ZIEGLER
ENERGY SOLUTIONS

RFP RESPONSE:

East Grand Forks Public Schools: Ground Mount Solar PV System

East Grand Forks Public Schools

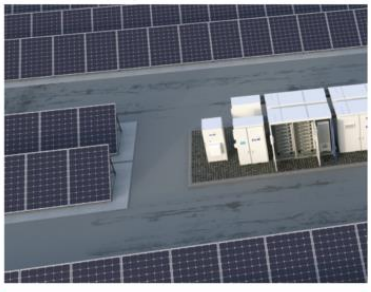
Central Middle School
1827 Bygland Road SE
East Grand Forks, MN 56721

Submitted By:

Chris Grunseth
Sales Engineer
763-620-0242
chris.grunseth@ziegleres.com
Ziegler Energy Solutions

Solar PV

Battery Storage



Microgrids

EV Chargers

Ziegler Background / History

For over 110 years, both small and large commercial businesses, communities, and entire municipalities have relied on Ziegler for dependable energy, grid backup, and sustainable, continuous power. Ziegler is currently developing renewable energy solutions that can lower operating costs by replacing conventional fuels, resulting in reduced electricity expenses for businesses and communities while meeting sustainability goals.

Ziegler has been in business since 1914 and has been involved in power generation since the 1930s. Over the past five years, we have installed over 500 MW of power generation systems operating in a variety of applications and fuels, including diesel, natural gas, digester gas, landfill gas, and solar. We are proud to be recognized as the leader in large utility-grade systems.

Ziegler Energy Solutions is a Ziegler Company. Ziegler is one of the largest Caterpillar dealers in North America. Ziegler Energy Solutions offers development, design, procurement and construction of turnkey hybrid energy systems.

ZIEGLER COMPANIES

ZIEGLER CAT | ZIEGLER POWER SYSTEMS CAT | ZIEGLER AG EQUIPMENT | ZIEGLER TRUCK GROUP | ZIEGLER ENERGY SOLUTIONS

Company Facts:

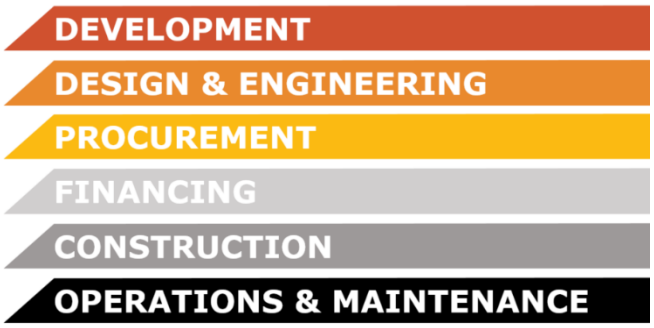
1914	2,400	31
Caterpillar dealer	Employees	Locations

Markets:

Construction | Agriculture | Mining | Paving | Forestry | Power Generation | Industrial Engines

Working with Us – Ziegler Advantages

Built by Ziegler



Ziegler Energy Solutions is your turnkey developer. We handle all aspects of the your project including site analysis, procurement of all materials, construction and the long term O&M of the assets. Our engineers will design a system that works with your existing infrastructure and accomplishes your goals whether they be financial or power. Our divisions work together to provide our customers with the same experience they've come to expect from Ziegler.

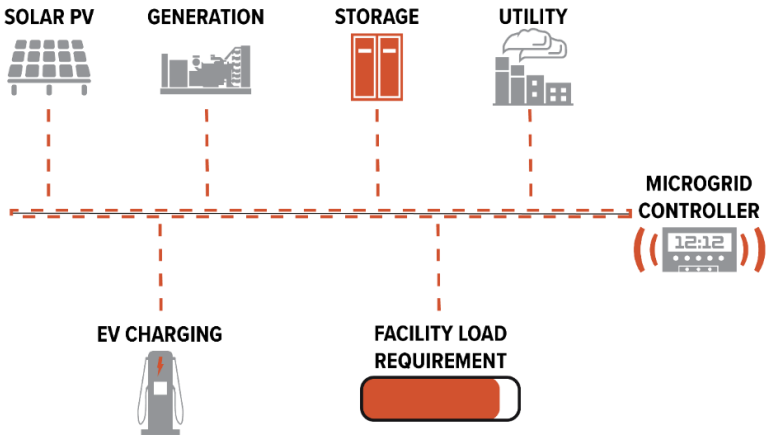
U.S. Made – Buy American Compliant

At Ziegler Energy Solutions, we prioritize quality by using top-tier hardware and software for all our projects. We take pride in sourcing products that are Buy American compliant whenever possible. Many of our solar and storage projects utilize exclusively qualifying products, enabling us to pass on additional incentives and discounts to our customers. This commitment to quality and compliance sets Ziegler Energy Solutions apart from the competition.

To qualify for the 10% Domestic Content direct pay adder, East Grand Forks Schools must ensure that eligible domestic content equipment is used throughout the project. **Ziegler Energy meets this requirement** by partnering with certified domestic suppliers and maintaining an inventory of compliant equipment in our facilities. This approach ensures both compliance and timely availability of equipment for the East Grand Forks project.

Integrating Multiple Generation Systems

Ziegler Energy Solutions is leading the charge of the energy transition, integrating renewable power with smart energy storage and conventional diesel- or gas-fueled power generation. Controlling your energy has never been easier. With a wealth of experience collaborating with utilities on intricate distributed generation projects, we can develop customized solar arrays, ranging from 50kW to 100MW. These solutions can fit right into your current setup so that you can integrate them with your conventional diesel and gas generator sets for a powerful and efficient energy mix.



Overview of Principal Elements

Ziegler Energy Solutions has a team of highly qualified individuals who thoroughly review all details of the project and provide a full, turnkey service from start to finish for our customers. Our company has stood the test of time for over 110 years and you can be sure we will be there to service any needs you may have in the future. Our approach to solar PV is a team effort. We complete our projects with precision that relies on our education and accountability. Our goal is to provide exceptional service and maximize uptime for our customers in the communities that we serve.

With the school district's budget in mind, we made design and hardware choices to maximize the Solar for Schools Grant and ITC incentives without sacrificing system size or optimal production. The entire project will use Heliene solar panels that are manufactured in Mountain Iron, MN. They also have a manufacturing plant in Rogers, MN.

Once the project is awarded, the interconnection process will begin with East Grand Forks Water and Light to confirm the technical details and greenlight the project to move foreward. We trust that this proposal will answer all of your questions and look forward to working with you on your new photovoltaic system.

Schematic Design Layout

System Design & Performance	
Module DC Nameplate	**558.54 kW**
Inverter AC Nameplate	**450 kW**
DC/AC Ratio	**1.22**
Annual Production (22% Loss)	***681,900 kWh***
Annual Production (14.5% Loss)	**747,200 kWh**
Azimuth/Tilt	**180 Azimuth**
Tilt	**30 deg fixed tilt**

Design Notes:

- Final Array location to be determined/confirmed by East Grand Forks Public Schools with guidance from Ziegler. Planned 550' home run to switchgear.
- **Systems losses** – System losses to be standardized at 22% as required by East Grand Forks Public Schools. Ziegler Energy designs and engineers solar systems to minimize losses and we have included a second, also conservative, production forecast using 14.5% System losses. It is typical for non-residential projects to be in this range. There are 2 attachments outlining paybacks for each System loss scenario.
- **System Size:** The maximum system size in this proposal is based on the financial target of $200,000 out-of-pocket investment by East Grand Forks Public Schools. The array will offset between 80%-87% of the school's annual usage.
    - The transformer at the school can handle up to 750kW AC of solar, or about 900kW DC. The annual usage of the school is 855,735kWh, which can be met by a 700kW DC Solar array.
    - Ziegler is happy to change the system size if financial investment allows.

Pricing & Incentives

System Pricing & Incentives	
Turnkey Price:	**$1,166,649**
ITC Direct Pay Eligible (30%)	*- $349,995*
US Domestic Material PV Incentive Eligible (10%)	*-$116,665*
Low-Income Communities Incentive Eligible (10%)	*-$116,665*
Solar for Schools Grant	*-$500,000*
Total Incentives	***- $1,083,325***
East Grand Forks Total Outlay	**$83,324**

***Note –** Low-Income Communities Incentives was not used in the ROI calculation in the attached Energy ToolBase reports (more information on the next page). We can run this upon request.*

***Product Pricing includes:**

- *Shipping to Site*
- *2-Year Part & Workmanship Warranty*
- *7ft black chain-link fencing surrounding the array*

Additional warranties available
5-Year Ziegler Energy Solutions Service Package (Annual Maintenance) Available

Investment Tax Credit (ITC) - 30%

The Inflation Reduction Act (IRA) of 2022 establishes and extends the federal Investment Tax Credit (ITC) for solar photovoltaic (PV) systems at a rate of 30% of the total PV system cost. The 30% ITC was extended for 10 years, through 2032. Unlike tax deductions, this tax credit can be used to directly offset your tax liability dollar for dollar. The IRA extended the carryback period to 3 years, and the carryforward period to 22 years, in cases where the tax credit exceeds a customer's tax liability in the 'placed-in-service' year. For PV projects greater than 1 MW AC in size, the IRA established prevailing wage and apprenticeship requirements in order to qualify for the full 30% "increased rate", rather than a "base rate" which would only qualify for a 6% ITC. Projects with an output of less than 1 megawatt qualify for the "increased rate" irrespective of if prevailing wage or apprenticeship requirements are met. In addition to the 30% ITC, the IRA establishes three different types of ITC "Adders", which provide additional tax credits of up to 10% each, for projects that meet specified requirements.

Domestic Content - 10%

For projects that meet specified domestic content requirements which will be set by Treasury, including 100% steel/iron for manufactured products with a 40% requirement through 2024 followed by 45% in 2025, 50% in 2026, and 55% in 2027 and beyond. Manufactured content is further explained: the products which are components of a qualified facility upon completion will be deemed to have been produced in the United States if the adjusted percentage of the total

costs of all such manufactured products of the facility are attributable to manufactured products which are mined, produced, or manufactured in the United States.

Low-Income Communities - 10%

The U.S. government offers a **Clean Electricity Low-Income Communities Bonus Credit Program** that can increase the solar tax credit by 10% for projects in low-income areas, tribal communities, or those that benefit lower-income households. Eligible projects must apply for an allocation, which are awarded competitively each year and can be used through 2032. This bonus is an add-on to the standard Investment Tax Credit (ITC). East Grand Forks, MN qualifies as a low-income community.

Source: https://experience.arcgis.com/experience/12227d891a4d471497ac13f60fffd822/page/Page

Solar for Schools Grant

Eligible schools may apply for grants up to 40-70% of the cost to purchase and install a solar energy system. For K-12 schools, the maximum allowable grant size is determined by the most recent Adjusted Net Tax Capacity (ANTC) divided by the Adjusted Pupil Unit (APU).

The overall maximum grant is $500,000 outside of Xcel service territory and $675,000 for within Xcel service territory. These are also both the lifetime caps for school districts both in and outside Xcel service territory meaning that the maximum grant dollars that a school's district can receiving for either one or multiple systems is $500,000 and $675,000 respectfully. The determination for the reduction in the grant value from past year to this current year was to account for tax credits that Solar for Schools' systems are eligible for. The determination for the cap for projects within Xcel service territory relates to the availability of both tax credits and the photovoltaic demand credit.

Ziegler Companies Strength

Ziegler Companies, a trusted name with over 110 years of experience, is a multibillion-dollar a year organization headquartered in Bloomington, MN. With a dedicated team of 2,400 employees and more than 31 branch offices across Minnesota and Iowa, Ziegler has successfully delivered countless distributed energy projects, including solar installations.

Our extensive expertise and commitment to excellence ensure we will be a reliable partner for years and years to come, providing unmatched uptime for your equipment—a standard that reflects our core values and unwavering dedication to customer satisfaction.

With a diverse portfolio of product lines and services, Ziegler is uniquely equipped to support East Grand Forks Public Schools in advancing energy resilience. Whether you're exploring Solar, Battery Energy Storage Systems, EV charging infrastructure, or future-forward energy solutions, Ziegler is ready to be your trusted partner for the road ahead.

Contact Person & Project Team

Design & Development Team: Ziegler Energy Solutions

MN Contractor General Contractor #IR776829

East Grand Forks Project Team

Troy Monson – *General Manager, B.S. Industrial Technologies*
-4 Yrs Ziegler Energy Solutions: General Manager
-4 Yrs Ziegler CAT: Sales Engineer
-11 yrs Stewart and Stevenson: Sr Project Manager
-7 Yrs Stewart and Stevenson: Division Operations Manager

Reda Shenouda – *Sr. Electrical Engineer, P.E. E.E.*
-31 yrs Ziegler CAT: Sr. Electrical Engineer

Casey Stufflebeem – *Electrical Engineer, (B.S.E.E.)*
-3 Yrs Ziegler Energy: Electrical Engineer
-7 Yrs Dexter Laundry: Electrical Engineer
-2 Yrs Vizient: Robotics/Automation Programmer

Payton Scandridge – *Sr. Project Manager* ***(Project Contact)***
-3 Yr Ziegler Energy: Project Manager
-3 Yrs Solar Connections: Project Manager
-2 Yrs NRI Electronics: Process Control Technician

Chris Grunseth – *Sales Engineer; B.A. Marketing, Int'l Business, Bus. Admin* ***(Pre-Project Contact)***
-3 Yrs Ziegler Energy Solutions: Sales Engineer
-4 Yrs ZEF Energy: Director Commercial Sales (EV Charging Developer)
-4 Yrs Sundial Energy: Director Sales Operations (Solar Developer)
-8 Yrs Ten K Solar: Sales Operations Manager (Solar Systems Manufacturer)

Installer Profile: AID Electric

AID Electric is a full-service electrical design, build, and maintenance firm headquartered in Blaine, Minnesota. Known for an uncompromising standard of excellence, AID Electric has earned its place on high-profile projects across a wide range of industries nationwide.

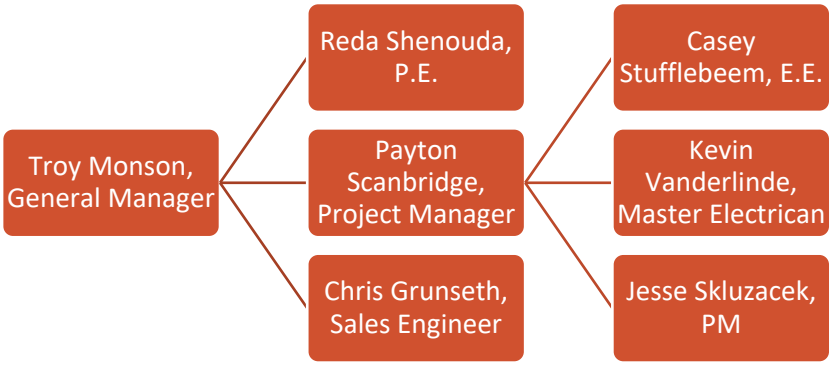
From corporate campuses and luxury apartment complexes to university facilities and solar fields, our work spans diverse environments. Our clients include some of the nation's largest healthcare providers, major industrial operations, and cutting-edge microgrid facilities.

We're lighting the way forward in the electrical industry—delivering cost-effective, environmentally responsible, and people-first solutions tailored to every client, every time.

AID Electric proudly employs over 70 highly skilled electricians and nearly 15 dedicated office professionals, all committed to powering innovation and reliability.

Company Type: S-Corporation
Years in Service: 45
Contact: Jesse Skluzacek**,** *Vice President*
(612)-221-8136
jesse@aidelectriccorp.com
Office: 1622 93rd LN NE, Blaine, MN 55449

East Grand Forks Project Team Org Chart



Warranties – Product & Service

Warranty Information:

Inverter Warranty:
10-year extended warranty

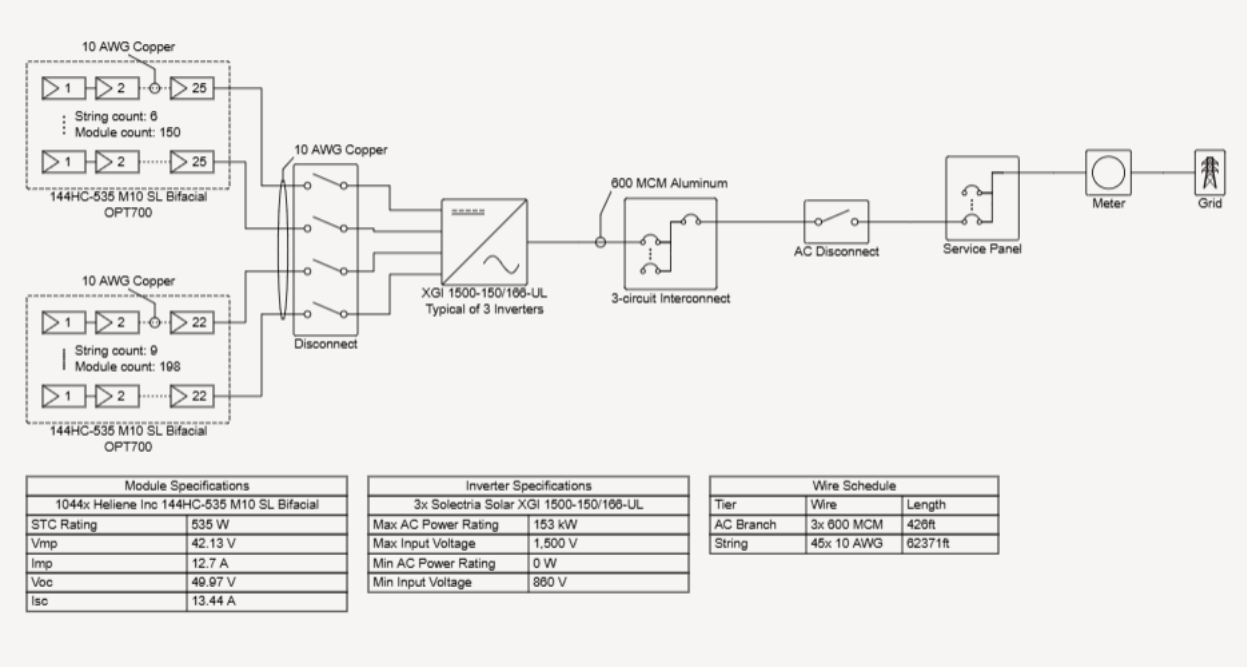
Solar Module Warranty:
15-year manufacturers workmanship warranty
25-year linear power guarantee

Installation warranty:
2-year workmanship warranty

Technical Specifications

Major Equipment Manufacturers	Heliene 535W Modules: 144HC M10 Bifacial modules US Made (qty: 1,044) Solectria Inverters 150kW US Made: XGI 1500-150/166-UL (qty:3), OMCO C-Channel ground mount racking US Made (pile driven, geotechnical report provided by Ziegler)
Description of Technology	Specification sheets included below
Electrical interconnection and metering/net-metering	Project engineer will initiate interconnection agreement with East Grand Forks Water and Light.
DC and AC capacity rating	558.54kW DC 450kW AC 1.22 DC/AC ratio
Expected annual energy production in kWh Yr 1 (22% Loss)	681,900 kWh
Expected annual energy production in kWh Yr 1 (14.5% Loss)	747,200 kWh
Communications, control & instrumentation	SolrenView, Solectria
Project Management plan	Project oversight & management by Ziegler through dedicated manager
Start-up & testing	Project manager will be present for site commissioning
Design life loading (wind, seismic, etc.)	Wind loading up to 180mph (see specification sheet below). Geotechnical Report to be performed by Ziegler, Electrical Engineering Report to be performed by Ziegler
Description of frequency & duration of scheduled maintenance	Maintenance recommendations and specifications to be provided with final system.
Data acquisition system	Solren, Site-specific actual kWh production, Site-specific instantaneous maximum kWh production
Proposed safety and interconnection standards	Recognized by UL & NEC

Preliminary Single-line Diagram



Module Specifications	
1044x Heliene Inc 144HC-535 M10 SL Bifacial	
STC Rating	535 W
Vmp	42.13 V
Imp	12.7 A
Voc	49.97 V
Isc	13.44 A

Inverter Specifications	
3x Solectria Solar XGI 1500-150/166-UL	
Max AC Power Rating	153 kW
Max Input Voltage	1,500 V
Min AC Power Rating	0 W
Min Input Voltage	860 V

Wire Schedule		
Tier	Wire	Length
AC Branch	3x 600 MCM	426ft
String	45x 10 AWG	62371ft

Fencing Used – Black, 7’ tall (NEC)

To ensure safety, security, code compliance, and visual appeal, a 7-foot black fence is proposed around the solar array located near the school. This fence serves multiple purposes: it restricts unauthorized access to electrical equipment, enhances student and public safety, and provides a clean, unobtrusive aesthetic that blends well with the surrounding environment. The black finish offers durability and a modern look, aligning with the school’s commitment to both safety and sustainability.

ENERGY RESPONSE TEAM

Always Ready. Always On.

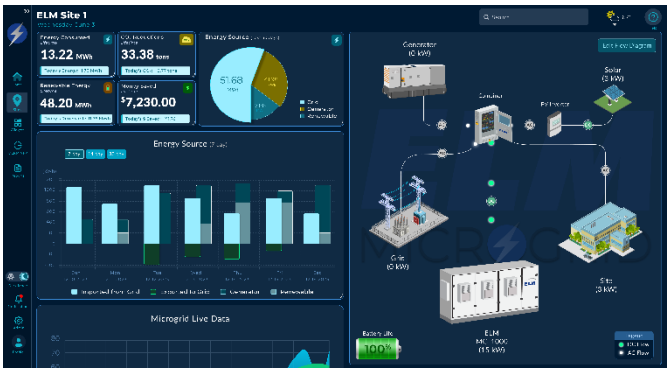
Ziegler's Energy Response Team is your frontline technical force—fast, dependable, and factory-certified to keep your advanced energy infrastructure operating at peak performance. With rapid deployment and highly trained professionals, we deliver maximum uptime, minimize costly disruptions, and safeguard the future of your energy assets.

RAPID RESPONSE	TECHNICAL MASTERY	RELIABILITY & TRUST
Always ready. Always on.	Factory-level support, locally delivered.	Maximizing uptime.

Monitoring

Ziegler Energy Solutions provides **24/365 monitoring** of your system. Ziegler monitors hundreds of distributed energy resources including Solar arrays. Depending on your hardware needs, we'll ensure quality software is in place to back it up. This enables our team to:

- Perform remote diagnostics
- Schedule annual service
- Ensure optimal performance
- Maximize customer uptime



Operations & Maintenance (O&M)

O&M is essential for keeping energy assets running smoothly. Detecting and fixing issues quickly is key for optimal performance, and a sound O&M plan protects your investment. Ziegler Energy Solutions offers both reactive and proactive services, including:

- Emergency response and dispatch
- Corrective maintenance and system repairs
- Scheduled preventative maintenance and system testing
- Spare parts inventory management
- Warranty service coordination/administration
- Annual maintenance reporting

Our basic philosophy for performing Operations and Maintenance (O&M) is centered on proactive and preventive care to ensure the longevity, efficiency, and reliability of the solar photovoltaic (PV) system. By employing a structured and data-driven approach, we aim to minimize downtime, optimize energy production, and address potential issues before they impact performance.

1. Proactive Maintenance and Inspection Schedule
   Our O&M plan includes routine inspections and preventive maintenance every six to twelve months, with additional inspections as needed based on system performance metrics or weather-related events. Each inspection includes:
   - Visual checks for physical damage or debris on panels and mounting structures.
   - Electrical testing of system components to ensure functionality.
   - Cleaning of PV panels to remove dirt and optimize energy output.
   - Verification of inverter performance and functionality.
2. Data Collection and Monitoring
   Our advanced monitoring system provides real-time performance data, allowing us to track system output and quickly identify underperforming components. Alerts for system anomalies are sent to our technical support team, ensuring prompt resolution.
3. Technical Support and Repairs
   Our technical support staff is available to address urgent issues. In the event of a component failure, we maintain a network of pre-approved contractors who can provide specialized repair services if needed. For non-urgent issues, repair work is completed during scheduled maintenance visits to minimize disruption.
4. Recycling and Sustainability
   We are committed to sustainability and comply with Minnesota Pollution Control Agency (MPCA) requirements. During the maintenance period, we will track and recycle any solar modules or inverters that cease to function as intended. Recycling records will be maintained and reported to the MPCA as required.
5. O&M Manual Delivery
   Upon system commissioning, we will provide comprehensive O&M manuals for all system components. These manuals include detailed information on system specifications, maintenance procedures, troubleshooting steps, and warranty details.
6. Long-Term Commitment
   Our maintenance agreement ensures peace of mind for the system owner, providing a clear and consistent schedule of care. The agreement includes:
   - A predefined schedule of inspections and preventive maintenance.
   - Access to a dedicated support team for technical inquiries.
   - Real-time system monitoring and annual performance reports.

Service & Support

When your energy systems need attention, Ziegler's Energy Response Team delivers **fast, expert service** to keep you running. From emergency repairs to scheduled maintenance, we provide:

- Rapid on-site response for critical issues
- Factory-trained technicians for solar PV, battery storage, EV chargers, UPS, and microgrid systems
- Diagnostic testing and performance optimization
- Warranty service coordination
- Comprehensive service reporting for transparency and compliance

Whether it's a planned service or an unexpected outage, our team ensures your systems are restored quickly and operate at peak efficiency.

Options for Your Project

- O&M Service plan available upon request

Project Schedule and Timeline

Preliminary Schedule:

Final contract and agreements executed

Permitting begins: 2 weeks after contract and agreement executed

Final design plans complete: 4 weeks after contract and agreement executed

Equipment Ordered: 1 week after final design plans complete

Construction Begins: 14 weeks after equipment ordered. Long lead items like switchgear and transformer could extend this.

Electrical Generation Begins (Permission to operate): Approximately 6 weeks after construction begins, dependent on utility Interconnection in place.

Signature Page

AGREED and ACCEPTED by the Parties' authorized representatives:

SUPPLIER:	Ziegler Energy Solutions
By	William Hoeft
Name	William M. Hoeft
Title	President
Date	11/7/2025

Experience & References

International Falls School District

Location: International Falls, MN | Date: 2025

Ziegler Energy Solutions was chosen to develop a new 411 kW DC solar array by the International Falls School District through the **Solar for Schools** program. Project features 100% US-made hardware (panels, racking & inverters). Ziegler will be responsible for all aspects of project including design, engineering, permitting, and procurement etc. including construction and commissioning.

Reference:

Beth Shermoen

Superintendent , International Falls School District

(218)-283-2571

Pine Point School District

Location: Ponsford, MN | Date: 2024
Contractor: Ziegler Energy Solutions

Ziegler Energy Solutions was chosen to develop a new 440 kW DC solar array and 2.7 MW battery strorage system by the Pine Point School District through the **Solar for Schools** program. Project features 100% US-made PV hardware (panels, racking & inverters) and an ELM BESS. Ziegler will be responsible for all aspects of project including design, engineering, permitting, and procurement etc. including construction and commissioning.

Reference:

Chris Schulz
Pine Point Superintendent
218-573-4102

Grand Rapids Utilities | Lake County Power | Minnesota Power

Location: Grand Rapids, MN | Date: 2022

Ziegler Energy Solutions was chosen to design, procure, install and maintain for a 1 MW-2.5 hour Ziegler CAT Lithium Ion Battery in Grand Rapids, MN. This project was commissioned in October, 2022 and provides multi-variable load management that is charged by onsite solar 3MW ground mounted PV array. The battery system/setup were designed to discharge during peaks to reduce wholesale power need.

Reference:

Eric Sutherland
Senior Engineer, Minnesota Power
218-355-2770

minnesota power

ZIEGLER ENERGY SOLUTIONS

Hutchinson Municipal Utilities

Location: Hutchinson, MN | Date: 2021

Ziegler Energy Solutions was the chosen contractor for a new 766 kW DC solar array by the Hutchinson Public Utility. Project featured Caterpillar 445W monocrystalline panels. Ziegler was responsible for all aspects of project including design, engineering, permitting, and procurement etc. including construction and commissioning.

Reference:

Dave Hunstad
HUC Distribution Manager
320-234-0508

HUTCHINSON

Protech Automotive

Location: Rosemount, MN | Date: 2019

Ziegler Energy Solutions was the chosen contractor for this turnkey installation of two (2) separate roof top arrays totaling 82 kW allowed by customer having two separate billing meters. Ziegler was responsible for all aspects of project including design, engineering, permitting, procurement including construction and commissioning.

Lanesboro Public Schools

Location: Lanesboro, MN | Date: 2022

Ziegler Energy Solutions was the chosen contractor for this turnkey installation of two (2) separate roof top arrays totaling 118.5 kW. Ziegler was responsible for all aspects of project including design, engineering, permitting, procurement including construction and commissioning.

LANESBORO BURROS

Iowa Great Lakes Sanitary District

Location: Milford, IA | Date: 2020

Ziegler Energy Solutions was awarded turnkey construction services on a new 507 kW ground mount solar array at the Iowa Great Lakes Sanitary District. All power generated by this array is utilized by the adjacent wastewater treatment plant. The critical component technical scope was furnished by Ziegler Power Systems also with responsibilities for construction and balance of system procurement. Ziegler Energy Solutions has been retained to provide annual operations and maintenance duties.

Reference:

Steve Anderson
District Superintendent
712-338-2626

IGL SANITARY DISTRICT
PROTECTING THE IOWA GREAT LAKES SINCE 1939

22% Losses

ZIEGLER ENERGY SOLUTIONS — Annual Production Report produced by Corey Orehek

EGF 558kW FINAL East Grand Forks Central Middle School, 1827 Bygland Rd SE, East Grand Forks, MN 56721

Report

Project Name	East Grand Forks Central Middle School
Project Address	1827 Bygland Rd SE, East Grand Forks, MN 56721
Prepared By	Corey Orehek corey.orehek@zieglercat.com

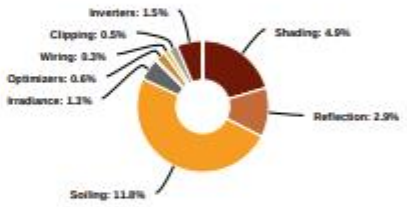
System Metrics

Design	EGF 558kW FINAL
Module DC Nameplate	558.54 kW
Inverter AC Nameplate	459.00 kW Load Ratio: 1.22
Annual Production	681.9 MWh
Performance Ratio	78.0%
kWh/kWp	1,220.9
Weather Dataset	TMY, 10km Grid (47.95,-96.95), NREL (prospector)
Simulator Version	064f15d163-0bad90110d-88ffa6fb1e-6de00b0e18

Project Location

Monthly Production

Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,317.3	
	POA Irradiance	1,565.0	18.8%
	Shaded Irradiance	1,488.7	-4.9%
	Irradiance after Reflection	1,445.5	-2.9%
	Irradiance after Soiling	1,275.0	-11.8%
	Total Collector Irradiance	**1,275.0**	**0.0%**
Energy (kWh)	Nameplate	712,197.3	
	Output at Irradiance Levels	703,035.9	-1.3%
	Output at Cell Temperature Derate	702,388.9	-0.1%
	Output after Electrical Mismatch	702,388.5	0.0%
	Optimizer Output	698,363.3	-0.6%
	Optimal DC Output	696,051.4	-0.3%
	Constrained DC Output	692,495.3	-0.5%
	Inverter Output	682,089.0	-1.5%
	Energy to Grid	**681,902.9**	**0.0%**
Temperature Metrics			
	Avg. Operating Ambient Temp		8.8 °C
	Avg. Operating Cell Temp		14.9 °C
Simulation Metrics			
	Operating Hours		4673
	Solved Hours		4673

Condition Set

Description	Condition Set 4											
Weather Dataset	TMY, 10km Grid (47.95,-96.95), NREL (prospector)											
Solar Angle Location	Meteo Lat/Lng											
Transposition Model	Perez Model											
Temperature Model	Sandia Model											
Temperature Model Parameters	Rack Type	a	b	Temperature Delta								
	Fixed Tilt	-3.56	-0.075	3°C								
	Flush Mount	-2.81	-0.0455	0°C								
	East-West	-3.56	-0.075	3°C								
	Carport	-3.56	-0.075	3°C								
Soiling (%)	J	F	M	A	M	J	J	A	S	O	N	
	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	
Albedo	J	F	M	A	M	J	J	A	S	O	N	
	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	
Rear Mismatch Loss	10%			Rear Shading Factor	5%							
Module Transparency	0%											
Irradiation Variance	5%											
Cell Temperature Spread	4° C											
Module Binning Range	-2.5% to 2.5%											
AC System Derate	0.50%											
Trackers	Maximum Angle			Backtracking								
	60°			Enabled								

	Type	Component	Characterization	Bi
Module & Component Characterizations	Module	144HC-535 M10 SL Bifacial (Heliene Inc)	144HC PERCHELIENE_144HC_535_M10_SL_Bifacial_20230123.PAN, PAN	Fa
	Buck Boost Optimizer	OPT700 (APsystems)	Mfg Spec Sheet	Na
	Inverter	XGI 1500-150V166-UL (Solectria Solar)	Spec Sheet	Na

14.5% Losses

ZIEGLER ENERGY SOLUTIONS — Annual Production Report produced by Corey Orehek

EGF 558kW FINAL East Grand Forks Central Middle School, 1827 Bygland Rd SE, East Grand Forks, MN 56721

Report

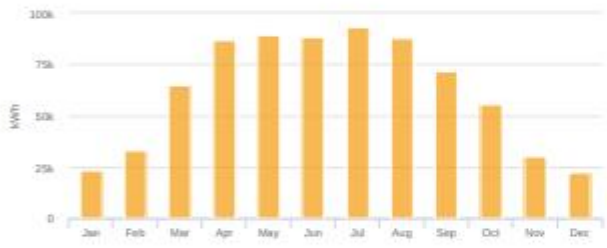
Project Name	East Grand Forks Central Middle School
Project Address	1827 Bygland Rd SE, East Grand Forks, MN 56721
Prepared By	Corey Orehek corey.orehek@zieglercat.com

System Metrics

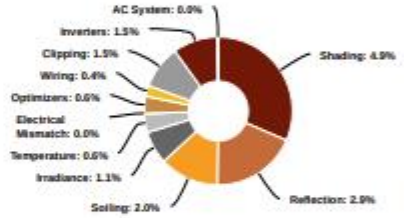
Design	EGF 558kW FINAL
Module DC Nameplate	558.54 kW
Inverter AC Nameplate	459.00 kW Load Ratio: 1.22
Annual Production	747.2 MWh
Performance Ratio	85.5%
kWh/kWp	1,337.8
Weather Dataset	TMY, 10km Grid (47.95,-96.95), NREL (prospector)
Simulator Version	064f15d163-0bad90110d-88ffa6fb1e-6de00b0e18

Project Location

Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,517.3	
	POA Irradiance	1,565.0	18.8%
	Shaded Irradiance	1,488.7	-4.9%
	Irradiance after Reflection	1,445.5	-2.9%
	Irradiance after Soiling	1,416.6	-2.0%
	Total Collector Irradiance	**1,416.6**	**0.0%**
Energy (kWh)	Nameplate	791,316.5	
	Output at Irradiance Levels	782,488.8	-1.1%
	Output at Cell Temperature Derate	777,478.2	-0.6%
	Output after Electrical Mismatch	777,477.7	0.0%
	Optimizer Output	772,999.8	-0.6%
	Optimal DC Output	770,190.3	-0.4%
	Constrained DC Output	758,922.3	-1.5%
	Inverter Output	747,411.2	-1.5%
	Energy to Grid	**747,191.0**	**0.0%**
Temperature Metrics			
	Avg. Operating Ambient Temp		8.8 °C
	Avg. Operating Cell Temp		15.6 °C
Simulation Metrics			
	Operating Hours		4673
	Solved Hours		4673

Condition Set

Description	EG 1
Weather Dataset	TMY, 10km Grid (47.95,-96.95), NREL (prospector)
Solar Angle Location	Meteo Lat/Lng
Transposition Model	Perez Model
Temperature Model	Sandia Model

Temperature Model Parameters

Rack Type	a	b	Temperature Delta
Fixed Tilt	-3.56	-0.075	3°C
Flush Mount	-2.81	-0.0455	0°C
East-West	-3.56	-0.075	3°C
Carport	-3.56	-0.075	3°C

Soiling (%)

J	F	M	A	M	J	J	A	S	O	N
2	2	2	2	2	2	2	2	2	2	2

Albedo

J	F	M	A	M	J	J	A	S	O	N
0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20

Rear Mismatch Loss	10%	Rear Shading Factor	5%
Module Transparency	0%		
Irradiation Variance	5%		
Cell Temperature Spread	4° C		
Module Binning Range	-2.5% to 2.5%		
AC System Derate	0.50%		

Trackers

Maximum Angle	Backtracking
60°	Enabled

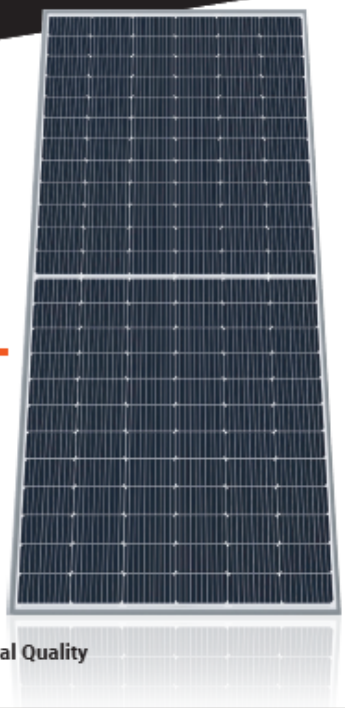
Module & Component Characterizations

Type	Component	Characterization	Bi
Module	144HC-535 M10 SL Bifacial (Heliene Inc)	144HC PERCHELIENE_144HC_535_M10_SL_Bifacial_20230123.PAN, PAN	Fa
Buck Boost Optimizer	OPT700 (APsystems)	Mfg Spec Sheet	N
Inverter	XGI 1500-150/166-UL (Solectria Solar)	Spec Sheet	N

HELIENE

144HC M10 Bifacial Module

144 Half-Cut Monocrystalline 520W – 540W



21%

Utilizes the latest M10 size super high efficiency Monocrystalline PERC cells. Half cut design further reduces cell to module (CTM) losses.

Stability & Looks

Rugged, double webbed frame design withstands wind, snow, and other mechanical stresses. Framed Glass–Backsheet aesthetic is ideal for high visibility installation.

Anti-Reflective

Premium solar glass with anti reflective coating delivers more energy throughout the day

High Reliability

Proven resistance to PID and reliable in high temperature and humidity environments.

BUY AMERICAN ACT COMPLIANT

Manufactured Using International Quality System Standards: ISO9001

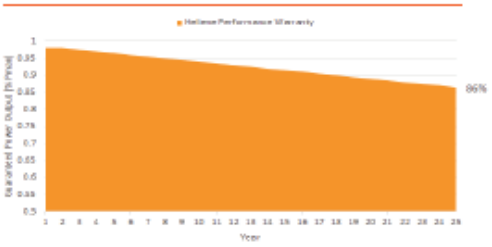
Half-Cut Design with Split Junction Box Technology

Bifacial Technology Enabling Additional Energy Harvest from Rear Side

1500V System Voltage Rating

No Compromise Guarantee

15 Year Workmanship Warranty
25 Year Linear Performance Guarantee



World-class Quality

- Heliene's fully automated manufacturing facilities with state-of-the-art robotics and computer aided inspection systems ensure the highest level of product quality and consistency
- All manufacturing locations are compliant with international quality standards and are ISO 9001 certified
- Heliene modules have received Top Performer rankings in several categories from PV Evolution Labs (PV EL) independent quality evaluations

Bankable Reputation

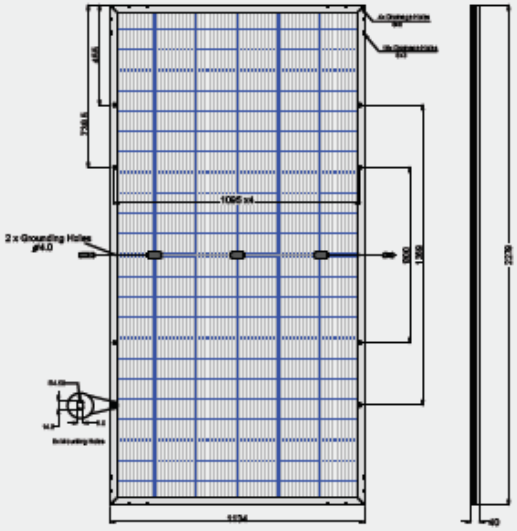
- Established in 2010, Heliene is recognized as highly bankable Tier 1 manufacturer of solar modules and has been approved for use by the U.S. Department of Defense, U.S. Army Corps of Engineers and from numerous top tier utility scale project debt providers
- By investing heavily in research and development, Heliene has been able to stay on the cutting edge of advances in module technology and manufacturing efficiency

Local Sales, Service, and Support

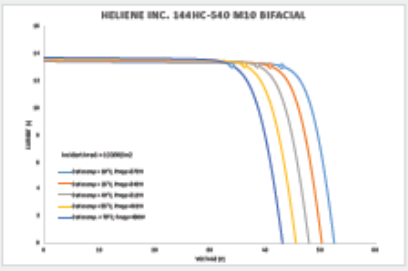
- With sales offices across the U.S. and Canada, Heliene prides itself on unsurpassed customer support for our clients. Heliene has become the brand of choice for many of the leading residential installers, developers and Independent Power Producers due to our innovative technology, product customization capability and just in time last-mile logistics support
- Local sales and customer support means answered phone calls and immediate answers to your technical and logistics questions. We understand your project schedules often change with little warning and endeavor to work with you to solve your project management challenges

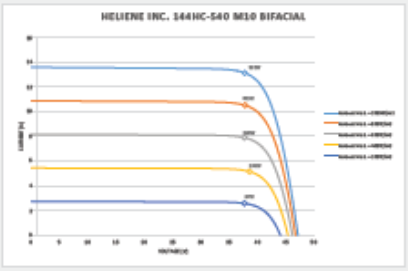
www.heliene.com

Dimensions for 144HC M10 Bifacial Series Modules



I-V Curves for 144HC M10 Bifacial Series Modules





Certifications & Listing

Electrical Data (STC)

Peak Rated Power	P_{mpp} (W)	540	535	530 ✓	525	520
Maximum Power Voltage	V_{mpp} (V)	42.32	42.13	41.94	41.75	41.56
Maximum Power Current	I_{mpp} (A)	12.77	12.70	12.64	12.58	12.52
Open Circuit Voltage	V_{oc} (V)	50.22	49.97	49.72	49.23	48.73
Short Circuit Current	Isc (A)	13.50	13.44	13.37	13.32	13.28
Module Efficiency *	Eff (%)	20.9	20.7	20.5	20.3	20.1
Maximum Series Fuse Rating	MF (A)	30	30	30	30	30
Power Output Tolerance			[- 0/+3%]			
Bifaciality Factor			70%			

STC - Standard Test Conditions: Irradiation 1000 W/m2 - Air mass AM 1.5 - Cell temperature 25 ºC

Electrical Data (NMOT)

Maximum Power	P_{mpp} (W)	400	395	390	385	380
Maximum Power Voltage	V_{mpp} (V)	39.19	38.58	38.58	37.97	37.96
Maximum Power Current	I_{mpp} (A)	10.21	10.24	10.11	10.14	10.01
Open Circuit Voltage	V_{oc} (V)	47.13	46.89	46.66	46.20	45.73
Short Circuit Current	Isc (A)	10.87	10.82	10.77	10.72	10.70

NMOT - Nominal Module Operating Temperature:
Irradiance at 800W/m2, Ambient Temperature 20ºC, Wind speed 1m/s

Mechanical Data

Solar Cells	144 Half Cut, M10, 182mm, PERC Cells
Module Construction	Framed Glass–Backsheet
Dimensions (L x W x D)	2279 x 1134 x 40 mm (89.72 x 44.65 x 1.6 inch)
Weight	29.2 kg (64.3 lbs)
Frame	Double Webbed 15-Micron Anodized Aluminum Alloy
Glass	3.2mm Low-Iron Content, High-Transmission, PV Solar Glass with Anti Reflective Coating
Junction Box	IP-68 rated with 3 bypass diodes
Output Cables	0.3-meter Symmetrical Cables
Connectors	Multi-Contact/ Stäubli MC4

Certifications

UL Certification — UL61215, UL61730

Temperature Ratings

Nominal Operating Cell Temperature (NOCT)	+45°C (±2°C)
Temperature Coefficient of P_{max}	-0.36%/°C
Temperature Coefficient of V_{oc}	-0.28%/°C
Temperature Coefficient of I_{sc}	0.034%/°C

Maximum Ratings

Operational Temperature	-40°C to +85°C
Max System Voltage	1500V
Mech. Load Test (Front)	113 psf / 5400 Pa
Mech. Load Test (Back)	50 psf / 2400 Pa
Fire Type	Type 1

Warranty

15 Year Manufacturer's Workmanship Warranty

25 Year Linear Power Guarantee

Packaging Configuration

Modules per box:	27 pieces
Modules per 53' trailer:	702 pieces

ZIEGLER ENERGY SOLUTIONS

YASKAWA
SOLECTRIA SOLAR

AMERICAN-MADE SOLAR INVERTERS

1500V UTILITY-SCALE APPLICATIONS

ZIEGLER
ENERGY SOLUTIONS

Yaskawa Solectria Solar is a wholly-owned subsidiary of Yaskawa America, Inc. and the largest inverter manufacturer based in the USA, with headquarters in Lawrence, MA, and world-class production facilities in Buffalo Grove, IL and Oak Creek, WI.

MADE IN THE U.S.A WITH GLOBAL COMPONENTS
Designed and engineered in Lawrence, MA, assembled and tested in Buffalo Grove, IL and Oak Creek, WI

YASKAWA QUALITY
Global technology leader with 100+ years experience and winner of the coveted Deming Prize for total quality management

XGI POWER RACKS
Factory integrated assembly with 4 - 8 XGI 1500 inverters and an AC Combiner, making a 1 - 2 MW build-block for large utility-scale projects

QUICK AND EASY SETUP
Reduce commissioning time with the ability to reach all in-network inverters from a single location using a wireless device

LOWERING COST FOR SYSTEM OWNERS
Simplified design resulting in the lowest cost of labor, installation, and O&M

STORAGE SYSTEMS
500kW DC-coupled and AC-coupled storage systems and factory integrated with bi-directional XGI inverters

EXTENDED COVERAGE
Industry standard 5-year warranty, extendable up to 20 years

Solectria is backed by Yaskawa, a global leader in motor drives and robotics with over 100 years of power electronics and inverter experience, and continues to build the highest quality solar inverters and provide new innovations for the marketplace.

100+ YEARS
MANUFACTURING EXCELLENCE

MADE IN THE USA

Proud Member of

CALIFORNIA SOLAR + STORAGE ASSOCIATION
SEIA
NABCEP
OSSIA

ZIEGLER ENERGY SOLUTIONS

OMCO SOLAR

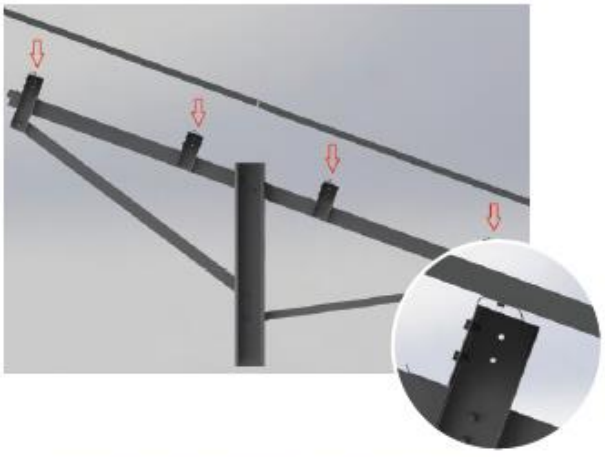
FIXED TILT MOUNTING SYSTEM

PRE-ASSEMBLED TILT BRACKETS

- Optimizes packaging and shipping
- Requires significantly less field labor
- Reduces construction schedules
- Eliminates loose hardware

INTEGRATED GROUNDING

- Eliminates third party grounding devices
- Accelerates assembly



HIGHEST DOMESTIC CONTENT - MADE BY OMCO SOLAR
IN OUR 6 US MANUFACTURING PLANTS

FACTORY DIRECT

- ⊘ Short Lead Times
- ⊘ Low Freight Costs
- ⊘ Enhanced Flexibility
- ⊘ Reduced Field Labor
- ⊘ Cost Efficient
- ⊘ Quality Assurance

MADE IN U.S.A.

180 MPH

ZIEGLER ENERGY SOLUTIONS

OMCO Choice™

Fixed Tilt Mounting System

Technical Specifications

Manufacturing	Made by OMCO Solar in our 6 US manufacturing plants nationwide and shipped directly to project sites.
Pre-Assembly	Each rack consists of pre-assembled components, which reduces the bill of material items, allowing rapid site staging and installation.
Materials	Galvanized steel, per ASTM A653 – latest edition
Hardware	Zinc-coated to 15 microns per UL 2703. The hardware arrives pre-sorted for easy identification. Additional plating options are available for corrosive environments.
Module Compatibility	OMCO Solar racks are optimized for all commercially available framed solar modules.
In-Field Flexibility	Built-in adjustability features account for post misalignment and terrain elevation changes with no additional components. Proprietary custom slot configurations come standard on every fixed-tilt mounting system.
Table Configuration	2-in-portrait is standard. Other configurations are evaluated per site-specific requirements.
Terrain Articulation	Accommodates up to 20% grade change
Foundation Options	Driven C posts - OMCO produced, lower cost, faster lead time Driven I or W posts - OMCO sourced
Tilt Angle	Accommodates from 5°- 45°
Wire Management	Integrated wire management
Bonding/Grounding	UL 2703 compliant
Post Tolerances	East-West ± 0.75" North-South ± 0.75" East-West tilt ± 1° North-South tilt ± 1°
Load Capacities	Wind – up to 180 MPH | Snow – up to 90 PSF
Certifications	ISO 9001:2015 standard, UL 2703 Ed. 1, CPP wind tunnel-tested, NEC compliant
Warranty	20-year limited warranty

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OMCO SOLAR

Rev | 11/23

ZIEGLER ENERGY SOLUTIONS