

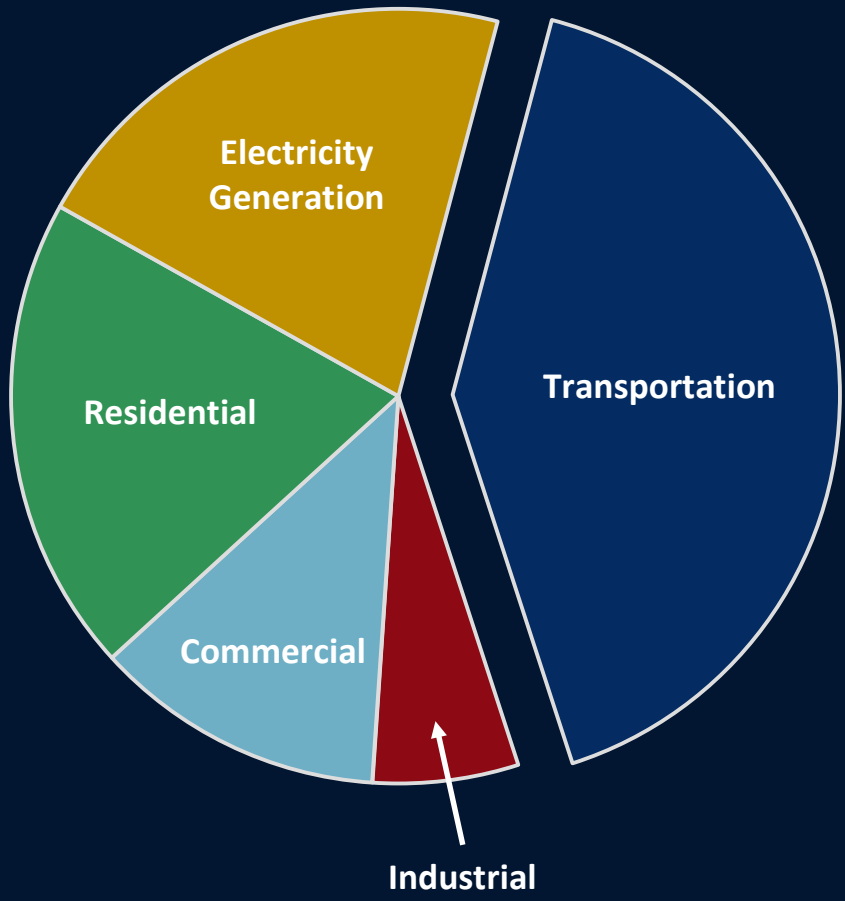
EVolveNY Update

Q4 2019


CHASING THE CARBON

40% of all carbon emissions derive from the transportation sector.


GHG Emissions In NY State 2018




- 10%




Light Duty Passenger Vehicles
- 15%



Light Duty Trucks
- 7%



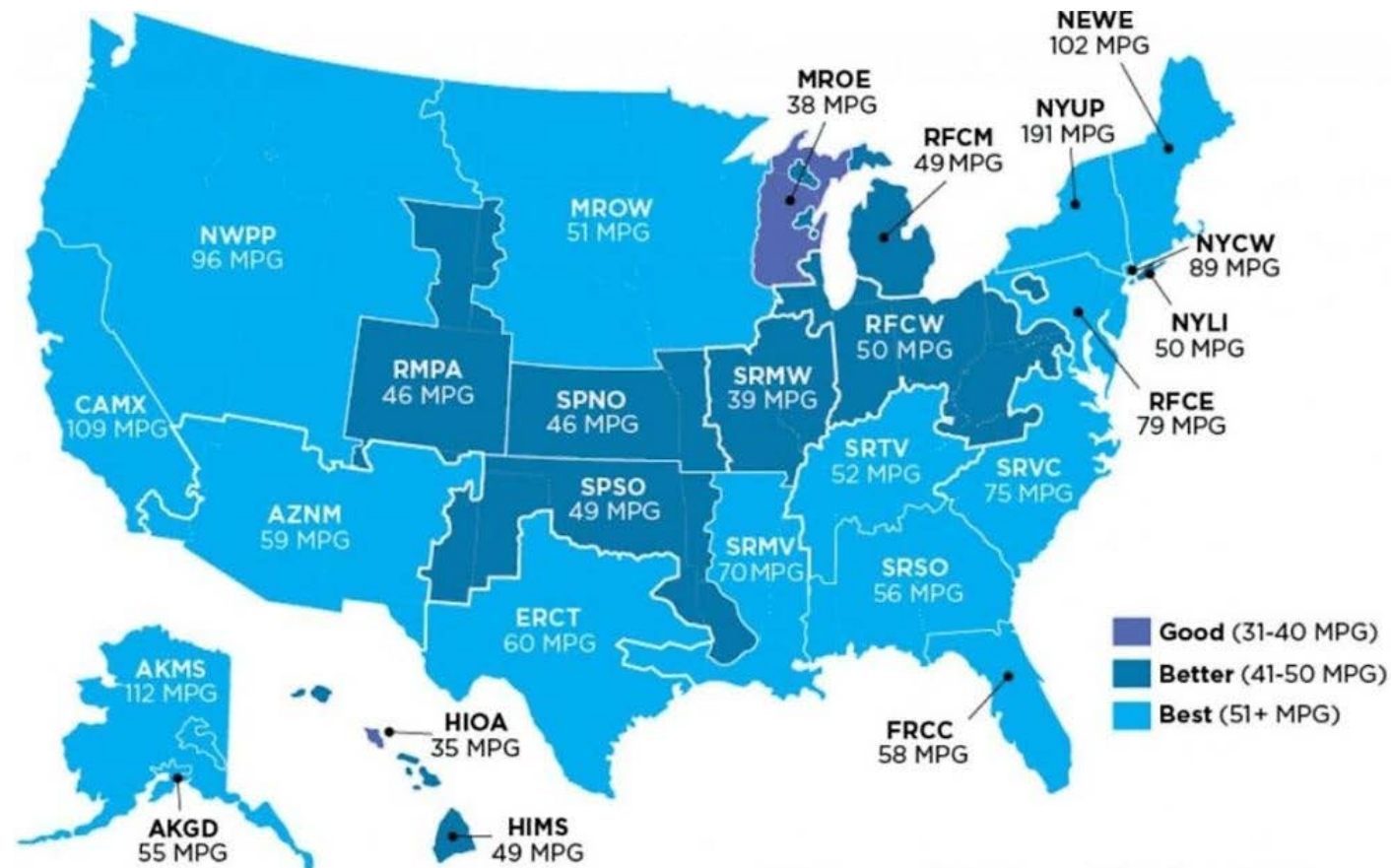
Medium / Heavy Duty Trucks
- 8%



Others

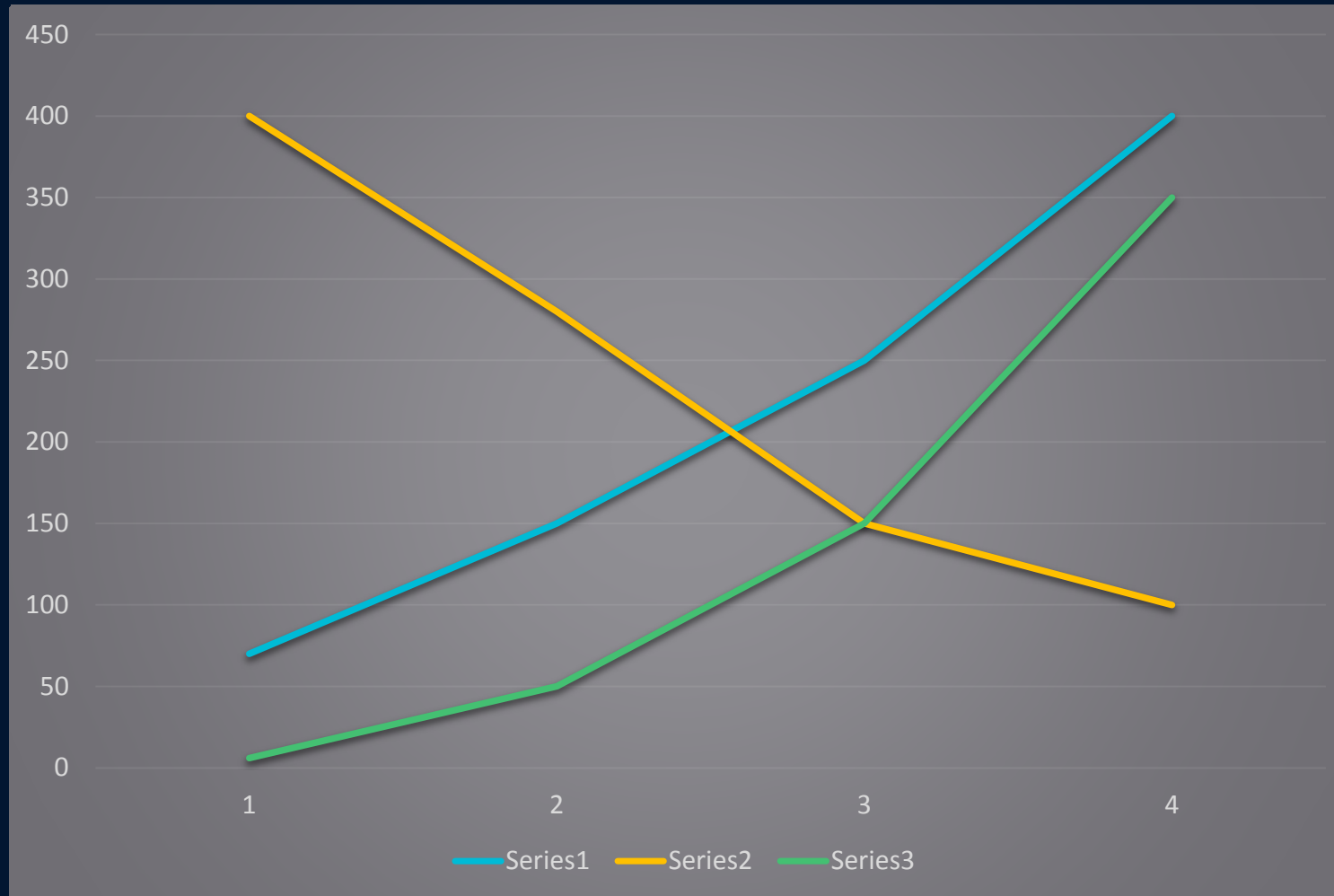
EVs are Much Cleaner than Gasoline Cars, Especially in NYS

EVs have an average efficiency of 50mpg in Long Island and 191mpg upstate vs. traditional cars, which have stagnated at ~25mpg.



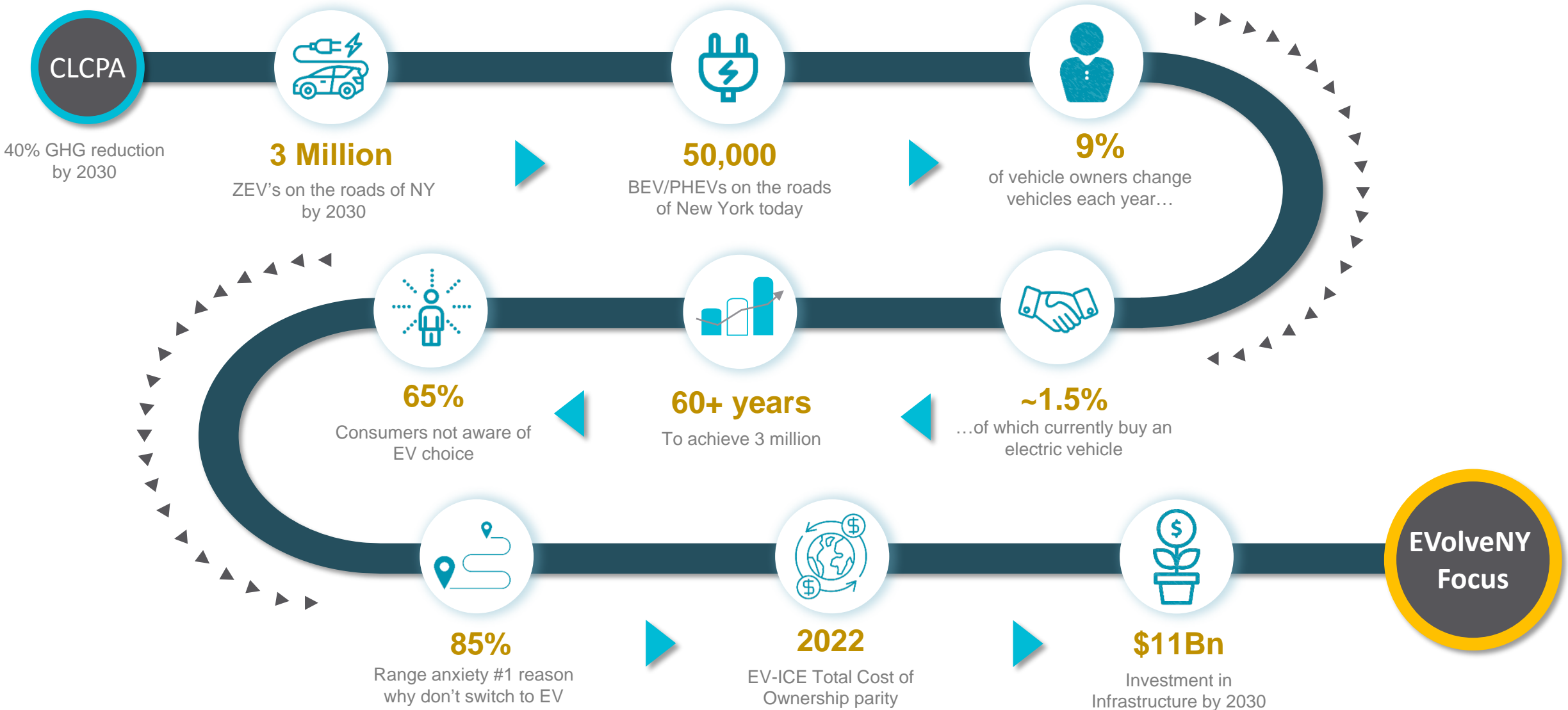
US Average (EV sales-weighted): 80 MPG

Electric Vehicles Continue to Improve



DECARBONIZATING TRANSPORTATION

A challenge of economics, technology advancement and human behavior.



EVolveNY: THREE KEY INVESTMENT AREAS

\$250M investment between now and 2025 to increase EV adoption and address decarbonization of the transportation sector.



PUBLIC DCFC NETWORK

- Eliminate EV range-anxiety for any EV owner
- De-risk the market for longer term private sector investments



CONSUMER ENGAGEMENT

- Improve awareness and education of electric vehicles
- Help communities optimally prepare for clean transportation ecosystem



CUSTOMER FLEET ELECTRIFICATION

- Help our customers affordably decarbonize their transportation emissions without impacting their operations

EVolveNY: PUBLIC DCFC – SITE DEVELOPMENT

Fast Charging. Fast Reaching. For Everyone.



Objective:

- **50 sites**, operational by end of 2020
- Typically **4x150 kw** chargers per site
- **JFK** charging hub: 10 DCFC
- Capability to increase speed **up to 350kw**
- Charge **any electric vehicle**

Thruway update

- Replacing the four DCFC in Central Hudson region
- Expanding DCFC service statewide
 - Faster and more abundant
- Commuter service



EVolveNY Electric Vehicle Accelerator Community

COMMUNITY RESIDENTS



SIMPLIFY HOME CHARGING



MANAGE WHEN TO CHARGE AT HOME IN ORDER TO OPTIMIZE ELECTRICITY COSTS AND VEHICLE USE



CHARGING OPPORTUNITIES FOR THOSE WITH NO ACCESS TO A DRIVEWAY OR GARAGE



MAKE ELECTRIC VEHICLES THE EASY CHOICE



CONSUMER EDUCATION

LOCAL SHOPS, COMMERCIAL AND INDUSTRIAL BUSINESSES



PUBLIC CHARGING – INSTALL PUBLIC CHARGERS AND DRIVE REVENUES TO LOCAL BUSINESSES



ECONOMICALLY DEMONSTRATE FLEET VEHICLE ELECTRIFICATION

THE MUNICIPAL UTILITY



AGGREGATE EV LOAD AND BATTERY STORAGE TO PROVIDE MUNICIPAL UTILITY LEVEL GRID SERVICES



OPTIMAL PLANNING AND INTERCONNECTION OF NEW ELECTRICAL LOAD

SCHOOLS AND OTHER PUBLIC SERVICES



CONSUMER EDUCATION



SCHOOL BUS ELECTRIFICATION

TOURISTS/VISITORS



CONSUMER EDUCATION



PUBLIC CHARGING



NY Power Authority

EV Charging Basics

A

STANDARD HOME OUTLET



HOW IT WORKS

Use the adapter cable that came with your car. Plug the standard 3-prong plug into your wall outlet, and plug the other end into your electric car.

WHEN TO USE IT

Plug it in overnight and your car will be ready by morning. It takes about 8-12 hours to fully charge a depleted battery.

B

RAPID HOME CHARGER



HOW IT WORKS

This requires an initial purchase and installation, but once set up, simply plug the charger cable directly into your electric car.

WHEN TO USE IT

If you drive multiple times a day, this type of charger may be for you, by ensuring that your car is fully charged between outings.

C

DESTINATION CHARGING STATIONS



HOW IT WORKS

Use a charging station app to find one of the 1,750+ Level 2 stations that is near your destination. Depending upon its host, using it may be free or cost a small fee.

WHEN TO USE IT

Ideal for topping off when you park somewhere for a while, like a workplace or parking garage.

D

ON-THE-GO CHARGING STATIONS



HOW IT WORKS

Pay and use any of the 100+ NYS fast chargers to rapidly charge your car, similar to how you would use a conventional gas station.

WHEN TO USE IT

As a stopover on longer road trips when you need to charge up as you go.

Home Charging

Public Charging

Transit bus electrification projects

- 150 kW DCFC = “slow charging”
- Overhead bus charging
 - New specification: SAE J3105
 - Depot or street-side
 - Pantograph up or down
 - 60 to 400 kW



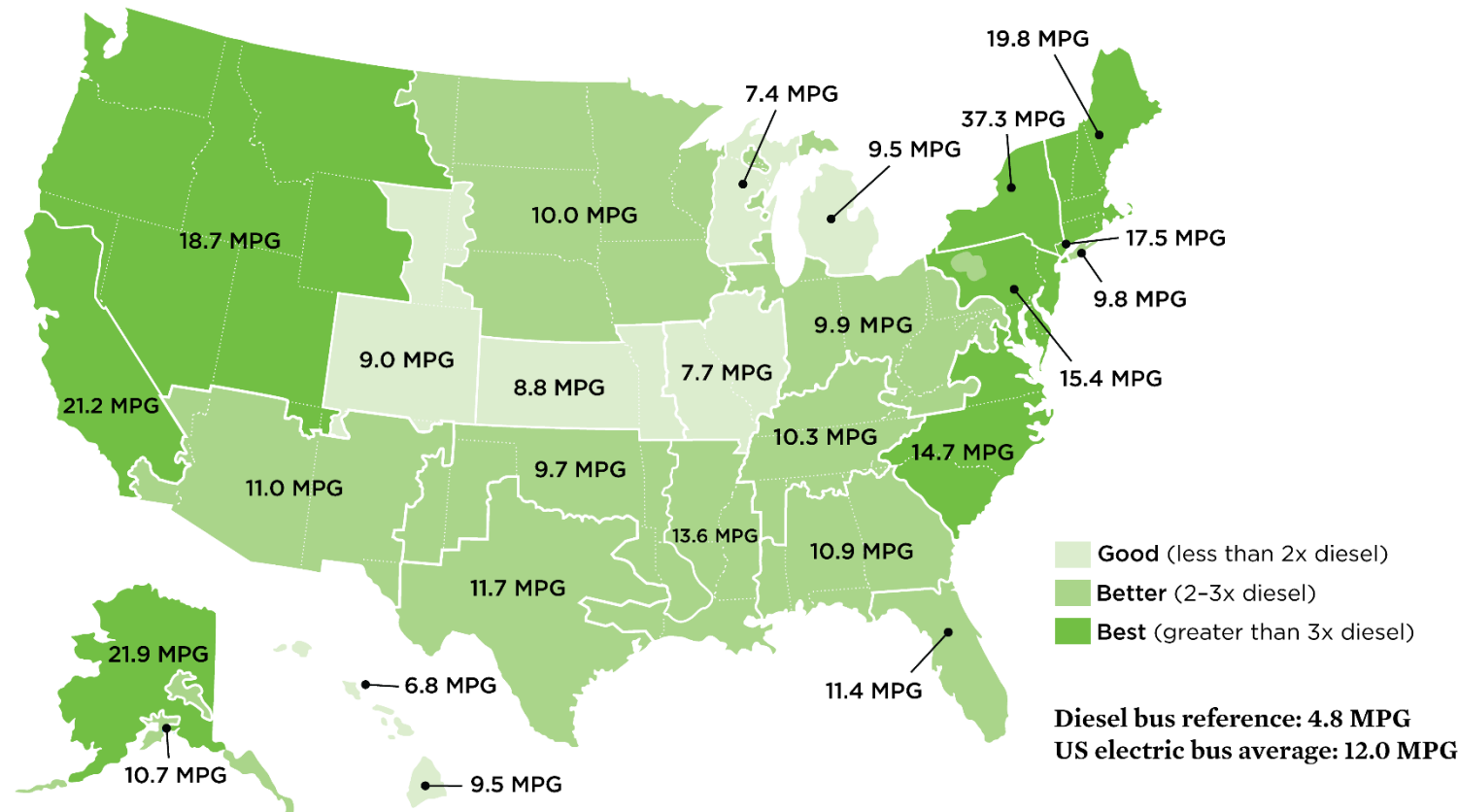
Fleet Electrification

- Electric options are now available for transit buses, school buses, shuttle buses, and many sizes and vocations of trucks
- Some buses are cost competitive now based on TCO
- Range of up to 400 miles, ultra-fast charging (400 kW+)
- MTA, PANYNJ, other transit agencies already buying electric buses
 - MTA goal of 100% electric buses by 2040
- Dozens of electric trucks already in use
- Still only a tiny fraction of fleet vehicles



E-buses are Much Cleaner than Diesel, Especially in NYS

Battery electric buses have lower global warming emissions than diesel (and natural gas) buses everywhere in the country.



**Union of
Concerned Scientists**

Note: The MPG (miles per gallon, diesel) value listed is the fuel efficiency a diesel bus would need to have the same life cycle global warming emissions as a battery electric bus in each region. Regional global warming emissions ratings are based on 2016 power plant data in the EPA's eGRID database (the most recent version). Argonne National Laboratory's GREET 2017 model was used to estimate emissions from diesel and electricity fuel production.

VW Diesel Settlement

- Over 60 percent of funding to EV projects
 - Reduced NOx, PM and reduced CO2
 - Transit buses represent 40 percent
 - EJ focus
 - Depots
 - Routes



Grid integration

- Lessons learned so far:
 - Grid upgrades take time (hospital vs. depot)
 - Procedural bypass is needed - partnership
 - Urban areas are lower voltage than anticipated
 - Depot electrical rooms are too small
 - Existing electric rates do not always fit
 - Transit buses not on utility regulator radar
 - Some depots cannot be upgraded – new site

Challenges to Scaling E-buses

- What an engineer is expected to say:
 - Vehicle / battery costs / range
 - Infrastructure costs
 - Cold weather energy use (“2x problem”)
- Regulatory / policy / business issues
 - The solar PPA / lease example
 - Make ready
 - Time of Use (TOU) electric rates
 - Demand charges
 - Financing – batteries and infrastructure



“We are stuck with technology when what we really want is just stuff that works.”

Douglas Adams (Author)