Much of the sales pitch for the Big Run Pump Storage Project has been based on a specious claim that it is "green." For example, FreedomWorks claims in its FERC filing (FERC P14889-000 Revised.PDF, 10/15/2018) that the project will (emphasis added):

- "[F]ulfill the public interest for a less expensive, more reliable, and evironmentally sound *source of renewable energy*" (p.7)
- "Through the development of the proposed Big Run Pump Storage Hydro Project, the applicant will provide an *additional* source of *clean, renewable energy*" (p.10)

Far from being a source of energy, however, the Big Run PSH project would be a major net consumer of energy.[1] Assuming 3600 GWh of annual output, the Big Run PSH project would consume about 900 GWh more electrical energy per year than it produces. In other words, the project as proposed would consume about the same amount of electrical energy per year as **87,000 average American homes**.[2] Although the facility would produce valuable energy storage and ancillary services in support of the utility grid, it would not be a source of clean, renewable, or any other kind of energy.

In public presentations (e.g., to the Tucker County Commission November 19, 2018) FreedomWorks further presses its claims that the Big Run PSH would produce 100% renewable energy, or "100% RE." Since it would not be a *source* of energy, though, the project could not claim be a source of *renewable* energy. So what could the "100% RE" claim possibly mean? Again referring to FreedomWorks' filing at FERC, apparently the "100% RE" claim means that Big Run PSH would be a customer and facilitator of *actual* renewable energy sources.

- "Providing a means to store excess energy especially from intermittent renewable sources such as the Mountaineer, NedPower and New Creek Wind Farms at times when demandis low and large thermal plants cannot shed load." (FreedomWorks' FERC filing, p.7)

There is a germ of truth to the developer's claim. It is well known that utility-scale solar and wind power plants have recently become competitive in cost with traditional fossil fuel sources. Still, renewable power resources are at a disadvantage to fossil fuel sources because of renewables' "intermittency." Intermittency means simply that wind power increases and decreases with wind speed and solar power is available only when the sun shines, so power generation from these renewable resources cannot be coordinated with demand. In contrast, system controllers can (within limits) manipulate the output from fossil-fueled power plants as needed. Electricity storage solves the intermittency problem by allowing a time lag between production and consumption, but at high cost. Pumped storage hydropower is currently the least costly method for storing electrical energy, so it can be a useful tool in integrating renewable resources into the utility's overall system.

It's wrong to conclude, though, that electricity storage at Big Run would primarily benefit wind and solar at the expense of fossil-fueled generators. Storage facilities such as Big Run PSH prolong the physical and economic life of the existing fleet of fossil-fired baseload plants by increasing the price of off-peak power and reducing the stress on generation hardware caused by cycling generators up and down to follow load. Storage of electrical energy also can improve

---

[1] Efficiency varies with engineering factors, but in general modern pumped-storage facilities are about 80% efficient, meaning that they consume about 25% more energy than they produce. See, for example, Yang, Chi-Jen, "Pumped Hydroelectric Storage" in Letcher, T.M. *Storing Energy* (2016) Elsevier, p. 25.

[2] This estimate is based on assumed production of 3600 GWh of electrical energy per year (mentioned in the developer's 11/18/18 presentation), and 80% efficiency. Production might increase to 4380 GWh (increasing the project's net consumption of electrical energy), or efficiency might be a little higher (reducing its net consumption). Average annual American household electrical energy use of 10,399 kWh was obtained from EIA (https://www.eia.gov/tools/faqs/faq.php?id=97&t=3) on January 29, 2019.

system stability and help avoid blackouts and brownouts, helping to assure that baseload power plants connected to the grid are able to function continuously. Therefore, the presence of adequate storage on the grid increases the value of nearly all generation assets, not just renewable generation assets.[3]

In his public presentations the Big Run PSH promoter attempts to support his claim of "100% RE" by saying that the facility would purchase its energy from wind generators using power purchase agreements (PPAs). This is misleading because energy taken off the grid is not traceable to specific generators – energy from all sources is mixed indistinguishably on the grid, so there's no *physical* sense in which the energy stored within the PSH project would be "100% RE." Financially, the Big Run PSH could make 100% of its *payments* to renewable sources if it eventually decides to purchase its energy through PPAs with wind farms, but there's no guarantee that the PSH plant will decide to use PPAs, or that it won't sign a PPA with a producer generating energy from fossil sources. Wholesale power markets are difficult to predict, and the operators of Big Run PSH would no doubt purchase their power from whatever source is most profitable for the shareholders.

The proposed Big Run PSH would have substantial negative environmental impacts on fisheries, forestry, wildlife, water resources, and scenic values, as is extensively documented by filings by the US Forest Service, the WV Division of Natural Resources, Friends of the Cheat, and other intervenors in this case. I will not address these impacts here, but will note that they exist and that they further undermine the claim by its promoters that the Big Run PSH Project is "green."

It's important to realize that there are storage alternatives to PSH that can promote integration of wind and solar just as well as the proposed Big Run PSH Project, but with greater flexibility and substantially less impact on the local environment. For example, utility-scale battery technology has advanced rapidly in recent years, has become increasingly cost-competitive with PSH, and has been implemented by utilities and independent power producers in West Virginia and nationwide.[4] According to the EIA, 39% of the 708 MW of large-scale battery storage capacity existing in 2017 was located in the PJM market that serves West Virginia. For example, the 32-MW AES Laurel Mountain Lithium-ion battery facility is located in Elkins, WV, and the 31.5 MW Beech Ridge Project is located in Rupert, WV. Batteries present less financial risk than PSH because they can be deployed anywhere, and in smaller increments. They have a lower impact on the local environment because they take up little land area, do not use significant water resources, and can be located out of sight. According to Bloomberg New Energy Finance, capital costs of batteries have been plummeting in recent years, and are expected to fall another 50% by 2030, which would make them cost-competitive with PSH.[5]

The Big Run PSH promoter's claims that the project is "100% RE" and "an additional source of clean, renewable energy" have little or no substance. It would be a significant net consumer rather than a producer of electric power. Although the project would promote the stability of the utility grid and the integration of intermittent renewable resources, it is not the only technology that can do so. It would also likely prolong the life of fossil-fueled power plants, and it would have significant and negative environmental impacts on Tucker County.

---

[3] Storage decreases the value of generation assets used to serve peak loads, such as gas-fired combustion turbines and diesel generators.

[4] See, for example, "U.S. Battery Storage Market Trends," Energy Information Administration, May 2018. Downloaded at https://www.eia.gov/analysis/studies/electricity/batterystorage/pdf/battery_storage.pdf on January 31, 2019. See also Bloomberg New Energy Finance slides of July 5, 2017, downloaded from https://data.bloomberglp.com/bnef/sites/14/2017/07/BNEF-Lithium-ion-battery-costs-and-market.pdf

[5] For coverage of the widely-quoted November 2018 Bloomberg NEF study on the electricity storage market see, for example, this November 9, 2018 article in Forbes magazine.

Author's Background:

Stratford Douglas is Associate Professor Emeritus of Economics at West Virginia University's Chambers College of Business & Economics. His specializations include energy economics, particularly the economics of electric energy markets, and econometrics. His refereed publications on electricity and energy market topics have appeared in *The Energy Journal*, *Energy Economics*, *Journal of Regional Science*, and the Federal Reserve Bank of St. Louis *Review*. His electricity market research and service has been funded by the US Department of Energy, NETL, the National Research Center for Coal and Energy, and the West Virginia Governor's Office. Prior to his service on the faculty at WVU he served for three years as a staff economist in the Federal Energy Regulatory Commission's Office of Economic Policy. He earned both a BA in History and a PhD in Economics from the University of North Carolina at Chapel Hill.