A Comparison of Existing Nuclear with Wind and Solar Energy

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If New York is serious about achieving carbon-free electricity as electricity demand doubles, it must invest in reliable and resilient nuclear power that is made in America, instead of focusing on wasteful, unreliable, fragile, costly and ecologically destructive wind and solar. Energy decision makers must start considering the viability and costs associated with various energy options rather than dictating solutions without first understanding their long term consequences. The information below is a comparison of existing wind and solar electrical generation to nuclear using the recently completed Vogtle nuclear plant in Georgia with the third largest wind farm in the world, the Alta Wind Energy Center in California, the Shepherds Flat Wind Farm in Oregon and the Solar Star Projects, Solar Star 1 and 2 in California. The data used is available from multiple online sites and links have been included.

The Vogtle nuclear plant has a capacity of 4,436 MW with a capacity factor of 91.25% which produces a net average of 4,139 MW. The construction cost was $34 billion with land usage of 3,100 acres. Existing nuclear technology has provided safe and effective energy for over 60 years and now Vogtle is the first nuclear reactor to be built in the United States in 40 years using new technology, with cost expected to drop for future construction.
Nucle(https://en.wikipedia.org/wiki/Vogtle_Electric_Generating_Plant)

The Alta wind farm contains 600 turbines, has a capacity of 1,550 MW with a capacity factor of 23.5% which produces a net average of 364 MW. The construction cost was $2.88 billion with land usage of 32,123 acres. (recently completed Vogtle nuclear plant in Georgia.
(https://en.wikipedia.org/wiki/Alta_Wind_Energy_Center)

To compare these two electrical generation options, we can equalize the energy outputs by scaling up the Alta wind farm net average output to equal that of the Vogtle nuclear plant, which turns out to be a factor of 11.36. This would require an increase in the number of turbines from 600 to 6,818, with a cost increase from $2.88 billion to $32.67 billion. Constructing the additional turbines using the same turbine/land density, the land used would soar to 365,025 acres. Because of the irregular and somewhat unpredictable nature of wind, there is a requirement for energy storage, batteries, cost not included in this example, a lot of them to spread the energy over time to equal the desired constant 4,436 MW produced by the Vogtle example which delivers consistent and predictable power without the need of energy storage. Whatever storage technology is used, it will be limited by the amount of time until the stored energy runs out and needs to be recharged, which will make the wind based system unreliable. We can hope that the wind doesn't stop blowing for very long, but most people would not consider hope to be a reliable strategy.

Next, lifecycles have to be considered. The Vogtle plant lifespan is 80 years, while a wind turbine lifespan is only 20 years. The original 6,818 turbines will have to be replaced 3 times over the 80 year lifespan of the single Vogle nuclear plant. Assuming 4 times the original $32.67 billion cost of the wind farm, the 80 year cost now rises to $131 billion. Almost 4 times the cost of the Vogtle nuclear plant, which was $34 billion. This example demonstrates the incredible amount of wind infrastructure, cost and wasted land resources it would take for wind turbines to equal just one nuclear plant. The task of replacing turbines would become never ending. This one example would

require replacement of the 6,818 turbines over 20 years, or 340 replacements per year, forever. Imagine the replacement schedule and the disposal of materials going to landfills required to power the state or the entire nation with wind.

Another large wind farm that can be considered is the Shepherds Flat Wind Farm in Oregon which has capacity of 845 MW with a capacity factor of 22.7% which produces a net average of 192 MW produced by 338 turbines. The construction cost was $1.9 billion, with land usage of 11,769 acres. Scaling up this wind farm by a factor of 21.58 to equal the energy output of Vogtle would result in 7,294 turbines with land usage of 253,975 acres. The construction cost would increase to $41 billion with an 80 year cost of $164 billion. These figures closely align with the Alta example. (https://en.wikipedia.org/wiki/Shepherds_Flat_Wind_Farm)

Looking at solar, the Solar Star Projects, Solar Star 1 and 2 in California with a capacity of 579 MW with a capacity factor of 32.8% which produces a net average of 435 MW. Solar Star cost $2.5 billion and uses 32,000 acres. Scaling up this solar farm by a factor of 9.51 to equal the energy output of Vogtle would result in the cost rising to $19 billion and land usage of 304,320 acres. The lifespan of the project is 25 years with the output dropping to 87% of the original as the panels age. The 80 year replacement cost would be $60 billion. (https://en.wikipedia.org/wiki/Solar_Star), (https://us.sunpower.com/sites/default/files/media-library/case-studies/cs-solar-star-projects-fact-sheet.pdf)

Considering the resource burden associated with unreliable wind and solar, along with an estimated 80% of wind and solar components being purchased from America's top adversary, China and its human rights issues, when reliable US made nuclear alternatives are available, the question has to be: Why would we even be considering wind and solar at all?

Recently in the news Google and Microsoft are preparing to secure their data center power requirements by either building their own nuclear plants or contracting with nuclear plant owners. Data centers have very large data processing and data storage equipment that cannot be subjected to power outages. These companies know that they cannot risk their businesses on the government's expectations that renewable energy will actually work. They see the future power grid uncertainties resulting from government mandates rather than sound engineering processes and are taking steps now to safeguard their interests. The government should be following their lead and start focusing on nuclear power development.

Conclusion:

Based on these wind and solar examples, to match the electrical energy produced by nuclear powered generators:

- Solar and wind will take about 100 times the land usage than nuclear
- The long-term construction cost of wind energy is about 4 times that of nuclear
- The long-term construction cost of solar energy is about 2 times that of nuclear
- Current wind and solar construction along with future replacement due to attrition perpetuates an increasing dependency on China
- These cost comparisons should become even more favorable toward nuclear with future construction becoming more efficient

- Additional financing and land usage will be required to build energy storage facilities to support wind and solar intermittent energy production
- The 20-25 year lifespan of wind and solar will create massive recycling and landfill challenges

Based on this comparison of a nuclear power plant with the required wind turbines or solar panels using actual power, capacity, land usage and cost data, it should be apparent that wind and solar do not offer a realistic path to achieving a reliable, cost effective, sufficient and maintainable clean energy goal. If New York is serious about achieving carbon-free electricity as electricity demand doubles, it needs to abandon its unrealistic and short sighted plan that is gambling taxpayer dollars that wind and solar will be able to meet present and future demands. Wind and solar have been attempted and compared to nuclear, they have proven to be a mistake. New York needs to stop investing in wasteful, expensive, unreliable, fragile, and ecologically destructive wind and solar and start investing in reliable and resilient nuclear power that is made in America.