



**UKAEA**  
**The path to delivering  
fusion power**

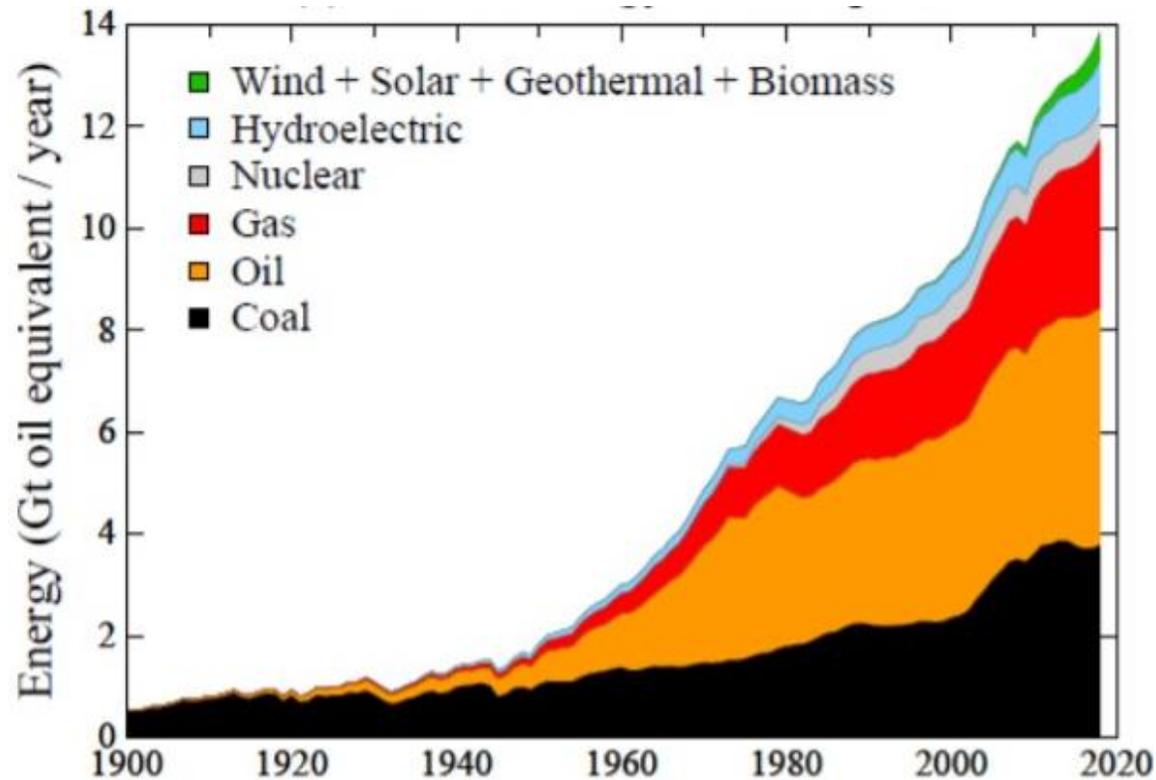
**Ian Chapman**

# Burning fossil fuels kills millions of people every year

Vohra et al, Environmental Research 2021, 8.7 million deaths, nearly one in five  
Global Burden of Disease Study, Lancet 2020, 4.2 million deaths

# What does net zero mean for the world's energy use?

Globally, we burn ~50% more fossil fuels now than we did in 2000



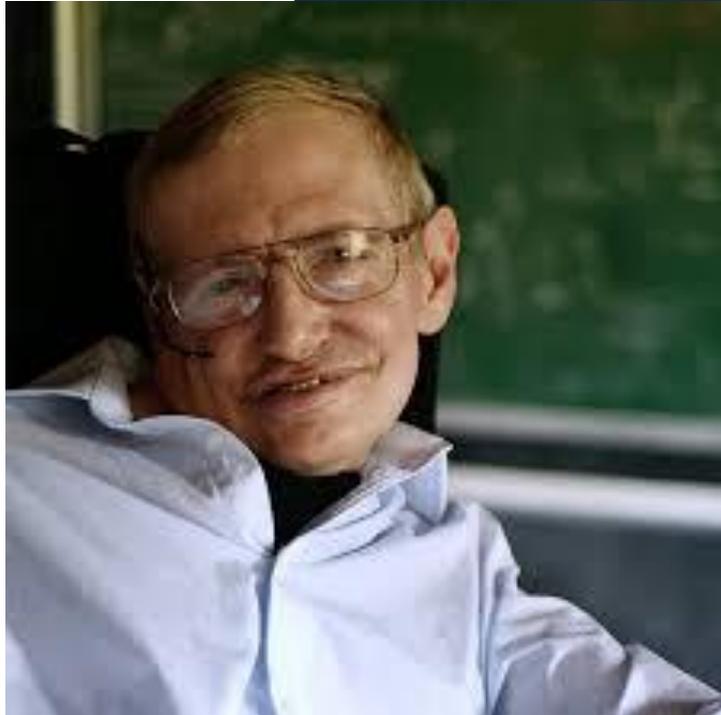
~11,000 days to 2050; ~11,000 Mtoe to displace\*

This is equivalent to one nuclear power station per day, or the largest offshore wind farm in the world per day, every day, for 30 years

Needs ~£10Bn per day, which is ~4% global GDP



\* assuming all growth in demand comes from carbon-free sources



Q: What world-changing idea, small or big, would you like to see implemented by humanity?

**A: This is easy. I would like to see the development of fusion power to give an unlimited supply of clean energy**



**Stephen Hawking, 'Brief Answers to the Big Questions', 2018**

# Fusion is now in the 'delivery era'



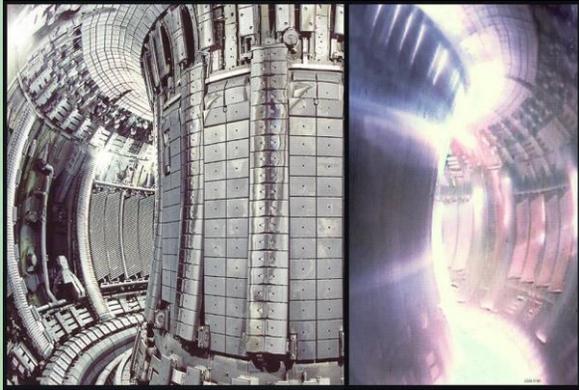
10x power gain  
Complete in 2025

# Government is backing fusion development

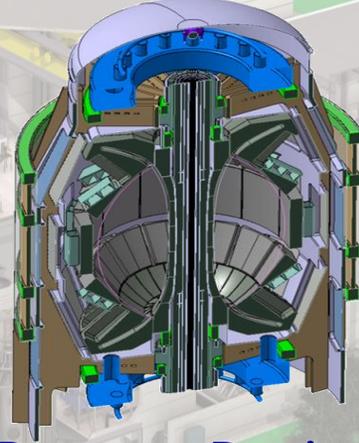
“The UK is a world leader in the most promising fusion technologies with research capabilities across the technical challenges of fusion. The government has already committed over £400 million towards new UK fusion programmes. The aims are to develop a concept design for the Spherical Tokamak for Energy Production (STEP) – expected to be the world’s first compact fusion power plant, to be built in the UK by 2040 – and to invest in facilities and infrastructure to make the UK a global fusion industry hub.”



# Fusion needs integrated solutions



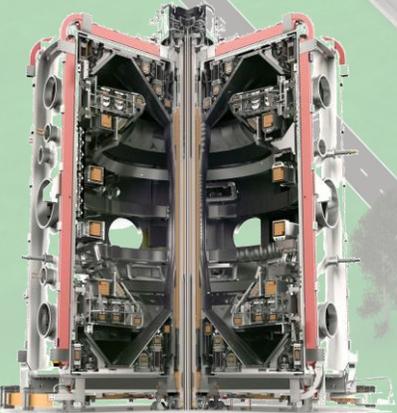
High performance plasmas in JET



Reactor Design STEP and DEMO



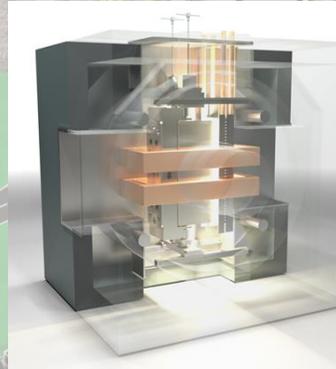
Advanced computing and digital design



Heat exhaust in MAST Upgrade



Develop materials in Materials Research Facility (MRF)



Test components in Fusion Technology Test Facilities (FTF)

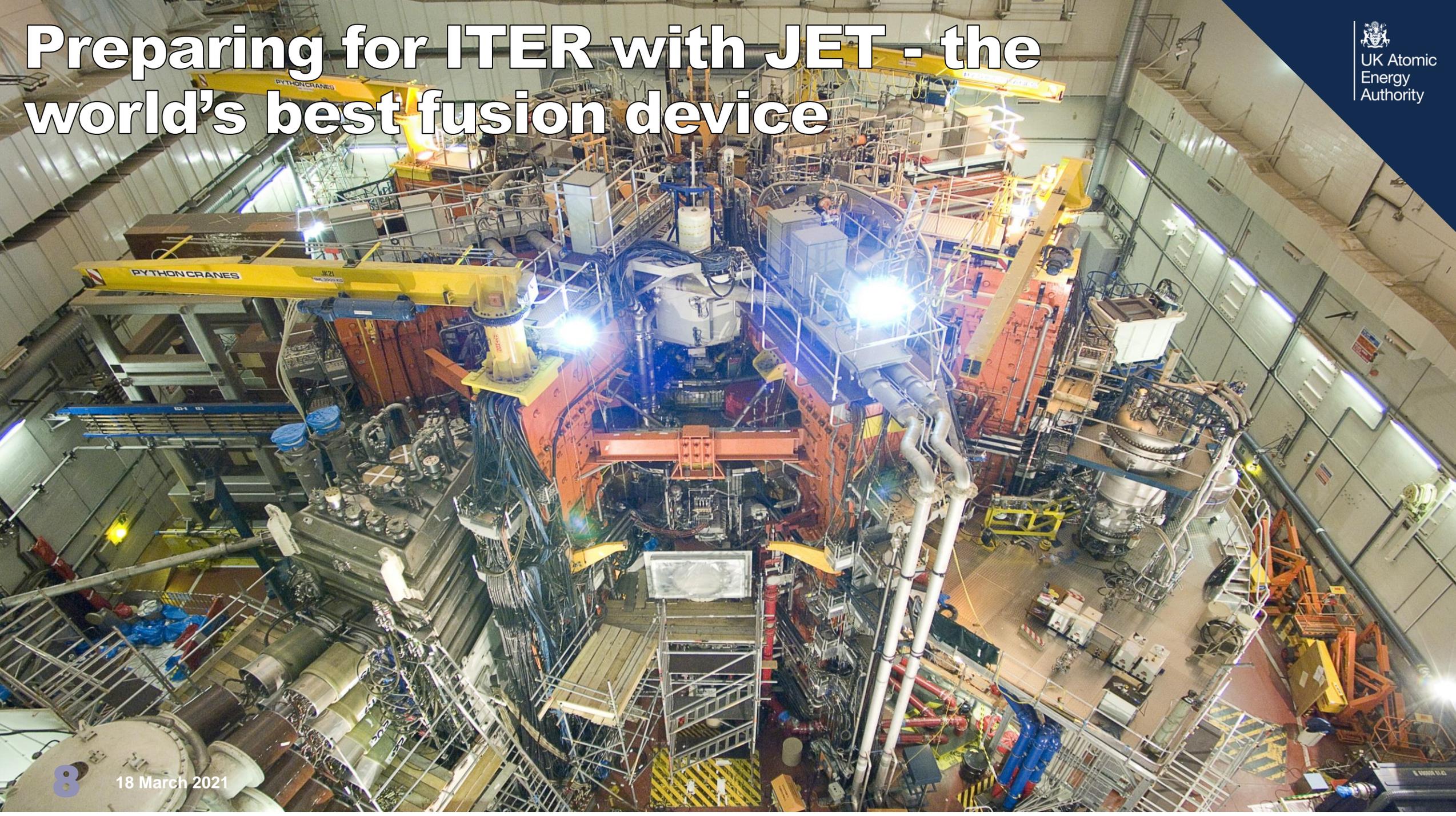


Tritium handling in Hydrogen-3 Advanced Technology (H3AT)



Robotic handling in RACE

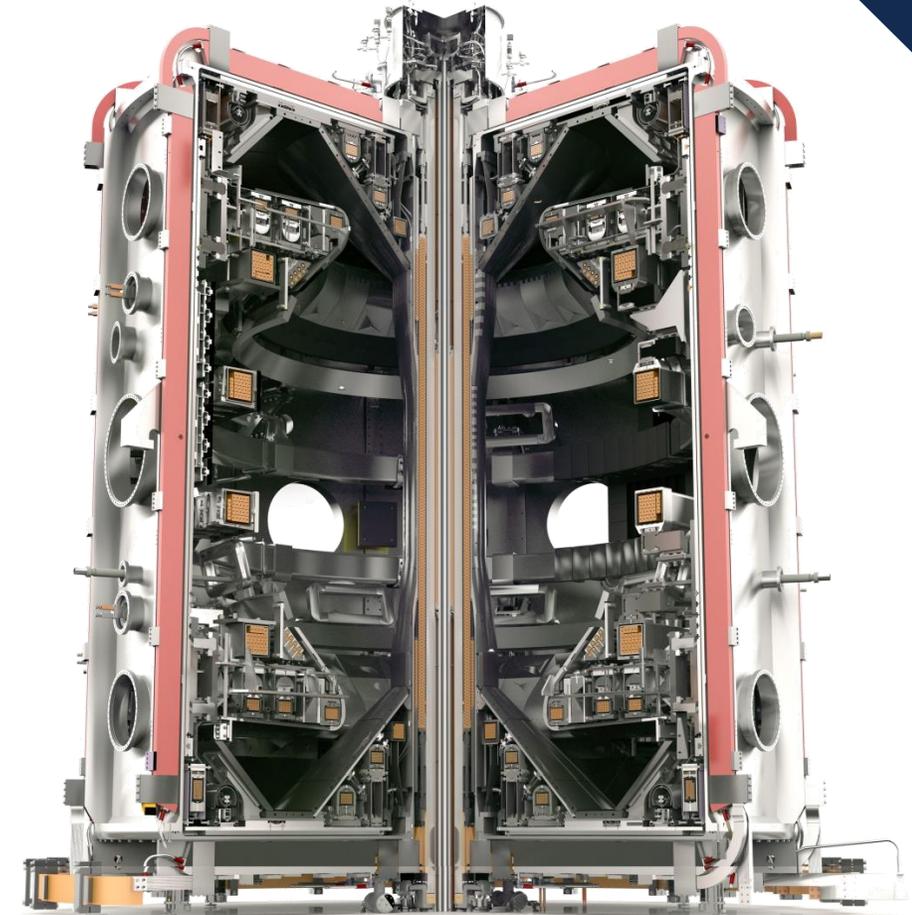
# Preparing for ITER with JET - the world's best fusion device



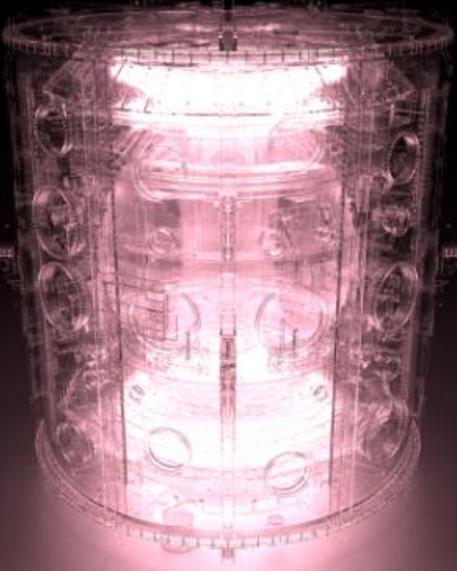
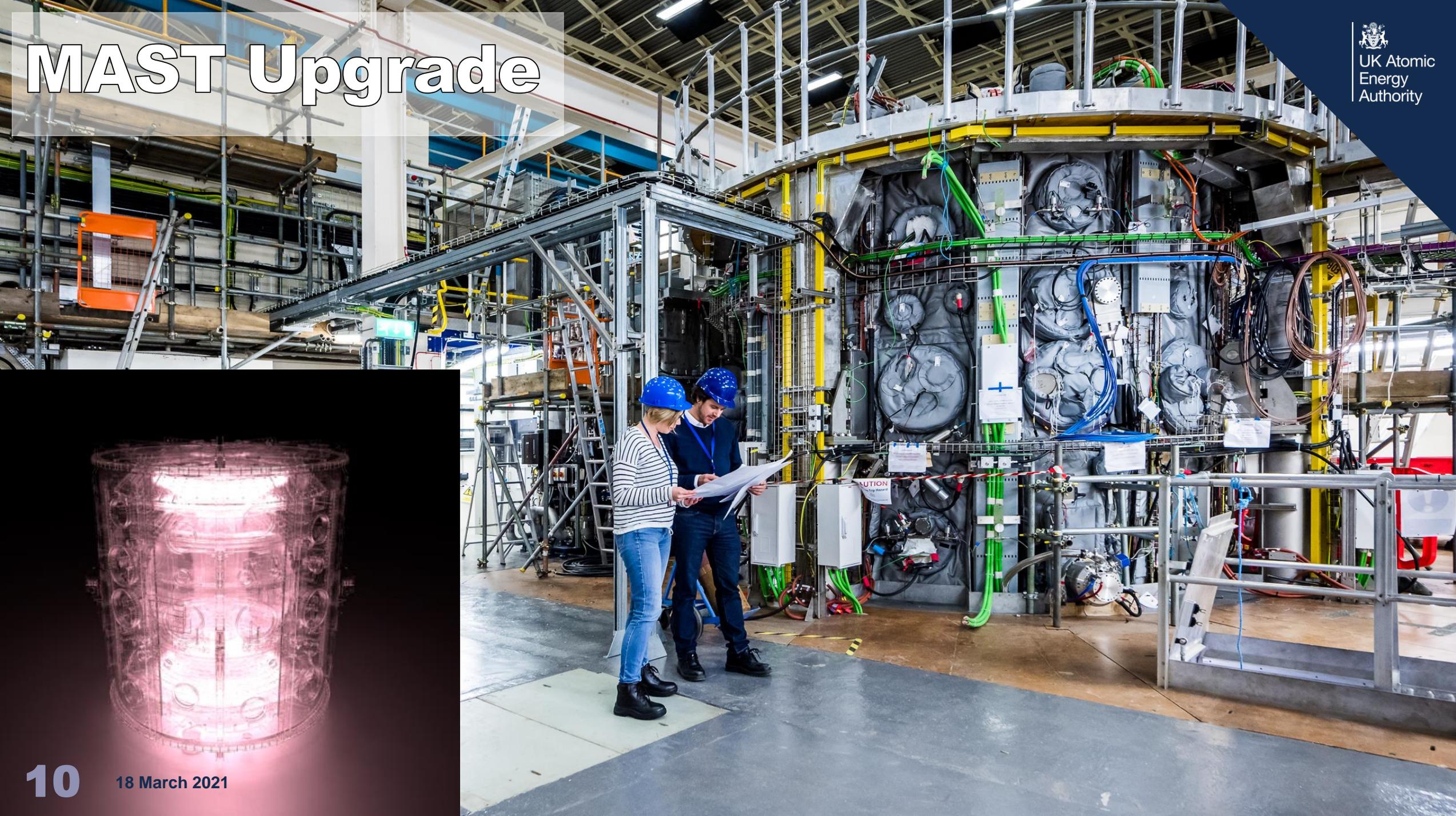
# The spherical tokamak

Make much more efficient use of the magnetic field, which enables a smaller device. This helps drive down the cost on the two most expensive parts of the plant: the magnets and the buildings

A big challenge surrounds how to exhaust the heat. We will test this in our new £50M device by the Summer

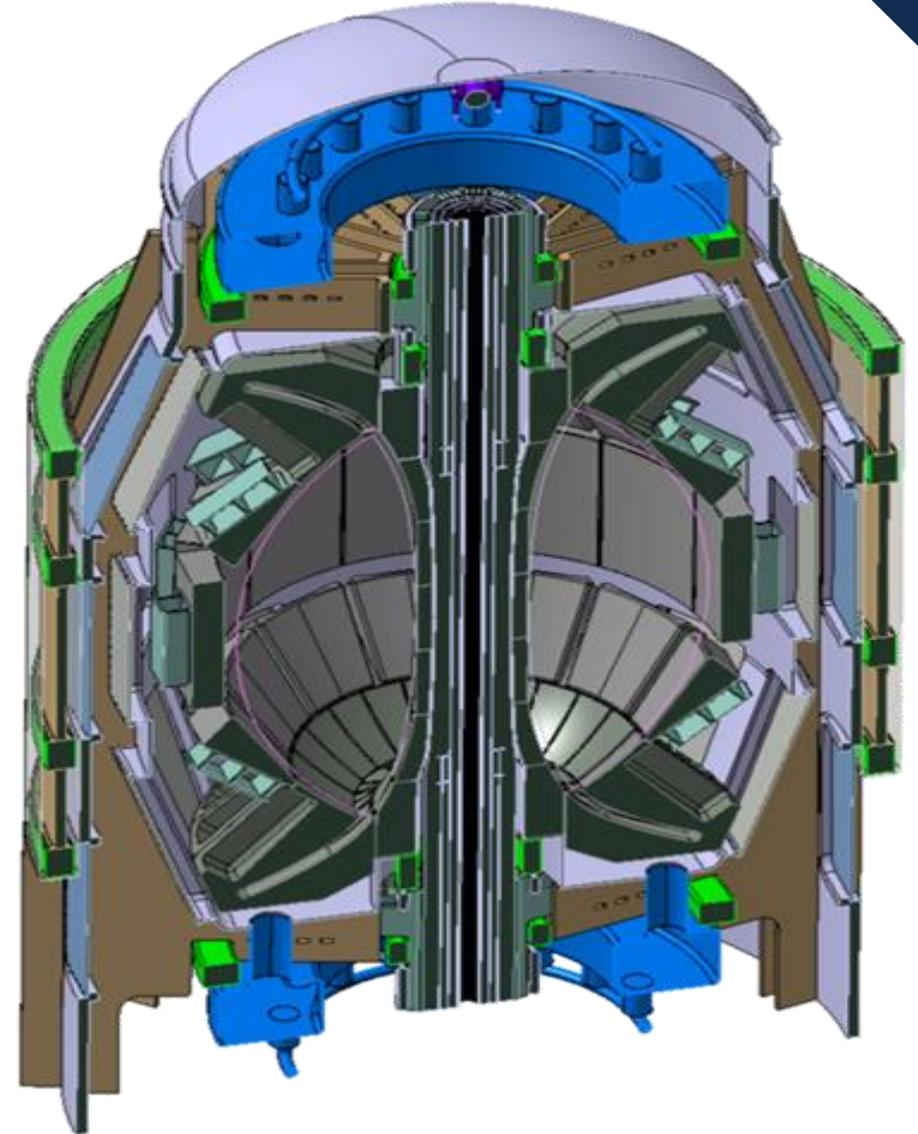


# MAST Upgrade

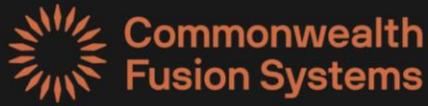


# Spherical Tokamak for Energy Production (STEP)

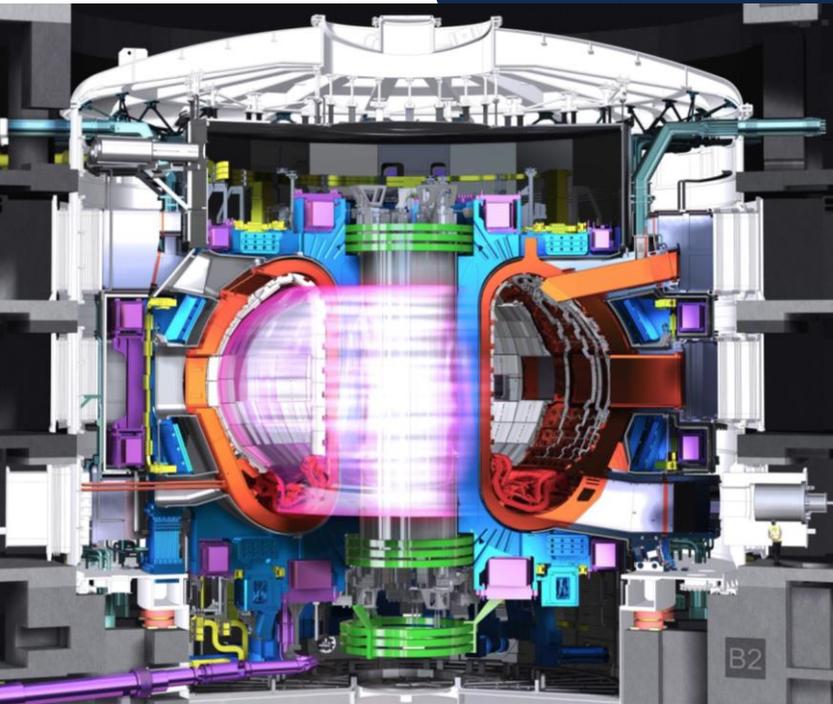
- Predictable net electricity production
- Lower capital cost than other fusion reactor designs
- £220M investment by UK Government



# Increasing investor appetite supporting many private firms



# The STEP to delivering fusion



- Strong international partnerships for JET, ITER and EUROfusion
- An ambitious domestic plan with major technology facilities supporting STEP
- A vibrant private sector supported by UKAEA facilities, training & colocation of industry at the Culham campus