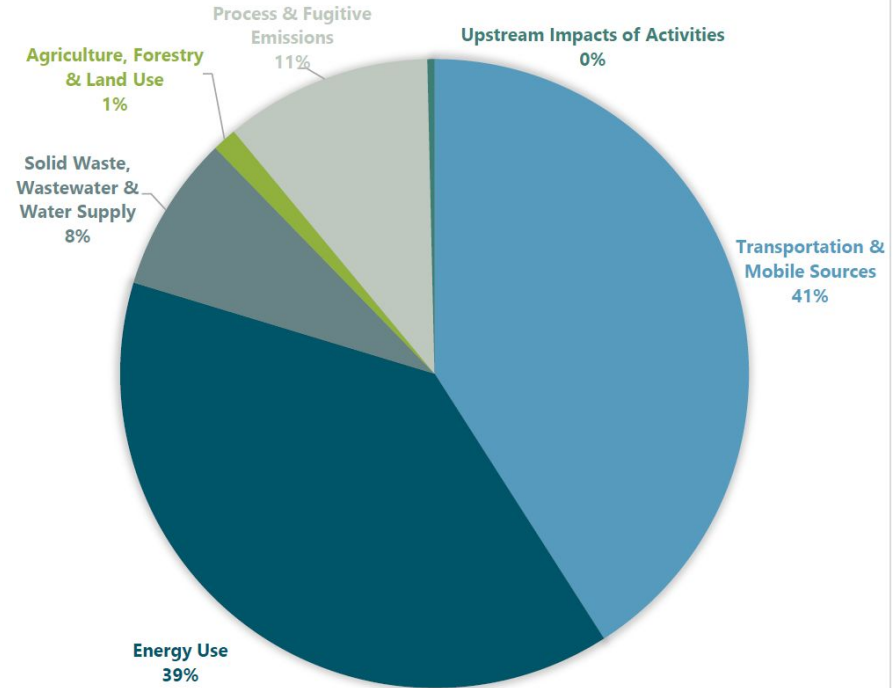
Monroe County Climate Action Plan (CAP)

- Develop effective actions for community-wide climate mitigation, climate adaptation initiatives, and alignment towards the Climate Smart Communities Program.
- Aim to minimize emissions of Greenhouse Gases (GHGs), advance NYS policy goals, such as energy efficiency and conservation, renewable energy, waste reduction and recycling, and support smart and sustainable economic growth.
- 2 Phases – County Operations and Community-wide



Monroe County Climate Action Plan (CAP)

- Greenhouse gas (GHG) inventory completed for county operations and for community
 - Phase I: Fleet is 7% of county government GHG emissions
 - Phase II: Transportation is 41% of GHG emissions countywide
- Electrifying county fleet and developing community-wide EV charging infrastructure are priorities



What's Next

- Adding more electric vehicles and equipment to the fleet
- Targeting locations with existing charging stations
- Installing more EV Charging Stations
- Developing Electric Vehicle Master Plan to strategically roll out fleet electrification and charging infrastructure



Questions?

Joseph A. Saurini, Sr.

Fleet Manager

JSaurini@monroecounty.gov

Madison M. Quinn

Sustainability Coordinator

MadisonQuinn@monroecounty.gov



Q&A

AMPED Resources

Building Electrification

Fully electric buildings come in all shapes and sizes.

Taking your facility from "piped in" to "plugged in" improves the health and safety of your workers, and can drastically lower operating costs.

Get Started

Let's Get Started!

Building Electrification Calculators

Because every building is unique and many factors should be considered when calculating the costs and benefits of energy improvements, we highly recommend getting a comprehensive energy assessment from a qualified professional. But if you want to crunch the numbers on your own, here are some calculators to help you explore the possibilities.



View Resources

Reasons to Believe

There are even more reasons to believe it's possible and important to electrify buildings in our community.

We've put together a list of electrifying buildings. Find th

View Resources

Tell me more

Buildings

Every building is different. That's why the best place to start is a **comprehensive energy audit**.

An energy audit will identify areas of your facility and operation where energy can be saved. This process will deliver you a report filled with energy- and cost-saving recommendations ranging from lighting to large-scale capital improvements. This gives you actionable advice to make informed investment decisions.

An energy advisor can help you navigate **incentives, tax credits, and financing options** to help bring down the costs.

Schedule a meeting with an AMPED Energy Advisor

Fleets

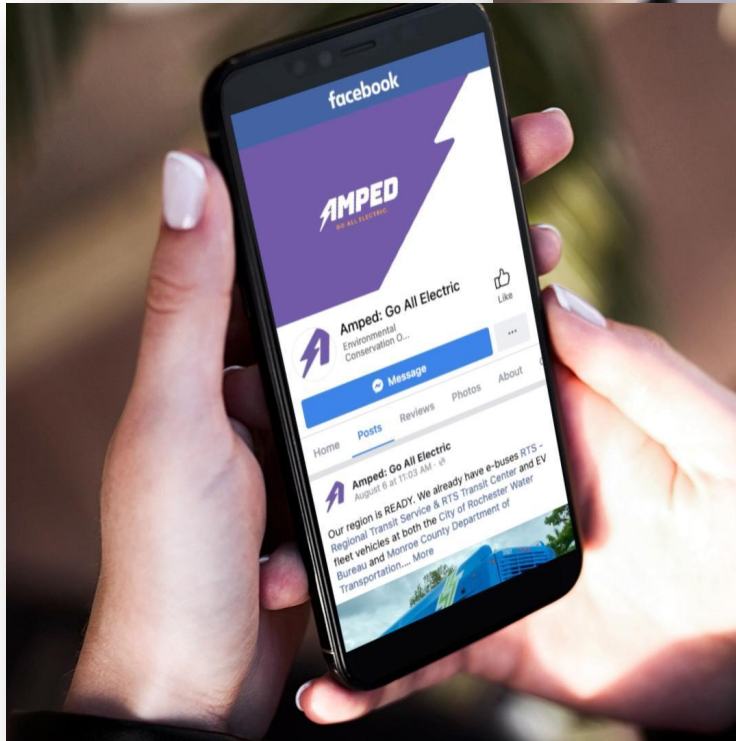
In today's rapidly-changing world of logistics and transportation, the best place to start is getting a **FREE CONSULTATION** from our non-profit partner: Greater Rochester Clean Cities.

As part of the national U.S. Department of Energy's (DOE) Clean Cities Program, **Greater Rochester Clean Cities** works with vehicle fleets, fuel providers, community leaders, and other stakeholders to save energy and promote the use of domestic fuels and advanced vehicle technologies in transportation.

Connect to an expert at Greater Rochester Clean Cities

Website with information and resources

Social Media





Get AMPED Forum May 16, 2024

The Future of Building Electrification