Montgomery County, Department of Transportation
Request for Energy Proposals
Solicitation Number: RFEP 01
Attachment A.1 - Master List of Facilities

MOCO28a	Woodmont Avenue Parking Garage	7730 Woodmont Avenue	Bethesda	MD	20814	NR-MGT-LV IIA	900,640	Parking Garage Carport	317	351,982	39%	Y
MOCO28b	Old Georgetown Road Parking Garage	7661 Old Georgetown Road	Bethesda	MD	20814	NR-MGT-LV IIB	348,584	Parking Garage Carport	39	43,304	12%	Y
MOCO29	Del Ray Avenue Parking Garage	4907 Del Ray Avenue	Bethesda	MD	20814	NR-MGT-LV IIA	1,146,080	Parking Garage Carport	684	757,355	66%	Y
MOCO30	1101 Bonifant Street Parking Garage	1101 Bonifant Street	Silver Spring	MD	20910	NR-MGT-LV IIB	588,288	Parking Garage Carport	227	256,096	44%	Y
MOCO31	8530 Cameron Street Parking Garage	8530 Cameron Street	Silver Spring	MD	20910	NR-MGT-LV IIA	1,249,920	Parking Garage Carport	308	338,956	27%	Y
MOCO32	Kenneth Street Parking Garage	8040 Kennett Street	Silver Spring	MD	20910	NR-MGT-LV IIB	486,360	Parking Garage Carport	298	331,316	68%	Y
MOCO33	Wayne Avenue Parking Garage	921 Wayne Avenue	Silver Spring	MD	20910	NR-MGT-LV IIA	1,883,380	Parking Garage Carport	661	734,898	39%	Y
MOCO34	Ellsworth Drive Parking Garage	801 Ellsworth Drive	Silver Spring	MD	20910	NR-MGT-LV IIA	1,676,880	Parking Garage Carport	576	643,260	38%	Y
MOCO35	Amherst Avenue Parking Garage	11304 Amherst Avenue	Wheaton	MD	20902	NR-MGT-LV IIA	589,720	Parking Garage Carport	364	409,819	70%	Y
MOCO36	1100 Bonifant Street Parking Garage	1100 Bonifant Street	Silver Spring	MD	20910	NR-MGT-LV IIA	1,091,680	Parking Garage Carport	TBD	TBD	TBD	N
MOCO37	8700 Cameron Street Parking Garage	8700 Cameron Street	Silver Spring	MD	20910	NR-MGT-LV IIA	1,103,596	Parking Garage Carport	TBD	TBD	TBD	N
MOCO38	St. Elmo Avenue Parking Garage	4935 St. Elmo Avenue	Bethesda	MD	20814	NR-MGT-LV IIB	293,040	Parking Garage Carport	TBD	TBD	TBD	N

MOCO28a: Woodmont Avenue Parking Garage

Site Address:	7730 Woodmont Avenue, Bethesda MD 20814
Type of PV System:	Carport
Annual Energy Usage:	900,640 kWh
Maximum System Size:	317 kW-DC
Maximum System Output:	351,982 kWh
Recommended System Size:	317 kW-DC
Recommended System Output:	351,982 kWh
Energy Offset:	39%

Issues:	Shading from neighboring building; Structural integrity to be confirmed
Opportunities:	Net metering eligible; High visibility

The Woodmont Avenue parking garage is located next to Old Georgetown Road parking garage in Bethesda and has ample space for a solar PV system. Sections 1-6 are the usable area at this garage, as shown in Figure 1 below. Sections 7-8 are on the Old Georgetown Avenue side. The portions of the garage that have not been highlighted have shading concerns from the tall apartment building located south of the garage. Additionally, certain areas that are ramps, such as the area west of Section 8, are considered not usable and therefore not highlighted.

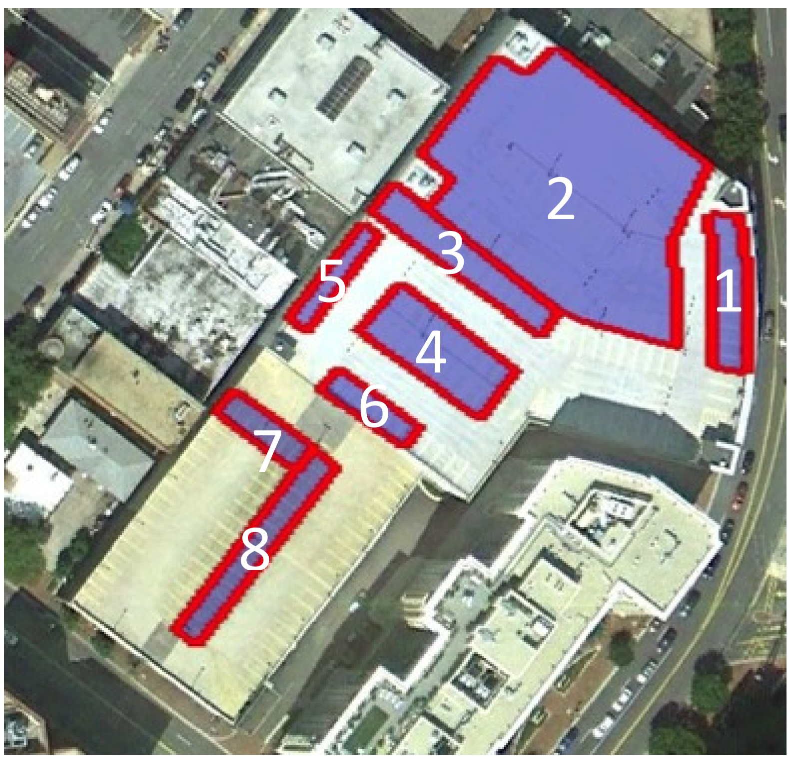


Figure 1: Woodmont Avenue Parking Garage Usable Areas

At this garage, a total of 317 kW-DC can be installed which is capable of producing about 352,000 kWh annually. There are 2 electricity meters at this site; one is located on the Woodmont Avenue side and the other is located on the Old Georgetown Road side. The average annual electricity usage over the past two years on the Woodmont

Avenue side was 900,640 kWh. The recommended PV system would offset 39% of the electricity usage at the Woodmont Avenue garage. For more detailed information about each highlighted section, see Table 1 below.

Table 1: Woodmont Avenue Parking Garage Solar PV System Potential Summary

Section	Azimuth (°)	Area (Sq. Ft.)	Size (kW DC)
1	215°	2,093	22
2	215°	19,887	208
3	215°	2,710	28
4	215°	3,579	37
5	215°	1,021	11
6	215°	1,082	11
Total		30,372	317
Total System Production			351,982
Recommended System Size			**317**
Recommended System Output (kWh)			**351,982**

The top level of the garage is in good condition. Figure 2 illustrates the condition of the top level of the garage. Nonetheless, a structural review will need to be conducted by a qualified party to ensure that the parking garage can withstand the additional load of a solar PV carport system.

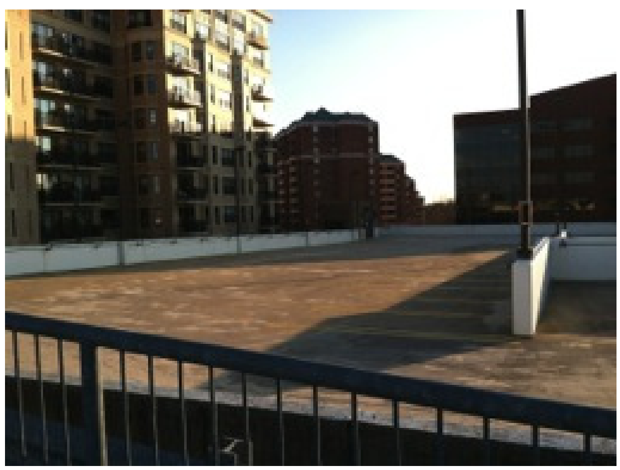


Figure 2: South-facing view of Woodmont garage

There is no electrical equipment information currently available for this site.

MOCO28b: Old Georgetown Road Parking Garage

Site Address:	7661 Old Georgetown Road, Bethesda MD 20814
Type of PV System:	Carport
Annual Energy Usage:	348,584 kWh
Maximum System Size:	39 kW-DC
Maximum System Output:	43,304 kWh
Recommended System Size:	39 kW-DC
Recommended System Output:	43,304 kWh
Energy Offset:	12%

Issues:	Shading from neighboring building; Structural integrity to be confirmed
Opportunities:	Net metering eligible; High visibility

The Old Georgetown Road parking garage is located next to the Woodmont Avenue parking garage in Bethesda and has minimal space for solar PV systems. The usable area at this garage is shown in Figure 3 below. Sections 7-8 are on the Old Georgetown Avenue side and Sections 1-6 are on the Woodmont Avenue side. The portions of the garage that have not been highlighted have shading concerns from the tall apartment building located south of the garage. Additionally, certain areas that are ramps, such as the area west of Section 8, are considered not usable and therefore not highlighted.

Figure 3: Old Georgetown Road Parking Garage Usable Areas

At this garage, a total of 39 kW-DC can be installed which is capable of producing about 43,000 kWh annually. There are 2 electricity meters at this site; one is located t the Woodmont Avenue garage and the other is located at the Old Georgetown Road garage. The average annual electricity usage over the past two years at the Old Georgetown Road garage was 348,584 kWh. The recommended PV system would offset 12% of the electricity usage at the Old Georgetown Road garage. For more detailed information about each highlighted section, see Table 2 below.

Table 2: Old Georgetown Road Parking Garage Solar PV System Potential Summary

Section	Azimuth (°)	Area (Sq. Ft.)	Size (kW DC)
7	215°	1,180	12
8	215°	2,568	27
Total		3,748	39
Total System Production			43,304
Recommended System Size			**39**
Recommended System Output (kWh)			**43,304**

The top level of the garage is in good condition. Figure 4 illustrates the condition of the top level of the garage. Nonetheless, a structural review will need to be conducted by a qualified party to ensure that the parking garage can withstand the additional load of a solar PV carport system.

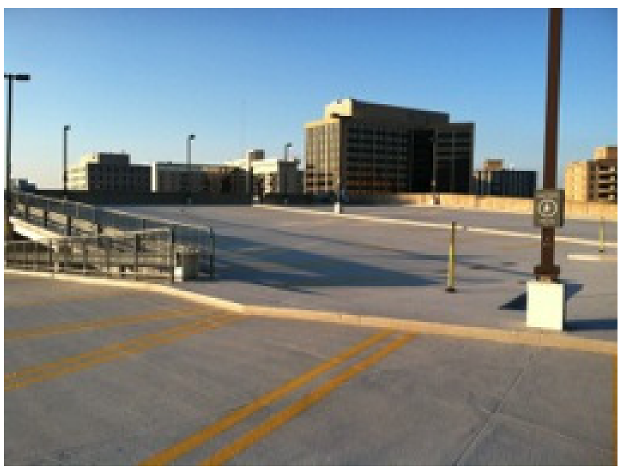
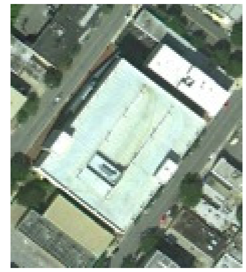


Figure 4: Surface condition of Old Georgetown Road garage

There is no electrical equipment information currently available for this site.



MOCO29: Del Ray Avenue Parking Garage

Site Address:	4907 Del Ray Avenue, Bethesda MD 20814
Type of PV System:	Carport
Annual Energy Usage:	1,146,080 kWh
Maximum System Size:	684 kW-DC
Maximum System Output:	757,355 kWh
Recommended System Size:	684 kW-DC
Recommended System Output:	757,355 kWh
Energy Offset:	66%
Issues:	Shading from HVAC equipment; Structural integrity to be confirmed
Opportunities:	Net metering eligible; High visibility

Located in Bethesda, the Del Ray parking garage is a relatively new structure. With a total of 6 floors, the top level of the garage has ample space for a large PV system. The usable area is shown in Figure 5 below. The area between Sections 2 and 4 has not been highlighted because it is a ramp that is used to enter and exit the top floor of the garage. Due to varying elevation changes, safety and structural concerns this areas have been left out.

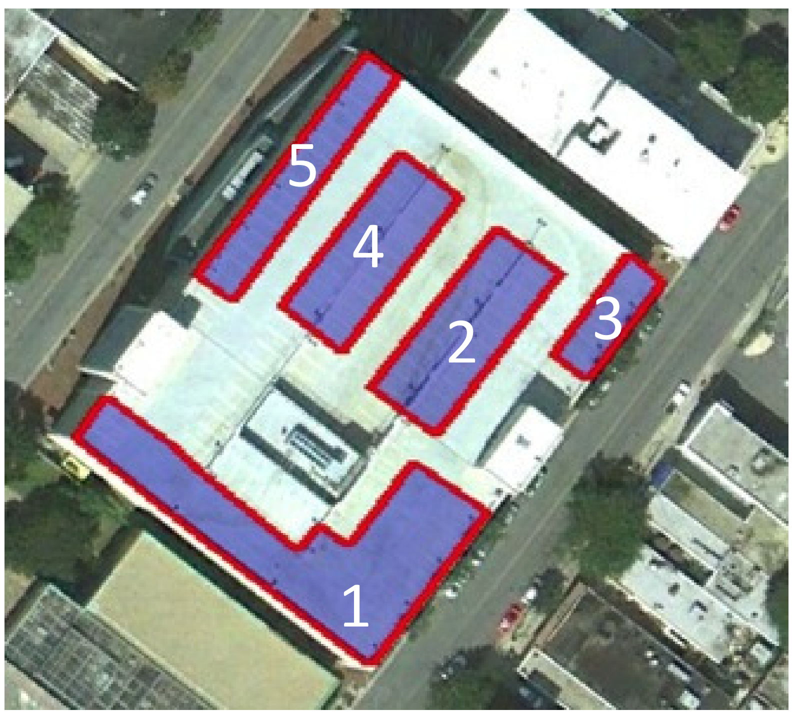


Figure 5: Del Ray Avenue Parking Garage Usable Areas

From a shade perspective, the top level of the garage has a large HVAC system located almost at the center of the garage. For protection, the HVAC equipment has a metal fence around the structure. Additionally, the garage has two stair rooms that are also considered as shading obstructions. Figure 6 shows a view of the HVAC equipment and the fence surrounding the equipment. Additionally, the figure shows a view of the South West stairway.

Figure 6: A view of the HVAC equipment surrounded by a fence and the stairway room

Table 3 shows the details about each highlighted usable section. At this site, a total of 684 kW-DC can be installed which is capable of producing about 757,355 kWh annually. The average annual electricity usage over the past two years at this site was 1,146,080 kWh. The recommended PV system, which is also the maximum PV system at this site, would offset 66% of the energy used at this site.

Table 3: Del Ray Parking Garage Solar PV System Potential Summary

Section	Azimuth (°)	Area (Sq. Ft.)	Size (kW DC)
1	215°	8,394	88
2	215°	4,194	43
3	215°	1,431	15
4	215°	48,248	505
5	215°	3,117	33
Total		65,384	684
Total System Production			757,355
Recommended System Size			**684**
Recommended System Production (kWh)			**757,355**

A structural review will need to be conducted by a qualified party to ensure that the parking garage can withstand the additional load of a solar PV carport system.

There is no electrical equipment information currently available for this site.

MOCO30: 1101 Bonifant Street Parking Garage

Site Address:	1101 Bonifant Street, Silver Spring MD 20910
Type of PV System:	Carport
Annual Energy Usage:	588,288 kWh
Maximum System Size:	227 kW-DC
Maximum System Output:	256,096 kWh
Recommended System Size:	227 kW-DC
Recommended System Output:	256,096 kWh
Energy Offset:	44%
Issues:	Shading from new development to south; Structural integrity to be confirmed
Opportunities:	Net metering eligible; High visibility

There are two parking garages on Bonifant Street in Silver Spring, which are connected at the fourth floor. The newer, larger garage is located at 1101 Bonifant Street and is situated to the south of the smaller, older garage at 1100 Bonifant Street. The garage at 1101 Bonifant Street is 3 stories taller than the garage at 1100 Bonifant Street. Figure 7 shows the usable areas of the southern garage at 1101 Bonifant Street. The garage at 1100 Bonifant Street was not assessed for solar PV potential, but is of interest to the County for development (see site MOCO36 in this document).

At the time of this assessment there were no shading issues for the garage at 1101 Bonifant Street. However, due to new construction to the south of the garage the area available for solar panels will differ due to shading from the neighboring building. Actual solar PV capacity must be confirmed by prospective bidders.

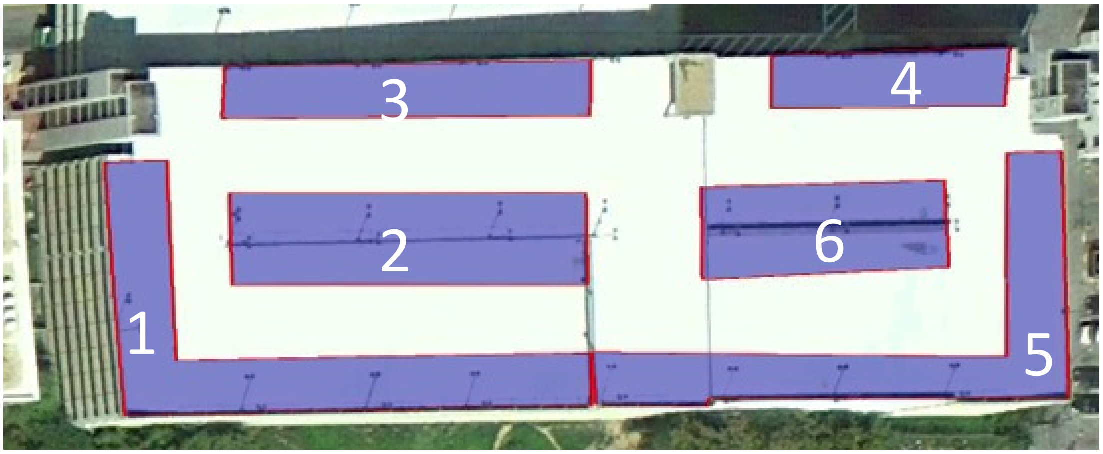


Figure 7: 1101 Bonifant Street Parking Garage Usable Areas

Sections 1 and 5 are located on inclined surfaces, with the area between Sections 2 and 6 being the tallest part of the garage. The area above the entrance and exit ramp is the tallest part of the garage.

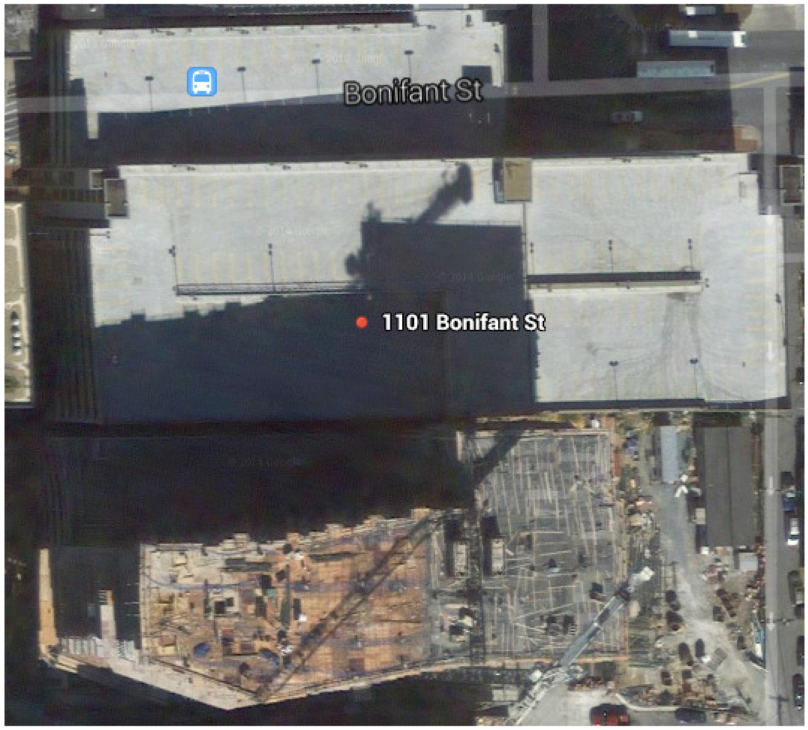


Figure 8: Imminent shading from new building under construction

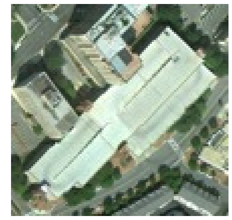
Table 4 lists the size and production for each section. A total of 227 kW-DC can be installed at this site. The total estimated production it 256,096 kWh yearly. About 44% of the site's electricity usage can be offset by the PV system. This assessment must be confirmed with new shading analysis.

Table 4: Bonifant Street Parking Garage Solar PV System Potential Summary

Section	Azimuth (°)	Area (Sq. Ft.)	Size (kW DC)
1	180°	5,184	54
2	180°	4,502	47
3	180°	2,674	28
4	180°	1,773	18
5	180°	4,604	48
6	180°	2,981	31
Total		21,718	227
Total System Production			256,096
Recommended System Size			**227**
Recommended System Production (kWh)			**256,096**

A structural review will need to be conducted by a qualified party to ensure that the parking garage can withstand the additional load of a solar PV carport system.

There is no electrical equipment information currently available for this site.



MOCO31: 8530 Cameron Street Parking Garage

Site Address:	8530 Cameron Street, Silver Spring MD 20910
Type of PV System:	Carport
Annual Energy Usage:	1,249,920 kWh
Maximum System Size:	308 kW-DC
Maximum System Output:	338,956 kWh
Recommended System Size:	308 kW-DC
Recommended System Output:	338,956 kWh
Energy Offset:	27%
Issues:	Low energy offset; Structural integrity to be confirmed
Opportunities:	Net metering eligible; High visibility

Located in Silver Spring, the Cameron Street parking garage is a 6-story building that has ample space for a PV installation. With that said, however, the garage has three taller buildings located south and west of the site. The usable areas at the Garage are shown in Figure 9 below. The portions of the top floor of the garage that have not been highlighted are ramps that are shaded by the surrounding building. Additionally, due to varying elevation changes, safety and structural concerns these entrance and exit ramps are not recommended.

Figure 9: 8530 Cameron Street Parking Garage Usable Areas

Section 3, as shown in the figure above, is one floor below Sections 1 and 2, hence the only the southern part of that section is recommended. Additionally, Figure 10 shows an example of shading west of Section 1 on the southern entrance ramp.

Figure 10: Example of surrounding building casting a shade on the area west of Section 1

Figure 11, below, shows a view of the building adjacent to the parking garage. This building reduces solar access by 20% on a yearly basis. Therefore, although ample space is available from a physical footprint perspective, the usable area is recommended due to minimal shading concerns.

Figure 11: A view of the apartment building adjacent to the parking garage

Over the past two years, this site used an annual average of 1,249,920 kWh. Given the usable area a 308 kW-DC PV system can be installed at this site. This system would produce approximately 338,956 kWh yearly. This production will offset 27% of the site usage. For more details on the production capacity of each section consult Table 5.

Table 5: Cameron Street Parking Garage Solar PV System Potential Summary

Section	Azimuth (°)	Area (Sq. Ft.)	Size (kW DC)
1	134°	9,089	95
2	134°	15,568	163
3	134°	4,774	40
Total		30,879	308
Total System Production			338,956
Recommended System Size			**308**
Recommended System Production			**338,956**

A structural review will need to be conducted by a qualified party to ensure that the parking garage can withstand the additional load of a solar PV carport system.

There is no electrical equipment information currently available for this site.

MOCO32: Kennett Street Parking Garage

Site Address:	8040 Kennett Street, Silver Spring MD 20910
Type of PV System:	Carport
Annual Energy Usage:	486,360 kWh
Maximum System Size:	298 kW-DC
Maximum System Output:	331,316 kWh
Recommended System Size:	298 kW-DC
Recommended System Output:	331,316 kWh
Energy Offset:	68%
Issues:	Structural integrity to be confirmed
Opportunities:	Net metering eligible; High visibility

The Kennett Street parking garage, located in Silver Spring, MD, is composed of four floors. The garage has ample space for a PV system. Additionally, the garage has a surface parking lot which can also be used for a PV carport. Figure 12 shows the usable area for the top level of the parking garage. The portions that have not been highlighted have shading concerns from elevated towers on the top floor of the garage.

Figure 12: Kennett Street Parking Garage Usable Areas

As stated above, the surface parking lot south of the garage is usable as well, but the garage is the recommended and preferred location for a PV carport. In terms of shading, there are no tall buildings or vegetation adjacent to the garage; therefore, the garage does not have any shading concerns.

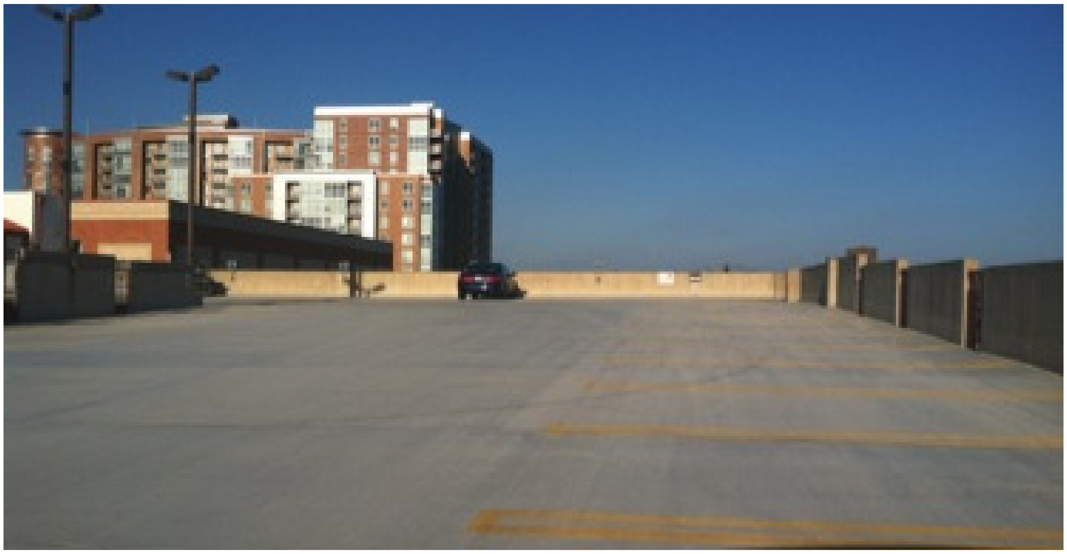


Figure 13: View of the elevation change for the entrance/exit ramp

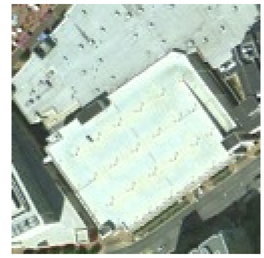
Over the past two years this site used an annual average of 486,360 kWh. Given the usable area a 298 kW-DC PV system can be installed at this site, which would produce 331,316 kWh and offset 68% of the site's usage. Table 6 shows the size and production details about the available PV size.

Table 6: Kennett Street Parking Garage Solar PV System Potential Summary

Section	Azimuth (°)	Area (Sq. Ft.)	Size (kW DC)
1	146°	28,472	298
Total		28,472	298
Total System Production			331,316
Recommended System Size			**298**
Recommended System Production			**331,316**

A structural review will need to be conducted by a qualified party to ensure that the parking garage can withstand the additional load of a solar PV carport system.

There is no electrical equipment information currently available for this site.



MOCO33: Wayne Avenue Parking Garage

Site Address:	921 Wayne Avenue, Silver Spring MD 20910
Type of PV System:	Carport
Annual Energy Usage:	1,883,380 kWh
Maximum System Size:	661 kW-DC
Maximum System Output:	734,898 kWh
Recommended System Size:	661 kW-DC
Recommended System Output:	734,898 kWh
Energy Offset:	39%
Issues:	Structural integrity to be confirmed
Opportunities:	Net metering eligible; High visibility

The Wayne Avenue Parking Garage is one of the County's largest garages located in Silver Spring, MD. Overall this garage is ample space for a large PV installation. Figure 14 shows the usable area on the top level of the garage. The entrance and exit ramp for the garage is in the northeast corner, which is not considered usable due to structural and safety concerns. Additionally, the west portion of the garage is not usable due to shading from an adjacent office building.

Figure 14: Wayne Avenue Parking Garage Usable Areas

From the usable area a 661 kW-DC system can be installed at this site. This system will produce approximately 734,898 kWh each year. Over the last two years this site used an annual average of 1,883,380 kWh. A PV system of the above stated size will offset about 39% of the site's electricity usage. Table 7 lists more details about the available PV size.

Table 7: Wayne Avenue Parking Garage Solar PV System Potential Summary

Section	Azimuth (°)	Area (Sq. Ft.)	Size (kW DC)
1	145°	63,154	661
Total		63,154	661
Total System Production			734,898
Recommended System Size			**661**
Recommended System Production			**734,898**

Overall the garage is in excellent condition, as shown in Figure 15.

As for shading, Figure 16 shows the adjacent building south of the garage, which is too far away to pose any shading concerns. The only structures on the top-floor are the lampposts, which the County desires to be replaced with LED lighting fixtures integrated into the solar PV carport structures.

Figure 15: Top level condition of the garage

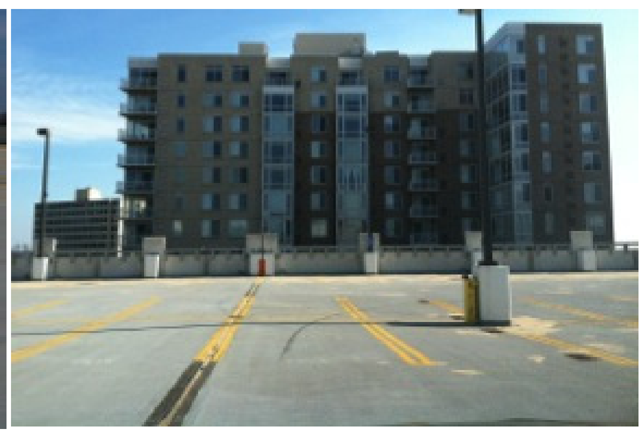
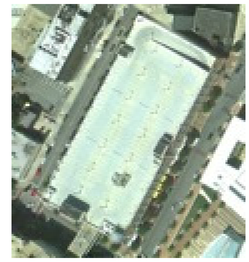


Figure 16: View of adjacent apartment building

A structural review will need to be conducted by a qualified party to ensure that the parking garage can withstand the additional load of a solar PV carport system.

There is no electrical equipment information currently available for this site.



MOCO34: Ellsworth Drive Parking Garage

Site Address:	801 Ellsworth Drive, Silver Spring MD 20910
Type of PV System:	Carport
Annual Energy Usage:	1,676,880 kWh
Maximum System Size:	576 kW-DC
Maximum System Output:	643,260 kWh
Recommended System Size:	576 kW-DC
Recommended System Output:	643,260 kWh
Energy Offset:	38%
Issues:	Structural integrity to be confirmed
Opportunities:	Net metering eligible; High visibility

The Ellsworth Drive parking garage is one of the tallest garages in Montgomery County. Figure 17, below, shows the usable area on the garage top floor, which has ample space for a solar PV installation. The area north of Section 1 has not been highlighted because it is a ramp that is used to enter and exit the top floor of the garage. Due to varying elevation changes, safety and structural concerns this areas have been left out.

Figure 17: Ellsworth Drive Parking Garage Usable Areas

Figure 18 shows an example of the garage condition and two adjacent buildings. As the figure shows, the garage is in good condition. As for the buildings, both of the buildings are north of the garage, therefore there are no shading concerns, even during the winter months.

Figure 18: Example of the garage condition and two adjacent buildings

A 576 kW-DC system can be installed at this site. This is capable of producing approximately 643,260 kWh each year. Over the last two years this site used an annual average of 1,676,880 kWh. The expected PV production would offset about 38% of the site's usage. Table 8 lists more details about the usable area.

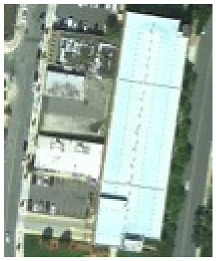
Table 8: Ellsworth Drive Parking Garage Solar PV System Potential Summary

Section	Azimuth (°)	Area (Sq. Ft.)	Size (kW DC)
1	205°	55,080	576
Total		55,080	576
Total System Production			643,260
Recommended System Size			**576**
Recommended System Production			**643,260**

As for shading, there are no outstanding shade issues at this site. The only structures on the top-floor are the lampposts, which the County desires to be replaced with LED lighting fixtures integrated into the solar PV carport structures.

A structural review will need to be conducted by a qualified party to ensure that the parking garage can withstand the additional load of a solar PV carport system.

There is no electrical equipment information currently available for this site.



MOCO35: Amherst Avenue Parking Garage

Site Address:	11304 Amherst Avenue, Wheaton MD 20902
Type of PV System:	Carport
Annual Energy Usage:	589,720 kWh
Maximum System Size:	364 kW-DC
Maximum System Output:	409,819 kWh
Recommended System Size:	364 kW-DC
Recommended System Output:	409,819 kWh
Energy Offset:	70%
Issues:	Structural integrity to be confirmed
Opportunities:	Net metering eligible; High visibility

The Amherst Avenue parking garage serves a dual purpose. The garage acts as an easy access parking garage for the WMATA metro station, and it serves as a parking area for the local office complexes. The top floor of the garage has ample space for a PV system installation. Figure 19 shows the usable areas for the garage. The garage is composed of 5 floors with no tall building adjacent to it. The southern part of that garage is not considered usable due to shading concerns from an elevated stairway and elevator room.

Figure 19: Amherst Avenue Parking Garage Usable Areas

Given the usable area a 364 kW-DC system can be installed within the identified section. The sites ideal south orientation helps with system production, which is estimated as 409,819 kWh. Over the past two years this site had a annual average electricity usage of 589,720 kWh. Given the expected production the PV system will offset about 70% of the site's usage. Table 9 lists the sizes and possible production the usable section.

Table 9: Amherst Avenue Parking Garage Solar PV System Potential Summary

Section	Azimuth (°)	Area (Sq. Ft.)	Size (kW DC)
1	190°	34,828	364
Total		34,828	364
Total System Production			409,819
Recommended System Size			**364**
Recommended System Production			**409,819**

Overall the garage is in excellent condition. Figure 20 shows the entrance and exit ramp for the top floor of the garage.

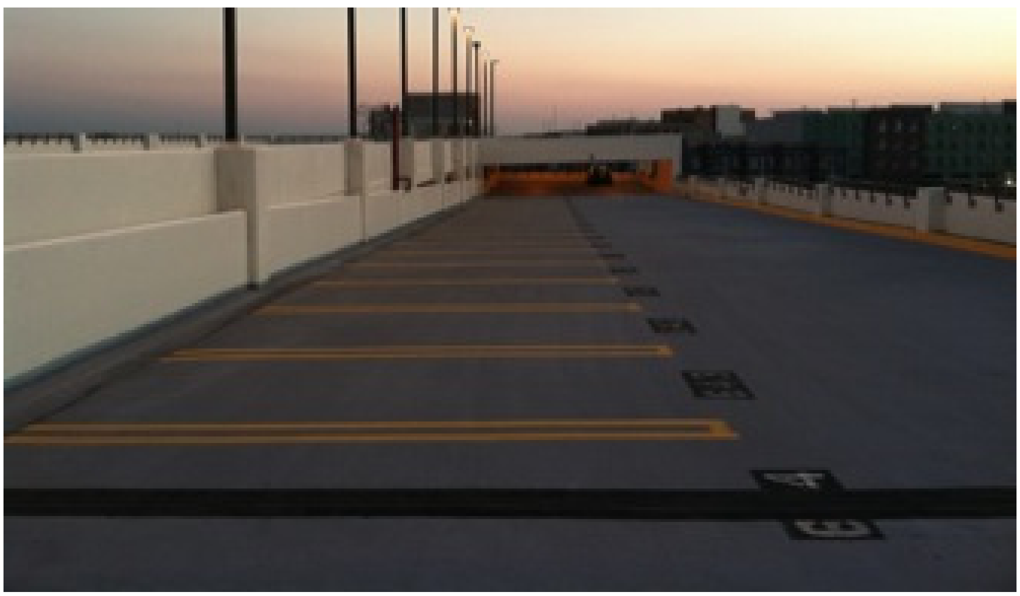


Figure 20: Example of parking lot layout

As for shading, there are no outstanding shade issues at this site. The only structures on the top-floor are the lampposts, which the County desires to be replaced with LED lighting fixtures integrated into the solar PV carport structures.

A structural review will need to be conducted by a qualified party to ensure that the parking garage can withstand the additional load of a solar PV carport system.

There is no electrical equipment information currently available for this site.

MOCO36: 1100 Bonifant Street Parking Garage

Site Address:	1100 Bonifant Street, Silver Spring MD 20910
Type of PV System:	Carport
Annual Energy Usage:	1,091,680 kWh
Maximum System Size:	TBD kW-DC
Maximum System Output:	TBD kWh
Recommended System Size:	TBD kW-DC
Recommended System Output:	TBD kWh
Energy Offset:	TBD%
Issues:	Structural integrity to be confirmed; Potential shading
Opportunities:	Net metering eligible; High visibility

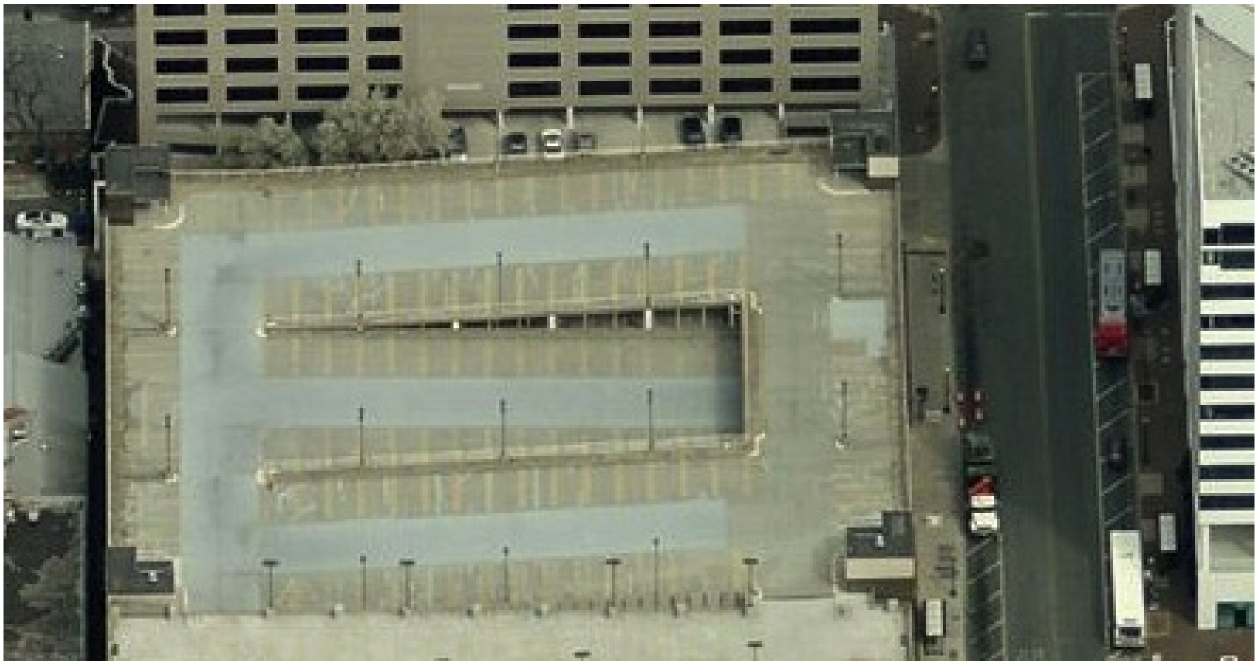
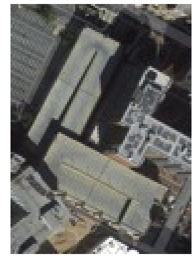


Figure 21: 1100 Bonifant Street Parking Garage



MOCO37: 8700 Cameron Street Parking Garage

Site Addresses:	8700 Cameron Street, Silver Spring MD 20910
Type of PV System:	Carport
Annual Energy Usage:	1,103,596 kWh
Maximum System Size:	TBD kW-DC
Maximum System Output:	TBD kWh
Recommended System Size:	TBD kW-DC
Recommended System Output:	TBD kWh
Energy Offset:	TBD%
Issues:	Structural integrity to be confirmed; Potential shading
Opportunities:	Net metering eligible; High visibility

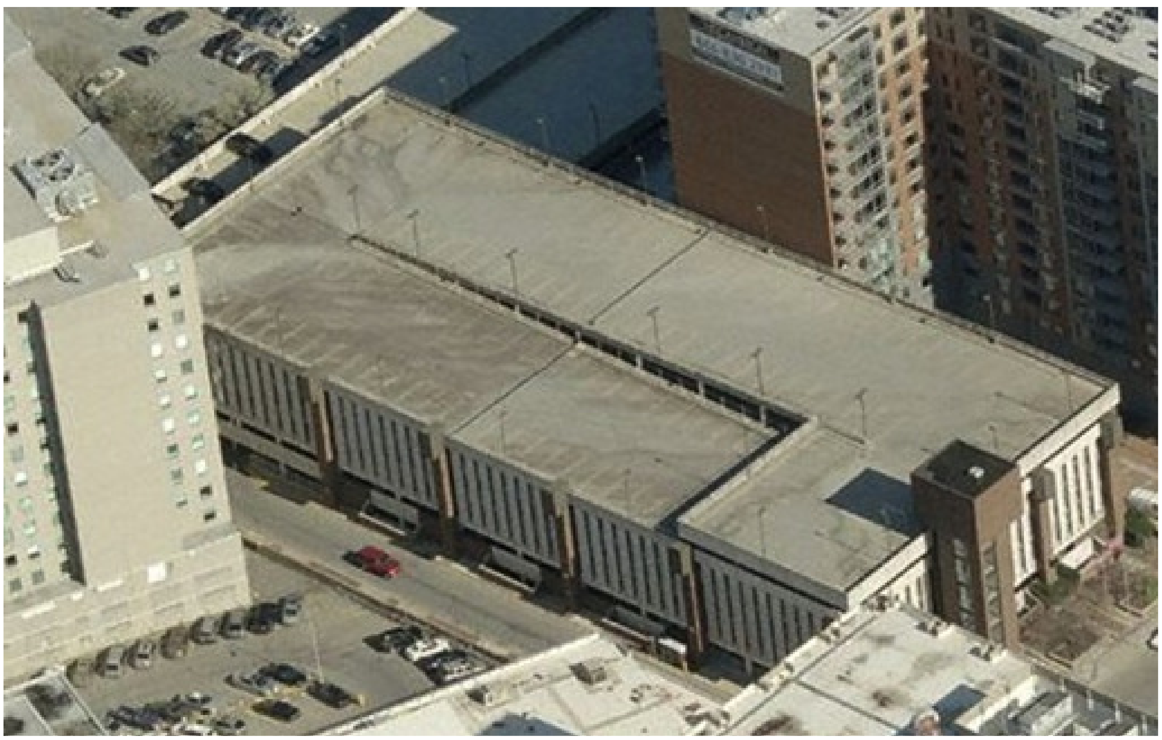
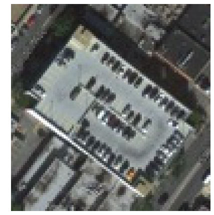


Figure 22: 8700 Cameron Street Parking Garage



MOCO38: St. Elmo Avenue Parking Garage

Site Address:	4935 St. Elmo Avenue, Bethesda MD 20814
Type of PV System:	Carport
Annual Energy Usage:	589,720 kWh
Maximum System Size:	TBD kW-DC
Maximum System Output:	TBD kWh
Recommended System Size:	TBD kW-DC
Recommended System Output:	TBD kWh
Energy Offset:	TBD%
Issues:	Structural integrity to be confirmed
Opportunities:	Net metering eligible; High visibility

Figure 23: St. Elmo Avenue Parking Garage

Montgomery County, Department of Transportation									
Request for Energy Proposals									
Solicitation Number: RFEP 01									
Attachment A.3 - Site Historical Electricity Usage									
ID#	**ADDRESS**	**Type**	**Dist**	**Gen/Trans**	**Tariff**	**2012 Usage (kWh)**	**2013 Usage (kWh)**	**12-13 Annual Avg Usage (kWh)**	**24-Month Electricity Usage Trend**
MOCO28a	7730 WOODMONT AVENUE Bethesda, MD 20814	PARKING GARAGE CARPORT	Pepco	WGES	NR-MGT-LV IIA	891,360	909,920	900,640	
MOCO28b	7661 OLD GEORGETOWN ROAD Bethesda MD 20814	PARKING GARAGE CARPORT	Pepco	WGES	NR-MGT-LV IIB	349,224	347,944	348,584	
MOCO29	4907 DEL REY AVENUE Bethesda, MD 20814	PARKING GARAGE CARPORT	Pepco	WGES	NR-MGT-LV IIA	1,128,960	1,146,080	1,137,520	
MOCO30	1101 BONIFANT STREET Silver Spring, MD 20910	PARKING GARAGE CARPORT	Pepco	WGES	NR-MGT-LV IIB	552,015	624,560	588,288	
MOCO31	8530 CAMERON STREET Silver Spring, MD 20910	PARKING GARAGE CARPORT	Pepco	WGES	NR-MGT-LV IIA	1,447,280	1,052,560	1,249,920	
MOCO32	8040 KENNETT STREET Silver Spring, MD 20910	PARKING GARAGE CARPORT	Pepco	WGES	NR-MGT-LV IIB	489,520	483,200	486,360	
MOCO33	921 WAYNE AVENUE Silver Spring, MD 20910	PARKING GARAGE CARPORT	Pepco	WGES	NR-MGT-LV IIA	1,845,000	1,921,760	1,883,380	
MOCO34	801 ELLSWORTH DRIVE Silver Spring, MD 20910	PARKING GARAGE CARPORT	Pepco	WGES	NR-MGT-LV IIA	1,912,960	1,440,800	1,676,880	
MOCO35	11304 AMHERST AVENUE Wheaton, MD 20902	PARKING GARAGE CARPORT	Pepco	WGES	NR-MGT-LV IIA	642,480	536,960	589,720	
MOCO36	1100 BONIFANT STREET Silver Spring, MD 20910	PARKING GARAGE CARPORT	Pepco	WGES	NR-MGT-LV IIA	1,211,760	971,600	1,091,680	
MOCO37	8700 CAMERON STREET Silver Spring, MD 20910	PARKING GARAGE CARPORT	Pepco	WGES	NR-MGT-LV IIA	1,136,935	1,070,256	1,103,596	
MOCO38	4935 ST. ELMO AVENUE Bethesda, MD 20814	PARKING GARAGE CARPORT	Pepco	WGES	NR-MGT-LV IIB	257,880	328,200	293,040	
					Totals	**11,865,374**	**10,833,840**	**11,349,607**	

Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Jan-13	Feb-13
77,760	81,120	71,520	65,120	71,040	62,880	77,760	63,680	69,920	68,320	92,320	89,920	82,080	82,080
29,864	30,560	26,800	26,880	29,920	28,880	29,360	28,400	28,640	28,160	30,160	31,600	29,864	28,000
90,560	103,520	90,560	99,360	89,760	85,440	93,600	85,600	99,360	100,000	87,200	104,000	89,760	89,600
25,200	60,975	46,080	40,080	35,840	42,480	39,120	43,040	43,680	48,240	60,240	67,040	66,080	67,680
126,000	123,120	117,360	123,840	115,920	112,080	106,080	113,440	115,040	130,160	125,040	139,200	126,640	105,040
44,240	46,800	42,560	38,960	38,000	43,040	33,920	36,480	31,360	43,360	41,440	49,360	43,200	44,640
179,040	168,480	148,000	142,880	154,560	143,200	137,280	156,000	179,240	75,520	176,640	184,160	164,800	165,760
187,680	126,400	107,360	102,400	109,120	105,600	79,680	90,400	494,080	178,720	188,160	143,360	163,360	99,680
54,560	58,640	51,680	51,280	52,160	56,320	51,840	52,880	57,680	51,760	55,520	48,160	46,640	51,120
134,720	124,080	136,080	127,200	117,840	102,480	35,680	92,560	88,080	76,960	84,560	91,520	80,960	84,400
87,413	90,560	90,080	87,920	172,960	89,362	121,600	96,480	19,680	96,560	96,480	87,840	136,176	94,000
23,040	23,960	21,560	19,320	21,480	19,040	23,040	19,720	19,560	9,760	26,880	30,520	24,800	24,800
1,060,077	**1,038,215**	**949,640**	**925,240**	**1,008,600**	**890,802**	**828,960**	**878,680**	**1,246,320**	**907,520**	**1,064,640**	**1,066,680**	**1,054,360**	**936,800**

Mar-13	Apr-13	May-13	Jun-13	Jul-13	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	24 Month Total
80,960	66,560	72,800	69,920	65,120	64,800	75,360	67,520	76,480	106,240	1,801,280
27,200	26,160	28,880	27,840	28,240	31,920	27,920	27,520	32,000	32,400	697,168
92,480	90,720	93,440	87,840	98,400	92,000	105,280	92,160	93,600	120,800	2,275,040
54,400	44,640	46,800	40,400	41,920	40,960	45,280	44,640	69,120	62,640	1,176,575
92,480	76,640	75,600	80,480	73,760	76,800	83,120	78,080	86,320	97,600	2,499,840
38,000	37,760	35,840	38,880	32,960	34,160	37,920	37,760	55,600	46,480	972,720
160,000	157,920	153,440	157,280	137,600	143,680	142,560	163,360	185,280	190,080	3,766,760
125,440	116,320	104,640	114,240	100,320	112,160	113,280	112,320	148,000	131,040	3,353,760
46,640	41,760	44,480	40,880	39,040	43,600	40,320	41,040	51,520	49,920	1,179,440
70,800	76,080	81,920	71,200	77,120	76,400	85,200	78,960	99,440	89,120	2,183,360
70,640	82,640	77,120	72,000	80,240	82,400	81,760	102,960	96,880	93,440	2,207,191
26,680	21,440	22,520	22,840	19,760	20,040	23,840	76,480	16,440	28,560	586,080
885,720	**838,640**	**837,480**	**823,800**	**794,480**	**818,920**	**861,840**	**922,800**	**1,010,680**	**1,048,320**	**22,699,214**

ATTACHMENT A.4: SOLAR PV SYSTEM DESIGN SPECIFICATIONS

Table of Contents

1. Site Access

Design-Builder shall conform to all Purchaser-Owner rules and requirements for accessing sites. Road usage, road closures, number of vehicles, access points, etc., may be regulated by the Purchaser-Owner. Site visits shall be approved and proper check-in requirements must be followed. Design-Builder shall provide signage and/or electronic notification of possible operational impacts upon request by Purchaser-Owner. Unless otherwise determined by Purchaser-Owner, Design-Builder shall be responsible for providing bathroom and storage facilities for all workers on-site, and shall be responsible for procuring, installing, securing, and removing temporary security fencing and scaffolding. No free parking while erecting/ maintaining the solar panel system.

2. Project Management

2.1 PROJECT MANAGER

Design-Builder shall assign a Project Manager from their firm upon execution of the Agreement and receipt of Notice to Proceed. The Project Manager shall ensure that all contract, schedule, and reporting requirements of the Project are met and shall be the primary point of contact for the Purchaser-Owner.

2.2 PROJECT SCHEDULE

A Project Schedule is to be prepared and submitted to the Purchaser-Owner within 14 days of Agreement execution. The Purchaser-Owner will review and approve the Project Schedule prior to the initiation of work. Updates shall be submitted every other week, though the Purchaser-Owner may allow less frequent updates at their discretion. The submittal shall be a Critical Path Method (CPM) schedule describing all Project activities including design, equipment procurement, construction and commissioning.

The following Mandatory Milestones shall be reflected in the schedule and where applicable, represents the dates upon which each milestone is to be achieved for all sites in the Agreement.

Mandatory Milestones

Mandatory Milestone	Date
50% Schematic Design submittal	TBD
90% Design Development submittal	TBD
100% Construction Documents submittal for permitting	TBD
Approved Construction Documents – All Agency Sites	TBD
Notice to Proceed	TBD
Mobilization – All Agency Sites	TBD
Substantial Completion – All Agency Sites	TBD
Final Completion – All Agency Sites	TBD

2.3 SUBMITTALS

Design-Builder shall provide the following submittals as part of the performance of the Work. The cost of developing and providing submittals shall be included in the Project price.

Agreement Submittals

a. System Design Documentation	At each design milestone	TBD
b. Warranties	At Construction Documents milestone	TBD
c. Testing Plan	At Construction Documents milestone	TBD
d. Power production modeling	At Construction Documents milestone	TBD
a. Safety Plan	30 days before commencement of construction	TBD
b. As-built Documentation	After completion of Proving Period	TBD
a. Acceptance Test Results	After Acceptance Test	TBD
b. Startup Test Results	After Startup Test	TBD
c. Monitoring Data (Proving Period)	Continually throughout Proving Period	TBD
d. Proving Period Report	30 days after System Startup	TBD
		TBD
a. Training Materials	30 days before Training Session	TBD
b. Monitoring Manual	30 days before Training Session	TBD
c. Operations & Maintenance Manual	30 days before Training Session	TBD

2.4 SOLAR INCENTIVES

Design-Builder shall submit applications for all available energy production incentives or, should the Purchaser-Owner already have submitted such applications, assume responsibility for all future requirements (agreements, submittals, etc.) related to these incentive programs. This includes actions necessary to ensure compliance with the Utility net metering program and all interconnection agreements and related documents for Purchaser-Owner participation and utilization of the benefits of each applicable program. Design-Builder shall attend all site verification visits conducted by the applicable public utility or Governmental Authority and shall assist the Purchaser-Owner in satisfying the requirements of the incentive program. Design-Builder shall be responsible for providing updated documentation to incentive program administrators throughout the project, as required by rules of the relevant incentive programs. Incentives shall be paid to the Purchaser-Owner if the system is to be purchased and to the Design-Builder should the system be owned by a third-party.

2.5 INTERCONNECTION

Design-Builder shall be responsible for preparing, submitting, and procuring interconnection application to appropriate utility and department. Design-Builder shall accept responsibility for payment for utility interconnection studies and/or project management that are not anticipated but may be required. All anticipated utility work (e.g. transformer installation, meter addition) shall be the responsibility of the Design-Builder. At project completion, Design-Builder shall confirm Permission To Operate with the utility, and shall verify most financially-beneficial rate schedule and billing.

Design-Builder must comply with all interconnection requirements. Systems installed as part of this project will take advantage of Net Energy Metering (NEM), unless specified otherwise by Purchaser-Owner or its agents. Design-Builder shall be responsible for ensuring the system design and interconnection qualifies for NEM, as applicable.

3. System Design

3.1 DESIGN REVIEW PROCESS/ PHASES

The Purchaser-Owner will review and approve design documentation based on the requirements in this RFP and as detailed in Section 3.3 of this document. Additional documents may be requested by the Purchaser-Owner as needed. The precise organization and format of the design submittals shall be agreed upon by Design-Builder and the Purchaser-Owner prior to the first design submission. The Purchaser-Owner will review all submittals, provide written comments, and conduct Design Review Meetings for each stage of the process. Design-Builder shall provide additional detail, as required, at each successive stage of the Design Review. Design-Builder shall not order equipment and materials until Schematic Design submittals have been approved. Design-Builder shall not begin construction until Construction Documents have been approved and all required permits have been obtained. The Purchaser-Owner will formally approve, in writing, each phase of the design and is the sole arbiter of whether each phase of the design has been completed. The Design-Builder shall not enter a subsequent design phase without the approval of the Purchaser-Owner.

Design-Builder is responsible for providing designs approved by the appropriate professional engineers registered in Montgomery County. Costs for engineering reviews and approvals shall be borne by the Design-Builder. System designs must take into account Purchaser-Owner aesthetic issues and not conflict with any current Purchaser-Owner operations.

3.2 DESIGN-BUILDERS' LICENSE CLASSIFICATION

In accordance with the relevant provisions of Montgomery County Public Contract Code, the Purchaser-Owner requires that Respondents possess, at the time of submission of a Proposal, at the time of award of the Agreement and at all time during construction activities, a General Contractor License, Electrical Contractor License, or Solar Contractor License (if applicable). It shall be acceptable for a Respondent that does not possess as appropriate License to list a Subcontractor with an appropriate License.

3.3 DESIGN SUBMITTALS

3.3.1 <u>Plan Set</u>

Design-Builder shall prepare a comprehensive submittal package for each phase of the Work that will be reviewed and approved by the Purchaser-Owner. At a minimum, each submittal package shall include the elements required to convey in sufficient detail the following for each phase of the design:

- Site Layout Drawings, with distances from roof edges and existing equipment, as applicable
- Construction Specifications (trenching, mounting, etc.)
- Equipment Layout Drawings
- Detailed Drawings
- Electrical Single-Line and Three-Line Diagrams
- Module Stringing Diagrams
- Electric Wire and Conduit Schedule
- Electrical Warning Labels & Placards Plans
- Lighting Plan (for carports, as required)
- Network Connection Diagrams
- Architectural Drawings
- Structural/Mechanical Drawings, including proposed alterations to parking structures
- Geotechnical Drawings
- Manufacturer's Cut Sheets with Equipment Specifications
- Data Acquisition System (DAS) Specifications, Cut Sheets, and Data Specifications

Design-Builder shall include adequate time for Purchaser-Owner review and approval of submittals, as well as re-submittals and re-reviews. Minimum Purchaser-Owner review time shall be ten (10) days from the date of receipt of each submittal package during each phase of the Design Review.

3.3.2 Production Modeling

Production modeling of the PV systems shall be performed using NREL's PVWatts™ Calculator (http://pvwatts.nrel.gov/) according to instructions provided in RFP and pricing attachments. The simulations shall accurately simulate energy production for proposed system layouts, sizes, and orientation. It is critical that PV production models are accurate with all methodology and assumptions described. The Purchaser-Owner will independently verify production models are accurate to the designed systems and utilize simulation results for economic evaluations. Design-Builder shall be responsible for updating the production models each time sufficient changes are made to the proposed system designs that will impact production.

Design-Builder shall avoid excessive shading on modules to the extent possible. Where shading losses are encountered, Design-Builder shall perform a shading analysis justifying the basis for their design, including any proposed tree removal, and explaining why shading does not create an adverse performance and/or economic impact.

3.4 PERMITS AND APPROVALS

Construction Documents must be reviewed and approved by all authorities having jurisdiction (AHJs) over the work, which may include, but are not limited to: the Purchaser-Owner, Montgomery County Department of of Transportation, the Montgomery County Department Permitting Services, and the Potomac Electric Power Company. Design-Builder shall be responsible for obtaining all approvals and shall account for permitting and inspection requirements in their system designs, project pricing, and schedule. Design-Builder shall attend all site verification visits conducted by the applicable public utility or Governmental Authority, including any special inspections for trenching, rebar, concrete, welding, and roof attachment work, according to AHJ requirements. The Purchaser-Owner will not grant Design-Builder relief based on Design-Builder's incomplete or incorrect understanding of permitting and approval requirements.

3.5 TECHNICAL REQUIREMENTS

3.5.1 General Considerations

All documentation and components furnished by Design-Builder shall be developed, designed, and/or fabricated using high quality design, materials, and workmanship meeting the requirements of the Purchaser-Owner and all applicable industry codes and standards. The installations shall comply with at least, but not limited to, the latest approved versions of the International Building Code (IBC), National Electrical Code (NEC), Utility Interconnection Requirements, Montgomery County Building Codes, and all other federal, state, and local jurisdictions having authority.

3.5.2 Electrical Design Standards

The design, products, and installation shall comply with at least, but not limited to, the following electrical industry standards, wherever applicable:

- Illumination Engineering Society of North America (IESNA) Lighting Standards
- Institute of Electrical and Electronics Engineers (IEEE) Standards
- National Electrical Manufacturers Association (NEMA)
- Underwriters Laboratories, Inc. (UL)
- National Fire Protection Association (NFPA)
- Montgomery County Department of Permitting Services (DPS) Codes
- Maryland Public Service Commission (PSC)
- Potomac Electric Power Company (Pepco) Requirements
- American National Standards Institute (ANSI)
- Occupational Health and Safety Administration (OSHA)
- International Code Council (ICC) Codes

3.5.3 Modules

In addition to the above, the PV modules proposed by Design-Builder shall comply with at least, but not limited to, the following:

- IEEE 1262 "Recommended Practice for Qualifications of Photovoltaic Modules".
- System modules shall be UL1703 listed and CEC listed.
- Modules shall be new, undamaged, fully warranted without defect.
- If PV modules using hazardous materials are to be provided, then the environmental impact of the hazardous material usage must be disclosed, including any special maintenance requirements and proper disposal/recycling of the modules at the end of their useful life.

3.5.4 Inverters

In addition to the above, inverters proposed by Design-Builder must comply with at least, but not limited to the following:

- Inverters shall be suitable for grid interconnection and shall be compliant with all Utility interconnection requirements.
- IEEE 929-2000 – "Recommended Practice for Utility Interface of Photovoltaic Systems".
- Inverters shall be UL 1741 and IEEE 1547 compliant.
- Inverters shall be CEC-listed with an efficiency of 95.5% or higher.
- Inverters must automatically reset and resume normal operation after a power limiting operation.
- Inverters shall be sized to provide maximum power point tracking for voltage and current range expected from PV array for temperatures and solar insolation conditions expected for Project conditions.
- Enclosures shall be rated NEMA 3R when the inverter is located outdoors. For outdoor installations in corrosive environments, NEMA 4X series 300 stainless steel enclosures must be used.
- Inverter selection shall take into account anticipated noise levels produced and minimize interference with Purchaser-Owner activities.

3.5.5 Electrical Balance of System Components

- Each proposed PV system shall include, at a minimum, one fused DC disconnect and one fused AC disconnect for safety and maintenance concerns.
- String combiner boxes shall be load-break, disconnecting types, such that opening the combiner boxes shall break the circuit between combiner box feeders and inverters.
- Design-Builder shall utilize lightning arrestors to protect appropriate equipment from lightning strikes.
- Design-Builder shall utilize surge suppressors to protect the appropriate equipment from electrical surges.

- All wiring materials and methods must adhere to industry-standard best practices, and all inter-module connections must require the use of a specialized tool for disconnecting.

3.5.6 Mounting Systems

The mounting systems shall be designed and installed such that the PV modules may be fixed or tracking with reliable components proven in similar projects, and shall be designed to resist dead load, live load, corrosion, UV degradation, wind loads, and seismic loads appropriate to the geographic area over the expected 25-year lifetime. Design-Builder shall conduct an analysis, and submit evidence thereof, including calculations, of each structure affected by the performance of the scope described herein, and all attachments and amendments. The analysis shall demonstrate that existing structures are not compromised or adversely impacted by the installation of PV, equipment, or other activity related to this scope. Mounting systems must also meet the following requirements at a minimum:

- All structural components, including array structures, shall be designed in a manner commensurate with attaining a minimum 25-year design life. Particular attention shall be given to the prevention of corrosion at the connections between dissimilar metals.
- Thermal loads caused by fluctuations of component and ambient temperatures shall be accounted for in the design and selection of mounting systems such that neither the mounting system nor the surface on which it is mounted shall degrade or be damaged over time.
- Each PV module mounting system must be certified by the module manufacturer as (1) an acceptable mounting system that shall not void the module warranty, and (2) that it conforms to the module manufacturer's mounting parameters.
- For unframed modules, bolted and similar connections shall be non-corrosive and include locking devices designed to prevent twisting over the 25-year design life of the PV system.
- Design-Builder shall utilize tamper-resistant PV module to rack fasteners for all PV module mounting.
- Final coating and paint colors shall be reviewed and approved by the Purchaser-Owner during Design Review.
- Painting or other coatings must not interfere with the grounding and bonding of the array.

3.5.7 Corrosion Control

In addition to the above, Corrosion Control proposed by Design-Builder must comply with at least, but not limited to the following requirements:

- Fasteners and hardware throughout system shall be stainless steel or material of equivalent corrosion resistance
- Racking components shall be anodized aluminum, hot-dipped galvanized steel, or material of equivalent corrosion resistance
- Unprotected steel not to be used in any components

- Each PV system and associated components must be designed and selected to withstand the environmental conditions of the site (e.g., temperatures, winds, rain, flooding, etc.) to which they will be exposed.

3.5.8 Roofing Requirements

The installation of PV modules, inverters and other equipment shall provide adequate room for access and maintenance of existing equipment on the building roofs. A minimum of three feet of clearance will be provided between PV equipment and existing mechanical equipment and other equipment mounted on the roof. A minimum of four feet of clearance shall be provided between PV equipment and the edge of the roof. Clearance guidelines of the local fire marshal shall be followed, if applicable. The PV equipment shall not be installed in a way that obstructs air flow into or out of building systems or equipment.

Proposed roof top mounted systems may be ballasted, standing seam attachment, or penetrating systems and must meet or exceed the following requirements:

- Systems shall not exceed the ability of the existing structure to support the entire solar system and withstand increased wind uplift and seismic loads. The capability of the existing structure to support proposed solar systems shall be verified by Design-Builder prior to design approval.
- Roof penetrations, if part of the mounting solution, shall be kept to a minimum.
- Design-Builder shall perform all work so that existing roof warranties shall not be voided, reduced, or otherwise negatively impacted. As part of the design submittals, Design-Builder shall include signed certificates from the roofing manufacturer stating:
  - The roofing contractor is certified installer of Complete Roofing System.
  - The manufacturer's Technical Representative is qualified and authorized to approve project.
  - Project Plans and specs meet the requirements of the warranty of the Complete Roofing System for the specified period.
  - Existing warranty incorporates the new roofing work and flashing work.
- No work shall compromise roof drainage, cause damming or standing water or cause excessive soil build-up.
- All materials and/or sealants must be chemically compatible.
- All penetrations shall be waterproofed.
- Detail(s) for the sealing of any roof penetrations shall be approved in writing to the Purchaser-Owner, as well as the manufacturer of the existing roofing system, as part of system design review and approval – prior to Design-Builder proceeding with work. The Purchaser-Owner will make available the roofing manufacturer for each building for consultation with Design-Builder as part of the design process.
- Any damage to roofing material during installation of solar systems must be remedied by Design-Builder.

3.5.9 Shade Structure (Carport) Requirements

Design-Builder will be responsible for incorporating the following elements in the design and construction of the System:

- Minimum height: all shade structures shall be designed to have a minimum clear height of ten (10) feet, unless specified in a Site's Specification Sheet to be taller to accommodate larger vehicles at the site.
- All shade structures shall be installed with a fascia surrounding the exposed edge of the structure's purlins.
- Shade structures located in parking lots shall have a concrete bollards installed on support posts. The bollards shall extend up to a minimum elevation of 36" above finished grade. This requirement may be waived at the Purchaser-Owner's sole discretion.
- Maximum concrete anchorage [MCA] to be ¾" deep, except for the structural elements. Design-Builder must review all anchor details with County official.
- Shade structure columns, beams, and fascia shall be painted to match site colors or to a color of the Purchaser-Owner's approval.

Installation of shade structure PV systems shall include new high efficiency lighting as desired by Purchase-Owner. Installation of shade structure PV systems shall include the removal of existing security light poles, foundations, and fixtures that are no longer effective. Lighting systems shall also meet the following requirements:

- County prefers that Design-Builder use existing columns/light pole pedestals for the structure to the maximum extent possible. Schematic design in Design-Builder's proposal should show this. Roof penetration will require GPR survey due to post-tensioned structure.
- In the event new lighting will be required, new fixtures shall be LED and shall provide parking lot illumination compliant with IESNA requirements or recommendations for illumination and safety.
- Any new LED lighting is required to illuminate the entire parking area and adjacent pedestrian walkways affected by the removal of existing lights, not just the area under the PV modules.
- Any new LED lighting under solar panels is required to provide 5 foot candle average lighting level with min. to max. ratio to be 1:4.
- A photometric illumination plot must be submitted for each parking lot showing all existing lighting and proposed new SSS canopy lighting.

Photocell controls shall be used in conjunction with a lighting control system for all exterior lighting and energize lighting when ambient lighting levels fall below two (2) foot-candles measured horizontally at ground level. Lighting shall also be required to operate manually without regards to photocell input. Replacement parking lot lighting shall be served from an existing parking lot lighting circuit and any existing circuits and existing control function shall be maintained, or if replaced, done so at the approval of the Purchaser-Owner.

3.5.10 Ancillary Equipment Enclosures

Design-Builder will be responsible for incorporating the following elements in the design and construction of the System:

- Fencing: all ancillary equipment be grouped to a single location per site and shall be surrounded by a fence to prevent access by unauthorized personnel. The fence shall be a six (6) foot high chain link fence with vinyl privacy slats. This requirement may be waived at the Purchaser-Owner’s sole discretion.
- Location: all ancillary equipment shall be located in a manner that minimizes its impact to normal Purchaser-Owner operations and minimizes the visual impacts to the site.

3.5.11 Placards and Signage

- Placards and signs shall correspond with requirements in the National Electric Code and the interconnecting utility in terms of appearance, wording, and placement.

- Permanent labels shall be affixed to all electrical enclosures, with nomenclature matching that found in As-Built Electrical Documents.

3.5.12 Infrastructure for Ground Mount Systems

Design-Builder will be responsible for incorporating the following elements in the design and construction of the System:

- Fencing: the site shall be surrounded by a fence to prevent unauthorized personnel from gaining access the site. The fence shall be a eight (8) foot high chain link fence with vinyl privacy slats.
- Gates shall be installed to enable site access for trucks.
- A pathway a minimum of ten (10) feet wide passable by a maintenance truck shall be provided within the array fence to allow for access to all equipment enclosed within the fence area.
- Access to water for maintenance (module cleaning) purposes, as determined adequate by Design-Builder and approved by the Purchaser-Owner.
- Access to low voltage (120V) AC power to power maintenance equipment and miscellaneous equipment.
- Design-Builder shall install and ensure activation of sufficient security cameras on site to monitor array area, connected to the site’s security system, in collaboration with the Purchaser-Owner.
- Design-Builder will be responsible for installing an acceptable surface cover material under and around the modules and throughout the site that provides appropriate weed control, erosion and dust management.
- Design-Builder will be responsible for creating an access road to any ground mount system for maintenance and fire access purposes. The access road shall be passable under all weather conditions.

3.5.13 Wiring and Cabling Runs

- Design-Builder shall install all AC conductors in IMC rated conduits with extra fish wire or pull string.
- Direct burial wire will not be acceptable. Conduit buried underground shall be suitable for the application and compliant with all applicable codes. A tracing/caution tape must be installed in the trench over all buried conduit.
- Conduit installed using horizontal directional boring (HDB), shall include tracer tape or traceable conduit. The minimum depth of the conduit shall be per NEC 2011 Article 300.5. The Design-Builder is responsible for demonstrating that all conduits installed utilizing horizontal boring meets the minimum depth requirement and is solely responsible for any remediation costs and schedule impacts if the specification is not met. The HDB contractor must provide documentation of final depth and routes of all conduit installed in horizontal bores.
- Conduit installed on building roofs shall not be installed near roof edges or parapets to reduce visibility. Any conduit penetrations through roof surfaces shall not be made within five (5) feet of the roof edge to reduce visibility. If conduit is installed on the exterior face of any building, it shall be painted to match the existing building color. In all cases, the visible impact of conduit runs shall be minimized and the design and placement of conduit shall be reviewed and approved by the Purchaser-Owner as part of Design Review.
- All spare conduits shall be cleaned, mandrelled, and provided with a pullwire. Spare conduits shall be required for security cameras for ground mount systems.
- All exposed conduit runs over 100-feet in length or passing over building connection points shall have expansion joints to allow for thermal expansion and building shift.
- Design Builder shall install and secure the exposed string cable homeruns along the beams or structure where the combiner box is installed.
- All exposed string wiring must be installed above the lower surface of the structural purlins and beams. Wire loops under framing members are not acceptable.
- Acceptable wire loss in DC circuits is < 1.5% and acceptable wire loss in AC circuits is < 1.5% as well.
- All cable terminations, excluding module-to-module and module-to-cable harness connections, shall be permanently labeled.
- All electrical connections and terminations shall be torqued according to manufacturer specifications and marked/sealed at appropriate torque point.

3.5.14 Grounding and Bonding

- Module ground wiring splices shall be made with irreversible crimp connectors.
- All exposed ground wiring must be routed above the lower surface of any structural framing.
- For shade structure installations, grounding electrode conductors shall be bonded to structure columns either just below grade or below the top surface of concrete bollards.

3.5.15 Monitoring System, DAS, and Reporting

Design-Builder shall design, build, activate and ensure proper functioning of Data Acquisition Systems (DAS) that enable the Purchaser-Owner to track the performance of the PV Systems as well as environmental conditions through an online web-enabled graphical user interface and information displays. Design-Builder shall provide equipment to connect the DAS via existing Wi-Fi network or cellular data network at all locations. The means of data connection will be determined during design. The Purchaser-Owner will pay for the cost of cellular data service if needed, but not for the modem or other equipment needed to connect to the cellular network.

The DAS(s) shall provide access to at least the following data:

- Instantaneous AC system output (kW)
- PV System production (kWh) over pre-defined intervals that may be user configured
- In-plane irradiance
- Ambient and cell temperature
- Inverter status flags and general system status information
- System availability
- Site Load information. Available load data for the meter the system is connected to shall be collected by the solar monitoring solution as part of the DAS.

Environmental data (temperatures and irradiance) shall be collected via an individual weather station installed for each site

Data collected by the DAS shall be presented in an online web interface, accessible from any computer through the Internet with appropriate security (e.g., password controlled access). The user interface shall allow visualization of the data at least in the following increments: 15 minutes, hour, day, week, month, and year. The interface shall access data recorded in a server that may be stored on-site or remotely with unfettered access by the Purchaser-Owner for the life of the Project. The online interface shall enable users to export all available data in Excel or ASCII comma-separated format for further analysis and data shall be downloadable in at least 15 minute intervals for daily, weekly, monthly and annual production.

The Monitoring system shall enable Purchaser-Owner staff to diagnose potential problems and perform remediating action. The monitoring system shall provide alerts when the system is not functioning within acceptable operating parameters. These parameters shall be defined during the design phase of the Project and specified in the DAS design document. At a minimum, Purchaser-Owner shall have the ability to compare irradiance to simultaneous power production measurements through linear regression analysis.

Additionally, Design-Builder shall make available, at no additional cost, the following reports for a term of 5 years after Final Completion of the project:

- Monthly Production report shall be available online to the Purchaser-Owner personnel.
- System performance data shall be made available electronically to the Purchaser-Owner in a format and at a frequency to be determined during the Design Review process.
- Additional reports shall be made available to the Purchaser-Owner to assist the Purchaser-Owner in reconciling system output with utility bills and the production guarantee, as determined in the Design Review process.

A Monitoring Manual shall be provided to the Purchaser-Owner in printed or on-line form that describes how to use the monitoring system, including the export of data and the creation of custom reports.

3.6 WARRANTIES

Design-Builder shall provide a comprehensive ten (10) year warranty on all system components against defects in materials and workmanship under normal application, installation, and use and service conditions.

Additionally, the following minimum warranties are required:

- PV Modules: The PV modules are to be warranted against degradation of power output of greater than 10% of the original minimum rated power in the first ten (10) years and greater than 20% in the first twenty (25) years of operation.
- Inverters: Inverters shall carry a minimum 10-year warranty (direct purchase price must include a 20-year warranty).
- Meters: At minimum, meters shall have a five (5) year warranty. For meters integrated in inverters, the meter warranty period must match the inverter.
- Mounting system: twenty (20) year warranty, covering at least structural integrity and corrosion.
- Balance of system components: the remainder of system components shall carry manufacturer warranties conforming to industry standards.

All warranties must be documented, in advance and be fully transferable to Client.

All work performed by Design-Builder must not render void, violate, or otherwise jeopardize any preexisting Purchaser-Owner facility or building warranties or the warranties of system components.

4. Procurement/Construction

4.1 TREE REMOVAL

Any trees that are in the footprint of systems to be installed by the Design-Builder shall be removed by the Design-Builder at their expense, subject to the approval of the Purchaser-Owner. A tree shall be considered to be in the footprint of a system if its canopy would extend over any part of the system, including structural components or modules. The Purchaser-Owner will remove or prune, at its discretion, trees planted outside of the work area that shade PV systems (at present time or in the foreseeable future), provided the Design-Builder identifies these trees during the design process. The Design-Builder shall be responsible for any required tree remediation efforts resulting from tree removal that is deemed the Design-Builder's responsibility.

4.2 LINE LOCATION

Design-Builder will be responsible for locating, identifying and protecting existing underground utilities conduits, piping, substructures, etc. and ensuring that no damage is inflicted upon existing infrastructure. In addition to USA Dig and utility line-locating, a private line-locator must be used for any project requiring underground work.

4.3 QUALITY CONTROL

To ensure safety and quality of the installation, Design-Builder shall:

- Keep the Site clean and orderly throughout the duration of construction. All trash and rubbish shall be disposed of off-site by licensed waste disposal companies and in accordance with applicable Law.
- Fully comply with all applicable notification, safety and Work rules (including Purchaser-Owner safety standards) when working on or near Purchaser-Owner facilities.
- Provide all temporary road and warning signs, flagmen or equipment as required to safely execute the Work. Street sweeping services shall also be provided as required to keep any dirt, soil, mud, etc. off of roads. Comply with all state and local storm water pollution prevention (SWPP) ordinances.

4.4 REMOVAL AND REMEDIATION

Design-Builder shall remove all construction spoils, abandoned footings, utilities, construction equipment and other byproducts of construction. All disturbed areas including landscaping, asphalt, and concrete shall be remediated to be in equal or better condition than found. Parking lots shall be re-striped if affected by construction operations.

The site shall be left clean and free of debris or dirt that has accumulated as a result of construction operations.

5. Testing and Commissioning

Following completion of construction, Design-Builder shall provide the following services related to startup and performance testing of the PV systems:

- Acceptance Testing

- System Startup
- Proving Period

A detailed Testing Plan covering each of the phases above shall be submitted and approved by the Purchaser-Owner prior to substantial completion of construction. A detailed description of each phase is provided below.

5.1 ACCEPTANCE TESTING

Design-Builder shall perform a complete acceptance test for each PV System. The acceptance test procedures include component tests as well as other standard tests, inspections, safety and quality checks. All testing and commissioning shall be conducted in accordance with the manufacturer's specifications.

The section of the Testing Plan that covers Acceptance Testing shall be equivalent or superior to the CEC (California Energy Commission) "Guide to Photovoltaic (PV) System Design and Installation", Section 4 and shall cover at least the following:

- Detailed list of all items to be inspected and tests to be conducted.
- Acceptance Criteria: For each test phase, specifically indicate what is considered an acceptable test result.

The Acceptance Testing section of the Testing Plan shall include (but not be limited to) the following tests:

- String-level voltage (open circuit) and amperage (under load) testing for all PV strings. Amperage testing shall be performed concurrently with irradiance testing.
- Inverter testing for all inverters. The inverters shall be commissioned on-site by a qualified technician and shall confirm that the inverter can be operated locally per specification and that automatic operations such as wake-up and sleep routines, power tracking and fault detection responses occur as specified. Performance testing shall be performed concurrently with irradiance testing.
- Testing of all sensors of the DAS.
- Testing of the Data Presentation interface of the DAS.

After Design-Builder conducts all Acceptance Testing based on the Testing Plan approved by the Purchaser-Owner prior to substantial completion, Design-Builder shall submit a detailed Acceptance Test Report to the Purchaser-Owner for review.

The Acceptance Test Report shall document the results of the tests conducted following the Testing Plan, and include additional information such as the date and time each test was performed. It shall also make reference to any problem and deficiencies found during testing. If there was troubleshooting done, the Report shall describe the troubleshooting methods and strategy. Design-

Builder shall be responsible for providing the labor and equipment necessary to troubleshoot the System.

5.2 PROVING PERIOD (30 DAYS)

Upon completion of Acceptance Testing and System Startup, and approval by the Purchaser-Owner, Design-Builder shall monitor the system during a thirty (30) day Proving Period and submit a report for Purchaser-Owner review and approval prior to final acceptance by the Purchaser-Owner. This includes monitoring system output and ensuring the correct functioning of system components over this time. The values for the following data shall be acquired every fifteen (15) minutes over thirty (30) days:

- AC system output (kW)
- PV system production (kWh)
- In-plane irradiance
- Ambient and cell temperature
- Inverter status flags and general system status information
- System availability

Design-Builder shall utilize calibrated test instruments and the DAS and monitoring system to collect the test data described above, which shall be made available to the Purchaser-Owner for access throughout the Proving Period. Design-Builder shall determine through analysis of data from the Proving Period whether the PV system delivers the expected production as determined by the final approved design (i.e., Construction Documents). Actual production shall be compared against expected production using actual weather data and other system inputs (such as module cell temperature factor, module mismatch, inverter efficiency, and wiring losses) for calculating expected production. The production figures for all meters, whether existing or installed by or on behalf of the IOU or by or on behalf of the Respondent, shall be correlated during this test to verify their accuracy in measuring system production.

All data and reports required in Section 3.5.15 shall be fully functional and available to the Purchaser-Owner at the commencement of the Proving Period. Data and reporting requirements are included in the testing scope of the Proving Period and deficiencies in these areas (including missing data, inaccurate reports, and other issues that make validation of system performance inconclusive) shall be grounds for denying approval of the Proving Period Report.

If the PV system does not perform to design specifications, diagnostic testing shall be performed by Design-Builder, deficiencies shall be identified with proposed corrective actions submitted to the Purchaser-Owner, and the Proving Period test repeated. Design-Builder shall be responsible for providing the labor and equipment necessary to troubleshoot the system. The Proving Period Report shall be submitted after the successful completion of this phase and submitted to the Purchaser-Owner for review and approval. The report shall contain, but not be limited to, the following information; calculations shall be provided in Excel format with formulas visible to allow for peer review:

- System description
- Test period
- Test results
- Anomalies identified during test
- Corrective action performed
- Actual measured performance
- Calculations detailing expected performance under TMY conditions

5.3 CLOSE-OUT DOCUMENTATION REQUIREMENTS

Close-Out documents prepared by Design-Builder must include at minimum, but not limited to, the following items:

- Final As-Built Drawing Set with accurate string diagram, provided in (2) hard copy sets and an electronic copy in DWG format (or as desired by Purchaser-Owner).
- Megger test Results
- Module flash-test results with serial numbers
- Component warranties
- Signed inspections cards from AHJ and required Special Inspections
- Interconnection agreements and Permission To Operate
- Owner’s Manual

5.4 TRAINING

The Design-Builder shall provide four (4) hours of on-site training for Purchaser-Owner personnel in all aspects of operation, routine maintenance, and safety of the PV systems, DAS, and monitoring solution. At a minimum, training topics shall include the following:

- PV system safety, including shut-down procedures
- PV module maintenance and troubleshooting
- Inverter overview and maintenance procedures
- Calibration and adjustment procedures for the inverters and tracking systems (if any)
- DAS and monitoring solution, including standard and custom reporting

Design-Builder shall submit a proposed Training Plan during the design process for approval and provide all training materials and manuals to support on-site training in advance of scheduled training sessions (see schedule of submittals in Section 2.3, “Submittals”). The on-site portion of the training program shall be scheduled to take place at the jobsite at a time agreeable to both the Purchaser-Owner and Design-Builder.

6. Operations and Maintenance

Design-Builder shall offer Operations and Maintenance services for ten (10) years with their Proposal, with an option to extend the Contract for up to an additional ten (10) years. The Purchaser-Owner reserves the right to not execute the Operations and Maintenance services agreement. In offering such services, Design-Builder shall perform all necessary preventive and corrective maintenance, which includes routine maintenance adjustments, replacements, and electrical panel/transformer/ inverter cleaning (interior and exterior) with supporting documentation delivered to the Purchaser-Owner after the Work has been performed. Maintenance by Design-Builder shall ensure that all warranties, particularly inverter warranties, are preserved. The frequency and timing of panel wash-downs shall be determined by Design-Builder based on system monitoring data. Environmental sensors such as pyranometers shall be tested and recalibrated at least once every three (3) years.

Design-Builder shall perform the following maintenance services, at a minimum, as described in the following sections:

6.1 PREVENTIVE MAINTENANCE

Preventive Maintenance shall be performed at least annually and include:

- System testing (voltage/amperage) at inverter and string levels
- System visual inspection to include but not be limited to the list below. All discovered issues shall be resolved as needed.
    - Inspect for stolen, broken or damaged PV modules, record damage and location. Report to the Purchaser-Owner and wait for the Purchaser-Owner to authorize a course of action.
    - Inspect PV wiring for loose connections and wire condition.
    - Inspect for wires in contact with the structure or hanging loose from racking.
    - Check mechanical attachment of the PV modules to the racking.
    - Check attachment of racking components to each other and the structure.
    - Verify proper system grounding is in place from panels to the inverter.
    - Check conduits and raceways for proper anchorage to structures.
    - Inspect all metallic parts for corrosion.
    - Check combiner boxes for proper fuse sizes and continuity.
    - Inspect all wiring connections for signs of poor contact at terminals (burning, discoloration).
    - Inspect disconnects for proper operation.
    - Survey entire jobsite for debris or obstructions.
    - Inspect fasteners for proper torque and corrosion.
    - Inspect inverter pad for cracking or settling.
    - Inspect electrical hardware for proper warning and rating labeling.
    - Inspect alignment of arrays and racking to identify settling foundations or loose attachments.
    - Inspect operation of tracking hinges, pivots, motors and actuators if present.
    - Check for proper operation and reporting of monitoring hardware.
    - Inspect sealed electrical components for condensation buildup.
    - Inspect wiring and hardware for signs of damage from vandalism or animal damage.

- Routine system maintenance to include correction of loose electrical connections, ground connections, replacement of defective modules found during testing, other minor maintenance repair work.
- Module cleaning, at a frequency to be determined by the ongoing monitoring of the system such that effect on production is no more than 5%, but not less often than twice a year.
- Routine DAS maintenance to include sensor calibration and data integrity check.

6.2 TROUBLESHOOTING, INSPECTION AND ADDITIONAL REPAIRS

- Dispatch of field service resources within two business days of notification (via automated or manual means) for repairs as necessary to maintain system performance.
- Any corrective action required to restore the system to fully operational status shall be completed within 24-48 hours of the service resources arriving on-site.
- Major system repairs, not to include mid-voltage switchgear or transformers.

6.3 CUSTOMER SERVICE SUPPORT

- Support telephone line made available to Purchaser-Owner staff to answer questions or report issues.
- Support line shall be staffed during operational hours from 8 am – 6 pm Eastern Standard Time. During times outside of this operational period, an urgent call shall be able to be routed to a supervisor for immediate action.

6.4 MAJOR COMPONENT MAINTENANCE AND REPAIR

- Inverter repair and component replacement and refurbishment as required in the event of inverter failure.
- Inverter inspection and regular servicing as required under inverter manufacturer's warranty specifications. Those include but are not limited to the following annually:
    - Check appearance/cleanliness of the cabinet, ventilation system and all exposed surfaces.
    - Inspect, clean/replace air filter elements
    - Check for corrosion on all terminals, cables and enclosure.
    - Check all fuses.
    - Perform a complete visual inspection of all internally mounted equipment including subassemblies, wiring harnesses, contactors, power supplies and all major components.
    - Check condition of all the AC and DC surge suppressors.
    - Torque terminals and all fasteners in electrical power connections.
    - Check the operation of all safety devices (E-stop, door switches).
    - Record all operating voltages and current readings via the front display panel.
    - Record all inspections completed.
    - Inform inverter manufacturer of all deficiencies identified.

    - o Oversee inverter manufacturer performance of In-Warranty replacement of failed inverter components.
- Customer advocacy with vendors.

6.5 OTHER SYSTEM SERVICES

- O&M Manuals – Design-Builder shall provide three (3) copies of O&M Manuals. Updated editions of O&M Manuals shall be sent electronically to the Purchaser-Owner as they become available.
- Management of long term service and warranty agreements, ongoing.
- Design-Builder shall log all maintenance calls and document all maintenance activities. These activities shall be presented in a report, which is to be submitted to the Purchaser-Owner upon request.

O&M services shall be priced separately from the design and construction of the PV system. Design-Builder shall submit a detailed description of their O&M services, detailing the activities and the intervals at which they will be performed, with their Proposal.