Date of Hearing: April 12, 2023

ASSEMBLY COMMITTEE ON UTILITIES AND ENERGY
Eduardo Garcia, Chair
AB 1172 (Calderon) – As Amended March 30, 2023

SUBJECT: Integrated energy policy report: fusion energy

SUMMARY: Requires the California Energy Commission (CEC) to evaluate as part of its 2025 integrated energy policy report (IEPR) various fusion technologies, as defined, and to analyze the feasibility of using nuclear fusion in the state.

EXISTING LAW:

1) Declares the policy of the state to encourage the use of nuclear energy, wherever feasible, recognizing that such use has the potential of providing direct economic benefit to the public, while helping to conserve limited fossil fuel resources and promoting clean air. (Public Resources Code § 800)

2) Prohibits any nuclear fission thermal powerplant from being permitted in the state until the federal government approves technologies to reprocess the spent nuclear fuel rods, and the CEC reports to the Legislature affirmative findings of that federal action. (Public Resources Code § 25524.1)

3) Requires the CEC to conduct assessments and forecasts of all aspects of energy industry supply, production, transportation, delivery and distribution, demand, and prices and use these assessments and forecasts to develop and evaluate energy policies and programs that conserve resources, protect the environment, ensure energy reliability, enhance the state's economy, and protect public health and safety. (Public Resources Code §§ 25000, et seq)

4) Requires the CEC to adopt the IEPR every two years, which must contain an overview of major energy trends and issues facing the state, including, but not limited to, supply, demand, pricing, reliability, efficiency, and impacts on public health and safety, the economy, resources, and the environment. (Public Resources Code §§ 25300-25327)

5) Requires the CEC to incorporate firm zero-carbon resources into the IPER in a timely fashion. (Public Resources Code § 25305.5)

FISCAL EFFECT: Unknown. This bill is keyed fiscal and will be referred to the Assembly Committee on Appropriations for its review.

BACKGROUND:

Nuclear Energy – There are two fundamental ways to release energy from nuclear reactions: fission and fusion of atomic nuclei. Nuclear fission is a process where the atomic nucleus splits apart; nuclear fusion is where atomic nuclei combine (or fuse) together. Both processes are theorized to generate energy. In nuclear fission, the process often yields some combination of particles and energy, often with radioactive decay. In nuclear fusion, the process can manifest as either an absorption or release of energy, sometimes with radioactive decay. Electricity generation based on fission is commercially available today, such as the Diablo Canyon Nuclear Powerplant. Electricity generation based on fusion has yet to become commercially viable, and is still in research and development.

Very generally, for fission-based electricity generation, the atomic splitting releases heat and energy which is used to boil water; the water produces steam, which turns a turbine to generate electricity.

There are multiple fusion methods that are currently being pursued for use in a commercial reactor system. Similar to fission, the released energy from a fusion process would be converted to heat, which in turn is converted to electricity via a conventional generator cycle. Although the fusion reaction theoretically does not produce significant or long-lived radioactive byproducts, the high-energy particles irradiate the surrounding reactor vessel and associated components. The irradiated material could pose potential disposal problems similar to those for the irradiated fission reactor vessel. The reasons fusion continues to be actively pursued is that unlike nuclear fission, there are less waste products, no risk of a nuclear melt down, and fusion power provides more energy for a given weight of fuel than any fuel-consuming energy source currently in use.

The aim of any controlled fusion process is to achieve “ignition,” which occurs when enough fusion reactions take place for the process to become self-sustaining, with fresh fuel then being added to continue it. Once ignition is achieved, there is net energy yield – about four times as much as with nuclear fission. According to the Massachusetts Institute of Technology, the amount of power produced increases with the square of the pressure, so doubling the pressure leads to a fourfold increase in energy production.

The world's most powerful laser fusion facility, the National Ignition Facility (NIF) at Lawrence Livermore National Laboratory, was completed in March 2009. Using its 192 laser beams, NIF is able to deliver more than 60 times the energy of any previous laser system to its target. In December 2022, a team at NIF conducted the first controlled fusion experiment in history to reach the ignition milestone, meaning it produced more energy from fusion than the laser energy used to drive it.

COMMENTS:

1) *Author’s Statement.* According to the author, “California’s commitment to creating climate resiliency policies has positioned the state as a leader in the renewable energy industry. With the goal of reaching carbon neutrality by 2045 and an exacerbated need for electricity, the state must continue investing in existing and promising renewable clean energy sources. There have been several millstones highlighting the promising progress of the nuclear fusion industry. Active stakeholders are on the path to creating commercially variable reactors that can safely generate clean energy to power cities and municipalities. AB 1172 is an effort to analyze how California can safely integrate fusion

energy technology as a renewable energy source. Identifying regulatory requirements and adoption hurdles is critical to deploying clean fusion energy and meeting our climate goals."

2) *The Readiness of Fusion.* While an assessment of the potential of nuclear fusion is a plausible assignment for the CEC, it is hard to imagine how the CEC, or anyone, could evaluate commercial viability at this stage. Determining the potential of fusion energy as a meaningful source of electricity requires a leap ahead of the current stage of research and demonstration, to consider cost and scale. At this stage, cost is astronomical and scale is tiny. It is not clear how the CEC will be able to predict the extent and timing of the significant innovations needed to achieve commercial viability. *As a result, it is important that any CEC evaluation into the feasibility of nuclear fusion consider the cost, scale, and timelines associated with bringing the process online. The author and committee may wish to consider an amendment to the CEC analysis to evaluate these real barriers to development, along with making minor, clarifying changes to the language.*

3) *Double Referral.* This bill was previously heard in the Assembly Committee on Natural Resources on March 27th, 2023, where it passed 11-0-0.

REGISTERED SUPPORT / OPPOSITION:

Support

Fusion Industry Association
Fusion Is Tomorrow's Energy
TAE Technologies

Opposition

None on file

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