

Proposal for
Public-Private Partnership for
On-Site Solar Projects

Bid #850

**Prepared for
Town of Bristol
and
Town of Barrington, RI**

Electronic Copy

November 30, 2016



AMERESCO 
Green • Clean • Sustainable

111 Speen Street, Suite 410
Framingham, MA 01701

P: 508 661 2200
F: 508 661 2201

ameresco.com

November 30, 2016

Town Clerk's Office
Bristol Town Hall
10 Court Street,
Bristol, RI 02809

RE: PUBLIC – PRIVATE PARTNERSHIP FOR ON-SITE SOLAR PROJECTS” - Bid #850”

Dear Sir/Madam,

Ameresco is pleased to submit its proposal to the Towns of Bristol and Barrington (Towns) for the Public-Private Partnership for On-Site Solar Projects.

Ameresco is one of the largest independent Energy Services Companies in North America and has completed over \$5 billion in energy efficiency and renewable energy projects. Currently, Ameresco is working with the Town of Barrington towards the design and implementation of Energy Efficiency measures on several of its public buildings.

Benefits of Working with Ameresco

Ameresco will provide the Towns with proven experience to deliver the following solar PV project benefits:

- a) **100% Construction and Operation of Awarded Projects:** Ameresco has built 100% of the solar projects we have been awarded, both public and private, and we provide our own construction financing.
- b) **Proven Track Record on Similar Rooftop and Ground-mounted Projects:** Ameresco has completed over 120MW of solar PV projects, the majority of which are for local government. In Rhode Island, we have recently been selected by the **Providence Water Supply Board** to design and construct a 765kW rooftop solar PV project at its newly acquired facility in Providence RI. The project is currently in the design phase and it is expected to be completed in Spring 2017.
- c) **\$2.2 Billion Project Financing:** Ameresco has financed \$2.2 billion of energy projects such as solar PV. Due to our financial strength, we are immediately able to finance project construction, and therefore proceed into the design, permitting, and construction phases without delay.
- d) **Headquarters in Framingham, MA:** Ameresco is a Massachusetts-based company, with headquarters located only approximately one hour away from Bristol and Barrington. Our development, construction and operation and maintenance teams are a short drive time from the various solar sites, ensuring quick response capability.



- e) **Strong Relationships with local Subcontractors:** Ameresco has been working with local contractors for over a decade on solar and other energy projects. Labor for these projects will be sourced from Rhode Island companies.
- f) **Profitable, Publically Owned, Financially Strong Company – Assuring Project Completion**
Fiscal year 2015 revenues were \$630 million. We have more than 1000 employees, comprised of professional engineers, construction managers, finance and capital markets professionals, legal and regulatory professionals, and operation and maintenance staff.
- g) **Project Services:** We have the in-house technology, staff, and systems to a) continuously monitor solar PV operations, b) report alarms and problems, and c) dispatch maintenance staff from our nearby Framingham office. We also test and re-commission each site once a year. Furthermore, our safety engineers have provided seminars for the local fire departments after the projects are commissioned.

RFP Addendums

Ameresco acknowledges receipt of Addendums 1, 2, 3, 4, 5 and 6 to RFQ/RFP Bid #850, as posted on the www.bristolri.us website.

Our Proposal

Ameresco proposes several systems that are designed to maximize the financial benefits to each Town. These systems include a ground-mounted installation on Bristol's landfill, several rooftop installations on Towns' buildings, and a ground-mounted system on off-site land in North Kingstown currently in the permitting phase by Ameresco.

As further described in our proposal, the financial benefits to the Towns are in the form of electricity savings or lease payments for hosting the PV systems as well as annual tax payments in the form of a Payment in-lieu-of Taxes (PILOT) agreement.

The financial benefit of our proposed systems to the Towns (under a conservative scenario of net metering credit annual escalation of 1%) is approximately \$15 million.

Partnering with Ameresco, the Towns can rest assured that the projects will be completed, and that Ameresco, as a diversified and viable energy company, will be in business in the long term to operate and maintain the solar PV systems throughout the 20-25 years contractual term.

Should you have any questions or require additional information regarding our proposal, please do not hesitate to contact me at 508-661-2263 or at ktaliadouros@ameresco.com.

Respectfully submitted,



Kleo Taliadouros
Director – Development





Prepared for
Town of Bristol and
Town of Barrington, Rhode Island

November 30, 2016

**Public-Private Partnership
for On-Site Solar Projects**

Bid #850

Presented by

Ameresco Inc.
111 Speen Street, Suite 410
Framingham, MA 01701

T: 508-661-2200

This Proposal contains data and information that has been submitted in response to a request for proposal or similar solicitation and is provided in confidence. The contents include proprietary information and trade secrets that belong to Ameresco, Inc., ("Confidential Information") and is disclosed to the recipient only for purposes of evaluation. In the event Ameresco is awarded a contract or purchase order as a result of or in connection with the submission of this proposal, Customer shall have a limited right as set forth in the governing contract or purchase order to disclose the data herein, but only to the extent expressly allowed. This restriction does not limit the Customer's right to use or disclose data obtained without restriction from any source, including the proposer.

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Section 1: Bid Documents

As requested, the bid documents are attached herein.

- Attachment A: Bid Form
- Attachment B: Non-Collusion Affidavit
- Attachment C: Insurance Coverage Statement
- Attachment D: Relevant Experience Statement

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TOWN OF BRISTOL and TOWN OF BARRINGTON, RI

INVITATION FOR RFQ/RFP
BID #850
PUBLIC-PRIVATE PARTNERSHIP FOR ON-SITE SOLAR PROJECTS

Attachment A
Town of Bristol

BID FORM

NAME AND ADDRESS OF BIDDING FIRM:

Ameresco, Inc.

111 Speen Street, Suite 410

Framingham, MA 01701

I herein agree to abide by all requirements as detailed in the "Invitation for Bid #850".

Signature: _____

Printed Name & Title: James J. Walker - Vice President - Solar PV

Date: 11/29/2016

TOWN OF BRISTOL and TOWN OF BARRINGTON, RI

INVITATION FOR RFQ/RFP
BID #850
PUBLIC-PRIVATE PARTNERSHIP FOR ON-SITE SOLAR PROJECTS

Attachment A
Town of Barrington

BID FORM

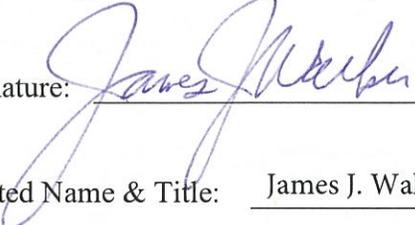
NAME AND ADDRESS OF BIDDING FIRM:

Ameresco, Inc.

111 Speen Street, Suite 410

Framingham, MA 01701

I herein agree to abide by all requirements as detailed in the "Invitation for Bid #850".

Signature:  _____

Printed Name & Title: James J. Walker - Vice President - Solar PV

Date: 11/29/2016

TOWN OF BRISTOL and TOWN OF BARRINGTON, RI

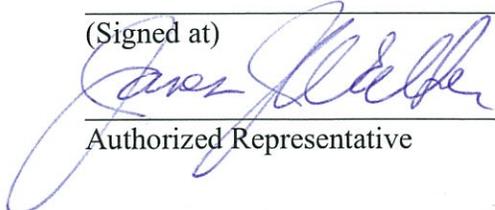
INVITATION FOR RFQ/RFP
BID #850
PUBLIC-PRIVATE PARTNERSHIP FOR ON-SITE SOLAR PROJECTS

ATTACHMENT B
Non-COLLUSION AFFIDAVIT
To Be Completed, Notarized, and Submitted With Bid

State of Rhode Island
County of Bristol

" Ameresco, Inc., Bidder, being first duly sworn, deposes and says that he or she is Owner of the party making the foregoing bid that the bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the Bidder has not directly or indirectly induced or solicited any other Bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any Bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that the Bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the Bidder or any other Bidder, or to fix any overhead, profit, or cost element of the bid price, or of that of any other Bidder, or to secure any advantage against the public body awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true; and further, that the Bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any corporation, partnership, company association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid."

11/30/2016
Date
Ameresco, Inc.
Bidder name
(Person, Firm, Corp.)
111 Speen Street, Suite 410
Address
Framingham, MA 01701
City, State, Zip

(Signed at)

Authorized Representative
James J. Walker
Representative's Name
Vice President - Solar PV
Representative's Title
John A. Abate II



TOWN OF BRISTOL and TOWN OF BARRINGTON, RI

INVITATION FOR RFQ/RFP
BID #850
PUBLIC-PRIVATE PARTNERSHIP FOR ON-SITE SOLAR PROJECTS

ATTACHMENT C

**BIDDER'S STATEMENT
REGARDING INSURANCE COVERAGE**

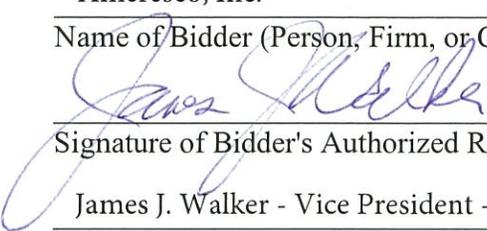
BIDDER HEREBY CERTIFIES that the Bidder has reviewed and understands the insurance coverage requirements specified in the Invitation for Bid No. 850, *Public – Private Partnership for On-Site Solar Projects*. Should the Bidder be awarded the contract for the work, Bidder further certifies that the Bidder can meet the specified requirements for insurance and agrees to provide the Town with a certificate of insurance which names the Town of Bristol and the Town of Barrington as an Additional Insured for the work specified.

Insurance Required:

- Workman's Compensation in compliance with statutory limits
- Comprehensive General Liability Insurance of at least \$1,000,000.

Ameresco, Inc.

Name of Bidder (Person, Firm, or Corporation)



Signature of Bidder's Authorized Representative

James J. Walker - Vice President - Solar PV

Name & Title of Authorized Representative

11/29/2016

Date of Signing

TOWN OF BRISTOL and TOWN OF BARRINGTON, RI

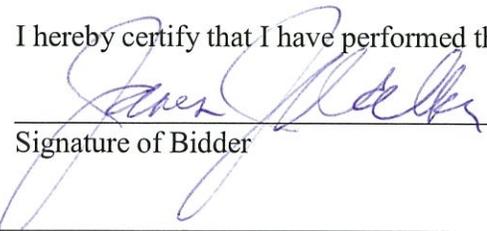
INVITATION FOR RFQ/RFP
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ATTACHMENT D

BIDDER STATEMENT OF RELEVANT EXPERIENCE

List three (3) references for which your firm provided service within the last five years.

I hereby certify that I have performed the work listed below.



 Signature of Bidder

DESCRIPTION	DATES	CONTRACT AMOUNT	CUSTOMER CONTACT	CUSTOMER TELEPHONE
Town of Natick Solar PV PPA Rooftop and Carport	2011 - present <i>multiple phases</i>	1.78MW approx \$5M	Jillian Wilson -Martin JWMartin@natickma.org	508-647-6555
Braintree Electric Light Department Solar PV PPA Landfill and Rooftop	2014-2016	1.96MW approx \$6M	William Bottigi bbottigi@beld.com	781-348-1010
Massachusetts Department of Transportation Solar PV PPA Ground Mount and Rooftop Sites	2015 -present	3.8MW / \$11M completed or in construction with another 1.5MW / \$3.5M in contracted and in design phase	Lily Oliver hongyan.oliver@state.ma.us	857-368-9025

*Note: Additional References contained in Section 4 of the proposal

Section 2: Company History and Information

Founded in 2000, Ameresco (NYSE: AMRC) is a leading publicly-traded energy services company headquartered in Framingham, MA specializing in renewable energy systems, including solar PV on landfills, rooftops, carports, and ground-mounts, and energy efficiency solutions. With more than 950 employees, our in-house staff capabilities include all skills and certifications to complete solar PV projects, including development, design, engineering, financing, major equipment procurement, construction management, commissioning, and operation. We operate in all fifty (50) States and additionally Canada and the United Kingdom.

Our skill, integrity, and financial strength to perform dependably and complete solar PV projects for Town of Bristol and the Town of Barrington are evidenced by:

- **\$5.5B in constructed projects.** Ameresco and its predecessors have completed over \$5.5B in energy efficiency and clean energy projects. We have over 950 employees across the country. Ameresco has the capacity and resources to meet requirements of this complex project.
- **120MW of solar PV Completed in North America.** Ameresco has completed over 120MW of solar PV projects throughout North America; operating approximately 100 individual PV systems for our customers, many of which are located on municipal capped landfills.
- **No barriers to construction.** Ameresco has the cash on hand as well as access to \$60 million through a term loan and \$40 million revolving credit facility with Bank of America to fund construction. We have always started construction without any delays in obtaining construction financing.
- **\$1.4 billion surety credit facility.** Ameresco maintains a \$1.4 billion surety credit facility through two corporate providers, both with an AM Best rating of “A Excellent”.
- **Strong municipal experience.** Ameresco works extensively with municipalities, school districts, and government agencies throughout Rhode Island and the New England area.
- **Well-versed in unique challenges.** Our expertise in PV rooftop, carport, landfill and large ground mount systems offers Bristol and Barrington a partner with an extensive background in the unique issues associated with complex sites.
- **Leader in energy projects.** Ameresco is the nation’s largest independent provider of energy efficiency solutions, with significant experience in Rhode Island.
- **Ameresco has designed and built 100% of the solar PV projects it has been awarded.**

Ameresco Corporate Office

111 Speen Street, Suite 410
Framingham, MA 01701

Contact Information

Kleo Taliadouros
Director -Development
111 Speen Street, Suite 410
Framingham, MA 01701
Ph: 508-661-2263
ktaliadouros@ameresco.com

Financial Qualifications & Stability of Company

As the Towns of Bristol and Barrington embark on this ambitious program, it's important to have an energy partner that not only is technically qualified but also financially strong and stable.

With 2015 revenues of over \$630 million and a construction backlog exceeding \$1.3 billion, Ameresco is one of the largest independent energy services companies in United States.

More than \$2.2 Billion in Project Financing

Ameresco has sourced and raised more than \$1.8 billion of project financing over the past 15 years, from various lending sources including John Hancock, Bayerische Landesbank, Bank of America, Capital One, Chase Bank, Crews and Associates, Union Bank and several other financial institutions. Using existing cash resources, cash flows from Ameresco's operating activities, and access to credit through multiple lending relationships, Ameresco has the resources necessary to develop, implement, and if needed, finance our customers' energy projects.

\$100 Million Revolving Credit Facility

Additionally, Ameresco maintains a commercial banking relationship with Bank of America, located at 100 Federal Street, Boston, MA 02110. This includes a \$100 million revolving credit facility. For reference:

Bank of America
c/o Michael A. Palmer, Senior Vice President
100 Federal Street, Boston, MA 02110
(617) 434-4647
Michael.a.palmer@baml.com

\$1.4 Billion Surety Credit Facility

We maintain a \$1.4 billion surety credit facility through two corporate providers, both with an AM Best Rating of “A Excellent”.

Using its significant resources, Ameresco has the financial fortitude to be a long-term partner with the Towns, ensuring a successful development execution, project implementation, and operations.

Financial Statements Overview

	Year Ended December 31,				
	2014	2013	2012	2011	2010
	(In thousands, except share and per share data)				
Consolidated Statements of Income Data:					
Revenues(1)	\$ 593,241	\$ 574,171	\$ 631,171	\$ 728,200	\$ 618,226
Cost of revenues	476,309	470,846	503,024	593,154	507,524
Gross profit	116,932	103,325	128,147	135,046	110,702
Selling, general and administrative expenses	103,781	96,693	98,474	84,360	64,710
Goodwill impairment	—	—	1,016	—	—
Operating income	13,151	6,632	28,657	50,686	45,992
Other expenses (income), net	6,859	3,873	4,050	6,506	6,293
Income before provision for income taxes	6,292	2,759	24,607	44,180	39,699
Income tax (benefit) provision	(4,091)	345	6,247	10,767	12,186
Net income	\$ 10,383	\$ 2,414	\$ 18,360	\$ 33,413	\$ 27,513
Net income per share attributable to common shareholders:					
Basic(2)	\$ 0.22	\$ 0.05	\$ 0.41	\$ 0.78	\$ 1.07
Diluted	\$ 0.22	\$ 0.05	\$ 0.40	\$ 0.75	\$ 0.66
Weighted average common shares outstanding:					
Basic(2)	46,161,846	45,560,078	44,649,275	42,587,818	25,728,314
Diluted	46,718,140	46,419,199	45,995,463	44,707,132	41,513,482
Other Operating Data:					
Adjusted EBITDA(3)	\$ 38,473	\$ 29,906	\$ 52,364	\$ 67,560	\$ 59,910

	As of December 31,				
	2014	2013	2012	2011	2010
	(In thousands)				
Consolidated Balance Sheet Data:					
Cash and cash equivalents	\$ 23,762	\$ 17,171	\$ 63,348	\$ 26,277	\$ 44,691
Current assets	226,735	247,009	297,843	283,062	211,710
Total assets	629,659	606,303	675,472	645,597	584,407
Current liabilities	146,089	133,288	148,889	148,268	142,587
Long-term debt, less current portion	90,037	103,222	109,079	86,754	43,417
Federal ESPC liabilities(4)	70,875	44,297	92,843	109,648	158,992
Total stockholders' equity	\$ 286,306	\$ 276,806	\$ 261,819	\$ 236,421	\$ 198,052

Key Personnel

Ameresco possesses the skills required to complete this project including licensed professional engineers, North American Board of Certified Energy Practitioners (NABCEP), certified solar PV installers, certified and licensed master electricians, and certified energy managers.

Kleo Taliadouros – Director of Development

Mr. Kleo Taliadouros has 30 years of experience in the energy and environmental fields. He is responsible for the entire life cycle of the project, from opportunity origination and initial concept development through to operation. Mr. Taliadouros manages client-Ameresco relationship, conducts technical and economic feasibility analysis, and oversees all aspects of project development including permitting, design management support, construction management, commissioning, and operational support.

Jack B Honor, Project Development Manager

Mr. Honor is a Project Development Manager within the Solar PV group at Ameresco. He is responsible for development and implementation of distributed generation and utility scale Solar PV projects across the country for customers including municipalities, commercial & industrial, university, and utilities. Mr. Honor has substantial experience in the development and construction of solar PV projects across the country, including recently in New York, Florida, Michigan, Connecticut, and Wisconsin. His project expertise spans rooftop, ground mount, landfills/brownfields, single-axis tracking systems, and utility-scale projects.

LUIS F. ALEGRIA, Director of Solar Engineering

Mr. Alegria has over 15 years of experience in the renewable energy industry. Mr. Alegria has expertise in renewable technologies including PV, Wind, Solar Thermal and Passive Solar. Mr. Alegria is knowledgeable in the following areas: RE Financial Analysis, NEC regulations, RE System Design, PV Product Sales, PV system Troubleshooting, Technical Training, UL and IEC Certification, PCB / Electronic Design, and Product Testing. Luis is a NABCEP Certified PV Installer.

PETER N. CHRISTAKIS, C.E.M., VP – Construction & Operations

Mr. Christakis is Vice President of Construction and Operations, responsible for all construction operations in the Northeast Region. Mr. Christakis has garnered experience in lighting, electrical, and mechanical project installation, design and operation with particular expertise in electrical wiring, lighting design, and project management. Mr. Christakis has expertise in the construction of various turnkey and energy savings performance contracts in all vertical markets. Mr. Christakis has supervised construction of notable large-scale projects such as the \$60M Boston Housing Authority contract as well as the 30MW of solar projects in the northeast.

JOSEPH P. DeMANCHE, P.E. Executive VP, Engineering & Operations

Mr. DeManche has served Ameresco's executive vice president, engineering and operations since 2002. He has overseen the design, construction, and operations for hundreds of millions of dollars in shared savings and performance contracts for large-scale energy efficiency upgrade projects. Mr. DeManche earned a Master of Architecture degree from Harvard University and a B.S. from the Massachusetts Institute of Technology. He is also a registered Professional Engineer in many states. His solar project experience includes overseeing the development and construction of more than 30MW within the northeastern United States in addition to some of the company's largest and most complex projects including the \$195M Savannah River biomass plant.

BRIAN PITREAU – Engineering Team Leader

Mr. Pitreau is an Engineering team leader focused on Solar PV design. With ten years of experience in energy engineering, he is responsible for taking a project from the development stage to construction. He is responsible for final design and design oversight of solar PV projects and specification of material and equipment to be used on a project. He is also accountable for ensuring systems conform to applicable codes and standards and for coordinating the work of installation subcontractors during construction. Brian is a NABCEP Certified PV Installer.

JAMES WALKER, P.E. Vice President, Solar PV Grid-Tie Projects

Mr. Walker leads Ameresco's Grid-Tie group, responsible for developing and building Ameresco's solar business in the eastern region, executing more than 30MW of PV projects while at the company. Mr. Walker brings more than 35 years of diverse energy experience in the power and natural gas industry, which included a focus on energy conservation engineering early in his career, then gas and power supply trading and delivery during the deregulation period, then technology business development and strategic energy market analysis.

Environmental Consultant – AMEC Foster Wheeler

AMEC Foster Wheeler is a regional leader in engineering and environmental consulting, with the expertise to speed permit approvals through various federal, state and local agencies. AMEC's team offers a breadth of disciplines, along with decades of permitting, planning, design, and construction experience for a wide variety of projects, to develop and execute environmental solutions that meet the changing environmental regulations. Globally, the company employs over 27,000 people with GBP 4 billion in annual revenue.



Ameresco teamed with AMEC to provide environmental engineering services at our Bethel, CT, Sudbury, Braintree, Pittsfield, Weston, Acton, and Lowell, MA solar PV sites. We are also currently working with AMEC on the design and development of the Lenox, Hampden, and Stockbridge landfill solar PV sites, and the West Newbury ground mount site in Massachusetts, and New Milford, CT totaling 35 MW. Given Ameresco's successful and continued work with AMEC on those and other projects, Ameresco continues to choose them as our primary consultant for ground mount and landfill solar PV projects.

Timothy Regan, PE, AMEC Foster Wheeler

Mr. Regan has spent the past 17 years managing and overseeing all aspects of environmental consulting groups. In addition, Mr. Regan support the City of Providence Departments of Planning and Development and Public Parks managing the investigation, remediation, permitting and compliance of over 15 projects at various high-visibility Brownfields including the former Louttit Laundry, Gorham Manufacturing, and American Tourister properties. Mr. Regan is responsible for progress reporting to City officials, public meeting coordination and presentations using fact sheets and presentations. The majority of his private sector experience has focused on site investigations, remedial designs, remedial activities, and regulatory compliance and negotiation support services for hazardous waste sites under both State and Federal authority. Mr. Regan's investigation experience includes multi-media environmental sampling, aquifer testing and analysis, landfill gas sampling programs, and analytical data evaluation. His design and construction experience includes landfill closure projects, technology evaluation, remedial alternative development, and feasibility studies. Typical support services have included rendering opinions on environmental conclusions made by other consultants; closing out sites with difficult regulatory issues; negotiating land usage restrictions; and facilitating problematic situations which often develop when local, state, and federal agencies are all involved in a project. Mr. Regan's regulatory experience at RIDEM has proven to be especially valuable in helping clients navigate through State and Federal rules and regulations and ensuring that their interests are adequately represented.

Section 3: Solar PV Qualifications

Solar PV Project Experience

Ameresco has built over **120MW** of Solar PV projects, the majority of which are in New England. We own, operate, and maintain the majority of these projects and **our portfolio is currently averaging 99% of expected production levels.**

Ameresco is the right partner for the Bristol and Barrington solar projects. We encourage the Towns to reach out to any of our references provided herein. Additional references can be made available upon request. Our customers choose Ameresco for their solar PV projects for a number of reasons:

Experience and Capabilities

Ameresco has built 100% of the solar projects we have been awarded. We have the in-house expertise to design, permit, construct, own, and operate PV facilities. We have construction financing already in place and are not reliant on outside financing to begin construction. This means Bristol and Barrington’s projects will begin promptly, with clean energy being produced as soon as December 2017.

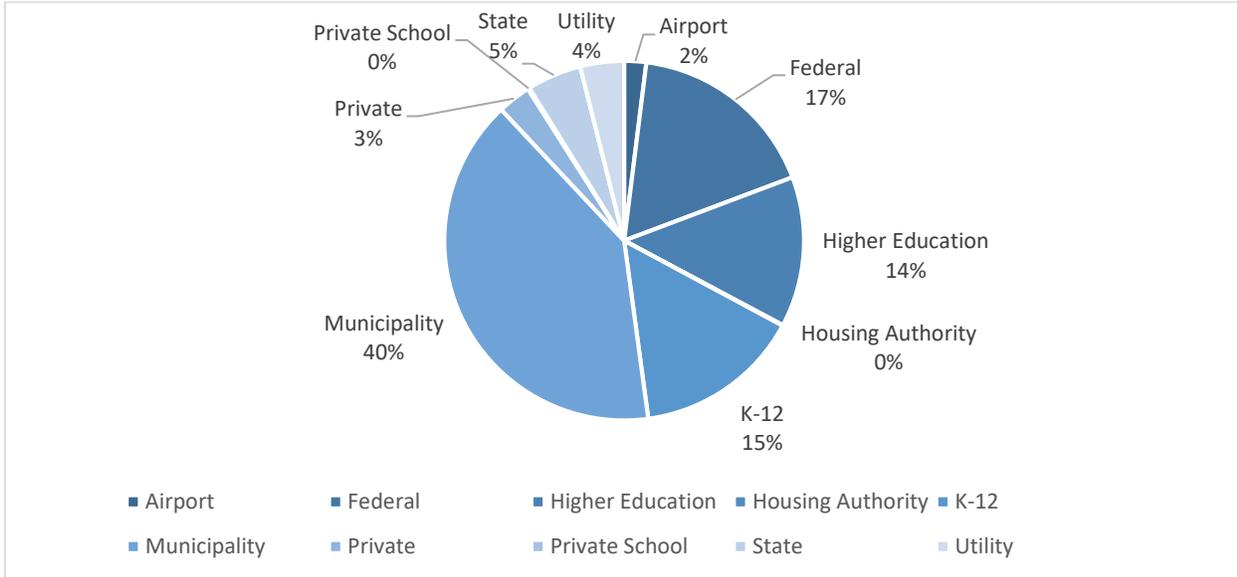
Reliability

Ameresco is financially strong with 2015 revenues of \$630 million, bonding capacity of \$1.4 billion, and access to \$100 million for construction financing. We have constructed over \$5.5 billion dollars of energy assets for our customers, the majority of which we operate and maintain. Our O&M staff is located a short drive from our proposed installation sites and Ameresco will be here for the life of the project to ensure that the systems are providing clean, renewable energy.

Solar PV Projects Developed by Ameresco's Regions	Completed (kW-DC)	Completed (Number of Installations)	In Construction (kW-DC)	Awarded (kW-DC)	Largest Project under Contract (kW-DC)	Smallest Project under Contract (kW-DC)
Eastern USA	29,982	74	12,918	32,247	6,000	20
Southwest USA	41,702	136	5,216	46,133	3,663	9
Federal USA	24,358	9	1,160	15,037	24,358	73
Canada	3,992	35	2,532	1,000	2,380	12
Ameresco Solar (Off-Grid)	2,543	7	0	0	290	53
Northwest USA	299		0	489	0	0
Total Completed/ In Construction (kW-DC)	102,876	261	21,826	94,906	24,358	0
		124,701				

Ameresco Solar PV Installations by Client Type

Ameresco’s project experience spans all segments of clients, with particular expertise (about 85%) in public sector clients such as K-12 schools, Federal Government, and Municipal.



Solar PV Experience in the Northeast

The table on the next page lists the solar PV projects Ameresco designed, built, owns and operates in the Northeast. We **specialize in providing solar PV to municipalities**, school districts and other public entities, customers which usually opt for a Power Purchase Agreement (PPA). Most of the projects below were built under a PPA with Ameresco (via a special purpose entity) as the project owner, and as such, construction costs were internal to Ameresco and not the responsibility of the customer, and there were no change orders.

In addition, to the completed projects listed in the table below, Ameresco was also competitively selected and awarded by the **Providence Water Supply Board** a **765kW rooftop solar PV project** to be constructed at its newly acquired facility in Providence, RI. The project is currently in the design phase and it is expected to be completed in Spring 2017.

Proposal for Public-Private Partnership for On-Site Solar Projects



Project	Number of Sites	Size kW DC	Location	Financing	Client	Installation Type
Completed Projects						
Braintree Electric Light Department Phase 2 - Braintree High School	2	664	Braintree, MA	PPA	Utility	Roof Mounted
City of Waltham, Phase II	6	1,738	Waltham, MA	PPA, Grant	Municipality	Roof Mounted
City of Fall River	4	576	Fall River, MA	PPA	K-12, Municipality	Roof Mounted
Town of Natick, Phase II	3	522	Natick, MA	PPA	K-12	Roof Mounted
City of Newburyport	2	502	Newburyport, MA	PPA	K-12, Municipality	Roof Mounted
Massport - Logan International Airport	2	370	Boston, MA	PPA, Grant	State	Roof Mounted
City of Lowell, Phase I	5	348	Lowell, MA	PPA	K-12, Municipality	Roof Mounted
Town of Natick, Phase III	2	311	Natick, MA	PPA	K-12, Municipality	Roof Mounted
City of Englewood, CO	4	219	Englewood, CO	PPA	Municipality	Roof Mounted
Town of Natick, Phase I	1	213	Natick, MA	PPA, Grant	K-12	Roof Mounted
City of Waltham, Phase I	1	193	Waltham, MA	PPA	K-12	Roof Mounted
Milton Academy	1	192	Milton, MA	PPA	K-12	Roof Mounted
Bridgewater State University	1	103	Bridgewater, MA	PPA, Grant	Higher Education	Roof Mounted
Mt. Wachusett Community College	1	97	Gardner, MA	Turnkey	Higher Education	Roof Mounted
City of Revere	1	47	Revere, MA	ESPC	K-12	Roof Mounted
Canton Housing Authority	1	51	Canton, MA	PPA, Grant	Housing Authority	Roof Mounted
Cambridge Housing Authority	1	46	Cambridge, MA	ESPC	Housing Authority	Roof Mounted
Worcester State University	1	41	Worcester, MA	PPA, Grant	Higher Education	Roof Mounted
Brockton Transit Authority	1	20	Brockton, MA	Turnkey	Transit Authority	Roof Mounted
City of Newton	4	686	Newton, MA	PPA	K-12	Roof Mounted
City of Melrose	1	301	Melrose, MA	PPA	K-12	Roof Mounted
Town of Lexington, MA	6	1,110	Lexington, MA	PPA	K-12	Roof Mounted
Town of Arlington, MA	6	719	Arlington, MA	PPA	K-12	Roof Mounted
Walnut Hill School	1	235	Natick, MA	PPA	Private School	Roof and Carport
Town of Acton	1	1,592	Acton, MA	PPA	Municipality	Landfill
City of Lowell, Phase II	1	1,502	Lowell, MA	PPA	Municipality	Landfill
Town of Sudbury	1	1,502	Sudbury, MA	PPA	Municipality	Landfill
Braintree Electric Light Department	1	1,300	Braintree, MA	PPA	Utility	Landfill
City of Hutchinson	1	400	Hutchinson, MN	TELP	Municipality	Landfill
Town of Weston, MA	1	2,347	Weston, MA	PPA	Municipality	Landfill
Town of Groton, MA	1	2,932	Groton, MA	PPA	Municipality	Landfill
Fisher Road Solar I	1	6,000	Dartmouth, MA	PPA	Municipality	Ground Mounted
MassDOT Phase 1a	5	2,537	Various in MA	PPA	State	Ground Mounted
West Newbury, MA	1	440	West Newbury, MA	PPA	Municipality	Ground Mounted
Total	72	29,855				

"Page content is subject to Confidentiality Restrictions"

System Performance

Ameresco’s solar portfolio in the Northeast is currently averaging 99% of its original modeled production. The following represents a selection of some of our projects which have been operational at least 2 years and their performance.

Actual Performance - % of Original Modeled Production			
Project	2014	2015	2016 YTD
Bridgewater State University	103%	100%	119%
Massport / Logan Airport	106%	109%	126%
Fall River – Phase 1	101%	97%	120%
Natick Phase 3	100%	97%	109%
Mass DOT Phase 1A	-	99%	113%

Ameresco O&M

Ameresco performs most O&M for our solar projects in the Northeast in-house. We have O&M personnel located in Framingham, MA. Below is a summary of projects in the Northeast Ameresco currently performs O&M on. These projects represent roughly \$2 million in O&M budget each year.

Location	System
Newburyport, MA	Nock Middle School
	DPW
Lowell, MA	Butler Middle School
	Pawtucketville Memorial Elementary
	Reilly Elementary
	Shaughnessy Elementary
	Lowell Memorial Auditorium
Englewood, CO	Civic Center
	Malley Senior Center
	Safety Service Center
	Service Center
Bridgewater State University	Crimson Hall
Worcester State University	Wasylean Hall
Canton Housing Authority	Elderly Home
Massport – Logan Airport	Terminal A
	Terminal A Satellite
Natick, MA - Phase I	Kennedy Middle School
Natick, MA - Phase II	Bennett-Hemenway Elementary
	Memorial Elementary
	Wilson Elementary
Fall River, MA	Kuss Elementary

	Talbot Elementary
	Silvia Elementary
	Water Treatment Plant
Waltham, MA - Phase I	Municipal Center
Waltham, MA - Phase II	High School
	Kennedy Middle School
	MacArthur Elementary
	Northeast Elementary
	Plympton Elementary
	Whittemore Elementary
Milton Academy	ACC
Natick, MA - Phase III	High School
	Senior Center
Braintree - BELD	Landfill
Lexington Municipal Buildings	High School
	Bowman
	Cary Memorial Library
	Harrington
	Joseph Estabrook
	Jonas Clarke
MassDOT Phase 1A	Natick Embankment
	Framingham Service Plaza
	Exit 13 North
	Exit 13 South
	Plymouth Route 3
West Newbury	Ground mount
Arlington Municipal Buildings	High School
	Dallin Elementary
	Stratton Elementary
	Ottoson Elementary
	Thompson Elementary
	Pierce Elementary
Braintree High School - BELD	Rooftop
Walnut Hill School	Rooftop/ Carport
Weston Landfill	Landfill

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Section 4: Reference Projects

Massachusetts Department of Transportation

Customer Name	MA DOT Highway Solar – Phase 1A
Project Dates (Start and Finish)	October 2014 to August 2015
Project Size	2.45 MW DC (with another ~4MW in development or construction)
Projected Annual Electricity Generation	3.19 million kWh
Project Completed on Schedule and on Budget?	Yes
Production Shortfalls	In first year of operation
Reference:	Hongyan (Lily) Oliver
Name:	Massachusetts Department of Transportation
Address:	10 Park Plaza, Suite 4150, Boston, MA
Email Address:	Hongyan.oliver@state.ma.us
Telephone Number	857-368-9025

The Massachusetts Department of Transportation (MADOT) partnered with Ameresco on an innovative solar PV project using excess MADOT along Massachusetts state highways. Through this public-private partnership, MADOT is expected to save \$15 million over the 20 year project life, and zero up-front capital was required from MADOT. MADOT will also receive lease revenue for each of the individual sites being leased by Ameresco for the project. Phase 1A of the project was completed in August 2015 and includes a total of 2.45 MW of solar PV.



Braintree Electric Light Department – Braintree Landfill

Customer Name	BELD - Town of Braintree Landfill
Project Dates (Start and Finish)	June 2013 to December 2013
Project Size	1.26 MW DC
Projected Annual Electricity Generation	1.65 million kWh
Project Completed on Schedule and on Budget?	Yes
Production Shortfalls	In first year of operation
Reference:	William Bottigi
Name:	General Manager, BELD
Address:	150 Potter Road, Braintree, MA
Email Address:	bbottigi@beld.com
Telephone Number	781-348-1010

The Braintree Electric Light Department partnered with Ameresco to use the Town of Braintree landfill for a solar PV project. The 1.26 MW DC facility is a ballasted solar PV system that sits on top of the landfill cap to protect cap integrity. The facility employs 4,142 solar panels and went into Commercial operation in January 2015.



Town of Lexington, MA – Municipal and School Buildings

Customer Name	Town of Lexington, MA
Project Dates (Start and Finish)	June 2013 to January 2015
Project Size	1.11 MW DC
Projected Annual Electricity Generation	1.32 million kWh
Project Completed on Schedule and on Budget?	Yes
Production Shortfalls	None
Reference:	Shawn Newell
Name:	Assistant Director of Facilities, Town of Lexington
Address:	201 Bedford Street, Lexington, MA
Email Address:	snewell@lexingtonma.gov
Telephone Number	508-324-2585

Ameresco was chosen by the Town of Lexington to implement rooftop solar PV on multiple school and town buildings. Five schools and one municipal building were identified as sites for solar photovoltaic panel installation.. The installed systems have a total capacity of 1,110kW_DC, delivering 1,320,800 kilowatt hours of electricity in the first year of operation. The systems were connected to the utility side of the existing building meters to maximize the net metering credit value and overall economic benefit to the Town. The municipal buildings that were selected include: Lexington High, Bowman Elementary, Clark Middle, Harrington Elementary and Estabrook Elementary.



City of Lowell, Massachusetts: 1850 kW-dc Installed

The City of Lowell and Ameresco have been partnering on renewable and energy efficiency projects for many years. Ameresco has been able to offer budget neutral solutions, including two solar PV Power Purchase Agreement which required no capital investment from the City.

- **Phase I:** In 2010, Ameresco completed solar PV installations at four (4) schools and the Lowell Memorial Auditorium
- **Phase II:** In 2013, Ameresco completed a 1.5 MW system solar PV array at the City's capped landfill
- Lowell was able to create a new position of City Energy Manager which is partially funded by the savings from Ameresco's projects
- PPA and ESPC projects have enabled Lowell to leverage government and utility incentives to become a Green Community.



"We are pleased to continue and expand our partnership with Ameresco, which has already had a positive impact on our environment and our local economy. These new solar installations will allow for significant energy cost savings that can be redirected into the reinvestment and rebuilding of our community for all residents."

**Bernie Lynch, City Manager
City of Lowell, MA**

Project Facts

- **Ameresco Responsibilities:** Development, Engineering, Procurement, Construction Management, Construction Financing, Own for Phase I, Secured Long-Term Financing (with third- party owner) for Phase II, Operation & Maintenance
- **Total System Size:** Roof: 348 kW; Landfill: 1.5 MW
- **Expected First Year kWh Output:** Roof: 435,000 kWh; Landfill: 1.88 million kWh
- **Project Type:** Power Purchase Agreement (PPA)
- **Permits Required:** MA DEP Post-Closure Use Permit, Building, Electrical
- **Construction:**
 - Phase I: February - November 2010
 - Phase II: July – December 2013
 - **Client Contact:** P. Michael Vaughn, Chief Procurement Officer
City of Lowell
375 Merrimack Street, Lowell, MA 01850; Phone: 978-970-4110

Town of Sudbury Landfill: 1,502 kW-dc

As part of Ameresco's award by the Metropolitan Area Planning Council (MAPC) for Comprehensive Energy Management Services, the Town of Sudbury and Ameresco partnered to development of a solar PV system on Town's capped landfill. Due to its quick approval with the MassDEP and Eversource (formally known as NSTAR), this project was able to start construction within 6 months of the Power Purchase Agreement being executed.

- 1st solar PV system to begin construction on a capped landfill by Ameresco
- Minimal site work was required and allowed for natural vegetation to remain

Project Facts:

- **Ameresco Responsibilities:** Engineering, Procurement, Construction Management, Construction Financing, Secured Long-Term Financing (with third-party owner), Operation & Maintenance
- **Total System Size:** 1,502 kW DC
- **Expected First Year kWh Output:** 1.8 million kWh
- **Project Type:** 20-year Power Purchase Agreement (PPA)
- **Permits Required:** MA DEP Post Closure Use Permit, Site Plan Review, Storm Water Plan, Building, Electrical
- **Construction:** April 2013 – December 2013
- **Client Contact:**
Jim Kelly, Building Inspector
Town of Sudbury
275 Old Lancaster Road Sudbury, MA 01776
Phone: 978-360-6131
kellyj@sudbury.ma.us



"This project is a great example of **commitment and collaboration** by state and local government personnel, public and private interests, and volunteer efforts."

Bill Braun
Energy Committee Chairman,
Sudbury, MA



Town of Acton Landfill: 1,592 kW-dc

Ameresco was awarded through competitive procurement the solar PV project to be installed on the Town of Acton's capped landfill. This system required unique site work and design to accommodate installation on the steep, sloped areas on the south side of the landfill, as seen in the photos.



- 1st solar PV system on a landfill to be designed by Ameresco
- 100% of the municipal buildings' electricity bills will be paid for by net metering credits generated from this solar PV system

Project Facts:

- **Ameresco Responsibilities:** Engineering, Procurement, Construction Management, Construction Financing, Secured Long-Term Financing (with third-party owner), Operation & Maintenance
- **Total System Size:** 1,592 kW DC
- **Expected First Year kWh Output:** 2 million kWh
- **Project Type:** 20-year Power Purchase Agreement (PPA)
- **Permits Required:** MA DEP Post-Closure Use Permit, Building, Electrical
- **Construction:** April 2013 – December 2013
- **Client Contact:**
Steve Ledoux
Town of Acton
472 Main Street Acton, MA 01720
Phone: 978-929-6611
manager@acton-ma.gov

Section 5: Proposed Solar PV Projects

Project Approach

Ameresco visited all of the Bristol and Barrington sites subject to this RFP and subsequently performed an engineering evaluation of each site to determine their technical and financial feasibility for solar PV installations.

In addition to information provided by Bristol and Barrington, our evaluation included the assessment of several site specific conditions, such as

- Roof building material
- Roof pitch
- Shading due to adjacent trees, roof objects roof structures
- Roof obstacles such as drains and plumbing vents
- Building switchgear voltage

Based on the above criteria, the following buildings were removed from further consideration:

Town of Bristol

- **Rogers Free Library:** Clear, flat parts of the roof are too narrow after allowing for safety and wind uplift setback. In addition, shading due to HVAC equipment.
- **Dreadnaught Fire Station:** Financially infeasible due to small size.
- **Bristol Maritime Center:** Financially infeasible due to small size. Also, structural issues were observed that have stalled planned renovations.
- **Bristol Police Station:** After allowing for setback, roof drain, HVAC clearances, and shading, project is too small to be financially feasible.
- **Dept. of Public Works:** Financially infeasible due to small size.
- **Wastewater Treatment Plant:** Insufficient roof area and no space available on grounds.
- **Former Reynolds School:** Very limited area due to shading by trees and building chimney.
- **Defiance Fire Station:** Small building with tree shading.

Town of Barrington

- **Barrington Public Works:** Withdrawn by the Town.
- **Library/Senior Center:** Clear, flat roof parts are too narrow after allowing for safety and wind uplift setback. In addition, shading due to HVAC equipment.
- **Public Safety Building:** Dormers on south side render PV installation is not feasible.

- **Barrington Middle School:** Withdrawn by the Town, as the existing school will be replaced with a new building.

Ameresco Proposal

Ameresco proposes several systems that are designed to maximize the financial benefits to each Town. These offers include a ground-mounted installation on Bristol's landfill, several rooftop installations on Towns' buildings that were deemed appropriate for solar PV, and a ground-mounted system on off-site land in North Kingstown currently in the permitting phase by Ameresco

Furthermore, in order to maximize the financial benefit to each Town, each system has been ascribed to a specific renewable energy program currently available in Rhode Island, based on its specific installation type, location and size and financial feasibility. As further described in the table below, these benefits may be in the form of savings on each Town's electric consumption (Virtual Net Metering program) or lease payments for hosting the PV systems (Renewable Energy Growth program) as well as annual tax payments in the form of a Payment in-lieu-of Taxes (PILOT) agreement.

Ground Mounted Systems – Virtual Net Metering

- **Option A** is based on a 5,292kW system to be installed on the Bristol landfill. Under this option, the electrical output of the system will be purchased under a Power Purchase Agreement (PPA) by Bristol and Barrington in two equal portions for 20 years. Bristol, as the owner of the landfill, will receive lease payments and property tax revenue from Ameresco for hosting the portion of the array whose electric generation will be purchased by Barrington.
- **Option B** is based on the 3,805kW system on the Bristol landfill. Under this option, the entire electrical output of the system may be purchased under a PPA by Bristol for 20 years. This option represents the maximum size based on electricity consumption provided by Bristol in the RFP documents. Upon our review, it is unclear if streetlight electricity consumption was included. An increase in the system capacity of this option is possible, upon review of revised electricity consumption information.
- **Off-Site Ground Mounted System - Virtual Net Metering** - Ameresco is currently developing an approximately 2.6MW ground-mounted system on private leased land located in North Kingstown. The output of the system may be purchased by Barrington under a PPA, should Bristol choose Option B. Alternatively, both Towns may participate in this PPA, should Option A be selected by both Towns.

Roof-Mounted Systems - Renewable Energy Growth Program

Based on our feasibility evaluation of the two Towns buildings (as described above) Ameresco proposes that PV systems be installed on the roofs of the buildings listed below and enroll them into the Rhode Island Renewable Energy Growth program.

- Bristol – Mount Hope High School
- Barrington – High School
- Barrington – Hamden Meadows School
- Barrington – Nyatt Elementary School
- Barrington – Primrose Hill School
- Barrington – Sowams Elementary School

Once accepted and enrolled in the program, Ameresco will sell the generation output of each system under long-term tariffs at fixed prices to National Grid and each Town will receive a lease payment for hosting each system as well tax revenue commensurate with the capacity of each system. After the expiration of 20 year program the Towns can choose to enter into a 5-year PPA for each system, thus further increasing their savings on their electric consumption.

Design/Build System – Town of Barrington

Town of Barrington has expressed an interest in owning the PV system proposed on the roof of its Town Hall.

Ameresco will design and construct a 14kW system that will be owned and operated by Barrington. This offer includes a significant discount in the system's installation price ("volume discount") should Barrington also contract with Ameresco for either Option A of the On-Site Ground Mounted System or the Off-site Ground Mounted System.

Bristol Landfill – Virtual Net Metering

This table outlines two (2) options for the development of the Bristol Landfill.

Description	Capacity (kW DC)	Year 1 Generation (kWh)	PPA Price & Term	Year 1 Electricity Savings*	Other Revenue	Total Benefit
<u>Option A:</u> 50% Virtual Net Metered to Bristol	2,646	3,463,500	\$0.118/kWh <i>20 Year PPA No escalator</i>	\$190,354	\$26,460 <i>Annual property tax</i> \$15,000 <i>Annual lease from Barrington Project</i>	\$231,754 <i>Year 1</i> \$5.6 million <i>Lifetime</i>
50% Virtual Net Metered to Barrington	2,646	3,463,500	\$0.126/kWh <i>20 Year PPA No escalator</i>	\$162,646	-	\$162,646 <i>Year 1</i> \$4.2 million <i>lifetime</i>
<u>Option B:</u> 100% Virtual Net Metered to Town of Bristol	3,805	4,976,940	\$0.118/kWh <i>20 Year PPA No escalator</i>	\$273,533	\$19,025 <i>Annual Property Tax</i>	\$292,588 <i>Year 1</i> \$7.2 million <i>Lifetime</i>

Notes:

- 1) Electricity Savings Calculated assuming current published National Grid C-06 rate of \$0.17296.
- 2) Property tax = \$5,000 per MW per year
- 3) Lease payment in Option B is \$15,000 per year; estimated as fair market rate for landfill lease in Rhode Island.
- 4) Lifetime calculations assume a 1% annual increase in Net Metering Credit Values
- 5) Interconnection assumption is \$213,000 per project
- 6) PPA includes prevailing wage

Offsite Virtual Net Metered System

Ameresco currently has a project under development in North Kingstown, RI. The land is under contract and interconnection and permitting are underway.

Description	Capacity (kW DC)	Year 1 Generation (kWh)	PPA Price & Term	Year 1 Electricity Savings*	Other Revenue	Total Benefit
3MW offsite virtual net metered project	2,600	3,400,800	\$0.126/kWh	\$159,702	-	\$159,702 <i>Year 1</i>
			<u>25</u> Year PPA No escalator			\$6.7 million <i>lifetime</i>

Notes:

- 1) 2.6MW DC is the approximate size pending final results from survey and wetland delineation.
- 2) Electricity Savings Calculated assuming current published National Grid C-06 rate of \$0.17296.
- 3) Property tax = \$5,000 per MW per year
- 4) Lease payment included in PPA price
- 5) Interconnection cost estimate already received and included into the PPA price.
- 6) No prevailing wage as the project is at an offsite location
- 7) Lifetime calculations assume a 1% annual increase in Net Metering Credit Values

Town of Barrington – Renewable Energy Growth

These projects are proposed to be developed under the Renewable Energy Growth Program.

Description	Capacity (kW DC)	Lease Revenue	Property Tax Revenue	Total Benefit	Energy Savings Years 21-25
Barrington High School*	271				
Hampden Meadows Elementary	138	\$25,000 <i>Annual</i>	\$4,410 <i>Annual</i>	\$29,410 <i>Annual</i>	\$15,000 to \$20,000 per year
Nyatt Elementary	120	<i>Years 1-20</i>	<i>Years 1-20</i>	\$588,200 <i>Years 1-20</i>	
Primrose Elementary	165				
Sowams Elementary	170				

- 1) Lease and property tax is 20 years
- 2) Savings in years 20-25 assume onsite net metering PPA after REG program completion
- 3) Barrington High School requires extensive roof repair or roof replacement prior to construction of the Solar PV System.
- 4) Prevailing wage included; interconnection expense estimated at \$5,000 per school

Town of Barrington – Town Hall Turnkey Install/Purchase

Description	Capacity (kW DC)	Installation Cost	Ameresco Volume Discount	Commerce Rhode Island Grant	Net Installation Cost
Barrington Town Hall	14	\$83,000	\$15,000	\$15,000	\$53,000

Financial Analysis – Turnkey Install/Purchase

Net Installation Cost	Annual Savings (avg)	Payback
\$53,000	\$2,400	22 years

Notes:

- 1) Ameresco Volume Discount is a reduction in installation cost provided the Town also contracts for either Bristol Landfill Option A or Offsite Virtual Net Metering System.
- 2) Commerce Rhode Island grant amount estimated based on current incentive levels.
- 3) Savings is average annual over 25 year period, rounded to the nearest \$100 assuming C-06 rate for Town Hall building.
- 4) Prevailing wage included; no interconnection upgrades included

Town of Bristol – – Renewable Energy Growth

Description	Capacity (kW DC)	Lease Revenue	Property Tax Revenue	Total Benefit	Energy Savings Years 21-25
Bristol High School	549	\$15,000 <i>Annual</i> Years 1-20	\$2,500 <i>Annual</i> Years 1-20	\$17,500 <i>Annual</i> \$350,000 Years 1-20	\$15,000 to \$20,000 per year

Notes:

- 1) Lease and property tax is 20 years
- 2) Savings in years 20-25 assume onsite net metering PPA after REG program completion
- 3) Prevailing wage included
- 4) Interconnection upgrades budget - \$5,000

Modules

Ameresco proposes **Hyundai HiS-S350TI**, 72-cell, 350-watt modules. The modules are Tier 1 and meet all other requirements presented in the RFP. A spec sheet is included in Appendix C.

Inverter

Ameresco proposes **Solectria 500XTM** inverters for the landfill project. Yaskawa - Solectria Solar's 500XTM are high efficiency central three-phase inverters. Solectria is a Tier 1 manufacturer and Ameresco has installed these on multiple large projects nationwide. For rooftop projects, we propose **HiQ TS480-8k**. Spec sheets for all inverters are included in the Appendix C.

Racking System

Ground/Landfill Mounted: Ameresco proposes **Solar Flextack G3-X** ground mount racking system. SFR is a Tier 1 manufacturer. The G3X product is an all-steel racking system with a 20-year warranty. A spec sheet is included in the Appendix C.

Rooftop: Ameresco proposes Panel Claw Polar Bear Gen III ballasted non-penetrating racking system. The Polar Bear product is a tier 1 product and carries a 20-year warranty.

System Performance Monitoring, Warranty, O&M

Data Collection

Ameresco will install a complete solar PV measurement and verification system. Using data from the data acquisition system, we will compare the actual production of the PV system to the estimated PV_{sys} production to confirm that the system is operating as expected.

The data acquisition system is composed of the following elements:

- **Electricity Meter:** Ameresco will install a revenue-grade electricity meter to measure the electricity generation from the solar PV array for billing purposes. We will use industry-standard, quality-approved meters.
- **Weather Station:** We will install a weather station to measure solar irradiance and panel temperature. This data is used by Ameresco to monitor actual electricity output against predicted output, adjusted by available sunlight.
- **Data Acquisition System:** We will also install a data acquisition system to record and monitor the fifteen-minute electricity data (kW and kWh) and weather data. This data and the reports will be available to the customer via the Internet. The spec sheet for PowerTrack from AlsoEnergy for the proposed Data Acquisition System is provided on the next page.

Monitoring and Verification

Ameresco records generation performance monthly and prepares bills for the customer reflecting the total electricity generated (kWh) and the applicable PPA electricity (kWh) billing rate. This generation data matches the reported and verified electricity production and can be viewed by our customers using the Also Energy dashboard.

User Interface

Ameresco proposes to use AlsoEnergy for Data Acquisition hardware and software. AlsoEnergy (<http://www.alsoenergy.com/>), was founded in 2007 to provide software-as-a-service monitoring solutions for the energy market, with a focus on solar PV. AlsoEnergy’s business is based on working with every customer to design and put in place a monitoring solution tailored to individual needs. To date, AlsoEnergy monitors over 4GW of energy at more than 12,000 independent sites worldwide.

AlsoEnergy offers a suite of software solutions to monitor site specific actual kWh generation and actual weather data. The following images provide a sampling of analysis tools available on their dashboard.

Equipment Manufacturer Warranties

The following table summarizes the specific warranties for the individual components we propose to use for this project.

Equipment	Manufacturer	Warranty Provisions
Modules	Hyundai	During the first year, Hyundai guarantees the actual power output of the module will be no less than 97% of the labeled power output. From year 2 to year 24, the actual annual power decline will be no more than 0.7%; by the end of year 25, the actual power output will be no less than 80% of the labeled power output
Inverters	Solectria and HiQ	Standard 10 year warranty with warranty extensions to 15 and 20 years. <u>Inverter replacement is included in our O&M Budget</u>
Racking	Racking Systems	20 years
DAS	Also Energy	Standard 5 year warranty on hardware features.

Operation & Maintenance Plan

To date, Ameresco, as system owner, has maintained nearly all of its solar PV projects under PPA with in-house personnel. Our Framingham, MA office will be the primary service center for all O&M staff required to maintain this proposed project. The staff works diligently to ensure that any

concerns are addressed quickly to minimize any downtime of the systems. For each project, an Operations Project Manager will be assigned responsibility for all operations and maintenance activities required at that site in order to ensure that the systems continue operating as expected.

Ameresco maintains its own O&M staff and a fleet of vehicles supplied with tools and equipment. We also maintain and stock replacement parts in our warehouse facilities. In addition, we enter into extended warranty programs and we contract with third-party specialty contractors to provide rapid service to our projects. This capability provides our customers long-term, worry-free service – assuring that the solar PV systems continue to operate over the 20-year length of its Power Purchase Agreement terms.

As the project owner and operator, it is in Ameresco’s best interest to ensure the project is operating as designed. O&M service is included in the power purchase agreement, and there is no additional cost to the Towns for the service. If the Town decides to purchase the system from Ameresco in the future, Ameresco can continue to provide O&M services through a contract with the Town. In the event the Town decides to purchase the project, Ameresco will work to provide a budget and guarantees on costs as appropriate with a mutually agreed upon contract.

Daily Monitoring and Preventative Maintenance

To maintain systems at optimal operation, our team manages the following:

- **Warranties:** Ameresco enters into extended warranty programs, and contracts. This provides our customers with long-term, worry-free service and assurance that the solar PV systems will be in continuous operation.
- **Responsiveness to service alerts and alarms:** For each project, Ameresco’s assigned Operations Project Manager receives alerts, alarms, and reports from the data acquisition system (DAS), notifying the manager of any fault(s) or performance problems. When an alert from the DAS occurs, the Operation Project Manager assesses the cause and severity of the alert – dispatching, as required, service technicians or engineers to access the on-site problem and repair or replace equipment.
- **Annual maintenance:** The Operations Project Manager is also responsible for scheduling the annual evaluation and preventative maintenance of the solar PV system(s).

PPA and Construction Financing

For the each project, but the Barrington Town Hall system, Ameresco will own and operate the solar PV project on its balance sheet. We will create a wholly-owned special purpose entity for the project(s). We will fund 100% of development and construction from our cash on hand or our existing construction credit line. Upon commercial operation (COD) this special purpose entity will be capitalized through a combination of Ameresco equity, tax equity and project debt.

We currently have a large master sale-leaseback tax equity facility available as a partnership with a top tier international bank, but also have experience in structuring the tax equity partnership flip structure if the project economics justify such a facility. We differentiate ourselves from other solar developers in a few key ways:

We don't sell your project to someone else. Each project will stay on Ameresco's balance sheet, be operated and maintained by us for the 20+ year life.

No barriers to construction. Ameresco has the cash on hand as well as access to \$60 million through a term loan and a revolving credit facility with Bank of America to fund construction. We have always started construction without any delays in obtaining construction financing.

\$1.4 billion surety credit facility. Ameresco maintains a \$1.4 billion surety credit facility through two corporate providers, both with an AM Best Rating of "A Excellent".

Subcontractors

Ameresco, as the developer, designer, and EPC contractor for the project, is responsible for all the installation and site preparation work. We team with experienced electrical contractors who bring the appropriate level of expertise to ensure high quality installation. **For these projects, 95% of the labor will be performed by licensed Rhode Island electrical contractors.**

Ameresco intends to establish subcontractor alliances on a case-by-case basis, as we do for virtually all of our customers. Our success, and that of any project, depends upon timely, professional quality workmanship performed by qualified subcontractors who are proficient in the specific technology. Along with technical proficiency, the ability to work cooperatively in a non-disruptive fashion within our client's facility is also required. To this end, it is generally beneficial to engage local subcontractors who have a proven track record of success at a particular location, and an established relationship with the facility personnel. In accordance with Ameresco's standard subcontractor management practice, we fully expect to undertake work at the Towns projects in this fashion.

Subcontractor Qualification & Performance

Whenever Ameresco uses a subcontractor to perform a service required by the contract or to supply materials and supplies for use on the contract, we insist that the subcontractor perform to the same standards and meet the same requirements that we are required to meet. The use of subcontractors to accomplish elements of this contract will be transparent to the Towns so far as responsibility for Quality Control is concerned. If a quality problem occurs, we resolve it as if the cause existed within the Ameresco organization. Each agreement contains the same flow down clauses and includes the requirements that are part of contract.

Ameresco inspects goods delivered and services performed. The same standards are applied to those goods and services as are applied to all other work performed under the proposed contract. If desired by the Towns, we can implement a procedure that will permit inspection of any vendor's operation. Where a contract is involved, we can annotate a Purchase Order with the following statement:

“Inspection: All goods, work, materials, and workmanship shall be subject to inspection and test at the request of representatives of the Towns and/ or Ameresco at all reasonable times and places. For this purpose seller shall allow inspectors and other authorized Towns and/ or Ameresco personnel free access to seller's plant and operations at all reasonable times and shall furnish such facilities, supplies, and services as may reasonably be required for this work. In case any supplies or lots of supplies are defective in material or workmanship or otherwise not in conformity with the requirements of this purchase order, Towns and/ or Ameresco may either reject them (with or without instructions as to their disposition) or require their correction. Unless seller corrects or replaces such supplies within the delivery schedule, Towns and/ or Ameresco may require their delivery at a reduction in price that is equitable in the circumstances.”

Additionally, under the Terms and Conditions on our Company's purchase order we can specify the following:

“Information Disclosed: Unless expressly agreed to in writing by the buyer, no information or knowledge disclosed to the buyer in the performance of or in connection with this order shall be deemed to be confidential or proprietary, and any such information or knowledge shall be free from any restrictions as part of the consideration for this order.”

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Section 6: Community and Educational Program

Ameresco offers a multi-component approach to using the solar PV project and its performance as an educational tool within the communities we serve.

1. **Monitor:** project statistics are available to the public through our monitor display to be installed in a school building lobby, classroom, or other site, and/or accessed on the School's website. Ameresco will furnish and install one LCD monitor for Bristol and one for Barrington, though we can budget for additional monitors at each Town's request. The monitor is a 32" flat screen monitor, wall-mounted on brackets that allow vertical tilt and horizontal side-to-side adjustment. It will be hard wired to an internet connection and require 120 V power.
2. **Online Dashboard:** student, teachers, parents and others may download actual historical production data on the system by accessing the site's data acquisition system on their school or home computer.
3. **Solar Curriculum Materials:** educators can teach students about renewable energy and relate solar with other class topics using the database of solar teaching materials for K-12 students, including lesson plans and topic summaries that we provide to our customers.
4. **Public Outreach:** our account managers, engineers and/or project managers provide an example of successful individuals working in the clean energy economy by participating in school or public events.

Public Online Access to System Performance

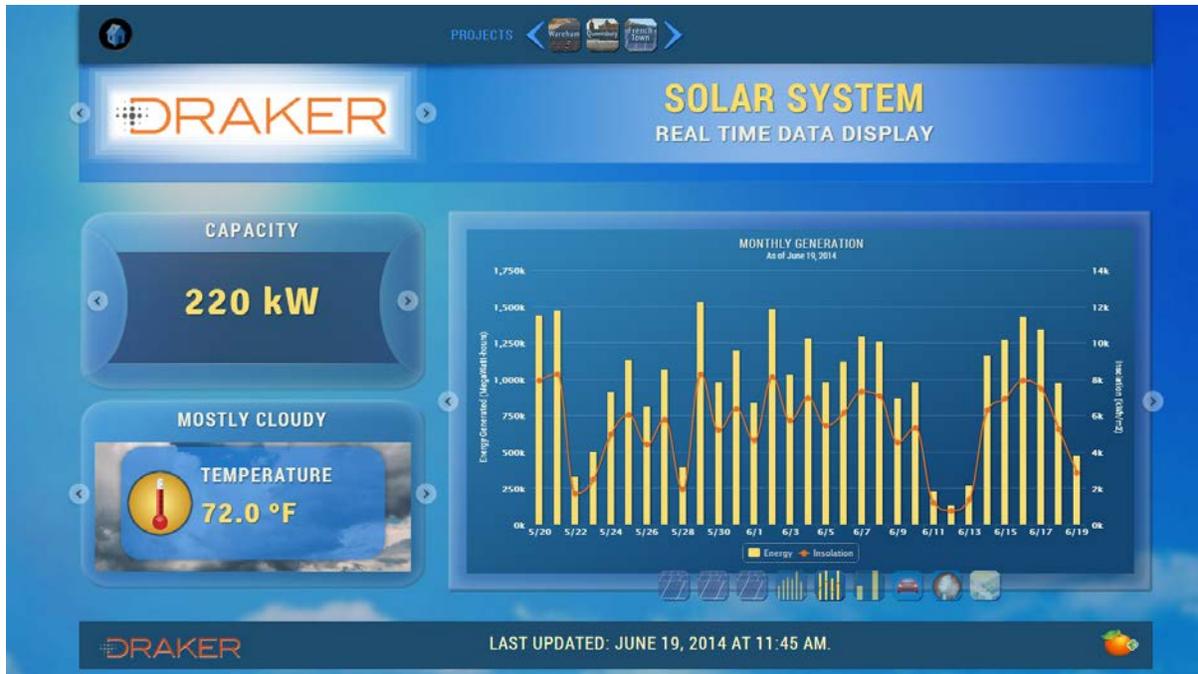
Ameresco offers several options for websites which may be displayed via a monitor in the school lobby or web browser access. The display provides an interactive, dynamic way for students and the public to learn about the solar project. The monitor displays solar performance in a user-friendly way by highlighting key data through pictures, graphs, and text. The data includes:

- current weather conditions,
- current PV performance,
- project photos and information,
- historical values of production, and
- CO₂ offset and equivalencies

The data updates on 15-minute intervals throughout the day. By accessing the website via a computer, users have access to this information and data as well as historical data. The Towns can also choose to host this website on a School's website, as a means to promote this green, cost-saving initiative.

For this project, Ameresco has included one LCD monitor to be installed at a school building. The Public Website and online dashboard may look like the one below, though our DAS partner is to be determined:

Public View Website



Solar PV Educational Curriculum

Ameresco has prepared and structured a Solar PV Educational Program. The goal of this program is to educate students about the environmental benefits of using renewable energy, the history of solar PV, the science behind the technology, and the theory used in system design. After acquiring this knowledge base, student will be better able to understand and analyze data from their system’s data acquisition system (DAS).

The Ameresco Solar PV Educational Program is meant to provide teachers with a database of teaching materials which includes all the necessary background and technical information as well as a compilation of lesson plans. Lessons are categorized by grade level for elementary school, middle school, and high school to ensure that lessons are catered to the appropriate grade level. Teachers are free to pick and choose the topics and lessons that are appropriate for their class and need not use all the materials provided.

The curriculum consists of fifteen (15) Solar PV Topics meant to guide students through an understanding of solar PV from an introduction in renewable energy to the analysis of actual data. Each Solar PV Topic consists of “Topic Information” which contains the necessary background information needed to teach the topic and a set of lesson plans divided by grade level. All lesson plans were obtained from a variety of school districts and solar educational programs. Links to these resources are given at the end of this document. The age and grade recommendations are given by the authors and may not be applicable to all students.

The relevancy of the topics discussed here is far-reaching and extends past the subject of solar energy into every math, science, and social studies classroom. The topics of power, energy, thermodynamics, electronics, the scientific method, economics, and history are valuable to any student. As part of these lessons, students will be encouraged to pass on the information they learn to the public at town and school events and, of course, have fun!

Learning Objectives of Solar PV Topics

Topic 1: Renewable Energy

The objective of this topic is to introduce students to renewable energy. Students will learn the terms “renewable” and “sustainable” and will be introduced to different forms of renewable energy.

Students will learn the environmental, economic, and societal reasons for promoting renewable energy and will also learn how renewable energy may be used in emergency situations such as natural disasters.

Topic 2: A History of Solar Photovoltaic Power

Students will be introduced to the main highlights in the history of solar PV power. They will learn that the history of solar PV dates back much further than the modern solar panels we know today. The information gives a summary of main points and students should be encouraged to research further on the topic.

Topic 3: Solar Photovoltaic (PV) Basics

The objective of this topic is to provide an introduction to the key terms used in the discussion of solar photovoltaic (PV) systems. Students will learn where the term “photovoltaic” originated and will learn the difference between solar thermal and solar photovoltaic. Students will learn the difference between “stand-alone” and “grid-tied” systems and will learn the key components of “grid-tied” systems, like the one installed on their school.

Topic 4: Electromagnetic Radiation

The objective of this topic is to introduce students to the electromagnetic radiation spectrum. The lesson will teach key terms used when discussing solar irradiation and discuss what may happen when solar radiation hits a solar panel.

Topic 5: Solar Irradiance

The objective of this topic is to describe the source of solar radiation and the several paths the radiation may take once it reaches the Earth's surface. This topic will also discuss the expected irradiance values for both direct and diffuse sunlight and how solar irradiance is measured.

Topic 6: The Earth's Path

The objective of this topic is to teach or refresh students on the science behind the Earth's rotation on its axis and revolution around this sun. Students will learn how these cosmic motions affect our planet's seasons as well as the length of our days and years. Students must understand these principles to understand the concepts of tilt and azimuth taught in future topics.

Topic 7: The Sun's Angles

The objective of this topic is to teach students the different paths the sun takes in the sky from sunrise to sunset at different times of the year and in different geographical locations. These differences in paths derive directly from the Earth rotation and revolution. The Sun's location in the sky is used by solar engineers to determine how much a panel should be tilted and oriented to produce the most electricity.

Topic 8: The Photovoltaic Effect

The objective of this topic is to teach students about the photovoltaic effect: the scientific principle which dictates how semiconductor materials in solar cells convert solar energy to electricity.

Topic 9: Solar Cell Types

The objective of this topic is to teach students about the main classification of solar cells: crystalline and thin film. Students will learn that silicon is the most used material for solar cells as well as why naturally found silicon must be purified through manufacturing steps. Further discussion is given to the differences in processing methods between monocrystalline, polycrystalline, and thin film cells.

Topic 10: Electrical Basics in PV Wiring

The objective of this topic is to introduce students to some of the key electrical terms used in the design of solar PV systems such as current, voltage, power, watts, and kilowatt hours. Students will also learn the difference between panels in series and panels in parallel and how this affects the overall voltage and current of the system.

Topic 11: Cell Parameters and I-V Curves

The objective of this topic is to further describe the electrical parameters of solar cells through the discussion of the characteristic I-V (Current-Voltage) curves. Students will learn to identify points such as the photovoltaic current, the short circuit current, the open circuit voltage, and the maximum power point on curves of crystalline cells. These parameters are used to quantify the DC electrical

performance of solar PV systems. Students will also learn more about the standard testing conditions for cells.

Topic 12: Factors Affecting Performance

The objective of this topic is to teach students about the three main factors that affect the performance of solar PV systems: irradiance, temperature, and shading. Students will learn that current is dependent on irradiance and that voltage is dependent on temperature. Furthermore, students will learn the negative effects of panel or cell shading.

Topic 13: Inverters

The objective of this topic is to teach students about different types of inverters and how they convert DC to AC current. Students will learn the difference between stand-alone grid-tied inverters and how they interact with the building and electric utility grid. Students will learn how to size systems and inverters to meet the building's needs and key features to look for when deciding on the inverter to use.

Topic 14: Design Process

The objective of this topic is to teach students the process and procedures involved in designing a grid-tied solar PV system. Students will learn the differences between designs for proposals and construction as well as what must be included in layout drawings and electrical drawings. Students will learn the theory and practice behind shading analyses as well as the procedure used to choose a mounting system.

Topic 15: Data Analysis

The objective of this topic is to teach students how to analyze actual data from solar PV systems such as the one providing electricity to their school. Students will learn why data must be recorded properly and what devices are used to measure environmental conditions. Students will learn how production graphs look from day to day and year to year as well as how the production graphs differ from sunny to cloudy days. Students will learn to compare actual data to modeled performance with tools such as PVSYST.

Community Outreach

In the past, Ameresco has offered community outreach in a number of ways including:

- Career day presentations by Ameresco engineers and project developers
- Earth Day activities
- Local energy expositions

We can also offer information sessions to be given at engineering and installation milestones of the solar PV project. These information sessions would be led by Ameresco solar PV engineers and project developers.

Thank you note from students at the Wang School in Lowell, MA

Brandon C
Leakana Hailee
Tyasha Josh
Teiyana Kristen
Aaron :)
Jennifer
Cristian
Kellie Kelly
Thank you!
Orlett

Section 7: Project Milestone Schedule

Approach to Schedule

Effective schedule (performance) controls begin with the development of a realistic progress schedule. Management must consider many factors (i.e. weather, location, facility availability, etc.) when developing the project schedule. The most effective means of ensuring compliance is through strong on-site management. That translates to timely submission of design packages, materials submittals, and other contract documentation. Our internal suspense system is a key management tool to meeting all schedule milestones and our strong internal quality control reviews ensure the submittals are done correctly the first time.

Ameresco utilizes subcontractors extensively to perform the on-site construction trades; however, all are pre-qualified and must maintain the same commitment to quality and schedule as Ameresco. The flexibility of increasing the number of subcontractors, or number of subcontractor employees, is a key element in meeting the schedule.

The establishment of a clear line of communication with all stakeholders (ex: Utility Company) and a single point of contact at Ameresco is critical to providing transparency on all potential delays or changes to the project. Ameresco has employed this practice with all of our solar PV installations and as a result has expeditiously overcome the following challenges without delay to date of commercial operation of the project.

After the completion of the 100% system design, Ameresco will procure equipment with delivery dates appropriately staggered to coincide with the appropriate project construction phase. This approach eliminates the need to warehouse equipment, something that adds cost due to additional transportation and storage. If the schedule warrants, we're prepared to advance order equipment or expedite shipping.

Major Milestone Schedule – Virtual Net Metered Projects

Activity	Proposed Milestone Date
Anticipated Agreement Execution Date	1/1/2017
Site Design and Permitting Complete	5/1/2017
Interconnection Study Complete	5/1/2017
Site Preparation Begins	6/1/2017
Mechanical Completion	10/1/2017
Interconnection Completion	11/1/2017
Commercial Operation	12/1/2017

Major Milestone Schedule – Renewable Energy Growth Rooftop Projects

Activity	Proposed Milestone Date
Anticipated Agreement Execution Date	1/1/2017
Preliminary Design and Interconnection per REG requirements	3/15/2017
Renewable Energy Growth enrollment	4/15/2017
Renewable Energy Growth Award	5/15/2017
Design and Permitting Complete	7/15/2017
Interconnection Approval	7/15/2017
Construction Begins	8/1/2017
Mechanical Completion	11/1/2017
Commercial Operation	12/1/2017

Appendix A: Certificate of Good Standing

A copy of Ameresco's Certificate of Good Standing to do business in the State of Rhode Island is provided on the following page.

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State of Rhode Island and Providence Plantations
Department of State | Office of the Secretary of State
Nellie M. Gorbea, Secretary of State

Certification Number: 16110017380

The office of the Secretary of State of the State of Rhode Island and Providence Plantations,
HEREBY CERTIFIES, that

Ameresco, Inc.

a Delaware corporation, qualified to do business in Rhode Island on

September 21, 2007 Effective September 21, 2007

IT IS FURTHER CERTIFIED that as of this date said foreign corporation is authorized to
transact business in this state and is in good standing according to the records of this office

SIGNED AND SEALED ON

Thursday, November 03, 2016

Secretary of State

Authorized Agent



Appendix B: System Design Drawings

Proposed system design drawings are provided on the following pages.

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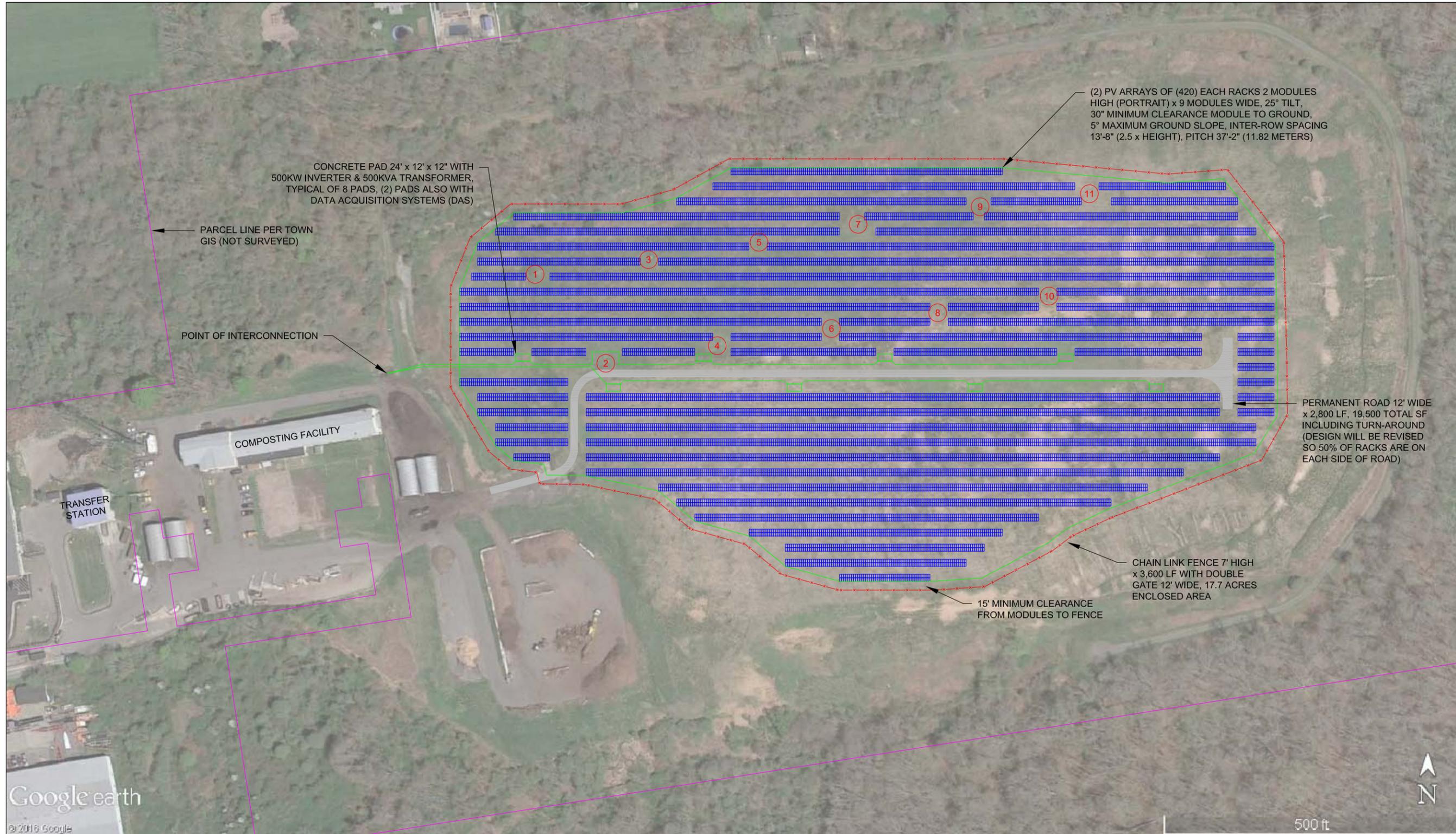
POWER TABLE														
ARRAY				MOUNT			INVERTER					TRANSFORMER		
LOCATION	# OF MODULES	MODULE TYPE	kWp	AZIMUTH	TILT	TYPE	TYPE	SIZE (kW)	QTY	EFFICIENCY	kW AC	TYPE	QTY	RATING
ARRAY 1	7,560	HiS-S350TI	2,646.00	180	25	BALLASTED 2Px9	SOLECTRIA SGI	500	4	98.0%	2,000	PAD MOUNT	(4)	500kVA
ARRAY 2	7,560	HiS-S350TI	2,646.00	180	25	BALLASTED 2Px9	SOLECTRIA SGI	500	4	98.0%	2,000	PAD MOUNT	(4)	500kVA
TOTAL	15,120		5,292.00								4,000			

**PRELIMINARY DESIGN
NOT FOR CONSTRUCTION**

NOTES:

- SHADING PATTERN IS CALCULATED BASED ON JUNE 21ST FROM 7AM TO 5PM, FEBRUARY 21ST FROM 9AM TO 3PM, AND DECEMBER 21ST AT NOON, TAKING INTO ACCOUNT SITE LATITUDE AND LONGITUDE.
- SHADING FOR OBJECTS NOT IMPACTING THE PV SYSTEM IS NOT SHOWN.
- ASCE 7 GROUND SNOW LOAD = 30 PSF, BASIC WIND SPEED = 126 MPH (RISK CATEGORY I), EXPOSURE TYPE C.
- LOCATIONS OF GAS VENT WELLS 1-11 ARE BASED ON BETA GROUP, INC. OVERALL SITE PLAN SEPTEMBER 2005, SHEET 2.

SCALE: 1" = 80' WHEN PRINTED 36" x 24"
 DRAWN BY: RWP
 CHECKED BY:
 DATE: 11/30/16
 REVISIONS:



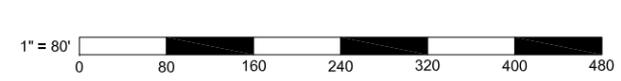
BRISTOL SOLAR PV PUBLIC-PRIVATE PARTNERSHIP
 MINTURN FARM ROAD
 BRISTOL, RHODE ISLAND 02809
 BRISTOL LANDFILL PV ARRAY (SPLIT SYSTEM)
 5,292.00 kWp DC STC PV ARRAY (4,000 kW AC)
 PHOTOVOLTAIC ARRAY LAYOUT

111 Speen Street, Suite 410
 Framingham, Massachusetts 01701
 (508) 681-2200



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BRISTOL LANDFILL - OVERALL ARRAY LAYOUT
 SCALE: 1"=80' WHEN PRINTED 36" x 24"

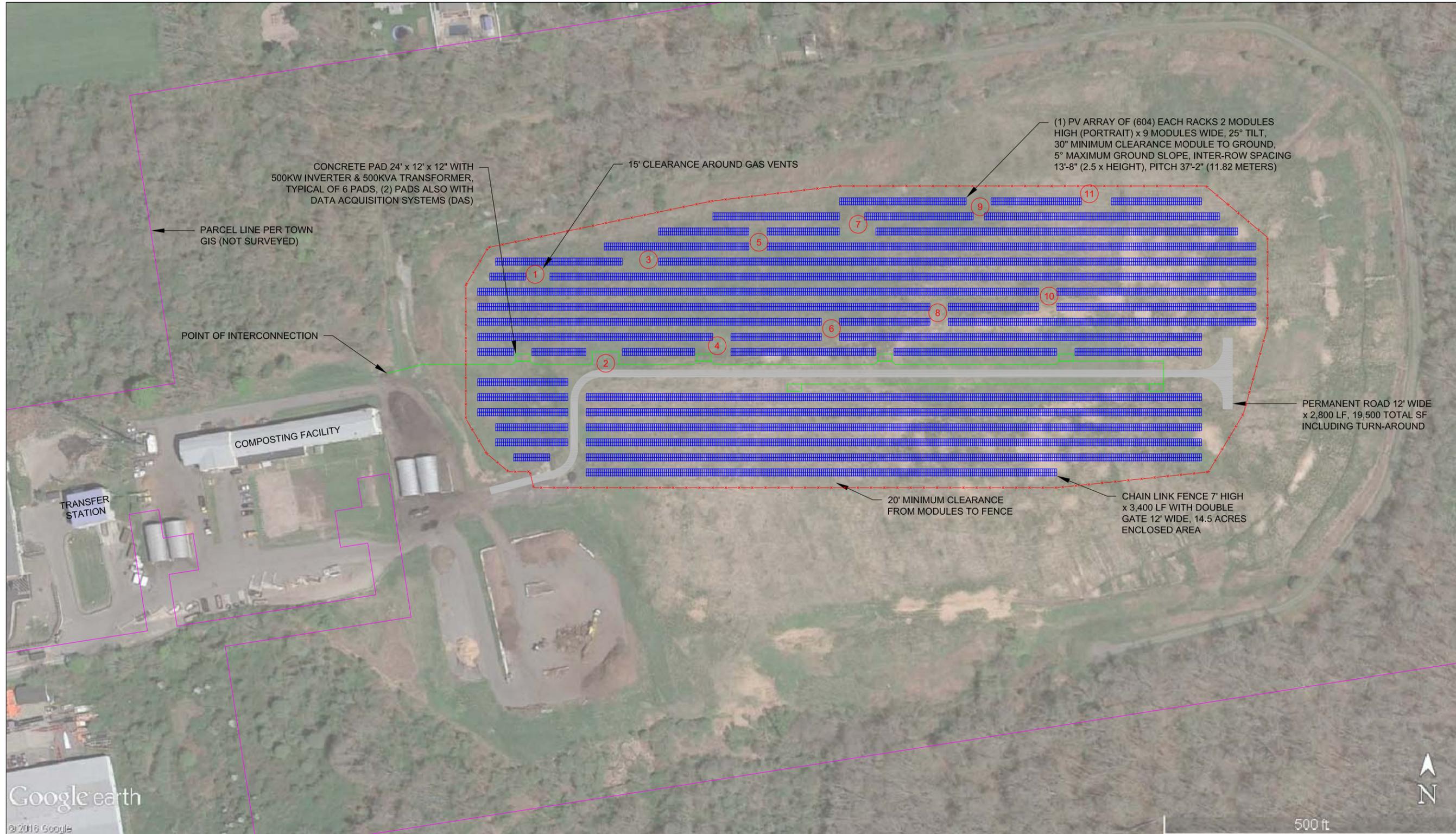


POWER TABLE														
ARRAY				MOUNT			INVERTER					TRANSFORMER		
LOCATION	# OF MODULES	MODULE TYPE	kWp	AZIMUTH	TILT	TYPE	TYPE	SIZE (kW)	QTY	EFFICIENCY	KW AC	TYPE	QTY	RATING
ARRAY 1	10,872	HiS-S350TI	3,805.20	180	25	BALLASTED 2Px9	SOLECTRIA SGI	500	6	98.0%	3,000	PAD MOUNT	(6)	500kVA
TOTAL	10,872		3,805.20								3,000			

**PRELIMINARY DESIGN
NOT FOR CONSTRUCTION**

- NOTES:**
- SHADING PATTERN IS CALCULATED BASED ON JUNE 21ST FROM 7AM TO 5PM, FEBRUARY 21ST FROM 9AM TO 3PM, AND DECEMBER 21ST AT NOON, TAKING INTO ACCOUNT SITE LATITUDE AND LONGITUDE.
 - SHADING FOR OBJECTS NOT IMPACTING THE PV SYSTEM IS NOT SHOWN.
 - ASCE 7 GROUND SNOW LOAD = 30 PSF, BASIC WIND SPEED = 126 MPH (RISK CATEGORY I), EXPOSURE TYPE C.
 - LOCATIONS OF GAS VENT WELLS 1-11 ARE BASED ON BETA GROUP, INC. OVERALL SITE PLAN SEPTEMBER 2005, SHEET 2.

SCALE: 1" = 80' WHEN PRINTED 36" x 24"
 DRAWN BY: RWP
 CHECKED BY:
 DATE: 11/30/16
 REVISIONS:



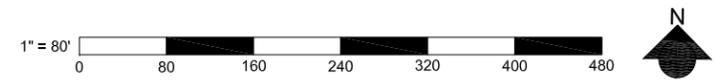
BRISTOL SOLAR PV PUBLIC-PRIVATE PARTNERSHIP
 MINTURN FARM ROAD
 BRISTOL, RHODE ISLAND 02809
 BRISTOL LANDFILL PV ARRAY (SINGLE SYSTEM)
 3,805.20 kWp DC STC PV ARRAY (3,000 kW AC)
 PHOTOVOLTAIC ARRAY LAYOUT

111 Speen Street, Suite 410
 Framingham, Massachusetts 01701
 (508) 681-2200



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BRISTOL LANDFILL - OVERALL ARRAY LAYOUT
 SCALE: 1"=80' WHEN PRINTED 36" x 24"

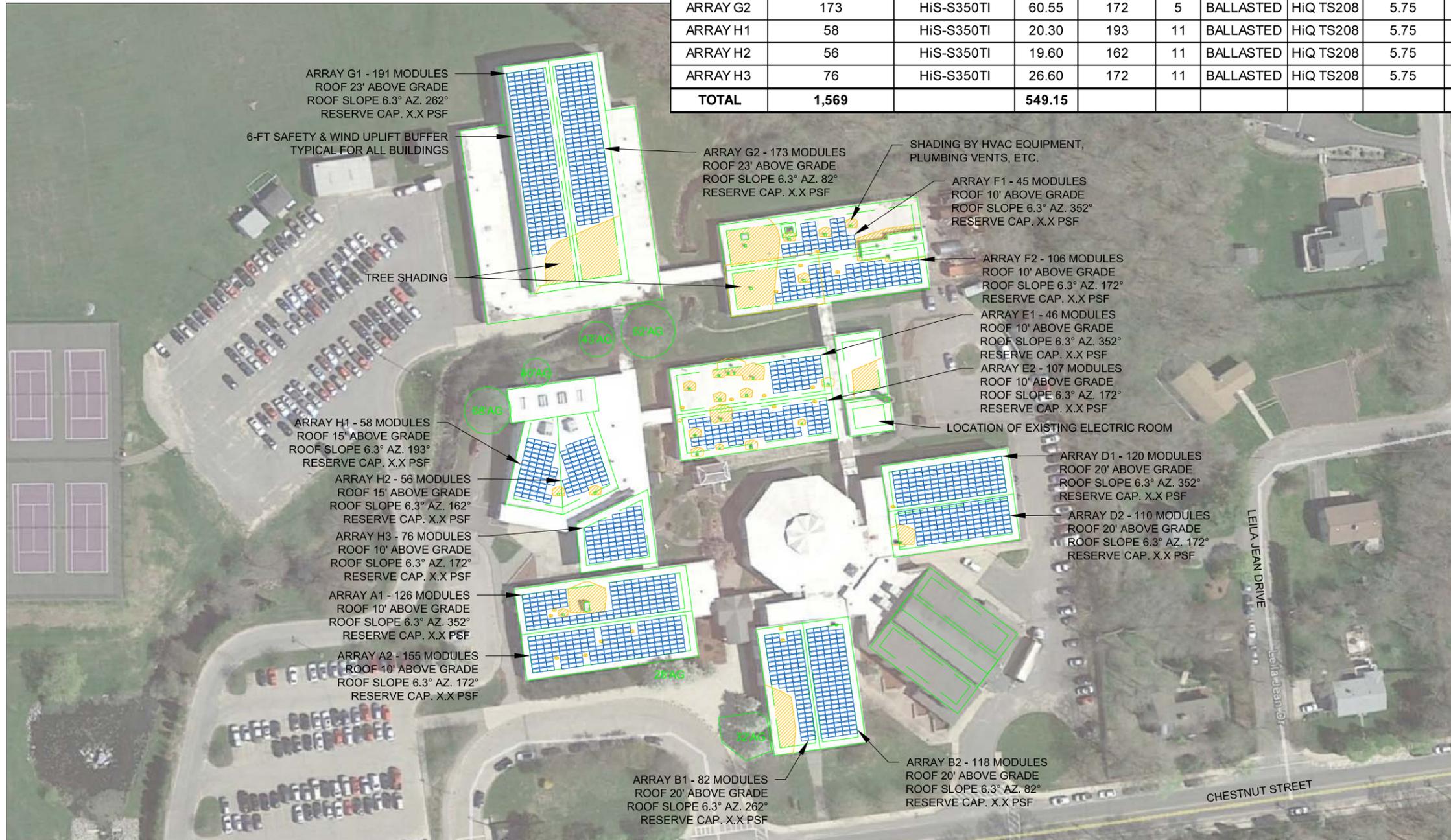


NOTES:

1. SHADING PATTERN IS CALCULATED BASED ON JUNE 21ST FROM 7AM TO 5PM, FEBRUARY 21ST FROM 9AM TO 3PM, AND DECEMBER 21ST AT NOON, TAKING INTO ACCOUNT SITE LATITUDE AND LONGITUDE.
2. SHADING FOR OBJECTS NOT IMPACTING THE PV SYSTEM IS NOT SHOWN.
3. ASCE 7 GROUND SNOW LOAD = 30 PSF, BASIC WIND SPEED = 148 MPH (RISK CATEGORY III), EXPOSURE TYPE C.
4. ALL ROOFS WERE REPORTEDLY REPLACED 2006 EXCEPT BLDG C (1993) AND 1-STORY WINGS OF BLDG G (2001)

POWER TABLE: 10-12 MODULES/STRING, 1-2 STRINGS PER INVERTER, MAXIMUM 23 MODULES/INVERTER

ARRAY				MOUNT			INVERTER				
LOCATION	# OF MODULES	MODULE TYPE	kWp	AZIMUTH	TILT	TYPE	TYPE	SIZE (kW)	QTY	EFFICIENCY	kW AC
ARRAY A1	126	HiS-S350TI	44.10	352	1	BALLASTED	HIQ TS208	5.75	6	98.0%	34.50
ARRAY A2	155	HiS-S350TI	54.25	172	11	BALLASTED	HIQ TS208	5.75	7	98.0%	40.25
ARRAY B1	82	HiS-S350TI	28.70	172	5	BALLASTED	HIQ TS208	5.75	4	98.0%	23.00
ARRAY B2	118	HiS-S350TI	41.30	172	5	BALLASTED	HIQ TS208	5.75	6	98.0%	34.50
ARRAY D1	120	HiS-S350TI	42.00	352	1	BALLASTED	HIQ TS208	5.75	6	98.0%	34.50
ARRAY D2	110	HiS-S350TI	38.50	172	11	BALLASTED	HIQ TS208	5.75	5	98.0%	28.75
ARRAY E1	46	HiS-S350TI	16.10	352	1	BALLASTED	HIQ TS208	5.75	2	98.0%	11.50
ARRAY E2	107	HiS-S350TI	37.45	172	11	BALLASTED	HIQ TS208	5.75	5	98.0%	28.75
ARRAY F1	45	HiS-S350TI	15.75	352	1	BALLASTED	HIQ TS208	5.75	2	98.0%	11.50
ARRAY F2	106	HiS-S350TI	37.10	172	11	BALLASTED	HIQ TS208	5.75	5	98.0%	28.75
ARRAY G1	191	HiS-S350TI	66.85	172	5	BALLASTED	HIQ TS208	5.75	9	98.0%	51.75
ARRAY G2	173	HiS-S350TI	60.55	172	5	BALLASTED	HIQ TS208	5.75	9	98.0%	51.75
ARRAY H1	58	HiS-S350TI	20.30	193	11	BALLASTED	HIQ TS208	5.75	3	98.0%	17.25
ARRAY H2	56	HiS-S350TI	19.60	162	11	BALLASTED	HIQ TS208	5.75	3	98.0%	17.25
ARRAY H3	76	HiS-S350TI	26.60	172	11	BALLASTED	HIQ TS208	5.75	4	98.0%	23.00
TOTAL	1,569		549.15						76		437.00



SCALE: 1" = 50' WHEN PRINTED 36" x 24"
 DRAWN BY: RWP
 CHECKED BY:
 DATE: 11/30/2016
 REVISIONS:

BRISTOL SOLAR PV PUBLIC-PRIVATE PARTNERSHIP
 199 CHESTNUT STREET
 BRISTOL, RHODE ISLAND 02809
 MOUNT HOPE HIGH SCHOOL ROOFTOP PV ARRAY
 549.15 kWp DC STC PV ARRAY (437.00 kW AC)
 PHOTOVOLTAIC ARRAY LAYOUT

111 Speen Street, Suite 410
 Framingham, Massachusetts 01701
 (508) 681-2200



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MOUNT HOPE HIGH SCHOOL - OVERALL ARRAY LAYOUT
 SCALE: 1"=50' WHEN PRINTED 36" x 24"



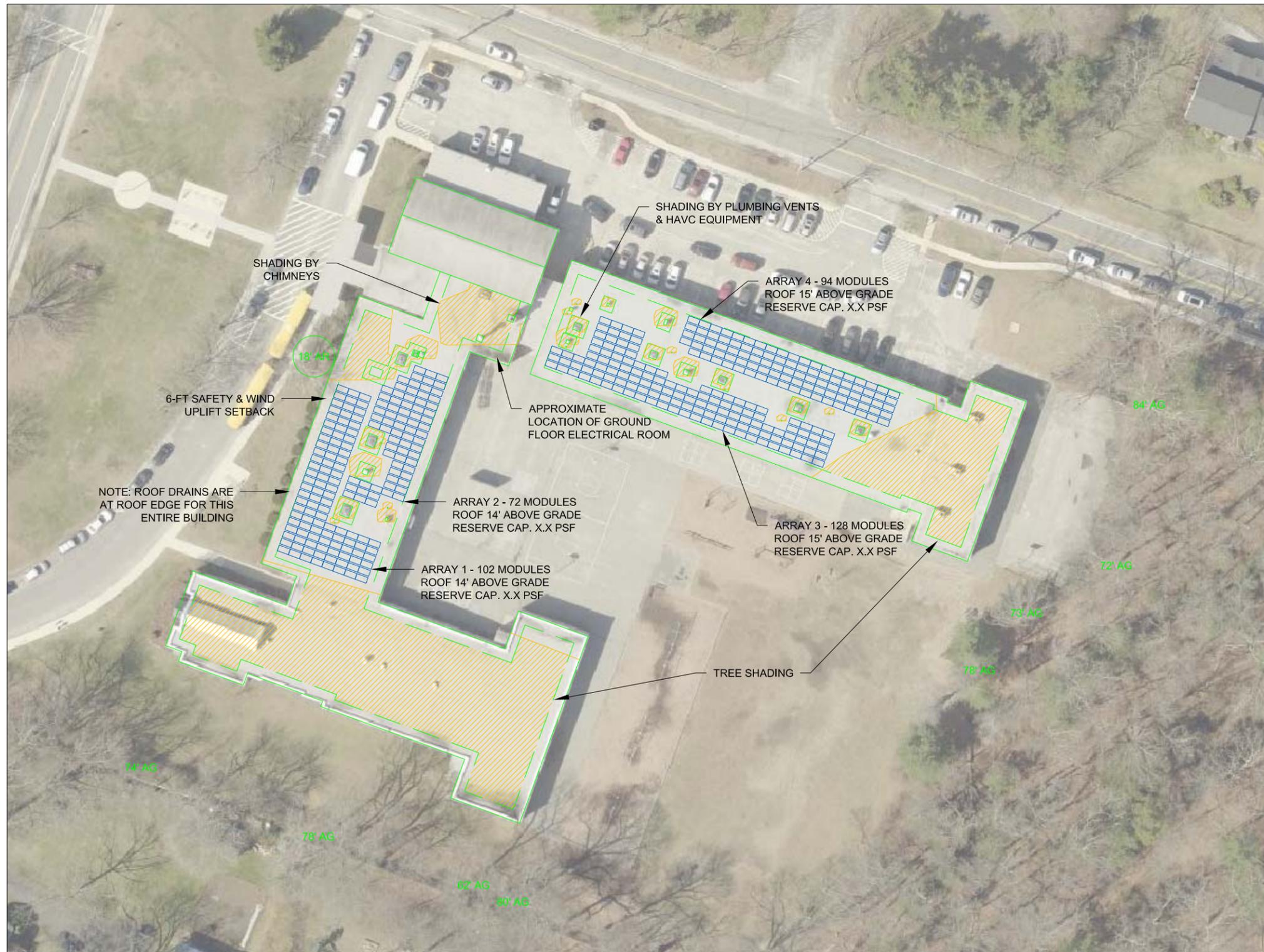
NOT FOR CONSTRUCTION

POWER TABLE: 10-12 MODULES/STRING, 1-2 STRINGS PER INVERTER, MAXIMUM 23 MODULES/INVERTER											
ARRAY				MOUNT			INVERTER				
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ARRAY 1	102	HiS-S350TI	35.70	200	5	BALLASTED	HiQ TS208	5.75	5	98.0%	28.75
ARRAY 2	72	HiS-S350TI	25.20	200	5	BALLASTED	HiQ TS208	5.75	3	98.0%	17.25
ARRAY 3	128	HiS-S350TI	44.80	200	5	BALLASTED	HiQ TS208	5.75	6	98.0%	34.50
ARRAY 4	94	HiS-S350TI	32.90	200	5	BALLASTED	HiQ TS208	5.75	4	98.0%	23.00
TOTAL	396		138.60						18		103.50

NOT FOR CONSTRUCTION

- NOTES:
- SHADING PATTERN IS CALCULATED BASED ON JUNE 21ST FROM 7AM TO 5PM, FEBRUARY 21ST FROM 9AM TO 3PM, AND DECEMBER 21ST AT NOON, TAKING INTO ACCOUNT SITE LATITUDE AND LONGITUDE.
 - SHADING FOR OBJECTS NOT IMPACTING THE PV SYSTEM IS NOT SHOWN.
 - ASCE 7 GROUND SNOW LOAD = 30 PSF, BASIC WIND SPEED = 146 MPH (RISK CATEGORY III), EXPOSURE TYPE C.

SCALE: 1" = 30' WHEN PRINTED 36" x 24"
 DRAWN BY: RWP
 CHECKED BY:
 DATE: 11/30/2016
 REVISIONS:



BARRINGTON SOLAR PV PUBLIC-PRIVATE PARTNERSHIP
 297 NEW MEADOW ROAD
 BARRINGTON, RHODE ISLAND 02806
 HAMPDEN MEADOWS ES ROOFTOP PV ARRAY
 138.60 kWp DC STC PV ARRAY (103.50 kW AC)
 PHOTOVOLTAIC ARRAY LAYOUT

HAMPDEN MEADOWS ELEMENTARY SCHOOL - OVERALL ARRAY LAYOUT
 SCALE: 1"=30' WHEN PRINTED 36" x 24"



111 Speen Street, Suite 410
 Framingham, Massachusetts 01701
 (508) 681-2200



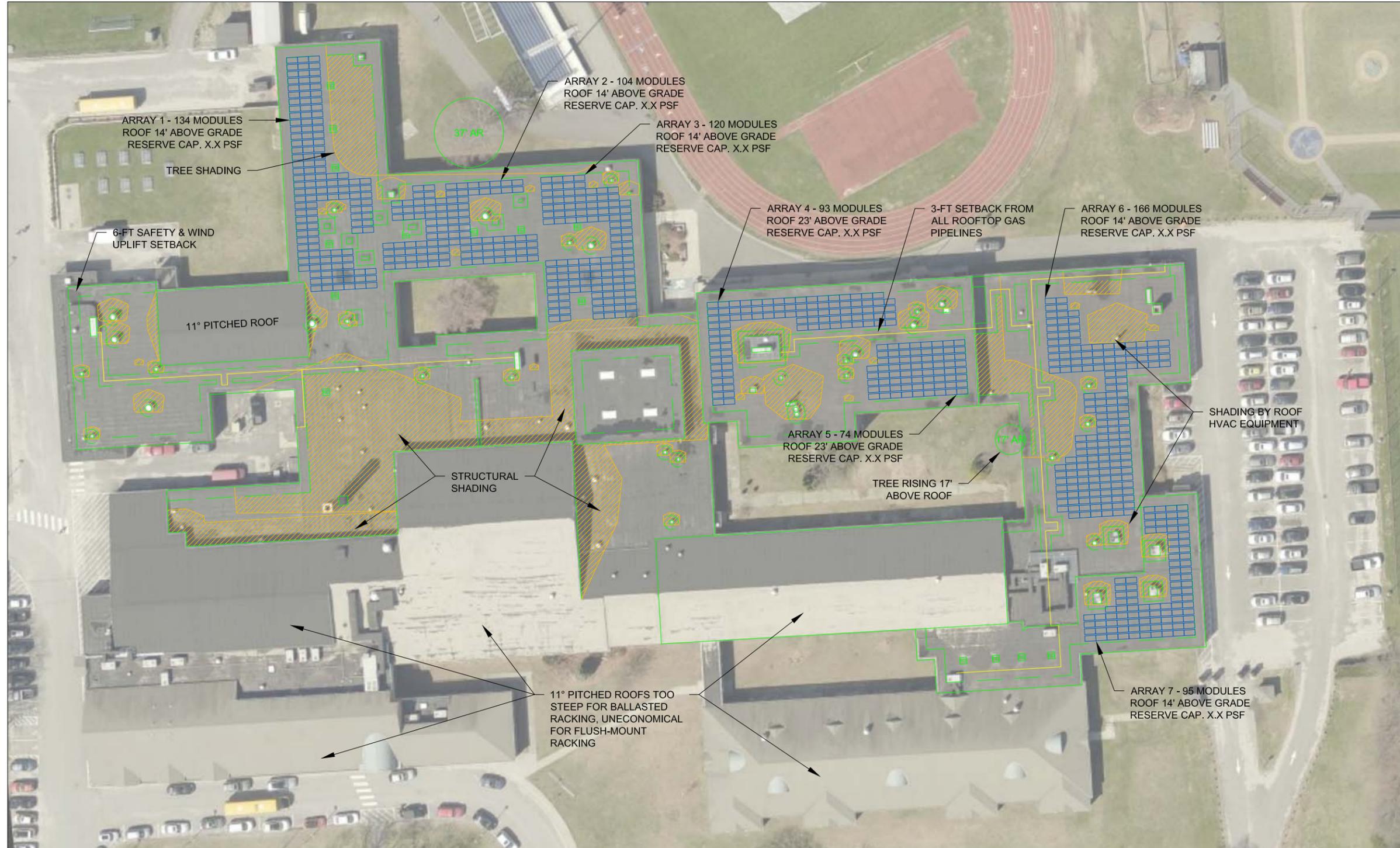
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POWER TABLE: 10-12 MODULES/STRING, 1-2 STRINGS PER INVERTER, MAXIMUM 23 MODULES/INVERTER											
ARRAY				MOUNT			INVERTER				
LOCATION	# OF MODULES	MODULE TYPE	kWp	AZIMUTH	TILT	TYPE	TYPE	SIZE (kW)	QTY	EFFICIENCY	kW AC
ARRAY 1	134	HiS-S350TI	46.90	177	5	BALLASTED	HiQ TS208	5.75	6	98.0%	34.50
ARRAY 2	104	HiS-S350TI	36.40	177	5	BALLASTED	HiQ TS208	5.75	5	98.0%	28.75
ARRAY 3	120	HiS-S350TI	42.00	177	5	BALLASTED	HiQ TS208	5.75	6	98.0%	34.50
ARRAY 4	92	HiS-S350TI	32.20	177	5	BALLASTED	HiQ TS208	5.75	4	98.0%	23.00
ARRAY 5	69	HiS-S350TI	24.15	177	5	BALLASTED	HiQ TS208	5.75	3	98.0%	17.25
ARRAY 6	166	HiS-S350TI	58.10	177	5	BALLASTED	HiQ TS208	5.75	8	98.0%	46.00
ARRAY 7	92	HiS-S350TI	32.20	177	5	BALLASTED	HiQ TS208	5.75	4	98.0%	23.00
TOTAL	777		271.95						36		207.00

NOT FOR CONSTRUCTION

- NOTES:
- SHADING PATTERN IS CALCULATED BASED ON JUNE 21ST FROM 7AM TO 5PM, FEBRUARY 21ST FROM 9AM TO 3PM, AND DECEMBER 21ST AT NOON. TAKING INTO ACCOUNT SITE LATITUDE AND LONGITUDE.
 - SHADING FOR OBJECTS NOT IMPACTING THE PV SYSTEM IS NOT SHOWN.
 - ASCE 7 GROUND SNOW LOAD = 30 PSF, BASIC WIND SPEED = 146 MPH (RISK CATEGORY III), EXPOSURE TYPE C.

SCALE: 1" = 30' WHEN PRINTED 36" x 24"
 DRAWN BY: RWP
 CHECKED BY:
 DATE: 11/30/2016
 REVISIONS:



BARRINGTON SOLAR PV PUBLIC-PRIVATE PARTNERSHIP
 220 LINCOLN AVENUE
 BARRINGTON, RHODE ISLAND 02806
 HIGH SCHOOL ROOFTOP PV ARRAY
 271.95 kWp DC STC PV ARRAY (207 kW AC)
 PHOTOVOLTAIC ARRAY LAYOUT

111 Speen Street, Suite 410
 Framingham, Massachusetts 01701
 (508) 681-2200



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BARRINGTON HIGH SCHOOL - OVERALL ARRAY LAYOUT
 SCALE: 1"=30' WHEN PRINTED 36" x 24"



POWER TABLE: 10-12 MODULES/STRING, 1-2 STRINGS PER INVERTER, MAXIMUM 23 MODULES/INVERTER											
ARRAY				MOUNT			INVERTER				
LOCATION	# OF MODULES	MODULE TYPE	kWp	AZIMUTH	TILT	TYPE	TYPE	SIZE (kW)	QTY	EFFICIENCY	kW AC
ARRAY 1	48	HiS-S350TI	16.80	173.67	5	BALLASTED	HiQ TS208	5.75	2	98.0%	11.50
ARRAY 2	86	HiS-S350TI	30.10	173.67	5	BALLASTED	HiQ TS208	5.75	4	98.0%	23.00
ARRAY 3	118	HiS-S350TI	41.30	173.67	5	BALLASTED	HiQ TS208	5.75	5	98.0%	28.75
ARRAY 4	93	HiS-S350TI	32.55	173.67	5	BALLASTED	HiQ TS208	5.75	4	98.0%	23.00
TOTAL	345		120.75						15		86.25

NOT FOR CONSTRUCTION

NOTES:

- SHADING PATTERN IS CALCULATED BASED ON JUNE 21ST FROM 7AM TO 5PM, FEBRUARY 21ST FROM 9AM TO 3PM, AND DECEMBER 21ST AT NOON, TAKING INTO ACCOUNT SITE LATITUDE AND LONGITUDE.
- SHADING FOR OBJECTS NOT IMPACTING THE PV SYSTEM IS NOT SHOWN.
- ASCE 7 GROUND SNOW LOAD = 30 PSF, BASIC WIND SPEED = 146 MPH (RISK CATEGORY III), EXPOSURE TYPE C.

SCALE: 1" = 20' WHEN PRINTED 36" x 24"
 DRAWN BY: RWP
 CHECKED BY:
 DATE: 11/30/2016
 REVISIONS:



BARRINGTON SOLAR PV PUBLIC-PRIVATE PARTNERSHIP
 400 NAYATT ROAD
 BARRINGTON, RHODE ISLAND 02806
 NAYATT ELEMENTARY SCHOOL ROOFTOP PV ARRAY
 120.75 kWp DC STC PV ARRAY (86.25 kW AC)
 PHOTOVOLTAIC ARRAY LAYOUT

111 Speen Street, Suite 410
 Framingham, Massachusetts 01701
 (508) 681-2200



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NAYATT ELEMENTARY SCHOOL - OVERALL ARRAY LAYOUT
 SCALE: 1"=20' WHEN PRINTED 36" x 24"

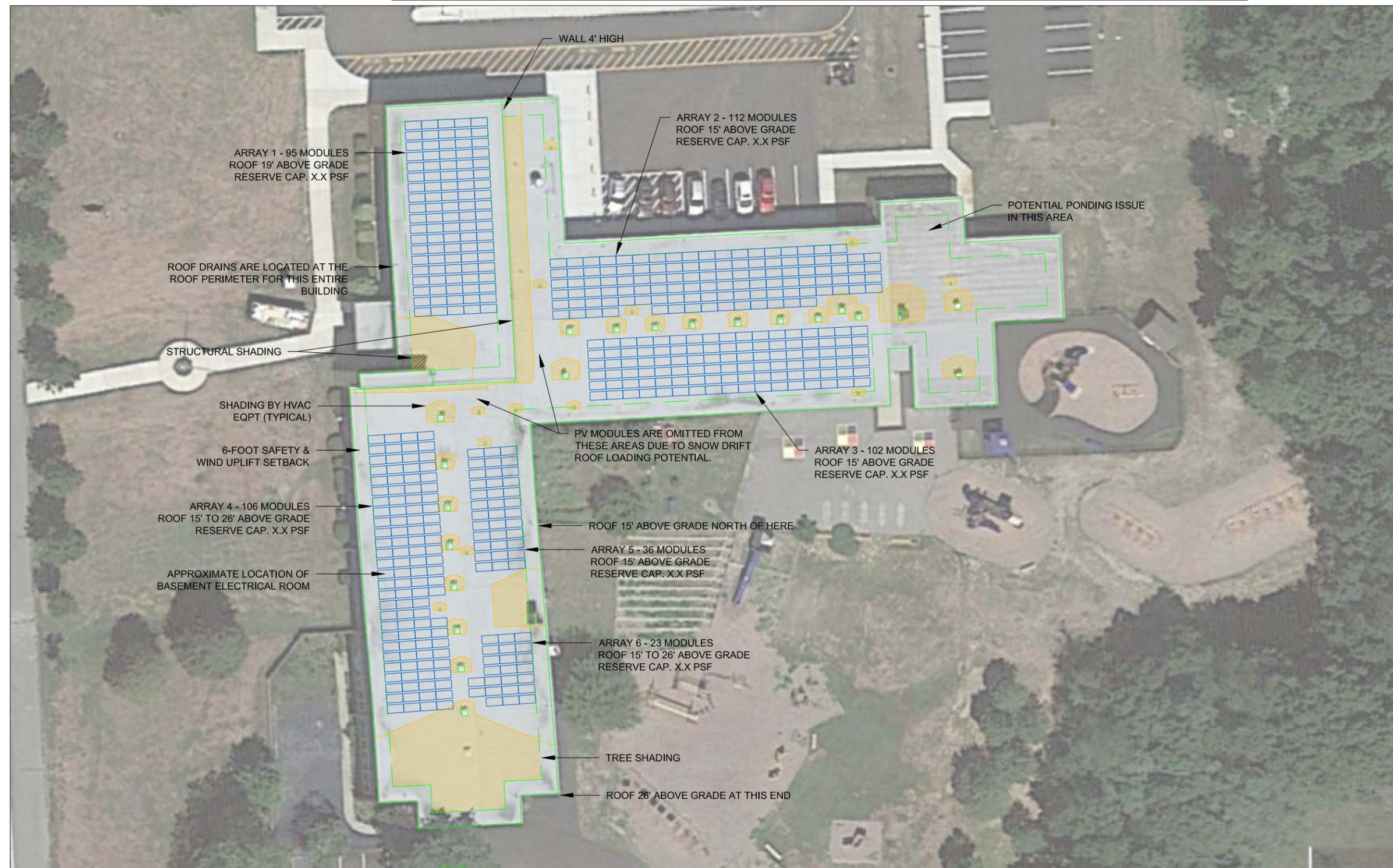


POWER TABLE: 10-12 MODULES/STRING, 1-2 STRINGS PER INVERTER, MAXIMUM 23 MODULES/INVERTER											
ARRAY				MOUNT			INVERTER				
LOCATION	# OF MODULES	MODULE TYPE	kWp	AZIMUTH	TILT	TYPE	TYPE	SIZE (kW)	QTY	EFFICIENCY	kW AC
ARRAY 1	95	HiS-S350TI	33.25	177	5	BALLASTED	HIQ TS208	5.75	4	98.0%	23.00
ARRAY 2	112	HiS-S350TI	39.20	177	5	BALLASTED	HIQ TS208	5.75	5	98.0%	28.75
ARRAY 3	102	HiS-S350TI	35.70	177	5	BALLASTED	HIQ TS208	5.75	5	98.0%	28.75
ARRAY 4	106	HiS-S350TI	37.10	177	5	BALLASTED	HIQ TS208	5.75	5	98.0%	28.75
ARRAY 5	36	HiS-S350TI	12.60	177	5	BALLASTED	HIQ TS208	5.75	2	98.0%	11.50
ARRAY 6	23	HiS-S350TI	8.05	177	5	BALLASTED	HIQ TS208	5.75	1	98.0%	5.75
TOTAL	474		165.90						22		126.50

NOT FOR CONSTRUCTION

- NOTES:
- SHADING PATTERN IS CALCULATED BASED ON JUNE 21ST FROM 7AM TO 5PM, FEBRUARY 21ST FROM 9AM TO 3PM, AND DECEMBER 21ST AT NOON, TAKING INTO ACCOUNT SITE LATITUDE AND LONGITUDE.
 - SHADING FOR OBJECTS NOT IMPACTING THE PV SYSTEM IS NOT SHOWN.
 - ASCE 7 GROUND SNOW LOAD = 30 PSF, BASIC WIND SPEED = 146 MPH (RISK CATEGORY III), EXPOSURE TYPE C.

SCALE: 1" = 20' WHEN PRINTED 36" x 24"
 DRAWN BY: RWP
 CHECKED BY:
 DATE: 11/30/2016
 REVISIONS:



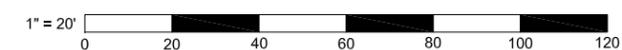
BARRINGTON SOLAR PV PUBLIC-PRIVATE PARTNERSHIP
 60 MIDDLE HIGHWAY
 BARRINGTON, RHODE ISLAND 02806
 PRIMROSE HILL ES ROOFTOP PV ARRAY
 165.90 kWp DC STC PV ARRAY (126.50 kW AC)
 PHOTOVOLTAIC ARRAY LAYOUT

111 Speen Street, Suite 410
 Framingham, Massachusetts 01701
 (508) 681-2200



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PRIMROSE HILL ELEMENTARY SCHOOL - OVERALL ARRAY LAYOUT
 SCALE: 1"=20' WHEN PRINTED 36" x 24"

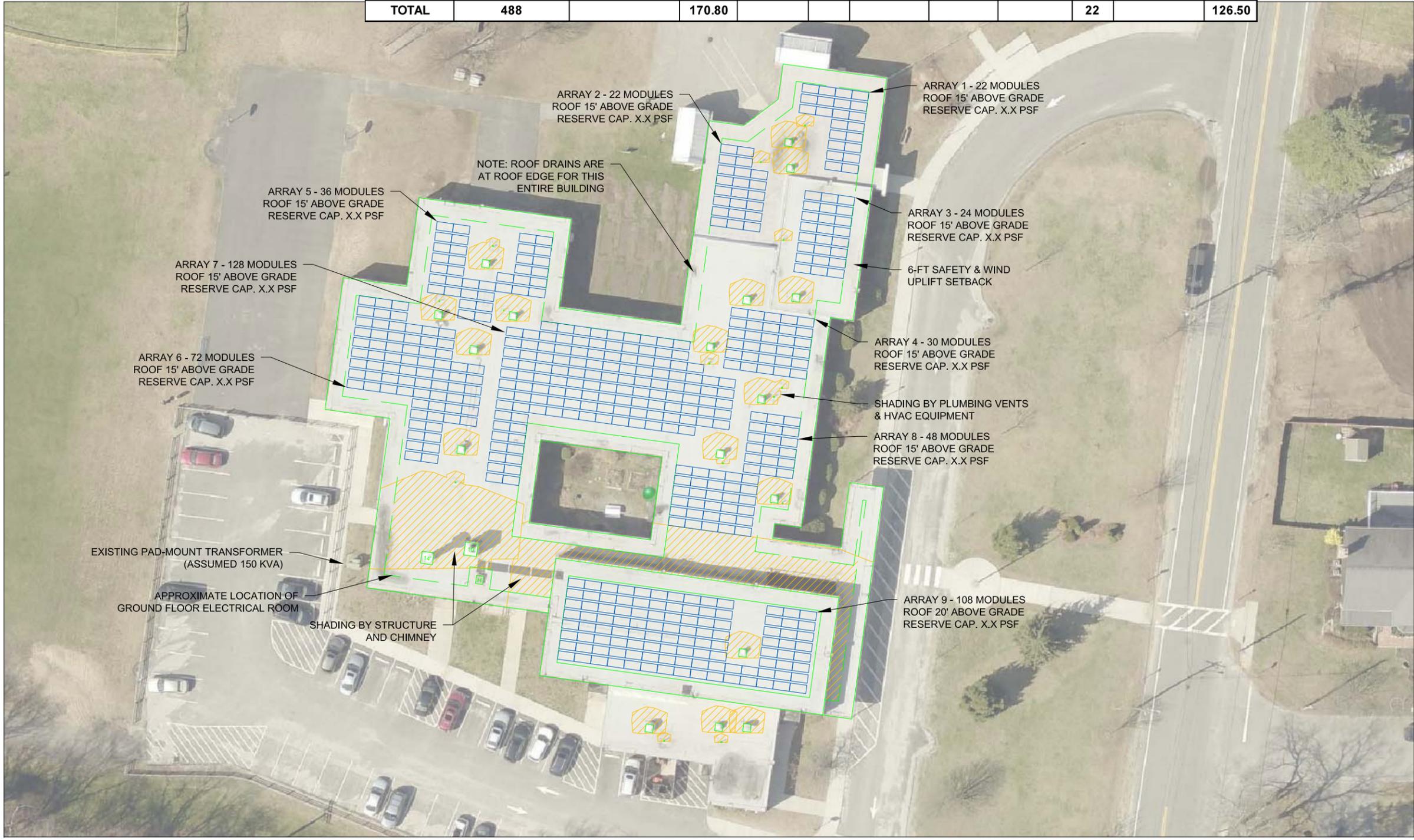


POWER TABLE: 10-12 MODULES/STRING, 1-2 STRINGS PER INVERTER, MAXIMUM 23 MODULES/INVERTER											
ARRAY				MOUNT			INVERTER				
LOCATION	# OF MODULES	MODULE TYPE	kWp	AZIMUTH	TILT	TYPE	TYPE	SIZE (kW)	QTY	EFFICIENCY	KW AC
ARRAY 1	22	HiS-S350TI	7.70		5	BALLASTED	HiQ TS208	5.75	1	98.0%	5.75
ARRAY 2	22	HiS-S350TI	7.70		5	BALLASTED	HiQ TS208	5.75	1	98.0%	5.75
ARRAY 3	24	HiS-S350TI	8.40		5	BALLASTED	HiQ TS208	5.75	1	98.0%	5.75
ARRAY 4	30	HiS-S350TI	10.50		5	BALLASTED	HiQ TS208	5.75	1.5	98.0%	8.63
ARRAY 5	36	HiS-S350TI	12.60		5	BALLASTED	HiQ TS208	5.75	1.5	98.0%	8.63
ARRAY 6	72	HiS-S350TI	25.20		5	BALLASTED	HiQ TS208	5.75	3	98.0%	17.25
ARRAY 7	128	HiS-S350TI	44.80		5	BALLASTED	HiQ TS208	5.75	6	98.0%	34.50
ARRAY 8	48	HiS-S350TI	16.80		5	BALLASTED	HiQ TS208	5.75	2	98.0%	11.50
ARRAY 9	106	HiS-S350TI	37.10				HiQ TS208	5.75	5	98.0%	28.75
TOTAL	488		170.80						22		126.50

NOT FOR CONSTRUCTION

- NOTES:
- SHADING PATTERN IS CALCULATED BASED ON JUNE 21ST FROM 7AM TO 5PM, FEBRUARY 21ST FROM 9AM TO 3PM, AND DECEMBER 21ST AT NOON, TAKING INTO ACCOUNT SITE LATITUDE AND LONGITUDE.
 - SHADING FOR OBJECTS NOT IMPACTING THE PV SYSTEM IS NOT SHOWN.
 - ASCE 7 GROUND SNOW LOAD = 30 PSF, BASIC WIND SPEED = 146 MPH (RISK CATEGORY III), EXPOSURE TYPE C.

SCALE: 1" = 20' WHEN PRINTED 36" x 24"
 DRAWN BY: RWP
 CHECKED BY:
 DATE: 11/30/2016
 REVISIONS:



BARRINGTON SOLAR PV PUBLIC-PRIVATE PARTNERSHIP
 364 SOWAMS ROAD
 BARRINGTON, RHODE ISLAND 02806
 SOWAMS ELEMENTARY SCHOOL ROOFTOP PV ARRAY
 170.80 kWp DC STC PV ARRAY (126.50 kW AC)
 PHOTOVOLTAIC ARRAY LAYOUT

111 Speen Street, Suite 410
 Framingham, Massachusetts 01701
 (508) 681-2200



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SOWAMS ELEMENTARY SCHOOL - OVERALL ARRAY LAYOUT
 SCALE: 1"=20' WHEN PRINTED 36" x 24"



POWER TABLE: 10-12 MODULES/STRING, 1-2 STRINGS PER INVERTER, MAXIMUM 23 MODULES/INVERTER											
ARRAY				MOUNT			INVERTER				
LOCATION	# OF MODULES	MODULE TYPE	kWp	AZIMUTH	TILT	TYPE	TYPE	SIZE (kW)	QTY	EFFICIENCY	kW AC
ARRAY 1	40	HiS-S350TI	14.00	231	5	BALLASTED	HiQ TS208	5.75	2	98.0%	11.50
TOTAL	40		14.00						2		11.50

NOT FOR CONSTRUCTION

NOTES:
 1. EVERY MODULE IN ARRAY 1 IS SHADED DURING SOME PORTION OF THE HOURS OF THE YEAR THAT ARE NORMALLY CONSIDERED PRODUCTIVE: JUNE 21ST FROM 7AM TO 5PM, FEBRUARY 21ST FROM 9AM TO 3PM, AND DECEMBER 21ST AT NOON. SEE SIMULATION RESULTS FOR ACTUAL ANNUAL KWH OUTPUT.

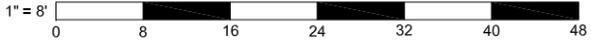
SCALE: 1" = 8' WHEN PRINTED 36" x 24"
 DRAWN BY: RWP
 CHECKED BY:
 DATE: 11/30/2016
 REVISIONS:

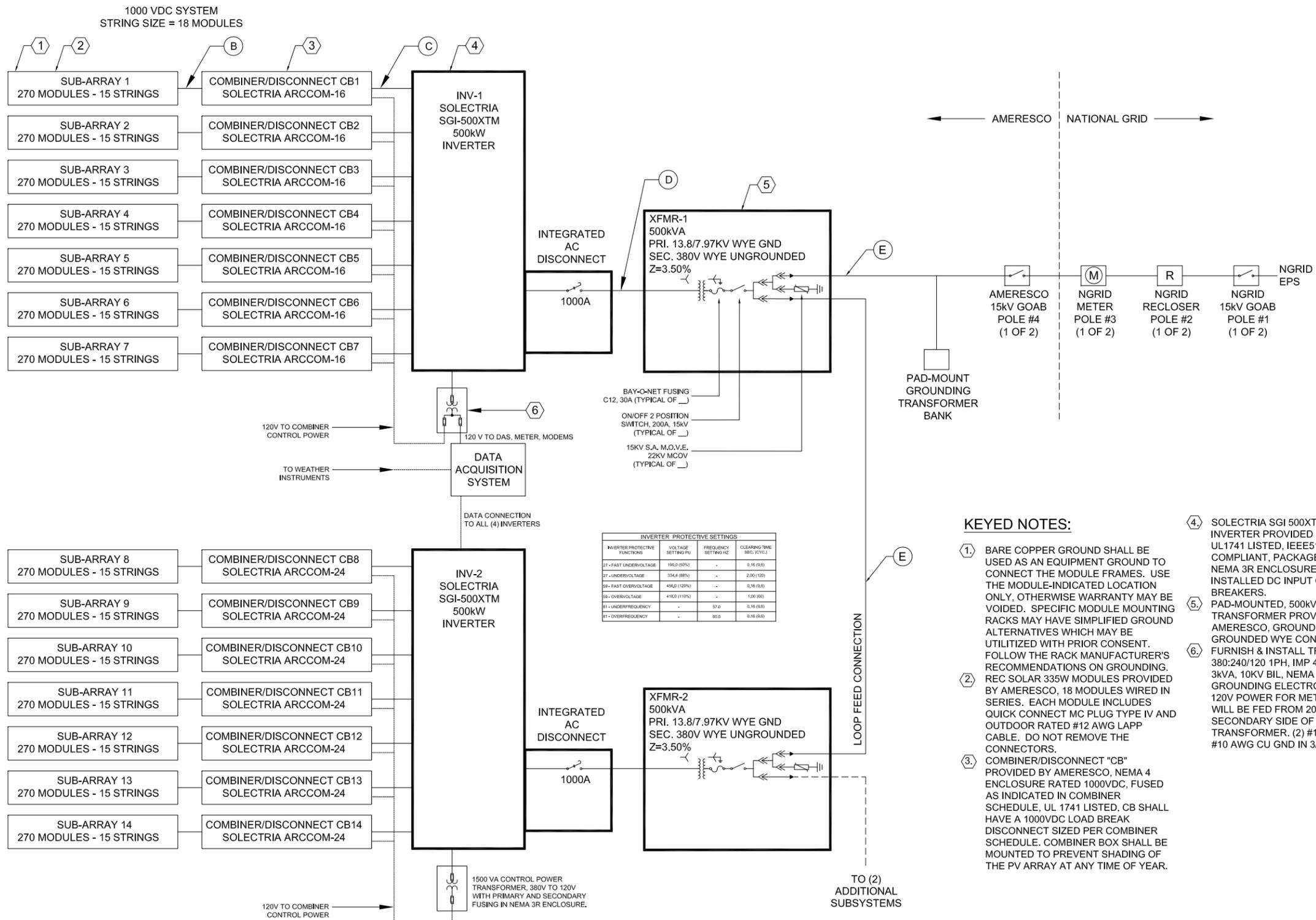


BARRINGTON SOLAR PV PUBLIC-PRIVATE PARTNERSHIP
 283 COUNTY ROAD
 BARRINGTON, RHODE ISLAND 02806
 TOWN HALL ROOFTOP PV ARRAY
 40.00 kWp DC STC PV ARRAY (11.50 kW AC)
 PHOTOVOLTAIC ARRAY LAYOUT

111 Speen Street, Suite 410
 Framingham, Massachusetts 01701
 (508) 681-2200
AMERESCO
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BARRINGTON TOWN HALL - OVERALL ARRAY LAYOUT
 SCALE: 1"=8' WHEN PRINTED 36" x 24"





INVERTER PROTECTIVE SETTINGS

INVERTER PROTECTIVE FUNCTIONS	VOLTAGE SETTINGS (V)	FREQUENCY SETTINGS (Hz)	CLEARING TIME (SECS) (C10)
U1 - FAST UNDERVOLTAGE	190.0 (50%)	-	0.10 (0.0)
U2 - UNDERVOLTAGE	334.4 (86%)	-	2.00 (120)
O1 - FAST OVERVOLTAGE	450.0 (120%)	-	0.10 (0.0)
O2 - OVERVOLTAGE	416.0 (110%)	-	1.00 (00)
F1 - UNDERFREQUENCY	-	57.0	0.10 (0.0)
F2 - OVERFREQUENCY	-	60.5	0.10 (0.0)

SYSTEM ONE-LINE DIAGRAM
NOT TO SCALE - TYPICAL OF (2) ELECTRICALLY SEPARATE SYSTEMS

SCALE: NOT TO SCALE
DRAWN BY: RWP
CHECKED BY:
DATE: 11/30/16
REVISIONS:

BRISTOL SOLAR PV PUBLIC-PRIVATE PARTNERSHIP
MINTURN FARM ROAD
BRISTOL, RHODE ISLAND 02809

BRISTOL LANDFILL PV ARRAY (SPLIT SYSTEM)
5,292.00 kWp DC STC PV ARRAY (4,000 kW AC)

PHOTOVOLTAIC ARRAY ONE-LINE DIAGRAM

111 Speen Street, Suite 410
Framingham, Massachusetts 01701
(508) 681-2200



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WIRING AND CONDUIT SCHEDULE PER 2,000KW AC SYSTEM

DC SCHEDULE

ITEM	DESCRIPTION	ID	QUANTITY	Voc (V)	Vmpp (V)	Imp (A)	Isc (A)	POWER (W)	CODE REQUIRED CURRENT (A)	CODE REQUIRED OCP (A)	FUSE (A)	MULTIPLE CONDUCTOR DERATE	TEMPERATURE DERATE	MAX ONE WAY LENGTH (FT)	WIRE SIZE	CONDUCTOR (CU OR AL)	WIRE AMPACITY (A)	DERATED WIRE AMPACITY (A)	GROUND SIZE PER NEC 250-122	WIRE TYPE	R/1000FT	V LOSS %	TEMP MAX	NOTES	
1	MODULE	HIS-S350TI	A	7,560	47.10	38.70	9.00	9.60	350	12.0	15.0	-	1	0.65	4	#12 AWG	CU	25	16.25	NONE	PV WIRE	1.980	-	65C	-
2	SOURCE CIRCUITS	SOURCE CIRCUITS TO CB1-CB28	B	15	847.8	696.6	9	9.60	6,300	12.0	15.0	15	0.7	0.82	49	#10 AWG	CU	35	20.09	#6 AWG	PV WIRE	1.240	0.16%	50C	-
3	COMBINERS	CB1-CB28 TO INV1-INV4	C	28	847.8	696.6	135	144.00	94,500	180.0	225.0	225	1	0.82	500	300 KCM	CU	285	233.7	#4 AWG	PV WIRE	0.043	0.83%	50C	-
																						0.99%			

AC SCHEDULE

ITEM	DESCRIPTION	ID	QUANTITY	VOLTAGE (V)	CURRENT (A)	POWER (W)	CODE REQUIRED CURRENT (A)	CODE REQUIRED OCP (A)	FUSE (A)	MULTIPLE CONDUCTOR DERATE	TEMPERATURE DERATE	MAX ONE WAY LENGTH (FT)	WIRE SIZE (PER PHASE, NEUTRAL SIZED SAME AS GROUND)	CONDUCTOR (CU OR AL)	WIRE AMPACITY (A)	DERATED WIRE AMPACITY (A)	GROUND SIZE PER NEC 250-122	WIRE TYPE	R/1000FT	V LOSS %	TEMP MAX	CONDUIT ** (NEUTRAL SIZED SAME AS GROUND)			
4	INVERTERS	INVERTERS TO TRANSFORMERS	D	4	380	760	760	950	1000	1.0	0.91	20	3 X 500 KCM	CU	1140	1037.4	2/0 AWG	THWN-2	0.011	0.07%	50C	(3) 3" EMT			
5	INTERCONNECTION	TRANSFORMERS TO POC	E	1	12,470	93	2,000,000	93	116	1.0	0.91	1400	3/0 AWG	AL	155	141.05	#4 AWG	15KV-EPR/133%	0.130	0.23%	40C	(2) 4" FRP			
																						0.31%			

- ALL DC WIRE SIZES ARE TO BE USED FOR BOTH POSITIVE AND NEGATIVE CONDUCTORS FOR THE ASSOCIATED EQUIPMENT
- ALL AC WIRES LISTED ARE PER PHASE
- THIS INSTALLATION INCLUDES A TOTAL OF 420 STRINGS OF 18 MODULES PER 2000 KW SYSTEM.

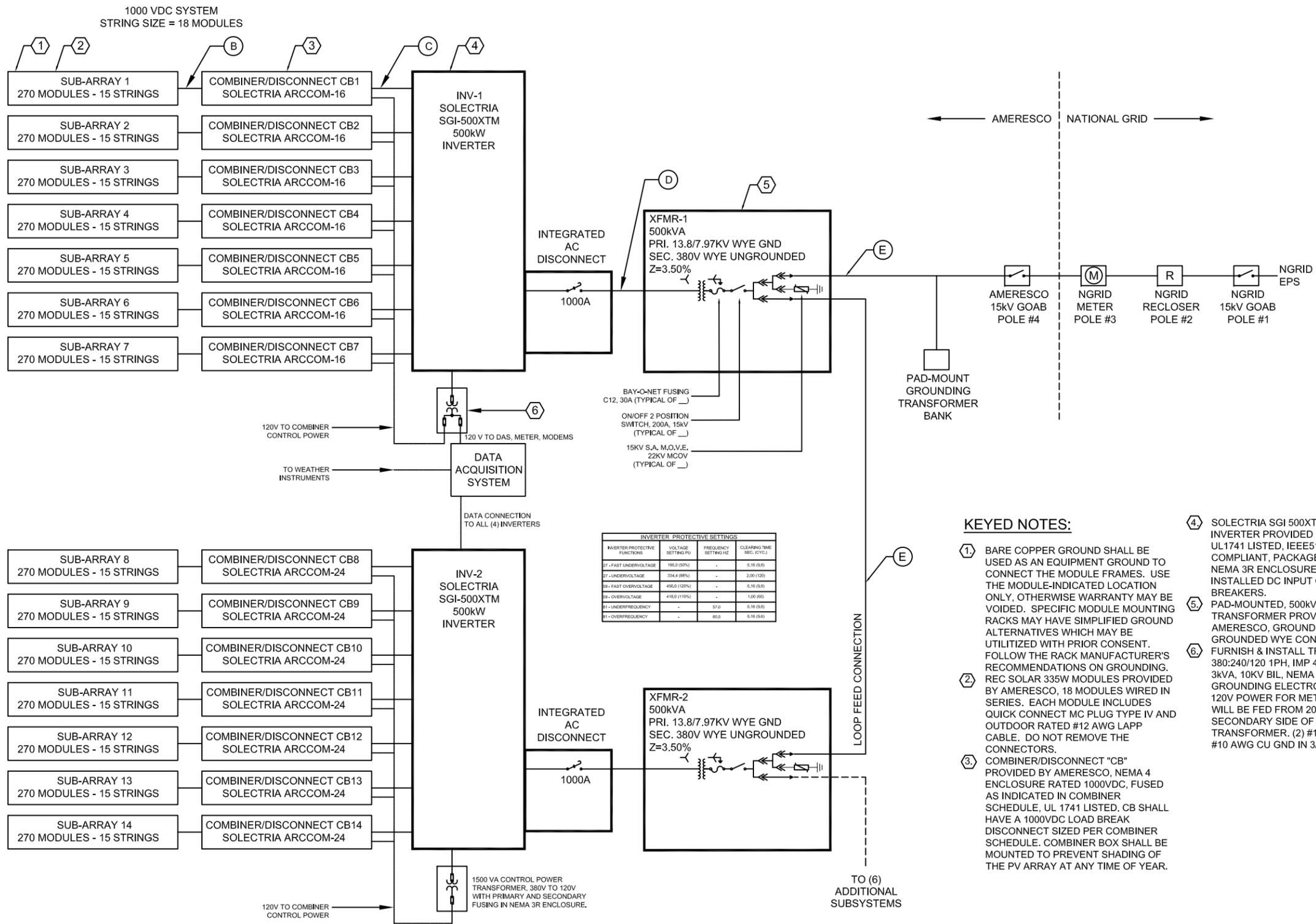
SCALE: NOT TO SCALE
 DRAWN BY: RWP
 CHECKED BY:
 DATE: 11/30/16
 REVISIONS:

BRISTOL SOLAR PV PUBLIC-PRIVATE PARTNERSHIP
 MINTURN FARM ROAD
 BRISTOL, RHODE ISLAND 02809
 BRISTOL LANDFILL PV ARRAY (SPLIT SYSTEM)
 5,292.00 kWp DC STC PV ARRAY (4,000 kW AC)
 PHOTOVOLTAIC ARRAY ONE-LINE DIAGRAM

111 Speen Street, Suite 410
 Framingham, Massachusetts 01701
 (508) 681-2200



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SYSTEM ONE-LINE DIAGRAM
NOT TO SCALE - TYPICAL OF (2) ELECTRICALLY
SEPARATE SYSTEMS

KEYED NOTES:

1. BARE COPPER GROUND SHALL BE USED AS AN EQUIPMENT GROUND TO CONNECT THE MODULE FRAMES. USE THE MODULE-INDICATED LOCATION ONLY, OTHERWISE WARRANTY MAY BE VOIDED. SPECIFIC MODULE MOUNTING RACKS MAY HAVE SIMPLIFIED GROUND ALTERNATIVES WHICH MAY BE UTILIZED WITH PRIOR CONSENT. FOLLOW THE RACK MANUFACTURER'S RECOMMENDATIONS ON GROUNDING. REC SOLAR 335W MODULES PROVIDED BY AMERESCO, 18 MODULES WIRED IN SERIES. EACH MODULE INCLUDES QUICK CONNECT MC PLUG TYPE IV AND OUTDOOR RATED #12 AWG LAPP CABLE. DO NOT REMOVE THE CONNECTORS.
2. COMBINER/DISCONNECT "CB" PROVIDED BY AMERESCO, NEMA 4 ENCLOSURE RATED 1000VDC, FUSED AS INDICATED IN COMBINER SCHEDULE, UL 1741 LISTED. CB SHALL HAVE A 1000VDC LOAD BREAK DISCONNECT SIZED PER COMBINER SCHEDULE. COMBINER BOX SHALL BE MOUNTED TO PREVENT SHADING OF THE PV ARRAY AT ANY TIME OF YEAR.
3. SOLECTRIA SGI 500XTM, 380V, 500kW INVERTER PROVIDED BY AMERESCO, UL1741 LISTED, IEEE519 AND IEEE929 COMPLIANT, PACKAGED IN A SINGLE NEMA 3R ENCLOSURE WITH FACTORY INSTALLED DC INPUT CIRCUIT BREAKERS.
4. PAD-MOUNTED, 500kVA, 380V/13.8KV TRANSFORMER PROVIDED BY AMERESCO, GROUNDED WYE TO GROUNDED WYE CONFIGURATION. FURNISH & INSTALL TRANSFORMER, 380:240/120 1PH, IMP 4-6%, 115C RISE, 3kVA, 10KV BIL, NEMA 3R. (1) #8 AWG GROUNDING ELECTRODE CONDUCTOR. 120V POWER FOR METER AND DAS WILL BE FED FROM 20A FUSES ON SECONDARY SIDE OF STEP DOWN TRANSFORMER. (2) #10 AWG CU AND (1) #10 AWG CU GND IN 3/4" EMT.

SCALE: NOT TO SCALE
DRAWN BY: RWP
CHECKED BY:
DATE: 11/30/16
REVISIONS:

BRISTOL SOLAR PV PUBLIC-PRIVATE PARTNERSHIP
MINTURN FARM ROAD
BRISTOL, RHODE ISLAND 02809

BRISTOL LANDFILL PV ARRAY (SINGLE SYSTEM)
5,292.00 kWp DC STC PV ARRAY (4,000 kW AC)

PHOTOVOLTAIC ARRAY ONE-LINE DIAGRAM

111 Speen Street, Suite 410
Framingham, Massachusetts 01701
(508) 681-2200



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WIRING AND CONDUIT SCHEDULE - 4,000KWAC SYSTEM

DC SCHEDULE

ITEM	DESCRIPTION	ID	QUANTITY	V _{oc} (V)	V _{mpp} (V)	I _{mpp} (A)	I _{sc} (A)	POWER (W)	CODE REQUIRED CURRENT (A)	CODE REQUIRED OCP (A)	FUSE (A)	MULTIPLE CONDUCTOR DERATE	TEMPERATURE DERATE	MAX ONE WAY LENGTH (FT)	WIRE SIZE	CONDUCTOR (CU OR AL)	WIRE AMPACITY (A)	DERATED WIRE AMPACITY (A)	GROUND SIZE PER NEC 250.122	WIRE TYPE	R/1000FT	V LOSS %	TEMP MAX	NOTES	
1	MODULE	HIS-S350TI	A	7,560	47.10	38.70	9.00	9.60	350	12.0	15.0	-	1	0.65	4	#12 AWG	CU	25	16.25	NONE	PV WIRE	1.980	-	65C	-
2	SOURCE CIRCUITS	SOURCE CIRCUITS TO CB1-CB28	B	15	847.8	696.6	9	9.60	6,300	12.0	15.0	15	0.7	0.82	49	#10 AWG	CU	35	20.09	#6 AWG	PV WIRE	1.240	0.16%	50C	-
3	COMBINERS	CB1-CB28 TO INV1-INV4	C	28	847.8	696.6	135	144.00	94,500	180.0	225.0	225	1	0.82	500	300 KCM	CU	285	233.7	#4 AWG	PV WIRE	0.043	0.83%	50C	-
																						0.99%			

AC SCHEDULE

ITEM	DESCRIPTION	ID	QUANTITY	VOLTAGE (V)	CURRENT (A)	POWER (W)	CODE REQUIRED CURRENT (A)	CODE REQUIRED OCP (A)	FUSE (A)	MULTIPLE CONDUCTOR DERATE	TEMPERATURE DERATE	MAX ONE WAY LENGTH (FT)	WIRE SIZE (PER PHASE, NEUTRAL SIZED SAME AS GROUND)	CONDUCTOR (CU OR AL)	WIRE AMPACITY (A)	DERATED WIRE AMPACITY (A)	GROUND SIZE PER NEC 250.122	WIRE TYPE	R/1000FT	V LOSS %	TEMP MAX	CONDUIT ** (NEUTRAL SIZED SAME AS GROUND)			
4	INVERTERS	INVERTERS TO TRANSFORMERS	D	8	380	760	500,000	760	950	1000	1.0	0.91	20	3 X 500 KCM	CU	1140	1037.4	2/0 AWG	THWN-2	0.011	0.07%	50C	(3) 3" EMT		
5	INTERCONNECTION	TRANSFORMERS TO POC	E	1	12,470	185	4,000,000	185	231	250	1.0	0.91	1400	500 KCM	AL	310	282.1	#2 AWG	15kv-EPR/133%	0.048	0.17%	40C	(2) 4" FRP		
																						0.25%			

- ALL DC WIRE SIZES ARE TO BE USED FOR BOTH POSITIVE AND NEGATIVE CONDUCTORS FOR THE ASSOCIATED EQUIPMENT
- ALL AC WIRES LISTED ARE PER PHASE
- THIS INSTALLATION INCLUDES A TOTAL OF 840 STRINGS OF 18 MODULES.

SCALE: NOT TO SCALE
 DRAWN BY: RWP
 CHECKED BY:
 DATE: 11/30/16
 REVISIONS:

BRISTOL SOLAR PV PUBLIC-PRIVATE PARTNERSHIP
 MINTURN FARM ROAD
 BRISTOL, RHODE ISLAND 02809
 BRISTOL LANDFILL PV ARRAY (SINGLE SYSTEM)
 5,292.00 kWp DC STC PV ARRAY (4,000 kW AC)
 PHOTOVOLTAIC ARRAY ONE-LINE DIAGRAM

111 Speen Street, Suite 410
 Framingham, Massachusetts 01701
 (508) 681-2200



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Appendix C: PV Specification Sheets

The manufacturer's specification sheets for the PV equipment proposed for this project are included on the following pages.

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Hyundai Solar Module

Hyundai Heavy Industries was founded in 1972 and is a Fortune 500 company. The company employs more than 48,000 people, and has a global leading 7 business divisions with sales of 51.3 Billion USD in 2013. As one of our core businesses of the company, Hyundai Heavy Industries is committed to develop and invest heavily in the field of renewable energy.

Hyundai Solar is the largest and the longest standing PV cell and module manufacturer in South Korea. We have 600 MW of module production capacity and provide high-quality solar PV products to more than 3,000 customers worldwide. We strive to achieve one of the most efficient PV modules by establishing an R&D laboratory and investing more than 20 Million USD on innovative technologies.

TI-Series

Multi-crystalline Type

HiS-M310TI | HiS-M315TI | HiS-M320TI | HiS-M325TI

Mono-crystalline Type

HiS-S330TI | HiS-S335TI | HiS-S340TI | HiS-S345TI | HiS-S350TI

Mechanical Characteristics

※ Several models are under certification process.

Dimensions	998 mm (39.29")(W) × 1,960 mm (77.17")(L) × 40 mm (1.57")(H)
Weight	Approx. 23.0 kg (50.71 lbs)
Solar cells	72 cells in series (6 × 12 matrix) (Hyundai cell, Made in Korea)
Output cables	4 mm ² (12AWG) cables with polarized weatherproof connectors, IEC certified (UL listed and UL 4703 certified), Length 1.2 m (47.2")
Junction box	IP67, weatherproof, IEC certified (UL listed)
Bypass diodes	3 bypass diodes to prevent power decrease by partial shade
Construction	Front : Anti-reflection coated glass (Anti reflection coated), 3.2 mm (0.126") Encapsulant : EVA Back Sheet : Weatherproof film
Frame	Anodized aluminum alloy type 6063

High Quality

- UL listed (UL 1703), Type 1 for Class A Fire Rating
- Output power tolerance +3/-0 %
- ISO 9001:2000 and ISO 14001:2004 Certified
- Advanced Mechanical Test (5,400 Pa) Passed (IEC)
/ Mechanical Load Test (40 lbs/ft²) Passed (UL)
- IEC 62716 (Ammonia Corrosion Resistance Test) Passed
- IEC 61701 (Salt Mist Corrosion Test) Passed
- Potential-Induced Degradation (PID) Test Passed
(85°C / 85 % / 600 hr-PVEL)

Fast and Inexpensive Mounting

- Delivered ready for connection
- IEC (UL) certified and weatherproof connectors
- Integrated bypass diodes

Limited Warranty

- 10 years for product defect
- 10 years for 90 % of warranted min. power
- 25 years for 80 % of warranted min. power

※ Important Notice on Warranty

The warranties apply only to the PV modules with Hyundai Heavy Industries Co., Ltd.'s logo (shown below) and product serial number on it.



Electrical Characteristics

| Multi-crystalline Type |

		HIS-M□□□□□□□□			
		310	315	320	325
Nominal output (Pmpp)	W	310	315	320	325
Voltage at Pmax (Vmpp)	V	36.0	36.2	36.4	36.6
Current at Pmax (Impp)	A	8.6	8.7	8.8	8.8
Open circuit voltage (Voc)	V	45.3	45.5	45.7	45.9
Short circuit current (Isc)	A	8.9	9.0	9.0	9.1
Output tolerance	%	+3/-0			
No. of cells & connections	pcs	72 in series			
Cell type	-	6" Multi-crystalline silicon (Hyundai cell, Made in Korea)			
Module efficiency	%	15.8	16.1	16.4	16.6
Temperature coefficient of Pmpp	%/K	-0.41			
Temperature coefficient of Voc	%/K	-0.32			
Temperature coefficient of Isc	%/K	0.039			

※ All data at STC (Standard Test Conditions). Above data may be changed without prior notice.

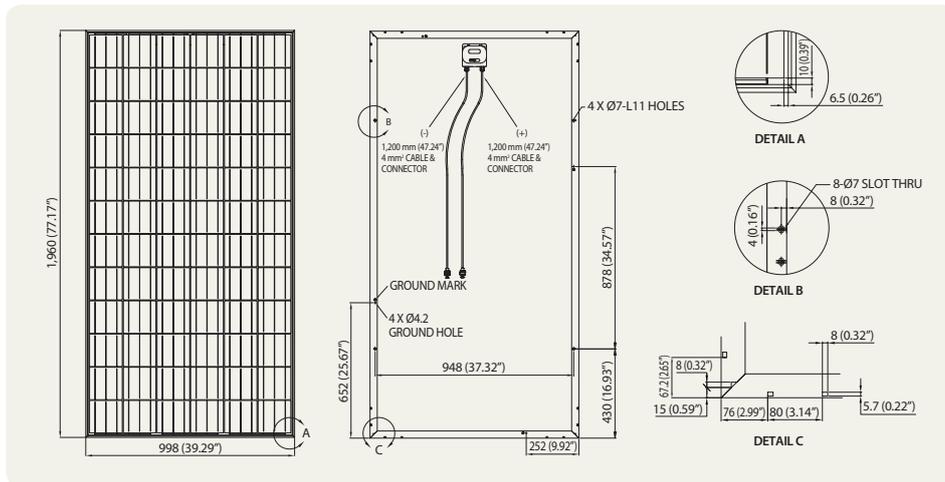
| Mono-crystalline Type |

		HIS-S□□□□□□□□				
		330	335	340	345	350
Nominal output (Pmpp)	W	330	335	340	345	350
Voltage at Pmax (Vmpp)	V	38.0	38.2	38.4	38.6	38.7
Current at Pmax (Impp)	A	8.7	8.8	8.9	9.0	9.0
Open circuit voltage (Voc)	V	46.3	46.5	46.7	46.9	47.1
Short circuit current (Isc)	A	9.3	9.4	9.5	9.6	9.6
Output tolerance	%	+3/-0				
No. of cells & connections	pcs	72 in series				
Cell type	-	6" Mono-crystalline silicon (Hyundai cell, Made in Korea)				
Module efficiency	%	16.9	17.1	17.4	17.6	17.9
Temperature coefficient of Pmpp	%/K	-0.42				
Temperature coefficient of Voc	%/K	-0.30				
Temperature coefficient of Isc	%/K	0.047				

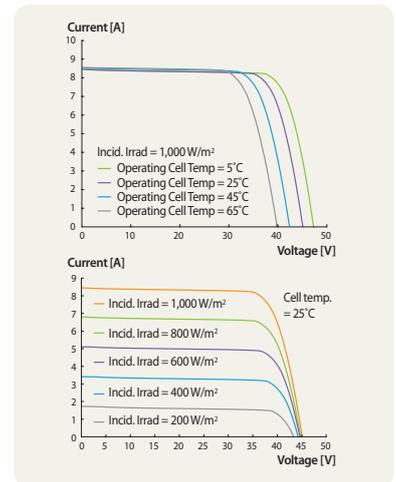
※ All data at STC (Standard Test Conditions). Above data may be changed without prior notice.

| Module Diagram |

(unit : mm, inch)



| I-V Curves |



| Installation Safety Guide |

- Only qualified personnel should install or perform maintenance.
- Be aware of dangerous high DC voltage.
- Do not damage or scratch the rear surface of the module.
- Do not handle or install modules when they are wet.

Nominal Operating Cell Temperature	46°C ± 2
Operating Temperature	-40 - 85°C
Maximum System Voltage	DC 1,000 V (IEC) DC 1,000 V (UL)
Maximum Reverse Current	15 A

[Printed Date : June 2016]



Sales & Marketing
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Polar Bear III

Flat Roof Mounting System

PRODUCT AND COST EVOLUTION



System Level Approach

Low-cost mounting components provide savings early in the project development process. However, when you are looking to lower the total installed cost, from delivery to a fully wired system, details make the difference. Polar Bear® III combines critical system features, A-to-Z project support, and long-term product reliability into a single low-cost platform. The system components, delivery, and installation procedures have been jointly designed to deliver a lower total cost and better service experience.

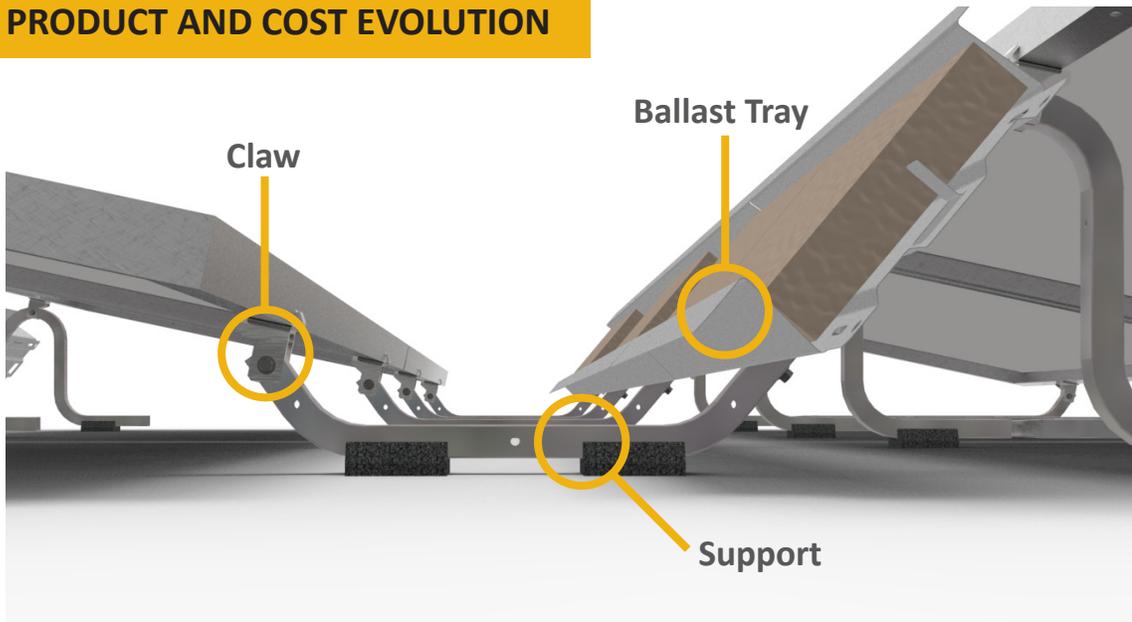
The Polar Bear® III takes the best features, service, and reliability from PanelClaw's earlier flat roof systems and combines them into a single platform.



Polar Bear III Flat Roof Mounting System 10 Degree



PRODUCT AND COST EVOLUTION



Trusted Roof Integrity

Polar Bear® III reduces potential long-term roof damage with fully captured ballast, integrated roof protection pads and a system design that allows for free water flow.

Accelerated Construction

The engineered design emphasizes built-in features to improve construction efficiencies:

- Three major components, light-weight and easy to move
- Pre-installed bolts to quickly mount Ballast Trays
- Single-module tilt-up to facilitate must-have access to roof, wiring and maintenance

Safety and Reliability

Polar Bear III is the result of PanelClaw's data-driven test program to improve PV reliability. Polar Bear III is proven technology based on hundreds of megawatts of project experience.

Three Components

Support

- Easy-to-handle components that weigh less than 2.5 pounds
- Integrated recycled rubber roof protection pads
- Pre-drilled holes for wire management cabling options

Ballast Tray

- Angled fit with locking end-tab to fully capture ballast blocks
- Hemmed edges and chamfered corners prevent wiring from coming into contact with sharp edges

Claw

- Attachment to module using standard module mounting holes
- UL 2703 certified for electric bonding and grounding

Applications

Flat roof (max slope 5°)

Fully ballasted or mechanically attached

Module Tilt Angle

10° nominal

Shading Ratio

2.3:1 and 2.7:1

Module-to-Module Spacing

21.88" and 18.38"

Platform Load

~1.9 - 8 psf

Module Orientation

Landscape

Module Attachment

Standard module mounting holes

Basic Wind Speed

Up to 120 mph
(>120 mph by approval)

Wind Exposure Category

B and C (D by approval)

Seismic Compatibility

C, D, E and F

Warranty and Certifications

25 year warranty

UL 2703 certification

System Fire Rating
Class A with Type 1 and
Type 2 modules



Made in USA

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(978) 688.4900 | sales@panelclaw.com



Printed on recycled paper



HiQ Solar TrueString 208V Inverter TS208-5k75 Specifications



Features

- Rugged 3-phase 208V plug & play system
- Small and light (hand holdable, 24 lb.)
- Non-isolated inverter for use with ungrounded DC systems
- Peak 98% efficiency, 97% CEC
- 200-850V MPP voltage range for 600V and 1,000V systems
- 5.75 kW_{AC} full power MPP voltage range 325-525V
- Two DC string inputs with independent monitoring and MPPT
- Waterproof NEMA6, silent convection cooling
- Designed for high reliability, uses no electrolytic capacitors
- Wide temperature range, -40 to +65 °C
- Utility-Interactive; Listed to UL1741
- Compliant with NEC 690.11 arc detection

Applications

- Rooftop commercial, usable where other solutions just won't work - for example coastal, desert, high altitude locations
- Car ports, parking and shade structures; units may be mounted at any orientation, under modules, on racking without extra strengthening, clear of risk of liability from vandalism

Note

Operates on 5-wire wye - neutral must be connected or damage may result



DC Input (2 identical inputs)	
Maximum open circuit voltage per String, V_{OC}	1,000 V_{DC}
Full power MPPT range, per string	325-525 V_{DC}
PV start voltage	200 V_{DC}
DC allowable stacking ratio (total, 2 inputs combined)	Must not exceed 8.9 under any circumstances ¹
DC maximum input current, per DC input	10 A
DC maximum input short circuit current	30 A
DC maximum input source back feed current to input source	0 A
DC disconnect means	The DC connector has been evaluated and approved for use as the load-break disconnect required by the NEC ²
AC Output	
AC maximum continuous total output power to +45 °C	5.75 kW_{AC} max
AC de-rate with temperature, +40 to +65 °C	-102 W/°C
AC maximum continuous output current, per phase	16.0 A
AC maximum output over current protection	40 A
AC 3-phase system compatibility	208V Wye, 3 phases, neutral and ground
AC voltage range, phase to phase (min / nominal / max)	183 / 208 / 229 V (Limits adjustable, see below)
AC voltage range, phase to neutral (min / nominal / max)	106 / 120 / 132 V (Limits adjustable, see below)
AC output frequency range (min / nominal / max)	59.3 / 60 / 60.5 Hz (Limits adjustable, see below)
Power Factor	≥0.98



Note 1: Stacking: On the DC side of the inverter, each input limits at 3 kW and/or 10A, and the combined total AC output is limited to 5.75 kW. Higher DC STC string powers may be applied, the inverter will limit as described above. Total stacking for inverter must not exceed 8.9 under any circumstances

Note 2: NEC section 690.17, allowed by the exception of meeting requirements specified in 690.33

AC Output, continued			
AC lower frequency trip limit	Default	59.3 Hz	+/- 0.1 Hz
	Adjustment	57-59.3 Hz in 0.1 Hz increments	
	Clearing time default	0.16 s	+/- 2 cycles
	Clearing time adjustment	0.16-300	
AC upper frequency trip limit	Default	60.5 Hz	+/- 0.1 Hz
	Adjustment	60.5-62.0 Hz in 0.1 Hz increments	
	Clearing time default	0.16 s	+/- 2 cycles
	Clearing time adjustment	0.16-300 s	
AC lower voltage trip limit (Phase to Neutral)	Default	106 V	+/- 2 %
	Adjustment	85-106 V	
	Clearing time default	2 s	+/- 2 cycles
	Clearing time adjustment	1-20 s	
AC upper voltage trip limit (Phase to Neutral)	Default	132 V	+/- 2 %
	Adjustment	132-144 V	
	Clearing time default	1 s	+/- 2 cycles
	Clearing time adjustment	1-20 s	
AC reconnect delay	Default	5 minutes	+/- 1 s
	Adjustment	1 s -10 minutes	
AC synchronization in-rush current		0 A	
Maximum output fault current and duration		16 A, <0.5 ms	
AC minimum wire gauge for grid connection		12 AWG	
AC disconnect means		The AC connector has been evaluated and approved for use as the load-break disconnect required by the NEC ²	
Other Specifications			
Peak efficiency		98 %	
CEC efficiency		97%	
Dimensions		475 x 334 x 76 mm (18 3/4 x 13 1/8 x 3")	
Weight		11 kg (24 lb.)	
Operating temperature range		-40 to +65 °C (-40 to 150 °F)	
Power consumption standby/ night		<4.5 W / <4.5W	
Cooling		Natural convection, no fan	
Communication		Powerline	
Environmental rating		Outdoor / rooftop, NEMA 6, IP67	
Certification		Listed to UL 1741 / IEEE 1547 (Utility Interactive) CSA C22.2 NO. 107.1, FCC Part 15, meets the requirements of NEC 690.11	
Included warranty		10 Years, optionally extendable	

Ordering Guide		
Item	Part Number	Description
TrueString System	TS208-5k75	TrueString 208V Inverter, 5.75kW, 3-phase. Inverter with MC4-compatible connectors. MPPT per string, monitoring per string. Includes 10 year limited warranty. <i>Does not include Gateway. Does not include AC cable, must be ordered separately.</i>
	TS208-5k75 Option A	Option - Add RS485 communication and Aux connector. Must be ordered at time of system purchase, not retrofittable.
	TS208-5k75 Option W25	Option - TrueString System Warranty Extension to 25 years for 1 TrueString 208V. Must be ordered at time of system purchase. Includes system Gateway(s).
TrueString AC Cables	CBL-208A-05	TrueString 208V AC Cable, 5ft. Includes TrueString 208V AC mating connector, other end unterminated.
	CBL-208A-15	TrueString 208V AC Cable, 15ft. Includes TrueString 208V AC mating connector, other end unterminated.
	CBL-208A-30	TrueString 208V AC Cable, 30ft. Includes TrueString 208V AC mating connector, other end unterminated.
	CBL-208A-50	TrueString 208V AC Cable, 50ft. Includes TrueString 208V AC mating connector, other end unterminated.



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2030 Duane Avenue, Santa Clara, CA 95054
info@hiqsolar.com, www.hiqsolar.com



HiQ Solar TrueString 480V Inverter TS480-8k Specifications



Features

- Rugged 3-phase 480V plug & play system
- Small and light (hand holdable, 24 lb.)
- Non-isolated inverter for use with ungrounded DC systems
- Peak 98.6% efficiency, CEC efficiency of 98%
- 200-850V MPP voltage range for 600V and 1,000V systems
- 8 kW_{AC} full power MPP voltage range 425-850V
- Two DC string inputs with independent monitoring and MPPT management.
- Waterproof NEMA6, silent convection cooling
- Designed for high reliability, uses no electrolytic capacitors
- Wide temperature range, -40 to +65 °C
- Utility-Interactive; Listed to UL1741
- Compliant with NEC 690.11 arc detection

Applications

- Rooftop commercial, usable where other solutions just won't work - for example coastal, desert, high altitude locations
- Car ports, parking and shade structures; units may be mounted at any orientation, under modules, on racking without extra strengthening, clear of risk of liability from vandalism



DC Input (2 identical inputs)	
Maximum open circuit voltage per String, V_{OC}	1,000 V_{DC}
Full power MPPT range, per string	425-850 V_{DC}
PV start voltage	200 V_{DC}
DC allowable stacking ratio (total, 2 inputs combined)	Must not exceed 6.375 under any circumstances ¹
DC maximum input current, per DC input	10 A
DC maximum input short circuit current	30 A
DC maximum input source back feed current to input source	0 A
DC disconnect means	The DC connector has been evaluated and approved for use as the load-break disconnect required by the NEC ²
AC Output	
AC maximum continuous total output power to +45 °C	8 kW _{AC} max
AC de-rate with temperature, +45 to +65 °C	-150 W/°C
AC nominal output current, per phase	9.6 A
AC maximum continuous output current, per phase	9.6 A
AC maximum output over current protection	40 A
AC 3-phase system compatibility	480V Wye, 3 phases, neutral and ground
AC voltage range, phase to phase (min / nominal / max)	422 / 480 / 528 V (Limits adjustable, see below)
AC voltage range, phase to neutral (min / nominal / max)	244 / 277 / 305 V (Limits adjustable, see below)
AC output frequency range (min / nominal / max)	59.3 / 60 / 60.5 Hz (Limits adjustable, see below)
Power Factor	≥0.98



Note 1: Stacking: On the DC side of the inverter, each input limits at 5 kW and/or 10A, and the combined total AC output is limited to 8 kW. Higher DC STC string powers may be applied, the inverter will limit as described above. Total stacking for inverter must not exceed 6.375 under any circumstances

Note 2: NEC section 690.17, allowed by the exception of meeting requirements specified in 690.33

AC Output, continued			
AC lower frequency trip limit	Default	59.3 Hz	+/- 0.1 Hz
	Adjustment	57-59.3 Hz in 0.1 Hz increments	
	Clearing time default	0.16 s	+/- 2 cycles
	Clearing time adjustment	0.16-300	
AC upper frequency trip limit	Default	60.5 Hz	+/- 0.1 Hz
	Adjustment	60.5-62.0 Hz in 0.1 Hz increments	
	Clearing time default	0.16 s	+/- 2 cycles
	Clearing time adjustment	0.16-300 s	
AC lower voltage trip limit (Phase to Neutral)	Default	245 V	+/- 2 %
	Adjustment	220-245 V	
	Clearing time default	2 s	+/- 2 cycles
	Clearing time adjustment	1-20 s	
AC upper voltage trip limit (Phase to Neutral)	Default	305 V	+/- 2 %
	Adjustment	305-315 V	
	Clearing time default	1 s	+/- 2 cycles
	Clearing time adjustment	1-20 s	
AC reconnect delay	Default	5 minutes	+/- 1 s
	Adjustment	1 s -10 minutes	
AC synchronization in-rush current		0 A	
Maximum output fault current and duration		10A, <0.5ms	
AC minimum wire gauge for grid connection		14 AWG	
AC disconnect means		The AC connector has been evaluated and approved for use as the load-break disconnect required by the NEC ²	
Other Specifications			
Peak efficiency		98.6 %	
CEC efficiency		98.0 %	
Dimensions		475 x 334 x 76 mm (18 3/4 x 13 1/8 x 3")	
Weight		11 kg (24 lb.)	
Operating temperature range		-40 to +65 °C (-40 to 150 °F)	
Power consumption standby/ night		<4.5 W / <4.5W	
Cooling		Natural convection, no fan	
Communication		Powerline	
Environmental rating		Outdoor / rooftop, NEMA 6, IP67	
Certification		Listed to UL 1741 / IEEE 1547 (Utility Interactive) CSA C22.2 NO. 107.1, FCC Part 15, meets the requirements of NEC 690.11	
Included warranty		10 Years, optionally extendable	



Ordering Guide		
Item	Part Number	Description
TrueString System	TS480-8k	TrueString 480V Inverter, 8kW, 3-phase. Inverter with MC4-compatible connectors. MPPT per string, monitoring per string. Includes 10 year limited warranty. <i>Does not include Gateway. Does not include AC cable, must be ordered separately.</i>
	TS480-8k Option A	Option - Add RS485 communication and Aux connector. Must be ordered at time of system purchase, not retrofittable.
	TS480-8k Option W25	Option - TrueString System Warranty Extension to 25 years for 1 TrueString 480V. Must be ordered at time of system purchase. Includes system Gateway(s).
TrueString AC Cables	CBL-480A-05	TrueString 480V AC Cable, 5ft. Includes TrueString 480V AC mating connector, other end unterminated.
	CBL-480A-15	TrueString 480V AC Cable, 15ft. Includes TrueString 480V AC mating connector, other end unterminated.
	CBL-480A-30	TrueString 480V AC Cable, 30ft. Includes TrueString 480V AC mating connector, other end unterminated.
	CBL-480A-50	TrueString 480V AC Cable, 50ft. Includes TrueString 480V AC mating connector, other end unterminated.



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PVI 3800TL
PVI 5200TL
PVI 6600TL
PVI 7600TL

FEATURES

- 600 VDC
- Highest industry peak and CEC efficiencies
- Lightweight, compact design - smallest in the industry
- Quick and easy installation
- Wide operating voltage range
- DC disconnect
- Passive cooling
- DC arc-fault detection and interrupt

OPTIONS

- Rapid shutdown combiner
- Web-based monitoring
- Revenue grade metering

1-PH TRANSFORMERLESS STRING INVERTERS

Yaskawa - Solectria Solar's PVI 3800TL, PVI 5200TL, PVI 6600TL, and PVI 7600TL are compact, transformerless, single-phase inverters with the highest peak and CEC efficiencies in the industry. These inverters come standard with an integrated DC disconnect, DC arc-fault detection and interrupt, 1 or 2 MPP tracker(s), and a user-interactive LCD and keypad. Their small and lightweight design make for quick and easy installation and maintenance. They have an innovative passive cooling design which eliminates the need for fans in the inverter. These inverters include an enhanced DSP control, comprehensive protection functions, and advanced thermal design enabling highest reliability and uptime. Any PVI 3800-7600TL may be purchased with our Rapid Shutdown Combiner to comply with NEC 2014.



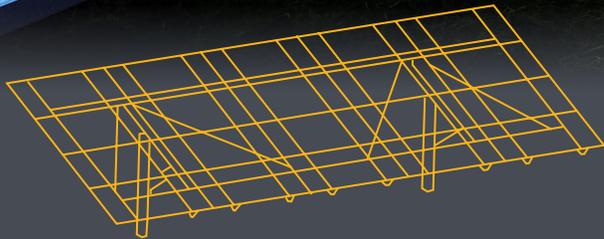
SPECIFICATIONS		PVI 3800TL	PVI 5200TL	PVI 6600TL	PVI 7600TL
DC Input					
Absolute Maximum Open Circuit Voltage		600 VDC			
Operating Voltage Range		120-550 VDC			
MPPT Input Voltage Range		200-500 VDC			
MPP Trackers		1	2		
Maximum Operating Input Current		20 A	15 A per MPPT	18 A per MPPT	20 A per MPPT
Maximum Input Short Circuit Current (Isc x 1.25)		24 A	48 A (24 A per MPPT)		
Maximum PV Power (per MPPT)		5.32 kW	3.64 kW	4.62 kW	5.32 kW
Start Voltage		150 V			
AC Output					
Nominal Output Voltage		208 or 240 VAC, 1Ø+/PE			
AC Voltage Range		-12%/+10%			
Continuous Output Power	208 VAC	3328 W	5000 W	6600 W	6656 W
	240 VAC	3800 W	5200 W	6600 W	7600 W
Maximum Continuous Output Current		16 A	24 A	32 A	
Maximum Backfeed Current		0 A			
Nominal Output Frequency		60 Hz			
Output Frequency Range		59.3-60.5 Hz			
Power Factor		Unity, > 0.99			
Fault Current Contribution (RMS)		4.7 A	11.8 A		
Total Harmonic Distortion (THD) @ Rated Load		< 3%			
Performance					
Peak Efficiency		98.3%			
CEC Efficiency		97.5%			
Tare Loss		< 2 W			
Ambient Temperature Range (full power)		-13°F to +122°F (-25°C to +50°C)			
Storage Temperature Range		-40°F to +185°F (-40°C to +85°C)			
Relative Humidity (non-condensing)		0-100%			
Audible Noise		< 45 dBA @ 3 m			
Operating Altitude		6,562 ft/2000 m			
Safety Listings & Certifications		UL 1741/IEEE 1547, UL 1699B, CSA C22.2#107.1, FCC part 15 A&B			
Testing Agency		CSA			
Mechanical					
DC Disconnect		Standard, fully-integrated			
Dimensions (H x W x D)		17.5 x 15.8 x 8.5 in. (445 x 402 x 216 mm)	26.8 x 15.8 x 8.5 in. (681 x 402 x 216 mm)		
Weight		43 lbs (19.5 kg)	65 lbs (29.5 kg)		
Enclosure Rating		Type 4 + Salt Mist Corrosion Protection			
Enclosure Finish		Aluminum			
Communications					
Data Logger Hardware		Optional, External			
SolrenView Monitoring Service		Optional			
Revenue Grade Meter/Monitoring		Optional, External			
Communication Interface		RS-485			
Warranty					
Standard		10 year			
Optional		Extended warranty not available			

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THE FLEXRACK SERIES G3-X



156 FlexRack Series G3P-X racks
1.9MW Nixon Farms Project | West Friendship, MD



+ TURN-KEY SERVICES

We're here for you because we care about your projects. From engineering to installation, you can also leverage our expert turn-key services on any job from start to finish.

Contact us to see how our team of project engineers, field techs, geologists and other specialists can help make sure your next project is a success.

Experience the Flex

CALL US TO FIND OUT HOW THIS GROUNDBREAKING
RACK CAN IMPROVE HOW YOU DO SOLAR

1.888.380.8138 | SOLARFLEXRACK.COM

Pick your preference

Solar Developers and EPCs demand choices and continued innovation to maintain their leadership position. The Field Assembled G3-X Ground Rack joins our flagship Pre-assembled G3L and G2P series as the latest advancement in our ongoing quest to provide products which meet project-specific needs. Solar FlexRack stands alone as the only racking company able to provide you with these options.

Easy assembly

The G3-X system is easily staged on the jobsite, can be assembled in the field by crews of nearly any skill level, and has been third-party verified for speed of installation by The Industrial Time Study Institute, Inc. Multiple pre-drilled holes, slot to slot connections, and generous construction tolerances make the G3-X an efficient and adaptable model on the jobsite.

Seamless flexibility

The G3-X, available in both Portrait and Landscape orientations, leverages the knowledge gained in delivering nearly 1 GW of pre-assembled ground mounts into a racking system which is assembled in the field. This product is a perfect fit for projects where labor costs are low and field assembly is preferred.

Intelligent design

The series G3-X is value-engineered by our professional team of best-in-class engineers to optimize materials and limit components to create a cost-effective solution. Our field engineering team will work with you personally to ensure that whatever system you choose will be the most cost effective solution for your project needs.

Bankability

Solar FlexRack is a product of Northern States Metals, a full service manufacturer with over 40 years of experience. With close to 1 GW of installed capacity Solar FlexRack has the experience and sustainability to be a reliable partner for your next successful solar project. The G3-X series also comes standard with a 20 year warranty.

MATERIALS	
Hardware	Mounting hardware is Magni 560 coated standard. Stainless available upon request.
Racking Structure	G 90 galvanized steel standard. Higher coatings available for high corrosion areas
Foundations	Hot Dipped Galvanized
DESIGN	
Orientation	Landscape or Portrait
Tilt Angle	5° - 45° (custom tilts can be accommodated)
Adjustability	20% E/W Landscape, 20% E/W Portrait
Wind Speed	Any
Snow Load	Any
Module Accommodation	Any 60 or 72 cell framed module along with any frameless module
Module Mounting Type	Direct bolt to vertical rails (bonded connection)
Foundation Accommodation	W-Section, SmartPost, Round Post, Helical Pier, Ballast
Warranty	20 Years
CERTIFICATIONS AND TESTING	
UL Compliance	UL 2703 (Issue 2) compliant.
Wind Tunnel Testing	CPP third party testing laboratory
Structural Connection Testing	Accutek Testing Laboratory
Code Compliance	Racks are designed using local environmental loads (wind, snow, and seismic) per the governing and/or local building codes
Finite Element Modeling	Risa 3D
Engineering	PE stamped drawings and calculations
SERVICES	
Geotechnical Engineering	Field investigation and engineering, laboratory testing, engineering analysis, push/pull tests, foundation design
Structural/Civil Engineering	Preliminary investigation, engineering, layout
Installation	Foundation, racking, module, and module pre-wiring



SGI 500XTM

SGI 750XTM

FEATURES

- Compliant with NEC 2014 690.11 & 690.12 arc-fault and rapid shutdown requirements when coupled with ARCCOM combiner
- 98% CEC efficiency
- 1000 VDC
- Parallel power stages
- Fuse and breaker subcombiner options
- Modbus communications
- User-interactive LCD

OPTIONS

- Stainless steel enclosure
- Web-based monitoring
- Built-in cellular connectivity
- AC breaker with shunt trip
- Revenue grade metering
- Air filters
- Uptime guarantee

OPTIONS FOR UTILITIES

- Real power curtailment
- Reactive power control
- Voltage ride through
- Frequency ride through
- Controlled ramp rates
- DMS tie-in
- Rule 21 compliant

1000VDC UTILITY-SCALE INVERTERS

The only 1000VDC inverter available that is compliant with NEC 2014 690.11 & 690.12 arc-fault and rapid shutdown requirements. Yaskawa - Solectria Solar's SMARTGRID series inverters are optimized for high efficiency, reliability, and economy. Available in two power classes, 500 kW and 750 kW, these inverters are designed for direct connection to an external transformer for large commercial or utility-scale applications. They are robust, outdoor rated inverters that can be configured as 1 or 1.5 MW Solar Stations. Available utility-scale options include advanced grid management features such as voltage and frequency ride through, reactive power control, real power curtailment and power factor control. Listed to 1000 VDC with 98% CEC weighted efficiency, the SGI 500/750XTM inverters set a new standard for large scale power conversion.

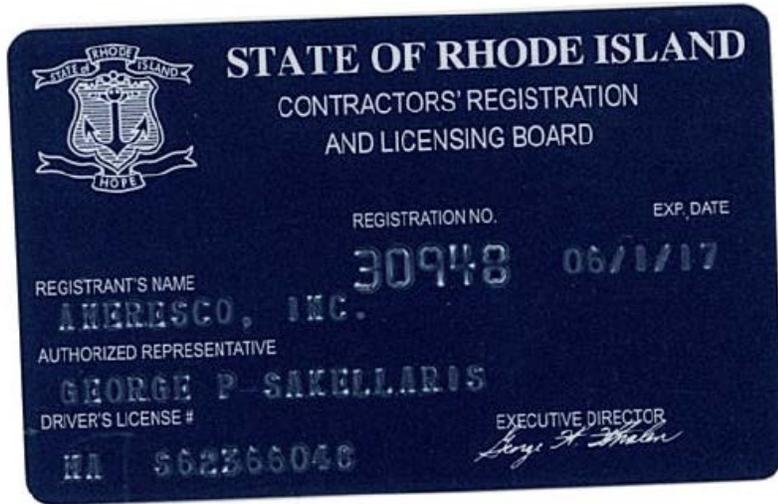


SPECIFICATIONS	SGL 500XTM	SGL 750XTM
DC Input		
Absolute Maximum Input Voltage	1000 VDC	
Max Power Input Voltage Range (MPPT)*	545-820 VDC	
Operating Voltage Range	545-1000 VDC	
Maximum Operating Input Current	965 A	1445 A
Maximum PV Power	700 kW	1050 kW
Strike Voltage	700 V	
AC Output		
Native Output Voltage	380 VAC, 3-Ph	
AC Voltage Range	-12/+10%	
Continuous Output Power	500 kW	750 kW
Continuous Output Current	760 A	1140 A
Maximum Backfeed Current	0 A	
Nominal Output Frequency	60 Hz	
Output Frequency Range	57-60.5 Hz	
Power Factor	Adjustable - 0.8 to +0.8, factory set at 1	
Fault Current Contribution (1 Cycle RMS)	912 A	1368 A
Total Harmonic Distortion (THD) @ Rated Load	< 3%	
Efficiency		
Peak Efficiency	98.3%	
CEC Efficiency	98.0%	
Tare Loss	89 W	123 W
Subcombiner Options		
Fuses	4 to 16 positions, 100-400 A	
Breakers	4 to 15 positions, 125-350 A	
Temperature		
Ambient Temperature Range (full power)	-40°F to +122°F (-40°C to +50°C)	
Storage Temperature Range	-40°F to +122°F (-40°C to +50°C)	
Relative Humidity (non-condensing)	5-95%	
Data Monitoring		
Optional SolrenView Web-based Monitoring	Integrated	
Optional Revenue Grade Monitoring	800 A	1600 A
Optional SolZone™ Sub-Array Monitoring (DC Current)	1 zone per protected input (up to 16 zones)	
Optional Cellular Communication	SolrenView AIR	
External Communication Interface	RS-485 SunSpec Modbus RTU	
Testing & Certifications		
Safety Listings & Certifications	UL 1741/IEEE 1547, CSA C22.2#107.1	
Testing Agency	ETL	
Warranty		
Standard	5 year	
Optional	10, 15, 20 year; extended service agreement; uptime guarantee	
Dedicated External Transformer		
Dedicated External Transformer	Required, provided by customer to Solectria's specification	
Transformer Type	Self cooled, step up, pad mount	
Output Voltage	Typical: 2.4-36.0 kV, 3-Ph	
Enclosure		
dBA (Decibel) Rating	< 67 dBA @ 10 m	
DC Disconnect (integrated)	Standard	
AC Disconnect/Breaker (integrated)	Optional disconnect, breaker or breaker with shunt trip	
Dimensions (H x W x D)	82 in. x 109 in. x 41 in. (2083 mm x 2769 mm x 1042 mm)	
Shading Set Back	137" (3480 mm) at 30° solar elevation	
Shipping Weight	3080 lbs (1398 kg)	3570 lbs (1620 kg)
Enclosure Rating	Type 3R	
Enclosure Finish	Polyester powder coated steel; optional 316 stainless steel	

*At nominal AC voltage

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Appendix D: RI Contractors License



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Appendix E: Certificate of Insurance

A copy of Ameresco's certificate of insurance is provided on the following page.

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CONTACTS:

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111 Speen Street, Suite 410

Framingham, MA 01701

T: 508-661-2200

Name of contact person in the firm:

Kleo Taliadouros, Director - Development

T: 508-661-2263

ameresco.com

