

Clean Slate

Climate tech startups are coming up with innovative products and solutions to solve environmental problems and ensure a cleaner, greener world

By DIVYA J SHEKHAR

CHAKR INNOVATION

Setting the Wheels in Motion

Through its patented technology, the cleantech startup offers an emission-control solution. It is now developing an indigenous energy storage technology to reduce dependence on lithium-ion

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In 2015, following a survey by the World Health Organization (WHO), Delhi had earned the notorious moniker of being the ‘world’s most polluted city’. At the time, Kushagra Srivastava was a second-year engineering student at IIT-Delhi. His faculty members were part of various expert committees and panels working with the government to tackle the air pollution issue, and on campus, there were regular discussions about how students could use their technological prowess towards this menace.

The next year, Srivastava, being a “native Delhi-ite”, formally registered a company called Chakr Innovation to develop innovations to reduce emissions that contribute towards air pollution. He spent the next two-and-a-half years on research and development (R&D), and in 2019, the product was ready for commercialisation. Chakr had developed what Srivastava calls

Chakr Innovation

FOUNDED IN: 2016

FOUNDERS: **Kushagra Srivastava** (CEO); **Arpit Dhupar, Bharti Singhla** (both no longer with the company)

FUNDING: **\$22 million** (about ₹162 crore); last funding round was Series B in **November 2021**

INVESTORS: Include **Neev Fund, ONGC Startup Fund, IDFC-Parampara Fund, IAN Fund, Globevestor**; angel investors **Jyoti Sagar, Rajiv Mehrishi**

KEY INNOVATION: A **patented retro-fit emission control device** for diesel generators that purportedly captures over **70%** of particulate matter emissions from the **exhaust** of the **generators**

the world’s first retro-fit emission-control device (RECD) for diesel generators. The Chakr Shield, a patented technology, reportedly captures over 70 percent particulate matter emissions from the exhaust of diesel generators. A video on the Chakr website says the innovation converts the pollution



Kushagra Srivastava, co-founder and CEO of Chakr Innovation, with an electric bike that runs on an indigenous battery, in Gurugram

captured into ink, and “each litre of ink purifies 700 litres of air”.

“We have already deployed this technology at over 1,000 locations,” says Srivastava, adding that they have more than 150 customers, including Hindustan Petroleum, the Tata group, ITC, Toshiba and The Coca-Cola Company, among others. He

adds that so far, over “40,000 metric tonnes of carbon dioxide has been prevented from going out into the air by deploying this emission-control technology at various locations”.

The RECD has received a type approval from the Central Pollution Control Board (CPCB), which gives Chakr a strong moat, believes Akshay Panth, chief investment officer of Neev Fund, a climate-

He adds that from a customer acquisition perspective, “they have the ability to generate repeat business from existing customers, which validates the product”.

Panth says Chakr only had a single product at the time of their investment and their thesis was that it had to become a multi-product company. “On the base case, we saw a large market for the

raised close to \$22 million (close to ₹162 crore) in funding, and has developed other technologies—one which has been commercialised, while another is in the R&D stage.

Their diesel fuel kit “enables a diesel engine to run on a mix of gas and diesel. It uses 70 percent gas and 30 percent diesel, which reduces emissions,” says Srivastava, adding that the tech has been deployed at various locations in the country. Another innovation that has been in the works for the past three years is an indigenous energy storage technology that Srivastava claims will reduce India’s dependence on lithium-ion, which is currently the default energy storage solution. As of now, India relies heavily on China and Hong Kong for its lithium requirements.

Chakr’s aluminium-air energy storage technology has an initial capex that is 40 percent less than lithium-ion, and the operational expense is 30 percent less than an internal combustion engine, says a June 2022 presentation deck made by the startup.

“This energy storage technology is recyclable, unlike lithium-ion, where the batteries you need to dispose of,” Srivastava adds. In electric vehicles, claims the presentation, the aluminium storage tech is non-flammable, unlike lithium-ion, has three times the range, and oxidised aluminium can be replaced, eliminating recharging time and infrastructure.

The cleantech startup is also developing a software platform for connecting decentralised sources of energy, which is in the R&D stage. Srivastava claims that Chakr is a profitable company, with average revenues of ₹8-10 crore a month.

As an investor, Panth calls the company “a multi-bagger” and feels that there are strong commercialisation prospects for the solutions that are currently in development.



focussed private equity fund that led the Series B fundraise of the cleantech startup in 2021. Anyone else coming into the sector will have to incur “significant amount of capital expenditure, and conduct hours of testing on the devices with the accredited government labs to get these approvals”.

RECD itself to build a strong, stable business in this case, but if they were to add additional products and services, then the multiplier effect becomes significant,” he says.

Srivastava, who started Chakr with two other co-founders, both of whom are no longer with the company, says the startup has

GPS RENEWABLES

Converting Waste to Bioenergy

Founders of the Bengaluru-based venture—who run what is reportedly Asia’s largest bioCNG plant—believe they have barely scratched the surface of the billion-dollar biofuels industry

Mainak Chakraborty did not opt for campus placements at the end of his postgraduate management diploma course at the Indian Institute of Management Bangalore (IIM-B). He wanted to start something on his own, a for-profit venture that was environment-facing, but was not sure what to do. Soon enough, along with a senior from IIM-B, Sreekrishna Sankar, he realised there was a business opportunity in a problem that was staring IT city Bengaluru in the face: Waste management. This led them to thinking about converting waste to bioenergy, where they realised technology could play a role and help the engineers put their skillsets to good use.

At the time (2010-2011), their idea was to “product-ise and decentralise biogas production for an urban setting”, Chakraborty says, by helping commercial spaces like hotels or corporate campuses convert their organic waste into energy. The duo launched GPS Renewables, a biofuels technology and execution company, in 2012. Until then, they had only seen solutions like cow dung gas plants that were designed to provide low-cost waste management solutions in rural areas. These were large, often smelly structures with a large footprint

Sreekrishna Sankar (left) COO, and Mainak Chakraborty, co-founders and CEO, of GPS Renewables



and involving a lot of civil work.

For urban settings, they had to find a way to make these plants smaller, not smelly, and as less messy as possible. In the absence of huge swathes of land, they had to build the plant vertically, spread across many floors. The health of these plants had to be monitored and tracked remotely. The non-profit Akshaya Patra helped them set up their first commercial pilot. They also catered to corporate campuses and



luxury hotels, often retrofitting their solutions to fit the available space.

Till now, GPS Renewables has set up close to 100 captive biowaste-to-energy plants across the country. “We have an original artificial intelligence [AI] solution called the BiogasBot with patented hardware, which keeps track of the bio-health of all our 100 plants across India,” says Chakraborty.

They also run two large, functional bioCNG plants. One in Indore, reportedly Asia’s largest bioCNG plant that processes about 500 tonnes of organic waste, and the second in Lucknow. “We are also setting up multiple plants that convert paddy straw, which is often burnt in the North and is a source of smog every winter, into bioCNG for vehicular applications,” Chakraborty says, adding that at Haji Ali in Mumbai, they run one of the world’s first biogas-powered electric vehicle (EV) charging station.

“We have multiple innovations, from special microbes and our own monitoring software to specialised products for carbon dioxide capture and removal,” says Chakraborty, claiming that GPS Renewables, with a 300-people strong team, has an annual revenue run rate of ₹500 crore and is a profitable company.

The Bengaluru-headquartered company has raised about \$20 million in funding, the most recent being a

Series B round of about \$17 million, led by Neev Fund, in 2022. Their Series A fundraise was in 2020. A bulk of the funding came only after seven to eight years of operations, Chakraborty points out, explaining how it has not been easy for startups in the climate tech space, with their engineering solutions and innovations having long gestation periods, finding it difficult to raise funds.

“Until then, we were very frugal with our operations and spends, surviving on seed money, R&D grants, debt and non-collateral loans under the government’s Credit Guarantee Fund Trust for Micro and Small Enterprises, and purchase-order financing,” Chakraborty says.

“We are bullish on GPS and what the company will be able to achieve in the biofuels space,” says Akshay Panth, chief investment officer, Neev Fund, which led the Series B fundraise. “When we invested, GPS was an SME that was growing fairly rapidly. They had done the Indore bioCNG project, were on the cusp of growth, and even though a lot of focus was on project and execution, they were a tech-driven company at the core.”

According to Panth, one challenge is that biofuels is still nascent with multiple segments emerging at a rapid pace. “There is a constant tussle between demand and supply, and a stable ecosystem is needed now,” he explains, adding that it is a capital-intensive business and if GPS were to decide to do all these projects on their own balance sheet, they would need to raise more capital. “That said, they have a good revenue visibility given their commercial and industrial-focussed client base,” he says.

Chakraborty believes they have barely scratched the surface of the multi-billion dollar global biofuels industry, and his goal for the next three to five years is to help GPS remain profitable and run some of the flagship biofuels projects across the world in India.

GPS Renewables

FOUNDED IN: **2012**

FOUNDERS: **Mainak Chakraborty** (co-founder and CEO); **Sreekrishna Sankar** (co-founder and COO)

FUNDING: **\$20 million**; last funding round was a Series B in **April 2022**

INVESTORS: Include **Neev Fund, Triodos Investment Management, Capsian Equity, i2India Holdings**

KEY INNOVATION: Building **tech-powered waste-to-renewable** energy infrastructure

SEA6 ENERGY

Sea of Possibilities

The startup uses automation to develop large-scale feedstock of seaweed, which has the potential to replace fossil fuels. It is now trying to make biofuels and bioplastics

India has a high dependence on crude oil; it's the third-highest importer in the world after the US and China. According to a July 25 report in the *Economic Times*, India imported \$31.4 billion worth of crude oil in the April-June quarter, about 60.1 mmt.

There is no easy alternative to the versatile crude oil, which powers our industry and energy needs, from transportation to textile, but which releases carbon dioxide that contributes to global warming.

A Bengaluru-based startup launched by a biotechnology research veteran from Biocon and three engineering graduates from the Indian Institute of Technology (IIT) Madras is contributing to the solution by farming the ocean. Sea6 Energy is developing a large-scale sustainable alternative feedstock from seaweed, which "can potentially replace everything that we do today with crude oil", says Shrikumar Suryanarayan, co-founder and managing director.

In 13 years since being founded, the startup has been working on two broad areas: First, large-scale seaweed production by developing automation, and second, converting this seaweed into useful products that have applications across sectors.

Growing seaweed—which absorbs carbon dioxide as it grows, transforming it into biomass—is traditionally a labour-intensive process restricted to shallow waters,

which makes it cost-ineffective. Sea6 has been inventing and scaling up machinery to counter these issues. It has a patent on a seaweed farming system, Suryanarayan says, which includes a tractor that automates the process of seeding and harvesting. There are also large-scale girds that float on the ocean on which seaweed can be grown.

The first product made from seaweed that they have commercialised is a bio-stimulant, when sprayed in small amounts on crops like rice, maize and sugarcane can drive the yield up by 10 to 30 percent depending on the crop, the inputs (fertilisers, irrigation) etc provided and the condition in which it is grown. "This is not a fertiliser, but improves the efficiency of how plants capture sunlight and use nutrients," says Suryanarayan. "This means we have found a way to produce more food from the same land and improve food security."

Sea6 has a global patent on this product, which is exported to the US, Europe, Latin America, Japan and other countries in Southeast Asia. These bio-stimulants are manufactured in India and Indonesia, though the bulk of the seaweed farming is done in the latter where Sea6 has a fully owned subsidiary because of the advanced maritime zoning and leasing regulations.

Sea6 is on track to earn about \$10 million this financial year largely on the back of the bio-stimulant, says Suryanarayan. He adds that



Sea6 Energy

FOUNDED IN: 2010

FOUNDERS: **Shrikumar Suryanarayan** (co-founder and MD), **Sowmya Balendiran** (co-founder and chief business officer), **Nelson Vadassery** (co-founder and chief technology officer), **Sailaja Nori** (co-founder and chief scientific officer)

FUNDING: **\$39.4 million**; last funding round Series B in **July 2022**, according to **Tracxn**

INVESTORS: **Tata Capital, BASF, Aqua Spark and Silverstrand**, apart from a handful of angel investors

KEY INNOVATION: Use **proprietary automation** to develop large-scale feedstock out of **seaweed**; develop **sustainable products** and use cases out of **seaweed**, including **bio-stimulants** for agriculture, **biofuels** and **bioplastics**

Shrikumar
Suryanarayan,
co-founder
and MD of
Sea6 Energy



they are working on making fuel from seaweed, and have published a paper with IIT Madras last year detailing how this can be possible. The startup, according to Tracxn, has raised a total funding of \$39.4 million from investors, including Tata Capital, BASF, Aqua Spark and Silverstrand, apart from angel investors, including Biocon CMD Kiran Mazumdar-Shaw. The Series B fundraise, which got in around \$18.5 million, came in July 2022.

The startup is yet to turn a profit, Suryanarayan says, because “expense on R&D is high” and the registration pathway required for commercialisation is long in different countries. “But once you get registration, sales are very rapid,” he says. “The agricultural bio-stimulants are inherently

profitable, and as the volumes build up, we expect to gain profitability in the next year or year and a half.”

As they scale up their farm technology, they have started doing research on converting seaweed to biodegradable plastic. “Next year, we will be in a position to start rolling out some of these products, and we are positioning our next fundraising round, which is Series C, as a growth round,” says Suryanarayan.

Vineet Chadha, partner, Tata Capital Innovations Fund, was one of the first to invest in Sea6 in 2015 and has been invested for the past eight years. According to him, the company has been consistently progressing and developing interesting products with seaweed, like, he says, water-soluble detergent pods, whose outer layer also

dissolves as the clothes get washed.

Chadha believes that the beauty of Sea6 is the founding team’s ability to innovate using simple, intuitive tools and technology and come up with large use cases and commercial applications. “They never complicate or over-engineer things. Their products, including the bio-stimulant, are testament to that. These guys think big, but simplistically. They have their science and their thought process very clear.”

As an investor, the exit has taken longer than what he expected, partly because of Covid-19, Chadha says, but he is happy that they’ve been getting partial exits at regular intervals, one in 2020 and another in 2022. “The team is committed to give, and has been giving us liquidity, which is a good thing,” he says.

SMART JOULES

Powering On

The Delhi-based energy-efficiency technology startup helps businesses, particularly hospitals, optimise power consumption; the excess electricity can be redirected to places that experience shortages

Energy efficiency is the lowest-hanging fruit in climate action, says Arjun Gupta. There are solutions and technologies that exist today, which are proven, scalable and profitable.

Gupta is co-founder and CEO of Delhi-based Smart Joules, an energy-efficiency technology startup, whose innovations help commercial businesses, particularly hospitals currently, optimise their energy requirements. The startup has a little over 40 clients across 25-odd cities in India, and Gupta claims to have generated an average energy savings of about 29 to 30 percent across the portfolio, meaning a “reduced energy cost of about ₹150 crore”. The startup has prevented the release of 140,000 tonnes of carbon dioxide since it was launched in 2016, Gupta claims, and his target for the decade is to reach 29 million tonnes. He had started this company with co-founders Sidhartha Gupta (also CFO) and Ujjal Majumdar (also COO).

Smart Joules offers to design new interventions or retrofit solutions for energy systems in existing structures without the business having to incur additional capital expenditure. They have started out with offering their solutions to hospitals and facilities in the health care sector, due to the latter’s 24x7 nature of operations and high unit electricity costs. Apollo, Aster and Fortis, among others,



Alex Loizos, chief product officer, and Arjun Gupta, CEO, of Smart Joules at a chiller plant in Apollo Hospital in New Delhi

are the hospitals it works with.

Gupta says over the years, they have collected granular data about energy consumption at the facility, systems and equipment level at hospitals, and this has been key to their ability to offer solutions

without increasing capex burden of companies. For example, he says, they are working with a hospital that was traditionally designed for a cooling load of maximum 1,000 tonnes and had air conditioning systems with 1,300 tonnes of

capacity. When they studied the facility, they realised that its cooling load was going to be a maximum 600 tonnes and the air conditioning capacity need not be more than 900 tonnes. “We were able to reduce 400 tonnes of capacity, purely on the basis of studying the energy consumption data.”

Their DeJoule technology platform deploys Internet of Things (IoT) systems and sensors to monitor



and optimise the performance of a facility real-time. This means various energy-related functions at a facility, like fan speed controls, air supply monitoring, user comfort sensing, alerts, alarms and monitoring can happen real-time.

“We have replaced PLC [programmable logic controllers—basically industrial computers, with various inputs and outputs, used to control and monitor industrial equipment based on custom programming] technology with IoT control technology, which is more advanced in processing capacity, speed and data storage, where logics can be updated in real-time,” Gupta explains. Second, software

Smart Joules

FOUNDED IN: **2016**

FOUNDERS: **Arjun Gupta** (co-founder & CEO), **Sidhartha Gupta** (co-founder & CFO), **Ujjal Majumdar** (co-founder & COO)

FUNDING: **\$6.47 million**; last funding round Series A in **March 2021**

INVESTORS: **Sangam Ventures, Raintree Family Office, ADB Ventures and Max India**, among others

KEY INNOVATION: Design **new interventions or retrofit solutions** in existing structures for **energy efficiency**; **IoT-based** systems to monitor and optimise **performance** of a **facility real-time**

of traditional automation systems used to be stored on an on-site server, which, in the case of Smart Joules, is entirely cloud-based.

Their payment is linked to the energy saving of the facility. This is to make sure they are incentivised to minimise energy costs. So far, Smart Joules has raised a total funding of close to \$6.47 million, with the last funding round being a Series A of about \$4.9 million in March 2021. Investors include Sangam Ventures, Raintree Family Office, ADB Ventures and Max India.

Gupta’s long-term goal is to ease the pressure off the electricity grid so that the inequity in power consumption can be corrected to whatever extent possible. “The commercial sector gets uninterrupted power, whereas many residential

neighbourhoods in India continue to face power outages. The power that is not used by the commercial sector can be sold by the utility to neighbourhoods that do not get power,” he says, adding that his business plan is to branch out of health care to sectors like hotels, pharmaceuticals, food and beverage, and data centres.

Since Smart Joules’ revenues are directly linked with energy saved, the growth of the company is accompanied with positive environmental impact, says Mandar Gupte, CEO, Raintree Family Office, who participated in the Series A fundraise. He adds that with a long runway of growth ahead, the startup has created a niche in the hospital sector and developed stickiness with their existing client base. “They have a track record in winning multiple hospital contracts with large chains such as Apollo, which should help them win incremental businesses,” says Gupte, adding that when they invested in the company in 2021, Smart Joules had about 16 projects with ₹12-13 crore of revenue. “Now they have more than doubled to about 42 projects, with revenues of ₹37 crore in FY23.”

Smart Joules has been just as successful in larger facilities, as they have been in smaller ones, Gupte says, adding that revenue growth should also be accompanied by healthy return on invested capital in projects. “As the business grows, it is important to achieve operational excellence in terms of building strong teams, setting up systems and processes to be able to service different industries at scale and deliver the savings as promised,” he says.

CEO Gupta, for his part, is clear about what he wants to do over the next few years: “Our strategy is to decarbonise, one company at a time,” he says.

RENKUBE

Maximising the Power of the Sun

Deeptech solar startup RenKube is developing an AI-powered light harvesting glass that helps panels gather more sunlight and redirect it to solar cells to increase energy yield



(From left) Lakshmi Santhanam, Balaji Lakshmikanth Bangolae and Deepika Gopal, co-founders of RenKube, at a solar energy plant in Karnataka

W

hile working at Cisco in Bengaluru, three engineers decided to get out of the corporate bubble to use their skills in the promising renewable energy space. They started out with a simple premise—India is still importing billions worth of oil and is not energy-secure. Being a tropical country, can we

capture solar energy better? This led them to start a deep-tech solar startup called RenKube in 2017.

Balaji Lakshmikanth Bangolae, Lakshmi Santhanam and Deepika Gopal did not have a background in solar and renewable energy, and spent the first few years trying to come up with a business model.

Their first endeavour to convert heat to electricity ended in failure after they realised there was no unit economics in it. They spent another two years in research and development. “We wanted to build something that was not done anywhere else in the world,” says Bangolae. They used the learning, and skills from their technology background, to develop an artificial intelligence (AI)-based software that develops the best designs to capture sunlight. Finally, they developed motion-free optical tracking (MFOT) of solar panels.

In traditional large solar farms, the panels are kept on motors and gears, and mechanical trackers help the panels move in the direction of the sun. These trackers come with an additional capex, and also need skilled manpower to maintain them. They are also viable only for huge solar farms, and not smaller residential or commercial spaces. “We have embedded this tracking capability in a completely motion-free manner using glass,” explains Santhanam.

They have designed a patent-pending optics and geometry on a light-harvesting glass to capture sunlight throughout the year and send it to solar cells. “We have demonstrated that this can increase the energy yield of the panel by up to 20 percent. We are now designing to increase the yield further to 40 percent,” she says. “We give the same benefits of a mechanical tracker, but in a completely motion-free manner so that you do not have the hassles associated with a tracker.”

While developing this, they made sure the glass is able to redirect light without damaging the solar cells or creating hotspots on the panel, and illuminates every cell. They can retrofit this to suit specific requirements. “You give all boundary conditions and our proprietary AI software comes up

with the best geometrical design of the glass,” Santhanam says.

Bangolae says they are also looking to collaborate with solar panel manufacturers to help manufacture their technology. The RenKube panels will cost up to 10 percent more, but the investment can be recovered in a year or two due to the 20-40 percent increased solar yield, Bangolae says, adding that paid pilots for this technology are expected to start early next year. The use cases for these panels can be in residential and commercial buildings, as

RenKube

FOUNDED IN: 2017

FOUNDERS: **Balaji Lakshmikanth Bangolae** (founder and CEO), **Lakshmi Santhanam** (co-founder, COO), **Deepika Gopal** (co-founder, researcher); **Janardhana V** (co-founder and president)

FUNDING: **₹5 crore (\$570,000)**; last round was a seed funding round in **August 2022**

INVESTORS: Include **Halliburton Labs, CIIE.CO, JITO Angel Network, K4 Forum Mumbai Network**

KEY INNOVATION: **A motion-free optical tracker (MFOT)** for solar panels—an AI-powered light-harvesting glass designed with proprietary software that can increase the energy yield of the panel

well as agri photovoltaic (PV).

The startup currently has an ongoing agri PV pilot at the Professor Jayashankar Telangana State Agricultural University (PJTSAU) in Telangana, conducted under the guidance of the AgHub Foundation. They have studied data over one crop cycle and will conduct another year of studies. In existing agri-PV set-ups in the country, when solar panels are used in an agriculture field, there is an assumed loss of crop yield of 30-40 percent, Bangolae explains. In such a setup, usually only shade-tolerant

crops can be grown as these panels cause a shadow underneath. “We realised that our panels cause minimal shadow because of their design, which means we can grow tropical crops. So there is no yield loss, and the land can be used for both solar and agriculture,” he says. “The light redirecting prisms on the panel also send excess sunlight that is not required by the solar panel to the ground beneath, which also helps in crop growth.”

RenKube has so far raised seed funding as a mix of equity and grant money, of about ₹5 crore (\$570,000), and are looking to raise Series A next year as soon as their products are commercialised. Their backers include Halliburton Labs, CIIE.CO, JITO Angel Network and K4 Forum Mumbai Network. Government grants like IISc-MSME, BIRAC, USISTEF have also been instrumental in their product development, says Bangolae.

“When we invested in them [in 2021] nobody was thinking of re-engineering on the glass side. What they were doing seemed to be disruptive in a space where nobody was thinking beyond putting up EPC [engineering, procurement, construction] power plants, data analytics or at best robots to maintain solar panels,” says Chintan Antani, vice president-seed funding at CIIE. He believes that the product has bright commercialisation prospects.

According to him, the co-founders bring an outsider’s lens to the renewables space and do not come with pre-conceived notions about doing business. “This makes them better at absorbing feedback. They are extremely coachable, and focussed on what they want to do. They understand that this cannot be hurried up and are cognizant of the partners they choose to bring on board.”

Green Building Blocks

There is a government push for biofuels adoption, but companies will not transition away from fossil fuels until they have a clear visibility on biofuel supply, which is currently fragmented. Buyofuel, an online B2B marketplace, wants to bridge these gaps



ARUN CHANDRABOSE FOR FORBES INDIA

Kishan Karunakaran, CEO of Buyofuel, at a wood chips factory in Perumbavoor, Kerala

Kishan Karunakaran says his entry into the biofuels space was purely coincidental.

In 2007-08, cultivation of a crop called *Jatropha curcas* was becoming

famous in India for production of biodiesels, advocated even by former President of India Dr APJ Abdul Kalam. The grandson of a farmer, Karunakaran decided to cultivate the crop. The idea was to sell it to biofuel manufacturers, but there was no demand. They decided to get into manufacturing themselves. "I set up

one of India's earliest commercial scale biodiesel plant, and ran my own manufacturing unit till 2014," he says. They had to soon shut shop for various reasons: They realised that the crop *Jatropha curcas* was not a viable option for biofuels, and both demand and supply was extremely fragmented. "Clients were big but

the supply was small,” he says.

In 2018, the Indian government launched the National Policy of Biofuels to reduce India's dependence on imports and improve local manufacturing of biofuels. This time around, Karunakaran, along with friends Venkat Selvan, Sumanth Kumar and Prasad P Nair, decided to plug the gaps across the value chain using technology and a mobile platform. “We wanted the platform to help fragmented suppliers of waste [that can be used as raw materials for biofuels] to connect with biofuel manufacturers easily, and also supply these biofuels to large fuel consumers,” he says.

They launched Buyofuel in 2020, which they call India's first B2B marketplace for buying and selling both biofuels and raw materials to make biofuels.

There are three main stakeholders that Buyofuel seeks to connect: First, suppliers of waste like used cooking oil, tyre/rubber waste, agro waste, wet organic waste, saw dust and plastic waste that can be used as raw materials to make biofuels. Second, manufacturers of solid, liquid and gaseous biofuel. Third, end consumers like factories or industries that can replace their petrol, diesel and coal requirements with bio-alternatives.

Examples of solid biofuels—typically used by industrial boilers as an alternative to coal—available on the platform include loose biomass, biomass briquettes and pellets. Liquid biofuels, a prospective replacement for fossil fuels based on petroleum, on the platform include biodiesel, bio LDO (plastic oil), bio ethanol and bio-FO (tyre oil). Gaseous biofuels available on the platform include bio CNG and green hydrogen.

It is easier for companies to source fossil fuels since the supply is more consistent and organised,

there is an assurance of quality, and transactions are transparent and simple, Karunakaran says, adding that Buyofuel is trying to build the same ecosystem for biofuels. “First, we want to aggregate and curate suppliers in terms of quantity. Second, offer a quality assurance. Third, being a tech platform, we want to give an end-to-end visibility from enquiry to doorstep delivery, thereby making it as easy to carry out these transactions as in the case of fossil and conventional fuels.” All transactions are done online on the platform. There is no subscription

Buyofuel

FOUNDED IN: 2020

FOUNDERS: **Kishan Karunakaran** (CEO), **Venkat Selvan** (CTO), **Sumanth Kumar** (CMO & CPO), **Prasad P Nair** (head of marketing)

FUNDING: Close to **\$2 million**; last funding was pre-series A round in **November 2022**

INVESTORS: Include **Inflection Point Ventures, Gruhas, Venture Catalysts** and **Lets Venture**

KEY INNOVATION: An online marketplace that **connects suppliers of waste / raw materials of biofuels, manufacturers of biofuels and end industry consumers**

fee, and revenue earned by the startup is through sales.

The Coimbatore-based startup works with 30 large consumers of biofuels across sectors like companies in the cement, pharmaceuticals, steel, paper, and food beverage sectors. Their clients include ITC, Aditya Birla Group, Saint Gobain, Hindustan Unilever, Cipla, Ramco Cements and Thermax.

“We are doing a monthly revenue rate of ₹7 crore, with transaction volume of about 12,000 tonnes of biofuels a month,” says Karunakaran, who is the chief executive officer at Buyofuel.

“We have ensured that more than 25,000 metric tonnes of carbon emissions are offset by replacement of fossil fuels by biofuels from our platform.”

Buyofuel has raised a total equity funding of close to \$2 million, the last funding being a pre-Series round in November 2022. Investors include Inflection Point Ventures, Gruhas, Venture Catalysts and Lets Venture.

“The challenge in biofuel adoption is supply, because despite government mandates, industry will only make the switch if they see uninterrupted supply,” says Ankur Mittal, co-founder, Inflection Point Ventures (IPV). “We wanted to invest in and promote businesses that can solve for this supply problem, and it was clear for us that if Buyofuel can solve for this, their growth can be exponential.”

Karunakaran has deep experience of more than 10 years of working in this space that will be helpful in solving for challenges that come with scale, adds Mittal, whose firm holds around 10 percent equity in Buyofuel. “We are now working with them to turn the business profitable, particularly at the state-level.”

With 58 employees, the startup is currently present in Tamil Nadu, Karnataka, Maharashtra, Andhra Pradesh, Telangana, Punjab and NCR. Their path to profitability, Karunakaran says, includes diversifying across various types of biofuels and waste, and working more closely with the government, which is one of the largest buyers of biofuel.

“We want to become an Ebitda-positive company over the next two-three months, and in the next three to five years, we want to target at least 1 percent of India's fuel sales to be replaced by biofuels through the platform,” he says. 