ADITYA BIRLA
HINDALCO

Manush Labs
Entrepreneurship Democratized

HINDALCO INDUSTRIES LTD - MANUSH LABS

CLEAN TECHNOLOGY STARTUP CHALLENGE 2022

Executive Summary

28th March, 2022

Background Context

The concept of the Circular Economy came into existence to enhance the existing manufacturing and utilization model of "take-make-dispose". The 12th Sustainable Development Goal (SDG) presented an urgent call to action to rethink and rework our current consumerist societies viz. : "Ensure sustainable consumption & production patterns". This, in tandem with SDG 9 for responsible industrialization and SDG 13 seeking urgent effort to work against climate change, has pushed the global community to move towards the Circular Economy. Now, it is eminently urgent to repurpose the multitude of industrial waste resources especially for use in highly CO2 emitting sectors, like construction & agriculture, by developing valuable, sustainable products and moving away from stop-gap downcycling solutions. One such waste-producer is industrial power plants generating a fascinating resource- **FGD waste**- and copious amounts of it; already more than 200 million tons annually[1] However, the semi-dry desulphurization process generates waste having components of sulfide and sulphite and the challenge is to identify applications for the effective use of this waste. A more familiar problem to the everyday consumer is the 300 million tonnes of waste produced globally, **of plastics alone** [2]. Where India generates 25.8 megatonnes **per day**[2].

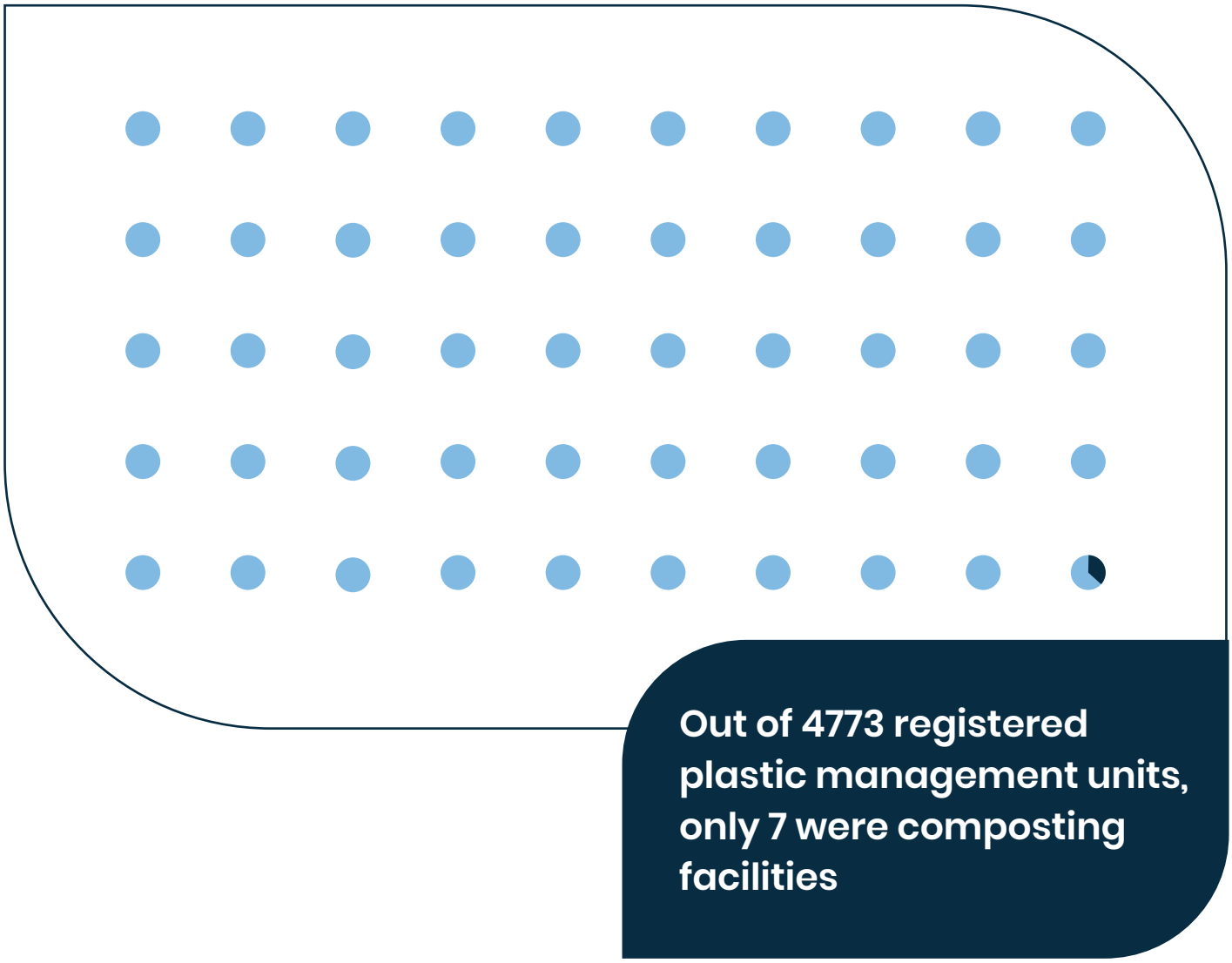
Hindalco, an Aditya Birla company, in partnership with us at Manush Labs, sees all of the above as an opportunity to innovate to eliminate and meet their target of 100% of waste utilization by 2050.

Each ton of plastic waste prevented (by either using an alternate material or recycling) is the equivalent of saving 600+ liters of petroleum, notwithstanding the CO2 emissions prevented in the process[6]. Though as a global community we continue to emphasize the need to reduce oil dependence for energy needs, plastics and their demands on the same resource are neglected. So much so that oil-focused companies are

looking to expand their plastics portfolios and by 2030 1/3rd of the global oil demand is projected to come from the production of plastics[4]. Of this unyielding need for plastics, almost half comes from the packaging that we use on everything, most of which is from virgin materials. For example, in 2018 just about 3% of Pepsi co's packaging material was from recycled plastics[5]. Only 1% of global plastics production is currently bioplastics [2].

Flexible packaging remains one of the biggest challenges, making up 42% of plastics consumption in India (2018) with continuously increasing usage across sectors due to higher energy efficiency, and requiring lower volume per product than rigid packaging [6]. Tackling this category of packaging materials remains a task since they are mostly single-use, tough to collect/recover, and made of polymers like low density polyethylene (LDPE) that require a lot of energy for recycling. Per the latest revision of Plastic Waste Management (PWM) rules in India, the minimum thickness requirements of these types of packaging as carry bags have been increased to 75 microns by September 2021 and 120 microns by December 2022. Such policy decisions further propel the shift to compostable alternatives but we must also solve for where the materials will go at their

end-of-life for a safe return to the natural environment– in 2019, out of 4773 registered plastic management units, only 7 were composting facilities [2]. While we transition to alternatives, the search is also still on for new methods of recycling some of the most problematic types of plastic- like multi-layer packaging (MLPs), polystyrene foams ("styrofoam") & polyvinyl chloride (PVC)- to boost our current limited 12% recyclability of plastics globally and reduce pollution of our land & water [3].



Simultaneously, big polluters of our air need to be curtailed like the coal-fired industrial power plants. These plants produce fly ash followed by the release of sulfur dioxide (SO2), nitrous oxides (NOx), and carbon dioxide (CO2) collectively called Flu Gas. This flue gas is responsible for air pollution and acid rain. Lime-gypsum wet flue gas desulfurization (FGD) process is used as the main desulfurization technology by most countries to control emissions of SO2, but this generates a huge amount of flue gas desulfurization (FGD) gypsum. In December 2015, the Ministry of Environment, Forest and Climate Change (MoEF&CC) issued standards for sulfur oxide, nitrogen oxide, mercury, and suspended particle emissions from thermal power plants with the deadline of December 2017 for the implementation of FGD units at all operating thermal power plants. The standards proposed were decided to be implemented by all existing thermal power plants by the year 2022, however the plants which were commissioned after 31st December 2016 are required to fulfill the standards. It is estimated that up to 17 million tons of FGD gypsum will be produced annually by India's power plants after incorporating FGD units [7].

In this race against catastrophic climate change, limited fossil fuel reserves, and rising environmental pollution concerns, several industries have started to make positive efforts. For example in the construction industry,

engineers and architects are searching for alternative and green construction materials using industrial wastes. At the same time, in the agriculture industry, agricultural inputs like urea from ammonia need to also move to more sustainable feedstocks, while also working towards the global goals of land rehabilitation and soil quality improvement to meet our food production needs.

Industrial waste disposal with utilization is thus crucial as it enhances the resilience and facilitates greater economic output for the industrial production systems & the manufacturing sectors. For example, Hindalco itself has been able to utilize 52% of its fly ash waste within construction applications like brick and cement making [8]. Not only does this effort reduce the waste output but also the CO2 emission from traditional construction material manufacturing methods, an important focus area considering concrete alone is responsible for 7% of the world's carbon emissions. The utilization of industrial waste-based materials across construction, agriculture and alternative energy requires pre-investigation of raw materials and the developed products for satisfactory long-term performance, with immense potential– such as meeting the 7.5 million tonne shortfall in domestic gypsum availability vis a vis the demand at present[7]. To assess and understand the performance of these developed alternate materials & chemicals from industrial wastes, multi-stakeholder participation is required.

Problem Area 1

Inviting solutions for Plastic Packaging Replacement

Plastic reuse-and-recycling is a 60 billion dollar global opportunity waiting to be taken. From advanced feedstock recycling to novel single-material packaging that increases recyclability of the plastics in circulation, our use and abuse of plastics is ripe for disruption. With government regulations in India and beyond facilitating the change, everyone from individual to industrial bulk consumers of plastics are looking for alternative solutions so they can step up & take responsibility. Hindalco has initiated a rigorous review and reflection on their plastic waste (primarily packaging) and today is seeking out innovations and ideas to lead the movement away from conventional plastics to more sustainable materials and solutions.

Flexibles/Film

Half of our plastic problem would disappear if we could create films and flexibles that disappear! However, beyond simply thinking of recycled, recyclable, or compostable options we need to create variety (read: "grades") for a range of consumer & industrial applications also building in optional features like adhesive properties, branding, high strength, additional stretch, etc into our product portfolio

Industrial Carry Bags

Right from the problematic "non-woven" plastic bags used mistakenly in markets as a replacement for pure thin-film plastic bags, to garbage bags and larger industrial storage sizes (up to 1 ton!) for material handling and transportatio, this application needs a rapid reinvention

Protective Packaging Materials

Much like the infinite bubble wrap and air pouches with the consumer goods we purchase, our industrial-scale products are burdened with the same lack of a non-virgin-plastics toolkit to enable clean & effective manufacturing and delivery. Solutions could include or substitute for foamed materials and account for corner & edge protection as well

End of Life — Separation, Recycling, Composting

A systems solution to our plastics challenges today requires intervention and planning for the end of life: both for our current range of plastics that need innovation in advanced feedstock recycling & related technologies and future compostable materials. Solutions in this space could help address larger issues with organic waste as well as plaguing societies worldwide.

Problem Area 2

Inviting solutions for FGD Process Waste Utilization

Industrial power plants continue to have a presence in our domestic energy landscape. Huge amounts of emissions of harmful chemicals like CO2, NOX, and SO2, are usually present in flue gases generated by these plants. To minimize SO2 emissions, wet/semi-dry flue gas de-sulphurization technologies are being deployed in coal-based power plants. Hindalco has adopted semi-dry FGD systems at its power plants and is now looking to convert the waste into usable applications like agriculture- soil modifiers, amenders, fertilizers(FCO approved), etc, and/or construction- cement, Gypsum board, etc. Hindalco is offering its ample & growing FGD process waste resource to be tested, processed, and converted to a high-value, quality-controlled end product. In this track, we invite startups to repurpose this enormous FGD process waste into something fruitful for the planet! Suggested Solution Areas:

Agricultural Amendments

Gypsum and its component compounds are an infinitely valuable resource– for our soils! Let's solutionize to assess the quality of our co-pious FGD process waste and augment the quality of our variety of soils across the country in the process

Fertilizers

Non-nitrogen based fertilizers already see the use of gypsum and are ripe for a transition to synthetic/waste gypsum with necessary solutions around processing and preprocessing, as required, creating an alternative to our petrochemical-based fertilizers

Gypsum Board (construction materials)

This robust & versatile indoor construction material is another high-value product, with some load-bearing properties, waiting for an influx of FGD gypsum waste to also increase its production and access to untapped domestic and international markets.

Our

Project Timeline

1. **15TH MAY**
   Program Launch

2. **20TH JUNE**
   Application Deadline

3. **10TH JULY**
   Results Announced

4. **15TH JULY**
   Program Begins

5. **FALL AND WINTER 2022**
   Piloting and Testing

References

[1] Bakshi, P., Pappu, A. & Gupta, M.K. 2022 A review on calcium-rich industrial wastes: a sustainable source of raw materials in India for civil infrastructure—opportunities and challenges to bond circular economy. J Mater Cycles Waste Manag 24, 49–62. https://doi.org/10.1007/s10163-021-01295-4

[2] Abdul Rafey & Faisal Zia Siddiqui 2021 A review of plastic waste management in India – challenges and opportunities, International Journal of Environmental Analytical Chemistry, DOI: 10.1080/03067319.2021.1917560

[3] Vollmer, Ina & Jenks, Michael & Roelands, Mark & White, Robin & Harmelen, Toon & Wild, Paul & Laan, Gerard & Meirer, Florian & Keurentjes, Jos & Weckhuysen, Bert. (2020). Beyond Mechanical Recycling: Giving New Life to Plastic Waste. Angewandte Chemie International Edition. 59. 15402– 15423 https://doi.org/10.1002/anie.201915651

[4] IEA 2018, The Future of Petrochemicals, IEA, Paris https://www.iea.org/reports/the-future-of-petrochemicals

[5] 2020, Why PepsiCo, L'Oreal and Nestle are banking on this French plastics recycling startup, https://www.greenbiz.com/article/why-pepsico-loreal-and-nestle-are-banking-french-plastics-recycling-startup

[6] Factsheet on plastic waste in India, 2018, The Energy and Resources Institute, https://www.teriin.org/sites/default/files/files/factsheet.pdf

[7] Sunita Narain and Vinay Trivedi 2020, Flue Gas Desulphurization: Limestone Availability and Gypsum Use, Centre for Science and Environment, New Delhi. https://www.cseindia.org/flue-gas-desulphurization-limestone-availability-and-gypsum-use-10043

[8] Sustainability Report 2019-20, Hindalco, http://www.hindalco.com/upload/pdf/sustainability-report-2019-20.pdf

Visit us at:

manushlabs.co