Buildings and Estates Department – How reliable is your electricity supply? - Advice on protecting critical equipment against power outages.

Introduction

UL purchases electricity at 10,000 volts from the national grid. The university is a single customer in terms of electricity supply with one point of supply to the campus (in fact two – one to the North bank and one to the South Bank but both normally served from the same ESB substation). Purchasing electricity this way as one large customer allows the university to take advantage of reduced cost 10kV Medium Voltage Maximum Demand tariffs available for large scale consumers. The electricity is then distributed from building to building on UL's network at 10,000 volts. On entering each building the voltage is reduced to a more usable level (230/400 volts).

Electrical power outages within UL can be broken in to two main categories:

External Outages

External outages refer to outages caused by faults occurring on the network outside of UL. These will generally affect all of the North Bank or all of the South Bank or both. Table 1 (appendix 1) below summarises a risk assessment carried out by Buildings and Estates in conjunction with ESB on possible causes of external outages to the campus supply. The table also shows the likelihood of each in terms of frequency and the expected average duration of the associated outage. B&E are sometimes asked why UL does not have generators to provide campus-wide power in the event of an external outage. The answer is that such generators would cost millions of euros to install, would of necessity be highly complex and would involve a huge amount of maintenance to have them always ready to deploy instantaneously. This option is not considered viable on a capital cost basis alone when evaluated in the context of the risk assessment summarized in Table 1.

Internal Outages

Internal outages refer to outages which occur within the UL infrastructure, either within individual buildings or on the 10,000 volt distribution network that transports electricity between buildings. Issues can occur, for example, due to the sensitivity of safety systems built in to the network which will trip circuits under certain conditions to prevent harm or to minimise potential damage. Modern electrical design practice means that a number of rooms within a building will typically share a circuit and, therefore, a faulty device or appliance plugged in to one outlet can affect those in other rooms if they share the same circuit.

Typical Scenarios

Different scenarios require different solutions. Some equipment/appliances are sensitive to very short term outages (IT equipment, servers, instrumentation etc.). Laboratory fridges/freezers on the other hand can usually maintain their low temperature for a long period of time - typically a number of hours (depending on the quality/condition of the unit, the set point and particularly whether or not the door is opened during the outage). In this

situation, local small diesel powered generators, either purchased or hired, can be an ideal solution when facing a prolonged outage.

Generators on their own however do not always provide a suitable solution - e.g. in the case of servers, instrumentation etc. mentioned above. This is because, for safety reasons, the normal electricity supply and the generator supply must never be connected to the circuit at the same time and accordingly, there is at very least a momentary switch over where power is lost. However, using generators in conjunction with uninterruptible power supply (UPS) units can overcome this. (UPS units are essentially intelligent batteries capable of storing power. They are placed between the incoming supply and the equipment to be protected. In the event of the incoming supply failing, the UPS unit continues to supply the equipment automatically from its stored supply - i.e. the equipment does not experience any loss of supply.) When used in conjunction with a generator the UPS fills the gap between the normal supply switching out and the generator supply switching in. The generator then keeps the equipment supplied and the UPS topped up. When normal supply is restored, the UPS again bridges the gap between disconnecting the generator and connecting the regular supply. Modern UPS units come with power conditioning as standard – i.e. they will regulate the voltage and remove any spikes etc. giving a perfectly clean supply on the output side. This can be particularly useful when running sensitive equipment on the supply from a portable generator.

In other situations e.g. where loads are small (e.g. a number of kW) options include the use of UPS units on their own. The UPS units are sized to support a specific equipment load for a specific duration (e.g. two kilowatts for sixty minutes) and prices vary according to the load and the duration.

Other options include the provision of a dedicated supply to a room or a piece of equipment in order to eliminate exposure to local faults caused by other items sharing the same local circuit. This will reduce local nuisance trips but obviously does not provide full protection in the event of a wider outage.

In all cases, where a large number of critical items are involved, there is an obvious advantage in centralizing the items in order to facilitate provision of back-up supply (generators etc.).

The only guarantee that Buildings and Estates can give in respect of power outages is that they will occur - i.e. there will be unplanned outages of both long and short duration. Consequently, departments/building users are advised to conduct a risk assessment. The steps taken should be appropriate to the risk and potential damage associated with unforeseen outages of both short term and long term duration.

B&E can advise and assist with this if required.

APPENDIX 1

Table 1 – Description of Possible Fault Scenarios (excluding local internal outages)

Event: Failure of	Approx Recovery Time	Risk Category*	Area Affected
1. ESB Distribution Station	1 Hour	A	Campus
2. ESB Medium Voltage (M.V.) ring cable	I Hour	A	Campus
3. ESB Intake Cable to UL Campus	I Hour	C	Campus
4. UL Incoming MV Switchgear	24 Hours	B	Campus
5. UL outgoing MV Switchgear/Ringmain switchgear (Serving Transformers in Individual Buildings	24 Hours	B	Individual Building
6. UL Transformer	24 Hours	C	Individual Building
7. UL Ringmain Distribution Cables - East Campus - West Campus	1 Hour 12 Hours	A A	Number Of Buildings
8. Strike by ESB Transmission/Distribution/ Generation Staff	Hours to days on Rota Basis	C	Campus & Surrounding regions
9. Natural Phenomenon eg severe storm	Hours to Days	B	Campus & Surrounding Regions

***Risk Categories:**

A – Rare (<1 per year)

B – Very Rare (1 per 10 years)

C – Extremely Unlikely (1 per 20 years)