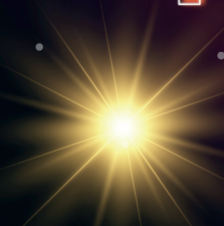
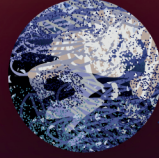


# FUSION ENERGY



Fusion takes place in the heart of stars like our sun and provides the power that drives the universe.



Scientists and engineers all over the world are developing the technology to recreate this process on earth to create a new source of sustainable energy.

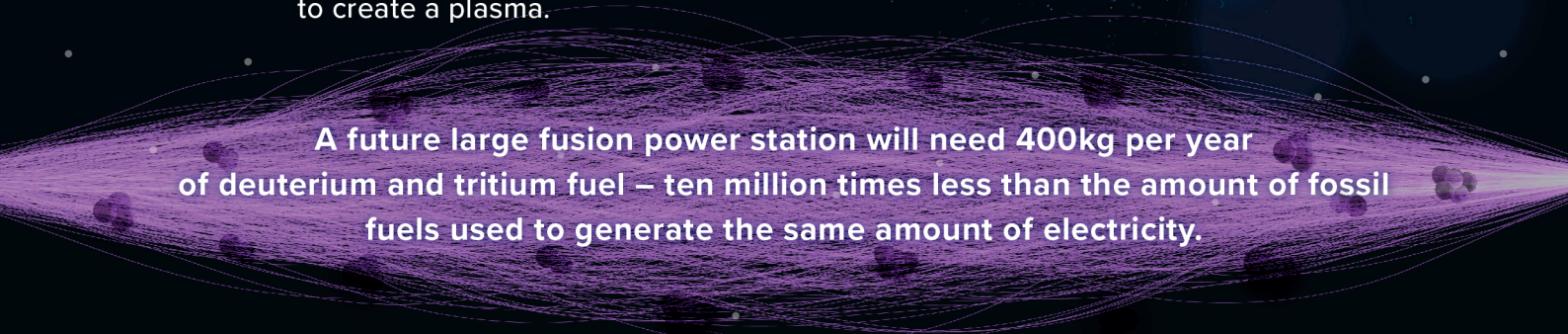
## HOW DOES IT WORK?



A combination of hydrogen gases, deuterium and tritium, are heated to very high temperatures to create a plasma.



Energy is released when deuterium and tritium atoms fuse together to form a helium atom and a neutron.



A future large fusion power station will need 400kg per year of deuterium and tritium fuel – ten million times less than the amount of fossil fuels used to generate the same amount of electricity.

## WHAT NEXT?

Many organisations worldwide are now actively designing powerplants to bring fusion to the power grid.



## FUSION ENERGY

Part of the world's future sustainable energy supply.



Efficient



Low carbon



Safe



Abundant



This work has been carried out within the framework of the EUROfusion Consortium, funded by the European Union via the Euratom Research and Training Programme (Grant Agreement No 101052200 – EUROfusion). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the European Commission can be held responsible for them.



# THE TOKAMAK



There are many approaches to making fusion happen on earth. The most developed is the 'tokamak', which uses powerful magnetic fields to confine a fusion plasma.

## HOW DOES IT WORK?

### FUSION FUELS

Fusion gases – deuterium and tritium – are injected into the vacuum vessel.

### THE PLASMA

The fuel is heated to around 150 million degrees Celsius, and changes from a gas into a plasma.

### VACUUM VESSEL

A ring-shaped vacuum vessel is used to contain the plasma.

### MAGNETIC FIELDS

Magnet coils create fields that hold and shape the plasma, keeping it away from the chamber walls.

### PLASMA EXHAUST

The plasma exhaust removes the fusion-produced helium from the chamber.

### MEASUREMENT SYSTEMS

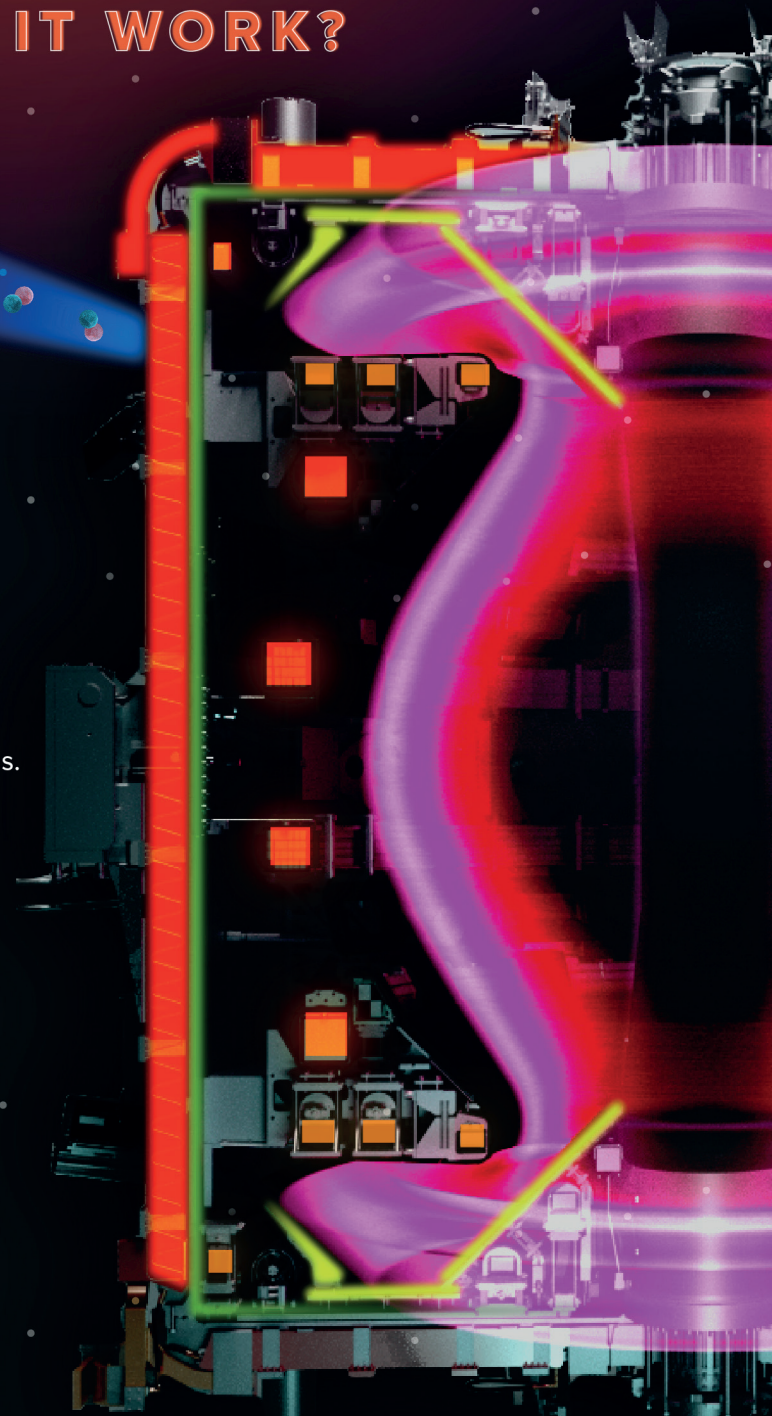
Systems measure and monitor properties including plasma density and temperature.

### HEATING SYSTEMS

Systems heat the plasma using an electrical current, powerful particle beams and radio waves.

### ENERGY

Energy is released when two atoms fuse together into a new, heavier atom. A plasma with millions of these fusion reactions happening every second will generate a huge amount of energy from less than a gram of fusion fuel.



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# WHY IS THE WORLD INVESTING IN FUSION ENERGY?



## LOW CARBON

- ✓ By 2040 the planet is predicted to be using twice as much electricity
- ✓ Fusion can provide reliable, continuous electricity with no greenhouse gas emissions



## ABUNDANT

- ✓ Fusion fuel reserves will last for many tens of thousands of years
- ✓ Deuterium is extracted from small amounts of water
- ✓ Tritium will be produced inside fusion machines from lithium which is abundant on earth



## SAFE

- ✓ The challenge of fusion is sustaining, not containing, a reaction
- ✓ Unlike traditional nuclear fission, fusion cannot produce runaway chain reactions
- ✓ Irradiated machine parts can be processed using technology already used successfully around the world



## EFFICIENT

- ✓ A few hundred kgs of fusion fuel could power a large powerplant for a whole year
- ✓ The deuterium in a bathtub of water when fused with tritium will provide all energy use for one person for 60 years



## INNOVATIVE

- ✓ Uses in aviation, elder-care, environmental clean-up and medical diagnosis
- ✓ Spin off technology sectors include advanced computing, materials research and robotics
- ✓ Bringing economic benefit, jobs and skills to markets around the world



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