PHOTOVOLTAIC (PV) SYSTEMS
INSTALLATION & SAFETY ARRANGEMENTS

Employers Requirements (ERs) for sustainability, energy efficiency and general safety design requirements - what you need to know:

**Mandatory** - UCL ‘the Client’ requires that design teams comply with the Regulatory Reform (Fire Safety) Order 2005. Specifically, the protection of UCL staff, students, visitors and property by providing suitable and effective control measures to mitigate the impact of fire from their design.

**Mandatory** - UCL ‘the Client’ requires that design teams comply with the Regulatory Reform (Fire Safety) Order 2005. Specifically, Article 37 - ‘other equipment’ designed to work at a voltage normally exceeding the ‘prescribed voltage’ to provide a cut-off switch on the low voltage side of the equipment.

**Mandatory** - UCL ‘the Client’ requires that the design and installation of photovoltaic panels are provided with individual units to monitor panel output performance, panel fault and provide local electrical isolation to reduce the risk of fire and assist firefighting operations, should it be needed.

**Prohibited** - the design and installation of individual photovoltaic panels without monitoring output performance, faults and providing local electrical isolation controls, to reduce the risk of fire and assist firefighting operations should it be needed.

**Essential Safety & Management Devices** - individual panels to be provided with module-level power management optimizers such as Solar Edge™ or similar devices, to monitor and close down panels to a safe voltage should a fault occur or, if required for maintenance and or by the emergency services;

**Consultation** - UCL Sustainability and Fire Safety Managers should be consulted on PV design and installation at project tender stage, to ensure that proposed PV system meets sustainability and basic fire safety requirements.

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1.0. Introduction

All too often within the construction industry, photovoltaic (PV) specifications focus on just energy efficiencies and outputs of the solar panels, omitting to give the same focus to ensuring the rooftop array is installed with methods that have as little impact on the building, safety and fire risks etc. Additionally, sustainability questions need to be considered and factored into the design, such as the maximum potential for its entire lifespan rather than just becoming a ‘tick box’ exercise to achieve sustainability credits and to make the most of the investment with the need for panels to be working at 100% efficiency at all times.

However, any design must address recommendations for all UCL premises PV installation for projects, designers and contractors. As a standard, it must include approved contractors for installation and ongoing maintenance. Photovoltaic systems installed integrated into buildings components introduce a variety of potential challenges and risks and their importance of safety systems must not be understated.

- **Essential to all UCL PV Installations** - are provided with a system that monitor, isolate fault areas and reduce the risk of a fire. One such system is the **SolarEdge™** safety PV Systems but other equivalent systems may be considered;

1.1. **Best Practice** - significant standards covering PV industry activities are IEC 61215 or BS 7671 (latest version):

- IEC 61215 (PV Module – design qualification and type approval);
- IEC 61345 UV test for PV modules;
- IEC 61730 -1:2004 /AMD2 2013, PV module safety qualification Part 1 Requirements for Construction;
- IEC 61730 - 2 2004 +AMD 1 2011 CSV, PV module safety qualification - part 2: Requirements for Testing;
- IEC 62790 2014 Junction Boxes for PV modules, safety requirements & tests;
- **Microgeneration Certification Scheme [MCS] (or current equivalent scheme)** - is a nationally recognised quality assurance scheme (or similar) which certifies microgeneration technologies used to produce electricity and heat from renewable sources;
- At the end of each installation, the installer must provide a MCS compliance certificate (Solar Thermal Compliance Certificate). Certification bodies only accredited by UKAS.
2.0. High Voltage Risk

2.1 There is a risk to installers, maintenance and firefighting personnel, as active panels potentially produce a dangerous voltage for any person touching exposed wiring, with high voltages remaining even if the inverter is disconnected from the panels/AC grid;

(a). Risk to firefighters - firefighters commonly cut off electric grid supply to burning buildings as a precaution procedure before extinguishing the fire. It then may be assumed that there is no risk of electrocution isolation with the grid disconnected but this assumption may not be true in case of a PV roof systems;

- PV systems are always energized when exposed to sunlight;
- traditionally, roof top PV systems operate at up to 1000\(^1\) volts Direct Current (DC) and a hazardous voltage may remain;

(b). the existence of a PV system on a building roof may delay the firefighting procedures, because of the risk to firefighters from electric shock;

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1 Regulatory Reform (Fire Safety) Order 2005 specifically, Article 37 and ‘other equipment’ - a ‘prescribed voltage’ means (a) 1000 volts AC or 1500 volts DC if measured between any two conductors; or (b) 600 volts AC or 900 volts DC if measured between a conductor and earth and as such, special isolation switches will be required for use by the fire service - see UCL Fire Safety Technical Note TN039 for specific details;
2.2 Ability to disable DC voltage is vital - inability of traditional inverters to provide safe DC voltage:

- for safety the ability to disconnect the DC voltage of each module, or at least the ability to limit it below a safety threshold is essential;
- generally this can be only be achieved with module-level power management optimizers;
- power optimizers shut down DC voltage in modules and string wires immediately when the inverter is turned off, or when the AC breaker is disconnected;
- inverters and power optimizers shut down when exposed to extremely high temperatures or electric arcs;

2.3. Firefighter Gateway (Desirable for Large Systems) - SolarEdge™ built-in automatic SafeDC™ with ‘Firefighter Gateway’ can be connected which enables DC systems to be shut down:

- By pressing the emergency stop button;
- By receiving an alarm from Fire Alarm Control Panel (Unit);
- Real time indication of system DC voltage for safety assurance;
- Remote indication of PV system status;

3.0. Further UCL Advice

Further advice from UCL Sustainability and Fire Safety Managers in respect to provision installation and safety systems to be provide in the design and installation of PV systems on UCL property (fire@ucl.ac.uk).