



Safety and Regulatory Certainty for the Fusion Industry

NRC's 36th Regulatory Information Conference

March 14, 2024

The FIA: *Building the Global Fusion Energy Industry*



FIA Mission

The Fusion Industry Association is the unified voice of the private fusion industry. It is a membership organization that supports efforts to accelerate commercial fusion energy through advocacy and education.

The FIA's members are the investor-backed fusion developers, and its affiliate members are the companies and organizations that will build the global fusion energy economy.

The FIA's goals are to **accelerate commercially viable fusion energy** by advocating for policies, partnerships, regulations, and industry incentives that support our member companies as they develop commercial fusion power.

FIA Membership



Commonwealth
Fusion Systems



HELION



tae



ZAP ENERGY



AVALANCHE

generalfusion®

TYPE ONE
ENERGY

REALTA
FUSION



GAUSS
FUSION



HB11
ENERGY
LASER BORON FUSION

Tokamak Energy



FOCUSED
ENERGY



THEA ENERGY

XCIMER

ENERGY
CORPORATION



first light



EX-Fusion

fuse



KYOTO
FUSIONEERING



MarvelFusion

SHINE



STELLAREX

MIFTi



Helical Fusion



LONGVIEW FUSION
ENERGY SYSTEMS



BLUE LASER
FUSION



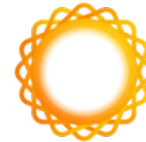
HelicitySpace



Proxima
Fusion



RENAISSANCE
FUSION



OPENSTAR
TECHNOLOGIES LTD



LPP FUSION

nT-tao
Compact Fusion Power



HORNE
TECHNOLOGIES

nearstar
FUSION



ELECTRIC
FUSION
SYSTEMS



accelaron



NOVATRON

Overview: The Private Fusion Industry Today

- 43 verified private fusion companies
- **\$6.2 billion in investment**
- Accelerating number of new fusion companies
- Increasing optimism on timescales
- Growing interest from governments in Public Private Partnerships
- Growing geographical diversity
- But – technical challenges remain



Why Now?

Fusion is coming



Today's Scientific and Technological Advances Enable Breakthroughs

New Materials

New materials, including High Temperature Superconductors, advanced lasers, new alloys, power management chips, and more enable smaller, cheaper machines.

High Speed Computing

Advances in computing power allow advanced modeling and the application of artificial intelligence to experiments.

Greater Scientific Understand of Plasmas

Breakthrough fusion experiments at NIF and elsewhere will bring greater fidelity to models and enable faster experimentation.

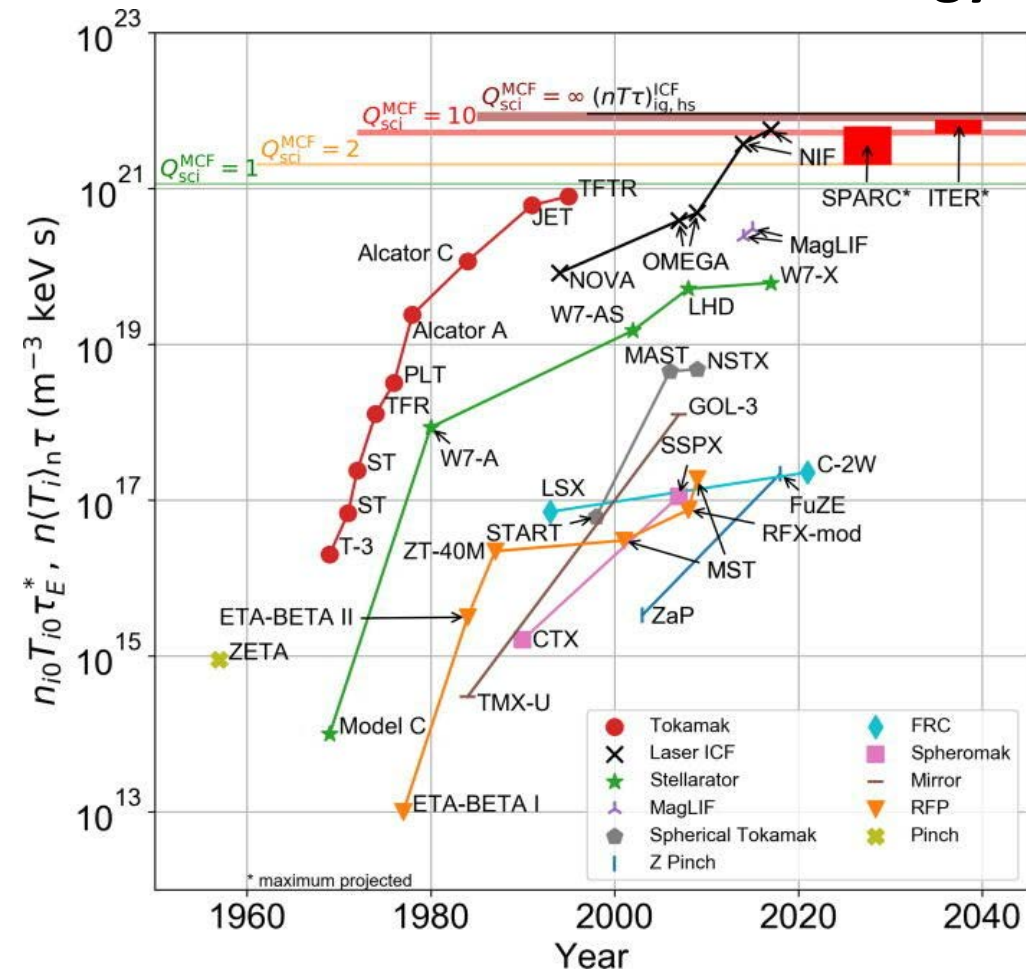
Advanced Manufacturing

Will allow quick and cheap production of components in complex shapes and with new materials.

Business Model Improvement

The application of the Silicon Valley-style venture capital has injected funding, urgency, and greater tolerance of risk.

Historical progress shows continuous advances towards fusion energy

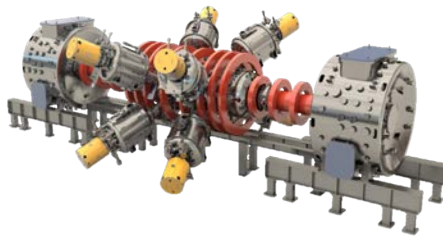


Industry's Timeline



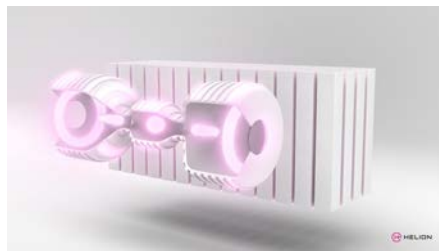
60 years of
research

- Scientific basis for fusion energy



Mid 2020s

- Scientific Proof of Concept



Late 2020s

- Design and build Pilot Plants



Early 2030s

- Operate Pilot Plants, first sales



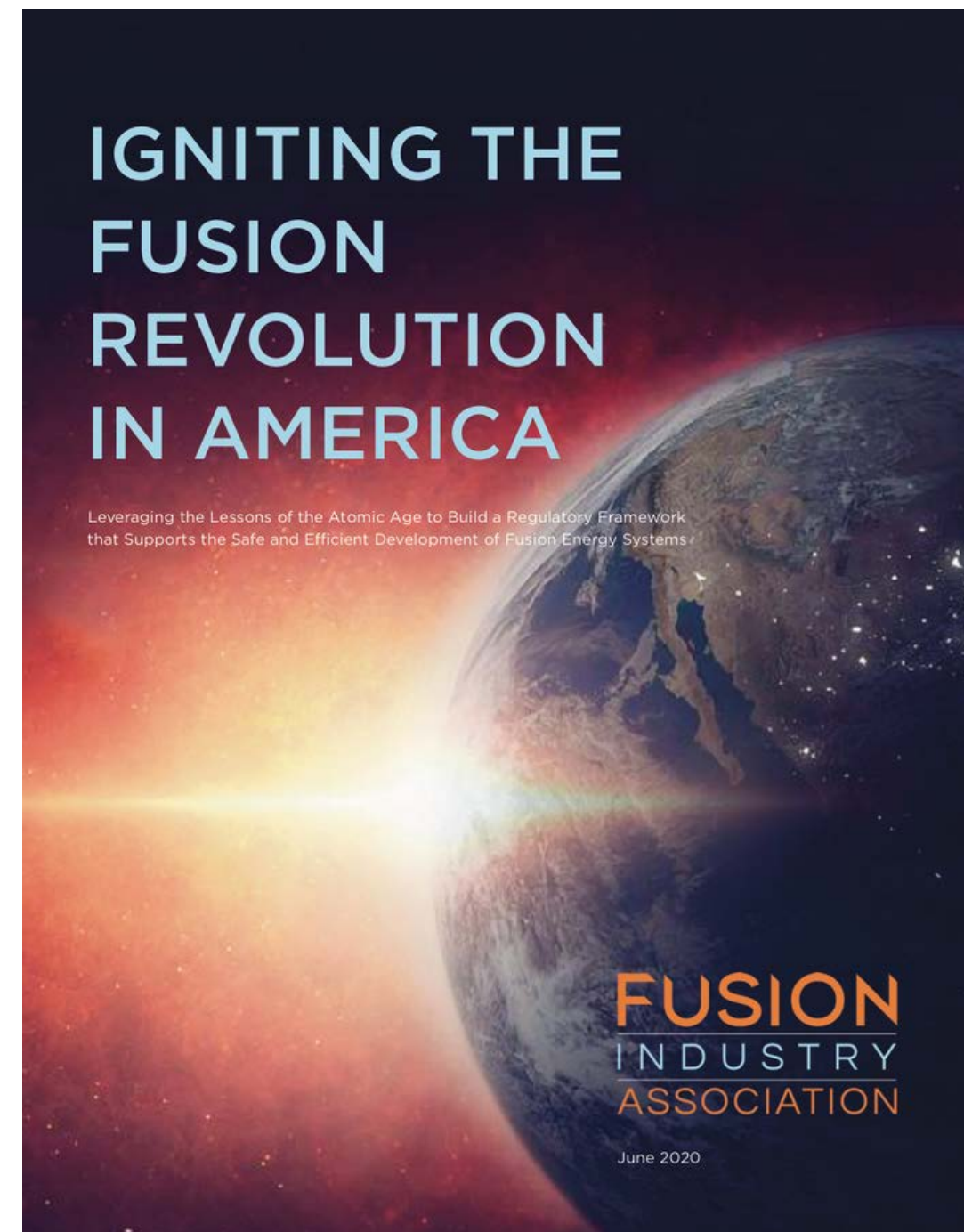
Mid 2030s

- Commercial Fusion, rapid scale-up to global deployment



FIA 2020 White Paper:

“U.S. 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.”



Scope of Commercial Fusion Plants in the US



Among FIA Members, there is no “generic” fusion power plant, but some common features

- Fusion fuel inventory in all fusion systems at any time is very small, and cannot be arbitrarily increased without system shutting off.
- **Zero** usage of special nuclear materials (i.e. uranium, plutonium) in fusion energy systems.
- New fusion fuel must be added and fusion products removed to maintain power production, **otherwise fusion power shuts off**
- All fusion approaches can only fuse a small amount of fusion fuel in the plasma at any time, **otherwise fusion power shuts off**
- Generally, plans are for smaller electric production than existing nuclear fission fleet (~1GWe) and smaller than international plans for DEMO (~2-3GW).
- None will require active cooling after shutdown

From a risk-informed perspective, all of the conceived fusion reaction types or fuel choices present risks that can be appropriately regulated under Part 30 regulations

Scope of Hazards for Commercial Fusion Energy



Hazards Under Normal Operation

- Normal fusion power plant operations can produce neutrons and gamma rays, so shielding must be used to protect workers and the public.
- Some fusion fuels are radioactive, particularly Tritium (an isotope of Hydrogen), so they must be handled carefully.
- Fusion materials will become “activated” by exposure to fusion conditions, so they must be protected from workers and properly disposed of.

Hazards of Accidents

- Accidents causing a loss-of-vacuum are the maximum credible accident
- Accidents result in automatic shutdown of fusion reactions, and cannot lead to a meltdown
- Impact of an accident is bounded by the amount of radioactive material in chamber at breach
- Tritium releases in credible fusion device accidents are below the annual dose limit to the public of 100 mrem, and in all scenarios are below emergency planning threshold of 1000 mrem

Differences from Nuclear Fission power plants

- Fusion requires no “**Special Nuclear Material**” (i.e. Plutonium or Uranium)
- A chain reaction is not possible so there is no risk of a supercritical meltdown

SECY-23-0001: *"Options for Licensing and Regulating Fusion Energy Systems,"*



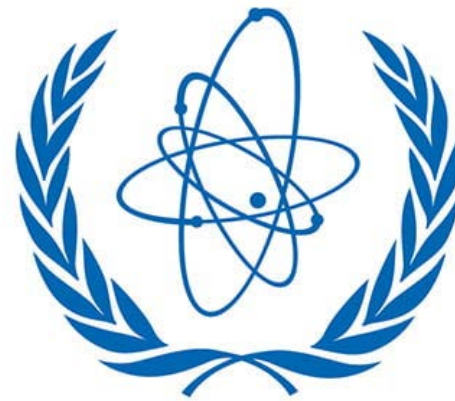
- 5-0 vote to initiate a rulemaking under the byproduct materials regulatory regime (10 CFR Part 30)
- Separates the regulatory oversight of fusion from the utilization facilities regime (10 CFR Parts 50 & 52)
- Regulatory Certainty + Safety & Security = Innovation & Investment

What's Next?

International Harmonization



Bundeskanzleramt



IAEA

International Atomic Energy Agency

Atoms for Peace and Development



What's Next?

Agreement State Engagement



Organization of Agreement States



WISCONSIN



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Thank you

<https://www.fusionindustryassociation.org/>