1. A sustainable resource management policy should be framed in terms of availability, exhaustibility, and remaining reserves. Comment.

Approach:

It expects students to write about - in first part write about need of Sustainable resource management policy - in second part write about how policy should be framed for sustainable resource management.

Introduction:

Sustainable Resource Management is the use of the available in a way that creates the ability of a system to thrive by maintaining economic viability and also nourishing the needs of the present and future generations by limiting resource depletion.

Body:

Need of Sustainable resource management policy:

- According to Global resources outlook 2019
  - Resource extraction has more than tripled since 1970
  - Resource extraction is responsible ~ 50% of greenhouse gas emissions and over 90 per cent of biodiversity loss and water stress.
- Exploding human consumption is the driving force for Anthropocene extinction as per 'The living planet report' of WWF.
- Economic activity (GDP)
  - Employment need increasing the industrial base.
  - Doubling the farmer's income require high energy consumption.
  - To increase India's manufacturing base and to decrease dependence on mineral import, resource extraction is important.
- Environmental impact
  - IPCC report has said that this is the last chance for fight against climate change.
  - Resource extraction is responsible ~ 50% of greenhouse gas emissions and over 90 per cent of biodiversity loss and water stress as per global resources outlook 2019 (UNEP).
  - Sustainable future is one three biggest challenges as per World Economic Forum.
  - Mean temperature in Indian has risen by 0.66-degree C.
  - Disaster – Kerala floods etc.

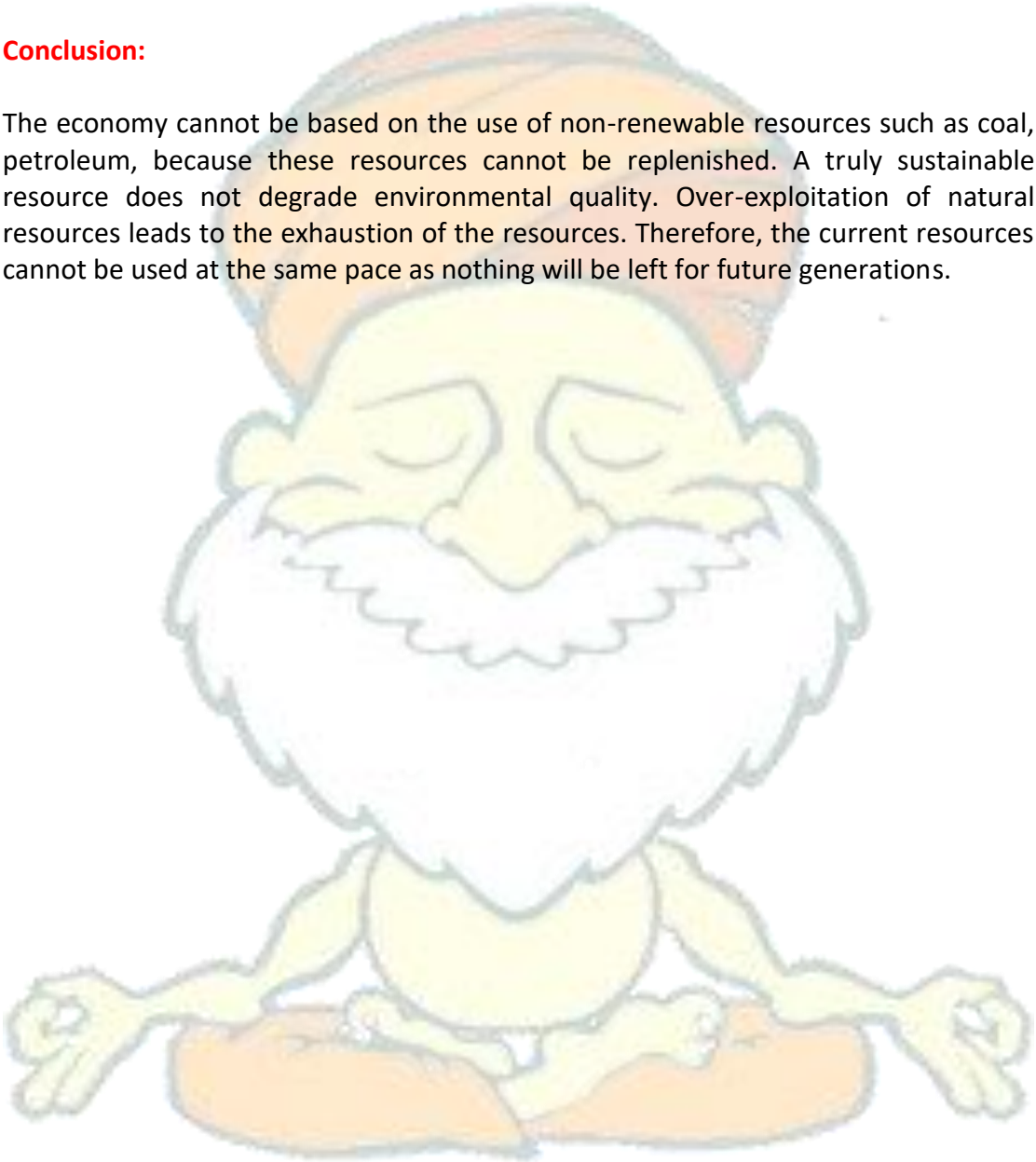
To resolve these issues sustainable resource management policy should be:

- It should be framed by keeping in mind various factors like availability, exhaustibility, and remaining reserves.
- Organisation like NITI Ayog should make medium and long term roadmap by keeping in mind various factors.
- Resource mapping need to be done in terms of availability and abundance of remaining resources.

- Policy should adopt best practices from across the world where sustainable resource management practices are adopted like Scandivian countries.
- Alternative resources should be streamlined to reduce dependence on traditional resources.
- 70% of India's power requirement is still fulfilled by coal. By promoting research and development in renewable energy as well as incentivising it can lead to check exhaustibility of traditional resources.

Conclusion:

The economy cannot be based on the use of non-renewable resources such as coal, petroleum, because these resources cannot be replenished. A truly sustainable resource does not degrade environmental quality. Over-exploitation of natural resources leads to the exhaustion of the resources. Therefore, the current resources cannot be used at the same pace as nothing will be left for future generations.



2. Should the Chinese model of constructing massive dams like the Three Gorges Dam to tap hydroelectricity be followed in India? Critically comment.

Approach:

It expects students to write about - in first part write about benefits of dam construction - while in second part write about issues pertaining to dam construction.

Introduction:

Amid simmering border tension with India along the Line of Actual Control (LAC) in Eastern Ladakh, China is planning to build a major hydropower project on Brahmaputra River in Tibet and a proposal for this has been clearly put forward in the 14th Five-Year Plan to be implemented from next year.

Body:

India also planning a dam on Brahmaputra river against Chinese projects. There are both benefits and issues related to adopting Chinese model of constructing massive dams like Three Gorges Dam to tap hydroelectricity which are as follows.
Benefits of dam construction:

- Water for drinking and industrial use
    - Due to large variations in hydrological cycle, dams and reservoirs are required to be constructed to store water during periods of surplus water availability and conserve the same for utilization during lean periods when the water availability is scarce.
    - Properly designed and well-constructed dams play a great role in optimally meeting the drinking water requirements of the people.
    - Water stored in reservoirs is also used vastly for meeting industrial needs.
    - Regulated flow of water from reservoirs help in diluting harmful dissolved substances in river waters during lean periods by supplementing low inflows and thus in maintaining and preserving quality of water within safe limits.
- Irrigation
    - Dams and reservoirs are constructed to store surplus waters during wet periods, which can be used for irrigating arid lands. One of the major benefits of dams and reservoirs is that water flows can be regulated as per agricultural requirements of the various regions over the year.
    - Dams and reservoirs render unforgettable services to the mankind for meeting irrigation requirements on a gigantic scale.
    - It is estimated that 80% of additional food production by the year 2025 would be available from the irrigation made possible by dams and reservoirs.
    - Dams and reservoirs are most needed for meeting irrigation requirements of developing countries, large parts of which are arid zones.

    - There is a need for construction of more reservoir based projects despite widespread measures developed to conserve water through other improvements in irrigation technology.
- Flood Control
    - Floods in the rivers have been many a time playing havoc with the life and property of the people. Dams and reservoirs can be effectively used to control floods by regulating river water flows downstream the dam.
    - The dams are designed, constructed and operated as per a specific plan for routing floods through the basin without any damage to life and property of the people.
    - The water conserved by means of dams and reservoirs at the time of floods can be utilized for meeting irrigation and drinking water requirements and hydro power generation.
- Hydro Power Generation
    - Energy plays a key role for socio-economic development of a country. Hydro Power provides a cheap, clean and renewable source of energy.
    - Hydro Power is the most advanced and economically viable resource of renewable energy.
    - Reservoir based hydroelectric projects provide much needed peaking power to the grid.
    - Unlike thermal power stations, Hydro Power stations have fewer technical constraints and the hydro machines are capable of quick start and taking instantaneous load variations.
    - While large hydro potentials can be exploited through mega hydroelectric projects for meeting power needs on regional or national basis, small hydro potentials can be exploited through mini/micro hydel projects for meeting local power needs of small areas. Besides hydro power generation, multipurpose hydroelectric projects have the benefit of meeting irrigation and drinking water requirements and controlling floods etc.
- Inland navigation
    - Enhanced inland navigation is a result of comprehensive basin planning and development, utilizing dams, locks and reservoirs that are regulated to play a vital role in realizing large economic benefits of national importance.
- Recreation:
    - The reservoir made possible by constructing a dam presents a beautiful view of a lake. In the areas where natural surface water is scarce or non-existent, the reservoirs are a great source of recreation.
    - Along with other objectives, recreational benefits such as boating, swimming, fishing etc. linked with lakes are also given due consideration at the planning stage to achieve all the benefits of an ideal multipurpose project.

While dams provide a yeoman service to the mankind, the following impacts of the construction of dams are required to be handled carefully: -

- Resettlement and Rehabilitation: displacement of local people due to dam project is major issues in India.
- Environment and Forests: dam construction required clearance of forest cover due to this Environment and Forests will be impacted.

- Geostrategic implications: it will impact India's big brother reputation and neighbourhood policy as building dams lead to low water flow to downstream countries.
- Sedimentary issues
- Socio economic issues
- Safety aspects

Conclusion:

The above problems related to the construction of dams may be resolved successfully in case the approach of government is objective, dynamic, progressive and responsive to the needs of the hour.

3. The Arctic region must be approached carefully for exploration and drilling? Do you agree? Substantiate your views.

Approach:

As the directive here is substantiating it is necessary to give examples while giving arguments. In the introduction candidate can start by giving importance of Arctic region. In the first half of main body part it is necessary to explain the reasons behind adopting a careful approach to explore and drill. A brief of way forward will enrich your answer. Conclusion in the context of sustainability will be good way to conclude.

Introduction:

Americans Robert Peary and Matthew Henson, along with several inuits, were the first people to finally reach the North Pole. They arrived on April 6, 1909, by traversing across the sea ice. It opened up a new land of opportunities for human kind. Subsequently, the global warming has intensified melting of glaciers thus started a new competition for the acquisition of resources.

Body:

Arctic a new land of opportunities:

- It is estimated that Arctic contains 90 billion barrels of oil, 1,670 trillion cubic feet of natural gas, and 44 billion barrels of natural gas, which is approximately 13% of the world's undiscovered oil resources, 30% of its undiscovered natural gas resources, and 20% of its undiscovered natural gas.
- The Arctic region also holds mineral resources, as mentioned earlier, including gold, nickel, copper, graphite and uranium. The potential of Arctic in terms of resources and to change geo-politics and in the Arctic are as represented in Figure 1.

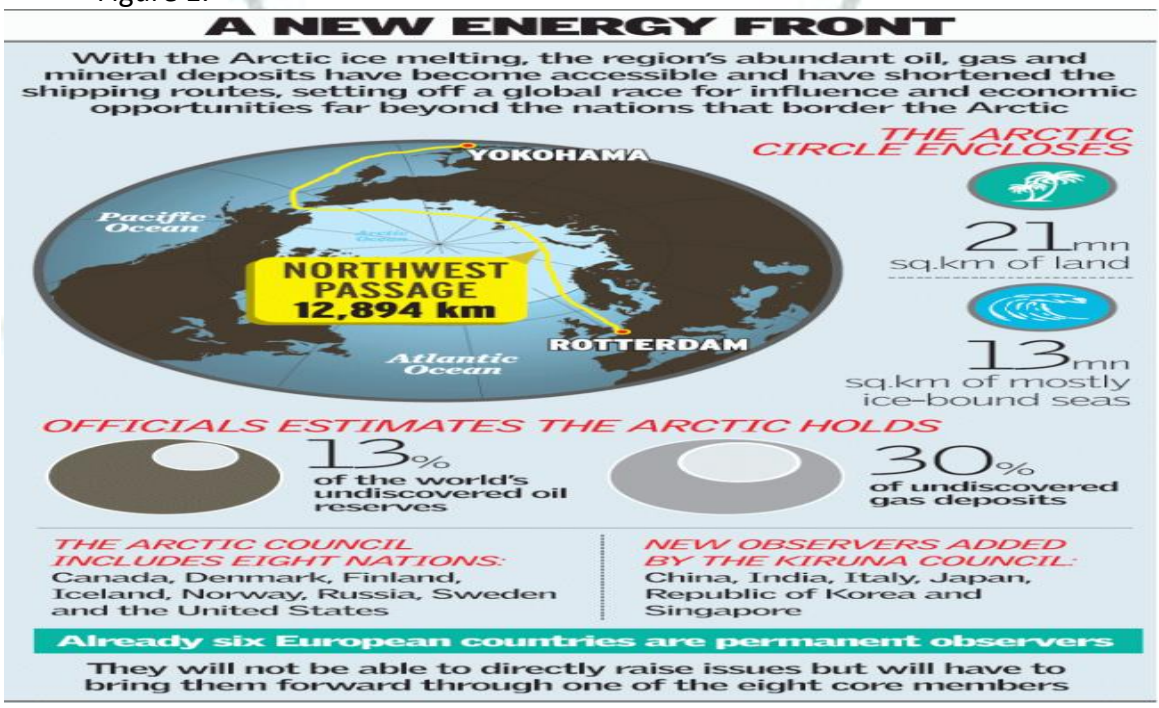


Figure 1

Hence, the opening of the Arctic Sea has given way for resource mapping in the Arctic region. Thereby initiating the processes of exploration and drilling. For instance, Russia has already started to venture as explorer. However, to save the mother earth and sustain humankind on the earth it is necessary to adopt a careful approach for exploration and drilling.

- The objective of an Arctic policy, should be centred on placing more weight on environmental and scientific aspects rather than the economic potential of the region.
- For instance, the kind of overexploitation of natural resources going on in Gulf region and South American continent actually shows the kind of environmental damage humankind is doing to Mother earth.
- Arctic as a land is not well known to humankind. If any aggressive action culminates into disaster like phenomena, then it will hamper survival of humankind.
- The race for resource utilisation at Arctic is swift. However, big countries like USA and Russia could dominate the landscape and may overexploit the resources. Which might also hamper other countries interests. Hence, there arises a need of well articulated policy for exploration and drill.
- Enhancement of economic activity in the Arctic Region will accelerate global warming and lead to large sea level rise. Melting ice may also supplement the problem of global warming with its reduced capacity to absorb carbon dioxide.
- Any drastic change in the Arctic is going to affect the monsoon system, which may fall worst on the agrarian economic countries like India.
- This may also results in thermal expansion, which increases the sea level, thereby allowing melted glacial water to flow into tributaries of Himalayan Rivers.
- The Arctic has enough hydrocarbons to cater to the needs of people. However, the technologically advanced solutions to explore and drill at the Arctic are not made or not tested. Hence, we need to adopt a very careful approach to utilise the resources of Arctic.
- Adding more water in the sea may result in submergence of coastal areas. Hence, while exploring at the Arctic it is necessary to consider this aspect also.
- The melting of arctic ice and the commercial exploitation of the resources would have detrimental effect on the local inhabitants like Inuits, Chukchis, Lapps etc.

It is in the everyone's best interest that , the Arctic Sea should be governed by an Antarctica type international treaty which makes the region a global common. India should remain engaged with the leading organisations like the Arctic Council where many important decisions on the future of the Arctic region will be taken. These can have direct or indirect impact on everyone. Universities and think tanks should pay greater attention to the study and analysis of the developments and needs to explore sustainable exploration and drilling opportunities in the Arctic Region.

Conclusion:

The opening of the sea routes and the exploration of hydrocarbons present economic opportunities which everyone can utilise. On the negative side, the enhancement of economic activity in the Arctic Region will accelerate global warming and lead to large sea level rise impacting the global climate to which India cannot remain indifferent.

Q.4 Marine resources form the next frontier of man's quest for development. Comment.

Approach - It expects students to write about marine resources and highlight on marine resources as man's new quest for development

Introduction

The oceans of the world cover around 70% of the surface of the Earth. Thus, they contain a major amount and variety of geological processes within them. These processes over a period of time, result in the formation of different minerals which when proved usable by human beings become Marine Resources. Examples of some minerals that are extracted today for human use are salt, magnesium, fresh water, etc. As most of these resources are used in our day-to-day activities, it's quite obvious why these resources are important.

Body

Some of the important marine resources are listed below –

- Salt
- Potassium
- Sand
- Limestone and Gypsum
- Manganese Nodules
- Gold and Diamonds
- Water
- Oil and Gas
- Coal

Marine resources as next frontier of man's quest for development -

1. Energy resources security: The main energy resources present in Indian Ocean are petroleum and gas hydrates. Petroleum products mainly includes the oil produced from offshore regions. Gas hydrates are unusually compact chemical structures made of water and natural gas. It will help in diversification of energy resources and will provide new resources for energy e.g. gas hydrates.
2. Employment generation: It will provide jobs, improve livelihoods of many. This will help in inclusive growth. E.g improving fishery resources exploitation can provide livelihood to many.
3. Food security: It will lead to food security through fishery sector and other sea food resources. It would also help in reducing malnutrition issue in India as fishes are good source of nutrition.
4. Efficient transportation and logistics: Indian Ocean is a major gateway of trade with 80% of global oil trade happening through it. Better connectivity in the region will significantly cut the transport cost and will reduce logistics inefficiencies.

5. Women empowerment: It will help in women empowerment especially fishery sector by providing them jobs. As these jobs do not require high skills, women will find it easy to earn a livelihood.
6. Climate Change: Oceans provide an alternate and cleaner source of energy. It also act as an important carbon sink. This will help in mitigating climate change.
7. Manganese Nodules and Crusts: Manganese nodules contain significant concentrations of manganese, iron and copper, nickel, and cobalt all of which have a numerous economic uses and development of humanity.
8. Sustainable development: Marine resources from Indian Ocean can serve as the backbone of India's economic growth and can help India to become a 5 trillion dollar economy by 2022. Blue economy, through sustainable use of oceans, has great potential for boosting the economic growth.

Why marine resources extraction is limited –

- Much of these resources, however, are not easily accessible, so their recovery involves technological challenges and high cost.
- Drilling in these oceanic deposits could destabilize the seabed, causing vast swaths of sediment to slide for miles down the continental slope.
- There are issues involved in issuance of licenses by International seabed authority etc.

Action areas in this regard for marine sustainable development:

- Reducing marine pollution and debris including from land-based activities.
- Promoting sustainable exploitation of marine resources.
- Halting the destruction of marine resources especially through acidification.
- Eliminating harmful subsidies that promote fishing overcapacity.
- Ensuring full implementation of regional and international regimes governing oceans and seas.
- Protecting marine recourses in areas beyond national jurisdiction, including by establishing Marine Protected Areas.
- Encouraging sustainable small-scale fisheries.

Conclusion

Sustainable Development Goal (SDG 14), calls to conserve and sustainably use the oceans, seas and marine resources for sustainable development. India should expedite its efforts to exploit oceanic resources in Indian Ocean. What is required is use of technology to exploit oceanic resources in Indian Ocean. India has rightly launched O-SMART scheme aiming at regulated use of oceans, marine resources for sustainable development in this direction.

Q.5 What are the key factors that leading to the ongoing global water crisis? Discuss.

Approach:

It expects students to write about global water crisis and about factors leading to global water crisis.

Introduction

Water is at the core of sustainable development and is critical for socio-economic development, healthy ecosystems and for human survival itself. It is vital for reducing the global burden of disease and improving the health, welfare and productivity of populations. It is central to the production and preservation of a host of benefits and services for people. Water is also at the heart of adaptation to climate change, serving as the crucial link between the climate system, human society and the environment.

Body

Water is essential to life, yet 785 million people in the world - 1 in 9 - lack access to it as per water.org is a global water crisis.
Key factors that leading to global water crisis:

- Groundwater Is Being Depleted: About 30 percent of Earth's fresh water lies deep underground in aquifers. And it's extracted daily for farming, drinking and industrial processes often at dangerously unsustainable rates. Nowhere is this more evident than India, which guzzles more groundwater than any other country. 54 percent of India's groundwater wells are decreasing, meaning that water is used faster than it's replenished. Unless patterns shift, in 20 years, 60 percent of India's aquifers will be in critical condition.
- Water Is Wasted: Although it's true that water is a renewable resource, it's often wasted. Inefficient practices like flood irrigation and water-intensive wet cooling at thermal power plants use more water than necessary. What's more, as we pollute our available water at an alarming rate, we also fail to treat it. About 80 percent of the world's wastewater is discharged back into nature without further treatment or reuse.
- Natural Infrastructure Is Being Ignored: Forested watersheds around the world are under threat: watersheds have lost up to 22 percent of their forests in the past 14 years. Loss of vegetation from deforestation, overgrazing and urbanisation is limiting our natural infrastructure and the benefits that it provides.
- Wrong pricing of water: Water is seriously undervalued. Its price does not reflect the true, total cost of service, from its transport via infrastructure to its treatment and disposal. This has led to misallocation of water, and a lack of investments in infrastructure and new water technologies that use water more efficiently.
- Water Infrastructure Is in a Dismal State of Disrepair: Having enough water to go around is only the beginning. That water also needs to be transported,

treated, and discharged. Around the world, water infrastructure treatment plants, pipes, and sewer systems is in a state of disrepair.

- More Water Demand: As populations increase and incomes grow, so does water demand. The world's population, now at 7.5 billion, is projected to add 2.3 billion more people by 2050. Growing incomes also exacerbate the water problem, because of the water-intensive products like meat and energy from fossil fuels that richer populations demand.
- Changing the Climate and Making Dry Areas Drier: Climate change is warming the planet, making the world's hottest geographies even more scorching. At the same time, clouds are moving away from the equator toward the poles, due to a climate-change driven phenomenon called Hadley Cell expansion. This deprives equatorial regions like sub-Saharan Africa, the Middle East and Central America of life-giving rainwater.

Effects of global water crisis:

- Death and disease: All life needs water; every 90 seconds, a child dies from water-related illness and disease.
- Warfare: Regional conflicts have arisen due to the loss of safe water sources.
- Lack of hygiene and sanitation and malnutrition: 1/3 of the world's population lives without access to a toilet. This leads to disease and kills nearly 1 million people each year. 160 million children suffer from chronic malnutrition linked to water and sanitation.
- Poor education: Most schools in the worst affected areas do not have a toilet or safe drinking water for students, which leaves students dehydrated and mentally incapable of achieving well in schools.

Sustainable solutions for global water crisis.

- Bilateral multilateral Integrated Water Resource Management through reuse and aquifer recharging.
- To follow holistic water resource approach, referred to as the Dublin - Rio principle (UNCED Rio de Janeiro 1992).
- Water pricing.
- Educate to change consumption and lifestyles.
- Improve water catchment and harvesting.

Conclusion

Governments, businesses, universities and citizens around the world are waking up to water challenges, and beginning to take action. Each year brings more solutions – like using wastewater for energy, using restoration to bring water back to dry topographies, and monitoring groundwater levels more closely. However, even the best solutions will not implement themselves. Along with fresh water, political will and public pressure are critical resources in ensuring a sustainable future for all.