

**ELECTRICAL AUTOMATION  
SYSTEMS TOWARDS INTELLIGENT  
AND ENERGY EFFICIENCY  
APPLICATIONS**

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Musse Mohamud Ahmed



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**ELECTRICAL AUTOMATION SYSTEMS**  
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**APPLICATIONS**

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# CHAPTER 1

## ELECTRICAL DISTRIBUTION SYSTEM

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This chapter consists of distribution overview and example of typical distribution system, types of substations and ring main unit for distribution substation.

### 1.1 Overview of Distribution System

Distribution systems in general and in Malaysia in particular start from the distribution substation whereby feeders consist of a 3 phases, 11kV/22 kV, 33 kV and others with single core and three core cross linked polyethylene (XLPE) cable type, feeder interconnection among substations and switch substation, and distribution transformers (step down 11/0.415 kV).

Each substation feeds its local load area by means of primary distribution feeders. Primary feeders are carried on poles or buried in the ground. The distribution transformers connect to the primary distribution lines. The lines which carry the energy at the utilization voltage from the transformer to consumer's services are called secondary distribution mains and may be found overhead or underground. For consumers that need large amounts of electrical energy, no secondary mains are required.

The electrical circuit between the utility company's mains and the consumer's wiring is called the service [1]. Energy is tapped from the secondary mains at the nearest location and carried by the service wires to the consumer's building either by overhead service or underground service. An overhead service consists of wires or cables extending from a pole carrying the main to a point on the consumer's building. Underground services consist of plastic or lead covered cables which extend from the consumer's service point on his or her premises to the mains to which they are connected. These mains can be cables directly buried in the ground, or located in a manhole. They may also be connected to overhead mains on a pole. These wires are also known as the service drop. It is the last link of the path over which the electrical energy is brought to the consumer.

Demand is the amount of electricity a consumer uses at any given moment and it reaches its maximum value. Based on the report on the performance of the electricity supply services in Malaysia written by the Energy Commission in the years 2002 and 2006 [2.3], the maximum demand of grid system in the year 2002 in Peninsular Malaysia has increased 7.29% to 10,783 MW from 10,060MW in the year 2001. The generation capacity has increased from 12,690MW to 13,742MW where 60% from the generation capacity was provided by Tenaga Nasional Berhad (TNB). TNB generation station in Kulim Hi-Tech Park shown an increase of