SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

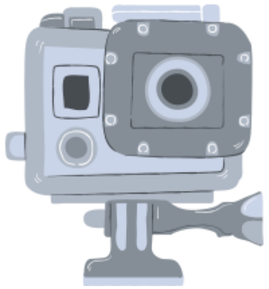
Accredited by NBA-AICTE and Accredited by NAAC – UGC with A+ Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME: 19EEE308/ SMART GRID

III YEAR / VI SEMESTER

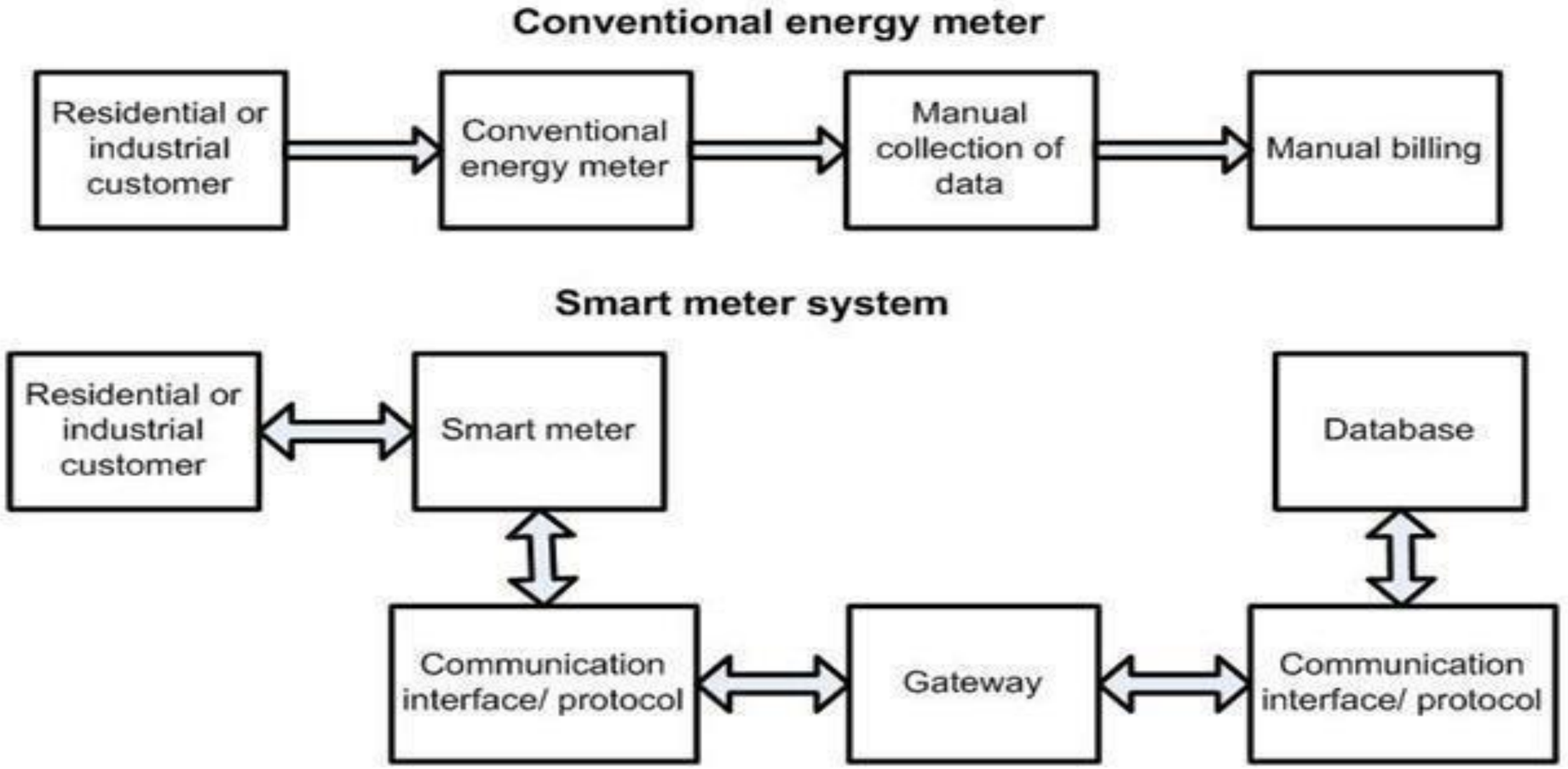
Unit 2 – SMART GRID TECHNOLOGIES



INTRODUCTION TO SMART METERS

- A smart meter is an electronic measurement device installed by the utility to maintain a two- way communication between the consumer and the utility.
- Also manage the electrical system of the consumer.
- A smart meter is capable of communicating the real time energy-consumption of an electrical system in very short intervals of time to the connected utility.
- In the electronic meters/electromechanical meters, the cumulative number of electricity units was recorded at the end of a month (or more) whereas a smart reader is connected to the utility which is capable of transmitting the electricity usage on a real-time basis.
- Smart meters do not save energy themselves but consumers do.
- The purpose of smart meters is to change the behaviour of the consumers. It is hoped that the consumers would save energy through awareness and the estimated bills.

Block Diagram for Smart Meters



ADVANTAGES OF SMART METERS

Accuracy in meter reading:

- In case of electromechanical/electronic meters, the meter readings have to be read by a representative of the utility.
- Smart meters automatically transmit the readings to the connected utility.

Data Recording:

- Conventional meters only record the electricity consumption of a system, and not how and when the electricity is used.
- Smart meters record real-time data corresponding to the electricity consumption. It means that they also record the time and patterns of electricity consumption

ADVANTAGES OF SMART METERS

Real time tracking:

- Consumers can go online and check out their electricity usage patterns and make changes to their consumption accordingly.
- In this way, smart meters offer a strong control to the consumers over their usage.

Automatic outage detection:

- A person having a conventional meter has to call the utility whenever there is a power outage whereas in case of smart meters, there is automatic outage detection as they are constantly synchronised with the electric grid.

Better service:

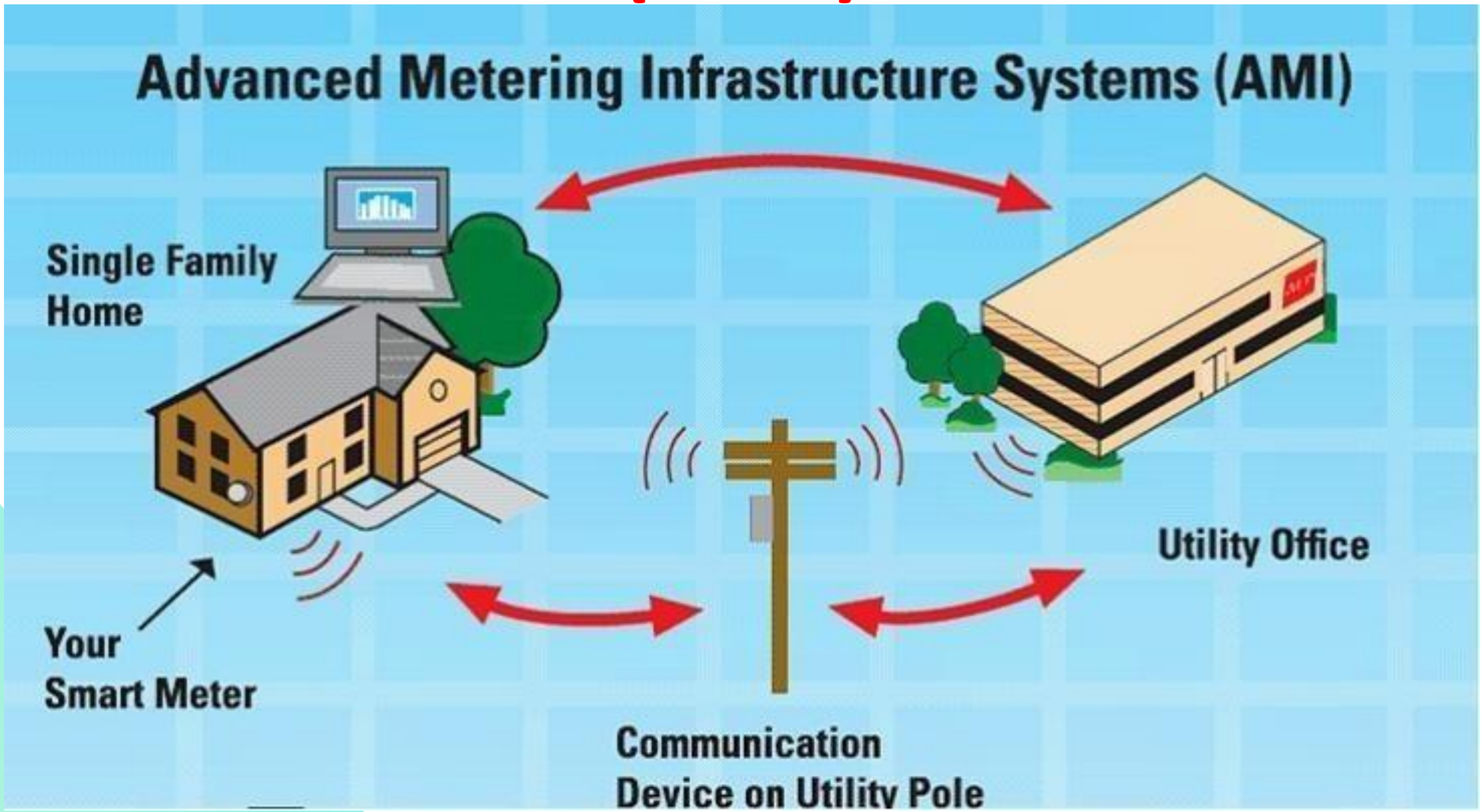
- As smart meters are directly connected to the utility, it becomes much simpler to connect/disconnect power for a particular house/property, saving the need of a technician going to the house in person and connect/disconnect the supply.

Sl. No	Smart Metering	Conventional Metering
1.	Digital with Alpha Numeric Display	Analog with Spinning Dials
2.	Will Measure how much and when electricity is used (Hourly with date and Time Stamping)	Measurement only for how much Electricity is used over a Billing Period (One or Two Months)
3.	Automated Meter Reading: Meters send data Electronically to Distribution Companies through a Wireless Network	Manual Meter Reading: Distribution comp[any Staff Physically visit ratepayer premises to Record Data
4.	Two Way communication between Meters and Distribution Companies	No Communication capability

Advanced Metering infrastructure (AMI)

- The present system of energy metering as well as billing in India uses electromechanical and somewhere digital energy meter. It consumes more time and labour.
- AMI (Advanced Metering Infrastructure) is the collective term to describe the whole infrastructure from smart meter to two-way communication network to control centre equipment and all the applications that enable the gathering and transfer of energy usage information in near real-time.

Advanced Metering infrastructure (AMI)



Building Blocks of AMI

AMI is comprised of various hardware and software components, all of which play a role in measuring energy consumption and transmitting information about energy, water and gas usage to utility companies and customers.

The technological components include:

1. Smart meters
2. Wide-area communications infrastructure
3. Home(local) area networks (HAN's)
4. Meter Data Management Systems (MDMS)
5. Operational gateways

Challenges in AMI

1. High capital costs:
A full scale deployment of AMI requires expenditures on Hardware and software components including meters, network infrastructure and network management software, along with cost associated with the installation and maintenance of meters and information technology systems.

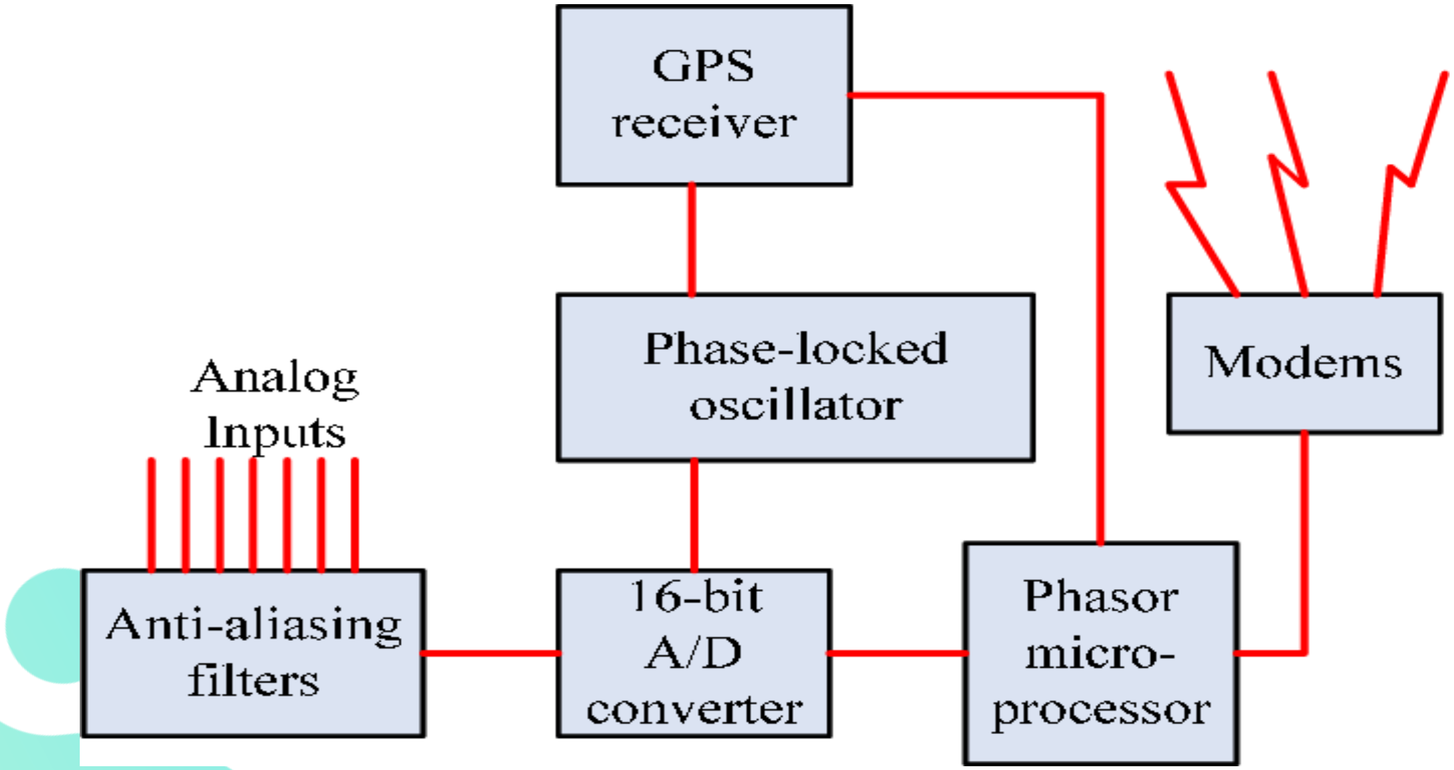
2. Integration: AMI is a complex system of technologies that must be integrated with utilities, information technology systems including Customer Information Systems (CIS), Geographical Information Systems (GIS), etc.

3. Standardization: Interoperability standards need to be defined, which set uniform requirements for AMI technology, deployment and general operations and are the keys to successfully connecting and maintaining an AMI based grid system.

Phasor Measurement Unit (PMU)

- A phasor measurement unit (PMU) is a device used to estimate the magnitude and phase angle of an electrical phasor quantity (such as voltage or current) in the electric grid using a common time source for synchronization.
- PMUs are capable of capturing samples from a waveform in quick succession and reconstructing the phasor quantity, made up of an angle measurement and a magnitude measurement.
- The resulting measurement is known as a synchrophasor. These time synchronized measurements are important because if the grid's supply and demand are not perfectly matched, frequency imbalances can cause stress on the grid, which is a potential cause for power outages.
- PMUs can also be used to measure the frequency in the power grid.

Phasor Measurement Unit (PMU) – Block Diagram



Intelligent Electronic Devices (IED)

The name Intelligent Electronic Device (IED) describes a range of devices that perform one or more of functions of protection, measurement, fault recording and control.

An IED consists of a signal processing unit, a microprocessor with input and output devices, and a communication interface.

An intelligent electronic device (IED) is a device that is added to industrial control systems (ICS) to enable advanced power automation


Thank
You!