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CARBON NEUTRALITY AND EMISSIONS REDUCTION

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Abstract:

The pulp and paper industry is among the top five energy-intensive industries globally and the fourth largest industrial energy user. This industry accounts for approximately 6% of global industrial energy use and 2% of direct industrial CO2 emissions.[1] Globally, the paper and pulp business was responsible for approximately 190 million metric tonnes (Mt) of CO2 emissions in 2021, which was a record high for the sector and accounted for approximately 2% of all industrial emissions.[2] Annual CO2 emissions rebounded quickly from the dip caused by the COVID-19 pandemic in 2020. If emissions trends were to continue along the same trajectory after 2050, and with commensurate changes in other sources of GHG emissions, the global average surface temperature rise would be around 2.7 °C in 2100 (with a 50% probability).[3] According to estimates published in the Global Carbon Budget Report in 2022, India had the highest rate of carbon emission growth among the world's main contributors to global warming. It increased by 3.8 per cent annually to become the fourth largest emitter worldwide.[4] According to the Report, India's total emissions in 2021 were estimated to be 2.7 billion tonnes, marginally less than the EU's total of 2.8 billion tonnes. India's share of global emissions in 2021 was 7.5 per cent, marginally lower than the EU's 7.7 per cent.[2]

Key words: *Emissions, Pulp, GHG, CO2, Global*

Introduction:

Because the Pulp and Paper industry is among the most energy-intensive sectors, this study brings the major areas into the discussion and possible ways to reduce their impact on nature in terms of GHG emissions. This study is not limited to a particular Pulp and paper industry but gives an insight into the key areas which are the major contributors to CO2 emissions. In this case study we have shown how a simple shift in the fuel selection and strategically chosen product mix can significantly reduce CO2 emission. However, the results are derived from the data taken from the product mix of Pakka Limited to compare the GHG emissions from the global levels. Focusing on the key areas in an integrated pulp and paper industry, major CO2 emissions occur from the Power boiler. The type of fuel plays a significant role in GHG emissions. Coal is responsible for more emissions than other fossil fuels, contributing approximately 40% of global fossil CO2 emissions in 2022.[5]

Problem Analysis

Why Carbon Neural? Why now it is important for the Pulp and Paper industry?

- India has pledged net zero commitments by the year 2070 under the Nationally Determined Contribution (NDC) Under the Paris Agreement (COP26, Glasgow).[6]
- India has committed to reducing the emissions intensity of its GDP by 45% by 2030 from 2005 levels (COP26, Glasgow).[6]
- India's commitment to reduce total projected carbon emissions by 1 billion tons from 2021 onwards till 2030 (COP26, Glasgow).[6]

The global pulp and paper sector was responsible for around 2% of all emissions from industry in 2022.[7] Total GHG emissions share by India is around 7.5%[4] out of which the Indian Pulp & Paper sector was around 30.5 million Tons in 2019 contributing to 1.09%.[8] This data makes this sector one of the major contributors to GHG emissions. Keeping India's above-mentioned commitments in mind this brings Pulp & Paper sector to the spotlight when it comes to meeting the carbon emission reduction targets. The Indian pulp and paper sector's projected growth rate is around 13% CAGR in the next 7 to 8 years.[9]

Methodology

This paper will cover two perspectives in terms of GHG emissions reduction from the

Pulp and Paper industry which are as follows:

1. Product directly replacing plastic – Especially single-use plastic:

In this study "Carbon Footprint Assessment" report by CHUK, a Pakka Limited brand, was followed which followed LCA guidelines by GHG to calculate its carbon footprint which includes upstream scope 3 emissions, scope 1 & 2 emissions and downstream scope 3 emissions.

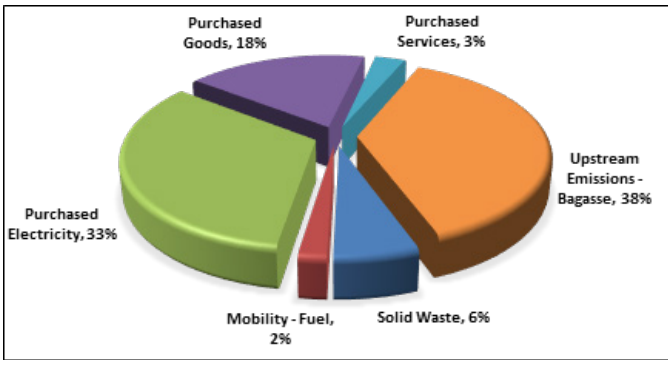

Fig.1 Emission Sources with their Contributions[10]

CHUK's emissions have been categorised into eight distinct categories. Firstly, stationary combustion contributes to emissions from the burning of fuel in boilers, furnaces, and other equipment that generates heat or power. Secondly, mobile combustion emissions from on-road vehicles, including cars, trucks, and other vehicles utilising gasoline or diesel fuel, contribute to emissions. The third category encompasses purchased electricity, accounting for emissions originating from the power plants supplying the electricity purchased. The fourth and fifth category is purchased goods and services, which entails emissions produced during the manufacturing and transportation of goods procured. The sixth category relates to the upstream emissions of bagasse, a form of biomass used for generating heat and power within the facilities. The seventh category focuses on solid waste generated during operation, incorporating emissions associated with the disposal of solid waste, including food scraps and packaging. Lastly, the eighth category concerns liquid waste generated during operation, encompassing emissions arising from the disposal of liquid waste, such as wastewater and cooling water.[10]

2. Using carbon-neutral fuels for the Power & Steam Generation:

In this part, the GHG emission intensity of different fuel stocks was compared with the Coal and Natural gas. GHG emissions in terms of tCO2eq./kWh power generation compared to highlight the impact of different fuel stocks on GHG emissions. The scope of the study is limited to the burning of the fuels in power boilers and no transportation emissions are taken into account.

Results and Discussion:

Based on the study conducted on fibre-based tableware it was found that the specific emissions from fibre-based tableware, and food packaging products are 0.13 tCO2e/MT[11], whereas in the case of plastic, it is around 2.1 tCO2e/MT[11]. This study particularly focussed on the replacement of single-use plastic which is being used in the food packaging segment. The average life span of a single-use plastic is 15 minutes[12] whereas it took more than 1000 years[18] for it to completely degrade. This particular reason makes plastic a big potential threat to the global environment.

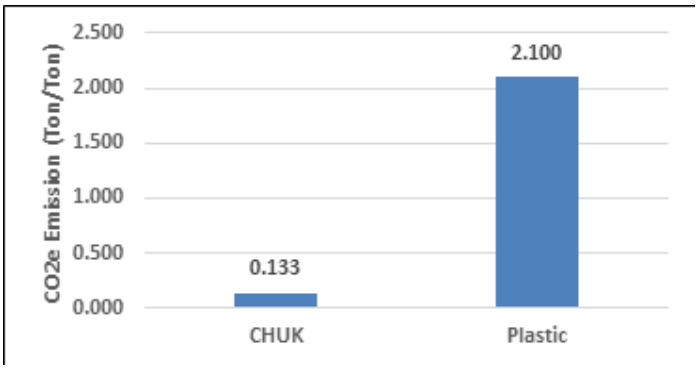

Fig.2 Specific GHG Emissions – Fiber Vs Plastic Tableware

On the given data we took CHUK's production data for Jan 2022 till Nov 2023. Total production in this period was 4092 MT. to make a comparison with the emission from plastic products of similar kind and same volume (MT). The results found were surprisingly good.

This 2-year (23-month) data study shows directly replacing plastic tableware (single-use plastic) with fibre-based products eliminated around 8000 tCO2e emissions. As per the data Global Plastic Packaging

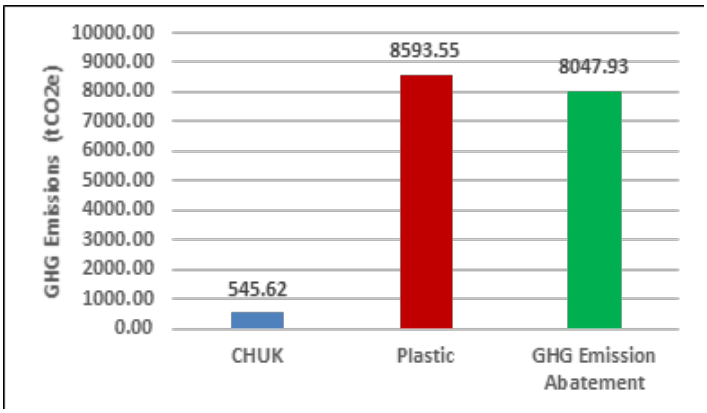

Fig.3 Absolute GHG Emissions – Fiber Vs Plastic Tableware

Market volume in 2024 is 103.48 million tons and by 2029 it will be 124 million tons.[13] As per the study made in this paper, replacing the faction of this plastic with fibre-based packaging solutions can save millions of tons of CO2e emissions.

In the second part of this study, we compared GHG emissions from agro-based fuel, Natural gas with Coal. This part of the study plays a significant role in the Pulp and paper industry because around 40% of the total emissions are from steam and power generation. Coal particularly contributed approximately 40% of global fossil CO2 emissions in 2022.[5]

Here we took a baseline as Rice Husk consumption, as fuel, in the FY 2022-23 in Pakka Limited, Ayodhya and compared the emissions with coal (Grade-9)[14] and natural gas[15] while keeping the same amount of energy required as produced by Rice Husk. During this period the total energy produced using rice husk was 7,91,370 MJ (Mega Joule). To produce the same amount of energy we have selected two fossil fuels one is coal and another one is natural gas. The reason behind making a comparative taking natural gas is to see the possibility of this clean gas where the availability of the rice husk is not possible or economically viable.

In this study, rice is considered a carbon-neutral fuel as per GHG emission guidelines. As per the study, in rice husk combustion for power or steam generation in a specially designed boiler, the total

emissions (CO2e) released during the process are equivalent to the CO2e absorbed during the period starting from seed till the time the crop is harvested. Specific GHG emissions (tCO2e/Ton Fuel)[16] are taken for both coal as well as natural gas to calculate the net impact made by each fuel in comparison to the rice husk used in the period of FY 2022-23.

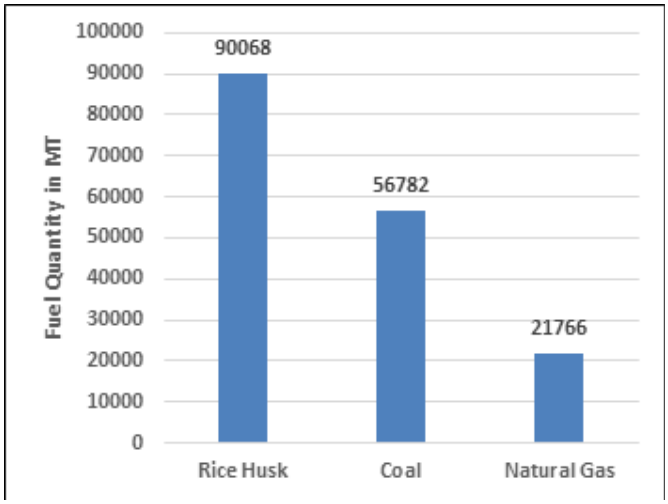

Fig.4 Fossil Fuel Quantity with respect to Rice Husk

Now based on the data available to us, we calculated the total emissions in comparison to the rice husk burning it as a fuel. As already mentioned, rice husk is a carbon-neutral fuel and hence total emissions from using rice husk as a fuel will remain zero. Whereas total GHG emissions would have been made by using coal or Natural Gas instead of rick husk are 1,35,141 tCO2e and 59,858 tCO2e, respectively. So technically in both scenarios using rice husk saved tons of GHG emissions in a single financial year considered under the scope of this study.

On the other hand, where coal is the primary fuel, as per the data we saw this opportunity to use Natural gas as a supporting fuel, because switching to a 100% natural gas-based boiler wouldn't be an economical decision. Each ton of Natural gas can replace around 1.66 Tons of coal with added boiler efficiency due to negligible impurities in the Natural gas.

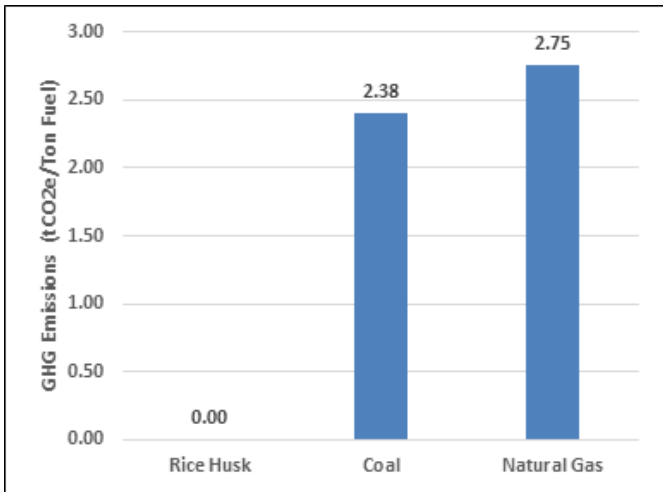

Fig.5 Specific GHG Emissions with respect to the fuels

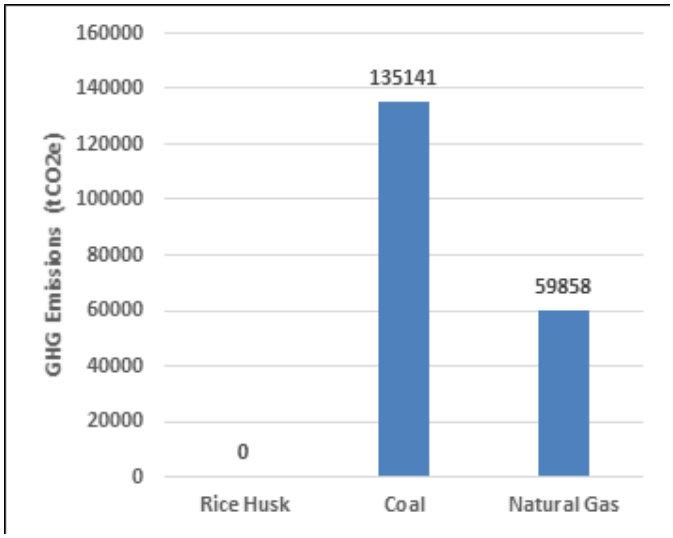

Fig.6 Absolute GHG Emissions

Conclusion

Based on the study carried out during this paper and information collected from various sources it is evident that directly targeting the replacement of plastic products (like single-use plastic) with innovative fibre-based products can give Pulp and Paper Industry a competitive edge in terms of reducing the GHG emissions by a large number. On the other part, agro-based fuel is a clear winner when compared with fossil fuel-based captive power generation units. The Pulp and Paper industry is energy energy-intensive unit, as already mentioned, so either by changing the fuel mix and choosing cleaner fuel options or taking focussed improvement projects to increase the power optimization is the key towards reducing the industry's carbon footprint. Each 1000 kW/day power reduction will contribute to the reduction of around 313 tCO2e and 115 tCO2e annually in coal-fired & natural gas-fired boilers, respectively[17]. Power saving and optimization projects are of equal importance.

Taking Natural gas as support fuel into consideration, this area needs further study in terms of gas availability and its economic factors. Above all this opportunity needs government support to support the Pulp and Paper sector to switch to this clean fuel, as a support fuel, to reduce the overall GHG emissions in the region where agro residue as a fuel is not an option.

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