Technical and Safety Considerations for the Safe Installation of Solar Panels.

Prior to the installation of solar panels consideration should be given to the design and weight of the panels. These panels will place a considerable structural loading upon a building. This will include vertical and lateral loading. This means that a design drawing and structural load calculations will be required. Precautions must also be taken for seismic activity, strong winds, and lightning. These precautions need to be taken to secure the panels, to prevent accidents, such as debris falling from height, and to prevent additional uncalculated structural stresses upon a building.

Solar panels are usually installed on the roof of a building or an adjacent area of land that can be secured land; other components of the system will need to be placed inside a building. These components are usually installed reasonably close to the solar panels.

In considering the live load of the installation it should be remembered that the maximum live load for the roof of an RCC structure is 30psf, for other buildings this live load is reduced. The minimum design lateral forces for the measures to secure the solar panels to the roof should be calculated as per **BNBC 2020 (article 2.5.15) and ASCE-7.**

Once installed a structural preventative maintenance plan will need to be scheduled and incorporated into the 90-Day Management Guidance and Reporting Process.

A competent and suitably qualified structural engineer should be consulted prior to the purchase of such equipment, so that a suitable design can be produced prior to installation.

Electrical and Fire Hazards Associated with Solar Panels.

Solar systems include many components that conduct electricity: solar array, an inverter that converts the panel's direct current (DC) to alternating current (AC), and other essential system parts. When any of these components are "live" with electricity generated by the sun's energy, they can cause injuries (electrocution) or fires from arcing. Even low-light conditions can create sufficient voltage to cause injury or a fire.

Electric shocks and fires can result from a short circuit in corroded cables and connections, improper grounding, and loose wiring. The arc risk is so pronounced within the solar system due to the direct current (DC) circuits found within typical PV installations, which can both generate and sustain arcs. DC circuits present a greater challenge than alternating current (AC) circuits due to the constant-current source rather than constant voltage, which makes calculating arc energies difficult.

Energy storage systems (batteries) are a serious safety hazard if incorrectly installed. Batteries pose a particular danger as they store a large amount of energy, and if that energy is dissipated in a short period of time, for whatever reason, the consequences can be substantial. Hazards can

result from overheating, electrical abuse (over/under –charging), mechanical damage or exposure to hazardous chemicals.

An experienced and competent installer who has proven experience in the installation of solar panels on buildings must be used. Preferably the installer's experiences should be checked. For correct performance and safe installation of PV systems. Any electrical engineer working on or maintaining such systems will require a detailed understanding of solar principles and of the characteristics of PV systems.

Solar panels are particularly vulnerable to lightning strikes due to their large surface area and placement in exposed locations, such as on rooftops. A lightning protection system can help keep systems running and profitable. Lightning protection system should be installed for solar array according to **NFPA 780. The standard is dedicated for LPS design, installation, and maintenance.**

A thermographic inspection should be carried out on all the electrical components, including cable connections, immediately after the solar array is ready to be used. Any identified faults should be repaired immediately. Thereafter thermographic surveys should be conducted every four months, as a minimum, for detecting possible hot spots.

All solar system and electrical connection should be periodically checked and maintained (routine testing, servicing, and maintenance) to ensure all safety measures. Also, ensure the PV system is suitably maintained as part of the building's electrical inspection and testing procedures. For DC cables, connectors and junction boxes, necessary precaution needs to be taken.

Annual maintenance should be performed in accordance with the manufacturer's specifications or applicable standards, and should include the testing of circuit breakers, inverters, fault to ground detectors and the overall electrical balance of the installation. **All electrical preventative maintenance work should be scheduled and documented within the 90-Day Management Guidance and Reporting Process.**

Regulatory standards and other sources of information applicable to the installation, use maintenance and testing of solar panels can be found at: BNBC 2020, ASCE-7, NFPA 70 including Article 690 (Solar Electric Systems) and Article 705 (Interconnected Electrical Power Production Sources), NFPA 780, NFPA 855, IBC, IFC, BRE & Renewable energy magazine, Best Practice Guidelines for Solar Power, Best Practice Guidelines for Solar Power Building Projects.