Sectorial Report on Digitization, Green & Clean Technologies: India

Policy initiatives, Growth Drivers, key challenges and Standardization

December 2023

Digitization

5G/6G
- 700 million 5G subscribers by 2028: Ericsson Mobility Report

AI
- Anticipated to reach USD 7.8 billion by 2025 from USD 3.1 billion in 2020: IDC report

IoT/M2M
- Indian IoT connectivity market size reached US$ 55 Million in 2022.
- IMARC Group expects the Market to reach US$ 197 Million by 2028

Quantum Technology
- According to NASSCOM-Avasant study Quantum tech potential will provide USD 310B cumulative value add to Indian economy by 2030

Blockchain
- Adoption could clock 46% by 2026

Cybersecurity
- India's core digital sectors is expected to grow to 8%-10% of GDP by 2025

Smart City/Urban Development
- Urban areas in India accommodate around 31% of total population and contribute to 63% of the country's GDP (2011 Census data)
- It is projected that by 2030, urban population will rise to approximately 40%, contributing as much as 75% to GDP.

Smart Grid/Meter
- Under NSGM, a total of 23 crore (230 million) smart consumer meters have been sanctioned on a pan-India basis as of September 30, 2023.

Digital India

Govt of India launched "Digital India" Program on 1st July 2015 to transform India digitally empowered society and knowledge economy.

Three core components

1. Development of secure and stable Digital Infrastructure
2. Delivering government services digitally
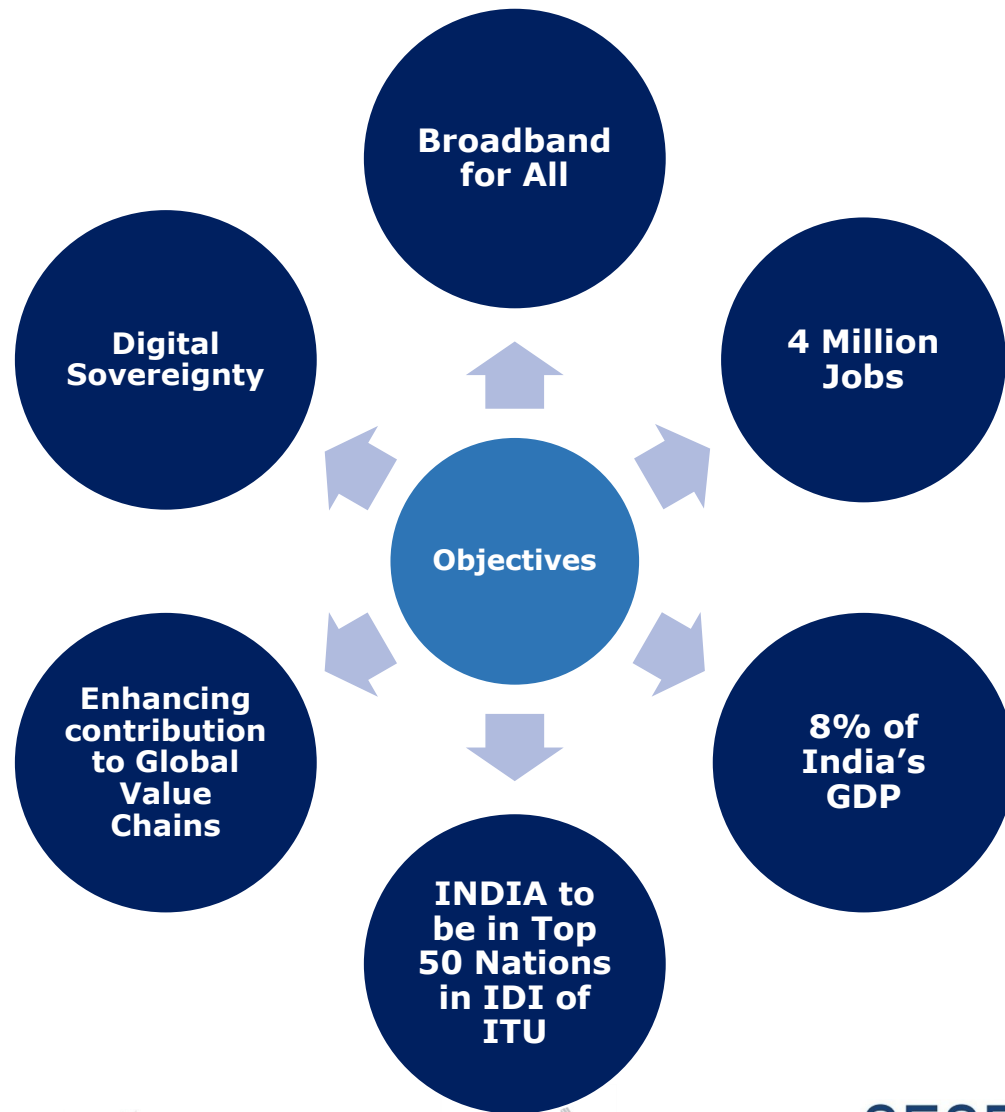3. Universal Digital Literacy

Nine Pillars

4. Broadband Highways
5. Universal Access to Phones
6. Public Internet Access Programme
7. e-Governance - Reforming government through Technology
8. e-Kranti - Electronic delivery of services
9. Information for All
10. Electronics Manufacturing - Target NET ZERO Imports
11. IT for Jobs
12. Early Harvest Programmes

Read more about Digital India programme>>

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National Digital Communication Policy, 2018

Broadband for All

Digital Sovereignty

4 Million Jobs

Objectives

Enhancing contribution to Global Value Chains

8% of India's GDP

INDIA to be in Top 50 Nations in IDI of ITU

NDCP 2018 envisages three Missions:

1. **Connect India**: Creating Robust Digital Communications Infrastructure To promote Broadband for All as a tool for socio-economic development, ensuring service quality and environmental sustainability.

2. **Propel India:** Enabling Next Generation Technologies and Services through Investments, Innovation and IPR generation To harness the power of emerging digital technologies, including 5G, AI, IoT, Cloud and Big Data to enable provision of future ready products and services; and to catalyse the fourth industrial revolution (Industry 4.0) by promoting Investments, Innovation and IPR.

3. **Secure India**: Ensuring Sovereignty, Safety and Security of Digital Communications To secure the interests of citizens and safeguard the digital sovereignty of India with a focus on ensuring individual autonomy and choice, data ownership, privacy and security; while recognizing data as a crucial economic resource.

Read more/Download>>

5G/6G: Key policy initiatives

Journey of 5G/6G in India

- 2017: Constitution of High-Level Forum (HLF) on 5G India
- 2018: HLF report "Making India 5G ready
- 2019: Telecom Regulatory, TRAI White Paper on 'Enabling 5G in India'
- 2021: Formulation of 6G Technology Innovation Group (TIG)
- 2022: Spectrum allocation and launch of 5G services
- 2023: Bharat 6G Vision" document, 6G R&D Test Bed and Bharat 6G Alliance - B6GA

5G/6G: Growth Drivers and key Challenges

Growth Drivers:

✓ Growing adoption of **emerging technologies** like **IoT/M2M, AR/VR, AI and edge computing**

✓ Increasing demand for **high-speed data services**, **video streaming, and IoT applications**

✓ Growing adoption of **IoT devices and applications** in sectors like **manufacturing, agriculture, healthcare, and smart cities**.

✓ Favorable Government programs like **BharatNet**

Key Challenges:

✓ **Insufficient Infrastructure:** Deploying 5G infrastructure requires significant investments in new cell towers, fiber optic networks, and other equipment.

✓ **High Costs:** Building 5G networks involves significant financial commitments. Costs include spectrum acquisition, infrastructure deployment, and technology upgrades.

✓ **Device Compatibility:** Not all devices are 5G-compatible, which can lead to a lag between network deployment and device availability.

5G/6G: Standardization

India's 5G journey takes a unique turn with the development of 5Gi – a homegrown standard aimed at enhancing connectivity in rural and remote areas.

- ✓ Jointly develop by IIT Madras, IIT Hyderabad, TSDSI, and CEWiT
- ✓ 5Gi/Radio Interface Technology (RIT), leverages Low Mobility Large Cell (LMLC) to extend 5G coverage.

In December 2021, International Telecommunication Union (ITU) formally approved the 5Gi standard.

- ✓ Integration with 3GPP Rel-17 NR specifications.
- ✓ Enables seamless interoperability with global 5G standards.

TSDSI transposes 3GPP specifications to create Indian national standards.

- ✓ Timely adoption of 3GPP technical specifications as National Standards by TEC.
- ✓ Ensures compliance with ITU-R and national requirements.

Telecommunication Engineering Centre (TEC) spearheads India's standardization efforts on the ITU 6G Framework.

- ✓ National Study Group (NSG) led by TEC.
- ✓ Extensive contributions to the development of ITU 6G framework.

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Artificial Intelligence (AI): key policy initiatives

Task Force on Artificial Intelligence (AI):

On 24th August 2017, Ministry of Commerce and Industry had constituted a Task Force on Artificial Intelligence (AI) for India's Economic Transformation.

✓ In its report on 19th January 2018, it has recommended an Inter-Ministerial National Artificial Intelligence Mission to act as a nodal agency for coordinating AI related activities in India.

✓ The recommendations of the Task Force have been shared with various Ministries and Departments of the Government of India.

National Strategy for Artificial Intelligence (AI) 2018:

✓ Released by NITI Aayog in June 2018 with aim to guide research and development in new and emerging technologies.

✓ Identified five sectors — healthcare, agriculture, education, smart cities and infrastructure and transportation — to focus its efforts on implementation of AI.

✓ As a follow up to National Strategy for AI, NITI Aayog has published various discussion papers on Responsible Artificial Intelligence (RAI)

Ministry of Electronics and Information Technology (MEITY) had created four committees to create a policy framework and to develop the ecosystem for Artificial Intelligence:

✓ Committees have released four reports covering all the aspects of AI.

National AI portal (www.ai.gov.in):

✓ It works as a one-stop digital platform for AI related developments in India, sharing of resources such as articles, start-ups, investment funds in AI, resources, companies and educational institutions related to AI in India

Artificial Intelligence (AI): Growth Drivers and key Challenges

Growth Drivers:

- ✓ **Data availability for AI model training**: Access to diverse datasets is crucial for training AI models, and India's data abundance can contribute to AI advancements.

- ✓ **Increasing professionals in AI:** In recent years, India has seen a significant growth of professionals skilled in AI.

- ✓ **Increasing number of AI Startup**: India has seen a surge in AI startups working on diverse applications, from healthcare to agriculture.

- ✓ **Favourable Government policies** such as National AI Strategy to promote its adoption.

Key Challenges:

- ✓ **Data quality:** impacts the performance, accuracy, and reliability of AI models.

- ✓ **Data security and privacy:** AI brings a range of security and privacy vulnerabilities, which can subsequently exacerbate any organizations exposure to cyber risk and geopolitical risk.

- ✓ **Limited AI expertise:** India need to focus on AI expertise in coming years.

- ✓ **Lack of AI and cloud computing infrastructure:**
  - ▪ India's own AI-first compute infrastructure, **AIRAWAT** developed by NITI Aayog, is a cloud platform for Big Data analytics with advanced AI processing capabilities.

- ✓ **Lack of integrity and ethics with AI/ML solutions:**
  - ▪ With the advent of AI products and algorithms and their increasing role in decision making, ethics and morality have emerged as a major challenge for the AI solution providers.

Artificial Intelligence (AI): Standardization

Bureau of Indian Standards (BIS):

BIS LITD 30: Artificial Intelligence Sectional Committee: responsible for standardization BIS in the area of Artificial Intelligence and Big Data. It is the National Mirror Committee for ISO/IEC JTC1/SC42 with same Title & Scope.

- ✓ IS/ISO/IEC/TR 24028: 2020: Information technology AI Overview of trustworthiness in artificial intelligence.
- ✓ IS/ISO/IEC/TR 24029-1: 2021: AI Assessment of the robustness of neural networks Part 1: Overview
- ✓ IS/ISO/IEC/TR 24030: 2021: AI Use cases.
- ✓ IS/ISO/IEC/TR 24368: 2022: AI Overview of Ethical and Societal Concerns
- ✓ IS/ISO/IEC/TR 24372: 2021: AI Overview of computational approaches for AI systems
- ✓ IS/ISO/IEC 24668: 2022: AI Process management framework for big data analytics
- ✓ IS/ISO/IEC 38507: 2022: Information technology Governance of IT Governance implications of the use of artificial intelligence by organizations.

Telecommunication Engineering Centre (TEC), Department of Telecom (DoT):

- **Department of Telecommunications, Ministry of Communications has formed a committee on standardisation in AI technologies to develop necessary AI standards.**
  - ✓ Committee has released its **Indian AI Stack discussion paper** on September 2, 2020, with the intention of mitigating impediments in AI deployment and essentially make AI uniform for application across sectors.
  - ✓ The AI Stack paper highlighted five major horizontal pillars and one main vertical pillar - thus covering some of the most crucial aspects in AI deployment today including security, data storage, privacy, customer experience and computing.

- **In July 2023, Telecommunication Engineering Centre (TEC), DoT has unveiled a Standard (No. TEC 570 50:2023) for "Fairness Assessment and Rating of Artificial Intelligence Systems".**
  - ✓ This Standard enumerates detailed procedures for accessing and rating artificial intelligence systems for fairness.

IoT/M2M: Key Policy Initiatives

- **National Telecom M2M Roadmap 2015:**

    ✓ It seeks to assimilate various M2M standards, outline policy and regulatory approaches and measures for increased M2M proliferation.

- **Telecom Department (DoT) issued "Guidelines for registration of M2MSP Service Providers and WPAN/WLAN Connectivity Providers" on Feb 8, 2022:**

    ✓ This will help in addressing concerns like connectivity with TSPs, KYC, traceability and encryption.

- **DoT set up two M2M committees on 16 February 2022**

    ✓ To discuss, analyse issues and suggest initiatives relating to the M2M ecosystem.

- **New license for UL(M2M) and UL-VNO(M2M) under UL and UL-VNO licenses** have been introduced and accordingly the guideline for UL and UL (VNO) were amended on 17th Jan. '22.

- **Addition of 1MHz spectrum to unlicensed 865-867 MHz band**: To have additional availability of spectrum for M2M/IoT applications, 1 (one) MHz additional spectrum is added in the earlier unlicensed 865-867 MHz band, making it 865-868 MHz. Also radiated power, channel bandwidth and duty cycle have been defined for different use cases.

- **Released 13-digit numbering plan exclusively for M2M/IoT devices** connected through mobile networks.

- Telecom Engineering Centre (TEC) has released recommendations on IoT/ M2M security in January 2019, Code of Practice for securing consumer IoT in August 2021, Technical report on Framework of National Trust Centre for M2M/ IoT Devices and Applications in March 2022 and Technical Report on Security by design for IoT device manufacturers in March 2023.

    ✓ These documents suggest ways to have safe and secure IoT deployments.

    ✓ TEC code of practice for securing consumer IoT is developed based on **EN 303645.**

IoT/M2M: Growth Drivers and Key Challenges

Growth Drivers:

✓ **Increasing adoption of Smart technologies such as IoT/M2M across industries** such as healthcare, transportation, and manufacturing.

✓ **Development of Smart cities and homes:** Adoption of M2M/IoT communications enables the integration of various systems, such as lighting, heating, and security, to improve the quality of life for citizens.

✓ **Low-cost sensors:** Low-cost sensors, declining cost of connectivity as well as reduced cost and time of processing will play a key role in rise and adoption of IoT.

✓ **Increasing usage of big data analytics and cloud computing** enables processing and analysis of unstructured data to move from insights to foresights.

✓ **Growing consumer interest** in IoT technologies is also rising due to increased reliance on mobile devices and other connected devices.

Key Challenges:

✓ **Robust connectivity**: It is very important for timely transmission of the data. Latency, availability, coverage and cost are some of the factors deciding the appropriate communication technology.

✓ **Security and Privacy:** IoT/M2M security challenges include various aspects of IoT such as authentication, confidentiality, privacy, access control etc.

✓ **Lack of standardization:** Interoperability, security, data sharing, changing vendors etc.

✓ **Technologies** for sustainability/ long life batteries are required for sensors.

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IoT/M2M: Standardization

Bureau of Indian Standards (BIS):

BIS LITD 27 on IoT and digital twin" is developing standards in the field of Internet of Things and related technologies including sensor networks. It is a mirror committee of ISO/IEC/JTC1 TC 41 / SC 41 - Internet of Things and related technologies. TC has adopted following standards:

✓ **IS/ISO/IEC/TR 22417 : 2017**: Information Technology Internet of Things (IOT) IOT Use Cases

✓ Series of **IS/ISO/IEC 30118 standards (Part 2 to Part 18)** on Information technology Open Connectivity Foundation OCF Specification

TEC and TSDSI:

TEC has adopted TSDSI transposed Release 2 and Release 3 oneM2M specifications as national standards.

✓ These specifications address the need for common M2M service layer that can be readily embedded within various hardware and software, relied upon to connect the myriad of devices in the field with M2M application servers worldwide.

✓ These transposed documents cover M2M functional architecture, requirements, service layer control protocols, Management enablement etc. oneM2M provides a fast-track and future proof IoT based smart city.

✓ Few of these TEC standards have also been included by Bureau of Indian Standards (BIS) in its standards on IoT Reference Architecture released in June 2021.

Quantum Technologies: Key Policy Initiatives

National Quantum Mission (NQM) 2023:

✓ **National Quantum Mission (NQM)** at a total cost of Rs.6003.65 crore (approx. €680 Million) from 2023-24 to 2030-31 approved by Govt. of India, aiming to seed, nurture and scale up scientific and industrial R&D and create a vibrant & innovative ecosystem in Quantum Technology (QT).

✓ Four Thematic Hubs (T-Hubs) will be set up in top academic and National R&D institutes on the domains – Quantum Computing, Quantum Communication, Quantum Sensing & Metrology and Quantum Materials & Devices.

✓ This mission will be implemented by the Department of Science and Technology (DST) under the Ministry of Science and Technology in collaboration with others

National Supercomputing Mission (NSM) 2015:

✓ It envisages empowering the academic and R&D institutions spread over the country by installing high-performance computing facilities.

✓ **Application areas:** Climate Modelling, Weather Prediction, Disaster Simulations and Management, Big Data Analytics, Computational Chemistry, Computational Material Science and Nanomaterials, Large Complex Systems Simulations and Cyber Physical Systems, Information repositories/ Government Information Systems, among others.

✓ It is being implemented jointly by Ministry of Electronics & IT (MeitY), DST with Indian Institute of Science (Iisc), Bangalore and C-DAC.

Quantum-Enabled Science & Technology (QuEST) program:

✓ In 2018, Department of Science & Technology set up QuEST program to develop quantum technology

✓ India established a national quantum hub — the I-HUB Quantum Foundation or I-HUB QTF in Pune in 2020 under National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS) dedicated to the development of QT.

Quantum Computing Applications Lab (QCAL):

✓ Launched by MeitY in collaboration with AWS with aims to accelerate the adoption of quantum computing by providing access to quantum computers, tools, and resources to researchers and developers.

QSim- Quantum Computer Simulator Toolkit:

✓ Launched by MEITY to allow researchers and students to write and debug Quantum Code for developing Quantum Algorithms

Quantum Technologies: Growth Drivers and Key Challenges

Growth Drivers:

- ✓ **Increasing adoption quantum technology in various sectors:** The manufacturing, high tech, banking, and defense sectors will likely lead the charge of adopting quantum technologies for critical and large-scale use cases.

- ✓ **Favorable Government policies and support:** Policy initiatives such as National Quantum Mission will help to create a vibrant & innovative ecosystem in Quantum Technology (QT). India also plans to spend $1 billion on a variety of quantum technology initiatives during the next five years, according to NASSCOM.

- ✓ **Awareness and Education:** Increasing awareness about the potential of quantum technology and its applications is essential.

Key Challenges:

- ✓ **Research and Development:** Factors such as insufficient funding for R&D, expertise, and access to advanced infrastructure and equipment pose challenges in adopting quantum technologies.

- ✓ **Lack of highly skilled workforce** in quantum physics, engineering, and related disciplines is a big challenge, as it requires specialized training programs, educational initiatives, and collaboration between academia and industry.

- ✓ **Inadequate Infrastructure and Resources:** Establishing and maintaining required infrastructure for quantum technology is a challenge, as it requires substantial investments and ongoing upgrades to keep pace with advancements in the field.

- ✓ **Lack of Standardization and Interoperability** among different quantum systems and ensuring compatibility across platforms

- ✓ **Ethical and Societal Implications:** Quantum technology raises ethical, legal, and societal considerations. The development and application of quantum technologies, may have significant societal implications, including data privacy, cybersecurity, and societal disruption.

Quantum Technologies: Standardization

Bureau of Indian Standards (BIS):

✓ Currently there is no technical committee within BIS developing standards related to quantum technologies.

Telecom Engineering Centre (TEC), DoT has released following standards in the field of quantum technologies.

✓ **TEC 91010:2023: Standard for Generic Requirements- Quantum-Safe and Classical Cryptographic Systems:**
  - The standards for Post Quantum Cryptography system provide the specifications for a cryptographic mechanism to ensure secured communication against vulnerabilities posed with the advent of Quantum computing.

✓ **TEC 91000:2022: Standard for Generic Requirements- Quantum Key Distribution System:**
  - This document describes the generic requirements and specifications for Quantum Key Distribution (QKD) systems as per, ITU-T Y.3801-3804 Recommendations for use in Indian telecom network.

Blockchain: Key Policy Initiatives

National Strategy on Blockchain:

✓ Ministry of Electronics and Information Technology (MEITY) released [National Strategy on Blockchain](#) in December 2021.

✓ **Vision:** create trusted digital platforms through shared Blockchain infrastructure; promote R&D, innovation, technology and application development; and facilitate state of the art, transparent, secure and trusted digital service delivery to citizens and businesses.

✓ Strategy lays out overall vision towards development and implementation strategies for a National Blockchain Platform covering the technology stack, legal and regulatory framework, standards development, collaboration, human resource development and potential use cases.

✓ It provides necessary guidance and support for realizing the vision and creating a nationwide ecosystem for creating the National Blockchain Platform and development of relevant applications using this platform in various domains.

Discussion Paper on Blockchain: The India Strategy

✓ Released by Indian Think Tank - NITI Aayog, recognizes many crucial areas blockchain technology can significantly benefit the country

✓ It covers the basics of distributed technology, its potential framework for India, the implementation challenges, lessons from NITI Aayog's own PoCs, its use cases, and recommendations.

Blockchain: Growth Drivers and key challenges

Growth Drivers:

✓ **Digital Transformation Initiatives:** Businesses in India are increasingly focusing on digital transformation initiatives. Blockchain, with its ability to provide secure and transparent digital transactions, aligns well with these efforts.

✓ **Government Support and Initiatives** such as the National Strategy on Blockchain aim to leverage blockchain for various sectors, including governance, finance, and supply chain.

✓ **Growing no. of Blockchain Startups and Innovation** are driving experimentation and adoption across various industries.

Key Challenge:

✓ **Lack of Regulation and Compliance** are the most prominent challenge standing in the way of successful adoption of the Blockchain in India.

✓ **Lack of Awareness and Education** about blockchain technology hindering the wider adoption of blockchain technology.

✓ **Security and data privacy:** The lack of individuals' understanding as to how blockchain-based applications and services can ensure personal data privacy and security reduces their perceived benefits and the public's willingness to adopt them.

✓ **Lack of Skilled professionals in Blockchain technology** in India

Blockchain: Standardization

Bureau of Indian Standards (BIS):

BIS Technical committee (TC) "LITD 29: Blockchain and Distributed Ledger Technologies" is responsible for developing standards for Blockchain and Distributed Ledger Technologies. It is a National Mirror committee for ISO TC ISO TC 307 - Blockchain and Distributed Ledger Technologies Sectional Committee. Following Standards are Published by this TC:

- ✓ **IS/ISO 23257 : 2022:** Blockchain and distributed ledger technologies Reference Architecture
- ✓ **IS/ISO/TS 23258 : 2021:** Blockchain and distributed ledger technologies Taxonomy and Ontology
- ✓ **IS/ISO/TS 23635 : 2022:** Blockchain and distributed ledger technologies Guidelines for governance
- ✓ **IS/ISO/TR 3242 : 2022**: Blockchain and distributed ledger technologies- Use cases

Cyber Security/Data Privacy: Key Policy Initiatives

Information Technology Act 2000:

✓ IT Act, 2000 (amendment ACT 2008) is the primary law in India for matters related to cybercrime and e-commerce.

National Cyber Security Policy-2013:

✓ NCSP 2013 aims (1) facilitating the creation of secure computing environment (2) enabling adequate trust and confidence in electronic transactions and (3) guiding stakeholders' actions for the protection of cyberspace.

Indian Computer Emergency Response Team (CERT-In):

✓ In IT Amendment ACT 2008, CERT-In has been designed to serve as the national agency to perform various functions around cyber security. Recently, CERT-In issued "Guidelines on Information Security Practices" for Government Entities for Safe & Trusted Internet, a roadmap for Government entities and industry to reduce cyber risk, protect citizen data and continue to improve the cyber security ecosystem in the country.

Cyber Surakshit Bharat:

✓ to ensure awareness about cybercrime and adequate safety measures for Chief Information Security Officers (CISOs) and frontline IT staff across all government departments.

Cyber Swachhta Kendra (Botnet Cleaning and Malware Analysis Centre):

✓ Part of **India's Digital India initiative** under **MEITY** to create a secure cyber space by detecting botnet infections in India and to notify, enable cleaning and securing systems of end users so as to prevent further infections.

Digital Personal Data Protection (DPDP) Act, 2023:

✓ DPDP Act was notified on 11 August 2023 with objective to establish a comprehensive framework for the Protection and Processing of Personal Data. The act borrows its broad definition of personal data from the EU's General Data Protection Regulation (GDPR)

Cyber Security/Data Privacy: Growth Drivers and Key Challenges

Growth Drivers:

✓ **Growing no. of cyber security startups**

✓ **Increasing use of technology in various sectors** such as finance, healthcare, transportation, Energy and manufacturing etc., which are particularly sensitive to cyber-attacks.

✓ **Increasing number of Cyber GCCs (Global Capability Centres) in India**
  ▪ Cyber GCCs have more than 40% of cyber GCCs deliver part of all cybersecurity functions from India

✓ **Increasing contribution of private sector**:
  ▪ DSCI promotes best practices and standards for cybersecurity and privacy, undertakes capacity-building projects with a focus on training and certification, including for government sector.

Key Challenges:

✓ **Lack of Infrastructure and Cyber security Regulations**

✓ **Rapid adoption of Emerging Technologies** such as IoT/M2M, cloud computing, and AI etc.,

✓ **Increasing Sophistication of Cyber Attacks**
  ▪ over 75% of Indian organizations facing cyber attacks and each breach costing an average of INR 35 crore (4 million Euro) of damage

✓ **Lack of Cybersecurity Awareness & Shortage of Skilled Professionals**
  ▪ India is expected to face a shortage of around 3 million cybersecurity professionals by 2023

Cyber Security/Data Privacy: Standardization

Bureau of Indian Standards (BIS):

BIS LITD 17 on Information Systems Security and Privacy: is responsible for standards in the field of Security and Privacy aspects of Information Systems. It is a National mirror committee for ISO/IEC TC-JTC 1 SC-27 (P) on Information security, cybersecurity and privacy protection. TC has adopted following standards:

- ✓ **ISO 27000 series of standards** for Information technology - Security techniques - information: Security management systems
  - ▪ IS/ISO/IEC 27032 : 2012: Information Technology - Security Techniques - Guidelines for Cyber Security
  - ▪ IS/ISO/IEC 24745 : 2022: Information security cybersecurity and privacy protection Biometric information protection
  - ▪ IS/ISO/IEC/TR 27103 : 2018: Information Technology - Security Techniques - Cybersecurity and ISO and IEC Standards

Finalized draft Standards:
  - ▪ LITD 17 (23560): Cybersecurity Guidelines for Internet security
  - ▪ LITD 17 (23562): Cybersecurity IoT Security and Privacy Guidelines

Electronic/Digital Signature: Key Policy Initiatives

Electronic/Digital signatures are regulated by **IT Act, 2000** in India and following rules made under this Act:

✓ Information Technology (Certifying Authorities) Rules, 2000;

✓ Digital Signature (End Entity) Rules, 2015; and

✓ Information Technology (Use of Electronic Records and Digital Signature) Rules, 2004.

IT Act also distinguishes between **electronic signatures** and **certificate-based digital signatures**, but both have same status as handwritten signatures under Indian law.

✓ Digital signatures are preferred for certain government transactions such as e-filing with the Ministry of Corporate Affairs, and goods and service tax filings.

✓ Valid electronic signatures must include an electronic authentication technique or procedure specified in the Second Schedule of the IT Act.

For an electronic signature to be considered reliable and presumptively valid under the IT Act:

✓ The signer certificates must be issued by a **certifying authority (CA)** recognized by **Controller of Certifying Authorities** appointed under the IT Act. A list of licensed CAs is available at http://www.cca.gov.in/licensed_ca.html.

Electronic/Digital Signature: Growth Drivers and Key Challenges

Growth Drivers:

✓ **Growth in paperless transactions and reduction of paper-based processes** have led to an increase in the demand for digital signatures.

✓ **Increasing Awareness among consumers** about digital signatures benefits, more businesses are adopting this technology for their transactions.

✓ **Cost-effectiveness and time saving of digital signatures compared to traditional paper-based signatures**, as they reduce the need for printing, mailing, and storage of physical documents. Businesses can also save on courier and postage expenses.

Key Challenges:

✓ **Lack of Awareness and Education** regarding digital signatures, digital signature certificates, and their adoption and usage has obscured the broader potential for digital signatures.

✓ **Security & privacy concerns:** Risks associated with the security and integrity of digital signatures, such as unauthorized access, data breaches, or forged signatures, pose challenges to their widespread adoption.

Electronic/Digital Signature: Standardization

Bureau of Indian Standards (BIS):

BIS SSD10: IT & IT enabled Services is responsible for Standardization in the field of Services, Processes, Supporting Frameworks, Management and Governance for the provisioning of IT and IT Enabled Services in areas such as (but not limited to), contract management, performance management, procurement management, customer satisfaction, contact center, covering existing and emerging digital and automation technologies.

✓ This technical committee has drafted "SSD 10 (21410): Electronic Signatures and Infrastructures ESI Policy and Security Requirements for Applications for Signature Creation and Signature Validation".

✓ SSD 10 (21410) is a technical adoption of the European Standard EN 119 101 V1.1.1 (2016-03) "Electronic Signatures and Infrastructures (ESI); Policy and security requirements for applications for signature creation and signature validation" developed by ETSI.

✓ Other ETSI Standards on this subject are included as part of roadmap for their adoptions

E-Accessibility: Key Policy Initiatives

Rights of Persons with Disabilities (RPwD)Act, 2016:

✓ RPwD Act mandates equal rights and opportunities for PwDs and requires government to take measures to promote accessibility.

✓ It covers various aspects, including physical infrastructure, transportation, and ICT.

MEITY Guidelines for Indian Government Websites, 2009:

✓ Guidelines ensure that government websites are accessible to people with disabilities.

✓ These Guidelines are based on International Standards including ISO 23026, W3C's Web Content Accessibility Guidelines (WCAG 2.0), Rights of Persons with Disabilities Act 2016 as well as IT Act of India.

Accessible India Campaign (Sugamya Bharat Abhiyan):

✓ Department of Empowerment of Persons with Disabilities (DEPwD) launched Accessible India Campaign (Sugamya Bharat Abhiyan) as a nation-wide Campaign for achieving universal accessibility for Persons with Disabilities (PwDs) on December 3,2015.

✓ It has three important verticals, namely - the Build Environment, the transportation sector and the ICT ecosystem.

E-Accessibility: Standardization

Bureau of Indian Standards (BIS):

BIS LITD-35: Active Assisted Living (AAL): is responsible for standardization in the area of accessibility, interoperability of AAL systems, services, products and components; and standardization of system level aspects of AAL such as safety, security and privacy.

✓ IS 17802 (Part 1): 2021: Accessibility for the ICT Products and Services Part 1: Requirements

✓ IS 17802 (Part 2): 2022: Accessibility for the ICT Products and Services Part 2: Determination of Conformance
   ▪ The IS 17802 (part 1 and 2) is based on the European Standard EN 301 549 v 3.2.1.

✓ IS 1885 (Part 89): 2023/IEC 60050-871: 2021: Electrotechnical vocabulary Part 871: Active assisted living AAL

✓ IS/IEC/TS 63134: 2020: Active assisted living AAL use cases.

Smart City/Urbanization: Key Policy Initiatives

Smart City Mission:

✓ Indian Government introduced "**Smart Cities Mission**" initiative on 25th June 2015 to develop 100 smart cities and drive economic progress and boost the quality of life by fueling local development and harnessing technology to create smart outcome for the citizens.

✓ The Union Housing and Urban Affairs Ministry has extended the deadline for the Smart Cities Mission until June 2024.

National Urban Digital Mission:

✓ Launched by MoHUA and MEITY, to establish a digital infrastructure & formalize a citizen-centric and ecosystem-driven approach to urban governance and service delivery in cities.

Open Data Platform/India Urban Data Exchange (IUDX):

✓ **IUDX initiative** is a collaboration between Smart Cities Mission and Indian Institute of Science (IISc), Bengaluru to facilitate secure and authenticated exchange of data amongst various data platforms, 3rd party applications, data producers and consumers, both within a city to begin with, and scaled up across cities eventually at a national level, in a uniform & seamless way.

✓ First software platform to fully adhere to the Architecture and API Specifications set by Bureau of Indian Standards (BIS) for data exchange platforms.

CCSP (C-DOT Common Service Platform):

✓ Developed by Centre for Development of Telematics (C-DoT), the oneM2M standards compliant **common service platform** can be deployed on any off-the-shelf generic server platforms or cloud infrastructure.

*Ministry of Housing and Urban Affairs (MoHUA), Government of India has also initiated several other programmes to support the Smart City Mission and Urbanization in the country. Please **click here** for the more details*

Smart City/Urbanization: Growth drivers and Key challenges

Growth Drivers:

✓ **Economic Development and Growing urbanization:** Smart Cities can attract businesses, increase economic growth and create job opportunities through the use of technology and data-driven decision making. As India has a rapidly growing urban population, there is growing need for efficient and sustainable urban infrastructure and services.

✓ **Growing adoption of new and emerging technologies** including IoT/M2M, Big Data, cloud computing etc. to improve urban efficiency.

✓ **Government Support and technological advancements:** Government has made significant investment and has launched several initiatives such as Smart city Mission to modernize cities and improve the quality of life for citizens.

Key challenges:

✓ **Privacy and Data Security:** Extensive use of sensors, cameras, and connected devices generates vast amounts of data.
  ▪ Ensuring ethical collection, secure storage, and responsible utilization of data are crucial.

✓ **Advanced Technology Solutions**: Most Smart City technologies fall under advanced categories. Examples include IoT-based data acquisition, AI/ML-driven data analytics, and real-time video systems.
  ▪ Implementing agencies need a working knowledge to ensure effective implementation.

✓ **Urban resilience:** Relying heavily on technology can make cities vulnerable to cyber- attacks, power outages, or system failures.
  ▪ Smart cities need robust backup plans and disaster management strategies to ensure their functionality during crises.

✓ **Interoperability and standardization:** Smart cities involve multiple systems from various vendors, leading to interoperability challenges. Lack of standardization can hinder seamless integration, limiting the effectiveness of initiatives.
  ▪ Emphasizing the need for standardized frameworks to ensure compatibility.

✓ **Financial Burden:** Implementing smart city technologies incurs immense financial burden. Investments in infrastructure, IoT devices, and data analytics require substantial funding.
  ▪ Many cities face budget constraints, posing challenges for large-scale smart city projects.

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Smart City/Urbanization: Standardization

Bureau of Indian Standards (BIS):

LITD 28: Smart Infrastructure Sectional Committee: Standardization in the field of Smart Cities (Electro-technical and ICT aspects).

- ✓ **IS 18000:2020** Unified Digital Infrastructure – ICT Reference Architecture (UDI-ICTRA)
- ✓ **IS 18003 (Part 1):2020** Unified Data Exchange Part 1 Architecture.
- ✓ **IS 18003 (Part 2):2021** Unified Data Exchange Part 2 API Specifications
  - ▪ It includes NGSI-LD (ETSI CIM).
- ✓ **IS 18004 (Part 1):2021** IoT System Part 1 Reference Architecture
  - ▪ It is based on oneM2M CSF
- ✓ **IS 18006 (Part 1):2021** Municipal Governance Part 1 Reference Architecture
- ✓ **IS 18006 (Part 3/Sec 1):2021** Municipal Governance Part 3 Property Tax Section 1 Taxonomy
- ✓ **IS 18008 (Part 1):2021** Smart Cities — GIS Part 1 Reference Architecture

CED 59: Smart Cities Sectional Committee: Standardization in the field of Smart Cities terminology, components, planning, design, integration, implementation, operation, maintenance and assessment.

- ✓ **IS 17738: 2022**: Sustainable development of habitats - Indicators for smart cities

TEC & TSDSI:

- ✓ Telecommunication Engineering Centre (TEC) has adopted TSDSI transposed oneM2M Release 2 and Release 3 specifications as national standards
- ✓ These standards will be quite useful for the development of interoperable ecosystem for IoT domain, especially for Smart cities.

Smart Grid/Meter: Key Policy Initiatives

India Smart Grid Forum (ISGF):

✓ Indian Government in 2011 established "India Smart Grid Forum (ISGF)", a public−private partnership, to accelerate electric grid modernization and energy transition in India.

Smart Grid Vision and Road map for India released by Ministry of Power in 2013:

✓ It offers a series of time-framed, specific, target driven measures, across these different areas, with which to enable the development of an Indian Smart grid model.

✓ The roadmap covers the 12th, 13th, and 14th 5-year plan periods from 2012 to 2027.

National Smart Grid Mission (NSGM):

✓ Ministry of Power (MoP) launched National Smart Grid Mission in 2015 with aims to accelerate Smart Grid deployment in India.

✓ So far, 12 Smart Grid pilot projects have been approved under NSGM,adopting the functionalities such as Advanced metering infrastructure, Peak Load Management, Cybersecurity, Distributed generation, Micro grid, Power quality measurement, Smart City Control Center, Smart homes, Advanced IT infrastructure, Renewable Energy Integration, EV with charging infra, Home energy management center, AMI (Smart Metering), Outage management system, Customer engagement social media for utility.

✓ According to NSGM as of September 30, 2023, a total of 23 crore (230 million) smart consumer meters have been sanctioned on a pan-India basis

Smart Grid/Meter: Growth Drivers and Key Challenges

Growth Drivers

✓ **Energy Efficiency:** Smart grid/meter allows utilities to monitor and manage energy flow in real-time, reducing losses during T&D.
  - It helps to address energy efficiency challenges and reduce energy wastage.

✓ **Renewable Energy Integration:** India has set an ambitious target of having 500 GW of installed renewable energy by 2030, which includes 280 GW of solar power and 140 GW of wind power.
  - Smart grids can integrate renewable energy sources like solar and wind more effectively by managing fluctuations in supply and demand. This makes the grid more reliable and resilient.

✓ **Growing concerns about environmental pollution and climate change**: Smart grids support the development of a more sustainable energy ecosystem and help in reducing carbon emissions

✓ **Policy reforms:** Government schemes such as Deen Dayal Upadhaya Gram Jyoti Yojana (DDUGJY), Integrated Power Development Scheme, NSGM etc. have boosted implementation of Smart Meter across the country.

Key challenges:

✓ **Data Security and Privacy:** Smart meters and grids collect a vast amount of data about energy consumption patterns, posing a risk of unauthorized access and potential misuse.

✓ **Cybersecurity**: Smart grids and meters also pose significant cybersecurity risks.
  - In October 2021, Power ministry and Central Authority of Electricity (CEA) have released the guidelines for cybersecurity in the power sector to be adhered by all Power Sector utilities to create cyber secure eco system.

✓ **High capital investment:** Substantial upfront investment is required for the deployment/implementation of smart grid infrastructure and installation of smart meters.

✓ **Lack of Interoperability Standards:** Lack of interoperability standards lead to compatibility issues and hinder the scalability of the technology.

Smart Grid/Meter: Standardization

Bureau of Indian Standards (BIS):

ETD-13: Equipment for Electrical Energy Measurement and Load Control (Smart Meter): Standards for equipment for electrical energy measurement, tariff - and load control, customer information, payment, local and/or remote data exchange, using electromechanical and/or electronic, technologies for applications ranging from electrical energy generation to residential. It is a mirror technical committee of IEC TC-13 (P): Electrical energy measurement and control.

- ✓ **IS 15959 (Part 2 and Part 3):** Data exchange for electricity meter reading tarif and load control - Companion specification

- ✓ IS 16444: 2015: AC static direct connected watt hour smart meter class 1 and 2 – Specification

ETD 46: Grid Integration: Standards in the field of Grid Integration comprising of LT (ON Grid, Off Grid and Hybrid with and without storage), HT and EHT for all capacities.

ETD 50: LVDC Power Distribution Systems: Standards for: a) LVDC System Requirements, Safety and Installation Guidelines b) LVDC products including electrical wiring accessories and Applications c) Integration of DC Infrastructure d) Non-Traditional Distribution Networks/Microgrids.

LITD 10: Power system Control and associated Communications: Standards relating to: a) Power system control equipment and systems including EMS (Energy Management System) b) DMS (Distribution Management System) c) SCADA (Supervisory Control and Data Acquisition) d) Distribution automation, Smart SGrid, tele-protection and associated communications used in planning, operation and maintenance of power systems.

- ✓ IS/IEC 62488-1: 2012: Power line communication systems for power utility applications Part 1: Planning of analogue and digital power line carrier systems operating over EHVHVMV electricity grids.

Green and Clean Technologies

Green Hydrogen

- *Accroding to NITI Aayog, the cumulative value of green hydrogen market in India could be $8 billion by 2030 and $340 billion by 2050.*

Electric Vehicle

- *According to Economic survey 2022-23, domestic EV market to grow at a CAGR of 49% between 2022 and 2030 and is expected to hit one crore (10 million) units of annual sales by 2030.*

Circular Economy

- *India's circular economy could touch $45 billion by 2030,.*
- *CPCB projected annual waste generation will increase to 165 MT by 2030.*
- *Hazardous, plastic, e-waste, and bio-medical waste is expected to increase proportionately, as well.*

Energy Storage System

- *By 2026-27, India aims to have 16.13 GW of energy storage capacity, comprising 7.45 GW of Pumped Storage Plants (PSP) and 8.68 GW of Battery Energy Storage Systems (BESS), with a combined storage capacity of 82.32 GWh.*

Green Hydrogen: Key Policy Initiatives

Green Hydrogen/Green Ammonia policy 2022:

✓ Policy sets India's strategy to meet its goal of becoming a global green hydrogen hub.

✓ It identifies the production of hydrogen and ammonia from unconsumed renewable power and connectivity to the grid as priorities.

National Green Hydrogen Mission 2023:

✓ Launched by Ministry of New and Renewable Energy (MNRE) on 4th January 2023 with objective to make India the Global Hub for production, usage and export of Green Hydrogen and its derivatives.

✓ Government approved initial outlay of INR 19,744 crore (€2.2 billion), including INR 17,490 crore (€1.9 billion) for SIGHT programme, INR 1,466 crore (€164 million) for pilot projects, INR 400 crore (€44 million) for R&D, and INR 388 crore (approx. 43 million) towards other Mission components.

Green Hydrogen Standard for India:

✓ Minimum standard for GH as having a well-to-gate emission of not more than 2 kg CO_2 equivalent per kg of H2 produced.

R&D Roadmap for Green Hydrogen ecosystem in India:

✓ The roadmap outlines R&D priorities for manufacturing and storing green hydrogen.

Green Hydrogen: Growth Drivers and Key Challenges

Growth Drivers:

✓ **Climate Goals:** India's commitment to reducing greenhouse gas emissions and transitioning to a low-carbon economy under the Paris Agreement is a significant driver for green hydrogen

✓ **Renewable Energy Potential:** Renewable energy resources can be harnessed to produce green hydrogen

✓ **Favorable Government Policies** such as National Green Hydrogen Mission, Green Hydrogen Policy etc.

✓ **International Collaborations**: India has also been actively engaging in international collaborations to promote green hydrogen.

✓ **Decarbonizing Sectors**: Sectors such as industry, transportation, and power generation can use green hydrogen as a clean alternative to fossil fuels.

Key Challenges:

✓ **High cost:** Currently, the production cost of green hydrogen from renewable energy is higher compared to hydrogen derived from fossil fuels.

✓ **Lack of investment and insufficient infrastructure**: Establishment of necessary infrastructure for producing, transporting, storing, and distributing green hydrogen requires significant investment.

✓ **Availability of water** for green hydrogen production could be a significant challenge in India.

✓ **Lack of harmonized standards and regulations** which is necessary to enable safe and rapid scaling up of projects for production, delivery, storage and use of green hydrogen.

Circular Economy: Key Policy Initiatives

Strategy paper on Resource Efficiency, 2017:

✓ Prepared by NITI Aayog and EU Delegation to India with objective to make recommendations for enhancing the resource-use efficiency, develop indicators for monitoring progress, and create an ecosystem for improving the resource security and minimising environmental impacts.

National Resource Efficiency Policy, 2019:

✓ Released by Ministry of Environment, Forests and Climate Change (MoEF&CC) with aims to drive the country towards circular economy through efficient use of available material resources, based on principle of 6R (reduce, reuse, recycle, redesign, re-manufacture and refurbish) and 'green public procurement'.

Policy paper on Circular Economy in Electronics and Electrical Sector (draft), 2021 by MEITY:

✓ It focuses on life cycle of electronics – including stages of raw material acquisition, design, manufacturing/production stage, consumption to end of life (e-waste) management, and secondary raw materials utilization, among other issues.

Circular Economy Cell- NITI Aayog:

• CE Cell constituted by NITI Aayog and is a dedicated unit to work in the area of Circular Economy.

Waste management Rules by MoEF&CC:

✓ Waste Management Rules such as the Plastic Waste Management Rules, e-Waste Management Rules, Construction and Demolition Waste Management Rules, Battery Waste Management Rules 2022, Solid Waste Management Rules, 2016 etc. towards reducing waste generation and maximizing recycling of waste.

NITI Aayog (GoI) has set up 11 core committees with key ministries to enable setting up of CE action plans

Circular Economy: Growth Drivers and Key Challenges

Growth Drivers:

✓ **Resource Scarcity**: India's growing population and economy put pressure on natural resources. Circular Economy minimizes resource depletion by maximizing the utilization of existing resources.

✓ **Increased awareness of Environmental degradation, pollution, and waste management issues** has led to a greater focus on sustainable practices like circular economy principles.

✓ **Increased demand for sustainable products and services** drives adoption of circular economy practices.

✓ **Economic Opportunities**: Circular Economy creates new business models, jobs, and economic growth by promoting recycling, remanufacturing, and value-added services.

✓ **Government Support**: Government policies, such as extended producer responsibility (EPR) regulations and waste management rules, drive businesses to adopt circular practices and reduce waste.

Key Challenges:

✓ Lack of awareness and understanding of circular economy concepts among businesses and consumers

✓ Inadequate waste collection and segregation

✓ Lack of infrastructure and recycling technologies

✓ Lack of R&D in adopting Circular Economy

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Circular Economy: Standardization

Bureau of Indian Standards (BIS):

PCD 12- Plastics:

✓ To formulate Indian Standards for specifications for thermosetting and thermoplastic resins-bonded and moulding materials; natural and synthetic polymers, synthetic resin bonded laminates thermoplastic films and sheets, plasticizers cellular plastics, finished plastic articles, composites and reinforced plastics (excluding sanitary wares and plastic pipes for water supply and plastic packaging containers) safety of toys, and natural and synthetic adhesives (excluding for plywood industry and electrical tapes).

CHD 32- Environment Protection:

✓ To formulate Indian Standards on i) Terminology, methods of sampling and characterization of soil (excluding engineering and agricultural purposes) ii) Codes of Practices and Guidelines on reduction, recycling, reuse, treatment and disposal of wastes (other than solid wastes); iii) Characterization and classification of wastes (other than solid wastes), iv) Guidelines and Codes of Practices for control of pollution.

CHD 33- Solid Waste Management:

✓ To formulate Indian Standards on i) Specifications, Terminology, methods of sampling and characterization of solid waste (Excluding Bio-Medical & Nuclear Waste), ii) Codes of Practices on reduction, recycling, reuse and treatment of Solid wastes (Excluding Bio-Medical & Nuclear Waste), iii) Guidelines and codes of practice for Solid waste disposal (Excluding Bio-Medical & Nuclear Waste).

CHD 34- Environmental Management:

✓ To formulate Indian Standards in the field of Environment Management tools and systems including: - Life Cycle Assessment - GHG management - climate change and adaptation - Environmental labelling - Circular Economy but excluding: - test methods of pollutant - setting limit values regarding pollutants of effluents - setting environmental performance levels - standardization of products.

ETD 43- Standardization of Environmental Aspects for Electrical and Electronic Products:

✓ To prepare the necessary guidelines, basic standards, in the environmental area, in close cooperation with product committees, which remain autonomous in dealing with the environmental aspects relevant to their products; To liaise with product committees in the elaboration of environmental requirements of product standards in order to foster common technical approaches and solutions for similar problems and thus assure consistency in standards.

Electric Vehicles: Key Policy Initiatives

National Electric Mobility Mission Plan (NEMMP) 2013:

✓ National Mission document providing vision and roadmap for the faster adoption of EVs and their manufacturing

✓ As part of NEMMP, Department of Heavy Industry formulated FAME India Scheme in 2015 to encourage electric and hybrid vehicle purchase by providing financial support and also by way of establishing a necessary charging Infrastructure for electric vehicles.

Technology platform for Electric Mobility (TPEM):

✓ A collaborative platform to work in five areas — lithium battery technology, motors and drives, charging infrastructure, drive cycle and traffic pattern, light-weighting of XEVs — and developing affordable electric technology.

Guidelines and standards for Charging infrastructure for EVs:

✓ The document spells out specifics such as definitions, compliance requirements for public charging infrastructure builders, tariff rules for supply of electricity to charging stations, provision of land at promotional rates for public charging, phase and priority-wise identification of locations for coverage and implementation mechanism.

National Mission on Transformative mobility and Battery storage:

✓ The mission aims to drive clean, connected, shared, sustainable and holistic mobility initiatives.

Battery swapping policy 2022 (draft) released by NITI Aayog:

✓ The draft policy aims to promote swapping of batteries with Advanced Chemistry Cell (ACC) batteries to decouple battery costs from the upfront purchasing costs of EVs.

Tax reduction on EVs:

✓ Government has reduced Goods and Services Tax (GST) on EVs from 12% to 5%; GST on chargers/ charging stations for EVs has been reduced from 18% to 5%.

Production Linked Incentive (PLI) Scheme for Automotive Sector and Advanced Chemistry Cell (ACC)

Electric Vehicles: Growth Drivers and Key Challenges

Growth Drivers:

✓ **Growing Demand for EVs in India:** due to sharp increase in petrol and diesel prices and environmentally consciousness of new generation

✓ **Favorable Government policies and support** such as reduced tax on EVs and providing incentives through various schemes such as FAME India Scheme.

✓ **Low-Cost Manufacturing:** India is one of the largest manufacturers in the world and can produce low-cost, good quality Electric vehicles using its substantial manufacturing process.

✓ **Decreasing battery costs** is a significant factor fueling the growth of EV market in India

Key Challenges:

✓ **Limited charging Infrastructure**

✓ **Shortage of Battery Raw Material such as** lithium and cobalt

✓ **Long charging time**

✓ **Lack of Consumer awareness and price sensitivity**

✓ **Lack of Standardization and interoperability** between different charging networks

Electric Vehicles: Standardization

Bureau of Indian Standards (BIS):

TED 27 on Electric and Hybrid Vehicles is responsible for standardization of Electric and Hybrid vehicles and their components. It is a National mirror technical committee of ISO/ TC 22/SC 37 and IEC/ TC 69.

ETD 51 on Electrotechnology in mobility is responsible for standardization of electrotechnical aspects of totally or partly electrically propelled road vehicles.

✓ IS/ISO 15118-1: 2013: Road vehicles - Vehicle to grid communication interface: Part 1 general information and use - Case definition.

✓ IS 17017 (Part 1): 2018: Electric Vehicle Conductive Charging System Part 1 General Requirements

✓ IS 17017 (Part 23): 2021: Electric Vehicle Conductive Charging Systems Part 23 dc Electric Vehicle Supply Equipment

✓ IS 17896 (Part 1): 2022/IEC TS 62840-1:2016: Electric vehicle battery swap system - Part 1: General and Guidance

✓ IS 17896 (Part 2): 2022/IEC 62840-2:2016: Electric vehicle battery swap system - Part 2: Safety requirements.

Automotive Research Association of India (ARAI):

✓ **AIS-138 Part1, Part2 / IS 17017** standard applies for charging infrastructure

✓ **AIS-102 (Part 1 & 2)** on CMVR Type Approval for Hybrid Electric Vehicles.

Energy Storage Systems (ESS): Key Policy Initiatives

National Energy Storage Mission (NESM):

✓ In February 2018, a committee with representatives from relevant ministries, industry associations, research institutions and experts, was constituted by the MNRE to propose a draft for setting up NESM.

✓ The Committee has drafted NESM with objective to strive for leadership in energy storage sector by creating an enabling policy and regulatory framework that encourages manufacturing, deployment, innovation and further cost reduction.

National Framework for promoting Energy Storage Systems:

✓ In August 2023, Ministry of Power (MoP) released comprehensive guidelines aimed at promoting energy storage adoption in India.

Guidelines for Procurement and Utilization of Battery Energy Storage Systems:

✓ Released by MoP, these guidelines ensure transparency and fairness in procurement processes and provide for a framework for an Intermediary Procurer as an Aggregator/Trading licensees/ Implementing Agency for the inter-state/intra-state sale-purchase of power.

National Programme on ACC Battery Storage:

✓ Ministry of Heavy Industries (MHI), notified PLI scheme, 'National Programme on Advanced Chemistry Cell (ACC) Battery Storage' in 2021 for implementation of giga–watthour scale ACC manufacturing facilities in India

Energy Storage Systems (ESS): Growth Drivers and Key Challenges

Growth Drivers:

✓ **Renewable Energy Integration:** India is rapidly expanding its renewable energy portfolio, primarily through solar and wind power. Energy storage systems are essential for managing the intermittent nature of these sources, ensuring a stable and reliable power supply.

✓ **Grid Stability:** Energy storage systems contribute to grid stability by providing ancillary services such as frequency regulation and voltage control.

✓ **Increasing adoption of Electric Vehicle (EV)** is driving demand for energy storage solutions, particularly in the form of lithium-ion batteries.

Key Challenges:

✓ **High Initial Capital Costs** of energy storage systems makes it challenging for many consumers, businesses, and utilities to invest in energy storage infrastructure.

✓ **Inadequacy of raw materials:** Scarcity of the critical elements required to make batteries like lithium, copper, cobalt and nickel.

✓ **Integrating energy storage systems** into the existing grid infrastructure can be complex. Issues related to grid compatibility, standardization, and seamless operation need to be addressed for widespread deployment.

✓ **Lack of Regulations** for energy storage regarding tariffs, grid interconnection, and safety standards can deter potential investors and slow down adoption.

✓ **Financing and Access to Capital** is a challenge for many stakeholders, including startups and small-scale projects.

  ▪ Indian government has recently approved Rs. 3,760 crore (approx. €417 million) Viability Gap Funding (VGF) for creating battery energy storage system.

Energy Storage Systems (ESS): Standardization

Bureau of Indian Standards (BIS):

BIS through its technical committee "**ETD 52 on Electrical Energy Storage System**" is responsible for Standardization in the field of grid integrated Electrical Energy Storage (EES) Systems:

- ✓ The Sectional Committee to focus on system aspects on EES Systems rather than energy storage devices and shall prepare Indian Standards dealing with the system aspects of electrical energy storage.

- ✓ EES to include any type of grid-connected energy storages, which can both store electrical energy from a grid or any other source and provide electrical energy to a grid.

- ✓ The Sectional Committee to include Chemical ES as one of the ESS.

- ✓ Thermal storage to be included in the scope, only from the electricity exchange point of view.

- ✓ Unidirectional energy storages such as UPS not to be included in the scope of the sectional Committee.

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