Advantages and Challenges of Nuclear Energy

Nuclear power plants currently generate around 19 percent of the electricity consumed in the United States. As the demand for electricity grows in the coming years, it will be necessary to build more nuclear power plants in order to keep nuclear energy meeting 19 percent of our needs. As the country moves forward in planning how to meet electricity demands, individuals and organizations will debate the costs and benefits of each energy source.

Advantages of Nuclear Energy

- Nuclear power plants do not emit carbon dioxide.
- Nuclear power plants do not give off pollutants such as soot, ash, or sulfur dioxide.
- There is a large supply of uranium fuel available—enough for several hundred to many thousands of years, and uranium costs are low relative to coal and natural gas.
- Nuclear energy can provide baseload electricity where renewable sources are intermittent.
- The operating cost of a nuclear power plant is low, and will continue to be reduced as plants become more efficient and operate for longer periods of time.
- New plant designs are safer and more efficient than those of older plants.
- Increasing the number of nuclear plants in the U.S. can reduce our dependence on foreign oil if Americans buy and drive electric-powered vehicles. This requires a dramatic increase in the design and production of electric-powered vehicles by car manufacturers and an increase of electricity generated.

Challenges of Nuclear Energy

- Overall costs of construction and spent fuel storage are high and highly political.
- It takes longer to build a nuclear power plant than a coal or natural gas plant.
- Radiation released from nuclear reactions must be contained, and radioactive spent fuel and nuclear waste must be safely and securely stored.
- A portion of the public continues to have major concerns about the safety of nuclear power plants.
- Transporting nuclear waste across the country will have challenges both regulatory and political.
- While environmental impact studies have been conducted to make predictions, it is unknown exactly how long-term storage of radioactive high-level waste, including nuclear spent fuel, will impact the environment.
- Uranium enrichment and nuclear fuel reprocessing technologies created during enriching and reprocessing can be used in producing fissile materials for nuclear weapons (nuclear proliferation).
- There are limited material resources and manufacturing plants to make reactor components, and an increased demand for raw materials, including concrete and copper, that are used in construction of these facilities.
- Most nuclear power plants in the U.S. were built over 30 years ago. Even with upgrades and regular maintenance, there are safety concerns regarding extending their operating licenses.

Careers in the Nuclear Industry

The following are examples of careers that require training in the use of nuclear energy or that help support nuclear industries.

Nuclear Power:

Entry-Level Engineer—Helps to develop complex plans to support plant operations. The engineer also monitors, assesses, and improves the performance and reliability of plant systems and components.

Experienced Engineer—An experienced or senior engineer at a nuclear power plant plans and coordinates programs and large-scale engineering projects or several medium projects while acting as a technical specialist for a specific engineering field.

Mechanical Technician—Performs preventive, corrective, and special maintenance on systems, components, and structural facilities to ensure the reliability of a nuclear power plant.

Electrical Technician—Performs maintenance and repair of highly complex electrical/electronic equipment required for a nuclear plant. Responsibilities include troubleshooting, testing, and inspecting the equipment in a highly skilled manner.

Instrumentation and Control Technician—Responsible for calibrating, testing, troubleshooting, reworking, modifying, and inspecting nuclear plant instrumentation and control components and systems.

Chemistry Technician—Measures and records plant chemistry and radioactivity levels, and operates chemical and radiochemical instrumentation and equipment.

Radiation Protection Technician—Radiation protection technicians measure and record radiation levels; in addition, they service and calibrate radiation protection instruments and equipment. They play a vital role in ensuring the safety of employees working in radiation areas, as well as the facility's compliance with radiation requirements.

Non-Licensed Operator—Supports the licensed reactor operators and senior reactor operators. Duties include opening and closing valves, electrical breakers, and other devices as well as directly monitoring plant equipment performance.

Reactor Operator—A reactor operator, licensed by the U.S. Nuclear Regulatory Commission, is responsible for operating a reactor's controls in cooperation with the remainder of the shift team. The reactor operator moves control rods, starts and stops equipment, implements operations procedures, conducts surveillance tests, and records data in logs.

Senior Reactor Operator—A senior reactor operator is licensed to operate a nuclear power plant in accordance with all regulations. Duties include operating the mechanical, electrical, and reactor systems from the plant control room in a safe and efficient manner to ensure maximum electrical generation in compliance with regulations.

Industrial Machinery Mechanic—Repairs, maintains, and helps install mechanical systems of reactors and generators.

Skilled Trade Workers—Includes electricians who repair, maintain, and help install electrical systems that supply reactors, and generators.

Electrical Line Workers—Repair, maintain, and help install electrical lines feeding and leaving electrical generators.

Welders—Install and repair various parts of reactors, generators, and cooling systems.

Non-Nuclear Power:

Archaeologist and Paleontologists—Use radiation to determine age and composition of fossils.

Biologist—Uses radiation in experiments to develop new varieties of crops.

Biological Research Assistants—Help scientists and food engineers collect and analyze data to improve food supply.

Civil Engineer—Designs, constructs, and/or supervises the building of roads, tunnels, bridges, facilities, water supply, and sewer systems.

Gamma Facilities Operators—Use radiation to destroy microorganisms like salmonella or E. coli in food supplies.

Health Physicists—Assure safe exposure levels of radiation in all areas where human radiation exposure may occur.

Medical Staff—Doctors, nurses, and other health practitioners use nuclear medicine to diagnose and treat diseases.

Nuclear Medicine Technologists—Run various tests in hospitals that use radiation.

Public Affairs—A career in public affairs often involves communicating with the public on nuclear energy and/or radiation topics. This may include writing press releases, attending public meetings, website administration, or leading tours at facilities.

Radiobiologist—Studies the effects of ionizing radiation on cells and organisms.

Radioecologist—An environmental scientist that studies and determines how radioactive material is transported through the environment and through ecosystems.

X-ray technicians—Administer and develop x-rays in health care settings.

Others—Persons trained in the use of radiation are needed in crime investigation, science education, policy making, and art appraisal and authentication.