Meeting the Demand of Electrically Driven Vehicles For Expanded Generation

A possible win for railroads, trucking AND utilities

The auto industry's commitment to electrically driven vehicles (EVs) necessitates planning for comparable development of greatly expanded power generation and distribution systems to support those vehicles. The Federal Energy Regulatory Commission (FERC) has predicted the country's electrical energy generation capacity will have to double by 2050 to support the forthcoming evolution of electrically powered vehicles. Presumably, that will be accompanied by the necessity of corresponding growth in electrical distribution networks.

Predicted increases in the volume of shipping in coming years, will put additional pressure on highway infrastructure as additional trucks are added. The American Trucking Association has predicted a 36% increase in truck milage from 2019 to 2031, while the US Department of Transportation, Bureau of Transportation Statistics has predicted a 57% increase from 2015 to 2045 in long haul, freight truck milage. Taken together with the truck industry's expected conversion to electrically powered trucks, the FERC's predicted need to double the country's electrical generation capacity by 2050 may well be understated.

Compounding the challenge created by the predicted need for greatly expanded electrical power generation capacity, the electrical industry also faces its commitment to future energy generation by non-fossil-fuel, renewable resources and the likelihood that expanded distribution systems will be required to transmit that energy from where it is most likely to be produced to where it is likely to be most needed.

So where and how will the expanded generation needed to meet these demands be located? Unlike the existing coal and gas fired electrical generation facility concentrations in the more populated eastern and western areas of the country where truck traffic is also highest, the southern and middle parts of the country provide the greatest potential for significant expansion of non-fossil-fuel electricity generating capacity, the southern states for solar-based and the mid-western states for wind-based generation. For example, one study, based on 1990-2010 data and technology, concluded that eight mid-western states (Oklahoma, Nebraska, Kansas, North and South Dakota, Wyoming, Minnesota and Iowa) alone have the wind energy potential for 4,400 megawatts of generation capacity, in turn with the potential to produce almost 17 million gigawatt-hours of electricity annually (operating with 80 meter wind turbine towers at 40% of capacity)

To put this potential in perspective, utility scale generators in the US in 2020, with a generating capacity of 1,112 megawatts, generated a net of just over 4 million gigawatt-hours, of which about 60% was generated with fossil fuels. And previous estimates of wind energy potential are now tripled according to a 2021 Department of Energy study,

The enormous investment required to develop these potential energy resources will necessarily include a much-expanded transmission network to deliver the wind and solar potential of energy generated in southern and mid-western states to the eastern and western states where the energy is likely to be most needed. To the extent the load on that transmission network can be lessened by some other means of making that southern- and mid-western-generated electricity available to vehicles in the East and West, the demands on the electrical transmission network may also be lessened. Existing railroad infrastructure may be part of the answer.

Railroads are projected to adopt non-fossil fuel locomotives in the coming decades. This may well lead to battery-carrying rail cars (BCs) similar to tenders such as those which accompanied coal-steam powered locomotives. To extend the utility of those BCs, and to further justify them, a train BC might also serve as a power source to recharge other electrically driven vehicles travelling with the train. Electrically driven trucks, capable of travelling on both conventional railroad tracks and on conventional roadways could be those other vehicles. Most likely, those trucks would be typical of those used in long range shipping. Recharging such trucks from BCs while *en route* would lessen the power demands they would otherwise present in their on-road service areas, lessening the demands on the electrical grid to that extent. To that end, the utility industry should have an interest in the development of such vehicles.

But the trucking and railroad industries may have other incentives for this development, as well. Ideally these trucks would be (1) autonomously drivable, to facilitate their assembly and disassembly in a train and their transition between road and rail travel, (2) electrically driven for efficiency and (3) conveniently capable of travel on both rails and roads, *i.e.* electrically driven, autonomously drivable, road and rail-capable trucks or AUTORRs. As indicated above, among the benefits of AUTORRs to the trucking industry would be the possibility of recharging AUTORRs *en route*, reducing or eliminating the driver and truck downtime required for recharging in the truck destination areas. A reduced need for drivers may also provide a partial answer to driver shortages. For railroads, AUTORRs could revive the stalled growth in truck-rail intermodal shipping, all while benefiting the utility industry with some reduction of the need for electrical grid expansion.

Serendipitously, AUTORRs may not only be feasible and practical, they also may be a highly desirable way of lessening highway traffic and improving the economic and environmental footprint of freight shipping generally. Summarizing, for the utility industry, AUTORRS could obviate the need for at least some of the distribution infrastructure otherwise necessary to recharge trucks in their service areas. From the standpoint of the trucking industry, the truck and driver downtime associated with localized recharging could also be largely eliminated, at least for long range trucks and truckers.

And railroads may find AUTORRS the missing tool to capture more of the trucking business. The transportation industries have already sought to lessen other demands on highways and drivers by the marriage of trucking and railroads with truck-rail intermodal shipping. That shipping mode grew tremendously over the last few decades but now faces limitations imposed by the conflict between more efficient computerized railroad scheduling and the delays inherent in rail-to-truck and truck-to-rail freight transfer. That deterrent to truck-rail intermodal transport could be overcome by the development of AUTORRs, obviating the need for truck-rail and rail-truck freight transfers.

If the possible multi-industry incentives to develop AUTORRs are sufficient to warrant consideration of their development, the feasibility of such vehicles is likely to become the next question. That such vehicles are feasible has been discussed elsewhere. Obviously, whether AUTORRs are practical remains to be determined. The incentive to do so is clear. Such vehicles could revive the growth of truck-rail intermodal shipping and relieve much of the truck traffic on US highways. BCs, accompanying trains of AUTORRs, could include capacity to recharge the trucks while *en route*, delivering the trucks to their off-rail transition locations fully charged.

Most importantly for the utility industry, BCs and AUTORRs could lessen the additional burden on the electrical power grid imposed by the distance between the most likely non-fossil fuel generation facilities and the demands for power by many tens, if not hundreds, of thousands of electrically driven trucks operating in the eastern and western areas of the country.

The overall cost of a fleet of such BCs and the cyclic cost of repeatedly transporting those cars to a turnaround point and return would be significant. But so too would be the cost of the additional electrical distribution network necessitated by the coming evolution of electrically driven cars and trucks and the additional cost of driver and truck downtime necessary to recharge such trucks in their service areas.