

Attachment H

CONSTRUCTION DELIVERABLES TEMPLATE

**FINAL CONSTRUCTION DELIVERABLES TEMPLATE
GREEN BUILDING NEW CONSTRUCTION OR MAJOR RENOVATION
CONSTRUCTION PHASE**

Grantee Name	Extrusion Technology, Inc.
Project Grant Agreement Number #	LRI-DS769-00651
Date Contract Signed	13 JUNE, 2006
Project Location (Insert whole address)	80 TRIM WAY, RANDOLPH, MA 02368
Name of Electric Distribution Company	NATIONAL GRID

Upon conclusion of each milestone in the project, grantee shall provide MTC with the deliverables contained in this template and the attachments described below. Please be aware that this information may be copied for use on the MTC website, which describes current MTC-funded projects.

1. **At the end of the first milestone (renewable energy system materials delivered onsite); you only need to provide the associated deliverables attachments given below.**
2. **At the end of the second milestone (renewable energy system installed), you need to submit a complete draft of this template and the associated deliverables attachments.**
3. **For the third milestone (renewable energy system commissioned); you need to submit the final version of this template that addresses any comments made by the MTC in the earlier draft, and the associated deliverables attachments.**

<i>CONSTRUCTION DELIVERABLE ATTACHMENTS</i>	<i>Done</i>
Milestone #1 – Renewable energy system materials delivered onsite	
1. Approved contractor submittals for the renewable energy system	<input checked="" type="checkbox"/>
2. Cut sheets related to the renewable energy system	<input checked="" type="checkbox"/>
3. Evidence of utility company authorization to install the renewable energy system	<input checked="" type="checkbox"/>
In case not submitted during the design phase, please submit:	
a. Plans & specifications for the renewable energy system(s) that MTC is being asked to fund (include site plan showing location of renewable energy system relative to surroundings)	<input checked="" type="checkbox"/>
b. Electrical one-line diagram for the renewable energy system(s)	<input checked="" type="checkbox"/>
c. Copies of relevant permitting approvals and any associated analysis including such items as: building permits, environmental studies, interconnection-related studies, etc.	<input checked="" type="checkbox"/>
d. For projects seeking the Green Buildings adder, a completed energy modeling report demonstrating that the building will use at least 20% less energy compared to a code-compliant building (ensure that report conforms to MTC's energy modeling report requirements)	N/A
Milestone #2 – Renewable energy system installed	
1. Completed deliverable template (below)	<input checked="" type="checkbox"/>
2. Digital photos of renewable energy system, including interconnection area, meter, data acquisition system, inverter and other relevant system components. (We will be using these pictures for publicity)	<input checked="" type="checkbox"/>

3. Digital photos of front view of the building for publications	<input checked="" type="checkbox"/>
4. Copies of any change orders regarding the renewable energy system	N/A
5. Copy of warranty or service contract showing evidence of compliance with MTC technical requirements.	<input checked="" type="checkbox"/>
For Projects seeking a Green Buildings adder only:	
6. LEED or CHPS checklist / score sheet.	N/A
7. For each LEED or CHPS credit claimed, provide a brief narrative description of what was done to achieve each individual credit. For energy star, supply a copy of energy star certification.	N/A
Milestone #3 - Renewable energy system commissioned	
1. Commissioning report documenting that the renewable energy system is operating as the design intended. See MTC technical requirements.	<input checked="" type="checkbox"/>
2. Certificate of completion signed by the electrical inspector and authorization to interconnect from the utility	<input checked="" type="checkbox"/>
3. Documentation showing the total dollar amount of electric and gas utility rebates for energy efficiency measures	N/A
4. Documentation showing the total dollar amount of any other energy efficiency or renewable energy grants or rebates	N/A

	Dates from Design Deliverable	Actual Dates
1. When was/when will the order be placed for the renewable energy system?	June 15, 2006	July 7, 2006
2. When will renewable energy system components be delivered to the project site?	July 1, 2006	August 27, 2006
3. When will the renewable energy system be installed?	July 7, 2006	September 29, 2007
4. When will the renewable energy system be commissioned?	July 14, 2006	October 5, 2006
5. What is the anticipated occupancy date of the facility?	N/a	n/a
Please add comments on the reasons behind schedule changes, if any: Inverter manufacturing delay. Additional engineering/construction to shore up roof.		

3. Incentive Adders: Please confirm your incentive adders. Check all of those adders that you are requesting.

	Check those that apply	Provide Explanation	MTC - PM Approval
Distributed Generation			
MA-Manufactured components	<input checked="" type="checkbox"/>	Schott solar panels and racks, Billerica Mass. Inverter, Satcon, Boston.	
Public Buildings	<input type="checkbox"/>		
Economic Target Area	<input checked="" type="checkbox"/>	Randolph, MA	
Back-up for Critical Loads	<input type="checkbox"/>		
Building-Integrated PV	<input type="checkbox"/>		
Fuel-less electricity generator	<input type="checkbox"/>		
Affordable Housing			
20 % to less than 50 % Low income/affordable Housing (40-B) /OR	<input type="checkbox"/>		
50 % or greater Low income/affordable Housing (40-B)	<input type="checkbox"/>		
High Performance Buildings: New Construction only			
Green Buildings LEED/CHPS /OR	<input type="checkbox"/>		
Advanced Buildings/ High Performance Homes (Energy Star)	<input type="checkbox"/>		

- 4. Lessons Learned:** Please describe lessons learned in each of the categories below. Think about what went well, what went wrong, what you would do differently next time, and how you would advise someone else going through this process. Please comment on schedule, budget, interaction with your utility, permitting, as appropriate.

1. Siting & Permitting of Renewable Energy System.

Sunlight Solar performed excellent original design work, using Google Earth and on site layout schematics. The final installation was very closely based on original design work. Extrusion Technologies has an ideal flat roof with a South facing exposure that made the siting of PV a simple process.

The only major permitting delay was because Sunlight Solar Energy, Inc. had to apply to become Massachusetts registered foreign corporation and contractor. This delay was minor, and did not impact the project timeline more than two weeks.

National Grid also delayed the startup timeframe because they requested final engineering, stamped drawings as part of the approval process. This delayed the startup timeframe by less than one week.

2. Renewable Energy System Installation

Schott Solar, the manufacturer of the panels and the roof mounting system, added additional engineering and construction requirements right at the start of installation. This additional engineering was not something that the team could anticipate, and required a redesign of the roof mounting system. This caused a small panel installation delay, but was important, as Schott provides a high level of quality assurance for these installations. Schott also supplied an onsite engineer to aid with the system installation, which reinforced the design and installation procedures.

The other important lesson that the team learned is that it would have helped to have the inverter on site while the DC (solar) side of the project was being installed. This would have facilitated communication between the AC and DC electricians and made the job easier.

3. Interconnection of the renewable energy system

National Grid had not, until recently, approved the installation of the SATCON inverter in their service territory. This delayed preliminary approval, as Grid needed to evaluate the technical specifications of the inverter. Both Sunlight and Extrusion are proud to have paved the way with this newer inverter system here in Massachusetts.

Based on work by Sunlight Solar Energy, Inc., Turtle Energy, SATCON and the City of Brockton, National Grid has now approved the use of this inverter. It will be smoother and easier for future projects.

4. Commissioning of Renewable Energy System

National Grid requires the depowering of the building in order to complete the onsite inspection. On a large manufacturing facility that operates 24/7, this can cause work delays, negatively impacting profits. The inverters are listed to UL 1741 for just such a reason. Witness testing seems to be a duplication of efforts.

The system commissioning was a smooth and painless process. The circuits were checked to ensure proper voltages, and no problems were found. The system will be monitored by a Fat Spaniel Data Acquisition System, with automatic control monitors that will automatically email Bob Cote of Extrusion and Paul Israel of Sunlight Solar if the system falls out of the standard operating conditions.

- 5. Operations and maintenance:** Who will be responsible for preventive maintenance? Routine maintenance and repairs? What is your operations and maintenance plan with regard to your Renewable Energy System? What are your anticipated operations and maintenance costs?

Bob Cote, Extrusion Technology.

All solstices, winter, summer, spring and fall will trigger a visual inspection of the system. The team will be looking specifically for discoloration of the panel's cells, wires touching the roof, excessive soiling of any panels, and a visual inspection of the fused combiner box in the roof.

As mentioned, there will be constant monitoring available on the Fat Spaniel website.
Costs. \$2,000 for amortized web monitoring and \$750 annual staff time.

- 6. RECs:** What do you plan to do with the renewable energy certificates (RECs) associated with your renewable energy system?

REC's are presently planned to be sold to Mass. Energy Consumers Alliance, and the price is still in negotiation.

7. Renewable Energy System Components and Installed Costs: Please provide information on the renewable energy system components and cost elements. This is an imbedded Excel spreadsheet, click twice to open Excel, click word document to close Excel. White cells are entry cells, and yellow cells are calculation cells.

Equipment Description	Model	Manufacturer	Location of Manufacture (City/ State/ Zip/ Country)	Quantity	Unit Cost	Total Cost
[list major equipment (e.g., panels, turbines, generator, etc.), insert rows as required]	ASE 300/315	Schott Solar	Billerica, MA USA	192	\$ 1,738.00	\$ 333,696.00
Main Equipment Costs						\$ 333,696
Inverter (if multiple inverters, insert rows as required)	Satcon 50-60	Satcon	HQ Boston, MA. Manuf. Ontario, Canada	1	\$ 28,000.00	\$ 28,000.00
Data Acquisition System (If Applicable)	FS-standard	Fat Spaniel, Inc	San Jose, California	1	\$ 6,000.00	\$ 6,000.00
Meter	Centron/Schlumberger	Centron/Schlumberger	Portland, Oregon	1	\$ 325.00	\$ 325.00
Mounting (if applicable)	FS System	Schott Solar	Billerica, MA USA	1	\$ 45,504.00	\$ 45,504.00
Tower (if applicable)	n/a	n/a	n/a	0	\$ -	\$ -
Storage Equipment (if applicable)	n/a	n/a	n/a	0	\$ -	\$ -
Peripheral Equipment Costs						\$ 79,829.00
Design Costs (engineering, architectural, etc.)						\$ 11,034.00
Installation costs (Labor costs, electrical, etc.)						\$ 30,846.00
Interconnection Fees (If Applicable)						\$ 895.00
Total Installed Cost						\$ 456,300

8. System Details:

Project contractors :	
Company: Sunlight Solar Energy, Inc.	Service rendered: [DC electrical, racking, overall job management.
Company: Tibbetts Electric	Service rendered: AC electrical, final testing, and hook-up
Company: Turtle Energy	Service rendered: Engineering and equipment layout
System Information	
Date in service: 10/25/06	Initial meter reading (before start up): Zero (solar kWh meter)
Total installed kW of the Renewable Energy System (Report in DC for PV; AC for other technologies): 59.6	Annual Expected Production (kWh) 78,000 kWh
Storage System (if applicable)	
Type: n/a	Model: n/a
Manufacturer: N/a	
System Meter 3 phase AC kWh meter	
Model: Schlumberger 480	Manufacturer: Centron
DAS Type/ Provider (If applicable): Fat Spaniel	
Model: Standard	Manufacturer: Fats Spaniel
PV Panel Details (if applicable): Schott Solar 300/315	
Orientation Type: x <input type="checkbox"/> Fixed <input type="checkbox"/> Single Axis <input type="checkbox"/> Dual Axis 5 degrees	Azimuth (in degrees): 185 degrees
Inclination (in degrees): If adjusted seasonally please note. n/a	NOTE: Horizontal arrays with inclination = 0 are assumed to have 180 degree azimuth.
Surface Area (sq meters entire array): 10,033 s/f	Shading Impact (as a percentage % of optimal production based on azimuth, inclination, and no shading): <1%
Fuel Cell Details (if applicable): n/a	
Fuel Cell Type: <input type="checkbox"/> Natural Gas <input type="checkbox"/> Landfill Gas <input type="checkbox"/> Anaerobic Digester Gas	Operating Mode: <input type="checkbox"/> Baseload <input type="checkbox"/> Peaking
Electricity Efficiency:	Use of Thermal Load:
Thermal Efficiency:	Expected Availability (%):
Gas Utility (if applicable):	Application: <input type="checkbox"/> CHP <input type="checkbox"/> Assured power <input type="checkbox"/> T&D deferral
Hydro Details (if applicable):	
Area drained by river/stream in Sq. Miles:	Hydraulic head available in ft:
Hydro type:	
Average annual flow rate cu.ft./sec: Source of Data:	Minimum average monthly cu.ft./sec at site: Source of Data:

Wind Turbine Details (if applicable):	
Tower type:	Turbine rotor hub height in ft:
Latitude & Longitude of tower:	Turbine rotor diameter in ft:
Average annual wind speed at hub height in kts:	Source of data:
Other Details (if applicable):	

9. Renewable Energy Certificate (REC) Contract Details (If Applicable):

Please list the expiration date for the REC Contract and what happens at expiration (“Reverts to Owner”, “No Action”, “No Contract”, “Other”)

Not decided yet.