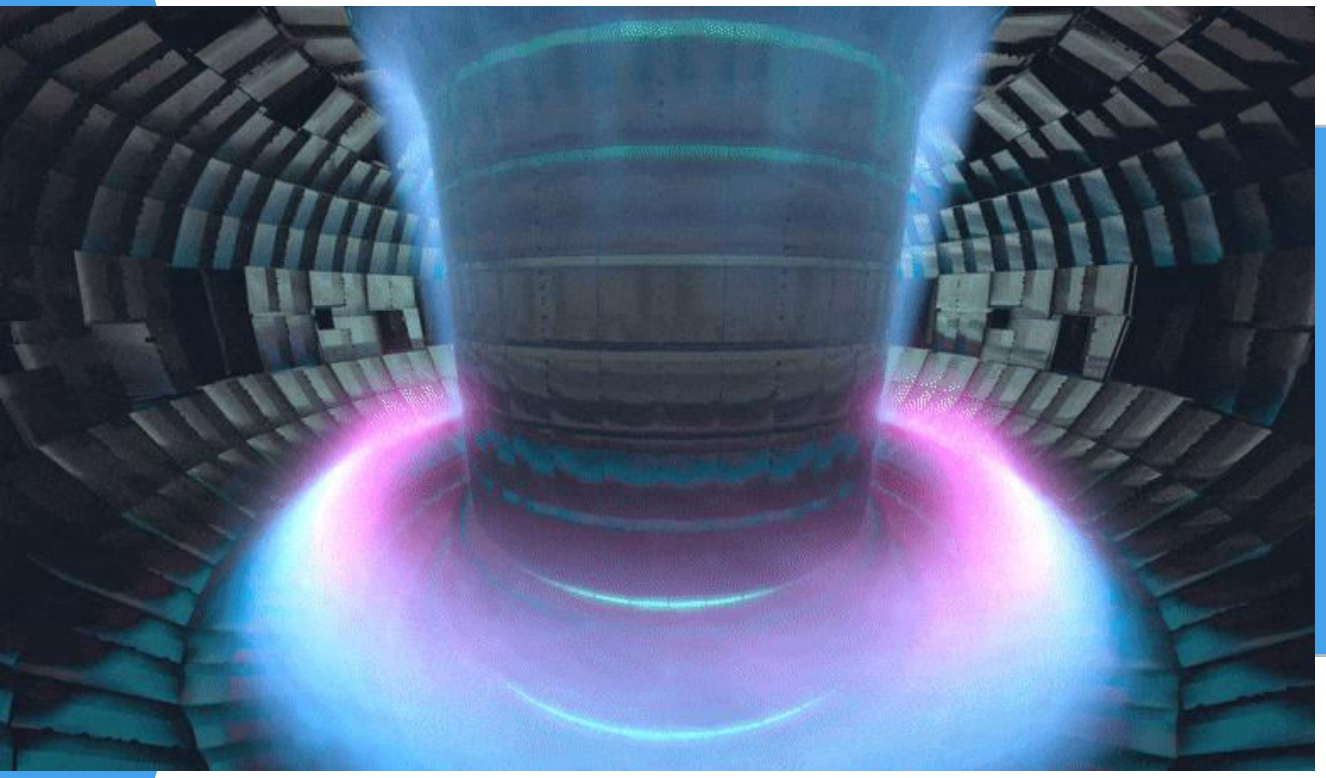


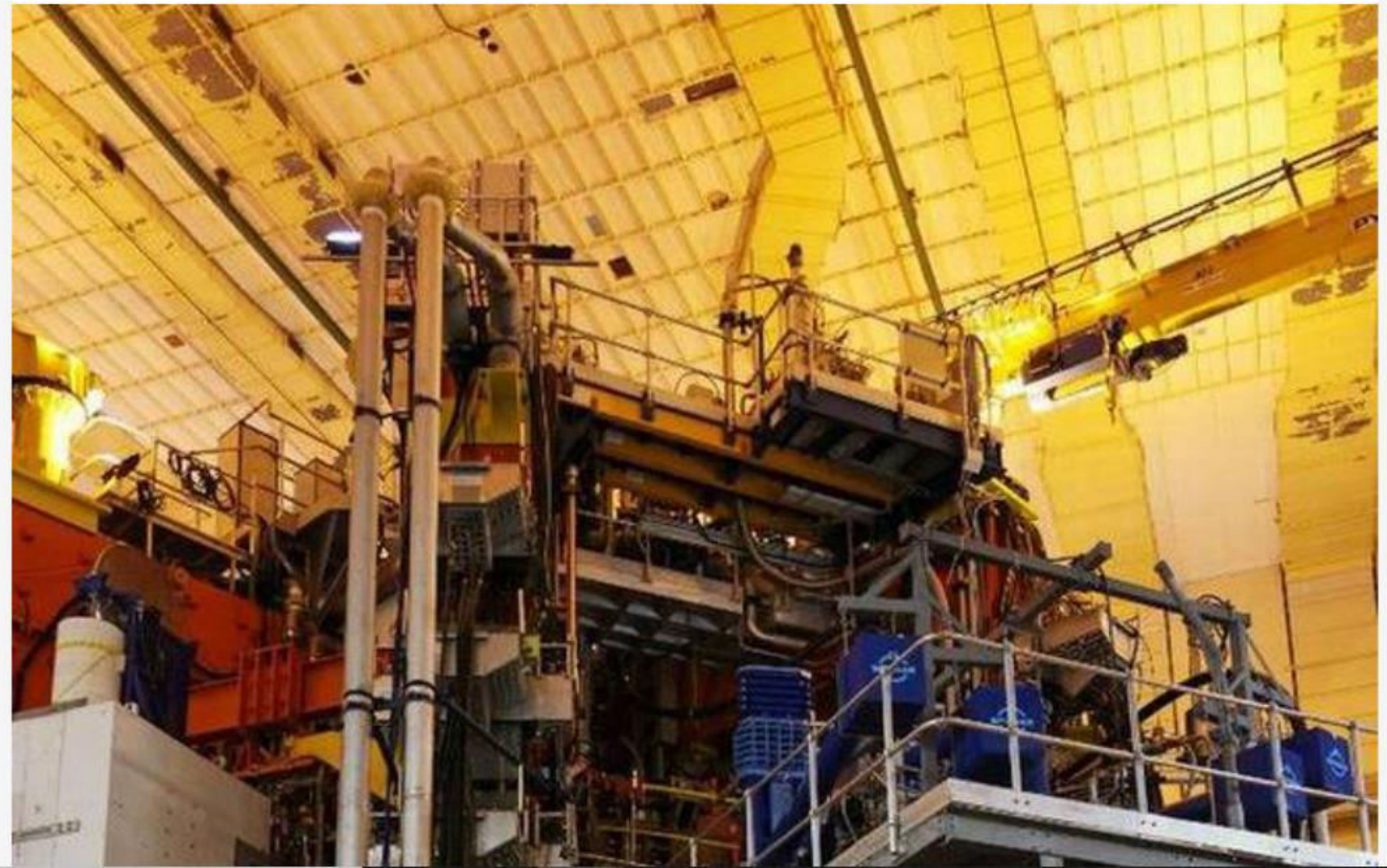
11 MW in 5 seconds, Major breakthrough on nuclear fusion energy

- By Ankit Agrawal

Scientists set new record in creating energy from nuclear fusion

Jacob Koshy

NEW DELHI, FEBRUARY 09, 2022 19:45 IST
UPDATED: FEBRUARY 10, 2022 18:57 IST



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WHAT HAS HAPPENED?

Scientists in the United Kingdom have managed to produce the largest amount of energy so far from a **nuclear fusion** reaction, the **same process that makes the Sun**, and **all other stars, shine and emit energy**.

This result is being seen as a major breakthrough in the ongoing global efforts to produce a fusion nuclear reactor.

The experiments produced 59 megajoules of energy over five seconds (11 megawatts of power).

This is more than double what was achieved **in similar tests back in 1997.**

ITS SIGNIFICANCE

It's not a massive energy output - only enough to boil about 60 kettles' **worth of water.**

But the significance is that it validates design choices that have been made for an even bigger fusion reactor **now being constructed in France.**

If nuclear fusion can be successfully recreated on Earth it holds out the potential of virtually **unlimited supplies of low-carbon, low-radiation energy.**

FISSION VS FUSION

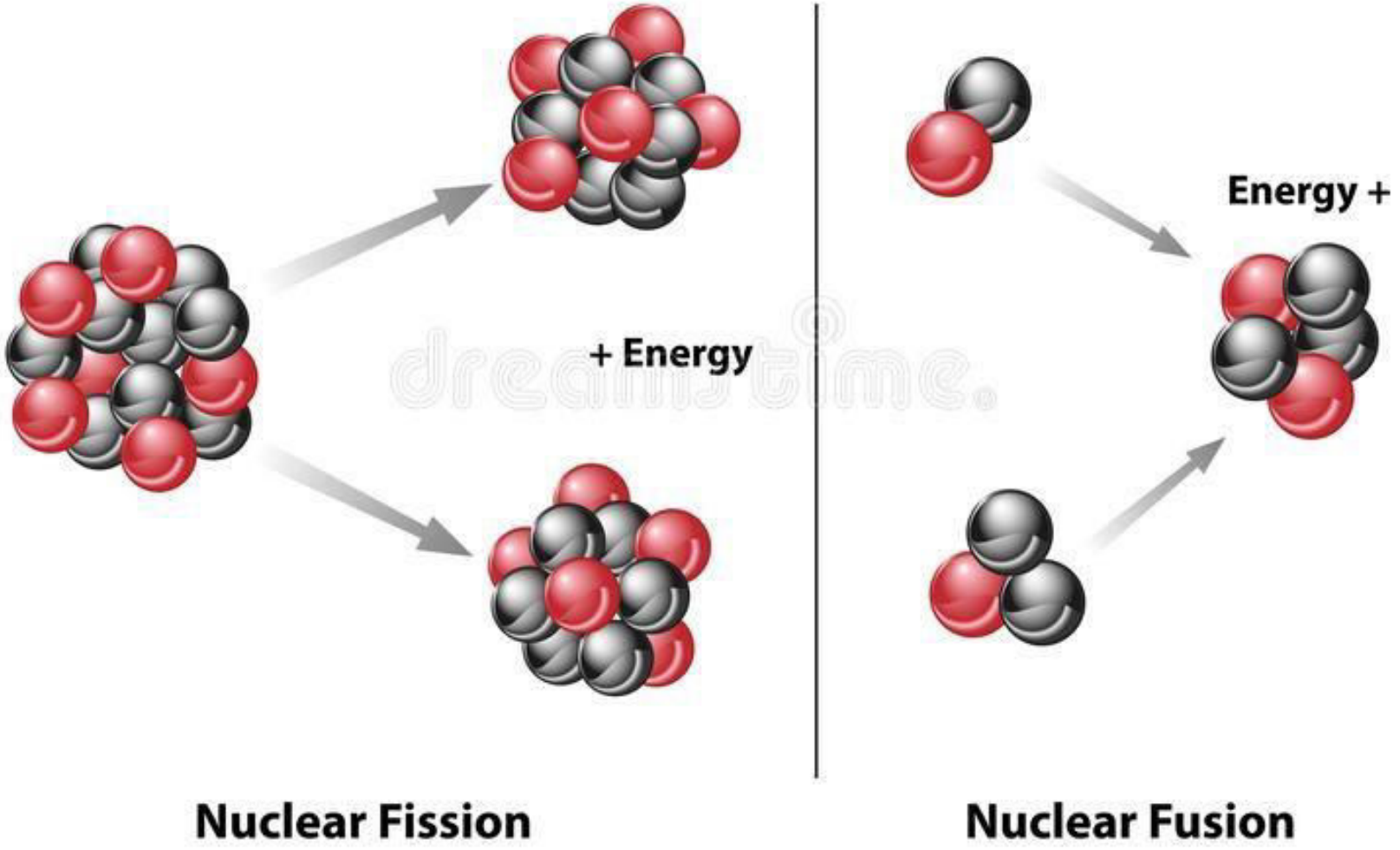
All current nuclear reactors are based on the fission process, in which the nucleus of a heavier atom is split **into those of lighter elements in a controlled manner.**

This process is accompanied with the release of large amounts of **energy.**

Fusion is the opposite process, in which nuclei of relatively lighter atoms, typically those of hydrogen, are **fused to make the nucleus of a heavier atom.**

Nuclear Reactions

Fission vs. Fusion



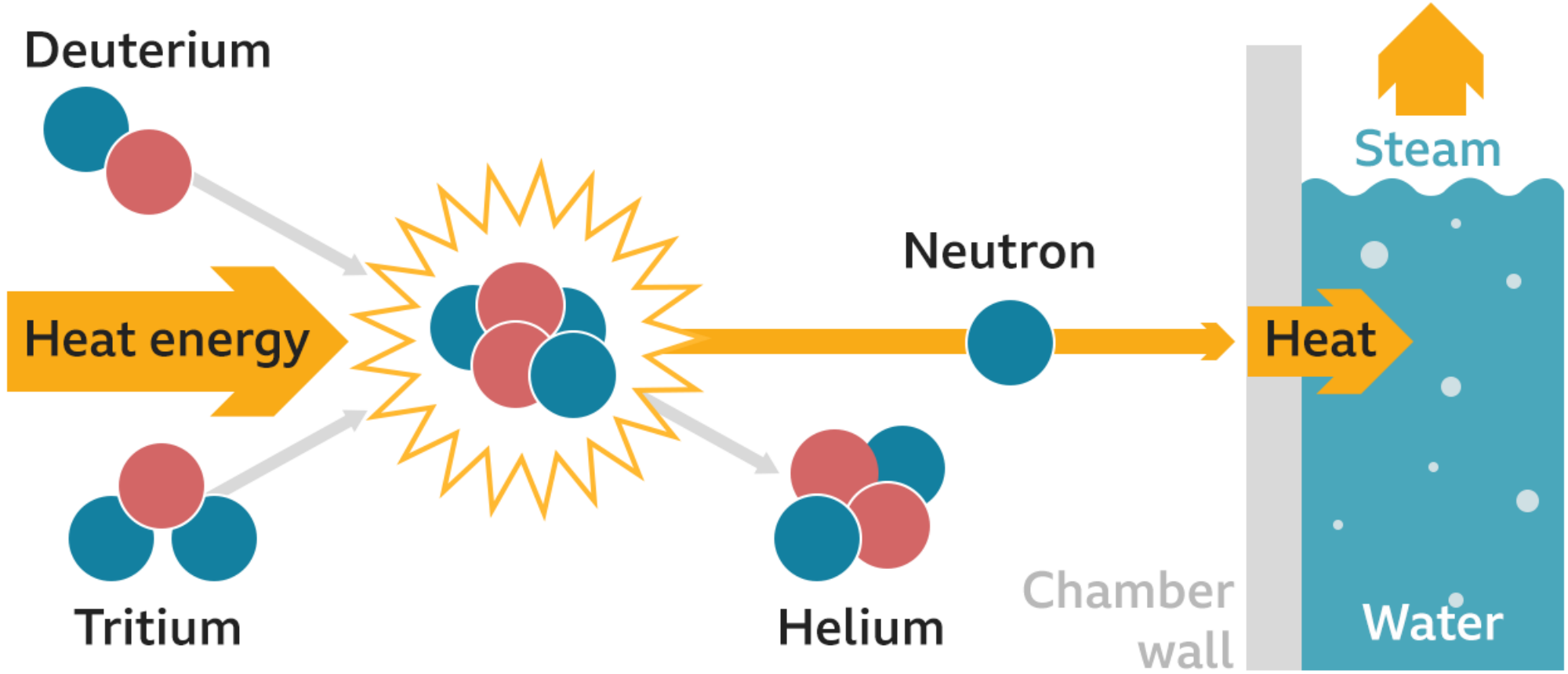
Much more energy is released in the fusion process **than in fission**.

The fusion of atoms of two heavier isotopes of hydrogen — **deuterium and tritium —**

For example, to form a helium nucleus produces four times as much energy as is released during the **fission of a uranium atom, the kind of which we see in our nuclear reactors.**

How nuclear fusion works

1	2	3	4
Hydrogen atoms are heated	Fusion reaction	Helium, neutron and energy released	Neutron energy heats water



QUEST FOR FUSION ENERGY

Trying to harness energy from fusion reaction is not a new endeavour.

Scientists have been making efforts to build a fusion nuclear reactor **for several decades, but the challenges are high.**

Fusion is possible only at very high temperatures, of the order of a few hundred million degrees Celsius, the kind of temperature that exists at the **core of the Sun and the stars.**

Recreating such extreme temperatures is no easy task. The materials that will make up the reactor, too, need to be able **to withstand such huge amounts of heat.**

There are several **other complications.**

At such high temperatures, matter exists only in the plasma state, where atoms break up into **positive and negative ions due to excessive heat**.

Plasma, which has a tendency to expand very fast, **is extremely difficult to handle and work with.**

BENEFITS

But the benefits of fusion reaction are immense.

Apart from generating much more energy, fusion **produces no carbon emissions,**

The raw materials are in sufficient supply, produces **much less radioactive waste** compared to fission, and is **considered much safer.**

Over the years, scientists have been able to draw up the plan **for a fusion nuclear reactor.**

It is called ITER (International Thermonuclear Experimental Reactor) and is being built in southern France **with the collaboration of 35 countries,**

Including India which is one of the seven partners, alongside the **European Union, the United States, Russia, Japan, South Korea and China.**

Several small-scale fusion reactors are already being used for research.

The one that produced this week's new record in energy generation is based at the **Culhum Centre for Fusion Energy**, just outside **of Oxford in England.**

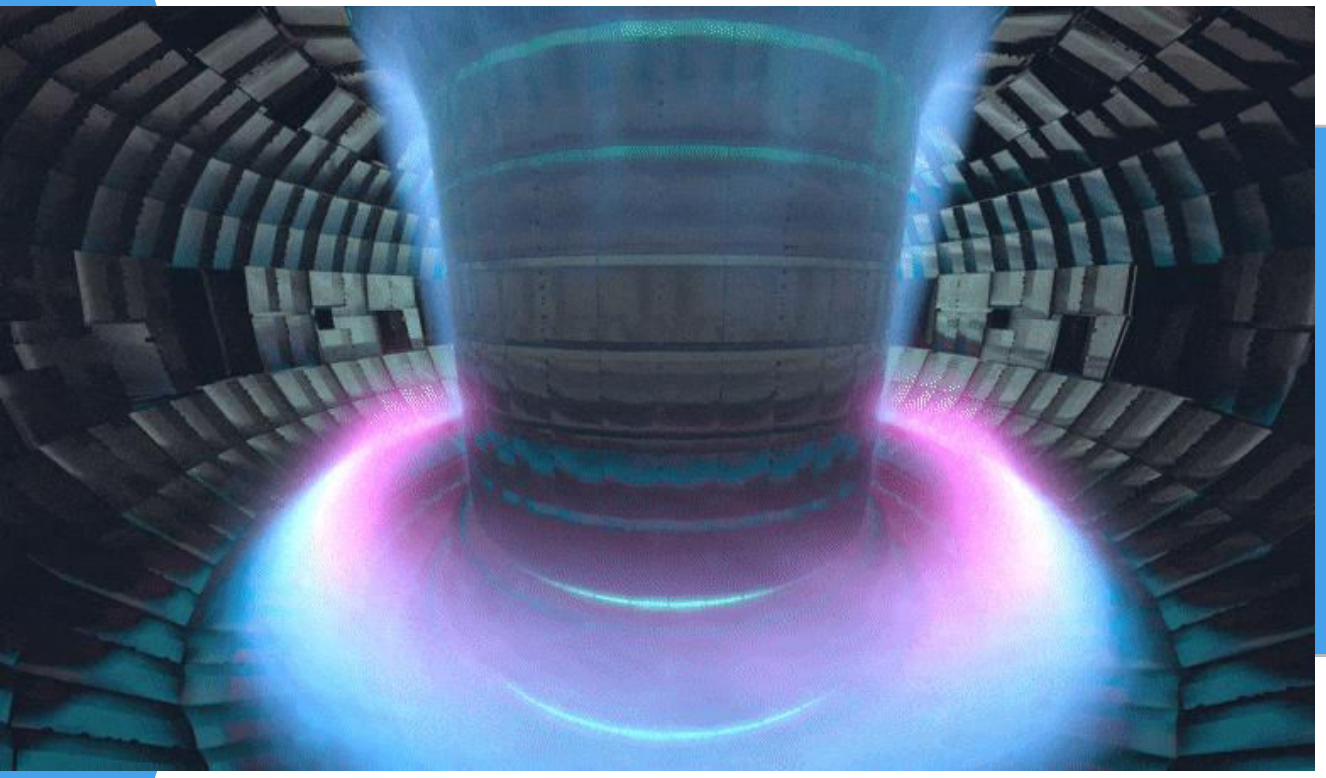
During the record-breaking experiment, the reactor **produced 11 megawatts of energy over a five-second period.**

Q. Which among the following is correct regarding ITER (International Thermonuclear Experimental Reactor)?

1. The ITER project began in 1985 and India joined in 2005.

2. The project is expected to become operational in 2035.

A) 1 only
B) 2 only
C) Both 1 & 2
D) None of the above



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