Energy Footprint

The South African Pulp and Paper Subsector

Prepared By: Catalyst Verification Solutions (Pty) Ltd

mineral resources & energy
Department:
Mineral Resources and Energy
REPUBLIC OF SOUTH AFRICA

sanedi
South African National Energy Development Institute.

PROJECT SUMMARY

1. INTRODUCTION

Catalyst Verification Solutions (Pty) Ltd (Catalyst) was tasked with determining the Current Average Energy Consumption (CAEC) and the Practical Minimum Energy Consumption (PMEC) of the pulp & paper subsector in South Africa.

For this study, the boundary included all pulp & paper mills in South Africa. Although reference is made to pulp & paper mills, it must be noted that the study also includes tissue mills.

To determine the CAEC and PMEC, Paper Manufacturer's Association of South Africa (PAMSA), the industry association for pulp & paper, collected energy consumption and production data for 11 pulp & paper mills on our behalf. Note that the information was anonymised for reasons of confidentiality. It is likely that these 11 pulp & paper mills approximately 90% of the production capacity in South Africa.

2. CURRENT AVERAGE ENERGY CONSUMPTION

According to the data provided by PAMSA, the CAEC of the pulp & paper mills in South Africa was 62 598 613 GJ over the 2021 calendar year. This energy consumption includes both electricity purchased from the national electricity grid and fuels consumed by the mills. It does not include electricity generated by the mills as this is already captured in the fuels consumed by the mills. Including the electricity generated by the mills would be double counting.

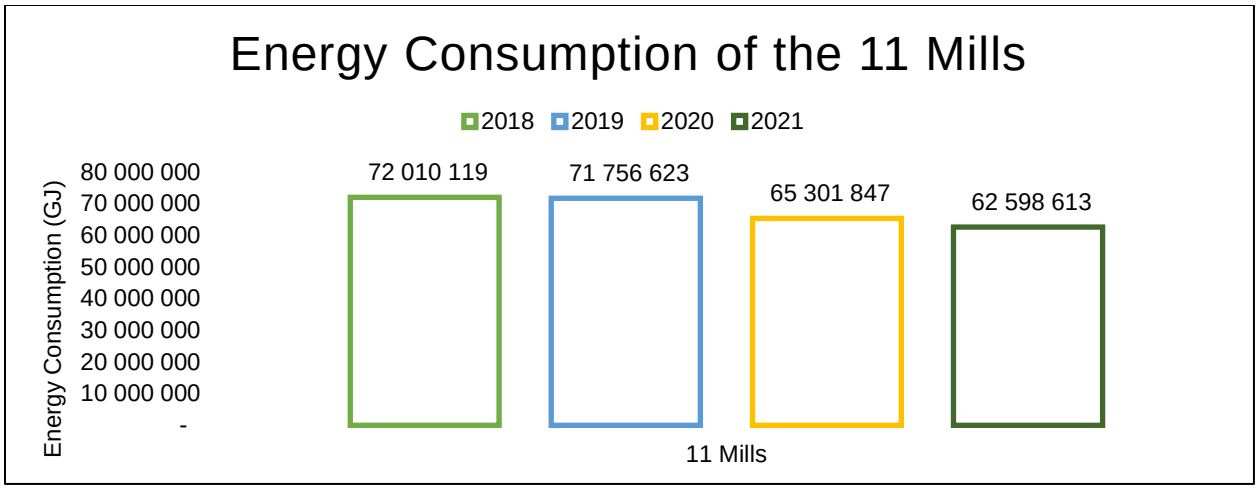

Figure 1: *Energy Consumption of the 11 Pulp & Paper Mills Over Time*

If one considers that the energy consumption above encompasses only the 11 pulp & paper mills captured in Table 2, it can be argued that the CAEC of the subsector is probably closer to 69 554 015 GJ. This assumes that the energy consumption of the 11 pulp & paper mills is approximately 90% of subsector's energy consumption in South Africa.

Production is an energy-governing factor. As such, it makes sense to report the energy consumption of the pulp & paper subsector on a 'per tonne' basis. The energy intensity of the subsector was 17.93 GJ/tonne over the 2021 calendar year.

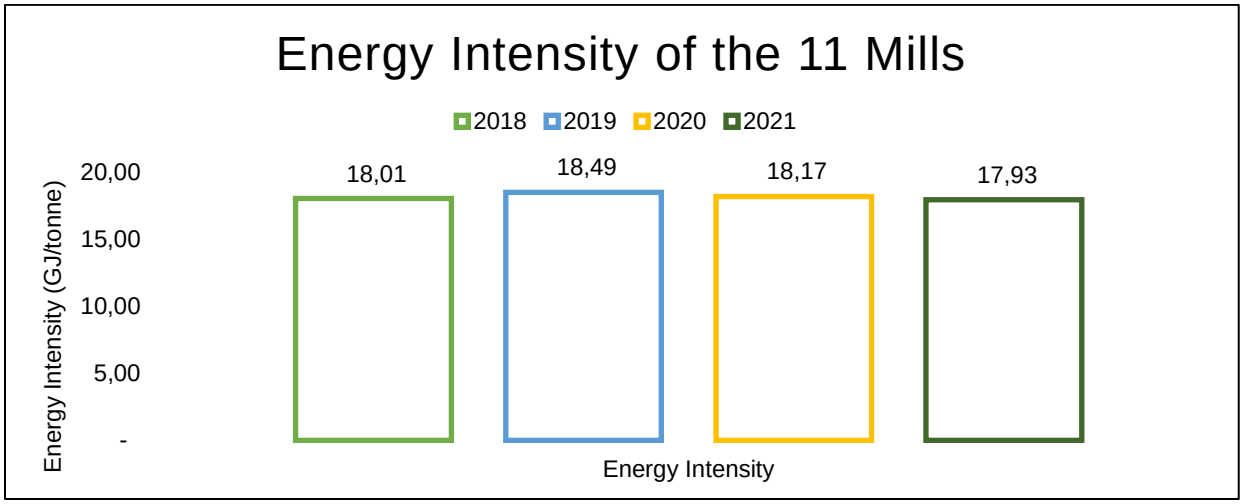

Figure 2: *Energy Intensity of the 11 Pulp & Paper Mills Over Time*

The energy intensity decreased from 18.01 GJ/tonne in 2018 to 17.93 GJ/tonne in 2021. This may show some energy efficiency improvements over time. However, it also may be due to other factors such as changes raw materials used and types of products manufactured.

Each of the pulp & paper mills had very different energy consumption values and energy intensities. With further analysis, it became clear that the energy consumed by the pulp & paper mills in South Africa is influenced by the following factors: production capacity (i.e., mill size), production (i.e., tonnages produced), mill type (i.e., integrated or non-integrated), raw material type (i.e., timber, recycled fibre, purchased pulp and other sources of biomass), product type (i.e. white paper, kraft etc.), process employed (i.e., chemical or mechanical pulping) and whether the mill generates its own electricity or is fully reliant on the national electricity grid. Unless adjustments can be made for all these factors, there is limited value is benchmarking the mills against each other. There are no two mills in South Africa that are the same.

3. PRACTICAL MINIMUM ENERGY CONSUMPTION

The PMEC is the least amount of energy consumption required to produce pulp & paper that can be practically achieved. It is achieved through the implementation of energy savings opportunities that are both currently financially and technically feasible.

Determining the PMEC of the pulp & paper subsector in South Africa is challenging. Given that pulp & paper mills in South Africa are all very different from each other, it is likely that the energy savings potential differs per mill. In an attempt to set the PMEC, the following was done:

- For each step in the production process, identify energy savings opportunities;
- Identify whether the pulp & paper mills in South Africa have implemented these energy savings opportunities;
- Quantify the energy savings that could result from the implementation of the remaining energy savings opportunities; and
- Unpack whether the remaining energy savings opportunities are financially and technically feasible.

To sense check the results of the above:

- Information was requested from the pulp & paper companies in South Africa;
- Calls were held with some of the pulp & paper companies in South Africa;
- Site visits were conducted to some of the pulp & paper mills in South Africa; and
- A literature review was conducted.

Several energy savings opportunities exist for the pulp & paper subsector in South Africa. These are tabulated below:

Table 1: *Energy Savings Opportunities in the South African Pulp & Paper Subsector – Savings Potential*

Area	**Potential Energy Saving (%)**	**Realistic Energy Savings (%) for Ease of Implementation**	**Comment**
Energy Management Programmes and Systems	3%	Already Been Done: 2% Simple: 1%	Online energy management systems could possibly result in a 2% saving.
Steam Systems	15%	Already Been Done: 12% Simple: 2% Moderate: 1%	Heat recovery from the flue gas and stream trap monitoring and maintenance could result in savings of 2%. Heat recovery from blowdown could result in savings of a further 1%.
Process Optimisation	3%	Moderate: 3%	Progress integration (pinch analysis) may result in 3% if waste heat can be reused in the process.
Combined Heat and Power Systems (CHP)	0%		Not relevant to all mills so no savings assumed in this assessment.
Lighting	0.11%	Simple: 0.11%	Savings may be slightly more, but not likely to be above 0.4%.
Raw Material Preparation	1.28%	Already being done: 0.45% Moderate: 0.33% Complex: 0.50%	

Chemical Pulping, Bleaching and Recovery	12%	Complex: 12%	On reflection, savings of 12% are possibly only realistic with significant overhaul of, changes to or replacement of the pulping process, bleaching and recovery.
Mechanical Pulping	0.11%	Complex: 0.11%	
Papermaking	13%	Already been done: 1% Simple: 1% Moderate: 3% Complex: 8%	On reflection, savings of 13% are possibly only realistic with significant overhaul of, changes to or replacement of the paper machine.

To determine PMEC, the energy savings opportunities were grouped into categories and the following scenarios were defined:

- **Simple and Moderate:** This scenario should be regarded as highly optimistic as not all opportunities are financially feasible. Significant capex would also be required.

- **Simple Only:** This savings scenario is a likely approximation of true savings potential for the subsector at present. Note also that several opportunities falling into this category are well understood by the mills and are at least partially implemented.

The possible energy savings under each scenario are tabulated below:

Table 2: *Possible Energy Savings for the Scenarios*

Scenario	% Total Annual Consumption (2021 data)	Total Savings (GJ)
Simple and Moderate	11.44% Probably more likely between 10 and 12%	7 956 979 Probably more likely between 6 955 402 GJ and 10 433 102 GJ
Simple Only	4.11% Probably more likely between 3 and 5%	2 858 670 Probably more likely between 2 086 620 GJ and 3 477 701 GJ

From the above, assuming it is only the simple energy savings opportunities that are currently financially and technically feasible, the energy savings are between 3 and 5%. The PMEC under this scenario is then between 66 076 314 GJ and 67 467 395 GJ. As more energy savings opportunities become financially and technically feasible, the savings may increase.

4. CONCLUSION

The assessment has shown that the CAEC of the pulp & paper mills in South Africa was 69 554 015 GJ over the 2021 calendar year. This can be reduced by an estimated 3 to 5%, if the financially and technically feasible energy savings opportunities are implemented. The resulting PMEC would be between 66 076 314 GJ and 67 467 395 GJ.

For further information, kindly contact:

Mr. Luvuyo Njovane	Specialist – DMRE	Luvuyo.Njovane@dmre.gov.za
Mr. Teslim Yusuf	Acting General Manager – SANEDI	teslimy@sanedi.org.za
Ms. Joslin Lydall	Division Manager – Catalyst Solutions	joslin@catalystsolutions.co.za