



MATERIAL IMPACT REPORT

FY 2024

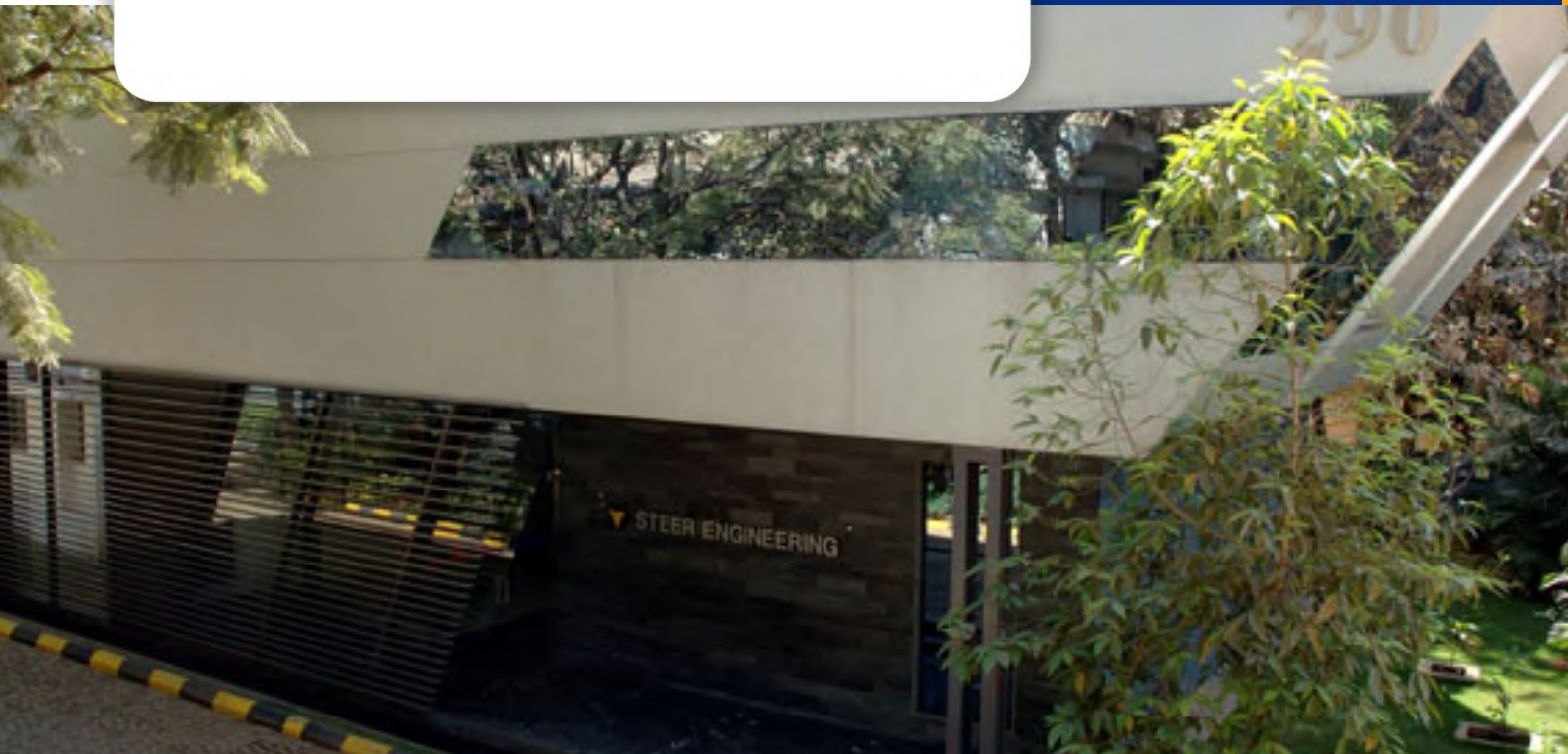


Material Impact Report

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BACKGROUND AND CONTEXT



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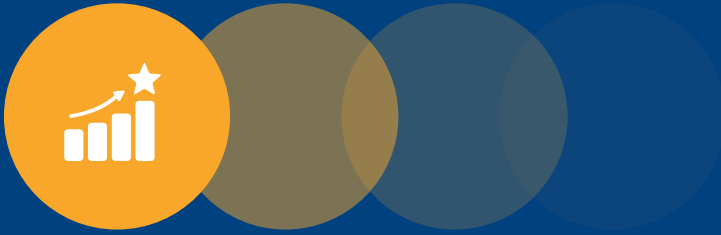
At STEER, we believe in unlocking the power of science to enable a sustainable future for our planet and its people.

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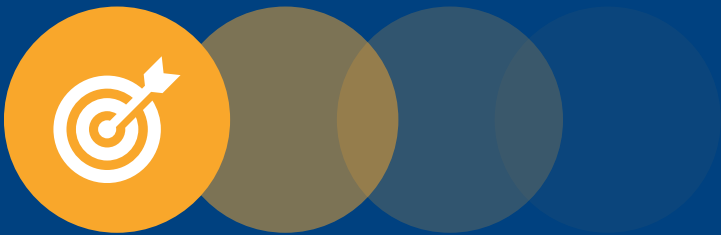
BACKGROUND

Founded in 1993 by Dr. Babu Padmanabhan, STEER World, is committed to the design, creation, and implementation of advanced materials platform technology that effectively transforms and functionalizes materials in the field of pharmaceuticals, plastics, food and nutraceuticals, biomaterials, and biorefining.

Operating 5 global offices, 10 satellite offices, 4 Application Development Centres and supported by a talented workforce of over 500 engineers, scientists, and technicians, STEER World serves over 50 countries across the globe. Driven by innovation, STEER World holds 90+ granted patents.



With a vision to STEER a new world, our group remains focused on the development of advanced platform technologies and processes to improve the quality of life and change the way people live, eat, and stay healthy.



In line with the UN Sustainable Development Goals, we are committed to driving sustainable impact in the following areas – SDG 3, 7, 9, 12 and 13.



SDG 3: Good Health and Well-Being



We do this through our work in the pharmaceutical and food science domain: **STEERLife**, where we enhance both the affordability and quality of food and medicine through our pioneered partial fusion technologies for drug development and ingredient transformation.

We focus on affordable antiretro-viral medicine, iron and calcium supplementation with improved tolerance through increased bioavailability as well as staple foods to address nutrition related life-threatening conditions.



SDG 7: Affordable and Clean Energy

SDG 9: Industry, Innovation and Infrastructure

At STEER, we drive this through our work in Advanced Manufacturing, ably supported by materials science innovation, enabling us to achieve energy savings and reduce carbon emissions.



This includes our **neti industrial waste recycling solution**. “neti”, with its pioneering technology, is engineered to address and solve one of the most challenging aspects of industrial waste management—processing complex multilayered waste on-site. It enables a fully circular, sustainable model, where waste is not seen as an end product but as the beginning of something new.



SDG 12: Responsible Consumption and Production



We drive this through our program **Phitons** which is bringing innovation in patented sustainable packaging with eco and biophilic alternatives. Besides preventing microplastics from affecting our biome, it will also enrich soil through bio-assimilation.

We also enable this through **GeoMATER** with our patented machine and technology that can handle commingled, multi-layer plastic waste (ocean-bound plastics) at origin and convert them into affordable and high-performance wood substitutes to mitigate deforestation.



SDG 13: Climate Action



Through all our programs, we are building for not just a circular economy but bringing a paradigm shift to build a regenerative economy. We believe that Mother Nature's blueprint operates in cycles and not circles giving us food for thought to design this. And that the role of materials science in driving sustainable innovation has never been more critical. This process is vital for maintaining biosphere integrity, land-system change, freshwater balance, and mitigating contamination by novel entities.

We care deeply about eliminating waste and building for climate mitigation with a multipronged approach through our different divisions: STEER Advanced Manufacturing, GeoMATER, Phitons, and STEERLife.



STEER's Impact Commitment



In the last 3 decades of operations, we have consistently aimed to create innovative solutions through materials transformation that can help advance industries and enhance the quality of life while also being deeply committed towards regenerating Mother Earth through our sustainability efforts.

As mentioned in the earlier section, we are a purpose-led company and a transformation believer working towards maintaining specific SDG goals via our range of solutions.

Our flagship innovation, the twin screw extruder was actually invented and patented by Rudolph Erdmenger in 1944. For the next 50 years, this piece of equipment, that launched the polymers revolution, remained in its original form without any further innovation. The next big breakthrough came from India in 1994 when Dr. Babu Padmanabhan used the ideas of fractional geometry to create the fractional lobe. This innovation has enhanced materials compounding capabilities manifold.

Using the idea of fractional geometry we have designed, manufactured, and installed new continuous-flow manufacturing platforms that are industry-first and enable applications never addressed before. The next 4 pages of this report focus on 3 of our innovations creating impact globally – **Twin Screw Extruders, Omega and INTEGRAAL.**

With a deep focus on innovation that can help in solving sustainability questions that are evolving globally, be it around bioavailability or around the feasibility of recycling commingled plastics, **our future-facing programs, UnWOOD, Phitons and SAFEReCYCLER (page no. 12-13)** will continue to offer sustainable solutions in the food-pharma-bioengineering- waste recycling and packaging ecosystem.



Impact Deep Dive

Across Advanced Manufacturing platforms of STEER, we are pioneering autonomous manufacturing and flow modelling to create process engineering solutions that are highly predictable and agnostic to operator skill levels.

Case Study 1

Co-rotating Twin Screw Extruder: Automotive

The client specializes in developing, manufacturing, and supplying advanced compounded materials

SCOPE OF INSTALLATION

- 1 Mega 50 with 1 side feeder SF50
- 2 1 volumetric feeder VF40
- 3 1 volumetric feeder VF40 with vertical feeder

WHAT IT DOES

It ensures uniform energy efficiency, enhanced intake, conveying, flow, and distribution. The customizable touchscreen with PLC integration enables advanced control and automation. It is preferable for high-volume manufacturing. Three levels of torque protection minimize breakdowns and provide process stability for continuous production.



Mega 50

The client specializes in developing, manufacturing, and supplying advanced compounded materials. Their portfolio includes PP compounds for the automotive sector, GPPS compounds for defense, nylon compounds for engineering, and ABS compounds for home appliances. These high-performance composites are known for their strength, durability, and lightweight properties.

Key Challenges Addressed:

The client, engaged in producing polymer compounds for the automotive industry, was previously reliant on second-hand, low-cost imported machines from another country. These machines fell short of meeting the stringent OEM (Original Equipment Manufacturer) requirements, leading to inconsistent quality and performance issues. Additionally, the use of push-button controls further compounded their difficulties, as it was challenging for operators to diagnose and address problems in real-time. This setup not only hindered production efficiency but also created significant obstacles in maintaining quality standards and operational reliability.

Impact/Outcome Generated for Client

Total compounded polymer processed using 62 STEER lines in FY 2023-24 (applied in the automobile segment) resulted in:

- **~272 Kilo tons (KT)** of metals replaced with **~125 Kilo tons (KT)** of compounded polymer in FY 2023-24.
- A total weight reduction of **~146 Kilo tons (KT)**.
- A carbon emission reduction of **~2930 tons in FY 2023-24**.

With the introduction of our Mega 50 co-rotating twin screw extruder with proven screw profile for compounding suiting automotive requirement, the customer was able to address these challenges effectively. The Mega 50 was specifically selected for its capability to meet the precise application and throughput requirements of their production processes. This state-of-the-art equipment enabled the customer to achieve the high-quality properties necessary for their polymer compounds, ensuring compliance with OEM standards.

Moreover, the integration of our Type 1 automation system provided the customer with a substantial improvement in process control. The advanced automation features offered enhanced visibility and control over the production process through the HMI (Human-Machine Interface) screen. This system enabled real-time monitoring and management of interlocks and alarm messages, significantly improving the ability to detect and resolve issues promptly. As a result, the customer experienced increased production efficiency, higher quality consistency, and greater operational reliability, ultimately strengthening their position in the automotive industry.

**Reduction
in total
weight**

**Reduction
in Carbon
emission**

**Increase in
total
production**

***What did our client feel
about working with us?***

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Overall, we have had a positive experience working with STEER and the extruder. Additionally, we appreciate their effective time management, local support, and their professional approach.

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Case Study 2

Co-rotating Twin Screw Extruder: Automotive

A specialist in
high quality compounds
and masterbatches

SCOPE OF INSTALLATION

1 Alpha 40 with 1 side
feeder SF50

2 1 volumetric feeder
VF40

WHAT IT DOES

An all in one performer, it stands out for its high efficiency, safety, and throughput, making it perfectly suited for round-the-clock production. It reduces stress concentration with high alloy steel and rupture grooves to protect the shaft and gearbox. It has high wear and corrosion resistance for tough applications.

ALPHA



The client excels in providing specialized polymer solutions for the automotive industry. They produce advanced polymers that replace metal components, reducing vehicle weight and improving fuel efficiency while enhancing safety features. Their offerings extend to interior parts, where their compounds meet rigorous safety standards and performance requirements, and exterior parts, which benefit from compounds designed for environmental resistance, flame retardance, UV stability, and superior color dispersion. The company made significant strides by pioneering the use of masterbatches in the Indian market, offering a more versatile and efficient alternative to dry color.

Key Challenges Addressed:

The customer had a requirement in processing high-shear applications suitable for their after-sales market. To meet the demands of producing high-quality color masterbatch compounds (which will be used in automotive components – used for interiors or exteriors of the car) with the required shear characteristics with our Alpha series co-rotating twin screw extruder.

Impact/Outcome Generated for Client

By integrating our Alpha 40 twin screw extruder, which features a 1.49 Di/Do ratio, the customer achieved a substantial improvement in their production capabilities. The Alpha 40's advanced design enabled the precise control of high shear conditions necessary for producing high-quality color masterbatch compounds. This enhancement allowed the customer to efficiently produce the specialized compounds required for their after-sales market. Consequently, they were able to better meet market demands, enhance product performance, and progressively advance their position in the after-sales sector. The successful implementation of the Alpha 40 co-rotating twin screw extruder has thus significantly contributed to the client's operational efficiency and market competitiveness.

Case Study 3

1.71 Do/Di Omega Platform:

An automotive compounder
and a speciality compound
manufacturer

Energy reduction through Omega Platform

SCOPE OF INSTALLATION

1 Omega 40
Installation on two
client sites

WHAT IT DOES

Its groundbreaking 1.71 Do/Di ratio enables a boost in production capacity due to its enhanced volume and torque capabilities. The patented fraction-lobe special elements improve process efficiency and output quality, ensuring significantly higher returns on investment.



Key Challenges Addressed:

- Carbon reduction for the automotive customer.
- For the speciality compounder, improving dispersion quality of effective compounds and increasing output of the product.

Impact Outcomes:

- For the Automotive compounder : CO2 reduction by 5443 kg CO2/year.
- For the Speciality compounder: Particle size of effective pigment retained after dispersion and the output was increased from 140 kg/hr to 300 kg/hr saving power cost at 6.5 lakhs/year.
- This technology boasts a significant 25% improvement in energy efficiency compared to traditional methods.
- Energy Saved (kwh in FY 2023-24): An impressive ~45.60 lakh kwh of energy has been saved through this platform's use.
- Total Cost of Energy Saved (Rs. in lakh in FY 2023-24): The cost savings are substantial, amounting to over Rs. ~228 lakh.

**1.71 DO/DI
OMEGA
PLATFORM:**

Improvement over
traditional methods:

25%

Cost Savings by
changing tech:

₹ 228 Lakhs

INTEGRAAL®

Paracetamol Manufacturer

SCOPE OF INSTALLATION

1 Integraal

WHAT IT DOES

STEERLife's Proprietary Continuous Granulation System enables true continuous manufacturing of oral solid drugs in a single step. This proprietary technology of STEER delivers significant cost, quality, and economic benefits over current granulation systems.

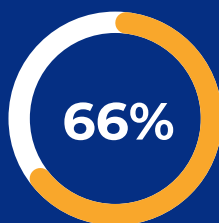


Benefits:

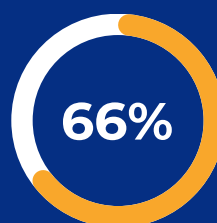
INTEGRAAL is an all-in-one true continuous processor. It is an automated machine that enables excellent temporal and spatial control and reduces a 7-8 step unit operation to 2-3 steps. This leads to a substantial reduction in processing time and removes multiple checkpoints. It is a formulation-agnostic system that makes the transition from batch to continuous processor without qualitative and quantitative changes in formulation. It can help meet long-term sustainable development goals. It is a clean and green process that generates no waste and dust, significantly cuts down energy consumption, and can help you earn carbon credits. Achieves immense cost savings as a Granulator over other conventional technologies like RMG (Rapid Mixture Granulator) or FBG (Fluid Bed Granulation).

Impact Outcomes:

- The manufacturer saved up to **\$750,000** annually in their granulation process and experienced a **13%** increase in gross margin.
- There was a **5% rise** in gross margin that was anticipated due to savings in testing at the European Agency, facilitated by larger batch sizes.
- Through INTEGRAAL, additional savings were made possible through integration with suitable upstream and downstream technologies.
- Savings were made possible at every stage without any additional capital cost.



Energy Cost Saving



Manpower Saving



Space Saving

**Payback period: 18 months*

Flexibility to harness economic benefits over a wide range of throughputs from a few Kg/hr to 400Kg/hr

Innovation in Sustainability

At STEER, we are constantly innovating new ways to build a safer and cleaner planet for our people across emerging applications of Materials Science and deploying our novel methods of continuous flow manufacturing. We find deep resonance in nature's cycles and aim to be inspired by its perfect designs to create solutions that are in harmony with Mother Earth. Each one of nature's forms is designed to serve a function, be it the aerodynamic body of birds or the burs on a Cocklebur plant to ensure its survival. Similarly, we aim that all our designs are deliberate and perform specific functions efficiently.



With this dream, we are working on new programs that can transform how we look at plastic waste, packaging and more. Our interventions and solutions are a two-pronged approach where, at one level, we aim towards efficiency (resource, water and energy) and reduced emissions. At the same time, we are actively working towards solving some of the most pressing problems that humanity faces, such as hidden hunger and deforestation, to keep the world safe. Here is a glimpse of some of our interventions.

1. SAFEReCYCLER

The issue: Globally, a 1.5X jump is expected in unprocessed plastic waste by year 2030. Over 8.3 billion tons of plastic has been produced since 1950. Not just that, over 60% of this is in landfills, incinerated or unethically dumped. Meanwhile, 77% of people tested were found to have microplastics in their bloodstream.

Our solution: Our patented SAFEReCYCLER is a first mile compact solution that is bringing a drastically different solution for at-source deployment to turn commingled plastic waste into high quality materials.

The proprietary formulations with our materials science background resets the life of recycled materials, creating customizable outputs and building a regenerative economy.

The benefit: This extends the use of recycled materials, reducing supply chain stress. It also enables rapid scaling by removing tech hurdles and manual intervention.



2. UnWOOD

The issue: Since 1950, 8.3 billion tons of plastic has been produced and over 60% of it is in landfills, incinerated, or unethically dumped. Plastic waste is a global and pressing problem. However, plastic packaging is indispensable and MLPs (multilayered plastics) used as packaging provide food and water security enabling day to day life. A solution to mitigate the plastic waste crisis is an urgent need. Another material that has become nearly indispensable for humans is wood. Globally humans deforest around 10 million hectares per year to meet their wood requirements and deplete the lungs of Mother Earth, essential to the planet's and its people's health.

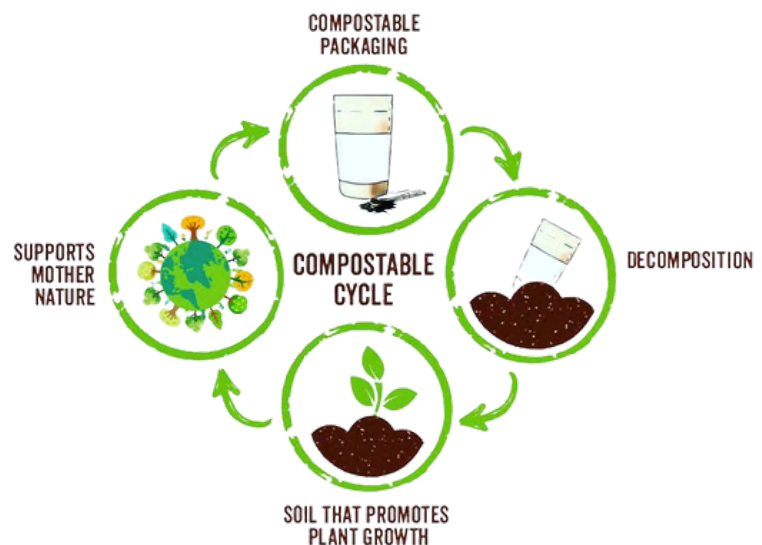
Potential opportunity: As per WEF, in India, plastic waste generation is estimated at 9.4 MMT annually with only 50% being collected, processed and recycled. Most waste is mismanaged. Moreover, 350 MMT of plastic waste is being generated by nations annually, which is expected to only grow.

Our solution: UnWOOD tackles two issues at once: deforestation and the plastic waste management crisis. It uses intelligent compounding technology to transform multi-layered plastic waste into a material mimicking natural wood and creating high-quality, climate-friendly wood substitutes.

3. Phitons

The issue: Today, 30% of the fresh produce is lost in retail due to the limited shelf life of farm products. Meanwhile, there is a significant energy cost incurred from cooling systems contributing to rising carbon emissions at delivery locations. Nearly 61% of the product is lost in transit from packing locations to retailers.

Our solution: Phitons focuses on sustainability and has a deep concern for the environmental impact of single-use plastics. It is focused on a mission to develop cutting-edge biomaterials and technologies to revolutionize the packaging and bioplastics industries. It includes compostable packaging, grow bags and mulch sheets, fibrocel nano cellulose alternative to paints and coatings as well as for personal care products. For example, the earthen fresh produce bags are 100% compostable, extending the shelf life of fresh fruits and vegetables by 3X. Made of plant-based components, there are no microplastics to harm the environment.





neti - our bioprocessor machine

4. Bioprocessors

The issue: The available biomass in India currently stands at 750 MMT/year with surplus biomass availability of 230 MMT/year approximately. Along with this India also produces 350 MMT of agricultural waste annually. These renewable resources hold the potential to produce up to 25,000 MW equivalent of energy, if harnessed properly. Moreover, the Indian government has set a target of 20% blending of ethanol in petrol by 2025-26 under the EBP programme.

Our solution: STEER has been working to overcome the traditional drawbacks of waste processing and challenges associated with the preconditioning of biomass. By incorporating its patented processor design, advanced metallurgy, and precisely controlled processing techniques, STEER has developed highly effective and efficient bio-processors that act as continuous preconditioners for biomass and agri-waste processing. These bio-processors convert the biomass from a hydrophobic to a hydrophilic state thus significantly enhancing the yield efficiency, cost-effectiveness, and environmental sustainability of renewable and bioenergy projects. Featuring a smaller footprint and a robust design, STEER's bio-processors are highly adaptable and can process a variety of biomass and waste materials. They are also capable of processing seaweed and other organic materials, showcasing their versatility.

Taking the Next Step Forward

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At STEER, we believe that as we continue to push the boundaries of materials science, we must prioritize advancements that reduce the carbon footprint and foster a sustainable future.

With innovation as our DNA and materials science as our core expertise, we will keep designing new solutions and applications that can bring positive impact and a regenerative approach to restore our planet and our people.

We take ESG (which denotes environmental, social, and governance responsibility) very seriously. For us ESG is not being driven from a top-down regulatory aspect or monitoring it, we actually drive it by implementing sustainable, ethical practices and collaboratively working towards a net zero organization.

Nature operates in cycles and not circles. These rhythmic cycles are perfectly designed and provide us with inspiration to work not only towards a circular economy but also a regenerative economy.

At STEER our philosophy is rooted in our commitment to innovation, human values and sustainability.

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~Dr. Babu Padmanbhan
Co-Founder and Group Managing Director