



Advanced Energy Innovation in the Freight Rail Industry

MIKE SWANEY | DIRECTOR OF ADVANCED ENERGY INNOVATION | BNSF RAILWAY

MAY 29, 2024

About BNSF Railway

Berkshire Hathaway company

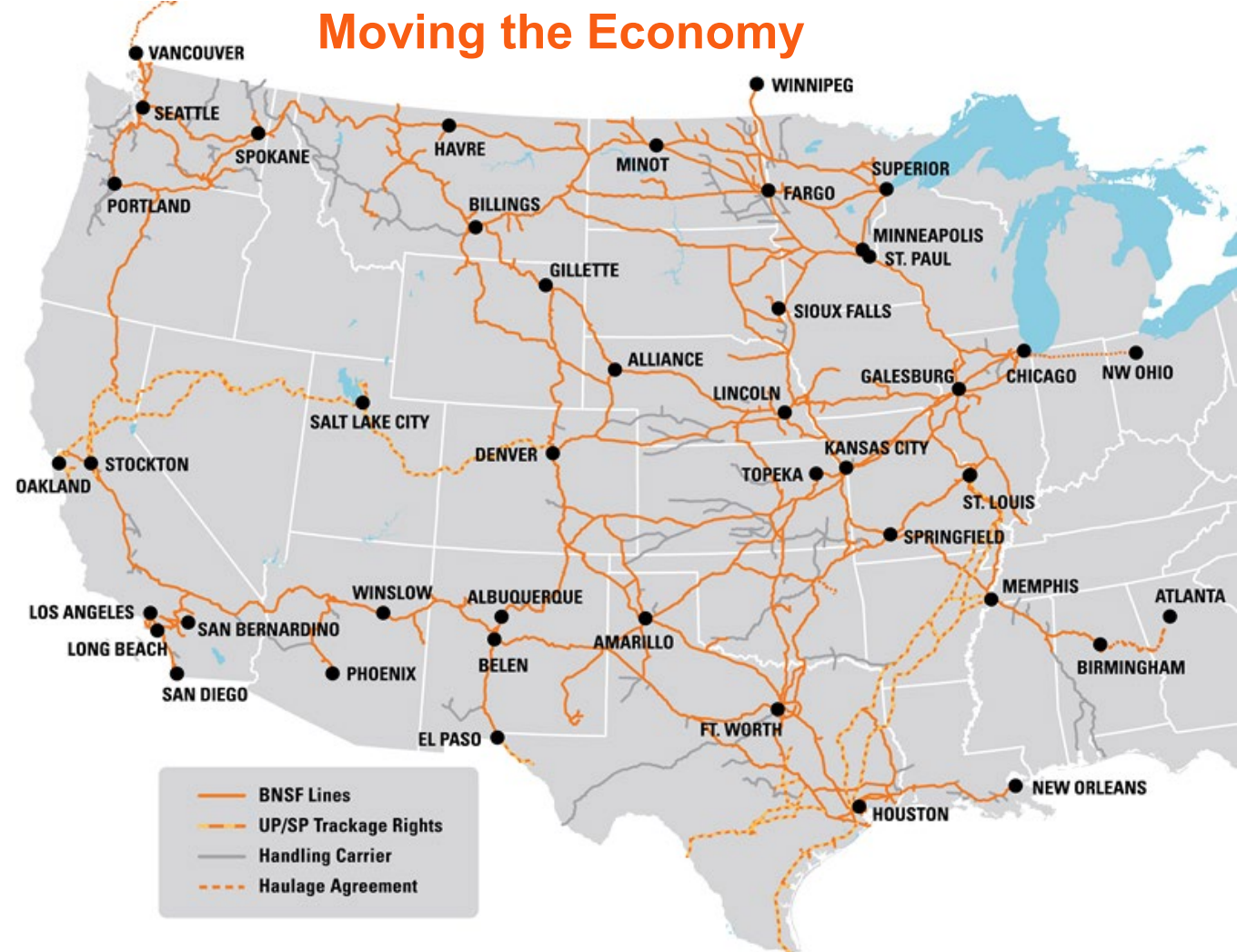
- ~37,000 employees
- ~ 7,500 locomotives
- Operates an average of 1,200 trains/day

We Move the Economy:

- 1.2M carloads of agricultural commodities
- 5.04M intermodal shipments
- 2.5M new cars and trucks
- 3.1M carloads of industrial products

Our Network:

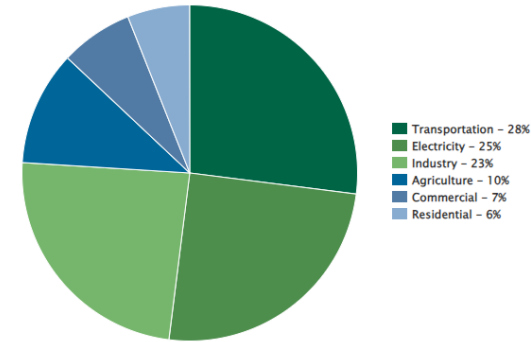
- 32,500 route miles in 28 states and 3 Canadian provinces
- Serves 40+ ports
- 27 intermodal facilities





Context

*Understanding panelists' perspectives on the barriers and opportunities in **decarbonization of the national freight system**, specifying **unique challenges and opportunities for their sector** of expertise, and identifying **how the federal government could support and partner** to overcome these barriers and take advantage of the opportunities they see.*



Decarbonization of the national freight system

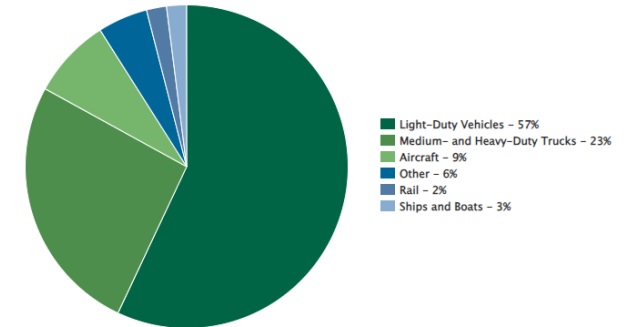
Transportation accounts for 28% of US GHGs¹

Rail equates to less than 2% of Transportation GHG emissions (i.e. *less than 0.6% of US GHGs*)¹

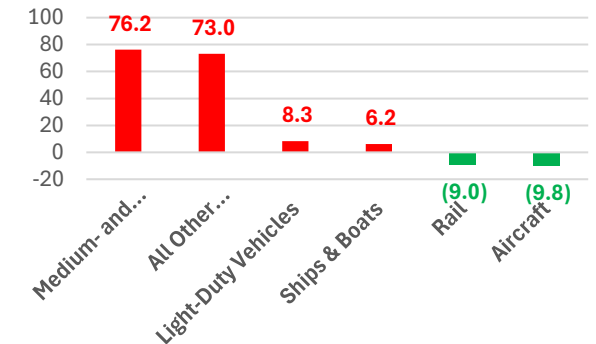
Freight rail is the most fuel-efficient way to move freight over land, moving one ton of freight nearly 500 miles on a gallon of fuel

All Class I's have committed to emissions reduction goals

2022 U.S. Transportation Sector GHG Emissions by Source



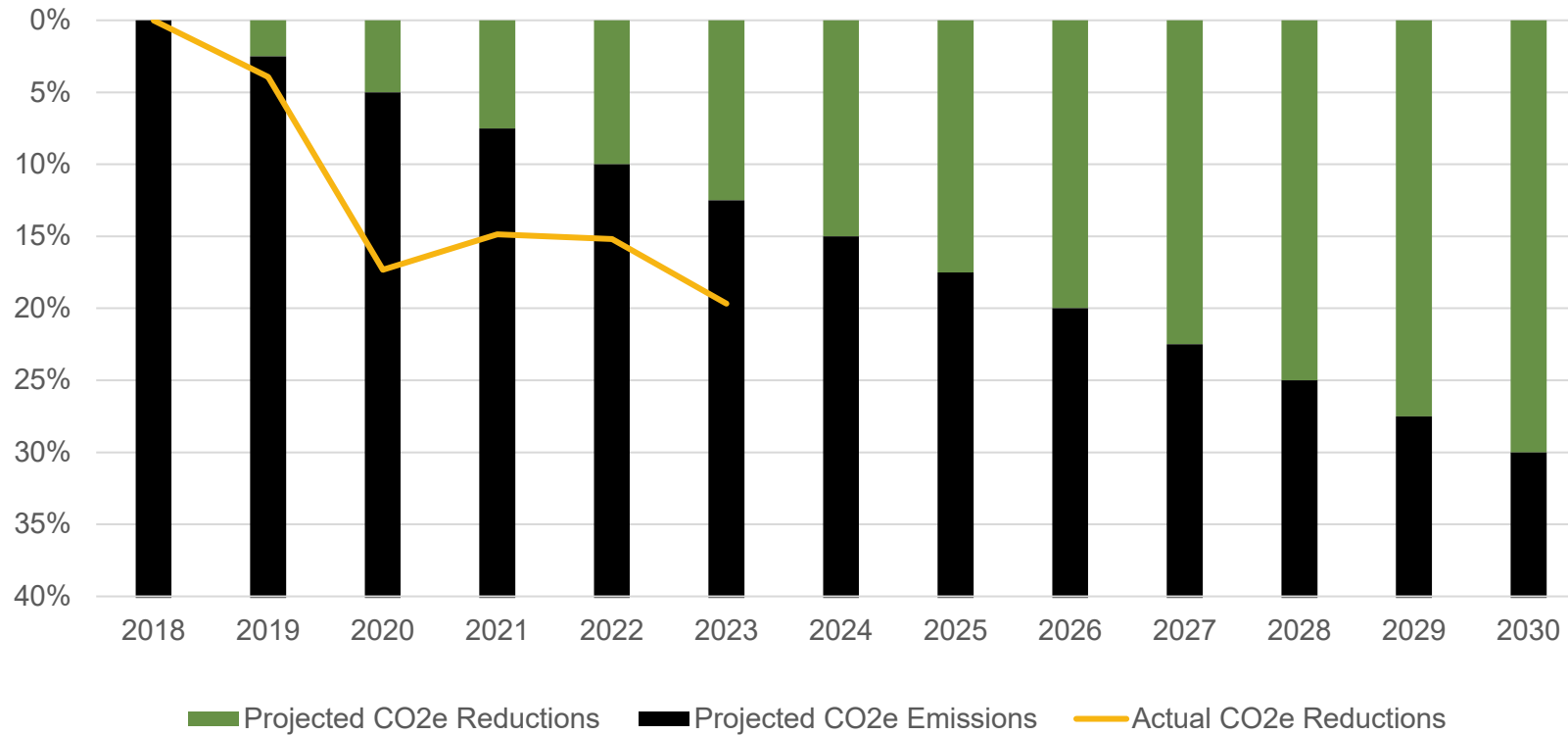
Emissions Change 1990 - 2022 (%)



1. US E.P.A. "Fast Facts - U.S. Transportation Sector Greenhouse Gas Emissions: 1990 - 2022." <https://www.epa.gov/system/files/documents/2024-05/420f24022.pdf>

BNSF Railway “30x30” Emissions Reduction Goal

BNSF Emissions Reduction by Year



Unique challenges...for their sector

- 6 Class I Railroads
- Nearly 140,000-mile network
- Private capital to maintain, upgrade and expand
- 23k+ locomotives and over 1.6M freight cars¹
- ~200MWh of on-board energy per locomotive
- Geographic, environmental, and operational diversity
- Multiple federal regulators
- Fully interoperable

1. Bureau of Transportation Statistics. "Class I Rail Freight Fuel Consumption and Travel."
<https://www.bts.gov/content/class-i-rail-freight-fuel-consumption-and-travel>

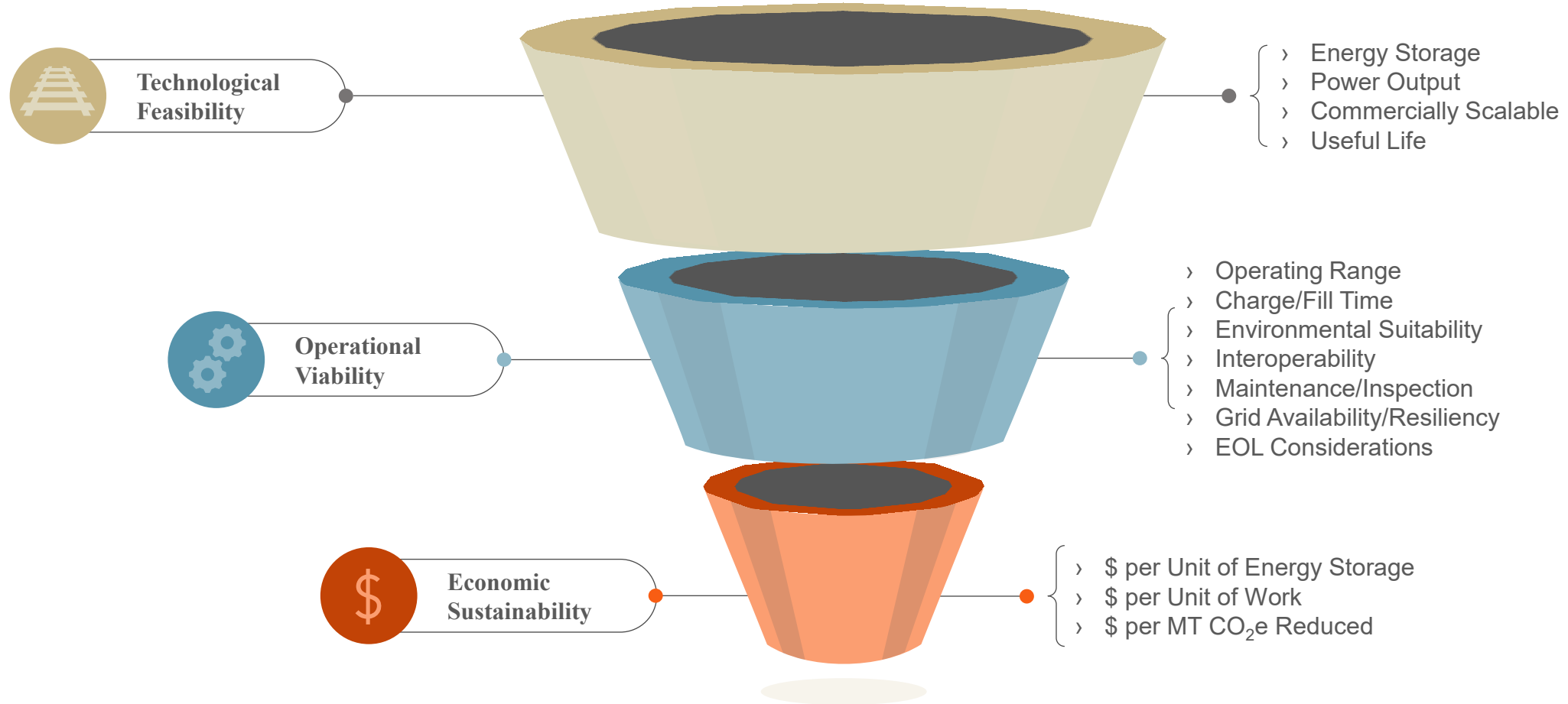


Unique...opportunities for their sector

- Accounts for 40% of long-distance ton-miles
- Cleanest form of land transportation
- Connector between multiple modes of transportation
- Modal shift drives immediate emissions reductions
- Technological innovation drives safety and efficiency
- Collaboration through innovation



Federal Government Support and Partnership



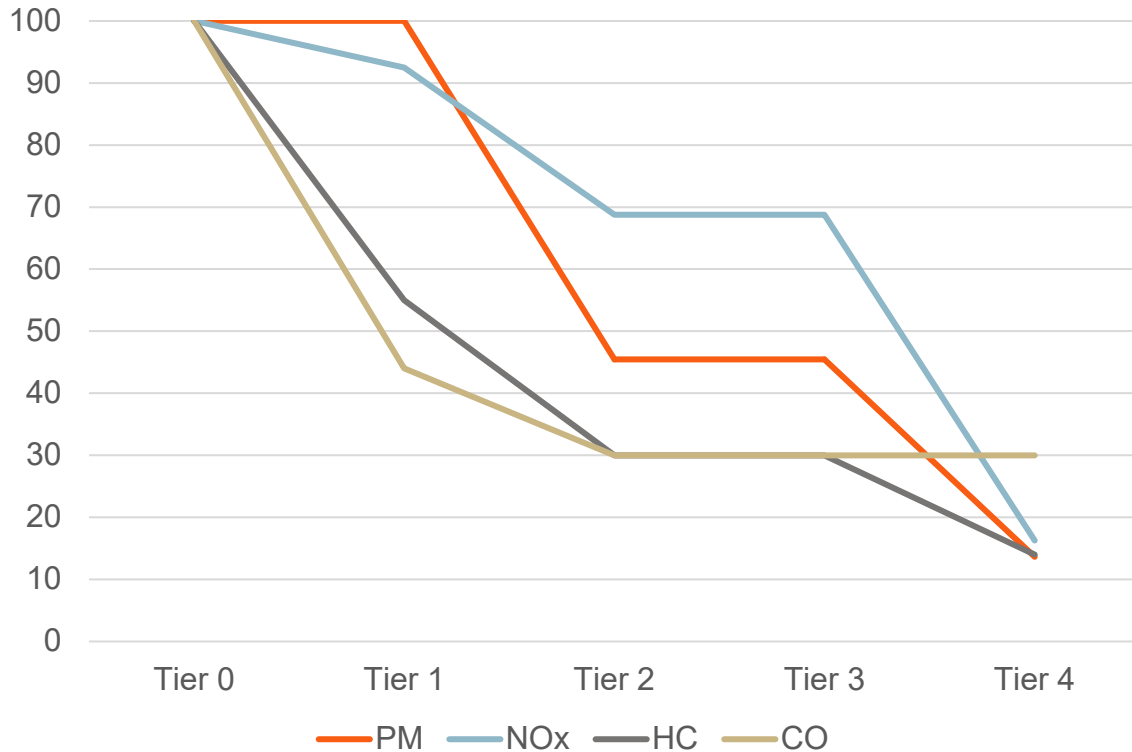
Elements to Consider:

- Operational regulations
- Economic regulations
- Grid reliability and resiliency
- Safety regulations
- Smarter funding paradigms
- Modal equity

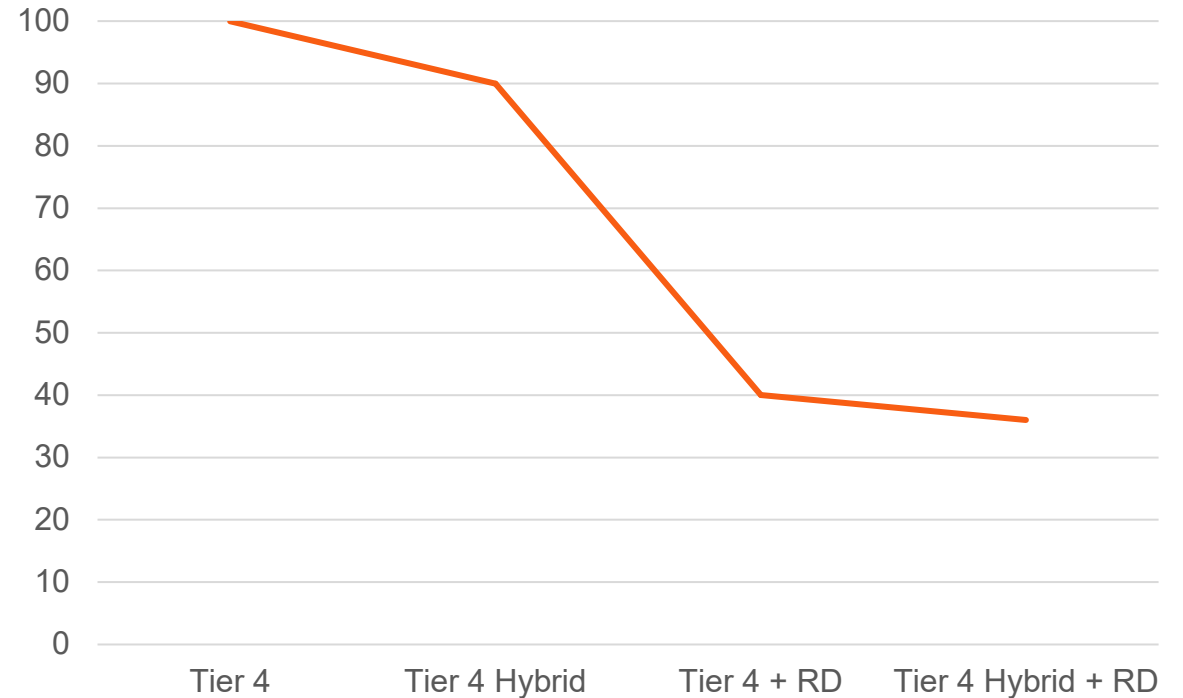
Pathway to Progress

- Regulations have driven lower emissions over the past 30 years
- Innovation has the potential for continued reductions
- Investment in “clean combustion” technology provides near-term opportunity

EPA Regulated Locomotive Emissions
% Reductions by Tier



Example: Potential Pathways for Lower Carbon Combustion*



*ESTIMATE ONLY. Sample calculation assuming 10% fuel savings with hybrid technology and Renewable Diesel with a Carbon Intensity of 40



8773

8773

8773

BNSF

BNSF

BNSF[®]
RAILWAY