PAGE PARTNERSHIP FOR ACTION ON GREEN ECONOMY

Policy Brief

Green and Inclusive Recovery through Circular Economy in Palm Oil Industry

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EXECUTIVE SUMMARY

Indonesia is endowed with abundant natural resources due to its tropical climate and archipelagic geography. However, the supply of crucial raw materials is limited. Finite supplies also mean that some countries depend on others for their raw materials. In addition, extracting and using raw materials have a significant impact on the environment, leading to increased energy consumption and CO_2 emissions. In fact, one of the biggest challenges for Indonesia is to preserve its natural resources while maintaining stable economic growth.

Despite experiencing stable macroeconomic growth in the last decade, propelling it to become one of the largest economies in Southeast Asia, the country still faces major challenges in addressing certain issues. Continuing along Indonesia's current development path, marked by unsustainable exploitation of natural resources and investment in high carbon, inefficient energy, and transport systems, will restrict the Indonesia's growth, job creation, and its potential to eradicate poverty.

In October 2017, the Government of Indonesia declared its goal of integrating climate action into the country's development agenda. The **Low Carbon Development Initiative** (LCDI) was launched at Indonesia's Ministry of National Development Planning (BAPPENAS). It aims to explicitly incorporate greenhouse gas (GHG) emissions reduction targets into the policy planning exercise, along with other interventions for preserving and restoring natural resources.

With the COVID-19 pandemic revealing the vulnerability of global systems to protect the environment, health, and economy, the response to the devastating impacts of the pandemic becomes a major concern for governments, businesses, and civil society. The development of policies that maintain economic growth, alleviate poverty, and help meet sector-level development targets is highly relevant as new sources of growth and economic renewal are considered. As COVID-19 has also influenced the development policies of Indonesia, there is a need to develop and integrate low-carbon strategies into the COVID-19 recovery plans.

The ministry is currently spearheading post COVID-19 green economic recovery efforts with its approach: **Building Back Better with the Low Carbon Development Initiative** or **B3-Low Carbon**. The Government of Indonesia plans to incorporate the circular economy approach into its LCDI and green recovery strategy moving forward. There are already plans to integrate a circular economy indicators matrix into the next medium-term development planning (RPJMN) 2025-2029. The circular economy is also referenced in Indonesia's Vision for 2045 and the National Mid-term Development Plan (RPJMN) 2020-2024.

This work of consultancy is proposed to provide stakeholders with a set of policy recommendation regarding green and inclusive economic recovery through the circular economy in the food and beverages industry sectors. This aligns with the First Thematic Area proposed by PAGE Indonesia: Impact Assessment, support for greening economic stimulus packages, and mobilizing private finance for green recovery.

The proposed activities are kept intact:

1. Designing the final Work Plan for the consolidated policy paper, which includes analysis and strategic action plans for green recovery through the circular economy in the food and beverages industrial sectors, with a primary focus on the palm oil processing industry
2. Developing the final version of the consolidated policy paper (in both Bahasa Indonesia and English) that has been consulted with and agreed upon by UNDP Indonesia (UN-PAGE coordinator) and the Government of Indonesia (Bappenas).
3. Developing the final version of the policy brief (in both Bahasa Indonesia and English) that has been consulted with and agreed upon by UNDP Indonesia (UN-PAGE coordinator) and the Government of Indonesia (Bappenas).

Proposed Tools/Analyses (Ellen McArthur)

This methodology aims to explore and prioritise circular economy opportunities; quantify their impact; identify barriers preventing these opportunities; map and prioritise policy intervention to overcome these barriers; and engage relevant stakeholders. It is crucial to map and engage relevant stakeholders early in the process, aligning on the starting point, ambition, and focus. Once the focus sectors are selected, the sector-specific assessment can commence. This step can be conducted in parallel sector working groups, and heavily relying on the involvement of businesses to assess sector-specific circular economy opportunities. After the assessment of sector-specific circular economy opportunities, these can be aggregated, and the economy-wide implications analysed. This step is typically led by a core group of policy makers, policy, and economics experts, with the participation of multiple government agencies to analyse economy-wide implications.

Align on the starting point, ambition, and focus

Relevant stakeholders need to be mapped and engaged early in the process. Based on an understanding of the national circularity and policy context (baseline circularity level and policy landscape), a realistic ambition level needs to be defined (set ambition level) and the sector scope needs to be determined (select focus sectors).

Table 1 Detail Align on Starting Point, Ambition, and Focus

Align on the starting point, ambition, and focus	Objective	End product
Baseline circularity level and policy landscape	Understand the country's starting point before deciding where to go.	Assess the country's level of circularity compared to other countries. Gain a broad understanding of the landscape of existing circular economy-related policies.
Set ambition level	Align stakeholders on the overall direction and focus for subsequent sector deep dives to work towards a common goal.	Clear, quantified ambition level.
Select focus sectors	Focus the assessment of sector opportunities on the most relevant parts of the economy.	A set of focus sectors is determined based on a prioritisation matrix that maps sectors according to their 'role in the national economy' and 'circularity potential'.

Assess sector opportunities

Once the focus sectors have been selected, the sector-specific assessment can begin. It involves mapping the most relevant circular economy opportunities in each focus sector and prioritising and detailing them. For the prioritised opportunities, a sector-specific economic impact needs to be assessed (quantify sector impact), barriers limiting their realisation identified (identify barriers), and policy options to overcome these barriers mapped (map sector-specific policy options).

Table 2 Detail Assess Sector Opportunities

Assess sector opportunities	Objective	End product
Map circular economy opportunities in each focus sector	Create an exhaustive overview of possible circular economy opportunities.	A structured mapping of potential circular economy opportunities for each focus sector, identified along the ReSOLVE framework.
Prioritise and detail circular economy opportunities	Prioritise and provide detailed information on opportunities in each focus sector based on their potential impact.	A set of one to three prioritised and detailed opportunities per sector.
Quantify sector impact	Understand the economic and resource impact of circular economy opportunities, either as input to an economy-wide assessment or as a standalone result.	Quantify the impact for each opportunity and circular economy scenario (where applicable).
Identify Barriers	Understand the barriers hindering the identified circular economy	Importance and description of barriers for each opportunity, structured by 15

Assess sector opportunities	Objective	End product
	opportunities, to render policy options more targeted.	types of barriers across four categories (economic, market failures, regulatory failures, social factors).
Map sector-specific policy options	Present all relevant available policy options to address the barriers.	A list of policy options for each barrier related to each opportunity.

Analyse economy-wide implications

Once the sector-specific circular economy opportunities have been assessed, they can be consolidated, and the national implications can be analysed. The sector-specific impact assessments could be combined into one an overarching whole-economy impact assessment to support the mandate for policy intervention (quantify economy-wide impact). Sector-specific policy options could be complemented by economy-wide policy options (map economy-wide policy options). The set of sector-specific and economy-wide policy options needs to be prioritised and assembled into coherent policy packages (prioritise, package, and sequence policy options).

Table 3 Detail Analyse Economy-Wide Implications

Analyse economy-wide implications	Objective	End product
Quantify economy-wide impact	Support the case for economy-wide and broad sectoral policy interventions.	Estimate the expected impact of circular economy opportunities on national macroeconomic indicators such as GDP, employment, net exports, and carbon emissions.
Map economy-wide policy options	Complement sector-specific policy options identified in the mapping of sector-specific policy options with economy-wide policy options to enable a broad transition to the circular economy.	List of economy-wide policy options.
Prioritise, package, and sequence policy options	Complement sector-specific policy options identified in the mapping of sector-specific policy options with economy-wide policy options to enable a broad transition to the circular economy.	List of economy-wide policy options.

This review emphasizes the importance of promoting circularity, creating green jobs, reducing waste, and enhancing sustainable agricultural practices, specifically within the palm oil industry, to build a more sustainable and resilient sector. It offers strategic policy recommendations for improving sustainability in palm oil supply chains through the implementation of circular economy principles and inclusive practices, which are detailed in Table 4.

Table 4 Strategic policy recommendations for improving sustainability in palm oil industry.

Policy Recommendation	Target Emission Reduction & Resource Efficiency	Key Stakeholders	Targeted Stakeholders
Enforce comprehensive agricultural practices within palm oil plantations, including the adoption of precision agriculture for fertilization, the substitution of chemical pesticides with predators, the utilization of biological agents for natural nutrient supply, incorporating Oil Palm Front (OPF) for nutrient recycling and soil conservation, and promoting Palm Oil Cattle Integration (POCI) to enhance sustainable and integrated land management practices.	Precise fertilizer application tools to reduce the use of organic and inorganic fertilizer by 55-60%.	Palm Oil Plantation Fund Management Agency	PTPN, Private Companies, Smallholders and Cooperatives
	Natural predators reduce expenditure cost by 80% in palm oil plantation compared to rodenticide utilization or chemical monitoring	Ministry of Environment and Forestry	Palm Oil Grower Association
	Fix atmospheric nitrogen & provide a nitrogen source for the soil to be used by future crops (150 kg N/ha)	Ministry of Environment and Forestry	Palm Oil Grower Association
	Reduce chemical fertilizer expenditure by 56.68%	Ministry of Environment and Forestry	PTPN and Private Palm Oil Company
	z2. Implement a Waste Water Treatment Plant (WWTP) initiative designed to recycle and reuse wastewater, thereby increasing circularity within the palm oil production process.	Ministry of Environment and Forestry	PTPN and Private Palm Oil Company
Introduce a holistic framework at the establishment of Miniature Sustainable Plantations, pilot mills, and refineries, strategically designed for tourism and investor funding support.	f. Transform OPF (Oil Palm Frond; trunks, frond, and leaves) into handicrafts and fertilizer	Ministry of Tourism and Creative Economy supported by KLHK; BPDPKS	Smallholders association; CSR private company
	z4. Establish Miniature Sustainable Plantations, pilot mills, and refineries, strategically designed for tourism and investor funding support.		

Policy Recommendation	Target Emission Reduction & Resource Efficiency	Key Stakeholders	Targeted Stakeholders
Disseminate an integrated and sustainable agricultural strategy within the palm oil sector, incorporating utilization of POME to value added products	Decrease chemical fertilizer utilization by 58.7%-64.91% (smallholder) & 34.4%-86.68% (corporate)	Utilize biomass produced in the palm oil sector, such as shells and fiber for palm oil plantation trucks & boiler	Mill industrial players & Palm Oil Grower Association
	Reduce fertilizer expenditure cost by 63.3% (smallholder) & 85.57% (corporate)		
	Enhance fresh fruit bunch (FFB) productivity by 14.29%, Obtain higher profit by 41.64%		
	Reduce GHG emission by 65% (smallholder) and 96.4% (corporate) if chemical fertilizer is entirely replaced by POME		
	Replace approximately 90% of the solar function in operating the boiler, reduce carbon emissions in boiler operations by 2.31%		
Institute a comprehensive approach in mill decentralization strategies and adoption of SPOT (Steamless Palm Oil Technology)	Reduce emission & transportation cost because most of existing mill facility is centralized and is located 40-50 km away from plantation.	Ministry of Industry supported by BPDPKS; PT. NGE & Regional Government	Smallholders' association
	Reduce production cost by 18%		
	Reduce Greenhouse gas emission by 80%		
Institute a comprehensive approach in utilization of Cooking Oil for Biodiesel Production strategy	With assumption, the use of 25% used cooking oil can replace 35% of national biodiesel demand.	Ministry of Environment and Forestry supported by BPDPKS; BRIN; Education institutions	Regional Government & Related Industrial players
	Use of 6 million tons of greenhouse gas emissions.		
	Save IDR 3.6 Trillion on biodiesel subsidy costs.		
	Save 1.16 Million tons of CPO/year.		
	Save 321 thousand hectares of forest from oil palm expansion/year.		

To effectively support the emerging green job opportunities and meet the demands of circular and sustainable practices in Table 4, individuals should develop a diverse set of skills. Inclusivity plays a key role, ensuring training and opportunities are accessible to all, fostering a diverse workforce that enhances creativity and problem-solving. Successful implementation hinges on strategic support from various stakeholders, with general recommendations of:

1. Improve data collection and transparency to inform the policy and decision-making process.
2. Accelerate program and policy to reduce the existing decent work challenges, especially in the value chain where vulnerable employment is predominant.
3. Promote social dialogue to forge consensus and maintain industrial relationships.
4. Maximize the green jobs potential by supporting and scaling up circular strategies.
5. Create an enabling environment for collaboration and industrial symbiosis.
6. Facilitate and promote reskilling and up-skilling, targeting vulnerable workers, and incorporating the basic skills for green jobs and circularity in formal education.
7. Design policy that supports an inclusive CE.
8. Link CE with sustainable palm oil initiatives.

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POLICY RECOMMENDATION

After conducting a thorough calculation and detailed analysis in the preceding reports, we have finally synthesized a set of recommended actions for the palm oil industry value chain. These suggestions are derived from a meticulous examination of the sequential processes involved in the production and distribution of palm oil industry. By leveraging our insights, we propose strategic steps that can be undertaken to enhance efficiency, sustainability, and overall effectiveness within the palm oil industry. These recommendations aim to contribute to the responsible management of the value chain, addressing key challenges and fostering positive outcomes for both industry and the broader ecosystem. Summarized technical recommendation based on stage/process in each value chain can be seen on Table I-1. Each technical recommendation corresponds to Waste and CO_2 Reduction as well as resource efficiency initiatives in subsequent sector.

Table I-1 Technical recommendation on each palm oil industry value chain stage & process

Value Chain	Stage/Process	Recommendation	WCR/RE Code
Plantation	Certification	z3. Strengthen ISPO and its implementation; support and encourage smallholders to implement sustainable palm oil FFB production and obtain ISPO certification; socialize the benefits of ISPO certified products which are more financially attractive.	REZ2, WCRZ1
	Land Preparation	a. Plant trees on the most suitable land that can support palm oil's growth naturally	RE1
	Pre-Nursery	b. Provide access & subsidize high-quality (superior) palm oil seed to increase yields and productivity	RE2
	Nursery		
	Seedlings Selection		
	Actual Planting	c. Encourage agroforestry & silvopasture that can naturally supply essential elements to reduce palm oil trees' needs for fertilizer Example: Agroforestry = integrate legume cover crops with palm oil trees Silvopasture = integrate cattle with palm oil trees (POCI)	RE5 & RE6
	Monitoring & Treatment	d. Enable precise fertilizer application and prevent excessive fertilization through advanced fertilizer technology such as FOSS NIR DA2500	RE3

Value Chain	Stage/Process	Recommendation	WCR/RE Code
		e. Substitute chemical pesticides with natural predators	RE4
		z1. Develop an Integrated Water Management System (IWMS) that incorporates wastewater treatment facilities, optimizing water use and enhancing sustainability across palm oil production.	REZ1
	Harvesting	f. Transform OPF (Oil Palm Front; trunks, front, and leaves) into handicrafts and fertilizer	WCR7 & WCR8
Milling	Mill development	g. Decentralize milling location to reduce transportation costs	RE7
	FFB Sterilization	h. Utilize highly-precise technology in controlling fresh fruit bunches (FFB)'s quality that goes into the milling process	RE8
	FFB Stripping	i. Substitute chemical substances from fresh fruit bunches (FFB) stripping process with clay bath technology	RE9
	Oil extraction	j. Implement semi-digital or digitalization to accurately identify issues within production processes	RE10
		k. Utilize advance technology (Such as FOSS NIR DA1650 analyzer) to detect oil loss at every production stage	RE11
	Waste treatment	**POME** l. Develop effluent treatment plants to reduce potential environmental harm and make POME a more effective fertilizer for soil health treatment	WCR1
		m. Develop methane capture technology to produce biogas from palm oil mill effluents (POME) for electricity production	WCR2
		n. Develop Bio-Compressed Natural Gas (Bio-CNG) plant to produce biomethane for palm oil plantation trucks' fuel	WCR3
		EFB o. Utilize empty fruit bunches (EFB)-based fertilizer for soil health treatment	WCR4
		Fiber & Shell (Biomass) p. Utilize biomass produced in the palm oil sector, such as shells and fiber for palm oil plantation trucks & boiler	WCR5 & WCR6
Milling & Refinery		**Water** z2. Implement a Waste Water Treatment Plant (WWTP) initiative designed to recycle and reuse wastewater, thereby increasing circularity within the palm oil production process.	WCRZ3

Value Chain	Stage/Process	Recommendation	WCR/RE Code
	Overall Process	q. Develop SPOT technology to streamline milling & refinery processes and reduce "liquid"-based waste	RE12
Refinery	CPO degumming	r. Optimize chemical & bleaching usage efficiency	RE14 & RE15
	Neutralization		
	CPO bleaching		
	DBCPO filtration	s. Optimize SBE conversion into R-Oil and de-oiled SBE (De-OBE) for industrial use (Biodiesel, biofuel, biolubricants, cement, & animal feed)	RE16, WCR10, & WCR11
		t. Utilize SBE to produce organic fertilizer	WCR9
	Oil deacidification & deodorization	u. Reuse hot steam for production to reduce cost	RE13
Plantation, Milling & Refinery	Best practice	z4. Establish Miniature Sustainable Plantations, pilot mills, and refineries, strategically designed for tourism and investor funding support.	REZ3, WCRZ2
Packaging & Distribution	Sustainable Packaging Development	v. Conduct research to reduce raw material and distribution volume of plastic packaging	RE17
		w. Develop biodegradable PET-based packaging	WCR12
Post-consumption	Plastic post-consumption	x. Recycle & ensure packaging recyclability	WCR13
	Cooking oil post consumption	y. Utilize used cooking oil for national biodiesel production to support B30	WCR14
	Side product utilization	z5. Facilitate the development of value-added products derived from palm oil, such as oleochemicals, biofuels, cosmetics, and pharmaceuticals. Attract domestic and foreign investors to the downstream palm oil sector.	WCRZ4

Every recommendation outlined in our analysis is also plotted by a well-defined set of policy guidelines, specifying the necessary regulatory framework to support its implementation. Therefore, we have also incorporated a dual-layered approach that includes both fiscal and non-fiscal (non-technical) recommendations to bolster the feasibility of our proposed technical recommendation. The fiscal recommendations encompass financial considerations such as taxation policies that can support the proposed measures. On the other hand, non-fiscal recommendations focus on non-technical aspects, including regulatory frameworks, social engagement strategies, and community involvement initiatives. This multifaceted approach aims to create a holistic environment conducive to the successful implementation of our suggestions. By addressing both the financial and non-financial dimensions, we strive to enhance the overall viability and sustainability of the recommended actions within the palm oil industry value chain. Each incentive or disincentive is labeled with "FX" for fiscal

incentives/disincentives, and "NFX" for non-fiscal incentives/disincentives. This coding simplifies the process of mapping technical and non-technical recommendations. Further details of the non-technical recommendation can be seen on Table 0-2.

Table 0-2 Synthesized non-technical (fiscal/non-fiscal) recommendation

Code	Incentives/Disincentives (Policy Recommendation)		Key Stakeholders	Targeted Stakeholders	Period
	Fiscal	Non-Fiscal			
NF1		Provide sufficient subsidies for small and privately owned plantations which have clear legality of land to obtain and renew ISPO certificate	BPDPKS	Smallholder Farmers	Short
NF2		Provide affordable financing schemes for ISPO certification such as through KUR (Business Credit for Micro and Small Enterprises) and UMI (Financing for Ultra Micro Enterprise)	Financial Services Authority (OJK) and Financial Institutions	Smallholder Farmers	Short
NF3		1) Simplify certification process and provide training and resources to help farmers understand the benefits of ISPO certification and how to obtain it 2) Fund ISPO certification fee assistance for smallholders through APBN, APBD and ohter sources as per relevant laws and regulations 3) Provide counseling related to CE applications to farmers.	Ministry of Agriculture	Smallholder Farmers	Short
F1	Reduce export excise tax for companies that purchase ISPO-based products at higher prices in order to establish price differential between ISPO and non-ISPO-certified products.		Ministry of Finance	Companies & Farmers	Short
F2	Reduce corporate income tax and/or reduce export excise tax for companies **using circular products**, such as palm bunch ash and POME-based fertilizers in the plantation.		Ministry of Finance	Companies	Medium

Code	Incentives/Disincentives (Policy Recommendation)		Key Stakeholders	Targeted Stakeholders	Period
	Fiscal	Non-Fiscal			
F3	Provide incentives for companies to build POME treatment installation, such as import duty free for POME installation capital goods (e.g. Boiler) and/or tax allowance		Ministry of Finance	Manufacturing companies, especially small and medium scale industry	Short
NF4		Provide affordable financing schemes for POME treatment installation such as through KUR and UMI	Financial Services Authority (OJK) and Financial institutions	Small and medium scale manufacturing companies	Short
NF5		Provide funding for RnD in palm oil based circular economy **such as** POME treatment and biodiesel production at a lower cost	BPDPKS	Manufacturing companies, research, and academic institutions	Short
NF6		Encourage utilization of biomass from POME as an energy input for PLN, with a competitive tariff	Ministry of energy and mineral resources, PLN	Manufacturing companies	Short
F4	Reduce VAT and/or corporate income tax for palm oil industries which adopt repair and reuse practices in their production		Ministry of Finance	Manufacturing Companies	Short
NF7		Provide business license issuance mechanism to control wastewater discharges	Investment Coordinating Board (BKPM), Ministry of Environment and Forestry, and District Government	Companies	Short
F5	Reduce VAT and/or corporate income tax for business that develop and utilize biodegradable packaging		Ministry of Finance	Manufacturing Companies	Medium
F6	Broadening the scope of plastic excise tax, not only on plastic bags but also on plastic based packaging for various consumer goods		Ministry of Finance	Manufacturing Companies	Medium
NF8		Create UCO collecting system and public campaign, and monitor UCO distribution and utilization	District/Local Government	Society or Consumers	Long

Code	Incentives/Disincentives (Policy Recommendation)		Key Stakeholders	Targeted Stakeholders	Period
	Fiscal	Non-Fiscal			
F7	Provide subsidies to UCO based biofuel companies to lower their production costs and boosting their price competitiveness with non-biofuel fuels		Ministry of Finance	UCO-based biofuel companies	Long
F8	Include UCO based biofuel in the VAT free list to stimulate demand for biofuels		Ministry of Finance	Consumers (Individuals and companies)	Long

Some technical recommendations will have non-fiscal incentives/disincentives to facilitate their implementation. Each recommendation comes with a clear target contribution, outlining the expected impact on key performance indicators or sustainability metrics. We have established a recommended period for implementation, taking into consideration factors such as feasibility, urgency, and potential ripple effects throughout the value chain in Table 0-3

Table 0-3 Synthesized technical & policy recommendation

Value Chain(s)	Target Contribution	Policy Recommendation	Recommended Actions for targeted Stakeholders	Key Stakeholders	Targeted Stakeholders	Period	Incentives/ Disincentives
Plantation	Reduction of land use & land-use change (LULUC) in areas with high carbon content, such as primary forests and peatlands	Develop standardized guidelines for mapping and implementation of best practice methods to ensure effective soil and water conservation in each region	a. Plant trees on the most suitable land that can support palm oil's growth naturally	Ministry of Environment and Forestry	PTPN, Private Companies, and Smallholders and Cooperatives	Short	NF1, NF3
		Enhance the implementation of the Indonesian Sustainable Palm Oil (ISPO) certification system by integrating with the Roundtable on Sustainable Palm Oil (RSPO) and instituting a moratorium on new oil palm plantations (Moratorium Sawit) to promote sustainable practices and environmental conservation within the palm oil plantation as well as global competitiveness of Indonesian palm oil products.	z3. Strengthen ISPO and its implementation; support and encourage smallholders to implement sustainable palm oil FFB production and obtain ISPO certification; socialize the benefits of ISPO certified products which are more financially attractive.	ISPO Certification Board; Ministry of Environment and Forestry	Private Companies, and Smallholders and Cooperatives	Short	NF1, NF2, NF3, F1
	Low Carbon and Intensification > Water recovery and carbon reduction.	Ensure equitable access to high-quality palm oil seeds by instituting a policy that allows the government to provide subsidies when necessary, promoting the cultivation of improved varieties and enhancing overall productivity in the palm oil industry.	b. Provide access & subsidize high-quality (superior) palm oil seed to increase yields and productivity	Ministry of Agriculture	Smallholders and Cooperatives	Short	NF5

Value Chain(s)	Target Contribution	Policy Recommendation	Recommended Actions for targeted Stakeholders	Key Stakeholders	Targeted Stakeholders	Period	Incentives/ Disincentives
		Enforce comprehensive agricultural practices within palm oil plantations, including the adoption of precision agriculture for fertilization, the substitution of chemical pesticides with predators, the utilization of biological agents for natural nutrient supply, incorporating Oil Palm Front (OPF) for nutrient recycling and soil conservation, and promoting Palm Oil Cattle Integration (POCI) to enhance sustainable and integrated land management practices.	d. Enable precise fertilizer application and prevent excessive fertilization through advanced fertilizer technology such as FOSS NIR DA2500	Palm Oil Plantation Fund Management Agency	PTPN, Private Companies, Smallholders and Cooperatives	Long	NF3
			e. Substitute chemical pesticides with natural predators	Ministry of Environment and Forestry	Palm Oil Grower Association	Long	NF3
			c. Encourage agroforestry & silvopasture that can naturally supply essential elements to reduce palm oil trees' needs for fertilizer	Ministry of Environment and Forestry	Palm Oil Grower Association	Mid	F2
			z1. Develop an Integrated Water Management System (IWMS) that incorporates wastewater treatment facilities, optimizing water use and enhancing sustainability across palm oil production.	Ministry of Environment and Forestry	PTPN and Private Palm Oil Company	Short	NF7, F2
			z2. Implement a Waste Water Treatment Plant (WWTP) initiative designed to recycle and reuse wastewater, thereby increasing circularity within the palm oil production process.	Ministry of Environment and Forestry	PTPN and Private Palm Oil Company	Short	NF7, F2

Value Chain(s)	Target Contribution	Policy Recommendation	Recommended Actions for targeted Stakeholders	Key Stakeholders	Targeted Stakeholders	Period	Incentives/ Disincentives
	Waste Management and Utilization	Introduce a holistic framework aimed at transforming Oil Palm Front (OPF) into handicrafts to enhance communities' livelihoods, alongside the establishment of Miniature Sustainable Plantations, pilot mills, and refineries, strategically designed for tourism and investor funding support.	f. Transform OPF (Oil Palm Frond; trunks, frond, and leaves) into handicrafts and fertilizer	Ministry of Tourism and Creative Economy supported by KLHK; BPDPKS	Smallholders association; CSR private company	Short	F2, NF5, F4
			z4. Establish Miniature Sustainable Plantations, pilot mills, and refineries, strategically designed for tourism and investor funding support.			Mid	
Milling		Disseminate an integrated and sustainable agricultural strategy within the palm oil sector, incorporating precision agriculture practices, substitution of chemical pesticides with natural predators, utilization of diverse biological agents to naturally supply essential elements for plants, incorporation of Oil Palm Front (OPF) to enhance nutrient recycling and soil conservation, and promotion of Palm Oil Cattle Integration (POCI) to foster sustainable land management practices.	l. Develop effluent treatment plants to reduce potential environmental harm and make POME a more effective fertilizer for soil health treatment	Utilize biomass produced in the palm oil sector, such as shells and fiber for palm oil plantation trucks & boiler	Mill industrial players & Palm Oil Grower Association	Short	F2, F3, NF4, NF5, F4
			m. Develop methane capture technology to produce biogas from palm oil mill effluents (POME) for electricity production & fertilizer				F2, F3, NF4, NF5, NF6
			n. Develop Bio-Compressed Natural Gas (Bio-CNG) plant to produce biomethane for palm oil plantation trucks' fuel				F2, F4, NF4, NF5
			o. Utilize empty fruit bunches (EFB)-based fertilizer for soil health treatment				NF5, F2, F4
			p. Utilize biomass produced in the palm oil sector, such as shells and fiber for palm oil plantation trucks & boiler				NF5, F2, F4

Value Chain(s)	Target Contribution	Policy Recommendation	Recommended Actions for targeted Stakeholders	Key Stakeholders	Targeted Stakeholders	Period	Incentives/ Disincentives
	Milling & Refinery Process Intensification	Institute a comprehensive technological advancement strategy in the palm oil industry, including the development and utilization of high-precision assessment technology, the substitution of chemical substances, and the digitalization.	h. Utilize highly-precise technology in controlling fresh fruit bunches (FFB)'s quality that goes into the milling process	KLHK supported by BRIN; BPDPKS & GAPKI	Industrial players	Long	
			i. Substitute chemical substances from fresh fruit bunches (FFB) stripping process with clay bath technology				
			j. Implement semi-digital or digitalization to accurately identify issues within production processes				
			k. Utilize advance technology (Such as FOSS NIR DA1650 analyzer) to detect oil loss at every production stages				
Refinery		Institute a comprehensive technological advancement and fiscal strategies as well as collaborative platform for the palm oil refinery, including chemical and bleaching usage optimization, SBE utilization, and steam reuse.	r. Optimize chemical & bleaching usage efficiency	Ministry of Environment and Forestry supported by BRIN; BPDPKS & GAPKI	Industrial players	Mid	
			s. Optimize SBE conversion into R-Oil and de-oiled SBE (De-OBE) for industrial use (Biodiesel, biofuel, biolubricants, cement, & animal feed)				
			t. Utilize SBE to produce organic fertilizer				
			u. Reuse hot steam for production to reduce cost				

Value Chain(s)	Target Contribution	Policy Recommendation	Recommended Actions for targeted Stakeholders	Key Stakeholders	Targeted Stakeholders	Period	Incentives/ Disincentives
Packaging & Distribution		Institute a comprehensive approach in mill decentralization strategies and adoption of SPOT (Steamless Palm Oil Technology)	q. Develop Steamless Palm Oil Technology (SPOT) to streamline milling & refinery processes and reduce "liquid"-based waste	Ministry of Industry supported by BPDPKS; PT. NGE & Regional Government	Smallholders' association	Long	
			g. Decentralize milling location to reduce transportation costs				
	Low Carbon Packaging	Institute Sustainability and Circular Economy approach in palm oil product packaging	v. Conduct research to reduce raw material and distribution volume of plastic packaging	Ministry of Environment and Forestry supported by BRIN	Related packaging industrial players	Mid	F6
			w. Develop eco and biodegradable-based packaging				F5
			x. Recycle & ensure packaging recyclability				F6
Use & Disposal	Market Expansion and Job Creation	Foster the expansion of the downstream palm oil industry by providing incentives, facilitating access to resources, and implementing value addition, product diversification, and innovation within the palm oil processing and manufacturing sector.	z5. Facilitate the development of value-added products derived from palm oil, such as oleochemicals, biofuels, cosmetics, and pharmaceuticals. Attract domestic and foreign investors to the downstream palm oil sector.	BAPPENAS supported by BPDPKS and Ministry of Foreign Affairs	BRIN; Related Industrial players; Education institutions	Long	NF5
	Promote Circular Economy and Energy Security.	Institute a comprehensive approach in utilization of Cooking Oil for Biodiesel Production strategy	y. Utilize used cooking oil for national biodiesel production to support B30	Ministry of Environment and Forestry supported by BPDPKS; BRIN; Education institutions	Regional Government & Related Industrial players	Long	NF8, F7, F8

In tandem with our fiscal and non-fiscal recommendations, we also advocate the integration of green jobs as a pivotal element to ensure the availability of resources crucial for the successful implementation of technical recommendations within each segment of the value chain. By incorporating green job initiatives, we aim to not only address environmental concerns but also stimulate economic growth and employment opportunities within the sustainable sector. These green jobs can span various roles, including research and development, conservation, renewable energy, and eco-friendly agriculture practices, aligning with the overarching goal of fostering environmental responsibility. This strategic inclusion of green jobs serves as a catalyst, promoting both ecological sustainability and economic prosperity, thereby reinforcing the foundation for the seamless execution of technical recommendations across the palm oil industry value chain.

Table 0-4 Green/circular jobs opportunities for sustainable palm oil industry value chain

Chain	Strategy	Technical recommendation	Innovation	Circular Jobs	Changes in Current Functions	Establishment of New Functions	Work Decency	Job Impact	Shade of Green
Plantation & Milling	Recovery (R9)	q. Utilize biomass produced in the palm oil sector, such as shells and fiber for palm oil plantation trucks & boiler	Core technology; Product design	- Product design - Waste processing - Machinery operation	- R&D - Waste management - Boiler operator	N/A	Above minimum national standard	Job transformation or creation	Medium
			Revenue model	- Trading by-product for bioenergy	n/a	Sales & marketing			
	Repurpose (R7)	n. Develop methane capture technology to produce biogas from palm oil mill effluents (POME) for electricity production	Core technology; Product design	- Product design - Waste processing - Machinery operation	- R&D - Waste management	Biogas plant operation	Above minimum national standard	Job creation or substitution	Medium
		o. Develop Bio-CNG plant to produce biomethane for palm oil plantation trucks' fuel							

Chain	Strategy	Technical recommendation	Innovation	Circular Jobs	Changes in Current Functions	Establishment of New Functions	Work Decency	Job Impact	Shade of Green
	Repurpose (R7)	f. Transform OPF (Oil Palm Front; trunks, front, and leaves) into handicrafts and fertilizer	Core technology; Product design	- Material & product design & development - Product development - Product marketing	R&D	- Business development - Product manufacturing - Sales & marketing	Above minimum national standard	Job transformation	Medium
	Reuse (R3)	m. Develop effluent treatment plants to reduce potential environmental harm and make POME a more effective fertilizer for soil health treatment p. Utilize EFB-based fertilizer for soil health treatment f. Transform OPF (Oil Palm Front; trunks, front, and leaves) into handicrafts and fertilizer	Core technology; Product design	- Circular product design - Biofertilizer production - Biofertilizer application	- R&D - Plantation maintenance - Plantation management	N/A	Meet minimum national standard	Job transformation	Medium
	Reduce (R2)	c. Encourage agroforestry & silvopasture that can naturally supply essential elements to reduce palm oil trees' needs for fertilizer d. Enable precise fertilizer application and prevent excessive fertilization through advanced fertilizer technology such as FOSS NIR DA2500	Product design; Core technology	-Material and methodology design & development - Implementation of new technique	- R&D - Plantation maintenance - Plantation management	N/A	Meet minimum national standard	Job transformation	Medium

Chain	Strategy	Technical recommendation	Innovation	Circular Jobs	Changes in Current Functions	Establishment of New Functions	Work Decency	Job Impact	Shade of Green
		e. Substitute chemical pesticides with natural predators							
	Rethink (R1)	c. Encourage agroforestry & silvopasture that can naturally supply essential elements to reduce palm oil trees' needs for fertilizer	Product design; Core technology	- Business development - Methodology design & development - Agricultural/Cattle-farm supervisor - Intercrop/Cattle farmers - Supply chain management	- R&D - Plantation maintenance - Plantation management	- Business development -Agricultural/Cattle-farm integration	Meeting minimum national standard	Job creation or substitution	Medium
Refinery	Rethink (R1)	h. Develop Steamless Palm Oil Technology (SPOT) to streamline milling & refinery processes and reduce "liquid"-based waste	Core technology; Socio-institution	- Business development - Construction - Business management - Facilities operation - Sales & marketing	N/A	- SPOT milling/refinery architecture and construction - Business management - SPOT milling operator	Meet minimum national standard	Job creation or substitution	Medium
	Reduce (R2)	**Optimize refinery process** r. Optimize chemical & bleaching usage efficiency	Product design	- Material & methodology design & development - Implementation of new technique	- R&D - Plant/refinery operator	N/A	Above minimum national standard	Job transformation	Dark
		u. Reuse hot steam for production to reduce cost							

Chain	Strategy	Technical recommendation	Innovation	Circular Jobs	Changes in Current Functions	Establishment of New Functions	Work Decency	Job Impact	Shade of Green
	Repurpose (R7)	**SBE Utilization** s. Optimize SBE conversion into R-Oil and de-oiled SBE (De-OBE) for industrial use (Biodiesel, biofuel, biolubricants, cement, & animal feed) t. Utilize SBE to produce organic fertilizer	Core technology; Product design	- Product design - Waste processing - Sales & marketing	- R&D - Waste management	- SBE facilities operation - Sales & marketing of R-Oil and DOBE	Above minimum national standard	Job creation or substitution	Medium
Packaging	Reduce (R2)	**Innovative packaging** v. Conduct research to reduce raw material and distribution volume of plastic packaging w. Develop biodegradable PET-based packaging	Product design	- Material design - Product design & production - Recycled material supply chain management	- R&D - Supply Chain Management - Packaging production	N/A	Above minimum national standard	Job transformation	Dark
	Recycling (R8)	x. Recycle & ensure packaging recyclability	Core technology; Product design; Socio-institution	- Waste management - Waste collecting - Plastic recycling - Supply chain management	- R&D - Waste picker/collector - Waste aggregator - Waste management - Plastic recycliing	- Business development & partnership - IT system development - Plastic use and disposal educator/campaigner - Plastic supply chain management	Meeting minimum national standard	Job transformation, creation, or substition	Light

Chain	Strategy	Technical recommendation	Innovation	Circular Jobs	Changes in Current Functions	Establishment of New Functions	Work Decency	Job Impact	Shade of Green
Post consumption	Repurpose (R7)	**UCO utilization** y. Utilize used cooking oil for national biodiesel production to support B30		- Waste management - Waste collecting - Biodiesel manufacturer - Sales & marketing	- R&D - Waste aggregator - Waste management - Biodiesel converter	- Business development & partnership - IT system development - UCO disposal educator/campaigner - UCO supply chain management	Meeting minimum national standard	Job transformation, creation, or substition	Light

To effectively support the emerging green job opportunities and meet the demands of circular and sustainable practices, individuals should develop a diverse set of skills. Proficiency in renewable energy technologies, environmental conservation, and sustainable agriculture remains critical. Additionally, expertise in circular analytics, innovation, and design, as well as circular creativity and innovation, is essential for fostering inventive solutions. Skills in agriculture management, energy efficiency, and waste management contribute to the sustainable development of green sectors.

Green construction skills, especially relevant for SPOT (Sustainable Practices in Operational Technologies), are crucial. Understanding good agricultural practices, coupled with effective communication, problem-solving, and critical thinking, are fundamental for navigating complex challenges in eco-friendly job roles. A grasp of basic software and hardware, along with ICT system design and development, enhances adaptability to technological advancements. Skills in supply chain management, negotiation, and collaboration and teamwork are indispensable for seamless integration into green industries. A willingness to learn, coupled with a strong foundation in occupational safety and health (OSH), business planning, and development, prepares individuals for dynamic roles in sustainable sectors. Proficiency in machinery operation further solidifies one's contribution to the circular economy and green job landscape. The successful implementation of these initiatives requires strategic support from multitude stakeholders. General recommendation that is applicable to all value chain can be found on

Table 0-5.

Table 0-5 General recommendation for all value chain

No.	General Recommendation	Enabling Condition	Potential Stakeholder	Key action(s)
1	Improve data collection and transparency to inform the policy and decision-making process.	Clear & comprehensive guidelines, free from unnecessary repetition	Ministry of Manpower, BPS Sectoral Ministry (Ministry of Agriculture, Ministry of Industry, Ministry of Environment), Relevant Business Association, relevant trade union, BPDKS	• Compiling data from the workforce survey and related sectoral data to provide granular data for estimating circular job • Collecting detailed data from related stakeholders when addressing certain issue • Improving Labor Market Information System (LMIS) that can integrate employment information • Implementing action plan on data collection as mandated by regulation on optimization of employment social protection (Presidential Instruction no. 2 of 2021) and National Action Plan on Sustainable Palm Oil (President Instruction no. 6 of 2019) • Availability of systematic and integrated data, disaggregated within granular level, to support evidence-based policy making, including green jobs.
2	Accelerate program and policy to reduce the existing decent work challenges, especially in the value chain where vulnerable employment is predominant	-	Ministry of Manpower, BPJS-TK, Relevant Business Association, Relevant Trade Unions, Ministry of Home Affairs, Development Partners	• Refining regulations on employment contracts, including for the emerging business models. • Collective effort from potential stakeholders to ensure freedom of association and collective bargaining to maintain industrial relationship. • Improving labor inspection process and the capacity of the labour inspectors to ensure adequate monitoring process. • Improving the coordination between national and sub-national government institution • Effective policy and mechanism to ensure human rights fulfilment, including decent working-condition, specifically targeted for sub-sector dominated by vulnerable employment

No.	General Recommendation	Enabling Condition	Potential Stakeholder	Key action(s)
3	Promote social dialogue to forge consensus and maintain industrial relationship	The mutual recognition of the urgency of the circular economy among relevant stakeholders to promote a collaborative effort towards fostering circular economic practices.	Ministry of Manpower, Regional Government, Enterprises/Business Association, Trade Union, Regional Government, Local community	• Maintaining healthy industrial relationships to enable effective mechanism for co-creating knowledge in planning a just circular transition. • Institutionalize the social dialogue process. • Promoting bipartite cooperating body (or LKS bipartit) • Optimizing the role of labor mediator to settle disputes during the transition process. • Enhancing the role of tripartite bodies at the national and sub-national levels in addressing issues related to the green transition. • Institutionalized mechanism for stakeholders' dialogue and knowledge co-creation process to maintain conducive environment and promote CE
4	Maximize the green jobs potential by supporting and scaling up circular strategies		Ministry of Industry, Ministry of Trade, Bappenas, National Research and Innovation Agency, Ministry of Manpower, BPDPKS, Ministry of Finance, Bappenas, Business Association	• Investing in circular innovations in the upstream and post consumption chain by allocating more public fund to finance R&D, provide capital investment for equipment and supplies, and train smallholders as well as emerging business. • Providing better incentive mechanisms, collaborating with business association to promote circular economy, and linking circular program with initiatives on sustainability • Establishing clear policy directives on the circular strategies, provision of mechanisms to incentivize private sector involvement or public-private partnerships in the circular transition • Promoting supply chain partnership for circularity • Availability of government-led programs and policies to scale-up circular approach in the industry (including access for finance and circular research and innovation)
5	Create enabling environment for collaboration and industrial symbiosis.	The establishment of policy that provide legal basis and ease of doing business for the emerging enterprises related to the identified circular strategy to operate	Regional Government, CSO, circular enterprises, research and educational institutions	• Supporting social campaign to accelerate socio-behavioural changes and infrastructure development necessary for the industry, depending on the capacity of region. • Policy and program to ease stakeholders in doing circular business model and support multi-parties' collaborations that accelerate the CE adoption.

No.	General Recommendation	Enabling Condition	Potential Stakeholder	Key action(s)
		within their jurisdiction by regional governments		
6	Facilitate and promote reskilling and up-skilling, targeting vulnerable workers, and incorporating the basic skills for green jobs and circularity in formal education.	-	BPDPKS, Ministry of Education and culture, BAPPENAS, Ministry of Manpower, Educational institution, Palm enterprises (including smallholders and cooperatives)	<u>For Smallholders</u> • Conduct continuous skilling program for smallholders through public funds allocation from BPDPKS. • Setting-up training program in the government training centres (BLK) • Establishing community based BLK in the palm regions and collaborating with universities or training providers to develop programs tailored programs. <u>For Enterprise</u> • Optimizing the labour inspection process to ensure that all workers receive the necessary training for appropriate skilling process. • Reorienting the industry's paradigm to recognize the importance of circularity and the green economy through dialogue and socialization. <u>General</u> • Incorporating fundamental skills namely the basic skills for green job and basic technology to formal education • Introducing syllabus or elements of CE into subjects and related programs of qualifications for fields that supply the industry such as STEM, Agriculture, Sustainability, Systems Information, and Business studies • Embedding circular economy principles into the roadmap for green jobs development such as Indonesian National Qualification Framework (KKNI) as the basis for skill development in green jobs • Availability of program and policy in skilling and mainstreaming circular economy within formal and informal education system.

No.	General Recommendation	Enabling Condition	Potential Stakeholder	Key action(s)
7	Design policy that support an inclusive CE.	- The establishment of regulations by the Financial Services Authority (OJK) to ensure that financial institutions provide accessible financing options for investments in the circular economy is necessary. Financial institutions, in turn, must develop business models to incorporate the mandate. - The availability of business license technical guideline, including the boundaries for permitted waste production and the evaluation and monitoring system.	Ministry of Finance, BPDPKS, local/sectoral government bodies (e.g Environmental Office under local government), Private sectors	• Provision of various incentive mechanisms such as subsidies or tax deductions, capacity development programs, research and innovation support, and a legal framework for operations • Improving governance for activities related to targeted groups, such as empowering smallholders (including those funded by BPDPKS), establishing clear rules for employment contracts, and ensuring labour protection in plantation, governance for waste management and waste recycling (particularly UCO and plastic recycling). • Designing specific program to provide adequate labour protection for women worker while assisting them to re-enter labor market when they face job loss risk • Designing policy that amplify the opportunity for youth to participate in CE by promoting the scaling up of emerging circular enterprises that contribute to youth employment and creating enabling environment for them to thrive • Targeted policy and program to increase participations of marginalized groups, such as youth, women, local people, informal workers, in partaking and reaping the benefit from CE approach.
8	Link CE with sustainable palm oil initiatives		Sectoral Ministry (Ministry of Industry, Ministry of Agriculture, Ministry of Environment), Private companies, Business Association, BAPPENAS, Certification bodies (e.g. RSPO, ISPO)	<u>Program Level</u> • Improving the mandatory sustainability mechanism (ISPO) with incentives mechanism and ensuring inclusivity • Promoting voluntary based sustainability incentives such as RSPO and ESG • Provision of policy that promotes supply-chain based sustainability initiatives <u>Strategic Level</u> • Strengthening policy coherence for CE in the palm oil industry by harmonizing policy guidelines on sustainable palm oil, palm oil industry development, circular economy, and green jobs • Coherence of CE policy and programs with the established policy/ mechanism/program on sustainability

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