



# THE HINDU ANALYSIS

**26th Feb 2024**

by saurabh  
pandey



# Topic-ISRO CE-20 Engine

- , the Indian Space Research Organisation (ISRO) reported it had successfully completed human-rating the CE-20 rocket engine ahead of its use in an important test flight later this year of the country's mission to launch an Indian astronaut to space onboard an Indian rocket.
- The CE-20 is an indigenous cryogenic engine ISRO developed to use with the GSLV Mk III, now called the LVM-3, launch vehicle.
- It represents an improvement on the CE-7.5 cryogenic engine and is instrumental to ISRO successfully realising its human spaceflight, a.k.a. Gaganyaan, mission.

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- Engineers prefer to use liquid fuels for rocket motors because they are less bulky and flow better than solid fuels. Using hydrogen as fuel is also desirable because when it is combusted, it generates the highest exhaust velocity.
- For example, combusting hydrogen with oxygen as the oxidiser results in an exhaust velocity of 4.5 km/s whereas that produced by unsymmetrical dimethylhydrazine and nitrogen tetroxide — the combination used by the second stage of the PSLV rocket, e.g. — is around 3.4 km/s.
- This is why hydrogen is a desirable fuel for rocket motors.

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# Working of CE ENGINE

- The operation of a cryogenic engine requires a cryopump, a device to trap and cool the hydrogen and oxygen to liquid form; special storage tanks; and turbopumps to move the cooled fuel and oxidiser to the engine.
- The CE-7.5 engine uses the staged-combustion cycle.
- Here, a small amount of the fuel is combusted in a pre-burner. The resulting heat is used to drive the turbine that powers the turbopump

- **.The CE-20 engine uses the gas-generator cycle, which discards the exhaust from the pre-burner instead of sending it to the combustion chamber.**
- **This reduces fuel efficiency but, importantly for ISRO, makes the CE-20 engine easier to build and test.**

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- .What is Human rating??

Rockets (and engines) that carry humans to space need to be tested more intensively — an exercise called ‘human-rating’.

Broadly speaking, human-rating entails processes to verify particular errors, like the failure of a particular component, happen at less than a particular rate

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# TRIAL BY FIRE

India is the sixth space power to develop own cryogenic engine after US, Russia, China, Japan and European Space Agency



## What it is

CE-20 is a high-thrust indigenous cryogenic engine to be **used for launching heavy satellites** on board GSLV-MarkIII

## How it works

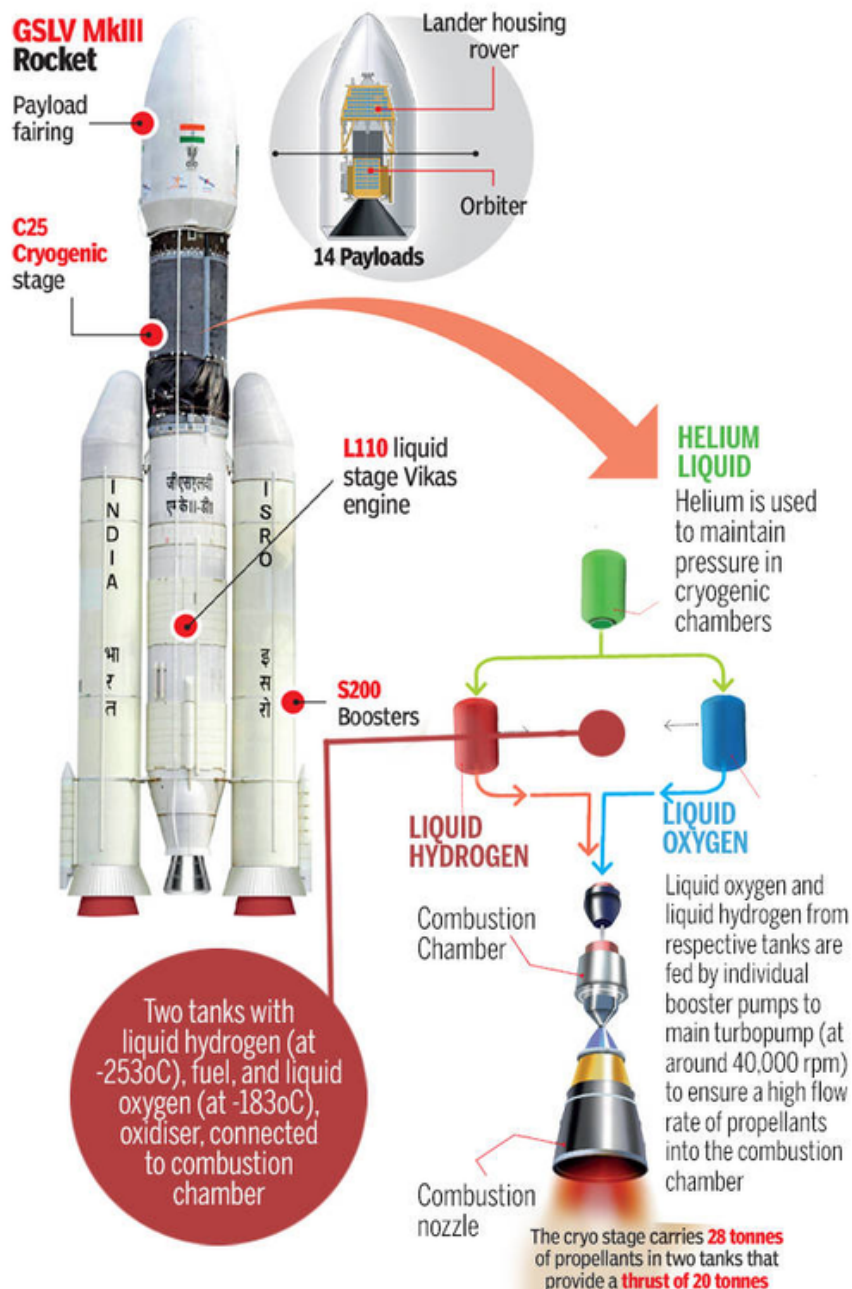
With an engine thrust of 19 tonnes against its predecessor's 7.5-tonne thrust, **CE-20 can propel to space payloads up to 4 tonnes**

## What it means for India

This means India can take up heavy communication satellite launches for itself, besides **earning foreign exchange through commercial launches** for other countries. It can also power India's manned space missions

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## THE ABC OF CRYOGENIC UPPER STAGE



- Two small steering engines provide for control of stage during its thrusting phase
- Thrust control and mixture ratio control are

achieved by two independent regulators

- Main engine and two steering engines together develop a nominal thrust of 73.55 kN in vacuum

### MAIN PROBLEMS

- Due to large temperature difference, heat transfer is very high. Therefore, lot of insulation needed
- Boiling causes sudden pressure rise in tanks. So

proper venting is required

- Material properties vary at low temperatures. Most materials become brittle. So if valve seats or seals become brittle and break, it causes leaks



# GAGANYAAN MISSION

## INDIA'S FIRST MANNED FLIGHT TO SPACE

The project was first approved by **PM Narendra Modi** on **August 15, 2018**

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It will send the three member crew to space for at least **seven days by 2022**.

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ISRO hopes to deploy its biggest rocket, **GSLV MK III**, for this project.

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It would be one of the cheapest manned spaceflights in world, with the estimated cost of not more than **Rs 10000 crore**.

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India plans to call its astronauts "**vyomnauts**" since '**vyom**' in Sanskrit means '**Space**'.

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# What are blanet??

- **blanets, as are all planets that orbit not stars but black holes.**
- **In 2019, a handful of scientists in Japan theorised that planets could form in the massive dust and gas clouds that astronomers have observed near supermassive black holes.**
- **However, these planets aren't expected to be anything like the earth.**
- **By observing black holes and their effects on their surroundings, we know they're surrounded by a colossal disc of gas and dust that the black hole is swinging around, pulling in, and heating up.**

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- **Scientists think there is reason to believe almost every galaxy has a black hole at its centre, a seed around which the stars in the galaxy organise themselves.**
- **We also know planets are formed when the dust and gas swirling around a young star collide and clump together.**
- **A similar process could be in play near supermassive black holes, where planets take shape inside the disc and eventually become planets**

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# Red sea crisis & IMEC

**Why is the Red Sea route important?**

- **The Red Sea owes its strategic importance for global trade to the Bab el-Mandab Strait which lies between Yemen and Djibouti.**
- **It is one of the world's busiest cargo and oil transit points with almost 12% of international merchandise trade passing through it.**
- **An immediate consequence of the Red Sea conflict has been that major container and oil carriers have been forced to re-route shipments via the Cape of Good Hope.**
- **The re-routing has led to rising ocean freight, inflated insurance costs, and longer voyage times leading to delays and shortage of products. It has also driven up transportation costs.**
- **The higher shipping costs will be passed onto consumers in the form of increased commodity prices.**

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## Alternative shipping route avoiding Red Sea



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## Impact of Red Sea crisis

War risk premiums higher by around Rs 10-15 lakh

Over **30%** increase in container freight rates

Avg 2-week increase in ship-ping time

About **20%** of India's exports pass through the Red Sea-Suez route

10 navies come together to address security challenges in the southern Red Sea



Red Sea route

**Alternative route:** Cape of Good Hope, joining Eastern Asia and Europe through southern parts of Africa

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## How has it affected India?

- India's trade with European and North African countries flows entirely through the Red Sea route which is almost 24% of its exports and 14% of its imports.
- As global supply chains are battling delayed shipments and rising costs, China is actively projecting China-Europe freight trains, which are part of the Belt and Road Initiative (BRI), as an alternate route.

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## What about the IMEC?

- The India-Middle East-Europe Economic Corridor (IMEC), which was announced during the G-20 summit in 2023, is another alternative which is not receiving much attention.
- Part of the problem is that apart from the MoUs, there have not been any investments or operations regarding the corridor.
- Furthermore, the Israel-Palestine conflict has put a pause on the normalisation of Arab-Israel relations which is a key element of the multi-nation initiative.

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**Another major challenge is the vulnerability of the Strait of Hormuz.**

- **The entire trade of the IMEC architecture flows through the Strait of Hormuz and with Iran's proximity and control over the strait, the risk of disruptions remain very high.**
- **Some experts argue that the Strait of Hormuz problem can be avoided by including Oman in the IMEC architecture and keeping the supply chain away from Iran's reach.**
- **However, that would mean further delays, as new ports and railway links will have to be developed across Oman connecting it to Saudi Arabia.**

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# India-Middle East-Europe Corridor (IMEC)



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## How can the IMEC be made viable?

- Despite such challenges, the economic logic of the corridor holds, which should encourage stakeholders to keep working towards it.
- First, an empirical study on the economic benefits of the corridor needs to be conducted.
- The corridor is estimated to cut the journey time from India to Europe by 40% and slash transit costs by 30%.
- However, there are speculations that multiple handling of cargo and multi-nation transit would increase carriage and compliance costs.

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- Therefore, it is critical to quantify the economic advantages of the corridor to attract more stakeholders.
- Secondly, a robust financial framework needs to be in place.
- Since there are no binding financial commitments on any of the signatories of the corridor, investments will have to be attracted from governments, international organisations, and private sector entities.
- Lastly, a comprehensive multi-nation operational framework is needed.
- As the corridor involves facilitating trade across different legal systems, a multi-national framework is necessary

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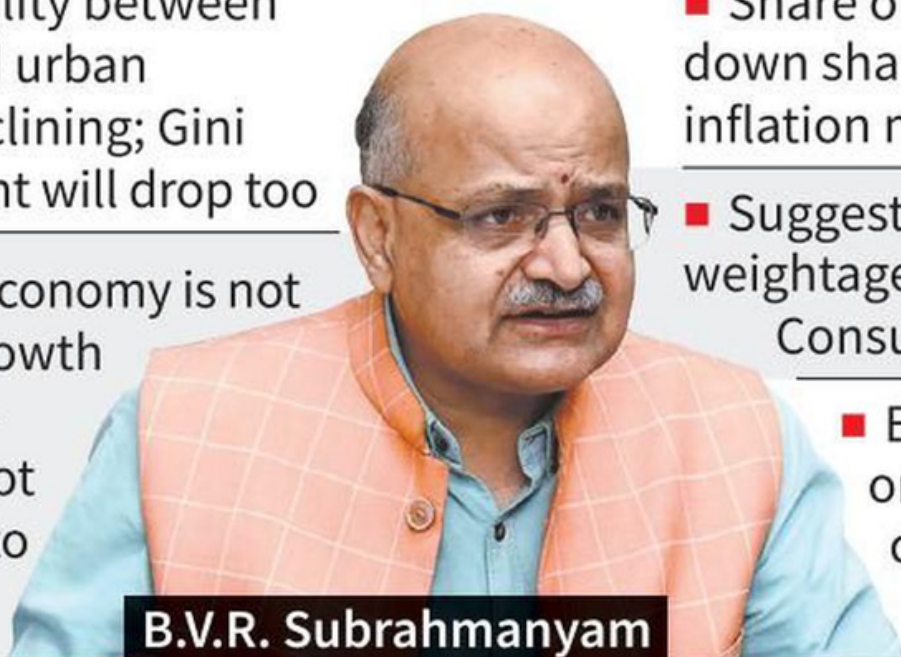
# Topics- Household Consumption Expenditure Survey

## Expert view

Niti Aayog CEO presents his take on consumption trends

- Inequality between rural and urban India declining; Gini coefficient will drop too

- Rural economy is not weak; growth is broad-based, not 'limited to a few'



**B.V.R. Subrahmanyam**

- Share of food spending down sharply; retail inflation may be overstated

- Suggests lower weightage for food in the Consumer Price Index

- Expects an impact on GDP growth calculations for the economy

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# Counting the **spending** | The All-India Households' Consumer Expenditure Survey will be conducted between July 2022 and June 2023

## What is it?

Usually carried out every five years, the survey helps assess poverty levels and consumption patterns across the country, and rebase GDP calculations

**What's the big deal?** The last survey whose findings were made public was conducted in 2011-12

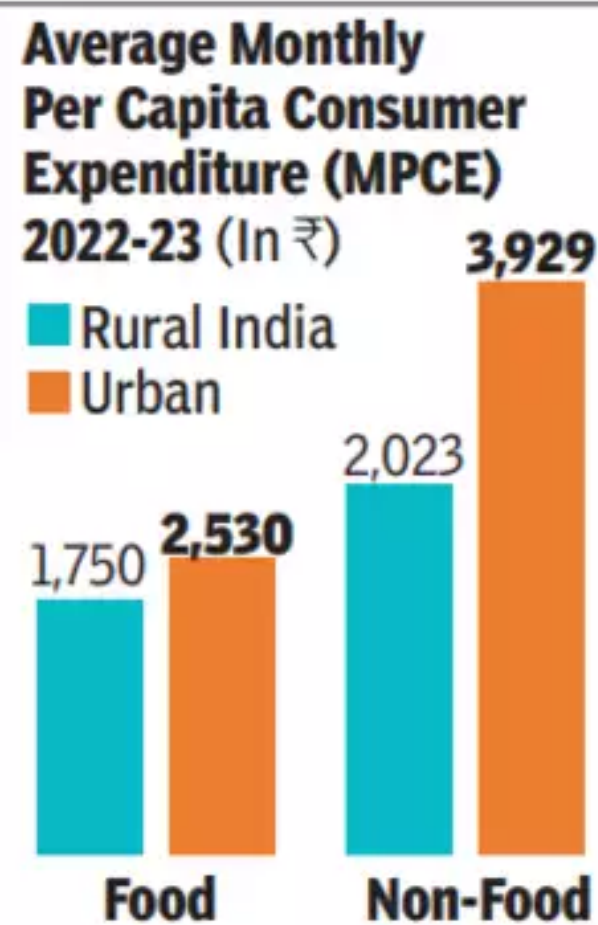
**Why this long pause?** A survey was conducted in 2017-18 too, but its results were not released owing to 'quality' concerns. It reportedly reflected the first drop in monthly per capita household spending since 1972-73, with a rise in poverty incidence



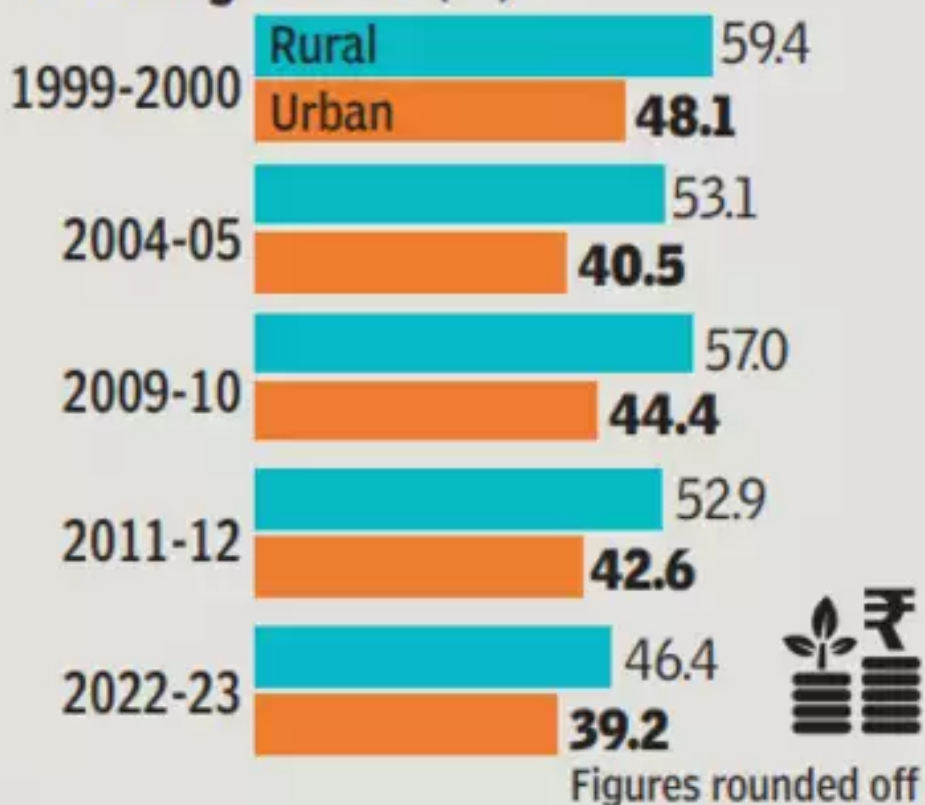
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# SPENDING ON FOOD DECLINING



## Share Of Food Consumption In Average MPCE (%)



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## Consumption Rises 2.5x in a Decade

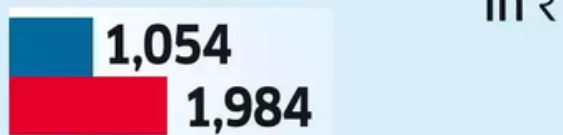
1999-2000



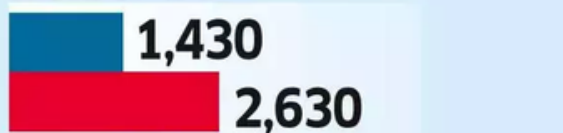
2004-05



2009-10



2010-11



2022-23



Average monthly per capita expenditure, in ₹

## Households Spend Less on Food (% share of total spending)



## Social Welfare Programmes Increasing Consumption

(avg monthly per capita expense, in ₹)

	Without social welfare programmes and home produce	Including social welfare programmes and home produce
Rural	3,773	3,860
Urban	6,459	6,521

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# Target Mains 2024

**Q Maritime routes are shaping world order” illustrate**

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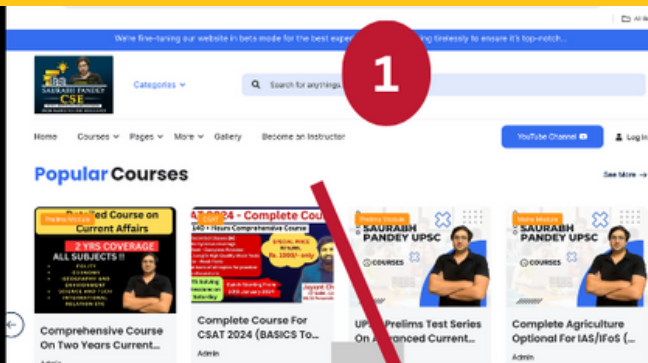


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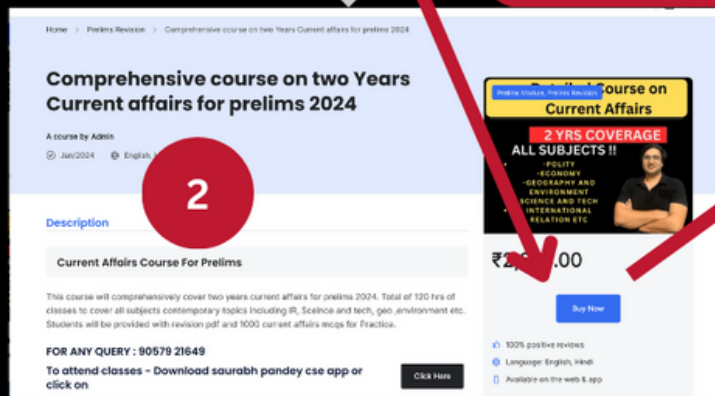
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