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- Mains Questions:
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    - Relevance to the UPSC Prelims and Mains syllabus under the following topics:

What is the news?

- The virtual launch of India’s first indigenously conceived and manufactured hydrogen fuel cell

ferry by Prime Minister Narendra Modi is a turning point in sustainable transportation.

Why is Important ?

- The first indigenously conceived and built hydrogen fuel cell ferry in India is a milestone in sustainable transportation.
- It is also part of Harit Nauka, a trial project exhibiting maritime technology.

Who Built It?

- This pioneering ship, built by Cochin Shipyard Limited (CSL), represents India’s dedication to green technology and maritime carbon reduction.

What is fuel Cell?

- A fuel cell is a device that generates electricity through an electrochemical reaction, not combustion. In a fuel cell, hydrogen and oxygen are combined to generate electricity, heat, and water.

Key features and benefits:

- Hydrogen fuel cells power this ferry's zero-emission propulsion. Energy from hydrogen and oxygen is produced cleanly by fuel cells, unlike diesel engines. Only water and heat are produced, making this transportation method zero-emission.
- Energy Efficiency: Hydrogen fuel cells outperform fossil fuel engines. Over the vessel's lifetime, this reduces operational costs and environmental impact.
- Quiet Operation: Fuel cell ferry systems operate quietly, making passengers happier and marine life happier.
- Passenger-Centered Design: The 50-passenger ferry has comfortable seating and an air-conditioned cabin.
- Indigenous Innovation: CSL's ferry development shows India's green technology excellence and marine self-reliance.

Importance and Effects:

- Green Mission: This launch supports India's objective of net-zero emissions by 2070 and climate leadership.
- Pioneering Sustainable Water Transport: The ferry proves that hydrogen fuel cells can be integrated into India's huge network of inland waterways for cleaner, more efficient water transportation.
- The ferry advances the Harit Nauka programme, which promotes renewable fuels in maritime

transport.
- Global leadership: India’s early use of hydrogen in maritime applications makes it a potential leader in sustainable shipping.

Future Path:

- India’s first hydrogen fuel cell ferry launch is just the start. More hydrogen-powered vessels will grace India’s waterways with continuous investment and innovation, contributing to a cleaner, greener, and more sustainable future.

The impact on India’s 2070 commitment:

India’s commitment to net zero emissions by 2070 centres on green hydrogen as a naval fuel.

First hydrogen fuel cell boat launch in India sends powerful and complex message about green energy commitment:

- Sincerity about Decarbonisation: India is investing in revolutionary technologies to reach net-zero, not merely making promises. India’s intention to address the maritime sector’s emissions shows its resolve.
- Innovation as a Driver: India’s fuel cell technology development shows its green energy innovation. This shows that India wants to create

sustainable solutions, not merely consume them.

- Beyond Land-Based Solutions: Solar, wind, and electric cars dominategreen energy discussions. India’s ferry shows that decarbonisation must include all sectors, including the marine industry.
- Practice: Hydrogen fuel cells aren’t just theory. This ferry shows their potential in powering real-world transportation, enabling replication and adoption.
- Growth with Sustainability: India’s economic growth doesn’t have to harm the environment. This programme shows that green technology can advance, create jobs, and improve clean energy.
- India’s ambitious move to employ hydrogen for maritime use can encourage other developing nations. It proves that fast-developing nations can prioritise renewable energy.

Summarising

- *The hydrogen fuel cell ferry project shows India’s commitment:*

  - Explore creative and practical green energy solutions across sectors.
  - Lead global demonstrations of rising technology viability.
  - Promote economic and environmental sustainability through sustainable growth.

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General Studies

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- After Attempting Last Question.
- Enter Name & Email
- Click on - Check Result
- Scroll down - Check out Solutions too.

Thank you.

Loading ...

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Category: **General Studies**

Which of the following is the primary government initiative associated with India's first hydrogen fuel cell ferry?

○ Harit Nauka Initiative

○ Atal Mission for Rejuvenation and Urban Transformation (AMRUT)

○ National Clean Air Programme (NCAP)

○ National Hydrogen Mission

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Category: **General Studies**

The development of India's indigenous hydrogen fuel cell ferry demonstrates the nation's growing capability in:

○ Sustainable marine transportation and green technology

○ Advanced nuclear propulsion systems

○ Reducing reliance on hydrocarbon imports

○ Expansion of shipbuilding capacity for commercial vessels

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Category: **General Studies**

Which of the following is the primary byproduct of the hydrogen fuel cell reaction used to power a fuel cell ferry?

○ Nitrogen oxides

○ Carbon dioxide

○ Water

○ Sulfur dioxide

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Category: **General Studies**

Which of the following is a key challenge for the widespread adoption of hydrogen fuel cell technology in the Indian maritime sector?

○ Limited availability of hydrogen

○ Lack of public acceptance of green technologies

○ High cost and limited infrastructure for hydrogen production and distribution

○ Insufficient skilled manpower in fuel cell maintenance

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Category: **General Studies**

Consider the following statements regarding hydrogen fuel cells:

1. **They offer higher energy efficiency compared to traditional combustion engines.**

2. **They contribute to air pollution through the emission of particulate matter.**

Which of the above statements is/are correct?

- ○ Only 1
- ○ Only 2
- ○ Both
- ○ None

Prev Finish

Check Rank, Result Now and enter correct email as you will get Solutions in the email as well for future use!

Check the Result

Your score is

0%

Restart quiz

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Mains Questions:

Question 1:

What are the environmental and economic benefits of using hydrogen fuel cell technology in the maritime sector? Discuss the challenges associated with its large-scale adoption in India. (250 words)

Model Answer:

Environmental Benefits:

- Zero-emission operation: Unlike conventional diesel ferries, hydrogen fuel cells generate electricity through a clean reaction, emitting only water vapor and heat. This significantly reduces air and water pollution, contributing to a cleaner environment.
- Enhanced energy efficiency: Compared to traditional engines, fuel cells offer better fuel efficiency, leading to lower fuel consumption and greenhouse gas emissions.

Economic Benefits:

- Reduced operating costs: Over time, the higher efficiency of fuel cells can translate to lower operating costs for ferry operators compared to diesel ferries.
- Job creation: Investing in and developing hydrogen fuel cell technology can create new job opportunities in research, manufacturing, and maintenance of these systems.

Challenges for Large-Scale Adoption:

- High initial cost: Currently, the technology is in its nascent stage, and the initial investment cost for hydrogen fuel cells and infrastructure is significantly higher than traditional options.
- Limited hydrogen infrastructure: Widespread adoption requires establishing a robust network of hydrogen production, storage, and refueling stations across the country.
- Scalability of production: Scaling up hydrogen production to meet the demands of a large fleet of ferries necessitates overcoming technological and economic hurdles.

Question 2:

Explain the significance of India's indigenous development of the first hydrogen fuel cell ferry. Discuss its potential impact on the

nation’s maritime sector and its global leadership aspirations. (250 words)

Model Answer:

Significance of Indigenous Development:

- Technological advancement: Successfully developing the ferry showcases India’s growing expertise in green technology and strengthens its self-reliance in the maritime sector, reducing dependence on foreign technology.
- Cost-effectiveness: Indigenous development can potentially lead to lower long-term costs compared to relying solely on imported technology.
- National pride and inspiration: This achievement fosters national pride and inspires further advancements in domestic research and development of clean technologies.

Potential Impact on the Maritime Sector:

- Pioneering sustainable practices: The adoption of hydrogen fuel cells can pave the way for cleaner and more sustainable water transportation, reducing the environmental footprint of the maritime industry.
- Boosting domestic innovation: The success of this project can encourage further investment and

innovation in the domestic green shipbuilding industry.
- Creating a model for other sectors: This initiative can serve as a model for the adoption of clean technologies in other transportation sectors like buses and trucks.

Global Leadership Aspirations:

- Demonstrating commitment to green energy: This initiative showcases India’s commitment to addressing climate change and transitioning towards a clean energy future, solidifying its position as a global leader in sustainability efforts.
- Inspiring other developing nations: India’s success can inspire and encourage other developing nations to adopt similar clean technologies, fostering global collaboration towards sustainability.
- Positioning India as a leader in green maritime technology: By pioneering the use of hydrogen fuel cells in the maritime sector, India can position itself as a global leader and potential exporter of this technology.

Remember: These are just sample answers. It’s important to further research and refine your responses based on your own understanding and perspective.

Relevance to the UPSC Prelims and Mains syllabus under the following topics:

UPSC Prelims:

- **Science and Technology in everyday life:** This section can potentially encompass recent advancements in clean energy technologies, including hydrogen fuel cells.
- **New initiatives and developments in science and technology:** This section might cover government initiatives like the National Hydrogen Mission, which promotes the development and adoption of hydrogen fuel cell technology.

  Therefore, staying updated on recent developments in hydrogen fuel cell technology might be beneficial for answering general science and technology-related questions in the Prelims.

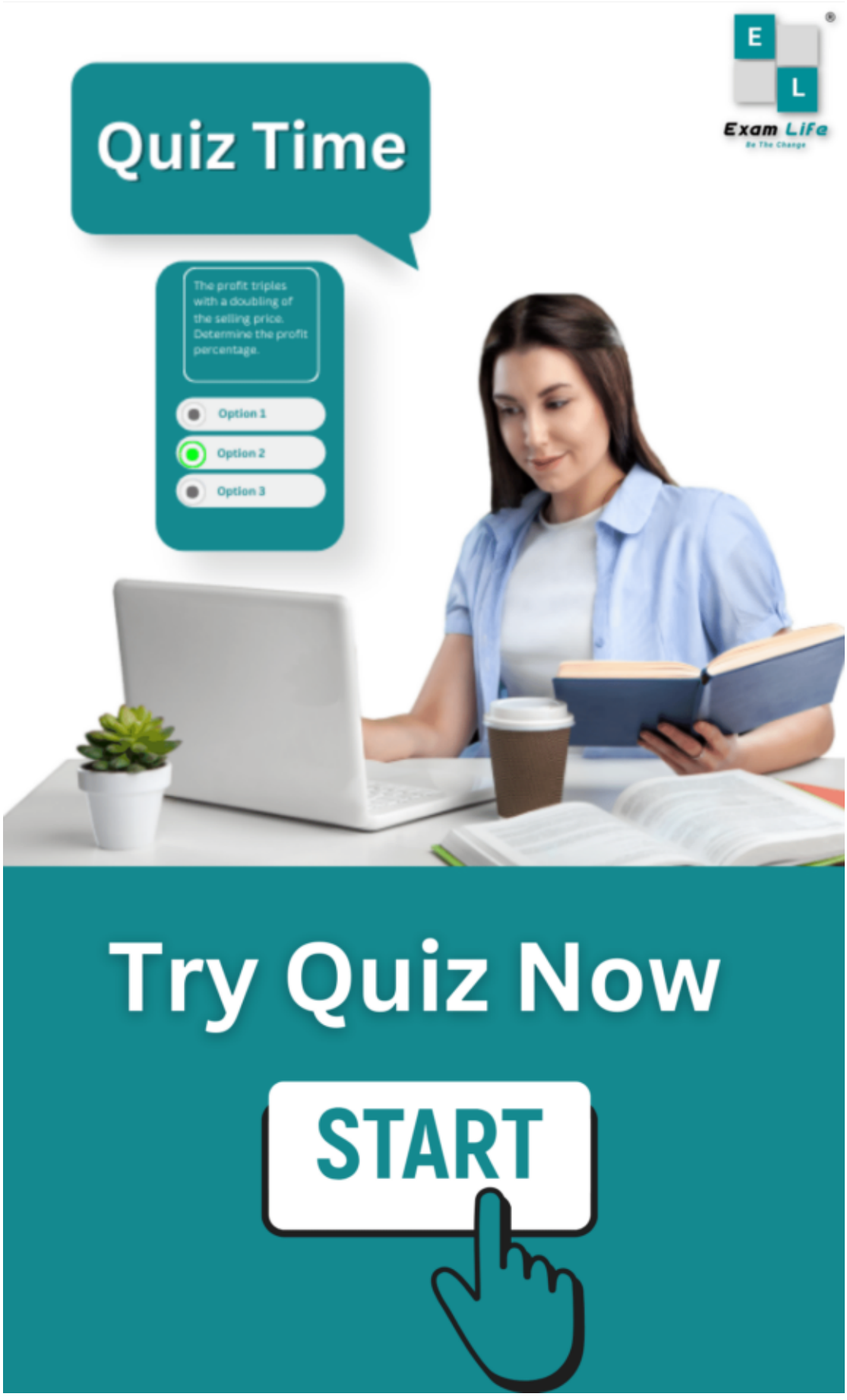
UPSC Mains:

- **GS Paper III (Science & Technology):Infrastructure:** This section can encompass advancements in clean transportation

infrastructure, potentially including hydrogen refueling stations.

Energy sources: This section might be relevant for discussing the potential of hydrogen as a future clean energy source and its associated challenges.

Innovation and development in Science & Technology in fields like Space, Computers, Robotics, Nano-science, **Bio-technology and Information Technology:** While not directly mentioning fuel cells, this section emphasizes technological advancements, which could include discussing hydrogen fuel cell technology as an innovative solution in the energy sector.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