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# Greentech

*Sustainable Technology For the Future*



Electric Vehicles- The Future is Bright Ahead  
*by Rehan Husain*

Green Business Ideas for Aspiring Entrepreneurs  
*by Srivani Mandapaka*

Green Technology Round-up of 2021  
*by Touluka Das*

# Peek into the future of technology

We bring our readers:

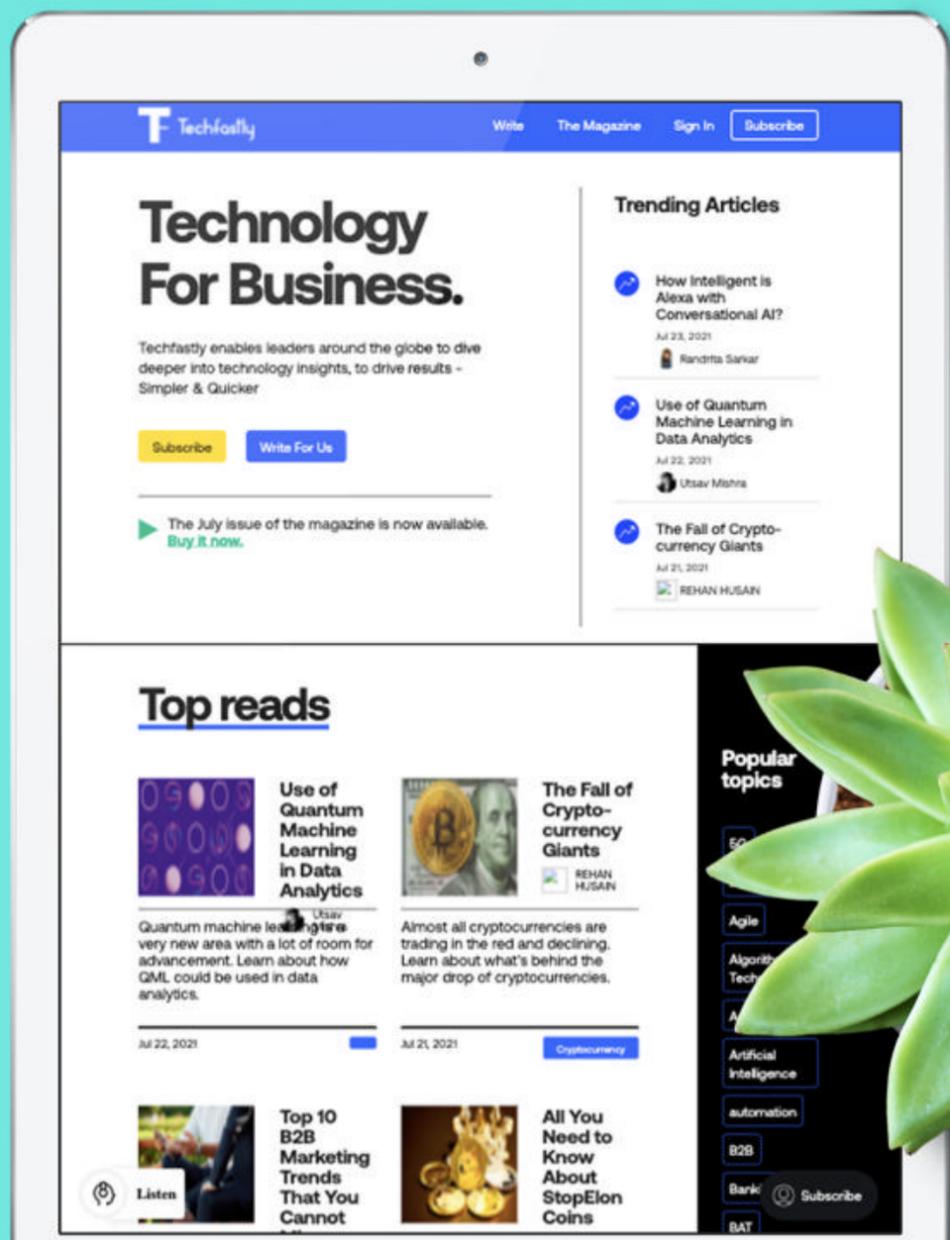


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## Editor's note

To A  
New Year of  
Sustainability

Dear Readers

The Recovery Act, which helped save the economy and prevented us from going into the great depression, was the largest investment in green technology and education. We rebuilt roads and bridges - Barack Obama.

A green economy is low in carbon emissions, makes effective use of natural resources, and is open to all members of society. Public and private investment in such economic activities, infrastructure, and assets reduces carbon emissions and pollution. Improved energy and resource efficiency, prevention of biodiversity loss, and ecosystem services are the key drivers of green economy revenue. "Green Economy" does not mean that sustainable development should overtake green economics. Instead, it is a reorientation of global economics, investment, capital, and infrastructure.

According to the World Energy Outlook 2020, an estimate of around 2 billion tons of emission reductions can take place by 2030. It doesn't really have a lengthy to-do list for that. Employing minor changes such as walking shorter distances, flying less, or resetting air conditioners can significantly impact. To that end, presently, big tech companies have been working toward carbon offsetting, direct air capture technology, other carbon capture, and utilization and storage (CCUS) solutions. Furthermore, many corporations are investing in clean energy technologies like wind and solar energy, geothermal, advanced nuclear energy, and green hydrogen.

According to the World Green Building Council, "construction and building are responsible for 39% of global carbon emissions". Businesses have a responsibility to reduce energy use and carbon dioxide emissions. Intelligent solutions such as radio-controlled heating control systems or on-demand lighting are natural steps toward achieving this aim while saving on hidden expenses.

The green economy aims to improve manufacturing and consumption practices across the entire life cycle of processes and products. In contrast, resource efficiency focuses on creating value for society by reducing waste generated per unit of product or service. The green economy is a macroeconomic strategy for long-term economic growth that places a premium on investments, jobs, and skills development.

If one subject has persisted over the last two decades, it is the green economy and sustainability. People are attempting to live sustainably by recycling, using less plastic, riding bikes, taking public transportation, and purchasing locally produced items. As private and public entities collaborate on technological developments to achieve zero carbon emissions, we hope to see a carbon-free future sooner than envisioned.

In that spirit, let us welcome the new year with the hope of a sustainable future.

Happy New Year!

*Srikant Rawat*

Chief Operating Officer, Techfastly

## Missed an Issue?

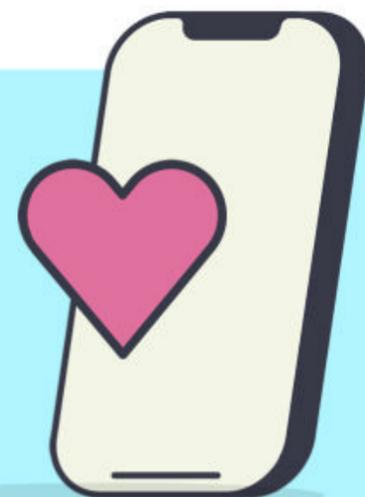
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# GREENFLATION

## Is It an Upward Road to Economic Doom?

*by Toulika Das*

In the struggle against climate change, the global population is increasingly confronted with a conundrum. The more the advocacy is for a greener economy, the more expensive it gets, and the less likely it is to live up to its potential of minimizing the worst consequences of global warming.

Green Marketing Comes at a Cost, and Environmentalists Must Pay Attention To It.





The expenses associated with turning green, may be a worry in several businesses in the medium term.

With sustainability gaining traction across sectors, industries, and regions, we decided to take a deeper look at one of the less-considered but potentially important macroeconomic consequences of increased green investment: Inflation.

## Greenflation As A Serious Concern For Climate Action

According to Vaibhav Chaturvedi, a researcher at the Council on Energy, Environment, and Water (CEEW), “Greenflation,” or the expenses associated with turning green, may be a worry in several businesses in the medium term. Materials such as tin, aluminum, copper, nickel, and cobalt, which are required for energy conversion technologies, have seen price increases of 20% to 91% this year. Chaturvedi, on the other hand, regarded the lower cost of financing for “green projects” as offsetting the rise in commodity prices.

According to Harry Boyd Carpenter, managing director for the renewable energy industry and climate change at the European Bank for Reconstruction and Development (EBRD), overall prices for the business will trend lower because there are minimal impediments to scaling up.

According to Allied Industry Research, the worldwide renewable energy market would more than quadruple to approximately \$2 trillion by 2030, from \$881 billion in 2020.

As a result, they told the Reuters Global Markets Forum last week that growing prices will not

pose a long-term threat to renewable energy's economic sustainability. As miners scale up to meet the ever-increasing demand, neither will supplies.

Lack of investment in oil and gas as a result of environmental impact in the market may undoubtedly increase the price of petroleum, according to Steven Desmyter, co-head of responsible investment at Man Group, an investment management business.

He stated in a recent blog post that oil companies' exploration and production investment has dropped as they focus more money on renewables. Because there is no new drilling to assist fulfil demand when demand rises post-pandemic, he predicts that prices will rise.

Desmyter told E&E News in an email that the greenflation phenomenon is still a huge concern in market dynamics in the long run. Green policies may have an impact on the oil industry's basic fundamentals over a certain time if the volume of oil accessible falls before the amount required does.

## **Green Marketing Comes at a Cost, and Environmentalists Must Pay Attention To It**

The executive decision-makers of the corporate world and several investors are fascinated by the interface between environmental, social, and governance (ESG) variables and economic resource performance – not least because, regardless of whether we are looking at independent directors' participation or emissions intensity, sustainability has a clear and realistic link with the truth of the matter.





This current episode of rising prices has a number of well-known reasons. Those voicing the alarm have a variety of motivations, ranging from real economic analysis to ideological efforts to prevent more stimulus expenditure. Beyond the COVID-19 pandemic, however, there's a new dynamic in the equation this time: green policy measures and the broader Environmental, Social, and Governance (ESG) movement for socially responsible investment.

Despite inflation and supply chain interruptions, Gauri Singh, deputy director-general of the International Renewable Electricity Agency (IRENA), stated that lower finance costs contributed to a record output of 260 gigawatts of energy from renewable sources last year.

**"Anything that poses a climate danger will not be sold for a low price. The market for renewables, on the other hand, is softening"**  
Singh said.

However, when we are talking about prices rising due to 'greenflation', we must keep one thing in mind. Some of these price hikes, according to specialists, are attributable to climate change. Let's take coal for example. Coal is more costly since lesser numbers of U.S. miners are supplying enough to fulfill



market demand, although steel is more highly priced partly just because a few steelmakers have hesitated to reactivate unused blast furnaces, fearful of growing output and increasing their greenhouse emissions or carbon footprints. Metals such as copper and nickel have only lately begun to recover from pretty big bull runs fueled by limited supplies to fulfill the needs of the rising renewable energy industry.

In the meantime, environmentalists emphasize the extremely real world consequences of climate risks such as storms and severe flooding on distribution networks and argue that increased customer prices should not deter actions that could ensure the earth remains livable for human existence.



# What Could Greenflation Do to The Economic Stability of Renewable Energy?

In an endeavor to profit from the enormous levels of income, manufacturers overproduce and develop surplus production capacity, resulting in inefficient supply allocations. Consequently, inefficiencies and inflation will stifle economic development and can frequently signal the start of an economic downturn.

To put it another way, an overheated economy is one that is growing at an unsustainable rate. Rising inflation rates and an unemployment rate that is lower than the average rate for an economy are the two key symptoms of an overheated economy.

Renewable sources of energy are critical to achieving long-term energy production since they release considerably fewer greenhouse emissions than fossil fuels.

The green transition will necessitate the use of fossil fuels, but sources are limited.

Permit fees, labor expenses for installation, and the money spent to attract new clients are all examples of overhead costs that may be lowered through economies of scale.

According to Reuters, growing costs, as well as access to raw materials and supply chain issues for some of the commodities and items required for green projects, will not pose a long-term hazard to renewable energy's economic sustainability.

Greenflation is a danger that extends beyond instances when supply is restricted to reduce its carbon footprint. Scientists are also concerned about a surge in demand for sustainable energy in the United States without sufficient mineral supply to support it.

## Instances of Exorbitant Rise in Prices Due to Greenflation

External environmental factors, socioeconomic, and democratic accountability, or ESG, pressure, and transition regulations are possible to induce a supply bottleneck without reducing dependency on fossil fuels, according to many industry experts. Experts, on the other hand, caution against seeing a grim reaper in today's soaring fuel costs.

There's no denying that prices are rising, a sign of the economy's post-pandemic recovery, which is beginning to affect consumers and fuel political mudslinging. As gas prices reach new highs, natural gas-heated households are projected to have a very costly winter season.



According to the US Energy Information Administration, over half of American families who use gas to warm their homes will face a 30% hike in their energy costs this winter especially in comparison to last. If this winter is 10% colder than the previous one, the cost will increase by 50%.

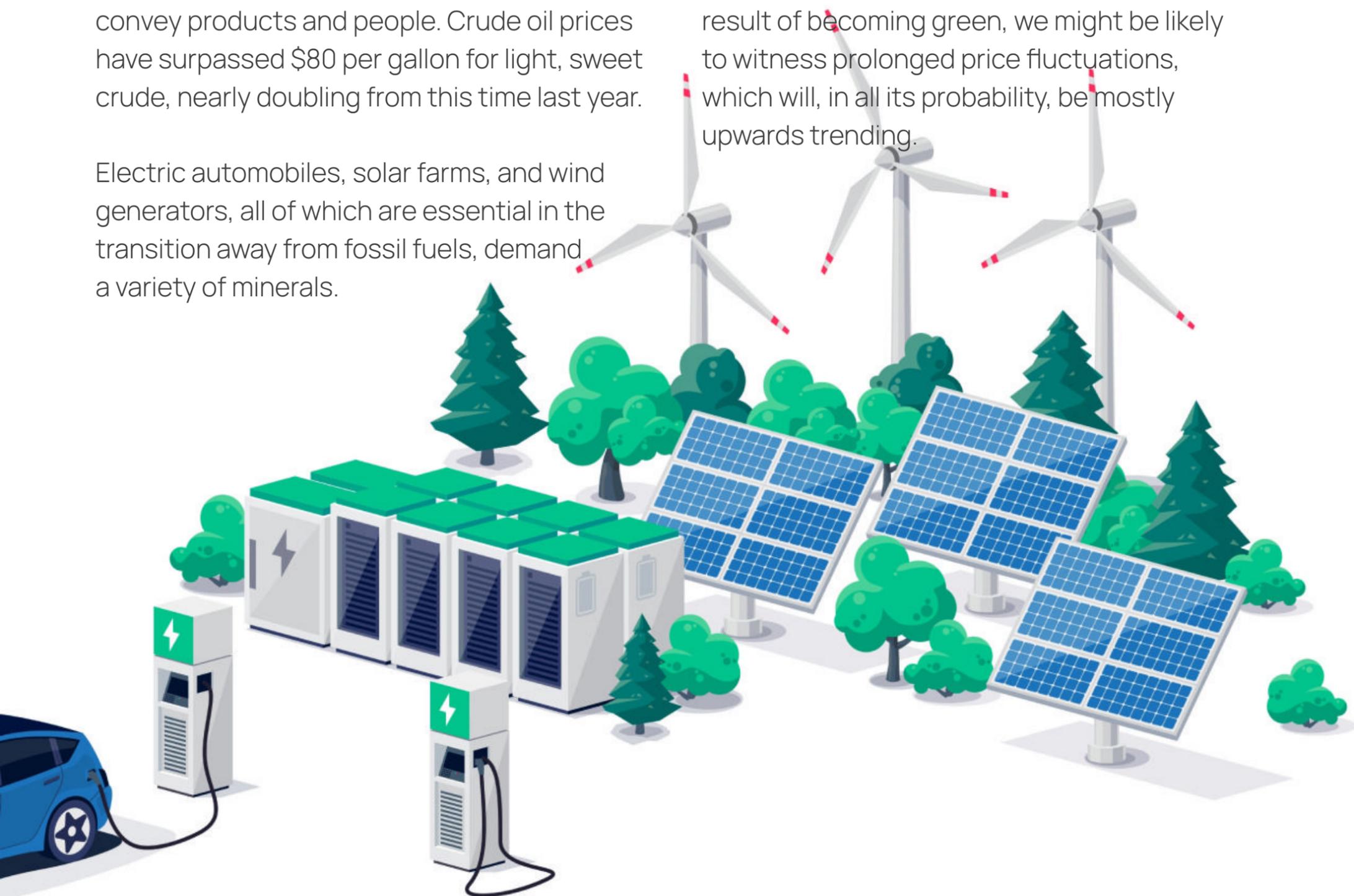
There are also gas prices, which have risen from near-record lows in 2020, when pandemic lockdowns halted aircraft, paralyzed workplace commutes, and forced leisure cancellations.

As the economy improves, so does the demand for transportation fuel, driving increasing the cost of the fuels used to convey products and people. Crude oil prices have surpassed \$80 per gallon for light, sweet crude, nearly doubling from this time last year.

Electric automobiles, solar farms, and wind generators, all of which are essential in the transition away from fossil fuels, demand a variety of minerals.

Copper, lithium, cobalt, and nickel, among other minerals, are all in low supply. Module costs in the solar sector have already risen by around 20% this year, with the entire impact projected in 2022, according to rating company Fitch Ratings. According to Fitch, the price rise is mostly due to higher expenses of getting raw materials such as polysilicon, aluminum, and copper.

The idea that more effective energy solutions would come at a higher cost could contribute to higher inflation and might have far-reaching ramifications for businesses, central banks, and governments, and many other organizations throughout the world. As a result of becoming green, we might be likely to witness prolonged price fluctuations, which will, in all its probability, be mostly upwards trending.



An aerial photograph of a dense green forest. A large, semi-transparent white flower with many petals is overlaid on the left side of the image. The text is positioned on the left side of the page, partially overlapping the flower and the forest background.

# A Key to Carbon-Free-Economy Green Hydrogen Ushers Us into The Future

*by Randrita Sarkar*

The planet is transitioning to clean, low-carbon energy sources at an unprecedented rate and scale. New technologies must be developed to replace fossil fuels for a carbon-neutral economy. Hydrogen has long been touted as the fuel of the future since it is abundant, inexpensive, and clean-burning.

It's difficult to transport, may corrode metal, and is 20 times more explosive than gasoline. However, "green hydrogen" — hydrogen produced without the use of fossil fuels — has recently been found as a renewable energy source that might help the world achieve net-zero emissions.

## **Why Is Hydrogen Used As A Source of Energy?**

From the usage of hydrogen cells for electricity delivery in the Athletes' Village to the construction of over 160 hydrogen stations for fuel cell cars, hydrogen technology was used to power the 2020 Tokyo Summer Olympic Games.

IT'S TIME TO GO

# GREEN HYDRO GEN

As an early adopter and developer of hydrogen-powered technology, Japan aims to cut emissions to less than a tenth of the present levels by 2050.

From carbon-free freight transportation to the portability of portable hydrogen "capsules," here are five reasons why hydrogen is a safe, clean, and economical option.

## NO CARBON EMISSIONS

The transportation industry, which is heavily reliant on fossil fuels for energy, accounts for a startling 20% of worldwide CO2 emissions. Fuel cell cars, which use hydrogen gas to power an electric engine, release only heat and water by-products, which might solve this problem.

## INCREASED DRIVING RANGE

One significant advantage of hydrogen is the simplicity with which it may be stored, delivered, and utilized. As a result, countries with limited areas for wind and solar technology will be able to profit from carbon-free energy.

## DECARBONIZATION

Steel and chemical manufacturing has long been recognized as an emissions-heavy industry due to the massive number of fossil fuels employed. However, hydrogen-powered technology is gradually altering things.





## EASE IN USING

One significant advantage of hydrogen is the simplicity with which it may be stored, delivered, and utilized. As a result, countries with limited areas for wind and solar technology will be able to turn a profit from carbon-free fuel.

## USED IN SPACE TRAVEL

The Apollo moon landing missions in 1967 were the most noteworthy uses of hydrogen, with NASA using 363 feet tall valves fuelled by liquid hydrogen, liquid oxygen, and kerosene to propel its rockets.

The "Saturn V" rockets were and still are thought to be the most powerful rockets ever created.

## Diverse Energy Sources

- Natural gas
- Renewable sources (wind, solar, biomass)
- Nuclear
- Coal (with carbon sequestration)

## Diverse Applications

### FUEL

- Fuel cells
- Engine/turbines
- Energy storage

### CHEMICALS

- Petroleum recovery and refining
- Methanol production
- Electronics
- Ammonia production
- Metal production and fabrication
- Food processing
- Cosmetics

# The Colour Spectrum of Hydrogen

Blue hydrogen, brown hydrogen, green hydrogen, and even turquoise hydrogen, yellow hydrogen, and pink hydrogen are all forms of hydrogen. They are simply colour codes or nicknames used in the energy business to distinguish between different forms of hydrogen. Different colours are attributed to hydrogen depending on the manner of manufacturing employed.

## Green Hydrogen

Green hydrogen is the colour created with no damaging greenhouse gas emissions in the kaleidoscope of hydrogen colours. We use the electrolyzation process to produce green hydrogen. This approach uses an electrical current to separate hydrogen from oxygen in the water. If the power required for electrolysis is obtained from renewable sources such as solar or wind, no greenhouse gas emissions are produced. Electrolyzers employ an electrochemical reaction to divide water into its constituents, hydrogen and oxygen, while producing no carbon dioxide.

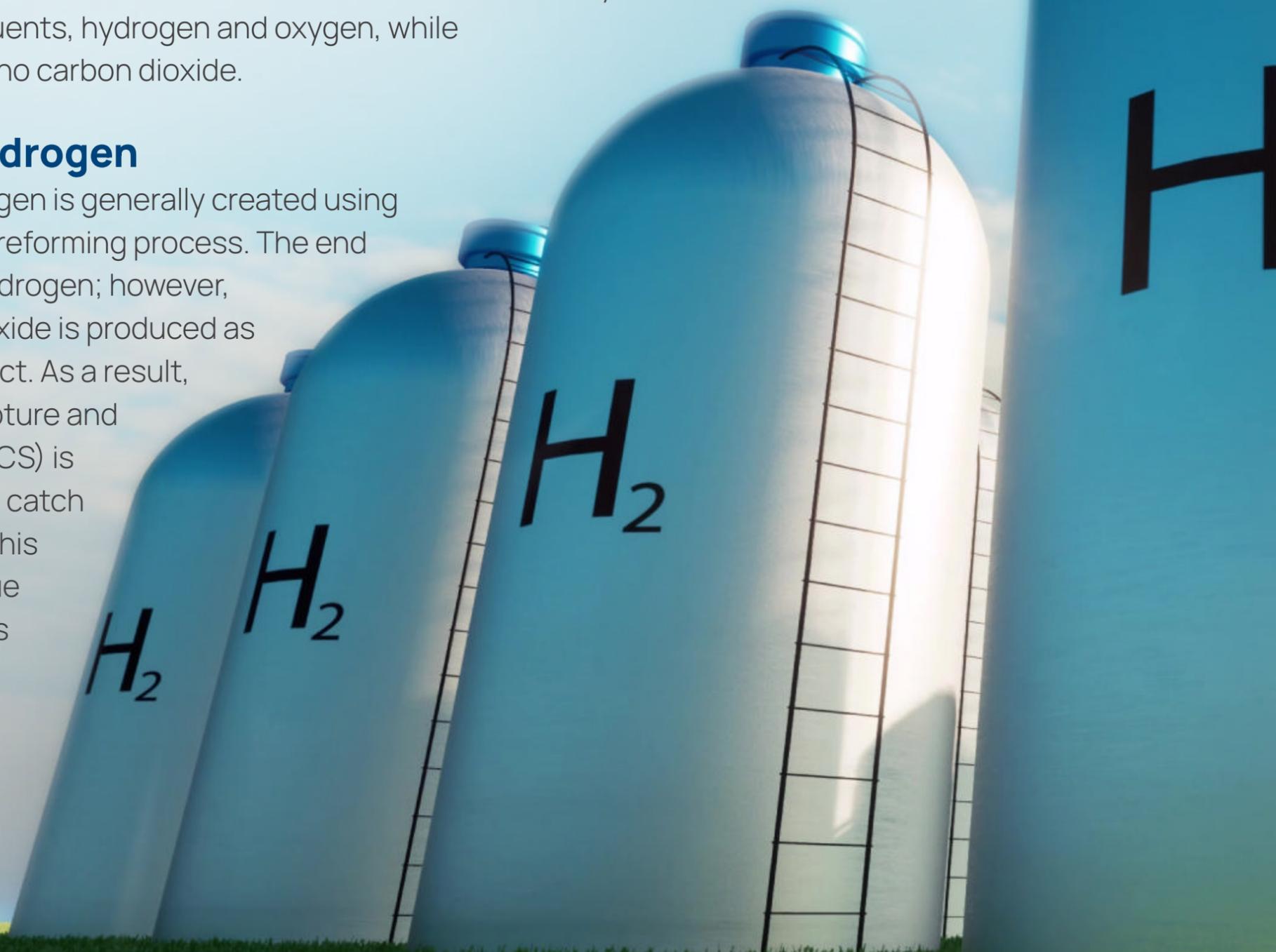
## Blue Hydrogen

Blue hydrogen is generally created using the steam reforming process. The end result is hydrogen; however, carbon dioxide is produced as a by-product. As a result, carbon capture and storage (CCS) is required to catch and store this carbon. Blue hydrogen is frequently

referred to as 'low-carbon hydrogen,' despite the fact that the steam reforming method does not prevent the production of greenhouse gases.

## Grey Hydrogen

Grey hydrogen is hydrogen that is generated from fossil fuels like natural gas. Regrettably, this accounts for about all of the hydrogen generated in the globe today.



## Brown and Black Hydrogen

This type of hydrogen is generated by using black coal or lignite (brown coal) in the hydrogen-production process, these black and brown hydrogen are the polar opposites of green hydrogen in the hydrogen spectrum and the most environmentally harmful.

## Pink Hydrogen

Pink hydrogen is created using nuclear-powered electrolysis. Purple hydrogen and crimson hydrogen are other names for nuclear-produced hydrogen.

## Turquoise Hydrogen

This is a new addition to the hydrogen colour chart, and scale production has yet to be shown. Turquoise hydrogen is created by a process known as methane pyrolysis, which produces hydrogen and solid carbon.

## Yellow Hydrogen

Yellow hydrogen is a relatively recent term for hydrogen produced using solar-powered electrolysis.

## White Hydrogen

White hydrogen is a naturally occurring geological hydrogen found in subsurface deposits that are produced by fracking. At the moment, there are no plans to utilize this hydrogen.

Some hydrogen colours may wane in relevance in the future, while others may blaze brighter. What is clear is that the hydrogen rainbow will play a big part in attaining net-zero as we shift away from our historical reliance on fossil fuels and toward green options to power our homes, companies, and transportation.



# Why Is Green Hydrogen Suddenly Becoming So Popular?

Electrifying the energy infrastructure and using clean, renewable energy is one way to reduce carbon emissions. However, compared to combining renewable energy with low-carbon fuels, electrifying the whole energy system would be difficult, if not impossible. On the other hand, alternative low-carbon fuels have their own set of problems, not the least of which is cost. Why not stick with the original product, considering that the bulk of them require the production of green hydrogen as a precursor?

Because hydrogen is already widely used in industry, proponents claim that technological challenges connected to storage and delivery are unlikely to be insurmountable. In addition, the gas has the potential to be highly versatile, with uses ranging from heating to long-term energy storage to transportation.

Green hydrogen has the potential to be used across a wide range of sectors, a growing hydrogen fuel economy might help a large

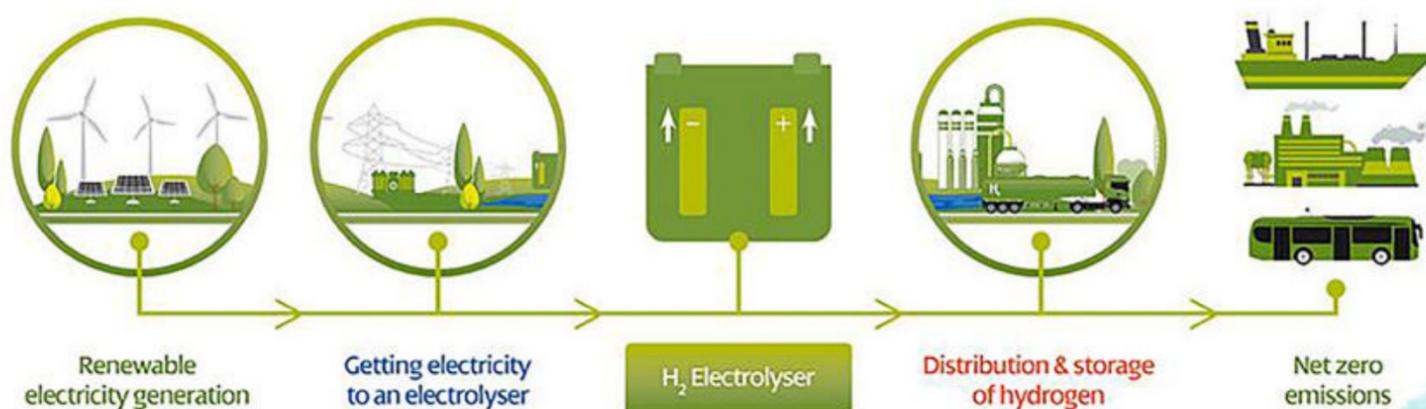
number of firms. The oil and gas businesses are undoubtedly the most important among them, as they are progressively being forced to lessen their dependency on fossil fuels. Green hydrogen generation would need enormous investment and scale, which the oil companies are well-positioned to provide.

## How Do You Keep and Utilize This?

In theory, green hydrogen may be used for a variety of purposes. It can be mixed with natural gas and used in thermal power plants or district heating facilities. It may be utilized as a source for other energy carriers like ammonia and synthetic hydrocarbons, or it can be used to power energy storage in cars and ships directly.

To begin, it may simply be used to replace the industrial hydrogen produced each year from natural gas, which amounts to around 10 million metric tonnes in the United States alone.

The key challenge in meeting all of these prospective markets is delivering green hydrogen to where it is required. It is difficult to store and transport the highly



Source: Scottish Power

combustible gas since it takes up a lot of space and tends to make steel pipelines and welds brittle and prone to failure.

## Cost of Green Hydrogen

According to the DOE, renewable energy hydrogen, also known as green hydrogen, presently costs around \$5/kg. The DOE stated the strategy is targeted at assisting demonstration projects and breaking down barriers to deploying hydrogen at scale to increase hydrogen production from renewable power, nuclear, and thermal conversion.

Competitive hydrogen produced from renewables has emerged as a significant

component of the energy mix as the world's economies attempt to attain carbon neutrality. According to the paper, falling renewable energy costs and improved electrolyzer technology might make "green" hydrogen cost-competitive by 2030.

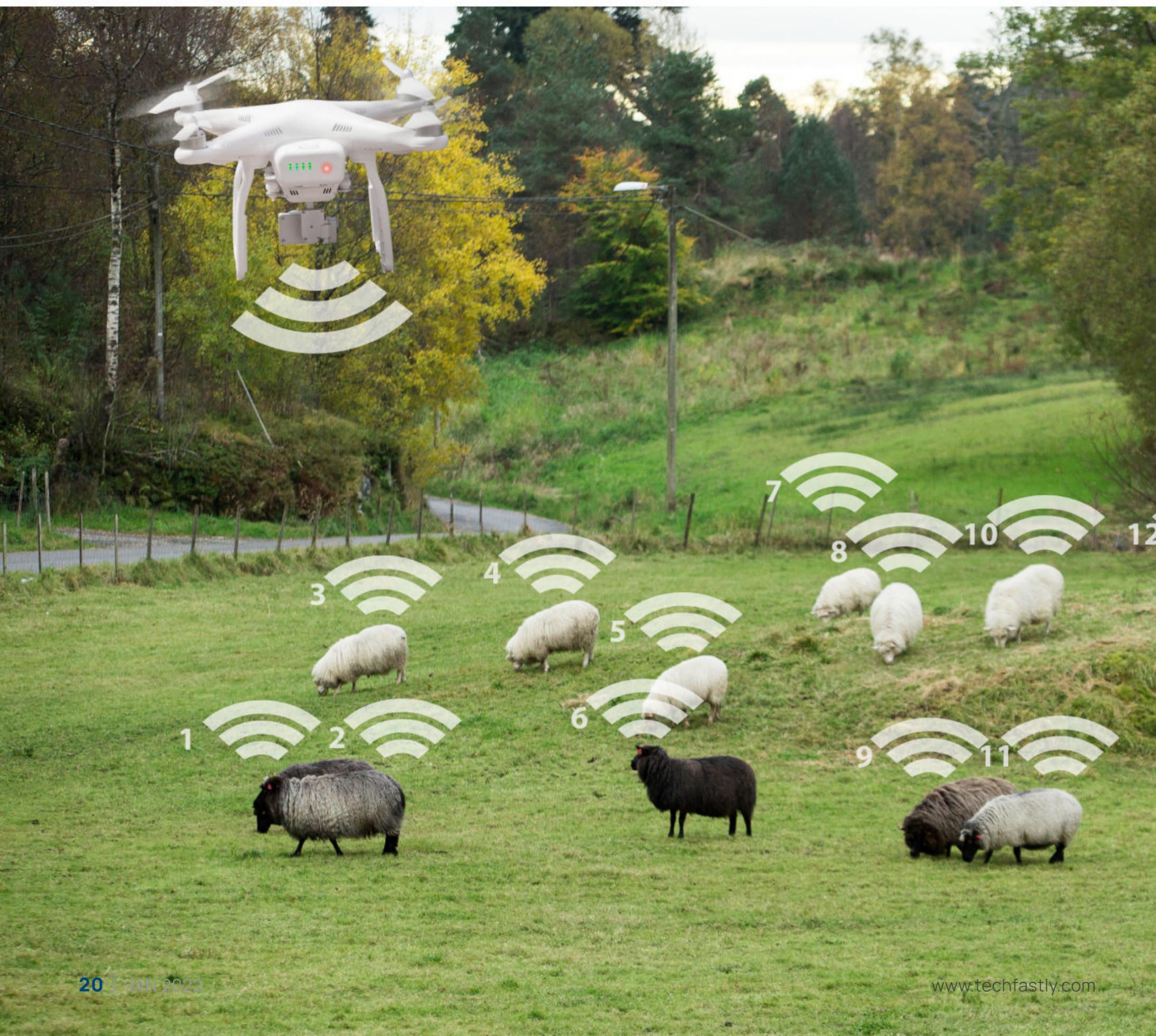
Whatever the future holds, it is evident that green hydrogen has a solid potential to become the fuel of the future, assisting civilizations in their efforts to decarbonize. The futuristic benefits of hydrogen are invigorated and provide a promising vision for the energy transition. Over the previous three years, product commercialization has increased this sector's growth. Improvement in the cost and performance of hydrogen-related technologies and the entire value chain would contribute to the emergence of a green hydrogen revolution.



# Going Green with The Internet of Things (IoT)

by Umar Nabi

Kevin Ashton coined the term "Internet of Things" during a 1998 presentation in which he said, "The Internet of Things can revolutionize the world, just as the Internet did. Maybe even more".



There is a growing awareness in businesses that they are going green – there are significant side effects from reducing the company’s carbon footprint, conserving resources, and protecting the environment. This is also good business.

Environmental issues affect many plants, but with the rapid spread of the Internet of Things (IoT), efficient, economical, and sustainable solutions are available. Innovative embedded IoT products benefit the environment while addressing some of these business challenges. It concludes by looking at IoT’s exciting capabilities to provide economically and environmentally conscious solutions.



## What is Green IoT?

Green Internet of Things (IoT) represents the concept of reducing IoT devices consumption and making the environment safer. It has been described in IoT as an energy-efficient way to either reduce the greenhouse effect caused by existing applications or eliminate it in IoT itself.

In general, the Green IoT is a low-power version of the IoT and is seen as the future of the IoT, which is "environmentally friendly."

The total installed base of IoT-connected devices worldwide is estimated at 30.7 billion by 2020.

**In addition, this amount will increase to 75.4 billion devices by 2025.**

By 2021, there will be more than **10 BILLION** active IoT devices.

It is estimated that by 2030, the number of active IoT devices will exceed **25.4 BILLION.**

**83%** of organizations have improved their performance by introducing IoT technology.

## Enabling Technology For Green IoT

The deployment of IoT in the real world is possible only with the help of many technologies. Here, we discuss highly relevant technologies and focus on the green aspects that strengthen the green IoT era.

# 1

### Green RFID Tags

"Communication anytime, anywhere" has long been a dream and driven by advances in wireless communication technologies. Today, the ratio between radio and humans is almost one to one. Size, energy consumption, and cost-reduction radio lead to its integration into almost every object. One of the most promising wireless systems to enable IoT is RFID. RFID is used for which they are connected. There are two types of RFID.

**ACTIVE TAGS:** They have built-in batteries that constantly transmit their signals.

**PASSIVE TAGS:** They store energy from the reader.

**Green RFID tags represent the concept of reducing the size of RFID tags. Thus reducing the amount of non-degradable material.**

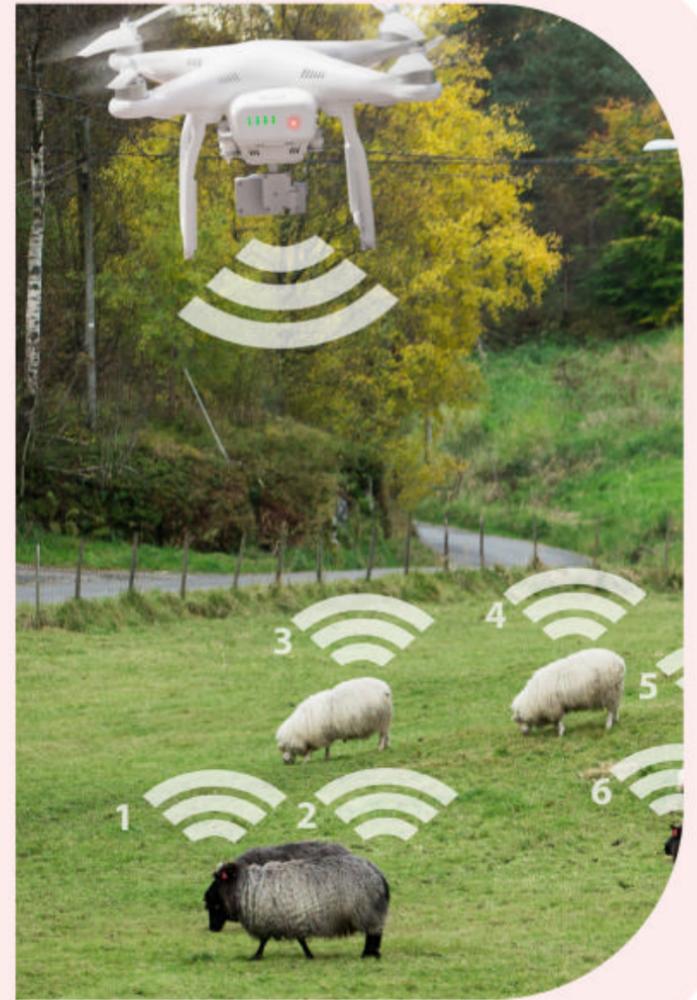


# 2

## Green Sensing Networks (WSNs)

The fusion of sensing and wireless communication has led to the emergence of Wireless Sensor Networks (WSNs) and represents a key enabling technology that helps IoT flourish. Recently, WSNs have been proposed for a variety of applications, such as fire detection, object tracking, and environmental monitoring. Accordingly, the commercial use of WSNs is expected to increase dramatically soon.

**This includes storing capacity requirements as well as implementing smart data algorithms to reduce data size.**



# 3

## Green Cloud Computing

The rapid expansion of data centers, the rapid development of cloud computing have led to a dramatic increase in energy consumption and the impact on the environment in terms of carbon footprints.

**Green Cloud Computing is an exercise in implementing policies and procedures to reduce the power consumption of data centers**

(i.e. alerting them to energy and shutting down inactive devices in the network and routing their packets.)



# 4

## Green M2M

Since a large number of machines involve machine-to-machine or M2M communication, there should be energy-saving routing algorithms and transmission power and optimized communication protocols. In addition, passive nodes should be constantly monitored to save energy.

# 5

## Green IoT and Beyond with 5G

In recent years, information technology trends such as cloud computing and Edge Cloud, artificial intelligence, and security assurance have accelerated the IoT ecosystem.

Similarly, implementing Green IoT with 5G adds additional barriers to the efficient transfer of huge data.

Green IoT aims to create a smarter, greener world, and energy harvesting forms the basis of a green, 5G-powered IoT ecosystem. This special issue aims to combine cutting-edge research into these key areas of green IoT systems capable of 5G for a smart future.

IoT is about collecting and using data, because IoT-based systems are becoming ubiquitous, meaning ever-increasing amounts of data. The International Data Corporation estimates that by 2020, 44 zettabytes will be collected, transmitted, analyzed, and implemented.



Few people think of internet companies as having resources for manufacturing. But with all this data, the biggest Internet companies run massive data centers that use a lot of energy.



# How IoT is Helping the Earth

Today, the majority of IoT application development companies develop applications to collect and analyze data using data science. What if these applications could be used more than that?

Here are some ways in which the concept of Green IoT can be used to benefit environmental protection and surveillance

## GREEN DRIVING

The IoT can be used to understand and operate the automobile on the road and what other vehicles are going to do. This is nothing but green driving. This enables traffic to move at a certain speed with minimal distance between vehicles, thus minimizing fuel shortages caused by regular changes in vehicle gears.

For example, IBM's Watson is used to make a car without a driver named Olli - Watson analyzes large amounts of data that emanate from in-car sensors and based on the analysis it is fast, slow, and lane changes (everything without a driver).

## SMART FARMING

Farmers can use IoT capabilities by installing sensors wherever they are needed such as in the field, in tools and equipment, in vehicles and tractors, etc, to collect data on aspects such as soil moisture and its health.

The collected data can be stored on a server/cloud, which farmers can later get in real-time. It offers farmers a smart, data-driven approach to improving their yields and reducing waste.

## REDUCE CO<sub>2</sub> EMISSIONS

IoT can help reduce carbon dioxide (CO<sub>2</sub>) emissions from automobiles through smart traffic management. Here, the purpose is to extract data from various sources such as traffic cameras, GPS/Sensors of vehicles, etc., and use it to examine and understand the traffic conditions and patterns.

## REDUCE AIR POLLUTION

IoT can help reduce air pollution by using real-time air quality monitoring it can spread small, mobile-powered sensors across a variety of locations and areas, from means of transportation to stationery. Air quality can be achieved by providing a broader picture of the surface.

Furthermore, this real-time information can be estimated to expose the onset and fluctuations of air pollution. It can be communicated to people through apps, which give them an update on the level of pollution they are living with.



Protecting the environment is a big part of the business



## Conclusion

Protecting the environment is a big part of the business - not only because citizens and legislators demand it, but also because it's good for the economy. While business challenges will continue to grow and evolve, technologies are emerging and changing to make it easier for businesses to meet these challenges and thrive.

Companies are already successfully using embedded technology and IoT applications to develop engineering innovations that benefit both the environment and the business.

# Green Business Ideas for Aspiring Entrepreneurs

*by Srivani Mandapaka*

Green technology (GT) is a broad term that covers a wide range of new innovative technologies that are environmentally friendly. A green product uses its resources wisely and protects the environment. Efficacious technologies aim to reduce fossil fuel use, thereby promoting the sustainability of humans, animals, plants, and the environment.

While it is challenging to define green technology precisely, it is safe to say that it refers to developing and applying products, equipment, and systems that conserve natural resources and minimize human activity's negative impact. GT is essentially how we meet our current needs without compromising the needs of future generations.

With such a trend around, are you one of those eco-entrepreneurs who want to change the way humans look at the environment? Would you like to start a business while also protecting the environment?





Profit maximization is not the primary goal of a green business model; instead, it prioritizes minimizing its environmental impact.

## Green Industry Businesses: What Are They?

Green industry businesses use sustainable materials in their products. While reducing carbon emissions, green industries use as little energy, water, and raw materials as possible. Companies like these use materials in ways that are sustainable and eco-friendly. As a result, industries minimize their impact on the environment. For instance, waste can serve as raw material or energy.

## How Does a Green Business Model Work?

With a traditional business model, a company provides raw material budgets, design processes, and ways of delivering services or distributing products. Profit maximization is not the primary goal of a green business model; instead, it prioritizes minimizing its environmental impact. For example, they may restrict fossil fuel use, supply power via solar panels, and other approaches to drastically reduce energy consumption.

## What Are the Steps Involved in Starting a Green Business?

Remember, the first step to green business is to reflect the ideology in your lifestyle and values. It is always easy to get fascinated or carried away in the trend pool. But how sustainable is your pledge towards a safe environment comes into reality with an eco-life?

As consumers have become more aware of CSR, many green businesses have arisen, but climate change poses many challenges. Identify a green service that no one in your market currently offers to start a green business. Then it's time to make a team of eco-minded people.

Now let's get straight to the business of green businesses.

# The Top Ideas to Establish a Green Business

In crux, every challenge needs a solution. Every environmental problem resulting from global warming, endangered species, or question sustainability is your opportunity. It need not be a ground-breaking idea that the world needs to shake it up on Twitter. Remember, a green business's goal is far more than an internet sensation, revenue, and craze. Here are a few inspirational ideas:

## Eco-Friendly Recycling Business

There's a good chance that your town's public works department oversees recycling. But there will always be uncertainty in this process. Check if the below points are in place:

1

There are equal chances that there is a fair chance that a single department can't recycle everything.

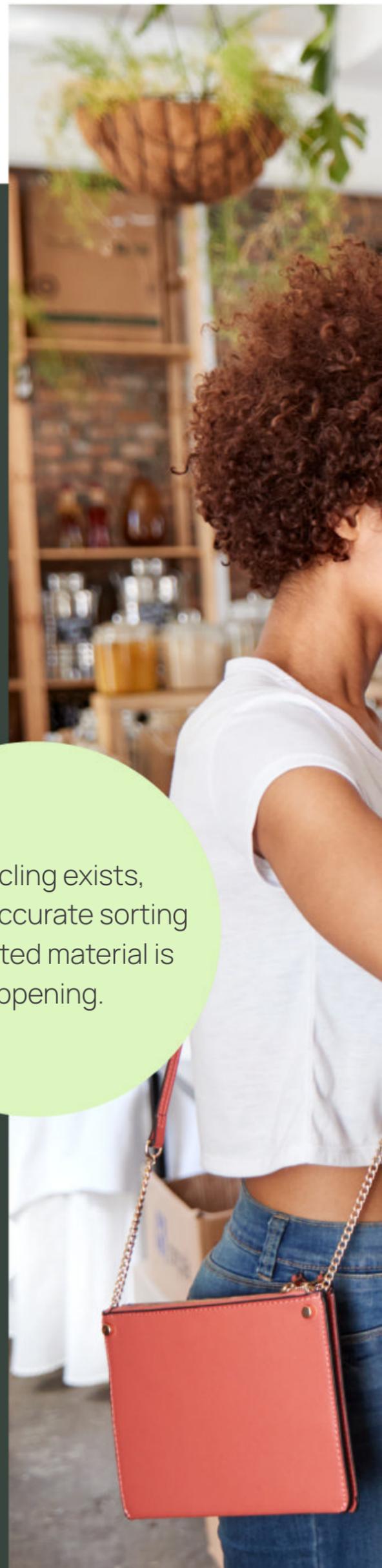
2

A few municipalities are specific to only a few recyclable containers.

3

If recycling exists, check if accurate sorting of collected material is happening.

These three steps will allow you to bring new ideas for eco-friendly local recycling businesses. Every recycling sector needs to answer a community if their goods are recycled. So why not give that assurance in a more precise way?





## Green Consulting

It's no secret that businesses are under pressure to adopt green practices to cut energy costs or reduce their carbon footprint. Consultants specializing in business sustainability can provide valuable insight into the numerous benefits of going green, including lowered risks, expenses, liabilities, higher productivity, and employee retention. So, a consultancy that could help firms with all paths towards going green can make it a great business idea. At least five years ago, no school academics were teaching sustainability. So, make plans on how this idea can make it big.

## Eco-friendly Retail

The e-commerce platform EcoPlum is no exception for consumer rewards programs. With every purchase, they reward customers with EcoChipz. These rewards are redeemable for products or donations to environmental charities. Additionally, each product on EcoPlum carries an eco-label or third-party green certification.

Like EcoPulm, creative ideas could help both the economy and the environment. Also, retails are the primary source that could set an eco-friendly example.

**Recycling old clothes for some goods in return is on a trend.**

So, a creative business idea need not be something from scratch; it could integrate with your existing establishment. Think about partnering with a company whose values and motives align with your green thoughts and how you could change one process into an eco-friendly one.



## Sustainable Construction

Construction might not seem environmentally friendly, but few companies now offer recycled materials across projects—for example, infrastructure repair. With their eco-friendly products, companies hope to change how they rebuild the nation's infrastructure. Many firms are coming forward to make railroad ties and pilings with recycled plastic instead of steel and concrete, which are non-renewable materials. So how about a set-up of supplying recycled material for infrastructure?

## Organic Catering

If you're both a food lover and an environmental passionist, then an organic food catering business is a choice you might want to consider. Catering unlimitedly but with a limited range of organic and locally grown ingredients like vegan, free-range meats, paleo meal, gluten-free, etc. Your business can appeal to health, nature, and wellness enthusiasts alike. Be sure to minimize the impact on the environment—the very core of your business goal. So, avoid plastic and paper goods. Try composting food waste.



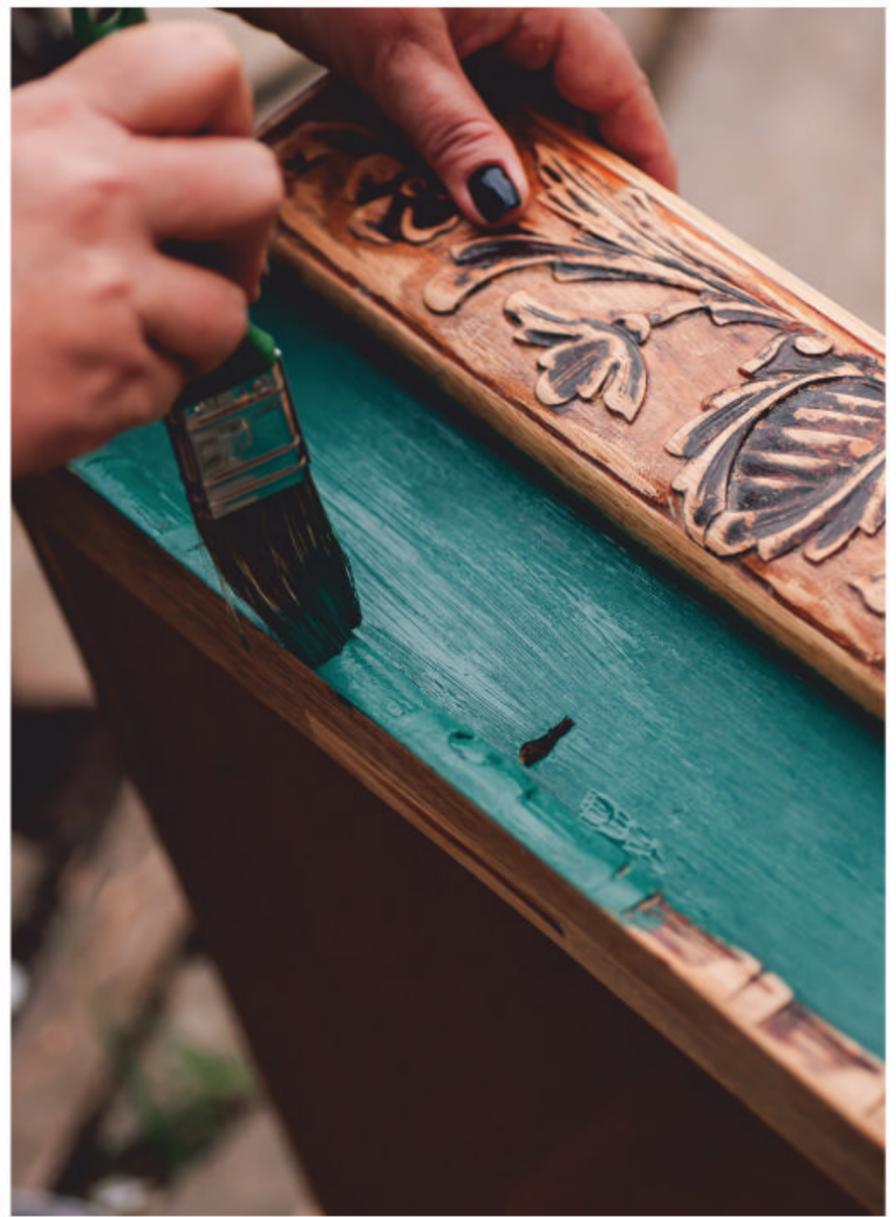
## Upcycled Furniture

Are you throwing away old, broken furniture? Or do you know someone who's planning to do it? That could be your green business idea. A basic template and power tools will allow you to disassemble and reassemble furniture into new pieces ready for resale. Hiring a creative and like-minded team can help you fully bring out a unique and valuable part of the furniture. Giving the old furniture a beautiful and holistic touch is like breathing back into the woods.

We are just scraping the surface of unlimited possibilities to ensure a sustainable environment and add value to the market. Speaking about the market, we have observed some decent and worth viewing trends in the global green technology industry. Have a look at those statistics that can help you firm your decision to start a green business.

## Sustainability and Green Technology Market Statistics

In 2020, the global green technology and sustainability market will stand at \$10.32 billion. By 2030, it is estimated to reach \$74.64 billion, growing at 21.9% a year from 2021 to 2030. Green technologies provide sustainable economic and social benefits. It is popularly known as clean technology, which aims at the energy generated as an alternative fuel that is more environmentally friendly. Additionally, the primary goal of green technology is to care for the environment and repair past damages. Several governments worldwide are investing heavily in green technology to preserve the environment, therefore boosting the market's growth.



Finally, the market's growth is driven by increased environmental awareness among businesses and individuals about global warming. Furthermore, adopting technologies that eliminate carbon emissions, increased industrial and consumer interest in sustainable energy resources made this even more robust. However, high production costs involved with green technology and sustainability solutions could impede the market's growth. Governments should develop favourable policies, and private firms should take initiatives to address this. Overall, the green technology business is something that's here to stay. As long as we have the universe and humans, we have problems balancing each other. So, every imbalance is an opportunity to make things right, not just a business proposal but for a sustainable, eco-friendly future.

# 2021

# Year in Review

## A Complete Green Technology Round-up

by *Toulika Das*

The twenty-first year of the 21st century has been a year of revolution in the field of technology. A significant number of highly lucrative and widely used technologies from the early 2000s have completely disappeared, and newer, better ones have replaced them.

Several completely new technologies have emerged, particularly in the fields of computer science and engineering. The year 2021 has been a great time for innovation in the field of green technology as well. Let's look back at the exciting year that 2021 was, in terms of innovation and technology.

### Emerging Technology Trends & Predictions

Innovative application factors, family-focused devices, and other innovations are all geared at keeping us away from our phones but still recording life's defining moments. These are a few of the breakthroughs in technology that helped define the technological year of 2021, as well as several to keep an eye on during the future.

#### Lithium-metal batteries

QuantumScape is working on a lithium-metal battery. According to early test findings, the battery may increase an electric vehicle's range by 80 percent and can be recharged quickly. VW has agreed to sell electric vehicles with the new type of battery by 2025, according to the company.

#### Green hydrogen

Green hydrogen is now affordable enough to be feasible, because of the tremendous decline in the cost of solar and wind power. Simply use electricity to zap water and you'll get hydrogen. Europe is leading the way, laying the groundwork for the necessary infrastructure.

#### Hyper-accurate positioning

New hyper-precise locating systems have accuracies of a few centimeters or millimeters, whereas today's GPS is accurate to within 5 to 10 meters. This opens up new possibilities, such as landslide warnings, distribution robots, and self-driving automobiles that can explore streets safely.

## Data trusts

Data trusts are one solution that some governments are beginning to investigate. A data trust is a legal body that gathers and handles personal information on behalf of individuals. Although the form and purpose of these trusts are still being established, and many uncertainties remain, data trusts stand out as a possible solution to long-standing privacy and security issues.

## Multi-skilled AI

Expanding AI's senses is one prospective way to improve its abilities; today, AI can perceive objects using computer vision or audio recognition, but it can't "speak" about what it sees and hears using natural-language algorithms. AIs with numerous senses will develop a better grasp of the environment around them, allowing them to be far more adaptable.

## 5G technology

5G, one of the top upcoming technologies, will enter new markets very soon, providing benefits such as faster internet speeds, lower latency, and greater capacity. The advantages would allow driverless vehicles and wireless VR to operate with little technological hiccups.

## Big data

With the increasing quantity of human-machine contact, the gadgets we carry with us every waking hour have become a tremendous data warehouse. Data that is just waiting to be transformed into useful information and advice that businesses can utilize to improve their service.



# Top 10 Green Technology Round-up of 2021

Within the two domains of climate tech and clean tech, we discover hundreds of new industries focusing on certain elements of business and society, which make up the green tech realm in 2021. Most of these industries focus only on climate technology or cleantech, while others combine the two to effect social change.

## Hydrogen planes

Hydrogen planes require special attention when it comes to green technologies. As the twenty-first century unfolds, the industry continues to demonstrate its desire for innovative design and innovation.

Sustainable aviation fuel, according to Airbus, is "produced from renewable raw materials." The most popular feedstocks include crops, leftover cooking oil, and animal fat, according to the report. United Airlines said that it has inked a commercial deal to buy planes from Boom Supersonic, a start-up.

## Solar-powered desalination systems

Water supplies in several areas are contaminated with excessive amounts of salt and pollutants, an issue exacerbated by shifting precipitation patterns as a result of the climate crisis and regional population growth. Desalination can aid in the diversification of available water supplies. This will assist the United States to achieve net-zero carbon emissions by 2050 while also providing additional freshwater supplies to all Americans.

The US Department of Energy (DOE) and the National Alliance for Water Innovation (NAWI) have announced \$5 million in government funding to assist develop desalination technology that will help towns around the country get freshwater.



## Satellite mapping

Governments and non-governmental organizations (NGOs) can use the technology to build climate adaption infrastructure or conduct significant restoration programs without unexpected negative impacts.

Cultivo, a recently formed platform, uses data from remote sensors to allow investors to contribute to natural capital initiatives run by NGOs and landowners. It aims to invest \$1 billion, which would be enough to repair 3.5 million hectares.

A company named 'Albedo' stated that it intends to create a constellation of low-orbit satellites that can give higher-resolution Earth imagery than is now available. It also

fundraising round led by Omnivore and Techstars.

## Smart farmland and forestry tracking

Nokia is collaborating with the Vodafone Foundation in India to implement IoT in the farming sector, beginning with soy and cotton. Over 400 sensors have been placed across 100,000 hectares of farmland to collect environmental data, which is then



just completed a \$10 million seed round. Jetstream, Liquid2 Ventures, and Soma Capital all contributed to the investment, which was headed by Initialized Capital.

Pixxel, a Space-tech business located in Bengaluru, has raised \$7.3 million in a venture

analyzed by a cloud-based program. The app communicates findings to farmers in simple English and local languages, as well as weather forecasts. It also includes advice on water conservation and pesticide management.

## High-end Recycled Plastic

Banyan Nation, a non-profit organization in India, has started a recycling program to combat the difficulties created by plastic pollution. Its recycling process comprises a high level of cleansing and purifying, resulting in high-grade recycled plastic that may be used in a variety of applications. Locals will be employed by the company, which claims to recover 100% of the water used in its recycling procedures.

Carbios, a plastic recycling technology company located in France, has received funding from the European Union's LIFE program valued at over 3 million euros (around \$3.38 million).

T.EN Zimmer GmbH will contribute its 'monomer repolymerization' expertise in 100 percent recycled polyethylene terephthalate (PET), and Deloitte will undertake an environmental management audit of the technology for plastic and textile garbage as part of the agreement.

## Vertical farms

The existing usage of land by mankind is a key factor in climate change and biodiversity loss. According to the IPCC, land use accounts for 23% of man-made GHG emissions, with agriculture accounting for the bulk. As a result, it's no surprise that the green agricultural business is booming. The advancements vary from record-keeping on blockchain to solar-powered robots that can prune and plant.





Despite using 95 percent less water, a two-acre vertical farm in California produced more food in 2020 than a regular 720-acre farm.

After a successful trial at M&S in 2019, the vertically-grown salad is now available at Selfridges and Whole Foods.

Infarm, a vertical farming company located in Europe, secured a \$200 million Series D funding round this week. The Qatar Investment Authority (QIA) sponsored the financing, which followed a \$170 million fundraising last year. It brings the company's total capital to above \$600 million, and its valuation to "well" over \$1 billion, cementing its status as Europe's first vertical farming unicorn.

### **Carbon Capture**

In the year 2021, collective efforts by the UK National Grid, which has already established a big carbon capture project in the Yorkshire and Humber region and is now trying to expand on this initiative with its partners Drax and Equinor, are anticipated to fuel the growth. The Humber might become the world's first net-zero-carbon region as a result of the initiative. The carbon is extracted from industrial companies in the area and pumped into storage in the North Sea for this project. The "storage" is a perforated rock beneath the seabed into which liquid carbon dioxide is pumped.





Along with this initiative, Phillips 66, Uniper, and Vitol have proposed the Humber Zero decarbonizing project, positioning the UK and Scandinavia, as well as the United States as world leaders in carbon capture technology.

And at last, a recent UN report advocated for greater use of carbon capture to deal with climate change, citing fundamental roadblocks to its development. Thus it can be safely said that carbon capture has a bright future.

### **Lab-grown meat and fish**

Overfishing depletes fish populations and has the potential to destroy finely balanced habitats such as coral reefs in the long run. Avant Meats, a Hong Kong-based start-up, is providing lab-grown fish fillets as an alternative. Fish stem cells are given nutrients and generate edible fillets in a fraction of the time it takes a fish to reach that size. The lab-grown substitute, apart from aquacultured fish, is devoid of pollution and illness.

### **AI helps verify offsetting**

A slew of "climate intelligence" firms have sprung up, offering predictive analytics solutions to help businesses better foresee and prepare for catastrophic weather occurrences. These companies often integrate machine learning with more traditional weather modeling approaches, training their models using a combination of publicly accessible, private, and customer-specific data.



One Concern, one of the oldest and most well-funded AI startup firms, just announced a fresh \$45 million fundraising round. One Concern is creating a "digital twin" of the world's natural and built surroundings in order to mimic the consequences of climate change dynamically and hyper-locally, dubbed "Resilience-as-a-Service" by the company. So far, the firm has largely concentrated on the Japanese market.

### **Waste-Water Electricity Generator**

Through the Indigenous Communities Notice of Funding Opportunity, the Economic Development Administration (EDA) hopes to help indigenous communities recover economically from the coronavirus epidemic (NOFO).

Competitive submissions for financing under this NOFO will offer programs aimed at fostering economic growth in indigenous communities and hastening the pandemic's growth in the economy.

**Broadband, electricity, road, water, and wastewater infrastructure (including community water facilities), vocational and higher education resources, and local health facilities are examples of core economic infrastructure projects that are required for future employment generation.**

## **Investing in Green Technology**

Green investment (or ESG investing) is gaining popularity with investors all over the world as a result of the freely available information and the increasing prominence of climate challenges in society. The pandemic of the coronavirus has heightened debates regarding the interdependence of finance and green technologies, with critical themes in climate change and social turmoil emerging as areas of interest to investors.

A new future is on the rise, one that is not what the world had anticipated. There will be no space for businesses that cling to the past as the future takes form. Will you stand by and observe while the world around you changes? Or do you want to be the one in charge?

# Agrivoltaism

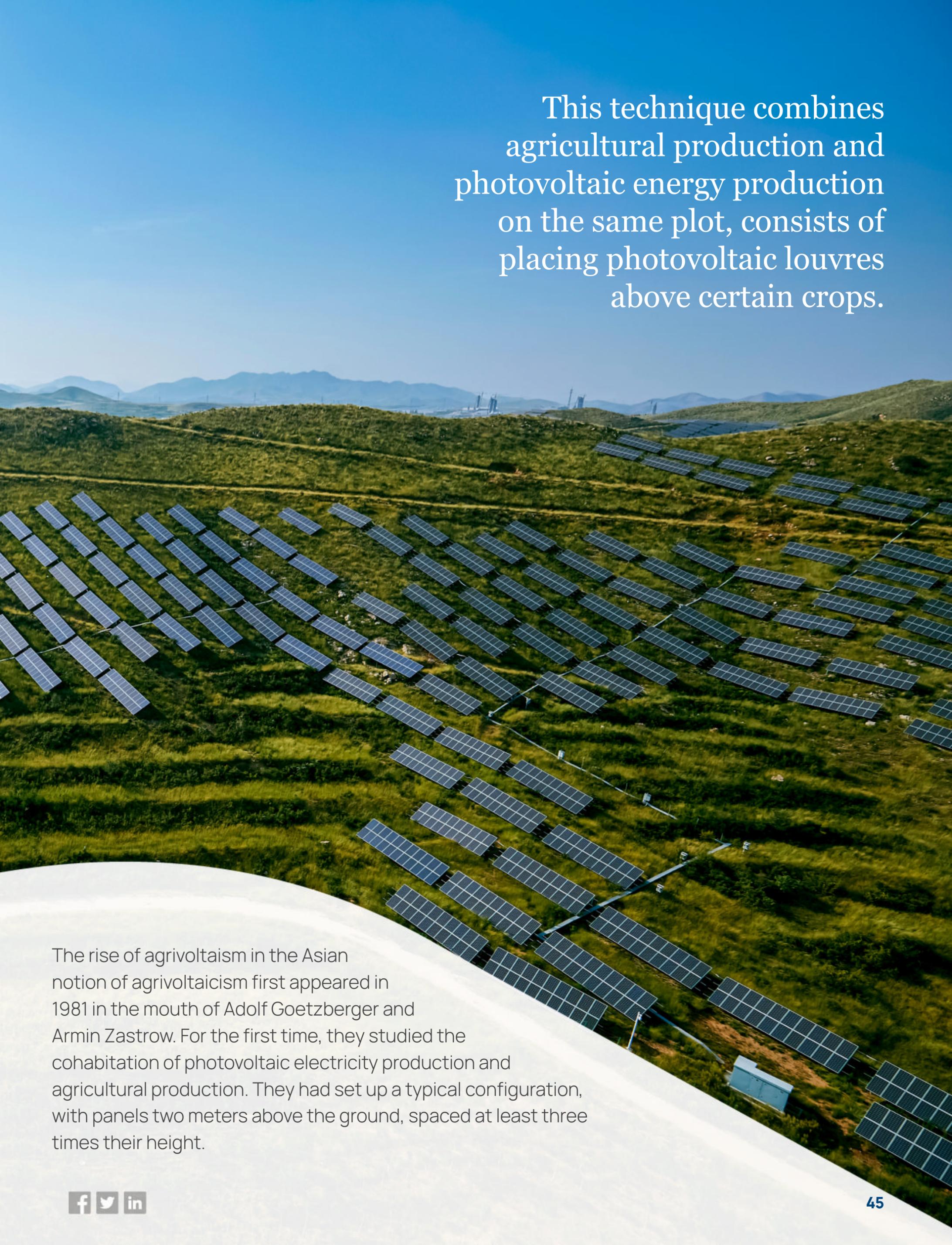
"Green Swindle" or Real "Energy Farmers"?

*by Bharggavi Ssayee*

Agrivoltaism, which first developed in Asia in countries such as Japan, South Korea, and Vietnam, has recently arrived in Europe and particularly in France. Today, this new practice is booming, with increasingly innovative projects showing great promise. So what exactly is agrivoltaism?



The installation of photovoltaic panels on crops has arisen due to population growth. Indeed, one of the significant challenges of this growth is to produce enough food to feed the planet. In addition, the increase in the population then induces an increase in the production of electricity on the earth, preferably green electricity, in a logic of sustainable development.

An aerial photograph of a solar farm installed on a rolling green hillside. The solar panels are arranged in neat, parallel rows, following the contours of the land. The background shows a clear blue sky and distant mountain ranges. The overall scene depicts a harmonious integration of renewable energy and agriculture.

This technique combines agricultural production and photovoltaic energy production on the same plot, consists of placing photovoltaic louvres above certain crops.

The rise of agrivoltaism in the Asian notion of agrivoltaicism first appeared in 1981 in the mouth of Adolf Goetzberger and Armin Zastrow. For the first time, they studied the cohabitation of photovoltaic electricity production and agricultural production. They had set up a typical configuration, with panels two meters above the ground, spaced at least three times their height.



The inclination of the panels corresponds to the latitude. The duo concluded that the radiation obtained was almost uniform over the day compared to two-thirds of the overall radiation on a control plot. Subsequently, the first agrivoltaic projects developed in Asia, particularly in Japan, where there is a solid urban sprawl, to the detriment of any agricultural land, before being emulated in South Korea, Malaysia, and Vietnam. However, these developing areas were very quickly faced with a lack of arable land. Therefore, renewable energy production had to be coupled with agricultural production.

To a lesser extent, agrivoltaism would also make it possible to produce green energy, even if this is not the stated objective. This emerging agricultural practice aims to respond to two significant challenges for the planet in the 21st century: first, to mitigate the climatic hazards that threaten agricultural yields using kinds of giant umbrellas. Then, produce renewable energy without artificializing arable land to install solar panels.

A paradox since the increase in population implies an urban sprawl done to the detriment of agricultural land. This problem arises in parallel with the need to obtain sustainable energy to contain the greenhouse effect and the global warming that inexorably results from it. However, here too, the establishment of solar farms (fields

filled with photovoltaic panels) is done to the detriment of agricultural land.

It is, therefore, in Asia and particularly in Japan, where the narrow coastal plain is saturated with urban constructions. At the same time, arable land is sorely lacking, that the first agrivoltaic projects were born.

Some crops lend themselves easily to agrivoltaism. The vine and fruit production, for example.

But also, market gardening. Concretely, solid gantries support the removable and swivelling infrastructure between the rows. Thus, crops can be successively shaded in the event of too much heat or protected from cold snaps (attenuation of around 3°). Finally, by adjusting the orientation of the panels, it is also possible to make a gutter for rainwater, which can then gently water the plants. Or be redirected to reserve wells to anticipate episodes of drought.



# How Does It Work?

A shutter is placed above the crops to provide partial coverage. Sturdy gantries support the removable and swivelling infrastructure between the rows. The deployment can be done on an axis of rotation or vertically.

A multitude of sensors is placed on the infrastructure to provide information on the climate and also on the state of growth of the plant. The sensors are different depending on the supplier. The most frequent sensors make it possible to monitor the following parameters:

## PLANT GROWTH, TEMPERATURE, HUMIDITY, AND SUNLIGHT

the measurement data is then sent to a cloud. The algorithm developed by the supplier takes into account the automatically transmitted data and information on the growth of the plant in question to order the opening and closing of the panels. The piloting is done remotely and automatically.





# Installing This Type of Sign-On Crop Field Has Many Advantages for Farmers

# 1

## **Agrivoltaism helps protect all types of crops**

Solar panels installed above crop fields protect crops from bad weather. Vines, orchards, market gardening easily lend themselves to agrivoltaism.

# 2

## **Additional income for farmers**

Colibri Solar is committed to paying rent to farmers to use their farmland. In exchange for this rent, Colibri Solar agrees to take care of the photovoltaic project from start to finish. You own the land, and Colibri Solar owns the panels and, therefore, the solar energy.

# 3

## **Green electricity for local players**

Colibri Solar is committed to supplying electricity produced by solar panels to the nearest you. Indeed, solar electricity will be used to power households and local actors.



## The Risks and Constraints of Agrivoltaism

Agrivoltaism is still in the experimental stage. Therefore, especially over the long term, actual performance cannot be guaranteed entirely even if the first results are encouraging.

There are many advantages to installing these types of solar panels. Their role as a protector in the face of different climatic conditions is undoubtedly one of the most interesting. During summer, shading helps protect crops

from the effects of soil temperature. It is also an effective way to save up to 20% water. Moreover, as Bruno Cheviron emphasizes, sustainable water management goes hand in hand with the concept. He is a researcher in soil sciences and physical sciences. In winter, the solar panels can be oriented to obtain a cover, forming a greenhouse. As a result, the minimum temperature does not drop below 3° C, which is particularly beneficial for crops.



## When Agriculture and Renewable Energy Production Are Combined

Although agricultural production remains the priority, this does not preclude pursuing another goal. Indeed, agrivoltaism can be a natural source of green energy. Now power plants can be installed on arable land. This solution is ideal for enabling farmers to earn additional income. This is by collecting rent for the exploitation of their land.

Homes and surroundings will not be left behind. They will also benefit from the electricity supplied by the photovoltaic panels. Global warming represents an opportunity for agrivoltaism. Indeed, energy is an increasingly watched and controlled item and a subject of research and development for many research centers worldwide.

Global warming is also causing more extreme climatic conditions for crops. Temperatures

can rise higher for longer, and prolonged sunshine can cause crops to dry out more frequently. Adaptation of production methods is mandatory, and agrivoltaism offers the double advantage of protecting crops and producing energy. The policies and public funds request and support these steps. As a result, the practice of agrivoltaism is inevitably debated in the agricultural sector. Some fear that agricultural yields will be reduced and that this system will be more profitable for solar energy production. The installation of an agrivoltaic power plant is indeed quite complex. One must consider many aspects to be effective, including the arrangement of solar panels, the type of land, or the reliability of the safety devices. Finally, the visual appearance of photovoltaic panels in crops is not to everyone's taste and can therefore also be an additional constraint.

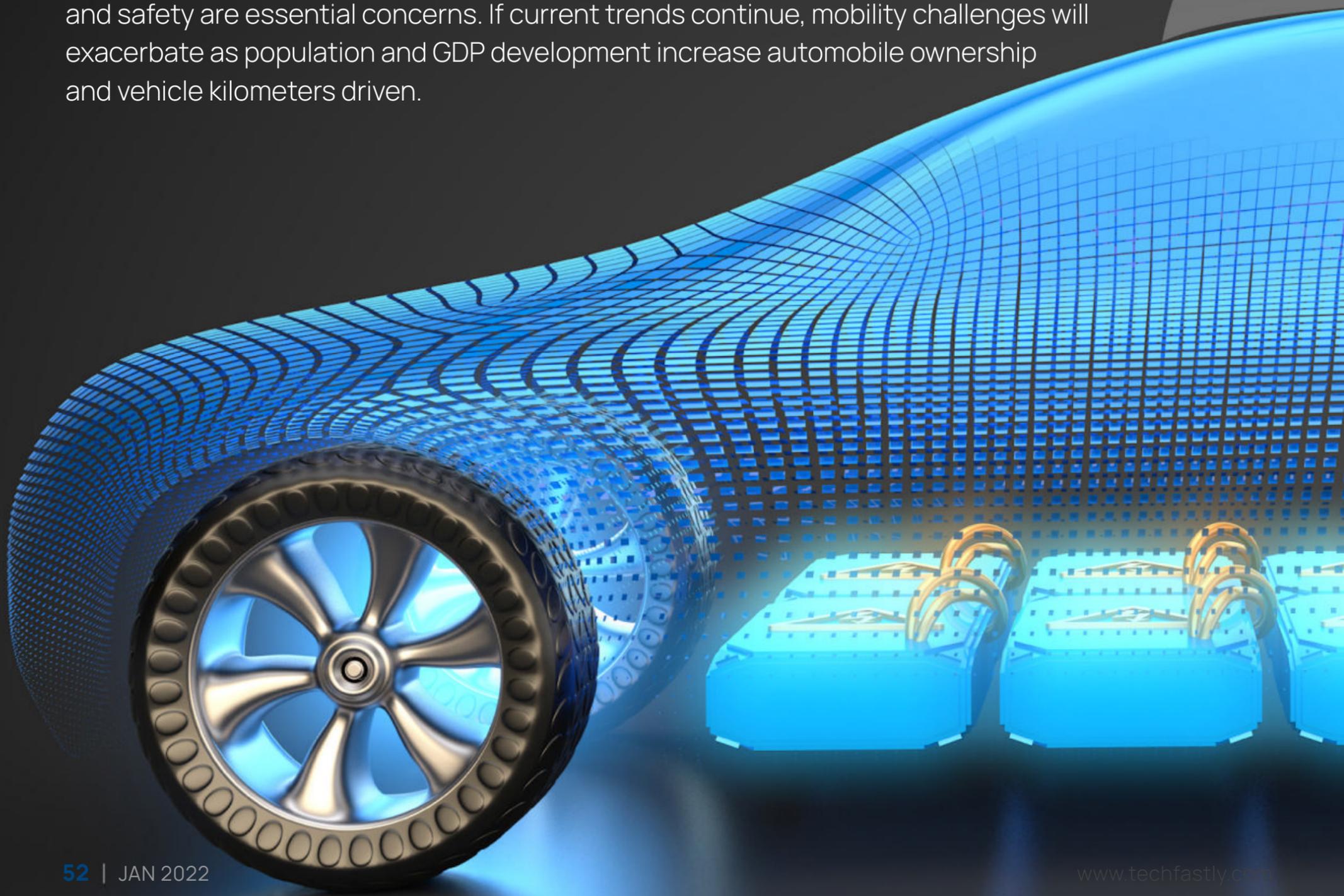
# Electric Vehicles

## The Future is Bright Ahead

by *Rehan Husain*

**E**lectric vehicles (EVs) present a chance for the transportation industry to transition away from fossil fuels. Electrification of the transportation industry can also positively impact energy efficiency and local pollution. However, legitimate worries exist regarding fulfilling future energy demand for charging EV batteries using clean and renewable energy sources. More critically, the question of EVs' long-term viability is highlighted by the supply uncertainties associated with essential raw materials utilized in EV batteries. Extraction of some of these material resources has severe environmental consequences, in addition to social and ethical concerns.

That distant hum is the sound of the mobility notion evolving—for the better. While obstacles to the electrification of the vehicle fleet continue to exist, possibilities worth fighting for also exist. This is especially true in cities, where today, pollution, congestion, and safety are essential concerns. If current trends continue, mobility challenges will exacerbate as population and GDP development increase automobile ownership and vehicle kilometers driven.



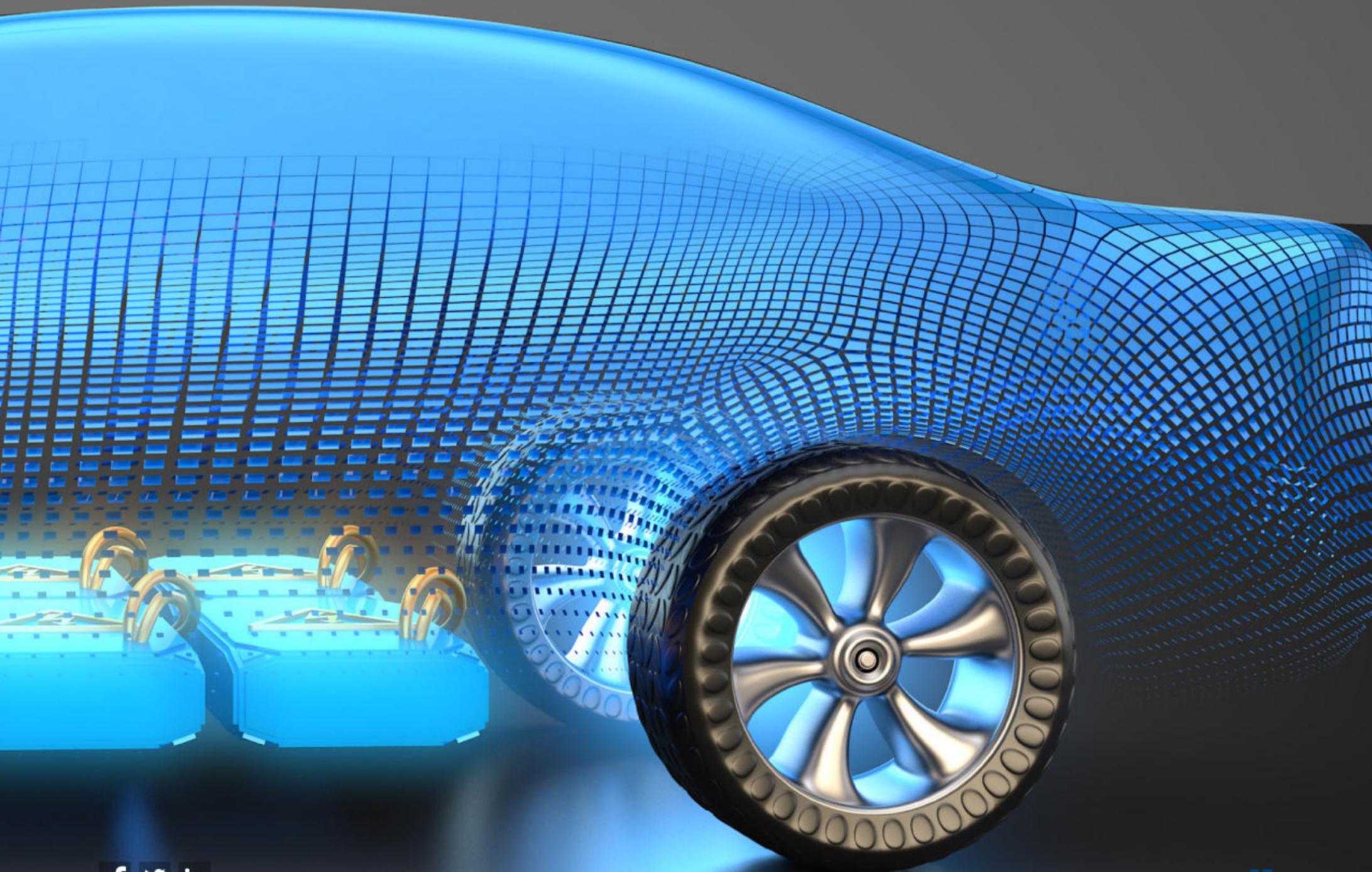
# We will not stop, until every car on road is electric

– Elon Musk

As a result, the mobility sector is unleashing a bevy of innovations aimed at urban roadways, including mobility-as-a-service, enhanced traffic management and parking systems, freight-sharing solutions, and novel two- or three-wheeled transportation concepts.

Although the EV industry anticipated the budget to be as revolutionary as promised, it fell short on several fronts. This has resulted in conflicting sentiments within the industry. The government announced an increase in customs duties on some vehicle components, which might harm the e-mobility market.

On the other side, to encourage individuals to acquire more ecologically friendly automobiles, the government suggested a voluntary vehicle scrappage program this year in India. Its goal is to phase out all commercial vehicles over 15-20 years old.



Electric powertrains are the way of the future for passenger vehicles; the transition is ongoing.

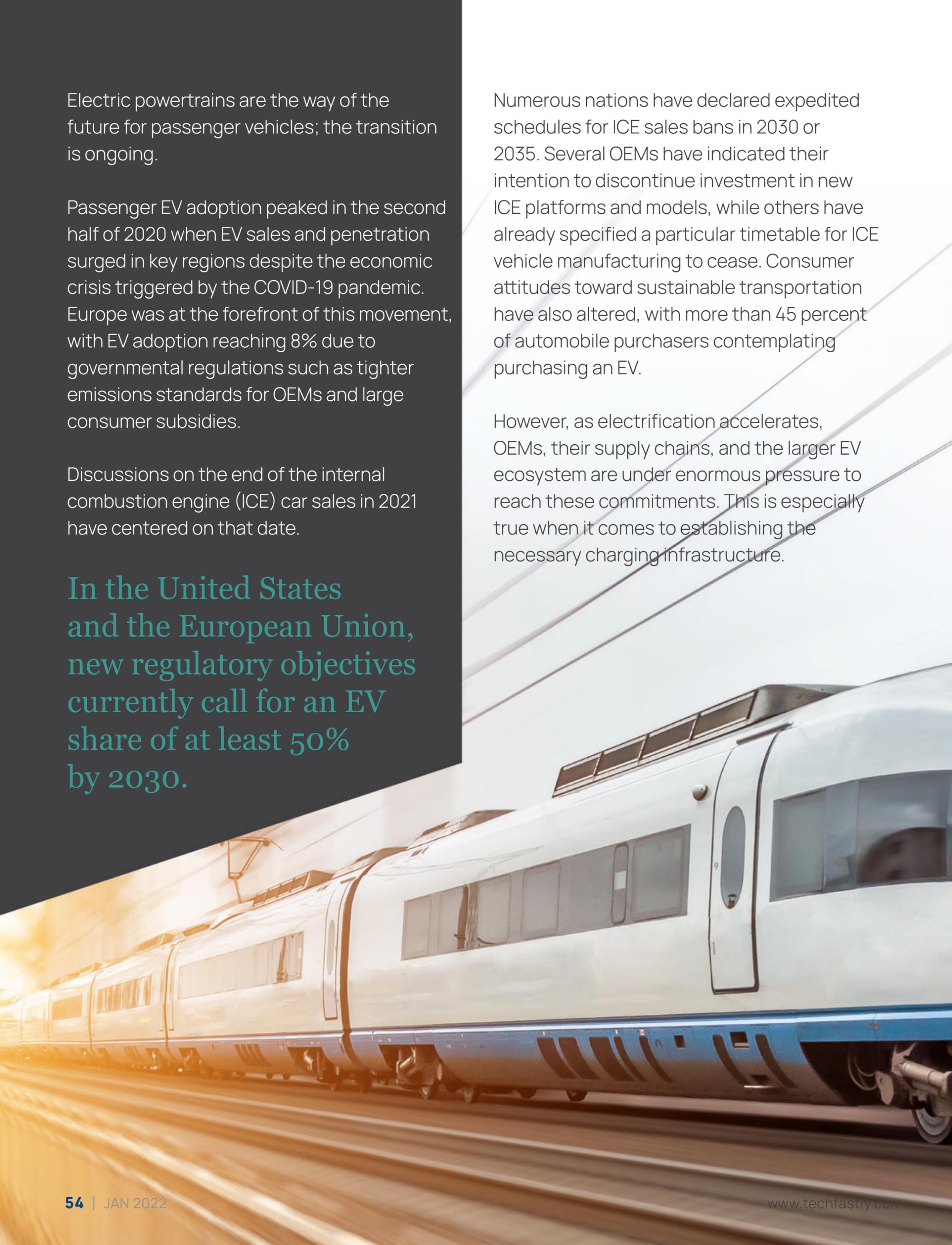
Passenger EV adoption peaked in the second half of 2020 when EV sales and penetration surged in key regions despite the economic crisis triggered by the COVID-19 pandemic. Europe was at the forefront of this movement, with EV adoption reaching 8% due to governmental regulations such as tighter emissions standards for OEMs and large consumer subsidies.

Discussions on the end of the internal combustion engine (ICE) car sales in 2021 have centered on that date.

**In the United States and the European Union, new regulatory objectives currently call for an EV share of at least 50% by 2030.**

Numerous nations have declared expedited schedules for ICE sales bans in 2030 or 2035. Several OEMs have indicated their intention to discontinue investment in new ICE platforms and models, while others have already specified a particular timetable for ICE vehicle manufacturing to cease. Consumer attitudes toward sustainable transportation have also altered, with more than 45 percent of automobile purchasers contemplating purchasing an EV.

However, as electrification accelerates, OEMs, their supply chains, and the larger EV ecosystem are under enormous pressure to reach these commitments. This is especially true when it comes to establishing the necessary charging infrastructure.



# Timeline of Electric Vehicle

When it comes to the innovation of electric automobiles, many people deserve recognition. Anyos Jedlik invented the electric motor in 1828 and used it to make the first little electric automobile. Between 1832 and 1839, a Scottish inventor, Robert Anderson, also invented a rudimentary electric vehicle

The first electric vehicle was a three-wheeler named VIKRAM SAFA, invented in 1996 by Scooter's India Pvt Ltd. Around 400 automobiles were manufactured and sold. In 2000, BHEL introduced a successful eighteen-seater electric bus. Approximately 200 electric vehicles were manufactured and operated in Delhi at the time. However, it did not do well on the market due to the expensive cost of the battery and its short life.

Electric vehicles were invented in the nineteenth century. Previously, they did not do well in the market because of their expensive cost, slow speed, and limited range. As a result, demand initially declined globally. They have, however, been utilized for transportation and public transit, most notably as rail vehicles.

As environmental concerns grew in the twenty-first century, it became clear that gas-powered automobiles release a great deal of smoke and are highly detrimental to the atmosphere.

As a result, interest in electric vehicles increased as well. Electric automobiles were popular with those who used them in cities, where their limited range was not an issue. Another factor contributing to its success was the lack of gear changes, which made it a straightforward option. It lacked vibrations and made no sound. Additionally, it did not require a manual start, which was a benefit.

In 2007, Hero Cycles introduced a range of motorcycles collaborating with UK-based ULTRA Motor. These electric motorcycles quickly gained popularity among other manufacturers such as Electrotherm India, TVS Motor, and Hero electric.



Additionally, they manufacture and market their items. Additionally, in 2017, Etro received over \$3 million in funding from HNIs to convert current gasoline-powered commercial vehicles to electric variations, setting a new standard for efficient and environmentally friendly transportation.

Electric rickshaws controlled the entire market due to their widespread appeal. In 2016-17, India sold around 500000 e-rickshaws. It was a tremendous aid to the population's everyday commute. Currently, these rickshaws are primarily used in the Delhi NCR. The government is now focusing its efforts on heavily polluted cities to boost the usage of electric vehicles. A scheme called FAME, i.e., "Faster Adoption and Manufacturing of Electric and Hybrid Vehicles in India," is being launched. A subsidy is being given to 11 cities to launch electric buses, taxis, and e-rickshaws.



# Electric Vehicle Future

Fast forward to 2021, when firms are hustling to produce inexpensive electric vehicles, intending to dispel the myth that electric automobiles are too expensive. For instance, E-Trio, an electric vehicle business, aims to make EVs accessible to the general public. They specialize in cars and related items such as electric light commercial vehicles, bicycles, and electric three-wheelers.

The Indian government intends to implement policies and incentives that will encourage more people to purchase Battery Electric Vehicles, accounting for 25% of all new car registrations by 2024. Currently, electric vehicles account for just 0.29 percent of total vehicle registrations in India. A two-pronged strategy must be implemented. To begin, India

must be truly EV-ready by establishing the required infrastructure and technologies to enable electric car manufacturing. Second, facilities must convert older cars to hybrid electric vehicles by retrofitting them to combat growing pollution levels.

Regulatory pressure and market preference for EVs differ significantly by area. Europe is primarily a regulation-driven economy with large subsidies, but in China, despite lower incentives, consumer pull is quite strong. In the United States, EV sales have been slow to rise due to a lack of governmental pressure and customer enthusiasm; however, that trend is expected to reverse under the next administration.

**By 2035, the world's leading automobile market will be all-electric.**

## Conclusion

Electric cars are on the way, and we are progressing toward decarbonizing the transportation sector while further steps must be taken. It is an industrial shift occurring at a breakneck pace. It also cuts across industries, encompassing energy, infrastructure, mobility, and automotive firms. While this is a significant problem, it also provides an enormous potential for incumbents and newcomers to play a leadership role in establishing new multibillion-dollar sectors and employment. The challenge will reconcile sustainability and economic feasibility with new technologies and a well-guided transportation revolution. With its diversified transportation landscape, commitment to sustainability, and demonstrated technological leadership, Europe has the potential to serve as a role model for other areas worldwide.

# Green Cities

## A Pathway to Sustainable Future

by *Rehan Husain*

Increased reliance on smart policies for sustainable mobility, energy-efficient building retrofits, renewable energy production expansion, better waste management, and ICT infrastructure implementation is becoming more common in cities around the world in response to rapid social and environmental change at all scales. One of the goals is to make these cities into smart ones capable of providing long-term opportunities for cultural, economic, and social development within a safe, exciting, and dynamic setting. In order to provide a broad reference for the identification of urban development sustainable plans and programs within the current legislative framework, an analysis of the most interesting international initiatives pursued by cities is provided.

**San Francisco is assuming a worldwide leader regarding green technology investment.**





# Green Technologies

In today's world, the more technologically advanced a city is, the more environmentally friendly it can and should be. With Facebook and Google in the neighborhood, San Francisco is assuming a worldwide leader regarding green technology investment. An analysis of the most forward-thinking cities came to this result.

Innovation encompasses a wide range of topics, from artificial intelligence and big data to biotechnology and the creation of new financial services, all of which do not necessarily aim to improve our quality of life.

However, by examining the amount of money invested by corporations in green technology, it is possible to determine which towns throughout the world are doing the most to influence the future world.

It looks like San Francisco is leading the pack in this regard. The city is more than simply a haven for the most forward-thinking, cutting-edge technology enterprises in the world. Additionally, the city is home to the most significant number of businesses engaged in environmental initiatives, including those in the fields of green technology, eco-building, environmentally-friendly consumer goods, and alternative energy. Green technology's business ecosystem in San Francisco has the largest size, according to a survey by FINOM, a start-up offering financial services in France, Germany, and Italy. This American city was determined to be the best in the sector based on the number of participating firms and the

amount of financing provided to those organizations.

However, one of the most cutting-edge destinations is investing more in research. The British capital is a world-class location for higher education with the most highly-ranked research universities globally, from University College London to City University London. London is also the most dedicated to promoting the growth of startups, out of the 100 cities in the survey. New York has gotten more start-up capital than any other U.S. city between 2010 and 2015, according to research that looked at how many firms were formed in each city following that year.



# Green Cities

We have compiled the list of innovative cities for their remarkable efforts in green technologies:

## Oslo, Norway

- Oslo, Norway's capital and most populous city, is one of many Scandinavian cities frequently ranked among the greenest in the world. This city's strategy has included sustainable environmental initiatives for years. Its carbon footprint is smaller because the government has a committee solely devoted to sustainable development plans and actively safeguards wild and natural regions from development.

An aluminum frame and netting of Roof-barrier by Safedesign, easy-to-install, and adaptable safety solution popular in Oslo. It is erected on the roof edge to keep employees and other things from falling. Roof-barrier saves up to 85% of the time required by traditional scaffolding for rooftop construction and maintenance. Transport and storage costs are also cut by 90%.





# Stockholm

Stockholm has several environmental planning projects and is one of the cleanest cities in the world. With a target date of 2050, the city hopes to be fossil-fuel-free. A study by HouseTrip found that nearly three-quarters of people either walk, bike, or utilize public transit to go to work.

By 2040, Stockholm aspires to be completely fossil-fuel-free, and it sees eco-policies as the most brilliant thing for the city and the entire globe.

This city is already quite environmentally friendly. Fuel stations around the city sell bio-fuel made from sewage, which is frequently utilized by taxis and private vehicles.





# Amsterdam

- Amsterdam is one of the world's most bicycle-friendly cities, with a well-developed network of bike paths. According to HouseTrip study, Amsterdam is one of the water-conserving cities in the world. Eco-friendly hotels may also be found in the city. Cisco and the city of Amsterdam announced a deal in 2014 to transform Amsterdam into the "Internet of Everything" metropolis and one of Cisco's showcase cities.

In recent decades, heated debate around green technology and its equitable access have aroused international scholars' concern. Consequently, researchers and planners must take further steps and develop effective instruments to improve equitable access to green technologies and achieve long-term urban social sustainability.



# Vancouver

Vancouver is one of North America's greenest cities and the most environmentally friendly in Canada, making it a popular destination for tourists. Since a Greenest City 2020 Action Plan was put in place some years ago, the government has set a goal to cut carbon emissions by 33% and is a world leader in hydroelectricity usage. Renewable energy sources are used in green technologies. One of the

most recent developments in green technology is green nanotechnology, which uses green engineering and green chemistry. The disposal of trash is a major contributor to environmental contamination in Vancouver. That is another area where green technology may help. A greener future is possible if we use it to alter our waste and production patterns in a way that does not affect our home planet.





## Curitiba

- Only one city in the whole South American continent scored above average in environmental sustainability on the South American Siemens Index. There has been a rapid-transit bus system in Curitiba for many years, a robust recycling program, and plans for a better bus system and additional bike lanes.

This city's carbon footprint is relatively modest compared to that of its neighbors. The rapid bus system is trying to utilize the green technologies for its functioning to its fullest- which can also be seen as an example for other states.





## Denmark

With most citizens living within walking distance of public transit and half utilizing a bicycle to get to work, Copenhagen is frequently ranked as Europe's greenest city. The city's carbon impact is relatively minimal, despite its size. Additionally, residents compost, recycle and do their best to save electricity. By 2025, Copenhagen aims to become carbon neutral.

At least 775,000 electric cars will be purchased in Denmark by 2030, thanks to

\$407.6 million in financing from the country's parliament on Friday (that includes hybrids). According to a larger plan, more than one million electric and hybrid vehicles will be on the road in Denmark by that time. That will minimize greenhouse gas emissions by more than 2 million tonnes. Denmark wants to meet its objective of reducing greenhouse gas emissions by raising taxes and levies on fossil-fuel vehicles based on their CO2 emissions. A mileage-based method will be phased out in favor of this one.



# Minneapolis

Minneapolis has been featured on numerous "green city" indexes and rankings these last several years. Cities in Minnesota have a program called Minnesota GreenStep Cities, which implements sustainable practices and activities. It also has 92 miles of on-street bikeways and 85 miles of off-street trails, decent air quality, and a well-maintained park system, making Minneapolis an environmentally friendly city.

By 2050, greenhouse gas (GHG) emissions must be reduced

by 80 percent from a 2005 baseline, making it one of the US's most severe climate action pledges. Taking advantage of falling costs and recognizing solar resources as the state's most plentiful and pervasive energy resource, made new pledges and established targets for the deployment of solar energy in 2013. After 13 years, Minnesota's efforts to cut emissions in the power sector have been most effective, with a 29% reduction in power sector emissions and a significant increase in renewable energy installations.

## Conclusion

The emissions from power generation and transportation might be reduced by using renewable energy technologies instead of fossil fuels. Developing and promoting renewable energy supply technologies and demand for renewable energy is imperative because of some detrimental and irreversible externalities in conventional energy production. More renewable energy sources should be used to lower the cost of generating electricity. Economic growth, population, energy pricing, weather, and technology influence energy usage.



# Transparent Aerogel

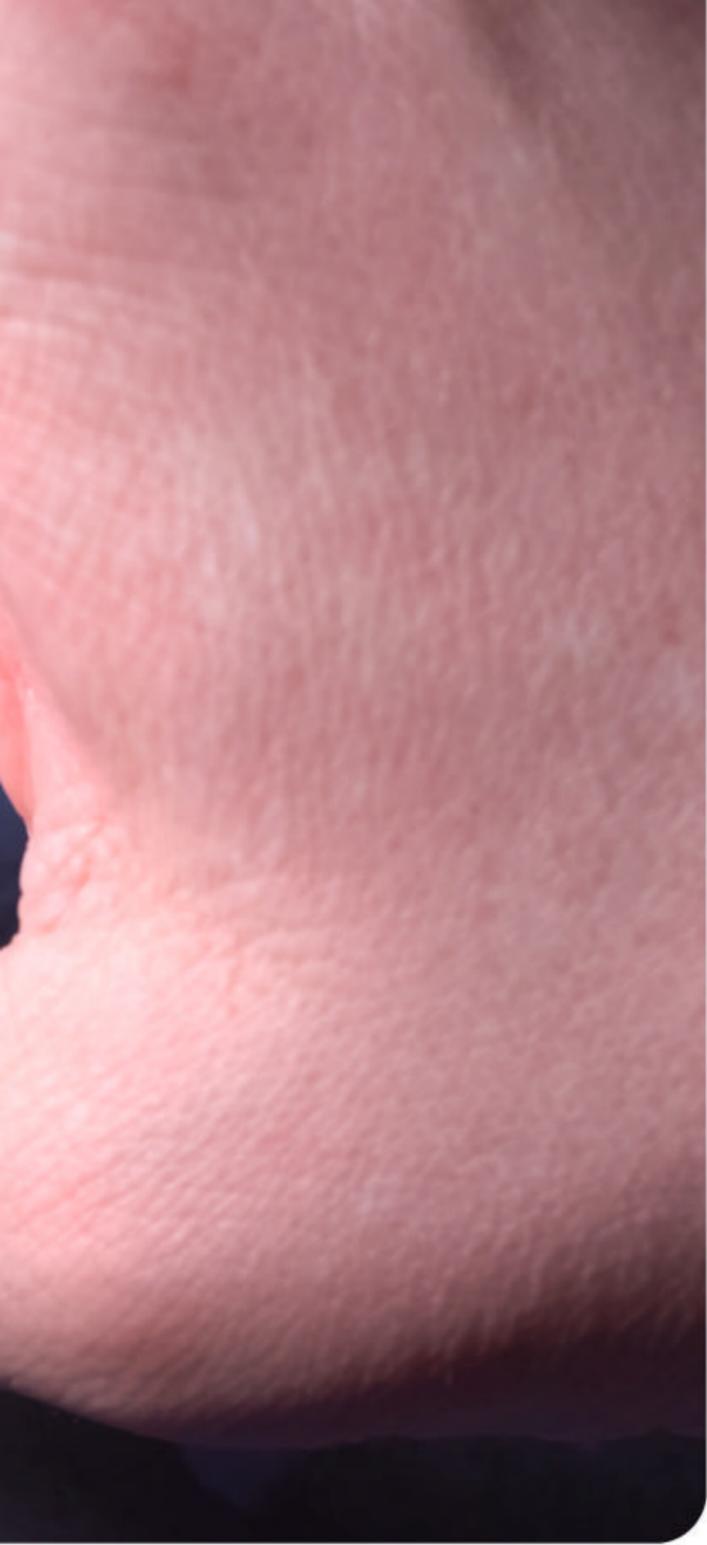
## Applications for Solar Devices and Windows

*by Yash Modi*

**A**erogel is a synthetic material made of tiny gel particles suspended in the air. There are numerous uses in insulation, packaging, and aeronautical engineering, making it one of the lightest solids known to man. Aerogel can also be used to make solar devices and windows more transparent.

Aerogels are ultra-light solids that are composed of 99.8% air. Despite being very light, they have high thermal conductivity and can block out extreme cold or heat. This makes them perfect for solar devices and windows that need energy efficiency. Transparent aerogel applications are becoming more popular as researchers find new and innovative ways to take advantage of this unique material.

**Aerogels are ultra-light solids that are composed of 99.8% air. Despite being very light, they have high thermal conductivity and can block out extreme cold or heat.**



## How Does It Work?

Aerogel is a transparent and flexible material that can be applied between two panes of glass to make windows and solar devices. The design involves applying a thin layer of nonporous silica aerogel onto the surface of one pane of glass, then sandwiching it in between two panes of glass. Because the material is so thin, light can pass through it quickly, making the window or solar device more transparent.

Aerogels are not new. They date back to the 1930s when they were first invented, but this gel has gone through a major transformation after NASA discovered some effective methods for producing advanced and high-quality aerogels that can change insulation.

Aerogel is a combination of silica and a solvent. The resulting gel is passed to the supercritical fluid extraction, which adds liquid CO<sub>2</sub> to the gel. The exchange process where the carbon dioxide is introduced to the solvent and is then vented out is carried out a couple of times or until the liquid is taken out from the gel.

### Transparent Aerogel for Solar Devices

There are many potential applications for aerogel in solar devices. For example, it can be used to insulate photovoltaic panels, allowing for better energy capture during the day because it would be able to hold its insulating properties at high temperatures. Transparent aerogel can also help improve cell efficiency rates by increasing light exposure on the cells.

### Transparent Aerogel for Windows

In buildings, windows are a significant source of light loss. By applying a thin layer of transparent aerogel to the surface of windows, the amount of light lost can be reduced. This would help reduce the need for artificial lighting during the day, saving energy costs. In hot climates, transparent aerogel can also help to keep buildings cooler by blocking out the sun's rays.

# Benefits of Aerogel

There are several benefits of using transparent aerogel in windows and solar devices. Some of them are listed here:

- 1** Aerogel is transparent, so it does not block any light, making the window or solar device more efficient.
- 2** It is made of loosely packed pores, and is incredibly lightweight which reduces the quantity of material used in the aerogel layering resulting in lower prices.
- 3** Aerogel can be applied onto both sides of the glass so it can be applied onto windows where both sides are evident, such as storefront windows.
- 4** Aerogel is flexible, so it has more applications than conventional rigid materials used for insulation and packaging.
- 5** Since it is made of non-toxic silica particles, it is safe to use on objects that have direct contact with humans.
- 6** Aerogel is highly durable, and is a great choice to be used for long-term insulation purposes, such as building insulation.
- 7** It is possible to recycle aerogel coatings by peeling them off of the glass and reusing them on new glass surfaces.

**Transparent aerogel is a very versatile material and can be used in various applications, including windows, solar devices, and aerospace engineering.**



# Various Applications of Aerogel

Transparent aerogel can be used in various applications, including windows, solar devices, and aerospace engineering. It can also be used in packaging and insulation. Transparent aerogel is a very versatile material that has many potential applications.

## Windows

Transparent aerogel can be applied to the surface of windows to make them more transparent. The aerogel layer is so thin that it does not block any light and allows more light to pass through than regular glass. This makes the window more efficient and reduces the need for artificial lighting.

## Aerospace Engineering

Transparent aerogel has many applications in aerospace engineering. It can be used as a part of a heat shield for cars, planes, and astronauts because it is very lightweight and durable. Transparent aerogel also has applications in the design of space rovers and other remote-control vehicles that travel into areas with extreme temperatures such as deserts or volcanoes.

## Solar Devices

Transparent Aerogel can be applied to solar devices to make them more efficient. The aerogel layer is fragile, so it does not block any solar radiation that the device could harvest.

## Building Insulation

Transparent Aerogel can be applied to building insulation for thermal and sound insulation purposes. Transparent Aerogel is so thin, it can be applied to multiple surfaces and panels within a building.

## Packaging

Transparent aerogel can be used as an eco-friendly packaging material because it is reusable, lightweight, and effective at insulating materials.

# Challenges

Aerogels have amazing potential across different sectors. While the soundproofing and thermal insulation properties make them a perfect fit for many applications, the aerogel production process is the biggest challenge for manufacturers. Here are a few common challenges that can only be resolved with investment.

## Expensive and Energy-intensive Production

# 1

The main challenge of making aerogel is its production. Currently, the transparent aerogel is made by taking a silica sol and evaporating the solvent until the mixture reaches a sol-gel state, where it can be applied to surfaces. The wet layer of gel is then baked in an oven at around 100°C, which turns it into a dry solid. However, this process is slow and expensive, so there is a need for more efficient production methods. Besides, it is an energy-intensive and material-intensive process.

## Limitations in the Sizes and Shapes of Aerogels

# 2

The traditional aerogel manufacturing techniques do not offer you a vast range of options when it comes to the sizes and shapes of the aerogels that can be produced. That's the reason aerogels have limited applications. The main use of aerogel is in the batteries, which also needs new R&D breakthroughs to work.

## Not Durable

# 3

Another challenge is that transparent aerogel is not as strong as traditional materials used in insulation and packaging. As a result, it can easily be damaged if mishandled or dropped. However, this can be overcome by using a thicker aerogel layer or applying transparent aerogel on more durable surfaces.

More efficient and inexpensive manufacturing processes and better material performance are needed before transparent aerogel can be used in many applications.



# Market Potential

Transparent aerogel could have several solar devices and windows applications because it has a high transparency rate. For example, an aerogel window could help reduce energy costs for homes by blocking out sound and pollution from the outside, acting as a soundproof barrier. In addition, solar devices would allow light to pass through more efficiently, allowing for better efficiency rates in energy capture.

In addition, the gel has an array of applications in the commercial industry. It is used in the pipe insulation, construction and building industry, appliances, and more. NASA also uses aerogel to launch space shuttles, vehicles, rocket engines, support equipment, and more.

## Conclusion

Transparent aerogel is a material that can be applied to windows and solar devices. It has better transparency rates than traditional glass, perfect for blocking the sun's rays. Transparent aerogel also makes solar cells more efficient by allowing more light onto the cells. There are many potential applications for transparent Aerogel in the future, from soundproofing windows to improving cell efficiency rates.



# How Green Tech Will Affect the Upcoming Industrial Revolution, Industry 4.0?

*by Sarah Shams*

**T**he German government coined the term Industry 4.0 (Industrie 4.0 originally) while working on a project to digitize the manufacturing industry. In 2011, this term was made public, describing the potential paradigm shift in the industrial automation sector caused by the cyber-physical systems responsible for the evolution of new business models.

Mechanisms monitored and controlled by 'computer-based algorithms' are known as intelligent systems or Cyber-Physical Systems (CPS).

Industry 4.0 is often used interchangeably with 'Fourth Industrial Revolution'. Although one might think that they are two names with the same meaning, their origins are different.

The term 'The Fourth Industrial Revolution' was coined by the founder and executive chairman of the World Economic Forum (WEF), Klaus Schwab, in 2016. In Klaus Schwab's words, the Fourth Industrial Revolution is "characterized by a fusion of technologies blurring the lines between the digital, physical, and biological spheres.





# A Brief History About The Industrial Revolution

Back in the 1700s, the invention of the steam engine in Europe brought major changes in the manufacturing sector. Machines powered by the steam engine replaced several sorts of work done by factory workers. This replacement was done for better efficiency, increased production and reduced production time, i.e., faster manufacturing. This resulted in new manufacturing processes, the boom in the textile industry and the formation of more and more factories—this new revolution in the manufacturing processes spread across North America during the early 1800s. By the late 1800s, manufacturing sectors saw another industrial revolution, the second one. The major inventions that caused this revolution were the internal combustion engine, the lightbulb, the telephone to name a few. The main features of this second industrial revolution were mass production and the

rise of steel, electricity and oil industries. The Digital Revolution during the late 1900s is said to be the third industrial revolution. We are best informed about this revolution as most of the changes occurred only a few decades ago. This revolution is also the most prompt one so far. The world witnessed the invention of the internet and personal computers. We are living in the third industrial revolution era, but the fourth industrial revolution is closer than we can think.

## What would be the major changes that the fourth industrial revolution will bring? What will be the next unimaginable invention?



Mechanization and the introduction of steam and water power

# 1.0



Mass production assembly lines using electrical power

# 2.0

Understanding the fourth industrial revolution might take time as we are only making calculated predictions based on the technology already in use. However, the main idea that separates the third industrial revolution from the fourth industrial revolution is that technology is merging more and more with human lives. Synthetic biology, genome, bioprinting etc., are a few subjects with great potential to bring major changes in the biological domain.

Industry 4.0 comes from the German Government-led project to expand Germany's leading position in the manufacturing industry around the globe. The information and communication technology that causes the intelligent networking of machines was



Automated production,  
computers, IT-system  
and robotics

# 3.0

the most important initiative of this project. This project formed partnerships with both national and international alliances. Similar initiatives taken up by other countries include Japan's 'Robot Revolution and Industrial IoT Initiative, France's (AIF) Alliance Industry of the future (Industrie-dufutur), Italy's Piano Industria 4.0 China's Made in China 2025 and Australia's industry 4.0.

Even with separate origins, both the Fourth Industrial Revolution and Industry 4.0 have the same motive. They are about smart manufacturing, automation and increased productivity.



The Smart Factory,  
Autonomous systems IoT,  
machine Learning

# 4.0



## Green Technology and Industry 4.0

The term Green Technology, being very self-explanatory itself, refers to the use of technology in environmentalism. Global warming is becoming a deadly issue; people are inclined towards the sustainability of the environment. From manufacturing reusable straws and banning plastic straws at restaurants to wastewater treatment plants, technology is also playing a major role in saving our world. Products that reduce energy consumption, wastage and any other adverse effect on the environment are undeniably a part of the Green Tech umbrella. The conservation of the earth's natural resources is the motive of this green technology. During the early 19th century, scientists started discovering the impact of industries like coal-burning plants and manufacturing factories on nature. Soon it was understood that the manufacturing processes must be altered if or else this modernization will eventually end the world. The government slowly acknowledged

the protection and preservation of natural resources worldwide.

There are several ways how technology can join hands with environmentalism. A few of them are:

- 1 Alternative energy, such as solar and wind power.
- 2 Electric vehicles to decrease the usage of fossil fuels like coal, oil, natural gases, etc.
- 3 Sustainable agriculture, for example, organic farming techniques.
- 4 Recycling.
- 5 Carbon capture and many more.

Solar Power is the cheapest form of alternative energy that can be used instead of burning all the fossil fuels. Photovoltaic solar energy is consistently cheaper than new coal- or gas-fired power plants in most countries.

# The Impact of Green Technologies on Industry 4.0

## I 4.0 in business logistics and circular economy

- Resource melioration
- Re-manufacturing
- Business sustainability

## Are you doing technologies in green supply chain

- KPI
- Sustainability
- Energy consumption

## I 4.0 environmental considerations

- Strategic decisions
- Competition
- Cost sharing contract

## Are you 4.0 and diffusion of green products

- Diffusion dynamics
- Economic and environmental performance

## I 4.0 and green supply chain - case studies, pilots and application

- Sustainable shipbuilding supply chain
- I 4.0 adoption for sustainability in multi-tier manufacturing supply chain
- Adoption of green practises in enabling technologies

## Are you 4.0 and green in green supply chain

- Lean practises in operational performance

## I 4.0 and supply chain performance

- Environmental perspective
- Self-sufficiency

## I 4.0 and sustainable business models

- Recycling
- Efficiency
- Value proposition

## Drivers of a 4.0 and circular economy

- Pollution control
- Waste disposal
- Smart system

# GREEN SUPPLY CHAIN



Industry 4.0 provides complete usage of green technological processes to gain sustainability. Green technological processes use technologies that are already in use to create innovations and social and technical conditions for people working in factories. This can also include maintenance and eco-design. Eco-design of the products makes in recyclable and reusable. This reduces the chemicals and energy used in the manufacturing process. Green manufacturing, the process of manufacturing products using decreased energy-intensive pieces of equipment to minimize the negative impact on the environment.

Organizational and technical sustainability is a sort of internal sustainability that focuses on a company's internal operations. It is concerned with the most efficient utilization of resources. It entails the employment of human labour, the upkeep of technical equipment

and machinery, and IT infrastructure implementation.

Sustainable manufacturing refers to the long-term viability of manufacturing processes in the manufacture of environmentally friendly products in compliance with the conditions imposed by environmental protection and cost-cutting demands.

Sustainable supply chain and logistics refer to the long-term viability of supply chains and logistics networks based on the need for continuous supply security and waste management. The key to managing and optimizing supplier networks is a collaboration between businesses involved in distribution, warehousing, transportation, and other logistics services. In the field of logistics, it's all about long-term sustainability as a result of transportation's negative environmental impact.

## The Triple Bottom Line is a fundamental notion of sustainability based on the 3P model (People, Planet and Profit).

Meeting human needs and achieving a satisfactory quality of life while efficiently allocating resources (economically), conserving natural resources, including ecosystems and biodiversity (ecologically), and making social resources accessible to all

while preserving cultural diversity (socially) are all part of the triple bottom line (socially).

Circular Economy (circularity) is an economic strategy that aims to reduce waste by allowing unrestricted resource utilization. The SGI 4.0 framework unifies the utilization of technology and resources through environmentally friendly processes, ensuring long-term viability.

Sustainability outcomes are characterized by the most commonly found advantages for each category and are separated into three groups (economic, environmental, and social).

### End Note

New research based on our SGI 4.0 paradigm should attempt to demonstrate empirical results of green process sustainability outcomes in relation to Industry 4.0. In the context of Industry 4.0, the SGI 4.0 framework enables the development of assessment tools for evaluating the sustainability of green processes. The framework identifies which sustainability outcomes should be considered when developing these techniques. This research creates a framework for companies using Industry 4.0 technology to adopt and facilitate sustainability through green operations. It provides a conceptual and theoretical framework for empirically testing the link between these variables.

According to reports, our world will change dramatically in 2024, with solar becoming 35% cheaper, wind energy capacity increasing by

57%, hydroelectric capacity increasing by 9%, and geothermal capacity increasing by 28%. This is demonstrated by the fact that India is the world's second-largest renewable energy generator, trailing only China and the United States.

Green technology is unavoidably the way of the future. Many investors have been focusing on start-ups that create a sense of security in reaction to the anticipation and worry surrounding climate change and a growing scarcity of natural resources. As a result, a significant number of firms have begun to revolve around the new trend of embracing green technology. Another reason corporations are focused on green technology is because a clean and safe future must support environmental goals and sustainable practices using the newest technical breakthroughs.

# India-UK 'Green Grids' Initiative Can Boost Transition to Clean Energy Worldwide

*by Ragini Agarwal*

According to a recent assessment by the International Energy Agency, annual grid expansion and modernization investments should quadruple from \$260 billion to \$800 billion by 2030. Prime Minister Narendra Modi (India) and his British counterpart Boris Johnson jointly presented a new flagship global project, backed by over 80 countries, to significantly accelerate the global transition to sustainable energy at the COP26 World Leaders' Summit in Glasgow.



During the World Leaders' Summit at COP26 on Tuesday, November 2, 2021, the Prime Ministers of India and the United Kingdom unveiled the Green Grids Initiative One Sun One World One Grid (GGI-OSOWOG). The International Solar Alliance (ISA) efforts are led by India and endorsed by the UK's COP26 core team. Prime Minister Narendra Modi first presented the concept during the ISA's

inaugural session in October 2018, when he urged that solar energy be connected across borders.

The new GGI-OSOWOG is another step forward in the International Solar Alliance's global efforts to develop solar energy infrastructure. It also acts as a model coalition for strengthening bilateral ties between India and the United Kingdom.



**The Green Grids Initiative intends to begin with a coalition of the willing, such as two nations that would mutually benefit from solar power transmission and, over time, lower solar prices throughout the world,** said ISA Director-General Dr. Ajay Mathur.

This infrastructure consists of considerably increased renewable energy generating capacity in energy-rich regions, all of which are connected by continental networks. Millions of solar cells, electric vehicle charging stations, micro-grids for rural areas, and weather resilience are all connected via smart grids. The project's primary goals are to enhance global collaboration for large-scale

renewable energy capacity addition, improve demand-side flexibility, and deal with the unpredictability of renewable energy output. The project will be completed in stages. The first connects West Asia, South Asia, and Southeast Asia, the second spread to African power pools, and the third perhaps leads to global grid connectivity.

Cross-border electricity trading in deregulated power markets can optimize renewable energy installations while lowering electricity rates. Long-term planning and commitment to building a global grid would attract investment, mitigate country-specific risks, generate employment, and improve technology. Against this backdrop, the International Solar Alliance (ISA) and Bloomberg Philanthropies recently announced a \$1 trillion deal to finance solar energy programs in ISA member nations throughout the world. Furthermore, the two organizations worked together with the World Resources Institute (WRI) to produce a Solar Investment Action Agenda and Roadmap, which was also announced during COP26.

## What's Ahead for the GGI-OSOWOG

The United States declared its desire to join the endeavour at the Steering Committee meeting following the formation of the GGI-OSOWOG. The truth that "all the power humanity utilizes in one year is equivalent to the power that arrives the globe from the sun in one hour," as declared by Jennifer Granholm, US Secretary of Energy, attracted attention to this critical initiative spearheaded by India and the United Kingdom.

The World Bank has teamed up with the initiative's Standing Committee's five-member countries (India, the United Kingdom, the United States, Australia, and Paris). It wants to use this cooperation to exploit the paybacks of renewable generators and non-center complementarity across states.

The GGI-OSOWOG initiative has the potential to shift the global electrical grid away from fossil fuels and toward more variable renewable energy sources. As a consequence, a new era of collecting a considerably larger percentage of renewable energy, taking advantage of the global energy transition, and contributing to the building of an ecosystem built on mutual trust and shared advantages will usher in.



## Some facts about the initiative

- 1** The United Kingdom and India want to improve global energy power grid connections.
- 2** More than 80 nations have signed up for the 'Green Grids Initiative.'
- 3** It will allow places with plenty of renewable energy to send it to areas with scarcity.
- 4** These grids are "important answers," according to India's Prime Minister Modi, for pushing the world toward a "clean and green future."
- 5** The agenda is a portion of a big ambition to accelerate the adoption of low-carbon technology that will benefit more than 70% of the global economy.



As a leading new international initiative, the global GGI-OSOWOG will support the recently launched 'Breakthrough Agenda,' specifically the 'Glasgow Power Breakthrough,' which aims to create

**"clean energy the most reasonable and dependable alternative for all nations to fulfill their energy requirements effectively by 2030."**

## Role of India in the Initiative

During the COP26 Facilitative Sharing of Views (FSV) on November 7, 2020, India presented its 3rd Biennial Update Report (BUR) to the United Nations Framework Convention on Climate Change (UNFCCC). India's achievement of a 24 percent drop in emission intensity relative to GDP from 2005 to 2014 and a stronger emphasis on solar energy utilization were the highlights of the presentation.

The COVID-19 outbreak has recently wreaked havoc throughout the globe. It also stressed the importance of solid medical facilities and infrastructure for administering life-saving chilled vaccines. As the country struggles with periodic heat waves and power outages, the importance of green energy, particularly solar energy, in



addressing these challenges has become apparent. Access to renewable energy sources may significantly impact health care facilities for many people, particularly in India's rural areas where the pandemic is causing havoc, possibly defining the difference between life and death.

India was willing to concede the advantages of solar power even before COVID-19. The government has set a lofty aim: by 2022, it will have generated 100 gigawatts (GW) of solar power capacity. Commercial and industrial customers would profit since they account for 74% of present energy capacity, compared to only 13% for residential customers and public sector organizations.

It had 38.8 GW of solar power installed in December 2020, comprising ground-mounted and rooftop installations. Other critical infrastructure, such as transportation, is also powered by solar energy. Rewa solar park,

India's largest solar arrays, powers the New Delhi metro train, which transports over 2.6 million passengers every day. Communities are becoming more empowered – both physically and metaphorically – due to government-led projects like 24x7 - Power for All, which aims to supply energy to every family 24 hours a day, seven days a week.

According to the BUR, India's solar capacity has expanded by 17 times in the last seven years, reaching 45 gigawatts. According to the study, despite having 17 percent of the world's population, China has historically contributed 4% of cumulative emissions, with current greenhouse gas emissions accounting for only 5% of overall emissions.





# Role of UK in the Initiative

At the COP26 climate talks in Glasgow, Scotland, more than 80 nations advocated the "Green Grids Initiative," which could serve as a benchmark for how rich countries can assist poorer countries in reducing emissions and meeting the goal of keeping global warming to 1.5 degrees Celsius (2.7 degrees Fahrenheit) above pre-industrial levels.

**"If the planet is to transition to a cleaner and greener tomorrow, these integrated transnational grids will be vital answers,"**

Indian Prime Minister Narendra Modi said in a statement.

According to Matthew Wald, an independent energy expert in the United States, the idea emphasizes the need for more transmission lines since renewable energy sources must typically be placed far from municipalities, unlike coal or gas-fired installations, whose fuel can be carried in.

"Planners in many countries, notably the former Soviet Union, have long dreamed of low-cost transmission across time zones but have made little progress," says Wald. Despite recent developments in powerline technology, Wald and others believe the project will be too costly.

## Conclusion

This endeavour highlights the long-standing bilateral relationship between the United Kingdom and India. This initiative was first agreed upon in May 2021 as part of the 2030 Roadmap for Future Relations between India and the United Kingdom.

The GGI-OSOWOG is a game-changing new initiative that aims to provide universal access to renewable energy by 2030 by guaranteeing that clean energy is the most cost-effective and dependable alternative for all countries to satisfy their energy demands. This will assist us in achieving the Paris Agreement's aims and keep the goal of limiting global warming to 1.5 degrees Celsius alive while promoting green investment and supporting millions of jobs throughout the world.

# Digitalization to Decarbonization

## What Steps are Private & Public Entities to Erase Carbon Footprints?

*by Saipriya Iyer*

The daunting issue of global warming has plagued major industrial sectors all over the globe. In a world characterized by increasing industrialization, urbanization, and a host of other issues including financial crises and food security, increasing carbon emissions stand out as a pressing problem that requires immediate action.



According to the World Meteorological Organization, there has been a considerable increase in temperature even in 2021 – the global mean temperature for this year was approximately 1.09°C more than the 1850-1900 average, indicating urgency for a solution.

## Climate Change and Importance of Decarbonization

Climate change has been a persistent problem since several years now. Excessive deforestation, improper waste management, and oceanic neglect are among the many reasons that have led to fluctuating climatic cycles, bringing about shrinking glaciers, heavy precipitation, rising maximum and minimum temperatures, and higher ocean temperatures. Carbon emissions are at an all-time high, brought about majorly by built environment.

According to the Urban Land Institute, built environment, i.e., man-made infrastructure is responsible for almost 40% carbon emissions worldwide. Think tank Chatham House propagates a similar line of thought, claiming that cement is responsible of around 8% of global carbon emissions.



In a scenario as grave as this, decarbonization has become more significant than ever before. Decarbonizing man-made structures with carbon-negative construction technologies is just one of the many ways to lower emissions and create a healthier environment. Energy-efficient buildings characteristic of enhanced HVAC systems, smart energy management systems, light upgrades, and better insulation are more than likely to have reduced carbon footprints, increasing energy efficiency by 20%, to say the least. As per [energy.gov](https://www.energy.gov), U.S. consumers are said to have saved around USD 14.7 billion in energy costs merely by making the switch to LED lighting.

Decarbonization goes well beyond constructing carbon-negative buildings though. Creating a decarbonized economy involves a host of strategies such as energy management with analytics solutions, alternative fuel usage in vehicles (or better still, to go full steam with electric vehicles), using renewables more often than not, and adopting sustainable procurement practices. Going carbon-free has a slew of advantages, significant among these including longer life expectancy and better economic output as a whole.



## How to Become Carbon-neutral with the Help of Technology

In a bid to mitigate global warming and achieve considerable reduction of greenhouse gases, authorized bodies the world over have been collaborating to bring about vital initiatives. One such major initiative is the Paris Agreement. It is a legally binding international treaty pertaining to climate change, signed by 196 Parties on 12 December 2015 in Paris. It came into force on 4 November 2016. Its implementation involves considerable social and economic transformation, aided by technological developments to achieve climate change and reduce GHG emissions.

**The Internet of Things (IoT) for example, can be effectively utilized to collect, store, and analyze data and information pertaining to buildings, plants, energy systems, and the like.**

In essence, this will enable businesses to adopt solutions that can measure actual device usage, control over/underuse, match consumption to targets, etc. Adopting AI on a large scale will help measure and control a company's carbon usage and help set sustainable targets for the future.

In a manner of speaking, massive advancements in technology may be one of the ways why our planet is currently in so much turmoil. The same technologies and the ingenuity however, can be easily deployed to ensure that we become carbon-neutral soon enough. The Internet of things, digitization, and artificial intelligence, in addition to numerous other technologies, will help lead the way to a decarbonized economy.

Speaking of AI, adopting Artificial Internet of Things (AIoT) will help in realizing a carbon-free economy, as it helps source real-time data from numerous systems, helping companies organize, collect, and collate data into detailed reports. Eventually, these reports help in monitoring and measuring emissions and enhancing data quality.

In an era where globalization and industrialization are rapidly shaping developments worldwide, digitalization may emerge as a double-edged sword, depending on where man chooses to put it to use. That is to say, some estimates claim that global data traffic is expected to triple to approximately 400 billion gigabytes monthly through 2022 – which is equal to the storage space of 100 billion DVDs. In essence, digitalization may be causing more carbon emissions than ever.

Having said that, digitalization can be conveniently deployed to better monitor and understand the ecological footprints of various products, although, this would require modern technologies to be completely integrated into the society. Digital solutions can be used to ensure clean air, lesser pollution, preservation of biodiversity, climate protection, and more. In the form of smart textiles for instance, digital solutions can be used to convert disposable items into products that are durable and recyclable. In the wake of COVID-19, with the work-from-home culture at the forefront, home office solutions such as video conferencing tools and the like gained precedence, greatly reducing unnecessary travel.

In a nutshell, technological solutions can be actively pursued to reduce carbon emissions and accomplish the net-zero emission targets promised by private and public entities. To ensure that carbon management solutions remain a major part of emission reduction agendas, technologies supporting offset integration and real-time measurement must be adopted on a large scale.

## The Trend of Corporate Decarbonization

### What Does the Scenario Look Like?

Climate protection is no longer an option or a fad; it is real and imperative and requires immediate attention. Corporate firms, to that end, have been doing everything in their capacity to bring about fundamental changes in the energy ecosystem.

According to the World Energy Outlook 2020, emission reductions of around 2 billion tons can be achieved in 2030 by employing minor changes such as walking shorter distances, flying less, or resetting air conditioners. To that end, presently, big tech companies have been working toward carbon offsetting, direct air capture technology, other carbon capture, and utilization and storage (CCUS) technologies. In addition, many corporate entities have been working to scale up vital clean energy technologies such as wind and solar energy, geothermal, advanced nuclear energy, and green hydrogen.

A noteworthy example of corporate decarbonization is that of Dalmia Cement.

**The leading Indian cement maker apparently manufactures the lowest carbon intensity cement in the world – around 20 percent lesser than the cement average the world over, and is further planning to scale up its targets. The company has committed to become carbon negative by 2040.**

Speaking of yet another instance defining the current scenario, Levi Strauss & Company has identified the significance of furthering its climate protection target, not only to adhere to the aims of the Paris Agreement, but also to ensure that its supply chain remains protected from the impact of climate change. In 2018, Levi Strauss & Co. committed to a target of 90 percent emission reductions in all its owned and operated facilities the world over and a 40 percent emission reduction in its supply chain, by 2025.



# Sustainability Efforts by Companies

Decarbonization efforts at the corporate level have not been limited to Dalmia Cement and Levi Strauss & Company; in recent times, a score of companies have been working to achieve the zero emissions target. A gist of the same is provided below:

## McDonald's Corporation

Globally renowned food chain, McDonald's Corporation announced its decarbonization commitment long back, having pledged to achieve net zero emissions spanning its operations worldwide, by 2050. As part of this commitment, the company has joined the SBTi's (Science Based Targets initiative) Business Ambition for 1.5°C campaign. To that end, the firm plans to increase the levels of emission reduction in its current 2030 science-based target. Since 2018, McDonald's has already achieved 8.5% reduction in restaurant and office emissions and 5.9% decrease in supply chain emissions.

## Google

Tech giant Google, since long, has been committed to reduce its carbon footprint. In 2007, the company became carbon-neutral and has recently claimed that with extensive investments in high-quality carbon offsets, it has erased its entire carbon footprint. Last year in September, it announced that it is going a step ahead with an approach called 24/7 Carbon Free Energy.

In effect, Google will now match electricity usage by the hour with locally sourced zero-carbon energy, thereby operating on carbon-free electricity 24/7, by 2030. Recently in May

2021, Google partnered with The AES Corp. for the supply of 24/7 carbon-free energy to its data centers in Virginia.

## Microsoft

Tech Corporation Microsoft recently declared that it will leverage the best of modern technologies to be completely carbon negative by 2030. By the year 2050, Microsoft aims to mitigate all the carbon it has generated since its inception in 1975. In addition, the firm will also launch an initiative to use Microsoft technology to help its clients and suppliers lower their own carbon footprints.

Microsoft has also come up with a new climate innovation fund worth USD 1 billion, to speed up the global development of carbon capture, reduction, and removal technologies. It plans to make carbon reduction a major part of its procurement processes as well.

## Apple

Last year in July, iPhone giant Apple announced that it plans to make its entire manufacturing supply chain and product life cycle, carbon neutral by 2030. As a matter of fact, Apple is already carbon neutral across its operations worldwide, but with this mission, the firm will ensure that every one of its products sold will have net zero climate impact by 2030. The company has been taking every possible initiative in this regard.

Recently in October, as a part of its decarbonization goal of 2030, Apple declared that the number of its suppliers committed to

deploying 100 percent clean energy has more than doubled since 2020. Close to 175 Apple suppliers will transition to using clean energy, as Apple plans to bring over 9 gigawatts of renewable power online, globally. Over time, this action will help mitigate over 18 million metric tons of CO2 emissions annually.

## **Amazon**

In 2019, Amazon was the co-founder of The Climate Pledge, i.e., a commitment targeted toward net-zero carbon across all its operations by 2040. The retail giant encouraged many other companies to join its pledge, claiming that cooperation is the only way toward global decarbonization. To that end, the company has generated an innovative carbon system of record that measures the sources of carbon across all Amazon operations, thereby enabling the firm to concoct ways to decrease emissions. Amazon also has plans to deploy 100,000 electric delivery vehicles and is further looking out for methods to enable sustainability in freight operations. In addition, it has invested in sustainable building technologies, such as carbon-sequestering cement, and is using the same in its construction projects.

## **American Airlines**

American Airlines has recently joined the bandwagon of companies aiming to lower carbon emissions through their operations. Early this year, the firm collaborated with Deloitte to increase the use of sustainable aviation fuel (SAF) for lowering aviation emissions. The agreement demands that both companies reduce CO2 life cycle emissions from aviation by around 3,050 metric tons of carbon dioxide – which apparently amounts

to around 10,000 passengers flying from New York City to Los Angeles (one-way).

Further, the company has pledged to mitigate greenhouse gas emissions by 2035, thereby supporting its current commitment to reach net-zero emissions by 2050. To that end, it has joined the Race to Zero and the Business Ambition for 1.5°C campaign. In September this year, American Airlines has also invested close to USD 100 million in a collaborative effort to increase the development of clean energy technologies for achieving a net zero economy by 2050.

## **BT Group**

UK-based telecom company BT Group has pledged to achieve net-zero carbon emissions by 2045. In the year 2016, the company achieved a target it had set earlier, four years ahead of schedule. The target was to lower carbon emissions intensity by 80% on 1996-97 levels. Since 2009-10, BT has managed to save USD 328 million, and during 2017-18, the company cut its energy bill by USD 37 million. It has accomplished this by bringing about efficient setups in its data centers, networks, and buildings. Further, BT also claimed that it aims to decarbonize by 87 percent, against the 2016-17 levels.

## **The IKEA Group**

The IKEA Group – one of the best furnishings giant worldwide, was indeed among the first ones to be a part of The Climate Group's EV100 initiative to fast-track the roll-out of electric transport last year. IKEA now uses electric vehicles (EVs) to further its goal of tackling emissions.

The company had pledged to transition its "last mile" home deliveries spanning key cities such as Los Angeles, Paris, Amsterdam, Shanghai, and New York, to zero-emission transport by 2020. By 2025, the company aims to have all its "last mile" home deliveries to be in the zero emissions bandwagon.

## NRG

U.S.-based energy company NRG is also a part of the global decarbonization move, and has raised the bar by announcing to help its customers decarbonize their power needs through reduced emissions and delivery of renewable energy. The utility aims to reduce 50% absolute emissions by 2030 as opposed

to the 2014 baseline – so far, it has already achieved 70% of this goal. NRG has also managed to reduce absolute emissions by almost 20 million tons.

## Signify

Philips Lighting – now Signify, has also joined the carbon neutral bandwagon. The firm has pledged to transition to 100% renewable energy with RE100. In addition, it will accelerate the transition to charging infrastructure and electric vehicles. Both these goals will be led by The Climate Group. Signify has also committed to using net-zero carbon buildings for its owned and operated sites – around 300 of them, to say the least.

# Efforts Undertaken by Government Bodies

As the issue of climate change becomes more and more pressing by the day, governments the world over have been charting out effective plans and policies to ensure carbon neutrality at the earliest. While some have already commenced decarbonization strategies, many others have joined carbon neutrality programs and have been collectively working toward a carbon free future. The paragraphs below enumerate the steps some governments have been taking in this regard.

## The UK Government

The UK government has been very proactive in this regard; indeed, emission reduction has been a major target for the nation since two decades. During 2000 and 2014, energy-related CO2 emissions in the UK reduced from 591 to 470 million metric tons, while GDP grew from USD 2.1 to USD 2.7 trillion. Recently in 2021, the UK government unveiled a Net

Zero Strategy that laid down a plan on how the country will create 440,000 well-paid jobs in addition to unlocking GBP £90 billion in investment in 2030.

## The City of Miami

The Miami City Commission recently approved the City's new comprehensive GHG reduction plan called Miami Forever Carbon Neutral, in a bid to achieve decarbonization in the state by 2050. Its main aim is to mitigate citywide GHG emissions from 2018 levels by 60% by 2035. In order to accomplish the same, the City plans to implement policies that address renewable energy usage, EV adoption, energy efficiency, and promoting a new green economy.

The Indian Government

India aims to achieve Net Zero emissions by 2070. To that end, the Indian Prime Minister recently declared a five-fold strategy at

the 26th Conference of Parties (CoP26). As a part of the same, the Indian government aims to obtain its non-fossil energy capacity to 500 gigawatts (GW) by 2030. The country has goals to meet 50 per cent of its energy requirements from clean energy by 2030 and it will reduce the total projected carbon emissions by 1 billion tons till the same year. In addition, India aims to mitigate the carbon intensity of its economy be lesser than 45 percent.

## The U.S. Government

The U.S. has been involved in decarbonization strategies since a very long time. Recently in April 2021, President Biden announced a new target for the U.S. for achieving a 50% to 52% reduction in economy-wide net greenhouse gas pollution by 2030, as opposed to the 2005 levels. In order to accomplish the same, the U.S. will focus on deploying clean and green technologies. In addition, it will invest in new technologies to mitigate emissions associated with the construction sector, say like, high-performance electrified buildings.

The U.S. will also help in reducing carbon pollution from the transportation sector by enhancing the efficiency of vehicles, providing funds for charging infrastructure, boosting R&D efforts, spending on low carbon new-generation renewable fuels, and bringing about cutting-edge transportation technologies.

Examples of a few other nations ramping up their efforts with regards to decarbonization:

- 1 In October 2020, the government of Japan declared its plans **to reach net zero carbon emissions by 2050**. Further in April 2021, the nation raised its earlier goal of emission reduction by 2030, to a massive 46% from its 2013 levels.
- 2 In June 2021, Germany passed a new Climate Action Law that pushed ahead the deadline for achieving climate neutrality, to 2045. The Law also states that the target for **greenhouse gas emission reduction will be 65% by 2030** as compared to 1990, while a new interim target of 88% reduction applies until 2040.
- 3 Switzerland already has an ambitious zero emissions started, and recently, it has declared that **it will need to spend USD 14 billion annually** (around 2% of gross domestic product), over the next thirty years, to achieve its 2050 carbon-zero goal.
- 4 In 2009, Singapore committed to reducing emissions by 16% from business-as-usual (BAU) levels, by 2020. In 2015, it pledged to reduce GHG emissions by 36% from 2005 levels, by 2030. On 31 March 2020, Singapore claimed that it **plans to halve its emissions by 2050, from its peak to 33MtCO<sub>2</sub>e to accomplish carbon neutrality by 2050**.

The adoption of advanced technologies such as machine vision and artificial intelligence to mitigate emissions will soon become mainstream considering the pace at which governments and corporate entities are working toward decarbonization. As private and public entities collaborate and work on technological developments that can be harnessed to achieve zero carbon emissions, we can perhaps, have hopes to expect a carbon-free future sooner than envisioned.



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