Association of American Railroads

South Coast Control Measure Symposium

June 10, 2015

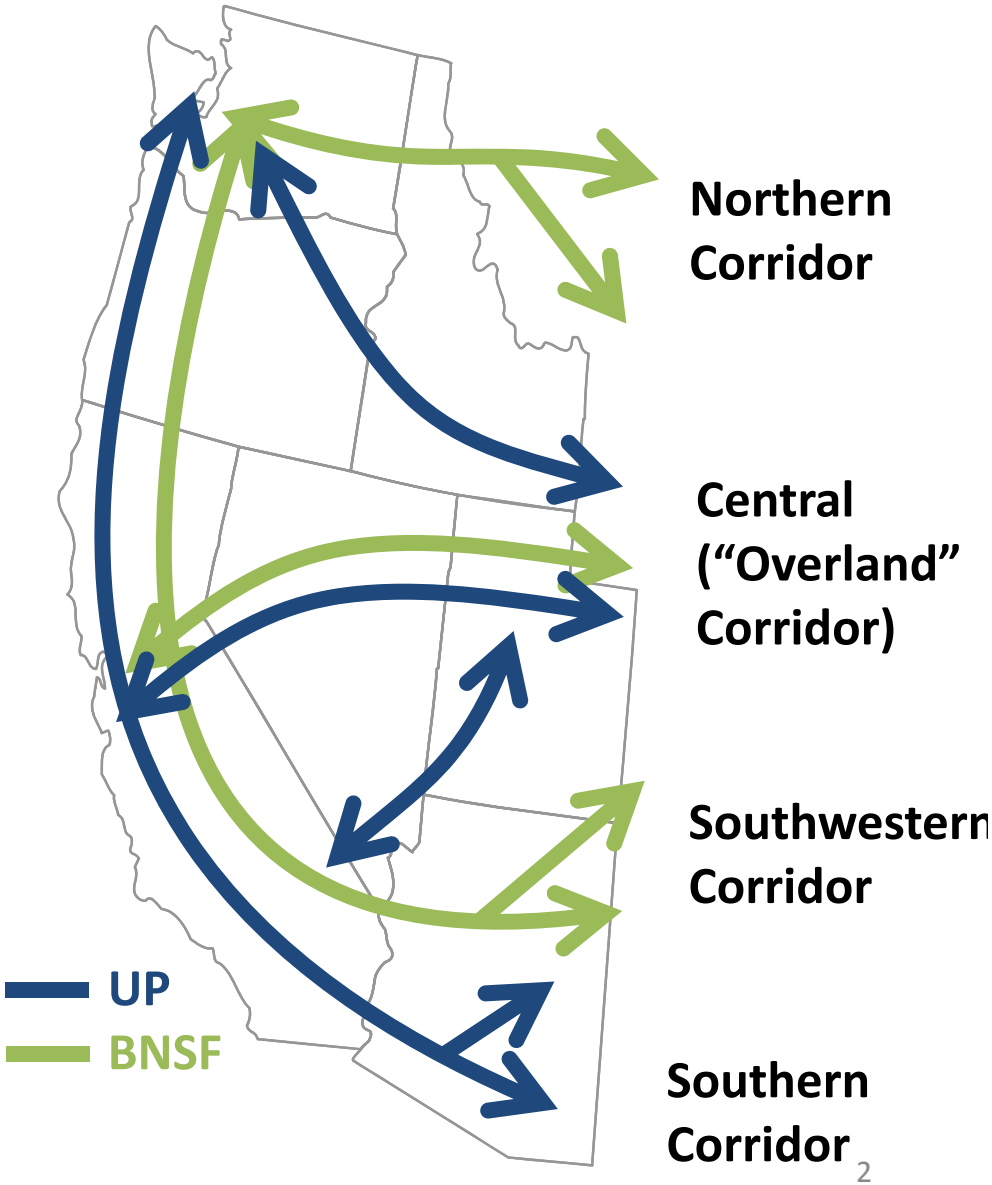
UNION PACIFIC BUILDING AMERICA®

ASSOCIATION OF AMERICAN RAILROADS

BNSF RAILWAY

A few opening thoughts

- Long history of working with State agencies to develop and introduce innovative strategies and the newest feasible technologies.
- Current focus is on Tier 4 and dual fuel LNG (LNG/diesel).
- All technologies must continue to improve efficiency and seamlessly integrate with complex national goods movement system.
- Continue to partner with others to research potential for advanced technologies – some of which may prove feasible.
- 4x greater fuel efficiency leads to GHG benefits.



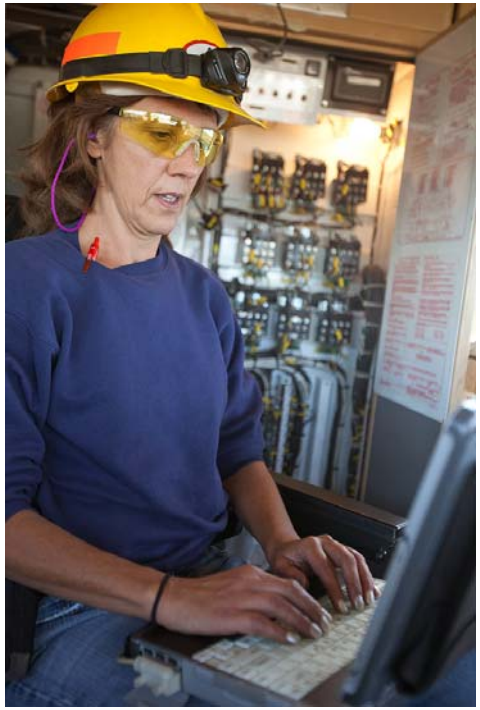
Current regulations and programs

US EPA Standards

- 1998 Rule
  - Tier 2 req'd in 2005
- 2008 Rule
  - Tier 4 req'd in 2015
- >90% red. since 2000
- T2 to T4 > 75% reduction

CARB Regulations

- Intrastate fueling, Drayage Truck, CHE, TRU, & Cap-and-Trade



CARB Agreements

- 1998 South Coast Fleet Avg.
  - 67% NOx Reduction
- 2005 MOU
  - 20% PM reduction in rail yards
  - Early Idle Reduction Technology

CARB/RR Tech Development

- $5M+ filter development and demonstration
- Fuel emissions testing

Evaluating locomotive technology

	Comments	Emissions	Infra-structure	$	Ops	Next Steps
Combustion						
Tier 4	Current Railroad investment. Significant challenges remain.			N/A		GE delivery in late 2015? EMD delivery unknown.
Dual Fuel / Nat Gas	Current Railroad investment. Potential for reductions.			Fuel; Maint.		Major freight railroads developing now.
Battery Locomotives, Hybrids, or Tenders	BNSF & UP recently operated battery locomotives. Could reconsider if technology becomes commercially and/or operationally viable.			Exch. points		Possible demonstration project.
Catenary Electric	Must have national system or multiple exchange points. $30-300M/mile.			$ 30-300M/ mile		None
Other Fuel Cell	Technology not yet viable					Technology development

Source: Adapted Ed Hall, GE, Presentation at SCAQMD, "Transitioning to Zero-Emission Freight Transport Technologies Symposium", April 11, 2013.

Incentive funding and locomotives

- Focus of State funding shifting to transformative technologies at and/or beyond Tier 4.
  - ARB has allocated $10M of AQIP funding for zero-emission tender technology or near-zero emission switch locomotives
  - Beyond Tier 4 for revenue service is not here yet
- Other Issues:
  - CA-focused deployment
  - Removal / Banning
  - OEMs and remanufacturers are key for technology development. Development can be accelerated by state funds, but will continue without it.

AB 32 GGRF	AQIP	Prop 1B	Carl Moyer
• Low carbon transportation funds paid through AQIP	• GHG Reductions • Advanced Tech Demonstration Projects - Beyond Tier 4	• Limited funds remain • Can fund retrofits and replacements to Tier 4	• Use Prop 1B first • Replacement = beyond Tier 3, • Retrofit = 30% NOx reduction

Reference Slide

Railpower Green Goat™ having replacement set (25 tons, largest possible package space-wise) of lead-acid batteries installed with stronger assembly rack, impact detectors and improved ventilation system. 265 hp diesel-generator (for recharging batteries) is behind louvers at rear end. (October 30, 2010)

NS 999 all-battery switcher, entire carbody (within "square box") and former-fuel tank area (between trucks) had lead-acid batteries. No diesel-generator onboard, intended for "plug-in" recharging. Reported to have had lead-acid batteries replaced with new-design lead-carbon nanotube batteries in 2013, but no results published. (2010 photo)