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PROGRAM

The RAIL ELECTRIFICATION COALITION'S April 30, 2024 ELECTRIFICATION WORKSHOP

Location: National Electrical Manufacturers Association
Hubbell Conference Rooms
1300 North 17th Street
Arlington, VA 22209

(<https://www.nema.org/about/visit/directions>)

Click to [RSVP for April 30th, 2024 Workshop](#)

Welcome. To the Coalition's second full-day meeting on railroad motive power and electric transmission, development, and siting. During the Workshop, all attendees are invited to participate actively. Given the pace of technological, regulatory, and commercial change in these critical industries, the Coalition looks forward to a series of such discussions in the future.

The April WORKSHOP is centered around diverse case studies and new innovations. business practices, entrepreneurship, and new technologies. Nevertheless, public policy is changing rapidly at FERC, DOE, DOT. Capitol Hill and at the State level. We want to encourage exploration of new proposals or projects which point the way toward electrification, digitalization, clean energy, and transportation efficiency. Please see the **APPENDIX** below, for more information, issue statements, and questions to think about!

9:00 a.m. Workshop begins.

- **Introductions- Steve Griffith & Jim Hoecker**
- **Presentation of goals and Objectives**

9:30 a.m. CASE STUDY 1: BRIEFING FROM INDIA ON ITS PATH TO BECOMING NET ZERO

Discussant: Apurva Chaturvedi, USAID, New Delhi

India has committed to reaching net zero emissions by 2070 and has set targets to achieve 50% of its energy requirements from non-fossil fuel sources by 2030. The International Energy Agency stated in its Net Zero 2050 report that "more efforts are needed" by the world's rail systems. India has emerged as an unlikely hero. Consistent with its big commitment made at COP28 in Dubai, India's rail network is now 94% electrified – an achievement largely made in the past decade. India Railways has electrified 40,000 km of track since 2014 at a cost of about \$5.5 Billion, jumping in the ranks of the Climate Change Performance Index (CCPI) from 31st to 7th despite its massive population and being 139th in per capital GDP. Behind electrification is an effort to move up the development trajectory from dependence on its abundant coal supply for fuel (for steam), to

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petroleum, to investments in solar and other renewables, and digitalization. Indian Railways plans to be a net-zero emitter by 2030.

1. What lessons can be fairly drawn from India's drive for rail electrification? Is North America in a better or worse position to perform as well on the range of climate change metrics?
2. Is Indian Railways as strong a service provider to the Indian economy as North American Class1s? Are there technological differences that make changes to the rail system more possible (e.g., passenger service as a bigger share, lighter rail equipment, less difficult terrain, etc)?
3. The major shift in Indian railway electrification is in part the product of a government industrial policy. However, the investments are strongly supported by the private sector. For instance, the government has allocated \$2.2B to develop 5 million metric tons of green hydrogen and 125 GW of renewable resources; another \$200B is pledged by private capital in support of India's energy roadmap. Is the US infrastructure legislation in 2022 sufficient to match this performance?

10:00 a.m. PROJECT OVERVIEW: COST AND BENEFIT RISK FRAMEWORK FOR MODERN RAILWAY ELECTRIFICATION OPTIONS. This new project is studying past electrification efforts to identify the organizational, technical, and economic reasons they were not built, and examining how changes in those areas might make electrification more feasible today.

Discussant: Rydell D. Walthall, Doctoral Student, University of Texas. Rydell will provide a high-level overview of this new research project.

10:15 a.m. CASE STUDY 2: WHAT ROLE WILL ENERGY STORAGE PLAY IN RAIL MODERNIZATION? New ideas about rail-based deployment of energy storage and dispatch are emerging. Rail transportation may become a new testbed for clean energy, greater grid resilience, new approaches to energy storage as an alternative to investment in transmission and conventional generation. We will discuss just how near these exciting new undertakings are to deployment and what niches battery usage can fill in the transformation of the electric power and transportation systems. Are these harbingers of a future rail system or the beginnings of a constructive discussion about individual electric power applications?

Discussants: Christopher Zappi, Wabtec on RD&D for battery-based motive power for heavy freight

Jeff Anderson, CEO, and Chris Smith, SunTrain on development of unit trains capable of moving large amounts of energy to demand much as would a coal train.

Jill Moraski, Natalie Popovich, Lawrence Berkeley National Lab on batteries as a mobile source for reinforcing systems and ensuring reliability in emergencies.

1. What is the feasible future role of battery technology in supporting expansion of the electric grid, either as a mobile resource, a resilience or reliability asset, a network real estate support, major load, or a combination?
2. How might the use of battery-powered locomotive propulsion impact the need for catenary,

and vice versa? Is there a strategic case for deploying catenary and battery technology jointly as a major or intermediate step toward rail electrification?

3. As part of locomotive propulsion systems, does the use of batteries as either propulsion or as grid support necessarily require development of a network of external charging facilities?
4. Does current development of prototype battery-electric locomotives indicate there is a nascent movement in the industry to a move away from established (diesel) traction?
5. What are battery capabilities now and potentially in the future, especially for heavy freight transport? What are their best uses and major disadvantages?
6. What battery technologies are best suited to railroad use, both on-board and trackside, at the present time? What technological developments will enhance that suitability?
7. Does the potential for delivering electric power from mobile sources like a unit train represent potential alternative or complement to development of macrogrid facilities? Can such development become an alternative base load resource in some regions? What is the potential impact on grid resilience and reliability? What appetite do investors have for such long-term investment?
8. What differences, if any, from the international state-of-the-art catenary installation will North America require?
9. What companies can build the machines that build the catenary? Can the electrification process be “industrialized” to support rapid implementation?
10. How is the Benefit-Cost Analysis of the catenary and battery/hybrid balance determined?

11:30 a.m. CASE STUDY 3: TRANSMISSION CO-LOCATION WITH RAIL. Installation of HVDC, or lower voltage electric facilities alongside existing (e.g., railroad or highway) rights-of-way. At a moment when transmission expansion and upgrades are needed to address coming challenges from extreme weather, massive demand growth, snarled supply chains, and a need to access more non-fossil energy, transmission development has proven incredibly difficult, in part due to regulatory delay and outmoded methods of planning the grid. Using existing rights of way – including railroads, highways, existing energy corridors, even pipeline routes – make sense. That trend is just getting started, however. What’s the experience so far and are railroads paying attention?

Discussants: **Alex Saar, Director of Corridor Services, CSX** on the potential roles and challenges for railroads as hosts to lateral electric power facilities.
Matt Pawlowski, VP, Development, NextEra Energy Transmission
Jay Caspary, Dept. of Energy Grid Deployment Office, former planner Southwest Power Pool; other participants will reflect the transmission development perspective on the challenges of siting and permitting inter-market, interstate transmission lines and other facilities and how existing rights of way might help address regulatory hurdles, private property impacts, and community issues that are barriers to entry.

Electric Grid Synergy

1. What are the needs of the electric industry for new transmission corridors?
2. Do railroad ROWs have particular advantages/disadvantages for transmission co-location?
Do railroads view this as a legitimate long-term business opportunity? What practical questions must be answered to evaluate the co-location of new transmission lines along rail rights-of-way? Are priorities compatible between rail and utilities or developers?

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3. What considerations impact the sharing of risks and economic benefits between railroad ROW owners and high voltage transmission developers? Can an electrified railroad serve both the needs of the larger grid and local needs for power and transportation?
4. Will rail electrification expand the market for the construction of new remote renewable power generation?
5. What is the value of grid-connected idle switching (and road) locomotives offering peak shaving, line conditioning, and backup electric power?
6. What potential benefits to trackside communities could be available as a result of installation of high voltage?
7. What other elements could use grid electric power, such as reefer units and crossing signals, charging stations?

Power Delivery

8. What are the cost and construction implications of each power delivery method (i.e., overhead wire, third rail, induction from buried cable, etc.?) Can a forensic and credible analysis demonstrate the variations, strengths, and weaknesses?
9. Installation of underground cable will entail disturbing a ROW; what issues does this raise for potential waste disposal, impacts on adjacent landowners, and reduction in permitting time and complexity compared to “greenfield” development.
10. What is the experience with overhead catenary suffering pole and wire damage from shifted loads and/or damaged railcars? How can this risk be minimized?
11. What are the lifecycle economics of using composite catenary poles versus steel poles?
12. What is the experience with catenary clearing double-stacked containers and other taller railcars?
13. Can power suitable for locomotives be drawn from very high-voltage transmission lines? How could this affect transmission development decision.

12:45 p.m. LUNCH

❖ **Lunchtime chat** on –

- pending siting legislation on the Hill,
- the pending study on the cost and benefit risk analyses for railway electrification options,
- recent developments at DOE and FERC

1:30 p.m. CASE STUDY 4: A REPORT FROM THE PASSENGER SIDE. North America’s vast expanse and competition from highway transportation (in part supported by taxpayers) has made passenger rail widely available only in metropolitan areas and in the Northeast US. Asian and European countries have invested more heavily in passenger service as a principal mode of moving people. The US has fewer miles of electrified rail than Uzbekistan, according to a recent Sierra Club report. Amtrak has received a recent infusion of funds, but much of it will be required for the improvement of existing railbed. Will it consider electrifying more of its routes outside of the Northeast, with some of its freight hosts? What does the future of high-speed rail in North America look like between now and 2050?

Discussants: **Michael Testerman**, Director, Virginia Rail Policy Institute
Meredith Richards, Chair, Rail Passenger Association
Melissa Figueroa & Ryan Scott, California High Speed Rail Authority

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1. Is improvement of passenger rail service to communities, especially those in rural America and rural Canada or Mexico, a sufficiently high priority among state and federal transportation legislators and other policy makers?
2. Can electric power and transportation policy makers work collaboratively to make deployment of their network industry resources more efficient and environmentally positive using strategic electrification and decarbonization?
3. What are the expected levels of investment in (non-local transit) passenger rail in the US? In Canada? What have been the most helpful/strategic investments of public monies the last two years and going forward? Does Congress need to do more?
4. How would electrification strategies for (non-electric) passenger rail compare to those for Class I, II, or III freight rail in terms of tactical steps, timing, or the available technological alternatives?
5. What is the per gallon price of diesel that would make electrification an obvious economic choice? Is this the key metric or only part of a more complex analysis?
6. How can locomotives be designed to take advantage of regenerative braking, vibration harvesting, and other waste energy capture methods?
7. What portion of the North American rail network should be electrified?
8. How are target sections determined?
9. How should electrification be staged to secure maximum benefits?
10. How will electrification coexist with residual diesel-powered segments?
11. What models of locomotives are candidates for conversion in the relatively near-term? Is this the most cost-effective option or an incremental approach?
12. What companies can perform the conversions?
13. How many fewer all-electric locomotives can be employed for the same service(s), compared to the same train using diesel-electric power?
14. What concerns do railroad management have about a move away from established (diesel) traction? To what extent do investors, consumers, and policy makers share those How can their fears be addressed or balanced by anticipation of new economic opportunities or social gains?
15. What entities and resources can (or should) be mobilized to advance such an industry transformation carefully but deliberately and economically?

2:45 p.m. CLOSING COMMENTS

ANNOUNCEMENT OF THE COALITION'S FINANCE & INVESTMENT CONFERENCE

3 p.m. ADJOURNMENT

APPENDIX

I. During all Coalition meetings, the central question we seek to answer is ----

Can we identify ways to ensure that technology developers, railroads, investors, and policymakers make the wisest energy and operational efficiency decisions so that North American railroads can (1) contribute to lowering the emissions and resource requirements of freight and passenger

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movement, (2) capitalize on their current and potential efficiencies to sustain and grow rail's market share, strengthen supply chains, enhance customer services, and participate in expansion and strengthening the electric system, and (3) attract private and public capital sufficient to support the transition to a cleaner energy economy?

Other issues and challenges on which we ask participants to work with us and to think about during and after our sessions ---

1. What does 'sustainable' mean in the context of rail motive power? How will this be measured? How can railroad companies best reflect and plan for sustainable practices in their ESG reporting?
2. What are the primary challenges rail electrification faces? What can we learn from the history of rail electrification? What can we learn from rail electrification in other countries?
3. How do the operating costs (besides fuel) compare with diesel locomotives?
4. How much faster are electric locomotives and what difference does that make in track capacity?
5. How much lifecycle emissions reduction can be gained from the use of electric locomotives?
6. What questions about rail electrification have to be answered more effectively?
7. What stakeholder groups need to align with rail electrification?
8. What concerns do railroad management have about a move away from established (diesel) traction? To what extent do investors, consumers, and policy makers share those apprehensions? How can their concerns be addressed or balanced by anticipation of new economic opportunities or social gains?
9. How much cheaper is electricity as a motive fuel?

II. GUIDE TO OUR RAIL ELECTRIFICATION WORKSHOPS

TO ALL STAKEHOLDERS: Welcome to the second workshop on railroad motive power, sustainability, decarbonization, catenary, technology, and electrification. This is a day-long meeting, and the agenda and course of discussion will be responsive to the participants. It is dedicated to finding viable pathway(s) forward involving the need to improve how freight and passengers are moved on North American railroads and how rail electrification can participate in the transformation of the electric grid. Our agendas contain a series of questions we ask you to consider and answer in anticipation of our discussions and during the discussion that day. While the REC considers all the questions to be important, we do not expect we will have time to seek answers to each one. The organizers will seek the views of all attendees willing to participate. Although not designed to arrive at specific conclusions, the Workshop will elicit views of disparate commercial actors and policymakers about the future of transportation, technology, operations, and regulation and guide the Coalition's future activities.

- The discussion will be moderated to ensure it moves forward within the time allotted. Chatham House rules mean that no comments will be recorded for attribution. Because our objective is to influence public policy formulation, the Coalition will consider more openness, including press access, in the future. For now, a summary will be sufficient and distributed after the meeting.

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- Specific project sponsors will present the case studies and respond to participant questions. The floor will be open to discussion of any projects or cases and their implications for other companies or projects.
- The moderators will seek comments from attendees in the room or online in response to the issue(s) raised and the questions provided below.
- **YOUR PROPOSALS FOR FUTURE WORKSHOPS, STUDIES, OR FILINGS ARE WELCOME.**