

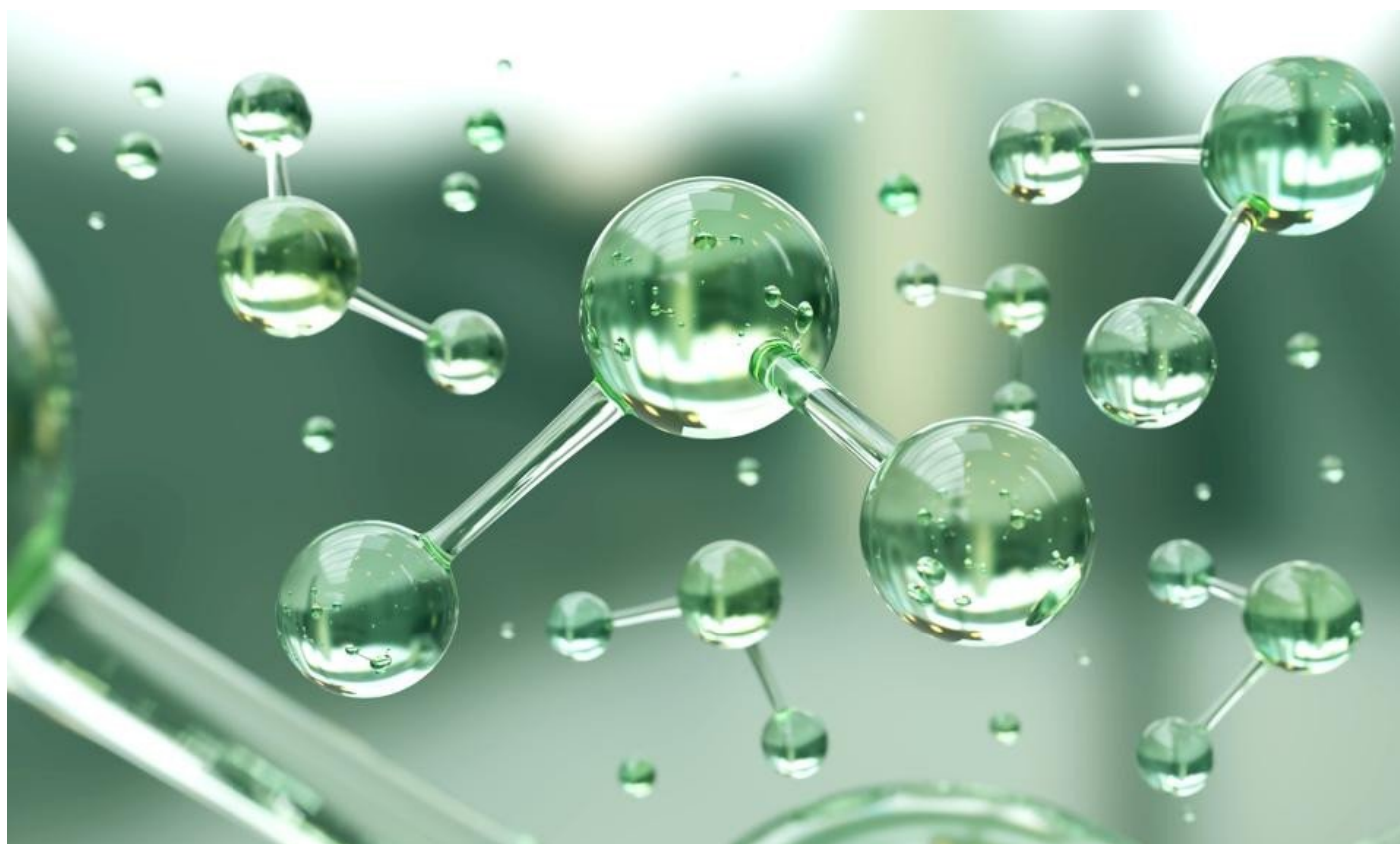
## India needs to promote and form Green Hydrogen Corridors, says NITI Aayog (GS Paper 3, Environment)

### Why in news?

- Recently, NITI Aayog released a report titled 'Harnessing Green Hydrogen - Opportunities for Deep Decarbonisation in India'.

### Key Highlights:

- It said India needs to form **Green Hydrogen Corridors** and governments can look at providing grants to startups as well as support entrepreneurs to promote green hydrogen.
- There is a need to facilitate investment through demand aggregation and **dollar-based bidding** for green hydrogen.
- The government can also use public procurement and purchase incentives (for green hydrogen) to create demand in niche markets and crowd in private investment.
- The government should **promote export of green hydrogen** and green hydrogen-embedded products through a **global hydrogen alliance**.



### Green Hydrogen/ Green Ammonia:

- Green Hydrogen/ Green Ammonia is defined as hydrogen/ ammonia produced by way of electrolysis of water using renewable energy, including renewable energy which has been banked and the hydrogen/ammonia produced from biomass.
- Most large economies including India have committed to net zero targets.
- Transition to green hydrogen and green ammonia is one of the major requirements for reduction of emissions, especially in the hard to abate sectors.

### Hydrogen demand in India:

- The report predicted that hydrogen demand in India could grow more than fourfold by 2050, representing almost 10 per cent of global hydrogen demand.

- In the longer term, steel and heavy-duty trucking are likely to drive the majority of demand growth, accounting for almost 52 per cent of total demand by 2050.

#### Roadmap:

- Emphasising that the roadmap should also identify a **timeline and scale of manufacturing support** for electrolyzers, it said **India may aim for 25 GW of electrolyzers by 2030**, while also investing USD 1 billion in R&D to catalyse the development of commercial green hydrogen technologies across the value chain.
- It noted that radically improving the speed of regulatory clearances coupled with preferential treatment in public tenders will help catalyse local manufacturing.
- The report suggested that grand challenges, public-private venture capital and financing test bench infrastructure could be part of the R&D investments.

#### Way Forward:

- The report aims to serve as a key knowledge base for India's Green Hydrogen Policy discourse and private sector investment decisions.

### India's first mRNA vaccine for Covid-19

(GS Paper 3, Science and Tech)

#### Why in news?

- India's first home-grown mRNA Covid-19 vaccine, **GEMCOVAC-19** developed at Pune's Gennova Biopharmaceuticals has got a 'restricted emergency use' nod for the 18-and-above age group.

#### Challenge:

- As mRNA vaccines are required to be kept at sub-zero temperatures, it was a mammoth task for Gennova scientists to develop a thermostable mRNA Covid-19 vaccine.
- Scientists had to innovate to suit local needs to make it affordable and deployable. The new vaccine can now be stored at the temperature of a standard medical refrigerator.



### The mRNA platform:

- As the Covid-19 pandemic spread, an mRNA vaccine candidate was the first to enter human trials globally. The first two vaccines that were made available for use in the US were based on mRNA technology.
- Unlike vaccines that put a weakened or inactivated virus in body to activate an immune response, these two Covid-19 vaccines (Pfizer-BioNTech and Moderna) used messenger RNA or mRNA to deliver a message to immune system.
- Basically, the **technology uses genetically engineered mRNA** to instruct cells to make the S-protein found on the surface of the Covid-19 virus.
- After vaccination, the **muscle cells begin making S-protein pieces** and displaying them on cell surfaces. This causes the body to create antibodies.
- But these vaccines have to be stored at sub-zero temperatures as **mRNA is fragile and breaks down easily**.

### Thermostable vaccine:

- Unlike in the West, where the vaccine has to be stored at sub-zero temperatures, the challenge in India was to be able to store the vaccine between 2-8 degree Celsius. GEMCOVAC-19 can now be stored at the temperature of a standard medical refrigerator.
- The **conversion from liquid to powder form of the vaccine takes place via Lyophilisation** — this is freeze-drying, a process where the water is removed from the product after it is frozen and placed under a vacuum allowing the ice to change directly from solid to vapor without passing through a liquid phase.
- However, just removing water by Lyophilisation of the mRNA vaccine does not work.
- So, the surrounding pressure has to be tweaked and then kept stable to ensure the characteristics of the vaccine are the same as before Lyophilisation.
- For this to be achieved, the key was to add an external agent which at a certain critical concentration keeps it stable under lyophilized conditions. The Lyophilisation technology is not new, but a lyophilized mRNA vaccine is unique.

### Trials and safety:

- Freeze-drying the large and unstable mRNA molecule with the nanoparticle was a daunting challenge. However, Gennova invested countless man-hours in the hope of lyophilizing the mRNA vaccine in a single vial within a year.
- This thermostable vaccine was thoroughly tested in various animal models to ensure its safety and immunogenicity before entering human clinical trials.
- The trial data showed that the vaccine was safe and well-tolerated. Immunogenicity measured at 2 weeks post-dose showed that GEMCOVAC-19 is non-inferior to Covishield.
- The two-dose vaccine will have to be administered intramuscularly, 28 days apart.

### Way Forward:

- For the first time, the mRNA platform has been used to develop a Covid-19 vaccine in India.
- Notably, this technology platform provides flexibility to quickly tweak the vaccine for any existing or emerging variants of the virus.

## Turkey made peace with Sweden and Finland joining NATO

(GS Paper 2, International Relation)

### Why in news?

- Recently, the North Atlantic Treaty Organization (NATO) announced the signing of a **memorandum of understanding (MoU) between Turkey, Finland and Sweden** in a trilateral meeting held in Madrid, Spain.
- The MoU was signed once the Finland President and Sweden Prime Minister agreed to address the national security concerns of Turkey.
- Following this assurance, Turkey President agreed to support Finland and Sweden in their bid to join NATO.

### The key provisions of the MoU include the following three points:

- a) A joint commitment between Turkey, Finland, and Sweden to counter terrorism;

- b) Addressing the pending extradition of terror suspects through a bilateral legal framework, and
- c) Investigating and interdicting “any financing and recruitment activities of the PKK and all other terrorist organisations.”
  - Besides the above, Finland and Sweden assured that “their respective national regulatory frameworks for arms exports enable new commitments to Allies”.
  - Both countries also promised to **stand against disinformation and to fully commit to EU’s CSDP (Common Security and Defence Policy) and Turkey’s participation in the PESCO (Permanent Structured Co-operation) Project on Military Mobility.**



**Why did Turkey withdraw its opposition?**

- Turkey was initially against Finland and Sweden joining NATO. Though there were no direct bilateral issues between Turkey with Sweden and Finland, the former was against the latter for their **position on the Kurdish issue and extradition of activists.**

**Turkey, after negotiations, agreed to withdraw its opposition for the following reasons:**

**Counter-terrorism provisions:**

- First, Finland and Sweden should promise to address counter-terrorism provisions within their countries.
- Finland has committed to modify its criminal code, and Sweden has assured to implement the new “Terrorist Offenses Act” from July 1.

**Kurdish activists:**

- Second, Turkey had raised concerns about Finland and Sweden being home to Kurdish activists and militant organisations.
- Finland and Sweden have now agreed to execute the pending “deportations or extraditions” of listed ‘terror’ suspects made by Turkey.

#### **Arms embargo:**

- Third, lifting the arms embargo. There has been no clear definition about the category of weapons, but Finland and Sweden will remove the arms embargo against Turkey.
- Since Finland and Sweden have addressed all the above primary concerns of Turkey, Ankara has decided to withdraw its opposition to Helsinki and Stockholm.

#### **Why have Finland and Sweden agreed to address the concerns raised by Turkey?**

- The earlier positions of Finland and Sweden on Turkey were based more on their principles relating to democracy, ‘separatism’, the rule of law etc.
- Their support to Kurdish activists from Turkey was based on their larger principles than any specific bilateral problem with Turkey.
- Both Helsinki and Stockholm have agreed to revisit their position on Turkey, primarily due to the threat from Kremlin.
- The security threat from Russia looms large in the national capitals of Finland and Sweden today as Russia’s military aggression on Ukraine continues.
- The fear of their own national security has pushed both nations to join NATO which in turn has made them agree to Turkey’s conditions.

#### **What does this mean for Russia?**

- **Russia shares a 1,340 kilometre long border with Finland.** Sweden, though it does not share a land border, shares the Baltic Sea with Russia. The land/sea borders with Russia place both countries under direct threat from the Kremlin.
- Russia has cautioned Finland and Sweden on continuing with their decision to join NATO. It underlined that there are no territorial disputes with these two countries; hence they should not worry about any security threat from Russia.
- Since 1948, Finland, Sweden and Russia have maintained economic cooperation, but the relations always remained strained due to the Cold War and Finland’s neutrality principle. If Sweden and Finland join NATO, it means an enlarged presence of the latter around the west and north of Russia.
- This would go against the very objective of Russia interfering in Ukraine — maintaining Russian influence in its immediate neighbourhood.
- Also, whether the two countries joining NATO will undermine Russia’s interests in the Arctic remains to be seen. Both Sweden and Finland are part of the Arctic States; Russia currently holds the Arctic Council chair and will remain the chair until 2023.
- For Russia, Finland and Sweden joining NATO not only means an **increased NATO presence** in its neighbourhood but also questions its Arctic interests.

#### **What does this mean for NATO?**

##### **Strengthening the alliance:**

- Both Finland and Sweden which have followed the non-alignment principle have broken from their natural rule and decided to join NATO.
- This does not only mean guarantee of security against Russia but it also gives NATO the power to engage.

##### **NATO will gain strategic ground to counter Russia:**

- The addition of more allies means a steady expansion of the NATO towards the East, through which it will now be able to exercise its military operations both on land and in the Baltic Sea, where Russia holds a strategic position.
- NATO will now also be able to position its weapon systems further its combat formation and plan its attack techniques to power up deterrence and defence.
- In 1997, NATO initiated the rapprochement in order to build bridges with Russia. However, with Russia annexing the Crimean Peninsula in 2014 and launching a war in Ukraine, NATO’s rapprochement efforts came to an end. So currently, this might seem an impossible act for both parties.

- However, with NATO encircling Russia from the West, Russia might consider the option to meet at the table at a later stage.

#### **A secured Euro-Atlantic:**

- NATO presence in the region will securitise and safeguard the Baltic states, Estonia, Latvia and Lithuania, which were earlier at risk due to their close proximity to Russia and Russian attacks.
- This will not only help Ukraine win the war but will also enable NATO to bring in advanced weapons such as fifth-generation aircraft, technological weapon systems and strong political institutions across the allied countries.

## **Payments for Ecosystem Services (PES)**

**(GS Paper 3, Environment)**

#### **Context:**

- Incentives for biodiversity protection and sustainable use include biodiversity-relevant taxes, fees, levies, tradeable permits, and **Payments for Ecosystem Services (PES)**.
- Through these economic instruments, governments can affect both public and private financing flows for biodiversity.

#### **Opportunity for biodiversity financing in India:**

- Mobilisation of biodiversity **finance through pesticide levies, admission fees to natural parks, hunting and fishing permit fees**, and the trade-in energy-saving certificates has gained governmental support and political will, but the mobilisation of private and public finance for PES has lacked lustre.
- Lack of academic research, governmental support, and political will have vexed environmental economists.
- Despite a solid theoretical foundation and the ability to tether investments more directly to outcomes, the debate revolves around the same issues from two decades: monetisation of environmental benefits, lack of additionality (how much environmental service would have been provided without conditional payments), and so on.



#### **Increasing ecosystem services**

##### **Potential of PES:**

- PES is one way to conserve and increase ecosystem services. It works through the establishment of performance contracts.
- People who can help provide the desired ecosystem service are rewarded based on their actions, or the quantity and quality of the services themselves.
- PES presents a unique scope for incentivising local land stewards to manage threatened ecosystems.

- It has the potential to **achieve the dual goals of conservation and poverty alleviation** towards the achievement of Sustainable Development Goals. This places PES as one of the pivotal economic instruments for conservation.

#### **PES implementation globally:**

- PES has not achieved much attention either in the research or policy mandate in the Indian subcontinent.
- This is in sharp contrast to the successful implementation of PES in Latin American and African countries. In the Western Cape, South Africa, the CapeNature Stewardship Programme protects biodiversity on private lands.
- Kitengela, Kenya's Wildlife Conservation Lease Programme, maintains open areas for wildlife and grazing on personal grounds.
- In terms of raising money, PES programmes such as Costa Rica's Pago Por Servicios and Ecuador's Socio Bosque were among the few to mobilise significant finances.

#### **Successful implementation:**

- A research paper argues that any successful PES programme is one that overcomes the impediments to implementation.
- Such limitations include a **solid institutional mechanism** capable of simultaneous transfer of funds from buyers to suppliers, monitoring through investment in local capacity building, cost efficiency, the scope for development benefits, and maintaining the sustainability of funds.
- A local monitoring mechanism is the key to successfully implementing a PES programme.
- A study conducted in the Kodagu district of Karnataka to restore native trees that grow in the understory of coffee plantations shows a successfully designed local institutional mechanism for PES implementation.
- However, the PES mechanism is yet to be implemented or even tested for efficacy. The results of such studies offer support for potential research funding in restoration financing.

#### **Impact evaluation:**

- Impact evaluation studies that evaluate financial instruments' performance in attaining biodiversity are also important.
- The **OECD (2019) Biodiversity: Finance and the Economic and Business Case for Action** highlighted the importance of evaluating financial instruments' performance in attaining biodiversity goals.
- According to recent OECD research, few thorough impact evaluation studies have been done for terrestrial biodiversity and fewer for ocean/marine biodiversity.
- The OECD advocates **comprehensive impact evaluations and the formulation of strategic criteria** to help determine which policies or initiatives warrant more scrutiny.

#### **Way Forward:**

- Additionally, a strong policy thrust, such as the TEEB India Initiative highlighting the economic consequences of the loss of biological diversity, would help prioritise ecosystem restoration financing through a direct approach.
- A global initiative such as the **United Nations Environment Programme Finance Initiative** to mobilise private sector finance to benefit people and the environment would help maintain the funds.
- The cheapest way to receive anything you desire is to pay for it directly. This would allow the country to effectuate the nation's commitments to achieving the 2030 agenda for sustainable development and the Paris Agreement on climate change.