Ranchview County Water District

Grid Integrated Solar Power for Water Delivery

Preliminary Engineering Report

117-750919-24001
May 2025

TETRA TECH

Ranchview County Water District
Grid Integrated Solar Power for Water Delivery
Preliminary Engineering Report

PRESENTED TO

Ranchview County Water District Board of Directors
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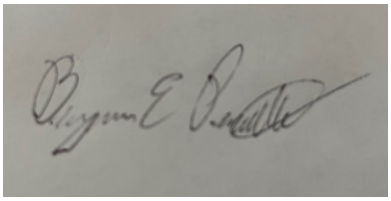

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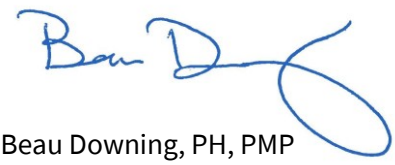

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
AC	Alternating Current
AEP	Annual Energy Production (in kilowatt-hours or kWh)
BOP	Balance of Plant
BESS	Battery Energy Storage System
CE	Categorical Exclusion
CREST	Cost of Renewable Energy Spreadsheet Tool (NERL)
DC	Direct Current
DNRC	Montana Department of Natural Resources and Conservation
EA	Environmental Assessment
EIS	Environmental Impact Statement
FT	Fixed Tilt
GEW	Great West Engineering
ITC	Investment Tax Credit
kW	Kilowatts
kWh	Kilowatt hours
LOD	Limits of Disturbance; assumed equal to the Site, Site boundary and buildable area
NREL	National Renewable Energy Labs
NEW	NorthWestern Energy
PER	Preliminary Engineering Report
PTC	Production Tax Credit
PVPEL	Kiwa's PV Evolution Labs
RCWD	Ranchview County Water District
ROM	Rough Order of Magnitude
RRPG	Renewable Resources Planning Grant
SAT	Single-Axis Tracker(s)
SLD	Single-Line Diagram
SWDA	Safe Water Drinking Act
TBD	To be determined

Acronyms/Abbreviations	Definition
USB	Universal System Benefits
USD	United States Dollar
W2ASACT	Water, Wastewater, and Solid Waste Action Coordinating Team

1.0 EXECUTIVE SUMMARY

Tetra Tech Inc. (Tetra Tech) has prepared this Preliminary Engineering Report (PER) and three accompanying conceptual solar plant design alternatives for a Grid-Integrated Solar Plant for the Ranchview County Water District (RCWD), with funding provided by a Montana Department of Natural Resources and Conservation (DNRC) Renewable Resource Planning Grant (RRPG).

This PER and the accompanying design documents are part of a task order Tetra Tech received from the DNRC to assist the RCWD Board of Directors with their Renewable Resource Planning Grant Application. The focus of the planning grant application was to secure funding to evaluate grid-integrated solar energy alternatives to supplement, or fully offset, the approximate 75,000 kilowatt-hours (kWh) consumed by the RCWD water delivery system that serves the Ranchview subdivision in Helena, Montana.

The RCWD maintains a public water system (Department of Environmental Quality Public Water System #MT0003782) under Lewis and Clark County Water and Sewer District, which consists of an irrigation supply system and potable domestic water. The RCWD currently serves 107 homes with an estimated population of 257 people.

Previous upgrades to the Ranchview Estates community water system were completed under the suggested alternatives of the Water System PER submitted by Great West Engineering (GWE) in 2020 (GWE, 2020). Though this conceptual solar plant design PER focuses on upgrades to the existing electrical source system, the previous Water System PER completed by GWE is referenced throughout this report.

Tetra Tech was tasked with developing three conceptual designs for a ground-mounted solar array including equipment recommendations, electric supply system designs, plant and equipment layouts, and energy production estimates for the proposed location on property owned by Lewis and Clark County, currently under a public utility easement to RCWD.

This PER provides background information on the Ranchview Estates water distribution electrical components, their water delivery systems, describes the solar plant design alternatives analysis, results of the analysis, and selects the preferred alternative of the fixed tilt solar array, and related electronic systems. This PER meets the requirements of the PER Outline within the Uniform Application Supplement for Montana Public Facility Projects, as required by Montana's Water, Wastewater, and Solid Waste Action Coordinating Team (W2ASACT, 2022).

2.0 PROJECT PLANNING

The RCWD board of directors, following implemented water efficiency upgrades based on the Water System PER (GWE, 2020), is evaluating opportunities to integrate solar energy into the RCWD water delivery system to increase system efficiencies and offset grid-supplied energy sources and costs.

The RCWD submitted the Renewable Resources Planning Grant (RRPG) application Tetra Tech assisted in developing and subsequently was awarded $30,000 to evaluate grid integrated solar energy alternatives to

supplement, or fully offset, the approximate 75,000 kilowatt-hours (kWh) consumed annually by the RCWD's water delivery system.

2.1 LOCATION

The existing service area consists of the RCWD service area boundary, which primarily covers the entirety of the Ranchview Estates subdivision. The RCWD is located within Lewis and Clark County, approximately 8 miles north of the City of Helena. The subdivision is bordered by Montana Avenue to the west, I-15 to the east, the Helena Valley Canal to the south, and undeveloped state and private land to the north. The address for the pump house is 7735 N Montana Ave, Helena, Montana 59602.

More specifically, the RCWD is located at:

- Township/Range/Section: Township 11N, Range 3W, Section 17.
- Average elevation: 3,800 feet.

Topography in the planning area generally slopes to the southeast toward Lake Helena, located approximately 3 miles southeast of Ranchview Estates. Elevations within the planning area range from 3,812 feet above mean sea level at the northwestern corner of the subdivision, to 3,778 feet above mean sea level at the southern portion of the boundary. **Figure 2-1**, below, presents a topographic map of the planning area. A full 7.5 minute topographic map, legal property boundaries, and aerial imagery are presented in **Appendix A**.

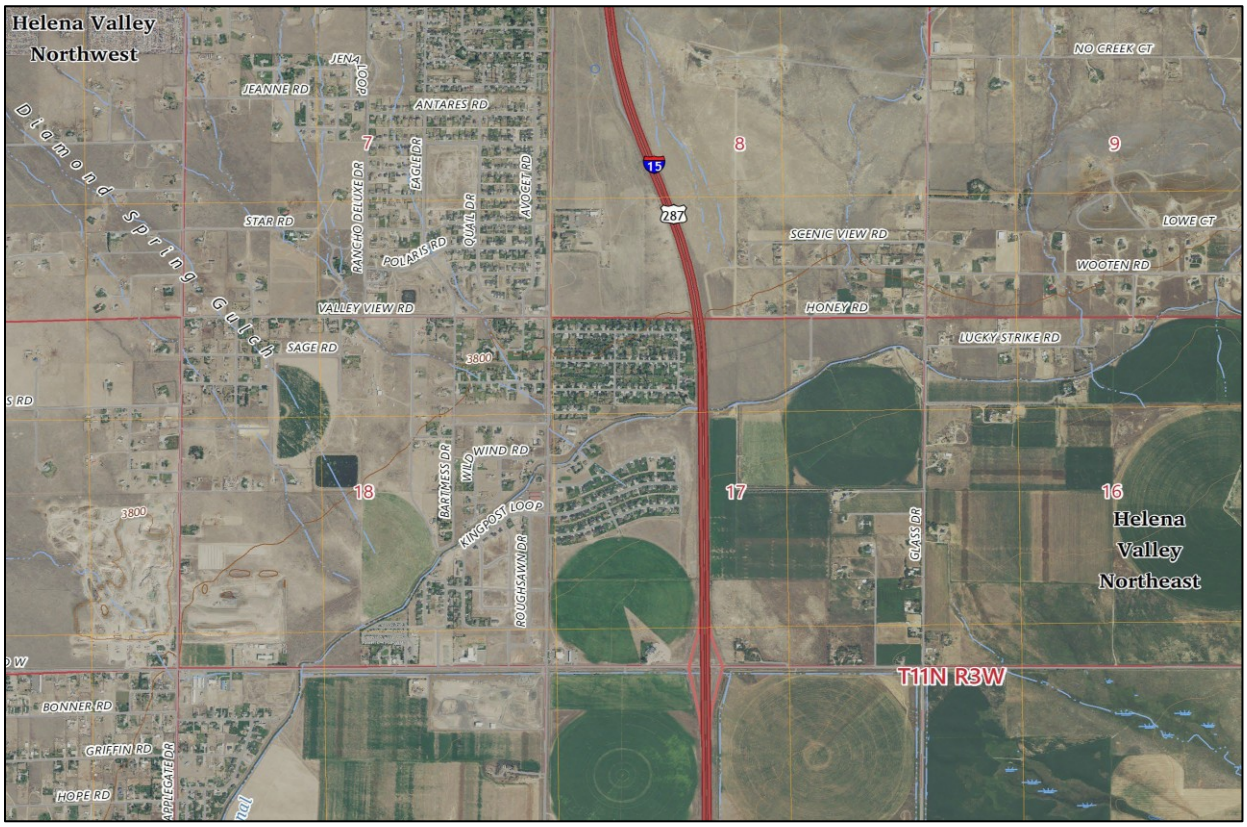

Figure 2-1. Topographic map of Site Location.

2.2 ENVIRONMENTAL RESOURCES PRESENT

The alternative selected by RCWD will impact approximately 0.5 acres of previously disturbed and currently undeveloped land. Prior to the development of these alternatives, the surrounding environmental resources were reviewed for potential impacts. A completed Uniform Environmental Checklist for the proposed solar panel conceptual design is included in **Appendix B**. Minimal impact resulting from the proposed improvements has been identified. Description of the environmental resources that may be impacted within and surrounding the site boundary are provided below.

Land Resources. Land use within the site boundary is previously disturbed and currently undeveloped grasslands surrounding the pumphouse and potential construction areas. The parcel being considered for solar panel construction is owned by Lewis and Clark County and contains grasses and shrubs or small trees (MTNHP). Tetra Tech personnel contacted Chrystal Ness, at the Community Development and Planning division, to initially assess if there would be additional permits required by the County for construction and electrical work. There will be construction and electrical permits required through NorthWestern Energy (NWE) and Lewis and Clark County. Permission will be needed to conduct construction on county land, regardless of minimal permanent impacts and avoidance of utilities within the designs.

Minimal permanent impacts are anticipated in association with the construction of the solar panels. Natural revegetation of the disturbances due to construction are likely to be effective, due to the limited size of the footprint of the site area. Areas of disturbance will be restored to original conditions, to the greatest extent possible, upon completion of construction. Minimal adverse impacts to biological resources are anticipated and the grasslands that would be permanently impacted are not classified as critical habitat (MTNHP).

Biological Resources. The solar panels will permanently impact the grasslands; however, the preferred selected alternative has a minimal footprint of only impacting approximately 0.5 acres of undeveloped grasslands. The site boundary does not fall within sage grouse habitat. There are no mapped wetlands within the preferred alternative location. The preferred alternative is not classified as an Important Bird Area or an Important Plant Area by the Montana Natural Heritage Program. Canadian Lynx, Grizzly Bears, Rufa Red Knot, Monarch Butteryfly, Suckley's Cuckoo Bumble Bee, and Bald and Golden Eagles are species that may be potentially impacted due to construction. The preferred alternative is not likely to impact these species as it does not impact critical habitat and has a minimal permanent footprint of approximately 0.5 acres, (MTNHP).

Visual Resources. The addition of the solar panels and fencing will cause visual obstructions. The fenced area would be approximately less than one acre and would remain within the Lewis and Clark County Utility Easement. The mechanical and electrical components of the solar panels would create a low volume, low frequency humming noise that may be audible when near the panels.

The proposed alternatives were designed to intentionally minimize permanent impacts to the residents of Ranchview Estates and the surrounding natural environment. Additional information including the sources used to make these assessments are listed within the completed environmental checklist, presented in **Appendix B**. Depending on the source of funding acquired to construct the selected alternative, additional review of the temporary and permanent impacts associated with the selected alternative may be required.

2.3 POPULATION TRENDS

The alternative analyses presented in this report are based on the existing population of Ranchview Estates and will not consider future growth.

There are 107 total households in the Ranchview Subdivision. Assuming 2.4 persons per household, as determined from Lewis and Clark County census data, equates to an existing population of approximately 257 people living within the planning area (GWE, 2020).

2.4 COMMUNITY ENGAGEMENT

RCWD Board meetings are publicly available and have been used to discuss and provide feedback for the PER alternatives. A website is established for RCWD to communicate updates regarding the Ranchview Estates community, www.ranchviewwaterusers.com, and regular board meetings are held to discuss community needs. Bob Bennett, RCWD Board President, will post this PER to the website which will then become publicly available for RCWD and surrounding community members to review. Ongoing discussion will be held within the community to provide the RCWD Board with feedback regarding the proposed project and future funding options.

3.0 EXISTING FACILITIES

3.1 LOCATION MAP

The existing water system configuration was mapped in the Water System PER (GWE, 2020) and is shown in **Appendix A**. A site walk was completed by Tetra Tech personnel and a RCWD representative in January 2025. Photographs of existing facilities are presented in **Appendix C**.

3.2 HISTORY

The water system that currently services Ranchview Estates was completed in phases throughout the 1990s and early 2000s. Additional upgrades were completed in 2018 and 2019, including installation of new riser pipe sections installed in potable wells, new submersible pumps at one potable well, and one new irrigation well pump (GWE, 2020).

At the suggestion of the Water System PER in November 2020, RCWD completed several updates which included replacement of two in-well pumps to improve water pressure across the potable water system; the purchase of a backup pump in preparation for mechanical pump failures or supply chain issues; replacement of aging PVC within the pumphouse and wellhouse areas to improve earthquake and natural disaster resiliency; installation of a new fence to increase security; and upgrades on the electrical system to its current configuration by replacing the flow and pressure meters.

3.3 CONDITION OF EXISTING FACILITIES

The condition of existing facilities pertaining to water supply and distribution was assessed utilizing information acquired through the Water System PER conducted in November 2020 by Great West Engineering (GWE, 2020). Additional updates to the water supply system that have occurred since the previous PER were reported to Tetra Tech personnel by RCWD Board personnel. Visual inspection of the current facility's electrical components was conducted in January 2025 by Tetra Tech personnel. The following assessments were made:

- The facility's main electrical service is a 3-Phase, 4-Wire, 480V/277V, Grounded Y configuration,
- The existing utility meter is a single-direction consumption meter,
- The existing main service panel is a 250A 480V NEMA 3R rated panel with an Eaton surge protection device installed, located on the exterior of the facility. The current rating of the main breaker in this service panel could not be determined at the time of the site visit. Loads include irrigation pumps and a step-down transformer,
- A Central Pacific 480V/240V step-down transformer located on the exterior of the facility feeds a subpanel on the interior of the facility utilizing variable frequency devices for the facility water pumps, facility lighting, and a data acquisition system.

3.4 FINANCIAL STATUS OF ANY EXISTING FACILITIES

RCWD does not currently have any debt related to the water system. To assess electricity and energy usage, energy bills from 2021 through 2024 were analyzed by Tetra Tech personnel. Financial statements were not included as part of the solar panel conceptual assessment; however, the offset cost of installing and operating solar panels is considered in each alternative.

3.5 WATER/ENERGY/WASTE AUDITS

No water, energy, or waste audits were conducted for RCWD's electrical supply to the water systems.

4.0 NEED FOR PROJECT

4.1 HEALTH, SANITATION, AND SECURITY

There are no concerns regarding health, sanitation, or security regulations in regard to the presented alternative actions for conceptual solar array design. Safe work practices will be implemented and followed during the construction process. The installation of solar panels may require additional security measures, including a fence surrounding the panel area. The RCWD regularly meets the requirements set forth in drinking water standards and regulations, as reviewed in the previous water systems and meets the requirements for the Safe Water Drinking Act (SWDA) (GWE, 2020) (Ranchview Estates, CCR 2024).

4.2 AGING INFRASTRUCTURE

The RCWD has identified energy conservation and energy sources as the next phase in potential system improvements. Implementing a solar array will conserve resources, improve the resiliency and efficiency of operations, and upgrade the current electrical system.

4.3 REASONABLE GROWTH

Ranchview Estates is fully developed within their current boundary. The District Board is not considering extending water service beyond the district boundary.

5.0 ALTERNATIVE CONSIDERED

Tetra Tech developed three conceptual designs, estimated each alternative's Annual Energy Production (AEP) through modeling and simulation, and reviewed 3+ years of RCWD utility bills to estimate future energy costs for the RCWD. Table 5-1, below, provides a summary, including preliminary stage cost and financial data, for the three alternative conceptual designs.

Table 5-1. System Summary Table for Each Alternative

Design	Alternative #1 SAT	Alternative #2 FT	Alternative #3 FT w/ BESS
System Size [kW-DC]	66.1	66.1	86.4
System Size [kW-AC]	50	50	48
System Footprint [Acres]	0.547	0.292	0.402
AEP (Est.) [kWh/Yr.]	112,900	88,217	99,232
Performance Ratio	80.92%	81.03%	69.7%[1]
Construction Cost [$USD/kW-DC] [2], Estimate	$2,120	$1,940	$2,680
Construction Cost Total [$USD] Estimate	$172,071	$160,092	$209,579
Annual Operating Expense [$USD/kW-DC/Yr] Estimate[2]	$17.21	$17.21	$17.21
Annual Operating Expense [$USD/Yr] Estimate	$1,137.581	$1,137.581	$1,486.94
Average Annual Energy Use[3] [kWh]	74,412		
Average Energy Cost [$USD/kWh]	$0.14175		
Average Annual Energy Cost (Av. over 3.31 Yrs) [$USD/Yr.]	$10,547.00		
Predicted Annual Costs (w\Solar) [$USD/Yr] Estimate	TBD – Pending inputs to CREST model		

NOTES:
AC – Alternating Current
BESS – Battery Energy Storage System
DC – Direct Current
FT – Fixed Tilt
SAT – Single-Axis Tracker(s)
TBD – To Be Determined

[1] *PVSyst is currently unable to model BESS accurately, so Alternative #3 performance ratio does not represent actual performance, as the BESS will use excess energy. The performance ratio will likely be significantly higher, depending on battery discharge profiles.*
[2] *U.S. Solar Photovoltaic System and Energy Storage Cost Benchmarks, With Minimum Sustainable Price Analysis: Q1 2022.*
[3] *Data derived from 3.3 years of energy bills. Data gaps filled in by averaging same months in different years.*

The energy and cost information in the table above is based on early-stage desktop analysis using publicly available data and incomplete data from the end client. As such, the cost and AEP data provided should be considered as a rough order of magnitude (ROM) estimate that will change as the project converges on one option and the design is refined.

The Cost of Renewable Energy Spreadsheet Tool (CREST) is a tool that contains economic, cash-flow models that were utilized to estimate the costs associated with the proposed alternatives. The CREST tool considers the effects of different economic drivers including tax rates and inflation while considering project characteristics such as location and land ownership. The awarded $30,000 RRPG funding already expended for the preliminary design and presentation of this PER is included within the Construction Cost Totals for each alternative. The associated costs with construction and operations and maintenance were derived utilizing the CREST tool by inputting information such as:

- the project size and performance,
- capital costs,
- operations and maintenance,
- construction financing,
- permanent financing,
- Tax Information,
- Cost-Based Tariff Rate Structure,
- Capital Expenditures during operations.

Beyond convergence on one design, further refinement would include, but not limited to, a more rigorous energy analysis using more comprehensive detailed design, more accurate weather data, refined system losses, details of any grants awarded, and any additional data not accounted for, such as:

- Interconnection costs,
- Interconnection application to the local utility,
- Updated equipment costs,
- PTC/ITC changes,
- Detailed environmental and engineering assessment of the land and vicinity (as needed).

The alternatives discussed throughout this PER were designed with a widely utilized simulation software tool, PVsyst, for modeling, simulation, and analysis of PV systems ranging from residential rooftop arrays to utility-scale solar farms. PVsyst generates detailed system specifications, visuals and simulates energy performance, presented in **Appendix D.**

5.1 ALTERNATIVE DESIGN #1 SINGLE AXIS TRACKER

Alternative design 1 is presented in **Appendix D** and includes the installation of solar panels across an approximate 0.54 acres located within the Lewis and Clark County utility easement property and with a

minimum setback of 50 feet from the canal. The solar array is located east of the pumphouse and within the required minimum of 20 feet setback from residential parcel lines. The preliminary design for Alternative 1 includes a 50 kW inverter and AC trenching west of the solar array towards the utility meter and point of connection, located at the pumphouse. This alternative would potentially require the removal of trees and installation of an array boundary fence.

50kW-AC capacity is the design criteria limitation for the Northwestern Energy utility grant this project will be applying for. The solar photovoltaic (PV) system was designed with a total DC capacity of 66.08 kW, based on standard test conditions, and a boosted DC capacity of 72.28 kW under best-case (BSTC) conditions. The system is supported by a single SMA Sunny Tripower CORE1 50-US inverter, offering an AC capacity of 50 kVA. This results in a DC/AC ratio of 1.32, and 1.45 under BSTC, providing a balanced performance between energy harvest and inverter capacity.

The design utilizes 112 Q.PEAK DUO XL-G11S.3 / BFG 590 modules, configured into 7 strings, ensuring optimal voltage and current matching. The system is mounted on a single-axis tracker, allowing for dynamic adjustment to the sun's position throughout the day. The array is oriented with an azimuth of 180° (true south) and installed at a tilt angle of ±55°, which is conducive to maximizing annual energy yield.

Alternative 1 is estimated to cost $172,071 at $2,120/kW DC, with an annual operating expense of $1,137.58. The design criteria and system specifications are detailed in table 5-2 and are presented within the PVsyst reports and included as **Appendix D**.

Table 5-2. Alternative #1 System Specifications

SYSTEM SPECS	
DC CAPACITY (kW)	66.08
DC CAPACITY - BSTC (kW)	72.28
AC CAPACITY (KVA)	50
DC/AC RATIO (%)	1.32
DC/AC RATIO - BSTC (%)	1.45
MODULE MODEL	Q.PEAK DUO XL-G11S.3 / BFG 590
TOTAL NUMBER OF MODULES	112
TOTAL NUMBER OF STRINGS	7
INVERTER MODEL	SMA SUNNY TRIPOWER CORE1 50-US
TOTAL NUMBER OF INVERTERS	1
TILT	+/- 55
AZIMUTH	180
RACKING	SINGLE-AXIS TRACKER

Map

The work will take place on the Lewis and Clark County owned parcel that is adjacent to the pumphouse. Maps and design drawings are presented in **Appendix D.**

Figure 5-1. Alternative #1 Map

Environmental Impacts

The removal of trees to the south of the fenced-in PV array area and within its boundaries may be required for constructability, minimizing shading on the array, and maximizing energy production. Leveling/grading of the fenced-in PV array area may be required and is to be determined at a later date by a chosen solar installation professional. There are no expected impacts on critical habitats, floodplains, wetlands, historic properties or endangered species. There are minimal permanent impacts associated with the solar panels and fencing including changes to the visual scenery and a low volume humming noise.

Land Requirements

The construction of this alternative would require approximately 0.54 acres of land. The parcel is currently owned by Lewis and Clark County and is under a utility easement for RCWD. Prior to construction, RCWD will need to obtain necessary permissions to construct on Lewis and Clark County land.

Potential Construction Problems

Electrical routing paths and methods within the proposed PV array area and from the proposed PV array area to the water pump house may be impacted by the pre-existing underground water line routing and pump locations and any other existing infrastructure. Prior to construction of the solar array, a 3rd party utility survey may be necessary to ensure that electrical and water utility services are not impacted by array or fencing construction.

Sustainability Considerations

This is a renewable energy project without net metering availability from the utility and is considered to be 'green' infrastructure. The system is intended to offset present electrical energy usage on site of the proposed facility and any excess energy is not credited to the facility owner, instead going to the grid free of charge. Efficiency measures have already been taken to upgrade the water pumping infrastructure prior to the consideration of a photovoltaic energy production system. Current preliminary designs address on site energy consumption with these measures already in place.

5.2 ALTERNATIVE DESIGN #2 FIXED TILT

The solar photovoltaic (PV) system was designed with a total DC capacity of 66.08 kW, based on standard test conditions, and a boosted DC capacity of 72.28 kW under best-case (BSTC) conditions. The solar array is located within the Lewis and Clark County utility easement property and with a minimum setback of 50 feet from the canal.

The solar arrays will occupy a footprint of approximately 0.3 acres. The system is supported by a single SMA Sunny Tripower CORE1 50-US inverter, offering an AC capacity of 50 kVA. This results in a DC/AC ratio of 1.32, and 1.45 under BSTC, providing a balanced performance between energy harvest and inverter capacity.

The design utilizes 112 Q.PEAK DUO XL-G11S.3 / BFG 590 modules, configured into 7 strings, ensuring optimal voltage and current matching. The system is mounted on a fixed-tilt racking system, providing structural stability and consistent solar exposure throughout the year. The array is oriented with an azimuth of 180° (true south) and installed at a tilt angle of 15°, which is conducive to maximizing annual energy yield.

A fixed-tilt racking system is a structural framework used to support and orient solar photovoltaic models at predetermined, non-adjustable angles relative to the horizontal plane. Within the design of Alternative 2, the racking system is set at a tilt angle of 15°, facing due south to increase winter performance by improving solar incidence during low sun angles.

Alternative 2 is estimated to cost $160,092 at $1,940/kW DC, with an annual operating expense of $1,137.58. The design criteria and system specifications are detailed in table 5-3 and are presented within the PVsyst reports and included as **Appendix D**.

Table 5-3. Alternative #2 System Specifications

SYSTEM SPECS	
DC CAPACITY (kW)	66.08
DC CAPACITY - BSTC (kW)	72.28
AC CAPACITY (KVA)	50
DC/AC RATIO (%)	1.32
DC/AC RATIO - BSTC (%)	1.45
MODULE MODEL	Q.PEAK DUO XL-G11S.3 / BFG 590
TOTAL NUMBER OF MODULES	112
TOTAL NUMBER OF STRINGS	7
INVERTER MODEL	SMA SUNNY TRIPOWER CORE1 50-US
TOTAL NUMBER OF INVERTERS	1
TILT	15
AZIMUTH	180
RACKING	FIXED-TILT

Map

The work will take place on the Lewis and Clark County owned parcel that is adjacent to the pumphouse. Maps and design drawings are presented in **Appendix D.**

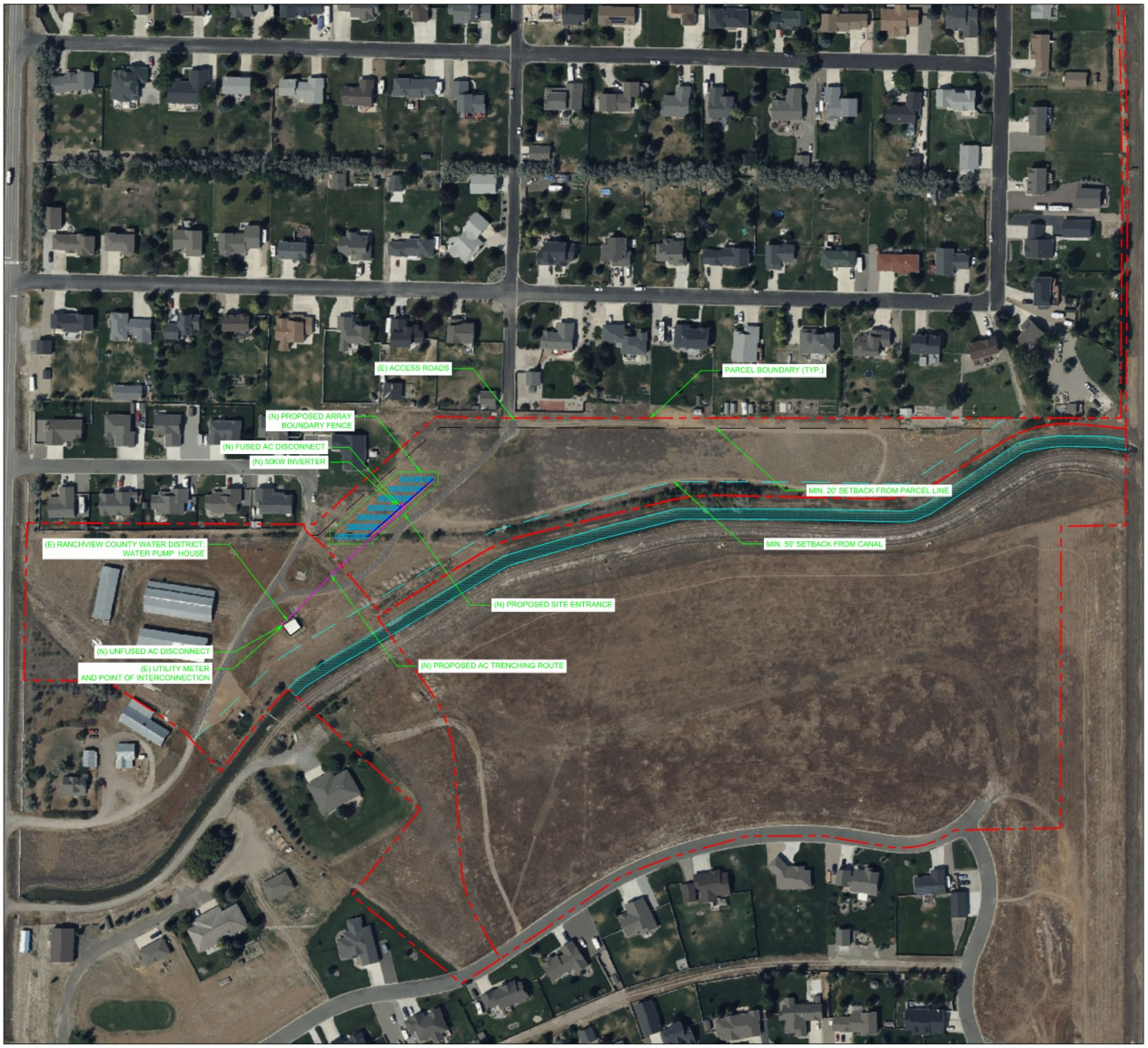

Figure 5-2. Alternative #2 Map

Environmental Impacts

The removal of trees and shrubs to the south of the fenced-in PV array area and within its boundaries may be required for constructability, minimizing shading on the array, and maximizing energy production. Leveling/grading of the fenced-in PV array area may be required and is to be determined at a later date by a chosen solar installation professional. There are no expected impacts on critical habitats, floodplains, wetlands, historic properties or endangered species. There are minimal permanent impacts associated with the solar panels and fencing including changes to the visual scenery and a low volume humming noise.

Land Requirements

The construction of this alternative would require approximately 0.3 acres of land. The parcel is currently owned by Lewis and Clark County and is under a utility easement for RCWD. Prior to construction, RCWD will need to obtain necessary permissions to construct on Lewis and Clark County land.

Potential Construction Problems

Electrical routing paths and methods within the proposed PV array area and from the proposed PV array area to the water pump house may be impacted by the pre-existing underground water line routing and pump locations and any other existing infrastructure. Prior to construction of the solar array, a 3rd party utility survey may be necessary to ensure that electrical and water utility services are not impacted by array or fencing construction.

Sustainability Considerations

This is a renewable energy project without net metering availability from the utility and is considered to be 'green' infrastructure. The system is intended to offset present electrical energy usage on site of the proposed facility and any excess energy is not credited to the facility owner, instead going to the grid free of charge. Efficiency measures have already been taken to upgrade the water pumping infrastructure prior to the consideration of a photovoltaic energy production system. Current preliminary designs address on site energy consumption with these measures already in place.

5.3 ALTERNATIVE DESIGN #3: FIX TILT SYSTEM WITH BESS

The system integrates fixed-tilt racking on a footprint of approximately 0.4 acres, modular battery storage, and grid-interactive inverters to support both self-consumption and resiliency.

The designed solar photovoltaic (PV) and energy storage system features a total DC capacity of 86.40 kW under standard test conditions and 94.50 kW under best-case (BSTC) conditions. The system is configured with an AC capacity of 48 kVA, resulting in a DC/AC ratio of 1.80 (1.97 under BSTC), which ensures high energy harvest with limited power clipping during peak solar conditions. The array consists of 180 Q.PEAK DUO XL-G10.3/BFG 480 W modules, organized into 20 strings for optimal electrical balance and energy distribution.

Energy conversion is handled by five SMA Sunny Boy Smart Energy-US 9.6 inverters, which are hybrid units capable of managing both solar production and battery integration. Energy storage is provided by five SMA Home Storage-US 18.9 batteries, each with a capacity of 18.9 kWh, for a combined system capacity of 94.5 kWh. This battery bank enables load shifting, supports backup power during outages, and enhances overall system resiliency.

The PV modules are mounted on a fixed-tilt racking system set at a 15° angle, facing due south (180° azimuth).

Alternative 3 is estimated to cost $209,579 at $2,680/kW DC, with an annual operating expense of $1,486.94. The design criteria and system specifications are detailed in table 5-4 and are presented within the PVsyst reports and included as **Appendix D**.

Table 5-4. Alternative #3 System Specifications

SYSTEM SPECS	
DC CAPACITY (kW)	86.40
DC CAPACITY - BSTC (kW)	94.50
AC CAPACITY (KVA)	48
DC/AC RATIO (%)	1.80
DC/AC RATIO - BSTC (%)	1.97
MODULE MODEL	Q.PEAK DUO XL-G10.3/BFG 480
TOTAL NUMBER OF MODULES	180
TOTAL NUMBER OF STRINGS	20
INVERTER MODEL	SMA SUNNY BOY SMART ENERGY-US 9.6
TOTAL NUMBER OF INVERTERS	5
BATTERY MODEL	SMA HOME STORAGE-US 18.9
BATTERY CAPACITY (kWh)	18.9
TOTAL NUMBER OF BATTERIES	5
TOTAL BATTERY CAPACITY (kWh)	94.5
TILT	15
AZIMUTH	180
RACKING	FIXED-TILT

Map

The work will take place on the Lewis and Clark County owned parcel that is adjacent to the pumphouse. Maps and design drawings are presented in **Appendix D.**

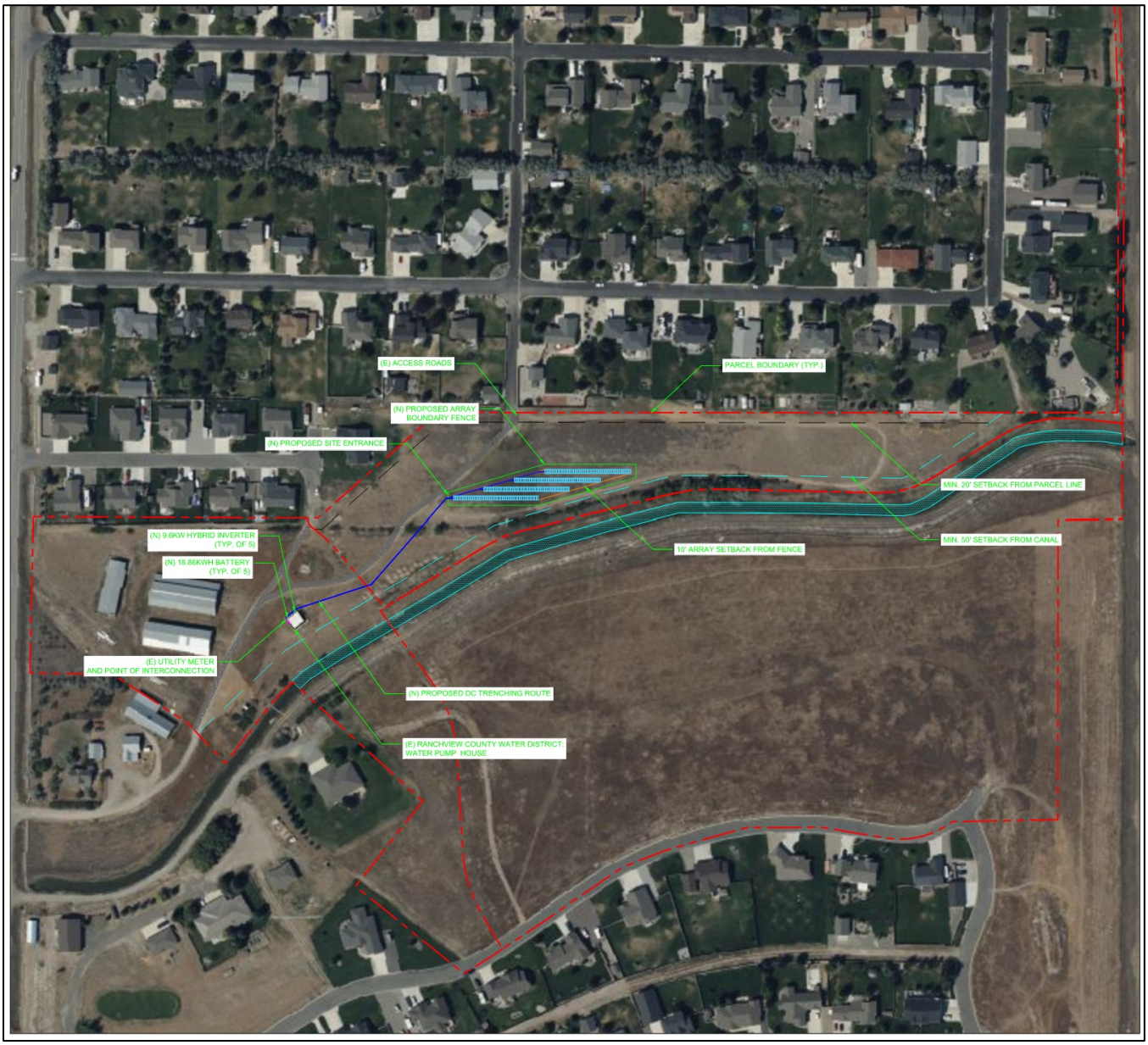

Figure 5-3. Alternative #3 Map

Environmental Impacts

The removal of trees to the south of the fenced-in PV array area and within its boundaries may be required for constructability, minimizing shading on the array, and maximizing energy production. Leveling/grading of the fenced-in PV array area may be required and is to be determined at a later date by a chosen solar installation professional. There are no expected impacts on critical habitats, floodplains, wetlands, historic

properties or endangered species. There are minimal permanent impacts associated with the solar panels and fencing including changes to the visual scenery and a low volume humming noise.

Land Requirements

The construction of this alternative would require approximately 0.4 acres of land. The parcel is currently owned by Lewis and Clark County and is under a utility easement for RCWD. Prior to construction, RCWD will need to obtain necessary permissions to construct on Lewis and Clark County land.

Potential Construction Problems

Electrical routing paths and methods within the proposed PV array area and from the proposed PV array area to the water pump house may be impacted by the pre-existing underground water line routing and pump locations and any other existing infrastructure. Prior to construction of the solar array, a 3rd party utility survey may be necessary to ensure that electrical and water utility services are not impacted by array or fencing construction.

Sustainability Considerations

This is a renewable energy project without net metering availability from the utility and is considered to be 'green' infrastructure. The system is intended to offset present electrical energy usage on site of the proposed facility and any excess energy is not credited to the facility owner, instead going to the grid free of charge. Efficiency measures have already been taken to upgrade the water pumping infrastructure prior to the consideration of a photovoltaic energy production system. Current preliminary designs address on site energy consumption with these measures already in place.

6.0 SELECTED ALTERNATIVE DESIGN

The alternatives described above are stand-alone, and do not require a detailed comparative analysis. Feedback received from RCWD representatives during the design process indicates that they have determined that the fixed-tilt system (Alternative 2) and single 50kW inverter alternative will be selected as the conceptual solar plant design.

Compared to Alternative 1, which uses a single-axis tracker, Alternative 2 offers equal power output and identical electrical specs (66.08 kW DC capacity, 50 kVA AC capacity, and a DC/AC ratio of 1.32), but with a fixed-tilt racking system. Fixed-tilt systems are mechanically simpler, require less maintenance and are more reliable in harsh or variable weather conditions. Though the tracking system in Alternative 1 may marginally improve energy yield, it introduces mechanical complexity and long-term maintenance costs. Alternative 3 provides a higher capacity (86.4 kW DC and 94.5 kWh battery storage) while requiring higher installation and equipment costs, increased system complexity and greater operational needs as the solar array system ages.

Additional non-monetary factors were considered by RCWD during the design process. These included efforts to minimize the system's permanent footprint in order to reduce potential impacts on natural resources, as well as the assessment of potential noise and visual disturbances associated with the tracker system proposed in Alternative 1.

Alternative 2 offers the lowest construction costs, a compact footprint, and meets the majority of energy demand. Alternative 2 provides optimal energy performance with reduced maintenance and construction costs, making it the most practical and efficient design option for RCWD.

6.1 LIFE CYCLE COST ANALYSIS

Life Cycle Cost Analysis (LCCA) is a method used to evaluate the costs associated with the solar array system over its life span, which is assumed to be 25 years, and includes construction costs and operational and maintenance costs. The initial construction cost of the selected alternative has been estimated at $160,092 using the CREST tool. This total includes $30,000 in RRPG funding already expended for the preparation of this PER, and a remaining balance of $130,092 representing anticipated implementation costs.

The selected design for a 50 kW AC and 66.08 kW DC photovoltaic system is categorized as a small commercial solar installation, utilizing the SMA Sunny Tripower CORE1 50-US inverter. The estimated market price for this ground-mounted system is $1.94 per watt DC, based on Q1 2022 U.S. PV cost benchmarks. As project funding will come from a grant, the interest and discount rates are set to zero. Energy production and capacity factor calculations were conducted using PVsyst modeling software, included in **Appendix D**. The fixed Operations and Maintenance (O&M) expense for the first year is projected at $17.21 per kW-yr DC, reflecting a 2.5% inflation rate based on Q1 2022 U.S. PV cost benchmarks. Additionally, inverter replacement costs are estimated at $0.150 per watt DC, based on the average price of the SMA Sunny Tripower CORE1 inverter, which is approximately $7,500.

When accounting for installation, maintenance, equipment replacement, Alternative 2 is the most cost-effective and reliable option for RCWD.

7.0 PROPOSED PROJECT

7.1 PRELIMINARY PROJECT DESIGN

Alternative 2 represents a fixed-tilt solar photovoltaic (PV) system optimized for energy performance, simplicity, and long-term operational efficiency. This system is particularly well-suited for RCWD, where durability, low maintenance, and consistent energy delivery are critical.

The array consists of 112 Hanwa Q-Cells Q.PEAK DUO XL-G11S.3/BFG 590W modules. The combination of efficiency, power output, technology, durability, and the manufacturer's reputation make the Hanwha Q-Cells Q.PEAK DUO XL-G11S.3/BFG 590W modules a strong choice for solar energy solutions. The system is designed with a DC capacity of 66.08 kW under STC, which increases to 72.28 kW under BSTC. This enhanced capacity reflects the theoretical maximum power output under ideal environmental conditions. The PV array is situated approximately 200 feet northwest of the main facility within the easement boundaries provided to Tetra Tech.

The PV array feeds into a single SMA Sunny Tripower CORE1 50-US inverter, located within the array boundary, which has an AC output capacity of 50 kVA. The inverter was placed in this location to minimize electrical losses

and provide ease in commissioning and O&M procedures. The Selected Alternative design presented in **Appendix D** is preliminary and will need additional refinement before its implementation.

7.2 PROJECT SCHEDULE

Tetra Tech recommends that RCWD utilize this PER to apply for funding to provide the capital needed to install the solar array and associated construction costs. The E+ Renewable Incentives provide a limited amount of Universal System Benefits (USB) for renewable energy installations on non-profit or government/public buildings. Proposals are considered twice a year with Spring proposals due on May 1 and Fall proposals due on November 1.

Following the acquisition of funding for the construction costs and solar array installation, a final design of the selected alternative will need to be completed. Additionally, RCWD will need to contact Lewis and Clark County representatives for required permits and permissions for the installation of the solar array on county land. RCWD will also need to apply for interconnection permitting with NWE, discussed in section 7.3 Permit Requirements.

Due to the minimal potential of grading, tree removal and small footprint of the solar arrays, construction is estimated to take less than one month. This estimate was applied within the CREST model. Additional construction, including the fencing and potential need for revegetation of surrounding impacted areas may include additional needed time.

7.3 PERMIT REQUIREMENTS

Tetra Tech personnel contacted Lewis and Clark County representative, Chrystal Ness, regarding permits needed for construction on county property. The associated designs do not interfere with current utilities and the construction of the solar array will produce minimal impacts. Due to the permanence of these solar panels, and the potential sources of funding received, additional environmental review may be required, including a Categorical Exclusion (CE), Environmental Assessment (EA), or Environmental Impact Statement (EIS).

Additional electrical permitting through Northwestern Energy will be required. Projects that receive funding through the E+ Renewable Energy Incentive must be installed by a NorthWestern Energy Qualified Installer. RCWD will need to perform a Level 1 Small Generator Facility Interconnect Request for interconnecting an electric small generator facility with aggregate nameplate capacity of up to 50kW AC using certified interconnection equipment. An example of this form is provided in **Appendix E.**

7.4 SUSTAINABILITY CONSIDERATIONS

The installation of a solar array by RCWD to power potable water distribution to Ranchview estates will offset energy usage that was previously provided by NorthWestern Energy. Reliable and affordable clean energy will benefit the Ranchview Estates community by offsetting energy costs, while providing a demonstrated example of the implementation of solar arrays for small community water systems.

RCWD is an early adopter within the Helena Valley of solar array systems; demonstrating success within this community may encourage other systems within the region to consider sustainable options for energy production.

The board of directors of the RCWD are aware there are approximately 60 other county water districts registered with the Montana Secretary of State. Upon successful implementation of a solar powered water delivery system within RCWD, the board intends to reach out to all other county water districts to provide detailed background information about the planning and implementation within the RCWD and encourage further consideration by other water districts to develop alternative options for power production.

7.5 TOTAL PROJECT COST ESTIMATE

The total project cost estimate for the selected alternative is based on the preliminary design and is subject to alteration during the finalization of design and implementation of the project during construction. Total project cost estimate is represented in Table 5-1, and was derived from estimates input in the CREST model. The total project cost estimate for the selected alternative is $160,092, which includes the construction and material costs, the design cost, and the RRPG award. This total includes $30,000 in RRPG funding already expended for the preparation of this PER, and a remaining balance of $130,092 representing anticipated implementation costs.

7.6 ANNUAL OPERATING BUDGET

RCWD does not currently have outstanding debt. There is no anticipated debt associated with the construction of the selected alternative or the operating costs, as the implementation of these alternatives will rely on the successful acquisition of funding from grant sources.

The annual operating budget is subject to change based on the yearly required maintenance of the solar panels, fencing and other material costs as the system ages. The annual operating expense is estimated at $1,137.58 per year based on a unit rate of $17.21 per kW-DC for a system size of 66.1 kW/DC.

8.0 CONCLUSION AND RECOMMENDATIONS

The Selected Alternative offers a strategic balance of performance, cost, and simplicity, making it the most suitable option for RCWD. Its high-performance ratio and reduced maintenance burden make it a strong long-term investment with the potential for rapid payback and substantial operational savings. Unlike more complex systems involving trackers or energy storage, this fixed-tilt system ensures mechanical simplicity and resilience, ease of maintenance, and predictable output, which are priorities for infrastructure systems with limited operational resources.

Tetra Tech recommends that the RCWD continues to pursue grant-based funding options to supply funds for the implementation of the solar array. Tetra Tech encourages RCWD to apply for the Renewable Resource Grant and Loan Program administered by the Resource Development Bureau of the DNRC. This program limits grant funding to a maximum of $125,000 and Project Planning Grants are limited to $15,000. Another funding option

is the NorthWestern Energy E+ Renewable Incentives program for renewable energy installations on non-profit or government/public buildings. Applications for this Universal System Benefits (USB) program are acceptable bi-annually and include the need for a cover letter and a written proposal. The project qualifications and proposal requirements are located in **Appendix F**.

Based on the sources of the funding received, additional environmental review may be required, including a CE, EA or an EIS. These permits are not exhaustive, and Tetra Tech personnel recommends RCWD contact a Lewis and Clark County representative regarding potential permitting needs for the selected alternative's construction.

Additionally, due to the current land use of the parcel of the selected alternative, the RCWD will need to apply for the proper permits regarding conducting construction within their easement. Additional permits from NWE for electric work, operations, and maintenance will be necessary.

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APPENDIX A: FIGURES

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map
OnDemand Topo

7.5-MINUTE TOPO QUADRANGLE
Custom Extent
7.5-MINUTE TOPO

Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid:Universal Transverse Mercator, Zone 12T

Data is provided by The National Map (TNM), is the best available at the time of map generation, and includes data content from supporting themes of Elevation, Hydrography, Geographic Names, Boundaries, Transportation, Structures, Land Cover, and Orthoimagery. Refer to associated Federal Geographic Data Committee (FGDC) Metadata for additional source data information.

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands. Temporal changes may have occurred since these data were collected and some data may no longer represent actual surface conditions.

Learn About The National Map: https://nationalmap.gov

UTM GRID AND 2021 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000 - m Square ID
VS
Grid Zone Designation 12T

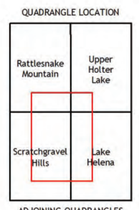
SCALE 1:24 000

1 0.5 0 KILOMETERS 1 2
1000 500 0 METERS 1000 2000
1 0.5 0 1
MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000
FEET

CONTOUR INTERVAL 40 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988
CONTOUR SMOOTHNESS = Medium

USER DEFINED CONTENT

QUADRANGLE LOCATION



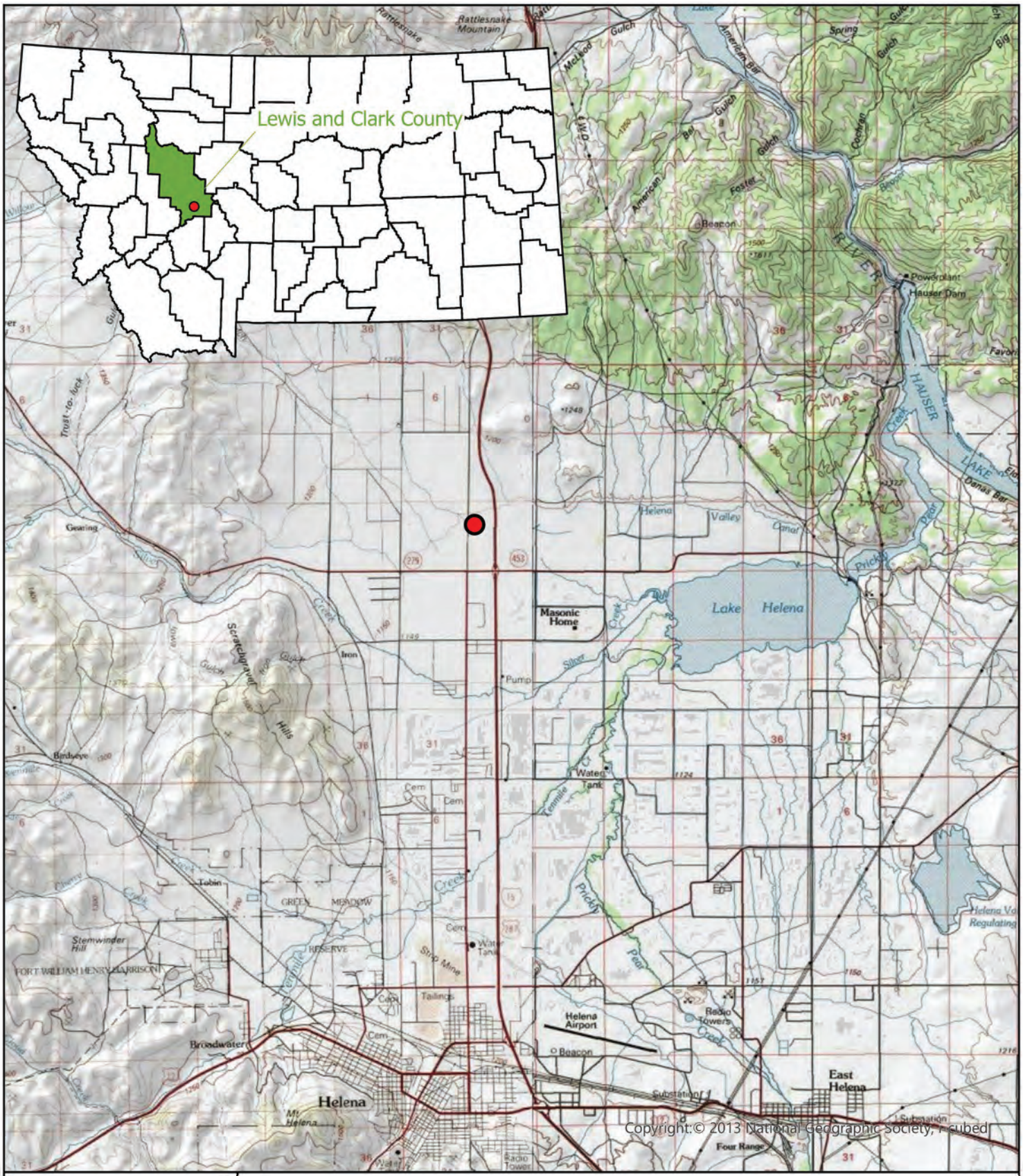
ADJOINING QUADRANGLES

ROAD CLASSIFICATION

Expressway	Local Connector
Secondary Hwy	Local Road
Ramp	4WD

Interstate Route · US Route · State Route

7.5-MINUTE TOPO, MT
2025



Project No.: 117-750919-24001
10/01/2024

TETRA TECH

Location Map

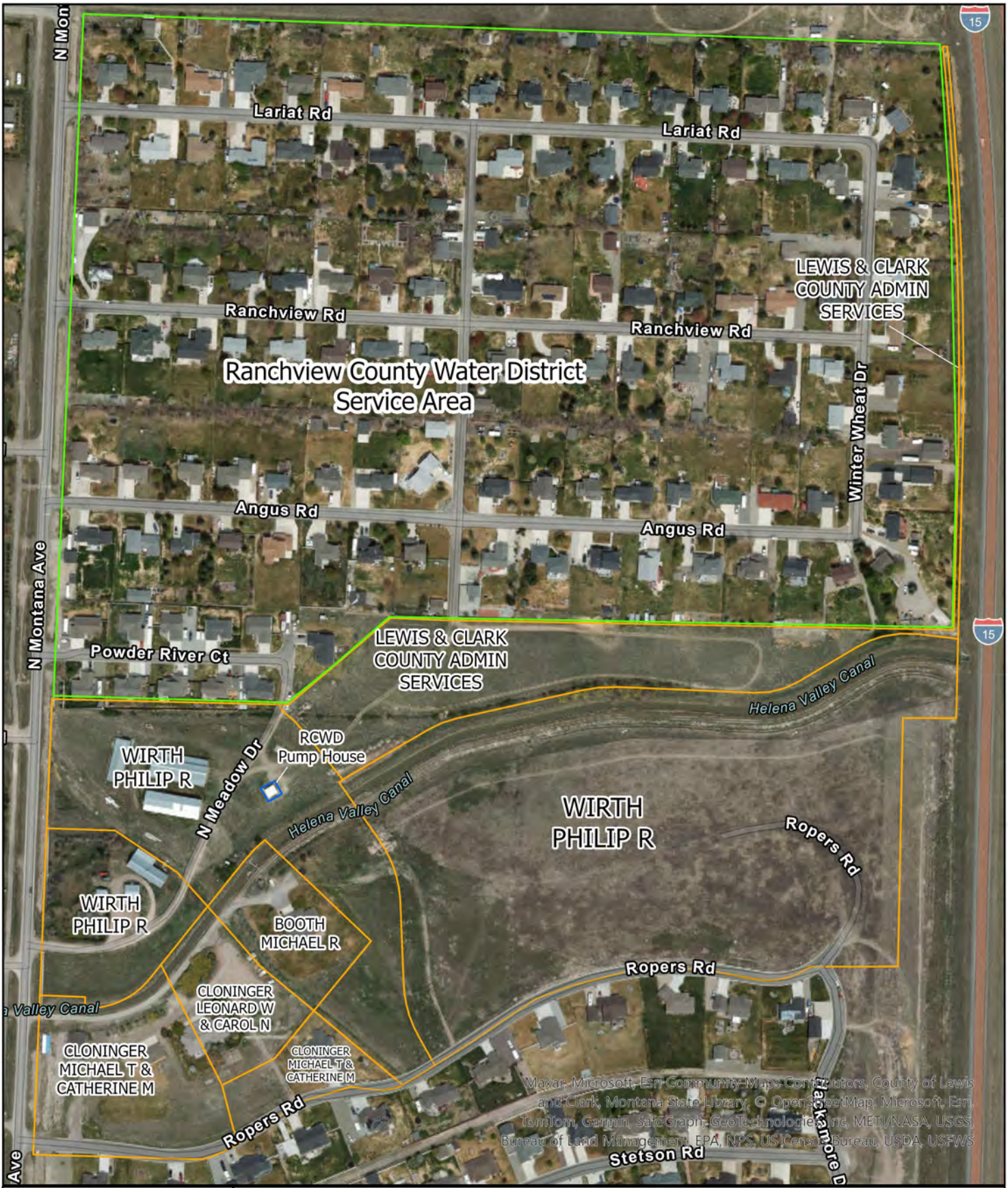
RANCHVIEW COUNTY WATER DISTRICT
LEWIS AND CLARK COUNTY, MONTANA

Ranchview County Water District

0 1.25 2.5 5 Miles

N

Path: O:\N-S\Ranchview County Water District\117-750919-24001 - RCWD Solar PER\08-GIS\RCWD MAPS.aprx



Project No.: 117-750919-24001
10/02/2024

TETRA TECH

Property Ownership

RANCHVIEW COUNTY WATER DISTRICT
LEWIS AND CLARK COUNTY, MONTANA

RCWD Adjacent Property Ownership Parcels
Ranchview County Water District Service Area

0 0.03 0.05 0.1 Miles

N

Path: O:\N-S\Ranchview County Water District\117-750919-24001 - RCWD Solar PER\08-GIS\RCWD MAPS.aprx

LARIAT ROAD

RANCHVIEW ROAD

ANGUS ROAD

MONTANA AVE

I-15

DISTRICT BOUNDARY (TYP.)

EXISTING 6" IRRIGATION LINE (TO SUBDIVISION)

POTABLE WELL #2

IRRIGATION WELL

EXISTING PUMP HOUSE

POTABLE WELL #1

BACKUP IRRIGATION WELL

NOTES:

1. ALL POTABLE WATER PIPING WITHIN SUBDIVISION IS 2" PVC. ALL IRRIGATION PIPING WITHIN SUBDIVISION IS 3" PVC
2. ALL WATER PIPING IS WITHIN A 30 FT WATER EASEMENT

LEGEND

- W — POTABLE WATER
- NPW — IRRIGATION SYSTEM
- POTABLE WELLS
- IRRIGATION WELLS

NORTH

0 125 250

SCALE IN FEET

GreatWest engineering®

Figure 3-1
Existing Water System

RANCHVIEW ESTATES WATER PER

F:\1-19148-Ranchview Estates Water District\CADD 1-19148\Exhibits\1-19148-Existing Water Lines.dwg

APPENDIX B: ENVIRONMENTAL CHECKLIST

Environmental Checklist

Environmental Checklist Prepared by: On: 4-29-2025

Name of Person 1 Beau Downing	Organization Tetra Tech, Inc.
Phone Number 406-437-9865	Email Beau.Downing@tetratech.com
Name of Person 2 Madison Moran	Organization Tetra Tech, Inc.
Phone Number 406-410-4964	Email Madison.Moran@tetratech.com

List additional people above. Include organization, phone number and email for all.

As the environmental specialist for the Engineer that prepared the preliminary engineering report I, Beau Downing, PH, PMP, have reviewed the information presented in this checklist and believe that it accurately identifies the environmental resources in the area and the potential impacts that the project could have on those resources. In addition, the required state and federal agencies were provided with the required information about the project and requested to provide comments on the proposed public facility project. Their comments have been incorporated into and attached to the Preliminary Engineering Report.

Engineer's Signature: 

Date: **4-29-2025**

Physical Environment			
Impact Code	**Impact Type**	**Permits/ Mitigation Required?**	**Explanation of Impact to Resource**
1. Soil Suitability, Topographic and/or Geologic Constraints (example: soil slump, steep slopes, subsidence, seismic activity)			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: Musselshell-Crago complex 2 to 8 percent slope, and Thess-Scravo complex 0 to 8 percent slope. Farmland of Local importance, but out of production. Land is designated as a county park with not infrastructure. There are no geologic constraints. Preferred Alternative Environmental Narrative: The preferred alternative will require minimal trenching to bury electrical lines that connect the solar panel array to the inverter and meter. The conceptual designs were created to minimize potential need for grading. USDA Natural Resource Conservation Service database.

2. Hazardous Facilities (example: power lines, hazardous waste sites, acceptable distance from explosive and flammable hazards including chemical/petrochemical storage tanks, underground fuel storage tanks, and related facilities such as natural gas storage facilities and propane storage tanks)			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The pumphouse stores utilities that supply water to the surrounding community. There is no historical storage of hazardous materials there. There are no Preferred Alternative Environmental Narrative: The preferred alternative will not interfere with hazardous facilities. The Montana DEQ Leaking Underground Tank Database, PFAS sites, Solid Waste Facilities, Tank Substances Releases, Potential Contaminant Source Review Areas are available at Untitled map.
3. Surrounding Air Quality (example: dust, odors, emissions)			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: There are no current impacts to air quality. Preferred Alternative Environmental Narrative: Adverse minimal impacts to air quality due to dust may occur during construction. Any impacts would be temporary, and reasonable efforts would be taken during construction to minimize impacts to air quality.
4. Groundwater Resources and Aquifers (example: quantity, quality, distribution, depth to groundwater, sole source aquifers)			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The groundwater depth and static water level averages 38- 60 feet below ground surface. The wells that supply the RCWD were drilled in 1993, and supply water to Ranchview Estates. Preferred Alternative Environmental Narrative: The preferred alternative will not directly impact the quantity or quality groundwater resources. It will indirectly impact the distribution of groundwater resources to Ranchview Estates residents by reducing costs, improving efficiency and providing access to a renewable energy resource. Montana Groundwater Information Center (GWIC)
5. Surface Water/Water Quality, Quantity and Distribution (example: streams, lakes, storm runoff, irrigation systems, canals)			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: There are no surface water resources present. The Helena Valley Canal is the nearest surface water Preferred Alternative Environmental Narrative: The preferred alternative will not impact surface water or water quality.

6. Floodplains and Floodplain Management (Identify any floodplains within one mile of the boundary of the project.)			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: There are no FEMA mapped floodplains identified within one mile of the boundary of the project. Preferred Alternative Environmental Narrative: There are no FEMA mapped floodplains identified within one mile of the boundary of the project. Fema Flood Map Service Center
7. Wetlands (Identify any wetlands within one mile of the boundary of the project and state potential impacts.)			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: No wetlands occur within the project boundary. Preferred Alternative Environmental Narrative: The preferred alternative does not impact wetland or riparian areas. USFWS National Wetlands Inventory
8. Agricultural Lands, Production, and Farmland Protection (example: grazing, forestry, cropland, prime or unique agricultural lands) Identify any prime or important farm ground or forest lands within one mile of the boundary of the project.			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The current owner of the land is Lewis and Clark County. The RCWD has an easement to operate and distribute water to Ranchview Estates. The land is classified as farmland of local importance, but the area is out of production and designated as undeveloped parkland. There are areas within one mile of the project that are classified as farmland of statewide or local importance or prime farmland. Preferred Alternative Environmental Narrative: The preferred alternative would permanently impact 0.5 acres of undeveloped, unused by Lewis and Clark County land that is classified as farmland of local importance. The construction of solar panels on this area will minimally impact the surrounding land and will provide a renewable energy source.
9. Vegetation and Wildlife Species and Habitats, Including Fish (example: terrestrial, avian and aquatic life and habitats)			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project boundary is not within sage grouse habitat. The current land resources within the project footprint of the preferred alternative is undeveloped grasses. Canadian Lynx, Grizzly Bears, Rufa Red Knot, Monarch Butterfly, Suckley's Cuckoo Bumble Bee, Bald and Golden Eagles are species that are listed as threatened or potentially threatened within the project region. Due to the residential surroundings and undeveloped but previously disturbed grasslands, this area is not likely to provide habitat for these species. Preferred Alternative Environmental Narrative: The preferred alternative has a small footprint of approximately 0.5 acres and impacts a plot of grassland owned by Lewis and

			Clark County with a utility easement for RCWD. The area that will potentially house the solar array will be permanently impacted (approximately 0.5 acres of undeveloped previously disturbed grasses) but the surrounding areas will likely not receive permanent adverse impacts. Montana Natural Heritage Program Montana Sage Grouse Habitat Conservation Program USFWS Resources – Listed in reference section of PER
10. Unique, Endangered, Fragile, or Limited Environmental Resources, Including Endangered Species (example: plants, fish or wildlife)			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands. Preferred Alternative Environmental Narrative: The preferred alternative is unlikely to impact unique, endangered, fragile, or limited environmental resources. Montana Natural Heritage Program Montana Sage Grouse Habitat Conservation Program USFWS Resources – Listed in reference section of PER
11. Unique Natural Features (example: geologic features)			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: There are no unique natural features that were present at the site during the site walks. Preferred Alternative Environmental Narrative: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands.
12. Access to, and Quality of, Recreational and Wilderness Activities, Public Lands and Waterways (including Federally Designated Wild & Scenic Rivers), and Public Open Space			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location is located within Lewis and Clark County and the RCWD has a utility easement. Preferred Alternative Environmental Narrative: The preferred alternative will require a portion (approximately less than 1 acre) of the Lewis and Clark County easement to be fenced off from the public for safety and security purposes. All other access will remain as it is currently. Interpretive signs and educational requirements of potential grant funding sources would provide a public educational benefit for park users.

Human Environment			
Impact Code	**Impact Type**	**Resource**	
1. Visual Quality – Coherence, Diversity, Compatibility of Use and Scale, Aesthetics			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands. Preferred Alternative Environmental Narrative: The solar panels and fencing will create a slight visual obstruction within the open space. Fence type and solar array siting will mitigate the adverse effects by limiting the size of the solar array and choosing fencing that blends with natural surroundings.
2. Nuisances (example: glare, fumes)			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands. Preferred Alternative Environmental Narrative: The preferred alternative may cause temporary and minimal impacts associated with construction such as increased construction traffic, dust, and exhaust fumes from construction equipment.
3. Noise – Suitable Separation Between Housing and Other Noise Sensitive Activities and Major Noise Sources (example: aircraft, highways and railroads.)			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands. Preferred Alternative Environmental Narrative: There may be temporary increases in noise activity during construction. There may be low vibrational humming associated with the mechanical aspects of the solar panels.
4. Historic Properties, Cultural, and Archaeological Resources			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands. Preferred Alternative Environmental Narrative: There is not a federally required cultural resources assessment needed for this property, but those requirements may change depending on the funding sources utilized to fund the preferred alternative. The Montana Cultural Resources Database Map Layers were reviewed for Historical Sites Present and Inventoried Sites Present, which were not present on this site. Montana Cultural Resources Database- State Historic Preservation Office

			Samantha McGowen, Montana SHPO Review and Compliance Team (contacted by Tetra Tech personnel via phone call on 4-29-2025).
5. Changes in Demographic (Population) Characteristics (example: quantity, distribution, density)			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands. Preferred Alternative Environmental Narrative: The preferred alternative is unlikely to impact the demographics within Ranchview Estates.
6. General Housing Conditions – Quality, Quantity, Affordability			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands. Preferred Alternative Environmental Narrative: The preferred alternative is unlikely to impact the general housing conditions within Ranchview Estates.
7. Businesses or Residents (example: loss of, displacement, or relocation)			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands. Preferred Alternative Environmental Narrative: The preferred alternative is unlikely to cause impact including loss of, displacement or relocation of residents.
8. Public Health and Safety			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands. Preferred Alternative Environmental Narrative: The preferred alternative will introduce temporary construction health and safety concerns. Worker hazards can be mitigated through safe work practices applicable to the nature of the work. The solar paneled area will be fenced and inaccessible from public access, which is unlikely to cause impact to public health and safety.
9. Local Employment – Quantity or Distribution of Employment, Economic Impact			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands Preferred Alternative Environmental Narrative: The preferred alternative is unlikely to impact the quantity or distribution of employment or economic impact.
10. Income Patterns – Economic Impact			

☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands Preferred Alternative Environmental Narrative: The preferred alternative is unlikely to impact the income patterns of the Ranchview Estates community.
11. Local and State Tax Base and Revenues			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands Preferred Alternative Environmental Narrative: The preferred alternative is unlikely to impact local and state based taxes and revenues.
12. Community and Government Services and Facilities (example: educational facilities; health and medical services and facilities; police; emergency medical services; and parks, playgrounds and open space)			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands Preferred Alternative Environmental Narrative: The preferred alternative is unlikely to impact community and government services and facilities.
13. Commercial and Industrial Facilities – Production and Activity, Growth or Decline			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands Preferred Alternative Environmental Narrative: The preferred alternative is unlikely to impact commercial and industrial facilities. There are not industrial facilities present on the project site.
14. Social Structures and Mores (example: standards of social conduct/social conventions)			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands Preferred Alternative Environmental Narrative: The preferred alternative is unlikely to impact social structures and mores.
15. Land Use Compatibility (example: growth, land use change, development activity, adjacent land uses and potential conflicts)			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands Preferred Alternative Environmental Narrative:

			The preferred alternative will be permanently changing from undeveloped, unutilized grasslands to solar panels. The land will remain developed.
16. Energy Resources – Consumption and Conservation			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands Preferred Alternative Environmental Narrative: The preferred alternative will create the addition of solar panels which will beneficially contribute towards reducing RCWD's energy impact.
17. Solid Waste Management			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands Preferred Alternative Environmental Narrative: The preferred alternative is unlikely to impact solid waste management.
18. Wastewater Treatment – Sewage System			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands Preferred Alternative Environmental Narrative: The preferred alternative is unlikely to impact the wastewater treatment and sewage systems.
19. Storm Water – Surface Drainage			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands Preferred Alternative Environmental Narrative: The preferred alternative is unlikely to impact the quantity or distribution of employment or economic impact.
20. Community Water Supply			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands Preferred Alternative Environmental Narrative: The preferred alternative will directly benefit the RCWD by providing access to solar energy to offset energy consumption of the water delivery system.
21. Fire Protection – Hazards			

☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands Preferred Alternative Environmental Narrative: The preferred alternative is unlikely to impact fire protection.
22. Cultural Facilities, Cultural Uniqueness and Diversity			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands Preferred Alternative Environmental Narrative: The preferred alternative is unlikely to impact cultural facilities, uniqueness and diversity.
23. Transportation Networks and Traffic Flow Conflicts (example: rail; auto including local traffic; airport runway clear zones – avoidance of incompatible land use in airport runway clear zones)			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands Preferred Alternative Environmental Narrative: The preferred alternative is unlikely to impact transportation networks.
24. Consistency with Local Ordinances, Resolutions, or Plans (example: conformance with local comprehensive plans, zoning, or capital improvement plans.)			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands Preferred Alternative Environmental Narrative: The preferred alternative is unlikely to impact local ordinances, resolutions or plans.
25. Private Property Rights (example: a regulatory action or project activity that reduces, minimizes, or eliminates the use of private property.)			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands Preferred Alternative Environmental Narrative: The preferred alternative is unlikely to impact the quantity or distribution of employment or economic impact.
26. Environmental Justice (example: does the project avoid placing lower income households in areas where environmental degradation has occurred, such as adjacent to brownfield sites?)			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands

			Preferred Alternative Environmental Narrative: The preferred alternative is unlikely to impact environmental justice.
27. Lead Based Paint and/or Asbestos (example: does the project replace asbestos-lined pipes? Do any structures qualify as containing lead-based paint?)			
☐ No Impact ☐ Beneficial ☐ Adverse	☐ Direct ☐ Indirect ☐ Cumulative	☐ Permit ☐ Mitigation ☐ NA	Current Conditions: The project location will take place within a utility easement area that is comprised of previously disturbed and undeveloped grasslands Preferred Alternative Environmental Narrative: The preferred alternative is unlikely to impact lead based paint and asbestos.

Additional Information

List all sources of information used to complete the Environmental Checklist. Sources may include studies, plans, documents, or the individuals, organizations, or agencies contacted for assistance. For individuals, groups, or agencies, please include a contact person and phone number. List any scoping documents or meetings and/or public meetings during project development.

The RCWD holds board meetings that were utilized to provide concerns and feedback regarding the solar panel project. The Board will discuss the potential environmental impacts, within the PER's selected alternative, with community members to consider their concerns during the design process. The sources of information used to prepare this environmental checklist are listed within the sections they are applicable to. Depending on the sources of funding, additional information to generate an Environmental Assessment or Environmental Impact Statement may be required.

Below is a list of electronic resources available for data gathering to aid in the development of the Environmental Checklist:

Abandoned Mines (DEQ): https://deq.mt.gov/cleanupandrec/Programs/aml
Agricultural Statistics (USDA): USDA - National Agricultural Statistics Service - Data and Statistics Air Quality

- Nonattainment Areas: Plan and Rule Development | Montana DEQ (mt.gov)
- Opening Burning Guidelines: Open Burning | Montana DEQ (mt.gov)

Army Corps of Engineers: http://www.usace.army.mil/Home.aspx

Bureau of Business and Economic Research, UM: http://www.bber.umt.edu/
Cadastral (for property ownership info): http://svc.mt.gov/msl/mtcadastral
Census Information, MT Dept. of Commerce: http://ceic.mt.gov
Conservation Districts, MT: http://macdnet.org/
Cultural Records

- Montana Historical Society: https://mhs.mt.gov/Shpo/CulturalRecords

DEQ data search tools: Montana DEQ's GIS Portal (mt.gov)

- Including Clean Water Act Info Center, Hazardous Waste Handlers, Petroleum Release Fund Claims, Unpermitted Releases, Underground Storage Tanks, Source Water Protection

EPA Enforcement and Compliance History Online http://echo.epa.gov/
Farmland Classification: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx
Fish (Also See Wildlife)

- Montana Fisheries Information System: Montana Fish, Wildlife & Parks GIS Data (arcgis.com)
- Aquatic Invasive Species: Montana FWP AIS Surveys Dashboard 2021 (arcgis.com)
- Floodplain Maps, FEMA: https://msc.fema.gov/portal

Geographic Information, Natural Resources Information System: http://nris.mt.gov/gis
Geologic Information - MBMG - Publications - Download Geologic Maps (mtech.edu)
Maps of Montana for species observations, land cover, wetland and riparian areas, land management: Montana Natural Heritage Program (mtnhp.org); http://mtnhp.org/mapviewer/?t=6
Montana Department of Transportation: https://www.mdt.mt.gov/

- Environmental Manual: http://www.mdt.mt.gov/publications/docs/manuals/env/preface.pdf
- Environmental Manual - Chapter 29, Permits Required: https://www.mdt.mt.gov/publications/docs/manuals/env/Chapter%2029%20PERMITS%20REQUIRED.pdf

Montana Board of Oil and Gas Conservation Information System:

- https://dnrc.mt.gov/BOGC/ Plants
- Plant database, USDA Natural Resources Conservation Service: http://plants.usda.gov/java
- Plant Species, MT Field Guide: http://fieldguide.mt.gov/default.aspx
- Plant Species of Concern: http://mtnhp.org/SpeciesOfConcern/Default.aspx?AorP=p
- Threatened, Endangered and Rare Plants, USDA: https://plants.usda.gov/home/raritySearch

Soils

- USDA Natural Resource Conservation Service database: https://websoilsurvey.nrcs.usda.gov/app/
- Montana soil and water conservation districts: http://swcdmi.org/

State Historic Preservation Office: http://mhs.mt.gov/Shpo
Tourism, UM – Institute of Tourism & Recreation Research: http://www.itrr.umt.edu
Tribal Resources:

- Blackfeet Tribal Environmental Permits: http://www.blackfeetenvironmental.com
- CSKT Natural Resources Department: http://nrd.csktribes.org/
- Montana Office of Indian Affairs: http://tribalnations.mt.gov/

- Tribal Historic Preservation Officer List: Search - NATHPO
- Tribal Directory Assessment Tool (TDAT): https://egis.hud.gov/tdat/

Vehicle Traffic Count (MDT): http://www.mdt.mt.gov/publications/datastats/traffic.shtml

Water

- Stream Record Extension Facilitator, USGS: USGS | National Water Dashboard
- Streamstats basin characteristics, USGS: http://water.usgs.gov/osw/streamstats/
- Water Resources Division, DNRC: https://dnrc.mt.gov/Water-Resources/ ArcGIS Web Application (mt.gov)
- Water Rights Bureau, DNRC: https://dnrc.mt.gov/Water-Resources/Water-Rights/
- Water Right Query System, DNRC: DNRC Water Right Query System (mt.gov)
- Wetlands database, USFWS: http://www.fws.gov/wetlands/Data/mapper.html
- Wild and Scenic Rivers: http://www.rivers.gov/montana.php

Wildlife

- Animal Species, MT Field Guide: http://fieldguide.mt.gov/default.aspx
- Animal Species of Concern: http://mtnhp.org/SpeciesOfConcern/Default.aspx?AorP=a
- Aquatic Invasive Species: Montana FWP AIS Surveys Dashboard 2021 (arcgis.com)
- Critical Habitat Mapper, USFWS: http://ecos.fws.gov/crithab/
- Crucial Areas Planning System/Habitat Assessment Tool: Habitat MT (HB 526) Funded Lands (arcgis.com)
- FWP Contact Map: http://fwp.mt.gov/gis/maps/contactUs/ (includes biologist responsibility areas)
- Maps and GIS Data, FWP: Montana Fish, Wildlife & Parks GIS Data (arcgis.com)
- Sage grouse management, FWP: Montana Fish, Wildlife & Parks GIS Data : Sage-grouse Habitat/Current Distribution (Montana) : Sage-grouse Habitat/Current Distribution (Montana) (arcgis.com)
- Sage grouse habitat conservation program, DNRC: http://sagegrouse.mt.gov/
- Sage grouse habitat map: https://sagegrouse.mt.gov/ProgramMap

APPENDIX C: SITE PHOTOGRAPHS

RANCHVIEW COUNTY WATER DISTRICT
LEWIS AND CLARK COUNTY, MONTANA
TETRA TECH PROJECT NO. 117-750919-24001

PHOTOGRAPH 1 View of the pumphouse and the surrounding area.

PHOTOGRAPH 2 View of the access road to the pumphouse and the surrounding area.

PHOTOGRAPH 3 NWE meter and breaker box.

PHOTOGRAPH 4 Flowmeter.

RANCHVIEW COUNTY WATER DISTRICT
LEWIS AND CLARK COUNTY, MONTANA
TETRA TECH PROJECT NO. 117-750919-24001

PHOTOGRAPH 5 Transducer.

PHOTOGRAPH 6 Current electrical configuration for potable water.

PHOTOGRAPH 7 Current electrical configuration for irrigation supply.

APPENDIX D: DESIGN DOCUMENTS

PVsyst - Simulation report

Grid-Connected System

Project: Ranchview County Water Dist.

Variant: RCWD_SAT

Tracking system

System power: 66.1 kWp

Helena Valley Northwest - United States

Author

Gemini - Tetra Tech (United states)

Project summary

Geographical Site
Helena Valley Northwest
United States

Situation

Latitude	46.72 °N
Longitude	-112.02 °W
Altitude	1152 m
Time zone	UTC-7

Project settings
Albedo 0.20

Weather data
Helena Valley Northwest
Meteonorm 8.2 (1991-2005) - Synthetic

System summary

Grid-Connected System

Tracking system

Orientation #1

Tracking plane, horizontal N-S axis	
Axis azimuth	0 °
Phi min / max.	-/+ 55 °
Diffuse shading	all trackers
Tracking algorithm	
Astronomic calculation	

Near Shadings
According to strings : Slow (simul.)
Electrical effect 100 %

User's needs
Unlimited load (grid)

System information

PV Array		Inverters	
Nb. of modules	112 units	Nb. of units	1 unit
Pnom total	66.1 kWp	Pnom total	50.0 kWac
		Pnom ratio	1.322

Results summary

Produced Energy	112.90 MWh/year	Specific production	1709 kWh/kWp/year	Perf. Ratio PR	80.92 %

Table of contents

General parameters

Grid-Connected System

Orientation #1

Tracking plane, horizontal N-S axis	
Axis azimuth	0 °
Phi min / max.	-/+ 55 °
Diffuse shading	all trackers
Tracking algorithm	
Astronomic calculation	

Tracking system

Trackers configuration	
Nb. of trackers	7 units
Tracking plane, horizontal N-S axis	
Shading limit angles	
Phi limits	+/- 78.2 °

Sizes

Tracker Spacing	12.0 m
Collector width	2.46 m
Average GCR	20.6 %

Models used

Transposition	Perez
Diffuse	Perez, Meteonorm
Circumsolar	separate

Horizon

Free Horizon

Near Shadings

According to strings : Slow (simul.)
Electrical effect 100 %

User's needs

Unlimited load (grid)

PV Array Characteristics

PV module

Manufacturer	Hanwha Q Cells
Model	Q.Peak-Duo-XL-G11S.3 / BFG-590
(Original PVsyst database)	
Unit Nom. Power	590 Wp
Number of PV modules	112 units
Nominal (STC)	66.1 kWp
Modules	7 string x 16 In series
At operating cond. (50°C)	
Pmpp	60.4 kWp
U mpp	656 V
I mpp	92 A

Inverter

Manufacturer	SMA
Model	Sunny Tripower STP50-US-41-Core1
(Original PVsyst database)	
Unit Nom. Power	50.0 kWac
Number of inverters	1 unit
Total power	50.0 kWac
Operating voltage	150-800 V
Pnom ratio (DC:AC)	1.32
Power sharing within this inverter	

Total PV power

Nominal (STC)	66 kWp
Total	112 modules
Module area	313 m²

Total inverter power

Total power	50 kWac
Number of inverters	1 unit
Pnom ratio	1.32

Array losses

Array Soiling Losses

Loss Fraction 3.0 %

Thermal Loss factor

Module temperature according to irradiance
Uc (const) 29.0 W/m²K
Uv (wind) 0.0 W/m²K/m/s

DC wiring losses

Global array res. 118 mΩ
Loss Fraction 1.5 % at STC

Serie Diode Loss

Voltage drop 0.7 V
Loss Fraction 0.1 % at STC

LID - Light Induced Degradation

Loss Fraction 2.0 %

Module Quality Loss

Loss Fraction -0.4 %

Module mismatch losses

Loss Fraction 2.0 % at MPP

IAM loss factor

Incidence effect (IAM): Fresnel, AR coating, n(glass)=1.526, n(AR)=1.290

0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	0.999	0.987	0.963	0.892	0.814	0.679	0.438	0.000

System losses

Unavailability of the system		Auxiliaries loss	
Time fraction	2.0 %	Night aux. cons.	200 W
	7.3 days,		
	3 periods		

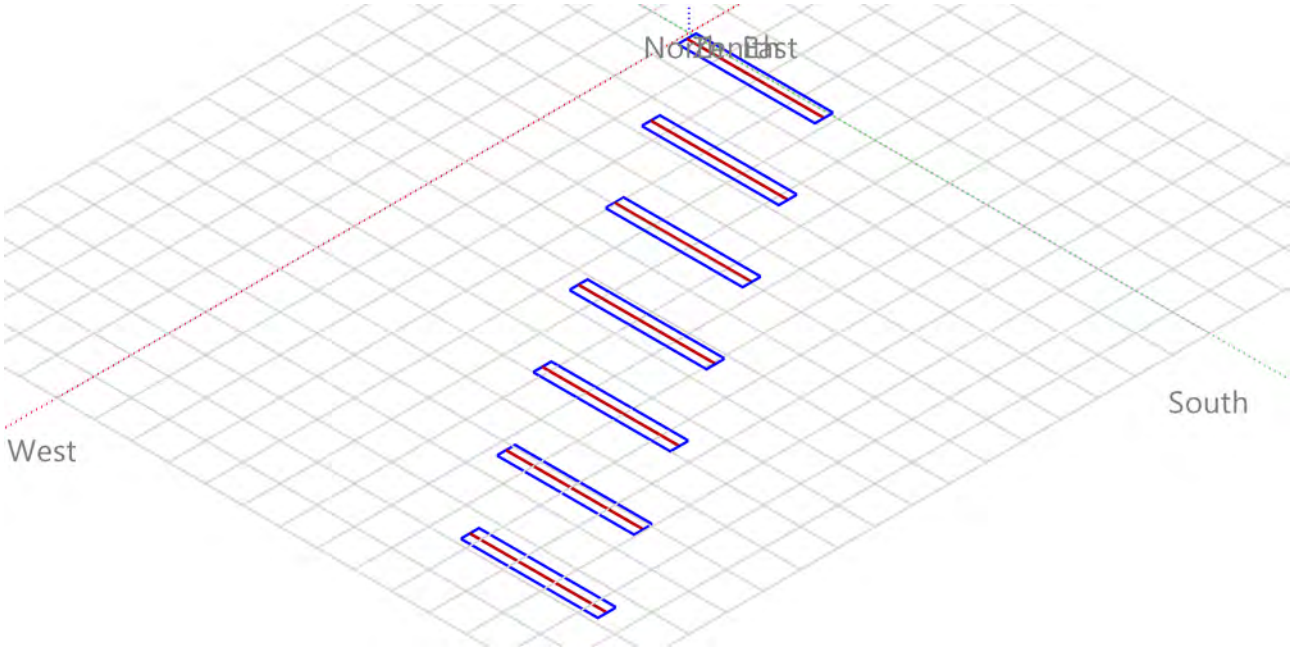
AC wiring losses

Inv. output line up to injection point

Inverter voltage	480 Vac tri
Loss Fraction	0.00 % at STC
Inverter: Sunny Tripower STP50-US-41-Core1	
Wire section (1 Inv.)	Copper 1 x 3 x 25 mm²
Wires length	0 m

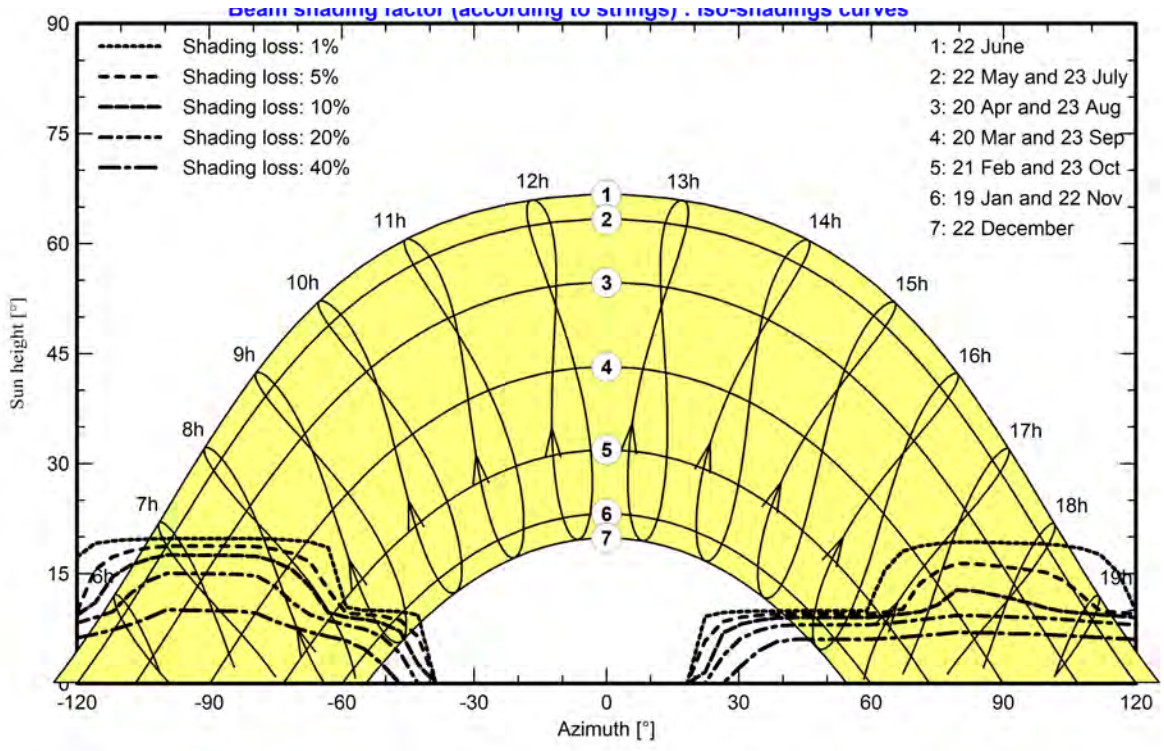
Near shadings parameter

Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Orientation #1 -



Main results

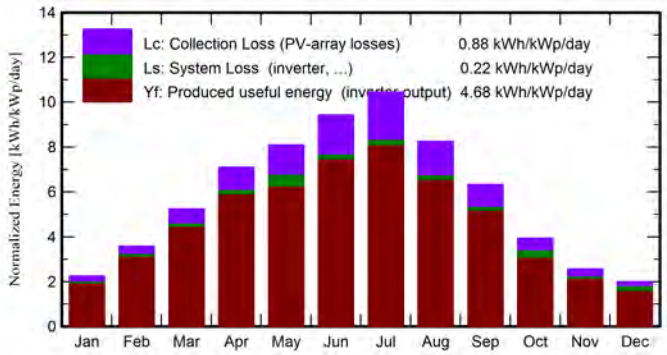
System Production

Produced Energy	112.90 MWh/year	Specific production	1709 kWh/kWp/year
		Perf. Ratio PR	80.92 %

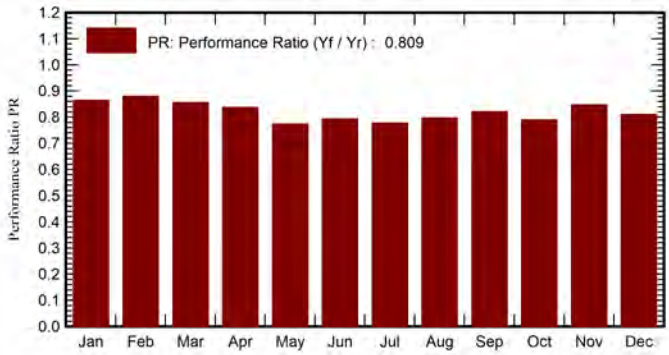
Economic evaluation

Investment		Yearly cost		LCOE	
Global	587,340.00 USD	Annuities	0.00 USD/yr	Energy cost	0.02 USD/kWh
Specific	8.89 USD/Wp	Run. costs	2,550.00 USD/yr		
		Payback period	Unprofitable		

Normalized productions (per installed kWp)



Performance Ratio PR



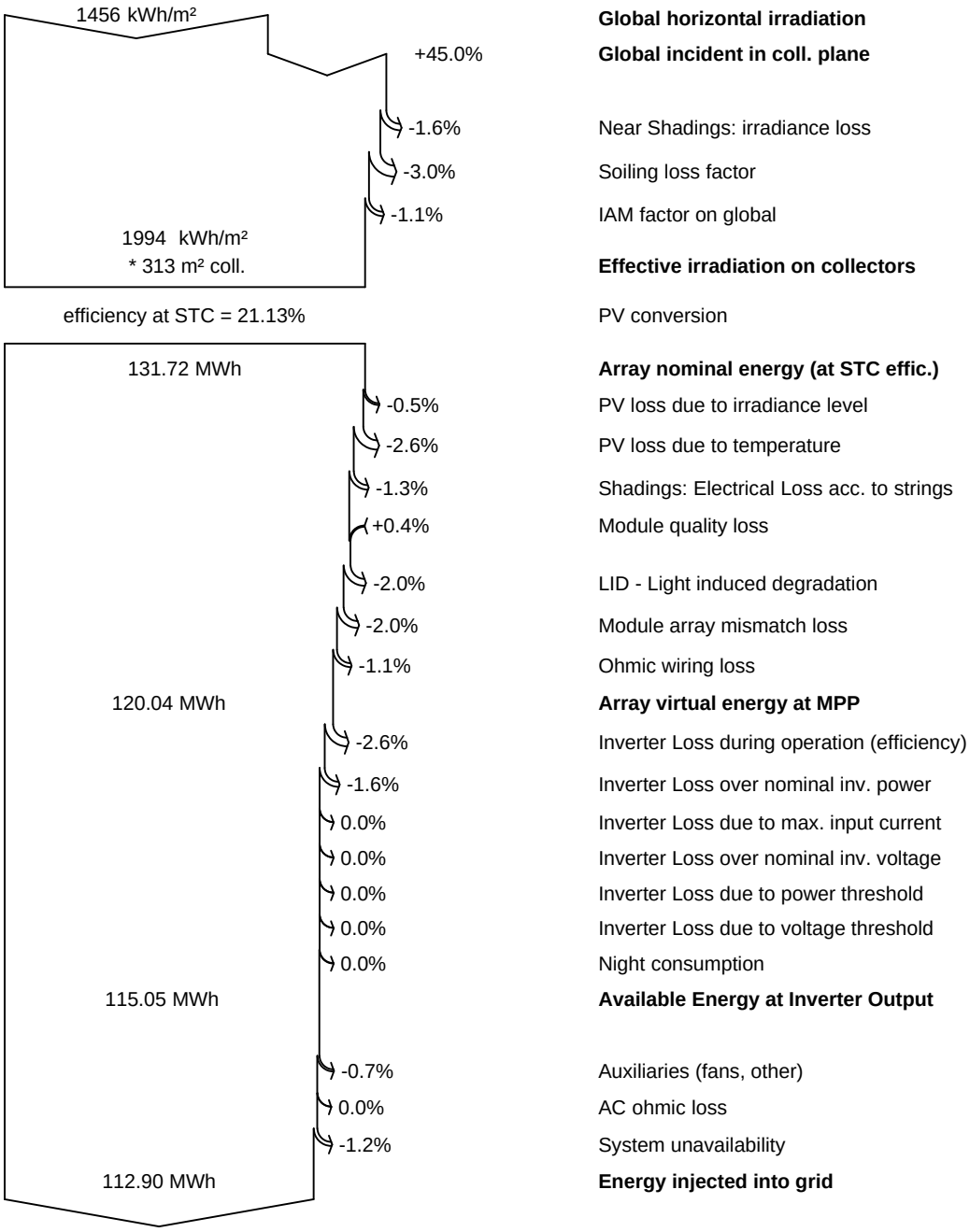
Balances and main results

	GlobHor kWh/m²	DiffHor kWh/m²	T_Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray MWh	E_Grid MWh	PR ratio
January	45.7	19.52	-4.60	70.1	64.2	4.19	4.00	0.864
February	66.3	25.80	-3.55	100.4	94.1	6.06	5.84	0.880
March	110.5	44.43	1.98	162.7	153.4	9.50	9.19	0.855
April	148.2	59.26	6.69	212.8	201.5	12.15	11.77	0.837
May	181.3	71.69	11.99	251.2	238.5	13.95	12.85	0.774
June	201.5	74.26	16.75	283.0	268.2	15.29	14.83	0.793
July	221.4	59.49	23.16	324.0	307.6	17.15	16.63	0.777
August	178.9	64.99	21.04	256.0	243.3	13.91	13.48	0.797
September	128.6	44.07	14.82	190.0	179.9	10.67	10.32	0.822
October	82.3	36.14	7.35	122.0	114.7	7.04	6.37	0.790
November	50.8	21.23	0.38	77.1	71.2	4.51	4.31	0.847
December	40.3	17.99	-4.61	62.0	57.1	3.77	3.32	0.810
Year	1455.8	538.86	7.69	2111.4	1993.7	118.19	112.90	0.809

Legends

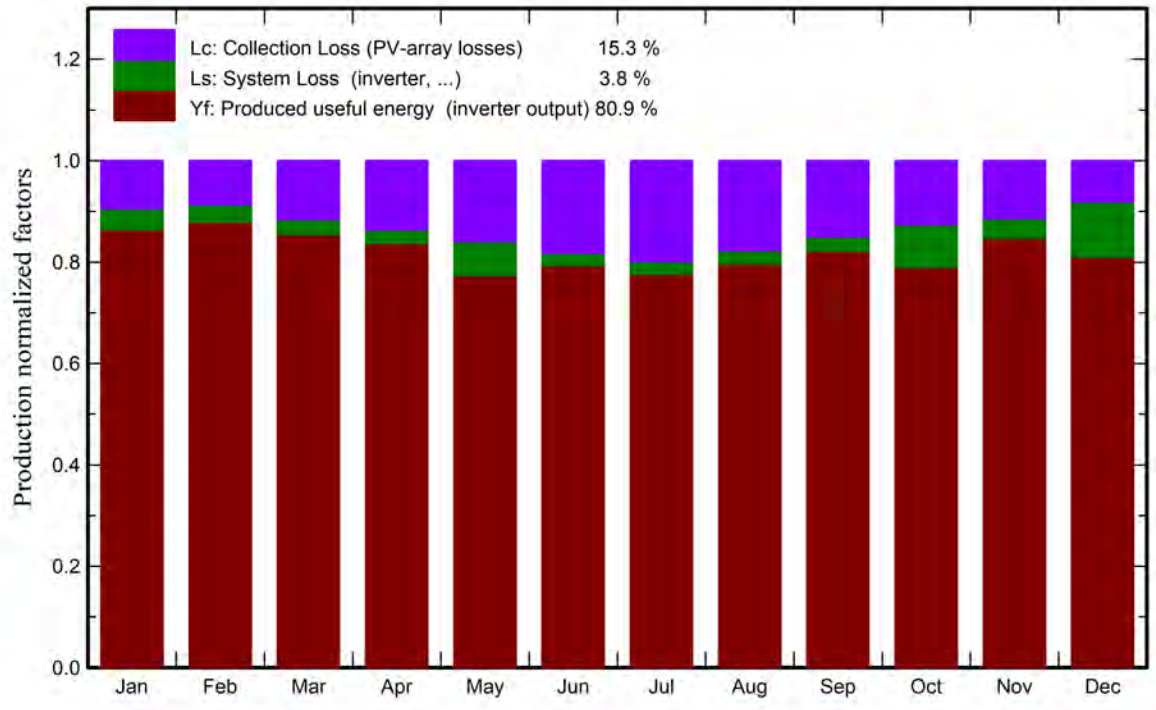
GlobHor	Global horizontal irradiation	EArray	Effective energy at the output of the array
DiffHor	Horizontal diffuse irradiation	E_Grid	Energy injected into grid
T_Amb	Ambient Temperature	PR	Performance Ratio
GlobInc	Global incident in coll. plane		
GlobEff	Effective Global, corr. for IAM and shadings		

Loss diagram

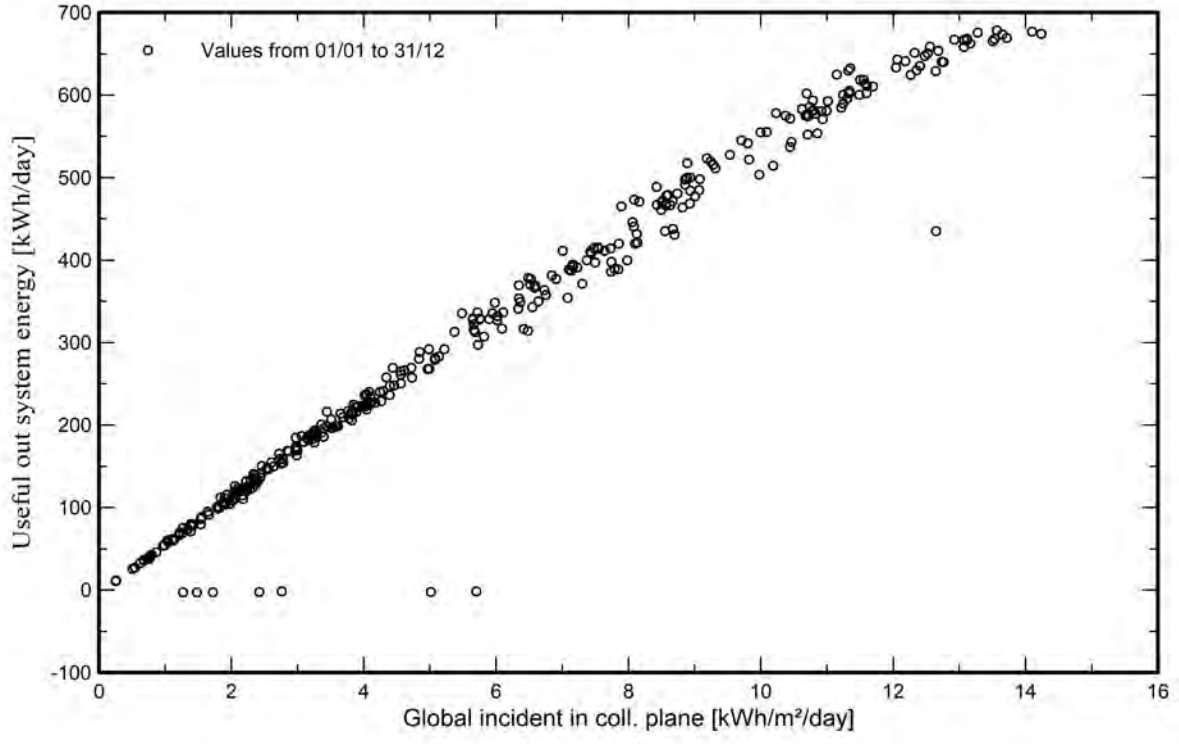


Predef. graphs

Normalized Production and Loss Factors

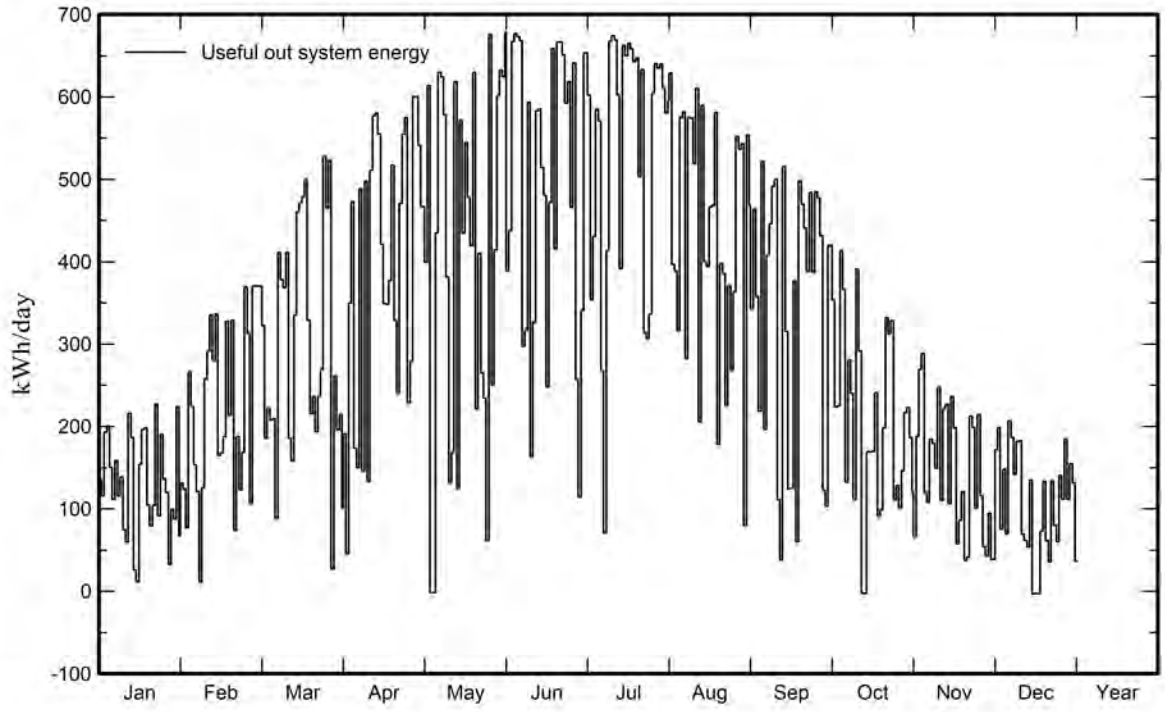


Daily Input/Output diagram

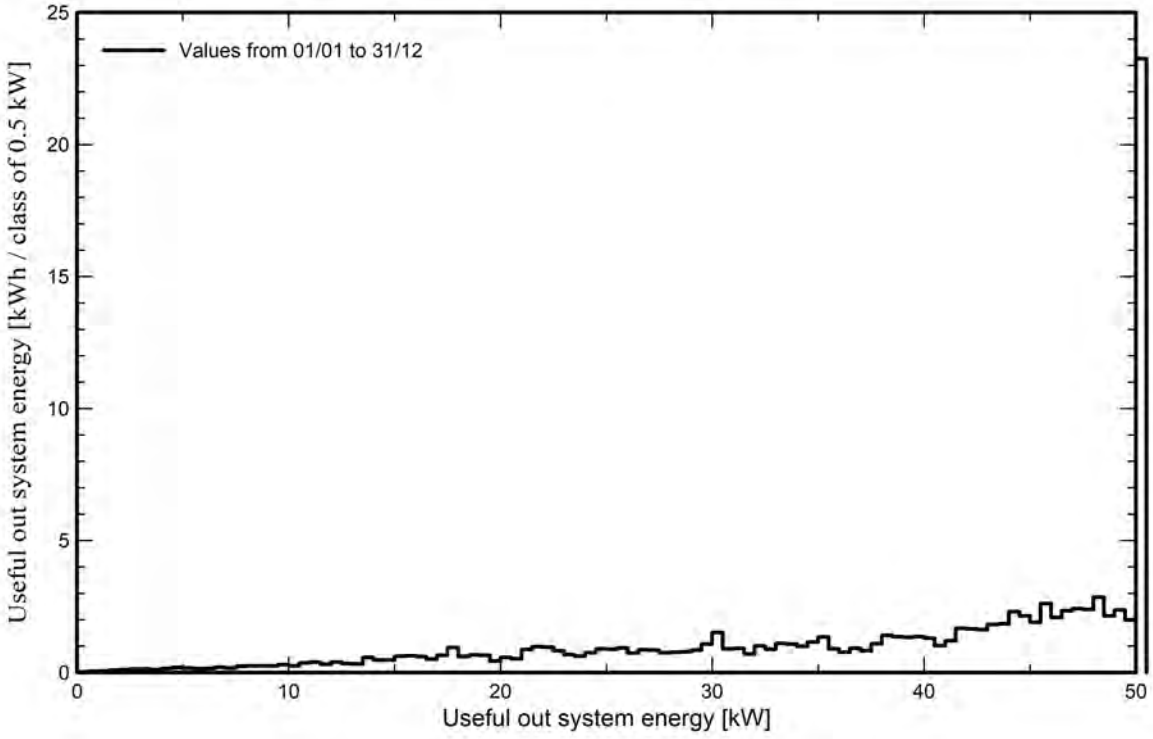


Predef. graphs

Daily System Output Energy



System Output Power Distribution



PVsyst - Simulation report

Grid-Connected System

Project: Ranchview County Water Dist.

Variant: RCWD_FIXED

Sheds on ground

System power: 66.1 kWp

Helena Valley Northwest - United States

Author

Gemini - Tetra Tech (United states)

Project summary

Geographical Site
Helena Valley Northwest
United States

Situation

Latitude	46.72 °N
Longitude	-112.02 °W
Altitude	1152 m
Time zone	UTC-7

Project settings
Albedo 0.20

Weather data
Helena Valley Northwest
Meteonorm 8.2 (1991-2005) - Synthetic

System summary

Grid-Connected System
Sheds on ground

Orientation #1
Fixed plane
Tilt/Azimuth 15 / 0 °

Near Shadings
According to strings : Slow (simul.)
Electrical effect 100 %

User's needs
Unlimited load (grid)

System information

PV Array		Inverters	
Nb. of modules	112 units	Nb. of units	1 unit
Pnom total	66.1 kWp	Pnom total	50.0 kWac
		Pnom ratio	1.322

Results summary

Produced Energy	88217 kWh/year	Specific production	1335 kWh/kWp/year	Perf. Ratio PR	81.03 %

Table of contents

General parameters

Grid-Connected System

Orientation #1

Fixed plane	
Tilt/Azimuth	15 / 0 °

Sheds on ground

Sheds configuration	
Nb. of sheds	7 units
Set of tables	
Shading limit angle	
Limit profile angle	12 °

Sizes

Sheds spacing	5.38 m
Collector width	2.46 m
Average GCR	45.7 %

Models used

Transposition	Perez
Diffuse	Perez, Meteonorm
Circumsolar	separate

Horizon

Free Horizon

Near Shadings

According to strings : Slow (simul.)
Electrical effect 100 %

User's needs

Unlimited load (grid)

PV Array Characteristics

PV module

Manufacturer	Hanwha Q Cells
Model	Q.Peak-Duo-XL-G11S.3 / BFG-590
(Original PVsyst database)	
Unit Nom. Power	590 Wp
Number of PV modules	112 units
Nominal (STC)	66.1 kWp
Modules	7 string x 16 In series
At operating cond. (50°C)	
Pmpp	60.4 kWp
U mpp	656 V
I mpp	92 A

Inverter

Manufacturer	SMA
Model	Sunny Tripower STP50-US-41-Core1
(Original PVsyst database)	
Unit Nom. Power	50.0 kWac
Number of inverters	1 unit
Total power	50.0 kWac
Operating voltage	150-800 V
Pnom ratio (DC:AC)	1.32
Power sharing within this inverter	

Total PV power

Nominal (STC)	66 kWp
Total	112 modules
Module area	313 m²

Total inverter power

Total power	50 kWac
Number of inverters	1 unit
Pnom ratio	1.32

Array losses

Array Soiling Losses

Loss Fraction 3.0 %

Thermal Loss factor

Module temperature according to irradiance
Uc (const) 29.0 W/m²K
Uv (wind) 0.0 W/m²K/m/s

DC wiring losses

Global array res. 118 mΩ
Loss Fraction 1.5 % at STC

Serie Diode Loss

Voltage drop 0.7 V
Loss Fraction 0.1 % at STC

LID - Light Induced Degradation

Loss Fraction 2.0 %

Module Quality Loss

Loss Fraction -0.4 %

Module mismatch losses

Loss Fraction 2.0 % at MPP

IAM loss factor

Incidence effect (IAM): Fresnel, AR coating, n(glass)=1.526, n(AR)=1.290

0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	0.999	0.987	0.963	0.892	0.814	0.679	0.438	0.000

System losses

Unavailability of the system		Auxiliaries loss	
Time fraction	2.0 %	Night aux. cons.	200 W
	7.3 days,		
	3 periods		

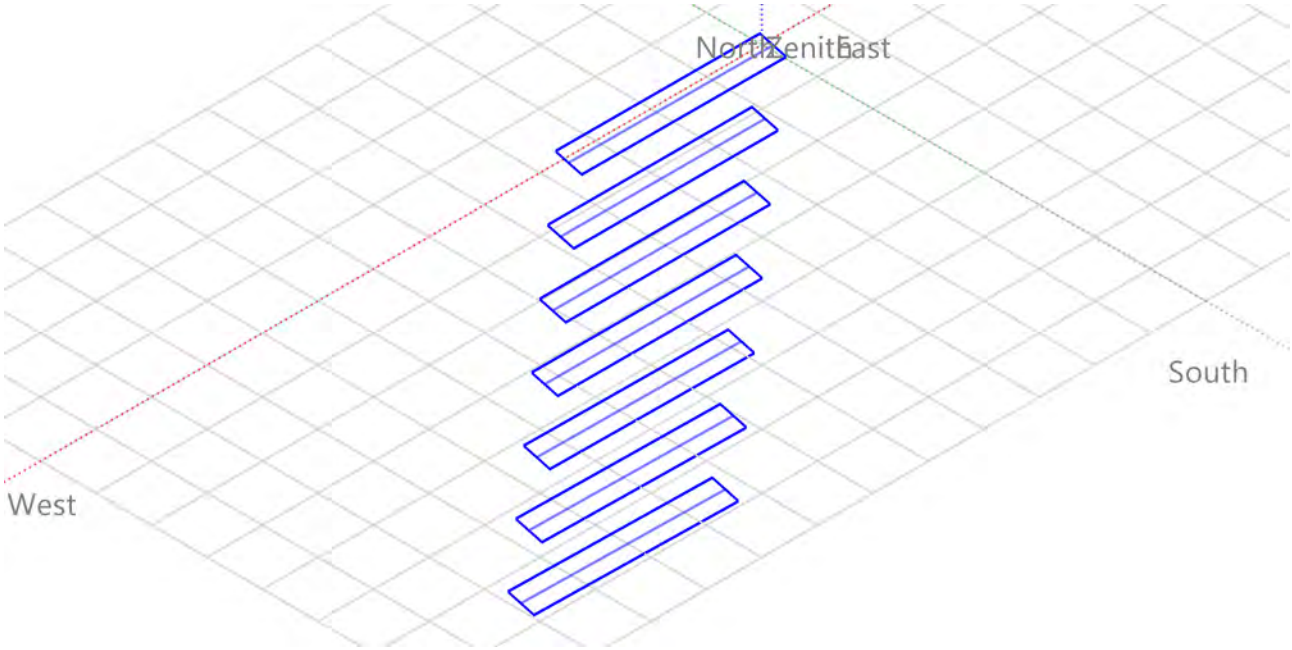
AC wiring losses

Inv. output line up to injection point

Inverter voltage	480 Vac tri
Loss Fraction	0.00 % at STC
Inverter: Sunny Tripower STP50-US-41-Core1	
Wire section (1 Inv.)	Copper 1 x 3 x 25 mm²
Wires length	0 m

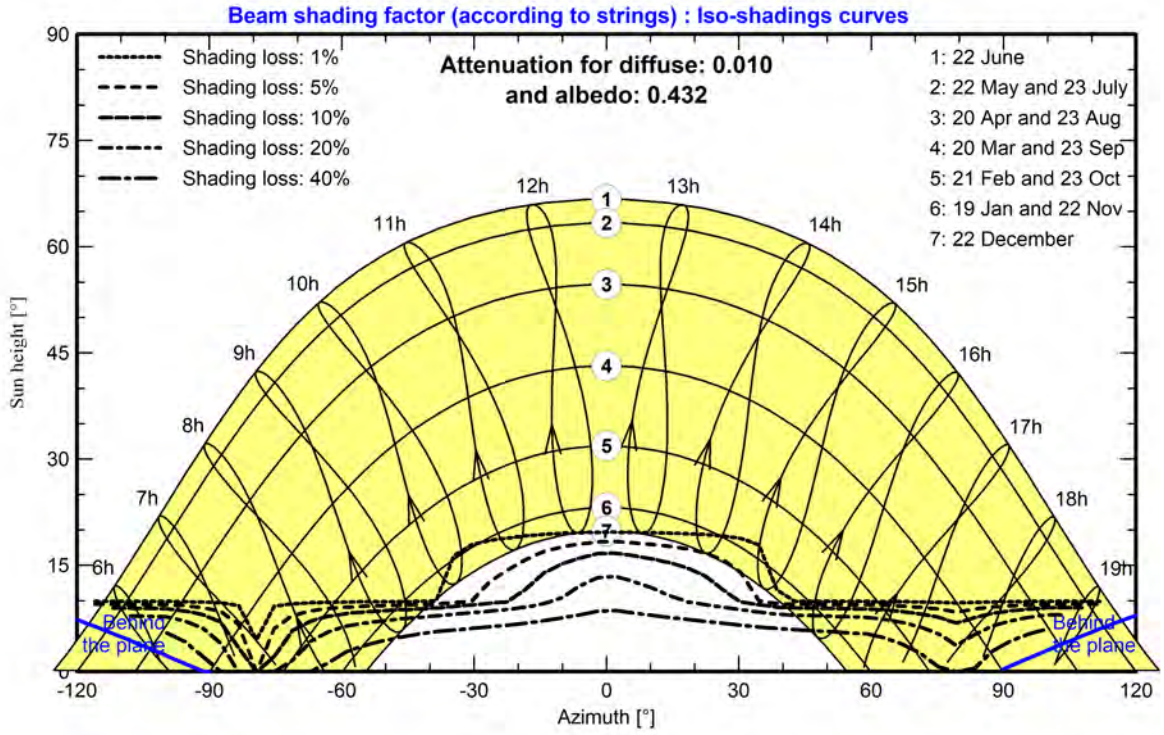
Near shadings parameter

Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Orientation #1 - Fixed plane, Tilts/azimuths: 15°/ 0°

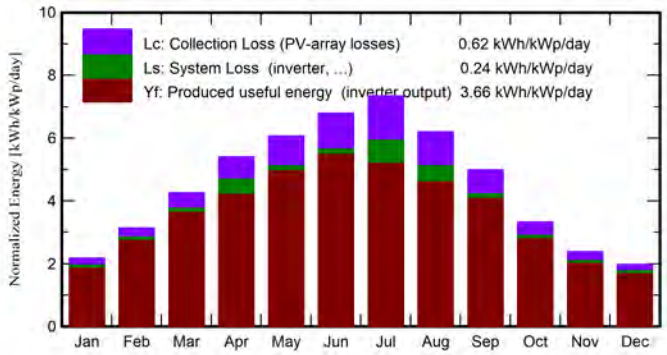


Main results

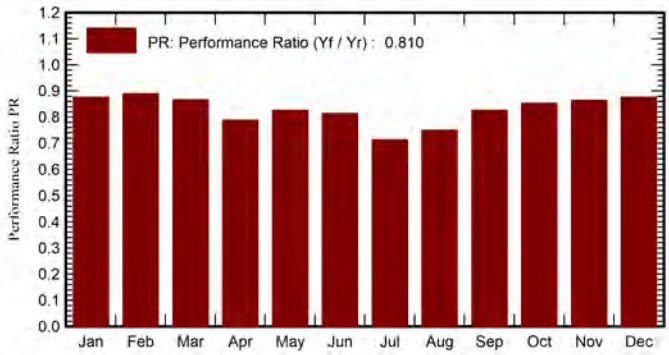
System Production

Produced Energy	88217 kWh/year	Specific production	1335 kWh/kWp/year
		Perf. Ratio PR	81.03 %

Normalized productions (per installed kWp)



Performance Ratio PR



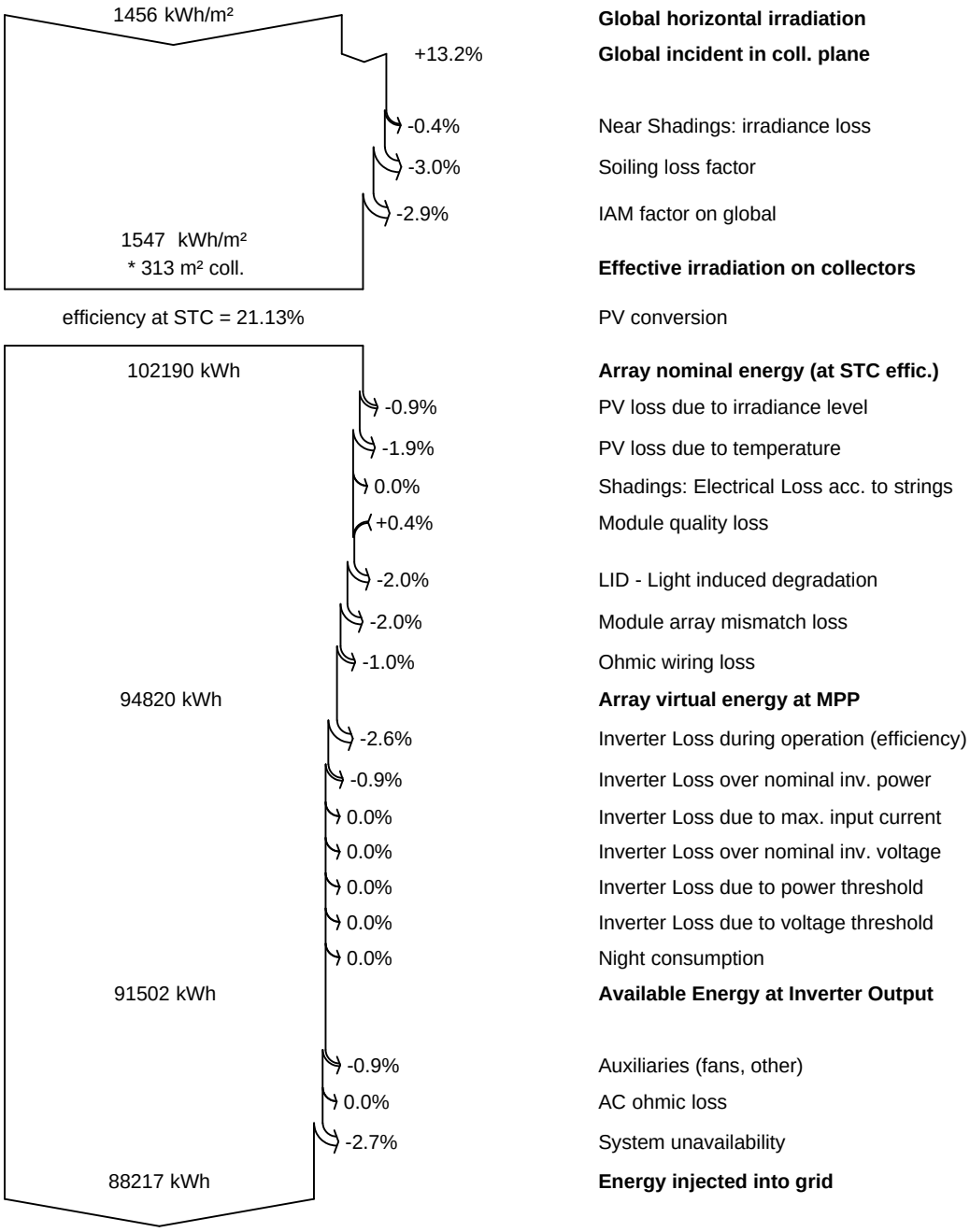
Balances and main results

	GlobHor kWh/m²	DiffHor kWh/m²	T_Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray kWh	E_Grid kWh	PR ratio
January	45.7	19.52	-4.60	67.5	62.6	4102	3910	0.877
February	66.3	25.80	-3.55	87.8	82.1	5370	5163	0.890
March	110.5	44.43	1.98	132.0	123.8	7824	7553	0.866
April	148.2	59.26	6.69	162.2	152.4	9406	8445	0.788
May	181.3	71.69	11.99	188.3	177.2	10606	10269	0.826
June	201.5	74.26	16.75	203.8	192.1	11311	10962	0.814
July	221.4	59.49	23.16	227.7	214.9	12263	10743	0.714
August	178.9	64.99	21.04	192.4	180.9	10588	9543	0.751
September	128.6	44.07	14.82	149.7	140.8	8470	8178	0.826
October	82.3	36.14	7.35	103.3	96.7	6055	5821	0.853
November	50.8	21.23	0.38	71.4	66.5	4269	4077	0.864
December	40.3	17.99	-4.61	61.4	56.8	3738	3552	0.876
Year	1455.8	538.86	7.69	1647.6	1546.8	94003	88217	0.810

Legends

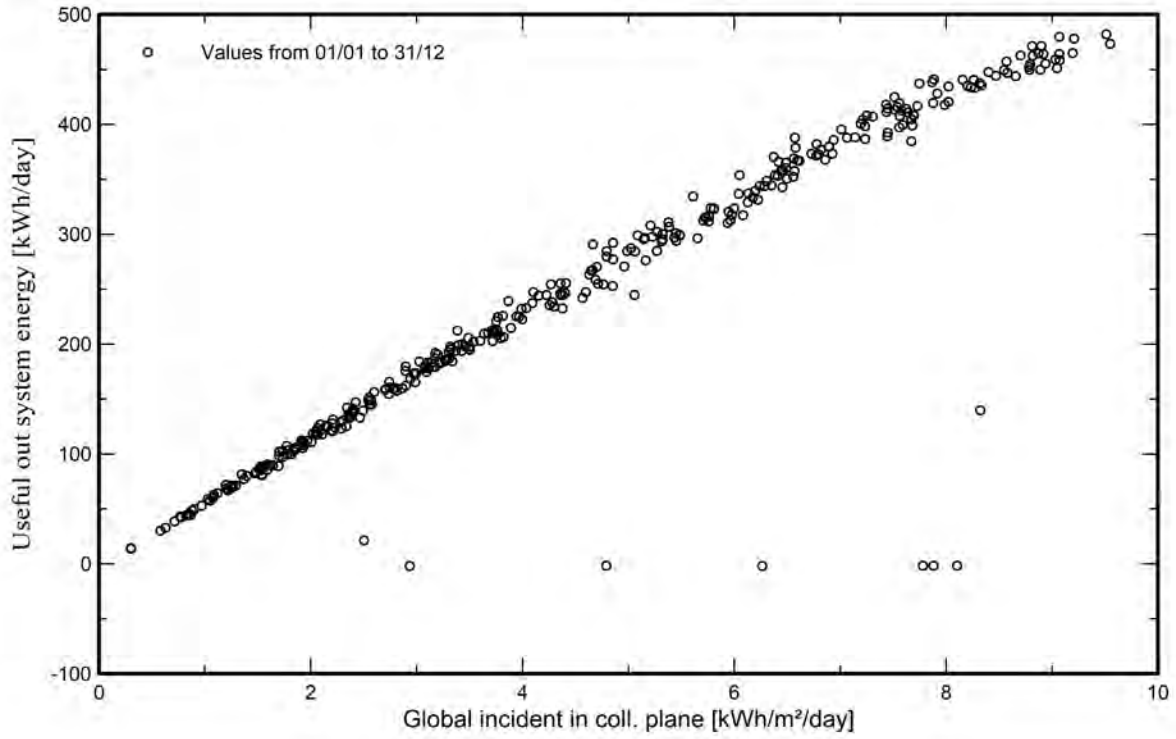
GlobHor	Global horizontal irradiation
DiffHor	Horizontal diffuse irradiation
T_Amb	Ambient Temperature
GlobInc	Global incident in coll. plane
GlobEff	Effective Global, corr. for IAM and shadings
EArray	Effective energy at the output of the array
E_Grid	Energy injected into grid
PR	Performance Ratio

Loss diagram

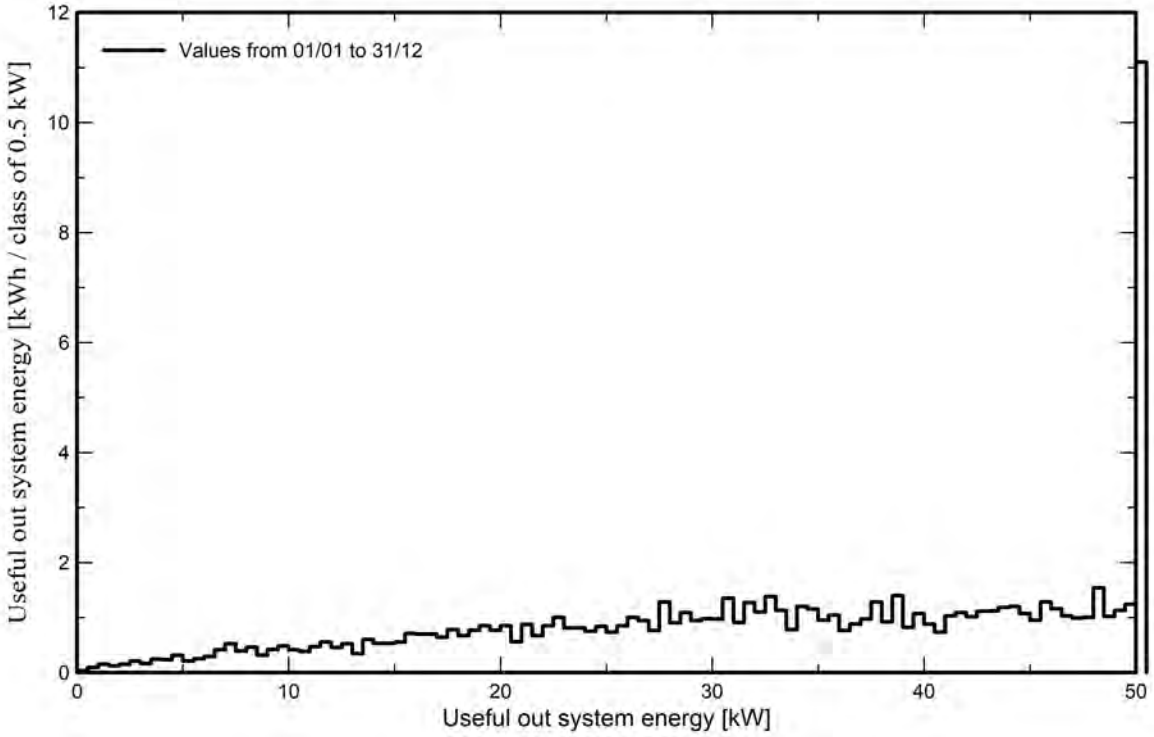


Predef. graphs

Daily Input/Output diagram



System Output Power Distribution



PVsyst - Simulation report

Grid-Connected System

Project: Ranchview County Water Dist.

Variant: RCWD_FIXED-W/bess

Sheds on ground

System power: 86.4 kWp

Helena Valley Northwest - United States

Author

Gemini - Tetra Tech (United states)

PVsyst V8.0.7
VC6, Simulation date:
06/03/25 10:50
with V8.0.7

Tetra Tech Inc.

Project summary

Geographical Site
Helena Valley Northwest
United States

Situation

Latitude	46.72 °N
Longitude	-112.02 °W
Altitude	1152 m
Time zone	UTC-7

Project settings
Albedo 0.20

Weather data
Helena Valley Northwest
Meteonorm 8.2 (1991-2005) - Synthetic

System summary

Grid-Connected System
Sheds on ground

Orientation #1
Fixed plane
Tilt/Azimuth 15 / 0 °

Near Shadings
According to strings : Slow (simul.)
Electrical effect 100 %

User's needs
Unlimited load (grid)

System information

PV Array		Inverters	
Nb. of modules	180 units	Nb. of units	5 units
Pnom total	86.4 kWp	Pnom total	48.0 kWac
		Pnom ratio	1.800

Results summary

Produced Energy	99232 kWh/year	Specific production	1149 kWh/kWp/year	Perf. Ratio PR	69.71 %

Table of contents

General parameters

Grid-Connected System

Orientation #1

Fixed plane	
Tilt/Azimuth	15 / 0 °

Sheds on ground

Sheds configuration	
Nb. of sheds	20 units
Set of tables	
Shading limit angle	
Limit profile angle	11 °

Sizes

Sheds spacing	5.08 m
Collector width	2.22 m
Average GCR	43.6 %

Models used

Transposition	Perez
Diffuse	Perez, Meteonorm
Circumsolar	separate

Horizon

Free Horizon

Near Shadings

According to strings : Slow (simul.)
Electrical effect 100 %

User's needs

Unlimited load (grid)

PV Array Characteristics

PV module

Manufacturer	Hanwha Q Cells
Model	Q.Peak-Duo-XL-G10-480
(Original PVsyst database)	
Unit Nom. Power	480 Wp
Number of PV modules	180 units
Nominal (STC)	86.4 kWp
Modules	20 string x 9 In series
At operating cond. (50°C)	
Pmpp	79.0 kWp
U mpp	367 V
I mpp	215 A

Inverter

Manufacturer	SMA
Model	Sunny Boy Smart Energy
(Custom parameters definition)	
Unit Nom. Power	9.60 kWac
Number of inverters	5 units
Total power	48.0 kWac
Operating voltage	168-480 V
Pnom ratio (DC:AC)	1.80
Power sharing within this inverter	

Total PV power

Nominal (STC)	86 kWp
Total	180 modules
Module area	417 m²

Total inverter power

Total power	48 kWac
Number of inverters	5 units
Pnom ratio	1.80

Array losses

Array Soiling Losses

Loss Fraction 3.0 %

Thermal Loss factor

Module temperature according to irradiance
Uc (const) 29.0 W/m²K
Uv (wind) 0.0 W/m²K/m/s

DC wiring losses

Global array res. 38 mΩ
Loss Fraction 2.0 % at STC

Serie Diode Loss

Voltage drop 0.7 V
Loss Fraction 0.2 % at STC

LID - Light Induced Degradation

Loss Fraction 2.0 %

Module Quality Loss

Loss Fraction -0.8 %

Module mismatch losses

Loss Fraction 2.0 % at MPP

IAM loss factor

Incidence effect (IAM): Fresnel, AR coating, n(glass)=1.526, n(AR)=1.290

0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	0.999	0.987	0.963	0.892	0.814	0.679	0.438	0.000

System losses

Unavailability of the system		Auxiliaries loss	
Time fraction	2.0 %	Night aux. cons.	1000 W
	7.3 days,		
	3 periods		

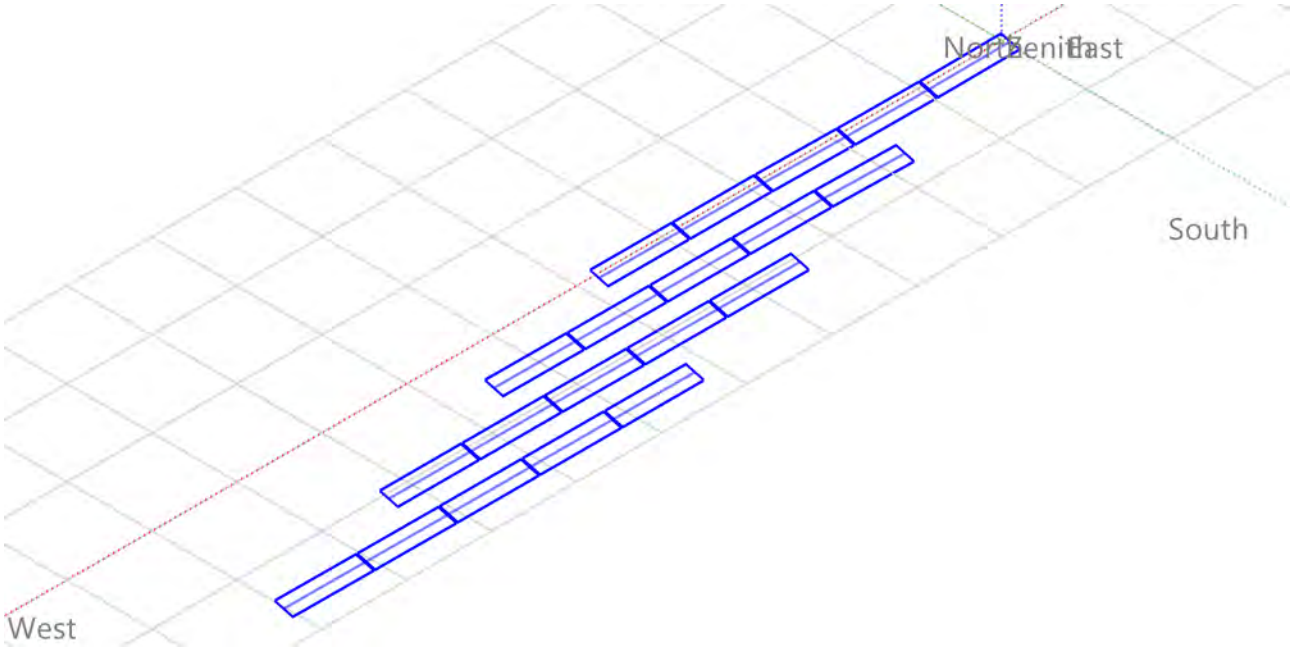
AC wiring losses

Inv. output line up to injection point

Inverter voltage	240 Vac mono
Loss Fraction	0.00 % at STC
Inverter: Sunny Boy Smart Energy	
Wire section (5 Inv.)	Copper 5 x 2 x 16 mm²
Average wires length	0 m

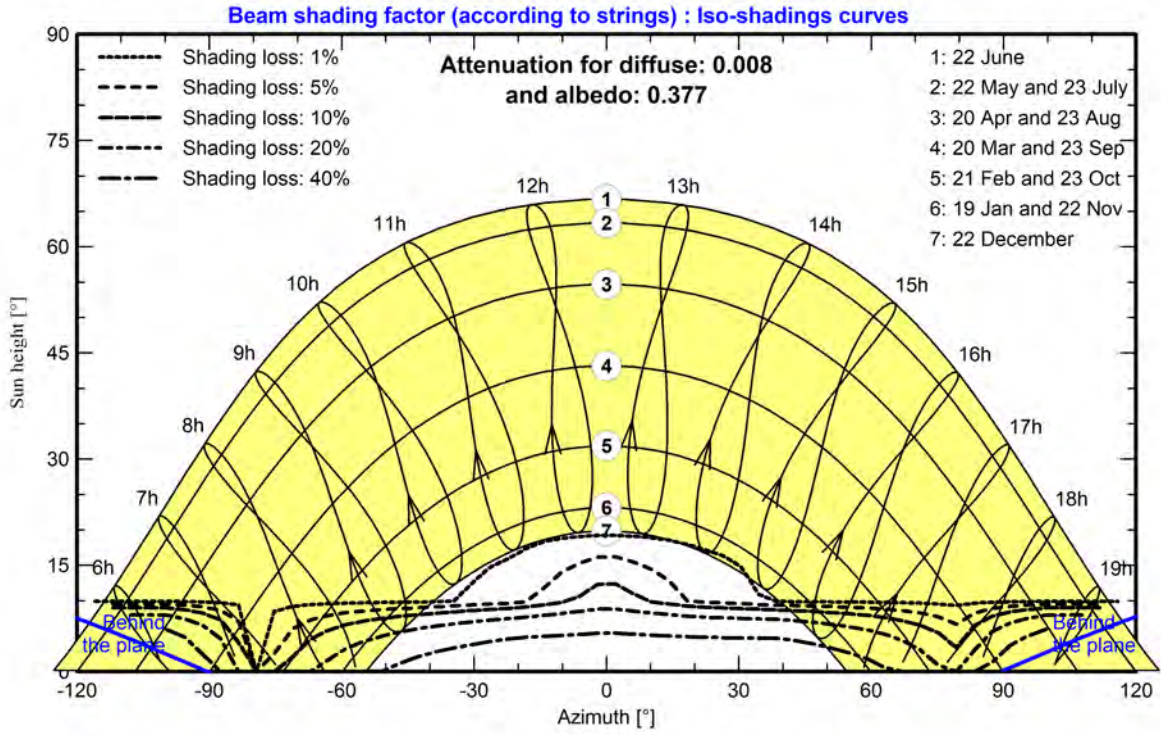
Near shadings parameter

Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Orientation #1 - Fixed plane, Tilts/azimuths: 15°/ 0°

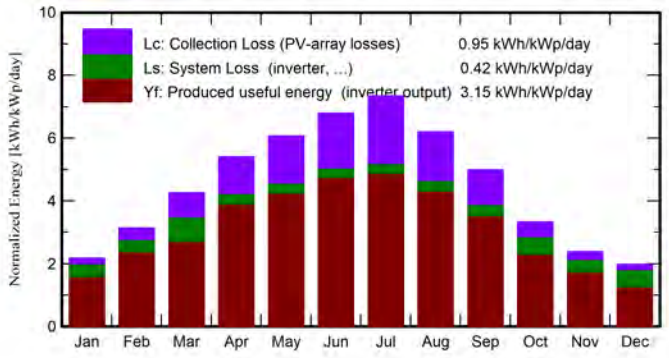


Main results

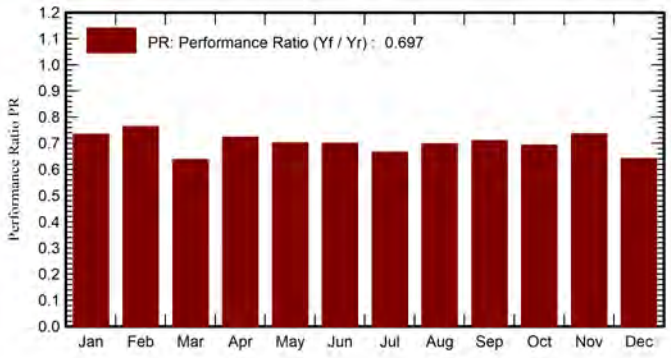
System Production

Produced Energy	99232 kWh/year	Specific production	1149 kWh/kWp/year
		Perf. Ratio PR	69.71 %

Normalized productions (per installed kWp)



Performance Ratio PR



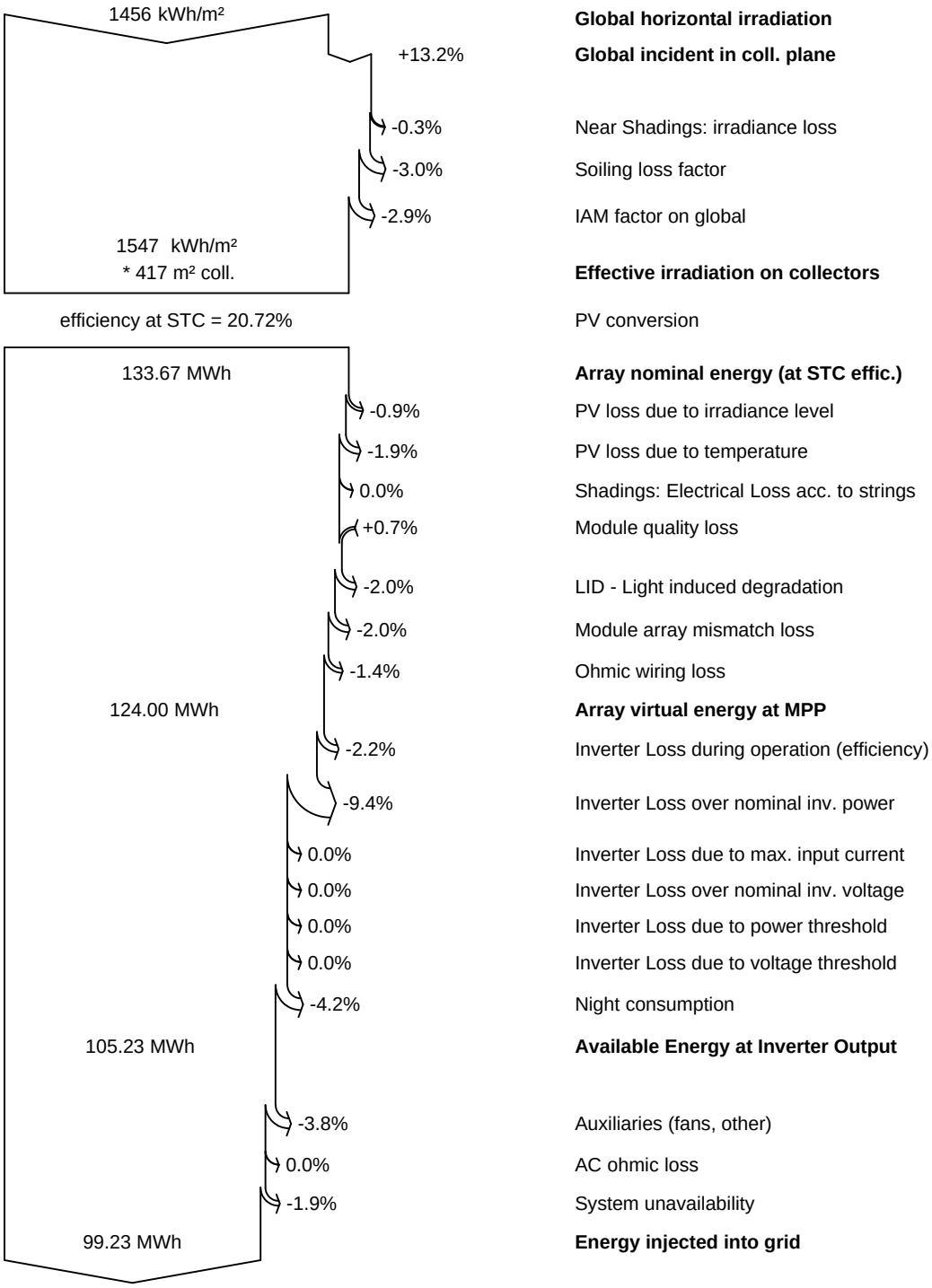
Balances and main results

	GlobHor kWh/m²	DiffHor kWh/m²	T_Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray MWh	E_Grid MWh	PR ratio
January	45.7	19.52	-4.60	67.5	62.6	5.37	4.28	0.735
February	66.3	25.80	-3.55	87.8	82.1	6.72	5.79	0.763
March	110.5	44.43	1.98	132.0	123.8	9.38	7.28	0.638
April	148.2	59.26	6.69	162.2	152.5	11.01	10.14	0.723
May	181.3	71.69	11.99	188.3	177.3	12.26	11.41	0.702
June	201.5	74.26	16.75	203.8	192.2	13.13	12.34	0.701
July	221.4	59.49	23.16	227.7	214.9	13.94	13.10	0.666
August	178.9	64.99	21.04	192.4	181.0	12.48	11.59	0.697
September	128.6	44.07	14.82	149.7	140.8	10.10	9.18	0.709
October	82.3	36.14	7.35	103.3	96.8	7.68	6.19	0.693
November	50.8	21.23	0.38	71.4	66.5	5.56	4.54	0.735
December	40.3	17.99	-4.61	61.4	56.8	4.90	3.40	0.642
Year	1455.8	538.86	7.69	1647.5	1547.3	112.54	99.23	0.697

Legends

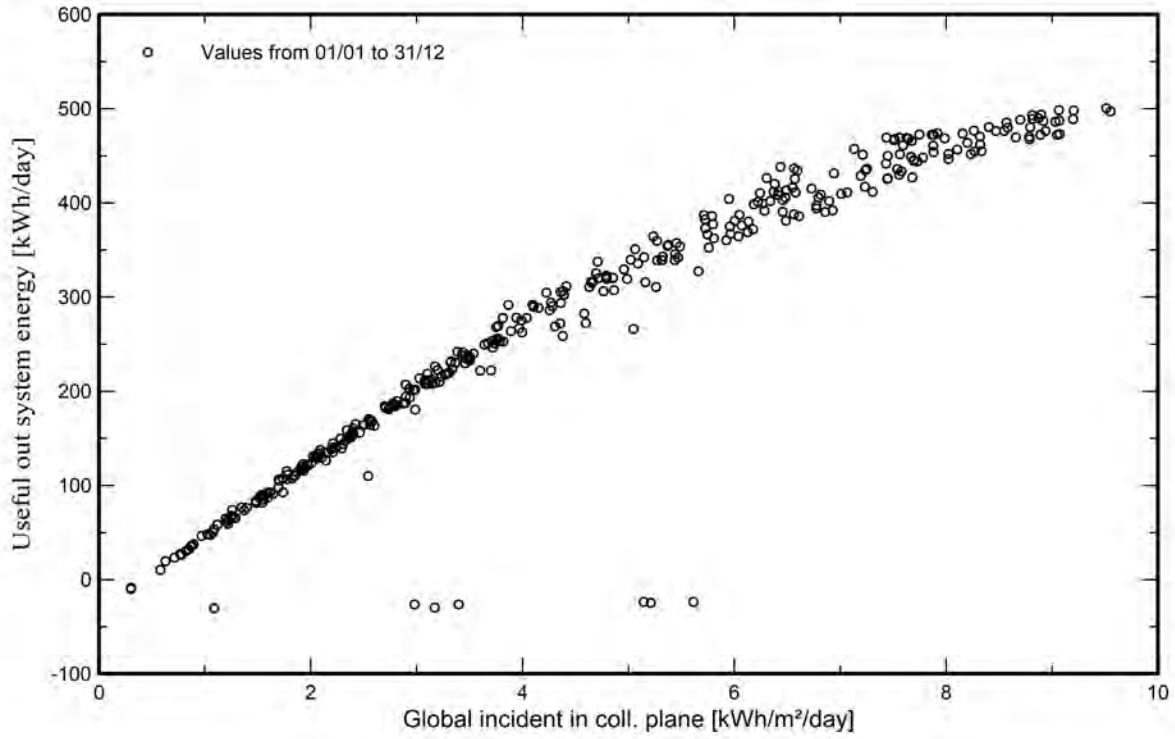
GlobHor	Global horizontal irradiation
DiffHor	Horizontal diffuse irradiation
T_Amb	Ambient Temperature
GlobInc	Global incident in coll. plane
GlobEff	Effective Global, corr. for IAM and shadings
EArray	Effective energy at the output of the array
E_Grid	Energy injected into grid
PR	Performance Ratio

Loss diagram

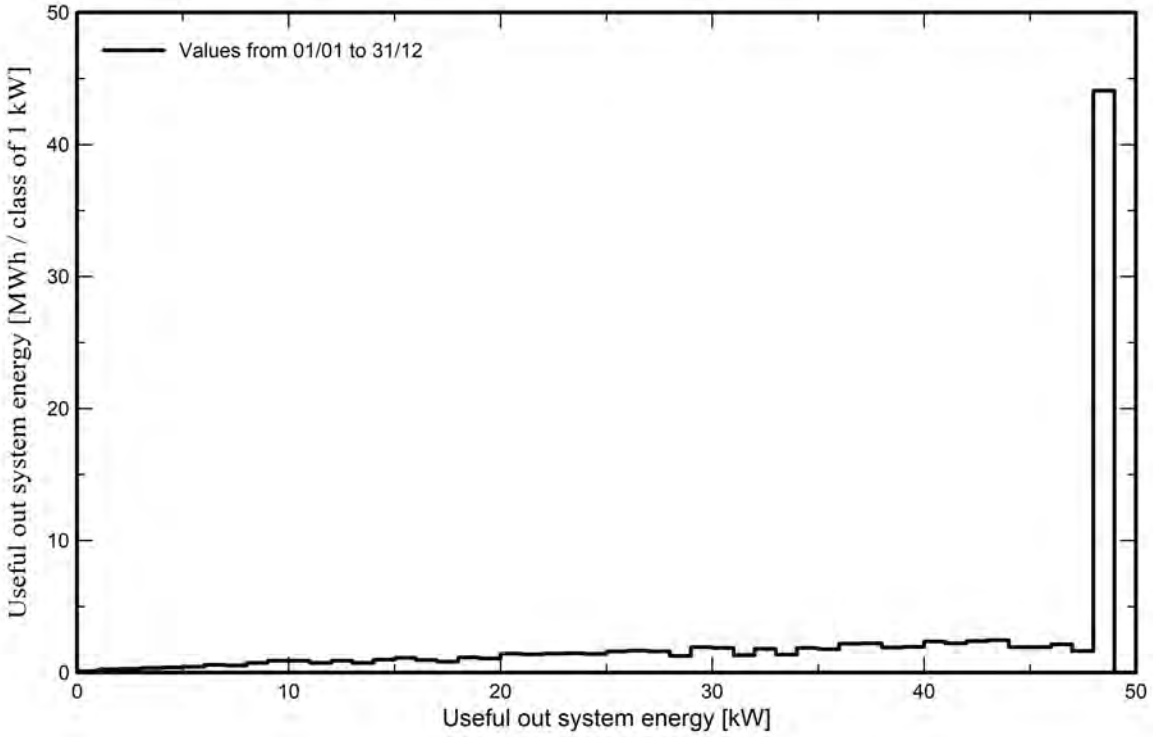


Predef. graphs

Daily Input/Output diagram



System Output Power Distribution



RANCHVIEW COUNTY WATER DISTRICT - SOLAR PLANT CONCEPTUAL DESIGN:

SCENARIO #1 - SINGLE-AXIS TRACKER PV RACKING

1 GENERAL ARRANGEMENT AND LAYOUT PLAN

SCALE: 1" = 100'

0 100' 200'

GENERAL NOTES:

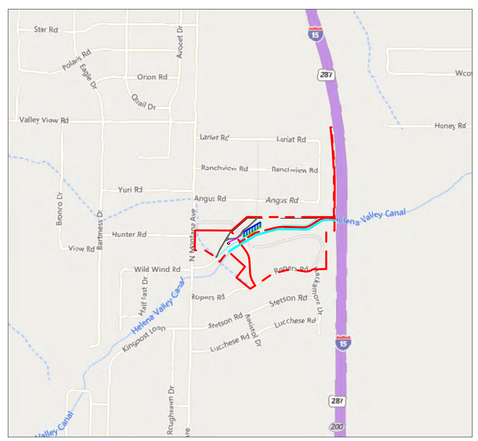
1. THIS IS A CONCEPTUAL LAYOUT FOR ELECTRICAL DESIGN, SEE THE RACKING MANUFACTURER LAYOUT AND SHOP DRAWINGS FOR MORE DETAIL ON RACKING STRUCTURES.
2. SITE ACCESS WILL BE THROUGH EXISTING ACCESS DRIVES. SEE CIVIL DRAWINGS FOR PROPOSED SITE ACCESS ROAD DETAILS.
3. UNDERGROUND ELECTRICAL AND COMM SHALL BE INSTALLED THROUGH TRENCHING.
4. THE UNITS OF THE DIMENSIONS IN THIS CONCEPTUAL LAYOUT ARE IN FEET, DECIMAL FORMAT.

LEGEND

- INVERTER
- SINGLE-AXIS TRACKER
- PARCEL BOUNDARY
- FENCE
- PV AREA
- AC TRENCH ROUTING
- CANAL
- 50' WATER SETBACK
- 20' PARCEL SETBACK
- EXISTING ACCESS ROADS
- DC TRENCH ROUTING

SITE CONDITIONS	
METEO STATION	HELENA, MT, USA (WMO: 727720)
EXTREME ANNUAL LOW TEMP (°C)	-28.3
AVERAGE HIGH AMBIENT TEMP (°C)	37
TILT	+/- 55

SYSTEM SPECS	
DC CAPACITY (kW)	66.08
DC CAPACITY - BSTC (kW)	72.28
AC CAPACITY (kVA)	50
DC/AC RATIO (%)	1.32
DC/AC RATIO - BSTC (%)	1.45
MODULE MODEL	Q.PEAK DUO XL-G11S.3 / BFG 590
TOTAL NUMBER OF MODULES	112
TOTAL NUMBER OF STRINGS	7
INVERTER MODEL	SMA SUNNY TRIPOWER CORE1 50-US
TOTAL NUMBER OF INVERTERS	1
TILT	+/- 55
AZIMUTH	180
RACKING	SINGLE-AXIS TRACKER



2 VICINITY MAP

Scale: NTS

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DRAFT

MARK	DATE	DESCRIPTION	BY
A	02/27/25	PRELIMINARY CONCEPTUAL DRAWING	BEP

RANCHVIEW COUNTY WATER DIST.
GENERAL ARRANGEMENT & LAYOUT PLAN
7788-7784 COUNTY RD 229
RANCHVIEW COUNTY, HELENA, MT 59602

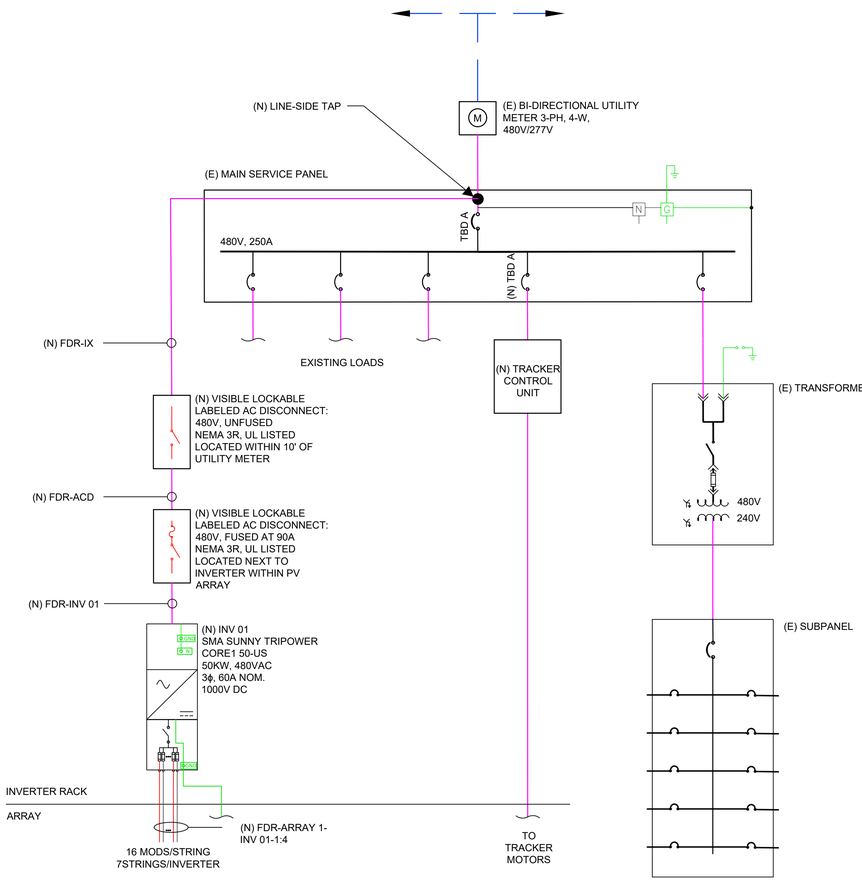
PROJ:	194-0117-0117
DESN:	BEP
DRWN:	BEP
CHKD:	MLC

E-101

Bar Measures 1 inch, otherwise drawing not to scale

3/18/2025 5:06:47 PM - C:\USERS\ALAN.TENNERY\DESKTOP\RCWD_UPDATE\E-101 GENERAL ARRANGEMENT AND LAYOUT PLAN - SAT.DWG - TENNERY, ALAN

STRING INVERTER SCHEDULE						
INVERTER TAG	FEEDER TAG	NOMINAL OUTPUT CURRENT (A)	MAXIMUM OUTPUT CURRENT x1.25 (A)	AC OCPD RATING (A)	THWN-2 CABLE SIZE (90 DEG) CABLE SIZE	AMPACITY (A) (75°]
INV 01	FDR-INV 01	64	80	90	(3) #3 AWG CU + (1) #8AWG GND	100
ACD	FDR-ACD	64	80	90	(3) #3 AWG CU + (1) #8AWG GND	100
IX	FDR-IX	64	80	90	(3) #3 AWG CU + (1) #6 AWG GND	100



INVERTER SPECS	
MAKE/MODEL: SMA SUNNY TRIPOWER CORE1 50-US	
QUANTITY	1
MAX DC CURRENT Isc (A)	120
MAX DC VOLTAGE (V)	1000
MPPT VOLTAGE RANGE (V)	150-1000
NOMINAL PHASE-TO-PHASE VOLTAGE (V)	480
NOMINAL AC POWER (kW)	50
MAX OUTPUT CURRENT (A)	64

MODULE SPECS	
MAKE/MODEL: Q.PEAK DUO XL-G11S.3 / BFG 590	
MODULE POWER (W)	590
MODULE Vmp (V)	44.96
MODULE Voc (V)	53.60
MODULE Imp (A)	13.12
MODULE Isc (A)	13.74

MODULE SPECS (BSTC)	
MAKE/MODEL: Q.PEAK DUO XL-G11S.3 / BFG 590 (BSTC)	
MODULE POWER (W)	645
MODULE Vmp (V)	44.95
MODULE Voc (V)	53.79
MODULE Imp (A)	14.36
MODULE Isc (A)	15.04

STRING SPECS	
MODULES PER STRING	16
STRING POWER (W)	9,440
NOMINAL STRING Vmp (V)	719.36
STRING Voc (V)	857.60
STRING Imp (A)	13.12
STRING Isc (A)	13.74
MAX CIRCUIT CURRENT (A)	17.18
MIN STRING OCPD RATING (A)	21.47
CORRECTED MAX STRING Voc (V)	16.00
CORRECTED MIN STRING VOLTAGE (V)	981.02

STRING SPECS (BSTC)	
MODULES PER STRING	16
STRING POWER (W)	10,326
NOMINAL STRING Vmp (V)	719.20
STRING Voc (V)	860.64
STRING Imp (A)	14.36
STRING Isc (A)	15.04
MAX CIRCUIT CURRENT (A)	18.80
MIN STRING OCPD RATING (A)	23.50
CORRECTED MAX STRING Voc (V)	16.00
CORRECTED MIN STRING VOLTAGE (V)	984.49

DC FEEDER SCHEDULE							
FEEDER TAG	STRING SHORT CIRCUIT CURRENT (Isc) (A)	MIN. OVERCURRENT DEVICE (FUSE) RATING (A)	No. CIRCUITS PER CONDUIT	(No.) CU CONDUCTOR	CONDUIT SIZE (PVC SCH. 80)	AMPACITY DERATING FACTOR	CALCULATED WORSE CASE CONDUCTOR AMAPACITY (PER NEC TABLE 310.15 (B)(3)(a))
FDR-ARRAY 1-INV 01-1:7	15.0	23.50	7	(14) #10 AWG	2"	0.5	20.0

1 SINGLE LINE DIAGRAM

Scale: NTS

TETRA TECH
www.tetratech.com

NOT FOR CONSTRUCTION
DRAFT

MARK	DATE	DESCRIPTION
A	02/27/25	PRELIMINARY CONCEPTUAL DRAWING

BY BEP

RANCHVIEW COUNTY WATER DIST.
AC SINGLE LINE DIAGRAM
7788-7784 COUNTY RD 229
RANCHVIEW COUNTY,
HELENA, MT 59602

PROJ:	194-0117-0117
DESN:	BEP
DRWN:	BEP
CHKD:	MLC

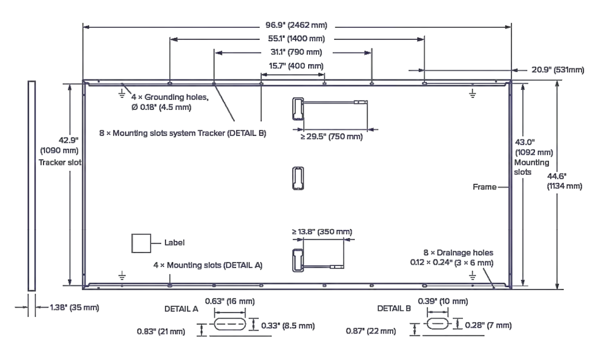
E-201

Bar Measures 1 inch, otherwise drawing not to scale

Q.PEAK DUO XL-G11S SERIES

Mechanical Specification

Format	96.9 in × 44.6 in × 1.38 in (including frame) (2462 mm × 1134 mm × 35 mm)
Weight	76.9 lbs (34.9 kg)
Front Cover	0.08 in (2.0 mm) thermally pre-stressed glass with anti-reflection technology
Back Cover	0.08 in (2.0 mm) semi-tempered glass
Frame	Anodised aluminium
Cell	6 × 26 monocrystalline Q.ANTUM solar half cells
Junction box	2.09-3.98 × 1.26-2.36 × 0.59-0.71 in (53-101 mm × 32-60 mm × 15-18 mm), Protection class IP67, with bypass diodes
Cable	4 mm² Solar cable; (+) ≥29.5 in (750 mm), (−) ≥13.8 in (350 mm)
Connector	Stäubli MC4; Stäubli MC4-Evo2; - IP68



Electrical Characteristics

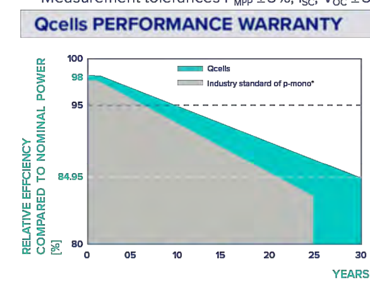
POWER CLASS			590		595		600		605	
MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC[1] (POWER TOLERANCE +5 W / −0 W)										
				BSTC*		BSTC*		BSTC*		BSTC*
Minimum: Power at MPP[1]	P_{MPP}	[W]	590	645.4	595	650.8	600	656.3	605	661.8
Short Circuit Current[1]	I_{SC}	[A]	13.74	15.04	13.77	15.07	13.80	15.10	13.82	15.13
Open Circuit Voltage[1]	V_{OC}	[V]	53.60	53.79	53.63	53.82	53.66	53.85	53.68	53.87
Current at MPP	I_{MPP}	[A]	13.12	14.36	13.17	14.41	13.22	14.46	13.27	14.52
Voltage at MPP	V_{MPP}	[V]	44.96	44.95	45.18	45.17	45.39	45.38	45.60	45.59
Efficiency[1]	η	[%]	≥21.1		≥21.3		≥21.5		≥21.7	

Bifaciality of P_{MPP} and I_{SC} 70 % ±5 % • Bifaciality given for rear side irradiation on top of STC (front side) • According to IEC 60904-1-2
[1]Measurement tolerances P_{MPP} ±3 %; I_{SC}, V_{OC} ±5 % at STC: 1000 W/m²; *at BSTC: 1000 W/m² + φ × 135 W/m², φ = 70 %, 25±2 °C, AM 1.5 according to IEC 60904-3

MINIMUM PERFORMANCE AT NORMAL OPERATING CONDITIONS, NMOT[2]			590	595	600	605
Minimum: Power at MPP	P_{MPP}	[W]	444.2	448.0	451.8	455.5
Short Circuit Current	I_{SC}	[A]	11.07	11.09	11.11	11.13
Open Circuit Voltage	V_{OC}	[V]	50.69	50.72	50.75	50.77
Current at MPP	I_{MPP}	[A]	10.34	10.38	10.42	10.47
Voltage at MPP	V_{MPP}	[V]	42.97	43.15	43.34	43.52

[1]Measurement tolerances P_{MPP} ±3 %; I_{SC}; V_{OC} ±5 % at STC: 1000 W/m², 25±2 °C, AM 1.5 according to IEC 60904-3 • [2]800 W/m², NMOT, spectrum AM 1.5

Qcells PERFORMANCE WARRANTY

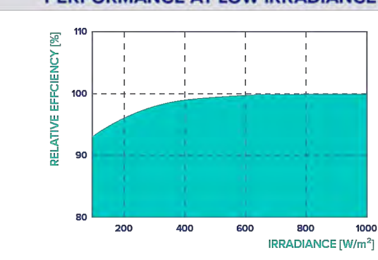


At least 98 % of nominal power during first year. Thereafter max. 0.45 % degradation per year. At least 93.95 % of nominal power up to 10 years. At least 84.95 % of nominal power up to 30 years.

All data within measurement tolerances. Full warranties in accordance with the warranty terms of the Qcells sales organisation of your respective country.

*Standard terms of guarantee for the 5 PV companies with the highest production capacity in 2021 (February 2021)

PERFORMANCE AT LOW IRRADIANCE



Typical module performance under low irradiance conditions in comparison to STC conditions (25 °C, 1000 W/m²).

TEMPERATURE COEFFICIENTS

Temperature Coefficient of I_{SC}	α	[% / K]	+0.04	Temperature Coefficient of V_{OC}	β	[% / K]	−0.27
Temperature Coefficient of P_{MPP}	γ	[% / K]	−0.34	Nominal Module Operating Temperature	NMOT	[°F]	108±5.4 (42±3 °C)

Properties for System Design

Maximum System Voltage	V_{SYS}	[V]	1500	PV module classification	Class II
Maximum Series Fuse Rating		[A DC]	30	Fire Rating based on ANSI / UL 61730	TYPE 29[4]
Max. Push Load[3], Test / Design		[lbs / ft²]	113 (5400 Pa) / 75 (3600 Pa)	Permitted Module Temperature on Continuous Duty	−40 °F up to +185 °F (−40 °C up to +85 °C)
Max. Pull Load[3], Test / Design		[lbs / ft²]	78 (3750 Pa) / 52 (2500 Pa)		

[3] See Installation Manual for instructions

[4] New Type is similar to Type 3 but with metallic frame

Qualifications and Certificates

UL61730-1 & UL61730-2, CE-compliant, IEC 61215:2016, IEC 61730:2016, U.S. Patent No. 9,893,215 (solar cells)

www.tuv.com ID 1111220277

Find product recycling details at QR code above

* Contact your Qcells Sales Representative for details regarding the module's eligibility to be Buy American Act (BAA) compliant.

Qcells pursues minimizing paper output in consideration of the global environment.

Note: Installation instructions must be followed. Contact our technical service for further information on approved installation of this product.

Hanwha Q CELLS America Inc. 400 Spectrum Center Drive, Suite 1400, Irvine, CA 92618, USA | TEL +1 949 748 59 96 | EMAIL hqc-inquiry@qcells.com | WEB www.qcells.com

Qcells

Q.PEAK DUO XL-G11S SERIES

Qcells

590-605 Wp | 156 Cells
21.7 % Maximum Module Efficiency

MODEL Q.PEAK DUO XL-G11S.3 / BFG

Bifacial energy yield gain of up to 21%
Bifacial Q.ANTUM solar cells make efficient use of light shining on the module rear-side for radically improved LCOE.

Low electricity generation costs
Q.ANTUM DUO technology with optimized module layout to boost module power and improve LCOE.

A reliable investment
Double glass module design enables extended lifetime with 12-year product warranty and improved 30-year performance warranty[1].

Enduring high performance
Long-term yield security with Anti LID and Anti PID Technology[2], Hot-Spot Protect.

Frame for versatile mounting options
High-tech aluminum alloy frame protects from damage, enables use of a wide range of mounting structures and is certified regarding IEC for high snow (5400 Pa) and wind loads (3750 Pa)[3].

Innovative all-weather technology
Optimal yields, whatever the weather with excellent low-light and temperature behavior.

[1] See data sheet on rear for further information.
[2] APT test conditions according to IEC/TS 62804-1:2015 method B (−1500 V, 168 h) including post treatment according to IEC 61215-1-1 Ed. 2.0 (CD)
[3] See Installation Manual for instructions

The ideal solution for:
Ground-mounted solar power plants

/ STP 33-US-41 / STP 50-US-41 / STP 62-US-41

SMA

Sunny Tripower CORE1-US

33 / 50 / 62

It stands on its own

/ New! Complies with IEEE 1547-2018 and UL 1741 SB standards

SMA Smart Connected · SMA ShadeFix · c UL us

Fully integrated
- No additional racking required for rooftop installation
- Integrated DC and AC disconnects and overvoltage protection
- 12 direct string inputs for reduced labor and material costs
- Up to 60% faster commercial PV system installation

Increased power, flexibility
- Six MPP trackers for flexible stringing and maximum power production
- ShadeFix, SMA's proprietary shade management solution, optimizes at the string level
- Intelligent string monitoring to pinpoint array performance issues

Enhanced safety, reliability
- Integrated SunSpec PLC signal for module-level rapid shutdown
- DC AFCI arc-fault protection certified to Standard UL 1699B Ed. 1

Smart monitoring, control, service
- I-V curve diagnostic function to visualize and document PV string electrical characteristics
- Increased ROI with SMA ennexOS cross sector energy management platform
- SMA Smart Connected proactive O&M solution reduces time spent diagnosing and servicing in the field

The Sunny Tripower CORE1 is the world's first free-standing PV inverter for commercial rooftops, carports, ground mount and repowering legacy solar projects.

From distribution to construction to operation, the Sunny Tripower CORE1 enables logistical, material, labor and service cost reductions, and is the most versatile, cost-effective commercial solution available. Integrated SunSpec PLC for rapid shutdown and enhanced DC AFCI arc-fault protection ensure compliance to the latest safety codes and standards. With Sunny Tripower CORE1 and SMA's ennexOS cross sector energy management platform, system integrators can deliver comprehensive commercial energy solutions for increased ROI.

SunSpec Modbus for 1547 CERTIFIED · Rapid Shutdown CERTIFIED · UL 3741 LISTED PV Hazard Control

Technical data	Sunny Tripower CORE1 33-US	Sunny Tripower CORE1 50-US	Sunny Tripower CORE1 62-US
Input (DC)			
Maximum array power	50000 Wp STC	75000 Wp STC	93750 Wp STC
Maximum system voltage		1000 V	
Rated MPP voltage range	330 V ... 800 V	500 V ... 800 V	550 V ... 800 V
MPPT operating voltage range		150 V ... 1000 V	
Minimum DC voltage / start voltage		150 V / 188 V	
MPP trackers / strings per MPP input		6 / 2	
Maximum usable operating input current / per MPP tracker		120 A / 20 A	
Maximum short circuit current per MPPT / per string input		32 A / 30 A	
Output (AC)			
AC nominal power	33300 W	50000 W	62500 W
Maximum apparent power	33300 VA	53000 VA	66000 VA
Output phases / line connections		3 / 3-(N)-PE	
Nominal AC voltage		480 V / 277 V WYE	
AC voltage range		244 V ... 305 V	
Maximum output current	40 A	64 A	80 A
Rated grid frequency		60 Hz	
Grid frequency / range		50 Hz, 60 Hz / -6 Hz ... +6Hz	
Power factor at rated power / adjustable displacement		1 / 0.0 leading ... 0.0 lagging	
Harmonics THD		<3%	
Efficiency			
CEC efficiency	97.5%	97.5%	97.5%
Protection and safety features			
Load rated DC disconnect		●	
Load rated AC disconnect		●	
Ground fault monitoring: Riso / Differential current		● / ●	
DC AFCI arc-fault protection		●	
SunSpec PLC signal for rapid shutdown		●	
DC reverse polarity protection		●	
AC short circuit protection		●	
DC surge protection: Type 2 / Type 1+2		○ / ○	
AC surge protection: Type 2 / Type 1+2		○ / ○	
Protection class / overvoltage category (as per UL 840)		I / IV	
General data			
Device dimensions (W / H / D)		621 mm / 733 mm / 569 mm (24.4 in x 28.8 in x 22.4 in)	
Device weight		84 kg (185 lbs)	
Operating temperature range		-25 °C ... +60 °C (-13 °F ... +140 °F)	
Storage temperature range		-40 °C ... +70 °C (-40 °F ... +158 °F)	
Audible noise emissions (full power @ 1m and 25 °C)		65 dB (A)	
Topology		Transformerless	
Cooling concept		OptiCool (forced convection, variable speed fans)	
Enclosure protection rating		Type 4X, 3SX (as per UL 50E)	
Corrosivity classification according to IEC 61701		C3*	
Maximum permissible relative humidity (non-condensing)		100%	
Additional information			
Mounting		Free-standing with included mounting feet	
DC connection		Amphenol UTX PV or H4Plus connectors	
AC connection		Screw terminals - 4 AWG to 4/0 AWG CU/AL	
LED indicators (Status / Fault / Communication)		●	
Network interfaces: Ethernet / WLAN / RS485		● (2 ports) / ▲ / ○	
Data protocols: SMA Modbus / SunSpec IEEE 1547 Modbus / Webconnect		● / ● / ●	
ShadeFix technology for string level optimization		●	
Intelligent string performance monitoring		●	
I-V curve diagnostic function		●	
Integrated Plant Control / Q on Demand 24/7		● / ●	
SMA Smart Connected (proactive monitoring and service support)		●	
Certifications			
Certifications and approvals		UL 1741, UL 1699B Ed. 1, UL 1998, CSA 22.2 107-1, PV Rapid Shutdown System Equipment, UL 3741	
FCC compliance		FCC Part 15 Class A	
Grid interconnection standards		IEEE 1547-2018, UL 1741 SA/SB - CA Rule 21, HECO SRD V2.0	
Advanced grid support capabilities		L/HFRT, L/HVRT, Volt-VAr, Volt-Watt, Frequency-Watt, Ramp Rate Control, Fixed Power Factor	
Warranty			
Standard		10 years	
Optional extensions		15 / 20 years	
Type designation	STP 33-US-41	STP 50-US-41	STP 62-US-41

○ Optional features ● Standard features – Not available ▲ Subject to availability Data at nominal conditions - status: 08/2023 * ≥ 2 km from the coast

Accessories
- SMA Data Manager M EDMM-US-10
- SMA Sensor Module MD.SEN-US-40
- Universal Mounting System UMS_KIT-10
- AC Surge Protection Module Kit AC_SPD_KIT1-10, AC_SPD_KIT2_T1T2; DC Surge Protection Module Kit DC_SPD_KIT4-10, DC_SPD_KIT5_T1T2

Toll Free +1 888 4 SMA USA
www.SMA-America.com

SMA America, LLC

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MARK	DATE	DESCRIPTION	BY
A	02/27/25	PRELIMINARY CONCEPTUAL DRAWING	BEP

RANCHVIEW COUNTY WATER DIST.
EQUIPMENT
DATA SHEETS
7788-7784 COUNTY RD 229
RANCHVIEW COUNTY,
HELENA, MT 59602

PROJ:	194-0117-0117
DESN:	BEP
DRWN:	BEP
CHKD:	MLC

E-1001

Bar Measures 1 inch, otherwise drawing not to scale

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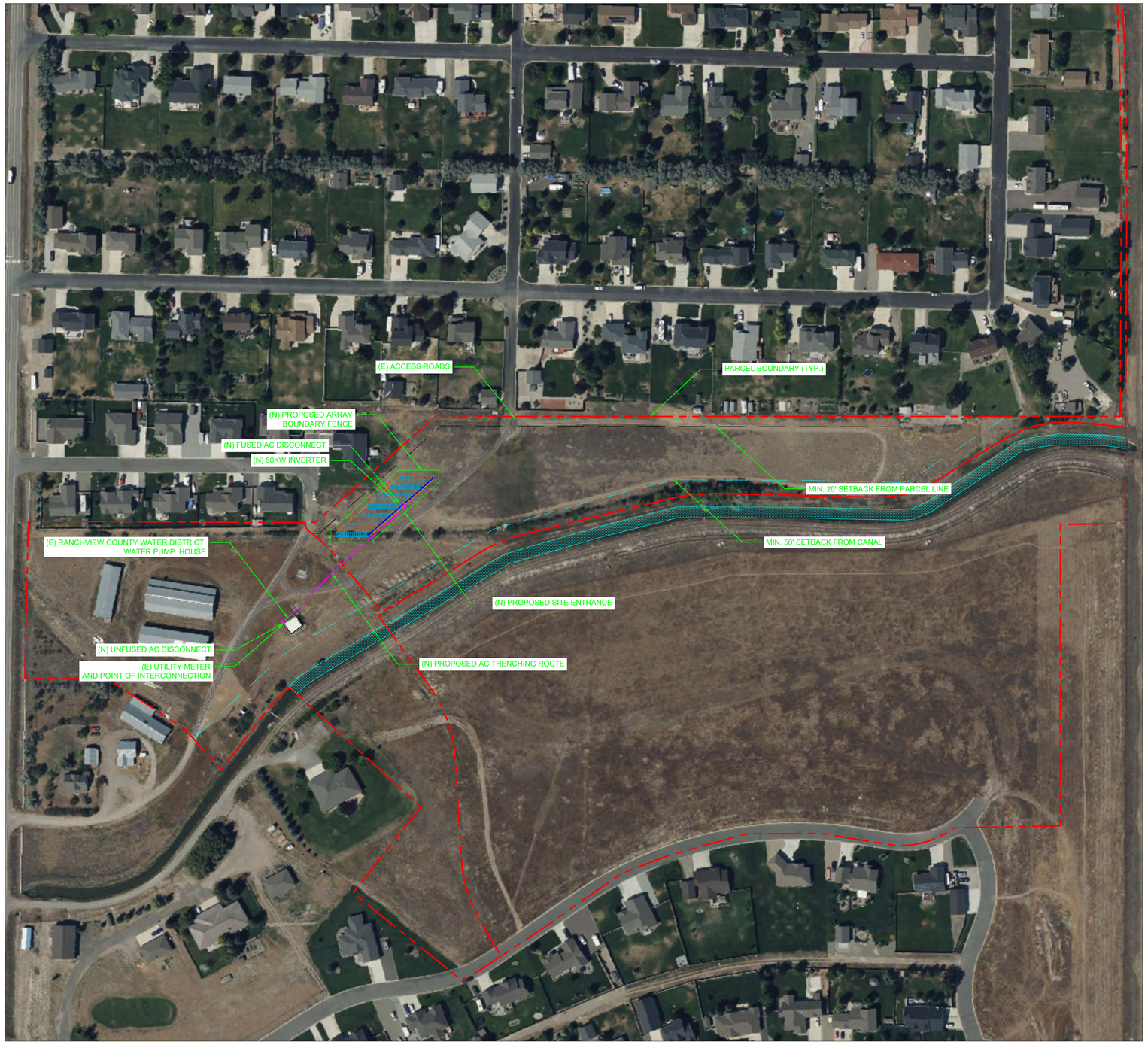
RANCHVIEW COUNTY WATER DISTRICT - SOLAR PLANT CONCEPTUAL DESIGN:

SCENARIO #2 - FIXED TILT PV RACKING



1 GENERAL ARRANGEMENT AND LAYOUT PLAN
SCALE: 1" = 100'

0 100' 200'

GENERAL NOTES:

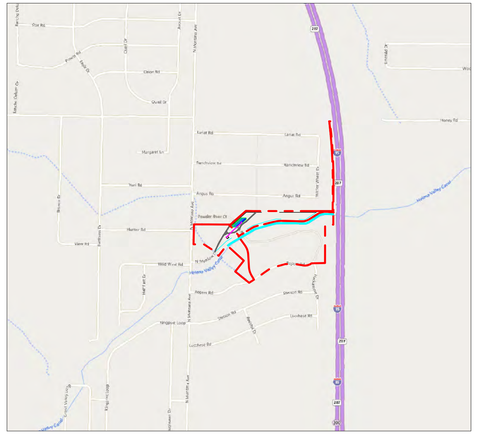
1. THIS IS A CONCEPTUAL LAYOUT FOR ELECTRICAL DESIGN, SEE THE RACKING MANUFACTURER LAYOUT AND SHOP DRAWINGS FOR MORE DETAIL ON RACKING STRUCTURES.
2. SITE ACCESS WILL BE THROUGH EXISTING ACCESS DRIVES. SEE CIVIL DRAWINGS FOR PROPOSED SITE ACCESS ROAD DETAILS.
3. UNDERGROUND ELECTRICAL AND COMM SHALL BE INSTALLED THROUGH TRENCHING.
4. THE UNITS OF THE DIMENSIONS IN THIS CONCEPTUAL LAYOUT ARE IN FEET, DECIMAL FORMAT.

LEGEND

- INVERTER
- CANAL
- PV RACKING (16 MODULES)
- 50' WATER SETBACK
- PARCEL BOUNDARY
- 20' PARCEL SETBACK
- FENCE
- EXISTING ACCESS ROADS
- PV AREA
- DC TRENCH ROUTING
- AC TRENCH ROUTING

SITE CONDITIONS	
METEO STATION	HELENA, MT, USA (WMO: 727720)
EXTREME ANNUAL LOW TEMP (°C)	-28.3
AVERAGE HIGH AMBIENT TEMP (°C)	37
TILT	15

SYSTEM SPECS	
DC CAPACITY (kW)	66.08
DC CAPACITY - BSTC (kW)	72.28
AC CAPACITY (KVA)	50
DC/AC RATIO (%)	1.32
DC/AC RATIO - BSTC (%)	1.45
MODULE MODEL	Q.PEAK DUO XL-G11S.3 / BFG 590
TOTAL NUMBER OF MODULES	112
TOTAL NUMBER OF STRINGS	7
INVERTER MODEL	SMA SUNNY TRIPOWER CORE1 50-US
TOTAL NUMBER OF INVERTERS	1
TILT	15
AZIMUTH	180
RACKING	FIXED-TILT



2 VICINITY MAP
Scale: NTS

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MARK	DATE	DESCRIPTION	BY
A	02/27/25	PRELIMINARY CONCEPTUAL DRAWING	BEP

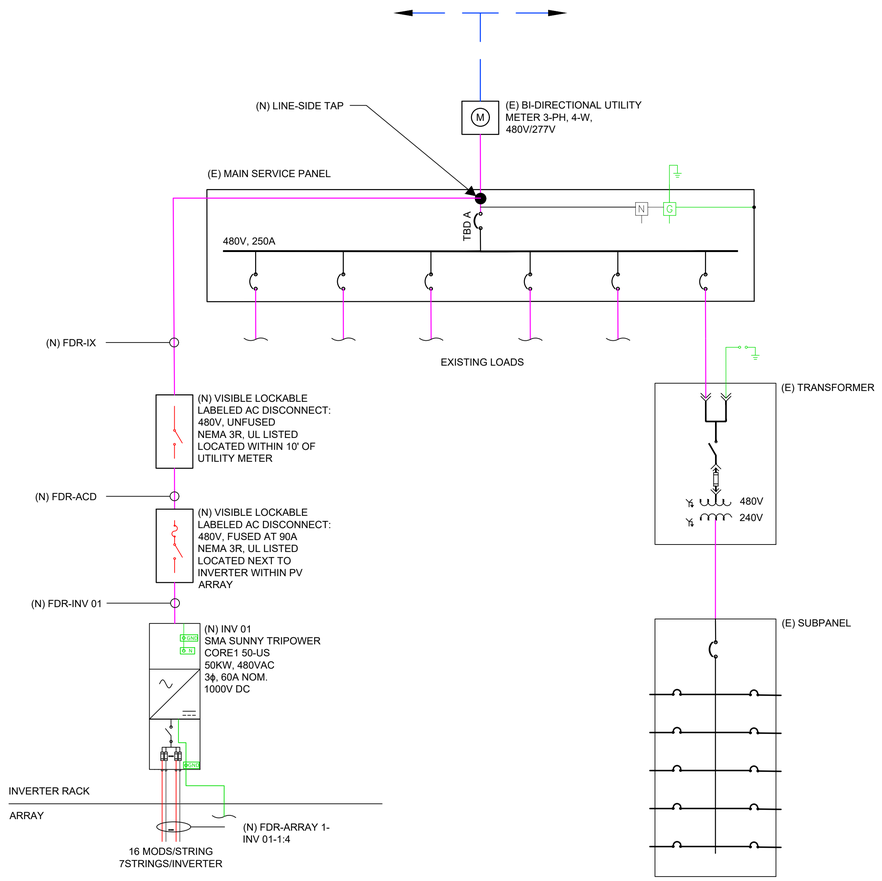
RANCHVIEW COUNTY WATER DIST.
GENERAL ARRANGEMENT & LAYOUT PLAN
7788-7784 COUNTY RD 229
RANCHVIEW COUNTY, HELENA, MT 59602

PROJ:	194-0117-0117
DESN:	BEP
DRWN:	BEP
CHKD:	MLC

E-101

Bar Measures 1 inch, otherwise drawing not to scale

STRING INVERTER SCHEDULE						
INVERTER TAG	FEEDER TAG	NOMINAL OUTPUT CURRENT (A)	MAXIMUM OUTPUT CURRENT x1.25 (A)	AC OCPD RATING (A)	THWN-2 CABLE SIZE (90 DEG) CABLE SIZE	AMPACITY (A) (75°)
INV 01	FDR-INV 01	64	80	90	(3) #3 AWG CU + (1) #8AWG GND	100
ACD	FDR-ACD	64	80	90	(3) #3 AWG CU + (1) #8AWG GND	100
IX	FDR-IX	64	80	90	(3) #3 AWG CU + (1) #6 AWG GND	100



INVERTER SPECS	
MAKE/MODEL: SMA SUNNY TRIPOWER CORE1 50-US	
QUANTITY	1
MAX DC CURRENT Isc (A)	120
MAX DC VOLTAGE (V)	1000
MPPT VOLTAGE RANGE (V)	150-1000
NOMINAL PHASE-TO-PHASE VOLTAGE (V)	480
NOMINAL AC POWER (kW)	50
MAX OUTPUT CURRENT (A)	64

MODULE SPECS	
MAKE/MODEL: Q.PEAK DUO XL-G11S.3 / BFG 590	
MODULE POWER (W)	590
MODULE Vmp (V)	44.96
MODULE Voc (V)	53.60
MODULE Imp (A)	13.12
MODULE Isc (A)	13.74

MODULE SPECS (BSTC)	
MAKE/MODEL: Q.PEAK DUO XL-G11S.3 / BFG 590 (BSTC)	
MODULE POWER (W)	645
MODULE Vmp (V)	44.95
MODULE Voc (V)	53.79
MODULE Imp (A)	14.36
MODULE Isc (A)	15.04

STRING SPECS	
MODULES PER STRING	16
STRING POWER (W)	9,440
NOMINAL STRING Vmp (V)	719.36
STRING Voc (V)	857.60
STRING Imp (A)	13.12
STRING Isc (A)	13.74
MAX CIRCUIT CURRENT (A)	17.18
MIN STRING OCPD RATING (A)	21.47
CORRECTED MAX STRING Voc (V)	16.00
CORRECTED MIN STRING VOLTAGE (V)	981.02

STRING SPECS (BSTC)	
MODULES PER STRING	16
STRING POWER (W)	10,326
NOMINAL STRING Vmp (V)	719.20
STRING Voc (V)	860.64
STRING Imp (A)	14.36
STRING Isc (A)	15.04
MAX CIRCUIT CURRENT (A)	18.80
MIN STRING OCPD RATING (A)	23.50
CORRECTED MAX STRING Voc (V)	16.00
CORRECTED MIN STRING VOLTAGE (V)	984.49

DC FEEDER SCHEDULE							
FEEDER TAG	STRING SHORT CIRCUIT CURRENT (Isc) (A)	MIN. OVERCURRENT DEVICE (FUSE) RATING (A)	No. CIRCUITS PER CONDUIT	(No.) CU CONDUCTOR	CONDUIT SIZE (PVC SCH. 80)	AMPACITY DERATING FACTOR	CALCULATED WORSE CASE CONDUCTOR AMAPACITY (PER NEC TABLE 310.15 (B)(3)(a))
FDR-ARRAY 1-INV 01-1:7	15.0	23.50	7	(14) #10 AWG	2"	0.5	20.0

1 SINGLE LINE DIAGRAM

Scale: NTS

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MARK	DATE	DESCRIPTION
A	02/27/25	PRELIMINARY CONCEPTUAL DRAWING

BY BEP

RANCHVIEW COUNTY WATER DIST.
AC SINGLE LINE DIAGRAM
7788-7784 COUNTY RD 229
RANCHVIEW COUNTY,
HELENA, MT 59602

PROJ:	194-0117-0117
DESN:	BEP
DRWN:	BEP
CHKD:	MLC

E-201

Bar Measures 1 inch, otherwise drawing not to scale

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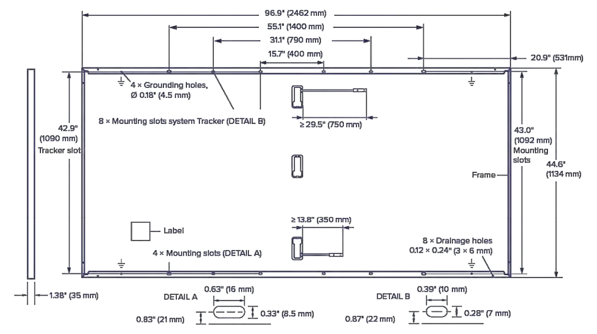
Q.PEAK DUO XL-G11S SERIES

Mechanical Specification

Format	96.9 in × 44.6 in × 1.38 in (including frame) (2462 mm × 1134 mm × 35 mm)
Weight	76.9 lbs (34.9 kg)
Front Cover	0.08 in (2.0 mm) thermally pre-stressed glass with anti-reflection technology
Back Cover	0.08 in (2.0 mm) semi-tempered glass
Frame	Anodised aluminium
Cell	6 × 26 monocrystalline Q.ANTUM solar half cells
Junction box	2.09-3.98 × 1.26-2.36 × 0.59-0.71 in (53-101 mm × 32-60 mm × 15-18 mm), Protection class IP67, with bypass diodes
Cable	4 mm² Solar cable; (+) ≥29.5 in (750 mm), (−) ≥13.8 in (350 mm)
Connector	Stäubli MC4; Stäubli MC4-Evo2; - IP68



Electrical Characteristics

POWER CLASS			590		595		600		605	
MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC[1] (POWER TOLERANCE +5 W / −0 W)				BSTC*		BSTC*		BSTC*		BSTC*
Power at MPP[1]	P_{MPP}	[W]	590	645.4	595	650.8	600	656.3	605	661.8
Short Circuit Current[1]	I_{SC}	[A]	13.74	15.04	13.77	15.07	13.80	15.10	13.82	15.13
Open Circuit Voltage[1]	V_{OC}	[V]	53.60	53.79	53.63	53.82	53.66	53.85	53.68	53.87
Current at MPP	I_{MPP}	[A]	13.12	14.36	13.17	14.41	13.22	14.46	13.27	14.52
Voltage at MPP	V_{MPP}	[V]	44.96	44.95	45.18	45.17	45.39	45.38	45.60	45.59
Efficiency[1]	η	[%]	≥21.1		≥21.3		≥21.5		≥21.7	

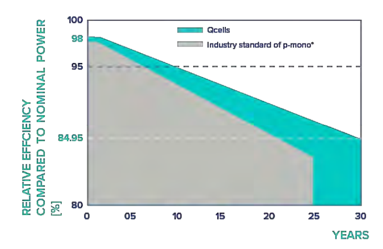
Bifaciality of P_{MPP} and I_{SC} 70% ±5% • Bifaciality given for rear side irradiation on top of STC (front side) • According to IEC 60904-1-2

[1]Measurement tolerances P_{MPP} ±3%; I_{SC}, V_{OC} ±5% at STC: 1000 W/m²; *at BSTC: 1000 W/m² + φ × 135 W/m², φ = 70%, 25±2 °C, AM 1.5 according to IEC 60904-3

MINIMUM PERFORMANCE AT NORMAL OPERATING CONDITIONS, NMOT[2]			590	595	600	605
Power at MPP	P_{MPP}	[W]	444.2	448.0	451.8	455.5
Short Circuit Current	I_{SC}	[A]	11.07	11.09	11.11	11.13
Open Circuit Voltage	V_{OC}	[V]	50.69	50.72	50.75	50.77
Current at MPP	I_{MPP}	[A]	10.34	10.38	10.42	10.47
Voltage at MPP	V_{MPP}	[V]	42.97	43.15	43.34	43.52

[1]Measurement tolerances P_{MPP} ±3%; I_{SC}; V_{OC} ±5% at STC: 1000 W/m², 25±2 °C, AM 1.5 according to IEC 60904-3 • [2]800 W/m², NMOT, spectrum AM 1.5

Qcells PERFORMANCE WARRANTY

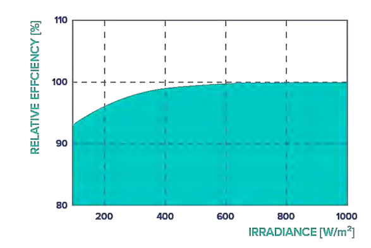


At least 98% of nominal power during first year. Thereafter max. 0.45% degradation per year. At least 93.95% of nominal power up to 10 years. At least 84.95% of nominal power up to 30 years.

All data within measurement tolerances. Full warranties in accordance with the warranty terms of the Qcells sales organisation of your respective country.

*Standard terms of guarantee for the 5 PV companies with the highest production capacity in 2021 (February 2021)

PERFORMANCE AT LOW IRRADIANCE



Typical module performance under low irradiance conditions in comparison to STC conditions (25 °C, 1000 W/m²).

TEMPERATURE COEFFICIENTS

Temperature Coefficient of I_{SC}	α	[%/K]	+0.04	Temperature Coefficient of V_{OC}	β	[%/K]	−0.27
Temperature Coefficient of P_{MPP}	γ	[%/K]	−0.34	Nominal Module Operating Temperature	NMOT	[°F]	108±5.4 (42±3 °C)

Properties for System Design

Maximum System Voltage	V_{SYS}	[V]	1500	PV module classification	Class II
Maximum Series Fuse Rating		[A DC]	30	Fire Rating based on ANSI / UL 61730	TYPE 29[4]
Max. Push Load[3], Test/Design		[lbs/ft²]	113 (5400 Pa) / 75 (3600 Pa)	Permitted Module Temperature on Continuous Duty	−40 °F up to +185 °F (−40 °C up to +85 °C)
Max. Pull Load[3], Test/Design		[lbs/ft²]	78 (3750 Pa) / 52 (2500 Pa)		

[3] See Installation Manual for instructions

[4] New Type is similar to Type 3 but with metallic frame

Qualifications and Certificates

UL61730-1 & UL61730-2, CE-compliant, IEC 61215:2016, IEC 61730:2016, U.S. Patent No. 9,893,215 (solar cells)

TÜVRheinland C US; CE; TÜVRheinland CERTIFIED www.tuv.com ID 1111220277

Find product recycling details at QR code above

* Contact your Qcells Sales Representative for details regarding the module's eligibility to be Buy American Act (BAA) compliant.

Qcells pursues minimizing paper output in consideration of the global environment.

Note: Installation instructions must be followed. Contact our technical service for further information on approved installation of this product.
Hanwha Q CELLS America Inc. 400 Spectrum Center Drive, Suite 1400, Irvine, CA 92618, USA | TEL +1 949 748 59 96 | EMAIL hqc-inquiry@qcells.com | WEB www.qcells.com

Qcells

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Q.PEAK DUO XL-G11S SERIES

Qcells

590 - 605 Wp | 156 Cells
21.7% Maximum Module Efficiency

MODEL Q.PEAK DUO XL-G11S.3/BFG

Bifacial energy yield gain of up to 21%
Bifacial Q.ANTUM solar cells make efficient use of light shining on the module rear-side for radically improved LCOE.

Low electricity generation costs
Q.ANTUM DUO technology with optimized module layout to boost module power and improve LCOE.

A reliable investment
Double glass module design enables extended lifetime with 12-year product warranty and improved 30-year performance warranty[1].

Enduring high performance
Long-term yield security with Anti LID and Anti PID Technology[2], Hot-Spot Protect.

Frame for versatile mounting options
High-tech aluminum alloy frame protects from damage, enables use of a wide range of mounting structures and is certified regarding IEC for high snow (5400 Pa) and wind loads (3750 Pa)[3].

Innovative all-weather technology
Optimal yields, whatever the weather with excellent low-light and temperature behavior.

[1] See data sheet on rear for further information.
[2] APT test conditions according to IEC/TS 62804-1:2015 method B (−1500 V, 168 h) including post treatment according to IEC 61215-1-1 Ed. 2.0 (CD)
[3] See Installation Manual for instructions

The ideal solution for:
Ground-mounted solar power plants

Specifications subject to technical changes © Qcells Q.PEAK_DUO_XL-G11S-BFG_series_590-605_2024-01_Rev04_NA

SMA

/ STP 33-US-41 / STP 50-US-41 / STP 62-US-41

Sunny Tripower CORE1-US

33 / 50 / 62

It stands on its own

/ **New! Complies with IEEE 1547-2018 and UL 1741 SB standards**

SMA Smart Connected · SMA ShadeFix · c UL us

Fully integrated
- No additional racking required for rooftop installation
- Integrated DC and AC disconnects and overvoltage protection
- 12 direct string inputs for reduced labor and material costs
- Up to 60% faster commercial PV system installation

Increased power, flexibility
- Six MPP trackers for flexible stringing and maximum power production
- ShadeFix, SMA's proprietary shade management solution, optimizes at the string level
- Intelligent string monitoring to pinpoint array performance issues

Enhanced safety, reliability
- Integrated SunSpec PLC signal for module-level rapid shutdown
- DC AFCI arc-fault protection certified to Standard UL 1699B Ed. 1

Smart monitoring, control, service
- I-V curve diagnostic function to visualize and document PV string electrical characteristics
- Increased ROI with SMA ennexOS cross sector energy management platform
- SMA Smart Connected proactive O&M solution reduces time spent diagnosing and servicing in the field

The Sunny Tripower CORE1 is the world's first free-standing PV inverter for commercial rooftops, carports, ground mount and repowering legacy solar projects.

From distribution to construction to operation, the Sunny Tripower CORE1 enables logistical, material, labor and service cost reductions, and is the most versatile, cost-effective commercial solution available. Integrated SunSpec PLC for rapid shutdown and enhanced DC AFCI arc-fault protection ensure compliance to the latest safety codes and standards. With Sunny Tripower CORE1 and SMA's ennexOS cross sector energy management platform, system integrators can deliver comprehensive commercial energy solutions for increased ROI.

SunSpec Modbus for 1547 CERTIFIED · Rapid Shutdown CERTIFIED · UL 3741 LISTED PV Hazard Control

Technical data	Sunny Tripower CORE1 33-US	Sunny Tripower CORE1 50-US	Sunny Tripower CORE1 62-US
Input (DC)			
Maximum array power	50000 Wp STC	75000 Wp STC	93750 Wp STC
Maximum system voltage		1000 V	
Rated MPP voltage range	330 V ... 800 V	500 V ... 800 V	550 V ... 800 V
MPPT operating voltage range		150 V ... 1000 V	
Minimum DC voltage / start voltage		150 V / 188 V	
MPP trackers / strings per MPP input		6 / 2	
Maximum usable operating input current / per MPP tracker		120 A / 20 A	
Maximum short circuit current per MPPT / per string input		32 A / 30 A	
Output (AC)			
AC nominal power	33300 W	50000 W	62500 W
Maximum apparent power	33300 VA	53000 VA	66000 VA
Output phases / line connections		3 / 3-(N)-PE	
Nominal AC voltage		480 V / 277 V WYE	
AC voltage range		244 V ... 305 V	
Maximum output current	40 A	64 A	80 A
Rated grid frequency		60 Hz	
Grid frequency / range		50 Hz, 60 Hz / -6 Hz ... +6Hz	
Power factor at rated power / adjustable displacement		1 / 0.0 leading ... 0.0 lagging	
Harmonics THD		<3%	
Efficiency			
CEC efficiency	97.5%	97.5%	97.5%
Protection and safety features			
Load rated DC disconnect		●	
Load rated AC disconnect		●	
Ground fault monitoring: Riso / Differential current		● / ●	
DC AFCI arc-fault protection		●	
SunSpec PLC signal for rapid shutdown		●	
DC reverse polarity protection		●	
AC short circuit protection		●	
DC surge protection: Type 2 / Type 1+2		○ / ○	
AC surge protection: Type 2 / Type 1+2		○ / ○	
Protection class / overvoltage category (as per UL 840)		I / IV	
General data			
Device dimensions (W / H / D)		621 mm / 733 mm / 569 mm (24.4 in x 28.8 in x 22.4 in)	
Device weight		84 kg (185 lbs)	
Operating temperature range		-25 °C ... +60 °C (-13 °F ... +140 °F)	
Storage temperature range		-40 °C ... +70 °C (-40 °F ... +158 °F)	
Audible noise emissions (full power @ 1m and 25 °C)		65 dB (A)	
Topology		Transformerless	
Cooling concept		OptiCool (forced convection, variable speed fans)	
Enclosure protection rating		Type 4X, 3SX (as per UL 50E)	
Corrosivity classification according to IEC 61701		C3*	
Maximum permissible relative humidity (non-condensing)		100%	
Additional information			
Mounting		Free-standing with included mounting feet	
DC connection		Amphenol UTX PV or H4Plus connectors	
AC connection		Screw terminals - 4 AWG to 4/0 AWG CU/AL	
LED indicators (Status / Fault / Communication)		●	
Network interfaces: Ethernet / WLAN / RS485		● (2 ports) / ▲ / ○	
Data protocols: SMA Modbus / SunSpec IEEE 1547 Modbus / Webconnect		● / ● / ●	
ShadeFix technology for string level optimization		●	
Intelligent string performance monitoring		●	
I-V curve diagnostic function		●	
Integrated Plant Control / Q on Demand 24/7		● / ●	
SMA Smart Connected (proactive monitoring and service support)		●	
Certifications			
Certifications and approvals		UL 1741, UL 1699B Ed. 1, UL 1998, CSA 22.2 107-1, PV Rapid Shutdown System Equipment, UL 3741	
FCC compliance		FCC Part 15 Class A	
Grid interconnection standards		IEEE 1547-2018, UL 1741 SA/SB - CA Rule 21, HECO SRD V2.0	
Advanced grid support capabilities		L/HFRT, L/HVRT, Volt-VAr, Volt-Watt, Frequency-Watt, Ramp Rate Control, Fixed Power Factor	
Warranty			
Standard		10 years	
Optional extensions		15 / 20 years	
Type designation	STP 33-US-41	STP 50-US-41	STP 62-US-41

○ Optional features ● Standard features – Not available ▲ Subject to availability Data at nominal conditions - status: 08/2023 * ≥ 2 km from the coast

Accessories

SMA Data Manager M EDMM-US-10 · SMA Sensor Module MD.SEN-US-40 · Universal Mounting System UMS_KIT-10 · AC Surge Protection Module Kit AC_SPD_KIT1-10, AC_SPD_KIT2_T1T2; DC Surge Protection Module Kit DC_SPD_KIT4-10, DC_SPD_KIT5_T1T2

Toll Free +1 888 4 SMA USA
www.SMA-America.com

SMA America, LLC

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MARK	DATE	DESCRIPTION	BY
A	02/27/25	PRELIMINARY CONCEPTUAL DRAWING	BEP

RANCHVIEW COUNTY WATER DIST.
EQUIPMENT DATA SHEETS
7788-7784 COUNTY RD 229
RANCHVIEW COUNTY, HELENA, MT 59602

PROJ:	194-0117-0117
DESN:	BEP
DRWN:	BEP
CHKD:	MLC

E-1001

Bar Measures 1 inch, otherwise drawing not to scale

RANCHVIEW COUNTY WATER DISTRICT - SOLAR PLANT CONCEPTUAL DESIGN:

SCENARIO #3 - FIXED-TILT PV RACKING WITH BACK-UP ENERGY STORAGE SYSTEM

1 GENERAL ARRANGEMENT AND LAYOUT PLAN
SCALE: 1" = 100'

0 100' 200'

GENERAL NOTES:

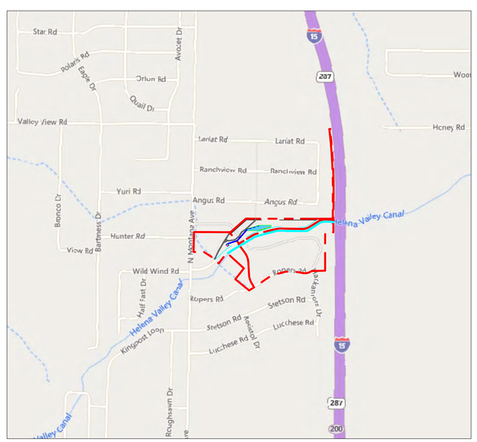
1. THIS IS A CONCEPTUAL LAYOUT FOR ELECTRICAL DESIGN, SEE THE RACKING MANUFACTURER LAYOUT AND SHOP DRAWINGS FOR MORE DETAIL ON RACKING STRUCTURES.
2. SITE ACCESS WILL BE THROUGH EXISTING ACCESS DRIVES. SEE CIVIL DRAWINGS FOR PROPOSED SITE ACCESS ROAD DETAILS.
3. UNDERGROUND ELECTRICAL AND COMM SHALL BE INSTALLED THROUGH TRENCHING.
4. THE UNITS OF THE DIMENSIONS IN THIS CONCEPTUAL LAYOUT ARE IN FEET, DECIMAL FORMAT.

LEGEND

- INVERTER
- PV RACKING (9 MODULES)
- PARCEL BOUNDARY
- FENCE
- PV AREA
- AC TRENCH ROUTING
- CANAL
- 50' WATER SETBACK
- 20' PARCEL SETBACK
- EXISTING ACCESS ROADS
- DC TRENCH ROUTING
- BATTERY

SITE CONDITIONS	
METEO STATION	HELENA, MT, USA (WMO: 727720)
EXTREME ANNUAL LOW TEMP (°C)	-28.3
AVERAGE HIGH AMBIENT TEMP (°C)	37
TILT	15

SYSTEM SPECS	
DC CAPACITY (kW)	86.40
DC CAPACITY - BSTC (kW)	94.50
AC CAPACITY (KVA)	48
DC/AC RATIO (%)	1.80
DC/AC RATIO - BSTC (%)	1.97
MODULE MODEL	Q PEAK DUO XL-G10.3/BFG 480
TOTAL NUMBER OF MODULES	180
TOTAL NUMBER OF STRINGS	20
INVERTER MODEL	SMA SUNNY BOY SMART ENERGY-US 9.6
TOTAL NUMBER OF INVERTERS	5
BATTERY MODEL	SMA HOME STORAGE-US 18.9
BATTERY CAPACITY (kWh)	18.9
TOTAL NUMBER OF BATTERIES	5
TOTAL BATTERY CAPACITY (kWh)	94.5
TILT	15
AZIMUTH	180
RACKING	FIXED-TILT



2 VICINITY MAP
Scale: NTS

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RANCHVIEW COUNTY WATER DIST.
GENERAL ARRANGEMENT & LAYOUT PLAN
7788-7784 COUNTY RD 229
RANCHVIEW COUNTY,
HELENA, MT 59602

PROJ:	194-0117-0117
DESN:	BEP
DRWN:	BEP
CHKD:	MLC

E-101

Bar Measures 1 inch, otherwise drawing not to scale

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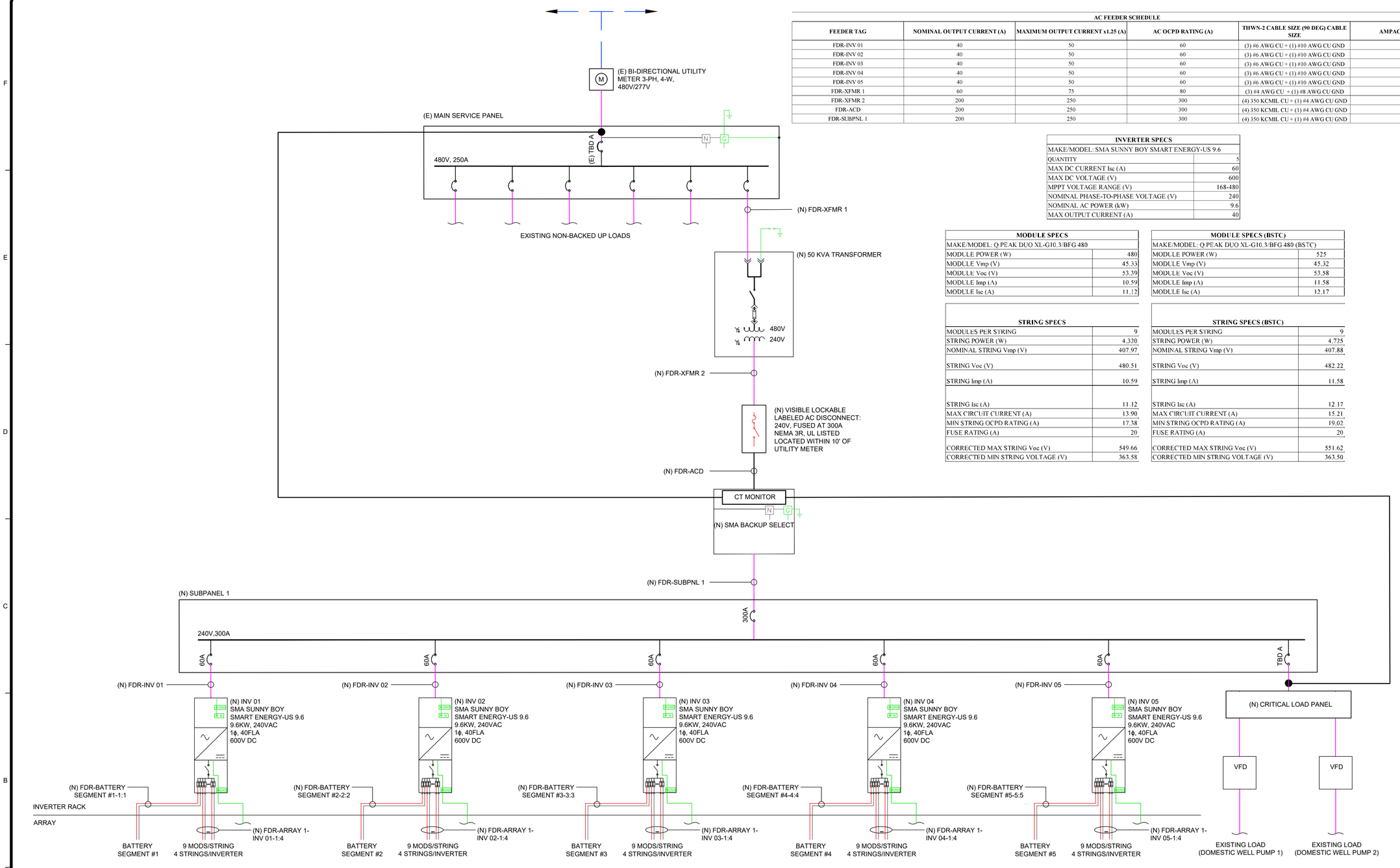

AC FEEDER SCHEDULE

FEEDER TAG	NOMINAL OUTPUT CURRENT (A)	MAXIMUM OUTPUT CURRENT x1.25 (A)	AC OCPD RATING (A)	THWN-2 CABLE SIZE (90 DEG) CABLE SIZE	AMPACITY (A) (75°)
FDR-INV 01	40	50	60	(3) #6 AWG CU + (1) #10 AWG CU GND	65
FDR-INV 02	40	50	60	(3) #6 AWG CU + (1) #10 AWG CU GND	65
FDR-INV 03	40	50	60	(3) #6 AWG CU + (1) #10 AWG CU GND	65
FDR-INV 04	40	50	60	(3) #6 AWG CU + (1) #10 AWG CU GND	65
FDR-INV 05	40	50	60	(3) #6 AWG CU + (1) #10 AWG CU GND	65
FDR-XFMR 1	60	75	80	(3) #4 AWG CU + (1) #8 AWG CU GND	85
FDR-XFMR 2	200	250	300	(4) 350 KCMIL CU + (1) #4 AWG CU GND	310
FDR-ACD	200	250	300	(4) 350 KCMIL CU + (1) #4 AWG CU GND	310
FDR-SUBPNL 1	200	250	300	(4) 350 KCMIL CU + (1) #4 AWG CU GND	310

INVERTER SPECS	
MAKE/MODEL: SMA SUNNY BOY SMART ENERGY-US 9.6	
QUANTITY	5
MAX DC CURRENT Isc (A)	60
MAX DC VOLTAGE (V)	600
MPPT VOLTAGE RANGE (V)	168-480
NOMINAL PHASE-TO-PHASE VOLTAGE (V)	240
NOMINAL AC POWER (kW)	9.6
MAX OUTPUT CURRENT (A)	40

MODULE SPECS	
MAKE/MODEL: Q.PEAK DUO XL-G10.3/BFG 480	
MODULE POWER (W)	480
MODULE Vmp (V)	45.33
MODULE Voc (V)	53.39
MODULE Imp (A)	10.59
MODULE Isc (A)	11.12

STRING SPECS	
MODULES PER STRING	9
STRING POWER (W)	4,320
NOMINAL STRING Vmp (V)	407.97
STRING Voc (V)	480.51
STRING Imp (A)	10.59
STRING Isc (A)	11.12
MAX CIRCUIT CURRENT (A)	13.90
MIN STRING OCPD RATING (A)	17.38
FUSE RATING (A)	20
CORRECTED MAX STRING Voc (V)	549.66
CORRECTED MIN STRING VOLTAGE (V)	363.58

MODULE SPECS (BSTC)	
MAKE/MODEL: Q.PEAK DUO XL-G10.3/BFG 480 (BSTC)	
MODULE POWER (W)	525
MODULE Vmp (V)	45.32
MODULE Voc (V)	53.58
MODULE Imp (A)	11.58
MODULE Isc (A)	12.17

STRING SPECS (BSTC)	
MODULES PER STRING	9
STRING POWER (W)	4,725
NOMINAL STRING Vmp (V)	407.88
STRING Voc (V)	482.22
STRING Imp (A)	11.58
STRING Isc (A)	12.17
MAX CIRCUIT CURRENT (A)	15.21
MIN STRING OCPD RATING (A)	19.02
FUSE RATING (A)	20
CORRECTED MAX STRING Voc (V)	551.62
CORRECTED MIN STRING VOLTAGE (V)	363.50

DC FEEDER SCHEDULE

FEEDER TAG	SHORT CIRCUIT CURRENT (Isc) (A)	MIN. OVERCURRENT DEVICE (FUSE) RATING (A)	No. CIRCUITS PER CONDUIT	(No.) CU CONDUCTOR	CONDUIT SIZE (PVC SCH. 80)	AMPACITY DERATING FACTOR	CALCULATED WORSE CASE CONDUCTOR AMAPACITY (PER NEC TABLE 310.15 (B)(3)(a))
FDR-ARRAY 1-INV 01-1:4	12.2	20	4	(8) #10 AWG	1-1/2"	0.7	28.0
FDR-ARRAY 1-INV 02-1:4	12.2	20	4	(8) #10 AWG	1-1/2"	0.7	28.0
FDR-ARRAY 1-INV 03-1:4	12.2	20	4	(8) #10 AWG	1-1/2"	0.7	28.0
FDR-ARRAY 1-INV 04-1:4	12.2	20	4	(8) #10 AWG	1-1/2"	0.7	28.0
FDR-ARRAY 1-INV 05-1:4	12.2	20	4	(8) #10 AWG	1-1/2"	0.7	28.0
FDR-BATTERY-SEGMENT #1-1:1	52.0	65.0	1	(2) #4 AWG	3/4"	1	70.0
FDR-BATTERY-SEGMENT #2-2:2	52.0	65.0	1	(2) #4 AWG	3/4"	1	70.0
FDR-BATTERY-SEGMENT #3-3:3	52.0	65.0	1	(2) #4 AWG	3/4"	1	70.0
FDR-BATTERY-SEGMENT #4-4:4	52.0	65.0	1	(2) #4 AWG	3/4"	1	70.0
FDR-BATTERY-SEGMENT #5-5:5	52.0	65.0	1	(2) #4 AWG	3/4"	1	70.0

1 SINGLE LINE DIAGRAM

Scale: NTS

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MARK	DATE	DESCRIPTION	BY
A	02/27/25	PRELIMINARY CONCEPTUAL DRAWING	BEP

RANCHVIEW COUNTY WATER DIST.
AC SINGLE LINE DIAGRAM
7788-7784 COUNTY RD 229
RANCHVIEW COUNTY, HELENA, MT 59602

PROJ:	194-0117-011
DESN:	BEP
DRWN:	BEP
CHKD:	MLC

E-201

Bar Measures 1 inch, otherwise drawing not to scale

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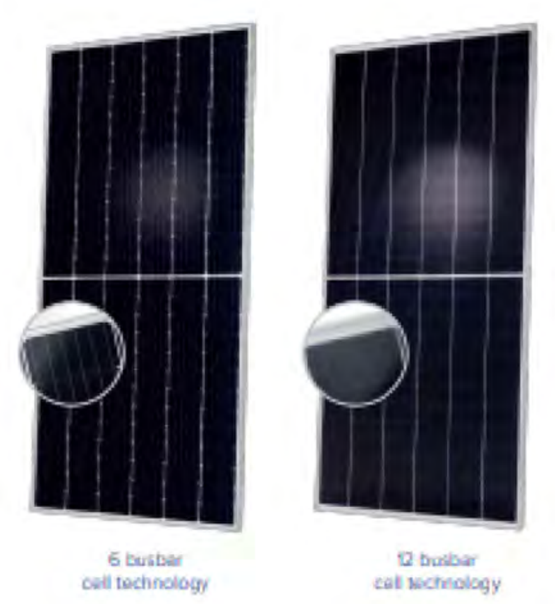
Q.PEAK DUO XL-G10 SERIES

qcells

475-490 Wp | 156 Cells
21.2 % Maximum Module Efficiency

MODEL Q.PEAK DUO XL-10.3/BFG



Bifacial energy yield gain of up to 20 %
Bifacial Q.ANTUM solar cells with zero gap cell layout make efficient use of light shining on the module rear-side for radically improved LCOE.

Low electricity generation costs
Q.ANTUM DUO Z combines cutting edge cell separation and innovative wiring with Q.ANTUM Technology for higher yield per surface area, lower BOS costs, higher power classes, and an efficiency rate of up to 21.2%.

A reliable investment
Double glass module design enables extended lifetime with 12-year product warranty and improved 30-year performance warranty[1].

Enduring high performance
Long-term yield security with Anti LeTID Technology, Anti PID Technology[2], Hot-Spot Protect.

Frame for versatile mounting options
High-tech aluminum alloy frame protects from damage, enables use of a wide range of mounting structures and is certified regarding IEC for high snow (5400 Pa) and wind loads (2400 Pa).

Innovative all-weather technology
Optimal yields, whatever the weather with excellent low-light and temperature behavior.

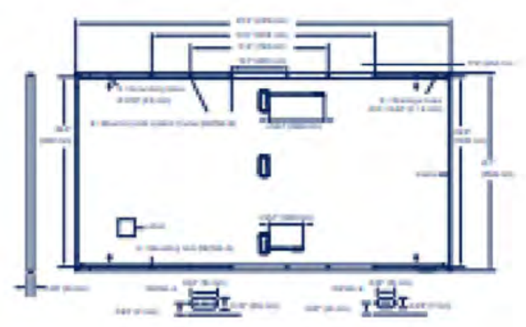
[1] See data sheet on rear for further information.
[2] APT test conditions according to IEC/TS 62804-1:2015 method B (-1500 V, 168 h) including post treatment according to IEC 61215-1-1 Ed. 2.0 (CD)

The ideal solution for:
Ground mounted solar panels

Q.PEAK DUO XL-G10 SERIES

Mechanical Specification

Format	87.2 in × 41.1 in × 1.38 in (including frame) (2216 mm × 1045 mm × 35 mm)
Weight	64.2 lbs (29.1 kg)
Front Cover	0.08 in (2.0 mm) thermally pre-stressed glass with anti-reflection technology
Back Cover	0.08 in (2.0 mm) semi-tempered glass
Frame	Anodized aluminum
Cell	6 × 26 monocrystalline Q.ANTUM solar half cells
Junction box	2.09-3.98 in × 1.26-2.36 in × 0.59-0.71 in (53-101 mm × 32-60 mm × 15-18 mm), IP67, with bypass diodes
Cable	4 mm² Solar cable; (+) ≥ 55.1 in (1400 mm), (-) ≥ 55.1 in (1400 mm)
Connector	Stäubli MC4, Stäubli MC4-Evo2, Hanwha Q CELLS HQC4, IP68



Electrical Characteristics

MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC[1] (POWER TOLERANCE +5 W / -0 W)

POWER CLASS			475	BSTC*	480	BSTC*	485	BSTC*	490	BSTC*
Power at MPP[1]	P_{MPP}	[W]	475	519.6	480	525.0	485	530.5	490	536.0
Short Circuit Current[1]	I_{SC}	[A]	11.08	12.12	11.12	12.17	11.16	12.21	11.20	12.26
Open Circuit Voltage[1]	V_{OC}	[V]	53.15	53.34	53.39	53.58	53.63	53.82	53.86	54.06
Current at MPP	I_{MPP}	[A]	10.55	11.54	10.59	11.58	10.63	11.63	10.67	11.67
Voltage at MPP	V_{MPP}	[V]	45.03	45.02	45.33	45.32	45.63	45.62	45.93	45.92
Efficiency[1]	η	[%]	≥20.5		≥20.7		≥20.9		≥21.2	

Bifaciality of P_{MPP} and I_{SC} 70% ±5% • Bifaciality given for rear side irradiation on top of STC (front side) • According to IEC 60904-1-2

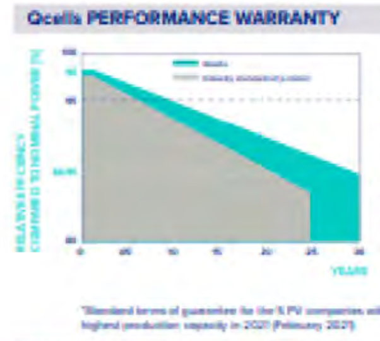
[1]Measurement tolerances P_{MPP} ±3%; I_{SC}, V_{OC} ±5% at STC: 1000 W/m²; *at BSTC: 1000 W/m² + φ × 135 W/m², φ = 70% ±5%, 25±2 °C, AM 1.5 according to IEC 60904-3

MINIMUM PERFORMANCE AT NORMAL OPERATING CONDITIONS, NMOT[2]

			475	480	485	490
Power at MPP	P_{MPP}	[W]	357.6	361.4	365.1	368.9
Short Circuit Current	I_{SC}	[A]	8.92	8.96	8.99	9.02
Open Circuit Voltage	V_{OC}	[V]	50.27	50.49	50.72	50.95
Current at MPP	I_{MPP}	[A]	8.30	8.34	8.37	8.40
Voltage at MPP	V_{MPP}	[V]	43.06	43.35	43.63	43.93

[2]800 W/m², NMOT, spectrum AM 1.5

Qcells PERFORMANCE WARRANTY



At least 98% of nominal power during first year. Thereafter max. 0.45% degradation per year. At least 93.95% of nominal power up to 10 years. At least 84.95% of nominal power up to 30 years.

All data within measurement tolerances. Full warranties in accordance with the warranty terms of the Qcells sales organisation of your respective country.

PERFORMANCE AT LOW IRRADIANCE

TEMPERATURE COEFFICIENTS

Temperature Coefficient of I_{SC}	α	[%/K]	+0.04	Temperature Coefficient of V_{OC}	β	[%/K]	-0.27
Temperature Coefficient of P_{MPP}	γ	[%/K]	-0.34	Nominal Module Operating Temperature	NMOT	[°F]	109 ± 5.4 (43 ± 3 °C)

Properties for System Design

Maximum System Voltage	V_{SYS}	[V]	1500	PV module classification	Class II
Maximum Series Fuse Rating		[A DC]	20	Fire Rating based on ANSI/UL 61730	TYPE 29[3]
Max. Design Load, Push/Pull[1]		[lbs/ft²]	75 (3600 Pa) / 33 (1600 Pa)	Permitted Module Temperature on Continuous Duty	-40 °F up to +185 °F (-40 °C up to +85 °C)
Max. Test Load, Push/Pull[1]		[lbs/ft²]	113 (5400 Pa) / 50 (2400 Pa)		

[1] See Installation Manual
[3]New Type is similar to Type 3 but with metallic frame

Qualifications and Certificates

Quality Controlled PV - TÜV Rheinland; UL 61730, CE-compliant, IEC 61215:2016, IEC 61730:2016, U.S. Patent No. 9,893,215 (solar cells)

Qcells pursues minimizing paper output in consideration of the global environment.

qcells

SMA

/ SBSE3.8-US-50 / SBSE4.8-US-50 / SBSE5.8-US-50 / SBSE7.7-US-50 / SBSE9.6-US-50 / SBSE11.5-US-50

Sunny Boy Smart Energy-US

3.8 / 4.8 / 5.8 / 7.7
9.6 / 11.5

The ideal solution for new and repowering installations

powered by ennexOS

SMA Smart Connected   SMA ShadeFix

Ultimate flexibility
- 200% DC/AC design capability
- PV and Hybrid use cases
- 3 or 4 MPPT optimizing channels

Easy installation
- Smaller and lighter, eases mounting
- 2-in-1 solution saves time, wall space and electrical upgrades
- Rapid commissioning via built-in SunSpec Certified RSD transmitter

Complete reliability
- No need for complex microinverters or optimizers
- 10-year warranty, extendable to 25
- SMA Backup Secure provides energy security with or without a battery

New, modern design
- Fresh aesthetic look, with more functional capabilities
- Curved, easy-open cover

Quick commissioning
- SMA 360° app saves installers time and money
- Scan, tap and connect multiple devices from your mobile device or tablet

For over 40 years, SMA has been the leader in solar energy and the new SMA Home Energy Solution will continue this trajectory. Installers choose SMA for reliability, performance and innovation.

At the center of the SMA Home Energy Solution is the Sunny Boy Smart Energy hybrid inverter. This groundbreaking inverter combines the functions of a PV and battery inverter into a single unit, keeping electrical upgrades to a minimum. The Sunny Boy Smart Energy features modular add-on options such as the SMA Energy Meter, Backup Secure and Backup Select*. These enhancements improve the system's performance and provide homeowners with tailored solutions to meet their specific needs.

The Sunny Boy Smart Energy is packed with new technology including an integrated system manager, SunSpec RSD transmitter, SMA ShadeFix, SMA Smart Connected and compatibility with both the SMA 360° and Energy Apps.

Trust in SMA America, your leader in residential energy - building reliable, high-performance and innovative solutions, with support you can depend on.

* Upcoming

Technical data	SBSE 3.8	SBSE 4.8	SBSE 5.8	SBSE 7.7	SBSE 9.6	SBSE 11.5
Input PV (DC)						
Max. PV array power (200% oversizing)	7680 Wp	9600 Wp	11520 Wp	15360 Wp	19200 Wp	23040 Wp
Max. DC voltage	600 V					
Rated MPP voltage range	91 V - 480 V	112 V - 480 V	136 V - 480 V	180 V - 480 V	168 V - 480 V	200 V - 480 V
Min. / Startup DC Voltage	60 V / 66 V					
Max. usable current input per MPPT	15 A					
Max. short-circuit current input per MPPT	30 A (the sum at all inputs must not exceed 60 A[2] and 90 A[3])					
Independent MPPT inputs / inputs per MPPT	3 / 1				4 / 1	
Connection of MPPT inputs in parallel	A and B*				A and B / C and D*	
Input battery (DC)						
Battery type	BYD Battery-Box Premium HVL 12.0, 16.0, 20.0, 24.0, 28.0, 32.0 (UL9540)				-	
Voltage range	90 V to 500 V					
Max. charging current / max. discharging current	30 A / 30 A					
Number of independent battery inputs	1					
Max. charging power / max. discharging power	10000 W / 4042 W	10000 W / 5053 W	10000 W / 6063 W	10000 W / 8084 W	12000 W / 10105 W	12000 W / 12000 W
Output (AC)						
Max. apparent AC power	3840 VA	4800 VA	5760 VA	7680 VA	9600 VA	11520 VA
AC Rated power (at 240 V, 60 Hz)	3840 W	4800 W	5760 W	7680 W	9600 W	11520 W
AC Rated power (at 208 V, 60 Hz)	3328 W	4160 W	4992 W	6656 W	8320 W	9984 W
AC voltage rated and range	240 V (211 V to 264 V) or 208 V (183 V to 229 V)					
AC grid frequency / range	60 Hz / 55 Hz to 66 Hz					
Max. rated output current	16 A	20 A	24 A	32 A	40 A	48 A
Breaker (overcurrent protection)	20 A	25 A	30 A	40 A	50 A	60 A
Power factor at rated power	1 / adjustable 0.8 overexcited to 0.8 underexcited					
Efficiency						
Max. efficiency	98.1%				98%	
CEC efficiency (240/208V)	96.5% / 97%	97% / 97%	97.5% / 97%		97.5%/97%	
Protective devices						
DC disconnect / DC reverse polarity protection	● / ●					
DC AFCI arc-fault protection	●					
Ground fault monitoring / Grid monitoring	● / ●					
AC short circuit current capability	●					
All-pole-sensitive residual-current monitoring unit	●					
Protection class	I					
Overvoltage category grid / battery / PV	IV / II / II					
General data						
Dimensions (W / H / D) / Weight	19.7 x 23.1 x 9.2 in / 38.6 lb				19.7 x 26.8 x 9.2 in / 48.5 lb	
Operating temperature range	−13 °F to +140 °F (−25 °C to +60 °C) with derating					
Topology / cooling method	Transformerless / Natural convection					
Environmental protection rating	Type 3R					
Equipment						
Communication protocols	Modbus (SMA, SunSpec), Speedwire / Webconnect, SMA Battery Interface					
Interfaces: WLAN / Ethernet / BAT-CAN / RS-485	● / ● / ● / ●					
2.4 GHz WLAN	●					
Ethernet ports / Number of outputs	2 / 1 (Multi function relay 30 Vdc / 1 A)					
Warranty: 10 / +5 / +10 / +15 years	● / ○ / ○ / ○					
Certificates and approvals	UL 1741 SB/SA, UL 62109-1, UL 1998, UL 1699B Ed. 1, UL9540[1], IEEE1547, FCC Part 15 (Class A & B), CAN CSA-C22.2, CA Rule 21, HECO Rule 14H, PV Rapid Shutdown System Equipment in accordance with UL1741, NEC 2020, NEC 2023 compliant					
SMA Smart Connected	●					
SMA ShadeFix (integrated shade optimization)	●					
SunSpec certified transmitter (Rapid Shutdown)	●					
Integrated System Manager						
Max number supported Inverters/ Energy Meter	5/1					
Centralized commissioning of all devices in the system	●					
SMA Backup Secure** (grid outage mode, with or without battery)						
Rated power (at 120 V, 60 Hz)	1920 W					
Max. apparent AC power	1920 VA					
Nominal AC voltage	120 V					
AC grid frequency	60 Hz					
Activation mode	Manual					
● Standard features ○ Optional features						
Type designation	SBSE3.8-US-50	SBSE4.8-US-50	SBSE5.8-US-50	SBSE7.7-US-50	SBSE9.6-US-50	SBSE11.5-US-50

* Upcoming ** SMA Backup Start module required to enable SMA Backup Secure in installations bound by NEC rapid shutdown requirements. [1] Not yet available for SBSE 9.6/11.5 [2] SBSE 3.8-7.7 [3] SBSE 9.6, 11.5

Accessories
- SMA Energy Meter EMETER-US-50
- SMA Backup Start BU-STRT-US-50
- SMA Shutdown Initiator RSI-US-50

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SMA

/ HS-BMS-20 / HS-BM-4.71-20 / HS-BU-20

preliminary

SMA Home Storage-US

Ease of installation. Long lifetime.
Seamless integration.

Future-proof electricity storage system
- Designed for intensive use, ensuring the system is ready to meet the demands of energy needs
- For immediate off-grid backup response, must be paired with SMA Backup Start module
- Up to 8,000 life cycles and 12.5-year warranty

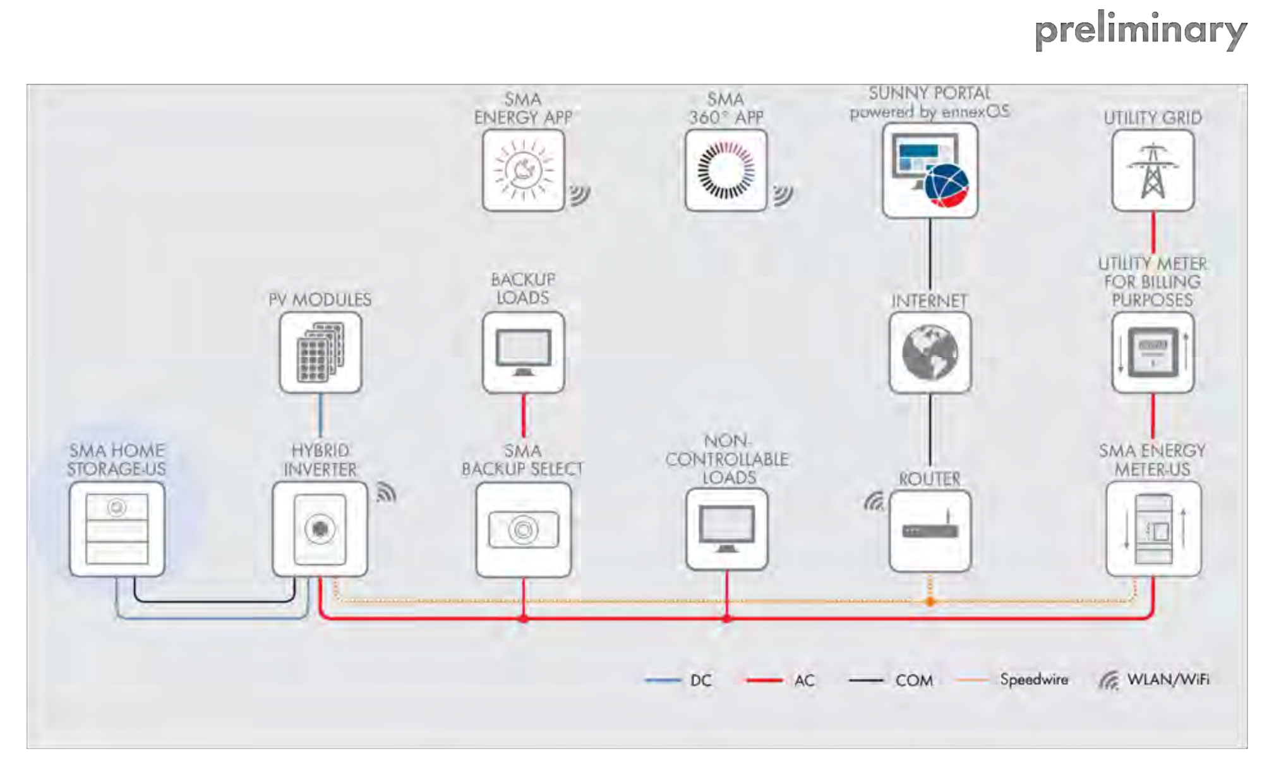
Easy installation, fast commissioning
- Plug-and-play solution and quick commissioning through the SMA 360° App
- Expandable capacity available
- Proprietary mounting simplifies servicing without the need to remove modules

Unmatched flexibility
- Compatible with Sunny Boy Smart Energy hybrid inverter
- Slim, stackable design expandable from 9.4 kWh to 18.9 kWh
- Flexible mounting options: wall-mounted or floor installation
- IP65- rated for durable indoor or outdoor use
- Parallel connection supports up to 4 battery stacks, offering a total usable capacity of up to 75.44 kWh

The complete SMA Home Storage Solution empowers homeowners to unlock the full potential of sustainable energy. By integrating SMA Home Storage, you can generate and store power all from a single source. It perfectly complements the Sunny Boy Smart Energy hybrid inverter, enabling comprehensive energy solutions for both today and tomorrow.

Rain or shine, SMA Home Storage stores solar energy efficiently, ensuring your home always has the power it needs. Designed with flexibility in mind, this system can be tailored to fit your specific energy demands and boasts a remarkable lifespan of up to 8,000 charging cycles. By choosing SMA Home Storage, you're investing in quality and security, supported by a reassuring 12.5-year warranty.

preliminary



Technical data	SMA Home Storage-US 9.4	SMA Home Storage-US 14.2	SMA Home Storage-US 18.9
Electrical data			
Usable energy capacity[1)]	9.43 kWh	14.15 kWh	18.86 kWh
Nominal voltage DC	192 V	288 V	384 V
Operating voltage range DC	168 V to 216 V	252 V to 324 V	336 V to 432 V
Charge / discharge power	9.04 kW[3)]	13.57 kW[3)]	18.09 kW[3)]
Peak charge / discharge power (at 25°C, 5s)	10.68 kW[3)]	16.02 kW[3)]	21.36 kW[3)]
Continuous charging / discharging current	up to 52 A[3)]		
General data			
Dimensions[2)] (W/H/D)	37.4 x 7.5 x 43.3 inch / 950 x 190 x 1100 mm	37.4 x 7.5 x 56.9 inch / 950 x 190 x 1445 mm	37.4 x 7.5 x 70.5 inch / 950 mm x 190 x 1790 mm
Wall mounting system weight	306 lb/ 139 kg	430 lb/ 195 kg	555 lb/ 252 kg
Floor standing system weight	319 lb/ 145 kg	444 lb/ 201 kg	568 lb/ 258 kg
Operating temperature discharging / charging	14°F to 122°F (-10°C to 50°C) / 32°F to 122°F (0°C to 50°C)		
Self-consumption (at night) per module	BMS: 10 W / Battery Module (each): 1.5 W		
Degree of protection (according to IEC 60529)	IP 65 / Type 3R		
Max. permissible value for relative humidity (non-condensing)	5% to 95%		
Cell technology	Lithium Iron Phosphate (LiFePO4) / LFP		
Efficiency			
Battery efficiency	up to 95.8% @ 0.2°C charge / discharge 25°C / 77°F with 4 battery modules		
Protective devices			
Input-side disconnection point	●		
DC reverse polarity protection	●		
Overvoltage category battery / inverter	II / II		
Equipment			
DC connection	Amphenol (H4PFM8DM)		
Interface / Communication	RJ45		
Communication protocols	SMA battery interface		
Warranty	12.5 years		
Certificates and permits (more available upon request)	UL 9540 AC System certification, UL 9540A, FCC Part 15 Class B, ICES 003 Class B, Type 4x rating, IEC 60529, IEC 62262, UN38.3, AC156, IEEE693		
Compatible SMA products	Sunny Boy Smart Energy-US (SBSE-US-50)		
Accessories	Base unit for floor mounting (HS-BU-20)		
Type designation	1 x HS-BMS-20 2 x HS-BM-4.71-20	1 x HS-BMS-20 3 x HS-BM-4.71-20	1 x HS-BMS-20 4 x HS-BM-4.71-20

● Standard equipment Data at nominal conditions Last revised: 09/2024
1) Under specific test conditions (100% DOD, 0.2 C charge and discharge at +25 °C).
2) Dimensions and weight without mounting devices. Dimension including wall mounting device and base unit can be found in the product manual.
3) Operation value depending on the connected inverter (see technical data of the inverter).

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DRAFT

MARK	DATE	DESCRIPTION	BY
A	02/27/25	PRELIMINARY CONCEPTUAL DRAWING	BEP

RANCHVIEW COUNTY WATER DIST.
EQUIPMENT DATA SHEETS
7788-7784 COUNTY RD 229
RANCHVIEW COUNTY,
HELENA, MT 59602

PROJ:	194-0117-0117
DESN:	BEP
DRWN:	BEP
CHKD:	MLC

E-1001

Bar Measures 1 inch, otherwise drawing not to scale

3/18/2025 5:21:46 PM - C:\USERS\ALAN.TENNERY\DESKTOP\RCWD_UPDATE\E-1001 EQUIPMENT DATASHEETS - STANDARD\E-1001 EQUIPMENT DATASHEETS.DWG - TENNERY, ALAN

Performance, Cost, Operating, Tax & Financing Inputs

Check	Selected Technology		Photovoltaic	Notes

Project Size and Performance	Units	Input Value	
Generator Nameplate Capacity	kW dc	66.1	?
Net Capacity Factor: Select "State Average" or "Custom" →		State Average	?
Net C.F.: If "State Average" method, then select state →		MT	?
Net Capacity Factor, Yr 1		15.0%	?
Production, Yr 1	kWh	112,900	?
Annual Production Degradation	%	0.5%	?
Project Useful Life	years	25	?

Capital Costs	Units	Input Value	
Select Cost Level of Detail		Intermediate	?
Generation Equipment	$	$140,132	?
Balance of Plant	$	$0	?
Interconnection	$	$0	?
Development Costs & Fee	$	$30,000	?
Reserves & Financing Costs	$	$1,939	?
Total Installed Cost (before rebates/grants, if any)	$	$172,071	?
Total Installed Cost (before rebates/grants, if any)	$/Watt dc	$2.12	?

Operations & Maintenance	Units	Input Value	
Select Cost Level of Detail		Intermediate	?
Fixed O&M Expense, Yr 1	$/kW-yr dc	$17.21	?
Variable O&M Expense, Yr 1	¢/kWh	0.00	?
O&M Cost Inflation, initial period	%	2.5%	?
Initial Period ends last day of:	year	10	?
O&M Cost Inflation, thereafter	%	2.5%	?
Insurance, Yr 1 (% of Total Cost)	%	1.0%	?
Insurance, Yr 1 ($) (Provided for reference)	$	$1,701	?
Project Management Yr 1	$/yr	$0	?
Property Tax or PILOT, Yr 1	$/yr	$0	?
Annual Property Tax Adjustment Factor	%	0.0%	?
Land Lease	$/yr	$0	?
Royalties (% of revenue)	%	0.0%	?
Royalties, Yr 1 ($) (Provided for reference)	$	$0	?

Construction Financing	Units	Input Value	
Construction Period	months	1	?
Interest Rate (Annual)	%	0.0%	?
Interest During Construction	$	$0	?

Permanent Financing	Units	Input Value	
% Debt (% of hard costs) (mortgage-style amort.)	%	0%	?
% Equity (% hard costs) (soft costs also equity funded)	%	100%	?
Target After-Tax Equity IRR	%	8.22%	?
			?
Other Closing Costs	$	$0	?

Summary of Sources of Funding for Total Installed Cost			
Senior Debt (funds portion of hard costs)	0%	$0	?
Equity (funds balance of hard costs + all soft costs)	19%	$31,939	?
Total Value of Grants (excl. pmt in lieu of ITC, if applicable)	81%	$140,132	?
Total Installed Cost	$	**$172,071**	?

Tax	Units	Input Value	
Is owner a taxable entity?		Yes	?
Federal Income Tax Rate	%	35.0%	?
Federal Tax Benefits used as generated or carried forward?		As Generated	?
State Income Tax Rate	%	8.5%	?
State Tax Benefits used as generated or carried forward?		As Generated	?
Effective Income Tax Rate	%	40.53%	?
Depreciation Allocation		see table ==>	?

Cost-Based Tariff Rate Structure	Units	Input Value	
Payment Duration for Cost-Based Tariff	years	25	?
% of Year-One Tariff Rate Escalated	%	0.0%	?
Cost-Based Tariff Escalation Rate	%	0.0%	?

Forecasted Market Value of Production; applies after Incentive Expiration			?

Federal Incentives	Units	Input Value	
Select Form of Federal Incentive		Neither	?
Additional Federal Grants (Other than Section 1603)	$	$0	?
Federal Grants Treated as Taxable Income?		Yes	?

State Rebates, Tax Credits and/or REC Revenue	Units	Input Value	
Select Form of State Incentive		Neither	?
Additional State Rebates/Grants	$/Watt	$2.12	?
Total $ Cap on State Rebates/Grants	$	$500,000	?
State Rebates/Grants Treated as Taxable Income?		No	?

Capital Expenditures During Operations: Inverter Replacement	Units	Input Value	
1st Equipment Replacement	year	12	?
1st Replacement Cost ($ in year replaced)	$/Watt dc	$0.150	?
2nd Equipment Replacement	year	25	?
2nd Replacement Cost ($ in year replaced)	$/Watt dc	$0.150	?

Reserves Funded from Operations	Units	Input Value	
Decommissioning Reserve			
Fund from Operations or Salvage Value?		Operations	?
Reserve Requirement	$	$0	?

Initial Funding of Reserve Accounts	Units	Input Value	
Debt Service Reserve			
# of months of Debt Service	months	6	?
Initial Debt Service Reserve	$	$0	?
O&M Reserve/Working Capital			
# of months of O&M Expense	months	6	?
Initial O&M and WC Reserve	$	$1,939	?
Interest on All Reserves	%	2.0%	?

Depreciation Allocation	*Input Values*		
Bonus Depreciation	Yes		?
% of Bonus Depreciation applied in Year 1	50%		?

Allocation of Costs	5-year MACRS	7-year MACRS	15-year MACRS	20-year MACRS	5-year SL	15-year SL	20-year SL	39-year SL	Non-Depreciable	
Generation Equipment	96.0%	0.0%	2.0%	0.0%	0.0%	0.0%	2.0%	0.0%	0.0%	?
Balance of Plant	50.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%	0.0%	?
Interconnection	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	?
Development Costs & Fee	80.0%	0.0%	0.0%	0.0%	0.0%	5.0%	5.0%	0.0%	10.0%	?
Reserves & Financing Costs	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	50.0%	?

Lookup for State Average Capacity Factor	
State List	DC Capacity factor
AK	9.0%
AL	15.1%
AR	15.1%
AZ	19.4%
CA	18.0%
CO	17.7%
CT	13.7%
DE	14.5%
FL	16.0%
GA	15.3%
HI	16.9%
IA	13.8%
ID	16.2%
IL	14.0%
IN	13.7%
KS	16.4%
KY	14.0%
LA	15.1%
MA	13.3%
MD	14.6%
ME	13.1%
MI	13.2%
MN	13.5%
MO	14.9%
MS	15.3%
MT	15.0%
NC	15.3%
ND	14.2%
NE	15.8%
NH	13.2%
NJ	14.5%
NM	19.5%
NV	18.6%
NY	13.3%
OH	13.2%
OK	16.5%
OR	14.6%
PA	13.5%
RI	13.8%
SC	15.8%
SD	14.8%
TN	14.9%
TX	16.2%
UT	17.9%
VA	14.9%
VT	12.9%
WA	13.2%
WI	13.7%
WV	13.1%
WY	17.1%

Unit Definitions

(kW) kilowatt – a standard measure of electrical capacity, equal to 1000 Watts.
(kWh) kilowatt hour – a standard measure of electrical output. A 1 kW generator operating at rated capacity for one hour will produce 1 kWh of electricity.
(DC) direct current – the unidirectional flow of electric charge
(AC) alternating current – the multidirectional flow of electric charge
($/kW-yr) – an annual expense (or revenue) based on generator capacity
($) – All CREST model values are in nominal dollars
(¢/kWh) –cents per kilowatt hour
(%) – an input with units expressed as a percentage
(years or year) – an input applicable to a specified duration or project year
($/yr) – inputs measured in dollars and applied annually
(months) –designates the number of months to which an input applies
Pass/Fail – denotes whether the two debt service coverage ratio tests have passed or failed.

Performance, Cost, Operating, Tax & Financing Inputs

Check	Selected Technology		Photovoltaic	Notes

Project Size and Performance	Units	Input Value	
Generator Nameplate Capacity	kW dc	66.1	?
Net Capacity Factor: Select "State Average" or "Custom" →		State Average	?
Net C.F.: If "State Average" method, then select state →		MT	?
Net Capacity Factor, Yr 1		15.0%	?
Production, Yr 1	kWh	88,217	?
Annual Production Degradation	%	0.5%	?
Project Useful Life	years	25	?

Capital Costs	Units	Input Value	
Select Cost Level of Detail		Intermediate	?
Generation Equipment	$	$128,234	?
Balance of Plant	$	$0	?
Interconnection	$	$0	?
Development Costs & Fee	$	$30,000	?
Reserves & Financing Costs	$	$1,858	?
Total Installed Cost (before rebates/grants, if any)	$	$160,092	?
Total Installed Cost (before rebates/grants, if any)	$/Watt dc	$1.94	?

Operations & Maintenance	Units	Input Value	
Select Cost Level of Detail		Intermediate	?
Fixed O&M Expense, Yr 1	$/kW-yr dc	$17.21	?
Variable O&M Expense, Yr 1	¢/kWh	0.00	?
O&M Cost Inflation, initial period	%	2.5%	?
Initial Period ends last day of:	year	10	?
O&M Cost Inflation, thereafter	%	2.5%	?
Insurance, Yr 1 (% of Total Cost)	%	1.0%	?
Insurance, Yr 1 ($) (Provided for reference)	$	$1,582	?
Project Management Yr 1	$/yr	$0	?
Property Tax or PILOT, Yr 1	$/yr	$0	?
Annual Property Tax Adjustment Factor	%	0.0%	?
Land Lease	$/yr	$0	?
Royalties (% of revenue)	%	0.0%	?
Royalties, Yr 1 ($) (Provided for reference)	$	$0	?

Construction Financing	Units	Input Value	
Construction Period	months	1	?
Interest Rate (Annual)	%	0.0%	?
Interest During Construction	$	$0	?

Permanent Financing	Units	Input Value	
% Debt (% of hard costs) (mortgage-style amort.)	%	0%	?
% Equity (% hard costs) (soft costs also equity funded)	%	100%	?
Target After-Tax Equity IRR	%	8.22%	?
			?
Other Closing Costs	$	$0	?

Summary of Sources of Funding for Total Installed Cost			
Senior Debt (funds portion of hard costs)	0%	$0	?
Equity (funds balance of hard costs + all soft costs)	20%	$31,858	?
Total Value of Grants (excl. pmt in lieu of ITC, if applicable)	80%	$128,234	?
Total Installed Cost	$	**$160,092**	?

Tax	Units	Input Value	
Is owner a taxable entity?		Yes	?
Federal Income Tax Rate	%	35.0%	?
Federal Tax Benefits used as generated or carried forward?		As Generated	?
State Income Tax Rate	%	8.5%	?
State Tax Benefits used as generated or carried forward?		As Generated	?
Effective Income Tax Rate	%	40.53%	?
Depreciation Allocation		see table ==>	?

Check		Notes

Cost-Based Tariff Rate Structure	Units	Input Value	
Payment Duration for Cost-Based Tariff	years	25	?
% of Year-One Tariff Rate Escalated	%	0.0%	?
Cost-Based Tariff Escalation Rate	%	0.0%	?

Forecasted Market Value of Production; applies after Incentive Expiration			?

Federal Incentives	Units	Input Value	
Select Form of Federal Incentive		Neither	?
Additional Federal Grants (Other than Section 1603)	$	$0	?
Federal Grants Treated as Taxable Income?		Yes	?

State Rebates, Tax Credits and/or REC Revenue	Units	Input Value	
Select Form of State Incentive		Neither	?
Additional State Rebates/Grants	$/Watt	$1.94	?
Total $ Cap on State Rebates/Grants	$	$500,000	?
State Rebates/Grants Treated as Taxable Income?		No	?

Capital Expenditures During Operations: Inverter Replacement	Units	Input Value	
1st Equipment Replacement	year	12	?
1st Replacement Cost ($ in year replaced)	$/Watt dc	$0.150	?
2nd Equipment Replacement	year	25	?
2nd Replacement Cost ($ in year replaced)	$/Watt dc	$0.150	?

Reserves Funded from Operations	Units	Input Value	
Decommissioning Reserve			
Fund from Operations or Salvage Value?		Operations	?
Reserve Requirement	$	$0	?

Initial Funding of Reserve Accounts	Units	Input Value	
Debt Service Reserve			
# of months of Debt Service	months	6	?
Initial Debt Service Reserve	$	$0	?
O&M Reserve/Working Capital			
# of months of O&M Expense	months	6	?
Initial O&M and WC Reserve	$	$1,858	?
Interest on All Reserves	%	2.0%	?

Depreciation Allocation	*Input Values*		
Bonus Depreciation	Yes		?
% of Bonus Depreciation applied in Year 1	50%		?

Allocation of Costs	5-year MACRS	7-year MACRS	15-year MACRS	20-year MACRS	5-year SL	15-year SL	20-year SL	39-year SL	Non-Depreciable	
Generation Equipment	96.0%	0.0%	2.0%	0.0%	0.0%	0.0%	2.0%	0.0%	0.0%	?
Balance of Plant	50.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%	0.0%	?
Interconnection	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	?
Development Costs & Fee	80.0%	0.0%	0.0%	0.0%	0.0%	5.0%	5.0%	0.0%	10.0%	?
Reserves & Financing Costs	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	50.0%	?

Lookup for State Average Capacity Factor	
State List	DC Capacity factor
AK	9.0%
AL	15.1%
AR	15.1%
AZ	19.4%
CA	18.0%
CO	17.7%
CT	13.7%
DE	14.5%
FL	16.0%
GA	15.3%
HI	16.9%
IA	13.8%
ID	16.2%
IL	14.0%
IN	13.7%
KS	16.4%
KY	14.0%
LA	15.1%
MA	13.3%
MD	14.6%
ME	13.1%
MI	13.2%
MN	13.5%
MO	14.9%
MS	15.3%
MT	15.0%
NC	15.3%
ND	14.2%
NE	15.8%
NH	13.2%
NJ	14.5%
NM	19.5%
NV	18.6%
NY	13.3%
OH	13.2%
OK	16.5%
OR	14.6%
PA	13.5%
RI	13.8%
SC	15.8%
SD	14.8%
TN	14.9%
TX	16.2%
UT	17.9%
VA	14.9%
VT	12.9%
WA	13.2%
WI	13.7%
WV	13.1%
WY	17.1%

Unit Definitions

(kW) kilowatt – a standard measure of electrical capacity, equal to 1000 Watts.
(kWh) kilowatt hour – a standard measure of electrical output. A 1 kW generator operating at rated capacity for one hour will produce 1 kWh of electricity.
(DC) direct current – the unidirectional flow of electric charge
(AC) alternating current – the multidirectional flow of electric charge
($/kW-yr) – an annual expense (or revenue) based on generator capacity
($) – All CREST model values are in nominal dollars
(¢/kWh) –cents per kilowatt hour
(%) – an input with units expressed as a percentage
(years or year) – an input applicable to a specified duration or project year
($/yr) – inputs measured in dollars and applied annually
(months) –designates the number of months to which an input applies
Pass/Fail – denotes whether the two debt service coverage ratio tests have passed or failed.

Performance, Cost, Operating, Tax & Financing Inputs

Check	Selected Technology		Photovoltaic	Notes

Project Size and Performance	Units	Input Value	
Generator Nameplate Capacity	kW dc	86.4	?
Net Capacity Factor: Select "State Average" or "Custom" →		State Average	?
Net C.F.: If "State Average" method, then select state →		MT	?
Net Capacity Factor, Yr 1		15.0%	?
Production, Yr 1	kWh	88,217	?
Annual Production Degradation	%	0.5%	?
Project Useful Life	years	25	?

Capital Costs	Units	Input Value	
Select Cost Level of Detail		Intermediate	?
Generation Equipment	$	$177,148	?
Balance of Plant	$	$0	?
Interconnection	$	$0	?
Development Costs & Fee	$	$30,000	?
Reserves & Financing Costs	$	$2,431	?
Total Installed Cost (before rebates/grants, if any)	$	$209,579	?
Total Installed Cost (before rebates/grants, if any)	$/Watt dc	$2.68	?

Operations & Maintenance	Units	Input Value	
Select Cost Level of Detail		Intermediate	?
Fixed O&M Expense, Yr 1	$/kW-yr dc	$17.21	?
Variable O&M Expense, Yr 1	¢/kWh	0.00	?
O&M Cost Inflation, initial period	%	2.5%	?
Initial Period ends last day of:	year	10	?
O&M Cost Inflation, thereafter	%	2.5%	?
Insurance, Yr 1 (% of Total Cost)	%	1.0%	?
Insurance, Yr 1 ($) (Provided for reference)	$	$2,071	?
Project Management Yr 1	$/yr	$0	?
Property Tax or PILOT, Yr 1	$/yr	$0	?
Annual Property Tax Adjustment Factor	%	0.0%	?
Land Lease	$/yr	$0	?
Royalties (% of revenue)	%	0.0%	?
Royalties, Yr 1 ($) (Provided for reference)	$	$0	?

Construction Financing	Units	Input Value	
Construction Period	months	1	?
Interest Rate (Annual)	%	0.0%	?
Interest During Construction	$	$0	?

Permanent Financing	Units	Input Value	
% Debt (% of hard costs) (mortgage-style amort.)	%	0%	?
% Equity (% hard costs) (soft costs also equity funded)	%	100%	?
Target After-Tax Equity IRR	%	8.22%	?
			?
Other Closing Costs	$	$0	?

Summary of Sources of Funding for Total Installed Cost			
Senior Debt (funds portion of hard costs)	0%	$0	?
Equity (funds balance of hard costs + all soft costs)	-10%	-$21,973	?
Total Value of Grants (excl. pmt in lieu of ITC, if applicable)	110%	$231,552	?
Total Installed Cost	$	**$209,579**	?

Tax	Units	Input Value	
Is owner a taxable entity?		Yes	?
Federal Income Tax Rate	%	35.0%	?
Federal Tax Benefits used as generated or carried forward?		As Generated	?
State Income Tax Rate	%	8.5%	?
State Tax Benefits used as generated or carried forward?		As Generated	?
Effective Income Tax Rate	%	40.53%	?
Depreciation Allocation		see table ==>	?

Cost-Based Tariff Rate Structure	Units	Input Value	
Payment Duration for Cost-Based Tariff	years	25	?
% of Year-One Tariff Rate Escalated	%	0.0%	?
Cost-Based Tariff Escalation Rate	%	0.0%	?

Forecasted Market Value of Production; applies after Incentive Expiration			?

Federal Incentives	Units	Input Value	
Select Form of Federal Incentive		Neither	?
Additional Federal Grants (Other than Section 1603)	$	$0	?
Federal Grants Treated as Taxable Income?		Yes	?

State Rebates, Tax Credits and/or REC Revenue	Units	Input Value	
Select Form of State Incentive		Neither	?
Additional State Rebates/Grants	$/Watt	$2.68	?
Total $ Cap on State Rebates/Grants	$	$500,000	?
State Rebates/Grants Treated as Taxable Income?		No	?

Capital Expenditures During Operations: Inverter Replacement	Units	Input Value	
1st Equipment Replacement	year	12	?
1st Replacement Cost ($ in year replaced)	$/Watt dc	$0.150	?
2nd Equipment Replacement	year	25	?
2nd Replacement Cost ($ in year replaced)	$/Watt dc	$0.150	?

Reserves Funded from Operations	Units	Input Value	
Decommissioning Reserve			
Fund from Operations or Salvage Value?		Operations	?
Reserve Requirement	$	$0	?

Initial Funding of Reserve Accounts	Units	Input Value	
Debt Service Reserve			
# of months of Debt Service	months	6	?
Initial Debt Service Reserve	$	$0	?
O&M Reserve/Working Capital			
# of months of O&M Expense	months	6	?
Initial O&M and WC Reserve	$	$2,431	?
Interest on All Reserves	%	2.0%	?

Depreciation Allocation	Input Values		
Bonus Depreciation	Yes		?
% of Bonus Depreciation applied in Year 1	50%		?

Allocation of Costs	5-year MACRS	7-year MACRS	15-year MACRS	20-year MACRS	5-year SL	15-year SL	20-year SL	39-year SL	Non-Depreciable	
Generation Equipment	96.0%	0.0%	2.0%	0.0%	0.0%	0.0%	2.0%	0.0%	0.0%	?
Balance of Plant	50.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%	0.0%	?
Interconnection	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	?
Development Costs & Fee	80.0%	0.0%	0.0%	0.0%	0.0%	5.0%	5.0%	0.0%	10.0%	?
Reserves & Financing Costs	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	50.0%	?

Lookup for State Average Capacity Factor	
State List	DC Capacity factor
AK	9.0%
AL	15.1%
AR	15.1%
AZ	19.4%
CA	18.0%
CO	17.7%
CT	13.7%
DE	14.5%
FL	16.0%
GA	15.3%
HI	16.9%
IA	13.8%
ID	16.2%
IL	14.0%
IN	13.7%
KS	16.4%
KY	14.0%
LA	15.1%
MA	13.3%
MD	14.6%
ME	13.1%
MI	13.2%
MN	13.5%
MO	14.9%
MS	15.3%
MT	15.0%
NC	15.3%
ND	14.2%
NE	15.8%
NH	13.2%
NJ	14.5%
NM	19.5%
NV	18.6%
NY	13.3%
OH	13.2%
OK	16.5%
OR	14.6%
PA	13.5%
RI	13.8%
SC	15.8%
SD	14.8%
TN	14.9%
TX	16.2%
UT	17.9%
VA	14.9%
VT	12.9%
WA	13.2%
WI	13.7%
WV	13.1%
WY	17.1%

Unit Definitions

(kW) kilowatt – a standard measure of electrical capacity, equal to 1000 Watts.
(kWh) kilowatt hour – a standard measure of electrical output. A 1 kW generator operating at rated capacity for one hour will produce 1 kWh of electricity.
(DC) direct current – the unidirectional flow of electric charge
(AC) alternating current – the multidirectional flow of electric charge
($/kW-yr) – an annual expense (or revenue) based on generator capacity
($) – All CREST model values are in nominal dollars
(¢/kWh) –cents per kilowatt hour
(%) – an input with units expressed as a percentage
(years or year) – an input applicable to a specified duration or project year
($/yr) – inputs measured in dollars and applied annually
(months) –designates the number of months to which an input applies
Pass/Fail – denotes whether the two debt service coverage ratio tests have passed or failed.

APPENDIX E: NWE ELECTRICAL PERMIT

Form No. _____

NorthWestern® Energy

Received:

Level 1 Small Generator Facility Interconnection Request

Applicability

For interconnecting an electric Small Generator Facility with aggregate Nameplate Capacity of up to 50 kilowatts ("kW") alternating current ("AC") using certified interconnection equipment.

Electric Distribution Company: NorthWestern Energy ("NorthWestern")

Designated Contact Person: Interconnection Specialist

Address: 11 East Park
Butte, MT 59701

Telephone: 406-497-4165

E-Mail: northwesternenergynetmeter@northwestern.com

Request for Interconnection ("Request") is considered complete when all applicable information required below is provided. Additional information to evaluate the Request may be required.

Preamble and Instructions

When used in this Request, with initial capitalization, the terms specified shall have the meanings indicated or specified in the Request. This Request applies to a Small Generator Facility located on the utility Customer's premises that:

- is connected, or will be connected, to NorthWestern's Electric Distribution System,
- has an aggregate Nameplate Capacity of generation and storage components of not more than 50 kW AC,
- has storage components that store and discharge only electrical energy produced from the net metering system and do not store or discharge electrical energy received from NorthWestern's Electric Distribution System, and
- is designed to operate in parallel with the Electric Distribution System, and has equipment-labeled and publicly listed by a Nationally Recognized Testing Laboratory at the time of the Request.

For Level 1 Small Generator Facilities that include a net meter, refer to NorthWestern's Electric Tariff Rule No. 16 Electric Net Metering for applicability, terms and conditions, and additional relevant information.

The Customer installing the Small Generator Facility must be in Good Standing with NorthWestern.

An Applicant may submit this Request by hand delivery, mail, or e-mail to NorthWestern's Interconnection Department.

Processing Fee
A non-refundable processing fee of $200 must accompany this Request.

Applicant
Legal Name of Applicant (or, if a business, business's name) – Must be the NorthWestern Customer, or the owner of the premises if the Customer is a tenant.

Name: _____

Contact Person: _____

Mailing Address: _____

City: _____ State: _____ Zip: _____

Telephone (Day): _____ (Evening): _____

E-Mail: _____

Facility Location (if Different from mailing address):

_____

_____

_____

Alternate Contact Information (if different from Applicant)

Contact Name: _____

Title: _____

Address: _____

City: _____ State: _____ Zip: _____

Telephone (Day): _____ (Evening): _____

E-Mail: _____

Form No. _____

Request is for:
- ☐ New Small Generator Facility on existing electric service that will be net metered
- ☐ New Small Generator Facility on existing electric service that will **not** be net metered
- ☐ Capacity addition to existing Small Generator Facility
- ☐ New Small Generator Facility on new electric service (New Construction)

For installations at locations with existing electric service to which the proposed Small Generator Facility will interconnect, provide:

Premises Address of Existing Service: _____

_____

_____

Existing Electric Account Number: _____

Existing Electric Meter Number (located on bill - is meter that will be replaced if net meter will be installed): _____

NorthWestern Energy
Delivering a Bright Future

NorthWestern Energy Net Metering Department
Interconnection Specialist
NorthWesternEnergyNetMeter@northwestern.com

O 406-497-4165

11 E Park St
Butte, MT 59701-1711

Small Generator Facility Information – Check all that apply (Note: Net metered facilities can only be fueled by solar, wind, and/or hydropower)

Energy Source: Solar ☐ Wind ☐ Hydro ☐ Diesel ☐ Natural Gas ☐
Fuel Oil ☐ Battery ☐ Other (describe) _____

Prime Mover: Reciprocating Engine ☐ Fuel Cell ☐ Turbine ☐
Other (state type) _____ ☐ Not Applicable ☐
Generator Type: Synchronous Generator ☐ Induction Generator ☐
Inverter Based Generator ☐ Not Applicable ☐

Total Nameplate Capacity (Aggregate of all Sources): _____ (kW) _____ (kVA)
Generator Nameplate Capacity: _____ (kW) _____ (kVA) (list for each source, if multiple generating sources)
Storage Nameplate Capacity _____ (kW) _____ (kVA) _____ (kWh)
Phase: Single Phase ☐ Three Phase ☐

Estimated Small Generator Facility Installation Date: _____
Estimated Small Generator Facility In-Service Date: _____

Will the external, visible load break switch (generator disconnect switch) be located more than 10 feet from the meter? ☐ Yes ☐ No

If yes, NorthWestern's written approval, which may require a site visit, will be required. Please show the proposed location of the disconnect switch in the detailed site diagram referenced below, and include an explanation for why it is preferable for the disconnect switch to be located more than 10 feet from the meter.

List components of the Small Generator Facility electrical equipment package, the certifying entity, and standard number. Attach additional sheets as needed for the components list and attach manufacturer specification sheets for all certified or standardized equipment, including Manufacturer and Model information. See Example below.

Electrical Equipment Description	Certifying Entity (IEEE 1547, NRTL*)	Standard #
1.		
2.		
3.		
4.		
5.		

*Nationally Recognized Testing Laboratory

Enclose copy of site electrical one-line diagram showing the configuration of all Small Generator Facility equipment, current and potential circuits, and protection and control schemes if applicable. See example below. Is One-Line Diagram enclosed? ☐ Yes ☐ No

Enclose a detailed site diagram and any other documentation necessary to indicate the precise physical location of the proposed Small Generator Facility and related equipment (e.g., solar array diagram, inverter location, storage location, USGS topographic map or other diagram or documentation including solar array, inverter location, disconnect location, etc.). An example has been provided below.

If the proposed net metering system includes storage components, please provide an explanation of the charging, discharging, and operating plan for the storage device, including a one-line diagram that includes the storage device. Prior to connection of the net metering system to NorthWestern Energy's Electric Distribution System, Customer must be prepared to demonstrate that the net metering system's storage charge and discharge functions comply with Rule 16 of NorthWestern Energy's Electric Tariff.

Is Physical Location Documentation enclosed? ☐ Yes ☐ No

Include in this Request a Line Diagram, Site Map of the proposed Small Scale Generator Facility and product specification sheets. See examples A, B and C as reference.

For installations requiring a net meter, provide the information required in Exhibit A, attached.

Applicant Signature

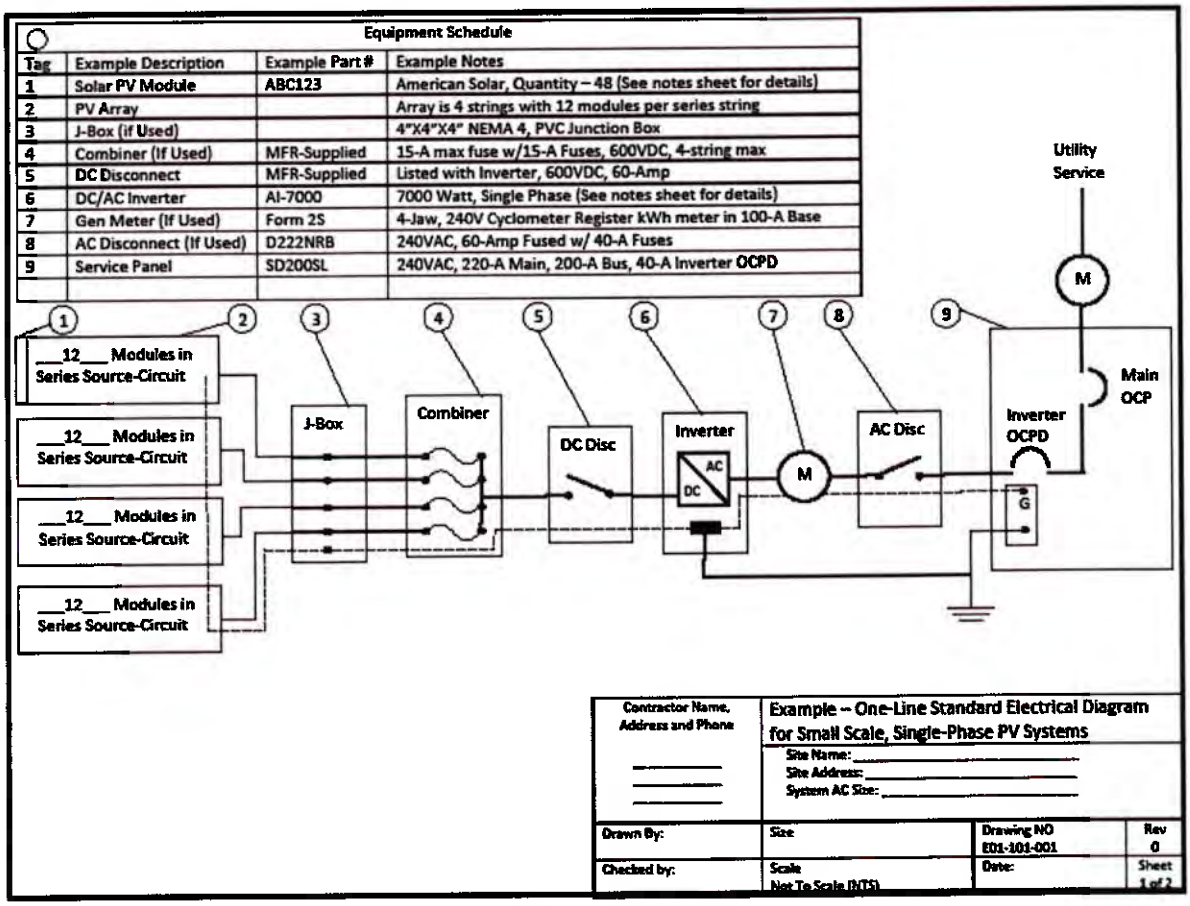
I hereby certify that, to the best of my knowledge, the information provided in this Request is true.

Print Name: _____

Signature: _____

Title (if applicable): _____ Date: _____

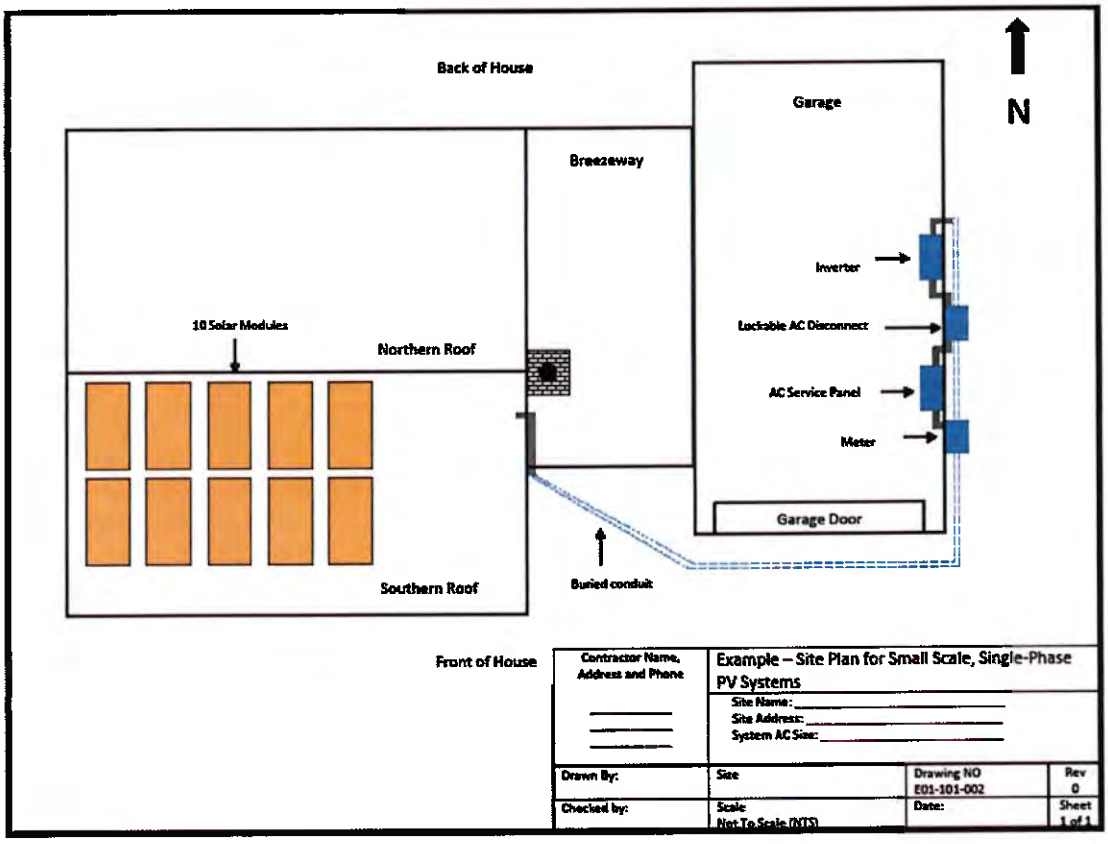
EXAMPLE 1: Line Diagram



Equipment Schedule

Tag	Example Description	Example Part #	Example Notes
1	Solar PV Module	ABC123	American Solar, Quantity – 48 (See notes sheet for details)
2	PV Array		Array is 4 strings with 12 modules per series string
3	J-Box (if Used)		4"X4"X4" NEMA 4, PVC Junction Box
4	Combiner (If Used)	MFR-Supplied	15-A max fuse w/15-A Fuses, 600VDC, 4-string max
5	DC Disconnect	MFR-Supplied	Listed with Inverter, 600VDC, 60-Amp
6	DC/AC Inverter	AI-7000	7000 Watt, Single Phase (See notes sheet for details)
7	Gen Meter (If Used)	Form 2S	4-Jaw, 240V Cyclometer Register kWh meter in 100-A Base
8	AC Disconnect (If Used)	D222NRB	240VAC, 60-Amp Fused w/ 40-A Fuses
9	Service Panel	SD200SL	240VAC, 220-A Main, 200-A Bus, 40-A Inverter OCPD

EXAMPLE 2: Site Plan



Example 3: Equipment Specification Sheets

PV Module Ratings @STC

Module Make	
Module Model	
Max Power-Point Current (I_{MP})	A
Max Power-Point Voltage (V_{MP})	V
Open-Circuit Voltage (V_{OC})	V
Short-Circuit Current (I_{SC})	A
Max Series Fuse (OCPD)	A
Max Power (P_{MAX})	W
Max Voltage (TYP 600V_{DC})	V
VOC Temp Coeff (mV/°C □ or %/°C □)	
If Coeff Supplied, Circle Units	

Inverter Ratings

Inverter Make	
Inverter Model	
Max DC Volt Rating	V
Max Power @ 40 °C	W
Nominal AC Voltage	V
Max AC Current	A
Max OCPD Rating	A

Contractor Name, Address and Phone _____ _____ _____	Example -- One-Line Standard Electrical Diagram for Small Scale, Single-Phase PV Systems Site Name: _____ Site Address: _____ System AC Size: _____		
Drawn By:	Size	Drawing NO E01-161-001	Rev 0
Checked by:	Scale Not To Scale (NTS)	Date:	Sheet 2 of 2

Exhibit A

Required Net Meter Applicant Information

Generally, Applicants utilizing a Net Meter strive to reduce their monthly total billed usage and minimize their unused excess energy balance (kilowatt-hour) at the time of the annual settle-up at the end of the selected 12-month billing period. This is very important because the excess energy balance resets to zero at that time.

In order to receive a Net Meter, please choose a settle-up month below. In accordance with normal metering practices, your applicable meter reading day during the selected settle-up month will be your annual settle-up date for the 12-month billing period. Depending on the date that the Small Generator Facility commences Interconnected operation, the first settle-up period may be more than 12 months. Tracking of excess electricity for billing purposes begins only after the Applicant is authorized for Interconnected operation of the Small Generator Facility in accordance with the Applicant's Interconnection Agreement. The Applicant should be aware that any generation from the Small Generator Facility that is exported onto NorthWestern's Electric Distribution System before a net meter installation is complete will be registered by the existing non-net meter and billed as consumption.

Settle-up Month for the 12-month Billing Period

January ☐ April ☐ July ☐ October ☐

The selection of the settle-up month for the 12-month billing period is an important decision. Applicants are encouraged to examine and understand their electrical usage patterns and renewable energy system output in order to select the settle-up month that works best. A graph of the most recent 12 months of electrical usage is shown on your monthly electric bill. It may also be helpful to consult with a renewable energy installer.

Once the original settle-up month has been selected, the Applicant could choose to change their settle-up month. NorthWestern will grant a one-time change to the settle-up month for the 12-month billing period. After the one-time change has been confirmed by NorthWestern, the Applicant's applicable meter reading day in the new settle-up month will then become the permanent settle-up date.

For Applicant:

Print Name:_____

Signature:_____

Title: (if applicable)_____

Date:_____

APPENDIX F: NWE PROJECT QUALIFICATIONS AND PROPOSAL REQUIREMENTS

NorthWestern Energy E+ Renewable Custom Incentive Proposal Requirements For Non-Profit or Government/Public Buildings

The E+ Renewable Energy Program provides custom incentives for projects that benefit organizations and communities for non-profit or government facilities. Projects must provide civic value including education and visible representation of renewable energy technologies to a broad audience. A limited amount of electric Universal System Benefits (USB) funding is available.

Qualifications and Requirements:

- Incentives are available to approved commercial electric customers that are a non-profit or a government/public building. Final determination of eligibility rests solely with NorthWestern Energy
- Proposals are considered twice a year:
  - Spring Proposals: Received by 5 p.m., Mountain Time on May 1
  - Fall Proposals: Received by 5 p.m., Mountain Time on November 1
- Project must be installed by NorthWestern Energy Renewable Energy Qualified Installer
- Project may not exceed total Alternating Current (AC) nameplate capacity of 50 kilowatts (kW)
- Project must meet NorthWestern's Interconnection Standards at the time of the installation
- Project must be net metered
- Projects that are not selected may submit for consideration in a future funding cycle

A cover letter and proposal are required. The cover letter must include:

- Organization name (name of non-profit organization or government/public building)
- Contact information (address, phone #, e-mail)
- Short project summary
  - Amount of incentive requested
  - Sector (i.e. government/public or non-profit)
  - Non-profit organizations—include summary of the organization's purpose or mission statement
  - Detailed Education Plan

A sample cover letter and Custom Incentive Proposal requirements are provided.

Projects are selected based upon ranking of the following five criteria:

- Non-Profit or Government/Public building
- Geographic Location – NorthWestern looks at locations of past projects and where there are geographic gaps or need for public purpose balance
- Participant Match (at least 10%)
- Educational Value – Detailed plan for providing education on the benefits of the project
- System Maintenance – Include equipment warranty and detailed future maintenance strategy

Email (preferred) the Proposal and supporting documents: **E+Programs@northwestern.com** Questions may be directed to the email above or by calling **888-700-6878**	Or mail the Proposal and supporting documents: NorthWestern Energy E+ Renewable Program 11 E Park St. Butte, MT 59701-1711

NorthWestern Energy E+ Renewable
Custom Incentive Proposal Requirements

The Proposal must include the following details, be accompanied with a cover letter, and submitted by the deadline in order to be considered. Contracts will be developed for selected projects in advance of installations. Project must be net metered and meet NorthWestern Interconnection Standards.

Item	What is Required?
1. Organization	Government or non-profit entity name. If non-profit, provide documentation of non-profit status.
2. Project description	Project type, nameplate size, and information such as component manufacturer(s) and mounting type (for solar PV), or component manufacturer(s), design, and tower height (for wind power).
3. Project location	Address of installation (use physical location - not PO box). If multiple buildings exist, give location description (i.e. – shop, main office) and the meter number associated with the interconnection.
4. Project parts list and costs	Include bid sheet (show complete and detailed parts list and costs).
5. Project design costs	If design costs are incurred, list amount and design contractor(s) name and contact information.
6. Project labor costs	Include labor costs, when applicable.
7. Project total costs	Total parts, design, and labor costs (total lines 3 + 4 + 5).
8. Amount of incentive requested	Provide amount and/or percentage of funding requested through the E+ Renewable Program.
9. Other sources of funding	Include other funding sources that will support the project and amount of funding. (i.e. - self funded, Montana Alternative Energy Revolving Loan).
10. Past projects	List and describe any other projects that were funded using USB renewable funding at this location.
11. Nameplate capacity of system	Total Alternating Current (AC) nameplate capacity in kilowatts (kW).
12. Projected system capacity factor	Expected average output divided by capacity.
13. Projected yearly output of system	Provide in annual kilowatt hours (kWh).
14. Projected life expectancy of system	Provide in years.
15. Projected lifetime output of system	Provide in kilowatt hours (kWh).
16. Describe if the system is being used in tandem with any other source of generation or storage.	List other system type (i.e. - gas generator, small wind, small hydro, battery storage).
17. Describe monitoring and verification plan for the project.	What methods will customer use to track kWh produced and how will system performance be determined?
18. Describe the system warranty and plan in place for system maintenance.	Include equipment warranty and detailed future maintenance strategy.
19. Permits and permit jurisdictions that are applicable to this project.	List type of permit and jurisdiction (i.e. Electrical permit, City of Billings).
20. Identify the customer group the project will most benefit.	List primary group (i.e. - residential, low-income, general public, government).
21. List environmental impacts of the project.	List impacts -positive and negative (i.e. - greenhouse gas reductions, visual impacts of installations).
22. NorthWestern Energy Renewable Energy Qualified Installer.	Provide the name of the NorthWestern Energy Renewable Energy Qualified Installer. (If to be competitively bid, please note.)
Education Plan is Required. Plans must include the Following:	
23. Projected costs for educational seminars, media, tours, publications.	Provide type and projected cost.
24. Projected number of people impacted.	Provide both direct and indirect contact statistics.
25. List target audience group(s).	Provide all types (i.e. students, general public, and industry professionals).
26. How will you verify project success?	Provide how contact statistics will be verified - if seminars or education, how will success be verified?

ANYWHERE MT LIBRARY 123 MAIN STREET ANYWHERE, MT 59700 406-555-5555

November 1, 2022

NorthWestern Energy E+ Renewable Program
11 E Park Street
Butte, MT 59701-1711
Email: E+Programs@northwestern.com

Attached is the proposal for the 25.8 kW total Alternating Current (AC) nameplate capacity solar PV system on the Anywhere Library. The total cost of the project is $86,700.00 for which we are requesting an incentive through Universal System Benefits dollars of $69,360. We have secured 20% matching funds for the balance of the project funding.

Prior to seeking an E+ Renewable incentive for this project for this Public Building, our library formed a study group to research renewable energy technologies for our library as both a way to reduce energy costs over the long haul and to provide additional education to our clients on renewable energy. We have contacted a contractor listed on the NorthWestern Energy Renewable Energy Qualified Installer list to complete this project.

We have had an energy audit on our building. We are making progress on the recommendations of the audit to reduce our energy costs separate of the installation of the renewable generation. We have already changed out our lights to LEDs and taken advantage of NorthWestern's E+ Commercial Lighting Rebate program to help offset costs.

Our library is a taxpayer-supported community gathering place in Anywhere. The orientation of the solar panels will allow them to be highly visible from Main Street in our community. Additionally, we plan to have information about the solar energy in a display area near our public meeting rooms and we have submitted an education plan as part of our application to reach the broad audience of clients who use the library and its services. Additional details of our education plan is provided in our proposal. We believe this project will benefit the library and provide the community with a better understanding of renewable energy.

Complete project details are provided in the proposal.

Please contact me Jane Doe, at 406-555-5555, jane.doe@anywherelibrary.com or at the Anywhere Library with any questions.

Thank you very much for your consideration of this proposal.

Sincerely,

Jane Doe
Anywhere Library Director