Railroad Technology

BNSF Railway and Union Pacific

September 30, 2021
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
**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**
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
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
### 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
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
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)
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