DPMPTSP
Dinas Penanaman Modal dan Pelayanan Terpadu Satu Pintu
Provinsi Kalimantan Tengah

EXECUTIVE SUMMARY

IPRO (Investment Project Ready to Offer)
Waste Management
in Central Kalimantan Province

PENYUSUNAN IPRO
(INVESTMENT PROJECT READY TO OFFER)
PENGOLAHAN SAMPAH
DI PROVINSI KALIMANTAN TENGAH

2025

Ethanol & Acetate Co-Production from Organic Waste

PREFACE

Puji syukur kami panjatkan ke hadirat Tuhan Yang Maha Esa atas tersusunnya Kajian *Investment Project Ready to Offer* (IPRO) Pengolahan Sampah Provinsi Kalimantan Tengah. Laporan ini merupakan studi kelayakan pengolahan sampah organik menjadi asam asetat dan bioetanol di Kota Palangka Raya, mencakup analisis aspek pasar, teknis, hukum dan kelembagaan, sosial ekonomi dan lingkungan, finansial, serta risiko dan mitigasi risiko. Kami berharap dokumen ini dapat menjadi acuan strategis bagi pemerintah, investor, dan mitra pembangunan dalam mendorong investasi berkelanjutan dan mewujudkan lingkungan yang lebih bersih dan sehat.

We express our gratitude to God Almighty for the completion of the Investment Project Ready to Offer (IPRO) Study on Waste Processing in Central Kalimantan Province. This report is a feasibility study on the processing of organic waste into acetic acid and bioethanol in Palangka Raya City, covering market, technical, legal and institutional, socio-economic and environmental, financial aspects, as well as risk and risk mitigation analysis. We hope this document can serve as a strategic reference for the government, investors, and development partners in promoting sustainable investment and realizing a cleaner and healthier environment.

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PROJECT PROFILE

1.1 Project Urgency

The Central Kalimantan Province Waste Management Project is highly needed to address the increasing volume of waste, prevent environmental pollution, and support sustainable waste management in Palangka Raya. Strategically located near main road access and equipped with adequate infrastructure facilities, this project also has a positive impact on the local economy through the empowerment of SMEs and job creation. The processing converts waste into value-added products (Acetic Acid and Bioethanol) while contributing to the achievement of greenhouse gas emission reduction targets and the Sustainable Development Goals (SDGs).

1.2 Project Location

Location Name:
Waste Processing Facility Km 14 Landfill (TPA), Palangka Raya

Location Address:
Tjilik Riwut Road km 14, Bukit Tunggal Subdistrict, Jekan Raya District, Palangka Raya City

Total Area :
Km 14 Landfill (TPA), Palangka Raya, covering approximately ±2 hectares

Land Status:
Clean and Clear, certified as Freehold (*Hak Milik*), and in accordance with the spatial plan for plantation use

Commodity Type:
Waste processing into Acetic Acid with a production capacity of 115,500 tons/year and Bioethanol with a production capacity of 49,500 tons/year


Spatial Plan Guidance
Plantation Designation


Site Area
Waste Processing Area

Development Readiness:

The waste processing project at Km 14 Landfill is strategically located near Tjilik Riwut Road with adequate infrastructure support. The project provides social, economic, and environmental benefits through waste and emission reduction, job creation, increased SME income, and support for the SDGs.

From a financial aspect, the project is considered feasible with an annual net revenue of approximately IDR 34.43 billion, cash flow growth of 7% per year, an IRR above 14%, a positive NPV, a capital structure of 70% loan at 9% interest, and a payback period of approximately 8 years.

Infrastructure Readiness:

Road Access:
The Km 14 Landfill location is connected to Tjilik Riwut Road, which has a road width of approximately 6 meters, and is accessible via paved secondary roads.

Clean Water:
Clean water needs can be met through bore wells around the site, with potential support from the local water utility (PDAM). The PDAM Water Treatment Plant has a distribution capacity of 191.32 liters/second (2022).

Electricity:
Serviced by the New Palangka Raya Substation with an electricity capacity of 150 kV.

Telecommunications:
Within a 3 km radius, there are 6 BTS towers, and a fiber optic network runs along the main Tjilik Riwut Road.

Indonesian Standard Industrial Classification **KBLI**

38	382	3821	38211

38211
Treatment and Disposal of Non-Hazardous Waste and Garbage

PROFIL PROYEK

1.1 Urgensi Proyek

Proyek Pengolahan Sampah Provinsi Kalimantan Tengah sangat dibutuhkan untuk mengatasi peningkatan volume sampah, mencegah pencemaran lingkungan, dan mendukung pengelolaan limbah berkelanjutan di Palangka Raya. Berlokasi strategis dekat akses jalan utama dan dilengkapi fasilitas infrastruktur memadai, proyek ini juga memiliki dampak positif bagi ekonomi lokal melalui pemberdayaan UMKM serta penyerapan tenaga kerja. Proses pengolahan mengubah sampah menjadi produk bernilai tambah (Asam Asetat dan Bioetanol), sekaligus berperan dalam pencapaian target pengurangan emisi gas rumah kaca dan tujuan pembangunan berkelanjutan (SDGs).

1.2 Lokasi Proyek

Nama Lokasi:
Fasilitas Pengolahan Sampah TPA Km 14 Palangka Raya

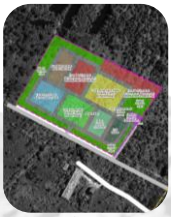
Total Area :
Fasilitas Pengolahan Sampah TPA Km 14 Palangka Raya seluas **± 2 ha**

Alamat Lokasi:
Jalan Tjilik Riwut km 14, Kelurahan Bukit Tunggal, Kecamatan Jekan Raya, Kota Palangka Raya

Status Lahan:
Clean and Clear, bersertifikat Hak Milik dan sesuai dengan tata ruang peruntukan perkebunan

Jenis Komoditas :
Pengolahan Sampah menjadi **Asam Asetat** dengan kapasitas produksi 115.500 ton/tahun **dan Bioetanol** dengan kapasitas produksi 49.500 ton/tahun


Arahan Pola Ruang
Peruntukan Perkebunan


Tapak Kawasan
Pengolahan Sampah

Kesiapan Pengembangan:

Proyek pengolahan sampah di TPA Km 14 berlokasi strategis **dekat Jalan Tjilik Riwut** dengan dukungan infrastruktur memadai. Proyek ini memberi manfaat sosial, ekonomi, dan lingkungan melalui pengurangan volume sampah dan emisi, penciptaan lapangan kerja, peningkatan pendapatan UMKM, serta mendukung SDGs.

Dari sisi finansial, proyek dinilai layak dengan pendapatan bersih tahunan ±Rp34,43 miliar, pertumbuhan kas 7% per tahun, IRR >14%, NPV positif, struktur modal 70% pinjaman bunga 9%, dan periode pengembalian ±8 tahun.

Kesiapan Infrastruktur:

Akses Jalan:
Lokasi TPA Km 14 terhubung dengan Jalan Tjilik Riwut yang memiliki lebar badan jalan ± 6 meters dan melalui jalan akses sekunder yang beraspal

Air Bersih:
Kebutuhan air bersih dapat dipenuhi melalui sumur bor di sekitar lokasi, serta potensi dukungan suplai dari PDAM. IPA PDAM kapasitas Distribusi 191,32 l/d (2022)

Energi Listrik:
Difasilitasi Gardu Induk New Palangka Raya dengan kapasitas energi listrik sebesar 150 kV.

Telekomunikasi:
Radius 3 km terdapat 6 tower BTS dan dilalui jaringan kabel *fiber optic* pada jalan utama Tjiliik Riwut.

Klasifikasi Baku Lapangan Usaha Indonesia **KBLI**

38	382	3821	38211

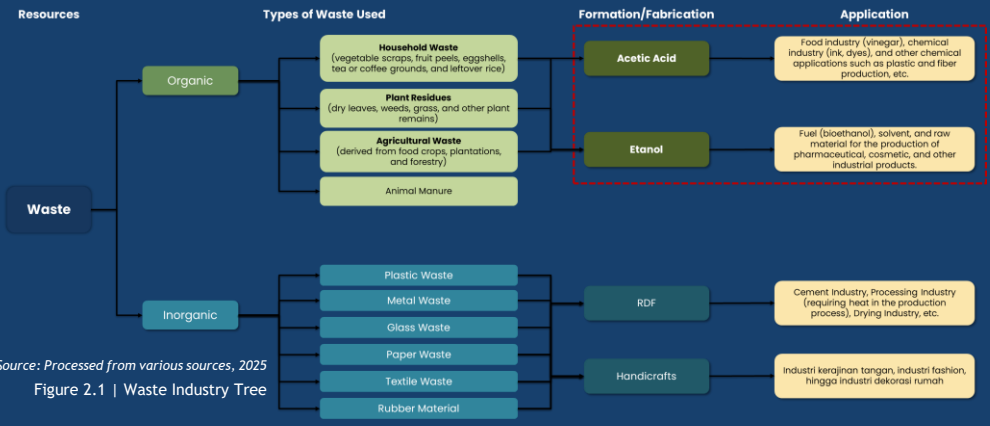
38211
Treatment dan Pembuangan Limbah dan Sampah Tidak Berbahaya

MARKET ASPECTS

2.1 Industrial Tree

The waste processing industry tree divides waste sources into two main categories: organic and inorganic.

- Organic waste (household waste, plant residues, agricultural waste, animal manure) can be processed into acetic acid (for the food, chemical, and plastic industries) as well as ethanol (used as fuel, solvent, and raw material for pharmaceutical and cosmetic industries).
- Inorganic waste (plastic, metal, glass, paper, textiles, rubber) can be utilized as RDF (alternative fuel for cement, processing, and drying industries) or processed into value-added handicrafts for the creative industry.



Source: Processed from various sources, 2025

Figure 2.1 | Waste Industry Tree

This scheme illustrates how waste can be converted into economically valuable products, supporting sustainable industries while reducing environmental impacts.

Acetic Acid

The acetic acid market, shows relatively stable conditions due to continuous demand from various industrial sectors. Growth in the food and beverage, textile, and chemical industries is the main factor driving the increasing need for acetic acid in the future. In addition, innovations in its applications, such as in wound care, are also opening new market opportunities that can expand the scope of acetic acid utilization while enhancing its competitiveness in the global market.

Level	Demand	Supply
Palangka Raya	Minimal (depending on local industries)	Imports from provinces/major cities
Indonesia (National)	Fertilizer industry (PTA), textile, food processing, and other chemicals	Limited local production, significant imports (such as from Singapore, Malaysia, China, South Korea, and Germany)
Global	17-27 million ton (2023-2035)	Capacity of 22-27 million tons, dominated by Asia Pacific

Source: Processed from various sources, 2025

MARKET ASPECTS

Bioetanol

The bioethanol industry in Indonesia heavily depends on the availability of abundant and sustainable raw materials. The main sources of bioethanol production come from sugarcane, cassava, corn, sago, and agricultural waste spread across various regions. With vast land capacity still available, there is significant potential for plantation expansion to increase raw material production, thereby supporting the sustainability of supply for the bioethanol industry in the future.

The market potential for bioethanol in Indonesia is very large, particularly in the transportation sector, which still relies on imports of more than 30 million kiloliters of fuel per year. In the industrial sector, bioethanol demand is around 300,000–500,000 kiloliters per year as a solvent, disinfectant, and raw material. The availability of local raw materials also supports this potential, with sugarcane molasses, cassava in various regions, and agricultural waste that can be processed into second-generation bioethanol.

Level	Demand	Supply
Palangka Raya	Very low, depend on project	No local production
Indonesia (National)	Target of 1.2 million KL of bioethanol by 2030	Limited production, establishment of a task force for sugarcane expansion
Global	Increase of 56% (2022-2027)	Exports to the Philippines, Japan, and Thailand

Source: Processed from various sources, 2025

2.2 Waste Processing Raw Materials

Palangka Raya City holds a strategic position surrounded by several regencies that can serve as potential partners in supplying raw materials (waste) to support the economic scale of the processing project, particularly for a regionalized waste management scenario. The following is an estimate and overview of the potential waste generation from the surrounding regencies:

Regency/City	Daily Waste Generation (tons)	Organic (ton/day)	Inorganic (ton/day)
Kotawaringin Timur Regency	237,97	142,78	95,19
Kapuas Regency	213,72	128,23	85,49
Katingan Regency	65,60	39,36	26,24
Pulang Pisau Regency	68,11	40,87	27,24
Palangka Raya City	156,01	93,61	62,40

Source: SIPSN, 2023

Table 2.1| Waste Raw Materials from Areas Surrounding Palangka Raya City

- The main raw materials for the organic waste processing project into bioethanol and acetic acid come from the daily waste generation in several regencies and cities surrounding Palangka Raya.
- The total potential daily waste from these five regions exceeds 740 tons/day, with an organic composition of approximately 500 tons/day and inorganic approximately 240 tons/day (2023 data).
- With a total potential of more than 500 tons of organic waste per day, the project has a very adequate raw material supply to operate sustainably.
- The collected organic waste will be processed through pre-treatment, fermentation, and distillation stages, producing bioethanol as a renewable energy source and acetic acid as a high-value industrial chemical.

MARKET ASPECTS

2.3 Marketing Strategy

Reaching **the target market for acetic acid and bioethanol** requires a focused strategy, starting with segmentation to adjust product quality according to the needs of each industry, such as food standards for the food sector or technical standards for textiles, along with direct marketing to provide more specific and relevant solutions. In addition, digital marketing can be leveraged to build an online presence through websites and social media, making product information more accessible to a wider audience.

Figure 2.2 | SWOT Matrix

STRENGTH

Acetic Acid

- **Availability of local organic feedstock** — the presence of the Palangka Raya Recycling Center (PDU) (capacity ~10 tons/day) and a network of waste banks (±56-65 units) indicates a flow of organic waste that can be utilized as raw material.
- **Support from local government & Ministry of Environment and Forestry (KLHK) programs** — the PDU was established with KLHK assistance, and there is local policy/educational support for waste management, facilitating government-industry synergy.

Bioetanol

- Central Kalimantan has abundant marginal and non-productive land that can be utilized for energy crops such as cassava, sugarcane, or corn.Agricultural and plantation waste (e.g., oil palm, sago, and rubber residues) can serve as feedstock for second-generation bioethanol.
- Its strategic location in Kalimantan allows distribution to East Kalimantan (industrial sector), West Kalimantan, and exports to Malaysia/Singapore.

OPPORTUNITY

Acetic Acid

- **Potential utilization of waste as feedstock (biobased acetic acid)** — Palangka Raya, with its PDU and waste banks, could serve as a pilot plant/biorefinery location.
- Import substitution & domestic demand.
- Financing schemes & support from the Ministry of Environment and Forestry (KLHK).

Bioetanol

- **National support for biofuels (BBN)** and the 2060 Net Zero Emission target drives investment opportunities in the regions.
- **Export potential to neighboring countries** such as Malaysia, Brunei, or Singapore.
- The Ministry of Energy and Mineral Resources (ESDM) and Bappenas **promote bioenergy development** outside Java through funding or PPP partnerships.
- **Opportunities for private sector collaboration** — involving village-owned enterprises (BUMDes), cooperatives, or local companies in the development of energy plantations and small-medium scale plants.

WEAKNESS

Acetic Acid

- **There is no large commercial acetic acid industry in the region**, and domestic commercial plants are still limited, so the industrial ecosystem (chemical suppliers, engineering services, major off-takers) is relatively underdeveloped at the local level.
- **The PDU scale is still small.**
- **Limited human resources and industrial infrastructure** — the lack of basic petrochemical/chemical facilities and specialized technical personnel in Palangka Raya to operate large-scale chemical processes.

Bioetanol

- **Lack of bioethanol plants**, logistics networks, and storage and distribution facilities for alternative energy.
- **No supporting industrial ecosystem yet** (chemicals, logistics, research, etc.).
- **Availability of trained workforce for the biofuel industry is still limited.**
- **Feedstock supply is not yet coordinated in a sustainable and efficient manner.**

THREATS

Acetic Acid

- **Price and technology competition from imports** — foreign producers already operating at large-scale economies (using methanol carbonylation, butane oxidation, etc.).
- **Fluctuations in feedstock availability and waste quality.**
- Regulatory and environmental challenges — constructing medium/large-scale chemical units requires environmental impact assessments (AMDAL) and permits, as well as process emission and waste management; **regulatory constraints can increase costs and extend project timelines.**

Bioetanol

- Bioethanol production costs are still higher than fossil fuels due to small-scale operations.
- Seasonal and climatic dependence can affect feedstock availability.
- Land and investment are more attracted to established commodities such as oil palm.
- Bioenergy is not yet widely recognized by the local community, so initial adoption may be slow.

Source: Analysis Results, 2025

Based on the SWOT analysis results, the marketing strategies that can be implemented for waste processing in Central Kalimantan include:

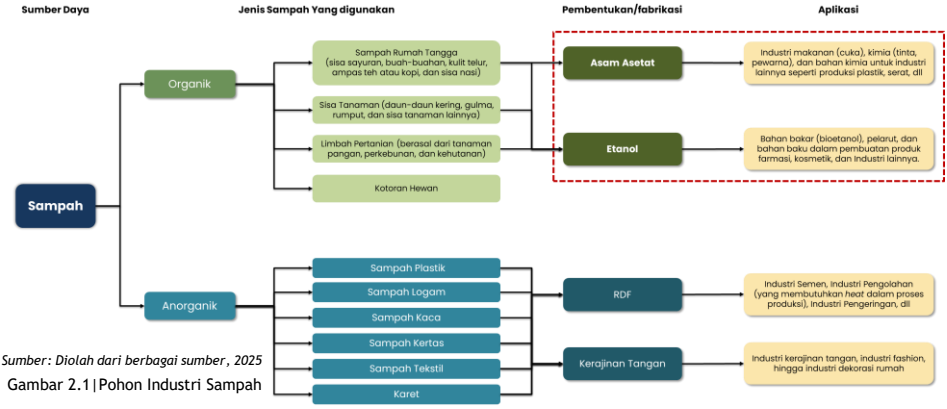
1. **A production route selection strategy that aligns with market needs, raw material availability, and production cost considerations.**
2. **A targeted marketing strategy through the determination of market segmentation according to the quality and quantity of the industry, technical standards, and food standards.**
3. **Utilization of digital marketing through websites and social media to reach a broader audience.**
4. **Public education to increase awareness of the benefits and positive impacts of the products on the environment.**
5. **Collaboration with the government to support policies and incentives related to acetic acid and bioethanol, while also establishing partnerships with relevant companies in the industry to expand market access and position.**

ASPEK PASAR

2.1 Pohon Industri

Pohon industri pengolahan sampah membagi sumber sampah menjadi dua kategori utama: organik dan anorganik.

- **Sampah organik** (rumah tangga, sisa tanaman, limbah pertanian, kotoran hewan) dapat diolah menjadi asam asetat (untuk industri makanan, kimia, dan plastik) serta etanol (sebagai bahan bakar, pelarut, dan bahan baku farmasi maupun kosmetik).
- **Sampah anorganik** (plastik, logam, kaca, kertas, tekstil, karet) dapat dimanfaatkan menjadi RDF (bahan bakar alternatif untuk industri semen, pengolahan, dan pengeringan) atau diolah menjadi kerajinan tangan bernilai tambah bagi industri kreatif.



Sumber: Diolah dari berbagai sumber, 2025

Gambar 2.1|Pohon Industri Sampah

Skema ini menunjukkan bagaimana sampah dapat dikonversi menjadi produk bernilai ekonomi, mendukung industri berkelanjutan sekaligus mengurangi dampak lingkungan.

Asam Asetat

Pasar asam asetat menunjukkan kondisi yang relatif stabil karena adanya permintaan berkelanjutan dari berbagai sektor industri. Pertumbuhan industri makanan dan minuman, tekstil, serta kimia menjadi faktor utama yang mendorong peningkatan kebutuhan asam asetat di masa depan. Selain itu, inovasi dalam pemanfaatannya, misalnya pada bidang perawatan luka, turut membuka peluang pasar baru yang dapat memperluas jangkauan penggunaan asam asetat sekaligus meningkatkan daya saingnya di pasar global.

Tingkat	Permintaan	Penawaran
Palangka Raya	Minim (tergantung industri lokal)	Impor dari provinsi/kota besar
Indonesia (Nasional)	Industri Pupuk (PTA), tekstil, pengolahan makanan, dan bahan kimia lainnya	Produksi lokal terbatas, impor signifikan (seperti : Singapura, Malaysia, Cina, Korea Selatan, dan Jerman
Global	17-27 juta ton (2023-2035)	Kapasitas 22-27 juta ton, dominasi Asia Pasifik

Sumber: Diolah dari berbagai sumber, 2025

ASPEK PASAR

Bioetanol

Industri bioetanol di Indonesia sangat bergantung pada ketersediaan bahan baku yang melimpah dan berkelanjutan. **Sumber utama produksi bioetanol** berasal dari tebu, singkong, jagung, sagu, serta limbah pertanian yang tersebar di berbagai wilayah. Dengan kapasitas lahan yang masih luas, terdapat potensi besar untuk ekspansi perkebunan guna meningkatkan produksi bahan baku, sehingga dapat mendukung keberlanjutan pasokan bagi industri bioetanol di masa depan.

Potensi pasar bioetanol di Indonesia sangat besar, terutama untuk sektor transportasi yang masih bergantung pada impor lebih dari 30 juta kiloliter BBM per tahun. Di sektor industri, bioetanol dibutuhkan sekitar 300.000–500.000 kiloliter per tahun sebagai pelarut, disinfektan, dan bahan baku. Ketersediaan bahan baku lokal juga mendukung, dengan molase tebu, ubi kayu di berbagai daerah, serta limbah pertanian yang berpotensi diolah menjadi bioetanol generasi ke-2.

Tingkat	Permintaan	Penawaran
Palangka Raya	Sangat rendah, tergantung proyek	Tidak ada produksi lokal
Indonesia (Nasional)	Target 1.2 juta KL bioetanol 2030	Produksi terbatas, membentuk task force perluasan tebu
Global	Meningkat 56% (2022-2027)	Ekspor ke negara Filipina, Jepang dan Thailand

Sumber: Diolah dari berbagai sumber, 2025

2.2 Bahan Baku Pengolahan Sampah

Kota Palangka Raya memiliki posisi strategis yang dikelilingi oleh beberapa kabupaten yang dapat menjadi mitra potensial dalam penyediaan bahan baku (sampah) untuk mendukung skala keekonomian proyek pengolahan, terutama untuk skenario regionalisasi pengelolaan sampah. Berikut adalah estimasi dan gambaran potensi timbulan sampah dari kabupaten sekitar:

Kabupaten/Kota	Timbulan Sampah Harian(ton)	Organik (ton/hari)	Anorganik (ton/hari)
Kab. Kotawaringin Timur	237,97	142,78	95,19
Kab. Kapuas	213,72	128,23	85,49
Kab. Katingan	65,60	39,36	26,24
Kab. Pulang Pisau	68,11	40,87	27,24
Kota Palangka Raya	156,01	93,61	62,40

Sumber: SIPSN, 2023

Tabel 2.1| Bahan Baku Sampah dari Wilayah Sekitar Kota Palangka Raya

- Sumber utama bahan baku proyek pengolahan sampah organik menjadi bioetanol dan asam asetat berasal dari timbulan sampah harian di beberapa kabupaten dan kota sekitar Palangka Raya.
- Total potensi sampah harian dari lima wilayah mencapai lebih dari **740 ton/hari**, dengan komposisi organik **±500 ton/hari** dan **anorganik ±240 ton/hari** (data 2023).
- Dengan total potensi **lebih dari 500 ton sampah** organik per hari, proyek ini memiliki pasokan bahan baku yang sangat memadai untuk beroperasi secara berkelanjutan.
- Sampah organik yang terkumpul nantinya akan diproses melalui tahapan pre-treatment, fermentasi, hingga distilasi, sehingga menghasilkan bioetanol sebagai energi terbarukan dan asam asetat sebagai bahan kimia industri bernilai tinggi.

ASPEK PASAR

2.3 Strategi Pemasaran

Dalam menjangkau **target pasar asam asetat dan bioetanol** memerlukan strategi terarah, dimulai dari segmentasi untuk menyesuaikan kualitas produk sesuai kebutuhan tiap industri, seperti standar pangan untuk makanan atau standar teknis untuk tekstil, serta pemasaran langsung agar solusi yang ditawarkan lebih spesifik dan relevan. Selain itu, pemasaran digital dapat dimanfaatkan untuk membangun kehadiran online melalui website dan media sosial, sehingga informasi produk lebih mudah diakses oleh audiens yang lebih luas.

Gambar 2.2|Matriks SWOT

STRENGTH

Asam Asetat

- **Ketersediaan *feedstock* organik lokal** — adanya Pusat Daur Ulang (PDU) Palangka Raya (kapasitas ~10 ton/hari) dan jaringan bank sampah (±56-65 unit) mengindikasikan aliran limbah organik yang bisa dimanfaatkan sebagai bahan baku
- **Dukungan pemerintah daerah & program KLHK** — PDU dibangun dengan bantuan KLHK dan ada dukungan kebijakan lokal/pendidikan untuk pengelolaan sampah, mempermudah sinergi pemerintah-industri.

Bioetanol

- Kalteng memiliki banyak lahan marginal dan non-produktif yang bisa dimanfaatkan untuk tanaman energi seperti singkong, tebu, atau jagung.
- Limbah pertanian dan perkebunan (misalnya limbah kelapa sawit, sagu, dan karet) bisa dijadikan bahan baku bioetanol generasi kedua
- Lokasi strategis di Kalimantan memungkinkan distribusi ke Kalimantan Timur (industri), Kalbar, dan ekspor ke Malaysia/Singapura

OPPORTUNITY

Asam Asetat

- **Potensi pemanfaatan limbah jadi bahan baku (*biobased acetic acid*)**, Palangka Raya dengan PDU dan bank sampah bisa menjadi lokasi pilot plant/biorefinery
- Impor substitusi & permintaan domestik
- Skema pembiayaan & bantuan KLHK

Bioetanol

- **Dukungan nasional** terhadap BBN dan target *Net Zero Emission* 2060 mendorong peluang investasi di daerah
- **Potensi Ekspor ke Negara Tetangga** seperti Malaysia, Brunei, atau Singapura.
- Kementerian ESDM dan Bappenas **mendorong pengembangan bioenergi** di luar Jawa melalui pendanaan atau kemitraan PPP
- **Peluang Kolaborasi Sektor Swasta, b**isa melibatkan BUMDes, koperasi, atau perusahaan lokal dalam pengembangan kebun energi dan pabrik skala kecil-menengah

WEAKNESS

Asam Asetat

- **Tidak ada industri asam asetat komersial besar di daerah**, belum banyak pabrik komersial domestik sehingga ekosistem industri (*supplier* bahan kimia, jasa engineering, *off-taker* besar) relatif terbatas di tingkat lokal
- **Skala PDU masih kecil**
- **Keterbatasan SDM dan infrastruktur industri**, kurangnya fasilitas petrokimia/kimia dasar dan tenaga teknik spesialis di Palangka Raya untuk mengoperasikan proses kimia skala besar

Bioetanol

- **Kurangnya pabrik bioetanol**, jaringan logistik, serta fasilitas penyimpanan dan distribusi energi alternatif
- **Belum ada ekosistem industri pendukung** (kimia, logistik, riset, dll).
- **Ketersediaan tenaga kerja yang terlatih untuk industri biofuel masih minim**
- **Pasokan bahan baku belum terkoordinasi secara berkelanjutan dan efisien**.

THREATS

Asam Asetat

- **Persaingan harga & teknologi impor**, produsen asing yang sudah berekonomi skala besar (menggunakan proses karbonilasi metanol, oksidasi butana, dsb.)
- **Fluktuasi ketersediaan *feedstock* & kualitas limbah**
- Regulasi & lingkungan, pembangunan unit kimia skala menengah/besar memerlukan AMDAL/izin lingkungan, serta manajemen emisi/limbah proses; **kendala regulasi bisa menambah biaya dan waktu**

Bioetanol

- Harga produksi bioetanol masih lebih mahal dibandingkan BBM fosil karena skala kecil.
- Ketergantungan pada musim dan iklim dapat memengaruhi ketersediaan bahan baku.
- Lahan dan investasi lebih banyak tertarik pada komoditas yang sudah mapan seperti sawit.
- Bioenergi belum dikenal luas oleh masyarakat lokal, sehingga adopsi awal bisa lambat.

Sumber: Hasil Analisis , 2025

Berdasarkan hasil analisis SWOT yang telah dilakukan, strategi pemasaran yang dapat diterapkan untuk pengolahan sampah di Kalimantan Tengah meliputi:

1. Strategi pemilihan jalur produksi yang disesuaikan dengan kebutuhan pasar, ketersediaan bahan baku, serta pertimbangan biaya produksi.
2. Strategi pemasaran terarah melalui penentuan segmentasi pasar yang sesuai dengan kualitas dan kuantitas industri, standar teknis, serta standar pangan.
3. Pemanfaatan pemasaran digital melalui website dan media sosial untuk menjangkau audiens yang lebih luas.
4. Edukasi publik untuk meningkatkan kesadaran akan manfaat dan dampak positif produk terhadap lingkungan.
5. Kerjasama dengan pemerintah guna mendukung kebijakan dan insentif terkait asam asetat dan bioetanol, sekaligus menjalin kemitraan dengan perusahaan terkait dalam industri untuk memperluas akses dan posisi pasar.

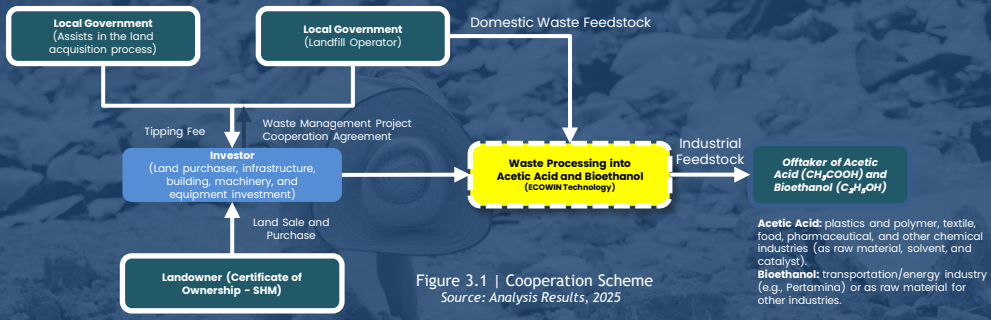
LEGAL AND INSTITUTIONAL ASPECTS

The main legal basis includes Law No. 18 of 2008 on Waste Management, Government Regulation No. 81 of 2012 on Household Waste Management, Presidential Regulation No. 97 of 2017 on the National Waste Management Policy and Strategy (Jakstranas), Law No. 11 of 2020 on Job Creation along with its derivatives concerning risk-based OSS, and Palangka Raya City Regulation No. 1 of 2017 on Waste Management.

In practice, there are important regulatory issues to consider, such as waste management from upstream to downstream, including sorting, collection, transportation, processing, and final disposal. Additionally, a tipping fee system is applied based on waste tonnage and is used to improve facilities and worker welfare. The government also provides support in the form of fiscal incentives, such as tax holidays, import duty exemptions for equipment, and special electricity tariffs to encourage investment.

Business licensing is conducted through OSS-RBA (Online Single Submission Risk-Based Approach), where all risk-based business permits must be processed online. Key requirements include Business Identification Number (NIB), KKPR, AMDAL or UKL-UPL, Building Permit (PBG), and Building Safety Certificate (SLF). This system aims to simplify the licensing process while maintaining environmental and project sustainability considerations.

From an institutional perspective, various stakeholders play crucial roles. The central government (KLHK, Ministry of Finance, Ministry of Industry, BKPM) functions as regulator and policy maker. Provincial and city governments are responsible for land provision, technical regulations, supervision, and field operations. Private sector and investors act as main partners in PPP schemes, while technology developers provide design and equipment. Communities, NGOs, and the media contribute through social support, public education, and strengthening the role of local waste producers and managers.



Acetic Acid: plastics and polymer, textile, food, pharmaceutical, and other chemical industries (as raw material, solvent, and catalyst).
Bioethanol: transportation/energy industry (e.g., Pertamina) or as raw material for other industries.

Figure 3.1 | Cooperation Scheme
Source: Analysis Results, 2025

The waste management partnership scheme involves local governments that manage landfills and provide waste, investors who purchase land and build facilities, and landowners who sell their land. Waste is processed into acetic acid and bioethanol using ECOWIN technology, which is then supplied to industries as raw materials. This scheme integrates the roles of government, private investment, and waste utilization into value-added products.

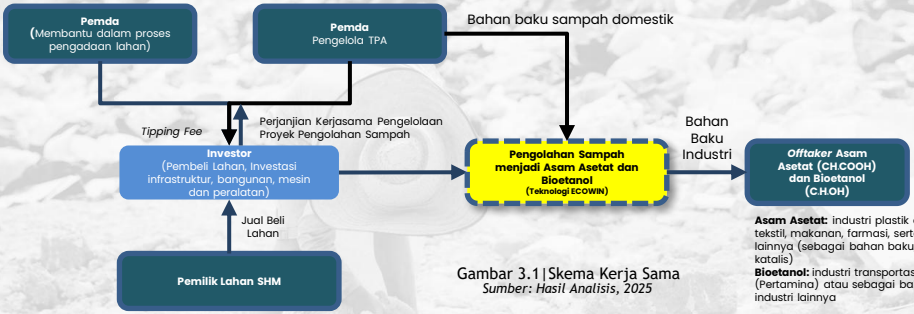
ASPEK HUKUM DAN KELEMBAGAAN

Dasar hukum yang menjadi landasan utama antara lain UU No. 18 Tahun 2008 tentang Pengelolaan Sampah, PP No. 81 Tahun 2012 tentang Pengelolaan Sampah Rumah Tangga, Perpres No. 97 Tahun 2017 tentang Kebijakan dan Strategi Nasional Pengelolaan Sampah (Jakstranas), UU No. 11 Tahun 2020 tentang Cipta Kerja beserta turunannya mengenai OSS berbasis risiko, serta Perda Kota Palangka Raya No. 1 Tahun 2017 tentang Pengelolaan Sampah.

Dalam praktiknya, terdapat **isu regulasi penting** yang perlu diperhatikan, seperti pengelolaan sampah dari hulu ke hilir mulai dari pemilahan, pengumpulan, pengangkutan, pengolahan, hingga pemrosesan akhir. Selain itu, sistem ***tipping fee*** diberlakukan berdasarkan volume tonase sampah dan digunakan untuk peningkatan fasilitas serta kesejahteraan pekerja. Pemerintah juga memberikan dukungan berupa insentif fiskal seperti *tax holiday*, pembebasan bea masuk alat, dan tarif listrik khusus untuk mendukung investasi.

Sistem perizinan usaha dilakukan melalui **OSS-RBA (*Online Single Submission Risk-Based Approach*)**, di mana semua izin usaha berbasis risiko harus diproses secara *online*. Persyaratan utamanya meliputi NIB, KKPR, Amdal atau UKL-UPL, PBG, serta SLF. Sistem ini bertujuan mempermudah proses perizinan dengan tetap memperhatikan aspek lingkungan dan keberlanjutan proyek.

Adapun dari sisi **kelembagaan**, terdapat berbagai pemangku kepentingan yang berperan penting. Pemerintah pusat (KLHK, Kemenkeu, Kemenperin, BKPM) berfungsi sebagai regulator dan penyusun kebijakan. Pemerintah provinsi dan kota berperan dalam penyediaan lahan, regulasi teknis, pengawasan, serta operasional lapangan. Pihak swasta dan investor menjadi mitra utama dalam skema KPBU, sementara pengembang teknologi menyediakan desain dan peralatan. Masyarakat, komunitas, LSM, serta media berperan dalam dukungan sosial, edukasi publik, serta penguatan peran produsen dan pengelola sampah lokal.

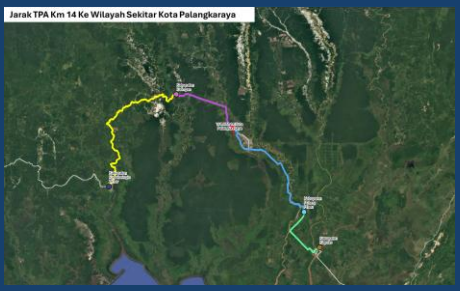


Gambar 3.1|Skema Kerja Sama
Sumber: Hasil Analisis, 2025

Skema kerja sama pengelolaan sampah melibatkan Pemda yang mengelola TPA dan menyediakan sampah, investor yang membeli lahan dan membangun fasilitas, serta pemilik lahan yang menjualnya. Sampah diolah menjadi asam asetat dan bioetanol menggunakan teknologi ECOWIN, yang kemudian disalurkan ke industri sebagai bahan baku. Skema ini menggabungkan peran pemerintah, investasi swasta, dan pemanfaatan limbah menjadi produk bernilai.

TECHNICAL ASPECTS

4.1 Resource Potential



Katingan Regency is the nearest destination, with a distance of 61.81 km that can be covered in approximately 1 hour and 17 minutes, while East Kotawaringin Regency is the farthest destination, with a distance of 206.60 km and an estimated travel time of around 4 hours and 11 minutes. This information is crucial to support resource distribution planning, logistics efficiency, and the determination of priorities in public service within Palangkaraya and its surrounding areas, as indicated by the 2025 analysis.

The potential generation of organic waste from Pulang Pisau, East Kotawaringin, Katingan, and Kapuas Regencies flows to the KM 14 Landfill in Palangka Raya, with an estimated total of around 50 tons per day. The waste comes from households, markets, and the agricultural/plantation sector, consisting of food scraps, vegetables, fruits, and plant residues. Transportation is carried out via trucks from the sanitation office or logistics partners. This organic waste stream is relatively stable, enabling processing into valuable products such as biobased acetic acid and bioethanol, while also supporting integrated regional waste management.

Table 4.1 | Potential Generation of Organic Waste from Surrounding Areas

No	Region	Population	Estimated Daily Generation of Organic Waste	Characteristics
1.	Pulang Pisau Regency	±130.000 persons	40,87 ton/day	Main sources from residential areas, local markets, and the agricultural sector
2.	Kotawaringin Timur Regency	±440.000 persons	142,78 ton/day	Significant potential from Sampit city, the trade sector, and plantation industry
3.	Katingan Regency	±165.000 persons	39,36 ton/day	Generation originates from the domestic sector and rural areas
4.	Kapuas Regency	±420.000 persons	128,23 ton/day	High potential from the activities of Kuala Kapuas city, markets, and small industries

Source: Analysis Results, 2025

4.2 Physical Condition of Land Around KM 14 Landfill

Physical and Environmental Conditions of KM 14 Landfill and Surroundings.

- Topography: Relatively flat to undulating, elevation 30–50 meters above sea level.
- Soil type: Podsolic & latosol, suitable for construction, although some areas require structural reinforcement.
- Disaster-free: Not prone to floods or landslides.
- Surroundings: Dominated by vacant land and natural vegetation.
- Settlement: At a safe distance, with minimal risk of direct pollution.
- Note: Regular monitoring of air quality, groundwater, and odor potential is still required

TECHNICAL ASPECTS

4.3 Infrastructure Around the Project Site

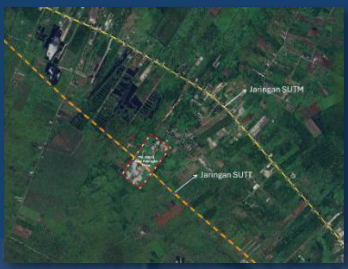
To support the operations of the waste processing project at KM 14 Landfill, Bukit Tunggal, Palangka Raya, adequate supporting infrastructure is required, particularly related to logistics, energy, and operational sustainability. The main infrastructure includes road access, availability of clean water, electricity, and telecommunications.

Telecommunication Network

The KM 14 Landfill area is covered by a telecommunication network. Within a 3 km radius, there are 6 BTS towers, and the main Tjilik Riwut road is traversed by a fiber optic cable network.

Electricity Network

The KM 14 Landfill area is supplied with electricity from PLN. It is facilitated by the New Palangka Raya Substation with an electricity capacity of 150 kV



Clean Water Network

There is potential for deep groundwater (bore wells) around the site, as well as potential support from the local water utility (PDAM). In 2022, the Palangka Raya City PDAM Water Treatment Plant distributed clean water with an average flow rate of 191.32 liters per day

Accessibility

The KM 14 Landfill (TPA) can be accessed via Tjilik Riwut Road at Km 14, with a road width of approximately 6 meters. This road serves as the main connector between the city center of Palangka Raya and other areas.

In general, the KM 14 Landfill is supported by adequate basic facilities. With improvements and development of access routes, the site will be more easily reachable by waste transport fleets, while also strengthening the sustainability of the integrated waste management system in Palangka Raya City.

TECHNICAL ASPECTS

4.4 Location Selection Analysis and Potential Development Sites

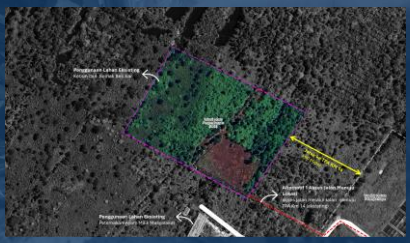
The potential location for the Waste Processing Project is beside the Km 14 landfill (TPA) located in Bukit Tunggal Village, Jekan Raya District, Palangka Raya City. This site has already been used as an existing final waste disposal location with a potential land area for development of 2 hectares. To support the development of a more modern and sustainable waste processing project in this area, a study has been conducted on several feasibility indicators, such as geological, hydrological, topographical aspects, distance to residential areas and the airport, as well as spatial planning status and disaster risk considerations.

Table 4.2| Location Selection Analysis

No.	Technical/Environmental Criteria	Condition at the Km 14 Landfill Site	Analysis/Suitability
1	Not located in a geological hazard zone (not situated on an active fault, volcano, karst area, or deep peatland)	The location is not situated on an active fault, nor is it in a volcanic or karst area; part of the area consists of mineral soil and shallow peatland.	**Moderately Suitable - A base lining system (liner) is required to prevent contamination**
2	The groundwater table is not less than 3 meters below the surface.	Groundwater table is more than 3 meters deep, especially during the dry season	**Suitable - Meets the minimum depth requirement**
3	Land slope less than 20%	Topography is predominantly flat to gently sloping (less than 10%)	**Suitable - Safe for construction and operation of the Waste Processing Project.**
4	Distance from the airport (>3000 meters for turbojet aircraft, >1500 meters for non-turbojet aircraft).	Distance from Tjilik Riwut Airport is approximately 10 kilometers	**Suitable - More than 3000 meters from the airport.**
5	Distance from the nearest residential area is ≥1 km.	Distance to the nearest residential area is greater than 1 km (pertaining to Kelurahan Bukit Tunggal).	**Suitable - Social impact and pollution risks can be minimized**
6	Not located in a protected area.	The location is within a cultivation zone according to the spatial planning (RTRW) and is not in a protected area.	**Suitable - Not in conflict with spatial planning policies**
7	Not located in a flood-prone area.	The site is situated at a sufficiently high elevation and is far from main river channels.	**Suitable - Low risk of flooding.**

Source: Analysis Results, 2025.

The location of the Waste Processing Facility around TPA Km 14 in Palangka Raya City required for the construction of the waste processing facility.



Potential Location for Integrated Waste Processing

- Potential Area: Approximately 2 hectares
- Spatial Planning Status (RTR): Plantation Area (100%)
- Ownership Status: Owned by the Community
- Land Certificate Status (HAT): Freehold Title (SHM)
- Distance to TPA Km 14: 90 meters
- Strategic location adjacent to the access road of Tjilik Riwut Street

TECHNICAL ASPECTS

4.5 Technical Overview of Waste Raw Material Distribution Pick-up Points

The pick-up point for waste distribution routes is planned to have a land area of approximately 500 m² in Katingan Regency and Pulang Pisau Regency, serving as a collection node before further processing. This location is chosen because it is on the main distribution route between regencies, allowing for a more efficient and integrated waste flow and supporting the processing facility's capacity. This pattern also increases logistics efficiency, reduces operational costs, and strengthens inter-regional cooperation in integrated waste management in Central Kalimantan

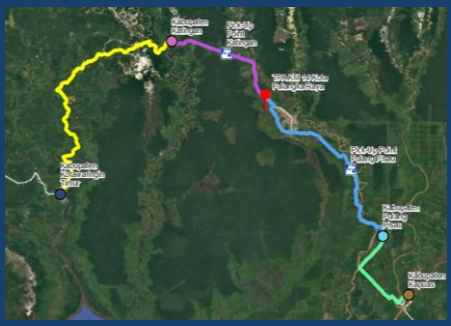
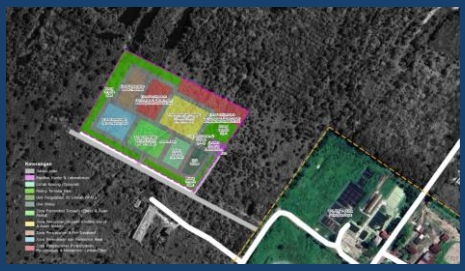


Table 4.3|Technical Overview of Distribution through Waste Raw Material Pick-Up Points

No	Pick-Up Point Locations	Coordinate Point	Distance from Final Disposal Site (TPA)	Distribution Route Description
1	Katingan Regency	113,6456, -1,9395	32,47 km	Distribution from Kotawaringin Timur - Katingan - Palangka Raya
2	Pulang Pisau Regency	114,1709, -2,4331	59,43 km	Distribution from Kapuas - Pulang Pisau - Palangka Raya

Source: Analysis Results, 2025.

4.6 Waste Processing Infrastructure and Operational Design



The design of the ECOWIN project infrastructure is modular and efficient, covering processing zones from sorting, pre-treatment, bioconversion into bioethanol, further conversion into acetic acid, to storage and distribution. The process runs inline with automatic control (SCADA/PLC), closed conveyors, quality monitoring, and a dual leakage protection system. Facilities are equipped with integrated waste handling, utility areas, electrical power supply, as well as

An integrated clean water circulation and waste treatment system. With this design, ECOWIN is capable of flexible operation to accommodate variations in input and market needs, while maintaining environmental sustainability and the economic value of the investment.

Table 4.3|Development Land Area

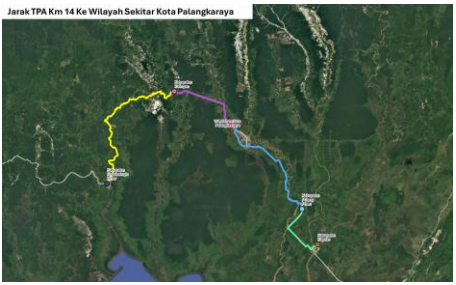
Zone	Land Area	Land Building
Sorting	1.500 m²	800 m²
Pre-treatment	1.000 m²	600 m²
Integrated Fermentation	2.500 m²	2.000 m²
Integrated Purification	1.500 m²	1.000 m²
Product Storage	1.500 m²	1.000 m²
WWTP	800 m²	500 m²
Utilities	1.000 m²	400 m²
Office & Laboratory	700 m²	500 m²

Source: Analysis Results, 2025.

3D Area Design Illustration

ASPEK TEKNIS

4.1 Potensi Sumber Daya



Kabupaten Katingan merupakan tujuan terdekat dengan jarak 61,81 km yang dapat ditempuh dalam waktu sekitar 1 jam 17 menit, sementara Kabupaten Kotawaringin Timur menjadi tujuan terjauh dengan jarak 206,60 km dan waktu tempuh sekitar 4 jam 11 menit. Informasi ini sangat penting untuk mendukung perencanaan distribusi sumber daya, efisiensi logistik, serta penentuan prioritas dalam pelayanan publik di wilayah Palangkaraya dan sekitarnya, seperti yang dihasilkan dari analisis tahun 2025.

Potensi timbulan sampah organik dari Kabupaten Pulang Pisau, Kotawaringin Timur, Katingan, dan Kapuas mengalir ke TPA KM 14 di Palangka Raya, dengan estimasi total sekitar 50 ton/hari. Sampah berasal dari rumah tangga, pasar, dan sektor pertanian/perkebunan, berupa sisa makanan, sayuran, buah, dan limbah tanaman. Transportasi dilakukan melalui truk pengangkut dari dinas kebersihan atau mitra logistik. Aliran limbah organik ini cukup stabil, memungkinkan pengolahan menjadi produk bernilai seperti biobased acetic acid dan bioetanol, sekaligus mendukung pengelolaan sampah regional yang terintegrasi.

Table 4.1|Potensi Timbulan Sampah Organik dari Wilayah Sekitar

No	Wilayah	Jumlah Penduduk	Estimasi Timbulan Sampah Organik Harian	Karakteristik
1.	**Kabupaten Pulang Pisau**	±130.000 jiwa	40,87 ton/hari	Sumber utama dari pemukiman, pasar lokal, dan sektor pertanian
2.	**Kabupaten Kotawaringin Timur**	±440.000 jiwa	142,78 ton/hari	Potensi besar dari kota Sampit, sektor perdagangan dan industri perkebunan
3.	**Kabupaten Katingan**	±165.000 jiwa	39,36 ton/hari	Timbulan berasal dari sektor domestik dan kawasan perdesaan
4.	**Kabupaten Kapuas**	±420.000 jiwa	128,23 ton/hari	Potensi tinggi dari aktivitas kota Kuala Kapuas, pasar, dan industri kecil

Sumber: Hasil Analisis, 2025

4.2 Kondisi Fisik Lahan Sekitar TPA KM 14

Kondisi Fisik dan Lingkungan TPA Km 14 dan sekitarnya

- **Topografi:** Relatif datar-bergelombang, elevasi 30-50 mdpl.
- **Jenis tanah:** Podsolik & latosol, cocok untuk konstruksi, meski beberapa titik butuh penguatan struktur.
- **Bebas bencana besar:** Tidak rawan banjir atau longsor.
- **Sekitar TPA:** Didominasi lahan kosong dan vegetasi alami.
- **Permukiman:** Berjarak aman, minim risiko pencemaran langsung.
- **Catatan:** Tetap perlu pemantauan rutin kualitas udara, air tanah, dan potensi bau.

ASPEK TEKNIS

4.3 Infrastruktur Sekitar Lokasi Proyek

Untuk mendukung operasional proyek pengolahan sampah di TPA Km 14, Bukit Tunggal, Palangka Raya, diperlukan infrastruktur penunjang yang memadai, terutama terkait logistik, energi, dan keberlanjutan operasional. Infrastruktur utama meliputi akses jalan, ketersediaan air bersih, listrik, dan telekomunikasi.

Jaringan Telekomunikasi

Area TPA Km 14 **terjangkau jaringan telekomunikasi.** Dalam radius 3 km terdapat 6 tower BTS dan dilalui jaringan kabel fiber optic pada jalan utama Tjiliik Riwut.

Jaringan Energi Listrik

Kawasan TPA Km 14 **telah dijangkau jaringan listrik dari PLN.** Difasilitasi **Gardu Induk New Palangka Raya** dengan kapasitas energi listrik sebesar **150 kV.**

Jaringan Air Bersih

Tersedia potensi air tanah dalam (sumur bor) di sekitar lokasi, serta potensi dukungan suplai dari PDAM. **Pada tahun 2022, IPA PDAM Kota Palangka Raya mendistribusikan air bersih dengan debit rata-rata 191,32 l/d.**

Aksesibilitas

TPA Km 14 dapat diakses melalui **Jalan Tjilik Riwut Km 14 dengan lebar badan jalan ±6 meter**, yang merupakan jalan utama penghubung pusat Kota Palangka Raya dengan kawasan lain

Secara umum, TPA Km 14 telah didukung oleh fasilitas dasar yang memadai. Dengan perbaikan dan pengembangan jalur akses, lokasi ini akan lebih mudah dijangkau armada pengangkut sampah sekaligus memperkuat keberlanjutan sistem pengelolaan sampah terpadu di Kota Palangka Raya.

ASPEK TEKNIS

4.4 Analisis Pemilihan Lokasi dan Lokasi Potensian Pengembangan

Lokasi Proyek Pengolahan Sampah potensial berada di samping TPA Km 14 yang terletak di Kelurahan Bukit Tunggal, Kecamatan Jekan Raya, Kota Palangka Raya telah menjadi lokasi eksisting penanganan akhir sampah dengan luas lahan yang potensial dikembangkan sebesar 2 Ha. Untuk mendukung pengembangan proyek pengolahan sampah yang lebih modern dan berkelanjutan di kawasan ini, dilakukan kajian terhadap sejumlah indikator kelayakan, seperti aspek geologi, hidrologi, topografi, jarak terhadap permukiman dan bandara, serta status tata ruang dan kebencanaan.

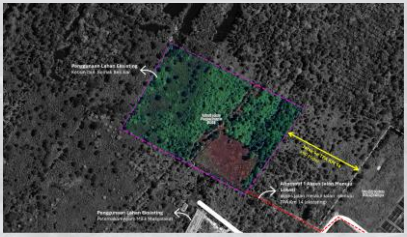
Tabel 4.2| Analisis Pemilihan Lokasi

No.	Kriteria Teknis/Lingkungan	Kondisi di Lokasi TPA Km 14	Analisis/Kesesuaian
1	Tidak berada di zona bahaya geologi (tidak berada di sesar aktif, gunung berapi, karst, atau lahan gambut dalam)	Lokasi tidak berada pada sesar aktif, bukan kawasan vulkanik atau karst; sebagian area berupa lahan mineral dan gambut dangkal	**Cukup Sesuai** – Diperlukan sistem pelapisan dasar (liner) untuk mencegah pencemaran
2	Muka air tanah tidak kurang dari 3 meter	Muka air tanah >3 meter terutama saat musim kemarau	**Sesuai** – Memenuhi syarat kedalaman minimum
3	Kemiringan lahan < 20%	Topografi dominan datar hingga landai (<10%)	**Sesuai** – Aman untuk konstruksi dan operasional Proyek Pengolahan Sampah
4	Jarak dari lapangan terbang (>3000 m untuk turbo jet, >1500 m untuk non-turbo jet)	Jarak dari Bandara Tjilik Riwut ±10 km	**Sesuai** – Lebih dari 3000 m dari bandara
5	Jarak dari permukiman ≥1 km	Jarak ke permukiman terdekat >1 km (Kelurahan Bukit Tunggal)	**Sesuai** – Risiko dampak sosial dan pencemaran dapat diminimalkan
6	Tidak berada di kawasan lindung	Lokasi berada di zona budidaya dalam RTRW, bukan kawasan lindung	**Sesuai** – Tidak bertentangan dengan kebijakan tata ruang
7	Tidak berada di daerah rawan banjir	Lokasi pada elevasi cukup tinggi, jauh dari aliran sungai utama	**Sesuai** – Risiko banjir rendah

Sumber: Hasil Analisis, 2025

Kesesuaian Pola Ruang

Lokasi **Pengolahan Sampah di sekitar TPA Km 14** Kota Palangka Raya memenuhi kriteria teknis dan lingkungan yang disyaratkan untuk pembangunan fasilitas pengolahan sampah.



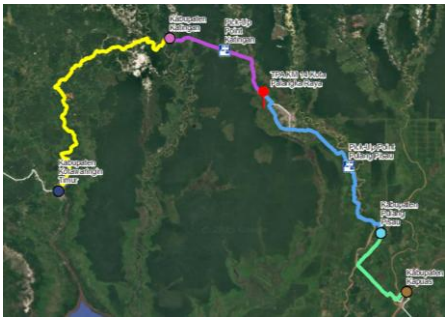
Lokasi Potensial Pengolahan Sampah terintegrasi

- Luas Potensial : ± **2 ha**
- Status RTR : Kawasan Perkebunan (100%)
- Status Kepemilikan : Milik Masyarakat
- Status HAT : SHM
- Jarak ke TPA Km 14 : 90 meter
- Lokasi strategis berdekatan dengan akses jalan Tjilik Riwut

ASPEK TEKNIS

4.5 Gambaran Teknis Pick-up Point Distribusi Bahan Baku Sampah

Titik *pick up point* untuk jalur distribusi sampah direncanakan memiliki luas lahan ±500 m² di Kabupaten Katingan dan Kabupaten Pulang Pisau, sebagai simpul pengumpulan sebelum pengolahan lebih lanjut. Lokasi ini dipilih karena berada di jalur distribusi utama antar kabupaten, sehingga memungkinkan alur sampah yang lebih efisien, terintegrasi, dan mendukung kapasitas fasilitas pengolahan. Pola ini juga meningkatkan efisiensi logistik, mengurangi biaya operasional, dan memperkuat kerja sama antar daerah dalam pengelolaan sampah terpadu di Kalimantan Tengah.

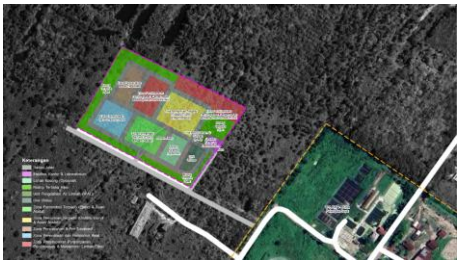


Tabel 4.3|Gambaran Teknis Distribusi melalui Pick-Up Point Bahan Baku Sampah

No	Lokasi Pick Up Point	Titik Koordinat	Jarak dari TPA	Keterangan Jalur Distribusi
1	Kabupaten Katingan	113,6456, -1,9395	32,47 km	Distribusi dari Kotawaringin Timur – Katingan – Palangka Raya
2	Kabupaten Pulang Pisau	114,1709, -2,4331	59,43 km	Distribusi dari Kapuas – Pulang Pisau – Palangka Raya

Sumber: Hasil Analisis, 2025

4.6 Desain Infrastruktur dan Operasional Pengolahan Sampah



Desain infrastruktur proyek ECOWIN bersifat modular dan efisien, mencakup zona pemrosesan dari pemilahan, pre-treatment, biokonversi menjadi bioetanol, konversi lanjutan menjadi asam asetat, hingga penyimpanan dan distribusi. Proses berjalan secara inline dengan kontrol otomatis (SCADA/PLC), conveyor tertutup, monitoring kualitas, dan sistem proteksi kebocoran ganda. Fasilitas dilengkapi penanganan limbah terpadu, area utilitas, pasokan energi listrik, serta sistem sirkulasi air bersih dan pengolahan limbah yang terintegrasi. Dengan desain ini, ECOWIN mampu beroperasi fleksibel terhadap variasi input dan kebutuhan pasar, sambil menjaga keberlanjutan lingkungan dan nilai ekonomis investasi.

Tabel 4.3|Luas Lahan Pengembangan

Zona	Luas lahan	Luas bangunan
Pemilahan	1.500 m²	800 m²
Pre-treatment	1.000 m²	600 m²
Fermentasi Terpadu	2.500 m²	2.000 m²
Pemurnian Terpadu	1.500 m²	1.000 m²
Penyimpanan produk	1.500 m²	1.000 m²
IPAL	800 m²	500 m²
Utilitas	1.000 m²	400 m²
Kantor & Lab	700 m²	500 m²

Sumber: Hasil Analisis, 2025

Ilustrasi Desain 3D Kawasan

SOCIAL, ECONOMIC, AND ENVIRONMENTAL ASPECTS

5.1 Potential Social-Economic-Environmental Impacts.

Environmental paradigms or environmental impacts always use an approach based on project stages, which are divided into pre-construction, construction, and operation phases. The identification of potential impacts on social life, economy, and environment from the Waste Processing Project (IPRO) in Central Kalimantan can be summarized as follows:"The English translation of the provided passage is:

PRE-CONSTRUCTION	Positive Impact: Opportunities for public consultation and participatory planning, and potential to increase environmental awareness. Negative Impact: Possible rejection from the community due to concerns about odors/pollution.
CONSTRUCTION	Positive Impact: Absorption of local labor and increased additional income for MSMEs supplying materials. Negative Impact: Possible rejection from the community due to concerns about odors/pollution.
OPERASIONAL	Positive Impact: Creating permanent jobs and increasing income for MSMEs from inorganic waste. Negative Impact: Emission of toxic gases such as H2S and CH4, which are harmful to health and the environment.

5.2 Project Contribution to Achieving the SDGs

Economic Pillar

- Through on-the-job training and opportunities to open training sessions, the Waste Processing Project in Central Kalimantan contributes to improving the competencies of the local workforce.
- It can drive a circular economy based on waste, strengthen MSMEs involved in inorganic waste recycling, and open opportunities for green investment in Central Kalimantan
- In the short term, the Waste Processing Project needs full support from the government through a waste management tipping fee scheme

Environmental Pillar

- With the existence of the Waste Processing Project, the volume of waste sent to landfills (TPA) can be reduced by tens of percent
- Additionally, it helps the local government achieve its target of 100% waste management by 2030..
- Operating a Wastewater Treatment Plant (IPAL) to prevent river pollution
- Implementing a system for recycling process water and harvesting rainwater.

Social Pillar

- Creation of new job opportunities for the local community.
- Increasing the income of waste pickers through integration into the formal supply chain.
- Job and entrepreneurship opportunities for women in the sectors of collection, sorting, and processing of derivative products.
- Through on-the-job training and opportunities to open training, the Waste Processing Project in Central Kalimantan contributes to improving the competence of the local workforce

ASPEK SOSIAL, EKONOMI DAN LINGKUNGAN

5.1 Potensi Dampak Sosial-Ekonomi-Lingkungan

Paradigma lingkungan atau dampak lingkungan senantiasa menggunakan pendekatan berdasarkan tahapan proyek yang terbagi menjadi tahap **prakonstruksi, konstruksi, dan operasi**. Identifikasi dampak-dampak yang berpotensi muncul terhadap kehidupan sosial, ekonomi, dan lingkungan dari IPRO Pengolahan Sampah Kalimantan Tengah secara ringkas adalah sebagai berikut:

PRA KONSTRUKSI	**Dampak Positif:** Dapat kesempatan untuk melakukan konsultasi publik dan perencanaan partisipatif dan Berpotensi meningkatkan kesadaran lingkungan **Dampak Negatif:** Adanya penolakan dari masyarakat karena kekhawatiran bau/polusi
KONSTRUKSI	**Dampak Positif:** Penyerapan tenaga kerja lokal dan meningkatkan pendapatan tambahan bagi UMKM pemasok material **Dampak Negatif:** Adanya penolakan dari masyarakat karena kekhawatiran bau/polusi
OPERASIONAL	**Dampak Positif:** Menciptakan lapangan pekerjaan tetap dan Meningkatkan pendapatan bagi UMKM dari sampah anorganik **Dampak Negatif:** Emisi gas beracun seperti H2S dan CH4 yang berbahaya bagi kesehatan dan lingkungan

5.2 Kontribusi Proyek terhadap Pencapaian SDG'S

Pilar Ekonomi

- Melalui *on the job training* dan peluang membuka pelatihan maka Proyek Pengolahan Sampah di Kalimantan Tengah **mempunyai kontribusi dalam meningkatkan kompetensi tenaga kerja setempat.**
- Dapat menggerakkan ekonomi sirkular berbasis sampah, **memperkuat UMKM daur ulang sampah anorganik, dan membuka peluang investasi hijau di Kalimantan Tengah.**
- Proyek Pengolahan Sampah dalam jangka pendek perlu mendapat dukungan penuh dari pemerintah **melalui skema *tipping fee* pengelolaan sampah**

Pilar Lingkungan

- Dengan adanya Proyek Pengolahan Sampah **dapat mengurangi volume sampah ke TPA hingga puluhan persen**
- Selain itu juga, **membantu pemda mencapai target pengelolaan sampah 100% pada 2030.**
- Mengoperasikan Instalasi Pengolahan Air Limbah (IPAL) untuk **mencegah pencemaran sungai**
- Menerapkan sistem daur ulang air proses dan penampungan air hujan.

Pilar Sosial

- **Penciptaan lapangan kerja** baru bagi masyarakat lokal.
- **Peningkatan pendapatan pemulung** melalui integrasi ke rantai pasok formal
- Peluang kerja & kewirausahaan bagi perempuan di sektor pengumpulan, penyortiran, dan pengolahan produk turunan.
- Melalui *on the job training* dan peluang membuka pelatihan maka Proyek Pengolahan Sampah di **Kalimantan Tengah mempunyai kontribusi dalam meningkatkan kompetensi tenaga kerja setempat**

FINANCIAL ASPECTS

6.1 Capital Expenditure(CAPEX)

Referring to the benchmark based on studies conducted by a Korean company on similar project development activities, it is known that the minimum land area requirement for the development of renewable energy infrastructure facilities utilizing waste into Acetic Acid and Bioethanol is 2 hectares. Referring to this capital expenditure component and considering tax and insurance costs, the total estimated CAPEX value for the Central Kalimantan Waste Processing Project is approximately IDR 599,164,285,500, with details as listed in the following table.

Area	Description	Quantity	Unit	Price (IDR)	Total (IDR)
Property /Land	The total land used	20,000	M2	350,000	7,000,000,000
	Land Leveling Cost	20,000	M2	20,000	400,000,000
	Licensing	1	1	25,000,000	25,000,000
	Dump Truck	123		573,100,000	70,491,300,000
	Pic up Point Kotim - Katingan	500	M2	350,000	175,000,000
	Pic up Point Kapuas - Pulang Pisau	500	M2	350,000	175,000,000
	Land Grading Cost	500	M2	20,000	10,000,000
				Subtotal	**78,276,300,000**
Zone 1	**Receiving and Initial Sorting Zone**				
	Conveyor Belt	6		218,000,000	1,308,000,000
	Trommel Screen	4		619,000,000	2,476,000,000
	Magnetic Separator	3		87,000,000	261,000,000
	Building	800		5,000,000	4,000,000,000
				Subtotal	**8,045,000,000**
Zone 2	**Shredding & Pre-Treatment Zone**				
	Mesin Shredder	3		100,000,000	300,000,000
	Mixer Homogenisasi	10		17,625,000	176,250,000
	Transfer Pump	6		20,000,000	120,000,000
	Dosing system	5		33,000,000	165,000,000
	Building	600		5,000,000	3,000,000,000
				Subtotal	**3,761,250,000**
Zone 3	**Fermentation Reactor Zone**				
	12 fermentor 50 m^3 stainless	12			24,000,000,000
	Sistem aerasi & blower	1			3,000,000,000
	Piping, Automation, Utilities Installation	1			5,000,000,000
	Building	2000		5,000,000	10,000,000,000
				Subtotal	**42,000,000,000**
Zone 4	**Purification & Distillation Zone**				
	Distillation Column (Kolom Fraksionasi)	4		750,000,000	3,000,000,000
	Condenser & Receiver Tank	4		300,000,000	1,200,000,000
	Pompa Vakum	3		300,000,000	900,000,000
	Filter Press	2		600,000,000	1,200,000,000
	Building	1000		5,000,000	5,000,000,000
				Subtotal	**11,300,000,000**
Zone 5	**Product & Waste Storage Zone**				
	Tangki stainless 10 m^3 (custom)	30		500,000,000	15,000,000,000
	Snyder horizontal tank 1 m^3	5		8,500,000	42,500,000
	Spill Pallet Justrite	10		5,000,000	50,000,000
	Waste Tank FRP 20 m^3	5		300,000,000	1,500,000,000
	Building	1000		5,000,000	5,000,000,000
				Subtotal	**21,592,500,000**

FINANCIAL ASPECTS

Area	Description	Quantity	Unit	Price (IDR)	Total (IDR)
Supporting Facilities	**Wastewater Treatment Plant (WWTP)**				
	Dissolved Air Flotation (DAF)	5		48,900,000	244,500,000
	Reverse Osmosis (RO)	1			1,250,000,000
	Anaerobic-Aerobic Reactor	1			1,500,000,000
	Building	500		5,000,000	2,500,000,000
				Subtotal	5,494,500,000
	Utility Unit				
	Boiler	2		47,000,000	94,000,000
	Chiller	3		583,000,000	1,749,000,000
	Backup Generator	2		710,399,000	1,420,798,000
	Substation & Electrical Panel	1		150,000,000	150,000,000
	Building	400		5,000,000	2,000,000,000
				Subtotal	5,413,798,000
	Construction of Office & Laboratory Facilities including:				
	Management Office & Control Room	1			
	QC Laboratory (chemistry & microbiology)	1			
	Operator Room & SCADA	1			
	Total Building	500		5,000,000	2,500,000,000
	Subtotal				**2,500,000,000**
	Total				**178,383,348,000**
Tax and *insurance*	Factory Design Consultant Fee	9%			16,054,501,320
	Kontijensi Cost	3%		4,459,583,700	4,459,583,700
	Tax				17,974,928,565
	Working Capital				420,780,937,500
	Insurance				14,979,107,138
	IDC				130,934,889,430
Grand Total					**783,357,795,653**
CAPEX					**599,164,285,500**

Source: Analysis Results, 2025.

Capital Expenditure Stages (CAPEX Stages)

Category	Years (IDR)			
	2029	2030	2031	2032
Stage 1	299,582,142,750		-	
Stage 2		119,832,857,100		-
Stage 3			119,832,857,100	
Stage 4				59,916,428,550
Initial Loan		228,623,116,418	340,694,168,086	462,874,028,615
Added Loan	209,707,499,925	83,882,999,970	83,882,999,970	41,941,499,985
IDC	18,915,616,493	28,188,051,698	38,296,860,559	45,534,360,680
Loan + IDC	228,623,116,418	340,694,168,086	462,874,028,615	550,349,889,280

Source: Analysis Results, 2025.

The total value of capital expenditure (CAPEX) required for the construction of the Waste Processing Project facility into Acetic Acid and Bioethanol

IDR 599.164.285.500,-

FINANCIAL ASPECTS

6.2 Operasional Expenditure (OPEX)

OPEX refers to the expenditures incurred by a company to meet its operational needs. In the operational activities of the Waste-to-Acetic Acid and Bioethanol Processing Project, OPEX generally consists of various components, including raw material supply, transportation costs, fuel usage, taxes, employee salaries, insurance, and others. The spending, which serves as an expenditure indicator, represents the cumulative operational value or OPEX of the Waste-to-Acetic Acid and Bioethanol Processing Project, as shown in the following table.

Operasional Expenditure (OPEX)	Cost (IDR)
1. Cost of Goods Sold (COGS):	
1.1 Production Raw Materials	273.097.687.500
1.2. Direct Labor	630.918.750
1.3. Manufacturing Costs	51.645.206.250
1.4. Work in Process Inventory	2.118.084.375
1.5. Finished Goods Inventory	21.992.025.000
1.6. Cost of Goods Sold – Packaging	6.895.040.625
2. General and Administrative Expenses	
2.1. Salaries and Benefits Expenses	12.528.243.750
2.2. Office Expenses	2.027.953.125
2.3. Employee Benefits Reserve	1.487.165.625
2.4. Repairs and Maintenance	2.076.173.345
2.5. Asset Depreciation	1.442.100.000
2.6. Professional Services	585.853.125
2.7. Rent Expense	495.721.875
2.8. Electricity, Post, Telephone, etc.	450.656.250
2.9. Research	315.459.375
2.10. Business Travel	270.393.750
2.11. Entertaiment	225.328.125
2.12. Donation	180.262.500
2.13. Health	135.196.875
2.14. Tax and Permit	90.131.250
2.15. Other Cost	2.208.215.625
3. Promotion and Sales Expenses	
3.1. Shipping Cost	26.002.865.625
3.2. Operasinal Cost	1.622.362.500
3.3. Commision	8.021.681.250
3.4. Salary and Benefits	1.216.771.875
3.5. Business Travel	630.918.750
3.6. Packaging	721.050.000
3.7. Tank Leasing	675.984.375
3.8. Others	991.443.750
Total	**420.780.937.500**

Source: Analysis Results, 2025.

Revenue Projection Analysis

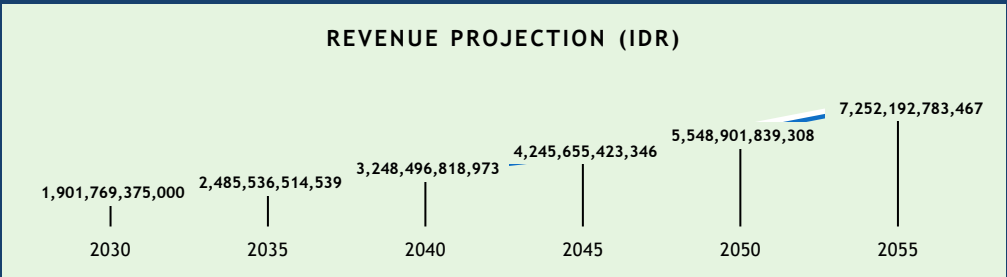
The types of revenue obtained from the planned waste processing facility come from various sources, including tipping fees, sales of acetic acid, and sales of bioethanol

Product	*Annual Capacity* (ton)	*Market Price*/ton/IDR	*Market Price* /ton/US	Est. Annual *Revenue* (IDR)
Tipping fee	165.000	125.000		20.625.000.000
Asam Asetat	115.500	12.000.000	710	1.386.000.000.000
Bioetanol	49.500	8.000.000	473	396.000.000.000

Source: Analysis Results, 2025.

FINANCIAL ASPECTS

Assuming an annual increase of 5.5% in the selling price of each product, the revenue projection from the waste processing project can be seen in the following graph



Source: Analysis Results, 2025.

Financial Feasibility Indicators

Financial Analysis

WEIGHTED AVERAGE COST OF CAPITAL (WACC)	10,78%
INTERNAL RATE OF RETURN (IRR)	14,51%
NET PRESENT VALUE (NPV)	IDR352.356.558.243
PAYBACK PERIOD (PP)	8 Years 12 Months

Financial Recap

Total Investment Value	IDR 783.567.295.652

Capacity of Product Types	
Asam Asetat	115.500 Ton/Years
Bioetanol	49.500 Ton/Years

Referring to the results of the financial feasibility analysis, the development of the Waste Processing Project into Acetic Acid and Bioethanol in Central Kalimantan Province can be stated as:

FEASIBLE

ASPEK FINANSIAL

6.1 Pembelanjaan Modal (CAPEX)

Mengacu pada *benchmark* terhadap kajian yang telah dilakukan oleh perusahaan korea terhadap kegiatan pengembangan proyek sejenis, pada komponen penyiapan lahan diketahui bahwa kebutuhan luas lahan minimum dalam pengembangan fasilitas infrastruktur energi terbarukan dengan memanfaatkan limbah persampahan menjadi Asam Asetat dan Bioetanol adalah sebesar 2 Ha. Dengan mengacu pada komponen pembelanjaan modal tersebut beserta mempertimbangkan biaya pajak dan asuransi nilai total CAPEX dari Proyek Pengolahan Sampah Kalimantan Tengah diperkirakan mencapai **Rp599.164.285.500** dengan rincian sebagaimana yang tercantum pada tabel berikut ini.

Area	Uraian	Unit	Satuan	Harga (Rp.)	Total (Rp.)
Property /Land	Lahan keseluruhan yang digunakan	20,000	M2	350,000	7,000,000,000
	Biaya Perataan Lahan	20,000	M2	20,000	400,000,000
	Perijinan	1	1	25,000,000	25,000,000
	Dump Truck	123		573,100,000	70,491,300,000
	Pic up Point Kotim - Katingan	500	M2	350,000	175,000,000
	Pic up Point Kapuas - Pulang Pisau	500	M2	350,000	175,000,000
	Biaya Perataan Lahan	500	M2	20,000	10,000,000
				Subtotal	**78,276,300,000**
Zona 1	**Zona Penerimaan dan Pemilahan Awal**				
	Conveyor Belt	6		218,000,000	1,308,000,000
	Trommel Screen / Mesin Pemilah Drum Putar	4		619,000,000	2,476,000,000
	Magnetic Separator	3		87,000,000	261,000,000
	Bangunan	800		5,000,000	4,000,000,000
				Subtotal	**8,045,000,000**
Zona 2	**Zona Pencacahan & Pre-Treatment**				
	Mesin Shredder / Pencacah Industri	3		100,000,000	300,000,000
	Tangki Pencampur / Mixer Homogenisasi	10		17,625,000	176,250,000
	Pompa transfer	6		20,000,000	120,000,000
	Dosing system	5		33,000,000	165,000,000
	Bangunan	600		5,000,000	3,000,000,000
				Subtotal	**3,761,250,000**
Zona 3	**Zona Reaktor Fermentasi**				
	12 fermentor 50 m^3 stainless	12			24,000,000,000
	Sistem aerasi & blower	1			3,000,000,000
	Instalasi pipa, otomasi, utility	1			5,000,000,000
	Bangunan	2000		5,000,000	10,000,000,000
				Subtotal	**42,000,000,000**
Zona 4	**Zona Pemurnian & Distilasi**				
	Distillation Column (Kolom Fraksionasi)	4		750,000,000	3,000,000,000
	Condenser & Receiver Tank	4		300,000,000	1,200,000,000
	Pompa Vakum	3		300,000,000	900,000,000
	Filter Press	2		600,000,000	1,200,000,000
	Bangunan	1000		5,000,000	5,000,000,000
				Subtotal	**11,300,000,000**
Zona 5	**Zona Penyimpanan Produk & Limbah**				
	Tangki stainless 10 m^3 (custom)	30		500,000,000	15,000,000,000
	Snyder horizontal tank 1 m^3	5		8,500,000	42,500,000
	Spill Pallet Justrite	10		5,000,000	50,000,000
	Tangki limbah FRP 20 m^3	5		300,000,000	1,500,000,000
	Bangunan	1000		5,000,000	5,000,000,000
				Subtotal	**21,592,500,000**

ASPEK FINANSIAL

Area	Uraian	Unit	Satuan	Harga (Rp.)	Total (Rp.)
Fasilitas Pendukung	**Unit Pengolahan Air Limbah (IPAL)**				
	Dissolved Air Flotation (DAF)	5		48,900,000	244,500,000
	Reverse Osmosis (RO)	1			1,250,000,000
	Reaktor Anaerobik-Aerobik	1			1,500,000,000
	Bangunan	500		5,000,000	2,500,000,000
				Subtotal	**5,494,500,000**
	Unit Utilitas				
	Boiler (steam untuk distilasi)	2		47,000,000	94,000,000
	Chiller (pendingin kondensor)	3		583,000,000	1,749,000,000
	Genset Cadangan	2		710,399,000	1,420,798,000
	Substation & panel listrik	1		150,000,000	150,000,000
	Bangunan	400		5,000,000	2,000,000,000
				Subtotal	**5,413,798,000**
	Bangun Fasilitas Kantor & Laboratorium meliputi:				
	Kantor manajemen & ruang kontrol	1			
	Laboratorium QC (kimia & mikrobiologi)	1			
	Ruang operator & SCADA	1			
	Total Bangunan	500		5,000,000	2,500,000,000
	Subtotal				**2,500,000,000**
	Total				**178,383,348,000**
Tax dan *insurance*	Fee Konsultan Perancangan Pabrik	9%			16,054,501,320
	Kontijensi Cost	3%		4,459,583,700	4,459,583,700
	Tax				17,974,928,565
	Working Capital				420,780,937,500
	insurance				14,979,107,138
	IDC				130,934,889,430
Grand Total					**783,567,295,652**
CAPEX					**599,164,285,500**

Tahapan Pembelanjaan Modal (CAPEX)

Kategori	Tahun (Rp.)			
	2029	2030	2031	2032
Stage 1	**299,582,142,750**		-	
Stage 2		**119,832,857,100**		-
Stage 3			**119,832,857,100**	
Stage 4				**59,916,428,550**
Pinjaman Awal		228,623,116,418	340,694,168,086	462,874,028,615
Tambahan Pinjaman	209,707,499,925	83,882,999,970	83,882,999,970	41,941,499,985
IDC	18,915,616,493	28,188,051,698	38,296,860,559	45,534,360,680
Pinjaman + IDC	228,623,116,418	340,694,168,086	462,874,028,615	550,349,889,280

Nilai total pembelajaan modal (CAPEX) yang dibutuhkan dalam pembuatan fasilitas Proyek Pengolahan Sampah menjadi Asam Asetat dan Bioetanol

Rp 599.164.285.500,-

ASPEK FINANSIAL

6.2 Pembelanjaan Operasional (OPEX)

OPEX merupakan pengeluaran yang dilakukan oleh sebuah perusahaan untuk memenuhi kebutuhan operasionalnya. Dalam kegiatan operasional Proyek Pengolahan Sampah menjadi asam asetat dan bioetanol secara umum terdiri dari berbagai komponen yang diantaranya menyangkut penyediaan bahan baku, biaya transportasi, biaya penggunaan bahan bakar, pajak, gaji karyawan, asuransi, dan lain sebagainya. Pembelanjaan yang merupakan indikator pengeluaran merupakan nilai komulatif operasional atau OPEX Proyek Pengolahan Sampah menjadi asam asetat dan bioetanol dapat dilihat pada tabel berikut ini.

Pembelanjaan Operasional (OPEX)	Biaya (Rp.)
1. Harga Pokok Penjualan:	
1.1 Bahan Baku Produksi	273.097.687.500
1.2. Upah Langsung	630.918.750
1.3. Biaya Pabrikasi	51.645.206.250
1.4. Persediaan Barang Dalam Proses	2.118.084.375
1.5. Persediaan Barang Jadi	21.992.025.000
1.6. Beban Pokok Penjualan Kemasan	6.895.040.625
2. Biaya Umum dan Administrasi	
2.1. Biaya Gaji dan Tunjangan	12.528.243.750
2.2. Biaya Kantor	2.027.953.125
2.3. Cadangan Imbalan Kerja	1.487.165.625
2.4. Perbaikan dan Pemeliharaan	2.076.173.345
2.5. Penyusutan Aset	1.442.100.000
2.6. Jasa Profesional	585.853.125
2.7. Biaya Sewa	495.721.875
2.8. Listrik, Pos, Telpon dll	450.656.250
2.9. Penelitian	315.459.375
2.10. Perjalanan Dinas	270.393.750
2.11. Jamuan dan Representasi	225.328.125
2.12. Sumbangan	180.262.500
2.13. Kesehatan	135.196.875
2.14. Pajak dan Perijinan	90.131.250
2.15. Biaya Lain lain	2.208.215.625
3. Biaya Promosi dan Penjualan	
3.1. Biaya Pengiriman	26.002.865.625
3.2. Biaya Operasional	1.622.362.500
3.3. Komisi	8.021.681.250
3.4. Gaji dan Tunjangan	1.216.771.875
3.5. Perjalanan Dinas	630.918.750
3.6. Pengemasan	721.050.000
3.7. Sewa Tangki	675.984.375
3.8. Lain-lain	991.443.750
Jumlah	**420.780.937.500**

Analisis Proyeksi Pendapatan

Jenis pendapatan yang diperoleh dari fasilitas pengolahan sampah yang direncanakan diperoleh dari berbagai macam pendapatan yang diantaranya meliputi ***Tipping Fee*, penjualan Asam Asetat, dan penjualan Bioetanol**

Product	*Annual Capacity* (ton)	*Market Price*/ton/Rp	*Market Price* /ton/US	Est. Annual *Revenue (Rp.)*
Tipping fee	165.000	125.000		20.625.000.000
Asam Asetat	115.500	12.000.000	710	1.386.000.000.000
Bioetanol	49.500	8.000.000	473	396.000.000.000

ASPEK FINANSIAL

Dengan asumsi adanya indikasi **kenaikan harga jual masing-masing produk per tahun sebesar 5.5%** maka proyeksi pendapatan dari proyek pengolahan sampah dapat dilihat pada grafik berikut ini.

Indikator Kelayakan Finansial

ANALISIS FINANSIAL

WEIGHTED AVERAGE COST OF CAPITAL **(WACC)** Biaya Modal Rata-Rata Tertimbang	**10,78%**
INTERNAL RATE OF RETURN **(IRR)** Laju Pengembalian Investasi	**14,51%**
NET PRESENT VALUE **(NPV)** Perkiraan Arus Kas Masa Mendatang	**Rp352.356.558.243**
PAYBACK PERIOD **(PP)** Jangka Waktu Pengembalian	**8 Tahun 12 Bulan**

Finansial Recap

TOTAL NILAI INVESTASI	**Rp783.567.295.652**
KAPASITAS JENIS PRODUK	
Asam Asetat	115.500 Ton/Tahun
Bioetanol	49.500 Ton/Tahun

Dengan mengacu pada hasil analisis kelayakan finansial, pengembangan proyek **Pengolahan Persampahan menjadi Asam Asetat dan Bioetanol di Provinsi Kalimantan Tengah** dapat dikatakan:

LAYAK

RISK AND MITIGATION ASPECTS

Risk identification is carried out comprehensively, starting from market aspects, inputs (raw materials), location, industrial processes, outputs (industrial product markets), to supporting factors such as regulations and policies. The purpose of risk identification is to recognize the existence of risks, the nature of the risks faced, and their impacts. Risk identification is an analytical process to systematically discover potential risks that may arise. A detailed explanation of the risks and the evaluation of risk assessment can be described as outlined in the following description.

Risk Identification	Mitigation Aspects
A. Demand/Market Risk	
1. Fluctuations in the demand for bioethanol and acetic acid in both local and global markets. 2. Changes in subsidy policies or biofuel mandates that affect prices and sales volumes. 3. Competition with other renewable energy producers or imports of similar products.	Product diversification (bioethanol, acetic acid, and derivative products), market expansion, monitoring of global price trends, and promotion of green products.
B. Land Risk	
1. Costs for soil investigation (bearing capacity, magnitude and time of settlement, thickness, and type of underlying soil). 2. Costs for improving the strength of the subgrade. 3. Land acquisition costs exceeding the initial plan.	Conducting public consultations to avoid conflicts, disaster risk mapping, and securing long-term land use rights.
C. Licensing Risk	
1. Delays or rejections of environmental, building, and operational permits. 2. Permit rejections due to public objections or negative environmental assessments. 3. Regulatory changes related to renewable energy or waste management. 4. Additional costs arising from lengthy permitting processes.	The availability of a one-stop licensing service.
D. Supporting Infrastructure Implementation Risk	
1. Limited road access for raw material logistics and product distribution. 2. Inadequate availability of electricity, clean water, and communication networks. 3. Delays in the development of internal supporting facilities, such as warehouses, waste treatment systems, or distribution routes.	Coordination with the government for infrastructure improvements, development of backup internal facilities (generators, wells, tanks), and flexible logistics planning.

Source: Analysis Results, 2025

RISK AND MITIGATION ASPECTS

Risk Identification	Mitigation Aspects
E. Financing and Currency Exchange Risk	
1. Interest rate increases that raise borrowing costs. 2. Exchange rate fluctuations affecting the cost of importing equipment or chemicals. 3. Delays in fund disbursement from investors or financial institutions.	Better financial forecasting and engagement of external consultants.
F. Construction and Project Development Risk	
1. Construction delays due to extreme weather, logistical issues, or labor constraints. 2. Increases in material and equipment costs leading to budget overruns. 3. Technical issues such as design errors or system failures during installation. 4. Workplace accidents causing project progress delays. 5. Poor contractor coordination disrupting the construction schedule.	• Collaboration with competent consultants and contractors. • Clarification regarding the competence of consultants and contractors.
G. Force Majeure, Social, and Environmental Risk	
1. Natural disasters such as floods, forest fires, or landslides. 2. Rejection or protests from surrounding communities. 3. Unexpected environmental impacts such as water pollution or strong odors.	• Establish long-term contracts with the Local Government. • Develop a Corporate Social Responsibility program aligned with social welfare, such as education, healthcare, and community environment. • Insurance. • Preparation of an integrated drainage system with the surrounding area, particularly related to runoff water management. • A contingency plan must be prepared to address disaster risks that may endanger lives and disrupt the production process.

Source: Analysis Results, 2025

RISK AND MITIGATION ASPECTS

Risk Identification	Mitigation Aspects
H. Project Operational Risk	
1. Equipment damage or failure that halts the production process. 2. Limited availability of skilled labor for operation and maintenance. 3. Disruptions in energy or water supply hindering operations. 4. Workplace accidents disrupting process continuity. 5. Operating costs higher than estimated.	• Availability of Standard Operating Procedures (SOPs). • Provision of reliable and high-quality human resources and equipment (resources). • Use of well-specified units. • Incorporation of knowledge transfer as part of investment policy and industrial implementation.
I. Raw Material Supply Risk	
1. Fluctuations in the supply of organic waste from landfills or other sources due to changes in collection patterns or competition for use. 2. Competition for raw materials with other industries such as animal feed or compost. 3. Inconsistent raw material quality, for example, high moisture content or low organic content. 4. Logistic disruptions in transporting waste from the source to the processing facility.	• Implement continuous supply management. • Establish commitments with the local government regarding the volume of raw materials.

Source: Analysis Results, 2025

ASPEK RISIKO DAN MITIGASI RISIKO

Identifikasi risiko dilakukan secara menyeluruh dimulai dari aspek pasar, input (bahan baku), lokasi, proses industri, output (pasar hasil industri) sampai pada faktor pendukung seperti regulasi dan kebijakan. Identifikasi risiko bertujuan untuk mengetahui adanya risiko, sifat risiko yang dihadapi dan dampaknya. Identifikasi risiko merupakan proses penganalisisan untuk menemukan secara sistematis risiko yang mungkin timbul. Penjabaran detail mengenai risiko serta evaluasi penilaian risiko dapat dijabarkan sebagai mana deskripsi detail di bawah ini.

Identifikasi Risiko	Mitigasi Risiko
A. Risiko Permintaan/Pasar	
1. Fluktuasi permintaan bioetanol dan asam asetat di pasar lokal maupun global. 2. Perubahan kebijakan subsidi atau mandatori biofuel yang mempengaruhi harga dan volume penjualan. 3. Persaingan dengan produsen energi terbarukan lain atau impor produk sejenis.	Melakukan Diversifikasi produk (bioetanol, asam asetat, produk turunan), perluasan pasar, pemantauan tren harga global, dan promosi green product.
B. Risiko Lahan	
1. Biaya untuk penyelidikan tanah (daya dukung, besar dan waktu penurunan, ketebalan serta jenis tanah yang berada di bawahnya); 2. Biaya untuk meningkatkan kekuatan tanah dasar; 3. Biaya pembebasan lahan yang membengkak di luar perencanaan.	Melakukan konsultasi publik untuk menghindari konflik, pemetaan risiko bencana, dan pengamanan hak guna lahan jangka panjang.
C. Risiko Perizinan	
1. Keterlambatan atau penolakan izin lingkungan, bangunan, dan operasional; 2. Penolakan izin karena keberatan masyarakat atau hasil kajian lingkungan yang negatif; 3. Perubahan regulasi terkait energi terbarukan atau pengolahan sampah; 4. Biaya tambahan akibat proses perizinan yang panjang.	Adanya kemudahan perizinan satu pintu
D. Risiko Implementasi Infrastruktur Pendukung	
1. Keterbatasan akses jalan untuk logistik bahan baku dan distribusi produk; 2. Ketersediaan listrik, air bersih, dan jaringan komunikasi yang belum memadai; 3. Keterlambatan pembangunan fasilitas pendukung internal, seperti gudang, sistem pengolahan limbah, atau jalur distribusi.	Koordinasi dengan pemerintah untuk peningkatan infrastruktur, pembangunan fasilitas internal cadangan (genset, sumur, tangki), dan perencanaan logistik yang fleksibel.

Sumber: Hasil Analisis, 2025

ASPEK RISIKO DAN MITIGASI RISIKO

Identifikasi Risiko	Mitigasi Risiko
E. Risiko Pembiayaan dan Nilai Tukar Mata Uang	
1. Kenaikan suku bunga yang meningkatkan biaya pinjaman; 2. Fluktuasi nilai tukar yang mempengaruhi biaya impor peralatan atau bahan kimia; 3. Terhambatnya pencairan dana dari investor atau lembaga pembiayaan	Prediksi keuangan yang lebih baik dan melibatkan konsultan eksternal.
F. Risiko Konstruksi dan Pengembangan Proyek	
1. Keterlambatan pekerjaan konstruksi akibat cuaca ekstrem, masalah logistik, atau kendala tenaga kerja; 2. Kenaikan harga material dan peralatan yang membuat anggaran membengkak; 3. Masalah teknis seperti kesalahan desain atau kegagalan sistem saat instalasi; 4. Kecelakaan kerja yang menunda progres proyek; 5. Koordinasi kontraktor yang buruk sehingga mengganggu jadwal pembangunan	• Bekerjasama dengan konsultan dan kontraktor yang kompeten. • Klarifikasi mengenai kompetensi konsultan dan kontraktor.
G. Risiko Force Majeure, Sosial, dan Lingkungan	
1. Bencana alam seperti banjir, kebakaran hutan, atau tanah longsor; 2. Penolakan atau protes dari masyarakat sekitar; 3. Dampak lingkungan yang tidak terduga seperti pencemaran air atau bau menyengat	• Membuat kontrak jangka panjang dengan pihak Pemerintah Daerah. • Membangun program *Corporate Social Responsibility* yang sesuai dengan kesejahteraan sosial, seperti Pendidikan dan kesehatan, serta lingkungan masyarakat. • Asuransi • Penyiapan sistem drainase yang terintegrasi dengan Kawasan sekitarnya terutama terkait penampungan air limpasan yang terjadi • Perlu dipersiapkan contingency plan (rencana cadangan) terhadap risiko kebencanaan yang akan menimbulkan dampak/mengganggu keselamatan jiwa dan proses produksi

Sumber: Hasil Analisis, 2025

ASPEK RISIKO DAN MITIGASI RISIKO

Identifikasi Risiko	Mitigasi Risiko
H. Risiko Operasional Proyek	
1. Kerusakan atau kegagalan peralatan yang menghentikan proses produksi; 2. Keterbatasan tenaga kerja terampil untuk pengoperasian dan pemeliharaan; 3. Gangguan pasokan energi atau air yang menghambat operasional; 4. Kecelakaan kerja yang mengganggu kelancaran proses; 5. Biaya operasional lebih tinggi dari perkiraan.	• Tersedianya *Standar Operasional Prosedur* (SOP) • Penyediaan SDM, alat (sumber daya) yang handal dan berkualitas tinggi • Menggunakan spesifikasi unit yang baik • Memasukkan transfer knowledge sebagai bagian dari kebijakan investasi dan pelaksanaan perindustrian
I. Risiko Sumber Bahan Baku	
1. Fluktuasi pasokan sampah organik dari TPA atau sumber lain akibat perubahan pola pengumpulan atau persaingan penggunaan; 2. Persaingan bahan baku dengan industri lain seperti pakan ternak atau kompos; 3. Kualitas bahan baku tidak konsisten, misalnya kadar air atau kandungan organik yang rendah; 4. Gangguan logistik dalam pengangkutan sampah dari sumber ke fasilitas pengolahan	• Melakukan *continuous supply management* • Membuat komitmen dengan pemerintah daerah terkait jumlah bahan baku

Sumber: Hasil Analisis, 2025

CONCLUSION AND RECOMMENDATIONS

A The waste processing project has high urgency and strategic value as a supplier of industrial raw materials.

B Using **ECOWIN technology**, it produces two products simultaneously:
- **Acetic Acid (CH_3COOH): annual capacity of 115,500 tons.**
- **Bioethanol (C_2H_5OH): annual capacity of 49,500 tons.**

C **Investment land: approximately 2 hectares, with Freehold Title (SHM), designated as Plantation Area (100%), in accordance with the Regional Spatial Plan (RTRW).**

D **Strategic location: near Jalan Tjilik Riwut, with access to the landfill (TPA) at Km 14 (distance ±90 meters).**

E The development plan for waste feedstock pick-up points in Katingan Regency and Pulang Pisau Regency requires approximately 500 m^2 of land each.

F The project will be implemented under a **Public-Private Partnership (PPP) scheme.**

CONCLUSION AND RECOMMENDATIONS

1. Intensive coordination among the regencies (Kotawaringin Timur, Kapuas, Katingan, and Pulang Pisau) is required regarding cooperation schemes, tipping fees, and waste supply.
2. Multi-stakeholder communication facilitation must involve investors, BKPM, local governments, the Ministry of Environment and Forestry (KLHK), and other relevant ministries/agencies.
3. Socio-economic aspects are important, particularly the creation of a conducive employment environment.
4. Basic infrastructure needs to be improved, including roads, supporting facilities, and basic utilities.
5. Licensing and certainty of **clean and clear** land status must be prioritized.
6. The government may provide incentives, such as tax allowances and one-stop integrated services, to facilitate investment.

KESIMPULAN DAN REKOMENDASI

A Proyek pengolahan sampah memiliki **urgensi dan nilai strategis tinggi** sebagai penyedia bahan baku industri.

B Menggunakan teknologi **ECOWIN** untuk menghasilkan dua produk secara simultan:
- **Asam Asetat (CH_3COOH)**: kapasitas 115.500 ton/tahun.
- **Bioetanol (C_2H_5OH)**: kapasitas 49.500 ton/tahun.

C **Lahan investasi**: seluas ±2 ha, berstatus **SHM** dengan peruntukan **Kawasan Perkebunan (100%)**, sesuai RTRW.

D **Lokasi strategis**: dekat Jalan Tjilik Riwut, dengan akses ke TPA Km 14 (jarak ±90 meter).

E Rencana pengembangan **pick up point bahan baku sampah** di Kabupaten Katingan dan Kabupaten Pulang Pisau, masing-masing membutuhkan luas lahan ±500 m^2.

F Proyek dilaksanakan melalui skema **Kerjasama Pemerintah dengan Badan Usaha (KPBU)**.

KESIMPULAN DAN REKOMENDASI

1. Koordinasi intensif antar Kabupaten (Kotawaringin Timur, Kapuas, Katingan, Pulang Pisau) diperlukan untuk skema kerja sama, tipping fee, dan suplai sampah.
2. Fasilitasi komunikasi multipihak harus melibatkan investor, BKPM, Pemda, KLHK, dan K/L terkait.
3. Aspek sosial-ekonomi penting, khususnya penciptaan lapangan kerja kondusif.
4. Infrastruktur dasar perlu ditingkatkan, termasuk jalan, fasilitas pendukung, dan utilitas dasar.
5. Perizinan dan kepastian status lahan **clean and clear** harus diprioritaskan.
6. Pemerintah dapat memberi insentif, seperti **tax allowance** dan layanan terpadu satu pintu untuk mempermudah investasi

DPMPTSP

Dinas Penanaman Modal dan Pelayanan Terpadu Satu Pintu

Provinsi Kalimantan Tengah