



1000 Volt 1 MW UL 1741 Integrated Solar Inversion Station

AETI's Integrated Solar Inversion Station: ISIS™

American Electric Technologies, Inc. (AETI), has been a leading global provider of power delivery solutions to the traditional and renewable energy industries for 65 years.

We have deployed over 1000 MWs of power delivery systems and have proven technology in 20+ year deployments into the world's harshest environments. We have also deployed wind power converters in harsh weather environments, such as Alaska and Inner Mongolia.

AETI has taken our multi-megawatt experience to develop the solar industry's first true utility grade & scale Integrated Solar Inversion Station called ISIS™.

Designed for utility scale solar projects, developers, financiers, Engineering, Procurement and Construction (EPC) firms and utilities can now successfully implement their utility scale solar projects with the world's first 1 MW 1000 Volt integrated solar inverter approved to UL 1741 — which also provides the highest performance and maximum reliability on the market.

World's First 1 MW 1000 Volt Centralized Solar Inverter Approved to UL 1741-2010

OSHA and the California Energy Commission (CEC) have approved a select few Nationally Recognized Test Laboratories, including TUV Rheinland of North America, to perform testing to UL 1741 standards as part of their solar inverter testing process. As an NRTL, TUV Rheinland validated compliance of AETI's 1 MW ISIS to all appropriate UL 1741 Year 2010 Standard criteria. AETI worked with TUV on this important milestone that enables 1000 Volt farms with the witness testing of a UL standard to become a reality for USA solar projects.

Utility scale solar projects can now realize higher ROI when designing with higher voltage 1000 Volt UL-tested photovoltaic (PV) panels, yet retain all of the farm electrical safety and lifetime reliability benefits of legacy 600 Volt UL-tested systems.

ISIS is the Highest Performing Solar Inversion System

Most of the legacy utility scale solar project designs come from a commercial-building NEC-oriented solar mindset, which means they were designed at levels of no more than 600 Volts. AETI's years of field experience in the traditional & utility power generation and wind markets has shown that when generating power at higher voltage levels, solar power project owners and operators can generate more power from the same physical size power generation asset.



Solar panel manufacturers have introduced new panels that provide 1000 Volt power output. AETI's ISIS is the first solar inverter approved to UL 1741 that enables project developers to take advantage of the increased voltage — which results in watts per string increased up to 15%.

ISIS delivers an industry leading maximum power point voltage of up to 1100 Volts for use with IEC 1000 Volt panels in a unipolar configuration or UL 600 Volt panels in a bipolar configuration. ISIS also has the industry's highest photovoltaic DC input current rating of 1600 Amps.

ISIS delivers power with low tare losses due its proprietary liquid and air cooling system, typically 150 watts when offline at night and up to only 5,000 watts when under full sun at its full 1 MW output power. In addition, ISIS delivers clean power quality of <3% IEEE-519 TDD @ 1 MW output. In addition to delivering solar inverter-only efficiency of 98%, ISIS is the only system that delivers an industry-leading input PV DC to output MV AC system solar power delivery efficiency of 96.3% or better across the 1000 Volt inversion

system, 15 kV step-up transformer and 15 kV utility interconnection system.

ISIS is the Most Reliable and Robust Solar Inversion System

ISIS' design leverages AETI's experience in deploying 1000s of MW of proven power delivery solutions into the world's harshest energy environments. ISIS' multi-tiered smart cooling architecture contains a self-contained liquid-cooling system for the inverter's power modules, and a low-air-flow low-dust-attraction air cooling system for the power filter & control components, using multiple, redundant, on-demand fans to ensure continued operation with the lowest tare loss versus the highest output power delivered.

ISIS' harsh-environment-duty NEMA 3R outdoor system packaging includes an air intake system that results in dirt & debris-less operation. ISIS' compartment doors themselves are sunlight heat-rejecting, and along with the integral liquid and air cooling system, deliver the industry's leading operational range of -40 to 55°C, without de-rating of output power up to 50°C.





ISIS' Utility Interconnect System Assures Successful Utility Grid Integration

Every utility has their own grid interconnect requirements. Each ISIS system incorporates a utility interconnect system that is customized to each utility's specific interconnect requirement.

Our engineers work directly with the solar farm designer and utility to incorporate project specific circuit breakers, multi-function protective relays, interconnect relays, disconnect switches, and revenue meters and their utility specific CTs and PTs into the system. We are the only inverter company with this in-house capability, which significantly reduces project risks and costs to the developer and financier alike.

In addition, AETI's low & medium voltage equipment engineering specialists are available to assist in not only configuring ISIS, but the front-end PV combiners and back-end MV central collection substations as well, for complete supply of electrical diagrams and interconnect application information to the utility's engineering team. AETI acts as a partner to the team of developer, EPC and utility to ensure the electrical balance of plant systems are integrated across the entire solar farm.

ISIS also incorporates key utility interconnect capabilities, such as

FERC 661A low voltage ride-through (LVRT) up to 5 cycles at 15% voltage. ISIS also has the world's widest VAR compensation capability, from 1 pf down to 0 pf, *regardless of the solar real power input*, to address regional utility grid reactive power compensation requirements.

ISIS can also be programmed to change its output power factor across the time of day, or on-demand, via its onboard Modbus based / DNP3 networked utility SCADA System, to provide dynamic VAR compensation.

In addition, ISIS is one of the first systems to provide programmed ramp up of output power to not only eliminate the undesirable "hammering" of the local utility grid like conventional systems — but lengthen the life of the farm's step-up transformers as well.

ISIS Significantly Reduces Project Schedules and Costs

ISIS' 1 MW solar inverter, 99% efficient 1 MVA transformer, and project specific utility interconnect system are all integrated on a pre-tested, skidded NEMA 3R outdoor package, resulting in less design engineering, field construction installation and field system integration, test, and start-up commissioning work, saving the financier, developer and EPC up to \$150,000 per 1 MW in overall project work, cost and schedule reductions.

ISIS Combiner Fuseboard

AETI has developed a UL 1741 compliant 1200 Volt solar combiner fuseboard for use with the 1 MW Integrated Solar Inversion Station. Designed to take full advantage of the maximum input operating range of ISIS up to 1100 Volts, the 1200 Volt combiner fuseboard utilizes a NEMA 3R AETI proprietary-paint galvanized steel enclosure, a pre-wired harness with PV string connectors pre-installed, and a 200 Amp 1200 Volt rotary disconnect switch with lockout.

The fuseboard is offered in a 1000 Volt uni-polar and 600 Volt bi-polar PV array configurations, with the PV+ and PV- poles fused and not grounded in order to comply with California Public Utility Commission requirements for inverter trip-off when detecting a DC ground fault condition in either the PV+ or PV- pole.

The fuseboard is ordered customized to suit a variety of string count options, from 8 to 18 (monocrystalline panels), or up to 36 (thin-film panel) strings, for feeding ISIS' 12 input circuits.

PV string current monitoring options based upon Modbus communications are available. When monitoring is selected, the fuseboard is also equipped with an outdoor duty 120 VAC outlet with GFCI for PV array panel maintenance and servicing.



AETI Solar Services

AETI offers a variety of solar farm electrical services, from the PV panels through the combiners, inverters and central collecting substations to the utility grid, to assure successful solar power production. AETI's 30+ power services technicians provide solar farm equipment start-up & commissioning, warranties and extended warranties, preventative maintenance & part spares programs and emergency on demand services.

AETI can also provide electrical start-up & preventative maintenance services for the solar farm infrastructure, including PV panel to combiner, combiner to inverter, inverter to substation and substation to the grid wiring & cabling. AETI offers our full set of services with 24 x 7 global hotline, technical response and experienced field support.

AETI has Your Answers!

From the design, manufacture, commissioning and servicing of combiners, inverters and central substations, we have the answer!



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June 2011