

If you can't see this message, [view it in your browser.](#)

SCIENCE DIPLOMACY NEWS ALERT | 16-31 MAY 2022| ISSUE 86

www.fisd.in

NEWS ALERT

Forum for Indian Science Diplomacy

RIS Science Diplomacy News Alert is your fortnightly update on Indian and global developments in scientific research, technological advancements, science diplomacy, policy and governance. The archives of this news alert are available at <http://fisd.in>. Please email your valuable feedback and comments to science.diplomacy@ris.org.in

CONTENTS

GLOBAL

[New material can Capture Toxic Pollutants from Air](#)
[New CRISPR Method for Insect Gene Editing](#)
[Synthetic Antibiotic against Drug-Resistant Pathogens](#)
[Highest Efficiency 1-Sun Solar Cell Created](#)
[Tomatoes Genetically Engineered to Boost Vitamin D](#)
[Fast Carbon Dioxide Direct Air Capture](#)

COVID-19 (WORLD)

[COVID Booster for Broad Protection Against Omicron Variants](#)
[Recombinant Protein Vaccine Works Against SARS-CoV-2 Variants](#)

COVID-19 (INDIA)

[Germany to recognise Bharat Biotech's 'Covaxin' from June 1](#)

INDIA- SCIENCE & TECHNOLOGY

[Smart Material to Harness Solar Energy](#)
[Using AI to make Roads in India Safer](#)
[Low-cost Braces to Improve Earthquake Resistance of Structures](#)
[Supercomputer Inaugurated at NIT, Tiruchirappalli](#)
[Indigenously developed Air launched Naval Anti-Ship Missile Tested](#)

IN BRIEF

[Crystalline Gamma-Graphyne synthesised](#)
[Low-cost Gel Film can Pluck Drinking Water from Desert Air](#)
[New Light-Powered Catalysts](#)
[Ultrasound-Assisted Laser Technique to remove Artery Plaque](#)
[Cadmium Free Efficient Flexible Thin-Film Solar Cell](#)

RESOURCES AND EVENTS

[India-Canada S&T Cooperation Strengthened](#)
[COP-15 of the UN Convention to Combat Desertification](#)

SCIENCE POLICY AND DIPLOMACY

[Colombia signs the Artemis Accords for Peaceful Space Exploration](#)
[Quad to Expand Science and Technology Collaboration](#)

GLOBAL

New material can Capture Toxic Pollutants from Air

Researchers at University of Limerick, Ireland have developed a material that has the ability to capture toxic chemicals like trace amounts of benzene from the air. According to the team, the sponge-like porous material could revolutionise the search for clean air and have a significant impact in the battle against climate change. It captures the toxic chemical even when present at just 1 part in 100,000. This material resembles Swiss cheese because it is full of holes and it is these holes that attract the benzene molecules. Based on smart design, our materials do well in addressing challenges of both technical and social relevance, such as trace benzene removal from air which is hard for conventional materials. The new generation of bespoke porous materials can enable a general approach to the capture of toxic chemicals from air. The research has opened up possibilities to design porous materials for efficient separation of these chemicals with low energy input as well as removal of other trace pollutants from air.

New CRISPR Method for Insect Gene Editing

Researchers from Japan and Spain have developed a simple and accessible method for insect gene editing called 'direct parental' CRISPR (DIPA-CRISPR), which involves the injection of materials into female adults where eggs are developing rather than into the embryos themselves. This overcomes the problems of gene editing of early embryos of most species. The team injected Cas-9 ribonucleoproteins (RNPs) into the main body cavity of adult female cockroaches to introduce heritable mutations in developing egg cells. The results demonstrated that gene editing efficiency could reach as high as 22 percent. In the red flour beetle, DIPA-CRISPR achieved an efficiency of more than 50 percent. The successful application of DIPA-CRISPR in two evolutionarily distant species demonstrates its potential for broad use. The experiments showed that the most critical parameter for success is the stage of the adult females injected. The new method is accessible, highly practical, and could be readily implemented in laboratories, extending the application of gene editing to a wide diversity of model and non-model insect species. It requires minimal equipment for adult injection, and only two components — Cas9 protein and single-guide RNA — greatly simplifying procedures for gene editing.

Synthetic Antibiotic against Drug-Resistant Pathogens

A Rockefeller University team has synthesized a new antibiotic, derived from computer models of bacterial gene products, which appears to neutralize even drug-resistant bacteria. The compound, named cilagicin, works well in mice and employs a novel mechanism to attack MRSA, C. diff, and several other deadly pathogens. The results suggest that a new generation of antibiotics could be derived from computational models. The team used algorithms to predict the structure of the antibiotic like compounds that a bacterium would produce. Organic chemists can then take that data and synthesize the predicted structure in the lab. The "cil"

gene cluster was fed into an algorithm, which proposed a handful of compounds that cil likely produces. One compound, aptly dubbed cilagicin, turned out to be an active antibiotic. Cilagicin reliably killed Gram-positive bacteria in the lab, did not harm human cells, and (once chemically optimized for use in animals) successfully treated bacterial infections in mice. Of particular interest, cilagicin was potent against several drug-resistant bacteria. Cilagicin works by binding two molecules, C55-P and C55-PP, both of which help maintain bacterial cell walls and may present an insurmountable barrier that prevents resistance. The team will optimize the compound and test it in animal models against more diverse pathogens to determine which diseases it may be most effective in treating.

Highest Efficiency 1-Sun Solar Cell Created

Researchers at the U.S. Department of Energy's National Renewable Energy Laboratory (NREL) created a solar cell with a record 39.5% efficiency under 1-sun global illumination. This is the highest efficiency solar cell of any type, measured using standard 1-sun conditions. The improvement in efficiency followed research into "quantum well" solar cells, which utilize many very thin layers to modify solar cell properties. The scientists developed a quantum well solar cell with unprecedented performance and implemented it into a device with three junctions with different bandgaps, where each junction is tuned to capture and utilize a different slice of the solar spectrum. The top junction is made of gallium indium phosphide (GaInP), the middle of gallium arsenide (GaAs) with quantum wells, and the bottom of lattice-mismatched gallium indium arsenide (GaInAs). The scientists used quantum wells in the middle layer to extend the bandgap of the GaAs cell and increase the amount of light that the cell can absorb. In tests for space applications, the new cell yielded 34.2 percent efficiency.

Tomatoes Genetically Engineered to Boost Vitamin D

Scientists at the John Innes Centre employed CRISPR-Cas9 gene editing to switch off the Sl7-DR2 enzyme of tomato plants so that provitamin D3 (7-dehydrocholesterol 7-DHC), accumulates in the tomato fruit. The leaves of the edited plants contained up to 600 ug (micrograms) of provitamin D3 per gram of dry weight and could be used for the manufacture of vegan-friendly vitamin D3 supplements, or for food fortification. Forty percent of Europeans have vitamin D insufficiency and so do one billion people worldwide. The 7-DHC accumulates in the tomato fruit, in both the leaves and fruit of the edited plants. The researchers found that the 7-DHC in the edited plants could be converted to vitamin D3 by shining UVB light on leaves and sliced fruit for 1 hour. After treatment with UVB light to turn the 7-DHC into Vitamin D3, one tomato contained the equivalent levels of vitamin D as two medium sized eggs or 28g tuna. The study says that vitamin D in ripe fruit might be increased further by extended exposure to UVB, for example during sun-drying. Blocking the enzyme in the tomato had no effect on growth, development, or yield of the tomato plants. Other closely related plants

such as aubergine, potato and pepper have the same biochemical pathway so the method could be applied across these vegetable crops.

Fast Carbon Dioxide Direct Air Capture

Researchers from Tokyo Metropolitan University have developed a new carbon capture system which removes carbon dioxide directly from the atmosphere with unprecedented performance. The team found that an aqueous solution of isophorone diamine (IPDA), could convert 99 percent of the carbon dioxide contained in the air to a solid carbamic acid precipitate. Crucially, they demonstrated that the solid dispersed in solution only required heating to 60 degrees Celsius to completely release the captured carbon dioxide, recovering the original liquid. The rate at which carbon dioxide could be removed was at least twice as fast as that of the leading DAC lab systems, making it the fastest carbon dioxide capture system in the world at present for processing low concentration carbon dioxide in air (400ppm). The team's new technology promises unprecedented performance and robustness in DAC systems, with wide implications for carbon capture systems deployed at scale.

COVID-19

COVID-19 (WORLD)

COVID Booster for Broad Protection Against Omicron Variants

Researchers at Ohio State University tested neutralizing antibody levels against the BA.2 and BA.3 omicron variants and deltacron, a recombinant variant created by the exchange of genetic material between delta and omicron. Results showed that a third mRNA vaccine dose was required to generate a high enough concentration of antibodies to neutralize BA.2 and deltacron, as well as other sublineage omicron variants, including the original, known as BA.1, and BA.1.1. Antibodies produced by just the two-dose series of mRNA vaccines were enough to neutralize BA.3. They tested antibody levels in serum from 10 health care professionals at Ohio State's Wexner Medical Center. After two vaccine doses, on average, antibody levels were 3.3-fold and 44.7-fold lower against BA.3 and deltacron, respectively, than those that neutralized the parent SARS-CoV-2 virus. After the booster, antibody levels were much higher against all variants tested, and the same antibody level reductions were 2.9-fold and 13.3-fold -- showing a dramatic improvement in protection, particularly against deltacron. They also examined blood samples from 18 patients in the ICU during the delta wave of the pandemic and found comparable levels of antibodies against the parent virus and BA.3, but 137.8-fold lower concentrations against deltacron compared to the parent virus. Blood samples from 31 hospitalized non-ICU patients during the omicron surge showed much better antibody protection against deltacron. The researchers conducted the cell-culture studies using pseudoviruses -- a non-infectious viral core decorated with different SARS-CoV-2 spike proteins on the surface structured to match known mutations.

The method used to detect neutralizing antibodies in the blood samples accounted for the varying concentrations of antibodies produced by individuals.

[Recombinant Protein Vaccine Works Against SARS-CoV-2 Variants](#)

A study by researchers in Texas describes a mouse model in which a subunit vaccine with alum-CpG adjuvant was tested for its ability to induce a broadly neutralizing antibody response against the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Protein subunit vaccines are more affordable, easy to produce, distribute and store. Moreover, protein vaccines have been used safely for decades. The researchers used a recombinant receptor-binding domain (RBD), on the S1 subunit of the viral spike, as a vaccine candidate, and developed new formulation that reduced the dose of the RBD antigen and introduced a CpG-like oligonucleotide, CpG1826. The results of this preclinical mouse study showed a robust antibody response to the alum-adjuvanted recombinant RBD antigen, in a dose-dependent manner. After CpG1826 was added in, the titers increased further by a hundred-fold. The vaccine led to a protective response against Alpha, Beta, Delta, and Omicron variants of the virus as well. The results of this preclinical study show that the RBD219-N1C1/alum + CpG vaccine tested here could produce a broader neutralizing response than human natural infection does. Even against Delta and Omicron variants, the neutralizing antibody titers induced by the vaccine candidate were among the highest reported by all such candidates. Further research will focus on the durability of protection and the possibility of developing a vaccine with merely one dose, which would greatly improve compliance with the vaccine. The yeast-produced RBD219-N1C1 vaccine fulfills multiple criteria for a low-cost, high-yield, effective platform that could be invaluable for LMICs seeking a mass vaccine.

COVID-19 (INDIA)

[Germany to recognise Bharat Biotech's 'Covaxin' from June 1](#)

The German Ambassador to India and Bhutan said the government of the European nation will start recognizing Bharat Biotech's COVID-19 vaccine for travel purposes there from June 1. In November last year, the World Health Organisation had recommended Emergency Use Listing (EUL) status for Covaxin. Several countries including Australia, Japan and Canada allow passengers vaccinated with Covaxin into those countries.

INDIA-SCIENCE & TECHNOLOGY

[Smart Material to Harness Solar Energy](#)

Indian scientists have developed a smart material which responds to light stimulus easily by converting light into thermal energy. This can be helpful for harnessing solar energy for applications in soft robotics and micro-electromechanical systems (MEMS) devices. A team of Indian researchers has fabricated spatially splay-deformed (spread out) Liquid crystal polymer networks (LCN) films, by crosslinking a mixture of mono-functional and bi-functional liquid crystal mesogens (a chemical compound). The two types of liquid crystal mesogens comprise one and two molecular units to absorb light, respectively, and incorporate near-infra-red (NIR)-active dye into the system. The NIR laser beam impinging

on the film causes a significant rise in the local temperature, and the ensuing order-disorder transition leads to a change in the macroscopic shape or, in other words, thermo-mechanical actuation. A further extension of the work demonstrated that the films also perform exceptionally well under solar stimulation, suggesting that they could be employed to harness solar energy for applications in soft robotics and MEMS devices.

Using AI to make Roads in India Safer

A project 'Intelligent Solutions for Road Safety through Technology and Engineering' (iRASTE) at Nagpur will identify potential accident-causing scenarios while driving a vehicle and alert drivers about the same with the help of the Advanced Driver Assistance System (ADAS). The project will also identify 'greyspots', i.e., by data analysis and mobility analysis by continuously monitoring dynamic risks on the entire road network. Grey Spots are locations on roads, which left unaddressed could become blackspots (locations with fatal accidents). The system also conducts continuous monitoring of roads and designs engineering fixes to correct existing road blackspots for preventive maintenance and improved road infrastructure. The iRASTE project is under implementation by the I-Hub Foundation, IIT Hyderabad, supported by the Department of Science and Technology (DST). A unique feature of the iRASTE project is that AI and technology is being applied to create practical solutions, as a blueprint, for Indian conditions. The eventual goal is to replicate the solution in other cities in India.

Low-cost Braces to Improve Earthquake Resistance of Structures

Researchers at IIT Delhi have developed low-cost buckling-restrained braces that can give improved protection to constructions from earthquakes. These braces have several advantages, such as all-steel components, onsite fabrication and assembling process, post-earthquake inspection, and easy replacement. The novel hybrid buckling-restrained braces (HBRBs) have higher strength, excellent ductility, and better energy dissipation potential. The seismic performance of full-scale HBRBs has been tested and a patent has recently been applied for the proposed bracing system. A typical HBRB comprises two segments, namely, elastic steel brace (non-replaceable) and short-core BRB (replaceable) segments, connected in series along their lengths. These braces can be customized depending on the seismic demand expected on buildings or bridges located in different seismic zones of India. The proposed technology is effective in the new constructions and has a great potential for the upgradation and retrofitting of seismically deficient reinforced concrete (RC) and steel framed structures, such as residential/office buildings, hospitals, and school buildings. These braces can also be conveniently adopted in steel and concrete bridges to enhance their earthquake resistance.

Supercomputer Inaugurated at NIT, Tiruchirappalli

PARAM PORUL, a state-of-the-art Supercomputer of 838 Teraflops capacity at NIT Tiruchirappalli was inaugurated on 25 May under National Supercomputing Mission (NSM). The supercomputing facility has majority of the components of Indian origin, along with an indigenous software stack developed by C-DAC, in line with the Make in India initiative. This Facility is equipped with a mix of CPU nodes, GPU nodes, High Memory nodes, High throughput storage and high performance Infiniband interconnect to cater the computing needs of various scientific and engineering applications. The system is based on

Direct Contact Liquid Cooling technology to obtain a high power usage effectiveness and thereby reducing the operational cost. Multiple applications from various scientific domains such as Weather and Climate, Bioinformatics, Computational Chemistry, Molecular Dynamics, Material Sciences, Computational Fluid Dynamics etc. have been installed on the system for the benefit of researchers. This high end computing system will be a great value addition for the research community and will also be shared with the nearby academic and research institutes. Under NSM, till date 15 supercomputers have been installed across the nation with compute capacity of 24 petaflops. All these supercomputers have been manufactured in India and operating with indigenously developed software stack.

Indigenously developed Air launched Naval Anti-Ship Missile Tested

Defence Research and Development Organisation (DRDO) and Indian Navy successfully conducted maiden flight-test of indigenously-developed air launched Naval Anti-Ship Missile launched from a Naval Helicopter from Integrated Test Range (ITR), Chandipur off the coast of Odisha on May 18, 2022. The mission met all its objectives. The missile followed the desired sea skimming trajectory and reached the designated target with high degree of accuracy, validating the control, guidance and mission algorithms. All the sub-systems performed satisfactorily. The sensors deployed across the test range and near impact point tracked the missile trajectory and captured all the events. The missile employed many new technologies, including an indigenously developed launcher for the helicopter. The missile guidance system includes state-of-the-art navigation system and integrated avionics.

IN BRIEF

Crystalline Gamma-Graphyne synthesised

A research team from University of Colorado, USA was able to successfully synthesize gamma-graphyne, a new material composed of carbon linked by triple, double and single bonds. Carbon atoms can form single, double or even triple bonds with neighboring carbon atoms and so produce various allotropes. The most well-known carbon allotropes are graphite and diamond with distinct properties. New carbon allotropes discovered include fullerene, carbon nanotubes, graphene etc. While the new material has been successfully created, further research is ongoing into the particular details of it, including how to create the material on a large scale and how it can be manipulated. It is predicted that graphyne would exhibit intriguing and unique electron-conducting, mechanical and optical properties.

Low-cost Gel Film can Pluck Drinking Water from Desert Air

Researchers at the University of Texas at Austin have developed a low-cost gel film made of abundant materials that can pull water from the air in even the driest climates. The materials that facilitate this reaction cost a mere \$2 per kilogram, and a single kilogram can produce more than 6 liters of water per day in areas with less than 15 percent relative humidity and 13 liters in areas with up to 30 percent relative humidity. The researchers used renewable cellulose and a common kitchen ingredient, konjac gum, as a main hydrophilic (attracted to water) skeleton. The open-pore structure of gum speeds the moisture-capturing process. Another designed component, thermo-responsive cellulose with hydrophobic (resistant to water) interaction when heated, helps release the collected water immediately so that overall

energy input to produce water is minimized. The reaction itself is a simple one, which reduces the challenges of scaling it up and achieving mass usage. The film is flexible and can be molded into a variety of shapes and sizes, depending on the needs of the user.

[New Light-Powered Catalysts](#)

MIT chemists have now designed a new type of photoredox catalyst that could make it easier to incorporate light-driven reactions into manufacturing processes. The new class of catalysts is insoluble, so it can be used over and over again. They could be used to coat transparent tubing and perform chemical transformations on reactants as they flow through the tube. The new catalysts, which can be tuned to perform many different types of reactions, could also be incorporated into other materials including textiles or particles. The researchers put the dyes that make up homogeneous catalysts into a plastic-like polymer with tiny pores that they had previously developed for performing gas separations. About a dozen different homogeneous catalysts could be incorporated into their new hybrid material. The researchers found that incorporating the catalysts into polymers also helped them to become more efficient. The physical properties of the polymer backbone, including its thickness and porosity, could be tuned based on the reaction targeted. The catalysts could also be used to coat magnetic beads, making them easier to pull out of a solution once the reaction is finished, or to coat reaction vials or textiles. The researchers are now working on incorporating a wider variety of catalysts into their polymers, and on engineering the polymers to optimize them for different possible applications.

[Ultrasound-Assisted Laser Technique to remove Artery Plaque](#)

Researchers led by the University of Kansas have developed a method that combines a low-power laser with ultrasound to remove arterial plaque safely and efficiently. A low power nanosecond pulsed laser directs thermal energy to vaporize water in the artery and create a vapor bubble, which expands and collapses to break the plaque. The addition of irradiation from ultrasound causes the microbubbles to expand, collapse, and disrupt the plaque. The combination of ultrasound and laser reduces the need for laser power and improves the efficiency of atherosclerotic plaque removal. The combination technique could have a lower restenosis rate, or re-narrowing of the artery, compared to balloon angioplasty or stenting, and lower risk of dissection and perforation in arteries. The team performed ex vivo experiments and are currently planning to perform in vivo experiments. Both the laser and ultrasound techniques are commonly used by clinicians and should be easy to teach and implement following the in vivo studies. Combining low-power lasers and ultrasound techniques can be used also for photo-mediated ultrasound therapy and ultrasound-assisted endovascular laser thrombolysis. The former can be used to remove abnormal microvessels in the eye to prevent blindness, while the latter can dissolve blood clots in veins.

[Cadmium Free Efficient Flexible Thin-Film Solar Cell](#)

Scientists in Japan have developed new processes for copper-indium-gallium-selenide (CIGS) solar cell manufacturing, entirely eliminating the use of cadmium and replacing a waste-intensive wet chemical stage. With a thin film deposited on a flexible steel substrate, the group achieved 16.7 percent efficiency, which is a record for a cell of this type produced using scalable fabrication processes. The group was able to replace the cadmium-containing buffer layer by oxidizing the surface of the CIGS film, forming a “native” buffer layer in a

six-hour air-annealing process at 130 C – which could potentially be implemented in large-scale dry manufacturing, significant waste reduction and cost savings.

RESOURCES & EVENTS

India-Canada S&T Cooperation Strengthened

The 7th India-Canada Joint Science and Technology Cooperation Committee (JSTCC) meeting has renewed two MoUs, setting priorities for the next period in a variety of innovative fields. Dr. Chandrasekhar, Secretary, DST, outlined the focus areas of the collaboration like the National Missions, quantum computing, AI, cyber-physical systems, and so on. He also pointed out that renewal of the MoUs would help intensify exchange of ideas and expertise between the two countries. The bilateral S&T Agreement 2005 provides for the Joint Science and Technology Cooperation Committee, to meet every 2 years to review ongoing collaboration. Both countries agreed to continue monitoring progress on key priorities on bilateral Science, Technology, and Innovation (STI) collaboration for 2022-2024.

COP-15 of the UN Convention to Combat Desertification

The 15th Session of the Conference of Parties (COP-15) to the United Nations Convention to Combat Desertification (UNCCD) was held in Abidjan, Core d'Ivoire, 9-20 May 2022. It adopted 38 decisions to improve drought resilience, reduce land degradation, and invest in land restoration efforts. Following the initial two-day High-Level Segment, the UNCCD's two subsidiary bodies, the Committee for the Review of the Implementation of the Convention (CRIC) and the Committee on Science and Technology (CST), convened in parallel to the COP. New commitments adopted during the COP included the Abidjan Call issued by the Heads of State and Government attending the Summit. Other initiatives launched include the Business for Land Initiative, and the Sahel Sourcing Challenge. Nearly 7,000 participants attended the COP, including Heads of State and Government, ministers, delegates from the 197 parties to the UNCCD, as well as members of the private sector, and civil society. Dealing with drought proved to be a difficult issue, given expected increases in the frequency and severity of droughts due to climate change.

SCIENCE POLICY AND DIPLOMACY

Colombia signs the Artemis Accords for Peaceful Space Exploration

Colombia has joined NASA's quickly growing Artemis Accords program, becoming the 19th nation to sign on, after recent pacts with Bahrain, Singapore and Romania. The Artemis Accords outline peaceful and responsible exploration of the moon and beyond. NASA is planning to send astronauts back to the moon later in the decade under the Artemis program. NASA and the U.S. Department of State unveiled the Artemis Accords in 2020, with eight nations signing on at that point: Australia, Canada, Japan, Luxembourg, Italy, the United Kingdom, the United Arab Emirates and the United States. Since then, Bahrain, Brazil, Israel, the Republic of Korea, Mexico, New Zealand, Poland, Romania, Singapore and Ukraine have also signed it. The Artemis Accords lay out certain principles to guide civil space actors, among them: peaceful purposes, transparency, interoperability, commitment to emergency assistance, registration of space objects, release of scientific

data, deconfliction of activities, protection of space heritage, and mitigation of orbital debris, including spacecraft disposal. NASA is working toward bringing astronauts to the moon's surface again to eventually establish a permanent human presence there. In addition to the landings near the lunar south pole, where water ice appears to be nestled inside permanently shadowed craters, the agency is creating a Gateway lunar station in orbit around the moon.

Quad to Expand Science and Technology Collaboration

The Quad countries - US, India, Japan and Australia plan to step up cooperation in key technologies including semiconductors, quantum, telecommunications and space. A statement issued on 24 May spelt out several areas of cooperation, including science and technology. The four countries will use their “complementary strengths” to create a “diverse and competitive” market for chips. They will also collectively map out where their semiconductor supply chains are vulnerable. In addition, they pledged more joint cooperation in the world of telecommunications standards. The Quad also “deepened discussions” on biotechnology and said they would also focus on quantum technologies. In space, each of the four countries aim to improve public access to Earth satellite data and applications, and will create a data portal aggregating links to national satellite resources. They will consult on “rules, norms, guidelines and principles for the sustainable use of space. The new Quad Fellowship will bring 100 STEM students from India, Australia and Japan each year to the US to pursue graduate degrees.

We welcome your comments and valuable suggestions. Please write to us for receiving publications, updates and notices regarding seminars, conferences etc.

NOTE TO OUR READERS AND STAKEHOLDERS:

The Science Diplomacy Programme at RIS has been sending you the fortnightly issues Science Diplomacy Alerts regularly. We request your cooperation to review the Alerts and improve its content. For this purpose, please complete the form at <https://forms.gle/o4d869FxaM9t3KNw7>, and submit it. Your support and cooperation is appreciated.

Research and Information System for Developing Countries

Core IV B 4th Floor, India Habitat Centre, Lodi Road, New Delhi 110003, India

Tel:-011- 24682176, E-mail: science.diplomacy@ris.org.in

Website: www.fisd.in

Disclaimer:

Opinions and recommendations in the report are exclusively of the author(s) and not of any other individual or institution including FISD. This report has been prepared in good faith on the basis of information available at the date of publication. All interactions and transactions with industry sponsors and their representatives have been transparent and conducted in an open, honest and independent manner as enshrined in FISD Memorandum of Association. FISD does not accept any corporate funding that comes with a mandated research area which is not in line with FISD research agenda. The corporate funding of an FISD activity does not, in any way, imply FISD endorsement of the views of the sponsoring organization or its products or policies. FISD does not conduct research that is focused on any specific product or service provided by the corporate sponsor.

To unsubscribe please [click here](#)