

# Wind Energy for Electric Vehicles

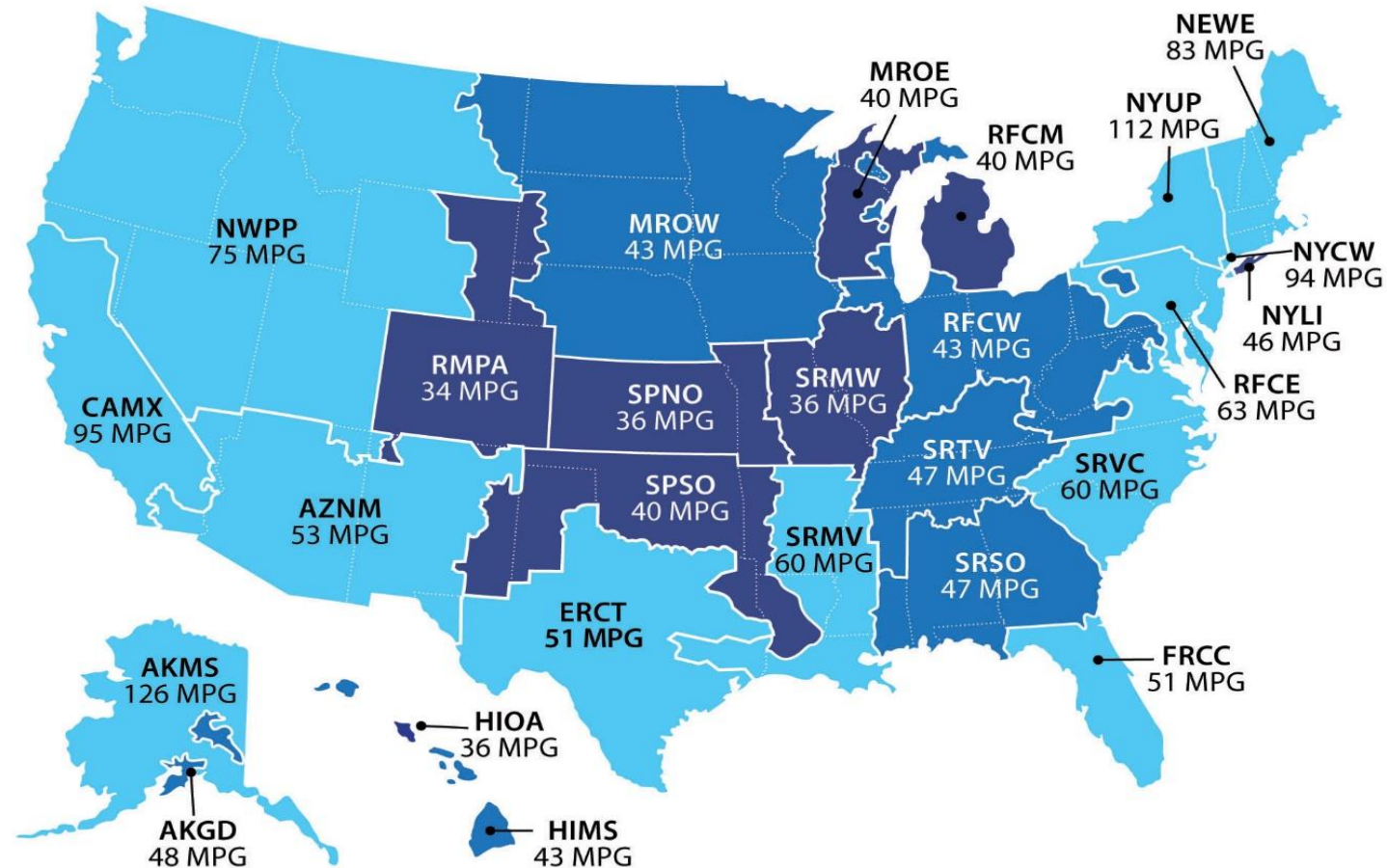
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MAE 579: Project

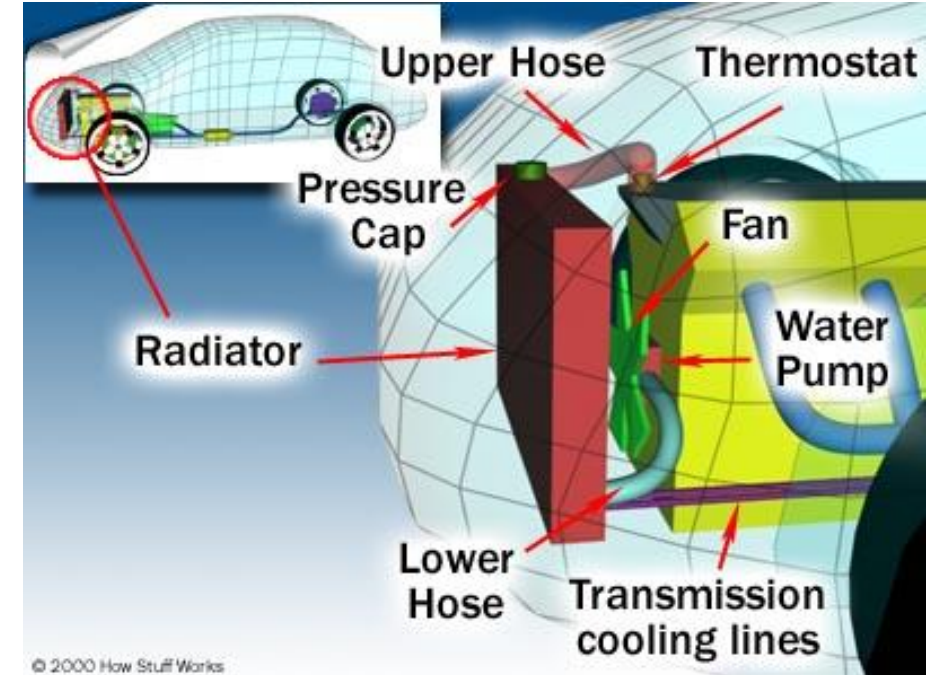
# Why we need cleaner vehicles

- As of 2017, 272.48 million vehicles were registered here in the United States
- 6.3 million cars sold in the U.S. per year.
- Motor vehicles collectively cause 75 percent of carbon monoxide pollution in the U.S

# Not as simple as just saying “Electric vehicles(EV)”



# On-board energy recovery system

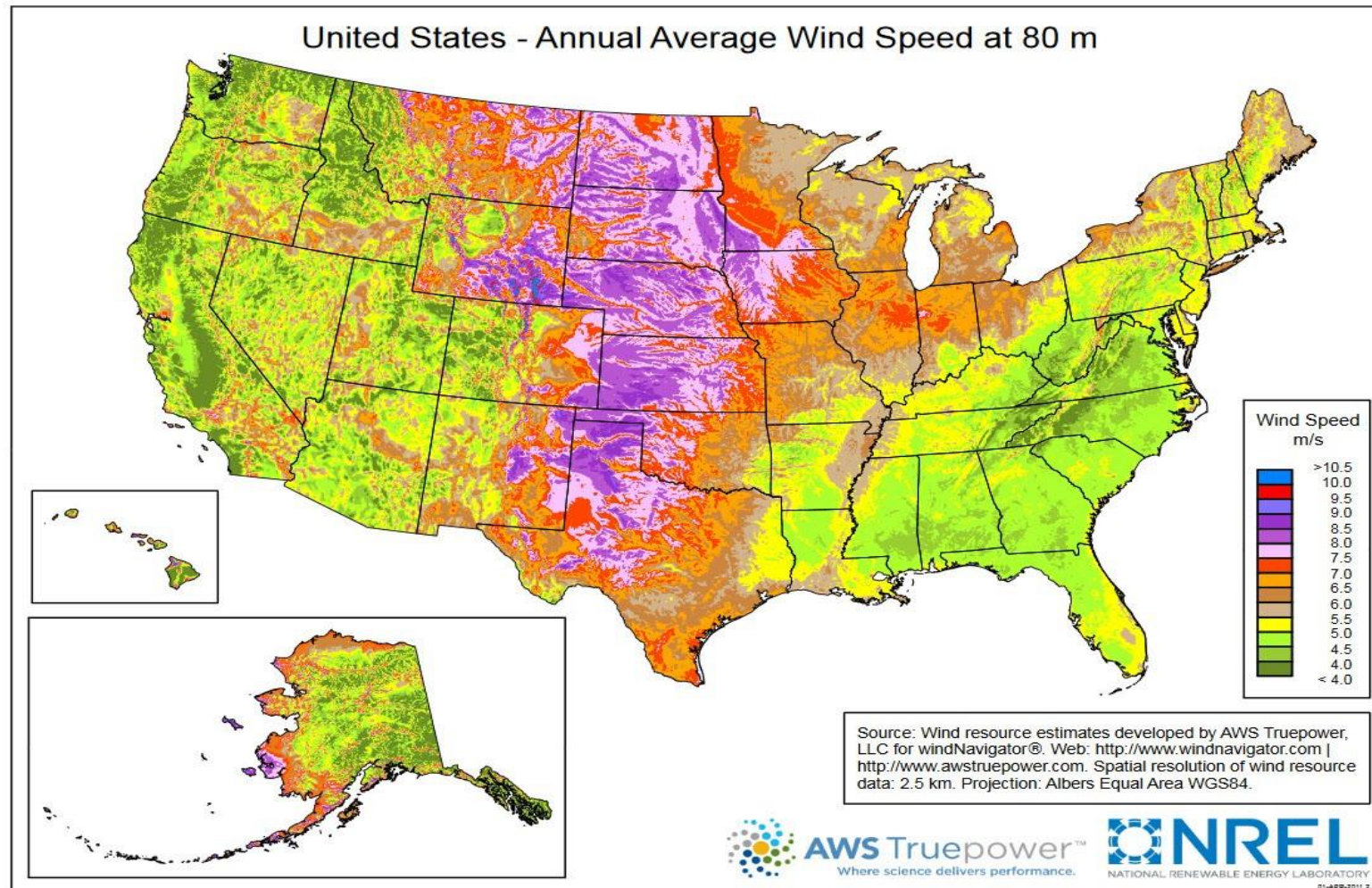


- Avg speed: 70mph
- Stopping distance 94m
- Stopping time is 6s.
- Using Betz:  $P = \frac{1}{2} \rho u^3 A * C_p$
- 50kW, which is that of a lightbulb.

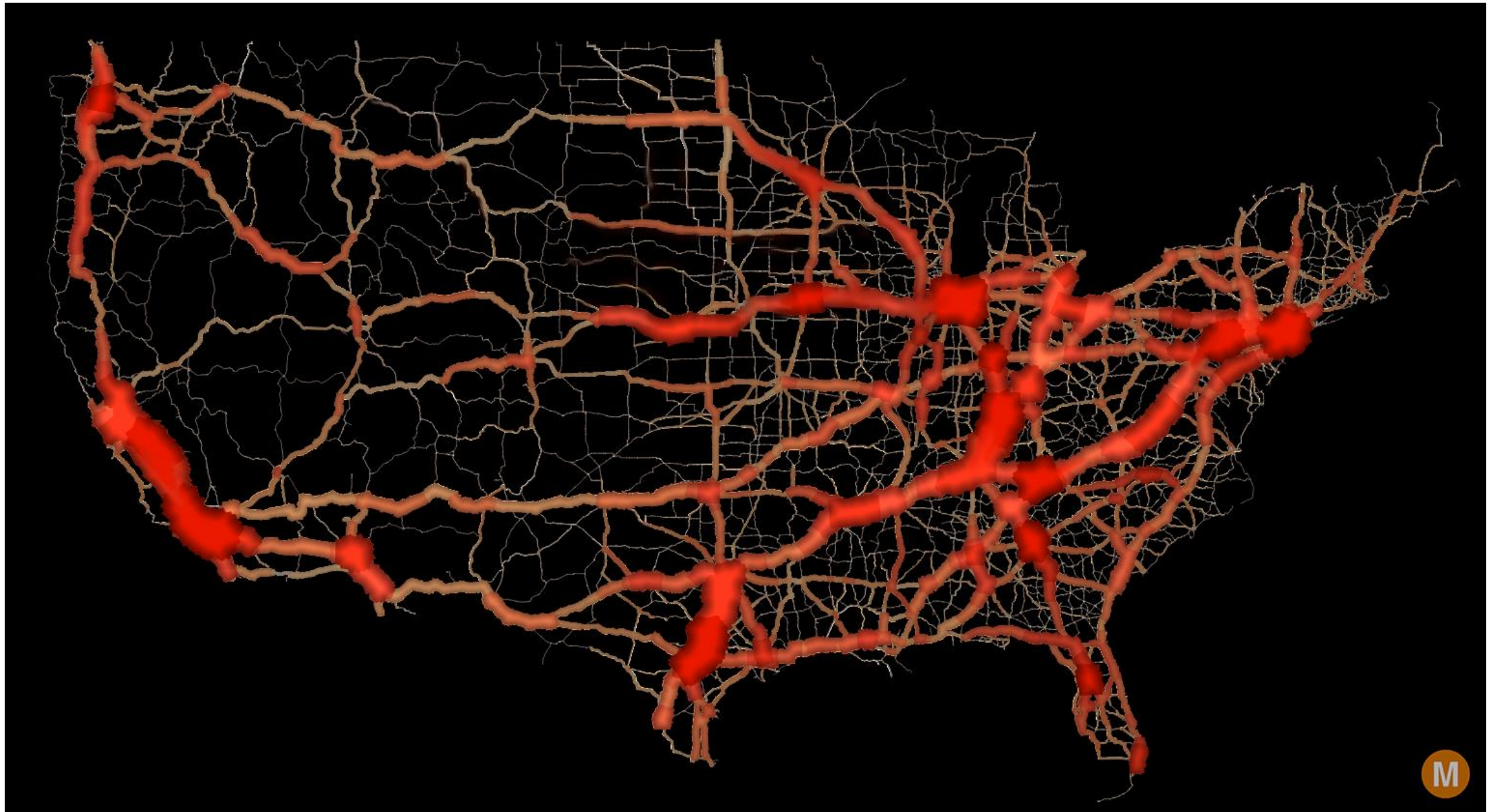
Theoretical maximum output is also limited by Betz, to the 59% of input energy.

KERS system has an efficiency of 45%, with new technologies pushing this higher.

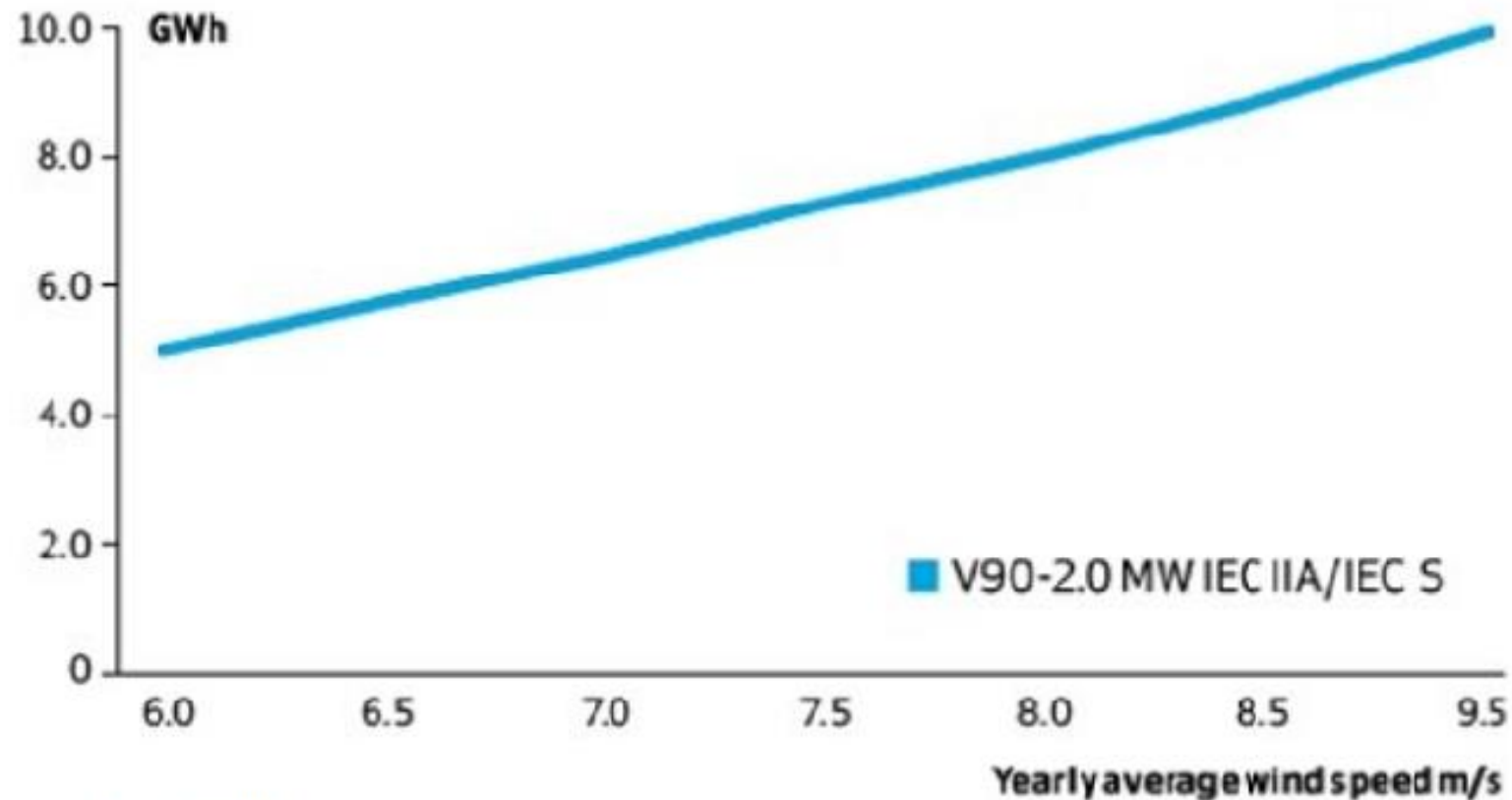
# External wind energy production







- The V90-2.0 MW™ IEC IIA/IEC S, at a hub height of 80m
- \$3 million fully installed.



**Assumptions**

One wind turbine, 100% availability, 0% losses, k factor =2,  
Standard air density = 1.225, wind speed at hub height



- The average power is 7GWh per turbine. This amounts to 19.17 MWh per day per turbine.
- That's enough to power 480 Nissan Leafs.
- 7GWh translates to around \$1M worth of electricity
- The average passenger vehicle emits about 404 grams of CO<sub>2</sub> per mile
- Eliminate 32tons of CO<sub>2</sub> per day per turbine!

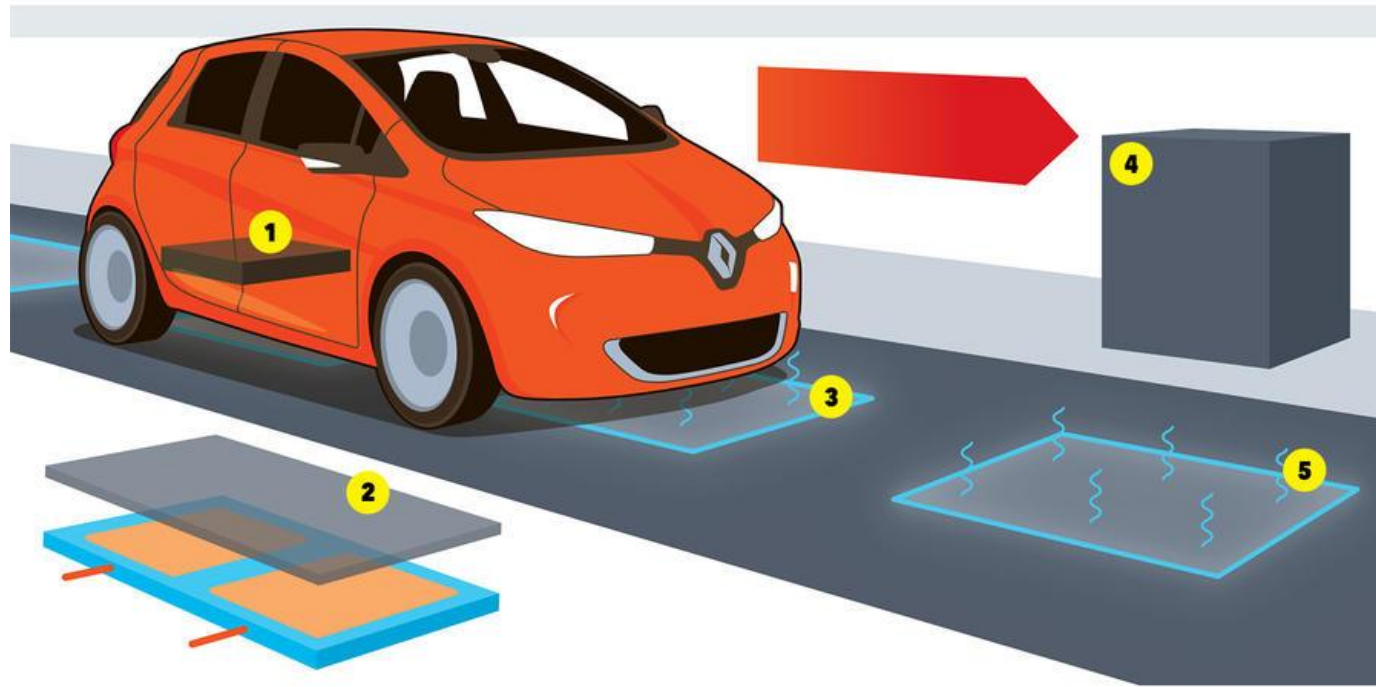
# Wind recharge stations

- 40% of all car owners avoid EV cars due to their low range and fear of not having recharge stations on highways
- Charging stations can convince half of the 40% of car owners to go electric, means 3 million fewer IC engine cars per year.
- A typical passenger vehicle emits about 4.6 metric tons of carbon dioxide per year.
- So that means 12 million metric tons of CO<sub>2</sub> reduced per year!

## Advantages:

- Remote.
- Self-sufficient
- Can be backed up by hybrid/Grid.
- Green, no emissions, no pollution.
- 1 Turbine – 100 miles worth of electricity per day.

# Recharge lanes



- \$1.6m per mile, 50 times lower than an urban tram line.
- 90% efficiency
- Can charge vehicle is traveling at up to 70mph
- Sweden, Qualcomm working on this technology
- 60mph, for 1 mile, can yield it 45 miles of range.