RFP No. 21-05 – Solar Installations for City Facilities

A Proposal Prepared By:

Homeland Solar
4975 Miller Road
Ann Arbor, MI 48105

A. Executive Summary
B. Professional Qualifications
C. Similar Projects and References
D. Proposed Work Plan
E. Preliminary System Designs
F. Cost Proposal (separate envelope, one for each bundle)
G. 20 Year Life Cycle Analysis
H. Proposed Construction Schedule
I. Authorized Negotiator
J. Attachments

We acknowledge receipt of Addendum 1 to this RFP.

A. Executive Summary

Homeland Solar is proud to present this response to RFP No. 21-05.

Homeland is a local, Ann Arbor based company with over 3 MW of solar installations on residential, commercial, religious, and municipal properties in southeast Michigan, largely in Washtenaw County. Our focus is simple: to help people and businesses realize their renewable energy goals, be they financial or other, in a quick and efficient way. Delighted customers are our #1 priority.

We have created an exceptionally talented, and multi-faceted local team that will help us not only flesh out but to complete these projects in a timely fashion. Given the complexity of many of the City sites and achieving as rapid an installation schedule as possible once Permits are approved, will set a good standard for future work. We feel this is extremely important as we support City climate goals.

This RFP includes letters of participation and support from the following local professionals, who will all commit with Homeland Solar to optimizing the final design and expediting execution of these projects:

- Harper Electric: licensed union Electrical Contractor
- Haley Mechanical: licensed union Electrical and Mechanical Contractor
- Neff Mechanical: licensed Electrical and Mechanical Contractor
- SUR Energy & Watershed Roofing: licensed Master Electrician, solar business owner
- Charles J (Chuck) Hookham, P.E. licensed Professional Structural Engineer
- Mills Capital and the National Energy Improvement (NEI) Fund, solar financing partner

Homeland has completed many local projects of similar scale and complexity to each of the City sites, including several 180 kW DC systems in the past year. We work with area roofing companies to local architects to ensure our installations maintain warranty coverages. As a licensed builder since 1990, we have built solar support structures and completed structural repairs to buildings where needed.

Within City limits, we have guided several non-profit institutions in crafting, and executing, PPA's. We have provided On-the-Job Training (OJT) to employees of 501-C-3 Superior Watershed Partnership for launch of its Michigan Energy Assistance Program, adding solar to enhance equity for very-low and low-Income households in its service area. This outreach by Homeland Solar builds on decades of work by long-time employees of the company with low and moderate income communities.

Homeland Solar is Michigan Saves Authorized Installer #100482 and over some 10-years has helped many scores of owners better afford and manage their investments in energy upgrades and solar PV. We employ licensed professionals in all our work and have excellent relations with City, County and State inspectors, as well as permitting authorities.

Our initial design and cost estimates are summarized in this response, including financing options for Direct Purchase, the requested 7 & 20-year PPA approach, and the Tax-Exempt Lease Purchase (TELP) option we believe may be of most interest to the City, either now or in the future.

As a diverse team of City and County resident professionals and taxpayers, Homeland Solar looks forward to working with the City to expedite the installation by the multi-faceted team of the finalized solar plans for each of the 13 sites. Without additional charge, we also offer to Solarize a 14th site, the Argo Canoe Livery (appendix 15), if a plan agreeable to all can be set in place.

B. Professional Qualifications

Homeland Solar is a partnership co-owned by local residents David R Friedrichs and Mark D Dorogi.

The company has specialized in solar installations in Ann Arbor and Washtenaw County for more than 10-years. On multiple occasions, the company has completed both private and public solar PV jobs sized precisely the same as the Scope of Work in the RFP 21-05 Site Inventory. www.HomelandSolar.com

For this RFP, the professional experience and reputation of Homeland Solar has allowed the company to broaden its base of local electricians and energy professionals to a scale intended to ensure ALL thirteen (13) sites for solar can be handled expeditiously and by local personnel. The strength of Homeland's installation team will allow for timely performance of work once details at each site are finalized and approval to proceed received. Homeland is able to add both skilled and unskilled local labor as needed.

Business Address:
Homeland Solar
4975 Miller Road
Ann Arbor, MI 48103

Warehouse & Meeting Space:
Homeland Solar
317 Metty Drive, Suite 4
Ann Arbor, MI 48103

Professional Certifications:
(*see attached profile info*)

Company Builder License #262000385
Homeland Builders of Michigan LLC
DBA – Homeland Solar
4975 Miller Rd, Ann Arbor, MI 48103
Qualifying Officer: David R M Friedrichs, #2101098412

Registered Electricians with the City of Ann Arbor for RFP 21-05 (*alphabetical, ea. w/ letter attached*)

Haley Mechanical, Henry Haley, Owner
8415 Dexter-Chelsea Rd, Dexter, MI 48130
www.HaleyMechanical.com 734-424-9170

Harper Electric, Brian Howard and Bill Engel
6920 Jackson Rd, Ann Arbor, MI 48103
www.HarperElectric.com 734-662-8367

Neff Mechanical, Tim Neff, Owner
515 Keech Ave, Ann Arbor, MI 48103
NeffMech@yahoo.com 734-320-5528

SUR Energy, John Wakeman, Owner
221 Buena Vista, Ann Arbor, MI 48103
www.SUR.biz 734-395-2990

Structural Engineering, Grid-Tie Engineering and Storage Planning & Design

Arbor Consultants PC, Charles J (Chuck) Hookham, P.E.
2902 E. Eisenhower Parkway, Ann Arbor, MI 48104
cjhookham@yahoo.com 517-416-4721

Architectural options and aesthetics: Sahba La'al, R.A., 1450 Jones Dr, AA 48105 734-761-2344

B. Professional Qualifications (continued)

In addition to electrical sub-contractors and their personnel, listed below are the Homeland personnel expected to be involved at varying levels in fulfillment of the City's Solar Installation Project (see attached for bio-paragraphs on job principals (first 5 listed below) and significant subcontractors).

- Dave Friedrichs, Managing Member – legal and contractual issues, financial fulfillment.
- Mark Dorogi, Chief Operating Officer – oversees all aspects of PV and electrical system design, materials procurement and installation.
- Darin Rowe, Installation Crew Leader – all aspects of installation and ground crew supervision
- Linda McFaul, Project Engineer – design, procurement, installation, inventory management, customer follow-up
- James (Mack) McMahan, Senior PV Installer – installation crew
- Jim McMahan, Senior PV Installer – installation crew, general duties
- Wyatt Rowe, PV Installer – installation crew, general duties
- Jay Packard, PV Installer – installation crew, general duties
- Eric Ackerman, PV Installer – installation crew, general duties
- Larry Kerber, Commercial Sales – financial modeling, business analysis
- Kevin Kerber, Residential Sales – general sales duties
- Ariel Dorogi, Junior PV Installer – general duties

Homeland brings in additional labor as required and works closely with each of its electrical sub-contractors and their personnel on every job, as will be done at each of the City's Site Inventory locations approved for installation of solar PV.

All of these individuals and **all** of the primary subcontractors engaged by Homeland Solar are located in Ann Arbor or its greater metropolitan area and Washtenaw County (see attachments and the list below of primary subcontractors). Worth a mention as well, is the location just off Ellsworth Road of the 111-year old principal wholesale supply to Homeland Solar, McNaughton McKay Electric Company.

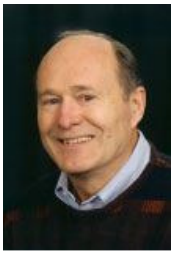
Should there be a need for additional information, please contact either Dave Friedrichs, 313-600-1066, dave@homelandsolar.com, or Mark Dorogi (734-846-8911, mddorogi@comcast.net. Details and contacts for individual subcontractors are provided above and in attached letters, each herein.

- Homeland Solar installation principals
- Haley Mechanical
- Harper Electrical
- Hookham, Chas J, P.E.
- Neff Mechanical
- Sahba La'al, R.A. (registered architect)
- SUR Energy – John Wakeman (aka, Watershed Solar Roofing)

Financing Options for City of Ann Arbor consideration – see letters in COST & FINANCING envelope

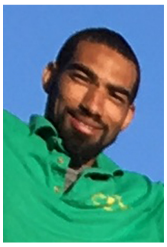
- Scott Hurd – Mills Capital Partners
- Heather Brathwaite – National Energy Improvements (NEI) Fund
- John D'Agostino – Inclusive Prosperity Capital (IPC)
- Roger Krugel – Brightcore Energy LLC

HOMELAND SOLAR
Own Your Own Power™
Residential • Commercial • Municipal
www.HomelandSolar.com



Dave Friedrichs is Managing Member of Homeland Solar. A licensed builder since 1990 and Certified Green Professional with NAHB, Dave formed Homeland to deploy renewable energy (RE) and work on energy efficiency (EE) with a focus on SE Michigan. The team he assembled shifted its focus to solar in 2008-2009. Dave's background is in asset management (CPM®), cooperative banking & finance, Energy Star construction and project management. He has a degree in economics from Michigan State, studied in Brasil and at UW, and has led build teams for Habitat for Humanity International. dave@homelandsolar.com

Mark Dorogi is Chief Operating Officer and lead design-engineer for Homeland Solar's installations and a production manager by education and experience. He has a Master's Degree in Applied Physics from Cornell University and came to Michigan with Philips Electronics in 1989. His interest in renewable energy and the potential of new start- ups kept him in the area after Philips left. Mark also has 5-years experience as a research and development engineer for a thin-film manufacturer of solar panels. He has managed both solar electric and solar thermal installations for Homeland, and has an insider's experience on all things solar. For RFP 21-05 fulfillment, on a collaborative basis, he will decide the technical aspects of the Work Plan and Schedule. mddorogi@comcast.net



James (Mack) McMahan II is a senior installation leader for Homeland and helps orient and train new personnel if added for completion of the installation work for the City of Ann Arbor. Mack has worked for Homeland Solar since 2014 and handled well in all aspects of hundreds of solar system installations. Besides dozens of ground-mounted PV arrays, Mack has installed well over 100 roof-mounted solar systems, assisting licensed builders in their structural work and apprenticed formally with journey and master electricians in wiring. Mack has overseen part-time contract workers, and handled On-the-Job Training for non-profits and owner-involved (DIY) installations. jamesmac141@gmail.com

Darin Rowe serves as Project Manager and installation team leader for Homeland Solar. Raised in Chelsea and living in Dexter with his family, he has over 25-years in construction and maintenance repairs at residential and commercial projects. He has worked on green building and rehab issues with Homeland's founder on Ann Arbor area single and multi-family housing projects since 2010. He certified with Advanced Energy Technologies (AET) in Jacksonville, FL and expanded into commercial solar work with Homeland in 2018. For Darin, the customer comes first and customer satisfaction is paramount. Safety and responsible use of equipment is also an emphasis, with worker training a duty. darinmrowe@aol.com

Linda McFaul serves as project coordinator for Homeland Solar collaborating with project engineers in permitting, grid-tie arrangements and timeline management for key tasks related to company installations. She has over 10-years' experience as an engineering technician and production operator for PV manufacturers. This work has included production supervision. In addition, Linda has well-rounded experience in retail services and inventory, maintenance and data management. She received her Bachelor's degree in Industrial and Systems Engineering from UM Dearborn. linda@homelandsolar.com

HALEY MECHANICAL
8415 DEXTER CHELSEA RD • DEXTER, MI 48130
(734)424-9170 (734)424-9173 info@haleymechanical.com

Office of Sustainability and Innovations

March 19th, 2021

Subject – RFP 21-05 Solar Installations for City Facilities

This letter is written to affirm ***Haley Mechanical's*** agreement to join as a respondent and team member of and with the ***Homeland Solar*** group for whatever professional electrical work and related services Homeland may subcontract to us for completion of work to be authorized under RFP No. 21-05 "Solar Installations for City Facilities."

As founder and owner of Haley Mechanical, I have met personally with the principals of Homeland Solar (Dave Friedrichs, Mark Dorogi and Larry Kerber) for preliminary review of the various City of Ann Arbor buildings listed in the site inventory.

We are an award winning heating, cooling and electrical services company serving Washtenaw County since 1998. Work we are known for includes generators of many types, transfer panel installations, service panel upgrades and geothermal installations. We consider solar PV a "next frontier", and look forward to coordinating with Homeland Solar as the market expands.

Dependable service is not just a slogan for us, but the way we operate every day. We have multiple Master Electricians and dozens of Service Technicians on the job each day. They're also on stand by on off-hours to meet needs as they arise, both routine and emergency.

As a member of IBEW, Homeland Solar and the City of Ann Arbor can rely on our technicians for prompt, courteous and professional service.

Homeland's decade-long experience in design-engineering and installation of solar PV has been demonstrated at hundreds of local commercial and residential locations in the County, including Zingerman's Mail Order facility, the Huron Ophthalmology building by St Joe's, Food Gatherers, numerous churches, schools and community centers. I am not aware of any complaint about the quality, workmanship or EPC aspects of their work.

A "team" or group approach to solarizing the multiple sites in the City's inventory for this RFP can be expected to accelerate completion of the work and help to ensure a high standard is met for all in the final plan for each site.

We look forward to participating with Homeland Solar in whatever way might make sure the work done is timely and within authorized allowances. Thank you.

Sincerely,

Henry Haley, Owner
Haley Mechanical

HARPER ELECTRIC, INC.

6920 Jackson Rd
Ann Arbor, MI 48103
(734) 662-8367
Fax (734) 662-8394
www.harperelectric.net

City of Ann Arbor
Attn: Missy Stults, Director of Sustainability
100 N. Fifth Ave
Ann Arbor, MI 48106

3/5/21

Re: RFP 21-05 Solar Installations for City Facilities

Please accept this letter as the agreement of ***Harper Electric*** to join as subcontractor to ***Homeland Solar*** for the timely and workmanship completion of sites to receive solar PV systems under RFP No. 21-05 "Solar Installations for City Facilities".

Our principals have met with the principals of Homeland for mutual acquaintance and preliminary review of the numerous City sites in the inventory (for subject RFP). Several in the inventory are sites Harper Electric is already familiar with, based on prior contracts with the City, and the company's status as a Preferred Installer for the City.

In a couple of cases, our company is already on tap to install EV charging. As the roll-out of solar is finalized for the RFP 21-05 sites, it may prove economical for EV charging to be added as a Change Order to one or more of the locations. If so, incremental work could prove affordable and easy to coordinate.

Our participation as part of the Homeland Solar team for certain parts of the 21-05 work will facilitate any complementary work involving EV charging, as well as any other ancillary electrical service work that may arise.

Harper Electric was founded in Ann Arbor more than 60-years ago, has upwards of 20 union electricians and prides itself on quality work, both commercial and residential. Our business has been built over the years by making sure that each and every client is treated with respect and gets a quality job done right the first time.

We look forward to collaborating through Homeland Solar on the completion of whatever work is finalized under RFP No. 21-05.

Thank you for your consideration.

Sincerely,

Brian K Howard, C.E.O.
Electrician/Estimator
Harper Electric

William R Engel, C.O.O.
Electrician/Estimator
Harper Electric

ARBOR CONSULTANTS, PC
2902 East Eisenhower, Ann Arbor, MI 48108 • (734) 971-5862

March 17, 2020

Mr. Dave Friedrichs / Mark Dorogi
Homeland Solar
4975 Miller Road
Ann Arbor, MI 48103

Subject: **City of Ann Arbor, Request for Proposals for Solar PV Installations, RFP 21-05**

Dear Dave/Mark,

This letter confirms that Arbor Consultants, PC will support the efforts of the Homeland Solar TEAM that expects to deliver optimized solar PV and energy storage solutions/installations for each of the City facilities listed in the subject RFP 21-05. As you are aware from our many past projects working together, Arbor Consultants can add value to the Team and City in a number of different topical areas including but not limited to the following:

- "Micro-siting" solar PV and energy storage solutions, which will be unique for every facility. Micro-siting includes verification of roof structural integrity, ground mount or awning opportunities, PV impact analysis on building occupants/systems, shading/tuning assessments, life cycle cost analysis to optimize solution(s), and energy storage potential review.
- Detailed structural and electrical engineering design, including preparation of: DTE generator interconnection applications, Ann Arbor building permit applications, PE-sealed design documents, and specifications enabling PV/storage system equipment procurement.
- Technical support and code-based inspections in conjunction with the City's Building Department and DTE. This includes quality control checks and pre-inspection for compliance with building/utility codes (e.g., National Electric Code, DTE's Service Installation Manual (Green Book)), and others in advance of Building Department/DTE inspections. Arbor Consultants is located in the City, with rapid mobilization to any of the facilities in question.
- Assistance with PV/controls system commissioning, energy performance testing, and turnover of as-built details, preparation of O&M books, and hands-on systems training for City staff assigned to asset management.
- Warranty after-care of the PV/battery systems.

In terms of defining optimal solar/battery solutions, it is understood that the City will supply facility details such as electric consumption (interval data, time-of-use, peak demand) and critical loads list so as to optimize energy storage and power back-up options at selected facility sites. Currently, the only commercially available and longer-term storage solutions involve lithium ion and vanadium flow batteries; while the RFP cites desired 72-hour ideal storage windows, there may be alternatives and layered solutions that can be considered (e.g., microgrids). From my experience in the City (e.g., Roos Roast Building, others) and in ahead- and behind-meter installations throughout Michigan (e.g., Circuit West), site-by-site analysis and facility use planning is needed and Arbor can bring a lot of experience to bear.

I should mention that I have worked on many solar PV installations in Ann Arbor and Ypsilanti, dating back to multiple PV arrays at Ypsilanti Food Cooperative and solar PV and solar thermal systems at the former Arbor Brewing and Corner Brewery facilities (the latter coupled with geothermal systems) and can offer a multitude of references if needed. The recent installations I supported Homeland Solar on including Zingerman's Mail Order and Washtenaw Dairy also are representative of challenging but doable solar PV installations.

Please advise if you have any questions or concerns regarding this letter.
Regards,

Charles J. Hookham, PE

Charles (Chuck) Hookham, P.E.
Michigan Professional Engineer #6201034897
Arbor, Consultants, PC
Cell: (517) 416-4721

Neff Mechanical
515 W Keech Ave
Ann Arbor, MI 48103
734-320-5528

Date: 3/19/21

On behalf of Neff Mechanical, this letter affirms our longstanding partnership for licensed electrical work with Homeland Solar and, specifically, our commitment to assist in whatever skilled trades work may be asked of us as relates to the completion of solar at the inventory of City-owned sites in RFP 21-05

I have been licensed as an electrician since 1980 and as a Master Electrician since 1993, always residing in Ann Arbor and registering annually with the City's Building Department. As a Master Electrician, I have Journey and Apprentice electricians – each of whom has worked through the years on solar PV building projects with Homeland Solar.

Like myself, those I employ are Ann Arborites and acquainted with the City-owned sites listed on the inventory for solar under the RFP. I also hold and perform skilled trades work under my Mechanical License from the Bureau of Construction Codes which has come in handy to help owners resolve and modify their use of fossil fuel appliances.

We have worked as principal electrician for Homeland Solar for some ten years and have installed over two (2) megawatts of local solar photovoltaics (PV) at a couple of hundred sites.

Work of the scale in the RFP has been commonplace.

We look forward to having the opportunity to continue and to expand this work.

Sincerely,

Timothy R Neff, Owner

Neff Mechanical

Electrical Contractor #6108312

Master Electrician #6210159

Mechanical Contractor #7110415

March 21st, 2021.

Sahba La'al, Architect

tel
734-761-2344
fax
734-761-3245

1450 Jones Drive
Ann Arbor
Michigan
48105
Email: sahla@umich.edu
Webpage: sahbalaal.com

To: David Friedrichs and Mark Dorogi
Homeland Solar
317 Metty Drive, Suite 4
Ann Arbor, Michigan 48103

Dear Dave and Mark,

To the extent helpful, please accept this offer of architectural services in the event your team is selected by the City as contractor for the above RFP, Solar Installations for City Facilities.

As an Ann Arbor resident since 1984, and practicing Ann Arbor architect since 1990, I am familiar with most of the sites expected to receive solar PV. I would be pleased to evaluate any of the sites for aesthetics and to provide structural and architectural recommendations, as appropriate. For example, at Gallup Canoe Livery which we visited together, placement of solar on the south-facing portico appears preferable to ground-mounting – due to space limitations and alternate uses, e.g. pedestrian, play and picnics. A preliminary/conceptual design for a 'mono-pitch truss' on the Gallup livery portico and Farmer's Market roof is attached.

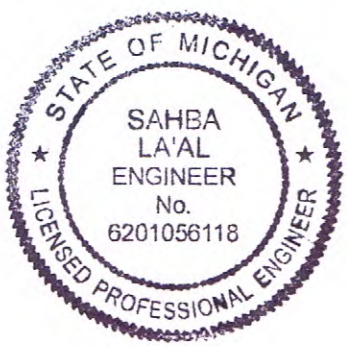
As a resident who frequents the Farmers Market, I have become aware of existing drainage challenges, there. It has occurred to me that the addition of new roof-mounted solar might be an opportunity to mitigate the drainage problems by employing similar mono-pitch trusses. Homeland Solar could explore these possibilities in its design discussions with City officials. I would be pleased to participate!

Given the local presence of the many professionals on Homeland Solar's team for this RFP, they are able to visit each site easily and as often as the City may require. In my experience, this can be very valuable when final engineering and designs are being developed.

Thank you in advance for the opportunity to participate on the Homeland Team, if and when you are selected.

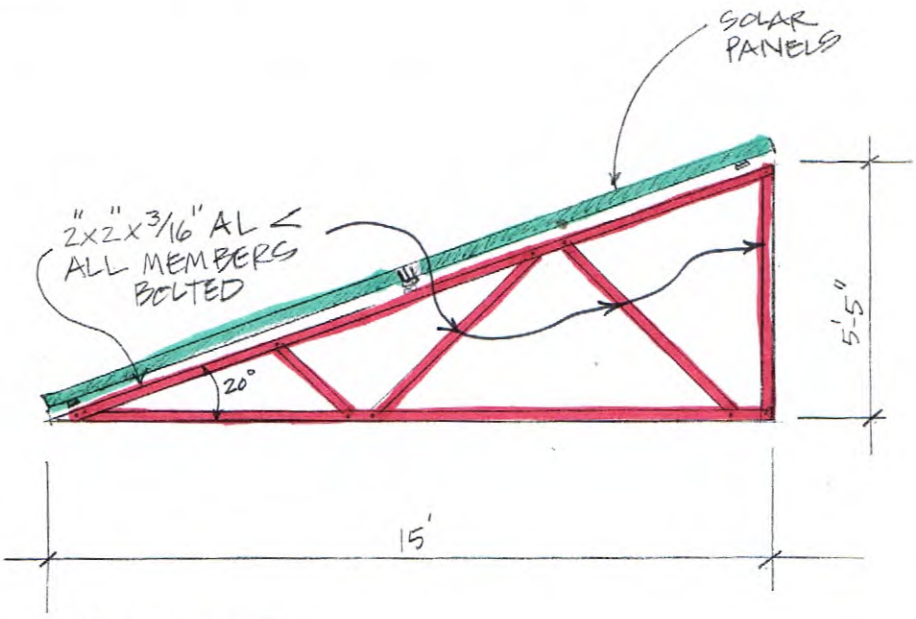
Sincerely Yours,

Sahba La'al, Architect, P.E., RA



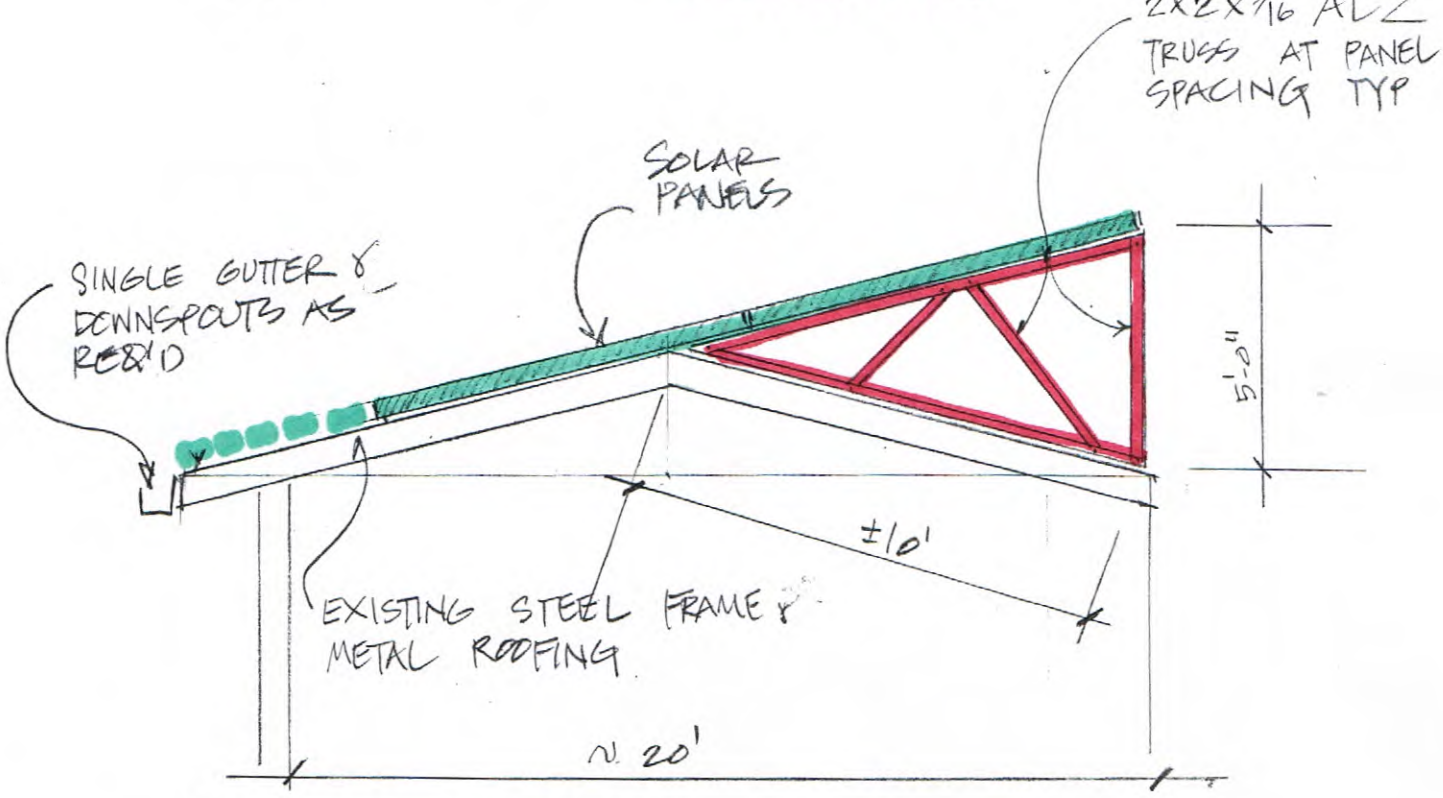
Sahba La'al, Architect
Tel: 734 761 2344
Fax: 734 761 3245
sahla@umich.edu
1450 Jones Drive
Ann Arbor, Michigan
48105

REVISIONS:
2/10/21
3/20/21



GALLUP
CANOE LIVERY
SOLAR FRAME/SUPPORT
1/4"=1'-0"

CONCEPTUAL



FARMERS MARKET
SOLAR FRAME/SUPPORT
1/4"=1'-0"

CONCEPTUAL

watershed solar roofing

Affordable – Durable – Beautiful

City of Ann Arbor
Attn: Missy Stults
301 East Huron Street, Fifth Floor
Ann Arbor, MI 48104
RE: RFP 21-05

March 18, 2021

Dear Missy,

This letter is to inform you of our intent to work as electrical subcontractor for Homeland Solar were they to be awarded contracts under the RFP. As you probably know SUR Energy has worked directly for the City of Ann Arbor, Washtenaw County, and the Federal Government, successfully completing solar projects in the Ann Arbor area for 20 years. As discussed with Homeland principal Mark Dorogi our role would be to do electrical integration of one or more of the smaller projects, and possibly help with site management for these projects.

Further, I have established a new company, Watershed Solar Roofing, LLC, a manufacturer of solar roofing components. If carport or utility building roofs were needed under the RFP, and it were advantageous to all parties concerned, we could supply materials and installation assistance to Homeland. This would be another chance to engage one more company with an Ann Arbor address.

Thank you for considering our colleagues at Homeland Solar for this RFP, and good luck with this and all of your sustainability projects.

Warmly,

John Wakeman

President
SUR Energy, LLC
www.sur.biz
Watershed Soar Roofing, LLC
www.watershed-solar.com
221 Buena Vista Ave.
Ann Arbor, MI 48103
O: 734-913-9944
M: 734-395-2990

C. Similar Solar PV Installation Projects & References

Homeland Solar invites reviewers to acquaint themselves with any of the many similar projects in and around Ann Arbor designed, engineered, and completed in recent years by the company. With RFP 21-05 having thirteen (13) – and possibly a 14th – here are a comparable number of like-sized local projects with address, contact info, year completed & reference as to payment. (*Letters of reference on request*.)

42kW	Miller Manor – Ann Arbor – Contact: Jennifer Hall, City Housing 734-794-6720	(2015)	Direct
	727 Miller, A2 48103 JHall@a2gov.org		Buy
26kW	City of Pleasant Ridge – Contact: James Breuckman, City Mgr 248-541-2901	(2017)	Direct
	4 Ridge Rd, P.R. 48069 citymanager@cityofpleasantridge.org		Buy
103kW	Ann Arbor Public Schools – Contact: Emile Lauzzana, Fac. Mgr 734-769-5513	(2020)	Direct
	Pattengill Elementary lauzzanae@aaps.k12.mi.us		Buy
165kW	Huron Valley Tennis Club – Contact: Bev Ghesquiere, principal, 734-904-0270	(2019)	Direct
	3235 Cherry Hill, A2 48105 tghesqui@comcast.net		
160kW	Food Gatherers – Contact: John Reed, manager, 734-761-2796	(2019)	Direct
	1 Carrot Way, A2 48105 John@FoodGatherers.org		
180kW	Zingermans Mail Order – Contact: Jason Atlee, mgr, 734-834-2035	(2020)	Direct
	610 Phoenix Dr, A2 48108 jatlee@Zingermans.com		
166kW	Huron Ophthalmology – Contact: Victoria Elkins, mgr, 616-690-2762	(2020)	Direct
	5477 Clark, Ypsi 48198 velkins@huroneye.com		
64kW	Genesis of Ann Arbor – Contact: David Lewis, architect	(2019)	PPA
	2309 Packard, A2 48104 david.lewis.architect@gmail.com		
165kW	Food Hub - Contact: Richard Andres, co-owner, 734-385-6540	(2013)	Direct
	4175 Old US23, A2 48103 tantrefarm@gmail.com		w/REAP
152kW	Keweenaw Bay Indian Community – Contact: Jason Ayres – 906-353-1302	(2014)	Direct
	16429 Beartown, Baraga 49908 jayres@kbic.nsn.gov		w/ grant
25kW	GESU Catholic School – Contact: Anita Sevier – 313-460-6051	(2017)	Direct
	17139 Oak Dr, Detroit 48221 Sevier.a@gesudetroit.org		
32kW	7th Day Adventist Church & School – Contact: Scott Reid Nelson 734-358-1204	(2018)	PPA
	2796 Packard St, A2 48104 scottreidnelson@gmail.com		
18kW	First Congregational Church (A2) – contact: Dan Jacobs 734-663-1910	(2019)	PPA
	608 E. Willams, A2 48104 djacobs@a3c.com		
30kW	First UU Congregation of AA – contact: Ed Lynn 734-665-6158	(2011-15)	Direct
	4001 A2-Saline Rd, A2 48103 ed@uuaa.org		
47kW	Trucent (Dexter) - contact: Tom Czartoski, 734-646-2056	(2017)	Direct
	7400 Newman, Dexter 48130 tomczartoski@trucent.com		
25kW	Okemos High School – contact: Steve Lathrop, 734-706-5037	(2016)	Direct
	2800 Jolly Rd, Okemos 48864 Steve.lathrop@okemosk12.net		
25kW	Northside Community Center – contact: Derrick Miller, Exec Dir 734-994-2985	(2020)	City/A2
	608 Taylor, A2 48105 dmiller@canwashtenaw.org		
36kW	Wildtype Native Plants Nursery – contact: Bill Schneider, owner 517-244-1140	(2019)	Direct
	900 N. Every, Mason 48854 wildtypeplants@gmail.com		w/REAP

End Note: There has been no litigation or threat of litigation against Homeland Solar. We have a practice of responding urgently to equipment failures or performance issues which arise. We provide or assist in securing warranty coverage for all goods & services supplied; and offer repair services to others.

D. Proposed Work Plan

Our philosophy is simple: delight the customers. We strive to keep open communications, be responsive, and get things done according to our commitments. We are honest in our appraisals and recommendations, and we do not sell services or products that we feel do not provide value to the customer.

Homeland completes 5-10 projects monthly, depending on size. Solar projects are complicated, involving utility companies, permitting authorities, material and equipment suppliers, sub-contractors, financing partners, weather, site conditions, and of course the customer. We have found that it takes an organized and dedicated effort to track the milestones and tasks for each project.

We track every project from start to finish with a detailed, spreadsheet-based list of over 20 tasks, starting with permitting and interconnection, through to installation, and ending with inspections, monitoring setup, operational tests, and customer close-out.

The list of City sites is varied in complexity. Some sites will be straightforward, with no major surprises or difficulties expected. Examples of these would be the Leslie Science Center, Veterans Park, and Buhr Park. Others, such as City Hall, Fire Station 1, and the Water and Wastewater plants will take more up-front time to review with appropriate stakeholders and to design professionally. Finally, as a school, we believe that Mack Pool may have to go through State permitting. This can be a several month process.

In terms of scheduling, our approach in terms will be geared to finish all projects within a minimum of 6 and a maximum of 9 months from award of contract. We plan to start soon after award of contract by getting activities going on those projects which can move most quickly. As those progress through the approval cycle, efforts will intensify at the sites where additional engineering and design – and decision-making as to options and alternatives are involved.

A broad outline of our work plan is as follows for each location in the Site Inventory:

1. Conduct site visits with City stakeholders and our electrical sub-contractors.
    a. As relevant, evaluate options and alternative, engaging departmental decision-making.
2. Complete Design Review.
    a. Layout and electrical plan review.
    b. Detailed assessment of storage possibilities.
    c. Update utility load information.
3. Accept Final Design.
    a. Resolve any uncertainties.
    b. Produce final system documentation.
    c. Procure any equipment that needs to be special ordered (e.g., transformers).
4. Submit permitting and Interconnection applications.
5. Schedule and complete installation.
    a. Arrange material deliveries as needed.
    b. Generate safety plan per site.
    c. Start installation after approval of permits and interconnection.
    d. Involve City personnel and other stakeholders to minimize disruptions.

6. Complete building and electrical inspections – and thorough labelling of PV system.
7. Submit interconnection documents.
8. Conduct system operational tests and complete monitoring set-up.
9. Place system in operation upon utility company approval and meter re-programming.
10. Hold training sessions with City stakeholders and site personnel.
11. Complete final documentation and close-out project.

Homeland's typical payment schedule is:

- Downpayment upon signing of contract (varies).
- 35% upon commencement of construction (materials on-site).
- Balance upon completion and parallel operation.

Homeland is experienced and comfortable working on a construction draw basis, where funds are secure (escrow equivalent) and AIA invoices (percentage complete) are submitted monthly and subject to retention pending final inspections and approvals. This latter AIA system is envisioned for 21-05.

E. Preliminary System Designs

GENERAL NOTES

Inverter Locations

Inverter locations are not generally clear, pending site visits. Homeland typically mounts inverters indoors in or near the electrical room. In certain instances, inverters are mounted outside, and Homeland constructs a sheltering structure to minimize exposure to the elements.

Battery Ready

SolarEdge single phase inverters are available in a "battery ready" version at additional cost – indicated per site in the Pricing Proposal. These can be installed when the solar is installed and in the future additional equipment and batteries could be added with no changes to the solar array or inverter. One single phase inverter can support two 16 kWh LG-Chem batteries.

Larger three phase systems would require a specifically engineered storage system based on detailed site conditions, utility rate, and power requirement at short term time intervals of 15 to 30 minutes.

Product Information

Data sheets and warranties are included as appendices. Homeland Solar uses solar panels and inverter equipment from major, tier 1 suppliers with industry standard warranty performance or better. Typical solar panel brands we use include Jinko Solar (all-black 375W) and Hanwha Q Cells (430W), and we have access to other should the need arise. We have standardized on SolarEdge inverter equipment as the DC optimizers provide module-level monitoring and rapid shutdown as required by NEC 2017. We have used racking from Unirac, Iron Ridge, Nuance Energy, AP Alternatives and have access to others.

There may be some alternate design options, carports for example, where bi-facial modules may give an extra energy boost of ~5% annually. These modules have cells on the back side and can generate extra power from light reflected from ground and other surfaces. Homeland has access to these modules and we expect they would be in the 455-475W range.

System Output – 20 Years

Appendix 14 has a tabular summary of 20 years of expected kWh generation for all 13 sites. The simulations are run using Helioscope, including shading, and with condition sets that Homeland has found agrees with actual production from existing installations.

Ancillary Work

Site visits may show the need for electrical service upgrades, structural work, underground directional boring or other unanticipated expense. These are not included in the project costs provided.

Site 1: Burns Senior Center

Annual Load 21,700 kWh, Rate D3.

Base Option: Appendix 1A, 16.5 kW DC Category 1 Rooftop System

The base system design is a rooftop system with 16.5 kW DC of capacity and will be a DTE Category 1 system. The rooftop design appears to be limited to around 16 kW DC due to vent stacks and skylights. This site has significant shading from trees and power lines near the building. Two inverters would be installed, which would potentially allow up to four 16 kWh batteries to be installed for 64 kWh of storage. The solar panels would be all-black 66 cell 375W panels.

Description	Module	DC (kW)	AC (kW)	1st Year kWh	Offset %
Base - Rooftop	375W	16.5	15.2	13,100	60

Alternate Option: Appendix 1B, 25.5 kW DC Category 1 Carport System

A carport option may be desirable at this site due to shading on the building roof. Carport costs would need to be determined based on location in parking lot and underground obstacles. A carport could use potentially 450-475W bi-facial modules for an extra power boost. EV charging stations could be installed at the carport.

Description	Module	DC (kW)	AC (kW)	1st Year kWh	Offset %
Alt - Carport	425W	25.5	20.0	26,800	124

Interval Data: Appendix 1C

Interval data shows higher power usage in the winter months at around 4000W, with slightly higher usage at mid-day. Usage in summer months is lower. There are slight increases in use around mid-day.

Site 1: Burns Senior Center

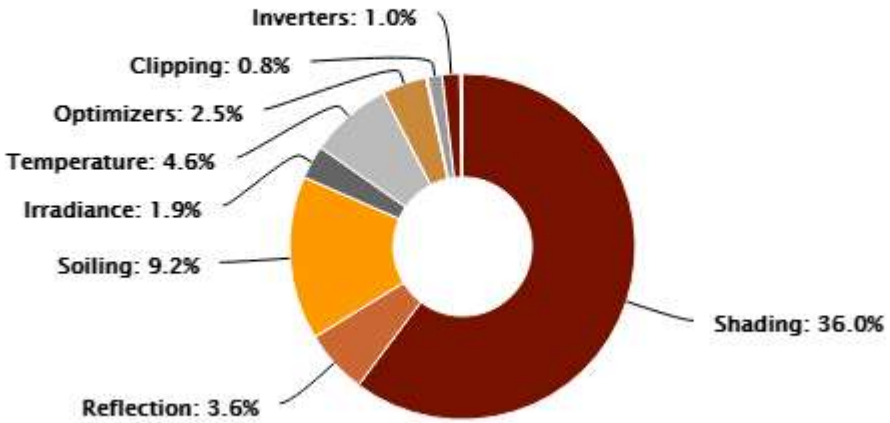
Appendix 1A: Base Option - Burns Senior Center Rooftop Layout

Appendix 1A: Base Option - Burns Senior Center Design Summary

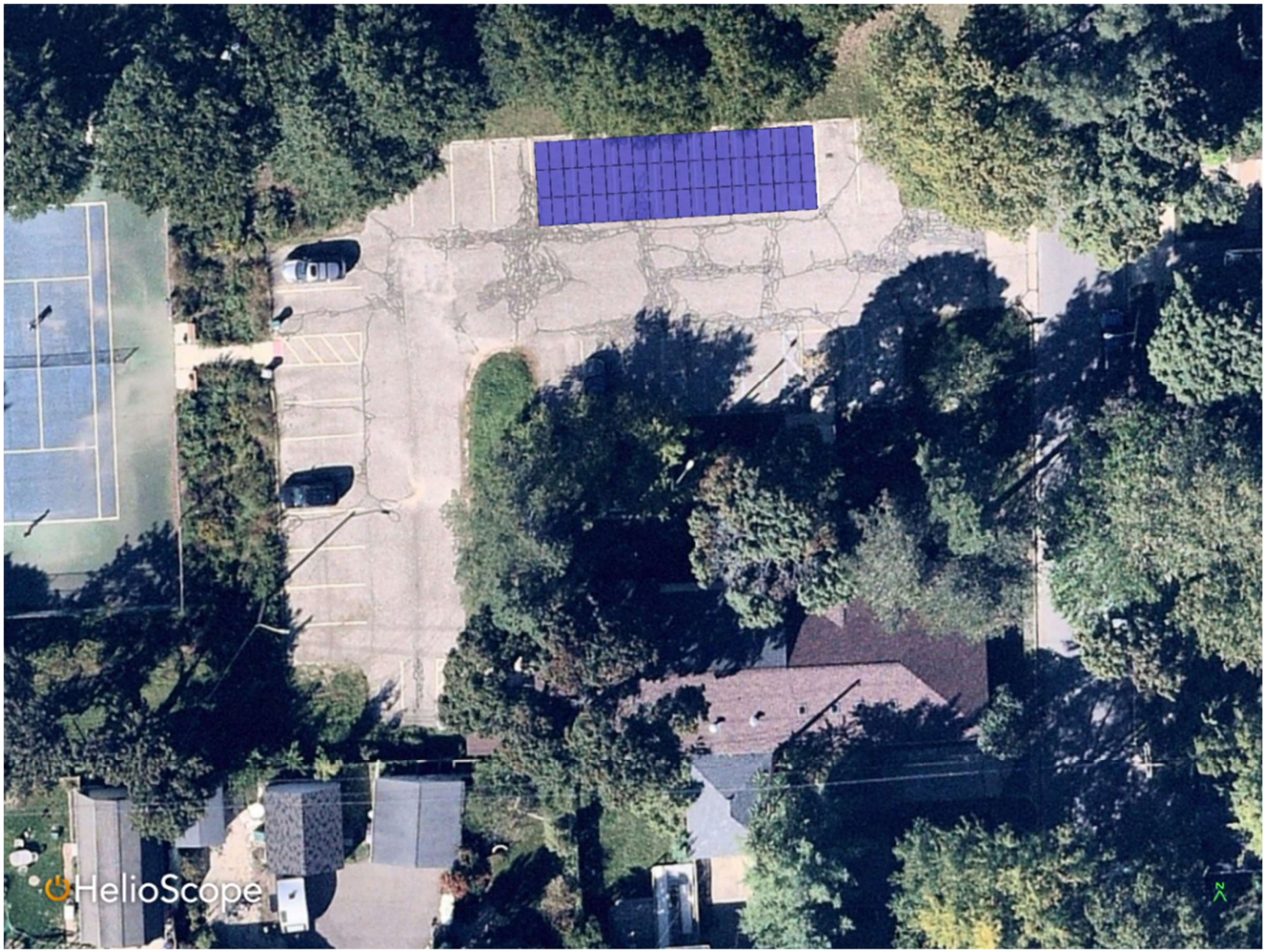
Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Flush Mount	Portrait (Vertical)	18.4°	176.5°	0.0 ft	1x1	44	44	16.5 kW

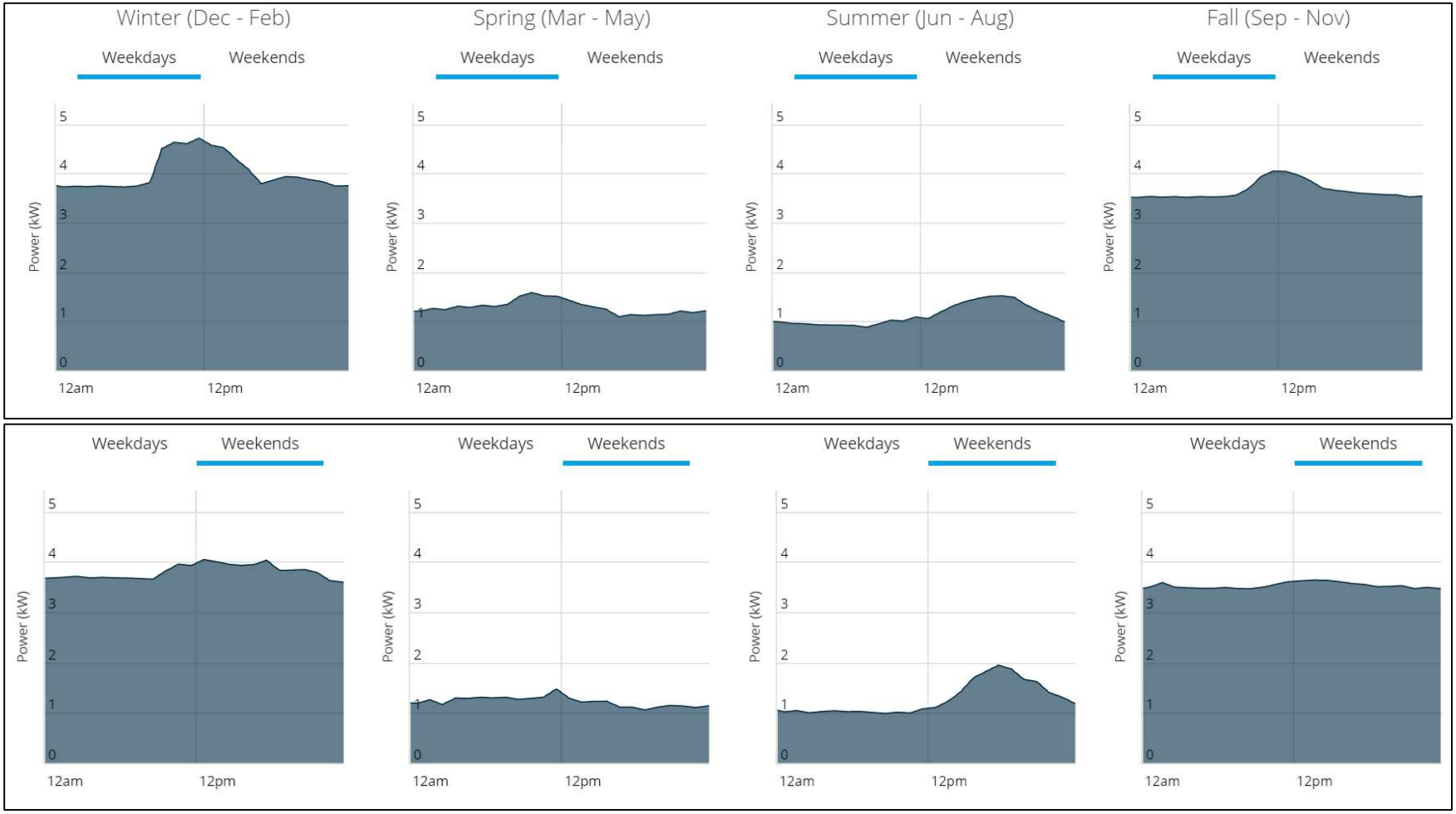
Sources of System Loss



Appendix 1B: Alternate Option - Burns Senior Center – Carport



Appendix 1C: Burns Senior Center Interval Data



Site 2: Gallup Canoe Livery

Annual Load 26,700 kWh, Rate D3.

Base Option: Appendix 2A, 21.0 kW DC Category 1 Pergola System

We believe that the best option at the Canoe Livery is a system mounted on a pergola constructed on the existing posts at the front of the building. The existing structure needs repair and using it for solar would avoid having panels on the ground, which would almost certainly interfere with land use patterns. Two inverters would be installed, which would potentially allow up to four 16 kWh batteries to be installed for 64 kWh of storage. The solar panels would be all-black 66 cell 375W panels.

The cost below does not include re-construction of existing pergola, which would need to be determined pending site visits and detailed engineering.

Description	Module	DC (kW)	AC (kW)	1st Year kWh	Offset %
Base - Pergola	375W	21.0	20.0	28,300	106

Alternate Option: Appendix 2B, 25.5 kW DC Category Ground Mount

A potential ground mount location to the north of the livery is shown in Appendix 2B. The use patterns in this area, along with undulating land and a couple good sized trees, make this option unlikely in our opinion. Likewise, the area in front of the livery is not suitable for solar due to land use, aesthetics and zoning restrictions.

Description	Module	DC (kW)	AC (kW)	1st Year kWh	Offset %
Alt Ground	425W	25.5	20.0	29,400	110

Interval Data: Appendix 1C

Interval data shows low power requirements, inconsistent with the reported annual usage.

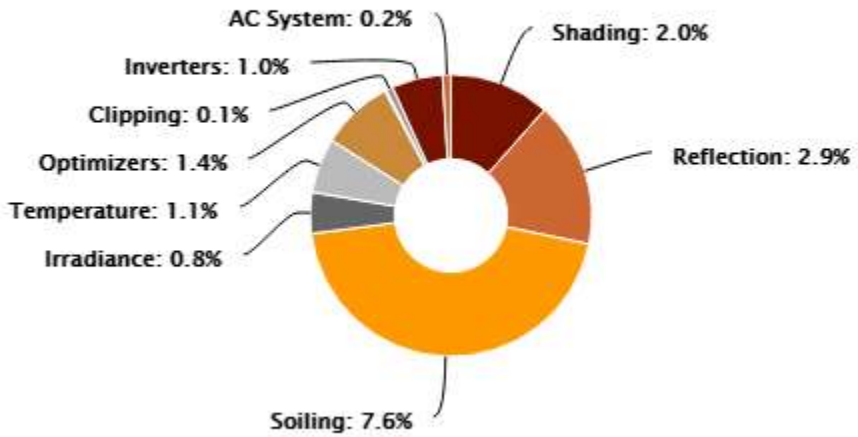
Appendix 2A: Base Option - Gallup Canoe Livery – Pergola Layout

Appendix 2A: Base Option - Gallup Canoe Livery – Design Summary

Field Segments

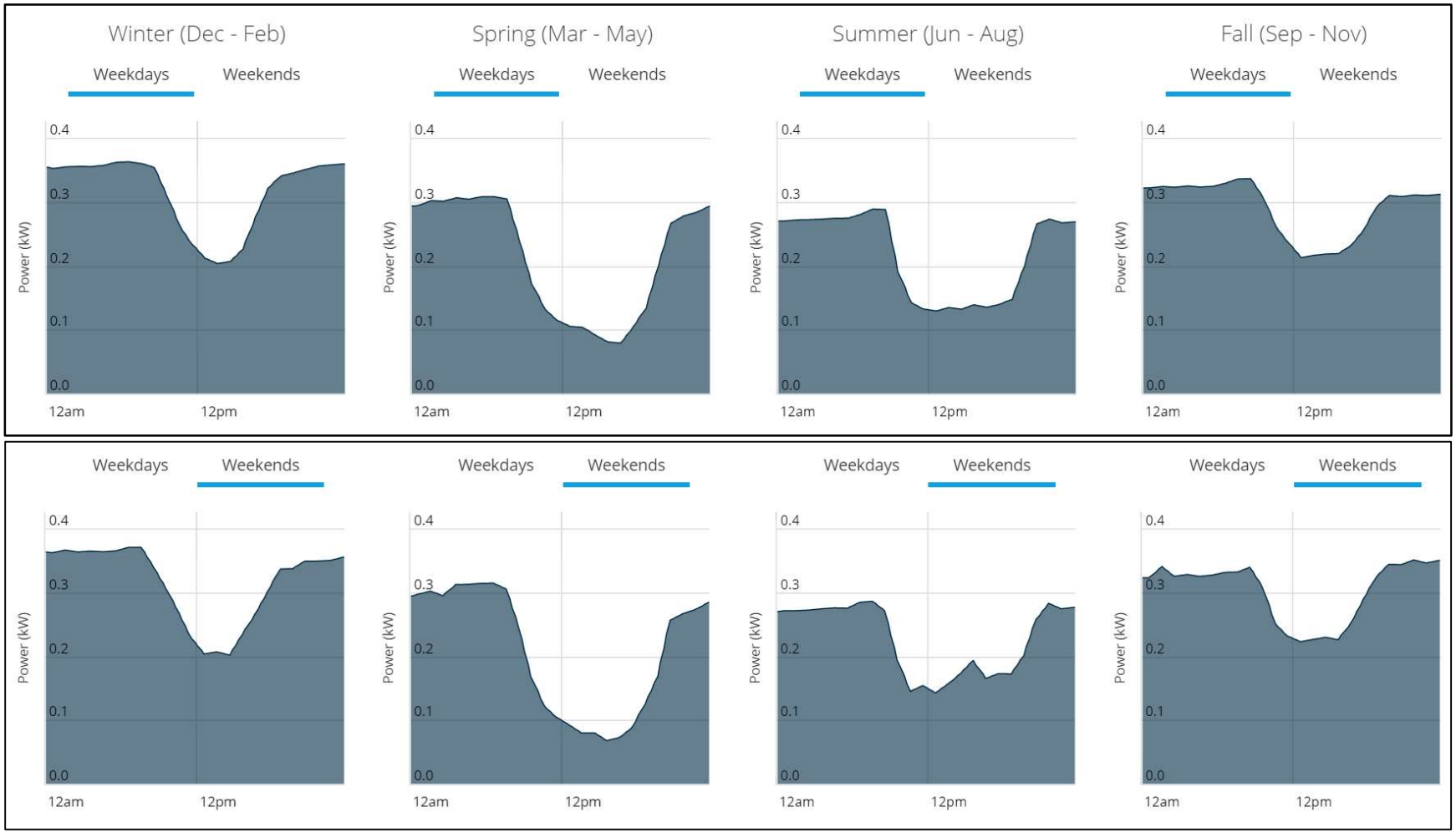
Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 2	Fixed Tilt	Portrait (Vertical)	35°	204°	0.0 ft	2x1	28	56	21.0 kW

Sources of System Loss



Appendix 2B: Alternate Option - Gallup Canoe Livery – Ground Mount

Appendix 2C: Gallup Canoe Livery Interval Data



Site 3: Ann Arbor Farmer's Market

Annual Load 28,400 kWh, Rate D3

Base Option: Appendix 3A, 28.5 kW DC Category 2 Rooftop System

The base 28.5 kW DC option should be approved by DTE based on the current load, perhaps with a little strong-arming. It uses the mostly south-east facing roof sections. The interval data shows that the peak energy use is in the morning hours, nicely coinciding with the south-east facing panels. This system is slightly oversized, and it is installed as Category 2 in anticipation of further oversizing in the future. The 375W all-black panels would be used and would have an attractive appearance.

The building has three phase service. This system includes a solar transformer which could be oversized, at additional expense, for future expansion. The system design is based on oversizing as much as possible given the current load. Base and expanded arrays are shown.

Description	Module	DC (kW)	AC (kW)	1st Year kWh	Offset %
Base - Rooftop	375W	28.5	30	34,700	122

Alternate Option: Appendix 3B, 113 kW DC Category 2 Expanded System

The conceptual expanded array is an example of what may be possible by using available roof surfaces and installing several carports. At 113 kW DC, the additional output could power several car chargers and provide over 300,000 driving miles annually. High output bi-facial modules could provide an additional energy boost of around 5% annually for the carports.

Description	Module	DC (kW)	AC (kW)	1st Year kWh	Offset %
Alt - Expanded	375W/455W	113	100	135,600	475

Interval Data: Appendix 1C

Interval data shows higher power usage in the winter months at around 4000W, with slightly higher usage at mid-day. Usage in summer months is lower. There are slight increases in use around mid-day.

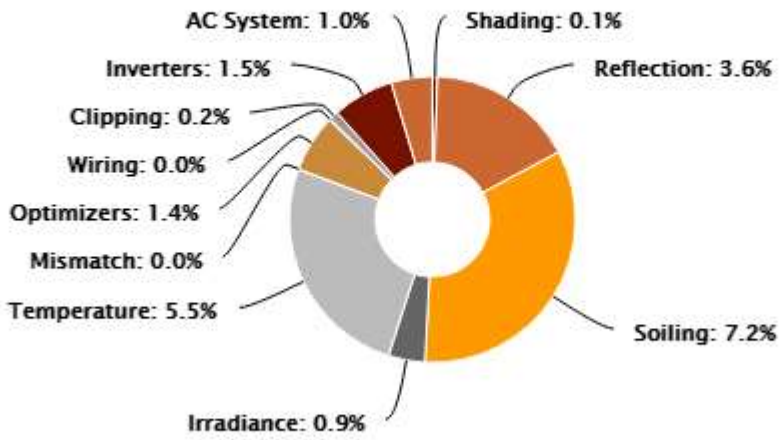
Appendix 3A: Base Option - Farmer's Market Rooftop Layout

Appendix 3A: Base Option - Farmer's Market Rooftop Layout Design Summary

Field Segments

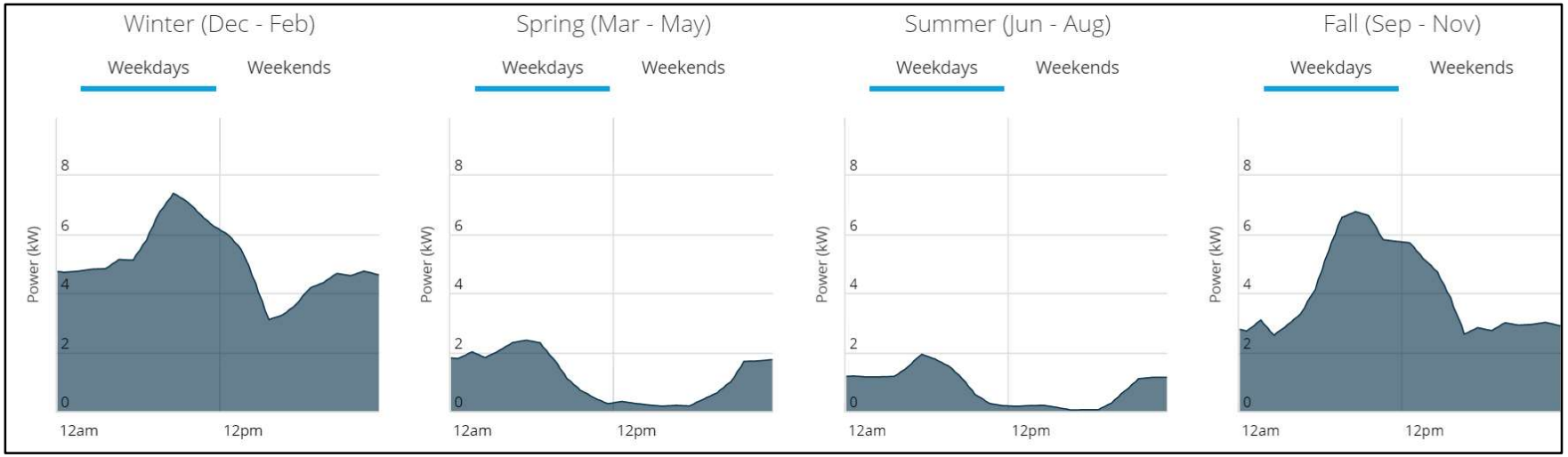
Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 2	Flush Mount	Portrait (Vertical)	15°	126.626976°	0.1 ft	1x1	60	60	22.5 kW
Field Segment 2	Flush Mount	Portrait (Vertical)	15°	126.626976°	0.1 ft	1x1	16	16	6.00 kW

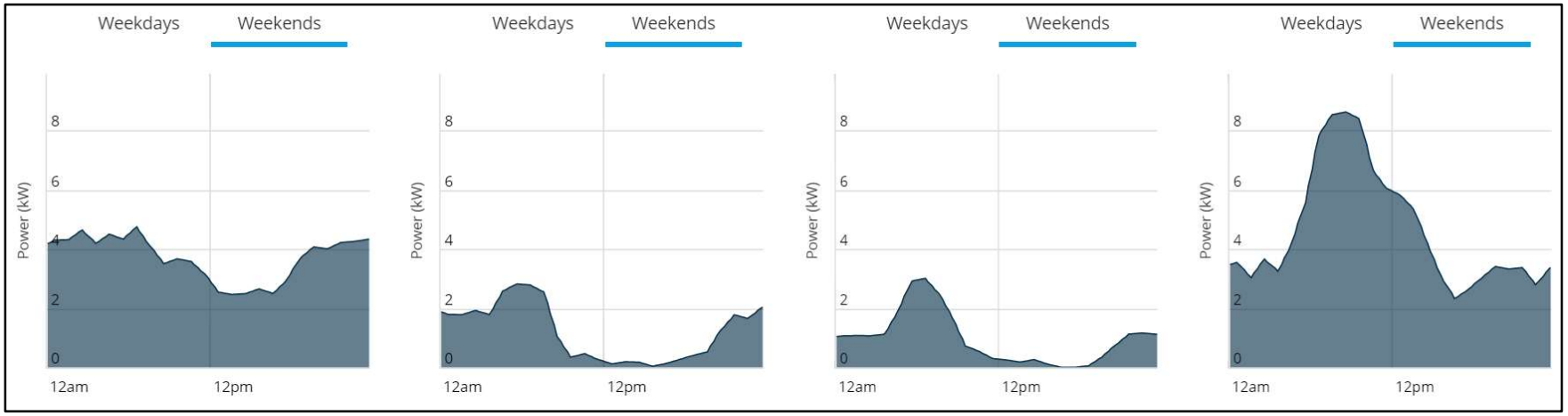
Sources of System Loss



Appendix 3B: Alternate Option: Farmer's Market – Expanded Layout with 302 panels, 113 kW DC

Appendix 3C: Farmer's Market Interval Data





Site 4: Leslie Science Center

Annual Load 32,800 kWh, Rate D3, single phase

Base Option: Appendix 4A, 30.3 kW DC Category 2 Ground Mount System

This Category 2 ground mount system has 74 panels and would be expected to provide over 100% of the indicated annual load. There would be some shading from the tall trees to the west of the array. We note that there are five meters at the Science Center and most likely they would need to be consolidated into one meter, which may potentially require a service upgrade.

Three SolarEdge inverters would be capable of supporting up to six 16 kWh batteries.

Description	Module	DC (kW)	AC (kW)	1st Year kWh	Offset %
Base – Ground	425W	31.5	30	38,600	118

Alternate Options

Ground mounted panels could be placed in the cul-de-sac in front of the Science Center, or on the ground to the west of the house. However, these options do not substantially change the system sizing or generation and are not included here.

Interval Data

Interval data was not available for this site.

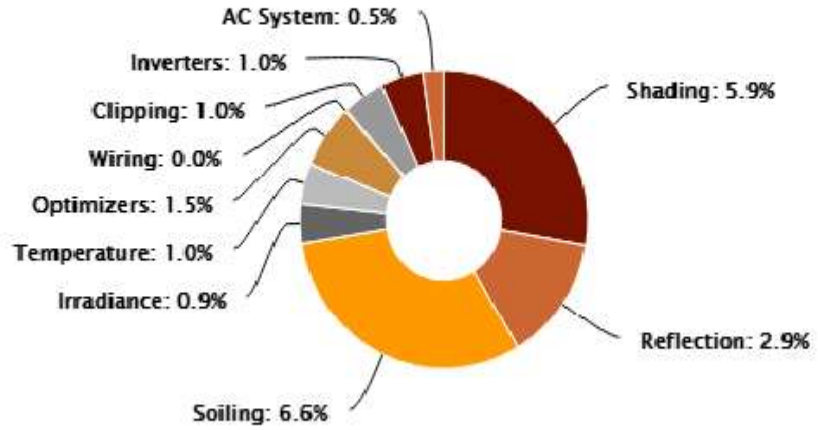
Appendix 4: Base Option - Leslie Science Center - Ground Mount Layout

Appendix 4: Base Option - Leslie Science Center – Design Summary

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Fixed Tilt	Portrait (Vertical)	30°	144°	16.5 ft	2x1	37	74	31.5 kW

Sources of System Loss



Site 5: Cobblestone House and Farm

House – Annual Load 9,800 kWh, Rate D1, single phase
Farm - 47.500 kWh, Rate D3, single phase

Base Option: Appendix 5A, 52.7 kW DC Ground Mount System

A ground mount system seems to be the preferred option; setbacks from the public sidewalk and Packard Street would need to be confirmed, along with acceptability of this location from a land use perspective. The proposed system would be approximately 124 panels, with 20 panels feeding a 7.6 kW inverter at the house, and the remaining 104 panels powering four 10 kW inverters at the farm building.

The house would be a DTE category 1 system, and the farm would be DTE category 2.

Description	Module	DC (kW)	AC (kW)	1st Year kWh	Offset %
Base – Ground	425W	52.7	47.6	67,300	117

Alternate Options:

Rooftop on Farm Building Appendix 5B

The farm building has a fair amount of roof space, although it is moderately steep and E/W facing which would cut production somewhat. There are also some tall oak trees in the vicinity of the building which would cause minimal shading loss.

One advantage of this location is that the meter is right on the north side of the farm building so wiring would be simpler than either the ground mount or carport options.

Carport Powering Farm Appendix 5C

There is plenty of space on the parking lot north of the farm building for carport-based solar. EV chargers could be integrated. The house would be too distance to power from this parking lot.

Rooftop on house Appendix 5D

The house has its own meter and it would have to be powered either from a system on the house itself or from a ground mount array to the east. Historic District considerations may limit the possibility of putting solar panels on the house itself. The most likely location is on the e/w facing roof sections on the north end of the house.

Interval Data Appendix 5E

Interval data shows relatively constant use of around 4 kW, with somewhat higher peak usage in summer afternoons.

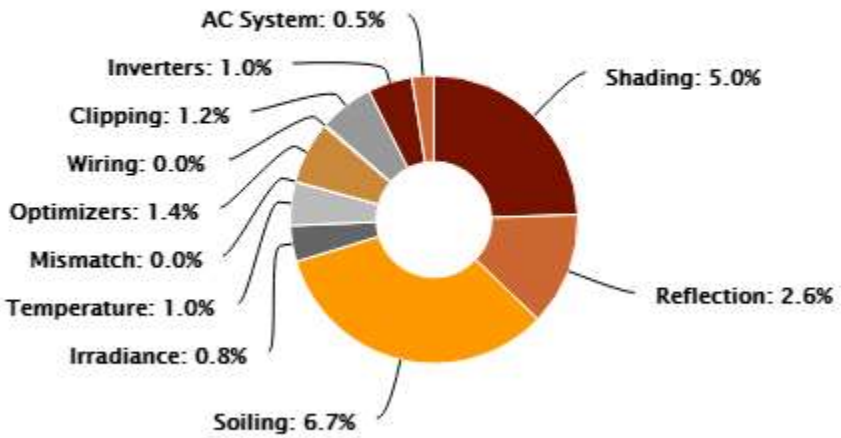
Appendix 5A: Base Option - Cobblestone Farm and House – Ground Mount

Appendix 5A: Base Option - Cobblestone Farm and House – Design Summary

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Fixed Tilt	Portrait (Vertical)	30°	180°	20.0 ft	2x1	62	124	52.7 kW

Sources of System Loss

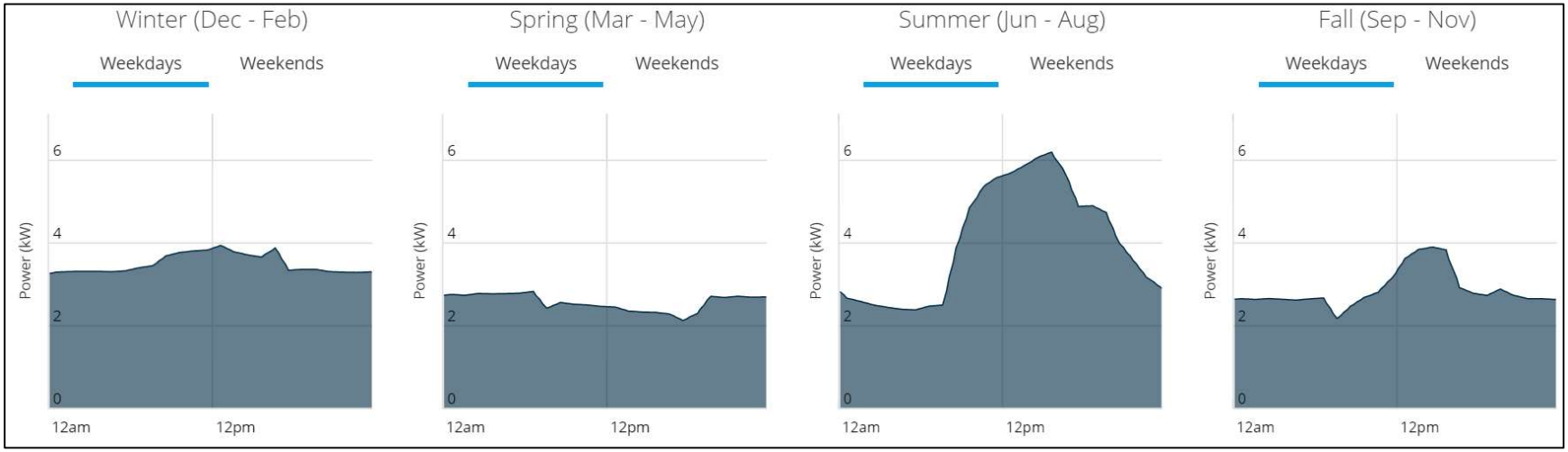


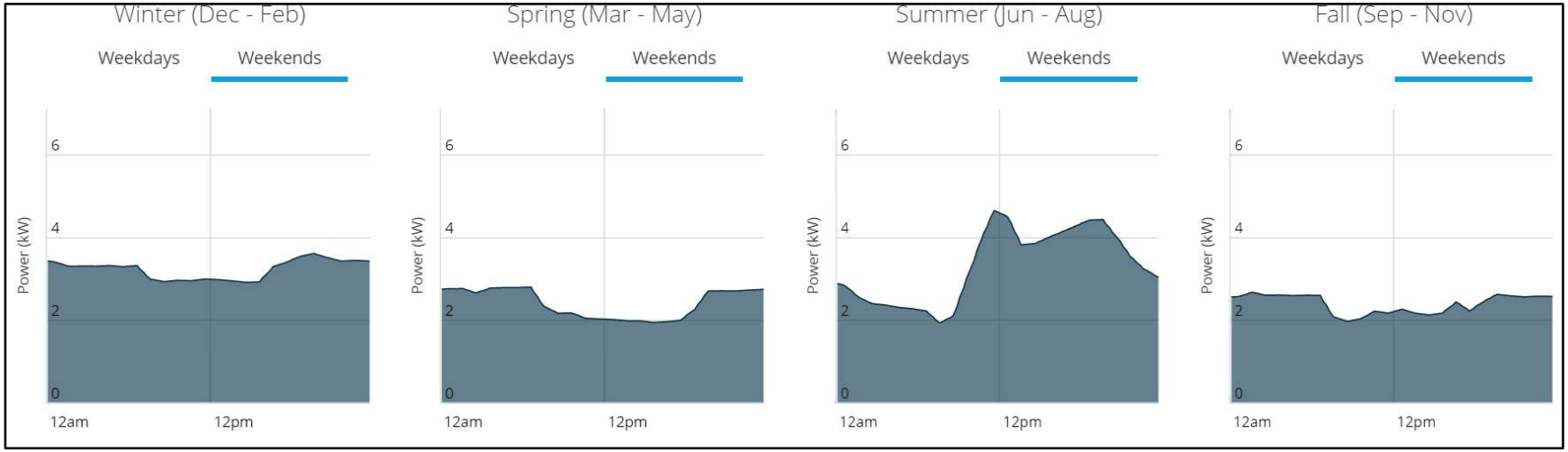
Appendix 5B: Alternate Option - Cobblestone Farm – Rooftop on Farm

Appendix 5C: Alternate Option - Cobblestone Farm – Carport for Farm

Appendix 5D: Alternate Option - Cobblestone Farm – Rooftop on House

Appendix 5E: Cobblestone Farm – Interval Data





Site 6: Fuller Park

Annual Load 145,280 kWh, Rate D3, 240V

Base Option: Appendix 6A, 136.9 kW DC Ground Mount System

The two options here are ground mount and carport. The ground mount location would be directly east of the pool and appears to be straightforward. In this layout, the ground mount panels are tilted at 20 degrees so that more panels could be placed in the available ground space. A small number of ballasted panels could also be included on one of the flat roof sections. We assume that the building has three phase service. This would be a DTE category 2 system.

Description	Module	DC (kW)	AC (kW)	1st Year kWh	Offset %
Base – Ground	425W	136.9	120	158,200	109

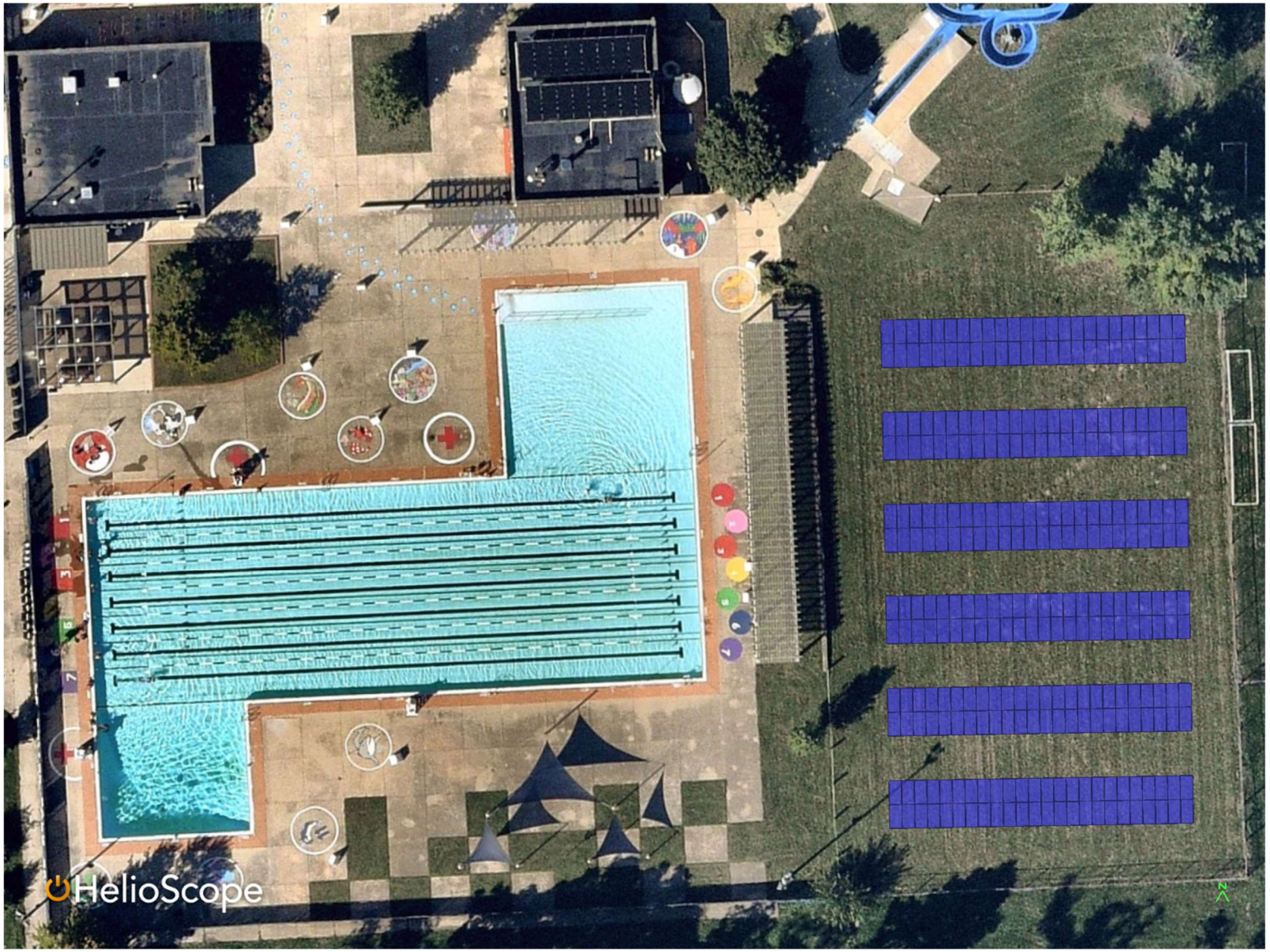
Alternate Option: Appendix 6B, Carport System

The parking lot offers ample space for large solar arrays should the ground mount location turn out to be infeasible due to zoning or land use consideration. An example layout is given with 172 kW DC of capacity, and much more capacity could be added to support car chargers or other loads.

Interval Data: Appendix 6C

Interval data shows similar patterns across seasons, with peaks evident in the early morning hours and again later in the afternoon and evening.

Appendix 6A: Base Option - Fuller Park – Ground Mount

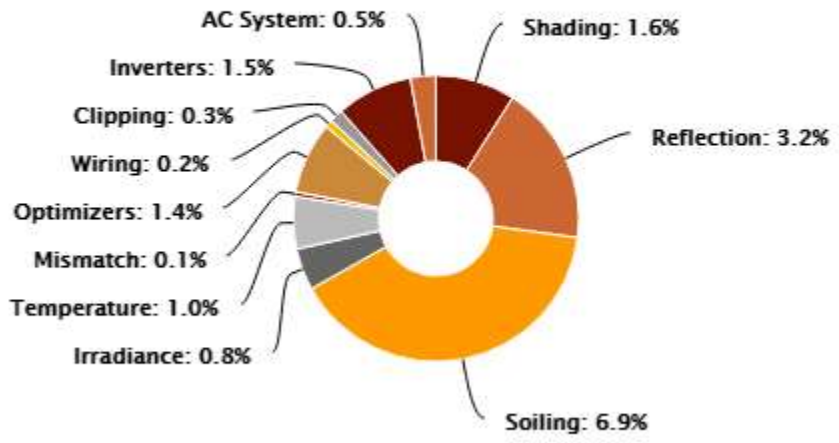


Appendix 6A: Base Option - Fuller Park – Ground Mount - Design Summary

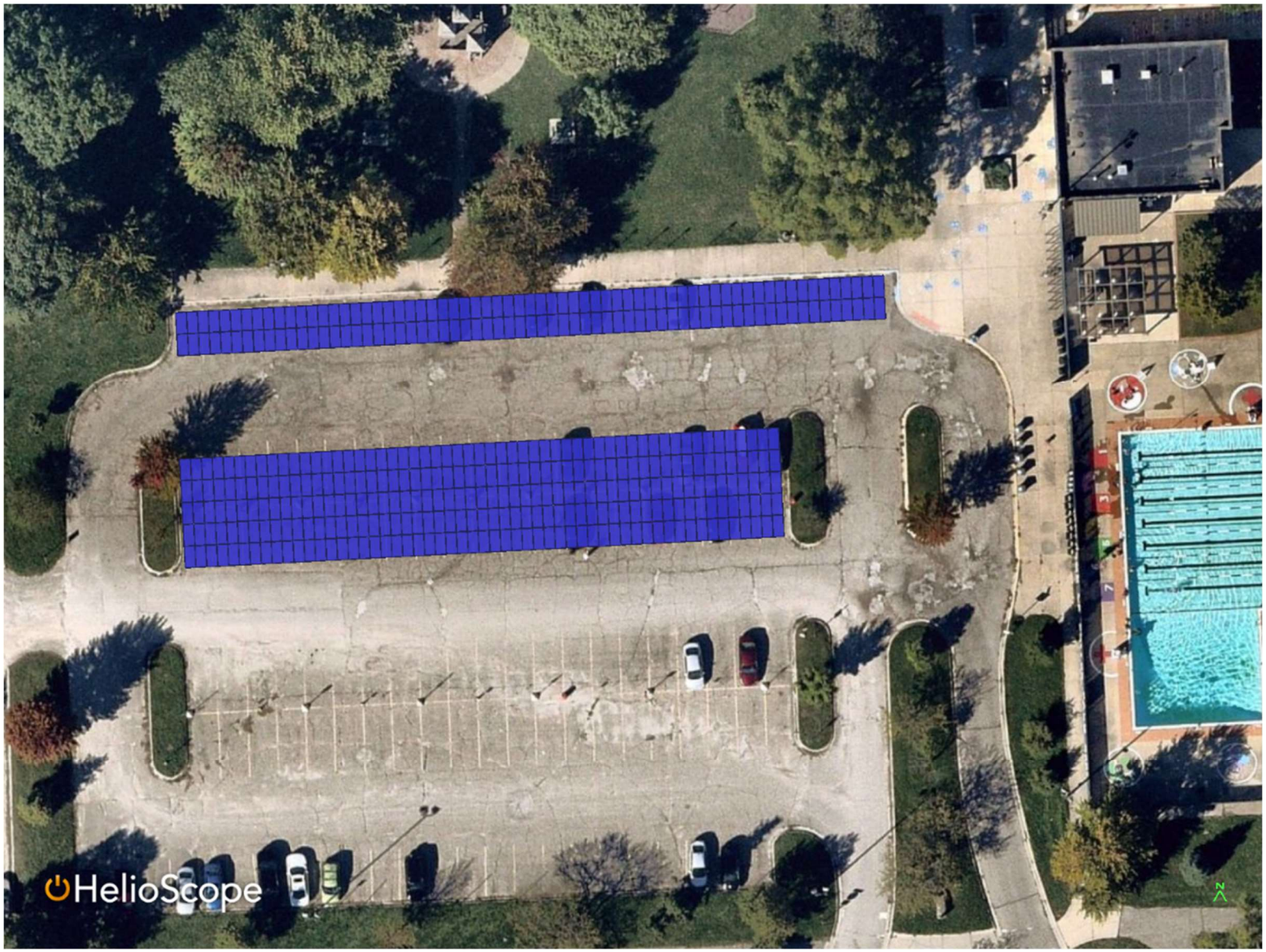
Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 2	Fixed Tilt	Portrait (Vertical)	20°	179°	12.0 ft	2x1	144	288	122.4 kW

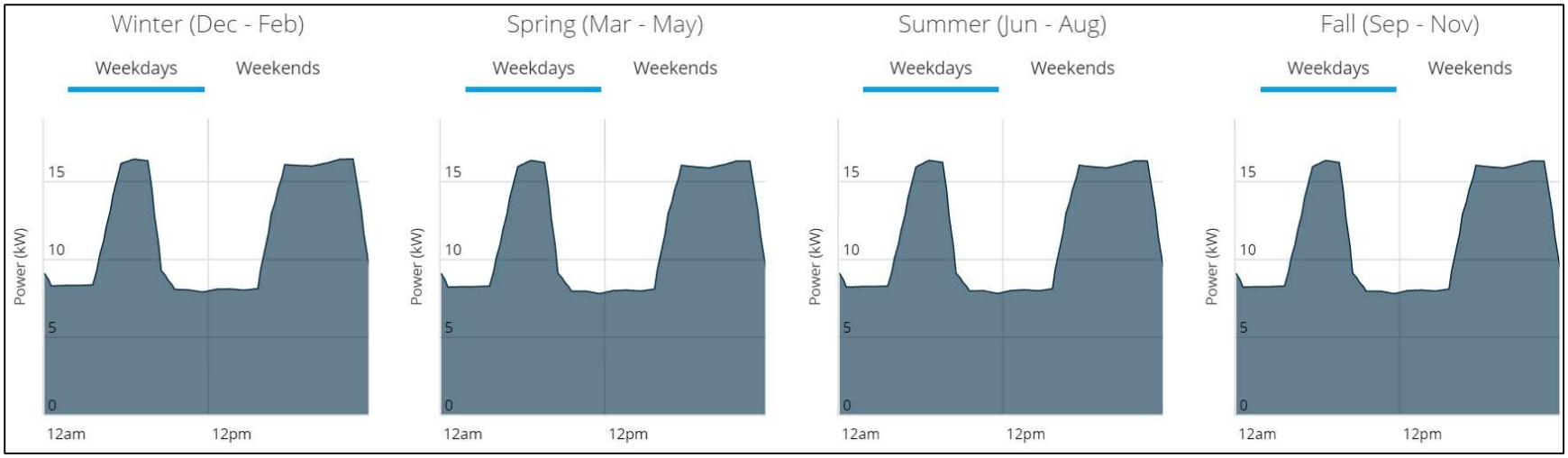
Sources of System Loss

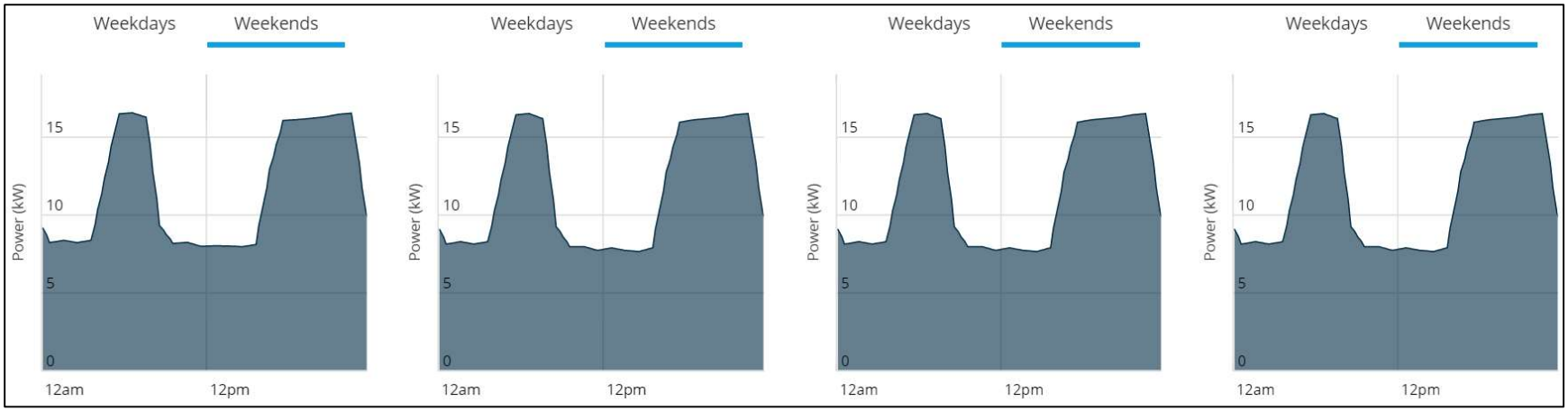


Appendix 6B: Alternate Option - Fuller Park – Carport



Appendix 6C: Fuller Park – Interval Data





Site 7: Mack Pool

Annual Load 218,000 kWh, Rate D4, 240V

Base Option: Appendix 7A, 192.1 kW DC Ballasted System

The site is assumed to have three phase service. A ballasted rooftop system is required here. A variety of roof surfaces are available, and a representative layout is given, with 452 panels, using 10-degree tilt racking.

This site is a school and would need to go through State permitting, with higher permitting costs than typical in Ann Arbor, as well as longer times needed for plan review and approval. The State requires 6' clear setback from roof edges. This would be a DTE category 2 system.

Description	Module	DC (kW)	AC (kW)	1st Year kWh	Offset %
Base – Ballasted	425W	192.1	150	222,400	102

Interval Data: Appendix 7B

Interval Data shows higher consumption of around 15-20 kW in winter and spring, with lower, flat usage of about 5 kW during the day.

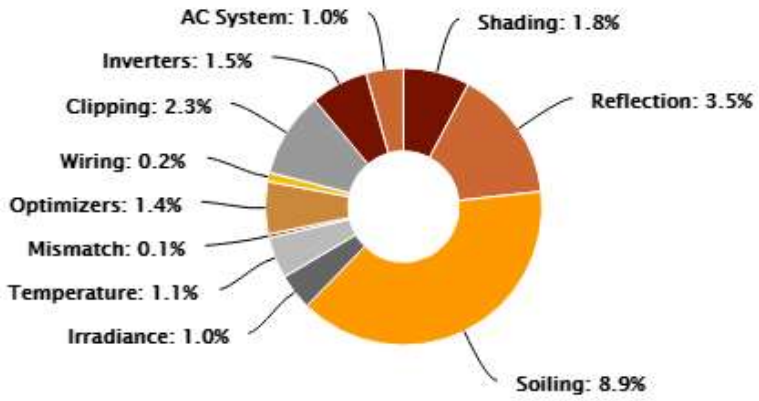
Appendix 7A: Mack Pool - Ballasted Rooftop Layout

Appendix 7A: Base Option – Mack Pool – Ballasted Rooftop - Design Summary

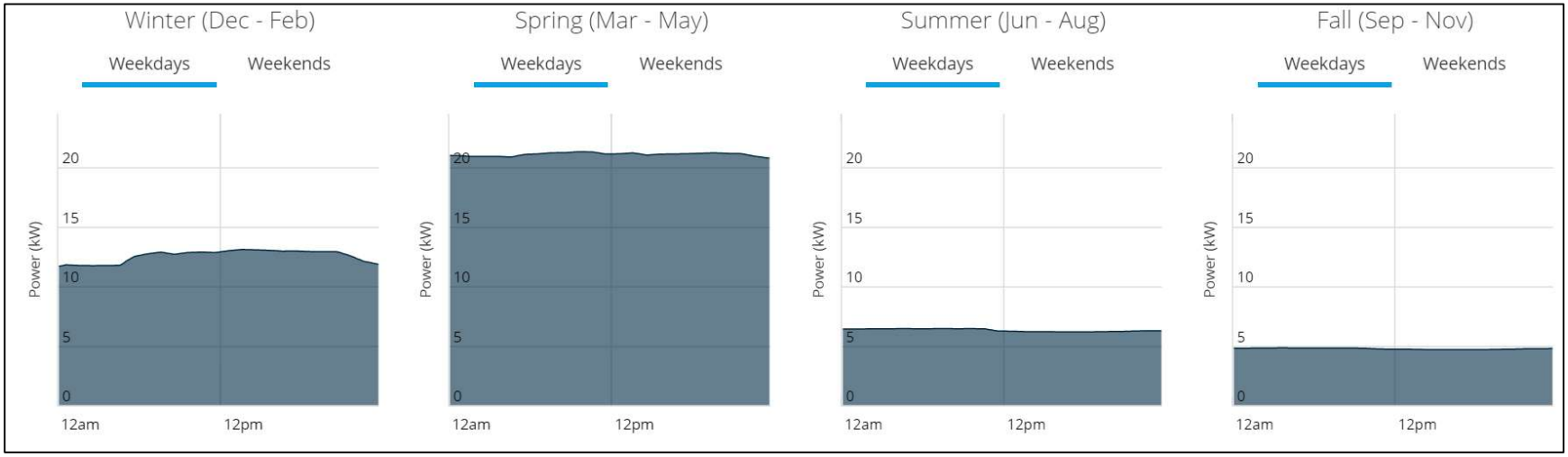
Field Segments

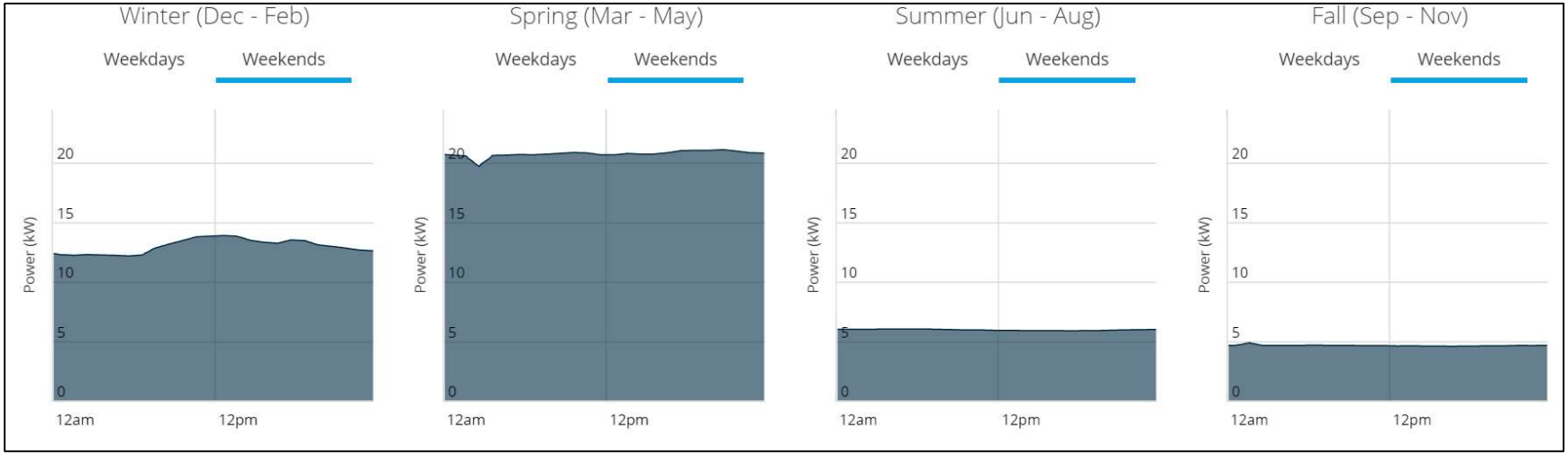
Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Fixed Tilt	Landscape (Horizontal)	10°	134°	1.1 ft	1x1	142	142	60.4 kW
Field Segment 2	Fixed Tilt	Landscape (Horizontal)	10°	134°	1.1 ft	1x1	22	22	9.35 kW
Field Segment 3	Fixed Tilt	Landscape (Horizontal)	10°	134°	1.1 ft	1x1	38	38	16.2 kW
Field Segment 4	Fixed Tilt	Landscape (Horizontal)	10°	134°	1.1 ft	1x1	26	26	11.1 kW
Field Segment 8	Fixed Tilt	Landscape (Horizontal)	10°	133°	1.1 ft	1x1	224	224	95.2 kW

Sources of System Loss



Appendix 7B: Base Option – Mack Pool – Ballasted Rooftop - Interval Data





Site 8: Fire Station 1

Annual Load: 335,000 kWh, Rate D4, 480V

Base Option: Appendix 8A, 54.4 kW DC Ballasted System

Fire Station 1 has many rooftop units and obstacles. It may be possible to relocate some of the conduits and remove some items from the roof, however this will only become clear during site visits. A layout using 10-degree racking is shown.

Description	Module	DC (kW)	AC (kW)	1st Year kWh	Offset %
Base – Ballasted	425W	54.4	50	60,600	18

Interval Data: Appendix 8B

Interval data shows fairly high constant usage of 30-40 kW, with afternoon peaks of closer to 60 kW evident during summer months.

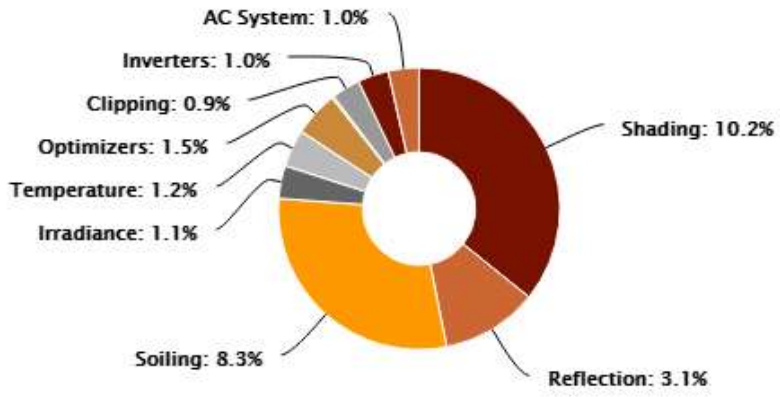
Appendix 8: Base Option - Fire Station – Ballasted Rooftop Layout

Appendix 8: Base Option - Fire Station – Ballasted Rooftop Layout Design Summary

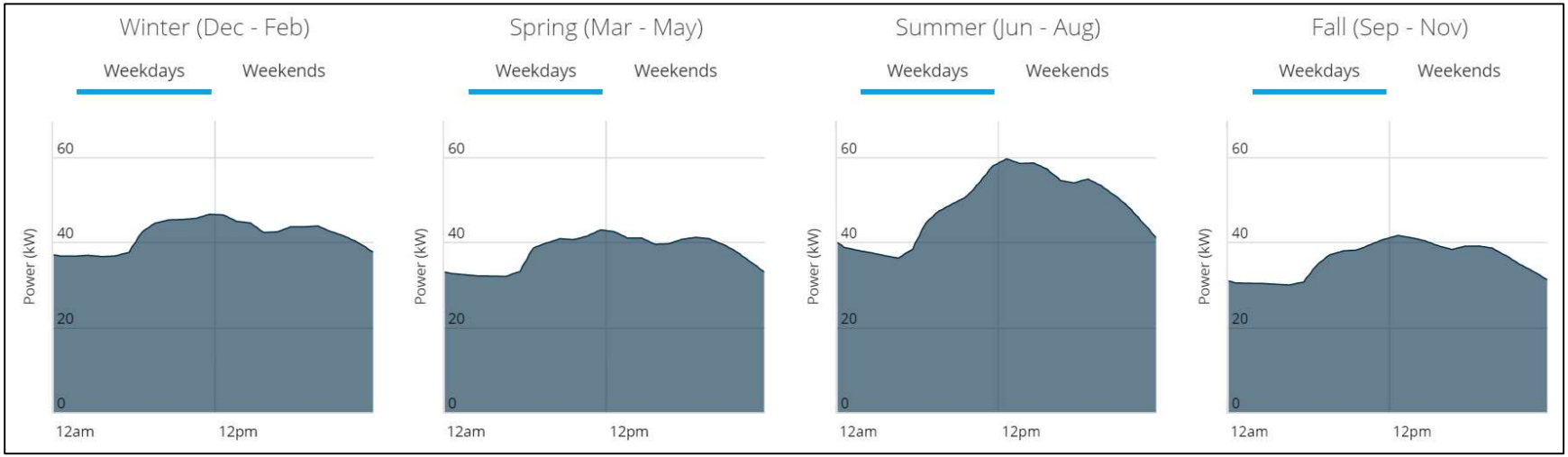
Field Segments

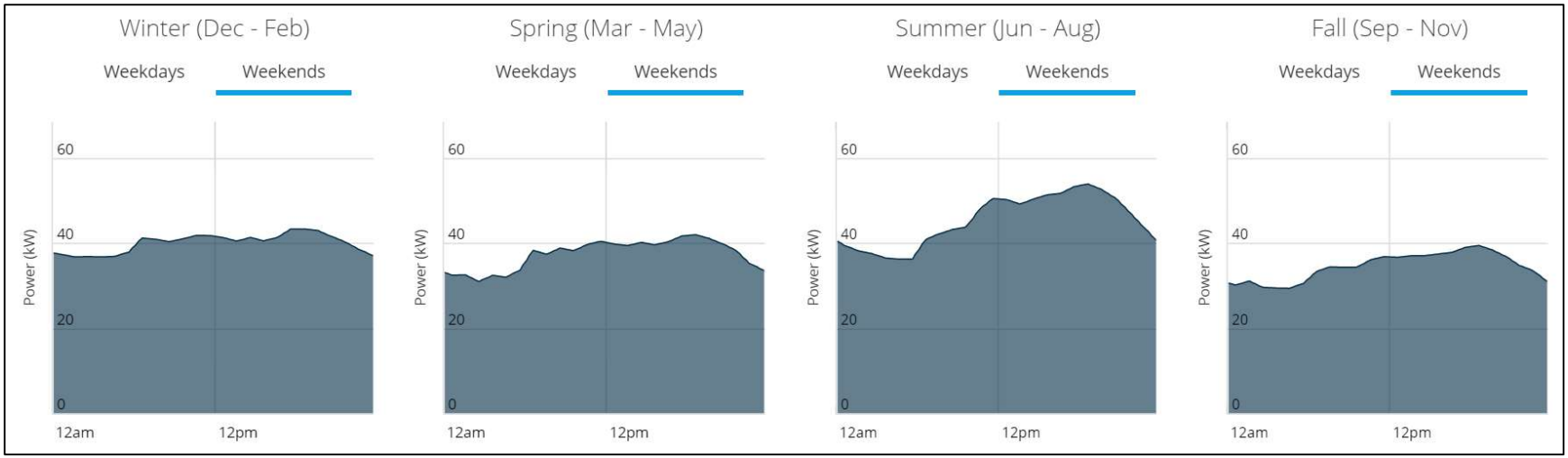
Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 2	Fixed Tilt	Landscape (Horizontal)	10°	182°	1.1 ft	1x1	18	18	7.65 kW
Field Segment 3	Fixed Tilt	Landscape (Horizontal)	10°	182°	1.1 ft	1x1	4	4	1.70 kW
Field Segment 3 (copy)	Fixed Tilt	Landscape (Horizontal)	10°	182°	1.1 ft	1x1	4	4	1.70 kW
Field Segment 5	Fixed Tilt	Landscape (Horizontal)	10°	182°	1.1 ft	1x1	18	18	7.65 kW
Field Segment 6	Fixed Tilt	Landscape (Horizontal)	10°	182°	1.1 ft	1x1	19	19	8.08 kW
Field Segment 7	Fixed Tilt	Landscape (Horizontal)	10°	182°	1.1 ft	1x1	10	10	4.25 kW
Field Segment 6 (copy)	Fixed Tilt	Landscape (Horizontal)	10°	182°	1.1 ft	1x1	15	15	6.38 kW
Field Segment 6 (copy 1)	Fixed Tilt	Landscape (Horizontal)	10°	182°	1.1 ft	1x1	18	18	7.65 kW
Field Segment 10	Fixed Tilt	Landscape (Horizontal)	10°	182°	1.1 ft	1x1	22	22	9.35 kW

Sources of System Loss



Appendix 8B: Fire Station 1 Interval Data





Site 9: Buhr Park

Annual Load: 300,000 kWh, Rate D4

Base Option: Appendix 9A, 172.6 kW DC Rooftop System

Buhr Park has a corrugated metal roof and should be a straightforward installation. It is assumed to have 480V service. The meter is remote from the building on a transformer.

Description	Module	DC (kW)	AC (kW)	1st Year kWh	Offset %
Base – Ballasted	425W	172.6	150	198,800	65

Interval Data: Appendix 9B

Usage is higher during the winter months when the ice-skating arena is in operation, and low during the summer. There would be a significant export of solar energy at this site.

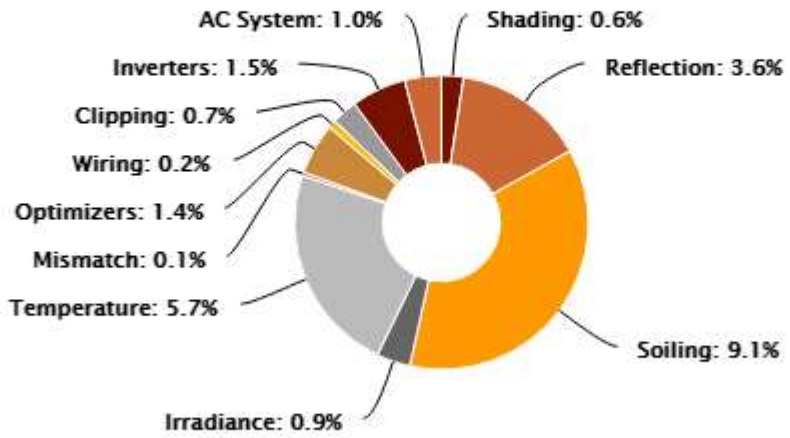
Appendix 9: Base Option – Buhr Park – Rooftop Layout

Appendix 9: Base Option – Buhr Park – Rooftop Layout Design Summary

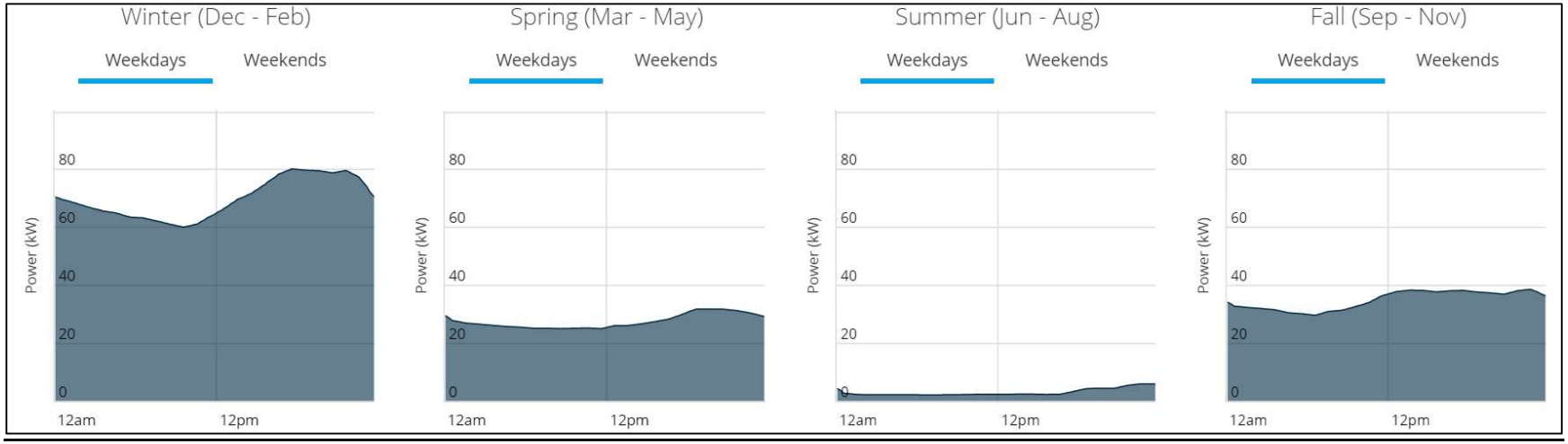
Field Segments

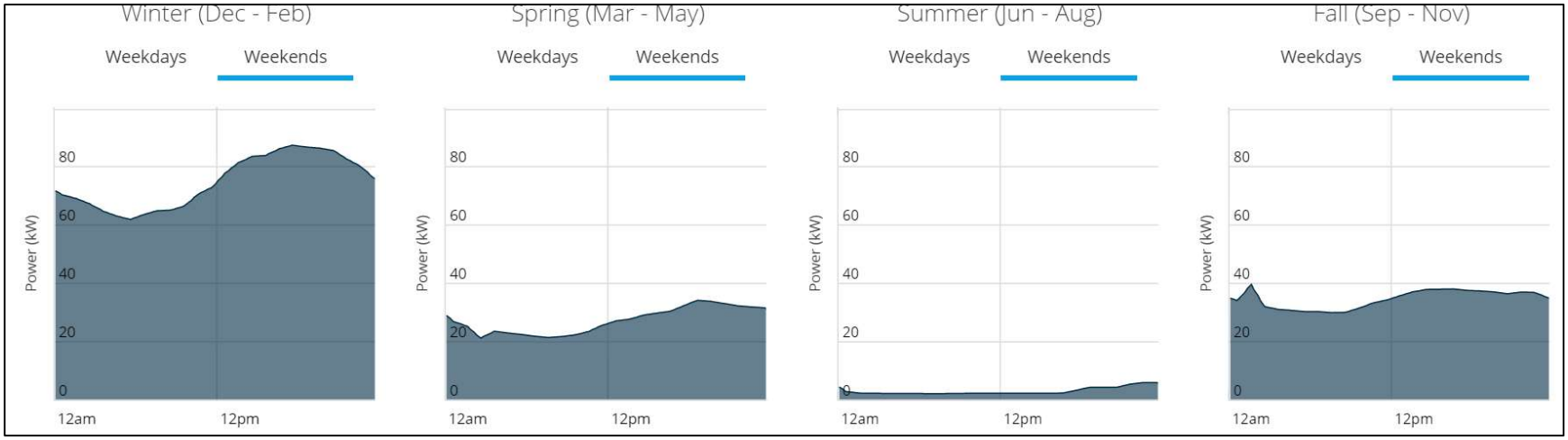
Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Flush Mount	Landscape (Horizontal)	10°	158.92062°	0.1 ft	1x1	406	406	172.6 kW

Sources of System Loss



Appendix 9: Buhr Park Interval Data





Appendix 10: Veteran's Park

Annual Load 837,000 kWh, Rate D4, 240V

Base Option: Appendix 10A, 184.5 kW DC Rooftop System

Vets Park has a standing seam metal roof and would be a straightforward installation. The load is large and it is assumed to be three phase service.

Description	Module	DC (kW)	AC (kW)	1st Year kWh	Offset %
Base – Ballasted	425W	184.5	150	214,200	26

Alternate Option: Appendix 10B - Addition of Ground Mount and Carports

Options for expansion beyond the Category 2 limit include carport and ground mount. The sample layout shown in appendix 10B has in total around 640 kW DC. Feasibility of the ground mount location would need to be explored.

Interval Data: Appendix 10C

Like Buhr Park, usage is higher during the winter months when the ice-skating arena is in operation, and low during the summer. There would be a significant export of solar energy at this site, and for that reason expanded options beyond category 2 would most likely not be wise.

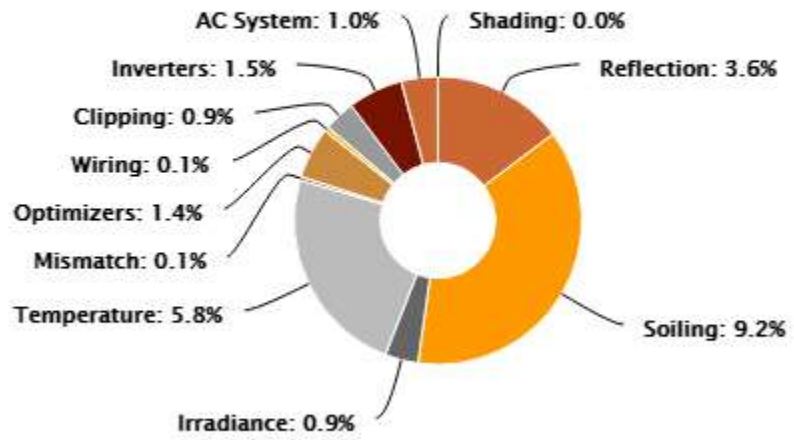
Appendix 10A: Base Option - Veterans Park – Rooftop Layout

Appendix 10A: Base Option - Veterans Park – Rooftop Design Summary

Field Segments

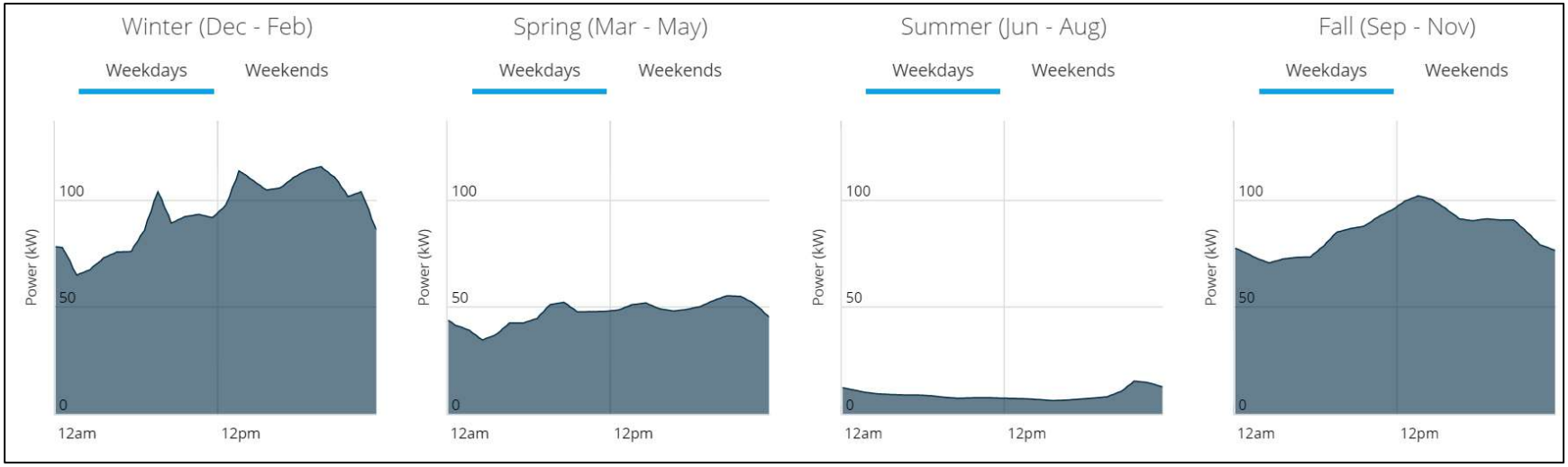
Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Flush Mount	Portrait (Vertical)	10°	174.48154°	0.1 ft	1x1	434	434	184.5 kW

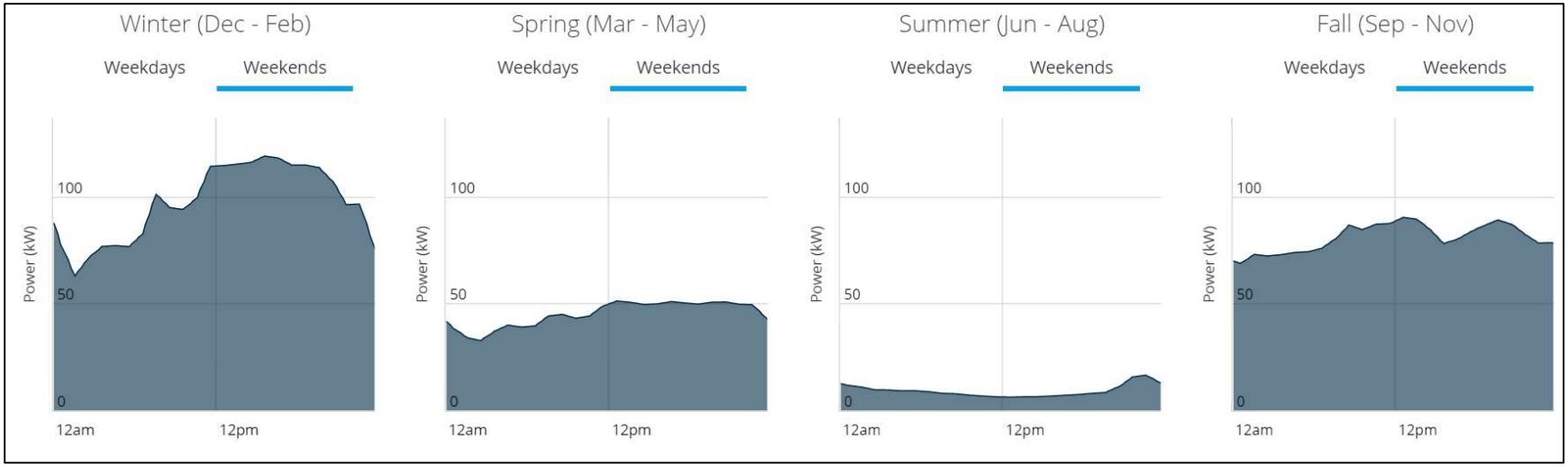
Sources of System Loss



Appendix 10B: Alternate Option - Veterans Park – Expanded Layout Options, Ground and Carport

Appendix 10C: Veteran's Park Interval Data





Appendix 11: City Hall/Justice Center

Annual Load 3,000,000 kWh, Rate D11, 480V

Base Option: Appendix 11A, 110 kW DC Ballasted System

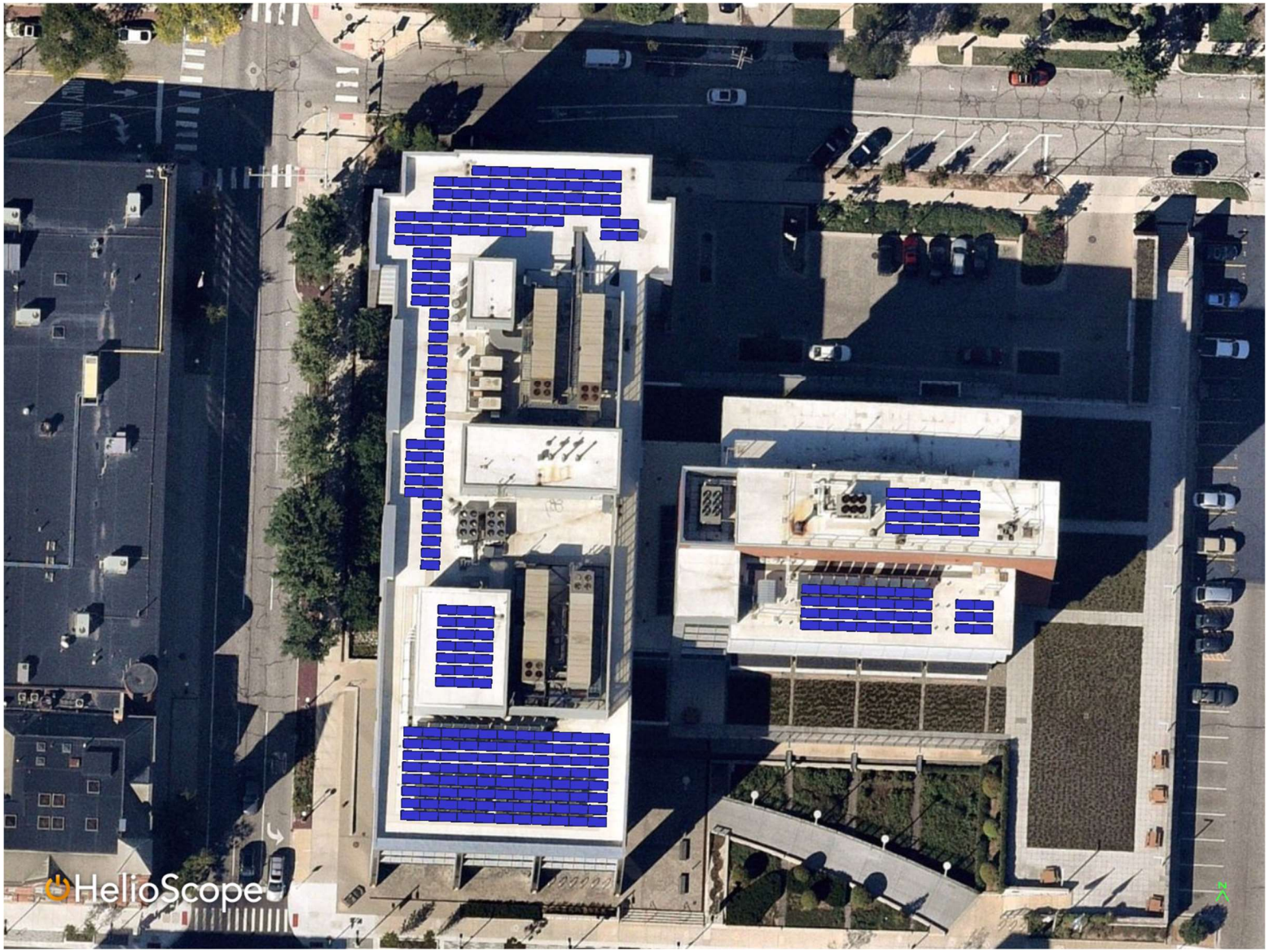
City Hall has multiple roof sections and solar hot water systems that would need to be removed. Approximately 110 kW of DC appears possible, although rooftop obstacles and setbacks may reduce panel count. Shading from some of the taller obstacles is a consideration as well.

Description	Module	DC (kW)	AC (kW)	1st Year kWh	Offset %
Base – Ballasted	425W	110	100	129,600	4

Interval Data: Appendix 11B

Power usage is high at City Hall and rarely goes below 200 kW. There would be limited or no exported energy at this site.

Appendix 11A: Base Option - City Hall/Justice Center Ballasted Layout

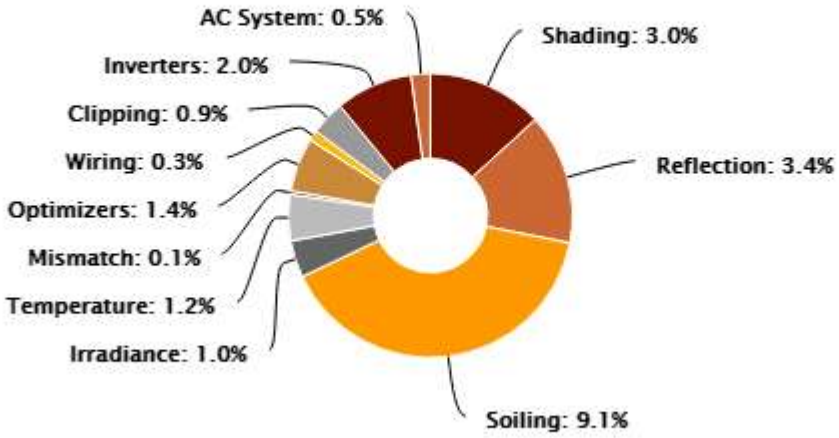


Appendix 11A: Base Option - City Hall/Justice Center Ballasted Layout – Design Summary

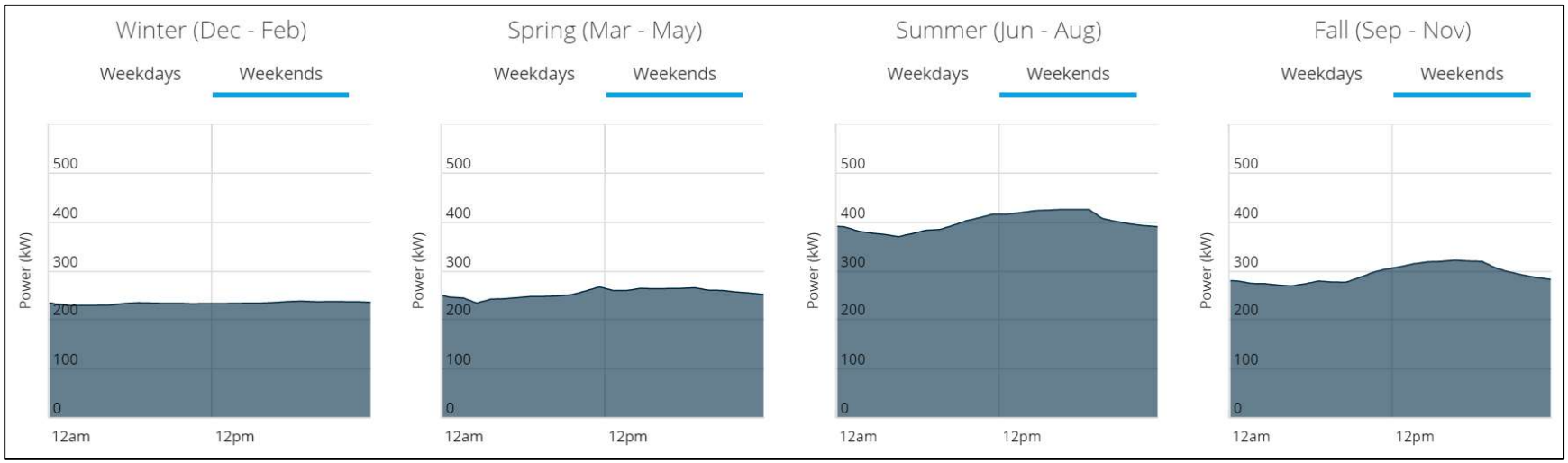
Field Segments

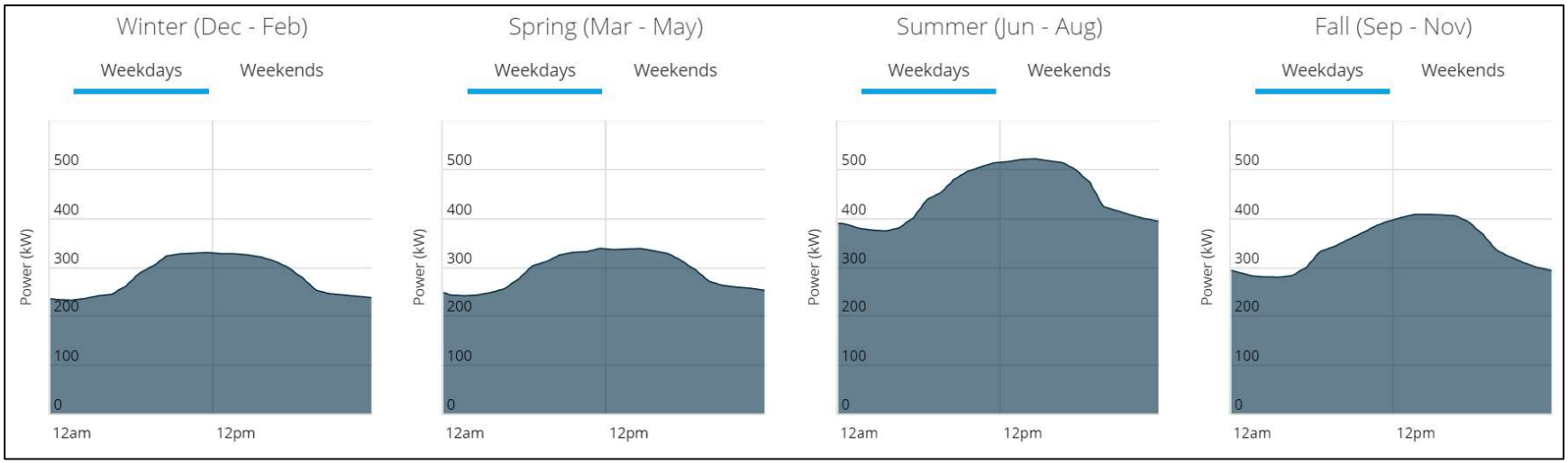
Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Fixed Tilt	Landscape (Horizontal)	10°	182°	1.1 ft	1x1	28	28	11.9 kW
Field Segment 2	Fixed Tilt	Landscape (Horizontal)	10°	182°	1.1 ft	1x1	20	20	8.50 kW
Field Segment 3	Fixed Tilt	Landscape (Horizontal)	10°	182°	1.1 ft	1x1	88	88	37.4 kW
Field Segment 4	Fixed Tilt	Landscape (Horizontal)	10°	182°	1.1 ft	1x1	21	21	8.93 kW
Field Segment 5	Fixed Tilt	Landscape (Horizontal)	10°	182°	1.1 ft	1x1	98	98	41.7 kW
Field Segment 6	Fixed Tilt	Landscape (Horizontal)	10°	182°	1.1 ft	1x1	6	6	2.55 kW

Sources of System Loss



Appendix 11B: City Hall/Justice Center Interval Data





Site 12: Water Treatment Plant

Annual Load 13,000,000 kWh, Rate D11, 480V

Base Option: Appendix 12A, 199 kW DC Ground Mounted System

The water treatment plant has a large load and comparatively limited roof space. Discussions with several parties have indicated that the grounds to the east of the treatment plant may be suitable for ground mounted solar. Our base option assumes that this location could be used, and a full category 2 system is proposed there.

Description	Module	DC (kW)	AC (kW)	1st Year kWh	Offset %
Base – Ground	425W	199	150	252,400	4

Alternate Option: Appendix 12B

With the large load, available roof space could be combined with ground space to go beyond Category 2 limits. The sample layout has about 300 kW DC

Interval Data: Appendix 12C

Power usage is very high at the Water Treatment Plant and rarely goes below 500 kW. Consumption rises in the early evening and stays high overnight. There would be limited or no exported energy at this site.

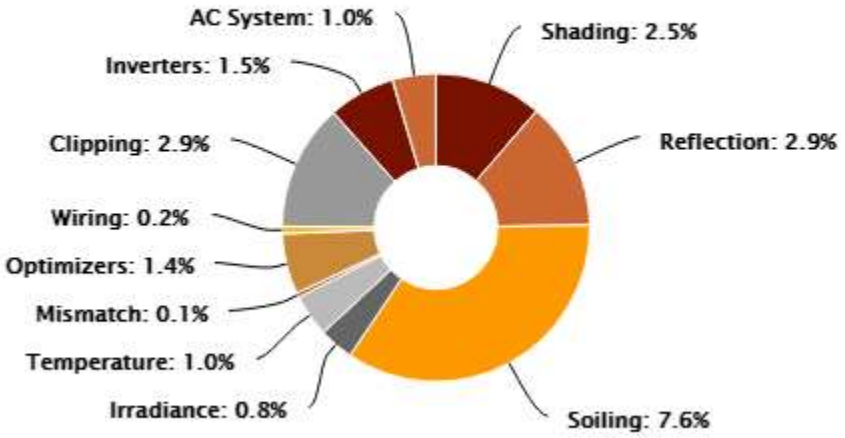
Appendix 12A: Base Option - Water Treatment Plant – Ground Mount Layout

Appendix 12A: Base Option - Water Treatment Plant – Ground Mount Design Summary

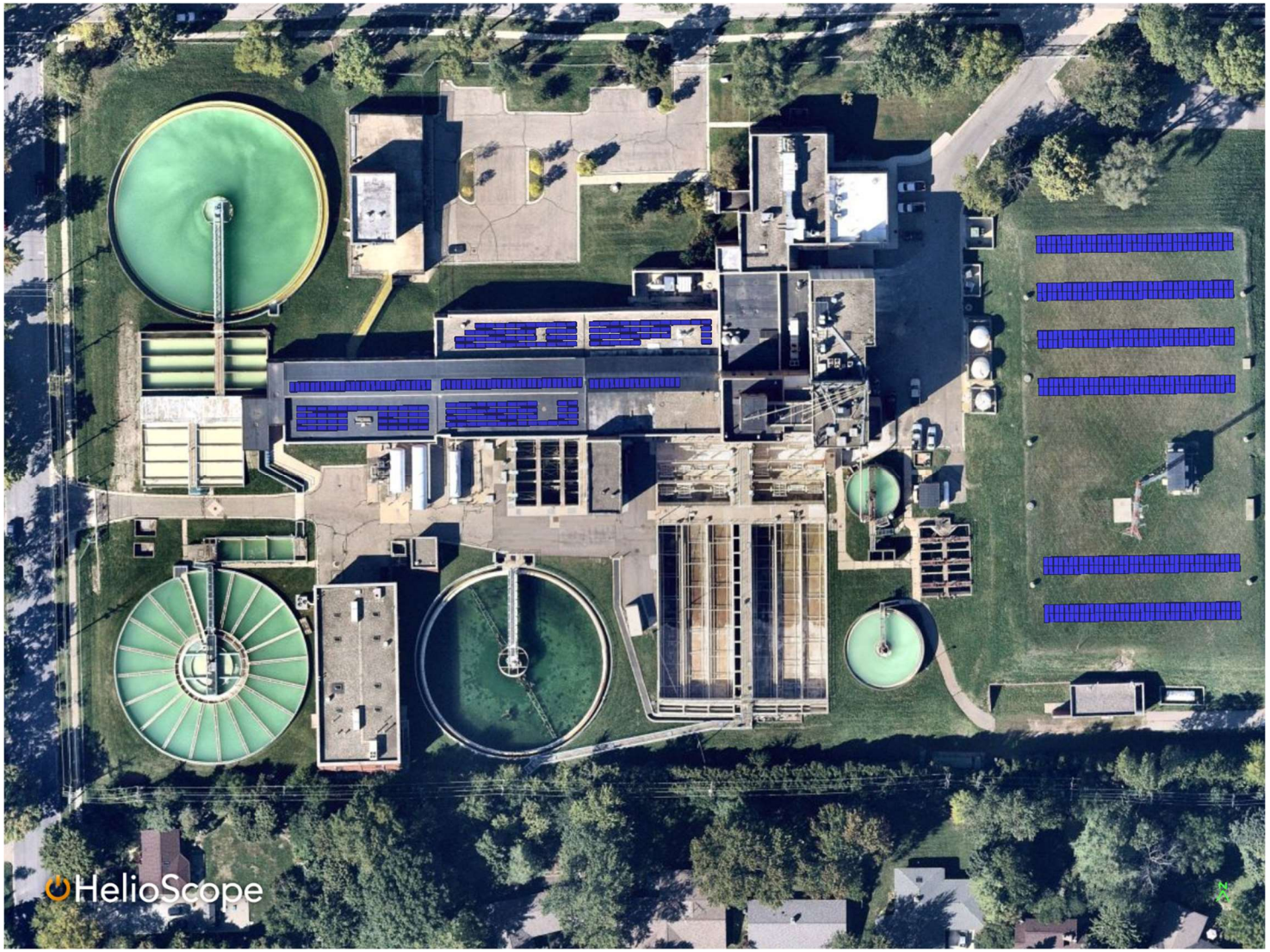
Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 8	Fixed Tilt	Portrait (Vertical)	30°	179.07382°	20.3 ft	2x1	156	312	132.6 kW
Field Segment 9	Fixed Tilt	Portrait (Vertical)	30°	179.07382°	20.3 ft	2x1	78	156	66.3 kW

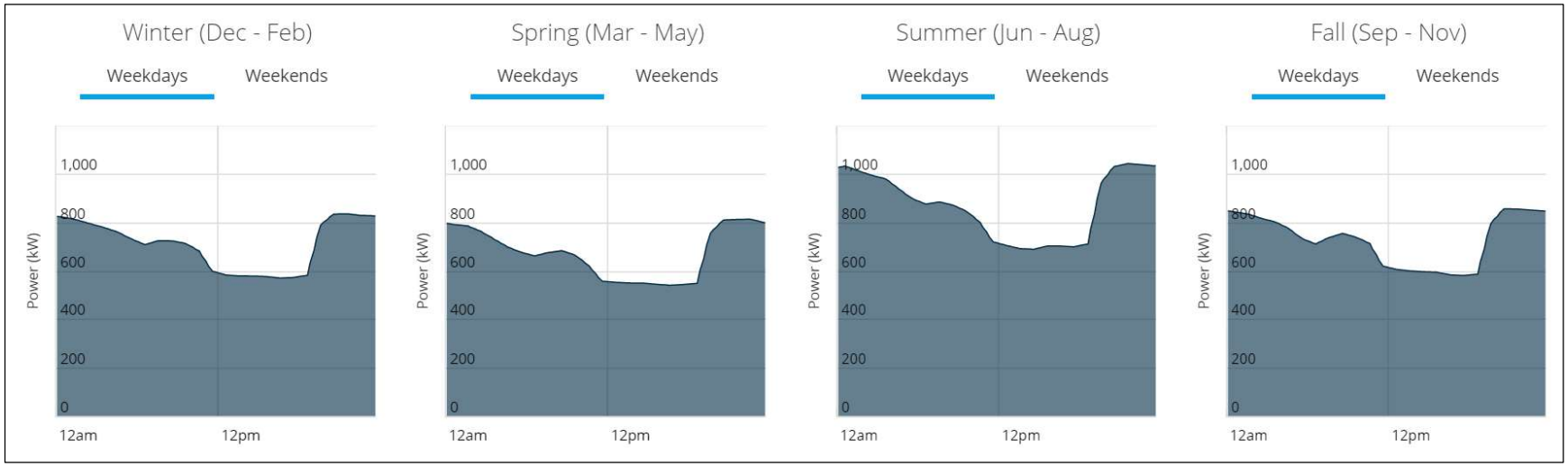
Sources of System Loss

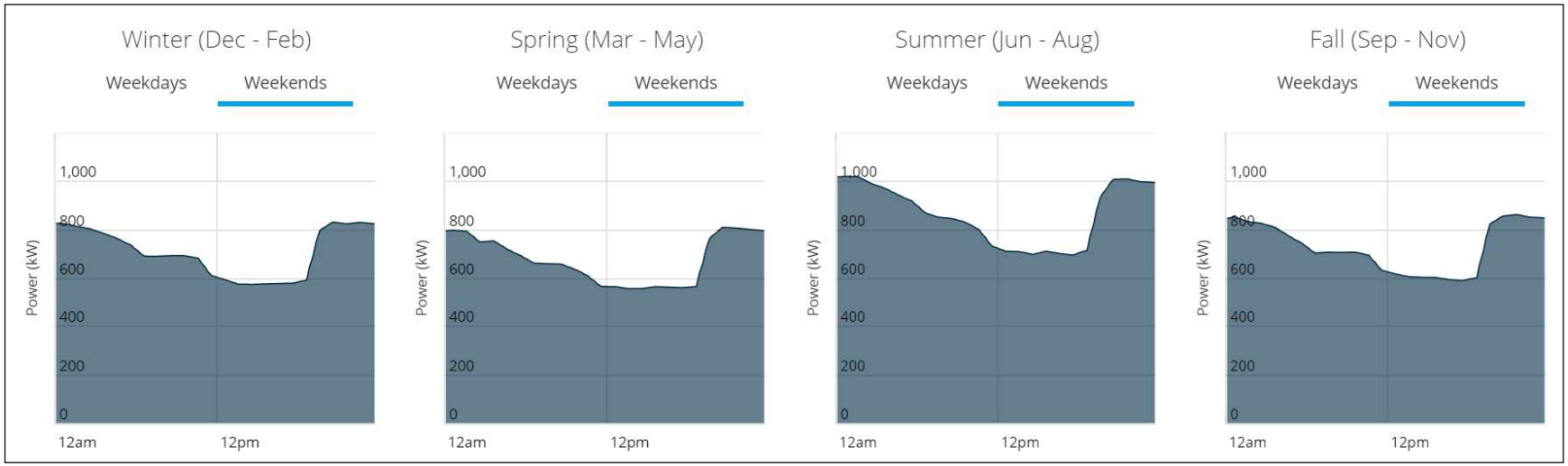


Appendix 12B: Alternate Option - Water Treatment Plant – Ground + Rooftop



Appendix 12C: Water Treatment Plant Interval Data





Site 13: Wastewater Treatment Plant

Annual Load 25,000,000 kWh, Rate D11, 480V

Base Option: Appendix 13A, 151 kW DC Ballasted Rooftop System

The wastewater treatment plant has a large load and comparatively limited roof space. A ballasted layout on one of the more promising buildings is shown.

Description	Module	DC (kW)	AC (kW)	1st Year kWh	Offset %
Base – Ground	425W	199	150	252,400	4

Alternate Option: Appendix 13B – 300 kW DC

With the large load, available roof space could be combined with ground space to go beyond Category 2 limits. The sample layout has about 300 kW DC, on several buildings.

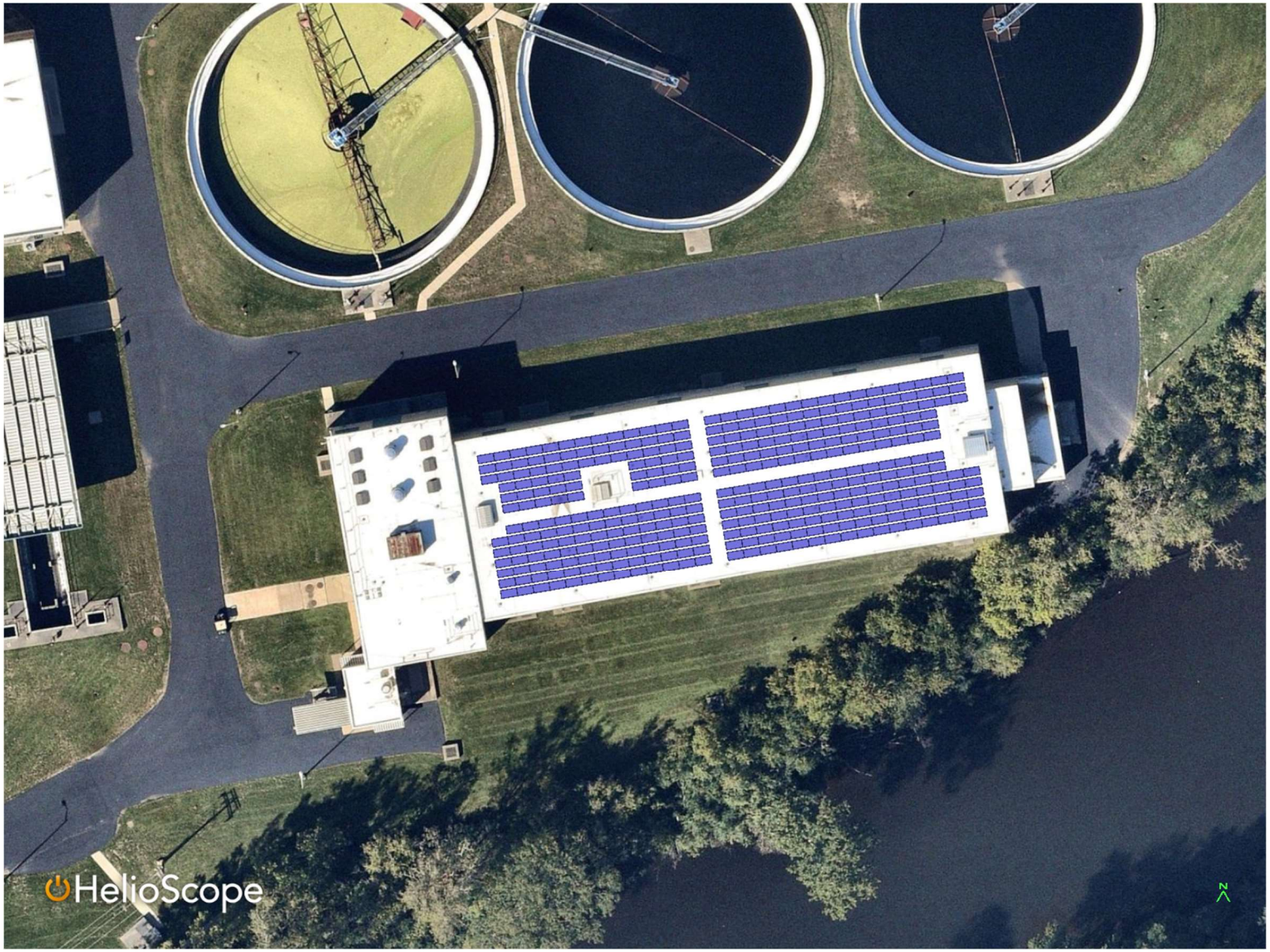
Alternate Option: Appendix 13C – Large Building 930 kW DC

There is a very large building on the northeast corner of the property. From satellite imagery, the roof appears to be in marginal condition with evidence of water ponding. A sample layout showing 930 kW DC of solar panels is shown.

Interval Data: Appendix 13D

The wastewater plant has a constant power usage of nearly 1.5 MW and even a 1 MW solar array would never export energy to the grid.

Appendix 13A: Base Option - Wastewater Treatment Plant – Ballasted Rooftop Layout

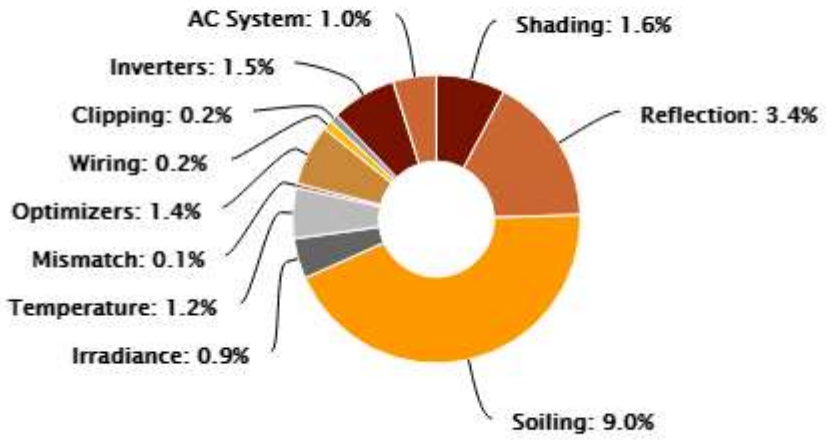


Appendix 13A: Base Option - Wastewater Treatment Plant – Ballasted Rooftop Layout Design Summary

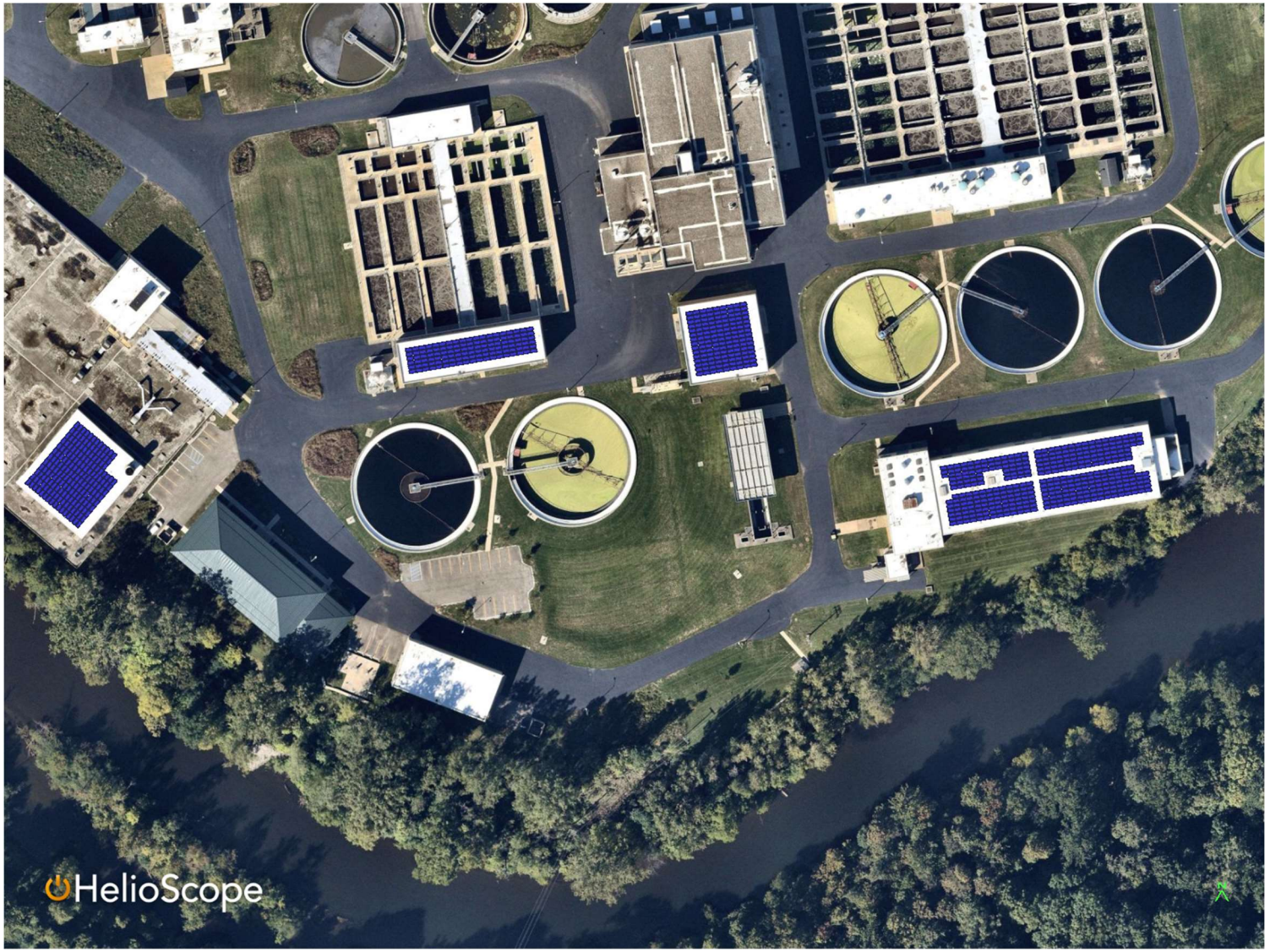
Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Fixed Tilt	Landscape (Horizontal)	10°	170.26324°	1.1 ft	1x1	354	354	150.5 kW

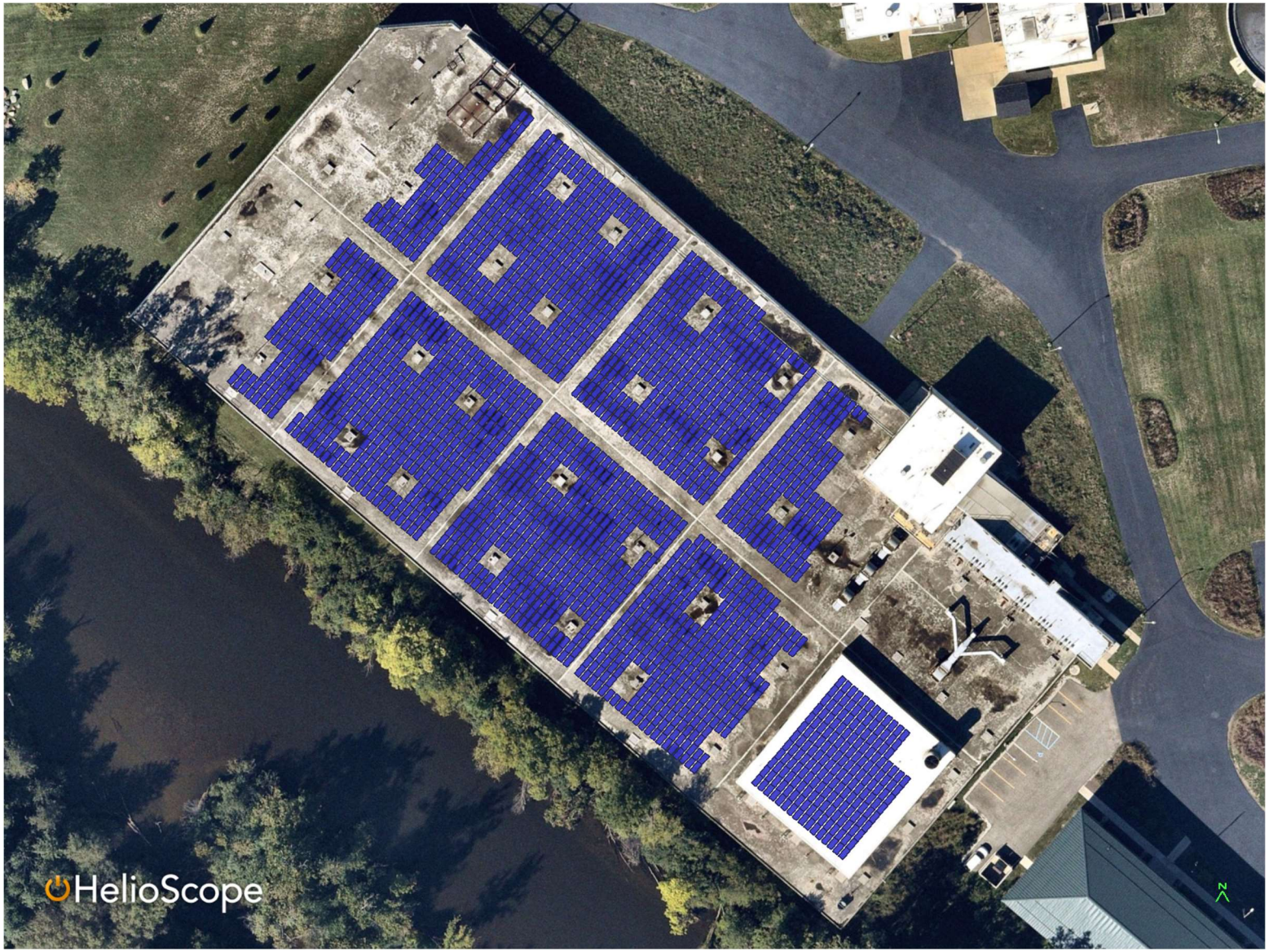
Sources of System Loss



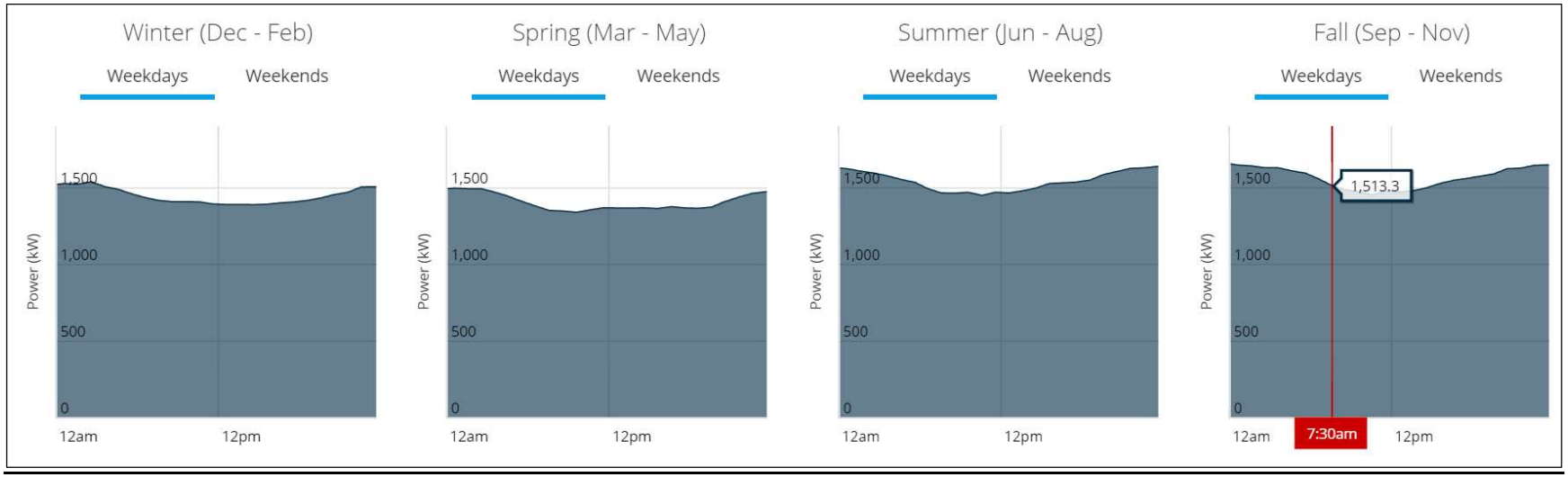
Appendix 13B: Alternate Option - Wastewater Treatment Plant – Ballasted Rooftop Additional Buildings

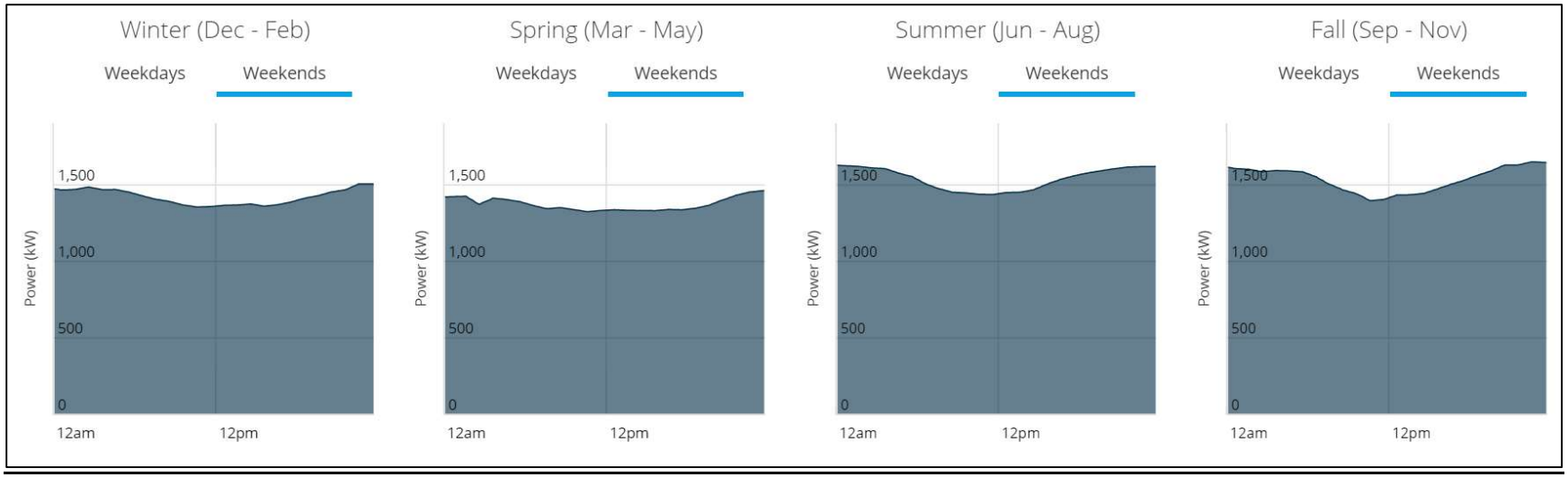


Appendix 13C: Alternate Option - Wastewater Treatment Plant – Ballasted Rooftop Large Building



Appendix 13D: Wastewater Treatment Plant – Interval Data





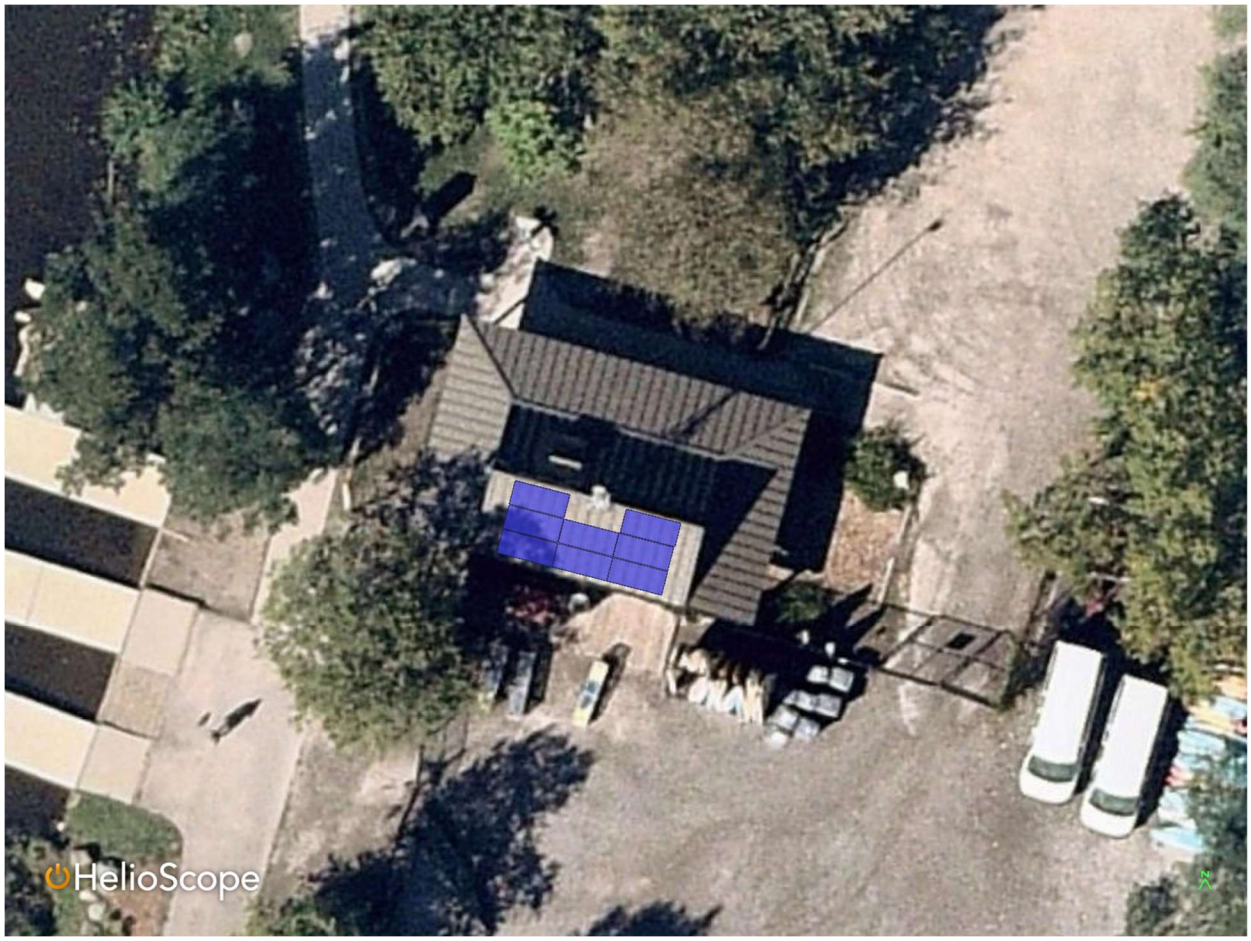
Appendix 14: Annual MWh Per Site for 20 Years

The values are generated using Helioscope using shade models where appropriate. Condition set (weather, soiling, temperature coefficients) values are chosen from actual Homeland installation historical data. For example, we specify different snow cover conditions for panels that are relatively flat (ballasted rooftop) compared to more tilted panels (ground mount).

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Burns	13	13	13	13	13	13	13	13	13	12	12	12	12	12	12	12	12	12	12	12
Gallup	28	28	28	28	28	28	27	27	27	27	27	27	27	26	26	26	26	26	26	26
Farmer's Mkt	35	35	34	34	34	34	34	33	33	33	33	33	33	32	32	32	32	32	31	31
Leslie	39	38	38	38	38	38	37	37	37	37	37	36	36	36	36	36	35	35	35	35
Cobblestone	67	67	67	66	66	66	65	65	64	64	64	63	63	63	62	62	62	61	61	61
Fuller Park	158	157	156	156	155	154	153	152	151	151	150	149	148	147	147	146	145	144	144	143
Mack Pool	222	221	220	219	218	216	215	214	213	212	211	210	208	207	206	205	204	203	202	201
Fire Station	61	60	60	60	59	59	59	58	58	58	57	57	57	56	56	56	56	55	55	55
Buhr Park	199	198	197	196	195	193	192	191	190	189	188	187	186	185	184	183	182	181	180	179
Veterans Park	214	213	212	211	210	208	207	206	205	204	203	202	201	200	199	197	196	195	194	193
City Hall	130	129	128	128	127	126	125	125	124	123	123	122	121	121	120	119	119	118	118	117
Water Plant	252	251	250	248	247	246	244	243	242	240	239	238	237	235	234	233	231	230	229	228
Wastewater	182	181	180	179	178	177	176	175	174	173	172	171	170	170	169	168	167	166	165	164

Appendix 15: Bonus Site: Argo Canoe Livery

Without additional charge, we also offer to Solarize a 14th site, the Argo Canoe Livery, if a plan agreeable to all can be set in place.



G. 20 Year Life Cycle Analysis

The 20-year energy savings per site in MWh annually is summarized here. Year 1 production is calculated using Helioscope as described in appendix 14. A solar module degradation rate of 0.54% annually is applied to the year 1 value to generate production in future years.

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Burns	13	13	13	13	13	13	13	13	13	12	12	12	12	12	12	12	12	12	12	12
Gallup	28	28	28	28	28	28	27	27	27	27	27	27	27	26	26	26	26	26	26	26
Farmer's Mkt	35	35	34	34	34	34	34	33	33	33	33	33	33	32	32	32	32	32	31	31
Leslie	39	38	38	38	38	38	37	37	37	37	37	36	36	36	36	36	35	35	35	35
Cobblestone	67	67	67	66	66	66	65	65	64	64	64	63	63	63	62	62	62	61	61	61
Fuller Park	158	157	156	156	155	154	153	152	151	151	150	149	148	147	147	146	145	144	144	143
Mack Pool	222	221	220	219	218	216	215	214	213	212	211	210	208	207	206	205	204	203	202	201
Fire Station	61	60	60	60	59	59	59	58	58	58	57	57	57	56	56	56	56	55	55	55
Buhr Park	199	198	197	196	195	193	192	191	190	189	188	187	186	185	184	183	182	181	180	179
Veterans Park	214	213	212	211	210	208	207	206	205	204	203	202	201	200	199	197	196	195	194	193
City Hall	130	129	128	128	127	126	125	125	124	123	123	122	121	121	120	119	119	118	118	117
Water Plant	252	251	250	248	247	246	244	243	242	240	239	238	237	235	234	233	231	230	229	228
Wastewater	182	181	180	179	178	177	176	175	174	173	172	171	170	170	169	168	167	166	165	164

G. 20 Year Life Cycle Analysis (continued)

Expected cash savings resulting from the solar generation are modeled using Energy ToolBase (ETB). Inputs to ETB are:

- DTE rates D3, D4, D11
- Solar generation from Helioscope
- Interval data supplied by DTE

ETB then models the amount of solar generation that is used behind the meter and the amount that is exported and calculates a resulting bill savings. A utility rate escalation of 2.5% is assumed. It is evident here, for example, that even though the sites on D11 have large generation, they do not result in the largest savings because of the demand component of the D11 rate. The question for the D11 sites becomes whether storage could successfully reduce the demand component. Homeland's team can perform this analysis and make a recommendation.

Site	Site	$ kWh	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Burns	1	$0.110	$1,274	$1,299	$1,325	$1,350	$1,376	$1,403	$1,430	$1,458	$1,486	$1,514
Gallup	2	$0.077	$2,175	$2,218	$2,261	$2,305	$2,349	$2,395	$2,441	$2,488	$2,536	$2,585
Farmers Mkt	3	$0.088	$2,871	$2,927	$2,984	$3,042	$3,100	$3,160	$3,221	$3,284	$3,347	$3,411
Leslie	4	$0.088	$2,871	$2,927	$2,984	$3,042	$3,100	$3,160	$3,221	$3,284	$3,347	$3,411
Cobblestone	5	$0.096	$5,736	$5,838	$5,942	$6,047	$6,154	$6,263	$6,373	$6,484	$6,598	$6,712
Fuller Park	6	$0.091	$13,768	$14,013	$14,262	$14,515	$14,772	$15,032	$15,296	$15,564	$15,836	$16,111
Mack Pool	7	$0.092	$10,464	$10,650	$10,840	$11,032	$11,227	$11,425	$11,625	$11,829	$12,035	$12,245
Fire Station	8	$0.037	$2,200	$2,239	$2,279	$2,320	$2,361	$2,402	$2,444	$2,487	$2,531	$2,575
Buhr Park	9	$0.090	$17,514	$17,826	$18,143	$18,464	$18,791	$19,122	$19,458	$19,798	$20,144	$20,494
Vets Park	10	$0.038	$7,721	$7,871	$8,024	$8,180	$8,338	$8,500	$8,664	$8,831	$9,001	$9,174
City Hall	11	$0.043	$5,504	$5,602	$5,702	$5,803	$5,905	$6,009	$6,115	$6,222	$6,330	$6,441
Water Plant	12	$0.043	$10,702	$10,893	$11,087	$11,283	$11,482	$11,685	$11,890	$12,098	$12,309	$12,524
Waste Plant	13	$0.043	$7,710	$7,848	$7,987	$8,129	$8,272	$8,418	$8,566	$8,716	$8,868	$9,022
		Total	$90,511	$92,152	$93,818	$95,511	$97,229	$98,974	$100,744	$102,542	$104,367	$106,218

G. 20 Year Life Cycle Analysis (continued)

Table (continued)

Site	Site	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Burns	1	$1,543	$1,573	$1,603	$1,634	$1,665	$1,696	$1,729	$1,761	$1,795	$1,828
Gallup	2	$2,634	$2,685	$2,736	$2,788	$2,841	$2,895	$2,950	$3,006	$3,063	$3,121
Farmers Mkt	3	$3,477	$3,543	$3,611	$3,680	$3,750	$3,821	$3,894	$3,967	$4,042	$4,119
Leslie	4	$3,477	$3,543	$3,611	$3,680	$3,750	$3,821	$3,894	$3,967	$4,042	$4,119
Cobblestone	5	$6,829	$6,947	$7,066	$7,188	$7,311	$7,435	$7,562	$7,690	$7,819	$7,950
Fuller Park	6	$16,390	$16,674	$16,961	$17,252	$17,547	$17,846	$18,149	$18,457	$18,768	$19,083
Mack Pool	7	$12,457	$12,672	$12,891	$13,112	$13,336	$13,564	$13,794	$14,027	$14,264	$14,503
Fire Station	8	$2,619	$2,664	$2,710	$2,757	$2,804	$2,852	$2,900	$2,949	$2,999	$3,049
Buhr Park	9	$20,850	$21,210	$21,576	$21,946	$22,321	$22,702	$23,087	$23,478	$23,874	$24,275
Vets Park	10	$9,350	$9,529	$9,711	$9,896	$10,085	$10,276	$10,471	$10,670	$10,871	$11,077
City Hall	11	$6,552	$6,666	$6,780	$6,897	$7,015	$7,134	$7,255	$7,378	$7,503	$7,629
Water Plant	12	$12,741	$12,961	$13,184	$13,411	$13,640	$13,872	$14,108	$14,347	$14,589	$14,834
Waste Plant	13	$9,179	$9,338	$9,498	$9,661	$9,827	$9,994	$10,164	$10,336	$10,510	$10,687
	Tot	$108,098	$110,004	$111,939	$113,901	$115,891	$117,910	$119,958	$122,034	$124,139	$126,273

G. 20 Year Life Cycle Analysis (continued)

Using the anticipated bill savings from above ($90,511 first year), the buy-down necessary for the TELP financing option (appendix F) is calculated such that the financing costs are equal to the bill savings:

	Date	Payment	Interest	Principal	Balance	Purchase
Loan	5/1/2021				$ 1,325,589	
1	5/1/2022	$ 90,511	$ 35,128	$ 55,383	$ 1,270,206	$ 1,295,610
2	5/1/2023	$ 92,152	$ 33,660	$ 58,492	$ 1,211,715	$ 1,235,949
3	5/1/2024	$ 93,818	$ 32,110	$ 61,708	$ 1,150,007	$ 1,173,007
4	5/1/2025	$ 95,511	$ 30,475	$ 65,036	$ 1,084,971	$ 1,106,671
5	5/1/2026	$ 97,229	$ 28,752	$ 68,477	$ 1,016,494	$ 1,036,824
6	5/1/2027	$ 98,974	$ 26,937	$ 72,037	$ 944,457	$ 963,346
7	5/1/2028	$ 100,744	$ 25,028	$ 75,716	$ 868,741	$ 886,116
8	5/1/2029	$ 102,542	$ 23,022	$ 79,520	$ 789,221	$ 805,005
9	5/1/2030	$ 104,367	$ 20,914	$ 83,453	$ 705,768	$ 719,884
10	5/1/2031	$ 106,218	$ 18,703	$ 87,515	$ 618,253	$ 630,618
11	5/1/2032	$ 108,098	$ 16,384	$ 91,714	$ 526,539	$ 537,070
12	5/1/2033	$ 110,004	$ 13,953	$ 96,051	$ 430,488	$ 439,098
13	5/1/2034	$ 111,939	$ 11,408	$ 100,531	$ 329,957	$ 336,556
14	5/1/2035	$ 113,901	$ 8,744	$ 105,157	$ 224,800	$ 229,296
15	5/1/2036	$ 115,891	$ 5,957	$ 109,934	$ 114,866	$ 117,163
16	5/1/2037	$ 117,910	$ 3,044	$ 114,866	$ -	$ -
	Grand Totals	**$ 1,659,809**	**$ 334,220**	**$ 1,325,589**		

H. Proposed Construction Schedule

Approximate installation dates, assuming contract awarded in early June:

- July/August
  - Burns Senior, Leslie, Farmer's Market, Veteran's Park, Buhr Park
- September/October
  - Cobblestone, Gallup Canoe Livery, Fuller Park, Mack Pool
- November/December
  - City Hall, Fire Station, Water and Wastewater Plants

It is assumed that no significant permitting or interconnection delays will occur.

I. Authorized Negotiator

Authorized Negotiator:
Dave Friedrichs
Homeland Solar
4975 Miller Road
Ann Arbor, MI 48103
(313)600-1066
dave@homelandsolar.com

ATTACHMENT G
LEGAL STATUS OF OFFEROR

(The Respondent shall fill out the provision and strike out the remaining ones.)

The Respondent is:

- ~~A corporation organized and doing business under the laws of the state of _____, for whom bearing the office title of _____, whose signature is affixed to this proposal, is authorized to execute contracts on behalf of respondent.*~~

*If not incorporated in Michigan, please attach the corporation's Certificate of Authority

- A limited liability company doing business under the laws of the State of Michigan, whom Dave Friedrichs bearing the title of Managing Member whose signature is affixed to this proposal, is authorized to execute contract on behalf of the LLC.

- ~~A partnership organized under the laws of the State of _____ and filed with the County of _____, whose members are (attach list including street and mailing address for each.)~~

- ~~An individual, whose signature with address, is affixed to this RFP.~~

Respondent has examined the basic requirements of this RFP and its scope of services, including all Addendum (if applicable) and hereby agrees to offer the services as specified in the RFP.

Dave Friedrichs Date: 3/23/2021

Signature

(Print) Name DAVE FRIEDRICHS Title MANAGING MEMBER

Firm: HOMELAND SOLAR

Address: 4975 MILLER ROAD, ANN ARBOR, MI 48103

Contact Phone (313)600-1066 Fax _____

Email dave@homelandsolar.com

ATTACHMENT H
CITY OF ANN ARBOR DECLARATION OF COMPLIANCE

Non-Discrimination Ordinance

The "non discrimination by city contractors" provision of the City of Ann Arbor Non-Discrimination Ordinance (Ann Arbor City Code Chapter 112, Section 9:158) requires all contractors proposing to do business with the City to treat employees in a manner which provides equal employment opportunity and does not discriminate against any of their employees, any City employee working with them, or any applicant for employment on the basis of actual or perceived age, arrest record, color, disability, educational association, familial status, family responsibilities, gender expression, gender identity, genetic information, height, HIV status, marital status, national origin, political beliefs, race, religion, sex, sexual orientation, source of income, veteran status, victim of domestic violence or stalking, or weight. It also requires that the contractors include a similar provision in all subcontracts that they execute for City work or programs.

In addition the City Non-Discrimination Ordinance requires that all contractors proposing to do business with the City of Ann Arbor must satisfy the contract compliance administrative policy adopted by the City Administrator. A copy of that policy may be obtained from the Purchasing Manager

The Contractor agrees:

(a) To comply with the terms of the City of Ann Arbor's Non-Discrimination Ordinance and contract compliance administrative policy.

(b) To post the City of Ann Arbor's Non-Discrimination Ordinance Notice in every work place or other location in which employees or other persons are contracted to provide services under a contract with the City.

(c) To provide documentation within the specified time frame in connection with any workforce verification, compliance review or complaint investigation.

(d) To permit access to employees and work sites to City representatives for the purposes of monitoring compliance, or investigating complaints of non-compliance.

The undersigned states that he/she has the requisite authority to act on behalf of his/her employer in these matters and has offered to provide the services in accordance with the terms of the Ann Arbor Non-Discrimination Ordinance. The undersigned certifies that he/she has read and is familiar with the terms of the Non-Discrimination Ordinance, obligates the Contractor to those terms and acknowledges that if his/her employer is found to be in violation of Ordinance it may be subject to civil penalties and termination of the awarded contract.

Homeland Solar
Company Name

Signature of Authorized Representative — Date: 3/23/2021

DAVE FRIEDRICHS, MANAGING MEMBER
Print Name and Title

4975 MILLER RD, ANN ARBOR, MI 48103
Address, City, State, Zip

(313)600-1066 dave@homelandsolar.com
Phone/Email address

Questions about the Notice or the City Administrative Policy, Please contact:
Procurement Office of the City of Ann Arbor
(734) 794-6500

ATTACHMENT I
CITY OF ANN ARBOR
LIVING WAGE ORDINANCE DECLARATION OF COMPLIANCE

The Ann Arbor Living Wage Ordinance (Section 1:811-1:821 of Chapter 23 of Title I of the Code) requires that an employer who is (a) a contractor providing services to or for the City for a value greater than $10,000 for any twelve-month contract term, or (b) a recipient of federal, state, or local grant funding administered by the City for a value greater than $10,000, or (c) a recipient of financial assistance awarded by the City for a value greater than $10,000, shall pay its employees a prescribed minimum level of compensation (i.e., Living Wage) for the time those employees perform work on the contract or in connection with the grant or financial assistance. The Living Wage must be paid to these employees for the length of the contract/program.

Companies employing fewer than 5 persons and non-profits employing fewer than 10 persons are exempt from compliance with the Living Wage Ordinance. If this exemption applies to your company/non-profit agency please check here [___] No. of employees___

The Contractor or Grantee agrees:

(a) To pay each of its employees whose wage level is not required to comply with federal, state or local prevailing wage law, for work covered or funded by a contract with or grant from the City, no less than the Living Wage. The current Living Wage is defined as $13.91/hour for those employers that provide employee health care (as defined in the Ordinance at Section 1:815 Sec. 1 (a)), or no less than $15.51/hour for those employers that do not provide health care. The Contractor or Grantor understands that the Living Wage is adjusted and established annually on April 30 in accordance with the Ordinance and covered employers shall be required to pay the adjusted amount thereafter to be in compliance with Section 1:815(3).

Check the applicable box below which applies to your workforce

[✓] Employees who are assigned to any covered City contract/grant will be paid at or above the applicable living wage without health benefits

[___] Employees who are assigned to any covered City contract/grant will be paid at or above the applicable living wage with health benefits

(b) To post a notice approved by the City regarding the applicability of the Living Wage Ordinance in every work place or other location in which employees or other persons contracting for employment are working.

(c) To provide to the City payroll records or other documentation within ten (10) business days from the receipt of a request by the City.

(d) To permit access to work sites to City representatives for the purposes of monitoring compliance and investigating complaints or non-compliance.

(e) To take no action that would reduce the compensation, wages, fringe benefits, or leave available to any employee covered by the Living Wage Ordinance or any person contracted for employment and covered by the Living Wage Ordinance in order to pay the living wage required by the Living Wage Ordinance.

The undersigned states that he/she has the requisite authority to act on behalf of his/her employer in these matters and has offered to provide the services or agrees to accept financial assistance in accordance with the terms of the Living Wage Ordinance. The undersigned certifies that he/she has read and is familiar with the terms of the Living Wage Ordinance, obligates the Employer/Grantee to those terms and acknowledges that if his/her employer is found to be in violation of Ordinance it may be subject to civil penalties and termination of the awarded contract or grant of financial assistance.

HOMELAND SOLAR — Company Name

4975 MILLER RD — Street Address

Signature of Authorized Representative — Date: 3/23/21

ANN ARBOR, MI 48103 — City, State, Zip

DAVE FRIEDRICHS, MANAGING MEMBER — Print Name and Title

(313) 600-1066 dave@homelandsolar.com — Phone/Email address

ATTACHMENT J

VENDOR CONFLICT OF INTEREST DISCLOSURE FORM

All vendors interested in conducting business with the City of Ann Arbor must complete and return the Vendor Conflict of Interest Disclosure Form in order to be eligible to be awarded a contract. Please note that all vendors are subject to comply with the City of Ann Arbor's conflict of interest policies as stated within the certification section below.

If a vendor has a relationship with a City of Ann Arbor official or employee, an immediate family member of a City of Ann Arbor official or employee, the vendor shall disclose the information required below.

1. No City official or employee or City employee's immediate family member has an ownership interest in vendor's company or is deriving personal financial gain from this contract.
2. No retired or separated City official or employee who has been retired or separated from the City for less than one (1) year has an ownership interest in vendor's Company.
3. No City employee is contemporaneously employed or prospectively to be employed with the vendor.
4. Vendor hereby declares it has not and will not provide gifts or hospitality of any dollar value or any other gratuities to any City employee or elected official to obtain or maintain a contract.
5. Please note any exceptions below:

Conflict of Interest Disclosure*	
Name of City of Ann Arbor employees, elected officials or immediate family members with whom there may be a potential conflict of interest.	( ) Relationship to employee _____ ( ) Interest in vendor's company ( ) Other (please describe in box below)

*Disclosing a potential conflict of interest does not disqualify vendors. In the event vendors do not disclose potential conflicts of interest and they are detected by the City, vendor will be exempt from doing business with the City.

I certify that this Conflict of Interest Disclosure has been examined by me and that its contents are true and correct to my knowledge and belief and I have the authority to so certify on behalf of the Vendor by my signature below:

HOMELAND SOLAR	(313)600-1066
Vendor Name	**Vendor Phone Number**

[signature]	3/23/2021	DAVE FRIEDRICHS
Signature of Vendor Authorized Representative	**Date**	**Printed Name of Vendor Authorized Representative**

Questions about this form? Contact Procurement Office City of Ann Arbor Phone: 734/794-6500, procurement@a2gov.org

ATTACHMENT K

CITY OF ANN ARBOR
PREVAILING WAGE DECLARATION OF COMPLIANCE

The "wage and employment requirements" of Section 1:320 of Chapter 14 of Title I of the Ann Arbor City Code mandates that the city not enter any contract, understanding or other arrangement for a public improvement for or on behalf of the city unless the contract provides that all craftsmen, mechanics and laborers employed directly on the site in connection with said improvements, including said employees of subcontractors, shall receive the prevailing wage for the corresponding classes of craftsmen, mechanics and laborers, as determined by statistics for the Ann Arbor area compiled by the United States Department of Labor. Where the contract and the Ann Arbor City Code are silent as to definitions of terms required in determining contract compliance with regard to prevailing wages, the definitions provided in the Davis-Bacon Act as amended (40 U.S.C. 278-a to 276-a-7) for the terms shall be used. Further, to the extent that any employees of the contractor providing services under this contract are not part of the class of craftsmen, mechanics and laborers who receive a prevailing wage in conformance with section 1:320 of Chapter 14 of Title I of the Code of the City of Ann Arbor, employees shall be paid a prescribed minimum level of compensation (i.e. Living Wage) for the time those employees perform work on the contract in conformance with section 1:815 of Chapter 23 of Title I of the Code of the City of Ann Arbor.

At the request of the city, any contractor or subcontractor shall provide satisfactory proof of compliance with this provision.

The Contractor agrees:

(a) To pay each of its employees whose wage level is required to comply with federal, state or local prevailing wage law, for work covered or funded by this contract with the City,

(b) To require each subcontractor performing work covered or funded by this contract with the City to pay each of its employees the applicable prescribed wage level under the conditions stated in subsection (a) or (b) above.

(c) To provide to the City payroll records or other documentation within ten (10) business days from the receipt of a request by the City.

(d) To permit access to work sites to City representatives for the purposes of monitoring compliance, and investigating complaints or non-compliance.

The undersigned states that he/she has the requisite authority to act on behalf of his/her employer in these matters and has offered to provide the services in accordance with the terms of the wage and employment provisions of the Chapter 14 of the Ann Arbor City Code. The undersigned certifies that he/she has read and is familiar with the terms of Section 1:320 of Chapter 14 of the Ann Arbor City Code and by executing this Declaration of Compliance obligates his/her employer and any subcontractor employed by it to perform work on the contract to the wage and employment requirements stated herein. The undersigned further acknowledges and agrees that if it is found to be in violation of the wage and employment requirements of Section 1:320 of the Chapter 14 of the Ann Arbor City Code it shall has be deemed a material breach of the terms of the contract and grounds for termination of same by the City.

HOMELAND SOLAR
Company Name

Signature of Authorized Representative — Date: 3/23/2021

DAVE FRIEDRICHS, MANAGING MEMBER
Print Name and Title

4975 MILLER RD, ANN ARBOR, MI 48103
Address, City, State, Zip

(313)600-1066 dave@homelandsolar.com
Phone/Email address

Questions about this form? Contact Procurement Office City of Ann Arbor Phone: 734/794-6500

ATTACHMENT N - Contractor Information and Responsible Contractor Criteria

Backup documentation may be requested at the sole discretion of the City to validate all of the responses provided herein by bidders. False statements by bidders to any of the criteria provided herein will result in the bid being considered non-responsive and will not be considered for award.

Failure to provide responses to all questions may result in being deemed non-responsive.

Attach additional pages as needed if space below is insufficient.

Pursuant to Sec 1:312(20) of the City Code which sets forth requirements of a responsible bidder, Bidder is required to submit the following:

1. Organization Name: HOMELAND SOLAR

Social Security or Federal Employer I.D. #: _____

Address: 4975 Miller Road

City: Ann Arbor State: MI Zip: 48103

Type of Organization (circle one below):

Individual Partnership Corporation Joint Venture (Other) LLC EIN 202416578

If "Other" please provide details on the organization:

Year organization established: 2005

2. Current owners/principals/members/managing members/partners of the organization:

DAVE FRIEDRICHS, MARK DOROGI

3. Assumed Names, "doing business as" d/b/a, and/or former organization names(s), if applicable:

HOMELAND BUILDERS OF MICHIGAN LLC

Explanation of any business name changes: DBA HOMELAND SOLAR

4. If applicable, please provide a list of all bidder's litigation and arbitrations currently pending and within the past five years, including an explanation of each (parties, court/forum, legal claims, damages sought, and resolution).

5. Qualifications of management and supervisory personnel to be assigned by the bidder:

See bio

6. State and local licenses and license numbers held by the bidder:

262000385 Builders License
2101098412 Dave Friedrichs Qualifying Officer

7. Will all subcontractors, employees and other individuals working on the construction project maintain current applicable licenses required by law for all licensed occupations and professions?

Yes (circled) No

8. Will contractors, subcontractors, employees, and other individuals working on the construction project be misclassified by bidder as independent contractors in violation of state or federal law?

Yes No (circled)

9. Submit a statement as to what percentage of your work force resides within the City of Ann Arbor, and what percentage resides in Washtenaw County, Michigan, and the same information for any major subcontractors.

Homeland Solar
60% City of AA 90% Washtenaw County.

Major Subcontractors
60% City 90% County

10. Submit documentation as to employee pay rates.

Minimum rate $18/hr all employees
Mark D. [illegible] Principal

11. Submit a statement whether bidder provides health insurance, pension or other retirement benefits, paid leave, or other benefits to its employees.

↳ sick & personal also

12. Submit a statement explaining bidder's Equal Employment Opportunity Programs for minorities, women, veterans, returning citizens, and small businesses along with supporting documentation or other evidence.

Homeland Solar has always maintained a diverse workforce and will continue to do so.

13. Has bidder had any violations of state, federal or local laws or regulations, including OSHA or MIOSHA violations, state or federal prevailing wage laws, wage and hour laws, worker's compensation or unemployment compensation laws, rules or regulations, issued to or against the bidder within the past five years?

Yes (No)

If you answered "yes" to the question above, for each violation provide an explanation of the nature of the violation, the agency involved, a violation or reference number, any other individual(s) or party(ies) involved, and the status or outcome and resolution.

14. Does bidder have an existing Fitness for Duty Program (drugs and alcohol testing) of each employee working on the proposed jobsite?

Yes (No)

15. By attachment, please provide the following:

- Disclosure of any debarment by any federal, state or local governmental unit and/or findings of non-responsibility or non-compliance with respect to any public or private construction project performed by the bidder. Proof of insurance, including certificates of insurance, confirming existence and amount of coverage for liability, property damage, workers compensation, and any other insurances required by the proposed contract documents.

Certificates on file w/ City.
Aggregate business liability $4M, Individual Occurrence $2M, Farm Bureau Insurance, can supply declarations page.

16. Does bidder have an on-going MIOSHA-approved safety-training program for employees to be used on the proposed job site?

(Yes) periodic on site safety review and planning No

17. Does bidder have evidence of worker's compensation Experience Modification Rating ("EMR")?

(Yes) No

EMR = 1%

18. Can bidder provide a ratio of masters and journeypersons to apprentices proposed to be used on the construction project job site, documentation of master or journeyperson certification or status and the source for same, and if not, the qualifications of employees who will be assigned to work on the project?

(Yes) No

If, yes, Ratio = 1 master → 2 journeyman → 2 apprentices per journeyman.

19. Can bidder provide documentation that it participates in a Registered Apprenticeship Program (RAP) that is registered with the United States Department of Labor Office of Apprenticeship or by a State Apprenticeship Agency recognized by the Office of Apprenticeship?

our electrical subcontractors all participate in State Licensing program.

(Yes) No

If bidder answered "yes" to the question above and is selected for this project, bidder will be required to submit the RAP to the City.

If bidder answered "no" to the question above, please provide details on how your organization assess the skills and qualifications of any employees who do not have master or journeyperson certification or status, or are not participants in a Registered Apprenticeship Program identified above.

---

20. Will bidder comply with all applicable state and federal laws and visa requirements regarding the hiring of non-US citizens, and disclosure of any work visas sought or obtained by the bidder, any of the bidder's subcontractors, or any of the bidder's employees or independent contractors, in order to perform any portion of the project?

(Yes) No

21. Can bidder provide audited financial information current within the past twelve (12) months, such as a balance sheet, statement of operations, and bonding capacity?

Yes No

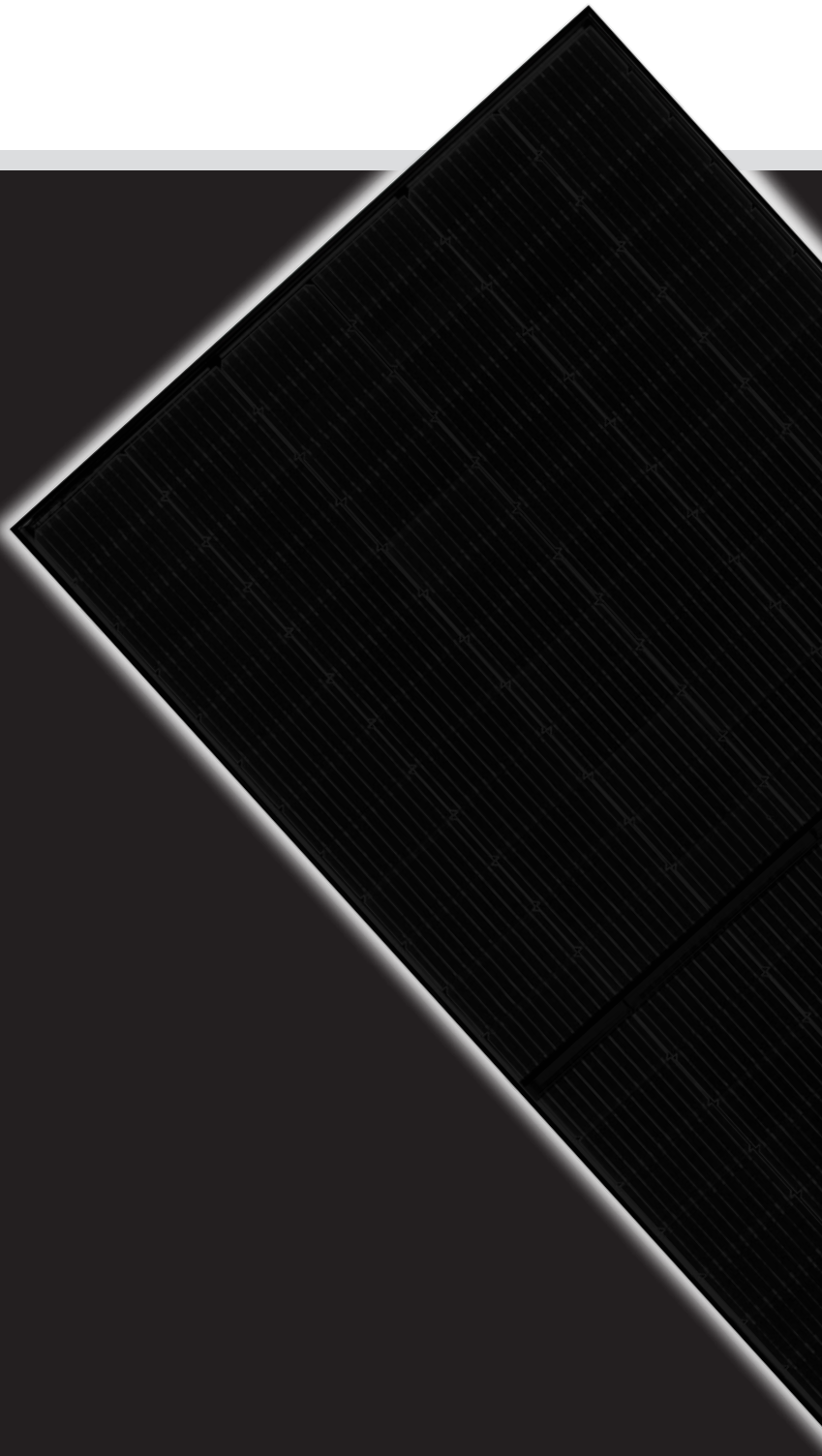
(Evidence that bidder has financial resources to start up and follow through on the project(s) and to respond to damages in case of default as shown by written verification of bonding capacity equal to or exceeding the amount of the bidder's scope of work on the project. The written verification must be submitted by a licensed surety company rated "B+" (or better) in the current A.M. Best Guide and qualified to do business within the State of Michigan, and the same audited financial information for any subcontractor estimated to be paid more than $100,000.00 related to any portion of the project.)

22. Can bidder provide evidence of a quality assurance program used by the bidder and the results of any such program on the bidder's previous projects?

Yes No

EAGLE
MODULES

THE MOST DEPENDABLE SOLAR BRAND



EAGLE 66TR G4

370-390 WATT
TILING RIBBON MONO MODULE

Positive power tolerance of 0~+3%

- NYSE-listed since 2010, Bloomberg Tier 1 manufacturer
- Best-selling panel globally for last 4 years
- Top performance in the strictest 3rd party labs
- 99.9% on-time delivery to the installer
- Premium solar panel factories in USA and Malaysia

KEY FEATURES

TR Technology
Tiling Ribbon eliminates cell gaps
to increase module efficiency and power.

9BB Half Cell Technology
Uniquely designed 9 busbar mono half cut solar cells
deliver ultra-high power in a small footprint.

Shade Tolerant
Twin array design allows continued performance
even with shading by trees or debris.

Designed for Long Life
Uses the same DuPont protective film as the Space
Station, Mars Lander, and jetliners.

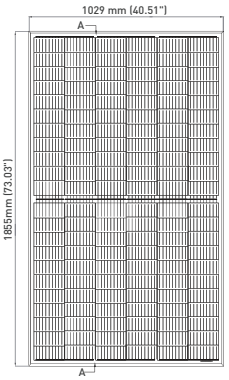
Leading Warranty
12-year product and 25-year linear power warranty;
98% guaranteed first year, max 0.55% annual loss.

BUILDING YOUR TRUST IN SOLAR. JINKOSOLAR.US

Jinko Solar

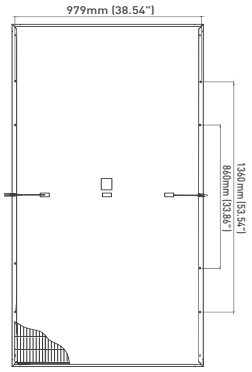
ENGINEERING DRAWINGS

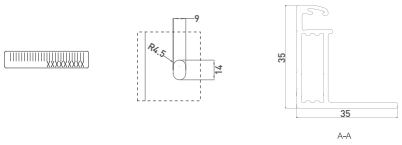
Front



Side

Back

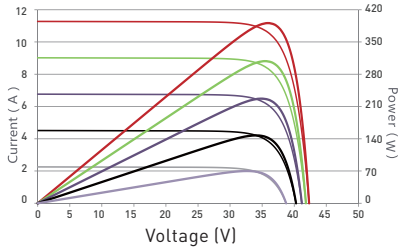




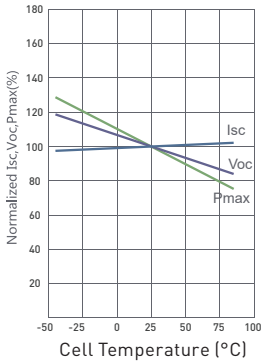
Length: +/- 2mm
Width: +/- 2mm
Height: +/- 1mm
Row Pitch: +/- 2mm

ELECTRICAL PERFORMANCE & TEMPERATURE DEPENDENCE

Current-Voltage & Power-Voltage Curves (400W)



Temperature Dependence of Isc, Voc, Pmax



MECHANICAL CHARACTERISTICS

Cells	Monocrystalline
No. of Cells	132 (6x22)
Dimensions	1855x1029x35mm (73.03×40.51×1.37 in)
Weight	21.3 kg (46.96 lbs)
Front Glass	3.2mm, Anti-Reflection Coating High Transmission, Low Iron, Tempered Glass
Frame	Anodized Aluminum Alloy
Junction Box	IP67 Rated
Output Cables	12 AWG, 1825mm (71.85in) or Customized Length
Connector	MC4
Fire Type	Type 1
Pressure Rating	5400Pa (Snow) & 2400Pa (Wind)

TEMPERATURE CHARACTERISTICS

Temperature Coefficients of Pmax	-0.35%/°C
Temperature Coefficients of Voc	-0.28%/°C
Temperature Coefficients of Isc	0.048%/°C
Nominal Operating Cell Temperature (NOCT)	45 ± 2°C

MAXIMUM RATINGS

Operating Temperature (°C)	-40°C~+85°C
Maximum System Voltage	1000VDC
Maximum Series Fuse Rating	20A

PACKAGING CONFIGURATION

2 pallets = 1 stack; 31pcs/pallets, 62pcs/stack, 744pcs/ 40'HQ Container

- ISO9001:2008 Quality Standards
- ISO14001:2004 Environmental Standards
- IEC61215, IEC61730 certified products
- UL1703/61730 certified products (pending)
- ISO45001:2018 Occupational Health & Safety Standards

ELECTRICAL CHARACTERISTICS

Module Type	JKM370M-6RL3-B		JKM375M-6RL3-B		JKM380M-6RL3-B		JKM385M-6RL3-B		JKM390M-6RL3-B	
	SCT	NOCT	SCT	NOCT	SCT	NOCT	SCT	NOCT	SCT	NOCT
Maximum Power (Pmax)	370Wp	275Wp	375Wp	279Wp	380Wp	283Wp	385Wp	286Wp	390Wp	290Wp
Maximum Power Voltage (Vmp)	36.71V	33.49V	36.80V	33.57V	36.90V	33.70V	37.02V	33.90V	37.15V	34.02V
Maximum Power Current (Imp)	10.08A	8.22A	10.19A	8.31A	10.30A	8.39A	10.40A	8.45A	10.50A	8.53A
Open-circuit Voltage (Voc)	44.02V	41.55V	44.12V	41.64V	44.22V	41.74V	44.34V	41.85V	44.47V	41.97V
Short-circuit Current (Isc)	10.90A	8.80A	11.01A	8.89A	11.12A	8.98A	11.22A	9.06A	11.32A	9.14A
Module Efficiency STC (%)	19.38%		19.65%		19.91%		20.17%		20.43%	

***STC:** Irradiance 1000W/m² Cell Temperature 25°C AM = 1.5
NOCT: Irradiance 800W/m² Ambient Temperature 20°C AM = 1.5 Wind Speed 1m/s

*Power measurement tolerance: +/- 3%

The company reserves the final right for explanation on any of the information presented hereby. JKM370-390M-6RL3-B-D2-US

EAGLE
MODULES

THE MOST DEPENDABLE SOLAR BRAND

EAGLE 72HM G2

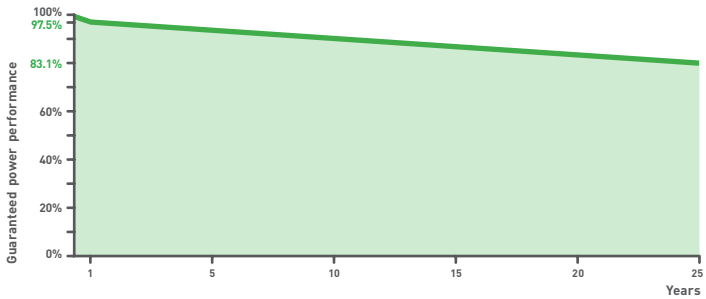
390-410 WATT • HALF CELL MONO PERC MODULE

Positive power tolerance of 0~+3%

- NYSE-listed since 2010, Bloomberg Tier 1 manufacturer
- Best-selling module globally for last 4 years
- Top performance in the strictest 3rd party labs
- 99.9% on-time delivery to the installer
- Automated manufacturing utilizing artificial intelligence
- Vertically integrated, tight controls on quality
- Premium solar panel factories in USA and Malaysia

LINEAR PERFORMANCE WARRANTY

25-Year Performance Warranty



Nomenclature:
JKM410M - 72HL-V

Code	Cell	Code	Cell	Code	Certification
null	Full	null	Normal	null	1000V
H	Half	L	Diamond	V	1500V

- ISO9001:2008 Quality Standards
- ISO14001:2004 Environmental Standards
- IEC61215, IEC61730 certified products
- OHSAS18001 Occupational Health & Safety Standards
- UL1703 certified products

KEY FEATURES

Diamond Half Cell Technology
World-record breaking efficient mono PERC half cut solar cells deliver high power in a small footprint.

Designed for Long Life
Uses the same DuPont protective film as the Space Station, Mars Lander, and jetliners. 25-year warranty.

Shade Tolerant
Twin array design allows continued performance even with shading by trees or debris.

Power Boost in Cloudy Conditions
A special film diffuses light, boosting performance even with shading by trees or debris.

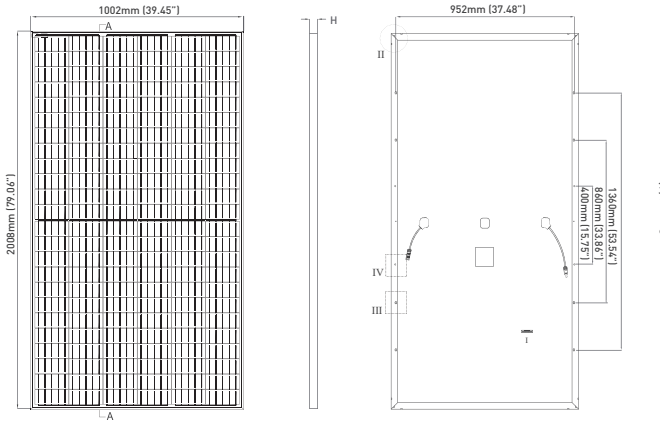
Protected Against All Environments
Certified to withstand humidity, heat, rain, marine environments, wind, hailstorms, and packed snow.

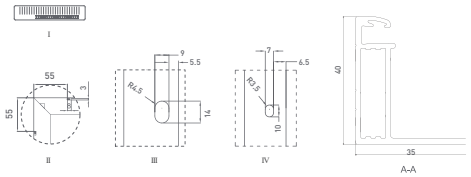
BUILDING YOUR TRUST IN SOLAR. JINKOSOLAR.US

Jinko Solar

ENGINEERING DRAWINGS

Front Side Back





Length: ± 2mm
Width: ± 2mm
Height: ± 1mm
Row Pitch: ± 2mm

MECHANICAL CHARACTERISTICS

Cells	Mono PERC Diamond Cell (158.75x158.75mm)
No. of Half Cells	144 (6×24)
Dimensions	2008×1002×40mm (79.06×39.45×1.57in)
Weight	22.5kg (49.6lbs)
Front Glass	3.2mm, Anti-Reflection Coating High Transmission, Low Iron, Tempered Glass
Frame	Anodized Aluminum Alloy
Junction Box	IP67 Rated
Output Cables	12 AWG, 1400mm (55.12in) or Customized Length
Fire Type	Type 1
Pressure Rating	5400Pa (Snow) & 2400Pa (Wind)

TEMPERATURE CHARACTERISTICS

Temperature Coefficients of Pmax	-0.35%/°C
Temperature Coefficients of Voc	-0.29%/°C
Temperature Coefficients of Isc	0.048%/°C
Nominal Operating Cell Temperature (NOCT)	45±2°C

MAXIMUM RATINGS

Operating Temperature (°C)	-40°C~+85°C
Maximum System Voltage	1500VDC (UL and IEC)
Maximum Series Fuse Rating	20A

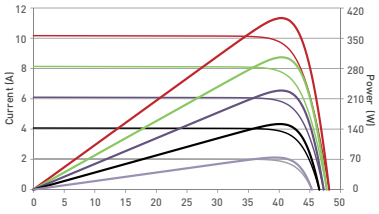
PACKAGING CONFIGURATION

(Two pallets = One stack)

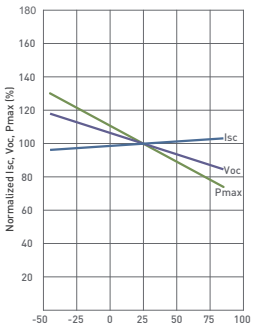
27pcs/pallet, 54pcs/stack, 594pcs/40'HQ Container

ELECTRICAL PERFORMANCE & TEMPERATURE DEPENDENCE

Current-Voltage & Power-Voltage Curves (410W)



Temperature Dependence of Isc, Voc, Pmax



ELECTRICAL CHARACTERISTICS

Module Type	JKM390M-72HL-V		JKM395M-72HL-V		JKM400M-72HL-V		JKM405M-72HL-V		JKM410M-72HL-V	
	STC	NOCT	STC	NOCT	STC	NOCT	SCT	NOCT	SCT	NOCT
Maximum Power (Pmax)	390Wp	287Wp	395Wp	291Wp	400Wp	294Wp	405Wp	298Wp	410Wp	302Wp
Maximum Power Voltage (Vmp)	39.64V	37.0V	39.90V	37.4V	40.16V	37.6V	40.42V	37.8V	40.68V	38.0V
Maximum Power Current (Imp)	9.84A	7.75A	9.90A	7.77A	9.96A	7.82A	10.02A	7.88A	10.08A	7.94A
Open-circuit Voltage (Voc)	48.6V	45.8V	48.8V	46.0V	49.1V	46.2V	49.4V	46.5V	49.6V	46.7V
Short-circuit Current (Isc)	10.46A	8.45A	10.54A	8.51A	10.61A	8.57A	10.69A	8.63A	10.76A	8.69A
Module Efficiency STC (%)	19.38%		19.63%		19.88%		20.13%		20.38%	

***STC:** Irradiance 1000W/m² Cell Temperature 25°C AM = 1.5
NOCT: Irradiance 800W/m² Ambient Temperature 20°C AM = 1.5 Wind Speed 1m/s

*Power measurement tolerance: ±3%

powered by Q.ANTUM DUO

Q.PEAK DUO L-G8.2

415-430

ENDURING HIGH PERFORMANCE

pv magazine award 2017 top innovation

EUPD RESEARCH TOP BRAND PV MODULES EUROPE 2019

Photon Q.PRO-G2 235 Best polycrystalline solar module 2014 Q CELLS 174 modules tested

Q CELLS YIELD SECURITY
- ANTI PID TECHNOLOGY (APT)
- HOT-SPOT PROTECT (HSP)
- TRACEABLE QUALITY (TRA.Q™)
- ANTI LID TECHNOLOGY (ALT)

Q.ANTUM TECHNOLOGY: LOW LEVELISED COST OF ELECTRICITY
Higher yield per surface area, lower BOS costs, higher power classes, and an efficiency rate of up to 20.3%.

INNOVATIVE ALL-WEATHER TECHNOLOGY
Optimal yields, whatever the weather with excellent low-light and temperature behaviour.

ENDURING HIGH PERFORMANCE
Long-term yield security with Anti LID Technology, Anti PID Technology[1], Hot-Spot Protect and Traceable Quality Tra.Q™.

EXTREME WEATHER RATING
High-tech aluminium alloy frame, certified for high snow (5400 Pa) and wind loads (2400 Pa).

A RELIABLE INVESTMENT
Inclusive 12-year product warranty and 25-year linear performance warranty[2].

STATE OF THE ART MODULE TECHNOLOGY
Q.ANTUM DUO combines cutting edge cell separation and innovative 12-busbar design with Q.ANTUM Technology.

[1] APT test conditions according to IEC/TS 62804-1:2015, method B (–1500 V, 168 h)
[2] See data sheet on rear for further information.

THE IDEAL SOLUTION FOR:

Rooftop arrays on commercial / industrial buildings

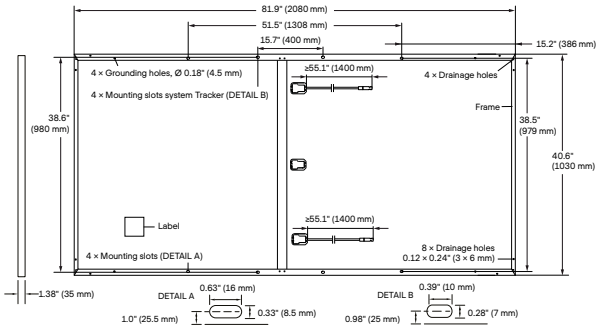
Ground-mounted solar power plants

Engineered in Germany

Q CELLS

MECHANICAL SPECIFICATION

Format	81.9 in × 40.6 in × 1.38 in (including frame) (2080 mm × 1030 mm × 35 mm)
Weight	55.1 lbs (25.0 kg)
Front Cover	0.13 in (3.2 mm) thermally pre-stressed glass with anti-reflection technology
Back Cover	Composite film
Frame	Anodized aluminum
Cell	6 × 24 monocrystalline Q.ANTUM solar half cells
Junction Box	2.09-3.98 in × 1.26-2.36 in × 0.59-0.71 in (53-101 mm × 32-60 mm × 15-18 mm), IP67, with bypass diodes
Cable	4 mm² Solar cable; (+) ≥55.1 in (1400 mm), (–) ≥55.1 in (1400 mm)
Connector	Stäubli MC4-Evo2, Hanwha Q CELLS HQC4, Amphenol UTX, Renhe 05-8, JMTHY JM601A; Tongling Cable01S-F, IP68 or Friends PV2e; IP67

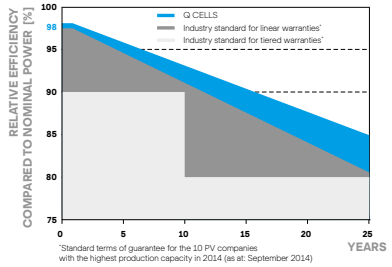


ELECTRICAL CHARACTERISTICS

POWER CLASS				415	420	425	430
MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC[1] (POWER TOLERANCE +5 W / –0 W)							
Minimum	Power at MPP[1]	P_{MPP}	[W]	415	420	425	430
	Short Circuit Current[1]	I_{SC}	[A]	10.69	10.74	10.78	10.83
	Open Circuit Voltage[1]	V_{OC}	[V]	48.59	48.84	49.09	49.33
	Current at MPP	I_{MPP}	[A]	10.18	10.22	10.27	10.31
	Voltage at MPP	V_{MPP}	[V]	40.77	41.08	41.39	41.70
	Efficiency[1]	η	[%]	≥19.4	≥19.6	≥19.8	≥20.1
MINIMUM PERFORMANCE AT NORMAL OPERATING CONDITIONS, NMOT[2]							
Minimum	Power at MPP	P_{MPP}	[W]	310.8	314.5	318.3	322.0
	Short Circuit Current	I_{SC}	[A]	8.61	8.65	8.69	8.72
	Open Circuit Voltage	V_{OC}	[V]	45.82	46.05	46.29	46.52
	Current at MPP	I_{MPP}	[A]	8.01	8.05	8.08	8.12
	Voltage at MPP	V_{MPP}	[V]	38.79	39.09	39.38	39.67

[1]Measurement tolerances P_{MPP} ±3%; I_{SC}; V_{OC} ±5% at STC: 1000 W/m², 25±2 °C, AM 1.5 according to IEC 60904-3 • [2]800 W/m², NMOT, spectrum AM 1.5

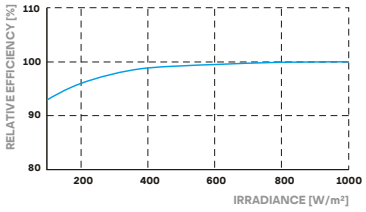
Q CELLS PERFORMANCE WARRANTY



At least 98% of nominal power during first year. Thereafter max. 0.54% degradation per year. At least 93.1% of nominal power up to 10 years. At least 85% of nominal power up to 25 years.

All data within measurement tolerances. Full warranties in accordance with the warranty terms of the Q CELLS sales organisation of your respective country.

PERFORMANCE AT LOW IRRADIANCE



Typical module performance under low irradiance conditions in comparison to STC conditions (25 °C, 1000 W/m²)

TEMPERATURE COEFFICIENTS							
Temperature Coefficient of I_{SC}	α	[%/K]	+0.04	Temperature Coefficient of V_{OC}	β	[%/K]	–0.27
Temperature Coefficient of P_{MPP}	γ	[%/K]	–0.35	Normal Module Operating Temperature	NMOT	[°F]	109±5.4 (43±3 °C)

PROPERTIES FOR SYSTEM DESIGN

Maximum System Voltage V_{SYS}	[V]	1500 (IEC) / 1500 (UL)	Safety Class	II
Maximum Series Fuse Rating	[A DC]	20	Fire Rating based on ANSI / UL 1703	C (IEC) / TYPE 1 (UL)
Max. Design Load, Push / Pull[3]	[lbs / ft²]	75 (3600 Pa) / 33 (1600 Pa)	Permitted Module Temperature on Continuous Duty	–40 °F up to +185 °F (–40 °C up to +85 °C)
Max. Test Load, Push / Pull[3]	[lbs / ft²]	113 (5400 Pa) / 50 (2400 Pa)		

[3] See Installation Manual

QUALIFICATIONS AND CERTIFICATES

UL 1703, CE-compliant, IEC 61215:2016, IEC 61730:2016, Application Class II, U.S. Patent No. 9,893,215 (solar cells)

PACKAGING INFORMATION

Number of Modules per Pallet	29
Number of Pallets per 53' Trailer	26
Number of Pallets per 40' HC-Container	22
Pallet Dimensions (L × W × H)	84.6 × 45.3 × 48.0 in (2150 × 1150 × 1220 mm)
Pallet Weight	1717 lbs (779 kg)

Note: Installation instructions must be followed. See the installation and operating manual or contact our technical service department for further information on approved installation and use of this product.

Hanwha Q CELLS America Inc.
400 Spectrum Center Drive, Suite 1400, Irvine, CA 92618, USA | **TEL** +1 949 748 59 96 | **EMAIL** inquiry@us.q-cells.com | **WEB** www.q-cells.us

Datasheet

IRONRIDGE

BX System

Uniquely shaped for flat roofs.

IronRidge BX delivers superior power density and design flexibility to flat roof solar arrays. Made of a glass-reinforced composite, the BX Chassis is engineered for extreme structural loading, yet is also shaped to be roof-friendly and easy to install.

Certified BX plan sets can be obtained instantly through an online Design Assistant or by contacting IronRidge Commercial Services.

Glass-Reinforced Composite

Corrosion-free and engineered for long-term structural performance.

Commercial Services

Engineering support to optimize system design.

Class A Fire Rating

Certified to maintain the fire resistance rating of the existing roof.

Design Assistant

Online software makes it simple to create, share, and price projects.

UL 2703 Listed System

Entire system and components meet newest effective UL 2703 standard.

25-Year Warranty

Products guaranteed to be free of impairing defects.

Chassis

5° Chassis

Ballasted mounting for 5 degree tilt angle.

- Max load spreading design
- Fully encloses ballast
- 360 degree drainage

10° Chassis

Ballasted mounting for 10 degree tilt angle.

- Max load spreading design
- Fully encloses ballast
- 360 degree drainage

Top Clamp

Combines with Bottom Clamp for top-bottom module grip.

- Secures above module
- One-tool attachment
- Mill aluminum 6000 series

Bottom Clamp

Combines with Top Clamp to up structural connection.

- Secures below module
- One-tool attachment
- Mill aluminum 6000 series

Grounding

8” Mod Bonding Jumper

Bond adjacent modules in the array.

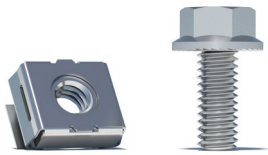
- Press-on installation
- Tin-plate copper wire
- Factory crimped connection

38” Row Bonding Jumper

Complete row-to-row bonding in the array.

- Press-on installation
- Tin-plate copper wire
- Factory crimped connection

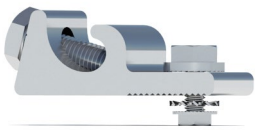
MLPE Mounting Hardware



Optional mounting hardware for MLPE devices.

- Cap screw and cage nut
- 5/16” socket install
- Stainless steel 300 series

PV Mod Grounding Lug



Connect arrays to equipment ground.

- Low profile
- Mounts to module frame
- One per continuous array

Accessories

Cable Tie

Complete wire management with weatherproof ties.

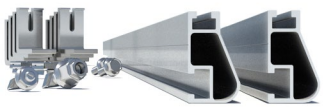
- UV stabilized polyamide
- 12” length, bundle of 100
- Black finish

Edge Clip Cable Tie

Manage wires underneath module and Chassis flange.

- Clips to module & Chassis
- UV stabilized polyamide
- Black finish

String Inverter Mount Kit



Create mounting platform for inverters.

- Chassis, XR10 rail, hdw
- Up to 4’ inverter base
- Raises inverter off deck

Flat Roof Attachment Kit

Add anchors to ballasted system.

- Includes hardware
- For ballast-attached hybrid
- Uses locally-sourced strut

Resources

Design Assistant

Go from rough layout to fully engineered system in minutes.

Go to IronRidge.com

Chassis Display #7 Recycle Label

Like most glass-filled nylons, it is 100% recyclable—usually living on in furniture.

Find more info at epa.gov/recycle

APA SOLAR RACKING

APALTERNATIVES.COM

WHERE INNOVATION MEETS AUTOMATION

READY RACK

APA's **Ready Rack** is one of our original designs, updated and optimized with innovative features to bring down hardware cost and install time. It is one of the most versatile systems on the market and is designed to easily accommodate changes with modules, layouts and terrain. The simplistic hardware allows contractors to streamline the install process with adjustable features for challenging sites.

Helical anchors and quick-install bracing along with carefully engineered, strong, and lightweight cee channels are highly configurable allowing infinite solutions with reduced part counts and high slope tolerance.

In business since 2008, APA offers the most versatile line of racking and foundation solutions for projects in even the most challenging environments. With projects nationwide, APA is a trusted quality racking partner.

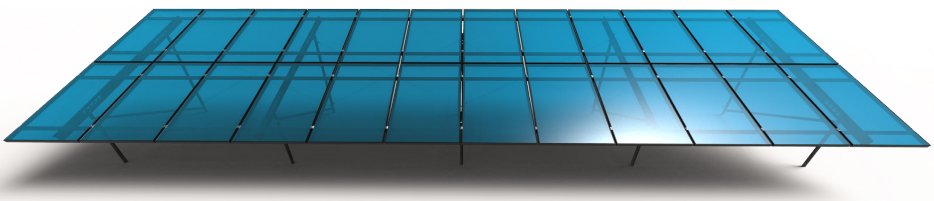
STANDARD SPECIFICATIONS

Racking Material: High Strength Steel
Corrosion Resistance: Galvanized; G90
Higher coatings as required.
Snow Load: Up to 100psf
Wind Load: Up to 150mph
Mounting Orientation: 2 High Portrait
Tilt Angle: 5-35 Degree tilt options
Anchor Depth: Based on soil type and frost line
Building Code Compliant: IBC 2012
PE Stamp: APA drawings can be PE stamped for all 50 states and territories

DUAL POST DESIGN

APA's Ready Rack system is a dual post design making it an ideal choice for challenging sites with heavy wind or snow loads and high topography.

Ready Rack comes standard with shallow micro helicals for soft or saturated soils, deep frost lines, shallow bedrock or high water tables. Other foundations with ground screws or ballast are available for sites with rock or non-penetrative soils.



20-345 COUNTY ROAD X P.O. BOX 326 RIDGEVILLE CORNERS, OH 43555

419.267.5280 SALES@APALTERNATIVES.COM

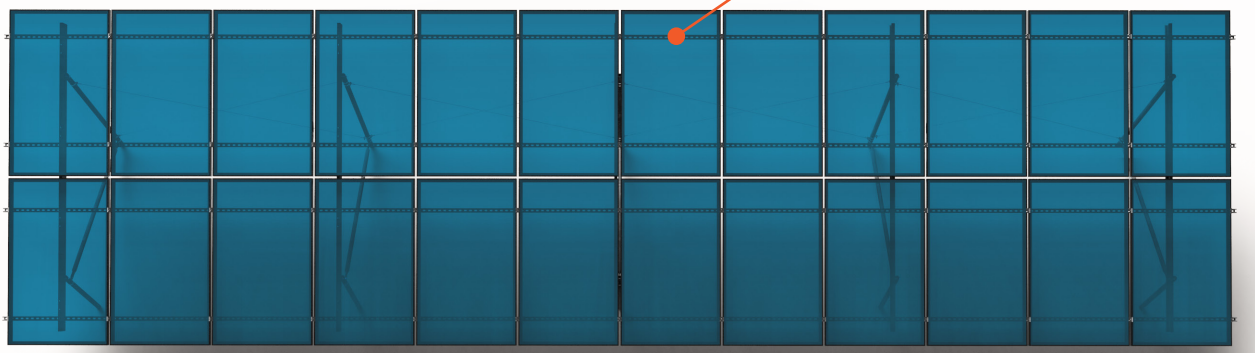
WHAT MAKES THE READYRACK SYSTEM SO SPECIAL?

FULLY CUSTOMIZABLE ROW LENGTHS

How do you fit more content while increasing production and reducing costs? Fill up every inch of space by creating rows as long or as short as you need.

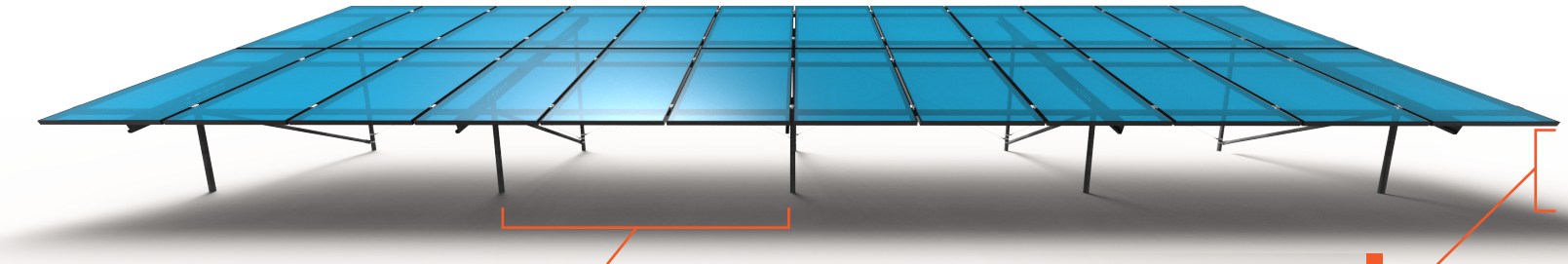
VERSATILE DESIGN

We can design your rack to fit any panel and in any space and configuration. This can all be done on the fly, thanks to highly adaptable components.



HIGH TERRAIN CAPACITY

Easily accomondating slopes over 20%, difficult terrain is no longer a problem. Put those extra acres to use, and let it roll.



INCREASED ANCHOR SPACING

Longer spans means less parts, faster installation, and more money in your pocket.

HIGH GROUND CLEARANCE

Whether your project needs clearance for snow or room for maintenance, our highly adjustable anchors have got you covered.

INSTALLER FRIENDLY

Sleek and strong, our super cee channel accommodates varying posts heights and spans, tilts, and adjustments in the field, making our rack an installer's dream.

HIGH STRENGTH PARTS

Engineered for the toughest northern winters and the harshest southern hurricanes, our racks will still be standing long after everything else.

APA SOLAR RACKING

419.267.5280 // SALES@APALTERNATIVES.COM

INVERTERS

Three Phase Inverter with Synergy Technology

for the 277/480V Grid for North America

SE66.6KUS / SE100KUS

Specifically designed to work with power optimizers

- Easy two-person installation – each unit mounted separately, equipped with cables for simple connection between units
- Balance of System and labor reduction compared to using multiple smaller string inverters
- Independent operation of each unit enables higher uptime and easy serviceability
- No wasted ground area: wall/rail mounted, or horizontally mounted under the modules (10˚ inclination)
- Integrated arc fault protection and rapid shutdown for NEC 2014, NEC 2017 and NEC 2020, per article 690.11 and 690.12
- Built-in module-level monitoring with Ethernet or cellular GSM
- Fixed voltage inverter for superior efficiency (98.5%) and longer strings
- Integrated DC Safety Switch
- Built-in RS485 Surge Protection, to better withstand surges caused by lightning or other events
- 150% DC oversizing, enabling higher energy production

solaredge

/ Three Phase Inverter with Synergy Technology

for the 277/480V Grid for North America

SE66.6KUS / SE100KUS

	SE66.6KUS	SE100KUS	
OUTPUT			
Rated AC Power Output	66600	100000	VA
Maximum AC Power Output	66600	100000	VA
AC Output Line Connections	4-wire WYE (L1-L2-L3-N) plus PE		
AC Output Voltage Minimum-Nominal-Maximum(1) (L-N)	244 - 277 - 305		Vac
AC Output Voltage Minimum-Nominal-Maximum(1) (L-L)	422.5 - 480 - 529		Vac
AC Frequency Min-Nom-Max(1)	59.3 - 60 - 60.5		Hz
Maximum Continuous Output Current (per Phase) @277V	80	120	A
GFDI Threshold	1		A
Utility Monitoring, Islanding Protection, Configurable Power Factor, Country Configurable Thresholds	Yes		
INPUT			
Maximum DC Power (Module STC) / Unit	100000 / 50000	150000 / 50000	W
Transformer-less, Ungrounded	Yes		
Maximum Input Voltage DC to Gnd	500		Vdc
Maximum Input Voltage DC+ to DC-	1000		Vdc
Nominal Input Voltage DC to Gnd	425		Vdc
Nominal Input Voltage DC+ to DC-	850		Vdc
Maximum Input Current	2 x 40	3 x 40	Adc
Maximum Input Short Circuit Current	120		Adc
Reverse-Polarity Protection	Yes		
Ground-Fault Isolation Detection	350kΩ Sensitivity per Unit		
CEC Weighted Efficiency	98.5		%
Nighttime Power Consumption	< 12		W
ADDITIONAL FEATURES			
Supported Communication Interfaces	RS485, Ethernet, Cellular GSM (optional)		
Rapid Shutdown	NEC2014, NEC2017 and NEC2020 compliant/certified, upon AC Grid Disconnect		
RS485 Surge Protection	Built-in		
DC SAFETY SWITCH			
DC Disconnect	1000V / 2 x 40A	1000V / 3 x 40A	
STANDARD COMPLIANCE			
Safety	UL1741, UL1741 SA, UL1699B, UL1998, CSA 2.22		
Grid Connection Standards	IEEE 1547, Rule 21, Rule 14 (HI)		
Emissions	FCC part15 class A		
INSTALLATION SPECIFICATIONS			
Number of units	2	3	
AC Output Conduit Size / Max AWG / Max PE AWG	1.5" / 2/0 / 6	2" / 4/0 / 4	
DC Output Conduit Size / Terminal Block AWG Range / Number of Strings(2)	2 x 1.25" / 6-14 / 6 strings	2 x 1.25" / 6-14 / 9 strings	
Dimensions (H x W x D)	Primary Unit: 37 x 12.5 x 10.5 / 940 x 315 x 260; Secondary Unit: 21 x 12.5 x 10.5 / 540 x 315 x 260		in / mm
Weight	Primary Unit: 105.8 / 48; Secondary Unit 99.2 / 45		lb / kg
Operating Temperature Range	-40 to +140 / -40 to +60(3)		°F / °C
Cooling	Fan (user replaceable)		
Noise	< 60		dBA
Protection Rating	NEMA 3R		
Mounting	Brackets provided		

(1) For other regional settings please contact SolarEdge support
(2) Single input option per unit (up to 3AWG) available
(3) De-rating from 50℃

CE RoHS

Three Phase Inverters for the 277/480V Grid

for North America

SE20KUS / SE30KUS / SE33.3KUS / SE40KUS

INVERTERS

The best choice for SolarEdge enabled systems

- Specifically designed to work with power optimizers
- Quick and easy inverter commissioning directly from a smartphone using the SolarEdge SetApp
- Fixed voltage inverter for superior efficiency (98.5%) and longer strings
- Built-in type 2 DC and AC Surge Protection, to better withstand lightning events
- Small, lightest in its class, and easy to install outdoors or indoors on provided bracket
- Integrated arc fault protection and rapid shutdown for NEC 2014 and 2017, per article 690.11 and 690.12
- Built-in module-level monitoring with Ethernet, wireless or cellular communication for full system visibility
- Integrated Safety Switch
- UL1741 SA certified, for CPUC Rule 21 grid compliance

solaredge

/ Three Phase Inverters for the 277/480V Grid[1] for North America

SE20KUS / SE30KUS / SE33.3KUS / SE40KUS

MODEL NUMBER	SE20KUS	SE30KUS	SE33.3KUS	SE40KUS	
APPLICABLE TO INVERTERS WITH PART NUMBER	SEXXK - USXXXBXXX	SEXXK-USX8IXXXX			
OUTPUT					
Rated AC Power Output	20000	30000	33300	40000	W
Maximum apparent AC output power	20000	30000	33300	40000	VA
AC Output Line Connections	4W + PE	3W + PE, 4W + PE			
AC Output Voltage Minimum-Nominal-Maximum[2] (L-N)	244 - 277 - 305				Vac
AC Output Voltage Minimum-Nominal-Maximum[2] (L-L)	422.5 - 480 - 529				Vac
AC Frequency Min-Nom-Max[2]	59.3 - 60 - 60.5				Hz
Maximum Continuous Output Current (per Phase)	24	36.25	40	48.25	Aac
GFDI Threshold	1				A
Utility Monitoring, Islanding Protection, Country Configurable Set Points	Yes				
Total Harmonic Distortion	≤ 3				%
Power Factor Range	+/- 0.85 to 1				
INPUT					
Maximum DC Power (Module STC)	27000	45000	50000	60000	W
Transformer-less, Ungrounded	Yes				
Maximum Input Voltage DC+ to DC-	1000				Vdc
Nominal Input Voltage DC+ to DC-	850				Vdc
Maximum Input Current	26.5	36.25	40	48.25	Adc
Maximum Input Short Circuit Current	33	55			Adc
Reverse-Polarity Protection	Yes				
Ground-Fault Isolation Detection	1MΩ Sensitivity	167kΩ Sensitivity[3]			
CEC Weighted Efficiency	98	98.5			%
Night-time Power Consumption	<3	<4			W
ADDITIONAL FEATURES					
Supported Communication Interfaces	2 x RS485, Ethernet, Cellular (optional)				
Inverter Commissioning	With the SetApp mobile application using built-in access point for local connection				
Arc Fault Protection	Integrated, User Configurable (According to UL1699B)				
Rapid Shutdown	NEC2014, NEC2017 and NEC2020 compliant/certified				
RS485 Surge Protection Plug-in	Supplied with the inverter, Built-in				
DC Surge Protection	Type II, field replaceable, optional	Type II, field replaceable, Built-in			
AC Surge Protection	-	Type II, field replaceable, Built-in			
DC Fuses (Single Pole)	-	25A, Built-in			
Smart Energy Management	Export Limitation				
DC SAFETY SWITCH					
DC Disconnect	Integrated				
STANDARD COMPLIANCE					
Safety	UL1741, UL1741 SA, UL1699B, CSA C22.2, Canadian AFCI according to T.I.L. M-07				
Grid Connection Standards	IEEE1547, Rule 21, Rule 14 (HI)				
Emissions	FCC part15 class A				
INSTALLATION SPECIFICATIONS					
AC output conduit size / AWG range	3/4" minimum / 12-6 AWG	¾" or 1" / 6 - 10 AWG			
DC input conduit size / AWG range	¾" or 1" / 6 - 12 AWG				
Number of DC inputs pairs	2	4			
Dimensions with Safety Switch (H x W x D)	30.5 x 12.5 x 10.5 / 775 x 315 x 260	31.8 x 12.5 x 11.8 / 808 x 317 x 300			in / mm
Weight with Safety Switch	74.2 / 33.7	78.2 / 35.5			lb / kg
Cooling	Fans (user replaceable)				
Noise	< 50	< 62			dBA
Operating Temperature Range	-40 to +140 / -40 to +60[4]				˚F / ˚C
Protection Rating	NEMA 3R				
Mounting	Bracket provided				

(1) For 120/208V inverters refer to: https://www.solaredge.com/sites/default/files/se-three-phase-us-inverter-208V-setapp-datasheet.pdf
(2) For other regional settings please contact SolarEdge support
(3) Where permitted by local regulations
(4) For power de-rating information refer to: https://www.solaredge.com/sites/default/files/se-temperature-derating-note-na.pdf

CE

Power Optimizer
For North America
P860 / P960

POWEROPTIMIZER

PV power optimization at the module-level
The most cost-effective solution for commercial and large field installations

- Specifically designed to work with SolarEdge inverters
- Up to 25% more energy
- Superior efficiency (99.5%)
- Balance of System cost reduction; 50% less cables, fuses and combiner boxes, over 2x longer string lengths possible
- Fast installation with a single bolt
- Advanced maintenance with module-level monitoring
- Module-level voltage shutdown for installer and firefighter safety
- Meets NEC requirements for arc fault protection (AFCI) and Photovoltaic Rapid Shutdown System (PVRSS)
- Use with two PV modules connected in parallel

solaredge

/ Power Optimizer
For North America
P860 / P960

Power Optimizer Model (Typical Module Compatibility)	P860 (for 2 x 72 cell modules)		P960 (for 2 x 72 cell modules)		
INPUT					
Rated Input DC Power[1]	860		960		W
Connection Method	Dual input for independently connected modules[2]				
Absolute Maximum Input Voltage (Voc at lowest temperature)	60				Vdc
MPPT Operating Range	12.5 - 60				Vdc
Maximum Short Circuit Current (Isc)	22		23		Adc
Maximum Short Circuit Current per Input (Isc)	11		11.5		Adc
Maximum Efficiency	99.5				%
Weighted Efficiency	98.6				%
Overvoltage Category	II				
OUTPUT DURING OPERATION (POWER OPTIMIZER CONNECTED TO OPERATING SOLAREDGE INVERTER)					
Maximum Output Current	18				Adc
Maximum Output Voltage	80				Vdc
OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED FROM SOLAREDGE INVERTER OR SOLAREDGE INVERTER OFF)					
Safety Output Voltage per Power Optimizer	1 ± 0.1				Vdc
STANDARD COMPLIANCE					
Photovoltaic Rapid Shutdown System	Compliant with NEC 2014, 2017[3], 2020				
EMC	FCC Part 15 Class A, IEC61000-6-2, IEC61000-6-3				
Safety	IEC62109-1 (class II safety), UL1741				
Material	UL94 V-0, UV resistant				
RoHS	Yes				
INSTALLATION SPECIFICATIONS					
Compatible SolarEdge Inverters	Three phase inverters				
Maximum Allowed System Voltage	1000				Vdc
Dimensions (W x L x H)	129 x 168 x 59 / 5.1 x 6.61 x 2.32				mm / in
Weight	1064 / 2.34				gr / lb
Input Connector	MC4[4]				
Input Wire Length Options	Input #1	Input #2	Input #1	Input #2	m / ft
1	(-) 0.16 / 0.52, (+) 0.16 / 0.52	(-) 0.16 / 0.52, (+) 0.16 / 0.52	(-) 1.6 / 5.2, (+) 1.6 / 5.2	(-) 1.6 / 5.2, (+) 1.6 / 5.2	
2	(-) 1.6 / 5.2, (+) 0.16 / 0.52	(-) 0.16 / 0.52, (+) 1.6 / 5.2			
3	(-) 1.6 / 5.2, (+) 1.6 / 5.2	(-) 1.6 / 5.2, (+) 1.6 / 5.2			
Output Wire Type / Connector	Double insulated; MC4				
Output Wire Length	2.2 / 7.2		2.3 / 7.5		m / ft
Operating Temperature Range[5]	-40 to +85 / -40 to +185				˚C / ˚F
Protection Rating	IP68 / NEMA6P				
Relative Humidity	0 - 100				%

(1) Rated power of the module at STC will not exceed the power optimizer "Rated Input DC Power". Modules with up to +5% power tolerance are allowed
(2) In the event of an odd number of PV modules in one string, installation of one P860 /P960 power optimizer connected to one PV module is allowed. When connecting a single module to the P860/P960, seal the unused input connectors with the supplied pair of seals
(3) NEC 2017 requires that the maximum combined input voltage does not exceed 80V
(4) For other connector types please refer to: https://www.solaredge.com/sites/default/files/optimizer-input-connector-compatibility.pdf
(5) For ambient temperature above +70˚C / +158˚F, power de-rating is applied. Refer to the Power Optimizers Temperature De-Rating Application Note for more details

PV System Design Using a SolarEdge Inverter[6]		Three Phase for 208V Grid[7]		Three Phase for 277/480V Grid		
		P860	P960	P860	P960	
Minimum String Length	Power Optimizers	8		14		
	PV Modules	15		27		
Maximum String Length	Power Optimizers	30				
	PV Modules	60				
Maximum Power per String		7200[8]		15300[9]		W
Parallel Strings of Different Lengths or Orientations		Yes				

(6) It is not allowed to mix P860/P960 with P801/P800p/P850/P950/P1100 in one string or to mix with P370-P505 in one string
(7) P860 design with three phase 208V inverters is limited. Use the SolarEdge Designer for verification
(8) For the 208V grid: It is allowed to install up to 7700W per string when the maximum power difference between each string is 1,000W
(9) For the 277/480V grid: it is allowed to install up to 17,550W per string when the maximum power difference between each string is 2,000W

RoHS

Intertek

INVERTERS

Single Phase Inverter with HD-Wave Technology

for North America

SE3000H-US / SE3800H-US / SE5000H-US / SE6000H-US / SE7600H-US / SE10000H-US / SE11400H-US

12-25 YEAR WARRANTY

Optimized installation with HD-Wave technology

- Specifically designed to work with power optimizers
- Record-breaking 99% weighted efficiency
- Quick and easy inverter commissioning directly from a smartphone using the SolarEdge SetApp
- Fixed voltage inverter for longer strings
- Integrated arc fault protection and rapid shutdown for NEC 2014, NEC 2017 and NEC 2020 per article 690.11 and 690.12
- UL1741 SA certified, for CPUC Rule 21 grid compliance
- Small, lightweight, and easy to install both outdoors or indoors
- Built-in module-level monitoring
- Optional: Faster installations with built-in consumption metering (1% accuracy) and production revenue grade metering (0.5% accuracy, ANSI C12.20)

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/ Single Phase Inverter with HD-Wave Technology

for North America

SE3000H-US / SE3800H-US / SE5000H-US / SE6000H-US/ SE7600H-US / SE10000H-US / SE11400H-US

MODEL NUMBER	SE3000H-US	SE3800H-US	SE5000H-US	SE6000H-US	SE7600H-US	SE10000H-US	SE11400H-US	
APPLICABLE TO INVERTERS WITH PART NUMBER	SEXXXXH-XXXXXBXX4							
OUTPUT								
Rated AC Power Output	3000	3800 @ 240V 3300 @ 208V	5000	6000 @ 240V 5000 @ 208V	7600	10000	11400 @ 240V 10000 @ 208V	VA
Maximum AC Power Output	3000	3800 @ 240V 3300 @ 208V	5000	6000 @ 240V 5000 @ 208V	7600	10000	11400 @ 240V 10000 @ 208V	VA
AC Output Voltage Min.-Nom.-Max. (211 - 240 - 264)	✓	✓	✓	✓	✓	✓	✓	Vac
AC Output Voltage Min.-Nom.-Max. (183 - 208 - 229)	-	✓	-	✓	-	-	✓	Vac
AC Frequency (Nominal)	59.3 - 60 - 60.5[1]							Hz
Maximum Continuous Output Current @240V	12.5	16	21	25	32	42	47.5	A
Maximum Continuous Output Current @208V	-	16	-	24	-	-	48.5	A
Power Factor	1, Adjustable - 0.85 to 0.85							
GFDI Threshold	1							A
Utility Monitoring, Islanding Protection, Country Configurable Thresholds	Yes							
INPUT								
Maximum DC Power @240V	4650	5900	7750	9300	11800	15500	17650	W
Maximum DC Power @208V	-	5100	-	7750	-	-	15500	W
Transformer-less, Ungrounded	Yes							
Maximum Input Voltage	480							Vdc
Nominal DC Input Voltage	380				400			Vdc
Maximum Input Current @240V[2]	8.5	10.5	13.5	16.5	20	27	30.5	Adc
Maximum Input Current @208V[2]	-	9	-	13.5	-	-	27	Adc
Max. Input Short Circuit Current	45							Adc
Reverse-Polarity Protection	Yes							
Ground-Fault Isolation Detection	600kΩ Sensitivity							
Maximum Inverter Efficiency	99	99.2						%
CEC Weighted Efficiency	99						99 @ 240V 98.5 @ 208V	%
Nighttime Power Consumption	< 2.5							W

(1) For other regional settings please contact SolarEdge support

(2) A higher current source may be used; the inverter will limit its input current to the values stated

Single Phase Inverter with HD-Wave Technology

for North America

SE3000H-US / SE3800H-US / SE5000H-US / SE6000H-US/ SE7600H-US / SE10000H-US / SE11400H-US

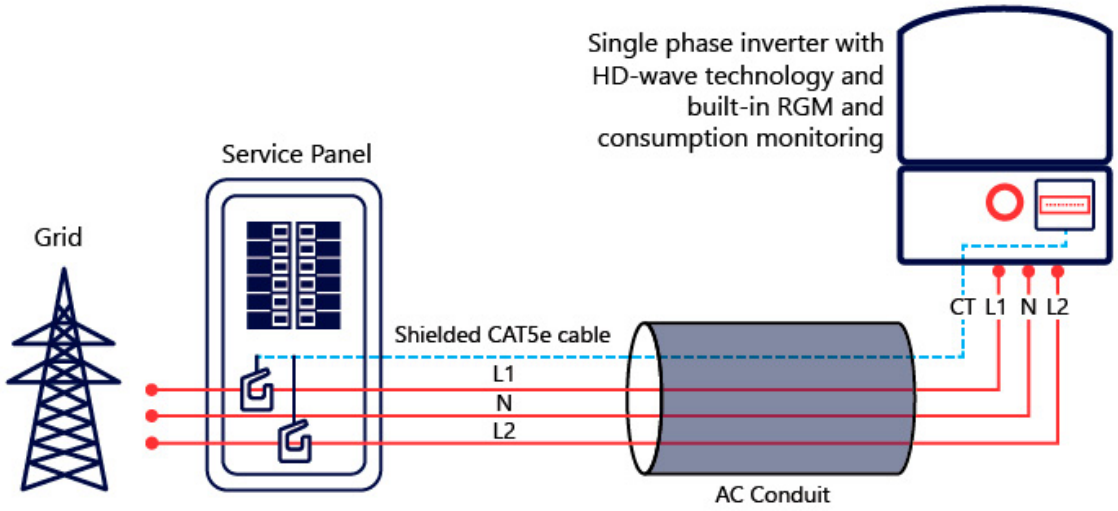
MODEL NUMBER	SE3000H-US	SE3800H-US	SE5000H-US	SE6000H-US	SE7600H-US	SE10000H-US	SE11400H-US	
ADDITIONAL FEATURES								
Supported Communication Interfaces	RS485, Ethernet, ZigBee (optional), Cellular (optional)							
Revenue Grade Metering, ANSI C12.20	Optional[3]							
Consumption metering								
Inverter Commissioning	With the SetApp mobile application using Built-in Wi-Fi Access Point for Local Connection							
Rapid Shutdown - NEC 2014, NEC 2017 and NEC 2020, 690.12	Automatic Rapid Shutdown upon AC Grid Disconnect							
STANDARD COMPLIANCE								
Safety	UL1741, UL1741 SA, UL1699B, CSA C22.2, Canadian AFCI according to T.I.L. M-07							
Grid Connection Standards	IEEE1547, Rule 21, Rule 14 (HI)							
Emissions	FCC Part 15 Class B							
INSTALLATION SPECIFICATIONS								
AC Output Conduit Size / AWG Range	1" Maximum / 14-6 AWG					1" Maximum /14-4 AWG		
DC Input Conduit Size / # of Strings / AWG Range	1" Maximum / 1-2 strings / 14-6 AWG					1" Maximum / 1-3 strings / 14-6 AWG		
Dimensions with Safety Switch (HxWxD)	17.7 x 14.6 x 6.8 / 450 x 370 x 174					21.3 x 14.6 x 7.3 / 540 x 370 x 185		in / mm
Weight with Safety Switch	22 / 10		25.1 / 11.4	26.2 / 11.9		38.8 / 17.6		lb / kg
Noise	< 25				<50			dBA
Cooling	Natural Convection							
Operating Temperature Range	-40 to +140 / -40 to +60[4]							°F / °C
Protection Rating	NEMA 4X (Inverter with Safety Switch)							

(3) Inverter with Revenue Grade Meter P/N: SExxxxH-US000BNC4; Inverter with Revenue Grade Production and Consumption Meter P/N: SExxxxH-US000BNI4 . For consumption metering, current transformers should be ordered separately: SEACT0750-200NA-20 or SEACT0750-400NA-20. 20 units per box

(4) Full power up to at least 50°C / 122°F; for power de-rating information refer to: https://www.solaredge.com/sites/default/files/se-temperature-derating-note-na.pdf

How to Enable Consumption Monitoring

By simply wiring current transformers through the inverter's existing AC conduits and connecting them to the service panel, homeowners will gain full insight into their household energy usage helping them to avoid high electricity bills



RoHS

Power Optimiser

For Australia
Module Add-On

P401 / P500 / P505

POWEROPTIMISER

PV power optimisation at the module-level

- Specifically designed to work with SolarEdge inverters
- Up to 25% more energy
- Superior efficiency (99.5%)
- Mitigates all types of modules mismatch-loss, from manufacturing tolerance to partial shading
- Flexible system design for maximum space utilization
- Fast installation with a single bolt
- Next generation maintenance with module level monitoring
- Module-level voltage shutdown for installer and firefighter safety

solaredge

/ Power Optimiser For Australia

Module Add-On

P401 / P500 / P505

Optimiser Model (Typical Module Compatibilty)	P401 (60&70 Cell modules)	P500 (for 96-cell modules)	P505 (for higher current modules)	
INPUT				
Rated Input DC Power(1)	400	500	505	W
Absolute Maximum Input Voltage (Voc at lowest temperature)	60	80	83	Vdc
MPPT Operating Range	8 - 60	8 - 80	12.5-83	Vdc
Maximum Short Circuit Current (Isc)	11.75	10.1	14	Adc
Maximum Efficiency	99.5			%
Weighted Efficiency	98.8			%
Overvoltage Category	II			
OUTPUT DURING OPERATION (POWER OPTIMISER CONNECTED TO OPERATING SOLAREDGE INVERTER)				
Maximum Output Current	15			Adc
Maximum Output Voltage	60	60	85	Vdc
OUTPUT DURING STANDBY (POWER OPTIMISER DISCONNECTED FROM SOLAREDGE INVERTER OR SOLAREDGE INVERTER OFF)				
Safety Output Voltage per Power Optimiser	1 ± 0.1			Vdc
STANDARD COMPLIANCE				
EMC	FCC Part 15 Class B, IEC61000-6-2, IEC61000-6-3			
Safety	IEC62109-1 (class II safety), UL1741			
RoHS	Yes			
Fire Safety	VDE-AR-E 2100-712:2013-05			
INSTALLATION SPECIFICATIONS				
Maximum Allowed System Voltage	1000			Vdc
Dimensions (W x L x H)	129 x 153 x29.5	129 x 153 x 33.5	129 x 162 x 59	mm
Weight (including cables)	655	750	1064	gr
Input Connector(2)	MC4(2)	MC4(2)		
Input Wire Length	0.16 / 0.9(4)	0.16		m
Output Connector	MC4			
Output Wire Length	1.2			m
Operating Temperature Range	-40 to +85			˚C
Protection Rating	IP68 / NEMA6P			
Relative Humidity	0 - 100			%

(1) Rated power of the module at STC will not exceed the optimiser "Rated Input DC Power". Modules with up to +5% power tolerance are allowed
(2) For other connector types please contact SolarEdge
(3) Dual version for parallel connection of 2 modules; P/N: P485-4RMDMRM. In a case of odd number of PV modules in one string it is allowed to install one P485 dual version power optimiser connected to one PV module. When connecting a single module seal the unused input connectors with the supplied pair of seals
(4) Longer inputs wire length are available for use. For 0.9m input wire length order P401-xxxLxxx

PV System Design Using a Solaredge Inverter(5)		Single Phase HD-WAVE	Single Phase	Three Phase Residential	Three Phase Commercial	
Minimum String Length (Power Optimisers)	P401, P500	8		9	16	
	P505	6		8	14	
Maximum String Length (Power Optimisers)		25		25	50	
Maximum Nominal Power per String		5700(6) (6000 with SE8000H, SE10000H)	5250(6)	5625(6)	11250(7)	W
Parallel Strings of Different Lengths or Orientations		Yes				

(5) It is not allowed to mix P505 with P401/P500 in one string
(7) It is allowed to install up to 13,500W per string when the maximum power difference between each string is 2,000W
(6) If the inverters rated AC power ≤ maximum nominal power per string, then the maximum power per string will be able to reach up to the inverters maximum input DC power Refer to: https://www.solaredge.com/sites/default/files/se-single-string-power-optimizer-application-note-aus.pdf

CE RoHS

LIMITED WARRANTY

REV. 031120-LINEAR

Jinko Solar Import and Export Co., Ltd. ("**Jinko**") generally provides the Warranties set forth herein to the original purchaser and its permitted successors and assigns ("**Customer**") with respect to any solar photovoltaic module set forth herein sold by Jinko under purchase agreements signed on or after November 3, 2020 ("**Module**"), subject to the terms and conditions herein ("**Limited Warranty**"). Jinko and Customer may hereinafter be referred to each as a "**Party**" and collectively as the "**Parties**".

1. WARRANTY START DATE. Jinko provides the Warranties set forth herein commencing upon the earlier of delivery of a Module to the original purchaser thereof or that date which is one hundred and eighty (180) days following the Module manufacture date, as indicated by the serial number [digit no. 7 – 12 (YYMMDD), starting from the left side of the serial number] for such Module ("**Warranty Start Date**").

2. LIMITED PRODUCT WARRANTY. Beginning on the Warranty Start Date and terminating on that date which is one hundred and eighty (180) months thereafter for N-Type mono-crystalline Modules and N-Type mono-crystalline Bifacial Modules, three hundred (300) months thereafter for N-Type all black mono-crystalline Modules, and one hundred and forty-four (144) months thereafter for all other types of Modules, Jinko warrants that the Module and its respective DC connector and cables, if any, shall be free from material defects in design, materials and workmanship that impair the performance of the Module ("**Limited Product Warranty**"). Material defects shall not include normal wear and tear.

3.A. LIMITED POWER WARRANTY FOR MONOFACIAL MODULES.

Jinko warrants that the Degradation Rate shall not exceed the amount for the applicable period following the Warranty Start Date as set forth below ("**Monofacial Module Limited Power Warranty**").

A. MONOFACIAL MODULES: for **poly-crystalline Modules**:

(1) SINGLE GLASS SERIES, only applicable to the following poly-crystalline Module types:

JKMxxxPP-72, JKMxxxPP-72-J, JKMSxxxPP-72, JKMSxxxPP-72-J, JKMxxxPP-72H, JKMxxxPP-72B, JKMSxxxPP-72B, JKMxxxPP-72HB, JKMSxxxPP-72-MX, JKMSxxxPP-72B-MX, JKMxxxPP-60, JKMxxxPP-60-J, JKMSxxxPP-60, JKMSxxxPP-60-J, JKMxxxPP-60H, JKMxxxPP-60H-J, JKMxxxPP-60B, JKMSxxxPP-60B, JKMxxxPP-60HB, JKMSxxxPP-60-MX, JKMSxxxPP-60B-MX, JKMxxxPP-72-V, JKMxxxPP-72-V-J, JKMSxxxPP-72-V, JKMSxxxPP-72-V-J, JKMxxxPP-72H-V, JKMxxxPP-72HB-V, JKMSxxxPP-72-MX-V, JKMSxxxPP-72B-MX-V, JKMxxxPP-60-V, JKMxxxPP-60-V-J, JKMSxxxPP-60-V, JKMSxxxPP-60-V-J, JKMxxxPP-60H-V, JKMxxxPP-60HB-V, JKMSxxxPP-60-MX-V, JKMSxxxPP-60B-MX-V

(i) 2.5% in the first year; (ii) 0.7% each year thereafter until that date which is twenty-five (25) years following the Warranty Start Date, at which time the Actual Power Output shall be not less than 80.7% of the Nominal Power Output.

(2) DUAL GLASS SERIES, only applicable to the following poly-crystalline Module types:

JKMxxxPP-72-DV, JKMSxxxPP-72-DV, JKMxxxPP-72-DV-J, JKMSxxxPP-72-DV-J, JKMxxxPP-72H-DV, JKMxxxPP-60-DV, JKMSxxxPP-60-DV, JKMxxxPP-60-DV-J, JKMSxxxPP-60-DV-J, JKMxxxPP-60H-DV

(i) 2.5 % in the first year; (ii) 0.5 % each year thereafter until that date which is thirty (30) years following the Warranty Start Date, at which time

the Actual Power Output shall be not less than 83.0 % of the Nominal Power Output.

B. MONOFACIAL MODULES: for **mono-crystalline Modules**:

(1) P-TYPE SERIES, only applicable to the following mono-crystalline Module types:

(a) JKMxxxM-72, JKMxxxM-72-J, JKMxxxM-72L, JKMSxxxM-72, JKMSxxxM-72-J, JKMxxxM-72H, JKMxxxM-72HL, JKMxxxM-72B, JKMSxxxM-72B, JKMxxxM-72HB, JKMxxxM-72BL, JKMxxxM-72HBL, JKMSxxxM-72-MX, JKMSxxxM-72L-MX, JKMSxxxM-72B-MX, JKMSxxxM-72BL-MX, JKMxxxM-60, JKMxxxM-60-J, JKMxxxM-60L, JKMSxxxM-60, JKMSxxxM-60-J, JKMxxxM-60H, JKMxxxM-60HL, JKMxxxM-60B, JKMxxxM-60BL, JKMSxxxM-60B, JKMxxxM-60HB, JKMxxxM-60BL, JKMxxxM-60HBL, JKMSxxxM-60-MX, JKMSxxxM-60L-MX, JKMSxxxM-60B-MX, JKMSxxxM-60BL-MX, JKMxxxM-72-V, JKMxxxM-72-V-J, JKMSxxxM-72-V, JKMSxxxM-72-V-J, JKMxxxM-72L-V, JKMxxxM-72H-V, JKMxxxM-72HL-V, JKMxxxM-72HB-V, JKMxxxM-72BL-V, JKMxxxM-72HBL-V, JKMSxxxM-72-MX-V, JKMSxxxM-72B-MX-V, JKMxxxM-60-V, JKMxxxM-60-V-J, JKMSxxxM-60-V, JKMSxxxM-60-V-J, JKMxxxM-60L-V, JKMxxxM-60H-V, JKMxxxM-60HL-V, JKMxxxM-60HB-V, JKMxxxM-60BL-V, JKMxxxM-60HBL-V, JKMSxxxM-60-MX-V, JKMSxxxM-60B-MX-V, JKMxxxM-66H，JKMxxxM-66HB，JKMxxxM-66H-V，JKMxxxM-66HB-V，JKMxxxM-78H，JKMxxxM-78H-V, JKMxxxM-78H-MBB-V, JKMxxxM-78H-MBB, JKMxxxM-66H-MBB-V, JKMxxxM-66H-MBB, JKMxxxM-66H-MBB-B-V, JKMxxxM-66H-MBB-B, JKMxxxM-72H-MBB-V, JKMxxxM-72H-MBB, JKMxxxM-60H-MBB-V, JKMxxxM-60H-MBB, JKMxxxM-60H-MBB-B-V, JKMxxxM-60H-MBB-B,

JKMSxxxM-60H-MX3, JKMSxxxM-60HB-MX3, JKMSxxxM-72H-MX3, JKMSxxxM-66H-MX3, JKMSxxxM-66HB-MX3, JKMSxxxM-60H-TI, JKMSxxxM-60HB-TI, JKMSxxxM-72H-TI, JKMSxxxM-66H-TI, JKMSxxxM-66HB-TI, JKMSxxxM-78H-TI

(i) 2.5% in the first year; (ii) 0.6% each year thereafter until that date which is twenty-five (25) years following the Warranty Start Date, at which time the Actual Power Output shall be not less than 83.1% of the Nominal Power Output.

(b) JKMxxxM-6RL3，JKMxxxM-6RL3-V，JKMxxxM-6RL3-B，JKMxxxM-6RL3-B-V，JKMxxxM-7RL3，JKMxxxM-7RL3-V, JKSM3-DACA-xxx, JKMxxxM-7RL3-V-J, JKMxxxM-7RL3-J, JKMxxxM-6TL4,JKMxxxM-6TL4-V,JKMxxxM-6TL4-B,JKMxxxM-6TL4-B-V, JKMxxxM-7TL4,JKMxxxM-7TL4-V,JKMxxxM-7TL4-B,JKMxxxM-7TL4-B-V, JKMxxxM-60HL4,JKMxxxM-60HL4-V,JKMxxxM-60HL4-B,JKMxxxM-60HL4-B-V, JKMxxxM-72HL4,JKMxxxM-72HL4-V,JKMxxxM-72HL4-B,JKMxxxM-72HL4-B-V, JKMxxxM-6RL4,JKMxxxM-6RL4-V,JKMxxxM-6RL4-B,JKMxxxM-6RL4-B-V, JKMxxxM-7RL4,JKMxxxM-7RL4-V,JKMxxxM-7RL4-B,JKMxxxM-7RL4-B-V, JKMxxxM-66HL4,JKMxxxM-66HL4-V,JKMxxxM-66HL4-B,JKMxxxM-66HL4-B-V, JKMxxxM-78HL4,JKMxxxM-78HL4-V,JKMxxxM-78HL4-B,JKMxxxM-78HL4-B-V，JKMxxxM-6TL3, JKMxxxM-6TL3-V,JKMxxxM-6TL3-B, JKMxxxM-6TL3-B-V，JKMxxxM-7TL4-J，JKMxxxM-7TL4-V-J,JKMxxxM-72HL4-J，JKMxxxM-72HL4-V-J,JKMxxxM-7RL4-J， JKMxxxM-7RL4-V-J，JKMxxxM-6RL3-V-J，JKMxxxM-6RL3-J, JKMxxxM-72HLM-V, JKMxxxM-60HLM-V, JKMxxxM-72HLM, JKMxxxM-60HLM, JKMxxxM-60HLM-B

(i) 2.0% in the first year; (ii) 0.55% each year thereafter until that date which is twenty-five (25) years following the Warranty Start Date, at which

time the Actual Power Output shall be not less than 84.8% of the Nominal Power Output.

(2) N-TYPE SERIES, only applicable to the following mono-crystalline Module types:

JKMxxxN-72H, JKMxxxN-72H -V,JKMxxxN-60H, JKMxxxN-60H-V, JKMxxxN-72H-MBB, JKMxxxN-72H-MBB-V,JKMxxxN-60H-MBB, JKMxxxN-60H-MBB-V, JKMxxxN-6RL3, JKMxxxN-6RL3-V, JKMxxxN-7RL3, JKMxxxN-7RL3-V, JKMxxxN-6TL4,JKMxxxN-6TL4-V, JKMxxxN-7TL4,JKMxxxN-7TL4-V, JKMxxxN-60HL4,JKMxxxN-60HL4-V, JKMxxxN-72HL4,JKMxxxN-72HL4-V, JKMxxxN-6RL4,JKMxxxN-6RL4-V, JKMxxxN-7RL4,JKMxxxN-7RL4-V, JKMxxxN-66HL4,JKMxxxN-66HL4-V, JKMxxxN-78HL4,JKMxxxN-78HL4-V JKMxxxN-78H-MBB-V, JKMxxxN-78H-MBB, JKMxxxN-66H-MBB-V, JKMxxxN-66H-MBB, JKMxxxN-6TL3, JKMxxxN-6TL3-V ， JKMxxxN-6RL3-V-J ， JKMxxxN-6RL3-J， JKMxxxN-7RL3-V-J ， JKMxxxN-7RL3-J

(i) 1% in the first year; (ii) 0.4% each year thereafter until that date which is thirty (30) years following the Warranty Start Date, at which time the Actual Power Output shall be not less than 87.4% of the Nominal Power Output.

(3) N-TYPE ALL BLACK SERIES, only applicable to the following mono-crystalline Module types:

JKMxxxN-6RL3-B, JKMxxxN-6RL3-B-V, JKMxxxN-7RL3-B, JKMxxxN-7RL3-B-V, JKMxxxN-60H-MBB-B, JKMxxxN-60H-MBB-B-V, JKMxxxN-72H-MBB-B, JKMxxxN-72H-MBB-B-V, JKMxxxN-60HB, JKMxxxN-60HB-V, JKMxxxN-72HB, JKMxxxN-72HB-V, JKMxxxN-6TL4-B,JKMxxxN-6TL4-B-V, JKMxxxN-7TL4-B,JKMxxxN-7TL4-B-V, JKMxxxN-60HL4-B,JKMxxxN-60HL4-B-V, JKMxxxN-72HL4-B,JKMxxxN-72HL4-B-V, JKMxxxN-6RL4-B,JKMxxxN-6RL4-B-V, JKMxxxN-7RL4-B,JKMxxxN-7RL4-B-V, JKMxxxN-66HL4-B,JKMxxxN-66HL4-B-V, JKMxxxN-78HL4-B,JKMxxxN-78HL4-B-V JKMxxxN-66H-MBB-B-V, JKMxxxN-66H-MBB-B ， JKMxxxN-6TL3-B, JKMxxxN-6TL3-B-V

(i) 1% in the first year; (ii) 0.4% each year thereafter until that date which is thirty (30) years following the Warranty Start Date, at which time the Actual Power Output shall be not less than 87.4% of the Nominal Power Output.

(4) DUAL GLASS SERIES, only applicable to the following mono-crystalline Module types:

(a) JKMxxxM-72-DV, JKMSxxxM-72-DV, JKMxxxM-72-DV-J, JKMSxxxM-72-DV-J, JKMxxxM-72H-DV, JKMxxxM-60-DV, JKMSxxxM-60-DV, JKMxxxM-60-DV-J, JKMSxxxM-60-DV-J, JKMxxxM-60H-DV, JKMxxxM-66-DV, JKMxxxM-66H-DV, JKMxxxM-78-DV, JKMxxxM-78H-DV.

(i) 2.5% in the first year; (ii) 0.5% each year thereafter until that date which is thirty (30) years following the Warranty Start Date, at which time the Actual Power Output shall be not less than 83% of the Nominal Power Output.

(b) JKMxxxM-6RL3-DV, JKMxxxM-7RL3-DV, JKMxxxM-72HL4-DV, JKMxxxM-60HL4-DV, JKMxxxM-78HL4-DV, JKMxxxM-66HL4-DV, JKMxxxM-7TL4-DV, JKMxxxM-6TL4-DV, JKMxxxM-7RL4-DV, JKMxxxM-6RL4-DV

(i) 2.0% in the first year; (ii) 0.45% each year thereafter until that date which is thirty (30) years following the Warranty Start Date, at which time the Actual Power Output shall be not less than 84.95% of the Nominal Power Output.

3.B. LIMITED POWER WARRANTY FOR BIFACIAL MODULES.

Jinko warrants that the Degradation Rate shall not exceed the amount for the applicable period following the Warranty Start Date as set forth below ("**Bifacial Module Limited Power Warranty**" :

BIFACIAL MODULES: for **mono-crystalline Modules**:

A. P-Type Bifacial Modules:

(1) DUAL GLASS BIFACIAL SERIES, only applicable to the following mono-crystalline Bifacial Module types:

(a) JKMxxxM-60-BDVP, JKMxxxM-60H-BDVP, JKMxxxM-72-BDVP, JKMxxxM-72H-BDVP JKMxxxM-60HL-BDVP, JKMxxxM-72HL-BDVP, JKMxxxM-66H-BDVP, JKMxxxM-78H-BDVP，, JKMxxxM-72H-MBB-BDVP, JKMxxxM-78H-MBB-BDVP

(i) 2.5% in the first year; (ii) 0.5% each year thereafter until that date which is thirty (30) years following the Warranty Start Date, at which time the Actual Power Output shall be not less than 83% of the Nominal Power Output.

(b) JKMxxxM-7RL3-BDVP, JKMxxxM-7RL3-BDVP-J, JKMxxxM-6TL4-BDVP,JKMxxxM-7TL4-BDVP,JKMxxxM-60HL4-BDVP,JKMxxxM-72HL4-BDVP,JKMxxxM-6RL4-BDVP,JKMxxxM-7RL4-BDVP,JKMxxxM-66HL4-BDVP,JKMxxxM-78HL4-BDVP, JKMxxxM-78HL3-BDVP, JKMxxxM-78HL3-MBB-BDVP, JKMxxxM-66HL3-BDVP, JKMxxxM-66HL3-MBB-BDVP, JKMxxxM-7TL4-BDVP-J,JKMxxxM-7RL4-BDVP-J, JKMxxxM-72HL4-BDVP-J JKMxxxM-72HLM-BDVP
(i) 2.0% in the first year; (ii) 0.45% each year thereafter until that date which is thirty (30) years following the Warranty Start Date, at which time the Actual Power Output shall be not less than 84.95% of the Nominal Power Output.

(2) TRANSPARENT BACKSHEET BIFACIAL SERIES, only applicable to the following mono-crystalline Bifacial Module types:

(a) JKMxxxM-60H-TV, JKMxxxM-72H-TV, JKMxxxM-60HL-TV, JKMxxxM-72HL-TV, JKMxxxM-66H-TV, JKMxxxM-78H-TV，JKMxxxM-72H-MBB-TV , JKMxxxM-78H-MBB-TV

(i) 2.5% in the first year; (ii) 0.55% each year thereafter until that date which is thirty (30) years following the Warranty Start Date, at which time the Actual Power Output shall be not less than 81.55% of the Nominal Power Output.

(b) JKMxxxM-7RL3-TV, JKSM3-DCCA-xxx, JKMxxxM-7RL3-TV-J, JKMxxxM-6TL4-TV,JKMxxxM-7TL4-TV,JKMxxxM-60HL4-TV,JKMxxxM-72HL4-TV,JKMxxxM-6RL4-TV,JKMxxxM-7RL4-TV,JKMxxxM-66HL4-TV,JKMxxxM-78HL4-TV, JKMxxxM-78HL3-TV, JKMxxxM-78HL3-MBB-TV, JKMxxxM-66HL3-TV, JKMxxxM-66HL3-MBB-TV, JKMxxxM-6RL3 -TV, JKMxxxM-7TL4-TV-J, JKMxxxM-7RL4-TV-J, JKMxxxM-72HL4-TV-J， JKMxxxM-6RL3-TV-J, JKMxxxM-72HLM-TV

(i) 2.0% in the first year; (ii) 0.45% each year thereafter until that date which is thirty (30) years following the Warranty Start Date, at which time the Actual Power Output shall be not less than 84.95% of the Nominal Power Output.

B. N-Type Bifacial Modules, only applicable to the following mono-crystalline Bifacial Module types:

JKMxxxN-7RL3-TV, JKMxxxN-7RL3-BDV, JKMxxxN-72H-MBB-TV, JKMxxxN-72H-MBB-BDV, JKMxxxN-6RL3-TV, JKMxxxN-6RL3-BDV, JKMxxxN-60H-MBB-BDV, JKMxxxN-60H-MBB-TV, JKMxxxN-6TL4-TV,JKMxxxN-7TL4-TV,JKMxxxN-60HL4-TV,JKMxxxN-72HL4-TV,JKMxxxN-6RL4-TV,JKMxxxN-7RL4-TV,JKMxxxN-66HL4-TV,JKMxxxN-78HL4-TV
JKMxxxN-6TL4-BDV, JKMxxxN-7TL4-BDV, JKMxxxN-60HL4-BDV, JKMxxxN-72HL4-BDV,JKMxxxN-6RL4-BDV,JKMxxxN-7RL4-BDV,JKMxxxN-66HL4-BDV,JKMxxxN-78HL4-BDV, JKMxxxN-78HL3-BDV, JKMxxxN-78HL3-MBB-BDV, JKMxxxN-66HL3-BDV, JKMxxxN-66HL3-MBB-BDV,
JKMxxxN-78HL3-TV, JKMxxxN-78HL3-MBB-TV, JKMxxxN-66HL3-TV, JKMxxxN-66HL3-MBB-TV, JKMxxxN-7RL3-TV-J，JKMxxxN-6RL3-TV-J，JKSN3-DCCA-***

(i) 1% in the first year; (ii) 0.4% each year thereafter until that date which is thirty (30) years following the Warranty Start Date, at which time the Actual Power Output shall be not less than 87.4% of the Nominal Power Output.

Notwithstanding anything to the contrary herein, the Degradation Rate for a Bifacial Module shall apply only to the front-side power output of such Bifacial Module under STC as defined below.

4. POWER DEFINITIONS. "**Nominal Power Output (PO_0)**" means the original manufactured nameplate specification of the Module, expressed in Watts, as certified by Jinko and indicated on the Module, excluding any specified positive tolerance. "**Actual Power Output (PO_t)**" means the power output of the Module, expressed in Watts, at Watt peak that a Module generates or, for a Bifacial Module, that the front-side of a Bifacial Module generates, at a given point in time in a year after the Warranty Start Date **(t)** in its 'Maximum Power Point' under Standard Test Conditions, corrected for any measurement error ("**STC**"). STC are as follows, measured in accordance with IEC 61215: (a) light spectrum of AM 1.5; (b) an irradiation of 1000W per m^2; and (c) a cell temperature of 25 degrees centigrade at right angle irradiation. The "**Degradation Rate (DR)**" shall be any positive amount calculated in accordance with the following formula, expressed as a percent:

$$DR = 1.00 - [(PO_t) / (PO_0)]$$

5. CLAIMS. Customer shall bear the burden of establishing a breach of the Warranties hereunder. If Customer believes there has been a breach of the Limited Product Warranty or Limited Power Warranty (collectively, "**Warranties**"), then Customer shall promptly, and not later than thirty (30) days after knowledge thereof, provide notice to Jinko setting forth the following information related to the claim: (a) party making claim; (b) detailed description; (c) evidence, including photographs and data; (d) relevant serial numbers; (e) Warranty Start Date; (f) Module type; (g) physical address; (h) any additional evidence reasonably requested by Jinko; and (i) upon request from Jinko, the actual Module(s) allegedly causing the breach. Notwithstanding anything to the contrary herein, Jinko shall be entitled, in Jinko's sole discretion upon written notice to Customer, to require that any breach of the Warranties alleged by Customer be reviewed by TÜV Rheinland, TÜV SUD or other neutral third party testing laboratory selected by Jinko and approved by Customer, such approval not to be unreasonably withheld or delayed ("**Independent Testing Lab**"). The power measurement tolerance of any testing equipment utilized by any Independent Testing

Lab in performing tests required by this Section 5 shall be disclosed in writing to both Parties prior to performance of any such tests and shall be reflected in any final test results provided by the Independent Testing Lab. The determination by an Independent Testing Lab as to whether a breach has occurred shall be final and conclusive with respect to the matters covered by such determination. Jinko shall be responsible for all costs incurred by it in connection with the shipment by Customer of a Module pursuant to Section 5(i) hereto and any Independent Testing Lab's services provided pursuant to this Section 5, including shipping, testing services, storage, insurance and any Module destruction incidental thereto; provided, however, Customer shall promptly upon receipt of notice indemnify Jinko for all such costs on a dollar-for-dollar basis in the event the Independent Testing Lab is unable to confirm a breach of the Warranties or, if no Independent Testing Lab was utilized, Customer is otherwise unable to establish a breach of the Warranties.

6. REMEDIES. In Jinko's sole discretion, Jinko shall repair, replace or provide additional modules compensating for the related power loss for any Module which causes a breach of the Warranties. Additional, repaired or replacement Modules shall be delivered to the same destination and on the same INCOTERMS 2010 delivery basis that the original Module causing breach of the Warranties was delivered under the purchase agreement to which this Limited Warranty applies. Replaced Modules received by Jinko pursuant to Section 5 shall be the sole property of Jinko. Jinko shall be solely responsible for all shipping costs incurred performing its additional supply, repair or replacement obligations under this Section 6. Additional or replacement Modules shall be of the same type and physical form as the original Module, electrically compatible with the original Module, and have an electrical output of not less than the warranted power output of the original Module at the time of supply or replacement, based on the warranted degradation rates set forth at Section 3 hereto. Notwithstanding the foregoing, if Jinko no longer supplies Modules meeting the foregoing criteria, then additional or replacement modules provided under this Section 6 shall be those modules then supplied by Jinko most substantially meeting the foregoing criteria. Jinko's performance of any repair, replacement or additional supply pursuant to this Section 6 shall not extend the term of any Warranties.

7. EXCLUSIONS. This Limited Warranty is subject to the exclusions set forth in this Section 7. The Warranties shall not apply to any Module which has been: (a) altered, repaired or modified without the prior written consent of Jinko or otherwise inconsistent with Jinko's written instructions; (b) removed and re-installed at any location other than the physical location in which it was originally installed following purchase by Customer or receipt from Jinko as a replacement Module; (c) subject to misuse, abuse, neglect, or accident except as may be caused by Jinko in the course of storage, transportation, handling, installation, application, use or service; (d) subject to force majeure, electrical surges, lightning, flood, fire, vandalism, tampering, accidental breakage, or other events beyond Jinko's control, resulting in material damage to the Module; (e) installed on mobile platforms (other than single or dual-axis trackers) or in a marine environment; (f) subject to direct contact with corrosive agents or salt water, pest damage, or malfunctioning PV system components; or (g) used in a manner inconsistent with the version of Jinko Installation Manual available at www.jinkosolar.com on the date the Module is manufactured. The Warranties shall not apply to any Module for which the labels thereon indicating type or serial number have been

altered, removed or made illegible. The Warranties shall not apply to any Module for which full and final payment has not been received by Jinko.

8. NOTICE. Any notice required or permitted under this Limited Warranty shall be in writing and deemed to be properly given by the sender and received by the addressee. Mailed notices and facsimile notices shall be addressed to the Jinko office located closest to the place of original installation, as identified at www.jinkosolar.com/contact.html. Notices by e-mail should be sent to cs@jinkosolar.com. Customer shall promptly provide contact information upon request. For the avoidance of doubt, e-mail alone shall not constitute valid notice pursuant to this Section 8.

9. LIMITS OF LIABILITY. **NOTWITHSTANDING ANYTHING TO THE CONTRARY IN THIS LIMITED WARRANTY, EXCEPT AS EXPRESSLY PROVIDED HEREIN, JINKO MAKES NO WARRANTIES, GUARANTEES OR CONDITIONS, EXPRESS OR IMPLIED, ARISING FROM OR RELATING TO THE MODULES AND JINKO DISCLAIMS ANY WARRANTY OR GUARANTEE IMPLIED BY LAW, INCLUDING IMPLIED WARRANTIES OF PERFORMANCE, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND IMPLIED WARRANTIES OF CUSTOM OR USAGE, ARISING FROM OR RELATING TO THE MODULES. THE REMEDIES FOR BREACH OF THIS WARRANTY ARE CUSTOMER'S SOLE AND EXCLUSIVE REMEDIES ARISING FROM OR RELATING TO ANY BREACH OF THE WARRANTIES. IN NO EVENT SHALL JINKO BE RESPONSIBLE PURSUANT TO THIS WARRANTY FOR ANY PERFORMANCE ANALYSIS, INSPECTION, DIAGNOSIS, REMOVAL, CUSTOMS, IMPORT DUTIES, EXPORT DUTIES, TAXES, REINSTALLATION COSTS, SPECIAL, INDIRECT, INCIDENTAL, PUNITIVE, EXEMPLARY OR CONSEQUENTIAL DAMAGES OF ANY NATURE WHATSOEVER, INCLUDING LOSSES OR DAMAGES CAUSED BY REASON OF LOSS OF USE, LOSS OF PROFITS OR REVENUE, INTEREST CHARGES (EXCEPT AS EXPRESSLY PROVIDED HEREIN), LOSS OF BONDING CAPACITY, COST OF CAPITAL OR CLAIMS OF CUSTOMER DAMAGES, WHETHER LIABILITY ARISES AS A RESULT OF BREACH OF CONTRACT, TORT LIABILITY (INCLUDING NEGLIGENCE), STRICT LIABILITY, BY OPERATION OF LAW OR IN ANY OTHER MANNER. EXCEPT AS SET OUT IN THIS LIMITED WARRANTY, JINKO SHALL HAVE NO RESPONSIBILITY OR LIABILITY WHATSOEVER FOR DAMAGE OR INJURY TO PERSONS OR PROPERTY, OR FOR OTHER LOSS OR INJURY RESULTING FROM ANY CAUSE WHATSOEVER ARISING OUT OF OR RELATED TO THIS LIMITED WARRANTY.**

10. ASSIGNMENT. Notwithstanding anything to the contrary herein, this Limited Warranty is for the sole and exclusive benefit of Customer and there are no third party beneficiaries hereof; provided, however, subject to written notice to Jinko and Jinko's receipt of full and final payment for the Modules, this entire Limited Warranty may be assigned in whole but not in part to any person or entity. Any permitted assignee of this Limited Warranty shall execute such agreements as may reasonably be requested by Jinko to confirm the applicability of any term hereof as a condition to assignment.

11. LAW AND FORUM. Any dispute related to or arising out of this Limited Warranty, including without limitation any question regarding its existence, validity, breach, or termination, shall be referred to and finally resolved pursuant to the governing law clauses and dispute resolution procedures under the purchase agreement between the original purchaser and Jinko. As a condition to any obligation of Jinko hereunder, Jinko may require any Customer seeking to enforce this Limited Warranty to execute such

additional agreements as may reasonably be required to enforce the terms of this Section 11.

12. MERGER CLAUSE. This Limited Warranty sets forth the entire agreement and understanding of the Parties relating to the subject matter herein and supersedes all prior or contemporaneous discussions, understandings and agreements, whether oral or written, between them relating to the subject matter hereof.

13. SEVERABILITY. If one or more provisions of this Limited Warranty are held to be unenforceable under applicable law, the Parties agree to renegotiate such provision in good faith. In the event that the parties cannot reach a mutually agreeable and enforceable replacement for such provision, then (a) such provision shall be excluded from this Limited Warranty, (b) the balance of this Limited Warranty shall be interpreted as if such provision were so excluded and (c) the balance of this Limited Warranty shall be enforceable in accordance with its terms.

14. MISCELLANEOUS. The terms of this Limited Warranty are conditioned upon their incorporation in a contractual agreement between Jinko and Customer, and when incorporated to such contractual agreement, this Limited Warranty shall be subject to the terms thereof and subject to modification when incorporated therein. Jinko reserves the right to modify or update this Limited Warranty at any time, with or without notice.

[END OF LIMITED WARRANTY]

LIMITED WARRANTY FOR CRYSTALLINE PHOTOVOLTAIC MODULES FROM Q CELLS

Valid from January 1st, 2020

This limited warranty ("Limited Warranty") is issued by Hanwha Q CELLS Malaysia Sdn. Bhd., Lot 1, Jalan CV 2, Selangor Cyber Valley, 63300 Cyberjaya, Selangor Darul Ehsan, Malaysia, or its successors or assigns ("HQC"), and applies exclusively to Q CELLS Modules (as defined in Section 1.a.).

1. SCOPE

a. Products

Q CELLS Modules are defined in this Limited Warranty as Q CELLS branded photovoltaic modules manufactured by HQC or its authorized manufacturers that are sold and installed within the United States, Canada, Mexico, Panama and Costa Rica and are of the following product type:

- Q.PEAK DUO-G5, Q.PEAK DUO-G5.2, Q.PEAK DUO BLK-G5
- Q.PEAK DUO L-G5, Q.PEAK DUO L-G5.1, Q.PEAK DUO L-G5.2, Q.PEAK DUO L-G5.3, Q.PEAK DUO RSF L-G5, Q.PEAK DUO RSF L-G5.3

- Q.PEAK DUO-G6, Q.PEAK DUO-G6.2, Q.PEAK DUO BLK-G6
- Q.PEAK DUO L-G6, Q.PEAK DUO L-G6.1, Q.PEAK DUO L-G6.2, Q.PEAK DUO L-G6.3

- Q.PEAK DUO-G7, Q.PEAK DUO-G7.2, Q.PEAK DUO BLK-G7
- Q.PEAK DUO L-G7, Q.PEAK DUO L-G7.1, Q.PEAK DUO L-G7.2, Q.PEAK DUO L-G7.3, Q.PEAK DUO RSF L-G7, Q.PEAK DUO RSF L-G7.3

- Q.PEAK DUO-G8, Q.PEAK DUO-G8.2, Q.PEAK DUO BLK-G8
- Q.PEAK DUO L-G8, Q.PEAK DUO L-G8.1, Q.PEAK DUO L-G8.2, Q.PEAK DUO L-G8.3

b. Beneficiary

The sole and exclusive beneficiary of this Limited Warranty is an end customer who purchases Q CELLS Modules from HQC or from any one of its authorized distributors ("Distributor") and is the initial installer of such modules into a specific photovoltaic (PV) solar energy project ("Project"), and any of the end customer's permitted successors or assigns ("Customer").

c. Validity

This Limited Warranty takes effect on January 1st, 2020 and shall remain valid until a new version of warranty applying to Q CELLS Modules is released by HQC.

d. Term

The term of this Limited Warranty ("Term") for the Customer begins on the date of initial delivery to the Customer ("Warranty Start Date") and ends at the end of the warranty periods set forth in Section 2. The performance of warranty services under this Limited Warranty does not extend the Term. HQC's obligations under this Limited Warranty are conditioned upon the Customer's compliance with its payment obligations for purchase of the applicable Q CELLS Module.

2. WARRANTY

a. Product Warranty

Subject to the terms and conditions in this Limited Warranty, HQC warrants to the Customer for a period of twelve (12) years following the Warranty Start Date that the Q CELLS Modules, when installed, used, and serviced under normal operating conditions and in accordance with Q CELLS Module Installation Manual provided by HQC or Distributor will be free from any defects in materials and workmanship that have a significantly negative effect on the power output of the Q CELLS Modules (collectively, „Product Defect"). The Product Warranty does not warrant a specific power output of the Q CELLS Modules, which shall be exclusively covered under the Performance Warranty in Section 2.b.. Product Defect does not include any cosmetic changes or other changes in the Q CELLS Modules' appearance, including but not limited to, any color changes, mold and normal wear and tear.

b. Performance Warranty

Subject to the terms and conditions of this Limited Warranty, HQC warrants to the Customer that the Q CELLS Modules are manufactured to (i) produce a power output of at least ninety-eight percent (98 %) of the minimum power output specified in the applicable module data sheet during the first twelve (12) months following the Warranty Start Date, and (ii) have a yearly maximum

decrease (or degradation) of power of not more than fifty four hundredths of one percent (0.54 %) from start of the second (2nd) twelve (12)-month period following the Warranty Start Date until the end of such twelve (12)-month period, and repeated for each successive twelve (12)-month period until the twenty-fifth (25th) anniversary of the Warranty Start Date, (collectively, "Performance Warranty"). As an example, the Q CELLS Module will be manufactured to have a minimum power output of eighty-five percent (85 %) of the minimum power output specified in the applicable module data sheet at the end of the term of this Limited Warranty. Failure to meet the Performance Warranty is defined herein as a "Performance Defect." In the event of a Performance Defect claim, the power output of any Q CELLS Modules described in this Section 2.b. shall be measured by HQC under the Standard Test Conditions ("STCs") defined in the IEC standards EN 61215 and 60904-3 in effect as of the Warranty Start Date.

3. EXCLUSIONS

The Limited Warranty shall not apply to any Q CELLS Modules affected by the following events or conditions:

1. usage, transport, storage, installation and/or handling in any manner that fails to strictly comply with the Installation Manual and the Packaging and Transportation Information sheet applicable to the Q CELLS Modules;

2. system or components of such system that are of a design, configuration or installation that does not meet the standards typically used by experienced professionals in the industry;

3. incorrect, improper or inadequate service, operation or maintenance of the Q CELLS Modules or of the Project, or any normal wear and tear of the Q CELLS Modules;

4. damage caused by extreme environmental sources of impact, including, but not limited to (i) acid rain or snow, (ii) blowing sand, (iii) saline air, (iv) pollution of any kind in the air, soil or groundwater, (v) unusual oxidation levels, (vi) mold, or (vii) any nearby fire, explosion, smoke or charring;

5. damage caused by acts of nature or acts of God, including, but not limited to, lightning, hail, frost, snow, storms, tidal waves, floods, extreme temperatures, earthquakes, typhoons, tornadoes, volcanic eruptions, meteorites, ground motions, earth fissures or landslides;

6. damage caused directly or indirectly by acts of violence or intervention by third parties or external forces, including but not limited to, misadventure, riots, war, insurrection, communal violence, unintentional damage by third parties, vandalism, damage caused by animals, and/or acts or omissions by third parties beyond the reasonable control of HQC;

7. damage to the Project in which the Q CELLS Modules are installed caused by external factors, including, but not limited to, voltage fluctuations, power peaks, excess current, power failure, poor electrical or mechanical engineering work, or other faults occurring in a power supply system with or without mains connection, whether or not such faults in the power supply system was contributed to by any act or omission of the Customer;

8. Q CELLS Modules are modified or used in processes involving other products, without obtaining the prior written consent of HQC;

9. the serial number or product label has been removed, changed, deleted or made unrecognizable;

10. the Q CELLS Modules are used on any mobile carriers (such as motor vehicles or ships)

11. the conditions of use at the Project, at any time, exceed the specifications set out in the applicable module data sheet; and/or

12. the Customer fails to notify the Distributor or HQC of a Product Defect or Performance Defect within 30 days of the initial discovery or prior to the end of the applicable warranty period set forth in Section 2..

4. WARRANTY CLAIMS

a. Customer Inspection

The Customer must inspect the Q CELLS Modules for visible defects when delivered. The Customer must notify HQC of any defects immediately, but in no event later than thirty (30) days any such defects were discovered during such visible defect inspection process.

b. Warranty Claims

The Customer will be entitled to make claims under this Limited Warranty ("Warranty Claims") only if the Customer has provided documented evidence sufficient to prove that the malfunctioning or non-conformity of the Q CELLS Modules resulted exclusively from a Product Defect or Performance Defect covered by this Limited Warranty. If the Warranty Claim is based on glass breakage, then the Customer shall conduct a static load calculation on the substructure.

c. Warranty Claim Compliance
The Customer must comply with the HQC's then-current Return Merchandise Authorization ("RMA") process to make any Warranty Claim. HQC will not accept any Warranty Claims not in compliance with the RMA or Warranty Claims that use the delivery of any unauthorized return shipments of Q CELLS Modules.

d. Warranty Claim Procedure
The Customer is responsible for shipping the Q CELLS Modules to HQC for evaluation at the Customer's expense. HQC shall pay the costs of a technical inspection and, in the event that the warranty claim is confirmed by such inspection, transportation. Otherwise, the Customer shall be charged with these costs. To make a Warranty Claim, the Customer must submit the original receipt or invoice, which bears the date of the purchase and of the delivery, the serial numbers of the relevant Q CELLS Modules and the name of the authorized distributor or seller.

e. Ownership Interest
The Q CELLS Modules sent to HQC in the course of the RMA process shall remain the property of the Customer until any inspection has been completed and HQC provides a replacement or refund. At the time any refund or delivery of a replacement Q CELLS Module to the Customer takes place under this Limited Warranty, the ownership interest of the defective module passes to HQC. Any repaired, replaced or additionally supplied modules will be warranted only for the remainder of the original warranty period applicable to the original Q CELLS Modules.

5. REMEDIES

a. Product Defect Remedy
If HQC determines, following a Warranty Claim, that a Q CELLS Module has a Product Defect, then HQC shall, at its discretion, within a reasonable time: (i) remedy or repair the Product Defect; (ii) provide a replacement module in place of the Q CELLS Module with the Product Defect; or (iii) provide the Customer monetary compensation equal to the purchase price of the Q CELLS Module subject to an annual four percent (4 %) depreciation rate on the original purchase price as evidenced by the invoice produced by the Customer; provided, however, if the Customer fails to produce an original invoice, then the price shall be based upon the then-current per watt market price of a comparable PV module in a similar market and the date shall be based upon the date of manufacture according to the HQC records.

b. Performance Warranty Remedy
If HQC determines following a Warranty Claim that a Q CELLS Module has a Performance Defect, then HQC shall, at its discretion, within a reasonable time: (i) remedy or repair the Performance Defect; (ii) provide a replacement module in place of the Q CELLS Module that has the Performance Defect; (iii) make up the difference to the guaranteed power output by providing additional modules; or (iv) provide to the Customer monetary compensation equal to the portion of the purchase price of the Q CELLS Module that is in the same proportion to the purchase price as the actual measured power is to the guaranteed power subject to an annual four percent (4 %) depreciation rate on the original purchase price as evidenced by the invoice produced by the Customer ; provided, however, if the Customer fails to produce an original invoice, then the price shall be based upon the then current per watt market price of a comparable PV module in a similar market and the date shall be based upon the date of manufacture according to the HQC records.

c. Sole and Exclusive Remedy and Obligation
THE REMEDIES SET FORTH IN THIS SECTION 5. ARE HQC'S SOLE AND EXCLUSIVE LIABILITY AND OBLIGATION, AND THE CUSTOMER'S SOLE AND EXCLUSIVE REMEDIES, FOR ANY PRODUCT DEFECT OR PERFORMANCE DEFECT IN ANY Q CELLS MODULE. THE REMEDY EXTENDED TO THE CUSTOMER SPECIFICALLY EXCLUDES ANY REIMBURSEMENT FOR THE COSTS OR EXPENSES INCURRED IN THE DISMANTLING OR INSTALLATION OF THE Q CELLS MODULES, REPLACEMENT MODULES OR PARTS, OR LOSS OF POWER.

6. WARRANTY LIMITATIONS

THE WARRANTIES SET FORTH IN THIS LIMITED WARRANTY ARE IN LIEU OF ALL OTHER WARRANTIES, WHETHER EXPRESS, IMPLIED, OR STATUTORY, REGARDING ANY Q CELLS MODULES, INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT.

HOWEVER, IF A Q CELLS MODULE IS SOLD AS A CONSUMER PRODUCT, TO THE EXTENT REQUIRED BY APPLICABLE LAW, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT ARE LIMITED TO THE PERIODS OF THE LIMITED PRODUCT AND LIMITED PERFORMANCE WARRANTIES SET FORTH ABOVE, OR SUCH SHORTER PERIOD AS REQUIRED BY APPLICABLE LAW. THIS LIMITED WARRANTY GIVES THE CUSTOMER SPECIFIC LEGAL RIGHTS, AND THE CUSTOMER MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE. HQC IS NOT RESPONSIBLE OR LIABLE IN ANY WAY FOR DAMAGE OR INJURY TO PERSONS OR PROPERTY, OR FOR OTHER LOSS OR INJURY RESULTING FROM ANY CAUSE WHATSOEVER, ARISING OUT OF OR RELATED TO ANY Q CELLS MODULES UNLESS OTHERWISE STIPULATED BY MANDATORY STATUTORY LAW. IN PARTICULAR, HQC'S LIABILITY FOR FRAUDULENT OR WILLFUL INTENT, GROSS NEGLIGENCE OR PERSONAL INJURY, IN EACH CASE, UNDER APPLICABLE MANDATORY LIABILITY LAW SHALL REMAIN UNAFFECTED.

EXCEPT AS PROVIDED IN THIS SECTION 6., THE Q CELLS MODULES, THE PRODUCT DOCUMENTATION AND ALL INFORMATION ARE PROVIDED ON AN "AS IS" BASIS.

THE CUSTOMER ACKNOWLEDGES THAT THE FOREGOING LIMITATIONS ON LIABILITY ARE AN ESSENTIAL ELEMENT OF THE RELEVANT SALES AGREEMENT BETWEEN THE PARTIES AND THAT IN THE ABSENCE OF SUCH LIMITATIONS THE PURCHASE PRICE OF THE Q CELLS MODULES WOULD BE SUBSTANTIALLY HIGHER.

SOME JURISDICTIONS LIMIT OR DO NOT PERMIT DISCLAIMERS OF LIABILITY, SO THIS PROVISION MAY NOT APPLY TO THE CUSTOMER IN SAID JURISDICTION. SOME JURISDICTIONS DO NOT ALLOW LIMITATIONS OR THE EXCLUSION OF DAMAGES SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO THE CUSTOMER IN SAID JURISDICTION. THE CUSTOMER MAY HAVE SPECIFIC LEGAL RIGHTS OUTSIDE THIS LIMITED WARRANTY FOR Q CELLS MODULES, AND MAY ALSO HAVE OTHER MANDATORY RIGHTS THAT VARY FROM JURISDICTION TO JURISDICTION, WHICH SHALL REMAIN UNAFFECTED.

IN NO EVENT WILL HQC BE LIABLE FOR ANY CONSEQUENTIAL, INDIRECT, EXEMPLARY, SPECIAL OR INCIDENTAL DAMAGES, INCLUDING LOSS OF USE, LOST REVENUE AND/OR LOST POWER, ARISING FROM OR RELATING TO THIS WARRANTY OR ANY Q CELLS MODULE OR ANY REPLACEMENT OR ADDITIONAL MODULE SUPPLIED BY HQC HEREUNDER, EVEN IF HQC IS AWARE OF THE POSSIBILITY OF SUCH DAMAGES.

THE TOTAL LIABILITY OF HQC, ANY DISTRIBUTOR, AND/OR THEIR RESPECTIVE OFFICERS, DIRECTORS, EMPLOYEES AND AGENTS ARISING FROM OR RELATING TO THIS LIMITED WARRANTY, WHETHER IN CONTRACT, TORT OR OTHERWISE, WILL NOT EXCEED THE AMOUNT RECEIVED BY HQC FOR THE Q CELLS MODULE THAT IS THE SUBJECT OF THE CLAIM OR DISPUTE. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO THE CUSTOMER IN SAID JURISDICTION.

7. ASSIGNMENT

Customer Assignment

Customer Assignment. Customer may assign this Limited Warranty for any Q CELLS Module to a new owner of the entire photovoltaic system in which such module is originally installed, provided that such system remains intact in its original place of installation. This Limited Warranty may not otherwise be assigned or transferred, and any attempt to assign or transfer in violation of this Section 7. shall be null and void.

8. MISCELLANEOUS

a. Survival

If any provision of this Limited Warranty terms and conditions is held to be invalid, illegal or unenforceable in any respect, such provision will be changed and interpreted to accomplish the objectives of such provision to the greatest extent possible under applicable law and the remaining provisions will continue in full force and effect.

b. Governing Law

All matters arising from or relating to this Limited Warranty shall be governed by the laws of the State of California, without regard to its choice of law rules. The UN Convention on the International Sale of Goods shall not apply.

c. Waiver of Jury Trial; Jurisdiction

Any dispute, controversy or claim arising out of or relating to this Limited Warranty or any of its provisions, or the breach, termination, interpretation, enforcement or validity thereof, including any dispute hereby is waived to the fullest extent permitted by applicable Law any right it may have to a trial by jury with respect to any litigation directly or indirectly arising out of, under or in connection with this Limited Warranty. Any dispute, controversy or claim arising out of or relating to this Limited Warranty or any of its provisions, or the breach, termination, interpretation, enforcement or validity thereof, including any dispute irrevocably is submitted to the jurisdiction of the courts of the State of California and the federal courts of the United States of America located in the State of California solely in respect of the interpretation and enforcement of the provisions of this Limited Warranty.

Hanwha Q CELLS America Inc.
400 Spectrum Center Drive, Suite 1400, Irvine, CA 92618, USA | **TEL** +1 949 748 59 96 | **EMAIL** claims@us.q-cells.com • inquiry@us.q-cells.com | **WEB** www.q-cells.us

LIMITED PRODUCT WARRANTY

This SolarEdge Technologies Ltd. Limited Warranty covers defects in workmanship and materials of the below-listed products for the applicable Warranty Period set out below (the "Products"):

Power optimizers: 25 years commencing on the earlier of: (i) 4 months from the date the power optimizers are shipped from SolarEdge; and (ii) the installation of the power optimizers, *provided, however*, that for the module embedded power optimizers (CSI and OPJ models), the Warranty Period shall not exceed the maximum of (1) the module product warranty and (2) the module power warranty periods provided by the applicable module manufacturer.

Inverters, Safety & Monitoring Interface (SMI), Auto-transformer, Backup Interface: 12* years commencing on the earlier of: (i) 4 months from the date the products are shipped from SolarEdge; and (ii) the installation of the products.

StorEdge Interface: 10 years commencing on the earlier of: (i) 4 months from the date the Interfaces are shipped from SolarEdge; and (ii) the installation of the Interfaces.

ZigBee Gateway, Commercial Gateway, Firefighter Gateway, Smart Energy products, Cellular Communication Products, RS485 Plug-in, Energy Meter, Smart EV Charger: 5 years commencing on the earlier of: (i) 4 months from the date the product is shipped from SolarEdge; and (ii) the installation of the product. Warranty duration of wireless communication products is the same whether or not the product is pre-installed in the inverter.

* In some countries the inverter warranty is limited to 7 years. For a list of these countries please access http://www.solaredge.com/articles/warranty_exceptions

The Limited Warranty does not apply to components which are separate from the Products, ancillary equipment and consumables, such as, for example, cables, cable holders, fuses, wires and connectors, whether supplied by SolarEdge or others. Some components may carry their own manufacturer warranty. See product datasheet for more details. In addition, for all power optimizers with a part number ending in C, the SolarEdge warranty does not apply to the input connector.

The Limited Warranty only applies to the buyer who has purchased the Products from an authorized seller of SolarEdge for use within the continent where SolarEdge originally sold the Products and in accordance with their intended purpose. The Limited Warranty may be transferred from buyer to any assignee, and will remain in effect for the time period remaining under the foregoing warranties, *provided* that the Products are not moved outside their original country of installation and any reinstallation is done in accordance with the installation directions and use guidelines accompany the Products (collectively the "*Documentation*").

If, during the applicable Warranty Period, buyer discovers any defect in workmanship and materials and seeks to activate the Limited Warranty, then buyer shall, promptly after such discovery, report the defect to SolarEdge by sending an email to support@solaredge.com with the following information: (i) a short description of the defect, (ii) the Product's serial number, and (iii) a scanned copy of the purchase receipt or warranty certificate of the applicable Product.

Upon buyer's notification, SolarEdge shall determine whether the reported defect is eligible for coverage under the Limited Warranty. The Product's serial number must be legible and properly attached to the Product in order to be eligible for Warranty coverage. If SolarEdge determines that the reported defect is not eligible for coverage under the Limited Warranty, SolarEdge will notify buyer accordingly and will

explain the reason why such coverage is not available. If SolarEdge determines that the reported defect is eligible for coverage under the Limited Warranty, SolarEdge will notify buyer accordingly, and SolarEdge may, in its sole discretion, take any of the following actions:

repair the Product at SolarEdge's facilities or on-site; or

issue a credit note for the defective Product in an amount up to its actual value at the time buyer notifies SolarEdge of the defect, as determined by SolarEdge, for use toward the purchase of a new Product; or

provide Buyer with replacement units for the Product.
SolarEdge will determine whether the Product should be returned to SolarEdge and, if SolarEdge so determined, the Return Merchandise Authorization ("*RMA*") Procedure (set out below) will be invoked. Where replacement Products are sent, SolarEdge generally sends such products within 48 hours. SolarEdge may use new, used or refurbished parts that are at least functionally equivalent to the original part when making warranty repairs. The repaired Product or replacement parts or Product, as applicable, shall continue to be covered under the Limited Warranty for the remainder of the then-current Warranty Period for the Product.

Where the RMA Procedure is invoked by SolarEdge, SolarEdge will instruct buyer how to package and ship the Product or part(s) to the designated location. SolarEdge will bear the cost of such shipment, upon receipt of the Product or part(s), SolarEdge will, at its expense and sole discretion, either repair or replace the Product or part(s).

SolarEdge will deliver the repaired or replaced Product or part(s) to buyer at buyer's designated location in countries where SolarEdge has an office and/or there is a significant PV market. For the specific list of countries to which such service is provided, please access http://www.solaredge.com/articles/shipping_cost_coverage_warranty. SolarEdge will bear the cost of such shipment, including shipping and customs (where applicable) and buyer shall bear any applicable value added tax. SolarEdge may elect to ship replacement Product and/or part(s) prior to receipt of the Product and/or part(s) to be returned to SolarEdge as per the above.

All costs, including, without limitation, labor, travel and boarding costs of SolarEdge service personnel or others that are incurred for labor relating to repairs, uninstalling and reinstalling of Products on-site, as well as costs related to buyer's employees and contractors repair or replacement activities, are not covered by the Limited Warranty and, unless otherwise agreed in writing in advance by SolarEdge, shall be borne by the buyer.

Cellular Communication Products

SolarEdge relies on third party network providers for its Cellular Communication services and is therefore not liable for problems caused by conditions beyond its control. Cellular Communication Products may be temporarily refused, interrupted, curtailed, or otherwise limited because of transmission limitations caused by any factor, including atmospheric, environmental, or topographical conditions; concentrated usage or capacity constraints; network limitations, changes, modifications, updates, maintenance, or other similar activities; a failure by third-party suppliers or service provider; or a public safety emergency. SolarEdge is not liable for any claims or damages related to or arising out of or in connection with (x) any coverage gap, or (y) any wireless network refusal, interruption, curtailment, or other limitation provided above.

SolarEdge reserves the right, without notice or limitation, to limit throughput speeds or quantities or to deny, terminate, end, modify, disconnect, or suspend wireless service if a Cellular Communication Product engages in any illegal or prohibited uses including without limitation those detailed below or if SolarEdge or its network provider, determine that action is necessary to protect the wireless network:

Cellular Communication Products may not be used to disrupt email use by others; to transmit or facilitate any unsolicited or unauthorized advertising, or bulk email; or for activities adversely affecting the ability of other people or systems to use either the Cellular Communication Products or other parties' Internet-based resources. Additionally, use of the Cellular Communication Products for libel, slander, infringement of copyright, or invasion of privacy is strictly prohibited.

Warranty Exclusions: This Limited Warranty will not apply if (a) buyer is in default under the General Terms and Conditions of other Agreement governing the purchase of the Product, or (b) the Product or any part thereof is:

- damaged as a result of misuse, abuse, accident, negligence or failure to maintain the Product;
- damaged as a result of modifications, alterations or attachments thereto which were not pre-authorized in writing by SolarEdge;
- damaged due to the failure to observe the applicable safety regulations governing the proper use of the Product;
- installed or operated not in strict conformance with the Documentation, including without limitation, not ensuring sufficient ventilation for the Product as described in SolarEdge installation guide;
- opened, modified or disassembled in any way without SolarEdge's prior written consent;
- used in combination with equipment, items or materials not permitted by the Documentation or in violation of local codes and standards;
- damaged by software, interfacing, parts, supplies or other product not supplied by SolarEdge;
- damaged as a result of improper site preparation or maintenance or improper installation;
- damaged or rendered non-functional as a result of power surges, lightning, fire, flood, pest damage, accident, action of third parties, direct exposure to sea water or other events beyond SolarEdge's reasonable control or not arising from normal operating conditions;
- damaged during or in connection with shipping or transport to or from buyer where buyer arranges such shipping or transport; or
- The Smart EV Charger Warranty does not include coverage for an EV charger cable that is damaged due to: physical abuse and damage, commercial use, rust, water damage, domestic wear and tear, use of car inlets which are incompatible with the Smart EV Charger connector.

This Limited Warranty does not cover cosmetic or superficial defects, dents, marks or scratches, which do not influence the proper functioning of the Product.

THE LIMITED WARRANTIES SET OUT HEREIN ARE IN LIEU OF ANY OTHER WARRANTIES WITH RESPECT TO THE PRODUCTS PURCHASED BY BUYER FROM SOLAREDGE, WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL (INCLUDING ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE), ALL OF WHICH ARE EXPRESSLY EXCLUDED TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW.

Claims by buyer that go beyond the warranty terms set out herein, including claims for compensation or damages, are not covered by the Limited Warranty, insofar as SolarEdge is not subject to statutory liability. In such cases, please contact the company that sold you the Product. Eventual claims in accordance with the law on product liability remain unaffected.

Coverage under the Limited Warranty is subject to buyer complying with the foregoing notification requirements and cooperating with SolarEdge's directions. SolarEdge's sole obligation and buyer's exclusive remedy for any defect warranted hereunder is limited to those actions expressly stated above. Such actions are final and do not grant any further rights, in particular with respect to any claims for compensation.

Unless otherwise specified in an executed Agreement with SolarEdge, the Limited Warranty and related provisions set out herein are subject to SolarEdge's General Terms and Conditions, including, without limitation, the provisions thereof, which relate to disclaimer of warranties, limitation of liability and governing law and jurisdiction.

Revised: May 2020

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IronRidge.com

Limited Warranties and Disclaimer

For products sold after April 1, 2020, IronRidge provides, to the original purchaser of the Products from IronRidge, and any subsequent owner of the Products, subject to assignability below ("Purchaser"), the following warranties for "Products" (defined as products manufactured by IronRidge or QuickMount PV, including BX Chassis but excluding other polymeric components) and installed properly and used for the purpose for which the Products are designed (collectively the "Warranty"), commencing on the earlier of (i) the date of complete installation of the Products or (ii) 30 days after the initial purchase of the Products from IronRidge:

a) for a period of five years, Products with finishes (excluding Products that are mill finished and excluding surface finish of BX Chassis) will be free of visible defects, peeling, or cracking; and
b) for a for a period of 25 years (except for the QBox Junction Box, for which the period is 5 years), Products will be free of defects in materials and manufacturing which materially impair the use of the Product for the purpose for which it was designed.

The Warranty excludes:

a) any defect that has not been reported to IronRidge in writing (i) within the warranty periods set forth above and (ii) within 60 days after discovery of such defect;
b) normal wear, or damage resulting from misuse, overloading, abuse, improper installation (including failure to follow professional instruction and certification), negligence, or accident, or from force majeure acts including any natural disasters, extreme weather, war, or criminal acts;
c) Products that have been altered, modified or repaired without written authorization from IronRidge or its authorized representative;
d) damage to or caused by, or defects in, parts or materials not sold by IronRidge (irrespective of IronRidge documentation);
e) Products installed, used or maintained in a manner contrary to IronRidge documentation; and damage to the Products during shipment, storage, installation or use.

The finish warranty above does not apply to surface oxidation or any foreign residue deposited on the Product finish, or to Products installed in corrosive atmospheric conditions, and is void if the practices specified by AAMA 609 & 610-02 –“Cleaning and Maintenance for Architecturally Finished Aluminum”, or ASTM A780/A780M -09 “Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings”, as applicable, are not followed.

The determination of the existence of a valid Warranty claim or the applicability of any exclusion set forth above will be made by IronRidge in its sole discretion. Any waiver of or failure to claim a warranty exclusion will

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not create a continuing waiver or any expectation of non-enforcement of any such exclusion. In the event of breach of or non-compliance with the warranties set forth above, IronRidge's sole obligation and liability, and Purchaser's sole and exclusive remedy, shall be correction by IronRidge or its authorized representative of defects by repair, replacement, or credit, at IronRidge's sole discretion, provided Purchaser submits written proof of purchase and the date thereof within the applicable warranty period. Such repair, replacement or credit will not cause the warranty periods above to be reset, will completely satisfy and discharge IronRidge's liability and obligation with respect to the Warranty, and will not create an expectation of Warranty coverage in the future. Refurbished Product may be used to repair or replace the defective components. Transportation, installation, labor, or any other costs or losses associated with failure of Warranty compliance, or Product replacement or repair, are not covered by this Warranty and are not reimbursable.

The Warranty is assignable by Purchaser and any subsequent owner of the Products, provided that the Products remain installed at the original installation location, and provided that any subsequent owner agrees in writing to be bound by the terms of this IronRidge Limited Product Warranty document. Change in ownership of the Products or assignment of this Warranty will not cause the warranty periods above to be reset. Any subsequent owners to whom the Warranty is assigned shall be considered a subsequent "Purchaser" for purposes of this Warranty during the period of ownership of the Product(s).

Except as set forth above, IronRidge sells the Products on an "AS IS" basis, which may not be free of errors or defects, and ALL EXPRESS OR IMPLIED REPRESENTATIONS AND WARRANTIES, INCLUDING ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, QUALITY, WORKMANLIKE EFFORT, CORRESPONDENCE TO DESCRIPTION, DESIGN, TITLE OR NON-INFRINGEMENT, OR ARISING FROM COURSE OF DEALING, COURSE OF PERFORMANCE OR TRADE PRACTICE, ARE HEREBY DISCLAIMED. IN NO EVENT WILL IRONRIDGE BE LIABLE FOR ANY INDIRECT, PUNITIVE, SPECIAL, INCIDENTAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES IN CONNECTION WITH, RELATED TO OR ARISING OUT OF THE WARRANTY OR THE PRODUCTS, OR OTHERWISE BE LIABLE FOR INTERRUPTION OF BUSINESS, COST OF COVER, LOSS OF PROFITS, LOSS OF REVENUE, LOSS OF USE, OR OTHER ECONOMIC ADVANTAGE, REGARDLESS OF THE THEORY OF LIABILITY, EVEN IF IRONRIDGE HAS BEEN PREVIOUSLY ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IronRidge will not be liable for claims by Purchaser for damages suffered by Purchaser's customers, or claims of third parties. IronRidge's maximum aggregate liability for all claims and obligations relating to or arising from the Warranty is limited to the original purchase price of the nonconforming Products. Liability for damages shall be so limited and excluded, regardless of the validity or efficacy of any remedy and even if any remedy fails of its essential purpose.

Third Party Claims; Indemnification. IronRidge shall have no liability for any injuries or damages to persons or property resulting from incorrect or improper installation, use, delivery or maintenance of the Products by or for Purchaser or Purchaser's agent, customer or vendor, or for any claims or demands brought against IronRidge or Purchaser by any employee of Purchaser, client of Purchaser, end-user of the Product or other party, even if IronRidge has been advised of the possibility of such claims or demands, resulting from incorrect

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or improper installation, use, delivery or maintenance of the Products (collectively, “Third Party Claims”). This limitation applies to all materials provided by IronRidge during and after the Warranty Period. Purchaser hereby agrees to indemnify and hold IronRidge harmless against any and all such Third-Party Claims, as well as any and all liabilities, losses, costs or expenses arising therefrom.

Force Majeure. IronRidge shall not be responsible for delays or failures in its performance resulting from acts or omissions beyond its reasonable control, whatever the source or cause.

AP-Alternatives, LLC
20-345 County Road X
P.O. Box 224
Ridgeville Corners, OH 43555
Phone: 419-267-5280
Fax: 419-267-5214

LIMITED WARRANTY
1-1-2020

AP-Alternatives, LLC (APA) warrants that its Solar Racking System (SRS), when sold and delivered pursuant to an APA Order, will be new, will conform to the specifications in the applicable APA Sales Order, and will be free from defects in material and/or workmanship for a period of twenty-five (25) years for ground-mount systems from the date of SRS shipment, except for the coating which may show corrosion but shall guard the racking from structural degradation for a period exceeding the warranty period; however, no copper wire shall touch the galvanized coating. The two materials are dissimilar metals and, if touching, may result in accelerated corrosion. Warranty claims that are found to be caused by copper touching the galvanized steel will be denied. Except for the foregoing limited warranties, APA makes no other warranties express or implied for the SRS.

Where APA is contracted to install the SRS, APA warrants its installation process will be free from defect in workmanship for a period of eighteen (18) months from the date of installation completion. Particular to ground-mount applications, no helical anchor or ballast shall be installed over filled trenches, due to the high probability of settling. APA may install may foundations or ballast over trenches at contractor's request, providing contractor assumes full responsibility for any settling that may occur, as this voids the APA installation warranty in such areas.

This warranty does not apply to damage incurred during shipment and does not apply to damage that is the result of improper handling unless shipping and installation of the system are contracted to APA. This warranty will be void if, during the warranty period, the SRS has been improperly or incorrectly installed, used, or maintained, or has been operated under abnormal conditions or contrary to applicable specifications.

This warranty is granted to the original SRS Purchaser, and may be passed on to a successor, assignee, or transferee upon written notification to, and approval by APA, whose approval will not be unreasonably withheld. This warranty is only applicable to the original installation of the SRS. This warranty does not apply to damage to the SRS that is the result of weather conditions that exceed local building code limits that were applicable at the time the SRS was ordered.

> IT IS RECOGNIZED AND AGREED THAT THE FOREGOING LIMITED WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED AND THAT APA DOES NOT MAKE ANY WARRANTY OF MERCHANTABILITY OR ANY WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

In the event the SRS fails to satisfy the foregoing limited warranties, APA will repair or replace, at its option and cost, the defective product. The foregoing remedy shall be in lieu of all others that the SRS Purchaser may have, and the Purchaser waives all other remedies.

To obtain warranty service, the Purchaser shall contact APA by telephone or e-mail, and APA will establish a Claim File and initiate action to repair or replace the defective product. APA will work with the Purchaser to determine the extent of the problem and may elect to perform site inspection. APA will arrange for removal and replacement of the defective product and bear all costs associated with transportation of new and defective products to and from the installation site.

APA will not assume expense or liability for correction of a defective SRS by the Purchaser or by third parties without prior written authorization from APA. In the event of the authorized correction of a defective SRS, the warranty period will be extended by the length of time during which the defective equipment was in the replacement cycle.

APA's total liability hereunder for the repair or replacement of a SRS, or any defective components thereof, shall not exceed the original purchase price of the system. In no event will APA be liable for or responsible to the Purchaser or to any other party for any consequential, incidental or special loss, cost, damage, or expense arising from the curtailment or interruption of plant operation or from the curtailment or interruption of any operations, processes or equipment connected to the SRS.

APA shall limit its warranty to 10 years if the equipment is shipped outside the Continental United States, unless additional arrangements are agreed upon in writing.

THIS WARRANTY GRANTS THE PURCHASER SPECIFIC LEGAL RIGHTS THAT MAY VARY ACCORDING TO THE STATE IN WHICH THE SRS IS INSTALLED. IN SOME STATES, SELLERS CANNOT LIMIT THE RIGHTS OF THE PURCHASER SO YOU MAY HAVE ACCESS TO LEGAL REMEDIES IN ADDITION TO OR GREATER THAN THOSE SPECIFIED HERE.

Warranty Service Contact
Justin Ridley, Engineering Manager
Phone: (419) 267-5280
E-mail: jridley@apalternatives.com

Customer Name:

Project Location:

Warranty Activation Date:

AP-Alternatives, LLC

Signed _____