



# HAWAII STATE ENERGY OFFICE STATE OF HAWAII

JOSH GREEN, M.D.  
GOVERNOR

MARK B. GLICK  
CHIEF ENERGY OFFICER

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Testimony of  
**MARK B. GLICK, Chief Energy Officer**

before the  
**HOUSE COMMITTEE ON ENERGY & ENVIRONMENTAL PROTECTION**

Tuesday, February 14, 2023  
9:10 AM  
State Capitol, Conference Room 325 and Videoconference

Providing COMMENTS on  
**HB 927**

**RELATING TO ENERGY.**

Chair Lowen, Vice Chair Cochran and Members of the Committee, the Hawai'i State Energy Office (HSEO) provides comments on HB 927, which would establish within the Hawai'i State Energy Office a future fusion task force.

HSEO's testimony is guided by its mission to promote energy efficiency, renewable energy, and clean transportation to help achieve a resilient, clean energy, decarbonized economy.

HSEO appreciates the importance of technological advancement and the value of planning ahead to remove roadblocks and create conditions for success so that technologies and desirable projects will not be delayed when they are economically, technically, socially, and environmentally ready for deployment. As reported in December of 2022 by the Lawrence Livermore National Laboratory (LLNL),

“On Dec. 5, a team at LLNL's National Ignition Facility (NIF) conducted the first controlled fusion experiment in history to reach this milestone, also known as scientific energy breakeven, meaning it produced more energy from fusion than the laser energy used to drive it...

LLNL's experiment surpassed the fusion threshold by delivering 2.05 megajoules (MJ) of energy to the target, resulting in 3.15 MJ of fusion energy output.”

From a research standpoint, the net positive result was highly newsworthy.

However, the magnitude of energy produced (the difference between 3.15 megajoules and 2.05 megajoules) is 1.1 megajoules. This is enough energy to drive one electric car one mile.<sup>1</sup>

The equipment required to deliver that result was, as stated in LLNL's press release, "...the world's largest and most energetic laser system... is the size of a sports stadium and uses powerful laser beams to create temperatures and pressures like those in the cores of stars and giant planets."<sup>2</sup>

Many years of additional research and development work will be required before this technology is ready for commercial use.

With so much undeveloped and unknowns about the final commercial form of fusion energy systems, we respectfully suggest that we all continue to be interested and inspired by these types of developments (many of which are reported daily by engineering and scientific societies), but that we refrain from creating a task force at this point.

Thank you for the opportunity to testify on this bill.

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<sup>1</sup> <https://www.forbes.com/sites/bradtempleton/2022/12/31/should-the-megajoule-replace-the-kwh-as-our-unit-of-electric-car-energy--hear-me-out/>

<sup>2</sup> <https://www.llnl.gov/news/national-ignition-facility-achieves-fusion-ignition>

**HB-927**

Submitted on: 2/9/2023 2:11:22 PM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b>        | <b>Testifier Position</b> | <b>Testify</b>         |
|---------------------|----------------------------|---------------------------|------------------------|
| Laulani Teale       | Ho'opae Pono Peace Project | Oppose                    | Written Testimony Only |

Comments:

Aloha Kākou,

Ho'opae Pono Peace Project strongly opposes this measure. There is no such thing as "safe" nuclear energy. We need a **nuclear-free, fully independent, Indigenous-led Pacific** for a better world for our future generations to survive.

Mahalo nui loa,

Laulani Teale

Coordinator, Ho'opae Pono Peace Project

**HB-927**

Submitted on: 2/10/2023 12:24:12 PM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>            |
|---------------------|---------------------|---------------------------|---------------------------|
| Jim Albertini       | Malu 'Aina          | Oppose                    | Written Testimony<br>Only |

Comments:

Our organization opposes HB927 and ALL nuclear power in Hawaii. I was personally involved in getting the 1978 Constitutional amendment passed on nuclear power restrictions. We wanted an outright ban but requiring a 2/3 vote was the best we could get. It's a safeguard against special interest money easily getting their way. Frankly, I have had enough of Hawaii's corruption. This bill smells of further corruption. It deserves the rubbish heap of history.

**HB-927**

Submitted on: 2/11/2023 10:43:41 AM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b>                            | <b>Testifier Position</b> | <b>Testify</b>            |
|---------------------|--|---------------------------|---------------------------|
| Joseph Kohn MD      | We Are One, Inc. -<br>www.WeAreOne.cc -<br>WAO | Oppose                    | Written Testimony<br>Only |

Comments:

STRONGLY OPPOSE NUCLEAR POWER IN HAWAII; NO SAFE WAY TO DISPOSE OF THE WASTE.

[www.WeAreOne.cc](http://www.WeAreOne.cc)

**HB-927**

Submitted on: 2/12/2023 11:09:32 AM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b>  | <b>Testifier Position</b> | <b>Testify</b>            |
|---------------------|----------------------|---------------------------|---------------------------|
| laurel brier        | Kauai women's caucus | Oppose                    | Written Testimony<br>Only |

Comments:

Strongly opposed. Nuclear power, be it fission or fusion, is NOT a zero-emission power source and has NO PLACE in Hawaii's clean energy future. Let's not be distracted and move forward on our path to clean, renewable, affordable, energy that truly addresses the climate issue .

**HB-927**

Submitted on: 2/12/2023 9:06:17 PM

Testimony for EEP on 2/14/2023 9:10:00 AM

| Submitted By | Organization          | Testifier Position | Testify           |
|--------------|-----------------------|--------------------|-------------------|
| Dave Mulinix | Our Revolution Hawaii | Oppose             | Remotely Via Zoom |

Comments:

Aloha Committee,

On behalf of Our Revolution Hawaii's 5,000 members and supporters statewide, we stand in **STONG OPPOSITION** to HB927 that establishes within the Hawaii State Energy Office a future fusion task force to promote the use of fusion as an energy source in the State.

There are endless reasons this is an incredibly bad idea, here are just three:

- we are in **strong opposition to HB927**, a measure full of dangerous misconceptions, and is a harmful distraction from Hawaii's goal to achieve a clean energy future. Nuclear fusion as an energy source is decades away from being little more than a science fiction gimmick. Scientists say we have less than a decade to achieve the changes that are necessary to avoid climate catastrophe. This technology won't arrive in time, if ever, and the money and resources would be better invested in real-life solutions we already have.

- Although fusion reactions do not release CO2, every aspect of the fuel cycle, from breeding tritium fuel with fission reactors at \$30,000 per gram, to building the \$30 billion football field sized reactor buildings, to decommissioning what will end up to be a highly radioactive building, produces tremendous amounts of greenhouse gases. Nuclear power, be it fission or fusion, is **NOT** a zero-emission power source and has **NO PLACE** in Hawaii's clean energy future.

- Nuclear fusion is not safe or clean. Fusion reactors produce radioactive waste, including tritium, a very dangerous, hard to contain air and water contaminant. Hawaii is already facing severe droughts and water contamination from the military. Why would we want to invest in something that risks more contamination to our water and ecosystem?

Please come to your senses and vote against this ill conceived idea, that if moved forward can only end in a very bad result.

Please vote against HB927, because nothing good can come from supporting it.

Mahalo for your kind attention,

Dave Mulinix, Cofounder & Hawaii State Organizer

Our Revolution Hawaii





To: The House Committee on Energy and Environmental Protection  
From: Sherry Pollack, 350Hawaii.org  
Date: Tuesday, February 14, 2023, 9:10am

**In strong opposition to HB927**

Aloha Chair Lowen, Vice Chair Cochran, and Energy and Environmental Protection Committee members,

I am Co-Founder of the Hawaii chapter of 350.org, the largest international organization dedicated to fighting climate change. 350Hawaii.org **opposes HB927** that would establish within the Hawaii State Energy Office the future fusion task force to promote the use of fusion as an energy source in the State.

There was a lot of buzz recently in the media about the nuclear fusion ‘breakthrough,’ but the hype is misleading and is serving as a distraction that is syphoning taxpayer dollars from real climate solutions. There is nothing “clean,” “safe,” or “efficient” about this technology. Nuclear fusion is dirty, dangerous, and expensive.

Nuclear fusion as an energy source is decades away from being little more than a science fiction gimmick, and as such, is a harmful distraction from Hawaii’s goal to achieve a clean energy future. Scientists say we have less than a decade to achieve the changes that are necessary to avoid climate catastrophe. This technology won’t arrive in time, if ever, and the money and resources would be better invested in real-life solutions we already have.

Although fusion reactions do not release CO<sub>2</sub>, every aspect of the fuel cycle, from breeding tritium fuel with fission reactors at \$30,000 per gram, to building the \$30 billion football field sized reactor buildings, to decommissioning what will end up to be a highly radioactive building, produces tremendous amounts of greenhouse gases. Nuclear power, be it fission or fusion, is not a zero-emission power source and has no place in Hawaii’s clean energy future.

Moreover, nuclear fusion is not safe or clean. Fusion reactors produce radioactive waste, including tritium, a very dangerous, hard to contain air and water contaminant. Hawaii is already facing severe droughts and water contamination from the military. Why would we want to invest in something that risks more contamination to our water and ecosystem?

**Please don’t buy the hype. Nuclear fusion is a dangerous delusion.** HB927 would undermine our progress towards 100% truly clean, renewable energy and take us in the wrong direction.

Mahalo for the opportunity to testify.

Sherry Pollack  
Co-Founder, 350Hawaii.org

**HB-927**

Submitted on: 2/3/2023 6:18:00 PM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>            |
|---------------------|---------------------|---------------------------|---------------------------|
| Caroline Azelski    | Individual          | Support                   | Written Testimony<br>Only |

Comments:

Support. Thank you.

**HB-927**

Submitted on: 2/3/2023 7:49:34 PM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>            |
|---------------------|---------------------|---------------------------|---------------------------|
| Andrew Crossland    | Individual          | Oppose                    | Written Testimony<br>Only |

Comments:

I oppose this Bill.

Members of the Committee:

My name is Brian Barbata, and I'm opposed to this senseless bill to establish a fusion task force. HB927 is one of those bills that has no real purpose or need, and will end up simply expanding the State Energy Office's budget to absolutely no effect. It also contains misstatements of facts.

The first misstatement is that the Hawaii Constitution needs to be amended. Article XI, Section 8 of the Hawaii Constitution provides the following:

"No nuclear **fission** power plant shall be constructed or radioactive material disposed of in the State without the prior approval by a two-thirds vote in each house of the legislature."

Clearly, there is no prohibition in the Constitution against a **fusion** reactor.

The second misstatement is that fusion is at a point where Hawaii needs to track it as a viable renewable source of electricity. Are we worried about being left behind? Every commentator, including Lawrence Livermore Lab, has said it is nowhere close.

The third misstatement is that the ignition project created more energy than it consumed. If you read the detail of the announcement, it disclosed that the positive energy balance did **not** include the energy input to the lasers, which was some 300 times greater than the energy actually produced. That electricity was provided by California's fossil fuel plants.

While this experiment has, after decades, finally demonstrated the scientific theory of artificial fusion, it is not even a small step closer to commercial feasibility. From Livermore, you will find not find a projection of feasibility, the steps that must be taken to get there, or whether there might ever be commercial use of fusion. Let's not get carried away by this science project. If it ever amounts to anything useful, it will be very apparent, and Hawaii, if it's not underwater by then, can solicit proposals.

**FURTHERMORE**, basic science like this deflects our attention from upcoming reality and provides a way to ignore future renewable power dependability. Why should we have a task force to follow the hoped for development of fusion, when we don't even have a plan to back up our solar power in 2045 when it rains? It's not going to come from fusion, that's for certain.

Mahalo for your common sense in defeating this measure.

**HB-927**

Submitted on: 2/4/2023 10:10:36 AM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>         |
|---------------------|---------------------|---------------------------|------------------------|
| Douglas Perrine     | Individual          | Oppose                    | Written Testimony Only |

Comments:

HB927 is a good way to waste the taxpayers' money. Practical fusion reactors are still decades away, and research towards that goal is already funded by private & federal sources. This bill is premised on misleading press releases claiming a recent fusion experiment produced more energy than the lasers igniting the fusion. This claim ignores the fact that the energy required to power those lasers was 100X more than the amount of energy produced. It would be a lot more sensible for Hawaii to look into modular fission reactors which have recently been approved by the federal government, but even that is a waste of time & money considering Hawaii's abundant solar, geothermal, wind, wave energy, and ocean thermal resources.

**HB-927**

Submitted on: 2/5/2023 11:02:12 AM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>            |
|---------------------|---------------------|---------------------------|---------------------------|
| Ted Bohlen          | Individual          | Oppose                    | Written Testimony<br>Only |

Comments:

I OPPOSE this bill!

Fusion is still far in the future as an energy solution. There will be worldwide study and efforts. Let's put our resources in Hawaii toward more realistic solutions.

**HB-927**

Submitted on: 2/5/2023 7:13:19 PM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>            |
|---------------------|---------------------|---------------------------|---------------------------|
| Keith Neal          | Individual          | Oppose                    | Written Testimony<br>Only |

Comments:

Strongly opposed.

Is it highly premature to task a state agency to develop or commercialize a technology that is still in it's infancy.

Fusion development must be left to national labs with resources to develop the basic science and engineering.

**HB-927**

Submitted on: 2/5/2023 8:15:33 PM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>            |
|---------------------|---------------------|---------------------------|---------------------------|
| tlaloc tokuda       | Individual          | Oppose                    | Written Testimony<br>Only |

Comments:

Aloha EEP Chair, Vice Chair & Committee.

Who introduced this bill, was it fist full of silver dollars Dela Cruz? nuclear fusion can't compete with PV + storege or wind generation! Nuclear fusion is the pipe dream...please read

<https://www.resilience.org/stories/2023-01-03/nuclear-fusion-dont-believe-the-hype/>

Mahalo and delete this bill!

tlaloc tokuda

Kailua Kona, HI 96740



**HB-927**

Submitted on: 2/6/2023 9:33:24 AM

Testimony for EEP on 2/14/2023 9:10:00 AM

| Submitted By         | Organization | Testifier Position | Testify                |
|----------------------|--------------|--------------------|------------------------|
| Anne ('Antu') Harvey | Individual   | Oppose             | Written Testimony Only |

Comments:

Aloha Committee Members,

This Bill proposes a TERRIBLE, highly premature expenditure of even 1 iota of State resources (including valuable legislative time).

We don't want to get left behind any emerging technology. But, fusion is so far from 'emerging' that any analysis will be hard pressed to even find data to lead to useful findings. And any recommendations will be worthless out of date by the time this technology does get off the ground. And our exploited 'Āina shouldn't become a 'bleeding edge' testbed anyway.

(To me this seems like forming a task force to pursue electric vehicles...if this was 1832, or even 1884 when the first ones actually would run. It took a 'few' years more before it took off. Any efforts made at the beginning would not have resulted in any direct value returns.)

Thank you for keeping an eye on new technologies, but please focus now on closer at hand alternative energy solutions that can provide sooner relief of 'āina degradation and our communities' needs. Do not be distracted by 'shiny pennies'.

Mahalo for your time and consideration,

Anne ('Antu') Harvey  
96725

**HB-927**

Submitted on: 2/9/2023 12:18:49 PM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>            |
|---------------------|---------------------|---------------------------|---------------------------|
| Michael S. Nakasone | Individual          | Support                   | Written Testimony<br>Only |

Comments:

I support nuclear energy for Hawaii.

## HB927: Don't Buy the Hype: Fusion is a Dangerous Delusion

By Lynda Williams

A bipartisan group of Hawaii legislators have submitted bill HB927 to create a task force to 'determine the feasibility of amending the Hawaii State Constitution to include provisions to allow for fusion-powered reactors.' Everything in this Bill is wrong or a lie and it must be stopped in committee. Let me break it down line by line.

***The legislature finds that in December 2022, the Lawrence Livermore National Laboratory announced that it had achieved fusion ignition, producing more energy from fusion than the laser energy used to initiate the ignition.***

There was a lot of media hoopla about this 'breakthrough' but it is misleading propaganda. The nuclear fusion reaction lasted less than a billionth of a second and it took much more energy to make the laser beam and the tritium fuel source than was released. The term 'ignition' doesn't mean efficient or self-sustaining – it's a milestone word invented by the Fusion industry who have been in a failed business for over 70 years and have sucked nearly 50 billion dollars from US taxpayers to try to reproduce on Earth fusion that makes the Sun and stars shine. "Achieving ignition" is pure engineering hype and the Hawaii State Legislature should not be perpetuating such pseudoscience & misinformation.

***The legislature recognizes that once fully realized as a source of power, fusion could allow the State to more efficiently meet the State's net-zero emission goals.***

Being decades if not centuries away from being practical, efficient, and affordable, Nuclear Fusion Power cannot address the urgent clean energy needs of the world in time to mitigate the catastrophic consequences of Climate Change. Although fusion reactions do not release CO<sub>2</sub>, every aspect of the fuel cycle, from breeding tritium fuel with fission reactors at \$30,000 per gram, to building the \$30 billion football field sized reactor buildings, to decommissioning what will end up to be a highly radioactive building, produces tremendous amounts of greenhouse gases. Nuclear power, be it fission or fusion, is not a zero-emission power source. The Hawaii Legislature should not 'recognize' what are in fact, absolute lies.

***The legislature notes that, unlike fission reactors, fusion reactors produce shorter-lived radioactive byproducts and are a safer and cleaner alternative to nuclear-powered fission reactors.***

This is the biggest lie in the bill that no informed person should sign on to. As stated above, the fuel source for fusion reactions is the rare and short-lived radioactive isotope of hydrogen, tritium, which must be created or 'bred' in a fission reactor. You cannot have fusion on Earth without fission to breed tritium. Tritium behaves chemically like atomic hydrogen and bonds with oxygen to form radioactive "tritiated water" or 'heavy water' and then decays to regular hydrogen by very dangerous beta emission so that if ingested it is carcinogenic. Released or leaked into the environment tritiated water is very dangerous because biologically behaves like regular water. Short lived radioactive are MORE dangerous because they are more active and decay more often! The fusion reaction also releases neutrons which make everything they come into contact highly radioactive. If you put uranium inside the reactor building it will create plutonium, the main ingredient in nuclear bombs and the deadliest substance ever created by humans. Fusion reactors therefore have a very high risk of nuclear weapons proliferation and

must be guarded by the US military. Because of this security risk, fusion power will never be distributed and democratized and must be operated by militarized corporate state control. There is nothing safe and clean about nuclear fusion or fission. Again, the Hawaii Legislature should not 'note' such dangerous lies.

***Accordingly, the purpose of this Act is to establish a future fusion task force to:***

***(1) Determine the feasibility of amending the Hawaii State Constitution to include provisions to allow for fusion-powered reactors;***

Why amend the Hawaii State Constitution? Because during the 1978 Constitutional Convention a provision prohibiting fission power or radioactive waste disposal in Hawaii was added to the constitution. Fusion power produces radioactive waste. The reactor and housing will become radioactive and would most likely have to remain & stored on site effectively forever.

***(2) Evaluate potential sites that may be reserved for fusion reactors; and***

***(3) Identify ways for the State to accelerate the progress of fusion development.***

We should not waste a penny or an ounce of human energy establishing a 'future fusion task force' to evaluate potential sites or accelerate the progress of fusion technology when Nuclear Fusion Power is a dirty dangerous militarized expensive and unviable power source that cannot solve our energy needs or mitigate the climate crisis and is illegal in the state of Hawaii.

The Hawaii Legislature Energy & Environmental Protection (EPP) committee will hear testimony on February 14<sup>th</sup> at 9:10 am. Testimony can be submitted here by :

[https://www.capitol.hawaii.gov/session/measure\\_indiv.aspx?billtype=HB&billnumber=927](https://www.capitol.hawaii.gov/session/measure_indiv.aspx?billtype=HB&billnumber=927)

More info on Fusion: <https://thebulletin.org/2017/04/fusion-reactors-not-what-theyre-cracked-up-to-be>

Lynda Williams is a physicist and peace activist in Hilo Hawaii.



**HB-927**

Submitted on: 2/10/2023 6:45:13 AM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>            |
|---------------------|---------------------|---------------------------|---------------------------|
| Shannon Rudolph     | Individual          | Oppose                    | Written Testimony<br>Only |

Comments:

Oppose

A 'task force to promote' is already biased.

**HB-927**

Submitted on: 2/10/2023 10:22:54 AM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>            |
|---------------------|---------------------|---------------------------|---------------------------|
| Nanea Lo            | Individual          | Oppose                    | Written Testimony<br>Only |

Comments:

Hello,

My name is Nanea Lo. I'm born and raised in the Hawaiian Kingdom a Kanaka Maoli.

I'm writing in STRONG OPPOSITION to HB927.

me ke aloha 'āina,  
Nanea Lo, Mō'ili'ili

**HB-927**

Submitted on: 2/11/2023 5:34:35 AM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>            |
|---------------------|---------------------|---------------------------|---------------------------|
| Keoni Pikini        | Individual          | Support                   | Written Testimony<br>Only |

Comments:

I fully support nuclear fusion technology, clean condensed energy! 10000x better then unreliable wind and solar!

**HB-927**

Submitted on: 2/11/2023 9:23:01 PM

Testimony for EEP on 2/14/2023 9:10:00 AM

| Submitted By     | Organization | Testifier Position | Testify                |
|------------------|--------------|--------------------|------------------------|
| Elizabeth Hansen | Individual   | Oppose             | Written Testimony Only |

Comments:

Aloha, Please oppose this bill!

I am in **strong opposition to HB927**, a measure full of dangerous misconceptions, and is a harmful distraction from Hawaii's goal to achieve a clean energy future. Nuclear fusion as an energy source is decades away from being little more than a science fiction gimmick. Scientists say we have less than a decade to achieve the changes that are necessary to avoid climate catastrophe. This technology won't arrive in time, if ever, and the money and resources would be better invested in real-life solutions we already have.

- Although fusion reactions do not release CO2, every aspect of the fuel cycle, from breeding tritium fuel with fission reactors at \$30,000 per gram, to building the \$30 billion football field sized reactor buildings, to decommissioning what will end up to be a highly radioactive building, produces tremendous amounts of greenhouse gases. Nuclear power, be it fission or fusion, is NOT a zero-emission power source and has NO PLACE in Hawaii's clean energy future.

-Nuclear fusion is not safe or clean. Fusion reactors produce radioactive waste, including tritium, a very dangerous, hard to contain air and water contaminant. Hawaii is already facing severe droughts and water contamination from the military. Why would we want to invest in something that risks more contamination to our water and ecosystem?

Please OPPOSE this bill.

Mahalo,

Elizabeth Hansen

Hakalau HI 96710



**HB-927**

Submitted on: 2/11/2023 9:34:39 PM

Testimony for EEP on 2/14/2023 9:10:00 AM

| Submitted By  | Organization | Testifier Position | Testify                |
|---------------|--------------|--------------------|------------------------|
| Rodger Hansen | Individual   | Oppose             | Written Testimony Only |

Comments:

Aloha, please oppose this bill.

I am in **strong opposition to HB927**, a measure full of dangerous misconceptions, and is a harmful distraction from Hawaii's goal to achieve a clean energy future. Nuclear fusion as an energy source is decades away from being little more than a science fiction gimmick. Scientists say we have less than a decade to achieve the changes that are necessary to avoid climate catastrophe. This technology won't arrive in time, if ever, and the money and resources would be better invested in real-life solutions we already have.

- Although fusion reactions do not release CO2, every aspect of the fuel cycle, from breeding tritium fuel with fission reactors at \$30,000 per gram, to building the \$30 billion football field sized reactor buildings, to decommissioning what will end up to be a highly radioactive building, produces tremendous amounts of greenhouse gases. Nuclear power, be it fission or fusion, is NOT a zero-emission power source and has NO PLACE in Hawaii's clean energy future.

-Nuclear fusion is not safe or clean. Fusion reactors produce radioactive waste, including tritium, a very dangerous, hard to contain air and water contaminant. Hawaii is already facing severe droughts and water contamination from the military. Why would we want to invest in something that risks more contamination to our water and ecosystem?

Please OPPOSE this bill.

Mahalo,

Rodger Hansen

Hakalau HI 96710

**HB-927**

Submitted on: 2/12/2023 1:26:14 AM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>            |
|---------------------|---------------------|---------------------------|---------------------------|
| Kaia Dunford        | Individual          | Oppose                    | Written Testimony<br>Only |

Comments:

Nuclear fusion is NOT a safe, healthy, or cost efficient energy source for Hawaii. The greenhouse gas emissions and radioactive waste pose a serious threat to our environment, particularly the concern of water and air contamination. Nuclear fusion is hazardous and with falsely hyped up benefits, and is a harm, not a contribution, to Hawaii's green energy goals and progress.

**HB-927**

Submitted on: 2/12/2023 6:27:09 AM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>            |
|---------------------|---------------------|---------------------------|---------------------------|
| Patricia Blair      | Individual          | Oppose                    | Written Testimony<br>Only |

Comments:

A dangerous idea that must be snuffed now!

**HB-927**

Submitted on: 2/12/2023 6:56:50 AM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>            |
|---------------------|---------------------|---------------------------|---------------------------|
| John NAYLOR         | Individual          | Oppose                    | Written Testimony<br>Only |

Comments:

Aloha,

No Nukes in Hawaii Nei !

Mahalo,

JN Makawao

**HB-927**

Submitted on: 2/12/2023 8:24:03 AM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>            |
|---------------------|---------------------|---------------------------|---------------------------|
| pamela burrell      | Individual          | Oppose                    | Written Testimony<br>Only |

Comments:

Aloha House members,

We don't have the time or money to waste on this technology!

Nuclear power, be it fission or fusion, is NOT a zero-emission power source and has NO PLACE in Hawaii's clean energy future.

Thankyou for your time,

pamela burrell, Kalihiwai, Kaua'i

**HB-927**

Submitted on: 2/12/2023 9:17:38 AM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>       |
|---------------------|---------------------|---------------------------|----------------------|
| Greg Misakian       | Individual          | Support                   | Remotely Via<br>Zoom |

Comments:

**Testimony in Support of HB927**

Submitted on 2/12/23

I strongly support HB927. This Bill provides a proactive path to help Hawaii meet its energy goals and make electricity more affordable.

Greg Misakian

2nd Vice President, Kokua  
Council

**HB-927**

Submitted on: 2/12/2023 10:24:00 AM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>         |
|---------------------|---------------------|---------------------------|------------------------|
| Severine Busquet    | Individual          | Oppose                    | Written Testimony Only |

Comments:

Aloha Chair, Vice Chair, and members,

I am in **strong opposition to HB927**, a measure full of dangerous misconceptions, and is a harmful distraction from Hawaii's goal to achieve a clean energy future. Nuclear fusion as an energy source is decades away from being little more than a science fiction gimmick. Scientists say we have less than a decade to achieve the changes that are necessary to avoid climate catastrophe. This technology won't arrive in time, if ever, and the money and resources would be better invested in real-life solutions we already have.

Thank you for the opportunity to submit testimony in opposition to HB927.

Severine Busquet  
Honolulu, 96825

**HB-927**

Submitted on: 2/12/2023 10:25:05 AM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>            |
|---------------------|---------------------|---------------------------|---------------------------|
| Melissa Barker      | Individual          | Oppose                    | Written Testimony<br>Only |

Comments:

Honorable Member,

I respectfully and strongly urge you to oppose HB927 establishing a task force to promote the use of fusion as energy in Hawaii.

Thank you for your attention and consideration.

Melissa Barker

Kapaa, HI



**HB-927**

Submitted on: 2/12/2023 12:53:33 PM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>            |
|---------------------|---------------------|---------------------------|---------------------------|
| Catherine Young     | Individual          | Oppose                    | Written Testimony<br>Only |

Comments:

As stated by Physics Teacher Lynda Lovon: "We should not waste a penny or an ounce of human energy establishing a 'future fusion task force' to evaluate potential sites or accelerate the progress of fusion technology when Nuclear Fusion Power is a dirty dangerous militarized expensive and unviable power source that cannot solve our energy needs or mitigate the climate crisis and is currently illegal in the state of Hawaii.

Thank you for keeping Hawaii safe.

**HB-927**

Submitted on: 2/12/2023 2:02:41 PM

Testimony for EEP on 2/14/2023 9:10:00 AM

| Submitted By   | Organization | Testifier Position | Testify                |
|----------------|--------------|--------------------|------------------------|
| Mary Lu Kelley | Individual   | Oppose             | Written Testimony Only |

Comments:

Aloha,

I am writing to you about a very important issue. I am in **strong opposition to HB927**, a measure full of dangerous misconceptions, and is a harmful distraction from Hawaii's goal to achieve a clean energy future. Nuclear fusion as an energy source is decades away from being little more than a science fiction gimmick. Scientists say we have less than a decade to achieve the changes that are necessary to avoid climate catastrophe. This technology won't arrive in time, if ever, and the money and resources would be better invested in real-life solutions we already have.

You must know that although fusion reactions do not release CO2, every aspect of the fuel cycle, from breeding tritium fuel with fission reactors at \$30,000 per gram, to building the \$30 billion football field sized reactor buildings, to decommissioning what will end up to be a highly radioactive building, produces tremendous amounts of greenhouse gases. Nuclear power, be it fission or fusion, is NOT a zero-emission power source and has NO PLACE in Hawaii's clean energy future.

I believe that nuclear fusion is not safe nor clean. Fusion reactors produce radioactive waste, including tritium, a very dangerous, hard to contain air and water contaminant. Hawaii is already facing severe droughts and water contamination from the military. Why would we want to invest in something that risks more contamination to our water and ecosystem?

**Hawaii does not want NUCLEAR FUSION. NUCLEAR FUSION IS A DANGEROUS DELUSION.**

**Mary Lu Kelley**

**Lawai, HI 96765**



**HB-927**

Submitted on: 2/12/2023 3:56:53 PM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>            |
|---------------------|---------------------|---------------------------|---------------------------|
| Mary Marvin Porter  | Individual          | Oppose                    | Written Testimony<br>Only |

Comments:

Aloha House Members considering HB927

I am opposed to HB927.

Recently the newspapers had articles sounding like great strides had been made in development of Fusion power. Unfortunately these articles were misleading and false as to how soon actually available and to it being a reasonable option cost or safety wise. At this time, it is a waste of time and money for the Hawaii legislature to spend either on this idea.

Please vote against HB927

Mahalo,

Mary Marvin Porter

Island Eyes Video Journalism

Kea'au Hawai'i, 96749

808-982-9100

**HB-927**

Submitted on: 2/12/2023 4:10:34 PM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>            |
|---------------------|---------------------|---------------------------|---------------------------|
| Lauren Blickley     | Individual          | Oppose                    | Written Testimony<br>Only |

Comments:

I am in **strong opposition to HB927**, a measure full of dangerous misconceptions, and is a harmful distraction from Hawaii's goal to achieve a clean energy future.

Nuclear fusion is not safe or clean. Fusion reactors produce radioactive waste, including tritium, a very dangerous, hard to contain air and water contaminant. Hawaii is already facing severe droughts and water contamination from the military. Why would we want to invest in something that risks more contamination to our water and ecosystem?

Nuclear fusion as an energy source is decades away from being little more than a science fiction gimmick. Scientists say we have less than a decade to achieve the changes that are necessary to avoid climate catastrophe. This technology won't arrive in time, if ever, and the money and resources would be better invested in real-life solutions we already have.

**HB-927**

Submitted on: 2/12/2023 4:52:05 PM

Testimony for EEP on 2/14/2023 9:10:00 AM

| Submitted By   | Organization | Testifier Position | Testify                   |
|----------------|--------------|--------------------|---------------------------|
| P Noel Bobilin | Individual   | Oppose             | Written Testimony<br>Only |

Comments:

- I am in **strong opposition to HB927**, a measure full of dangerous misconceptions, and is a harmful distraction from Hawaii's goal to achieve a clean energy future. Nuclear fusion as an energy source is decades away from being little more than a science fiction gimmick. Scientists say we have less than a decade to achieve the changes that are necessary to avoid climate catastrophe. This technology won't arrive in time, if ever, and the money and resources would be better invested in real-life solutions we already have.

- Although fusion reactions do not release CO2, every aspect of the fuel cycle, from breeding tritium fuel with fission reactors at \$30,000 per gram, to building the \$30 billion football field sized reactor buildings, to decommissioning what will end up to be a highly radioactive building, produces tremendous amounts of greenhouse gases. Nuclear power, be it fission or fusion, is NOT a zero-emission power source and has NO PLACE in Hawaii's clean energy future.

-Nuclear fusion is not safe or clean. Fusion reactors produce radioactive waste, including tritium, a very dangerous, hard to contain air and water contaminant. Hawaii is already facing severe droughts and water contamination from the military. Why would we want to invest in something that risks more contamination to our water and ecosystem?

**HB-927**

Submitted on: 2/12/2023 10:51:36 PM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>            |
|---------------------|---------------------|---------------------------|---------------------------|
| Cory Harden         | Individual          | Oppose                    | Written Testimony<br>Only |

Comments:

Aloha legislators,

Please strongly oppose this bill! Fusion has many drawbacks, including generation of radioactive waste that nobody wants to deal with.

mahalo, Cory Harden

**HB-927**

Submitted on: 2/13/2023 12:15:09 AM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>            |
|---------------------|---------------------|---------------------------|---------------------------|
| Katherine Fryer     | Individual          | Oppose                    | Written Testimony<br>Only |

Comments:

I am strongly opposed to HB927, which underestimates the dangers of nuclear fission power, and diverts time and resources away from investing in cleaner energy sources.

Nuclear fusion is not safe for human health or our environment. It produces tritium, a radioactive isotope that contaminates air and water and is very hard to contain. We are already facing water shortages due to jet fuel leaks and worsening droughts, and we cannot afford radioactive pollution.

Climatologists say we have less than 10 years to reduce greenhouse gas emissions and avoid climate breakdown. Nuclear fusion power not economically viable yet, there is no guarantee that it ever will be, and state funds would be better spent on cleaner, cheaper alternatives such as wind and solar power. We need to act on climate change *now*, not later.

Thank you for your consideration.



**HB-927**

Submitted on: 2/13/2023 3:34:07 AM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>            |
|---------------------|---------------------|---------------------------|---------------------------|
| Joan Gannon         | Individual          | Oppose                    | Written Testimony<br>Only |

Comments:

Aloha Joan Gannon from South Kona asking you to strongly oppose HB927. This plan of fusion is not yet usable if it ever will be. It produces radioactive waste which is not good for humans and has to be stored forever. It would cost the state millions if not billions of dollars and then might not work. I say NO oppose this bill.

thank you for your service. Joan

**HB-927**

Submitted on: 2/13/2023 5:51:45 AM

Testimony for EEP on 2/14/2023 9:10:00 AM

| Submitted By       | Organization | Testifier Position | Testify                   |
|--------------------|--------------|--------------------|---------------------------|
| Daniela Escontrela | Individual   | Oppose             | Written Testimony<br>Only |

Comments:

I am in **strong opposition to HB927**, a measure full of dangerous misconceptions, and is a harmful distraction from Hawaii's goal to achieve a clean energy future. Nuclear fusion as an energy source is decades away from being little more than a science fiction gimmick. Scientists say we have less than a decade to achieve the changes that are necessary to avoid climate catastrophe. This technology won't arrive in time, if ever, and the money and resources would be better invested in real-life solutions we already have.

**HB-927**

Submitted on: 2/13/2023 7:27:14 AM

Testimony for EEP on 2/14/2023 9:10:00 AM

| Submitted By     | Organization | Testifier Position | Testify                |
|------------------|--------------|--------------------|------------------------|
| Michele Nihipali | Individual   | Oppose             | Written Testimony Only |

Comments:

I am in **strong opposition to HB927**, a measure full of dangerous misconceptions, and is a harmful distraction from Hawaii's goal to achieve a clean energy future. Nuclear fusion as an energy source is decades away from being little more than a science fiction gimmick. Scientists say we have less than a decade to achieve the changes that are necessary to avoid climate catastrophe. This technology won't arrive in time, if ever, and the money and resources would be better invested in real-life solutions we already have.

Although fusion reactions do not release CO2, every aspect of the fuel cycle, from breeding tritium fuel with fission reactors at \$30,000 per gram, to building the \$30 billion football field sized reactor buildings, to decommissioning what will end up to be a highly radioactive building, produces tremendous amounts of greenhouse gases. Nuclear power, be it fission or fusion, is NOT a zero-emission power source and has NO PLACE in Hawaii's clean energy future.

-Nuclear fusion is not safe or clean. Fusion reactors produce radioactive waste, including tritium, a very dangerous, hard to contain air and water contaminant. Hawaii is already facing severe droughts and water contamination from the military. Why would we want to invest in something that risks more contamination to our water and ecosystem?

The people of Hawaii know that the state does not have the capability to safely oversee anything of this magnitude and potential danger. Don't buy into the "hype" that is the answer for Hawaii's energy independence.

**Oppose HB 927**

Thank you for your consideration,

Michele Nihipali

54-074 A Kam Hwy.

Hauula, HI 96717

2/12/2023

To: State of Hawaii House of Representatives  
State Capital Building

From: Retired Hawaii County Councilmember Bob Jacobson  
PO Box 900  
Kurtistown, HI 96760  
Phone 808-966-8831 email: [jacobson.puna@gmail.com](mailto:jacobson.puna@gmail.com)

Topic: Opposition to HB927

Esteemed Chair and Members of the Hawaii House of Representatives,

I am writing in opposition to HB927, that allows nuclear fusion in this state. This is not a proven technology that carries a great potential for harm. Time and time again, snake oil salesmen approach our state to victimize us and the environment. Witness the push for irradiation of fruits and vegetables energy officials and profiteers hoped to push onto the land and people of Hawaii. They tried to bring Cobalt 60 (a favorite method of mass death and terror when constructed into a "dirty" bomb) or Cesium 90 to irradiate our foods. Luckily, the people of our island stopped this boondoggle before these deadly substances were brought here. Many millions of dollars were expended to promote this toxic plan. Nowadays responsible scientists ridicule the idea of such substances being used for this purpose. The snake oil salesmen promised safety and prosperity when all they could deliver was sickness and death. Even when the supposed safe electron beam plant was opened operators swore everything would be safely shielded and totally safe. After a few years of operation it was revealed that the irradiation facility in Kea`au had missing or inadequate shielding that exposed a nearby resident to excessive exposure to radiation. The papaya industry collapsed because Japanese consumers were not interested in buying our papayas once they were irradiated.

Now we are expected to approve the introduction of fusion energy to Hawaii. Few successes have been encountered in the long search for mastering fusion energy. By allowing fusion here with little or no understanding of the processes' safety or costs, we will be allowing our state to be used as a test plantation with the residents bearing both the physical risks and the dangers of corrupt promoters to soiling our environment. There is not widespread agreement over the safety, much less the practicality of fusion-

produced energy. Breaking atomic bonds does release large amounts of energy but the side effects of fusion are not documented, understood or currently measured. Until more research is done and the process is proven to be practical, do not amend our laws to allow this nuclear research to be carried out or approved in this state. Because at this point, let's face it, this is just dangerous experimentation. Our constitution admonishes our leaders to take care of the health and welfare of the people of the state of Hawaii. I accepted that charge after I was elected, you should too. Approving the introduction of fusion energy programs and research in Hawaii without adequate understanding of the risks and costs, while some scientists themselves speak of fusion as potentially world ending, does not protect the health and welfare of Hawaii's land or peoples.

Vote down HB 927.

Sincerely,

Bob Jacobson, RN and retired Hawaii County Councilmember

## Opposition to HB927

Ann Pitcaithley, Wailuku

Researchers' claims that nuclear fusion is safe and clean, and sustainable is incorrect. According to the Bulletin of Atomic Scientists, the (ITER) International Thermonuclear Experimental Reactor, a multinational international nuclear fusion research and engineering megaproject, these claims regarding Nuclear Fission technology is misguided.

**Fossil fuel consumption to build a fusion plant.** It would take an estimated 25- 30 years for commercial use to power an electrical grid for a city. The energy to produce these power plants has been largely provided by fossil fuels, leaving an unfathomably large "carbon footprint" for site preparation and construction of all the supporting facilities, as well as the reactor itself over the 8 years it would take to build this.

The most reactive fusion fuel is a 50/50 mixture of the hydrogen isotopes deuterium and tritium; this fuel (often written as "D-T") has a fusion neutron output 100 times that of deuterium alone, resulting in a spectacular increase in radiation consequences.

**Deuterium.** Deuterium is abundant in ordinary water, but there is no natural supply of tritium, a radioactive nuclide with a half-life of only 12.3 years. The ITER website states that the tritium fuel will be "taken from the global tritium inventory." That inventory consists of tritium extracted from the heavy water of CANDU nuclear reactors, located mainly in Ontario, Canada, and secondarily in South Korea, with a potential future source from Romania. Today's "global inventory" is approximately 25 kilograms, and increases by only about one-half kilogram per year, notes Muyi Ni and his co-authors in their 2013 journal article, "Tritium Supply Assessment for ITER," in *Fusion Engineering and Design*. The inventory is expected to peak before 2030.

**Tritium.** Tritium is somewhat radioactive, so there are safety concerns connected with its potential release to the environment. Also, there is unavoidable production of radioactive materials as D-T fusion neutrons bombard the reactor vessel, requiring enhanced shielding that greatly impedes access for maintenance and introducing radioactive waste disposal issues.

In 65 years of research involving hundreds of facilities, only two magnetic confinement systems have ever used tritium: the Tokamak Fusion Test Reactor, at the Princeton Plasma Physics Lab, and the Joint European Tokamak (JET) at Culham, UK, way back in the 1990s.

ITER's present plans call for the acquisition and consumption of at least 1 kilogram of tritium annually. Assuming that the ITER project can acquire an adequate supply of tritium, it is uncertain that 500 MW of fusion power actually be achieved?

**"First plasma"** at ITER is supposed to occur in 2025. That will be followed by a relatively subdued 10 years of continued machine assembly and periodic plasma operations with hydrogen and helium. These gases produce no fusion neutrons, and thereby permit the resolution of shakedown problems and optimization of plasma performance with minimal radiation hazards. Plasma instabilities must be kept at bay to ensure adequate energy confinement, so the reacting plasma can be heated and maintained at high temperature. Influxes of non-hydrogenic atoms must be curtailed.

ITER's schedule calls for deuterium and tritium use beginning in the late 2030s. But there's no guarantee of hitting the 500 MW target; generating fusion power in large quantities depends, among other things, on developing the optimal recipe of deuterium and tritium injection by frozen pellets, particle beams, gas puffing, and recycling. During the unavoidable teething stage through the early 2040s, it's likely that ITER's fusion power will be only a fraction of 500 MW, and that more injected tritium will be lost by non-recovery than burned (i.e., fused with deuterium).

Analyses of D-T operation in ITER indicate that only 2 percent of the injected tritium will be burned, so 98 percent of the injected tritium will exit the reacting plasma unscathed. While a high proportion simply flows out with the plasma exhaust, much tritium must be continually scavenged from the surfaces of the reaction vessel, beam injectors, pumping ducts, and other appendages for processing and re-use. During their several dozen traverses of the Tritium Trail of Tears around the plasma, vacuum, reprocessing and fueling systems, some tritium atoms will be permanently trapped in the vessel wall and in-vessel components, and in plasma diagnostic and heating systems.

The permeation of tritium at high temperature in many materials is not understood. R. A. Causey and his co-authors explained in "[Tritium barriers and tritium diffusion in fusion reactors.](#)" The deeper migration of some small fraction of the trapped tritium into the walls and then into liquid and gaseous coolant channels will be unpreventable. Most implanted tritium will eventually decay, but there will be inevitable releases into the environment via circulating cooling water.

Designers of future tokamak reactors commonly assume that all the burned tritium will be replaced by absorbing the fusion neutrons in lithium completely surrounding the reacting plasma. Tritium is permanently lost in its globetrotting through reactor subsystems. As ITER will demonstrate, the aggregate of unrecovered tritium may rival the amount burned and can be replaced only by the costly purchase of tritium produced in fission reactors.

**Radiation and radioactive waste.** As noted earlier, ITER's anticipated 500 MW of thermal fusion power is *not* electric power. But what fusion proponents do not tell you is that this fusion power is not some benign solar-like radiation but consists primarily (80 percent) of streams of energetic neutrons whose only apparent function in ITER is to produce huge volumes of radioactive waste as they bombard the walls of the reactor vessel and its associated components.

Just 2 percent of the neutrons will be intercepted by test modules for investigating tritium production in lithium, but 98 percent of the neutron streams will simply smash into the reactor walls or into devices in port openings.

In fission reactors, at most 3 percent of the fission energy appears as neutrons. But ITER is akin to an electrical appliance that converts hundreds of megawatts of electric power into neutron streams. A peculiar feature of D-T fusion reactors is that the overwhelming preponderance of thermal energy is not produced in the reacting plasma, but rather inside the thick steel reactor vessel as the neutron streams smash into it and gradually dissipate their energy. In principle, this thermalized neutron energy could somehow be converted back to electricity at very low efficiency, but the ITER project has opted to avoid addressing this challenge. That is a task deferred to delusions called demonstration reactors that fusion proponents hope to deploy in the second half of the century.

A long-recognized drawback of fusion energy is neutron radiation damage to exposed materials, causing swelling, embrittlement, and fatigue. As it happens, the total operating time at high neutron production rates in ITER will be too small to cause even minor damage to structural integrity, but neutron interactions will still create dangerous radioactivity in all exposed reactor components, eventually producing a staggering 30,000 tons of radioactive waste.

Surrounding the ITER tokamak, a monstrous concrete cylinder 3.5 meters thick, 30 meters in diameter and 30 meters tall called the bioshield will prevent X-rays, gamma rays and stray neutrons from reaching the outside world. The reactor vessel and non-structural components both inside the vessel and beyond up to the bioshield will become highly radioactive by activation from the neutron streams. Downtimes for maintenance and repair will be prolonged because all maintenance must be performed by remote handling equipment.

For the much smaller Joint European Torus experimental project in the United Kingdom, the radioactive waste volume is estimated at 3,000 cubic meters, and the decommissioning cost will exceed \$300 million, according to the *Financial Times*. Those numbers will be dwarfed by ITER's 30,000 tons of radioactive wastes. Fortunately, most of this induced radioactivity will decay in decades, but after 100 years some 6,000 tons will still be dangerously radioactive and require disposal in a repository, says the "Waste and Decommissioning" section of ITER's *Final Design Report*.

Periodic transport and off-site disposal of radioactive components as well as the eventual decommissioning of the entire reactor facility are energy-intensive tasks that further expand the negative side of the energy accounting ledger.

**Massive water consumption.** Torrential water flows will be needed to remove heat from ITER's reactor vessel, plasma heating systems, tokamak electrical systems, cryogenic refrigerators, and magnet power supplies. Including fusion generation, the total heat load could be as high as 1,000 MW, but even with zero fusion power the reactor facility consumes up to 500 MW(e) that eventually becomes heat to be removed. ITER will demonstrate that fusion reactors would be much greater consumers of water than any other type of power generator, because of the huge parasitic power drains that turn into additional heat that needs to be dissipated on site. (By "parasitic," we mean consuming a chunk of the very power that the reactor produces.)

During fusion operations, the combined flow rate of all the cooling water will be as large as 12 cubic meters per second (180,000 gallons per minute), or more than one-third the flow rate of the Canal. That level of water flow can sustain a city of 1 million residents. (But the actual demand on the Canal's water will be only a very small fraction of that value because ITER's power pulse will be just 400 seconds long with at most 20 such pulses daily, and ITER's cooling water is recirculated.)

Even while ITER is producing nothing but neutrons, its maximum coolant flow rate will still be nearly half that of a fully functioning coal-burning or nuclear plant that generates 1,000 MW(e) of electric power. In ITER as much as 56 MW(e) of electric power will be consumed by the pumps that circulate the water through some 36 kilometers of nuclear-grade piping.



<https://thebulletin.org/2018/02/iter-is-a-showcase-for-the-drawbacks-of-fusion-energy/#:~:text=A%20long%2Drecognized%20drawback%20of,causing%20swelling%2C%20embrittlement%20and%20fatigue.>

**HB-927**

Submitted on: 2/13/2023 12:03:50 PM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>            |
|---------------------|---------------------|---------------------------|---------------------------|
| Regina Gregory      | Individual          | Oppose                    | Written Testimony<br>Only |

Comments:

This would be a waste of money.

**HB-927**

Submitted on: 2/13/2023 2:58:02 PM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>         |
|---------------------|---------------------|---------------------------|------------------------|
| Dale Jensen         | Individual          | Oppose                    | Written Testimony Only |

Comments:

Dear Committee Members:

I am a Mechanical/Ocean Engineer who has followed with great interest renewable energy technology of all types for the last 40 years. I worked in OTEC and seawater air conditioning for Makai Ocean Engineering, Inc. at Makapuu for 35 years.

I am sorry to say that fusion energy is not going to be a reality for any of us alive today. If one has followed fusion research, you will realize that even the recent highly publicized "break-through" in which more energy was created than was consumed was more of a ploy to continue funding this very expensive research than any meaningful advancement. The entire concept of harnessing the energy of the sun in some usable way here on earth with similar temperatures will greatly challenge existing metallurgy and material science. This is an important allied area of research that has barely begun, yet will determine the final practicality of fusion, even if they can improve the existing energy break-through by about 300% as is needed, to approach a practical system.

It seems like a waste of the Hawaii Legislatures' time to spend any more time debating or considering this technology. Let's find renewable technologies that have some practical application in the near term, as climate change effects are already upon us and will be ruinous to our children and grandchildren life if we do not act now.

Sincerely,

Dale Jensen

Professional Engineer

**HB-927**

Submitted on: 2/13/2023 9:46:11 PM

Testimony for EEP on 2/14/2023 9:10:00 AM

| <b>Submitted By</b> | <b>Organization</b> | <b>Testifier Position</b> | <b>Testify</b>         |
|---------------------|---------------------|---------------------------|------------------------|
| Dylan Ramos         | Individual          | Oppose                    | Written Testimony Only |

Comments:

Aloha,

As somebody who is actually interested in nuclear power, I stand with others in OPPOSITION to HB927. Frankly, it seems like a waste of time and resources. Despite encouraging advancements in the news, we are much too far from any type of feasible, scalable fusion. I understand the need to plan ahead and encourage innovation, but even if Hawaii was all in on nuclear power, planning around fusion in particular is nearly pointless at this time. Almost anything the proposed task force could come up with that may even be arguably worthwhile would certainly need to be heavily re-evaluated by the time even advanced planning was necessary. If this Legislature wishes to support fusion research this session, it should probably just issue a resolution and/or find other ways to start the conversation, starting with shifting the narrative around nuclear energy in general, let alone bringing it to Hawaii beyond submarines.

Mahalo,  
Dylan Ramos  
96816