

Solar Shines as Renewable Energy Source in the Midwest



Dave Klostermann, Manager of Renewables, Van Meter Inc.

Dave Klostermann is the Renewable Energy Manager at Van Meter, Inc. He has worked at Van Meter for 17 years in a variety of sales roles. Dave currently does business development in the wind and solar power markets for Van Meter. Dave is married to Natalie and lives near Lisbon, Iowa. They have five children and two dogs and enjoy spending time outdoors.

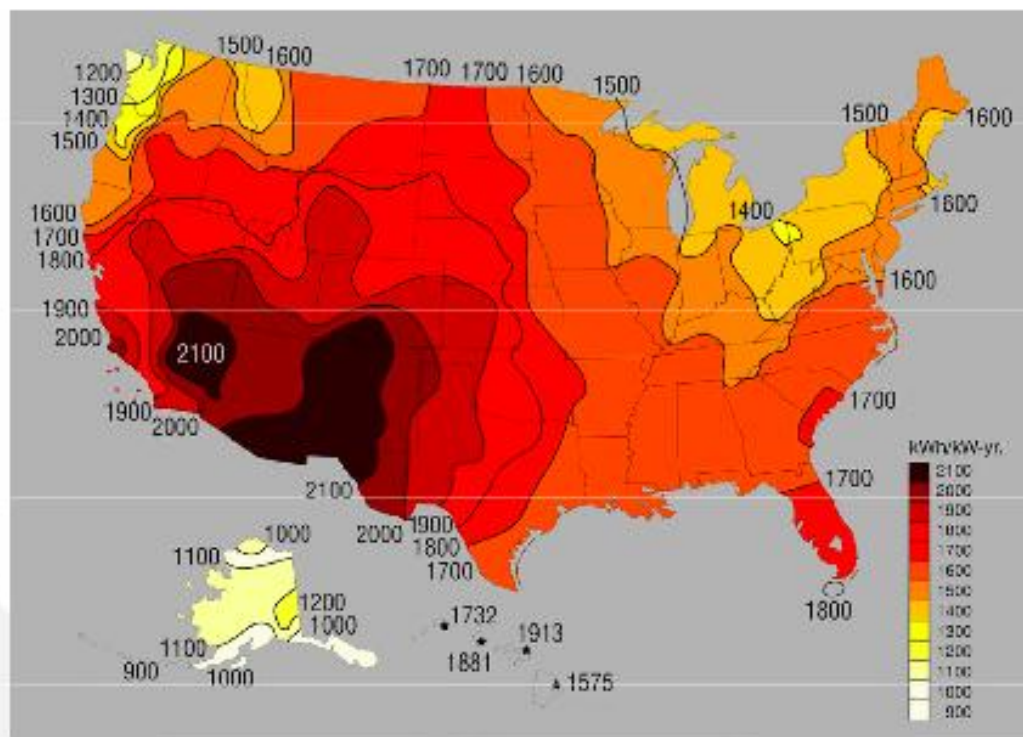


Timothy Dwight, Business Development Manager, Integrated Power Corporation

Timothy Dwight has been a part of the PV (solar) industry since 2009. He is the owner and President of Integrated Power Corporation, a solar integrator company that specializes in commercial, industrial and utility solar solutions. Timothy was born in Iowa City, Iowa. He attended the University of Iowa from 1994—1997 and graduated with a B.A. He also had a professional football career from 1998—2007. He resides in Iowa and California.

US Solar Market

Potential



The world's largest solar market (Germany) installed ~1.3 Gigawatts of solar in 2008— approx \$9,100,000,000 USD

•Germany = 47% Global Solar Market

•USA = 8% Global Solar Market

Germany's Solar Resources



Solar Basics

- Enough energy from the sun hits the Earth every hour to power the planet for an entire year
- Solar photovoltaics (PV Systems) are a clean, cost-effective way to harness power for homes and businesses-durable, no moving parts
- PV systems generate power without pollution – and recent advancements have greatly improved their efficiency and electrical output
- DOE has a solar grid parity goal by 2015
- Cost per watt is decreasing: avg. \$11/watt in 1998; avg. \$7/watt in 2010
- ~\$400 per panel (price coming down)
- ~200 watts are generated per module/panel
- Solar systems like colder temperatures

“Quotables”

- Because we are now running out of gas and oil, we must prepare quickly for a third change, to strict conservation and to the use of coal and permanent renewable energy sources, like solar power. -- **JIMMY CARTER**

- Clearly, we need more incentives to quickly increase the use of wind and solar power; they will cut costs, increase our energy independence and our national security and reduce the consequences of global warming. -- **HILLARY RODHAM CLINTON**

- To truly transform our economy, protect our security, and save our planet from the ravages of climate change, we need to ultimately make clean, renewable energy the profitable kind of energy. -- **BARACK OBAMA**

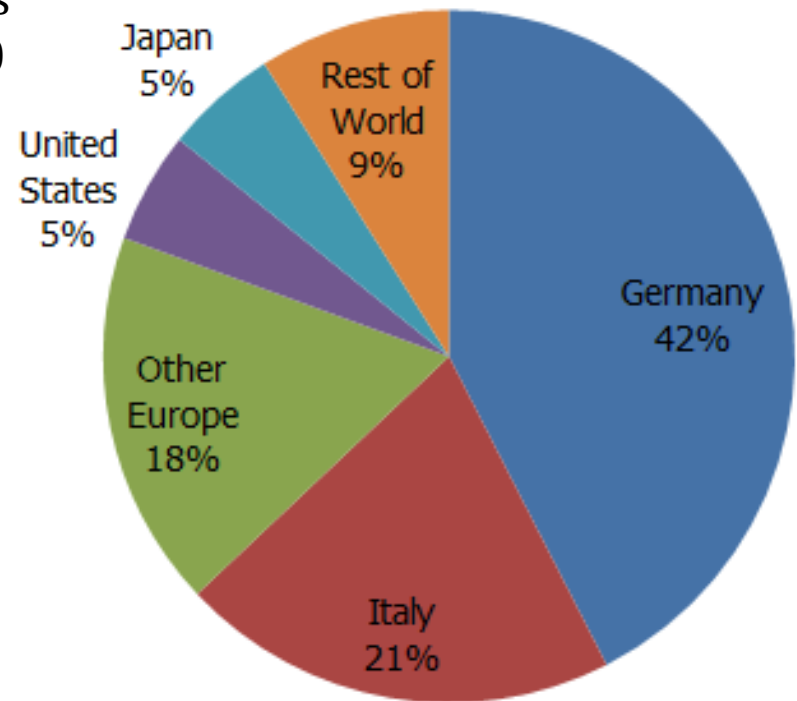
- The use of solar energy has not been opened up because the oil industry does not own the sun. -- **RALPH NADER**

- Some of our businesses use more energy than others, but our strategy everywhere is the same.. first, reduce our use of energy as much as possible. Then, switch to renewable sources of power where it makes economic sense. And, over time, as a last resort, offset the emissions we can't avoid. -- **RUPERT MURDOCH**

- Renewable energy is proven technology, the price is dropping, the rest of the world is going that way, that's where our investment should be going as well. -- **BOB BROWN**

Share of Global PV Demand in 2010

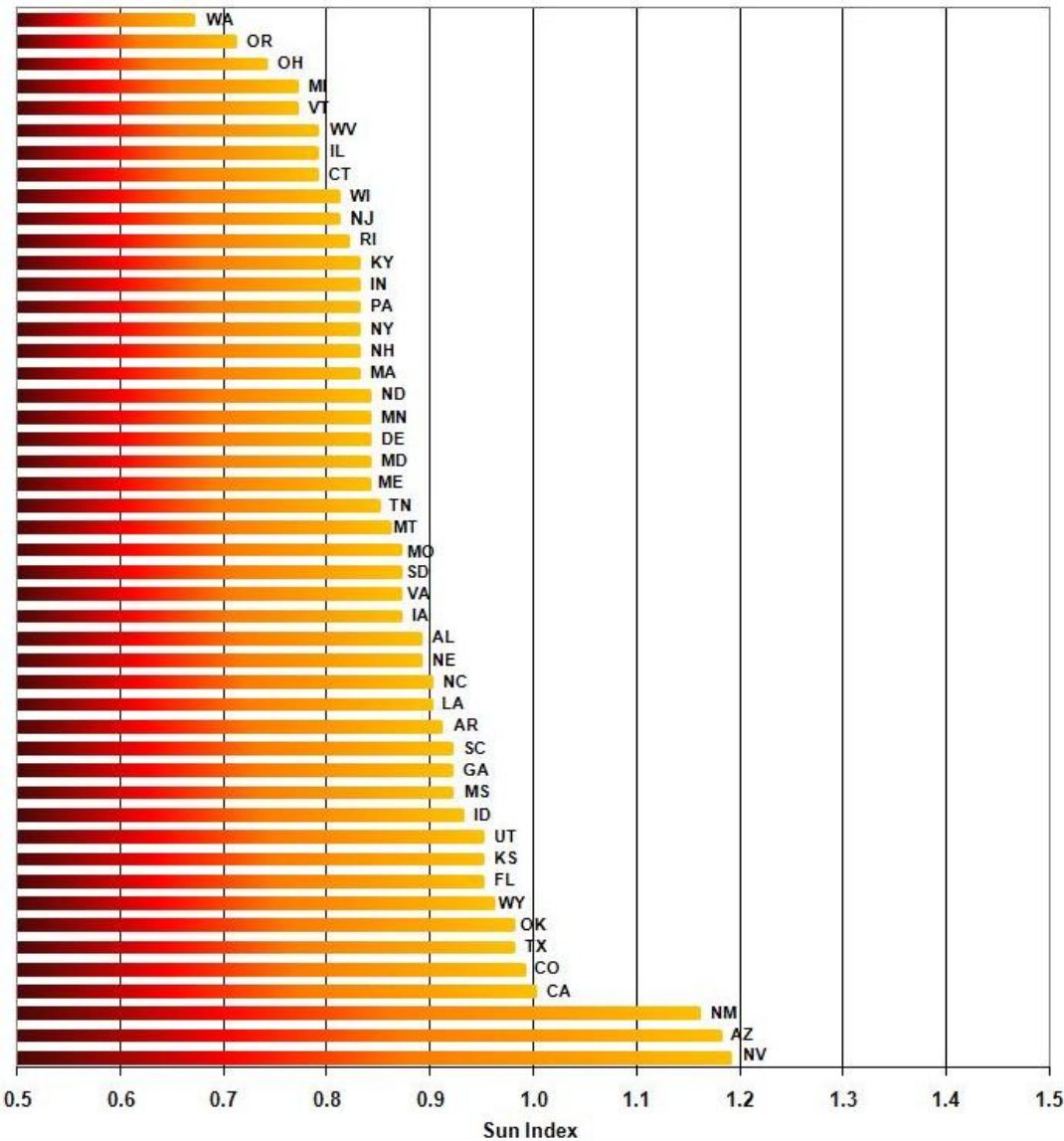
- Worldwide solar /PV market installations reached a record high of 18.2 GW in 2010
- This represents growth of 139% over the previous year
- PV industry generated \$82 billion in global revenues in 2010, up 105% Y/Y from \$40 billion in 2009
- In 2010, the US market grew by 96 percent
- Predictions:
 - By 2015, the European market share will fall to between 45-54% as North America and several Asian markets grow rapidly
 - Prediction: The US will be the fastest growing major country market over this period



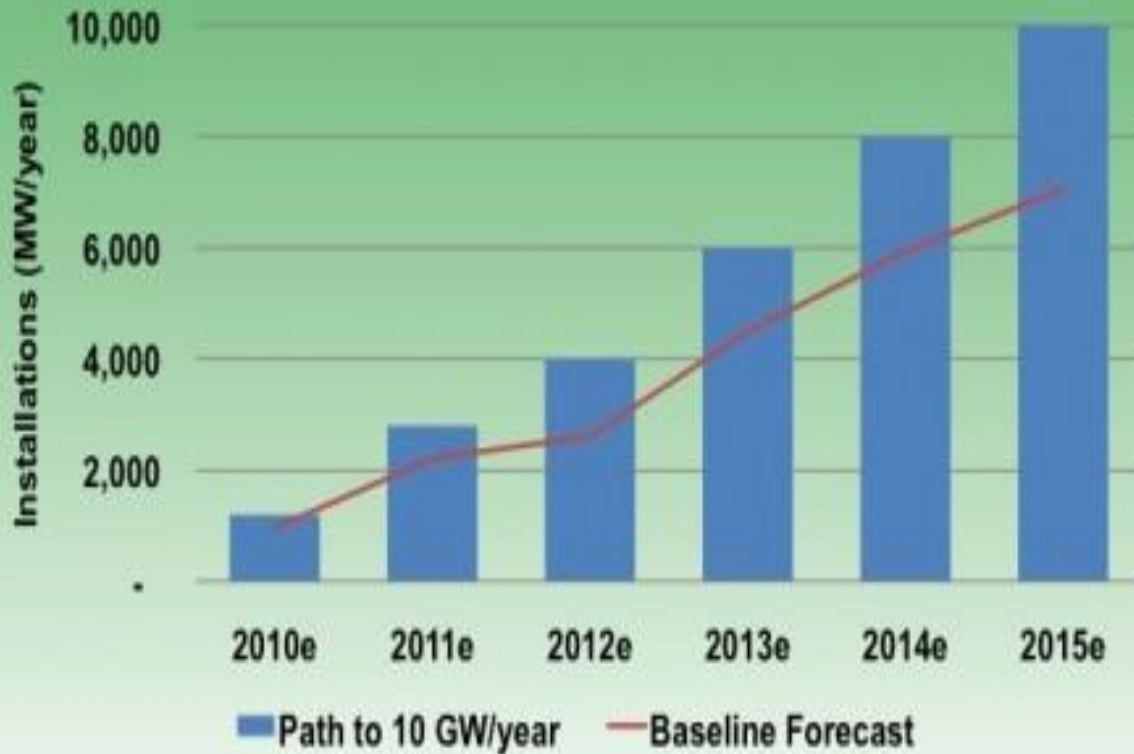
Total: 18.2 GW

Source: Solar Buzz/2011Market Buzz Report

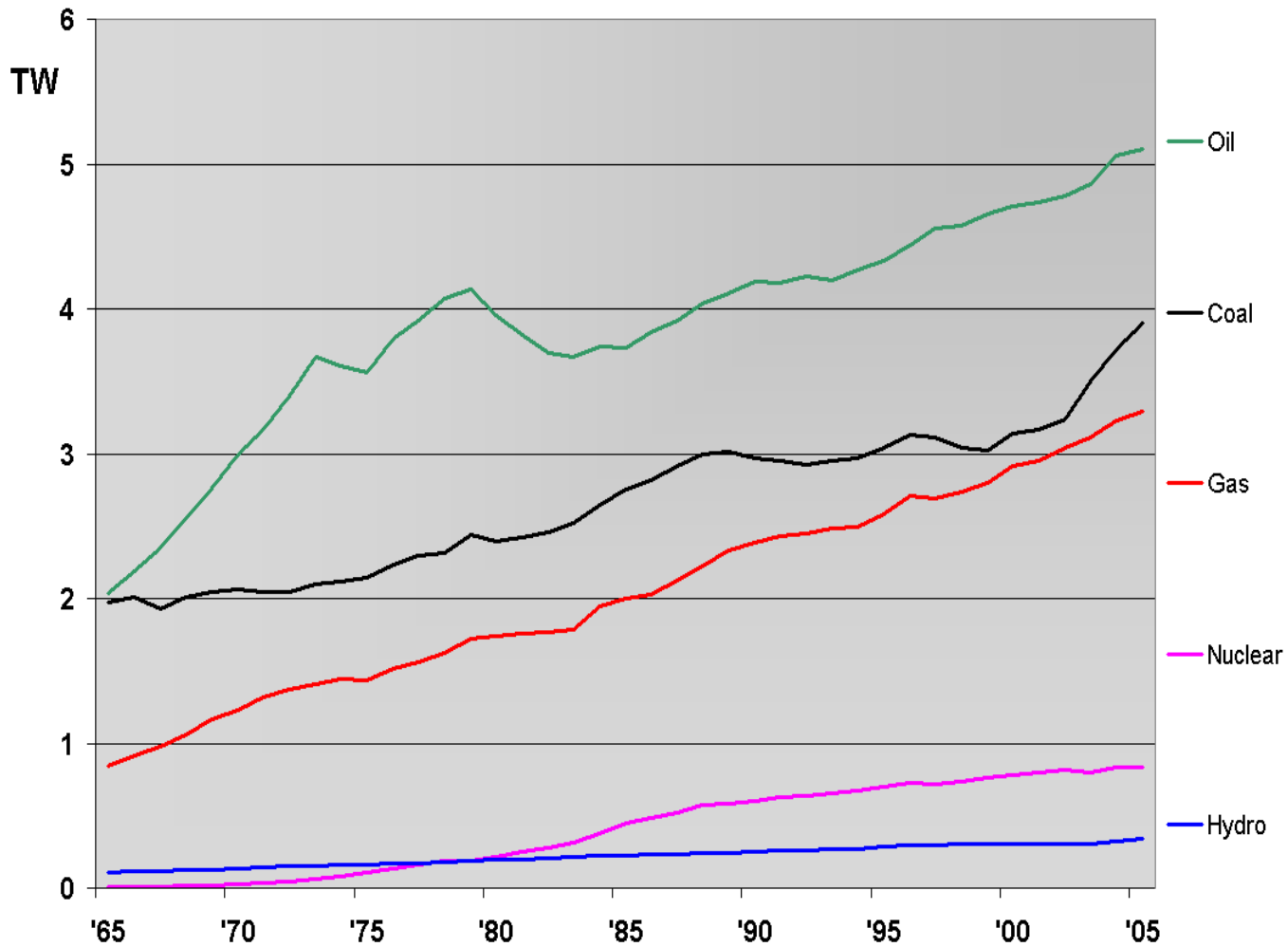
Solar Power Potential by State



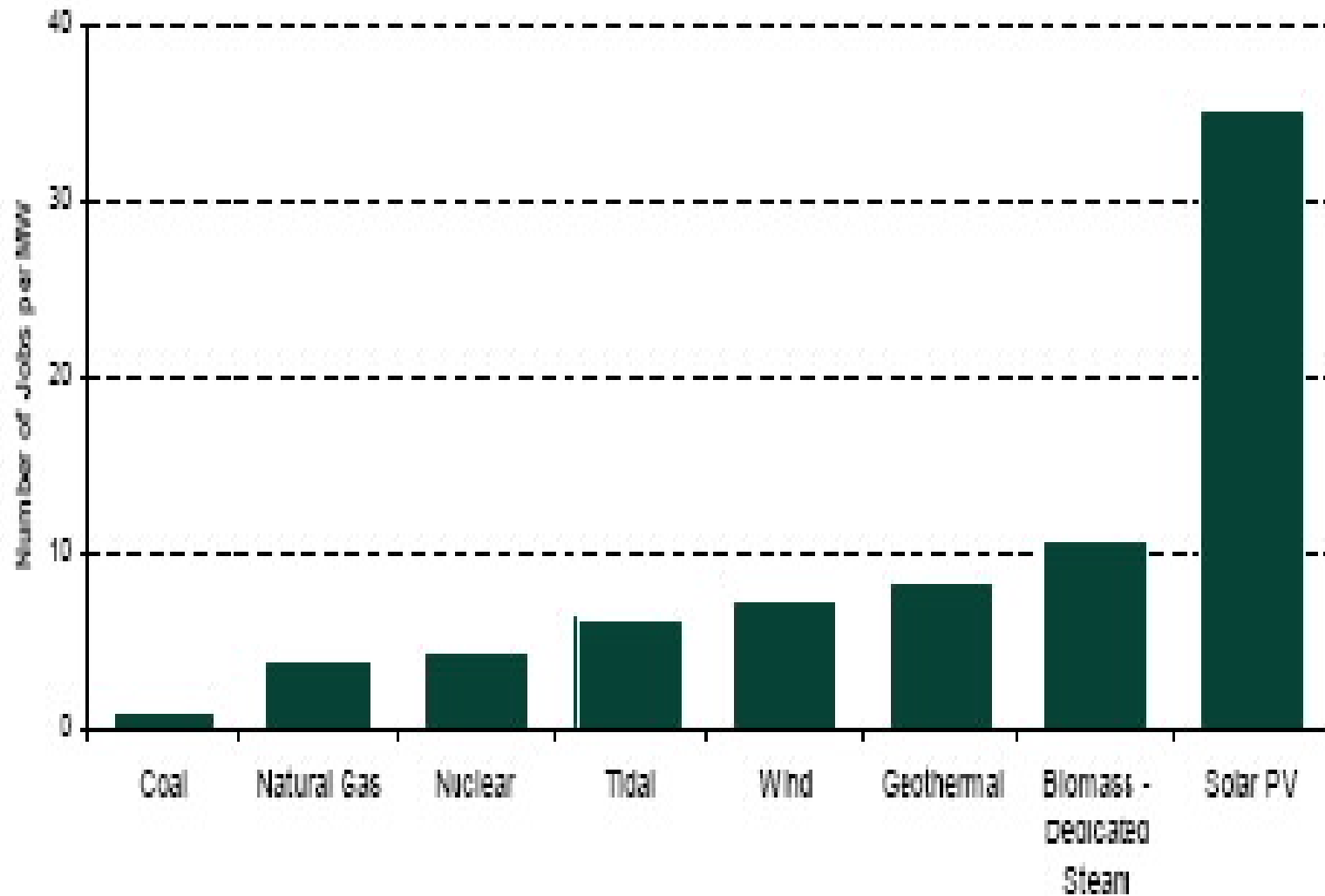
- Based on the NREL sun index level, Iowa is ranked 14th among the states with the greatest energy potential from solar power
- The sun index is defined as an index of the amount of direct sunlight received in each state and accounts for latitude and cloud cover.
- The sun index was calculated as the average number of hours of peak direct sunlight hours per year from 1960 to 1990.



Baseline: SEIA/GTM Research. U.S. Solar Market Insight: 2nd Quarter 2010



Job Creation Potential of Various Electricity Generation Assets



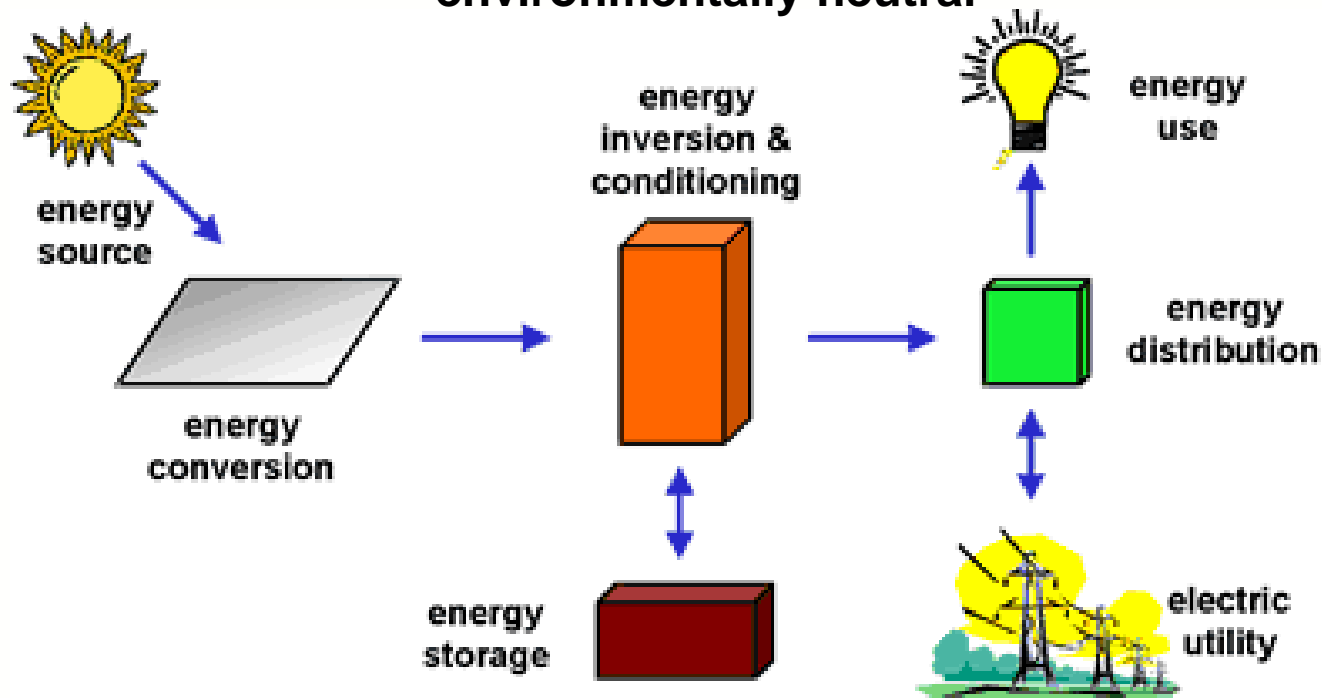
Source: INEEL, BC Sustainable Energy Association, Renewable Energy Policy Project, Lehman Brothers research



- PV Installer
 - PV/DC Professional installer
 - A/C Electrician
 - System Designer
 - PV electrical engineer
 - Structural engineer
 - Project Manager
 - PV salesperson
 - Program/office administrator
 - Maintenance/warranty personnel
 - Financing support (CPA/Bank officers)
 - SREC trader
-
- *Germany states PV creates additional jobs including all manufacturing/shipping of components components, etc. Germany employed 42,000 full time PV jobs in 2007.

Photovoltaics

Photovoltaics generally have no moving parts, are relatively simple in design, need very little maintenance and are environmentally neutral



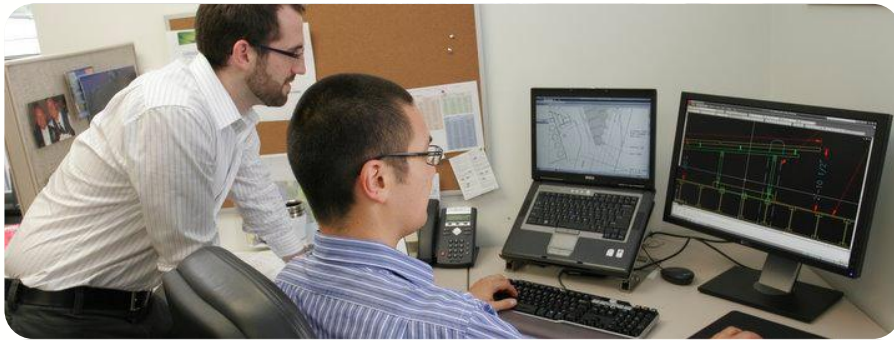
Design Considerations

What information is required to design a system

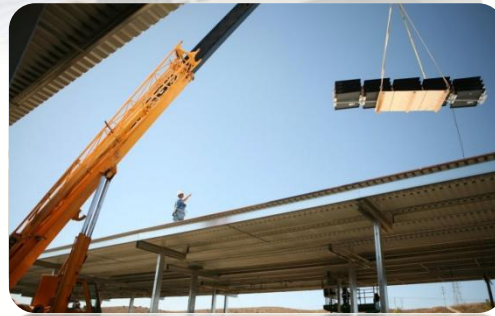
- Type, size and pitch of roof
- Roof orientation/direction (south, north, east, west)
- Electric utility provider – Alliant Energy offers a rebate which helps with payback
- Type of electrical service
- Monthly energy consumption for the property (12 months; know rate plan)
- Shading issues on the property (i.e. trees, HVAC units)
- Goals for installing solar
- Payback expectations; interest in financing
- Pictures, drawings, measurements of roof



Solar Design and Engineering



- Systems need to be designed for the application
- Care needs to be taken with matching solar module strings to the inverters
- Systems need to be properly installed so that there are not issues with shading and overloading a roof



Photovoltaic Module IPC240P01-US

Specifications

Cell Type	Poly-Crystalline Silicon
Cell Size	156mm×156mm (6.14×6.14in)
No. of cells and connections	60(6×10)
Dimension of module(mm)	1640×992×40mm (64.57×39.06×1.57in)
Weight	18.5Kg (40.8lbs)
Power Tolerance	+/- 3%

Electrical Characteristics

Model	IPC240P01-US
Maximum power at STC(P _m)	240W
PTC	215.7W
Open-circuit voltage(V _{oc})	37.20V
Short-circuit current(I _{sc})	8.82A
Voltage at P _{max} (V _{mp})	30.9V
Current at P _{max} (I _{mp})	7.77A

STC: Irradiance AM1.5, 1000W/m², 25°C

Limits

Fuse rating	15A
Maximum system voltage	600VDC (UL)
Operating temperature	-40°F to +185°F (-40°C to +85°C)

Temperature and Coefficients

NOCT	48°C +/- 2°C
Temp coefficient of V _{oc}	-0.33%/°C
Temp coefficient of I _{sc}	0.046%/°C
Temp coefficient of power	-0.47%/°C

NOCT: Nominal Operation Cell Temperature

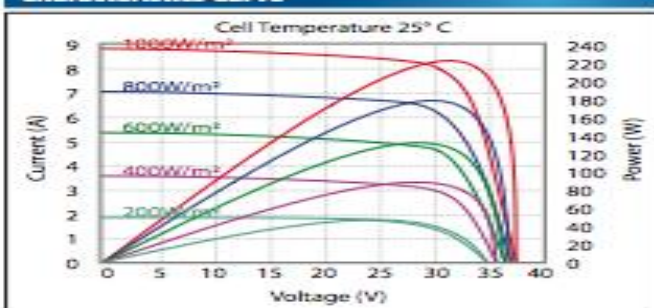
Output

Type of output terminal	Junction box
Cable	12AWG
Cable lengths	1000mm (39.37in)
Connector	Tyco Electronics Solarlok

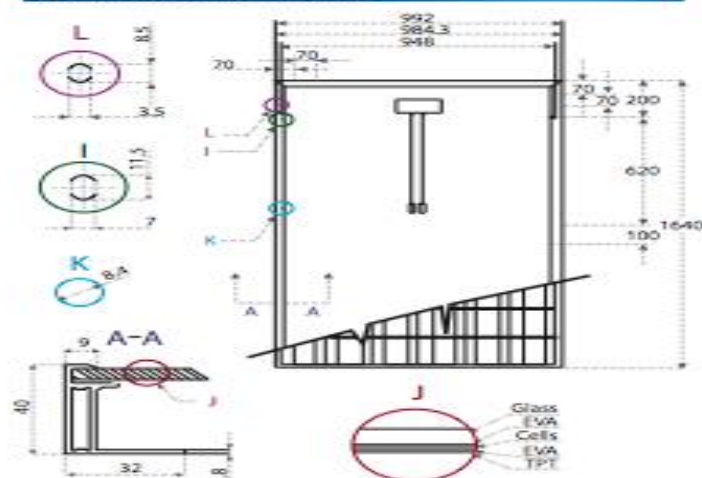
Distributor Information



Characteristics Curve



Mechanical Characteristics



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www.ipowercorp.com



Made in the U.S.A.



SOLAR INNOVATION POWERING A SUSTAINABLE WORLD

HelioVolt HVC-170X

Next Generation Thin Film CIGS Solar Modules

AESTHETICS & DESIGN

Superior performance delivered in an all black, frameless presentation. Frameless modules integrate seamlessly to urban-distributed solar systems.

ENDURING RELIABILITY

HelioVolt glass-glass laminates are distinguished by their aesthetic design, durability and superb weathering characteristics. Rigorous testing confirmed HelioVolt modules exhibit degradation rates one to two orders of magnitude lower than typical module performance.

Our modules are produced to meet UL, IEC, Safety Class II certification requirements.

www.heliovolta.com

HelioVolt modules provide high performance and lasting reliability for scalable, low cost distributed solar power. Developed and manufactured in the USA, HelioVolt's monolithic modules demonstrate unprecedented environmental performance and reliability.

High Performance Modules

HelioVolt modules are designed to deliver the highest energy harvest:

- 10 to 20% higher performance** per nameplate efficiencies than c-Si PV technologies
- Superior diffused light performance** results high energy yield
- Versatile product platform** that excels at any installation angle

Applications

- Commercial rooftops:** HelioVolt modules deliver outstanding energy production even in sub-optimal orientation.
- Car ports and BIPV:** HelioVolt has invested considerable resources to accommodate complex installations.
- Ground mounts:** Our products are designed to yield the highest energy harvest versus peak power rating.



SUNNY BOY 5000-US / 6000-US / 7000-US / 8000-US



SB 5000US / SB 6000US / SB 7000US / SB 8000US



UL Certified

- For countries that require UL certification (UL 1741, IEEE 1547)

Efficient

- 97% peak efficiency
- OptiCool™ active temperature management system

Safe

- Galvanic isolation

Simple

- Patented automatic grid voltage detection*
- Integrated DC disconnect switch

SUNNY BOY 5000-US / 6000-US / 7000-US / 8000-US

Versatile performer with UL certification

The Sunny Boy 5000-US, 6000-US, 7000-US and 8000-US inverters are UL certified and feature excellent efficiency. Graduated power classes provide flexibility in system design. Automatic grid voltage detection* and an integrated DC disconnect switch simplify installation, ensuring safety as well as saving time. These models feature galvanic isolation and can be used with all types of modules—crystalline as well as thin-film.



PowerVault



The Turnkey DC-to-Medium Voltage Building Block for MW-Scale Projects

The PowerVault™ from PV Powered is a fully integrated power conversion solution for MW-scale PV projects that accepts PV DC inputs and provides medium voltage AC output. The PowerVault is built around PV Powered's line of commercial inverters which offer exceptional reliability and 20+ year operating life. The PowerVault also offers industry-leading efficiency and the widest MPPT input range of any commercial inverter in the industry. This combination of reliability, long life, and maximized energy harvest makes the PowerVault the right choice to maximize return on investment in a MW-scale PV system.

The pre-wired outdoor-rated enclosure reduces project engineering costs, accelerates project schedules, and significantly decreases the cost of on-site labor and installation. The entire package is also designed to be pier mounted to further simplify installation.

The enclosure is certified to UL QRNZ for walk-in electrical equipment, and houses the inverters, distribution switchboard, and low voltage service power panel. The transformer with integrated medium-voltage switch is a compact and cost-effective choice that enables low-cost loop-feed installations and minimizes the need for individual pieces of medium-voltage switchgear. The flexible design offers several configuration options to meet local utility requirements and installation preferences.

PV Powered backs all its commercial inverters with an industry-leading 10-year nationwide warranty, an unprecedented optional 20-year warranty, and the most responsive and experienced service and support team in the business.

PERFORMANCE MONITORING

Increase uptime and reduce maintenance costs with inverter-integrated monitoring solutions from market-leading third party partners. Each engineered solution is housed on a UL508A panel to deliver the highest level of safety and reliability. With the optional revenue grade meter and subcombiner monitoring, PV Powered offers unprecedented choice and convenience.

SYSTEM FEATURES

Superior Reliability

- Low inverter-parts count reduces potential failure points
- Redundant cooling system with Smart Air Management™
- Card-cage circuitboard system minimizes electronic interconnections and enables fast service
- Factory pre-wired and tested, reducing potential for field errors
- Up to four inverters for increased redundancy

Significant Financial Benefits

- Factory installation and wiring greatly reduce field labor
- Pier-mount skid installation reduces pad costs and simplifies conduit entry
- High efficiency and long service life maximize energy harvest every day for 20+ years
- Integrated solution reduces project engineering costs, and shortens project construction cycle
- Protected from vandalism without additional fencing or other on-site construction

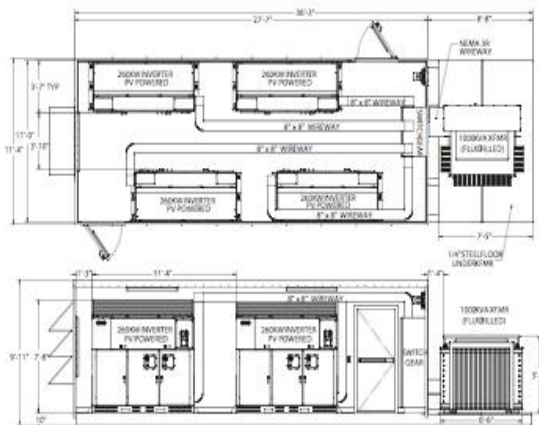


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WWW.PVPOWERED.COM

All PV Powered products are designed and manufactured in the U.S. are fully compliant with the Buy American Act, and qualify for projects funded by the federal stimulus package.

DIMENSIONS

(complete design documentation including seismic calculations available upon request)



ELECTRICAL SPECIFICATIONS

MODEL	MV-620kW	MV-780kW	MV-880kW	MV-1040kW
Continuous Output Power (kW)	620	780	880	1040
System Weighted CEC Efficiency at 480 VAC (%)	95.8%	9.7%	96.9%	9.7%
Maximum DC Input Voltage (VOC)	600	600	600	600
DC Peak Power Tracking Range (V)	295 - 500	295 - 500	295 - 500	295 - 500
Optional DC Peak Power Tracking Range (V)		265 - 500		265 - 500
DC Input Nominal Current (A)	2206	2775	3131	3700
AC Nominal Voltage	4.16kV - 35kV	4.16kV - 35kV	4.16kV - 35kV	4.16kV - 35kV
AC Operating Voltage Range (% of nominal)	-12% to +10%	-12% to +10%	-12% to +10%	-12% to +10%
AC Frequency Range (Hz)	59.3 - 60.5	59.3 - 60.5	59.3 - 60.5	59.3 - 60.5
AC Maximum Continuous Current (A)	28 @ 12.47kV	35 @ 12.47kV	40 @ 12.47kV	47 @ 12.47kV
Harmonic Distortion (%THD)	< 3%	< 3%	< 3%	< 3%
Power Factor	> .99	> .99	> .99	> .99

MECHANICAL SPECIFICATIONS

MODEL	PowerVault
Dimensions (H" x W" x D")	9' 11" x 11' 4" x 36' 3"
Construction	Powder-coated steel base, stucco aluminum exterior walls, insulated membrane roof
Mounting	Pier Mount
Weight (lbs)	48,000 maximum in 1,040kW configuration
Cooling	Forced Convection
Operating Ambient Temperature Range (°C)	-30 to 50
Standby/Storage Ambient Temperature Range (°C)	-40 to 60

CONFIGURATION OPTIONS

- **Inverters** Wide range of customizable subcombiner fusing options
- **Switchboard** Branch breakers for tracker power and other onsite power requirements
- **Single Phase Load Center** Power for plug loads and other single phase convenience loads
- **Medium Voltage Transformer with Integrated Medium Voltage Switch** Select AC output from 4,160V to 35kV AC, loop feed or radial feed, multiple protection and switching options
- **Metering** Revenue grade metering can be selected for each inverter, at the switchboard, and at the medium voltage output

AGENCY APPROVALS

UL 1741 for Inverters UL QRNZ for Walk-in Electrical Equipment



AE Advanced Energy **PowerVault** Advanced Energy **And** Advanced Energy **SENDERNO RFPFP**

The PV Powered commercial inverter portfolio is now combined under AE's global service offerings – including the 99% inverter uptime guarantee.



[e] ENPHASE MICRO-INVERTER



The Enphase Energy Micro-Inverter System improves energy harvest, increases reliability, and dramatically simplifies design, installation and management of solar power systems. The Enphase System includes the micro-inverter, the Envoy Communications Gateway, and the web-based Enlighten monitoring and analysis website.

PRODUCTIVE

- Maximum energy production
- Resilient to dust, debris and shading
- Performance monitoring per module

RELIABLE

- MTBF of 365 years
- System availability greater than 99.8%
- No single point of system failure

SMART

- Quick & simple design, installation and management
- 24/7 monitoring and analysis



S-5![®]

The Right Way!

S-5-PV Kit



S-5-PV Kit

The concept of combining photovoltaic arrays with standing seam metal roofing is growing—and for good reasons. A standing seam metal roof has a life expectancy consistent with that of framed PV modules. A 30-year power source, on a 30-year roof, along with zero-penetration technology creates the most sustainable roof system available coupled with alternative power generation!

The challenge has been in how to attach the PV modules to the standing seam roof systems without jeopardizing roof material and weather-tightness warranties. The answer is the S-5-PV Kit and the S-5! Mini.



With a service life compatible with the expectancy of metal roofs and attached accessories, the S-5-PV Kit offers unmatched sustainability. Penetration-free attachment, lower installation costs, and cooler roofs, combined with rising energy costs and increased environmental concerns all spell a bright, sunny future for PV and standing seam metal roofs. S-5! makes it easy.



Attach almost **anything** to standing seam metal roofs without piercing the panel!

888-825-3432

www.S-5.com

**Silverback is Addressing the
Barriers for Adoption of Solar
with Practical Solutions for All:
Installers, Roofers and
Building Owners.**





Payback Considerations- Federal and State (Iowa) Incentives

- Renewable Energy Production Tax Credits (Corporate)
- Business Energy Investment Tax Credit (ITC)
- Property Tax Exemption for Renewable Energy Systems
- Wind and Solar Energy Equipment Exemption
- Modified Accelerated Cost-Recovery System (MACRS) + Bonus Depreciation (2008-2012)
- Interstate Power and Light (Alliant Energy) - Business and Farm Renewable Energy Rebates
- Rural Energy for America Program Guaranteed Loan Program (REAP LOAN) USDA



What's in the News?

- US Military signs with SolarCity for \$1BB
- China signs in new domestic FiT program-multi gigawatt market
- Renewables pass nuclear on energy production
- 500MW plant switches from CSP to PV
- APS hits RPS targets 3 years in a row

Questions?