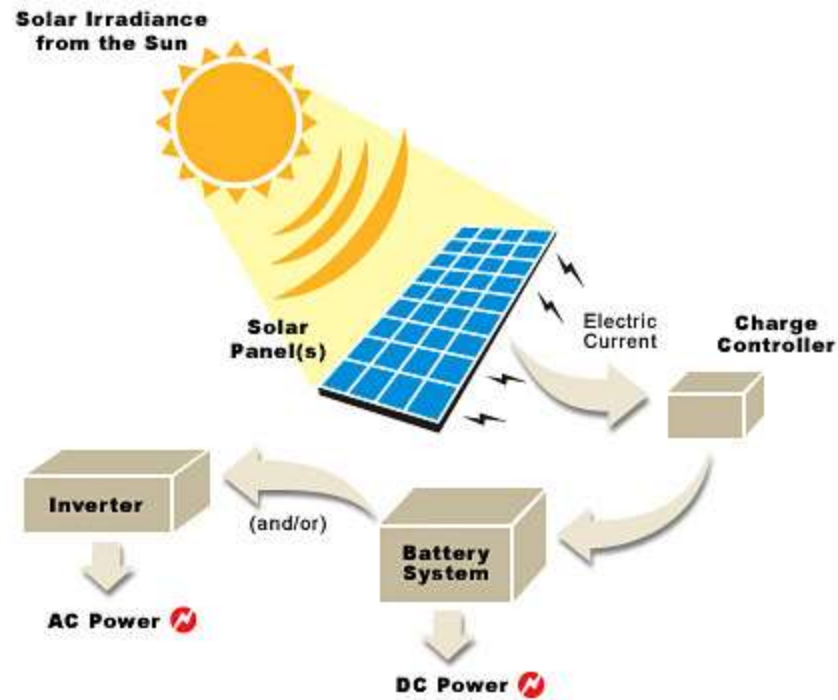


Grafton Solar Photovoltaics (PV)

March 28, 2013



Proposed Solar Electricity in Grafton

Site	System Size (kW DC)	System Size (kW AC)	Energy (kWh/year)	Area (Acres)
Grafton Campus			11,325,421	
Science Park	1,296	1,000	1,702,000	4.8
Knoll	<u>2,580</u>	<u>2,000</u>	<u>3,380,000</u>	<u>14.00</u>
Total	3,876	3,000	5,082,000	18.80
Grafton solar % Grafton Total			45%	
Grafton solar % University Total			8%	

Proposed Grafton Solar Project

- Two ground mounted systems
- Owned and operated by solar developer
- Solar developer sells Tufts electricity
- All solar generated electricity is used by Tufts
- Contractual vehicle is Power Purchase Agreement (PPA)

Power Purchase Agreement (PPA)

- Long-term (20 year) agreement between the solar provider and the host (Tufts)
- Host is obligated to buy ALL power generated from the solar installation
- Fair market value buyout option starts in year 6 of contract
- Contractual financial guarantees for system removal and site restoration

Solar PPA Benefits

- Affordable
- No on-going maintenance costs
- Locks in “all in” price of electricity
- Provides hedge against future price increases for 45% of campus needs
- Demonstrates Tufts’ leadership and commitment to climate change action



Emissions Reductions

U.S. Environmental Protection Agency's Greenhouse Gas Equivalencies Calculator

The systems will generate approximately
5,082,000 kWh of electricity annually to avoid

3,586 Metric Tons of Carbon Dioxide emissions

This is equivalent to:

Annual greenhouse gas emissions from

747 passenger vehicles

CO₂ emissions from

401,974 gallons of gasoline consumed

CO₂ emissions from

8,339 barrels of oil consumed

CO₂ emissions from

47 tanker trucks' worth of gasoline

CO₂ emissions from electricity use of

537 homes for one year

CO₂ emissions from energy use of

185 homes for one year

Carbon sequestered by

91,939 tree seedlings grown for 10 years

Carbon sequestered annually by

2,939 acres of pine or fir forests

Carbon sequestered annually by

28 acres of forest preserved

CO₂ emissions from

149,400 propane cylinders used for home barbecues

Greenhouse gas emissions avoided by recycling

1,343 tons of waste instead of sending it to landfill

Estimated forest acreage to be removed: 11

Benefits of Ground Mounted

- Ability to build large scale systems
- Simpler, less expensive installation
- Easiest to maintain
- Lower installation costs reflected in cost of power for 20 years
- Mounting angle is optimized (usually 30 degrees)
- Direction is optimized (due south)

The Solar Developer

- **SunEdison** selected after a rigorous competitive process lead by PowerOptions
- Selection based on best PPA pricing methodology, 10 year SREC fixed value, willingness to develop large and small projects, strength of company and team, **financial backing**
- SunEdison is a subsidiary of MEMC Electronics Materials, a global leader in polysilicon and silicon wafer manufacturing (the foundation of most solar cells and semiconductor devices)

Sites Selected for Development



Science Park
Phase II

The Knoll

Grafton Science Park

TOTAL SYSTEM DESCRIPTION	
MODULE TYPE	MEMC-M630RMC
QUANTITY	3,300
SYSTEM SIZE (DC)	1,298 KW DC
SYSTEM SIZE (AC)	1,000 KW AC
INVERTER	(2) AE SOLARON 500
TILT ANGLE	20°
AZIMUTH	180°
TOTAL AREA	4.8 ACRES
ENERGY OUTPUT	1,702 MWH/yr

GENERAL NOTES:

(1) ALL EXTERNAL REFERENCES USED TO IDENTIFY USABLE AREA ARE NOT TO SCALE AND ARE THEREFORE NOT VERIFIED. EXACT AREA LOCATIONS WILL BE IDENTIFIED DURING FULL DESIGN.

(2) ANY AND ALL TREES LOCATED INSIDE FENCING OR CREATING SHADE ON MODULES SHALL BE REMOVED. AREAS SHOWN IN RED INDICATE APPROXIMATE AREAS OF TREES TO BE REMOVED.



MEMC 630W PHOTOVOLTAIC MODULES TO BE INSTALLED ON SITE

(2) AE SOLARON 500W INVERTER AND (1) 15KVA STEP-UP TRANSFORMER ON INVERTER PAD

SECURITY FENCE TO BE INSTALLED BY PERMITTEE OF PROPERTY

Sun Edison
12500 BARKHURST AVENUE
BELLINGHAM, MA 01915
(443) 909-1200

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PROJECT NAME: **TUFTS UNIVERSITY - GRAFTON CAMPUS**

PROJECT NUMBER: **MA-11-0159**

GRAFTON, MA

PROPOSAL SUBMITTAL

REVISION	NO.	DATE

DATE: _____

SOLAR ELECTRIC SYSTEM CLIENT:
TUFTS UNIVERSITY

DESIGNER	DATE
REVISION	DATE
ENERGY CONSULTANT	DATE

SCALE: _____

PRELIMINARY DESIGN
TUFTS UNIVERSITY - GRAFTON CAMPUS

SHEET NO.: **1 OF 1**

PRELIMINARY DESIGN
NOT FOR CONSTRUCTION

Science Park Phase II

South East



Revised

Location shifted
Reduced system size
Net-metered:
Generation assigned to main campus meter

Science Park

- System engineering just completed
- To be reviewed by Tufts
- Submitted to National Grid for review
- SunEdison performing due diligence at the site

The Knoll

View from Route 30 Looking South



Photo Location Map

The Knoll – Simulated View from Route 30 Looking South

Tufts University—Grafton Campus I Solar Energy Project



Simulated Condition



FIGURE 6b
Project Visualization
The Knoll Site
View from Grafton Road Looking South

The Knoll – Simulated View from Access Road Looking South

Tufts University—Grafton Campus I Solar Energy Project



Simulated Condition

FIGURE 5b
Project Visualization
The Knoll Site
View from Project Access Road Looking South



What is the technology?

- The preliminary designs use:

- Modules:

- MEMC-M310AMC

- Manufacturing locations in the US and worldwide

- Inverters:

- AE Solaron 500

- AE Solaron 333

- Solaron products built in the US are fully compliant with the Buy American Act

- The final design could use a different manufacturers' panel



Important to remember that...

- The solar system cannot provide power during an emergency
 - Electric code requires that the photovoltaic arrays automatically disconnect with the loss of utility power to prevent back feeding the utility grid and possible electrocution of personnel

Project Status

- Sites finalized
- PPA language amended with “out clause” should property tax negotiations fail
- PPA signed September 2012
- Preliminary engineering completed
- Knoll interconnection submitted to Ngrid January 2013
- Science Park interconnection to be submitted April 2013
- Local permitting process
- Construction anticipated in Fall 2013 or spring of 2014

More information:

- PowerOptions www.poweroptions.org
- SunEdison www.sunedison.com