Project Title: Solar: A Photovoltaic Manufacturing Development Facility
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Contract Number: DE-EE0004948
Project Start Date: 06/28/2011
Project End Date: 06/27/2014

Notice: The following is a compilation of information from Quarterly Reports submitted to the Department of Energy's Office of Energy Efficiency Solar Energy Technologies Office by the State University of New York Research Foundation. The report has been uploaded to OSTI by DOE as a substitute for the required Final Technical Report which was never received from the project recipient.

Executive Summary:

The project goal to create a first-of-a-kind crystalline Silicon (c-Si) photovoltaic (PV) Manufacturing & Technology Development Facility (MDF) that will support the growth and maturation of a strong domestic PV manufacturing industry, based on innovative and differentiated technology, by ensuring industry participants can, in a timely and cost-effective manner, access cutting-edge manufacturing equipment and production expertise needed to accelerate the transition of innovative technologies from R&D into manufacturing.

The Department of Energy's Solar Energy Technologies Office provided a financial assistance award (DE-EE0004948) to SVTC Technologies with the work to be done by a subsidiary, SVTC Solar. This award was eventually novated to the State University of New York Research Foundation ("the Foundation") on 29 November 2012. The award began on 28 June 2011 and the period of performance ended on 27 June 2014.

SVTC Technologies experienced financial difficulties in the summer/fall of 2012. The financial situation lead to liquidity issues and eventually the closing of the company. It was at this time SVTC Solar, the award and all associated property was transferred to the Foundation.

Since November 29, 2012, the Foundation has dismantled and moved the assets to the State of New York. After the tooling was moved, the Foundation hired staff to manage the facility and bring in business. Ultimately, not enough business could be attracted to warrant the full set up of all tooling. Eventually the Foundation had to cease work on the effort and conclude the award.

Project Objectives:

The project would have allowed industry participants across the entire PV supply chain to dramatically reduce the cost, time, and risk associated with transitioning innovative, emerging technologies from research to commercial manufacturing by providing ready access to state-of-the-art manufacturing equipment, services, and expertise. Expansion of the highly skilled workforce that the U.S. PV manufacturing industry needs would also be supported.

The MDF would have supported silicon-based PV technologies, providing a range of services and equipment, including complete manufacturing lines, access to individual tools, manufacturing experts, secure fab space for users' proprietary tools, and pilot production services, in an intellectual property (IP) secure environment. Companies would have worked in the MDF fab, collaboratively with MDF staff, to achieve the same touch-and-feel development experience as obtained in their own fabrication facilities.

This effort was meant to create an entity which could replicate the role SEMATECH played for the semiconductor industry in photovoltaic manufacturing.

Project Results and Discussion:

Quarter 1 2011- SVTC Solar

Section I – Accomplishments

SVTC Solar is pleased to present its first quarterly under the award DE-EE0004948. We welcome the opportunity to share the results of our first quarter of work and our plans for the future.

During the quarter, SVTC Solar pursued its strategy as set out in the company's Statement of Project Objectives ("SOPO"). This first quarter was dedicated to the validation of the business approach with key customers, final specification of the equipment set and construction preparation. Highlights of the quarter included the following:

Revalidation of business plan

SVTC Solar hired an experienced manager, Gunter Ziegenbalg, as its President. Gunter has a semiconductor background and has spent the last six years of his career in photovoltaics (PV) where he has been responsible for constructing and operating of two PV manufacturing facilities. He has first-hand knowledge of the solar market and its customer needs, the construction process and has experience of developing products for manufacture.

One of Gunter's initial objectives was to revalidate SVTC's business plan. The result of our work indicates that there is sufficient market demand for the Manufacturing Development Facility ("MDF") and that the market is awaiting its opening. Another main finding was that the scope of the MDF needs to be expanded downstream towards full module manufacturing and in-field testing in order to provide customers with enough data to provide validation of their products and materials in real world conditions, thereby enabling subsequent financing of the end product (bankability).

Equipment planning

A key activity of this first quarter was to finalize the equipment and tool set of the MDF. This process has been completed and may result in several changes to our initial plan. Key changes could include the replacement of Roth & Rau as a principal supplier by ME Baker and Applied Materials. We are currently negotiating supply agreements with the different suppliers. If agreements can be satisfactorily concluded, we believe this change will allow the MDF to benefit from a more innovative and forward-looking equipment set as well as lower operating and maintenance costs. It will also allow the facility to be constructed in a more flexible manner – a manner well suited to a development facility. Whilst we realize that there are some benefits to an MDF customer developing processes on a high-throughput Roth & Rau equipment set, we considered that the cost and flexibility benefits offered by other suppliers outweighed the benefits of the Roth & Rau tools. Furthermore, the relationship with Applied Materials, the leading semiconductor and solar equipment maker in the world, as key supplier for SVTC Solar will guarantee access to the best tools in-class for the long-term and will both enable our customers to innovate faster and also generate and help secure manufacturing jobs at several domestic equipment suppliers.

Facility design and Permit submission

Facility design has commenced and SVTC has retained M+W Group as the design lead for the facility planning. Since the business plan revalidation and equipment planning was carried out in parallel to the construction planning, building plans have not yet been submitted to the City of San Jose for permitting. We believe that the permits will be submitted by November 29 and that the project will be completed on-time and will be operational by Calendar Q3 of 2012, or Q5 of the project.

In addition, SVTC evaluated the acquisition of an existing facility that was being vacated by a local PV company as an alternative to its planned facility on Hellyer Road. Acquiring this facility would have accelerated the operational date of the MDF and offered the benefit of an existing turn-key line. Unfortunately, an economic agreement could not be achieved, and SVTC is no longer pursuing this potential facility acquisition. We will nevertheless continue to act opportunistically and will examine opportunities to add capabilities. We will inform the DOE of any such opportunities prior to undertaking any economic action.

Customers

During the course of the last 3 month we had meetings with more than 30 key customers in the areas cell/module manufacturing, materials, equipment, IP development, banking and education. The feedback on the planned MDF was unanimously positive and validated the business model. SVTC performed development-related work for three customers during the quarter at SVTC's Austin facilities. The value of the work was approximately $300,000 and exceeds our goal for the first year of the project of $142,000. Further details of customer work are included in Section VI.

Next quarter

Our primary goals for next quarter include: finalizing and placing orders for all equipment; commencement of facility construction; and establishing technology development, field testing and a business development organization. We will heavily rely on the main competencies of SVTC in the area of facility planning and operation, equipment validation and also its sales and marketing organization. We do not currently foresee any difficulties with meeting these milestones.

Section II – Products

SVTC has nothing to report in this section. Given the nature of the project of providing a development facility for use by third-parties, we consider it likely that SVTC may often have no items to report under this section. Nevertheless, reports under this section will be provided as appropriate.

Section III – Participants

Name:	**Gunter Ziegenbalg**
Project Role:	President SVTC Solar
Nearest person month worked:	2

Contribution to Project: Mr Ziegenbalg coordinates the project, is responsible for the business plan, customer interaction, equipment set selection, and general market approach.

Collaborated with individual in foreign country: Yes
Country(ies) of foreign collaborator: Italy, Germany
Traveled to foreign country: Yes
If traveled to foreign country(ies), duration of stay: 1 week

Name: **Sanjay Thekdi**
Project Role: Manufacturing Manager SVTC Solar
Nearest person month worked: 3
Contribution to Project: Mr Thekdi coordinates the equipment needs for the project, and is the main interface for the communication with the equipment suppliers.

Collaborated with individual in foreign country: No

Name: **Bryan Wang**
Project Role: Controller SVTC Solar
Nearest person month worked: 3
Contribution to Project: Mr Wang coordinates finances for the project, and is the main contact person for all commercial terms with suppliers as well as the government reporting.

Collaborated with individual in foreign country: No

Name: **Gregory Knight**
Project Role: Consultant at PV Tech Group
Nearest person month worked: 1
Contribution to Project: Mr Knight works on the equipment set selection and supports the layout and facility planning for the factory. He works in close relationship with Mr Thekdi.

Collaborated with individual in foreign country: No

Name: **Charles Elliott**
Project Role: Facility Manager SVTC
Nearest person month worked: 1
Contribution to Project: Mr Elliot works on facility planning of the production plant. He works in close relationship with Mr. Thekdi.

Collaborated with individual in foreign country: No

Main Partners involved in the project:

Organization Name: **M+W U.S., Inc. – A Company of the M+W Group**
Location of Organization: San Francisco
Partner's contribution to the project: Manufacturing line planning and permitting

Organization Name:	**Applied Materials, Inc.**
Location of Organization:	Santa Clara
Partner's contribution to the project:	Equipment vendor for key equipment for line & automation

Organization Name:	**Roth & Rau AG / Meyer Burger AG**
Location of Organization:	Hohenstein-Ernstthal, Germany
Partner's contribution to the project:	Equipment vendor for metrology and line

Organization Name:	**M.E. Baker**
Location of Organization:	Boston
Partner's contribution to the project:	Equipment vendor for etching tools

Organization Name:	**AB Sandvik Materials Technology**
Location of Organization:	Sonora
Partner's contribution to the project:	Equipment vendor for Diffusion furnaces

Organization Name:	**Sematech**
Location of Organization:	Albany
Partner's contribution to the project:	Partner in PVMI project for coordination of activities in solar

Section IV - Impact

During the first three month of the project SVTC Solar met with more than 30 potential customers and suppliers to define the business model and to adjust the planned technology service offering to the current highly competitive market conditions. The entire feedback from Tier 1 customers in the areas of module & cell, equipment and material manufacturing as well as well as the feedback from Tier 2 customers such as start-up companies, financial institutions and R&D / educational institutions was extremely positive. The enormous cost pressure in the industry requires innovative ways of enabling technology development in order to increase light efficiencies of solar cells and, in parallel, the validation of the technology in order to enable financing of the solar modules in the market. The offering of SVTC Solar will help organizations to innovate faster and more cost efficiently and will also increase their competitiveness in the international market.

With the newly defined enhanced equipment set, centered on state-of-the-art equipment from Applied Materials, SVTC Solar will be able to provide a near volume production environment to run production type R&D in all areas of the solar module supply chain. There is not a single other facility like the MDF, neither in planning nor in execution, in the world. SVTC Solar will enable innovation in the solar sector and improve the competitiveness of the industry in the different areas. With technologies proven in a volume environment, it will encourage future domestic volume production and will help maintain technologies in an intellectual property (IP) secure way.

The biggest addition to the original plan is the extension of the scope of SVTC Solar from being a pure wafer-to-cell line into the area of actual module manufacturing and field testing. This will further improve the time-to-market by providing customers the ability to test their end-products in a real environment and provide data for bankability.

Section V – Changes/Problems

As noted in the summary in Section I, SVTC is considering changes in the planned equipment and tool set and is also slightly behind schedule in its timeline for submitting its construction plans to the City of San Jose. Any change made to the equipment set will be made in order to enhance the economic viability and flexibility of the MDF. The tool sets that had been originally chosen were the leading, most advanced, production tools available on the market. Since this time, there have been many changes within the tool industry. Some of the equipment selected has been replaced by higher throughput tools, and the technical superiority of some tools has been eclipsed by other manufacturers. As a result of these market dynamics, it may no longer be economically appropriate to operate the highest volume tools. If agreements can be appropriately structured, these high-volume tools will be replaced with lower capacity production tools. The additional costs of operating the highest volume tools is not cost efficient and is not commensurate with any added benefit that could be gained from having such high-volume tools available. In addition, SVTC's goal is to bring the best technology to the facility for use by the MDF's customers, which will be accomplished by this selection. As a result of our review, certain tools were replaced in order to provide more advanced technology and greater flexibility to the MDF's customers.

Some of the more significant changes are further explained below.

Incoming inspection

SVTC's initial proposal did not include an incoming wafer inspection process. The thought was that customers would provide their own silicon and, that since SVTC was not responsible for the wafers, there was no reason to have an incoming inspection process. We now consider that incoming wafer inspection provides a value-added and necessary service (since most customers would be unable to perform this) and also believe that an incoming inspection process will establish a baseline quality and eliminate poor wafers from process flows. This also will help to maintain equipment availability within the MDF.

Roth & Rau Baseline

As noted above, the equipment industry has experienced continuing evolution during the period from when the MDF was first proposed to the present. Over the last two years, the market has changed from one in which turn-key, complete lines were viewed as the best way to meet customer demand to one, in which customers now demand best-in-class solutions at each processing step in order to allow for the most cost-effective solution. Roth & Rau AG was a leader in the turn-key equipment line market for crystalline solar cells, and at the time of developing the MDF concept, Roth & Rau AG was an ideal equipment partner. However, given the changes in the market, the offerings of Roth & Rau are no longer as compelling for the intended business model of SVTC Solar as they once were.

In addition, the market has become much more focused on expenses and on minimizing operating costs. The tool sets now offered by Roth & Rau support this drive to efficiency and are designed for very high throughputs, but the tools are now inefficient and expensive to operate in a development environment such as the MDF. The evolution of the Roth & Rau equipment has also led it to become less flexible. Changes to recipes and related chemicals and consumables are lengthy and expensive when compared to other tools. In summary, the

current tool sets of Roth & Rau are not ideally suited to support modern innovation and prototyping.

As a result of the above, SVTC has selected Applied Materials (AMAT) as its strategic equipment supplier. AMAT provides a number of best-in-class products that we will compliment with offerings from other best-in-class suppliers. It also allows for future expansion of the offering into the clean energy sector with tools in the LED and power electronics space. Equipment agreements must be formalized, and we will be working to close these during the current quarter.

Construction schedule

As noted above, we are currently in the process of presenting the building plans for the site construction to the City of San Jose. We had planned on performing this prior to the end of the first quarter in September 2011. We will submit the plans in mid-November and already submitted a plan for demolition by the end of October. We plan to compensate for the six to seven week delay by commencing the demolition work immediately and to then very closely manage our schedule. Although there may be some slippage in the intermediate milestones between now and MDF completion, we believe that the facility will be open on schedule and will be available for customer use in quarter 5 of the project (Calendar Q3 2012). We will update our milestone schedule once the planning stage has been completed.

Budget

We are in the process of determining the effects of the changes in the equipment set upon the project's budget. We do not expect the changes to result in significant changes to the projects viability and cost-share expectations.

Section VI – Special reporting requirements

Progress against milestones

We have included an analysis of the milestones and the progress achieved as Appendix I to this report.

Spending against plan

Spending is currently somewhat behind plan. This is largely due to market revalidation and equipment planning activities that were undertaken and the fact that the commencement of facility planning was delayed. We do not expect any significant variance in overall spending for the year.

Progress toward achieving financial self-sustainability

It is very early in the life-cycle of the project. The MDF will not be operational until July 2012. However, the results of our market validation efforts and the recognition of $300,000 of revenue in this initial quarter provide further evidence to help support our goal of financial self-sustainability. As mentioned above, customer feedback is very positive and we are planning to pull-in revenue generation substantially. We hope to be able to show positive results on those activities in the next quarterly report.

Aggregated user satisfaction performance data

User satisfaction performance measurement techniques and processes tools are to be established in Quarter 7 of the project. We will continue to report upon this reporting requirement and provide updates as appropriate.

Technologies and MDF capabilities currently supported

Although the MDF is not yet operational, SVTC is currently supporting the following technologies in its semiconductor facilities.

Semiconductor Process	Equipment	Application
Oxidation Furnace	AVIZA VTR Oxide1	Hard mask
AMAT Endura for metals deposition	AMAT Endura	Conductive layer
SiON dep on Novellus	Novellus Concept 1	Dielectric deposition
I-Line Litho on ASML	ASML I-Line Litho tool ASM11	Patterning
Dielectric Etch on AMAT MxP	AMAT MxP Centura	Pattern etch
AMAT P5000 PECVD chamber (Fab2)	AMAT P5000	Active material deposition
AMAT Producer PECVD (Fab1)	AMAT Producer	Active material deposition
FSI cleaner	FSI Wet Clean tool	Wafer clean
AMAT P5000 PECVD for a-Si dep	AMAT P5000	Active layer deposition
AMAT Endura for metals deposition	AMAT Endura	Conductive layer
Mattson Spike Anneal	Mattson	Firing
SiN LPCVD Furnace	FUR11	ARC deposition

Planned technologies and MDF capabilities to be supported

The planned technology offerings are set out in the tables below (equipment table and metrology table). Please note that the offerings are subject to satisfactorily concluding a formal agreement with the appropriate tool suppliers.

Process Technology/Step	Equipment	Equipment Detail
Incoming wafer test & sort	AMAT	Wafer Inspection System to do: micro-crack, breakage, resistivity, TTV etc.
Texture Etch for Multi-crystalline Si	M.E. Baker – Flex Tool	Four Modules to support; Texture Etch, Edge Isolation, PSG Etch, Polish Etch, surface prep & Clean.
Oxide Wet Etch (PSG Etch)		
Edge Isolation		
Texture Etch for Mono-crystalline Si	Wet Bench (Supplier TBA)	Batch Tool for Mono c-Si Texture
SiN ARC Deposition	Tube PECVD (Supplier TBA)	Batch tool to deposit ARC
Al2O3 Deposition	AMAT PECVD	Advanced passivation deposition tool
Sintering	Belt Furnace (Despatch or BTU)	~1,000 WPH
Screen printing – Ag, Al and Clean	AMAT - Baccini	Baccini Softline with 3 (load + printer + dryer + unload) islands to do Ag, Al and etch paste/dopant printing.
Emitter formation (N - type doping)	Sandvik (previously MRL) Furnace with 4 tubes	4 Tube Gen2 with WTS with BTA Tubes include: POCl3, BBr3, TOX & Anneal. This equipment will do both Phosphorous and Boron doping, PLUS Thermal oxide growth and forming gas anneal.
Emitter formation (P- type doping)		
Thermal Oxidation		
Annealing		
End of Line Cell Inspection	ICOS-KLA	Installed directly on the Spire Test & Sort system
Cell tester & sorter	Spire	Spi-Cell Sorter Rev D 3-10. Test and sort solar cells.
Plating process – Cu/Ni/Sn	Technic	Support LoBaCo roadmap

Metrology	Model	Make
Silicon weight measurement (Pre/Post Texturing)	Analytical Balance	Mettler Toledo
Optical Surface Inspection	Microscope VHX 600	Keyence
Sheet Resistance after Diffusion and PSG Etch	SheerScan /	SunLab
Bath Concentration	Titration Tool T70	Mettler Toledo
Aluminum weight measurement	Precision Balance PB602-S	Mettler Toledo
Silver weight measurement	Precision Balance XS603SDR	Mettler Toledo
Contact Resistance Measurement	CoreScan	SunLab
ARC Thickness and RI measurement	Ellipsometer 400 adv	Sentech SE
Location of short-circuits (shunts)	Shuntometer SISC 704	Pasan
Reflection measurement	Reflectivity tool D8-3	RadiTech
Electroluminescence	Electrolumineszenz	Graphikon
Photoluminescence	Photolumineszenz Nanometrix	BT Imaging
IQE EQE measurement	IQE EQE	PV Measure
Minority carrier Lifetime measurement	Lifetime tester-Sinton-WCT 120	Sinton
Post diffusion process control	Sinton Suns Voc	Sinton
Reflectivity SpectroPhotometer with DRA (diffused reflectance accessory)	Cary 6000i	Agilent
Bond Density Si-H, N-H	Perkin Elmer-FTIR 100	Perkin Elmer
Firing Furnace profiling	Datapaq	Datapaq

Quarter 2 2011- SVTC Solar

Section I – Accomplishments

SVTC Solar is pleased to present its quarterly under the award DE-EE0004948. We welcome the opportunity to share the results of our work and our plans for the future.

During the quarter, SVTC Solar pursued its strategy as set out in the company's Statement of Project Objectives ("SOPO"). After utilizing our initial quarter for the revalidation of the business approach, final equipment set specifications and construction preparation, our second quarter was devoted to initializing our plans. Highlights of the quarter included the following:

Opportunity to acquire an existing facility

At the suggestion of the DOE, SVTC Solar re-engaged with a local, Sunnyvale-based wafer and cell manufacturer to investigate the purchase of the company's existing cell and wafer line. Results of the investigation were encouraging and SVTC Solar pursued the acquisition, including the signing of a term sheet and completion of due diligence procedures. The acquisition essentially allows SVTC Solar to accelerate the deployment of the Manufacturing Development Facility ("MDF") while also increasing the MDF's capacity and capabilities. The added capacity would allow SVTC Solar to increase its pilot production resources and allow the facility to perform specialty production services. The added capabilities would permit SVTC to offer ingot growth and wafering services.

In addition to the added capacity and capabilities noted above, acquisition of the facility can be performed within the existing budget. The cost of the facility and equipment roughly match the facility build-out costs that are required under our existing plan of record.

The downside risk in pursuing the opportunity largely surrounds the higher operating costs (largely related to personnel) associated with the facility. Although it is one of the prime benefits, acquiring the company's workforce also represents the single largest risk of pursuing the acquisition strategy. Our existing plan of record is based on the assumption that personnel will be added as MDF volumes increase. Consequently, it is imperative that MDF volumes ramp quickly in order to alleviate the effect of carrying the personnel costs. Our due diligence leads us to believe that we can manage and mitigate this risk by commencing specialty production and projects within the first quarter following acquisition. Target customers have been identified and qualified, and we have received expressions of interest from others.

The current state of the transaction is somewhat disappointing. The facility's landlord has the right to recapture the building in certain circumstances – one of which is the transaction that is being proposed. Although the landlord has provided notice that it intends to recapture the portion of the building proposed to be subleased to SVTC, it is clear that the landlord's intention is to attempt to recapture the entire facility. The landlord has made offers to its tenant to release the building, but the tenant has thus far rejected the proposals as it favors the transaction with SVTC.

We are currently awaiting resolution of the issue and have proposed deadlines to both the landlord and the company. We plan to take action upon a path forward and commence construction activities at our retained site by the end of February if there is no resolution upon this issue.

Equipment planning

Although SVTC completed its due diligence procedures on the equipment to be included as part of the proposed acquisition, much of the original equipment planning and acquisition activities have been placed on-hold given the circumstances. SVTC Solar's equipment needs will differ markedly depending on whether the acquisition is successful. If the acquisition is unsuccessful, SVTC Solar will likely revert to the equipment plan provided to the DOE during its last quarterly review meeting.

Facility design and planning

Given the risk to the project timeline inherent in pursuing the acquisition strategy if it ultimately fails to be concluded, SVTC Solar continued to pursue its facility design and planning activities as per its plan of record. The company stopped short of formally submitting plans to the City of San Jose given the costs of doing so but is ready to submit when and if required.

In addition, given the proposed change in equipment vendors noted in our last quarterly report, SVTC Solar continues to evaluate other potential facilities. The facility included in the plan of record was selected in order to meet the requirements of Roth & Rau's equipment set. The proposed equipment, currently being reviewed by the DOE, requires a smaller footprint and may be better suited to a smaller facility.

Notwithstanding the status of the acquisition and the matters noted above, SVTC's goal is to have a largely operational facility available by July 10, 2012 in order to allow for a launch event to coincide with the Intersolar San Francisco trade show. SVTC Solar will present its capabilities in an exhibitor booth at this show.

Customers

During the course of the last 3 months we continued to have meetings with potential customers, including identifying and qualifying potential customers that would be required under the acquisition scenario.

SVTC performed development-related work for three customers during the quarter at SVTC's facilities. The value of the work was approximately $60,000. Further details of customer work are included in Section VI.

Next quarter

Our primary goals for next quarter include: concluding upon a path forward regarding the facility selection and acquisition proposal; finalizing and placing orders for all equipment; commencement of facility construction (if applicable); and establishing technology development, field testing and a business development organization. We will heavily rely on the main competencies of SVTC in the area of facility planning and operation as well as equipment validation. We do not currently foresee any difficulties with meeting these milestones.

We are planning to engage with a minimum of 3 customers next quarter by using existing capabilities and equipment of SVTC Technology's factories.

Section II – Products

SVTC has nothing to report in this section. Given the nature of the project of providing a development facility for use by third-parties, we consider it likely that SVTC may often have no items to report under this section. Nevertheless, reports under this section will be provided as appropriate.

Section III – Participants

Name:	**Gunter Ziegenbalg**
Project Role:	President SVTC Solar
Nearest person month worked:	3
Contribution to Project:	Mr Ziegenbalg coordinates the project, is responsible for the business plan, customer interaction, equipment set selection, and general market approach.
Collaborated with individual in foreign country:	Masdar Solar, Buerckle, Trina, Suntech
Country(ies) of foreign collaborator:	Germany, China
Traveled to foreign country:	No
If traveled to foreign country(ies), duration of stay:	0

Name:	**Sanjay Thekdi**
Project Role:	Sr. Engineering & Operations Manager SVTC Solar
Nearest person month worked:	3
Contribution to Project:	Mr. Thekdi coordinates the equipment needs for the project, and is the main technical interface for the communication with the equipment suppliers, customers and facility designers.
Collaborated with individual in foreign country:	No

Name:	**Bryan Wang**
Project Role:	Controller SVTC Solar
Nearest person month worked:	3

Contribution to Project: Mr. Wang coordinates finances for the project, and is the main contact person for all commercial terms with suppliers as well as the government reporting.

Collaborated with individual in foreign country: No

Name: **Gregory Knight**
Project Role: Consultant at PV Tech Group
Nearest person month worked: 1
Contribution to Project: Mr. Knight works on the equipment set selection and supports the layout and facility planning for the factory. He works in close relationship with Mr. Thekdi.

Collaborated with individual in foreign country: No

Name: **Charles Elliott**
Project Role: Facility Manager SVTC
Nearest person month worked: 1
Contribution to Project: Mr. Elliot works on facility planning of the production plant. He works in close relationship with Mr. Thekdi.

Collaborated with individual in foreign country: No

Main Partners involved in the project:

Organization Name: **M+W U.S., Inc. – A Company of the M+W Group**
Location of Organization: San Francisco
Partner's contribution to the project: Manufacturing line planning and permitting

Organization Name: **CaliSolar Inc.**
Location of Organization: Sunnyvale
Partner's contribution to the project: Equipment and know-how provider

Organization Name: **Applied Materials, Inc.**
Location of Organization: Santa Clara
Partner's contribution to the project: Equipment vendor for key equipment for line & automation

Organization Name: **Roth & Rau AG / Meyer Burger AG**
Location of Organization: Hohenstein-Ernstthal, Germany
Partner's contribution to the project: Equipment vendor for metrology and line

Organization Name: **M.E. Baker**
Location of Organization: Boston
Partner's contribution to the project: Equipment vendor for wet chemistry equipment (Inline)

Organization Name: **AB Sandvik Materials Technology**
Location of Organization: Sonora
Partner's contribution to the project: Equipment vendor for Diffusion furnaces

Organization Name: **Chemical Safety Technologies, Inc.**

Location of Organization: San Jose
Partner's contribution to the project: Equipment vendor for wet chemistry equipment (Batch)

Organization Name: **Sematech**
Location of Organization: Albany
Partner's contribution to the project: Partner in PVMI project for coordination of activities in solar

Section IV - Impact

During the quarter under review, SVTC pursued two parallel project paths.

1. As noted above, we continued design and planning work related to constructing the MDF facility to be located at Hellyer Avenue in San Jose, and
2. Pursued a very unique acquisition opportunity.

As noted earlier, the opportunity is to acquire a local company's equipment and operations. The company is a vertically integrated low-cost upgraded metallurgical-grade ("UMG") silicon cell manufacturer. The company's key competence is in manufacturing low-cost UMG polysilicon using its proprietary process, and its goal is to divest of the wafering and cell manufacturing portions of its business.

The wafering line annual capacity is approximately 35 MW, and the cell line is capable of producing 70 MW each year. This capacity represents an increase over SVTC's current plan of record of 10 MW of annual cell capacity. Pursuing the acquisition has the potential to increase SVTC's impact in the marketplace through greater capacity, increased capabilities and accelerated time to market.

The acceleration will allow the MDF to offer services and enable its customers sooner than previously planned. The increased capacity will allow SVTC greater scope to provide pilot and specialty production services thereby directly serving one of the indirect goals of the MDF of enabling US manufacturing. Finally, the addition of the wafering line will allow SVTC to offer ingot growth and wafer sawing capabilities not envisioned in the original proposal.

For item 1, we engaged with M+W Group to prepare and plan the design of the Hellyer site for permitting. We completed a 90% design review of this plan prior to the end of the quarter. Designs are ready to be submitted to local authorities for permitting. The submission for permitting was intentionally put on hold due to the current situation with the potential acquisition.

Section V – Changes/Problems

As noted in the summary in Section I, SVTC pursued a potential acquisition that would, if successful, accelerate the project. Pursuing this acquisition was a calculated risk that was considered worthwhile to pursue by both SVTC and the DOE. SVTC has liaised with the DOE throughout the acquisition process and has kept the Department apprised of developments. In order to control costs, SVTC has limited its activities in developing the site it had previously

procured at Hellyer Avenue. Accordingly, the project is now approximately two months behind schedule.

SVTC's plan is to continue to push for a resolution of the landlord issue noted in Section I for the next 30 days. If SVTC is able to gain sufficient confidence and evidence that any remaining potential obstacles to the acquisition have been addressed, SVTC will continue to pursue the acquisition strategy, thereby accelerating the project's schedule. If however SVTC is unable to obtain sufficient confidence and evidence regarding potential obstacles to the acquisition, it will pursue a build-out of its existing facility with a goal of being ready for a launch in early July 2012.

We are in the process of refining our contingency plans in the event that the proposed acquisition fails to occur. We will update our milestone schedule in early March, once the contingency plans have been completed.

Budget

We have completed a budget based on the facility acquisition scenario and have provided this to the DOE. If the acquisition is unsuccessful, SVTC will revert to its former plan, which will be updated to reflect the changes in timing caused by the delay in pursuing the acquisition. We do not expect the budget revisions to result in significant changes to the project's viability and cost-share expectations.

Section VI – Special reporting requirements

Progress against milestones

We have provided an analysis of the milestones and the progress achieved under separate cover.

Spending against plan

Spending is currently somewhat behind plan. This is largely due to the pursuit of the acquisition opportunity. We do not expect any significant variance in overall spending for the year.

Progress toward achieving financial self-sustainability

It is very early in the life-cycle of the project. The MDF will not be operational until July 2012. However, the results of our market validation efforts and the recognition of $360,000 of revenue in the project's first two quarters provide evidence to help support our goal of financial self-sustainability.

Aggregated user satisfaction performance data

User satisfaction performance measurement techniques and processes tools are to be established in Quarter 7 of the project. We will continue to report upon this reporting requirement and provide updates as appropriate.

Technologies and MDF capabilities currently supported

Although the MDF is not yet operational, SVTC is currently supporting the following technologies in its semiconductor facilities.

Semiconductor Process	Equipment	Application
Oxidation Furnace	AVIZA VTR Oxide1	Hard mask
AMAT Endura for metals deposition	AMAT Endura	Conductive layer
SiON dep on Novellus	Novellus Concept 1	Dielectric deposition
I-Line Litho on ASML	ASML I-Line Litho tool ASM11	Patterning
Dielectric Etch on AMAT MxP	AMAT MxP Centura	Pattern etch
AMAT P5000 PECVD chamber (Fab2)	AMAT P5000	Active material deposition
AMAT Producer PECVD (Fab1)	AMAT Producer	Active material deposition
FSI cleaner	FSI Wet Clean tool	Wafer clean
AMAT P5000 PECVD for a-Si dep	AMAT P5000	Active layer deposition
AMAT Endura for metals deposition	AMAT Endura	Conductive layer
Mattson Spike Anneal	Mattson	Firing
SiN LPCVD Furnace	FUR11	ARC deposition

Planned technologies and MDF capabilities to be supported

The planned technology offerings per our plan of record are set out in the tables below (equipment table and metrology table). Please note that the offerings are subject to satisfactorily concluding a formal agreement with the appropriate tool suppliers and the status of acquisition scenario.

Process Technology/Step	Equipment	Equipment Detail
Incoming wafer test & sort	AMAT	Wafer Inspection System to do: micro-crack, breakage, resistivity, TTV etc.
Texture Etch for Multi-crystalline Si	M.E. Baker – Flex Tool	Four Modules to support; Texture Etch, Edge Isolation, PSG Etch, Polish Etch, surface prep & Clean.
Oxide Wet Etch (PSG Etch)		
Edge Isolation		
Texture Etch for Mono-crystalline Si	Wet Bench (Supplier TBA)	Batch Tool for Mono c-Si Texture
SiN ARC Deposition	Tube PECVD (Supplier TBA)	Batch tool to deposit ARC
Al2O3 Deposition	AMAT PECVD	Advanced passivation deposition tool
Sintering	Belt Furnace (Despatch or BTU)	~1,000 WPH
Screen printing – Ag, Al and Clean	AMAT - Baccini	Baccini Softline with 3 (load + printer + dryer + unload) islands to do Ag, Al and etch paste/dopant printing.
Emitter formation (N - type doping)	Sandvik (previously MRL) Furnace with 4 tubes	4 Tube Gen2 with WTS with BTA Tubes include: POCl3, BBr3, TOX & Anneal. This equipment will do both Phosphorous and Boron doping, PLUS Thermal oxide growth and forming gas anneal.
Emitter formation (P- type doping)		
Thermal Oxidation		
Annealing		
End of Line Cell Inspection	ICOS-KLA	Installed directly on the Spire Test & Sort system
Cell tester & sorter	Spire	Spi-Cell Sorter Rev D 3-10. Test and sort solar cells.
Plating process – Cu/Ni/Sn	Technic	Support LoBaCo roadmap

Metrology	Model	Make
Silicon weight measurement (Pre/Post Texturing)	Analytical Balance	Mettler Toledo
Optical Surface Inspection	Microscope VHX 600	Keyence
Sheet Resistance after Diffusion and PSG Etch	SheerScan /	SunLab
Bath Concentration	Titration Tool T70	Mettler Toledo
Aluminum weight measurement	Precision Balance PB602-S	Mettler Toledo
Silver weight measurement	Precision Balance XS603SDR	Mettler Toledo
Contact Resistance Measurement	CoreScan	SunLab
ARC Thickness and RI measurement	Ellipsometer 400 adv	Sentech SE
Location of short-circuits (shunts)	Shuntometer SISC 704	Pasan
Reflection measurement	Reflectivity tool D8-3	RadiTech
Electroluminescence	Electrolumineszenz	Graphikon
Photoluminescence	Photolumineszenz Nanometrix	BT Imaging
IQE EQE measurement	IQE EQE	PV Measure
Minority carrier Lifetime measurement	Lifetime tester-Sinton-WCT 120	Sinton
Post diffusion process control	Sinton Suns Voc	Sinton
Reflectivity SpectroPhotometer with DRA (diffused reflectance accessory)	Cary 6000i	Agilent
Bond Density Si-H, N-H	Perkin Elmer-FTIR 100	Perkin Elmer
Firing Furnace profiling	Datapaq	Datapaq

Quarter 3 2011- SVTC Solar

Section I – Accomplishments

SVTC Solar is pleased to present its quarterly under the award DE-EE0004948. We welcome the opportunity to share the results of our work and our plans for the future.

During the quarter, SVTC Solar pursued its strategy as set out in the company's Statement of Project Objectives ("SOPO"). Our first two project quarters were devoted to the revalidation of the business approach, final equipment set specifications, and construction preparation. Our third quarter was devoted to initiating and executing our plans. Highlights of the quarter included the following:

Opportunity to acquire an existing facility

As previously reported, SVTC Solar had been engaged in a process to acquire the assets and premises of a local, Sunnyvale-based wafer and cell manufacturer. Although this potential acquisition offered considerable advantages from a cost, technology and business standpoint, we were ultimately unable to conclude a transaction due to the unique terms of the target company's lease agreement.

The lease agreement allowed the landlord to recapture the premises in the event of a request to assign the lease to a third-party. The landlord elected to recapture the building and to lease it to a major Silicon Valley technology company. SVTC was unable to compete with the package provided by the new tenant. The increase in rent made the project less viable than under the original plan.

First Street location

As communicated during the previous two quarters, SVTC Solar began to reconsider the planned equipment set due to the potential difficulty in retaining Roth & Rau as its primary equipment partner. Roth & Rau had experienced financial difficulties and it became difficult for Roth & Rau to continue to meet its obligations under the agreement. SVTC took action to re-evaluate the equipment plan and focused its attention on defining a smaller, more flexible, and operationally less costly tool configuration.

The equipment set that was determined through the above process occupied a much smaller footprint than that initially defined with the Roth & Rau tool set. After conducting further study, SVTC determined that the smaller equipment set could be located at the company's North First Street campus in San Jose. The new site selection allows for the solar clean area to be co-located with SVTC's existing semiconductor clean rooms. This allows for the solar area to utilize many of the existing services located at the facility thereby lowering construction and operating costs from originally planned levels.

Equipment planning and procurement

SVTC Solar was able to make significant progress in defining, sourcing and securing equipment over the last quarter. To date, SVTC has secured substantially all the baseline equipment and some differentiation equipment through purchase orders and supplier agreements. Further details of the status of equipment sourcing are included at Section VI.

Facility design, planning and construction

SVTC has made significant progress in the design, planning and construction phase of the project. The plans for the facility have been completed through “City Phase III” stage with the last stage being “City Phase IV”. In addition, the offices and customer area that previously occupied the space dedicated to the new solar clean area have been relocated, and demolition work on the clean area has commenced.

SVTC continues to pursue its aggressive goal of having a largely operational facility available by July 10, 2012, in order to allow for a launch event to coincide with the Intersolar San Francisco trade show. SVTC Solar will present its capabilities in an exhibitor booth at this show.

Customers

During the course of the last three months we continued to have meetings with potential customers, including identifying and qualifying potential customers that would be required under the acquisition scenario.

SVTC performed development-related work for three customers during the quarter at SVTC’s facilities. The value of the work was approximately $344,000. Further details of customer work are included in Section VI.

People

SVTC ramped its hiring efforts over the last quarter and has built the team to twelve employees. We have now secured capabilities in engineering, production, metrology and sales and marketing. We consider that we have assembled a high-performance team, many of whom had worked together previously at a Sunnyvale-based cell manufacturer, and the team is already engaged in designing the cell line and developing working practices.

The sales and marketing team will be engaged in developing a product marketing strategy as well as initial customer engagements.

Next quarter

Our primary goals for next quarter include: completing construction of development facility; finalizing any outstanding baseline equipment agreements; securing differentiation equipment; and developing facility working practices and procedures as well as a product marketing strategy. We are relying heavily on SVTC in the fields of facility planning and operation as well as equipment validation. We do not currently foresee any difficulties with meeting these milestones.

We are planning to engage with a minimum of three customers next quarter by using existing capabilities and equipment of SVTC Technologies’s facilities.

Section II – Products

SVTC has nothing to report in this section. Given the nature of the project of providing a development facility for use by third-parties, we consider it likely that SVTC may often have no items to report under this section. Nevertheless, reports under this section will be provided as appropriate.

Section III – Participants

Name:	**Gunter Ziegenbalg**
Project Role:	President SVTC Solar
Nearest person month worked:	3
Contribution to Project:	Mr Ziegenbalg coordinates the project, is responsible for the business plan, customer interaction, equipment set selection, and general market approach.
Collaborated with individual in foreign country:	Masdar Solar, Buerckle, Trina, Suntech
Country(ies) of foreign collaborator:	Germany, China
Traveled to foreign country:	No
If traveled to foreign country(ies), duration of stay:	0

Name:	**Sanjay Thekdi**
Project Role:	Sr. Engineering & Operations Manager SVTC Solar
Nearest person month worked:	3
Contribution to Project:	Mr. Thekdi coordinates the equipment needs for the project, and is the main technical interface for the communication with the equipment suppliers, customers and facility designers.
Collaborated with individual in foreign country:	No

Name:	**Bryan Wang**
Project Role:	Controller SVTC Solar
Nearest person month worked:	3
Contribution to Project:	Mr. Wang coordinates finances for the project, and is the main contact person for all commercial terms with suppliers as well as the government reporting.
Collaborated with individual in foreign country:	No

Name:	**Enno Holzenkaempfer**
Project Role:	Customer Program Manager
Nearest person month worked:	3
Contribution to Project:	Mr. Holzenkaempfer coordinates and manages customer programs. He is the main contact person for all customer discussions.
Collaborated with individual in foreign country:	No

Name:	**Gregory Knight**
Project Role:	Consultant at PV Tech Group
Nearest person month worked:	1
Contribution to Project:	Mr. Knight works on the equipment set selection and supports the layout and facility planning for the factory. He works in close relationship with Mr. Thekdi.
Collaborated with individual in foreign country:	No

Name:	**Charles Elliott**
Project Role:	Facility Manager SVTC
Nearest person month worked:	2
Contribution to Project:	Mr. Elliot works on facility planning of the production plant. He works in close relationship with Mr. Thekdi.
Collaborated with individual in foreign country:	No

Main Partners involved in the project:

Organization Name:	**Advanced Design Consultants**
Location of Organization:	San Jose
Partner's contribution to the project:	Manufacturing line planning and permitting

Organization Name:	**CaliSolar Inc.**
Location of Organization:	Sunnyvale
Partner's contribution to the project:	Equipment and know-how provider

Organization Name:	**Applied Materials, Inc.**
Location of Organization:	Santa Clara
Partner's contribution to the project:	Equipment vendor for key equipment for line & automation

Organization Name:	**Roth & Rau AG / Meyer Burger AG**
Location of Organization:	Hohenstein-Ernstthal, Germany
Partner's contribution to the project:	Equipment vendor for metrology and line

Organization Name:	**M.E. Baker**
Location of Organization:	Boston
Partner's contribution to the project:	Equipment vendor for wet chemistry equipment (Inline)

Organization Name:	**AB Sandvik Materials Technology**
Location of Organization:	Sonora, California
Partner's contribution to the project:	Equipment vendor for diffusion furnaces

Organization Name:	**Chemical Safety Technologies, Inc.**
Location of Organization:	San Jose
Partner's contribution to the project:	Equipment vendor for wet chemistry equipment (Batch)

Organization Name:	**Despatch Industries, Inc.**
Location of Organization:	Minnesota
Partner's contribution to the project:	Equipment vendor for sintering furnace

Organization Name:	**Sematech**
Location of Organization:	Albany
Partner's contribution to the project:	Partner in PVMI project for coordination of activities in solar

Section IV - Impact

Following are the key items that we would like to mention with respect to the impact in this quarter.

Location of MDF

As noted above, SVTC has commenced construction work at its existing North San Jose facility. This location offers several benefits over the Hellyer facility: lower construction costs; lower operating costs; and enhanced operational efficiencies with the existing semiconductor business. We consider that these benefits will allow the project to invest in other areas, such as a module line, and increases the probability of the project's ultimate success.

Finalized equipment set

The equipment set is now final. We have placed agreements in place with Baker Solar, Chemical Safety Technologies, Despatch Industries and others. We are finalizing agreements with Sandvik, Applied Materials, and Spire.

Commenced facilities construction

We have completed phase I of the design and build-out plan and have relocated the office and customer areas to allow for construction of the development ballroom. We have submitted building permit applications for phase II and have commenced demolition.

Hired engineering and operations staff

We interviewed, selected, and issued offer letters to key engineering and operations staff for the MDF. The majority of these hires were discussed during our monthly reporting conference call. These new hires have now joined SVTC Solar (the last four joined on Monday, Apr 30th). All of the new employees possess solid c-Si PV manufacturing and technology development experience.

Identified a target for module development, fabrication and reliability testing

We have identified D2 Solar as a potential acquisition target. The company provides development, small-scale sample production and reliability testing services to module developers. We are currently in negotiations with the company. Our ideal scenario would be to purchase D2 Solar for a mixture of cash and shares in SVTC Solar.

Section V – Changes/Problems

As discussed with DOE during the quarter, SVTC was unsuccessful in its efforts to acquire an existing wafer and cell line based in Sunnyvale. The landlord of the property was in a unique position to reclaim the building and lease it to a third-party. The landlord elected to recapture the premises and leased them to a major consumer electronics firm. SVTC was unable to compete in the market for this property as the asking rental rate made the project uneconomic.

As noted in Section I, SVTC continued its re-examination of the equipment set as necessitated by the unwillingness of Roth & Rau to fulfill its obligations under the partnership agreement. SVTC ultimately defined a smaller, more flexible tool set for the MDF. This tool set required a much smaller footprint than the tools proposed by Roth & Rau. Upon further examination, SVTC concluded that the optimal solution would be to locate the MDF in its existing

semiconductor facility in North San Jose. This site allows SVTC to leverage its existing facilities infrastructure to reduce both construction and operating costs.

Construction on this site has commenced. Plans have been submitted to the City of San Jose, and demolition work in the development area is underway.

SVTC is continuing to work with PG&E in support of the utility's application to the California Public Utilities Commission ("CPUC") that would allow it to invest in SVTC Solar. This $9.9 million investment forms a key component of SVTC's planned cost-share funds. PG&E's application has met with some resistance from consumer advocacy groups. SVTC is working through the CPUC process to increase the attractiveness of PG&E's application. SVTC recently offered to increase the equity interest to be held by PG&E by more than 25% and it also offered to re-institute the education and training initiatives that were included in SVTC's original application. PG&E's application concerning SVTC is scheduled for a vote at the May 10th CPUC meeting.

Budget

We have recently completed a budget based on the current facility location and have provided this to the DOE.

Section VI – Special reporting requirements

Progress against milestones

We have provided an analysis of the milestones and the progress achieved under separate cover.

Spending against plan

Spending is currently somewhat behind plan. This is largely due to the pursuit of the acquisition opportunity. We do not expect any significant variance in overall spending for the year.

Progress toward achieving financial self-sustainability

It is very early in the life-cycle of the project. The MDF will not be operational until July 2012. However, the results of our market validation efforts and the recognition of $724,000 of revenue in the project's first three quarters provide evidence to help support our goal of financial self-sustainability.

Aggregated user satisfaction performance data

User satisfaction performance measurement techniques and processes tools are to be established in Quarter 7 of the project. We will continue to report upon this reporting requirement and provide updates as appropriate.

Technologies and MDF capabilities currently supported

Although the MDF is not yet operational, SVTC is currently supporting the following technologies in its semiconductor facilities.

Semiconductor Process	Equipment	Application
Oxidation Furnace	AVIZA VTR Oxide1	Hard mask
AMAT Endura for metals deposition	AMAT Endura	Conductive layer
SiON dep on Novellus	Novellus Concept 1	Dielectric deposition
I-Line Litho on ASML	ASML I-Line Litho tool ASM11	Patterning
Dielectric Etch on AMAT MxP	AMAT MxP Centura	Pattern etch
AMAT P5000 PECVD chamber (Fab2)	AMAT P5000	Active material deposition
AMAT Producer PECVD (Fab1)	AMAT Producer	Active material deposition
FSI cleaner	FSI Wet Clean tool	Wafer clean
AMAT P5000 PECVD for a-Si dep	AMAT P5000	Active layer deposition
AMAT Endura for metals deposition	AMAT Endura	Conductive layer
Mattson Spike Anneal	Mattson	Firing
SiN LPCVD Furnace	FUR11	ARC deposition

Planned technologies and MDF capabilities to be supported

The planned technology offerings per our plan of record are set out in the tables below (equipment table and metrology table). Please note that the offerings are subject to satisfactorily concluding a formal agreement with certain tool suppliers.

Process Technology/Step	Equipment	Equipment Detail
Incoming wafer test & sort	Jonas & Redmann WIS	Wafer Inspection System to do: micro-crack, breakage, resistivity, TTV etc.
Texture Etch for Multi-crystalline Si	M.E. Baker – Flex Tool	Four Modules to support; Texture Etch, Edge Isolation, PSG Etch, Polish Etch, surface prep & Clean.
Oxide Wet Etch (PSG Etch)		
Edge Isolation		
Texture Etch for Mono-crystalline Si	Chemical Safety Technologies	Batch Tool for Mono c-Si Texture
Emitter formation (N - type doping)	Sandvik (previously MRL) Furnace with 4 tubes	4 Tube Gen2 with WTS with BTA Tubes include: POCl3, BBr3, TOX & Anneal. This equipment will do both Phosphorous and Boron doping, PLUS Thermal oxide growth and forming gas anneal.
Emitter formation (P- type doping)		
Thermal Oxidation		
Annealing		
SiN ARC Deposition	Centrotherm PECVD Furnace	Batch tool to deposit ARC
Screen printing – Ag, Al and Clean	AMAT – Baccini (3 print islands)	Baccini Softline with 3 (load + printer + dryer + unload) islands to do Ag, Al and etch paste/dopant printing.
Sintering	Despatch Firing Furnace	Advanced belt design to reduce marks
Cell tester & sorter	Spire	Spi-Cell Sorter Rev D 3-10. Test and sort solar cells.
a-Si PECVD Deposition	AMAT 4300 PECVD	Capable of depositing a-Si for Si HJT cells and advanced frontside passivation of standard cells
Plating process – Cu/Ni/Sn	Technic	Support LoBaCo roadmap

Metrology	Model	Make
Minority carrier Lifetime measurement	Lifetime tester-Sinton-WCT 120	Sinton
Post diffusion process control	Sinton Suns Voc	Sinton
Optical surface inspection	Nikon Optiphot 66 with camera	Nikon
Silicon weight measurement	Mettler Toledo-XP205DR	Mettler Toledo
Acid concentration	Mettler Toledo - Titration Tool-T70	Mettler Toledo
Aluminum weight measurement	Mettler Toledo-XP 802S	Mettler Toledo
Silver weight measurement	Mettler Toledo-XB 603-S	Mettler Toledo
To measure thickness, refractive index and extinction coefficient of thin layers	Spectroscopic Ellipsometer - Sentech S800pv	Sentech
Firing Furnace profiling	Datapaq	Datapaq
IQE / EQE / Reflectance	PV Measurements - QEX10 or QEX7	PV Measurements
Solar cell stand alone I-V tester	PV Measurements IV-16L	*Use D2Solar*
Measure height and width of the fingers	Dektak profilometer 3030	Dektak
Electroluminescence	Electroluminescence	*Use D2Solar*
Shunt detection	Shuntometer	Pasan
Bulk resistivity and sheet resistance	Jandel four point probe RM3000	Jandel
Adhesion strength tester (pull tester)	Pull tester	*Use D2Solar*
3D Microscopy and Analysis	Dual Beam FIB	FEI
Element concentration in bulk Si	Glow Discharge Mass Spectroscopy	TBD

Quarter Ending June 30, 2012- SVTC Solar

Section I – Accomplishments

SVTC Solar is pleased to present its quarterly report under the award DE-EE0004948. We welcome the opportunity to share the results of our work and our plans for the future.

During the quarter, SVTC Solar pursued its strategy as set out in the company's Statement of Project Objectives ("SOPO"). Our previous project quarters were devoted to the revalidation of the business approach, final equipment set specifications, and construction preparation. The past quarter was devoted to finishing facility demolition, commencement of build-out, signing of initial contracts, and hiring key personnel. Highlights of the quarter included the following:

First Street location

As summarized in our prior quarter report, our original equipment supplier, Roth & Rau, was unable to meet their commitment to SVTC Solar. SVTC Solar took action to re-evaluate the equipment plan and focused its attention on defining a smaller, more flexible, and operationally less costly tool configuration at our North First Street location. The new site selection allows for the solar clean area to be co-located with SVTC Technologies' existing semiconductor infrastructure. This allows for the solar area to utilize many of the existing services located at the facility thereby lowering construction and operating costs from originally planned levels.

Facility design, planning and construction

SVTC Solar has made significant progress in the design, planning and construction phase of the project. All plans were approved by the city, and we have secured all of the necessary permits to begin construction of the facility. The offices and customer area that previously occupied the space dedicated to the new solar clean area have been relocated; demolition work on the clean area was completed; and the build-out of the MDF is in process. As explained to the DOE in our July 3rd phone call, we were unable to meet a planned July 10 launch date as we were managing with the effects of the PG&E funding shortfall.

In spite of this delay, SVTC Solar continues to pursue its aggressive goal of having a fully operational facility available by September 27, 2012, commensurate with the end of Budget period 1, and to meet all Budget period 1 milestones as planned. In order to reach this goal, we will have each individual process module qualified by mid-September to accommodate initial customers.

Equipment planning and procurement

SVTC Solar was able to make significant progress in defining, sourcing and securing equipment over the last quarter. The company has secured substantially all the baseline equipment and some differentiation equipment through purchase orders and supplier agreements. Our Despatch furnace has been delivered and is in our possession. Spire, Chemical Safety, ME Baker, Applied Materials and other cell baseline process equipment are planned to be delivered by August 17th, as per current plan. A technology differentiation tool, Sandvik MRL furnace, is scheduled to be installed prior to the end of budget period 1. Additionally, some of the test & measurement (Metrology) tools have also been delivered to SVTC Solar. Further details of the status of equipment sourcing are included at Section VI.

In addition, we have been able to integrate our procurement of gases, water, personal protective equipment, etc with the fabrication facilities of SVTC Technologies. All one-time expenses are scheduled to be completed by early September.

Customers

During the course of the last three months, we have been diligently pursuing customers. The following table summarizes our more significant customer opportunities. We consider that we should be able to close two to five customer agreements by the end of budget period 1. We were able to sign Applied Materials (AMAT) as a key customer for using our facility. AMAT will transfer all of its development work on hetero-junction cells to SVTC and will subsequently refer all potential hetero-junction customers to SVTC for demonstrations and technology development

Account Name	Opportunity	Status
1366 Technologies	**Cell process development & validation**	**NDA pending. Proposal pending.**
Air Products and Chemicals, Inc	Organo-silane precursor evaulation via PECVD	NDA / Budgetary Proposal stage.
Alta Devices	**Cell development support svcs.**	**Support services discussions.**
AMAT - Solar	Cell process development & validation	Master agreement in place. Booked.
AstroWatt, Inc	**Cell optimization / Pilot**	**NDA pending. Proposal pending.**
ATMI	Process chemical development	Commercial discussions in progress.
Bandgap Engineering, Inc.	**Wafer processing / cell conversion**	**Preparing proposal.**
Crystal Solar	Cell development / support svcs.	Discovery meeting set.
Dupont	**PV solar materials / DOE program**	**DuPont mgmnt visit mid-August @ SVTC Solar**
Hanwha Solar America LLC	Cell efficiency development / POC	New. Discussions ongoing.
Honeywell Electronic Materials	**PV cell & modules materials dev.**	**NDA in place. Early AUG Meetings.**
Impel	Cell development / pilot mfg.	Program approved. Funding pending.
Intevac	**Eng. services / wafer runs**	**Commercial discussions in progress.**
JA Solar USA, Inc.	Cell process development & validation	CTO visit early Sept.
Lockheed Martin Solar	**PV paste development / nanocopper particle base**	**Initial discussions started.**
MEMC Electronic	PV Materials Dev.	New. Follow up from Intersolar req'd - ongoing.
Praxair, Inc.	**Gas precursor evaluation**	**Ongoing discussions.**
REC	Cell development / support svcs.	New opportunity.
Skyline Solar	**Cell development / CPV**	**Initial dicussions early AUG.**
Solar Energy Consortium	Cell process development & validation	Sunshot program partnering.
Suniva	**Cell development / pilot mfg.**	**Discussions ongoing. MDF timing.**
Technic, Inc.	Copper plating optimization	Discussions ongoing.
TetraSun	**Cell dev + Pilot mfg.**	**High interest. Project reviews early AUG.**
Transform Solar	Cell pilot production	Discussions ongoing.
Translucent Inc.	**Tool hosting + process dev.**	**Ongoing discussions.**
Trina	Cell development / pilot mfg.	Exec level discussions.

We have accelerated our customer engagement strategy as follows:

- All known contacts were uploaded into our Customer Relationship Management (CRM) system for engagement development / tracking (approximately 75 customers / 200 contacts)
- Prospective Tier I PV manufacturer clients have been engaged or are being contacted directly by executive management

- We attended Intersolar 2012 and achieved the following: booth presence, company presentation by our President at the show, direct email campaign run the last 2 weeks announcing our presence, etc.
- Completed outbound marketing: Web site / collateral was prepared specifically for Intersolar.

In addition to focusing on acquiring large-scale customers for the MDF, we have continued to engage solar customers during the quarter at SVTC Technologies' semiconductor facilities.

People

We had a focused hiring effort over the last quarter and have built the team to sixteen employees. We have now secured capabilities in engineering, production, metrology and sales and marketing. We consider that we have assembled a high-performance team, many of whom had worked together previously at a Sunnyvale-based cell manufacturer, and the team is already engaged in designing the cell line and developing working practices. A full list of associated personnel is included in the appendix.

The sales and marketing team will be engaged in developing a product marketing strategy as well as initial customer engagements. The engineering team is now committed to equipment inspection, qualification and delivery. The development and management team are exploring funding options (State and private) after PG&E was denied the ability to invest $9.9M of ratepayer funds in the MDF project (more below).

Product marketing

We also increased our marketing efforts by attending the DOE Sunshot event in Denver, and we were an exhibitor at Intersolar North America in San Francisco (July 10-12). For this event, we distributed "tri-folds" that outline our services and capabilities and constructed a booth. In preparation for the event, we sent invitations to over 300 potential customers and over 15,000 electronic mails based on Intersolar's mailing list. In addition, we are planning press releases related to our partnerships with Applied Materials and other tool suppliers and to announce the [illegible] our team.

Artist's rendition of SVTC Solar booth for Intersolar

Next quarter

Our primary goals for next quarter include:

- Completing construction of development facility
- Delivery and acceptance of baseline toolset
- Definition and qualification of baseline process flows for mono & poly silicon cells
- Securing differentiation equipment
- Signing initial contracts with development customers
- Securing module development capabilities
- Developing facility working practices and procedures as well as product marketing strategies.

We are relying heavily on SVTC Technologies for future facility planning and operation as well as equipment validation. We do not currently foresee major difficulties with meeting these milestones.

We are planning to secure between two and five customers by the end of next quarter. In addition, we will use D2 Solar as a subcontractor for module development and reliability services while we further negotiate an acquisition. We will also be preparing for our Stage Gate Review, scheduled for August.

Section II – Products

SVTC Solar has nothing to report in this section. Given the nature of the project of providing a development facility for use by third-parties, we consider it likely that SVTC Solar may often have no items to report under this section. Nevertheless, reports under this section will be provided as appropriate.

Section III – Participants

Name:	**Gunter Ziegenbalg**
Project Role:	President SVTC Solar
Nearest person month worked:	3
Contribution to Project:	Mr. Ziegenbalg coordinates the project, is responsible for the business plan, customer interaction, equipment set selection, and general market approach.
Collaborated with individual in foreign country:	No

Name:	**Sanjay Thekdi**
Project Role:	Director of Solar Operations, SVTC Solar
Nearest person month worked:	3
Contribution to Project:	Mr. Thekdi coordinates the equipment needs for the project, and is the main technical interface for the communication with the equipment suppliers, customers and facility designers.

Collaborated with individual in foreign country: No

Name: **Bryan Wang**
Project Role: Controller SVTC Solar
Nearest person month worked: 3
Contribution to Project: Mr. Wang coordinates finances for the project, and is the main contact person for all commercial terms with suppliers as well as the government reporting.

Collaborated with individual in foreign country: No

Name: **Enno Holzenkaempfer**
Project Role: Customer Program Manager
Nearest person month worked: 3
Contribution to Project: Mr. Holzenkaempfer coordinates and manages customer programs. He is the main contact person for all customer discussions.

Collaborated with individual in foreign country: No

Name: **Richard Yerman**
Project Role: Sales Manager
Nearest person month worked: 3
Contribution to Project: Mr. Yerman coordinates all of our sales efforts. He is the main contact person for all new customer introductions.

Collaborated with individual in foreign country: No

Name: **Siamak Sani**
Project Role: Senior Manager, Product Marketing
Nearest person month worked: 3
Contribution to Project: Mr. Sani coordinates and manages our marketing and sales efforts. He is the main contact person for trade shows, hand-outs, and website design.

Collaborated with individual in foreign country: No

Name: **Kamel Ounadjela**
Project Role: CTO
Nearest person month worked: 1
Contribution to Project: Mr. Ounadjela manages our efforts in our comprehensive clean energy efforts. He is the main contact person for strategic engagements and outdoor testing facility.

Collaborated with individual in foreign country: ALG Solar, UPAC,
Country(ies) of foreign collaborator: Algeria, Morroco
Traveled to foreign country: Yes
If traveled to foreign country(ies),

duration of stay: 4 weeks

Name: **Gregory Knight**
Project Role: Consultant at PV Tech Group
Nearest person month worked: 1
Contribution to Project: Mr. Knight works on the equipment set selection and supports the layout and facility planning for the factory. He works in close relationship with Mr. Thekdi.

Collaborated with individual in foreign country: No

Name: **Charles Elliott**
Project Role: Facility Manager SVTC Technologies
Nearest person month worked: 2
Contribution to Project: Mr. Elliot works on facility planning of the production plant. He works in close relationship with Mr. Thekdi.

Collaborated with individual in foreign country: No

Main Partners involved in the project:

Organization Name: **Advanced Design Consultants**
Location of Organization: San Jose
Partner's contribution to the project: Manufacturing line planning and permitting

Organization Name: **Applied Materials, Inc.**
Location of Organization: Santa Clara
Partner's contribution to the project: Equipment vendor for key equipment for line & automation

Organization Name: **M.E. Baker**
Location of Organization: Boston
Partner's contribution to the project: Equipment vendor for wet chemistry equipment (Inline)

Organization Name: **AB Sandvik Materials Technology**
Location of Organization: Sonora, California
Partner's contribution to the project: Equipment vendor for diffusion furnaces

Organization Name: **Chemical Safety Technologies, Inc.**
Location of Organization: San Jose
Partner's contribution to the project: Equipment vendor for wet chemistry equipment (Batch)

Organization Name: **Despatch Industries, Inc.**
Location of Organization: Minnesota
Partner's contribution to the project: Equipment vendor for sintering furnace

Organization Name: **Sematech**
Location of Organization: Albany

Partner's contribution to the project: Partner in PVMI project for coordination of activities in solar

Section IV – Impact

Following are the key items that we would like to mention with respect to the impact in this quarter.

Finalized equipment set

The equipment set is now final. We have placed agreements in place with Applied Materials, Baker Solar, Chemical Safety Technologies, Despatch Industries and others. We are finalizing agreements with Sandvik and Spire.

Completed facilities demolition and commenced construction

All plans have been approved by the city of San Jose for our North First Street location. We have completed demolition, and commenced facilities construction and tool delivery.

Hired engineering and operations staff

We have brought on a total of sixteen key personnel onto our marketing, engineering and operations staff for the MDF. These new hires have now joined SVTC Solar (the last joined on June 19, 2012). All of the new employees possess solid c-Si PV industry experience.

On-going negotiations with D2 solar

Last quarter, we identified D2 Solar as a potential acquisition target to bring in module development, fabrication, and reliability testing capabilities. The company provides development, small-scale sample production and reliability testing services to module developers. By early September, we will begin subcontracting module development services through D2. By the end of October, we plan to purchase D2 Solar for a mixture of cash and shares in SVTC Solar. With D2 comes a solid customer base and trained staff.

Section V – Changes/Problems

Although the company had to delay its planned launch event, scheduled for July 10, due to the situation regarding the CPUC (see below), construction of the MDF continues. Plans have been approved by the City of San Jose, and demolition work in the development area is complete. We consider that the MDF will be operational by the end of September.

As stated above, the California Public Utilities Commission (“CPUC”) denied PG&E permission to invest rate-payer funds in SVTC Solar. This $9.9 million investment forms a key component of SVTC Solar’s planned cost-share funds. SVTC Solar is working directly with the Governor’s office and the CPUC in parallel to procure the funds from an alternative source.

In parallel, SVTC Technologies is exploring private funds. We have engages with Savvian Bank and BG Partners. We are also pursuing a more strategic approach by approaching large-scale customers for pre-payments and strategic investors such as contract manufacturers (Celestica & Flextronics).

In case the company is unable to secure third-party funds, SVTC Solar's parent, SVTC Technologies LLC, company committed in meetings with DOE representatives that it will provide non-federal funds to meet the project's cost share requirements.

Budget

We have recently completed a revised budget based on the current facility location and the withdrawal of Roth & Rau from the project and are working with the DOE to finalize the revised budget.

Section VI – Special reporting requirements

Progress against milestones

We have provided an analysis of the milestones and the progress achieved under separate cover.

Spending against plan

Spending is currently somewhat behind plan. This is largely due to the smaller facility footprint and North First Street location. We do not expect any significant variance in overall spending for the year.

Progress toward achieving financial self-sustainability

It is early in the life-cycle of the project. The MDF will not be operational until September 2012. However, the results of our market validation efforts provide evidence to help support our goal of financial self-sustainability.

Aggregated user satisfaction performance data

User satisfaction performance measurement techniques and processes tools are to be established in budget period 2 of the project. We will continue to report upon this reporting requirement and provide updates as appropriate.

Technologies and MDF capabilities currently supported

Although the MDF is not yet operational, SVTC Solar is currently supporting the following technologies in its semiconductor facilities for existing solar customers (Bloo Solar, MTPV, Sionyx, Solargreen, etc.). In parallel, we have established a protocol for transferring solar-grade silicon wafers between the semiconductor and solar clean areas and are in the process of writing standard operating procedures for specific tools.

Semiconductor Process	Equipment	Application
Oxidation Furnace	AVIZA VTR Oxide1	Hard mask
AMAT Endura for metals deposition	AMAT Endura	Conductive layer
SiON dep on Novellus	Novellus Concept 1	Dielectric deposition
I-Line Litho on ASML	ASML I-Line Litho tool ASM11	Patterning
Dielectric Etch on AMAT MxP	AMAT MxP Centura	Pattern etch
AMAT P5000 PECVD chamber (Fab2)	AMAT P5000	Active material deposition
AMAT Producer PECVD (Fab1)	AMAT Producer	Active material deposition
FSI cleaner	FSI Wet Clean tool	Wafer clean
AMAT P5000 PECVD for a-Si dep	AMAT P5000	Active layer deposition
AMAT Endura for metals deposition	AMAT Endura	Conductive layer
Mattson Spike Anneal	Mattson	Firing
SiN LPCVD Furnace	FUR11	ARC deposition

Planned technologies and MDF capabilities to be supported

The planned technology offerings per our plan of record are set out in the tables below (equipment table and metrology table). Most of these tools are ordered and will be delivered by August 17th. Installation of the equipment will be completed in 2 to 3 weeks following this. The advanced tools in red are scheduled to be delivered in October/November and will be available for customer use by early December.

Process Technology/Step	Equipment	Equipment Detail
Incoming wafer test & sort	Jonas & Redmann WIS	Wafer Inspection System: check micro-crack, breakage, resistivity, TTV etc.
Texture Etch for Multi-crystalline Si	M.E. Baker – Flex Tool	Four Modules to support; Texture Etch, Edge Isolation, PSG Etch, Polish Etch, surface prep & Clean.
Oxide Wet Etch (PSG Etch)		
Edge Isolation		
Texture Etch for Mono-crystalline Si	Chemical Safety Technologies	Batch Tool for Mono c-Si Texture
Emitter formation (N - type doping)	Sandvik (previously MRL) Furnace with 4 tubes	4 Tube Gen2 with WTS with BTA Tubes include: POCl3, BBr3, TOX & Anneal. This equipment will do both Phosphorous and Boron doping, PLUS Thermal oxide growth and forming gas anneal.
Emitter formation (P- type doping)		
Thermal Oxidation		
Annealing		
Laser Edge Isolation	InnoLas Laser Systems	Laser system for edge isolation and wrap-through technologies
SiN ARC Deposition	Centrotherm PECVD Furnace	Batch tool to deposit ARC
Screen printing – Ag, Al and Clean	AMAT – Baccini (3 print islands)	Baccini Softline with 3 (load + printer + dryer + unload) islands to do Ag, Al and etch paste/dopant printing.
Sintering	Despatch Firing Furnace	Advanced belt design to reduce marks
Cell tester & sorter	Spire	Spi-Cell Sorter Rev D 3-10. Test and sort solar cells.
a-Si PECVD Deposition	AMAT 4300 PECVD	Capable of depositing a-Si for Si HJT cells and advanced frontside passivation of standard cells
Plating process – Cu/Ni/Sn	Technic	Support LoBaCo roadmap

Process Technology/Step	Tool	Supplier
Minority carrier Lifetime measurement	Lifetime tester-Sinton-WCT 120	Sinton
Post diffusion process control	Sinton Suns Voc	Sinton
Optical surface inspection	Nikon Optiphot 66 with camera	Nikon
Silicon weight measurement	Mettler Toledo-XP205DR	Mettler Toledo
Acid concentration	Mettler Toledo - Titration Tool-T70	Mettler Toledo
Aluminum weight measurement	Mettler Toledo-XP 802S	Mettler Toledo
Silver weight measurement	Mettler Toledo-XB 603-S	Mettler Toledo
Measure thickness, refractive index and extinction coefficient of thin layers	Spectroscopic Ellipsometer - Sentech S800pv	Sentech
Firing Furnace profiling	Datapaq	Datapaq
IQE / EQE / Reflectance	PV Measurements - QEX10 or QEX7	PV Measurements
Solar cell stand alone I-V tester	PV Measurements IV-16L	PV Measurements
Measure height and width of the fingers	Dektak profilometer 3030	Dektak
Electroluminescence	Electroluminescence	Spire
Shunt detection	Shuntometer	Pasan
Bulk resistivity and sheet resistance	Jandel four point probe RM3000	Jandel
Adhesion strength tester (pull tester)	Pull tester	Pasan

Quarter Ending September 30, 2013- SVTC Solar

Explanatory note

The award recipient, SVTC Technologies, LLC, became financially distressed during the period under review. SVTC Technologies notified the DOE of its distressed state during the quarter reviewed, and the DOE suspended payments in respect of the award immediately following receipt of this notice. SVTC Technologies, LLC entered into an Assignment for the Benefit of Creditors on October 15, 2012, and the company is now being operated by an Assignee whose fiduciary responsibility is to liquidate assets to raise cash to fund claims of creditors.

SVTC Solar, Inc, the company operationally responsible for completion of the DOE project, has been impacted by these events. Progress on the facility construction was suspended as were engagements with prospective customers. SVTC Solar is currently engaged in identifying and securing a project sponsor to continue the work under the DOE award.

Given the status of the project and the effects that the DOE funding suspension has had upon it, the reporting for this period will not be completed until such time as SVTC Solar has secured a sponsor to enable the project's continuation.

Quarter Ending April 2013- The Foundation

Section I – Accomplishments

CNSE MDF is pleased to present its quarterly under the award DE-EE0004948. We welcome the opportunity to share the results of our work and our plans for the future.

During the quarter, CNSE MDF pursued its strategy as set out in the company's Statement of Project Objectives ("SOPO"). Highlights of the quarter included the following:

Relocation of SVTC Solar fab

All Solar Fab equipment was decommissioned & transferred from San Jose, CA to Rochester, NY
The SVTC facility was closed & handed over to DSI on 2/28/13

New Solar Fab location at 115 Canal Landing Blvd., Rochester, NY

CNSE MDF acquired a former Kodak facility at 155 Canal Landing Blvd., Rochester. It was built in 1996 and thoroughly renovated in 2001, and again in 2005. This 57,000 square foot R&D property is comprised of office, clean room, lab, and manufacturing space.

Equipment planning and procurement

To date, CNSE MDF has secured substantially all the baseline equipment and some differentiation equipment from SVTC. Further details of the status of equipment sourcing are included at Section VI.

Facility design, planning and construction

CNSE MDF contracted Bergmann Associates to provide architectural and engineering services to construct the new solar fab. Start for construction is being planned for Q2 with the demolishing of unwanted parts in the existing building. CNSE MDF continues to pursue its aggressive goal of having a baseline process qualified by November 15, 2013.

Customers

CNSE MDF is in the process of re-engaging multiple partners for the MDF. Surveys were sent out in mid-March, 2013 to all firms indicated in SVTC documentation as being interested in utilizing MDF capabilities. Thirty (30) surveys were distributed, six (6) were returned. Of those six, three firms continue to be interested in utilizing the MDF, 2 are likely interested once the infrastructure is in place and operating, and several firms are no longer involved in the solar industry. Those still interested in participating with the MDF at some stage included Solar 3D, Bandgap Engineering, Banyan Energy, Caelux Solar, and MTPV.

In addition, meetings have taken place, and an MOU is in process of development with Solar Science, Celestica, both located outside of Toronto, Ontario and a potential joint partnership with V3 Solar from Los Angeles, CA.

Additional outreach activities will continue to occur as the MDF facility design and construction is ongoing.

People

Presently leveraging key staff and technical positions from CNSE STC facility in the Rochester region to continue program progress, these resources include Facilities, Process integration review, HR, and equipment maintenance.

Next quarter

Our primary goals for next quarter include: staffing fulfillment; starting construction of development facility; finalizing any outstanding baseline equipment agreements; securing differentiation equipment; and developing facility working practices and procedures as well as a product marketing strategy.

Section II – Products

CNSE MDF has nothing to report in this section. Given the nature of the project of providing a development facility for use by third-parties, we consider it likely that CNSE MDF may often have no items to report under this section. Nevertheless, reports under this section will be provided as appropriate.

Section III – Participants

Name: **Paul R Tolley**
Project Role: CNSE VP Disruptive Technologies & Ex. Dir. STC.

Nearest person month worked:
Contribution to Project: Mr. Tolley coordinates the project, is responsible for the business plan, customer interaction, equipment set selection, and general market approach.

Collaborated with individual in Foreign country: N/A
Country(ies) of foreign collaborator: N/A
Traveled to foreign country: N/A
If traveled to foreign country(ies), duration of stay: N/A

Name: **Enno Holzenkaempfer**
Project Role: Program Manager
Nearest person month worked:
Contribution to Project: Mr. Holzenkaempfer oversees and leads process development plans and projects to support the development and operational efforts. Mr. Holzenkaempfer coordinates and manages customer programs. He as well provides the government reporting.

Collaborated with individual in Foreign country: No

Name: **Rebecca Lathrop**

Project Role: Director of EHS & Facilities
Nearest person month worked:
Contribution to Project: Ms. Lathrop is the project manager for the facilities construction of the production line. She works closely with the A&E and Construction management firms to ensure process design needs are met.

Collaborated with individual in Foreign country: No

Main Partners involved in the project:

CNSE MDF is in the process of re-engaging multiple partners for the MDF. Surveys were sent out in mid-March, 2013 to all firms indicated in SVTC documentation as being interested in utilizing MDF capabilities. Thirty (30) surveys were distributed, six (6) were returned. Of those six, three firms continue to be interested in utilizing the MDF, 2 are likely interested once the infrastructure is in place and operating, and one firm is no longer involved in the solar industry. Those still interested in participating with the MDF at some stage included Solar 3D, Bandgap Engineering, Banyan Energy, Caelux Solar, and MTPV.

In addition, meetings have taken place, and an MOU is in process of development with Solar Science located outside of Toronto, Ontario with an additional joint partnership with V3 Solar

from Los Angeles, CA.

Additional outreach activities will continue to occur as the MDF facility design and construction is ongoing.

Organization Name:	**Bergmann Associates**
Location of Organization:	Rochester, NY
Partner's contribution to the project:	Manufacturing line planning and permitting

Organization Name:	**Applied Materials, Inc.**
Location of Organization:	Santa Clara
Partner's contribution to the project:	Equipment vendor for key equipment for line & automation

Organization Name:	**Roth & Rau AG / Meyer Burger AG**
Location of Organization:	Hohenstein-Ernstthal, Germany
Partner's contribution to the project:	Equipment vendor for metrology and line

Organization Name:	**M.E. Baker**
Location of Organization:	Boston
Partner's contribution to the project:	Equipment vendor for wet chemistry equipment (Inline)

Organization Name:	**AB Sandvik Materials Technology**
Location of Organization:	Sonora, California
Partner's contribution to the project:	Equipment vendor for diffusion furnaces

Organization Name:	**Chemical Safety Technologies, Inc.**
Location of Organization:	San Jose
Partner's contribution to the project:	Equipment vendor for wet chemistry equipment (Batch)

Organization Name:	**Despatch Industries, Inc.**
Location of Organization:	Minnesota
Partner's contribution to the project:	Equipment vendor for sintering furnace

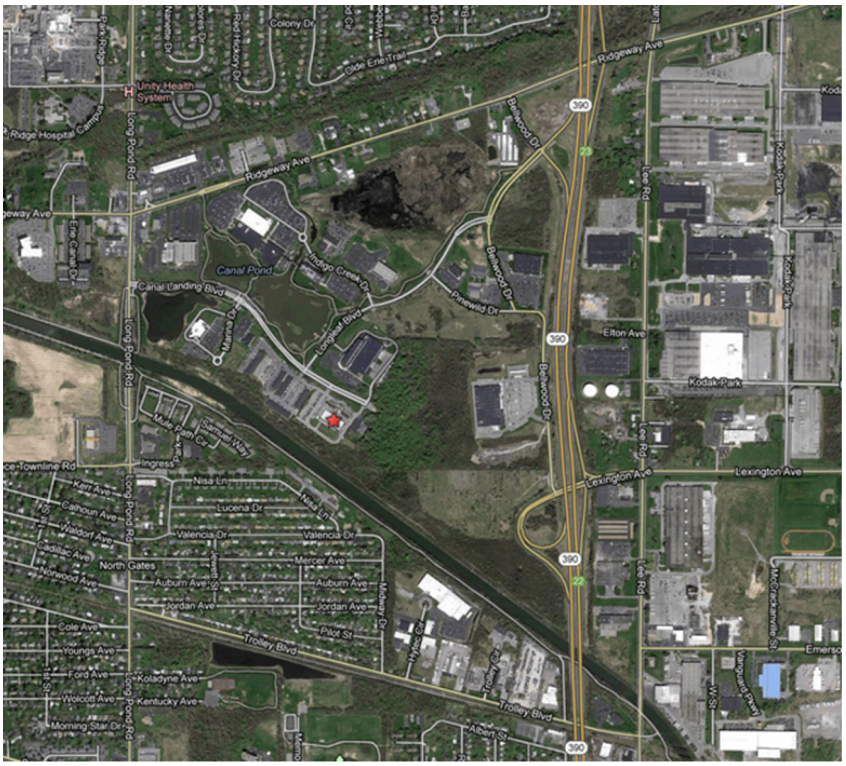
Organization Name:	**Sematech**
Location of Organization:	Albany
Partner's contribution to the project:	Partner in PVMC project for coordination of activities in solar

Section IV - Impact

Following are the key items that we would like to mention with respect to the impact in this quarter.

Location of MDF

As noted above CNSE MDF acquired a former Kodak facility at 155 Canal Landing Blvd., Rochester, NY. Facility is conveniently located within Canal Ponds Ponds Business Park in the Town of Greece. Canal Ponds is accessible via I-390 at the Lexington Avenue and Ridgeway Avenue Exits, and is minutes from the Greater Rochester International Airport as well as Downtown Rochester.



The facility includes:

- 13,000 square feet of clean rooms (class 1,000 and 10,000)
- Large Lab Area with work benches and extensive utility infrastructure.
- Electric & Lighting: Energy Saving T-8 Lighting; Horton Lighting Control Systems; 2 Load Centers
- HVAC: Multi-Zoned, Multi-Utility System with temperature, humidity and dew point controls.
- Utilities: Low Pressure Steam; Condensate Receivers/Return; Compressed Air; Chilled Water; 480V Circuits; Nitrogen; Process Vacuum RODI Water System; Natural Gas.
- Chemical storage room with blow out walls and 2 docks with levelers.
- 168 parking spaces secured access system and fully sprinklered.
- Large Break room, Employee Patio, and Men's and Women's Locker Rooms and Showers.

Finalized equipment set

The substantial baseline process equipment & some differentiation process equipment are finalized and transferred to CNSE MDF in Rochester, NY.

Equipment needed to complete a MDF type solar cell facility is an autoloader for the Sandvik Diffusion furnace and a wafer transfer system.

A profilometer, an electroluminescence, and a pull tool are needed to complete the baseline metrology tool set.

Facilities construction

CNSE MDF contracted Bergmann Associates to provide architectural and engineering services to construct the new solar fab. The permitting process with the city started and demolition of the facility is planned to start in Q2.

Hired engineering and operations staff

We are currently recruiting for the following positions: Operations Manager, Senior Engineer Mgr./ Integration, Senior Solar Engineers to include a Diffusion Engineer, PEVCD Engineer, Wet Chemical Engineer and Test Engineer, Solar Process Technicians, Facilities Technician, Maintenance Technicians and Equipment Technicians. We have received approximately three hundred resumes to date and have begun screening candidates for the Operations Manager and Senior Solar Engineer positions. We have selected a candidate for the Facilities Maintenance position and are currently waiting for the proper approvals. Hiring the Operations Manager and Senior Engineers are our top priority at this time and our focus has been selecting the candidates for initial screening, with an in-person interview to follow.

Identified a target for module development, fabrication and reliability testing

Currently in process of developing an MOU with Celestica for module fabrication, qualification and TUV/UL certification.

Section V – Changes/Problems

SVTC provided CNSE with information regarding the solar facilities, equipment, qualitative solar manufacturing process, metrology tools and other documentation. However detailed documentation is missing for:

- no start up documentation for equipment
- documentation for equipment qualification
- equipment and cell type specific recipes
- standard operating procedures
- materials, chemicals, gases and other consumables specification and proposed suppliers

To complete the Solar MDF line following equipment and tools need to be acquired and installed:

Metrology tools profilometer, electroluminescence, and a pull tester.

The Sandvik Diffusion Furnace does not have a cassette load & unload station. Manual loading adds the risk off wafer breakage and tool contamination. A GLA automation tool would minimize this risk and makes the Sandvik tool MDF compliant.

A wafer transfer system for transfer of wafers from wafer stack to 3 different cassettes is not acquired yet. This tool enables a faster transfer from one process equipment to the next in the process flow. It is needed to make the solar line MDF compliant.

A MES system, a data collection & process recipe management system need to be acquired and installed to operate the solar facility efficiently.

Budget

We have recently completed a budget based on the current facility location and have provided this to the DOE.

Section VI – Special reporting requirements

Progress against milestones

We have provided an analysis of the milestones and the progress achieved under separate cover.

Progress toward achieving financial self-sustainability

It is very early in the life-cycle of the project. An operational business plan has been developed through 2016. (Attached)

Aggregated user satisfaction performance data

User satisfaction performance measurement techniques and processes tools are to be established in Quarter 7 of the project. We will continue to report upon this reporting requirement and provide updates as appropriate.

Planned technologies and MDF capabilities to be supported

The planned technology offerings per our plan of record are set out in the tables below:

Tool#	Process Technology/Step	Equipment	Comments	Planned Delivery
1	Incoming wafer test & sort	Jonas & Redmann WIS	Wafer Inspection System: check micro-crack, breakage, resistivity, TTV etc.	Delivered
2a	Texture Etch Multi-c Si	M.E. Baker – Flex Tool	Four Modules to support; Texture Etch, Edge Isolation, PSG Etch, Polish Etch, surface prep & Clean.	Delivered
	Oxide Wet Etch			
	Edge Isolation			
2b	Texture Etch Mono-c Si	Chemical Safety Tech	Batch Tool for Mono c-Si Texture	Delivered
3	Emitter formation (N - type doping)	Sandvik	4 Tube Gen2 with WTS Tubes include: POCl3, BBr3, TOX & Anneal. This equipment will do both Phosphorous and Boron doping, PLUS Thermal oxide growth and forming gas anneal. Needs automation conversion to eliminate manual wafer loading.	Delivered
	Emitter formation (P-type doping)			
	Thermal Oxidation			
	Annealing			
4	SiN ARC Deposition	Centrotherm PECVD	Batch tool to deposit ARC with Jonas & Redmann automation	Delivered
5a	Screen printing – Ag Island	AMAT - Baccini	Baccini Softline with 3 (load + printer + dryer + unload) islands to do Ag, Al and etch paste/dopant printing. The three Baccini stations all have different wafer cassette handling and require interface automation to be operational.	Delivered
5b	Screen printing – Al Island			
5c	Screen printing – Dopant & Etch Pastes Island			
6	Sintering	Despatch	Advanced belt design to reduce marks	Delivered
7	Cell tester & sorter	Spire	Spi-Cell Sorter Rev D 3-10. Test and sort solar cells.	Delivered
8	Laser System	Innolas	Equipment for Laser Edge Isolation.	Delivered
14	a-Si Deposition - PECVD	AMAT	Capable of depositing a-Si for Si HJT cells and advanced front side passivation of standard cells	TBD
	Wafer Transfer system		Capable of transferring wafer from a wafer stack to 3 different cassettes. This tool is needed to make the solar line MDF compliant.	TBD

Tool #	Process Technology/Step	Importance	Tool	Supplier	Planned Delivery
1	Minority carrier Lifetime measurement	Baseline	Lifetime tester-Sinton-WCT 120	Sinton	Delivered
2	Post diffusion process control	Baseline	Sinton Suns Voc	Sinton	Delivered
3	Optical surface inspection	Baseline	Nikon Optiphot 66 with camera	Nikon	Delivered
4	Weight measurement	Baseline	Mettler Toledo-XS204	Mettler Toledo	Delivered
5	Acid concentration	Baseline	Mettler Toledo - Titration Tool-T70	Mettler Toledo	Delivered
6	Weight measurement	Baseline	A&D HR60	A&D	Delivered
7	Weight measurement	Baseline	A&D EK12-Ki scale	A&D	Delivered
8	To measure thickness, refractive index and extinction coefficient of thin layers	Baseline	Spectroscopic Ellipsometer - Sentech S800pv	Sentech	Delivered
9	Firing Furnace profiling	Baseline	Datapaq	Datapaq	Delivered
10	IQE / EQE / Reflectance	Baseline	PV Measurements - QEX10	PV Measurements	Delivered
11	Solar cell standalone I-V tester	Baseline	PV Measurements IV-16L	PV Measurements	Delivered
12	Measure height and width of the fingers	Baseline	Dektak profilometer 3030	Dektak	TBD
13	Electroluminescence	Baseline	Electroluminescence	Spire	TBD
14	Shunt detection	Baseline	Shuntometer	Pasan	Delivered
15	Bulk resistivity and sheet resistance	Baseline	Jandel four point probe RM3000	Jandel	Delivered
16	Adhesion strength tester (pull tester)	Baseline	Pull tester		TBD

Quarter Ending June 2013- The Foundation

Section I – Accomplishments

CNSE MDF is pleased to present its quarterly under the award DE-EE0004948. We welcome theopportunity to share the results of our work and our plans for the future. During the quarter, CNSE MDF pursued its strategy as set out in the company's Statement of Project Objectives ("SOPO"). Highlights of the quarter included the following:

Relocation of SVTC Solar fab

All Solar Fab equipment was decommissioned & transferred from San Jose, CA to Rochester, NY

The SVTC facility was closed & handed over to DSI on 2/28/13

New Solar Fab location at 115 Canal Landing Blvd., Rochester, NY

CNSE MDF acquired a former Kodak facility at 155 Canal Landing Blvd., Rochester. It was built in 1996

and thoroughly renovated in 2001, and again in 2005. This 57,000 square foot R&D property is comprised of office, clean room, lab, and manufacturing space.

Equipment planning and procurement

To date, CNSE MDF has secured substantially all the baseline equipment and some differentiation equipment from SVTC. Further details of the status of equipment sourcing are included at Section VI.

Facility design, planning and construction

CNSE MDF contracted Bergmann Associates & subcontractors to provide architectural and engineering services to construct the new solar fab. In this reporting period of Phase 1 the focus was on facility layout, code compliance, and waste stream. The city permitting process was started. Several alternative proposals were developed and studied to accommodate different scenarios for efficiency and flexibility. In addition contacts to suppliers were reestablished to plan re-installation and operational qualification of the equipment. CNSE MDF continues to pursue its aggressive goal of having a baseline process qualified by early Q2, 2014.

Customers

CNSE MDF is in the process of re-engaging multiple partners for the MDF. Intevac, Sun Core, Solar World, Bloo Solar, Bandgap, Soloexel, Solar 3D, Si Solar Solutions are potential partners and/or customers. Those recently contacted and still interested in participating with the MDF at some stage include Solar 3D, Intevac, Bandgap, Solexel, and Bloo Solar. Follow up discussions with these and other companies are planned. In addition, meetings have taken place, and an MOU is in process of development with Solar Science, Celestica, both located outside of Toronto, Ontario and a potential joint partnership with V3 Solar from Los Angeles, CA.

Additional outreach activities will continue to occur as the MDF facility design and construction is ongoing.

People

Presently leveraging key staff and technical positions from CNSE STC facility in the Rochester region to continue program progress, these resources include Facilities, Process integration review, HR, and equipment maintenance.

Next quarter

Our primary goals for next quarter include: staffing fulfillment; starting construction of development facility; finalizing any outstanding baseline equipment agreements; securing differentiation equipment; and developing facility working practices and procedures as well as a product marketing strategy.

Section II – Products

CNSE MDF has nothing to report in this section. Given the nature of the project of providing a development facility for use by third-parties, we consider it likely that CNSE MDF may often have no items to report under this section. Nevertheless, reports under this section will be provided as appropriate.

Section III – Participants

Name: Paul R Tolley
Project Role: CNSE VP Disruptive Technologies
& Ex. Dir. STC.
Nearest person month worked:
Contribution to Project: Mr. Tolley coordinates the project, is responsible for the business plan, customer interaction, equipment set selection, and general market approach.
Collaborated with individual in
Foreign country: N/A
Country(ies) of foreign collaborator: N/A
Traveled to foreign country: N/A
If traveled to foreign country(ies),
duration of stay: N/A

Name: Enno Holzenkaempfer
Project Role: Program Manager
Nearest person month worked:
Contribution to Project: Mr. Holzenkaempfer oversees and leads process development plans and projects to support the development and operational efforts. Mr. Holzenkaempfer coordinates and manages customer programs. He as well provides the government reporting.
Collaborated with individual in
Foreign country: No

Name: Rebecca Lathrop
Project Role: Director of EHS & Facilities
Nearest person month worked:
Contribution to Project: Ms. Lathrop is the project manager for the facilities construction of the production line. She works closely with the A&E and Construction management firms to ensure process design needs are met.
Collaborated with individual in
Foreign country: No

Main Partners involved in the project:
CNSE MDF is in the process of re-engaging multiple partners for the MDF. Intevac, Sun Core, Solar World, Bloo Solar, Bandgap, Soloexel, Solar 3D, Si Solar Solutions are potential partners and/or customers. Those recently contacted and still interested in participating with the MDF at some stage include Solar 3D, Intevac, Bandgap, Solexel, and Bloo Solar. Follow up discussions with these and other companies are planned.

In addition, meetings have taken place, and an MOU is in process of development with Solar Science located outside of Toronto, Ontario with an additional joint partnership with V3 Solar from Los Angeles, CA.
Additional outreach activities will continue to occur as the MDF facility design and construction is ongoing.

Organization Name: Bergmann Associates
Location of Organization: Rochester, NY
Partner's contribution to the project: Manufacturing line planning and permitting
Organization Name: Applied Materials, Inc.
Location of Organization: Santa Clara
Partner's contribution to the project: Equipment vendor for key equipment for line & automation
Organization Name: Roth & Rau AG / Meyer Burger AG
Location of Organization: Hohenstein-Ernstthal, Germany
Partner's contribution to the project: Equipment vendor for metrology and line
Organization Name: M.E. Baker
Location of Organization: Boston
Partner's contribution to the project: Equipment vendor for wet chemistry equipment (Inline)
Organization Name: AB Sandvik Materials Technology
Location of Organization: Sonora, California
Partner's contribution to the project: Equipment vendor for diffusion furnaces
Organization Name: Chemical Safety Technologies, Inc.
Location of Organization: San Jose
Partner's contribution to the project: Equipment vendor for wet chemistry equipment (Batch)
Organization Name: Despatch Industries, Inc.
Location of Organization: Minnesota
Partner's contribution to the project: Equipment vendor for sintering furnace
Organization Name: Sematech
Location of Organization: Albany
Partner's contribution to the project: Partner in PVMC project for coordination of activities in solar

Section IV - Impact

Following are the key items that we would like to mention with respect to the impact in this quarter.

Location of MDF

As noted above CNSE MDF acquired a former Kodak facility at 155 Canal Landing Blvd., Rochester, NY. Facility is conveniently located within Canal Ponds Ponds Business Park in the Town of Greece. Canal Ponds is accessible via I-390 at the Lexington Avenue and Ridgeway Avenue Exits, and is minutes from the Greater Rochester International Airport as well as Downtown Rochester.

Facilities construction

CNSE MDF contracted Bergmann Associates to provide architectural and engineering services to construct the new solar fab. The permitting process with the city started and demolition of the facility is planned to start in Q2.

Hired engineering and operations staff

We are currently recruiting for the following positions: Operations Manager, Senior Engineer Mgr./ Integration, Senior Solar Engineers to include a Diffusion Engineer, PEVCD Engineer, Wet Chemical

Engineer and Test Engineer, Solar Process Technicians, Facilities Technician, Maintenance Technicians and Equipment Technicians. We have received approximately three hundred resumes to date and have begun screening candidates for the Operations Manager and Senior Solar Engineer positions. We have selected a candidate for the Facilities Maintenance position and are currently waiting for the proper approvals. Hiring the Operations Manager and Senior Engineers are our top priority at this time and our focus has been selecting the candidates for initial screening, with an in-person interview to follow.

Identified a target for module development, fabrication and reliability testing
Currently in process of developing an MOU with Celestica for module fabrication, qualification and TUV/UL certification.

Section V – Changes/Problems

SVTC provided CNSE with information regarding the solar facilities, equipment, qualitative solar manufacturing process, metrology tools and other documentation. However detailed documentation is missing for:
☐no start up documentation for equipment
☐documentation for equipment qualification
☐equipment and cell type specific recipes
☐standard operating procedures
☐materials, chemicals, gases and other consumables specification and proposed suppliers

To complete the Solar MDF line following equipment and tools need to be acquired and installed:
Metrology tools profilometer, electroluminescence, and a pull tester.
The Sandvik Diffusion Furnace does not have a cassette load & unload station. Manual loading adds the risk off wafer breakage and tool contamination. A GLA automation tool would minimize this risk and makes the Sandvik tool MDF compliant.
A wafer transfer system for transfer of wafers from wafer stack to 3 different cassettes is not acquired yet. This tool enables a faster transfer from one process equipment to the next in the process flow. It is needed to make the solar line MDF compliant.
A MES system, a data collection & process recipe management system need to be acquired and installed to operate the solar facility efficiently.
Budget
We have recently completed a budget based on the current facility location and have provided this to the DOE.

Section VI – Special reporting requirements

Progress against milestones
We have provided an analysis of the milestones and the progress achieved under separate cover.
Progress toward achieving financial self-sustainability
It is very early in the life-cycle of the project. An operational business plan has been developed through 2016. (Attached)
Aggregated user satisfaction performance data
User satisfaction performance measurement techniques and processes tools are to be established in Quarter 7 of the project. We will continue to report upon this reporting requirement and provideupdates as appropriate.
Planned technologies and MDF capabilities to be supported
The planned technology offerings per our plan of record are set out in the tables below:

Quarter Ending March 2014- The Foundation

Section I – Accomplishments

CNSE MDF is pleased to present its quarterly under the award DE-EE0004948. We welcome the opportunity to share the results of our work and our plans for the future.
During the quarter, CNSE MDF pursued its strategy as set out in the company's Statement of Project Objectives ("SOPO"). Highlights of the quarter included the following:

Equipment planning and procurement

To date, CNSE MDF has secured substantially all the baseline equipment and some differentiation equipment from SVTC. Further details of the status of equipment sourcing are included at Section VI. On February 11, a meeting was held with the Doug Hall, Michael Bolen, and Lidija Sekaric of Dept. of Energy, and Paul Farrar, Paul Tolley, Paul Kelly, Scott Bateman, Rebecca Lathrop, and Pradeep Haldar of CNSE to discuss the direction of the CNSE MDF. A redirect plan was agreed upon in which CNSE would manage spending over six month period to meet DOE cost share obligations, finalize agreements with MDF anchor tenants, focus on unit process development instead of building complete c-Si solar cell manufacturing line, and complete construction at the Canal Ponds Facility in order to support redirect activities. Since the redirect meeting, equipment planning and procurement activities have focused on understanding the needs the CNSE MDF will have in a unit process development scenario. With focus on the evolving relationship with c-Si solar cell manufacturer Silevo, facility and process design has shifted focus away from complete solar cell manufacturing line infrastructure build-out to identification of infrastructure needs to develop key processes.
On April 2, a meeting was held with Chris Beitel of Silevo, and Paul Farrar, Pradeep Haldar, and Ian Cooper of CNSE to discuss project definition and statement of work development for partnership between Silevo and CNSE MDF. From this meeting, it was agreed both parties would move forward on at least one project to be implemented by the Q4 2014 – Q1 2015 timeframe. As of the submission of this report, first conversations have begun with major equipment supplies with final goal of acquiring an advanced inline copper electroplating production tool. This tool will be the focal point of initial project with Silevo.

Facility design, planning and construction

The Pike Company, selected as the demolition contractor in December 2013, has completed internal demolition of the Canal Ponds building as of the end of February, 2014. The image below is a panoramic view of the completed demolition area. In this image, the full bay area of the Canal Ponds building is visible in which the future PV MDF equipment will be housed.

On February 20, the Town of Greece conducted a hearing to address the award of a special use permit to CNSE for construction of gas and chemical storage necessary to support future processing activities at the PV MDF. At this meeting, the Town of Greece officially awarded the special use permit.CNSE has engaged two design firms to complete plans for facility and process construction. Bergmann Associates is a full service, multi-disciplinary design firm with core business segments in Transportation Systems, Civil Works, Building Design, Development Services, and Program Management. Bergmann is responsible for facility design. Process Logic is responsible for process design. Process-Logic's core competency is in designing, programming and commissioning industrial process control and automation systems for the manufacturing sector. They specify all the device-level sensors, transmitters, and control elements needed for system automation. They prepare the design drawings, the installation details and the work instructions required to install the equipment. They produce the custom software programming and configuration of the control hardware to integrate the system. They

provide start-up and commissioning services to deliver a fully-tested, functional, and validated system.
As of March 31, Bergmann Associates has completed the Canal Ponds facility design and released the design for construction bidding. The facility design includes drawings for civil, structural, architectural, mechanical, electrical, and fire protection construction and improvements.

On April 9, representatives from construction agencies responsive to the Canal Ponds RFP convened at the Canal Ponds building to go over the facility design plan, ask any questions, and tour the facility. Contract award is scheduled for April 28 (?) and facility construction is scheduled to begin at the beginning of May. It is anticipated that facility construction will be complete by the end of June.

Customers

Silevo

Significant progress has been made in advancing relationship with c-Si solar cell and module manufacturer Silevo. On March 19, Chris Beitel sent a white paper outlining the projects they are interested in working on with the CNSE MDF. The white paper consisted of three projects with focus on advanced inline copper plating, metallization via physical vapor deposition (PVD), transparent conductive oxide (TCO) via reactive plasma deposition. In response to this white paper, CNSE prepared project definition and further detail pertaining to SOW development. At the meeting held April 2 between Chris Beitel and CNSE, enthusiastic support for development of a project around advanced inline copper plating was expressed on both sides. The near term action items are 1) for Silevo to prepare process specification with which to engage inline plating equipment makers, 2) for CNSE to begin engaging equipment makers for an inline plating tool. The long term goal is to have a statement of work agreed upon by June 2014 and MOU finalized by August 2014.

Companies Expressing Interest

The following companies have expressed interest in partnering with SR for process and/or device development: Bandgap Engineering, Natcore Technology, SunPower, and Varian-AMAT.

Bandgap Engineering (BGE) is a small technology development firm located in Salem, NH. BGE has developed a process for formation of Si nanowires. The purpose of the nanowires is to reduce surface reflection of Si solar wafers and enable higher cell efficiency than available using traditional surface texturization. BGE has demonstrated cell efficiency enhancement using their first generation nanowire process. BGE has interest in using SR facilities to demonstrate similar cell performance improvement in their next generation processes. The extent of BGE's interest involves use of pilot-scale Si solar cell fabrication. In the context of the unit process development scenario, near-term engagement with BGE is unlikely as 3 of the 4 process modules needed for solar cell fabrication (diffusion/oxidation, SiN, and metallization) will not be online.

Natcore Technology is a small technology with operations located in Rochester, NY. Natcore is developing processes to enable formation of "black Si". Black Si is a term describing the formation of a thin porous Si layer on a wafer surface which is intended to minimize surface reflection beyond what is capable with traditional surface texturization. In a second project, Natcore is seeking to develop low temperature doping of Si through laser processing. Natcore has expressed interest in access to processing using the SiN and metallization process modules as well as interest in accessing metrology services. Based on the unit process

scenario, SR will be able to engage Natcore partially in project development. Project definition around metrology services will be possible by the end of 2014. However, the SiN and metallization process modules will not be online in the near-term.

SunPower is a well established c-Si solar cell and module manufacturer and PV system developer. SunPower makes one of the highest efficiency solar cells commercially available using the interdigitated back conctact (IBC) cell structure. Representatives from SunPower R&D in CA have reached out to CNSE and SR seeking process capability to develop new wet process chemistries. Their primary interest is in tool 2B, the Baker Solar Multi-Purpose Flex Tool, which is intended for installation as part of the wet process module. Discussion is ongoing with SunPower R&D in effort to define a project which meets their timeline goals.

Varian Semiconductor Equipment Associates (VSEA) is a semiconductor equipment maker located in Gloucester, MA, which was acquired by Applied Materials in 2011. As Varian-AMAT, the company focuses on c-Si solar cell technology development using in-house developed processes including ion implantation for doped layer definition. Representatives from Varian AMAT have reached out to CNSE and SR seeking process capabilities for Si wafer planarization, advanced laser processing, and Cu metallization. The primary tools of interest based on proposed project scope are 2B, the Baker Solar Multi-Purposed Flex Tool, and tool 8, the Innolas Laser System. Both tools are planned for installation in the near-term. Furthermore, as part of the project currently in development with Silevo, Cu metallization capability is being sought. Discussion with Varian-AMAT is ongoing and project definition is anticipated.

Companies Responsive to Contact
The following companies have responded to initial communication and request for discussions surrounding potential partnership with SR: Scifiniti, Sunpreme, and SunEdison.

Scifiniti is a small technology development firm located in San Jose, CA. Scifiniti is developing processes for thin Si absorber formation on low-cost substrates. Their aim is to reduce the cost of Si wafer production and reduce the raw materials input for device absorber layer formation. The author maintained an R&D relationship with Scifiniti at Georgia Tech (GIT) and has re-engaged representatives for possible partnership with SR.

Sunpreme is a small c-Si solar cell and module developer/manufacturer with offices in Sunnyvale, CA, Jiaxing, China, and Aguada, Puerto Rico. Sunpreme makes solar cells using low-cost mc-Si wafers and a-Si heterojunction architectures. Sunpreme representative Chenlei Wang has been engaged for possible partnership between Sunpreme and SR.

SunEdison is a well established Si materials and PV systems developer. SunEdison develops tools and processes for Si crystallization including casting and CZ methods. SunEdison's potential interest in partnership with SR may come from the need for characterization of Si solar wafers and fabrication of solar cells using SunEdison wafers. SunEdison representative Jeff Binns has been engaged for possible partnership between SunEdison and SR.
Companies where Contact has been Initiated

The following companies have been contacted with no substantial response yet received: 1366 Technologies, Solexel, and TetraSun.

1366 Technologies is a small technology development firm located in Boston, MA. 1366 seeks to commercialize technology designed for direct casting of mc-Si wafers intended for sale to

solar cell manufacturers. 1366's potential interest in partnership with SR may come from the need for characterization of Si solar wafers and fabrication of solar cells using 1366 wafers. 1366 representatives Adam Lorenz and Vlad Tarasov have been contacted.

Solexel is a small technology development firm located in Milpitas, CA. Solexel has developed a process for high efficiency solar cells using formed thin absorber layers. Solexel holds the world-record for cell efficiency using thin crystalline Si films. Solexel representative Pranav Anbalagan has been engaged for possible partnership between Solexel and SR. Though a response has been received, it is believed that Pranav has left the company and may not be an appropriate contact.

TetraSun is a small technology development firm located in San Jose, CA. TetraSun was recently acquired by First Solar, a well established CdTe thin film module manufacturer and PV system developer. Though full details of TetraSun's technology is not known, it is known that they are developing c-Si solar cell technology which takes advantage of Cu contacts. TetraSun representative Victor Prajapati has been contacted.
Other companies of interest include:

Intrinsiq Materials:
• Manufactures highly functional electronic inks for use at room temperature
• Includes conductive and silicon ink for Solar Cells
• Available products are screen printable copper paste and copper ink for inkjets
• In development is nickel ink, which could be used on solar cells
• In June 2013 NYSERDA awarded $887K to develop copper ink for Solar Cell Applications
• www.intrinsiqmaterials.com

Intevac:
Intevac Technology:
☐Implant dopants to form the Emitter (P/N junction)
☐Ability to implant various dopants (P, B, other)
☐Compatible with Selective Emitter architecture Intevac Advantage:
☐Performance improvement (~1% absolute efficiency) Uniform Emitter formation (WTW & LTL)
Processing yields better surface passivation
☐Cost Reduction
Eliminates need for PSG etch step
Eliminates need for Edge Isolation
Customer inquiry: Equipment hosting and also, to use the capabilities to integrate Implant technology to develop advanced Solar cells Additional outreach activities will continue to occur as the MDF facility design and construction is ongoing.

People
The Director Solar Programs position has been filled. Dr. Ian Cooper started February 17, 2014. We expect the Director to be thoroughly involved in the hiring process and expect to start actively recruiting beyond the current efforts for the positions listed in this report.
We have hired Henry Wilson as Senior Facilities Technician for the Canal Ponds building. Henry will start April 21.

Next quarter
Our primary goals for this next quarter include:

Hiring

As project plans develop around key partners and interested companies, we will begin to engage the large pool of applicants collected during the last year and at the job fair held in 2013 in order to fill positions needed to effectively service projects. A critical focus will be placed on immediately staffing the following positions:

Process Engineers
Process Operators
Solar Metrology Engineer
Facilities and Shipping/Receiving Associate

Equipment
Finalizing any outstanding baseline equipment agreements will be completed after the start of the dir. Securing differentiation equipment:
Based on project negotiation with key partner Silevo, mutual agreement has been made to develop statement of work surrounding advanced inline copper plating.

CNSE MDF has nothing to report in this section. Given the nature of the project of providing a development facility for use by third-parties, we consider it likely that CNSE MDF may often have no items to report under this section. Nevertheless, reports under this section will be provided as appropriate.

Section III – Participants
Name: Paul R Tolley
Project Role: CNSE VP Disruptive Technologies & Ex. Dir. STC COO Solar MDF
Nearest person month worked:
Contribution to Project: Mr. Tolley coordinates the project, is responsible for the business plan, customer interaction, equipment set selection, and general market approach.
Collaborated with individual in
Foreign country: N/A
Country(ies) of foreign collaborator: N/A
Traveled to foreign country: N/A
If traveled to foreign country(ies), duration of stay: N/A

Name: Ian Cooper
Project Role: Director of Si Solar Technology
Nearest person month worked:
Contribution to Project: Dr, Cooper oversees and leads process development plans and projects to support the development and operational efforts. Dr. Cooper coordinates and manages customer programs. He as well provides the government reporting.
Collaborated with individual in Foreign country: No

Name: Rebecca Lathrop
Project Role: Director of EHS & Facilities
Nearest person month worked:
Contribution to Project: Ms. Lathrop is the project manager for the facilities construction of the production line. She works closely with the A&E and Construction management firms to ensure process design needs are met.
Collaborated with individual in Foreign country: No

Main Partners involved in the project:

Additional outreach activities will continue to occur as the MDF facility design and construction is ongoing.

Organization Name: Bergmann Associates
Location of Organization: Rochester, NY
Partner's contribution to the project: Manufacturing line planning and permitting

Organization Name: Applied Materials, Inc.
Location of Organization: Santa Clara
Partner's contribution to the project: Equipment vendor for key equipment for line & automation

Organization Name: Roth & Rau AG / Meyer Burger AG
Location of Organization: Hohenstein-Ernstthal, Germany
Partner's contribution to the project: Equipment vendor for metrology and line

Organization Name: M.E. Baker
Location of Organization: Boston
Partner's contribution to the project: Equipment vendor for wet chemistry equipment (Inline)

Organization Name: AB Sandvik Materials Technology
Location of Organization: Sonora, California
Partner's contribution to the project: Equipment vendor for diffusion furnaces

Organization Name: Chemical Safety Technologies, Inc.
Location of Organization: San Jose
Partner's contribution to the project: Equipment vendor for wet chemistry equipment (Batch)

Organization Name: Despatch Industries, Inc.
Location of Organization: Minnesota
Partner's contribution to the project: Equipment vendor for sintering furnace

Organization Name: Sematech
Location of Organization: Albany
Partner's contribution to the project: Partner in PVMC project for coordination of activities in solar

Organization Name: Intrinsiq Materials
Location of Organization: Rochester, NY
Partner's contribution to the project: Development of inkjet process for Cu/Ni contacts on solar cells

Organization Name: AIS Automation
Location of Organization: Dresden, Germany
Partner's contribution to the project: Partner in Solar MDF for DES/MES project

Organization Name: Clean Development Group (CDS)
Location of Organization: Halliburton, Ontario, Canada
Partner's contribution to the project: Partner for module manufacturing at Solar MDF site

Organization Name: Celestica
Location of Organization: Toronto, Ontario, Canada
Partner's contribution to the project: Partner for module manufacturing at Solar MDF site

Organization Name: Silevo
Location of Organization: Freemont CA.
Partner's contribution to the project: Partner for process development and cell & Module Mfg.

Section IV - Impact

Location of MDF

As noted above CNSE MDF acquired a former Kodak facility at 155 Canal Landing Blvd., Rochester, NY.

Facility is conveniently located within Canal Ponds Business Park in the Town of Greece. Canal Ponds is
accessible via I-390 at the Lexington Avenue and Ridgeway Avenue Exits, and is minutes from the
Greater Rochester International Airport as well as Downtown Rochester.

Facilities construction

The drawing below shows a proposed facility and equipment layout.
SVTC provided CNSE with information regarding the solar facilities, equipment, qualitative solar manufacturing process, metrology tools and other documentation. However detailed documentation is missing for:

- ☐no start up documentation for equipment
- ☐documentation for equipment qualification
- ☐equipment and cell type specific recipes
- ☐standard operating procedures
- ☐materials, chemicals, gases and other consumables specification and proposed suppliers

Since submission of the previous quarterly report, CNSE and DOE have agreed upon a redirection of the PV MDF. This redirection involves focus on unit process development rather than complete c-Si solar cell manufacturing line installation. Based on this redirection, unit process development activities have been discussed with key partner Silevo and SOW development is ongoing. Equipment and process intended to support Silevo is planned for installation as outlined in the next section under title “planned technologies and MDF capabilities to be supported”. As new partners engage with CNSE and PV MDF, equipment necessity will be reassessed.

Budget

Federal non matching funds
A budget proposal representing a large portion of additional non-Federal matching funds, previously approved by the New York State Energy Research & Development Authority (NYSERDA) has been submitted and is awaiting final sign-off approval from the Office of the (NY) State Comptroller. CNSE has opened an at risk award to leverage these funds and provide immediate source funding for demolition and construction activities.

Section VI – Special reporting requirements

Progress against milestones

We have provided an analysis of the milestones and the progress achieved under separate cover.

Progress toward achieving financial self-sustainability

It is very early in the life-cycle of the project. An operational business plan has been developed through 2016.

Aggregated user satisfaction performance data

User satisfaction performance measurement techniques and processes tools are to be established in Quarter 7 of the project. We will continue to report upon this reporting requirement and provide updates as appropriate.

Planned technologies and MDF capabilities to be supported

The planned technology offerings per our plan of record are set out in the tables below:

Quarter Ending June 2014- The Foundation

Section I – Accomplishments

CNSE MDF is pleased to present its quarterly under the award DE-EE0004948. We welcome the opportunity to share the results of our work and our plans for the future.

During the quarter, CNSE MDF pursued its strategy as set out in the company's Statement of Project Objectives ("SOPO"). Highlights of the quarter included the following:

Equipment planning and procurement

Initial Tool Selections

Based on the redirect plan agreed up in Febraury 2014, select silicon solar process tools have been chosen for initial start-up by the end of 2014. The choice of tools for initial start-up was based on perceived demand from potential industry customers as well as cost of operation. The tools chosen for initial start-up activities at CNSE Solar Rochester are:

1. Jonas & Redmann Wafer Inspection System
2. Chemical Safety Technologies Automated Linear Process Wet Bench model CST-198-ACL-TEX
3. M. E. Baker Multi Purpose Solar Flextool Inline Wet Bench, serial number 499
4. Innolas Laser System model ILS 700P, serial number P258
5. Chemical Safety Technologies 72" Fumehood

Recent project development with Intrinsiq Materials has pushed ahead the start-up of at least one Applied Materials Baccini Screen Printer and the Despatch Industries Contact Annealing Furnace.

Most tool manufacturers have been contacted for assistance with unpacking, setup, and start-up of the tools listed above. Leadership at ME Baker contacted CNSE in 2014Q2 to inform of impending business closure and to engage in final knowledge and services transfer to satisfy the service contract in place. Consequently, Baker compiled a final offering to satisfy the service agreement which consisted of:

1. Electrical drawings including the line electrical, main control cabinet, related junction boxes and HMI all updated to reflect changes made in the field when installed at SVTC (approximately 40 sheets),
2. Electrical Bill of Materials
3. Electrical wire harness list (point-to-point)
4. Various photos of the build and install
5. Utilities layout defining required connection interface
6. Plumbing layout defining interconnection of various modules and sumps as well as showing location and piping of the 34 pumps
7. Enclosure layout
8. Dosing and sampling layout
9. Detailed Manual with maintenance, trouble shooting, parts list and module-by-module description

10. Back-up details on parts ordered for job including where applicable purchase orders, invoices and related documents allowing SUNY to trace vendors and pricing on individual items.
11. Completion of and royalty free license to use the software
12. Bill of Sale for the Equipment

Receipt of all materials has been made and final payment to ME Baker has been issued which terminates the outstanding service agreement.

Inline Copper Electroplating Tool

Substantial progress has been made in the procurement of an inline copper electroplating (Cu ECP) tool which will be used to engage of Silevo in project service. It is perceived that the process expertise gained from project completion with Silevo and CNSE Solar Rochester ownership of an inline Cu ECP will aid in winning further JDA's or project contracts with other industry players in Si PV wishing to engage use Cu metallization. Three vendors have been identified as qualified for the job of design, manufacture, and assembly of the Cu ECP tool: Rena GmbH, Schmid Group GmbH, and Besi Meco B. V. Nondisclosure agreements (NDA) has been exchanged and executed with each company. Upon final execution of individual NDAs, technical specifications were shared for an inline Cu ECP tool which will enable development of Cu metallization for Silevo's solar cell technology. The following is the current version of the technical specifications submitted to each tool manufacturer:

Request for Quotation for In-line Copper Electrochemical Plating System

Overview: CNSE is interested in an in-line electroplating system without using jigs for high efficiency c-Si solar cell manufacturing. This document serves as a high level requirements document to enable a draft quotation. System configurations are as follows.

• In-line system, where wafers are loaded with plating electrode in direct contact with wafers, no jig is needed. The system does not call for electroless plating.
• Wafers are either on conveyors or belts

System Configuration: CNSE has consolidated both global and individual deposition requirements in the next sections and would like to include these items as key performance criteria and requirements in our final definitive agreement documentation package.

Global Requirements: Parameter	**Requirement / Comment**
Wafer (Substrate) Size	156 mm x 156 mm (239cm^2) substrates transported in a carrier. Substrate is 140 um thick and laminated with 40 um resist on each side.
Pattern:	A side: The wafers are patterned with insulating resist except exposing multiple fingers spaced 2-2.5 mm, and 3 busbars up to 1.7 mm in width on one side. Seed layer thickness 100 nm.

	B side: Two possibilities: could be either the same as the A-side (B1), or denser fingers with spacing about 0.6 mm (B2) Finger opening width: 40-60 um
Plating thickness	20-30 um on A side 20-30 um on B-side for B1, 15-20 um for B2
Uniformity	< +/- 5%
Thru-put per system	> 1600 WPH
Process sequence	Clean 1/Clean 2/Plating/Rinse/dry
Light induced plating	No
Plating current density	15-20 ASD on effective plating area (openings from finger and busbars). Plating current density must enable throughput and plated copper resistivity specs
Availability	> 90% (Scheduled & unscheduled downtime to be less than 10%)
Schedule Downtime (SDT)	< 7%
Unscheduled Downtime (USDT)	< 3%
Automation integration	Integrated with automation for wafer loading/unloading.
Grounding strap lifetime	> 12months
Interface with MES	Need MES to communicate with tool to collect data
Warranty	12 months

Deposition Requirements: Parameter	**Requirement / Comment**
Resistivity (ohm-cm)	< 2.5E-6
Stress	< 0.5 mm warping for a bifacial gridline post annealing 150° C 1hr

Final Acceptance Test Requirements: Requirement / Comment
1. 24 hr mechanical cycling without fault- Test will validate through-put requirement above
2. 24 hr process run without fault
3. 1 week reliability run. Daily process quals to validate process spec performance (film thickness and uniformity, etc.). Monitor tool faults and downtime to validate < 3% unscheduled downtime. Data can be collected before FAT.

Each tool manufacturer has acknowledged receipt of the technical specifications. As of July 25, 2014, Rena GmbH and Besi Meco B. V. have returned quotes for inline Cu ECP tools.

Ion Implantation

Discussions are ongoing with Applied Materials (AMAT) to locate an Early Learning Tool (ELT) Ion Implanter at CNSE Solar Rochester. Placement of an ion implanter at CNSE Solar Rochester would enable n-type Si solar cell processing. In addition, AMAT's Si PV technology roadmap predicts industry adoption of n-type technologies increasing over the next few years, in line with predictions made in the International Technology Roadmap for Photovoltaics (ITRPV). Part of the technology roadmap envisions adoption of all implanted IBC cell structures. Cooperation with AMAT (including location of an ion implanter) will 1) enable CNSE Solar Rochester to provide a

platform to interested organizations to test ion implantation as a strategic solution to silicon solar cell junction formation, 2) allow deeper collaboration on internal R&D with AMAT, 3) enable CNSE Solar Rochester to host potential AMAT customers in a secure, third party atmosphere for applied R&D and tool demonstration. AMAT anticipates that an ELT will become available in 2015.

Facility design, planning and construction

Since submission of the previous RPPR, facility renovation award was given to LeChase Corporation. LeChase will be responsible for renovation activities specified in the facilities release prepared by Bergmann Associates. Briefly, facilities renovation consists of upgrades to HVAC, digging and preparation for waste water sump pit, construction of rooms to house waste water treatment and storage, construction of fab area outer walls, and erection of the new addition for storage of acid/base CDUs and pyrophoric materials. The images below highlight the progress made to date on facilities renovation.

Top image - panoramic view of fabrication area: waste water treatment and storage room walls are visible on far left, new HVAC ductwork can be seen near ceilings, and fab area enclosure

walls can be seen at far right; **bottom left –** opposite walls of waste treatment and storage rooms; **bottom right –** exterior of new addition for chemical CDUs and pyrophoric gas storage.

Process renovation designs have been released for bidding and award for process renovations work should be given the first week of August 2014. Process renovation work briefly consists of layout and installation of process gas and liquid lines from storage points to valve manifold boxes and out to point-of-use at the initially selected process tools. It also consists of installation of waste lines and exhausting.

Customers

Silevo

Since submission of the previous RPPR, Silevo has delivered high level specification documents for two proposed process points: inline Cu ECP and reactive plasma deposition (RPD) of transparent conductive oxides (TCOs). Using specifications given for inline Cu ECP tool, CNSE Solar Rochester has engaged Rena, Schmid, and Meco for equipment quotations. Draft SOW for both inline Cu ECP and TCO RPD has been exchanged. Continued collaboration is expected as Cu ECP tool vendor is chosen and SOW is finalized.

SunShot Summit and Company Visits in San Jose, CA

At the SunShot Summit in Anaheim, significant and meaningful contacts were made with Bjoern Seipel with SolarWorld Instustries America, Douglas Hutchings with Silicon Solar Solutions, and Vijay Yelundur with Suniva.

During the stay in San Jose, I met with 8 companies in 5 different positions in the c-Si PV industry: an equipment provider (Applied Materials, twice), two start-up Si material developers (Scifiniti and Crystal Solar), three start-up cell technology developers/manufacturers (Silevo, TetraSun/First Solar, and Sunpreme), one high volume manufacturer (SunPower), and one consumables developer/supplier (DuPont). In my presentation of the Solar Rochester Overview, I have encouraged companies to consider what problems or barriers they are facing and how the DOE investment can be leveraged to help them overcome these problems/barriers through collaboration with Solar Rochester. Resounding comment themes include desire for details around IP and cost model, the need for a cell baseline for unit process qualification purposes and establishment of facility credibility, and the need for “next gen” cell process capability/expertise in order to enable development of high efficiency cells.

1. Applied Materials: Met with **Karey Bodey** (Solar Sales Manager), **David Lee** (Senior Director Technical Marketing), **Suho Cho** (Director, AGS), and **Michel Frei** (Process Engineering Director), **Peter Thimm** (on phone, title unknown).
    a. Karey provided presentation of the AMAT solar roadmap. The tool focus for the solar roadmap are ion implantation (through the Solion product line), screen-printing/metallization/laser processing (through Baccini product line), and passivation tools (through “Terracotta” product, which is an inline PECVD tool for deposition of AlOx and SiNx passivation/ARC thin film layers).
    b. I informed Karey, et al., that we are not continuing to pursue the AKT a-Si PECVD tool for purchase due to lack of perceived demand.

c. AMAT roadmap involves adoption of double printing for fine lines without breaks (Baccini), equipment offerings that can enable PERC (passivated emitter and rear cell) processing (Solion, Terracotta), migration through equipment platform alterations toward n-type structures (PERT, PERL, IBC). Note – heterojunction devices don't play heavily in the AMAT solar roadmap.

2. Silevo: Met with **Chris Beitel** (Business Development) and **Ben Heng** (VP Product Engineering)
    a. I gave an update of our progress in building Solar Rochester following the timeline used in the presentation I brought, which is still in line with their project demands.
    b. I handed off hard copies of the Cu ECP and RPD SOW drafts for their review and followed up with electronic copies.
    c. The ball is in their court to provide feedback around the SOW drafts. Chris is confident that we can deal directly with Cu ECP vendors for tool quotation. I mentioned that I've received the "cold shoulder" from Sumitomo Heavy Industries when I inquired about RPD tools. Chris acknowledges that the Japanese can be elusive and that he will probe his network for possible in-roads.

3. Scifiniti: Met with **Dirk Weiss** (Chief Scientist) and **Sachit Grover** (Senior Device Engineer)
    a. Currently, Scifiniti has contract work done at ISC Konstanz, a German research institute located in Konstanz, DE. One way to attract business from Scfiniti in this space would be to undercut ISC Konstanz in pricing for services.

4. TetraSun/First Solar: Met with **Oliver Schultz-Wittman** (Director, c-Si R&D) and **Adrian Turner** (EVP Technology Development)
    a. TetraSun shows some interest in access to our near-term wet process tool as they are not strong (in R&D) in surface texturization. Interest in Cu ECP also indicated.
    b. Voiced concern about cleanliness of wet processing and how we plan to survey quality assurance. One possible route is through basic cell processing capabilities through which cell performance metrics can be monitored for indications of contamination.

5. Chemical Safety Technology (KemSafe): Met with **Lincoln Bejan** (President)
    c. I informed Lincoln that we plan to install and start his wet bench up by the end of the year. From his recollection, the bench was never used and he was not involved in the dismantling of the tool. He believes the PLC will need to be reset (software reinstalled) since it has been so long since the bench has seen power and battery backup is most likely dead. It is logical to bring him and his team in to ensure that reinstallation and start-up go smoothly. Lincoln believes the time frame (start-up by the end of the year) is reasonable. I will keep in touch with him as we move forward to be sure we have the proper communication channels and planning in place to include KemSafe.

6. DuPont Innovalight: Met with **Homer Antoniadis** (previous CTO of Innovalight, current DuPont Global Technology Director), **Terry Mason** (Technology Lab Manager), **Andreas Meisel** (Technical Manager/Program Manager), **Dmitry Poplavskyy** (PI, Project Leader), one other process engineer whose name I cannot recall.
    a. Homer did the majority of the talking during the meeting. No interest in Cu, and he feels the demand and infrastructure needed to sustain Cu metallization in Si PV is lacking.
    b. Homer feels that basic cell processing will be critical to establish capability as well as metrics to evaluate quality from a unit process stand-point. To his point, Solar Rochester must begin to build reputation in order to establish credibility in the industry. A common metric for credibility is achievable in-house cell efficiency. With the current toolset, bringing on bare minimum cell process capability (as I have advocated in the past) will enable 19-19.5% cell efficiency. At the rate the world is moving, this is too low for maximum credibility, but for the cell architecture (p-type base with n-type emitter), this is a good efficiency range. All this underscores the need for Solar Rochester to bring on “next gen” capabilities for advanced cell processing (ie – ion implantation, APCVD, advance passivation layers, etc).
    c. Homer is very interested in ion implantation capabilities and would potentially engage in project development around such a tool.

7. SunPower: Met with **Ansat Masad** (Cell R&D Director, Passivation and Etching), **Gabriel Harley** (Principle Engineer), **Joseph Behnke** (Principle Development Engineer), **Ann Waldhauer** (Materials Characterization), **Hung-Ming Wang** (Process Engineer, Metallization Plating), **Thomas Pass** (Technical Staff). The main contact and meeting coordinator Scott Harrington (Equipment R&D Engineer) was not present.
    d. Original contact with SunPower arose when Scott Harrington inquired about the availability of the KemSafe wetbench for development of IPA-free surface texturing chemistries. Since the bench is not set up, and a suitable arrangement was not found using existing PVMC/CNSE process tools, no project developed.
    e. I was quite happy with the turnout for this meeting given the secrecy and relative autonomy SunPower has over its process.
    f. Many questions were asked about specific IP policy, which I deferred answers for until I can gain access to said information. It was suggested that Solar Rochester resembles IMEC (Belgian technology development center)
    g. Concern was raised over the ability to truly safeguard project details in a multi-user environment. Particularly for SunPower, many tools they use require modification in order to fit their process flow.
    h. Tool specifications were requested and I have opted to follow-up with the individuals with specific tool inquiries.
    i. Overall, SunPower has the greatest interest in “reliability” services both on the module and cell process level. This implies a possible fit for SunPower with PVMC, however, more detail is need for specific needs and how to best address them.

j. Scott has said that he will provide a name for most appropriate follow-up in the future, at which time specific detail about reliability testing needs can be addressed.

8. Crystal Solar: Met **T. S. Ravi** (Founder and CEO), and presented materials and had discussion with **Ashish Asthana** (EVP and Co-founder)
    a. The company maintains some basic cell fabrication capability, but has out sourced cell processing to universities (GIT in particular) as well as partner manufacturing site. Company mainly in development and demonstration phase now, but will expand capacity onsite (for epi wafer growth) in the next 6-12 months. Company has begun talks with state governments to identify a location for manufacturing scale-up in the US. I mentioned the WNY hydropower corridor ($0.03/kwh utility rates) and said I would pass on information and contacts for economic development in WNY.
    b. Ashish was very receptive to the Solar Rochester concept, but voiced concern over quality control which a basic cell process could address.
    c. If a baseline process can be offered, Ashish would be interested in project development to test some epi structures they are developing (grown-in high low junctions, etc.).

9. Sunpreme: Met with **Rishi Ramanathan** (Device Integration Engineer), **Chenlei Wang** (Senior Director of Technology), **Farhad Moghadam** (CTO), and two others from whom I did not receive contact information.
    d. Company background: Start-up with small manufacturing capacity in China (similar to Silevo). Core technology is around heterojunction architecture on n-type Si.
    e. Farhad concerned about cost model. In a university setting, administration can take a significant portion of funding for overhead (at GIT this was ~50-60%), he threw out 95% at Stanford which may be hyperbole. Follow-up with Solar Rochester's cost structure would be good. I said I thought it would not be based on the university model.
    f. Interest in specifics around IP protection/sharing/non-haring model requested.
    g. Farhad believes current tool set is out dated and incapable of helping US companies. The tool set is able to make 19-19.5% cell efficiency (maybe up to 20.5% using a PERC structure), but the Chinese are already making cells at this efficiency level with greater throughput and lower cost. US companies can only compete if they can enter the market at 21+% efficiency. For Solar Rochester to truly impact US companies, a toolset must be offered which enable 21+% cell efficiency.

10. Applied Materials: Met with **Mike Riordan** (Managing Director, Solar Marketing)
    a. Presented AMAT Si PV roadmap (similar to Karey's presentation)
    b. We spent some time discussing possible collaboration routes between AMAT and Solar Rochester. I mentioned that it will be important for Solar Rochester to be able to address n-type processing needs since I believe (as well as AMAT) that n-type

cell technology will continue to claim market share. We both acknowledge that critical barriers exist for companies to ramp n-type cell production (ie – boron junction formation, surface passivation, n-type Si availability). I acknowledged that ion implantation can be a potential gateway for n-type cell processing since it allows single side doping, patterned doping, etc., which will be important for widespread adoption of IBC cell structures.

c. I mentioned that placement of an ion implantation tool at Solar Rochester is favorable for the ability to address n-type cell development, to allow third party companies to use the tool for development, and provide a demonstration platform for AMAT customers. To this point, Mike with follow-up with John Graf in Gloucester to arrange a meeting with his team in MA (which I've been trying to coordinate with Chris Dube and Vikram Bhosle for a few months now) where we can continue to discuss and brainstorm appropriate win-win scenarios for collaboration/tool placement. The option for a discounted tool was brought up, which may take the form of a trade-in or refurbishment. I mentioned the idea of in-kind services provided to AMAT in exchange for tool discount. Here, it is worth mentioning that an ion implanter alone is not sufficient for cell technology development. After implantation, a high temperature anneal is required to electrically activate the junction. This can be performed in the Sandvik oxide tube.
d. Another avenue for collaboration, or simply an opportunity to bring Solar Rochester closer to the cutting edge in Si PV manufacturing, is upgrading the existing Baccini screen printers to have dual printing capabilities.

Intrisic Materials

CNSE Solar Rochester has engaged Intrinsiq Materials in project development to support DOE Incubator 9 award (in negotiation) for Ni/Cu contacts. The project calls for metrology, laser processing, and screen-printed contacts to be supplied by CNSE Solar Rochester. The Incubator award is planned to begin September 2014 and will take place over one year.

Natcore Technology

Small technology start-up with operations located in Rochester, NY. Natcore is developing processes to enable formation of "black Si". Black Si is a term describing the formation of a thin porous Si layer on a wafer surface which is intended to minimize surface reflection beyond what is capable with traditional surface texturization. In a second project, Natcore is seeking to develop low temperature doping of Si through laser processing. Natcore has expressed interest in access to processing using the SiN and metallization process modules as well as interest in accessing metrology services. Based on the unit process scenario, SR will be able to engage Natcore partially in project development. Project definition around metrology services will be possible by the end of 2014. However, the SiN and metallization process modules will not be online in the near-term.

Additional outreach activities will continue to occur as the MDF facility design and construction is ongoing.

People

The Director Solar Programs position has been filled. Dr. Ian Cooper started February 17, 2014. We expect the Director to be thoroughly involved in the hiring process and expect to start actively recruiting beyond the current efforts for the positions listed in this report.

We have hired Henry Wilson as Senior Facilities Technician for the Canal Ponds building. Henry started April 21.

As project plans develop around key partners and interested companies, we will begin to engage the large pool of applicants collected during the last year and at the job fair held in 2013 in order to fill positions needed to effectively service projects.

A critical focus will be placed on immediately staffing the following positions:

Process Engineers
Process Operators
Solar Metrology Engineer
Facilities and Shipping/Receiving Associate

Equipment

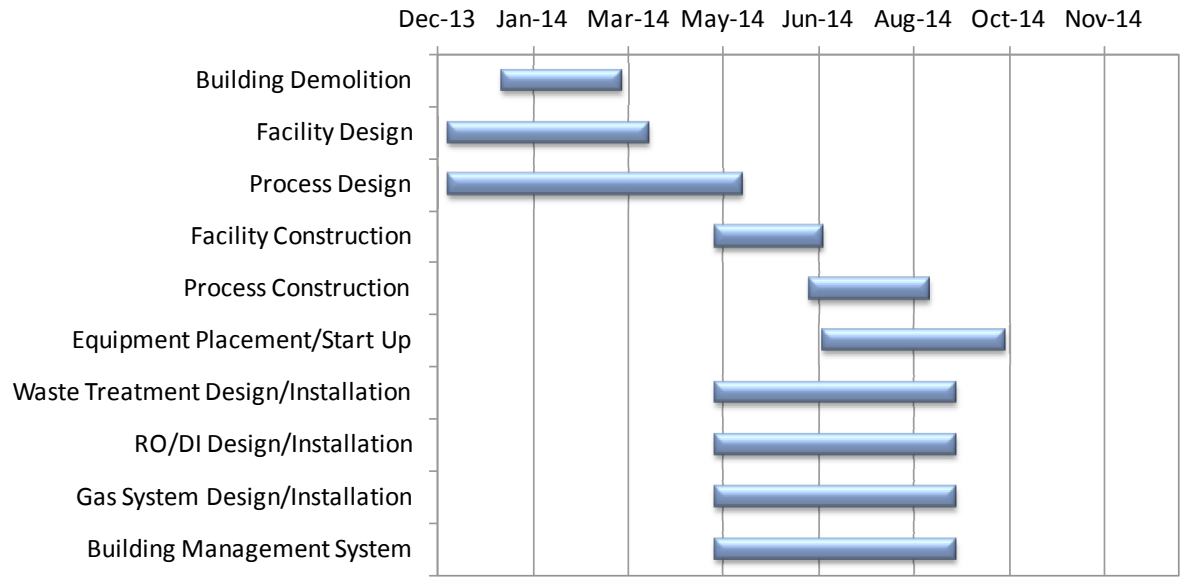
Finalizing any outstanding baseline equipment agreements will be completed after the start of the dir.

Securing differentiation equipment:
Based on project negotiation with key partner Silevo, mutual agreement has been made to develop statement of work surrounding advanced inline copper plating. Further project development may come for advanced physical vapor deposition (PVD) and reactive plasma deposition (RPD). Additional technologies under consideration are: Ion Implant for P & B blanket and selective emitter implant

Advanced Passivation – PECVD Al2O3
Partnership with Intrinsiq Materials to develop Cu/Ni inkjet process for printed conductors

Construction Schedule

The following chart provides a high-level overview of the design and construction milestone anticipated over the course of 2014.



Represented in the chart are Building Demolition, Facility and Process Design, Facility and Process Construction, Equipment Placement and Start-up, Waste Treatment Design and Installation, Reverse Osmosis/Deionized Water (RO/DI) Design and Installation, Gas System Design and Installation, and Building Management System installation. Process Design is anticipated to be complete in May 2014 and will encompass the functional needs of the process equipment chosen to support identified key partners. Process Construction is anticipated to begin in June 2014 and be completed by August 2014. In parallel, the current assets for c-Si PV manufacturing will be placed and the selected process equipment for near-term project support will be assembled for process coordination. Also in parallel with Facility and Process Construction, key facility support systems (Waste Treatment, Reverse Osmosis/Deionized Water, Gas System, and Building Management System) will be designed and installed. The timeline in Fig. 1 culminates in process start and validation to be completed in Q4 of 2014.

Section II – Products

CNSE MDF has nothing to report in this section. Given the nature of the project of providing a development facility for use by third-parties, we consider it likely that CNSE MDF may often have no items to report under this section. Nevertheless, reports under this section will be provided as appropriate.

Section III – Participants

Name: **Paul R Tolley**
Project Role: CNSE VP Disruptive Technologies
& Ex. Dir. STC
COO Solar MDF

Nearest person month worked:
Contribution to Project: Mr. Tolley coordinates the project, is responsible for the business plan, customer interaction, equipment set selection, and general market approach.
Collaborated with individual in
Foreign country: N/A

Country(ies) of foreign collaborator: N/A
Traveled to foreign country: N/A
If traveled to foreign country(ies), duration of stay: N/A

Name: **Ian Cooper**
Project Role: Director of Si Solar Technology
Nearest person month worked:
Contribution to Project: Dr. Cooper oversees and leads process development plans and projects to support the development and operational efforts. Dr. Cooper coordinates and manages customer programs. He as well provides the government reporting.
Collaborated with individual in Foreign country: No

Name: **Rebecca Lathrop**

Project Role: Director of EHS & Facilities
Nearest person month worked:
Contribution to Project: Ms. Lathrop is the project manager for the facilities construction of the production line. She works closely with the A&E and Construction management firms to ensure process design needs are met.
Collaborated with individual in Foreign country: No

Main Partners involved in the project:

Additional outreach activities will continue to occur as the MDF facility design and construction is ongoing.

Organization Name: **Bergmann Associates**
Location of Organization: Rochester, NY
Partner's contribution to the project: Manufacturing line planning and permitting

Organization Name: **Applied Materials, Inc.**
Location of Organization: Santa Clara
Partner's contribution to the project: Equipment vendor for key equipment for line & automation

Organization Name: **Roth & Rau AG / Meyer Burger AG**
Location of Organization: Hohenstein-Ernstthal, Germany
Partner's contribution to the project: Equipment vendor for metrology and line

Organization Name: **M.E. Baker**
Location of Organization: Boston
Partner's contribution to the project: Equipment vendor for wet chemistry equipment (Inline)

Organization Name: **AB Sandvik Materials Technology**
Location of Organization: Sonora, California
Partner's contribution to the project: Equipment vendor for diffusion furnaces

Organization Name: **Chemical Safety Technologies, Inc.**
Location of Organization: San Jose
Partner's contribution to the project: Equipment vendor for wet chemistry equipment (Batch)

Organization Name: **Despatch Industries, Inc.**
Location of Organization: Minnesota
Partner's contribution to the project: Equipment vendor for sintering furnace

Organization Name: **Sematech**
Location of Organization: Albany
Partner's contribution to the project: Partner in PVMC project for coordination of activities in solar

Organization Name: **Intrinsiq Materials**
Location of Organization: Rochester, NY
Partner's contribution to the project: Development of inkjet process for Cu/Ni contacts on solar cells

Organization Name: **AIS Automation**
Location of Organization: Dresden, Germany
Partner's contribution to the project: Partner in Solar MDF for DES/MES project

Organization Name: **Clean Development Group (CDS)**
Location of Organization: Halliburton, Ontario, Canada
Partner's contribution to the project: Partner for module manufacturing at Solar MDF site

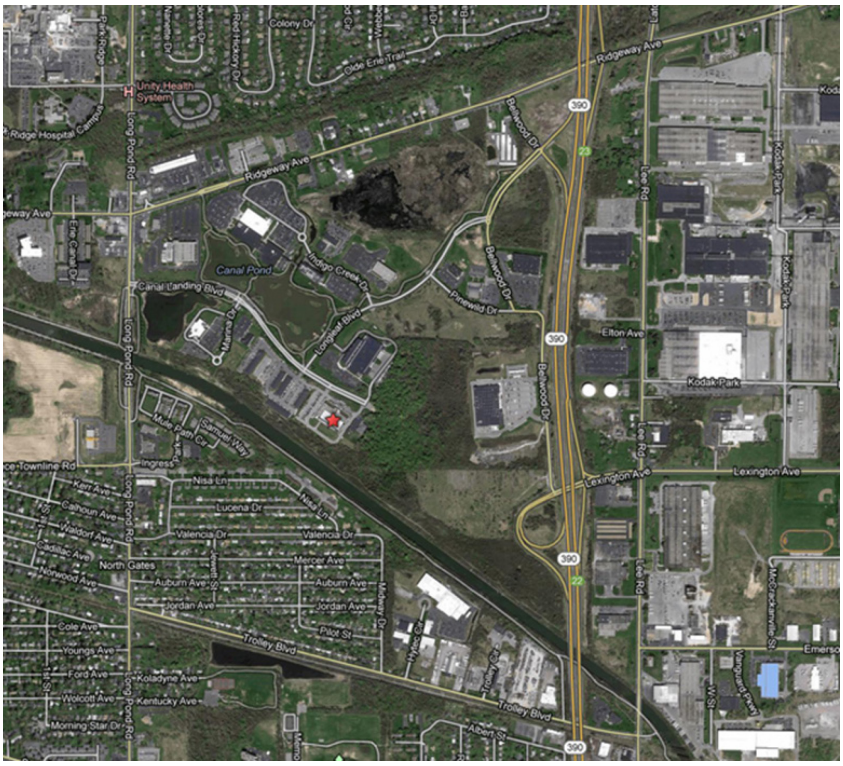
Organization Name: **Celestica**
Location of Organization: Toronto, Ontario, Canada
Partner's contribution to the project: Partner for module manufacturing at Solar MDF site

Organization Name: **Silevo**
Location of Organization: Freemont CA.
Partner's contribution to the project: Partner for process development and cell & Module Mfg.

Section IV - Impact

Location of MDF

As noted above CNSE MDF acquired a former Kodak facility at 115 Canal Landing Blvd., Rochester, NY. Facility is conveniently located within Canal Ponds Business Park in the Town of Greece. Canal Ponds is accessible via I-390 at the Lexington Avenue and Ridgeway Avenue Exits, and is minutes from the Greater Rochester International Airport as well as Downtown Rochester.



The facility includes:

- 13,000 square feet of clean rooms (class 1,000 and 10,000)
- Large Lab Area with work benches and extensive utility infrastructure.
- Electric & Lighting: Energy Saving T-8 Lighting; Horton Lighting Control Systems; 2 Load Centers
- HVAC: Multi-Zoned, Multi-Utility System with temperature, humidity and dew point controls.
- Utilities: Low Pressure Steam; Condensate Receivers/Return; Compressed Air; Chilled Water; 480V Circuits; Nitrogen; Process Vacuum RODI Water System; Natural Gas.
- Chemical storage room with blow out walls and 2 docks with levelers.
- 168 parking spaces secured access system and fully sprinklered.
- Large Break room, Employee Patio, and Men's and Women's Locker Rooms and Showers.

Finalized equipment set

The substantial baseline process equipment & some differentiation process equipment are finalized and transferred to CNSE MDF in Rochester, NY.

A profilometer, an electroluminescence, and a pull tool are needed to complete the baseline metrology tool set.

In electroluminescence an electrical current is injected into the solar cell and radiative recombination of carriers creating photons in the near infrared range. An electroluminescence image visualizes high and low defect areas in the solar cell. Therefore this tool is a good gauge to determine and analyze the quality of a solar cell. Spire Solar is being identified as a potential supplier for this measurement tool.

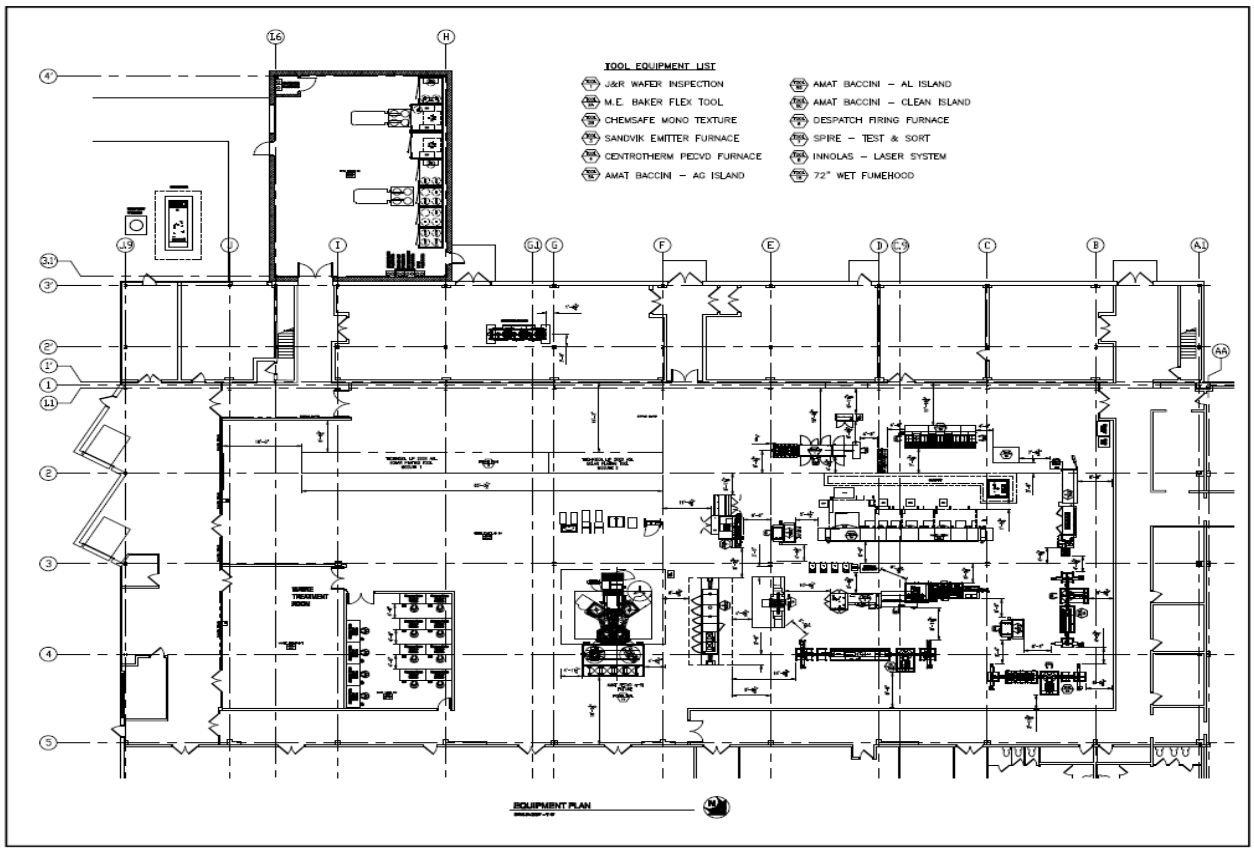
A profilometer measures the height and width of the finger structure on the solar cell. The uniformity and the geometry of the fingers have a main effect on the resistance of the contacts and therefore the performance of the solar cell.

The Dektak 3030 Surface Profiler is an advanced surface profile measuring system, which accurately measures vertical features ranging in height from 131 micron to 50 angstroms on a wide variety of substrate surfaces.

A pull tester is needed to determine the adhesion strength of the solar cell metallization. A good adhesion is important to enable a life time of a solar cell of more than 20 years. Pull tester commonly used in microelectronics would to have been substantial modified to be usable for thin large area solar cells. A supplier for this specialized gauge has to be identified.

Facilities construction

The drawing below shows a proposed facility and equipment layout.



Section V – Changes/Problems

SVTC provided CNSE with information regarding the solar facilities, equipment, qualitative solar manufacturing process, metrology tools and other documentation. However detailed documentation is missing for:

- no start up documentation for equipment
- documentation for equipment qualification
- equipment and cell type specific recipes

- standard operating procedures
- materials, chemicals, gases and other consumables specification and proposed suppliers

Since submission of the previous quarterly report, CNSE and DOE have agreed upon a redirection of the PV MDF. This redirection involves focus on unit process development rather than complete c-Si solar cell manufacturing line installation. Based on this redirection, unit process development activities have been discussed with key partner Silevo and SOW development is ongoing. Equipment and process intended to support Silevo is planned for installation as outlined in the next section under title "planned technologies and MDF capabilities to be supported". As new partners engage with CNSE and PV MDF, equipment necessity will be reassessed.

Budget

Federal non matching funds

A budget proposal representing a large portion of additional non-Federal matching funds, previously approved by the New York State Energy Research & Development Authority (NYSERDA) has been submitted and is awaiting final sign-off approval from the Office of the (NY) State Comptroller. CNSE has opened an at risk award to leverage these funds and provide immediate source funding for demolition and construction activities.

Section VI – Special reporting requirements

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Planned technologies and MDF capabilities to be supported

The planned technology offerings per our plan of record are set out in the tables below:

Tool#	Process Technology/Step	Equipment	Comments	Planned Delivery
1	Incoming wafer test & sort	Jonas & Redmann WIS	Wafer Inspection System: check micro-crack, breakage, resistivity, TTV etc.	Delivered
2a	Texture Etch Multi-c Si	M.E. Baker – Flex Tool	Four Modules to support; Texture Etch, Edge Isolation, PSG Etch, Polish Etch, surface prep & Clean.	Delivered
	Oxide Wet Etch			
	Edge Isolation			
2b	Texture Etch Mono-c Si	Chemical Safety Tech	Batch Tool for Mono c-Si Texture	Delivered
8	Laser System	Innolas	Equipment for Laser Edge Isolation.	Delivered

Tool #	Process Technology/Step	Importance	Tool	Supplier	Planned Delivery
1	Minority carrier Lifetime measurement	Baseline	Lifetime tester-Sinton-WCT 120	Sinton	Delivered
2	Post diffusion process control	Baseline	Sinton Suns Voc	Sinton	Delivered
3	Optical surface inspection	Baseline	Nikon Optiphot 66 with camera	Nikon	Delivered
4	Weight measurement	Baseline	Mettler Toledo-XS204	Mettler Toledo	Delivered
5	Acid concentration	Baseline	Mettler Toledo - Titration Tool-T70	Mettler Toledo	Delivered
6	Weight measurement	Baseline	A&D HR60	A&D	Delivered
7	Weight measurement	Baseline	A&D EK12-Ki scale	A&D	Delivered
8	To measure thickness, refractive index and extinction coefficient of thin layers	Baseline	Spectroscopic Ellipsometer - Sentech S800pv	Sentech	Delivered
9	Firing Furnace profiling	Baseline	Datapaq	Datapaq	Delivered
10	IQE / EQE / Reflectance	Baseline	PV Measurements - QEX10	PV Measurements	Delivered
11	Solar cell standalone I-V tester	Baseline	PV Measurements IV-16L	PV Measurements	Delivered
12	Measure height and width of the fingers	Baseline	Dektak profilometer 3030	Dektak	TBD
13	Electroluminescence	Baseline	Electroluminescence	Spire	TBD
14	Shunt detection	Baseline	Shuntometer	Pasan	Delivered
15	Bulk resistivity and sheet resistance	Baseline	Jandel four point probe RM3000	Jandel	Delivered
16	Adhesion strength tester (pull tester)	Baseline	Pull tester		TBD

Significant Accomplishments and Conclusions:

Ultimately this effort was unable to attract the needed private sector participation to become self-sustaining.

Inventions, Patents, and Publications:

Not applicable.

The intention of this project was not to generate inventions or patents. This was a user facility meant to allow US based silicon PV manufacturers and related technologies test their products in a manufacturing relevant environment. All inventions and patents were meant to reside with the users of the facility.

Path Forward:

Since the time this award was made the global PV manufacturing industry has gotten increasingly competitive with the sale price of modules falling at a rate not anticipated years ago. This has coincided with the rapid scale up of foreign manufacturers who have been able to bring a scale to manufacturing which has put tremendous downward pressure across the globe. These market conditions made the continued operation of PV manufacturing facilities in the US increasingly difficult. Due to those market pressures the number of PV manufacturers has reduced dramatically. This being the case, there has not been an adequate user base for the MDF leading to a financially untenable situation and the eventual closure of the facility built under this award.