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- Youth and Sports
- Renewable Resources

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YOUTH AND SPORTS

Today, India has one of the largest youth populations in the world. With the right policy measures, youth, a key demographic, has the potential to usher in positive change to transform India into an economy with diversified and sustainable high economic growth. Therefore, it is necessary not only to address problems faced by the youth but also to provide them with opportunities to grow.

To optimally tap the constructive and creative energies of the youth, the Government of India has the twin objectives of personality-building and nation-building, i.e., developing the personality of youth and involving them in various nation-building activities. When youth develop valuable skills and build self-confidence, we prosper multi-fold as a country.

Sports are particularly key to youth development. The fundamental principles of sport, such as teamwork, fair play, cooperation, and discipline, contribute to the development of soft skills in the youth such as collaboration, self-initiative, self-direction, self-discipline, teamwork, responsibility, citizenship, etc. FIT India movement with a goal to make fitness an integral part of our daily lives has been a symbol of the paradigm shift in our approach towards sports.

Sport is a great unifier and equaliser. It is a key driver for societal harmonisation irrespective of various differentiating factors including culture, language, colour and geographic boundaries. There has been a tremendous shift in the public perception towards sports with the Government's persistent efforts and impetus given to the sports ecosystem that got reflected in the nation's impressive performance in the recent editions of the Olympics, Paralympics and Commonwealth Games.

A. Khelo India Scheme

Introduced to revive the sports culture in India at the grass-root level by building a strong framework for all sports played in our country, and establishing India as a great sporting nation.

Vision: To infuse sports culture and achieve sporting excellence in the country

Mission: Revamped scheme is to encourage sports for all thus allowing the population across gender and all age groups to harness the power of sports through its cross-cutting influence, namely, holistic development of children & youth, community development, social integration, gender equality, healthy lifestyle, national pride and economic opportunities related to sports development. Also, the scheme aims at addressing a bigger problem, that of optimal use of resources.

Focus on:

- Creating world-class sports infrastructure
- Identifying talented sportspersons in various sports disciplines
- Conducting sports competitions for positive youth engagement.
- Promoting rural and indigenous games to revive India's culture and tradition.
- Make quality sports infrastructure equitably accessible to the citizens (MoYAS has sanctioned 294 sports infrastructure projects across the country, amounting to close to Rs 2,500 crore.)

Ministry: Youth Affairs and Sports

Khelo India State Centres of Excellence (KISCE)

- The States will run the centres and build capacity to turn them into world-class sporting facilities.
- They will be responsible for all aspects of the management of the centre.

- Funds for expert coaches, supporting staff, equipment, infrastructure will be extended through the Khelo India Scheme.

Recent Developments:

- More than 23 lakh school-going children in the age group of 5-18 years have been assessed using the Khelo India Mobile App.
- More than 82,000 physical education teachers have been trained to assess the sporting prowess of children.
- Establishment of district level Khelo India Centres, Khelo India State Centres of Excellence, organising annual Khelo India Games (Youth Games, University Games, Winter Games, etc.), community coaching development programmes (e-Khelpathshala), promotion of women's participation in sports through women sporting leagues in various sporting disciplines, large-scale sports & fitness promotion events through the FIT India programme.
- The scheme has a robust early-stage talent identification and development mechanism through which talented sportspersons in various sports disciplines are identified and supported through out of pocket allowance and training support through Khelo India Accredited Academies.

Source: https://kheloindia.gov.in/about

"Padhoge Likhoge to banoge Nawab, Kheloge Kudoge to honge lajawab."

Initiatives by the Government

- Nehru Yuva Kendra Sangathan under the guidance of the Ministry of Youth Affairs and Sports (MoYAS) - organized various Swachh Bharat 2.0 programme activities.

- The Ministry of Youth Affairs and Sports has had a large focus to engage youth volunteers for the twin objective of personality building and nation building.
- The Ministry has launched a Capacity Building Training Programme for 14,000 Youth Volunteers of NYKS to enhance their life skills. These trained youth volunteers will play pivotal role in realising the Panch Pran (five resolve).
- A new National Education Policy 2020 was also brought for strengthening the education system in India.
- Universities and educational institutions are upgrading their sports infrastructure to enable the active participation of youth in the FIT India campaign. It will promote physical fitness and endurance and reduce carbon footprint.

The Way Forward

- States can be encouraged to take up initiatives like "One State, One Sport" and prioritize one game based on the available infrastructure, talent pool, and interest of the residents.
- Sporting culture should be embedded in Indian society.
- More leagues/tournaments/competitions should be organized at local, district, and state levels.
- Government should handhold the youth towards international platforms.
- All required facilities and training services should be put in place.

Conclusion

A youthful mind, body and soul is the key to a healthy and fit India. The youth of a nation is the most progressive section and has the most crucial role in the vision of New India.

B. FIT India: Towards a Healthy Future

'अपि यथा युवानो मत्सथा नो विश्वं जगदभिपित्वे मनीषा

This Rig Vedic phrase reminds us that it is the youth who pave the way for a better world.

The movement to take the nation forward on the path of fitness and wellness. The vision is to bring about behavioural changes and move towards a more physically active lifestyle.

The goals and objectives of this are:

- To promote fitness as easy, fun and free.
- To spread awareness on fitness and various physical activities that promote fitness through focused campaigns.
- To encourage indigenous sports.
- To make fitness reach every school, college/university, panchayat/village, etc.
- To create a platform for citizens of India to share information, drive awareness and encourage sharing of personal fitness stories.

This movement attempted to put the nation on a path towards wellness and fitness.

- Fitness is a crucial component of well-being in a modern environment of stress and lifestyle disorders and is crucial to maintaining our health, preventing illness, and assuring a higher standard of living.
- A special and exciting chance to work towards a healthier India is provided by this initiative.
- In order to support the movement, individuals and organisations can take a variety of actions to enhance both their own health and well-being and the health and well-being of their fellow Indians.

Initiatives

(i) Samagra Shiksha Scheme: Under the scheme, sports grant on an annual basis has been provided to all government schools. Furthermore, an additional sports grant of up to Rs 25,000 has been made available to schools if at least two students from that school win a medal at the National level in the Khelo India school games.

(ii) FIT India School Movement: The FIT India Mission encourages schools to organise a FIT India School Week in month of November/December.

(iii) FIT India School Week: With the use of numerous events including debates, quizzes, essay competitions, poster-making contests, yoga and meditation, the promise of fitness, indigenous sports, etc., school fraternities around the nation are invited to participate in this programme.

(iv) FIT India Quiz: The FIT India Quiz was introduced in 2021 as a celebration of "Azadi Ka Amrit Mahotsav," with the goal of strengthening its presence in schools and spreading the FIT India message to school children.

(v) FIT India Freedom Run 3.0: To make it a movement of the people, the Department of Sports has created a rating system based on the resources offered in the FIT India Schools.

(vi) Football for Schools Programme: The ambitious FIFA-UNESCO programme, Football for Schools (F4S) aims to help 700 million students around the world with their education, development, and empowerment. The F4S Programme seeks to achieve the following four key outcomes:

- Empower learners (boys and girls) with valuable life skills and competencies.
- Empower and provide coach-educators with the training to deliver sport and life-skills activities.
- Build the capacity of stakeholders (schools, member associations- MAs and public authorities) to deliver training in life skills through football.
- Strengthen the cooperation between governments, MAs and participating schools to enable partnerships, alliances and intersectoral collaboration. Schools continue to be the most practical and effective way to get kids involved in sports.

The sporting landscape in India has changed enormously in recent years. Today, sport is an important component of the socioeconomic development of a country. India is a storehouse of talent, especially in the field of sports. All these recent initiatives have provided much-needed systemic interventions and a change of mindset concerning sports.

C. Youth and Health

Youth – though definitions vary – are considered those individuals in the age group of 15 to 44 years. Therefore, this age group includes late adolescence (15 to 19 years) and early adulthood (20 to 44 years). The youth are amongst the healthiest of population sub-groups. This age group has the least burden of illnesses and mortality. Although, there are a few concerns which are more common in this age group such as road traffic injuries. In addition, the health behaviour adopted in this age group determines the health situation in later life.

Health Issues faced by the Youth

- ***Mental Health:*** It is a major challenge for the population of this age group. The reasons behind mental health issues are scholastic or workplace performance, violence, poverty and unemployment, stigma, marginalization, discrimination, humanitarian crises, etc.
- ***Alcohol and Drug Use****:* It is majorly associated with several high-risk behaviours that can also cause other diseases.

- ***Tobacco Use:*** It can cause cancer and increase the risk of other lifestyle diseases like diabetes, hypertension, heart disease, etc.
- ***Physical Inactivity:*** It is estimated that only 20% of the young population exercises adequately. Inactivity is extremely common in females.
- ***Diabetes and Hypertension:*** Diabetes is becoming a potential epidemic in India with every 1 in 10 adults suffering from it. Hypertension is also prevalent in one among five individuals.

Government Initiatives which aim at Healthier Youth

Sl. No	Programmes/Initiatives	Features
1.	Rashtriya Kishor Swasthya Karyakram (RKSK)	• The programme's main strength is its health promotion approach. • The focus of the programme is shifted from the clinic-based approach to prevention and promotion and reaching the adolescents in their own environment which includes their communities or families or schools.
2.	Adolescent Friendly Health Clinics (AFHC)	• It includes all health issues from sexual and reproductive health to injuries, violence, substance abuse, nutrition, NCDs, etc. • The components of AFHC are acceptable, equitable, accessible, appropriate, comprehensive.
3.	Peer Education Programme	• The selected peer educators have to ensure that the adolescents benefit from RKSK. • These peer educators are called 'Saathiya'. • Four peer educators (two boys and two girls) are selected per village/1000 population/ASHA habitation to reach out to adolescents.
4.	Menstrual Hygiene Scheme	MoHFW launched a scheme for promotion of menstrual hygiene in adolescents. It mainly focuses on increasing the awareness, increasing access and usage of sanitary napkins along with its safe disposal.
5.	Health and Wellness Centres under Ayushman Bharat Programme	The HWCs promote a comprehensive health approach by preventive and promotive interventions.
6.	FIT India	This initiative is aimed at adoption of healthier lifestyle in youth by getting involved in sports and other related activities.
7.	Other Health Programmes	Various health programmes like National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases & Stroke. (NPCDCS), Reproductive, Maternal, Newborn, Child Plus Adolescent Health (RMNCH+A), National AIDS Control Programme (NACP), National Mental Health Programme (NMHP) and others also strive in improving youth health.

D. Enablers for Employment

India, with an average age of 29 years and housing a fifth of the global youth population, is the world's largest democracy. Youth play a crucial role in nation-building. The Ministry of Youth Affairs & Sports (MoYAS) released a Draft National Youth Policy (NYP) in April 2022 with a 10-year vision for youth development, aligning with the Sustainable Development Goals (SDGs).

Five Focus Areas:

1. Education
2. Employment & entrepreneurship
3. Youth leadership & development
4. Health, fitness & sports
5. Social justice

During the pandemic, young people faced numerous mental health issues like academic stress, peer pressure, anxiety, depression, eating disorders, and learning difficulties.

Government interventions for students

- Prime Minister Shri Narendra Modi engages with students through an interactive session called ***'Pariksha pe Charcha'*** that aims to create a stress-free environment for exams.
- To influence people's behaviours and encourage them to live a physically active lifestyle, the **'FIT India' movement** was launched in 2019.
- ***Swayam Prabha*** is an initiative of the Government of India that helps learners in remote areas to get access to quality educational programs 24×7 through a group of 22 DTH channels.
- ***PM e-VIDYA*** enables multimode access to education by unifying all efforts related to digital/online/on-air education.
- The Ministry of Education has established the ***National Education Alliance for Technology (NEAT)***, implemented by the All-India Council for Technical Education (AICTE) to serve as a bridge between ed-tech businesses, academic institutions, and students.
- To bridge the digital divide, students can take online courses from class 9 till post-graduation on the ***SWAYAM portal.***

Government interventions for career opportunities

- The ***Make in India*** initiative launched in 2014 is helping foster innovation, build world-class infrastructure, and make India a hub for manufacturing and design.
- ***Rozgaar Mela***, a recruitment drive for 10 lakh personnel was launched in a mission mode.
- ***Karmayogi Bharat*** was launched, it is a Special Purpose Vehicle (SPV) under the administrative control of the Department of Personnel and Training (DoPT) for capacity building of all government employees. It operates the iGOT (Integrated Government Online Training) Karmayogi platform.
- ***Karmayogi Prarambh*** is an online orientation course for all new recruits in various Government departments.
- ***Pradhan Mantri National Apprenticeship Mela (PMNAM)*** is a part of the Skill India Mission that provides apprenticeship opportunities.
- ***Agnipath Scheme*** is launched by the government to recruit 46000 young people as 'Agniveers' in the armed forces for a four-year term.

Apart from government efforts, private and non-profit organizations should also contribute to increasing the participation of young people in nation-building.

E. Youth for Environment Sustainability

Our earth is our home and the source of our sustenance, and it is imperative that we coexist peacefully with nature. Anthropogenic activities harm our ecosystems and environmental biodiversity, from rising carbon emissions to deforestation and land degradation. Contrary to Milton Friedman's (1962) assertion, ecological values are not finding their place in the market, which explains why they are wildly undervalued and exploited.

The hazards of climate change are the most considerable negative externalities that affect India's development.

- Immediate action is required to deal with climate change and declining biodiversity, and to create pathways for environmental conservation.
- Youth-driven climate action initiatives could help augment the overall quality of education and attain net-zero emissions by 2030. It would further help in ensuring the quality of life for future generations on this planet.
- Innovative and focused approaches would be required to develop and prepare strategic frameworks, policies, and procedures; monitor land management, crisis, and disaster management; and conserve biodiversity.
- At present, there are 1.8 billion people between the ages of 10 and 24. This is the largest generation of youth in history. Moreover, around 90% of them reside in developing countries.
- The ability, ambition, and creativity of the younger generation should be utilized for sustainable cities and livelihoods.

Roles for Youth and the SDGs

- **Critical thinkers-** Youth can see and confront current power systems, obstacles to change, and inconsistencies and biases.
- **Change-makers-** Youth can mobilise others and take action. Globally, youth activism is increasing due to improved connectivity and access to social media.
- **Innovators-** Young people frequently have firsthand knowledge of and insights into topics that are not available to adults, in addition to bringing new viewpoints. Youth can provide fresh perspectives and unique solutions since they are most familiar with the issues they confront.
- **Communicators-** Young people can collaborate to spread the development agenda among their peers and communities locally as well as internationally.
- **Leaders-** Young people may influence change in their communities and nations when they are empowered with awareness of their rights and leadership abilities.

Youth are increasingly leveraging the strength of their collective voice to argue for the adoption of environment-friendly practices and regulations, and to lead initiatives in this regard. As young people connect more, they are also embracing digital platforms to spread knowledge, educate others, and increase their reach. Youth also play a crucial role in promoting the SDGs, particularly SDG 15, "Life on Land," which calls for the conservation and restoration of the planet's terrestrial ecosystems, forests, and biodiversity.

Lifestyle for the Environment (LiFE)

- **Launched on** June 5, 2022, World Environment Day
- **Vision:** To harness the power of individual and collective action across the world to address the climate crisis.
- **The objective** of the movement is to nudge individuals and communities to adopt simple and specific climate-friendly behaviours in their daily lifestyles.

Precedents of pro-planet initiatives around the world

- Denmark promotes the use of bicycles by limiting parking within the city centre and providing exclusive bike lanes.
- Japan has its unique "walk-to-school" mandate, which has been in practice since the early 1950s.

LiFE, however, is planned as a first-of-its-kind global movement, led by India in partnership with other countries, that will provide the world with a unique people-powered platform to relentlessly focus on bringing individual and collective actions to the core of the climate action narrative.

- **Consume responsibly:** LiFE plans to nudge the world to consume responsibly, rather than consuming less. Building on the unique insights from India's recent jan andolans such as the Swachh Bharat Mission (SBM), LiFE will deploy a range of tested behavioural techniques, including nudges, social and behaviour change communication and norm influencing to make mindful consumption a mass movement.
- **Produce responsibly:** By nudging the consumption patterns of the society at scale, LiFE can also trigger a huge boost for the sustainability market. Several green industries and a large number of jobs are likely to be initiated as a positive externality of LiFE.
- **Live responsibly:** Through its multi-dimensional, multi-cultural and global approach, the LiFE movement can play a pivotal role in not merely reversing the effects of climate change but, at a broader level, mainstream a harmonious and mindful way of living — a staple of Indian culture and tradition, practised by its people over centuries.

The Way Forward

- Social media is a major source of information for youths. Thus, it can be used to encourage a wider social learning process for sustainable development.
- A sustainable lifestyle should be promoted. For instance, reusing and recycling resources.
- To help the youth in the best way to maximise their potential, a holistic and laser-focused approach to the development of an enabling social entrepreneurship ecosystem is required.
- A strong commercial environment must be incorporated into an ecosystem that supports young social entrepreneurs.
- There is a need for strengthening job placement procedures and educational programs for green careers.
- Environmental and socially sustainable development information and skills should be included in all majors so that students can become educated employees or employers, customers, community members, and investors.

RENEWABLE RESOURCES

F. Sustainable Development through Renewable Resources

Context

- Livelihoods powered by clean energy are major outliers in the country that's the **third-largest emitter** of planet-warming gases in the world
- India missed its target to install 175 gigawatts of renewable energy to its overall power production by 2022.
- To meet its 2030 renewable energy target of installing a total of 450 gigawatts, India needs to build out clean energy at a far greater rate than it is doing now.

As a developing nation, India has a massive demand for energy to fuel its rapidly growing economy and developmental needs. However, the country has always been committed to looking for more alternative energy sources for sustainable development. Therefore, it has been promoting clean energy resources and making efforts to deal with climate change.

- Sustainable Development, as defined by the United Nations, is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
- The scale, spread and pace of development have posed an inevitable challenge of balancing the spirit of human endeavour to conquer new heights without compromising the fundamental principles of sustainable development.

Energy Sector

- The use of renewables has scope in the energy sector primarily due to the fact that energy is the main driver in automation, and in any other fields which demand inputs beyond human efforts.
- As of today, India is consuming about 9000 billion units of energy for various purposes.
- About 47 per cent of the total energy is sourced from coal and lignite, 31 per cent from crude oil, about 15 per cent from electricity (hydro, nuclear and other renewable sources) and 8 per cent from natural gas.

Impact of Fossil Fuels

- Fossil fuels pose many strategic and health challenges apart from the fear of extinction and carbon emission.
- The turbulence in oil supply nations caused distress in oil-consumer countries. The recent conflict between Russia and Ukraine has also prompted many countries to explore alternative energy options to fossil fuels.
- The 2022 report of the Lancet Countdown on Health and Climate Change says that the changing climate is affecting the spread of infectious diseases, putting populations at higher risk of emerging diseases and co-epidemics.
- These facts clearly indicate the necessity to explore renewable energy options.
- In view of this, in August 2022, India updated the Nationally Determined Contributions (NDCs) as stipulated in the Paris Agreement. This demonstrates India's commitment at the highest level for decoupling of economic growth from greenhouse gas emissions.

Fossil Fuels

- Fossil fuels are made from decomposing plants and animals.
- These fuels are found in the Earth's crust and contain carbon and hydrogen, which can be burned for energy.

- In 2019, 84% of primary energy consumption in the world and 64% of its electricity was from fossil fuels.

Major Fossil Fuel:

- Coal: Coal is a material usually found in sedimentary rock deposits where rock and dead plant and animal matter are piled up in layers.
  - More than 50 percent of a piece of coal's weight must be from fossilized plants.
  - Countries by proven coal reserve: USA>Russia>Australia>China>India
- Natural Oil: Oil is originally found as a solid material between layers of sedimentary like shale.
- This material is heated in order to produce the thick oil that can be used to make gasoline.
- Countries by proven Oil Reserve: Venezuela>Saudi Arabia>Iran>Canada>Iraq
- Natural Gas: Natural gas is usually found in pockets above oil deposits.
  - It can also be found in sedimentary rock layers that don't contain oil.
  - Natural gas is primarily made up of methane.
- Countries by proven Natural Gas: Russia>Iran>Qatar>Saudi Arabia>USA

Fossil Fuel as a Conflict Factor:

- Climate change: Climate change is the consequence of overuse of fossil fuels over centuries.
  - Fossil fuels are responsible for greenhouse gas emission and other air and water pollutants.
- War-Conflict: Large quantities of fossil fuels are concentrated in tiny geographical pockets.
  - Hence, the urge to control regions rich in reserves of coal, oil, and natural gas forms the sum and substance of foreign policy worldwide.
  - Countries neighboring these prized regions, as well as others, play all sorts of games to grab them — deploying religion, language, alliances to that end.
  - Conflicts also suddenly start when there is a temporary change in the balance of power, breaking the earlier, often fragile, equations of peace.
  - For example, occupation of minerally and industrially rich Ruhr region by French and Belgian troops led to the crash of the German currency and the economy, which eventually led to the start of World War II.
- Inflation: Wars induced situations lead to inflation which has a cyclic effect on economic and social sectors.
  - For example, Inflation induced due to the Ukraine-Russia war.

Renewable Energy

Today, India is a power surplus nation with a total installed electricity capacity of over four lakh Mega Watt (MW). Keeping in mind the sustainable development goals, India's power generation mix is rapidly shifting towards a more significant share of renewable energy.

- Today, India is the world's third largest producer of renewable energy, with about 42 per cent of our installed electricity capacity coming from non-fossil fuel sources.
- Estimated renewable energy potential of India (other than large hydro) is about 1.5 million MW, of which 50 per cent is from solar, 46.7 per cent from wind, and the remaining from small-hydro, biomass and waste to-energy.

Status

- Contribution It currently contributes about 10% of India's electricity needs.
- Price of renewable energy has plummeted.
- The cost of solar power has dropped roughly sixfold from 12 rupees (14 cents) per kilowatt-hour in 2011 to 2.5 rupees (0.03 cents) per kilowatt-hour.

- Economic savings The planned buildout of 76 GW of solar and wind power by 2025 will avoid the use of almost 78 million tons of coal annually and could lead to savings of up to 1.6 trillion rupees ($19.5 billion) per year.
- **Gujarat**
  - Coal's share in producing electricity for Gujarat fell from 85% to 56% in the last six years, according to analysis by London-based energy think tank Ember
  - The share of renewable energy for Gujarat grew from 9% to 28% in the same period.
  - Gujarat is one of four of India's 28 states that met their renewable energy targets for 2022.
- **Other states:** Most states have installed less than 50% of their targets and some states such as West Bengal have installed only 10% of their target.

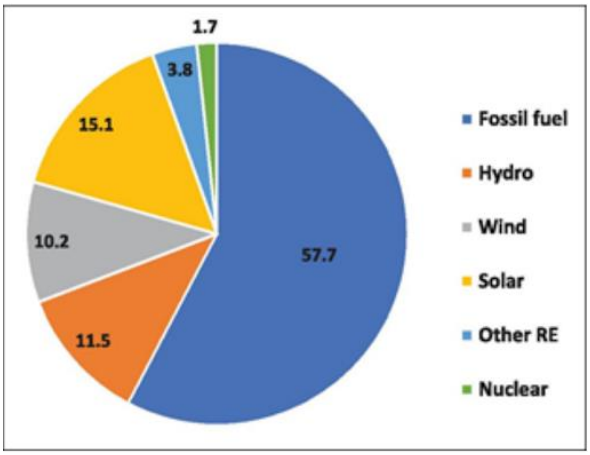
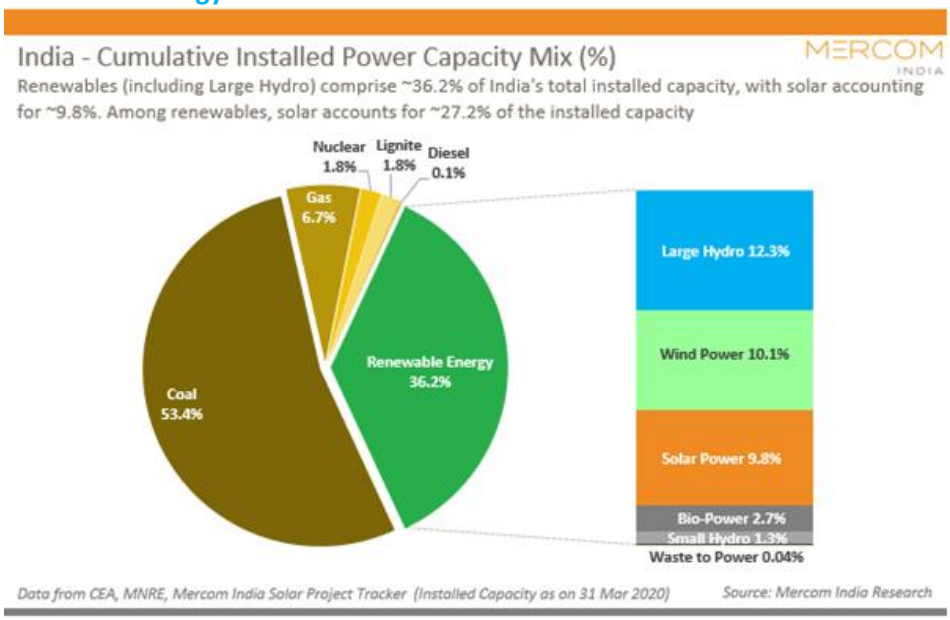


Image Source: Kurukshetra

Role of coal in India's Energy mix



- Coal is by far the largest share of dirty fuels.
- Nationwide fossil fuels generate more than 70% of India's electricity and have been doing so for decades.
- The Indian government has repeatedly defended its use of coal and its energy transition strategy, stating that the fuel is necessary for the nation's energy security.

- In 2021, India announced its biggest-ever auction for coal mines inviting bids for 141 mines spread across 12 states in the country
- It will contribute to its target of producing 1 billion tons of coal by April 2024.
- From 2001 to 2021, India installed 168 gigawatts of coal-fired generation, nearly double what it added in solar and wind power combined, as per Ember data.
- Coal India limited, a government-owned company, is the largest state-owned coal producer in the world.
- It is responsible for about 82% of the total coal produced in India.
- The country's coal-fired power plants have an average age of 13 years and India has 91,000 MW of new proposed coal capacity in the works, second only to China
- According to the Draft National Electricity Plan 2022, coal's share in the electricity generation mix will decrease to 50% by 2030, compared to the current contribution of 70%

Why is the 'move away from coal' so important?

- An effective way to keep the danger (unprecedented natural calamities as a result of climate change) at bay is to **cut the use of fossil fuels — coal, natural gas and oil.**
- About **80% of the world's energy requirements are met by these three fuels.**
- They have likely brought on the climate crisis we now face, **as they trigger the emission of carbon dioxide.**
- The **worst culprit of them all is coal**, which emits nearly **twice as much carbon dioxide as natural gas and about 60% more than oil,** on a kilogram-to-kilogram comparison.
- Combusting coal also leaves behind partially-burnt carbon particles that feed pollution and trigger respiratory disorders.
- The consequence of these chemical reactions gains great significance because, **the power sector in India accounts for 49% of total carbon dioxide emissions, compared with the global average of 41%.**

G. The Transition from Fossil Fuels to Renewable Energy

Since emissions of greenhouse gases are one of the primary causes of climate change, nations all over the globe are making concerted efforts to transition to cleaner forms of energy by altering the processes by which energy is generated.

The term "energy transition" refers to the change that is taking place in the global energy sector away from fossil-based systems of energy production and consumption, such as oil, natural gas, and coal, and toward renewable energy sources such as wind and solar, as well as lithium-ion batteries. Renewable energy technologies are called "clean" or "green" since they generate very few pollutants, if any.

India to lead the Global Energy Sector

Between 2019 and 2040, India will have the highest rise in energy demand of any country, accounting for about one-quarter of the total global increase.

- India, which is currently a major player in solar photovoltaics (PV), will take on a similar role in battery storage, attracting more than a third of global investment between 2019 and 2040.
- India's power system will grow larger than the European Union's by 2040, and it will be the world's third-largest in terms of electrical generation.
- Furthermore, India's installed renewable energy capacity will be thirty per cent greater than that of the United States.

- To capitalise on India's position as a leader in the deployment of battery storage and other clean energy technologies, as well as a country with a large and growing domestic market, the government intends to capture a larger share of this demand through domestic production.
- India's policymakers will have the critical responsibility of managing the risks and geopolitical hazards connected with these increasingly crucial value chains.
- By the year 2040, the solar PV module, wind turbine, lithium-ion battery, and water electrolyzer businesses in India are expected to generate a combined annual revenue of over $ 40 billion.
- With a total yearly trade volume of over $ 3 billion, India is now a net importer of goods such as solar photovoltaics (PV) and batteries.
    - The solar photovoltaic (PV) cell and module production facilities in India have had difficulty operating with high capacity factors and competing with imports, notably those coming from China.
    - It is possible that local production would be able to satisfy a greater share of demand, which would be in line with the policy aim of the government to increase domestic manufacturing.
    - The Advanced Chemistry Cell and Battery Gigafactory plan developed by NITI Aayog offers financial incentives to companies who want to construct battery cell plants.
    - In addition, the first plant in India to produce anodes for lithium-ion batteries was recently commissioned in the state of Karnataka.

The global transition away from fossil fuels to renewable energy sources could trigger financial challenges for India and major developing countries because of their high dependence on revenues from fossil fuel, according to a study by the International Institute of Sustainable Development (IISD)

- Though India is a net importer of petroleum products, it earns substantial revenues — via cesses and taxes — from the consumption of petrol, diesel and oil.
- The study finds that by 2050, overall fossil fuel revenues in Brazil, Russia, Indonesia, India and China could be as much as $570 billion lower than a business-as-usual scenario where governments fail to phase down fossil fuels enough to avoid the worst climate impacts.
- The widest gaps are expected to occur in India ($178 billion), China ($140 billion), and Russia ($134 billion).
- Public revenues from fossil fuel production and consumption currently account for 34% of general government revenue in Russia, 18% in India, and 16% in Indonesia. This includes only direct, first-order, government financial revenues — fossil fuel dependence would be much larger if private incomes and flow-on effects in these economies were added.
- Fossil fuel revenue streams, were unreliable and erratic and undermined by the negative economic impacts of fossil fuel use such as health costs due to air pollution and damage from climate change.

Emerging economies have an enormous opportunity to build more resilient and economically sustainable energy systems as they decarbonize — but they must plan ahead to avoid shortfalls in public revenues that could reverse progress on poverty eradication and economic development.

Challenges in Achieving the Clean Energy Target

1. **Mobilization of the Necessary Finance:**
    - Gearing up the banking sector for arranging finances for larger deployment goals, exploring low-interest rate, long-term international funding, and developing a suitable mechanism for risk mitigation or sharing by addressing both technical and financial bottlenecks are major challenges.
2. **Land Acquisition:**

- Identification of land with Renewable Energy potential, its conversion, clearance from land ceiling Act, decision on land lease rent, clearance from revenue department, and other such clearances take time.
- State governments have to play a major role in acquisition of land for RE projects.

3. **Creating Ecosystem:**
   - Creating an innovation and manufacturing eco-system in the country.
4. **Others:**
   - Integrating a larger share of renewables with the grid.
   - Enabling supply of firm and dispatchable power from renewables.
   - Enabling penetration of renewables in the so called hard to decarbonize sectors.

Suggestions for future

- Planning It is great that India has a 2070 net zero target, but changes need to happen now for us to achieve this.
- Building renewables capacity and energy storage– electricity distribution companies need to allow for more rooftop solar installations even if it results in short-term economic losses for them.
- Investing in modernizing and building new wind energy projects will also speed up the transition.
- India needs $223 billion to meet 2030 renewable capacity goals
- Enacting more progressive policies — such as the $2.6 billion government scheme that encourages making components required to produce solar energy — and ensuring these policies are being implemented is essential to speed up a move toward renewables
- New laws such as the energy conservation bill as well as updated mandates issued by the federal government that make it necessary for electricity companies to purchase renewables provide hope
- Investment in new technology such as clean fuels like green hydrogen may improve battery storage for renewables to provide uninterrupted electricity
- Sovereign green bonds India is expected to launch its first-ever sovereign green bonds auction, with the Reserve Bank of India

H. Solar Energy in India

- Solar energy is radiant light and heat from the Sun that is harnessed using a range of ever-evolving technologies such as solar heating, photovoltaics, solar thermal energy, solar architecture, molten salt power plants and artificial photosynthesis
- **Some of its advantages include**: Pollution free, virtually inexhaustible supply and global distribution.
- Due to global warming and climate change, world is now compelled to move from fossil based energy towards clean and green energy.

Solar energy has many advantages among which the abundance in supply, ability to generate power on a distributed basis, and ability for capacity addition in short time leads are prominent. The last decade has witnessed a surge in the use of solar energy-based decentralised and distributed applications. Millions of Indians are now using solar power for lighting, cooking, mobility and other energy needs.

- The solar power-based cooking has significantly improved the quality of life, especially of rural women and girl children, by reducing the drudgery of long haul of fuel woods and risk of lung and ailments caused by kitchen smoke.

- Easy access to power in remote areas have boosted economic activities and employment opportunities, and thus helped in mainstreaming the underdeveloped zones.
- Estimates by National Institute of Solar Energy suggest that covering three per cent of the waste land area with solar photovoltaic modules can generate about 748 GW power.

What is the Technology used to harness solar energy?

- **Solar Photovoltaic**: Solar photovoltaic (SPV) cells convert solar radiation (sunlight) into electricity. A solar cell is a semi-conducting device made of silicon and/or other materials, which, when exposed to sunlight, generates electricity.
- **Solar thermal**: Solar Thermal Power systems, also known as Concentrating Solar Power systems, use concentrated solar radiation as a high temperature energy source to produce electricity using thermal route (water converted into steam to turn turbines).

Solar Energy in India

- India's Intended Nationally Determined Contributions (INDC's) commitment includes 100 GW of solar power out of 175 GW of renewable energy by 2022.
- **India's current installed solar power capacity**: 26025.97 MW which is 34% of total renewable energy sources i.e, 75055.92 MW till February 2019.
- Ministry of new and renewable energy is the nodal agency to tackle India's renewable energy issues.
- Recently, India achieved **5th global position in solar power deployment** by surpassing Italy.
- **National Solar Mission** aims to establish India as a global leader in solar energy by creating the policy conditions for its deployment across the country.
- **Rooftop Solar Scheme**: To generate solar power by installing solar panels on the roof of the houses
- **Production-linked Incentive (PLI) scheme** to promote manufacturing of high efficiency solar PV modules in India.
- **International Solar Alliance (ISA):** Launched by the Indian Prime Minister and the French President in 2015 with a vision to enable **One World, One Sun, One Grid (OSOWOG).**
    - **One Sun, One World, One Grid (OSOWOG):** A framework for facilitating global cooperation, building a global ecosystem of interconnected renewable energy resources (mainly solar energy) that can be smoothly shared.

SOURCES OF ENERGY

Wind Power:

- The study conducted by the National Institute of Wind Energy (NIWE) identified seven states viz. Gujarat, Maharashtra, Rajasthan, Tamil Nadu, Madhya Pradesh, Karnataka, and Andhra Pradesh have significant potential for wind power generation.
    - The wind potential of these 7 seven states at 100 m above ground level (agl) is 293 GW and the potential at 120 m agl is 652 GW.
- The Government has been
    - Promoting wind power projects by incentivizing the investments through an Accelerated Depreciation Benefit, which allows an investor to claim a higher rate of depreciation in wind power infrastructure than that for the general assets.
    - Introduced a waiver of Inter-State Transmission System (ISTS) charges for the inter-State sale of solar and wind power, for projects to be commissioned by 30 June 2025.
- India, having a natural advantage of a 7500 km long coastline, has the potential of harnessing offshore wind energy.

- In 2015, the Government of India notified National Offshore Wind Energy Policy with the primary objective of exploring and promoting the deployment of offshore wind farms in the Exclusive Economic Zone (EEZ) of the country, including those under Public Private Partnership.

Hydropower:

- Since March 2019 Government of India has been recognizing Large Hydro Power Projects (LHPs) including Pumped Storage Projects (PSPs) having a capacity of more than 25 MW as part of renewable energy.
- According to the Central Electricity Authority (CEA) assessment, India has the potential of economically exploitable hydro-power to the tune of 1,48,700 MW.
- However, only less than 30 percent of this is presently exploited despite having a long life, low cost, and high efficiency among many other advantages.

Bio Fuels:

- Ethanol and biodiesel are the two most common types of biofuels in use today.
- The Government has been implementing Ethanol Blended Petrol (EBP) Programme wherein the Oil Marketing Companies (OMCs) sell petrol blended with 10 per cent ethanol.
- Since the biomass-based renewable hydrocarbon fuels are nearly identical to petroleum-based fuels, the transition becomes easier.
- The National Policy on Biofuels announced in 2018 is aimed at accelerated promotion of biofuels with indicative targets of achieving 20 per cent blending in Petrol and 5 per cent blending in diesel by 2030.

Ocean and Geo-thermal:

- Ocean energy refers to energy derived from Wave Energy, Tidal Energy, and Ocean Thermal Energy Conversion. The technology development in these areas is at the research and development stage.
    - The estimated theoretical power potentials for Tidal and Wave energy are 12,455 MW and 41,300 MW respectively.
- Geothermal Energy is a source of heat stored in the earth's crust, which is manifested on the surface as hot springs.
    - In India, Geological Survey of India (GSI) has estimated that a tentative power potential of 10 GW could be extracted from geothermal energy.

I. Green Hydrogen

What is Hydrogen fuel?

- A colourless, odourless, tasteless, non-toxic and highly combustible gaseous substance, hydrogen is the lightest, simplest and most abundant member of the family of chemical elements in the universe.
- Hydrogen **does not occur freely** in nature in useful quantities. It can be made from natural gas or it can be made by electrolysis of water—using electricity to split water into its constituent components of hydrogen and oxygen.
- When hydrogen is burned, it only emits water vapour and **carbon dioxide (CO_2) is not produced.**
- It is more efficient than internal combustion engine.
- Although hydrogen is a clean molecule, the process of extracting it is energy-intensive. Also, manufacturing hydrogen fuel based vehicle is expensive.

What is Green Hydrogen?

The sources and processes by which hydrogen is derived, are categorised by colour tabs.

- Hydrogen produced from fossil fuels is called grey hydrogen; this constitutes the bulk of the hydrogen produced today.
- Brown hydrogen is produced using coal where the emissions are released to the air.
- Hydrogen generated from fossil fuels with carbon capture and storage options is called blue hydrogen.
- Hydrogen generated entirely from renewable power sources is called green hydrogen. In the last process, electricity generated from renewable energy is used to split water into hydrogen and oxygen.

Advantages of Green Hydrogen?

- **Environment Friendly:** Green Hydrogen as energy source is seen as the next big thing as its usage would lead to zero emissions
- **Potential to Decarbonise "hard to abate" sectors:** It is a clean burning molecule, which can decarbonise a range of sectors including iron and steel, chemicals, and transportation. It is also a suitable fuel for shipping and other heavy road freight vehicles because its energy density is 3X of diesel and 3.5X of heavy fuel oil.
- **Efficient utilization of Renewable Energy:** Renewable energy that cannot be stored or used by the grid can be channelled to produce hydrogen. The stored hydrogen can be used to produce electricity using fuel cells.
- **Usable By-products:** Oxygen, produced as a by-product (8 kg of oxygen is produced per 1 kg of hydrogen), can also be monetised by using it for industrial and medical applications or for enriching the environment.
- **Reduced Dependence on Rare Minerals:** Green Hydrogen also holds the key to clean electric mobility that doesn't depend on rare minerals. Green Hydrogen helps achieve long-term vision of reduced dependency on minerals and rare-earth element-based battery as energy storage.
- **Reduces Import Bill:** India's average annual energy import bill is more than $100 billion. Due to the availability of cheaper renewable energy, India is in a unique position to produce hydrogen for its own needs & thus reduce its import bill.
- **Helps Achieve Paris Goal:** Green hydrogen energy is vital for India to meet its Nationally Determined Contributions and ensure regional and national energy security, access and availability.
    - Under the Paris Agreement of 2015, India is committed to reducing its greenhouse gas emissions by 33-35% from the 2005 levels. However, the commitments were updated in Glasgow Climate Summit of 2021.
    - New Glasgow Commitments include Net Zero by 2070, and by 2030, take cumulative non fossil fuel generation capacity to 500 GW, meet 50 percent of energy needs from renewable energy, reduce the energy intensity of the economy by 45 percent, and reduce carbon emissions by 1 billion tons.

How Hydrogen based vehicles are better than Battery based Electric Vehicles?

- **EV still has dependence on Coal:** India's electricity grid is predominantly coal-based and will continue to be so, thus negating collateral benefits from a large-scale EV push — as coal will have to be burnt to generate the electricity that will power these vehicles
    - In several countries that have gone in for an EV push, much of the electricity is generated from renewables — in Norway for example, it is 99 per cent from hydroelectric power.
- **Applicable to multiple sectors:** Experts believe hydrogen vehicles can be especially effective in long-haul trucking and other hard-to-electrify sectors such as shipping and long-haul air

travel. Using heavy batteries in these applications would be counterproductive, especially for countries such as India, where the electricity grid is predominantly coal-fired. Thus, Hydrogen based fuel offers a greener alternative.

- **Efficiency:** Hydrogen based vehicles enables a refuelling time of just five minutes, compared to 30-45 minutes charging for a Battery based EV. Also, consumers get about five times better energy storage per unit volume and weight

National Hydrogen Policy

On August 15, 2021, Prime Minister Modi announced a National Hydrogen Mission to make India a Global Hub for Green Hydrogen Production and Export.

- Government is targeting production of **5 million tonnes of green hydrogen** by 2030.
- The policy allows **free inter-state wheeling of renewable energy** used in the production of green hydrogen and ammonia as it seeks to boost usage of the carbon-free fuel, and make India an export hub.
    - It offers 25 years of free power transmission for any new renewable energy plants set up to supply power for green hydrogen production before July 2025.
    - This means that a green hydrogen producer will be able to set up a solar power plant in Rajasthan to supply renewable energy to a green hydrogen plant in Assam and would not be required to pay any inter-state transmission charges.
- There will also be a **single portal for all clearances** required for setting up green hydrogen production as well as a facility for producers to bank any surplus renewable energy generated with discoms for upto 30 days and use it as required.
- Energy plants set up to produce green hydrogen/ammonia would be given connectivity to the grid on a priority basis.
- Power distribution companies may also procure renewable energy to supply green hydrogen producers but will be required to do so at a concessional rate.
    - Such procurement would also count towards a **state's Renewable Purchase Obligation (RPO)** under which it is required to procure a certain proportion of its requirements from renewable energy sources.
- Under the policy, port authorities will also provide land at applicable charges to green hydrogen and green ammonia producers to set up bunkers near ports for storage prior to export.
    - Germany and Japan could be key markets for green hydrogen produced in India
- The move is likely going to make it more economical for key users of hydrogen and ammonia such as the oil refining, fertiliser and steel sectors to produce green hydrogen for their own use. These sectors currently use grey hydrogen or grey ammonia produced using natural gas or naphtha.

What are the challenges with regard to Hydrogen Fuel?

- **Fuelling Infrastructure:** A big barrier to the adoption of hydrogen fuel cell vehicles has been a lack of fuelling station infrastructure — fuel cell cars refuel in a similar way to conventional cars, but can't use the same station (only 500 in the world & that too in Europe, Japan, South Korea)
- **Safety is seen as a concern:** Hydrogen is pressurised and stored in a cryogenic tank, from there it is fed to a lower-pressure cell and put through an electro-chemical reaction to generate electricity. Therefore, safety is a big concerns which can push the cost of adoption of this energy base.
- **Scaling up the technology** and achieving critical mass remains the big challenge. More vehicles on the road and more supporting infrastructure can lower costs.

- **Role of Universities:** As Indian businesses invest in research and development across the entire green hydrogen value chain, the lack of a homegrown research workforce will become a bottleneck.
- **Cost:** Currently, the production of green hydrogen is expensive compared to fossil fuels. This is because it requires large amounts of renewable energy to produce.
- **Limited availability:** Currently, the production of green hydrogen is limited and unable to meet the demand of various sectors.

Here are some ways India can leverage them to become a leader in green hydrogen:

- **Scaling up renewable energy capacity:** India has set a target of achieving 450 GW of renewable energy capacity by 2030. By achieving this target, India can generate a significant amount of green hydrogen using solar, wind, and other renewable energy sources.
- **Developing a green hydrogen ecosystem:** India needs to develop a complete green hydrogen ecosystem, including production, storage, transportation, and distribution infrastructure. The government can play a critical role in developing this ecosystem by providing incentives and subsidies for green hydrogen production and adoption.
- **Encouraging private sector participation:** The private sector can play a vital role in driving green hydrogen production and adoption in India. The government can encourage private sector participation by providing tax incentives, subsidies, and other benefits for green hydrogen projects.
- **Collaborating with international partners:** India can collaborate with international partners to develop green hydrogen technologies, share knowledge and best practices, and attract investment. Collaboration with countries like Japan, Germany, and Australia, which are investing heavily in green hydrogen, can help India accelerate its green hydrogen ambitions.
- **Supporting research and development:** India can invest in research and development to develop new and innovative green hydrogen technologies. This can help India overcome technical and economic barriers to green hydrogen production and adoption.

By leveraging its abundant renewable energy resources, developing a green hydrogen ecosystem, encouraging private sector participation, collaborating with international partners, and supporting research and development, India can become a leader in green hydrogen production and adoption.

Pradhan Mantri Kisan Urja Suraksha Evam Uttham Mahabhiya (PM KUSUM)

Context: The deadline for a key scheme by the Ministry of New and Renewable Energy to install 30,000 MW solar power capacity in rural India by 2022, has now been pushed to March 2026.

About the scheme:

- Ministry of New and Renewable Energy (MNRE) has launched the PM KUSUM Scheme for farmers for installation of solar pumps and grid connected solar and other renewable power plants in the country.
- The scheme will open a stable and continuous source of income to the rural land owners for a period of 25 years by utilization of their dry/uncultivable land.
- The scheme would ensure that sufficient local solar/ other renewable energy-based power is available for feeding rural load centres and agriculture pump-set loads, which require power mostly during the day time.

The Scheme consists of three components:

- **Component A:** 10,000 MW of Decentralized Ground Mounted Grid Connected Renewable Power Plants of individual plant size up to 2 MW.
- **Component B:** Installation of 17.50 lakh standalone Solar Powered Agriculture Pumps of individual pump capacity up to 7.5 HP.
- **Component C:** Solarization of 10 Lakh Grid-connected Agriculture Pumps of individual pump capacity up to 7.5 HP.

J. Powering Growth in Agriculture Sector

Agriculture is the mainstay of the Indian economy contributing nearly 15 percent to the national GDP as it provides livelihood to around two-thirds of the total working population in the country

- Further, agriculture is the primary source of raw materials for some of the major industries such as textile, sugar, food, pharma (mainly Ayurveda) and new age health and fitness products.
- Recently, agriculture has jumped to the 7th position as net exporter, across the globe.

Energy Demand

Agriculture also demands high energy inputs in many of its activities, mainly irrigation. According to estimates, agriculture consumes nearly 20 per cent of the electricity consumed at national level.

- Farmers have installed around nine million diesel pump sets to harvest groundwater for irrigation purposes.
- Energy consumption at this high level has raised concern in view of India's commitment to reduce the carbon intensity by less than 40 per cent by 2030 (COP-26).
    - Recently, the Government has set a target to make the agriculture sector diesel free by 2024.
    - Renewable energy (RE) has emerged as the most viable and sustainable option to address environmental concerns and meet the targets as envisaged by the Government of India.
    - RE also promises to increase the income of farmers and save precious natural resources, mainly water.
- A series of steps to empower farmers with RE systems to make them energy self-sufficient, particularly in irrigating their fields.
    - Various sources of renewable energy such as solar, wind, small hydro, biomass and agricultural wastes are being deployed in rural settings for agricultural purposes.
    - Facilitates related research, design, development and manufacture.
    - At state level, a network of Renewable Energy Development Agencies actively co-operate and co-ordinate with MNRE to connect with various stakeholders, primarily farmers.
    - First bio-energy plant of a private company in Sangrur district of Punjab - It will produce Compressed Bio Gas (CBG) from paddy straw, thus converting agricultural waste into wealth.

1. Bioenergy

- Bioenergy is renewable energy made available from organic materials derived from biological sources. It is the energy derived from biomass such as bagasse, cotton stalk, coconut shell and wood, plants, etc.

Compressed Bio Gas (CBG):

- Bio-gas is produced naturally through process of anaerobic decomposition from waste and bio-mass sources like agriculture residue, cattle dung, municipal solid waste, sugarcane press mud, sewage treatment plant (STP) waste, etc.
- It is called CBG after biogas is purified and compressed, which has pure methane content of over 95%. CBG is exactly similar to commercially available natural gas in its composition and energy potential. Its calorific value and other properties are similar to CNG.

The need for CBG:

- It has become common practice among farmers in Punjab, Haryana and western Uttar Pradesh to dispose of paddy stubble and the biomass by setting it on fire to prepare fields for the next crop, which has to be sown in a window of three to four weeks. The resultant clouds of smoke engulf the entire National Capital Territory (NCT) of Delhi and neighbouring

States for several weeks between October to December. This plays havoc with the environment and affects human and livestock health.

- The Capital's air quality index (AQI) deteriorated slightly and continued to be in the "poor" category on Tuesday, according to the Central Pollution Control Board (CPCB) data of October 2022.
- Meanwhile, recently the Delhi government started spraying Pusa bio-decomposer solution in paddy fields in the city to reduce stubble burning. Commission for Air Quality Management in NCR and Adjoining Areas (CAQM) recently announced an immediate ban on all construction and demolition activity unregistered with the authority.

Some measures:

- The Government of India has put in place several measures and spent a lot of money in tackling the problem. The Commission for Air Quality Management in National Capital Region and Adjoining Areas (CAQM) had developed a framework and action plan for the effective prevention and control of stubble burning. The framework/action plan includes:
- in-situ management: incorporation of paddy straw and stubble in the soil using heavily subsidised machinery (supported by crop residue management (CRM) Scheme of the Ministry of Agriculture and Farmers Welfare).
- Ex-situ management, i.e., CRM efforts include the use of paddy straw for biomass power projects and co-firing in thermal power plants, and as feedstock for 2G ethanol plants, feed stock in CBG plants, fuel in industrial boilers, waste-to-energy (WTE) plants, and in packaging materials, etc.
- Additionally, measures are in place to ban stubble burning, to monitor and enforce this, and initiating awareness generation. Despite these efforts, farm fires continued unabated.

A project in place

Ex-situ uses of rice straw:

- In its search for a workable solution, NITI Aayog approached FAO India in 2019 to explore converting paddy straw and stubble into energy and identify possible ex-situ uses of rice straw to complement the in-situ programme.
- The results suggest that to mobilise 30% of the rice straw produced in Punjab, an investment of around ₹2,201 crore would be needed to collect, transport and store it within a 20-day period. This would reduce greenhouse gas (GHG) emissions by about 9.7 million tonnes of CO 2 equivalent and around 66,000 tonnes of PM 2.5.

Pellets:

- A techno-economic assessment of energy technologies suggested that rice straw can be cost-effective for producing CBG and pellets. Pellets can be used in thermal power plants as a substitute of coal and CBG as a transport fuel.
- Union Environment Ministry recently announced a ₹50 crore scheme to incentivise industrialists and entrepreneurs to set up paddy straw palletisation and torrefaction plants.
    - Paddy straw made into pellets or torrefied can be mixed along with coal in thermal power plants.
    - This saves coal as well as reduces carbon emissions that would otherwise have been emitted were the straw burnt in the fields, as is the regular practice of most farmers in Punjab and Haryana.

SATAT Scheme

- With 30% of the rice straw produced in Punjab, a 5% CBG production target set by the Government of India scheme, "Sustainable Alternative Towards Affordable Transportation (SATAT)" can be met.

SATAT has following four objectives:

- Utilising more than 62 million metric tonnes of waste generated every year in India,

- Cutting down import dependence,
- Supplementing job creation in the country
- Reducing vehicular emissions and pollution from burning of agricultural / organic waste.
- From paddy stubble, CBG valued at ₹46 per kg as per the SATAT scheme will be produced. Paddy straw from one acre of crop can yield energy output (CBG) worth more than ₹17,000 — an addition of more than 30% to the main output of grain. This initiative is an ideal example of a 'wealth from waste' approach and circular economy.

GOBARdhan (Galvanising Organic Bio-Agro Resources Dhan) scheme

- Government of India has launched a dedicated GOBARdhan (Galvanising Organic Bio-Agro Resources Dhan) scheme (Swachh Bharat Mission Grameen Phase-2) with twin objectives – to make the villages clean and generate clean power from organic wastes.
    - The scheme also aims to increase income of farmers by converting biodegradable waste into compressed biogas (CBG).
    - Technical and financial assistance under the scheme is attracting entrepreneurs for establishing community based CBG plants in rural areas.
        - CBG is a purified form of biogas (98 per cent purity of methane content) which makes it suitable for use as green and clean fuel for transportation or filling in cylinders at high pressure (250 bar). Scheme is also promoting rural employment and income generation opportunities for rural youth and others.
- Recently, Asia's largest CBG plant was inaugurated at Sangrur, Punjab with an FD/ investment of Rs. 220 crores.
- CBG plant offers a much needed substitute for burning crop stubbles which is a serious environmental and health issue.
    - It is claimed that this plant will reduce the burning of stubble on 40,000-45,000 acres of fields, resulting in an annual reduction of 150,000 tonnes of carbon dioxide emissions. This will help India meet its CoP-26 climate change targets of reducing carbon emissions.

2. Biomass

- Biomass materials used for power generation primarily include bagasse, rice husk, straw, crop waste and agricultural residues.
- MNRE has been implementing biomass power/ cogeneration programs since the mid-nineties.
- Over 800 biomass power and bagasse/ non-bagasse cogeneration projects aggregating to over 10,206 Mega Watt capacity have been so far installed in the country with central financial assistance from Government of India.
- Power from biomass is generated by installing biomass gasifiers in proximity to the source of raw materials to reduce costs.
- Irrigation pumps powered by rice-husk electricity are cheaper, long lasting and more eco-friendly than diesel powered pumps. Irrigation facility at low cost allows farmers to increase crop intensity and also improves crop yield.

3. Solar Energy

- Addressing the energy concerns in the agriculture sector, a large number of solar devices/ equipment have been developed and deployed that include solar water pumps, solar dryers, solar dusters etc.
- The PM-KUSUM scheme is one of the largest initiatives of the world to provide clean energy to more than 35 lakh farmers and also enhance their income. The scheme is being implemented through its three components with specific objectives:
    - In addition to day time reliable power and increase in farmer's income, the scheme also has direct employment generation potential for skilled and non-skilled work

force. According to estimates, each solar installation creates approximately 24.50 job years per MW.
    - PM-KUSUM will help reduce subsidies required from states for electricity supply to agriculture.
    - It will also help boost domestic solar manufacturing mainly to make solar cells and solar modules for which we still depend on imports.
    - The scheme will lead to an annual reduction of 1.38 billion litres in diesel consumption per year, thus, reducing the import bill on account of petroleum products.
    - The scheme will also lead to reducing carbon emissions by as much as 32 million tonnes per annum.

A few concerns

- Due to the immense potential and scope of renewable energy in the agriculture sector, the Government is focusing on decentralised RE systems and products.
- MNRE has recently released a framework (2022) to promote RE based applications that are used for earning livelihoods. A special focus on engaging all stakeholders, skill development and capacity building would scale up RE-based livelihood applications.
- However, financing for the end-users and enterprises would be critical to enable the adoption of solutions and scale-up of the sector.
- RE based decentralised and distributed applications have benefitted millions of farmers in villages by meeting their energy needs in an environment friendly manner.

The Way forward:

- There are several other benefits of adopting CBG for a renewable energy revolution:
    - the slurry or fermented organic manure from the plant (CBG) will be useful as compost to replenish soils heavily depleted of organic matter, and reduce dependence on chemical fertilizers.
    - The plant will also provide employment opportunities to rural youth in the large value chain, from paddy harvest, collection, baling, transport and handling of biomass and in the CBG plant.
- Every year, about 27 million tonne of paddy straw is generated in Punjab and Haryana. About a third of this straw is from non-basmati rice, which cannot be fed to cattle as fodder because of its high silica content. This is usually burnt which adds to the air pollution crisis in Delhi NCR and adjoining areas. So, converting it into CBG is the last resort.

From the point of view of environmental benefits, renewable energy, value addition to the economy, farmers' income and sustainability, this initiative is a win-win situation. It is replicable and scalable across the country and can boost the rural economy.

Green technologies in Transport Sector

India's transport demand is expected to increase by 2.7 times in over 30 years.

Electric vehicles (EVs) are as green as the electricity powering them and the sustainable supply chain of batteries. Lifetime emissions from EVs today are 19-34 per cent lower than ICE cars.

- **FAME SCHEME:** In India, mass mobility relies on public transport, two-wheelers, and three-wheelers. Therefore, FAME India Scheme Phase II was focused on these three segments.
    - Bus transport in India accounts for 38 per cent of passenger km, though its share in overall registered vehicles in India is just around 3.5 per cent.
    - Two-wheelers account for 76-80 per cent of the total registered automotive in India.

    - Last-mile connectivity mainly depends on three-wheelers and sub-seven-metre buses.
- India is already the biggest manufacturer and most significant market for 2 wheelers globally. However, electric two-wheeler vehicle manufacturing is being led by startups and first-time entrants. Traditional players are also now switching to electric models.
- Electric two-wheelers will also see Mobility on Demand (MoD) and Mobility as a Service (MaaS) models to develop. This is because the upfront cost of fixed-battery electric two-wheelers is still higher than ICE vehicles.
- India has a chance also to become the global hub of manufacturing for the entire EV Value chain (except raw material mining).
- Therefore, billion-dollar incentive programs such as the advanced chemistry cell program with an outlay of 2.5 bn USD over five years were rolled out and received an overwhelming response from the industry.
- Several states have also rolled out incentives for battery manufacturing.

The Road Ahead:

- India needs to have million-plus fast chargers to cater to the needs of EVs. However, fast chargers are imported into India and only a few players are manufacturing locally developed/manufactured fast chargers. Government-led companies such as BHEL / BEL can join hands to develop the local supply chain for chargers manufacturing.
- Research institutions such as IISc and labs CPRI/ CSIR/ARCI can provide further technical support.
- The battery swap stations in rural areas will change the EV adoption and Battery storage landscape. These swap stations can serve as micro power grids, which can power the villages/houses in the vicinity and supply the excess power to the grid.
- India also needs a comprehensive mission plan to deal with **advanced chemistry cells (ACC) recycling** as >95 per cent of the original critical minerals can be recovered from these ACC batteries and reused in cell manufacturing.
- Government should focus on capacity building at all levels, along with upskilling and reskilling with respect to EVs.
    - NITI Aayog is working with IITs to nudge them to start EV-specific courses.
    - **"Shoonya – Zero pollution Mobility"** is a consumer and corporate-facing campaign hosted by NITI Aayog.
        - Aims to accelerate the transition of vehicles used for ride-hailing and deliveries into EVs by creating awareness and demand for zero-pollution rides and deliveries in Indian cities.

Renewable Energy Transforming Rural Women

Renewable energy is transforming the lives of rural women in India and has the potential to do much more.

- Energy supply to rural households helps increase women's non-farm self-employment.
- Reliable energy access also affords women extra time that they can utilise in skill training sessions to get a job or start their own business.

Some Initiatives

- **Surya Mitra' skill development programme:** Special emphasis is being given to rural women candidates during the selection process.
- **A women-led initiative, Hariyali Green** is aimed to enhance access to clean energy technologies and improve livelihood opportunities at the household level in rural India. Their goal is to create 100 Green Villages by 2025.
- **Distributed Renewable Energy (DRE) Spurring Rural Women's Micro-Entrepreneurship:** The New policy supports the adoption of DRE livelihood technologies among women by providing access to finance for entrepreneurs and end users. This will support the women SHG members in creating new jobs and scaling their existing businesses using DRE technologies.
- **Resilient Rural Health Systems for Women:**
    - A 2021 study states that lack of reliable electricity in healthcare centres is associated with a decrease of 64 per cent in child deliveries affecting women's access to safe healthcare.
    - Renewable energy can empower rural hospitals by providing uninterrupted electricity and upgrading basic and critical-care services.
- **Access to Clean Energy Equals Access to Better Education and Health:**
    - The World Health Organisation (WHO) reports that 500,000 deaths occur yearly due to unclean cooking fuels in India. The International Energy Agency (IEA) estimated that the average firewood load carried by women for several miles daily varies from 25-50 kg.
    - Providing clean energy access can reduce the drudgery among rural women, giving them time for education or skill upgradation and improving their health.

All the best
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PRELIMS EXCLUSIVE PROGRAMME (PEP) 2023

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