

# **Solar Power Switchgear & Energy Storage** *Renewable Energy* *Systems*



**ADVANCED POWER**  
**TECHNOLOGIES**



## *Solution Brochure*



**PROVIDING A COMPREHENSIVE  
APPROACH TO RELIABLE POWER**

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# Solar Power Plant Equipment



Figure 1: Medium Voltage Utility Intertie Switchgear, Step-Up Transformer, Low Voltage Combiner Switchboard, & Grounding System Outdoor Pad mount NEMA 3R Non-Walk-In

## Balance of System (BOS) Equipment & Services for Solar Farm Systems

Costs of implementation of Solar Power Systems continue to go down. Let APT be your source for alternative renewable energy Balance of System (BOS) equipment for Solar Farm Power Systems & Photovoltaic (PV) Power Plants. APT has the resources and expertise to provide safe, reliable, and cost-effective solutions for the collection of solar generated power for utility scale grid tie and microgrid applications. No matter how large or small, simple or complex the site is, APT has you covered from the inverters to Point of Common Coupling (PCC) in utility applications or connection to a micro-grid for power distribution with the following:

- ❑ Solar Site Planning, One-Line Diagram Development, Engineering and Design Review
- ❑ Low and Medium Voltage Utility Intertie Switchgear according to IEEE 1547 and Utility Company requirements.
- ❑ Advanced microgrid controls for peak shaving, paralleling with utilities, other generators and islanding
- ❑ Integration of battery storage and motor-generators for increased microgrid stability, transient response and improved motor starting
- ❑ Outdoor Walk-In PV Combiner & Utility Intertie Switchgear Modules with sheltered working and maintenance rooms
- ❑ Custom Energy Storage Systems
- ❑ Low to Medium Voltage Solar Step-up Transformers
- ❑ Outdoor NEMA 3R Non-Walk-In Solar Application Specific Solar PV Power Combiner Switchgear, Custom AC Switchboards and AC Panelboards
- ❑ Solar PV Effective Grounding Equipment including grounding transformers.
- ❑ Pole Mounted or Pad Mounted Low and Medium Voltage Gang-Operated Disconnect Switches, Fuses, Surge Arresters, and Cut-Outs
- ❑ Go Solar California! approved Solar Power Metering
  - For more information on the California Solar Initiative (CSI) and Go Solar California!, visit <http://www.gosolarcalifornia.ca.gov/>
- ❑ Remote Monitoring SCADA systems
- ❑ On-site Commissioning Assistance and Training

# Utility Interconnection for Solar Farms



Figure 2: Pole Mount Fused Cutouts Disconnect Switches



Figure 3: Utility Intertie Switchgear with Isolated Controls NEMA 3R



Figure 4: Inside Utility Intertie Protection & Generator Interrupter Switchgear

## Utility Intertie Protection & Solar Generation Intertie Switchgear

- System Voltage range:
  - 2.4 kV – 38 kV, 60/50 Hz
- Design Amperages:
  - Up to 3000A
- Produced to the following standards:
  - ANSI/IEEE C37.20.2 - Metal-Clad Switchgear or ANSI/IEEE C37.20.3 – Metal-Enclosed Switchgear
  - IEEE 1547 -IEEE Standard for Interconnecting Distributed Resources with Electric Power
- Main bus:
  - Insulated silver plated copper, with bolted connections covered by insulating boots
- Symmetrical Interrupting Capacity (5-15 kV):
  - 25kA, 40kA or 50 kA
  - Typical system voltage: 2.4kV, 4.16kV, 12.47kV, 11kV, 13.2kV, 13.8kV
- Draw-out or Fixed mount Vacuum Circuit Breakers with visible disconnect
- Protective Relay Functions as required
- Distribution or Station class surge arresters
- Self-derived control power with on-site convenience receptacle
- Integrated Battery System
- Advanced Power Metering
  - UL recognized ANSI C12-20-1998 Class 10 0.5% Accuracy
- Enclosure
  - Available in NEMA 1 (indoor) and NEMA 3R (outdoor) installation.
  - Carbon steel, Stainless or Aluminum
  - Powder coated ANSI 61 Gray.
  - All hardware is stainless steel.
  - Door handles are padlockable.
- Optional Features:
  - Undervoltage release
  - Metal Clad Construction
  - 3-pole Gang-Operated dead-break Visible Disconnect Switch

# Generated Solar Power Combination Solutions



Figure 4: 600A Solar Combiner Panelboard



Figure 5: 2000A Solar Collector Switchboard

## Low Voltage Utility Intertie, Combiner/Aggregation Switchboards & Panelboards

- Application:
  - Utility Intertie Protection
  - Overcurrent Protection
  - Visible Disconnect
  - Aggregation of String Inverters and Micro Inverters
  - Station services
- Applicable standards:
  - IEEE 1547 - IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems
  - UL 891 Standard for Switchboards
  - UL 67 Standard for Panelboards
- Voltage:
  - 208V – 690V, 3Ø, 3 or 4 Wire
- Frequency:
  - 60Hz or 50Hz
- Surface Mountable Panelboard
  - Main Circuit Breaker or Main Lugs Only
  - Fourteen (14) 3-pole Feeder Circuit Breakers maximum per section
- Floor Standing Switchboard
  - Standard bus ampacity up to 4000A
  - Silver plated copper bus
  - Busbar connections with NEMA standard hole pattern
  - Bus Access & Cable Entry:
    - Front Access for bottom cable entry
  - Insulated Case Main Circuit Breaker
  - Molded Case Feeder Circuit Breakers
  - Revenue Grade Current Transformers
  - Advanced Power Metering
    - UL recognized ANSI C12-20-1998 Class 10 0.5% Accuracy
  - Enclosure:
    - Manufactured from Carbon Steel
    - Powder coated ANSI 61 Gray
    - Lockable handles
    - NEMA 1 (indoor) or NEMA 3R (outdoor)
    - NEMA 3R Internal Climate Control
    - Anti-condensation Heater w/ Thermostat.

# Power Transformers & Grounding Systems



Figure 6: 2000kVA Solar Step-Up Power Transformer



Figure 7: Effective Grounding System Equipment

## Power Transformers

- Application:
  - Step up Solar Generated Voltage for use on the utility grid
- Oil Filled Pad mount
- Ratings:
  - 500kVA – 4000kVA
- Voltage:
  - LV: 208V – 690V
  - MV: 2.4kV – 38kV
- Frequency:
  - 60Hz or 50Hz
- Outdoor NEMA 3R
- Paint Finish:
  - Munsell 7GY 3.29/1.5 Padmount Green

## Effective Grounding Systems

- Application:
  - Provide effective grounding to solar generator side to meet utility intertie requirements for grounding
- APT calculations can be provided to the Owner to demonstrate conformance to the design criteria.
- Current sensing outputs for ground fault tripping.
- Enclosure
  - Carbon steel.
  - Enclosure can be UL508A listed for NEMA 3R outdoor applications.
  - Powder coated ANSI 61 Gray with custom colors available.
  - All hardware is stainless steel.

\*Actual product may look different from images shown, based on actual specifications.

## *Energy Storage & Outdoor Walk-In Modules*



Figure 8: Solar Generated Power Battery Energy Storage System (BESS)

- ❑ APT Solar Generated Power Battery Energy Storage System (BESS) can be stand alone, outdoor NEMA 3R or fully integrated with low voltage switchboards, transformers, and medium voltage switchgear all in a single Outdoor Walk-In ISO Container Based Solar Power Combination Module
- ❑ APT Battery Energy Storage System (BESS) shall be sized in accordance with desired operating specifications
- ❑ Fully integrated solar power module comes pre-wired from the factory and only external connections need to be made upon installation,
- ❑ Fast and clean installation allows for less installation time and more generation time.



Figure 9: Outdoor Walk-In ISO Container Based Solar Power Combination Module