

GREEN JOBS



NEWSLETTER

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MESSAGE

From the CEO's Desk

It is my privilege to share the remarkable progress of the Skill Council for Green Jobs (SCGJ) as we continue our mission to foster a sustainable and inclusive future by developing a skilled workforce capable of driving India's clean energy transition. This year has been defined by significant milestones and impactful initiatives that demonstrate our commitment to advancing green skills and technologies across the nation. One of the most notable achievements was the signing of a Memorandum of Understanding (MoU) with the Directorate of Skill Development and Employment (DSDE), Government of Odisha, on August 14, 2024. This partnership aims to skill 500 youth in Solar PV Installation and train 60 candidates as Green Hydrogen Plant Entrepreneurs, equipping them with the expertise needed to contribute to India's renewable energy goals. Funded under the NUA Odisha scheme and implemented through SCGJ's affiliated training partners, this collaboration reflects Odisha's proactive approach to creating a skilled and empowered workforce for the green economy.

SCGJ has also made significant strides in capacity building for green hydrogen and renewable energy. Through masterclasses and workshops, such as those conducted with GERMI in Gandhinagar and the Tata Power Skill Development Institute, we have expanded knowledge in hydrogen production, storage, transportation, and safety. Under the TISA Project, supported by GIZ, multiple workshops have been held to promote solar and hydrogen technologies, aligning with our efforts to drive innovation and sustainability. At the global level, SCGJ's efforts were recognized at the World Skills 2024 competition in Lyon, France, where India won a bronze medal in Renewable Energy and a Medallion for Excellence in Water Technology. These achievements, led by the exemplary performance of Mr. Amaresh Kumar Sahu, underscore our dedication to advancing expertise in green technologies and positioning India as a global leader in sustainable development.

SCGJ has complemented its technical initiatives with impactful social programs, such as the "Safai Karmcharyo Ki Sarahna" and "Har Ghar Swachhata Pledge" campaigns under Swachhata Hi Seva 2024. These initiatives highlight the importance of health, safety, and hygiene while promoting a culture of responsibility and cleanliness among individuals and organizations.

Such programs reflect our belief in the intersection of environmental stewardship and social empowerment. Over the years, SCGJ has trained more than 615,000 individuals across sectors such as Solar PV, Wind Energy, Waste Management, and Green Hydrogen, with over 582,579 certifications awarded. Under PMKVY 4.0, we are working to train candidates in critical green hydrogen roles, ranging from technicians to entrepreneurs. These efforts are part of our broader commitment to addressing the growing demand for a skilled workforce that supports India's energy transition.

Looking ahead, SCGJ is focused on expanding renewable energy adoption, including initiatives like the PM Surya Ghar Muft Bijli Yojana, where we are training 20,500 Solar PV Installation Helpers to support widespread solar deployment. International collaborations, such as those with Denmark for offshore wind energy skills, will further reinforce India's leadership in the global clean energy sector. Programs like the TISA initiative will continue to focus on innovative solar applications, reducing carbon emissions, and fostering long-term economic growth. SCGJ's journey this year has been marked by partnerships, innovation, and an unwavering focus on empowering the workforce for a sustainable future. These successes have been made possible through the collaboration of governments, industries, and our dedicated team. Together, we will continue to transform challenges into opportunities, paving the way for a green economy and a better world.



COP 29: Overview and Key Outcomes and Key Outcomes and India's Advocacy for Equity”



The 29th United Nations Climate Change Conference of the Parties (COP 29) took place in Baku, Azerbaijan, from November 11 to 22, 2024. This pivotal event brought together world leaders, negotiators, and activists to address the escalating climate crisis, revisiting commitments under the Paris Agreement and the Kyoto Protocol. As a vital global platform for climate action, COP 29 tackled pressing issues such as climate finance, loss and damage, and the implementation of enhanced transparency mechanisms. While there was significant progress in some areas, the conference faced criticism for not taking decisive action on several fronts. This essay explores the key themes, discussions, challenges, and broader implications of COP 29.

Key Themes and Discussions

Global Climate Finance

A cornerstone of the discussions at COP 29 was the contentious approval of a \$300 billion climate finance deal aimed at supporting vulnerable nations. These funds are intended to mitigate the effects of climate change and facilitate adaptation strategies for developing countries that are disproportionately affected by global warming. Although the approval of this deal marked a step forward, it elicited mixed reactions.

Developing nations argued that the financial commitment was insufficient, especially as the impacts of climate change accelerate in severity. Conversely, wealthier nations expressed concerns over transparency and accountability regarding how the funds would be utilized. A particularly heated debate centered on the allocation of responsibilities, with developing countries calling for greater contributions from major economies such as China and the European Union.

Efforts to establish a new collective quantified goal for climate finance also advanced during COP 29, building on the \$100 billion annual pledge made at COP 15 in Copenhagen. The new target aims to address both current needs and projected costs of addressing climate challenges. However, disagreements over the specifics of funding mechanisms and equity considerations

highlighted the complexity of reaching a consensus on this critical issue.

Enhanced Transparency Framework (ETF)

A significant achievement at COP 29 was the progress made in operationalizing the Enhanced Transparency Framework (ETF), a mechanism under the Paris Agreement designed to improve the transparency and accountability of nations' climate actions. Delegates worked towards harmonizing Biennial Transparency Reports (BTRs) with Nationally Determined Contributions (NDCs) to streamline climate reporting.

The ETF aims to create a standardized approach for reporting emissions reductions, financial support, and adaptation efforts. By enhancing data accuracy and accessibility, the ETF is expected to foster greater trust among nations and enable more informed decision-making. However, challenges remain in ensuring that all countries, particularly developing nations, have the capacity to meet the reporting requirements.

Loss and Damage Fund

Building on agreements reached at COP 28, the operationalization of the Loss and Damage Fund was a focal point at COP 29. This fund is designed to provide financial assistance to countries facing irreversible climate impacts, such as rising sea levels and extreme weather events. Delegates debated governance structures and funding mechanisms to ensure that the fund effectively supports the most vulnerable nations.

Despite progress in establishing the fund, disagreements over its governance revealed deep divisions. Developing countries demanded greater representation in decision-making processes, while some developed nations pushed for stricter conditions on fund disbursement. These tensions highlight the ongoing struggle to balance equity with accountability in international climate finance.

Global Stocktake (GST)

COP 29 concluded the first Global Stocktake (GST) process under the Paris Agreement, providing a comprehensive assessment of progress toward limiting global temperature rise to 1.5°C. The GST findings painted a sobering picture: although some progress has been made, the world remains far from meeting its climate targets. Emissions continue to rise, and the adoption of renewable energy is not occurring at the scale or speed necessary to close the emissions gap.

The GST underscored the urgent need for transformative action, including increased investments in renewable energy, phasing out fossil fuels, and enhancing energy efficiency. It also highlighted the critical role of international cooperation in accelerating climate action.

Nature-Based Solutions

Nature and biodiversity received significant attention at COP 29 as essential tools for achieving climate goals. Delegates discussed scaling up urban nature-based solutions, forest conservation, and investments in nature-positive projects. These solutions, which leverage natural ecosystems to address climate challenges, offer a dual benefit of mitigating climate impacts

while preserving biodiversity.

Urban greening initiatives, reforestation projects, and wetland restoration were among the strategies highlighted. However, the implementation of these initiatives still faces several challenges.

India's Role and Stance at COP 29

India's delegation to COP29 in Baku, Azerbaijan, reflects a moderated presence compared to previous years. The delegation is led by Kirti Vardhan Singh, Union Minister of State for Environment, Forest, and Climate Change, with senior officials such as Leena Nandan, Secretary of the Ministry, serving as a deputy leader. Prime Minister Narendra Modi and Environment Minister Bhupendra Yadav are notably absent this year, and India has opted not to host a pavilion, indicating a scaled-down role.



Indian team attends a closing plenary meeting the COP29 United Nations Climate Change Conference, in Baku Azerbaijan. (REUTERS)

Despite this, India has been active in negotiations, focusing on key issues such as

1. Equity and Justice: India highlighted the principle of Common but Differentiated Responsibilities (CBDR), criticizing the unfair burden placed on developing countries due to inadequate pre-2020 mitigation efforts by developed nations.

2. Finance Gaps: India deemed the \$300 billion finance target as insufficient and referred to it as an “optical illusion.” India argued that this target does not adequately address the challenges faced by vulnerable nations. Furthermore, India urged developed countries to fulfil their historical financial commitments and to provide unconditional grants instead of loans.

3. Technology and Innovation: India stressed the critical need for unrestricted technology transfer to enable developing nations to transition to low-carbon economies. The country called for the elimination of Intellectual Property Rights (IPR) barriers on green technologies to ensure equitable access.

4. Global Cooperation: India advocated for trust-building and equitable collaboration among nations, rejecting unilateral measures that would shift climate costs onto developing countries.

5. Adaptation and Capacity Building: India called for an increase in funding for adaptation and the development of disaster-resilient infrastructure to address climate-induced vulnerabilities affecting developing regions.

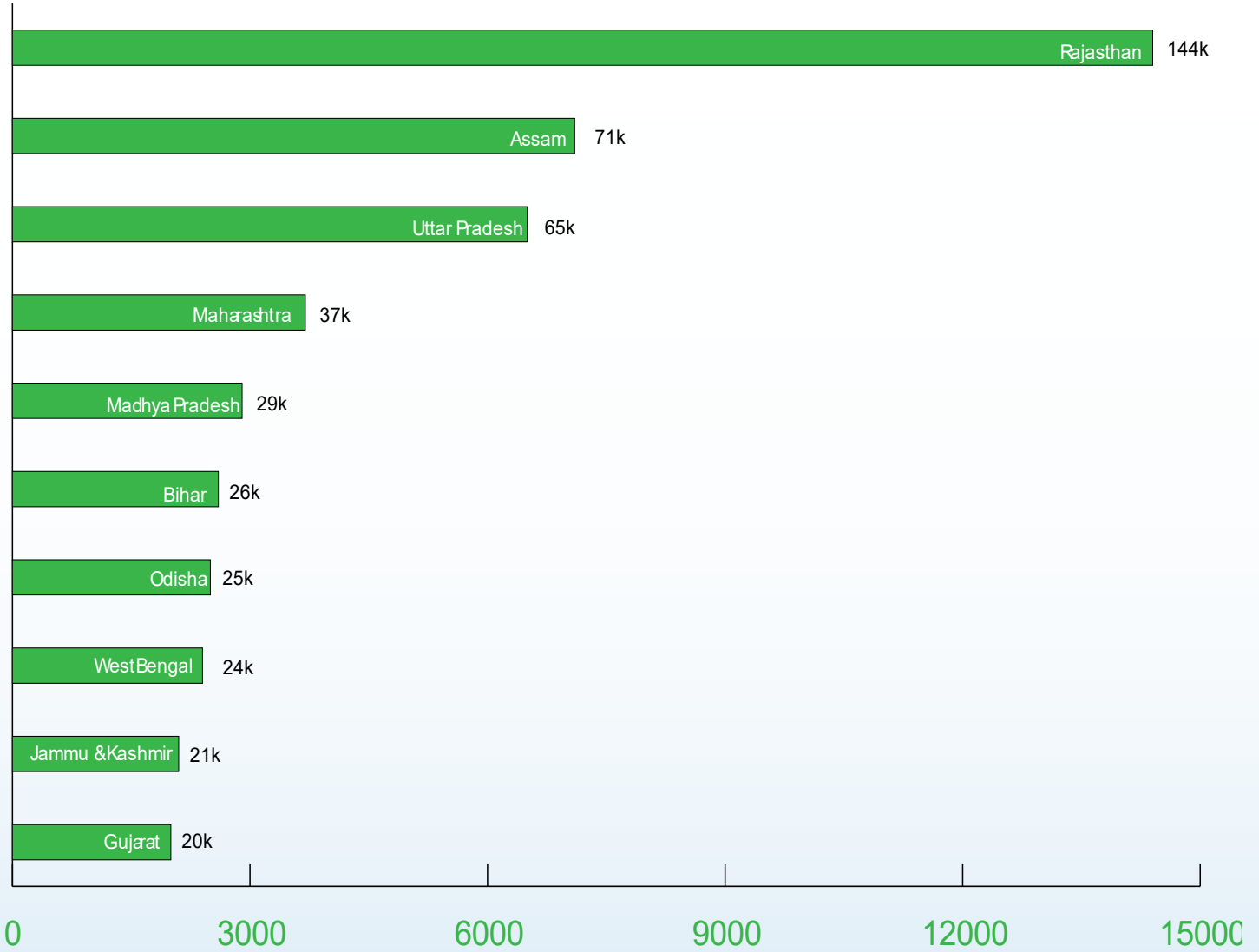
These points reflect India's commitment to promoting fairness and support for developing nations in the context of global climate action.





SCGJ Statistics

Training & Certification (Top 10 States)



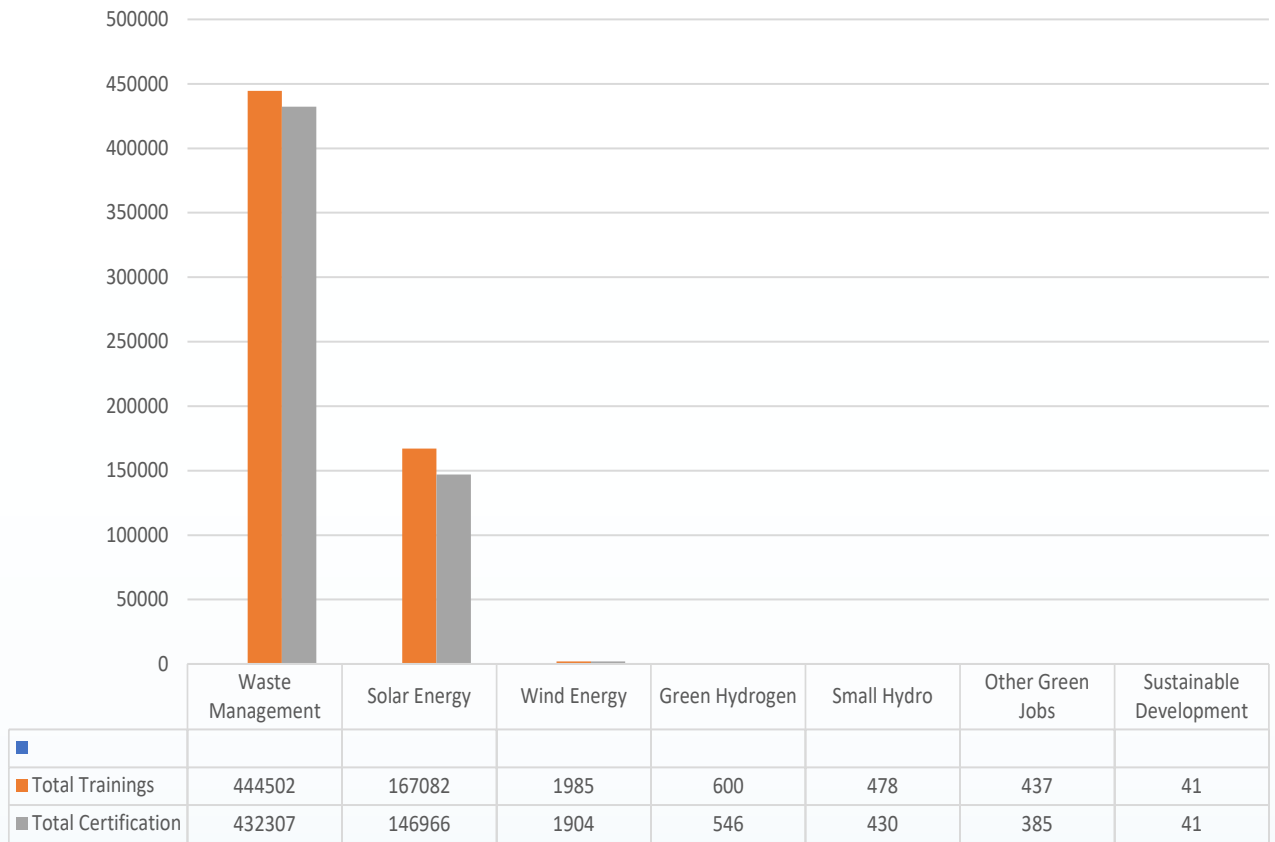
578K
Total Candidates Certified

4845
Total Trainers

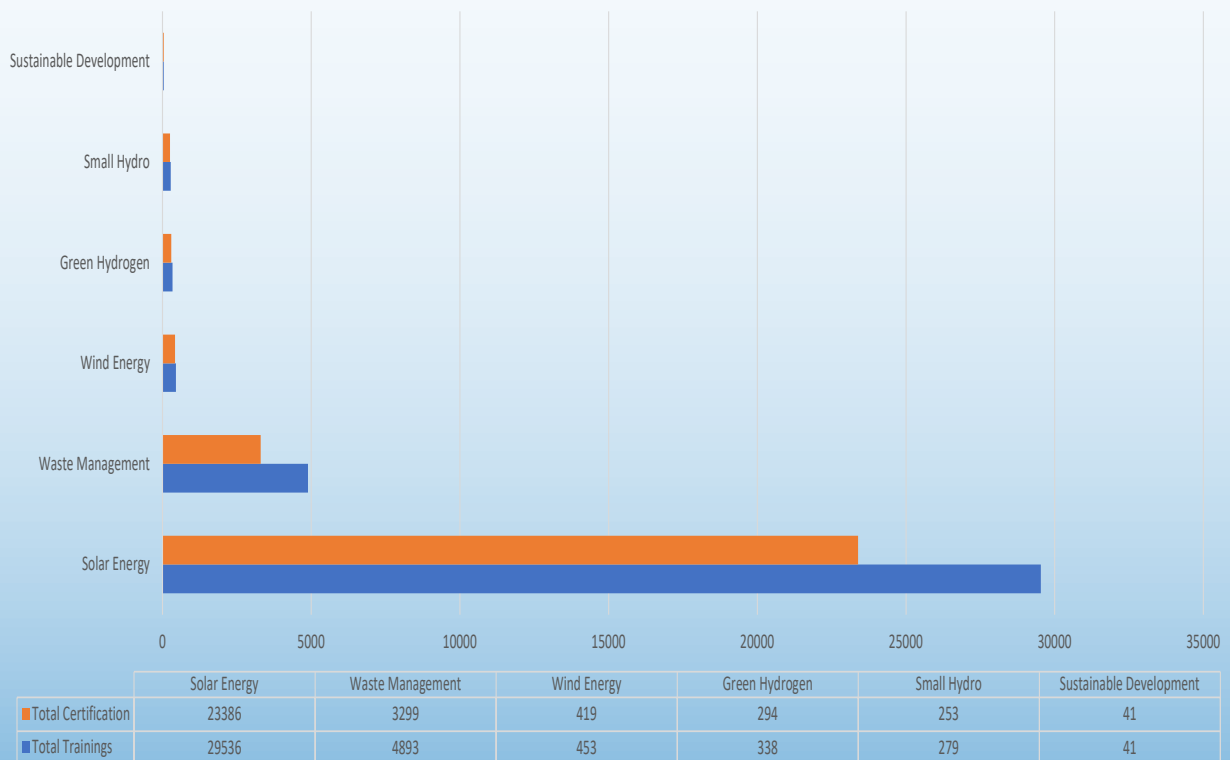
1132
Total Training Center



Domain wise Training and Certification

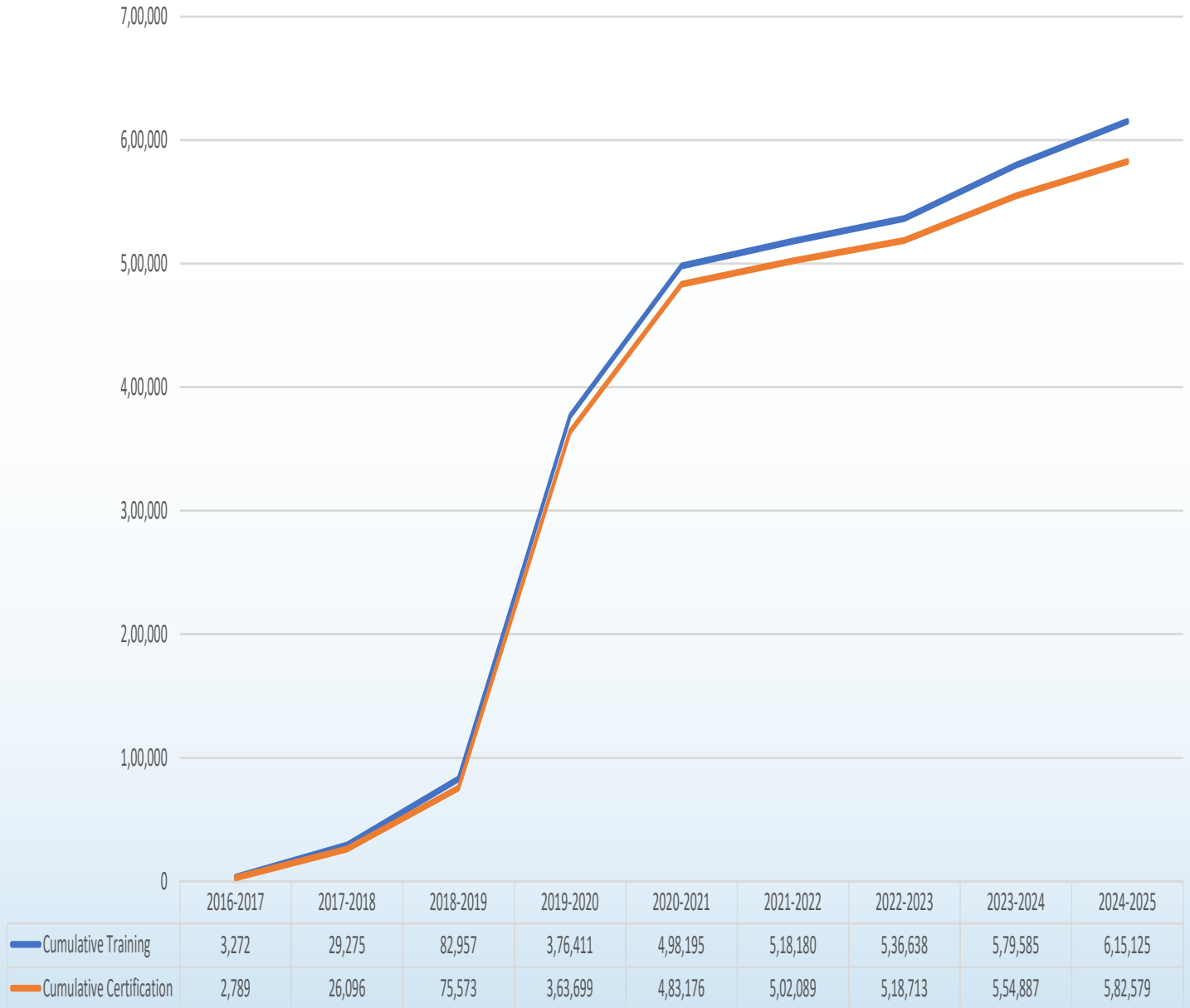


Domine wise Training for FY 24-25





Cumulative Training And Certification



Currents Projects and Training

1. TISA Project Overview (Jan 2024 - Present)

The TISA Project, launched in January 2024 under the Indo-German Energy Programme (INSolar), is supported by GIZ and jointly implemented by SCGJ and EY. Focused on innovative solar applications, the project offers four key services: capacity-building workshops, national study tours, conferences and panel discussions, and e-learning platform development. Running until June 2025, the project has so far conducted Nine Green Hydrogen workshops and developed content on green hydrogen and floating solar technologies. The TISA initiative aims to enhance the skilled workforce in solar energy, supporting India's renewable energy targets, reducing carbon emissions, and promoting long-term economic growth through green jobs.





2. PMKVY 4.0

The following Target has been awarded to SCGJ under PMKVY 4.0

Training Proposed by SCGJ		
Training Category	Target Allocated	Job Roles
STT	9250	SCGJ is planning to complete the allocated target in 6 job roles 1. “Green Hydrogen Plant Entrepreneur”, 2. “Green Hydrogen Plant Technician”, 3. “Green Hydrogen Plant Junior Technician – Storage”, 4. “Green Hydrogen Plant Junior Technician – Desalination”, 5. “Green Hydrogen Plant Junior Technician – Electrolyzer”, 6. “Green Hydrogen Plant Junior Technician – Power Sources”
RPL	9750	
Total	19000	Trainings shall be completed approx. by March 2025.

3. Capacity Building Program under PM Surya Ghar Muft Bijli Yojana

The “PM Surya Ghar: Muft Bijli Yojana”, launched by the Ministry of New and Renewable Energy (MNRE) on February 15, 2024, aims to provide free electricity to 1 crore households by promoting solar panel installations with a 40% subsidy.

The Directorate General of Training (DGT), under the Ministry of Skill Development and Entrepreneurship (MSDE), is the Project Implementing Agency for skill development.

In its first meeting on July 9, 2024, the Project Implementation Committee tasked the Skill Council for Green Jobs (SCGJ) with submitting a proposal to train electricians for solar panel installation.

SCGJ proposed a 60-hour training program on the NCVET approved qualification Solar PV Installation Helpers. The proposal to train 20,500 Solar PV installation helpers has been approved by REC. This training shall create a skilled workforce for solar energy deployment. This initiative supports the scheme’s goal of widespread solar energy adoption and job creation in renewable energy



4. Green Energy Skills – Jakson Program

On October 3rd, the Skill Council for Green Jobs (SCGJ), in collaboration with Jakson Group under its CSR initiative, launched specialized training programs in Solar PV and Green Hydrogen for Diploma/Graduate students. This initiative, part of the Jakson Skilling Project - Green Energy Skills, is being held at Image Engineering and Technology Institute, Kheda, Gujarat, with industry partner GoRenewable Pvt. Ltd. SCGJ's master trainer and World Skills RE expert, Mr. Japen Gor, will lead the sessions, aiming to develop a skilled workforce for the renewable energy sector. This significant step by Jakson Group and SCGJ highlights their commitment to sustainability and fostering green energy solutions



This initiative, part of the Jakson Skilling Project - Green Energy Skills, is being held at Image Engineering and Technology Institute, Kheda, Gujarat, with industry partner GoRenewable Pvt. Ltd. SCGJ's master trainer and World Skills RE expert, Mr. Japen Gor, will lead the sessions, aiming to develop a skilled workforce for the renewable energy sector. This significant step by Jakson Group and SCGJ highlights their commitment to sustainability and fostering green energy solutions



5. OSDA Program

Directorate of Skill Development and Employment (DSDE), Government of Odisha and Skill Council for Green Jobs have signed a MoU for skilling of the unemployed youth in Odisha on 14th August 2024 in Solar PV and Green Hydrogen NSQF aligned job roles to enhance their employability skills and certification as per the NSQF guidelines.

DSDE has agreed to fund the total project cost under the NUA Odisha scheme to SCGJ and SCGJ has agreed to deliver the above-mentioned skill development program through its affiliated training partners in the state of Odisha.



Objective

Skilling unemployed youth in Odisha in NSQF-aligned job roles for Solar PV and Green Hydrogen. Enhance employability skills and provide certification as per NSQF guidelines.

Training Plan

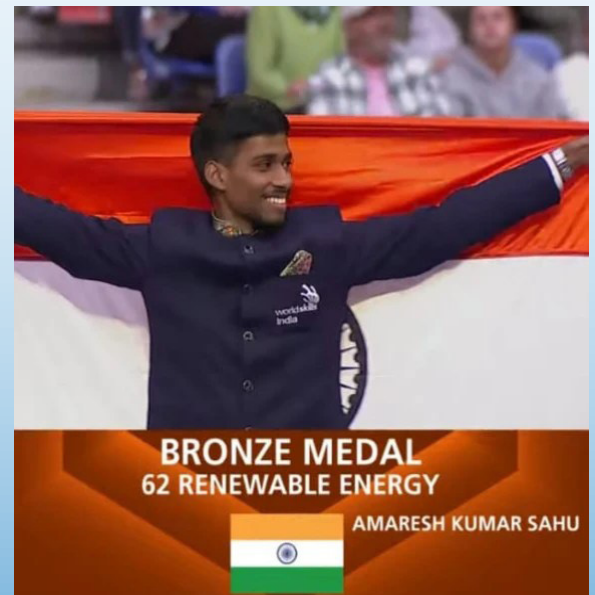
Conduct residential training for 500 candidates in Solar PV Installation.
Train 60 candidates as Green Hydrogen Plant Entrepreneurs.

Significance

Reflects a proactive approach of the state to creating a sustainable future through skilled manpower, innovation, and green energy solutions.

6. World Skill 2024

At World Skills 2024 in Lyon, France, the Skill Council for Green Jobs (SCGJ) achieved notable success, winning a bronze medal in Renewable Energy and a Medalion for Excellence in Water Technology. The standout performer was Mr. Amaresh Kumar Sahu, a Diploma student in Mechatronics, who secured the bronze in Renewable Energy. His journey was supported by SCGJ and CTTC Bhubaneswar, with intensive training at top institutes like I-AGE, NIWE, and overseas exposure at Eastern International University, Vietnam. These achievements underscore SCGJ's commitment to advancing skills in green technologies, showcasing India's leadership in sustainable development on a global stage.





7. PM Surya Ghar Muft Bijli Yojana (PMSGMBY)

The PM Surya Ghar Muft Bijli Yojana (PMSGMBY) is a flagship program under which the Skill Council for Green Jobs (SCGJ) has been awarded a capacity-building initiative. SCGJ is tasked with training 20,500 solar helpers across India, focusing on promoting solar energy adoption and creating skilled manpower for the solar sector. The program aligns with SCGJ's mandate of supporting India's renewable energy goals by fostering a skilled workforce.

SCGJ has mobilized its affiliated training centres to implement this program, ensuring wide geographical coverage and accessibility. The initiative, which is extended until July 2024, reflects SCGJ's commitment to skilling, reskilling, and upskilling in the green energy domain, further contributing to sustainable employment opportunities and clean energy development in the country.

8. National Green Hydrogen Mission (NGHM)

The National Green Hydrogen Mission (NGHM) is a transformative initiative by the Government of India to position the country as a global hub for green hydrogen production and utilization. In alignment with this mission, the Skill Council for Green Jobs (SCGJ) plays a pivotal role in developing a skilled workforce to support the emerging green hydrogen economy.

SCGJ has developed 10 qualifications in green hydrogen, covering areas such as production, storage, and handling. It has also conducted a skill gap study, identified job roles, and trained 585 candidates so far through partnerships with industries and academia. Under NGHM, SCGJ is implementing a skilling, reskilling, and upskilling program.

9. Pradhan Mantri Kaushal Vikas Yojana 4.0 (PMKVY 4.0)

PMKVY 4.0 has been designed to make the scheme flexible, inclusive, technology enabled, and

market driven resulting in better employability. Broad design principles are outlined below: Enhance industry-connect, greater reliance on On-the-Job Training in short-term training for learning by doing. In addition, encourage industry buy-in and contribution for skilling (including sharing of training infrastructure, demand aggregation, OJT, etc.).

The Skill Council for Green Jobs (SCGJ) has made significant contributions to PMKVY 4.0, advancing skill development in green and renewable energy sectors. SCGJ has actively collaborated with various industries and academic institutions to enhance training infrastructure and curriculum delivery under this initiative.

Industry Collaborations: To ensure industry-relevant training, SCGJ has also signed MOUs with 16 leading industries. This partnership aligns training content with industry requirements, ensuring that candidates are job-ready.



Partnerships with Academic Institutions: SCGJ has signed MOUs with 15 academic institutions, including centres of higher education, universities, colleges, and ITIs. These institutions will play a vital role in conducting training programs under PMKVY 4.0.

Expanding Training Scope: By leveraging these partnerships, SCGJ is helping to create training programs that focus on emerging green sectors such as solar energy, green hydrogen, ensuring alignment with India's sustainability goals with a target of 20,500 and 19,000 respectively.

Focus on Green Hydrogen and Solar PV: Specific programs have been designed to meet the demands of these high-growth sectors, reflecting SCGJ's strategic approach to skill development in renewable energy.

Through its efforts, SCGJ is not only addressing the skill gap but also contributing to India's broader objectives of sustainable development and employment generation under PMKVY 4.0. These initiatives underscore SCGJ's pivotal role in driving a skilled and sustainable workforce for India's green economy.



A brief Report on the 20th Governing Council Meeting and 9th Annual General Meeting of Skill Council for Green Jobs (SCGJ)

The Skill Council for Green Jobs (SCGJ) held its 20th Governing Council Meeting and 9th Annual General Meeting on October 14, 2024, in New Delhi. The meetings focused on organizational performance, sectoral initiatives, skill development strategies, and governance changes. The 20th GC meeting highlighted SCGJ's role in supporting India's goals in green hydrogen, solar PV, and offshore wind sectors. The council reviewed SCGJ's statutory compliance status and discussed the ongoing process to convert it from a Society to a Section 8 Company.

The 9th AGM also discussed SCGJ's progress over the past year, including milestones in green energy skilling, capacity building in green hydrogen, and strategic partnerships in offshore wind and solar PV sectors. The AGM received and adopted SCGJ's annual report and audited financial statements for FY 2023-24, showcasing financial and operational progress made over the year.

SCGJ's major projects and sectoral initiatives include the PM Surya Ghar Yojana and Green Hydrogen Mission, which are critical to India's energy and sustainability goals. The organization played a key role in RE-INVEST 2024, focusing on R&D, Skilling, and Technical Vocational Education and Training (TVET) for India's energy transition. SCGJ signed 13 MoUs with industry partners and academic institutions to support short-term and RPL training for green jobs. The organization's efforts in the green hydrogen sector are extensive, with 10 approved qualifications and an ambitious target of training 19,000 candidates under PMKVY 4.0. The strategic focus on offshore wind collaboration with Denmark aims to establish international cooperation in offshore wind energy skills, complementing India's renewable energy roadmap.

In conclusion, the 20th Governing Council and 9th AGM emphasized SCGJ's commitment to addressing India's green workforce requirements and meeting international standards in green job skills. By expanding training initiatives, fostering industry-academia partnerships, and progressing towards organizational goals, SCGJ is well-positioned to contribute to India's green economy transition.



September 2024

1. SCGJ and GERMI are jointly organizing a one-day Master Class on Green Hydrogen production and utilization at GERMI in Gandhinagar, Gujarat. On 13 September 2024.
2. The Tata Power Skill Development Institute (TPSDI) held a 3-Day “Masterclass on Green Hydrogen” in September 2024, focusing on hydrogen production, storage, transportation, consumption, and safety. The event, supported by GIZ GmbH and Skill Council for Green Jobs, provided insights into hydrogen production methods, storage solutions, transportation infrastructure, consumption, and safety standards. The event aimed to expand knowledge and engage in discussions about sustainable energy.
3. The Chairman and CEO of SCGJ attended a session on “Capacity Building for Energy Transition” at RE INVEST 2024. Key insights included expanding clean energy access, the need for skilled labor, job creation potential, and enhancing productivity. The session also highlighted the importance of structured educational pathways and a globally mobile workforce for achieving India’s clean energy goals and sustainable development.
4. At the NSDC HR Leadership Council Connect event, NSDC CEO Ved Mani Tiwari and SCGJ CEO Arpit Sharma signed an MOU for capacity building for India’s Green Hydrogen mission, focusing on comprehensive training programs for a skilled workforce.



One-Day Master Class on Production and Utilization of Green Hydrogen

Training Mode
Offline Training Program

Course Content

- Introduction to green hydrogen production technologies
- Navigating policy & market landscape
- Site visit to a green hydrogen plant

Who Can Attend

- Entrepreneurs
- Academicians
- Engineering Graduates
- Government Officials

Eligibility Criteria: Engineering Graduates with a minimum 1 year of experience

Date & Time
13 September, 2024
10:30 AM to 04:00 PM

Training Location
Gujarat Energy Research & Management Institute, PDEU Campus, Raisan Village, Gandhinagar - 382 426

Scan the QR Code for Registration




3-Day Program
Graduate/Diploma in Engg. with 2+ Year Experience in Power, Oil or Gas sector

Location
TPSDI, SHAHAD

Green Hydrogen MASTERCLASS
Organized By **TPSDI**

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23 - 25 Sep 2024



TPSDI
TATA POWER
SKILL DEVELOPMENT INSTITUTE





October 2024

1. SCGJ has signed an MoU with the Odisha Skill Development Authority in Vivanta, Bhubaneswar, for capacity-building activities.



2. India's Mr. Amaresh Kumar Sahu won a bronze medal in renewable energy at the World Skill Competition 2024 in Lyon, SCGJ successfully nurtured and trained the winning of an international medal at the Olympics of Skills, the World Skills competition..



3. Mr. Amaresh Sahu, Bronze Medallist of Renewal Energy in the World Skill Competition, received a Rs. 25 lakh cash prize from the Odisha Government.





4. SCGJ implemented the “Safai Karamcharyo Ki Sarahna” initiative as part of the “Swachhata Hi Seva 2024” campaign, specifically designed to recognize and raise awareness among Safai Karamcharis (sanitation workers) about the importance of health, safety, and hygiene practices in their daily work. This initiative aimed to ensure that Safai Karamcharis, who are on the frontline of keeping cities clean, are not only appreciated for their efforts but also equipped with the knowledge to protect themselves from health risks and hazards.



5. SCGJ successfully carried out the “Har Ghar Swachhata Pledge” initiative as part of the Swachhata Hi Seva 2024 campaign. This initiative was aimed at promoting cleanliness in both personal and professional spaces, encouraging SCGJ employees to take a proactive role in maintaining cleanliness at home and in the workplace.



6. The Skill Council for Green Jobs (SCGJ) and Jakson Group have launched specialized training programs in Solar PV and Green Hydrogen for Diploma/Graduate students, part of the Jakson Skilling Project - Green Energy Skills, aiming to develop a skilled workforce in renewable energy.



7. The Skill Council for Green Jobs (SCGJ) recently conducted a 2-day “Workshop on Green Hydrogen” on October 22 and 23, 2024, at Parishkar College, Jaipur. This workshop was part of the TISA project, supported by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH and jointly implemented by SCGJ and EY.

giz | TISA | SCGJ | EY

2-Day Program
Graduate/Diploma in Engg. with 2+ Year Experience in Power, Oil or Gas sector

Workshop On
Production & Utilization of Green Hydrogen

Location
Shipra path, Mansarovar (jaipur-302020)

Organized By
Parishkar College of Global Excellence (Autonomous)

22 - 23 oct 2024



8. SCGJ's involvement in RE Assets India 2024 provided a valuable opportunity to connect with industry leaders, showcase innovative projects, and explore potential collaborations. Ms. Sangeeta Patra, Vice President of Marketing & Partnerships at SCGJ, participated as a panel member discussing the "National Apprenticeship Promotion Scheme (NAPS), industry manpower needs, job opportunities for ITI students, and the NSDC JobX portal for industry requirements." Her insights were particularly well-received by the industries attending it.



9. Shri Jayant Chaudhary, Minister of State (I/C), Ministry of Skill Development and Entrepreneurship (MSDE), and Minister of State, Ministry of Education, today felicitated the winners & experts of WorldSkills 2024 competition which was recently held in Lyon, France. Bronze Medal Winner in Renewable Energy - Mr. Amaresh Kumar Sahoo & National expert on Renewable Energy - Mr. Prem Prakash Bharti, SCGJ, facilitated by the Honourable Minister.



10. Mr. Arpit Sharma, CEO, SCGJ & team facilitated, Mr. Amaresh Kumar Sahoo, Bronze Medallist, Renewable Energy, World Skills Competition, Lyon, France, at the SCGJ office. This accomplishment is a testament not only to Mr. Sahoo's individual talents but also to India's growing expertise and innovation in the renewable sector. The SCGJ team expressed pride in supporting young professionals like Mr. Sahoo, who represent the nation's potential in sustainable technologies and are setting benchmarks for future generations.



November 2024

1. The Skill Council for Green Jobs (SCGJ) recently held a 3-day “Workshop on Green Hydrogen” from November 5 to 7, 2024, at KREDL Bangalore. This event was a part of the TISA project, supported by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH and jointly implemented by SCGJ and EY. The comprehensive workshop covered all critical aspects of Green Hydrogen Generation, including safety protocols and operational procedures.
2. The Skill Council for Green Jobs (SCGJ) signed of a Memorandum of Understanding (MoU) with Avaada Group to advance workforce development in the green hydrogen sector. This collaboration, undertaken under the Pradhan Mantri Kaushal Vikas Yojana (PMKVY) 4.0 and the Skilling, Re-Skilling, and Upskilling Scheme of the National Green Hydrogen Mission, focused on providing specialized training to equip individuals with the skills required to support India’s green energy transition. Through this partnership, SCGJ and Avaada Group worked to build a skilled talent pool, contributing to India’s mission of creating a workforce proficient in the green hydrogen domain.
3. Skill Council for Green Jobs (SCGJ) organised a three-day RPL training Program on Green Hydrogen (GH₂) at the “Karnataka Renewable Energy Development Limited” (KREDL), Bangalore. The event, which commenced on November 5th and concluded on November 7th, featured insightful sessions on GH₂ Technologies and their implementation for industry professionals. A key highlight of the program was a site visit to the Indian Institute of Science (IISc), led by Prof. Dasappa, where participants from the

Industry explored cutting-edge research and innovations in hydrogen energy. This comprehensive training delved into all critical aspects of green hydrogen generation, safety, and operations.



The Relevance of Carbon Credits in the ESG Domain

By Mukul Saxena

Carbon credits play a crucial role in the Environmental, Social, and Governance (ESG) domain, representing a quantifiable way for companies to address their environmental impact. As investors, regulators, and consumers increasingly prioritize sustainability, carbon credits serve as a practical tool to help organizations meet their ESG commitments, especially in the environmental dimension.

In ESG frameworks, carbon credits are primarily linked to reducing a company's carbon footprint, a key metric in the environmental pillar. By investing in carbon credits, companies can offset emissions they cannot directly eliminate, balancing their environmental impact while transitioning to greener operations. This practice helps organizations achieve “net-zero” or “carbon-neutral” status by compensating for residual emissions through contributions to environmental projects, like reforestation or renewable energy initiatives. As a result, carbon credits contribute to the preservation of ecosystems, reduced reliance on fossil fuels, and improvements in air quality, aligning corporate activities with broader environmental goals.

Moreover, carbon credits are relevant to ESG strategies because they create a financial incentive to lower emissions. Companies that reduce their carbon output below required levels can sell excess credits, promoting innovation and investments in cleaner technologies. This market-based approach aligns with the “E” in ESG, encouraging businesses to adopt sustainable practices that ultimately benefit both the environment and their bottom line. Many companies also use carbon credits as a transparency tool, showcasing their commitments in ESG reports to build trust with investors, stakeholders, and the public.

In summary, carbon credits are integral to the ESG domain by offering organizations a mechanism to offset unavoidable emissions, foster sustainable innovation, and improve their environmental standing. They provide an avenue for companies to contribute to climate action while strengthening their ESG profile, ultimately supporting the shift toward a low-carbon economy.

Which Skills Are Necessary for Carbon Trading?

Working in the carbon trading field requires a unique blend of financial, environmental, regulatory, and analytical skills. Here's a look at the core competencies necessary for a successful career in carbon trading:

- 1. Environmental Science and Sustainability Knowledge:** Professionals need a solid understanding of climate science and the carbon cycle, including insights into how emissions impact the planet. This knowledge is essential for assessing

carbon offsets, evaluating the effectiveness of emission-reducing projects, and understanding the broader climate context.

- 2. Financial and Economic Analysis:** Carbon trading is a market-driven field, so a firm grasp of financial principles is crucial. Professionals must evaluate the cost-effectiveness of trades, understand pricing dynamics, and interpret economic indicators that affect carbon credit markets. Skills in cost-benefit analysis, financial modeling, and understanding market mechanisms are vital.
- 3. Regulatory and Policy Expertise:** As carbon trading is heavily regulated, a strong understanding of relevant local, national, and international regulations is essential. Professionals need to stay up-to-date on evolving climate policies, like the Paris Agreement, and understand compliance requirements to ensure that trades and offset projects align with regulatory standards.
- 4. Data Analytics and Quantitative Skills:** Carbon trading relies heavily on data, from emissions measurements to financial metrics. Proficiency in data analysis, statistical modeling, and interpreting complex datasets is critical for evaluating market trends, assessing risk, and calculating emissions reductions accurately.
- 5. Risk Management:** Market volatility, regulatory changes, and environmental factors all contribute to the risk landscape in carbon trading. Professionals need to assess, mitigate, and manage these risks effectively, requiring a good understanding of risk management strategies and the ability to make informed decisions under uncertainty.
- 6. Project Management:** Many carbon credits come from specific projects, such as reforestation or renewable energy installations. Effective project management skills help in overseeing these initiatives, ensuring they meet regulatory and certification standards, and verifying their impact on emissions reductions.
- 7. Communication and Negotiation:** Carbon traders work with a diverse range of stakeholders, including corporate clients, environmental groups, and governmental agencies. Strong communication and negotiation skills are essential to navigate these relationships, explain technical concepts, and reach beneficial agreements.

By mastering these skills, professionals in carbon trading can successfully navigate the complex, data-driven, and regulation-heavy nature of carbon markets. These competencies enable them to contribute meaningfully to sustainable development and climate change mitigation while driving financial and environmental benefits.



Are We on Track to Limit Global Warming to Below 2°C?

With an even more ambitious goal of 1.5°C, the Paris Agreement represents a historic commitment by countries to keep global warming far below 2°C over pre-industrial levels. This dedication is crucial to reducing the negative consequences of climate change, which include serious repercussions on ecosystems, human health, and economies around the globe. There is a notable discrepancy between this objective and reality, nevertheless, as evidenced by current emissions patterns and climate legislation. Examining emissions data, the efficacy of policies, advancements in renewable energy, and the general obstacles to progress, this article examines the current status of global climate action.

Current Global Warming Levels and Projections

As reported by the Intergovernmental Panel on Climate Change (IPCC), the global average temperature has increased by roughly 1.1°C compared to pre-industrial levels. This increase has led to noticeable changes in climate patterns around the world. Severe heatwaves and prolonged droughts are becoming more frequent, impacting agriculture, water resources, and biodiversity. The rise in temperatures has hastened the melting of the Arctic ice cap, resulting in a concerning increase in sea levels that endangers coastal populations and disrupts marine ecosystems. Ecosystems globally are compelled to adapt or face collapse as species either migrate to new areas or struggle to thrive in altered climates.

The critical concern is that, if emissions continue to rise unchecked, the planet might hit or surpass the 1.5°C threshold around 2030 to 2035. Surpassing this limit could trigger irreversible consequences for the climate, emphasizing the necessity for prompt action more than ever.

Greenhouse Gas Emissions and the Carbon Budget

To avoid severe warming, researchers have determined a “carbon budget,” which indicates the maximum amount of CO₂ emissions that can be tolerated while still maintaining global temperature rise within acceptable limits. The IPCC projects that for a 50% likelihood of restricting warming to 1.5°C, humanity can only emit 500 gigatons of CO₂ (GtCO₂) starting from 2020. However, this budget is rapidly being exhausted. In 2023 alone, global emissions from the burning of fossil fuels and industrial activities reached approximately 37.4 GtCO₂. If emissions continue at this level, the carbon budget for 1.5°C will be depleted within the next ten years.

The outlook for 2024 remains uncertain, but following the pledges made at COP28, specialists think that global emissions could reach their peak before 2025. If the growth of clean energy proceeds as expected, a reduction in emissions might start to occur in the next few years. Nonetheless, robust decarbonization initiatives in areas such as transportation and heavy indus-

try are crucial for successfully achieving the climate objectives set by the Paris Agreement. To achieve the 2°C target, there is some flexibility, with an estimated carbon budget of 1,350 GtCO₂. However, without significant reductions in emissions, even this more lenient goal could be surpassed by mid-century. The swift depletion of our carbon budget highlights the urgent need for unprecedented emissions reductions to remain within safe limits.

Emissions Reduction Commitments and the Reality of Nationally Determined Contributions (NDCs) Countries worldwide have submitted Nationally Determined Contributions (NDCs) under the Paris Agreement, outlining their pledges for reducing emissions. Unfortunately, the combined impact of these pledges does not align with the targets of 1.5°C or even 2°C for global warming. Recent estimates suggest that if current NDCs are fully implemented, global temperatures could still rise by between 2.4°C and 2.7°C by the end of the century. This means that even in the best-case scenario where all nations meet their NDC targets, we will still fall short of our climate goals. A report by the United Nations Environment Programme (UNEP) further emphasizes this shortfall, cautioning that current NDCs are inadequate to achieve the 1.5°C target. Even if all countries reach their net-zero goals by mid-century, there would still be only a 66% chance of limiting warming to around 1.8°C. While some nations, including the European Union, the UK, and Japan, have implemented policies aimed at keeping warming below 2°C, the world's largest emitters—such as China, India, and the United States—lack legally binding measures to ensure compliance with their targets.

The Emissions Gap: Policy Limitations and Shortfalls

The emissions gap refers to the difference between projected greenhouse gas emissions based on current policies and the levels needed to limit global warming to 1.5°C or 2°C. The United Nations Environment Programme's (UNEP) 2023 Emissions Gap Report presents a concerning forecast, estimating that existing policies are likely to result in approximately 2.7°C of warming by the end of the century. In order to align with the 1.5°C target, global emissions need to decline by 45% from 2010 levels by 2030. Unfortunately, instead of decreasing, emissions have been steadily rising. If no additional actions are taken, we can expect only stabilization at best, which falls significantly short of the required reductions.

Progress in Renewable Energy and the Path to Decarbonization

Renewable energy plays a vital role in reducing emissions and achieving the targets set by the Paris Agreement. While the adoption of renewable sources has accelerated, the rate of increase remains insufficient. In 2023-24, renewables contributed nearly 30% of global electricity generation; however, coal, oil, and natural gas continue to dominate the broader energy landscape, particularly in sectors such as transportation and industry. According to the International Energy Agency (IEA), annual capacity additions for renewables need to nearly triple by 2030 to align with the 1.5°C target. Key renewable sources like solar, wind, and green hydrogen must

be rapidly scaled up to reduce dependence on fossil fuels. Although advancements in technology and decreasing costs for renewable energy have made progress, the pace of adoption still needs to increase significantly to meet the global demand for clean energy and remain within climate-safe limits.

Fossil Fuel Dependence and Subsidies

Despite growing awareness of the harms associated with fossil fuel reliance, many countries continue to provide financial support for coal, oil, and gas. In 2023, global fossil fuel subsidies reached around \$1 trillion, representing a 35% increase from previous years. These subsidies lower the cost of fossil fuels, which can hinder the transition to renewable energy by making carbon-intensive energy sources artificially affordable. According to the International Energy Agency's 2023 World Energy Outlook, no new oil, gas, or coal projects should be approved beyond 2021 if the world aims to meet its climate goals. Nevertheless, new fossil fuel projects are still being approved, especially in high-demand regions and by major oil and gas producers. This situation underscores the conflict between climate commitments and economic policies in many countries.

Sector-Specific and Regional Challenges

Certain sectors, such as heavy industry and transportation, encounter significant obstacles in their efforts to decarbonize due to high costs and technological barriers. Industries like cement, steel, and chemicals are energy-intensive, making it challenging to lower emissions without considerable investment in new, less carbon-intensive technologies. Similarly, the transportation sector, including aviation and shipping, struggles with a limited availability of low-carbon alternatives, complicating the decarbonization process. Regional disparities also pose challenges for global climate initiatives. Developing countries, particularly in Africa and Southeast Asia, face substantial difficulties in financing and implementing green infrastructure. These nations need considerable financial and technological support to achieve their climate goals without compromising their development. It is estimated that climate finance for renewable energy alone will require an investment of \$4 trillion annually by 2030. The insufficiency of funding for climate initiatives remains a significant obstacle for many developing regions, hindering their transition to low-carbon economies at the necessary pace.

The Consequences of Exceeding the 1.5°C and 2°C Targets

Exceeding the 1.5°C target has significant consequences, but reaching a warming level of 2°C could lead to even more severe impacts. Extreme weather events such as hurricanes, droughts, and heatwaves will become more frequent and intense, resulting in widespread economic damage, loss of life, and displacement. Sea levels are projected to rise an average of 10 cm more at 2°C compared to 1.5°C, increasing the risks of coastal flooding and erosion. The world's eco-

systems will also suffer greatly. Coral reefs, which support a diverse array of marine life, are highly sensitive to temperature increases. At 1.5°C, it is estimated that between 70% and 90% of coral reefs will be lost; however, nearly all would disappear at 2°C. The Arctic would face even more dramatic consequences, with a higher likelihood of experiencing ice-free summers. This would disrupt polar ecosystems and have far-reaching effects on global weather patterns

An Urgent Call to Action

The data and trends presented here convey a clear and concerning message: despite some progress, the current pace and scale of climate action are insufficient to meet the targets of the Paris Agreement. To remain below the 1.5°C or 2°C thresholds, we must implement immediate and large-scale emissions reductions, transition rapidly to renewable energy, and significantly increase climate finance, particularly for developing nations.

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Pradhan Mantri Kaushal Vikas Yojana (PMKVY) 4.0



The Pradhan Mantri Kaushal Vikas Yojana (PMKVY) 4.0 provides an extensive set of guidelines for the fourth phase of the flagship skill development scheme under the Government of India. This version of the PMKVY aims to streamline skill development efforts across diverse

demographics, focusing on employability, industry needs, and inclusivity in skilling opportunities. Below is a summary based on the key sections of the document.

1. Introduction and Background

The PMKVY initiative was first launched in 2015 by the Ministry of Skill Development and Entrepreneurship (MSDE) to enhance skill development for youth in India, supporting both employment and economic productivity. Since its inception, the program has undergone three iterations, training over 1.37 crore individuals. PMKVY 4.0, launched for FY 2022-2026, aligns with the Skill India Programme, adopting a flexible, market-driven, and technology-enabled approach to address emerging economic demands.

2. Objectives of PMKVY 4.0

The scheme's core objectives emphasize:

- Establishing an ecosystem for skill development that aligns with youth aspirations.
- Delivering market-oriented training to improve employability.
- Facilitating lifelong learning by promoting upskilling and reskilling.
- Focusing on inclusivity, targeting SC/ST groups, women, and other marginalized communities.
- Leveraging digital platforms to streamline training and assessment processes.

3. Design Principles

PMKVY 4.0 introduces several design principles to enhance scheme flexibility, such as:

- Increased industry involvement and reliance on On-the-Job Training (OJT).
- Expanded digital and blended learning opportunities.
- Empowerment of trainees through choice in career paths, with an emphasis on self-employment.
- Simplified procedural requirements and the establishment of a robust trainer and assessor pool.

4. Implementation Strategy and Structure

The implementation of PMKVY 4.0 involves several layers:



- **Policy Framework:** MSDE provides overall guidance, with the National Council of Vocational Education and Training (NCVET) overseeing regulatory requirements.
- **Implementing Agencies:** The National Skill Development Corporation (NSDC) coordinates execution.
- **Training Providers:** Various centers, including Pradhan Mantri Kaushal Kendras (PMKKs), Industrial Training Institutes (ITIs), Skill Hubs, and institutions from private sectors, are integrated as training centers.
- **Administrative Structure:** A Steering Committee at the apex level and an Executive Committee oversee policy direction, monitoring, and periodic reviews.

5. Training Types and Target Groups

PMKVY 4.0 introduces three types of training to cater to different groups:

- **Short-Term Training (STT):** Focuses on job roles requiring 300-600 hours of instruction.
- **Recognition of Prior Learning (RPL):** Validates prior knowledge or experience through certification.
- **Special Projects:** Addresses skill gaps for marginalized communities, specialized roles, and challenging geographies.

Each training type targets specific age groups (typically 15-45 years) and skill backgrounds. Training locations include aspirational, tribal, and Left-Wing Extremism (LWE) affected districts to ensure comprehensive geographic coverage.

6. Training Providers and Accreditation

The scheme defines criteria for institutions to become Training Providers, with various categories of eligible centers, such as PMKKs, Skill Hubs, and government/private institutions. Training centers must meet accreditation standards and register with the Skill India Digital (SID) platform. Accreditation criteria include infrastructure availability, legal establishment, and compliance with job role specifications.

7. Skill Gap Identification and Target Allocation

The document outlines a multi-layered approach for identifying skill gaps:

- **Skill Gap Studies:** Conducted by Sector Skill Councils to assess demand across industries.
- **District and State Skill Plans:** Developed by District Skill Committees, aggregating local data to address district-specific skill demands.
- **National Skill Development Plan:** Consolidates district and state findings into a national report for strategic planning.
- **Targets are assigned based on these studies, with considerations for geographic, cultural, and economic diversity. Priority is given to sectors linked to government initiatives like PM Gati Shakti and Sagarmala.**

8. Training Lifecycle Management

The guidelines set forth a structured training lifecycle, which includes:



- **Registration and Counselling:** Candidates register through the SID, with eligibility verification and course counselling.
- **Facilities and Entitlements:** Candidates receive induction kits, with additional support for disadvantaged groups.
- **On-the-Job Training (OJT):** An integral part of STT, OJT provides practical exposure, making candidates industry-ready. Training providers are responsible for arranging OJT opportunities.
- **Assessment and Certification:** Following training, candidates are assessed by NCVET-approved agencies. Certifications are awarded based on a grading system.

9. Skill Hubs and Specialized Training Centers

Skill Hubs, which include educational institutions, offer short-term training under PMKVY 4.0, enabling resource optimization within existing infrastructures. Skill Hubs in schools, colleges, and universities can deliver programs and coordinate OJT in nearby industries. NSDC provides technical support and financial provisions to these institutions.

10. Financial Management

The PMKVY 4.0 scheme operates within budgetary allocations and adheres to General Financial Rules. Cost norms are established, including fixed costs per candidate based on training type and duration. Payment mechanisms are defined to ensure transparent fund disbursement to implementing agencies, based on candidate enrollment and program outcomes.

11. Convergence and Monitoring

Convergence is a key aspect, with cross-collaborations among ministries to integrate PMKVY with other government initiatives. Monitoring and evaluation are critical to ensuring program effectiveness, involving regular data analysis, field visits, and feedback collection. Capacity building and grievance redressal are integral parts of the monitoring framework.

12. Training of Trainers and Assessors

A national pool of trainers and assessors will be created to maintain quality across the skilling ecosystem. Training programs for trainers and assessors are classified into Basic and Advanced Certifications, with specific assessment criteria and financial provisions.

13. Branding and Communication

Effective branding and communication strategies are outlined to increase PMKVY's visibility and improve skilling's aspirational value. This includes national campaigns, local outreach



programs, and digital engagement on platforms like SID.

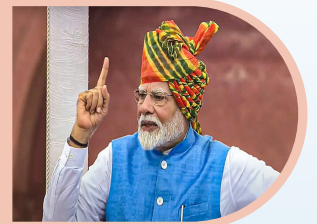
Conclusion

PMKVY 4.0 represents a comprehensive effort to address India's evolving skill needs, fostering employability, inclusivity, and economic growth. The scheme aims to empower individuals through structured training paths, ensuring industry alignment and accessibility for underrepresented communities. The robust digital infrastructure and monitoring mechanisms are key to the scheme's success, supporting PMKVY's vision of transforming India into a global skill capital.



Scan to know more about
GUIDELINES FOR PRADHAN MANTRI KAUSHAL VIKAS YOJANA 4.0

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Latest Qulification in Green Hydrogen



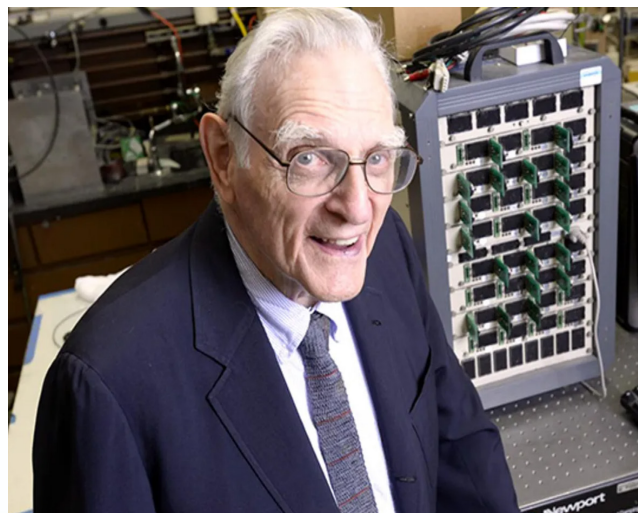
Qulification	Qulification Id	Level
Electrolyser Manufacturing Plant Supervisor	QG-05-ES-02028-2024-V1-SCGJ	5
Electrolyser Manufacturing Plant Technician	QG-04-ES-02027-2024-V1-SCGJ	4
Fundamentals of Financing for Green Hydrogen Project	NM-06-ES-02253-2024-V1-SCGJ	6
Overview of Instrumentation and Control for Green Hydrogen Plant	NM-06-ES-02254-2024-V1-SCGJ	6



Lithium-Glass Batteries: The Future of Safe, High-Density Energy Storage

Introduction

Lithium-glass batteries are an innovative breakthrough in energy storage technology, offering remarkable benefits that could revolutionize the market. With enhanced safety, superior energy density, and a longer lifespan compared to traditional lithium-ion batteries, these batteries are poised to meet the escalating global energy demands. Pioneered by battery expert John Goodenough and his team, lithium-glass technology stands out as a superior alternative to conventional batteries that often rely on liquid electrolytes, which are susceptible to leakage and fire hazards. As the call for sustainable and high-efficiency energy solutions grows louder, lithium-glass technology paves the way for safer, higher-capacity batteries. At the core of lithium-glass batteries is the innovative use of a glass electrolyte, a solid material that significantly differs from the liquid or polymer electrolytes found in standard lithium-ion batteries. This glass electrolyte not only enhances energy density but also provides exceptional stability. Such outstanding properties position lithium-glass batteries as a compelling choice for a wide range of applications, including electric vehicles (EVs) and renewable energy storage. In this article, we will delve into the structure and operational mechanisms of lithium-glass batteries, examine their advantages, address the challenges inhibiting their commercialization, and highlight the potential applications where their impact could be most profound.



Structure and Working Mechanism

Lithium-glass batteries are distinguished by their innovative design, which replaces the traditional liquid electrolyte with a solid glass electrolyte. This solid electrolyte is typically composed of compounds containing lithium, sodium, or other alkali metal oxides, giving the battery unique properties that offer several advantages over conventional lithium-ion batteries. To enhance ionic conductivity, the glass electrolyte is usually doped, allowing for a smooth flow of lithium ions within the battery. The electrochemical process of a lithium-glass battery involves the movement of lithium ions from the anode to the cathode through the glass electrolyte. During charging, lithium ions accumulate in the anode, and when discharging, these ions migrate through the glass electrolyte to the cathode, generating an electric current that powers devices. The use of a glass-based solid electrolyte enables lithium-glass batteries to maintain a high concentration of lithium ions, resulting in greater energy density, which can extend the operating life of the devices they power. Furthermore, the solid-state nature of the

glass electrolyte significantly enhances safety and durability. Unlike liquid electrolytes, which can be vulnerable to thermal and mechanical stresses, the glass electrolyte is less susceptible to degradation. This solid structure also minimizes the risk of thermal runaway—a dangerous occurrence that can lead to fires and explosions—making lithium-glass batteries a safer option for high-energy applications, such as electric vehicles and grid storage solutions.

Key Advantages

Lithium-glass batteries offer several significant advantages that make them a compelling alternative to traditional lithium-ion technologies. One of the most notable benefits is their higher energy density, which results from the unique structure of the glass electrolyte. This solid material can accommodate a high concentration of lithium ions, allowing lithium-glass batteries to store more energy per unit volume than their lithium-ion counterparts. Consequently, devices such as electric vehicles and portable electronics can operate for longer periods on a single charge, catering to the demands of today's energy-intensive applications. Safety is another important advantage of lithium-glass batteries. The solid glass electrolyte is non-flammable, significantly reducing the risk of fires. In contrast, the liquid electrolytes found in lithium-ion batteries can be volatile and may ignite during overcharging or physical stress. By utilizing solid-state glass electrolytes, lithium-glass batteries eliminate this volatility, providing a much safer solution, particularly for applications that require high energy densities.

In addition to their safety and energy density, lithium-glass batteries have a wide operating temperature range, performing effectively even in extremely low temperatures, sometimes as low as -20°C . This temperature resilience allows these batteries to function well in various climates, reducing the need for extensive thermal management systems commonly required for lithium-ion batteries. Such flexibility is particularly beneficial for sectors like automotive and renewable energy storage, where operating conditions can be unpredictable and demanding. Another significant advantage of lithium-glass batteries is their extended lifespan. These batteries exhibit minimal dendrite formation, a common problem in lithium-ion batteries that can lead to short circuits and reduced battery life. Dendrites are needle-like lithium structures that form during charging, ultimately causing the battery to degrade or fail. However, the glass electrolyte in lithium-glass batteries is resistant to dendrite growth, enabling these batteries to undergo thousands of charge cycles without significant capacity loss. This durability is especially valuable for applications that require long-lasting, high-reliability batteries, such as electric vehicles and grid storage. Finally, lithium-glass batteries have the potential to reduce environmental impact and production costs. Conventional lithium-ion batteries often rely on expensive and environmentally harmful materials like cobalt, which are limited in supply and raise ethical and environmental concerns. In contrast, lithium-glass batteries can utilize more abundant and less expensive materials, such as sodium. This shift in materials could not only lower the production costs of lithium-glass batteries but also promote more sustainable and responsible supply chains.

Potential Challenges and Limitations

Despite the significant advantages that lithium-glass batteries offer, there are several challenges that currently hinder their commercial viability. One major challenge is the need to scale up

and standardize the manufacturing process. The production methods for lithium-glass batteries are still complex and not as refined as those for traditional lithium-ion batteries. This lack of standardization makes it difficult to achieve consistent quality and performance at scale, which is essential for any technology aiming for mass-market adoption. Until manufacturing processes become more streamlined, large-scale production of lithium-glass batteries will remain a challenge. Another important issue is the inherent brittleness of the glass electrolyte material. Although solid electrolytes tend to be more stable than liquid ones, glass-based materials are susceptible to cracking under physical stress. This brittleness raises durability concerns, especially in applications where batteries are subjected to frequent handling, mechanical shocks, or vibrations, such as in electric vehicles and portable electronics. Researchers are actively working to enhance the mechanical resilience of the glass electrolyte, but striking a balance between brittleness and functionality is still an area of ongoing research. Optimizing ion conductivity within the glass electrolyte is also a significant technical hurdle. While the glass electrolyte enhances safety, achieving a level of ion conductivity that matches or exceeds that of liquid electrolytes remains challenging. High ion conductivity is crucial for enabling rapid charging and discharging cycles, a feature that modern consumers expect in applications like smartphones and electric vehicles. The current levels of ionic conductivity in glass electrolytes may limit the speed and efficiency of lithium-glass batteries, potentially affecting their competitiveness with lithium-ion technology.

The initial costs associated with the development of lithium-glass batteries present a significant challenge. As this technology is still in the experimental phase, a substantial investment in research and development is necessary to bring lithium-glass batteries to market. The specialized materials and techniques required for their production contribute to high manufacturing costs, which may impact affordability for consumers. Although costs are expected to decrease over time as economies of scale are achieved, the high initial expenses currently remain a potential barrier to widespread adoption.

Potential Applications and Future Prospects

If current technical and manufacturing challenges can be overcome, lithium-glass batteries hold significant potential across various industries. One of the most promising applications is in electric vehicles (EVs). The high energy density and extended lifespan of lithium-glass batteries could enable EVs to travel longer distances on a single charge, while their safety features reduce the risks associated with battery fires. Additionally, their durability could enhance the overall lifespan of EV batteries, potentially lowering the frequency and cost of battery replacements, making EVs more economically viable in the long term. Consumer electronics is another area where lithium-glass batteries could have a substantial impact. Portable devices like smartphones, laptops, and wearable technologies could greatly benefit from longer battery life, faster charging, and a safer battery chemistry. As consumers demand more from their devices, lithium-glass batteries could provide a competitive advantage in the consumer electronics market by enabling manufacturers to produce devices that last longer and charge more quickly. The renewable energy sector could also benefit from lithium-glass batteries, particularly for grid-scale energy storage solutions. With the increasing reliance on intermittent renewable energy sources, such as solar and wind power, efficient and long-lasting energy



storage is essential for stabilizing energy supply. The extended lifespan and high energy density of lithium-glass batteries make them well-suited for storing renewable energy, ensuring a steady power supply even during periods of low generation. Furthermore, their ability to function efficiently across a wide temperature range supports their use in various environmental conditions, making them ideal for diverse locations and applications.

Lithium-glass batteries represent a significant advancement in battery technology, offering the potential to outperform traditional lithium-ion batteries in several key areas, including energy density, safety, lifespan, and environmental impact. By using a solid glass electrolyte instead of a liquid one, lithium-glass batteries provide enhanced stability, reducing the risks associated with thermal runaway and degradation. These advantages make them particularly appealing for high-demand applications, such as electric vehicles and renewable energy storage. However, there are several challenges that must be addressed before lithium-glass batteries can be commercially viable. Key areas requiring further research and innovation include scaling up manufacturing processes, addressing the brittleness of glass electrolytes, improving ion conductivity, and lowering production costs. Despite these challenges, the potential benefits of lithium-glass batteries make them a promising area for research and investment. With ongoing advancements in material science and engineering, lithium-glass batteries could become a crucial component in the transition toward sustainable and high-performance energy storage solutions. As the world pushes toward a cleaner and more efficient energy future, lithium-glass batteries could play an essential role in meeting the growing demand for safe, reliable, and environmentally friendly power.

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