Net Zero Wired

Leading India Towards Net Zero

India`s First Digital Magazine on Net Zero

May-23

ANKIT SHARMA
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Net Zero Wired

Editor's Message

Dear readers,

Welcome to the latest edition of Net Zero Wired, your go-to platform for all things related to the pursuit of a sustainable future. As we continue to grapple with the pressing issue of climate change, it is crucial now more than ever to explore innovative solutions that pave the way towards a net-zero world. With each passing month, we witness remarkable advancements and inspiring initiatives that bring us closer to our shared goal.

In this edition, we delve into three fundamental pillars of the net-zero journey: Green Hydrogen, Carbon Market, and Decarbonization of Industries. These areas hold immense potential to transform the way we produce and consume energy, mitigate greenhouse gas emissions, and drive sustainable economic growth. Our team of experts and researchers has meticulously curated a collection of insightful chapters, providing you with a comprehensive understanding of these key subjects.

Within the pages you will get to know what all has happened in the last 30 days in the carbon market, green hydrogen, renewable energy, net zero, financing industry and many more.

At Net Zero Wired, our mission is to empower and inspire our readers with the knowledge and insights needed to drive meaningful change. We aim to foster a community of like-minded individuals and organizations dedicated to creating a net-zero future. Through our monthly publication, we strive to equip you with the latest information, ideas, and perspectives to navigate the complex landscape of sustainability.

We sincerely hope that this edition of Net Zero Wired enriches your understanding of Green Hydrogen, Carbon Market, and Decarbonization of Industries, igniting your passion and inspiring actionable steps towards a sustainable and equitable future. Together, let us forge a path towards a world where economic progress and environmental stewardship go hand in hand.

Thank you for your continued support and engagement.

Warm regards

Ankit Sharma

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Market Update: Carbon Market of India

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India asks European Union to recognise its carbon credit trading scheme

India has asked the European Union to recognise its Carbon Credit Trading Scheme (CCTS) amid concerns that its iron, steel and aluminium exports to the bloc will face extra scrutiny under the EU's Carbon Border Adjustment Mechanism (CBAM) that is due to kick in from October.

Creating a Carbon Market: MoP sets the ball rolling with the draft CCTS

The Ministry of Power (MoP) has recently released the draft Carbon Credit Trading Scheme (CCTS), which aims to establish a framework for the Indian carbon market for both voluntary trading and compliance. As per the draft scheme, the Indian Carbon Market Governing Board (ICMGB) will be set up to oversee administrative and regulatory functioning of the carbon market.

EU Carbon Tax will impact only 1.8% of Indian Exports

The world’s first carbon tax, approved by the European Parliament last month, could impact no more than 1.8% or $8 billion of India’s exports, according to an internal assessment by the commerce ministry. After being passed by lawmakers of the 27-nation bloc, the CBAM Bill is expected to come into force this month, empowering the bloc to charge a Carbon Border Tax (CBT) on imports of steel, aluminium, fertilizer, electricity, cement and hydrogen from January 2026.

Global Carbon Black Market is predicted to be worth US$ 22,133.52 Million at a decent CAGR of 4.8% by forecast period ending 2033

Market Update: Green Hydrogen

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Rising Demand for Hydrogen in Transportation Critical for India’s Energy Transition, Says ISA DG

International Solar Alliance (ISA) Director General Ajay Mathur has stated that rising demand for hydrogen in the transportation industry will play a crucial role in India’s energy transition.Mathur highlighted hydrogen’s non-toxicity and adaptability to existing petrol or diesel infrastructure as essential components for the shift towards renewable energy.

The prospects of Green Hydrogen: India Panama’s upcoming collaboration

The National Secretariat of Energy of Panama launched the “Green Hydrogen Roadmap” in the global south. It pursues strengthening the green hydrogen and derivatives industry in Panama. The nation is working on a specific strategy that aims to become the node or hub of storage, commercialization, and transmission of the green hydrogen produced in the region of Latin America.

India Introduces New Plans for Green Bunkering and Emission Reduction

The Indian Government has unveiled plans to provide green hydrogen at the country's largest ports by 2035. The "**Harit Sagar**" Guidelines, introduced to reduce carbon emissions per tonne of cargo by 25% by 2030 and two-thirds by 2047, outline these new initiatives. The 12 major ports in India will each adopt the guidelines in their manner, while the government has established specific requirements.

Larsen & Toubro’s electrolyzer fab to start production this fiscal

Larsen & Toubro expects to start production from its electrolyzer factory by the end of this fiscal year 2023-24. The company is setting up a pressurized alkaline electrolyzer manufacturing facility with a capacity of 1 GW per annum. It will manufacture electrolyzers at this facility under a technology license from McPhy France.

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$50 million Investment for a Green Hydrogen Project in Gujarat

Greenzo Energy India will invest $50 million to manufacture 250 MW of anion exchange membrane (AEM) electrolyzers per year and the balance of plant (BOP) in the Sanand-II Industrial Estate, a part of Gujarat Industrial Development Corporation (GIDC)

A 3 Episode Mini-Series on

"Role of Green Hydrogen in India's Quest for Energy Security"

Tracks under Northeast Frontier Railway to be fully electrified by the end of this year

The electrification work under Northeast Frontier Railway is progressing at full throttle for achieving the Indian Railways target of net zero carbon emission by 2030. NF Railway chief PRO Sabyasachi De said about 1661.83 route kms (RKMs) of railway tracks under the jurisdiction of NF Railway have been electrified between 2014 and 2023 and the balance portion is targeted to be electrified by this year.

India’s Green Financing Requirement Estimated At 2.5% Of GDP

As per the Reserve Bank of India’s (RBI) report on Currency and Finance (RCF) for the year 2022-23, India would require at least 2.5% of GDP annually until 2030 for green financing. The report addresses various areas such as the extensive and rapid impact of climate change, implications for financial stability, and policy choices to mitigate climate-related risks.

Access to cheaper capital expected to boost G20's energy transition financing

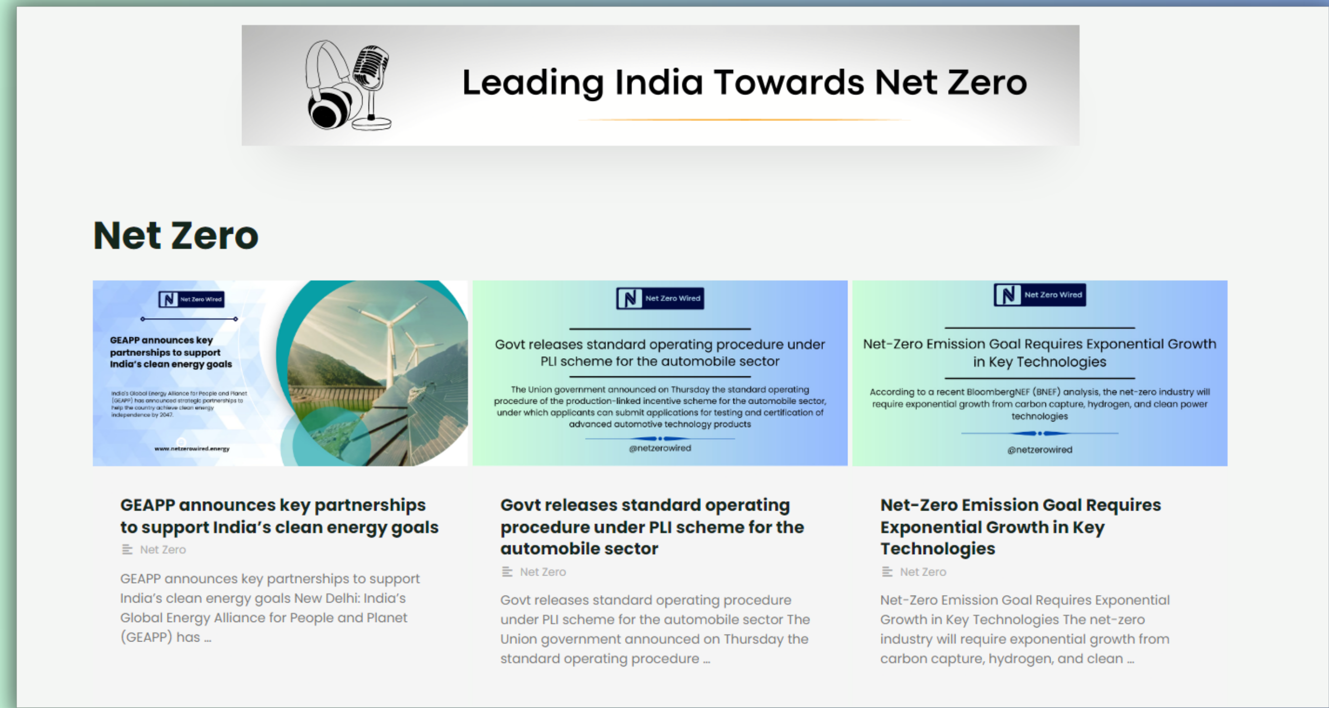
Access to cheaper capital will play a significant role in boosting financing for energy transition projects in G20 countries while collaboration between public and private sectors will help to catalyse institutional capital flows

ALD Auto completes acquisition of LeasePlan; makes local management changes

Joining forces, ALD Automotive and LeasePlan will lead the way to net zero and further shape the digital transformation of the industry. The combined entity will leverage on scale and complementary capabilities to strengthen its competitiveness and deliver sustained growth.

Qatar Airways CEO suggests 2050 net-zero goal beyond reach

The head of Qatar Airways voiced scepticism on Tuesday over an aviation industry target of achieving net-zero emissions by 2050, citing inadequate supplies of Sustainable Aviation Fuel and alternative hydrogen designs in their infancy.



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Need for a low carbon economy in India

Santosh K Gurunath
Founder Umagine

The transition towards a low carbon economy and to adhere to the Paris Climate Goals commitments, India as a nation has to play a central and leading role.

Being the nation with one of the fastest growth rates, and rising population would lead to India beating the entire European Union in the total carbon emissions within the next 2 years, and thereby becoming the 3rd nation after China and United States to be responsible for the most emissions. Given the high population, the carbon emissions per capita is quite low in both China and India.
Absolute carbon emissions and carbon emissions per capita are both not necessarily the right metrics for comparison, looking at from a perspective from an inclusive energy transition. Growth at the cost of environment is not the right thing, but at the same time, the western nations those who have contributed to the carbon intensive industrialization in the first place are not in position to dictate terms on what should happen and how.

Irrespective of the definitions, an inclusive energy transition towards a low carbon economy should be among the top 3 policy imperatives and priorities for the Indian government. The definition of the inclusive transition should include, carbon emissions, bio-diversity, poverty, inequality, resource scarcity, air pollution, water pollution, and right to a just growth.

Without a holistic view, it will be very difficult to achieve a sustainable change that will last for a longer term. Although the will and intention exists at a central government level, there are several challenges that impedes the timely transition to the low carbon economy.

These challenges are across, technology, manufacturing, access to capital, definition of bankability, shortage of skills, urge to focus on exports, financial health of state owned enterprises, and overall bureaucracy and ease of doing business. I will focus on the first four challenges as part of this article, and the others will follow in a subsequent article later.

Traditionally, the Indian ecosystem has been far behind on R&D and technology. We as a nation have consistently been dependent on other nations on the technology, and only after a couple years are able to reverse engineer and replicate the technologies.

lthough there is some shift with new age start-ups in the EV and batteries space developing 100% indigenous technologies, this is unfortunately just a drop in the ocean. There has to be a structural shift in the mindset, where bottom-up R&D is the key focus areas of academic institutions and research labs, rather than just publishing in journals or running after placements. Only if we start now, we will be in a position to lead the technology development which will be required beyond 2035.

Manufacturing ecosystem in India is quite advanced and developed. This holds true specifically for automobile, textile, pharmaceuticals, and heavy engineering. However in the climate space, China is leaps and bounds ahead of India in almost all the technologies. At the moment of writing this article, the solar panels manufactured in India and mostly exported to the US, and those installed in India are imported from China. This doesn't make any sense from multiple perspectives. The Indian business mentality is still very much focussed on squeezing out every last paisa, at the cost of long term development in the country.

There has to be a mindset shift, which is slowly but steadily taking place. But we need to accelerate this, if not, we will continue to be dependent on China and other nations.

Access to low cost capital, and definition of bankability are two things which have to be addressed with immediate priority as well. Unless there is a 10-15% equity IRR, most of the projects are not considered bankable. Unlike several other new industries, right from software to semiconductors, where high margins were the flavour of the day in the initial few years; the climate space is very different.

Most of the new technologies, right from battery energy storage to offshore wind, and hydrogen electrolyzers to carbon capture, are expensive and high margins are almost impossible. The private equity firms and the major fund houses have to revise their definition of bankability, and accept low IRRs and margins. It is still difficult to get low cost of capital in India, unless one has the holding company registered abroad. There has to be a mechanism devised by the government to enable this.

Shortage of skills, especially in the high-tech and deep-tech space is something that is still very scarce in India. There is minimum focus on such skills at an academia level. The focus is either on leaving the country to pursue higher education, or enrolling in business schools in India. Developing and honing these skills locally should be another priority focus. As this is directly linked to the technology development, there should be focus on improving the visibility and profile of technical masters programmes within the country.

A mission-mode approach to make India a leader in all these aspects should be followed. Unless we do this, the inclusive energy transition towards a low carbon economy will take much longer. The probability of this happening is very high given the current state of affairs, and thereby posing a risk to the entire world. Without India stepping up on these aspects, averting climate change seems unrealistic both for India and the globe.

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Need for a low carbon economy in India

Megha Rawat
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As the world transitions to clean sources of energy, hydrogen is being seen as more than just another fuel. Hydrogen-fueled economies could become energy independent, while potentially eliminating their carbon footprint, and many economies would have a fair shot at 'just' economic progress for all of their citizens. While this may sound eutopic, the energy independence and self-sufficiency it brings can enable nations to achieve at least some degree of such progress.

In the past decade, there has been a major push for a transition to clean and sustainable energy sources. While such decarbonization is good news for all habitants of Earth, it also translates into a more sustainable, relatively responsible, and profitable economy. And although most efforts and investments in this pursuit have been towards solar, wind, and now lithium-ion batteries, there is an urgent need for several other technologies to enable such a transition. One such technology is green hydrogen.

Hydrogen is one of the best-known fuels, with the highest known calorific value. Unfortunately, there are several challenges because of which we prefer fossil fuels over hydrogen. Being highly flammable and difficult to store, hydrogen is an extremely hazardous fuel to handle and transport (the sight of Hindenburg comes to mind!).

Storing hydrogen has always been a roadblock to its adoption. But with the advanced technologies of today, handling hydrogen has become much easier. It can be stored as high-pressure gas, cryogenic liquid, or within metal hydrides, and can be transported like natural gas via road, rail, or pipelines.

But there is another problem. While hydrogen is a clean fuel, producing only water vapor as a byproduct, over 95% of all hydrogen produced today is through fossil fuels by a process called steam reforming. This is where green hydrogen comes into the picture.
We already produce over US$120 billion worth of hydrogen today, but for economies to transition to hydrogen, we need to shift from gray and brown hydrogen to green hydrogen. Hydrogen is often color-coded to differentiate between hydrogen produced through different methods and indicates the environmental impact associated with each production process. This helps classify hydrogen based on its carbon intensity, with green hydrogen being the most environmentally friendly.

Grey hydrogen refers to hydrogen produced from fossil fuels, particularly natural gas, through a process called steam reforming of methane – this is the conventional method of hydrogen production and has high carbon emissions.
Brown hydrogen is produced through coal gasification which involves heating coal to produce synthetic gas that contains hydrogen and carbon monoxide. This process also has high carbon emissions.
Blue hydrogen is also produced through steam reforming of methane, but carbon emissions generated from this process are captured and stored or utilized through carbon capture and storage (CCS) technologies. This process, although not entirely clean has reduced overall environmental impact compared to gray or brown hydrogen.
Green hydrogen is produced through the electrolysis of water, wherein the electricity is generated completely from renewables like solar, wind, hydro, etc. It has a minimal carbon footprint and is considered the cleanest form of hydrogen production.

n today’s world, hydrogen can play a very important role in decarbonization for several reasons. While the world transitions towards solar and wind, they are unfortunately unpredictable and intermittent. Clean hydrogen can be generated using off-peak renewable electricity generated during periods when supply outstrips demand, instead of curtailing generation. This hydrogen can easily be stored at a very low cost and utilized to generate power in fuel cells or gas turbines when demand outstrips supply.

Hydrogen can also be the much-needed solution to decarbonize industries that are inherently difficult to decarbonize. In energy-intensive industries like cement, aviation, shipping, long haul trucks, steel, chemicals and many others, where large amounts of energy is required - often as heat - with a high degree of reliability, renewables prove to be significantly inadequate and expensive. Hydrogen, with its highest known calorific value, can be the perfect replacement for fossil fuels in these industries

Most types of engines in airplanes, trucks and ships can be modified to burn hydrogen instead of petrol, diesel, or natural gas. Industries and existing power plants can be upgraded to burn hydrogen for their thermal needs, which can be transported on-site via national pipelines much like how natural gas is transported from them today. Green hydrogen can also be used to produce green ammonia, which can be used to transport hydrogen with ease and safety, and can also help reduce the carbon footprint of the agriculture sector by being used as fertilizer.

If the conditions are right, hydrogen can even replace lithium ion in EV's and thus eliminating range anxiety. This shows the enormous potential of hydrogen to radically change human existence, just the way fossil fuels had done over a century ago.

Consistent efforts to bring down hydrogen's cost and its implementation possibilities across high energy intense as well as carbon-emitting industries with a push for achieving ambitious net zero targets indicates a signal for good market share. It is estimated that hydrogen could meet up to 24% of the world's energy needs by 2050 with a consumption capacity of 187 MMT(if a supportive but piecemeal policy is in place). (Source Hydrogen Economy Outlook, Bloomberg NEF, March 30, 2020)

ike all great opportunities, there are several challenges to the mass adoption of green hydrogen, its cost being one of the biggest. The cost of producing GH2 is usually around $3-7 per kg, while it was $1-2 per kg for gray hydrogen. This cost difference exists due to the price of renewable energy and expensive electrolyzers. But this gap should reduce as technology advances, economies of scale are realized, and the cost of renewable energy continues to decline. With the enormous benefits of GH2, there are enough incentives for all nations and global markets to take measures to reduce this gap in as little time as possible.

Supply chain, storage, and, H2 infrastructure are other major hurdles to mass adoption of the hydrogen economy. Being an extremely flammable fuel with high energy content, proper handling during production, transportation, and storage is very essential. Building codes and infrastructure to enable such a safe supply chain is critical, but will also need significant investment and time. Fortunately, several aspects of the hydrogen supply chain can be built in a similar manner as for natural gas. There's even a possibility of modifying existing natural gas infrastructure to handle GH2. Hydrogen can already be stored and transported as pressurized gas or cryogenic liquid in trucks, trains, and ships. It can also be stored in metal hydrides and on a large scale in naturally occurring underground caverns. Pipelines can also be built across long distances for the mass transportation of hydrogen to industries.

Technology advancement in the generation of GH2 is a critical challenge to overcome. Advancing existing GH2 generation technology and developing newer technologies is key to cost reductions of GH2. Components like catalysts and membranes need to come down, and innovations in electrolysis processes, such as alkaline, proton exchange membrane (PEM), and solid oxide electrolyzers, will be needed to improve efficiency and lower capital costs.

Lastly, policy and regulatory hurdles need to be overcome. Clear and consistent policies and regulations are essential to build a sustainable market for GH2. Governments will need to provide long-term incentives and build support mechanisms like feed-in tariffs, tax credits, and capital for research, to encourage investment of private capital in GH2 infrastructure and technology. Public awareness can also help in this regard. Educating the public about the benefits of GH2 and addressing concerns related to its safety, will gain wider acceptance. Building public support and engagement can help overcome potential resistance to new infra and tech for GH2.

deMITasse Energies

Need for a low carbon economy in India

Dr. Yogesh Kumar Singh
Head - Government Affairs & Policy,
Business Development and Strategy

India is working to reach its ambitious objective of 280 GW of solar power by 2030, and the industry is still debating how government and state policies might give it the boost it needs to succeed.

With capacity additions exceeding the 10 GW barrier for the first-time last year, India's solar industry had a landmark year. This gives reason for optimism that India will meet its goal of 500 GW of renewable energy by 2030. 280 GW of the 500 GW renewable energy target is designated for solar power. This indicates that through 2030, an additional 27 GW of solar capacity must be added yearly. The aim is undoubtedly difficult. But despite the difficulties the renewable energy sector faces, both industry and policymakers remain optimistic.

There are various obstacles to overcome; for example, the Basic Customs Duty (BCD) and Approved List of Models and Manufacturers (ALMM) limit the import of solar modules. This means that only solar modules developed in India may be purchased by developers. The ability to produce domestic modules is, however, constrained. Through programmes like the performance-incentive linked (PLI) programme for module manufacturing, the government has put a strong emphasis on fostering self-reliance.

Like this, the recently announced green energy open access policy and rooftop solar subsidies are positive milestones. These regulations are anticipated to influence consumers in the commercial and industrial sectors to choose solar. According to the National Institute of Solar Energy, assuming that 3% of the country's wasteland area is covered by solar photovoltaic modules, the country has a solar potential of roughly 748 GW.

The gross wind potential at 120 metres is 695 GW, according to the National Institute of Wind Energy. A number of the largest solar parks in the world have been established thanks to the nation's focus on creating large-scale renewable parks through the "Ultra Mega Power Projects" programme.

In addition, legislative assistance in the form of programmes like priority grid access for renewable energy sources has greatly increased utility-scale renewable capacity and attracted a sizable amount of private investment. Through programmes like the "Grid Connected Rooftop Solar Programme" and the "PM KUSUM" scheme for farmers constructing solar pumps and grid-connected solar," even small-scale renewable energy adoption has been promoted.

The industry has experienced difficulties controlling project costs and preserving profitability as the cost of renewable energy components increases as a result of supply chain and availability challenges. To control price hikes and the scarcity of solar modules, a local solar manufacturing ecosystem is required. "The renewable purchase obligations also need more stricter restrictions to ensure successful implementation. Another crucial component is resolving the conundrum of the state DISCOMs' cash flow issues, which the government is attempting to do by amending the Central Electricity Act.

Possibilities for longer-term financing, for which the government must develop regulations that adhere to the conditions of the power purchase agreement. "The government must provide interest rates that are globally competitive and increase the amount of financing available, either by creating a separate clean energy fund or by encouraging banks and other financial institutions to allocate more funds to clean energy." policies pertaining to land acquisition and connection. The list of substations with available injection capacity is now being published by states like Gujarat, Maharashtra, and Rajasthan.

The remainder of the nation needs to follow suit. The process for allocating connectivity at a specific substation must be open and transparent, and the list must be updated on a regular basis to reflect connectivity awarded since the last state tender.

Utility-scale, hybrid, peak power, and round-the-clock (RTC) installations should be the main focus. The need for RTC power would rise with higher adoption of renewable energy. "Economies of scale and the adoption of EVs will cause the price of energy storage to decrease as well. A substantial role will also be played by green hydrogen. It is an ambitious goal, so both the central and state regulatory commissions must collaborate to develop supportive regulations.

We need a uniform policy across all states to ensure stability and meet our renewable energy goals, and then state governments must address their specific local issues.

It will be crucial for all the states to work together and contribute to this endeavour, even though the central government has been introducing supportive policies to aid the sector in achieving the set target. The government has taken a number of steps to strengthen the DISCOMs' financial standing, which will contribute to the energy sector becoming more resilient in terms of capital flow.The government's aim of installing 280 GW of solar power by 2030 can only be reached with the implementation of strict regulatory measures, such as rewards for achieving objectives and sanctions for failing to do so. A yearly objective with accountability will guarantee that the objective is still attainable. To make this work, all enabling policies must be connected and supported by the states. For instance, if the government applies a fundamental customs duty to create a domestic supply chain, it must also make sure that enforceable procedures are in place up until the signing of the PPA to prevent a delay in procurement. Right now, that is the missing component.

The Union Minister for Power and New and Renewable Energy R. K. Singh has reiterated the need for India to keep adding energy capacity so that the nation can keep growing in the times to come. “What we need to be concerned about is the requirement of energy for our growth. There can be no compromise on this. Our electricity demand is growing rapidly. By 2030, energy consumption is expected to double.

We will need to add capacity so that our country can grow. Net Zero is important, but what is more important is that we ensure enough electricity for our growth. The living standards of our people will need to improve - and that will require higher per capita consumption of electricity”.

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Top 10 Leading Carbon Capture Companies

Carbon capture firms seek to bridge the gap between the energy transition and reliance on difficult-to-abate industries; we look at the top ten.

What appeared to be a pipe dream is slowly but steadily becoming a sustainable reality: large investments by major carbon capture firms have resulted in cheaper solutions, presenting a hopeful future for both companies and technology in carbon capture projects. This opens up new avenues for combating climate change by lowering greenhouse gas emissions, which is critical in achieving net-zero goals.

Global Thermostat
Carbon capture per year (in tonnes of CO_2): 4,000

Founded in 2010, Global Thermostat's DAC technology uses a patented process called the "Carbon dioxide Removal Assembly" (CDRA), which involves capturing CO_2 using a proprietary adsorbent material that is regenerated by a low-grade heat source.

Climeworks
Carbon capture per year (in tonnes of CO_2): 4,000

Climeworks is a Swiss company that specializes in direct air capture (DAC) technology, which involves extracting carbon dioxide directly from the atmosphere. Founded in 2009 by Christoph Gebald and Jan Wurzbacher, the company has become a prominent player in the carbon capture industry.

CO2 Solutions by SAIPEM
Carbon capture per year (in tonnes of CO_2): 11,000

CO2 Solutions is a carbon capture technology developed by the Italian engineering and energy services company Saipem, in 1997. The technology uses an enzyme-based approach to capture carbon dioxide from industrial emissions, such as those from power plants, cement factories, and steel mills.

CarbonFree
Carbon capture per year (in tonnes of CO_2): 800 million

CarbonFree is a company that employs patented technologies to capture carbon dioxide emissions from stationary point source emitters and convert them into carbon-negative chemicals.

LanzaTech
Carbon capture per year (in tonnes of CO_2): 150,000

LanzaTech is a biotechnology company that specialises in developing and commercialising carbon capture and utilization (CCU) technology. The company was founded in New Zealand in 2005 by Dr. Sean Simpson and has since expanded to locations around the world, including the United States, China, India, and Europe.

Carbon Clean
Carbon capture in 2022 (in tonnes of CO_2): 335,745

Carbon Clean Solutions Limited, also known as Carbon Clean, is a company that provides low-cost carbon capture technology to help reduce carbon emissions. The company was founded in 2009 and is headquartered in London, UK, with additional offices in India and the United States.

Aker Carbon Capture
Carbon capture per year (in tonnes of CO_2): 400,000

Aker Carbon Capture, a subsidiary of Aker Solutions, is a leading player in the carbon sequestration industry. Aker Carbon Capture utilises its own proprietary carbon capture technology to capture CO_2 from waste flue gases generated by various industries, such as oil refineries and cement plants.

Carbon Engineering
Carbon capture per year (in tonnes of CO_2): 1 million

Carbon Engineering established itself as a prominent player in the industry. Its unique liquid DAC technique, which employs a potassium hydroxide solution to trap CO_2, has garnered confidence and investments from renowned names such as Chevron, Occidental, Airbus, Air Canada, and Bill Gates, among others.

Quest Carbon Capture & Storage (SHELL)
Carbon capture per year (in tonnes of CO_2): 1.2 million

Quest Carbon Capture and Storage is a project developed and operated by Shell Canada, which involves capturing and storing carbon dioxide (CO_2) emissions from a bitumen upgrader plant in Alberta, Canada.

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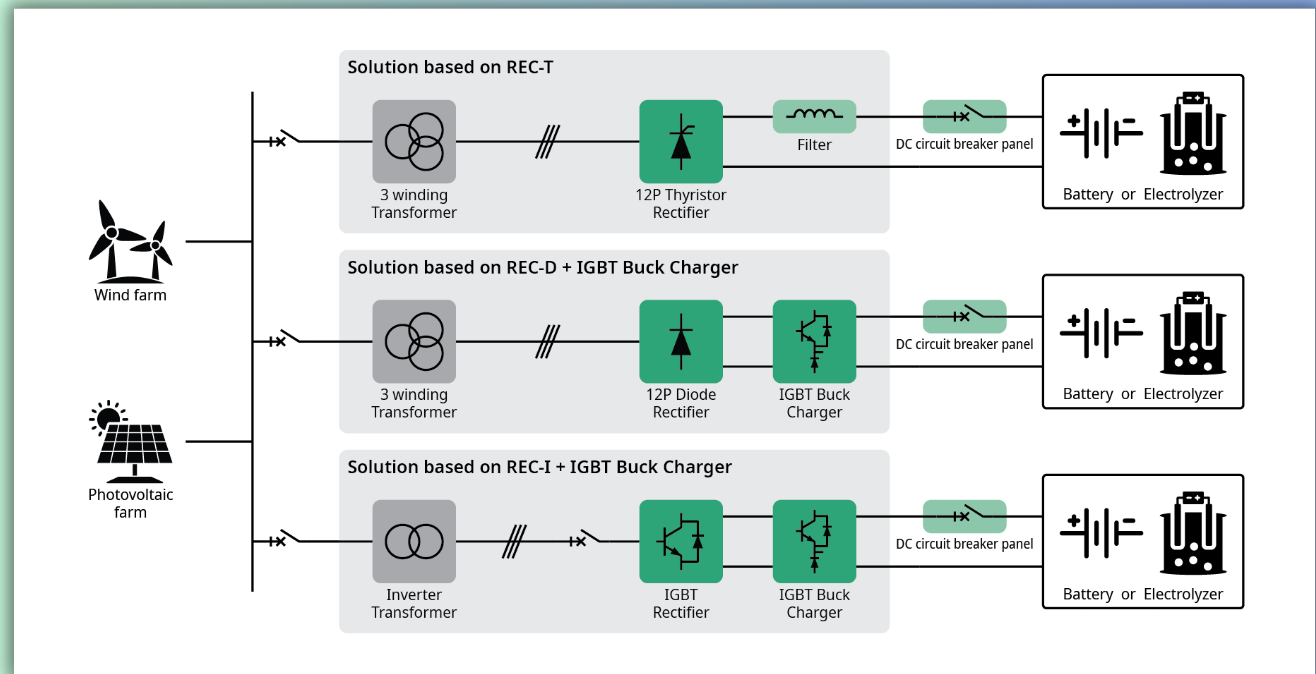
Types of Rectifiers used in Green Hydrogen

Power units for green hydrogen production refer to the sources of power or energy systems used to generate electricity for electrolysis. These power units supply the necessary electricity to drive the electrolysis reactions and facilitate the production of green hydrogen.
Power units for green hydrogen production typically involve renewable energy sources like solar, wind & Other Renewable Energy Sources, as the goal is to produce hydrogen without contributing to greenhouse gas emissions.

Power conversion and control systems are crucial elements of the green hydrogen production process, in addition to the power units themselves. These systems contain inverters and converters that make it possible to combine electrolyzers with renewable energy sources. They facilitate the conversion of electricity produced by the power units into the proper form and voltage needed for effective electrolysis. Technology advancements in power management and grid synchronisation guarantee the reliability and compatibility of the power supply for electrolysis processes.

The power consumption of electrolysis to generate green hydrogen varies depending on several factors, including the type of electrolyzer used, the operating conditions, and the desired production rate. Generally, electrolysis is an energy-intensive process, and the power consumption is measured in kilowatt-hours (kWh) per cubic meter (m^3) or kilogram (kg) of hydrogen produced.



Rectifiers are used to convert alternating current (AC) to direct current (DC). In the context of green hydrogen generation, rectifiers play a crucial role in providing the necessary DC power for electrolysis.

The primary function of a rectifier in green hydrogen production is to convert the AC power from the electrical grid or renewable energy sources into the DC power required by the electrolyzer. This DC power is then utilized to drive the electrolysis reactions and facilitate the production of green hydrogen.

There are different types of rectifiers commonly used in green hydrogen generation:

Diode Rectifiers: Diode rectifiers are the simplest type of rectifiers and consist of diodes arranged in a bridge configuration. They allow current to flow in one direction (from the positive terminal to the negative terminal) and block it in the reverse direction. Diode rectifiers are relatively inexpensive and widely used for small-scale electrolysis systems or in situations where the power demand is low.

Thyristor Rectifiers: Thyristor rectifiers, also known as silicon-controlled rectifiers (SCRs), use semiconductor devices called thyristors for rectification. Thyristors are capable of handling higher power levels than diodes and offer more precise control of the DC output. Thyristor rectifiers are commonly used in medium to large-scale electrolysis systems where higher power requirements are necessary.

Pulse Width Modulation (PWM) Rectifiers: PWM rectifiers are a more advanced type of rectifier that use pulse width modulation techniques to control the output voltage and current. They can provide smooth and precise control of the DC power output, allowing for efficient operation of the electrolyzer. PWM rectifiers are often used in high-power electrolysis systems or in applications where dynamic power control is required.

The selection of the rectifier type depends on factors such as the power requirements of the electrolyzer, the desired level of control, the availability of electrical infrastructure, and the specific project requirements. Efficiency, reliability, and cost considerations also play a role in choosing the appropriate rectifier technology.

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Textile Industry Carbon Footprint

India's textile industry, which accounts for 4% of global textile and apparel trade, is predicted to increase at a compound 10% annual rate to $190 billion by 2026. The industry creates jobs and draws a lot of investment, thanks to large domestic and overseas demand. However, this developing business relies heavily on coal and natural gas to produce energy and heat, which contributes to its growing carbon impact.

Globally, the textile and garment sector accounts for6%-8% of total carbon emissions, amounting to 1.7 billion tonnes of annual CO_2 emissions per year.

One single cotton t-shirt requires 2,700 litres of water, while 5.9 trillion litres of water are used annually for dying fabric, according to the World Resources Institute.

The dying and treatment process of textiles contributes 20% of industrial water pollution in the world and 8,000 synthetic chemicals are used to turn raw materials into textiles.

The industry also has an array of other issues, like the complexity of its supply-chain networks and the panoply of stakeholders for raw materials; any sustainability measures therefore require the involvement of all contributors, as well as a transparent system for tracing emissions contributions and changes.

With the high environmental impact, but large room for improvement, it is very probable that measures to implement sustainability in the textiles sector will have a significant impact. With this goal in mind, the government's Ministry of Textiles has signed a cooperation agreement between the United Nations' Environment Programme and The Cotton Corporation of India to ensure circularity and mainstream sustainability in the supply chain.

Conscious manufacturers are hence making concerted efforts to introduce sustainability by using innovative materials, using safe dyes, reducing water and energy consumption, treating waste material and ensuring a greater focus on reducing, reusing and recycling.

An important aspect is shifting gears from linear to circular operations, ensuring that both pre-consumer and post-consumer waste are controlled. Zero Liquid Discharge, for instance, is a wastewater treatment process that removes all liquid discharge from a system. Apart from prioritising organic fabrics, the focus of the sector is all about conserving the natural environment. Other projects, like processing PET bottles to make recycled polyester fibres, are also underway.

This has triggered the movement towards slow fashion that works on a 'fit-to-demand' model, reducing surplus and investing in garments that have a long life. With new innovations like 3D printing and new age fabrics made from hemp and bamboo, these changes come as first steps in a long journey towards sustainability

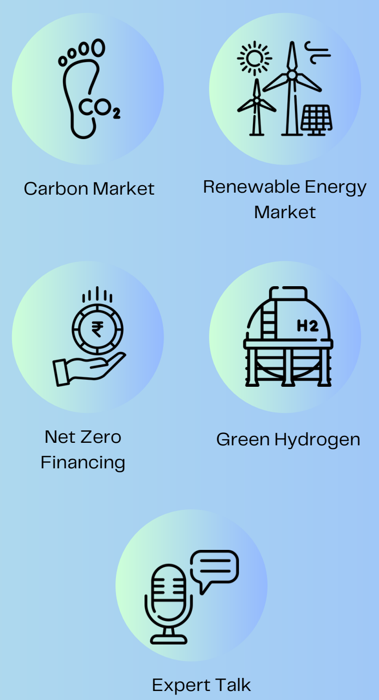
Content Credit: FairPlanet

About Net Zero Wired

In an era marked by pressing climate concerns, the world is increasingly recognizing the urgent need for sustainable practices and renewable energy sources. Among the countries at the forefront of this global movement is India, a nation poised to revolutionize its energy landscape and embrace a net-zero future. Net Zero Wired, a groundbreaking digital platform, has emerged as a vital hub where India's sustainable ambitions and achievements converge.

Net Zero Wired serves as an all-encompassing platform, catering to the growing demand for knowledge, insights, and updates on net zero initiatives in India. With a multifaceted approach, the platform not only disseminates news and information but also features a captivating podcast that engages industry experts in thought-provoking discussions surrounding India's roadmap to a net-zero economy.

Net Zero Wired is a pioneering digital platform that plays a pivotal role in India's sustainable revolution. By providing a comprehensive and accessible resource, it empowers individuals, businesses, and policymakers with knowledge, insights, and updates on renewable energy, the carbon market, green hydrogen, and net-zero initiatives in India. With its engaging podcast series, the platform serves as a catalyst for inspiring conversations and collective action, driving India toward a greener and more sustainable future.



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