

Date of Hearing: June 25, 2025

ASSEMBLY COMMITTEE ON UTILITIES AND ENERGY

Cottie Petrie-Norris, Chair

SB 80 (Caballero) – As Amended April 28, 2025

SENATE VOTE: 38-0

SUBJECT: Energy: Fusion Research and Development Innovation Hub Program

SUMMARY: This bill creates the Fusion Research and Development Innovation Hub Program (Fusion Program) within the California Energy Commission (CEC); and requires CEC to designate three hubs in the state to accelerate growth of fusion energy and to adopt regulations to award grants to those hubs. Specifically, **this bill:**

- 1) Establishes the Fusion Program at the CEC to accelerate the development and growth of fusion energy with the goal of delivering the world's first fusion energy pilot plant in California in the 2040s.
- 2) Requires the CEC, in consultation with the Governor's Office of Business and Economic Development (Go-Biz) and the President of the University of California (UC), to designate three fusion research and development innovation hubs that represent southern California, the Central Valley, and the San Francisco Bay Area.
- 3) Requires the CEC, in consultation with Go-Biz and the UC, to oversee, coordinate and provide assistance to the designated fusion hubs.
- 4) Requires the CEC, using moneys in the Fusion Research and Development Fund that this bill establishes in the State Treasury, to administer the Fusion Program to provide grants to designated hubs for the purpose of accelerating research and development of technology that supports the commercialization of fusion energy.
- 5) Requires the CEC, in consultation with Go-Biz and the UC, to adopt regulations to establish priority areas of funding and a process for the funding and selection of grantees that shall complement and facilitate the goals of the Fusion Program to ensure alignment with California's broader decarbonization and clean energy goals.
- 6) Requires each designated hub, to the maximum extent practicable, to reflect a combination of all of the following factors for advancing research and development diversity:
 - a. The inclusion of existing national fusion infrastructure, including national labs and national scientific user facilities.
 - b. Opportunities to develop or expand facilities focused on fusion energy research, development, testing and demonstration projects.
 - c. The inclusion of diverse approaches to fusion energy, including magnetic confinement, inertial confinement, novel approaches, and diverse fuel types.
 - d. Opportunities to support the future demonstration of the production, processing, delivery, and end use of fusion energy.

- e. The inclusion of apprenticeship programs and partnerships with academic institutions, including vocational schools and community colleges, to support workforce development and create new job pathways.
 - f. Entities that are likely to create or preserve opportunities for skilled training and long-term employment to the greatest number of residents of the region.
 - g. Opportunities to develop or expand research and testing facilities to address key gaps in science and technology applicable to multiple fusion energy concepts.
- 7) Requires the three designated fusion hubs to seek to do all of the following:
- a. Support the advancement of pre-demonstration commercial fusion energy programs by driving research and development in science, technology, academia, and workforce initiatives aligned with California's workforce goals for clean energy technologies.
 - b. Leverage state, federal, and private sector investments and incentives to advance research and technology applicable to fusion energy, including public-private partnerships and philanthropic collaborations.
 - c. Coordinate activities as a statewide network to facilitate a fusion energy economy.
- 8) Makes this bill contingent upon an appropriation.

EXISTING LAW:

- 1) 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)
- 2) 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)
- 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, as part of its 2027 Integrated Energy Policy Report (IEPR), to include an assessment of the potential of fusion energy to contribute to the state's power supply. Defines "fusion" to mean a reaction in which at least one heavier, more stable nucleus is produced from at least one lighter, less stable nucleus, typically through high temperatures and pressures, and emitting energy as a result. Defines "fusion energy" to mean the product of fusion reactions inside a fusion device and used to generate electricity or other commercially usable forms of energy. (Public Resources Code § 25302.4)
- 5) Establishes and vests the California Public Utilities Commission (CPUC) with regulatory authority over public utilities, including electric IOUs. Authorizes the CPUC to fix the rates

and charges for every public utility and requires that those rates and charges be just and reasonable. (Article XII of the California Constitution and Public Utilities Code § 451)

- 6) Requires the CPUC to adopt a process for each load-serving entity (LSE) serving end-use customers in the state, to file an integrated resource plan (IRP) to identify the LSE's resource procurement over the coming decade, and schedule periodic updates to the plan to ensure that LSEs accomplish specified objectives. Requires each LSE to prepare and file an IRP consistent with those objectives on a time schedule directed by the CPUC and subject to CPUC review. (Public Utilities Code § 454.52)
- 7) Establishes a state policy that eligible renewable energy resources and zero-carbon resources supply 90% of all retail sales of electricity to California end-use customers by December 31, 2035, 95% of all retail sales of electricity to California end-use customers by December 31, 2040, 100% of all retail sales of electricity to California end-use customers by December 31, 2045, and 100% of electricity procured to serve all state agencies by December 31, 2035, as provided. (Public Utilities Code § 454.53)
- 8) Establishes the California Independent System Operator (CAISO) governing board with five members appointed for three-year terms by the governor and subject to confirmation by the Senate. (Public Utilities Code § 337 et seq.)
- 9) Charges CAISO with management of the transmission grid and related energy markets in order to ensure the reliability of electric service and the health and safety of the public. (Public Utilities Code § 345.5)

FISCAL EFFECT: According to the Senate Appropriations Committee, this bill creates significant cost pressures of an unknown amount (various funds) to provide grant and other funding to fusion hubs established by this bill; will result in ongoing costs of at least \$175,000 annually (General Fund, Energy Resources Program Account, or other fund) for two CEC technical experts with nuclear fusion energy experience in order to consult with GO-Biz and the President of the UC to develop three hubs in each specified region of California and develop grant offerings; and will result in unknown but likely minor costs for GO-Biz and UC to consult with the CEC to develop hubs and grant offerings.

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.

Nuclear fission electricity generation is commercially available today, such as the electricity generated at the Diablo Canyon Nuclear Powerplant outside San Luis Obispo. 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. Similar indirect conversion cycles are envisioned for fusion electricity generation, where the energy from the reaction is transferred to a working fluid (usually water), which then produces

steam to run a turbine. Electricity generation based on fusion has yet to become commercially viable, and is still in research and development. There are multiple fusion methods that are currently being pursued for use in a commercial reactor system. 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.

Nuclear fusion as a zero-carbon energy resources – The need for zero-carbon and renewable energy resources is critical to advance the state’s clean energy and climate goals, including those for 100% zero-carbon and renewable energy by 2045 as established by SB 100 (De León, Chapter 312, Statutes of 2018) and the interim targets established by SB 1020 (Laird, Chapter 361, Statutes of 2022). Nuclear fusion energy has the potential to become a source of clean and resilient energy, however, many important science and technological challenges remain. Unlike nuclear fission, fusion energy theoretically provides less waste products, no risk of a nuclear melt down, and a higher energy density (fusion power has the potential to provide 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.

Fusion energy is nascent technology – Multiple reports have stated that commercially available nuclear fusion technology may be decades away. 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. Recent technological breakthroughs have also spurred interest in nuclear fusion development. In December 2022, the team at the world’s most powerful laser fusion facility, the National Ignition Facility (NIF) at Lawrence Livermore National Laboratory (LLNL), conducted the first controlled fusion experiment in history to reach the ignition milestone, meaning it achieved a net energy gain, producing more energy from fusion than the laser energy used to drive it. Using its 192 laser beams, NIF is able to deliver more than 60 times the energy of any previous laser system to its target. To date, the NIF at LLNL has achieved laboratory fusion ignition eight times: beginning with the historic event on December 5, 2022, and with subsequent success as recently as April 2025.¹ Each ignition event lasts for a few hundred picoseconds (i.e., 100 trillionths of a second);² far less than the blink of an eye.

California collaborative – In the hopes of advancing the state’s efforts, the UC established the Pacific CREST Fusion initiative and the concept of a Pacific CREST Fusion special purpose entity, which the Board of Regents approved at its January 22, 2025, meeting. The vision is to have the Pacific CREST Fusion organization be a UC led not-for-profit organization to advance fusion energy in California through a public-private partnership. The Pacific CREST Fusion initiative is intended to build off the existing laboratories, research capabilities, and private

¹ <https://lasers.llnl.gov/science/achieving-fusion-ignition>

² <https://st.llnl.gov/news/st-highlights/national-ignition-facility-experiment-puts-researchers-threshold-fusion-ignition>

companies to advance nuclear fusion energy. In addition to LLNL, these include other research and development facilities in the state, specifically: the DIII-D National Fusion Facility in San Diego, Lawrence Berkeley National Laboratory, Sandia National Laboratories, and the SLAC National Accelerator Laboratory at Stanford University, as well as, the world-class researchers at the state's universities, including at several of the UC campuses.

Federal funding opportunities – Under the Biden-Harris administration, the federal government announced and pursued efforts to advance fusion energy, including the U.S. Department of Energy's (US DOE) funding and initiatives to support Bold Decadal Vision for Commercial Fusion Energy. The Pacific CREST initiative is largely positioning for potential US DOE funding via the Bold Decadal Vision for Commercial Fusion Energy, as well as, public-private collaboration to advance fusion energy research, development, deployment, and demonstration given the growing need for zero-carbon energy resources. Senate amendments to this bill align the state goal of siting a fusion pilot plant in California in the 2040s, rather than 2030s, the same timeframe noted by the U.S. Fusion Energy Sciences Advisory Committee in its long-range plan, "*Powering the Future: Fusion & Plasmas*," which calls for constructing the first U.S. fusion pilot plant by the 2040s. However, recent actions by the new federal administration, including the plethora of executive orders, federal employee layoffs, and other actions by the Trump administration, have created some uncertainty, which remains unresolved, about the US DOE's continued efforts to advance nuclear fusion energy research and development. Moreover, as of the date of this analysis, the federal budget reconciliation bill does not include a continuation of federal tax credits for fusion energy, due to its federal definition as a separate class of zero-emission technology from "advanced nuclear facilities."³ It is unclear if this will remain in the final reconciliation bill.

COMMENTS:

- 1) *Author Statement.* According to the author: "Fusion energy, considered the 'holy grail' of energy solutions, promises virtually unlimited clean energy without long-lived nuclear waste. California has some of the most prestigious universities, and they are training the next generation of scientists in the mechanics of fusion energy. Yet if California does not invest in this emerging technology, students will be forced to leave the state to continue their careers. Additionally, fusion research has been supported primarily through the federal government with little to no state involvement or facilitation. This bill would authorize the [CEC] to establish regional fusion energy hubs in California and provide grant funding to assist in closing the infrastructure gap to make fusion energy part of California's zero-carbon energy system. California is a leader in technology and green energy; it should similarly lead the nation in fostering fusion energy."
- 2) *CEC's Oversight and Coordination Role.* This bill requires CEC to oversee, coordinate, and provide assistance to each designated hub. At the same time, the bill specifies duties that each hub shall seek to accomplish, including "[c]oordinate activities as a statewide network to facilitate a fusion energy economy." *To clarify roles, enable statewide coordination managed by CEC, and ensure overall accountability for the Fusion Program, the committee recommends amending this bill to state that the hub's individual responsibilities are subject to CEC's statewide oversight and coordination duties.*

³ Katie Brigham, "The One Big, Beautiful Bill's Fusion Exclusion," *Heatmap*; June 13, 2025, <https://heatmap.news/climate-tech/one-big-beautiful-bill-fusion>

- 3) *Role of CAISO and CPUC* – This bill requires the CEC to consult with Go-Biz and the UC for three purposes: (1) when designating the three fusion research and development innovation hubs in the specified geographic areas; (2) to oversee, coordinate, and provide assistance to each hub; and (3) to adopt regulations for award of grants to further the goals of the Fusion Program and “ensure alignment with California’s broader decarbonization and clean energy goals.” Given the significant role of the CAISO and CPUC in achieving these decarbonization and clean energy goals, it would seem beneficial for the CEC to also consult with CAISO and the CPUC. Moreover, fusion’s potential to be a firm energy source makes the CAISO and CPUC’s roles in energy planning and procurement relevant to where and how it is developed in California. *Thus, the committee recommends amending this bill to also require the CEC to consult with CAISO and the CPUC in all three instance where consultation with Go-Biz and the UC already is required.*
- 4) *Grants for Designated Hubs Only.* This bill requires the CEC to provide grants to designated hubs “for the purpose of accelerating the deployment of new research and technology capabilities that support the commercialization of fusion energy.” The bill further requires CEC to adopt regulations “to establish priority areas of funding and a process for the funding and selection of grantees that shall complement and facilitate the goals of the program to ensure alignment with California’s broader decarbonization and clean energy goals.” The bill could be read to contemplate CEC award of grants to the hubs *and* to some other unspecified universe of potential grantees. The author states that the intent is to authorize grants *only* to the designated hubs, although each hub is likely to have collaborating partners and participants in hub projects as described in this bill’s definition of a “hub.” *Thus, the committee recommends amending this bill to clarify that only the three designated hubs are potential recipients of Fusion Program grants.*

Regarding criteria for award of grants, there are multiple stated purposes of the Fusion Program, and just one explicitly stated “goal” – to deliver the world’s first fusion energy pilot program in the state by the 2040s. *Thus, the committee also recommends technical amendments to consolidate and clarify the goal and purposes of the Fusion Program that CEC is required to consider for award of grants to the three hubs.*

5) *Related Legislation.*

SCR 25 (Blakespear) celebrates the numerous contributions of public and private sector organizations within California for advancing nuclear fusion energy research and supports developing the fusion energy ecosystem with the goal of siting a first-of-its-kind fusion pilot plant in California by the 2040s. Status: *set for hearing* in this committee on June 25, 2025.

SB 86 (McNerney) authorizes the California Alternative Energy and Advanced Transportation Financing Authority to provide financial assistance, in the form of exclusions from sales and use tax, to electrical generation facilities using nuclear fusion technology. Status: pending in the Assembly Committee on Revenue and Taxation.

6) *Prior Legislation.*

AB 1172 (Calderon) required the CEC as part of its 2027 IEPR to include an assessment of the potential for fusion energy to contribute to California's power supply. Status: Chapter 360, Statutes 2023.

REGISTERED SUPPORT / OPPOSITION:

Support

B3k Prosperity
City of Livermore
Cleantech San Diego
General Atomics
Innovation Tri-valley Leadership Group
Kyoto Fusioneering America
San Diego Regional Chamber of Commerce
San Diego Regional Economic Development Corporation
San Diego State University

Support If Amended

Tae Technologies

Opposition

None on file.

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