

STATE OF MARYLAND
GAME CHANGER COMPETITIVE GRANT
FINAL REPORT

PREPARED FOR
MARYLAND ENERGY ADMINISTRATION

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1. COVER LETTER

FEB 25th, 2017

Sam Beirne
Maryland Energy Administration
(443) 203-8790

Dear Mr. Beirne,

Today I am writing to you on behalf of three partnering entities, Inman Solar, Quest Renewables, and Manheim Maryland. Whereby these entities worked together to successfully apply and win a MEA Game Changer Grant to develop and install a solar energy generating facility at the Manheim Car Auction facility in Elk Grove, Maryland. The grant was awarded to our project due to the 'game changer' racking product we used called QuadPod, developed by the company, Quest Renewables. Inman Solar acted as the solar project developer and lead Installer, Quest Renewables supplied the racking and performed the racking install as part of their cost saving solution and Manheim Maryland was the business that received the grant funding to build the solar array at their facility.

Enclosed in this report you will find that the grant recipients achieved what they set out to do, to develop a solar array using the Quest Renewables solution by providing a solar car canopy at less of the cost than a traditional car canopy solution. With in the report you will find the basis for our application to the grant, how we substantiated our challenge to provide a system that would improve the market accessibility for car canopy solar installations.

This team is pleased about our successful project and we hope we met or exceeded the expectations of MEA. We are proud of this project and for being given the opportunity to work with the State of Maryland to build a successful project that will be effective in changing the future of renewable energy deployment in your state.

Sincerely,
Brion Fitzpatrick,
Inman Solar Inc.

2. PROJECT DISCRPTION

Cox Conserves, a division of Cox Enterprises, through its subsidiary, Manheim Remarketing, Inc. the governing entity to Manheim Maryland, Inc. has installed a 294.5kW Solar PV Car Canopy in the parking lot of its car auction facility. 950 Solar Phono Solar Modules connected to 10 SMA Tri-power 1000US Inverters. Further Design information can be found in the drawing set section of this report.

This project utilized a game changing racking technology for solar car canopies called **QuadPod**. QuadPod is a product offered by a company called Quest Renewables. Developed at the Georgia Tech Institute, Quadpod has been designed to provide efficiency for solar developers and customers desiring to install solar energy on parking lots by lowering the cost of the steel canopy.

QuadPod is a revolutionary, patent pending structural system that leverages the efficiencies of a deep 3d space frame truss paired with the material and labor savings of nesting, bolted connections for rapid assembly in the field. The QuadPod Canopy is specifically designed to address the challenges of deploying solar installations over parking areas. This unique canopy system represents advantages over conventional solar canopy technologies by enabling longer spans, higher material and labor productivity, improved safety, and superior project economics and aesthetics. Typical solar canopies are a mere adaptation of standard shaded parking structures that have had their membrane shade covering (metal or otherwise) replaced with solar panels. These are inefficient structures being deployed with solar panels, and they are not designed with the specific considerations of constructability, safety, cost, and aesthetic that are required for the continued growth of this application of solar technology. QuadPod was developed through rigorous research and development, pairing world-class research from Georgia Tech Research Institute and solar industry expertise to address the fundamental challenges of creating a scalable, innovative and cost effective solar canopy structure. QuadPod is now in the commercialization and optimization phase of its development, and this application seeks the support of the MEA to continue refining the product, so clean energy deployment can be accelerated in Maryland and nationwide.

System Construction Timeline:		System Payback (Assumptions)	
MD Grant Award	March 2015	Project Size	294.5kW
Customer Final Contract Sign and Deposit	April 2015	Total Cost	\$ REDACTED
Engineering and Design	May 2015	Fed Tax Credit	\$ REDACTED
Equipment Ordering	June 2015	Maryland Grant	\$ REDACTED
Installation	July 1 st - 21 st 2015	Net Power value	\$ REDACTED
Completion/ Commissioning	Feb 5 th 2016	Market REC value 5 year strip	\$ REDACTED
		ROI	12%
		Payback	5.00 Years

3. PRE-PROJECT EVALUATION CRITERIA

QUESTIONS AND ANSWERS

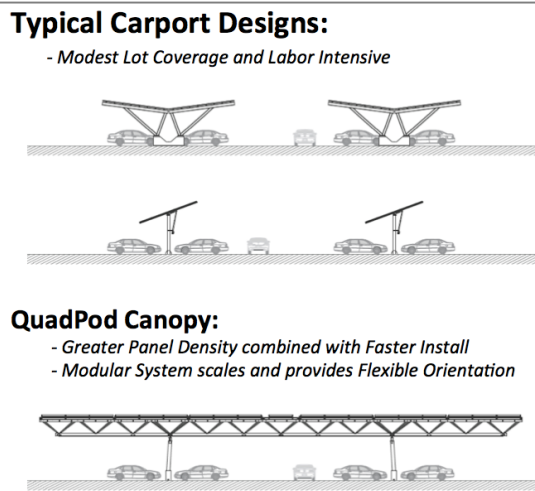
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- INCREASE IN PRODUCTIVITY

A. How does productivity of the “game changing” system compare to the productivity of a traditional system?

Solar canopies over parking lots and garages have been inhibited in their adoption due largely to being higher cost than traditional solar installation options; flat roofs, ground mounts, residential, etc. Placing solar over parking areas typically requires a substantial amount of steel per kW installed as well as large numbers of concrete supporting piers and the associated cutting, coring and pouring that comes with the construction process. QuadPod Canopy aims to shift this paradigm by leveraging more efficient structural systems that can achieve longer spans, minimize piers, and require fewer labor hours per kilowatt installed. This results in increased material resource productivity, labor productivity and throughput for the project installer. QuadPod will enable Maryland solar companies to install more solar parking projects in less time, with less steel, at a lower cost. Not only does this increase the efficiency and profitability for Maryland installers, but it also will increase the size of the potential market for solar in Maryland and lead to more clean energy installed in the state.



Another critical element of productivity is safety, and it is one that is not often considered or quantified. Traditional canopies require the bulk of the solar installation to be performed as overhead work at height. The installation process begins with construction of the structure at its final height, then the supporting beams, solar modules, and wiring must all be installed via scissor lifts that require fall protection and special training. Placing workers at height increases the risk to the installer, slows down productivity, and drives up both labor and equipment costs. QuadPod Canopy is built almost completely on the ground, inclusive of module mounting and wiring, before it is lifted into place and mounted by no more than 2 workers operating at height. This translates into increased safety for the installers, less rental equipment onsite, and lower cost. We aim

not only to increase the amount of solar that Maryland installers can deploy, but we will do it in a manner that ensures their safety.

Please reference the following statistics and graphic that illustrates some of the advantages of QuadPod over typical systems:

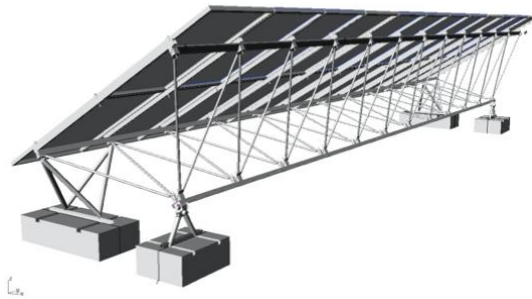
Productivity	Traditional Canopy	QuadPod Canopy
Kilowatts/Pier Installed	< 17 kW/pier	> 23 kW/pier
Structural Span	20' – 30'	60' – 75'
Parking Area Coverage	50% - 60%	80% - 90%
Overhead Work requiring Fall Protection	50% - 80%	< 10%
Percentage of installation time shutting down parking area	80% - 90%	10% - 20%

The progression of the QuadPod Canopy product has been driven by a constant, unyielding focus on improving productivity of the structure, installation labor and flexibility of the design. The following illustrations provide insight into the development of the product from its inception, through R&D, our first full scale pilot

completed with Inman Solar at Agnes Scott College, and the vision for QuadPod Canopy at Manheim’s facility in Maryland.



Early truss node prototype to identify efficient, low cost web connection options!



Short span Ground Mount conceptual model!



Short span structural prototype investigating ground connection concepts and ballasting!



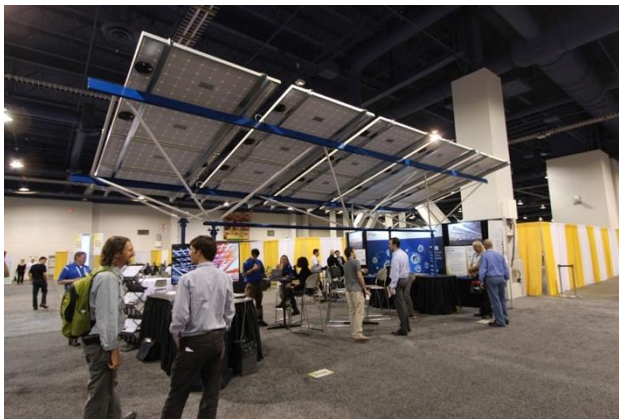
Physical load testing performed to validate structural integrity of prototype QuadPod!



Test installation of 30' QuadPod at Georgia Tech!



Testing module mounting variations at Georgia Tech!



QuadPod debuts at Solar Power International 2014!

FROM RENDERING TO REALITY

The Game Changer Grant solar project was the second for project for Quest Renewables. Below you will find examples of our first project at Agnes Scott College, Decatur, GA.



Agnes Scott College pilot project rendering:



Successful Completion of Agnes Scott College pilot project installation: (Taken: **12/16/14**)



Game Changer Competitive Grant Program conceptual rendering for Manheim project:

- MARKET POTENTIAL

A. How will the “game changing” system accelerate the market for renewable energy in Maryland?

Accelerating the market for renewables in Maryland will largely be a product of increased productivity, lower costs, and flexible, replicable systems. QuadPod Canopy addresses all of these aspects and will enable Maryland solar installers to successfully deploy more clean energy in the near term as well as after the federal Investment Tax Credit (ITC) decreases. Solar parking canopies are one of the most practical and desirable project types for the end customer, because they do not lockup undeveloped land for future projects as does ground mounted solar, and they don’t represent a facilities risk for leaks or reroofing as do flat and pitched roof mounted systems. Removing redevelopment and facilities risks are also paired with the additional customer satisfaction derived from providing shade to parked cars. Many solar technologies are geared towards specific, niche market segments, but QuadPod Canopy can be applied across multiple major customer groups. By helping support the development of QuadPod, the Maryland Energy Administration will be facilitating the development of a game changing technology that can be implemented at schools, commercial locations, community residential projects, government facilities, parks and more.

QuadPod Canopy will achieve lower costs and increased productivity through technological innovation and economies of scale. Meanwhile, the partners of this project are laser focused on increasing safety, ensuring unmatched quality, and expanding the market potential for solar. Our assumptions for installed cost reductions can be summarized in the following table:

Innovation	Timing	Installed Cost Reduction	Total QuadPod Installed Cost
QuadPod Parking Deck	Current	N/A	\$1.20/watt
5-6 modules/row capacity QuadPods	January - February '15	\$.15/watt	\$1.05/watt
Parking Lot Optimization	February - April '15	\$.05/watt	\$1.00/watt
Component & Labor Improvement	May – July '15	\$.05/watt	\$.95/watt
Increased module density on QuadPod trusses	August – October '15	\$.07/watt	\$.88/watt
Substructure Redesign & Tool-Up	Q4 '15 – Q1 '16	\$.10/watt	\$.78/watt
Manufacturing Economies of Scale	Q3 – Q4 '16	\$.13/watt	\$.65/watt

Industry leading companies such as SolarCity have set a target of \$2.50/watt installed by 2017ⁱ (see Endnotes). Achieving this cost target is critical to being able to continue increasing solar capacity in Maryland and across the country following the reduction in the federal tax credit. The technological innovations and economies of scale achieved by QuadPod Canopy over the next 2 years will enable Maryland companies to continue increasing solar deployment in the state in 2017 and beyond. The following table illustrates how \$2.50/watt total installed cost can be achieved by 2017 for QuadPod Canopy projects:

2017 QuadPod Canopy Installed Cost Target

Project Component:	\$/watt
PV Modules	\$.70/watt
Inverters	\$.15/watt
QuadPod Racking	\$.68/watt
Balance of Systems	\$.15/watt
Electrical Labor	\$.30/watt
Engineering, Design, Permitting	\$.05/watt
Project Management	\$.10/watt
Installer Overhead & Profit	\$.37/watt

Total Installed Cost: \$2.50/watt

- VISIBILITY/ REPLICABILITY

A. What about this project would lead other interested parties to invest in a similar project?

The QuadPod Canopy has three advantages over traditional carport systems. 1) It has unique features to increase Parking Coverage Ratio (PCR) and thus the kW deployed per commercial parking lot. By lowering the cost of energy to the end customer while also maximizing the energy generation capacity onsite compared to other technologies, QuadPod Canopy will be the obvious choice for customers on its merits of cost, quality, and energy density. 2) The QuadPod Canopy requires less time to deploy under safer work conditions, thus impacting customer sites for less time with lower risk. 3) The QuadPod Canopy will reduce costs by decreasing the labor for installs, the number of ground connections per kW, and the steel per kW. This will lead installation companies in Maryland to choose QuadPod over competing technologies, because they will be able to deploy more solar with fewer site complications and logistical challenges.

B. How would the applicant work with MEA to replicate a successful project?

This project will be our showcase in the state and an avenue towards additional business. By demonstrating a successful, low cost solar canopy in Maryland, other prospective customers will be able to visit the site, see the results firsthand, and work with the MEA and project partners to replicate the quality and potential of QuadPod Canopy at their own sites.

- COST-SHARE

A. As MEA expects to cover no more than 30% of the project costs; What are the other sources of funds for the project?

Manheim Maryland Car Auction has committed to funding 70% of the system Cost should in win a Game Changer Grant from the State of Maryland. Manheim has a 2015 budget for this project and these funds will not be dependent on any loan or other funding sources nor any other contingencies.

B. What Percent of the total project cost is the applicant seeking from MEA?

Manheim Maryland Car Auction received 30% of the total project cost.

-PERFORMANCE DATA

A. How does the applicant plan to collect and analyze performance data?

In the field, we can capture and code the labor required at each stage of the build. Prior to being in the field, we can assess the density of panels we are implementing relative to other technologies to compare the difference in kW per square foot (the Parking Coverage Ratio or PCR), the kW per pier / ground connection, and the amount of steel per kW (structural efficiency). This data can be compared to customer experiences with other canopy systems to solidify the superior quality, safety and reliability of QuadPod Canopy.

B. What metrics best characterize the project?

- Tracking the labor hours per kW will help us track the success of our design and innovations at reducing labor costs relative to prior and future projects.
- The Parking Coverage Ratio is a differentiating design feature versus other products that allows greater energy yield per project.
- Structural Efficiency is the steel per kW. If there is less steel per kW and design matches efficient manufacturing process, the cost of the system will decrease with volume.
- Kilowatts per pier correlates directly to sub-contractor costs relative to onsite labor, materials, and deployment time.

C. How will the data be used to inform policies and increase market potential?

The data we gathered will be used to prove and validate the cost savings to increase market adoption. Furthermore, the minimal amount of time spent working at height will demonstrate to building inspectors and safety officials that QuadPod Canopy is designed for safety and reliability. This will increase confidence at the city, county and state level and garner the support of local officials and legislators to support further deployment of the technology across the state.

-VIABILITY/ REASONABLENESS

A. Can the project be executed within the grant time frame? (For reference it is Dec 2015)

Yes. The collaboration of Inman Solar and Quest Renewables represents a very strong development / construction team. Inman Solar has demonstrated its ability to exceed customer expectations and quality standards across a myriad of solar technologies and installations. The company has earned its reputation as one of the most respected and capable solar developers in the southeast that can manage projects of any size and complexity with high profile clients and project sites. Quest Renewables has more than twenty years of solar construction experience, and an additional twenty years experience bringing technology and innovation to commercial reality. On December 16, 2014 Quest and Inman Solar completed the first QuadPod pilot project on the parking deck at Agnes Scott College in Decatur GA. This four QuadPod, 92.72 kW project was implemented on time with only ten active construction days onsite. Though we have not yet implemented the product on a surface lot, it should represent less complexity due to greater access to the work area and less need for specialty equipment. In terms of manufacturing capacity and engineering resources, Quest Renewables has a team in place that can go from contract signing to onsite delivery of materials within 12 weeks time, which aligns perfectly with the desired timeframe for product deployment as outlined in the grant.

B. Is this a reasonable idea?

Absolutely. The QuadPod has a clear cost reduction path to disrupt the pricing structure for photovoltaic car canopies through design innovation. With opportunities like the Game Changer Competitive Grant Program provides, we can continue to refine and test these innovations to ensure this adoption path. Our design, engineering and manufacturing resources are all aligned on the product innovation goals, and we are laser focused on achieving our targets for this project and onward towards our 2017 installed cost milestone.

C. Has it been tested anywhere?

In addition to the Agnes Scott College pilot, QuadPod was first prototyped at GTRI (Georgia Tech Research Institute) on a small scale, and has undergone extensive wind tunnel and UL testing. What's more, in Q1 of 2015, a full scale QuadPod will undergo a full-scale stress test to failure to further inform the structural model.

D. What evidence supports the expected outcomes of this project?

We have a robust structural model of the QuadPod from both rigorous testing and design work. With this model, we are able to take our practical experience from prototyping and pilot projects to refine the design to reduce both our manufacturing and labor costs. Every component of the QuadPod is designed for volume manufacturing processes. With additional pilot sites to refine the product, and future volume to bring our manufacturing to scale, we will be the lowest cost option on the market while offering unique design features.

Three primary innovations are already underway to achieve the necessary installed cost for the project at Manheim's parking lot in Maryland. First, we have received the results from our wind tunnel testing, reviewed them with our third party structural engineer, and confirmed that the QuadPod Canopy can accommodate 5-6 modules per row as compared to the 4 modules installed per row at Agnes Scott College. Second, we performed time-in-motion studies at Agnes Scott that have confirmed where we will be able to achieve labor and equipment

efficiencies on a surface lot (Manheim) as compared to a parking garage (Agnes Scott). Lastly, our product designers have outlined a plan for optimizing the physical QuadPod components for reduced labor and material costs at the Manheim project. These improvements can be made without additional tooling investment or delays, so they are readily actionable for the proposed project.

-COMMITMENT FROM PARTNERS

A. What other entities have to be involved to make this project a success?

Manheim Maryland, Quest Renewables & Inman Solar.

B. Are these entities committed to the project success?

Absolutely, All 3 Entities are full committed to the success of the project

4. KEY PERSONNEL AND CORPORATE QUALIFACATIONS

- **Quest Renewables, Inc.**
- **Inman Solar, Inc.**

1. QUEST RENEWABLES COMPANY BRIEF, REFERENCES & KEY MEMBER BIO

COMPANY BACKGROUND

Quest Renewables was created to commercialize products developed as part of the Georgia Tech Research Institute's work as part of the United States Department of Energy's Sunshot program. In the third quarter of 2011, GTRI was awarded a BOS-X award, as part of Sunshot's broad initiative to revolutionize the solar industry. GTRI Researchers developed radical new products that would allow solar to compete with other conventional energy sources by reducing projected labor costs and boosting installation efficiencies. Between 2011 and 2014, the relationship between GTRI and DoE strengthened, and it became clear that GTRI's products would exceed the expectations set forth by the DoE. The team further refined the products to design and fabricate PV racking solutions that are functional, durable cost-effective, and aesthetically superior. In early 2014, Quest Renewables formed to bridge the gap between product development and commercial availability of these products. The Quest Partners were all involved substantially in the work of GTRI prior to company formation, and are committed to making the solar industry larger and more profitable as a result of these innovations.

The mission of Quest Renewables is to expand the solar market by enabling financeable projects in segments of the PV market that have previously been uneconomic. Quest's first product, QuadPod Canopy, leverages state-of-the-art technology and engineering that was developed through an award-winning, multi-million-dollar Department of Energy research project. In addition to delivering game changing technology, Quest backs up its racking with best-in-class speed, quality, and reliability for its customers.

The objective of the Department of Energy research, and the resulting technology, was to expand the solar industry by increasing install speeds and improving productivity of operations. The commitment to speed for our customers also extends to the design of our products, all of which are manufactured in the USA with flexible, on-time delivery for ease of project planning.

The development of QuadPod Canopy was completed with the highest level of academic research standards. Every aspect of product testing was completed with the leading supplier of services to the solar industry. In many cases, where industry experts felt the testing "could be better," we tested to the higher standard of those experts.

The installation of our racking solutions is only as good as the installation process. Our racking solutions are straight-forward in their installation, focusing on eliminating tools, hardware connections, and on-site movement wherever possible.

ADDITIONAL COMPANY INFORMATION

Company Name: Quest Renewables, LLC
Main Office Address: 3914 Ivy Road NE, Atlanta, GA 30342
County: Fulton
Jurisdiction: Georgia
Year Established: 2014
Number of Employees: 6
NAICS #: 221114
EIN #: *REDACTED*
Points of Contact - Officers:
Finn Findley, CEO | Finn@QuestRenewables.com | (404) 580-4444
Beau Baldock, VP Supply Chain | Beau@QuestRenewables.com | (307) 690-8845
Will Arnold, VP Construction | Will@QuestRenewables.com | (404) 372-1945

COMPANY REFERENCES

Agnes Scott College
92.72 kW (crystalline)
REDACTED NAME

Affordable Housing Projects, Ontario, CA – SolarCity
1.5 MW (crystalline)
REDACTED NAME

Residential Operations Management – SolarCity
>2 MW deployed across 3 locations in California
REDACTED NAME

QUEST RENEWABLES TEAM SUMMARY

WILLIAM ARNOLD

With 8 years of solar industry experience across multiple leadership roles, Will Arnold is uniquely prepared to drive strategy and operational excellence at Quest. Over the course of six years at SolarCity, Will progressed through installation and support field roles before taking on the leadership and growth of Los Angeles, CA, and, later, Toronto, Ontario. Following SolarCity, Will spent time at the Georgia Institute of Technology as a Solar Technology Specialist, bringing Georgia Tech a wealth of industry expertise that has helped shape the commercial application and business strategy of Quest Renewables' racking solutions. Will has a degree in Philosophy from Brown University.

BEAU BALDOCK

Beau Baldock comes to Quest with six years of solar industry experience, five of them managing and standardizing residential solar operations at SolarCity. His track record of developing efficient operational processes that achieve high customer satisfaction has prepared him to help scale Quest's operations and supply chain organizations. Additionally, Beau's time spent in the field as a solar installer and field engineer provides him with the necessary perspective to ensure Quest's products are

catered to the needs of the end customer, installers, and quality and safety professionals. Beau has a degree in Architecture from Middlebury College.

NORMAN FINDLEY

Norman (Finn) Findley has more than twenty years of commercialization and brand expertise, principally at The Coca-Cola Company. In his career, he has worked in brand development, field management, channel strategy, and key account management. His most recent experience at Coca-Cola includes the development of a new commercialization process for Coca-Cola in the United States, inclusive of all brands, packages, and innovations. Finn serves Quest Renewables as a general manager, ensuring that all functions of Quest Renewables work seamlessly together, as well as leading the sales, marketing, and commercialization efforts for The Company. Finn completed his undergraduate studies at Emory University and received an MBA from Babson College.

JOSEPH GOODMAN

Joseph Goodman has more than eleven years experience in renewable energy. He began his career in renewable energy in the private sector with GE Energy and ARUP as an Energy and Sustainability Consultant. For the last five years, Joseph has worked with sustainable projects as part of the Georgia Institute of Technology. He is the principal investigator of the technologies that Quest Renewables offers to customers today. At Quest, Joseph leads technology innovation drawing from his professional experience and masters degree in Mechanical Engineering from the Georgia Institute of Technology.

GEORGIA TECH RESEARCH INSTITUTE

While not an individual, Georgia Tech Research Institute plays a tremendous role in Quest Renewables' success. Through this association, Quest is able to develop leading racking solutions. When the team at Georgia Tech Research Institute are not helping us develop new racking solutions, they are developing nuclear containment vessels, creating new structural engineering software, being featured in art exhibitions, or otherwise changing the world through ground-breaking research. And that is just the last year. All of this expertise intersects with Quest Renewables' commitment to customers and creates incredible products. More information about GTRI can be found at <http://gtri.gatech.edu/>

2. INMAN SOLAR, COMPANY BRIEF, REFERENCES & KEY MEMBER BIO

Inman Solar is a full service solar developer and installer of commercial solar PV systems. Inman Solar has extensive with experience through the entire solar project cycle. Since its formation in 2008, Inman has completed over 90 commercial projects totaling over 20MWs in eight states. Inman provides turn-key project development and Installation as well as system maintenance. Our experience includes site selection, system design, financing, installation, and maintenance. Clients and partners include public and private sector entities ranging from the federal government, universities, regional airport authorities, and corporations.

Inman Solar is made up of a small but capable team of engineers, project managers and business professionals that allow us to manage complex technical projects of any size and scope. We have integrated solar in some of the most unique projects in the US. In the process, Inman Solar has developed a reputation for completing projects on time and on budget.

ADDITIONAL COMPANY INFORMATION

Company Name: Inman Solar, Incorporated

Main Office Address: 320 North Highland Ave. NE, Atlanta GA 30307

County: Fulton

Jurisdiction: Georgia

Year Established: 2008

Number of Employees: *REDACTED*

Points of Contact - Officers:

Daniel Scott Fossitt, CEO | danfossitt@inmansolar.com | (404) 915-8154

Steve Chiariello, CFO | stevec@inmansolar.com | (404) 502-1915

Mark Jones, Secretary | markjones@inmansolar.com | (404) 863-0753

Size of Firm: 3 year average, \$ REDACTED M Annual Gross Sales

Bond Capacity/ Ability: Up to \$ REDACTED

Control #: REDACTED

Duns#: REDACTED

EIN# : REDACTED

CAGE Code #: REDACTED

NAICS #: 221114

NABCEP CERT. REDACTED

Small Business designation/status: SB. *Inman Solar is a Small Business under the North American Industry Classification Standard (NAICS) code for this procurement, 221114- Solar Electric Power Generation with a size standard of 250 employees.

COMPANY REFERENCES

Chattanooga Metropolitan Airport Authority

1 MW Ground Mount Solar Farm (crystalline)

REDACTED NAME

Legacy Properties

21.1kW (crystalline)

REDACTED NAME

Stafford Properties, Tifton GA

350kW (crystalline) in Gainesville FL

REDACTED NAME

Experience with parking structures and other complex buildings:

Inman Solar has completed some of the most unique and challenging solar projects in the southeast. Inman Solar's three founders consist of two engineers and an architect, which has allowed the company to take on and excel on more challenging projects.

Georgia Tech Carbon Neutral Energy Solutions Laboratory (GT CNES) –The project involved maximized the solar production capability of the building, which included canopies above parking and walkways, on all available roof spaces, and on the south facing façade of the building. The façade posed several engineering challenges, most notably, the project had to be part of a water tight building envelope, and it had to be constructed to much tighter tolerances than a typical solar installation. Inman was actively involved with the building architects and project general contractors to design the system and manage construction.

Edgewood at the Beltline Canopy – The project is a 16 kW system on the roof top terrace of a three story building. What is unique about this project is that it created multiple benefits beyond the project return on investment. First, it is a watertight canopy that was designed to divert water away from a problem area on the roof, which Inman learned about in the discovery stage of the project. Second, the canopy provides shade for floor-to-ceiling windows, reducing building cooling costs. Last, the canopy increases the functionality of the terrace level of the building for the tenants, which in turn resulted in higher rents for the landlord.

3. SUMMARY OF PROJECT SUCESES

The project was successful in the regard that the project archived the project and grant application goals. To meet the financial requirements displayed in the grant application to install a car canopy for less that the traditional cost

of a car canopy. To design and build a Quest Renewables QuadPod car canopy system to hold a 294.5 kW solar array to meet all requirements by the property owner, the grant source agency, the utility company and the Authority Having Jurisdiction (Howard County, Maryland)

4. LESSONS LEARNED

The project advanced the deployment methodology of the QuadPod product substantially. First, we successfully transitioned the way we set up and build the QuadPod trusses from hand built saw horses, a methodology that is not scalable, to scaffolding that is standard across the US, therefore reducing barriers to large scale deployment. Second, we utilized our triangulated sub-structure for the first time, thereby reducing the loads to the foundations, enabling reduced foundation costs and a fast paced means of steel erection. Third, we developed a unique foundation solution with our foundation subcontractor Foundation Shoring Solutions (FSS), to handle the poor soil on the site after seeing the results of the Geotech report. Fourth, this project represented the first surface lot implementation of the QuadPod Canopy, and it created the first large scale embodiment of our construction and steel erection process. The lessons learned are nearly too numerous to fully describe, but were all incredibly impactful to the advancement of the product.

The greatest indication of the lessons learned, which also reflects the project's success, is that the triangulated substructure debuted on this project ended up enabling another project in MD during the summer of 2016, which would have been financially infeasible without this unique structural solution. For this project, we deployed the same system with the same number of QuadPod units and panels on a parking garage, taking only 3 weeks of full restricted access to the top floor of the parking deck for completion. What's more, it has been replicated in both GA and OR, and continues to develop beyond the significant strides we made with the assistance of this grant with further incremental improvements.

The project was held up with the county permitting department, due to this authority having jurisdiction the project was severely delayed in meeting its Dec 31st 2016 project commissioning goal date. In the future it would be hard for the project developer to have any control over improving the speed of the permitting department. Any project in this jurisdiction would be advised to submit their application as soon as possible.

5. PERFORMANCE DATA ANALYSIS

System Size: 294.5 kW (DC)

System Location: 7120 Dorsey Run Road, Elkridge, MD, 21075

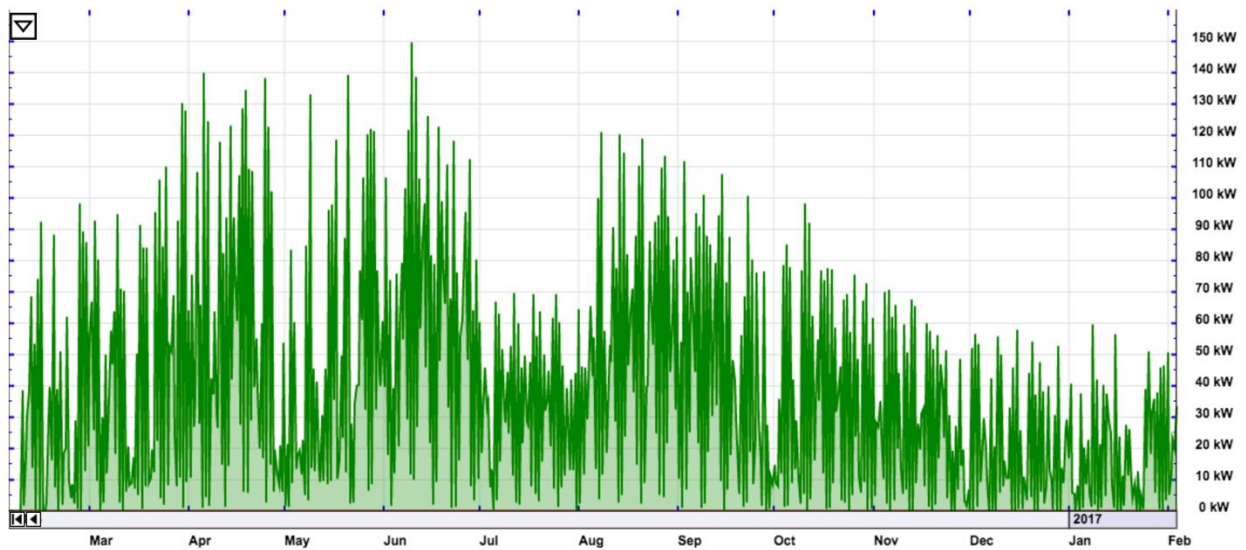
Start up DATE: FEB 5th 2015

Date of Last Report: Jan 30th 2017 10pm

Total Kilowatt Hours Generated from Start up to Jan 30th 2017: 327,590 kWh

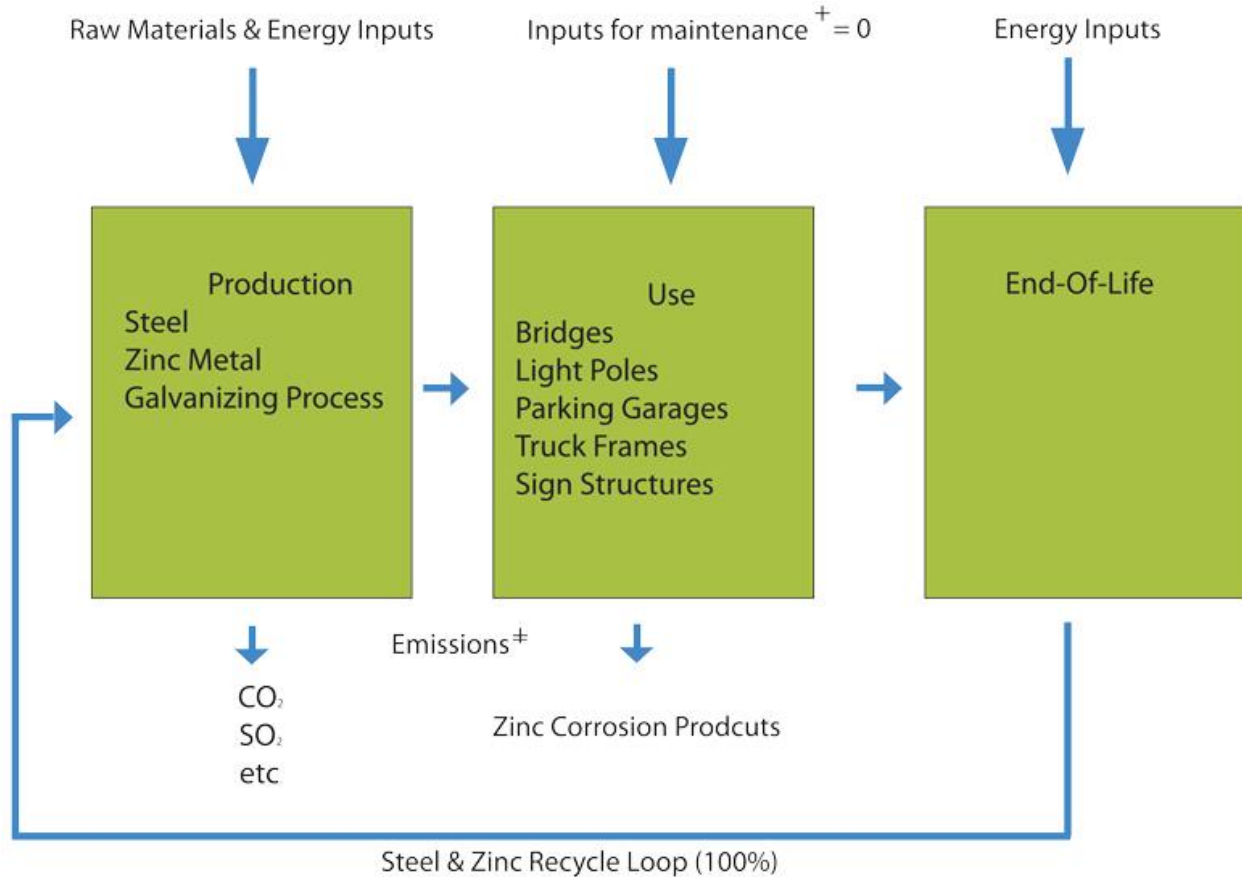
100% of the Energy Generated has been used on-site

Monthly Energy graph for the past 12 months.



8. LIFE CYCLE ANALYSIS

The materials of the QuadPod canopy are all pre-galvanized or hot dip galvanized steel, under a 10 year manufacturing warranty, with an expected life that is expected to exceed that of the solar panels expected 25-30 year life. The following chart describes the lifecycle of galvanized steel:



⁺ For all but the most aggressive environmental conditions, there are no energy/raw material inputs during use (75= years).
[±] For hot-dip galvanized steel, naturally occurring zinc oxide, zinc hydroxide, and zinc carbonate.

Source: <http://www.galvanizeit.org/transportation-seminar/environmental-advantages/life-cycle-assessment-lca>

At the end of the useful life of the panels, the QuadPod Canopy should be inspected for physical defect, at which point panels could be added back to the structure, or the structure could be deconstructed for recycling. Both the process of mounting new panels and deconstructing the 10 QuadPod system at the Manheim Car Auction would take approximately one week.

9. CERTIFICATE OF OCCUPANCY

Howard County
Department of Inspections, Licenses & Permits
3430 Court House Drive
Ellicott City, MD 21043
(410) 313-2455

Howard County
M A R Y L A N D

CERTIFICATE OF USE AND OCCUPANCY

Issued On March 3, 2016

Pursuant to the provisions of the Zoning Regulations for Howard County, Maryland and to the provisions of the Howard County Building Code for Howard County, Maryland which were in effect on the date Building Permit No. B15004442 was filed.

Permission is granted to AA PROPERTY HOLDINGS INC at 6205 PEACHTREE DUNWOODY RD ATLANTA, GA 30328 to use and occupy the land and/or building described and located as follows:

7120 DORSEY RUN RD
ELKRIDGE, MD 21075
Lot Number PAR 1

For the purpose set forth below:

Commercial New Building Permit

Description of Work:
INSTALL (950) GROUND -MOUNTED SOLAR MODULES AND 10 GRID-TIED PHOTOVOLTAIC INVERTERS

Conditions/Comments:

Certificate of Use And Occupancy for Building Permit Number B15004442 Issued on 11/30/2015 approved by the Designee of the Department of Inspections, Licenses & Permits of Howard County, Maryland, Shavon Logan on 3-3-16.

THIS CERTIFICATE IS GOOD FOR THE USE AND TO THE EXTENT DESCRIBED ABOVE. A CHANGE IN USE, OR ANY EXTENSION THEREOF, REQUIRES A NEW PERMIT

9.

LETTER OF APPROVAL FROM UTILITY COMPANY



Manheim Remarketing Inc
7120 Dorsey Run Rd
Elkridge, MD 21075

June 9, 2016
SR# 04552965
Subject: 7120 Dorsey Run Rd- Level 2 Interconnection Application to BGE's Distribution System

Your application for a Level 2 Interconnection has been given a: **Final Approval**

This letter certifies that BGE has accepted and provided final approval for the project at the above address.

Please contact your solar contractor in regards to operating instructions and turning on your system.

Thank You,

Megan L. Emerick

Megan L. Emerick
BGE Interconnection Coordinator
1068 N. Front Street
Baltimore, Maryland 21202
410 470-6770
megan.emerick@bge.com

10. PROJECT PHOTOS



11. PROJECT DRAWING SET
