FARM STRUCTURES

1.1 DEFINITION

- Farm structures involve the study of the erection of buildings for man, animals, crops and farm equipment.

- The design and construction of farm structures is one of the major technical services agricultural engineers render to agriculture.

1.2 EXAMPLES OF FARM STRUCTURES

a) Farm houses: Dwellings for operators, retired parents, relatives, workers with families.

- **b) Buildings for livestock** e.g. horse, dairy, beef-cattle, sheep, goat, hogs and poultry buildings.
- **c) Buildings for product storage** e.g. hay barns, granaries, bins, silos, vegetable storages, frozen product storages, Cold rooms etc.

Other Farm Building Examples

- **d) Buildings for crop production** especially green houses.
- **e) Buildings for processing** e.g. milk houses, pasteurizing and bottling plants; slaughter houses, grain dryers, dehydration structures etc.
- **f) Buildings for equipment and supplies** e.g. implement sheds, garages, farm shops, fuel storage etc

1.3 PLANNING OF FARM STRUCTURES

- Planning of farm structures refers to all processes undergone right from conception to completion of the structures.
- The planning stages include:
- **a) Conception & Feasibility:** Investigate different alternatives for investments and development of the farm, now and in the future. Check possible sources of finance for the investment. The feasibility involves studies of user requirements, site conditions, requirement from authorities, functional and technical requirements and cost.

Stages in Planning Contd.

- **b) Sketch Plans:** Roughly sketch alternatives to the general approach to layout, functional planning, design and construction. Choose the required layout and prepare preliminary constructional design and cost calculations.

- Alternatively, drawings can be collected from reliable sources e.g. research stations. Study the drawings and evaluate them regarding the functional and technical requirements.

Steps in Planning Contd.

- **c) Detailed design of every component of the building.** Complete cost and checking of designs. Final decision on construction.

- The design of farm structures is essentially similar to the design of Civil Engineering structures like buildings.

The various components of the building include foundations, walls, floors, roof, columns, beams and connectors like welds, nails, nuts and rivets. The design implies the sizing of these components so as to make the structure stable and economical.

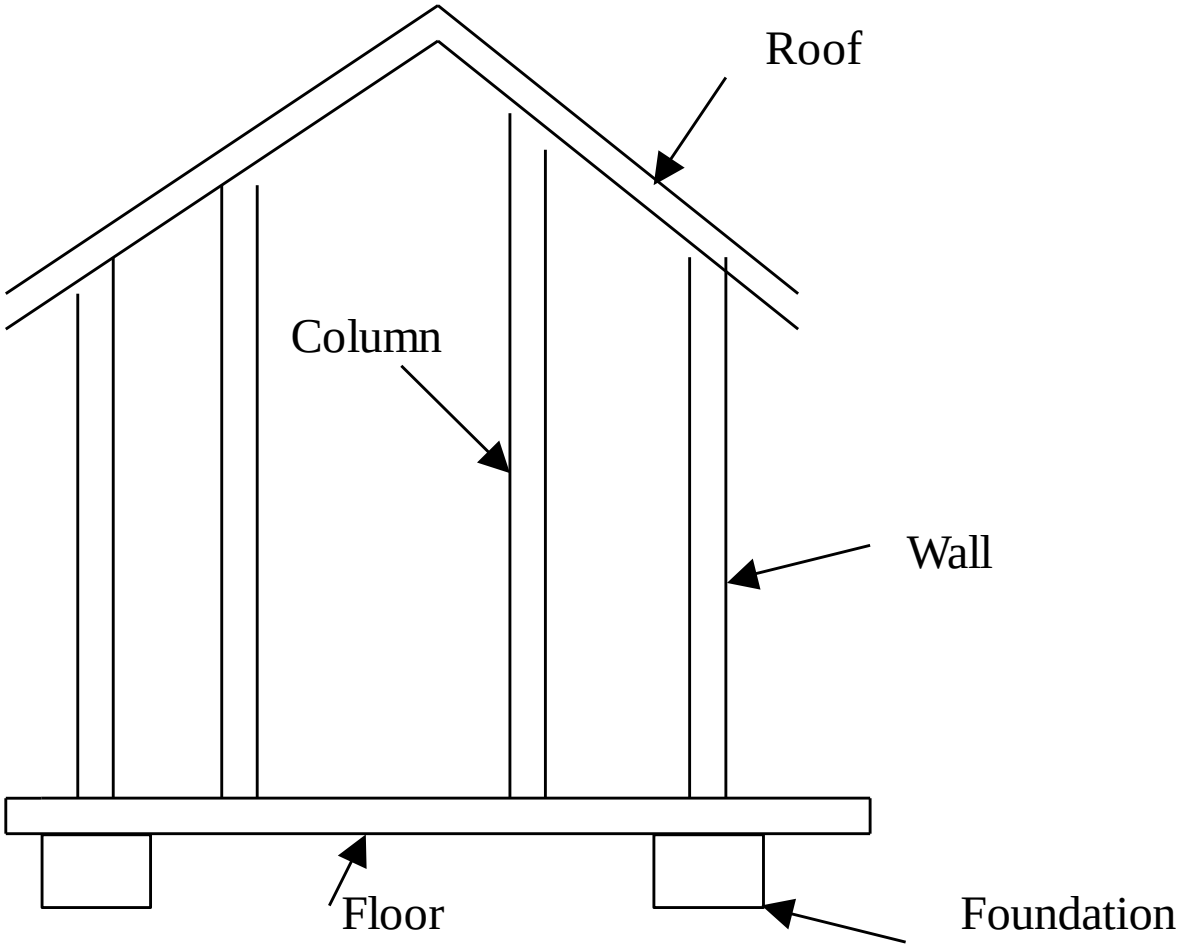

Fig. 1.1 End View of a Typical Farm Structure e.g. Poultry House

Stages in Planning Contd.

- **d) Working drawings**, schedules, and specifications regarding production methods and assembly and installation instructions. Preparations of a time schedule for the production of the building.

  e) Bill of Quantities: The aim of quantity surveying is to provide an accurate bill of quantities, that is a list of the amounts of all materials and labour necessary to complete a construction project. See example in Note Bk.

Stages in Planning Contd.

- **f) Invite tenders from contractors** out of which one is chosen. Tenders can be by open tenders e.g. Advertised in papers and selective tenders (meeting capable contractors). Sign contracts.

- Contracting can be by:
- **i) Complete Contracting:** The whole work is given to one contractor. A lot of specifications is required. Gives the owner more rest. The contractor can employ best technicians to protect his reputation.

Types of Contracts Contd.

- **ii) Semi-Contracting:** Contracting various items needed for the building separately. There is waste of time. Best technicians may not be known to the owner.

- **iii) Self-Aid:** No contract is involved and is cheaper. Used for small buildings e.g. chicken house. Construction may take a longer time.

Stages in Planning Concluded

- **g) Site operations** including hiring of labour**,** provision of tools, preparation of access roads to sites, provision of temporal stores and sheds, clearing of sites, delivery of construction materials and technical inspection during construction.

1.4 ECONOMIC FEASIBILITY OF FARM STRUCTURES

- In addition to the actual cost of constructing a building, which must be considered in relation to the financial capacity of the farmer, the total annual cost of the building should be determined.
- This annual cost should be compared with the expected increase in income or the saving in storage costs to determine whether the new building is a worthwhile investment i.e. the economic feasibility of the building is determined.

ECONOMIC FEASIBILITY OF FARM STRUCTURES CONTD.

- Consider the following factors:

- **a) Cost of Land and Building**
- **b) Interest of Capital Money:** This represents the interest paid for money borrowed for building the house or in case the farmer used his money, the interest that could have accrued to him if he had used his capital for other purposes. The interest rate should be either the rate paid or the current rate of mortgage loans in the area.

Economic Feasibility Contd.

- **c) Insurance and Taxes:** Insurance cost should be included in capital investment whether or not the building is insured. The risk of fire and other hazards is borne by the insurance company if it is insured or by the owner himself if it is not. This may range from 1/2 to 1 % of the original cost of the building.
- For countries where taxes are charged on buildings, this should be included. Taxes may range from 1 to 2 % of the original cost.

Economic Feasibility Contd.

- **d) Repairs and Maintenance:** All buildings require some maintenance but the cost varies with age, type of building, climate and environment, construction materials and use of the building.
- One to three percent of initial construction cost is usually assumed as a uniform annual allowance throughout the life of the building.

Energy

- Energy is the capacity of a physical system to perform work. Energy exists in several forms such as heat, kinetic or mechanical energy, light, potential energy, electrical, or other forms.

>> Sources of Energy:

1. **Conventional Energy Sources**
2. **Renewable Energy Sources**

Conventional Energy Sources

- The term "Conventional" means "not unusual or extreme or ordinary." Conventional energy sources are the traditional sources of energy like coal and petroleum. Conventional energy sources are finite. They will not last forever.

Natural Gas

Natural gas in its purest form is pure methane but before it is refined, it also contains varying amount of ethane, propane, butane and carbon dioxide. When refined, it is colorless and odorless but can be burned to release large amounts of energy.

Conventional Energy Sources

Coal

Coal releases large amounts of energy when it is burned because of the density of hydrocarbons in the material. Coal is formed by dead plants being put under significant pressure and temperature for millions of years. There are four grades of coal: lignite, subbituminous, bituminous coal and anthracite. Bituminous coal is the best for releasing energy and is the most commonly mined type of coal .

Conventional Energy Sources

Petroleum

Petroleum is formed from the compression of animal and plant remains over millions of years. Petroleum has to be drilled for because it is usually located deep below the earth's surface and is then refined to produce a number of different products including gasoline, heavy fuel oil and diesel fuel.

Renewable Energy Sources

- Renewable energy is natural energy which does not have a limited supply. Renewable energy can be used again and again, and will never run out.
- Renewable energy is energy which comes from natural resources such as sunlight, wind, rain, tides and geothermal heat, which are renewable (naturally replenished.)
- Renewable energy is an alternative to fossil fuels and nuclear power, and was commonly called alternative energy.

Renewable Energy Sources

A list of renewable energy sources:

- Biomass
- Hydro
- Geothermal
- Solar
- Tidal
- Wave
- Wind
- Wood

Renewable energy replaces conventional fuels in four distinct areas:

- power generation,
- hot water/ space heating,
- transport fuels and
- rural (off-grid) energy services.

WIND ENERGY

Wind power

- Airflows can be used to run wind turbines. Modern wind turbines range from around 600 kW to 5 MW of rated power, although turbines with rated output of 1.5–3 MW have become the most common for commercial use; the power output of a turbine is a function of the cube of the wind speed, so as wind speed increases, power output increases dramatically.

Hydropower

- Energy in water can be harnessed and used. Since water is about 800 times denser than air, even a slow flowing stream of water, or moderate sea swell, can yield considerable amounts of energy.
- There are many forms of water energy:

Micro hydro systems are hydroelectric power installations that typically produce up to 100 kW of power. They are often used in water rich areas as a remote-area power supply (RAPS). There are many of these installations around the world, including several delivering around 50 kW in the Solomon Islands.

Damless hydro systems derive kinetic energy from rivers and oceans without using a dam. Ocean energy describes all the technologies to harness energy from the ocean and the sea. This includes marine current power, ocean thermal energy conversion, and tidal power.

Solar energy

- Solar energy is the energy derived from the sun through the form of solar radiation. Solar powered electrical generation relies on photovoltaic and heat engines. A partial list of other solar applications includes space heating and cooling through solar architecture, day lighting, solar hot water, solar cooking, and high temperature process heat for industrial purposes.

Biomass

Biomass (plant material) is a renewable energy source because the energy it contains comes from the sun. Through the process of photosynthesis, plants capture the sun's energy. When the plants are burned, they release the sun's energy they contain. In this way, biomass functions as a sort of natural battery for storing solar energy. As long as biomass is produced sustainably, with only as much used as is grown, the battery will last indefinitely.

In general there are two main approaches to using plants for energy production: growing plants specifically for energy use, and using the residues from plants that are used for other things. The best approaches vary from region to region according to climate, soils and geography.

Tidal Energy

- This is another unlimited and inexhaustible source of energy. The Gulfs of Kutch is preferably suited to build up electricity from the energy produced by high and lofty tides entering into slender creeks.

Biofuel

- Liquid biofuel is usually either bio alcohol such as bioethanol or an oil such as biodiesel. Bioethanol is an alcohol made by fermenting the sugar components of plant materials and it is made mostly from sugar and starch crops. With advanced technology being developed, cellulosic biomass, such as trees and grasses, are also used as feedstock for ethanol production. Ethanol can be used as a fuel for vehicles in its pure form, but it is usually used as a gasoline additive to increase octane and improve vehicle emissions.
- Biodiesel is made from vegetable oils, animal fats or recycled greases. Biodiesel can be used as a fuel for vehicles in its pure form, but it is usually used as a diesel additive to reduce levels of particulates, carbon monoxide, and hydrocarbons from diesel-powered vehicles. Biodiesel is produced from oils or fats using trans esterification.

Geothermal energy

- Three types of power plants are used to generate power from geothermal energy: dry steam, flash, and binary.
- Dry steam plants take steam out of fractures in the ground and use it to directly drive a turbine that spins a generator.
- Flash plants take hot water, usually at temperatures over 200 °C, out of the ground, and allows it to boil as it rises to the surface then separates the steam phase in steam/water separators and then runs the steam through a turbine.
- In binary plants, the hot water flows through heat exchangers, boiling an organic fluid that spins the turbine. The condensed steam and remaining geothermal fluid from all three types of plants are injected back into the hot rock to pick up more heat.
- The geothermal energy from the core of the Earth is closer to the surface in some areas than in others. Where hot underground steam or water can be tapped and brought to the surface it may be used to generate electricity.

ENVIRONMENTAL POLLUTION

- Environmental Pollution can be defined as any undesirable change in physical, chemical, or biological characteristics of any component of the environment i.e. air, water, soil which can cause harmful effects on various forms of life or property.

- Pollution: The term pollution can be defined as influence of any substance causing nuisance, harmful effects, and uneasiness to the organisms

- Pollutant:- Any substance causing Nuisance or harmful effects or uneasiness to the organisms, then that particular substance may be called as the pollutant.

TYPES OF POLLUTION

- WATER POLLUTION
- AIR POLLUTION
- LAND POLLUTION
- NOISE POLLUTION

- **Water Pollution** can be defined as alteration in **physical, chemical,** or **biological** characteristics of water through natural or human activities and making it unsuitable for its designated use.

- Fresh Water present on the earth surface is put to many uses. It is used for drinking, domestic and municipal uses, agricultural, irrigation, industries, navigation, recreation. The used water becomes contaminated and is called waste water.

SOURCES OF WATER POLLUTION

- Most of Water Pollution is man made It may also occur naturally by addition of soil particles through erosion animal wastes and leaching of minerals from rocks

- The sources of water pollution can be classified as
  - Municipal Waste Water
  - Industrial Waste
  - Inorganic Pollutants
  - Organic Pollutants
  - Agricultural Wastes
  - Marine Pollution
  - Thermal pollution

INDUSTRIAL WASTE

The major source of water pollution is the waste water discharged from industries and commercial bodies, these industries are chemical, metallurgical, food processing industries, textile, paper industries. They discharge several organic and inorganic pollutants. That prove highly toxic to living beings.

AGRICULTURAL WASTES

- Chemical fertilizers and pesticides have become essential for present day high yielding crops.

- Consequently , they have become a potential source of water pollution. These fertilizers contain major plants nutrients mainly nitrogen, phosphorous, and potassium.

- Excess fertilizers may reach the ground water by leaching or may be mixed with surface water of rivers, lakes and ponds by runoff and drainage.

MARINE POLLUTION

- Ocean are the final sink of all natural and manmade pollutants. Rivers discharge their pollutants into the sea. The sewage and garbage of costal cities are also dumped into the sea. The other sources include, discharge of oils, grease, detergents, and radioactive wastes from ships.

THERMAL POLLUTION

- Thermal Pollution of water is caused by the rise in temperature of water. The main source of thermal pollution are the thermal and nuclear power plants. The power generating plants use water as coolants and release hot water into the original source. Sudden rise in temperature kills fish and other aquatic animals.

- **Air pollution** is the introduction of chemicals, particulate matter, or biological materials that cause harm or discomfort to humans or other living organisms, or cause damage to the natural environment or built environment, into the atmosphere.

- A substance in the air that can cause harm to humans and the environment is known as an air pollutant.

CAUSES OF AIR POLLUTION

- Carbon dioxide-this happens because of Deforestation and fossil fuel burning.
- Sulfur dioxide –Due to the burning of sulfur containing compounds of fossil fuels.
- Sulfur oxides- very dangerous to humans at a high concentration. Sulfur in the atmosphere is responsible for acid rain.

CONSEQUENCES OF AIR POLLUTION

- CO_2 is a good transmitter of sunlight, but it also partially restricts infrared radiation going back from the earth into space, which produces the so-called greenhouse effect that prevents a drastic cooling of the Earth during the night.

- CO_2 in atmosphere –> GLOBAL WARMING

- **Land pollution** is the demolition of Earth's land surfaces often caused by human activities and their misuse of land resources. It occurs when waste is not disposed properly.

- Urbanization and industrialization are major causes of land pollution.

CAUSES OF LAND POLLUTION

- Four Main causes of land pollution:
  - Construction
  - Agriculture
  - Domestic waste
  - Industrial Waste

AGRICULTURE

- As there are more and more people inhabiting the earth, food is in higher demand and so forests are chopped down and turned into farmland

- In addition, herbicides, pesticides, artificial fertilizers, animal manure are washed into the soil and pollute it.

DOMESTIC WASTE

- Tons of domestic waste is dumped every day. Some waste from homes, offices and industries can be recycled or burnt in incinerators .

- There is still a lot of garbage, such as refrigerators and washing machines that are dumped in landfills simply because they cannot be reused in anyway, nor recycled .

INDUSTRIAL WASTE

- Plastics factories, chemical plants, oil refineries, nuclear waste disposal activity, large animal farms, coal-fired power plants, metals production factories and other heavy industry all contribute to land pollution.

- **Noise pollution** is excessive, displeasing human, animal, or machine-created environmental noise that disrupts the activity or balance of human or animal life.

- Sound becomes undesirable when it disturbs the normal activities such as working, sleeping, and during conversations.

- World Health Organization stated that "Noise must be recognized as a major threat to human well-being"

SOURCES OF NOISE POLLUTION

- Transportation systems are the main source of noise pollution in urban areas.
- Construction of buildings, highways, and streets cause a lot of noise, due to the usage of air compressors, bulldozers, loaders, dump trucks, and pavement breakers.
- Industrial noise also adds to the already unfavorable state of noise pollution.
- Loud speakers, plumbing, boilers, generators, air conditioners, fans, and vacuum cleaners add to the existing noise pollution.

EFFECTS OF NOISE POLLUTION

- According to the USEPA, there are direct links between noise and health. Also, noise pollution adversely affects the lives of millions of people.

- Noise pollution can damage physiological and psychological health.

- High blood pressure, stress related illness, sleep disruption, hearing loss, and productivity loss are the problems related to noise pollution.

- It can also cause memory loss, severe depression, and panic attacks.

SOLUTIONS FOR NOISE POLLUTION

- Planting bushes and trees in and around sound generating sources is an effective solution for noise pollution.
- Regular servicing and tuning of automobiles can effectively reduce the noise pollution
- Social awareness programs should be taken up to educate the public about the causes and effects of noise pollution.
- Workers should be provided with equipments such as ear plugs and earmuffs for hearing protection.

- Similar to automobiles, lubrication of the machinery and servicing should be done to minimize noise generation.

- Soundproof doors and windows can be installed to block unwanted noise from outside.

- Regulations should be imposed to restrict the usage of play loudspeakers in crowded areas and public places.

- Factories and industries should be located far from the residential areas.

WAYS TO STOP POLLUTION

- Webelieve that it is the responsible thing to do to increase recycling.
- It is just like doing laundry and separating blacks and colors.
- The residents of the country should also try and do their part and put in at least one day of litter picking up.