SolarPath sun solutions

SPECIFIER'S GUIDE

OFF-GRID SOLAR INFRASTRUCTURE

LIGHTING · PEDESTRIAN SAFETY · SMART CONTROLS

A practical guide for engineers, municipalities, and project teams evaluating off-grid solar solutions.

SolarPath Inc.
Engineering off-grid solar solutions since 2005.

02

INTRODUCTION

START WITH THE PROJECT, NOT THE PRODUCT

Off-grid solar infrastructure is not a one-size-fits-all solution. Every project brings a different combination of site conditions, performance requirements, operating needs, structural considerations, environmental constraints, and procurement requirements.

For lighting applications, factors such as required illumination levels, optics, mounting heights, operating schedules, and solar availability influence system design.

For pedestrian safety, transit, and other off-grid applications, the equipment may change, but the principle remains the same: the power system and infrastructure should be designed around the actual requirements of the project.

A solution that performs well at one site may not be appropriate for another. That is why successful off-grid solar projects begin with the project requirements, not with a product.

This guide outlines the key considerations project teams should evaluate when planning and specifying off-grid solar infrastructure, and the questions worth asking before a system is selected.

THE RIGHT QUESTION ISN'T SIMPLY

"Which solar product should we use?"

IT'S

"WHAT DOES THIS PROJECT REQUIRE THE SYSTEM TO DO?"

THE PRINCIPLE

The system should be designed around the project. The project should never be designed around the system.

UNDERSTAND THE SITE

01

GOOD SYSTEM DESIGN STARTS WITH THE SITE

An off-grid solar system generates and stores its own energy. That makes site conditions a fundamental part of system design. Before equipment is selected, the project team should understand the conditions that influence both available solar energy and project demand.

SOLAR ACCESS

The amount of usable solar exposure available at the proposed installation location.

SHADING

Trees, buildings, structures, and other obstructions can affect solar collection throughout the day and across seasons.

GEOGRAPHIC LOCATION

Available solar energy varies by location and season. System design should reflect the conditions of the actual project site.

OPERATING REQUIREMENTS

Required operating hours, performance levels, schedules, dimming profiles, activation patterns, and controls can all affect energy demand.

SITE CONSTRAINTS

Landscaping, utilities, pedestrian circulation, roadway geometry, structures, property boundaries, and other physical conditions can influence equipment placement and system configuration.

> *A configuration that works at one site should not automatically be assumed to work at another.*

UNDERSTAND THE SITE

QUESTIONS TO ASK BEFORE SPECIFYING

01 Has the system been evaluated for the project’s actual geographic location?

02 Have available solar exposure and potential shading been considered?

03 Is the energy system configured around the required operating profile?

04 What level of autonomy is required for the application?

05 Have seasonal variations in solar conditions been considered?

06 Have physical site constraints been incorporated into the proposed configuration?

WHAT SOLARPATH PROVIDES

- Site-specific solar evaluation
- System sizing
- Battery and solar generation requirements
- Operating profiles and controls
- Autonomy calculations
- Product and system configuration

SITE CONDITIONS VARY BY PROJECT — GEOGRAPHY, SHADING, AND CLIMATE ALL INFORM SYSTEM DESIGN.

YOU PROVIDE THE PROJECT REQUIREMENTS.
WE ENGINEER THE SYSTEM AROUND THEM.

02

PHOTOMETRICS

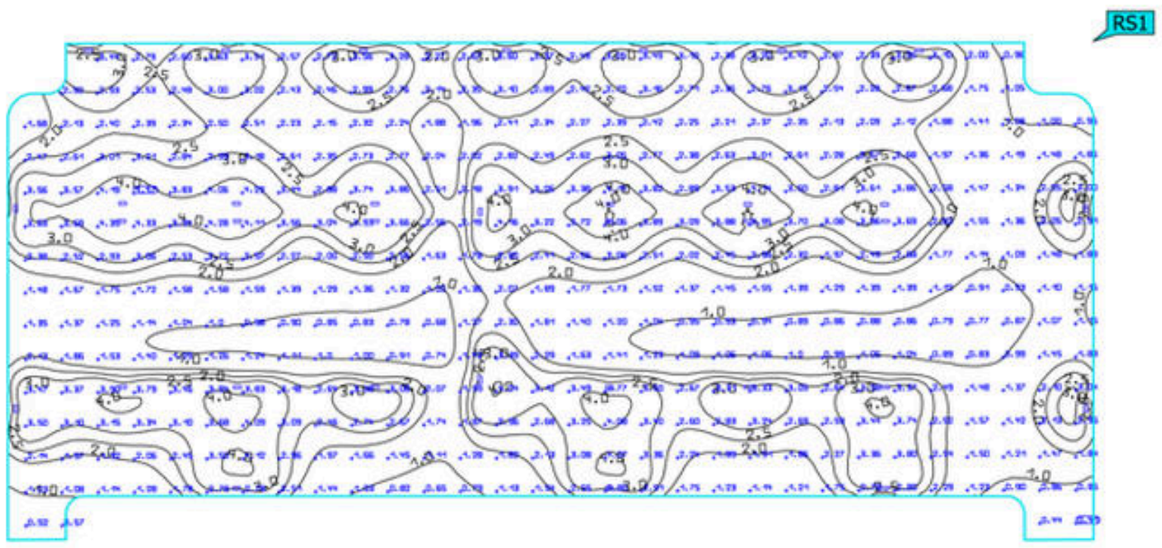
LIGHTING PERFORMANCE SHOULD BE DESIGNED, NOT ASSUMED

Lumen output alone does not determine how a site will perform. Lighting design should consider required light levels, uniformity, fixture optics, mounting height, pole spacing, site geometry, and the actual requirements of the application.

> **A HIGHER LUMEN OUTPUT DOES NOT AUTOMATICALLY CREATE A BETTER LIGHTING DESIGN.**
>
> The goal is to put the appropriate amount of light where it is needed.

SITE → LUMINAIRE PLACEMENT → LIGHT DISTRIBUTION → **VERIFIED RESULTS**

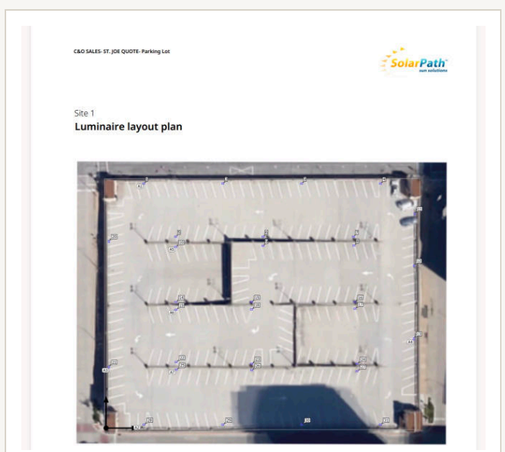
Fixture placement, distribution and light levels are modeled before installation.



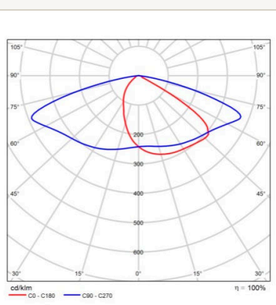
Properties	Ø	min	max	U_o (g_1)	g_2	Index
North Parking lot Perpendicular illuminance (adaptive) Height: 0.000 ft	1.78 fc	0.51 fc	3.37 fc	0.28	0.15	RS2

ACTUAL SOLARPATH DIALUX PHOTOMETRIC STUDY

FIG. RS1 — SURFACE RESULT



LUMINAIRE LAYOUT PLAN — LUMINAIRE PLACEMENT



POLAR LIGHT DISTRIBUTION CURVE — LIGHT DISTRIBUTION

206 lm/W • 4000K • CRI 84

PHOTOMETRICS

QUESTIONS TO ASK ABOUT PHOTOMETRICS

01 Has a project-specific photometric analysis been completed?

02 Are the calculations based on the actual fixture, optic, mounting height, and proposed pole locations?

03 Do the results address the project’s required illumination levels?

04 Has uniformity been evaluated rather than looking only at average light levels?

05 Can the proposed layout be reviewed before equipment is ordered and installed?

WHAT SOLARPATH PROVIDES

- Fixture selection and optical distribution
- Pole locations and spacing
- Mounting heights
- Expected illumination levels
- Uniformity across the target area
- Alternative configurations when site conditions require adjustment

DESIGN IT FIRST.
EVALUATE PERFORMANCE BEFORE INSTALLATION.

SYSTEM SIZING & AUTONOMY

03

THE SYSTEM HAS TO WORK AS A SYSTEM

Solar generation, battery capacity, connected load, operating profile, controls, and local solar conditions must work together.

ENERGY GENERATION

Solar panel output sized to the site’s available solar resource and connected system load.

ENERGY STORAGE

Battery capacity sized to maintain required operation through periods of reduced solar production.

CONNECTED LOAD

The total power demand of fixtures, controls, and any connected devices.

OPERATING PROFILE

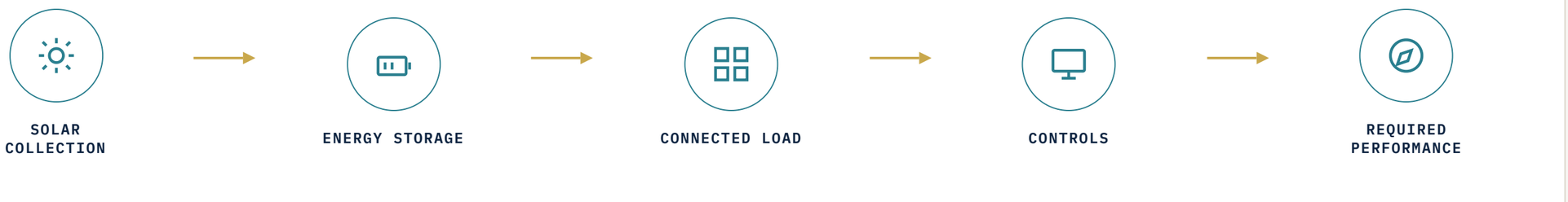
Required operating hours, dimming schedule, and activation pattern for the application.

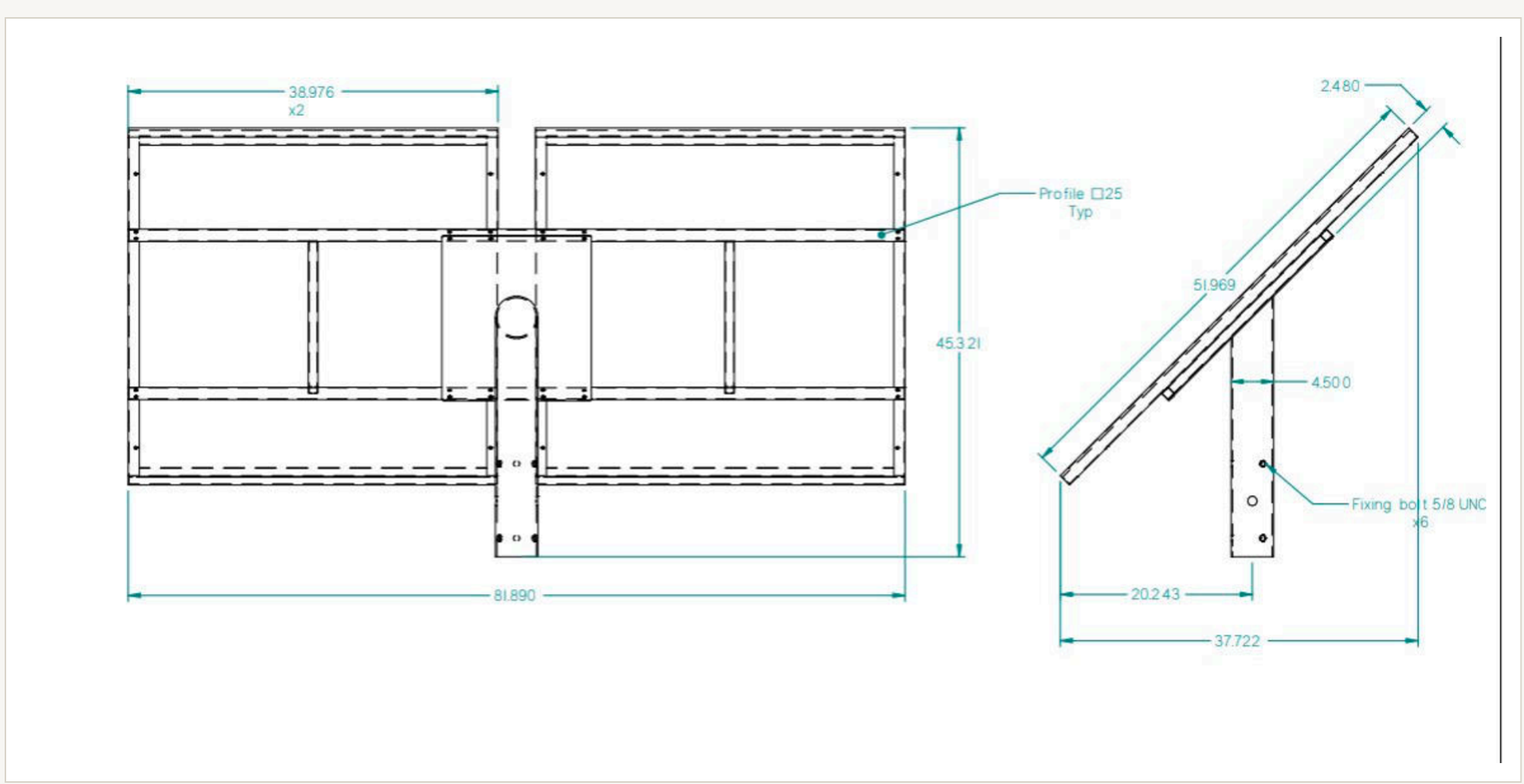
SEASONAL PERFORMANCE

System performance evaluated across seasonal changes in solar availability.

COMPONENT SIZE IS NOT THE SAME AS SYSTEM PERFORMANCE.

What matters is how the complete system is designed to perform at the actual project location.





Example SolarPath solar system engineering detail.

Internal system configuration shown for engineering reference.

System configuration varies by project requirements.

SYSTEM SIZING & AUTONOMY

AUTONOMY: ASK WHAT THE SYSTEM IS DESIGNED TO DO

Autonomy describes the system’s ability to continue operating during periods when available solar energy is reduced.

01 What operating profile was used to size the system?

02 Has the system been sized for the actual project location and seasonal solar conditions?

03 What level of autonomy has been designed into the system?

04 What happens during consecutive periods of limited solar production?

05 Does the system use an energy-management strategy?

06 Are battery, solar generation, connected load, and controls being evaluated as one complete system?

THE OBJECTIVE IS NOT TO SPECIFY THE LARGEST INDIVIDUAL COMPONENTS.
IT IS TO CONFIGURE THE RIGHT SYSTEM FOR THE PROJECT.

WHAT SOLARPATH PROVIDES

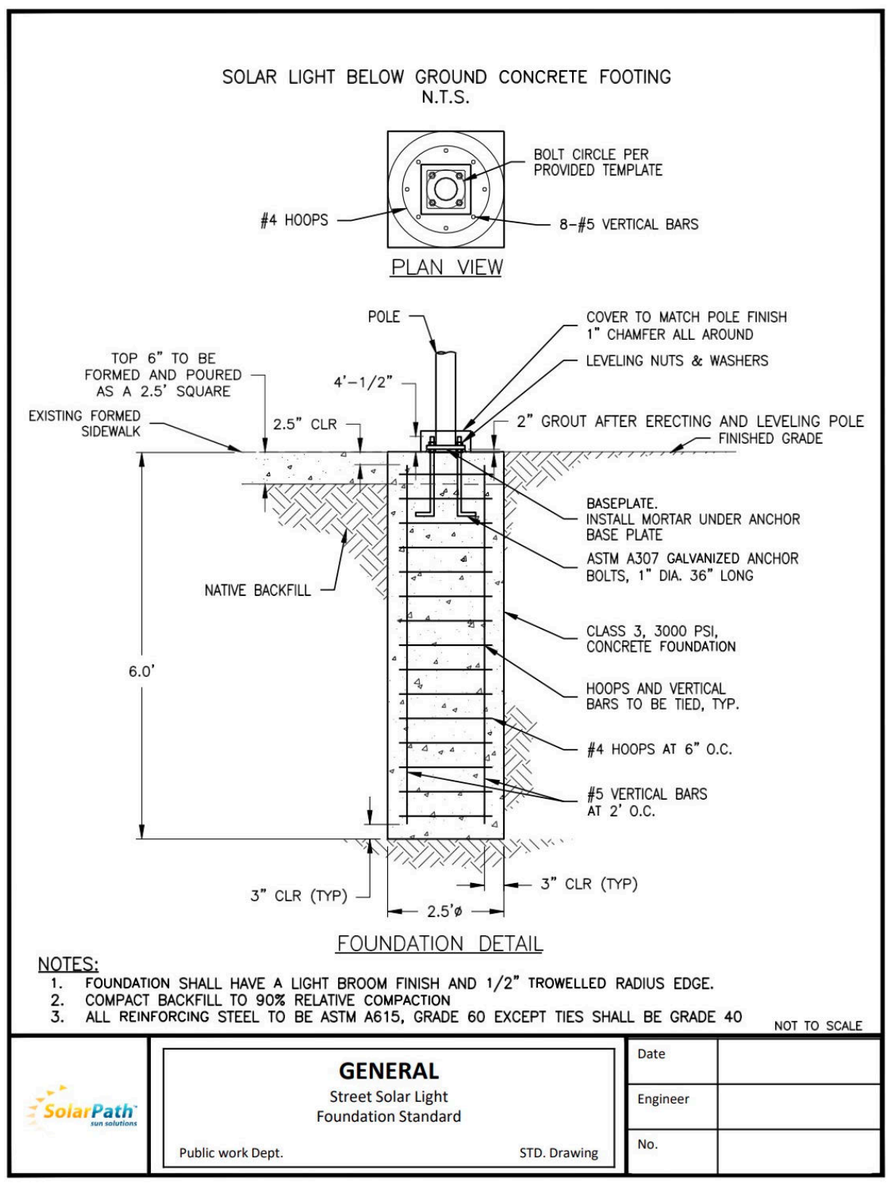
- Geographic location and available solar resource
- Required system load
- Operating hours or activation profile
- Battery storage requirements
- Solar generation requirements
- Controls and operating strategies
- Required system autonomy

WIND & FOUNDATION ENGINEERING

04

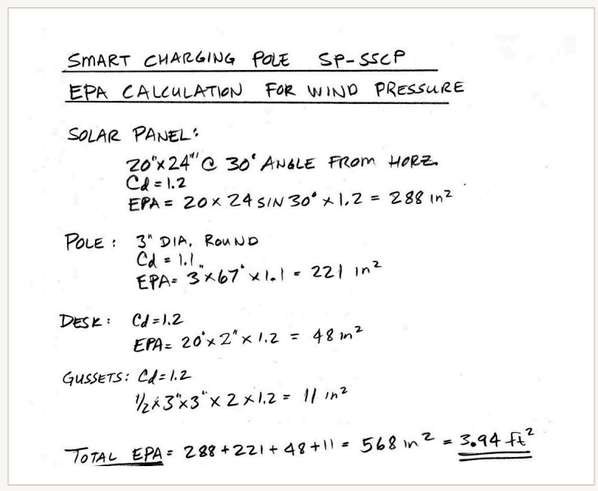
OFF-GRID SOLAR INFRASTRUCTURE IS ALSO STRUCTURAL INFRASTRUCTURE

Poles, solar components, fixtures, signs, beacons, and other mounted equipment can become part of a structural system that must be appropriate for the installation site — considering wind conditions, pole configuration, exposed surface area, foundation design, and project engineering requirements.



Example SolarPath foundation engineering detail.
Foundation requirements are evaluated based on project-specific structural and site conditions.

- EPA / WIND LOAD EVALUATION
- STRUCTURAL REQUIREMENTS
- FOUNDATION DESIGN



Example SolarPath EPA (effective projected area) calculation for wind loading.
EPA is evaluated per system configuration. Values shown are project-specific, not a fixed rating.

01 Has the configuration been evaluated for local wind requirements?

02 Are mounted solar components, fixtures, signs, or beacons included in the structural evaluation?

03 Is the proposed foundation appropriate for the project conditions?

04 Can project-specific engineering documentation be provided when required?

05 Can PE-stamped documentation be provided when required by the project or jurisdiction?

PERFORMANCE ABOVE GROUND.
ENGINEERING SUPPORT BELOW IT.

WHAT SOLARPATH PROVIDES

- Project-specific wind calculations
- Foundation engineering
- Structural documentation
- PE-stamped engineering documentation when required
- Coordination of system configuration

INFRASTRUCTURE & RESILIENCE

SOMETIMES THE BIGGEST ADVANTAGE IS WHAT YOU DON’T HAVE TO BUILD

Conventional outdoor electrical infrastructure can require trenching, conduit, underground wiring, electrical service, surface restoration, and connection to the grid. Independent off-grid systems can reduce reliance on this continuous electrical infrastructure — a factor worth weighing alongside trenching and site disruption, grid availability, installation complexity, and existing utilities at developed sites.

OFF-GRID SOLAR DOESN’T JUST CHANGE THE POWER SOURCE.

It can change the infrastructure required to deliver the project.

INFRASTRUCTURE VULNERABILITY

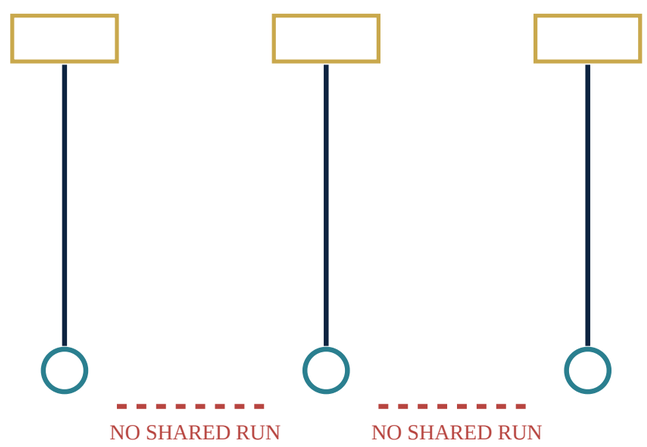
DESIGNING OUT A COMMON VULNERABILITY

Conventional systems can include long runs of underground conductor connecting multiple lighting assets. When that wiring is stolen or damaged, multiple lights may be affected.

Off-grid solar uses a different architecture because each system can operate independently.

This does not make every component of an off-grid solar system immune to theft or vandalism.

It removes one specific vulnerability: long interconnected runs of underground power conductor between equipment locations.



06

LONG-TERM OPERATION & MAINTENANCE

DESIGN BEYOND DAY ONE

A system should be evaluated for how it will be operated, monitored, serviced, and maintained over its useful life — component access, monitoring capabilities, battery lifecycle, replacement requirements, warranties, serviceability, and ongoing technical support.

01 How can system performance be monitored after installation?

02 How are faults or performance issues identified?

03 Are major components accessible for service or replacement?

04 What warranty terms apply to the proposed configuration?

05 What support is available after installation?

06 Can operating schedules or profiles be adjusted if project needs change?

FIELD SERVICE & COMPONENT ACCESS

A SUCCESSFUL PROJECT ISN’T JUST ONE THAT WORKS ON DAY ONE.

It should be designed with long-term operation and service in mind.

REMOTE MONITORING & ASSET MANAGEMENT

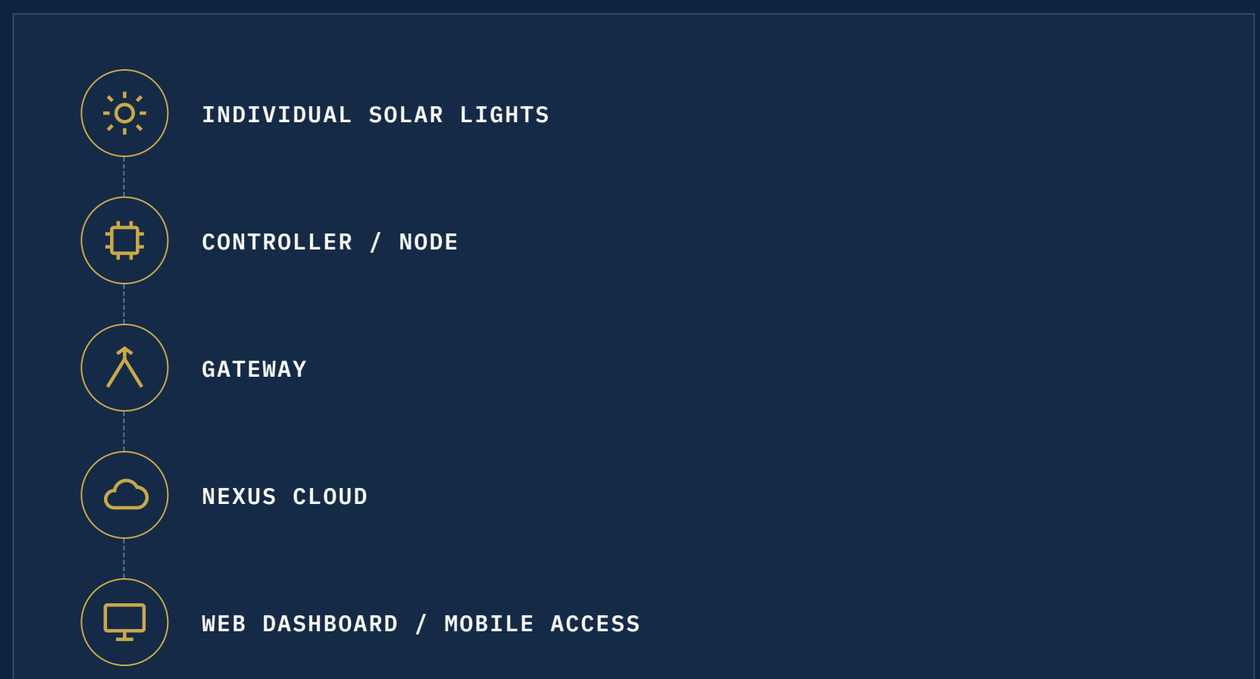
NEXUS INTELLIGENT LIGHTING

Solar lighting does not have to operate as isolated infrastructure. Nexus Intelligent Lighting provides centralized visibility and control across connected SolarPath lighting assets, allowing owners and operators to monitor system performance, manage assets, and identify issues remotely.

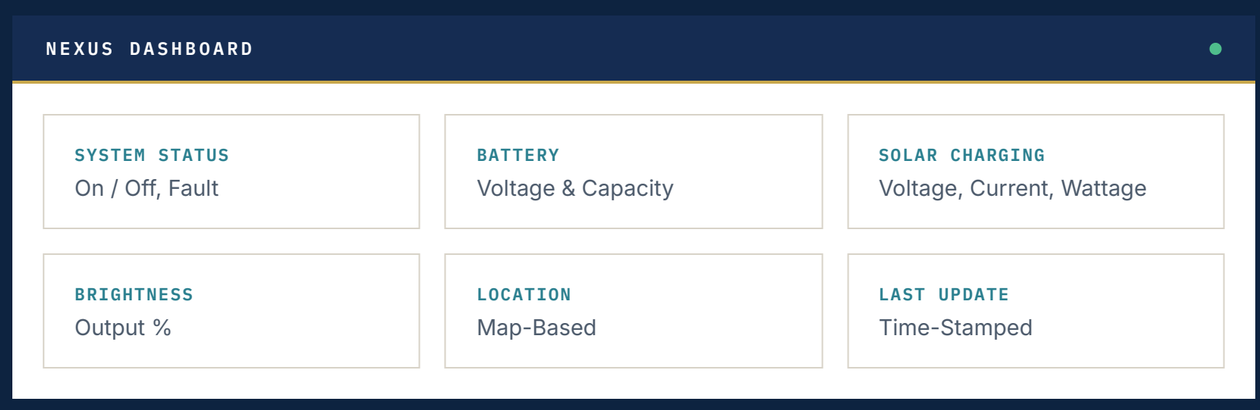
KEY CAPABILITIES

- ✓ System status monitoring
- ✓ Battery voltage and remaining capacity
- ✓ Solar charging performance
- ✓ Luminaire operating status
- ✓ Brightness / output status
- ✓ Remote dimming and scheduling
- ✓ Alerts and system notifications
- ✓ Historical performance data
- ✓ Asset-level reporting
- ✓ Map-based system visibility

SYSTEM ARCHITECTURE



REPRESENTATIVE DASHBOARD VIEW



INDEPENDENT OPERATION.
CONNECTED INTELLIGENCE.

08

WILDLIFE & ENVIRONMENTAL CONSIDERATIONS

LIGHT THE SPACE WITHOUT IGNORING THE ENVIRONMENT

Wildlife-sensitive locations, light source and wavelength, light distribution, spill light, operating strategy, and local environmental requirements all inform a responsible lighting design — wildlife-friendly lighting options for coastal and environmentally sensitive applications.

LOW

Mounting and application strategies that minimize unnecessary light exposure.

LONG

Amber / long-wavelength LED options available for wildlife-sensitive applications.

SHIELDED

Fixture design that directs illumination toward the intended area and limits unnecessary spill.

AMBER LED OUTPUT — CONTROLLED, DOWNWARD LIGHT DISTRIBUTION

SHIELDED FIXTURE PROFILE

> Environmental requirements should inform the lighting design from the beginning, not be added at the end.

WHERE OFF-GRID SOLAR FITS

ONE APPROACH. MULTIPLE APPLICATIONS.

Not every application requires the same system, and not every site is an appropriate candidate for the same off-grid approach. Project-specific evaluation matters.

LIGHTING

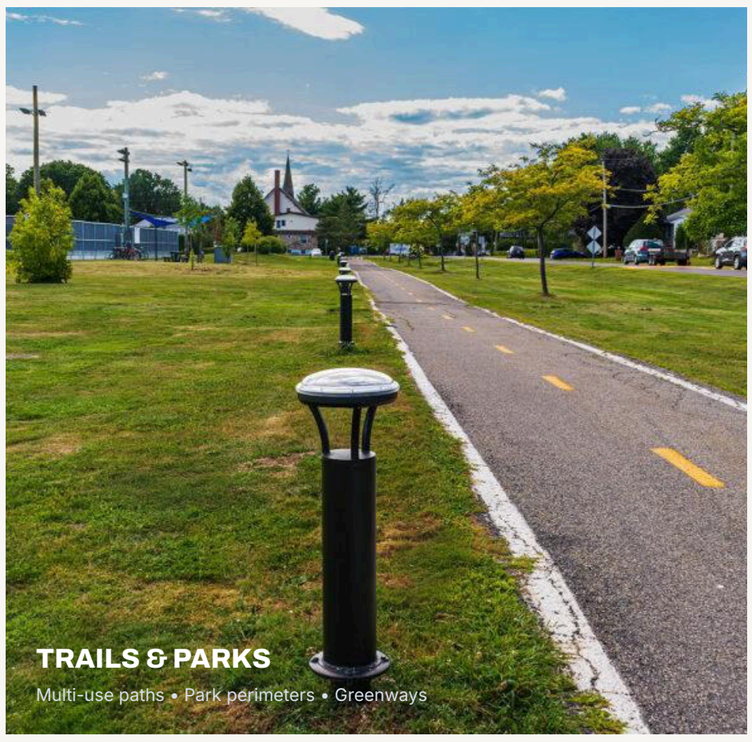
Roadways • Parks • Trails • Parking • Streetscapes • Waterfronts • Campuses • Residential

PEDESTRIAN SAFETY

Crosswalk Warning Systems • RRFB Systems • Pedestrian-Activated Beacons

PATHWAYS & PUBLIC SPACES

Solar Bollards • Walkways • Plazas • Community Paths • Waterfront Paths



TRAILS & PARKS

Multi-use paths • Park perimeters • Greenways

RESIDENTIAL COMMUNITIES

Entry drives • Common areas • Community streetscapes

SMART INFRASTRUCTURE

MONITORING • CONTROLS • SCHEDULING • ALERTS • ASSET MANAGEMENT

PEDESTRIAN SAFETY

SOLAR POWER CAN SUPPORT SAFER CROSSINGS

Rectangular Rapid-Flashing Beacons (RRFBs) are one type of pedestrian warning treatment that may be used at eligible crossing locations, subject to applicable roadway standards and agency requirements.

Crossing conditions, solar access, activation method, system configuration, and applicable roadway and agency requirements should all be evaluated together.

01 Has the crossing and proposed system configuration been evaluated for the specific site?

02 Is the solar power system designed for the actual project location and expected operating demand?

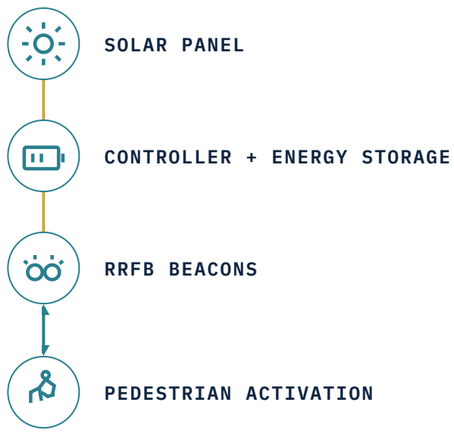
03 What pedestrian activation options are available?

04 Are the power system, controls, beacons, and signage being considered together?

05 What technical documentation is available?

06 What applicable standards or agency requirements need to be addressed?

SYSTEM ARCHITECTURE — CONCEPTUAL



WHAT SOLARPATH PROVIDES

- Solar power system configuration
- RRFB system configuration
- Pedestrian activation options
- Technical documentation
- Engineering support
- Coordination with project requirements

FUNDING AWARENESS

FUNDING AWARENESS SHOULD START EARLY

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Public infrastructure projects may have access to federal, state, regional, or local funding programs. Depending on the program and project, funding opportunities may exist for certain transportation, pedestrian safety, trail, transit, public-space, and infrastructure improvements.

Funding eligibility is determined by the specific program, applicant, project scope, eligible activities, and current program requirements. It is not determined simply by the product being used.

QUESTIONS WORTH ASKING

- $ Are there current funding programs that align with the goals of this project?
- $ Is the agency or project an eligible applicant?
- $ Are the proposed activities eligible?
- $ Are there application deadlines, planning, or matching requirements?
- $ Does the funding source introduce domestic-content, procurement, documentation, or other compliance requirements?

> Funding programs and requirements change.
>
> **Always review current program guidance and confirm eligibility with the appropriate funding agency.**

WHAT SOLARPATH CAN SUPPORT

SolarPath can provide technical product information and project documentation that may be needed when an agency is evaluating a funded project.

ASK EARLY. VERIFY THE REQUIREMENTS.
PLAN ACCORDINGLY.

PROCUREMENT & DOMESTIC CONTENT

PLAN FOR PROCUREMENT EARLY

Public projects may involve procurement and domestic-content requirements that should be identified before product selection is finalized. Depending on the funding source and administering agency, federally funded projects may be subject to BABA, Buy America, or other applicable domestic-content requirements. Requirements vary by program and project.

01 What procurement requirements apply?

02 Are domestic-content requirements applicable?

03 What manufacturer documentation will be required?

04 Is cooperative purchasing an available procurement path?

05 Have these requirements been identified before equipment is ordered?

WHAT SOLARPATH PROVIDES

- Available BABA / BAA compliant configurations
- Supporting product documentation
- Project-specific technical information
- Cooperative purchasing options where applicable

AVAILABLE THROUGH
CarolinaBuy

AVAILABLE BEGINNING SEPTEMBER 1, 2026
BuyBoard

THE SPECIFIER'S CHECKLIST

BEFORE YOU SPECIFY AN OFF-GRID SOLAR SYSTEM

SITE & APPLICATION

- ☐ Geographic location and climate identified
- ☐ Shading and solar access evaluated
- ☐ Site constraints documented

PERFORMANCE

- ☐ Illumination or performance requirements defined
- ☐ Operating profile established

SOLAR SYSTEM DESIGN

- ☐ System sized for location and load
- ☐ Autonomy requirements confirmed

STRUCTURAL ENGINEERING

- ☐ Wind requirements evaluated
- ☐ Foundation appropriate for site
- ☐ PE-stamped documentation confirmed if required

INFRASTRUCTURE & RESILIENCE

- ☐ Trenching / grid dependency assessed
- ☐ Vulnerability considerations reviewed

ENVIRONMENTAL REQUIREMENTS

- ☐ Wildlife-sensitive needs identified
- ☐ Light source and spill light evaluated

CONTROLS & MAINTENANCE

- ☐ Monitoring approach defined
- ☐ Service access and warranty confirmed

PEDESTRIAN SAFETY

- ☐ Crossing configuration evaluated
- ☐ Agency requirements identified

FUNDING, COMPLIANCE & PROCUREMENT

- ☐ Funding eligibility verified
- ☐ Procurement path and domestic-content confirmed

ONE PROJECT. ONE SYSTEM.

Site conditions affect system sizing. Performance requirements affect energy demand. System configuration affects structural requirements.
Evaluate the system as a whole.

WHAT SOLARPATH BRINGS TO THE PROJECT

FROM PROJECT REQUIREMENTS TO AN ENGINEERED SOLUTION

SolarPath works with municipalities, engineers, landscape architects, transportation professionals, developers, and other project teams to develop solutions around site-specific requirements rather than forcing projects into a standard configuration.

SITE EVALUATION
Understanding project conditions, solar availability, application requirements, and infrastructure constraints.

SOLAR SYSTEM ENGINEERING
System configuration based on location, operating profile, energy requirements, and required autonomy.

PEDESTRIAN SAFETY SOLUTIONS
Solar-powered RRFB and crossing solutions configured around project requirements.

ENVIRONMENTAL OPTIONS
Available configurations for projects with wildlife-sensitive or other environmental lighting requirements.

PHOTOMETRIC DESIGN
Project-specific lighting layouts to evaluate performance before installation.

WIND & FOUNDATION ENGINEERING
Structural calculations and foundation design, with PE-stamped documentation when required.

SMART CONTROLS
Remote monitoring, scheduling, alerts, asset management, and system visibility through Nexus Intelligent Lighting.

DOCUMENTATION & PROCUREMENT
Technical documentation, available domestic-content configurations, and cooperative purchasing options where applicable.

WE DON’T FIT THE CLIENT TO THE PRODUCT. WE FIT THE PRODUCT TO THE PROJECT.

HAVE A PROJECT YOU’RE EVALUATING?

Send us the site plan, application requirements, or project specifications. Our team can help evaluate the project and determine the appropriate next steps.

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