North American Railroad Zero Emission Overview

NGEC 12th Annual Meeting
February 25, 2022

Dave Warner, PRIIA Emeritus
Senior Vehicle Engineer, STV Inc.

Next Generation Equipment Committee NGEC

The NGEC will provide national leadership in standardization, acquisition, financing and management of passenger rail equipment.

STV 100 Years

Discussion Scope

- Notes
- 2011: Locomotive Technology Task Force
- 2022:
  - Natural Gas
  - Battery
  - Hydrogen
  - U.S. & Overseas

Wilmington News Journal
December 17, 2021

BNSF said Wednesday that it plans to test out a hydrogen-powered locomotive on its railroad lines as part of its plan to reduce its emissions, joining Canadian Pacific in experimenting with that technology. AP FILE

Freight rails work to cut emissions

Continue to experiment with alternative fuels

Josh Funk
ASSOCIATED PRESS

OMAHA, Neb. – The major freight railroads across North America continue to experiment with alternative locomotive fuels as a way to reduce their greenhouse gas emissions.

BNSF railroad said Wednesday that it plans to test out a hydrogen-powered locomotive along its lines, joining Canadian Pacific in experimenting with that technology. Canadian National railroad recently announced plans to test out a battery-powered locomotive to haul freight across Pennsylvania, and Union Pacific has said it would like to try using battery-powered locomotives in some of its railyards once they are more widely available in a few years.

Several other past tests at other railroads have looked at natural gas-powered locomotives and battery-powered options. Using some combination of these new fuel options will be key to helping the railroads achieve their goals to significantly cut their emissions in the coming years.

Both of the major locomotive manufacturers, Wabtec and Caterpillar's Progress Rail unit, are working on developing locomotives that use other fuels.

But the railroads all caution that these are only pilot tests at this stage, and the new technology won't be ready to start replacing the diesel workhorses that have been pulling freight across the continent since World War II for at least several more years.

"This technology could one day be a lower-carbon solution for line-haul service, as it has the potential to reduce carbon emissions and remain cost competitive," said John Lovenburg, BNSF's vice president of environmental.

Wabtec's Vice President of Engineering Alan Hamilton said his company is already selling a production version of its battery-powered locomotive to some railroads after it was tested out in California earlier this year. And Wabtec is working on a variety of other approaches to improve the efficiency of all its locomotives regardless of the fuel they use. But the major railroads will likely phase in the new technology gradually as they upgrade their locomotives over time. "We really aren't focused on just one technology," Hamilton said. "We're focused on a whole range of technologies and how they work in the customer's network."

BNSF didn't say how quickly it expects the hydrogen-powered locomotive from Progress Rail it plans to use will be ready to try out while a Canadian Pacific spokesman said it plans to begin using three hydrogen-powered locomotives around the province of Alberta sometime next year. CP received a $15 million grant earlier this year to double the amount it planned to invest in the program. Before the railroads could make wholesale changes in their locomotive fleets, they would have to invest millions in new fueling stations and other infrastructure. And any changes would likely have to be somewhat standardized across the industry because the major freight railroads regularly pass locomotives back and forth to keep trains moving efficiently.

BNSF said it plans to work with Chevron to help set up the fueling infrastructure it will need for its hydrogen test.

Another thing that will likely slow the transition to new fuels is that railroads typically use locomotives for decades to get the most out of their investment in them. And the major freight railroads have thousands of locomotives in storage currently because operational changes the industry has made over the past few years have allowed them to use fewer locomotives as they rely on increasingly longer trains.

The Association of American Railroads trade group points out that railroads are already significantly more efficient than trucks at delivering freight. On average, freight railroads haul one ton of freight more than 480 miles per gallon of fuel, but the major U.S. railroads still consume more than 3.4 million gallons of diesel fuel each year.

The railroads already invest in an assortment of measures that help them improve the efficiency of its trains, including systems that operate like cruise control to help engineers use the least amount of fuel possible as they cross the countryside.

"Every locomotive, piece of equipment and operational decision is an opportunity to reduce fuel usage and drive down emissions," said Ian Jefferies, president of the rail trade group. "Working with suppliers, railroads are piloting alternative and lower carbon solutions across the nation capable of delivering for both the economy and environment."

Discussion Notes

- Pro/Con neutral regarding technologies
- No vehicle endorsement implied or intended
- This is not an in-depth equipment discussion
- For equipment details, see a manufacturer representative in this room
- Not ALL “climate friendly” vehicles are mentioned

“The views, opinion, conclusions, recommendations expressed in this report are those of the authors themselves and do note represent the policy or position of their respective employers of the Section 305 Next Generation Corridor Equipment Poot Committee (NGEC) or any of its officers or members.”

(*adopted 1/3/2012*)

Locomotive Technology Task Force (LTTF)

- 2-15-11: EB Discussed Technology Options for Dual Mode Locomotive
- 3-16-11: EB Approved TSC's formation of the LTTF
- the magic happened
- 8-11-11: Report Issued
  - Operational Vehicles
  - Experimental/Operating
  - Research

Natural Gas

- BNSF 1980/1990s Tests
- BNSF & CN 2014 Tests
- IHB CNG Dual-Fuel Switchers
- FEC LNG Dual-Fuel

OptiFuel Systems, LLC
Press Release, 5/7/17

FEC Railway Photo
Progressive Railroading

Batteries

- WABTEC FLXdrive Battery Loco (BNSF + UP)
- EMD® Joule Battery Switcher (PHL + UP)
- LIRR M-7 BEMU (Alstom)
- Viva Rail Pop-Up Metro
- Amtrak ICT

Wabtec Photo
Supplied to press

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MTA LIRR-Glen Sager
The Gothamist 4-20-21

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dcwarnerphotos

Hydrogen

- CP Road Locomotive(s)
- BNSF (w/Caterpillar & Chevron)
- SBCTA FLIRT H_2 ZEMU

[CP looks to hydrogen locomotives to lead decarbonization of freight transportation sector - Emissions Reduction Alberta (eralberta.ca)]

Emissions Reduction Alberta

Hydrogen

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Stadler Image
Urban Transport Magazine

Overseas Examples

- Battery
  - Alstom Coradia Continental
  - Hitachi DENCHA
  - Stadler Trimodal MU
- Hydrogen
  - Alstom Coradia iLint
  - Siemens Mireo Plus H

Alstom Image
Press Release Feb. 5, 2020

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Hitachi Image
www.railjournal.com news item
Oct. 19, 2021

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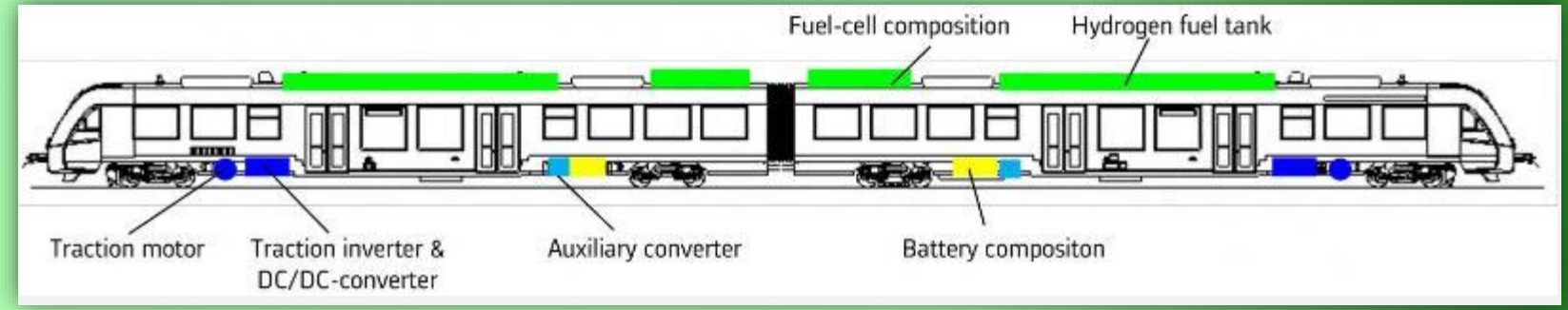
Alstom Coradia iLint Product Sheet
Used with Alstom permission



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Siemens Image
Mireo Plus H webpage

What's Next

- PRIIA
  - Vendor Technology Talks
  - Observe
  - Amtrak
    - Intercity Trainset
      - Battery
      - ALC42E
    - Switchers
      - Battery
      - H_2
- TRB Research
  - AR020 Rail Rolling Stock and Motive Power
  - AR030 Standing Committee and Railroad Operating Technologies