

NESEA- Building Energy NYC 2018

October 4, 2018

Solar Soars Above & Beyond the Rooftop

Ron Celentano of Celentano Energy Services (CES)

**Ron Celentano - Solar Industry Consultant – Design; Project Oversight; Installation; Inspection;
Technical Training & Support; Policy Issues; Interconnection/Net Metering, SRECs;
Pres. Of Pennsylvania Solar Energy Industries Assoc.(PASEIA); VP of MSEIA
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Brief Overview of Solar Canopies over Rooftops in Philadelphia

- Progression of five Onion Flats construction projects, with integrating solar PV into their buildings over the last 14 years (Onion Flats has been practicing in Philadelphia as developers, architects and builders since 1997)
- Couple of other examples of solar rooftop canopies in Philadelphia



CAPITAL FLATS : 3 PHASES, 42 UNITS, 18 YEARS

Onion Flats – Rag Flats Project



- 2005 – 2006: 11 PV systems installed for Rag Flats Condominium (part reconstruction/part new construction)

Rag Flats Project



Belfield Passive House Project



FIRST
CERTIFIED
PASSIVE HOUSE
IN
PENNSYLVANIA

START: APRIL 20, 2012
CERTIFICATE OF OCCUPANCY: JULY 20, 2012

 Certified
Passive House
Passive House Institute

RECIPIENT OF THE
2014 INTERNATIONAL
PASSIVE HOUSE AWARD

 PHIUS
Passive House Institute US

SECOND PLACE WINNER
2015 PHIUS AWARD
"AFFORDABLE HOUSING"

 Passive House
Award
Award Recipient
PASSIVE HOUSE INSTITUTE

 2013
AIA
HONOR
AWARD



Rooftop PV – Belfield Passive House Project



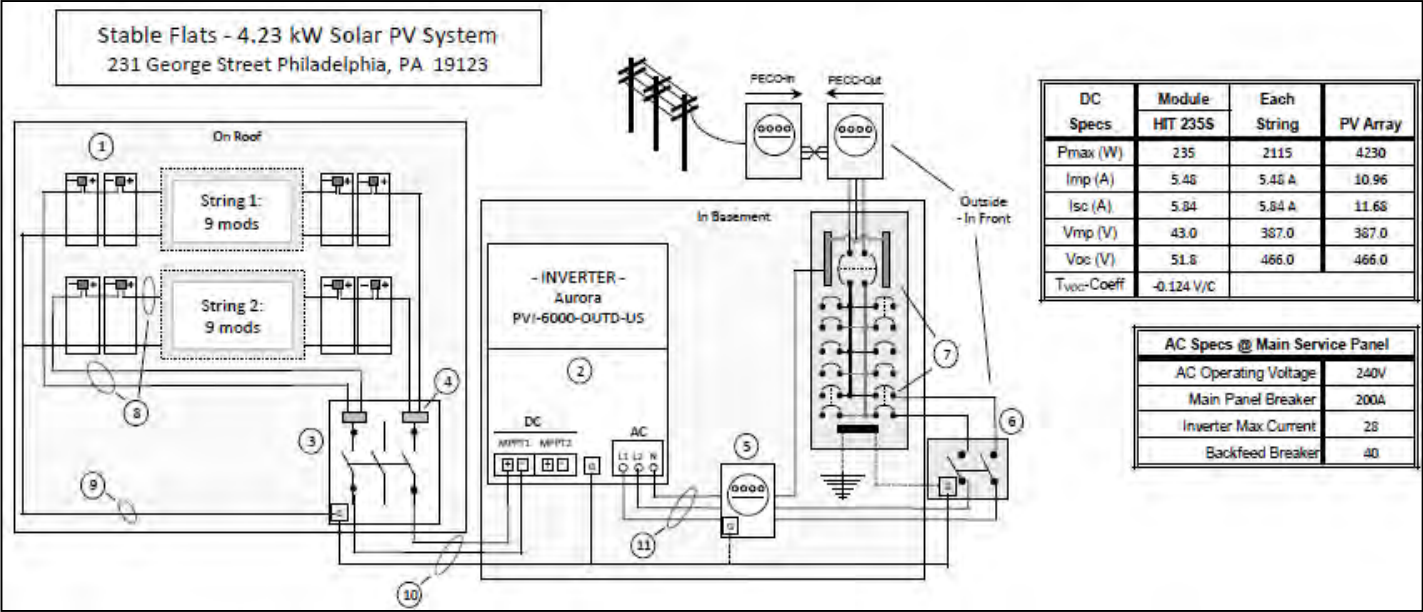
Stable Flats Passive House Project



Stable Flats Passive House Project



Onion Flats – Stable Flats Passive Home Project



Capital Flats Multi-Family Passive House Project



CAPITAL FLATS : 3 PHASES, 42 UNITS, 18 YEARS

Capital Flats Multi-Family Passive House Project Characteristics and Modeling Results

- 25 Apartments (500-1000sf)
- 17,400 sf
- R34 walls
- R 54 roof/floors
- .13 Uvalue windows
- .6 SHGC
- **Centralized** VentilationERV, 82% efficient
- **Centralized** Hot Water: Geothermal
- **Centralized** heating/cooling: Geothermal VRF
- **Centralized** Electric Metering
- 77 kw PV array to get to Net Zero

210 mods x 370 watts = 77 kW system

PHIUS+ 2015 Multi-Family Calculator	
*Results in green	
iCFA _{TOTAL} (ft ²)	16,782
PV Utilization	
Site electricity (kWh/yr)	84085
Output from PV Watts (kWh/yr) http://pvwatts.nrel.gov/	98554
Annual PV Output/Annual Electricity Demand	1.17
Utilization fraction from utilization curve	0.334
Primary Energy offset by PV (kBtu/ft ² /yr)	21.15

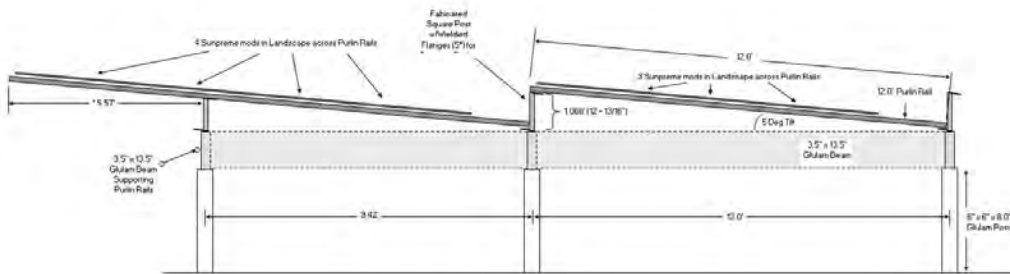
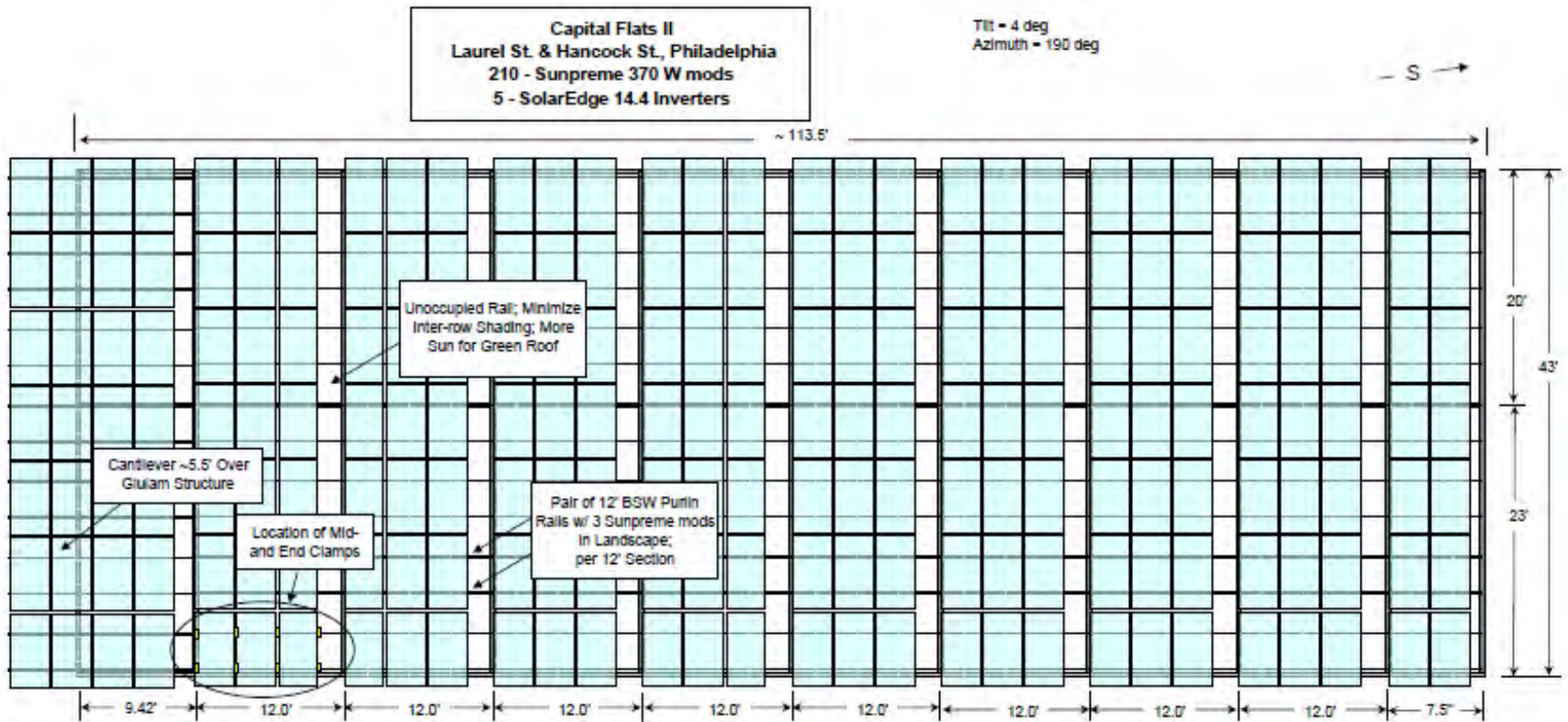
Primary Energy
45 kBtu/sf/yr

Site Energy: 84,085 kWh/yr
Output from PV: 98,554 kWh/yr

NET-POSITIVE! 🍌

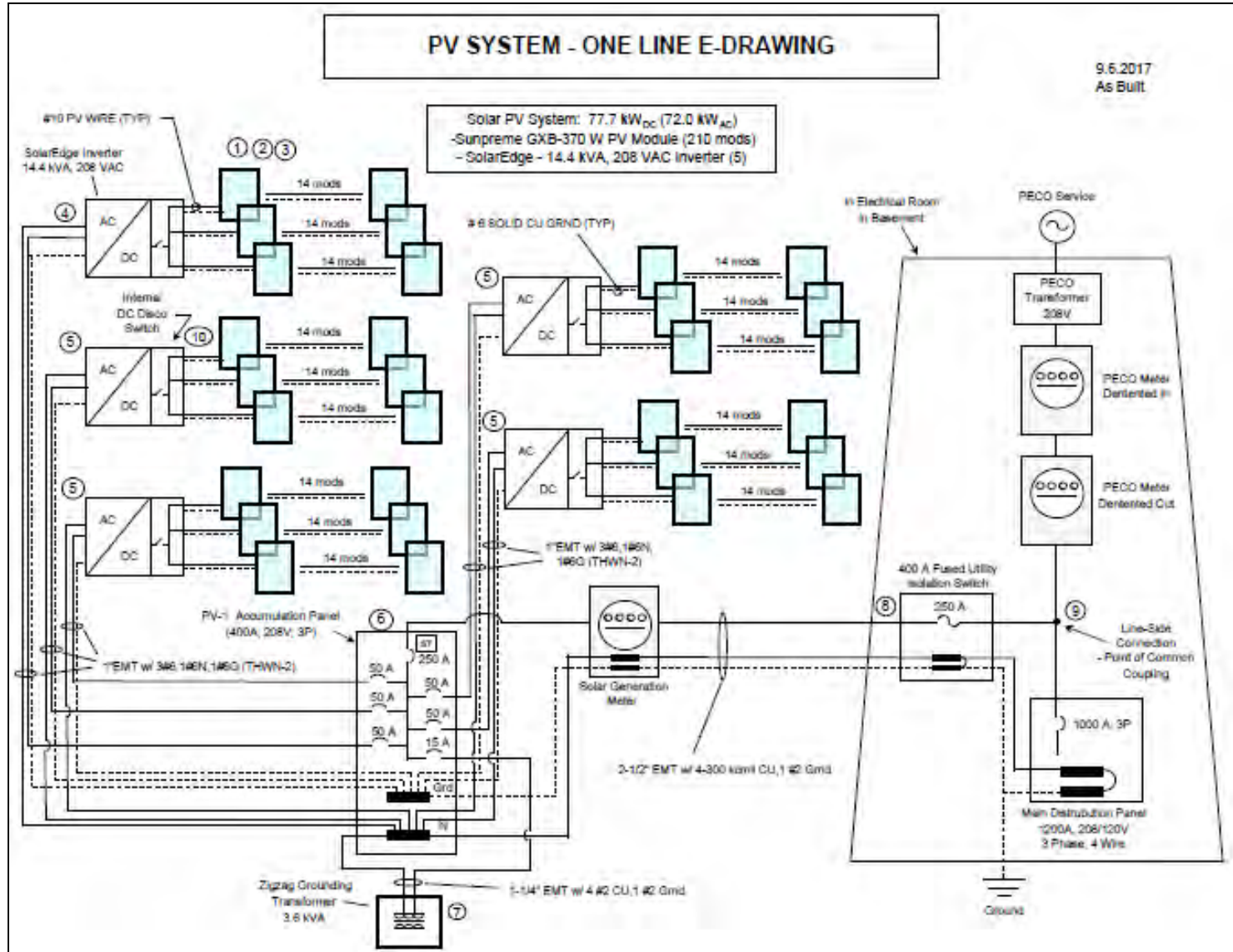


77 kW_{DC} PV Array Layout & Rack Support



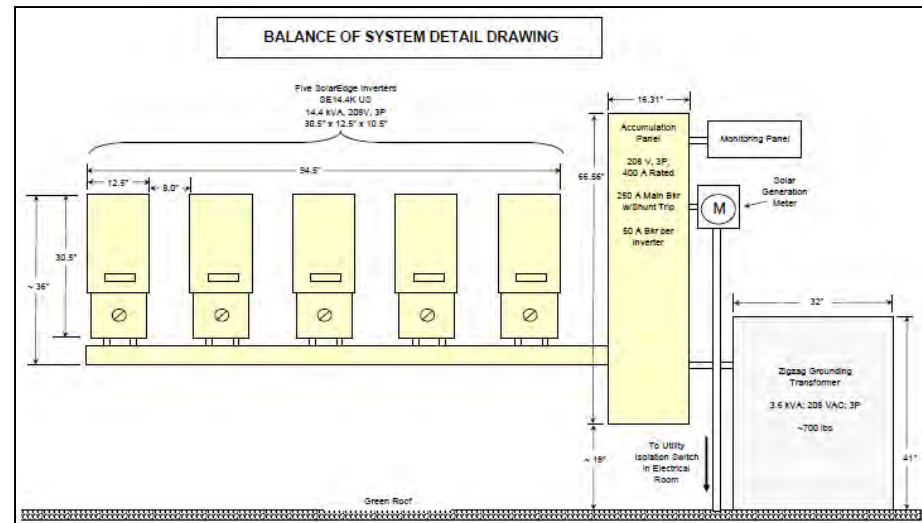
DPW / Preformed Line Products
 P14 Rails; 10", 8" & 7" Stanchions

Solar PV One-Line E Drwg



Balance of System Layout & String Map

Capital Flats II
 Laurel St. & Hancock St., Philadelphia
 210 - Sunprime 370 W mods
 5 - SolarEdge 14.4 Inverters



Efficient Wall Panels / Canopy Post Support Structure



2017: Buildsmart system

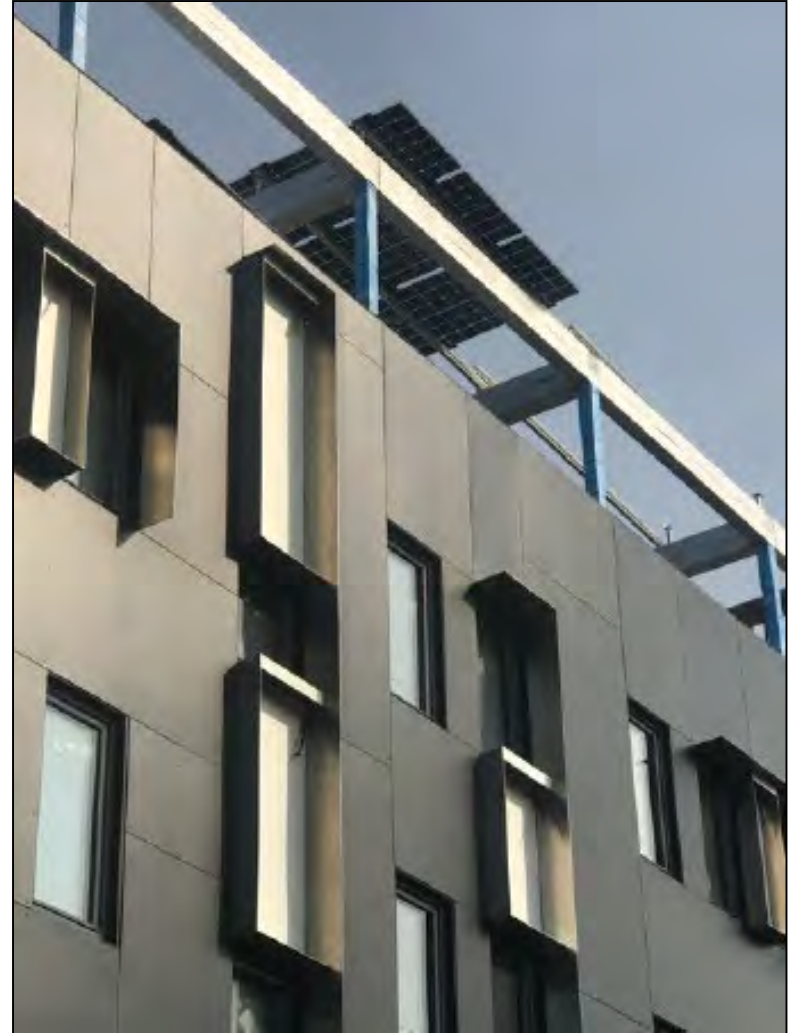
Canopy Beam Support Structure / PV Modules Staged



- PV Racking on Support Structure -
- Thinking Out DC Optimizer Locations -



- Mounting PV Mods Onto Racking



Care Taken Spacing Mods and Torquing Them Down



DC Optimizers Installed After Mounting PV Mods



Wire Management of Homeruns and Bonding Detail



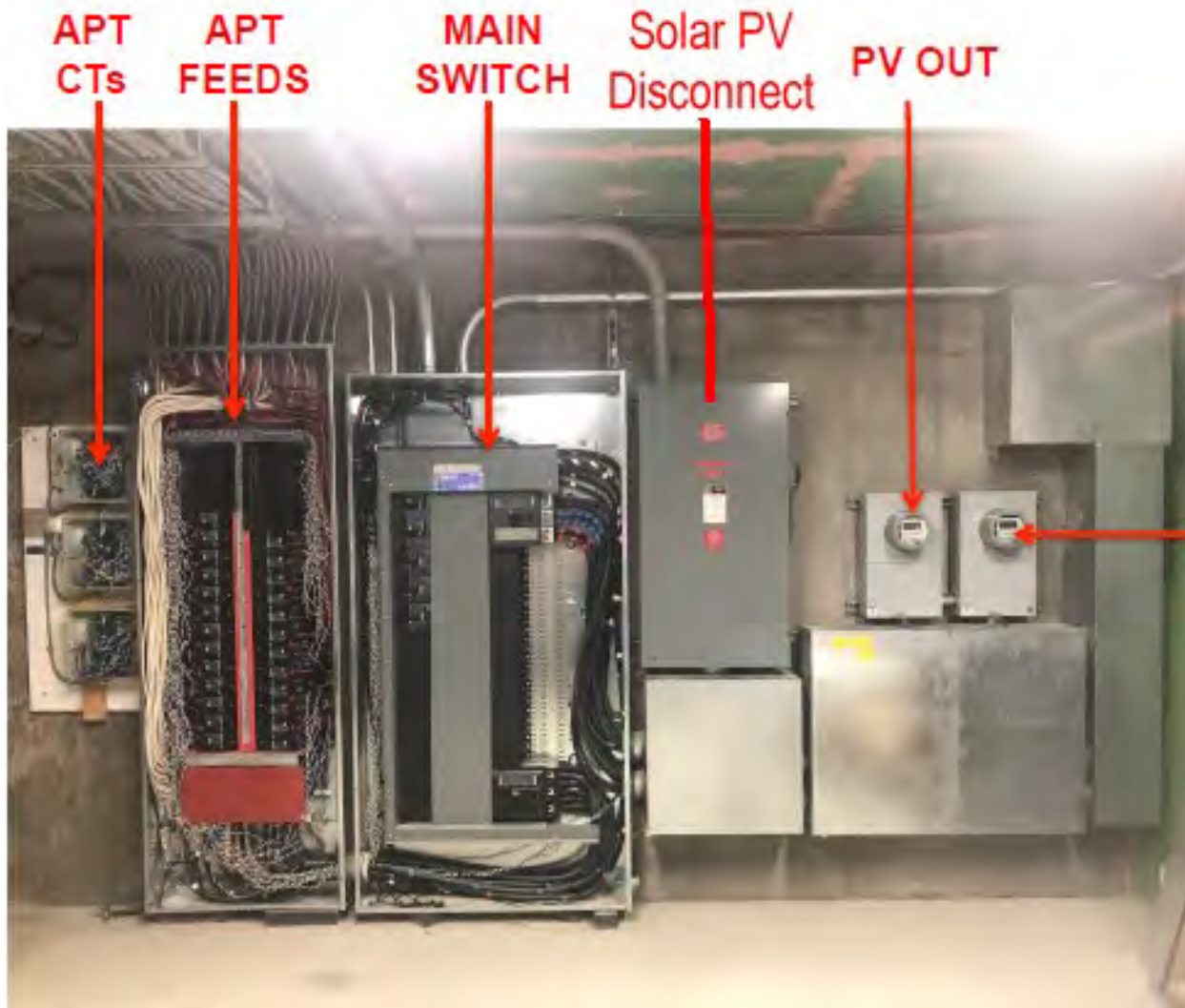
Installing Inverters & Accumulation Panel On Roof



Inverter Installation Completed



Main Electric Panel and Point of Interconnection



ELECTRICITY IN

Completed Construction



Dark Truth About Building Energy Performance & Behavior

210 mods x 370 watts = 77 kW system

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*Results in green	
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NET-POSITIVE! 



Capital Flats						
PECO Bills					Total	Usage
	2018	Meter In	Meter Out	Net kWh	Solar Generation	Building Usage Offset by Solar
Jan	1/6 - 1/31	10,400	960	9,440		
Feb	1/31 - 3/2	12,560	1,520	11,040		
Mar	3/2 - 3/30	10,880	2,960	7,920		
Apr	3/30 - 5/1	9,520	4,880	4,640		
May	5/1 - 5/28	9,600	3,920	5,680		
Jun	5/28 - 6/29	12,320	4,160	8,160		
Jul	6/29 - 7/30	11,920	4,720	7,200		
Aug	7/30 - 8/25	9,920	2,800	7,120		
Sep	8/25 - 9/28	13,280	2,480	10,800		
Subtotal		100,400	28,400	72,000	78,191	150,191 52.1%

Estimated projection on actual total building electric usage is about 200,255 kWh/yr, or 2.4X more than what was modeled!! Under investigation.....Some of it is technical that can be fixed, while some of it is behavioral, which is more challenging....

Energy Monitoring

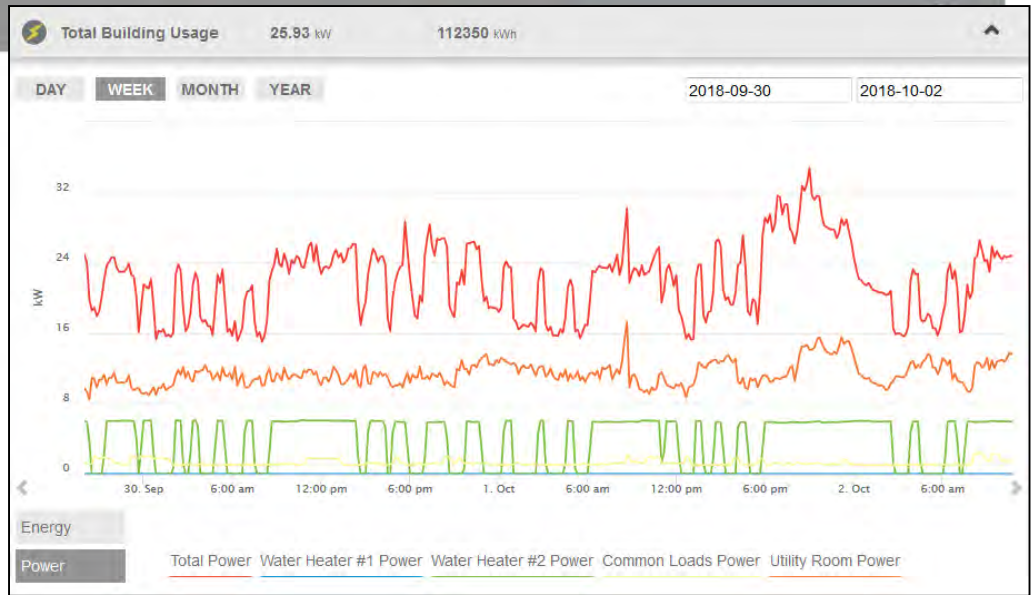
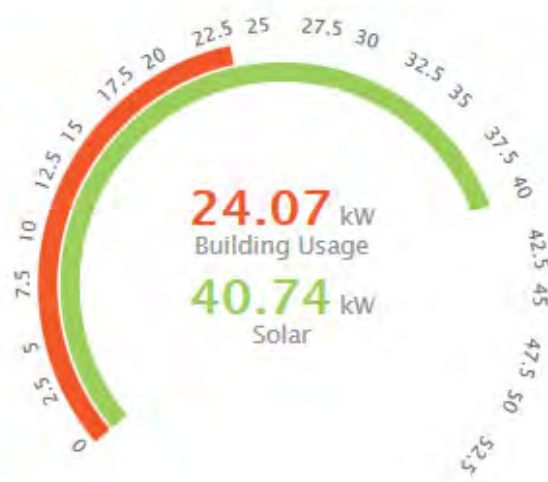


inView™ Building Management
Capital Flats - 152 W. Laurel



Home Building Electricity Apartment Energy DHW Data

Summary



Behavior Energy Management



Meeting the Energy Budget

Passive House Certified



FINAL BLOWER DOOR TEST
 Sept 29, 2017
.53 ACH50





The Passive House Institute US Awards

The Designation of

PHIUS+ 2015 CERTIFIED PROJECT

No. 1414

Capital Flats II

152-158 W. Laurel Street
Philadelphia, PA 19123

Onion Flats		
PROJECT OWNER	• INTERIOR CONDITIONED FLOOR AREA	
April 10, 2018	16,782	ft ²
DATE	• ANNUAL HEATING DEMAND	
Tim McDonald Kara Haggerty Wilson	3.0	kBTU/ft ² ·yr
CPHCA	• ANNUAL COOLING DEMAND	
Onion Flats Architecture	6.2	kBTU/ft ² ·yr
ARCHITECT	• PEAK HEATING LOAD	
Onion Flats Construction	3.3	BTU/ft ² ·hr
CONSTRUCTION	• PEAK COOLING LOAD	
Neil Goldman	2.8	BTU/ft ² ·hr
ON-SITE VERIFICATION	• AIR-TIGHTNESS TEST RESULTS	
	0.05	CFM50/ft ²
	• SOURCE ENERGY	
	4,788	kWh/person·yr
	• SITE ENERGY USE INDEX (EUI)	
	17.0	kBTU/ft ² ·yr


 Executive Director


 Passive House Institute US

Passive House Certified



Capital Flats Multi-Family Passive House Project - Costs

ACTUAL RENTS ACHIEVED

NO. OF UNITS	RENT	PROPOSED	PROPOSED	PROPOSED
		2018	2019	2020
1	100	\$2,775	\$2,775	\$2,775
2	100	\$2,775	\$2,775	\$2,775
3	100	\$2,775	\$2,775	\$2,775
4	100	\$2,775	\$2,775	\$2,775
5	100	\$2,775	\$2,775	\$2,775
6	100	\$2,775	\$2,775	\$2,775
7	100	\$2,775	\$2,775	\$2,775
8	100	\$2,775	\$2,775	\$2,775
9	100	\$2,775	\$2,775	\$2,775
10	100	\$2,775	\$2,775	\$2,775
11	100	\$2,775	\$2,775	\$2,775
12	100	\$2,775	\$2,775	\$2,775
13	100	\$2,775	\$2,775	\$2,775
14	100	\$2,775	\$2,775	\$2,775
15	100	\$2,775	\$2,775	\$2,775
16	100	\$2,775	\$2,775	\$2,775
17	100	\$2,775	\$2,775	\$2,775
18	100	\$2,775	\$2,775	\$2,775
19	100	\$2,775	\$2,775	\$2,775
20	100	\$2,775	\$2,775	\$2,775
21	100	\$2,775	\$2,775	\$2,775
22	100	\$2,775	\$2,775	\$2,775
23	100	\$2,775	\$2,775	\$2,775
24	100	\$2,775	\$2,775	\$2,775
25	100	\$2,775	\$2,775	\$2,775
26	100	\$2,775	\$2,775	\$2,775
27	100	\$2,775	\$2,775	\$2,775
28	100	\$2,775	\$2,775	\$2,775
29	100	\$2,775	\$2,775	\$2,775
30	100	\$2,775	\$2,775	\$2,775
31	100	\$2,775	\$2,775	\$2,775
32	100	\$2,775	\$2,775	\$2,775
33	100	\$2,775	\$2,775	\$2,775
34	100	\$2,775	\$2,775	\$2,775
35	100	\$2,775	\$2,775	\$2,775
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38	100	\$2,775	\$2,775	\$2,775
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40	100	\$2,775	\$2,775	\$2,775
41	100	\$2,775	\$2,775	\$2,775
42	100	\$2,775	\$2,775	\$2,775
43	100	\$2,775	\$2,775	\$2,775
44	100	\$2,775	\$2,775	\$2,775
45	100	\$2,775	\$2,775	\$2,775
46	100	\$2,775	\$2,775	\$2,775
47	100	\$2,775	\$2,775	\$2,775
48	100	\$2,775	\$2,775	\$2,775
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51	100	\$2,775	\$2,775	\$2,775
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60	100	\$2,775	\$2,775	\$2,775
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68	100	\$2,775	\$2,775	\$2,775
69	100	\$2,775	\$2,775	\$2,775
70	100	\$2,775	\$2,775	\$2,775
71	100	\$2,775	\$2,775	\$2,775
72	100	\$2,775	\$2,775	\$2,775
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74	100	\$2,775	\$2,775	\$2,775
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76	100	\$2,775	\$2,775	\$2,775
77	100	\$2,775	\$2,775	\$2,775
78	100	\$2,775	\$2,775	\$2,775
79	100	\$2,775	\$2,775	\$2,775
80	100	\$2,775	\$2,775	\$2,775
81	100	\$2,775	\$2,775	\$2,775
82	100	\$2,775	\$2,775	\$2,775
83	100	\$2,775	\$2,775	\$2,775
84	100	\$2,775	\$2,775	\$2,775
85	100	\$2,775	\$2,775	\$2,775
86	100	\$2,775	\$2,775	\$2,775
87	100	\$2,775	\$2,775	\$2,775
88	100	\$2,775	\$2,775	\$2,775
89	100	\$2,775	\$2,775	\$2,775
90	100	\$2,775	\$2,775	\$2,775
91	100	\$2,775	\$2,775	\$2,775
92	100	\$2,775	\$2,775	\$2,775
93	100	\$2,775	\$2,775	\$2,775
94	100	\$2,775	\$2,775	\$2,775
95	100	\$2,775	\$2,775	\$2,775
96	100	\$2,775	\$2,775	\$2,775
97	100	\$2,775	\$2,775	\$2,775
98	100	\$2,775	\$2,775	\$2,775
99	100	\$2,775	\$2,775	\$2,775
100	100	\$2,775	\$2,775	\$2,775

Average Rent : \$2.77sf

AS-BUILT EXPENSES

CAPITAL 2 COSTS	15-Jun
DESCRIPTION OF WORK	ACTUAL VALUE
Concrete/Site/Excavation	\$172,000.00
Windows/Doors/Panelized	\$336,778.76
Rough Carpentry	\$195,032.69
Finish Carpentry	\$37,296.00
Cabinetry/Appliances/Fixtures	\$284,284.77
Insulation	\$39,500.00
Roofing Greenroof	\$119,400.00
Exterior Cladding	\$221,619.51
Drywall, Metal Studs	\$118,630.95
Interior Doors/Frames/Hardware	\$43,142.86
Flooring	\$151,625.40
Paint	\$48,000.00
Specialties: Steel	\$55,500.00
Fire Sprinklers	\$44,000.00
Plumbing	\$130,000.00
HVAC: Air-sourced	\$0.00
HVAC Geothermal, VRF	\$312,208.00
Electric	\$158,379.00
General Reqs	\$234,860.00
OH& Profit	\$176,227.23
Soft Costs	\$314,560.77
Contingencies	\$221,940.50
SOLAR- structure, panels, racking	\$250,000.00
TOTAL	\$3,664,986.44

Total Sf:

17910 sf

COSTS: Hard

\$169/sf

















Onion Flats Won 4 Awards: Capital Flats Multi-Family Passive House Project

Green Building United – 2018 Groundbreaker Award: Capital Flats – The Battery

<https://greenbuildingunited.org/newsroom/cheers-to-more-than-a-year-of-green-building-celebration>

Urban Land Institute (ULI) - Philadelphia Willard Rouse Award of Excellence 2018:
For Capital Flats Phases 1, 2 & 3

<https://philadelphia.uli.org/press-releases/announcing-winners-awards-excellence-2018/>

PHIUS Multifamily Project of the Year Award 2018:

<http://www.phius.org/2018-phius-passive-house-projects-competition>

Design Philadelphia 2018: 2nd Place - Onion Flats: The Battery

<https://www.designphiladelphia.org/best-design-competition>

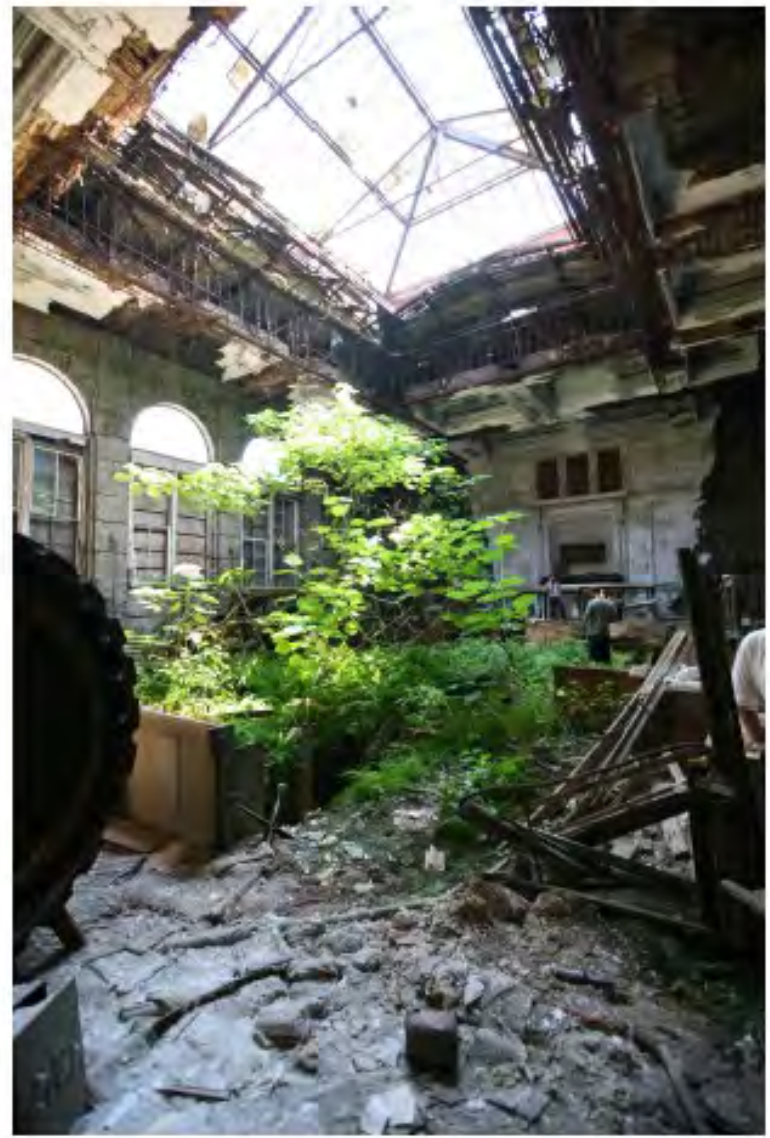
Next Onion Flats Project



FRONT FLATS 2018: 28 units and retail

COPPER FLATS 2020: 68 units



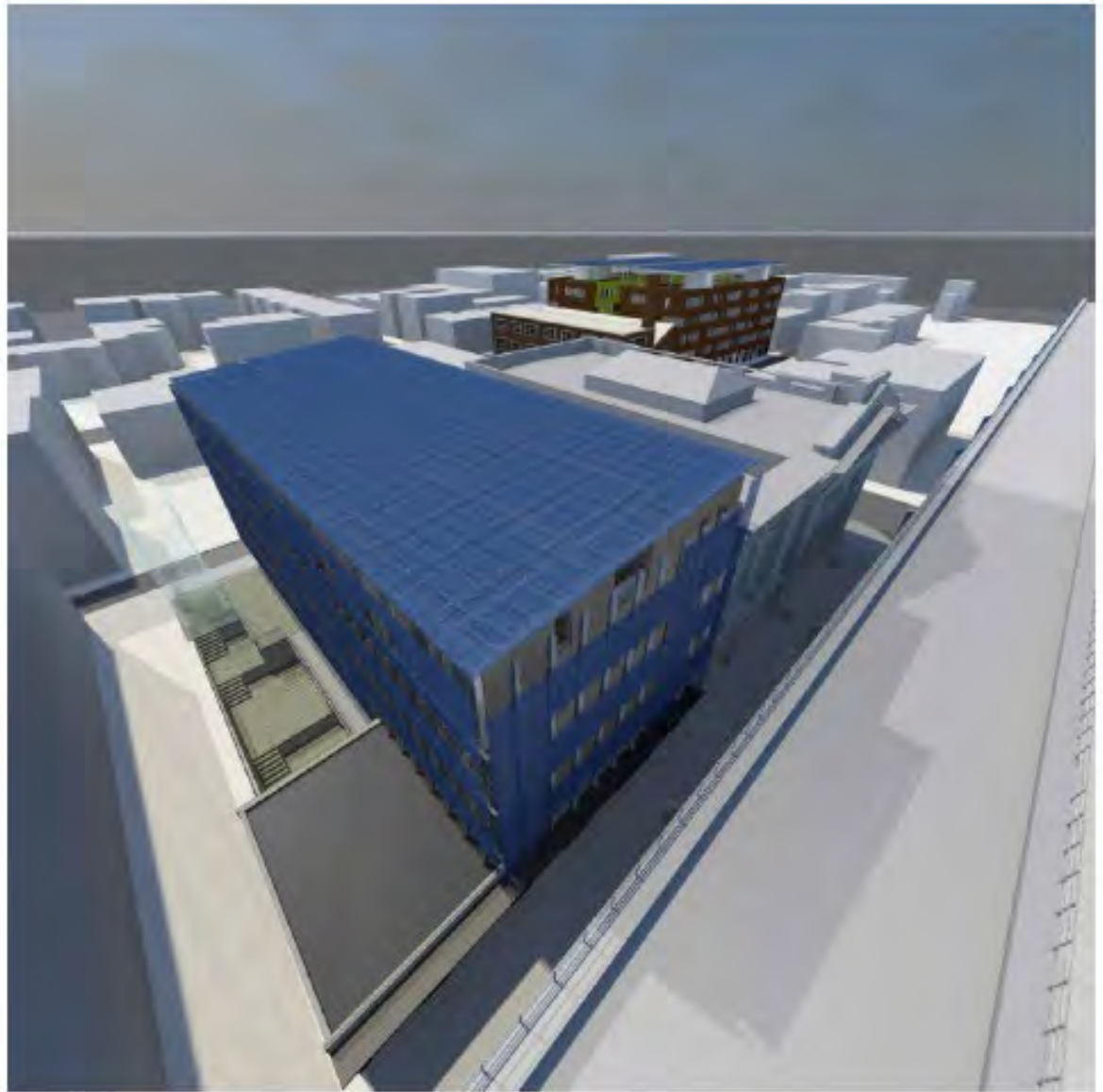


BANKS 2017



BANKS 2018





FRONT FLATS 2018: 28 units and retail

COPPER FLATS 2020: 68 units





FRONT FLATS 2018: 28 units and retail

PROJECT SPECS

- 28 Apartments (300-500sf)
- 24,141 sf
- R34 walls, Buildsmart system
- R 54 roof/floors
- .13 Uvalue windows
- .28 SHGC
- *DE-Centralized* VentilationERV
- *SEMI-DE-Centralized* Hot Water
- *DE-Centralized* heating/cooling
- *DE-Centralized* Electric Metering
- 174 kw PV array to get to Net Zero



BANK FLATS 2018: 28 units and retail

Other Solar Rooftop Canopy Projects in Philadelphia Installed by Solar States



LUIS MORA PERGOLA/ROOFDECK:

Address: 744 S. Warnock St.

Philadelphia, PA 19147

- 24 x Lumos LSX 250 (250 Watt solar modules)
- 6 kW solar array
- SMA SB 5.0 (5 kW inverter)

Other Solar Rooftop Canopy Projects in Philadelphia Installed by Solar States



FINANTA:

Address: 1301 N. 2nd St.
Philadelphia, PA 19122

- 81 x Renogy 260W Modules (21.06 kW)
- 91 x Renogy 245W Modules (22.295 kW)
- Total: 43.355 kW array
- Enphase M215 inverters



Thank You!!