

Below is a description of the deficiencies itemized in the repair workbook. Please note that all measures have been taken to assure the plants are safe in the current operational condition. In order to accomplish this, a number of solar panels and/or strings of solar panels have been isolated pending repair. In addition to issues at the module level, a number of other issues have been identified as safety related. We include items such as wire management and crumbling ballast block in the safety related group, but please note that we do not believe that any of the issues poses a current and imminent risk. Alternatively, these items should be addressed as to prevent further deterioration in the quality of the plants, thereby greatly reducing a future compounded matter that may present a greater risk threat. In example, if the ballast continues to deteriorate, it is anticipated that the solar array may fall below the wind load requirements and be exposed to a high wind event.

You will also see an estimation for many line items that includes the approximate revenue restoration that is related to the repair. This is mainly applicable to the module and string that have been isolated for safety until the repair can be completed, as well as any strings that are currently inactive due to reasons not yet determined. The loss revenue calculations are included in the fourth tab of the workbook and are not exact. They rely on an estimated 1100 kWh / kWDC to estimate the revenue impact at the module / string level.

We have also provided what we feel is the sense of priority for each item, as well as the repair type, whether it be related to safety, revenue, aesthetics, or a combination thereof.

- 1) DAS Service: These costs are provided in the "DAS" tab of the workbook. These projects were originally placed onto MYPVDATA's DAS site. MYPVDATA was purchased by ABB a couple of years ago, which was in turn purchased by Fimer Spa. The company has recently made the decision to shut down the MYPVDATA servers. As a result, any plant originally on MYPVDATA will no longer be active on the Fimer/ ABB Auroravision DAS as of October 31, 2020. As a result, a new DAS provider is required in order to maintain remote monitoring for the plants. We have collected and provided to you the estimates for each plant to convert the DAS to AlsoEnergy's PowerTrack. This is the DAS platform that we manage the Morris II program under. You will see that the price summary includes an option to add a weather station at each location. The initial pricing does not include the weather stations as we can provide the option to reference the nearby active weather stations managed in the Morris II Program. However, should the County wish to include the weather stations in the conversion, we are more than happy to have AlsoEnergy update the quotes to include the hardware. From our experience, we know that the existing SolarMagic (MYPVDATA) weather station hardware is incompatible with AlsoEnergy, so in addition to the subscription cost, there is a small hardware cost. Lastly, if the County has an alternate recommendation for a new DAS provider, we are more than happy to reach out and work through the pricing aspect.
- 2) Inverter Filter Replacement: A high volume of the inverters across the plants should have new filters installed. These inverters are now out of warranty and the best thing that can be done to extend their useful life and minimize at-cost repairs moving forward is to provide the inverters with an unobstructed cooling system, which results in lower operating temperatures and stress on the inverters' internal components and electronics

- 3) Wire Management: Periodically, and more importantly for roof mounted systems, wire management should be conducted in order to re-secure string wiring under the solar panels to the wire management system provided by the racking. Over time, string wiring experiences an expansion and contraction effect seasonally. Additionally, storm events can detach wire harness and clips. These issues cause the string wiring to sag onto the roof and should be re-secured periodically in order to prevent conductors from sitting on the roof surface.
- 4) Ballast Block Deterioration: A number of the plants have isolated issues related to deteriorating ballast block. In many early solar projects, a PSI specification was not in place and as a result, many solar plants are experiencing a deterioration of the rooftop ballast used to hold the array in place. As the block deteriorates, it falls away from the ballast trays and onto the roof surface. In addition to the potential exposure in a high wind event to movement or possible damage within the array, the deteriorated block can also flush from the roof and possibly impact roof drains. We have included the hard estimate (one of two) received for the replacement project at the Mennen Arena. The other identified cases are far less extreme (and the plants are much smaller). Should the County wish to advance this potential repair, we will quantify the number of damaged blocks at each plant and provide an estimate for the replacement work.
- 5) Broken Modules: These modules have visual defects and, in most cases, have shattered and require replacement. Any string of modules identified to contain a broken module is now isolated at the combiner box pending repair.
- 6) Modules with Hot Spots: Through thermal scanning, we have detected a number of modules where one or more cells within the module are operating at an elevated temperature and have the potential to experience burnout of the cell. Some modules have advanced to this condition already. These modules must be replaced. Any string of modules identified to contain a module with hot spots is now isolated at the combiner box pending repair.
- 7) Module blistering: A number of modules were identified to have blistering on the back-sheet of the module. No heat anomalies have been detected on these modules and they remain in operation. These modules should be replaced, but are not as high of a priority as the broken and hot spot modules.
- 8) Inverter and combiner Box External Rusting: External rusting on a number of inverters, combiner boxes, conduit and enclosures has been identified. This is an aesthetic issue only. Rusted areas of the equipment will be sanded and repainted.
- 9) Combiner Box Internal Rusting: There is one combiner box with moisture damage that should be treated. Although not an emergency situation, the box should be cleaned and restored.
- 10) Dead strings / Fuses Blown: A number of dead strings were identified within the plants. Some issues have been rectified when the cause was identified. Those listed on the sheet require additional inspection and troubleshooting
- 11) Faded Signage: As is expected a large amount of the signage required on the plants has deteriorated and or faded and should be replaced.
- 12) Inverter Breaker Trips on Generator Startup: There are two sites with this issue: Parsippany High School and Parsippany Central Middle School. Each of these will require additional inspection, testing and troubleshooting. Each time the generator is started, a trip to the site is required to reset the solar back-fed breaker located in the building's main distribution panel.
- 13) Kiosks Removed: For any kiosk that has been removed and remains on site, we have provided a price to reinstall and setup the kiosk. This has no impact on system performance.

- 14) Issues to Convey to the Local Unit: There are a couple of items that have been identified that normally the responsibility of the local unit to manage. These issues include clogged roof drains and the buildup of leaves and debris under the arrays. While on site to conduct additional repairs, we will discuss these items with each local unit in a cooperative effort.
- 15) Mennen Arena Lighting Project: There is a high volume of lights that are inoperable at the Mennen Arena. As you may recall, we are developing a repair project for the County College of Morris and can work to obtain a repair quote for the Mennen Arena, should it be of interest to the County. It may be possible to take advantage of economies of scale by coupling the projects for a single contractor.

\$ 1,083.86		Priority			Repair Type			Est. Loss Annual	ManHours	Est. Repair Cost	Notes
Morris I Site:	Repair Item:	High	Medium	Low	Safety *	Revenue	Aesthetic	Revenue	\$ 105.00		
Schuyler Parking Deck	1. Minor wire management		x		x				4	\$ 420.00	
104.65	2. One module on roof top array has burn/broken*	x			x	x		Yes		\$ 235.00	
1 inv	3. Inverter filters need replacement		x			x				\$ 520.00	
	4. Inverter has patches of rust			x			x		7	\$ 735.00	2 person crew / 3.5 hours per inverter
	5. CBs have surface rust			x			x		2	\$ 210.00	
	6. WS wiring deteriorated			x		x				TBD	DAS provider must be changed - discussion on WSS
	7. Failed photocell for lot lighting		x		x		x		0.5	\$ 127.50	\$75 for photocell
	1 * Total 1 string off							\$ 1,083.86			
	Total 0 strings repaired/fuse replaced										
									plant subtotal:	\$ 2,247.50	
Voter Machine Tech Center	1. Leaves under array (to be communicated to local unit)	x			x					NA	
101.66	2. 3 modules have backpanel blistering - no thermal issues		x		x			Yes			
1 inv	3. 2 modules have burning cells	x			x	x		Yes		\$ 575.00	
	4. Roof drain was clogged (to be communicated to local unit)		x		x					NA	
	5. Inverter has large patches of rust on top and front			x			x		7	\$ 810.00	2 person crew / 3.5 hours per inverter
	6. Filters need replacement		x			x				\$ 671.72	
	7. Dirty inverter pad			x			x			\$ -	
	8. CBs all have surface rust			x			x		2	\$ 210.00	
	9. CB1 has rust on the backing plate			x	x				1	\$ 105.00	
	2 * Total 2 strings off							\$ 2,167.72			
	Total 0 strings repaired/fuse replaced										
									plant subtotal:	\$ 2,371.72	
Mennen Sports Arena	1. Wire management under parking lot arrays			x			x		30	\$ 3,150.00	
1572.743	2. Ballast block on all three roof arrays in poor condition	x			x		x		sub	\$ 93,700.00	2 Estimates collected from subcontractors
7 inv	3. 125+ light fixtures not working		x		x		x			TBD	Should subcontractor look at Mennen as we develop CCM?
	4. Inverter filters need replacement		x			x				\$ 7,388.92	Filter pricing to be provided by inverter manufacturer
	5. Inverters all have patches of rust			x			x		35	\$ 3,750.00	2 person crew / 3.5 hours per inverter (discounted here for volume)
	6. CBs on roof all have surface rust			x			x		4	\$ 495.00	
	7. 2 strings 0 voltage in canopy arrays	x				x		Yes	4	\$ 420.00	2 man hrs troubleshooting per string
	8. WS wiring has deteriorated			x		x				TBD	DAS provider must be changed - discussion on WSS
	9. Kiosk stored in a closet - requires replacement computer			x			x			\$ 250.00	
	10. 1 broken module	x			x	x		Yes			
	11. Parking lot canopy Row #1 missing 3 panels	x				x		Yes		\$ 490.00	
	6 * Total 6 strings off							\$ 6,503.16			
	Total 40 strings repaired/fuse replaced										
									plant subtotal:	\$ 109,643.92	
West Morris Central HS	1. Ballast block deteriorated in spots		x		x		x			TBD	Subcontractor Bids to be collected
260.13	2. 31 panels with burning cells	x			x	x		Yes		\$ 2,785.00	
3 inv	3. Inverter filters need to be replaced		x			x				\$ 2,686.88	
	4. Inverter pads have vines growing up the fence		x				x			\$ -	
	5. DAS Ethernet wire broken/not working	x				x			3	\$ 315.00	Temporary cell modem in place until hardline repair completed
	6. Leaves under spots of array (was discussed w local unit)	x			x					NA	
	7. Signage faded		x		x					\$ 150.00	Estimated \$50 per inverter
	8. CBs have surface rust			x			x		4	\$ 420.00	
	9. Inverters have patches of rust			x			x		21	\$ 2,205.00	2 person crew / 3.5 hours per inverter
	29 * Total 29 strings off							\$ 31,431.95			
	Total 0 strings repaired/fuse replaced										
									plant subtotal:	\$ 8,561.88	
West Morris Mendham HS	1. Ballast block deteriorating in spots		x		x		x			TBD	Subcontractor Bids to be collected
191.36	2. Signage fading		x		x		x			\$ 200.00	Estimated \$100 per inverter
2 inv	3. Inverters have surface rust			x		x			14	\$ 1,470.00	2 person crew / 3.5 hours per inverter
	4. Inverter filters need replacement		x			x				\$ 1,343.44	
	5. 2 CBs with surface rust			x			x		2	\$ 210.00	
	Total 0 strings off							\$ -			
	Total 7 strings repaired/fuse replaced										
									plant subtotal:	\$ 3,223.44	
Morris Hills HS	1. Ballast block starting to deteriorate		x		x		x			TBD	Subcontractor Bids to be collected
80.73	2. 4 modules have blistering		x		x					\$ 490.00	
2 inv	3. Signage fade		x		x		x			\$ 100.00	Estimated \$50 per inverter
	4. Surface rust on inverters			x			x		14	\$ 1,470.00	2 person crew / 3.5 hours per inverter
	5. Inverter filters need to be replaced		x			x				\$ 404.70	
	6. CB3 have surface rust			x			x		2	\$ 210.00	
	7. No kiosk found			x			x			NA	No planned action for kiosk unless advised
	Total 0 strings off							\$ -			
	Total 1 string repaired/fuse replaced										
									plant subtotal:	\$ 2,674.70	

2 inv	Total 0 string repaired/fuse replaced								plant subtotal: \$	508.40
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Grand Total Est. Loss Annual Revenue resulting from system deficiencies: \$ 58,528.46 \$ 142,080.60 Grand Total Work

*** Please note, measures have been taken on site to isolate all damaged equipment in order to eliminate any current safety issue. \$ 48,380.60 Grand Total Work minus Mennen Ballast Project**

DAS Migration Costs

Current DAS expired October 2020

	No Weather Stations							With Weather Stations			
	AlsoEnergy w/ 5-year	Labor *	Materials - Azimuth **	Total Cost	System Size DC	\$/W estimate	% of Total Cost	Plus Weather Station	Total Est. Cost w/ Weather Station	\$/W estimate	% of Total Cost
Morris I Site:											
Schuyler Parking Deck	\$ 1,350.00	\$ 380.00	\$ 585.00	\$ 2,315.00	104.65	\$ 0.022	5%	\$ 750.00	\$ 3,065.00	\$ 0.029	5%
Voter Machine Tech Center	\$ 1,850.00	\$ 380.00	\$ 585.00	\$ 2,815.00	101.66	\$ 0.028	6%	\$ 750.00	\$ 3,565.00	\$ 0.035	6%
Mennen Sports Arena	\$ 6,850.00	\$ 380.00	\$ 585.00	\$ 7,815.00	1572.743	\$ 0.005	16%	\$ 750.00	\$ 8,565.00	\$ 0.005	14%
West Morris Central HS	\$ 2,850.00	\$ 380.00	\$ 585.00	\$ 3,815.00	260.13	\$ 0.015	8%	\$ 750.00	\$ 4,565.00	\$ 0.018	8%
West Morris Mendham HS	\$ 1,850.00	\$ 380.00	\$ 585.00	\$ 2,815.00	191.36	\$ 0.015	6%	\$ 750.00	\$ 3,565.00	\$ 0.019	6%
Morris Hills HS	\$ 1,975.00	\$ 380.00	\$ 585.00	\$ 2,940.00	80.73	\$ 0.036	6%	\$ 750.00	\$ 3,690.00	\$ 0.046	6%
Morris Knolls HS	\$ 1,725.00	\$ 380.00	\$ 585.00	\$ 2,690.00	38.87	\$ 0.069	6%	\$ 750.00	\$ 3,440.00	\$ 0.089	6%
Mountain Lakes HS	\$ 2,100.00	\$ 380.00	\$ 585.00	\$ 3,065.00	173.42	\$ 0.018	6%	\$ 750.00	\$ 3,815.00	\$ 0.022	6%
Parsippany HS	\$ 1,725.00	\$ 380.00	\$ 585.00	\$ 2,690.00	23.92	\$ 0.112	6%	\$ 750.00	\$ 3,440.00	\$ 0.144	6%
Brooklawn MS	\$ 2,100.00	\$ 380.00	\$ 585.00	\$ 3,065.00	173.42	\$ 0.018	6%	\$ 750.00	\$ 3,815.00	\$ 0.022	6%
Central MS	\$ 2,100.00	\$ 380.00	\$ 585.00	\$ 3,065.00	185.389	\$ 0.017	6%	\$ 750.00	\$ 3,815.00	\$ 0.021	6%
Troy Hills School	\$ 1,850.00	\$ 380.00	\$ 585.00	\$ 2,815.00	62.79	\$ 0.045	6%	\$ 750.00	\$ 3,565.00	\$ 0.057	6%
Boonton HS	\$ 2,100.00	\$ 380.00	\$ 585.00	\$ 3,065.00	167.44	\$ 0.018	6%	\$ 750.00	\$ 3,815.00	\$ 0.023	6%
School Street School	\$ 1,850.00	\$ 380.00	\$ 585.00	\$ 2,815.00	50.83	\$ 0.055	6%	\$ 750.00	\$ 3,565.00	\$ 0.070	6%
John Hill School	\$ 1,850.00	\$ 380.00	\$ 585.00	\$ 2,815.00	10.12	\$ 0.278	6%	\$ 750.00	\$ 3,565.00	\$ 0.352	6%
Total Cost	\$ 34,125.00	\$ 5,700.00	\$ 8,775.00	\$ 48,600.00	3197.472	\$ 0.015	100%	\$ 11,250.00	\$ 59,850.00	\$ 0.019	100%

* 2 men / 2 hc ** New Obvius Data Logger - Required

Inverter Filter Estimates

	Inverter Type - Quantity per Site				
	35	50	75	100	260
Schyuler				1	
Voter Machine				1	
Mennen			1	2	4
W Morris Central			1	1	1
W Morris Mendham			1	1	
Morris Hills	1	1			
Morris Knolls	1				
Mountain Lakes		1		1	
Brooklawn		1		1	
School Street School		1			
Totals	2	4	3	8	5

Inverter Replacement Filter Pricing					
\$ 175.50	\$ 229.20	\$ 671.72	\$ 671.72	\$ 1,343.44	Site Totals
35	50	75	100	260	
\$ -	\$ -	\$ -	\$ 671.72	\$ -	\$ 671.72
\$ -	\$ -	\$ -	\$ 671.72	\$ -	\$ 671.72
\$ -	\$ -	\$ 671.72	\$ 1,343.44	\$ 5,373.76	\$ 7,388.92
\$ -	\$ -	\$ 671.72	\$ 671.72	\$ 1,343.44	\$ 2,686.88
\$ -	\$ -	\$ 671.72	\$ 671.72	\$ -	\$ 1,343.44
\$ 175.50	\$ 229.20	\$ -	\$ -	\$ -	\$ 404.70
\$ 175.50	\$ -	\$ -	\$ -	\$ -	\$ 175.50
\$ -	\$ 229.20	\$ -	\$ 671.72	\$ -	\$ 900.92
\$ -	\$ 229.20	\$ -	\$ 671.72	\$ -	\$ 900.92
\$ -	\$ 229.20	\$ -	\$ -	\$ -	\$ 229.20
\$ 351.00	\$ 916.80	\$ 2,015.16	\$ 5,373.76	\$ 6,717.20	\$ 15,373.92

Estimation - Loss Revenue per String

Module Wattage	230	Estimated Revenue Rate to the County	\$ 0.3295410
Modules per string	13	Energy Sales	\$ 0.0975410
String kW	2.990	SRECs	\$ 0.2320000
Estimated Annual kWh per kW	1100		
Estimated Annual kWh / string	3289		
Estimated Revenue Rate per kWh	\$ 0.32954		
Estimated Annual Revenue per string	\$ 1,083.86		

String Repair