UNIVERSITY of HOUSTON
OFFICE OF THE PROVOST
UH Energy

GOING NUCLEAR: RISK, ODDS AND POTENTIAL

UH Energy is hosting a provocative panel discussion on the risk, odds, and potential of nuclear power for energy production.

So how big is nuclear energy?

The U.S. Energy Information Administration (EIA), estimates that nuclear power contributes nearly 20 percent of the electricity generated in the US. Nuclear power is the largest source of carbon-free electricity -- more than 60 percent of the total carbon free electricity generated in U.S.. Nuclear power has the highest capacity utilization factor, highlighted by the fact that while being only 9 percent of the installed capacity for electrical power, it generates nearly 20% of the U.S.'s electric power needs..

In the U.S., the first commercial nuclear power plant came into operation in the mid-50s and their numbers grew steadily for 40 years, with just over 100 operable units whose total capacity is 100 Gigawatts. The United States is number one in using nuclear power to generate electricity. At 30 percent, it beats out France, Japan, China and Russia.

The U.S. now has 100 operating commercial nuclear reactors at 60 nuclear power plants. In 2000, the largest 12 utilities owned slightly more than half of operating plants. However, the U.S. nuclear power industry has undergone significant consolidation in recent years because of the deregulation of electricity prices in 17 states. Now, the top 10 utilities own nearly three-fourths of the total nuclear capacity. (include animated graph showing change in numbers)

In May, 2016 the Nuclear Regulatory Commission, (NRC), had about 20 applications for new reactors in various stages of review. That application review process can take up to five years. Construction of a nuclear power plant may take another five years or longer. The EIA estimates that new nuclear power plants built to generate electricity will be added through 2040. But, capacity retirements and derates will result in only a small net increase in nuclear power plants' capacity by 2040.

Is nuclear energy a renewable energy resource?

Although nuclear energy is considered a clean energy source, experts debate whether it should be included on the renewable energy list. Renewable energy is defined as an energy source or fuel type that can regenerate and replenish itself indefinitely. Examples include biomass, wind, solar, hydro and geothermal. Nuclear power, on the other hand, makes use of nuclear reactions that release nuclear energy to generate heat, and it is then used in steam turbines to produce electricity in a nuclear power plant. Power plants convert heat into electricity using steam. Nuclear fission is created when the heat to make the steam splits atoms apart. The fission releases energy in the form of heat and neutrons. The released neutrons then go on to hit other radioactive atoms and repeat the process, again generating more heat. The capacity of traditional nuclear power plants in the US range from 500 MegaWatts to nearly four Gigawatts.

What does nuclear energy mean for the economy?

The NEI estimates that a new nuclear energy facility creates 400 to 700 permanent jobs for every 1,000 megawatts of electricity generating capacity, A coal plant with the same capacity generates 90 jobs. A wind farm or a natural gas plant adds only 50 jobs to the economy.

What kind of risks does the use of nuclear energy create for the environment?

Three nuclear accidents - Three Mile Island, Chernobyl and most recently Fukushima - have heavily influenced the decisions to end nuclear power in many countries:. A "major nuclear accident" is considered detrimental to the surrounding environment when a reactor core is damaged, and it releases significant amounts of radioactivity into the atmosphere.

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Perhaps the most catastrophic nuclear accident was the 1986 Chernobyl disaster in the Ukraine. The disaster occurred when uncontrolled reaction conditions flashed water into steam, generating a destructive steam explosion and a subsequent open-air graphite "fire." As a result, an area of one-thousand square miles was immediately designated as an exclusion zone around the Chernobyl nuclear power plant. No one is allowed in that area where the highest levels of radioactive contamination from fallout exists.

An earthquake and subsequent tsunami in 2011 destroyed the Fukushima Daiichi nuclear power, creating massive radioactive contamination of the Japanese mainland. It's estimated the events cost an estimated two-hundred and fifty billion dollars. There are 23 nuclear reactors with the same design as those at Fukushima now operating in the U.S.

What is next?

Following the Fukushima disaster, Germany took a major step in the ongoing energy transition by shutting down eight reactors and announcing a complete nuclear phase-out by 2022. Switzerland and Belgium also announced nuclear phase-out plans. Sweden followed suit in 2014, setting up an energy commission to phase out nuclear power and with a goal of achieving 100% renewable energy production.

France, China and the US have separately undertaken aggressive and expensive efforts to retrofit existing nuclear power plants to improve safety. The plans to build new plants are back under consideration in China, Poland, Vietnam and the U.S.

Technological solutions are also on the horizon and close to commercialization. According to the U.S. Department of Energy, Small Modular Reactors are nuclear power plants that are smaller in size (300 MWe or less) These smaller, compact designs are factory-fabricated reactors that can be transported by truck or rail to a nuclear power site. SMRs will play an important role in energy security, economic and climate goals if they can be commercially deployed within the next decade. Small modular reactors offer a lower initial capital investment, greater scalability, and flexibility for locations unable to accommodate more traditional, larger reactors.

The future of nuclear industry remains complex: The high capacity utilization, the no carbon impact during operations and technological advances such as SMRs make nuclear energy a tempting solution. The risks on the other hand as exemplified by Fukushima and Chernobyl are likely to keep the debate active.

We will continue the discussion on Wednesday, February 15th at 5:30pm in the Student Center South Houston Room. We look forward to a great discussion and hope to see you there.

RELATED REPORTS:

Small Modular Reactors: An Analysis of Factors Related to Siting and Licensing in Washington State

Reactor Technology Development Status Report: Small Modular Reactor

Small Modular Reactors (SMR) Feasibility Study

SEAB Subcommittee on Small Modular Reactors (SMR)