Non-Wire Alternatives Meet Energy Efficiency

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ABSTRACT

The existing electric grid we have today closely resembles the one our grandparents used, as it has remained unchanged since its initial construction. We are all familiar with the sight of electric wires stretching across towers and poles for miles. However, can we anticipate a time when these wires will become obsolete? Although that day is still distant, the direction we are heading suggests a future with fewer wires within our lifetime.

Introduction

The concept of Non-Wires Alternatives (NWA) is exactly as it sounds. The notion begs the question of the alternatives to wired electric towers, transmission and distribution lines, substations, and all the equipment that comes with building and maintaining these structures. What if utilities could defer some or all the future construction of these structures? The first NWA projects were implemented in the late 1980s-90s. It is important to understand some of the reasoning as to why a utility would choose a non-wires alternative. The biggest reason is that they have no choice in the matter. Certainly, how our electric grid has been created and maintained still works for most electric utilities seeking rate-payer funding for large, multi-million-dollar infrastructure investments like new substations. The top reason for this is decarbonization.

Today, several states are requiring that non-wires alternatives be considered prior to any new requests to fund major wired infrastructure projects. States like New York, California, Minnesota, Vermont, Massachusetts, Rhode Island, and the District of Columbia all have some NWA requirements. New York and California have mandates for NWA's with over 70% of the projects in those two states alone. In 2020, there were over three hundred non-wires alternative projects in some stage of development across several states, but only 16% of all projects were implemented. This tells us that although there is a desire for non-wires alternatives, there are still barriers to them coming to fruition. Those barriers are identified after NWA's are further defined below.

Defining Non-Wire Alternatives

The definition of a Non-Wire Alternative (NWA) refers to an alternative solution or approach that serves as a substitute for traditional wired infrastructure. NWAs aim to address the challenges and requirements typically met by wired electric towers, transmission and distribution lines, substations, and associated equipment. NWAs entail innovative alternatives such as Distributed Energy Resources (DERs) like solar power, battery storage, geothermal energy, or microgrids. These alternatives enable the distribution of electricity to homes and businesses in a decentralized manner. Additionally, NWAs can encompass demand-side management programs

designed to alleviate system constraints or enhance energy efficiency. The goal of NWAs is to provide efficient, sustainable, and cost-effective solutions while minimizing environmental impact.

Barriers to Entry

The NWA market is plagued by high barriers to entry. The number one barrier is cost-effectiveness. Given that the grid has remained unchanged for a century, traditional models that offer reasonable cost-benefit have been the standard. The "benefit" primarily pertains to the advantage for ratepayers. In many cases, NWAs incur prohibitive costs for limited coverage. In many cases, NWAs entail excessive costs for limited coverage. DERs (Distributed Energy Resources) constitute most NWA projects, with solar energy serving as the archetypal representation of DERs. For instance, the scenario of a utility-grade solar farm supplying energy to a residential community is an example. If a substation were built instead, it could potentially power not only that community but also the regional area, including businesses and public works. To achieve a similar reach, acres of land would be required for the solar farm. Furthermore, the footprint of a solar farm can be considerably larger than that of a substation, not to mention the availability and cost of land acquisition. These factors contribute to the escalation of NWA DER prices to a level that can outweigh its societal benefits. Despite the challenges, the desire for NWA’s is stronger than ever. New and innovative ways to distribute and transmit energy will continue to be sought by the nation's utilities at the behest of states. Regulators are passing legislation to reduce GHG emissions through the electrification of cars, roads, homes, and businesses. The rise of exciting recent technologies like battery storage and fuel cells are finally coming down in cost.

Constraints

A constraint is a limitation or restriction that hampers the utility's ability to efficiently generate, transmit, distribute, or manage electrical power. Such constraints can come from multiple factors, including failing infrastructure, capacity limitations, regulatory obligations, resource scarcity, technological restrictions, or major changes in demand patterns. These constraints present challenges for utilities in reliably, efficiently, and sustainably meeting the electricity requirements of their customers. Recognizing and addressing these constraints is important for utilities to ensure reliability of the grid. The correlation between utility constraints and NWA's (Non-Wires Alternatives) becomes apparent. NWAs are always contemplated by electrical utilities when faced with constraints that render substation upgrades or other conventional solutions unfeasible or prohibited by local or state regulations. Washington, DC serves as an example of a location where regulations discourage its electrical utility, Pepco, from building new substations.

"Power Path DC" is an initiative led by the DC Public Service Commission (DCPSC) with the objective of supporting, managing, and expanding Distributed Energy Resources (DERs) in Washington, DC. In 2015, Washington, DC issued Order No. 17912, which aimed to identify and promote the development and implementation of DERs within the District. Presently, DC has enacted additional legislation under the umbrella of Power Path DC.

Chairman Willie L. Phillips expressed, "By aligning “Power Path DC” with the District's clean energy goals, we take another important step towards achieving our strategic vision of a customer-focused, clean, and renewable energy grid for the District” (Phillips 2015).

In 2020, an RFI for proposed NWA solutions was released by Pepco. The criteria included meeting technical requirements and aligning with DC's Power Path Guiding Principles, which encompassed values such as safety, reliability, affordability, and sustainability.

The photo below is from the 2020 Pepco RFI and details the areas of constraint.

Figure 1. Ward 6 Constraint Map, 2020 *Source*: Pepco 2020

B. Type of Constraint – A description of the system needs to be addressed, such as a new substation or feeder heavy-up. The total load on the substation firm capacity of the existing 4 transformers is due to the significant load growth in the area and planned load transfers.

C. Total Size and % Summer Overload – MW/MWH and % over capacity in the summer of forecasted constraint. The substation will be 95% percent loaded, or within 5% of exceeding the substation firm capacity. The existing firm capacity is 216 MVA, and the projected total load on Substation will be 206.2 MVA.

D. Year Forecasted – Year violation of system planning criteria is expected to occur. 2026.

The constraint was identified over six years in advance, with the scheduled occurrence set for 2026. Hence, the NWA needed to be identified and implemented before 2026 to effectively mitigate the constraint. NWAs were considered to avoid the development of a new substation or feeder heavy up as expressed in Section B above.

Evaluation

The evaluation of available renewable resources, including battery, CHP, and solar, was conducted. Significant efforts were made to address challenges related to technology selection and land scarcity. Meetings were held with landowners, building owners, and other DC landowners. It proved to be a challenging task. It was concluded that NWAs did not meet all the criteria, such as fully addressing the constraint and being affordable for ratepayers. As mentioned earlier, approximately 16% of all NWA projects are executed, with Pepco's RFI serving as an example of an NWA that could not be initiated. These challenges persist across NWA projects. Enhancing the percentage of NWA implementation in the United States is crucial to address deficiencies in our grid infrastructure.

NWA's Meet Energy Efficiency

Energy Efficiency (EE) has far less barriers to implementation than NWA's. The United States has a wide range of energy efficiency programs at various levels, including federal, state, and local programs, as well as those implemented by utility companies. These programs aim to promote energy conservation, reduce energy consumption, and improve overall energy efficiency across different sectors such as residential, commercial, and industrial. There are thousands of EE programs active today. In contrast to NWA projects, EE initiatives have high completion rates and significantly better cost-effectiveness ratios. Traditionally NWAs are renewable energy assets which have significant challenges to initiate and execute. Why is EE not part of the solution?

Pepco's 2020 RFI could have benefited from an energy efficiency (EE) solution due to the infeasibility of the NWA approach. The areas of constraint were in Southwest/Southeast Ward 6 in Washington, DC. By applying the principles of EE program design, the focus of energy efficiency efforts could be directed towards Ward 6. The objective would be to reduce overall energy consumption in Ward 6, thereby delaying or completely resolving the predicted constraint. EE Programs require significantly less design and implementation time compared to NWA projects. The proposed EE Program would target a radius of 2-3 miles surrounding the constrained areas in Ward 6, with the aim of conducting deep energy efficiency retrofits and/or incorporating renewable energy measures for the buildings within that region. Incentives in the form of cash payments, like Pepco's existing Commercial & Industrial Energy Savings Programs, would be offered to encourage building owners and managers to undertake these projects. In fact, there is another piece of DCPSC regulation which would support this approach.

The program is BEPS, Building Energy Performance Standards. BEPs requires buildings in Washington, DC, over 10,000 square feet, to be benchmarked using Energy Star Portfolio Manager (EPM). Therefore, BEPs data could inform Pepco as to the current energy performance of buildings in Ward 6 and allow the utility to specifically target outreach to buildings on the lower end of the score. The proposed Energy Efficiency Program could perform direct outreach

to buildings with EPM scores of >75, focusing on energy efficiency upgrades and building performance. Buildings on the lowest end of the spectrum could additionally benefit from deep HVAC retrofits and electrification solutions. Incentives can be aligned to the increase in EPM score for building performance, energy efficiency upgrades, retrofits, and renewable energy. It would also be advantageous to prolong savings by providing a separate incentive encouraging continuous energy improvements for several years after the initial projects. This comprehensive approach could lead to long-term energy savings and new DER projects while delaying or alleviating constraints with a significantly higher rate of return in energy savings, higher chance of success in avoidance of constraints and adherence to DC Power Path for a lower cost than traditional NWA's. If this concept was considered as an NWA, it would boost the overall implementation rates of NWAs across the country.

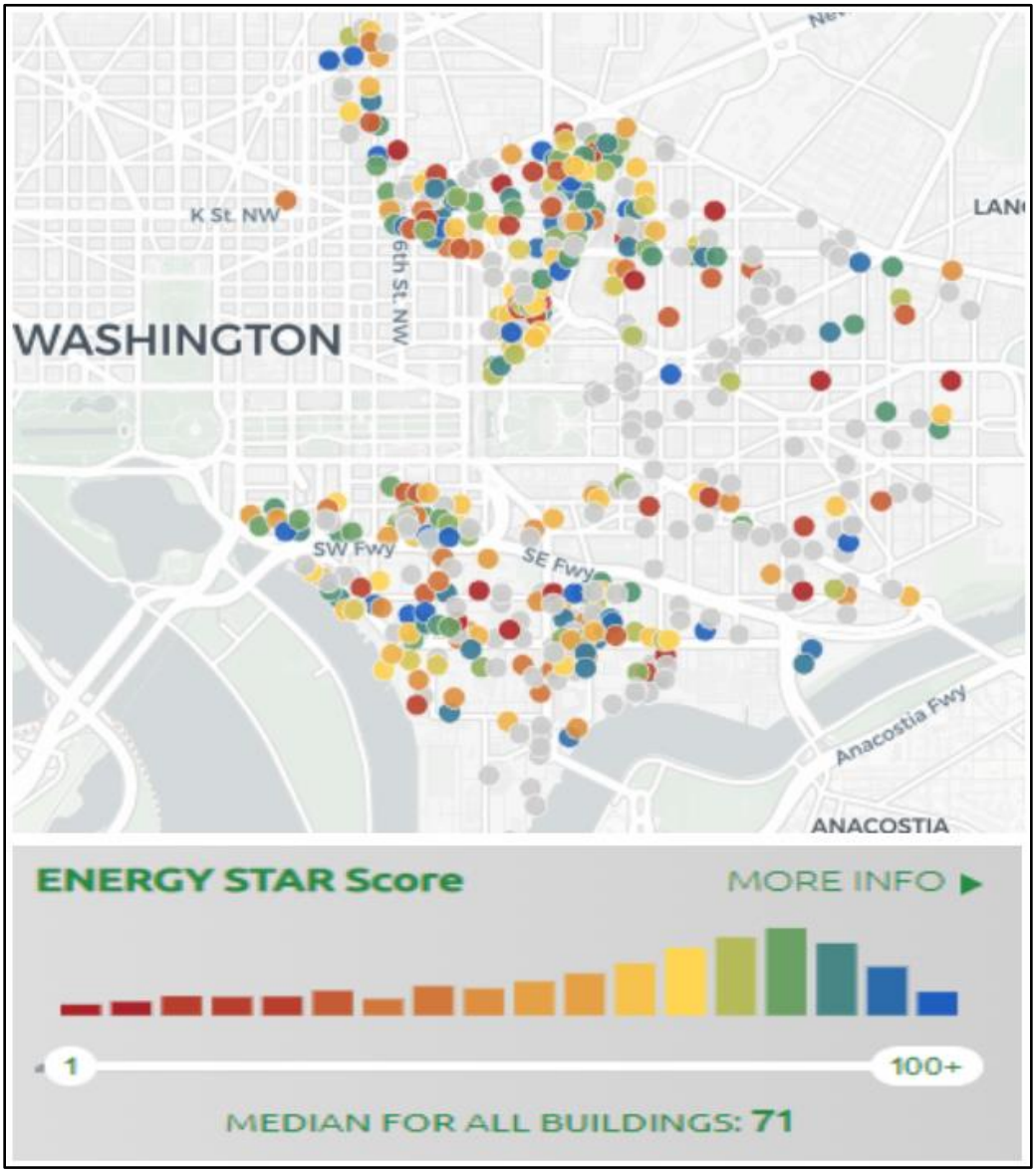

Figure 2. Example of the Proposed Design of the EE Program *Source*: Pepco 2020

In this layer, we can see the Load Serving Capacity, with yellow and red indicating a problem area and BEPS program ratings of buildings that have potential for energy efficiency improvements.

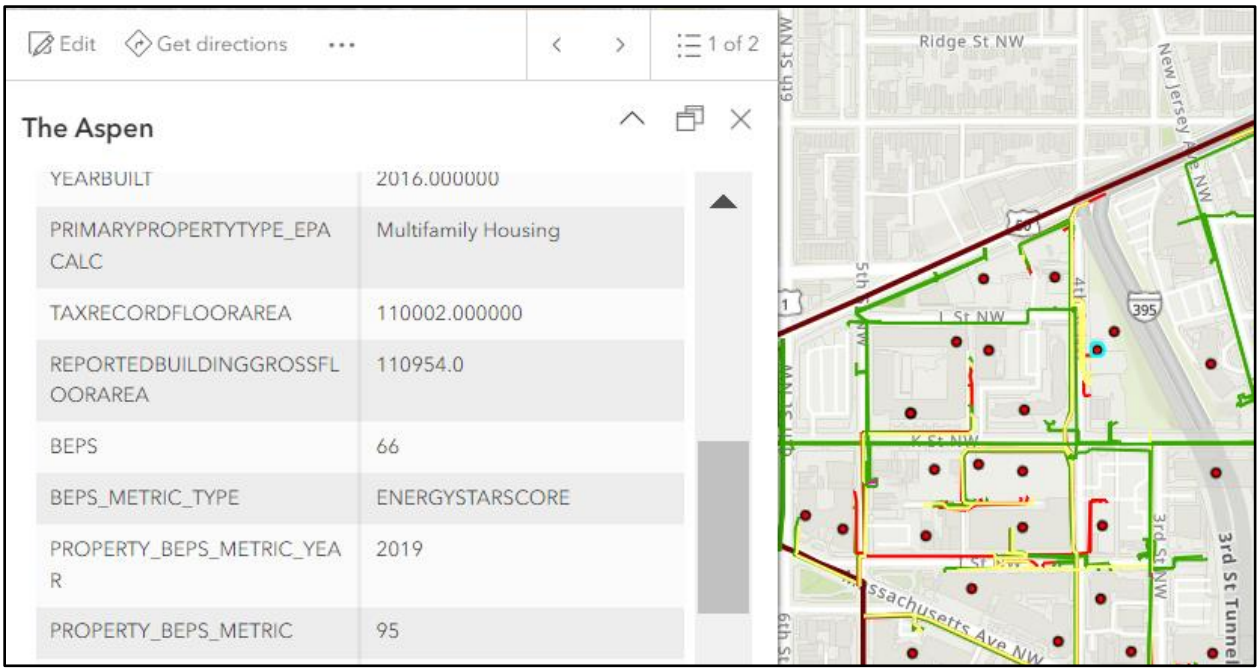

Figure 3: Example 2. *Source*: Pepco 2020

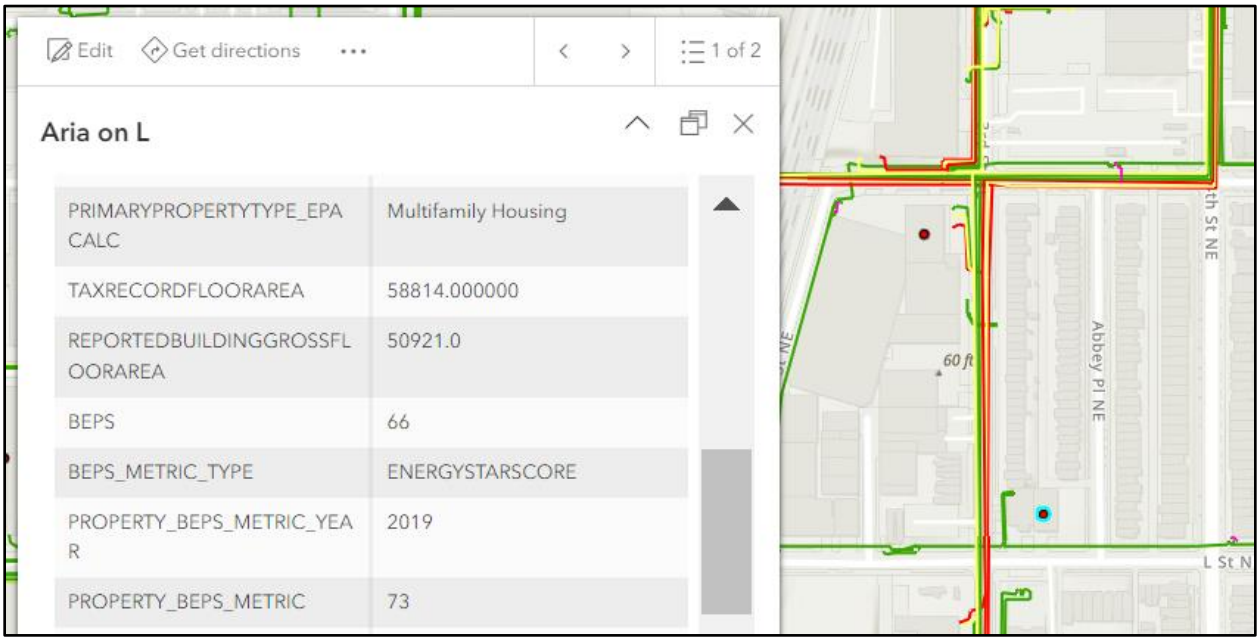

Figure 4: A targeted EE program addressing the rating of specific buildings in the overloaded lines makes sense as a primary component of the NWA solution. *Source*: Pepco 2020

Conclusion

Non-Wires Alternatives encompass a wide range of solutions, including DERs (renewable energy), but it should also consider energy efficiency as a solution. NWA barriers such as access to private land and prohibitive cost of equipment pose persistent obstacles to the advancement of NWA's. Targeted Micro Energy Efficiency Programs tailored to address constrained areas can emerge as a compelling, cost-effective alternative to alleviate constraints and yield enduring benefits.

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