



**Malaysian Palm Oil Board**  
**Ministry of Plantation and Commodities**



# REVOLUTIONIZING OF MALAYSIA PALM OIL MILLING INDUSTRY: CURRENT STATUS, CHALLENGES, OPPORTUNITIES AND WAY FORWARD

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**Palm Oil Milling Technology Exhibition & Conference (POMtec) |**  
**8 - 9 August 2023 | Imperial Hotel, Miri, Sarawak**



# PRESENTATION OUTLINE

01

**Introduction**

02

**Overview of Malaysian & Sarawak palm oil industry**

03

**Current status of the palm oil milling industry & technology**

04

**Issues & challenges**

05

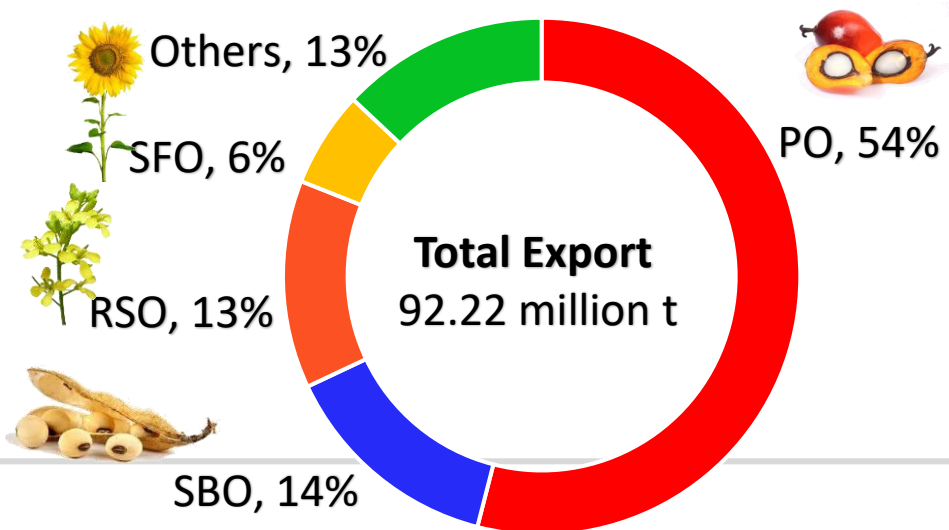
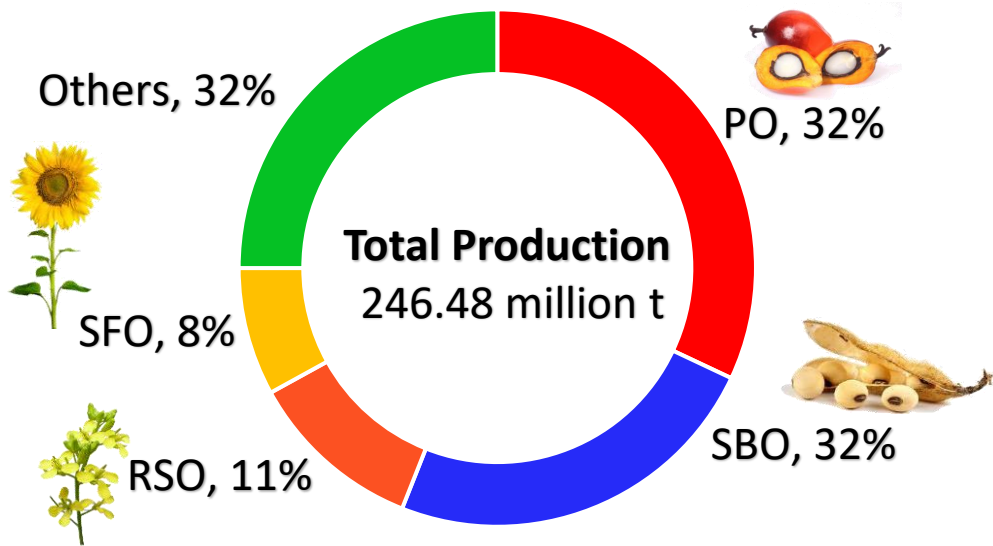
**Opportunities & way forward**

06

**Conclusion**



# MALAYSIA'S PALM OIL CONTRIBUTION TO THE GLOBAL OILS AND FATS 2022



**5<sup>th</sup>** largest producer of oils and fats

**8.4%** of total global oils and fats production

**2<sup>nd</sup>** largest exporter of oils and fats

**17.1%** of total global oils and fats export

**15.72 million tonnes** of total global oils and fats export

# MALAYSIA'S POSITION TO THE GLOBAL PALM OIL TRADE 2022



## Total Global Production

78.23 million tonnes



## Total Global Export

50.10 million tonnes

**2<sup>nd</sup>** largest producer and exporter of palm oil

**23%** of total global palm oil production

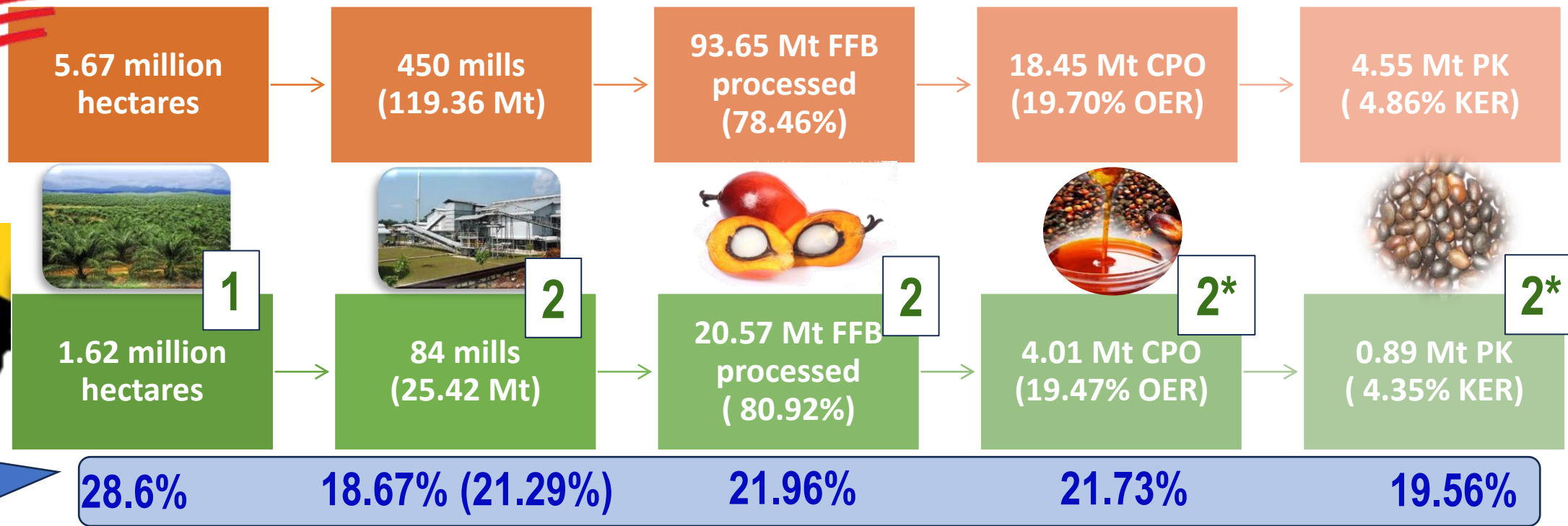
**18.45 million tonnes** CPO production

**31%** of total global palm oil trade

**15.72 million tonnes** palm oil trade

# STATUS of MALAYSIA & S'WAK PALM OIL INDUSTRY 2022

- The Malaysian palm oil industry experienced **better performance** in terms of price with marginally increased in yield and export, compared to 2021.

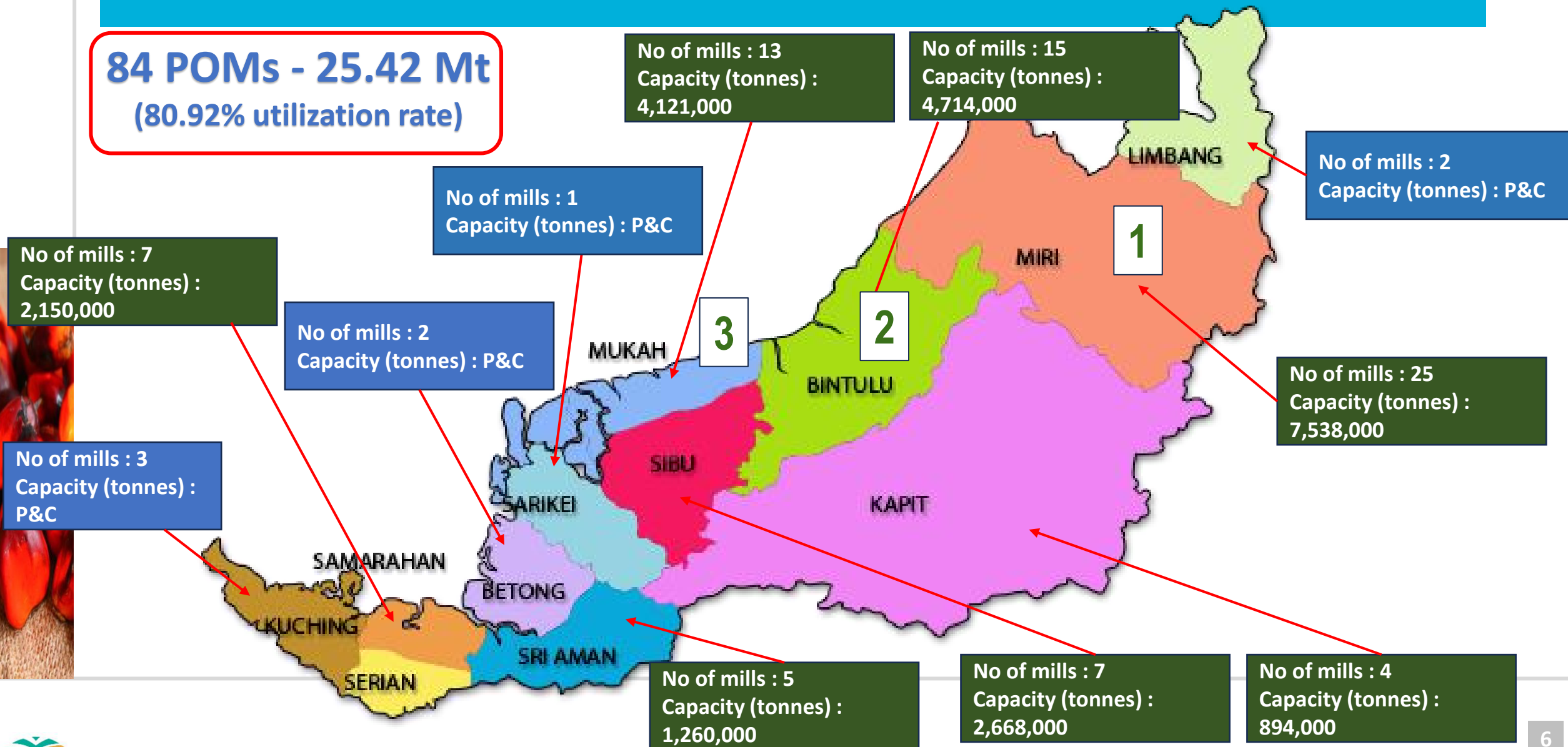


- Sarawak palm oil industry – the country's largest oil palm planted areas & 2<sup>nd</sup> largest producer
- Mill performance:** Bottom 3 and the lowest of OER % and KER%, respectively in the country

\*mass/volume basis  
Mt = million tonnes

# SARAWAK PALM OIL MILLS IN 2022 (BY DISTRICT)

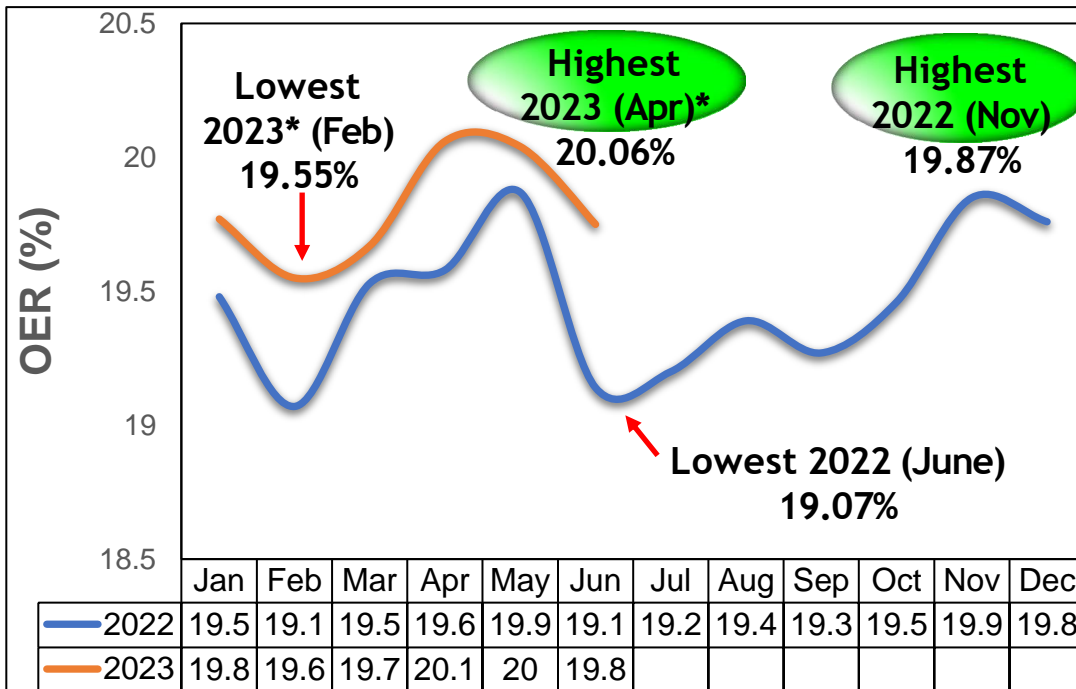
**84 POMs - 25.42 Mt**  
(80.92% utilization rate)



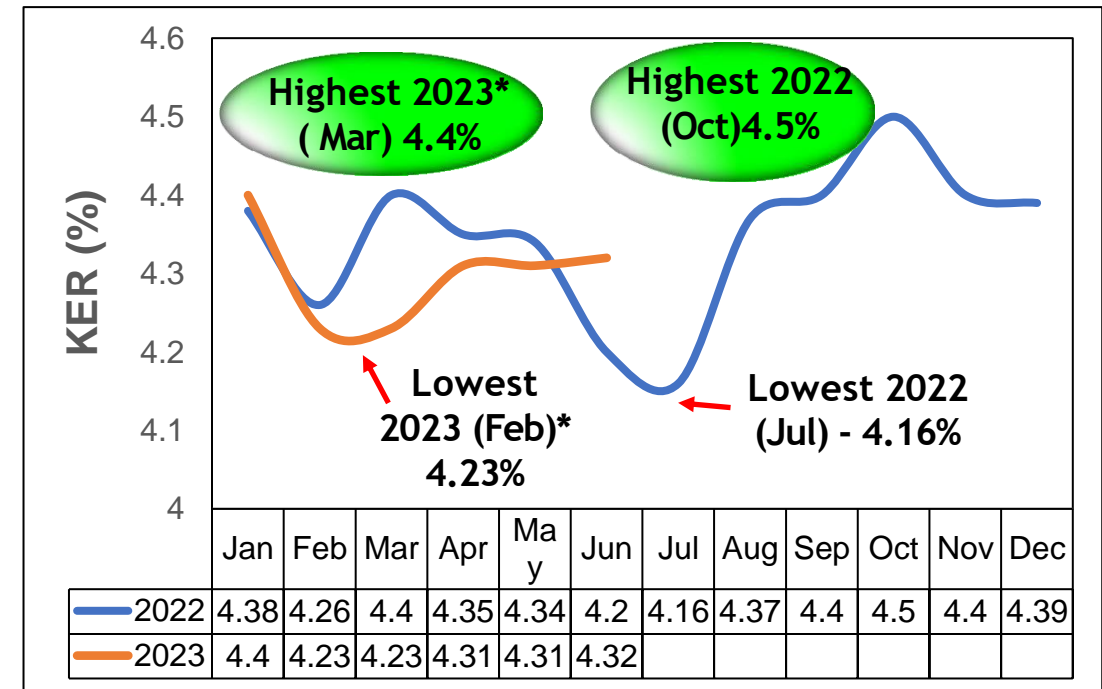
\*P&C = private & confidential



# PERFORMANCE OF PALM OIL PROCESSING IN SARAWAK



- Average OER in Swak's POMs (2022) – 19.47 %
- BOTTOM 3 among other states in Malaysia



- Average KER in Swak's POMs (2022) – 4.35 %
- The LOWEST in the country

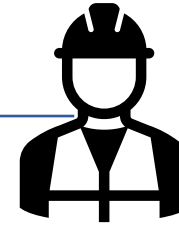
\*Until June 2023

# CURRENT STATUS OF PALM OIL MILLING PROCESS & TECHNOLOGY

- Based on Mongana Report (published in 1950's)
- No major transformation/ low process integration using the latest technological innovations

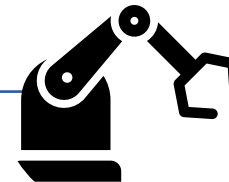


## CONVENTIONAL PROCESS & TECHNOLOGY



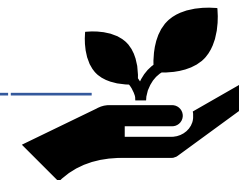
**Labour intensive**

- Low/unskilled foreign labour
- Semi-continuous/ semi automated process



**Less efficient**

- Mechanical process
- Oil losses
- low oil-losses recovery



**Less sustainable**

- High water/ resources usage
- Inefficient waste/ resource/ utility mgmt.



# WHERE ARE WE RIGHT NOW?



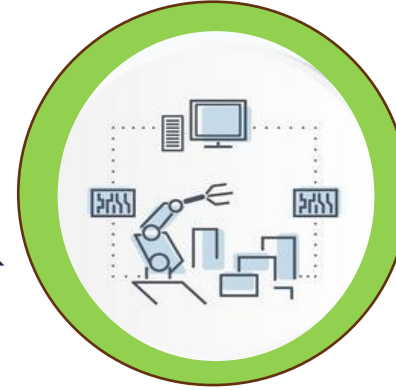
## INDUSTRY 1.0

Mechanical production equipment powered by steam



## INDUSTRY 2.0

Mass production assembly line via electrical energy & labor



## INDUSTRY 3.0

Automated production using electronics & IT



## INDUSTRY 4.0

Intelligent production incorporated with IoT, cloud technology & big data

The palm oil milling technology currently in 2<sup>nd</sup> and 3<sup>rd</sup> industry revolution  
( Semi-continuous & semi-automated process)



# CHALLENGES IN PALM OIL MILLING INDUSTRY



# CHALLENGES IN PALM OIL MILLING INDUSTRY

Palm oil milling industry is facing an uphill battle with challenges associated with process efficiency, safety, quality and sustainability



**SHORTAGE  
OF LABOUR**

**PROCESS  
EFFICIENCY**

**WASTE  
MANAGEMENT  
& REGULATORY  
COMPLIANCE**

**FOOD SAFETY  
& QUALITY**





# MAJOR ISSUES ON ENVIRONMENTAL REGULATIONS COMPLIANCE



- BOD 20/50 ppm – sensitive areas
- Proposed new monitoring parameters by the DOE – odour & color
- **Exemption of mandatory biogas implementation in Swak POMs requesting for throughput expansion to be expired by 2023**



- Clean Air Regulation 2014 (CAR 2014) - particulate emissions < 150 mg/Nm<sup>3</sup> & commitment to install air pollution control system (APCs)
- High CAPEX



- Particulate emissions from EFB incinerator to comply to CAR 2014
- Garis Panduan Pelan Pengurusan Tandan Kosong Sawit (2021) - leachate issue



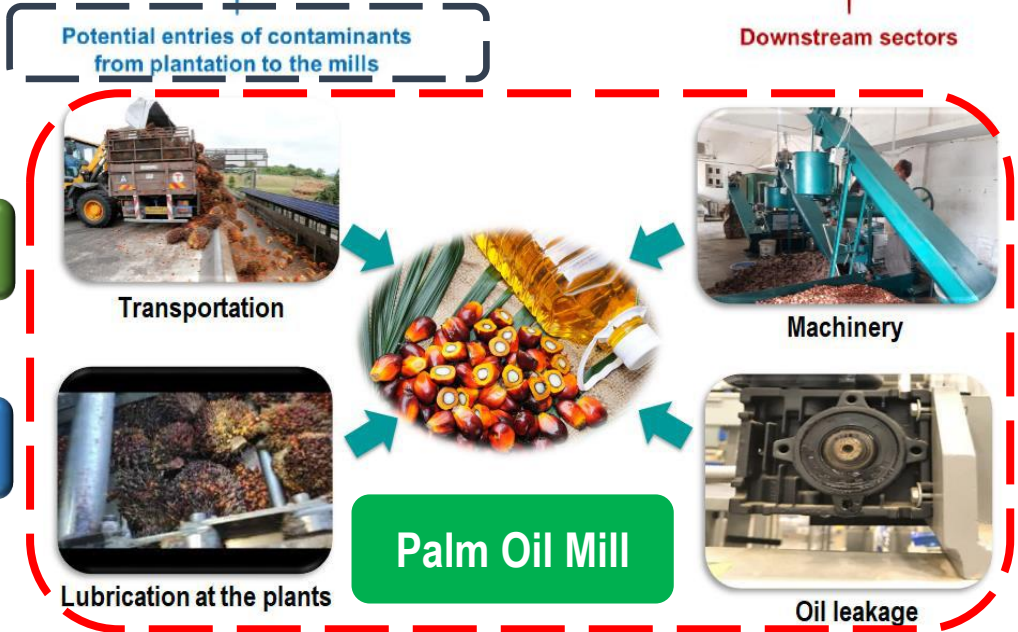
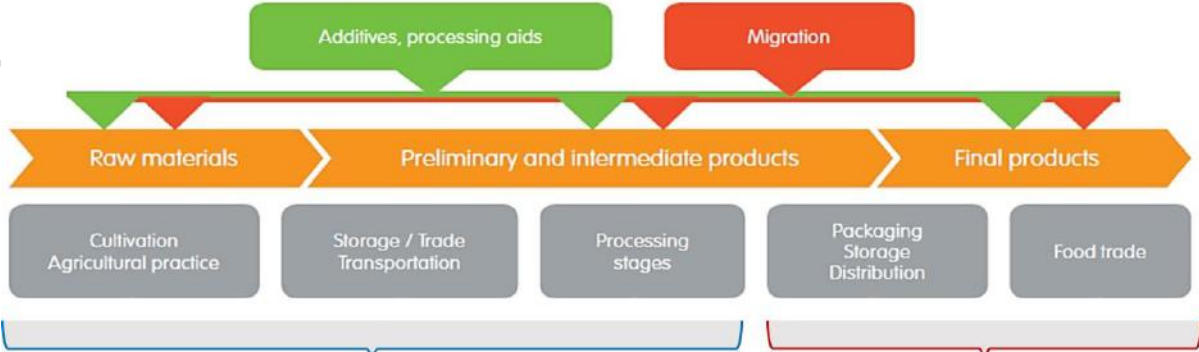
# FOOD QUALITY & SAFETY ISSUES

3-monochloropropane-1,2-diol esters (3-MCPD)  
(max limit 1.25 ppm)

Glycidyl esters (GE) (max level 1ppm)

Mineral oil saturated hydrocarbons (MOSH)

Mineral oil aromatic hydrocarbons (MOAH)



	Max level (applicable 01.07.2020)		
	<b>Palm oils and Coconut oils</b>	<b>Other vegetable oils and Animal Fats including Fish oils</b>	<b>Infant Grade ingredients **ALARA</b>
MOSH	< 20 mg/kg oil	13 mg/kg oil	< 10 mg/kg oil
MOAH	< 2 mg/kg oil	<LOQ mg/kg oil*	< 2 mg/kg oil





# HOW TO ADDRESS ALL THESE ISSUES & CHALLENGES?



- **Turning these into opportunities to revolutize palm oil milling industry**
- **Requires a comprehensive tool that would uplift the productivity, efficiency, cost-effectiveness and safety of the palm oil milling industry as a whole**
- **IR 4.0 is seen as a vital tool in driving the industry to embrace a more sustainable future.**

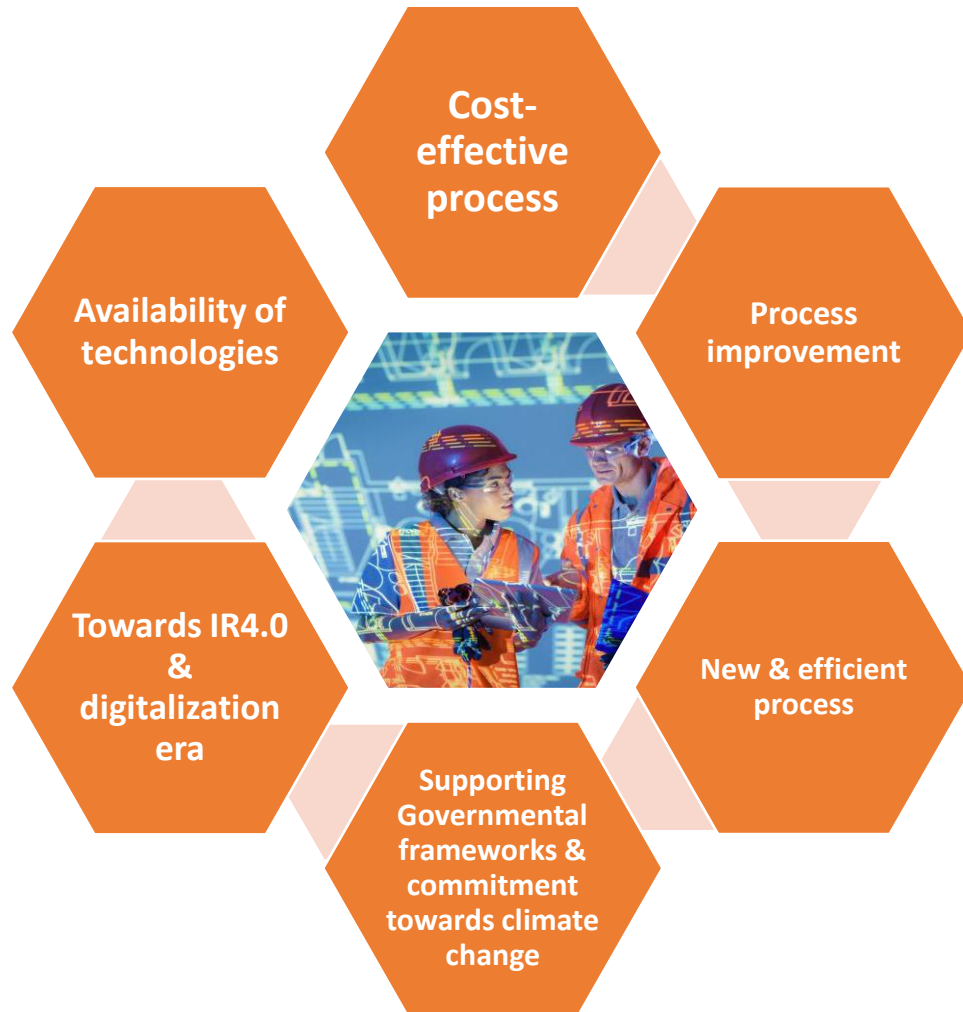




# OPPORTUNITY & WAY FORWARD TO REVOLUTIONIZE PALM OIL MILLING INDUSTRY



# WHY EMBARK ON REVOLUTIONIZING PALM OIL MILLING INDUSTRY?



How this can be done :



**NEW PALM OIL MILL CONCEPT** is needed by integrating all the new-efficient technologies & processes with regulatory and quality compliance supported by AI, IOT & automation



# CURRENT TECHNOLOGY ADVANCEMENT IN PALM OIL MILLS TOWARDS IR4.0



## FFB RECEPTION

Currently at **IR2.0** with the use of hydraulic ramp gate and conveyor



## STERILISATION STATION

Currently at **IR3.0** with the use of PLC and SCADA system to automate sterilization process

## STERILISER TECHNOLOGY ADVANCEMENT

Ready for  
IR 4.0

## PRESS STATION & OIL ROOM

Currently at **IR3.0** with automatic dilution control and could be improved to **IR4.0** to improve oil recovery efficiency



Conventional sterilizer



Continuous Sterilizer



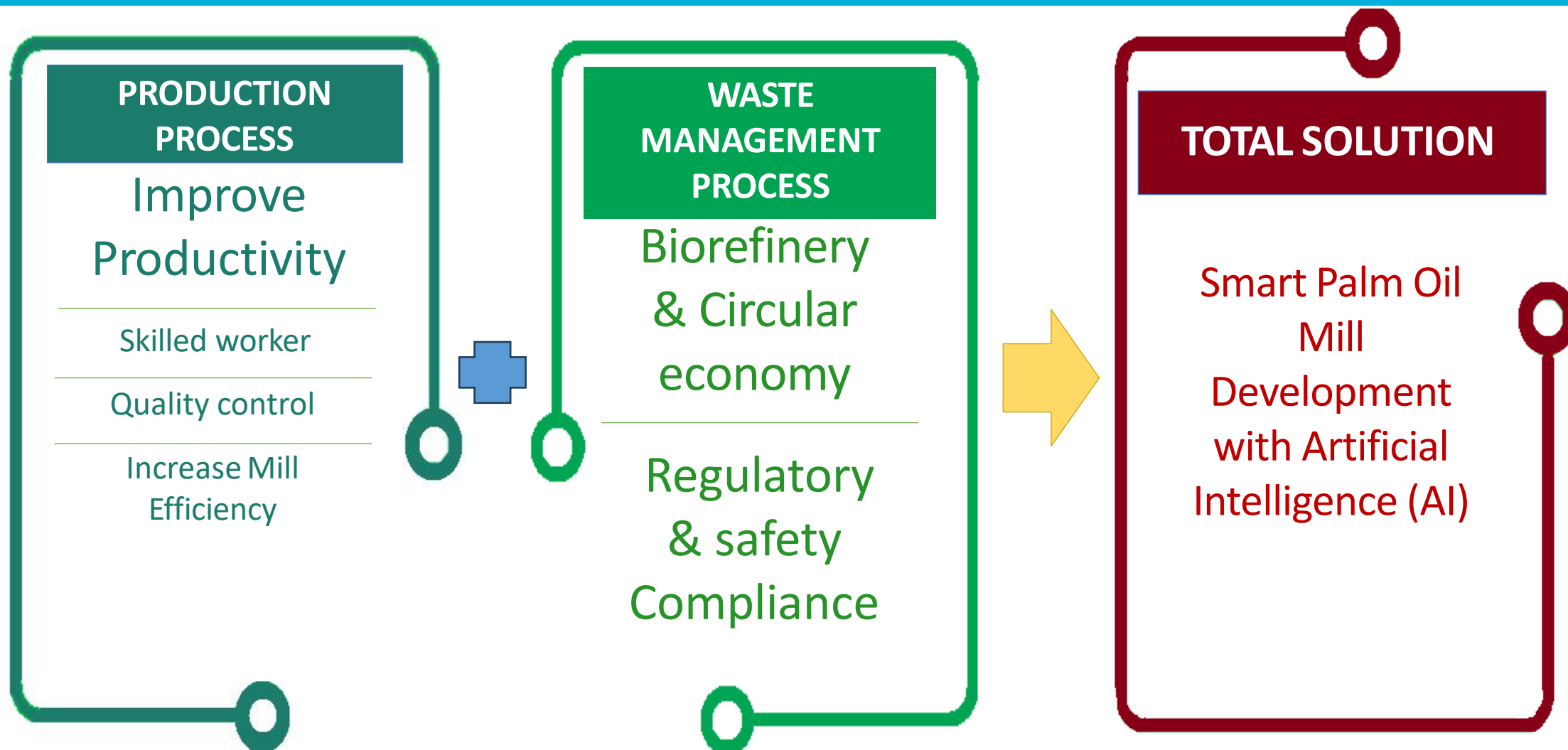
Vertical sterilizer



Tilting sterilizer



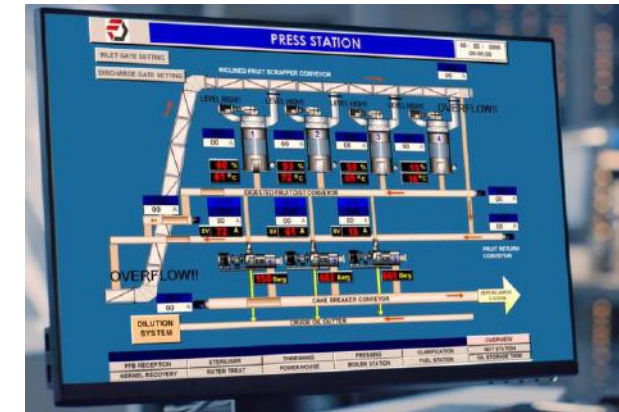
# SUSTAINABLE PALM OIL PROCESSING VIA SMART PALM OIL MILL



# SMART PALM OIL MILL DEVELOPMENT WITH ARTIFICIAL INTELLIGENCE (AI)

The aim of the smart mill is to addressing current challenges such as:

Current issues	Target to achieve
Quality of crude palm oil	<ul style="list-style-type: none"> <li>Chloride &lt; 2 ppm</li> <li>FFA &lt; 5 %</li> <li>DOBI &gt; 2.3</li> </ul>
Smoke and effluent pollution to the environment	<ul style="list-style-type: none"> <li>Particulate matter &lt; 150 mg/Nm<sup>3</sup></li> <li>Effluent BOD &lt; 20 ppm</li> </ul>
High labour requirement in the palm oil mill	<10 technical work force in 30 t/h mill
Ruggedness and inconsistency in FFB grading	Automated grading system
High oil losses to effluent pond	0.3 % oil losses per FFB processed
High power and water resources requirement	Reduce power consumption by simplifying milling process and water dilution requirement





# DEVELOPMENT OF SMART PALM OIL MILL

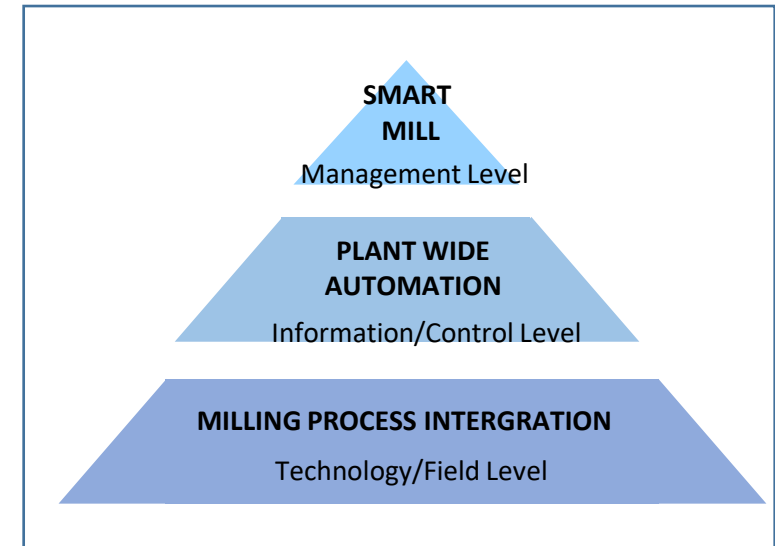
- MPOB in collaboration with FXA Solutions Sdn. Bhd. to jointly design and construct a 30 t/hr smart palm oil mill with artificial intelligence (AI) system and zero effluent discharge technology.
- The smart mill will be located at MPOB Plasma Keratong, Pahang.
- Expected to be commissioned in 2025



## SMART mill concept

Identify process approaches to be integrated with IR4.0 :

- Big data collections and analysis
- Internet of Things (IoT) for communication
- Artificial Intelligence (AI) for trained decision making (Programmable logic control (PLC) , fuzzy logic, neuron network)
- Comply with all regulatory and quality requirements
- Reduced un-skill labour dependency



HIERARCHY OF INDUSTRIAL REVOLUTION 4.0 ( IR 4.0 )

# SMART PALM OIL MILL- KEY FEATURES

- **Fully automated**
- **Real time monitoring**
- **Reduces manpower & increased skilled local worker**
- **Process monitoring**
- **Quality analysis & control**
- **Data driven - report & record**
- **Efficient & sustainable**





# MAJOR PROSPECTS OF IR4.0 IN PALM OIL MILL

## PROCESS & QUALITY CONTROL

## RESOURCE & WASTE MANAGEMENT, MAINTENANCE & REGULATORY COMPLIANCE

Automatic determination of FFB ripeness

Premium oil segregation using NIR online system

Air pollution control & Continuous emission monitoring system

Predictive maintenance

Online monitoring of oil losses at press station

OER-based algorithm & mass balance automation

Steam & energy management

POME treatment & zero discharge system



# POTENTIAL OF IR 4.0 APPLICATIONS IN PALM OIL MILLS

## Automatic Determination of FFB Ripeness



## OER Based Algorithm & Mass Balance Automation

- Automated process control for oil room
- Determines mass rate
- Analyses crude oil composition
- Online measurement of process parameters

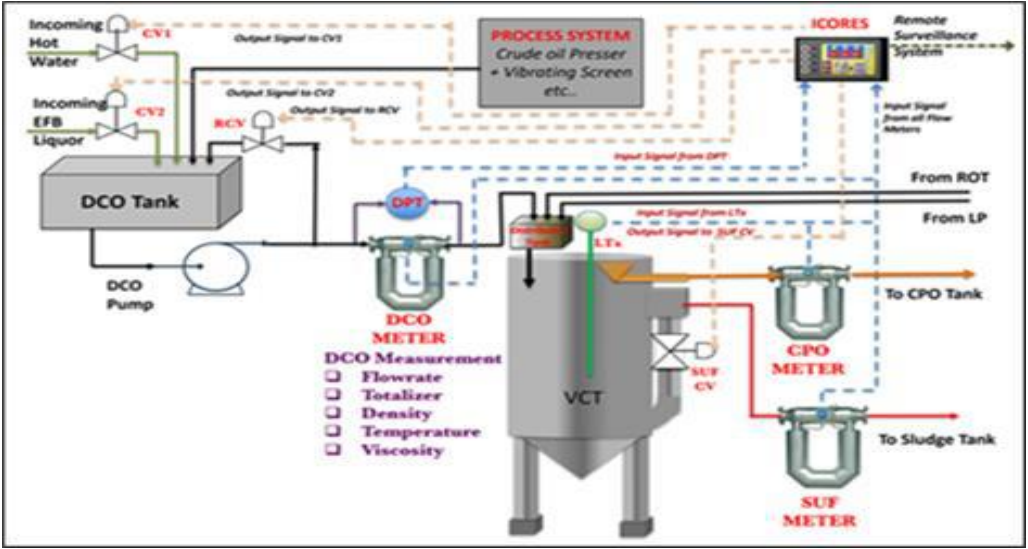


## Near Infrared (NIR) system in POM

- Premium oil segregation
- Automated crude oil dilution
- Rapid oil losses monitoring



Source: Fatabyah et al. 2017, Gerhardt Malaysia, BUCHI Labortechnik



Source: Hady Munsif et al., (2021)



# METHANE AVOIDANCE TECHNOLOGIES TOWARDS SUSTAINABLE PALM OIL PRODUCTION

Biogas from POME contributes about 50% of total GHG emissions to CPO production

## MITIGATION STRATEGIES :

- 1.0 POME utilisation
- 2.0 POME pretreatment
- 3.0 POME elimination via evaporation process

Effective 1<sup>st</sup> Jan 2014 - Mandatory implementation of biogas plant / methane avoidance technologies applies to all new mills and existing mills requesting for throughput expansion (>270,000 t FFB /year)



\*\*\*Source: POMEVap – [www.alfalaval.com](http://www.alfalaval.com)



# BIOREFINERY CONCEPT FOR CIRCULAR ECONOMY IN PALM OIL MILLS

- Promotes POMs to adopt and integrate biorefinery concept in POMs as downstream business
- Optimizing resource recovery from milling by-products (biomass & POME) for circular economy
- Improves sustainability and economic performance of palm oil milling industry
- Focuses on low hanging fruit approaches





# WAY FORWARD ON FOOD SAFETY AND QUALITY

12

MILLS



6

REFINERIES



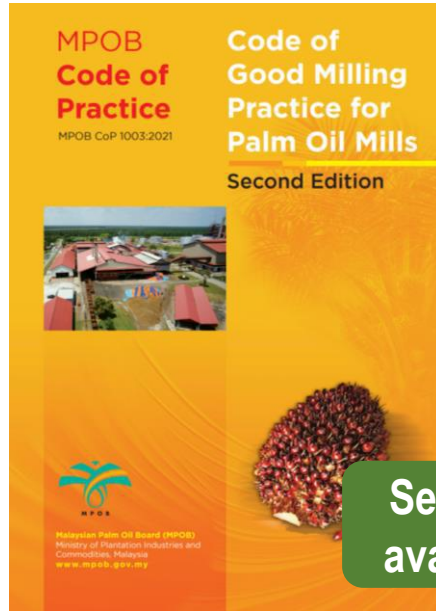
Malaysian Government has allocated substantial amount of research grant for strategizing the mitigation of 3-MCPDE and GE at the mills and refineries

- ✓ Chloride removal in CPO at the mills and refineries
- ✓ Process to reduce the level of 3-MCPDE and GE at the refineries

**Reviving Malaysian Standards (MS) related to palm oil safety and quality**

“...Inclusion of **3-MCPDE and GE** in Malaysian Standards (MS) for palm oil and palm kernel oil products and **total chloride content** in MS for crude palm oil...”

# REVISION OF MPOB CODE OF GOOD MILLING PRACTICE FOR PALM OIL MILLS



CODE OF PRACTICE FOR THE REDUCTION OF 3-MONOCHLOROPROPANE-1,2- DIOL ESTERS (3-MCPDEs) AND GLYCIDYL ESTERS (GEs) IN REFINED OILS AND FOOD PRODUCTS MADE WITH REFINED OILS

CXC 79-2019

Adopted in 2019.



Ministry of Health Malaysia



Second edition is now available from Q2 2022

Strengthening of **MPOB Code of Good Milling Practice for Palm Oil Mills** coincides with *Code of Practice for the Reduction 3-MCPDE and GE in Refined Oils and Products Made from Refined Oils Especially for Infant Formula and Makanan Selamat Tanggungjawab Industri (MeSTI)* scheme...

MESYUARAT KELIMA BELAS

MAJLIS KESELAMATAN MAKANAN DAN PEMAKANAN KEBANGSAAN (MKMPK)

27 APRIL 2021





# CONCLUSION

**1** Revolutionising palm oil milling industry is timely for improved, efficient and sustainable milling process.

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**2** Modernizing and rebranding the industry towards IR4.0 and digitalization era

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**3** Requires commitment from all industry players and stakeholders





*See You at*



# PIPOC 2023

## MPOB International Palm Oil Congress and Exhibition

**Navigating Uncertainties Building Resilience**

**7-9 NOVEMBER 2023**  
**Kuala Lumpur Convention Centre**





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