GOVERNMENT OF INDIA
MINISTRY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH

LOK SABHA
UNSTARRED QUESTION NO. 5628
(TO BE ANSWERED ON 06.04.2022)

LABORATORIES ON INNOVATIVE TECHNOLOGIES

5628. SHRI SISIR KUMAR ADHIKARI:

Will the Minister of SCIENCE AND TECHNOLOGY be pleased to state:

(a) whether the Government consults with the state Governments to introduce the innovative technologies of the laboratories in different State programmes;

(b) if so, the number of laboratories with CSIR therefor and the recent developments therein; and

(c) the details of the induction of innovations on the projects of road, drainage system, medical, solar, e-wastes and other technologies in the Central and State Government programmes therefor?

ANSWER

MINISTER OF STATE (INDEPENDENT CHARGE) OF SCIENCE AND TECHNOLOGY & EARTH SCIENCES (DR. JITENDRA SINGH)

(a)&(b) Yes, Sir. Council of Scientific and Industrial Research (CSIR) has been entering into knowledge partnership with State/UT Governments to promote science and technology-led development of the State/UT through deployment of identified technologies/ knowhow as per the State/UT requirement. The list of CSIR constituent laboratories is placed at Annexure-I.

(c) CSIR through its R&D efforts is contributing to the various Central Government initiatives/programmes. Some of the recent CSIR Initiatives for Central Government Programmes and CSIR S&T interventions that have been identified in consultation with the State Governments/Union Territories for S&T led development of State/UTs are placed at Annexure-II and Annexure-III respectively.

****

Annexure-I

S.No.	CSIR Lab
1.	CSIR-Advanced Materials and Processes Research Institute (CSIR-AMPRI), Bhopal
2.	CSIR-Central Building Research Institute (CSIR-CBRI), Roorkee
3.	CSIR-Centre for Cellular Molecular Biology (CSIR-CCMB), Hyderabad
4.	CSIR-Central Drug Research Institute (CSIR-CDRI), Lucknow
5.	CSIR-Central Electrochemical Research Institute (CSIR-CECRI), Karaikudi
6.	CSIR-Central Electronics Engineering Research Institute (CSIR-CEERI), Pilani
7.	CSIR-Central Food Technological Research Institute (CSIR-CFTRI), Mysore
8.	CSIR-Central Glass Ceramic Research Institute (CSIR-CGCRI), Kolkata
9.	CSIR-Central Institute of Mining and Fuel Research (CSIR-CIMFR) Dhanbad
10.	CSIR-Central Institute of Medicinal Aromatic Plants (CSIR-CIMAP), Lucknow
11.	CSIR-Central Leather Research Institute (CSIR-CLRI), Chennai
12.	CSIR-Central Mechanical Engineering Research Institute (CSIR-CMERI), Durgapur
13.	CSIR-Central Road Research Institute (CSIR-CRRI), New Delhi
14.	CSIR-Central Scientific Instruments Organisation (CSIR-CSIO), Chandigarh
15.	CSIR-Central Salt Marine Chemicals Research Institute (CSIR-CSMCRI), Bhavnagar
16.	CSIR-Institute of Genomics and Integrative Biology (CSIR-IGIB), Delhi
17.	CSIR-Institute of Himalayan Bioresource Technology (CSIR-IHBT), Palampur
18.	CSIR-Indian Institute of Chemical Biology (CSIR-IICB), Kolkata
19.	CSIR-Indian Institute of Chemical Technology (CSIR-IICT), Hyderabad
20.	CSIR-Indian Institute of Integrative Medicine (CSIR-IIIM), Jammu
21.	CSIR-Indian Institute of Petroleum (CSIR-IIP), Dehradun
22.	CSIR-Indian Institute of Toxicology Research (CSIR-IITR), Lucknow
23.	CSIR-Institute of Minerals and Materials Technology (CSIR-IMMT), Bhubaneswar
24.	CSIR-Institute of Microbial Technology (CSIR-IMTECH), Chandigarh
25.	CSIR-National Aerospace Laboratories (CSIR-NAL), Bengaluru
26.	CSIR-National Botanical Research Institute (CSIR-NBRI), Lucknow
27.	CSIR-National Chemical Laboratory (CSIR-NCL), Pune
28.	CSIR-National Environmental Engineering Research Institute (CSIR-NEERI), Nagpur
29.	CSIR-North - East Institute of Science and Technology (CSIR-NEIST), Jorhat
30.	CSIR-National Geophysical Research Institute (CSIR-NGRI), Hyderabad
31.	CSIR-National Institute for Interdisciplinary Science and Technology (CSIR-NIIST), Thiruvananthapuram

32.	CSIR-National Institute of Oceanography (CSIR-NIO), Goa
33.	CSIR-National Institute of Science Communication and Policy Research (CSIR-NIScPR), New Delhi
34.	CSIR-National Metallurgical Laboratory (CSIR-NML), Jamshedpur
35.	CSIR-National Physical Laboratory (CSIR-NPL), New Delhi
36.	CSIR-Structural Engineering Research Centre (CSIR-SERC), Chennai

*****

Annexure – II

Some of the recent CSIR Initiatives for Central Government Initiatives/ Programmes

CSIR through its R&D efforts is contributing to the various Central Government initiatives/programmes. Some significant technologies developed/ S&T interventions under these initiatives are as given below:

Road related initiatives:

- CSIR-Central Institute of Mining and Fuel Research (CSIR-CIMFR), Dhanbad has been working with Border Road Organization (BRO) and providing scientific and technical inputs for construction of different strategic border roads in Arunachal, Uttarakhand, Ladakh and other states. The inputs provided by CSIR-CIMFR enhanced the progress in construction by 30-40% at different strategic roads. BRO has acknowledged the effectiveness of CSIR-CIMFRs control blasting technique and other measures for safe and efficient rock excavation. Further, BRO has signed an agreement with CSIR-CIMFR for "Advice on Controlled Blast Design for Excavation of Rock at BRO Road Construction Sites"; and

- CSIR-Central Institute of Mining and Fuel Research (CSIR-CIMFR), Dhanbad provided very vital technical support to National Highway Authority of India (NHAI) for construction of the Chenani-Nashari tunnel in Jammu and Kashmir. CSIR-CIMFR was associated in this project throughout the construction period for continuous evaluation and design of tunnel and monitoring of the tunnel construction quality;

- CSIR-Central Road Research Institute (CSIR-CRRI), New Delhi has developed a cold mix technology which is environment friendly and consumes low energy involving use of cationic bitumen emulsions. For rural roads, it would prove not only cost-effective but also enable achievement of larger lengths due to availability of longer working season particularly in north-east region and hilly states. The developed Cold Mix Technology has been commercialized by an industry partner. Several States have successfully utilized this technology in both Central & State rural roads schemes; and

- CSIR-Central Road Research Institute (CSIR-CRRI), New Delhi plays an unique role in the preparation of national standards and specifications, code of practices issued by Indian Roads Congress, Bureau of Indian Standards, Ministry of Roads Transport & Highways and National Rural Road Development Agency (Ministry of Rural Development, Government of India) in all road transportation related areas especially on materials, geometric and pavement design of roads, road construction maintenance management, traffic engineering, safety and socio-economic analysis.

Drainage system related initiatives:

- CSIR-National Environmental Engineering Research Institute (CSIR-NEERI), Nagpur has designed and developed in-situ nallah treatment technology known as RENEU - Restoration of Nallah with Ecological Units. RENEU refers to "treatment of sewage in the running flow without displacing/disturbing the shape/structure of Nallah; and by employing physical and biological operations in the aerobic and facultative environment to degrade sewage. Physical operation includes silt-trap, screening and sedimentation and biological operations include aeration, microbial

and phytoremediation. The RENEU technology has been installed at many drains in the country in different states; and

- CSIR-National Environmental Engineering Research Institute (CSIR-NEERI), Nagpur has designed and developed Phytorid Wastewater Treatment Technology which is a self-sustainable technology for wastewater treatment that works on the principle of natural wetland for the treatment of municipal, urban, agricultural and industrial wastewater . It uses certain specific plants which can absorb nutrients directly from wastewater but do not require soil. These plants act as nutrient sinker and remover. Using Phytorid Technology for the treatment of sewage, it is possible to recover and reuse the treated water for gardening purposes. The Phytorid Wastewater Treatment Technology has been installed at many places in the country in different states.

Medical/ Health related initiatives:

- CSIR-Indian Institute of Petroleum (CSIR-IIP) has developed Medical Oxygen Concentrator plants based on Pressure Vacuum Swing Adsorption (PVSA) technology and is setting up 120 of them under PM CARES along with Defence Research and Development Organization (DRDO). CSIR-IIP's first field-deployed medical oxygen (MO2) plant was successfully commissioned at Aundh Chest Hospital, Pune. The developed technology can be useful for providing oxygen to patients particularly those afflicted by COVID- 19;

- CSIR had designed and developed UV-C disinfection technology for inactivation of virus that can be installed in air ducts in malls, movie theatres and auditoriums etc. The technology meant for mitigation of airborne transmission of SARS-COV-2 was installed in the Central Hall, Lok Sabha Chamber and Committee Rooms 62 and 63 of the Parliament;

- Whole Genome Sequencing of 1000 Indians for Healthcare and Biomedical Applications completed by CSIR in 6 months' time;

- A product for management of sepsis has been developed due to gram negative bacterial infections;

- CSIR has set up 11 makeshift hospitals at different places in India with a total bed capacity of about 350;
- CSIR was one of the earliest institutions in India that set-up COVID-19 testing facilities as early as in March 2020. Today, thirteen CSIR laboratories have carried out over 15,00,000 tests.

- CSIR-Institute of Genomics and Integrative Biology (CSIR-IGIB), Delhi has developed a technology for FELUDA (FNCAS9 Editor-Linked Uniform Detection Assay) which is a Novel, Rapid, Simple, Affordable and Innovative COVID-19 Diagnostic. It can be used for detecting single nucleotide variants in RNA or DNA or more broadly detecting any DNA or RNA fragment, without the need for sequencing. The technology has been licensed to TATA Sons is now being manufactured and marketed as TataMD CHECK;

- CSIR-National Environmental Engineering Research Institute (CSIR-NEERI), Nagpur has developed a technology for Dry Swab RNA Extraction Free RTPCR Method. CSIR-NEERI has successfully utilised this method and tested more than 50,000

samples. Many industries have licensed this method and have developed kits that will enable large scale testing, which is the need of the day;

- On the COVID-19 surveillance front, CSIR laboratories have undertaken sequencing of SARS-CoV-2 to find the type of strains present in India and to understand if the virus undergoes genetic changes while it is spreading in the country. As a part of INSACOG they have played a critical role in genomic surveillance and more than 50,000 sequences have been determined.

- CSIR-Indian Institute of Chemical Technology (CSIR-IICT), Hyderabad has developed a technology for Process to develop imidazoquinoline molecule in larger quantities as part of the adjuvant component used in Covaxin vaccine. Covaxin is a vaccine with no sub-zero storage, no reconstitution requirement, and ready to use liquid presentation in multi-dose vials, stable at 2-8 degree;

- CSIR-National Aerospace Laboratories (CSIR-NAL), Bengaluru has developed a technology for Coverall. It can be used to ensure safety of doctors, nurses, paramedical staff and healthcare Workers. The technology has been transferred to M/s MAFL, Bengaluru;

- CSIR has also come out with comprehensive ventilation guidelines for offices and buildings to decrease air borne transmission of virus;

- CSIR also developed a cost-effective process of Favipiravir and transferred the technology to Cipla, which is being sold in the market as Ciplenza. CSIR has undertaken many clinical trials for repurposing of drug for treatment of COVID-19;

- The Aarogyapath and Kisan Sabha apps developed by CSIR in a short span of time ensures a national healthcare supply chain and connects farmers to the supply chain and freight transportation management system respectively; and

- Affordable dental implants for edentulous situations have been developed and licensed to an industry for commercialization.

Solar power related initiatives:

- CSIR-Central Mechanical Engineering Research Institute (CSIR-CMERI), Durgapur has developed a Solar Energy based Cooking System (Solar Chulha). The institute has developed three types of solar energy based cooking systems (Solar Chulha), namely (i) Solar PV energy based electric cooking system; (ii) Hybrid solar PV and Biogas cooking system; and (iii) Solar assisted improved biomass cooking system. Technology of solar PV energy based electric cooking system has been transferred to two industries on non-exclusive basis for production and commercialization; and

- To address the energy needs of remote areas, particularly off grid locations in the country, CSIR-National Aerospace Laboratories (CSIR-NAL), Bengaluru has developed and successfully demonstrated Wind Solar Hybrids (WiSH) systems in the range of 1 - 20 kW class. It shall pave the way for electrification by harvesting renewable energy at discrete and multiple locations in a Decentralized Distributed Generation (DDG) mode.

e-waste related initiatives:

CSIR-National Metallurgical Laboratory, Jamshedpur has developed a process for ecological recovery of cobalt and other valuable metals from the black powder and other constituents of lithium-ion batteries. Further, laboratory has also developed a process flow sheet to recover precious metals and Co & Au from e-waste. The processes developed have been transferred to industries for extraction of cobalt metal/ salt from black powder of lithium batteries and recovery of precious metals from e-waste.

Other significant initiatives:

- Under CSIR's Aroma Mission Phase-I, about 6000-hectare additional area has been brought under cultivation of economically important aromatic crops. 25 new superior varieties of various aromatic crops and 34 agro technologies have also been developed. 231 distillation units have been installed in various clusters developed across the country enabling the distillation of 500 tons quality essential oils which helped to reduce the import of these oils. This has helped aroma industry in India especially during the long pandemic time duration. So far in Phase II of CSIR Aroma Mission, about 9500-hectare land has been brought under the cultivation of aroma crops. Three new superior varieties have been developed along with 09 region-specific agro technology's. The most significant achievement under CSIR Aroma Mission is the "Purple Revolution" in Jammu and Kashmir through CSIR S&T intervention of introduction and promotion of Lavender cultivation, processing and marketing of its essential oil in Jammu & Kashmir;

- CSIR initiated a 'Floriculture Mission" in 2020-21 which is expected to utilize the knowledgebase available in CSIR institutes and leverage it in an effort to help Indian Floriculture farmers and industry reposition itself to meet the import requirements in the domain by developing and deploying improved varieties. The Mission is being implemented in collaboration with Khadi and Village Industries Commission (KVIC), Agricultural and Processed Food Products Export Development Authority (APEDA), Tribal Cooperative Marketing Development Federation of India (TRIFED), Indian Council of Agricultural Research (ICAR) and Academic Institutions;

- CSIR has launched an ambitious mission of "High-Resolution Aquifer Mapping & Management in Arid Regions of North-Western India which is being implemented in association with the Ministry of Jal Shakti. CSIR-National Geophysical Research Institute (CSIR-NGRI), Hyderabad would carry out Multi-moment Heliborne geophysical (TEM and magnetic) surveys in arid and semi-arid regions with an area of ~1 lakh sq. km in the states of Rajasthan, Gujarat, Punjab & Haryana States;

- CSIR has been working with the Ministry of Jal Shakti under Jal Jeevan Mission to demonstrate and deploy innovative, cost-effective and smart technologies for measuring and monitoring water service delivery for safe and sustainable water resource management at pilot location across the country. Four locations Bairia Block, Balia District, Uttar Pradesh; Bandikui block, Dausa District, Rajasthan; Narkhed Block, Nagpur District, Maharashtra and Choutuppal, Yadadri Bhuvanagiri District, Telangana have been identified for the purpose;

- CSIR-Central Building Research Institute (CBRI), Roorkee has played an important national role in participating in various societal mission programmes of the country such as "Navodya Vidyalaya schools", "Indira Awas Yojana", Setting up Building

centres with HUDCO, "Sarva Shiksha Abhiyan", etc. to improve public welfare by enhancing quality and safety of buildings;

- CSIR-National Environmental Engineering Research Institute (CSIR-NEERI), Nagpur has contributed immensely for reorientation of environmental policy towards prevention of pollution and developed technologies for substitution of non-renewable resource base with renewable resources, recycle and reuse of industrial and domestic wastewater & conducted environmental impact and risk assessment studies and environmental audit of industrial and mining projects across the country;

- CSIR-National Physical laboratory (CSIR-NPL), New Delhi has been engaged in the production of Indian Certified Reference Material (CRMs) Trademarked as BHARATIYA NIRDESHAK DRAVYA, (BND®) by signing a MoU with NABL accredited reference material producers for the speedy production of CRMs to meet the national demand. CRMs are widely used for the calibration of measuring apparatus, for the evaluation of measurement procedures and for the internal or external quality control of measurements and laboratories. CSIR-NPL has initiated CRM production under “Make in India” initiative for “cost-effective” production. The availability of SI traceable BNDs® is poised to boost the “Aatmnirbhar Bharat” initiative and harmonize the quality infrastructure in the country and equip the quality regulatory bodies of almost all the ministries;

- CSIR is promoting sea weed farming in association with National Fisheries Development Board, Hyderabad to get the assured income for the fisherman. M/s. Aquagri private limited is the private partner offering buyback of the biomass produced by the beneficiaries from cultivation. The program has been developed with M/s. Pidilite industries where capacity building and hands on training will be imparted to the fishermen of coastal areas;

- CSIR has devised an innovative solution to curb the high pollution caused by burning of conventional firecrackers during Diwali and other festive occasions. CSIR launched green firecrackers in various variants (flowerpots, pencils, chakkar and sparklers) which are eco-friendly and decrease pollution at least by 30%. Over 250 MoUs and 325 non-disclosure agreements (NDAs) signed with fireworks manufactures and nearly 600 emissions testing certificates issued to fireworks manufactures;

- CSIR-National Aerospace Laboratories (CSIR-NAL), Bengaluru has developed indigenous transmissometer ‘Drishti’ which is a visibility measuring system that provides information to pilots on visibility for safe landing and take-off operations. CSIR-NAL and the India Meteorological Department (IMD) are jointly producing the Drishti system, so as to enable the deployment of 70 such systems at Indian airports. Further, CSIR-NAL and Tata Power have signed the MoU for the supply of 54 numbers of Drishti Systems which are installed in Indian Air Force Airfields under Modernisation of Air Field Infrastructure (MAFI) project of Tata Power SED with Indian Air Force;

- An energy efficient domestic cooking burner has been designed and developed for Piped Natural Gas (PNG) by CSIR-Indian Institute of Petroleum (CSIR-IIP), Dehradun. The improved energy efficiency of the developed PNG burner may lead to significant reductions in energy consumption in the household sector and enable delivery of energy to household for cooking via lower PNG supply per household for the same energy duty;

- CSIR-National Botanical Research Institute (CSIR-NBRI), Lucknow has signed an MoU with Delhi Development Authority (DDA) to achieve Horticulture works at Amrut Biodiversity Park,108 Hectares area. CSIR-NBRI will be replicating journey of independent India through its Horticulture scheme;

- CSIR-National Aerospace Laboratories (CSIR-NAL), Bengaluru has developed Indigenous AWMS (Aviation Weather Monitoring System) technology. The developed system can be used for weather monitoring. Bangalore International Airport Limited (BIAL) – operator of Kempegowda International Airport (Bengaluru Airport) – became the first airport in India to install the indigenous AWMS (at both ends of the new runway);

- CSIR-Central Scientific Instruments Organisation (CSIR-CSIO), Chandigarh has developed technologies for Light Combat Aircraft Fly-By-Wire Control Systems Head Up Display and Associated Test Equipment. The developed Head-up display give pilot access to critical flight information to safely fly aircraft by overlaying flight information on forward view to provide simultaneous view of flight symbology & forward view. The technology has been licenced to Bharat Electronics Limited for production and manufacturing;

- CSIR-Central Electronics Engineering Research Institute (CSIR-CEERI), Pilani has developed a technology for Prevention of adulteration in milk- a real-time remote milk supply chain monitoring network (PRADUMN) which can be used by agencies (food inspectors) to monitor the supply chain of interest from a single point. The technology has been transferred to M/s Rajasthan Electronics & Instrument Limited (REIL), Jaipur;
- In view of the high local emissions from conventional crematoria, CSIR-National Environmental Engineering Research Institute (CSIR-NEERI), Nagpur has developed an air pollution mitigation system for Green Crematoria. The project was funded by Delhi Pollution Control Committee (DPCC). The developed system has been installed at VIP Pyre 3,4,5,6 of Nigam Bodh Ghat, New Delhi. The system comprises of Fume collection and handling, Processing/cleaning, Utilities and Waste Handling systems. Innovative and efficient design of scrubbing system results in reduced emission of smoke, oil/grease GHG and particulates with ease of recycle and disposal of scrubbed liquid and solids. This technology aids in achieving the commitment under Swachh Bharat Mission.

- CSIR-Central Scientific Instruments Organisation (CSIR-CSIO), Chandigarh has developed a technology for Earthquake Warning System. The developed EqWS may be utilized to safeguard vital installations such as Refineries, Nuclear establishments, Power Plants, Metro & High-Speed Railway, Airports, Hospitals etc. The technology is deployed and operational at Delhi Metro;

- Technical support for design & construction of houses under the Pradhan Mantri Awaas Yojana – Gramin (PMAY-G) in Odisha. Design and building plans suitable for various geo-climatic zones;

- Indigenous pilot plant scale reactor has been developed with a capacity of producing 24lit/day of Dimethyl ether (DME) along with stable catalysts for conversion of methanol to DME and optimized process for catalytic conversion of Methenol to DME;

- CSIR-Central Salt Marine Chemicals Research Institute (CSIR-CSMCRI), Bhavnagar has developed novel seaweed-based animal feed additives formulations to enhance the productivity of animals, improving the quality of animal products, and boosting immunity;

- India's first indigenous Flying Trainer HANSA-NG designed and developed by CSIR-National Aerospace Laboratories, Bangalore has successfully completed the sea level trials at Puducherry. The aircraft was flown to Puducherry covering 140 nautical miles in one and half hours at a cruising speed of 155 km/hr. The objectives of sea level trials were to evaluate handling qualities, climb / cruise performance, balked landing, structural performance including positive & negative G, power plant and other systems performance;

- CSIR has collaborated with IIT, Delhi and Vijanana Bharati for contributing in Unnat Bharat Abhiyan (UBA) which is a flagship national program of the Ministry of Human Resource Development (MHRD) envisioning transformational change in rural development processes by leveraging knowledge institutions to help build the architecture of an Inclusive India. CSIR will organize webinars on CSIR technologies at regular intervals and would carry out live demonstration/dissemination of technologies to promote participative-cum-partnership collaboration;

- CSIR has launched the program on 'Skill India Initiative' which aims to equip young minds with the necessary technological skills through exposure to CSIR laboratories. CSIR has already trained more than 100000 personnel, since launch of the scheme, in the areas of Biological Sciences, Chemical Sciences, Engineering Sciences and Physical Sciences;

- The Indian Navy and CSIR signed a MoU to undertake joint research and development of advanced technologies for the Indian Navy;

- CSIR has entered into a Memorandum of Understanding (MoU) with the Khadi and Village Industries Commission (KVIC) to leverage the expertise available in CSIR with the effort of KVIC for promotion of honey production and also to enable wider outreach of the CSIR technologies and products;

- To promote scientific temper amongst the school students, CSIR had launched the programme named "JIGYASA" in collaboration with Kendriya Vidyalaya Sangathan (KVS). The CSIR's Jigyasa program is a unique platform for bringing scientists and teachers for nurturing young minds. This program envisages opening up the national scientific facilities to school children, enabling CSIR scientific knowledgebase and facility to be utilized by schoolchildren. CSIR Laboratories have implemented the programme connecting schools, benefitting about 3 lakh students during the last 5 years. Further, 295 Atal Tinkering Labs (ATLs) of AIM were officially adopted by CSIR across the country towards inculcating Scientific research and innovation culture among students. Taking forward CSIR's Jigyasa program to millions of school students, the Jigyasa-Virtual Lab concept has been formalized in association with IITB, Mumbai. The Virtual Lab platform shall enhance the scientific temper amongst school children where the students will read, have fun and carry out experiments and materials which are presented by the CSIR scientists and other stakeholders.

****

Annexure – III

Some of the recent CSIR Initiative and S&T interventions that have been identified by CSIR in consultation with the State Governments/Union Territories for S&T led developments

Road related initiatives:

- CSIR-Central Road Research Institute (CSIR-CRRI), New Delhi in collaboration with Intel, INAI, IIIT, Hyderabad, Mahindra & Mahindra and Nagpur Municipal Corporation has launched the artificial intelligence-powered project, on a pilot basis in Nagpur City, Maharashtra. This project would help reduce road accidents and understand the factors responsible for these events and in engineering solutions to mitigate them. The project would focus on vehicle safety, road infrastructure safety, mobility analysis to move towards a Vision Zero, accident scenario. The use of AI to map accident spots would help collect data about a road surface condition, marking, signage, signal details, type of vehicles, and models in use as well as utility assets;

- India's first ever Steel slag road built with 100% processed steel slag aggregates in all layers of bituminous roads at Hazira, Surat, Gujrat by an Industry in collaboration with CSIR-CRRI under a project supported by the Ministry of Steel. The road was constructed utilizing waste steel slag;

- CSIR-CRRI has developed Soil Nailing Technique for underpass construction which is a simple, easy, safe, time-saving, economical and user friendly technique in live loading condition. Four projects namely (Yamuna Bazar Underpass, Delhi; Apsara Border Underpass, Delhi; Sahibabad Underpass, Ghazibad, UP and Mahipalpur - Delhi Gurgaon Road underpass, Delhi) underpass had been successfully completed using Soil Nailing Technique with box jacking/Box pushing below live traffic;

- Application and demonstration of CSIR sustainable technologies for flexible pavements in J&K region;

- Plastic waste management in Jammu & Kashmir (Energy, Road, Tiles etc.); and

- CSIR-CRRI has been providing technical and consultancy support in several roads related projects to various state government.

Drainage system and wastewater & solid waste management related initiatives:

- CSIR-National Environmental Engineering Research Institute (CSIR-NEERI), Nagpur has been instrumental in designing and commissioning Common Effluent Treatment Plants (CETPs) for homogenous and heterogeneous industrial clusters in the country. CETPs designed and commissioned by CSIR-NEERI at various industrial clusters helped in prevention of water and soil pollution. About 30 Common Effluent Treatment Plants (CETPs) have been installed in 6 different states which prevented water and soil pollution besides providing recyclable treated water;

- Improvisation of the traditional practices of night soil composting in dry toilets (chaksa) of Ladakh using microbiological intervention;

- Ecological mapping, mapping for natural resources, geothermal energy, and ground water, as well as earthquake hazard assessment in Ladakh;

- Rejuvenation of lakes/water bodies in Jammu & Kashmir;

- Drinking water purification and wastewater treatment in Jammu & Kashmir; and

- Implementation of remunerative solid waste treatment technologies for the recovery of value added products in Jammu & Kashmir

Medical/ Health related initiatives:

- The Maharashtra Government has signed a memorandum of understanding (MoU) with CSIR-Institute of Genomics and Integrative Biology (CSIR-IGIB), New Delhi for SARS-CoV- 2 genome sequencing to better understand the mutation of the novel coronavirus and validate the policies implemented to contain its transmission;

- The Andhra Pradesh Industrial Infrastructure Corporation Ltd (APIIC) has entered into a Memorandum of Understanding (MoU) with CSIR-Indian Institute of Chemical Technology (CSIR-IICT), Hyderabad as a step forward in the direction of setting up a Bulk Drug Park (BDP) under a scheme by the Ministry of Chemicals and Fertilisers, Department of Pharmaceuticals. CSIR-IICT shall provide necessary technical support as the knowledge partner in preparing the proposal to be submitted by the Andhra Pradesh government to the Department of Pharmaceuticals;

- CSIR has launched a drone-driven aerial delivery facility to transport Covid-19 vaccines and emergency medicines to inaccessible and difficult areas in a short span of time in Jammu & Kashmir and Karnataka. The Medium Multi-copter Unmanned Air Vehicle (MMAV) has been developed indigenously by CSIR-National Aerospace Laboratory (CSIR-NAL), Bengaluru for its applications in Healthcare and Agriculture sectors. Autonomous flight with MEMS (Micro Electro-Mechanical System) based digital Autopilot UAV has been authorized in India by Ministry of Civil Aviation for BVLOS (Beyond Visual Line of Sight) operations;

- A cost effective and easy to use non-invasive ventilation device that can be used in Makeshift hospitals, wards and dispensary has been developed by CSIR-National Aerospace Laboratory (CSIR-NAL), Bengaluru. It has undergone stringent tests at NABL accredited labs and clinical trials on more than 100 COVID-19 patients. It has been approved by DGHS for use in COVID-19 patients who need oxygen supplementation up to 35%. It has a unique “T” coupler with a HEPA filter tominimize dispersal of the virus into ambient air. Technology has been transferred to seven Industries. About 1200 units have been supplied to Delhi Government;

- Under its Mission program on Sickle cell anemia, CSIR in collaboration with State Medical Colleges and clinical centers are involved in Population screening, genetic testing, carrier testing, prenatal diagnosis and genetic counselling, treatment of identified patients. The Sickle Cell Disease is prevalent in certain weaker section of society. The activities of Mission have largely focused on two states, Chhattisgarh and Maharashtra in the phase I (2017-2020) and in Phase II, it has now been extended to Madhya Pradesh using the comprehensive protocols established during phase I;

- The CSIR-Institute of Microbial Technology (IMTECH), Chandigarh has signed a Memorandum of Understanding (MoU) with Punjab Government's Department of Science, Technology and Environment to jointly address the issues pertaining to public health and environment under Mission Tandrust Punjab 2.0 besides working together for making the state Research and Innovation Hub under Mission Innovate Punjab. Under the MoU, both organizations will strive to promote Research and Innovation (R&I) ecosystem in Punjab to enhance competitiveness, boost economic growth and create quality jobs. Department of Science Technology and Environment of Punjab State and CSIR-IMTECH have jointly identified several areas in monitoring and analysis of water quality and conducting technical studies on diseases linked with water pollution in the state.

Solar power related initiatives:

CSIR-Central Mechanical Engineering Research Institute (CSIR-CMERI) has designed and developed a "Solar Power Tree" to harness maximum solar energy utilizing minimum land. The institute has installed developed solar power trees at different locations such as Circuit House, Durgapur Steel Plant; Durgapur Steel Thermal Power Station, Andal; Bhilai Steel Plant, Chattisgarh; Baba Bhagwan Ram Ashram Trust, Chattisgarh, Rajbhavan Kolkata through West Bengal Renewable Energy Development Agency (WBREDA); Srijani Auditorium, Durgapur Municipal Corporation; Different Primary Schools of West Bengal etc.

Other significant initiatives:

- Knowledge partner of Uttar Pradesh, Manipur and Meghalaya States - CSIR has entered into knowledge partnership with Uttar Pradesh, Manipur and Meghalaya States Government to promote science and technology-led development of the State through deployment of identified technologies / knowhow as per the requirement. The efforts are aimed at knowledge-led development of the State in areas such as infrastructure, water and water resources, agriculture, healthcare, chemicals and petrochemicals, pharmaceuticals including biopharmaceuticals and drugs, etc;

- CSIR-Central Institute of Mining and Fuel Research (CSIR-CIMFR), Dhanbad has provided technical support for blast-induced ground vibration, air overpressure and optimization of blast design parameters for Naitwar-Mori Hydro Electric Project in Uttarakhand State. CSIR-CIMFR also carried out Insitu evaluation and provided technical advice on the present condition of track and haulage ropes of Passenger Ropeway from Bhawan to Bhairon Ghati, Katra, Jammu & Kashmir;
- CSIR-CIMFR has been working with the Meghalaya State Pollution Control Board (MSPCB) for (i) technology development for the treatment of acid mine water for its reuse and safe disposal; and (ii) Technical advice for closure of abandoned coal mines using controlled blasting techniques;

- CSIR-CIMFR has been working with the Rajasthan State Mines & Minerals Limited (RSMML) for evaluation of explosives and blasting accessories to improve its quality and suggestions at Jhamarkotra Rock Phosphate Mines, RSMML;

- Indigenous Cultivation of Heeng to reduce imports - Ferula assafoetida (Heeng) one of the top spices in India is imported from Iran, Afghanistan, and Uzbekistan. CSIR-Institute of Himalayan Bioresource Technology (CSIR-IHBT), Palampur along with ICAR-National Bureau of Plant Genetic Resources, has addressed the lack of planting material and agrotechnology, which were major bottlenecks in cultivation. Now the plants have been introduced for cultivation in the country with the first

seedlings of heeng panted at Lahaul valley after the Institute successfully conducted experiments with plants and seed germination. Cold desert areas of India such as Lahaul and Spiti, Ladakh, parts of Uttarakhand and Arunachal Pradesh are suitable for cultivation of asafetida and can decrease the imports of Heeng substantially after successful cultivation;

- A technology has been developed by CSIR-Central Building Research Institute (CSIR-CBRI), Roorkee for recycling and utilization of Kota Stone Cutting and Slurry wastes in making tiles, paver blocks and cellular blocks. The developed items meet the requirements of Indian Standard Specifications. The utilization of high volumes of Kota stone slurry waste in lightweight concrete leads to higher strengths than that of normal lightweight blocks. The technology has been transferred to Rajasthan State Pollution Control Board, Jaipur for mass deployment;

- Introduction of high value cash crops for Socio-economic upliftment of hill, remote, Schedule Tribe farming community of cold-arid Ladakh;

- Cultivation, domestication and value addition of some non-conventional fodder plants for Pashmina goat in Ladakh;

- Design and Development of Sea Buckthorn fruit/berry Harvester in Ladakh;

- Cultivation, processing and value added products of medicinal, aromatic and floriculture crops along with apiculture in Jammu & Kashmir;

- Development of Leather Value Chain in Ladakh and Jammu & Kashmir;

- Earthquake and landslide hazard, risk preparedness and energy efficient Earthquake Resistance structures in Jammu & Kashmir;

- CSIR-Central Food Technological Research Institute (CSIR-CFTRI), Mysore has been recognized as the State Level Technical Institution for the implementation of the PM Formalisation of Micro food processing Enterprises (PMFME) Scheme in Karnataka. The Scheme is being implemented jointly by both the Central and State govt. during 2020-25 in order to bring almost 2 lakh unorganized food processing units into the organized sector. Under this, almost 300+ FPOs / Entrepreneurs were trained under One District One Product (ODOP) across the State;

- Implementation of Value addition food technologies for agri-horti produce of Jammu & Kashmir; and

- CSIR-Institute of Himalayan Bioresource Technology (CSIR-IHBT), Palampur signed an MoU with Himachal Pradesh Agro Industries Corporation Limited, Shimla for strategic and implementation partnership for livelihood promotion and rural development in selected districts of the state. CSIR-IHBT will facilitate the Corporation in establishment of soil health clinic, farmers training centre cum knowledge hub, development of training materials and certifying the inputs for recommendation to the farmers. The institute will also support in undertaking innovative farm income enhancement projects through the introduction of advanced technologies and cash crops.

******