TO ELECTRIFY OR NOT TO ELECTRIFY: A CASE FOR THE CITY OF GRAND RAPIDS

This material is based upon work supported by the Department of Energy and the Michigan Energy Office (MEO) under Award Number EE0008653 as part of the Catalyst Communities program. Find this document and more about the CLC Fellowship that supported this project at graham.umich.edu/clcf.

AGENDA

INTRODUCTION

Before joining the Ross School of Business, Alhan Fakhr (MBA and Master of Public Policy '24) earned his Bachelor of Arts in Politics, graduating with the inaugural class of New York University – Shanghai. Born and raised in Pakistan, Fakhr attended college in China, and has studied and worked in the United States, the United Arab Emirates, the Czech Republic, Rwanda, and Malaysia.

At Ross, Fakhr is also involved with the International Investment Fund as a Due Diligence Lead. Additionally, he serves as Director of Marketing and Communications for Energy Club at Ross, and has been a Graduate Student Instructor for six consecutive semesters in International and Comparative Studies.

ACKNOWLEDGEMENTS

Sean Moeller, Equipment Maintenance Superintendent, City of Grand Rapids

Jane McCurry, Executive Director, Clean Fuels Michigan

Sarah Lee, Clean Energy Engagement Specialist, Graham Sustainability Institute

James Leonard, Research and Program Analyst, NextEnergy

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PROBLEM BACKGROUND

Transportation alone accounts for <u>30% of Grand Rapids total emissions, with 18% coming from gasoline powered vehicles</u>

The City of Grand Rapids has identified **<u>sustainability</u>** as one of its **<u>six core values</u>** in its October 2022 Strategic Plan impacting all departments

Efforts to reduce emissions include assessing existing municipal **<u>fleet of 600+ vehicles</u>** and identifying best candidates for **<u>electrification at scale</u>**

The State of Michigan through EGLE is offering **<u>grants, infrastructural, and institutional support, and resources to access federal tax credits</u>** needed to meet net zero goals

WHAT DOES ELECTRIFICATION AT-SCALE ENTAIL?

Develop a **methodology** for **selecting vehicles to electrify** within municipal fleets

Make a **financial and logistical case** for making electrification possible

Ensure **scalability within the model** to enable the city to electrify a significant proportion of its fleet

Ensure **other cities and municipalities in Michigan** and nation-wide can **replicate this model**

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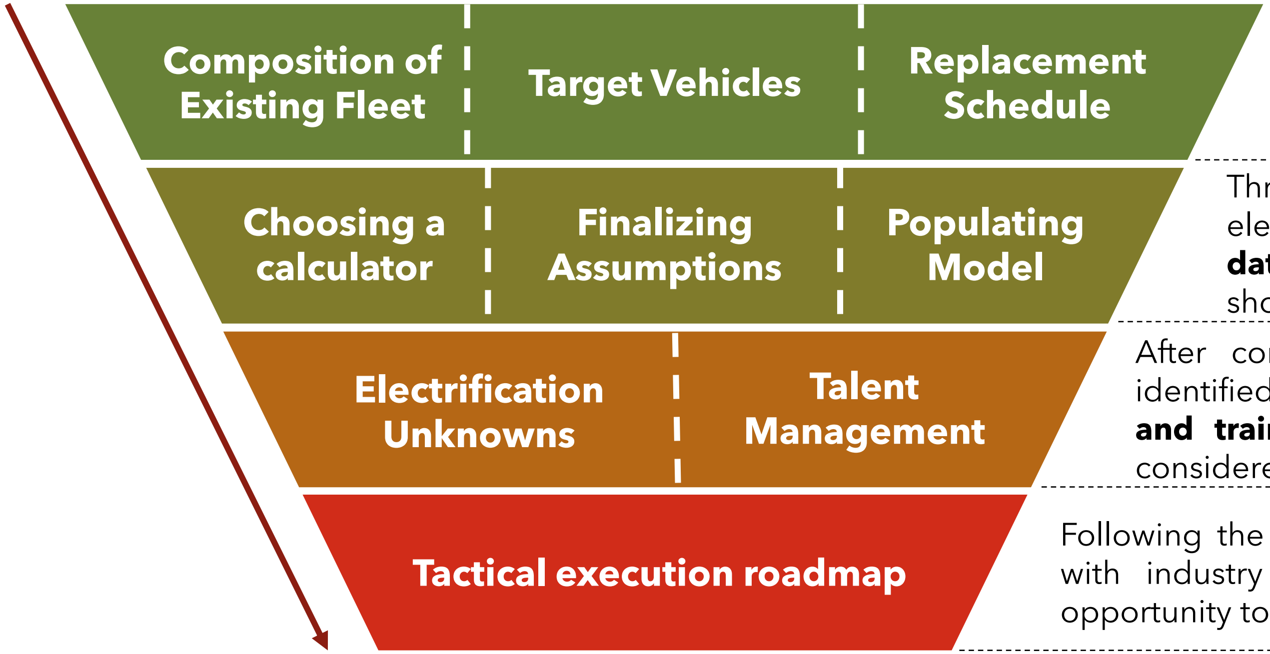
Methodology



To meet emissions reduction targets, the fleet management department should identify similar types of vehicles, which can be ordered in large quantities

Three key elements should be considered when considering electrification at scale: **existing calculators and resources, data-driven assumptions and robust modelling**. These should collectively inform any decision around electrification.

After conducting financial and emissions reduction analyses, I identified 2 crucial factors: **charging infrastructure** and **staff buy-in and training** around changing practices. These should also be considered when electrifying municipal fleets at-scale.

Following the identification of quantitative and variable factors, I spoke with industry experts to understand the steps to execute on the opportunity to electrify a municipal fleet at-scale.

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Roadmap for Analysis

This roadmap is not only specific to the City of Grand Rapids, but can also be replicated in other cities and municipalities across the State of Michigan and across the United States

Conduct Preliminary Fleet Composition Analysis

Clean and summarize existing data to identify target segment of the fleet. For Grand Rapids, ~56% of their fleet comprises of light vehicles. ~83% of the LTV fleet consists of vehicles run on fossil fuels.

Defining the Scope of the Project

Because LTVs usually tend to have 1) generalized and replicable use cases, and 2) can be ordered in larger quantities, this project centered around determining the cost of replacing EVs.

Choose Calculator from Existing Resources

The Department of Energy offers an Alternative Fuels Data Center which provides resources for different types of projects. Based on this project's focus on cost of ownership and emissions, we chose the AFLEET Tool.

Finalize Assumptions and Evaluate Results

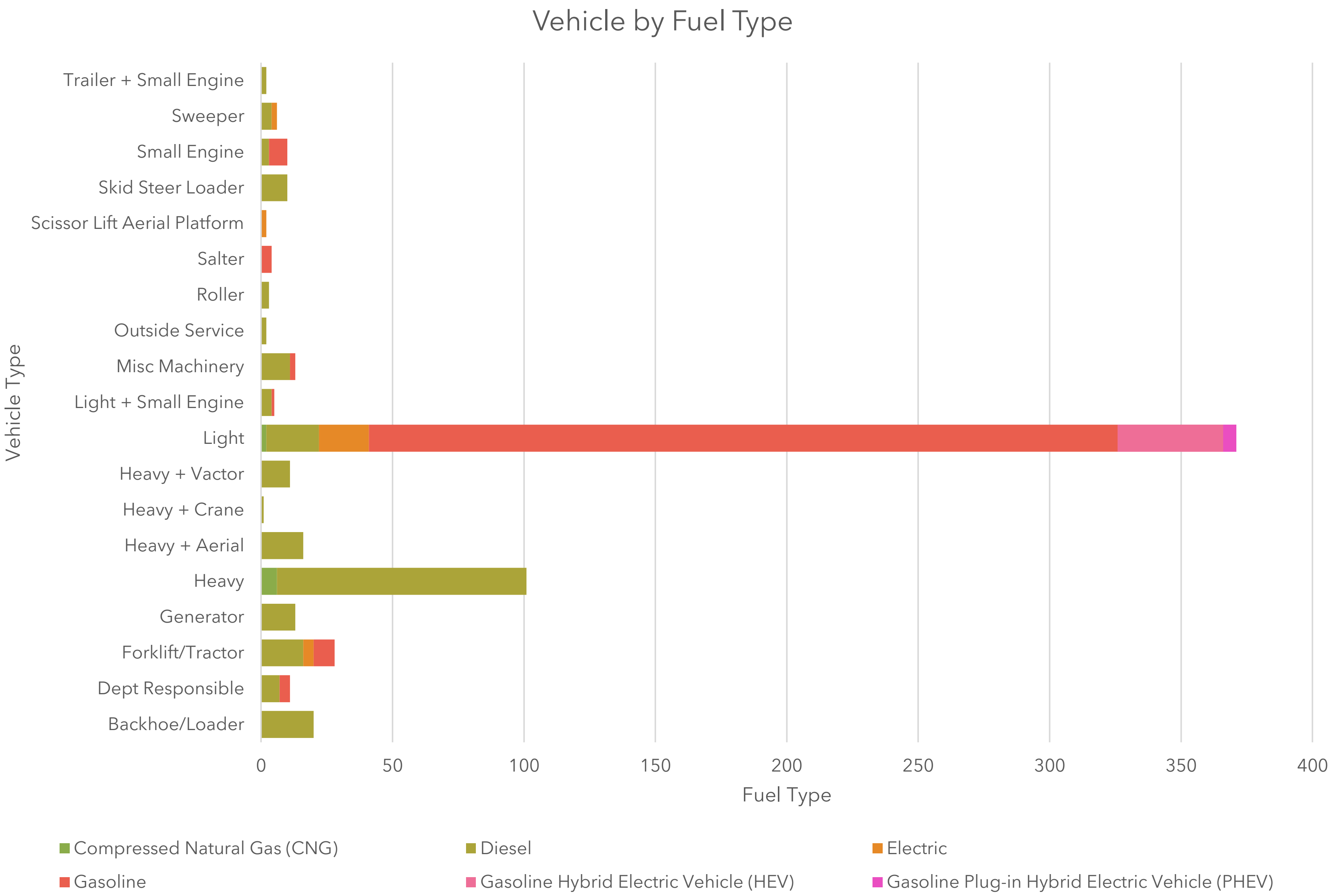
First, this project used data from the City of Grand Rapids to finalize assumptions and used them as inputs for the AFleet Calculator. Results from the Calculator were then evaluated to determine if electrification is plausible.

Consider Unknowns

Upon evaluating this model, it is also important to consider hidden costs associated with electrification and buy-in from staff members who will ultimately implement this policy.

EXISTING FLEET

- **This fleet does not include police vehicles or vehicles used for more sensitive purposes**
- **285 gasoline selected for electrification**



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Vehicle Type	Compressed Natural Gas (CNG)	Diesel	Electric	Gasoline	Gasoline Hybrid Electric Vehicle (HEV)	Gasoline Plug-in Hybrid Electric Vehicle (PHEV)	Grand Total
Backhoe/Loader		20					20
Dept Responsible		7		4			11
Forklift/Tractor		16	4	8			28
Generator		13					13
Heavy	6	95					101
Heavy + Aerial		16					16
Heavy + Crane		1					1
Heavy + Vactor		11					11
Light	2	20	19	285	40	5	371
Light + Small Engine		4		1			5
Misc Machinery		11		2			13
Outside Service		2					2
Roller		3					3
Salter				4			4
Scissor Lift Aerial Platform			2				2
Skid Steer Loader		10					10
Small Engine		3		7			10
Sweeper		4	2				6
Trailer + Small Engine		2					2
Grand Total	**8**	**238**	**27**	**311**	**40**	**5**	**629**

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WHY LTVs?

- **Intended Use**: Designed for lighter loads, such as small deliveries, passenger transport, local distribution, and shorter distances. These vehicles also have smaller weight capacity, typically up to 3.5 tons

- **Examples**: Vans, pickup trucks, sedans, hatchbacks, and light delivery trucks

- Can **order in larger quantities** instead of smaller quantities for more specialized use-cases, like in the case of HTVs

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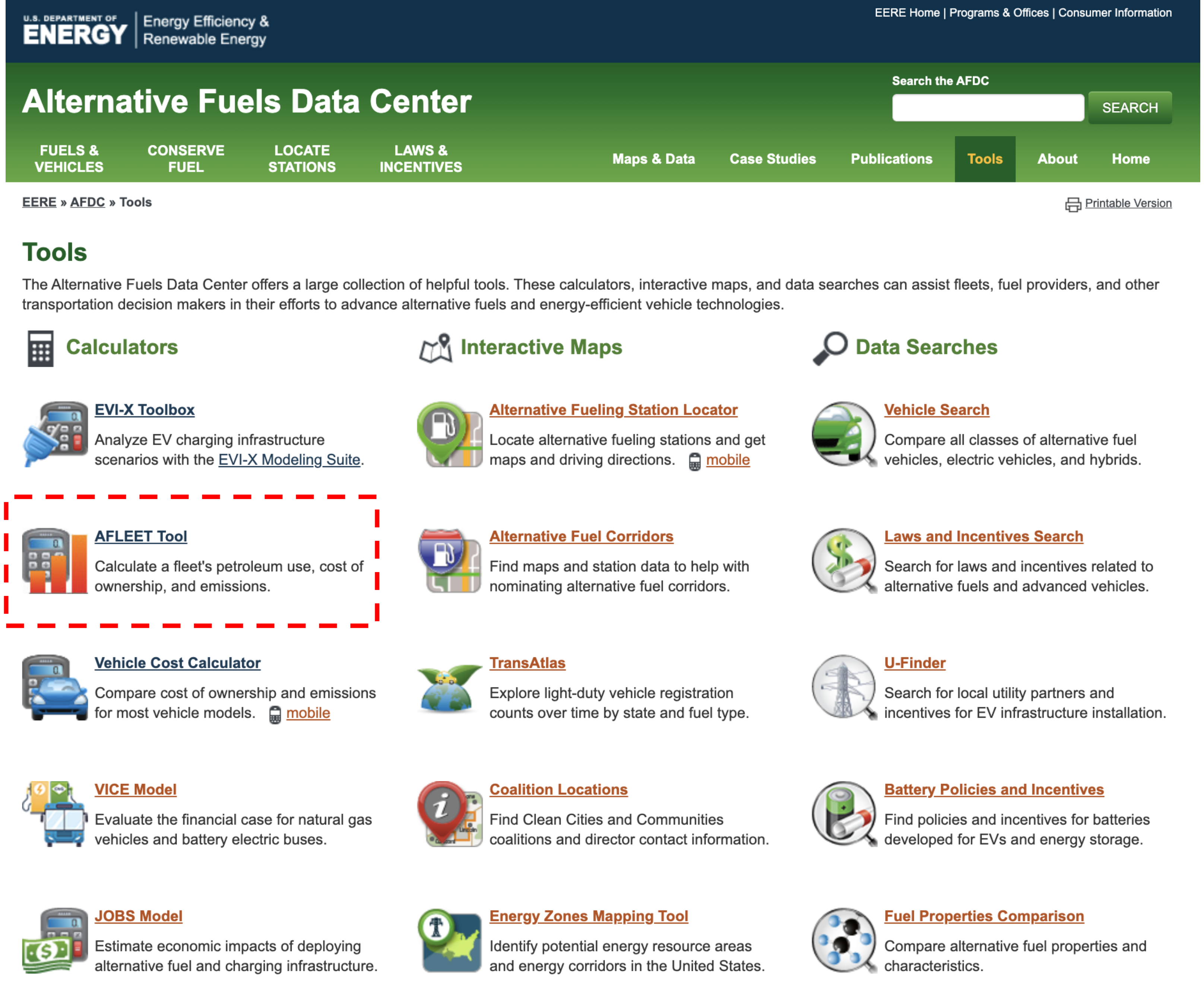
EXISTING RESOURCES

- **The Department of Energy** has put together an **Alternative Fuels Data Center** to help organizations at all levels compute emissions and financial obligations.
- For this study, I chose the **AFleet Tool** which assesses **fleets' petroleum use, cost of ownership and emissions.**



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PRELIMINARY FINDINGS

Payback Period

Payback period is the amount of time it takes for the project to begin paying for itself, calculated by:

Initial Investment / Cost Savings Across Lifetime of Fleet

$17.8M

Initial Investment assumes acquisition costs, maintenance costs, electricity cost, and cost of chargers

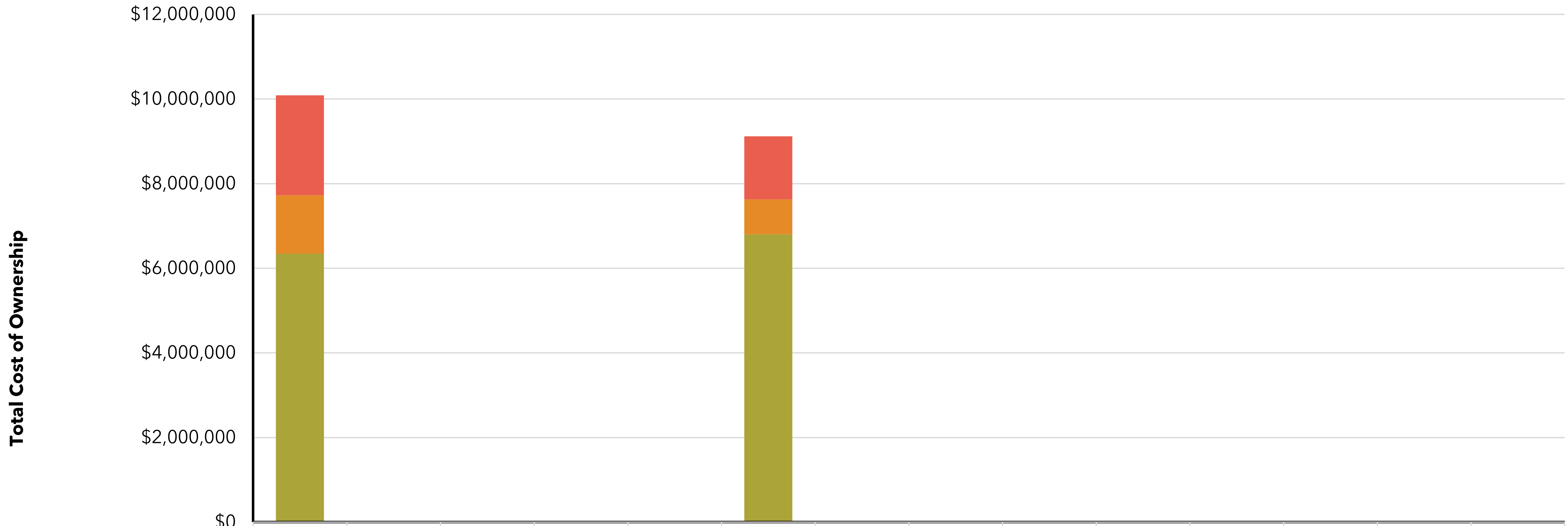
~5 Years

Payback period factoring in cost savings achieved from fuel savings and maintenance and repair

~4 Years

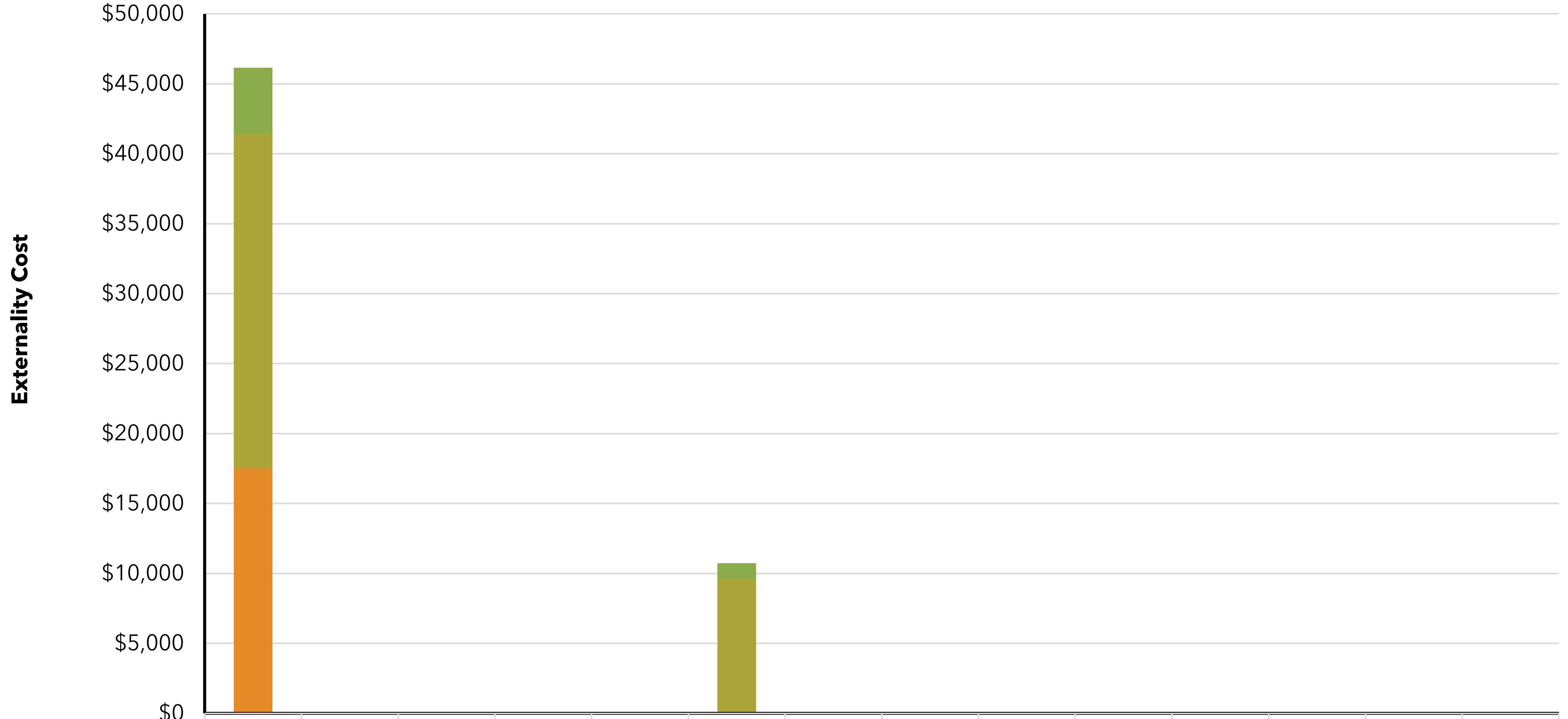
Payback period factoring in cost savings achieved from fuel savings and maintenance and repair and factoring in savings from emissions

Maintenance, repair, and fuel make gasoline vehicles more expensive than EVs



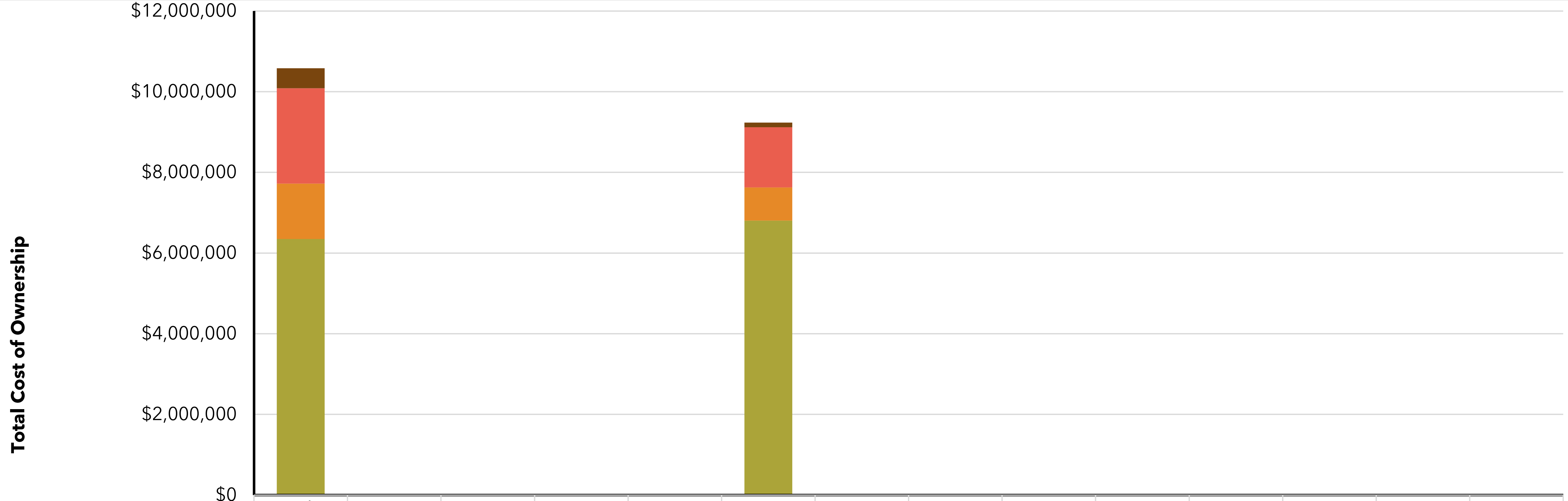
	Gasoline	EV
License and Registration	$0	$0
Insurance	$0	$0
Maintenance and Repair	$2,365,44	$1,491,33
Diesel Exhaust Fluid	$0	$0
Fuel	$1,374,25	$822,620
Depreciation	$6,348,82	$6,804,30
Financing	$0	$0

Pricing for externalities generates ~$35,000 in annual cost savings from EVs



	Gasoline	EV
Air Pollutants	$4,711	$1,063
GHGs	$23,896	$9,566
Petroleum Use	$17,544	$108

Factoring externalities of gasoline vehicles makes them even more expensive



	Gasoline	EV
Externalities	$494,463	$118,649
License and Registration	$0	$0
Insurance	$0	$0
Maintenance and Repair	$2,365,44	$1,491,33
Diesel Exhaust Fluid	$0	$0
Fuel	$1,374,25	$822,620
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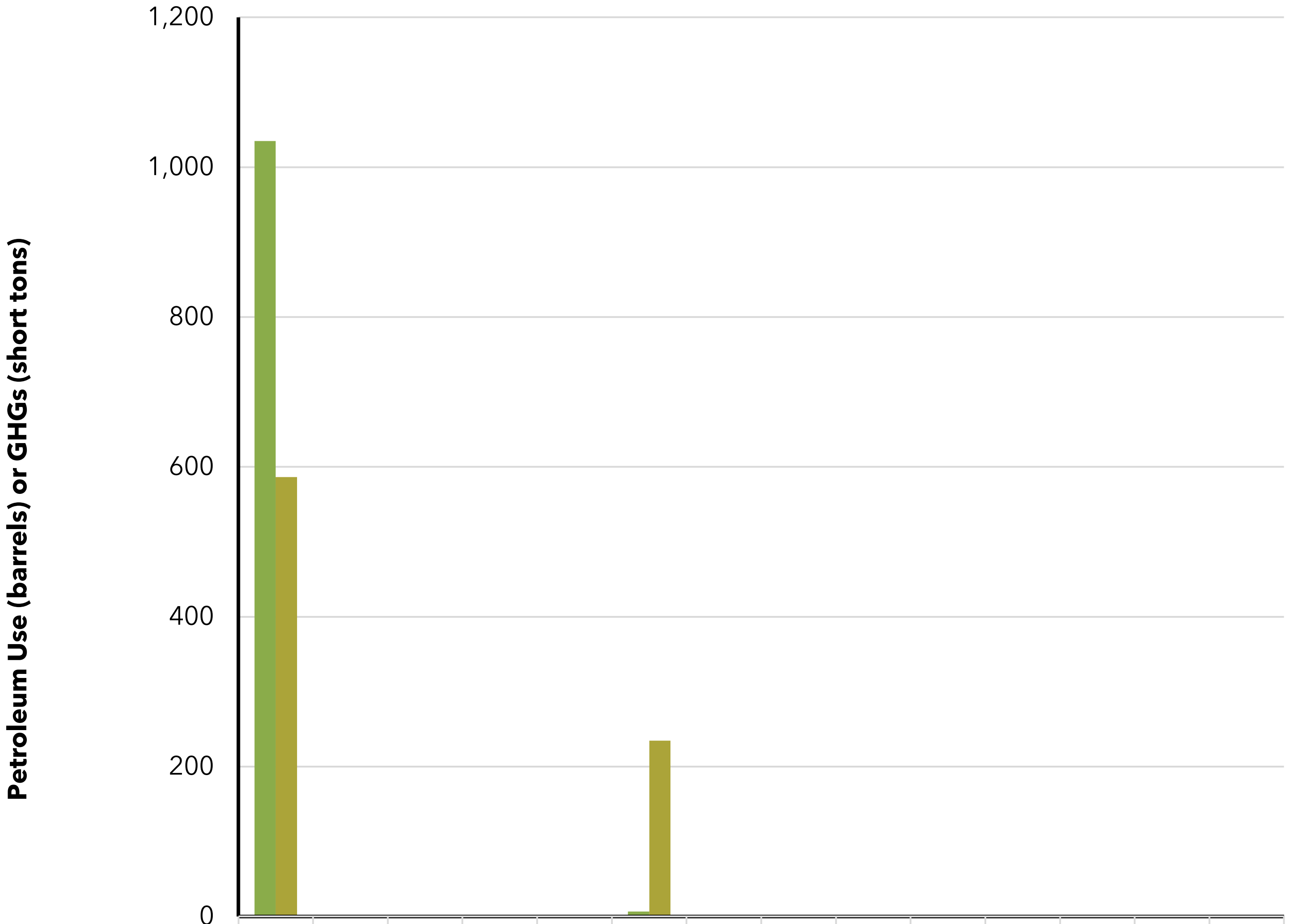
285 EVs save >1,000 barrels of petroleum and 235 short tons of GHGs



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Petroleum Use	1,035	6
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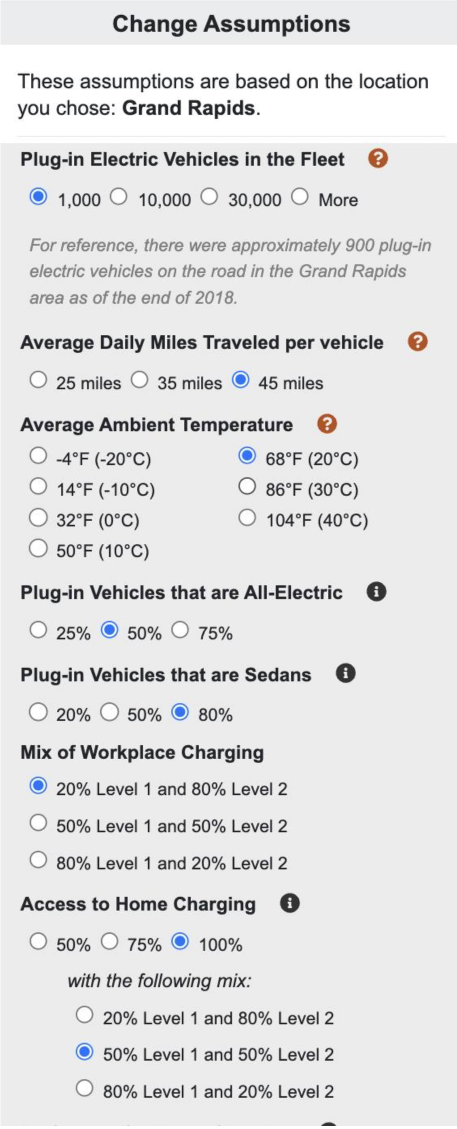
Significantly more Unknown than Known Costs

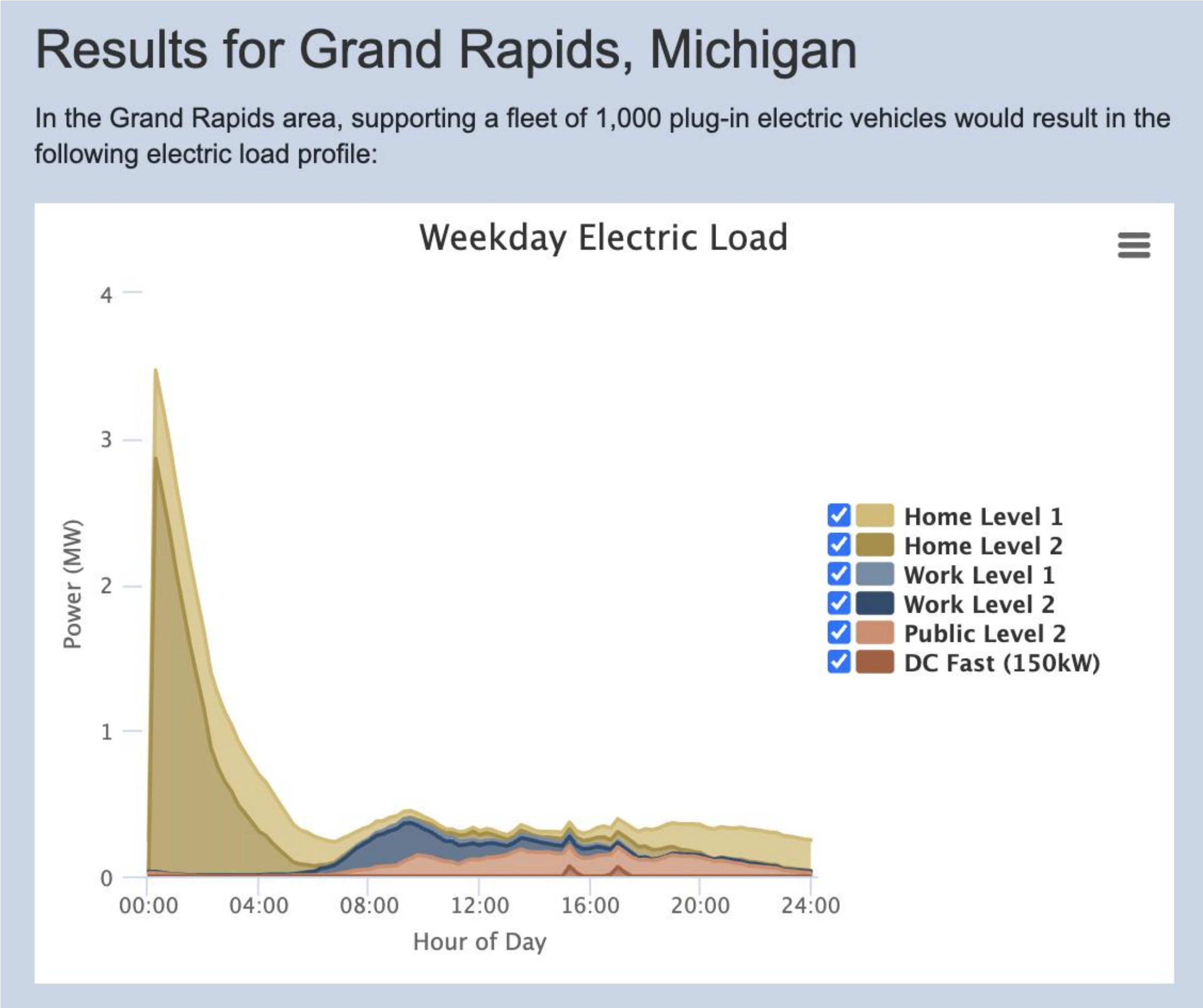
Fixed Costs	**Charger Costs**	This is dependent on the types of chargers and vehicle to charger ratios determined for the project. Some larger-scale fleet facilities use a 1:1 vehicle to charger ratio, whereas some use a 3-4:1 vehicle to charger ratio.
	Construction and Installation Costs	This is the greatest unknown as we don't know the extent to which existing infrastructure can support required upgrades, and can support any upgrades.
Variable Costs	**Labor and Mechanic Costs**	Upskilling program costs and hiring costs for mechanics and fleet managers to be determined based on the fleet.
	Maintenance and Parts	Maintenance schedule and parts needed for repairs dependent on vehicle make and fleet composition.
	Software Fees	Software like Gridlink control power flow between multiple chargers. For example, one has ten vehicles all plugged in, but power only flows to five, then to the other five when the first batch are done charging. Effectively using software can reduce charging costs by 30-50%.
	Electricity Costs	Subsidized $/KWH rates for the City of Grand Rapids.
	Utility Charges	Hidden costs and service fees charged by utility companies such as DTE and Consumers Energy.

Source: How Amazon Became the Largest Private EV Charging Operator in the US

LOAD FACTOR

- Managing load factors will be **crucial** for navigating **EV charging costs, scheduling, and fleet operations.**
- **Limitation:** Need a fleet of **at least 1000 vehicles** to calculate fleet load factor accurately using the linked calculator. Nonetheless, it provides an indication of what fleet managers can expect.





Source: [Electric Vehicle Infrastructure Toolbox, Alternative Fuels Data Center]()

AGENDA

TALENT MANAGEMENT

How to get your team onboard to upskill for the future?

01

Invest in skills training for staff

Specialized Learning Programs which may require additional investment from the city.
Source: Legacy EV

02

Connect staff to available resources

$1,500 state scholarship to help cover tuition for private training school. Support staff applications to the EV Jobs Academy. Both these programs are supported by the Michigan Labor and Economic Opportunity Dept.

03

Build a culture around sustainability

Organize events for staff to participate in office-wide "sustainability fairs" where staff learn from each other. For example, who purchased the latest e-bike or used a grant to install solar panels at home.

04

Conduct EV trials for the team

When the city buys a new EV, encourage staff members to gather around and test the vehicle. People need to be able to drive an EV, with a trusted resource explaining the charging process, to generate buy-in.

Execution Roadmap—What's next?

Step 1 — **Create initial deck and study to generate buy-in**

This slide deck can be used as a blueprint to pitch at-scale electrification to the City Manager

Step 2 — **Collaborate with other cities in the United States who have already deployed municipal electric fleets**

Draw on lessons from cities like Seattle, Houston, and Ann Arbor among others to see how they achieved their goals

Step 3 — **Contract consultants, utility managers, and developers**

Industry experts, car manufacturers, utility companies, and construction consultants can help execute create execution strategies around each of the unknowns

Step 4 — **Develop sensitivity and scenario analyses**

Such projects always cost more than originally intended. More accurate best and worst case sensitivity analyses can help prepare financially and logistically.

THANK YOU AND QUESTIONS

AGENDA

Assumptions

$29,653
Average price of gasoline vehicle
Source : Internal data from the City of Grand Rapids

0%
Discount Rate
Source : Sean Moeller - Equipment Maintenance Superintendent for the City of Grand Rapids; being owned by the city takes risk down to 0%

$31,780
Average price of EV factoring in rebates
Source : Internal data from the City of Grand Rapids

5,410 Miles
Average annual vehicle mil eage for each LTV
Source : Internal data from the City of Grand Rapids

$0
Insurance costs
Source : Sean Moeller – Equipment Maintenance Superintendent for the City of Grand Rapids

10 years
Average amount of time each car is owned for
Source : Estimates based on data from City of Grand Rapids

$0
Registration costs
Source : Sean Moeller – Equipment Maintenance Superintendent for the City of Grand Rapids

285
Gasoline Vehicles
Source : Internal data from the City of Grand Rapids

$2.35/gallon
Price of gasoline
Source : Sean Moeller – Equipment Maintenance Superintendent for the City of Grand Rapids

0%
Interest Rate
Source : Sean Moeller: Cars not financed but paid for fully at the time of acquisitions

$4,200
Average price of Level 2 charger
Source : AFleet Tool

Note: Charger costs factor into operational costs for EVs in the modeling calculator

RESOURCES

- **Fleet Electrification Guides:**
  - Sourcewell Public Fleet Electrification Guide
  - Electrification Coalition Electrification Roadmap
  - City of Boston: Electric Vehicle Development
  - City of Seattle: Green Fleet Management
  - Houston EV Roadmap
  - City of Ann Arbor Electric Vehicles

- **EV Consulting Experts:**
  - Enel Way
  - Kimley Horn
  - EV Group
  - Scott Madden

- **Alternative Fuels Data Center Resources:**
  - Electric Vehicle Infrastructure Toolbox
  - EV Charging Station Resources