The main components of all renewable energy systems that are capable of or made to be utilised to provide electrical supply simultaneously with one or more additional electrical energy sources must be duly approved by an acceptable manufacturing approval body and/or the Bureau of Standards, Jamaica. The main components requiring approval are kilowatt-hour meters, power inverters, solar panels, wind turbines, fuses and circuit breakers.

All approval manufacturing bodies shall be recognised by the Bureau of Standards, Jamaica.

PHOTOVOLTAIC (PV) SYSTEMS

PV systems, in terms of circuit configuration, may be categorised as Interactive, Hybrid and Stand-alone systems.

Interactive systems are systems which operate in parallel with and may deliver power to an electrical production distribution network (energy grid).

Hybrid systems are systems which are supplied from multiple power sources but are not connected to the electrical production distribution network (energy grid);

Stand-alone systems are those supplied from a source comprising PV modules/panels only and are independent of any electrical production and distribution network (energy grid).

By and large, these systems produce dc current and rely on an inverter to change the dc current to an ac current. Because of the presence of the dc supply, the need to install dc-rated accessories in the dc section of this system cannot be overstated and this must be observed at all times.

Below are specific requirements for the installation of any PV systems of any (or every) circuit configuration.
Mounting Solar Panels/Modules

- Panels must be firmly held together by means of a proper structure that prohibits movements/vibrations of same;
- The structure, if metallic, must be effectively bonded together and to ground by means of a conductor of the appropriate size;
- Where structure is made from a particular type metal, the bolts used to facilitate bonding conductor terminations should be of a similar metal;
- The structure, whether installed on roof or at ground level, shall have supporting legs that prevents the panels/modules from coming in direct contact with the roof or ground;
- The supporting legs or base of the structure must be so anchored and be of such strength that it cannot be dislodged by wind of hurricane strength;
- Cables/conductors used to connect one panel/module to another shall be rated for use with dc current, appropriately sized (according to NEC 2008), insulated and of a length that will not allow contact with roof top if broken at one end;
- Where two or more modules are to be connected in parallel for the purpose of operating as a single system, an appropriately sized fuse must be installed in each positive conductor of each module;
- Where there is a need to use a system combiner box to combine two or more systems to operate as a single system, each system, on entering the combiner, must be terminated to a separate and appropriately sized dc rated circuit breaker/fuse;
- Each combiner box shall facilitate the exit of a single dc supply. This supply shall emanate from a single appropriately sized dc rated circuit breaker/fuse located either within the combiner box or within two feet (2 ft.) of same;
- Where cables carrying dc current are to be installed such that they are in direct contact with flammable roof or with structures made from flammable material, they shall be installed in rigid conduits that are soundly bonded to earth;
- The colour coding of conductors used as positive and negative shall be in accordance with the requirements of the NEC 2008 and shall be observed throughout the dc section of the installation;
- PV power sources (panels/modules) may be installed on the roof of buildings or at ground level;
- The location of PV power sources (panels/modules) at ground level must be such that it does not hinders the free movement of pedestrians or vehicular traffic and is inaccessible to unauthorised persons;
- **Power Inverter**

- The name plate and its contents of power inverters must be clearly visible and legible;
- Inverters shall be installed in areas where they are inaccessible to children;
- Interactive inverters are also known as grid-tie inverters;
- Cables, upon entering or exiting inverters, must be connected to dc/ac fuses/circuit breakers of the appropriate sizes;
- Inverter terminals, to which cables are (or to be) connected, must be protected against inadvertent contact;
- Where inverters are to be installed in common areas of buildings/structures, they shall be installed at a minimum height of four feet (4 ft.) measured from floor level to the nearest point on the inverter;
- No inverter shall be installed directly above a stove/cooker, sink, tub or basin. No inverter shall be installed within a bathroom;
- The ac inverter output from a stand-alone system shall be permitted to supply ac power to the building or structure disconnecting means at current levels below the rating of that disconnecting means;
- All inverters shall be registered with the Bureau of Standards Jamaica, prior to its use. Written certification of approval from the Bureau will be required;
• **Back-up Battery**

  • Battery(s) shall be secured from unauthorised persons and located in an area that is well ventilated;
  • The terminals of the batteries shall be secured/guarded so as to prevent accidental contact by persons or objects, regardless of voltage or battery type;
  • Batteries shall be installed on material suitable for such purposes and also minimize discharging;
  • Conductors of photovoltaic source and output circuits shall be of the appropriate size and rated for conducting dc current and voltage;
  • The rated voltage and ampere-hour of all batteries shall be clearly and permanently indicated on each battery;
  • Where leads from the battery travels on wall surfaces, inside any building or structure, they shall be installed in rigid (metallic) conduit of the appropriate size;
  • The interconnected battery cells shall be considered grounded where the photovoltaic power source, of a two-wire system rated above 50 Volts, is grounded;
  • Storage batteries for dwellings shall have the cells connected so as to operate at less than 50 Volts nominal. Lead acid storage batteries for dwellings shall have no more than twenty-four 2-volts cells connected in series (48-volts nominal);
  • A current limiting over-current device (fuse/circuit breaker) shall be installed in each circuit adjacent to the batteries where the available short-circuit current from battery/battery-bank exceeds the interrupting or withstand rating of other equipment in that circuit;
  • Photovoltaic power systems using grid-tie inverters to control battery state-of-charge by diverting excess power into the utility system shall have a second, independent means of controlling the battery charging process for use when the utility is not present or when the primary charge controller fails or is disabled;
4. GENERAL

• A solar photovoltaic system shall be permitted to supply a building or other structure in addition to any service(s) of another electricity supply system(s);
• **Photovoltaic source circuits** represent circuits between modules and from modules to the common connection point(s) of the dc system;
• **Photovoltaic output circuits** are circuit conductors between the photovoltaic source circuit(s) and the inverter or dc utilization equipment;
• Photovoltaic source/output circuits shall not be contained in the same medium as circuits from other systems, unless the conductors of the different systems are separated by a durable partition or are connected together;
• The connection to a module/panel shall be so arranged that removal of a module/panel from a photovoltaic source circuit does not interrupt a grounded (negative) conductor to another photovoltaic source circuit;
• Sets of modules interconnected as systems rated at 50 Volts or less, with or without blocking diodes and having a single over-current device, shall be considered as a single source circuit;
• In a dc photovoltaic source or output circuit, the maximum photovoltaic system voltage for that circuit shall be calculated as the sum of the rated open-circuit voltage of the series-connected photovoltaic modules corrected for the lowest expected ambient temperature;
• Roof-mounted dc photovoltaic arrays/panels located on dwelling houses shall be provided with ground-fault protection (fuse/circuit breaker) to reduce fire hazards. The ground-fault protection device/system shall be capable of detecting a ground fault and interrupting the flow of the fault-current by automatically disconnecting the positive conductors of the faulted source circuit;
• If the grounded (negative) conductors of the faulted source circuit are disconnected, all conductors (positive and negative) of the faulted source circuit shall be opened automatically and simultaneously;
• In one- and two-family dwelling houses, photovoltaic source circuits and output circuits that do not include lamp-holders, fixtures or receptacles shall be permitted to have a maximum photovoltaic system voltage of 600 Volts;
• In one- or two-family dwellings, live parts in photovoltaic source circuits and photovoltaic output circuits rated over 150 Volts to ground shall not be accessible to other than qualified persons, while energized;

• Over-current devices, either fuses or circuit breakers, used in any dc portion of a photovoltaic power system shall be listed for use in dc circuits and shall have the appropriate voltage, current and interrupt ratings;

• Means shall be provided to disconnect equipment, such as inverters, batteries, charge controllers, and the likes from all live (positive) conductors of all sources; If the equipment is energized from more than one source, the disconnecting means shall be grouped and identified;

• Where direct current photovoltaic source or output circuits of a utility-interactive (grid-tie) inverter from a building-integrated or other photovoltaic system are run inside a building or structure, they shall be contained in metallic raceways or enclosure from the point of penetration of the surface of the building or structure to the first readily accessible disconnecting means;

• For a photovoltaic power source, one conductor of a two-wire system with a photovoltaic system voltage of over 50 Volts and the reference (center tap) conductor of a bipolar system shall be solidly grounded;

• The dc circuit grounding shall be made at any single point on the photovoltaic output circuit;

• Exposed non-current carrying metal parts of module frames, equipment and conductors enclosures shall be grounded regardless of voltage;

• Where not protected by the ground-fault protection equipment, the equipment-grounding conductor for photovoltaic for photovoltaic source and photovoltaic output circuits shall be sized for 125% of the photovoltaic-originated short-circuit current in that circuit;

• Where buildings or structures with both utility service and a photovoltaic system shall have a permanent plaque or directory providing the location of the service disconnecting means and the photovoltaic system disconnecting means, if not located at the same location;

• Only inverters and ac modules approved by the Bureau of Standards and identified as interactive (grid-tie) shall be permitted in interactive (grid-tie) systems;

• In a series-connected string of two or more modules, a single over-current protection device shall be permitted;
Photovoltaic Source Circuit Current

- The maximum current shall be the sum of parallel module rated short current multiplied by 125%.

Photovoltaic Output Circuit Current

- The maximum current shall be the sum of parallel source circuit maximum current as calculated above (photovoltaic source circuit current).

Inverter Output Circuit Current

- The maximum current shall be the inverter continuous output current rating.

Stand-alone Inverter Input Circuit Current

- The maximum current shall be the stand-alone continuous inverter input current rating when the inverter is producing rated power at the lowest input voltage.

The contents of this represent excerpts from the promulgated National Building Code for Jamaica – the code that shall be utilized when installing Renewable Energy Systems in Jamaica. This code may be purchased from the Bureau of Standards, Jamaica.