



THE PROCEEDINGS OF THE SPRING 2023 MEETING OF THE RAIL ELECTRIFICATION COUNCIL (REC)

IS RAIL ELECTRIFICATION ON TRACK?

Steve Griffith, NEMA Executive Director, introduced special guest, **Debra Phillips, NEMA President & CEO**

Welcoming Remarks of Ms. Phillips

NEMA is a \$23 Million trade association that advocates for a future for transportation that is electrified, digitized, and interconnected. In this transitional time for electrical manufacturers and the industries they supply, we must focus on important priorities, collaboration, advocacy, and utilizing opportunities created by government policies and incentive. Ms. Phillips stressed the importance of communications, especially regarding matters involving the ESG objectives of members, climate change policies, and improving lives and solving problems in our society. There's 1.1 trillion available in government funding for electrification spending, and an increasing excitement about investment in North American infrastructure. NEMA, together with REC, will be addressing the current barriers to electrification, which currently include the supply chain and the supply of electrical steel, chips, and critical minerals. NEMA wishes REC great success.

James Hoecker, REC Co-founder & Counsel, Husch Blackwell followed with observations about the REC's current focus on electric transmission development and its co-location within railroad rights-of-way (ROWs) and the electrification of railroad operations. The Council has a unique mission, which touches on efficient delivery of clean energy, mitigation of climate change impacts, sustainable freight, and passenger transportation, ESG considerations, technological developments in both rail and power operations, and expansion and integration of the grid. Today's agenda highlights part of those concerns and initiatives.

You'll hear today from participants in charting the way forward. Steam locomotion and the dieselization of the rails are history. In 2023, the talk is about an array of propulsion alternatives and structures. The Congress has helped set the table and talk about grid expansion and major HVDC additions is everywhere. What's happening in electrification across the economy is contagious. Electrification and decarbonization (not identical things) will drive sustained deployment of renewable energy and other fuels. But, in our pursuit of change, we can't disable the most successful freight delivery system in the world.

Hoecker reported that the Council has completed work on the following in the past few weeks:

- Comments to FERC on backstop transmission siting.
- Comments to DOE (jointly with NextGen Highways) on use of existing ROWs for transmission
- Podcast on Council activities with Rail Age publications

KEYNOTE ADDRESS: A Forward-Looking Perspective on the Technology and Operations That Drive Railroads in the 21st Century.

Kari Gonzales- President & CEO of MxV Rail.

MxV is made of the 6 Class 1s plus APTA, AAR, and Amtrak with Ian Jeffries (AAR) serving as chair. MxV is known for its research, which receives \$13.3 million annually, but it is also a major consultant, conducts testing, and develops standards. Current key focus is derailments that have transpired in the past year; railroads are working toward zero derailments and will explore any technology applications to solve this issue. The capital cost of electrification is a major concern, and it doesn't appear that all railroads will adopt one solution. Ms. Gonzales indicated that MxV does not have an approach to rail electrification that is separate from the work of the American Association of Railroads. However, MxV is working with both Japan and China to research high speed rail.

PANEL 1 – Freight and Passenger Railroads Reflect on the Economic, Policy, and Technology Challenges of Decarbonization and the Electric Future

Francois Belanger, Senior Director, Sustainability, Canadian National

Railroads all provide emissions reductions calculations. They all have goals to decarbonize by 2050, with a 43% GHG reduction by 2030 for CN. To reach the 2030 target, most will come from fuel efficiency. Generally, CN improves its fuel efficiency 1.5-2% annually. CN is exploring biofuels, biodiesel, and renewable diesel, with the availability at competitive costs. CN also has a \$100 million investment in testing battery-electric systems in both warm and cold climates.

Thad Call, General Director, Sustainability, Union Pacific

Reducing emissions is what UP customers want, but providing reliable service is key, because rail customers don't have the flexibility of trucking. UP aims to both lower emissions and lower costs. Every class 1 railroad buying a locomotive is making an investment for a long time, so it has to be reliable.

Alternative forms of propulsion are not coming fast enough, technologically. The sustainability of the railcars is a concern. Battery electric, hybrid, or hydrogen propulsion systems are not widely available yet, although UP is working to figure out how to pilot them. Currently all Class 1s operate on the same technology, Thad believes that important changes will occur after 2030.

With respect to co-location of transmission, UP has a process for evaluating those opportunities. It has concerns about whether the railroad would be losing space or access on its rights of way – for example in areas where UP might want to double track. Rail ROWs are not uniform. Overall, UP would welcome a conversation about co-location. In general, smaller projects may be viewed more favorably.

Michael Iden, P.E. Tier 5 Locomotive LLC

When it comes to alternative forms of propulsion, there's currently no silver bullet that changes all propulsion systems like dieselization. Multiple Zero Emission (ZE) technologies are likely to be adopted following a semi-ZE transition. These include Battery Electric Locomotives (BELs), Hydrogen Fuel Cells, and Overhead Catenary Systems

There are grid dependencies between transition of the rolling stock and corresponding infrastructure that will need further attention and economic analyses as this transition occurs. Grid-to-rail traction energy efficiencies are generally higher with BELs and Overhead Catenary Systems. BELs need to be tethered to a large recharging network and have a shorter operating range requiring more recharging enroute. Hydrogen Fuel Cells do tend to have a longer operating range but have a low grid-to-rails energy efficiency. Overhead Catenary Systems have the greatest ability to regenerate dynamic braking energy.

Regenerative braking is recovered energy, and there are concerns that, even on larger descents, all the energy from regenerative braking cannot be captured. For battery-electric systems, new charging and installations will be necessary. Not all are alike -- there's slow release/charging and fast release/charging. New systems create operational challenges.

AAR will only support economically feasible solutions. The major railroads all look to copy each other and in general are looking to standardize and have as much interoperability as they can. There are fewer providers of new electrical technologies, so it should be easier for railroads to collaborate. This transition to newer, cleaner propulsion systems will be a "messy period" as there is no quick or inexpensive solution. Replacing the entire diesel-electric rolling stock is not a trivial task, it needs to also address key items such as interoperability, common fuel, and associated infrastructure. So, any approach that allows for changes to be made over time with less impact on reliability and deliveries are what railroads will be looking for. There are large rail projects in the UK that can provide financial lessons learned for such a transition.¹

Michael Cleveland, Director, Advanced Energy, Progress Rail

Progress is currently developing 3 kinds of locomotives: hybrid-battery, battery-electric 2nd iteration, battery electric 1st iteration. Progress is working on testing a biodiesel system but does not anticipate that railroads will likely buy into the identical propulsion solution.

PANEL 2 – Perspectives on Rail-Grid Synergies and the Pace of Change in Our Two Critical Industries

Panelists: Michael Johnsen, Senior Advisor on Climate & Sustainability, Federal Railroad Administration, USDOT

FRA's CRISI program has 1.7 billion dollars for investments in a wide range of projects within the United States to improve railroad safety, efficiency, and reliability; mitigate congestion at both intercity passenger and freight rail chokepoints; enhance multi-modal connections; and lead to new or substantially improved Intercity Passenger Rail Transportation corridors. 2022 grant applications are currently under review.

Passenger rail needs to be electric to keep up with the rest of the world. The US decarbonization blueprint for transportation has a goal of getting the sector to carbon neutral by 2050². FRA spends money on research but cannot compel implementation. Railroad chapter of the decarbonization plan

¹ <https://www.railwayage.com/mechanical/locomotives/follow-the-megawatt-hours-hydrogen-fuel-cells-batteries-and-electric-propulsion/?RChannel=home>

² <https://www.energy.gov/eere/us-national-blueprint-transportation-decarbonization-joint-strategy-transform-transportation>

will be out some time this summer with input from DOE, EPA, and FRA. The goal is not to pick a single technology as there is no silver bullet.

Liza Reed PhD., Advisor, Grid Deployment Office, US Department of Energy

Grid Deployment Office has a focus on Generation Credits, Transmission, and Grid Modernization. There's general agreement that, to meet 2030 goals, the US needs to increase transmission by ~60%, and there are lots of opportunities to explore for transmission such as via the National Interest Electric Transmission Corridors (NIETCs) The GDO had issued a transmission "needs" study³ and is collecting information for its grid development program including exploring the use of existing ROWs for transmission co-location.

Guy Van Uytven, Canadian Society of Senior Engineers (ret.), Bowman Center for Sustainable Energy, Class 3 Member, WECC

Wind and solar energy are going to be huge in electrification and decarbonization. Long distance inter-regional transmission lines allow us to not build as many gas lines. Transmission lines are costly when built above ground, so exploring underground along ROWs is an important opportunity to avoid environmental, aesthetic, and regulatory impact. GHG mitigation (Zero emissions) goals are quickly approaching, and burying transmissions lines is a way to help with achieving them.

Patty Long, President, Railway Supply Institute

Ms. Long, although new to the rail industry, has a background in trade associations (manufacturers, plastics, asphalt pavement). RSI represents the folks who make the railcars. RSI is also a part of the AAR discussions on pilot programs, collaboration, and coordination. The whole transportation ecosystem is connected, and RSI wants more products and passengers travelling by rail. It's imperative that they are involved in these discussions.

Further Discussion

Will the new Joint Office (<https://driveelectric.gov>) participate in conversation about rail electrification? The Joint Office is currently focused on large scale EV projects. The Council will continue to engage with the Joint Office as appropriate.

What measures will DOE undertake to incentivize transmission development? Will it look at co-locating transmission on transportation ROWs to advance grid modernization? The DOE can only designate NIETC corridors in the context of "backstop siting (FPA sec. 216). This initiative is an applicant-driven approach seeking narrower corridor designations compared to its previous approach under the 2005 Act, which was overly broad and rejected by the courts. The Council is invited to argue for co-location and to meet with the GDO. Existing ROWs may make the transmission development path easier with respect to land ownership, usage restrictions, and environmental factors. Backstop siting lends itself to public-private partnerships with limitations in certain corridors, but there are inherent development opportunities. The GDO needs to figure out the limiting factors.

³ <https://www.energy.gov/gdo/national-transmission-needs-study>