FUSION INDUSTRY ASSOCIATION

The Voice of a new Industry

The Fusion Industry Association is an international coalition of companies working to electrify the world with fusion - the unparalleled power of the stars. Energy from fusion will provide clean power for everyone that's safe, affordable, and limitless.

The FIA: *Building the Fusion Economy*

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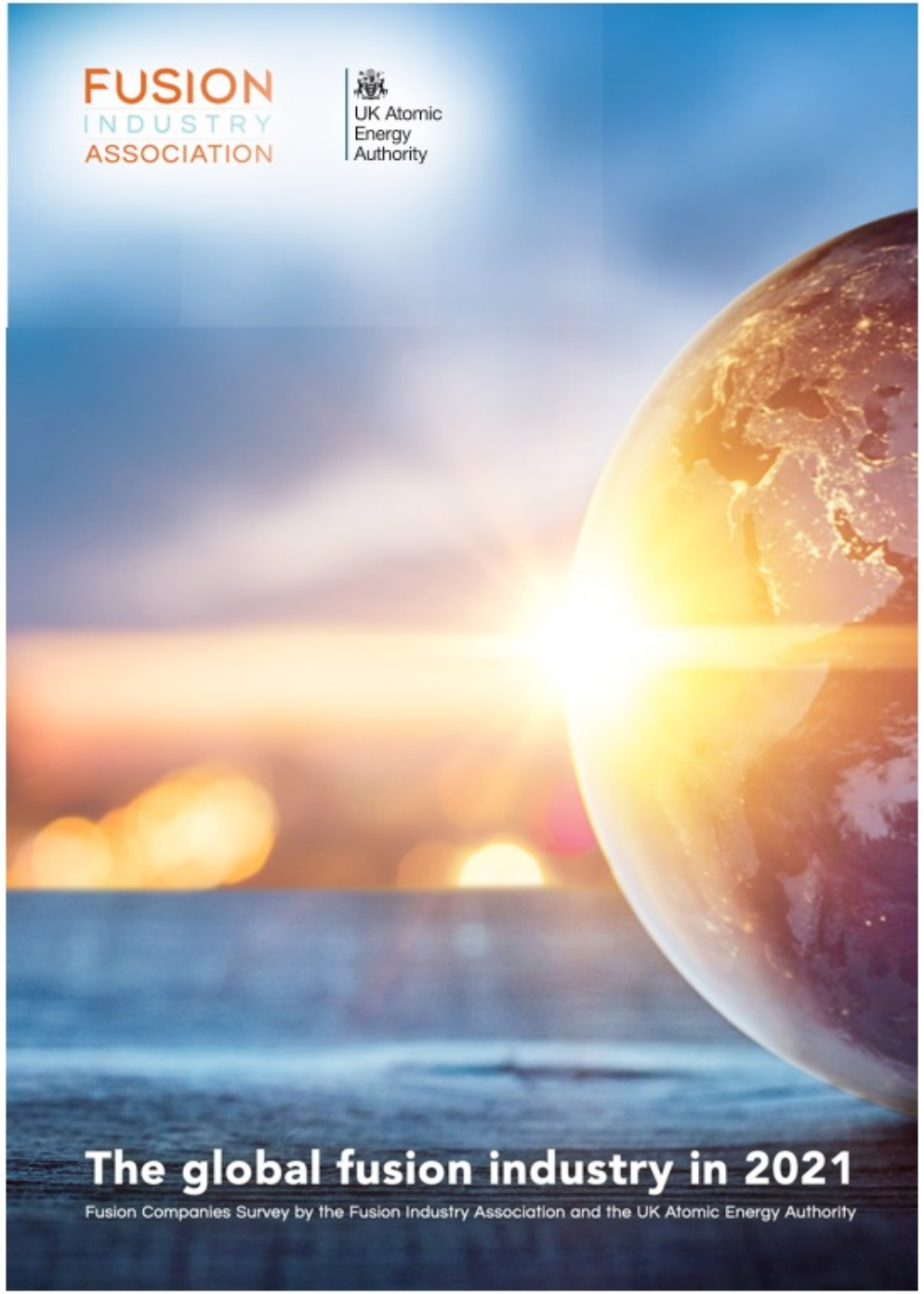
Fusion energy will revolutionize the global energy system. It can solve the climate crisis while providing abundant and secure energy, anywhere.

- The Fusion Industry Association is **accelerating commercially viable fusion energy** by advocating for policies and regulations that support our 27 member companies as they develop commercial fusion power.
- The FIA is showing the world how important clean, safe, affordable, and secure fusion will be to the future energy system. The FIA is educating key stakeholders in the private, public, and philanthropic sectors about the importance of tomorrow's fusion power economy.

The FIA is seeking affiliate members to expand operations and accelerate efforts to support the transition to clean, safe, sustainable fusion energy.

The global fusion industry in 2021

- Survey from Q2 2021
- 31 verified private fusion companies
  - 18 responded
  - 27 Members of the FIA, 20 American
- $1.87 Billion (++++)
- Focused on electricity generation (96%) by the 2030s or before (83%)



The global fusion industry in 2021

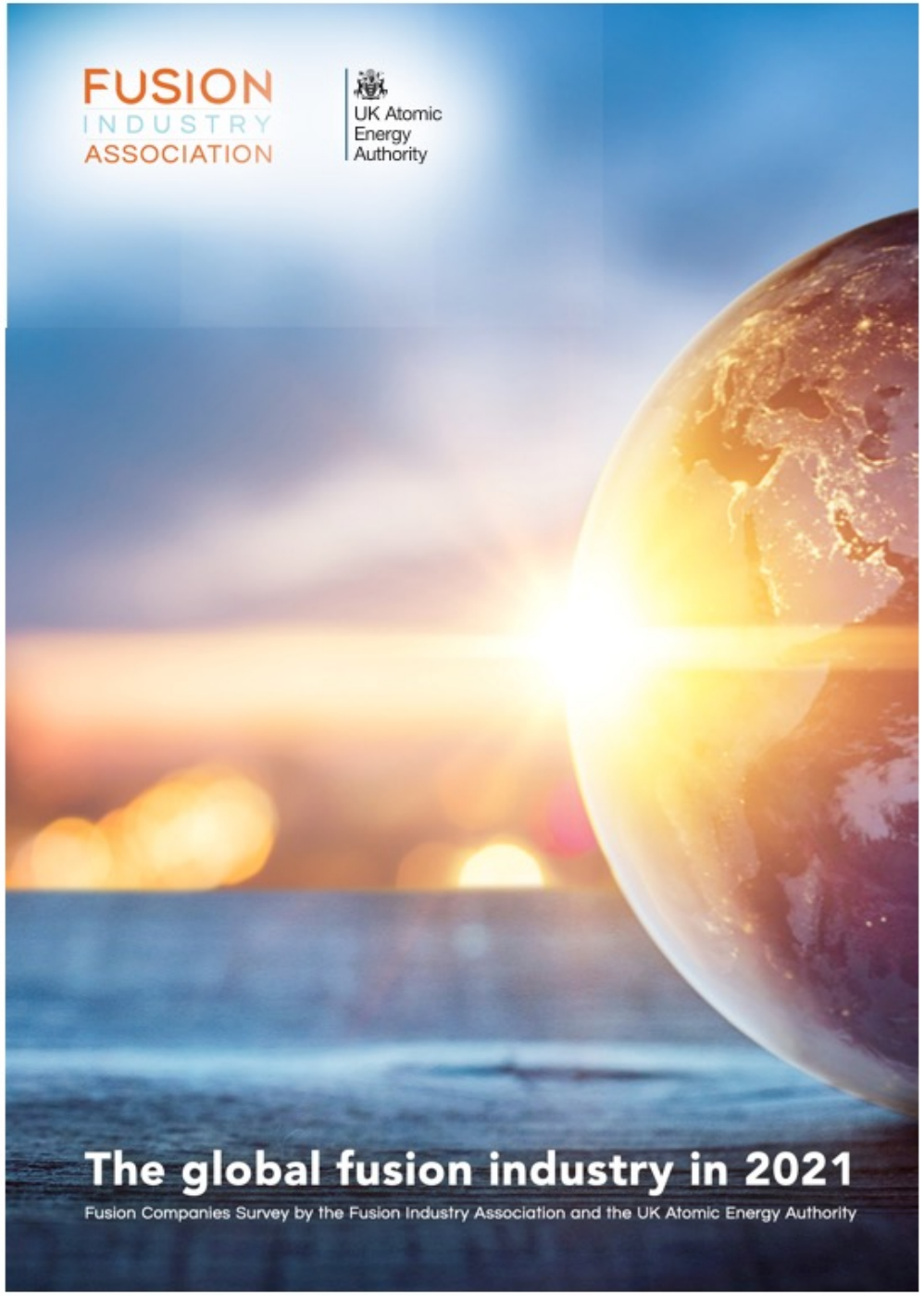
6. Technical approach taken by global fusion companies

General approach

- 13 Magnetic confinement
- 5 Magneto-inertial
- 2 Hybrid electrostatic confinement
- 2 Inertial confinement
- 1 Non-thermal laser fusion
- 0 Cold fusion/LENR
- 0 Muon-catalysed fusion

Specific approach

- 3 Field Reversed Configuration
- 3 Tokamak
- 2 Spherical tokamak
- 2 Stellarator
- 2 Z-pinch
- 1 Dense plasma focus
- 1 Direct laser-driven pB11
- 1 Inertial-electrostatic confinement
- 1 Laser-driven inertial confinement (quantum enhanced)
- 1 Magnetic-electrostatic confinement
- 1 Magnetized target fusion
- 1 Plasma jet driven magneto-inertial fusion
- 1 Plectoneme
- 1 Shock-driven inertial confinement
- 1 Spheromak
- 1 undeclared
- 0 Laser-driven inertial confinement



Why Now?

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Government, science, business, and investors are getting organized for accelerated fusion development and deployment

project portfolio operations technology Chevron sustainability investors about

press release

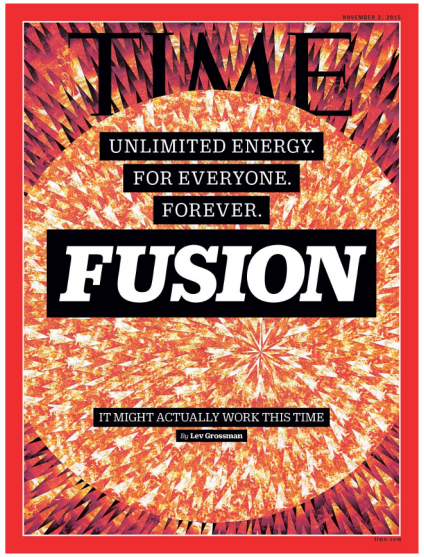
Chevron Invests in Nuclear Fusion Start-up

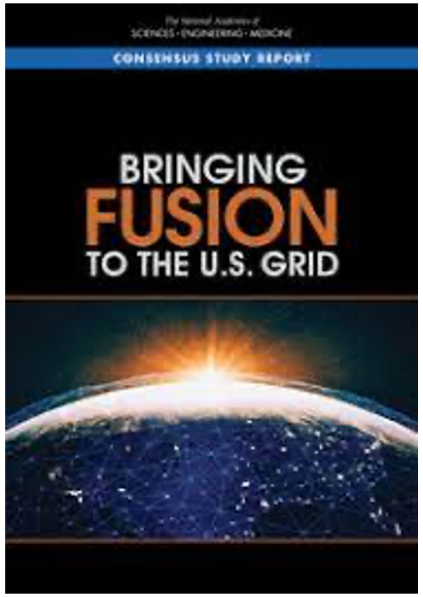
Technology Ventures Team Identifies Zap Energy

Houston, Texas, August 12, 2020 — Chevron Corporation (NYSE: CVX) today announced a Series A investment in Zap Energy Inc., a Seattle-based start-up

Claiming a landmark in fusion energy, TAE Technologies sees commercialization by 2030

The company has raised nearly $1 billion to harness the power of the sun





The New York Times

Compact Nuclear Fusion Reactor Is 'Very Likely to Work,' Studies Suggest

A series of research papers renews hope that the long-elusive goal of mimicking the way the sun produces energy might be achievable.

By Henry Fountain

Sept. 29, 2020

Energy & Science

Bezos-Backed Fusion Startup Picks U.K. to Build First Plant

Canada's General Fusion plans to start testing a $400 million pilot facility outside London by 2025.

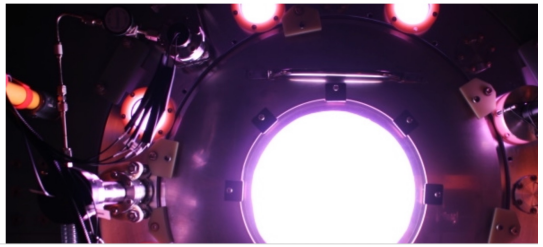
By Jonathan Tirone
June 16, 2021, 7:01 PM EDT

Helion passes 100 million degrees Celsius

23 June 2021

Share

Fusion energy developer Helion Energy said yesterday it has become the first private company to announce exceeding 100 million degrees Celsius in its sixth fusion generator prototype, Trenta. It also announced its Trenta prototype recently finished a 16-month testing campaign, completing almost 10,000 high-power pulses.



China's Fusion Research Is Heating Up

The EAST reactor in Hefei broke records last month as it edges toward the sustained stellar temperatures needed to generate fusion energy.

THOMAS CORBETT and PETER W. SINGER | JUNE 28, 2021

Membership

FUSION INDUSTRY ASSOCIATION

Commonwealth Fusion Systems

generalfusion®

tae TECHNOLOGIES

HB11 ENERGY
LASER BORON FUSION

tokamak energy
a faster way to fusion

ZAP ENERGY

HELION

CTFusion
As Brilliant as the Sun

TYPE ONE ENERGY

SHINE

FOCUSED ENERGY

MIFTi

LPP FUSION

ALBOT

MarvelFusion

first light

fuse

RENAISSANCE FUSION

HYPERJET FUSION CORP

INNOVEN Energy

AVALANCHE

HelicitySpace

HORNE TECHNOLOGIES

NK

PrincetonSATELLITE SYSTEMS

nearstar FUSION

Electric Fusion
Transforming energy for all humanity

Affiliate Members

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Jema Irizar Group innovative energy
equinor
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OXFORD SIGMA
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PATRIOT FORGE CO.
Major Tool & Machine
FRAZER-NASH CONSULTANCY
EPRI ELECTRIC POWER RESEARCH INSTITUTE
BILFINGER
BILFINGER NOELL GMBH
pillsbury
Hogan Lovells
K&L GATES
Morgan Lewis
Sapient
CLEARPATH
Energy for the Common Good
Soon enough to make a difference
CleanTech Alliance
COSYLAB

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How does the Fusion Industry Association advance fusion?

Three strategic priorities for accelerating fusion energy

FIA Strategy

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1. **Partnering with Governments**
   The private sector should have access to the scientific research that governments have pursued for decades. *Public-Private Partnerships* that include government support to private fusion companies can rapidly accelerate fusion development by driving private financial support.
2. **Ensuring Regulatory Certainty**
   Fusion research, development, and deployment should be subject to appropriate, risk-informed regulation when experiments are built and sited.
3. **Communicating the Benefits of Fusion**
   The world should know how important clean, safe, affordable, and secure fusion will be to the future energy system. FIA is educating key stakeholders in the private, public, and philanthropic sectors about the importance of tomorrow's fusion power economy.

Ongoing Activities:
1. Partnering with Governments

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Proposal: Government Cost-Share with Private Fusion

Modeled on the successful NASA COTS and DOE SMR cost-share programs, this new program would directly reimburse private companies for the development of new US-based fusion capabilities over a 5-year period.

Government dollars would be leveraged with at least a 50% private sector cost share. Payments would be based on performance

STATUS:

PASSED BY CONGRESS, Awaiting DoE Action and Congressional Appropriations

- Plan is a 5-year program, funded up to $1 billion

Infrastructure & Reconciliation

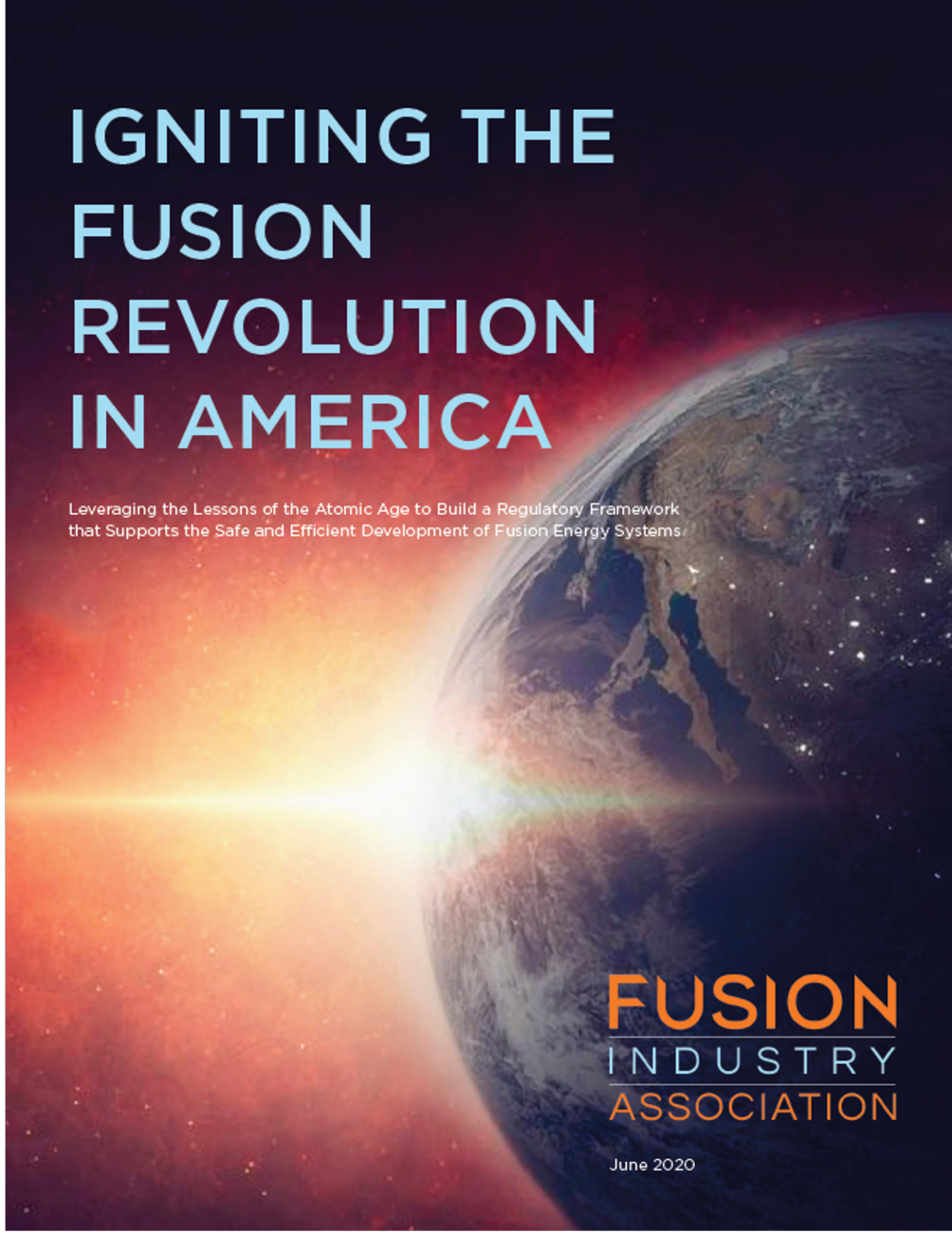
- $325m of $885m in House-passed Reconciliation bill for FIA's PPP
- Fusion funding changed in the Senate draft bill. There is an effort to increase funding for National Lab Infrastructure
- Senate outlook remains unclear

FY22 Annual Appropriations

- The Biden Administration Budget for Fusion of $675m includes no funding for PPP, similar to Senate bill. The House-passed bill includes $698m with $45 million in initial funding for PPP.
- FIA working closely with Senate Appropriations to show support for fusion funding.

Ongoing Activities:
2. Ensure Regulatory Certainty

- Working with the US Nuclear Regulatory Commission to inform regulatory plans
- Publishing and convening legal experts to determine the proper posture for regulatory action.
- Working with the IAEA to inform a global fusion regulatory structure.



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FIA action on regulatory policy rests on one principle…

Fusion is different from Fission

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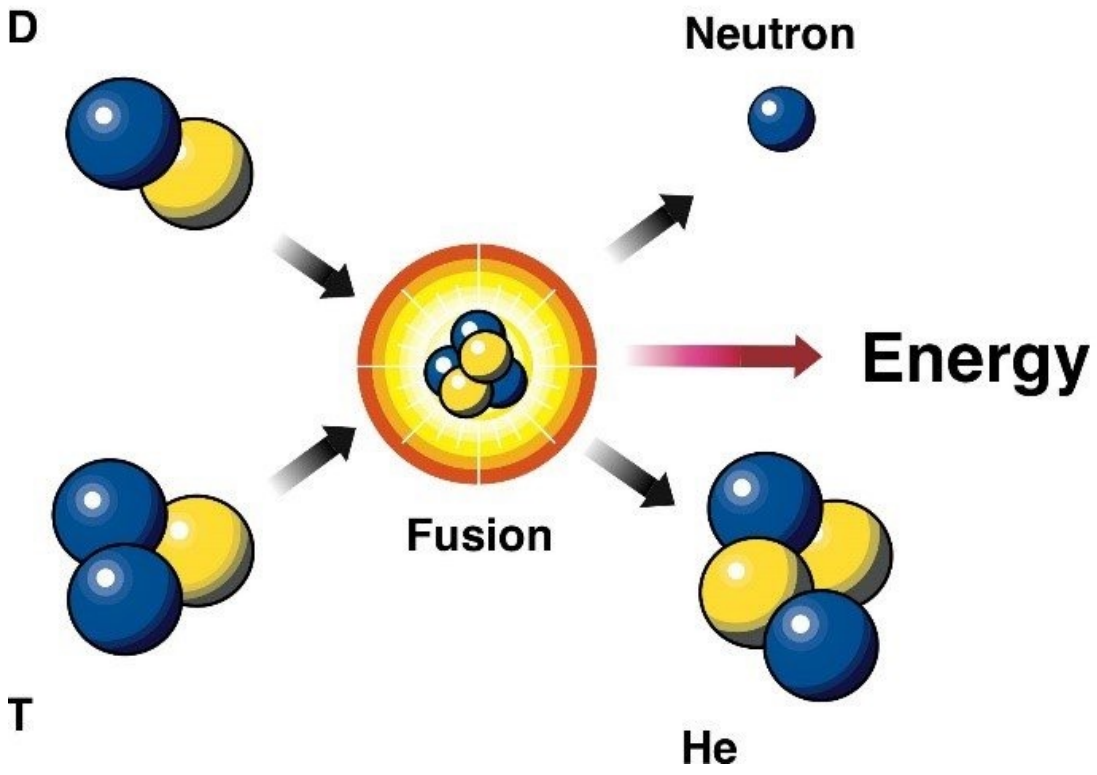

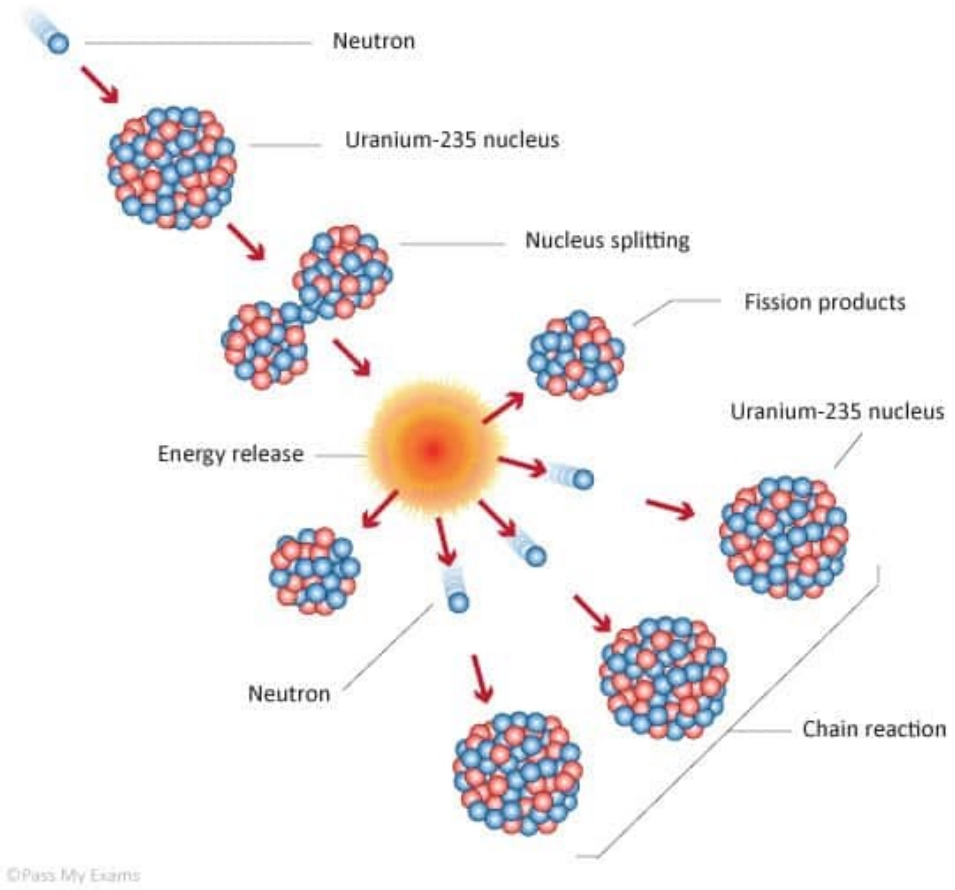

Fusion is different from Fission

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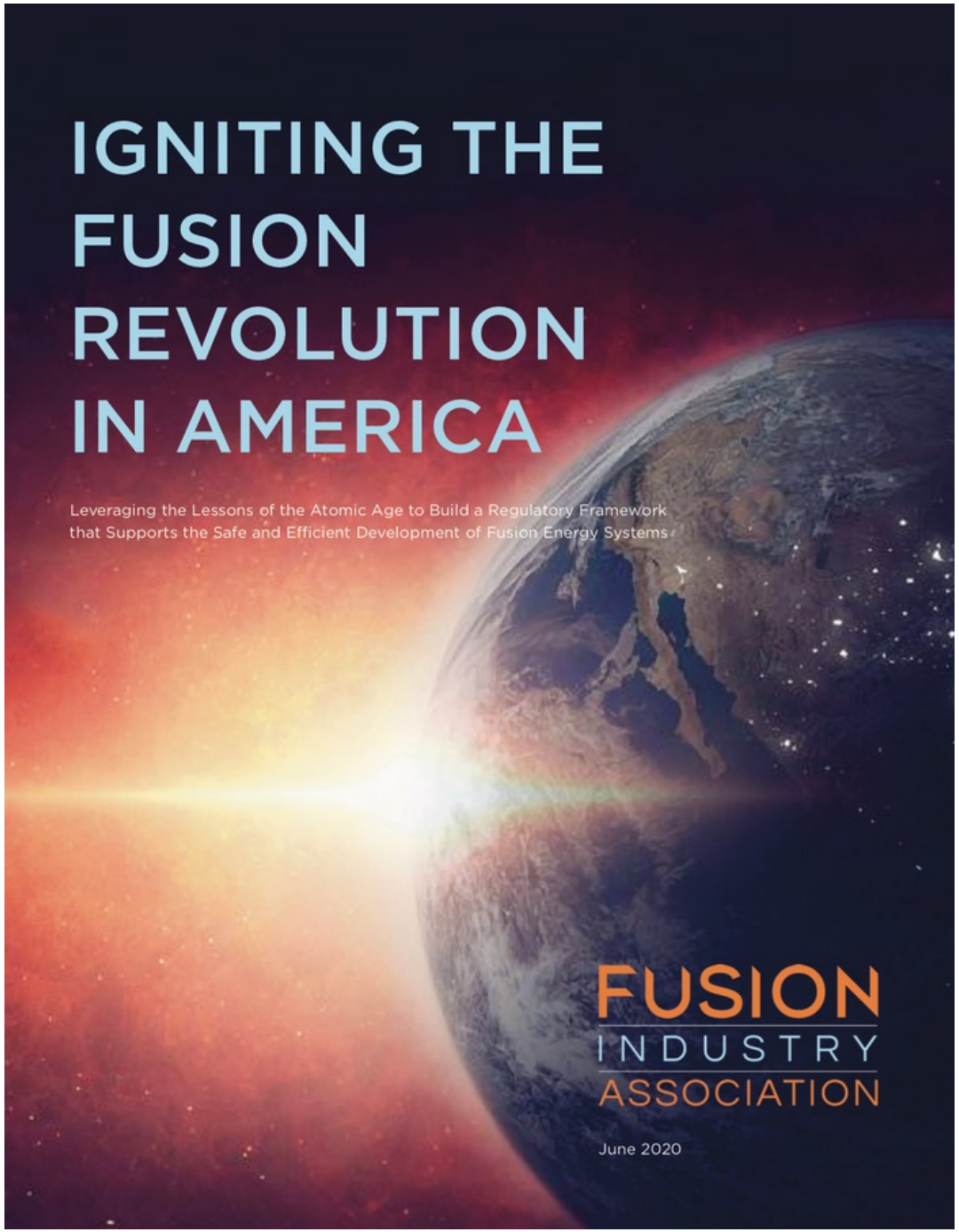
- **No Chance of Meltdown** Fusion energy devices do **not** use any special nuclear material or source material, creating a much lower risk profile than fission facilities, thus, criticality or meltdown accidents are physically impossible
- **Minimal Safety Risk to the General Public** With reasonable design, construction, and operations procedures, fusion energy generating facilities would not create a credible safety risk to the general public (i.e., that requires an evacuation of members of the public near the fusion energy generating station) that is any greater than hydrocarbon power plants or other comparably sized industrial facilities
- **No long-lived, highly radioactive waste** The waste output from a fusion facility consists of helium plus small amounts of solid, slightly activated device components and other materials that can easily be disposed of as low-level waste.

FIA Regulatory Goal

Policymakers should establish a broad legislative and regulatory framework that ***explicitly and permanently removes fusion energy from the regulatory approaches that the federal government has taken towards fission power plants.***

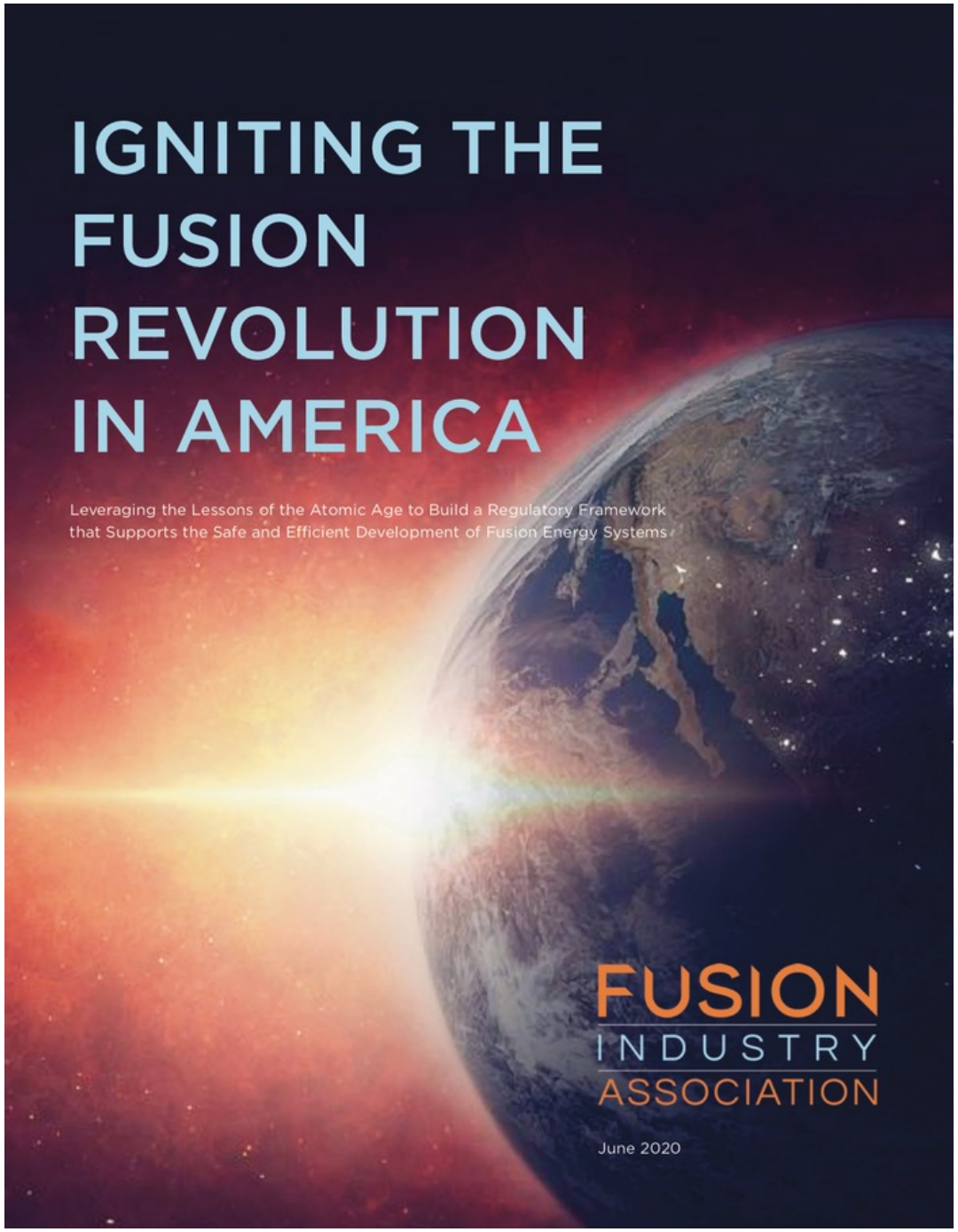


Building a Different Approach than Fission in the U.S.

- The NRC's Part 50, 52 and proposed 53 regulations for large commercial fission reactors address a **different suite of risks** compared to risks that fusion facilities could create and therefore are not appropriate for fusion systems.

Fusion is already Regulated

- Rules like the NRC's Part 20 regulations for general radiation protection and Part 30 rules for handling byproduct material **properly address fusion** facilities' risk profiles.



There is no legal definition of a "Fusion Reactor" under U.S. law

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- "***Nuclear reactor*** means an apparatus, other than an atomic weapon, designed or used to sustain nuclear fission in a self-supporting chain reaction." (10 CFR § 140.3)
- "***Utilization facility*** means:
  (1) Any **nuclear reactor** other than one designed or used primarily for the formation of plutonium or U-233; or
  (2) An accelerator-driven subcritical operating assembly used for the irradiation of materials **containing special nuclear material**..." (10 CFR § 50.2)

There are no Commercial Plans for ITER or DEMO-scale Machines

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- The large scale of an ITER/DEMO machine is economically unattractive
- Significant tritium requirements (e.g. 5-15 kg)
- Large scale will result in large amounts of activated materials and low-level waste
  - Most of the academic literature and national government expertise is focused on fusion at these scales – and is therefore

Regulatory Issues

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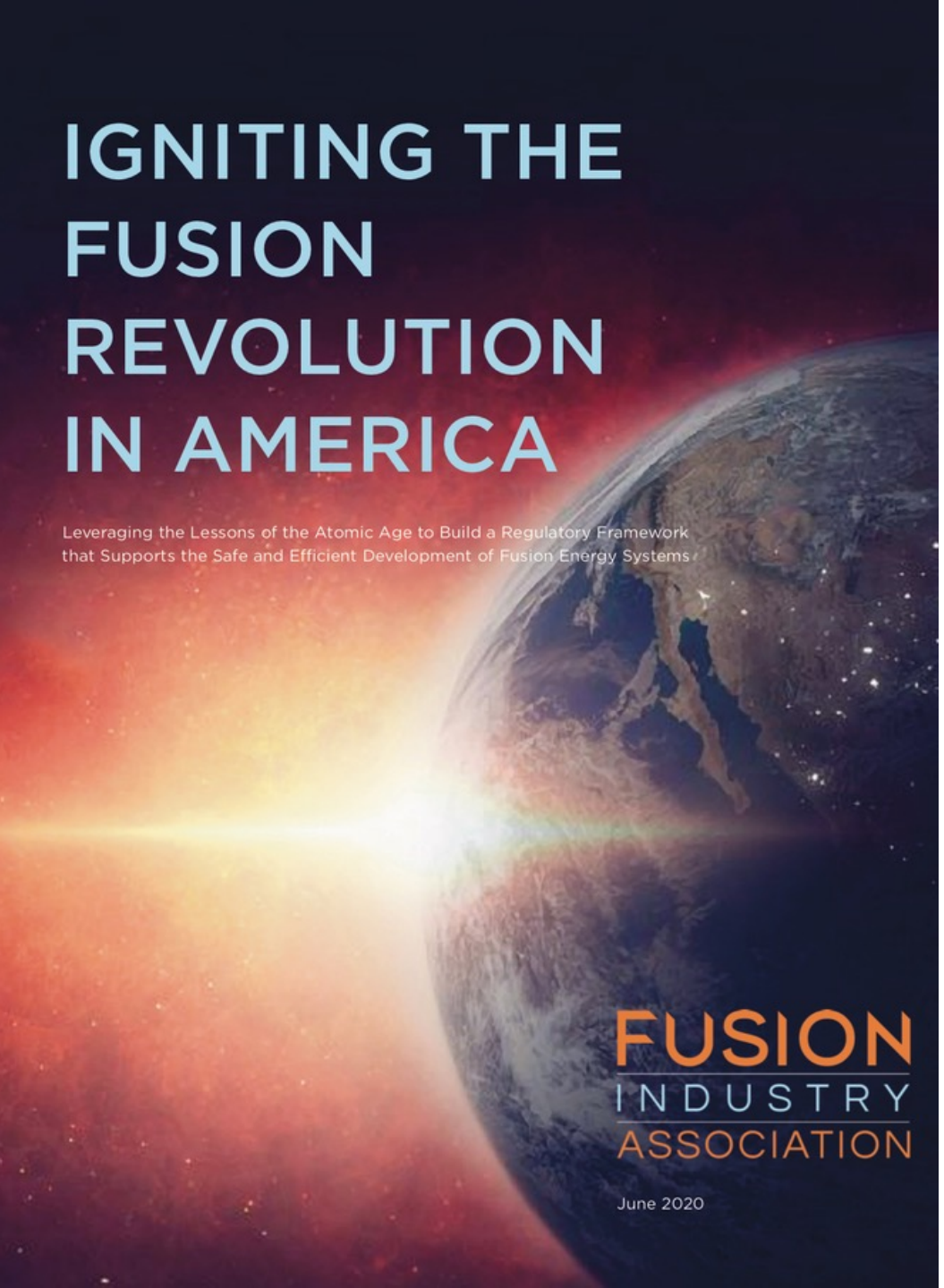
- NRC Process & Planning
  - 4 public meetings in 2021. Undetermined number planned for 2022.
  - Part 53 (new advanced fission regulations) have been delayed by 9 months.
  - NRC Staff's "Options Memo" for Commissioners (previously scheduled for Spring 2022) can also be delayed, as FIA had requested.
- Impressions
  - Is fusion a "Square peg into round hole" of Byproduct Material legal approach?
- Next Steps
  - Further detail on upper bounds for accident scenarios, byproduct material amounts on site and in facilities, and maximum dosage possibilities.
- **FIA Strategy**: over the next 6 months, FIA and our consultants will continue to repeat low risk of fusion and the legal argument for the Byproduct Materials approach to regulation.



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Thank You

https://www.fusionindustryassociation.org/post/fusion-regulatory-white-paper

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