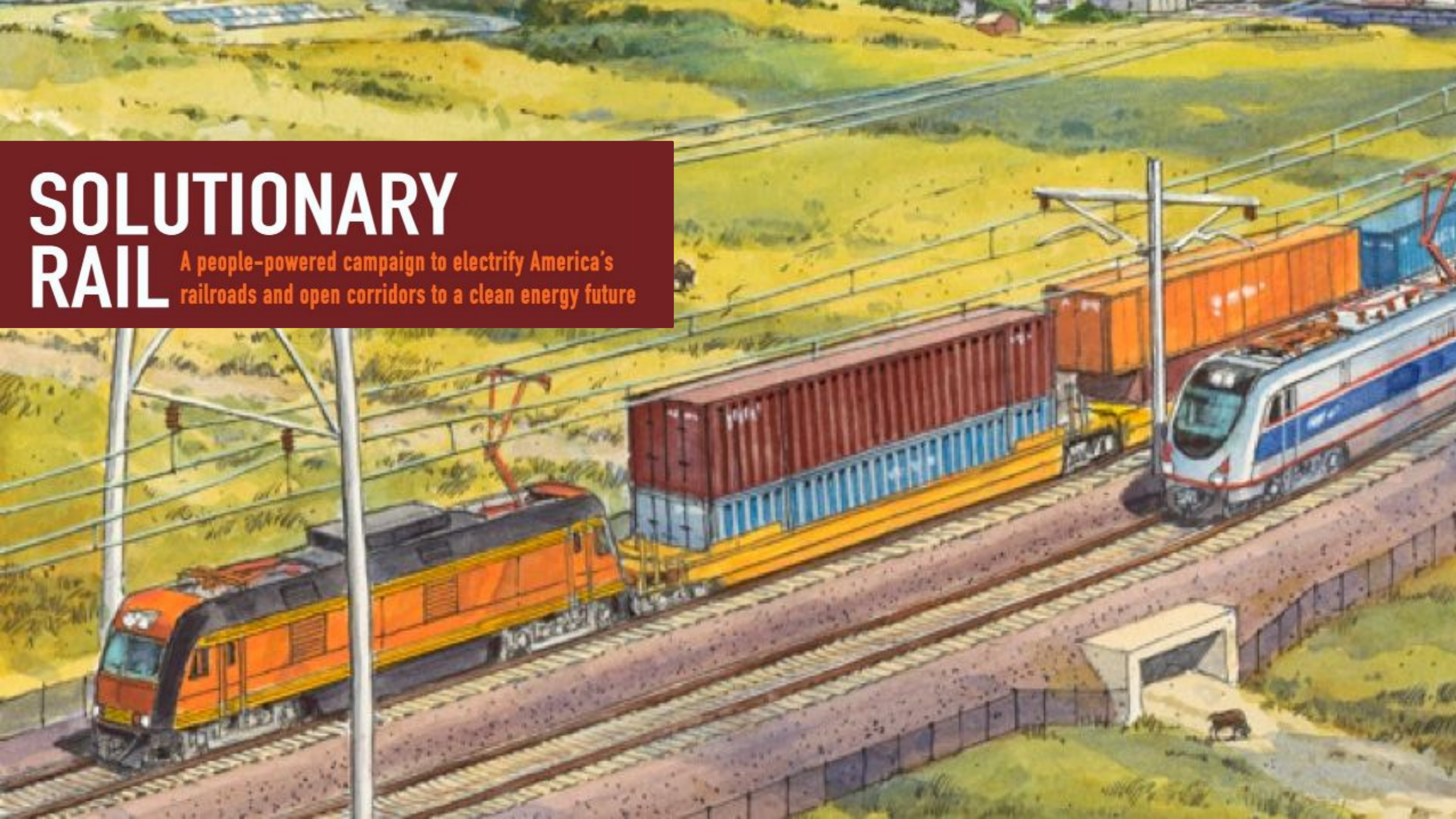
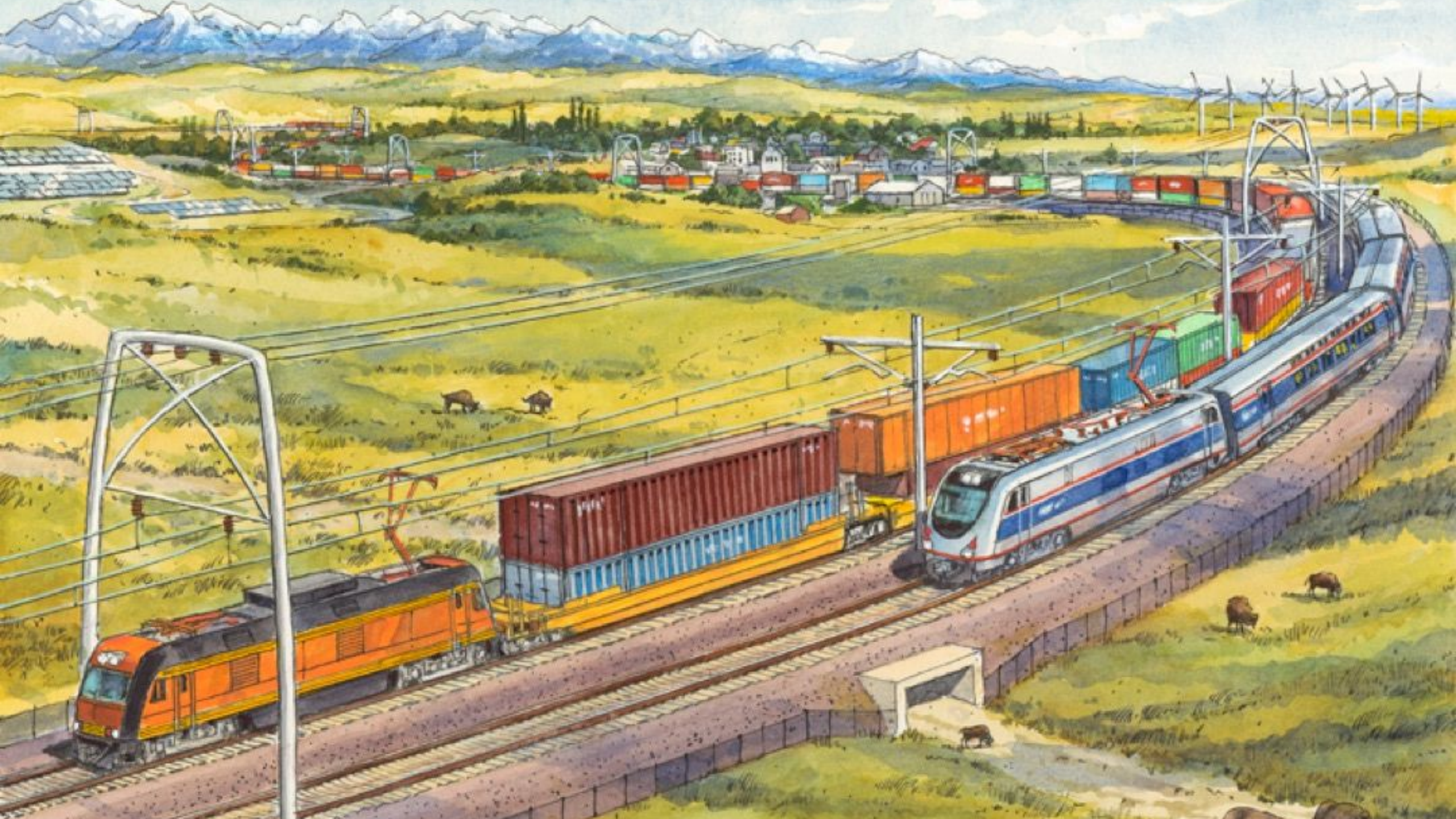
SOLUTIONARY RAIL

A people-powered campaign to electrify America's railroads and open corridors to a clean energy future

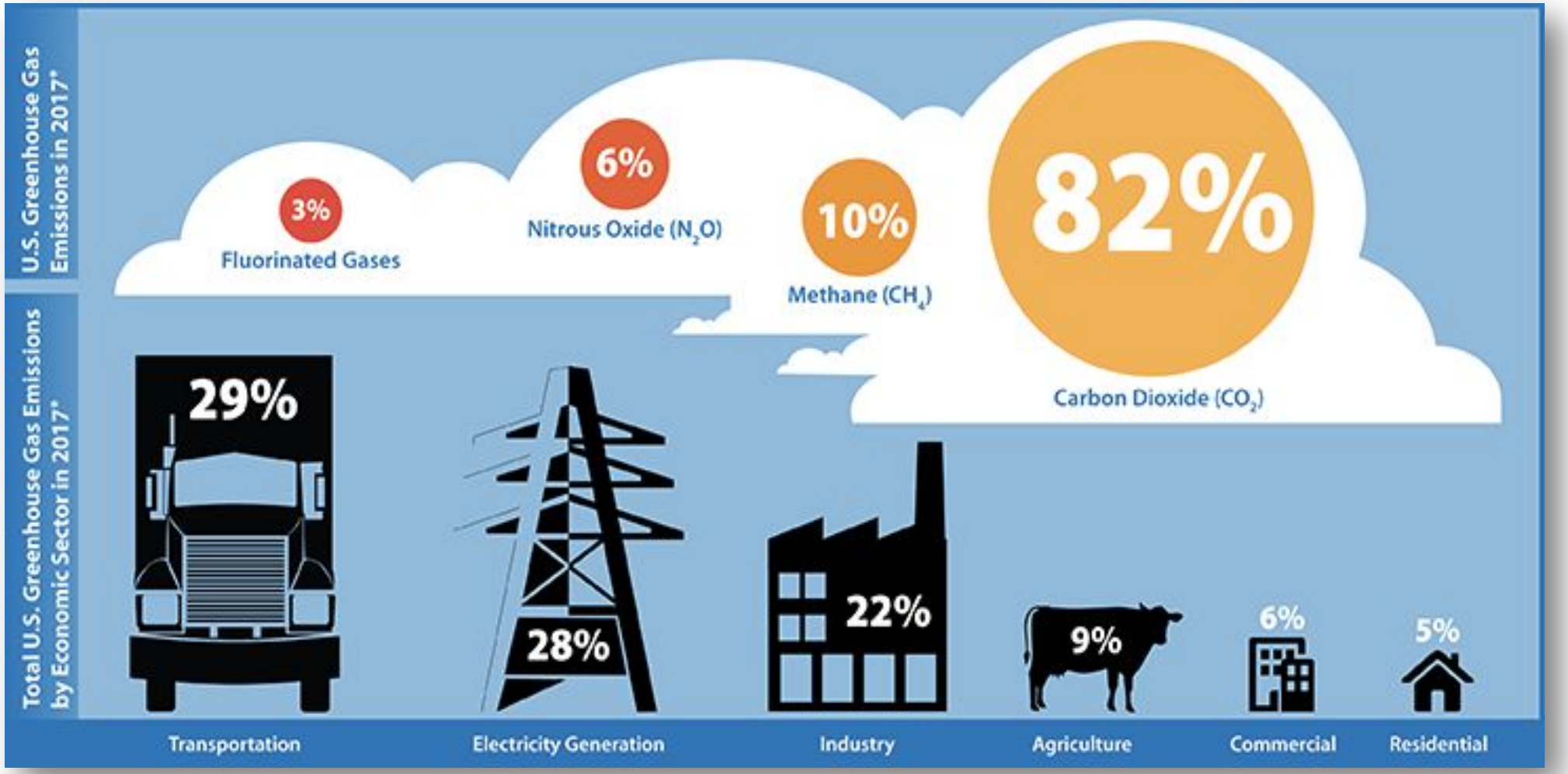




PLEASE begin by watching this short introductory video (3:41)
(source: https://www.solutionaryrail.org/video)

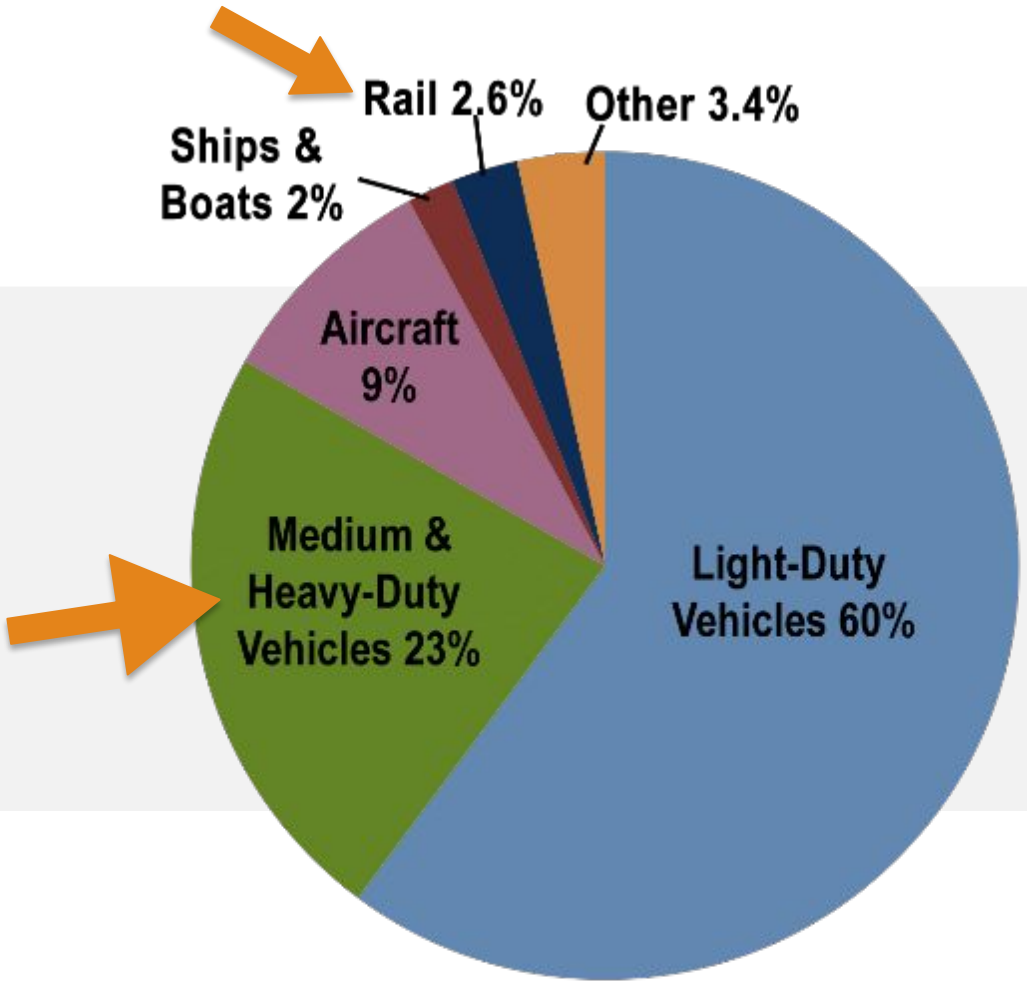
Look for link to PDF of book & coupon code
4WRD2GTHR for free download

US GHG EMISSION SOURCES



Approximately 30% each from energy & transportation

TRANSPORTATION EMISSION SOURCES



- Rail GHG emissions currently represent a relatively small portion
- Heavy-duty vehicles are a far more significant GHG emitter, and far more difficult to electrify.

Mode shift of long haul freight from roads to rails is therefore an important component of our transportation decarbonization strategy.

ADVANTAGES OF TRAINS

- **Trains use 1/3 the energy required by cars and trucks**
- **Steel on steel (trains) is more efficient than rubber on concrete (trucks)**
- **Freight moved from roads to rail:**
  - Reduces wear and tear on roads and bridges
  - Reduces motorist-truck accidents
  - Improves water quality
  - Improves air quality **and public health**
  - Reduces CO2/GHG emissions

The Freight Analysis Framework (FAF4)
indicates that annually
the US moves
OVER 1 TRILLION ton miles
(approximately 40%)
of long haul freight
traveling distances greater than 500 miles
on trucks instead of trains!

THAT'S NUTS!

1 TRILLION ton miles annually amounts to +/-

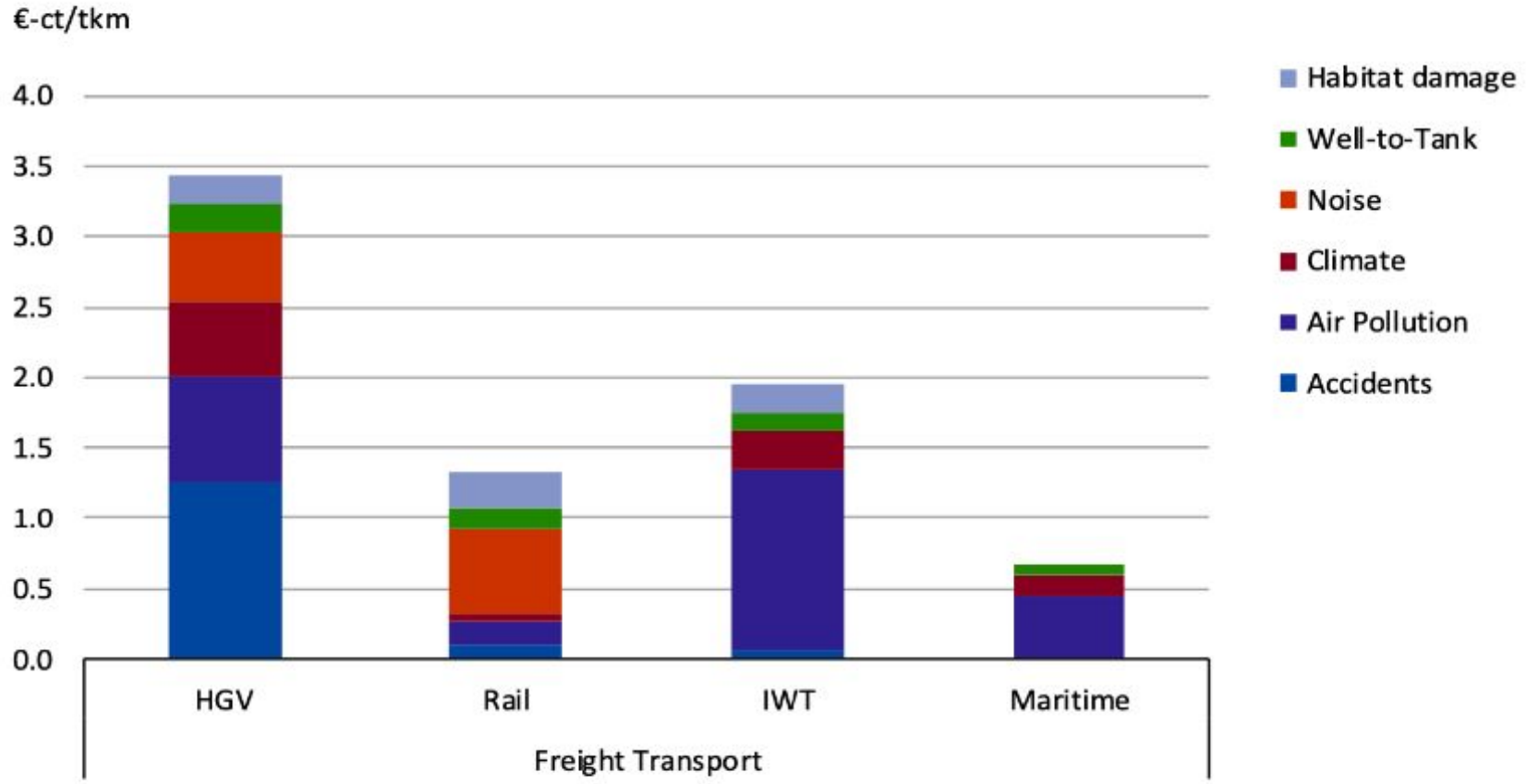
- Hundreds of $billion$ of gallons of diesel
- Tens of $billion$ in wear & tear on US roads and bridges
- Millions of metric tons of GHG/CO2
- Tens of thousands of premature deaths from diesel pollution
- Thousands of freeway deaths
- Tens of $billion$ in the costs of congestion

What's also nuts is that the US doesn't actually have a single tool for assessing these impacts accurately.

The US needs to
DO A BETTER JOB
CHARACTERIZING
the TRUE COST
of the current state of
FREIGHT.

The EU is investing in characterizing external costs of freight and prioritizing a Shift2Rail

Figure 16 - Average external costs 2016 for EU28: freight transport (excluding congestion)



* Maritime: average for selected EU28 ports.

From EU's 2019 External Costs of Transport Handbook

The EU is investing in characterizing external costs of freight and prioritizing a Shift2Rail

Table 66 - Total external costs 2016 for EU28 freight transport by cost category and transport mode

	Freight Transport						
	Road				Rail		IWT
	LCV-petrol	LCV-diesel	LCV-total	HGV - total	Electric freight	Diesel freight	Inland vessel
Cost category	bn €/a	bn €/a	bn €/a	bn €/a	bn €/a	bn €/a	bn €/a
Accidents	19.8			23.0	0.3		0.1
Air Pollution	0.3	15.2	15.5	13.9	0.01	0.7	1.9
Climate	0.7	12.5	13.2	9.6	0.00	0.2	0.4
Noise	5.4			9.1	2.1	0.4	
Congestion*	55.5			14.6			
Well-to-Tank	0.2	3.6	3.8	3.7	0.5	0.1	0.2
Habitat damage	0.2	4.2	4.4	3.6	0.8	0.2	0.3
Total			**117.6**	**77.5**	**5.4**		**2.9**
Total per mode	**195.1**				**5.4**		**2.9**
Total as % of EU28 GDP	**1.31%**				**0.04%**		**0.02%**
Total freight transport	**203.4**						

* Congestion in terms of delay cost generated by the various vehicle categories.

From EU's 2019 External Costs of Transport Handbook

Connecting the dots on the true cost of transportation (especially freight) is an opportunity for immediate interagency collaboration.

Bureau of Transportation Statistics

bts

Making Transportation Coun

USDA

TRB

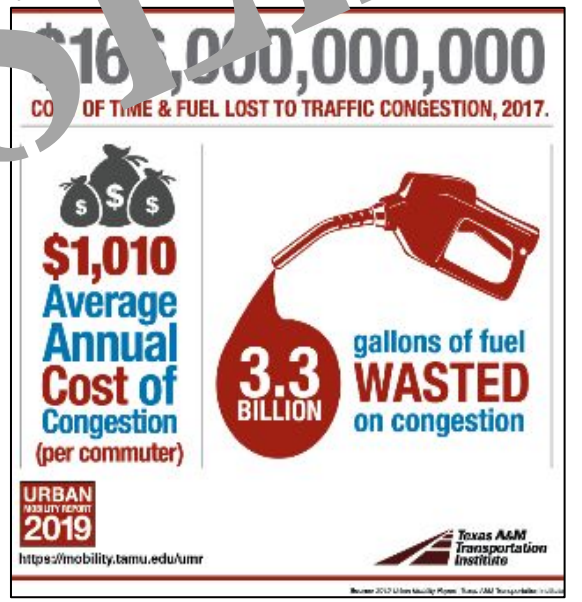
TRANSPORTATION RESEARCH BOARD

OF THE NATIONAL ACADEMIES

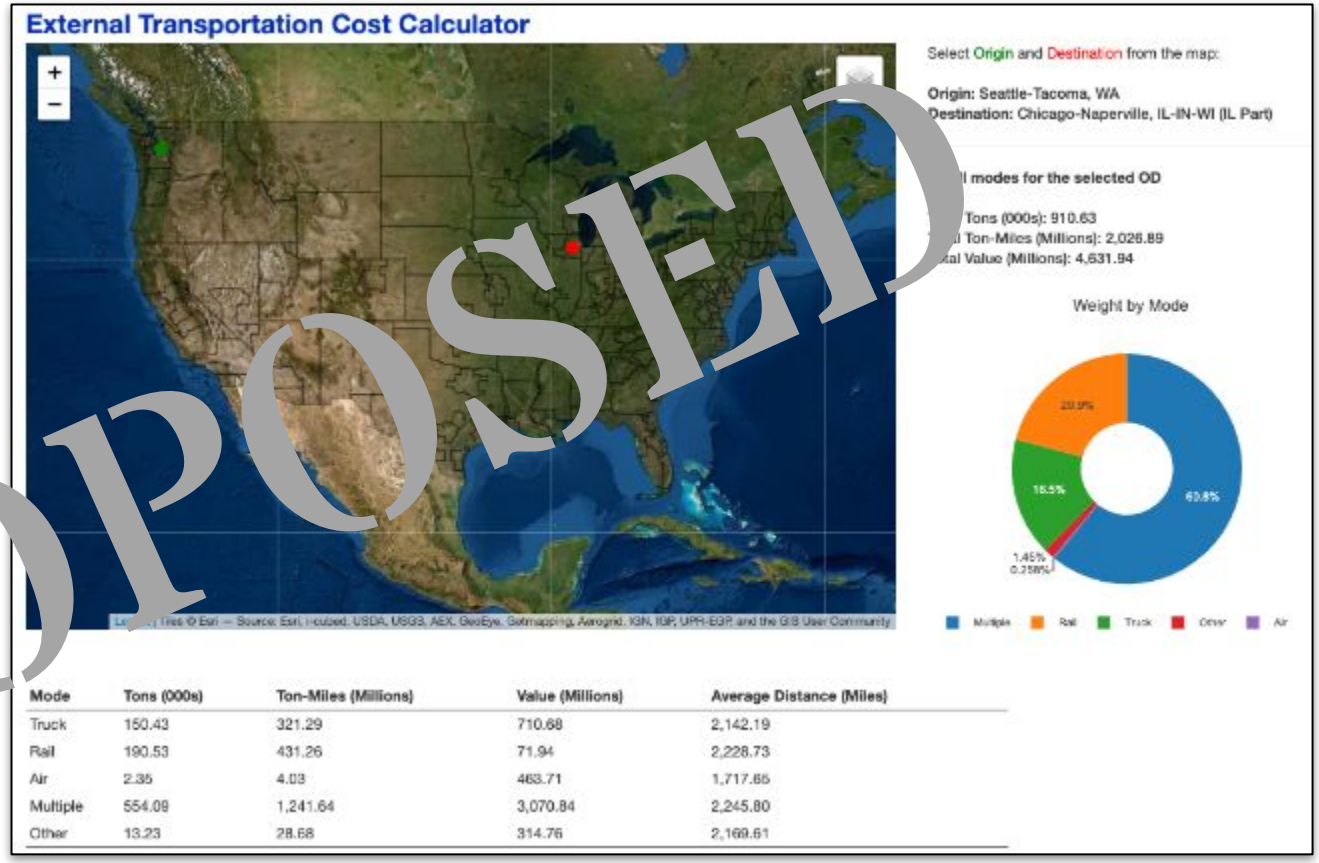
SmartWay Transport Partner

Getting There With Cleaner Air

OAK RIDGE National Laboratory



Solutionary Rail would like to work with USDOT and other agencies to develop a True Cost Calculator. The next slides show our PRE-BETA, earliest version



See the BETA prototype at SolutionaryRail.org/truecost

External Transportation Cost Calculator

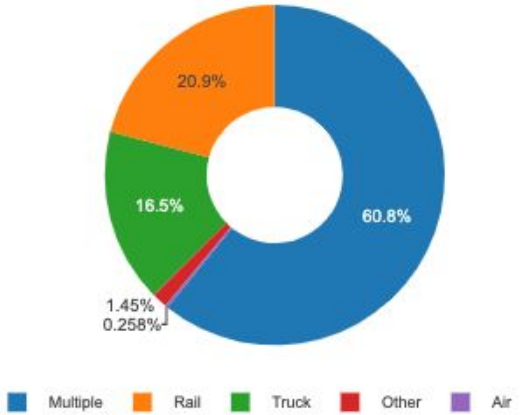
Select Origin and Destination from the map:

Origin: Seattle-Tacoma, WA
Destination: Chicago-Naperville, IL-IN-WI (IL Part)

By all modes for the selected OD

Total Tons (000s): 910.63
Total Ton-Miles (Millions): 2,026.89
Total Value (Millions): 4,631.94

Weight by Mode



Mode	Tons (000s)	Ton-Miles (Millions)	Value (Millions)	Average Distance (Miles)
Truck	150.43	321.29	710.68	2,142.19
Rail	190.53	431.26	71.94	2,228.73
Air	2.35	4.03	463.71	1,717.65
Multiple	554.09	1,241.64	3,070.84	2,245.80
Other	13.23	28.68	314.76	2,169.61

https://solutionaryrail.shinyapps.io/external_cost_faf/

Emission Cost | Safety Cost | Pavement Damage Cost | Efficiency Benefits

Emissions Rate (grams / ton-mile)

CO2 Rail: 22.33927	**CO2 Truck:** 98.1366
NOx Rail: 0.23614	**NOx Truck:** 0.2698
PM2.5 Rail: 0.00573	**PM2.5 Truck:** 0.0138
VOC Rail: 0.00967	**VOC Truck:** 0.0131
SO2 Rail: 0.00411	**SO2 Truck:** 0.0009

Emissions Cost ($/ton)

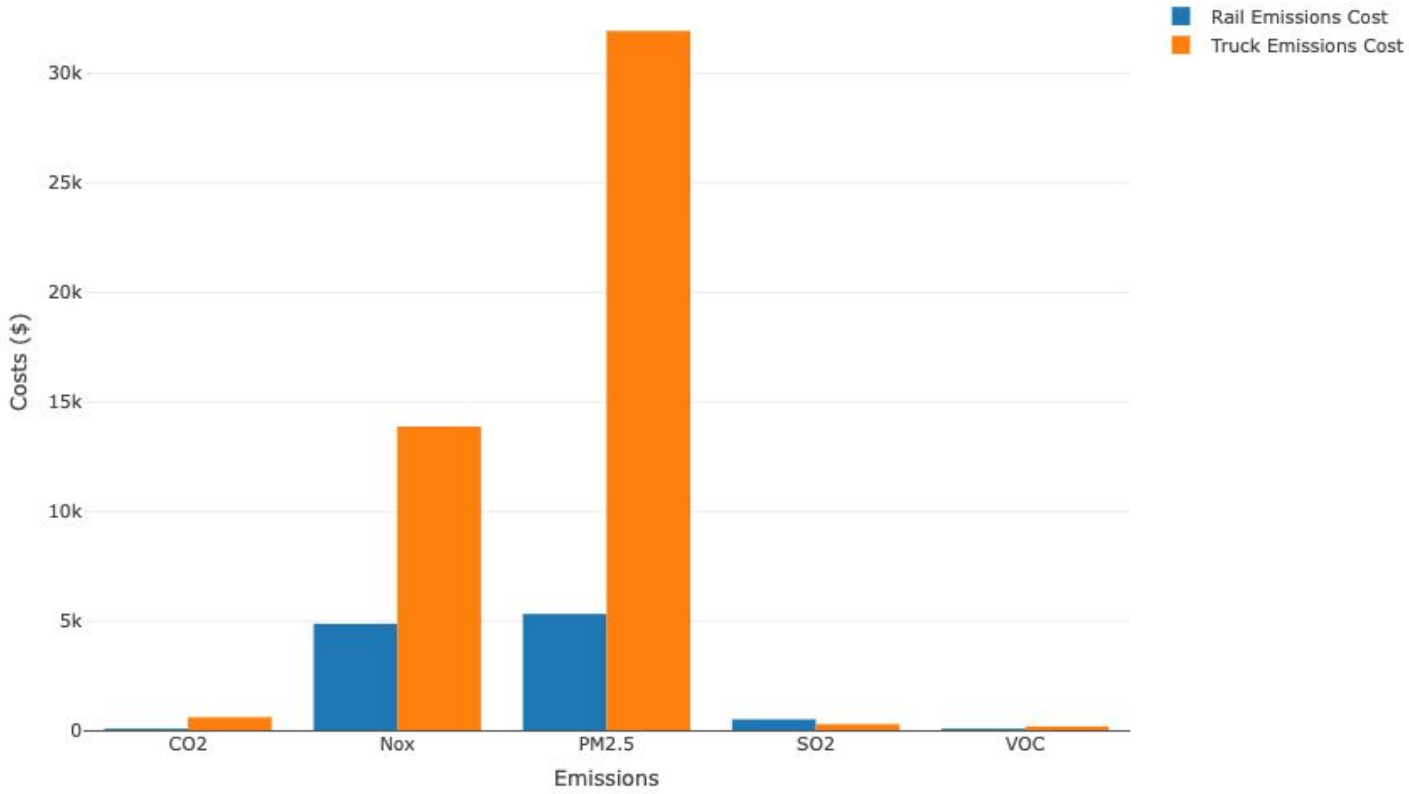
CO2 Cost: 1.0174243	**VOC Cost:** 2136.5911
NOx Cost: 8749.8496	**SO2 Cost:** 50972.961
PM2.5 Cost: 394048.46	

Reset Emissions Rate

Emission_Cost	Value_Amount
Annual Rail Emissions Costs	10,750
Annual Truck Emissions Costs	46,813
Annual Net Emissions Cost Savings	36,062

From Inputs

Annual Total Tons (000s): 266.35
Annual Loaded Rail Ton-Miles (000s): 2,130.77
Annual Truck Ton-Miles (000s): 5,326.92



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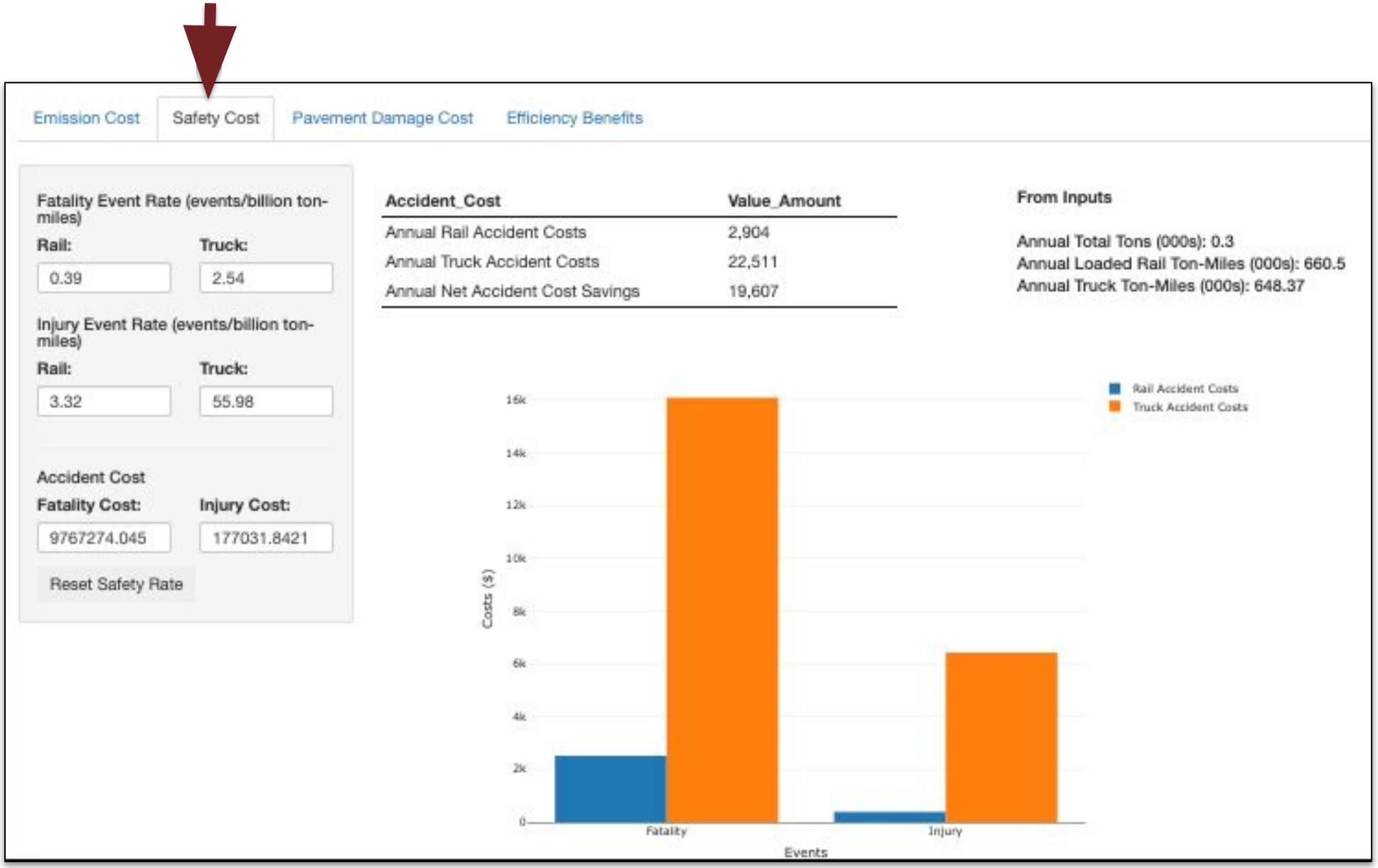

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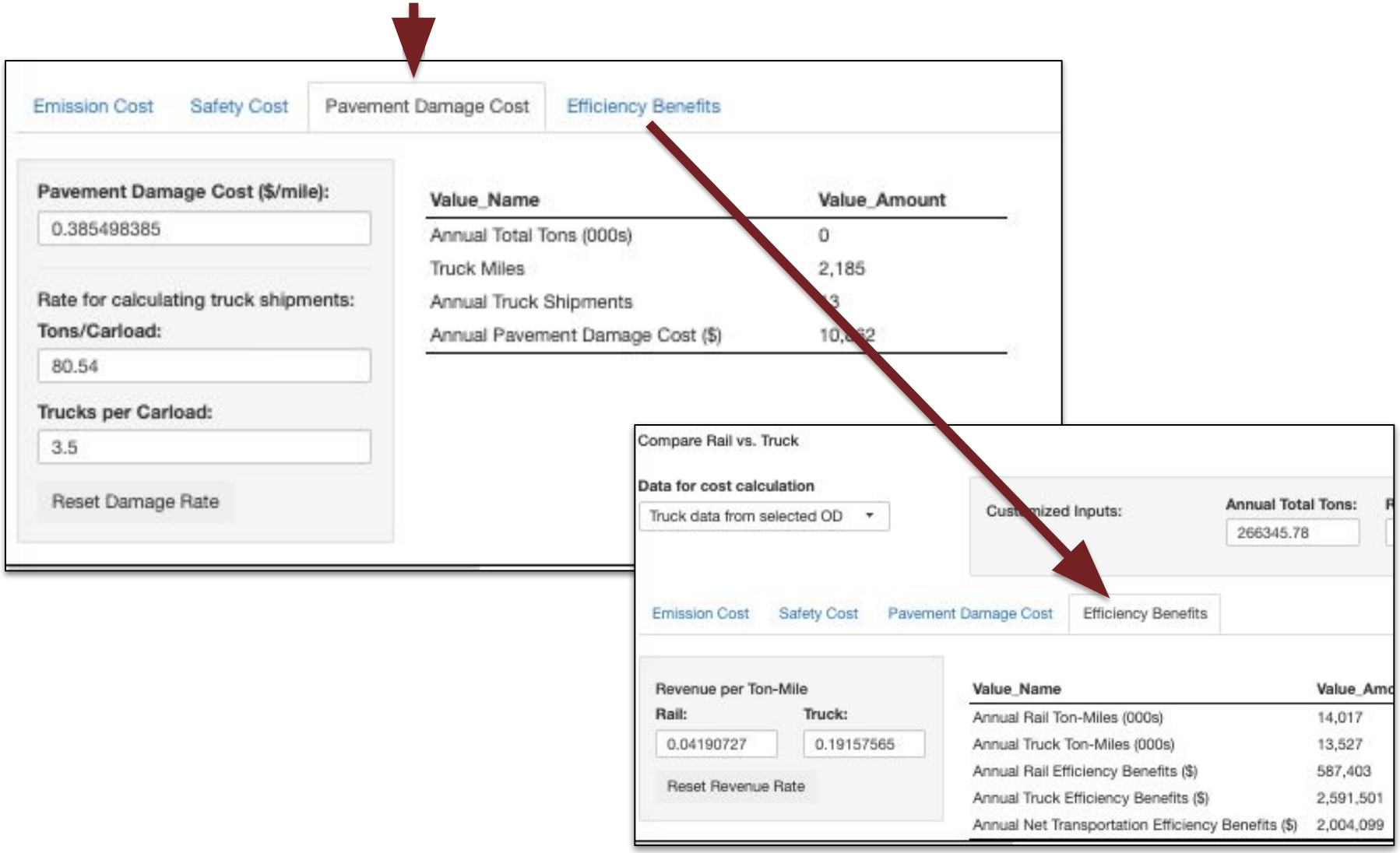


https://solutionaryrail.shinyapps.io/external_cost_faf/

IT QUICKLY BECOMES OBVIOUS THAT

the mode shift of freight - especially long haul freight traveling >500 miles - from trucks to trains ***is a public policy priority.***

That's why Solutionary Rail starts with...

MODE SHIFT

Leveraging the efficiency of rail
for decarbonizing freight transport

In 2020, it became clear that too few were promoting mode shift at a scale commensurate with the crises we face.
So, we proposed a…

MOONSHOT MODESHIFT

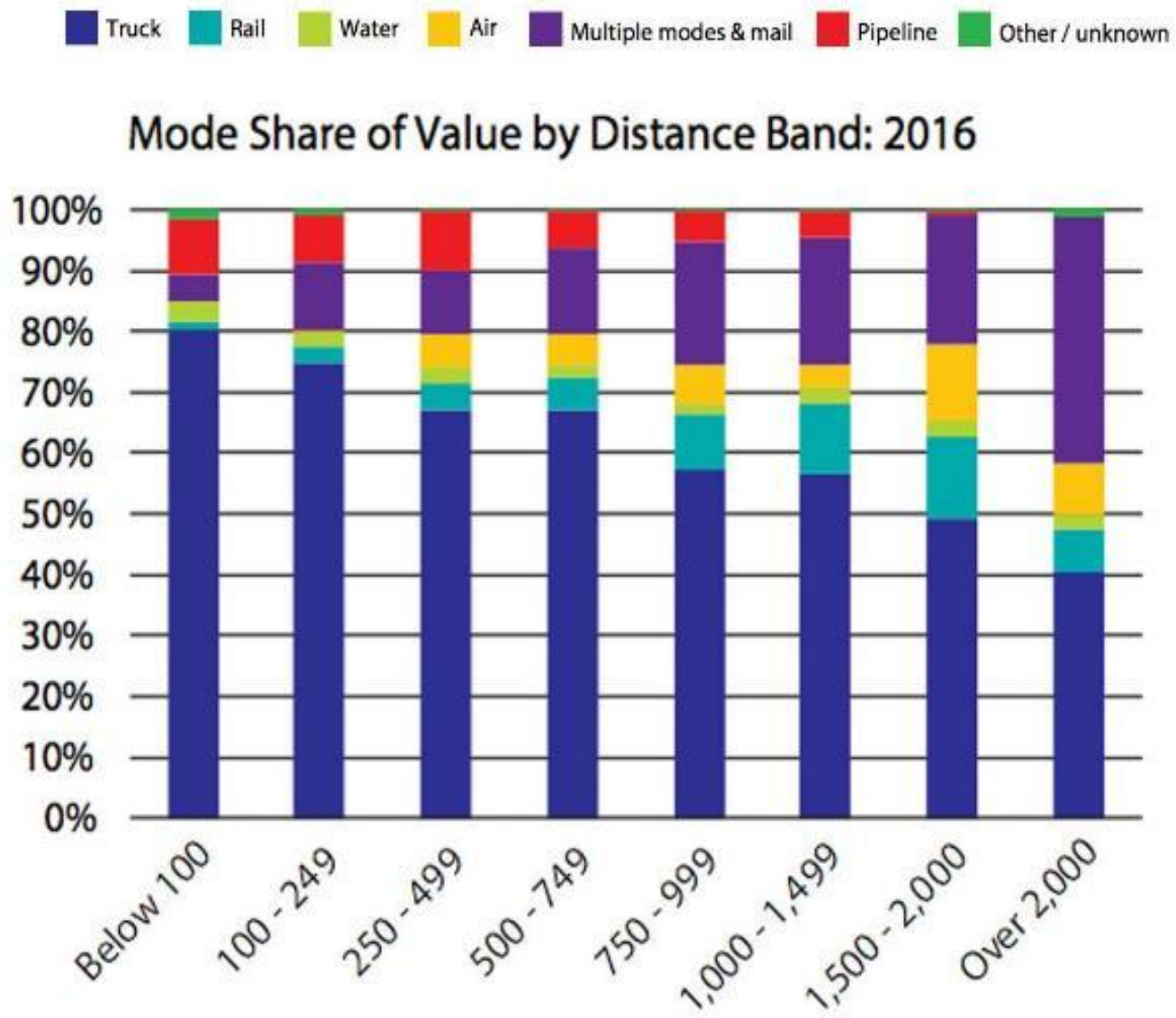
Solutionary Railroads

Moonshot Modeshift

Supplemental Brief #1 for the Select Comm. on the Climate Crisis

Available at: SolutionaryRail.org/msms

Mode shifting freight from trucks to trains (both value & volume) requires a freight rail business model with improved service, accessibility, reliability and speed.



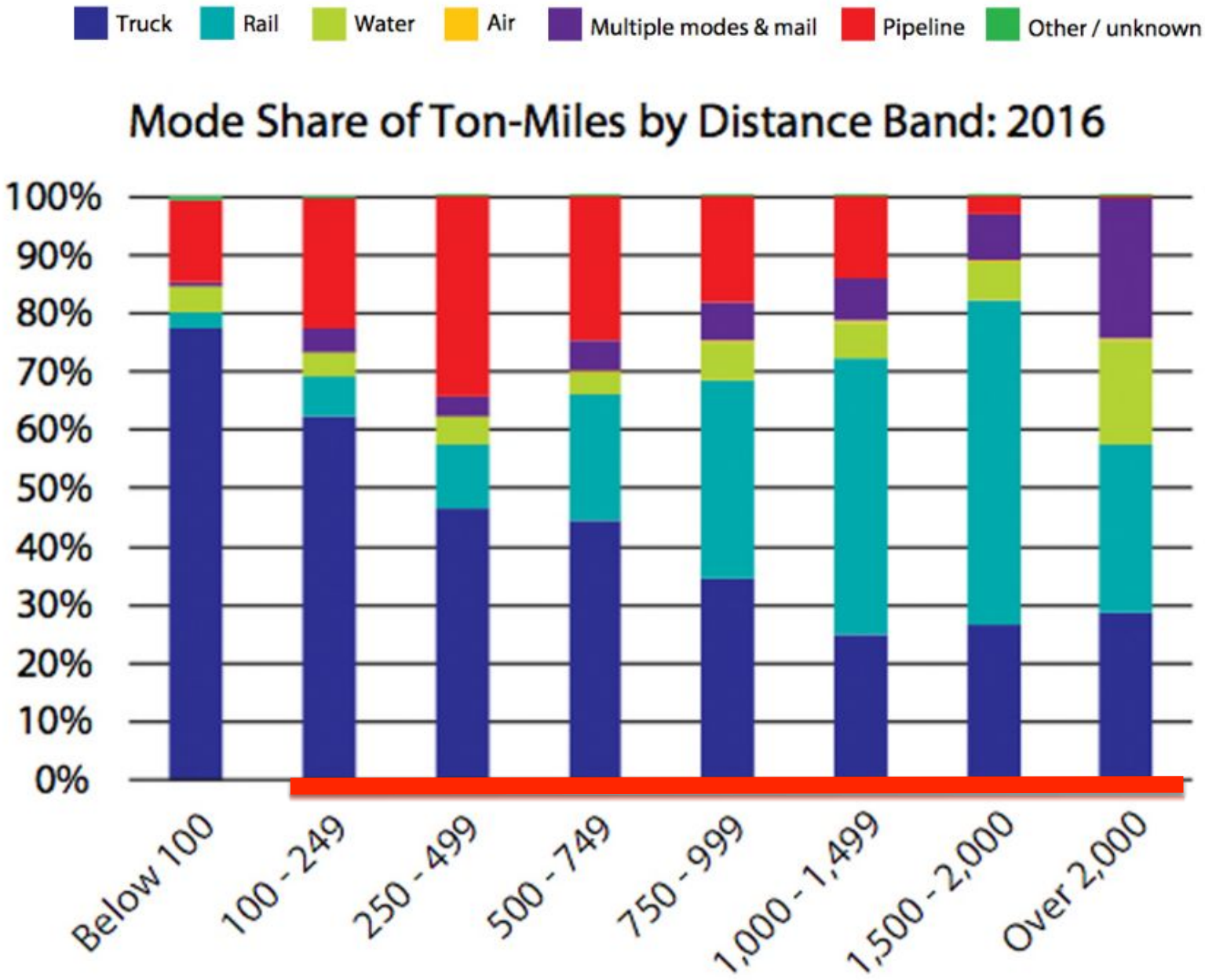
IN THE MOONSHOT MODESHIFT BRIEF, WE PROPOSED BOLD TARGETS FOR 2030:

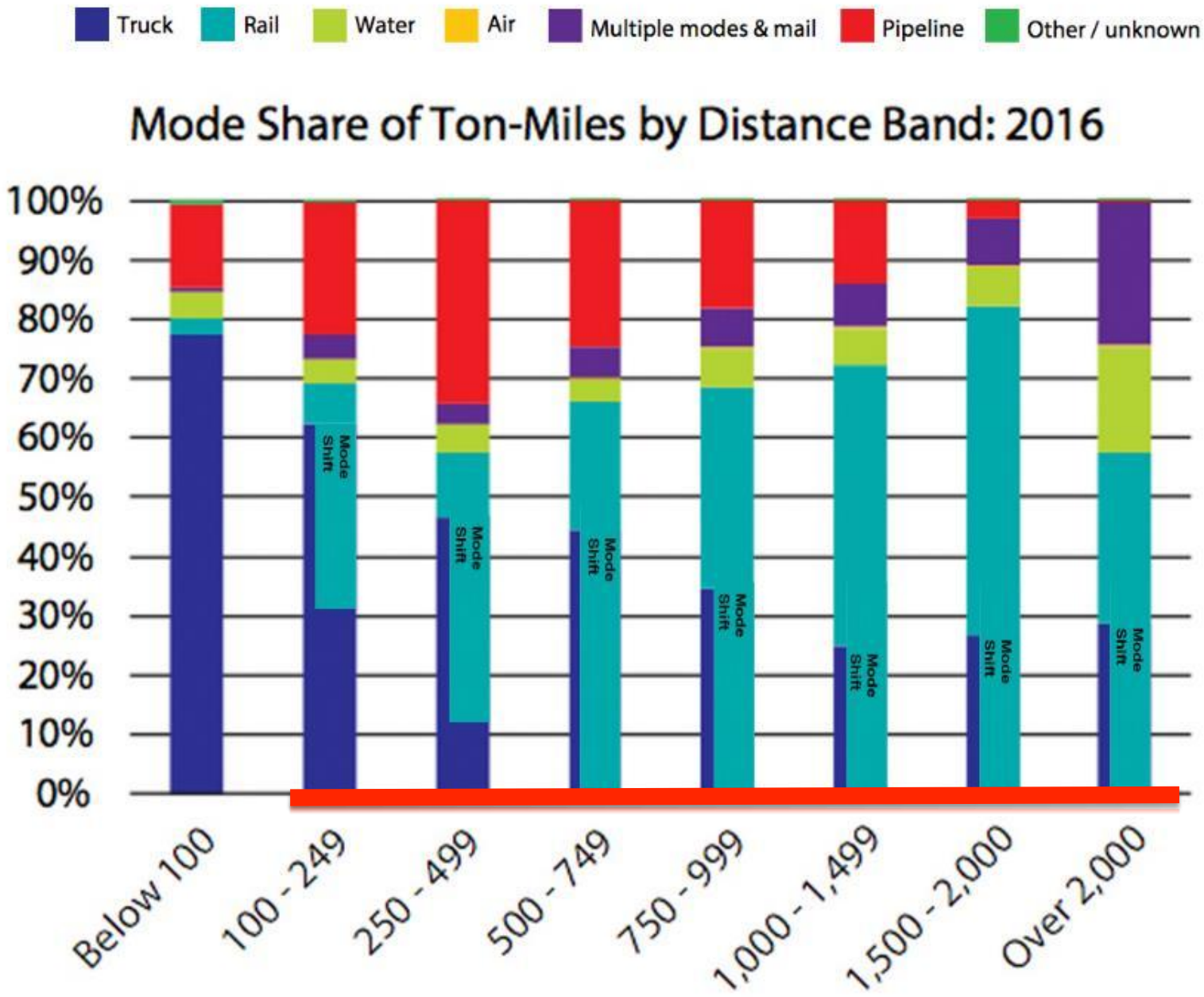
50% of freight traveling 100-249 miles

75% of freight traveling 250-499 miles

and

100% of freight traveling over 500 miles


Truck
Rail
Water
Air
Multiple modes & mail
Pipeline
Other / unknown
Mode Share of Ton-Miles by Distance Band: 2016
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Below 100
100 - 249
250 - 499
500 - 749
750 - 999
1,000 - 1,499
1,500 - 2,000
Over 2,000


Truck
Rail
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100%
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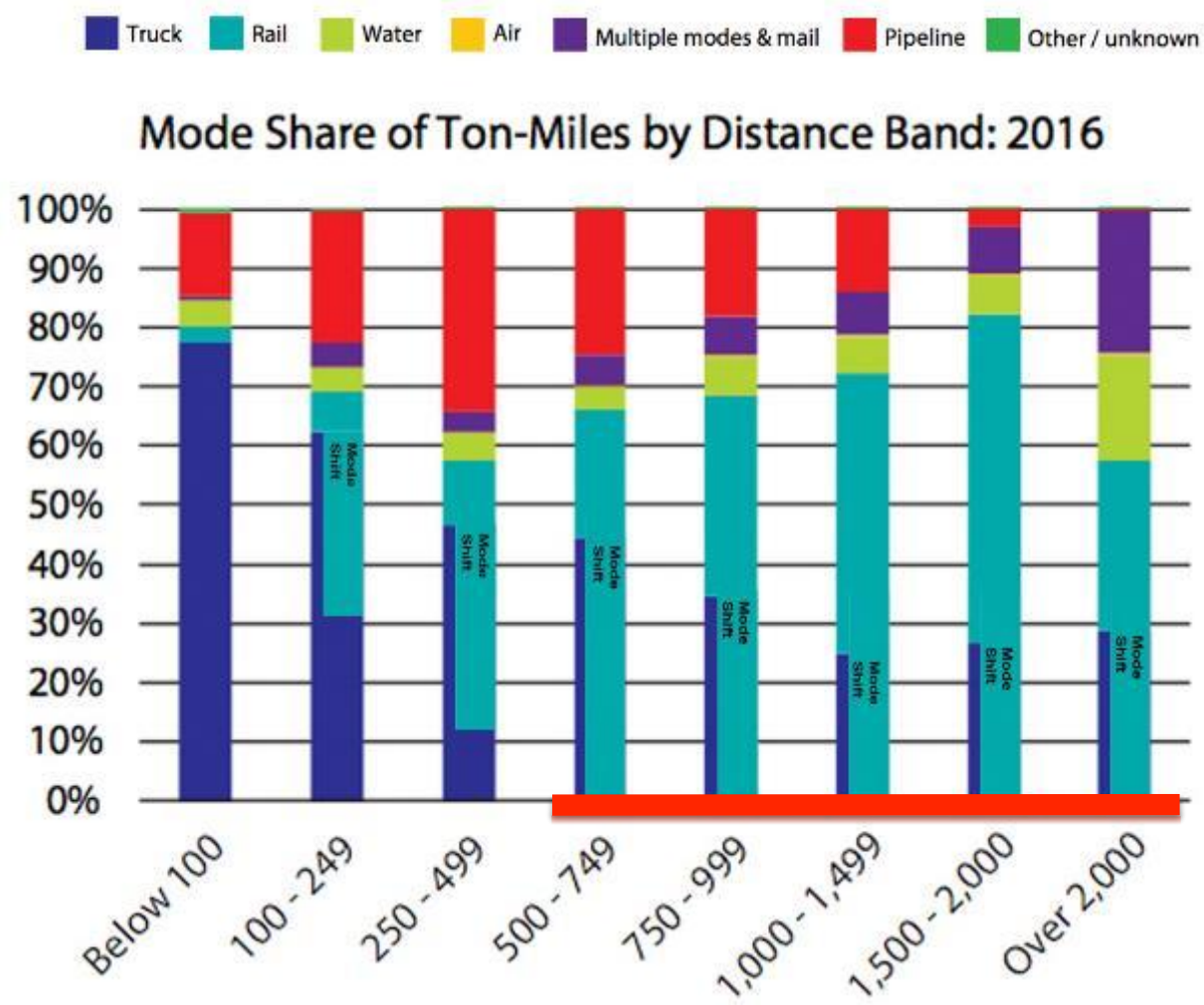
10%
0%
Mode Shift
Below 100
100 - 249
250 - 499
500 - 749
750 - 999
1,000 - 1,499
1,500 - 2,000
Over 2,000

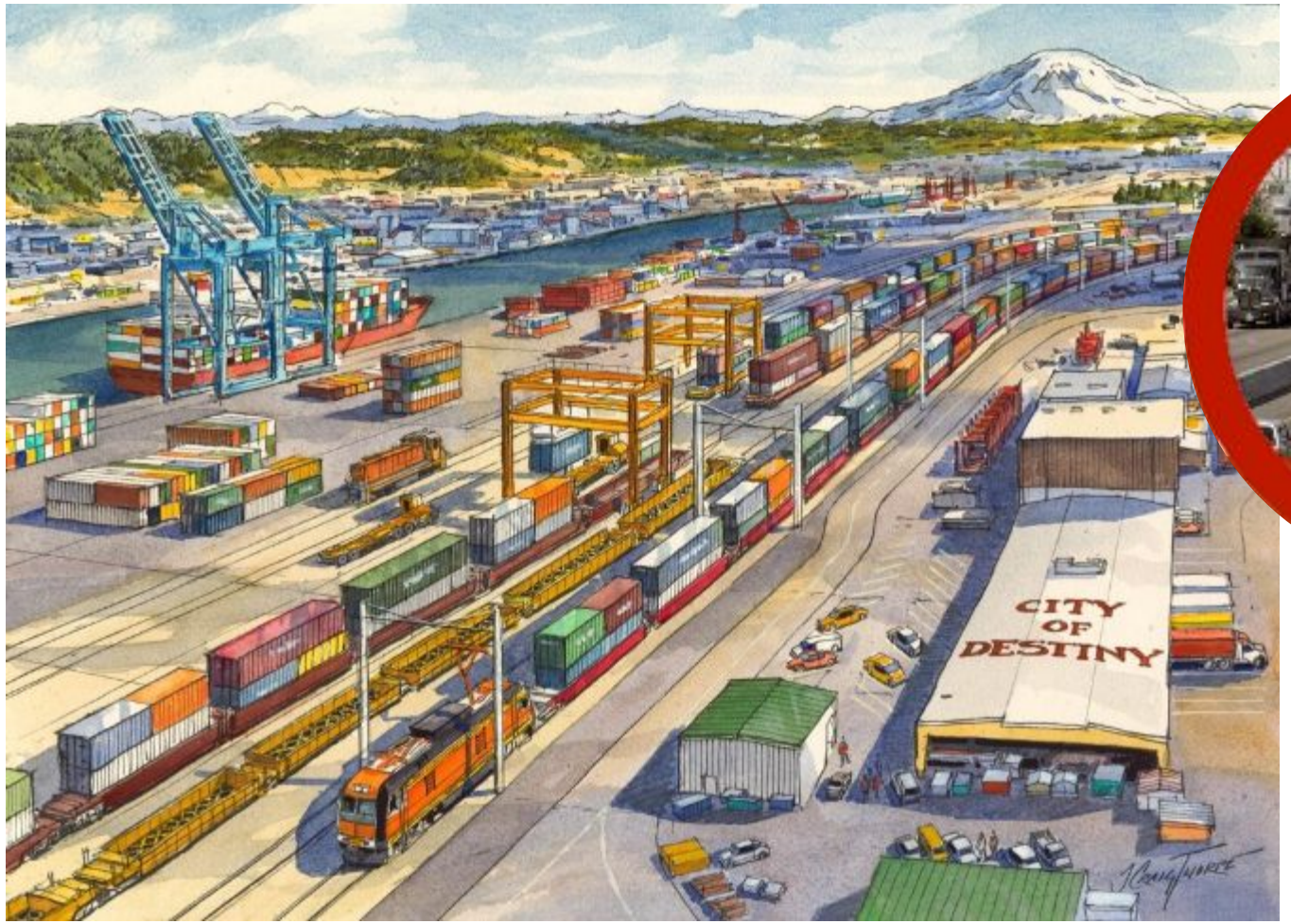
Mode shifting 100% of freight ***traveling over 500 miles*** *from roads to rails by 2030 is a reasonable, worthy & achievable goal.*



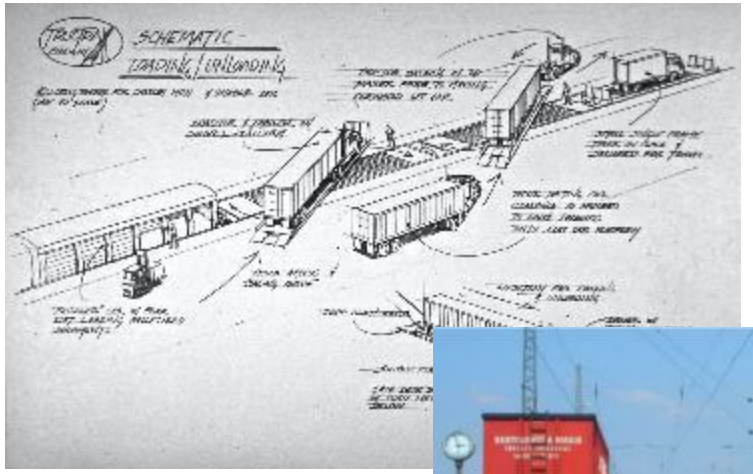
MODE SHIFT EXAMPLES:

- On dock rail
- Roll-On, Roll-Off (“RoRo”)
- Protecting short line railroad access to mainlines
- Connectivity & Access

ON DOCK RAIL FOR INTERMODAL:



ROLL ON/ROLL OFF 'S MULTIPLE FORMS:



Versions of carless technology by three manufacturers. (Left to right: RoadRailer, RailRunner and RailMate)[3]

SUPPORT THE 605 SHORT LINE & REGIONAL RAILROADS

Unlike Class 1 railroads that are chasing away the less profitable business to maximize profits, short line railroads continue to pursue a growth model.
Short line railroads provide essential “first and last mile” service to and from, and between Class 1 RRs
Shippers complain to the STB about Class 1 practices, but it is more difficult for vulnerable short line railroads to complain. As one short line executive said confidentially, ***“We know who brought us to the dance.”***

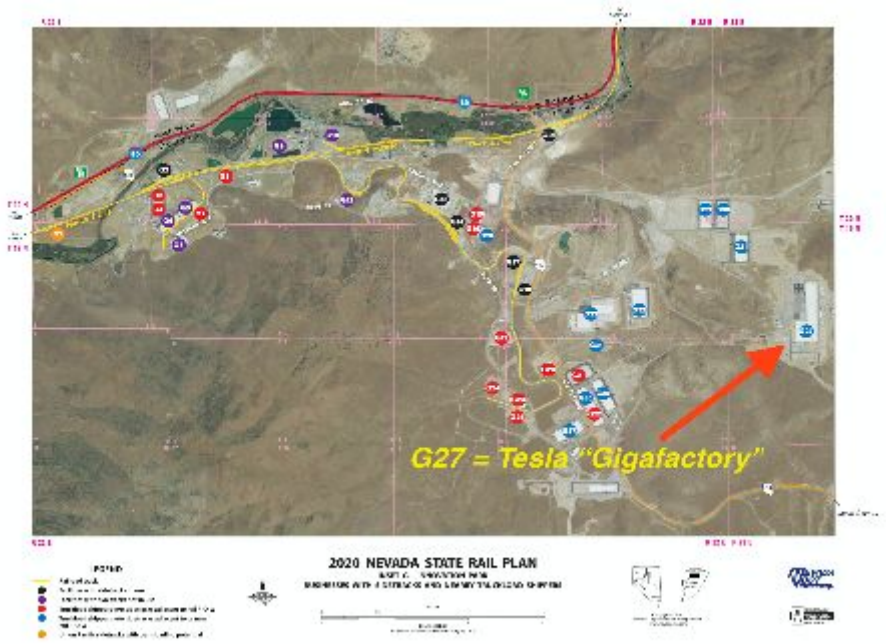
Minimum carloads (52) and requiring heavier (286k lb) grain cars for unit trains puts a burden on shippers, short line railroads, grain elevators, and track capacity. This forces many farmers and manufacturers to ship by truck.

The **Kansas DOT Short Line** program and the **Washington State Grain Train** programs are examples of addressing some of these burdens.

Failures to protect short lines and innovative shipping projects like the **Cold Train** using BNSF and UP’s **Cold Connect** harms local and regional economies.

State Rail Plans should be actual plans.

Require State Rail Plans to include serious study of public interest goals such as mode shift, electrification, and regional connectivity, as done in the recent **Nevada State Rail Plan**. In service of modal shift, rail plans should map industrial areas to catalog access to, past and potential future utilization of rail sidings, and incentivize mode shift wherever feasible.



LEGEND

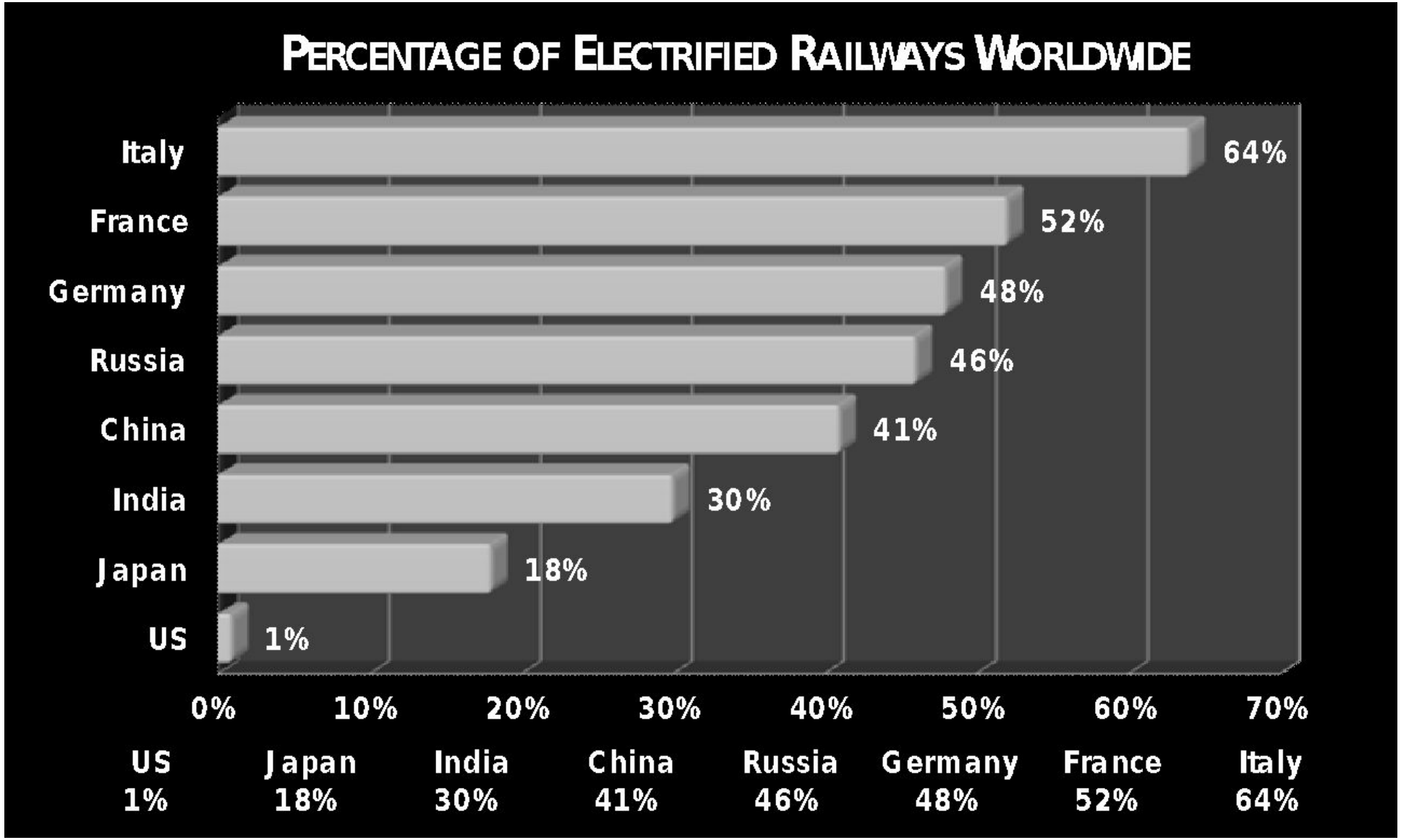
- Railroad track
- Facilities with sidetracks in use
- Facilities with sidetracks not in use
- Truckload shippers w/o sidetracks adjacent to rail R-O-W
- Union Pacific sidetracks with transloading potential

ELECTRIFICATION

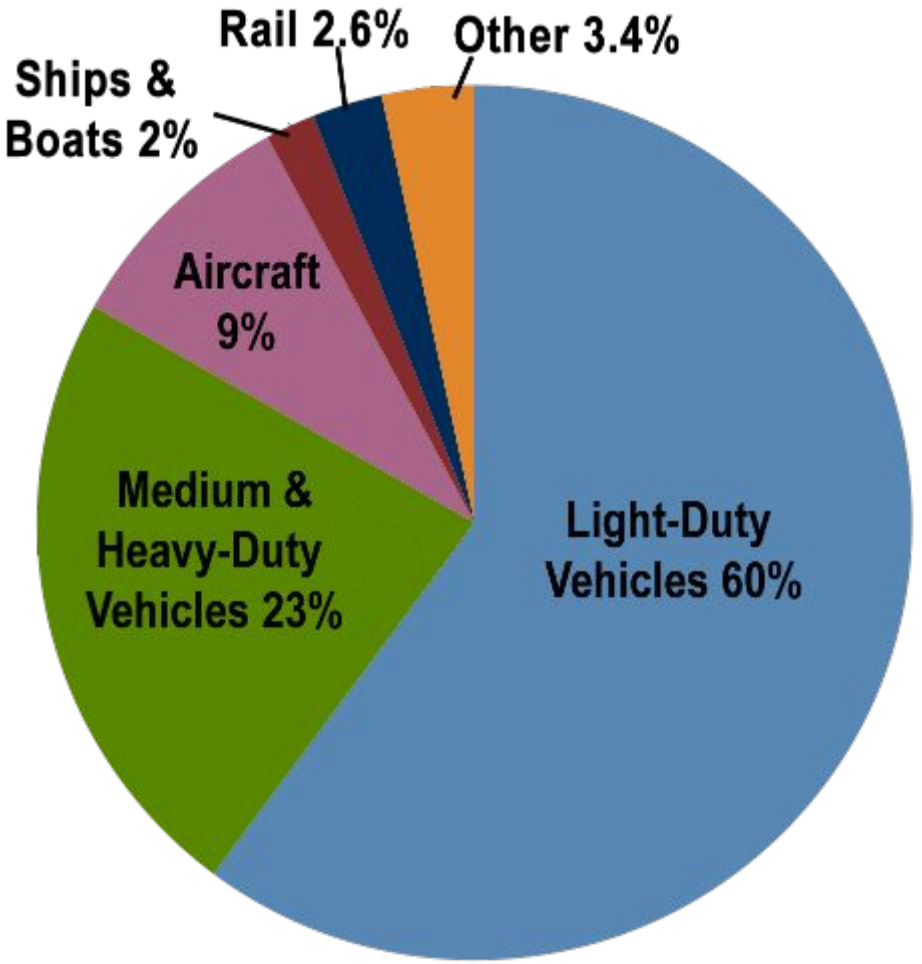
Essential for Workers, Communities, & Climate

ADVANTAGES OF ELECTRIC TRAINS

- Electricity can come from renewable sources
- Electricity costs less than diesel fuel
- Electric locomotives are cheaper to maintain
- Regenerative braking reduces consumption
- Electric locomotives add capacity through more rapid acceleration and deceleration

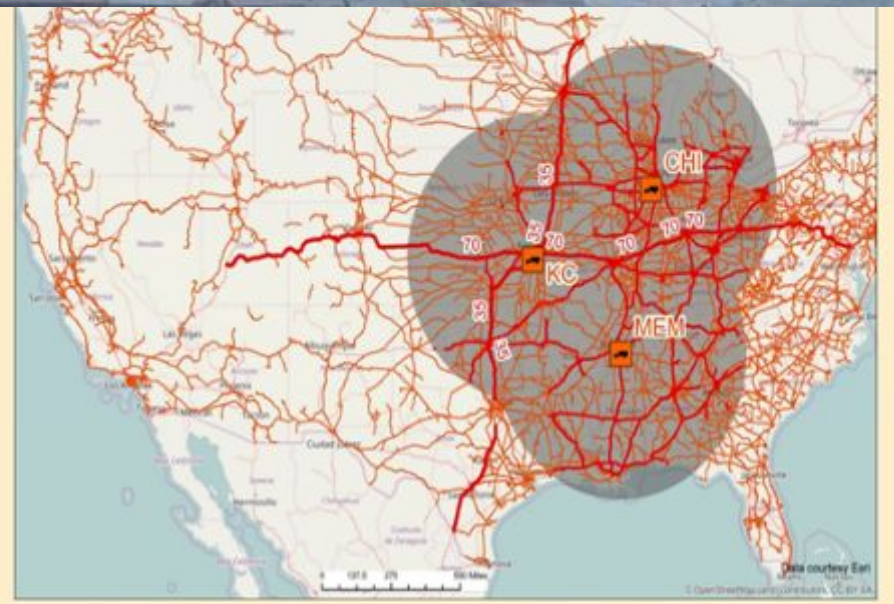

PERCENTAGE OF ELECTRIFIED RAILWAYS WORLDWIDE
Italy
France
Germany
Russia
China
India
Japan
US
64%
52%
48%
46%
41%
30%
18%
1%
0%
10%
20%
30%
40%
50%
60%
70%
US 1%
Japan 18%
India 30%
China 41%
Russia 46%
Germany 48%
France 52%
Italy 64%

Mode shift will expand rail GHG and other emission impacts unless electrified. Workers & trackside communities deserve decarbonization now.

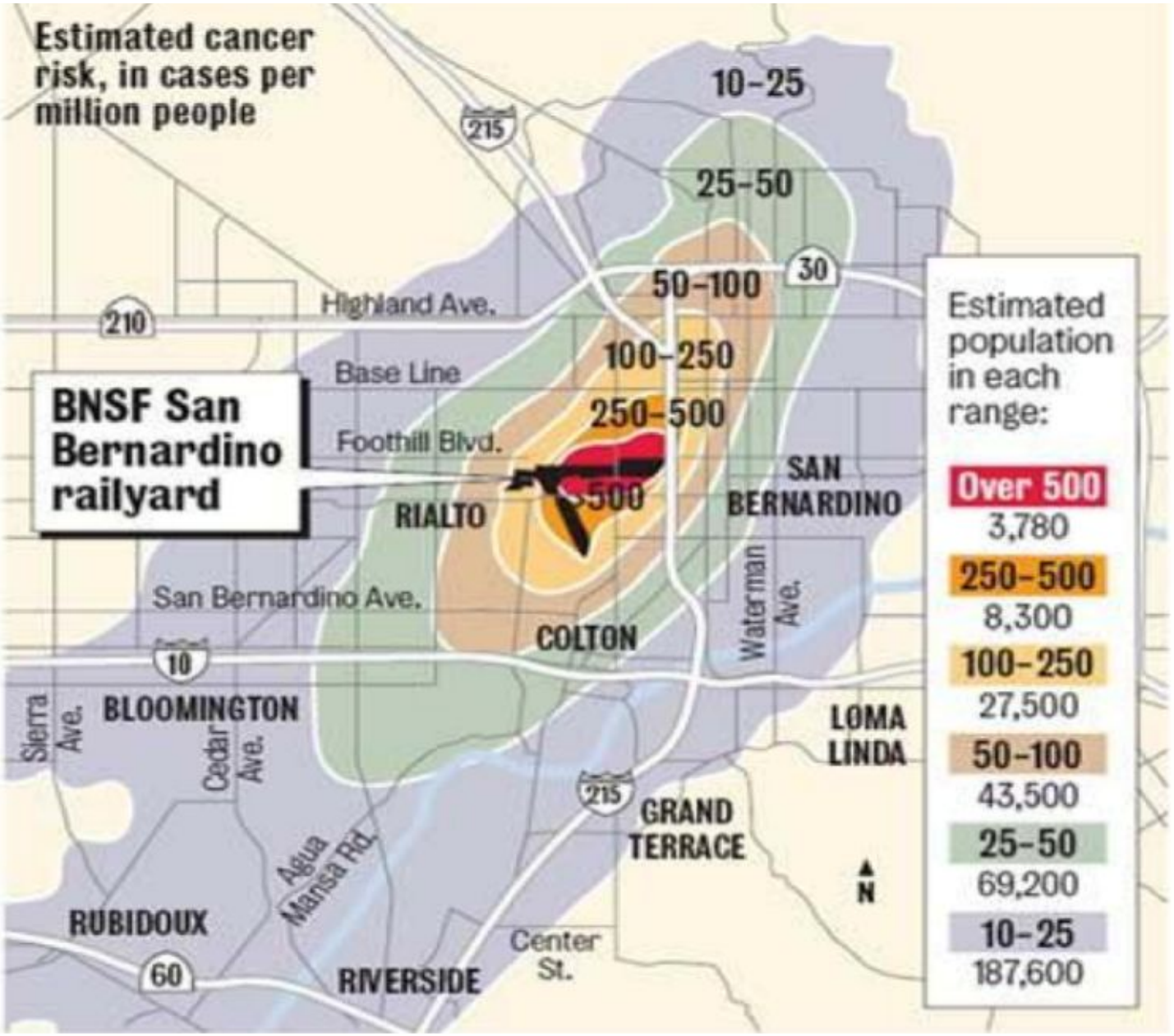


The Moving Forward Network is an environmental justice coalition of primarily community-based organizations working to end the negative impacts from diesel emissions from freight.

See MovingForwardNetwork.com



Map by Martin Koch, University of Kansas



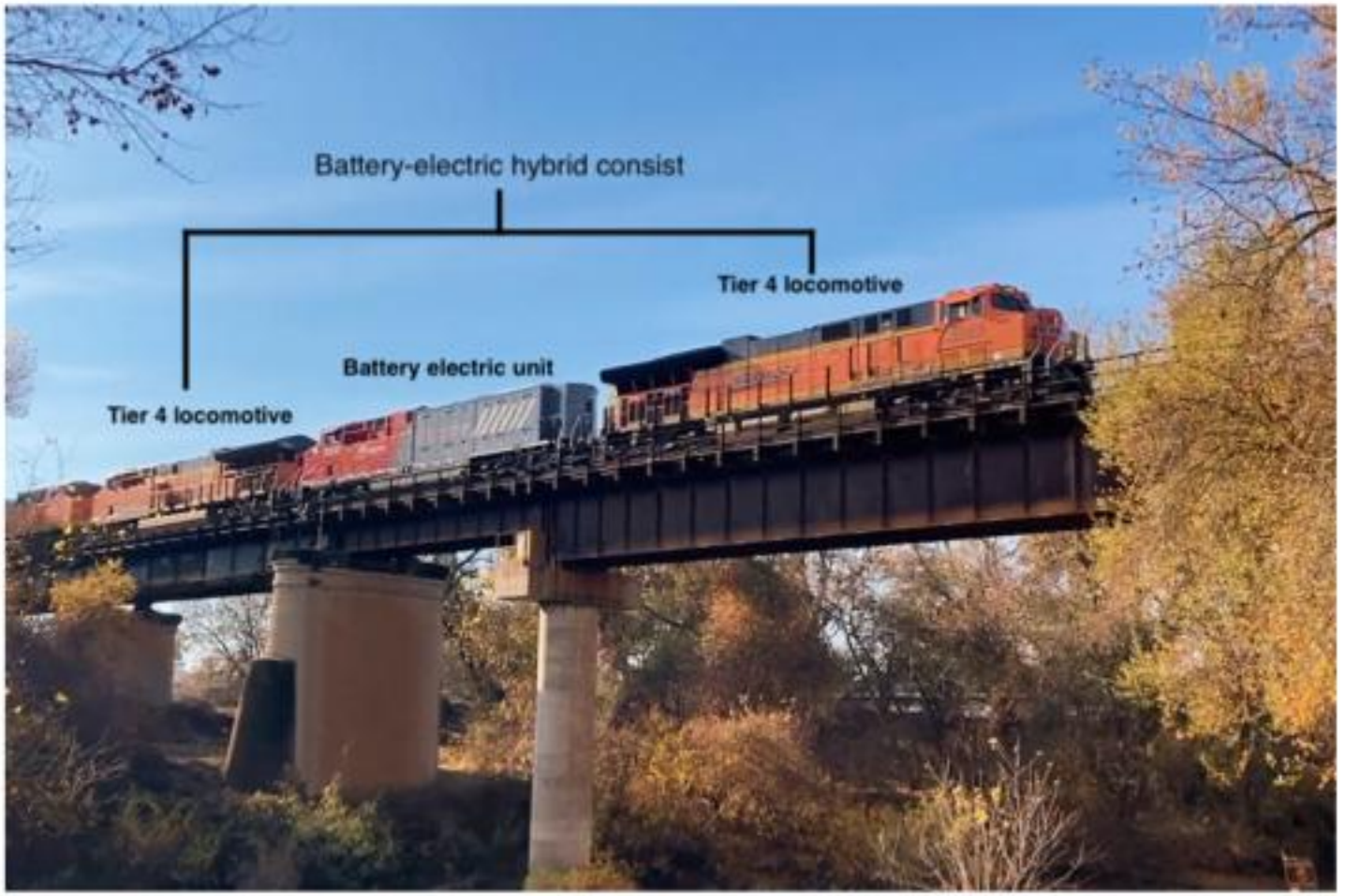
Source: California Air Resource Board – the Press Enterprise

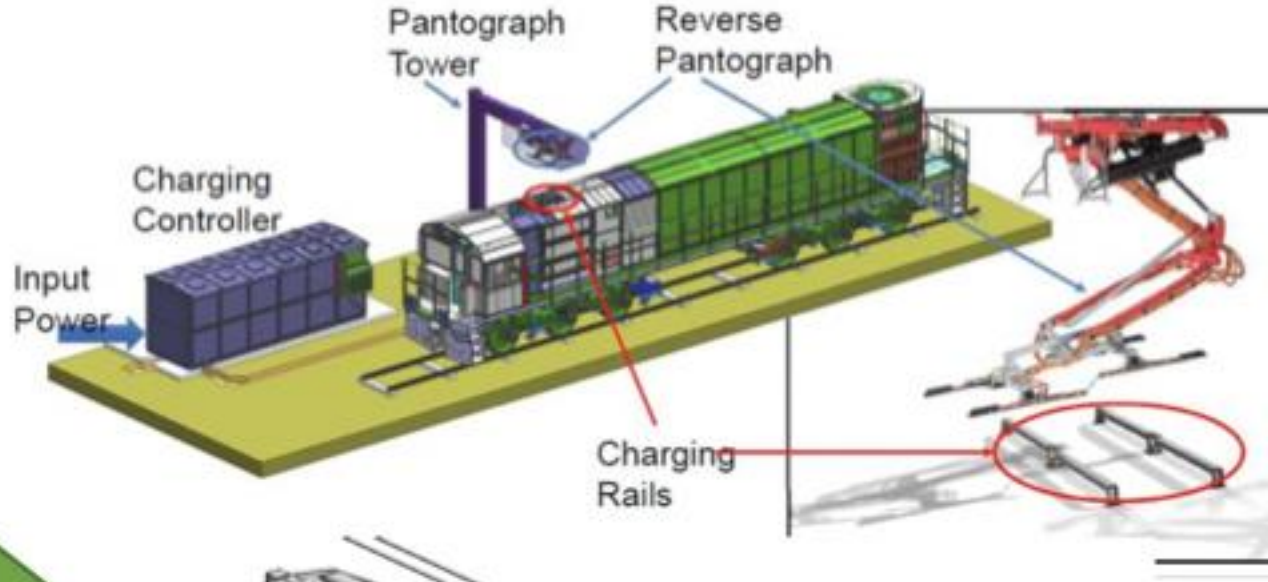
WHERE TO START WITH ELECTRIFICATION?

- Ports & Drayage
- Rail yards
- Mainlines

The Long Beach project will convert nine rubber-tired gantry cranes from diesel power to electric at a cost of about $585,000 each. Above: A container area on a dock at the Port of Long Beach. Photo credit: Shutterstock.com.

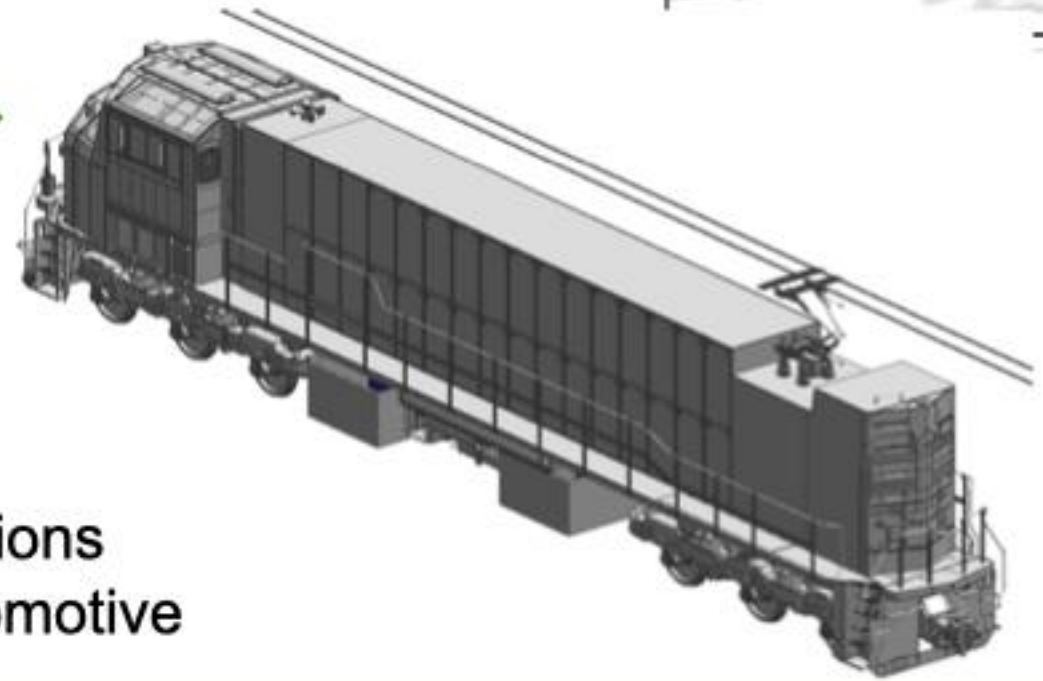

Energy Capacity
2,400 kilowatt hours
Energy Source
Lithium-ion Batteries
Emissions
Reduces the train's emissions by at least 10 percent
Maximum Speed
Approximately 75 MPH
6 Axles
Battery to supply energy to all four powered axles
Weight Maximum
Approximately 430,000 lbs


Battery-electric hybrid consist
Tier 4 locomotive
Battery electric unit
Tier 4 locomotive



DYNAMIC CHARGING

DISCONTINUOUS ELECTRIFICATION



- Charging power supplied by catenary
- Conventional pantograph on each locomotive
- Short segments of catenary installed at key locations
- Transformer and charging electronics on the locomotive

Of 140,000 miles of US track, the DoD designates 38,800 miles as the Strategic Rail Corridor Network (STRACNET). Consider electrifying that first.

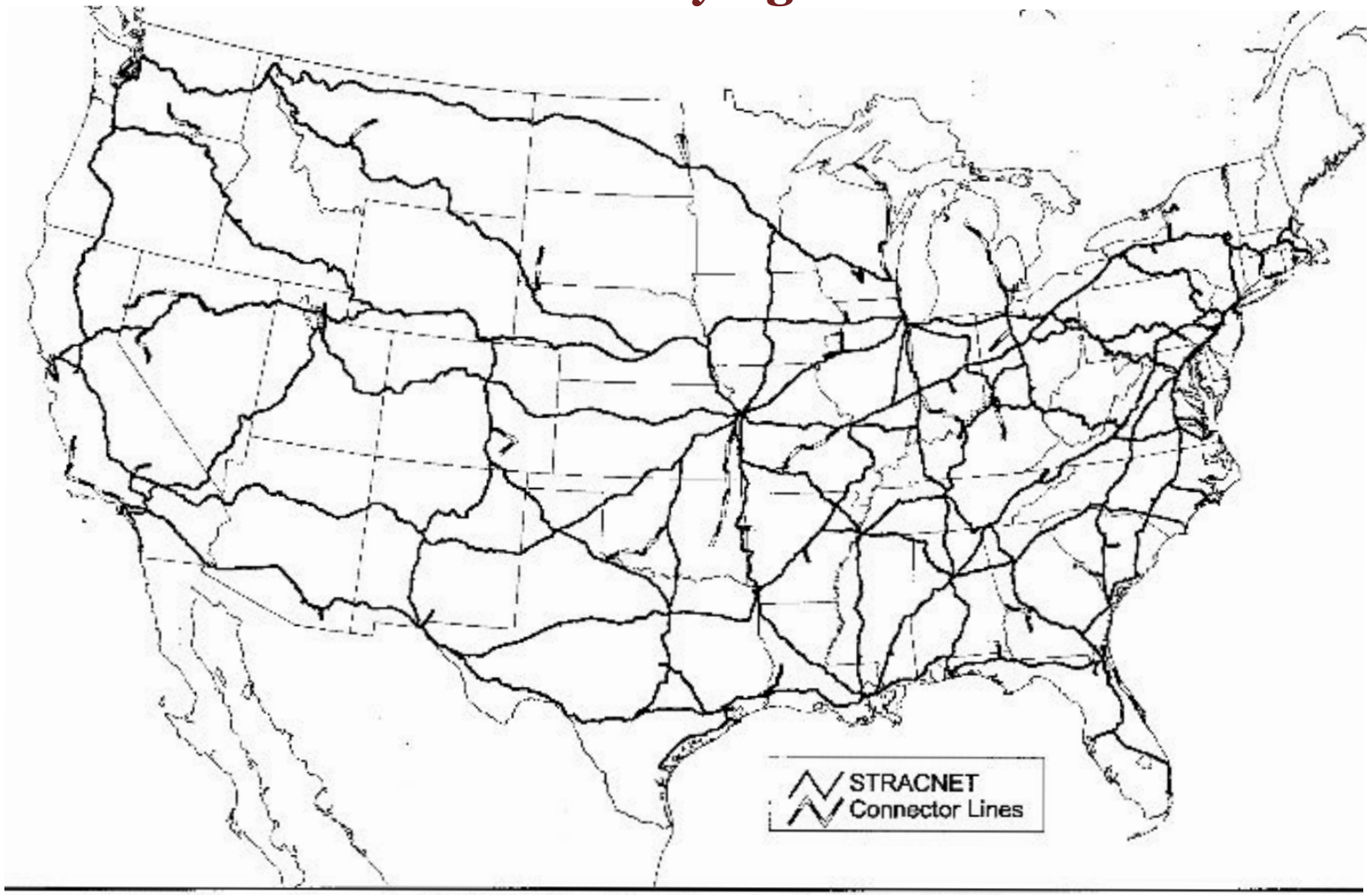
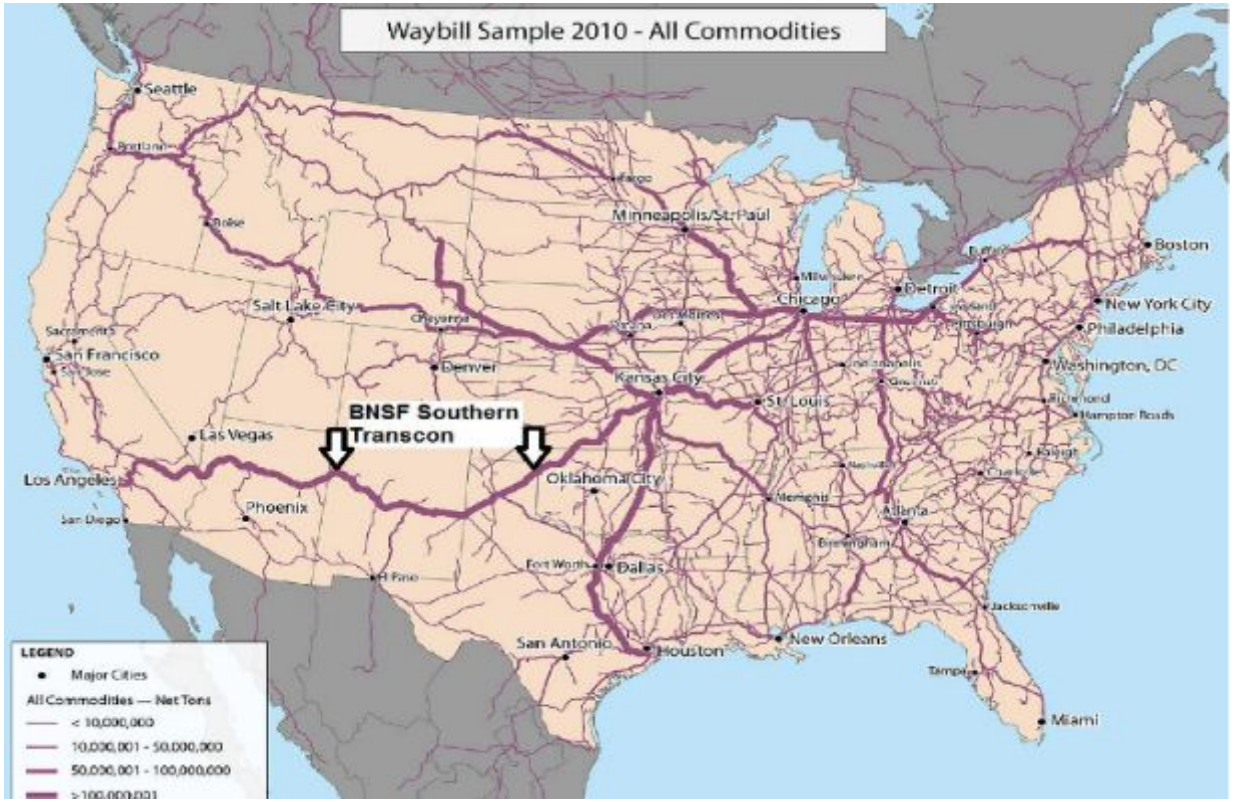
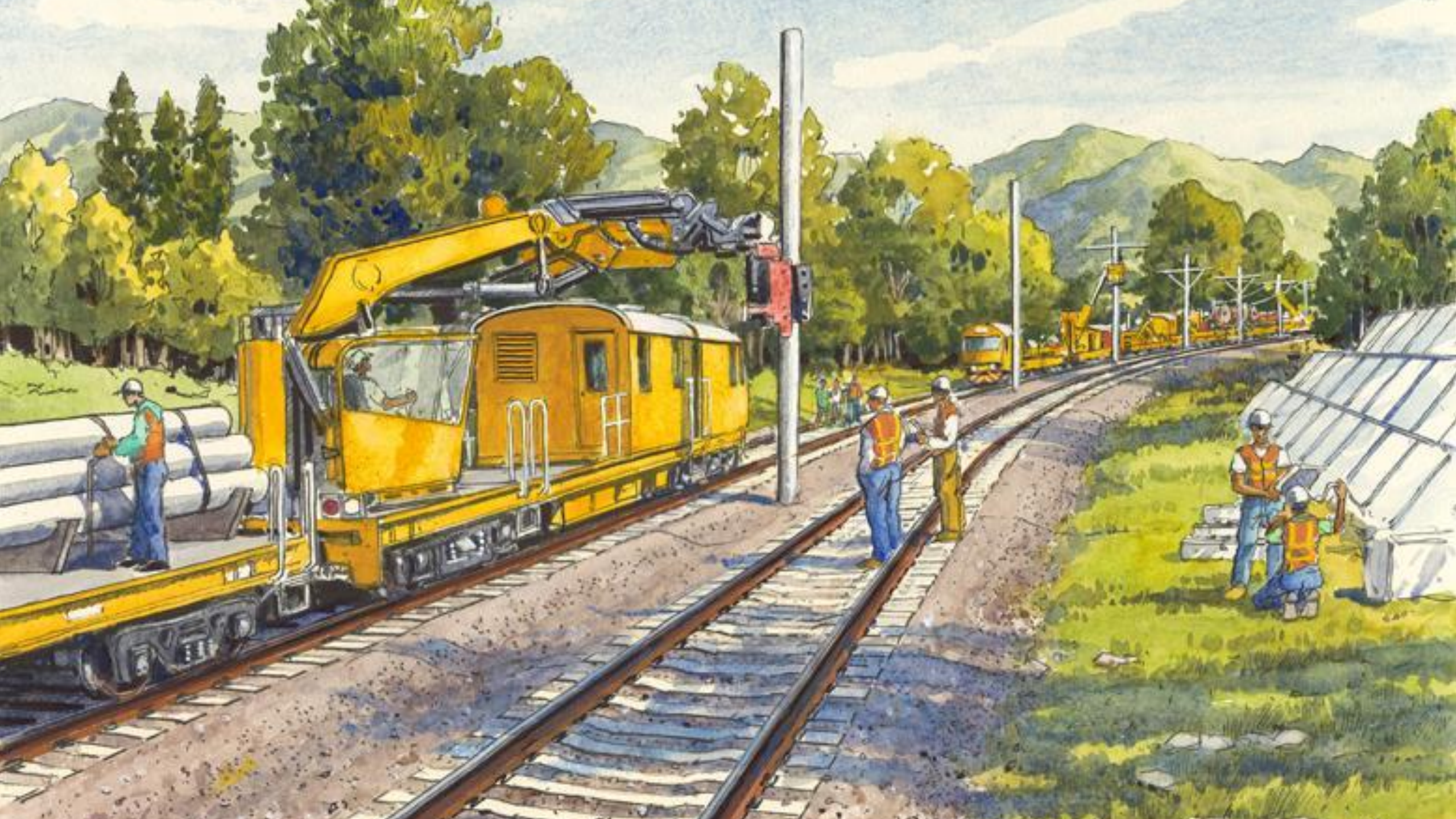


Figure 2. Civil Rail Lines Most Important to National Defense

Or prioritize the most densely utilized interstate freight corridors - the Northern and Southern Transcon

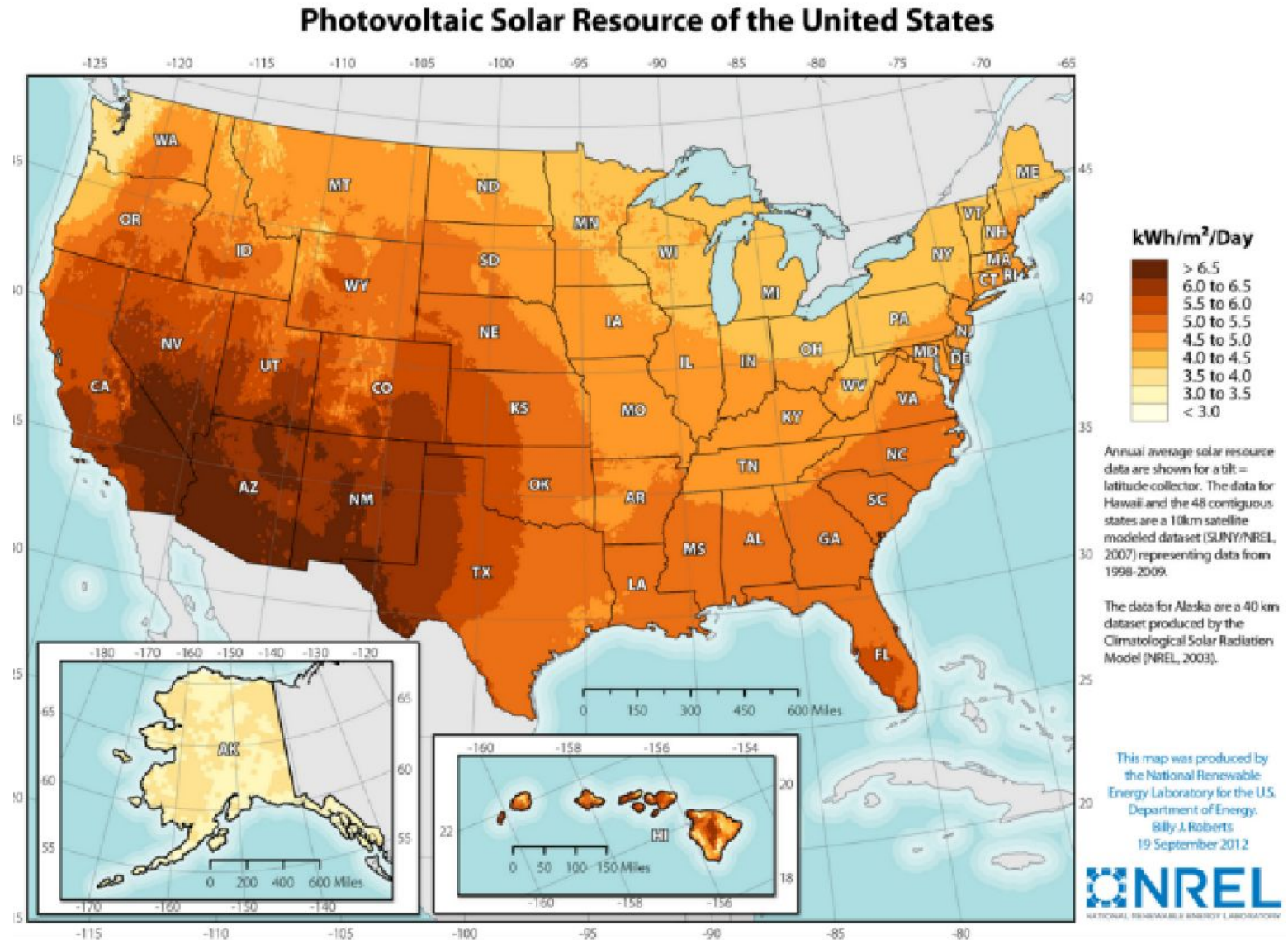




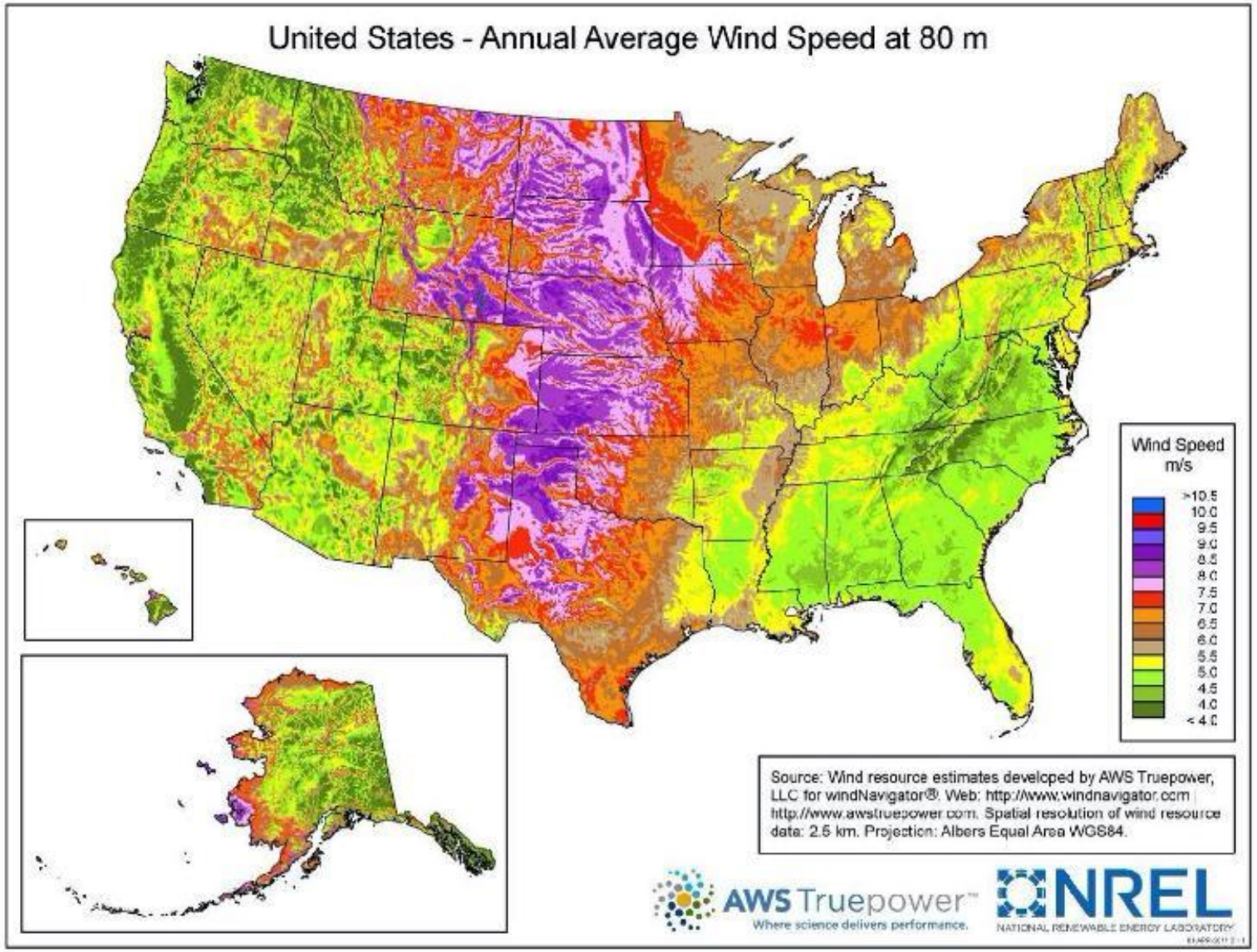
TRANSMISSION

Connecting regions to increase energy supply & stabilize the variability of renewable energy

UNLOCKING STRANDED SOLAR



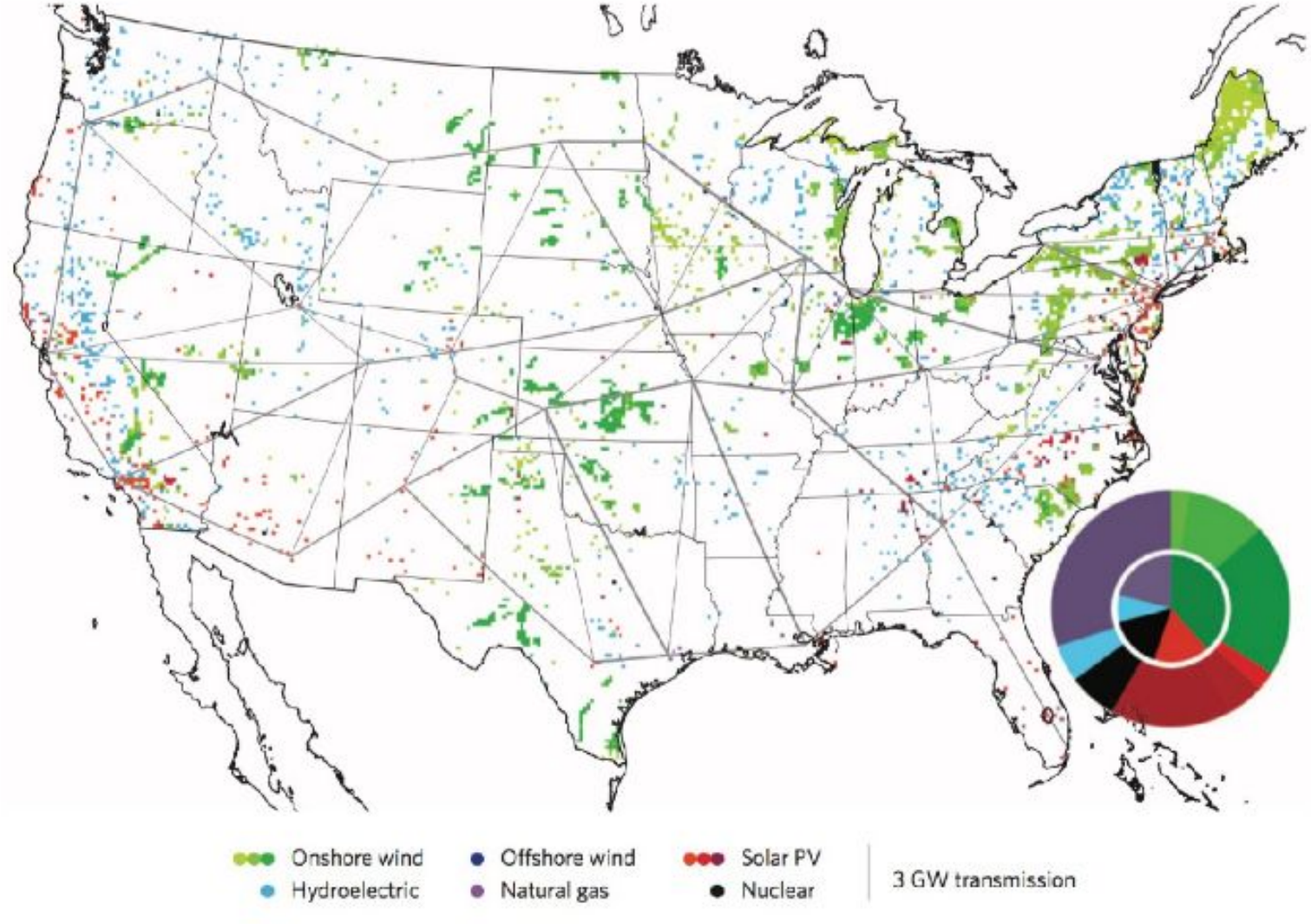
UNLOCKING STRANDED SOLAR



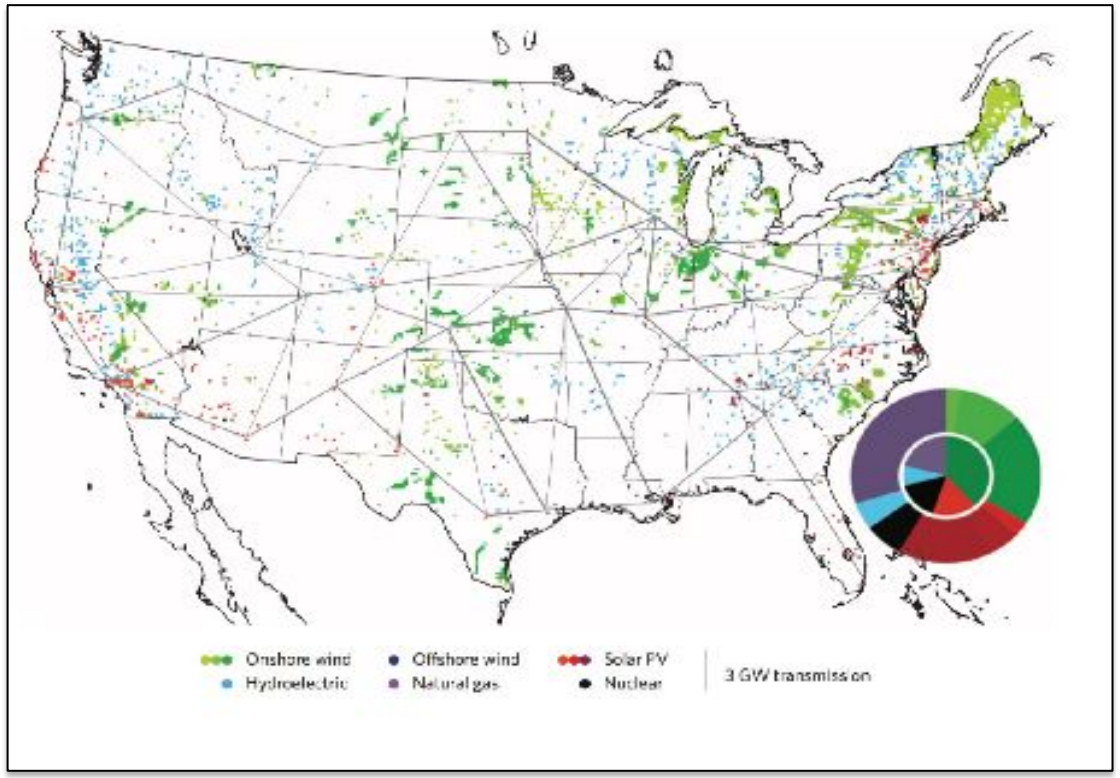
REQUIRES EFFICIENT TRANSMISSION

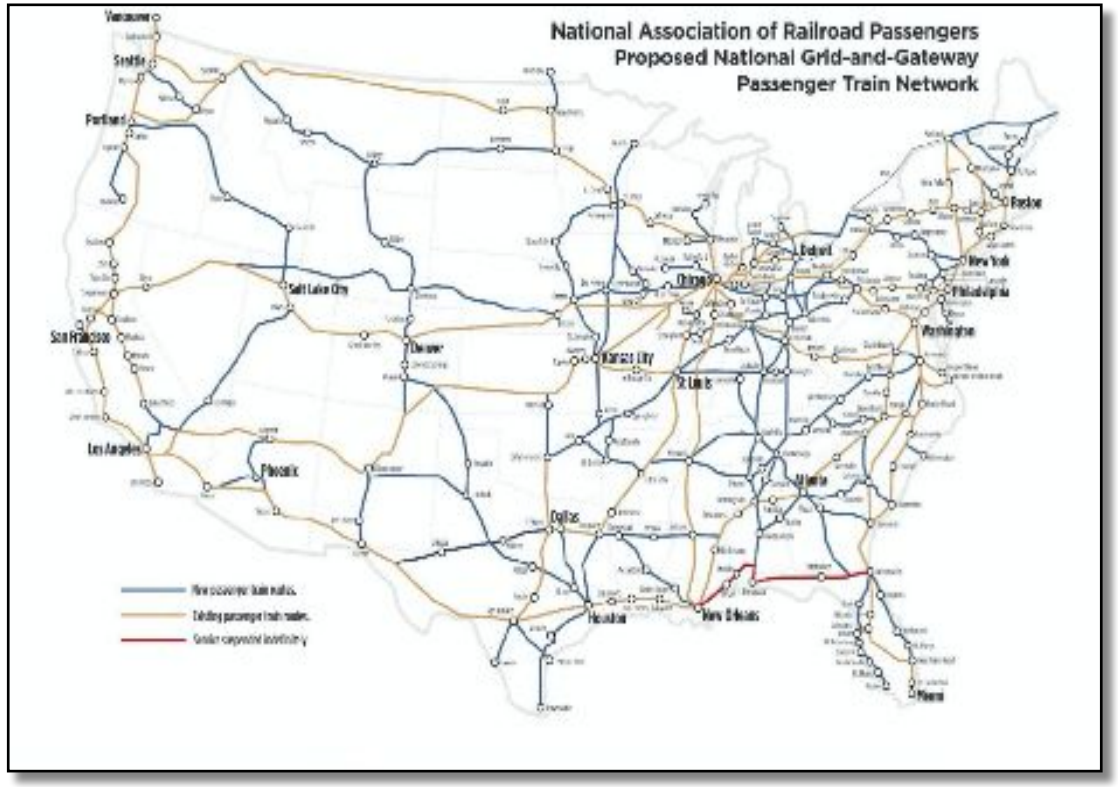
- **Access to transmission** is a prerequisite for the development of renewable energy resources.
- One of the largest obstacles to energy transition is the **lack of a national HVDC transmission infrastructure.**
- A **National SuperGrid** would provide that critical component to a just transition off fossil fuels.
- A **NOAA study** published in 2016 did the modeling for such an HVDC system and a pathway to **80% renewables by 2030**.
- **HVDC (High Voltage Direct Current)** transmission is dramatically more efficient than HVAC (High Voltage Alternating Current)
- Improvements in HVDC transmission technology has made buried HVDC more feasible
- **Voltage Source Converters** (VSCs) to exchange power between the HVDC lines and the regional high-voltage alternating current (HVAC) systems already in place are becoming more efficient, compact and cost competitive
- **The largest obstacle to building a National HVDC SuperGrid is finding the Rights-of-Way**

NOAA modeling for such an HVDC system and a pathway to 80% renewables by 2030



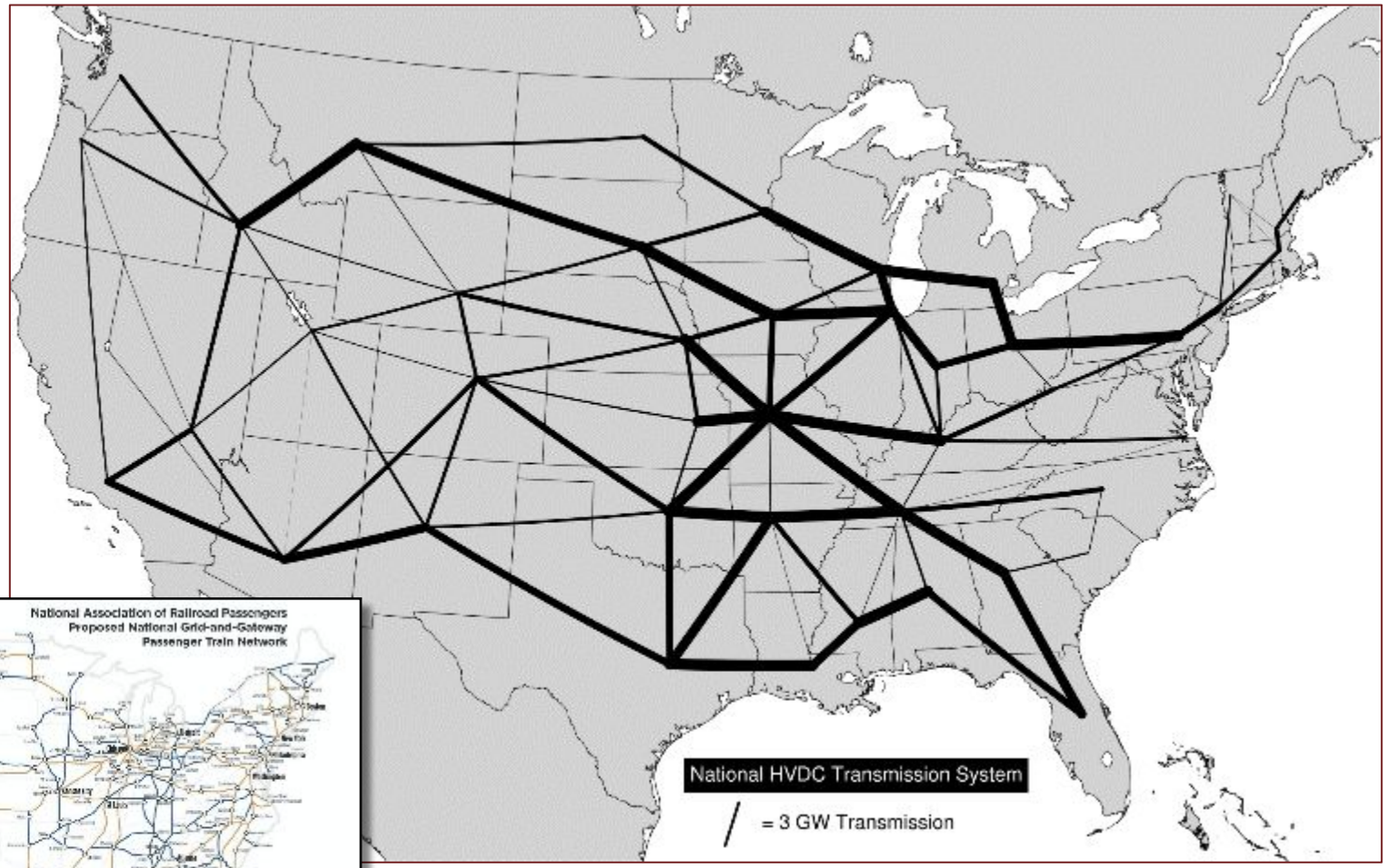
Compare density of transmission grid from **NOAA model** to a mainline rail map

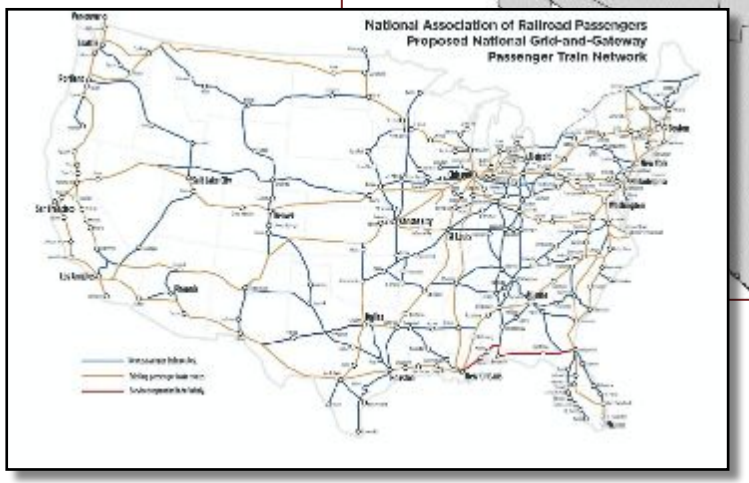




Interstate (Class 1) railroads have the perfect rights-of-way for a **National SuperGrid**

RECENT 2-STATE ALTERNATIVE TRANSMISSION MODEL



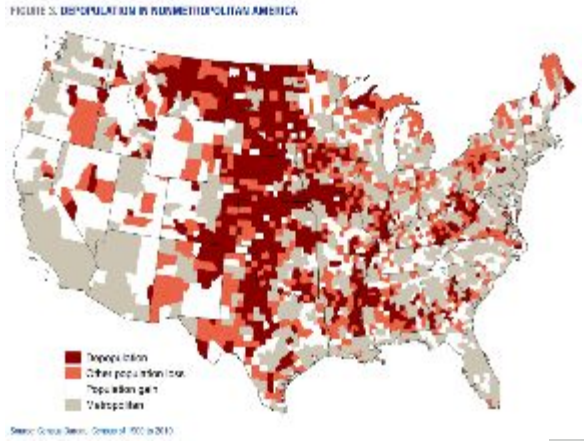


The US could put interstate rail rights-of-way to use for a National SuperGrid

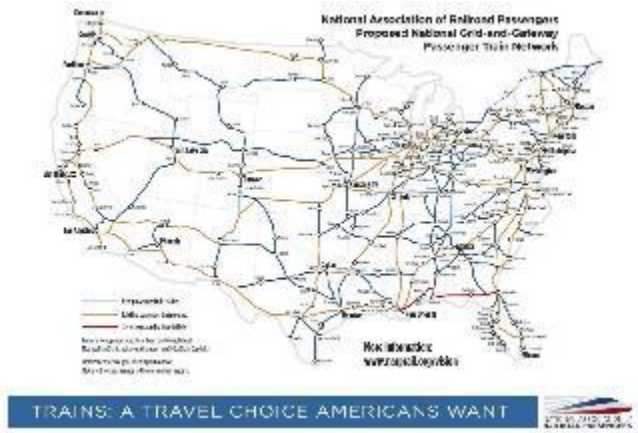
SOO Green private buried HVDV project

Other considerations for rural economic vitality, passenger service, and opportunities for energy export to urban centers…

Chronic rural depopulation

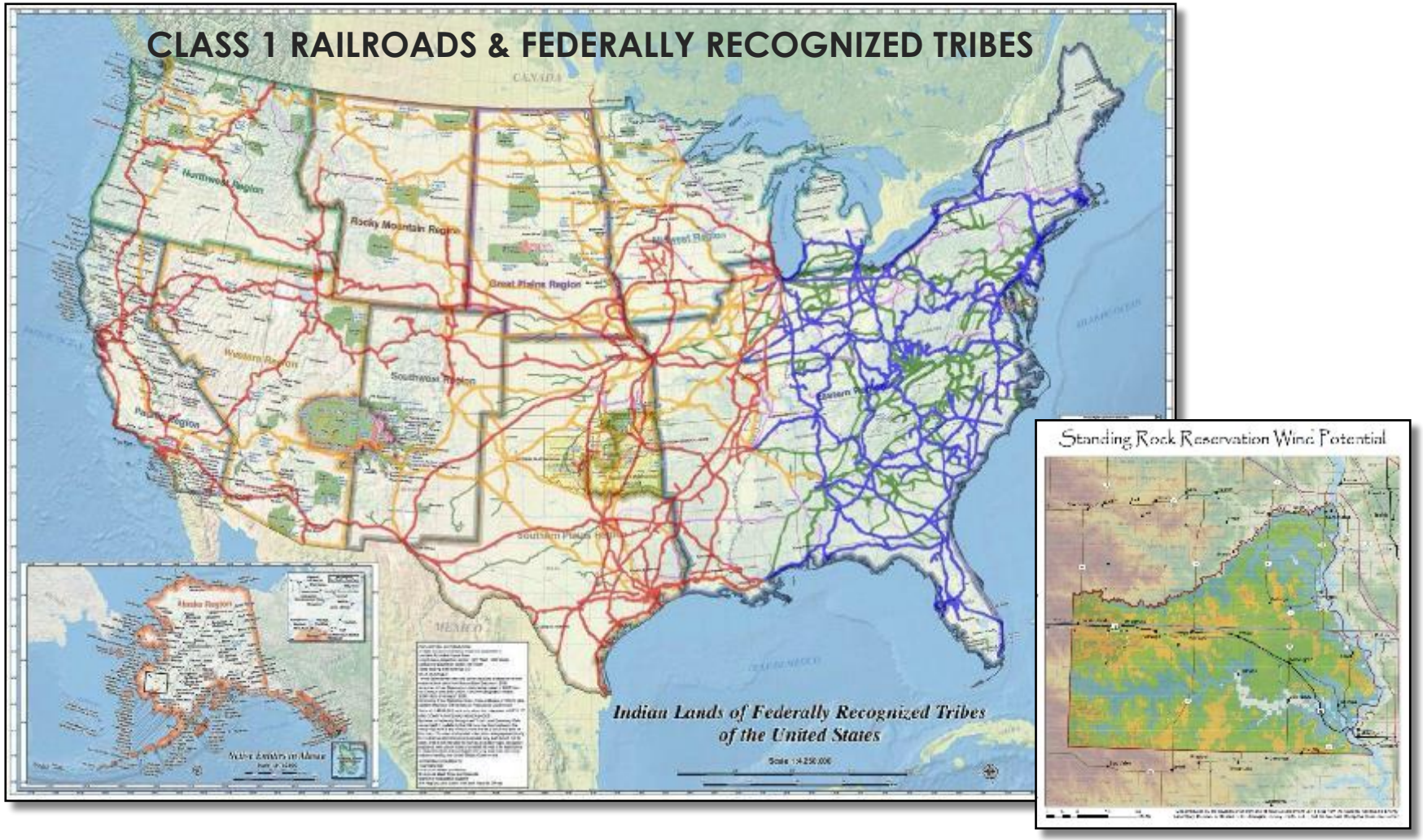


Expanded Passenger Service



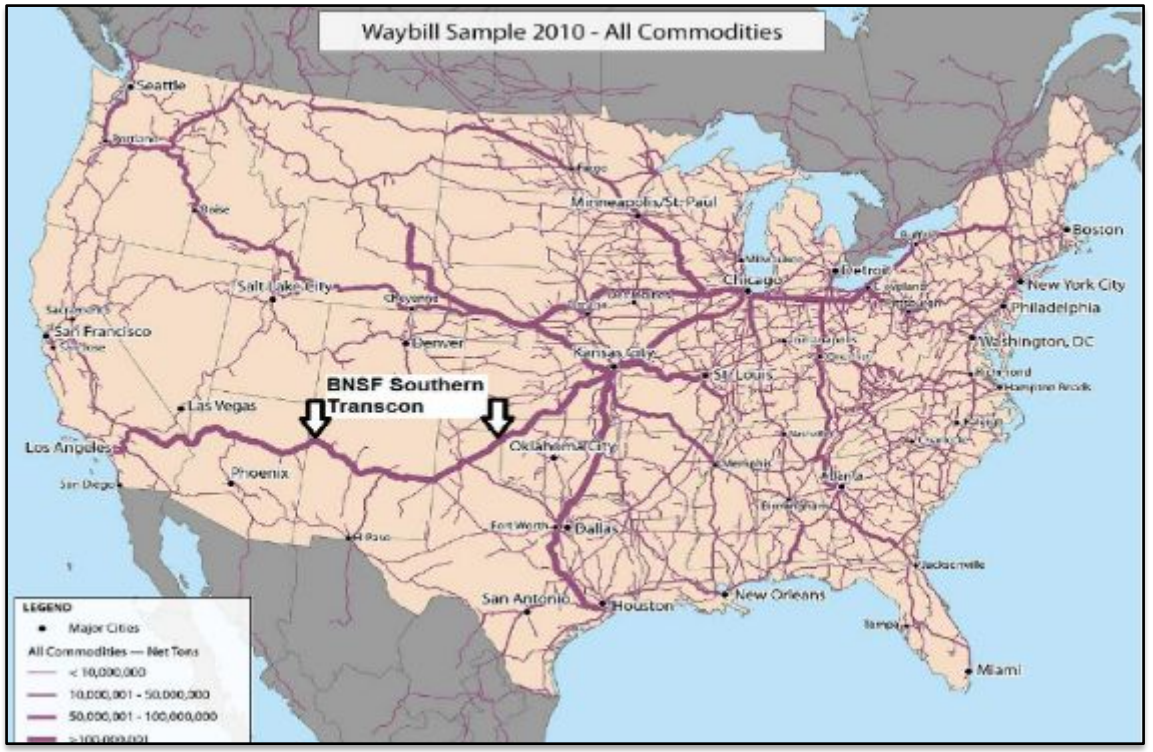
Rural Electric Co-ops

Opportunities for Tribal leadership & ownership, energy sovereignty & export and Right-of-Way Justice



Opportunities to address the national security threat of climate change by hardening transmission and building resilient domestic supply chains.

Figure 2. Civil Rail Lines Most Important to National Defense



Seems like a Win-Win-Win!

RIGHT?

So, we initially imagined PPPs through Steel Interstate Development Authorities (SIDA)

SIDA = Not-for-profit corporation chartered with the authority to raise funds for infrastructure investment on both publicly and privately owned rights-of-way that would:

- Issue tax-exempt bonds to sell at low-interest rates
- Oversee funding, construction, and management of electrification infrastructure
- Self-finance through user fees paid by railroads
- Negotiate with right-of-way owners of site infrastructure
- Make direct investments in track improvements
- Seek financing in the form of TIFIA loans

Who could say "No" to that?

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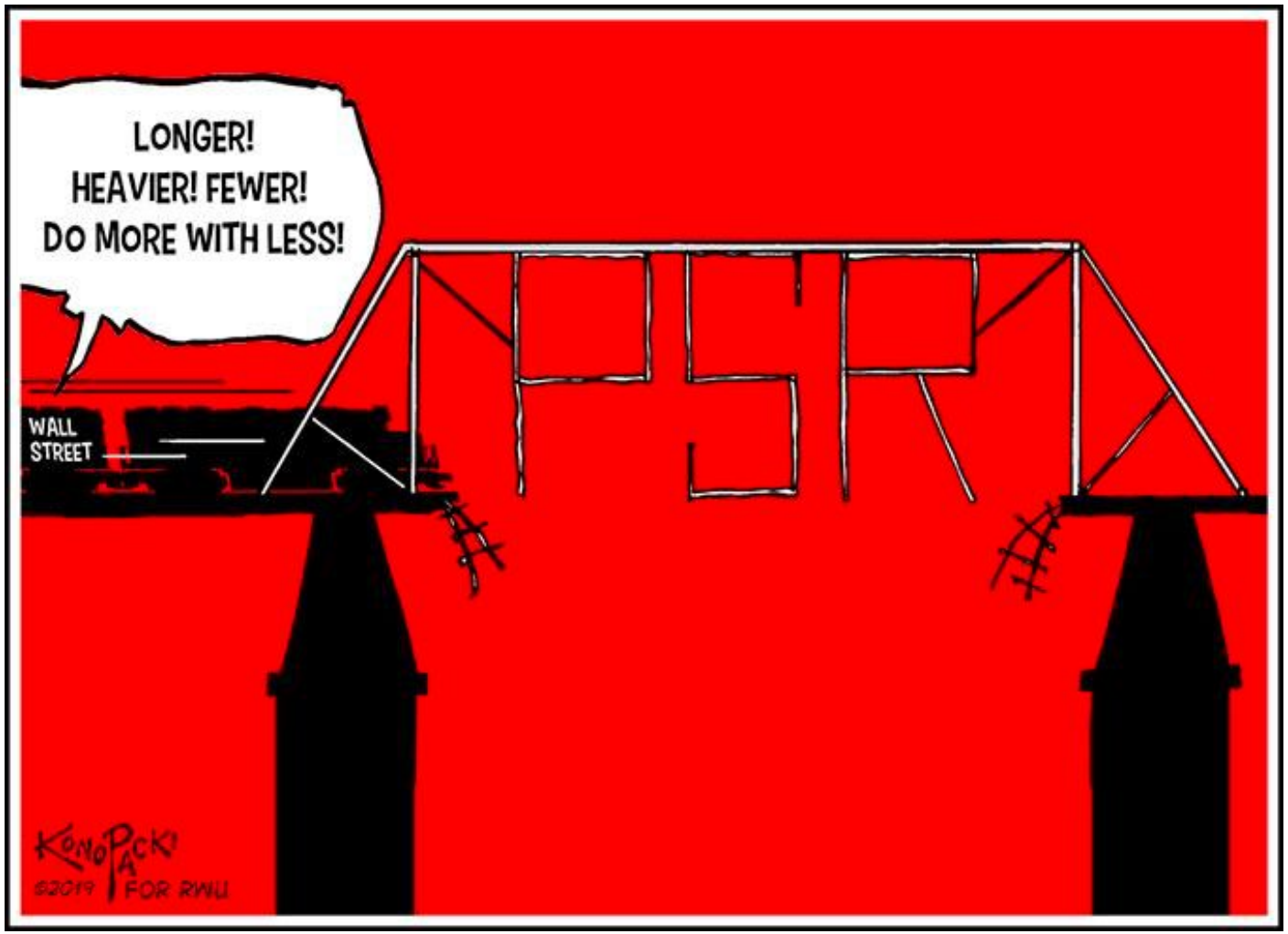
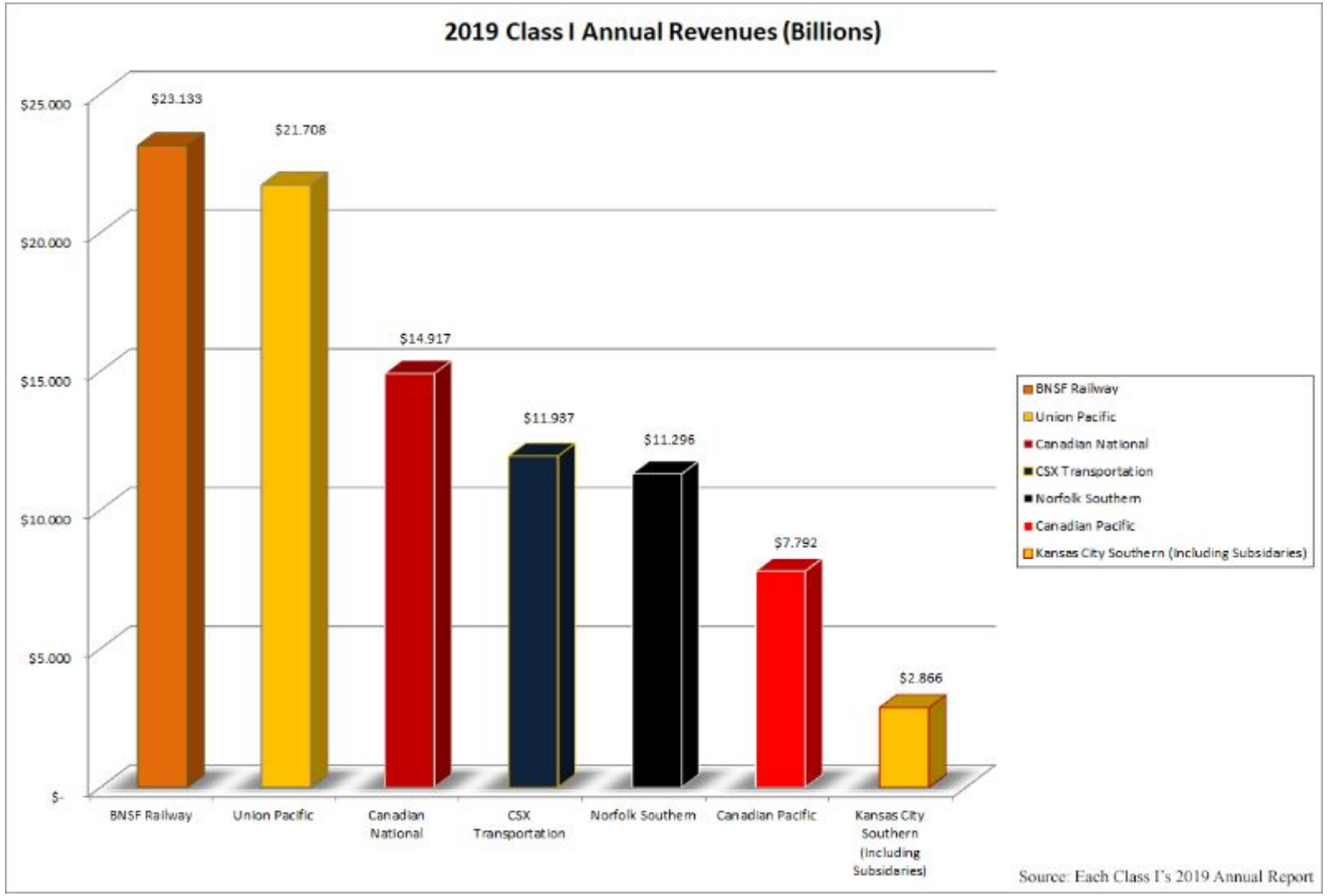
ANSWER = CLASS 1 RAILROADS

Class 1 interstate railroads are too busy lowering operating ratios for short term profits to invest in long term vitality.



It is paying off - for shareholders, but NOT for shippers, short line railroads, nor the public. Whose interests are served by the long term vitality of the interstate railroad infrastructure



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- **“*Electrification is a non-starter*.”**
  Only possible through PPPs with “strings attached.”

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- **Batteries + Catenary = Seriously Good Idea for hastening rail electrification**

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*That would amount to an actual **NET DECREASE** in capacity when coal business goes away.*

ALL THIS IS THE CLASS 1 VERSION
OF THE CLASSIC *JEDI MIND TRICK*

"We're not the droids you are looking for."

BUT THE CLASS 1 (INTERSTATE)

RAILROADS ARE PRECISELY

"the droids we are looking for."

THE PUBLIC INTEREST IS TRULY SERVED WHEN:

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Interstate rail quality of service attracts and has the capacity to carry <u>100% of truck</u> freight now moving <u>over 500 miles</u>,

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railroads share the right-of-way with a National SuperGrid for the efficient transmission of renewable energy.

SO, GIVEN CLASS 1 RAILROADS' RESISTANCE TO INVESTMENTS IN MODE SHIFT, ELECTRIFICATION, OR SHARED USE OF RIGHTS OF WAY…

What pathways are possible
to put interstate railroad monopolies
in service of these
urgent public interests?

POSSIBLE PATHWAYS:

- Re-regulate the interstate railroads and update common carrier obligations
- Break up the railroad monopolies, separating infrastructure from operations to create an Open Access system like Europe and the UK
- Federal govt. purchase of key corridors for rapid freight and passenger service, and national SuperGrid
- Apply National Defense Production Act or eminent domain to battle the national security threat of climate change
- or something else…

STEP #1"Interstate Railroads = Common Carriers"

- Update policy directives for Surface Transportation Board (STB) related to and clarifying:

- Common Carrier Obligations of railroads*
- Clarify and Enforce obligations to provide access to service
- Guarantee that access does not discriminate against shorter hauls or smaller volume shipments
- Expand scope of rate complaint process to include access to service
- Revoke Commodity Exemptions
- Explore separating infrastructure from operations to create an Open Access model as in Europe and the UK

*Details on Recommended CCOs at SolutionaryRail.org/cco

SolutionaryRail.org/mediarelease101521

FALL 2021 Letter to STB Chairman Martin Oberman:

Establish Open Access National Interstate Railroad

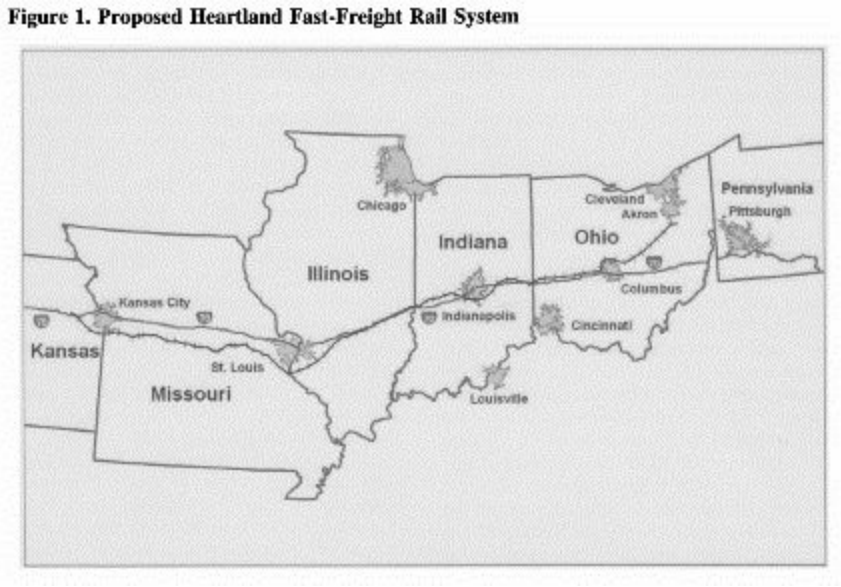
- Federal Government purchases trackage and rights-of-way from one or more Class 1 interstate railroads
- Use antitrust powers to break up the Class 1 railroads, “Separating Wheels from Steel,” i.e. Trains operating companies remain carriers, but the infrastructure becomes publicly owned and managed to increase capacity & electrify
- Or _____? (It is time to think outside the box.)

POSSIBLE WAYS TO BEGIN:

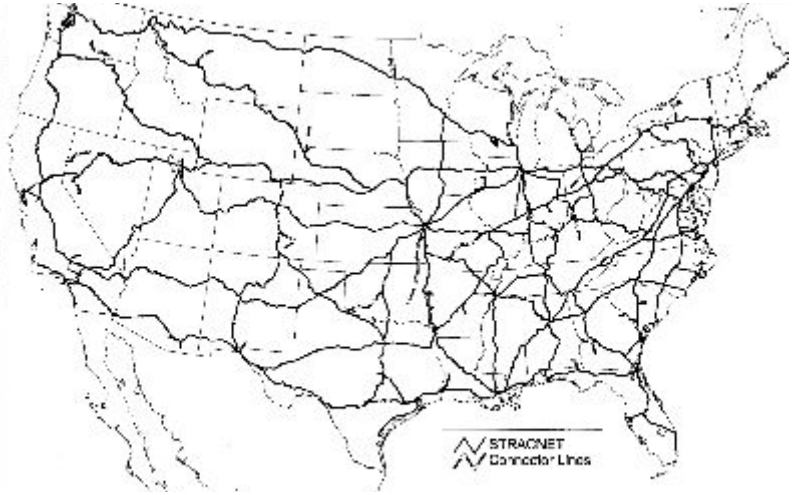
Our original idea for SIDA on Northern Transcon

Expand original to Northern & Southern bargain with Buffett & BNSF

Heartland Fast-Freight concept:

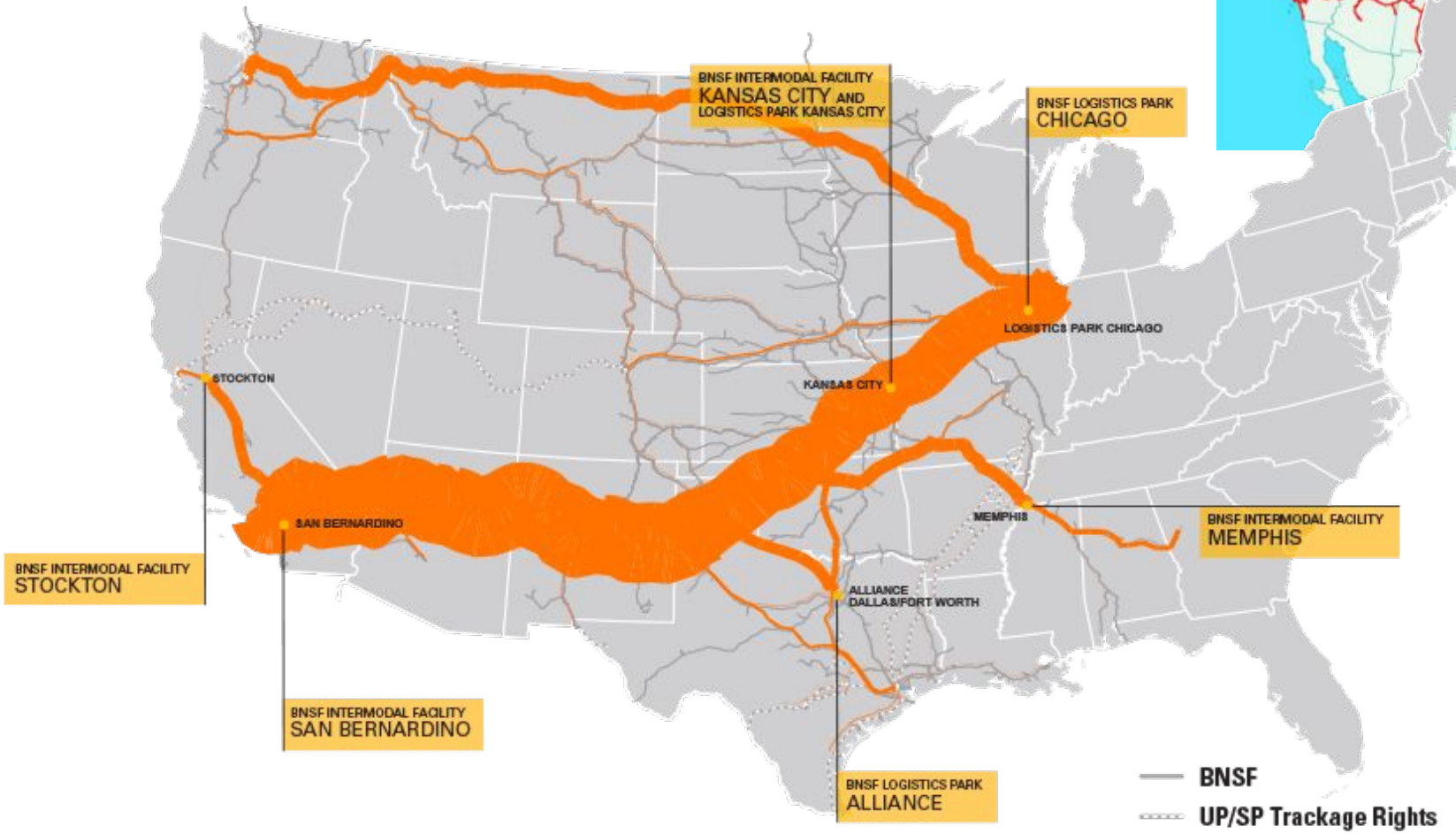


Invoking Climate as National Security Threat
Negotiate deal w/Class 1 RRs for STRACNET

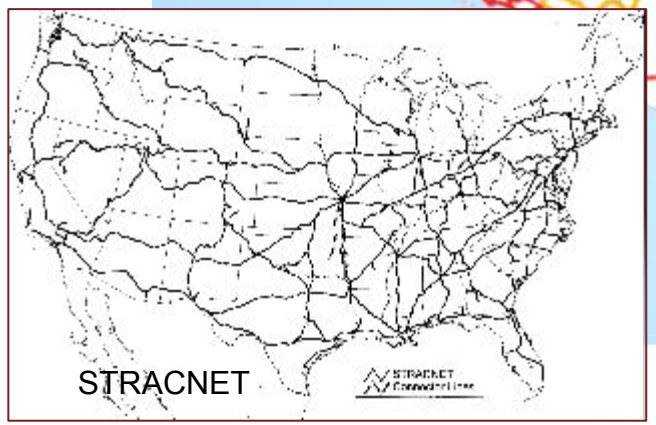


BNSF's Northern & Southern Transcon offer unique synergies for freight capacity & National SuperGrid:

BNSF total value = approx. $200 billion



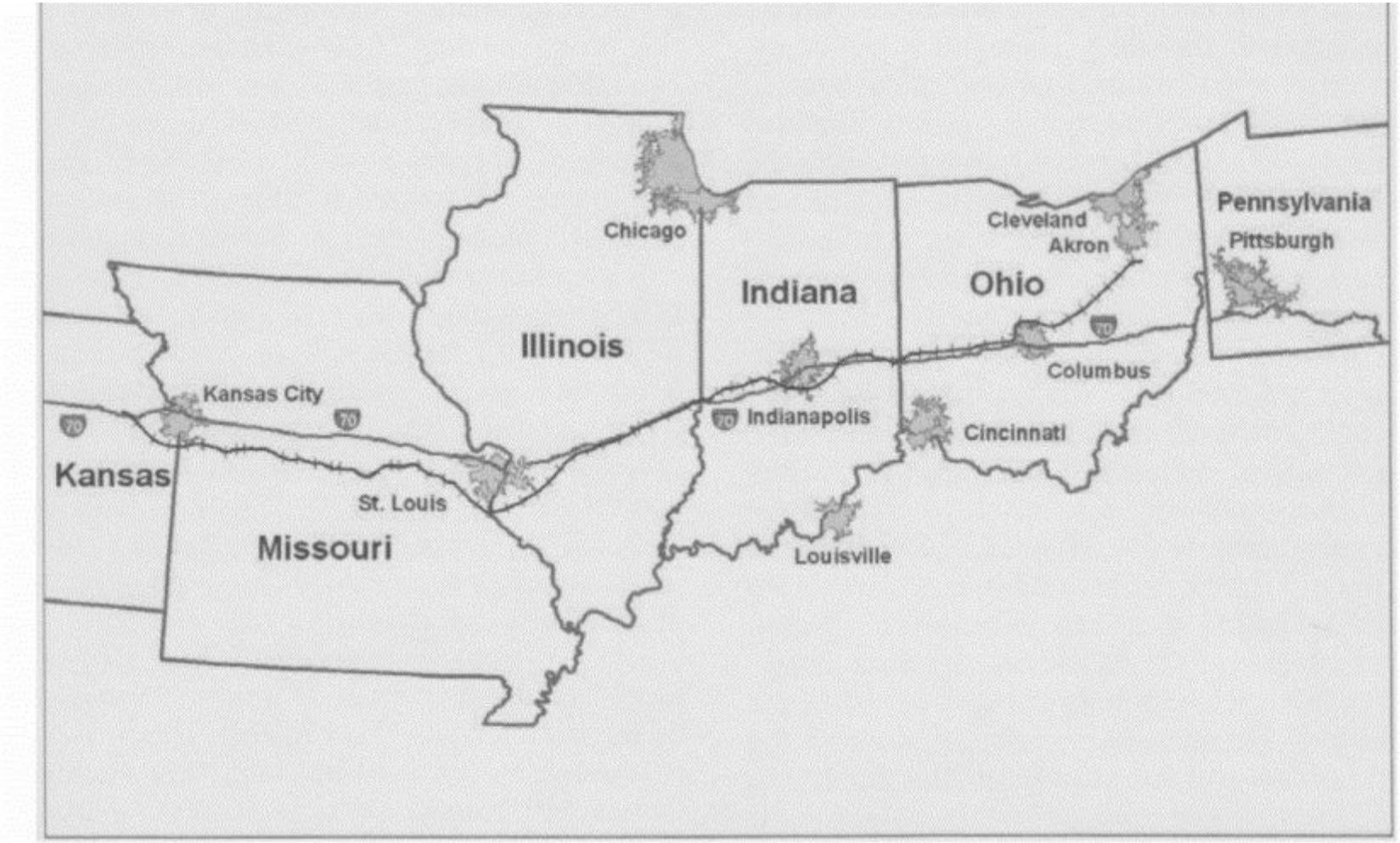
THE FOUR LARGEST US-BASED CLASS 1 RRS' TOTAL VALUE = $450 BILLION (+/-)



STRACNET < 42% of Class 1 RR route miles
Total US route miles (all classes) is approx. 140.5k

HEARTLAND FAST-FREIGHT RAIL SYSTEM PROPOSAL BY KEITH BUCKLEW

2007 ESTIMATED COST $6-10 BILLION



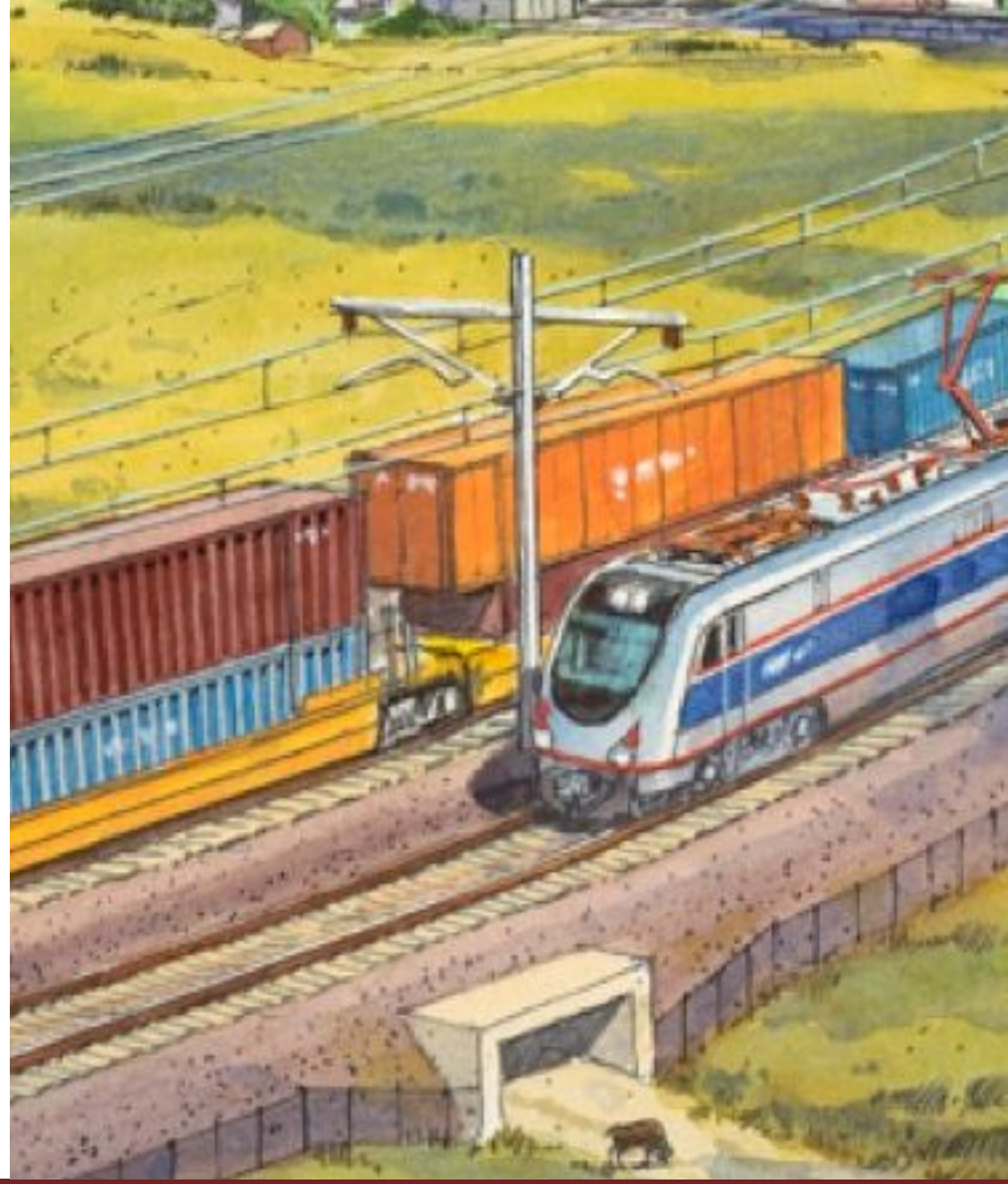
See: **http://SolutionaryRail.org/heartland** to access the 2007 paper by Keith Bucklew

BUILDING AN UNCONVENTIONAL ALLIANCE

Manifesting the Solutionary Rail vision is not going to be easy. It will require leadership at every level of the federal government, interagency collaboration, and broad outreach to and the involvement of every sector of US society.

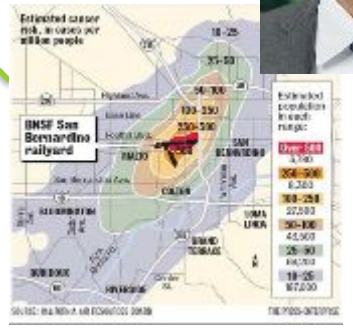
Never before has the confluence of crises made this transformative vision more urgent, nor the opportunity to manifest it more possible.

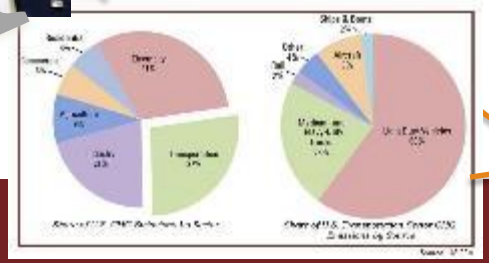
Solutionary Rail is a resource to the Biden-Harris Administration, the Cabinet, and Congress. One way to utilize us would be to have us help design an **Interagency Solutionary Rail Summit**



SOLUTIONARY RAIL INTERAGENCY SUMMIT

Solving Problems Together



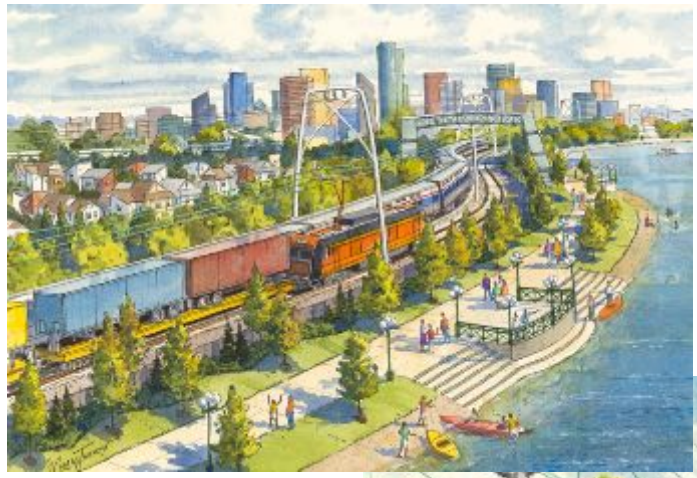


Interdisciplinary Problems Demand Interdisciplinary Solutions

Solutionary Rail has invested years developing the foundation for a broad stakeholder alliance.

We continue to learn from community and technical experts so that we can stand in alignment with multiple interests, aspirations and concerns in order that everyone is “at the table” and no one is “on the menu.”

Our work has made us cognizant of the opportunities as well as the obstacles and potential pathways forward.
Utilize Solutionary Rail



Check out dozens of interviews at:
SolutionaryRail.org/interviews
PPT oriented toward sector interests here
SolutionaryRail.org/srppt

SOLUTIONARY PERSPECTIVES [video podcast series]

Interviews with stakeholders and allies to build mutual understanding and solidarity

SOLUTIONARY RAIL'S OTHER RECENT NEWS:

- NEMA - established Rail Electrification Council
- SR participation in Transportation Research Board Rail Freight Committee AR040
- SR participation in multiple coalitions
- La Crosse, WI city council resolution passed, triggering BNSF/AAR response
- 2021 increased momentum and expanded awareness amongst NGO allies, key elected & appointed officials in state and federal government
- We are building a **True Cost of Freight** online calculator

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