U.S. DEPARTMENT OF ENERGY

Office of the
UNDER SECRETARY
FOR SCIENCE & INNOVATION

Fusion Energy

Dr. Scott Hsu, DOE Lead Fusion Coordinator

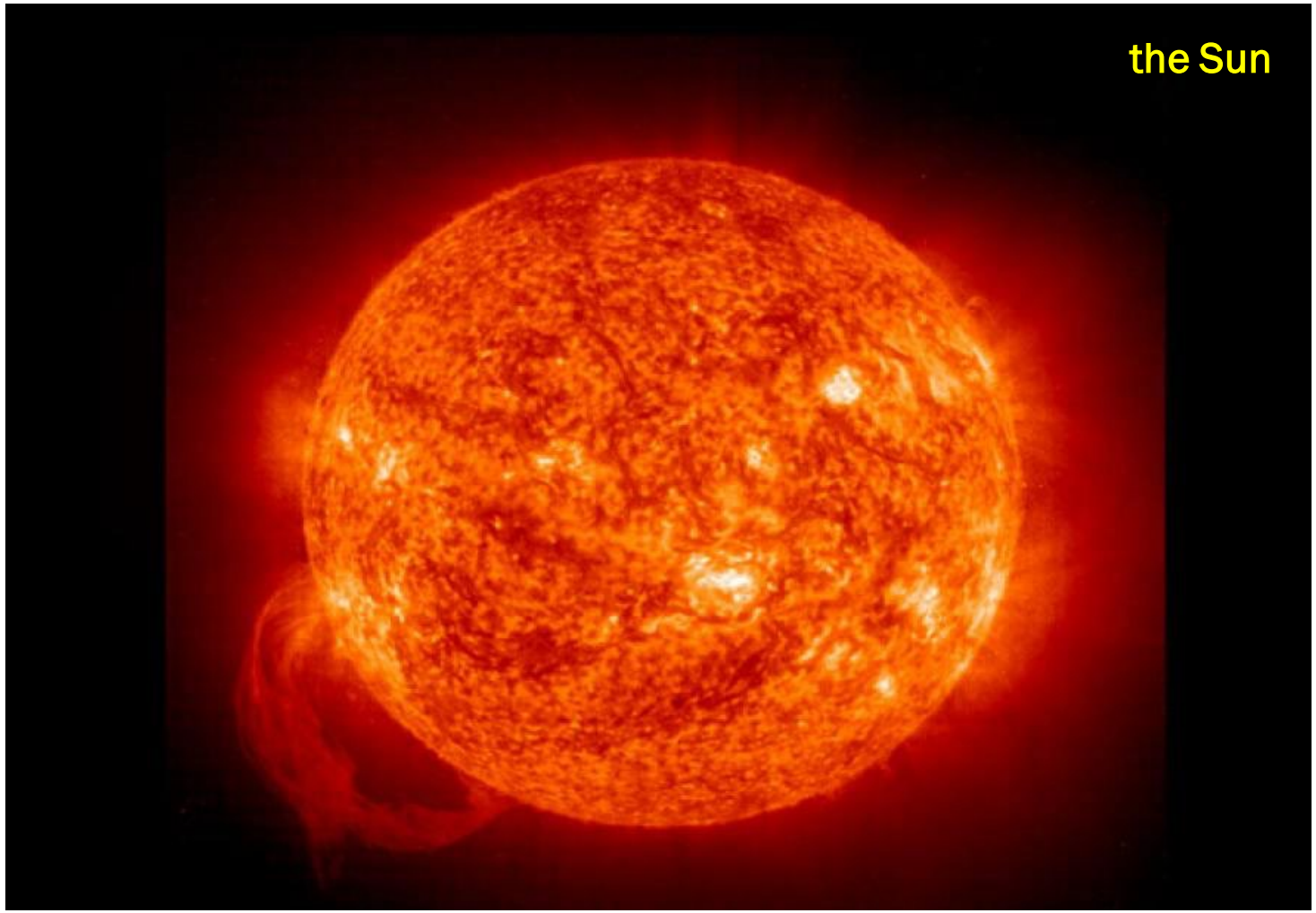
Fusion Panel Discussion
Sacramento Municipal Utility District

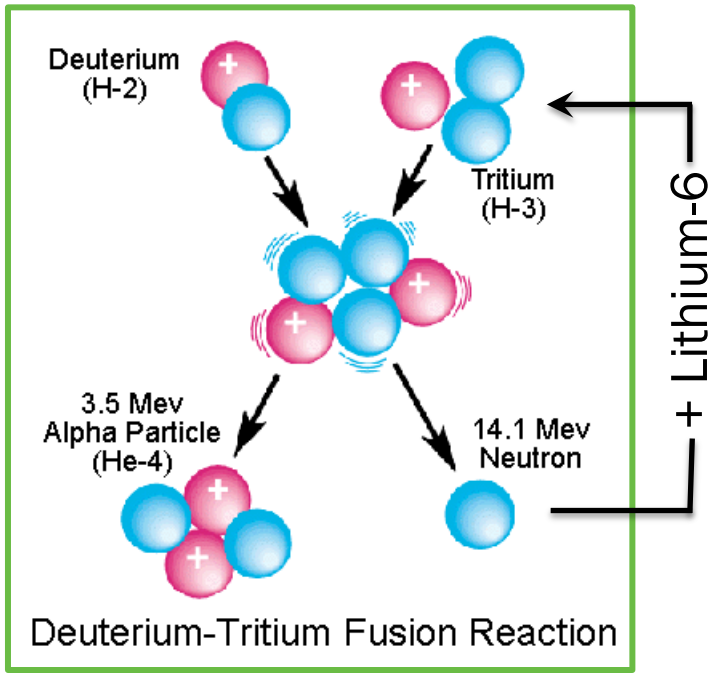
October 11, 2022

Outline

- What is fusion?
- Fusion approaches
- DOE programs and vision

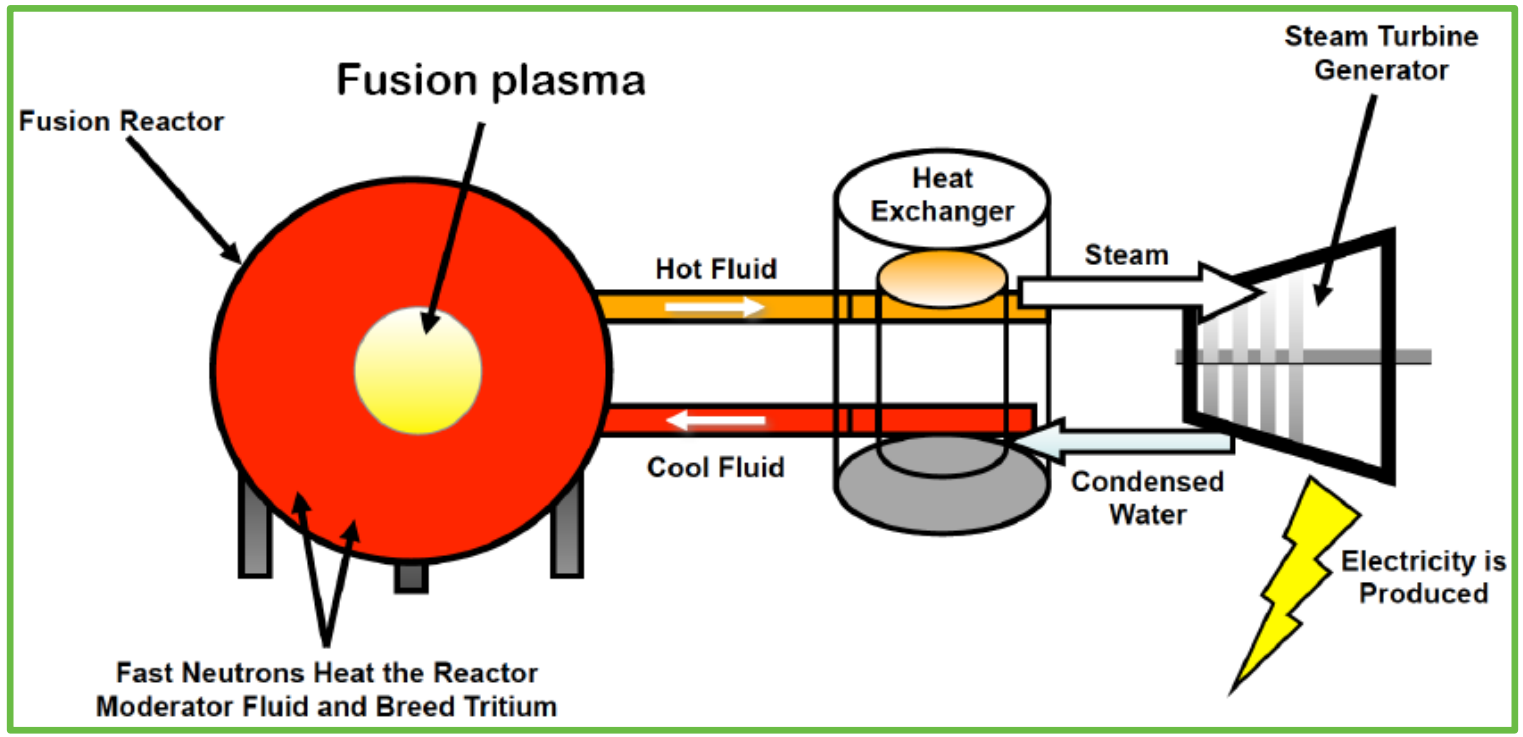
What is fusion?





1.5 “train cars” of D and Li-6 (200 tons) = 1 year of electricity for the U.S.

Potential uses, benefits, and safety considerations for fusion energy



Potential uses:

- Electricity generation
- Industrial processes
- Production of transportation fuels
- Desalination

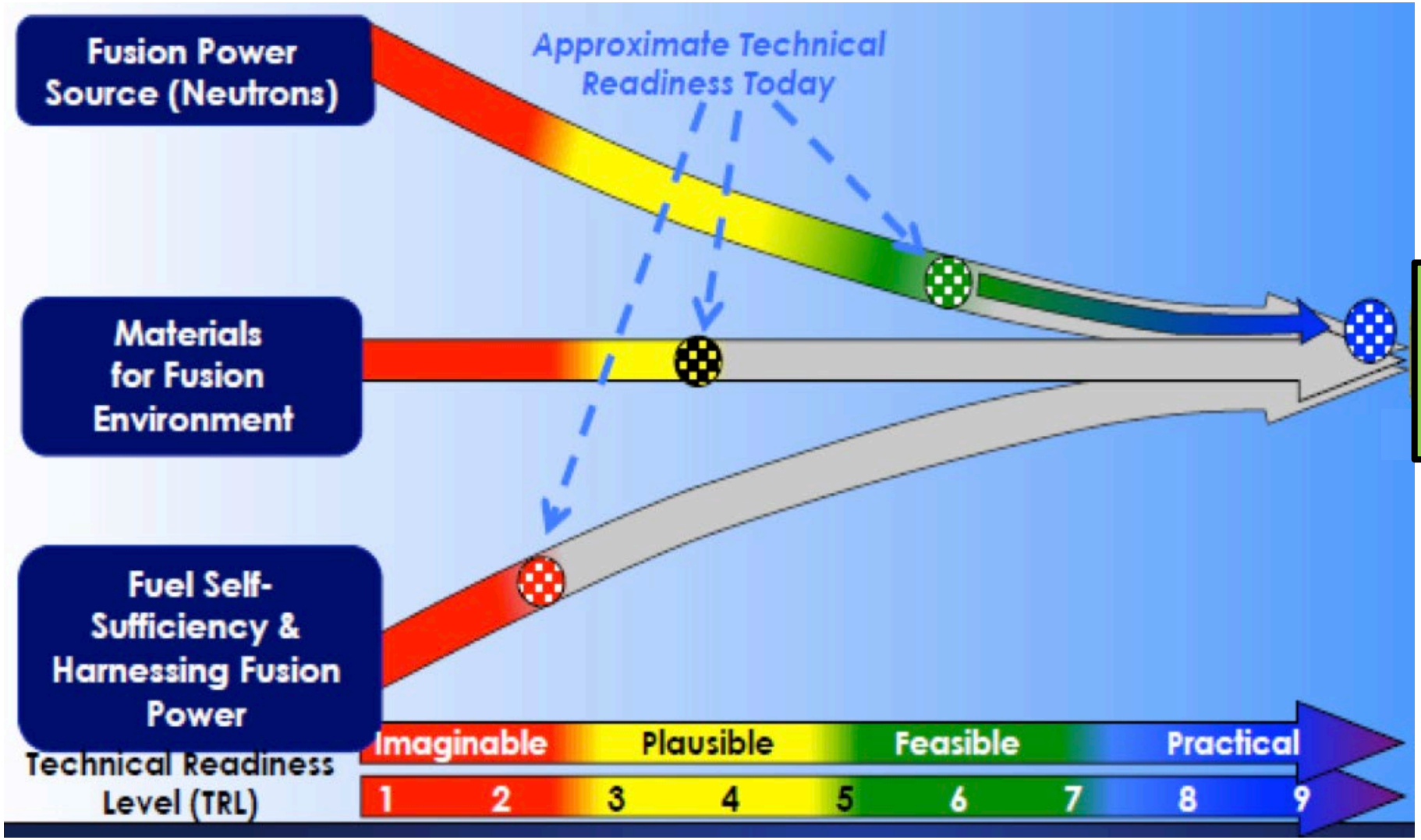
Potential benefits:

- Firm, on-demand, no carbon emissions
- Globally scalable
- Low land use
- Site in or near cities
- No risk of "meltdown"
- No long-lived radioactive waste

Potential safety considerations:

- Containment of mildly radioactive tritium
- Disposition of short-lived, neutron-activated structural materials
- Conventional risks of any large industrial facility

Continued R&D is needed to achieve sufficient energy gain and to develop and demonstrate the many required enabling materials/technologies



†As defined in the 2021 NASEM report *Bringing Fusion to the U.S. Grid*, i.e., >50 MWe net electricity for >3 continuous hours with timely path to 1 full-power year; on the path to commercial viability.
Figure adapted from presentation by M. Wade at APS-DPP community planning workshop (2019).

Different fusion approaches

Magnetic confinement fusion (MCF)

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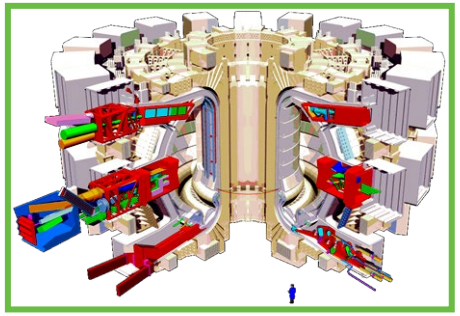
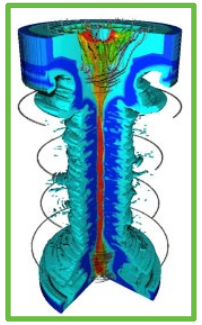
china eu india japan korea russia usa



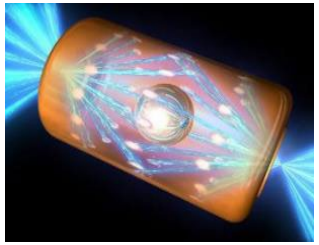
Companies: e.g., Commonwealth Fusion Systems, Tokamak Energy, Type One, TAE Technologies

Magneto-inertial fusion (MIF)



Companies: e.g., General Fusion, Helion, Zap

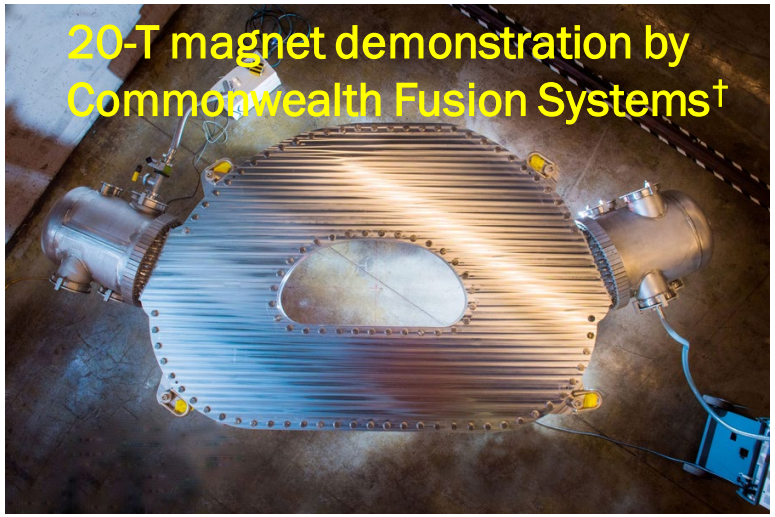
Inertial confinement fusion (ICF)

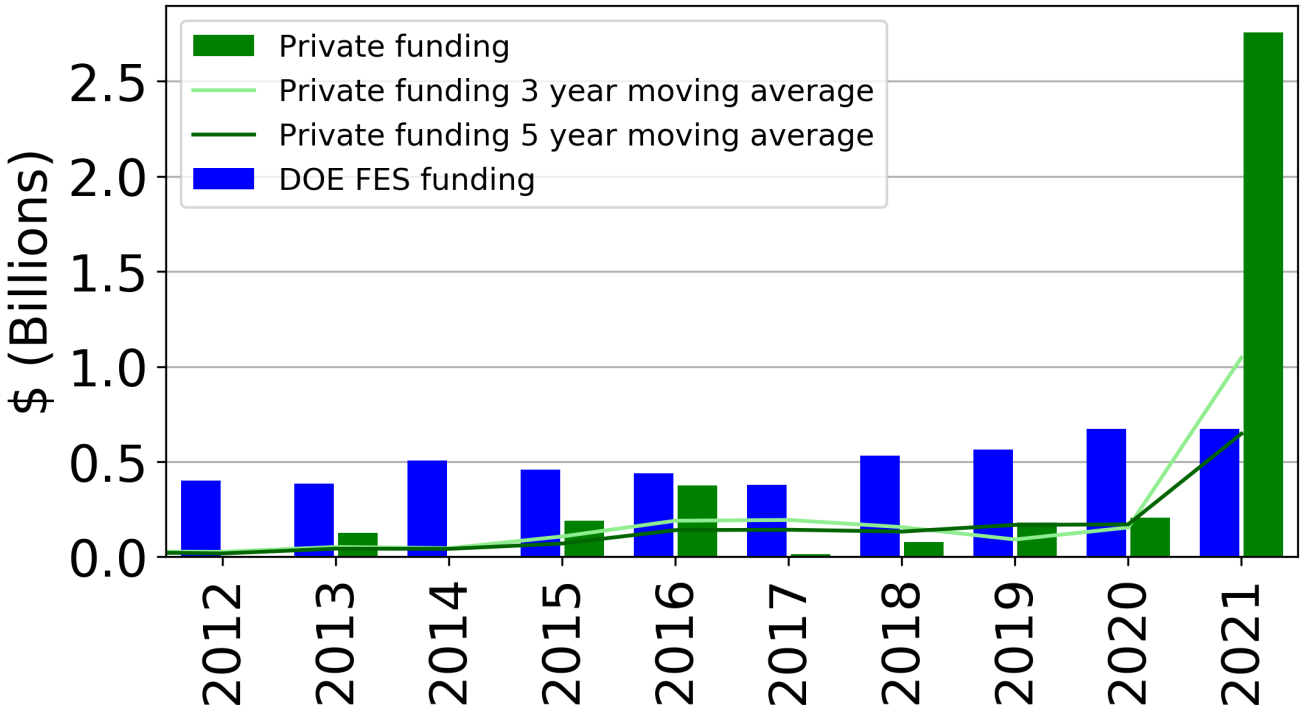


Companies: e.g., Focused Energy, Xcimer, Marvel Fusion

For a 12-minute, light technical overview of fusion approaches, see video starting at 59 minutes here: https://www.youtube.com/watch?v=aRUnNgfqSIM).

Increasing technical readiness and market pull warrant a new U.S. strategy for fusion research, development, and demonstration





Growth of private-sector fusion investments
Figure credit: Sam Wurzel, ARPA-E

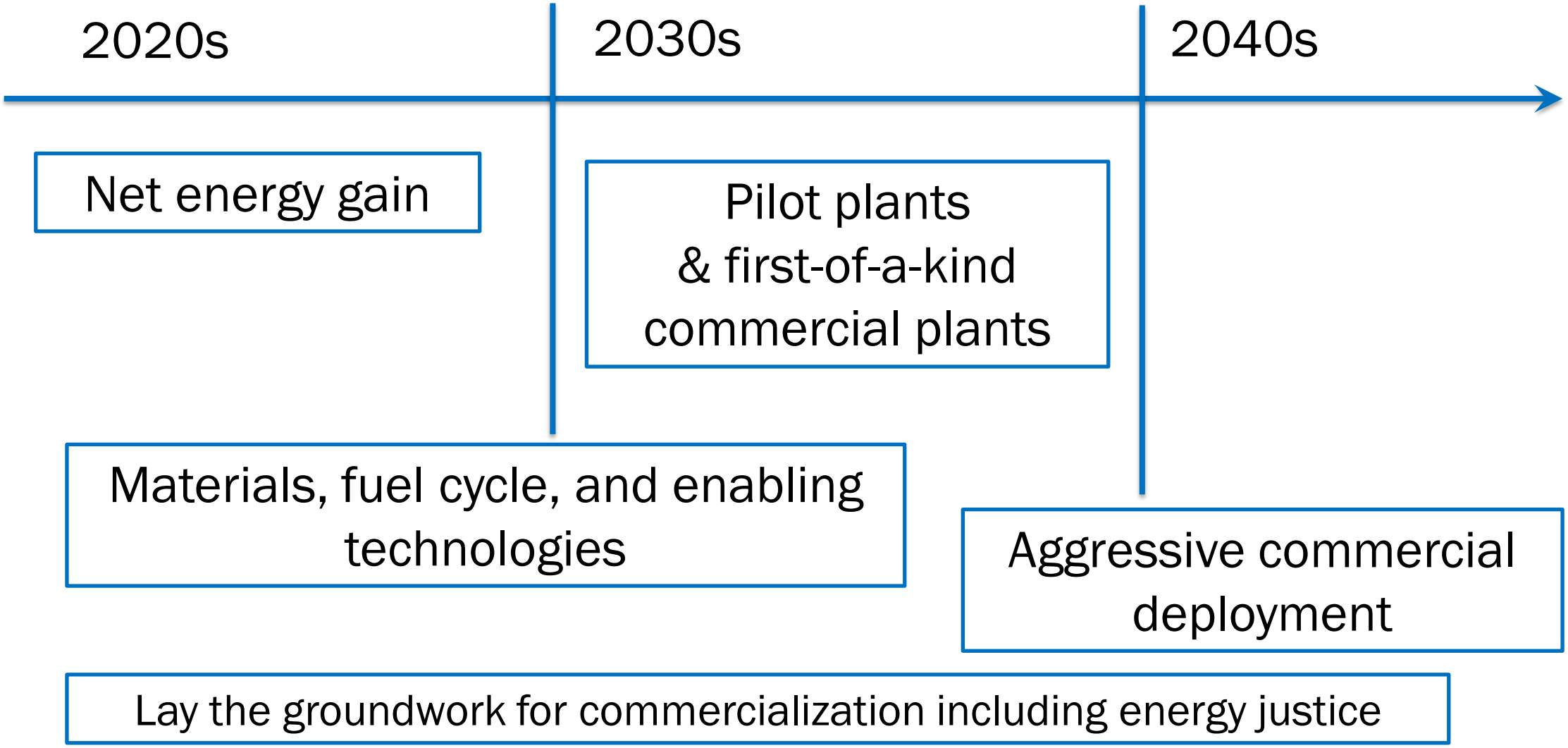
*https://www.llnl.gov/news/national-ignition-facility-experiment-puts-researchers-threshold-fusion-ignition

†https://news.mit.edu/2021/MIT-CFS-major-advance-toward-fusion-energy-0908

White House fusion summit in March 2022 signaled U.S. ambition to develop a bold decadal vision to enable commercial fusion energy

https://www.whitehouse.gov/ostp/news-updates/2022/04/19/readout-of-the-white-house-summit-on-developing-a-bold-decadal-vision-for-commercial-fusion-energy/

With adequate resources, the *Bold Decadal Vision* seeks to enable:



Regulatory framework for commercial fusion is expected to be finalized by 2027 or sooner

- Nuclear Regulatory Commission (NRC) has been holding a series of public forums since 2020 to gather stakeholder input
  - https://www.nrc.gov/reactors/new-reactors/advanced/policy-development/fusion-energy.html
- Draft position paper recently released (available at link above)
- Two of the three identified options would regulate fusion fundamentally differently than nuclear fission plants

DOE recently launched a new program to partner with the growing fusion private sector to accelerate RD&D toward a fusion pilot plant

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

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