



GHG Emissions



Context

The pharmaceutical industry generates a significant share of the world's greenhouse gas emissions.² Emissions are generated from almost every stage of the pharmaceutical life cycle, including manufacturing, procurement, transportation, packaging, disposal, and even the use of drugs. The industry is fast on its way to becoming oxymoron-producing medicines for the betterment of health yet creating more significant hazardous health impacts in the process of making them. Innovative and collaborative approaches are essential in ensuring a reduced carbon footprint. However, nothing can start without good measurement. Therefore, GHG inventorization becomes the most essential part of the climate journey.

Approach

Following the GHG Protocol Corporate Standards, we have implemented a comprehensive greenhouse gas (GHG) emissions inventorization process. The GHG Protocol provides a globally recognized framework for measuring and managing emissions. By adhering to this methodology, Granules India ensures the inventorization process is robust and transparent. This facilitates a firm ground for action on Granule's net zero commitment aligned to the SBTi.

We have adopted the operational control approach for GHG inventorization, accounting for emissions from operations where we have the control to implement the changes. Therefore, our GHG reporting boundary includes Granules India Limited and all its subsidiaries, ensuring a complete accounting of emissions across all operations. The subsidiary section of this report includes detailed emissions data for each subsidiary, while this section presents the GHG inventory data for Granules India Limited only.

We began GHG estimation for Scope 1 and Scope 2 emissions in FY 21. Scope 1 covers direct emissions from sources we own or control, such as fuel combustion in manufacturing processes. Scope 2 includes indirect emissions from the generation of electricity purchased by our facilities. These efforts laid the foundation for our GHG emissions inventorization and management. In FY 23, we expanded inventorization to include Scope 3 emissions, which are indirect emissions in our value chain. We identified 11 out of 15 Scope 3 categories relevant for Granules.

The base year for our GHG inventories is FY 23. This baseline allows us to accurately measure future emissions reductions and evaluate the effectiveness of our sustainability initiatives.





Actions and Initiatives

GHG Emission Profile

(GRI 305 - 1,2,3)

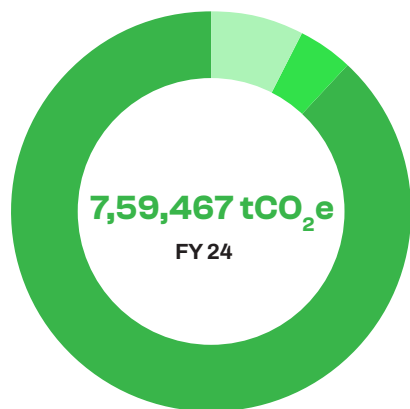
The outcome of our GHG inventorization activity provided deep insights into our emission profile. While it is known that the majority of the GHG emissions in the pharmaceutical sector are indirect emissions that occur in the value chain, the percentage contribution of the Scope 3 emissions in our GHG inventory was much higher than the generally observed norms. The Scope 3 emissions constitute 87.8% of the total GHG emissions of Granules.

Our detailed approach towards the Scope 3 GHG emission, especially the estimation of Category 1 emissions, has led to higher contribution from Scope 3 emissions. This underscores the significant environmental impact of the supply chain and other indirect business activities. Scope 1 emissions, accounting for 7.7% of the total, represent direct emissions from operations owned or controlled by the Company. Scope 2 emissions, at 4.5%, are from indirect emissions associated with purchased electricity consumption.

Our Carbon Footprint - Overview

Scope	FY 23	FY 24
Scope 1	57,816	58,354
Scope 2 (Market-Based)	57,974	34,519
Scope 3	6,25,236	6,66,694
Total Emissions*	7,41,026	7,59,467

All values in Tonnes of CO₂ equivalent



- Scope 1 — 7.7%
- Scope 2* — 4.5%
- Scope 3 — 87.8%

* Market-Based

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9967855/>

Our Goal

Achieve Net Zero Emission by 2050

7,59,467 MTCO₂e

Total GHG emissions
(Scope 1, 2 & 3) in FY 24

21.9%

Absolute reduction in GHG emissions
(Scope 1 & Scope 2)

26.7%

Intensity reduction in GHG emissions
(Scope 1 & Scope 2)

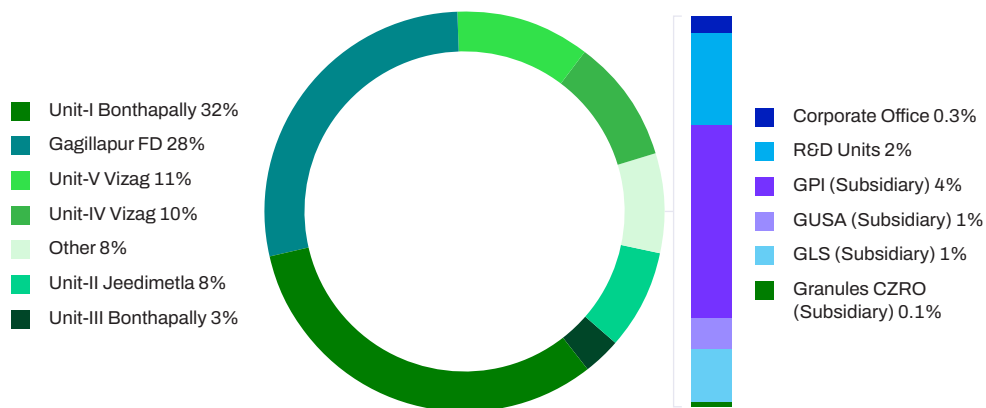




Scope 1 and Scope 2 Analysis by Site (FY 24)

Unit-wise Profile - Scope 1 and Scope 2 Emission

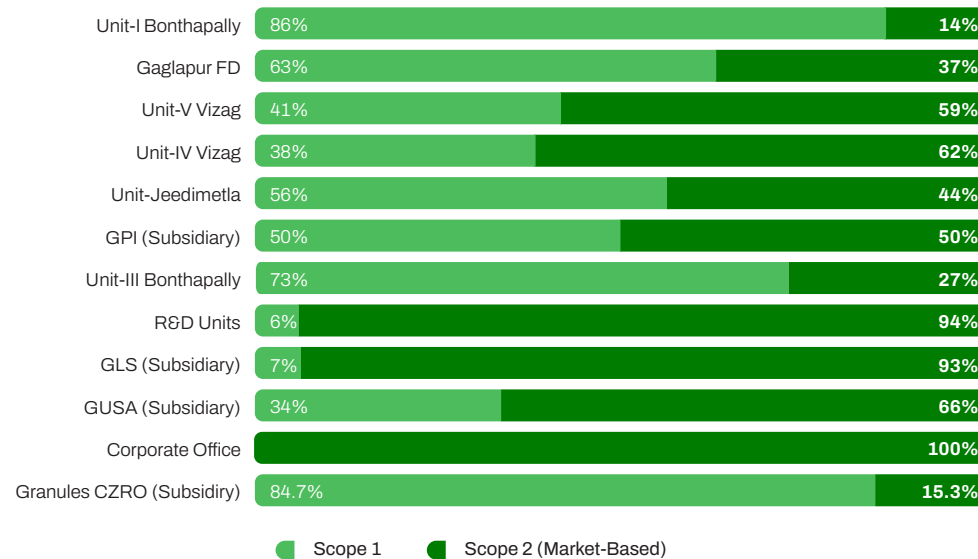
(Market-Based Method)



Scope 2 as per Market-Based Method

The market-based method reflects the renewable adoption through power purchase agreement (PPA), solar roof top at site and purchase of Energy Attribute Certificates (EAC) through International Renewable Energy Certificates (IREC).

Unit & Location	Scope 1 tCO ₂ e	Scope 2 tCO ₂ e (Market-Based)	Total (Scope 1+Scope 2 Market-based)
Gagillapur FD	16,227	9,644	25,871
Unit-I Bonthapally	25,402	4,240	29,641
Unit-II Jeedimetla	4,484	3,482	7,966
Unit-III Bonthapally	2,351	876	3,227
Unit-IV Vizag	3,540	5,746	9,286
Unit-V Vizag	4,152	5,867	10,019
Corporate office	-	272	272
R&D Units	99	1,504	1,603
GPI (Subsidiary)	1,673	1,679	3,352
GUSA (Subsidiary)	196	386	582
GLS (Subsidiary)	57	808	866
Granules CZRO (Subsidiary)	74	13	87
Total Scope 1+Scope 2 (Market-Based), tCO₂e	58,254	34,519	92,773





Disclosure of Our Carbon Footprint

Granules GHG Emissions Profile, tCO ₂ eq		Emission Profile for FY 23			Emission Profile for FY 24		
Scope	Emission Category	GIL Standalone	GIL All Subsidiaries	GIL Consolidated	GIL Standalone	GIL All Subsidiaries	GIL Consolidated
Scope 1	Direct emissions from sources owned or controlled by the Company (Coal, Fuels)	56,265	1,551	57,816	56,254	2,001	58,254
Scope 2 (Market-Based)	Indirect emissions from the generation of purchased energy (Electricity)	56,306	1,668	57,974	31,632	2,886	34,519
Scope 2 (Location-Based)	Indirect emissions from the generation of purchased energy (Electricity)	62,433	1,668	64,101	60,191	2,886	63,078
	Scope 1+2 Total	1,12,571	3,219	1,15,790	87,886	4,887	92,773
Scope 3	Category 1 - Purchased Goods & Services	4,95,807	882	4,96,689	5,14,516	5,292	5,19,808
	Category 2 - Capital Goods	4,705	465	5,170	10,265	18,565	28,830
	Category 3 - Fuel and Energy Related Activities	26,788	403	27,191	22,579	875	23,453
	Category 4 - Upstream Transportation & Distribution	8,392	33	8,425	8,557	83	8,640
	Category 5 - Waste Generated from Operations	2,992	1,625	4,618	3,571	150	3,721
	Category 6 - Business Travel	295	37	332	850	81	931
	Category 7 - Employee Commuting	1,476	314	1,790	1,571	518	2,089
	Category 8 - Upstream Leased Assets	587	4,205	4,792	1,628	6,153	7,781
	Category 9 - Downstream Transportation & Distribution	22,381	3,131	25,512	24,827	1,097	25,924
	Category 10 - Processing of Sold Products	46,658	-	46,658	41,187	1	41,188
	Category 11 - Use of Sold Products	-	-	-	-	-	-
	Category 12 - End of Life Treatment of sold products	4,031	28	4,059	4,287	43	4,330
	Category 13 - Downstream Leased Assets	-	-	-	-	-	-
	Category 14 - Franchises	-	-	-	-	-	-
	Category 15 - Investments	-	-	-	-	-	-
	Scope 3 Total	6,14,113	11,123	6,25,236	6,33,837	32,857	6,66,694
Total Emissions - Scope 1, Scope 2 (Market-Based) and Scope 3		7,26,684	14,342	7,41,026	7,21,723	37,744	7,59,467





Scope 3 Emissions

Purchased goods and services contributed the largest share of Scope 3 emissions in both years, accounting for approximately 78% of total Scope 3 emissions. Processing of Sold Products, fuel, and energy-related activities, as well as downstream transportation and distribution, contribute 16% of the emissions. Therefore, these are the four categories that will continue to remain the focus for good GHG accounting practices in the future as well.

Key Contributing Geographies

Eleven countries play an essential role in the supply of materials to Granules. From our Inventorization exercise, we found that China and India contribute over 70% of our raw material and packaging material supply chain emissions, with shares of about 40% and 30%, respectively. Chinese suppliers accounted for approximately 31% of the procured raw and packaging materials by weight and 43% of emissions. In comparison, Indian suppliers accounted for 50% of the procured weight and 30% of emissions, indicating a relatively cleaner profile. Select supplier geographies are planning significant decarbonization, particularly in electricity generation; however, implementation levels may vary. Therefore, we do expect the emissions to reduce with the grid-level measures; however, they may not be enough to provide the anticipated results towards decarbonization.

Deep Dive - Our Top 20 Raw Materials and their Carbon Footprint

Total Scope 3 Emissions (tCO₂e)

Key RM#1	1,79,208
Key RM#2	69,334
Key RM#3	50,789
Key RM#4	40,236
Key RM#5	34,279
Key RM#6	19,040
Key RM#7	10,054
Key RM#8	8,416
Key RM#9	7,165
Key RM#10	5,062
Key RM#11	3,441
Key RM#12	3,252
Key RM#13	3,131
Key RM#14	2,199
Key RM#15	2,173
Key RM#16	1,662
Key RM#17	1,557
Key RM#18	1,517
Key RM#19	1,378
Key RM#20	1,182

Scope 3 - Analysis by Category (FY 24)

Category 1

78.0% | 5,19,808 tCO₂eq

Purchased Goods & Services

Category 10

6.20% | 41,188 tCO₂eq

Processing of Sold Products

Category 2

4.30% | 28,830 tCO₂eq

Capital Goods

Category 9

3.90% | 25,924 tCO₂eq

Downstream Transportation & Distribution

Category 3

3.50% | 23,453 tCO₂eq

Fuel- and Energy-related Activities

Category 4

1.30% | 8,640 tCO₂eq

Upstream Transportation & Distribution

Category 8

1.20% | 7,781 tCO₂eq

Upstream Leased Assets

Category 12

0.60% | 4,330 tCO₂eq

End of Life Treatment of Sold Products

Category 5

10.6% | 3,721 tCO₂eq

Waste Generated from Operations

Category 7

10.3% | 2,089 tCO₂eq

Employee Commuting

Category 6

0.10% | 931 tCO₂eq

Business Travel

Category 11

0% | 0 tCO₂eq

Use of Sold Products

Category 13

0% | 0 tCO₂eq

Downstream Leased Assets

Category 14

0% | 0 tCO₂eq

Franchises

Category 15

0% | 0 tCO₂eq

Investments

Total

6,66,694 tCO₂eq

Total Scope 3





Intensity

Scope: GHG Intensity (S1+S2+S3)

12.53

FY 24

13.02

FY 23

Performance

3.8% ↓

Scope: GHG Intensity (S1+S2)

1.53

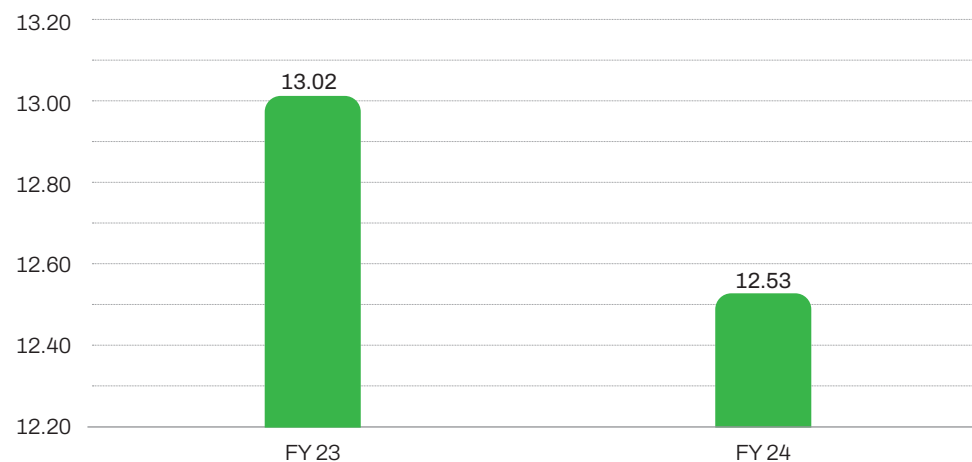
FY 24

2.03

FY 23

25% ↓

GHG Intensity (S1+S2+S3)



Scope 3 GHG Emission Estimation Methodology

Our approach to GHG emission estimation aligns with the GHG Protocol, which offers multiple methodologies for precise and accurate measurement. We have selected estimation methods for each category under Scope 3 that ensure accuracy and reliability. Recognising that Category 1 is typically the most significant contributor to Scope 3 emissions, Granules has prioritised the use of the most accurate estimation methods for estimating emissions under Category 1 for over 80% of the value chain:

- **Supplier-Specific Emission Estimation:** This method involves gathering detailed emissions data directly from our suppliers, allowing us to tailor our inventory to reflect actual emissions from the goods and services we purchase.
- **Hybrid Method:** This method enhances the accuracy of our emissions calculations by combining elements of supplier-specific data and broader industry averages.

We conducted a detailed breakdown of Category 1 emissions to understand our emissions profile better. This analysis focused on manufacturing, packaging, and logistics.

We analyzed emissions associated with 30 critical raw materials, enabling us to identify specific areas for improvement and drive targeted sustainability initiatives. For detailed information on our category-wise approach and the sources of key activity data, please refer to the annexure of this report.

Our meticulous approach to GHG estimation lays a robust foundation for Granules' journey toward net zero emissions. By employing precise estimation techniques, we can better strategize and implement long-term GHG reduction initiatives.

We decided minimize the usages of one of the most prevalent methods, the spend-based method, for any Scope 3 GHG estimation scenario, as it does not provide the precision required for well-founded net-zero strategies. GHG emissions estimated largely based on spend-based methods are much lower than those of the above approaches. It does not provide an in-depth understanding of the GHG emission hotspots within the pharmaceutical supply chain. For example, the carbon footprint of locally sourced materials in large quantities may differ notably from those sourced internationally in smaller batches.





Product Carbon Footprint

The product carbon footprint (PCF) exercise is a cornerstone of Granules' strategy to achieve net-zero emissions. It supported developing a GHG reduction plan for high-impact products from the highest GHG emission-contributing category under Scope 3. The comprehensive PCF exercise conducted at Granules quantified and identified key emissions across the raw materials supply chain, which is a significant contributor to the carbon footprint of pharmaceutical products.

We have estimated the Product Carbon Footprint (PCF) for five key molecules (for all SKUs) of our molecules covering 65% of our product sales. In the near future, we will conduct Life cycle assessments covering all the impact categories.

PCF Coverage - Product in Focus

We have estimated the Product Carbon Footprint (PCF) for 5 Key molecules (for all SKUs) of our molecules covering 65% of our product sales. In the near future, we will conduct Life cycle assessments covering all the impact categories.

PCF Coverage - Product in Focus		
5 Products	65% of our sales	59% of our dispatches by line-item count
Product Choice Product on which the GHG life cycle inventory is performed	Paracetamol (API/PFI/FD) Metformin (API/PFI/FD) Potassium Chloride (PFI/FD) Metoprolol Succinate (API/PFI/FD) Venlafaxine (PFI/FD)	
Unit of Analysis Performance characteristics and services delivered by the product being studied	Strength/Concentration (for PFI/FD) Dosage form – Tablets/Capsules/Gel Caps/Caplets (for FD) Release profile – IR/ER (for FD)	
Reference Flow Amount of product on which the results of the study are based	MT (for API and PFI) Number of tablets (for FD)	
Coverage	Cradle-to-Factory-Gate-to-Customer-Gate Does not include Product Processing by customer, usage, end-of-life treatment, etc.	

The methodology employed for the PCF exercise was thorough and collaborative. The PCF was conducted for five essential products, accounting for 65% of our revenue. We engaged with 80% of our vendors in the PCF determination process, focusing on products representing 80% of our spending and integrating Scope 1 and 2 data with Scope 3 emissions to offer a complete carbon profile. This collaboration ensured accurate data collection and informed decision-making.

The PCF exercise provided valuable insights and outcomes. For instance, approximately 79% of Scope 3 emissions were linked to 30+ critical raw materials, contributing around 450,000 MT CO₂e. This insight directs our focus on these essential areas for emissions reduction. Similarly, for selected suppliers, Scope 1 and 2 contributions to the material PCF were significant, while for others, the distance of material travel significantly impacted the GHG emissions.

These detailed and systematic insights helped Granules identify and implement strategic actions to support emission reductions across the product material sourcing value chain. Some of these interventions emphasize sourcing certain materials from geographically closer suppliers, setting up supplier-specific GHG reduction targets, and efforts to identify 'greener suppliers' and encourage suppliers to reduce GHG emissions.

By adopting a near-sourcing strategy alone, we estimate potential savings of approximately 14,000 MT CO₂ on the current baseline for select raw and packing materials. As the implementation of all identified strategies to reduce product-specific footprint continues, we shall achieve significant reductions in the coming years.

Our plan, targeting high-impact products to address the highest GHG emission categories under Scope 3, yields several collateral benefits, such as improved stakeholder trust and enhanced reputation with customers, investors, and partners. Additionally, cost savings are realized with an efficient and optimized material supply chain.



Initiatives to Reduce GHG Emissions

Our sustained and ongoing efforts to minimize our in-house Scope 1 and Scope 2 GHG emissions

At Granules, we have identified measures to decarbonize Scope 1 and 2 emissions for two of our largest facilities — [Bonthapally](#) and [Gagillapur](#), focusing on high-emission assets and utilities.

We have conducted technical evaluations of energy efficiency and performance of key assets like HVAC, Boilers, AHUs, and Air Compressors to identify decarbonization projects.

We conducted a value discovery process to identify Carbon Emission Reduction Measures (CERMs) focused on improving efficiency by adopting advanced technologies and reducing energy waste and solutions (e.g., optimizing

HVAC, coal consumption in boilers, optimization of air compressor systems).

We have analyzed selected CERMs, including engineering assessments, a responsibility matrix, savings potential, baseline agreements, and an action plan. Implementation is currently underway with a defined goal.

We are addressing specific Technical Gaps in Boilers, Air Compressors, Chiller plants, and AHUs and have initiated carbon emissions reduction measures (CERMs).

Initiatives Taken

Our GHG Emission Reduction Strategy and Implementation in Near Term

During FY 24, Granules implemented various initiatives to enhance energy efficiency and reduce greenhouse gas (GHG) emissions across its units, leading to significant energy savings and improved environmental sustainability.

Efficiency Measure for Electricity Consumption

Use of Energy-efficient Pump: One of the key initiatives involved the replacement of outdated vacuum pumps at API unit-I Hyderabad, resulting in a remarkable energy saving of 70,296 kWh.

Use of Energy-efficient Blower Motors: Replaced conventional belt-driven blower motors at FD unit-Gagillapur with energy-conserving EC blowers, saving 474,272 kWh.

Interlocks and Cut-offs for Energy Savings: Interlocks were added to RT pumps at API unit-I to automatically shut down reaching the set temperature, saving 28,244 kWh.

Other measures included implementing auto cut-off systems for cooling tower fans, installing Variable Frequency Drives (VFDs) on motors,

and incorporating automatic tube cleaning systems for chillers, resulting in significant energy savings.

Rooftop Solar: Installation of rooftop solar panels at FD unit Gagillapur enabled direct generation and utilization of solar energy.

Moreover, by purchasing Renewable Energy Certificates (33,000 MWh) and utilizing solar energy, the Company avoided 28,700 MT of GHG emissions, contributing to environmental protection.

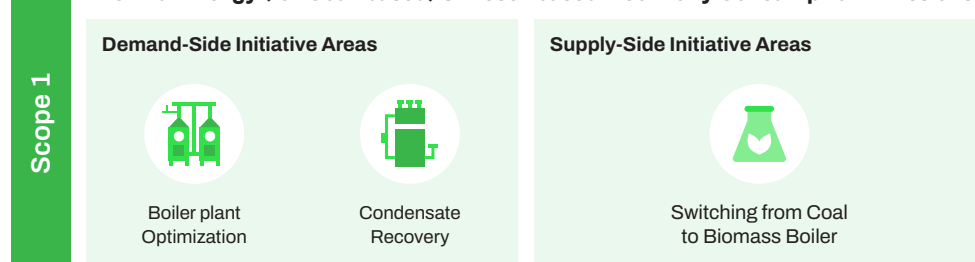
Granules renewable energy use is notable, with GIL-GGP contributing 17.98%. These energy-saving initiatives have resulted in significant financial savings of approximately ₹ 120.23 lakhs across all units.

Granules invested in a 320 KWp rooftop solar project in FY 23 and a 660 KWp project in FY 24 at Gagillapur. The company is also exploring equity investments in group captive solar power projects to secure renewable energy access, enhance sustainability, and reduce carbon emissions.

Altogether, these initiatives led to a total annual energy saving of

915,945 kWh

Thermal Energy (for Coal-based) & Diesel-based Electricity Consumption Emissions



Grid-based Electricity Consumption-related Emissions





Initiatives to Reduce Greenhouse Gas Emissions

A comprehensive strategy integrating supply-side and demand-side initiatives has been identified to reduce Scope 1 and 2 greenhouse gas emissions and support decarbonization through 2030. Continued support for green energy will be crucial beyond 2030. This approach is based on an analysis of emissions from coal-fired boilers and grid electricity at the Bonthapally and Gagillapur facilities, and Granules will apply a similar methodology at its other operational locations.

API Unit-1 Bonthapally Facility

At Bonthapally, carbon emissions predominantly arise from thermal energy and grid electricity, contributing 79% and 22% to energy consumption and 60% and 39% to the carbon footprint, respectively. Our decarbonization strategy focuses on implementing Facility Improvement Measures (FIMs) across key systems. For Scope 1 emissions, we are transitioning from coal to biomass boilers, optimizing boiler efficiency through better scheduling, and implementing condensate recovery systems to minimize waste, for significant direct emissions reduction.

For Scope 2 emissions, we are concentrating on demand-side initiatives such as optimizing air compressor operations by adjusting generation pressure and improving chiller plant efficiency through digitalization. Additionally, we are exploring integrating renewable energy sources and using carbon offset programs to reduce our reliance on non-renewable grid electricity, reducing our carbon footprint by 16,869 tonnes of CO₂.

FD unit Gagillapur Facility

The Gagillapur facility's decarbonization strategy targets reducing Scope 1 and Scope 2 emissions from coal-fired boilers and grid electricity. Our analysis shows these sources significantly impact the carbon footprint. To address this, we are optimizing boiler operations, refining scheduling, and improving coal boiler efficiency. We are also enhancing air compressor systems by optimizing pressures and reducing purge losses. Additionally, we are upgrading chiller plants and Air Handling Units (AHUs) to more efficient systems with EC fans and IE3 motors to boost overall operational efficiency.



**Mr. Ramraj
Rangarajulu**

President & Head –
Formulations Operations



**Mr. Sethumadhavan
Sankaran**

Sr. VP & Head –
API Operations

At Granules, operational excellence goes hand in hand with sustainability. We are deeply committed to prioritizing safety across all our facilities, ensuring a secure environment for our teams. Our energy initiatives emphasize the efficient use of resources, adoption of renewable energy, and innovative technologies to minimize consumption. By optimizing water usage and investing in conservation measures, we contribute to resource sustainability. Additionally, we actively pursue strategies to reduce greenhouse gas emissions, supporting our transition to a low-carbon future. These collective efforts reflect our unwavering dedication to integrating sustainability into operations while driving positive environmental and social outcomes.





Carbon Emissions and Reduction Strategies for Granules' Gagillapur Facility

Carbon Footprint Contribution

The Gagillapur facility's carbon emissions emerge from using coal, diesel, and grid electricity contributing to Scope 1 and Scope 2 emissions:

- Scope 1 emissions account for 62.7% of the total emissions, comprising 60.1% from coal consumption and 1.1% from diesel consumption used for electricity generation.
- Scope 2 emissions make up the remaining 37.3% of total emissions, driven entirely by grid electricity, which contributes 37.3%.

Gagillapur Carbon Emissions



■ Scope 1 Emissions 62.7%
■ Scope 2 Emissions 37.3%

Reduction Methodologies and Proposed Decrease

To tackle these emissions, the facility has laid out a set of strategies to reduce its carbon footprint, focusing on both Scope 1 and Scope 2 areas:

- Scope 1 initiatives aim to reduce emissions from coal and diesel by optimizing boiler operations, implementing condensate recovery systems, and gradually switching from coal to biomass as a sustainable fuel source.
- Scope 2 strategies focus on reducing emissions from electricity use. The facility is improving energy efficiency by chiller and air compressor optimization, while also increasing renewable energy through a Renewable Power Purchase Agreement and a solar rooftop installation.

Expected Emissions Reductions

With these strategies in place, the Gagillapur facility expects to reduce its overall carbon emissions by 47% in near term.

This breakdown includes:

- Efficiency measures across boiler and air compressor operation leading to 8% reduction of Scope 1 and 2 emissions. The initiatives include operational optimization and condensate recovery in boilers, various efficiency improvement measures such as pressure optimization, drain traps, and heat recovery in air compressor operations.
- Fuel switch for boiler: 39% reduction through transitioning from coal to biomass boilers, boiler optimization to improve efficiency, and condensate recovery to recycle steam and cut down on energy usage.
- In the long run, all the residual carbon footprint for the Gagillapur site operation (Scope 1 and Scope 2), will be decarbonized through accelerated renewable energy adaption via increased renewable power purchase agreement, installing solar rooftops up to permissible limits by the govt. authorities and renewable energy credits (RECs).

The Gagillapur facility's action plan targets a 47% reduction in Scope 1 and 2 emissions by optimizing boilers, recovering condensate, switching to biomass, enhancing chiller and air compressor efficiency, and increasing renewable energy use.





Carbon Emissions and Reduction Strategies for Granules' Bonthapally Facility

Carbon Footprint Contribution

Granules' Bonthapally (Unit I) facility's carbon emissions come mainly from the use of coal, diesel, and grid electricity. These energy sources contribute to both Scope 1 and Scope 2 emissions:

- Scope 1 emissions account for 85.7% of the total emissions. This includes coal consumption, which contributes 81.1% of the overall carbon emissions, and diesel consumption, which adds 1.6% to the total emissions.
- Scope 2 emissions account for the remaining 14.3%, driven by Grid electricity responsible for 14.3% of Scope 2 emissions.

Bonthapally Carbon Emissions



- Scope 1 Emissions 85.7%
- Scope 2 Emissions 14.3%

Reduction Methodologies and Proposed Decrease

To address these emissions, the Bonthapally facility has developed strategies focused on reducing its carbon footprint in both Scope 1 and Scope 2 areas:

- Scope 1 initiatives target emissions from coal, and diesel and include boiler optimization to improve efficiency and reduce coal consumption, condensate recovery to recycle steam and cut down on energy usage in short run, and switching from coal to biomass as an alternative fuel source in the long run in a progressive manner, which will significantly lower emissions.
- Scope 2 strategies focus on reducing emissions from electricity use, with the facility implementing chiller and air compressor optimization to improve energy efficiency and lower electricity consumption, along with increased share of renewable energy, in the electricity mix through Renewable power purchase agreement at the facility.
- Efficiency measures across Boiler and air compressor operation lead to 15% reduction of scope 1 and 2 emissions. The initiatives include operational optimization and condensate recovery in boilers, various efficiency improvement measures such as pressure optimization and purge loss elimination, lowering the operating pressure, and chiller plant optimization and digitalization.
- Fuel switch for boiler: 32% reduction through transitioning from coal to biomass boilers, boiler optimization to improve efficiency, and condensate recovery to recycle steam and cut down on energy usage.
- In the long run, all the residual carbon footprint for the Bonthapally site operation (Scope 1 and Scope 2), will be decarbonized through accelerated renewable energy adaption through increased renewable power purchase agreements up to permissible limits by the govt. authorities and renewable energy credits (RECs).

Expected Emissions Reduction

With these reduction strategies in place, the Bonthapally facility expects to achieve a total reduction of 46% in emissions. This breakdown includes:

The actions implemented at the Bonthapally facility will result in an overall 46% reduction in emissions, significantly lowering the facility's carbon footprint. Through initiatives such as boiler optimization, condensate recovery, switching to biomass, chiller, and air compressor optimization, and increased adoption of renewable energy.





Our Breakthrough Initiatives on Environmental Stewardship

Initiative 1

Granules CZRO

Our Commitment towards Net Zero

The Scope 3 Context

Pharmaceutical stakeholders have set various decarbonization and net zero goals. However, a decade of progress shows that while companies have reduced operational emissions (Scope 1 and 2), Scope 3 emissions—over 80% of the industry's total—remain largely unaddressed. To achieve decarbonization, the sector must focus on reducing these Scope 3 emissions linked to fossil fuel-based materials.

Why Scope 3 Emissions Are Hard to Abate

The pharmaceutical supply chain relies on essential chemicals like Ammonia, Ethanol, Ethylene, Benzene, Toluene, Xylene, and others, primarily produced from fossil fuels—Oil, Gas, and Coal. In China, the chemical industry mainly uses coal gasification to convert coal into 'syngas', which is then transformed into various chemicals. This process emits substantial CO₂, increasing the GHG intensity in chemical and pharmaceutical products.

The chemical industry is unique among fossil fuel-dependent sectors, using about 70% of these fuels as feedstocks and only 30% for energy. Feedstocks are crucial inputs that transform into final product components. For example, 80% of global methanol is produced via steam methane reforming, which uses water and methane, with much of the carbon from methane incorporated into the methanol. However, some final products, like ammonia (NH₃), derived from fossil fuels, contain no carbon. Focusing on decarbonizing the production of these essential building blocks can significantly reduce greenhouse gas emissions.

Granules Approach towards Solving Scope 3 Challenge

There are three aspects to eliminating GHG emissions from the chemicals industry and achieving zero carbon chemicals. The first is cleaning up the feedstocks present in chemical products. The second one is to decarbonize the heat driving chemical reactions and the third is



24/7

Carbon-free energy

to use the circular economy principle and avoid the release of by-products. Three sources of zero-carbon chemical feedstocks have great potential- green hydrogen combined with captured carbon dioxide, biomass, and recycled chemicals.

Granules CZRO: Chemicals & Pharmaceuticals Manufacturing Reimagined

Granules CZRO aims to revolutionize chemical and pharmaceutical manufacturing and supply chain management by integrating key principles. In partnership with Greenko, we are developing a green pharmaceutical zone (GPZ) in Kakinada, Andhra Pradesh, India, using renewable energy, sustainable feedstocks, and circular economy practices.

Granules CZRO's new 100-acre greenfield facility will utilize an Integrated Green Energy and Green Chemicals Platform, developed with our partner, to produce green hydrogen, green ammonia, and essential chemicals like nitric acid. These green molecules, vital for

Green molecules

Such as Hydrogen(H₂), Ammonia(NH₃), Nitric acid (HNO₃) and Methanol(CH₃OH)

Built-in Circularity



pharmaceutical production, will be generated using renewable energy, water, air, and sustainable carbon sources, including carbon capture.

The project will be completed in the next five years. However, we have already started with a pilot plant at Vishakhapatnam, Andhra Pradesh.

The Kakinada facility will run on continuous carbon-free green energy, requiring minimal external materials from Granules and its partners. Granules will produce Active Pharmaceutical Ingredients (APIs) and their Key Starting Materials (KSMs) on-site, using mostly in-house chemicals, resulting in a final API with a negligible carbon footprint. This will enable Granules CZRO to achieve a near net zero carbon footprint from 'Cradle to Gate' across all three scopes: Scope 1, 2, and 3.





Complete Supply Chain Decarbonization Plan for Paracetamol & Metformin

Granules is a leading global producer of two essential health molecules: Paracetamol for pain relief and Metformin for Type 2 Diabetes management, consumed in vast quantities worldwide. At Granules CZRO, we are launching a comprehensive decarbonization strategy for the entire value chain of these products, crucial for meeting the pharmaceutical industry's climate commitments. We will subsequently expand our efforts to include the value chains of other products in our portfolio and pipeline, including those from fermentation processes.

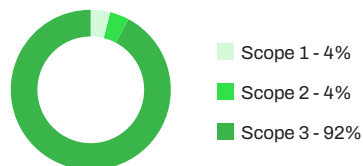
Paracetamol, or acetaminophen, is a non-opioid analgesic and antipyretic used to reduce fever and relieve mild to moderate pain. Available over the counter under brands like Tylenol and Panadol, global demand for Paracetamol API is around 170,000 metric tonnes annually. Its production involves acetylating para-aminophenol (PAP) with acetic acid or anhydride, using precursors such as benzene, chlorine, nitric acid, hydrochloric acid, caustic soda, methanol, and carbon dioxide.

Metformin, used to lower blood glucose in Type 2 diabetes, has an annual global usage of nearly 90,000 metric tonnes. Its main raw materials are dicyandiamide (DCDA) and dimethylamine hydrochloride (DMA HCl), which are derived from precursor chemicals like calcium cyanamide, produced from calcium carbide, nitrogen, ammonia, methanol, and hydrochloric acid. The production of DCDA requires high temperatures (up to 1400°C), resulting in a significant carbon footprint.

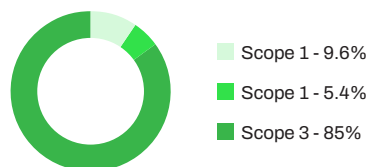
Understanding Emission Profile for Paracetamol and Metformin

Scope 3 Contribution to Paracetamol and Metformin API

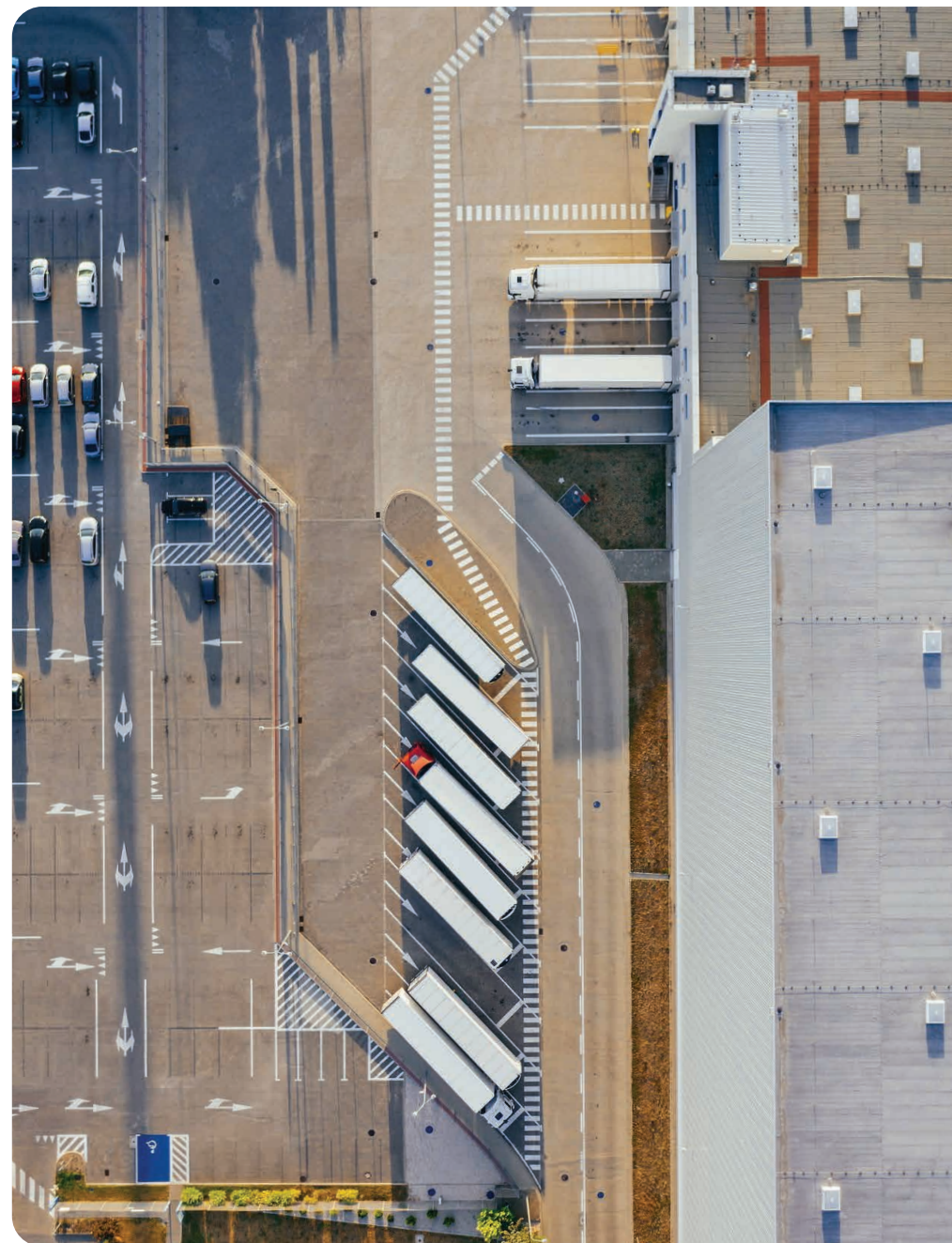
Paracetamol API Carbon Footprint



Metformin API Carbon Footprint



A large portion of the chemicals for Paracetamol and Metformin APIs comes from fossil fuels. At Granules CZRO, we aim to fully decarbonize this supply chain, which accounts for two-thirds of our revenue, achieving an 80% reduction in carbon footprint across all scopes for these compounds.



CZRO Pilot Plant at Vishakhapatnam

At CZRO pilot plant, we have successfully validated our technology for sustainable manufacturing of DCDA, the key starting material for Metformin.

The DCDA Challenge: This material has high carbon intensity in our supply chain, sourced from a few suppliers in China. Its hazardous manufacturing process uses calcium cyanamide and involves temperatures over 1400°C, resulting in a large carbon footprint and difficult-to-manage waste byproducts.

Our Solution: At Granules CZRO, we have developed a novel process using a non-hazardous starting material that operates at just 700°C. This innovation enables us to utilize

electric energy from renewable sources, unlike the previous method that required fossil fuel combustion at 1400°C.

The procedure reduces energy demand and carbon footprint by 50%, even with fossil fuels. This lower heat requirement can now be met with renewable electric energy, bringing the carbon footprint close to zero and marking a significant advancement in heat decarbonization.

The DCDA pilot plant at Vishakhapatnam commenced operations in March 2024 with a capacity of 360 kg/day equivalent to 108 tonnes per annum, a testament to our R&D capability for sustainable product development and manufacturing.

DCDA ROS Comparison Decarbonization of Metformin through DCDA Breakthrough Achieved at our CZRO Pilot Plant in Vizag

Conventional Process

EXISTING COMMERCIAL PROCESS
Calcium Carbide

Nitrogen

Calcium Cyanamide

Continuous carbonation

Dicyandiamide

1400°C

Process heat requires fossil fuel

GRANULES CZRO Process

ALTERNATE ROUTE OF SYNTHESIS
Replacing Calcium Carbide

ALTERNATE Raw Materials

INNOVATIVE PROCESS

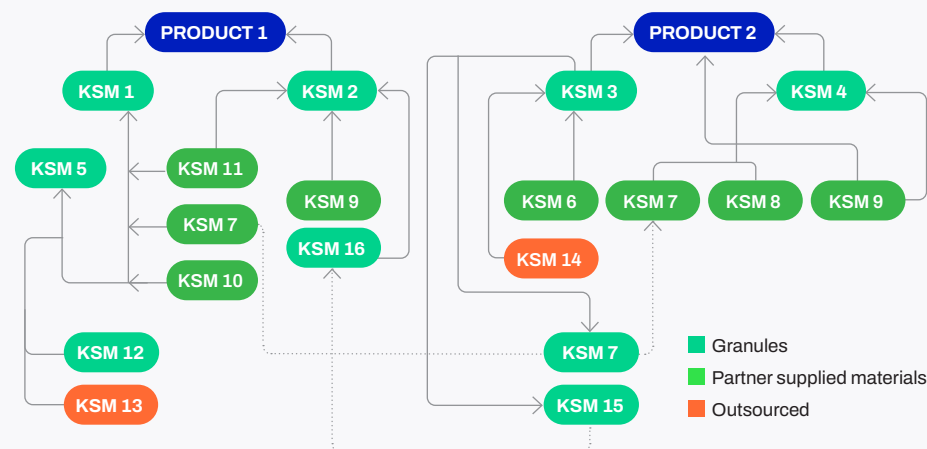
700°C

Process heat through electric furnace, powered by carbon-free energy

Embracing Circular Economy Principle

The Granules CZRO initiative emphasizes a circular economy by highlighting material flow circularity in basic chemical manufacturing. Waste from one segment can be reused as input in another; for example, ammonia produced during DCDA production can be used to make Urea and DMA HCl. Similar circularity is seen with CaCO₃ and CO₂ in the value chains of Metformin and Paracetamol.

Ownership and Decarbonization of Entire Value Chain with Built-in Circularity



Only two inputs, namely KSM13 and KSM14, will be sourced externally. The carbon footprint associated with these inputs will be offset through carbon sequestering methods.



Initiative 2

EcoScale – Eco-conscious Product Development for Sustainability

Pioneering Green Product Development for Sustainable Growth: At Granules, sustainability has been a core focus since our inception. We emphasize green chemistry principles like atom economy and efficiency, and we are implementing enzymatic processes and continuous manufacturing in our R&D. We are committed to advancing green science, including biocatalysis and flow technology, and are establishing green scores at each stage of the manufacturing process to ensure consistent application of these practices.

Choosing the right route for chemical synthesis (ROS) is a major challenge for chemists at the start of any project. To ensure the ROS is cost-effective and environmentally sustainable, we integrate the 'EcoScale' concept early in product development, alongside key green chemistry principles. We assess factors like atom economy, atom efficiency, and the E-factor against established criteria to highlight the importance of sustainability.

We evaluate factors such as acquisition simplicity, operational specifications, chemical characteristics, and effluent types and quantities up to commercialization. Our methodology includes a penalty point system with set acceptability standards, and manufacturing will only begin once these standards are met.



Granules EcoScale

EcoScale assesses process efficiency through evaluation across

6

Parameters

38

Sub-parameters

every stage.

The EcoScale integrates our green chemistry matrix with principles such as atom economy, atom efficiency, and E-factor, supported by eco-friendly enzymes and biotransformation. Our superior capabilities in identified chemistries enhance sustainability at product development stage. Operational targets and green score thresholds drive our commitment to embedding sustainability in each product cultivating a greener and more responsible approach.



Dr. P.V. Srinivas

Chief Technology Officer & Head of API R&D

At Granules, innovation fuels our journey toward sustainable manufacturing. We embed green chemistry principles into every stage of our API development and manufacturing lifecycle, focusing on reducing environmental impact through process optimization and waste minimization. Tools like the Green card and Ecoscale, introduced during API product development, enable us to benchmark progress and align with our sustainability goals right from the start. Leveraging advanced technologies such as flow chemistry and biocatalysis, we enhance efficiency and minimize resource consumption. By integrating these transformative approaches, we aim to deliver eco-friendly solutions that advance our mission of pioneering green science, safeguarding the environment, and creating enduring value for all our stakeholders.





Initiative 3

Innovation in Finished Dosage Manufacturing

Industry-Academia Partnership between Granules India Limited and NIPER, Mohali: **Dr. Chigurupati Center of Excellence in Innovative and Sustainable Pharmaceutical Development (CCE-ISPD)**

Collaborative Research Initiatives/Academic Partnerships

Center of Excellence in Innovative and Sustainable Pharmaceutical NIPER X Granules

The center will focus on crucial areas such as exploring

- ▶ Plant-based excipients
- ▶ Polymer-free formulations
- ▶ Directly compressible crystals
- ▶ Promotion of solvent-free pharmaceutical processes
- ▶ Resource-efficient and energy-efficient pharmaceutical products



The formulation stage of converting API into formulating tablets into injectables or liquids has a significant environmental impact with solvents, excipients, and plastics.

The center aims to develop environmentally friendly pharmaceutical technologies, focusing on:

- ▶ Plant-based excipients
- ▶ Polymer-free formulations
- ▶ Directly compressible crystals
- ▶ Solvent-free processes
- ▶ Resource-efficient products

Granules India will invest in advanced laboratories and research instruments at NIPER to enhance research capabilities. This collaboration will promote joint research, and knowledge sharing through seminars and workshops, and provide research opportunities for faculty and students.

The collaboration promotes sustainability and innovation in the pharmaceutical industry, enabling research and strengthening academia-industry ties with potentially transformative impacts on the global pharmaceutical sector and society.



Manikandan Ramalingam

Senior Vice President & Head, Formulation R&D

At Granules, we are reshaping pharmaceutical innovation in finished dosage formulation development with a strong emphasis on sustainability. Our efforts focus on optimizing the use of excipients, polymers, and solvents to minimize environmental impact. Through our collaboration with NIPER, we are pioneering green formulations that promote eco-friendly practices throughout the formulation process. Initiatives such as advancing plant-based excipients, developing polymer-free and solvent-free formulations, creating directly compressible crystals, and designing resource-efficient products are setting new benchmarks in sustainable pharmaceutical technology. Granules remains committed to investing in state-of-the-art laboratories and fostering academia-industry collaboration through joint research, seminars, and workshops. These initiatives not only enhance sustainability across our operations but also contribute to the industry's ability to deliver innovative, environmentally conscious solutions with meaningful societal impact.





Tackling Carbon Emissions in Value Chain (Scope 3 Emissions)

Supplier Engagement Program

Granules India Limited is committed to sustainability through a Suppliers' Sustainability Program. We prioritize selecting suppliers aligned with our sustainability goals and work with Our top suppliers, responsible for 80% of our carbon footprint, to reduce emissions. This involves pledges, disclosures, and adherence to SDGs and SBTi.

Key Features of Our Supplier Sustainability Program

Granules' Supplier Sustainability Program is built on collaborative partnerships to advance decarbonization and sustainable practices. The program's key components include:



Carbon Footprint Disclosure:

Suppliers are required to report Scope 1, 2, and 3 emissions related to their business with Granules.



Product Carbon Footprint (PCF):

Suppliers are expected to provide product carbon footprint sold to Granules.



Science-Based Targets initiative (SBTi):

Suppliers must develop and submit science-based targets by 2025 aligned with global climate objectives.



Renewable Energy Adoption:

Suppliers are encouraged to increase renewable energy usage, targeting 100% renewable energy for the next five years.

This program underscores Granules' dedication to responsible and sustainable sourcing, aligning with our broader environmental goals.

Granules enforces its climate commitments and requires suppliers to adhere to ethical standards outlined in our Code of Conduct, which includes labor rights, environmental sustainability, business ethics, data privacy, and information security. Suppliers must ensure compliance among their employees and subcontractors, communicate these standards to their vendors, and incorporate similar provisions in their contracts. In case of conflicting laws or agreements, suppliers must follow the highest standard, reinforcing Granules' dedication to ethical supply chain practices.

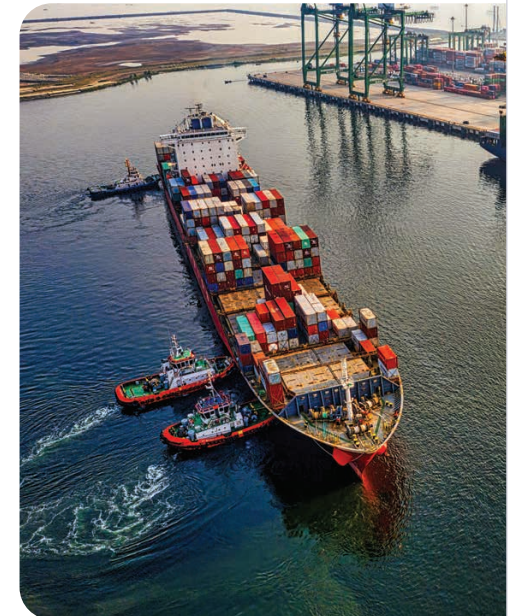
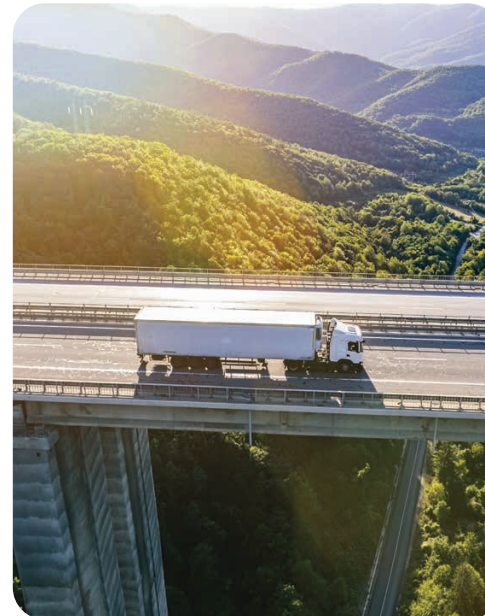


Riaz Ahmed

Senior Vice President & Head of Supply Chain Management

At Granules, supplier sustainability is integral to our responsible business practices and is a key driver in reducing Scope 3 emissions, which account for approximately 88% of our total emissions. Through our Supplier Sustainability Program, we collaborate with top suppliers covering 80% of our spend by value, setting clear expectations on baseline surveys, disclosures, pledges, actionable initiatives, and targets.

Our program focuses on aligning suppliers with our climate goals, resource efficiency, and sustainable sourcing principles. By fostering transparency, building capacity, and driving shared progress, we are creating a resilient and responsible supply chain. This approach strengthens our ecosystem while delivering long-term value for stakeholders and advancing our mission of sustainability and environmental stewardship.

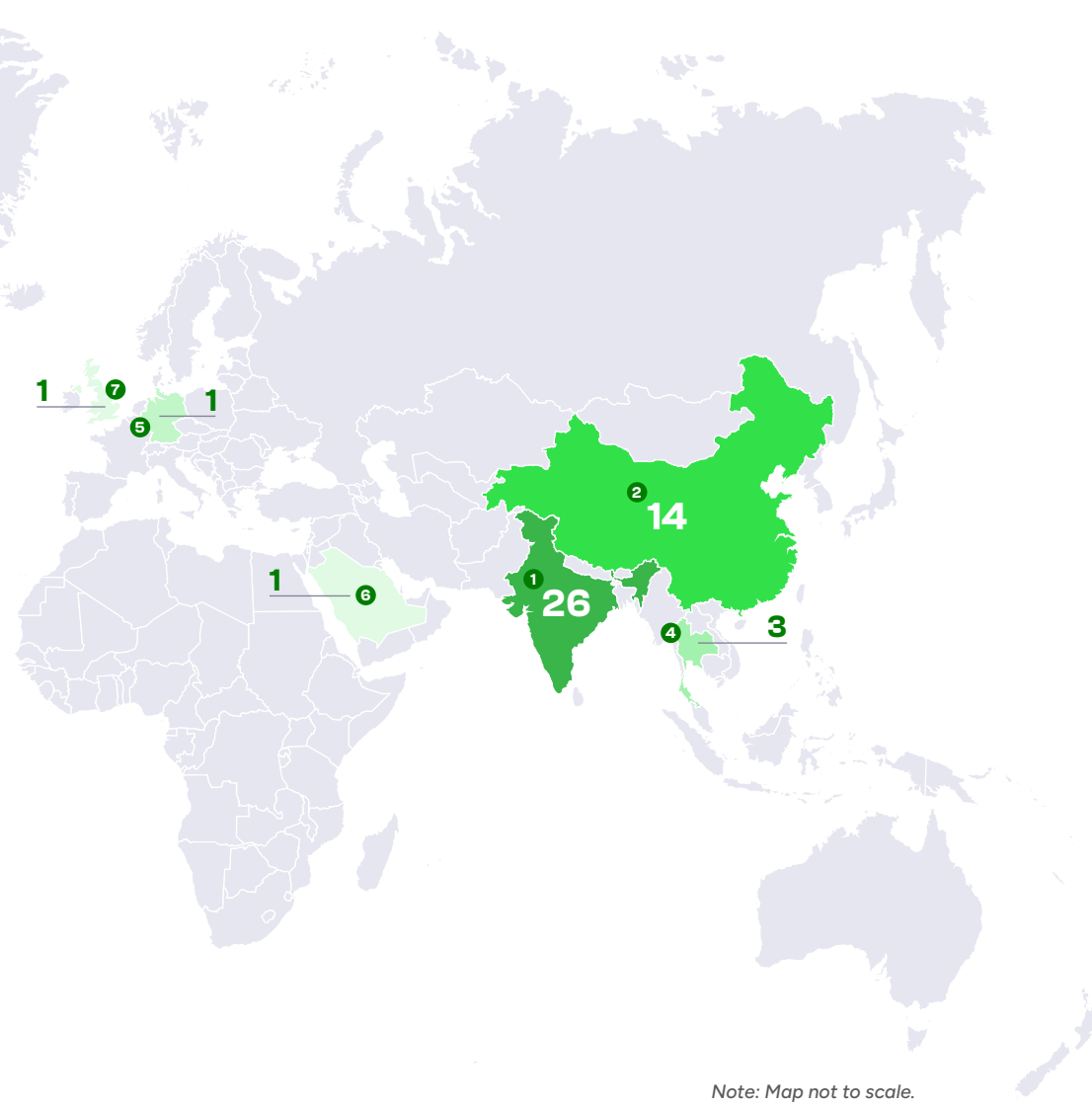




Our Supplier Sustainability Program - Coverage in Numbers

Geographical spread of our top 50 suppliers

① India	26
② China	14
③ United States	4
④ Thailand	3
⑤ Germany	1
⑥ Saudi Arabia	1
⑦ United Kingdom	1



62

No. of suppliers covered

>85%

Coverage on purchase spend

>80%

Suppliers with ESG/
Sustainability policy

100%

Suppliers has conducted training
on human rights

>65%

Suppliers certified for EHS
management system

