



Renewable Energy in the North American-Freight Transportation Industry

Walter G*

Right of Way & Transportation, Dallas, USA

*Corresponding author: Walter G, Right of Way & Transportation, Dallas, USA, Tel: 214-944-4545; E-mail: gwfwfer@gmail.com

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Abstract

Railroads, while still the most efficient form of transportation are some of the largest consumers of fuel in the world with thousands of miles of track and thousands of locomotives. With depleting energy reserves, climate change and secured sources of energy, new innovations are required. Railroads along with the energy industry can situate themselves to make great strides in resolving these issues while producing historic changes in the process. Electrified trains or "Wind Trains" as it has been described could be running on renewable energy from wind and solar, once large scale wind and solar operations are placed across wind and solar producing areas. With electric grids traversing inside railroad right of ways across North America from wind farms, solar farms and other sources of generation, mutual benefits can be gained.

Keywords: Renewable energy; Consumers; Fuel; Energy

Introduction

Some questions are raised at present about the reliability of renewable energy. However, with ERCOT, the isolated electrical grid of Texas, now gives non-coastal Texas wind, a capacity value of 14.2 percent and coastal wind will be at 32.9 percent [1]. Some wind is blowing somewhere in Texas all the time and for that matter all over the western US Rail System, Canada and Mexico as well. If rail gets the first megawatt with the balance sold into the grid, then wind & solar can run the rails. However, limited pumped storage will provide much greater reliability. The below US Annual Average Wind Power And Production map with the BNSF System overlaid shows the potential of one Class 1 Railroad. Double the transmission potential by including only Union Pacific, then additional increases with the remaining 3 eastern US Railroads along with Canada's and Mexico's. In addition, one could conceive of a future where trains that are not time sensitive (grain for example) could run slow when power is expensive (night and poor wind) and fast when power is cheap (sunny day and windy). The simple solution for back-up is either hydroelectric and/or pumped storage. SBB (Swiss Rail) provides 90% of their electricity (data a few years old**) from company owned hydroelectric plants. They are building a pumped storage plant (30% SBB owned) to buy either French nuclear at 3 AM or German renewables when they are a glut on the market and store the power for when needed. The SBB environmental report of 2002 noted that SBB provided 1/3rd of Swiss freight tonne-km and 1/6th of Swiss passenger-km* for 3% of all energy used for transportation in Switzerland. SBB is 100% electrified [2].

How the Combined Railroad/Transmission came to be

As a Transaction Manager for a company that managed the right of way for leases, sales, licenses (pipelines, electric cable, etc.) and economic development for the BNSF Railway Company, a major western US Railroad, part of my responsibilities was to research local real estate markets that the BNSF serves. In February of 2008 after coming across an article in the Galveston (Texas) Daily News about

imports of wind generators from Japan, I realized this might be something the Railroad might want to ship these items along with the components associated with it. There was surplus property in southeastern Colorado and other places across the system that I might possibly locate generators along with running transmission lines down the right of way. This was not my job, just something I did in my spare time. I marketed the right of way to electric companies, transmission companies and wind developers and a few months later T. Boone Pickens made the announcement in the Dallas Morning News of Mesa Energy's upcoming Wind Project Development in the Texas Panhandle. But he had this one problem. He couldn't get his wind generated electricity from the panhandle area to the Dallas-Fort Worth area because of lack of transmission, a big problem all across the US. The BNSF right of way runs almost directly to the area and through some of the most active wind areas across the US as demonstrated on the map. When contacted to Mesa Energy representatives, I explaining what I wanted whereby they advised "sounded like a good idea, but they were real busy that day, but as soon as things slowed down, they would get back in touch with me." After exchanging email addresses I sent Mesa a recap of our conversation along with the Wind Map and within minutes he called back and said, "we gotta talk and we gotta talk as soon as possible!" We soon met and there was not the usual tension of a typical company negotiating meeting, there was a synergy of cooperation between us. At this meeting they proposed substantial use of the southern corridor and electrification of the railroad to begin along with expansion later. I will say the BNSF management leaped upon the opportunity. Mesa then changed direction with changes in the renewable energy market and the economy.

After 2 years at the height of the economic recession, Berkshire Hathaway's Warren Buffett met with BNSF and proposed an outright purchase of the BNSF at 30% premium over the stock price. A large amount of it was purchased in exchange for stock. I had contemplated contacting his company earlier but I was concerned him being from Omaha, Nebraska he might be too connected with Union Pacific Railroad Co. If he purchased the Railroad for electrification as just part of his reasoning, he will have a ready-made right of way for transmission of electricity which could assist him in electrification of the Railroad. He will then be able to reduce the fuel costs by as much

as 60% (depending upon diesel prices and electrical costs) and will also be able to sell electricity to the Railroad for operations for the other 40% they would now use. In 2008 BNSF used approximately \$4 Billion in diesel, \$2.4 billion in cost reductions and another \$1.6 in increased electric sales, if he electrified the entire system.

Benefits of Rail Electrification to Society

- Rebuilding of infrastructure to US (and possible Canada and Mexico) with most efficient means of transportation.
- Substantial reduction in fuel consumption, import and CO₂ emissions, especially if all Class 1 Railroads in North America are electrified [3].
- Higher speed freight trains running upwards to 120 mph and establishment of a useable national (or international if Canada and Mexico are included) passenger rail system. Also, increased capacity as much as 15% due to electric over diesel.
- Reduction in Truck traffic/maintenance costs on Interstate Highways as rail would be more competitive with Trucking Industry with possible exception of cities where truck traffic delivery would increase until such time as industries are relocated back along railway lines or Industry tracks extended. One intermodal train typically holds 280 trucks. Trains would also become competitive to 120 miles instead of the present 500 miles with trucking.
- Substantial boost in the economy with higher paying manufacturing and construction jobs, not only with rail construction for increased capacity and alignment, but highway overpasses as well, reduction of at grade crossings, now adding saved lives to the equation. It would also require redesign of freight cars and locomotives (dual fuel locomotives to start) as well as they are not presently designed for higher speeds [4].
- Substantial reduction in transportation fuel cost after electrification, reaching the 60% range [5].
- Regeneration of electricity as locomotives use dynamic breaking (generates electricity when slowing with engine) that can be sent back to the grid, by as much as 20% [6]. This now generates heat.
- Also, environmental benefits due to refueling facilities could be eliminated or reduced from typical 1 million gallon tank facility.
- Benefit in time to Electric Transmission Companies as a ready-made transmission corridor is available for wind/solar sites to major/minor population areas, and large user new customers.
- Partial reduction in electrification cost to Railroads as they could use portions of transmission towers for electrification. Possible mergers or purchases between large utility companies and railroads because of mutual benefits to each.

- It has been estimated that electrification of a select 35,000 miles of main line US Railroads will reduce fuel imports by 20%, carbon emissions by 40% and an increase of the Gross Domestic Product of the US by 13% per annum. Now consider these numbers when all US, Canadian and Mexican Class 1 Railroads could be electrified when added to reduced trucking and reduction in commercial air travel as well. A reduction in personal travel cost as well would occur [7].
- National Defense. The ability to transport troops and food throughout the United States in the event of fuel embargos.

Russia has already electrified, China, New Zealand and India are in the process. Europe has but their railroad gauges weren't synchronized to become practical throughout Europe.

The main negating factors are the cost to electrify. When weighed with the efficiencies of combined use for electrification/transmission purposes, fresher faster foods, substantial reduction in carbon emissions, reduced fuel imports, faster ability to construct new electric grid, a reduction in the loss of lives as a result of at grade road crossings, fewer trucks on the roads along with national defense, possibly the benefits outweigh the costs. Without question it is expensive to electrify railroads and I don't expect it to derive all power from renewable sources from the first round of electrification. Some will come from renewable sources while others might tap into existing transmission lines crossing Railroads from other sources, still more efficient when compared to diesel.

With everything considered, maybe it time for the US and the rest of North America as well.

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