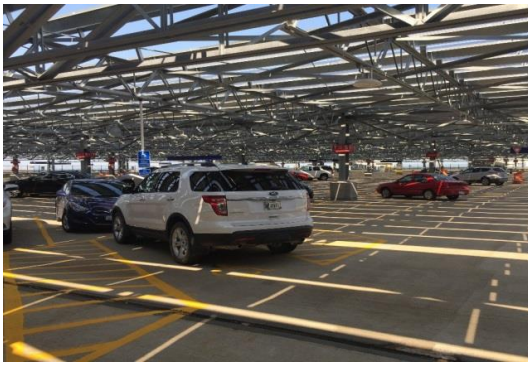
PV Solar Generation

Terminal 1 Blue Parking Ramp

Minneapolis-St. Paul International Airport



FINAL REPORT

May 2, 2016

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Project Title: Solar PV Parking Ramp Production Project

Contract Number: **Report Date:** 01.08.16

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Congressional District: Minnesota 5 (Corporate Office and Project Location)

FINAL REPORT

Project funding provided by customers of Xcel Energy through a grant from the Renewable Development Fund.

Overview/Executive Summary

The Metropolitan Airports Commission (MAC) installed 1,471 kilowatts of DC-rated solar equipment from Minnesota manufacturer tenKsolar, Inc. on its Blue Ramp adjacent to Terminal One at Minneapolis-St. Paul International Airport (MSP). The solar facility was constructed on the exposed nine-story upper deck of the parking ramp on a custom-designed super-structure with rainwater and snow conveyance that preserved the parking capacity of this outdoor parking level. The tenKsolar installation supported by RDF is in addition to a 1,539 kilowatt solar energy facility on the adjacent Red Ramp and LED lighting retrofits in all four of the major parking structures that serve Terminal One. These initiatives are part of a comprehensive solar energy program at MSP that will showcase energy innovations at the airport and bring greater public awareness to renewable energy and clean energy innovations.

An RDF grant of $2,022,507 provided by the customers of Xcel Energy was part of a total project cost of $7,613,091 for the Blue Ramp solar project and more than $25.4 million in overall energy efficiency and solar energy improvements at MSP Airport. MAC retained GreenMark Enterprises to interview national energy development firms and pre-qualify three firms for further negotiation, ultimately resulting in an award to Ameresco, Inc. for design, installation, interconnection and commissioning of all of the energy improvements.

This extensive installation of solar energy on a large-scale parking structure is the first of its kind in Minnesota and perhaps the largest such project to-date at any airport in the world. GreenMark also developed an innovative marketing and sponsorship program for the energy initiatives at MSP that will generate additional revenue for MAC and utilize multiple platforms for business-to-business marketing, consumer branding and public awareness of solar energy and other energy measures at MSP.

This unique program will be visible for the more than 35 million passengers that use MSP airport, the 14th busiest in the nation, and will amplify the story-telling ability of the MAC and MSP to increase awareness of solar energy and showcase tenKsolar as a Minnesota-based solar energy equipment manufacturer.

Solar energy facilities and LED lighting upgrades will annually reduce or offset about 16,800,000 kilowatt-hours of electrical usage at MSP, offsetting a significant portion of peak electric energy use at

MSP. Peak demand, as defined by Xcel Energy as part of its electrical service agreement with MSP, is defined as occurring between the hours of 9 a.m. and 9 p.m., Monday through Friday, exclusive of five holidays. On that basis, the solar facility at MSP will produce 69.86 percent of its electrical output during this peak period.

II. Project Objectives

The MAC Solar Project had five principal objectives, all of which were met to a significant degree, upon completion of the project in December 2015. As part of these objectives, a long-term energy services agreement and performance guarantee with Ameresco will allow MAC to realize immediate cashflow benefits from these improvements, and cumulative cash benefits of at least $25 million over the next 30 years, with a net present value in 2016 of $8,764,582. These solar and energy efficiency investments supported 253 jobs, and included local union labor and local companies as suppliers and subcontractors.

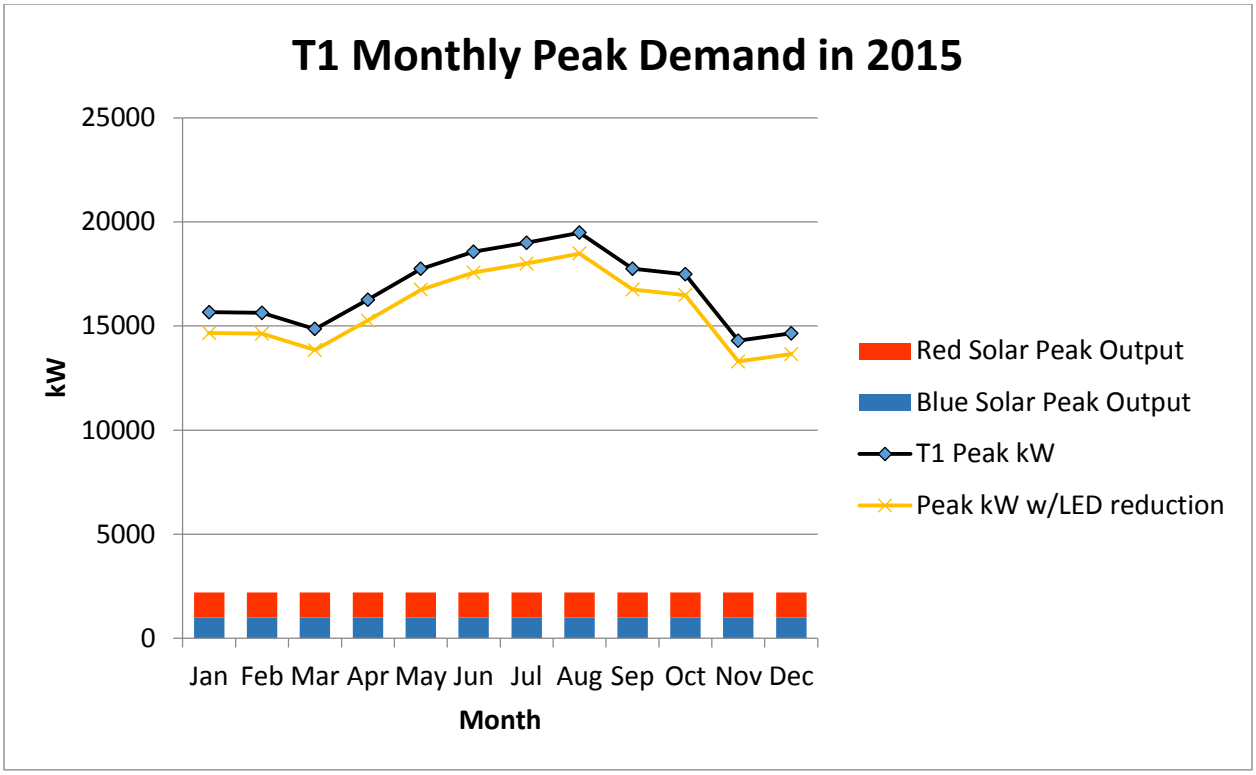
Objective #1: Demonstrate a parking structure solar model. The RDF-funded solar project on the Blue Ramp was the prototype for the simultaneous installation of a similar solar facility on the adjacent Red Ramp parking facility. Using these two projects as models, MAC has since authorized the installation of approximately 1,300 kilowatts of additional solar PV on the Purple Ramp adjacent to Terminal Two at MSP. All three of these projects are based on the design of the Blue Ramp solar facility, which required a custom structural element to hold the solar panels above parking areas in order to maintain the ability to park vehicles underneath the solar array.

The design also needed to incorporate additional features to convey stormwater and snow melt to minimize the effects of rain and snow falling directly onto the vehicles below. Initial engineering analysis determined that the design of the solar facility also needed to meet significant wind-loading that was likely on the roof of a structure nine stories above ground. Ameresco determined from this initial engineering review that this wind-loading capacity needed to be at up to 100 miles an hour.

In addition, the solar arrays needed to meet FAA regulations related to reflection and glare for solar facilities to prevent visual interference with aircraft landings and take-offs. These standards related to glare have been evolving as more solar energy has been deployed at U.S. airports and solar modules have improved in their ability to absorb light rather than reflect it. However, in this case, glare issues were largely eliminated by removing the reflective film from the standard tenKsolar equipment configuration, a decision that was made primarily due to the structural strength of the reflective panels rather than the potential for glare that might disrupt aircraft landings or take-offs.

Objective #2: Maximize on-peak power production. Although ultimately constrained by the building orientation of the Blue Ramp and structural limitations on off-azimuth positioning, the RDF solar facility is still expected to contribute significantly to reducing peak energy demand at the airport.

The chart below illustrates how the 2015 T1 monthly peak demand (data from Xcel billing history), varies from a low of 14,000 kilowatts (kW) in November to over 19,400 kW in August. (MAC's annual electric use and demand at T1 includes the terminal building, concourses and parking ramps.) The installation of LED lighting in the four Terminal 1 parking ramps, done in coordination with the Blue and Red Ramp solar installations, is expected to lower this peak demand at Terminal 1 by approximately 1,000 kW.



The blue and red columns on the chart represent the nameplate rating on the Blue and Red Ramp solar systems. In theory, the peak output of the 1,008 kW rated Blue Ramp system can contribute about 6 to 8 percent of the monthly T1 peak demand, depending on seasonal peak demand and seasonal solar irradiation. Because the system design features, the peak output at optimum times may produce a higher peak output than nameplate. Therefore, the Blue Ramp contribution to the T1 peak in certain months could be about 10 percent of total T1 peak demand.

Historical interval use data analyzed at the beginning of this project found typical daily peaks at MSP between 8:15 a.m. to 8:45 p.m. and approximately 70 percent of solar power production is projected to occur during that time period. Actual production data for January through March 11 2016 shows no more than 3 percent of total production occurring outside of this time range.

Overall, both daily and annual peak demand at MSP will most likely continue to occur when the solar PV facility will be producing power at the highest levels. These savings on peak demand will be monitored and reflected in ongoing energy production data and billing information. Solar output from the Blue Ramp and Red Ramp systems will be monitored separately by Xcel Energy's production meters and by Ameresco's Draker System. Actual production December 2015 through mid-March 2016 is shown below.

Actual Solar Production (kWh)					
(December production per Xcel meters; Jan-Mar production per Draker System)					
	Dec	Jan	Feb	Mar	Cumulative
Blue Ramp	39,680	58,780	94,102	117,349	309,911
Red Ramp	37,760	51,538	95,566	124,586	309,450
	77,440	110,318	189,668	241,935	619,361

Objective #3: Prototype future solar projects. The installation of solar energy will have immediate and long-term savings to MSP. In addition to the RDF solar project on the Blue Ramp, the similarly-sized solar energy facility was installed on the Red Ramp that is immediately adjacent to the Blue Ramp at MSP and LED lighting was installed in all four of the ramps serving Terminal 1. Annual net savings to the MAC from these projects is estimated as $170,000 a year, of which an estimated $25,160 can be attributed to the RDF-funded Blue Ramp solar project.

The Blue Ramp solar energy output by itself is expected to offset at least 30 million kWh of grid power over 20 years, resulting in an estimated savings of $4-5 million depending on assumptions about increases in Xcel energy rates over time. Based on annual savings of $170,000 and assumptions of an annual increase in Xcel energy rates of 2.75 percent, the estimated net present value of the financial savings to the airport over a 30-year life from integration of these solar and LED lighting improvements is $8,764,582.

MAC resolved critical design issues for this project with a super structure that holds the solar panels on the exposed ninth floor of the parking ramps without eliminating any parking spaces. The design also needed to disperse stormwater, handle significant snow falls and snow melt, perform in below-zero temperatures, and be structurally capable of wind loads on the open-air floor of the parking structures that could be in excess of 100 miles an hour.

Ameresco determined from its initial engineering studies that the reflective film component of the tenKsolar equipment would not be structurally strong enough to meet these wind-loading requirements and the reflective panel was eliminated from the design. This also eliminated many of the issues with glare from the reflective film that may have conflicted with aircraft landings and take-offs. Ameresco was still required to meet Federal Aviation Administration (FAA) regulations on airport glare and submitted the structural design and equipment specifications for review and approval by the FAA office that is located on-site at MSP.

In addition to the RDF grant from Xcel, the solar energy and energy efficiency projects were financed through the use of Qualified Energy Conservation Bonds (QECBs). Nine separate city and county jurisdictions approved use of their QECB allocations for the energy projects at the MAC. The result was a 21-year Municipal Lease Financing agreement with a net effective interest rate of 0.75 percent, estimated annual net cashflow to the MAC of $170,000 and a net present value of cashflows over 30 years of nearly $9 million. These savings are despite a financing package for the project that did not utilize any of the value of the federal Investment Tax Credit (ITC) or accelerated depreciation expensing allowed for solar energy projects.

Based on the successful completion of the projects on the Blue and Red Ramps, MSP has approved plans for design and installation in 2016 of a third solar facility of 1,300 kW DC capacity at the Purple Ramp adjacent to Terminal 2. As a result, the RDF grant for the Blue Ramp solar project will be a catalyst for installation of 4,300 kilowatts of DC-rated solar energy capacity at MSP, which the MAC believes will be the largest amount of structurally-mounted solar energy capacity at any airport in the world.

Objective #4: Implement a solar marketing and sponsorship program. GreenMark was successful in implementing this program as part of the RDF-funded project and the larger energy efficiency and renewable energy investments being made at MSP. The program will include payments of $500,000 a year for three years to the MAC for the right of official project sponsors to use multiple platforms within

the airport complex for promotion of themselves as MSP's exclusive sustainability partners. These platforms include a digital display located in the elevator area on the ninth floor of the Blue and Red Ramps, and 28 additional digital displays within Terminal 1. In also includes a reference business center, internal and external visibility with the solar arrays, site tours and exclusive on-site meetings for business-to-business marketing.

The sponsorship program offers dozens of opportunities for official sponsors to execute marketing, business development and brand strategies associated with the solar projects and other sustainable energy initiatives at MSP. There will be sustained marketing exposure to 35 million airport users annually as well as visitors to the Mall of America, one of the top ten tourist destinations in the U.S. Additional information on the MAC's energy initiatives and multi-media communication strategies for this information are under development by MAC staff and will be available to both the traveling and general public.

Objective #5: Reinforce MAC's leadership role on sustainability issues. MAC has had an internal energy management initiative in which Xcel Energy has been a partner since 2002. The MAC Energy Conservation Program (MECP) is part of MAC's larger commitment to the traveling public to implement energy efficiency, renewable energy and other sustainability measures at MSP. Prior to the RDF project, MAC had invested about $3 million in nine funding cycles in a variety of energy efficiency improvements that are measured for their return on investment within a five-year timeframe. As an example, in 2011, MECP projects reduced electrical demand at MSP by 1,380,000 kilowatt-hours and natural gas use by 168,400 therms, saving $307,111 in energy costs plus an additional $65,000 received in energy rebates from Xcel and other utilities.

The RDF (Blue Ramp) solar project , Red Ramp solar installation and the LED lighting retrofit at four T1 parking ramps, are major steps forward in this commitment to greater sustainability in its operations. From an environmental standpoint, these projects will save an estimated 4,724 metric tons annually in carbon dioxide emissions based on Xcel's emissions reporting for Upper Midwest generation. The Blue Ramp solar output accounts for about 695 metric tons of reduced carbon dioxide. (See table on page 8 for emissions reduction details.)

The solar and lighting projects have already received two awards: Minnesota Department of Transportation Innovation in Environmental Stewardship, and City of Chicago Department of Aviation "Airports Going Green Award."

Ameresco has entered into an extensive Measurement and Verification Agreement, and an Operations and Maintenance Agreement with the MAC for the full 20-year period of the Energy Services Agreement between MAC and Ameresco. The Marketing and Sponsorship Program will supplement the dissemination of this information about MAC's leadership role on sustainability issues. Over time, the RDF-funded solar project will be a key part of the sponsorship program and is likely to generate positive media attention and further recognition within the airline industry in the form of industry awards.

III. Project Benefits

MAC's original RDF application submitted in April 2013 identified a number of anticipated benefits in four categories: economic benefits, environmental benefits, benefits for Xcel ratepayers, and other benefits.

Economic Benefits. The original proposal projected at least 3-4 construction jobs per megawatt of solar energy installed. Total jobs on the RDF project, the additional Red Ramp solar facility and lighting improvements totaled 253 jobs, in addition to the in-direct jobs at tenKsolar related to the manufacturing of their solar equipment. MAC and its development team benefitted from the exemption from state sales tax on solar equipment and MAC's exemption from real or property taxes as a result of the solar energy facilities.

Because operations at MSP are funded by various user fees and on-site revenue streams, savings on operational costs of at least $170,000 a year, plus revenue from the sponsorship agreement, can be passed on to MSP tenants and to airline customers. As noted elsewhere in this report, MAC will realize about $9 million in cost savings from the solar and energy efficiency investments over the next 30 years. These dollars are likely to be re-invested within MSP and otherwise stay in the regional economy rather than being exported for the purchase of energy using imported fossil fuel supplies. In addition, the RDF funded project has already lead to installation of an additional 2.8 megawatts of solar capacity.

Although the MAC did not utilize federal tax credits in its project financing, it has positioned MSP for future changes in state and federal energy and climate policies by shifting a portion of its energy sources from fossil fuels to renewable energy. For example, the associated reductions in carbon emissions may contribute to meeting future regulatory compliance with emissions standards that could be imposed if the Twin Cities moves into non-attainment status for the Federal Clean Air Act.

Environmental Benefits. The combined solar projects and lighting efficiency investments will reduce carbon dioxide emissions, the major greenhouse gas component, by 4,724 tons. The table below illustrates the carbon dioxide, sulfur dioxide and nitrogen oxide reduction by individual projects.

	Blue Ramp Solar	Red Ramp Solar	LED Retrofit	Total
Annual Avoided Xcel Generated mWh				
Avoided/Reduced mWh	1,453	1,764	6,663	9,880
Emissions Reduction (Metric Tons)				
	Blue Ramp Solar	Red Ramp Solar	LED Retrofit	Total
Carbon Dioxide (CO_2) @ 1054 lbs/mWh	695	843	3,186	4,724
Sulfur Dioxide (SO_2) @ 1.6 lbs/mWh	1.1	1.3	4.8	7.2
Nitrogen Oxide (NO_X) @ 1.3 lbs/mWh	0.9	1.0	3.9	5.8

Emissions Data Source: Xcel Energy 2014 Corporate Responsibility Report. CO_2 emissions are reported as Xcel Upper Midwest owned and purchased resources. SO_2 and NO_X emissions represent all Xcel owned generation.

This project's unique marketing and sponsor partnership will enhance the visibility of the project and the role of solar energy for the 35 million people who use MSP each year, a significant number of whom are themselves likely to be Xcel Energy customers. MAC and its marketing partners will have the platforms and the motivations to promote this project and the use of solar energy. Greater interest and investment in solar energy will extend these environmental benefits.

Ratepayer Benefits. RDF grant funds of $2,022,507 were highly leveraged and resulted in a total project investment of $25.4 million in solar energy and energy efficiency. Total installed costs for the Blue Ramp solar project were higher than anticipated in the original application for RDF funds ($5.15/watt versus $4.00/watt). This was due to significantly higher costs for the structural element needed on top of the parking structure than was originally estimated. However, these additional costs were offset by the savings from the investment in lighting upgrades, and did not require additional grant support.

Offsetting a significant portion of MSP's peak demand will benefit ratepayers by reducing demand for high-cost peak power supplies from Xcel. The design-build EPC development agreement between MAC and Ameresco resulted in a project that was built on time and within its established budget and ratepayers were protected by structuring RDF funds as reimbursement only when the project was fully completed. Future costs of solar energy at MSP are likely to be further reduced based on the experience of MAC and its EPC partner in installing this project.

Xcel Energy and its ratepayers will receive substantial benefits from the high visibility of this solar energy project at the MAC and Xcel's participation in the integrated solar and energy efficiency investments. This positive exposure and visibility for Xcel and its ratepayers will reinforce the company's leadership on renewable energy and solar energy with millions of people.

Benefits from comparative field testing of solar technologies. Because the RDF project utilizing tenKsolar equipment is on a parking ramp that is immediately adjacent to an very similar installation of another technology on another parking ramp, this project will provide highly valuable comparative data on the performance of tenKsolar equipment relative to the other Tier 1 solar equipment package. This comparative data on production, degradation rates, maintenance costs and other performance parameters from side-by-side systems will provide valuable verification of equipment performance levels in actual field conditions in Minnesota.

Emerging companies such as tenKsolar benefit from this type of comparative data when it establishes their performance relative to competing technologies. Solar developers also benefit from actual data from the field in Minnesota on production, degradation and ongoing expenses for solar energy systems. These benefits are likely to result in better design and estimating of financial benefits for customers considering their own solar energy projects. Greater certainty about product performance will enhance the marketability of solar equipment, such as the package made by tenKsolar, which in turn, can lead to its growth as a Minnesota-based manufacturer. This will also be a benefit for policy makers that are considering incentives designed to encourage the growth of Minnesota-made solar energy equipment.

Other Benefits. This project has reinforced a strong working relationship between Xcel Energy and the MAC, one of its largest utility customers. The project provides a distinct message to visitors about the commitment of Minnesota, its residents and businesses to address climate change and a clean energy future.

IV. Project Lessons Learned

Important lessons have been learned from the RDF solar project at MSP that will advance the development of solar energy in Minnesota. These key project lessons are summarized below.

Long-term economic benefits. As noted, the RDF project has demonstrated a financing structure that shows the benefits from the integration of solar energy with energy efficiency improvements. These

economic benefits result from kilowatt-hours generated on-site from solar facilities combined with the overall reductions in energy demand from efficiency improvements. This integrated strategy reduces costs for the purchase of grid energy from the utility, with the energy efficiency measures accelerating the payback on the solar energy investment. This is a lesson learned that may be helpful to other public agencies considering both solar and energy efficiency investments. When combined with a low-interest financing package that results in net revenues after service of debt and other expenses, there can be significant economic benefits immediately and over the life of the solar energy project.

These economic lessons learned from the RDF project led to an immediate expansion of other solar projects at the MAC that more than doubled the total amount of solar DC capacity installed at MSP in 2015 which will establish a record for other institutions to follow. The lesson learned from this approach was a demonstration of the effectiveness of integrating energy efficiency measures with solar energy installations to achieve an overall higher financial return on the energy investments. As noted, MAC recently decided on further expansion of solar energy to a third parking ramp at MSP in 2016 that will result in total solar capacity at MSP of about 4,300 kilowatts, which will reinforce these lessons earned for other public agencies.

The MAC RDF project has created a template for other large institutions that may be considering a high-profile solar energy project. In addition to the integration of solar energy and energy efficiency, MAC will benefit from sponsorship payments from its sustainability partners for at least the first three years of solar project operation. This sponsorship agreement can be negotiated by other public agencies with clean energy businesses that are seeking greater visibility and market exposure.

These savings from energy investments and additional revenues from a sponsorship agreement will reduce the costs of operation for the airport. That, in turn, will result in reduced costs for the traveling public. Other public agencies can use these lessons learned to develop similar projects that will reduce their costs for offering services to the public.

Cost-effective implementation of solar PV on a parking structure. Despite rigorous requirements associated with airport operations and the location of the solar arrays, the RDF project has demonstrated that solar PV can be installed on a structured parking facility at a major airport. Even with these added costs, the project at MSP shows that a similar investment in solar energy on parking structures can be implemented and financed with immediate net cashflow and long-term financial benefits to the owner of a parking structure. Other parking ramp owners are unlikely to face the same rigorous standards as the MAC---in other words, if the MAC can do it on their parking structures, others should be able to do it as well.

This RDF project demonstrated an alternative approach to selection of an EPC contractor. Retaining an outside firm, GreenMark, to pre-qualify a list of finalists streamlined the project and facilitated the selection of a well-qualified contractor. This pre-qualification process is a variation on Energy Savings Guarantee contracting approaches used by other public agencies. In this case, it allowed the MAC to communicate its goals to developers, ascertain interest in its proposed marketing and sponsorship program, and reduce the time required to evaluate and select a contractor.

In addition, the unique and innovative sponsorship program was successfully implemented and will result in additional revenues for the MAC. It creates marketing and branding opportunities for program partners as well as creating significant platforms for educating the public about solar energy and energy

efficiency measures. It is the only such sponsorship program to-date with a solar energy project at a major airport in the U.S. The sponsorship program demonstrates the additional financial benefits and promotional value that can be monetized on high-profile solar projects on major facilities serving large numbers of the public. This project has established a dollar value for such programs and has demonstrated that such a sponsorship program can be effective when the solar energy and energy improvements will be visible to large numbers of the public.

V. Usefulness of Project Findings

The MAC RDF-funded program at MSP has resulted in important lessons learned that will be useful to the State of Minnesota and customers of Xcel Energy.

Institutional investments in solar energy. This RDF project provides useful lessons to other large institutional organizations that may be considering solar energy investments. Specifically, this project shows how to integrate solar energy with other energy efficiency measures, and identify the potential for additional marketing and sponsorship revenues.

Parking ramp solar installations. There are thousands of similar structured parking ramps in Minnesota that could develop solar energy projects on their exposed upper deck levels. This RDF project demonstrates actual costs for such installations and strategies for cost-effective implementation of such projects. The RDF project also demonstrates how solar energy installations on parking structures can be integrated with electric vehicle charging stations in those structures, a feature that is likely to be of increasing interest over time as vehicle fleets convert to electric use.

Comparative data on solar technologies. Over time, the RDF project will provide comparative performance data on tenKsolar equipment versus another Tier 1 solar equipment system. This data will be useful in validating higher production and lower degradation values on tenKsolar equipment, which is one of the technologies specified for installations in Xcel Energy's Minnesota service territory.

VI. Technical Progress.

The Blue Ramp solar project included installation of 3,588, 410-watt XT-A solar panels from tenKsolar, manufactured in Bloomington, Minnesota. The solar panels were integrated with 120 of tenK's RAIS inverters and installed on a custom racking system set 9.5 feet above the parking ramp floor on a galvanized steel structure on concrete stub columns. Solar panels were installed at a 20-degree tilt and an azimuth of 120 degrees.

The structural element holding the panels was required to meet a wind load of 100 miles an hour, as determined from an initial engineering analysis by Ameresco. System design plans were submitted for review and approval by the local FAA office. Although the FAA has regulations related to glare from solar arrays at airports, those regulations were not a significant factor at MSP because the tenKsolar reflective film was not installed as part of this system. Additional aesthetic considerations included bundling of wires in conduit along the under-side of support beams to improve the look of the system.

Total DC-rated capacity for the Blue Ramp solar facility is 1,471 kilowatts. The RDF project on the Blue Ramp leveraged installation of an additional 5,130, 300-watt Renesola panels with a DC-rated capacity of 1,539 kilowatts on the adjacent Red Ramp. The system is interconnected through a 600-volt platform with distributed shut-off at localized sites as well as for the system as a whole. Additional metering was

installed to allow for discreet monitoring of the solar arrays separately from other energy usage at MSP. No energy storage has been implemented at this time, however the tenKsolar equipment was selected, in part, due to its general compatibility with energy storage systems because of its low-voltage architecture. There is no direct linkage of the solar energy arrays with the new electric vehicle charging stations, which are fully grid-connected, however the solar production can be expected to offset grid power at the Red Ramp EV charging stations when the solar panels are producing power.

The RDF solar project also leveraged conversion of 7,743 metal halide light fixtures in the four parking ramps serving Terminal 1 to LED lighting technology. In addition, eight electric vehicle (EV) charging stations were added at the Red Ramp, bringing the total number of EV stations at MSP parking ramps to 18.

Construction was managed by Ameresco, a global energy services firm with a Minnesota office that was selected through a two-stage Request for Proposals process. Ameresco has since been retained to implement a second-phase solar energy facility in 2016 at the Purple Ramp adjacent to Terminal 2 that will also use tenKsolar technology. Ameresco has entered into a 20-year agreement with the MAC that guarantees energy production, includes measurement and verification requirements, and includes annual operation and maintenance of the solar facilities.

Commissioning of the system was completed in November 2015 and the solar facility began producing grid-connected power on or about December 1, 2015.

The following is a high-level summary of the technical progress on this project, prior to and including the final execution of the RDF grant contract and commercial operation of the RDF-funded solar facility.

Final selection of EPC Contractor	April 2014
Preliminary design and engineering completed	June 2014
Structural analysis and one-line drawings	June 2014
Final design and engineering report	July 2014
Approval of project financing	August 2014
Mobilization on-site and construction start	October 2014
Execution of sponsorship agreement	November 2014
Delivery of equipment to project site	January 2015
Substantial completion of installation	October 2015
Commissioning and inspection	November 2015
Completion of net metering and interconnection agreement	December 2015
Commercial operation date	December 2015
RDF Advisory Committee tour	March 2016
Submission of RDF grant final report	April 2016

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Attachment 1

RAIS® XT-A PV Module 410W$_P$

ten K SOLAR™

» The Efficient, Reliable, and Flexible Cornerstone of tenKsolar's RAIS® XT PV System

More Energy per Roof
When paired with the RAIS® Inverter Bus and Reflector, the RAIS® XT-A PV Module outputs up to 50% more energy per roof than conventional modules

Built-In Electronics and Cell Matrix Interconnects
Provide ability to more densely pack array on roof and add light with reflection

Low Voltage Safety
Eliminates lethal shock hazard and arc hazards within module and PV system

- **Tolerates Shading:** Unique Cell Optimized design ensures output of solar module is minimally impacted by incidental shading or soiling
- **Optimization of Cell Output:** Cell area Maximum Power Point Tracking (MPPT) optimizes output under all field conditions
- **More Flexible Layouts:** Parallel connections permit multiple non-coincident arrays to be combined onto a single solar branch
- **Superior Construction:** Aluminum backsheet impedes moisture ingress and reduces operating cell temperature enhancing silicon efficiency
- **Easy to Install:** Integrated racking attachments help reduce parts count and speed installation. Parallel connections eliminate need to sort modules
- **Safer Operation:** Integrated GFDI powers off module when a current imbalance is detected
- **Utility Grade Connector:** Self-tapping connection and UV resistant housing provides robust environmental protection and increased efficiency

Application	Key Benefit	tenK Solution	Model
Low-slope / Flat Roof	More Energy per Roof	RAIS® XT PV system	XT-A

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@tenksolar

fundamentally better solar

Attachment 2

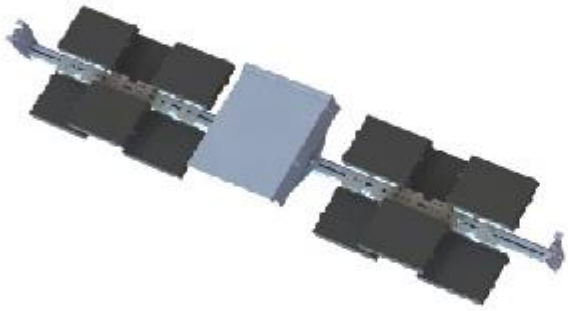
RAIS® Inverter Bus

ten K SOLAR™

Optimal Energy Conversion
Multiple low voltage inverter modules work together to maximize the DC to AC conversion

Extended Longevity
tenKsolar load sharing technology reduces inverter workload

tenK Integrated
Designed by tenK's engineers to fully integrate with the RAIS PV system without hassle



- **Intelligent Load Sharing Among Inverters**
  Maximizes inversion efficiency
- **Intrinsic Wear Leveling**
  Extends service life of the inverter system
- **Shipped as a Pre-Wired Assembly**
  Lowers install times and costs
- **Fault Tolerant Configuration**
  Eliminates any single point of failure
- **Environmentally Hardened Inversion Shells**
  Maximizes lifetime / reliability
- **Inverter Module Platform**
  Maximum flexibility among inverter suppliers
- **Compatible to any Service Requirement**
  Simple design process and deployment
- **AC at the Array**
  Early conversion to AC simplifies balance of system requirements, lowering costs
- **Available AC Disconnect with Integrated Extensions**
  Speeds Installation
- **Reduces O&M Costs**
  No required inverter manufacturer service contracts

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fundamentally better solar

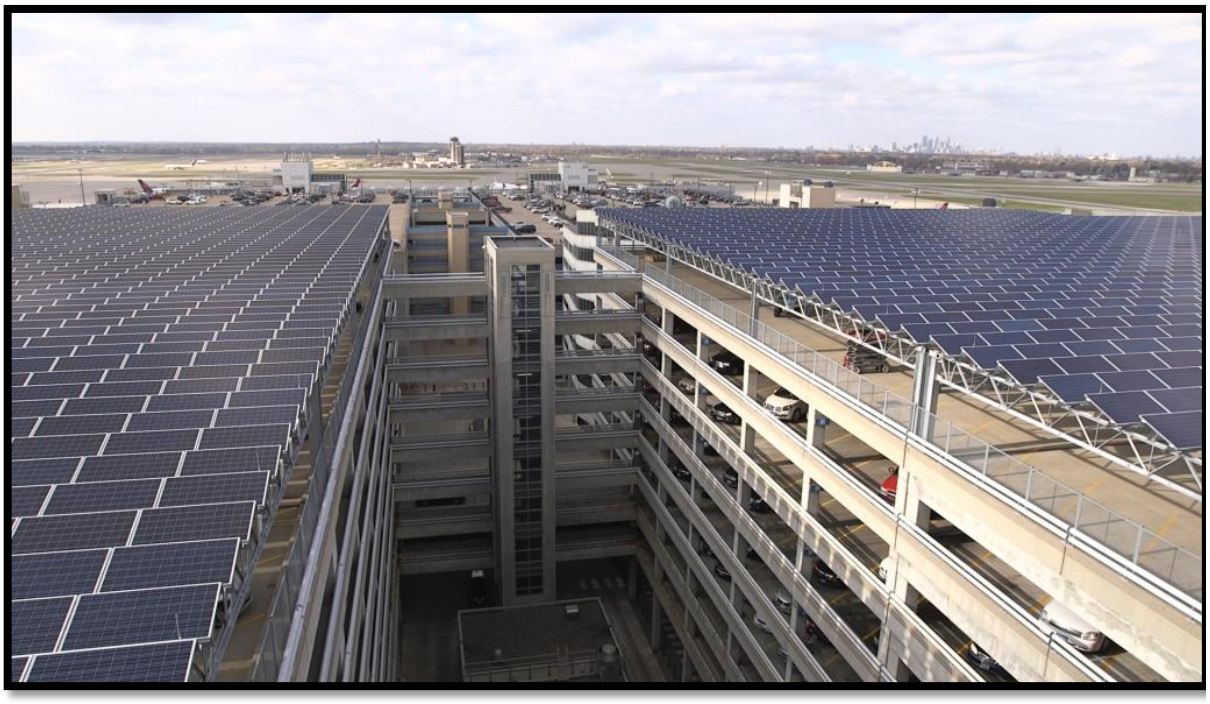
Attachment 3

MSP Terminal 1 Solar/LED Project

FACT SHEET

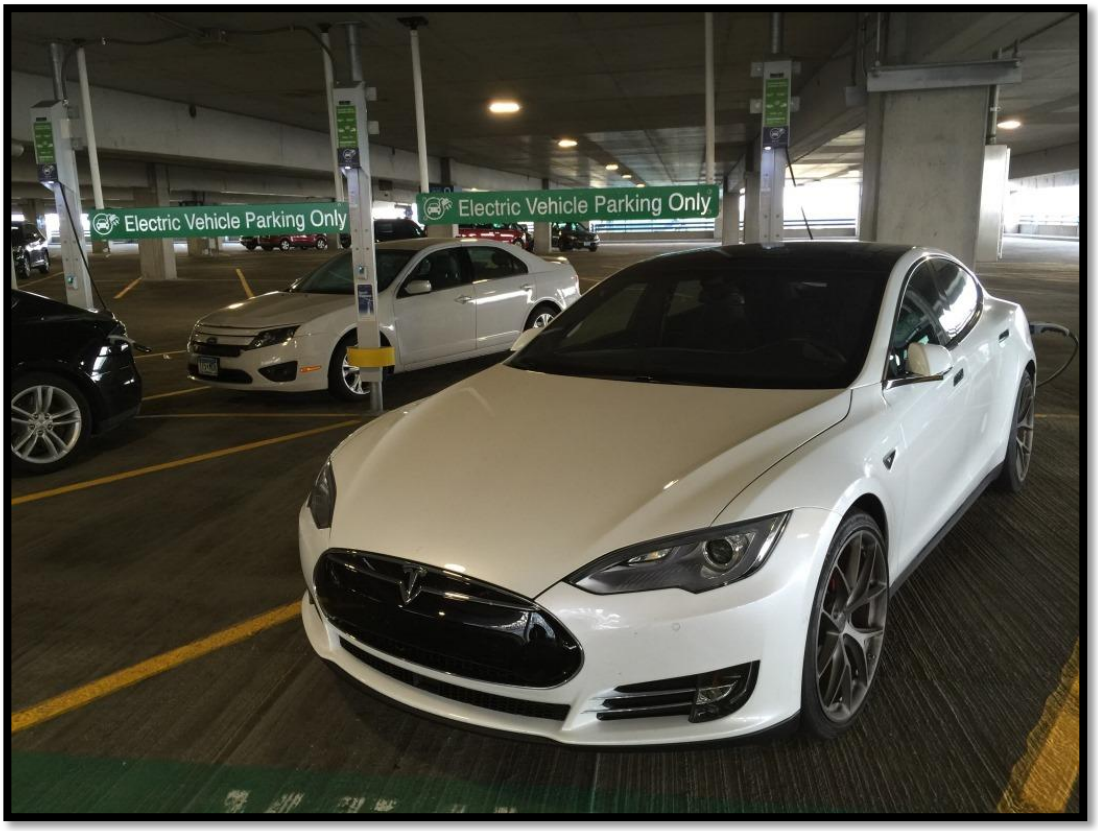
- Minneapolis-St. Paul International Airport (MSP) is located in the state of Minnesota and governed by the Metropolitan Airports Commission (MAC)
- In 2014, MSP served more than 35 million passengers
- 3 MW DC Solar Photovoltaic system installed on the Red and Blue parking ramps at Terminal 1
- 20 degree tilted modules at 121 degree azimuth, custom steel superstructure 8'6" clear from top deck
- 8,705 solar panels
- 7,743 fixture LED conversion within Four (4) Parking Ramps (Red, Blue, Green and Gold) at Terminal 1
- Four (4) electric vehicle charging stations with Two (2) at each of the red and blue parking ramps
- Estimated 10 million kWh of combined supplied and/or reduced energy in year 1—nearly 9 percent of 2015 annual electric usage at T1.
- 253 jobs created during construction
- Local union labor, local installation companies, local product companies, and local financing
- Currently, the largest solar project in Minnesota at 3 MW DC
- Largest integrated (demand reduction and energy supply) airport energy project in the world
- Ameresco to provide 20 year operation and maintenance (O&M) services
- 21 year Municipal Lease Financing with 0.75% Net Effective Interest Rate
- 100% Qualified Energy Conservation Bonds (QECBs) funding with seven (7) neighboring cities and counties relinquishing their allocations to the MAC
- Project self-funds the initial project cost and generates more than $10M of Net Present Value Bottom Line Cash Flow over 30 years
- The project was awarded a grant from Xcel Energy for $2.1M
- Project reduces 4,724 metric tons of carbon dioxide based on Xcel Energy's Upper Midwest generating emissions reporting.
- Construction started early October 2014 and was completed December 2015

Attachment 4 – Photos



Over 8,700 solar panels were installed on level 9 of the Red (left) and Blue parking ramps at T1. Collectively the two solar systems are capable of producing over 3.2 million kWh annually.

With a desire to “buy local” the Blue Ramp solar system used tenK solar panels produced in Minnesota.. The 3,595 tenK 410-watt panels installed on Blue Ramp are capable of producing over 1.4 million kWh annually.

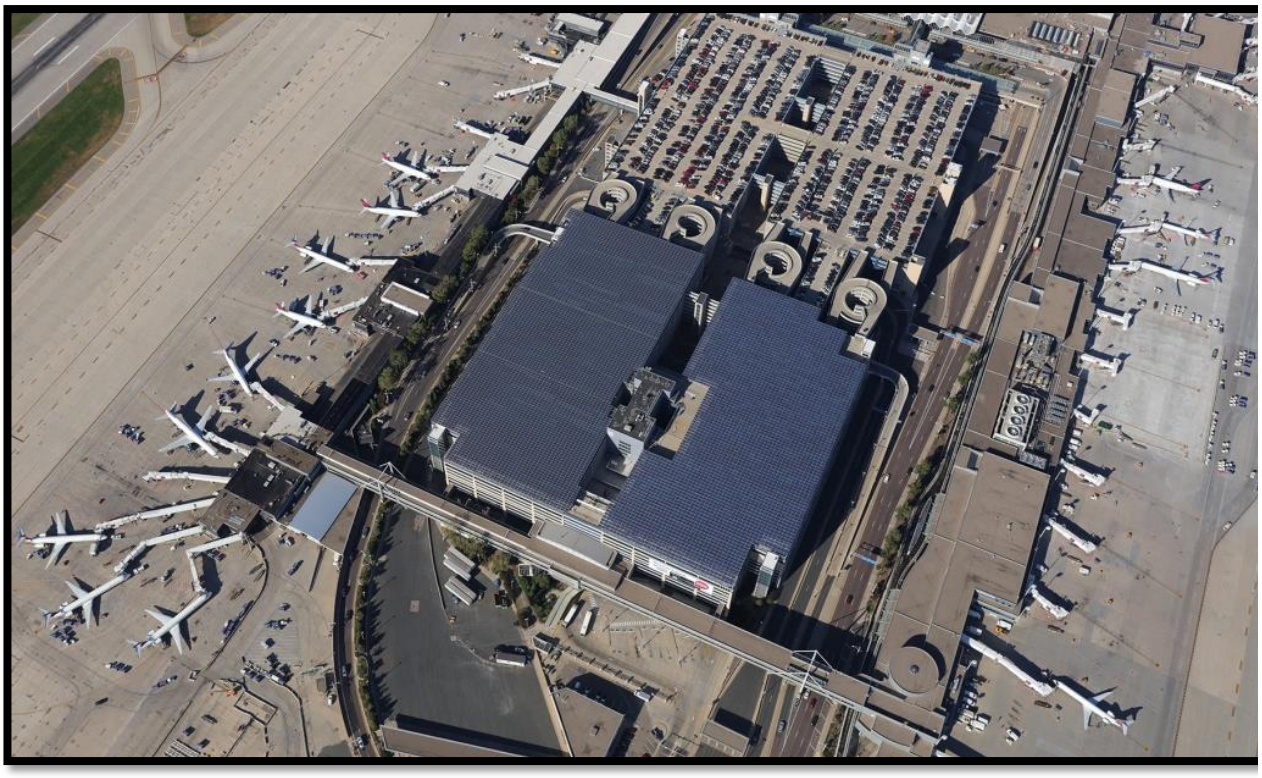


Four electric vehicle charging stations were installed as part of the overall T1 project in addition to the Blue and Red ramp solar generation and the LED lighting retrofit for the four parking ramps at T1.

Construction during the 14-month project was completed coincident with MSP normal operations. Despite challenges with weather, and working in a high safety and security controlled environment, the project was completed on schedule.

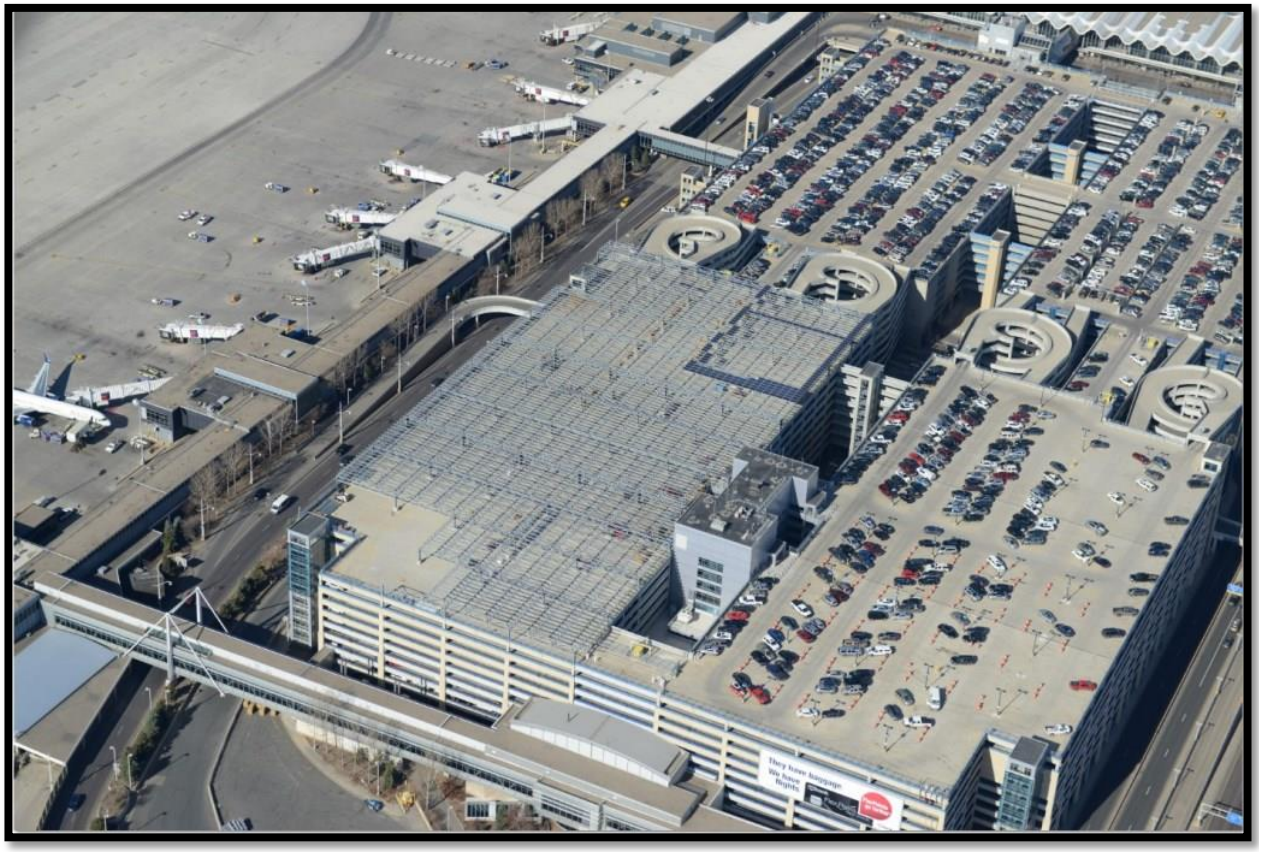
The galvanized steel superstructure is designed to withstand wind gusts of 90+ mph. Besides capturing optimum solar irradiation, the tilt of the panels also prevents the build-up of snow and ice that could damage parked vehicles. The tilt prevents collection of large deposits of snow and ice.

PV solar systems on the Red (left) and Blue parking ramps at T1 are nearly 10 percent of the 35 megawatts of installed solar in MN as of February 2016 (statistics reported by Minnesota Department of Commerce).



Completed PV solar project at MSP Terminal 1 Red and Blue parking ramps.

Covered parking is a related benefit of the solar systems on the Red and Blue parking ramps. The superstructure and panels provide relief from harsh winter and summer weather.



Construction started October 2014 with assembling the steel superstructure on the Red Ramp (left). Construction activity was designed to minimize closure of parking spaces during erection of the super structure and installation of the solar panels.

Panels were oriented to capture optimum solar radiation while complying with FAA rules that eliminate or minimize glare for approaching aircraft.