

Powering the Future of Transportation: The Energy to Electrify



CERV 2020
February 11
Mike Rowand

Understanding the Transportation Electrification Opportunity

**U.S. Total spend
on Electricity**

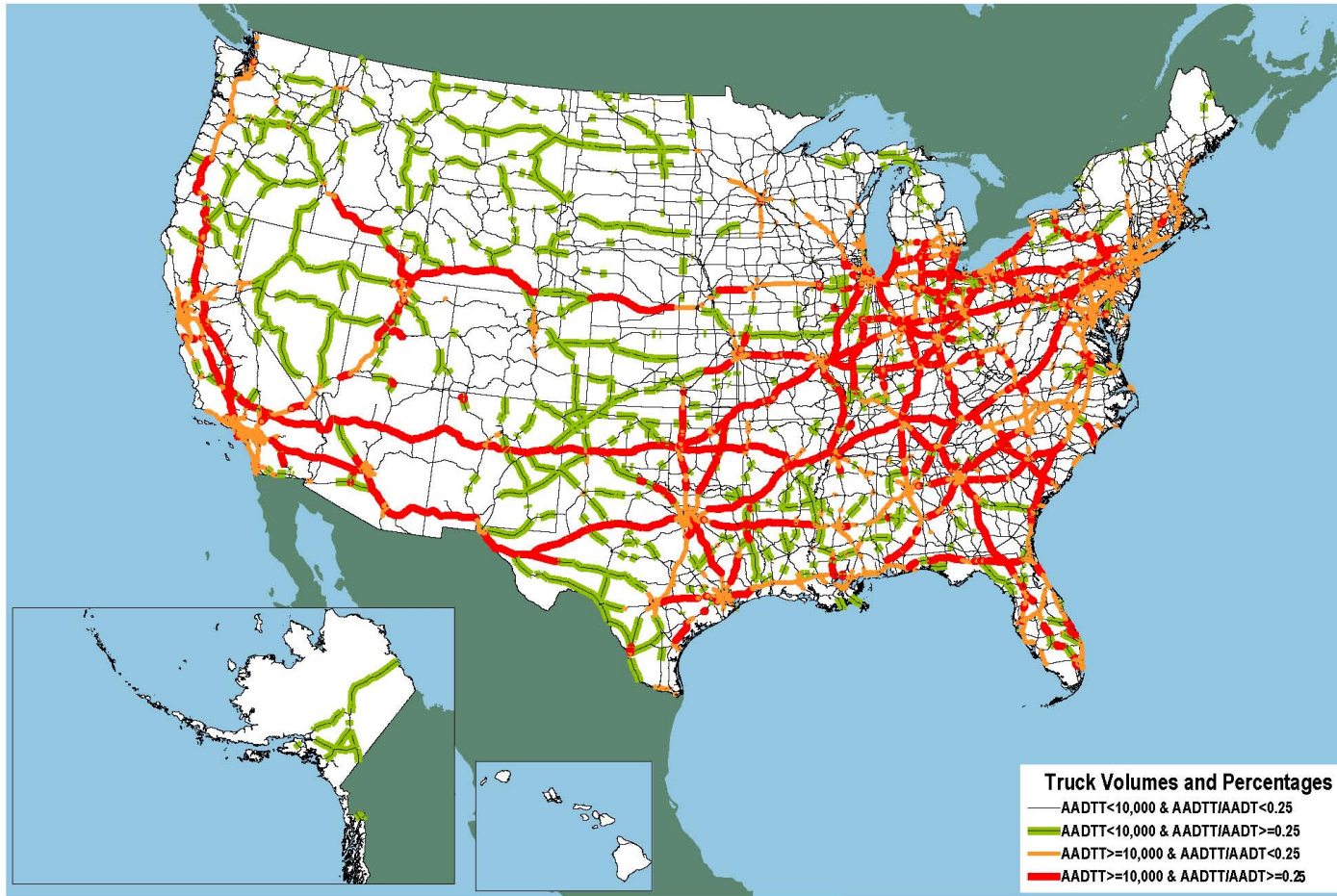
~ \$1B per day

**U.S. Total spend
on Gasoline**

~ \$1B per day

This Conference is about Roads

Major Truck Routes on the National Highway System: 2035



Red

- Trucks > 10,000 per day
- Cars < 4x trucks

Orange

- Trucks > 10,000 per day
- Cars > 4x trucks

Note: AADTT is average annual daily truck traffic and includes all freight-hauling and other trucks with six or more tires. AADT is average annual daily traffic and includes all motor vehicles.

Source: U.S. Department of Transportation, Federal Highway Administration, Office of Freight Management and Operations, Freight Analysis Framework, version 2.2, 2007.

How much Power is That?



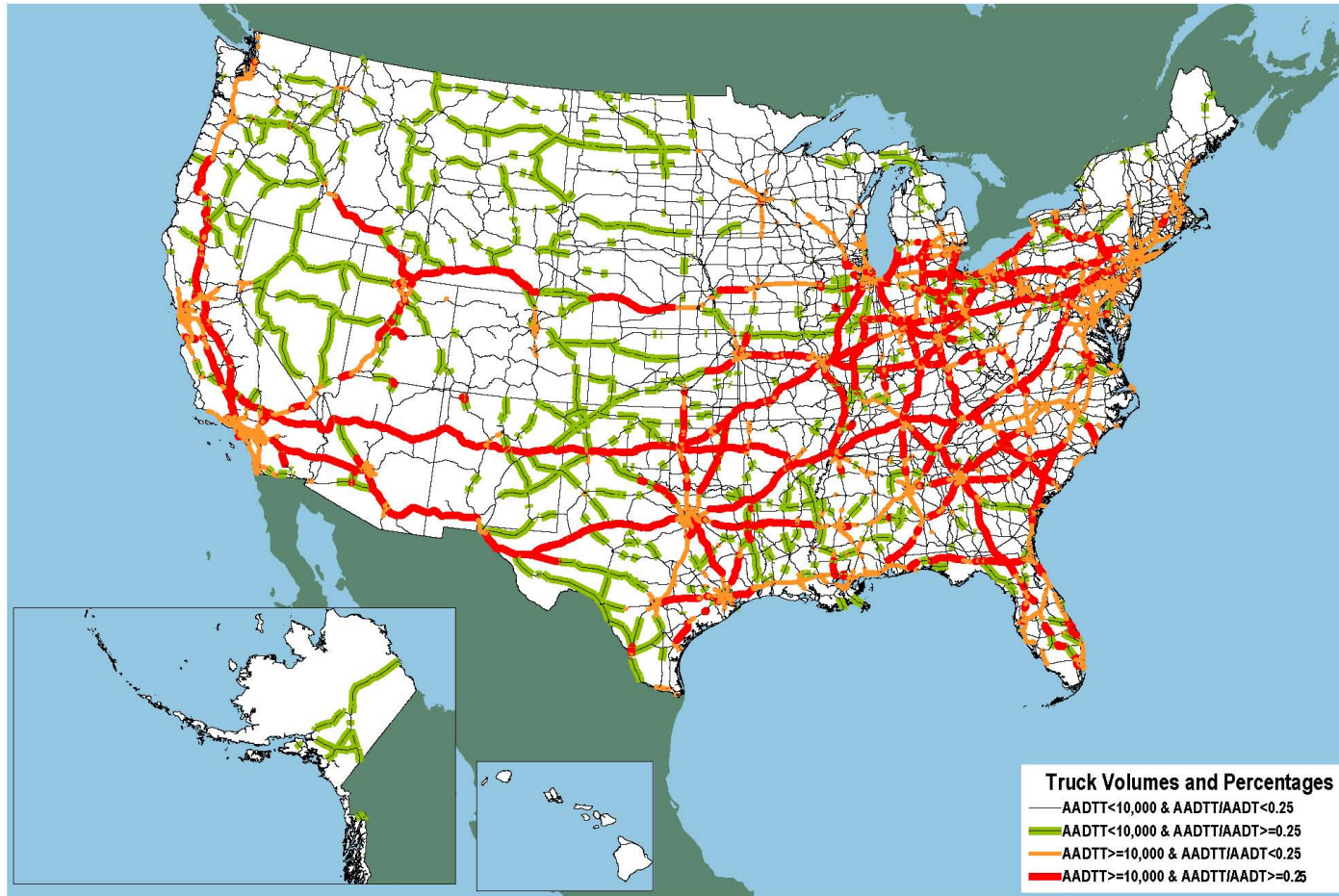
- 2 kWhs / mile @ 60 mph = 120 kW
- 12K vehicles per day ~ 1 MW / mile



- 0.3 kWhs / mile @ 60 mph = 18 kW
- 40K vehicles per day ~ 0.5 MW / mile

This Conference is about Roads

Major Truck Routes on the National Highway System: 2035



Note: AADTT is average annual daily truck traffic and includes all freight-hauling and other trucks with six or more tires. AADT is average annual daily traffic and includes all motor vehicles.

Source: U.S. Department of Transportation, Federal Highway Administration, Office of Freight Management and Operations, Freight Analysis Framework, version 2.2, 2007.

- Most charging will not be “in route”
- Conservative assumptions
 - 1 MW / mile
 - 10 % is “in route”
- 100 kW / Mile
- 1 MW / 10 Miles

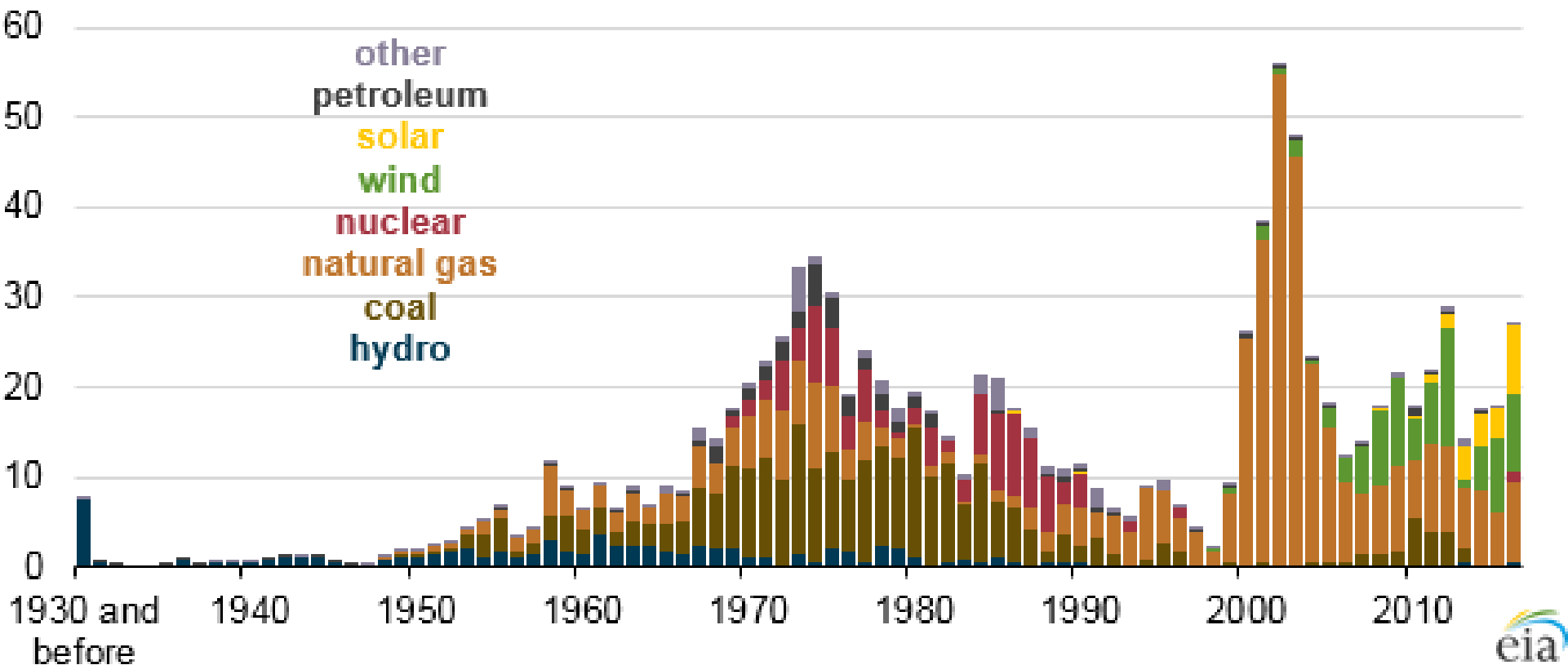


How much Grid Capacity is Needed?

Natural Diversity of passenger EV load ≤ 1 kW

1 GW ~ 1 Million cars

U.S. utility-scale electric generating capacity by initial operating year (as of Dec 2016)
gigawatts



Use Cases are Still Developing

Light Duty – Passenger Vehicles and Light Trucks

- **Residential**

- Dedicated home locations (garage)
- Street side parking
- Multi-family

- **Workplace (employees)**

- **Public Charging**

- Level 2
- Individual (or few) DCFC
- Multi-High Power Depots

- **Ride-Share**

May create inconveniences and/or need Innovative solutions, but no grid level concerns

More uncertainty for Local Grid Impacts (T&D)

Medium & Heavy Duty

- **Medium Duty Fleet (e.g. Package Delivery, School Bus)**

- Company / Depot location
- In Route

- **Transit**

- Overnight Depot
- In Route

- **Heavy Duty Fleet – Short Haul**

- Company / Depot location
- In Route

- **Heavy Duty – Long Haul**

- Overnight Depot
- In Route



Powering the Future of Transportation: The Energy to Electrify



CERV 2020
February 11
Mike Rowand