APCTT
Asian and Pacific Centre
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ESCAP

वैज्ञानिक और औद्योगिक अनुसंधान विभाग
Department of
**Scientific and Industrial Research**

*Provisional agenda*

# TECHNOLOGY AND INNOVATION CONCLAVE 1.0

**24-26 September 2024**

**Jointly organized by**
**Department of Scientific and Industrial Research, Ministry of Science & Technology, Government of India,**
**and**
**Asian and Pacific Centre for Transfer of Technology (APCTT) of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP)**

**Venue:**
**National Agricultural Science Complex (NASC)**
**Indian Council of Agricultural Research (ICAR), Pusa, New Delhi, India**

## INTRODUCTION:

**Reducing greenhouse gas (GHG) emissions through deep decarbonization is critical in achieving the goals under the Paris Agreement and the Sustainable Development Goals (SDGs).** While there has been a momentum to shift towards cleaner fuels, there is still a huge reliance on fossil fuels in various sectors like transportation, energy, construction, etc, particularly in the Asia-Pacific. According to the theme study for the 79th Session of the Economic and Social Commission for the Asia and the Pacific, "The race to net zero: accelerating climate action in Asia and the Pacific", transport carbon dioxide emissions constitute 27 per cent of the Asia - Pacific region's total emissions and are above the global average.

**Enhancing the development and transfer of new and emerging technologies is a key pillar for low carbon transition**. Increasing their dissemination and adoption at a wide scale is also equally important. The success of this low carbon transition depends on the strength of national policy and regulatory environments and capacities to absorb, deploy and improve the technologies appropriate to national and sub-national levels.

India stands 4th globally in renewable energy installed capacity, wind power capacity & solar power capacity[1]. According to India's updated Nationally Determined Contributions (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC), India now stands committed to achieve about 50 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030. So far, a total of 167.75 GW Renewable Energy capacity has been installed as on 31.12.2022 in the country. Further, projects of 78.75 GW capacity are under various stages of implementation[2]. Apart from the progress achieved under various government schemes the **Ministry of New and**

[1] As per REN21 Renewables 2022 Global Status Report
[2] Annual Report – 2022 – 2023 Ministry of New and Renewable Energy.

**Renewable Energy introduced policy reforms and enablers to push progress in key segments like green hydrogen, decentralized renewable energy, rooftop solar, wind repowering, and offshore wind.**

**Startups are playing a critical role in accelerating the adoption of renewable energy sources** — including wind, solar, and geothermal power. Startups and the entire innovation ecosystem are the engines of growth for any country. In India, the Government launched **a Startup India Online Hub on 19th June 2017** which is one of its kind online platform for all stakeholders of the entrepreneurial ecosystem in India to discover, connect and engage with each other. The Online Hub hosts Startups, Investors, Funds, Mentors, Academic Institutions, Incubators, Accelerators, Corporates, Government Bodies and more. **The Government in January 2020 notified constitution of the National Startup Advisory Council** to advise the Government on measures needed to build a strong ecosystem for nurturing innovation and startups in the country to drive sustainable economic growth and generate large scale employment opportunities.

**BACKGROUND INFORMATION:**

**The Technology and Innovation Conclave 1.0 is jointly organised by Department of Scientific and Industrial Research (DSIR) and Asian and Pacific Centre for Transfer of Technology (APCTT).**

**The Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology** has a mandate to carry out the activities relating to indigenous technology promotion, development, utilization and transfer. The primary endeavour of DSIR is to promote R&D by the industries, support a larger cross section of small and medium industrial units to develop state-of-the art globally competitive technologies of high commercial potential, Catalyse faster commercialization of lab-scale R&D, enhance the share of technology intensive exports in overall exports, strengthen industrial consultancy & technology management capabilities and establish user friendly information network to facilitate scientific and industrial research in the country. It also provides a link between scientific laboratories and industrial establishments for transfer of technologies through National Research Development Corporation (NRDC) and facilitates investment in R&D through Central Electronics Limited (CEL).

**The Asian and Pacific Centre for Transfer of Technology (APCTT)** is a regional institution of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) servicing the Asia-Pacific region. APCTT promotes an enabling environment for innovation, transfer and commercialization of technologies in 53 member states and 9 associate members of ESCAP. All member states and associate members of the United Nations ESCAP are de facto members of APCTT. The Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology, Government of India has been the national focal Department, on behalf of India, for APCTT.

The Centre is governed by a Governing Council (GC) comprising members and associate members of ESCAP elected for 3 years. The present Governing Council, elected for the tenure 2023-2026, comprises 11 member States, namely Bangladesh, China, India, Islamic Republic of Iran, Pakistan, Philippines, the Republic of Korea, Russian Federation, Tajikistan, Thailand, and Uzbekistan. The Government of India is a permanent member of APCTT's Governing Council, and guides the Centre's technical and administrative operations, as well as supports a variety of regional projects.
The Governing Council meets annually to review the activities, administration and financial status of the Centre and advise on the formulation and implementation of its programme of work.

**ENERGY STORAGE:**
Currently, there are various types of energy storage systems. Some examples of technologies based on their composition; mechanical energy systems (pumped hydro storage, compressed air (CAES), Flywheel (FES), thermal storage systems (sustainable heat storage, latent heat storage), chemical energy storage systems (fuel cells, aluminum), Electrochemical batteries (rechargeable and flow batteries), electrostatic and hybrid energy systems. However, an energy storage facility's efficiency is determined by how rapidly it can respond to demand changes, its total capacity to store energy, the rate of energy lost in the storage process, and how easily it can be recharged[3]. Based on the scale of deployment, end use, demand for energy storage, battery storage technologies may be classified as below[4]:

[3] https://iopscience.iop.org/article/10.1088/1742-6596/1962/1/012035/pdf
[4] https://www.adb.org/sites/default/files/publication/479891/handbook-battery-energy-storage-system.pdf

| Scale | Utility | User | Examples of Preferred Technologies |
|---|---|---|---|
| Small Scale<br>~ 0 to 50 kW | self-consumption or utility transfer | Generation | supercapacitors, batteries |
| Medium Scale<br>~ 50kW to 20 GW | voltage regulation, frequency regulation, Transfer and Distribution referral | network operator or energy transmission stage | scale storage systems flywheels, supercapacitors, batteries are being employed |
| Large Scale<br>~20 GW to 100 GW | arbitrage, inter-seasonal storage, and seasonal storage | light vehicle owner or one producing and sharing small-scale power | pumped storage systems, and compressed air energy storage |

Based on application following technologies are being used[5]:
For Transportation: Batteries, Flywheel, ultracapacitors
For emergency applications: Batteries, Compressed air in vessels, flywheel, Hybrid systems, thermal energy storage, ultracapacitors
For Large Scale Applications: Battery Energy Storage Systems (BESS), Compressed Air Storage (CAES), Flywheel Energy Storage System (FAES), Pumped hydroelectric, ultracapacitor.
In particular for batteries, there are many characteristics to determine efficiency and suitability for a particular function. Some of key characteristics like power rating (rate of energy storage), discharge time (amount of time to fully discharge), lifetime (number of years of functioning per rated capacity), energy density (energy that can be contained in the storage material per unit volume) and efficiency (ratio between energy stored and energy contained) are important.

India has been exploring meticulously towards development of efficient energy storage systems, particularly batteries. Initiatives by the Indian Institute of Science (IISc), National Chemical Laboratory (NCL), Centre for Materials for Electronics Technology (C-MET), Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), CSIR - Central Electro Chemical Research Institute (CSIRCECRI), Indian Institute of Science Education and Research (IISERs), Indian Institute of Technology (IITs) and National Institute of Technology (NITs) have been instrumental. In 2018, Indian Space Research Organisation's (ISRO) Vikram Sarabhai Space Centre (VSSC) successfully developed and qualified lithium-ion cells of capacities ranging from 1.5Ah to 100Ah for use in satellites and launch vehicles. ISRO has signed an MOU with Bharat Heavy Electricals Ltd (BHEL) to manufacture Li-ion batteries for electric vehicles in India.

The Ministry of New and Renewable Energy (MNRE) and Ministry of Power have jointly launched the national mission namely "Mission on Advanced and High-Impact Research (MAHIR)". Mission will serve as a catalyst for national priorities such as achieving Net Zero emissions and promoting initiatives like Make in India and Start-up India, and also contribute towards achieving the United Nation's Sustainable Development Goals (SDGs). MAHIR will work with premier institutions such as IITs, IIMs, NITs, IISERs and Universities on the one hand and public & private power sector start-ups and established industries with government acting as an enabler for creating an innovation ecosystem. Some of the Areas Identified for Research are Alternatives to Lithium-Ion storage batteries, green hydrogen for mobility (High Efficiency Fuel Cell), Carbon capture, Nano technology for EV battery, etc.

**GREEN HYDROGEN:**

Globally, countries are investing in hydrogen research, infrastructure, and market development to accelerate the transition to a hydrogen economy (van Renssen, 2020). In the Asia-Pacific region, several countries are at the forefront of adopting hydrogen to combat climate change. Japan has been a pioneer in hydrogen technology, with its Basic Hydrogen Strategy aiming to establish a "hydrogen society" by integrating hydrogen into its energy mix. The Republic of Korea is also making significant strides with its Hydrogen Economy Roadmap, which envisions the widespread use of hydrogen across various sectors. Australia, rich in renewable energy resources, is positioning itself as a major player in the global hydrogen market by investing in large-scale hydrogen production and export projects. China, with its vast industrial base, is focusing on scaling up hydrogen production and developing fuel cell technologies to reduce its carbon footprint.

5 https://www.sciencedirect.com/topics/engineering/energy-storage-system

The National Green Hydrogen Mission with an initial outlay of Rs.19,744 crore was approved in January 2023 with the overall objective to develop at least 5 million metric tons of green hydrogen production capacity per annum with an associated renewable energy capacity addition of about 125 GW in the country by 2030. NISE has a dedicated Hydrogen Energy and Fuel Cell Division to carry out R&D in Hydrogen generation, dispensing and Fuel Cells. NISE campus has a solar PV-based green Hydrogen generation cum storage and dispensing facility that was set up under MNRE funded project. This facility is powered by a 120 kWp SPV system installed on the roof of one of the buildings of NISE. This is India's first solar-based Green Hydrogen-generating facility. There is a growing emphasis on integrating green hydrogen production with abundant renewable energy sources, such as solar and wind, to ensure the sustainability and low-carbon nature of hydrogen production.

India is implementing large-scale green hydrogen projects, such as the Green Hydrogen Refueling Demonstration (GHORD) project at Indian Oil Corporation's Faridabad refinery, to demonstrate and commercialize green hydrogen production technologies. Oil and Natural Gas Corporation (ONGC) of India is exploring the export of hydrogen to Japan using its refining facilities, tapping into the growing global demand for clean energy. Technological interventions in hydrogen storage aim to enhance the efficiency of storage and transportation, including high-pressure gaseous storage and metal hydride-based storage systems. Reliance Industries Limited (RIL) is preparing to produce green hydrogen by 2025 and is establishing the necessary infrastructure for its disbursement from the proposed plant in Gujarat.

**OBJECTIVE OF THE CONCLAVE:**

The Conclave would focus on the themes of energy storage technologies and green hydrogen technologies and showcase innovations from the participating member States in the Asia Pacific region.

The objectives of the Conclave are:

**1.** Enhance the knowledge and awareness of policy makers and stakeholders through facilitated exchange of learnings and good lessons on the developments, challenges and opportunities for innovations and start-ups in energy storage and green hydrogen technologies in the participating countries.

**2.** To map out and develop a knowledge product that would review the policies and strategies related to the innovative technologies in the Asia Pacific, specifically focussed on energy storage and green hydrogen. It would include recommendations on addressing the critical challenges for creating better policy regimes and strengthening regional cooperation for innovation and technology transfer in these sectors.