

Infrastructure changes when fossil fuels are scarce

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Three areas of change

Governmental

- Nation/state wide changes

Industrial

- Changes unique to commercial enterprises

Personal

- How infrastructure changes due to consumers/citizen needs

Governmental changes

Motivation for changes?

- Public opinion
- Private sector push

Political

- Tied in to economical

Economical

- More money to be made for developers of emergent technologies
- A new age of infrastructure presents many opportunities for companies

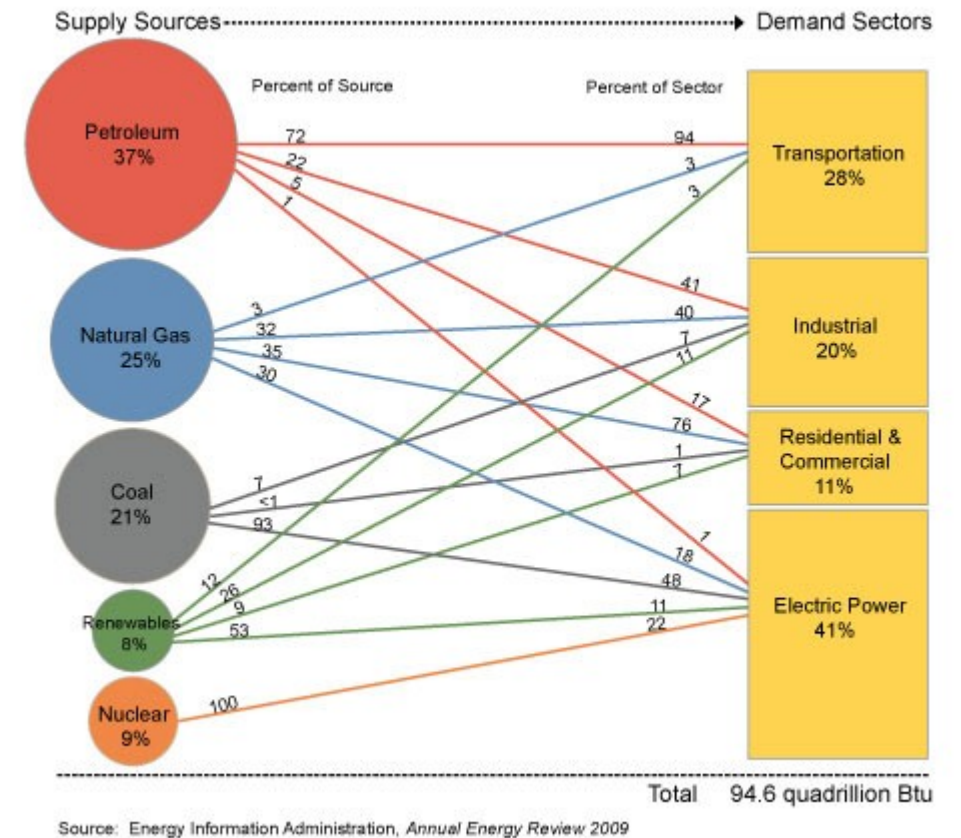
The big question: Transportation

Transportation of energy

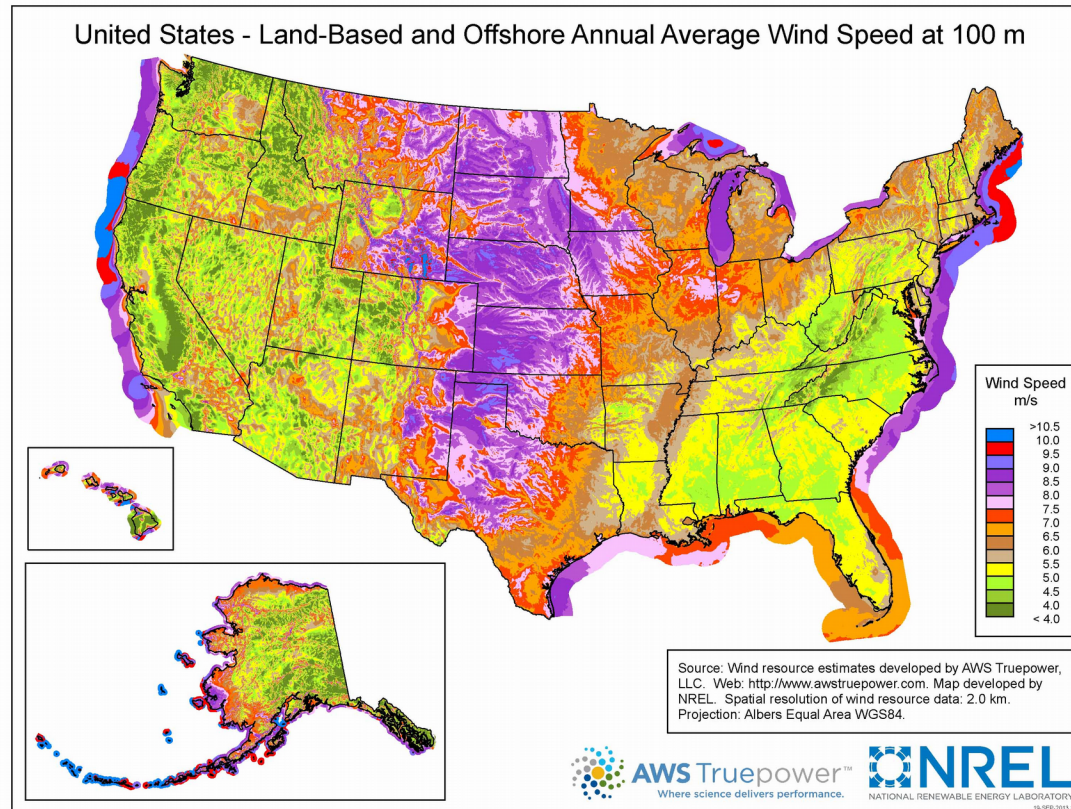
- DC long distance transmission lines

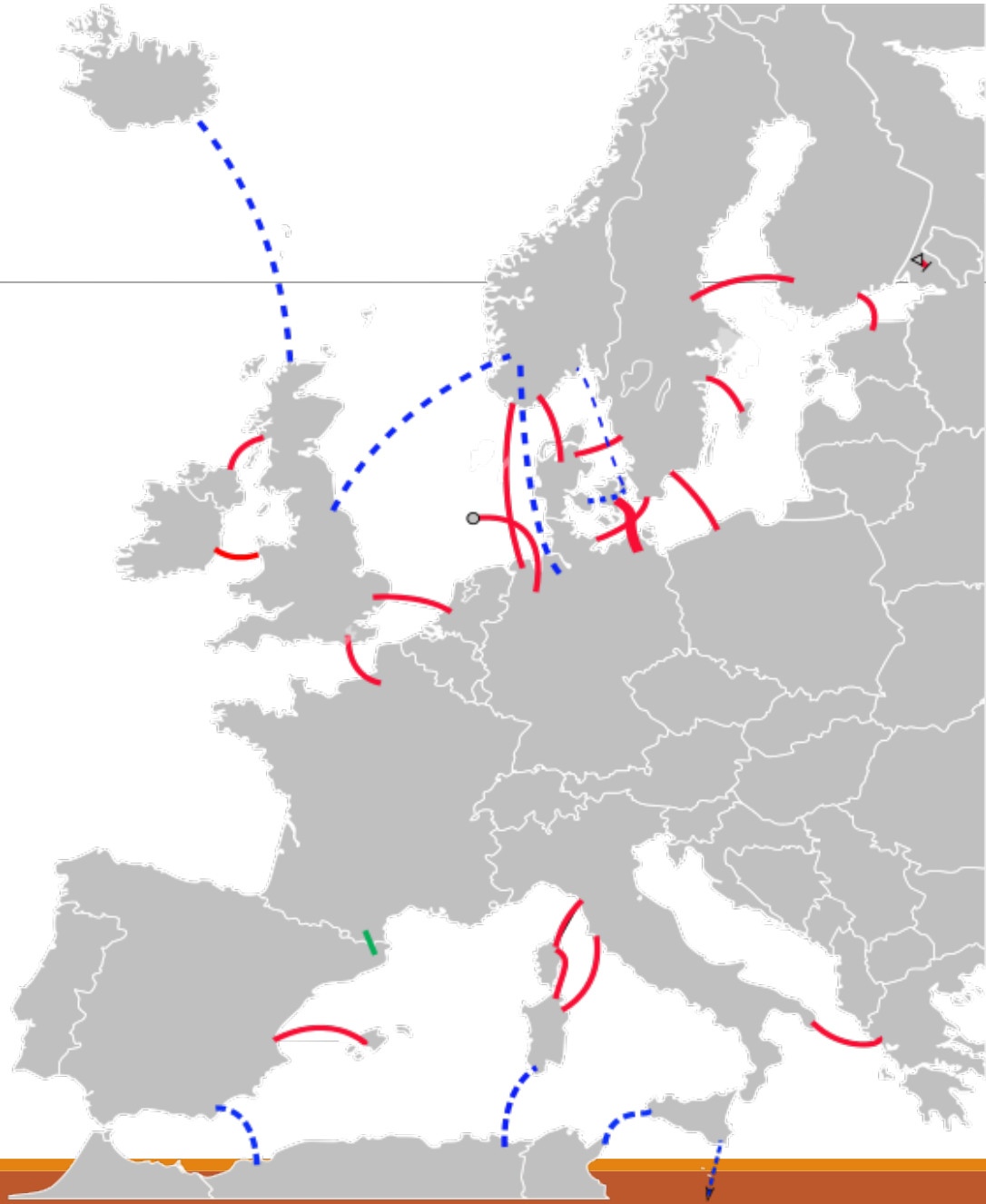
Transportation of people

- Electrical cars
- Trains
 - Maglev?
 - New technologies?



Transportation of energy





Advantage of (High Voltage direct current)HVDC over AC

Lower initial cost

- Long range powerlines require less infrastructure along the way for DC

3.5% transmission loss per 1000km

- 30-40% less than AC

Transportation of People

New emergent technology

- Electric Cars
- Hyperloop

Older Technology

- Sail Boats
- Electric trains
- Maglev trains

Air travel?



HOW MUSK'S SUPERTRAIN COULD WORK

Rail gun technology

1. Electric current flows up positive rail

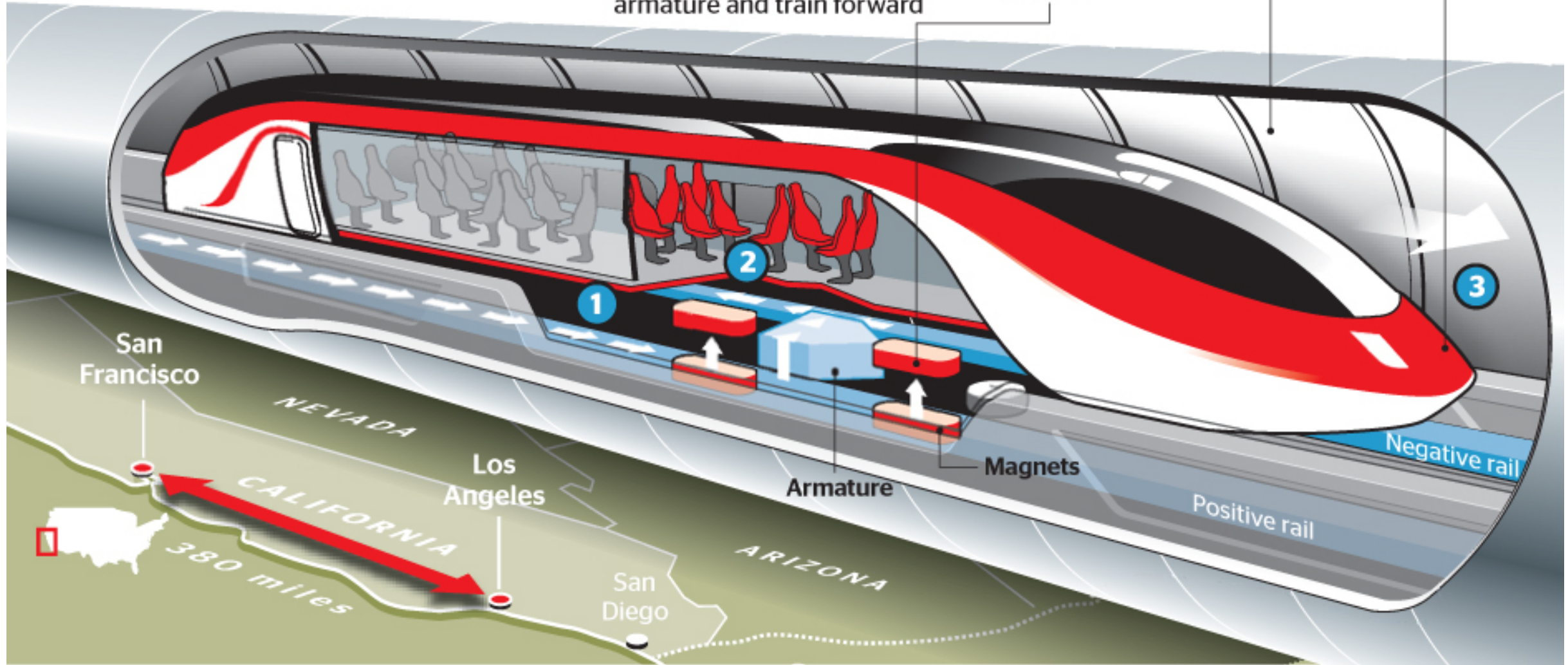
2. Current flows across armature and down negative rail

3. Magnetic force is directed towards end of rails which pushes armature and train forward

Maglev technology levitates the train eradicating rail friction

Reduced air pressure in tunnel cuts wind resistance

Top speed 750mph



Cincinnati to Columbus (1 Train vs 500 Cars)

100 miles from Columbus to Cincinnati

Passenger trains in the US get around 1.125 mpg (Diesel)

Average car gets ~25mpg

One gallon of Diesel = .8800 gal Gasoline

So Passenger trains carrying 500 passengers are using 88.88 gallons of diesel to travel to Columbus.

500 cars are using 2000 gallons of gasoline to reach Columbus

Converting to gasoline from diesel we get that the passenger trains are using 25 times less energy than the 500 drivers

Public mass transportation is key

Much more energy efficient

New infrastructure and technology is needed to make this happen

People's perception of Public transportation needs to change as well

Commercial Concerns

The Middle Ground

Companies need to ship their products

Customers need to receive their products

The government needs the companies to help the nation grow and thrive

Potential new/renewing areas

Trains

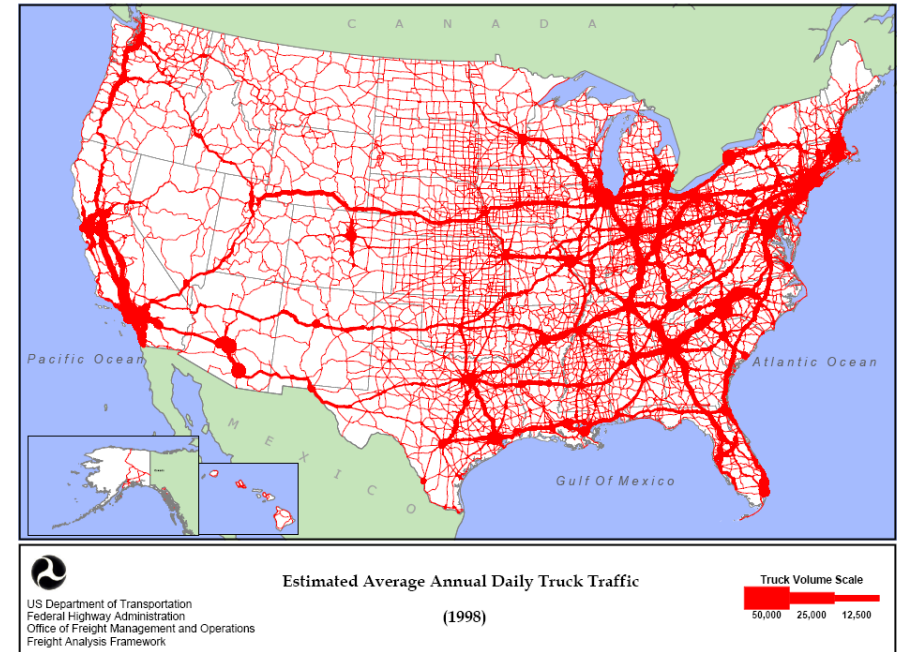
- Electric trains
- Already used to transport goods
- Much more efficient than semis

Trucks

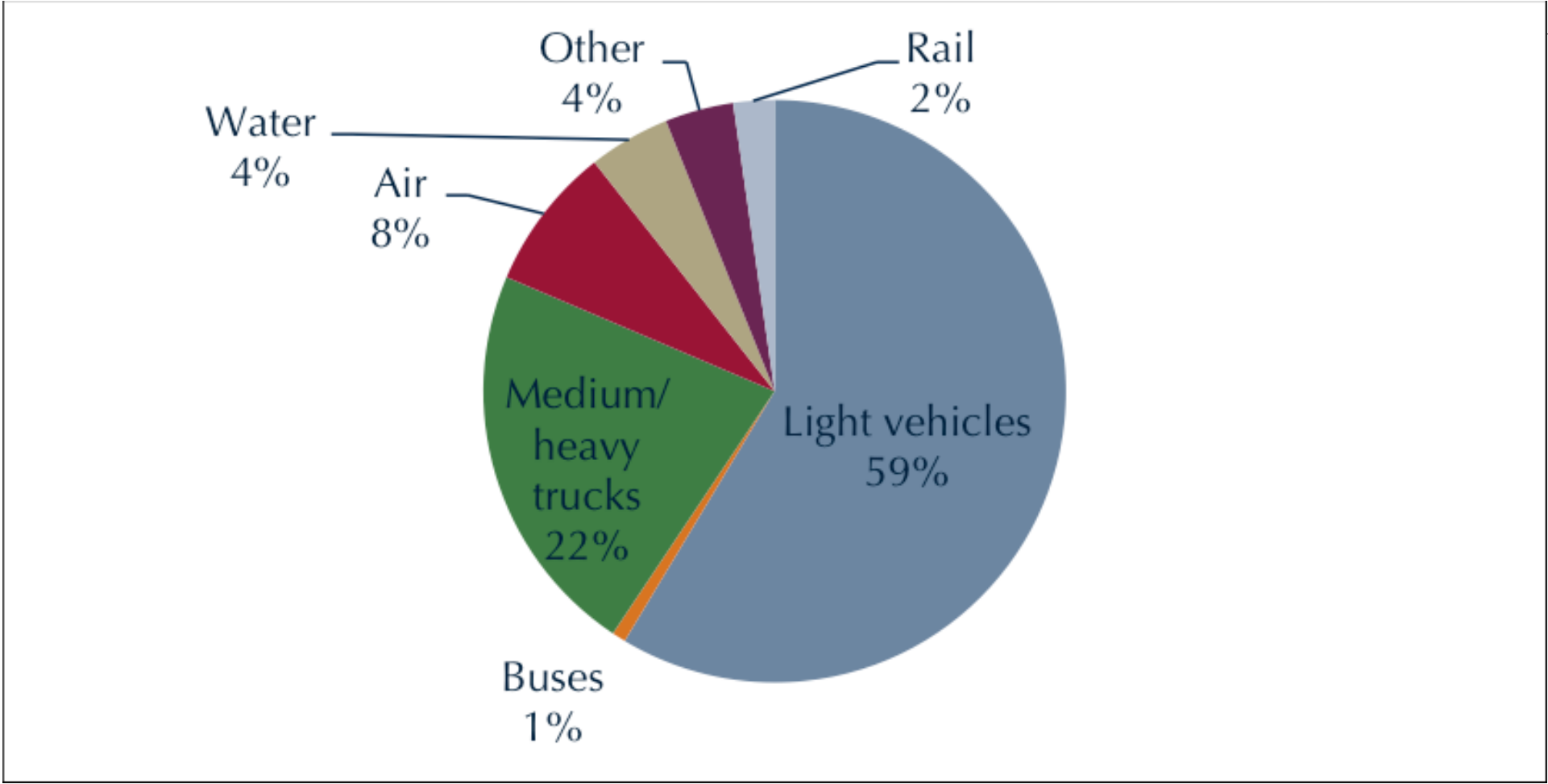
- Electric semis for localized distribution
- High torque

Boats

- Another efficient method of shipping already in use
- Most boats are diesel however



Benefit of Reducing Truck emissions?



Trains and boats

<http://business.tenntom.org/why-use-the-waterway/shipping-comparisons/>

Personal Effects

Personal - Food with FF

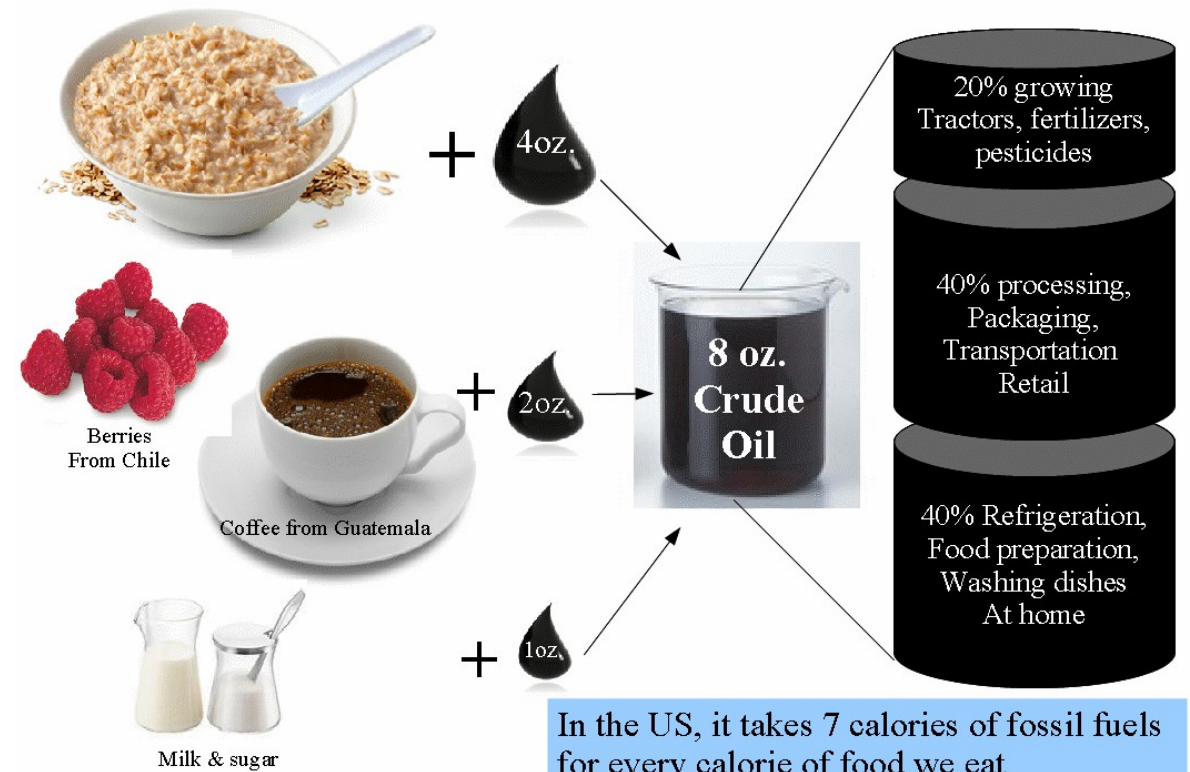
Petroleum byproducts in synthetic fertilizers and pesticides

Food preservatives, flavorings, and colorings

- Help agriculture industry produce more food, cultivate it faster, & keep it fresh longer

Energy for packaging, refrigeration, transportation, and household cooking

What's for breakfast? Our food & crude diet.



Personal - **Food** without FF

Renewable energy technologies would have to be put in place

Use livestock manures in place of fossil fueled-based fertilizers

Population size and consumption would have to be compatible with maintaining the stability of environmental processes

- “To achieve a sustainable economy and avert disaster, the United States must reduce its population by at least one-third”
- “Global population will have to be reduced 68% or over two-thirds”

Personal – Petroleum products

A 42-gal barrel of oil creates 19.4 gal of gasoline. The rest is used to make petroleum products.

Americans consume petroleum products at a rate of 3.5 gal of oil and more than 250 ft³ of natural gas per day.

Medicines: antihistamines, benzene derived meds, vitamin capsules

Toiletries: toothpaste, shampoo, shaving cream, cosmetics

Synthetic fabrics: clothes, carpet, curtains, furniture

Chemical: cleaning products, solvents, lubricants, antifreeze

Rubber: Tires, sports balls, some shoes, gloves



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EnergyTomorrow.org

Personal - Transportation

Asphalt – Paves 11 million miles of road in the world

- Would need an alternate source to fix damaged roads
- Taxes would likely increase significantly

Fossil fuels power most vehicles

- Prices of gas would increase. Would need an alternate source.

Electric cars (powered by renewable energy)

Trains and/or boats powered by electricity or nuclear energy (Thorium)

Personal – Electricity

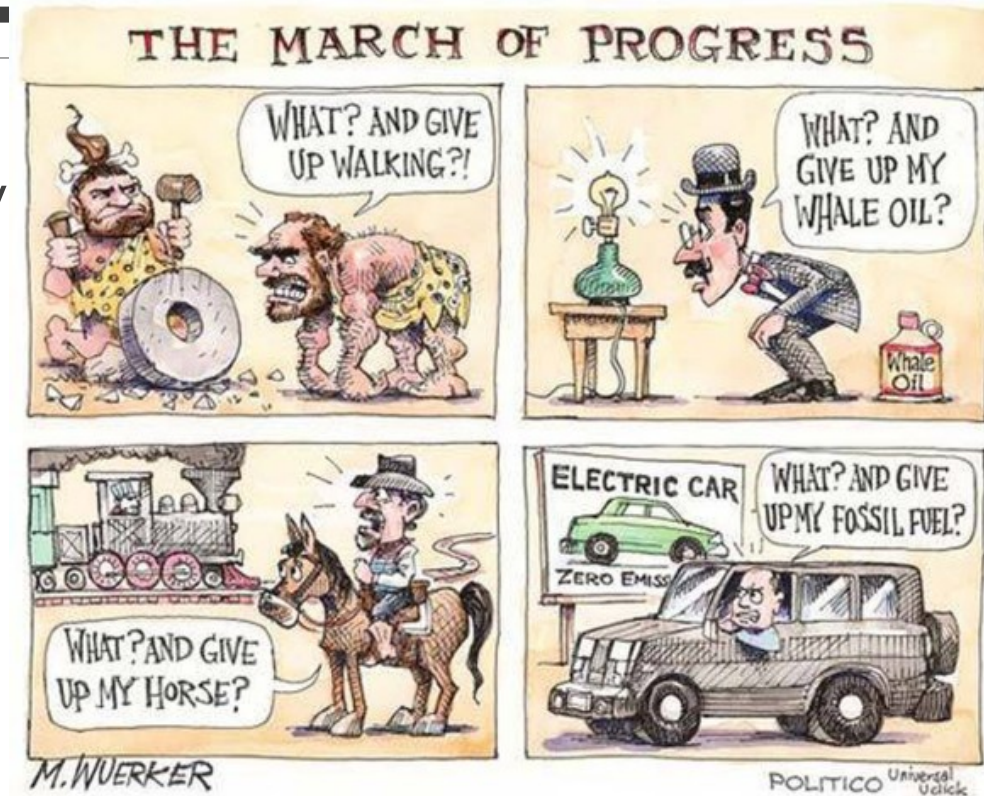
Currently mostly powered by fossil fuels

Possible alternatives in future (What we usually

- Wind (offshore and onshore)
- Solar panels (Concentrated and Photovoltaic)
- Geothermal
- Hydroelectric (Dams)
- Tidal
- Wave Energy

Other interesting alternatives:

- Space-based solar panels
- Planet's natural heat through harnessing power of volcanoes
- Particle accelerator
 - Can create the same amount of energy from 1 tonne thorium as 200 tonnes uranium or 3.5 million tonnes of coal



Resources

U.S. and World Population Clocks. U.S. Census Bureau.
<http://www.census.gov/main/www/popclock.html>

A Distant Mirror, Tuckman Barbara. Ballantine Books, 1978.

<http://www.ranken-energy.com/products%20from%20petroleum.htm>

<http://www.thegreenage.co.uk/tech/thorium-nuclear-energy/>

http://islandsenergymatters.blogspot.com/2011_11_01_archive.html