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Response to RFI issued by Fusion Energy Sciences, Office of Science, Department of Energy
Fusion Energy Public-Private Consortium Framework
GOAL: *to help establish a world-leading and vibrant U.S. fusion industry*

Federal Register URL:
https://www.federalregister.gov/documents/2024/06/07/2024-12539/fusion-energy-public-private-consortium-framework

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- RDD&D - Research, Design, Development, Demonstration of Fusion Energy
- PPCF - public private consortium framework
- FPP - fusion pilot plant
- BDV - Bold Decadal Vision
- FES - Fusion Energy Sciences
- Milestone Program - Milestone-Based Fusion Development Program
- FIRE - Fusion Innovation Research Engine Collaboratives
- FASST - Frontiers in Artificial Intelligence for Science, Security and Technology

The broad framework articulated in the RFI Summary seems to structurally reference the recent NSF Regional Engines that have been, and are being, coordinated across the nation by the National Science Foundation.

RFI - "The proposed PPCF is envisioned to be executed by a network of regional teams that would stimulate economic development and domestic fusion supply chains anchored in fusion S&T translation and innovation."

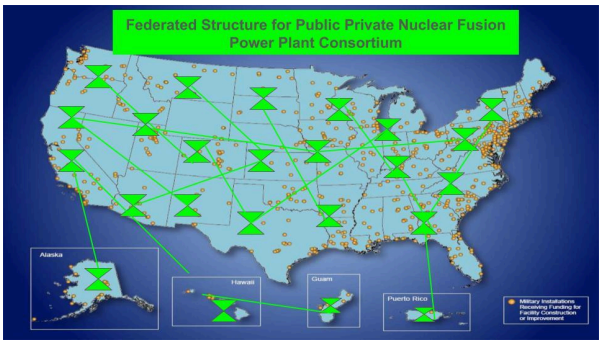
In brief, the NSF Engines: About the NSF Engines Program
The U.S. National Science Foundation's (NSF) Regional Innovation Engines (NSF Engines) program supports the development of diverse, regional coalitions to catalyze and foster innovation ecosystems across the U.S. Each NSF Engine focuses on use-inspired research and development that creates new technologies, jobs and economic opportunities for national, societal and geostrategic impact. The program was launched in May 2022 by NSF's Directorate for Technology, Innovation and Partnerships (TIP) and established in the "CHIPS and Science Act of 2022."

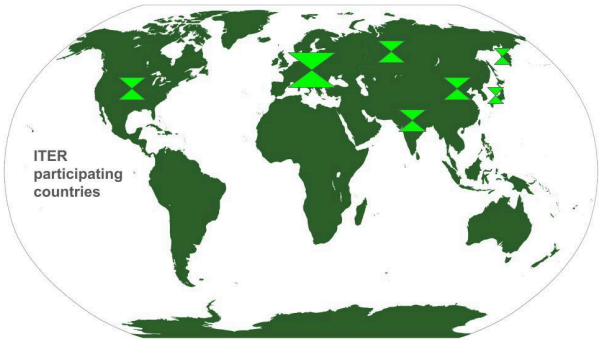
FASST - announced July 16th, 2024

> "FASST aims to enable AI-ready scientific data repositories at DOE user facilities and build AI supercomputers to create trustworthy AI models that would allow researchers to achieve technological breakthroughs in various scientific and energy applications." - DOE

Federated, Regional Approach vs. Centralized Technology Development & Disbursement

Potential Structured Approach For A PPCF (hypothetical with the Green Icons eventually representing small-medium modular nuclear fusion on-the-grid energy producing and research facilities)





ITER - European-led International Thermonuclear Experimental Reactor - Green Icons represent participating countries and the EU region

PPCF Purpose: (from RFI) *…To enable timely commercial fusion demonstration and deployment led by the private sector and to help establish a world-leading and vibrant U.S. fusion industry.*

Stated Goals from the RFI

(1) conduct applied R&D to help address and resolve common, priority S&T gaps in the technology roadmaps of private-sector-led FPPs aligned with the SC FES Fusion Science & Technology (FS&T) Roadmap, with an emphasis on pre-competitive R&D
(2) deliver and operate critical test platforms for the benefit of all consortium members
(3) stimulate the growth of supply chains that will be needed to support fusion demonstration and deployment

A. *Q.What organizational structures may work to achieve the mission, vision, and impact of the proposed PPCF?*

Noted above, the NSF's regional innovation engines offer a recent framework model. Since they are already deployed, the learnings from this for rapid and continuous improvements and adaptations could be applied as necessary to a PPCF model framework.

B. *Q.PPCF organizational structure and relationship to DOE:*

The PPCF could be an autonomous organization that acts independently from the DOE but in consultation with equally authoritative governing members formed as a council. These council members can come from the private sector, industry, academia, government, venture and philanthropic capital as well as other fusion oriented organizations (for example F4E, FIA, EUROfusion, JET, J-Fusion, etc).

Further to this, considering the recently proposed BILL 'Dept of Energy AI Act' tasking the DOE with: *(1) the Department has a leading role to play in making the most of the potential of artificial intelligence to advance the missions of the Department relating to national security, science, and energy (including critical materials) & the just announced FASST by DOE:*

A collaborative relationship between the PPCF and the DOE for purposes of information sharing for the express intention of rapid iteration could be architected. When considering the above Act as well as the just announced FASST by DOE (Frontiers in Artificial Intelligence for Science, Security and Technology), a plausible scenario is to make available and incorporate 'Frontier AI Models' that shall be developed under the direction of this Act & FASST, for the above stated intention and goals. *"AI-accelerated scientific discoveries can lead to affordable batteries for electric vehicles, breakthroughs in fusion energy,..."* - FASST

A working collaboration could facilitate accessibility to, and integration of, data sets from a wider set of inputs. These wider sets of inputs could come from PPCF member-participants as well as international inputs like ITER and other allied international facilities. This could augment and be supplementary to our domestic 17 national laboratories with its workforce of 40,000 scientists, researchers and engineers and the Dept. of Energy's network of 34 user facilities.. Making this type of compute power available in any form or capacity to members and participants of the PPCF could offer a competitive advantage for all.

C. *Q Which sources of funding are likely to be available from non-Federal sources (including State/local governments, private sector, philanthropy)?*

Our response from IoT Logistics, LLC to this broad and comprehensive question will be narrowly interpreted to focus on private and philanthropic sources. Company founder, Paige Donner's, XPrize 'FusionX' competition design was selected by XPrize for their Climate and Energy track for further refinement and development (May 2024). Discussions and project design are still in the early phase, but one of the focus areas is to integrate both private capital and publicly sourced capital such as in a 'crowdfunding' type of model to generate prize money and incentives for the participating companies and entities. Donner has extensive experience with Quadratic Funding initiatives for public goods funding. Quadratic funding is a type of crowdfunding mechanism whereby small donations from many participating donors (such as $1 to $5) are match funded using quadratic funding mathematical formulas by bigger, institutional donors. What this results in is 1) higher levels of participation in broader demographics in competitions and project funding, 2) donations become and act as 'vonations' which is voting with your donation, pragmatic for competition design that uses a down-select model to

determine finalists and a winner and 3) higher community engagement with the funding round participants and the project they represent. (For readers not yet familiar with Quadratic Funding there is much written about it HERE (Harvard).

D. *Q.Which flexibilities may be required to meet S&T goals in the areas of intellectual property, U.S. manufacturing, research security, foreign work, and partnerships, etc.?*

One of the flexibilities that will be required is in regards to the federal government's Open Science policies. Fusion energy technology offers the potential to disrupt a multi trillion dollar energy market. The companies pursuing fusion energy are well aware of this. Intellectual property ownership is the basis for capital wealth creation. If private companies are required to share, or put into a collective, their hard-won intellectual property, there will be little incentive for them to continue their RDD&D. On the other hand, what we are witnessing today in the development of Artificial Intelligence by privately held and controlled companies, offers a model that might best be avoided as much as possible for this next hugely transformational technology of fusion energy.

E. Q*. What are some public-private consortia models that could be emulated or adapted to best serve the needs of the U.S. in establishing a robust fusion power industry?*

EUROfusion offers some model learning, especially in their strong academic partnerships and engagement and their international collaborations. Mentioned above, the NSF Engines offer a recently deployed framework. ITER is, of course, a model that could offer insights into supply chain sourcing and international, intergovernmental collaborations.

F. *Q. Near-to-medium term (in the next three, five, and ten years) feasibility of a fusion energy PPCF:*

An ambitious and bold perspective could be that a fusion energy PPCF is not a matter of *if* but *when*. Accepting that it is a matter of when, then it will be a question of architecting a smooth governance framework for funding, IP ownership and sharing; Resource allocation and sharing; And equally privileging government and private industry roles in the endeavor. Congruently, if clean and super abundant energy is to be seen as a public good, giving citizens an ongoing and constant voice as stakeholders in the eventual deployment of this public good is also necessary and wise..

G. *Q. What will be the impact of the PPCF, as envisioned?*

The ultimate impact could be a prudent, pragmatic and informed governing council that marries private industry with government and its citizenry in order to provide affordable, super abundant,

clean baseload energy sources to as many people and communities on the planet as possible, as soon as possible. The participating fusion energy companies can become wealthy and profitable by doing this, but they will not exercise a monopoly over this energy source. A PPCF can be both catalytic for the maturation and deployment of this technology, and it can then evolve into a sort of governing body/council that has a (massively) broad stakeholdership.

H. Q. On which topics should a public-private consortium framework focus? Possible topics include (but are not limited to): the fusion fuel cycle, blankets, structural materials, and gyrotrons.

1. Workforce development.
2. Public engagement.
3. Supply chain
4. Other

I. Q. How can a PPCF help support supply chains, community engagement and technology adoption of fusion energy in the long term?

A PPCF can act as a coordinated body that, in addition to all the aforementioned tasks, privileges and responsibilities, can help communicate about the benefits of superabundant, affordable baseload energy for a broad population. We are still at the point where nuclear fission and nuclear fusion technologies are often confused with one another by the public at large. These early fusion energy R&D companies can innovate towards the best, cleanest and cheapest source of energy our planet has ever known, but if people don't want (or are afraid due to lack of understanding) to use it, it will make deployment that much more difficult. By having a regional focus and liaising with state and local governments, a PPCF allows for more people to become involved and be 'fusion ambassadors' at the city, community and even neighborhood levels. When considering fusion energy, it's not just technology/user adoption we are addressing, it is also lifestyle, consumer habits and how we have been conditioned to see energy as an expensive commodity rather than as a public good. A mindset shift of this magnitude in the collective psyche is a bigger undertaking than just one company can achieve. It will take a consortium that allows for, and provides for, the broadest stakeholdership.