

To: Planning Board

Re: Site Plan Review, Chenery Solar Array

Date: June 30, 2017

Enclosed please find an application with supporting documents to install a small solar array on the south-facing gym roof of the Chenery Middle School. The array is being donated by Direct Energy Solar as a gift to the Town in recognition for the most successful solar program in Massachusetts.

Please note the following regarding the application materials:

1. **Application** – submitted by Gerald Boyle, Director of Facilities, Town of Belmont
2. **Project Statement** – attached.
3. **Neighborhood Letters or Petition** – consists of a summary of abutter comments received from telephone interviews, an on-line survey and a public meeting.
4. **Fees** – \$350 administrative fee is waived; \$150 advertisement fee is included; \$50 adjacent town fee is not applicable.
5. **Additional material submitted** – PowerPoint presentation slides that explain the project and process.
6. **Certified Plot Plan** – not required according to the Office of Community Development
7. **Zoning Compliance Check List** – not required according to the Office of Community Development.
8. **Elevations and Plans** – submitted as color renderings on 11" x 17" sheets.
9. **Site Plan** – is not required according to the Office of Community Development.
10. **Stormwater Removal calculations** etc. – not required according to the Office of Community Development.



Town of Belmont
Planning Board

APPLICATION FOR DESIGN AND SITE PLAN REVIEW

Date: June 30, 2017

Planning Board
Homer Municipal Building
19 Moore Street
Belmont, MA 02478

To Whom It May Concern:

Pursuant to the provisions of Section 7.3, Design and Site Plan Review, of the Town of Belmont Zoning By-Laws, I/We the undersigned, being owner(s) of certain parcel of land (with the buildings thereon) situated on 95 Washington Street, hereby make application to your Board for **DESIGN AND SITE PLAN REVIEW** for the erection or alteration on said premises or the use thereof under the applicable Section of the Zoning By-Laws of said Town for the installation of a small solar array on the south-facing gym roof of the Chenery Middle School, donated to the Town of Belmont by Direct Energy Solar, on the ground that the same will be in harmony with the general purpose and intent of said Zoning By-Law.

Petitioner(s) are further to comply with the requirements of Section 7.3.5 of said Zoning By-Law attached.

Signature of Petitioner

Gerald R. Boyle

Print Name Gerald R. Boyle, Director of Facilities

Address Town of Belmont

Daytime Telephone Number

617-993-2640

Chenery Middle School Solar Array – Project Statement

The volunteer BelmontGoesSolar.org (BGS) campaign has been the most successful program in Massachusetts. As a result, the program installer, Direct Energy Solar (DES) rewarded the Town by offering to install, at no charge, a small 13.2kW DC solar array on a Town-owned building of the Town's choice.

Site Selection

In early 2017, the Town's Energy Committee (EC) formed a subcommittee called the Solar Site Selection Subcommittee (SSSS) headed by Marty Bitner, to search for suitable locations. The subcommittee considered and evaluated seven sites on the basis of viability (space, structural, electrical, aesthetics) educational value, visibility, and production (see attached slide).

The subcommittee recommended the south-facing metal gym roof of the Chenery Middle School gym as the best option. The installer's site, structural and electrical assessments all determined that the Chenery location was a suitable option. Even though Chenery is 20 years old, the metal roof has a 50 year life. The panels will shade and protect the roof underneath it. The metal roof has a higher reflectance than the proposed array so any glare from the panels will be less than what abutters see now from the existing roof. The existing snow guards will prevent the snow from sliding off the roof all at once. The trees are also ideally positioned to protect abutter views without shading the panels (see attached slides).

Process

- Subcommittee chair Marty Bitner and Phil Thayer (BGS volunteer) attempted to contact all immediate abutters on Branchaud Rd, Carleton Rd, Chester Rd, Oakley Rd, and Selwyn Rd in the first two weeks of May 2017 to discuss the proposal and find out any concerns. They reached 6 abutters. Five supported the proposal and one was undecided. (see attached).
- Subcommittee chair Marty Bitner and Phil Thayer presented at the Chenery PTO meeting on May 17, 2017, which Principal McAllister also attended. Approximately fifteen parents attended the meeting all expressed support (see attached minutes).
- Gerald Boyle (Belmont Director of Facilities), Marty Bitner, Tom Eger (DES lead electrician), Martin Plass (BGS volunteer and mechanical engineer), Phil Thayer and Fred Domenici (Supervisor of Building Maintenance) met on the site on June 1 and 2, 2017 and made design enhancements to reduce visual impact and simplify installation.
- Phil Thayer presented to Finance Sub-Committee of the School Committee on June 6, 2017. They recommended to put an item on the agenda for the June 20, 2017 School Committee meeting.
- Marty Bitner and Phil Thayer presented to Board of Selectmen on June 19, 2017, who voted to accept the donated array, valued at \$50,000.(see attached gift letter)
- On June 20, 2017, the School Committee voted unanimously in favor of submitting an application to the Planning Board for a Full Site Plan Review. (See attached motion. Minutes not yet published)

- Marty Bitner and Phil Thayer hand delivered a survey to all 160 abutters on June 22, 2017. 15 responses were received by June 29 and all were supportive except two people who suggested instead to replace the metal roof with Tesla solar shingles whenever they become available. (see attached)
- Gerald Boyle, Marty Bitner and Phil Thayer held an abutter information session at the Chenery Community Room at 7pm on 6/28 and 6 abutters attended. The presentation showed views of the panels from vantage points. All attendees were supportive. See attached list of attendees.

Educational Benefits

The site offers educational opportunities for students to learn about the science and environmental benefits of solar. Solar production is viewable real-time from PCs in every classroom in every school. Data can be downloaded and analyzed. Teachers can design lessons around them. Phil Thayer has identified a Belmont resident who has designed solar curricula for schools.

Technical Details

- The panel racking will mount on the standing seams of the metal roof so that there will be no roof penetrations and there will be no risk of voiding the roof warranty; please see the attached plans for racking and conduit run.
- The cable is enclosed in grey Schedule 40 conduit (painted the background color at installation). The conduit is laid out on the roof to minimize visual impact from the ground. The conduit will rest on floating ballasts every 3' so there will be no roof penetrations. The weight of 400' of copper cable in the conduit holds the ballasts down. (see attached rendering)
- The DC to AC SolarEdge inverter is mounted on north side of the cupula so there is no visual impact from the ground. The inverter emits a hum at <25dBA, which is the noise level of a whisper. The hum is inaudible beyond ten feet. Any noise in any case be reflected northwards and westwards across the 100' span of roof. The hum will be inaudible inside the school.
- Conduit running down the southeast corner of building to behind the utility fence would be painted with a durable paint to match the background color. The only penetration of the building envelope is a 2" diameter hole next to the electrical meter.

Schedule and Installation

If approved by Planning Board and School Committee, construction would take place over a long-weekend such Thanksgiving, so as to not interfere with school operations. Panels, inverter, conduits, production, workmanship are all covered by a 20-year warranty. An unlikely "Act of God" event such as a tree branch damaging a panel would be covered by the existing town-wide insurance policy. A \$50K rider on the existing Town insurance policy would be required. Panels could be removed if needed with no impact to the roof. The removal cost would be covered by insurance. The panels are expected to degrade in production about 1%/year. Arrays installed 30 years ago are still producing today.

Financials

- In the DES gift letter presented to the by the Board of Selectmen it states “Understanding that the town has no line item in the budget for this gift, we want to make clear that this gift includes (but isn't limited to) the design and approval process costs, panel costs, installation costs, warranty costs, and post-installation costs such that the town will bear no costs related to this gift” (see attached)
- The expected additional annual premium cost based on total Town buildings value of >\$200M is expected to be zero.
- The revenue and saving from this array would help in a small way to relieve future tax increase pressure.
- The Town would realize \$83,000 in Solar Renewable Energy Certificate (SREC) income and utility savings over 20 years. SREC is a time-limited state sponsored incentive program. The Town will miss out on 10 years of annual SREC income totaling \$27,000 if the array is not installed by November 2017. In order to stay on schedule and prevent the loss of the potential SREC income stream, the petitioner asks that the Planning Board review this application on July 18, 2017.

Abutter Flyer

6/22/17

Dear Chenery Middle School Abutter,

We've talked to some of you already about this opportunity but we're reaching out more broadly now. Belmont received a free gift of a small solar panel array. Over 20 years, the solar panels will save the town about \$80,000. The south-facing gym roof is an ideal location due to its minimal visual impact, viability and educational value.

Your feedback is important to us. To learn more about this proposed project and express your support/concern, please go to www.tinyurl.com/CMS-FS21 or attend an info session at Chenery this coming Wednesday (6/28) at 7pm or call 617-855-8209. Thank you!

Marty Bitner

Chair of Solar Site Selection Sub-Committee of Belmont Energy Committee

Feedback from Abutters

Telephone Interviews with Immediate Abutters 5/1/17 - 5/16/17				
First Name	Last Name	Street Name	Support?	Comments
AARON	PIKCILINGIS	24 BRANCHAUD RD	Yes	Makes sense to me
ALEX	FARONI	26 BRANCHAUD RD	Yes	Saves money
JOHN	FEDIGAN	15 CARLETON RD	Yes	good idea
ARIANE	FRANK	179 OAKLEY RD	Yes	all in favor of it
AMY	QUIGLEY	2 SELWYN RD	Yes	I like that it will help to reduce taxes
MARIA	GEOVANOS	70 CHESTER RD	Undecided	

On-line survey responses from survey to all abutters (6/24-6/27)

First Name	Last Name	Street Name	Support?	Comments
Jay	Bonnar	61 Warwick Road	Yes	I have DES solar and it works great
Haskell	Werlin	3 Carleton Rd.	Yes	the town should do much more solar
Michelle	Faroni	26 Branchaud Rd	Yes	why would anyone oppose this?
Rajesh	Kasurirangan	3 Carleton Rd	Yes	
Markus	Greiner	60 Carleton Rd	Yes	what about solar on incenerator site?
Alice	Rushworth	55 Warwick Rd	Yes	great idea
Ayae	Takahashi	61 Warwick Road	Yes	
Jeremy	Seeger	148 Oakley Road	Yes	
Alex	Faroni	26 Branchaud Rd	Yes	Makes sense to me
Rebecca	Furth	3 Carleton Rd	Yes	in favor
Nancy	Greiner	60 Carleton Rd	Yes	
Rock	Pulak	55 Warwick Rd	Yes	
Carolyn	Fedigan	15 Carleton Rd	Yes	
David	Quigley	2 Selwyn Rd	Yes	
Stephan	Frank	179 Oakley Rd	Yes	in favor

Kimberly	Shaknis	148 Oakley Road	Yes	Please put panels front and center to maximize their effectiveness at producing solar energy. I am not concerned with hiding them, but rather with showcasing them as much as possible.
Sophia	Navickas	41 Carleton Road	No	
Leon	Navickas	76 Chester Rd	No	Technology is improving at a rapid pace. We will have much better solutions in a few years (e.g. see Elon Musk's solar roof tiles)

Info Session at Chenery (6/28)

First Name	Last Name	Street Name	Support?	Comments
Mary	Dominguez	22 West St	Yes	
Kenneth	Boghigian	10 Branchaud Road	Yes	Looks cut and dried to me
Jack	Jones	12-14 Branchaud Road	Yes	
Lena	Wong	11 Selwyn Rd	Yes	Why is the array sized as it is? What DES offered
Norma	Jones	12-14 Branchaud Road	Yes	make solar part of the curriculum. Contacting Elizabeth Baker, Chenery science coordinator
Jorge	Dominguez	22 West St	Yes	What is the plan for maintenance over 20 years? No maintenance required. System monitored by DES



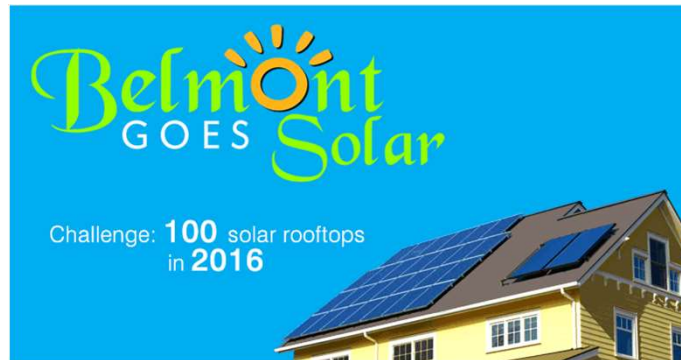
Proposal for Free Solar Panels on Cheney

Presentation to Planning Board

Gerald Boyle, Director of Facilities, Petitioner
Assisted by: Marty Bitner, member of Belmont Energy Committee, Chair of
the Energy Committee Solar Panel Site Selection sub-committee, TMM8
Phil Thayer, volunteer for BelmontGoesSolar.org, TMM6

7/18/17

What is Belmont Goes Solar?



Belmont volunteers running a group discount program to promote solar. BGS is supported by:

- Board of Selectmen
- Belmont Energy Committee
- Mothers Out Front
- Sustainable Belmont
- Belmont Light

2

Installer Rewards Town

Because Belmont Goes Solar campaign was so successful (260 installs as of 12/31/16. Thus, most successful program in MA):

- Belmont earned a **free \$50K** rooftop solar system installed **at no charge** on any town building of town's choosing.
- The 13.2kW DC system will consist of 44 LG 300W solar panels
- The electricity savings from the panels are expected to be about \$2,700 per year. SREC revenue is additional \$27K over 10 years (if installed by 11/17). Over 20 years, \$83K in savings and income.
- Sub-committee of town's Energy Committee formed in Jan '17 to search for suitable locations

3

Method Used to Evaluate Suitable Sites

Solar Site Selection Matrix

	Visibility	Educ. Value	Production	Viability	Sum
Chenery	3	3	3	3	12
Wellington	1	3	3	3	10
Beech St Center	2	2	3	-9	-2
Pool House	3	2	2	-9	-2
Substation	1	1	3	-9	-4
Belmont Light Building	1	1	2	-9	-5
Skating Rink	1	2	3	-9	-3

Scale: 1-3 where 1=Low and 3=High

Note: Viability (space,struct,elec,roof,aesthetics)

-9 = fatal flaw

4

Chenery is Leading Contender

- The installer site, structural and electrical assessments all positive (attached)
- Metal roof has 50 year life and can bear the weight of the panels
- Trees ideally positioned to protect abutter views
- Reflectance is lower than existing metal roof
- Abutters thus far contacted are overwhelmingly supportive
- Site offers educational opportunities for students to learn about the science and environmental benefits of solar. Teachers can design lessons around them. Production viewable from PCs in every classroom in every school.
- Chenery PTO and Principal McAllister are supportive
- Reduces Chenery utility expenses which helps to relieve tax increase pressure.

5

Installer's Proposed Design



6

Solar Potential is bright yellow which is excellent. Bartlett Pear trees in front have reached their adult height so no future shading of array.



7

The existing metal roof has a higher reflectance than the proposed array

SECTION 1

The reflection/refraction behavior of a medium is directly related to its index of refraction. The lower the index of refraction for a medium, the less light it reflects because the medium is allowing more of the incident beam to pass directly through (in our case, directly through the glass to the solar cells). The following list and graphical representation are one-to-one in the order of a materials' representation;

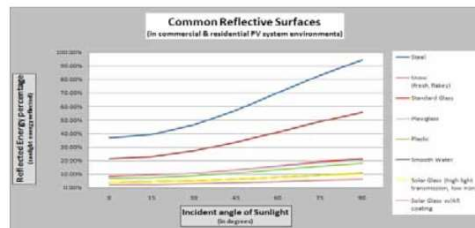


Figure 2.4: Common Reflective Surfaces and reflectance percentages.

Common Reflective Surfaces (in surrounding environments for PV systems)	
n	
2.500	Steel
1.980	Mirror (high light transmission, low cost)
1.517	Standard Glass
1.500	Plastic
1.460	Plastic
1.333	Smooth Water
1.329	Solar Glass (high light transmission, low cost)
1.250	Solar Glass with coating

Figure 2.3: Common Reflective Surfaces and Index of Refraction, "n" (the value "n" may vary by reference source, but the hierarchy of "n" values from one material to another will remain the same).

8

Trees Protect Abutters' Views



9

View from 24 Branchaud Rd (circle #1)



10

View from 49 Carleton Rd (circle #1)



11

View from 72 Chester Rd (circle #2)



12

View from back of 174 Oakley Rd (circle #2)



13

View from 159 Oakley Rd (south of circle #3)



14

View from 165 Oakley Rd (south of circle #3)



15

View from 2 Selwyn Rd (circle #3)



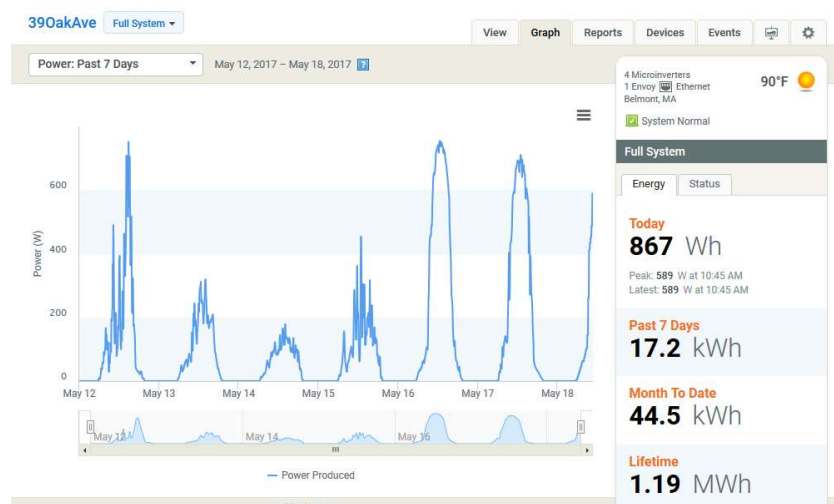
16

View from 5 Selwyn Rd (circle #3)



17

Students can view solar production from any PC town-wide real-time and download data to analyze

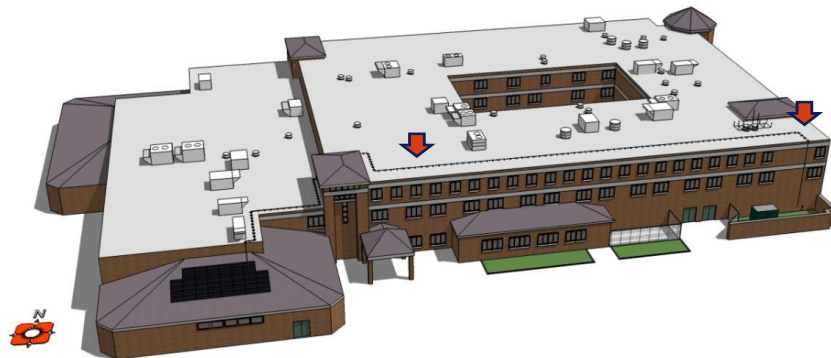


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Design/Installation Details

Proposed Design showing conduit path running east along south edge of upper roof

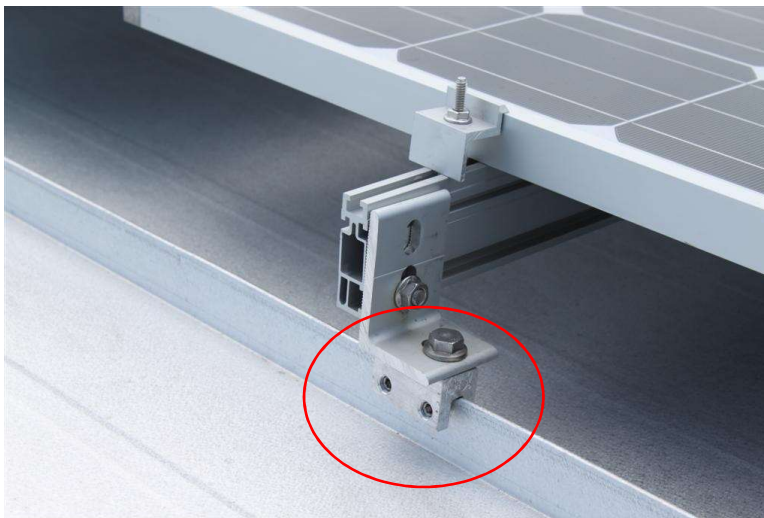


View from ground level looking up at bottom edge of gym roof. Standing seams on metal roof circled.



21

Close-up of typical rack mount showing how it clamps onto standing seam. Thus no roof penetrations.



22

Cable will be in grey conduit (painted brick red after installation) attached to brick façade and runs up to flat roof. Conduit laid out on roof to minimize visual impact from the ground.



23

View of cable in conduit (painted brick red after installation) coming from array leading onto roof. Photo showing trees which block view from the ground but won't shade the array. Cupola in upper right.



24

Conduit to be secured to these floating ballasts every 3 feet. Thus no roof penetrations and no impact on roof warranty.



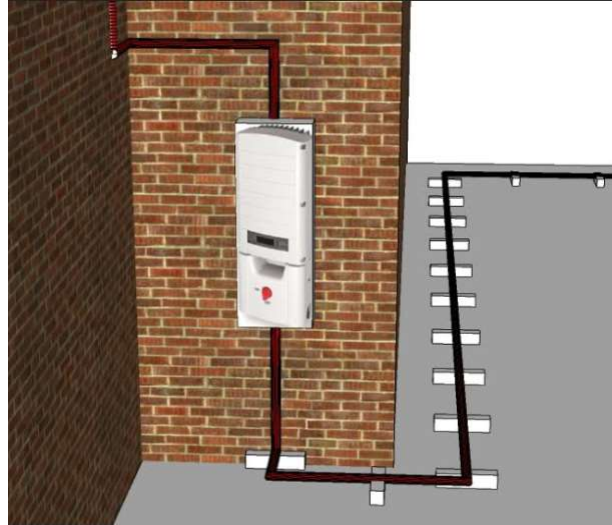
25

View from north side of cupola looking south



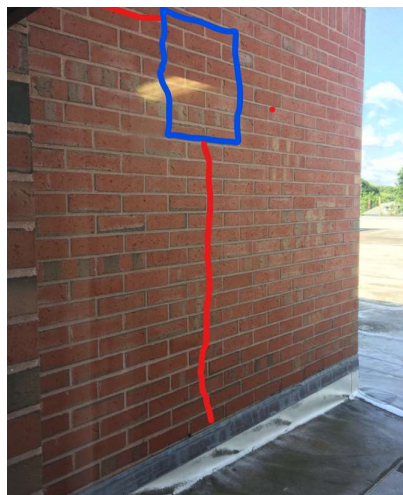
26

Inverter placement on north side of cupola



27

From the 2nd floor hallway and thru the window, students can see the inverter in action



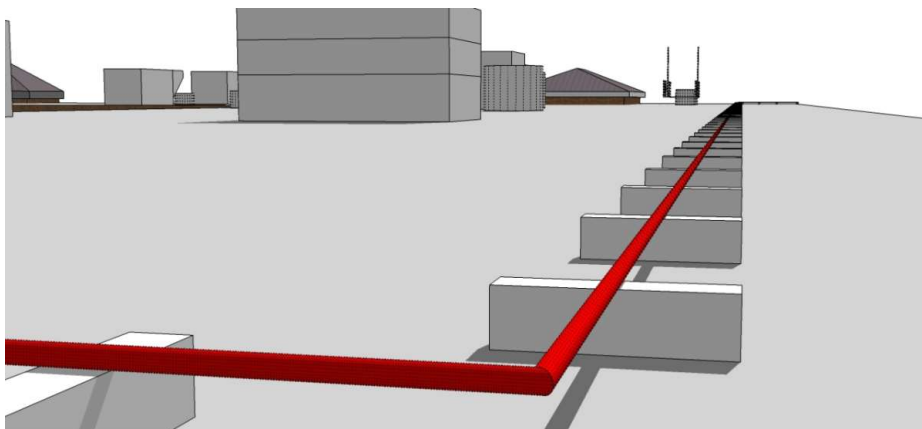
28

Conduit (grey not red) around cupola



29

Straight run of ballasted conduit (grey not red) from cupola heading due east to far SE corner of building



30

Conduit (painted background color) at SE corner (parking lot side of building) running down and into a locked utility enclosure and into wall to the left of electric meter



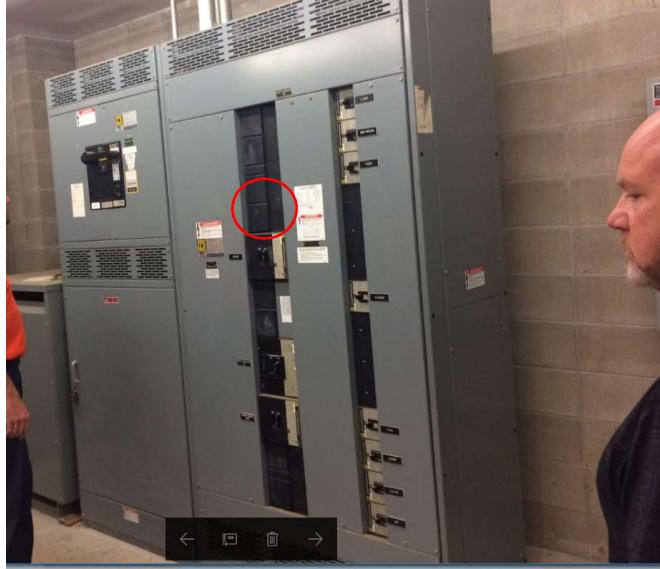
31

Conduit comes through wall and into utility room on the other side and into the free-standing power panel. This conduit is parallel to existing meter conduit behind it. This 2" diameter hole is the only building envelope penetration for the whole installation.



32

Front of power panel. Available slot circled. Fred Domenici, Supervisor of BPS Building Maintenance, on the right.



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Notes

- 20 year warranties on panels, inverters and workmanship
- Panels come with a production guarantee
- Panels have textured anti-reflective surface
- Panels shade and protect roof underneath
- All electrical production expected to be consumed on the premises
- Installer will bear all the costs of pre- and post- installation
- Installer will file all paperwork to apply for the SREC allocation
- No additional costs foreseen to existing insurance policy
- Installation could take place on a long weekend so as to not interfere with school operations

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Steps to Approval

- Get input from interested parties 5/17 (some abutters, PTO, Principal - done)
- Present to Finance Sub-committee of School Committee 6/6 (done)
- BOS accepted the free gift 6/19 (done)
- School Committee voted to allow application for FSPR 6/20 (done)
- Outreach to 160 abutters around entire school perimeter 6/22 (done)
- Info session for abutters at Chenery on 6/28 (done)
- Application for Full Site Plan Review to the Planning Board on 6/30 (done)
- Full Site Plan Review by Planning Board in the summer
- Public hearings are part of Full Site Plan Review
- If Planning Board votes in favor then School Committee votes final approval

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Questions or Comments?

Thank you for your time and consideration

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June 12, 2017

To: Belmont Goes Solar
20 Highland Road
Belmont, MA 02478
BelmontGoesSolar.org
617-855-8209

From: Eric Collins
Project Manager
P [508-259-2268](tel:508-259-2268)
F [508-302-7994](tel:508-302-7994)
E eric.collins@directenergysolar.com
5 Lyberty Way, Room 3
Westford, MA 01886
www.directenergysolar.com
YOUR SUN. YOUR POWER. YOUR WAY

Whereas the Belmont Goes Solar campaign exceeded first its 100 home goal and then its 200 home goal and now stands at 260 homes making it the most successful program in MA to date, we, Direct Energy Solar, hereby award and commit to installing a 13.2kW DC array on a town-owned building of the town's choice. Understanding that the town has no line item in the budget for this gift, we want to make clear that this gift includes (but isn't limited to) the design and approval process costs, panel costs, installation costs, warranty costs, and post-installation costs such that the town will bear no costs related to this gift. Congratulations on exceeding your program goals and on a job well done.

Regards,

A handwritten signature in black ink, appearing to read "Eric Collins", is written over a horizontal line.

Eric Collins
Project Manager

Financial Statement

Chenery Middle School - Proposed Solar Array
P. Thayer - 6-27-2017
Source: PVWatts: Monthly PV Performance Data
Requested Location: 95 Washington St, Belmont, MA 02478
Nearest Weather Data Location: BOSTON, MA
Lat (deg N): 42.37
Long (deg W): 71.03
DC System Size (kW): 13.2
Module Type: Premium
Array Type: Fixed (open rack)
Array Tilt (deg): 14
Array Azimuth (deg): 180
System Losses: 14
Invert Efficiency: 96
DC to AC Size Ratio: 1.1
Average Cost of Electricity Purchased from: 0.13
Capacity Factor (%) 14.7

Calculate System Losses Breakdown

Modify the parameters below to change the overall System Losses percentage for your system.

Soiling (%):

Shading (%):

Snow (%):

Mismatch (%):

Wiring (%):

Connections (%):

Light-Induced Degradation (%):

Nameplate Rating (%):

Age (%):

Availability (%):

Estimated System Losses:
14.08%

		Plane of Array					
		AC System	Solar Radiation	Irradiance	DC array Output		
Month	Output(kWh)	(kWh/m^2/day)	(W/m^2)	(kWh)	Value (\$)		
1	866.4	2.5	\$ 77	911.0	\$ 112.63		
2	1,088.1	3.4	\$ 96	1,139.9	\$ 141.46		
3	1,486.0	4.3	\$ 134	1,555.4	\$ 193.18		
4	1,620.6	4.9	\$ 148	1,696.5	\$ 210.68		
5	1,891.1	5.8	\$ 178	1,978.8	\$ 245.85		
6	1,891.0	6.1	\$ 183	1,978.4	\$ 245.84		
7	1,968.1	6.2	\$ 191	2,058.3	\$ 255.86		
8	1,849.6	5.8	\$ 179	1,933.3	\$ 240.44		
9	1,500.6	4.8	\$ 143	1,570.4	\$ 195.08		
10	1,279.2	3.8	\$ 119	1,339.1	\$ 166.29		
11	799.4	2.4	\$ 73	842.6	\$ 103.92		
12	737.7	2.1	\$ 66	777.5	\$ 95.90		
Total	16,978.0	52.1	\$ 1,587	17,781.3	\$ 2,207.13		

Economic Savings Calculation:

Value per kWh (\$) \$ 0.13 (mix of 11c feedback and 18c town rate)
Degradation/Year 0.50%
Elec. Price Increase/Year 3.00%

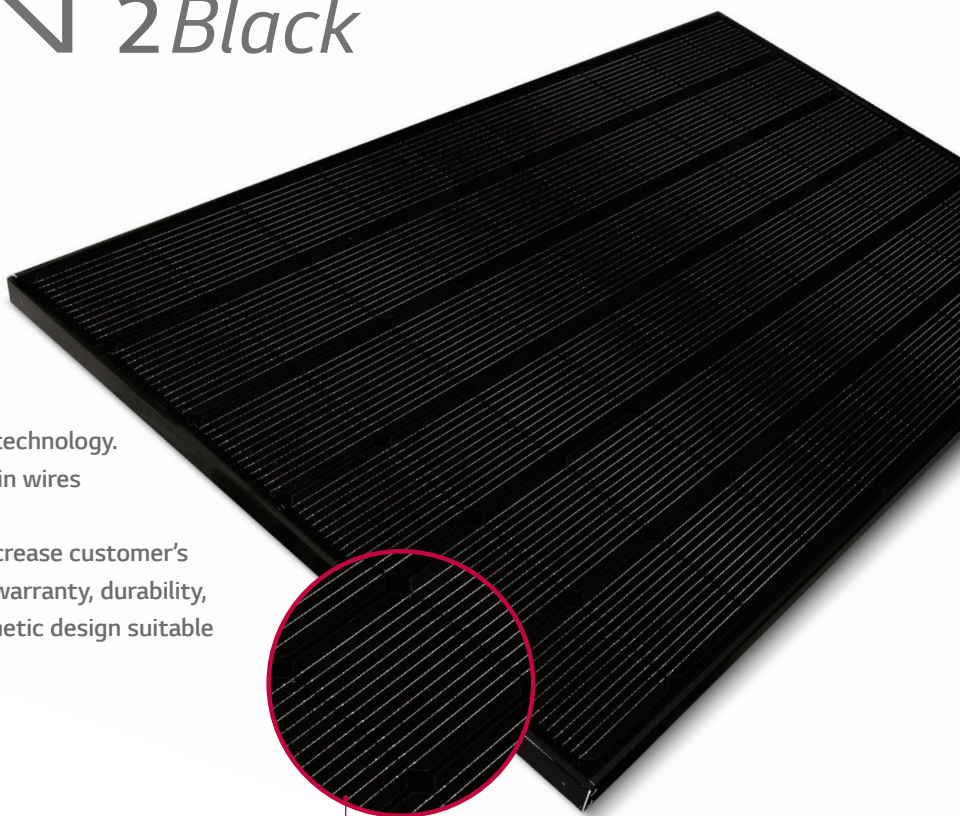
				SRECs Bid Price			
				after 5% Fee at		Proj. SREC	Proj, Total
Year	FY	Production (kWh)	Elec. Savings	80%		Income	Savings
1	2018	16,978	\$ 2,207	\$206	\$	3,497	\$ 5,705
2	2019	16,893	\$ 2,262	\$195	\$	3,294	\$ 5,556
3	2020	16,809	\$ 2,319	\$185	\$	3,110	\$ 5,428
4	2021	16,725	\$ 2,377	\$176	\$	2,944	\$ 5,320
5	2022	16,641	\$ 2,436	\$168	\$	2,796	\$ 5,232
6	2023	16,558	\$ 2,497	\$159	\$	2,633	\$ 5,130
7	2024	16,475	\$ 2,560	\$151	\$	2,488	\$ 5,047
8	2025	16,393	\$ 2,624	\$144	\$	2,361	\$ 4,984
9	2026	16,311	\$ 2,689	\$137	\$	2,235	\$ 4,924
10	2027	16,229	\$ 2,756	\$130	\$	2,110	\$ 4,866
11	2028	16,148	\$ 2,825				\$ 2,825
12	2029	16,067	\$ 2,896				\$ 2,896
13	2030	15,987	\$ 2,968				\$ 2,968
14	2031	15,907	\$ 3,043				\$ 3,043
15	2032	15,827	\$ 3,119				\$ 3,119
16	2033	15,748	\$ 3,197				\$ 3,197
17	2034	15,670	\$ 3,277				\$ 3,277
18	2035	15,591	\$ 3,358				\$ 3,358
19	2036	15,513	\$ 3,442				\$ 3,442
20	2037	15,436	\$ 3,528				\$ 3,528
20 Year Total		323,904	\$ 56,381		\$	27,466	\$ 83,846
21	2038	15,358	\$ 3,617				\$ 3,617
22	2039	15,282	\$ 3,707				\$ 3,707
23	2040	15,205	\$ 3,800				\$ 3,800
24	2041	15,129	\$ 3,895				\$ 3,895
25	2042	15,054	\$ 3,992				\$ 3,992
26	2043	14,978	\$ 4,092				\$ 4,092
27	2044	14,903	\$ 4,194				\$ 4,194
28	2045	14,829	\$ 4,299				\$ 4,299
29	2046	14,755	\$ 4,407				\$ 4,407
30	2047	14,681	\$ 4,517				\$ 4,517
30 Year Total		474,079	\$ 96,899		\$	27,466	\$ 124,365

LG NeON™ 2 Black

LG300N1K-G4

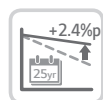
60 cell

LG's new module, NeON™ 2 Black, adopts Cello technology. Cello technology replaces 3 busbars with 12 thin wires to enhance power output and reliability. NeON™ 2 Black demonstrates LG's efforts to increase customer's values beyond efficiency. It features enhanced warranty, durability, performance under real environment, and aesthetic design suitable for roofs.



Cello Technology

Key Features



Enhanced Performance Warranty

LG NeON™ 2 Black has an enhanced performance warranty. The annual degradation has fallen from -0.7%/yr to -0.6%/yr. Even after 25 years, the cell guarantees 2.4%p more output than the previous NeON™ modules.



Aesthetic Roof

LG NeON™ 2 Black has been designed with aesthetics in mind; thinner wires that appear all black at a distance. The product can increase the value of a property with its modern design.



Better Performance on a Sunny Day

LG NeON™ 2 Black now performs better on a sunny days thanks to its improved temperature coefficient.



High Power Output

Compared with previous models, the LG NeON™ 2 Black has been designed to significantly enhance its output efficiency making it efficient even in limited space.



Outstanding Durability

With its newly reinforced frame design, LG has extended the warranty of the NeON™ 2 Black for an additional 2 years. Additionally, LG NeON™ 2 Black can endure a front load up to 6000 Pa, and a rear load up to 5400 Pa.



Double-Sided Cell Structure

The rear of the cell used in LG NeON™ 2 Black will contribute to generation, just like the front; the light beam reflected from the rear of the module is reabsorbed to generate a great amount of additional power.

About LG Electronics

LG Electronics is a global big player, committed to expanding its operations with the solar market. The company first embarked on a solar energy source research program in 1985, supported by LG Group's vast experience in the semi-conductor, LCD, chemistry and materials industries. In 2010, LG Solar successfully released its first MonoX® series to the market, which is now available in 32 countries. The NeON™ (previous MonoX® NeON) and The NeON™2 won the "Inter-solar AWARD" in 2013 and 2015, which demonstrates LG Solar's lead, innovation and commitment to the industry.

LG300N1K-G4

LG NeON™ 2Black

Mechanical Properties

Cells	6 x 10
Cell Vendor	LG
Cell Type	Monocrystalline / N-type
Cell Dimensions	156.75 x 156.75 mm / 6 inches
# of Busbar	12 (Multi Wire Busbar) 
Dimensions (L x W x H)	1640 x 1000 x 40 mm
Front Load	6000 Pa 
Rear Load	5400 Pa 
Weight	17.0 ± 0.5 kg
Connector Type	MC4, MC4 Compatible, IP67
Junction Box	IP67 with 3 Bypass Diodes
Length of Cables	2 x 1000 mm
Glass	High Transmission Tempered Glass
Frame	Anodized Aluminum

Certifications and Warranty

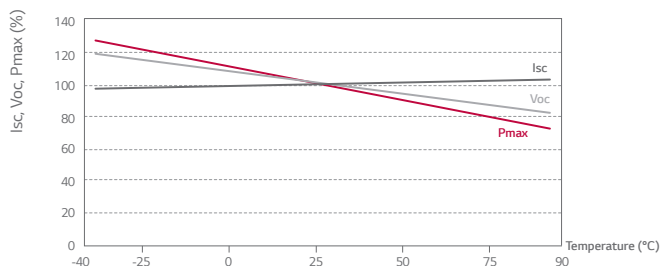
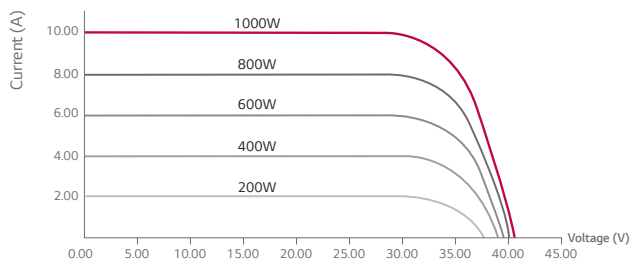
Certifications	IEC 61215, IEC 61730-1/-2
	IEC 62716 (Ammonia Test)
	IEC 61701 (Salt Mist Corrosion Test)
	UL 1703
	ISO 9001
Module Fire Performance	Type 2 (UL 1703)
Product Warranty	12 Years 
Output Warranty of Pmax	Linear Warranty* 

* 1) 1st year: 98%, 2) After 2nd year: 0.6%p annual degradation, 3) 83.6% for 25 years

Temperature Characteristics

NOCT	46 ± 3 °C
Pmax	-0.38 %/°C 
Voc	-0.28 %/°C
Isc	0.03 %/°C

Characteristic Curves



Electrical Properties (STC*)

Module Type	300 W
MPP Voltage (Vmpp)	32.5
MPP Current (Impp)	9.26
Open Circuit Voltage (Voc)	39.7
Short Circuit Current (Isc)	9.70
Module Efficiency (%)	18.3
Operating Temperature (°C)	-40 ~ +90
Maximum System Voltage (V)	1000
Maximum Series Fuse Rating (A)	20
Power Tolerance (%)	0 ~ +3

* STC (Standard Test Condition): Irradiance 1000 W/m², Module Temperature 25 °C, AM 1.5

* The nameplate power output is measured and determined by LG Electronics at its sole and absolute discretion.

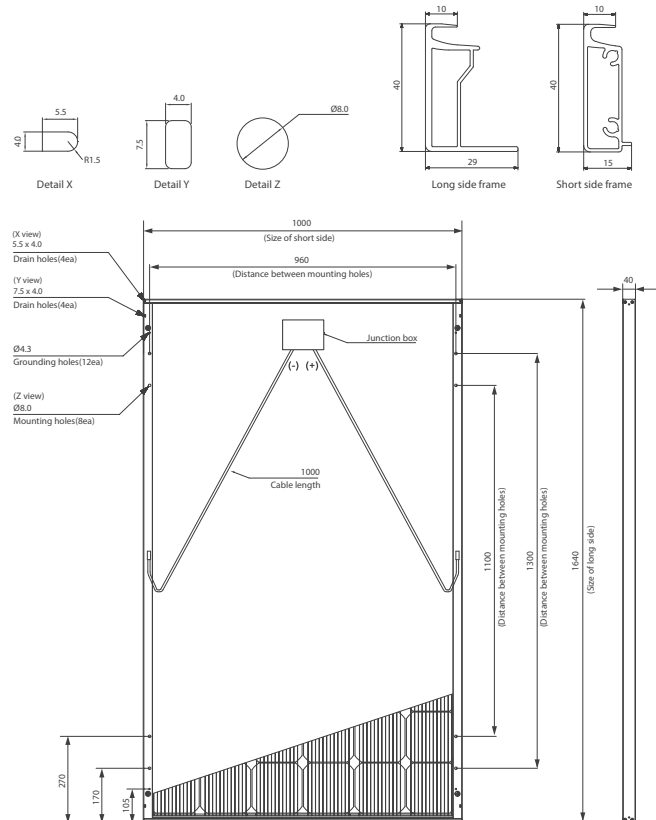
* The typical change in module efficiency at 200 W/m² in relation to 1000 W/m² is -3.0%.

Electrical Properties (NOCT*)

Module Type	300 W
Maximum Power (Pmax)	218
MPP Voltage (Vmpp)	29.5
MPP Current (Impp)	7.38
Open Circuit Voltage (Voc)	36.5
Short Circuit Current (Isc)	7.83

* NOCT (Nominal Operating Cell Temperature): Irradiance 800 W/m², ambient temperature 20 °C, wind speed 1 m/s

Dimensions (mm)



* The distance between the center of the mounting/grounding holes.





SolarEdge Single Phase Inverters-16A

SE3000(*) (**) / SE3500(*) (**) / SE4000-16A



INVERTERS

Specifically designed to work with power optimizers

- Superior efficiency (97.6%)
- Small, lightweight and easy to install
- Built-in module-level monitoring
- Internet connection through Ethernet or Wireless
- IP65 – Outdoor and indoor installation
- Fixed voltage inverter, DC/AC conversion only
- Compatible with the StorEdge Interface for Smart Energy Management StorEdge™ applications



Single Phase Inverters - 16A

SE3000⁽¹⁾⁽²⁾ / SE3500⁽¹⁾⁽²⁾ / SE4000-16A

	SE3000 ⁽¹⁾⁽²⁾	SE3500 ⁽¹⁾⁽²⁾	SE4000-16A	
OUTPUT				
Rated AC Power Output	3000	3500	3680	VA
Maximum AC Power Output	3000	3500	4000	VA
AC Output Voltage (Nominal)	220 / 230			Vac
AC Output Voltage Range	184 - 264.5			Vac
AC Frequency (Nominal)	50 / 60 ± 5			Hz
Maximum Continuous Output Current	16			A
Residual Current Detector / Residual Current Step Detector	300 / 30			mA
Utility Monitoring, Islanding Protection, Country Configurable Thresholds	Yes			
Input				
Maximum DC Power (Module STC)	4050	4700	5400	W
Transformer-less, Ungrounded	Yes			
Maximum Input Voltage	500			Vdc
Nominal DC Input Voltage	350			Vdc
Maximum Input Current	11.5	13.5	15.5	Adc
Reverse-Polarity Protection	Yes			
Ground-Fault Isolation Detection	600k Ω Sensitivity			
Maximum Inverter Efficiency	97.6			%
European Weighted Efficiency	97.5			%
Nighttime Power Consumption	< 2.5			W
ADDITIONAL FEATURES				
Supported Communication Interfaces ⁽³⁾	RS485, Ethernet, ZigBee (optional), Wi-Fi (optional), Built-in GSM (optional)			
Smart Energy Management	Export Limitation, StorEdge applications			
Standard Compliance				
Safety	IEC-62103 (EN50178), IEC-62109			
Grid Connection Standards	VDE 0126-1-1, VDE-AR-N-4105, AS-4777, RD-1663 , DK 5940			
Emissions	IEC61000-6-2, IEC61000-6-3, IEC61000-3-11, IEC61000-3-12, FCC part15 class B			
RoHS	Yes			
Installation Specifications				
AC Output	Cable Gland - diameter 9-16			mm
DC Input	1 MC4 pair			
Dimensions (HxWxD)	540 x 315 x 172	540 x 315 x 191		mm
Weight	20.2	21.7		kg
Cooling	Natural Convection			
Noise	<25			dBA
Operating Temperature Range	-20 - +50 (M40 version -40 - +50)			°C
Protection Rating	IP65 - Outdoor and Indoor			
Bracket Mounted (Bracket Provided)				

⁽¹⁾ SE3000-GBR & SE3500-GBR for United Kingdom

⁽²⁾ SE3000 & SE3500 for Denmark, Ireland, Latvia, Portugal and Poland should be set to country code DEN, IRL, LAT, PRT or POL respectively to limit to 16A. For other countries contact SolarEdge

⁽³⁾ Refer to Datasheets -> Communications category in Downloads page for specifications of optional communication options: <http://www.solaredge.com/groups/support/downloads>



SAMPLE



Direct Energy Solar Residential Installation Contract

TERMS AND CONDITIONS

1. Contract Inclusions:

- a. Appropriately Sized and Rated Solar Edge Inverter System (1 per panel);
- b. Monitoring Device and Monitoring for Duration of Solar Edge Inverter System Warranty;
- c. System Design and Engineering by a NABCEP Certified Solar Installer;
- d. All Standard Installation Components;
- e. Installation Services and Labor Performed by Direct Energy Solar Employees with all Electrical Work Supervised by a Master Electrician;
- f. All Permitting Applications, Costs and Permit Service Fees;
- g. Permit Inspection Oversight and Scheduling;
- h. Assistance with Homeowners Associations and Historic Preservation Approval Processes (if applicable);
- i. Utility Company Interconnection Application, Oversight and Meter Replacement Scheduling;
- j. State and Local Rebate/Grant Applications Preparation and Processing (if applicable);
- k. Solar Renewable Energy Credit Applications Preparation and Processing (if applicable);
- l. Solar System Remote Monitor Set-up and Training;
- m. Solar System Training and Orientation; and
- n. Any Other Inclusions Set Forth in an Addendum if Applicable.

2. Warranties and Guarantees:

- a. 20 Year Direct Energy Solar Limited Warranty on Parts and Labor on Installation;
- b. 20 Year Direct Energy Solar Limited Production Warranty;
- c. 20 Year Direct Energy Solar System Moving Guarantee;
- d. 20 Year Direct Energy Solar New Roof Guarantee;
- e. Limited Manufacturer's Warranty on Solar Module Performance; and
- f. Limited Manufacturer's Warranty on Solar Edge Inverter System.

3. Operational Date. Defined as the date upon which, pursuant to applicable law, Customer has received all applicable building and electrical permits, and the photovoltaic solar energy system (the "System") is authorized to produce electricity.

4. System Design Guarantee. Direct Energy Solar will install the System at the Property (the "Installation") in the areas to be marked on a diagram to be approved by Customer prior to beginning work.

5. Site Conditions/Preparations. If after the Installation has commenced, Direct Energy Solar discovers unanticipated site conditions that will increase the cost to perform the Installation, at Customer's choice, (a) Direct Energy Solar may unilaterally rescind this Contract with no liability to Direct Energy Solar whatsoever and Direct Energy Solar shall refund all deposits paid to Direct Energy Solar reduced by any expenses actually incurred; or (b) if Customer and Direct Energy Solar agree, the Contract price may be renegotiated to reflect the true cost of the Installation. Customer is responsible for removing and replacing appliances, floor coverings, and any other obstacles or hazards required to perform the Installation. Direct Energy Solar is not responsible for replacement of or damage to these items if they are removed by Direct Energy Solar.

6. Customer Obligations. Customer agrees to: (a) notify Direct Energy Solar immediately upon discovery of an emergency condition relating to the System, damage to the System, or theft of the System; (b) notify Direct Energy Solar within twenty-four (24) hours if Customer discovers that any component of the System is not producing electricity; (c) only have the System repaired pursuant to the Limited Warranty (as defined herein); (d) not modify the Property in a way that shades the System; (e) keep trees and bushes trimmed so that the System receives as much sunlight as it did at Installation; (f) not do anything, permit or allow to exist any condition or circumstance at the Property which would cause the System not to operate as intended; and (g) permit Direct Energy Solar, after providing reasonable notice, to inspect the System for proper operation, and to make any necessary repairs. Customer agrees to not make any modifications, improvements, revisions or additions to the System or take any other action that could void the Limited Warranty (as defined herein) without Direct Energy Solar's prior written consent. In the event that Customer fails to comply with the provisions of this paragraph, Customer's Limited Warranty and Limited Production Warranty shall be automatically voided.

SAMPLE



Direct Energy Solar Residential Installation Contract

7. Liability. Direct Energy Solar assumes no liability for damage to: improperly installed, improperly maintained, defective, old, or deteriorated roof coverings or supports; siding; exterior covering or paint; underground pipes; sewer or drain lines; tanks; or any other non-visible installations. Direct Energy Solar's liability shall be limited to the Installation area specified in the System Design Guarantee. Direct Energy Solar shall not be liable for damage to deteriorated or improperly installed sub-roof or roofing within the serviced area. IN NO EVENT SHALL DIRECT ENERGY SOLAR BE LIABLE FOR CONSEQUENTIAL, INCIDENTAL, PUNITIVE, EXEMPLARY, SPECIAL OR INDIRECT DAMAGES OR LOSSES RELATING TO THIS CONTRACT. TO THE EXTENT PERMITTED BY LAW, DIRECT ENERGY SOLAR'S TOTAL LIABILITY UNDER THIS CONTRACT, TO THE EXTENT NOT COVERED BY INSURANCE, SHALL NOT EXCEED THE SOLAR SYSTEM NET COST LISTED ON THE FIRST PAGE OF THIS CONTRACT. Customer is encouraged to increase the dwelling coverage on any homeowner's policy to ensure adequate insurance for the System.

8. Insurance. Direct Energy Solar will carry liability insurance covering personal injury in an amount not less than \$1,000,000, and insurance covering property damage caused by the work of a home improvement contractor in an amount not less than \$3,000,000. Direct Energy Solar's current property damage insurance policy limit is \$10,000,000. Direct Energy Solar's current personal injury insurance policy limit is \$10,000,000.

9. Past Due Payment Policy. Unless otherwise agreed to in writing by Direct Energy Solar, Customer understands that payment in full is due at final inspection and approval of all permits related to the Installation. An interest charge of two percent (2%) per month will be charged on any outstanding balance not paid by such date. In the event the account is turned over to an attorney for collection, Customer shall pay interest charges and reasonable attorney's fees allowed by the law. There is a \$50.00 return check charge.

10. Entire Agreement. This Contract cannot be modified or discharged orally unless consent in writing is made by Direct Energy Solar and Customer (the "Parties"), and this Contract shall be binding upon the heirs, successors, and assigns of the Parties. This Contract supersedes all agreements previously made between the Parties. There are no other understandings or agreements. If there is an addendum to this Contract, the terms of that addendum supersede any and all contrary terms in this Contract. Any changes to the terms and conditions of this Contract must be approved in writing by a sales manager. Unless otherwise agreed to in writing by Direct Energy Solar, the Installation does not include roof repair or replacement; painting, drywall repair, trench digging, engineering and/or main structure reinforcement costs; civil work; electrical panel upgrades; any upgrades to utility-owned equipment required by applicable interconnection standards; or the repair of any pre-existing electrical equipment or code violations required by municipal code, applicable law or inspectors necessary to approve inspection of the System, but not directly related to the work performed by Direct Energy Solar to install the System, or anything else not clearly specified in this Contract.

11. Force Majeure. Neither Customer nor Direct Energy Solar will be in default of this Contract for any delay or failure in the performance under this Contract if the delay or failure is due to Force Majeure. Force Majeure includes acts of God such as storms, fires, floods, lightning and earthquakes, war, riot, acts of a public enemy or other civil disturbance, or a strike, walkout, lockout or other significant labor dispute. Force Majeure does not include economic hardship of either Customer or Direct Energy Solar, a power grid failure (except if caused directly by a Force Majeure event), a failure or delay in the granting of permits, or insufficiency, unavailability, failure, or diminishment of solar resources, except as a result of an event that would otherwise qualify as a Force Majeure. Force Majeure cannot be attributable to fault or negligence on the part of the Party claiming Force Majeure and must be caused by things beyond that Party's reasonable control.

12. Notice Concerning Nonpublic Personal Information ("NPI"). "We", "us" or "our" as used herein shall mean Direct Energy Solar and/or an Affiliate. An "Affiliate" includes all companies related to us by common ownership or control. They can be financial and nonfinancial companies. Our Affiliates include the Direct Energy brand family of companies. "Nonaffiliates" are companies not related by common ownership or control. They can be financial or nonfinancial companies. We do not share your NPI with Nonaffiliates under this Agreement for marketing purposes. We may share certain aspects of your NPI with our partners in connection with any shared renewables program, for assistance in processing the transaction hereunder and the ongoing servicing of your account with us. The types of NPI we collect and share depends on the product or service you have with us. NPI can include: Social Security Number, income, account balances, payment history, account transactions, and credit card or other debt. Companies may choose how they share your NPI. Federal and/or state laws gives consumers the right to limit some but not all sharing. Federal and/or state laws also requires us to tell you how we collect, share, and protect your NPI. Please read this notice carefully to understand what we do.

Your NPI may be shared in the following instances: (i) for our everyday business purposes (i.e. – to process this transaction, maintain your account, respond to court orders or legal investigations, or report to credit bureaus) (ii) for our marketing purposes to

SAMPLE



offer our products and/or services to you, (iii) for joint marketing with other financial companies; (iv) for an Affiliate's everyday business purposes (i.e. – information about your transactions and experiences), (v) for an Affiliate's everyday business purposes (i.e. – information about your creditworthiness), (vi) for an Affiliate to market to you and (vii) for Nonaffiliates to market to you. By using our products and services, or by submitting your NPI to us, you are consenting to the terms of this notice and our privacy policy located at <https://www.directenergy.com/privacy-policy>.

TO LIMIT OUR SHARING: Federal and/or state laws give you the right to limit our sharing of your NPI only with respect to (i) sharing with Affiliates for their everyday business purposes (i.e. – information about your creditworthiness); (ii) sharing with Affiliates in order to market products and/or services to you; and (iii) sharing with Nonaffiliates in order to market products and/or services to you. If you limit our sharing with respect to an account you hold jointly with a third party, your NPI sharing choices will apply to each party on the account unless you expressly indicate otherwise. Please note that if you are a *new* customer, we can begin sharing your information 30 days from the date you receive this notice. When you are *no longer* our customer, we can continue to share your information as described herein. If you would like to limit our use of your NPI as described above, you may request so in writing at Direct Energy, LP, 12 Greenway Plaza, Ste 250, Houston, TX 77046, Attn: Privacy Officer, c/o Compliance Department or by email at privacy@directenergy.com.

SAMPLE



Direct Energy Solar Residential Installation Contract

WARRANTIES AND GUARANTEES

1. Limited Warranty. Direct Energy Solar warrants that, under normal use and service conditions, the System will be free from defects in workmanship or defects in materials or components for Twenty (20) years following the date of Installation (this "Limited Warranty"). This Limited Warranty covers installation hardware, brackets and supports, and all other components not covered by a manufacturer's warranty. This Limited Warranty includes servicing Customer's manufacturers' warranties free of charge. If a defect is discovered, Direct Energy Solar will, at no additional cost to Customer, provide such labor and materials as required to restore the System to its originally installed state. If Direct Energy Solar finds problems in an area that have not been caused by the Installation, or if the problems are not an actual problem of the System (e.g. shade or un-authorized alterations to the System), Customer will pay for any new parts and materials, and Direct Energy Solar reserves the right to charge Customer a service charge of \$100 per hour with the minimum service charge equal to \$200.

This Limited Warranty does not cover: power outages; Force Majeure; damage caused by unforeseeable events; or normal wear and tear of the roof or other site of the System, sub-structure, siding, plumbing or electrical work not related to the System. This Warranty does not cover any problems caused by improper maintenance of the System or any other improper action by any party other than Direct Energy Solar. No work will be done under the terms of this Limited Warranty if Customer is delinquent in payments under this Contract.

2. Roof Warranty. Direct Energy Solar warrants any damage to Customer's roof within a five (5) inch radius of roof penetrations during Installation for the length of any existing installation warranty or new home builder performance standard for Customer's roof, whichever is greater.

3. LIMITATION ON WARRANTY. EXCEPT AS EXPRESSLY PROVIDED HEREIN OR IN ANY ADDITIONAL WARRANTY DIRECT ENERGY SOLAR PROVIDES, DIRECT ENERGY SOLAR MAKES NO WARRANTY OR REPRESENTATION, EITHER EXPRESS OR IMPLIED, REGARDING THE SYSTEM, INCLUDING ANY WARRANTIES OF MERCHANTABILITY OR FITNESS, AND TO THE MAXIMUM EXTENT PERMITTED BY LAW, ANY AND ALL IMPLIED WARRANTIES ARE EXPRESSLY DISCLAIMED.

4. Limited Production Warranty. For Twenty (20) years starting on the first day of the first month after the Operational Date (the "Warranty Start Date"), Direct Energy Solar guarantees that the System will generate the guaranteed annual kilowatt-hours (kWh) ("Guaranteed Annual kWh") of energy set forth in Exhibit B, provided that Customer complies with the terms of this Contract (this "Limited Production Warranty"). If the System does not generate the Guaranteed Annual kWh during any twelve-month period commencing on the Warranty Start Date or any anniversary of the Warranty Start Date (each, a "Contract Year"), after adjusting for any carry forward of excess production from prior years as provided for below, Direct Energy Solar will, within thirty (30) days after the end of such Contract Year, mail to Customer a payment equal to the product of the annual imputed energy payment per kilowatt-hour during the Contract Year (as specified in Exhibit B) multiplied by the difference between the Actual Annual kWh (as defined herein) for the Contract Year and the Guaranteed Annual kWh; provided, however, that prior to making such calculation, the Guaranteed Annual kWh shall be reduced by any lost electric production of the System during the Contract Year for which Direct Energy Solar is not liable, as provided above. SUCH PAYMENT TO CUSTOMER WILL CONSTITUTE CUSTOMER'S SOLE AND EXCLUSIVE REMEDY WITH RESPECT TO PERFORMANCE OF THE SYSTEM AND ANY POWER GENERATION SHORTFALL.

Direct Energy Solar shall not have liability under this Limited Production Warranty for lost electricity production due to: (a) damage or destruction to the System not caused by Direct Energy Solar or its agents (such as a casualty loss like a tree falling on the System); (b) any failure or lost production not caused by a System defect; (c) theft of the System; (d) Force Majeure or damage caused by unforeseeable events; or (e) a breach by Customer of Customer's obligations under this Contract. If the System has produced power levels in excess of the levels set forth in prior Contract Years, then the cumulative excess of prior Contract Years' production, less the amount of such excess production used to offset any production shortfalls in prior Contract Years, shall offset any shortfall in the given Contract Year's production before calculating any shortfall for purposes of administering this Limited Production Warranty for such Contract Year and if the cumulative excess exceeds the given Contract Year's shortfall, the remaining excess shall be carried forward to succeeding Contract Years. In connection with this Limited Production Warranty, Direct Energy Solar reserves the right to make repairs or upgrades to the System and in connection therewith to repair or replace parts of the System with new or used parts.

SAMPLE



Direct Energy Solar Residential Installation Contract

"Actual Annual kWh" means the AC electricity produced by the System in kilowatt-hours measured and recorded by Direct Energy Solar during each Contract Year. Direct Energy Solar will use the monitoring service or to the extent such service is not available, Direct Energy Solar will estimate electricity production through other reasonable means as determined by Direct Energy Solar.

5. System Moving Warranty. If, for any reason, Customer moves from the Property at any time after the one (1) year anniversary of the Operational Date but prior to the Twenty (20) year anniversary of the Operational Date, and provided that the Customer's new location is within Direct Energy Solar's then current installation service area as detailed at www.directenergysolar.com, at Customer's request, Direct Energy Solar will for a one-time fee of \$250 survey the new location, provided that Direct Energy Solar is afforded proper access to such location, and provide a time-and-material proposal to uninstall the System and transport and reinstall the System at Customer's new location (the "System Moving Proposal"). Customer may choose to accept or decline the time and material proposal in writing to Direct Energy Solar. This System Moving Warranty can only be exercised one (1) time by Customer and only applies to roof-installed systems. Customer must provide Direct Energy Solar with at least sixty (60) days prior notice of Customer's intent to move the System. Upon payment of the required fee by Customer, receipt of any necessary permits, and weather and scheduling permitting, Direct Energy Solar will uninstall the System within sixty (60) days of receipt of Customer acceptance of System Moving Proposal and will reinstall the System within sixty (60) days following the completion of the uninstall. If Customer's new house is unavailable for an installation, for any reason, for a period exceeding sixty (60) days from the date of the uninstall, Direct Energy Solar is entitled to charge Customer reasonable storage fees not to exceed \$10.00 per day. Exercise of this Warranty voids the Limited Production Warranty.

6. New Roof Warranty. If Customer replaces the roof of the Property at any time after the one (1) year anniversary of the Operational Date but prior to the Twenty (20) year anniversary of the Operational Date, and the removal of the System is required to replace the roof, Direct Energy Solar will for a one-time fee of \$100 review the new roof plans and re-survey the location, if necessary and provided that Direct Energy Solar is afforded access to such location, and provide a time-and-material proposal to uninstall the System and upon replacement of the roof, reinstall the System (the "New Roof Proposal"). Customer may choose to accept or decline the time-and-material proposal. Customer can exercise the proposal outlined in this section only one (1) time during the duration of this Contract. Customer must provide Direct Energy Solar with at least thirty (30) days prior notice of Customer's intent to replace Customer's roof. Upon acceptance of the New Roof Proposal by customer, and weather and scheduling permitting, Direct Energy Solar will uninstall the System within forty-five (45) days of Customer acceptance and will reinstall the System within forty-five (45) days following the completion of the roof replacement. Storage will be provided for free for a period of 60 days. In the event that Customer's new roof is unavailable for an installation for a period exceeding sixty (60) days from the date of the uninstall, Direct Energy Solar is entitled to charge Customer reasonable storage fees not to exceed \$10.00 per day. For the period during which the panels are not operational, the Limited Production Warranty for that given period shall be decreased pro-rata to reflect the downtime of the System.

7. Acknowledgement of Tax Consequences. Customer hereby acknowledges that the exercise of the System Moving Guarantee may trigger adverse federal, state and/or local tax and/or other financial consequences and may cause Customer to be required by law to refund all or a pro-rata portion of any federal, state and local tax or other financial incentives received by Customer in connection with the Installation. In addition, the exercise of the System Moving Guarantee will likely result in the termination of any Solar Renewable Energy Credit ("SREC") and related income Customer was otherwise entitled to receive. Prior to exercising the System Moving Guarantee, Customer is strongly encouraged to consult Direct Energy Solar and Customer's tax and/or financial advisor.

Thank you for choosing Direct Energy Solar! Should you have any questions or concerns, please contact our Customer Service Department at customercare@directenergysolar.com or 1-888-603-6085.

SAMPLE



Direct Energy Solar Residential Installation Contract

EXHIBIT A

MASSACHUSETTS HOME IMPROVEMENT CONTRACT CONSUMER PROTECTION ACT

Massachusetts Home Improvement Contractor Registration. Direct Energy Solar's federal identification number is 27-1427044. All home improvement contractors and subcontractors must be registered with the Office of Consumer Affairs and Business Regulation. Direct Energy Solar is a registered home improvement contractor in Massachusetts, registration number 168228.

Any inquiries about a contractor or subcontractor should be directed to:
Office of Consumer Affairs and Business Regulation
Ten Park Plaza, Suite 5170
Boston, MA 02116
Phone: (617) 973-8700

Start and Completion Dates. The approximate start date for installing the System and the approximate completion date for installing the System are set forth as the Timeline on the front page of this Contract.

Copy of Signed Contract. Direct Energy Solar will provide you with a copy of this Contract after it is signed by you and by Direct Energy Solar, prior to Installation of the System.

Permits. It shall be the obligation of Direct Energy Solar to obtain any permits necessary for the Installation. If you secure your own permits, you will be excluded from the Guaranty Fund provisions of Chapter 142A of the Massachusetts General Laws.

RIGHT OF RESCISSION. NOTICE TO CONSUMER:

YOU MAY CANCEL THIS AGREEMENT IF IT HAS BEEN SIGNED BY A PARTY THERETO AT A PLACE OTHER THAN AN ADDRESS OF DIRECT ENERGY SOLAR, WHICH MAY BE ITS MAIN OFFICE OR BRANCH THEREOF, PROVIDED YOU NOTIFY DIRECT ENERGY SOLAR IN WRITING AT ITS MAIN OFFICE OR BRANCH BY ORDINARY MAIL POSTED, BY TELEGRAM SENT OR BY DELIVERY, NOT LATER THAN MIDNIGHT OF THE THIRD BUSINESS DAY FOLLOWING THE SIGNING OF THIS AGREEMENT.

SEE THE ATTACHED NOTICE OF CANCELLATION FORM FOR AN EXPLANATION OF THIS RIGHT.

SAMPLE



SolarEdge Extended Warranty Addendum

Customer Name _____

Address _____

Date of Disclosure _____ Date of Contract _____

Notwithstanding anything in Customer's purchase agreement to the contrary, in exchange for a one-time payment by Customer to Astrum Solar, Inc. d/b/a Direct Energy Solar ('Direct Energy Solar') in an amount equal to the Customer's system size in watts * \$0.10, Direct Energy Solar will purchase on behalf of Customer an extended warranty on SolarEdge inverters, extending the warranty period from 12 to 25 years. This Warranty is only applicable to purchased systems. This extended warranty shall be void in full if Customer does not pay the full fee within 30 days of the invoice of such fee by Direct Energy Solar.

Customer and Direct Energy Solar hereby agree to enter into this Contract subject to the terms and conditions set forth below. NOTE: Contracts over \$100,000 must be co-signed by a sales manager.

CUSTOMER

Date: _____

DIRECT ENERGY SOLAR

Date: _____

Date: _____

**Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
Department of Energy Resources**

Massachusetts RPS

RENEWABLE ENERGY CERTIFICATES PURCHASE AGREEMENT

I, Deborah Levy (Name of Generation Unit Owner) certify that I am the owner of the system installed and located at 40-42 Lewis Rd, Belmont, MA 02478 (address) and executed a contract on _____ (Date) with Direct Energy Solar (Name of Aggregator) authorizing Direct Energy Solar (Name of Aggregator) to include my system as part of an Aggregation. I also certify that I will notify DOER in writing within 30 days upon termination of that contract.

I, Direct Energy Solar (Name of Aggregator) certify that I have executed a contract with Deborah Levy (Name of Generation Unit Owner) on _____ (date) to include the system located at 40-42 Lewis Rd, Belmont, MA 02478 (address) in an Aggregation. I also certify that I will notify DOER in writing within 30 days upon termination of that contract.

Signature of Generation Unit Owner: _____ Date _____

Signature of Aggregator Agent: _____ Date _____

**MA RPS Program
Department of Energy Resources
100 Cambridge St. Suite 1020
Boston, MA 02114**

BELMONT PUBLIC SCHOOLS

JOHN P. PHELAN
SUPERINTENDENT OF SCHOOLS
(617) 993-5401



ANTHONY R. DI COLOGERO
DIRECTOR OF FINANCE,
BUSINESS & OPERATIONS
(617) 993-5430
FAX (617) 993-5439

JANICE G. DARIAS
ASSISTANT SUPERINTENDENT
FOR CURRICULUM & INSTRUCTION
(617) 993-5410

644 PLEASANT STREET
BELMONT, MASSACHUSETTS 02478-2589
(617) 993-5400
FAX (617) 993-5409

MARY PEDERSON
DIRECTOR OF HUMAN RESOURCES
(617) 993-5425

To: School Committee
From: John P. Phelan, Superintendent of Schools
Date: June 20, 2017 School Committee Meeting

RE: Approval Language for the Belmont Energy Committee Solar Project Application to Planning Board

Phil Thayer a member of the Belmont Energy Committee made a presentation at the Finance Sub Committee meeting on June 6, 2017. The outcome of that meeting was to bring this topic to the full School Committee at our June 20, 2017 meeting. I have provided a copy of the presentation provided on June 6th in your packet and wanted to give you the actual language we would use at our School Committee meeting, if in fact the members wanted to grant this permission.

If approved....

The Belmont School Committee will vote the following language as it relates to a potential solar project at the Chenery School:

The Belmont School Committee approves the request of the Belmont Energy Committee to seek application to the Town of Belmont Planning Board to put solar panels on the roof of the small gym at the Chenery School.

This approval is only for the application process and the School Committee reserves the right to await the Planning Board decision before voting the approval of this project in the fall.

Chenery PTO Meeting, Wednesday 17 May, 2017

Welcome from Co-Presidents Jamie Shea and Laurie Bufano

Treasurer's Report, Elena Ruggiero. Talked about where most of the last years money came from, and what a difference a couple of BIG donations made, but can't rely on these going forward.

Secretary Meeting notes missing from last meeting. (Sorry).

Liz Baker, Director of Science, Belmont Public Schools: Spoke about the benefits to the kids, school and teachers, of the new Science books the PTO purchased recently for the Chenery 5th Grade. The text books reinforce the practical science side of things the kids are studying.

Mike McAllister (Principal) added how the text books are a foundation to the curriculum - NOT the curriculum - but a really big support/supplement to the curriculum.

Parent Qt: Why don't the kids bring the books home?

Ans: Online access to the books will be available online come September.

MA: Welcome talk from Mike. Talking about making the PTO even stronger than it already is. He worked on this at Butler, and would like to do similar work here. The more people involved, the more benefit to all.

JS: Spoke about events and programs the PTO raise funds for at Chenery. These events/programs can be found listed on PTO Newsletters.

Belmont Goes Solar presentation by Phil Thayer (& Belmont Energy committee member).

<https://belmontgoessolar.org>

Belmont Goes Solar ran a discount promotion for going solar at the beginning of 2016. Hoped for 100 homes to go solar, but got 260. With this great result, the solar installer (Direct Energy Solar) company awarded the town \$50,000 worth of panels to install, for free, on any public building. The leading contender right now is the Chenery Middle School. The south facing metal roof, which has a life of 50 years is the ideal location for the solar panels. Currently, no objections from abutting home owners. Great opportunity for the kids to learn about the science of solar power. There may be a kiosk or computer giving regular updates on power coming from the panels, so they can watch it's progress. End relief will be savings to the tax payers as reduces the school's bills. Still at Draft Steps to Approval stage. More research/feedback/support needed. If get the green light, will be installed before November 2017.

MA: Other schools have solar panels installed already (out of district) and they have a way for the kids to watch the gauge of the electricity coming in and the savings. Such a computer display page will come with the installation. There is a site to go to check your data.

There will be a public hearing to approve the public building selection for the panels. Chenery could be the first Belmont Public Building to go solar.

Belmont Energy committee and Belmont Solar committee meet at the library on the first and second Wednesday of each month. Attendance is encouraged.

Qt.: Do the installers maintain the panels?

Ans: CMS will own them but they will be under warranty for the maximum number of years available.

Director of Technology, Belmont Public Schools, Steve Mazzola, and Caitlin Corrieri talk about Technology at CMS.

CC: talked about teachers use of computer labs. About 90 teachers for 5 computer labs = limited availability. Recent addition to technology of the chrome book carts. They can bring technology into the classroom and continue teaching without being disruptive to others. Also talked about benefits of ipad, but also limitations. PTO bought the 8th grade team a chrome book cart about a month ago. One cart, for multiple classes.... FBE bought one for the 6th grade social sciences.

SM: Talked about getting access to technology. Survey about technology, of teachers, k-12: the teachers needed technology close to their classrooms. Asked about which device: more labs? smaller no. of devices in class? or carts working on a team level? Desktops/laptops/ipads etc. Overall response: First, ipad carts to use close to class (30 ipads), and chromebook carts came second. They all wanted wireless devices that would work in the classroom. Currently at 7 ipad carts (Some classes have a handful of ipads too), about 340 ipads total and 90 chromebooks. The school needs more. Applied to Capitol Committee to support 150 chromebooks, and to finish wireless infrastructure in the building. Presented 3 wks ago. Both got approval. Now need approval by warrant committee and town meeting in June. Wiring of building will be done. After town meeting, assuming approval, will put new carts into the 2018 budget plan.

Chrome book testing: 4th & 8th grade did their testing online. If other grades go to online testing, the school needs more devices! 8th grade could only go one team at a time... but the online test itself was a success. CMS did the online testing field test 2 yrs ago. The school needs a reliable wireless system for all that traffic online at once during testing. Other, out of district, schools had trouble with this.

Pending necessary approvals, come september, CHENERY WILL HAVE 1 DEVICE FOR EVERY 1.5 KIDS!

LB: Introduced board for 2017-2018 year:

Co-Presidents: Laurie Bufano and Barbara Bulfoni

Treasurer: Karen Thomson

Assistant Treasurer: Anna Freitag

Secretary: Laura VanderHart

Upcoming event: GUEST SPEAKER, Peter Shelley, Senior Counsel, Conservation Law Foundation

Wednesday, May 31, 7:00 pm Chenery Auditorium. Don't miss this important discussion of the impact of climate change and environmental stewardship on one of New England's most precious resources, our oceans!



AOstructures Inc.
916.541.8586
www.AOstructures.com

June 14, 2017

To: Direct Energy Solar

Re: PV Addition
Cheney Middle School
Belmont, MA

To whom it may concern:

This letter is in reference to the proposed PV addition at the above referenced project location. The following calculations and findings are based on our review of the structural framing based on a set of 'as-built' plans provided to us by the contractor. The contractor shall field verify that site conditions meet the original specifications of the plans prior to starting installation and contact engineer if field conditions differ.

Per the 5% exemption allowed by Chapter 34 of the IBC, the roof framing of the gym is deemed adequate to support the proposed array weight of the PV system. All standoffs shall be installed per the specifications of the mounting hardware company. All waterproofing shall be provided by the contractor. The scope of this review is limited to the portion of the roof directly supporting the PV array.

The design criteria for this project is listed below:

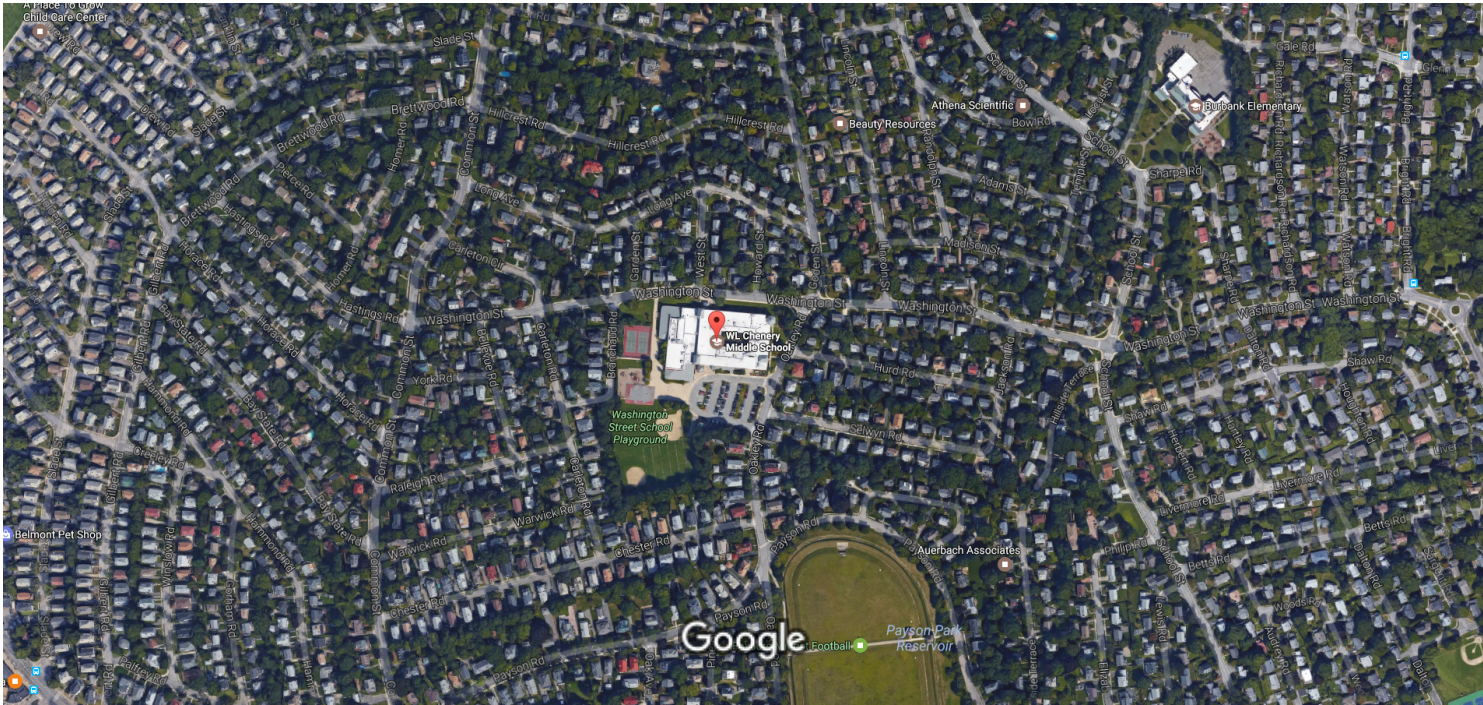
- Codes: MA 780 CMR, ASCE 7-05
- Ground Snow Load: 45 psf – Reduced to 32 psf Roof Snow Load
- Wind: 105 mph, Exposure B
- Importance Factor: 1.15
- Proposed Weight of PV system: 3.4 psf

If you have any questions on the above, do not hesitate to call.

Sincerely,

Andrew Oesterreicher, PE

Google Maps W L Chenery Middle School



Imagery ©2017 Google, Map data ©2017 Google 200 ft



Wind Calculations

Per ASCE 7-05 Components and Cladding

Input Variables	
Wind Speed	105 mph
Exposure Category	C
Roof Shape	Gable/Hip
Roof Slope	15 degrees
Mean Roof Height	20 ft
Effective Wind Area	19.3 ft

Design Wind Pressure Calculations	
Wind Pressure $P = qh \cdot G \cdot C_n$	
$qh = 0.00256 \cdot K_z \cdot K_{zt} \cdot K_d \cdot V^2 \cdot I$	(Eq. 6-15)
K_z (Exposure Coefficient) = 0.9	(Table 6-3)
K_{zt} (topographic factor) = 1	(Fig. 6-4)
K_d (Wind Directionality Factor) = 0.85	(Table 6-4)
V (Design Wind Speed) = 105 mph	
Importance Factor = 1.15	(Table 6-1)
$qh = 24.83$	

Standoff Uplift Calculations				
	Zone 1	Zone 2	Zone 3	Positive
$G C_p =$	-0.86	-1.51	-2.37	0.42
Uplift Pressure =	-21.40 psf	-37.49 psf	-58.90 psf	10.5 psf
X Standoff Spacing =	2.67	2.67	0.00	
Y Standoff Spacing =	2.67	2.67	0.00	
Tributary Area =	7.11	7.11	0.00	
Footing Uplift =	-152 lb	-267 lb	0 lb	

(Fig. 6-11)

Standoff Uplift Check	
Maximum Design Uplift = -267 lb	
Standoff Uplift Capacity = 275 lb	
275 lb capacity > 267 lb demand Therefore, OK	



Lateral Check

Per 2009 IBC Chapter 34

Existing Weight of Effected Building			
Level	Area	Weight (psf)	Weight (lb)
Roof	2500 sf	15.0 psf	37500 lb
Ceiling	2500 sf	0.0 psf	0 lb
Ext. Walls	150 ft	30.0 psf	27000 lb
Int. Walls	0 ft	0.0 psf	0 lb
Existing Weight of Effected Building			64500 lb

(12'-0" Wall Height)

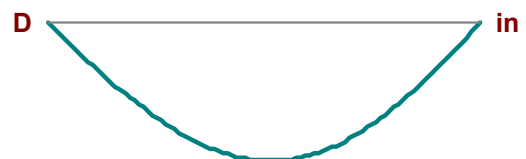
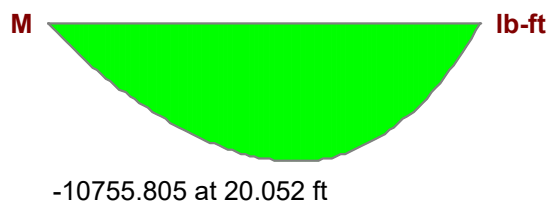
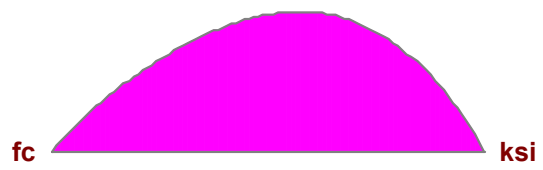
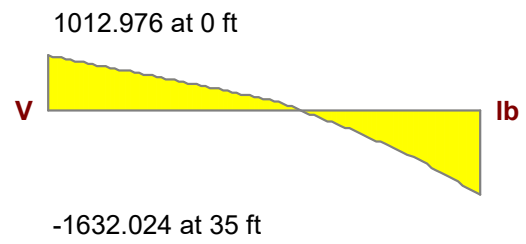
Proposed Weight of PV System	
Weight of PV System (Per Direct Energy - MA)	3.8 psf
Approx. Area of Proposed PV System	847 sf
Approximate Total Weight of PV System	3219 lb

10% Comparison	
10% of Existing Building Weight (Allowed)	6450 lb
Approximate Weight of PV System (Actual)	3219 lb
Percent Increase	5.0%
6450 lb > 3218.6 lb, Therefore OK	

Moment and shear diagram
BEFORE installation of panels.

A ————— lb

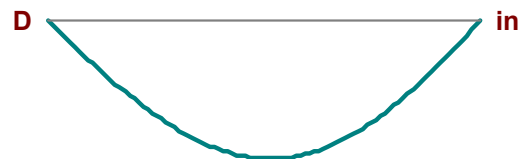
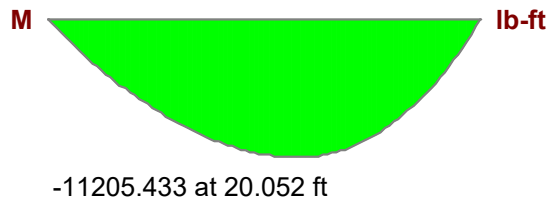
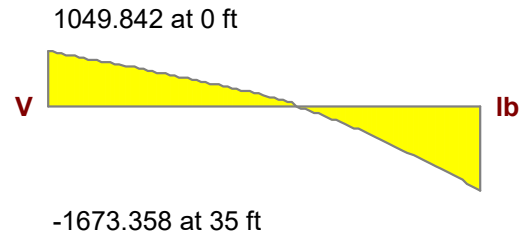
fa ————— ksi



Moment and shear diagram
AFTER installation of panels.

A ————— lb

fa ————— ksi



Allowed = 5% increase from "BEFORE"

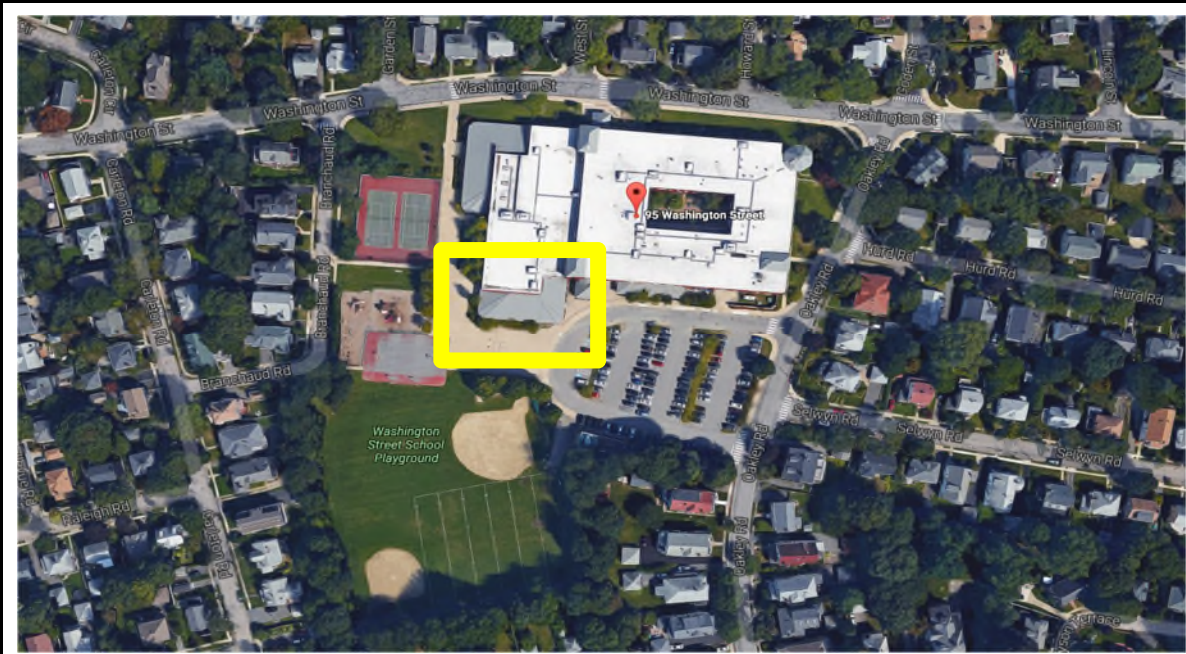
Moment: $10755 * 1.05 = 11293$

Shear: $1623 * 1.05 = 1713$

Actual:

Moment: $11205 < 11293$, therefore, OK

Shear: $1674 < 1713$, therefore, OK



The Chenery Middle School

95 Washington St
Belmont, MA, 02478

13.2 kW DC

Photovoltaic Solar Array

Homeowner

Chenery MS
95 Washington St
Belmont, MA 02478

System Owner

Chenery MS

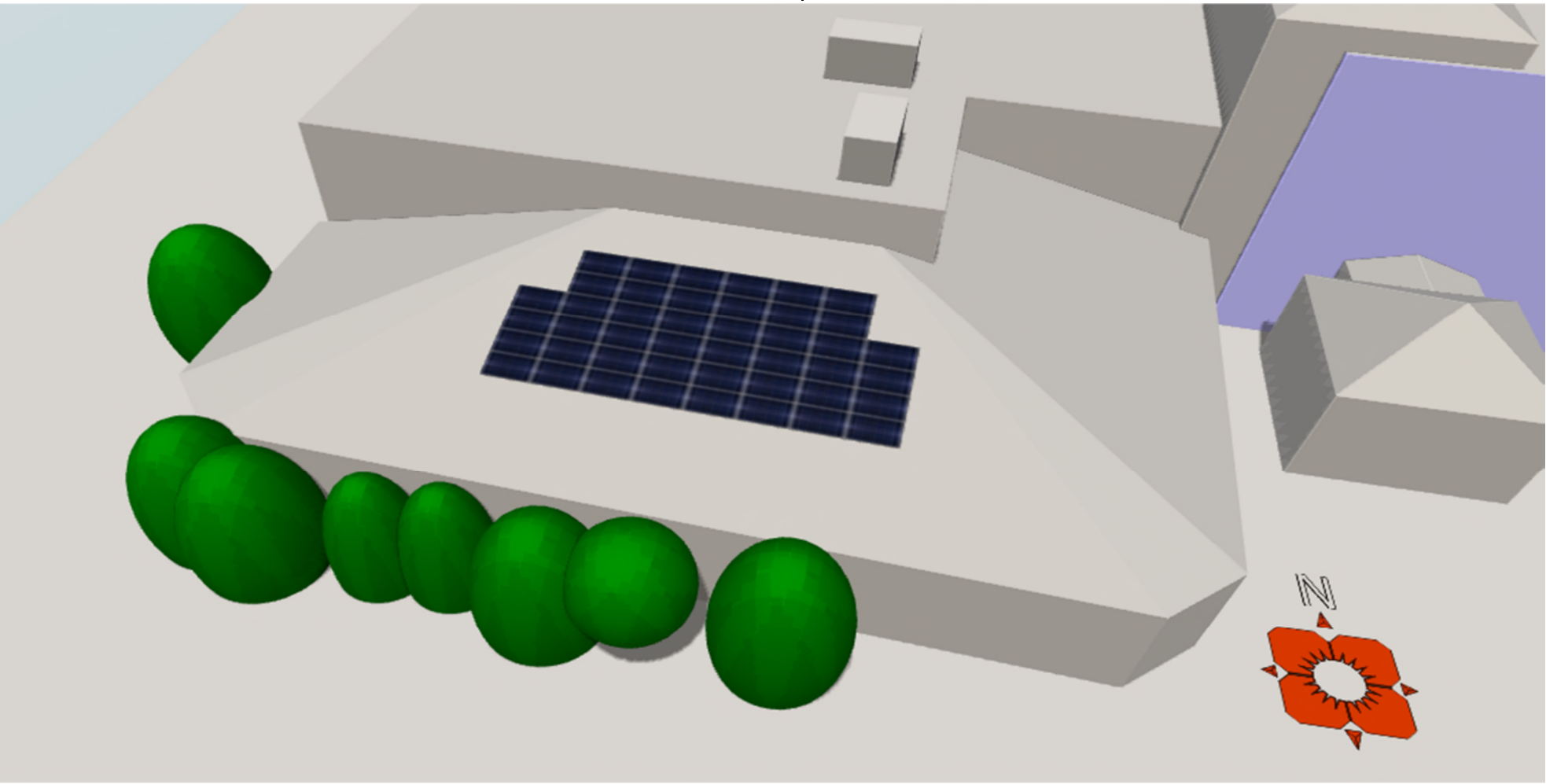
AHJ

Town of Belmont
455 Concord Ave
Belmont, MA 02478

DIRECT ENERGY SOLAR
5 Lyberty Way,
Westford, MA, 01886

June 16, 2017

REVISIONS



Project Scope:

To install (44) LG 300W Modules and (1)
SolarEdge 14.4K inverter

Governing Codes:

2017 NEC
2015 International Building
Underwriters Labratories (UL)
Standards OSHA 29 CFR 1910.269
ASCE 7-10

Index of Pages:

TS Title Sheet
PV-1.1 Attachment Detail
PV-2 Electrical Diagram
PV-3 Electrical Calculations
PV-4 String and Conduit Layout
PV-5 Equipment Ratings & Signage



Chenery MS PROJECT
95 Washington St,
Belmont, MA, 02478

UTILITY ACCT# -

GENERAL NOTES

PREPARED BY:

David Brook, Solar Engineer
&
Daniel Cramer, Electrical Designer

Job ID-P-00123924-1

TITLE SHEET

TS

ROOF : 1

PITCH : 14°
AZIMUTH : 185°
MODULES : 44

Roof Type: Metal Seam

Roof
Support: Metal I-Beams

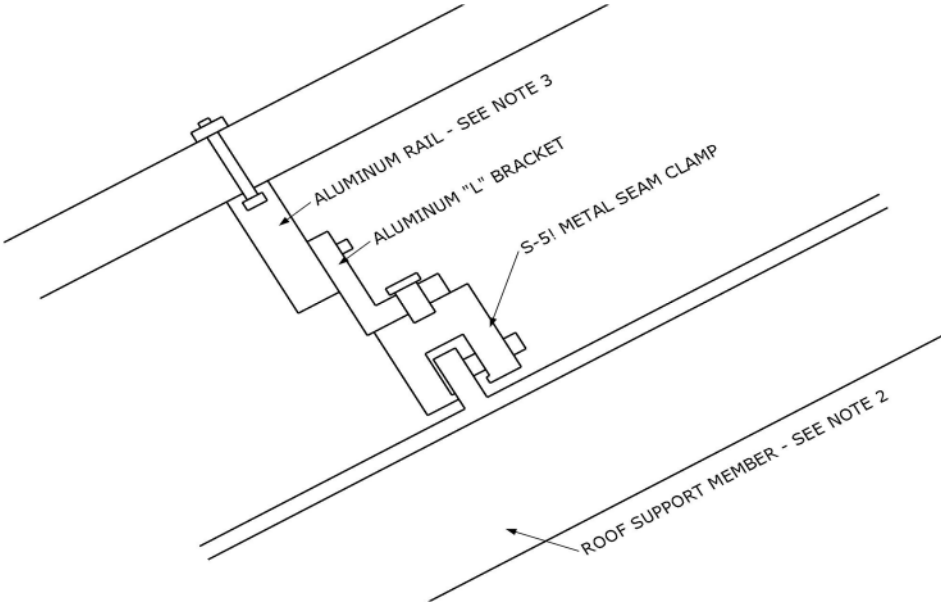
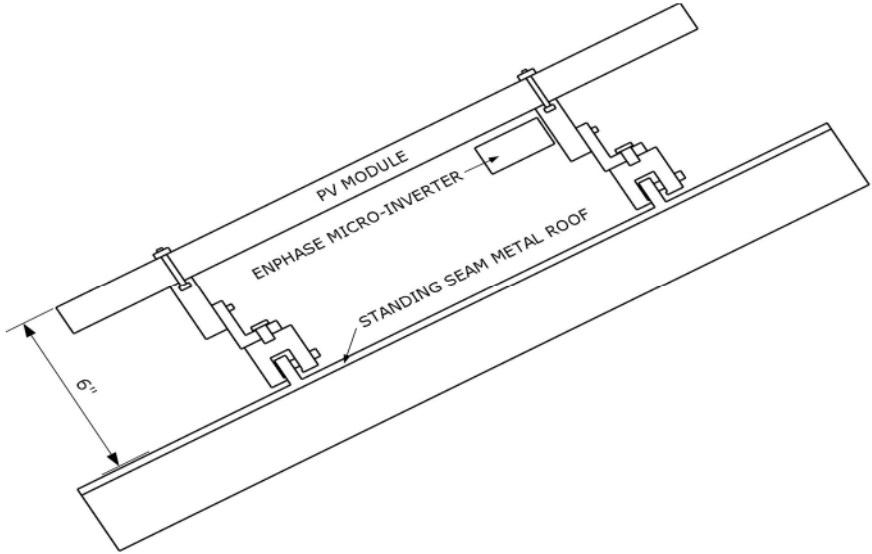
SYSTEM DETAILS

Module Weight	1650 lbs
Racking Weight	816 lbs
Micoinverter Weight	0 lbs
System Weight	2466 lbs
System Square Footage	777 sq ft
System Distributed Load	3.17 psf
Racking Max Attachment Span	48 in
Lag Screw Thread Depth	2.25 in
Point Load Max Spacing	48 in
Number of Roof Attachments	176
Max Allowable Rail Overhang	16 in

SYSTEM CONDITIONS

Building Height (h)	15 ft
Building Least Horizontal (H)	38 ft
Year Building built	2017
Basic Wind Speed (V)	127 mph
Snow Load	40 psf
Roof Zone	3
Effective Roof Area [sq ft] (E)	50

TYPICAL SECTION



Note 1: N/A
Note 2: See Roof Details Table
Note 3: Unirac Solarmount Racking

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UTILITY ACCT# -

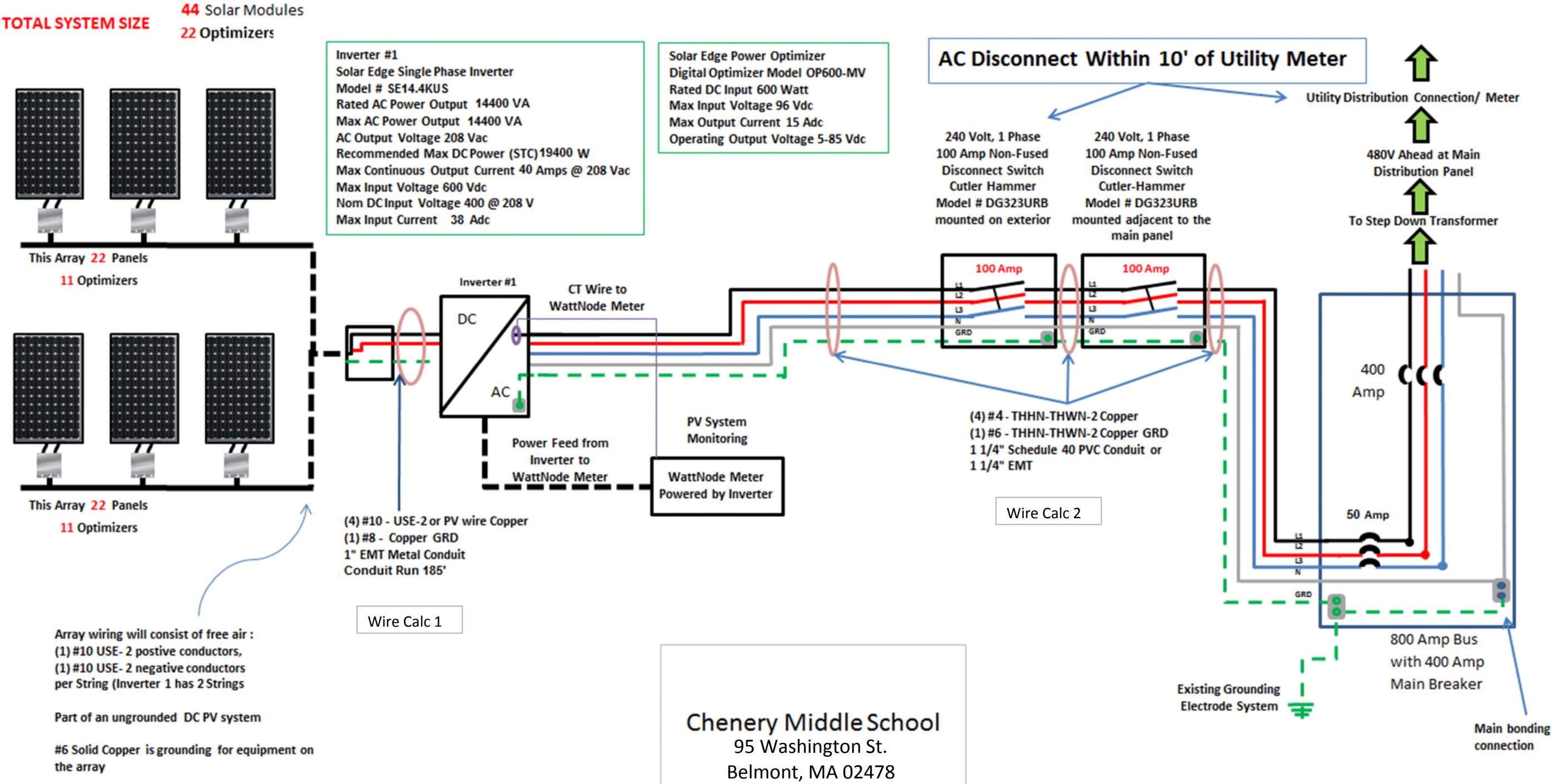
Racking and Structural Notes

Job ID-P-00123924-1

ATTACHMENT
DETAIL

PV-1.1

Electrical Diagram for Chenery MS - 13.2 kW DC Photovoltaic Solar Array



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Chenery MS PROJECT
95 Washington St.,
Belmont, MA, 02478

UTILITY ACCT# -

Job ID-P-00123924-1

ELECTRICAL -
LINE DIAGRAM

PV-2

Electrical Diagram for Chenery MS - 13.2 kW DC Photovoltaic Solar Array

PV Circuit Conductors

PV Inverter to PV Array

Minimum #10 AWG Cu

WIRE SIZING CALCULATION

2011/2014 NEC Article 310

Full Load Amperage : 14.575

Source Voltage : 400

Length of Run (Feet) : 185

Load Duty : Continuous

Conductor Type : THWN-2

Conductor Material : Copper

Conductor Location : Dry or Wet

Conductor Insulation Temperature : 90 °C

Rooftop Installation: NEC 310.15(B)(3)(c)

Distance Above Roof : Above 13 mm to 90 mm [above 1/2 inch to 3 1/2 inch]

Average Outside Temp : 90 Deg. F 32.2 Deg. C

Temperature Adder : 40 Deg. F 22 Deg. C

Adjusted Ambient Temperature : 130.0 Deg. F 54.2 Deg. C

Terminal Temperature Rating : 60 °C

Circuit Type : Single Phase 2 Wire (2 phase conductors, or phase & neutral)

Qty. of Circuit Current-Carrying Conductors : 2

Additional Current-Carrying Conductors : 2

Total Qty. Current-Carrying Conductors : 4

Conductor Requirement:

Full Load Amps : 14.58

Load Duty Multiplier : 1.25

Ambient Temp. Multiplier : 1.32

Qty. Conductors Multiplier : 1.25

Required Conductor Ampacity: 30.06

Terminal Requirement:

Full Load Amps : 14.58

Load Duty Multiplier : 1.25

Required Terminal Ampacity : 18.22

Selected Conductor:

Conductor Ampacity : 40.0

Ambient Temp. Derate : 0.76

Qty. Conductors Derate : 0.8

Adjusted Ampacity : 24.32

SELECTED CONDUCTOR SIZE : 10 Awg

2 x Ohms/MilFt x Length x Amps 2 x 1.24 x 185 x 30.06

VD = = = 6.69

1000 x Qty Wires per Phase 1000 x 1

Volts At Load Terminals : 393.31

Actual Percent Voltage Drop : 1.67

Wire Calc 1

PV Circuit Conductors

Interconnection: Breaker Tie In

#4 AWG Cu required

WIRE SIZING CALCULATION

2011/2014 NEC Article 310

Full Load Amperage : 40

Source Voltage : 208

Length of Run (Feet) : 25

Load Duty : Continuous

Conductor Type : THWN-2

Conductor Material : Copper

Conductor Location : Dry or Wet

Conductor Insulation Temperature : 90 °C

Ambient Temperature : 26-30 °C = 78-86 °F

Terminal Temperature Rating : 60 °C

Circuit Type : Three Phase 4 Wire Y (3 phase & neutral)

Qty. of Circuit Current-Carrying Conductors : 3

Conductor Requirement:

Full Load Amps : 40.0

Load Duty Multiplier : 1.25

Ambient Temp. Multiplier : 1.15

Qty. Conductors Multiplier : 1.0

Required Conductor Ampacity: 57.5

Terminal Requirement:

Full Load Amps : 40.0

Load Duty Multiplier : 1.25

Required Terminal Ampacity : 50.0

Selected Conductor:

Conductor Ampacity : 95.0

Ambient Temp. Derate : 0.87

Qty. Conductors Derate : 1.0

Adjusted Ampacity : 82.65

SELECTED CONDUCTOR SIZE : 4 Awg

0.866 x 2 x Ohms/MilFt x Length x Amps 0.866 x 2 x 0.308 x 25 x 57.5

VD = = = 0.53

1000 x Qty Wires per Phase 1000 x 1

Volts At Load Terminals : 207.47

Actual Percent Voltage Drop : 0.26

Wire Calc 2

DIRECT ENERGY SOLAR
5 Lyberty Way,
Westford, MA, 01886

June 16, 2017

REVISIONS



Chenery MS PROJECT
95 Washington St,
Belmont, MA, 02478

UTILITY ACCT# -

Job ID-P-00123924-1

ELECTRICAL

PV-3

Electrical Notes

1) All equipment to be listed and labeled for its application.

2) All conductors shall be copper, rated for 90C and wet environment, unless otherwise noted.

3) Working clearances around al new and existing electrical equipment shall comply with NEC110.26

4) All wire terminations shall be appropriately labeled and readily visible.

5) Module grounding clips to be installed between module frame and module support rail, per grounding clip manufacturers instruction.

6) Module Support rail to be bonded to continuous copper GEC via WEEB lug per NEC 690.4(C).

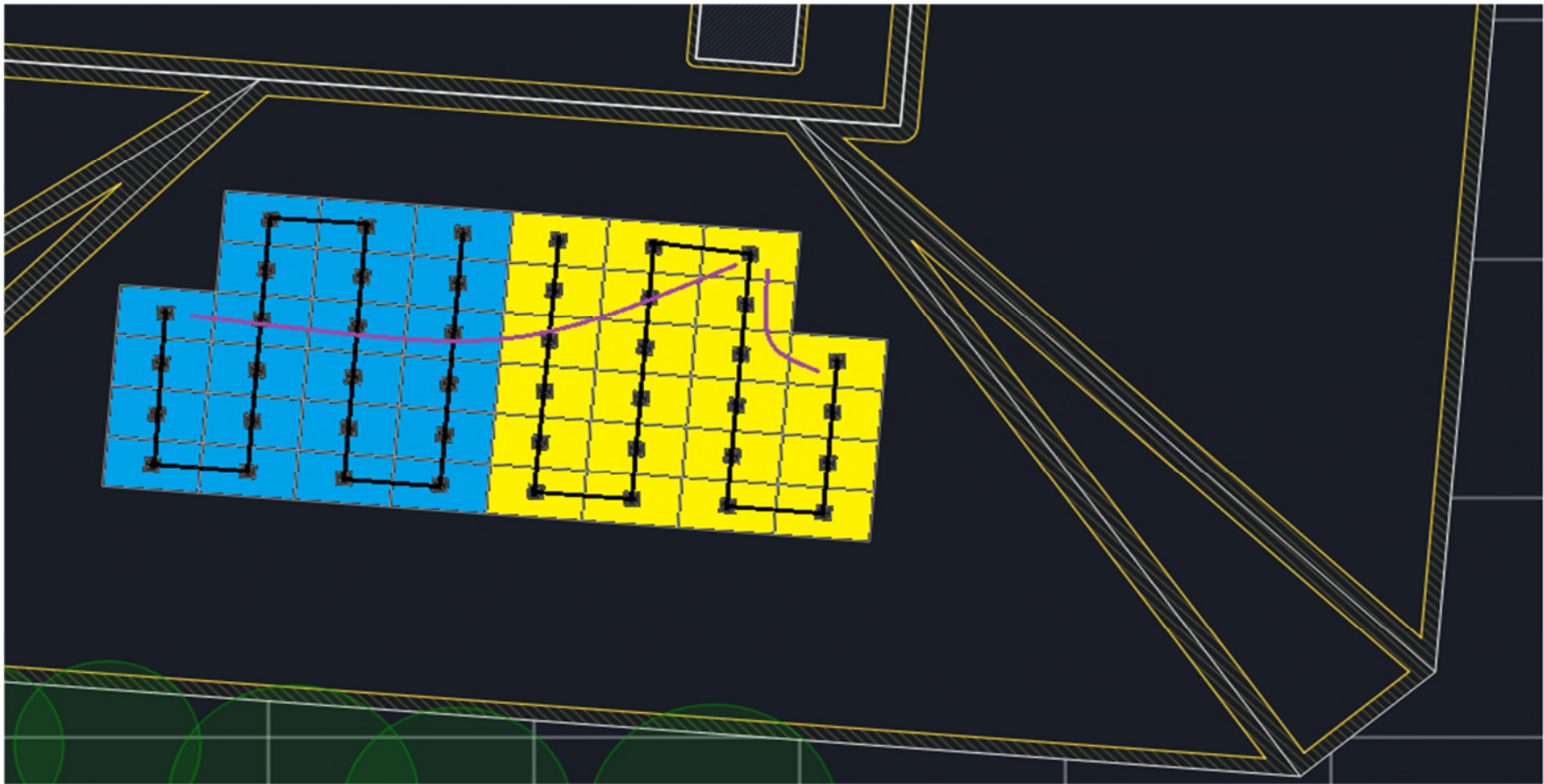
7) If used PV power source breaker to be located at bottom of bus per NEC 690.64(B)(7).

8) AC combiner panels shall be labeled as "Inverter AC Combiner Panel".

9) Listing agency name and number to be indicated on inverters and modules per NEC 110.3(B)

10) PV power source breaker to be suitable for backfeed per NEC 690.64(B)(5).

String and Conduit Layout



SolarEdge Inverter SE14.4KUS

String 1 (22)

String 2 (22)

Negative

Positive

Reviewed By:
Eli S. (484-684-2386)

DIRECT ENERGY SOLAR
5 Lyberty Way,
Westford, MA, 01886

June 16, 2017

REVISIONS



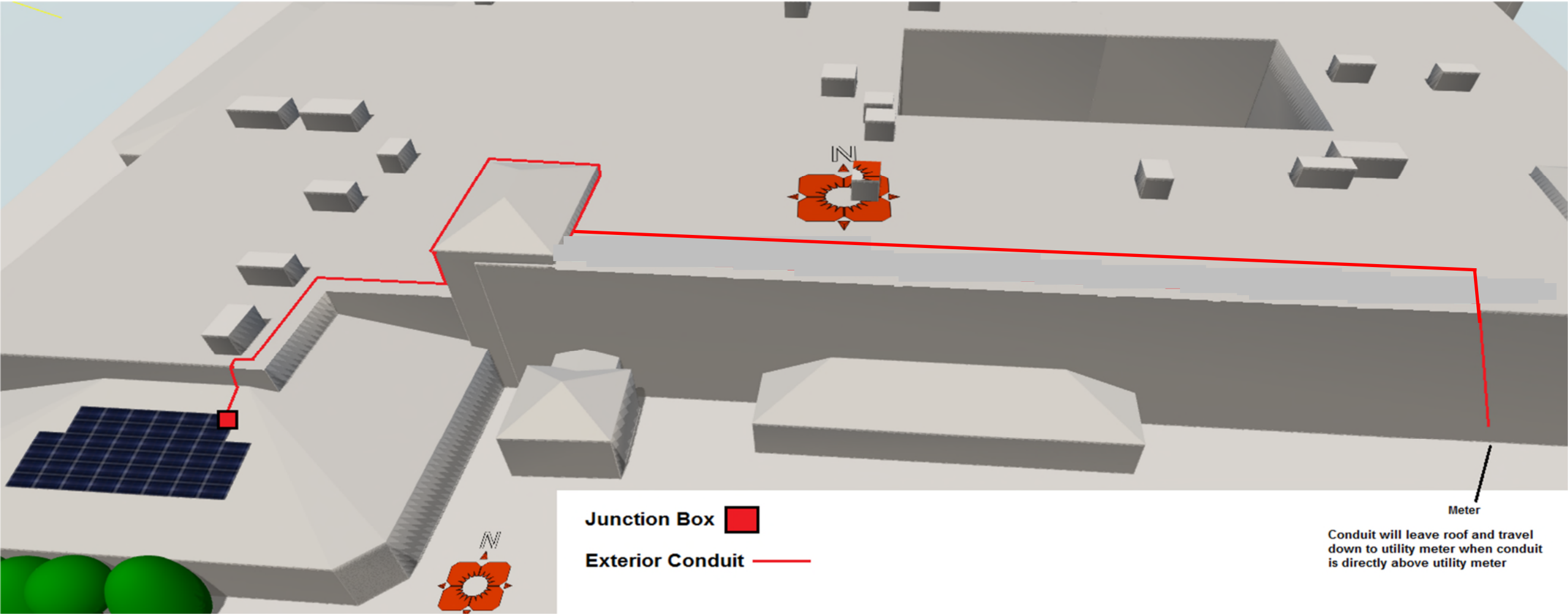
Chenery MS PROJECT
95 Washington St,
Belmont, MA, 02478

UTILITY ACCT# -

Job ID-P-00123924-1

ELECTRICAL

PV-4



Junction Box

Exterior Conduit

Meter

Conduit will leave roof and travel
down to utility meter when conduit
is directly above utility meter

PV Module Ratings @ STC		
Module Make	LG	
Module Model	LG300N1K-G4	
Max Power-Point Current (Imp)	9.26	
Max Power-Point Voltage (Vmp)	32.50	
Open-Circuit Voltage (Voc)	39.70	
Short-Circuit Current (Isc)	9.70	
Max Series Fuse (OCPD)	20.00	
Maximum Power (Pmax)	300.00	
Max Voltage	1000.00	
Voc Temp Coeff (%Voc/C)	-0.28	

Inverter Ratings		
Inverter Make	SolarEdge	
Inverter Model	SE14.4KUS	
Max DC Voltage Rating	600	
Max Power @ 40 Degrees C	14400	
Nominal AC Voltage	208V	
Max AC Current	40	
Max OCPD Rating	50	

Signage Requirements

- 1) Red Background
- 2) White Lettering
- 3) Min 3/8" Letter Height
- 4) All Capital Letters
- 5) Arial or Similar Font
- 6) Suitable for environment installed

DIRECT ENERGY SOLAR
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Westford, MA, 01886

June 16, 2017

REVISIONS



Chenery MS PROJECT
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Belmont, MA, 02478

UTILITY ACCT# -

Job ID-P-00123924-1

EQUIPMENT
RATINGS AND
SIGNAGE

PV-5

WARNING: PHOTOVOLTAIC
POWER SOURCE

SOLAR CIRCUITS ONLY DO NOT
ADD CIRCUITS TO THIS PANEL

PHOTOVOLTAIC SYSTEM EQUIPPED WITH
RAPID SHUTDOWN

SOLAREdge DC OPTIMIZER DISCONNECT
SE9KUS
MAX DC POWER: 12150W
MAX DC INPUT VOLTAGE: 500VDC
NOM. DC INPUT VOLTAGE: 400VDC
MAX INPUT CURRENT: 26.5ADC
SHORT CIRCUIT CURRENT: 45ADC

WARNING
INVERTER OUTPUT CONNECTION. DO NOT RELOCATE
THIS OVERCURRENT DEVICE

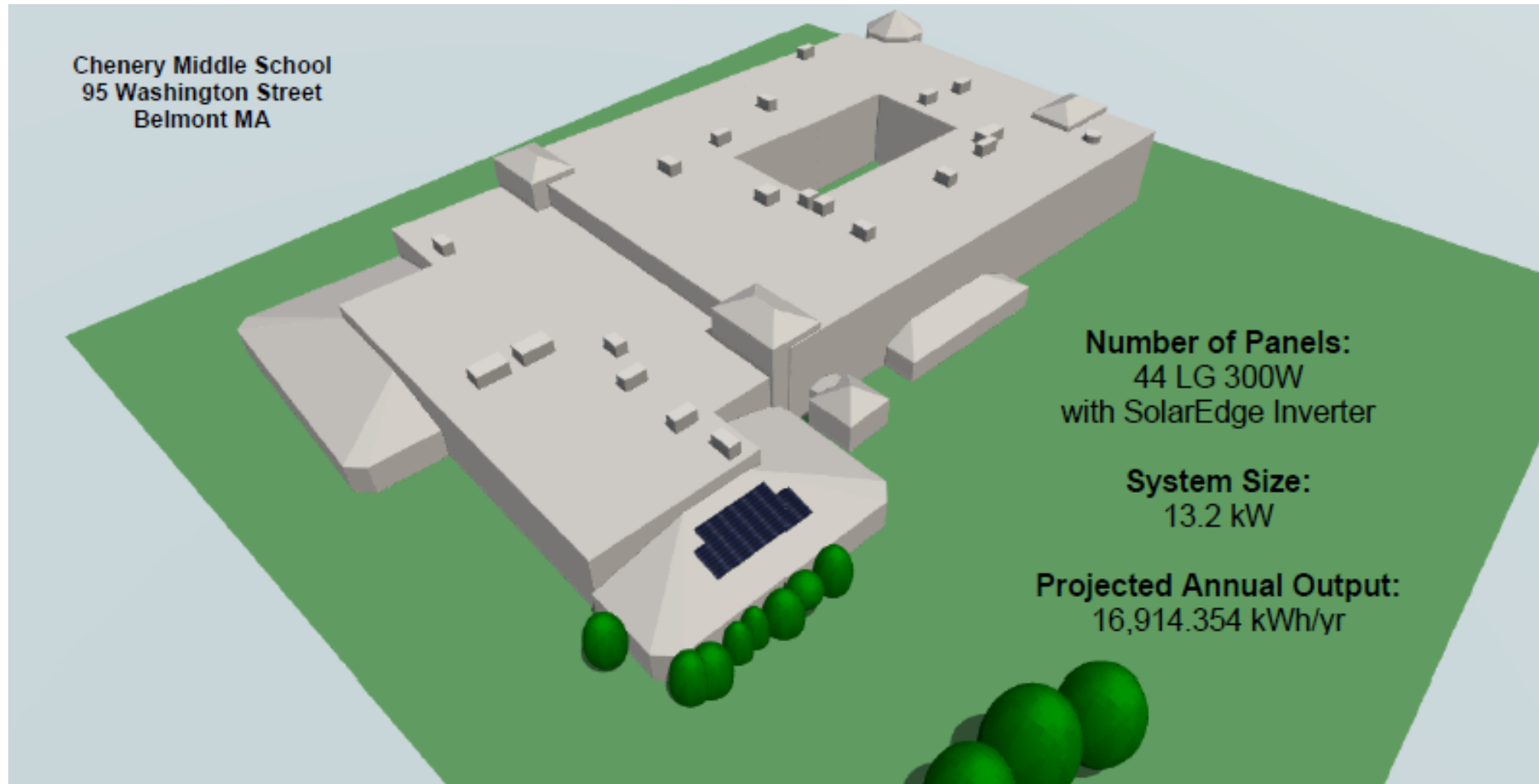
WARNING
DUAL POWER SOURCE SECOND SOURCE
IS PHOTOVOLTAIC SYSTEM

SOLAR PV LOADCENTER
13.2 kW DC Solar Array
240 VOLT AC SYSTEM
INSTALLED COMPONENTS
44 LG 300W Modules
(1) SE9kUS Inverter
CIRCUIT CALCULATIONS
System Current = 9000 / 208 = 25 Amps
Design Amperage = 25 X 1.25 = 31.25 Amps
String # 1 = 5830 / 400√ X 1.25 18.219 Amps
String # 2 = 5830 / 400√ X 1.25 18.219 Amps
Installed By: Direct Energy Solar June, 2017

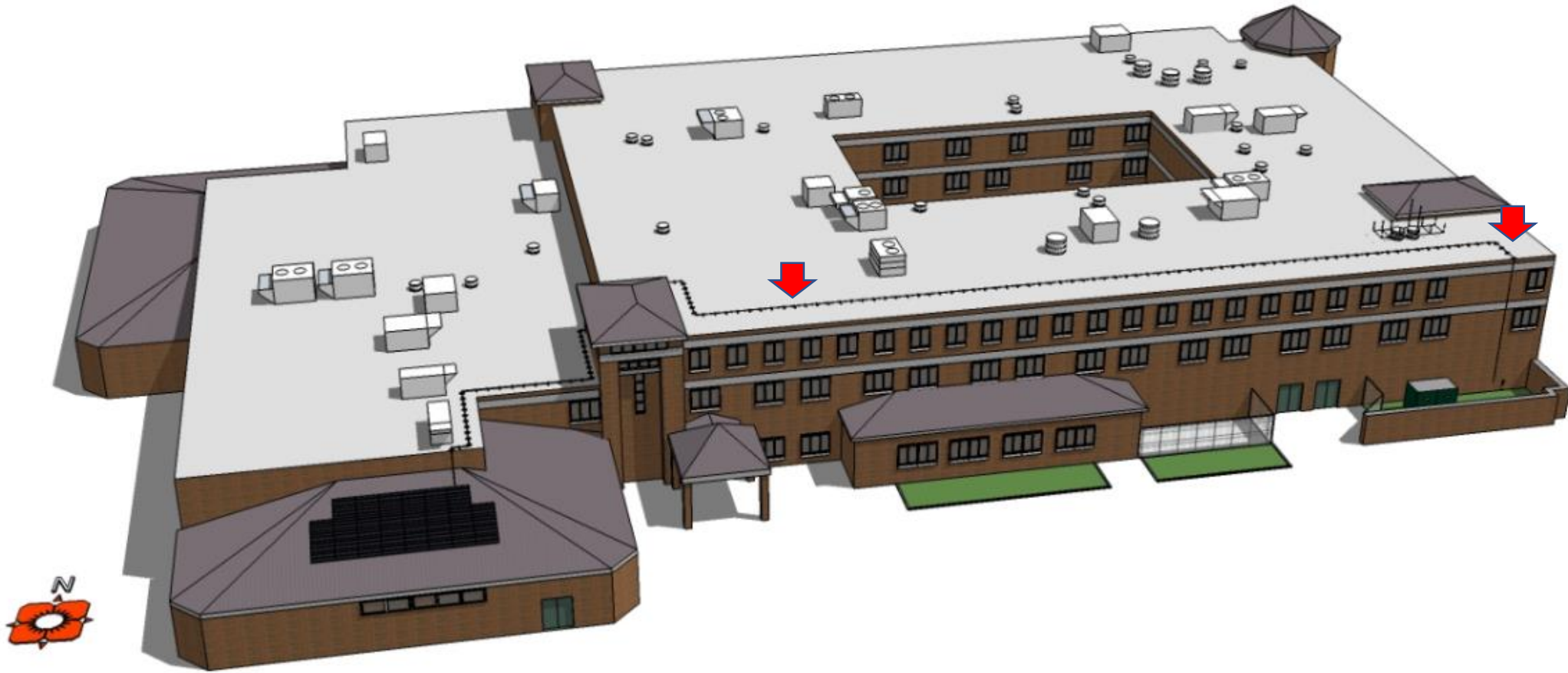
WARNING
ELECTRICAL SHOCK HAZARD
DO NOT TOUCH TERMINALS!
TERMINALS ON BOTH LINE AND
LOAD SIDES MAY BE ENERGIZED
IN THE OPEN POSITION

WARNING
ELECTRICAL SHOCK HAZARD
THE DC CONDUCTOR OF THIS
PHOTOVOLTAIC SYSTEM ARE
UNGROUNDDED AND MAY BE
ENERGIZED.

Installer's Proposed Design



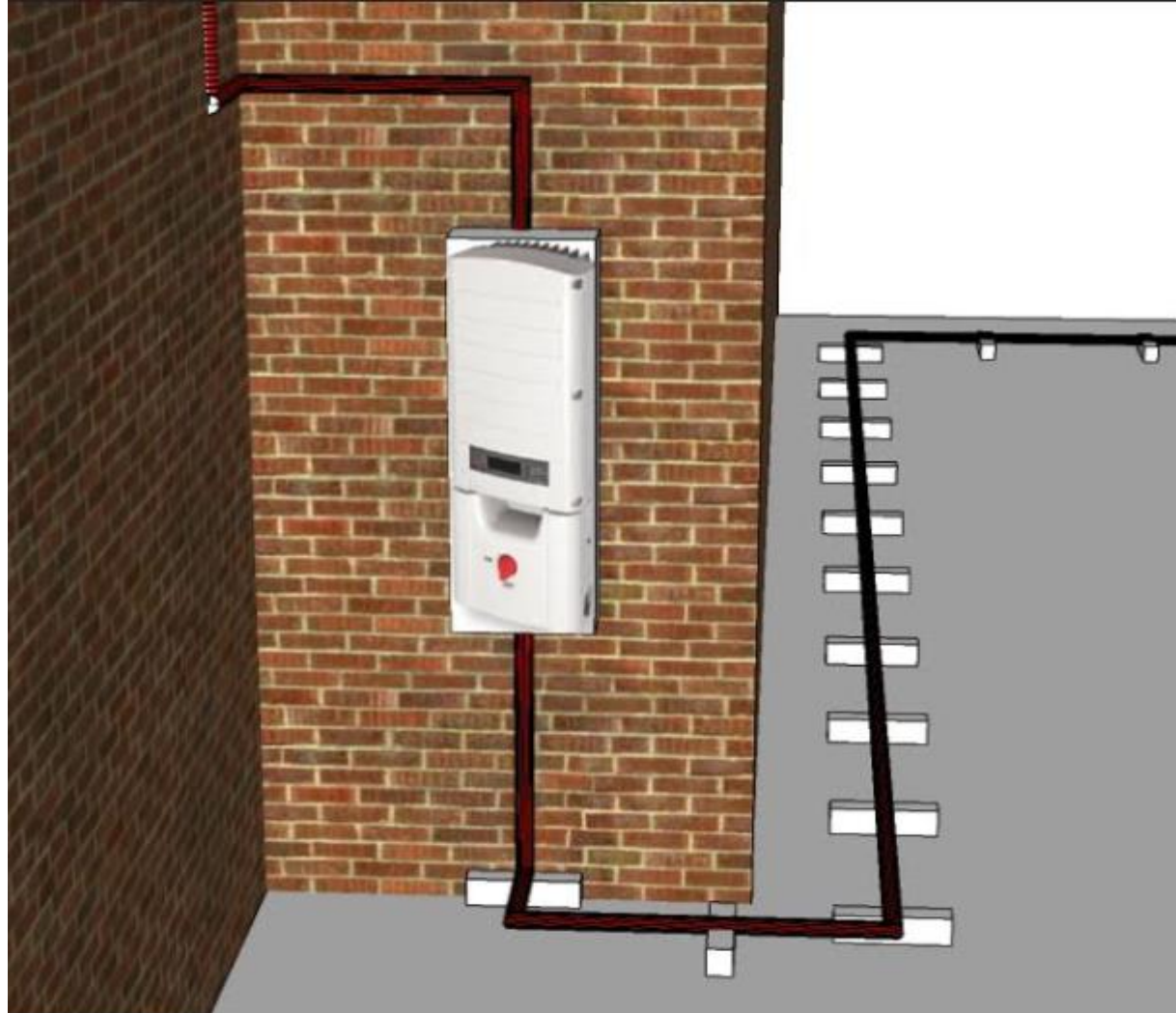
Proposed Design showing conduit path running east along south edge of upper roof



Cable will be in grey conduit(painted brick red after installation) attached to brick façade and runs up to flat roof. Conduit laid out on roof to minimize visual impact from the ground.



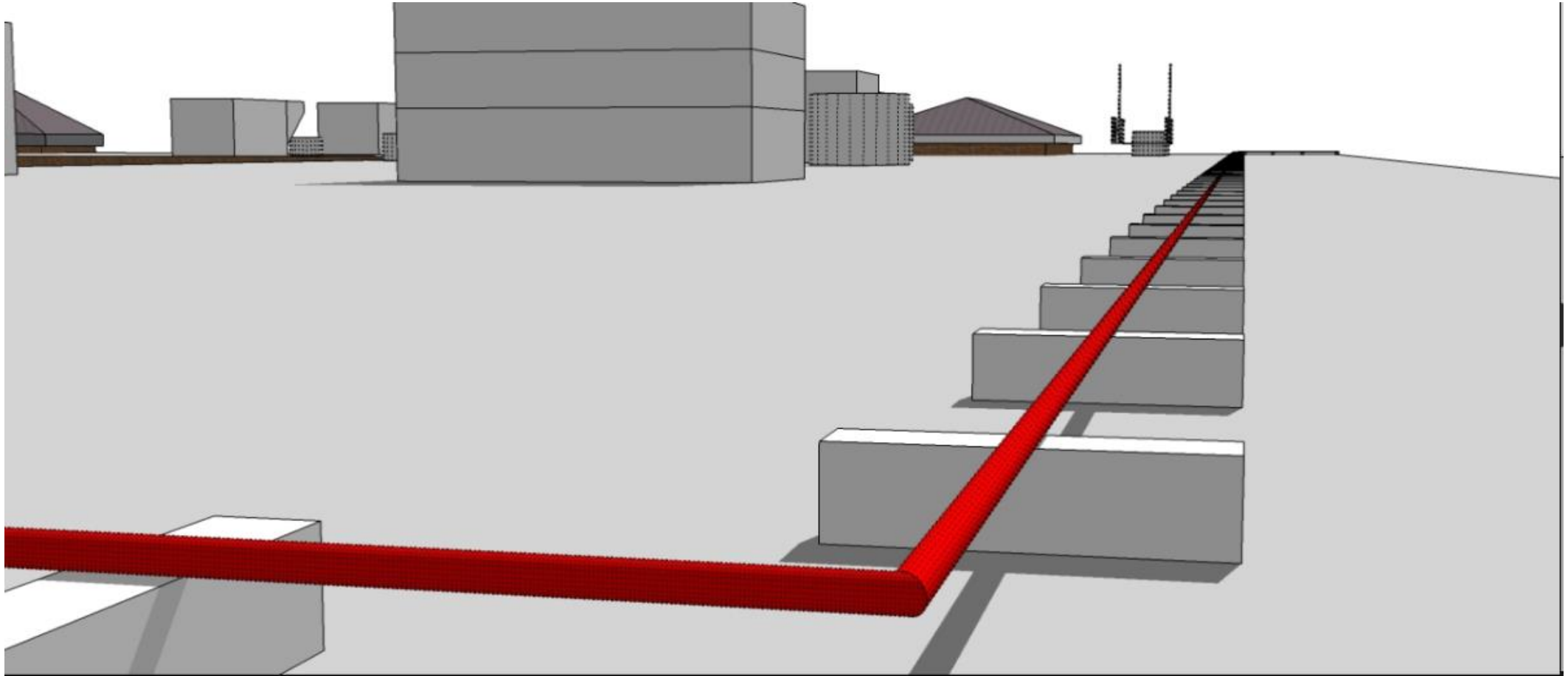
Inverter placement on north side of cupola



Conduit (grey not red) around cupola



Straight run of ballasted conduit (grey not red) from cupola heading due east to far SE corner of building



Conduit (painted background color) at SE corner (parking lot side of building) running down and into a locked utility enclosure and into wall to the left of electric meter



To: Planning Board

Re: Supplemental Information, Site Plan Review, Chenery Solar Array

Date: July 12, 2017

Subsequent to submitting the Site Plan Review Application for the Chenery Solar Array on June 30, 2017, Direct Energy Solar on July 10, 2017 modified its technical design with respect to the type of conduit and the inverter location. In summary, the conduit will be changed to metal and the inverter will now be located next to the meter at ground level. Changes to the submittal are attached and summarized below.

Technical Details

1. Conduit is changed from grey Schedule 40 PVC to grey metal (EMT). The conduit will be attached to floating ballasts every 10' rather than 3'. The metal conduit is more rigid and durable than PVC, which is why the number of ballasts can be reduced and spaced farther apart. The conduit will be painted to match the background color.
2. The 2'x1'x1' inverter will be located at ground level near the southeast corner of the school, next to the utility meter, which is behind a locked 7' high solid utility enclosure. This new location will fully comply with rapid shut down code 2017 N.E.C. The inverter is also more accessible for maintenance and the fire department, if needed. The fire department has a key to the lock on the utility gate. This enclosure eliminates the visual impact of the inverter.
3. Contrary to the original inverter spec sheet, the inverter has a noise rating of <55 dBA (decibels) from a fan which is comparable to the noise level of conversational speech. The fan will only be on when the array is maximally exposed to sunlight (11am-2pm) and barely audible beyond 15' because sound intensity decreases inversely proportional to the squared distance. The solid enclosure dimensions are 7'x17'x 42' which further blocks noise from this or any other existing equipment in this enclosure.
4. These changes have no effect on the structural assessment by AOstructures, Inc or Direct Energy Solar's electrical Permit Design Plan (PDP).

Process:

5. The Director of Facilities, Superintendent of Schools, School Committee Chair, Chenery PTO Chair, Principal McAllister, Superintendent of Maintenance and immediate abutters were notified of the change by email on 7/12/17.

Modifications to submittal:

6. Presentation Slides #27-#31 and 11"x17" Installer Design renderings #4-#7 are no longer applicable.
7. New 11"x17" renderings replace those slides and renderings. These new 11x17" renderings show:
 - the metal conduit without the inverter on the north side of cupola
 - 10' spacing of the floating ballasts
 - the new location of inverter to the left of the meter in the utility enclosure
8. New spec sheet for the SolarEdge inverter model number : SE14.4KUS



SolarEdge Three Phase Inverters for the 208V Grid for North America

SE9KUS / SE14.4KUS

INVERTERS



The best choice for SolarEdge enabled systems

- Integrated arc fault protection for NEC 2011 690.11
- Rapid shutdown for NEC 2014 690.12
- Outdoor and indoor installation
- Built-in module-level monitoring
- Internet connection through Ethernet or Wireless
- Small, lightweight and easy to install on provided bracket
- Fixed voltage inverter, DC/AC conversion only
- Integrated Safety Switch



Three Phase Inverters for the 208V Grid for North America

SE9KUS / SE14.4KUS⁽¹⁾

	SE9KUS		SE14.4KUS	
OUTPUT				
Rated AC Power Output	9000		14400	
Maximum AC Power Output	9000		14400	
AC Output Line Connections	4-wire WYE (L1-L2-L3-N) plus PE or 3 wire Delta			
AC Output Voltage Minimum-Nominal-Maximum ⁽²⁾ (L-N)	105-120-132.5			Vac
AC Output Voltage Minimum-Nominal-Maximum ⁽²⁾ (L-L)	183-208-229			Vac
AC Frequency Min-Nom-Max ⁽²⁾	59.3 - 60 - 60.5			Hz
Max. Continuous Output Current (per Phase)	25		40	A
GFDI Threshold	1			A
Utility Monitoring, Islanding Protection, Country Configurable Set Points	Yes			
INPUT				
Maximum DC Power (Module STC)	12150		19400	W
Transformer-less, Ungrounded	Yes			
Maximum Input Voltage DC to Gnd	250		300	Vdc
Maximum Input Voltage DC+ to DC-	500		600	Vdc
Nominal Input Voltage DC to Gnd	200		Vdc	
Nominal Input Voltage DC+ to DC-	400		Vdc	
Maximum Input Current	26.5		38	Adc
Max. Input Short Circuit Current	45		Adc	
Reverse-Polarity Protection	Yes			
Ground-Fault Isolation Detection	1MΩ Sensitivity			
CEC Weighted Efficiency	96.5		97	%
Night-time Power Consumption	< 3		< 4	W
ADDITIONAL FEATURES				
Supported Communication Interfaces	RS485, Ethernet, ZigBee (optional)			
Rapid Shutdown – NEC 2014 690.12	With installation of rapid shutdown kit ⁽³⁾			
STANDARD COMPLIANCE				
Safety	UL1741, UL1699B, UL1998, CSA 22.2			
Grid Connection Standards	IEEE1547			
Emissions	FCC part15 class B			
INSTALLATION SPECIFICATIONS				
AC output conduit size / AWG range	3/4" minimum / 12-6 AWG			
DC input conduit size / AWG range	3/4" minimum / 12-6 AWG			
Number of DC inputs	2 pairs	3 pairs (with fuses on plus & minus) ⁽⁴⁾		
Dimensions (HxWxD)	21 x 12.5 x 10.5 / 540 x 315 x 260			in/mm
Dimensions with Safety Switch (HxWxD)	30.5 x 12.5 x 10.5 / 775 x 315 x 260			in/mm
Weight	73.2 / 33.2		99.5 / 45	
Weight with Safety Switch	79.7 / 36.2		106 / 48	
Cooling	Fans (user replaceable)			
Noise	< 50		< 55	dBA
Operating Temperature Range	-40 to +140 / -40 to +60			°F/°C
Protection Rating	NEMA 3R			

⁽¹⁾ For 277/480V inverters refer to: <http://www.solaredge.com/files/pdfs/products/inverters/se-three-phase-us-inverter-datasheet.pdf>

⁽²⁾ For other regional settings please contact SolarEdge support.

⁽³⁾ Rapid shutdown kit P/N: contact SolarEdge.

⁽⁴⁾ Field replacement kit for 1 pair of inputs P/N: DCD-3PH-1TBK.

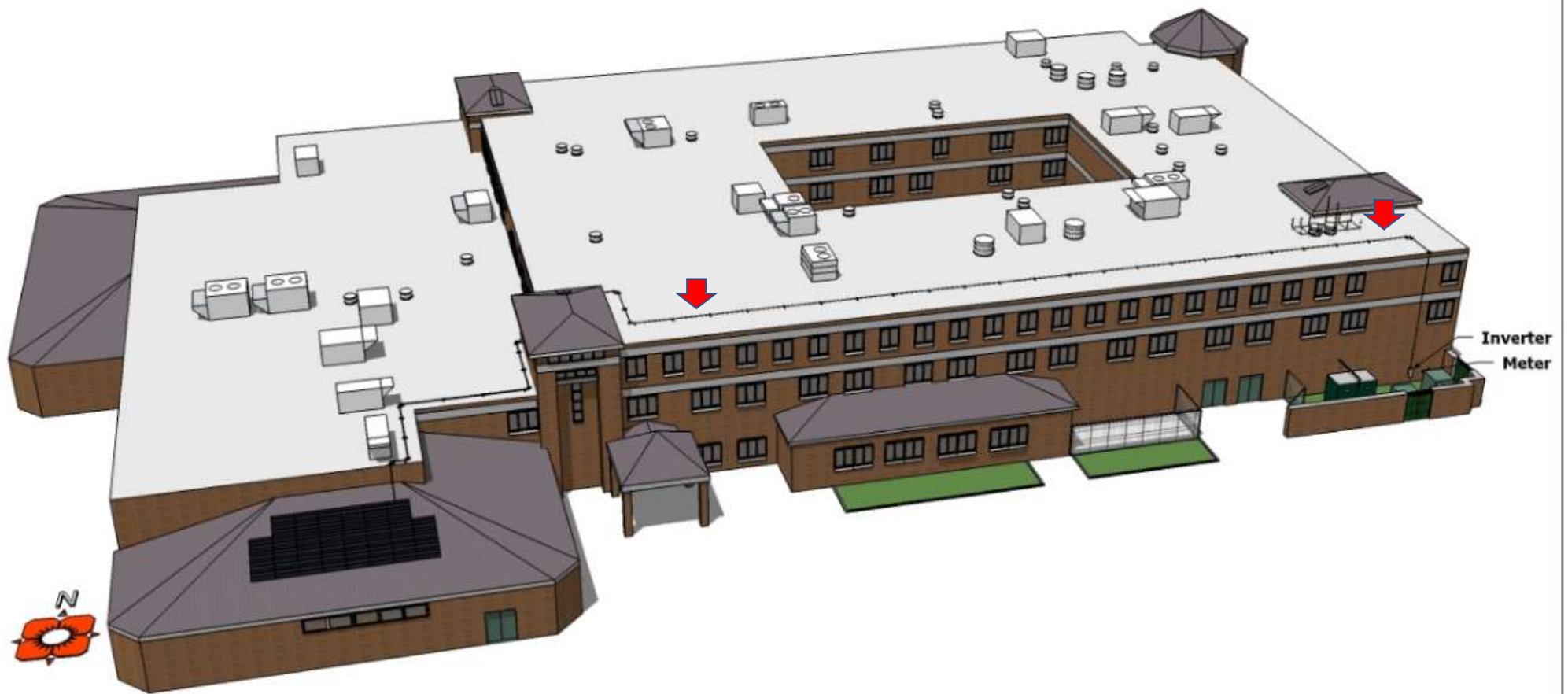


RoHS

Installer's Proposed Design as of 7/12/17



Proposed Design showing conduit path running east along south edge of upper roof



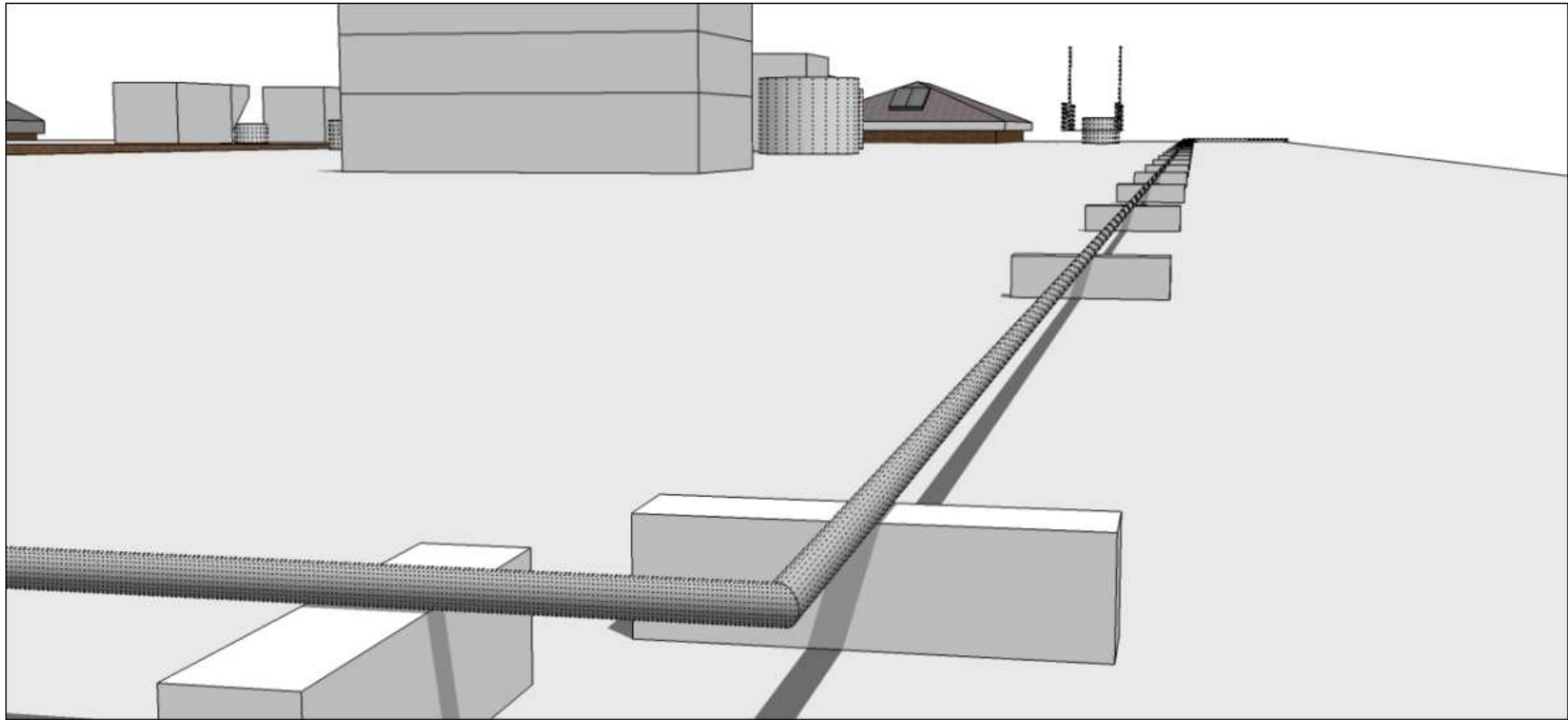
Cable will be in grey conduit (painted brick red after installation) attached to brick façade and runs up to flat roof. Conduit laid out on roof to minimize visual impact from the ground.



View of conduit run facing south running around north side of cupola



Straight run of ballasted conduit from cupola heading due east to far SE corner of building. Conduit attached to ballast with a bracket.



Conduit (painted background color) at SE corner (parking lot side of building) running down and into a locked utility enclosure and into inverter mounted left of electric meter



Close-up of inverter and meter behind locked 7' high utility enclosure.

