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NEWS ALERT

Forum for Indian Science Diplomacy

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CONTENTS

Low cost individual medical bed isolation system developed for covid-19 patients.

Israel, India conduct trials for 4 technologies to detect Covid in about 30 seconds

All five clades of Covid-19 genome found in Odisha

DST completes first Pan India Genome sequencing of SARS- CoV-2

NCASR devises adaptive model to estimate & strategize critical resources in pandemic

INDIA – SCIENCE & TECHNOLOGY

Device for non-invasive screening of bilirubin level in new-borns

Karnataka starts Rs 50 billion life sciences park project in Bengaluru

IITH researchers use corn husk to produce carbon electrode for super capacitors

IUCAA to build India's first optical atomic clock

India well-poised for digital transformation of manufacturing

Nokia to set up robotics lab at Indian Institute of Science

Indian researchers synthesize cost-effective catalyst for Hydrogen production

Shadesmart & Radiant Cooling to promote energy-efficient cooling in buildings

India-Canada discusses ways of taking cooperation to new level

Magnetic hyperthermia-mediated cancer therapy for inoperable tumours

IN BRIEF

Making more durable roads from recycled tyres and rubble

NASA astronauts safely splash down after first commercial crew flight to space station

Materials science researchers develop first electrically injected laser

RESOURCES AND EVENTS

G20 digital economy ministers meeting, adopts declaration

International Solar Alliance (ISA) membership opened to all UN member states

UNFCCC papers highlight technologies supporting low-carbon transition

GLOBAL

Turning carbon dioxide into liquid fuel

A research team, led by the Argonne National Laboratory has discovered a new electrocatalyst that converts carbon dioxide (CO_2) and water into ethanol with very high energy efficiency, high selectivity for the desired final product and low cost. This process could by electrochemically converting the CO_2 emitted from industrial processes into valuable commodities at reasonable cost. The team's catalyst consists of atomically dispersed copper on a carbon-powder support. The research revealed a reversible transformation from atomically dispersed copper to clusters of three copper atoms each on application of a low voltage. The CO_2-to-ethanol catalysis occurs on these tiny copper clusters. The electrocatalytic selectivity, or "Faradaic efficiency," of the process is over 90 percent, much higher than any other reported process. What is more, the catalyst operates stably over extended operation at low voltage. Because the process runs at low temperature and pressure, it can start and stop rapidly in response to the intermittent supply of renewable electricity.

Cellulose-metal nanoparticle composites with interesting applications

When nanocellulose is combined with various types of metal nanoparticles, materials are formed with many new and exciting properties. They may be antibacterial, change colour under pressure, or convert light to heat. Researchers from Sweden have used a biosynthetic nanocellulose produced by bacteria and originally developed for wound care. They have decorated the cellulose with metal nanoparticles, principally silver and gold, forming a material that consists of a network of particles and cellulose forms. They can also mix particles of different metals and with different shapes - spherical, elliptical and triangular. The properties of the material change when pressure is applied. Optical phenomena arise when the particles approach each other and interact, and the material changes colour. The scientists have named the phenomenon “the mechanoplasmonic effect”, and it has turned out to be very useful. Potential application is in sensors for detecting certain proteins. The ability of the material to absorb light from a much broader spectrum can be used for both energy-based applications and in medicine. The manufacture of composites of nanocellulose and metal nanoparticles that are soft and biocompatible materials opens up many optical, catalytic, electrical and biomedical applications.

Scientists from WMG at the University of Warwick developed a 1cm by 1cm wireless artificial aquatic polyp, which can remove contaminants from water. Apart from cleaning, this soft robot could be also used in medical diagnostic devices by aiding in picking up and transporting specific cells for analysis. 'An artificial aquatic polyp that wirelessly attracts, grasps, and releases objects' researchers demonstrate how their artificial aquatic polyp moves under the influence of a magnetic field, while the tentacles are triggered by light. This motion results in the generation of an attractive flow which can guide suspended targets, such as oil droplets, towards the artificial polyp. Once the targets are within reach, UV light can be used to activate the polyp's tentacles, composed of photo-active liquid crystal polymers, which then bend towards the light enclosing the passing target in the polyp's grasp. It exemplifies how motion of different stimuli-responsive polymers can be harnessed to perform wirelessly controlled tasks in an aquatic environment.

COVID-19

COVID-19 (WORLD)

‘AeroNabs’ promise powerful, inhalable protection against COVID-19

UC San Francisco scientists have engineered a completely synthetic, production-ready molecule that blocks the crucial SARS-CoV-2 machinery that allows the virus to infect our cells. In an aerosol formulation they tested, dubbed “AeroNabs” by the researchers, these molecules could be self-administered with a nasal spray or inhaler. AeroNabs were inspired by nanobodies, antibody-like immune proteins that naturally occur in llamas, camels and related animals. Nanobodies are an order of magnitude smaller than human antibodies, which makes them easier to manipulate and modify in the lab. The scientists then engineered a nanobody to make it into a potent antiviral. They also engineered a molecular chain that could link three nanobodies together. The linked triple nanobody is 200,000 times more potent than a single nanobody alone in blocking the action of the spike RBD of SARS-Cov2. AeroNabs are a potent SARS-CoV-2 antiviral that could be practical to administer via a shelf-stable inhaler or nasal spray.

Russia’s fast-track's coronavirus vaccine deployment

Russia’s president Vladimir Putin announced on 11 August that the country’s health regulator had become the world’s first to approve a COVID-19 vaccine developed by the Gamaleya Research Institute of Epidemiology and Microbiology in Moscow, called "Sputnik V". The registration certificate allows the vaccine, to be given to “a small number of citizens from vulnerable groups,” including medical staff and the elderly, but stipulates that the vaccine cannot be used widely until 1 January 2021, presumably after larger clinical trials have been completed. Russian health-care minister said that the vaccine would be gradually introduced to citizens and given to health workers and teachers first. The vaccine is given in two doses 21 days apart and is made of two adenoviruses that express the coronavirus spike protein. The first dose is an Ad26 virus, while the second ‘booster’ dose is made from an Ad5 virus. Gamelaya has used the Ad5 vector in vaccines for Ebola and MERS. The Gamaleya vaccine has been given to 76 volunteers as part of two early-stage trials. All 38 participants who received one or two doses of the vaccine had produced antibodies against SARS-CoV-2’s spike protein, including potent neutralizing antibodies that inactivate viral particles. Side effects were observed, such as fever, headache and skin irritation at the site of

efficacy trial involving more than 2000 people will begin on 12 August in Russia, the United Arab Emirates, Saudi Arabia, Brazil, and Mexico.

The six strains of SARS-CoV-2

According to research from Bologna university, SARS-CoV-2 mutation rate remains low and across Europe and Italy, the most widespread is strain G, while the L strain from Wuhan is gradually disappearing. These mutations, however, do not impinge on the process of developing effective vaccines. The virus causing the COVID-19 pandemic, SARS-CoV-2, presents at least six strains. Despite its mutations, the virus shows little variability, and this is good news for the researchers working on a viable vaccine. These are the results of the most extensive study ever carried out on SARS-CoV-2 sequencing based on the analysis of 48,635 coronavirus genomes, which were isolated by researchers in labs all over the world. It was then possible for researchers to map the spread and the mutations of the virus during its journey to all continents. This implies that the treatments that are being developed, including a vaccine, would be effective against all the virus strains.

COVID-19 vaccine shows promise in mouse studies

Scientists at the National Institute of Allergy and Infectious Diseases (NIAID) have done preclinical research to identify the atomic structure of the spike protein on the surface of the novel coronavirus. This structure was used by VRC and Moderna in the development of the vaccine candidate. The findings show that the investigational vaccine induced neutralizing antibodies in mice when given as two intramuscular injections of a 1-microgram (mcg) dose three weeks apart. Additional experiments found that mice given two injections of the 1-mcg dose and later challenged with SARS-CoV-2 virus either 5 or 13 weeks after the second injection were protected from viral replication in the lungs and nose. Importantly, mice challenged 7 weeks after only a single dose of 1 mcg or 10 mcg of mRNA-1273 were also protected against viral replication in the lung. The investigational vaccine also induced robust CD8 T-cell responses in mice.

What the world can learn from South Korea's COVID-19 response

As the world continues to closely monitor the newest coronavirus outbreak, the government of South Korea has been able to keep the disease under control without paralyzing the national health and economic systems. In January, the Korea Centers for Disease Control and Prevention, in partnership with the Korean Society for Laboratory Medicine and the Korean Association of External Quality Assessment Service, developed and evaluated the real-time reverse transcription polymerase chain reaction (rRT-PCR) diagnostic method for coronavirus. By February, the diagnostic kit was authorized, and as of March 9, 15,971 kits were produced, capable of testing 522,700 people. As of April 15, South Korea has tested 534,552 people for coronavirus, which is 10.4 people per one thousand population. The critical factors in South Korea's public health administration and management that led to success include national infectious disease plans, collaboration with the private sector, stringent contact tracing, an adaptive health care system, and government-driven communication.

Low cost individual medical bed isolation system developed for covid-19 patients.

Defence Institute of Advanced Technology, (DIAT) has developed Aashray a single bed Medical Bed Isolation System for proper isolation of COVID-19 patients. Bed Isolation System envelopes are made up of specialized material of 7.5(l) ×7(w) ×6.5(h) feet size supported on medical grade materials structure. The product is modular and portable and can be suitable for different requirements such as institutional, hospitals and home/ individual quarantine. The envelope is reusable as it is antibacterial-antifungal and can be sanitized. Each envelope is capable of housing one set of bed, table and chair along with some walking space. The entire envelope is maintained at a low pressure (suction) with adjustable flow rate to restrain spread of virus/ infection inside the hall/ ICU. Each envelope is connected to the main duct equipped with UV light and filter circuit of Pre, fine and HEPA filter (recommended for medical application) and suction blower. The virus/contaminants in the outgoing air are continuously removed by filters which are sterilized with UV light. The prototype manufacturer has indicated the cost of the setup for a unit of 10 beds at Rs 100,000 approximately and for single bed home quarantine at 15,000/- (approx).

Israel, India conduct trials for 4 technologies to detect Covid in about 30 seconds

Israel and India are conducting trials on a large sample of patients for four different kinds of technologies that have the potential to detect COVID-19 in about 30 seconds, including a breath analyser and a voice test. The rapid testing is being jointly developed in cooperation with the Defense Research and Development Directorate of the Israeli Ministry of Defence, and India's DRDO and CSIR. RML hospital is one of the testing sites which started trials on these technologies. These simple, non-invasive technologies include a voice test that uses artificial intelligence to identify changes in the patient's voice and a breath analyser test which requires the patient to blow into a tube and it detects the virus using terra-hertz waves. There is also isothermal testing that enables identification of the coronavirus in a saliva sample and a test using polyamino acids that seeks to isolate proteins related to COVID-19.

All five clades of Covid-19 genome found in Odisha

Analysis of Odisha samples conducted by Institute of Life Sciences (ILS) Bhubaneswar and ICMR-Regional Medical Research Centre (RMRC) Bhubaneswar showed the presence of all five reported clades- 19A, 19B, 20A, 20B and 20C of Covid-19 genome. The Clade 20C was observed in Odisha and not present any other isolates included in more than 1000 genome analysis across the country. Five research institutions in the country including ILS Bhubaneswar have carried out analysis of 1,062 genomes from 18 Indian states. ILS and RMRC researchers have analysed 225 viral genomes of Covid-19 positive patients those who migrated from 13 Indian states. Initial results indicated that multiple lineages of SARS-CoV-2 are circulating in India, probably introduced by travel from Europe, USA and South East Asia. Clade means a group having the same source of origin or characteristics. Analysis of Odisha samples showed the presence of all five reported clades of Covid-19 genome.

DST completes first Pan India Genome sequencing of SARS- CoV-2

and dedicated to the nation the largest network of five dedicated COVID-19 Biorepositories established by the BDT. The biorepositories would have access to bio-samples and are authorised to share these samples with academia and industry involved in development of diagnostics, vaccines, etc. after scrutinising the purpose of request and ensuring benefit to the country. The repositories already have over 44,000 clinical and 17 viral samples in the bank. Of these, over 5,000 samples have already been shared with 30 institutes or companies. The Minister also announced that that the data will soon be released in Global Initiative on Sharing All Influenza Data (GISAID) for use by researchers across the Globe.

JNCASR devises model to estimate & strategize critical resources in pandemic

Scientists from Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) have developed a model to estimate key aspects of medical inventory requirements, a calculation that is required to scale up both the testing capabilities and the critical care facilities, which are essential to reduce the mortality. It would be extremely relevant for COVID-19, as the disease character and the behavioural patterns of the people change and affect the efficacies of disease spread and management in a second wave, requiring constant alertness on the part of the forecasters. The model showed that the uncertainties in the parameters and reported infections can be compensated for by using (phase-space) representations. The team demonstrated that, with this approach, there is a universality to the evolution of the disease across countries that can then be used to make reliable predictions. This approach allows for planning of requirements for critical resources such as ICUs, PPEs during the pandemic.

INDIA – SCIENCE & TECHNOLOGY

Device for non-invasive screening of bilirubin level in new-borns

The device called "AJO-Neo" developed by a group at S.N. Bose National Centre for Basic Sciences (SNBNCBS), Kolkata, measures neonatal bilirubin levels by non-contact and non-invasive spectrometry-based techniques for measurement of neonatal bilirubin level as an alternative of total serum bilirubin (TSB) test. The newly developed device (AJO-Neo) is reliable in measuring bilirubin levels in preterm, and term neonates irrespective of gestational or postnatal age, sex, risk factors, feeding behaviour or skin colour. The device can deliver an almost instantaneous report (about 10 seconds) to a doctor, who is sitting 10000 km away from the point of care. The conventional "blood test" method may take more than 4 hours to generate the report. Detection of neonatal blood bilirubin (Hyperbilirubinemia) faster is extremely important for therapeutic management in order to avoid problems. The Technology has been transferred to M/s Zyna Medtech Private Limited for commercialization.

Karnataka starts Rs 50 billion life sciences park project in Bengaluru

The Karnataka government has launched a mega project to build a life sciences park in the southern suburbs of the tech city, which has a potential to generate about 50,000 jobs. To be built under the public-private partnership (PPP), the 9-million square feet mega park's

developing biotechnology on a global scale. With the help of the Institute of Bioinformatics and Applied Biotechnology for R&D, and other institutions, the life sciences park hopes to become India's global biotech hub. With 380 firms and 200 start-ups, Karnataka is home to about 60 percent of the biotech firms in the country, which have a 9 percent market share in Asia and 35 per cent in the Indian subcontinent. The park will also offer incubation space with shared instrumentation lab facilities and office suites for biotech enterprises and start-ups.

IITH researchers use corn husk to produce carbon electrode for super capacitors

The Inter-University Centre for Astronomy and Astrophysics (IUCAA) will build India's first optical atomic clock. The accuracy level of the clock is so high that it may miss only one second over the entire age of the universe, which is 13.8 billion years, approximately. The clock will be a part of the futuristic Precision and Quantum Measurement laboratory (PQM-lab) being established on the campus. The Department of Science and Technology launched Quantum Enabled Science and Technology (QuEST) in 2019 under which building a PQM lab led by IUCAA was sanctioned Rs 10 crore funding and the optical atomic clock which will take at least three years to build. The clock will help in advanced astronomical instrumentation, quantum communication, meteorology, mega-science initiatives like LIGO-India, Thirty Meter Telescope and researching questions of fundamental science such as gravity, dark matter etc. Apart from supporting the national missions, the technological outcomes from the PQM-lab will lead to products that can be commercialised.

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India well-poised for digital transformation of manufacturing

The United Nations Industrial Development Organization (UNIDO) released its flagship Industrial Development Report on "Industrializing in the digital age". The report presents a first of its kind assessment of the development and application of Advanced Digital Production (ADP) technologies—also known as Industry 4.0 technologies—from a developing country perspective. Among the assessment of 10 global frontrunners, India is the single lower middle-income country that made it to the second group of leading economies. Indian research centers and companies are patenting new innovations in ADP technologies in leading markets such as the EU, Japan and the USA. They are also

knowledge intensive business and ICT services that control and connect these technologies on the shop floor, between supply chain partners and with markets

Nokia to set up robotics lab at Indian Institute of Science

Nokia will set up a robotics lab at the Indian Institute of Science (IISc), Bengaluru for research on socially relevant use cases based on 5G and emerging technologies. Nokia Center of Excellence (CoE) for networked robotics will promote interdisciplinary research involving robotics, advanced communication technologies and artificial intelligence (AI) to develop socially relevant use cases in areas like emergency management, agriculture and industrial automation. The centre will promote engagement and cooperation between academia, start-ups and industry ecosystem. Some of the use cases that the collaboration will explore are using drones for remote management of agricultural orchards to promote water conservation and avoid human contact with pesticide, and drones using a 5G-enabled wide-area network to gather situational information, helping first responders to save lives by accessing the affected areas during disaster relief. Nokia will share its expertise in network innovations to help the research and development of the end-to-end use case technology solutions.

Indian researchers synthesize cost-effective catalyst for Hydrogen production

In order to phase out fossil fuels and combat climate change, hydrogen is projected as one of the next generation low carbon fuels. The future of use of hydrogen as a fuel lies in the design of efficient electrocatalysts for facilitating electrochemical splitting of water to produce hydrogen. Metal-organic frameworks (MOFs) and coordination polymers (COPs) are envisioned as the next generation catalysts as they can be tailored to achieve high surface area but researchers from the Centre for Nano and Soft Matter Sciences (CeNS) have synthesized a novel COP consisting of palladium Pd(II) ions, that serve as a source of active sites for H-adsorption, and benzene tetramine (BTA) chelating ligands capable of better charge transfer. The COP based catalyst exhibited exceptionally high durability for 70 h at a high current density of -300 mA/ cm2.

Shadesmart & Radiant Cooling to promote energy-efficient cooling in buildings

Indian building sector has realized the importance of energy efficiency, but it is yet to be effectively integrated in the construction industry. The Energy and Resources Institute (TERI) in partnership with DST has developed novel external shading solution for windows in residential and commercial buildings. The shading system named as “ShadeSmart” has been developed as an innovative and cost-effective solution with reduced electricity consumption in air conditioning and lighting. ShadeSmart changes its configuration depending upon the Sun’s position. The criterion of design for residential and commercial buildings substantially differs due to differences in activity and occupancy patterns, each design derived through a unique methodology ensuring highest benchmarks of comfort and energy efficiency. ShadeSmart is being commercialized, and efforts are being made to make ShadeSmart more affordable than air conditioning in small thermal zones next to external windows, especially in the residential sector. This technology will help to bring inside the buildings more daylight with less heat, thus making occupants comfortable and also more productive and healthier.

India-Canada IC-IMPACTS Annual Research Conference discussed ways of taking the cooperation between the countries to the next level by strengthening existing international connects, sharing best practices in multiple areas, and initiating new collaborations in government and institutions. The Indian side focussed on identifying best practices in the areas of women in science, technology deployment, diversity in science, and STEM at schools could be shared between them, besides exploring new research in Artificial Intelligence, Quantum Sciences, and Electric Mobility. Projects implemented under this partnership have directly resulted in 7 start-ups and the creation of many jobs for our young graduates. The major focus areas of research cooperation under the IC-IMPACT are green buildings and smart cities; occupants' survivability in buildings during fires; integrated water management & safe and sustainable infrastructure; and health problems arising from water-borne and infectious diseases.

Magnetic hyperthermia-mediated cancer therapy for inoperable tumours

Magnetic hyperthermia-mediated cancer therapy (MHCT), a non-invasive cancer treatment technique involves the delivery and localisation of magnetic materials within the targeted tumour site followed by subsequent application of an alternating magnetic field (AMF), thereby generating heat at the tumour site. It can efficiently act against deep-seated inaccessible solid tumours like glioblastoma and is highly thermo-sensitive towards normal cells with minimal toxicity against healthy counterparts. Scientists from Institute of Nano Science & Technology, Mohali synthesised different magnetic nano-transducers for successful application as magnetic hyperthermia agents for cancer therapy. They have also developed water-stable nanomaterials with a biomolecule as the surfactant to address two of the main concerns regarding the translation of nanotechnology-based strategies to clinical applications - biocompatibility of the material used and therapeutic response of these nano-systems. The synthesized "nano-heaters" were subjected to magnetic hyperthermia either alone or in combination with other adjuvant therapy like photothermal therapy. This resulted in enhanced hyperthermia output which makes it an efficient system to be used for Cancer therapy. The optimization of various parameters like size, shape and surfactant moieties of nano-heaters has the potential for successful glioblastoma therapy with minimum side-effects to the normal cells.

IN BRIEF

Making more durable roads from recycled tyres and rubble

Researchers from RMIT University Australia, have used a blend of old tyres and rubble left over from construction projects, to make material able to take the pressures of traffic and is more flexible than standard road materials, and less likely to crack. The mix of recycled concrete aggregate (RCA) and tyre crumbs is suitable for use as a base layer, beneath the asphalt laid on top. RCA is already used in this way, but the addition of pieces of tyre makes it even better able to cope with the elements. The blended material is a 100 percent recycled alternative, performing strongly on key criteria like flexibility, strength, and permanent deformation. Researchers found that 0.5 percent fine crumb rubber to 99.5 percent RCA was the best composition.

NASA astronauts safely splash down after first commercial flight to space station

Two NASA astronauts splashed down safely in the Gulf of Mexico Sunday for the first time

spaceflight. SpaceX's Crew Dragon, carrying Robert Behnken and Douglas Hurley, splashed down under parachutes in the Gulf of Mexico. Behnken and Hurley participated in a number of scientific experiments, spacewalks and public engagement events during their 62 days aboard station. Overall, the astronaut duo spent 64 days in orbit, and contributed more than 100 hours of time to supporting the orbiting laboratory's investigations. This is SpaceX's final test flight and is providing data on the performance of the Falcon 9 rocket, Crew Dragon spacecraft and ground systems, as well as in-orbit, docking, splashdown, and recovery operations.

Materials science researchers develop first electrically injected laser

Materials science researchers at Arizona university have demonstrated the first electrically injected laser made with germanium tin. Used as a semiconducting material for circuits on electronic devices, the diode laser could improve micro-processing speed and efficiency at much lower costs. In tests, the laser operated in pulsed conditions up to 100 kelvins, or 279 degrees below zero Fahrenheit. The results are a major advance for group-IV-based lasers and could serve as the promising route for laser integration on silicon and a major step toward significantly improving circuits for electronics devices. The alloy germanium tin is a promising semiconducting material that can be easily integrated into electronic circuits, such as those found in computer chips and sensors. The material could lead to the development of low-cost, lightweight, compact and low power-consuming electronic components that use light for information transmission and sensing.

RESOURCES AND EVENTS

G20 digital economy ministers meeting, adopts declaration

The Declaration adopted at the G20 Digital Economy Minsters Meeting on 22 July, acknowledges responses to COVID-19, and recognizes the importance of trustworthy artificial intelligence (AI) solutions, data flows, smart cities, and measurement of – and security in – the digital economy. It presents five Principles for the Responsible Stewardship of Trustworthy AI and five policy recommendations to support them. The principles themselves center around: 1) inclusive growth; 2) human-centered values and fairness; 3) transparency and explainability; 4) robustness, security, and safety; and 5) accountability. The policy recommendations focus on means of implementation, such as, inter alia, investment in AI research and development, shaping an enabling policy environment for AI, and international cooperation for trustworthy AI. It also provides an overview of seven G20 Smart Mobility Practices, as well as a G20 Roadmap toward a Common Framework for Measuring the Digital Economy.

International Solar Alliance (ISA) membership opened to all UN member states

The International Solar Alliance (ISA), launched jointly by the Prime Minister of India and the President of France during COP21 in Paris aims to contribute to the implementation of the Paris Climate Agreement through rapid and massive deployment of solar energy. As on 30 July 2020, 87 Countries have signed the Framework Agreement of the ISA and of these 67 have deposited their instruments of ratification. The First General Assembly of the ISA, held on 3 October 2018, adopted the amendment of the Framework Agreement to expand the scope of Membership of the ISA to all Member States of the United Nations. After the

ISA Member countries the amendment has entered into force on 15 July 2020 allowing all the Member States of the United Nations to join the International Solar Alliance.

UNFCCC Papers Highlight Technologies Supporting Low-Carbon Transition

The UNFCCC Secretariat has published three papers that document the climate technology "journey" – the path between the identification of technological needs for countries to increase sustainability and develop climate change resilience, to full implementation of those technologies. The publications review best practices for responding to countries' technological requirements, the significant role that innovation plays in speeding up the implementation of technology, and opportunities to leverage new technology approaches to increase coastal resilience to climate change. The Technology Executive Committee (TEC), the policy arm of the UNFCCC's Technology Mechanism, launched the publications. which show the crucial role of technologies in the transition to low-carbon, resilient economies.

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