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Green Bond: Financing Alternative for UCO Based Biodiesel Industry

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Abstract

Along with the growing demand of biodiesel, the unlocking potential for using Used cooking oil (UCO) as feedstock, and the abundant amount of UCO, make their utilization becomes relevant. However, such efforts were constrained by economic scales issue, due to supply chain and financing problems. This paper aims to provide references regarding the feasibilty of UCO-based biodiesel project and its financing schemes through green bond. The main focus of this paper's discussion includes project feasibility, business model, and analysis of green bond issuance in financing the industry. The study was carried out by performing integrative literature review method on project feasibility studies in several countries, business model performed in several region, as well as framework and regulation regarding green bonds in Indonesia. Based on the analysis, it can be concluded that the UCO-based biodiesel project is financially and economically feasible to be scaled up. Subseuently, the business model of this industry is fulfilling the green criteria and is eligible to be financed through green bond. Future study regarding the spatial mapping and technical assessment upon the transformation of existing facilities into UCO based biodiesel plants is immensely prominent.

Key words : Green bond, Used cooking oil, UCO, Biodiesel

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INTRODUCTION

The Indonesian government's commitment to addressing climate change has been demonstrated by ratifying the Paris Agreement to the United Nation Framework Convention on Climate Change in Law Number 16 Year 2016. The government's commitment is to reduce green house gas (GHG) emissions by 834 million tons of CO2e (or around 29%) in 2030, where the energy sector owns a portion of reduction target in as much of 314 million tons of CO2e (*Kementerian ESDM*, 2019). Increasing renewable energy proportion within the energy mix has become one of the mitigations in reducing GHG emissions in the energy sector. This has particularly been regulated in Government Regulation (PP) Number 79 Year 2014, where the use of new and renewable energy (RE) will reach at least 23% and 31% in 2025 and 2050, and the share of petroleum will be reduced gradually to only 25% and 20% in 2025 and 2050 from the primary energy mix (Government of Republic of Indonesia, 2014).

Diverse efforts have been made in response to augmenting renewable energy's apportionment in Indonesia, one of which is the production and application of biofuels. This is in accordance with Article 12 of PP Number 79 Year 2014, where the use of biofuels, biomass and waste is part of the national energy resource utilization strategy. Furthermore, article 19 paragraph (3) letter b of the PP stipulates that the supply and the consumption of energy must minimize waste production, need to use, or extract benefits from waste. Referring to these provisions, the use of used cooking oil (UCO) as raw material to generate biodiesel becomes exceptionally relevant.

Biodiesel is type of fuel used to fuel diesel engines, which is generated from vegetable oil that has undergo through a chemical process (Widyarini, 2022). Concomitant with the government's target in energy mix through the mandatory biodiesel program (B10, B20, B30), the adoption of biodiesel in Indonesia has experienced an upward trend over time. In 2017, domestic biodiesel utilization was 3.42 million kL and surged to 9.3 million kL in 2021 (Katadata, 2022). This can be discerned from the following domestic biodiesel usage during 2017-2022 data (Figure 1).

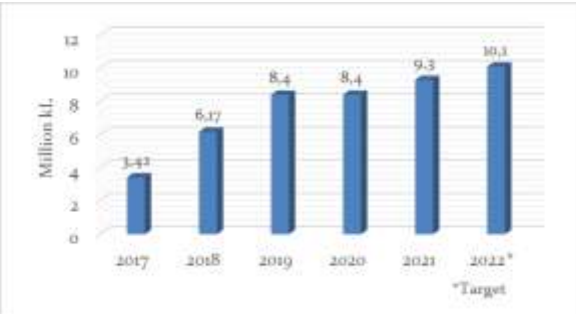

Figure 1. Domestic Biodiesel Utilization, 2017 - 2022
Source: Databoks (Katadata, 2022)

The presence of a moratorium on new permits for oil palm land (for example through Presidential Instruction Number 8 Year 2018) further heightens the rationale for UCO adoption, due to meeting the demand for palm oil, both for cooking/ food processing purposes and for biodiesel, it is prioritized not to performed through extensification/ opening new land.

UCO is oil that has commonly been used by the food industry, restaurants and households, and is no longer consumed by humans (Korakaki and Georgakellos, 2014). The implementation of UCO as a raw material in biofuel production possesses manifold benefits, including economic benefits, namely as an affordable and abundant energy raw material (Karmee, Patria and Lin, 2015; Geng et al., 2019), the ability to save subsidies for palm oil-based biofuels (Kharina et al., 2018), as well as plays a role in generating employment (Sheinbaum-Pardo, Calderón-Irazoque and Ramírez-Suárez, 2013; Moecke et al., 2016; *Kementerian ESDM*, 2020b; Perdana, 2021). Apart from that, the use of UCO also has environmental benefit, including reducing the impact/ pollution of used cooking waste disposal in the biosphere (Ripa et al., 2014; Moecke et al., 2016; Kharina et al., 2018; Hartini, Puspitasari and Utami, 2021; Perdana, 2021; Falowo et al., 2022) and reducing GHG emission (Sheinbaum-Pardo, Calderón-Irazoque and Ramírez-Suárez, 2013; Moecke et al., 2016; Hartini, Puspitasari and Utami, 2021; Widyarini, 2022); also owing health benefits by reducing the reuse of used cooking oil in the food processing process (Kharina et al., 2018).

On January 1st, 2020, the Indonesian Government established the mandatory 30% biodiesel (B30) program as a priority to reduce dependence on fossil energy. Taking into account the realization of diesel imports, distribution of biodiesel in 2021, and the assumption of a 5.5% increase in demand, the Ministry of Energy and Mineral Resources estimates that the biodiesel allocation would be 10.1 million kL (*Kementerian ESDM*, 2021b). As the renewable energy mix target intensifies, the demand for biodiesel is also projected to increase.

The use of UCO as a raw material also has a prominent chance of meeting the target of biodiesel demand in Indonesia in terms of availability. Indonesia has actually great potential in terms of UCO availability. However, the amount which can be converted into biodiesel is still limited. Indonesia's cooking oil consumption in 2021 was recorded at 18.42 million tons, of which 8.954 million tons were used for food consumption. Approximately 40-6-% UCO can be generated from palm oil consumption for cooking purpose (*Kementerian ESDM*, 2020a; Perdana, 2021), or roughly 5.37 million tons (around 6.31 million kL). Nonetheless, a study conducted by the National Team for the Acceleration of Poverty Reduction (TNP2K) and Traction Energy Asia which was published in the Press Release of the Ministry of Energy and Mineral Resources, reported that only 3 million kL of UCO were collected, and only 570 thousand kL were converted into biodiesel and other products, while 2.43 million kL were exported or recycled into cooking oil again (TNP2K and Traction Energy Asia, 2020). In fact, referring to the study, by taking into account other sources of used cooking oil (coconut oil, peanut kernels, copra seeds, soybean seeds, palm kernel kernels), the potential availability of UCO exhibiting around 5.7 million kL.

Several obstacles in implementing UCO as feedstock in biodiesel production include institutional problems due to the lack of regulations regarding UCO is among (Perdana, 2021), supply chain problems due to weak UCO collection systems (Geng et al., 2019; Hartini, Puspitasari and Utami, 2021), and sub-optimal attainment of production targets within economies of scale (Kharina et al., 2018). This hurdle occurs due to regulatory issues and insufficient financing. In fact, there are various empirical studies related to financial feasibility and techno-economic feasibility disclosing that the project is worthy to be developed (Singhabhandhu and Tezuka, 2010a; Ahmad, Hermadi and Arkeman, 2015; Al-Sakkari et al., 2020; Farid et al., 2020). Furthermore, there are schemes that serve as potential solutions regarding financing problems, one of which is green bonds.

However, empirical research related to financial feasibility or techno-economic feasibility mostly comes from the results of studies in several countries outside Indonesia. Apart from that, there is still no research in Indonesia on the topic of using Green Bonds which are specifically used to finance the UCO-based biodiesel industry. This is due to limited study on the UCO-based biodiesel industry in Indonesia, which is a newly emerging topic. Likewise, literature on green bonds is mostly discussed only for financing other green industries.

This paper was prepared to explain how green bonds can be used as an alternative financing for UCO-based biodiesel production project or business. The focus of the discussion in this paper is the feasibility of a biodiesel project with UCO as raw material, as well as regulations and green bond issuance schemes.

The aim of this paper is to provide additional reference regarding the feasibility of the UCO-based biodiesel business and financing schemes through green bonds to support the development of the UCO-based biodiesel industry in Indonesia. This is due to an exceptionally limited literatures which focus on this matter, even though green bonds themselves have experienced quite significant growth in Indonesia.

Green bonds are fixed income bonds issued to funds environmentally friendly projects or programs which satisfy certain conditions (ICMA, 2015). The World Bank and European Investment Bank (EIB) first introduced the instrument to finance projects for mitigating climate change. During the development, the green bond market is increasingly promising, as of more and more governments and corporations are issuing green bonds, including Indonesia. In November 2019, the Indonesian Government managed to collect IDR 1,459 trillion through the issuance of the National Savings Sukuk, which was the first retail green Sukuk in the world (*Dirjen Pengelolaan Pembiayaan dan Risiko Kementerian Keuangan RI (DJPPR Kemenkeu RI)*, 2020). On April 2019, Indonesia has attained the top green bond issuance in ASEAN with the value of USD 2.75 trillion (*Sekretariat NDA GCF Indonesia,* 2021). Moreover, according to Bank Indonesia, global green bond issuance in 2021 will reach USD 482 billion (Republika, 2022). The priority sectors that can take advantage of green bonds include sustainable transportation, new/ renewable energy, and sustainable agriculture. Thus, UCO-based biodiesel project is relevant to scrutinize in order to obtain funding from this instrument.

METHOD

This paper was prepared using integrative literature review method to investigate three subjets becoming the main focus of discussion, namely financial feasibility, business model, and financing with green bonds for UCO-based biodiesel projects. Integrative literature review Integrative literature review is a research method by conducting reviews, providing criticism and synthesizing several literatures that represent a topic in an integrated manner (Torraco, 2005). Financing the UCO-based biodiesel indu-stry using Green Bonds is a new perspective on the topic of alternative financing for the biodiesel industry. This is in accordance with the aim of using the integrative literature review method, namely to produce a new perspective on a topic or create an initial conceptualization of a newly emerging topic (Torraco, 2005; Snyder, 2019).

Even though this method can be carried out in various ways, it still must follow the applicable conventions in describing how this research is carried out (Snyder, 2019). Therefore, the methodology used is to identify the literature that has been collected, carry out critical analysis of the literature, create synthesis of the results of the analysis and reporting the results in this study (Torraco, 2005).

The collected data and information consist of the result from previous financial and techno-economic feasibility studies regarding biodiesel projects made of UCO or waste cooking oil (WCO), UCO-based biodiesel business models, and biodiesel industry financing schemes through green bonds in the Indonesian context. For the feasibility study, we utilize results from various countries representing the conditions in developing and developed countries, for obtaining a more comprehensive depiction of UCO-based biodiesel project feasibilty. This stage is the process of identifying the collected literature.

Based on the literature that has been assembled, we carry out a critical analysis of the literature by carefully reviewing the main ideas and analyzing the relationship with the main topic as well as providing criticism in the form of evaluating how well the literature represents the topic being discussed. Based on the critical analysis, we then perform a synthesis to gain a better understanding of the topic. The results of a comprehensive literature synthesis will create a new perspective even though the review summarizes previous research.

RESULT AND DISCUSSION

Financial and Economic Feasibility Study. There are growing research related to technical and technological improvement in the biodiesel production process from UCO to generate product that meet industry standards (Karmee, Patria and Lin, 2015; Falowo et al., 2022), so as business in this field becomes increasingly attractive and has great potency. Apart from the mandatory "green" or environmentally friendly character, the profitability and economic feasibility of the project and the maturity of production techniques/ technology are among the subject matters that were considered by the issuer, so that the green bonds issued are attractive to investors.

As stated in the introduction, there has been a lot of empirical research denoting that biodiesel from UCO is financially, economically, and socially beneficial. As studies concersning the profitability/ financial and techno-economic feasibility of biodiesel projects from UCO in Indonesia on an industrial scale are still limited, we present the results of studies from several countries.

Tabel 1. Summary of Financial and Techno-economic Feasibility of UCO Based Biodiesel Project

Source/ Country	Process	Conversion rate	Capacity	Unit production Cost (/kg biodiesel)	Project year	Profitability			
						PBP (year)	ROI (%)	NPV	IRR%
(Al-Sakkari et al., 2020) Egypt	homogenous Transesterification	95%	7900 ton/yr	USD 1.06/kg		1.7	74.2		83.57
(Karmee, Patria and Lin, 2015) Hongkong	Transesterification	>90%	8000 ton/yr	USD $0.75/kg	15		-		34 (based on $0.36/L UCO price)
(Korakaki and Georgakellos, 2014) Greek	alkaline transesterification	80%	15000 ton/yr		8	2.5 - 5		EUR 4.2 million ($0.75/L biodiesel price)	19 (biodiesel EUR 0.75/L)
(Farid et al., 2020) Malaysia	Transesterification	74.25%	4950 ton/yr	USD 0,47/L	10			USD 1,37 million	62
(Glisic, Pajnik and Orlović, 2016) Serbia	hydrotreating process - incorporated in refinery	96%	100000 ton/yr	$0.631-$0.68/L	10			$7 million	
(Lee, Posarac and Ellis, 2011) Canada	transesterification (Supercritical process)	96%	40000 ton/yr	$0.72/kg or $0.63/L	10	4.2		$21.08 million	49.6
(Kelloway et al., 2013) UK	transesterification		20kg/hr		15			$618k	80
(Cao et al., 2020)	transesterification		7199.28 t/y	$0.41/kg	10	5.47 - 7.8		7,541,880.23	33.51
Iran	2step supercritical		6823.87 t/y	$0.56/kg	10	6 - 7.6		5,199,701.2	35.76

Source: previous empirical studies

From the summary of previous study results in Table 1, it can be noticed that in general, the UCO-based biodoesel project is financially feasible to develop. The UCO-based biodiesel project has a relatively short payback period compared to other infrastructure projects, for example roads, trains, etc. According to the results of previous research, the average project payback time is around 5 years. Whilst internal rate of return (IRR) varies from 19% to 83% with an average of 49.7%. On top of that, Al-Sakkari et al. (2020) predicting that return on investment (ROI) may gain 74%. Per unit production costs of biodiesel are also varied. If we merely employ the latest research data (2020), the average production cost/unit of biodiesel is USD 0.625/kg or around IDR 8,818 (spot rate dated 3 December 2020 is IDR 14,110).

By observing the biodiesel production costs determined periodically by the Director General of EBTKE of the Ministry of Energy and Mineral Resources in the Biofuel (BBN) Market Index Price (on December 3rd, 2020), we find that the market index price is IDR. 9,505 plus transportation costs. It means that by considering the Indonesian biodiesel market index, biodiesel production from UCO is feasible accordingly.

Subsequently, according to the previous studies, the profitability of the biodiesel business using UCO as feedstock is extremely sensitive to UCO price itselves. (Karmee, Patria and Lin, 2015; Glisic, Pajnik and Orlović, 2016; Lee et al., 2020), production capacity (Glisic, Pajnik and Orlović, 2016), and selling price of biodiesel (Kelloway et al., 2013). Thus, the design of production facilities and cost efficiency in collecting raw materials (UCO) are absolutely crucial (Sheinbaum-Pardo, Calderón-Irazoque and Ramírez-Suárez, 2013).

Proposed UCO Based Biodiesel Business Model. For the UCO-based biodiesel business to be feasible to be financed by expl-oiting green bonds, readiness must first be assessed in terms of the business model. In general, the UCO-based biodiesel business model is divided into three activity stages, namely UCO collection as biodiesel raw mate-rial, processing of UCO into biodiesel, and sales of biodiesel. The UCO-based biodiesel business model can be depicted in the follo-wing chart (figure 2).

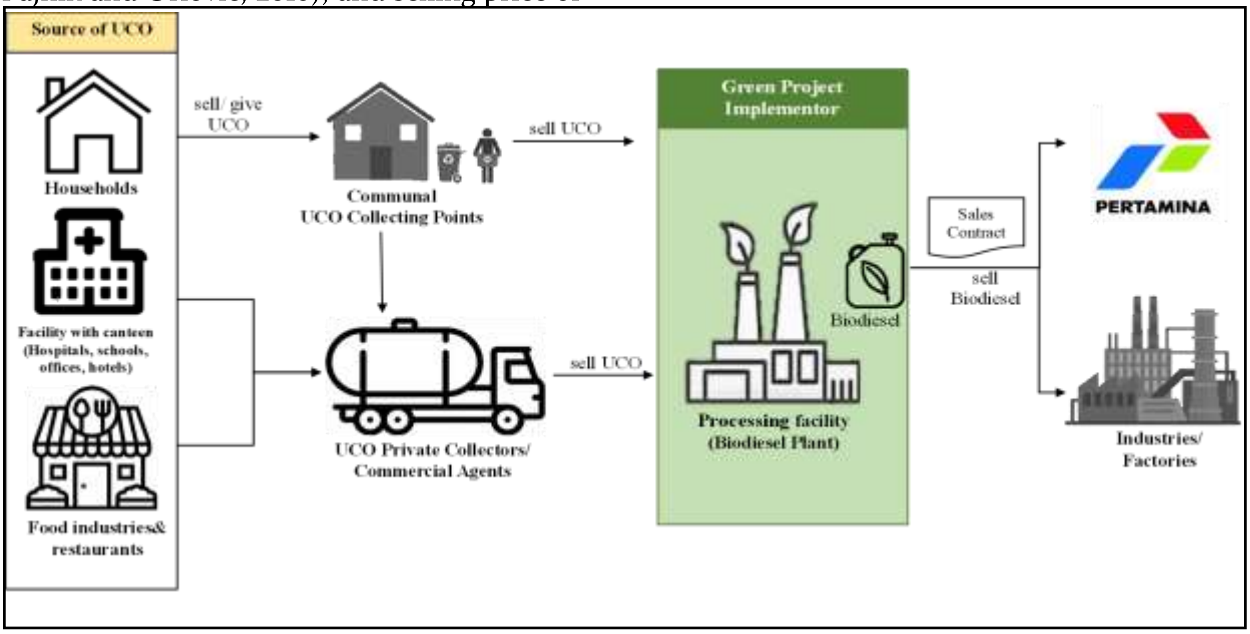

Figure 2. Business Model for UCO Based Biodiesel Project

The UCO used as raw material here is limited to palm oil-derived UCO because its availability in Indonesia is quite abundant. Based on its origin, UCO can be obtained from the three largest sources, specifically from households, the food and restaurant industry, and public facilities with canteens (for example hospitals, schools, offices and hotels) (Kharina et al., 2018). With this circumstance, there are different collection strategies that can be applied. Commonly, large-scale UCO-genera-ting entities such as the food industry and hosp-itals can sell or provide UCO to agents or colle-ctors (Zhang and Jiang, 2017; Perdana, 2021). Meanwhile, based on existing best practices, household UCO-collection can be done through public collection points in places that are easily accessible to residents (European Biomass Indu-stry Association, 2015; Dubey, Prasad and Singh, 2020; Rahman et al., 2020; Hartini, Puspitasari and Utami, 2021), for instance at the collection point of each region, canteen, school, superm-arket, or, other public facilities (Singhabhandhu and Tezuka, 2010b; Syahdan, Arkeman and Wij-aya, 2017; Kharina et al., 2018; Loizides et al., 2019). To be more effective, UCO collection poin-ts should be focused in densely populated areas (Sheinbaum-Pardo, Calderón-Irazoque and Ra-mí-rez-Suárez, 2013; Hartini, Puspitasari and Ut-ami, 2021) and optimize the use of mobile app-lications (Perdana, 2021). Based on survey cond-ucted by Hartini, Puspitasari and Utami (2021), inhibitants are willing to take UCO to the colle-ction point if the distance from their residence does not exceed 2 km. Apart from that, the colle-ction point administrator can sell the collected UCO to agents/ collectors (Kharina et al., 2018; Rahman et al., 2020) or directly to the nearest biodiesel project facility. Furthermore, there is a large body of literature regarding UCO collection systems and governance (Moecke et al., 2016; Syahdan, Arkeman and Wijaya, 2017; Loizides et al., 2019; Goh et al., 2020; Hartini, Puspitasari and Utami, 2021) which can be used as reference for Indonesia.

Because the UCO-based biodiesel industry is still in the early stages of growth, to protect the industry players, the government can determine domestic and export price limit for UCO. This se-lling price component should include the trans-portation costs and margin expected by the age-nt/ collector.

The following stage is the activity of processing UCO into biodiesel. It can be carri-ed out using certain methods, inter alia ultra-sonic and microwave (Mohammadshirazi et al., 2014); also transesterification (Ma and Ha-nna, 1999; van Kasteren and Nisworo, 2007; Mohammadshirazi et al., 2014; Mukherjee, 2014; Tapanwong and Punsuvon, 2019; Al-Sakkari et al., 2020; Dubey, Prasad and Singh, 2020; Goh et al., 2020). In its progress, the transesterification process was more comm-only used (Farid et al., 2020). Transesterific-ation is a chemical process between trigly-cerides within oil or fat with alcohol, which forms biodiesel and glycerol, by utilizing cata-lyst. (Ma and Hanna, 1999; Tapanwong and Punsuvon, 2019). The catalyst employed can be in form of alkali, acid, or enzyme, although enzymes require a longer reaction time (Sing-habhandhu and Tezuka, 2010a), and much more expensive (Al-Sakkari et al., 2020) compared with acid and alkali. There are four main types of facilities for biodiesel (fatty acid methyl ester) production using a homogeno-us transesterification process. The first is the reaction facility as place for UCO to react with alcohol and a catalyst; secondly is gravity separator or tool to separate biodiesel and gly-cerol; the third is the refining unit, where the raw biodiesel is refined and purified until its purity meets industry standards; and fourth is an isolated storage tank where pure biodiesel is sto-red and additives are added for enhancing its stability (Al-Sakkari et al., 2020). Prior to the beginning of the production process, UCO may require pre-treatment facilities before entering the production process, depending on the raw materials collected. If the FFA content in the raw material is high, this can reduce the quality of the biodiesel produced, thus entails an impurity cle-aning process at the preparation stage (Kharina et al., 2018). Then supporting facilities are also required in the form of a glycerin purification unit if biodiesel production also produces a by-product in the form of glycerin, as well as waste processing facilities.

The next phase in the business operation is product sales (pure biodiesel and glycerin). For the Indonesian context, potential buyers consu-ming this product on a large scale are Pertamina, and industrial areas requiring biodiesel. Regar-ding this, UCO-based biodiesel producers can enter sales and purchase agreement with Perta-mina or companies in nearby industrial areas. The government, in this case is the Ministry of

Energy and Mineral Resources (ESDM) together with the Indonesian Biofuel Producers Association (APROBI), in the future can coordinate and serve as facilitators in UCO-based biofuel trading mechanism between producers and Pertamina and manufacturer in the nearest industrial area or within the area of a biodiesel-based factory.

According to Ministry of ESDM (*Kementerian ESDM*, 2021), there exist approximately 25 of biofuel industry players in Indonesia who have joined the Indonesian Biofuel Producers Association (APROBI), where 24 produce biodiesel, while one provides bioethanol. Subsequently, there are 29 biodiesel factories in Indonesia with a total of 13,432,032 kL production capacity, of which 58% are located in Sumatra, 23% are in Java, 15% are in Kalimantan, and the rest are in Sulawesi (*Kementerian ESDM*, 2021a). This is reasonable as the factories are normally close to the location of the main ingredient, specifically palm oil, which is mostly located in Sumatra.

The use of UCO as biodiesel feedstock implies a change in the orientation in terms of factory location selection, where it is no longer closer to oil palm plantations or palm oil producers, but rather adjacent to the source of UCO. The UCO-based biodiesel factories or processing facilities must be located not far from urban or densely populated areas. It is considered as a movement towards efficiency in transportation costs because more UCO is produced by the region counted as a pocket or source of UCO. Bearing in mind that there are several palm oil-based biodiesel factories operating in several big cities, mapping and technical studies regarding the transformation process of existing units or facilities may then be carried out, given that the production feedstock is to be shifted from palm oil to UCO, in accordance with the location of UCO source and biodiesel users.

Fulfillment of Green Criteria from Green Bond. ICMA defines Green Bonds as any type of bond instrument whose proceeds will be used exclusively to fund or refinance, partially or fully, new establishment and/ or existing green projects that meet the requirements (according to predetermined criteria) and that are aligned with the four core components of the Green Bond Principle (GBP) (ICMA, 2022). The first of the four core components of GBP are '*Use of Proceeds*' which requires that all projects that meet the criteria in the guideline must have clear and assessable environmental benefits so that they can be measured by the issuer.

One of the criteria or program considered a green project is a renewable energy (RE) program that includes production, transmission, equipment, and products (ICMA, 2022). RE is an alternative sort of energy that may overcome environmental problems arising from the provision of non-renewable energy. RE attempts to apply existing natural resources such as wind, sun, rivers/ water streams, oceans, and bioenergy to produce energy. OJK Regulation Number 60 Year 2017 also defines renewable energy as an energy source generated from sustainable energy resources if managed properly, including geothermal heat, wind, bioenergy, sunlight, water flows, and waterfalls, as well as the movement and temperature differences of the ocean layers.

Bioenergy is one of the renewable energy sources. The Climate Bond Initiative (CBI) defines bioenergy as energy produced from the conversion process of solid, liquid, and gaseous materials originating from biomass (Climate Bond Initiative, 2022). Regarding this, biodiesel is included in bioenergy criteria. This is due to the fuel from vegetable oil that has undergone several chemical processes in order that it can be used as diesel engine fuel (Widyarini, 2022). As previously explained, this financing will be used to fund business activities/ projects related to biodi-esel production. It can be said that biodiesel is a sort of bioenergy and is included in the criteria for green projects satisfying the requ-irements for the issuance of Green Bonds. This is also in line with OJK Regulation num-ber 60 Year 2017 postulating that renewable energy is included in business and/or other activities that are Green Bonds financeable.

However, another matter that needs to be highlighted from the first component is that the green project must have benefits for the environment. The green project discussed in this study is the production of UCO-based biodiesel. The use of UCO as a raw material has implications for reducing the use of palm oil as feedstock, thus this provides very substantial environmental benefits. Kharina et al. (2018) suggests that when UCO collection can be maximized for biodiesel production, it may replace the use of 2.4 billion liters of CPO-based biodiesel, then it potentially reduces greenhouse gas emissions by 11.5 million tons of CO_2e per year accordingly. Other advantages of using biodiesel as transportation fuel are the attainment of energy independence, improved air quality, and reduced CO_2 emissions (Dahman et al., 2019). Based on these studies, it is noted that the environmental benefits obtained from the Biodiesel Manufacturing project are one of the mitigations related to the effects of greenhouse gases.

The environmental benefits of the biodiesel project can be an additional criterion in the selection and evaluation process for a project to be financed by Green Bonds. Thus this also fulfills the requirements for the second component of the Green Bond Principle, viz the project evaluation and selection process (ICMA, 2022). Hereafter, corresponding to the green project criteria and the environmental benefits obtained, the company can develop a framework for issuing Green Bonds (Asian Development Bank, 2021).

Barriers to Green Bond issuance in Indonesia. Based on a survey done by ADB (2022), there are three main obstacles for companies or investors to issue Green Bonds in Indonesia. These hindrances are a lack of knowledge or awareness about green bonds, additional procedures and issuance costs compared to conventional bonds, and the absence of technical policy guidelines from regulators. These obstacle have actually become issues in the global world, as the result of Green Finance Study Group's research (Ma et al., 2016) suggesting that the barriers to increasing green bonds are a lack of awareness concerning the benefits of green bonds, insufficiency in knowledge regarding the definition of green bonds, and the substantial costs for meeting green bond requirements.

The first impediment is the lack of knowledge or awareness about green bonds, denoting that the benefits of Green Bonds have not been clearly articulated and bond issuers have not yet been assured of the benefits of Green Bonds emission (ADB, 2022). The emitents are assured that the issuance of thematic bonds such as green bonds is more complex than conventional bonds and does not provide substantial additional benefits. This problem also exists in several other countries, such as inadequacy of comprehension among issuers, investors, policymakers, and regulators regarding the potential benefits of green bonds, and even some financial professionals may have never heard of green bonds (Ma et al., 2016).

The second obstacle is that there are additional procedures and extra issuance costs compared to conventional bonds, which is problematic, especially if the entity that would have been the issuer is a small company or one that has not yet gained substantial economic scale. Most biodiesel enterprises in Indonesia are currently still producing below the economic scale or below their production capacity (Kharina et al., 2018). Projects related to renewable energy are usually small-scale with high transactional costs, causing funding from banks difficult (Azhgaliyeva, Kapoor and Liu, 2020). However, if an enterprise wants to obtain funds from the financial markets, it will be hurdled by additional costs related to issuance and additional compliance procedures that must be performed.

The additional issuance costs arises because OJK regulation declares that business activities and/or other activities which become the basis for the issuance of green bonds must obtain an opinion or assessment from an Environmental Expert, so costs are required related to this. Furthermore, based on this OJK regulation, the exertion of Environmental Experts is done not only when registering a green bond public offering, but also when preparing a Review Results Report periodically (once a year). Thus the environmental expert fees will also be an additonal burden for green bond issuers each year. Additional compliance procedures set in OJK regulation require green bond issuers to make two types of reports, namely Review Reports from Environmental Experts and Reports on the Use of Public Offering Proceeds. The obligation to generate those reports can be an additional administrative and procedural burden for issuers because they must incur additional costs and procedures to comply with the regulation.

However, this rule actually follows common practice in the international world, which is the obligation of green bond issuers to make continuous reporting, viz reporting related to the issuance and use of green bond funds in accordance with the main principles in the GBP (ICMA, 2022). This aims to ensure and provide the latest information regarding the use of funds obtained from the green bonds yearly (OJK, 2016). Besides, sustainability reporting can be used to prevent greenwashing practices of green bonds, viz an act carried out with the aim of misleading investors, by providing the impression that the investment is in line with its sustainability goals. Such practice occurs often because issuers have unilaterally labeled their bonds as environmentally friendly products without any preference for investors to carry out independent assessment and to scrutinize the label's true notion (Rumpf, 2019; Freeburn and Ramsay, 2020).

Green Bond Funding Scheme. The financing scheme that will be analyzed is the one with Green Bonds issued by financial institutions. This scheme wass chosen because in Indonesia, financial institutions (including banks) are currently become the largest Green Bond issuers - apart from the Indonesian Government. The financial institutions that have issued large amounts of green bonds in Indonesia are Bank Rakyat Indonesia, Bank Mandiri, Bank Negara Indonesia and PT. Multi Infrastructure Facilities. This is also in line with the results of a survey conducted by ADB (2022) in Indonesia indicating that the majority of issuers of Green Bonds operate in the financial, real estate, and industrial sectors; whilst issuers whose business is in energy, consumer, technology, and transportation sectors are relatively few.

Either the causes of the phenomenon is that small and medium-scale companies do not have access to the green bond issuance process due to their small-economic scale capabilities and limited credit absorption abilities (Chang, 2019). UCO-based biodiesel companies in Indonesia are currently still producing below the economic scale or under their production capacity. Kharina et al. (2018) in The International Council on Clean Transportation (ICCT) Report explicates that in 2018 there were less than ten UCO-based biodiesel producers in Indonesia with an estimated total annual capacity of 5.3 million liters. This biodiesel company is still producing below its capacity, due to limited feedstock supplies and lack of production facilities development funds. The UCO Lengis Hijau for instance, is one biodiesel company with 1.1 million liters production capacity per year, but only gene-rates an average of 572,000 liters per year. Another example is Genoil, which has a produ-ction capacity of 1.46 million liters per year but only yields 511,000 liters of UCO biodiesel per year (Kharina et al., 2018). It reveals that projects related to renewable energy are yet small in scale and their transaction costs are consid-erably high, making bank-sourced funding difficult while access to financial markets is also limited (Azhgaliyeva, Kapoor and Liu, 2020).

Built upon that, a financing scheme with Green Bonds issued by financial institutions is the main choice for financing UCO-derived biodiesel industry. Financial institutions are considered to have adequate capacity both in terms of capital and human resources (ADB, 2022). Capable human resources are needed since issuing Green Bonds requires technical skills for monitoring and assessment of the funding during the project life cycle, while capital is required to overcome market obstacles in the form of a minimum bond value that must be covered by green bonds to make them attractive to underwriters (Banga, 2019). Many green proje-cts such as UCO-based biodiesel businesses are still marginal in scale and do not meet the minimum size required by investors for green bond transactions.

The Green Bonds funding scheme issued by financial institutions can be described as follows (figure 3).

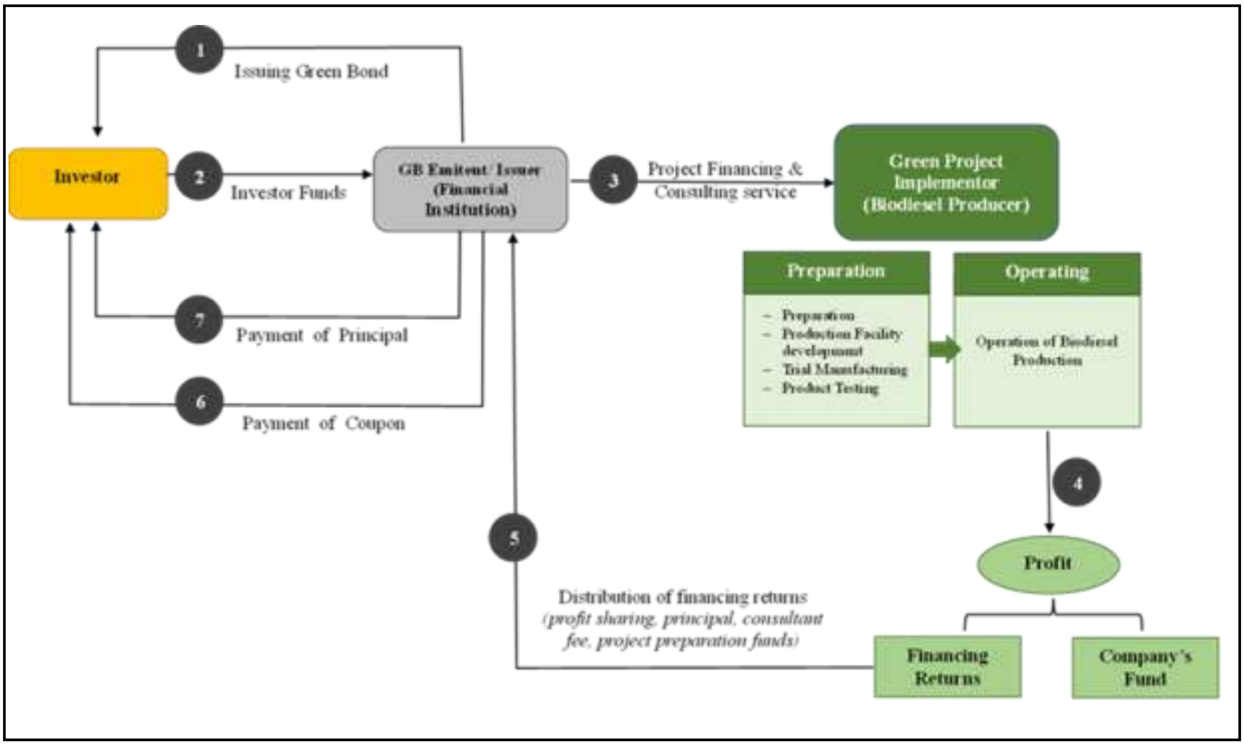

Figure 1. UCO-Based Biodiesel Project Financing Scheme via Green Bon

First, the bank or financial institution as the issuer would offer Green Bonds on the financial market. Afterward, investors purchase Green Bonds with the result that their funds flow to financial institutions/ green bond issu-ers. The issuer will then channel the funding to projects that have passed the selection and evaluation as green projects that are Green Bonds financeable. UCO-based biodiesel prod-uction is categorized as a green project that can be financed by Green Bonds. The issuer also provides consulting services to green project implementors so that the project is always on track throughout its lifecycle. In the following phase, the funds received by the biodiesel producers are used to develop facilities and start biodiesel production activities, where margin can be obtained from those operational activities ultimately. A portion of business profits will then be returned to the issuer as a form of profit sharing or interest payments according to the agreement made. The issuer's onus to pay coupon in each period is in accordance with the agreement with the investor. Another issuer's obligation is to pay off the principal value of the green bond at the end of the funding period.

Based on the above scheme, it can be viewed that there are mutually beneficial cooperations among the involving parties, especially between bond issuers from financial institutions and project implementors or UCO-based biodiesel producers. Producers are able to access the funding to carry out their business activities and may overcome barriers related to capital and access to the Green Bond market, also are able to surmount additional costs incurred in green bond issuance as well as technical deficiencies in human resources (Banga, 2019). From the side of a bank or financial institution, this can improve the company's reputation as an entity with sustainable economic policies demonstrated with the commitment to improving environmental preservation (Ma et al., 2016).

CONCLUSION

The application of UCO as a raw material for biodiesel is considered as an effort to mitigate climate change. This is because in addition to providing economic benefits, the use of UCO also provides social benefits (creation of jobs), health merit (reducing the reuse of used cooking waste for food processing), and environmental benefit (reducing pollution due to disposal of UCO).

The UCO-based biodiesel project is empirically feasible and profitable to develop, both financially and economically. Based on the results of previous studies, the payback period (PBP) for this project is relatively short, ranging from 1.7 to 7 years, with an average PBP of 5 years. Internal rate of return (IRR) varies from 19% to 83% with an average of 49.7%. The project is also feasible when observed from production costs per unit because it has a lower market index price than CPO-based biodiesel.

According to the Ministry of Energy and Mineral Resources, there are 29 biodiesel factories with a total capacity of 13 million kL, of which 58% are located in Sumatra, and 23% in Java. Some of these factories or facilities can be transformed into UCO-based biodiesel production units, thus further mapping and technical studies are in demand.

UCO-based Biodiesel production is qualified as a project or activity which can be financed by Green Bonds according to the green project criteria described in the Green Bond Principle and OJK Regulation Number 60 Year 2017. This is because biodiesel is inclusive in the Renewable Energy category which is derived from bioenergy. Besides, UCO-based biodiesel also benefits the environment in terms of reducing greenhouse gas emissions as a consequence of the palm oil usage in biodiesel production. This can be categorized as a climate change mitigation effort.

Nevertheless, the issuance of Green Bonds has several main obstacles, namely lack of public's knowledge or awareness concerning green bonds; ancillery procedures and extra issuance costs compared to conventional bonds; also, the absence of policy guidelines from regulators. On top of them, the UCO-based biodiesel industry in Indonesia has another restraint, because producers still generate their output below the economic scale or under their production capacity. This makes the companies become more difficult to seek funding from banks and limits access to the financial market through Green Bonds.

Therefore, UCO-based biodiesel producers should collaborate with financial institutions or banks in the issuance of Green Bonds. Financial institutions or banks will act as issuers of Green Bonds, while biodiesel producers serve as project implementors of green projects. The financing scheme can benefit both parties, where the UCO biodiesel producer can gain access to funds to carry out its business activities by overcoming obstacles related to bond issuance, while the bank or financial institution can gain a reputation as a company committed to improving environmental sustainability through funding the green projects.

The novelty of this paper is providing additional references regarding the feasibility and business model of the UCO-based biodiesel industry based on practices that have been carried out in several countries. Apart from that, this paper presents that the project has met the green criteria as regulated in the green bond principle, so it is eligible to be financed through green bonds; as well as providing insight into how green bond financing scheme provides benefits for both issuers and implementors of green projects. Further technical studies regarding mapping, location determination and infrastructure assessment in the context of transformation and development of UCO-based biodiesel facilities from existing facilities in Indonesia are required.

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