



Green Skills: A Pathway to Innovation and Sustainability

India stands at a crucial juncture of balancing its developmental journey with its ambitious climate action commitments. Two landmark international climate agreements in year 2015 i.e., the Paris Agreement and United Nations Sustainable Development Goals (UN-SDGs), have led to significant outcomes, including countries coming up with national sustainable development plans, committing to Nationally Determined Contributions (NDCs), pledging Net-zero targets, and submitting Biennial Transparency Reports (BTRs). In an era defined by climate crises, growing awareness, and international pressure have made transition to low-carbon, sustainable practices an urgent necessity. This transition compels nations to prioritize and invest in non-conventional resources to achieve their development objectives. However, this shift not only requires technological advancements but also a skilled workforce capable of implementing these innovations through their 'green skills'.

Green skills, encompassing knowledge and competencies that contribute to the efficient use of resources and the preservation of ecosystems, are becoming essential. From renewable energy and sustainable agriculture to circular economy practices

and eco-friendly technologies, these skills are transforming the global workforce, empowering it to tackle pressing environmental challenges while enhancing economic resilience. Governments, businesses, and educational institutions are increasingly recognizing the importance of fostering green skills to meet the demands of a transitioning economy, as investing in green skills offers an opportunity to create jobs, drive innovation, and ensure environmental stewardship.

This article explores how green skills are reshaping the future of work, their pivotal role in advancing sustainability, and their potential to unlock both economic and environmental benefits for a greener and more inclusive world.

Defining Green Skills

The United Nations Framework Convention on Climate Change (UNFCCC) defines **Green Skills as “technical knowledge, expertise and abilities that enable the effective use of green technologies and processes in professional settings.”** They draw on a wide range of competencies including knowledge, values, and attitudes that enable us to adapt and thrive in resource-efficient setting to facilitate environmentally sustainable

decision-making at work and in life. There are **three main ways in which the transition to a green economy affects needed skills:** (1) Structural changes leading to alternate or additional tasks; (2) New economic activity creating new occupations; and (3) Existing occupations and industries applying greening changes. According to the International Labour Organization (ILO) report, the transition to sustainable energy sources in a circular economy scenario can create about 100 million jobs. People are required to have proper training and support systems where all people benefit equally and keep up with the future of work. Green skills can be broadly categorized into two categories –

- 1. Technical skills** are specialized abilities essential for developing, implementing, and maintaining green technologies and infrastructure. For instance, expertise in renewable energy technologies involves knowledge of installing, maintaining, and operating systems like solar panels and wind turbines.
- 2. Soft Skills (Non-technical competencies / Sustainability Management Skills)** involve strategic thinking and managerial capabilities to integrate sustainability into business models, policy frameworks, and community initiatives.



Table: A range of strategies for climate change mitigation and adaptation, along with examples of the technical and soft skills necessary for their successful implementation

Climate Action Strategy/ Sector	Examples of Technical Green Skills	Examples of Non-technical Green Skills
Renewable Energy	Knowledge on Wind turbine and Photovoltaic systems, Electric vehicle (EV). Bioenergy production	Project management, Team collaboration, Problem-solving skills, Stakeholder communication
Energy Efficiency	Energy auditing; Heating, Ventilation, and Air Conditioning (HVAC) system optimization; Smart grid technology implementation; Retrofitting buildings	Analytical thinking; Negotiation with clients; Decision-making; Sustainable leadership
Waste Management and Circular Economy	Waste segregation techniques/software; Analytical thinking; Negotiation with clients; Decision-making; Sustainable leadership Waste Management and Circular Economy Recycling process optimization; Hazardous waste handling; Circular economy implementation	Community engagement; Behavioural change advocacy
Sustainable Agriculture	Techniques of sustainable and organic farming, Soil health management; Water-efficient irrigation systems; Software like CROPWAT for crop management	Knowledge sharing with farmers; Training and capacity building; Adaptability to new technologies
Green Building and Construction	Sustainable architecture design; Eco- friendly materials sourcing, Green construction technologies; Energy-efficient building codes	Client collaboration; Conflict resolution; Adaptation to environmental standards
Water Resources Management	Water harvesting system design; Water management and efficiency; Hydrology modelling and analysis; Wastewater treatment-techniques;	Individual and Community driven water management; Policy advocacy. Interpersonal communication
Environmental Conservation	Biodiversity monitoring; GIS and remote sensing for environmental analysis; Eco-restoration practices	Environmental awareness campaigns; Advocacy and policy implementation
Sustainable Forestry (Development of Carbon Sink)	Forest resource mapping; Carbon sequestration techniques; GIS and remote sensing for LULC mapping; Forest carbon accounting; Forest restoration and biodiversity conservation; Climate Co-benefit Calculation	Negotiation with indigenous communities; Conflict resolution in land use; Community engagement participatory planning
Disaster Risk Reduction and Early Warning Systems	AI and ML tools for weather forecasting (rain, flood, drought predictions); Satellite imagery analysis; Hazard mapping	Disaster preparedness planning; Emergency response coordination; Risk assessment and decision- making
Urban Planning and Development	GIS-based urban planning; Flood modelling; Storm water management; Green infrastructure development; Forestry and Plantation in urban settings (Terrace Garden); Rain water harvesting	Sustainable urban design principles; Minimize energy and water consumption; Strategic vision for long-term urban sustainability; Cross-functional collaboration
Carbon Capture and Storage (CCS) Technology	CCS system design and engineering; Monitoring and verification of carbon sequestration; CO2 transportation	Policy advocacy on CCS benefits; Collaboration with regulatory bodies; Public awareness
Coastal Protection	Coastal ecosystem restoration; Mangrove rehabilitation techniques	Communication with communities in coastal areas, coordination with stakeholders in resilience projects





Relevance of Green Skills in Business: Fostering Innovation & Green Jobs

Green skills are essential not only for driving innovation but also for fostering a sustainable and resilient economy, allowing businesses to succeed in an era marked by heightened environmental and social awareness. The global shift toward sustainability has created an increasing demand for a workforce skilled in green practices. These skills are vital for businesses in several key areas:

- Green skills ensure that businesses remain compliant with increasingly stringent environmental regulations, such as carbon reduction targets, waste management standards, and energy efficiency requirements. By equipping companies to meet these regulations, green skills help them avoid penalties and uphold a positive reputation.
- Businesses can achieve cost savings by applying green skills to optimize resource use, minimize waste, and improve energy and material efficiency. Companies committed to sustainability also gain a competitive advantage in attracting and retaining top talent, as the workforce increasingly values environmental responsibility.
- Green skills enable the redesign of business models to reduce waste and enhance resource efficiency, fostering innovation and

the integration of advanced technologies like the Internet of Things (IoT), Geographic Information Systems (GIS), Artificial Intelligence (AI), Machine Learning (ML), and data analytics. These digital green skills are essential for tackling environmental challenges and improving product design and operational efficiency.

- Furthermore, green skills drive the creation of eco-friendly products, services, and processes, enhancing innovation and competitiveness. By promoting collaboration across fields such as engineering, environmental science, and design, green skills empower businesses to develop innovative solutions for complex environmental issues.
- Access to new markets is another significant advantage. As consumers and investors increasingly prioritize sustainability, companies that showcase environmental responsibility through green certifications and sustainable practices can attract eco-conscious customers and explore new market segments. Initiatives like India's Start-up India, which supports clean-tech start-ups in renewable energy, waste management, and sustainable agriculture, highlight the potential of green skills to unlock new opportunities.

- Lastly, green skills are crucial for risk management, enabling businesses to address environmental risks such as resource scarcity, regulatory changes, and the financial implications of climate change. They also enhance corporate social responsibility (CSR) efforts and sustainability reporting, improving a company's public image through transparent environmental disclosures.

Beyond environmental benefits, the development of green skills is key to building economic resilience. This can be seen in the fact that green jobs are seen as a pathway to economic recovery, with many nations, including the European Union, implementing large-scale green recovery plans that create millions of jobs in renewable energy, green infrastructure, and sustainable agriculture. For example, according to the International Renewable Energy Agency (IRENA), the global renewable energy sector employed 12 million people in 2021, a figure set to rise in the coming decades. India, with its ambitious renewable energy targets, is also poised to benefit from the growth of green skills. The International Labour Organization (ILO) estimates that 16 million jobs could be created by 2030 in the waste and water management sectors, along with 8.8 million in green construction and 4.3 million in renewable energy. The ILO also predicts that the country's transition to a green economy could add 3 million jobs in renewables alone by 2030.



Green Skills in India: Challenges

India faces several challenges in developing green skills, despite its young workforce, with 75% in the working-age population. According to the International Labour Organisation (ILO), the country could face a shortage of 29 million skilled workers by 2030. The Accenture also projected that, without timely investment in new technologies and industry-relevant skills, this deficit could cost India nearly US\$ 1.97 trillion in GDP over the next decade. Key challenges include the need for reskilling and upskilling workers in traditional industries like coal and steel to transition them into green jobs. Limited awareness of specific green job roles among the youth, coupled with insufficient infrastructure and uneven access to training, particularly in rural areas, further exacerbates the issue. Additionally, the lack of policy support, expert trainers, and adequate resources, along with resistance to adopting sustainable practices, presents significant barriers to fostering a green-skilled workforce in India.

Green Skills in India: Missions, Schemes and Initiatives

Despite facing challenges, India has set ambitious climate goals outlined in its Nationally Determined Contributions (NDCs). Achieving these targets necessitates a substantial expansion of the workforce, equipped with the necessary green skills to promote sustainable practices. The government has acknowledged this need and launched various missions, schemes, and initiatives,

including Make in India, the National Electric Mobility Mission Plan (NEMMP), the Smart City Mission, the National Solar Mission, the National Mission for Green Hydrogen, the Green India Mission, the National Water Mission, and the Swachh Bharat Mission. These initiatives aim to enhance green skills and stimulate demand for green jobs. Collaborative efforts among the government, educational institutions, and private companies are fostering green entrepreneurship and skill development, particularly in rural and urban areas. In addition to these initiatives, several targeted schemes and programs have been established to instill green skills in businesses and individuals –

- **Green Skill Development Program (GSDP)** aims to train individuals, especially youth, in environmental conservation, renewable energy, waste management, and sustainable agriculture.
- **Skill India Mission (SIM) and National Skill Development Mission (NSDM)** promote sustainable livelihoods and help India become 'Aatmanirbhar' (self-reliant). Initiatives like the **National Council for Vocational Education & Training (NCVET)** and the **National Skill Development Corporation (NSDC)** introduce specialized courses in renewable energy, sustainable agriculture, and water & waste management.
- The NSDC has approved

dedicated **Sector Skill Councils (SSCs)** that focus on enhancing green skills and creating green jobs through **Power Sector Skill Council (PSSC)**, **Water Management and Plumbing Skill Council (WMPSC)**, and **Skill Council for Green Jobs (SCGJ)**.

- **The National Mission on Strategic Knowledge for Climate Change (NMSKCC)** aims to establish a vibrant knowledge system to inform and support national actions for ecologically sustainable development.
- **Incorporating Digital Green Skills:** GIS-based tools like 'Bhuvan' have been developed for environmental monitoring, requiring specialized skills in data interpretation. are transforming green technologies by optimizing eco-friendly processes, with relevant programs being launched to train the workforce in these digital green skills.

Green Skills in Indian Public Sector Enterprises (PSEs)

Public Sector Enterprises (PSEs) play a pivotal role in driving India's green transition, given their significant contribution to the country's economy, accounting for nearly 14% of GDP and employing around 1.5 million people. Despite their economic importance, many PSEs operate in sectors that are major greenhouse gas emitters, such as coal, petrochemicals,



steel, and cement, making them critical players in India’s climate action efforts. As India aims for net zero emissions by 2070, PSEs are aligning with this goal, with several setting their own net zero targets for 2047, the year India aspires to become a developed nation.

To meet these ambitious targets, PSEs must transition to renewable and alternative energy sources, which in turn requires a strong focus on green skills. Green skills are essential for improving operational efficiency, reducing emissions, and fostering innovation. By integrating these

skills into their operations, PSEs can adopt new technologies such as solar, wind, and green hydrogen, which not only mitigate environmental impact but also enhance competitiveness and sustainability.

Green skills also help PSEs meet regulatory requirements, including Business Responsibility and Sustainability Reporting (BRSR) and Environmental, Social, and Governance (ESG) standards, ensuring transparency and compliance. Capacity-building initiatives within PSEs, through training programs on renewable energy and operational

efficiency, are key to upskilling the workforce in sustainable practices.

SCOPE, an apex body of India PSEs, in collaboration with international partners like GIZ, Germany, are supporting PSEs through training workshops focused on low-carbon and climate-resilient pathways. Furthermore, government initiatives like the Green Skill Development Programme (GSDP) and regulatory frameworks like the Perform, Achieve, and Trade (PAT) scheme under the Bureau of Energy Efficiency (BEE) are driving the demand for green

skills, preparing both existing workers and new entrants for green jobs. In this way, green skills are central to PSEs leading India’s transition to a low-carbon economy while achieving sustainable growth.

Table: Selected examples from various working areas, current focus, and scope of enhancement of green skills

Working area	Current Focus	Scope for enhancement
Energy	Renewable Energy Expansion: NTPC Limited, Power Grid Corporation, and IOCL - investing solar, wind, and biofuels	Upskilling workforce for technologies like floating solar panels, offshore wind farms, and battery storage solutions
	Energy efficient and Smart grid technologies: Power Grid Corporation and Bharat Heavy Electricals Limited (BHEL)	Energy Management Skills, Digital Skills for Green Tech, Green Building Standards
	Alternate fuels: IOCL, BPCL, and GAIL(I) Limited involved in biofuels and CNG initiatives; NTPC and IOCL investing in green hydrogen	Technology training for CNG, biofuel (Waste-to- Energy skills), green hydrogen
	Decentralized and Off-Grid Energy solutions for rural and remote areas: NTPC and GAIL	Develop capacities in designing, installing, and maintaining microgrids in off-grid areas; Focus on upskilling technicians to deploy hybrid renewable systems
Carbon Management and Emission Reduction	NTPC and ONGC setting ambitious targets for carbon capture technologies	Train employees in Carbon Accounting/ Auditing. CCS technologies and their integration with existing infrastructure; Enhance knowledge on carbon offset markets
Afforestation projects	CIL, SAIL, and ONGC are implementing afforestation projects and promoting water conservation	Expand community outreach programs focused on community-based green skill programs and green job creation
Transport	Incorporation of renewables and alternate fuels OIL, NTPC, BEL, IOCL, NHAI	Upskill employees in EV design, manufacturing, maintenance, and charging infrastructure; workforce with skills in intelligent transportation systems (ITS)





Water and Waste Management	SAIL focusing on steel recycling; CIL recycling water, PSEs in agriculture sector promoting Integrated Water Resource Management (IWRM) practices	Upskill employees in methods for efficient water use, waste segregation, safe management and disposal, green technologies for waste treatment, training programs focused on community engagement
Sustainability / Environmental Compliance in Operations	Energy PSEs are gradually integrating sustainability into their operations	Train employees Corporate Sustainability: Environmental Impact Assessment (EIA); Environmental, Social, and Governance (ESG) reporting frameworks

Conclusion and the Way Forward

Green skills are not merely a response to India’s climate commitments; they represent a transformative force that drives innovation, ensures sustainability, and creates vast economic opportunities. With the largest youth population in the world, India has a unique opportunity to cultivate a green workforce capable of spearheading sustainable innovation and driving economic growth. By prioritizing the development of green skills, India can not only meet its Nationally Determined Contributions (NDCs) but also accelerate progress toward its ambitious Net Zero target, potentially achieving it before 2070. Investing in green skills

will also enable India to position itself as a global leader in the transition to a green economy, addressing pressing domestic challenges like climate change, unemployment, and resource scarcity. Public Sector Enterprises (PSEs), as key contributors to India’s economy, must play a central role in this transition by investing in continuous learning, collaborating with educational institutions, and embedding sustainability across their operations. By doing so, PSEs can lead by example, showcasing how green skills can drive both environmental sustainability and long-term economic resilience.

The combined efforts of government, private industries, and PSEs in fostering green

skills will pave the way for a more sustainable, resilient, and prosperous future. Developing green skills is not just an environmental necessity but it is a pathway to innovation and growth. The transition to a green economy presents a remarkable opportunity for India to reimagine its industries, reshape its workforce, and ensure the well-being of future generations. Through strategic investments in education, training, and policy reforms, India can unlock the full potential of green skills and lead the world in the sustainable development of tomorrow.

