

# The Energy Industry: Structure and Organization

*Module 1, Unit B*

# Student Learning Outcomes

- Explain the different structures of energy companies
- Explain the different types of energy businesses
- Identify the role and function of generation, transmission, and distribution organizations

# Integration

Historically, electric companies were **vertically integrated** in that electric utility companies provided generation, transmission, and distribution services. This has changed somewhat to less vertically integrated structures due to recent **regulatory changes** occurring in the industry in which generation, transmission, and distribution services are now commonly **separate entities**.

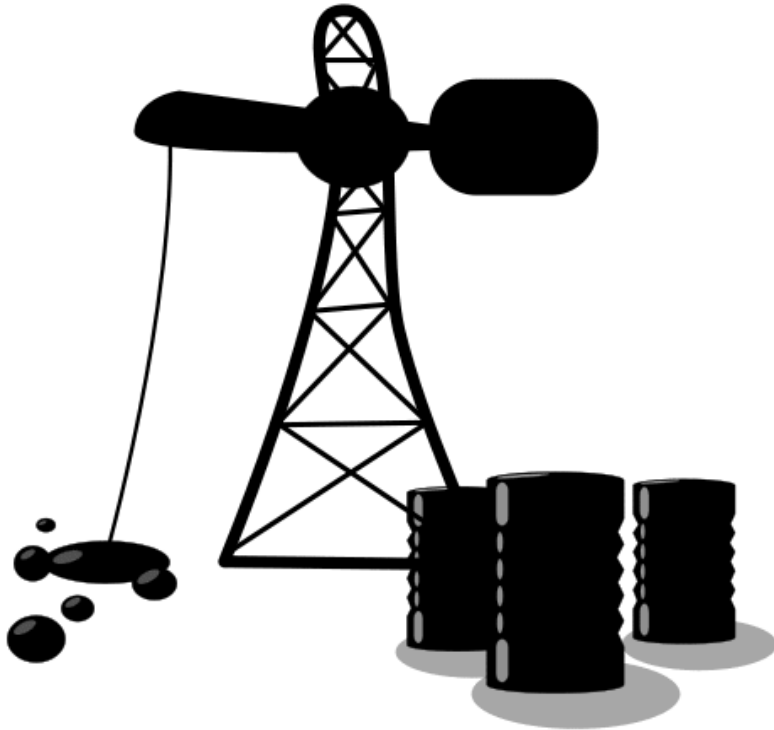
# Generation

Electric power generation is decentralized, and the majority of generating plants are privately-owned and subject to federal and state laws and regulations.

Electrical energy is created in a **generator when a conductor is moved through a magnetic field or a magnet is moved across a conductor.**

Although there are many fuel sources for powering the mechanical processes that generate electricity, the majority of the electricity used in the U.S. is generated by three main fuels: coal, natural gas, and nuclear.

# Fossil Fuels



The burning of fossil fuels (such as coal, gas, and oil) is the most common method of electric generation in the U.S.

Fossil fuels are burned to create high-pressure steam or hot combustion gases that turn turbine-generator units that produce electricity.

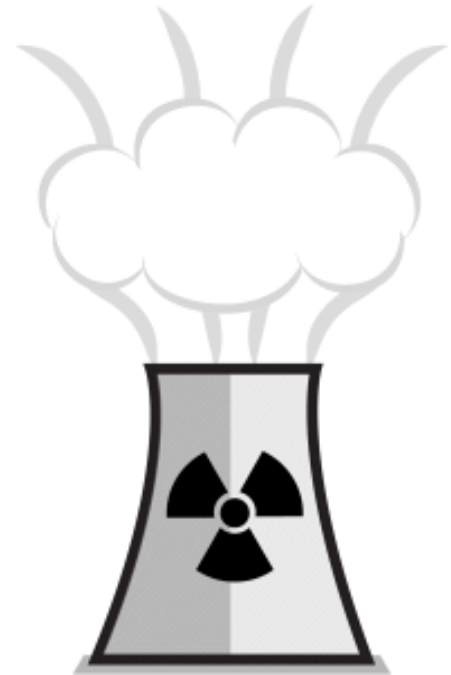
(More on this in Module 3).

# Nuclear

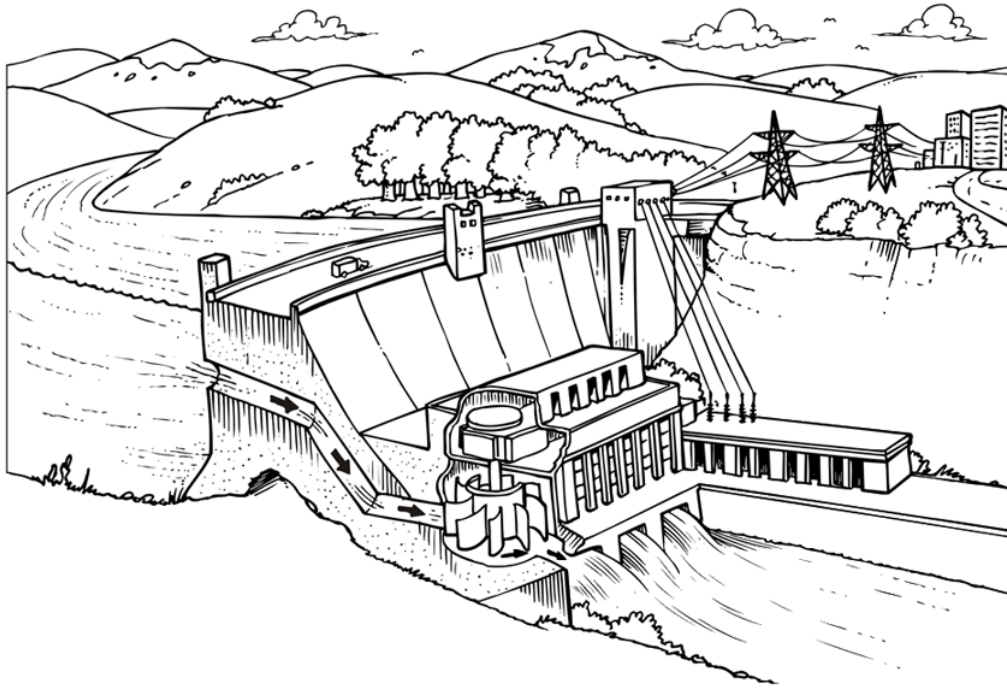
In nuclear power generation, steam is produced by the heating of water by nuclear fission.

The steam passes through turbines creating mechanical energy that produces electrical current.

After the steam leaves the turbine it is usually condensed back to water and pumped back into the nuclear-fueled boiler for the process to begin again.



# Hydroelectric



In hydroelectric power plants, the **mechanical energy** to rotate the generator comes from the force of **falling water** pushing against the blades of a water turbine.

The source of water for hydroelectric generation is usually a lake or reservoir located several hundred feet above the level of the water turbine and generator.

# Transmission

Electric power transmission is the **bulk transfer of high-voltage electrical energy** from its source at generating plants to substations. The electric power transmission system consists of power lines, substations, and control centers.





# Distribution



Electric power distribution is the **transfer of high voltage electrical energy from substations to the end customer.**

The majority of customers are supplied from a distribution system that is an output of a substation, rather than the transmission or sub-transmission systems. Similar to the transmission system, the distribution system consists of power lines, substations and control centers.

# Public Utilities



Public utility is a term commonly used to refer to a group of businesses that supply vital services, which are subjected to the regulation of rates and service practices. Public utilities usually include water service, phone service, waste-management service, and electric service.

The primary purpose of the energy and utility industries is to provide **safe, adequate, and reliable** services to the public.

# Utility Company Structures

The term “public utility” refers to the nature of the business, not to the ownership of the organizations.

Most public utilities in the United States are **investor-owned**. Governmental organizations and the service users own the remaining public utilities.



# Investor-Owned Utilities

Privately invested electric power companies were the earliest form of business structure for the electric power industry.

**Investor-owned utilities are the most predominant type of utility in the U.S. today.**

Investor owned utilities are privately owned by individual investors, private funds, and private pension plans that purchase shares or stocks in the investor-owned utility for the purpose of receiving a financial return on investment.

# Municipal Utilities

Historically, municipal utilities were created to provide service to their respective local community in cases where service needs were not being met by other providers.

**Municipal utilities are nonprofit entities that are publicly-owned and controlled by local government agencies.**

Municipal utilities may include the following services: natural gas, water, sewage, and telecommunications. Most municipal electric utilities just distribute power to their customers, but a small number actually generate and transmit electricity as well.

# Cooperatives

Historically, utility cooperatives were formed to serve areas that were not serviced by larger, privately-owned utility providers.

**Cooperative energy utilities are nonprofit entities that are owned by the customers who are supplied with the services.**

Electric cooperatives are typically distribution cooperatives that do not own generation, but gather electricity from a variety of sources and distribute it to customers. However, a small number of co-ops are generation and transmission co-ops that create and send power to customers.

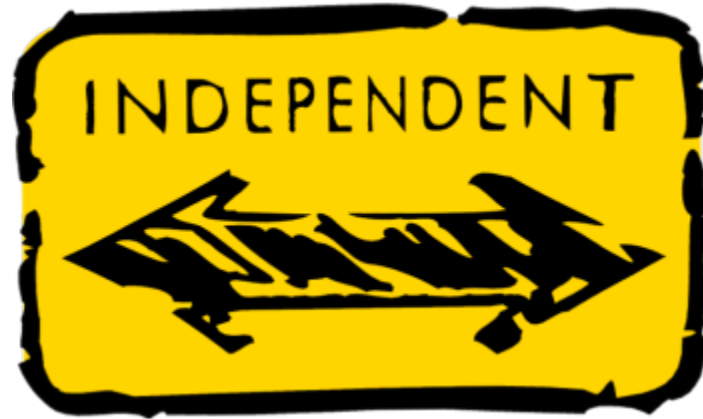
# Government-Owned Utilities

Government-owned utilities include entities such as local authorities, local agencies, and county-governing powers.

Profits from government-owned utilities are used to pay for operating costs such as interest on loans, taxes, labor, and other human resources.

# Independent Power Producers

An Independent Power Producer (IPP), also known as a Non-Utility Generator (NUG), is an entity which is **not** a public utility, but which owns facilities to **generate electric power to sell**, usually to public utilities. There are more than 1,700 IPPs in the United States. IPPs must use the transmission capabilities of other utilities to transmit the power they generate.





# Cogeneration

Cogeneration accounts for the largest part of the IPP sector.

Cogeneration typically involves the coproduction of **power and useful heat** from an energy source such as a steam turbine, gas turbine, or internal combustion engine.

Cogenerators use the heat and electricity that is generated to power their own operations and often **sell excess power back to local utilities**.

# Small Power Producers

Small Power Producers are small power plants that **generate power for resale to others through renewable technologies** such as biomass, geothermal, wind, and solar.

To meet the criteria for the Public Utility Regulatory Policies Act (PURPA) classification for a small power producer, **renewable resources must provide at least 75 percent of the total energy input.**



# Merchant Generators

Merchant generators are **businesses that have been formed to own power plants** and market their output.

A merchant plant is one that has been **built without a specific end user selected**, which allows the plant to be more competitive in the wholesale energy market.

# Independent System Operators

Independent System Operators (ISOs) were formed under the authority of FERC from Orders 888 and 889. **FERC established ISOs as a way to provide non-discriminatory access to transmission.**

Independent System Operators are nonprofit organizations that combine the transmission capabilities of multiple transmission providers into a single transmission system that can be accessed by many other energy entities.

ISOs coordinate, control, and monitor the operation of the electric power system in their respective geographical area.

# Regional Transmission Organizations

Regional Transmission Organizations (RTOs) were formed under the authority of FERC from Order Number 2000. FERC encouraged transmission-owning utilities to turn over control of transmission systems to RTOs.

RTOs coordinate, control, and monitor the operation of the transmission grid in their respective geographical area. **RTOs provide equal access to the electric transmission network.**

**RTOs differ from ISOs in that they are required to meet specific FERC regulations.**

# Review

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- Explain the different types of energy businesses
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transmission, and distribution organizations