



# Promoting Sustainability Principles and Diversification of Biofuel Raw Materials in the New and Renewable Energy Bill (RUU EBT)

## Executive Summary

Achieving national energy independence and climate commitment in accordance with the Nationally Determined Contributions (NDCs) are two of Indonesia's current main goals, both of which need to consider the aspects of environmental sustainability. The government has chosen to implement an energy mix policy as an effort to accomplish this. In the fuel sector, the policy is manifested in the form of biofuel implementation, both for the PSO (Public Service Obligation) and non-PSO sectors, by using biodiesel from crude palm oil. However, this choice of policy is highly vulnerable, for it largely depends on only one commodity and has various socio-ecological issues. The proposal of the New and Renewable Energy Bill (*Rancangan Undang-Undang Energi Baru Terbarukan* or RUU EBT) that has been included in the 2020-2024 National Legislation Programme (PROLEGNAS) is an opportunity to consider various needs and clarify the direction of Indonesia's energy policy (especially biofuels). Yet the latest draft of RUU EBT seems to have not addressed the diversification of raw materials for biofuels as well as other sustainability aspects of biofuel implementation. Therefore, this policy brief proposes two recommendations that can be taken into consideration in the development of RUU EBT, especially in regard to:

1. Strengthening the regulations on the fulfillment of social and environmental sustainability principles in biofuel development, including the biofuel upstream and downstream industries.
2. Strengthening the regulations related to provisions that require biofuel development to prioritise the diversification of raw materials and focus on the utilisation of second-generation biofuel technologies (using waste as a raw material).



## The New and Renewable Energy Bill and Biofuels

The inclusion of the New and Renewable Energy Bill (*Rancangan Undang-Undang Energi Baru Terbarukan* or RUU EBT) as a proposal from the Commission VII of the House of Representatives of the Republic of Indonesia (DPR RI) in the 2020-2024 National Legislation Programme (PROLEGNAS) is a strategic opportunity for Indonesia to promote energy transition, that is from fossil fuels to renewable energy, as well as to reduce dependence on fossil fuels, so that Indonesia can lower their emissions and achieve energy independence. RUU EBT is also one of the fundamental instruments for Indonesia to achieve Net-Zero Emissions (NZE) by 2060 or earlier<sup>1</sup> and the Nationally Determined Contributions (NDCs) by 2030 because it provides a legal certainty regarding the development of renewable energy in Indonesia. The energy sector per se is the key for Indonesia to achieving the climate commitment, considering that its greenhouse gas (GHG) contribution, especially transportation, reaches 157,771 Gg CO<sub>2</sub>e or about 16.75% of the total CO<sub>2</sub> emissions.<sup>2</sup>

The energy mix policy has been implemented for quite some time. One of its measures is the development of biofuels as a form of renewable energy whose raw materials are abundantly available in Indonesia. Nevertheless, such an abundance does not automatically translate to a challenge-free biofuel implementation. Amongst the challenges is the vulnerability of Indonesia's biofuel industry due to its dependence on a single commodity, which is palm oil.

Essentially, this commodity is both a basic staple (cooking oil) and primary export commodity. In addition, the upstream and downstream industries of palm oil are also shrouded by a plethora of sustainability-related social and environmental issues, such as deforestation, peat drying, forest and land fires, and agrarian conflicts. The dependence on this single commodity makes the government place other plantation commodities in the second priority of biofuel raw materials.

The insufficient attention put on the challenges faced by the biofuel industry in Indonesia can be counterproductive to the objective of actualising energy independence and achieving the government's climate commitment. With the existence of RUU EBT, there are opportunities to provide a robust and positive legal basis on which sustainability principles can be laid on and to give direction to the development of biofuels in Indonesia.

Hence, the fulfillment of sustainability principles in biofuel development is of paramount importance. However, regulations on the sustainability aspects and variety of biofuel feedstocks in RUU EBT remain limited. This can be potentially counterproductive to the goal of achieving energy independence and climate commitment as endeavoured by the government.

<sup>1</sup> Ministry of Environment and Forestry. 2021. Indonesia Long-Term Strategy for Low Carbon and Climate Resilience 2050. Jakarta: Ministry of Environment and Forestry.

<sup>2</sup> Ministry of Environment and Forestry. 2021. Laporan Inventarisasi Gas Rumah Kaca (GRK) dan Monitoring, Pelaporan, Verifikasi (MPV) Tahun 2020. Jakarta: Ministry of Environment and Forestry. Accessed from: [http://ditjenppi.menlhk.go.id/reddplus/images/adminppi/dokumen/igrk/LAP\\_igrk2020.pdf](http://ditjenppi.menlhk.go.id/reddplus/images/adminppi/dokumen/igrk/LAP_igrk2020.pdf).

# The Lack of Provisions that Promote Sustainability Principles and Diversification of Biofuel Raw Materials in RUU EBT

## A. The Sustainability Principles<sup>3</sup> of Biofuel Raw Materials

The current RUU EBT does not include provisions on the fulfillment of sustainability principles in biofuel development, especially regarding the raw materials used in its production. The lack of regulations on this matter might pose the risk of perpetuating various environmental and social problems. This risk is even bigger because the current biofuel development in Indonesia only depends on a single commodity, which is palm oil.

Palm oil is a renewable commodity with an abundant supply, hence its ability to ensure the availability of raw materials for the biofuel development. However, the palm oil governance leaves various issues of social and environmental sustainability.

From the perspective of carbon emissions, biofuels in general produce lower exhaust emissions than fossil fuels.<sup>4</sup> However, from the perspective of Life-Cycle Analysis (LCA), the development of palm oil-based biofuels might

result in higher emissions when they are produced from plantations grown on previously forested lands and peatlands.<sup>5</sup> The expansion of palm oil plantations is linked to almost a third of deforestation in Indonesia in the last 19 years (2001-2019).<sup>6</sup> The high number of palm oil plantations on peatlands also poses the risk of emission production from peat decomposition and forest and land fires. Approximately 20% of the oil palm plantations in Southeast Asia are grown on peatlands, which are found the largest in Sumatra (1.3 million ha), followed by in Kalimantan (0.7 million ha).<sup>7</sup> In addition to the emissions caused by the suboptimal governance of plantations on peat, there is also a great risk of land use change from peatlands to oil palm plantations, because there are about 4 million ha of peat ecosystem in the existing palm oil permit that is not fully opened.<sup>8</sup> When biofuels come from oil palms produced on dried and previously peatlands, the CO<sub>2</sub> emissions are predicted to be far higher by approximately 500%.<sup>9</sup> It should also be noted that land clearance by burning is also a prevalent practice because it is considered the cheapest land preparation method.<sup>10</sup> Peatlands are the

<sup>3</sup> The sustainability principles in this policy brief are principles which ensure that biofuels are produced by considering several risk analyses, which are: a) other uses of feedstocks, b) GHG calculation, both directly and indirectly as a result of feedstock use, and c) potential direct and indirect social impacts. Taylor, R. 2014. *Advanced Biofuel Feedstocks: An Assessment of Sustainability*. E4tech.

<sup>4</sup> A study from ICCT shows that palm oil-based biofuels (biodiesel) can (memperbaiki) the emissions of unburned hydrocarbons (HC) by 20%, carbon monoxide (CO) by 25%, and particulate matter (PM) by 43% in the B100 scenario compared to conventional diesel fuel. However, the nitrogen monoxide (Nox) is predicted to be higher by 0.8% with a 10% biodiesel blend compared to conventional diesel fuel. Source: Malley, Jane., et al. 2021. *Air Quality Impacts of Palm Biodiesel in Indonesia*. ICCT White Paper.

<https://theicct.org/publication/air-quality-impacts-of-palm-biodiesel-in-indonesia/>

<sup>5</sup> Traction Energy Asia. 2019. *Greenhouse Gas Emissions from Biodiesel Production in Indonesia Based on Lifecycle Analysis*. Jakarta: Traction Energy Asia.

<sup>6</sup> Gaveau, David., et al. 2021. *Slowing Deforestation in Indonesia Follows Declining Oil Palm Expansion and Lower Oil Prices*. Research Square, DOI: <https://doi.org/10.21203/rs.3.rs-143515/v1>. Accessed from <https://www.cifor.org/knowledge/publication/8010>

<sup>7</sup> Tinhout, B. 2016. *Towards Sustainable Palm Oil*. Wetlands International. Source: <https://www.wetlands.org/casestudy/towards-sustainable-palm-oil/>

<sup>8</sup> Analisis Spasial Madani, 2021.

<sup>9</sup> Malins, C. 2018. *Driving Deforestation: The Impact of Expanding Palm Oil Demand through Biofuel Policy*. London. Source: [http://www.cerulogy.com/wp-content/uploads/2018/02/Cerulogy\\_Driving-deforestation\\_Jan2018.pdf](http://www.cerulogy.com/wp-content/uploads/2018/02/Cerulogy_Driving-deforestation_Jan2018.pdf)

<sup>10</sup> The World Bank. 2016. *The Cost of Fire: An Economic Analysis of Indonesia's 2015 Fire Crisis*. Jakarta. Source: <http://pubdocs.worldbank.org/en/643781465442350600/Indonesia-forest-fire-notes.pdf>



primary targets of land burning because they are highly flammable and seldom occupied. The practice of land expansion by burning was the main cause of the 2015 peatland fire crisis in Indonesia.<sup>11</sup>

From the perspective of social sustainability, the main problem comes from the high rate of agrarian conflicts involving large-scale oil palm plantations. According to a record from the Consortium for Agrarian Reform (*Konsorsium Pembaruan Agraria* or KPA), there were a total of 101 agrarian conflicts involving oil palm plantations in 2020,<sup>12</sup> which was an increase from 69 in 2019 and 83 in 2018.<sup>13</sup> Conflicts that occur in oil palm plantations usually revolve around land disputes, overlapping permits, unclear partnership programmes between the company and smallholders, environmental degradation that involves palm oil companies, and clashes between the indigenous and local people and company's security guards and paramilitary force.<sup>14,15</sup> Amongst the causing factors of the conflicts is the failure to consult the local community and obtain their Free and Prior Informed Consent (FPIC). The land acquisition process often disregards customary rights and local authorities. For example, surrounding communities are unaware of the plantation's development plan.<sup>16</sup> Meanwhile, the palm oil plantation's operations create significant

environmental impacts on the community whose livelihood greatly depends on environmental services. Additionally, from the perspective of manpower, labour policy legitimises a vulnerable employment relationship (no employment certainty). This prompts employment relationship conflicts between the workers and company, such as low wage (minimal working days), lack of occupational protection and safety, intimidation in forming unions, etc.<sup>17</sup>

Environmental and social impacts can be mitigated by acquiring sustainability certifications, both compulsory under the applicable laws and regulations and optional based on the market demand. However, currently, there are only 26.53% of palm oil plantations in Indonesia that have sustainability certifications, both the Roundtable on Sustainable Palm Oil (RSPO) and Indonesian Sustainable Palm Oil (ISPO) certifications, or the No Deforestation, No Peat, No Exploitation (NDPE) commitment.<sup>18</sup> The low attainment of sustainability certification can also be attributed to the lack of detailed regulations from the Ministry of Energy and Mineral Resources that require the sustainability of raw materials. This causes fuel enterprises such as PT Pertamina to not pay specific attention to the sustainability certification status of their suppliers.<sup>19</sup>

<sup>11</sup> Balch, O. 2015. Indonesia's Forest Fires: Everything You Need to Know. The Guardian. Source:

<https://www.theguardian.com/sustainable-business/2015/nov/11/indonesia-forest-fires-explained-haze-palm-oil-timber-burning>

<sup>12</sup> Consortium for Agrarian Reform. 2020. Catatan Akhir Tahun 2020 Konsorsium Pembaruan Agraria, Edisi Peluncuran I: Laporan Konflik Agraria di Masa Pandemi dan Krisis Ekonomi.

<sup>13</sup> Palm Oil Moratorium Coalition. 2019. Implementasi Inpres Moratorium Sawit: Jauh Panggang dari Api?

<sup>14</sup> Sawit Watch. 2014. Kaleidoskop Perkebunan Sawit 2014: Tugas Menyelesaikan Warisan Konflik di Sektor Perkebunan Sawit. Tandan Sawit Edisi No. 8/ Desember 2014.

<sup>15</sup> Galih Andreanto. 2014. Bias Arah Reforma Agraria Jokowi-Jusuf Kalla. Jurnal Land Reform, Consortium for Agrarian Reform.

<sup>16</sup> Koaksi Indonesia. 2018. Dinamika Hulu Hilir Industri Biodiesel di Indonesia. Jakarta: Koaksi Indonesia.

<sup>17</sup> Sawit Watch. 2018. Lembar Fakta Perlindungan Buruh Sawit Indonesia. <https://sawitwatch.or.id/2018/04/18/lembar-fakta-perlindungan-buruh-sawit-indonesia-2018/>

<sup>18</sup> Analisis Madani, 2021.

<sup>19</sup> Ahsinin, Adzkar., Karunian, Alia Yofira., Fuad, Muhammad Busyrol. 2020. Policy Brief. Menempatkan PT Pertamina (Persero) sebagai Aktor Kunci dan Teladan dalam Penghormatan HAM dan Perlindungan Lingkungan: Pengembangan Kebijakan Biofuel sebagai Modalitas dalam Mewujudkan Produk Biofuel yang Berkelanjutan. Jakarta: Elsam.

## B. Diversification of Biofuel Raw Materials

Biofuel development that focuses on a single commodity, or in this case oil palm, which is a food crop<sup>20</sup>, poses the risk of food vs. fuel competition<sup>21</sup>. Furthermore, Indonesia's current oil palm yield is relatively low at around 3.6 tons/hectare/year, below Malaysia's yield of 4-6 tons/hectare/year.<sup>22</sup> Without an increase in yield and diversification of biofuel raw materials to meet the rising demand for food and biofuel raw materials, the current circumstance can lead to a growing need for additional lands that will encourage agricultural land use change, deforestation, and peat clearance.

A number of studies have estimated the need for additional land areas as an impact of using oil palm as biofuel raw materials. Rahmadi, Aye, and Moore's study (2013) estimates that a potential additional 5.15 million hectares of land is needed to achieve the target of 5% biofuel in the national energy mix by 2025.<sup>23</sup> LPEM UI (2020) predicts that roughly 338 thousand hectares of new oil palm land will be needed for the B20 scenario, that can rise up to 5.2 million and 9.2 million hectares for B30 and B50, respectively, in the same year.<sup>24</sup> IESR (2021) expects the need for 4-6 million hectares of new oil palm lands to meet both domestic and export demands with the B30-B50 scenarios in 2024.<sup>25</sup> The highest number as CDP (2021) concludes is that the biodiesel programme will require 9-15

million hectares of additional oil palm plantations.<sup>26</sup> All the mentioned scenarios of required additional lands are very likely to happen if oil palm productivity remains low, oil palm rejuvenation is not working effectively, and palm oil export is not decreased to be diverted to domestic consumption.

The Ministry of Energy and Mineral Resources is currently developing B40, proposed as two scenarios, namely: 1) B30 FAME development plus 10% of Distilled Palm Oil Methyl Ester (DPME); 2) B30 FAME development plus 10% of Hydrogenated Vegetable Oil (HVO). Both options are proposed because B40 with pure FAME does not meet the recommended biofuel quality standards.<sup>27</sup> Nevertheless, the availability of CPO for DPME production remains a challenge in accomplishing B40.<sup>28</sup>

The focus on a single commodity also leads to the underdevelopment of biofuels from other types of raw materials, especially non-edible raw materials, which have lower risks of competing with food materials, as well as materials from waste or residue, which does not require additional lands. In other words, the use of such alternatives can minimise the social and environmental impacts. This is in accordance with the spirit of biofuel diversity when the government initiated it as a part of the energy mix policy in 2006, which includes biodiesel, bioethanol, etc.<sup>29</sup>

<sup>20</sup> Lee, R.A., & Lavoie, J.M. 2013. From First to Third Generation Biofuels: Challenges of Producing a Commodity from a Biomass of Increasing Complexity. *Animal Frontiers*, Volume 3, Issue 2, April 2013, Pages 6-11, <https://doi.org/10.2527/af.2013-0010>

<sup>21</sup> Prasad, S., & Ingle, A.P. 2019. Impacts of Sustainable Biofuels Production from Biomass. *Sustainable Bioenergy, Advances and Impacts*, Pages 327-346, DOI: <https://doi.org/10.1016/B978-0-12-817654-2.00012-5>.

<sup>22</sup> Katadata. 2019. Perbandingan Produktivitas Lahan Sawit Berdasarkan Kepemilikan Lahan. Accessed from <https://databoks.katadata.co.id/datapublish/2019/11/28/perbandingan-produktivitas-lahan-sawit-berdasarkan-kepemilikan-lahan> on 11th of January 2022

<sup>23</sup> Rahmadi, Arie., Aye, Lu., Moore, Graham. 2013. The Feasibility and Implications for Conventional Liquid Fossil Fuel of the Indonesian Biofuel Target in 2025. *Energy Policy*, Volume 61, Pages 12-21.

<sup>24</sup> LPEM UI. 2020. Risiko Kebijakan Biodiesel dari Sudut Pandang Indikator Makroekonomi dan Lingkungan. Jakarta: LPEM UI.

<sup>25</sup> IESR. 2021. Critical Review on the Biofuel Development Policy in Indonesia. Jakarta: IESR.

<sup>26</sup> Carbon Disclosure Project. 2021. Seberapa Hijaukah Bahan Bakar Nabati (Biofuel)? Memahami Risiko dan Lanskap Kebijakan di Indonesia.

<sup>27</sup> Moffitt, Lauren. 2021. Indonesia to Push Back B40 Rollout to 2025: MEMR. Accessed from <https://www.argusmedia.com/en/news/2278871-indonesia-to-push-back-b40-rollout-to-2025-memr> on 11th of January 2022.

<sup>28</sup> Moffitt, Lauren. 2021. Indonesia to Push Back B40 Rollout to 2025: MEMR. Accessed from <https://www.argusmedia.com/en/news/2278871-indonesia-to-push-back-b40-rollout-to-2025-memr> on 11th of January 2022.

<sup>29</sup> Tim Nasional Pengembangan Bahan Bakar Nabati untuk Percepatan Pengurangan Kemiskinan dan Pengangguran. 2006. Blueprint 2006-2025 Pengembangan Bahan Bakar Nabati untuk Percepatan Pengurangan Kemiskinan dan Pengangguran. Jakarta: Tim Nasional Pengembangan Bahan Bakar Nabati untuk Percepatan Pengurangan Kemiskinan dan Pengangguran.



## Policy Recommendations

Based on the abovementioned issues, we recommend the two following measures to be followed up by the House of Representatives of the Republic Indonesia, especially the House's Commission VII and government's partners in addressing RUU EBT:

**Strengthening the regulations on the fulfillment of social and environmental sustainability principles in biofuel development, including the biofuel upstream and downstream industries**

RUU EBT should incorporate regulations that encourage the fulfillment of sustainability principles that accommodate the biofuel production supply chain from upstream to downstream, such as ISPO and the Indonesian Bioenergy Sustainability Indicators (IBSI). Such provisions aim to ensure the source of biofuel raw materials and the optimal benefits of biofuels. Compliance to sustainability principles can be achieved through the fulfillment of sustainability standards covering social and environmental criteria, which regulate the sustainability of biofuel raw materials that can be further determined in the implementing regulations of RUU EBT. The sustainability standards can also adjust to the existing international standards in order to increase biofuel export acceptance.

As a proof that a biofuel production chain truly complies to sustainability standards, a requirement of sustainability certifications for biofuel raw materials and biofuel as a particular type of fuel should be addressed in this bill. Furthermore, provisions that govern the State-Owned Enterprises' (BUMN) obligation to purchase sustainable biofuels are also crucial to be applied in RUU EBT.

## Strengthening the regulations related to provisions that require biofuel development to prioritise the diversification of raw materials and focus on the utilisation of second-generation biofuel technologies (using waste as a raw material)

In addition to including provisions to comply with sustainability principles in biofuel development, RUU EBT needs to address provisions that promote the use of non-edible and waste or residual raw materials to avoid the urge for additional land areas to meet the demands for food and fuels.

Using non-edible and waste or residual raw materials for biofuel development can minimise the social and environmental impacts of plantation land expansion. Various types of waste or residues have the potential to be used as biofuel raw materials, such as used cooking oil. The European Union, especially after the Renewable Energy Directive II was enforced, started to use waste cooking oil on a large scale for biofuel development.<sup>30</sup> Likewise, this can potentially be implemented in Indonesia. There is a considerable amount of used cooking oil that can be collected from households, restaurants, and food processing waste, which

potentially amounts to 715 kilotons if collected and can be converted into 651 kilotons of Biodiesel and 608 kilotons of Green Diesel.<sup>31</sup>

Used cooking oil as a biofuel raw material offers several advantages, such as lowering up to 6 million tons of GHG emissions, reducing soil pollution, saving subsidy costs up to IDR 3.6 trillion, and even saving 321 thousand hectares of forests per year from oil palm expansion.<sup>32</sup>

Besides used cooking oil, residues from palm oil production can also be used as an alternative for biofuel development in Indonesia, particularly *Cellulosic Ethanol*. Currently, oil palm residues like trunk, empty fruit bunch, and mesocarp fibres remain unused. Zhou, et al. (2020) mentioned that the Indonesian palm oil industry produces a remarkable volume of oil palm biomass residue, which is more than sufficient to support numerous commercial-scale biofuel plants.

Commodity	2018 Yield (Million Tons)	Agricultural Residue	Amount of Residue (Million Tons)	Cellulosic Ethanol (Billion Litres)
Rice	83	Straw	151	40
Corn	30	Corn stover	31	10
Sugarcane	21.2	Sugarcane bagasse	8	2

**Source:** Zhou, Yuanrong, et al. 2020. Analisis Tekno-Ekonomi Pemanfaatan Cellulosic Ethanol di Indonesia yang Berasal dari Limbah Kelapa Sawit. ICCT White Paper

<sup>30</sup> Grinsven, et al. 2020. Used Cooking Oil as Biofuel Feedstock in the EU. CE Delft.

<sup>31</sup> Krustiana, Baldino, & Searle. 2022. Current Collection and Potential for Used Cooking Oil from Major Asian Exporting Countries. ICCT (in press).

<sup>32</sup> Katadata. 2021. Menakar Peluang Pemanfaatan Minyak Jelantah untuk Biodiesel. Accessed from <https://katadata.co.id/timrisetdanpublikasi/analisis-data/5ff67457daed7/menakar-peluang-pemanfaatan-minyak-jelantah-untuk-biodiesel> on 11th of January 2022.

Residues from other commodities also have a promising potential to be used as a biofuel, particularly *Cellulosic Ethanol*. In Indonesia, residues like rice straw, corn stover, and sugarcane bagasse can produce approximately 40 billion litres, 10 billion litres, and 2 billion litres of biofuel, respectively.<sup>33</sup>

Besides residues, non-food plant-based biofuel raw materials like tamanu (*Calophyllum inophyllum*), karanja (*Pongamia pinnata*), *Pongamia*<sup>34</sup>, and Philippine tung (*Reutealis trisperma*) can be used as alternatives in meeting the increasing demands for biofuels. Those raw materials can be produced by utilising degraded lands that are not used for food production, carbon sequestration, and biodiversity conservation.<sup>35</sup> Moreover, Philippine tung and tamanu can be cultivated

through agroforestry<sup>36</sup> that combines forest management with commodity development, which is much more environmentally friendly than large-scale monoculture-plantation development.

The drafting of RUU EBT is a strategic opportunity for Indonesia to accelerate the transition from fossil fuel to renewable energy sourced from its abundant natural resources. By including provisions that encourage the fulfillment of sustainability principles in biofuel development and diversification of biofuel raw materials, RUU EBT can be a policy instrument to step up Indonesia's efforts in achieving energy independence and mitigating climate change impacts, which significantly affect the safety and prosperity of Indonesian people today and in the days to come.

---

<sup>33</sup> Zou, Yuanrong, et al. 2020. Analisis Tekno-Ekonomi Pemanfaatan Cellulosic Ethanol di Indonesia yang berasal dari Limbah Kelapa Sawit. ICCT White Paper.

<sup>34</sup> T. Hasnah et al., "Pongamia as a Potential Biofuel Crop: Oil Content of Pongamia pinnata from the Best Provenance in Java, Indonesia," 2020 International Conference and Utility Exhibition on Energy, Environment, and Climate Change (ICUE), 2020. Pp.1-6, doi: 10.1109/ICUE49301.2020.9307094.

<sup>35</sup> Jaung, Wanggi, et al. 2018. Spatial Assessment of Degraded Lands for Biofuel Production in Indonesia. Sustainability 2018, 10, 4595; doi: 10.3390/su10124595

<sup>36</sup> Siti Maimunah et al. 2018. Assessment of Suitability of Tree Species for Bioenergy Production on Burned and Degraded Peatlands in Central Kalimantan, Indonesia. Land, 7, 115; doi: 10.3390/land7040115.

## References

- Ahsinin, Adzkar., Karunian, Alia Yofira., Fuad, Muhammad Busyrol. 2020. Policy Brief. Menempatkan PT Pertamina (Persero) sebagai Aktor Kunci dan Teladan dalam Penghormatan HAM dan Perlindungan Lingkungan: Pengembangan Kebijakan Biofuel sebagai Modalitas dalam Mewujudkan Produk Biofuel yang Berkelanjutan. Jakarta: Elsam.
- Analisis Madani, 2021.
- Analisis Spasial Madani, 2021.
- Balch, O. 2015. Indonesia's Forest Fires: Everything You Need to Know. The Guardian. Source: <https://www.theguardian.com/sustainable-business/2015/nov/11/indonesia-forest-fires-explained-haze-palm-oil-timber-burning>
- Carbon Disclosure Project. 2021. Seberapa Hijaukah Bahan Bakar Nabati (Biofuel)? Memahami Risiko dan Lanskap Kebijakan di Indonesia.
- Consortium for Agrarian Reform. 2020. Catatan Akhir Tahun 2020 Konsorsium Pembaruan Agraria, Edisi Peluncuran I: Laporan Konflik Agraria di Masa Pandemi dan Krisis Ekonomi.
- Galih Andreanto. 2014. Bias Arah Reforma Agraria Jokowi-Jusuf Kalla. Jurnal Land Reform, Consortium for Agrarian Reform.
- Gaveau, David., et al. 2021. Slowing Deforestation in Indonesia Follows Declining Oil Palm Expansion and Lower Oil Prices. Research Square, DOI: <https://doi.org/10.21203/rs.3.rs-143515/v1>. Accessed from <https://www.cifor.org/knowledge/publication/8010>
- Grinsven, et al. 2020. Used Cooking Oil as Biofuel Feedstock in the EU. CE Delft.
- IESR. 2021. Critical Review on the Biofuel Development Policy in Indonesia. Jakarta: IESR.
- Jaung, Wanggi, et al. 2018. Spatial Assessment of Degraded Lands for Biofuel Production in Indonesia. Sustainability 2018, 10, 4595; doi: 10.3390/su10124595
- Katadata. 2019. Perbandingan Produktivitas Lahan Sawit Berdasarkan Kepemilikan Lahan. Accessed from <https://databoks.katadata.co.id/datapublish/2019/11/28/perbandingan-produktivitas-lahan-sawit-berdasarkan-kepemilikan-lahan> on 11th of January 2022.
- Katadata. 2021. Menakar Peluang Pemanfaatan Minyak Jelantah untuk Biodiesel. Accessed from <https://katadata.co.id/timrisetdanpublikasi/analisis-data/5ff67457daed7/menakar-peluang-pemanfaatan-minyak-jelantah-untuk-biodiesel> on 11th of January 2022.
- Koaksi Indonesia. 2018. Dinamika Hulu Hilir Industri Biodiesel di Indonesia. Jakarta: Koaksi Indonesia.
- Krustiana, Baldino, & Searle. 2022. Current Collection and Potential for Used Cooking Oil from Major Asian Exporting Countries. ICCT (in press).
- Lee, R.A., & Lavoie, J.M. 2013. From First to Third Generation Biofuels: Challenges of Producing a Commodity from a Biomass of Increasing Complexity. Animal Frontiers, Volume 3, Issue 2, April 2013, Pages 6-11, <https://doi.org/10.2527/af.2013-0010>
- LPEM UI. 2020. Risiko Kebijakan Biodiesel dari Sudut Pandang Indikator Makroekonomi dan Lingkungan. Jakarta: LPEM UI.
- Malins, C. 2018. Driving Deforestation: The Impact of Expanding Palm Oil Demand through Biofuel Policy. London. Source:

[http://www.cerulogy.com/wp-content/uploads/2018/02/Cerulogy\\_Driving-deforestation\\_Jan2018.pdf](http://www.cerulogy.com/wp-content/uploads/2018/02/Cerulogy_Driving-deforestation_Jan2018.pdf)

Malley, Jane., et al. 2021. Air Quality Impacts of Palm Biodiesel in Indonesia. ICCT White Paper. Ministry of Environment and Forestry. 2021. Indonesia Long-Term Strategy for Low Carbon and Climate Resilience 2050. Jakarta: Ministry of Environment and Forestry.

Ministry of Environment and Forestry. 2021. Laporan Inventarisasi Gas Rumah Kaca (GRK) dan Monitoring, Pelaporan, Verifikasi (MPV) Tahun 2020. Jakarta: Ministry of Environment and Forestry. Accessed from: [http://ditjenppi.menlhk.go.id/reddplus/images/adminppi/dokumen/igrk/LAP\\_igrk2020.pdf](http://ditjenppi.menlhk.go.id/reddplus/images/adminppi/dokumen/igrk/LAP_igrk2020.pdf).

Moffitt, Lauren. 2021. Indonesia to Push Back B40 Rollout to 2025: MEMR. Accessed from <https://www.argusmedia.com/en/news/2278871-indonesia-to-push-back-b40-rollout-to-2025-memr> on 11th of January 2022.

Palm Oil Moratorium Coalition. 2019. Implementasi Inpres Moratorium Sawit: Jauh Panggang dari Api?

Prasad, S., & Ingle, A.P. 2019. Impacts of Sustainable Biofuels Production from Biomass. Sustainable Bioenergy, Advances and Impacts, Pages 327-346, DOI: <https://doi.org/10.1016/B978-0-12-817654-2.00012-5>.

Rahmadi, Arie., Aye, Lu., Moore, Graham. 2013. The Feasibility and Implications for Conventional Liquid Fossil Fuel of the Indonesian Biofuel Target in 2025. Energy Policy, Volume 61, Pages 12-21.

Sawit Watch. 2014. Kaleidoskop Perkebunan Sawit 2014: Tugas Menyelesaikan Warisan Konflik di Sektor Perkebunan Sawit. Tandan Sawit Edisi No. 8/ Desember 2014.

Sawit Watch. 2018. Lembar Fakta Perlindungan Buruh Sawit Indonesia. <https://sawitwatch.or.id/2018/04/18/lembar-fakta-perlindungan-buruh-sawit-indonesia-2018/>

Siti Maimunah et al. 2018. Assessment of Suitability of Tree Species for Bioenergy Production on Burned and Degraded Peatlands in Central Kalimantan, Indonesia. Land, 7, 115; doi: 10.3390/land7040115.

T. Hasnah et al., "Pongamia as a Potential Biofuel Crop: Oil Content of Pongamia pinnata from the Best Provenance in Java, Indonesia,". 2020 International Conference and Utility Exhibition on Energy, Environment, and Climate Change (ICUE), 2020. Pp.1-6, doi: 10.1109/ICUE49301.2020.9307094.

Taylor, R. 2014. Advanced Biofuel Feedstocks: An Assessment of Sustainability. E4tech.

The World Bank. 2016. The Cost of Fire: An Economic Analysis of Indonesia's 2015 Fire Crisis. Jakarta. Source: <http://pubdocs.worldbank.org/en/643781465442350600/Indonesia-forest-fire-notes.pdf>

Tim Nasional Pengembangan Bahan Bakar Nabati untuk Percepatan Pengurangan Kemiskinan dan Pengangguran. 2006. Blueprint 2006-2025 Pengembangan Bahan Bakar Nabati untuk Percepatan Pengurangan Kemiskinan dan Pengangguran. Jakarta: Tim Nasional Pengembangan Bahan Bakar Nabati untuk Percepatan Pengurangan Kemiskinan dan Pengangguran.


Tinhout, B. 2016. Towards Sustainable Palm Oil. Wetlands International. Source: <https://www.wetlands.org/casestudy/towards-sustainable-palm-oil/>

Traction Energy Asia. 2019. Greenhouse Gas Emissions from biodiesel Production in Indonesia Based on Lifecycle Analysis. Jakarta: Traction Energy Asia.


Zou, Yuanrong, et al. 2020. Analisis Tekno-Ekonomi Pemanfaatan Cellulosic Ethanol di Indonesia yang berasal dari Limbah Kelapa Sawit. ICCT White Paper.

### **Acknowledgement:**

We would like to thank Tenny Kristiana from The ICCT for her valuable reviews that enabled us to write this policy brief comprehensively and thoroughly.

 [@madaniberkelanjutan.id](https://www.instagram.com/madaniberkelanjutan.id)

 [@yayasanmadani](https://twitter.com/yayasanmadani)

 [Madani Berkelanjutan](https://www.facebook.com/MadaniBerkelanjutan)

 [www.madaniberkelanjutan.id](http://www.madaniberkelanjutan.id)