

generalfusion

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# GENERAL FUSION

FPA

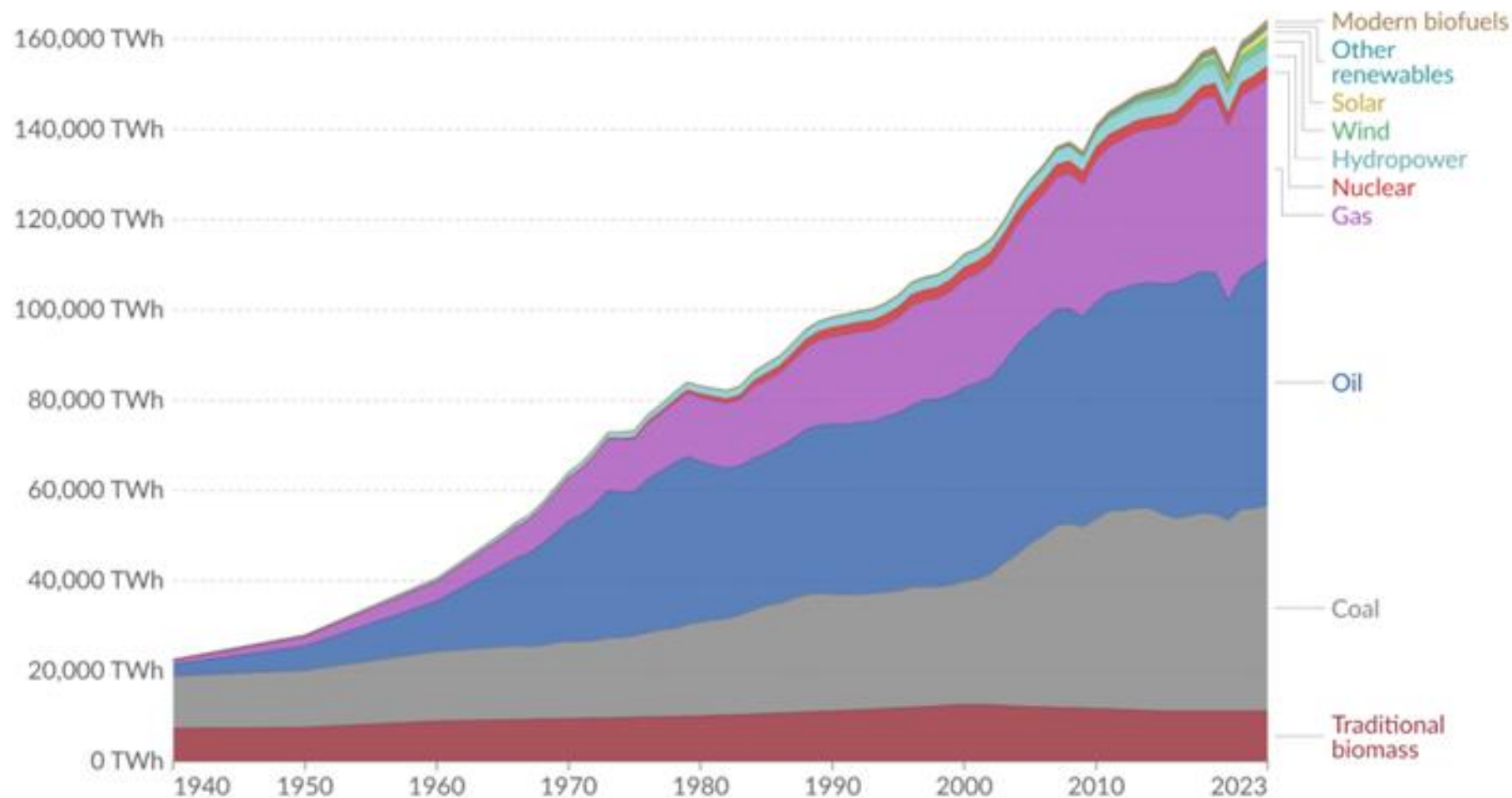
DECEMBER 2024

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# Global direct primary energy consumption

Our World  
in Data

Energy consumption is measured in terawatt-hours<sup>1</sup>, in terms of direct primary energy<sup>2</sup>. This means that fossil fuels include the energy lost due to inefficiencies in energy production.

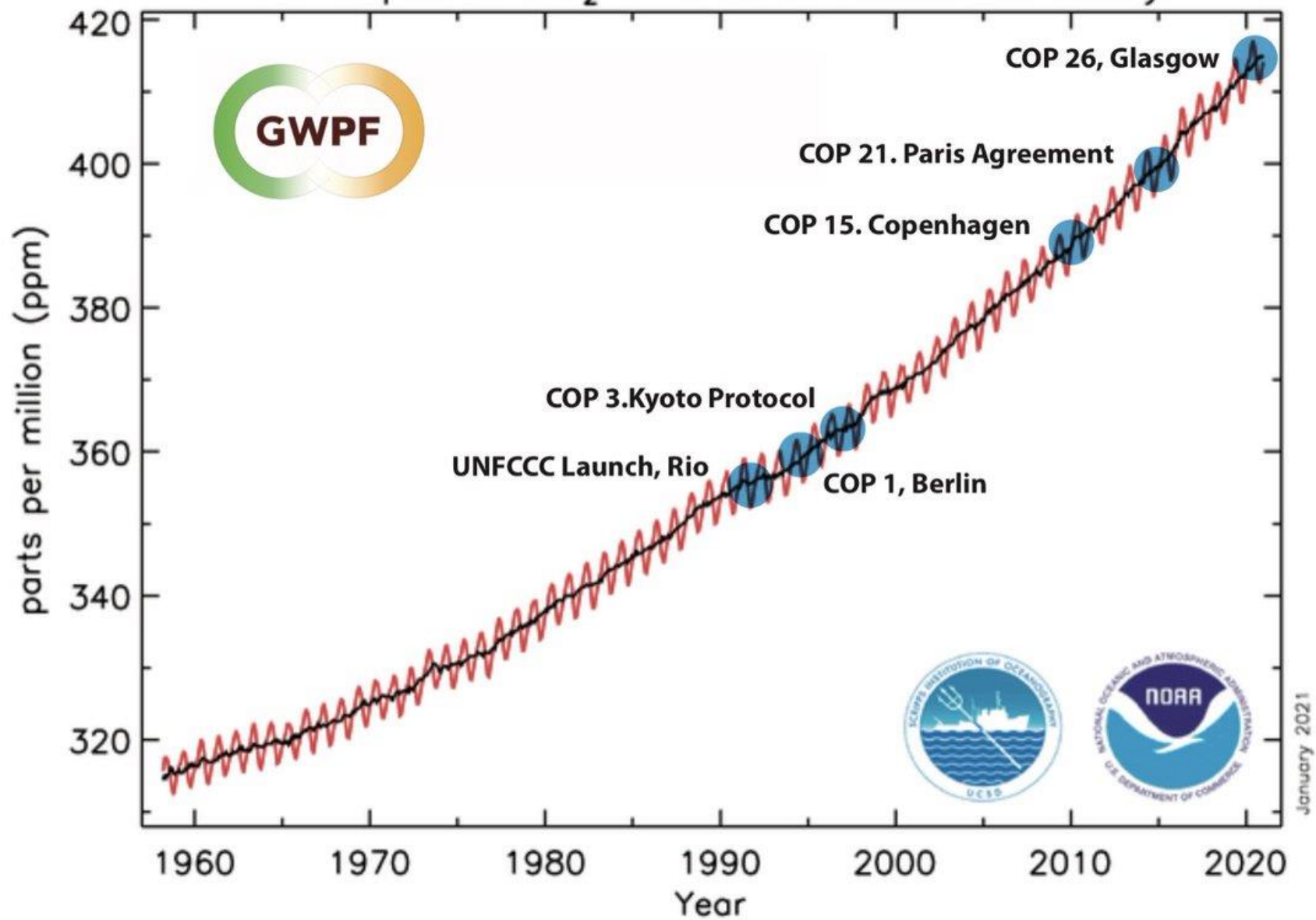


Data source: Energy Institute - Statistical Review of World Energy (2024); Smil (2017)

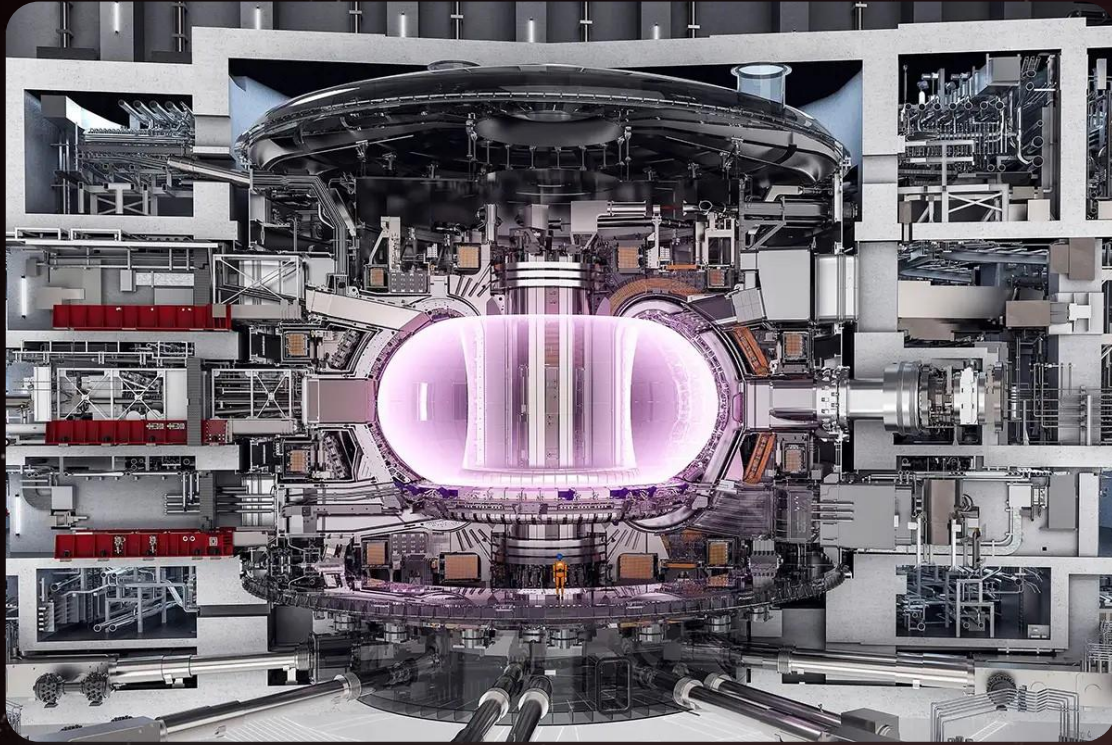
OurWorldInData.org/energy | CC BY

Note: In the absence of more recent data, traditional biomass is assumed constant since 2015.

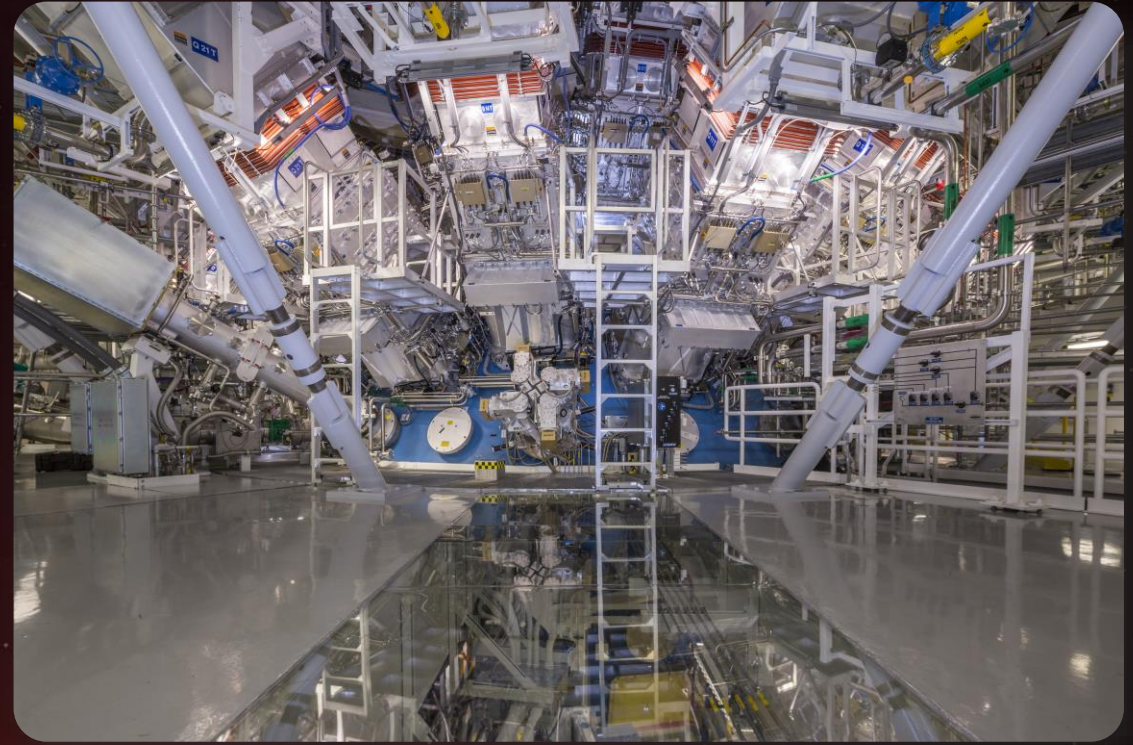
# Atmospheric CO<sub>2</sub> at Mauna Loa Observatory



# Conventional Academic Research Programs Put Electricity on the Grid Too Late



Source: ITER



Source: National Ignition Facility

- These experimental devices produced good scientific results
- But they were not designed to become a practical power plant

# Problems with traditional fusion

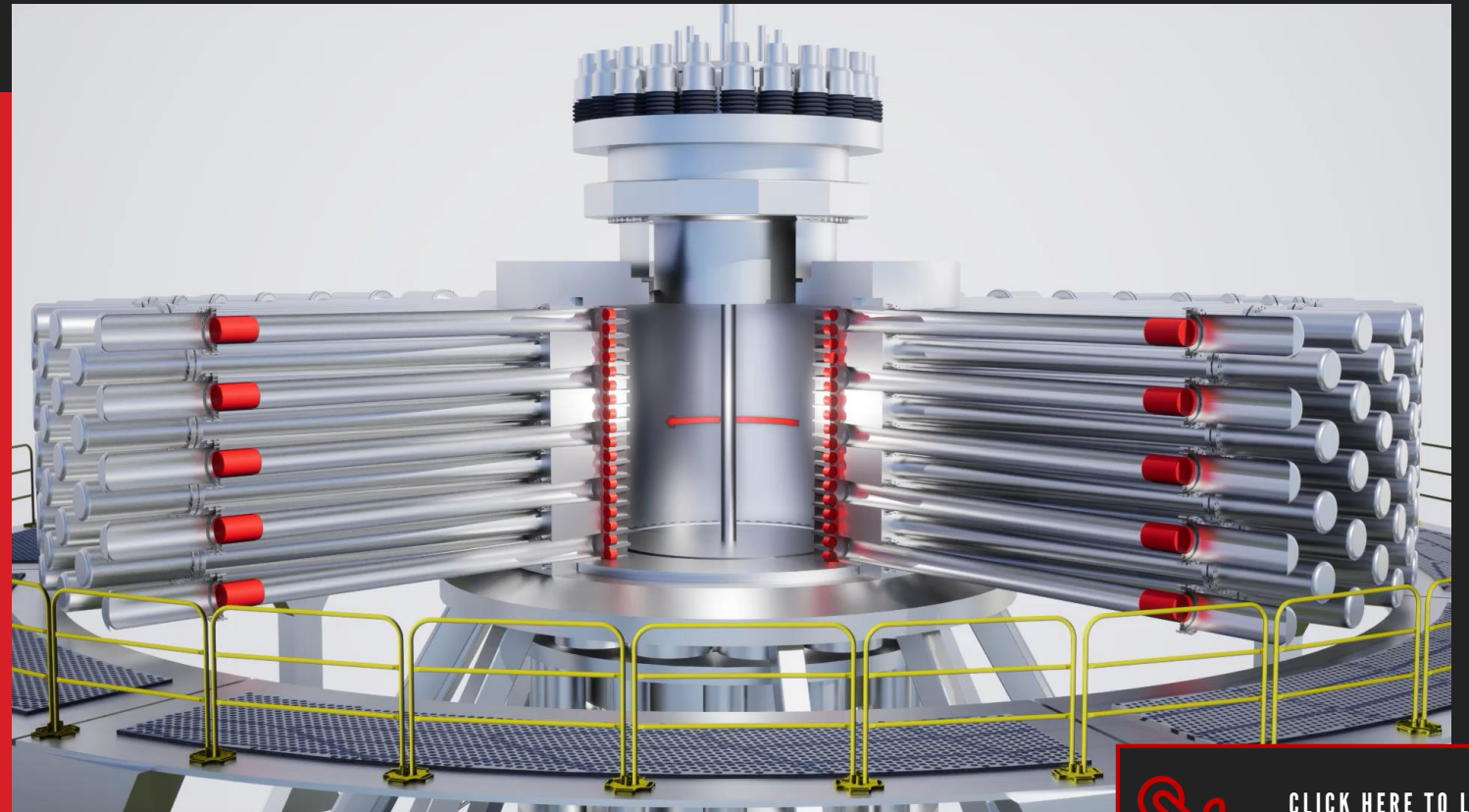
- Neutron damage
- High heat load on divertor/limiter
- HTC makes these two problems worse
- Robots to change the first wall
- Low tritium breeding ratio, enriched Li6 is expensive
- Complicated blankets to extract thermal energy
- High cost
- PB11 to avoid these is much harder than DT
- DHe3 is a bit harder but hard to find He3

# Solution: liquid first wall

- Thick, high coverage liquid protects the wall
- Good tritium breeding ratio
- Straightforward energy extraction
- Handles the high heat load
- Difficult to implement in traditional systems because of numerous apertures

# GENERAL FUSION'S MAGNETIZED TARGET FUSION TECHNOLOGY

**THE FUSION EQUIVALENT  
OF A DIESEL ENGINE:  
PRACTICAL, DURABLE  
AND COST-EFFECTIVE**

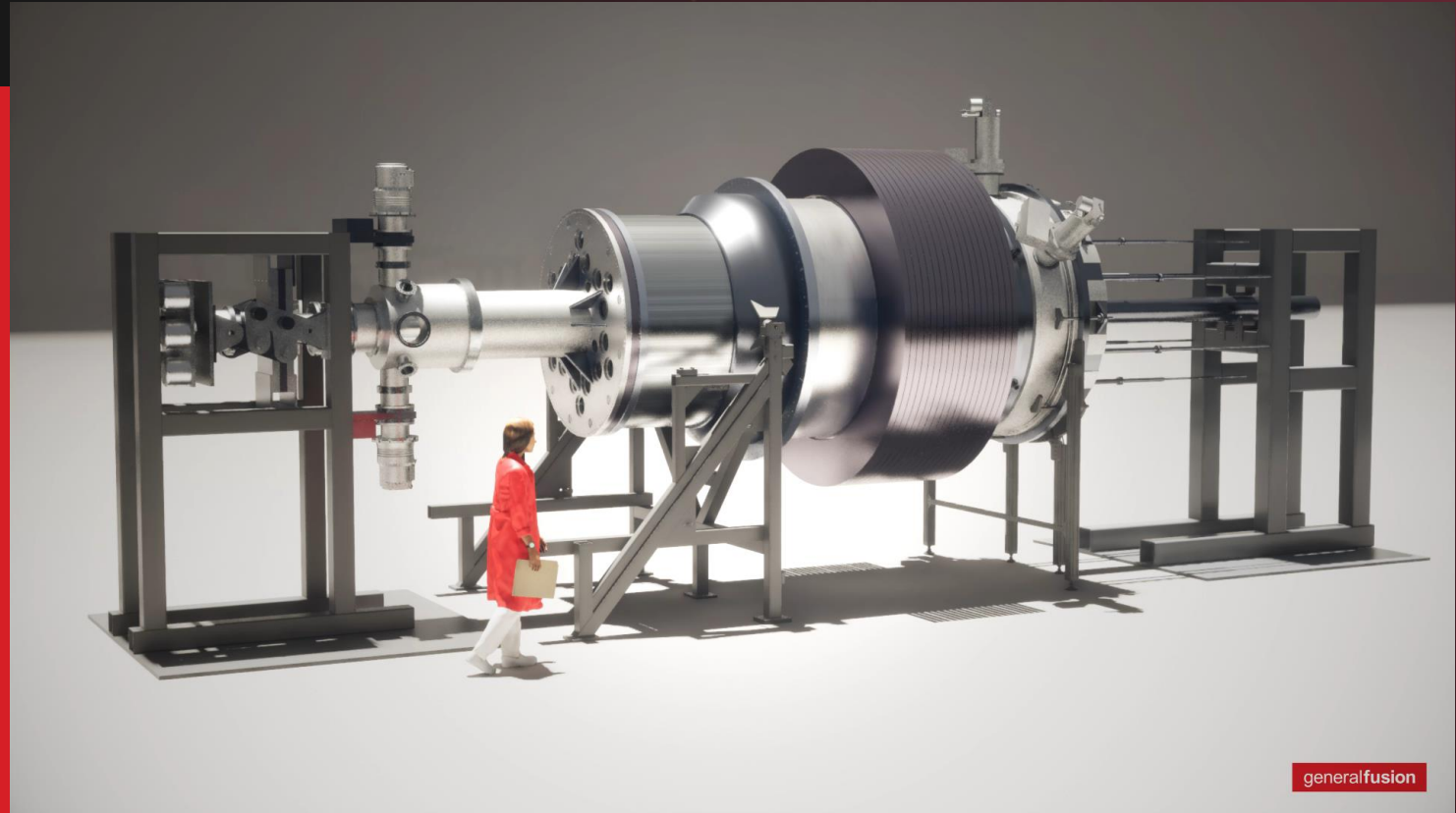


**CLICK HERE TO LEARN  
MORE ABOUT OUR  
FUSION TECHNOLOGY**

# LAWSON MACHINE 26 ("LM26")

## ON THE PATH TO TRANSFORMATIVE TECHNICAL MILESTONES

- 1 keV
- 10 keV
- Scientific Breakeven (100% Lawson)





## PI3 spherical tokamak

Density:  $5e19 \text{ m}^{-3}$

Temperature: 350 eV

Energy confinement time: 10 ms

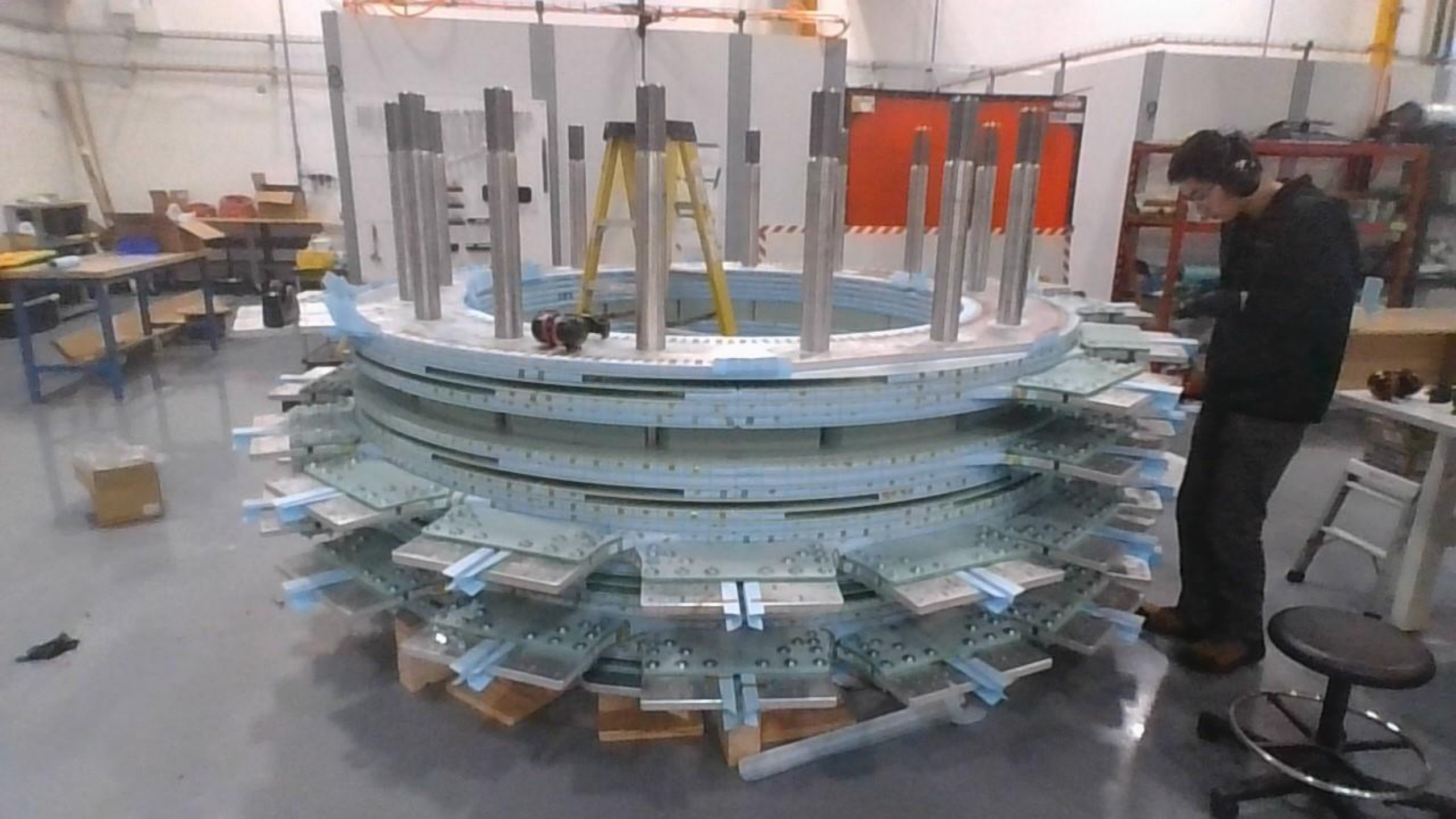
Flux conserver diameter: 2 m

Shaft diameter: 0.2 m

Plasma current: 400 kA



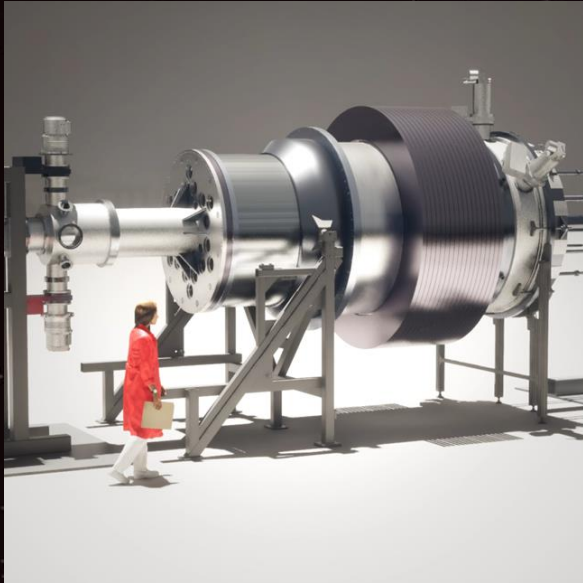




# LM26

- 3 ms compression time
- 2:1 radial compression ratio to 1 keV spring 2025
  - Density  $\sim 8 \times 5e19 \text{ m}^{-3} = 4e20 \text{ m}^{-3}$
  - Temperature 1keV
- 10:1 to 10 keV end of 2025
  - Density  $5e22 \text{ m}^{-3}$
  - Temperature 10 keV
- Increase density of PI3 to  $5e20 \text{ m}^{-3}$ , same as SPECTOR (40 cm diameter)  
more capacitors
- 12:1 to Lawson criteria by end of 2026
  - Density  $9e23 \text{ m}^{-3}$
  - Temperature 20 keV
  - Energy confinement time  $\sim 50 \text{ us}$
  - $nT\tau \sim 1e21 \text{ m}^{-3} \text{ keV s}$

# PATH TO POWER



2023-2026: LM26

- Reach 1 keV
- Reach 10 keV
- Breakeven equivalent (100% Lawson)



~2030: COMMERCIAL SCALE MACHINE

- Demonstrate full scale machine with liquid compression system



MID 2030's: FIRST-OF-A-KIND COMMERCIAL PILOT PLANT

- Electricity on the grid

# Is the short timeline reasonable?

- Liquid metal solves many of the hard, long to solve problems
- Machine is smaller (150 MW<sub>e</sub>)
- No difficult technologies (superconductors, lasers, neutral beams, RF power, etc.)
- Tritium processing is still required, this could be a problem
- Fusion yield at very high energy density (~100 T) estimated from scaling laws is unproven. LM26 will remedy this
- Much better power plant prospect after that

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