



U.S. DEPARTMENT OF  
**ENERGY**

Office of the  
**UNDER SECRETARY  
FOR SCIENCE & INNOVATION**

## **Update on the Bold Decadal Vision (BDV) for Commercial Fusion Energy**

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Senior Advisor and Lead Fusion Coordinator

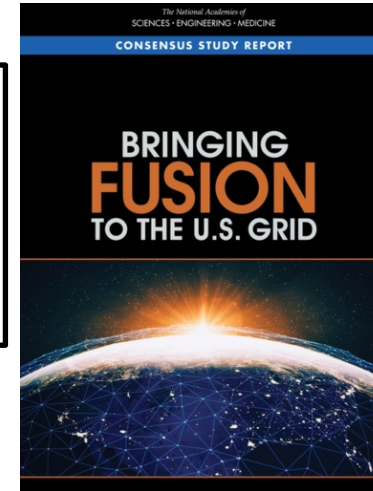
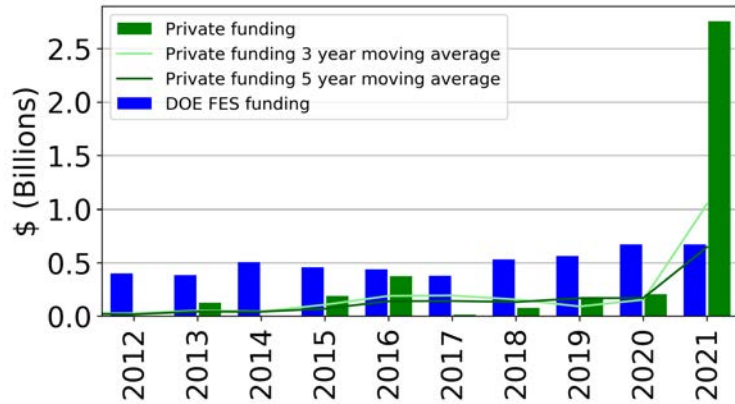
Fusion Power Associates

43<sup>rd</sup> Annual Meeting and Symposium: The Road Ahead

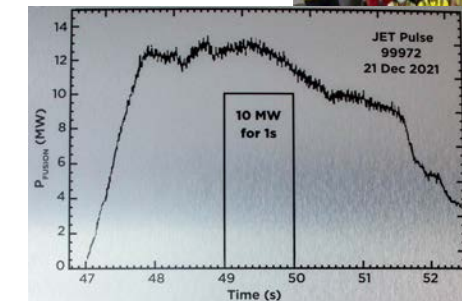
December 7, 2022



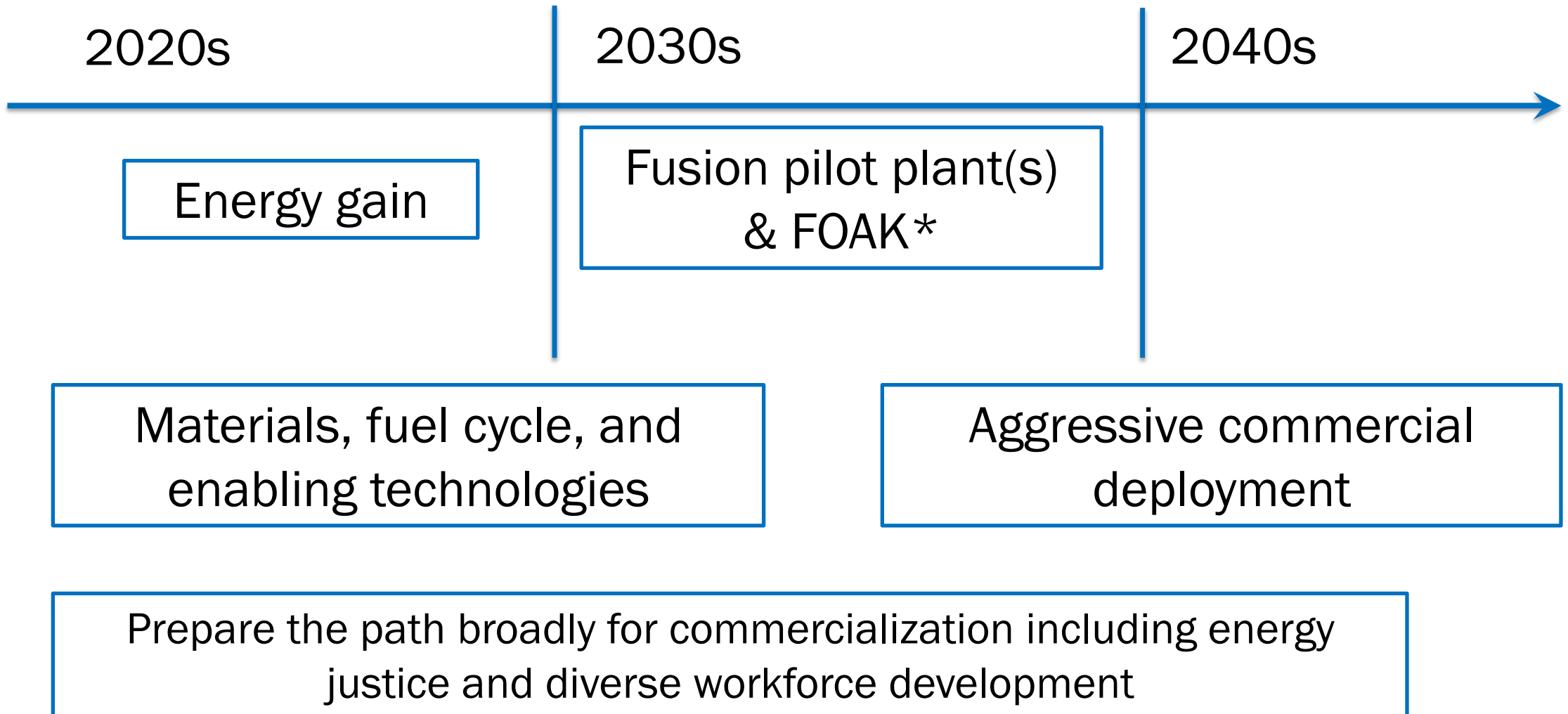
# Developments over the past decade have dramatically altered the fusion energy R&D landscape, warranting a re-assessment of U.S. strategy



DOE Workshop on Fusion Energy Development via Public-Private Partnerships  
 June 1 - 3, 2022  
 Capital Hilton, 1001 16th Street NW, Washington, DC  
 Hosted by the Office of the Under Secretary for Science and Innovation  
 Sponsored by the Office of Science

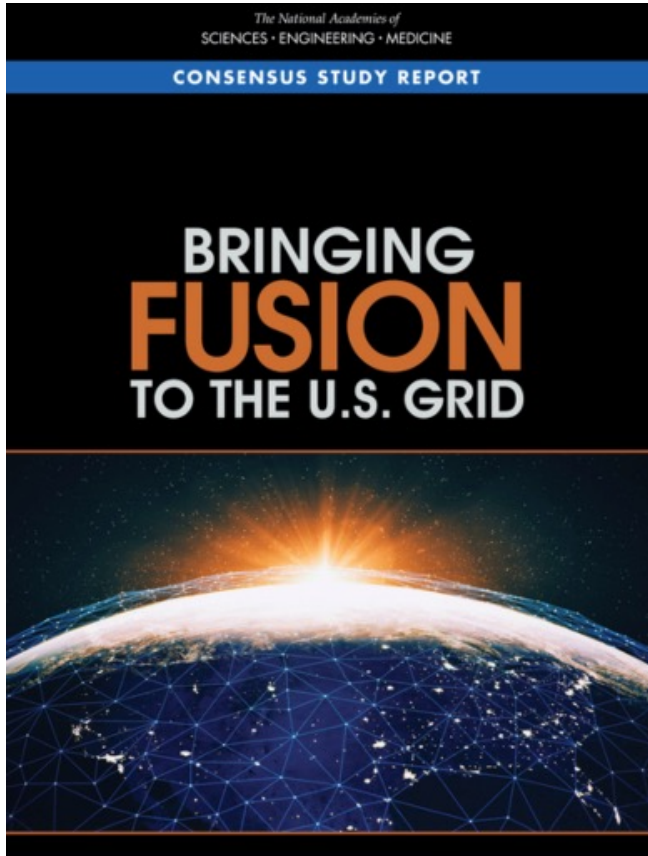


# Bold Decadal Vision for Commercial Fusion Energy seeks to partner with the private sector to enable...





# ***Bold Decadal Vision (BDV) is guided by key recommendations from the National Academies report *Bringing Fusion to the U.S. Grid (2021)****



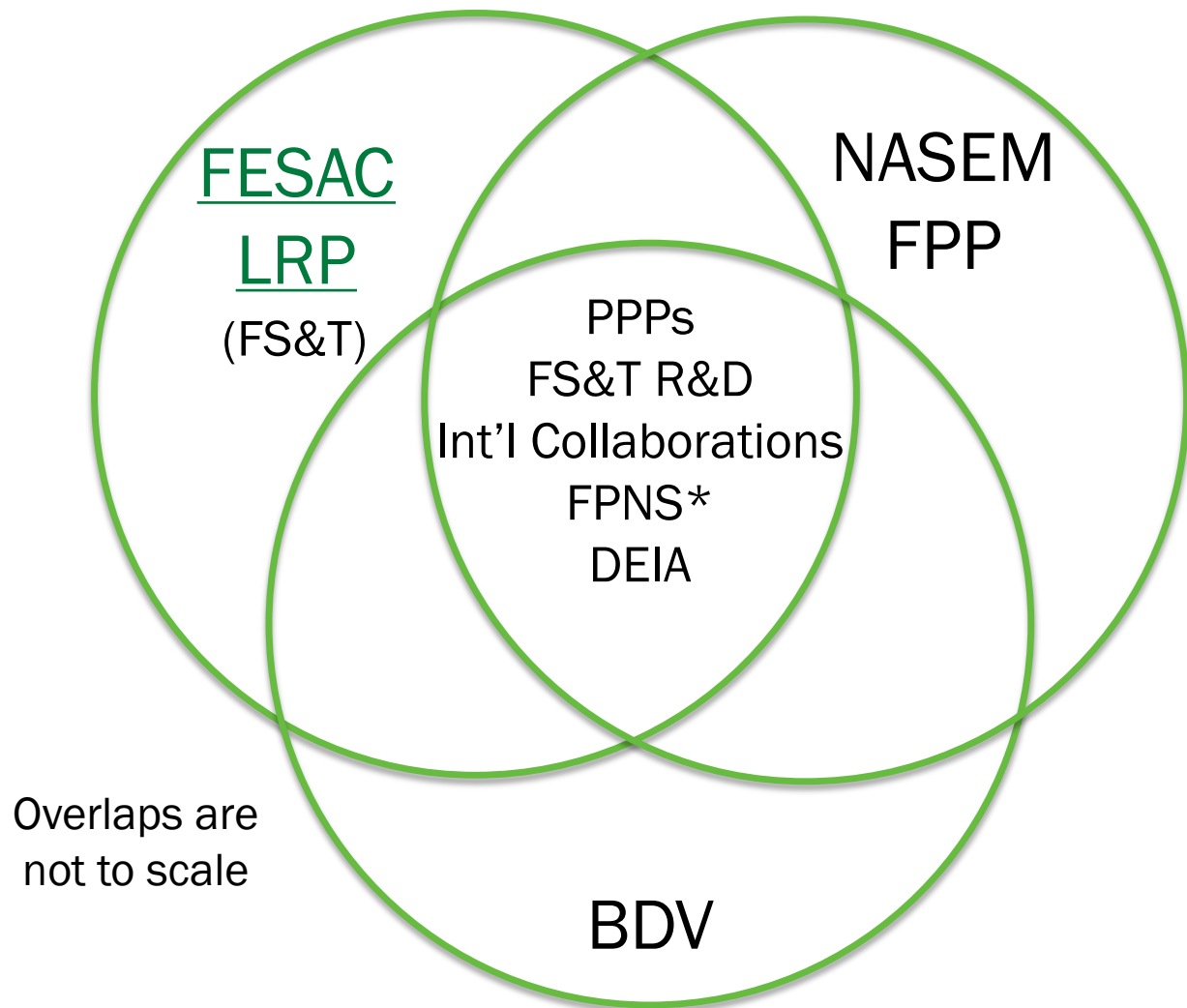
## Key abbreviated recommendations:

- DOE and the private sector should demonstrate net electricity in a fusion pilot plant in the 2030s
- DOE should move forward now via public-private partnerships to resolve key S&T challenges needed to bring fusion to commercial viability
- Urgent investments by DOE and private industry are needed

<https://nap.nationalacademies.org/catalog/25991/bringing-fusion-to-the-us-grid>



# BDV aspirational timeline and emphasis on public-private partnerships (PPPs) imply necessary deviations from recent reports

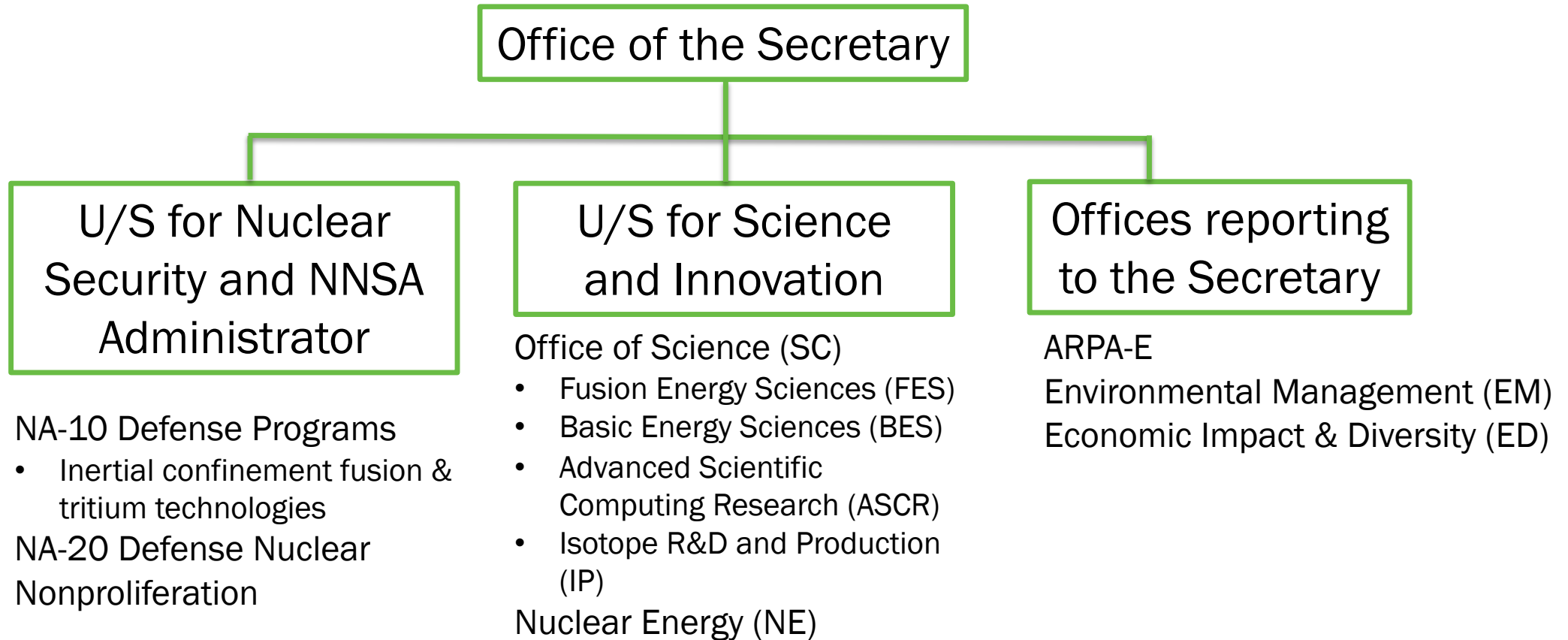


## Policy considerations:

- **Impact of BDV schedule on priorities**
  - What is a “must have” for FPP\* preliminary design?
- **Roles/prioritization of fusion user facilities**
  - Method of funding/delivering new user facilities (e.g., FPNS)
  - Leveraging privately funded and international facilities
- **Roles of international collaborations**

**Implementation plan needs to be developed consistent with budget**

# New DOE Fusion Crosscut Team has been formed with representatives from 10 DOE program offices



# Fusion Crosscut Team charter (signed by Under Secretary Richmond)

- **Develop DOE-wide plan to accelerate fusion energy RD&D in partnership with the private sector**
  - Realize a commercially relevant FPP on a decadal timescale
  - Help prepare the path broadly for commercialization
- **Identify/coordinate opportunities for crosscutting RD&D and budget requests**
- **Guiding documents:**
  - 2021 NASEM *Bringing Fusion to the U.S. Grid* (goals/requirements of FPP)
  - 2020 FESAC Long-Range Plan (fusion “S&T drivers”)
- **Success will be an operating FPP that will bring fusion to technical and commercial viability in the 2030s, with phased objectives per the NASEM report**
  - Net electricity >50 MWe for 3 continuous hours (phase 1b)
  - Net electricity >50 MWe for environmental cycle, e.g., 1 full power year (phase 2)
  - Low-enough capital cost to attract investors and commercialization partners



# Fusion Crosscut Team activities/priorities thus far

- **Milestone-Based Fusion Development Program**
  - Supported FOA development and supporting the selection process
- **Fusion Prototypic Neutron Source (FPNS)**
  - Participated in FPNS workshop (Sep. 2022)
  - Supporting establishment of mission need (CDO) & exploring PPP opportunities to co-fund construction and enable rapid delivery
- **Coordination among DOE offices and R&D communities**
  - Fuel-cycle/blanket and fusion non-proliferation workshops
  - How to best leverage NNSA capabilities for inertial fusion energy (IFE) and tritium technologies
  - Assessing critical materials, supply chains, and fuel supply
  - Engaged with NRC process for a fusion regulatory framework
- **Identify international collaborations to support the *Bold Decadal Vision***
  - Discussions underway with UK, Canada, EU (and select member nations)
- **Incorporating energy justice and DEIA in all Fusion Crosscut activities**
- **Interagency engagement/coordination**





# DOE recently launched a new program to partner with the growing fusion private sector to accelerate R&D toward FPP preliminary designs

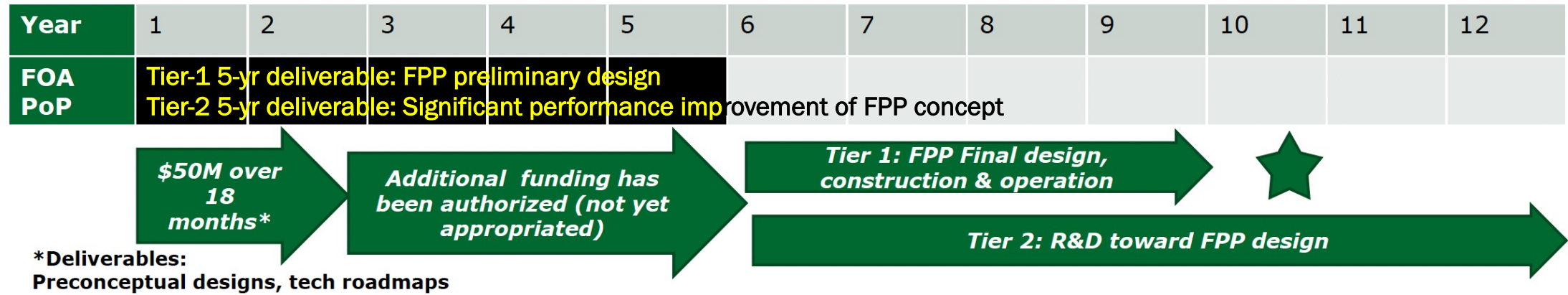
DOE Deputy Secretary David Turk announcing the program at the Global Clean Energy Action Forum on Sep. 22, 2022 in Pittsburgh:



Photo credit: Fusion Industry Association

<https://www.energy.gov/science/articles/department-energy-announces-50-million-milestone-based-fusion-development-program>

# Milestone-Based Fusion Development Program is a first step of the *Bold Decadal Vision*



- First authorized in Energy Act of 2020 and re-authorized in CHIPS/Science (2022)
  - Total of \$415M authorized; FOA assumes \$50M available (including FY22 and FY23 appropriations) for first 18 months
  - Additional appropriations are required to complete the 5-year program
  - Modeled after elements of both [NASA/COTS](#) and [NE/ARDP](#)
- All awards will be made under Technology Investment Agreements (TIA), through which DOE exercises its Other Transactions (OT) authority
  - >50% non-Federal contributions expected but >20% will be considered on case-by-case basis for Tier 2
- DOE/OSTP white paper underlying the White House Summit: public-private partnerships should be the approach to realize one or more operating FPPs on a decadal timescale

# DOE is committed to energy justice and DEIA: Milestone-based program requires applicants to submit a Community Benefits Plan

- **Community and labor engagement**
  - Engage community stakeholders, e.g., environmental groups, labor unions, local governments, tribal governments, and community-based organizations that support disadvantaged, underserved, and underrepresented communities
- **Investing in the American workforce**
  - Commitments to support workforce education and training, and to increase productivity from a committed and engaged workforce for the project
- **DEIA (diversity, equity, inclusion, accessibility)**
  - Partner with minority-owned businesses and minority-serving institutions
  - Advance DEIA in the project team through evidence-based practices



# Workshop (Sep. 2022) hosted by EPRI updated performance requirements for a Fusion Prototypic Neutron Source (FPNS) in light of the BDV

Parameter	Capability Requirement by 2028 or earlier	Capability Requirement by 2032 or earlier
Damage rate	5 to 11 <u>dpa</u> /calendar year (Fe equivalent)	15 <u>dpa</u> /calendar year (Fe equivalent)
Spectrum	Gaseous and solid <u>transmutant</u> generation rates consistent with 14 MeV fusion neutron	Gaseous and solid <u>transmutant</u> generation rates consistent with 14 MeV fusion neutron
Sample volume in high flux zone	$\geq 50 \text{ cm}^3$	$\geq 300 \text{ cm}^3$
Temperature range	~300 to 1200°C	~300 to 1200°C
Temperature control	3 independently monitored and controlled regions	4 independently monitored and controlled regions
Flux gradient	$\leq 20\%/cm$ in the plane of the sample	$\leq 20\%/cm$ in the plane of the sample

Report available at <https://www.epri.com/research/products/000000003002023917>





# DOE engagement with the Nuclear Regulatory Commission

Dr. Richard Hawryluk (Senior Technical Advisor in the Office of Science) presented at the Nov. 8 NRC *Briefing on Regulatory Approaches for Fusion Energy Devices*

- **DOE will support the NRC in developing a risk-appropriate fusion regulatory framework that provides regulatory certainty and...**
  - Ensures public safety
  - Enables investor/developer confidence by minimizing unnecessary regulatory burden [2021 NASEM report]
  - Addresses equity, energy-justice, and environmental concerns
- **Fusion is fundamentally different than fission**
  - No special nuclear materials and no concerns about criticality
  - Therefore, 10 CFR Part 50, which is tailored to fission power reactors, is not well suited to fusion technology [2021 NASEM report]
- **Tritium dominates the source term, and mitigation of tritium release is key**
  - Experience from TFTR, JET, NIF, and ITER can be leveraged

# Fusion energy is 1 of 5 priorities of White House Net-Zero Game Changers Initiative to help the U.S. achieve net-zero by 2050

## U.S. INNOVATION TO MEET 2050 CLIMATE GOALS

### ASSESSING INITIAL R&D OPPORTUNITIES

NOVEMBER 2022





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