Electric Cars

By Jake Benson, Wes Barnett, Cal Abdulky, Nana Kwesi, Forrest Park

Agenda

1. Overview of Industry
2. Electrification Is Profitable
3. Limitations of EVs
4. Environmental Costs

Overview of Industry

Growth Numbers

- 3 types
  - All-electric/battery electric
  - Plug-in hybrids
  - Fuel cell
- 2011: 16,000 battery and plug-ins sold
- 2020: 1.7m sold
- 2021: 2m + sold
- China has largest fleet, Europe fastest growing

Europe leads the way in new electric vehicle sales

New global electric car registrations and automobile market share, 2010-2020

Note: Electric car totals include all-electric, plug-in hybrid and fuel cell vehicles. "Europe" includes the 27 nations in the EU, plus Iceland, Norway, Switzerland and the UK. "Other" includes Australia, Brazil, Canada, Chile, India, Indonesia, Japan, Malaysia, Mexico, New Zealand, South Africa, South Korea and Thailand.
Source: International Energy Agency, "Global EV Outlook 2021."

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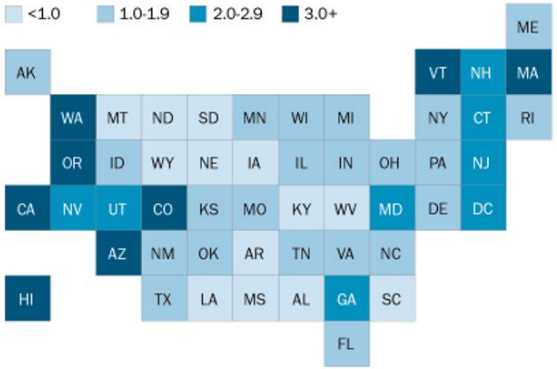
Electric vehicle registrations in the U.S.

Total electric vehicle registrations per 1,000 people, 2018



Note: Figures include all-electric vehicles and plug-in hybrid electric vehicles.
Source: Office of Energy Efficiency & Renewable Energy, U.S. Energy Department.

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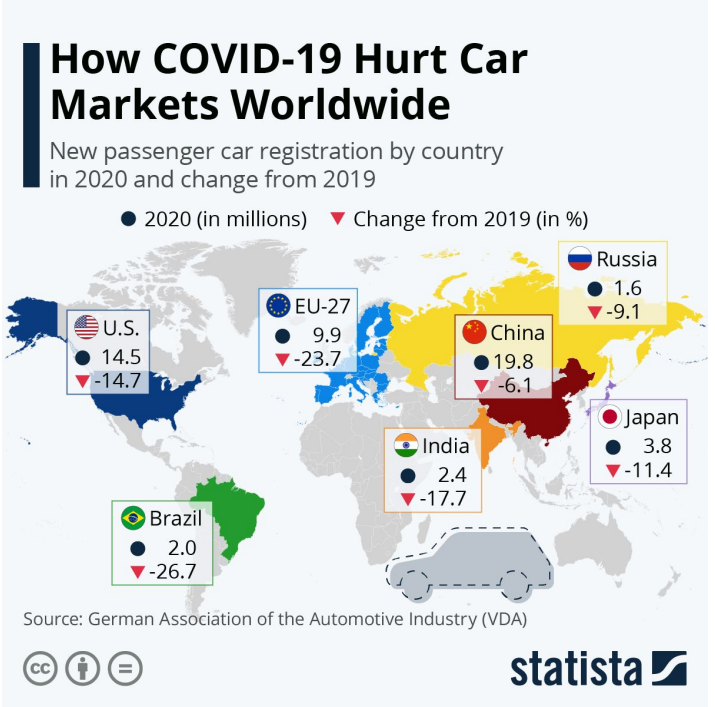
COVID-19 Impact

- The first part of 2020 saw new car registrations drop about one-third from the preceding year
- Electric car market was very resilient!
- Policy support schemes
- As overall car registrations fell, global electric car sales share rose 70% to a record 4.6% in 2020
- Lack of government push to encourage transition to electric cars



Government Incentives

- Governments and cities incentivize people to make the switch
- More sustainable public transport
- The European Union “Fit for 55” program
- The Biden administration introduced a 50 percent electric vehicle target for 2030

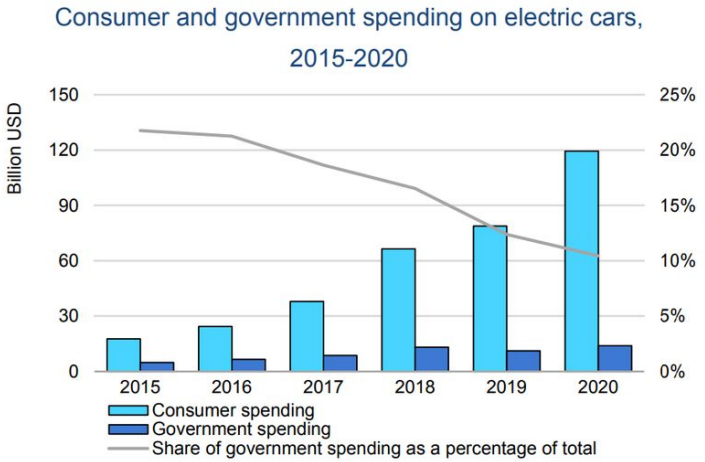


Figure: Global statistics (IEA)

ELECTRIFICATION IS PROFITABLE

Similarities?

VOLKSWAGEN
GROUP

Electrification

VOLKSWAGEN GROUP

Ford

TESLA

NIO 蔚来

Ford's Electric Revolution

Ford commits $30 billion to electrification through 2025

(11 billion of their total investment allocated to build electric vehicle plants and battery factories)

Commercial Vehicles

FULL RANGE
Zero emission capable
by 2024

2/3 OF SALES
expected to be all-electric or plug-in hybrid
by 2030

Passenger Vehicles

FULL RANGE
All-electric or plug-in hybrid
by mid-2026

50% OF SALES
expected to be all-electric
by 2030

https://media.ford.com/content/fordmedia/fna/us/en/news/2021/09/27/ford-to-lead-americas-shift-to-electric-vehicles.html

Ford's Comeback

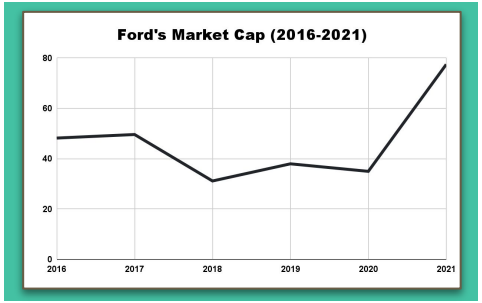
About the Company

Brief About Ford's Recent Performance

2022 F-150 Lightning

Reports of having over 160,000 reservations for the Ford F-150 Lightning despite not releasing until Spring 2022

- 75% of buyers are switching from other brands



SUV retail sales expanded 56.0 percent over October, while retail share increased an estimated 3.9 points to 10.1 percent

Ford was the best-selling automaker in America for the past two months, which was last accomplished 23 years ago.

November 2021 EV sales increased by **153.6%**

3x faster than the EV sector's overall growth rate

2021 Mach-E

200% increase in Ford's EV market share 12 months after its release

2021 North American SUV of the Year Award

https://media.ford.com/content/fordmedia/fna/us/en/news/2021/09/27/ford-to-lead-americas-shift-to-electric-vehicles.html

TESLA

535%

Since
2/20/2020

https://finance.yahoo.com/quote/TSLA?p=TSLA&.tsrc=fin-srch

Ford

232%

Since
6/1/2020

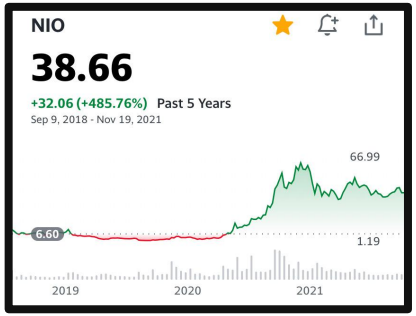
https://finance.yahoo.com/quote/F?p=F&.tsrc=fin-srch

Coincidence?

NIO 蔚来

833%

Since
2/20/2020



https://finance.yahoo.com/quote/TSLA?p=TSLA&.tsrc=fin-srch

VOLKSWAGEN
GROUP

72%

Since
8/12/2020

https://finance.yahoo.com/quote/VWAGY?p=VWAGY&.tsrc=fin-srch

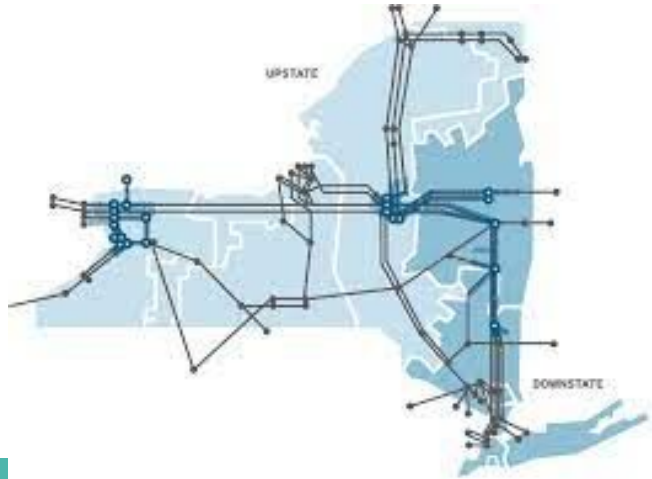
Limitations of EVs

Power Grid

How much energy do electric cars consume?

Infrastructure problems

Where the power comes from

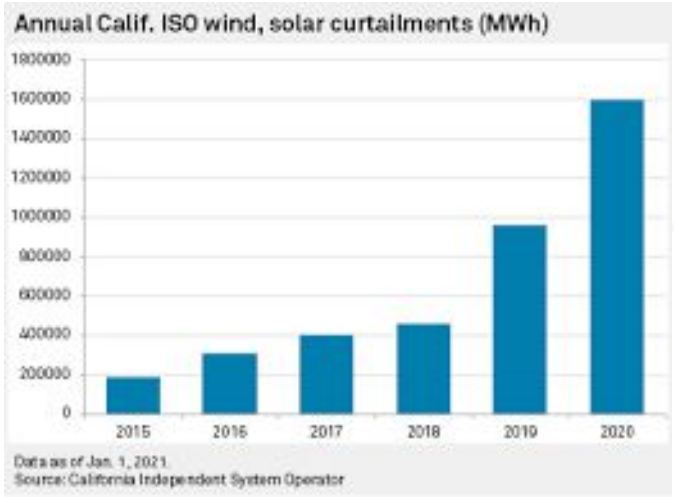


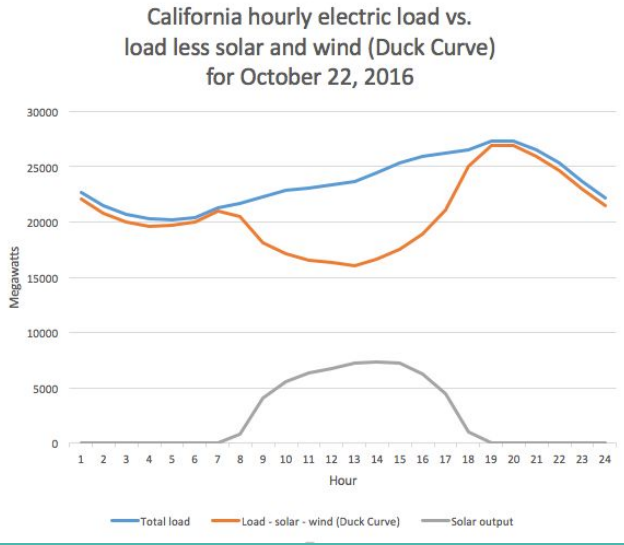
Power Grid

Stability in power demand

Save money in power

Use green power





Electric vehicles are expensive

- Electric vehicles cost more an average than gasoline vehicles
  - EV Average Cost : **$55,000**
  - GV Average Cost: **$30,000**
  - Cheapest EV: **$19,000**

- Prices will fall in the future
  - Highly anticipated rise in supply

Currently EV Range is limited

- Consumers cite range anxiety
  - Maximum Range ~ **400 miles**
  - Average Range ~ **200 miles**

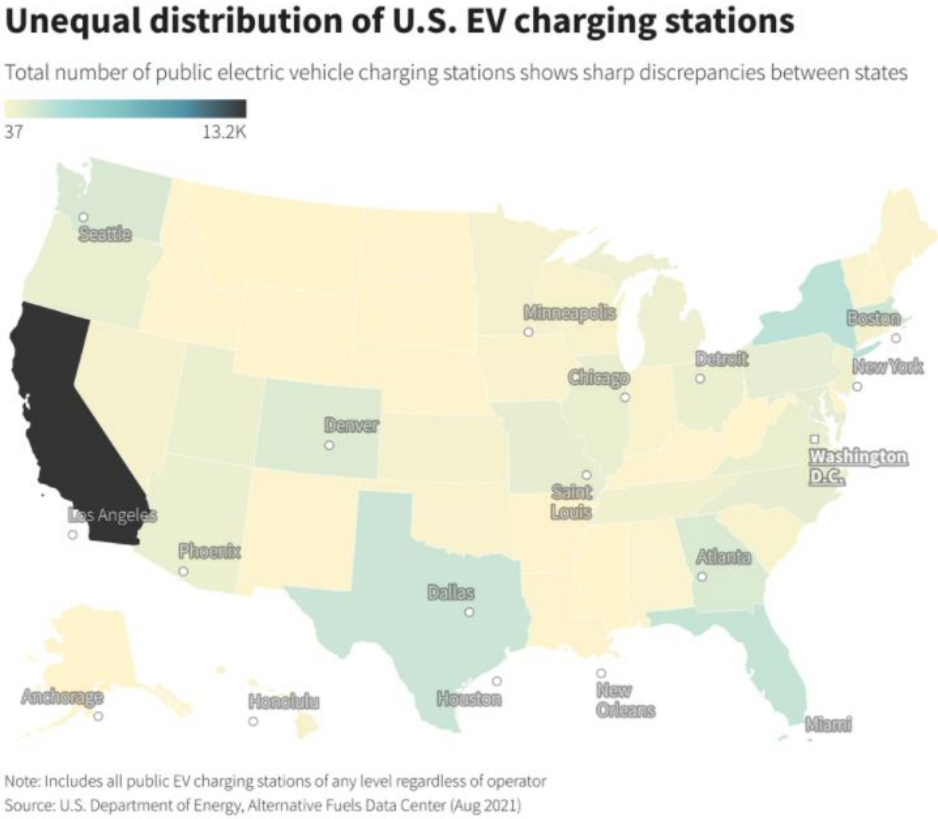
- Battery optimization is a growing research field amidst energy transition

- Range on EVs increases each year

Current infrastructure for EVs is limited

- Limited Infrastructure
  - **43,000** EV Charging stations in US

- Recently passed infrastructure bill allocates ~ $7.5 billion to EV infrastructure expansion



Environmental Costs

A Great Alternative (Almost)

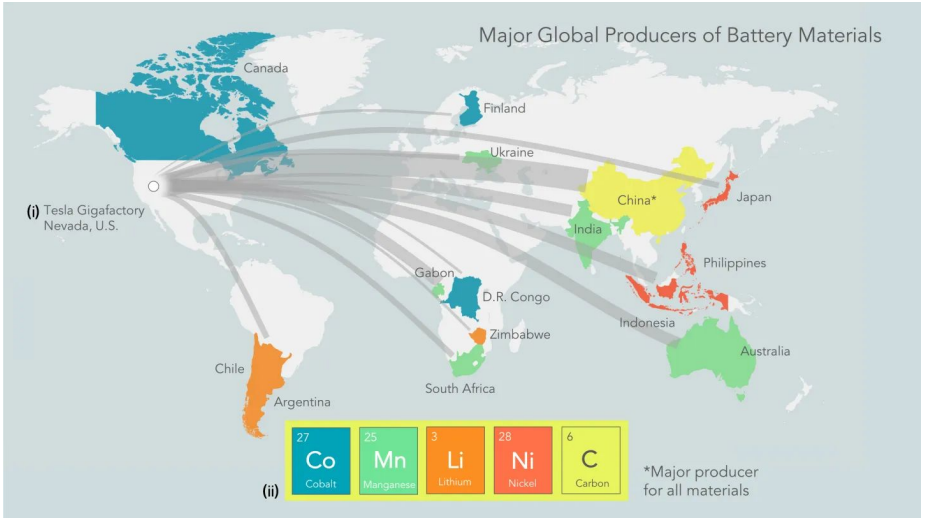
Electric cars are a great alternative to modern petrol cars, but they still carry environmental costs associated with production of the car, such as battery production as well as the source of energy that charges it.

Regardless of what is advertised, they are not ‘zero-emission’ vehicles.

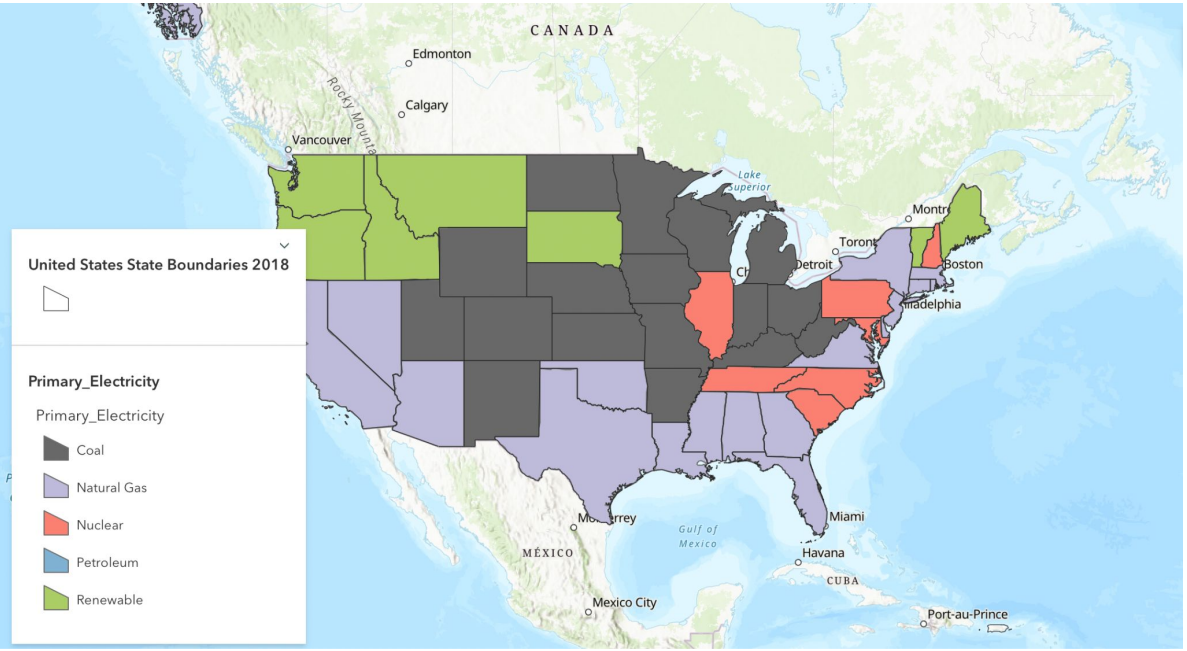
To get to a net-zero vehicle off the production line, the industry still has a ways to go to develop a clean way to manufacture EVs. Some of these factors include battery production and power station generation, known as **embodied emissions.**

Battery Production

- The biggest environmental impact an EV makes is the production of the battery.
- Rare metal and chemical extraction costs
- For a Tesla Model 3, 4,500 kg of CO2 are emitted when the 75-kWh battery is made - the equivalent of a gas-powered car being driven 18,000 miles.



Where Does the Power Come From?

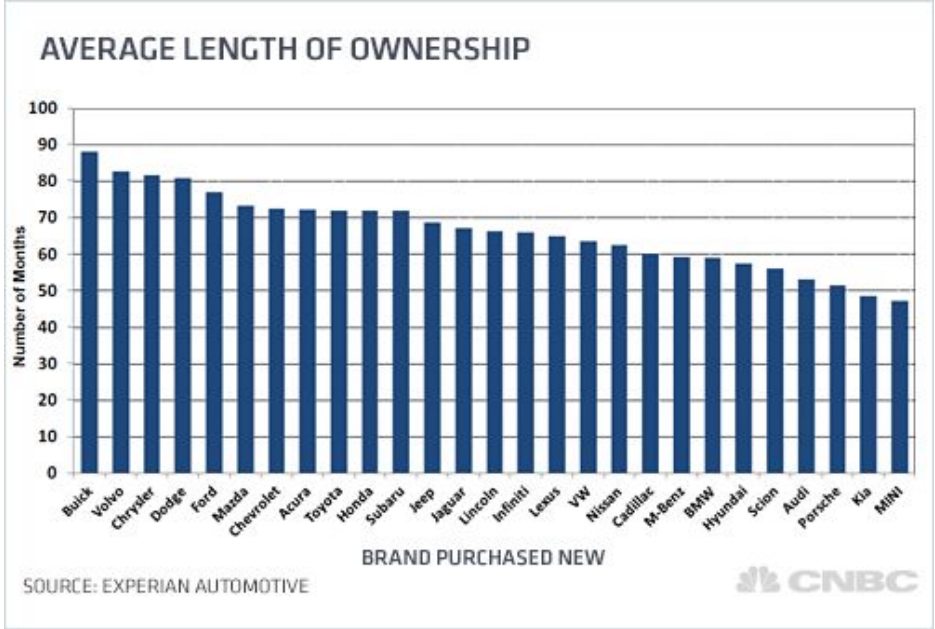


Right now, fossil fuels are powering our EV charging stations.

The charging process is not very environmentally friendly. Making the source for power renewable is one of the first steps to creating a net-zero EV.

The Last Step: Ownership Longevity

- **How long are the cars owned for?**
- Crucial to the justification of emissions from EV production
- EVs can be green *if* they are owned past a certain point.
- Passing the mileage ‘checkpoint’ for battery production and charging emissions can justify the CO2 output they produce.

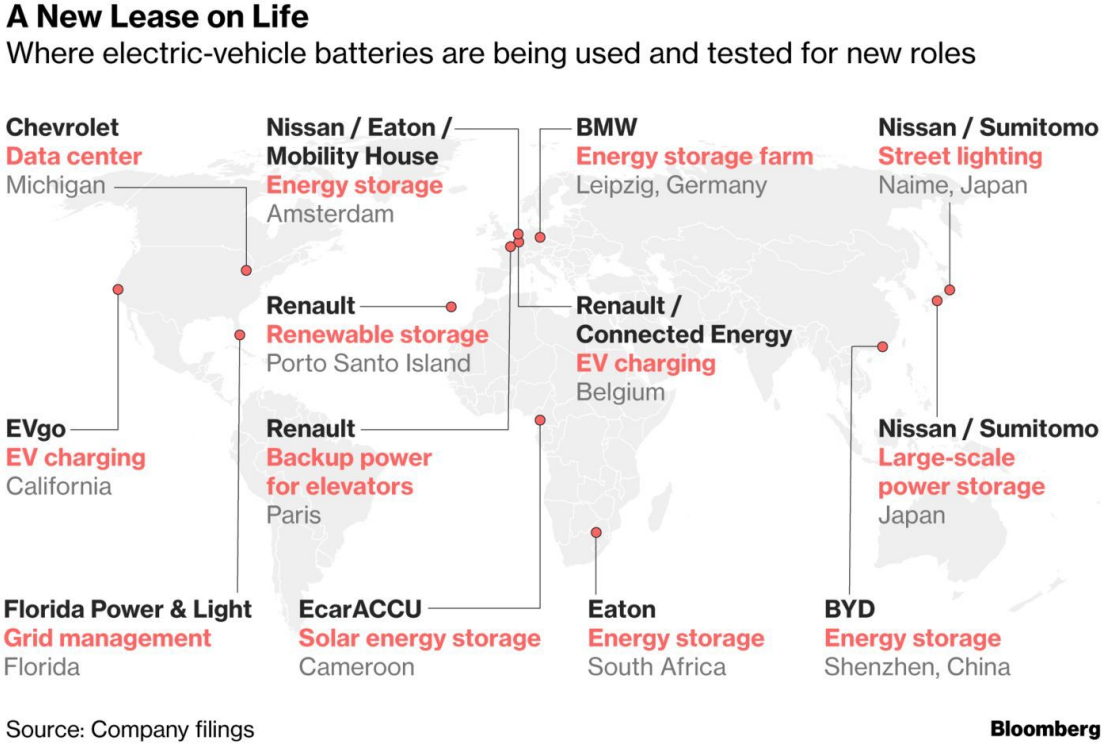


What Gives?

- Here's what can be done to lower these embodied emissions:
  - Requires government support for friendly mineral extraction
  - Sourcing and producing locally: defeating emissions from container ships can lower shipping emissions to produce these EVs closer to where they will be assembled.
  - Car ownership longevity; National car ownership is 7 years as of May 2021; we are beating the car ownership point by a great margin.

What Happens After?

- The first group of EV batteries are beginning to reach the end of their life, now what do we do with the old batteries?
- New roles are assigned such as energy storage and powering car-charging stations
- Rules are being made to keep these used batteries out of landfills



Thank you!

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