TECHNICAL REPORT

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City of Grand Rapids

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CITY OF GRAND RAPIDS BUILDING SOLAR ROOF DEMONSTRATION

GRAND RAPIDS, MICHIGAN

City of Grand Rapids (MI) Water/Environmental Services Building

Executive Summary

Grand Rapids, Michigan is striving to reduce its environmental footprint. The municipal government organization has established environmental sustainability policies with the goal of securing 100% of its energy from renewable sources by 2020. This report describes the process by which the City of Grand Rapids evaluated, selected and installed solar panels on the Water/Environmental Services Building. The solar panels are the first to be placed on a municipal building. Its new power monitoring system provides output data to assess energy efficiency and utilization. It is expected to generate enough clean solar energy to power 25 percent of the building. The benefit to the public includes the economic savings from reduced operational costs for the building; an improved environmentally sustainable area in which to live and work; and increased knowledge about the use of solar energy. It will serve as a model for future energy saving applications.

Narrative

The City of Grand Rapids City Building Solar Panel Demonstration project goal was to place a photovoltaic array on or adjacent to a City of Grand Rapids building (facility). This was consistent with the City of Grand Rapids sustainability policies and its ongoing effort to secure 100% of its energy from renewable sources by 2020. Placement of photovoltaic panels is one component of the city's overall plan to reduce building energy consumption, and promote environmental sustainability. Phase I of the project included evaluation of the ideal site conditions for various panel types, evaluation of the existing facilities to determine the best panel type and facility match, and additional funding source requirements and conditions. Phase I was completed in March 2011. The resulting Panel System and the Facility Options Report provided a recommendation for the proposed type of panel, location and additional costs, funding, rebates, interconnection requirements and sustainability. Phase II included design of the selected option, bidding and awarding of the project, preparation of the site and installation and interconnection of the panels and finally, their integration into the building's electrical system. Phase II was completed in June 2012.

Based on the recommendations of the Phase I evaluation the selected site was the roof of the City of Grand Rapids Water/Environmental Services Building located at 1900 Oak Industrial Drive, NE. The facility offered the best exposure to the sun, the best supporting infrastructure and best opportunity for electrical savings. This LEED certified building consists of 4 main roof sections, 3 of which were acceptable for mounting the PV array (71,000 square feet). The building elevation is approximately 730 feet from the building floor level. The installation work included the necessary preparation and ancillary improvements to accept the photovoltaic panels to the existing facility, and installation of the panels.

Installation of the solar photovoltaic power system began in March 19, 2012 and was completed on schedule on June 5, 2012. The completed system includes 3 arrays each with 13 strings of 11 panels, a total of 429 panels, and each panel able to provide a maximum 285 watts creating a maximum output of 122,625 watts direct current (DC) power per hour. This power is fed into an inverter serviced by "Solectria Renewables" which converts the DC power to AC with a maximum output of 95 Kw. From the inverter, the power is fed through the Consumers Energy owned "net meter" into the building transformer. The system has a 25 year warranty. Photographs of the project are included in Attachment 1 of this report.

The system was furnished with a complete Power Monitoring System. The inverter serviced by "Solectria Renewables" also utilizes sensors to capture real time output data associated with the operation of collection and transfer of the power. This data is sent through an internal modem to the manufacturer, Solectria Renewables, which makes the data available on a website specifically for the

Water/Environmental Services Building location. The power monitoring system began collecting real time data on May 21, 2012. In 5.3 months (ending October 31, 2012) the system had captured 80,534 kilowatts of solar power. The predicated annual solar power is 125,501 kilowatts based on the National Renewable Energy Laboratory– PVWatts performance calculator. Thus, the city was approximately 20% ahead of schedule for generating solar power. The system is expected to offset 25 percent of the facility’s annual electric consumption. Attachment 2 shows a screen view of the output data website. Real time data for the system can be accessed via the City of Grand Rapids website at the following link:
http://www.solrenview.com/cgi-bin/cgihandler.cgi?&sort=pvi_IDs&cond=site_ID=1341

The project has presented a partnership opportunity between the City of Grand Rapids and the public utility company, Consumers Energy. Upon review by the Utility Advisory Board and City Commission, the City entered into an “INTERCONNECTION AND PARALLEL OPERATING AGREEMENT FOR CATEGORY 2 PROJECTS” agreement with Consumers Energy. This agreement allows the City to direct power from the inverter back to Consumers Energy electric utility grid at times when the city’s electrical generation exceeds the city’s own use.

The inverter also contains an automatic switch gear which will terminate the flow of electricity upon failure of delivery of power by Consumers Energy to prevent damage to the stand-by generator at the facility and avoid a hazard to repairs crews which may be working on downed power lines.

Environmental Footprint through June 2013

The power monitoring system provides data that can be viewed in real time. Although the data is technical in nature, certain data is presented in such a way that it is understandable by a layperson. An animated view provides a basic description of the solar energy conversion process. It also provides information about the system’s effect on the environmental footprint by providing examples of real life energy usage effects. For example, the system’s lifetime (14 months) energy generated is currently 167 MWH which represents:

- ☀ 30,957,530 smart phone charges
- ☀ 5 days of powering 1 search engine data center
- ☀ 100 CO₂ tons emission avoided
- ☀ 14,776 gallons of gasoline offset
- ☀ 6,972 electric cars charged
- ☀ 4,980 nights of powering the Christmas tree at Rockefeller Center

The environmentally sustainable solar panel system is intended to be a well-designed, proven, long term system with a cost effective return on investment and long life system expectancy. The city will benefit greatly from the sustainable benefits offered.

Attachment 1

City of Grand Rapids (MI) Water/Environmental Services Building
1900 Oak Industrial Drive, Grand Rapids, MI

Project site during the solar panel installation

Project site during the solar panel installation

Grand Rapids Mayor, George Heartwell, at completed project site

Attachment 2

Output Data Website Page

SolrenView™ - City of Grand Rapids - Summary