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# Railroad Technology

BNSF Railway and Union Pacific

September 30, 2021

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## Today's Objectives

- Overview of each railroad
- Emissions reductions achieved
- Requirements for new technology
- High-level overview of technology initiatives

## About BNSF Railway and Union Pacific Railroad

### Union Pacific

- Omaha, NE
- 23 states
- 8,205 locomotives

### California

- 3,363 miles of track
- 3,181 employees
- \$336M annual payroll
- ~270M capital spending

### South Coast

- 5 Intermodal yards
- 1 Primary classification yard
- 1 Auto facility



### BNSF

- Fort Worth, TX
- 28 states + Canada
- 8,000 locomotives

### California

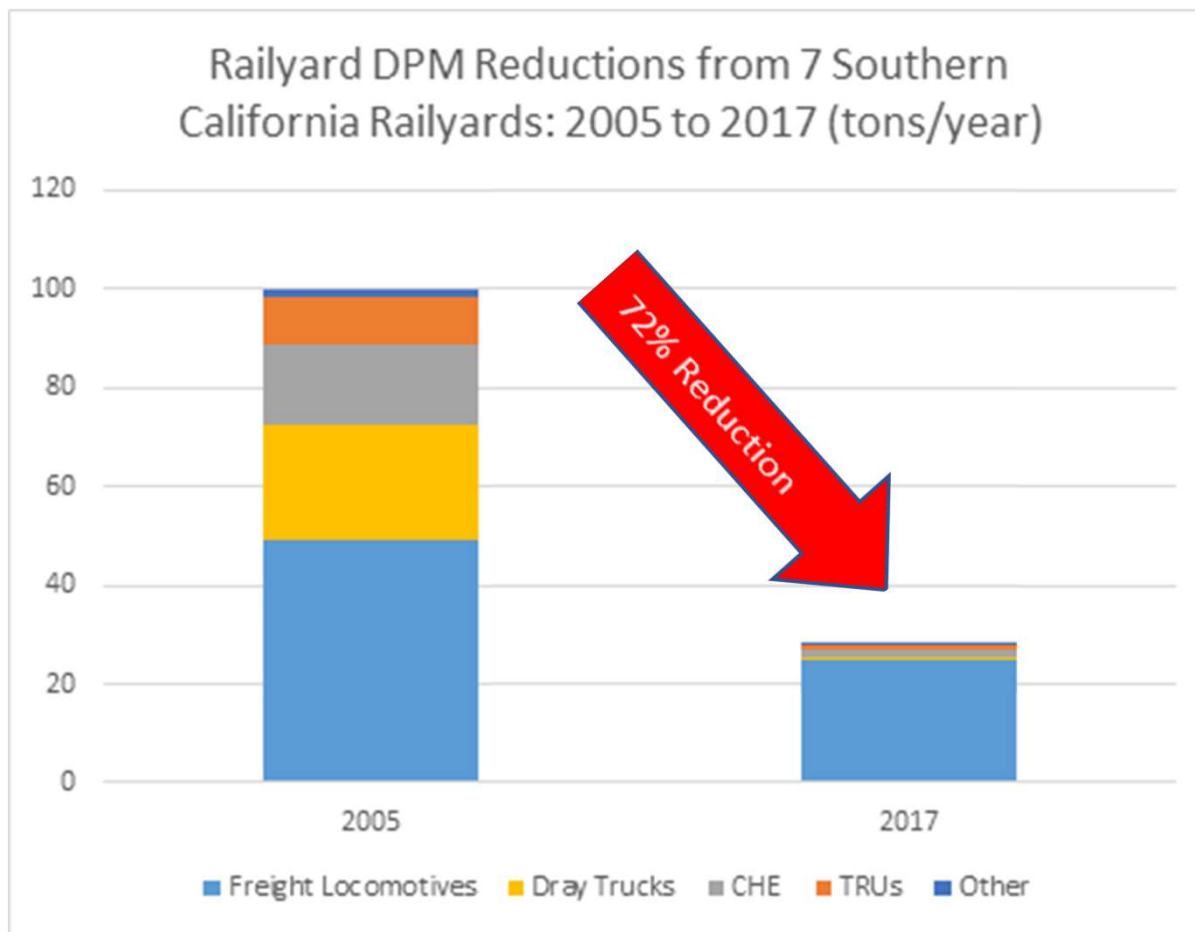
- 913 miles of track
- 3,358 employees
- \$274M annual payroll
- ~220M capital spending

### South Coast

- 3 Intermodal yards
- 7 Classification yards
- 1 Mechanical yard



## South Coast Railyard Reductions Through 2017



Source: Railyard inventories provided to CARB and air districts in 2019/2020  
Further reductions have been achieved after 2017

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## Railyard Equipment

### Battery Electric Locomotive



Source: trains.com

### Battery Electric Hostler



Source: en.byd.com/truck/

### Hybrid Rubber Tired Gantry Crane (RTG)



Source: mi-jack.com

### Battery Electric Top Pick



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## Requirements for New Technology

- Technology readiness must be demonstrated
  - Offerings must be safe, reliable, and cost-effective
  - Railyard operations are demanding – we operate 24/7/365
- Preference to work with domestic and established OEMs
  - Proven need for nearby customer service and available parts

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## Actions to Reduce Locomotive Emissions

- 1998 and 2005 MOUs with CARB
  - NOx and PM reductions in the South Coast and statewide
- Battery Electric (BE) Locomotives
  - Very early stage with many questions to address
  - Tested hybrid “Green Goat” switcher locomotives in the South Coast in early 2000s; pulled from service after reliability issues
  - In 2021, BNSF pilot tested a Wabtec BE locomotive with CARB (ZANZEFF Program), and plan to pilot test additional BE locomotives
  - In 2022, PHL will pilot test a 2.4 MW Joule BE switch locomotive
  - UP has approved purchase of a BE locomotive for switching cars at a California yard
  - Both BNSF and UP want to further partner with CARB and SCAQMD to pilot test and demonstrate this technology

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## Actions to Reduce Locomotive Emissions

- Tier 4 locomotives
  - Both using Tier 4 line-hauls
  - UP developed Tier 4 switcher; 10 in use in northern CA
- Hydrogen Fuel Cell Locomotives
  - BNSF tested one locomotive in the past
  - Canadian Pacific (linehaul) and Sierra Northern (switch) are pursuing
- LNG Locomotives and Tenders
  - Several Class 1's tested in the past; no future plans due to safety and other concerns
- Genset Locomotives
  - Pulled from service after ongoing reliability issues



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## Other Railyard Equipment Technology

- Yard Trucks (hostlers)
  - Zero-emission yard trucks have seen multiple pilot tests in the South Coast with mixed results
  - CARB proposes to require ZE yard trucks in its Advanced Clean Fleets Regulation
- Rubber Tired Gantry Cranes (RTGs)
  - Currently testing hybrid RTGs with mixed results
  - CARB proposes to promulgate new CHE regulation



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## Other Railyard Equipment Technology

- Forklifts, Top Picks & Side Loaders
  - BNSF is pilot testing ZE in this category
  - CARB proposes to require Zero Emissions in this category
- Renewable Diesel and Biodiesel
  - AAR, BNSF and UP are participating with CARB to test renewable diesel.
  - AAR is talking with DOE about renewable diesel
  - UP and Progress Rail Partner to Reduce GHG Emissions with Biodiesel
- Evaluating piloting BE light duty vehicles (F-150s)

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## Conclusion

- High level takeaways
  - Significant reductions at railyards
  - UP, BNSF, PHL, and Sierra Northern are committed to pioneering new technology
  - New technology is a journey, not a sprint