Electric Vehicles and Charging Infrastructure in Minnesota

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Shift2Electric.com

- EV market and business development
  www.Shift2Electric.com
- Charging information for condos and apartment buildings
  www.MUDCharging.com
- Charging information for workplaces
  www.WorkplaceCharging.com
- MN EV Owners
  www.MNEVOwners.org
- EV market expert at Fresh Energy
  www.Fresh-Energy.org
- EV Market and Technologies,
  University of St. Thomas

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Photo: Jukka Kukkonen

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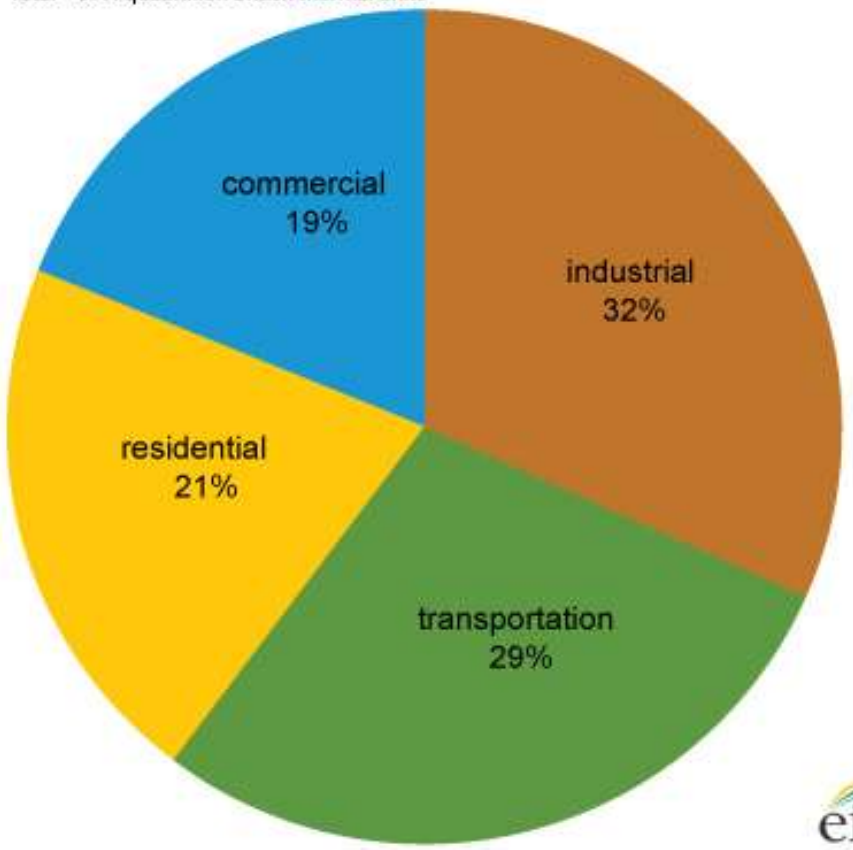
Share of total U.S. energy consumed by end-use sector in the United States, 2016

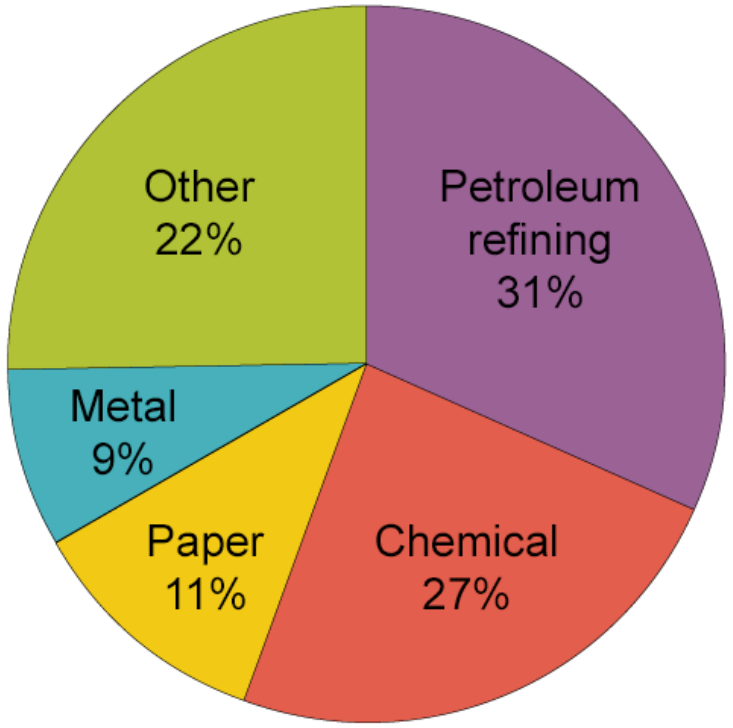
Total = 97.4 quadrillion British thermal units



Note: Sum of individual percentages may not equal 100 because of independent rounding.

Source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 2.1, April 2017, preliminary data

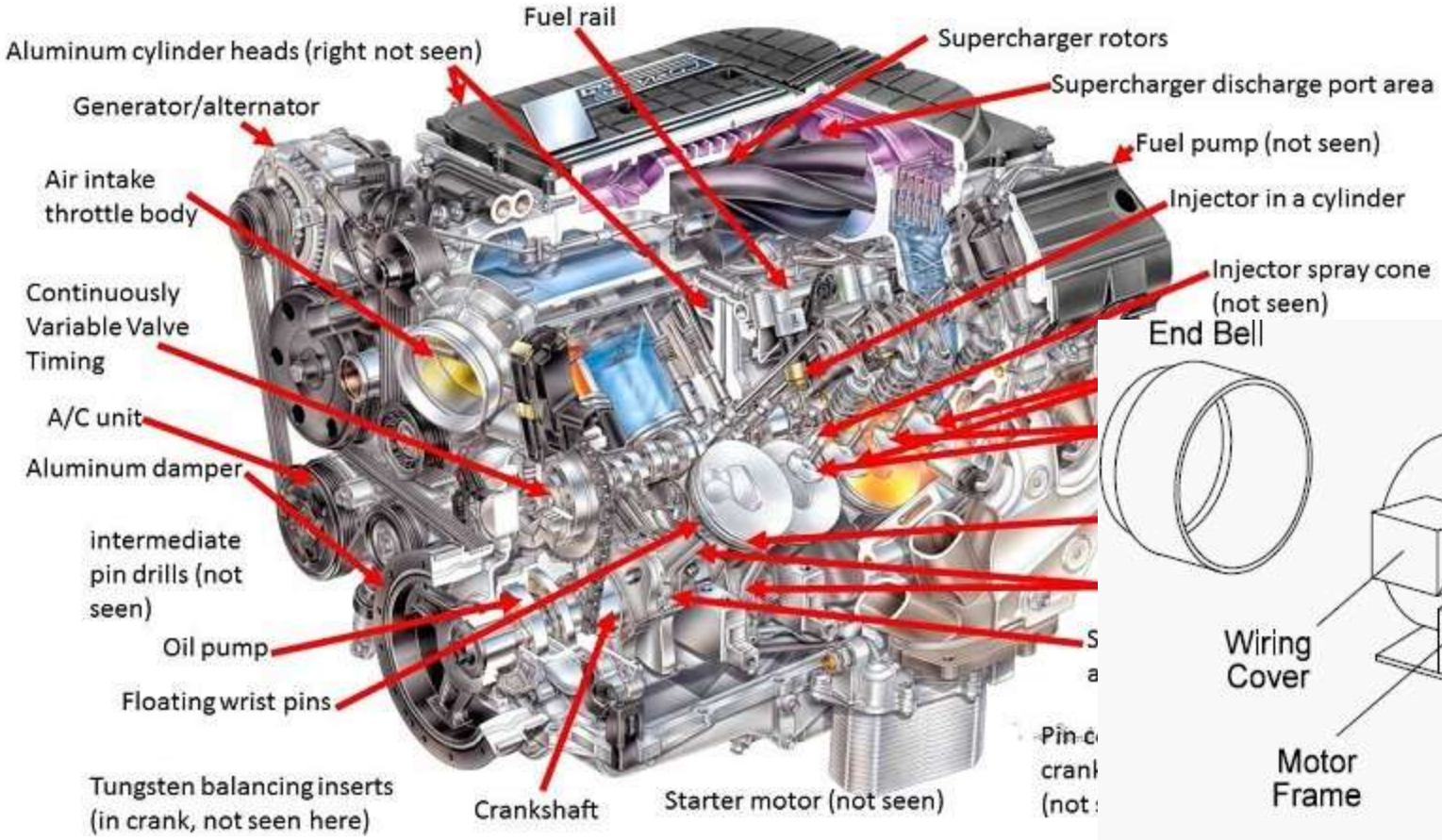
Energy use by type of industry, 2010[1]

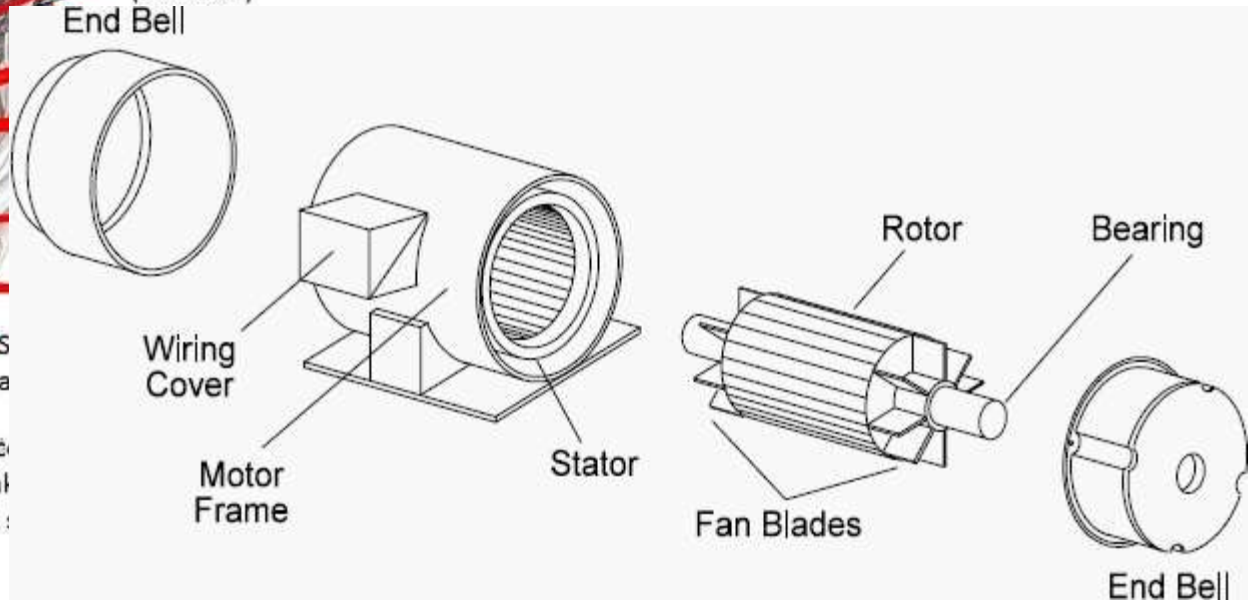


Source: U.S. Energy Information Administration, *Manufacturing Energy Consumption Survey 2010*, Table 1.2 (March 2013)

[1]Includes all use of energy and fuels; excludes shipments of energy sources produced onsite.

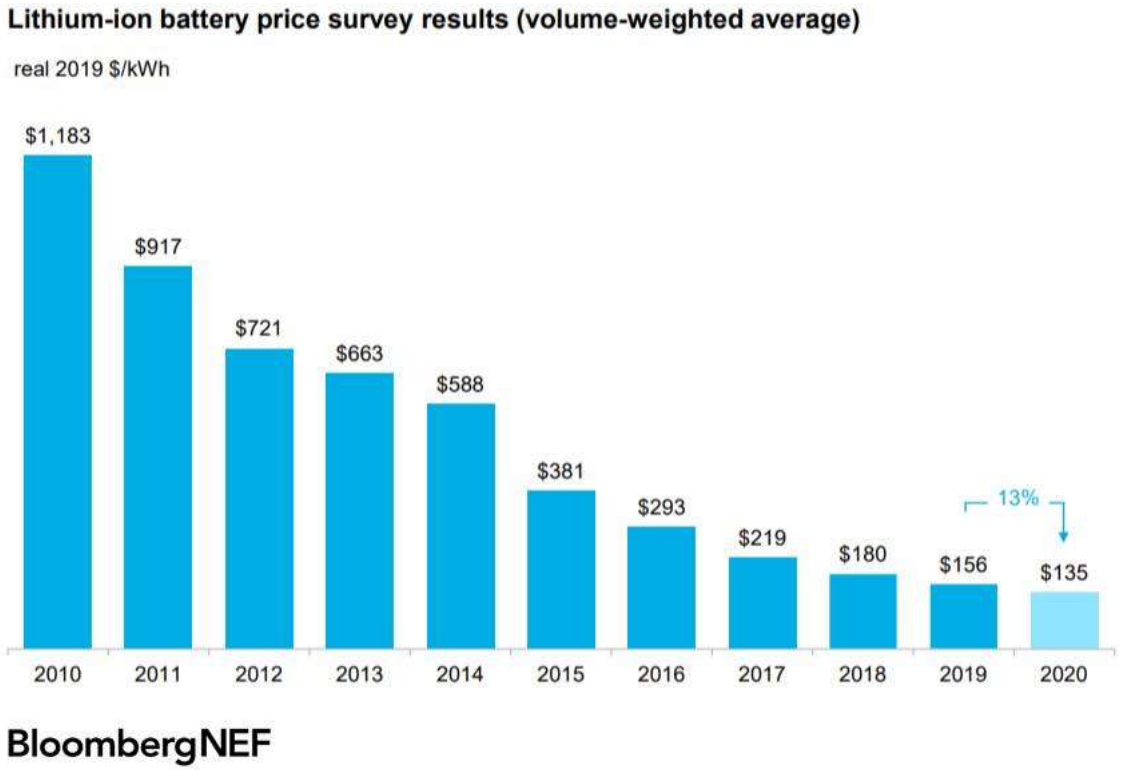
Internal Combustion Engine vs. Electric Motor





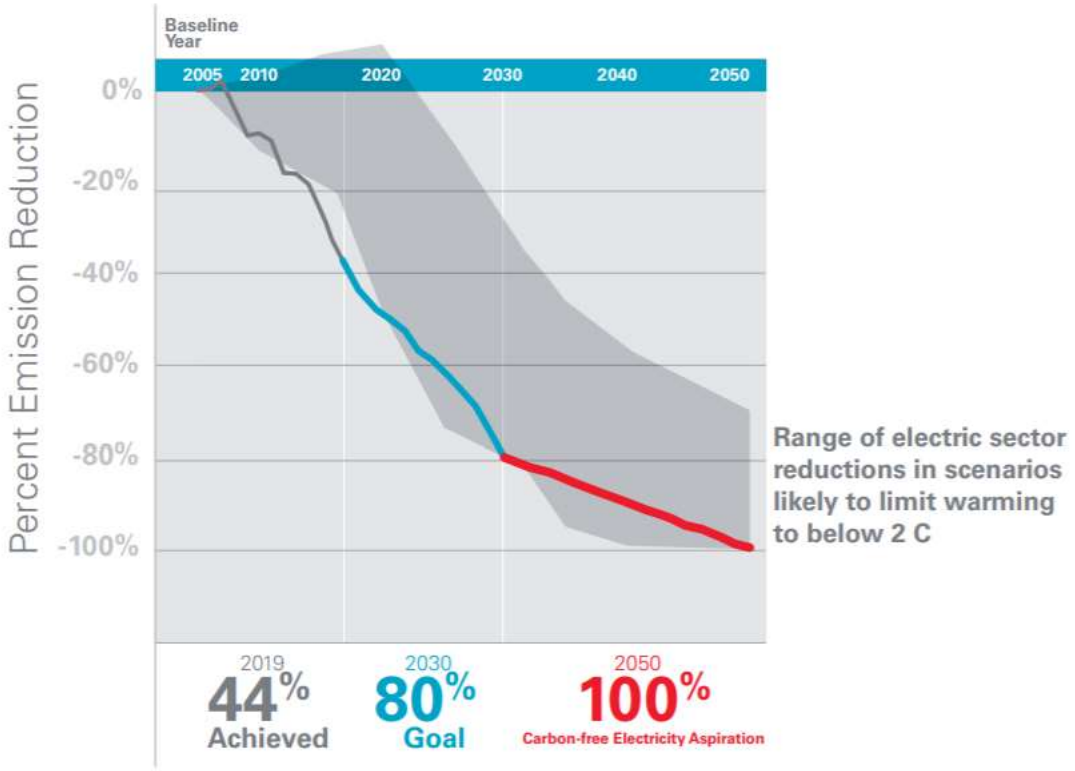
Technology advancements

Battery tech advancement



Shift to renewable electricity

Xcel Energy's carbon emissions



Graphs:
Bloomberg NEF, Xcel Energy

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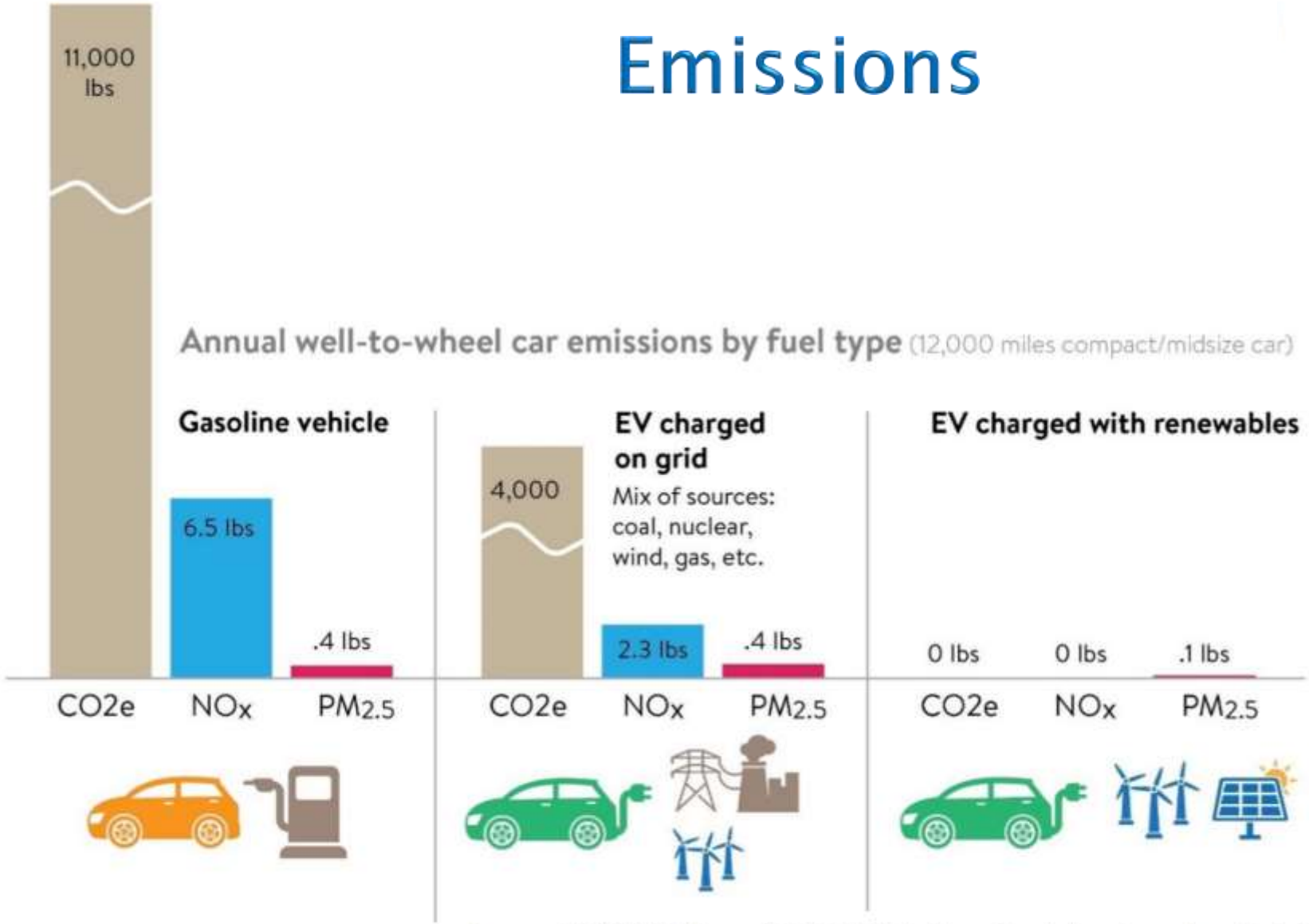
Emissions



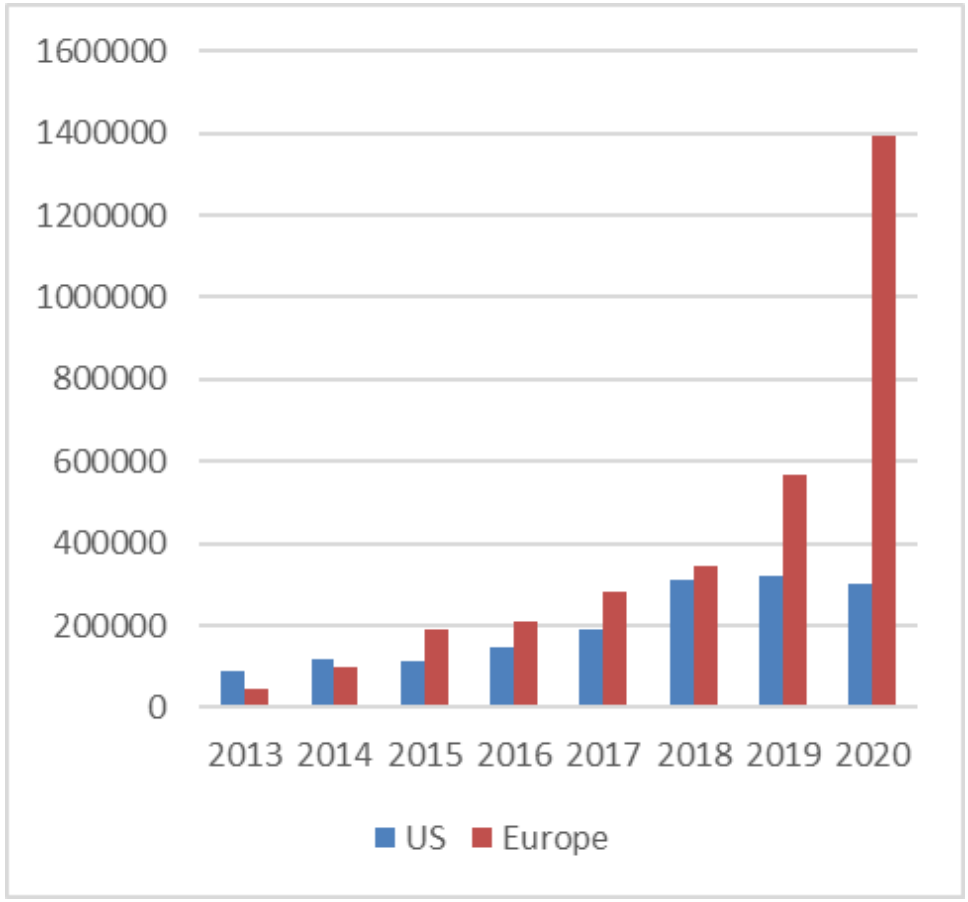
Source: MOVES2014a and 2014 EPA National Emissions Inventory Database

Basic facts about EVs

- EVs get over 100 MPGe so they use only a quarter of the energy compared to average internal combustion engine vehicles
- Cheaper to drive and maintain
- No local emissions – much lower overall emissions
- Can be powered with renewable energy
- EVs are more powerful and provide smoother ride
- 85% of charging happens at home
- EVs always start in cold weather and heat up much faster
- In 2020 average range of EVs sold in the US was over 250 miles
- Only 5% of vehicle trips people take in the US are over 30 miles

EV market developments

EV sales in US vs Europe



Some market trends by numbers:

2020 US light duty sales down 14.4%

2020 Tesla US sales up 20%

Tesla market share of US EV sales 66%

Tesla market share in MN 2019 0.9%

Tesla market share in MN 2020 1.1%

EV market share in Europe 2019 3.3%

EV market share in Europe 2020 10.2%

EV market share in Norway 2020 75%

EV market share in Germany Jan 2020 22%

European auto industry expects that EV market share in Europe 2025 is 40%

Industry perspectives:

- By the end of 2025 General Motors will offer 30 all-electric models globally and 40 percent of the company's U.S. models offered will be battery electric vehicles. GM has also pledged to eliminate tailpipe emissions from new light-duty vehicles by 2035.
- Ford Europe says 100 percent of its passenger vehicles will be zero-emissions capable by 2026 and by 2030 all electric.
- Norway is planning to phase out sales of all new fossil-fuel vehicles by 2025.
- Jaguar is switching to all electric by 2025.
- Volvo CEO Hakan Samuelsson: "I would be surprised if we wouldn't deliver only electric cars from 2030."

Deborah Wahl, Chief Marketing Officer, GM: "There are moments in history when everything changes. Inflection points. We believe such a point is upon us for the mass adoption of electric vehicles."
Automotive News 1/18/2020

Electric era in transportation is coming.

- Over 1,800,000 electric vehicles on US roads.
- Over 14,000 EVs in MN. Over 100 million gas free miles in 2019.

- Very high satisfaction: Over 90% of owners say their next vehicle will be an EV too.
- People are hesitant to try new things but we are approaching the tipping point.

Photo: Chevrolet

Midwest EV Info List (March 2020) Page 1 of 3

Midwest EVOLVE

Manufacturer										Range			Charging speed (miles/hr)			Performance				
Make	Model	Photo	Seating	EV Type	FWD/ RWD/ AWD	Base MSRP	Federal tax credit	Price after federal tax credit	Battery size (kWh)	Electric Range (miles)	Total Range (miles)	Charging rates (kW) L2/DCFC	Level 1 120V	Level 2 240V	DCFC 400+V	MPGe/ MPG	Top Spd (mph)	0-60 mph (sec)	Towing capacity (lbs)	Crash Ratings: IIHS/NHTSA
Audi	e-tron		5	BEV	AWD	$74,800	$7,500	**$67,300**	95	204	204	11/130	3	24	228	74	155	5.5	4000	Top Safety Pick +/ Not rated
Audi	Q5 e		5	PHEV	AWD	$52,900	$6,712	**$46,188**	14.1	20	390	7.4	2	14	N/A	65/27	130	5	4400	Good/ Not rated
Audi	A8L PHEV		5	PHEV	AWD	$94,000	$6,795	**$87,205**	14.1	17	420	7.4	2	12	N/A	54/23	130	4.9	0	Not Rated
BMW	i3		4	BEV	RWD	$44,450	$7,500	**$36,950**	42	153	153 (200)	7.4/50	4	27	147	124 (39)	93	6.9-7.2	0	Good-Acceptable/ Not rated
BMW	i8		4	PHEV	AWD	$147,500	$3,793	**$143,707**	7.2	15	330	3.3	3	7	N/A	76/28	155	4.2	0	Not rated/ Not rated
BMW	X3 xDri																		)	Top Safety Pick + / Not rated
BMW	53																		)	Top Safety Pick + / Not rated
BMW	745e		5	PHEV	AWD	$95,550	$5,836	**$89,714**	12	16	290	3.7	2	6	N/A	56/22	155	4.9	0	Not rated / Not rated
Chevrolet	Bolt EV		5	BEV	FWD	$36,620	$1,875	**$34,745**	66	259	259	7.2/50	4	25	140	118	98	6.5	0	Top Safety Pick / 5 star
Chrysler	Pacifica Hybrid (PHEV)		7	PHEV	FWD	$39,995	$7,500	**$32,495**	16	33	570	6.6	3	16	N/A	84/32	107	7.8	0	Top Safety Pick / 5 star
Ford	Fusion Energi		5	PHEV	FWD	$35,000	$4,609	**$30,391**	9	26	610	3.3	3	9	N/A	97/42	85	8.5	0	Good/ 5 star
Honda	Clarity PHEV		5	PHEV	FWD	$33,400	$7,500	**$25,900**	17	48	340	6.6	4	22	N/A	110/42	110	8.8	0	Not rated/ Not rated
Jaguar	I-PACE		5	BEV	AWD	$69,850	$7,500	**$62,350**	90	246	246	7.0/85	3	16	153	76	124	4.5	0	Not rated
Kia	Niro PHEV		5	PHEV	FWD	$28,500	$4,543	**$23,957**	8.9	26	560	3.3	4	10	N/A	105/46	107	9	0	Top Safety Pick + / 4 star

This table is updated by Jukka Kukkonen, Shift 2 Electric. Photos and information sources: Manufacturers' websites and www.fueleconomy.gov Get the latest version: www.EVInfoList.com

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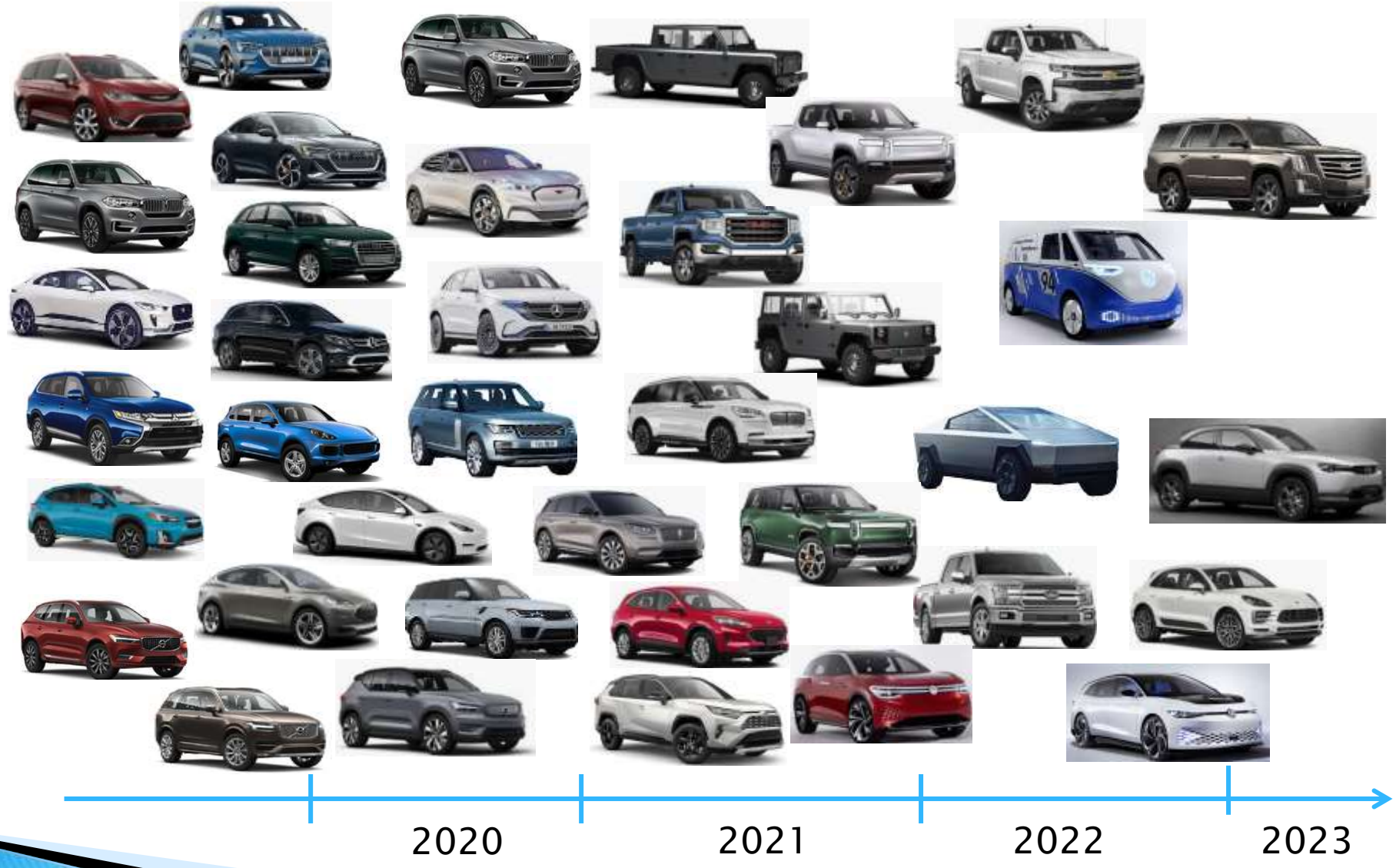
Electric CUVs, SUVs and Pickup trucks



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EVs coming to the US market 2021

Sedans


Polestar 2


Audi e-tron GT


Lucid Air


Mercedes EQS

Crossovers and SUVs


Volkswagen ID.4


Nissan Ariya


BMW iX


Hyundai Tucson PHEV


Ford Mustang Mach-E


Chevrolet EUV


Audi Q4 e-tron


Kia Sorento PHEV


Volvo XC40 Recharge


Hyundai Ioniq 5


Ford Escape PHEV


Jeep Wrangler 4xe


Rivian R1S

Pickup trucks


GMC Hummer EV


Rivian R1T


Tesla Cybertruck


Ford F-150 Electric

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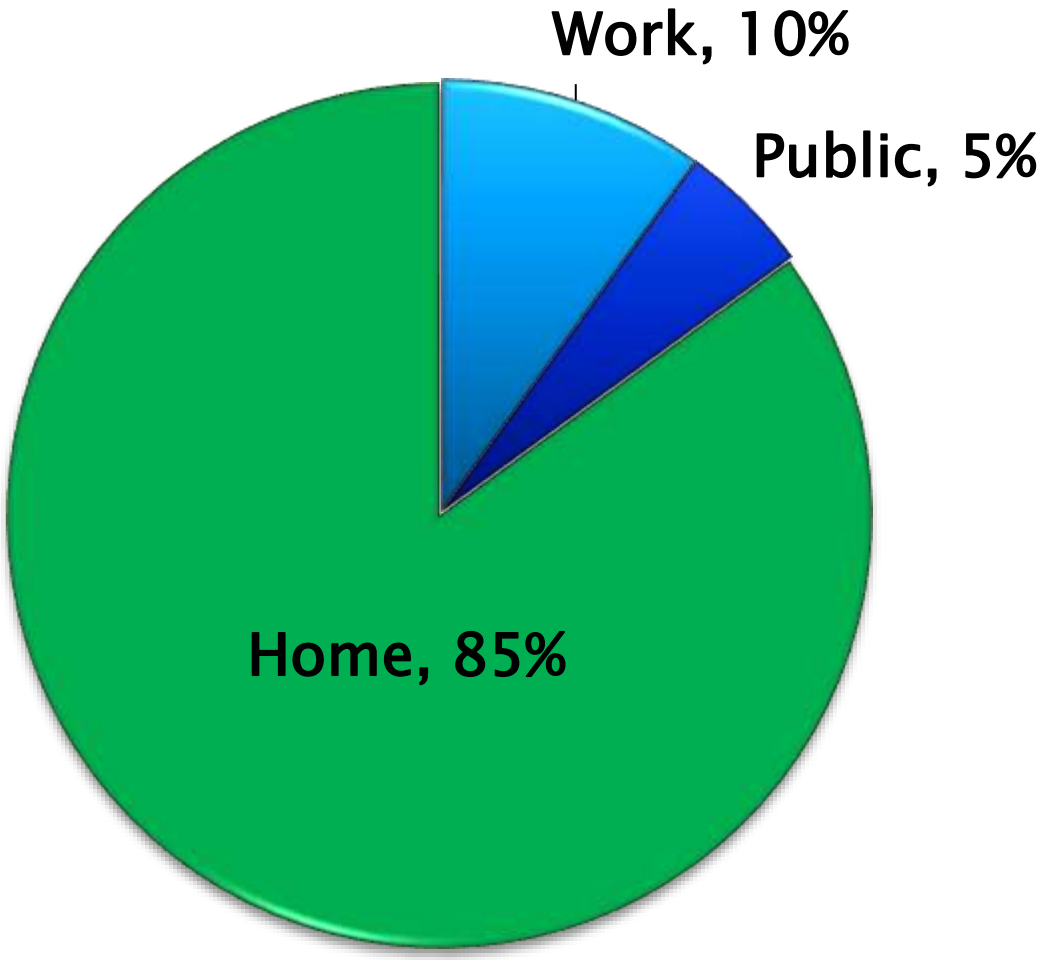
Where does the energy flow?



How to charge an EV?

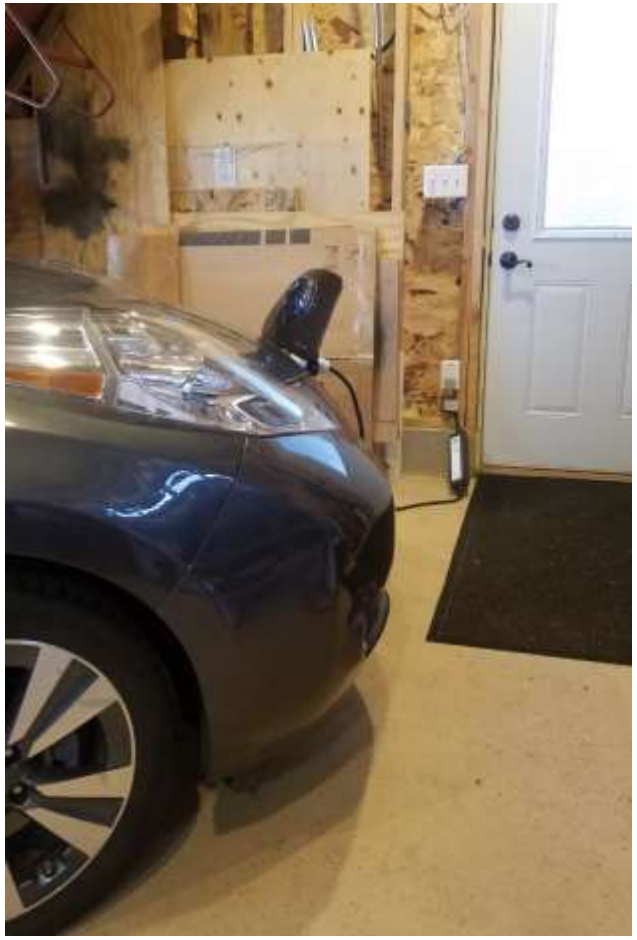
Level 1
120 Vol

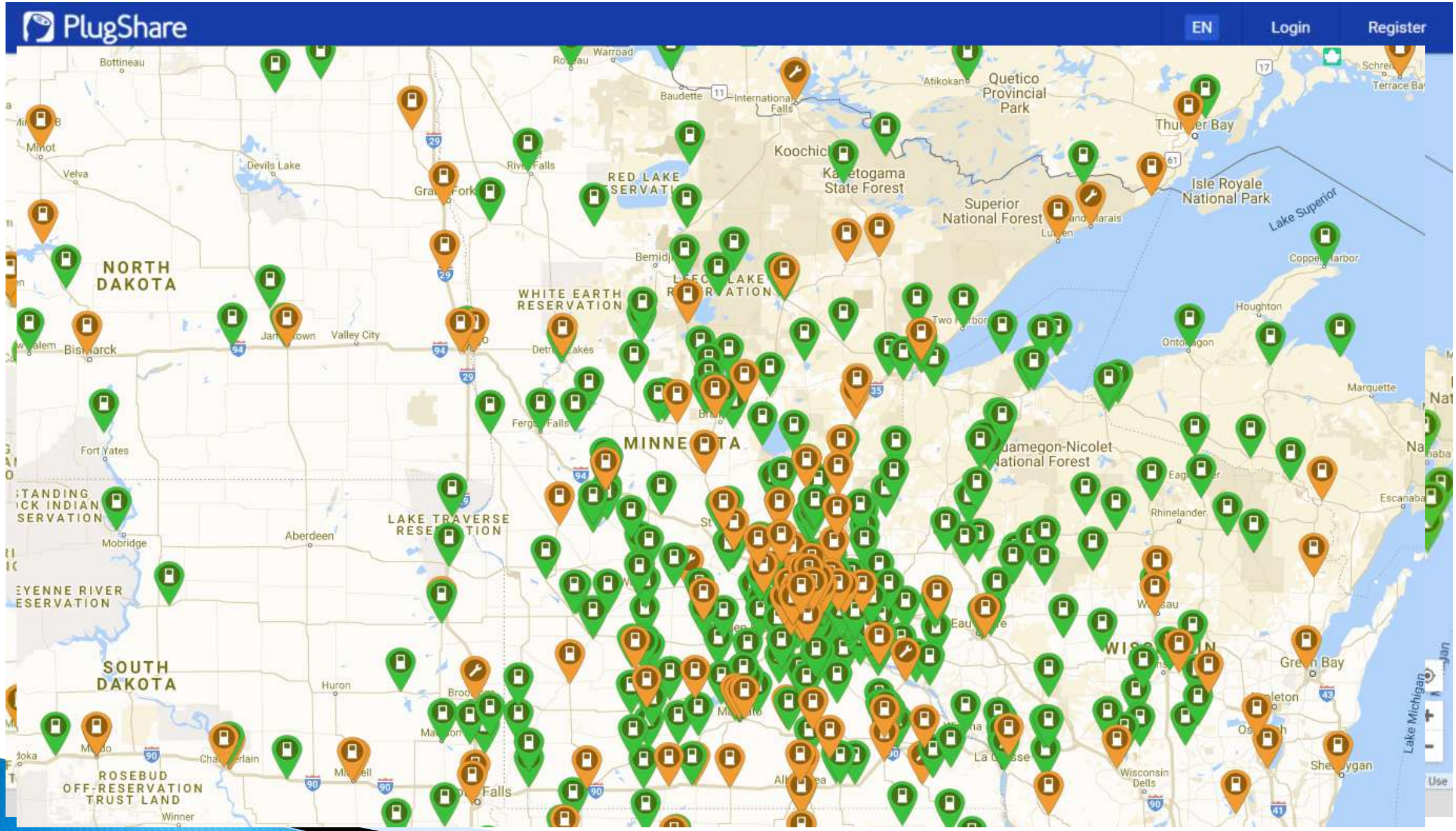
Level 2
240 Volt

DC fast charge

Pictures: Bosch, Clipper Creek, ChargePoint, ABB

Level 1 home charging





Map: PlugShare.com

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ICE vs EV household

13,500miles/year x 1.8 drivers =24,300miles/year

ICE household

- 25MPG
- 970 gallons
- 33.7 kWh/gallon
- 33,000kWh
- $2/gallon
- $1,940

EV household

- 3 miles/kWh
- 8,100kWh
- $0.07/kWh
- $570

Annual energy cost difference: $1370.

Incentives

- Federal tax credit for EVs
  - Up to $7500 dollars tax credit

- Federal tax credit for EV charging station installations
  - 30% of installation costs up to $1000 for homeowners and up to $30,000 for commercial properties

- MnPASS Electric Vehicle Incentive pilot
  - One time credit
    - $250 for BEVs
    - $125 for PHEVs

- Check utility credits with www.MNCharging.org

Q&A MNEVBuyer.com

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