Topics

- Indigen
- (PRaGeD)
- What is NGS?
- What is multiomics?
- Rhisotope’
- The Resolve Tibet Act
- What is the RTS (rooftop solar) programme?
- Mains

By saurabh Pandey

THE HINDU

Google Play Games Apps Movies Books Kids

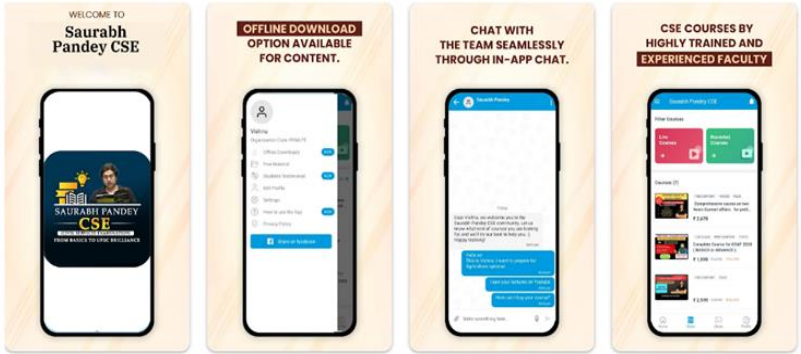
Saurabh Pandey CSE

Saurabh Pandey CSE

4.8★ 77 reviews | 1K+ Downloads | 3+ Rated for 3+

Install Share Add to wishlist

This app is available for your device



App support

Target Mains -2024/25 -

Q Suggest steps to increase solar energy adoption in india .

Connect with sir 9057921649

send your answer - Saurabh pandey upsc telegram channel

Yeeta

U.P.S.C.

इस भाग में कुछ न लिखें (Don't write anything in this part)

1. आपराधिक न्याय प्रणाली में प्रौद्योगिकी क्या भूमिका निभा सकती है?

आपराधिक न्याय प्रणाली का तात्पर्य सरकार की उन एजेंसियों से है जो कानून लागू करने, आपराधिक मामलों पर निर्णय देने और आपराधिक आचरण में सुधार करने हेतु कार्यरत हैं। इस प्रकार आपराधिक न्याय प्रणाली सरकारी एजेंसियों और संस्थानों की एक शृंखला है।

आपराधिक न्याय प्रणाली के उद्देश्य :- 1) अपराधियों को दण्डित करना।
2) अपराधों को होने से रोकना।
3) पीड़ितों को नैतिक समर्थन प्रदान करना।

वर्तमान में बढ़ते अपराधों की जटिलता व प्रौद्योगिकी का तेजी से होते विकास व इस्तेमाल ने यह जरूरी बना दिया है कि, आपराधिक न्याय में इन उभरती तकनीकों प्रौद्योगिकियों का से जुड़ी एजेंसियां भी इन उभरती तकनीकों को न्याय प्रणाली में करें, ताकि अपेक्षा अपराधिक न्याय प्रणाली को अधिक त्वरित, जिससे आपराधिक न्याय बनाया जा सके! सक्षम व विश्वसनीय

आपराधिक न्याय प्रणाली में प्रौद्योगिकी की भूमिका :-

1) निगरानी व मॉनीटरिंग में प्रौद्योगिकी की भूमिका -> इसमें साक्ष्य एकत्र करना व इनका बारीकी से विश्लेषण करना शामिल है। वर्तमान में कई तकनीकों ने इसमें मदद की है उदा०
- चेहरे की पहचान से जुड़ा सॉफ्टवेयर टूल
- रैपिड मास्क फिंगरप्रिंट - यह सॉफ्टवेयर जांच के घटनास्थल पर ले जाने की आवश्यकता को सीमित करता है।

2) पूर्वानुमानित पुलिसिंग के क्षेत्र में प्रौद्योगिकी की भूमिका :- वर्तमान में बड़ी मात्रा में डेटा उत्पन्न हो रहा है, जिसका विश्लेषण अलावा है केवल डेटा ही नहीं इसलिए प्रमुख चुनौती जो रहा है,

U.P.S.C.

प्रश्न संख्या (Question No.)

इस भाग में कुछ न लिखें (Don't write anything in this part)

डेटा तक पहुंचना नहीं बल्कि वास्तविक समय में इसका विश्लेषण करना है। पूर्वानुमानित पुलिस इन डेटा का विश्लेषण करके यह बताती है कि अपराध करने की संभावनाएं कब अधिक हैं व कब कम। इससे यह भी पता चल सकता है कि कानून प्रवर्तन अधिकारियों को कब और कहां तैनात किया जाए!

3) पुलिस द्वारा दुर्व्यवहार के जोखिमों को सीमित करना :- अक्सर पुलिस द्वारा अपराधियों के साथ प्रताड़ना व दुर्व्यवहार के मामले सामने आते हैं। बॉडी वॉर्न कैमरे दुर्व्यवहार के जोखिमों को सीमित करते हैं और पुलिसिंग में निष्पक्षता को मजबूत करते हैं।

4) डी.एन.ए व बायोमेट्रिक्स का आपराधिक न्याय प्रणाली में योगदान -> डी.एन.ए घटना स्थल या जैविक साक्ष्य के सटीक रूप से मिलान में मदद करता है। यह उन लोगों को दोषमुक्त करने में भी मदद करता है जिन पर गलत तरीके से अपराध करने का आरोप लगाया गया।

इसी प्रकार बायोमेट्रिक्स उंगलियों के निशान व आंखों के पैटर्न का संग्रहण करता है। फिंगरप्रिंट जांच में महत्वपूर्ण भूमिका निभाता है क्योंकि यह भौतिक साक्ष्य के रूप में कार्य करते हैं।

इसी प्रकार फेशियल रिकॉग्निशन सॉफ्टवेयर (एफ.आर.एस) का उपयोग करता है कि बोलचाल की ए.आर का उपयोग करता है जो कि व्यक्तियों को पहचान का पता लगाने, व पुराने अपराधियों की महत्वपूर्ण टूल है।

इसी दिशा में सरकार द्वारा 'ई-साक्ष्य' एप तैयार किया गया है जो कि पुलिस को क्राइम सीन का डेटा एकत्र करने, व सर्च व सीजर में मदद करेगा!

हालांकि, जहां इन तकनीकों का आपराधिक न्याय प्रणाली में सकारात्मक योगदान है वहीं यह कुछ नैतिक चिंताएं भी प्रदान करते हैं

उदा० सोशल मीडिया निगरानी, व्यक्ति के भाषण व अभिव्यक्ति

MAINS GURUJI

Connect with sir 90579 21649

UPSC MAINS MENTORSHIP PROGRAM

starting 10th JULY 2024

Target 400 + in GS paper

How to approach Essay ??

Only for serious UPSC ASPIRANTS

Batch-1

BY SAURABH PANDEY SIR

Genomics and metagenomics are coming in handy to analyse antimicrobial resistance. Representative illustration. GETTY IMAGES

'Multi-omics' is transforming how India spots and treats TB, cancers

Researchers are building datasets to address health problems at the individual level. They have extracted more value from these data using AI and machine learning, and combining their output with proteomic, transcriptomic, and epigenomic information to develop 'multi-omics' approaches

T.V. Padma

In the last decade, India's use of genomics has undergone a significant transformation, so much so that the diagnoses, management, and treatment of many diseases — including tuberculosis, cancers, and those caused by antimicrobial resistance — stand on the cusp of a revolution.

Most recently, in January 2024, the Department of Biotechnology said it had completed sequencing 10,000 genomes from 99 ethnic groups under its 'Genome India' project. This national initiative aims at developing a reference genome for Indian people, which will help design genome-wide and disease-specific 'genetic chips' for low-cost diagnostics and research.

Earlier, in October 2020, the Council for Scientific and Industrial Research (CSIR) had reportedly sequenced the entire genomes of 1,008 individuals in India representing diverse ethnic groups in six months. This effort was part of a mission called 'IndiGen' — to create a pilot dataset with which researchers could analyse the epidemiology of genetic diseases and help develop affordable screening approaches, optimise treatment, and minimise adverse events for them.

Other, more disease-specific consortia have also sprung up around the country and efforts are underway to create new datasets to address individual health problems, ranging from the age-old scourge of tuberculosis to cancers, rare genetic disorders in children, and even antimicrobial resistance. Researchers have also been able to extract more value from these using artificial intelligence and machine learning, and by combining their contents with other extensive datasets on proteins (proteomics), gene expression in cells (transcriptomics), and chemical changes that regulate gene expression (epigenomics) to develop a 'multi-omics' approach to tackle diseases.

Tuberculosis

A recent consortium concerns tuberculosis, a disease that continues to pose significant challenges to its eradication, in India and around the world. The Indian Tuberculosis Genomic Surveillance Consortium (InTGS) comprises 10 Report India sites covering eight States for tuberculosis, with the goal of sequencing around 32,000 tuberculosis clinical strains from active patients, and develop a centralised biological repository of clinical *Mycobacterium tuberculosis* strains in India.

Other major objectives vis-à-vis tuberculosis include mapping the genetic diversity of pulmonary and extra-pulmonary isolates of the tuberculosis bacterium from newly reported active cases in India, the associated treatment outcomes, and correlating mutations with drug resistance patterns, according to Vinay Nandicoori, director of the CSIR-Centre for Cellular and Molecular Biology (CCMB), Hyderabad. The project's ultimate goal is to validate identified mutations to develop a sequence-based method to determine drug resistance, and to combine the epidemiological data with results from whole-genome sequencing to develop working solutions.

Scientists from a mix of leading research institutes have divided the various parts of the project thus. In the first stage, scientists from the Jawaharlal Institute of Postgraduate Medical Education and Research, Puducherry; the National Institute for Research in Tuberculosis, Bhagwan Mahavir Medical Research Centre, Hyderabad; the Byramjee Jeejeebhoy Government Medical College, Pune; and the P.D. Hinduja Hospital, Mumbai, will collect the clinical samples, including the patients' metadata. Next, scientists at the International Centre for Genetic Engineering and Biotechnology, New Delhi, will isolate the genetic material from the samples and set up a strain repository. In the third stage, scientists at CCMB and the National Institute of Biomedical Genomics, Kalyani, will conduct whole genome sequencing. In the fourth and final stage, a team at the National Institute of Immunology, New Delhi, will conduct RNA sequencing data analysis, and develop artificial intelligence (AI) and machine learning (ML) models to predict drug resistance and take cognisance of the metadata to detect resistance patterns, according to Dr. Nandicoori.

"This is a huge, huge, huge project," he added. The starting point is to generate baseline data — a relatively ignored task in India compared to several other countries.

Rare genetic disorders

India has also launched a pan-country mission for Paediatric Rare Genetic Disorders (PRaGeD), which, despite their rarity, have become a common public health concern. Mission PRaGeD is planning to create awareness, perform genetic diagnosis, discover and characterise new genes or variants, provide counselling, and develop new therapies for rare genetic diseases that afflict India's children.

The mission will incorporate IndiGen data in its in-house bioinformatic pipelines it will use to analyse the parts of a genome that code for proteins (exome). The CSIR-Centre for DNA Fingerprinting and Diagnostics (CDFD), Hyderabad, in collaboration with 15 centres across India, plans to recruit patients and their families with rare genetic disorders.

> In January, the Department of Biotechnology said it had completed sequencing 10,000 genomes from 99 ethnic groups under its 'Genome India' project. The aim is to develop a reference genome for Indian people

"The study aims to identify novel genes for various known as well as unexplained inherited phenotypes (observable traits) but also help the patient and family with management of disease and prenatal diagnosis," Ashwin Dalal, group leader for diagnostics and a scientist at CDFD said. The team will also characterise novel genes or variants thereof to determine their function or role in the disorder, using cell lines and/or model organisms such as mice, fruit flies, and zebrafish.

Also on the anvil in the mission is the use of next-generation sequencing, one of the latest tools to manage rare diseases and to assess the probability of developing several chronic ailments, especially when conventional tests give negative results. "Implementing newborn genetic testing at a national level can contribute to the management of rare genetic conditions through faster and more accurate diagnoses," Dr. Dalal said.

Cancers

The Indian Cancer Genome Consortium (ICGC-India), part of the larger International Cancer Genome Consortium (ICGC) and supported by the Department of Biotechnology, plans to characterise genomic abnormalities in different types of cancers in Indian patients and identify population-specific genetic variations that are linked to cancer risk and treatment response. Such population-wide genome sequencing projects can facilitate the discovery of novel biomarkers, potential new treatment targets, and personalised treatment strategies, according to Dinesh Gupta, group leader of translational bioinformatics at the International Centre for Genetic Engineering and Biotechnology, New Delhi.

Several Indian institutions have established ICGC-like genomic data repositories to facilitate cancer research and precision medicine initiatives that cater to the genetic makeup of Indian people, Dr. Gupta said. Another example is the Indian Cancer Genome Atlas project, a not-for-profit public-private-philanthropic initiative that is trying to create a comprehensive catalogue of genomic alterations across various cancer types prevalent in India. This could help researchers identify novel biomarkers and treatment targets. The Atlas collects and generates detailed genomics with linked clinical data.

Clinical trials in cancer are also beginning to incorporate genomics in the country, Dr. Gupta added. Indian cancer centres classify patients using genomic profiling for clinical trials that are based on their molecular subtypes, and match potential responders with targeted therapies.

Antimicrobial resistance

Genomics and metagenomics are coming in handy to analyse antimicrobial resistance and understand the possibility of rapid spread of any antibiotic resistance functions between bacterial species. Some of the microbes, such as the bacteria that cause tuberculosis, grow very slowly, even in laboratory conditions, Bhabhatosh Das, associate professor at the Translational Health Science and Technology Institute, Faridabad, explained. "So clinicians prescribe antibiotics without knowing the actual resistance profile of the infectious agents."

In such cases, genome sequencing is very helpful because it can provide information about the resistance profile of microbes without researchers having to grow them in the lab, he said. "Such information helps clinicians make judicious use of antibiotics." In tuberculosis, pathogen-specific resistance signatures "should add immense value to antimicrobial-resistance diagnostics and the selection of appropriate drug combinations for successful antimicrobial therapy."

AI, ML, and multi-omics

Meanwhile, AI and ML algorithms are lending a helping hand to genomics in analysing the extensive datasets. These technologies can help predict an individual's risk of developing cancer, develop diagnostic tools to detect some cancers early, classify them, and develop treatment strategies, Dr. Gupta said.

Researchers have also started using AI and ML to help with analysing genome-sequencing data in cases of rare genetic disorders. A single instance of sequencing the entire exome of an individual can yield 5 GB of data and whole-genome sequencing can yield 90 GB, Dr. Dalal explained: "Analysis of such massive sequencing is impossible without use of computational tools." Technicians are using AI- and ML-based approaches in the in-house bioinformatic pipelines as well as part of commercial tools for analysis of the sequencing data to identify disease-causing variants.

With the rapid expansion of AI, it is now easy to access multi-omics and analyse Big Data products easily, even with only standard computational facilities, according to Dr. Das, adding that multi-omics is today an emerging technology in the field of clinical science in India.

(T.V. Padma is a science journalist in New Delhi.)

Indigen

- in October 2020, the Council for Scientific and Industrial Research (CSIR) had reportedly sequenced the entire genomes of 1,008 individuals in India representing diverse ethnic groups in six months.
- This effort was part of a mission called ‘IndiGen’ — to create a pilot dataset with which researchers could analyse the epidemiology of genetic diseases and help develop affordable screening approaches, optimise treatment, and minimise

(PRaGeD)

- India has also launched a pan-country mission for Paediatric Rare Genetic Disorders (PRaGeD), which, despite their rarity, have become a common public health concern.
- Mission PRaGeD is planning to create awareness, perform genetic diagnosis, discover and characterise new genes or variants, provide counselling, and develop new therapies for rare genetic diseases that afflict India’s children.

- **The mission will incorporate IndiGen data in its in-house bioinformatic pipelines it will use to analyse the parts of a genome that code for proteins (exome).**
- **The CSIR-Centre for DNA Fingerprinting and Diagnostics (CDFD), Hyderabad, in collaboration with 15 centres across India, plans to recruit patients and their families with rare genetic disorders.**

What is NGS?

- Next-generation sequencing (NGS) is a massively parallel sequencing technology that offers ultra-high throughput, scalability, and speed.
- The technology is used to determine the order of nucleotides in entire genomes or targeted regions of DNA or RNA.
- NGS has revolutionized the biological sciences, allowing labs to perform a wide variety of applications and study biological systems at a level never before possible.
- Today's complex genomics questions demand a depth of information beyond the capacity of traditional DNA sequencing technologies. NGS has filled that gap and become an everyday tool to address these questions.

What is multiomics?

- Multiomics (multiple omics) provides an integrated approach to power discovery across multiple levels of biology.
- By combining data from genomics, transcriptomics, epigenetics, and proteomics, researchers can achieve a more comprehensive understanding of molecular changes contributing to normal development, cellular response, and disease.
- Multiomics can also combine separate omic data from past experiments, known as in-silico multiomics, to efficiently analyze novel biological relationships

James Larkin (left) from the University of the Witwatersrand implants radioisotopes into a sedated rhinoceros' horns, along with other Rhisotope Project members in the Waterbury UNESCO biosphere in Mokopane, on Tuesday. AFP

Radioactive implant for rhino horns to curb poaching

Agence France Presse

South African scientists on Tuesday injected radioactive material into live rhinoceros horns to make them easier to detect at border posts in a pioneering project aimed at curbing poaching.

The country is home to a large majority of the world's rhinoceroses and, is a hotspot for poaching driven by demand from Asia, where horns are used in traditional medicine for their supposed therapeutic effect.

At the Limpopo rhinoceros orphanage in the Waterberg area, in the country's northeast, a few of the thick-skinned herbivores grazed in the low savannah.

James Larkin, director of the University of the Witwatersrand's radiation and health physics unit who spearheaded the initiative, said he had put "two tiny little radioactive chips in the horn" as he administered the radioisotopes on one of the large animals' horns.

The radioactive material would "render the horn useless... essentially poisonous for human consumption," added Nithaya Chetty, professor and dean of science at the same university.

The dusty rhinoceros, put to sleep and crouched on the ground, wouldn't feel any pain, Mr. Larkin said. The radioactive material's dose was so low that it wouldn't affect the animal's health or the environment in any way, he added.

In February, the environment ministry said that despite government efforts to tackle the illicit trade, 499 of the giant mammals were killed in 2023, mostly in state-run parks, an 11% increase over 2022 figures.

The radioactive material would render the horn poisonous for human consumption and trigger alarms at international borders

Twenty live rhinos in total are part of the pilot 'Rhisotope' project, whereby they will be administered a dose "strong enough to set off detectors installed globally" at international border posts, originally "to prevent nuclear terrorism," Mr. Larkin said.

Rhinoceros horns are highly sought after on black markets, where their price by weight rivals that of gold and cocaine.

According to Arrie Van Deventer, the orphanage's founder, dehorning the rhinoceros and poisoning the horns have failed to deter poachers.

"Maybe this is the thing that will stop poaching," the conservationist said. "This is the best idea I've ever heard."

Wildebeest, warthogs, and giraffe roamed the vast conservation area as more than a dozen team members performed the delicate process on another rhinoceros.

Mr. Larkin drilled a small hole into the horn, hammered in the radioisotope, and finished off by spraying 11,000 microdots over the horn.

About 15,000 rhinoceroses live in the southern African nation, according to an estimate by the International Foundation.

The last phase of the project will be the animal's aftercare following "proper scientific protocol and ethical protocol," project COO Jessica Babich said.

The team will then take follow-up blood samples to ensure the rhinoceroses are effectively protected. The material itself will last five years on the horn, resulting in a cost lower than dehorning every 18 months, Mr. Larkin said.

Rhisotope’

- South African scientists on injected radioactive material into live rhinoceros horns to make them easier to detect at border posts in a pioneering project aimed at curbing poaching.
- Twenty live rhinos in total are part of the pilot ‘Rhisotope’ project, whereby they will be administered a dose “strong enough to set o detectors installed globally” at international border posts, originally “to prevent nuclear terrorism

It's time for India to reclaim its voice on Tibet

Suhasini Haidar

The timing of the visit by a delegation of U.S. lawmakers to Dharamshala made it clear what it would be about. The delegation arrived just days after the passage of the 'Promoting a Resolution to the Tibet-China Dispute Act' in both Houses of U.S. Congress, which now awaits U.S. President Joe Biden's signature. Both Democrat and Republican co-authors of the Bill were part of the delegation, invited by the Central Tibetan Administration that manages affairs of the Tibetan diaspora-in-exile worldwide, for a special facilitation. Given the circumstances, New Delhi would have been more than aware of the content of the speeches they would make, slamming China for its repression of the Tibetan people, calling for talks between the Dalai Lama's representatives and Beijing that were suspended in 2010 to be restarted, and for a Free Tibet. "This bill is a message to the Chinese government that we have clarity in our thinking on this issue, for the freedom of Tibet," said former House Speaker Nancy Pelosi. "[The Dalai Lama's] legacy will live forever, but you, the President of China, will be gone, and no one will give you credit for anything."

Weakness, not strength

While the sharp tone of these comments and even the presence of U.S. officials and lawmakers in Dharamshala is not new, this is the first time in recent years that a public rally of this kind has been held in India. India's External Affairs Minister hosted the delegation for a late dinner the same evening as the rally, and the Prime Minister met them the next day, indicating that this was a more considered decision by New Delhi. Some people have even interpreted it as a strong message from New Delhi to Beijing amidst continuing tensions between the two countries, as a resolution to the Line of Actual Control military stand-off eludes them since the deadly 2020 Galwan clash.

However, New Delhi's decision to allow American politicians to take centre stage amongst the Tibetan refugee population in India in order to promote a U.S. law and pitch U.S. policy is not a show of strength, but could convey weakness. It also denotes the danger of letting a carefully calibrated foreign policy narrative on Tibet spin out of its control.

To begin with, India has not joined the U.S. in publicly articulating its concerns on the treatment of Tibetans simply because its actions since 1959, of offering the Dalai Lama refuge and allowing Tibetan refugees to settle in India, speak much louder. To this day, people from Tibet trek across the Himalayas to seek refuge in India. Often, parents send just their children over, fearing for their future as Tibetan curriculum gets more standardised to the mainland's system, rigorously enforced by the Chinese Communist Party.

Given India's own sensitivities on sovereignty and territorial integrity, New Delhi has worked out its own formulation on the Tibet issue and ties with China. It has "recognised" the Tibet Autonomous Region (TAR) as part of the territory of the People's Republic of China since 1954. Since 2010, however, given China's refusal to respect India's territorial integrity, its renaming of places in Arunachal Pradesh, and its issuance of stapled visas to residents of Jammu and Kashmir, India stopped articulating a 'One China' policy or making references to Tibet in official statements. It contends that the Dalai Lama is a revered spiritual leader, despite China's protests that he is a "separatist" or "splittist".

India also does not officially recognise the Tibetan Government in Exile or Parliament in Exile as more than organising mechanisms for the Tibetan people based here and abroad. Even though Prime Minister Narendra Modi invited the Tibetan Sikyong (elected leader) to his swearing-in ceremony in 2014, he did not do so in 2019 or this month. In 2018, a government circular reminded officials of India's policy, asking them not to attend events commemorating the 60th year since the Dalai Lama's flight to India. New Delhi has become more sensitive on such issues, as is evident from its objections to U.S. Ambassadors visiting Pakistan-occupied Kashmir, or to the space given for political or extremist Khalistani separatist rallies and referendums in the U.S., U.K., Canada, and Australia.

India must avoid ceding the centre stage in its own region on foreign policy and on Tibet issues

Moving out of the picture

If the government wishes to change its line to mirror the more strident position on Tibet adopted by the U.S., then Indian officials and leaders should have made the statements that were addressed instead by U.S. lawmakers to Tibetans in Dharamshala, who were all waving U.S. flags (Indian flags were far fewer). The superfluousness of allowing the U.S. delegation to do so is underlined by the fact that the Dalai Lama travelled to the U.S. for medical treatment just days after their visit, and all the U.S. lawmakers could have met him in Washington DC instead.

Above all, the problem with allowing U.S. leaders to aim messages at Beijing from a pulpit in India, and then have Beijing respond to those directly, is that India is getting cut out of a picture where it has been the most important external figure. This is not unlike its predicament in other parts of South Asia, including the Maldives, Sri Lanka, Nepal, and the Indian Ocean islands where its space is being diminished by growing U.S.-China contestations. With the U.S. giving the Karmapa a home and accepting more Tibetan refugees on the one hand, and China's ever-tightening control of Tibetan Buddhist monasteries in the TAR on the other, India must consider the future of its own policy, especially with regard to the question of the Dalai Lama's succession. New Delhi must move more decidedly to reclaim its own voice and the pace of its own policy narrative without being "bigfooted" by others.

The Resolve Tibet Act

- **The Resolve Tibet Act enhances U.S. support for Tibet— empowering State Department officials to actively and directly counter disinformation about Tibet from the Chinese government, rejecting false claims that Tibet has been part of China since “ancient times,” pushing for negotiations without preconditions between the Chinese government and the Dalai Lama or his representatives or the democratically elected leaders of the Tibetan community, and affirming the State Department’s responsibility to coordinate with other governments in multilateral efforts toward the goal of a negotiated agreement on Tibet.**

- **No formal dialogue between Tibetan and Chinese authorities has happened since 2010, and Chinese officials continue to make unreasonable demands of the Dalai Lama as a condition for further dialogue.**

How well is India tapping its rooftop solar potential?

Which are the States with the highest RTS capacities? How can more awareness be spread?

Shantanu Roy

The story so far:
India's installed rooftop solar (RTS) capacity increased by 2.99 GW in 2023-2024, the highest growth in a year. As of March 31, the total installed RTS capacity in India was 11.87 GW, according to the Ministry of New and Renewable Energy. To meet rising energy demand, India needs to double down on its efforts to expand its RTS potential.

What is the RTS programme?
India launched the Jawaharlal Nehru National Solar Mission in January 2010. Its main objective was to produce 20 GW of solar energy (including RTS) in three phases: 2010-2013, 2013-2017, and 2017-2022. In 2015, the government revised this target to 100 GW by 2022, including a 40-GW RTS component, with yearly targets for each State and Union Territory. In December 2022, India had an installed RTS capacity of 7.5 GW and extended the deadline for the 40-GW target to 2026. While financial incentives, technological advances, awareness, and training have improved RTS installation numbers, there is a long way to go. India's overall RTS potential is approximately 796 GW. To meet India's target of installing 500 GW of renewable energy capacity, with a solar component of 280 GW, by 2030, RTS alone needs to contribute about 100 GW by 2030.

How are States faring?
As of March 31, 2024, the RTS capacities of Gujarat, Maharashtra, and Rajasthan had taken big strides while some others were behind the curve. An installed RTS capacity of 3,456 MW in Gujarat is the result of its government's quick approval process, a large number of RTS installers, and high consumer awareness. Similarly, Maharashtra, with an RTS capacity of 2,072 MW, is one of the top-performing States owing to its robust solar policies and conducive regulatory environment.

Thanks to its land area and high solar irradiance, Rajasthan boasts of the highest RTS potential in the country: 1,154 MW. Its efforts to streamline approvals, provide financial incentives, and promote RTS through public-private partnerships have spurred this growth.

Kerala, Tamil Nadu, and Karnataka, with respective installed capacities of 675, 599, and 594 MW, have also performed reasonably well. However, Uttar Pradesh, Bihar, and Jharkhand, among others, are yet to fully explore their RTS potential. Their challenges include bureaucratic hurdles, inadequate infrastructure, and lack of public awareness.

The 'Pradhan Mantri Surya Ghar Muft Bijli Yojana' is a flagship initiative to fit one crore households with RTS systems and help them get up to 300 units of free electricity every month. An average system size of 2 kW for targeted households will result in a total RTS capacity addition of 20 GW. The scheme has a financial outlay of ₹75,021 crore, which includes financial assistance for consumers (₹65,700 crore), incentives for distribution companies (₹4,950 crore), incentives for local bodies and model solar villages in each district, payment security mechanisms, capacity building (₹657 crore), and awareness and outreach (₹657 crore). The scheme also encourages the adoption of advanced solar technologies, energy storage solutions, and smart grid infrastructure.

How can we ensure RTS growth?
Creating awareness is key to getting consumers on board. In addition, RTS needs to be economically viable for households. While government subsidies are helping, multiple low-cost financing options are required. The number of banks and non-bank financial companies providing RTS loans has increased of late. Access to low-cost RTS loans should be as easy as getting a bike or car loan.

Promoting R&D in solar technology, energy storage solutions, and smart-grid infrastructure can lower costs, improve performance, and enhance the reliability of RTS systems. Investments in training programmes, (like the 'Suryamitra' solar PV technician programme initiated in 2015), vocational courses, and skill development initiatives will help build a skilled workforce.

As the scheme's implementation enters full swing, net-metering regulations, grid-integration standards, and building codes should be reviewed and updated to help address emerging challenges and facilitate smooth implementation.

Shantanu Roy works with the Center for Study of Science, Technology and Policy.

THE GIST

- India's installed rooftop solar (RTS) capacity increased by 2.99 GW in 2023-2024, the highest growth in a year.
- As of March 31, 2024, the RTS capacities of Gujarat, Maharashtra, and Rajasthan had taken big strides while some others were behind the curve. An installed RTS capacity of 3,456 MW in Gujarat is the result of its government's quick approval process, a large number of RTS installers, and high consumer awareness.
- Creating awareness is key to getting consumers on board. In addition, RTS needs to be economically viable for households.

What is the RTS (rooftop solar) programme?

- **India launched the Jawaharlal Nehru National Solar Mission in January 2010.**
- **Its main objective was to produce 20 GW of solar energy (including RTS) in three phases: 2010-2013, 2013-2017, and 2017-2022. In 2015, the government revised this target to 100 GW by 2022, including a 40-GW RTS component, with yearly targets for each State and Union Territory.**

- In December 2022, India had an installed RTS capacity of 7.5 GW and extended the deadline for the 40-GW target to 2026.
- While financial incentives, technological advances, awareness, and training have improved RTS installation numbers, there is a long way to go.
- India’s overall RTS potential is approximately 796 GW.
- To meet India’s target of installing 500 GW of renewable energy capacity, with a solar component of 280 GW, by 2030, RTS alone needs to contribute about 100 GW by 2030.

How can we ensure RTS growth?

- Creating awareness is key to getting consumers on board. In addition, RTS needs to be economically viable for households.
- While government subsidies are helping, multiple low-cost financing options are required.
- The number of banks and non-bank financial companies providing RTS loans has increased of late.

- **Access to low-cost RTS loans should be as easy as getting a bike or car loan.**
- **Promoting R&D in solar technology, energy storage solutions, and smart-grid infrastructure can lower costs, improve performance, and enhance the reliability of RTS systems.**
- **Investments in training programmes, (like the ‘Suryamitra’ solar PV technician programme initiated in 2015), vocational courses, and skill development initiatives will help build a skilled workforce.**

Link in description

Msg -9057921649

Download -
saurabh pandey
cse app

Scan - to get free content

The hindu session pdf

Download the hindu session pdf

Telegram link in description box

Download the hindu pdf - https://t.me/gesreporter

Connect with sir 9057921649

Target Mains -2024/25 -

Q Suggest steps to increase solar energy adoption in india .

Connect with sir 9057921649

send your answer - Saurabh pandey upsc telegram channel