Feasibility of Using Renewable Energy Technology to Power the NJ TRANSITGRID TRACTION POWER SYSTEM Microgrid

NJ Transit has stated it needs to build a 140 MW power plant in order to fully power selected train lines during a commercial power outage. Working with the US DOE and the NJ BPU It engaged Sandia Laboratories to do a feasibility analysis of this project in 2014. Sandia recommended the use of natural gas turbines to produce this power. Neither Sandia nor New Jersey Transit has ever produced evidence that they conducted a serious analysis of the use of any renewable technologies for this purpose.

The Don't Gas the Meadowlands Coalition has been working with two experts in renewable energy, Lyle Rawlings, CEO of Advanced Solar Products (who is also one of the nation's leading professionals in the field of solar energy) and Paul DiMaggio, CEO of GMax Tidal Energy. Both have stated that their renewable energy technologies could meet NJT's power requirements. Mr. DiMaggio has produced a proposal demonstrating how his tidal energy system, located adjacent to the planned NJT power plant site on the Hackensack River could produce the necessary power.[1] Mr. Rawlings, while not producing a full proposal, has investigated NJ Transit's overall need for power as well as potential locations for solar panels (with the support of Tim Sevener of our coalition who has studied the solar potential of hundreds of properties owned by NJT) and the issues of using solar and energy storage to accelerate trains, and has stated that solar and storage is a feasible solution. However, Mr. Rawlings pointed out that a solar/storage solution by itself may still require a significantly smaller amount of temporary, gas powered baseload generation due to sunlight variability. (The main obstacle to obtaining a full proposal from Mr. Rawlings has been NJT's refusal to provide detailed power requirements for each train line and details of power needed over very short time intervals to accelerate trains).

The combination of tidal and solar power could be an even more effective solution than either one separately as tidal produces a very steady baseload (eliminating the need for any type of fossil fuel baseload generation), while solar offers an opportunity to locate power sources in many locations adjacent to the train routes which is potentially more cost effective than a single tidal power station.

While we do not have a complete proposal utilizing these technologies, our experts have indicated that this is just a matter of engineering, based on obtaining detailed specifications from NJT. Our work with these two experts has also enabled us to address NJT's specific concerns with renewable energy technologies.

<u>Load generation capacity and siting concerns</u>

[1] Available upon request

As stated above, GMax Tidal Energy has tested the tidal currents in the Hackensack River next to the planned power plant site and has found they are sufficient to generate the 140MW of power needed. By utilizing an “energy by water storage tank” approach to store excess tidal energy and release it during low flow periods, this power requirement would be completely reliable 24x7.

Solar panels could also provide the required 140 MW of power. Based on studies of existing NJT properties as well as nearby lagoons[2] (solar panels float and still water ponds are excellent sites) there is sufficient space (at 2.5 acres per MW of usable area) to produce the total amount of power. NJ Transit has disputed this by claiming that some of its property is registered as historical sites, but this does not automatically exclude these sites from supporting solar panels and areas such as parking lots and equipment garages are not registered. The Koppers Coke site, planned for the gas plant, has 130 acres, which could provide up to 40 MW by itself. Other NJT sites include the Meadowlands Maintenance Complex shed roofs, PRR Rail yard, Hoboken Ferry roofs, Secaucus Transfer station, roof of Penn Station Newark and many others. This does not include the potential for solar panels to be placed directly above the tracks or adjacent to the tracks or even on the sleepers between the tracks (an approach being used in Europe). One mile of track can support enough solar panels to produce 1 to 3 MW of power. With 100 miles of track plus other buildings and infrastructure used as solar panel platforms. NJ Transit could easily produce this amount of energy from solar power.

Meeting rapidly fluctuating loads

Powering trains is not like powering a house. Accelerating trains from a dead stop requires a great deal of power over a very short period of time. An intermittent source of energy such as solar requires energy storage to support this. One problem with lithium battery storage is that repeated rapid discharging shortens battery life so lithium batteries alone are not effective long-term solutions to this problem. Other storage technologies such as flywheels and supercapacitors can be charged and discharged without the degradation of lithium batteries. (NJ Transit has stated its intention to incorporate flywheels for this application even with its gas-powered plant). Other potential efforts that can contribute solutions (in part or whole) to this problem include use of firm baseload tidal power for acceleration, stationary regenerative braking and storage (as SEPTA does in Philadelphia), staggering train start/acceleration periods, coordinating the times of accelerating trains with the times of decelerating trains, using slower acceleration rates and other timing optimization schemes.

NJ Transit also identified the need for very rapid availability of power and implied this may not be available with renewable energy solutions. The Tesla Powerpack has a response time of less

[2] Next to the Koppers Coke site is the long shutdown polluted Standard Chlorine Site, which has several lagoons for waste containment and could potentially contribute 10 MW.

than 100 milliseconds, and is used in South Australia to provide the same grid services as peaker plants (although both faster and cheaper) which NJ Transit uses today.

Another issue raised by NJ Transit is the need for very clean energy with very precise power output frequency. Frequency issues often arise from using only a single turbine (combining the power of many turbines evens out frequency variations). Batteries have extremely stable power frequency and can be an asset in meeting this need.

Overall, this is an engineering exercise, not an insurmountable technical issue.

Guaranteed reliability of the power source

This issue is addressed above. Solar power and battery storage alone are not enough to meet this need, but can be augmented by much smaller gas-powered turbines which would only be used infrequently, or by a combination of solar and tidal power. These solutions are technically and commercially available. Designing the optimal mix of power sources is an engineering exercise, not an insurmountable technical issue.

Cost

The cost advantage for solar and storage power systems over gas-fired systems have improved markedly since 2014.

According to Greentech Media, energy industry analysts at Wood Mackenzie say the combination of renewables with battery systems can currently replace approximately two-thirds of U.S. natural gas turbines — right now. Estimates predict the cost of storage alone could drop 80 percent by 2040.[3]

A September 2019 article on Utility Dive stated:[4] If all proposed [U.S.] gas plants are built, 70% of those investments will be rendered uneconomic by **2035**, according to the Rocky Mountain Institute. Clean energy portfolios, defined as an optimized combination of wind, solar, storage and demand-side management, are cheaper than **90%** of the 88 gas-fired projects proposed across the U.S., according to **RMI.** (See RMI charts in appendix). A two page summary of the RMI report can be downloaded at https://rmi.org/wp-content/uploads/2019/09/clean-energy-portfolio-two-pager.pdf.

The full RMI report can be downloaded at https://rmi.org/insight/clean-energy-portfolios-pipelines-and-plants

[3] https://www.desmogblog.com/2019/02/22/inevitable-death-natural-gas-bridge-fuel-renewables
[4]https://www.utilitydive.com/news/renewables-storage-poised-to-undercut-natural-gas-prices-increase-strande/562674/

While the NJ TRANSITGRID TRACTION POWER SYSTEM is more complex than just a power station, the current costs of renewable energy technologies are already competitive with gas technology and promise to be even more competitive over time.

CONCLUSION

NJ Transit's objective, to build a power system that will run electric trains for two weeks without any commercial power, is a high bar as this has never been accomplished and our coalition supports this goal. However, NJ Transit has never thoroughly investigated renewable power technologies and is using outdated (and false) assumptions to avoid dealing with this issue. The obstacle to using renewable energy for this project is NJ Transit's unwillingness to perform the analysis and engineering work needed to prove its feasibility.

In order to fight climate change, protect public health, and achieve the aggressive renewable energy and storage goals in his energy master plan, Governor Murphy must order NJ TRANSIT to halt all work on the proposed 140MW full time gas fired power plant, and engage community stakeholders and renewable energy experts in an accurate, complete and timely assessment of renewable energy and storage solutions for the NJ TRANSITGRID project.

APPENDIX

From the Rocky Mountain Institute "The Financial Risks of the 'Rush to Gas' in the US Power Sector."

EXHIBIT 1 2019 represents a tipping point for CEP economics versus new gas-fired power plants

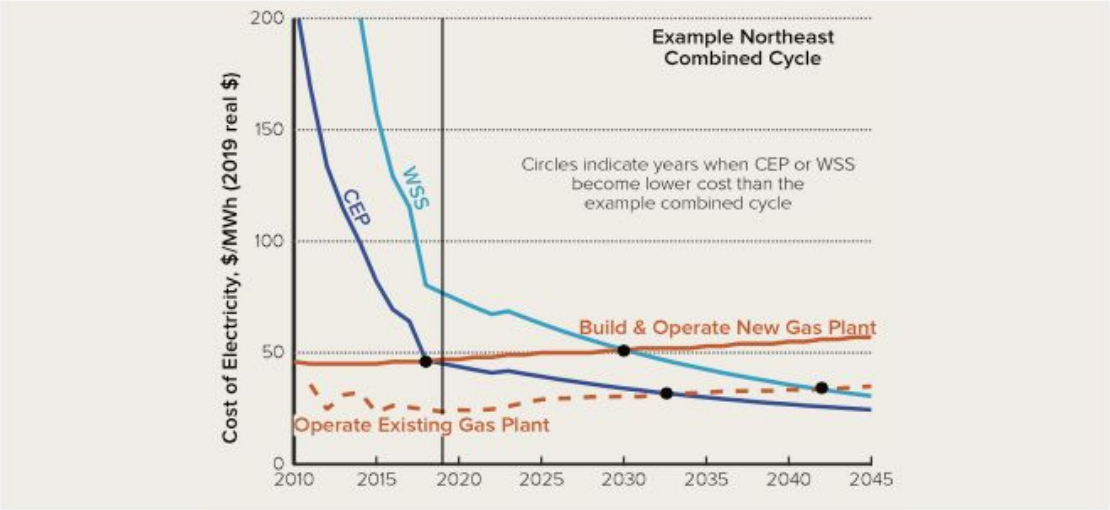

EXHIBIT 2 Percent of proposed combined-cycle gas plants that, if built, will face stranded cost risk