

A PROPOSED MICRO GRID FOR THE WEST WINDSOR TOWNSHIP MUNICIPAL COMPLEX

We all depend on electricity

Our country is powered by electricity, generated by various means, and distributed to users via the nation's electrical power grid. When portions of that electrical grid shut down, as a result of storms, equipment failures, etc., businesses and households can face major and costly disruptions. These outages can be even more serious for critical government services and emergency responders. While electrical grid managers work tirelessly to prevent outages, and to restore power as quickly as possible after outages occur, outages will happen.

Super Storm Sandy brought lots of rain, but also precipitated action

The trauma inflicted by Super Storm Sandy prompted New Jersey to adopt a program to increase the resiliency of municipal governments, that is, their ability to function safely and effectively in the face of challenging conditions created by extreme weather events such as hurricanes, tornadoes, floods, blizzards, and ice storms. Such resiliency is equally important in the face of other non-weather related events, such as earthquakes, massive electrical black outs, explosions, train derailments or terrorist attacks on infrastructure.

Back-up power systems.....and Micro Grids.....Keys to Resiliency

A key feature in any back-up power application is technology which permits a specific location to disconnect from the larger electrical grid and switch to a locally generated (or stored) power source. In short, technology that allows the location to act as a micro grid. Some homeowners have installed backup power generators to ensure that their homes have power during grid outages. Such residences become their own micro grids during outage periods. Larger locations supporting critical functions—such as hospitals, police departments, air traffic control towers, etc.—are almost always designed with micro grids and equipped with back-up power generators to keep them operating through grid outage emergencies.

Days after Hurricane Sandy struck some locations that were relying on diesel powered back-up generators eventually ran out of fuel and were unable to provide back-up electric power. In some cases, suppliers had no electricity and were thus unable to pump diesel fuel into delivery trucks. In other cases, delivery trucks were loaded with fuel, but were prevented from delivering it by flooded roads or fallen trees. The failure of these back-up systems during Sandy underscores the importance of resiliency in the design of back-up power supply systems.

The Solar 4 All Program

Public Service Electric and Gas (PSE&G), working with the Board of Public Utilities (BPU), has sponsored programs to encourage municipalities and organizations throughout NJ to become more resilient. One part of the **Solar 4 All** program offers incentives to pursue "storm hardening and grid resiliency" projects. One portion of this program encourages the adoption by municipalities of resilient micro grids to supply power for critical municipal services during general power grid outages. A particularly attractive approach to resiliency for some municipalities is to couple micro grid technology with battery storage of electrical power generated by solar arrays.

West Windsor is ideally positioned to pursue greater resiliency

Two factors make West Windsor ideally suited to participate in the **Solar 4 All** resiliency incentive program:

1. West Windsor owns a parcel of mostly open land adjacent to the municipal complex that is ideally suited for a solar array.
2. The municipal complex includes, among other things:
 - a. Police Department
 - b. Municipal Court
 - c. Municipal Building
 - d. Fire and Emergency Services Building
 - e. Princeton Junction Fire House
 - f. Senior Center

Thus, the vast majority of services critical to the functioning of West Windsor Township in emergency situations are already clustered in the municipal complex.

Two other factors worth mentioning are:

1. West Windsor Township has been a recognized leader in the adoption of sustainability practices, having twice received the highest level of certification offered under the Sustainable Jersey program.
2. A company started in West Windsor (now based in Lawrenceville), Princeton Power Systems, LLC, (PPS), is a recognized leader in the development of systems that integrate micro grids with battery storage technologies. PPS built and maintains the first off grid micro grid system in 2012 on Alcatraz Island. (Visit the PPS website to learn more: www.princetonpower.com)

What has been done thus far?

At the behest of Mayor Hsueh, preliminary work on the design of a micro grid for the municipal complex was jointly undertaken by the volunteer members of the West Windsor Environmental Commission and PPS. A summary of this preliminary design work was presented to the West Windsor Council on September 26, 2016 at a public work session.

The Council voiced support of the concept, and asked that more details be developed. The Environmental Commission and West Windsor staffs continue to work with PPS to refine a design for a micro grid for the municipal complex, including a solar array and a battery storage system. If a final review of this design by Council is favorable, the design will be submitted to PSE&G for possible implementation under the **Solar 4 All** program. If PSE&G favorably reviews the proposed design, a contract will be executed between West Windsor Township, PSE&G, and PPS to build the system, on West Windsor property leased to PSE&G.

A brief summary of how the proposed arrangement would work

PSE&G would:

- Lease approximately 5 acres of land adjacent to the municipal complex.
- Pay an annual lease payment of approximately \$30,000 per year ^(Note 1) to West Windsor Township.
- Design, install, and maintain a solar array on the leased land.
- Install a small battery storage and operations facility on the leased land.
- Fence the entire area, providing safety and visual screening.
- Interconnect the solar array and storage facility to the larger electric grid.
- Install a micro grid, and all related controls, interconnecting the storage facility and various building in the West Windsor municipal complex.
- Operate the installed equipment, generate power, store power, and deliver power through its grid to its customers. ^(Note 2)
- During periods when the larger electrical grid is experiencing an outage, deliver uninterrupted electrical power from the battery storage unit, the solar array, and/or backup generators, to power critical Township facilities connected to the micro grid. ^(Note 3)
- Install a kiosk or other electronic display in a public area of the municipal complex to permit the public to witness and better understand the functioning of the system. ^(Note 4)

Benefits to West Windsor residents

- **Approximately \$30,000 in annual revenue to West Windsor** from the ground lease. This annual lease payment would be about **100 times the amount the Township currently receives by renting this property for agricultural use.**
- The project would lead to a **savings of approximately \$150,000** in capital expense as well as the recurring expenses for fuel and maintenance, for the purchase of a back-up generator for the Fire and Emergency Services Building. This expenditure would be unnecessary if the micro grid project is built and the building is connected to the micro grid.
- Allow the municipal complex, during outage periods, to function as a place where citizens could charge phones and computers, store temperature sensitive medicines, or refill oxygen tanks.
- Allow the municipal complex to function as a warming center should extended outages occur during frigid weather.
- The comfort of knowing that electric power for critical municipal services is guaranteed by a state-of-the-art electric power back-up system featuring resilient and at least triple back-up protection. ^(Note 5)

Construction and location details

- All above ground components would be located on the field bounded by Everett Drive and Clarksville Road, setback from the streets, as depicted on the Conceptual Layout below.
- The power lines for the micro grid would be run underground.
- The entire solar array would be ground mounted, and fenced.
- The location of the array and storage module would not interfere with, nor prevent the expansion of the community garden off Clarksville Road, nor any future expansion of the municipal complex.
- Given the level ground on the proposed site, and the screening, the solar array would not be visible from any residence in West Windsor, and would be buffered from the roadway.
- There would be no adverse environmental impacts from construction and operation of the system.
- The system would not produce noticeable noise in operation, and would not produce carbon or other pollution. ^(Note 6)
- The ground mount solar array would not meaningfully add impervious coverage to the property, and would not create any runoff problems.
- At the termination of the initial lease period, a renewal could be negotiated.
- Upon any final termination of the lease arrangement the solar array, including mountings, would be removed by PSE&G, along with the battery storage facility and all fencing. Any disturbed areas would be graded and seeded, and the acreage could then be used as the Township saw fit.



Conceptual Layout
(Clarksville Road – bottom right / Everett Drive – top and left)

A win-win for West Windsor

In summary, if this project is brought to fruition, West Windsor will receive an attractive annual income stream, and receive the resiliency benefits of hosting a state-of-the-art micro grid interconnecting municipal complex facilities. The solar powered battery storage system would ensure uninterrupted electrical power for critical municipal functions during emergencies and would provide citizen protection in a variety of ways, as described above. The solar power generated by the system would help reduce the amount of carbon entering the atmosphere as PSE&G supplies electricity to its customers. Importantly, PSE&G would cover all equipment, installation and maintenance costs for the life of the entire system.

NOTES

NOTE 1: The exact lease payment would be driven by the amount of electric power generated by the solar array. This could vary slightly from year to year depending on cloud cover and snow fall patterns. An annual price escalation clause would be included in any final contract.

NOTE 2: PSE&G would recoup its investment in this project via sale of power generated by the system, and via use of battery capacity to support electrical grid management functions (e.g., peak shaving and frequency regulation functions) during normal power grid operations. Or as their web site says: "The revenue PSE&G receives from the sale of **Solar 4 All** solar energy and capacity, the sale of the solar credits (SRECs) and the federal investment tax credit (ITC) realized is returned to ratepayers by offsetting the overall cost of the **Solar 4 All** Program".

NOTE 3: During any grid outage periods, the power generated by and stored in the backup system would flow exclusively to the West Windsor Municipal micro grid, ensuring continuous, uninterrupted electrical supply for critical municipal operations. It is anticipated that the battery storage system would handle all municipal complex electric power needs during all but the most unusual outage periods. Existing generators would be employed only to supplement and/or replenish the stored power.

NOTE 4: The kiosk display would provide both a detailed description of the entire micro grid/solar array/battery storage system, and continuously updated information on the performance of the system (kilowatts of energy generated, carbon offset by use of solar as a means of power generation instead of fossil fuel combustion, etc.) It is expected that the local schools could incorporate this educational component into their science programs.

NOTE 5: The first backup source would be battery stored power that routinely flows into the battery storage system from the solar array; second backup source would be power generated by the solar array that continues to flow into the storage system even during larger grid outage periods; existing natural gas and/or diesel powered generators could be used as a third backup source. The final design of the grid will determine which buildings, and which existing generators, are included in the micro grid set-up.

NOTE 6: All four of the existing electric power back-up generators that currently power most, but not all, Township facilities during outages do use fossil fuels. One or more of these generators may be tied to the proposed micro grid to provide added resiliency and redundancy, and would be present to create a robust backup system. It is likely that these fossil fuel consuming units would be activated only during regular required testing and exercising intervals.

Here is a link to materials on the **Solar 4 All** program:

https://www.pseg.com/info/media/pdf/solar4all_factsheet.pdf