General Introduction

Electrical services for buildings consist of

- Electrical Power Installations (includes generator installations etc.),
- Lighting Installations,
- Lifts/Escalator Installations,
- Fire Detection and Alarm Systems Installations,
- Intruder Alarm Systems,
- Electrical Systems (ICT) Installations.

  Electrical Systems (ICT) Installations may consist of:

  - Structured Cabling Installations,
  - Public Address and Audio Visual Systems,
  - Building Management Systems,
  - Security Systems (such as Access Control Installations, Closed Circuit Television (CCTV) Installations, Electric Fence Installations, and Boom Barriers).

Installations in a building include different kinds of electrical and ICT apparatus installed in place with the necessary connecting conductors, cables, protection and control gear.

Electrical Engineers are responsible for the design, installation, operation and monitoring of the electrical systems required for the safe, comfortable, environmentally friendly and economically feasible operation of buildings. It's the role of an Electrical Engineer to design building protection and alarm systems for fire and theft to minimize loss of life and property. It is the responsibility of the Electrical Engineer to ensure conformance to local regulations and standards. This extends even to the installation and operation stages. Operations have an economic implication and it is the responsibility of the Electrical Engineer to ensure that the installation is economically feasible at installation and also during the operation and maintenance period.

Lighting and Power Design

- It is the electrical engineer who designs the lighting of a building. He takes care of the different lighting levels required for given environment or work. For example the lighting

level for a library is different from the one for say, a bedroom. He also chooses the best lighting fitting for the same reasons. We have fittings for warm light, cool light and daylight as well. The lighting must be designed to reflect the required mood. It is the role of the Electrical Engineer to double up as a lighting designer and design a building's lighting system to guarantee visual comfort, energy efficiency all the while being visually pleasing. The engineer also designs the electrical power distribution in a building to enhance its utilization. All loads in the building have to be supplied with enough electrical power. He also has to have provisions for future load expansion as well as a backup generator in case of Mains failure. Sockets must be well positioned to ensure convenience.

Lightning Protection

- Electrical Building Services Engineers are tasked with the design of lightning protection systems for buildings especially for those in lightning prone areas, say in the High lands of Rift Valley, Kericho, Kisii region, South Nyanza and along the shorelines of Lake Victoria.

Fire Alarms Systems Design.

- The electrical engineer also undertakes the fire alarm system design. Smoke detectors, Heat detectors must be properly positioned according to the chosen zones. Sounders and Beacons, as well as break glass must be well positioned. The latest technologies must be applied.

Public Address & Audio Visual/IP TV

- Television and piped music is also provided at specific locations. During normal conditions, these systems play music in common areas and can be used to page people and to make public announcements. In case of fire, a signal from fire alarm panel initiates announcement of pre-recorded message in all the groups/zones. Manual announcements can also be made through the PA system.
  The electrical engineer must choose the right amplifiers, mixers, speakers and displays.

Security Systems Installations

- These include Digital CCTV systems (Day and night fixed cameras Exit / entry barrier systems, and Walk-through metal detectors.
  Design must consist of high-resolution surveillance cameras which are capable of recording on a full time basis or on motion (every time there is movement) and playback events at will. One must also be able to also view the cameras remotely using their Cell phone, tablet or PC.

Electric Fences

- Electric Fences are now a common non-lethal effective barrier protection system for most households and businesses. The electrical engineer is also tasked with design of the same.
  Why Electric Fences?
  • Effective physical and psychological barrier against intruders
  • Integrate with existing alarms systems
  • Durable and easy to maintain
  • Add sensor switches to automatically adjust sensitivity
  • Zoning provides information on attempted point of entry

Turnstiles, Bollards & Traps

- Effective crowd control is essential when it comes to certain types of businesses. Turnstiles offer an effective solution for employee management and crowd movement especially in super markets, large factories and the like.
  Rising or fixed bollards are used as vehicle barriers. The main benefit of rising bollards is that they operate even in the event of a vehicle knocking into them. Operated automatically, bollards can be programmed to allow certain vehicles at allocated times to ensure effective vehicle control.

UVIS (Under Vehicle Inspection System)

- Under Vehicle Inspection Systems are also specified by the electrical engineer. Modern UVIS (Under Vehicle Inspection System) use LED infrared lighting which has numerous

merits: no sensitivity to sunlight, long life, low power consumption, and, contrary to halogen, invisible to the 'audience'. They provide clear images of the underside of the vehicle – from small cars to trucks.

Access Control Installations

- Access control systems design for sensitive areas like server rooms, offices and storage areas must also be properly carried out. Sample equipment include, IP access readers with Ethernet capabilities, Finger print reader, proximity card reader, high quality optical sensor, magnetic door lock, and RFID Hotel Door Locks.

  Why Access Control?

  • Restrict unauthorized Access

  • Track entry/exit of personnel

  • Allow restricted access to the work place after office hours

  • Eliminate key problems – duplications, jams, etc.

Structured Cabling Installations

- Structured cabling design consists of Data/Internet and communication services for all offices, meeting rooms and any other room where these services are required. Copper or Fiber optic is used depending on the complexity and length of cables use. Fiber optics is used to provide high quality compressed signal communication, thus reducing on cable space volume and ductwork. Sample Equipment include Dual RJ45 Cat 6 outlets for Voice and Data, Wireless access points for Wi-Fi access, IP Phones ; Voice over IP (VoIP) methodology is the preferable technology for the delivery of voice communications and multimedia sessions over Internet Protocol (IP) networks.

Lifts/Elevators Installations

- Electrical Engineers are also involved in lift installations design. Will the lift be used for carrying people or goods, or to provide special disabled access? What size and speed would the new lift have? How many stops? These questions are all answered by the electrical engineer. A lift may be designed to reflect an individual tastes, or to be consistent with a corporate brand.

Generator Installations

- Full back up generator for all services with Automatic Load Transfer switch.
  The electrical engineer also designs the electrical back up system of a building. The load must be accurately calculated. The generator is also sized according to the attitude of the building location. The running at sea level is different form say a generator running at 1800M above sea level.

Guestroom Management System

- This is mainly for hotels. The system manages different scenarios in each guest room, including welcome, living and sleeping settings. Lighting, temperature and curtains can be controlled to suit the activity of the occupant. The guest room management systems can be integrated into any Building or Property Management System (PMS) to help reduce running costs and increase the efficiency of a building. Settings can either be adjusted in the room by the guest or centrally via the hotel management system.

Building Management System (BMS)

- The electrical engineer is also responsible for the overall design of the building management system. BMS integrates all the above systems as well as mechanical systems. The BMS comprises the following parts: Automation stations, Field devices, Field communication network, Main server, LAN Network.

Solar Energy Systems Installations

- Electrical Engineers are involved in the design of these systems as well as street lighting. Electrical engineers first embark on determining the economic viability of a solar system before immersing themselves in the detailed design. They then advice the client accordingly.

Electrical Engineers use popular design software such as **AutoCAD** and **Revit MEP** to carry out their design work. It is very prudent for building developers to engage the services of professional engineers in any undertaking. They will ultimately save on time and money as well as ensure quality work.

Typical Project Team:

A. The Management Team

The owner often utilizes the services of management and consulting companies that can relieve the internal staff from the burden of managing a large project. These entities may work with the real estate, construction management or logistical aspects of the project.

The Developer.

Developers generally find land (with or without an existing building), invest in it to generate income, and prepare it for sale or lease to a potential buyer or lessee.

The developer is concerned about the budget, schedule, and scope of the project. Because the developer is often financially invested in the project, he or she is even more sensitive to project costs and future value.

Construction or Program Manager.

The construction manager (CM) is a separate entity hired by the owner to manage the construction process. The CM's job is to manage the schedule, scope and budget of the building for the owner. Sometimes also called the program manager (PM), the CM maintains the approved program (the document that establishes the basic parameters of the building including overall size, budget, features, quality and space configurations, allocations and adjacencies).

Sometimes, the CM hires the architect and general contractor. Or, the CM merely coordinates the process while the owner holds the contracts.

Building Management Agency.

Some building owners may hire a building management agency to handle day-to-day operations, maintenance and leasing. Managers may be located in the buildings they manage or off-site. The management agency may be the gatekeeper for when and how contractors can work in a building. They are concerned about the operation of the building and the comfort of the existing tenants and/or disruption of their routine. As a result, they have a great deal to say about which contractors are hired and when they can work in a building.

B. Project Design Team

The team consists of the architect, interior designer, engineering and other consultants.

In addition to the architect, other designers are critical players in the construction of the building. The most typically required roles are mechanical, electrical and plumbing (these three together often referred to as “MEP”) and structural engineer.

Architect

The architect is responsible for the design and functionality of the building to meet the owner’s programmatic needs, aesthetic expectation, and budgetary requirements. The architect is also responsible for the life safety and building code compliance of the project. Generally, the architect’s firm holds the “prime” contract for the building and the technical system designs, subcontracting other design consultants under its contract.

The architect’s role can be filled by individuals from a wide variety of practices including individual architects in practice (standard architectural firms), combined with engineers (either A/E or E/A firms), and combined with contractors (design-build firms) or as licensed representatives of the owner’s own staff. There may be two architectural/engineering design team entities if the complexity of the project warrants it. This is common for large projects where there may be a design team for the base building and another for the interior fit. Often one team represents the building owner and the other the end-user.

Interior Designer

The interior designer is closely associated with the architect and may even be the same individual performing both roles. The designer is most often concerned with the furnishing and appearance of the room: how the wall, floor, ceiling and furnishings are finished and situated. He or she advises on or decides if surfaces are to be painted, fabric-covered, tiled or textured and what product, material, colors and patterns are to be provided.

Quantity Surveyor

A quantity surveyor (QS) is a concerned with construction costs and contracts. Services provided by a quantity surveyor may include: Cost planning and commercial management throughout the entire life cycle of the project from inception to post-completion, Value engineering, Risk

management and calculation, Procurement advice and assistance during the tendering procedures, Tender analysis and agreement of the contract sum, Commercial management and contract administration, Assistance in dispute resolution, Interim valuations and payment assessment, Cost management process, Assessing the additional costs of design variations

Mechanical Consultant.

The mechanical consultant designs the heat, ventilating and air conditioning (often referred to as "HVAC") systems. This consultant works with the architect to determine the mechanical system needs for the building and creates the designs that include the chillers, pumps, fans, piping, ducts, diffusers, and grilles that heat, cool and ventilate the building. Often, the mechanical consultant in conjunction with the electrical consultant deals with building automation systems that include computer-based monitoring, control and diagnostics of the mechanical system.

Plumbing Consultant

The plumbing consultant is responsible for the piping associated with water and waste into and within the building. This includes sprinkler piping, chiller water for the HVAC system, and natural gas service.

Electrical Consultant

The electrical consultant designs the "high voltage" power distribution systems in the building. This includes the basic electrical power systems from the power company's entrance to the facility, following through to the power outlets in the building. The electrical consultant often designs and/or coordinates the conduit and cable tray designs that support the "low voltage "systems, such as data/telecom, AV, life safety and security systems. In many cases, the electrical consultant work entails security design, Audio Visual Systems, BMS, Structured Cabling, and Light Design. Check their comprehensive roles.

Structural Consultant

The structural consultant is the designer for the building structure. This involves fundamental decisions, such as whether the building will be formed concrete or steel frame and the size, spacing, and placement of beams, joists or columns throughout the building.

Audio Visual (AV) Designer.

Throughout the project process, the AV designer is involved with analyzing the end-users' needs and translating them into infrastructure and systems designs. AV designers must be focused on coordinating and monitoring the process from start to finish to ensure the AV system's success.

Lighting Consultant

The lighting consultant is responsible for determining the required lighting for each space and must provide layout and specifications for the lighting system for each area. This includes the fixture types, lamps, wiring and control features (switching and dimming) associated with each space.

Data/Telecom Consultant

Data/Telecom includes the design of the cabling and physical infrastructure (sometimes call the "structured cabling system") that accommodates local area computer networking, Internet access, telephone systems, and other communications systems. Typically, the scope of work includes the cabling, space planning, and associated infrastructure requirements, such as conduit and power requirements.

Acoustical Consultant

The acoustical consultant designs the building components that affect sound isolation, reverberation time and noise reduction as they relate to every physical element of the building, including ceiling, wall and floor finishes, wall and floor/ceiling constructions, window selections, fan and chiller selections, duct and pipe routing, equipment mountings and room shapes.

Working closely with the architect, interior designer, HVAC engineer, and the AV contractor, the acoustical consultant can properly establish the appropriate acoustical criteria for each space and provide recommendation.

Security Consultant

The security consultant deals with audio and video equipment such as cameras, microphones, recording equipment, and video displays as part of the security designs. These systems are very

specialized and include barrier construction, door lock and card key systems, and owner procedural issues.

If the security system is not completely separate from the AV system, there may be crossover where cameras, microphones, video displays or intercom systems are positioned. The AV and security consultant need to coordinate their system designs and infrastructure to ensure that they are operating in alignment.

Life Safety Consultant

Life safety systems provide emergency alert to building occupants. The most common design issues are related to fire detection, occupant alerts or hazardous substances, such as natural gas and refrigerant leaks.

Other Industry- or Trade-specific Consultants.

On any building project, numerous other "industry-specific" consultants may be involved, especially when the building requires specialized systems, such as a restaurant, hospital, lab or theater. Even standard office buildings may involve consultants for door hardware, landscaping, or civil engineering.

C. The Installation Team.

After the designers convert the owner's requirements to paper (and electronic documents), the installers/contractors begin their work. Installation contractors are often firms solely dedicated to installation. However, in a design-build process, the designers and installers may be part of the same company. In some cases, a "fast-track" process is used in which construction starts before some of the designs are finished (e.g. structural designs are completed and construction begins before the interior space plans are designed).

For all members of the installation team participating in the construction phase, coordination is key.

General Contractor.

The general contractor (GC) or main contractor (MC) is the counterpart to the architect; he holds the prime contract with the owner (or the owner's representative) for building the facility. The

MC may have some “in-house” capabilities for site construction, but most of the work is managerial in nature. MCs hire out most of the specialty work to subcontractors while they coordinate, arbitrate, facilitate, and schedule all the work that needs to be completed.

Subcontractors.

There are many subcontractors to the general contractor. For the most part these are the contractor counterparts to the various **trade designers** previously discussed. They include contractors in charge of mechanical, electrical and plumbing and other traditional trades as well as the other specialized trades such as data/telecom and AV. Coordination of work and scheduling between these subcontractors and the other trades during the construction phase is critical to the ultimate success of any project.

Close coordination is required among the electrical contractor, the AV consultant, the AV integrator, the data/telecom installers, and the other low voltage contractors. Their installation sequencing and scheduling of infrastructure will determine when the AV designer can begin to pull cabling and start installation and testing of equipment. Back box, conduit, and cable tray locations and installation will often require review by the AV contractor and electrical consultant during construction, which also requires coordination. If any electrical outlets will serve the AV systems, they may require special treatment, such as power conditioning or isolated grounding schemes.

AV Integrator

The AV integrator (who may also be referred to as the AV contractor) installs the AV systems. Typically, this includes all the AV electronic equipment (projectors, audio and video routers, loudspeakers, amplifiers, cameras, DVD players, and other audio, video and control devices and their software programming), as well as the dedicated AV cabling, such as base band video coaxial cabling, audio line, microphone and speaker cabling, plus proprietary control system cabling. The AV contractor may also install some networking cabling (when it is required for special AV use), such as point-to-point video and audio distribution that bypasses the data/telecom patching scheme.

Due to the need for architectural integration, some equipment may need to be provided to the general contractor early in the process. In addition, the sequencing and scheduling of the AV

integrator's on-site installation time is extremely important. Cable pulls must be done at the point at which there is easy access to conduit and cable trays, preferably before lay-in ceiling grids are installed.

Useful Links:

Typical Traditional Building Procedure:
https://www.eeekenya.com/typical-traditional-building-procedure/

Roles of Building Services Electrical Engineers

Why is Fire Detection Important

Electrical Engineering Building Services

Typical Traditional Building Procedure

Typical Project Teams

CFLs vs. LEDs: Blow by Blow Comparison

What to consider when buying LED lighting fittings