MOTT MACDONALD

Technical Note
Solar Feasibility

Project:	Pensacola – Solar Feasibility		
Our reference:	502100054-031		
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Subject:	Solar Feasibility		

1 Introduction

This Technical note is to address feasibility of solar photovoltaic (PV) power at sites designated by the City of Pensacola. This memo encompasses performance estimates, site impact of PV installation, and includes methodology utilized to determine feasibility of the sites.

2 Methodology

The following sections discuss the process followed to develop the feasibility study.

2.1 Mapping Areas on Sites for PV Installation

The team utilized AutoCAD and its Online Map Data to import a to-scale aerial view of the designated sites. Areas where PV panels can be mounted were mapped out in AutoCAD, these areas are indicated as Max Area. We used Google Earth to identify the Sun's path, and roof geometry. As a result, new practical areas were drawn with consideration of the present shadows.

2.2 Estimating the Performance of PV Installation

We used PVWatts® to determine potential power (kW) size for each site by multiplying the practical area, standard module efficiency, and standard module power. PVWatts® is a web application developed by the National Renewable Energy Laboratory (NREL) that estimates the electricity production of a grid-connected roof- or ground-mounted PV system based on location and the system size.

2.3 Determining a Feasible System Size

Based on the Florida Power and Lighting (FPL) energy bill data provided to us by the City, we were able to approximate the average annual kilowatt hours (kWh) used by each site and convert that value into an equivalent PV system size. To determine a feasible system size, we compared the two system sizes and used the lesser amount. This is based on the current limitations of power production under a net metering agreement with FPL. In general, only 110% of the kWh used would be allowed per meter in the FPL net metering agreement. So, while a building or site may be able produce much more than is consumed, there will be limitations to the size.

3 Summary of Findings

The table below summarizes the practical area in ft^2 for each building as well as the associated PV size that could be generated.

Table 3.1: Working Feasibility Data

Site Name	Practical Area (ft^2)	Potential PV System Size (kW)	Avg kWh used system Size (kW)	Site Calculated Size (kW)	Feasible Power Size (kW)	Added Percent Renewable Per Site	Percent towards 30% goal	Budget Installation
Airport	98744.05	13760	TBD	TBD	TBD		TBD	
Blue Wahoos Stadium	9991.81	139.24	698	139.2	139	20%	0.75%	$348,100.92
Fire Administration Building/ Fire Station 1	5938.94	82.73	204	82.8	82	41%	0.44%	$206,904.50
Fire Station 2	10561.83	147.18	91	147.2	91	100%	0.49%	$226,310.95
Fire Station 3	6758.64	94.18	64	94.2	64	100%	0.35%	$161,125.76
Fire Station 4	12362.45	172.27`	87	172.3	87	100%	0.47%	$218,730.55
Fricker Community Center	8921.09	124.31	176	124.3	124	71%	0.67%	$310,798.51
Housing Department	6828.61	95.15	53	95.2	53	100%	0.29%	$133,448.43
Malcolm Youge Center	9607.25	133.88	88	133.9	88	100%	0.47%	$220,124.02
Osceola Golf Course & Club House	16954.16	644.78	201	881.0	201	100%	1.09%	$501,258.52
Pensacola Energy Operations Center	23066.57	321.44	221	321.4	221	100%	1.18%	$552,059.05
Port of Pensacola, Admin Bldg	1603.94	22.35	28	1640.6	22	81%	0.15%	$55,879.06
Port of Pensacola, Warehouse #4	46438.79	647.14	24	1640.6	24	100%	0.13%	$60,551.03
Port of Pensacola, Warehouse #8	69688	971.13	148	1640.6	148	100%	0.80%	$369,970.19
PPD	15160.52	211.26	980	211.3	211	22%	1.14%	$528,171.67
Roger Scott Athletic Complex	1919.44	26.74	64	304.0	27	42%	0.34%	$66,870.65
Roger Scott Tennis Center	1909.14	26.60	466	304.0	27	6%	1.62%	$66,511.81
Vickrey Resource Center	17986.48	250.64	222	304.0	222	100%	1.21%	$554,056.23
Field Service Center	27560.13	384.06	386	1219.2	384	100%	2.09%	$960,157.03
Fleet Garage	17992.85	250.73	72	1219.2	72	100%	0.39%	$181,244.58
Sanitation	5412.36	75.42	111	1219.2	75	68%	0.60%	$188,559.18
Second Garage at FSC	8644.76	120.46	19	1219.2	19	100%	0.10%	$47,542.83
Parks Shed at FSC	10651.81	148.43	22	1219.2	22	100%	0.12%	$54,927.26
Transfer station	12775.67	178.03	2	1219.2	2	100%	0.01%	$7,787.12
Sanders Beach Community Center	9899.04	137.94	164	137.9	138	84%	0.74%	$344,868.94
Theophilis May Community Center	9668.45	134.73	105	168.2	105	100%	0.56%	$263,111.27
Totals:					**3981.3**		**16%%**	**$7,632,089.68**

Practical Area (ft^2)	The area available at a site that could support a solar install.
Potential PV System Size (kW)	The size of PV system that could fit given the area available.
Avg kWh used system Size (kW)	The size of PV system required to meet 100% of the site's energy needs, based on provided data.
Site Calculated Size (kW)	The size of PV system that could fit given the size of the grouped site.
Feasible Power Size (kW)	The size of PV system that could be installed to meet as much of the site's energy needs as possible.
Added Percent Renewable Per Site	The percentage of renewable energy that the feasible PV system could provide to a site.
Percent towards 30% goal	The percentage of renewable energy that the feasible PV system could provide towards the City's 30% renewable energy goal.
Budget Installion	The estimated cost of installation for the feasible PV system.

3.1 System Value

Almost two-thirds of the sites in **Table 3.1** can have PV systems installed to meet average annual kWh usage, with the capability to expand beyond demand and generate credit.

3.2 Single Systems

The following sites could have roof-mounted PV systems installed that would supply the average kWh used per year: Fire Stations 2, 3, & 4, Housing Department building, Malcolm Younge Center, Pensacola Energy Operations Center, and Theophilis May Community Center.

3.3 Campus Systems

Campuses are a group of buildings sub-fed by a shared meter. The Fire Administration building and Fire Station 1 (FS1) currently are sub-fed from the same meter and could have roof-mounted PV systems installed that supply almost half of the average kWh used per year.

Though these building are not campuses, they are located on adjacent properties. The Port of Pensacola has many buildings on separate meters that could be combined in one of two ways to have roof-mounted PV systems installed that can meet demand. One way would be to re-work the head-end electrical equipment and create a single campus-wide meter. Combining these under one meter would lead to higher costs and extend any payback period. The second approach would be to use the largest building on the site as the location for the majority of the solar arrays. Instead of feeding only the one building, feeders from that larger array could be fed to the other buildings on site that have individual meters and tied-in to those systems. Doing so does pose some concerns for meeting the requirements of Article 225 of the National Electric Code. Something that would easily be addressed during a design phase.

Similarly, the following sites could be combined onto one meter to meet demand: Field Service Center, Fleet Garage, Parks Shed at FSC, Sanitation, Second Garage at FSC, and Transfer Station. The Roger Scott Tennis Center and Vickery Resource Center could also be reworked to share one meter and have a PV system that almost meets demand.

Account Number	Group	Building or Site Name	Area Type	Maximum Area	Practical Roof Area	Potential Carport Area	Potential Roof kW Size	PVWatts kWh/yr	Approx. kWh/yr used	AVG $/kWh	Hours	Building Used kW Size	Site Calculated kW	Feasible kW	Added percent Renewable	Percent towards goal	Budget Install
	Airport	Airport Ground	Ground		963333.97		13424	19,895,098			1,482	0.0	0.0	0.0	-	-	$ -
	Airport	Airport S. Parking L:ot	Carport		24110.84		336	497,945			1,482	0.0	0.0	0.0	-	-	$ -
	Commerdencia St Lot	Commerdencia St Lot	Carport		27943.44		389	571,027		0.15	1,466	0.0	0.0	0.0	-	-	$ -
2105467910	East Pensacola Heights clubhouse	East Pensacola Heights clubhouse	Roof	3500	0		49	72,285	27,532	0.28	1,482	18.6	48.8	18.6	100%	0.10%	$ 46,442.82
2105303941	Fire Admin	Fire Administration Building	Roof	10118.75	3100.64		43	63,121	297,440	0.11	1,461	203.6	82.8	82.8	41%	0.44%	$ 206,904.50
2105303941	Fire Admin	Fire Station 1	Roof	18251.39	2838.3		40	57,249		0.11	1,447	0.0	0.0	0.0	-	-	$ -
2100953211	Fire Station 2	Fire Station 2	Roof	13100.23	10561.83		147	216,754	133,313	0.09	1,473	90.5	147.2	90.5	100%	0.49%	$ 226,310.95
2107799070	Fire Station 3	Fire Station 3	Roof	10434.55	6758.64		94	139,617	95,540	0.12	1,482	64.5	94.2	64.5	100%	0.35%	$ 161,125.76
2102983968	Fire Station 4	Fire Station 4	Roof	13957.32	12362.45		172	253,885	128,938	0.10	1,474	87.5	172.3	87.5	100%	0.47%	$ 218,730.55
2104833682/2102965296	Fricker Community Center	Fricker Community Center	Roof	22058.8	8921.09		124	182,024	257,608	0.11	1,464	175.9	124.3	124.3	71%	0.67%	$ 310,798.51
2106436740/2102624448	Golf	Osceola Club House	Carport		14075.46		196	285,644		0.10	1,456	0.0	0.0	0.0	-	-	$ -
2106436740/2102624448	Golf	Osceola Club House	Roofs		2878.7		40	58,295		0.10	1,453	0.0	0.0	0.0	-	-	$ -
2106436740/2102624448	Golf	Osceola Golf Course	Ground	46269.39			645	955,841	297,230	0.10	1,482	200.5	881.0	200.5	100%	1.09%	$ 501,258.52
2104975418	Highland Terrace Park	Highland Terrace Park	Roof	15410.02	7166.55		100	145,977	2,373	0.15	1,462	1.6	99.9	1.6	100%	0.01%	$ 5,680.95
2101950109	Housing Department	Housing Department	Roof	9068.48	6828.61		95	139,454	78,226	0.12	1,465	53.4	95.2	53.4	100%	0.29%	$ 133,448.43
	Jefferson Lot	Jefferson Lot	Carport		38121.08		531	779,474		0.15	1,467	0.0	0.0	0.0	-	-	$ -
	Jefferson St Garage	Jefferson St Garage	Carport	34548.8	29361.67	17620.39	409	600,386		0.15	1,467	0.0	0.0	0.0	-	-	$ -
2105586214	Legion Field	Legion Field	Roof	3594.6	2404.25		34	48,442	33,170	0.14	1,446	22.9	168.2	22.9	100%	0.12%	$ 57,354.04
2104230889	Legion Field	Theophilis May Community Center	Roof	16001.82	9668.45		135	196,703	153,650	0.12	1,460	105.2	168.2	105.2	100%	0.56%	$ 263,111.27
2106543909	Malcolm Youge Center	Malcolm Youge Center	Roof	10008.08	9607.25		134	195,235	128,400	0.12	1,458	88.0	133.9	88.0	100%	0.47%	$ 220,124.02
351	Maritime Park	Blue Wahoos Stadium	Roof	31745.02	9991.81		139	204,043	1,023,413	0.09	1,465	698.4	139.2	139.2	20%	0.75%	$ 348,100.92
	N Palafox Lot	N Palafox Lot	Carport		10076.44		140	207,472		0.15	1,478	0.0	0.0	0.0	-	-	$ -
2108646726	Pensacola Energy Operations Center	Pensacola Energy Operations Center	Roof	29204.93	23066.57		321	468,555	321,886	0.21	1,458	220.8	321.4	220.8	100%	1.18%	$ 552,059.05
700S	Port	Port of Pensacola, Admin Bldg	Roof	2782.97	1603.94		22	32,295	39,921	0.15	1,445	27.6	1640.6	27.6	100%	0.15%	$ 69,074.10
2105561134	Port	Port of Pensacola, Warehouse #4	Roof	90367.9	46438.79		647	949,754	35,546	0.20	1,468	24.2	1640.6	24.2	100%	0.13%	$ 60,551.03
2103278871	Port	Port of Pensacola, Warehouse #8	Roof	116280.81	69688		971	1,425,365	217,207	0.03	1,468	148.0	1640.6	148.0	100%	0.80%	$ 369,970.19
2105891903	PPD	PPD	Roof	25554.61	15160.52		211	309,734	1,437,168	0.09	1,466	980.3	211.3	211.3	22%	1.14%	$ 528,171.67
	Public Works	Code Enforcement	Roof	5272.57	4454.1		62	91,420		0.15	1,473	0.0	0.0	0.0	-	-	$ -
2103447450	Public Works	Field Service Center	Roof	33118.46	27560.13		384	566,215	568,853	0.10	1,474	385.9	1219.2	385.9	100%	2.09%	$ 964,630.41
2107790392	Public Works	Fleet Garage	Roof	23291.43	17992.85		251	368,630	106,585	0.11	1,470	72.5	1219.2	72.5	100%	0.39%	$ 181,244.58
2105592360	Public Works	Parks Shed at FSC	Roof	11223.01	10651.81		148	218,229	32,301	0.13	1,470	22.0	1219.2	22.0	100%	0.12%	$ 54,927.26
2107731651	Public Works	Sanitation	Roof	7145.24	5412.36		75	110,589	162,826	0.13	1,466	111.1	1219.2	111.1	100%	0.60%	$ 277,625.60
2104593427	Public Works	Second Garage at FSC	Roof	11865.63	8644.76		120	176,942	27,932	0.13	1,469	19.0	1219.2	19.0	100%	0.10%	$ 47,542.83
2101795496	Public Works	Transfer station	Roof	12953.51	12775.67		178	262,464	3,280	0.07	1,474	2.2	1219.2	2.2	100%	0.01%	$ 7,787.12
2106567346/2107274397/2104164781/2	Roger Scott	Roger Scott Athletic Complex	Roof	3612.74	1919.44		27	38,618	92,506	0.33	1,444	64.1	304.0	64.1	100%	0.34%	$ 160,182.72
2107274397	Roger Scott	Roger Scott Tennis Center	Roof	2635.68	1909.14		27	38,618	676,554	0.21	1,452	466.1	304.0	304.0	65%	1.62%	$ 760,006.69
2101906622	Roger Scott	Vickrey Resource Center	Roof	26000	17986.48		251	371,322	328,320	0.17	1,481	221.6	304.0	221.6	100%	1.21%	$ 554,056.23
2105006627/2102116015	Sanders Beach Community Center	Sanders Beach Community Center	Roof	22756.16	9899.04		138	201,107	238,481	0.12	1,458	163.6	137.9	137.9	84%	0.74%	$ 344,868.94
									6,946,198			**4739.7**		**3051.3**	**64%**	**16%**	**$ 7,632,089.68**