

groSOLAR

## Vermont Air National Guard

### Overview

**DESIGNER:** Brian Browning, electrical engineer; Tim Macke, solar engineer; groSolar, grosolar.com

**INSTALLATION TEAM:** Harold Craig, site superintendent; Frank Griffin, project executive; Matt DiNisco, commercial project manager; Rod Viens, procurement manager; groSolar

**DATE COMMISSIONED:**  
September 2011

**INSTALLATION TIME FRAME:**  
120 days

**LOCATION:** Burlington, VT, 44.5°N

**SOLAR RESOURCE:** 4.3 kWh/m<sup>2</sup>/day

**HIGH/LOW DESIGN TEMPERATURES:**  
Per Solar ABCs Solar Reference Map:  
88°F/-15°F

**ARRAY CAPACITY:** 1.446 MW (1,388.7 kW fixed-tilt ground mount, 25.2 kW dual-axis tracked ground mount, 31.9 kW roof mount)

**ANNUAL AC PRODUCTION:**  
1,827 MWh

### Equipment Specifications

**MODULES:** 5,798 Kyocera KD245GX-LPB, 245 W STC, +5/-3%, 8.23 Imp, 29.8 Vmp, 8.91 Isc, 36.9 Voc; 120 Evergreen ES-A-210-fa3, 210 W STC, +4.99/-0 W, 11.48 Imp, 18.3 Vmp, 12.11 Isc, 22.8 Voc

#### Fixed-Tilt Ground Mount

**INVERTERS:** Inverter A: One Satcon PVS-250, 250 kW, 600 Vdc maximum input, 320–600 Vdc operating range, 3-phase 480Y/277 Vac output; Inverters B and C: Two Satcon PVS-500, 500 kW, 600 Vdc maximum input, 320–600 Vdc operating range, 3-phase 480Y/277 Vac output

**ARRAY:** 13 Kyocera KD245GX-LPB modules per source circuit (3,185 W,



The federally funded Multiple Award Task Order Contract (MATOC) Renewable Energy Project at the Vermont Air National Guard Base in Burlington utilizes three PV-mounting methods: a fixed-tilt ground mount (the largest of the three), a dual-axis tracked array and a flush-mounted rooftop array. All system components were purchased under Buy American guidelines.

The project is being deployed in three distinct phases. Phase 1 included all three arrays. Phase 2 added capacity to the fixed, ground-mounted array. Phase 3, which will further expand the ground-mounted array, was incorporated into the overall project design and will be awarded and installed at a later date. The Phase 3 interconnection switchgear, transmission lines, inverter pad and conduit, and data acquisition systems were included in the first two phases.

The site for the fixed, ground-mounted array was formerly used for aircraft storage. Prior to the PV system

installation, the entire area was graded, leveled and covered in gravel or topsoil by Engineers Construction, the project contractor. After completing soil testing and determining pile depth, groSolar installed Schletter racking posts, binders and purlins. All racking components were carefully leveled to provide a consistent structure for the array.

The Base's utility provider, Green Mountain Power (GMP), performed a feasibility study to assess how all three phases of the fixed ground-mount array would affect the utility's existing infrastructure. To accommodate the system's location and generation capacity, GMP installed new transmission lines and a new transformer.

The roof-mounted array, located on the Base's Building 90, was installed on a standing-seam metal roof. DeWolfe Engineering reviewed the building's structure, assessed the additional load imposed by the PV system and provided specifications for attachment points based on calculated uplift forces. The



system was interconnected at the building's utility service after a feasibility study determined that the existing utility infrastructure would support the PV system's output.

The dual-axis tracking system consists of six AllSun trackers that utilize GPS array positioning. These six sub-array outputs are combined at a dedicated subpanel that is incorporated into the fixed ground-mount array switchgear, transformer and transmission lines. The tracker interconnection was originally designed to combine with the roof-mounted system. However, the GMP feasibility study determined that the present infrastructure

could not support the additional power that the tracked array would introduce. Therefore, this system was redesigned to combine with the fixed ground-mount array switchgear.

"Every detail of this project was mapped out to specific requirements, from site work to conduit runs to the landscaping. Our nimbleness and ability to install the three types of applications in a single project, while maintaining high standards, resulted in a nice-looking project that will save the Vermont Air National Guard millions of dollars over the next several decades."

—Jeffery Wolfe, CEO and cofounder, groSolar

8.23 Imp, 387.4 Vmp, 8.91 Isc, 479.7 Voc); 11 source circuits per combiner, typical (35 kW, 90.53 Imp, 387.5 Vmp, 98.01 Isc, 479.7 Voc); Inverter A: 88 source circuits total (280.3 kW, 724.24 Imp, 387.4 Vmp, 784.08 Isc, 479.7 Voc); Inverter B: 176 source circuits total (560.6 kW, 1,448.48 Imp, 387.4 Vmp, 1,568.16 Isc, 479.7 Voc); Inverter C: 172 source circuits total (547.8 kW, 1,415.56 Imp, 387.4 Vmp, 1,532.52 Isc, 479.7 Voc); array total 1,388.7 kW

**ARRAY INSTALLATION:** Fixed ground mount, Schletter FS System Generation 6 racking, 170° azimuth, 30° tilt

**ARRAY STRING COMBINERS:** 40 Cooper Bussmann BCBS Series Standard Combiner Boxes, 15 A fuses

### Tracked Ground Mount

**INVERTERS:** Six SMA Sunny Boy 6000-US, 6 kW, 600 Vdc maximum input, 250–480 Vdc MPPT range, single-phase/277 Vac output

**ARRAY:** 20 Evergreen ES-A-210-fa3 modules per source circuit (4,200 W, 11.48 Imp, 366 Vmp, 12.11 Isc, 456 Voc), one circuit per inverter; array total: 25.2 kW

**TRACKERS:** Six AllSun Tracker Series 20; packaged system includes modules, tracker and inverter

**ARRAY INSTALLATION:** Dual-axis tracked ground mount

### Roof Mount

**INVERTER:** One Satcon PVS-30, 30 kW, 600 Vdc maximum input, 305–600 Vdc operating range, 3-phase/208 Vac output

**ARRAY:** 13 Kyocera KD245GX-LPB modules per source circuit (3,185 W, 8.23 Imp, 387.4 Vmp, 8.91 Isc, 479.7 Voc), 10 source circuits total (31.9 kW, 82.3 Imp, 387.4 Vmp, 89.1 Isc, 479.7 Voc)

**ARRAY INSTALLATION:** Roof mount, standing-seam metal roofing, S5! Mini Clamps, Unirac SOLARMOUNT racking, 131° azimuth, 16° tilt

**ARRAY STRING COMBINER:** Cooper Bussmann BCBS Series Standard Combiner Box, 15 A fuses

**SYSTEM MONITORING:** ArgusON SPM-150 system performance and environmental monitoring, Shark revenue-grade energy meter, Control Technologies building performance monitoring