The Hydrogen Fuel Cell Locomotive as National Energy Policy Insurance

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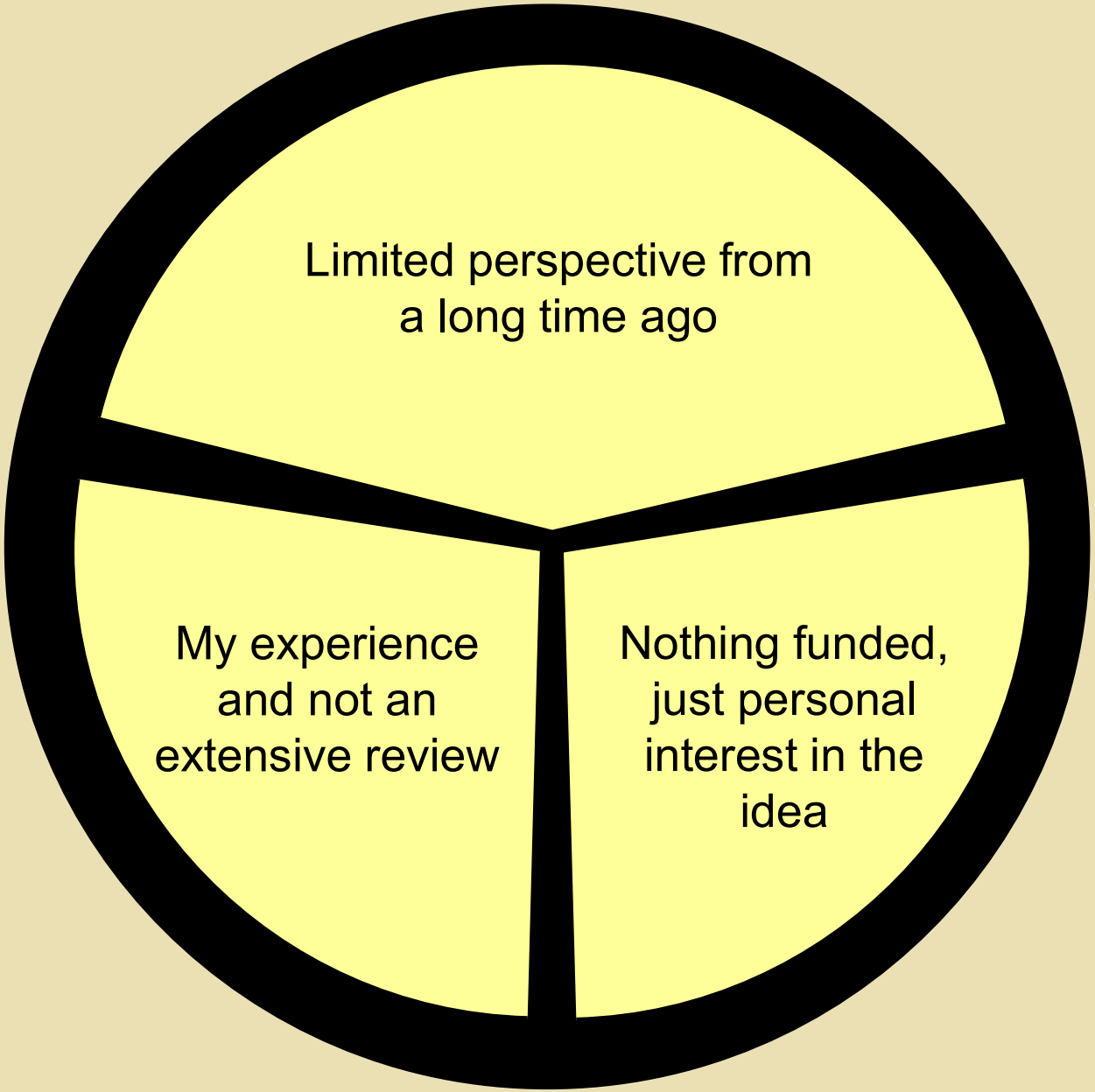
Parts Unknown

The History of the Idea



Circa 1995-1997

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Three Reasons Supporting the Hydrail Marriage

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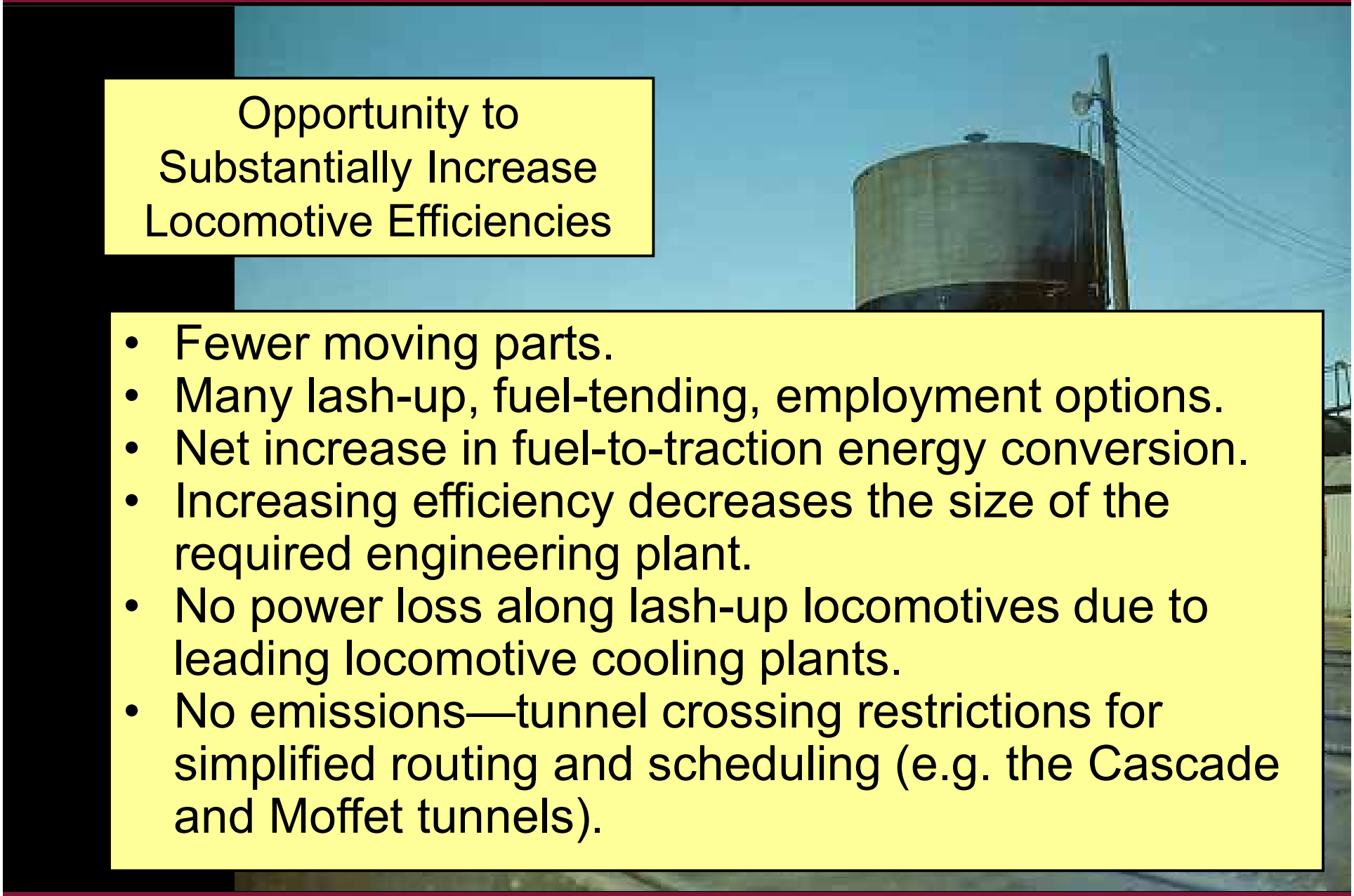
One of those Reasons flips the Rational on Hydrail

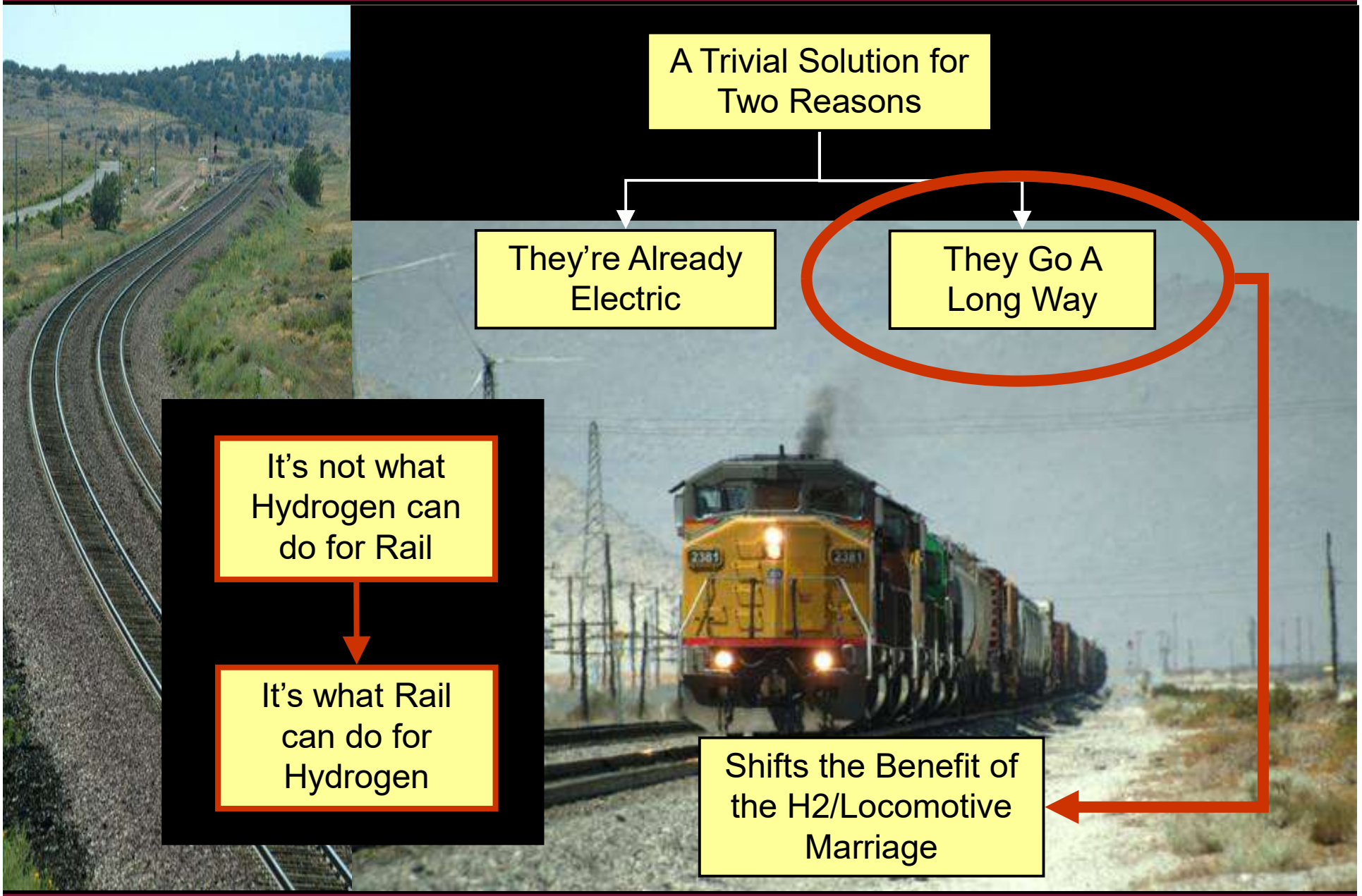
Why Hydrogen Railroads: Reason 1



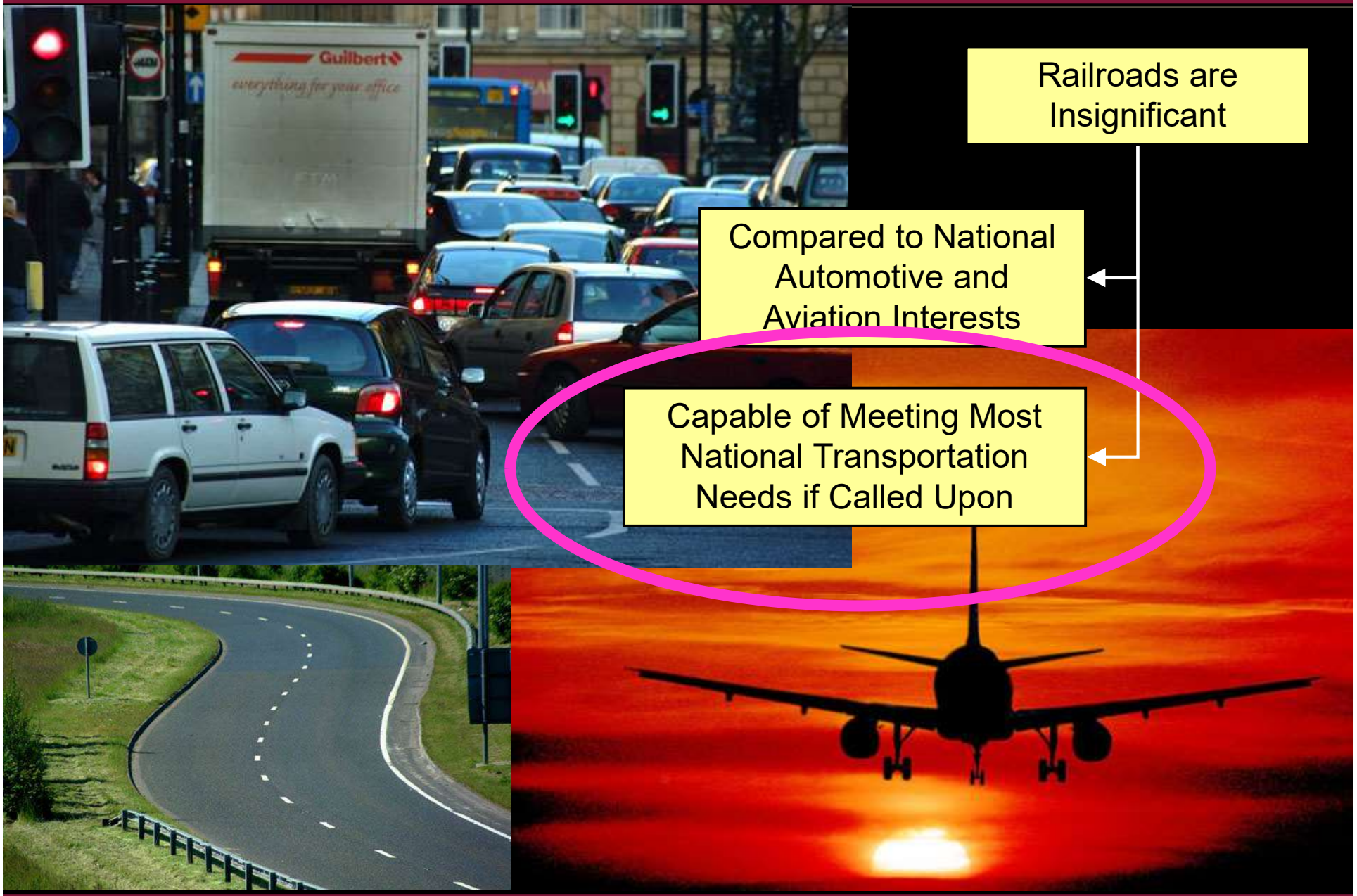
Opportunity to Substantially Increase Locomotive Efficiencies

- Fewer moving parts.
- Many lash-up, fuel-tending, employment options.
- Net increase in fuel-to-traction energy conversion.
- Increasing efficiency decreases the size of the required engineering plant.
- No power loss along lash-up locomotives due to leading locomotive cooling plants.
- No emissions—tunnel crossing restrictions for simplified routing and scheduling (e.g. the Cascade and Moffet tunnels).

Why Hydrogen Railroads: Reason 2



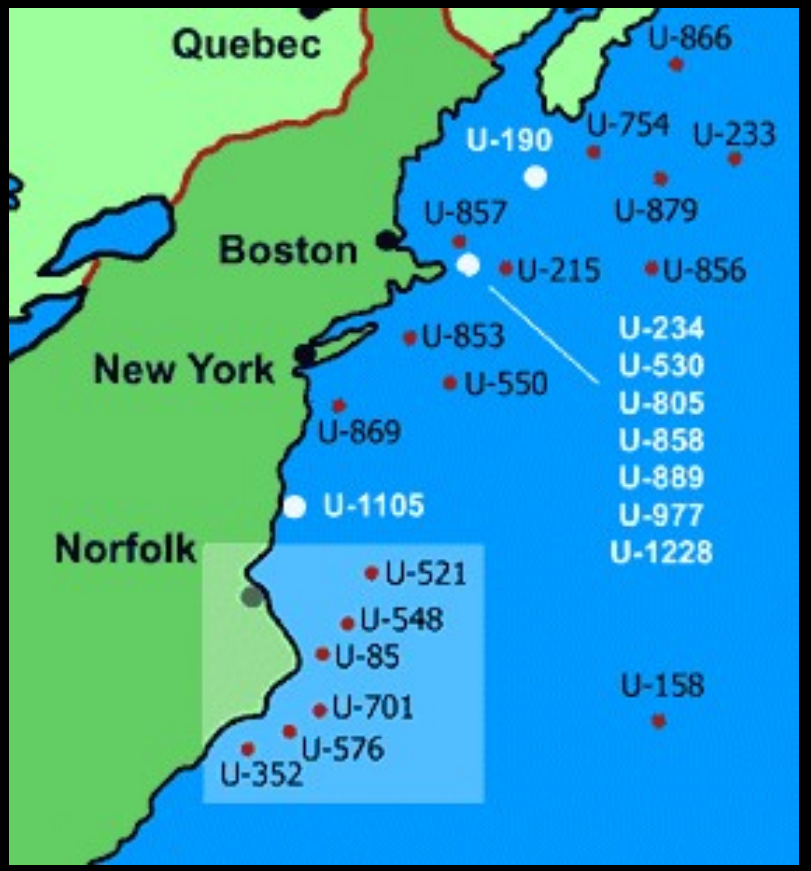
Why Hydrogen Railroads: Reason 3



January-June 1942

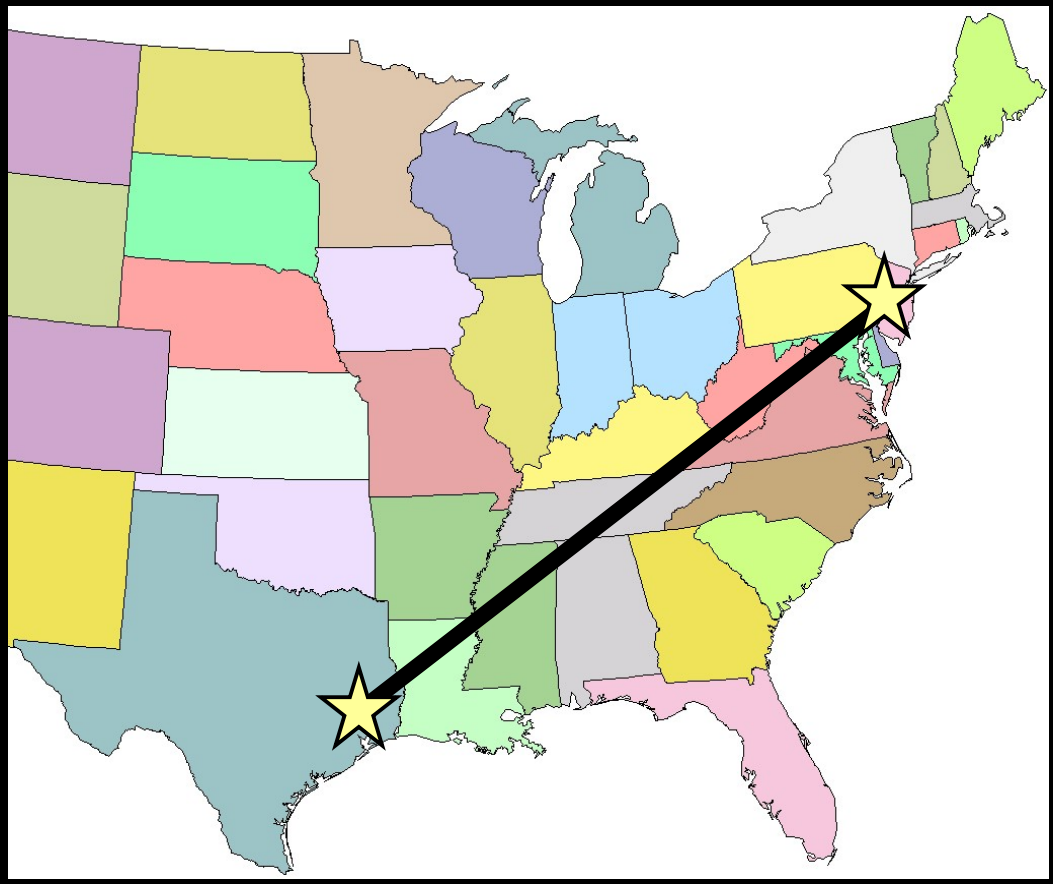
Operation Drumbeat

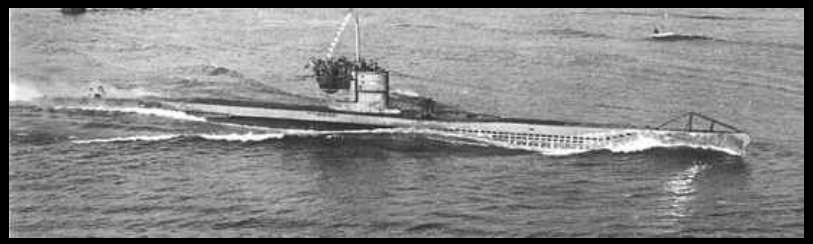
- German U-boat offensive to disrupt commerce shipping along the American seaboard.
- Admiral King did not view convoys as effective along coastal waters.
- 400 ships (3M tons) sunk between January and June 1942.
- 5,000 Merchant Marine.



There was a plan for this?

1940: Interior Secretary Harold Ickes requests plan to connect NYC with east Texas

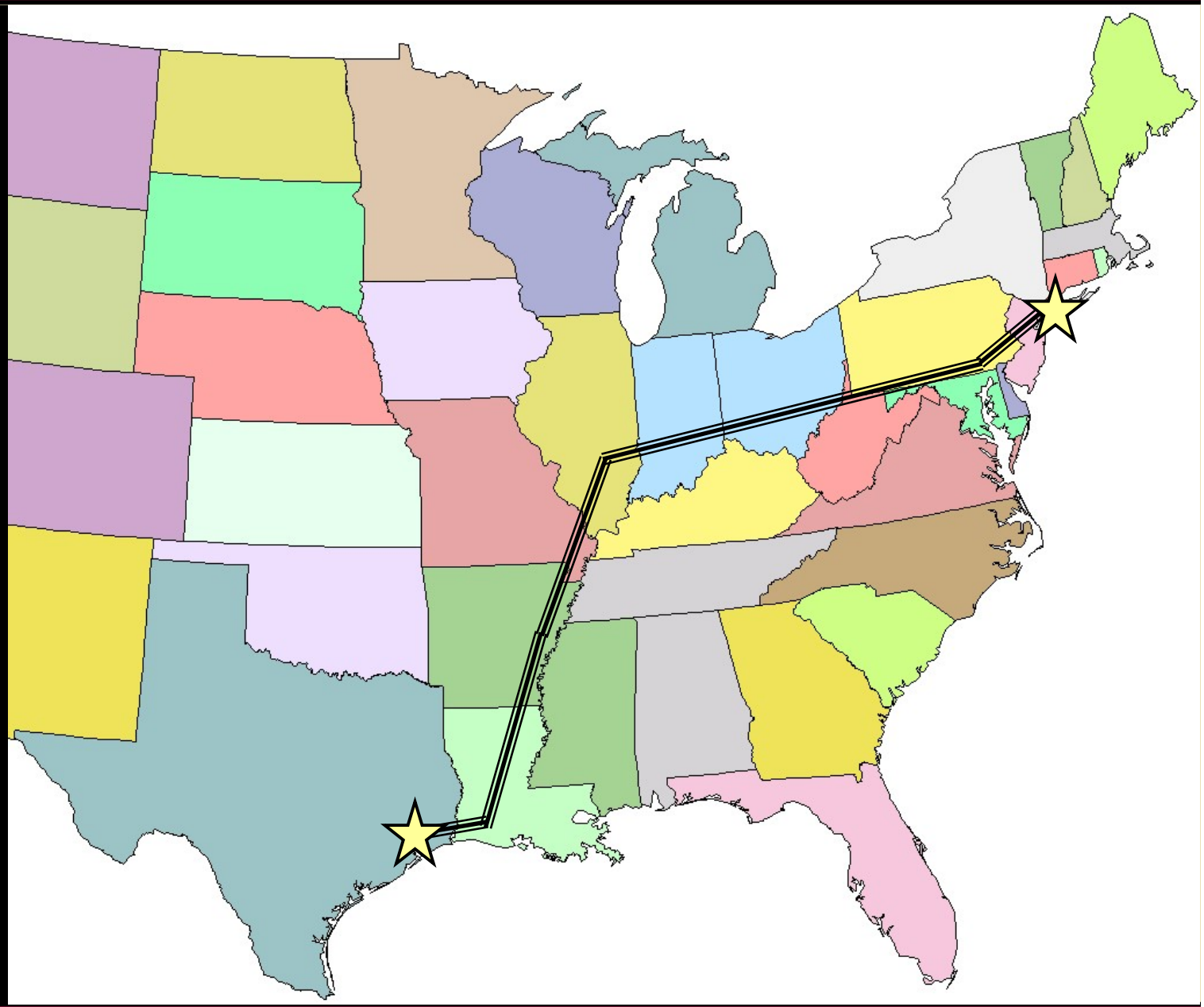




The Big Inch and Little Big Inch Pipelines

Jun 42-Feb 43: Longview to Illinois Leg

Aug 42-Aug 43: through to NYC



Goal of our mid-1990s Paper

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1.0 Abstract

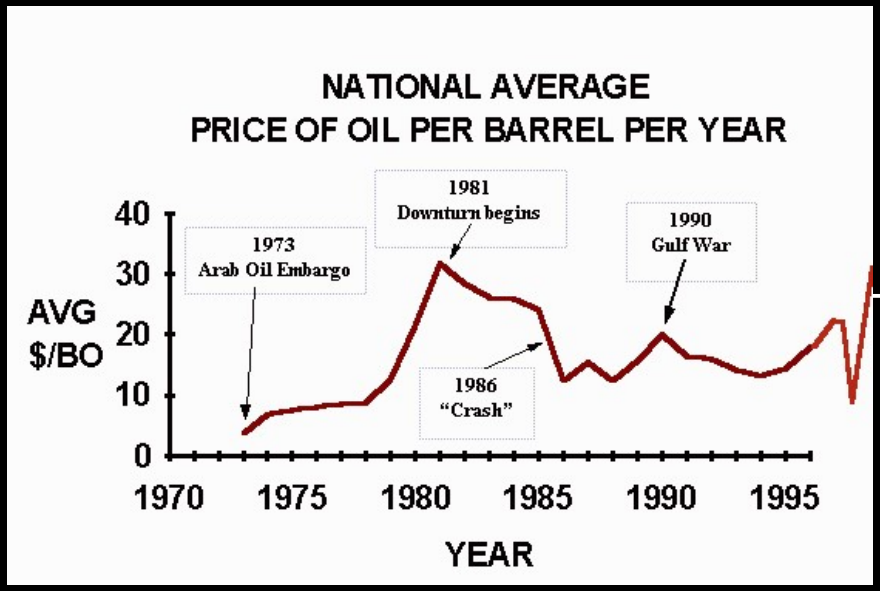
Debates rage over fossil fuel availability during the coming two decades. Through renewable sunlight, electricity generation, and electrolysis, hydrogen fuel cells offer an alternative energy collection and distribution option which is sustainable and non-polluting. Equipping locomotives with fuel cells has received considerable attention, although most conclusions indicate rail-owners cannot justify the associated re-engineering costs. However, from a national policy perspective, there are three reasons full federal funding for this re-engineering could be demanded.

First, the hydrogen fuel cell has the near-term potential to double locomotive operating efficiencies, quite similar to the sweeping advantage of diesel over steam. Second, installing a hydrogen distribution network for the railroad would be as trivial as it is pioneering, because locomotives travel thousands of kilometers between fueling stops. Third, and most important, the rail sector is insignificant relative to other fossil fuel demands, yet capable of meeting most all national transportation needs if called upon. For the smallest investment, the federal government could purchase insurance against changes to world energy supply or policy. What is necessary is federal subsidy of the 1-5 MWe fuel cell for locomotive purposes, perhaps nothing greater then the money spent on diesel development during the two world wars. Given a united rail fuel cell commitment, the entire railroad sector could reap greater profits and national stature given any world energy scenario or crisis.

Mirror the 1940 Ickes Back-Pocket Plan

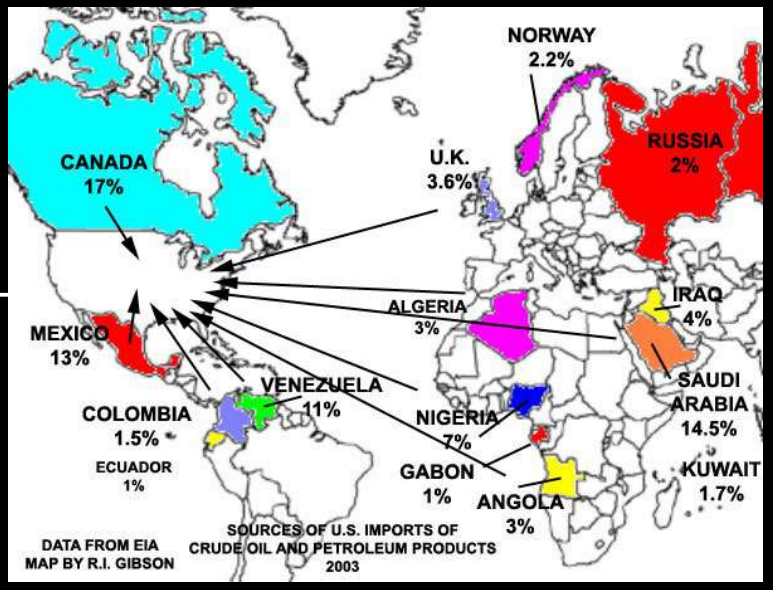
How to get the Word Out

21st Century Givens

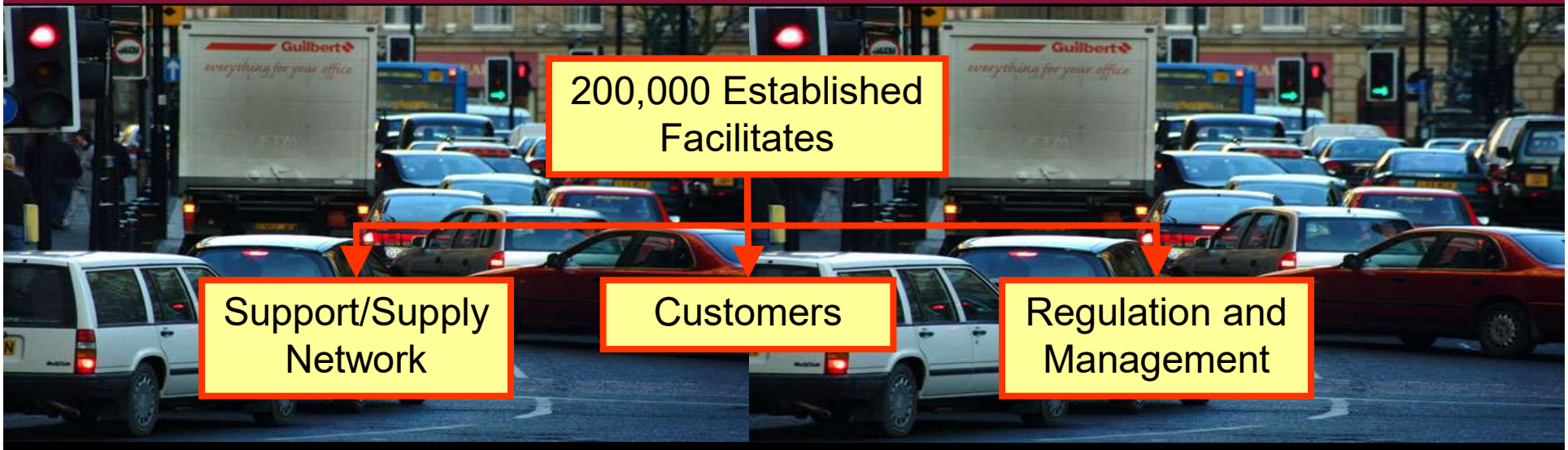


Oil at $50 a Barrel

US dependent on Oil from Everywhere



Gasoline . . . is still Cheap!?!



Barrier to Entry

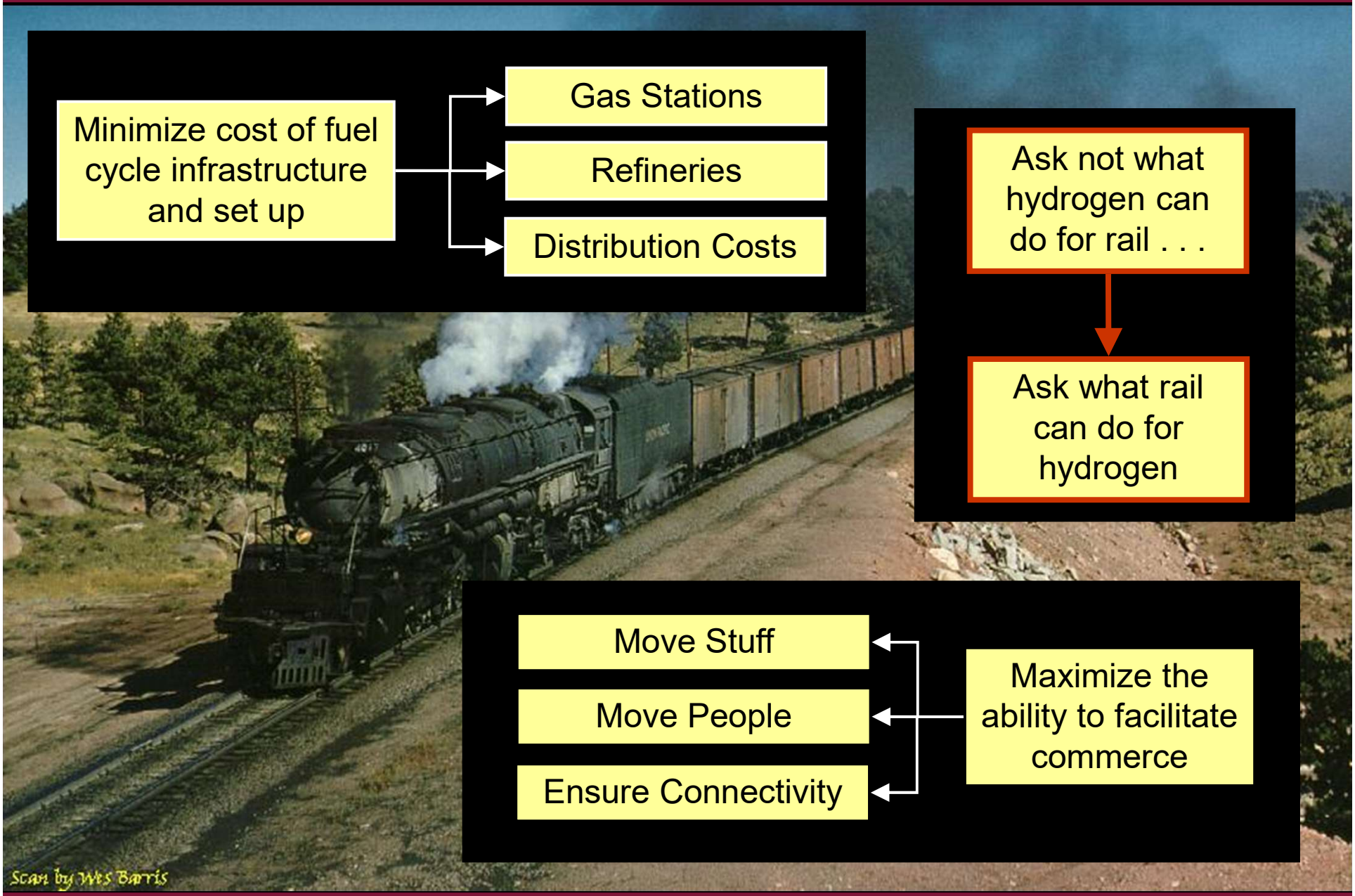
Build Fueling Sites

Build Support/Supply Network

Get Customers

Create/Combat Regulation and Management

Alternate Fuel Cycle/Economy Goal



Trains go a long way

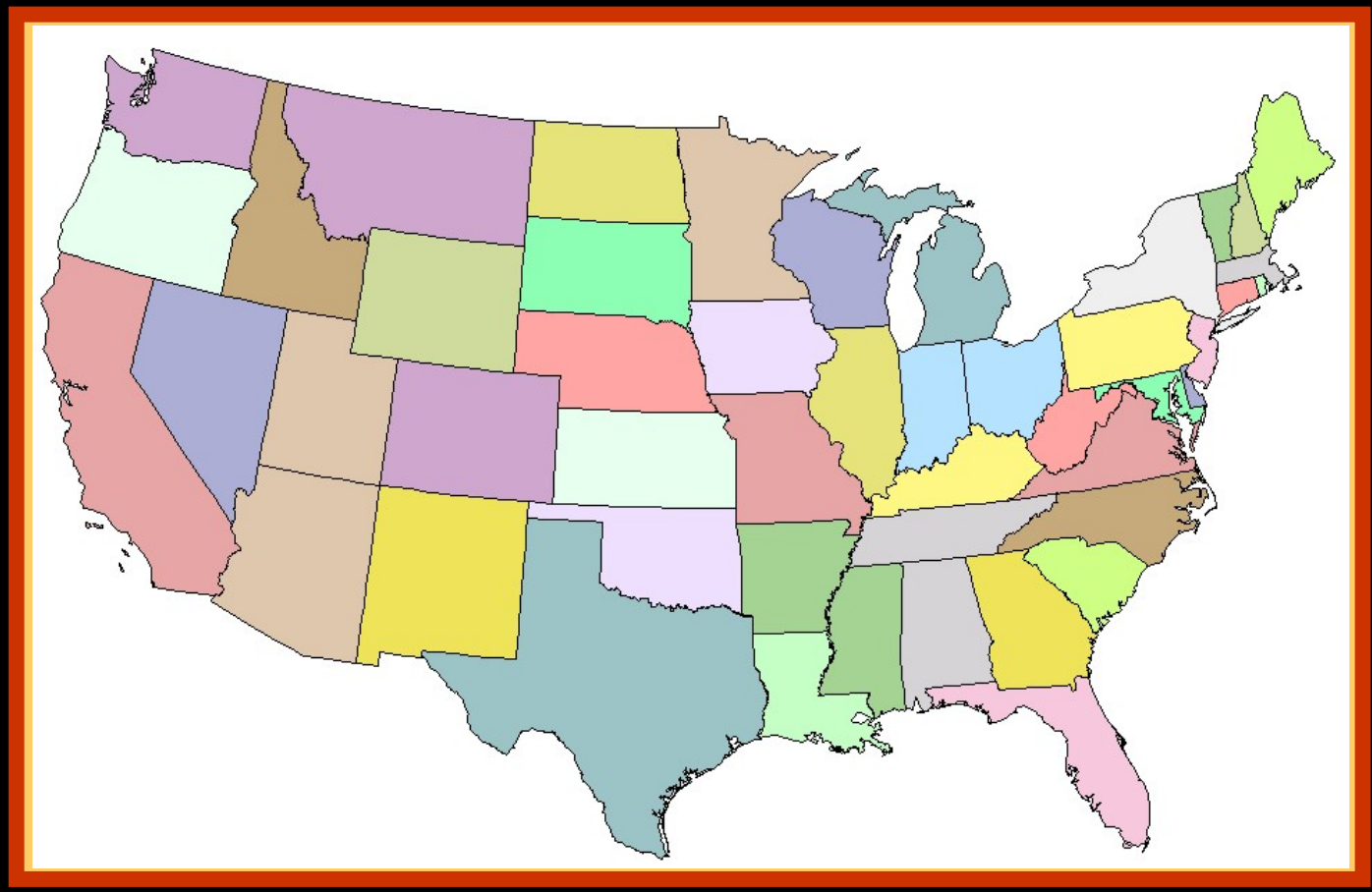
Rail Solution is Trivial

Already Electric

Go a Long Way

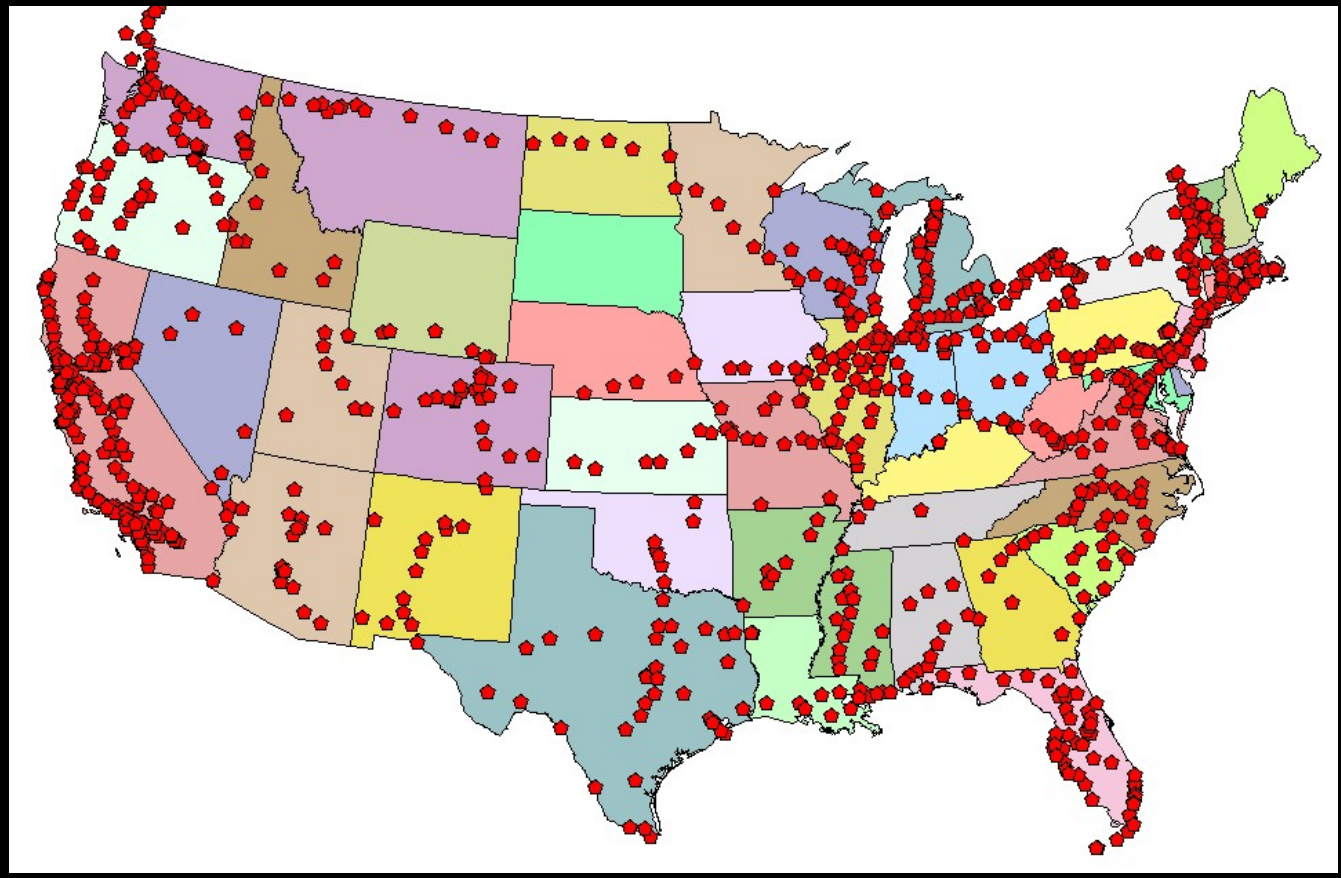
How far do they need to go?

USA: in a box
1,500 x 3,000 miles



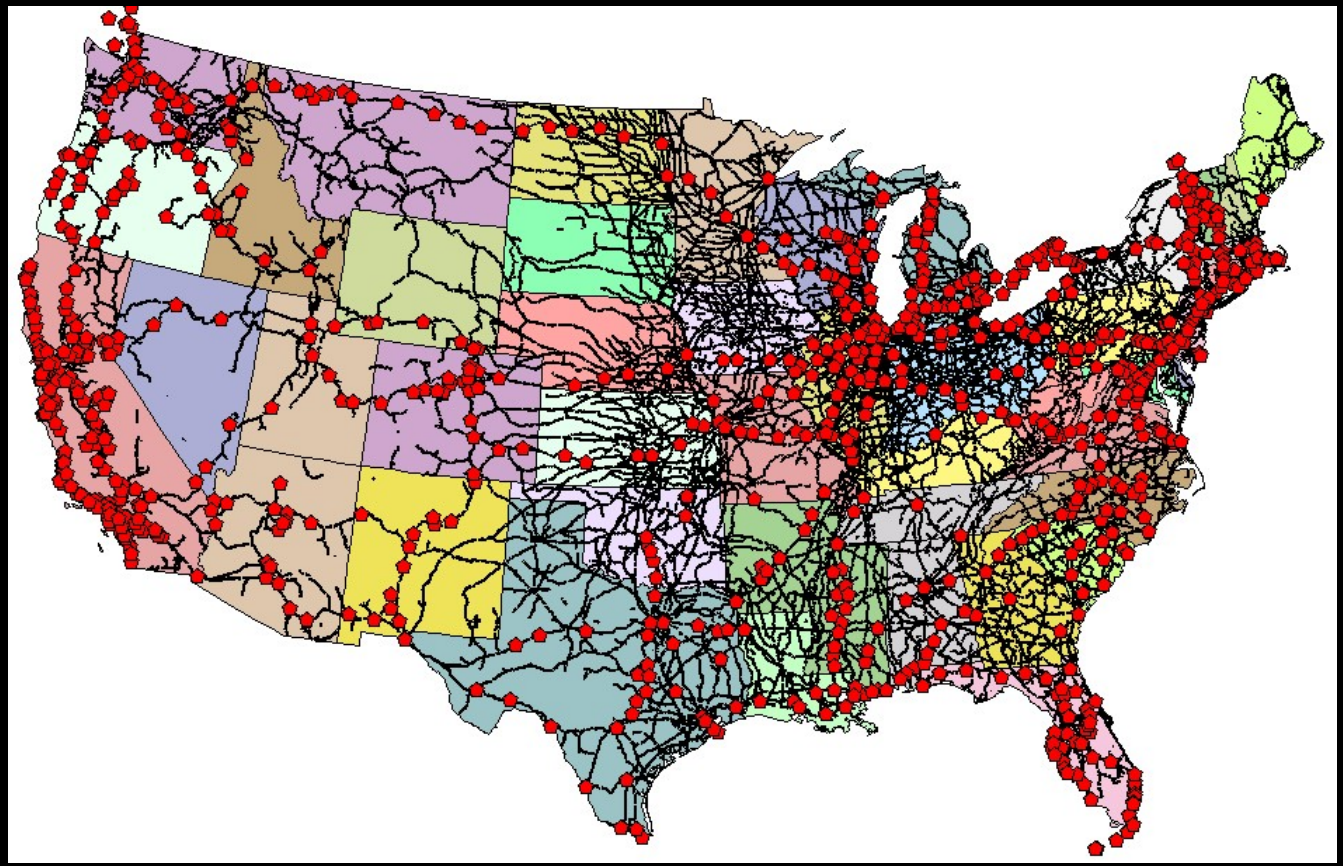
Existing Rail Stations

923 Stations



Existing Miles of Rail

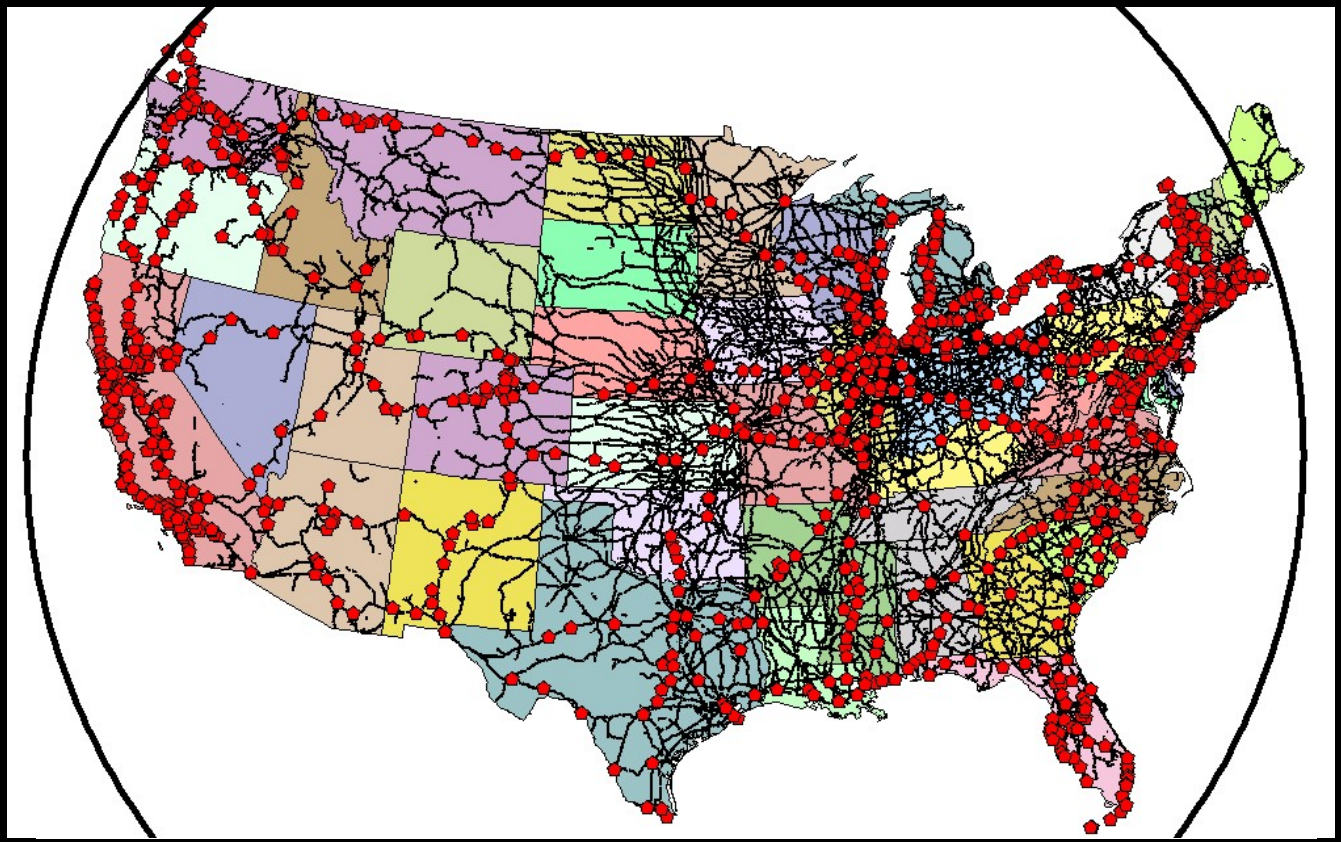
100,000 miles



Hutchinson, Kansas and 1,500 Mile Range

Hutchinson, KS

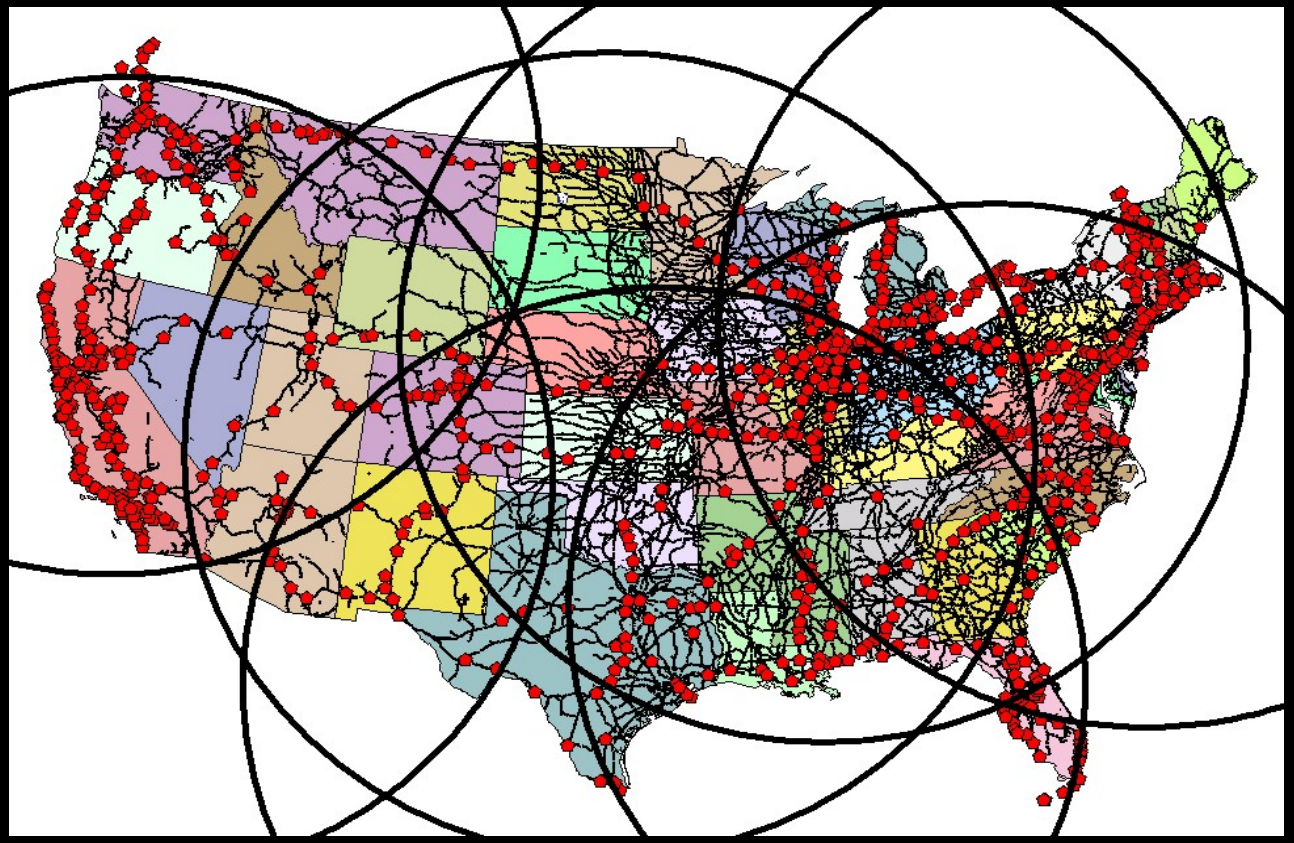
1 Fuel Depot and
1,500 Mile Range



7 Fuel Depots and 1,000 Mile Range

Hutchinson, KS
Portland, OR
Barstow, CA
Houston, TX
Chicago, IL
New York, NY
Jacksonville, FL

7 Fuel Depots and 1,000 Mile Range



New Presidential Helicopter Purchase/17

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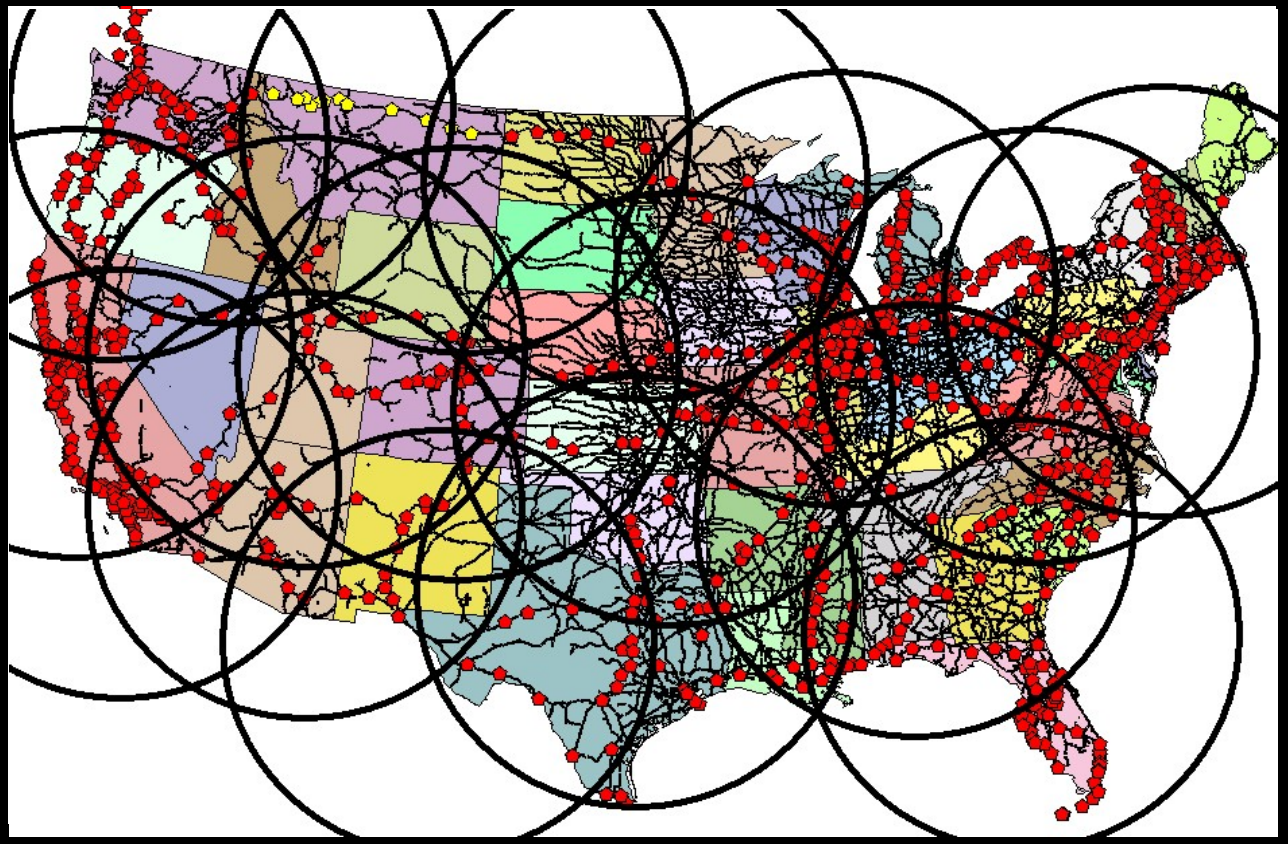
$360 million per gas station

17 Fuel Depots and 500 Mile Range



Benefits of a Hydrogen Rail Economy

- A complete and fully functional alternative fuel cycle.
- An avenue to establish a fuel cell operating history for further policy development.
- The creation of a manageable and supportable demand for a new energy industry.
- A no-impact economic demonstration for established energy firms to evaluate.
- An insured ability to meet national transportation needs in the event fossil fuel supplies are lost.

The Hydrogen Fuel Cell Locomotive as National Energy Policy Insurance

The History of the Idea

Sandia NRL

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There is no Manhattan Project

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The approach is grassroots systemic

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It's going to Happen

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Is in the Room

Where to from here?

Where does the hydrogen come from?

- Hydro-carbon Conversion
- Power Plants and Peaking
- Solar/Alternatives

- Fuel Storage
- Fuel Cells
- Fuel Cycle

Engineering Processes

Making it Work

- Leadership & Vision
- Anger & Frustration
- Do-It-Ourselves Attitude

The future is as bright as the light in our eyes