Jansta Associates
LIMITED

# IMPLEMENTING TECHNOLOGY TRENDS

# INTEGRATED PHYSICAL SECURITY SOLUTION FOR SUBSTATIONS

GUIDE NOTE

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# 1. INTRODUCTION

This document is part of the Implementing Technology Trends - Guide Note series, focusing on physical security, project management, electrical, control engineering, and telecoms sectors.

As the world is becoming interconnected, the interdisciplinary approach is essential. It is also clear that a simple application can be the best value on many occasions. The intent is to provide solutions that fit the purpose and simplify even the most complex systems.

The boundaries between physical security and cyber security are becoming ever so thin. Understanding current industry developments will help to deliver practical solutions.

This Guide Note will focus on the implementation of the physical security systems in the Electrical Substations. The perimeter system is a fundamental part of the integrated solution.

The implementation process will depend on the country's regulator-specific requirements of the project stage. Integrated Security systems should meet minimum operational needs (Operational Requirements). The systems migration will differ, and the gap analysis will guide toward a practical solution.

The below flowchart chart *(© JAL)* shows the process in the project management control environment when developing integrated security solutions in the electrical substations. The chart captures the complete project life cycle. The technology implementation will occur during the last stage (see fig.1, right).

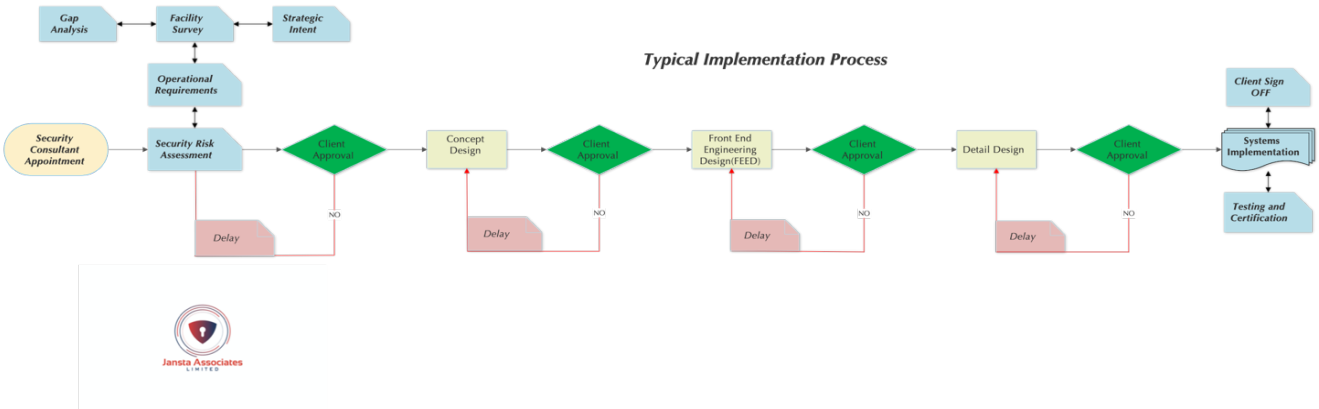



**Fig.1** Typical Implementation Process

# 2. TECHNOLOGY TRENDS

Substations are complicated environments, so the approach to deploying the latest technology will be unlike others. There are many regulatory restrictions, health and safety, facility operator-specific requirements, country-specific regulations. Cyber security will also play a crucial part.

## 2.1 General

Electrical Substations are the interface between the distribution grid and transmission systems parts. Different types are categorised based on specific functions:

- Step-up Substation

As the name suggests, this type raises the voltage from the power plants so electricity can be transmitted efficiently.

- Step-Down

This facility lowers the voltage from transmission lines to what is known as a sub-transmission voltage.

- Distribution Substation

This facility further lowers the sub-transmission voltage that can supply commercial or residential requirements with the aid of a distribution transformer.

## 2.2 Perimeter Security

Substation security is more than just a fence and signage. Early detection is the key to preventing potential attacks on electrical substations from copper theft, vandalism, accidents, and other activities that could disrupt the stability of the power grid.

Electrical substations are often located in isolated areas, and the 24/7 surveillance of these sites is monitored remotely. Even though the early warning of an intrusion is necessary, the continuous surveillance and tracking of the assets are critical to providing an accurate situational awareness.

The typical perimeter solution will consist

- A Security Fences (see General Fence section profile drawing). [1]
- Perimeter Detection Systems
- Access Control
- Gates
- Video Surveillance
- Security Lighting

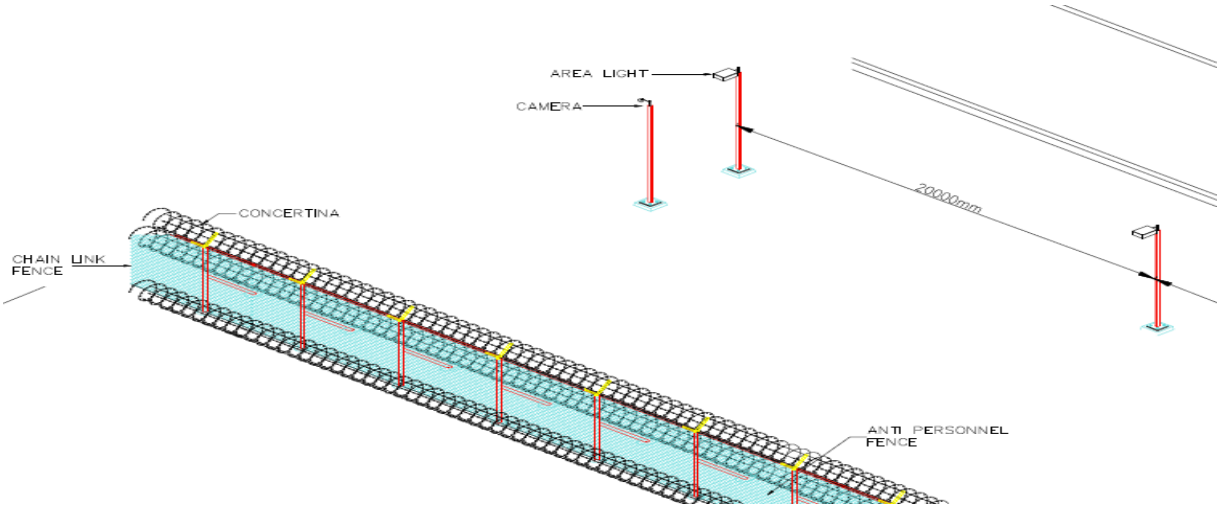
The solution will be based on the countermeasures derived from the Security Risks Assessment.

[1] https://www.janstaassociateslimited.com/news

### 2.2.1 Security Fence

Fences are a low-tech first layer of defence to keep threats away from sensitive areas or people. Chain Link is the most common low-cost security fence. The next step beyond chain-link is a Picket style fence. The most substantial, imposing, and barricading fence types in common use are 'welded wire' types.

Security Fence enhancement is electrification, high voltages, and the amperages is low. Applying DC electricity to wires adjacent to fence lines is typically used to deter livestock or animals. For security fences, these lines discourage vandalism and incidental contact. Equally imposing as electrified fences are rolls of barbed or razor wire. Wire rolls improve the 'anti climb' value of fences and provide a lightweight method of increasing standoff distances when used at ground level.




### 2.2.2 Video Surveillance

Technologies like video analytics, thermal cameras, and PTZs are often deployed alongside visual video cameras.

The use of security cameras will assist in detecting and identifying threats. If the facility is in a remote area, it may be practical to deploy thermal cameras. In large and remote facilities, radar technology combined with CCTV can be a cost-effective tool that meets the Operational Requirements (OR).

Perimeter video analytics can be employed to enhance some functionalities, such as reduced false alarms due to vegetation, animals, change in lighting and weather conditions.

### 2.2.3 Perimeter Intrusion

In general, technologies like microwave detectors, inductive cable, acoustic sensors, and seismic detection sensors are used in conjunction with the fence.
The PIDS will be integrated to achieve minimum false alarms within defined zones whilst avoiding integration complexities.

### 2.2.4 Gates

A critical element of the fence are gates. The type depends on the application and local site conditions - different gates are needed to stop intruders versus provide vehicle checkpoints - but a vast array of standard operators and gate styles are available.

### 2.2.5 Access Control Systems

The ACS will comprise hardware and software to electronically authenticate a request by a person to access the facility and issue notification of the unauthorised attempts.

### 2.2.6 Security Lighting

A common perimeter solution enhancement is the addition of ambient light along fence lines. During low daylight levels, lighting will deter and aid in the identification of unauthorised personnel—for example, perimeter areas, checkpoints, as well as other critical areas.

## 2.3 Safety

A paramount safety concern at all substations is grounding, and this is just as important when designing and implementing the security system. Two important considerations are fence grounding and security equipment grounding. It is crucial to verify your electrical touch potential levels are within IEEE 80, IEEE Guide for Safety in AC Substation Grounding guidelines.

Another touch potential hazard may occur where the substation fence buts up to an existing fence or metallic structure that is not tied into the same grounding system.

In these situations, an electrical isolation panel may be required. A non-conductive fence panel or section of a wall may provide the necessary isolation to reduce the risk of potential touch hazards.

## 2.4 Transformer monitor

Video analytics thermal monitoring applications can be employed to reduce costs, such as thermal monitoring of transformers and their components. For example, Planned Preventive Maintenance (PPM) programmes, where dedicated locations can be monitored 24/7 and produce accurate reports with real-time analysis.

## 3. DEPLOYMENT

The regulator and the facility operator's firm requirements will determine the deployment of the solution for the substation. Location, classification, and facility size will be one of the key factors driving the integration.

The improved processes, level of integration and hardware selection combined with full project life cycle understanding will contribute to innovation. We can then develop a solution that complies with the regulation and exceeds expectations.

## 4. CONCLUSION

The key to successful transformation is managing the stages and simplifying complex solutions. To achieve the desired output, a clear objective and planning are essential.

Developing robust and practical integrated security solutions for the electrical substation is no easy task and requires a multidisciplinary approach. There are too many factors to consider from a very early start to determine the project's outcome.

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