

**GREEN TECHNOLOGY INNOVATIONS IN THE  
MALAYSIAN PALM OIL  
INDUSTRY'S DOWNSTREAM SECTOR**



*Sustainability and Green Technology  
Innovations in The Malaysian Palm Oil  
Refining Sector*

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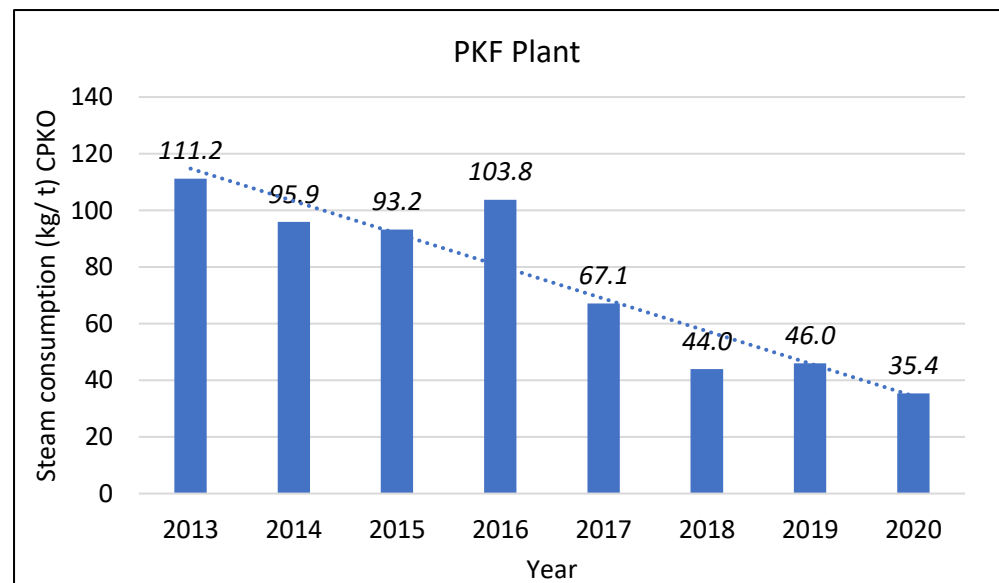
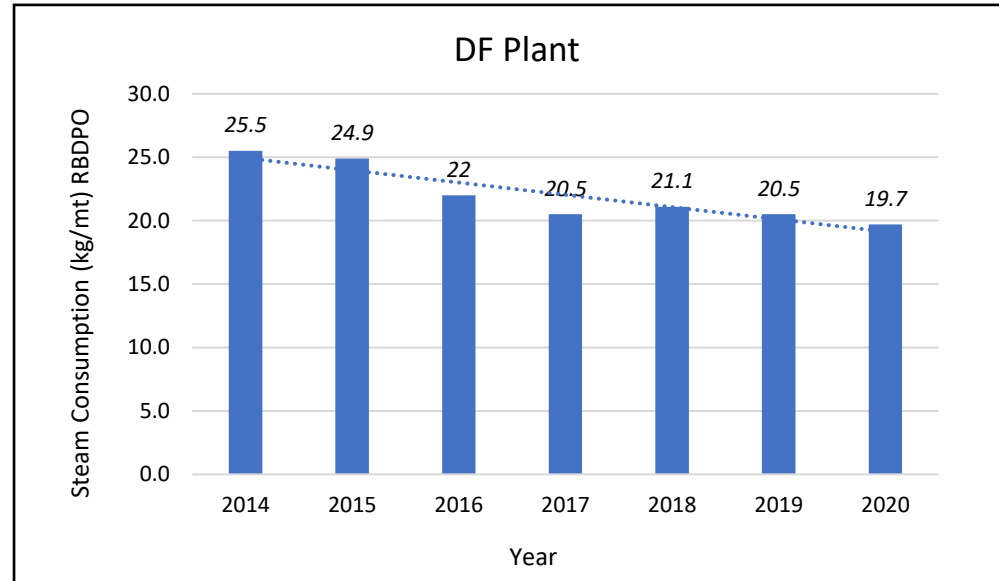
# Vent economizer, steam saving



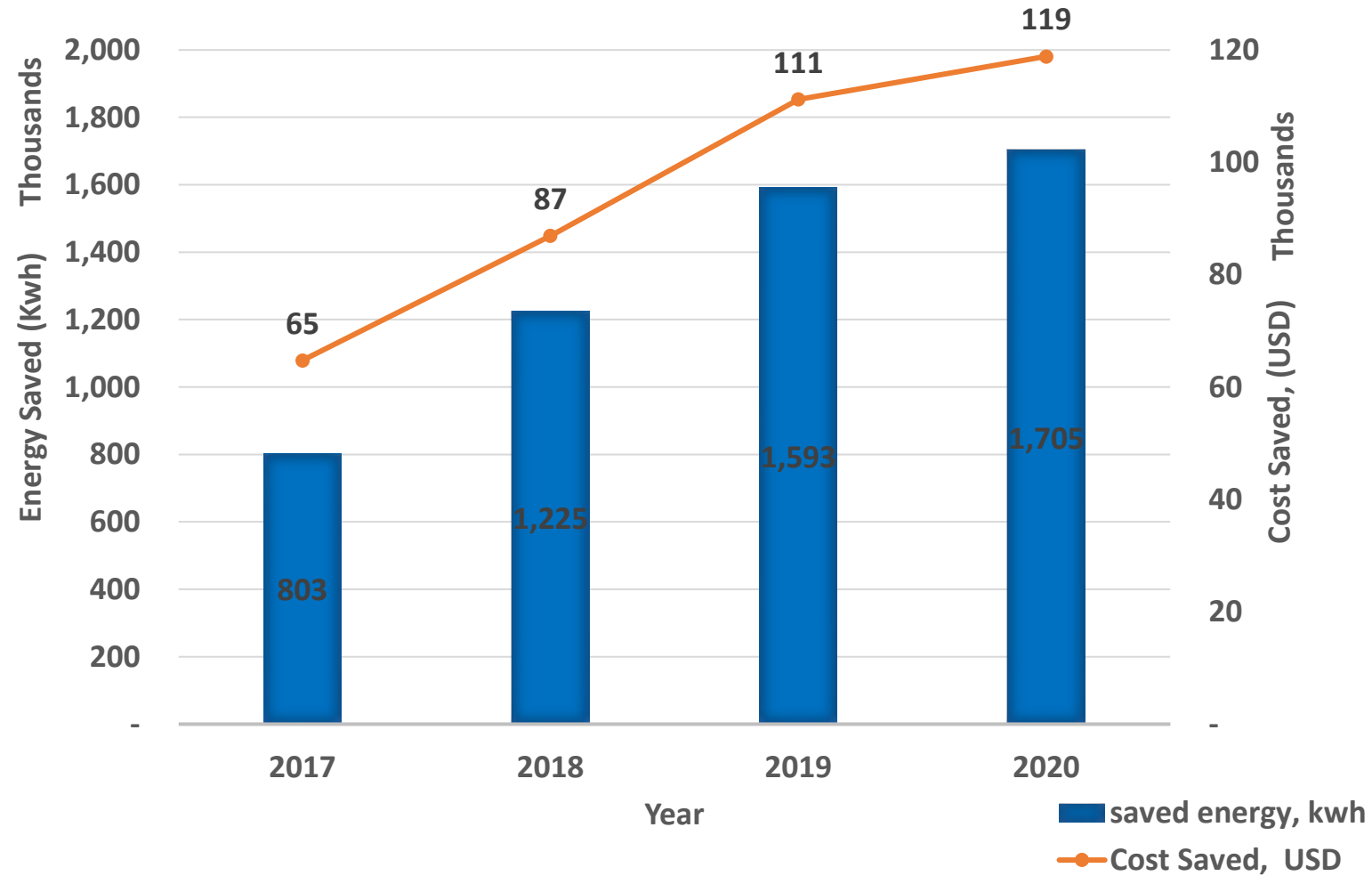
Steam saving at fractionation plants

Dry fractionation- 20%

Palm kernel dry fractionation- 68%



# Heat exchanger, inverter, LED light



# LNG replaces diesel



LNG system was commissioned in July 2019 starting with Refinery 2 and Refinery 3. The more environmental-friendly LNG replaced diesel for Geka boilers and reduced carbon footprint.

LNG has an emission of 0.07 kg CO<sub>2</sub>eq/MJth which is much lower than the emission of diesel rated at 3.14 kg CO<sub>2</sub>eq/L.

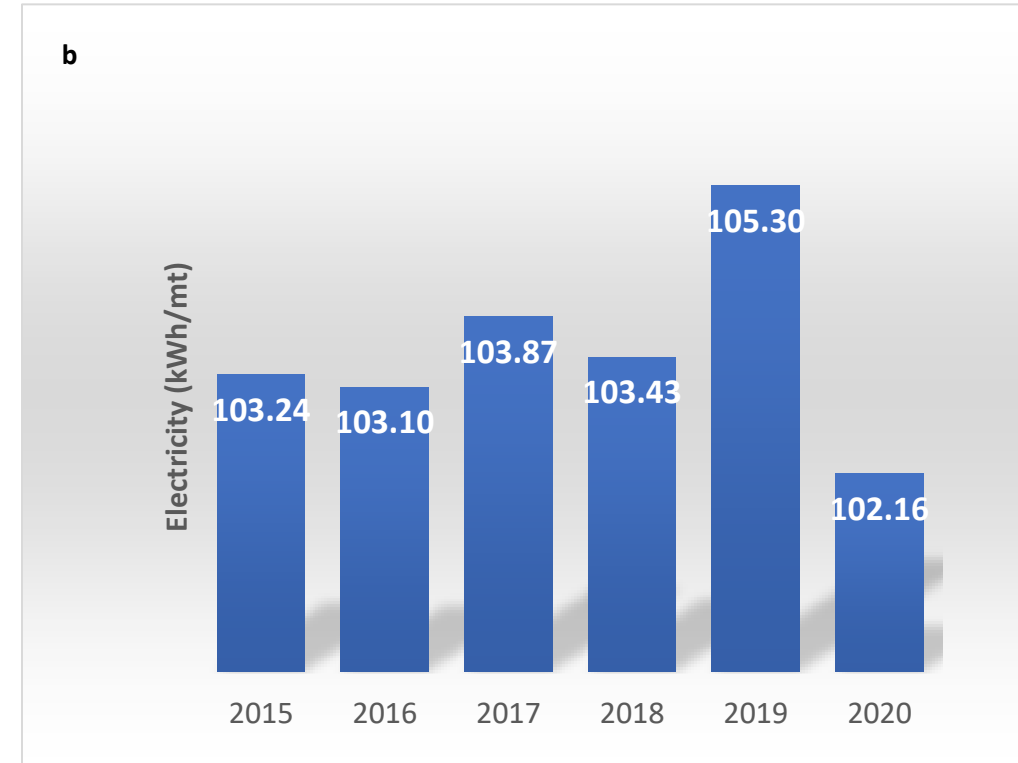
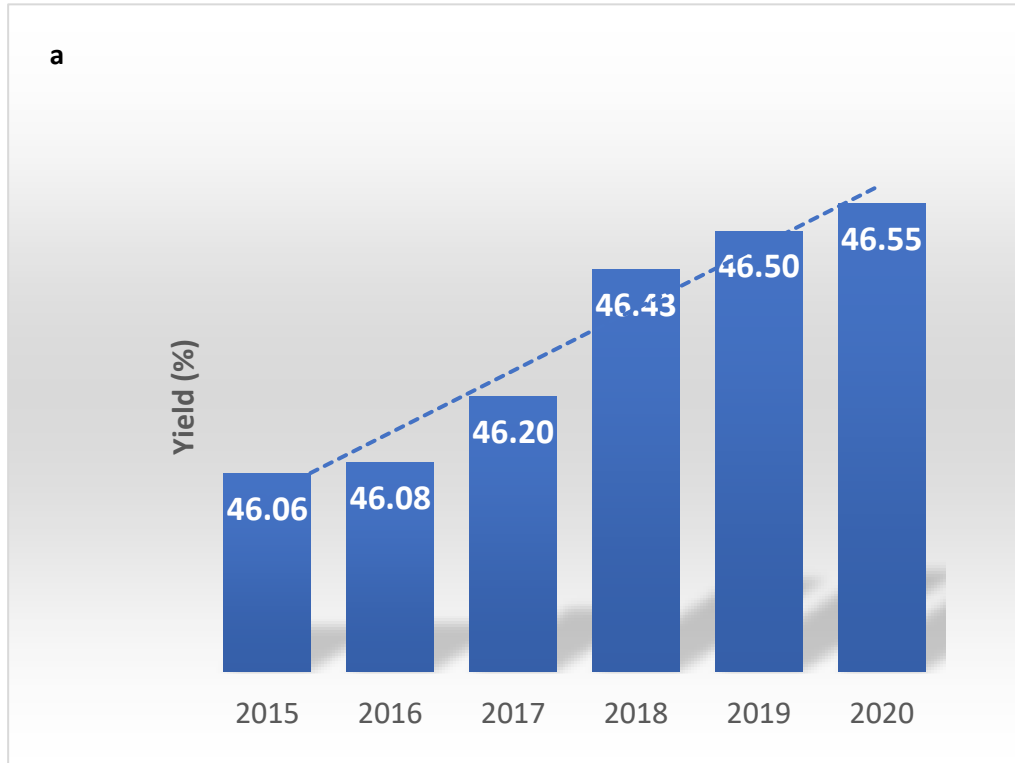
This project reuses the existing concrete foundation from old Vickers boiler and thus, avoid the use of new pilling and concrete.

# Heat Recovery

Year	2014	2015	2016	2017	2018	2019	2020
Refinery 3 (Diesel + LNG) L/t or Sm <sup>3</sup> /t RBDPO	5.73	5.17	3.93	3.38	3.65	3.65	2.89
Reduction (%)	Baseline	10%	31%	41%	36%	36%	50%
Configuration	Falling film (FF)		Change to Spiral Heat Exchanger (SHE)				SHE + FF

The average LNG consumption for the period from March to May 2020 was noticed to have reduced to 3.348 Sm<sup>3</sup>/t RBDPO, which was equivalent to a 16.6% reduction. Given the annual throughput of 245,000 t (for Refinery 2), this results in a savings of 160,000 Sm<sup>3</sup> LNG, which amounts to a cost savings of USD 57,831, while the total CO<sub>2</sub> emission has been reduced by 460,000 kg/y.

# KCP CPKO Yield



KCP has taken proactive measures to improve its yield. The yield can be seen to be on an increasing trend for the past 3 years.

This year's achieved yield was the highest at **46.55%**

The efforts to raise the yield has been an on-going exercise.

# Dust plants at KCP





# CPO washing



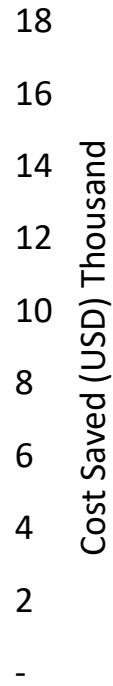
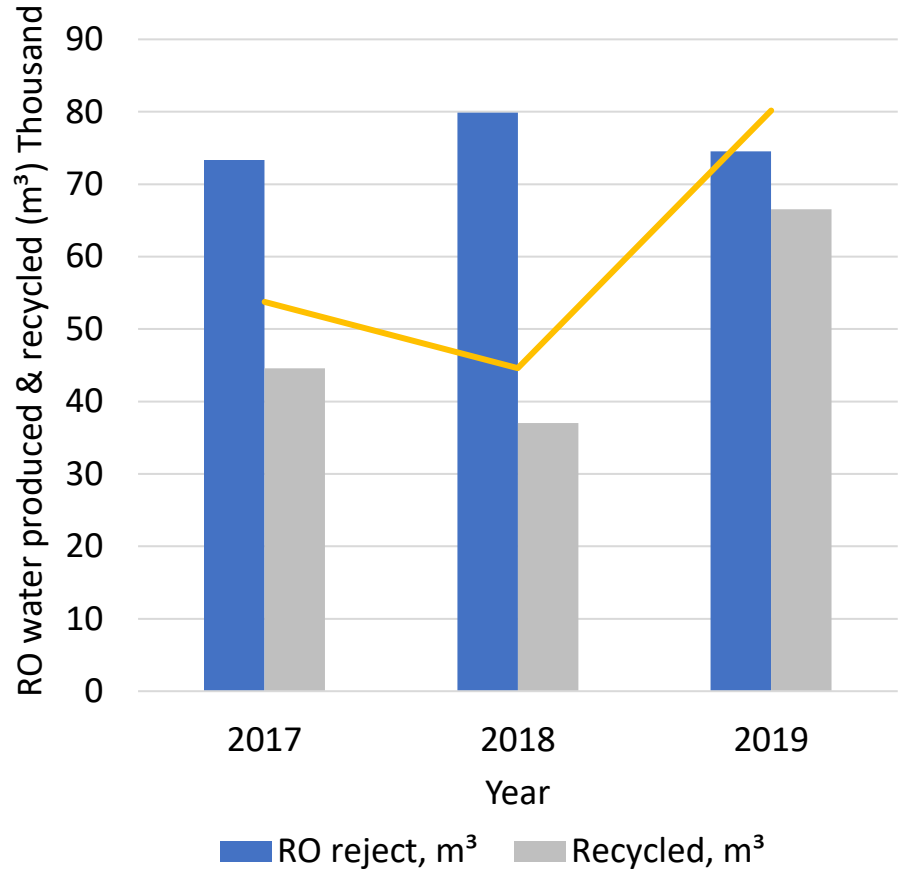
Reduces bleaching agent needed and lower oil loss

Lower oil loss

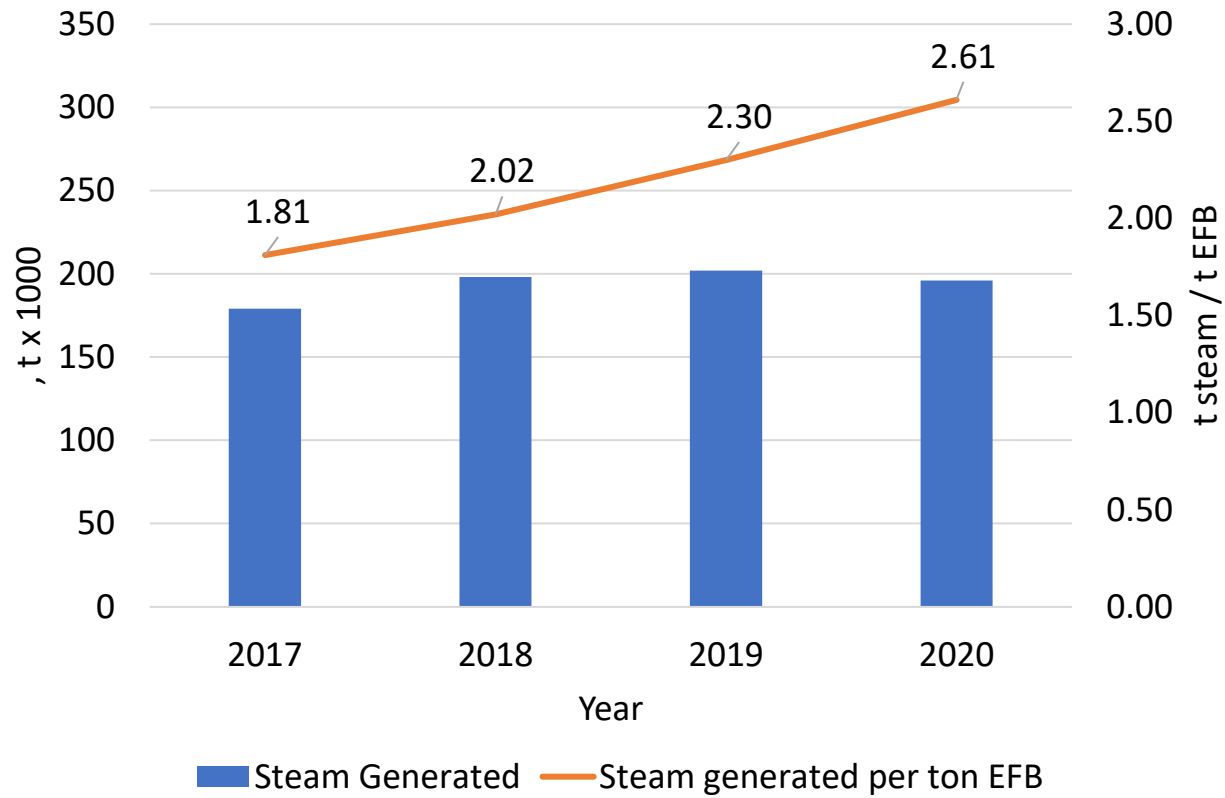
Removes most water soluble chlorides, lower 3-MCPDE in refined oil

Reduces phosphorus, metal ions & impurities

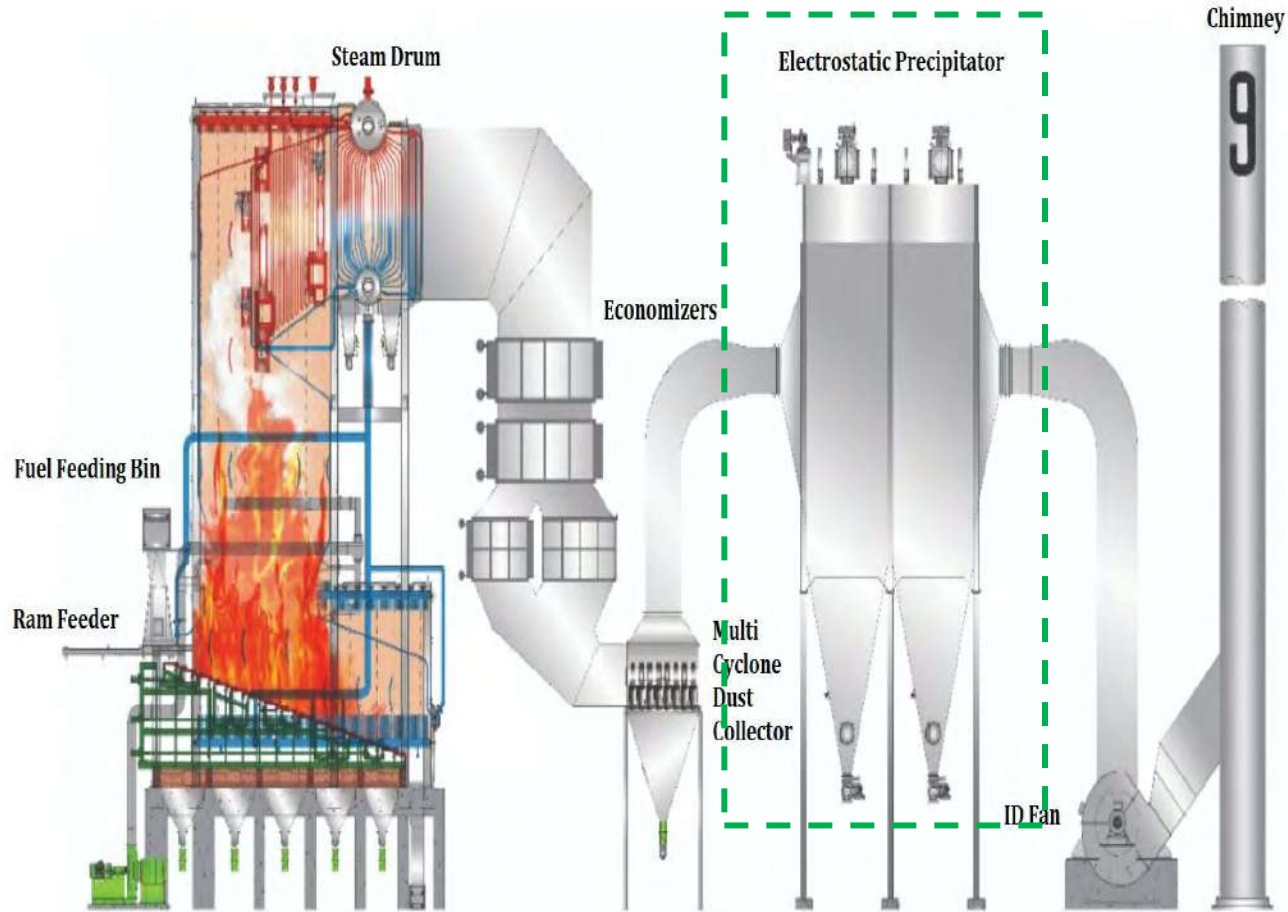
# Water recycling

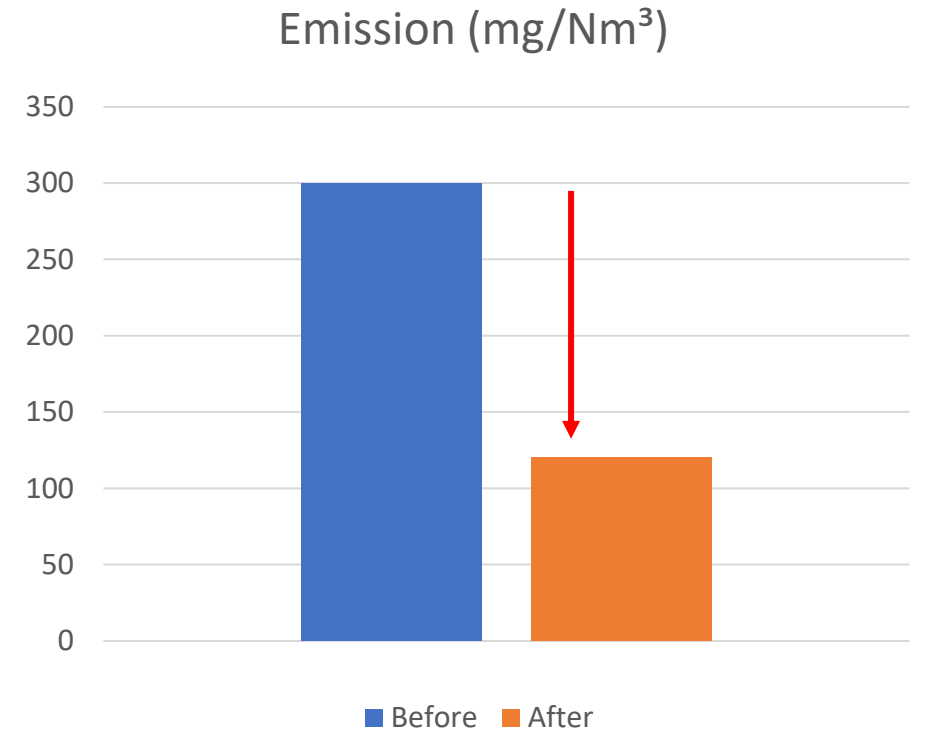
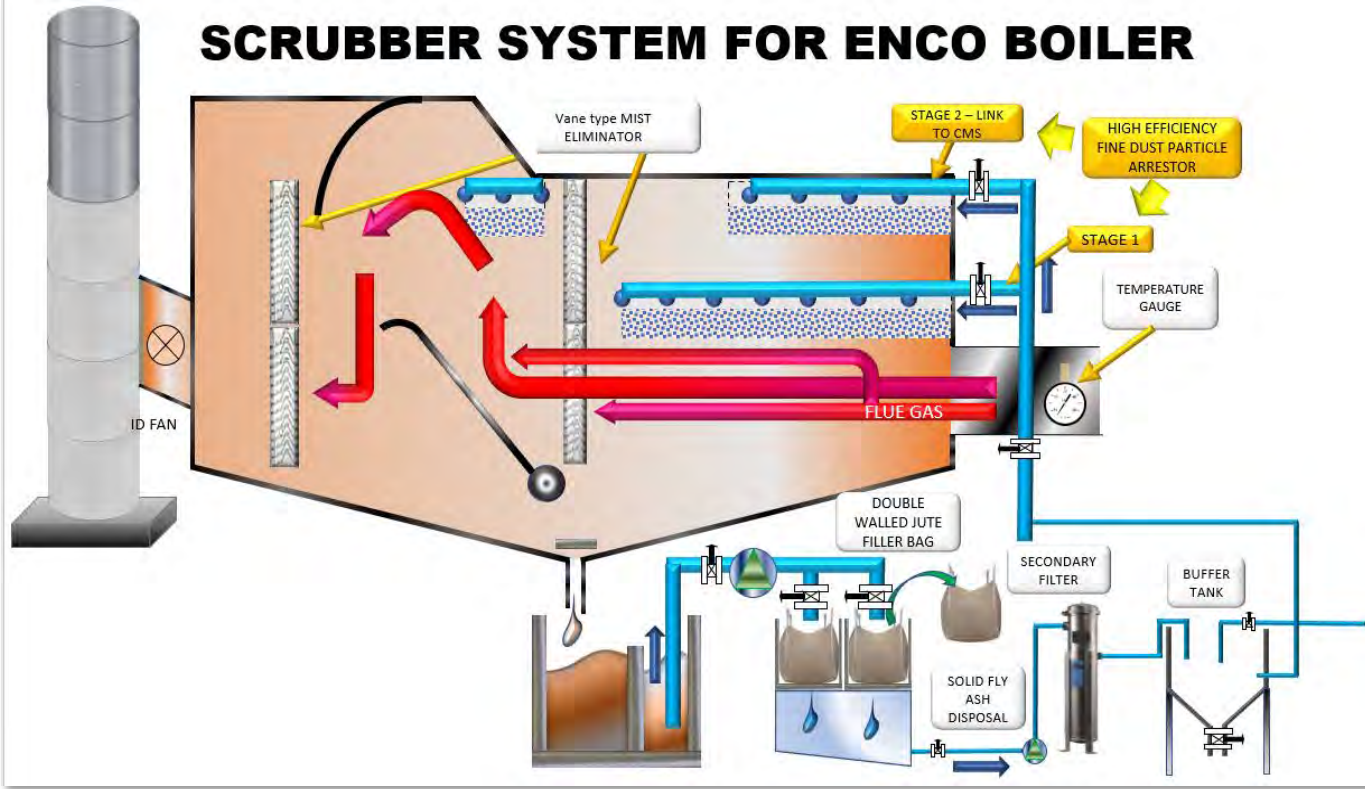


# Biomass boiler

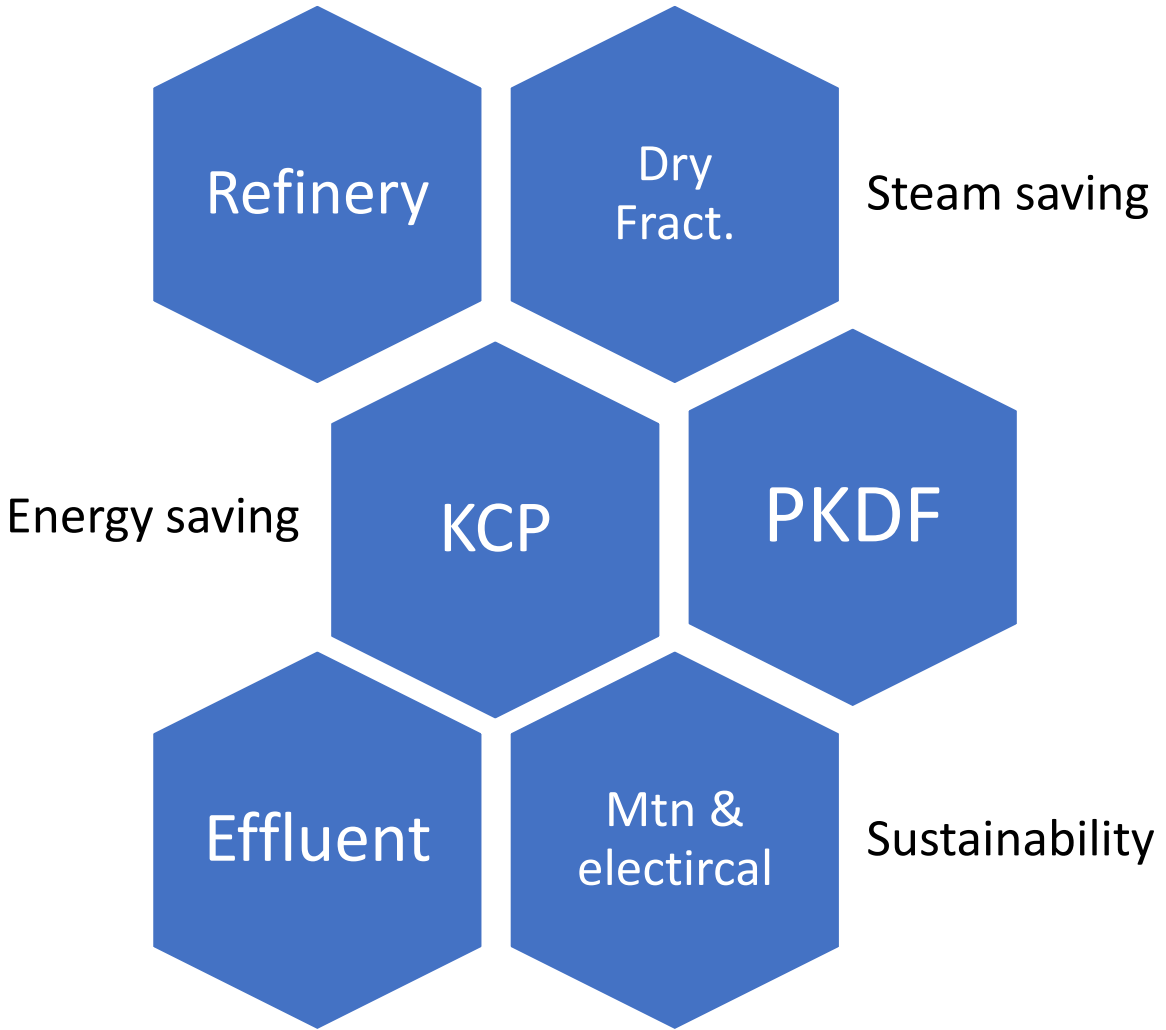


# High Pressure boiler





# Sustainable practices at whole complex



# Publications

1. Shyam Lakshmanan & Yen Li Yung (2021). *Chloride reduction by water washing of crude palm oil to assist in 3-monochloropropane-1, 2 diol ester (3-MCPDE) mitigation. Food Additives & Contaminants: Part A.* <https://doi.org/10.1080/19440049.2020.1842516>
2. Mun Cheng Tan, Dominic Chwan Yee Foo & Shyam Lakshmanan (2021). An integrated simulation–optimisation approach for free fatty acid removal in palm oil deodorisation process. *Asia-Pacific Journal of Chemical Engineering* <http://doi.org.10.1002/apj.2602>
3. Shyam Lakshmanan, Yen Li Yung, Kalaiselvan Palanisamy & How Kee Ling (2020). Lessons learnt from biomass-fueled power plant *Journal of Oil Palm, Environment & Health* 2020, 11:6-20. (DOI tbc)
4. Shyam Lakshmanan; Yen Li Yung; Boon San Chan & Zhe Haw Chong (2020). Sustainable Practices of an edible oils refining complex *JOPEH* 2020, 11:42-56. <http://doi:10.5366/jope.2020.05>
5. Shyam Lakshmanan & Yen Li Yung (2019). Reduction of chlorate and regeneration of activated carbon used for chlorate adsorption *Blue-Green Systems* 1(1) <https://doi.org/10.2166/bgs.2019.193>
6. Shyam Lakshmanan & Yen Li Yung (2019). [3-MCPDe and GE Mitigation Measures in Refined Palm Oil](#), PIPOC 2019. Poster.