

# Virtual Public Forum: A Regulatory Framework for Fusion

## Industry Perspective--Legal

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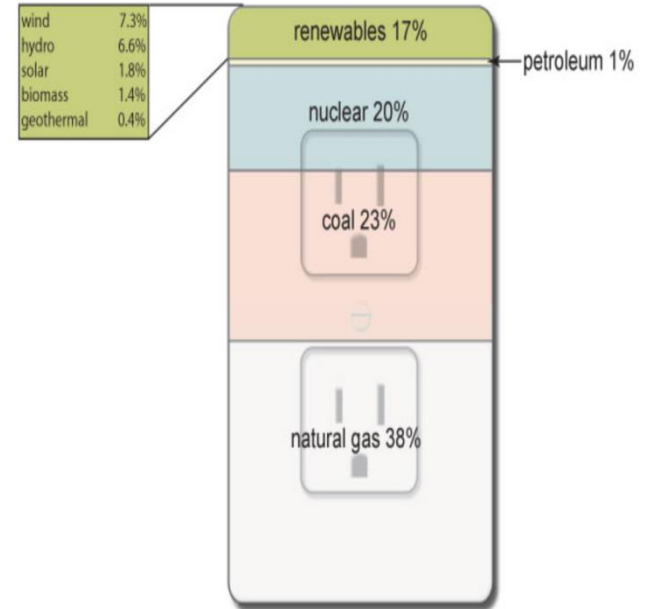
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# Benefits of fusion

- “Energy from fusion will provide clean power for everyone that’s safe, affordable, and limitless.”
  - Climate change/environmental
  - Energy independence and security
  - Raising the global standard of living
  - Technological competitiveness
  - Both power and non-power applications

## Sources of U.S. electricity generation, 2019

Total = 4.12 trillion kilowatthours



Note: Electricity generation from utility-scale facilities. Sum of percentages may not equal 100% because of independent rounding.

Source: U.S. Energy Information Administration, *Electric Power Monthly*, February 2020, preliminary data



# Statutory Framework and NRC Framework

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- Key underlying statute the Atomic Energy Act, 42 U.S.C. §2011 et seq.
  - Fundamental U.S. law on the civilian use of nuclear materials.
  - Provides for both the development and the regulation of nuclear materials and facilities.
  - Requires that civilian uses of nuclear materials and facilities be licensed by the NRC.
  - Sec. 274 also sets up the NRC Agreement State Program
    - Permits the NRC to enter into an agreement with a state that delegate's the NRC's regulatory authority over some materials licensees within the state.
    - The state must show that its regulatory program is compatible with the NRC's and adequate to protect public health and safety.

# Key NRC Framework

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- Part 20, Standards for Protection Against Radiation
- Part 30, Byproduct Materials
- Part 40, Source Materials
- Part 70, Special Nuclear Materials (including fuel fabrication facilities, uranium enrichment facilities)
- Part 50/52, Licensing or Production or Utilization Facilities
- Part 53, [RESERVED]
  - Risk-informed, Technology Inclusive Regulatory Framework for Advanced Reactors

# NRC has had limited discussions on fusion in the past

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- NRC has jurisdiction over fusion for the use of radioactive material alone.
- Fusion not otherwise expressly addressed in AEA or NRC regulations.
- NRC has had some limited discussions in the past about fusion—
  - In 2009, the NRC staff raised the question of fusion regulation to the Commission. In SECY -09-0064 (Apr. 2009), *Regulation of Fusion-Based Power Generation Devices*, the NRC staff sought the Commission’s input on the NRC’s jurisdiction over fusion.
  - The NRC staff focused on the definition of “utilization facility” in the AEA (42 USC § 2014).
    - The AEA defines “utilization facility” to include those facilities that use “special nuclear material” or “atomic energy” “in such quantity as to be of significance to the common defense and security, or in such manner as to affect the health and safety of the public.”
    - The NRC further narrows the definition of “utilization facility” in its own definitions to include primarily nuclear fission reactors.
  - In response, the Commission issued SRM-SECY-09-0064, *Staff Requirements Memorandum-- Regulation of Fusion-Based Power Generation Devices* (Jul. 2009)
    - “The Commission asserts, as a general matter, that the NRC has regulatory jurisdiction over commercial fusion energy devices whenever such devices are of significance to the common defense and security, or could affect the health and safety of the public.”
    - The Commission further directed the NRC staff to --
      - “Conduct further evaluations of the technical and legal issues associated with the regulation of specific fusion devices and provide status information regarding the development of fusion technology.”
      - And to “[w]ait until commercial deployment of fusion technology is more predictable...before expending significant resources to develop a regulatory framework for fusion technology.”

# DOE's involvement in fusion

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- U.S. government has invested approximately \$29 billion in fusion science and technology over the past 50 years.
- **Office of Science, Fusion Energy Sciences (FES).** Directs continuing research on fusion energy-related areas. Its program help researchers coordinate across the fundamental sciences that are involved with fusion, including plasma physics, nuclear engineering, and advanced scientific computing. Also supports the ITER experiment.
- **ARPA-E.** Three fusion programs:
  - **ALPHA (2015).** Seeks to create and demonstrate tools to aid in the development of new, lower-cost pathways to fusion power and to enable rapid progress in R&D.
  - **BETHE (2020).** Supports the development of timely, commercially viable fusion energy.
  - **GAMOW (2020).** Joint project between ARPA-E and FES that will prioritize certain fusion R&D.
- **Private-Public Partnerships**
  - **INFUSE (2019).** Innovation Network for Fusion Energy program within FES provides private companies access to DOE national laboratories and other expertise for assistance in developing fusion technologies.
  - On September 24, the House passed H.R. 4447, the Clean Economy Jobs and Innovation Act. The Act--
    - Directs DOE to carry out a fusion energy sciences R&D program with a goal of building a cost competitive fusion power plant and to establish a competitive fusion power industry in the United States.
    - Authorizes new DOE research programs in Inertial Fusion Energy and Alternative Concepts, potentially finding new attractive pathways towards fusion power.
    - Creates a new milestone-based development program that would support the U.S.-based fusion power industry through the R&D of technologies that will enable the construction of new full-scale fusion systems.

# Private Sector

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- The private sector's investment in fusion energy is rapidly growing, and currently exceeds \$2 billion.
- Focus on bringing fusion energy to market.
- A number of private fusion companies looking at demonstration and then commercial scale facilities in the near future.