A PROJECT FEASIBILITY OF CONVERTING LOW-DENSITY POLYETHYLENE AND COAL FLY ASH INTO FUEL

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A B S T R A C T

Ineptly handled plastic waste has both economic and environmental repercussions. The country's reliance on single-use plastics such as multilayer sachets and pouches has led to the country becoming a "sachet economy," worsening the region's concerning levels of land and marine plastic pollution. By most estimates, the Philippines use a massive 163 million sachets every day. Unfortunately, only the sachets have been counted, not the whole projected number of used plastics throughout the country. Thus, the researchers have proposed an idea to test the feasibility of converting low-density polyethylene and coal fly ash as catalyst into fuel. Coal fly ash is a byproduct that can be found most especially in coal-fired power plants. The plastics will undergo the process of pyrolysis wherein depolymerization takes place in order to produce fuel. For the Statistical Computation of the Sample Size to be Surveyed, the researchers used the Slovin's formula wherein the obtained data and decided to use a 95% confidence level and 5% margin of error and therefore got 399 respondents. Forecasted demand was obtained using the Statistical Straight-Line Method with an average annual increase of 5.58%. The same method was used to forecast the supply which has an average annual increase of 4.49% for the next five years. The initial projected net sale is P515, 650,864.11. The highest possible quality of the desired product is attainable with 82.55% plant capacity utilization that operates in 287 possible manufacturing days with one production shift. The product underwent four different tests, all of which has a positive outcome for the product as an alternative for LPG. The total project cost is P400, 000,000.00 and has a 3.25 years payback period. Therefore, this project is feasible.

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I. INTRODUCTION

Having an LPG (Liquefied Petroleum Gas) in every household has become a part of the daily lives of Filipinos. It can be used in different household gas appliances such as gas stove, cooktops, oven, etc. To produce this fuel, people process raw natural gases present in the environment which are considered as fossil fuels. Sooner or later, the environment and humans might suffer from exploiting these non-renewable resources. As inhabitants of this planet, it is part of people's duty to partake in developing innovations and seeking alternative resources to sustain the daily needs.

According to the 2021 market study [1], the Philippines' plastic industry has a lot of impact on our economy contributing more than US $2.8 billion dollars in 2018 as plastic is more convenient in providing cheaper commodities for the lower and middle-class Filipino families. However, the reliance on single-use plastics such as multilayer sachets and pouches has led to the country becoming a "sachet economy," worsening the region's worrying levels of land and marine plastic pollution. Noticing the increasing demand of single-use plastics, it is estimated that the Philippines utilizes a massive amount of plastic at around 163 million sachets each day [2].
Unfortunately, these were just the sachets and not the whole estimated count of different kinds of used plastics in the country [3].

Coal is used to produce 37% of the world's power and more than 70% of the world's steel. This material is composed of water, minerals, oil, gas, rock fragments, fossils, and most of the elements listed in the Periodic Table [4]. In the present, there are about a total of 28 coal-fired power plants running throughout the country, and it produces millions of metric tons of coal fly ash. Despite the immense production of coal combustion products, it is still not fully utilized in the country. Some of these are used in different construction projects and some ended up in landfills. Coal fly ash is ideally used to expand the drive towards environmental-friendly raw construction materials used in the Philippines without neglecting the quality produced [5]. This can also be used to improve the workability of the product or material. Therefore, utilizing coal fly ash has several benefits for the environment as the quantity of waste that will be piled up in the landfills will

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significantly decrease and other natural resources can be preserved and maintained.

With all the problems arising in today's society, the researchers strove to turn global wastes like Low-Density Polyethylene and coal fly ash into in-demand and sustainable fuels. Pyrolysis has found a broader scope in defining any chemical changes caused by the application of heat, including the addition of air or other additives [6] Pyrolysis of waste low-density polyethylene (LDPE) is regarded to be a highly efficient and promising treatment technology process [7].

Hence, with the plastics and fly ash's properties and composition, it can be converted into fuel using the right processes. With low-cost fuel, Filipino families would get to use an alternative source for traditional LPG. This could be a way to help the environment and make a livelihood for the local residents of Calamba City, Laguna.

II. RESEARCH METHOD

A. Sources of data

1. Research instrument.

Researchers conducted hybrid collection of data through Google Forms and printed standardized survey questionnaire. Mainly, the survey questionnaire is divided into three parts. The first is the Respondent's Demographic Profile, it is a multiple choice and fill-up type. In this type of questionnaire, respondents are guided in their responses. The possible responses are given, and the respondents will only select their answer. For the second part, which is LPG Consumption Preferences of the Respondents, and the last is the Product Profile of Polymerized fuel; it is a multiple response type of questionnaire.

2. Sample size to be surveyed.

The total number of households in Calamba City, Laguna is shown in Table I. It was obtained from the City Population Management Office of Calamba City, and it shows the number of households per annum from 2017 until 2019. Meanwhile, the data for 2020 and 2021 are projected by the City Population Management Office and was used by the researchers to determine the sample size. Using the Slovin's formula with 5% margin of error, 389.91 or 399 respondents was obtained.

TABLE I
NUMBER OF HOUSEHOLDS IN CALAMBA CITY

YEAR	NO. OF HOUSEHOLDS
2017	107, 795
2018	111, 014
2019	114, 329
2020	124,401
2021	145, 798

Source: City Population Management Office

3. Historical annual data for LPG demand.

The historical demand for LPG was determined based on the data of the Number of Households in Calamba City and was obtained in the City Population Management Office. Aside from that, researchers used the data gathered from structured survey questionnaire for the average consumption of LPG per household. The Figure 1 shows the historical annual demand for LPG in Calamba City. It was obtained by getting the product of number of households, percentage of LPG users, and average annual LPG consumption (in kg). It can be observed that the demand for LPG is increasing.

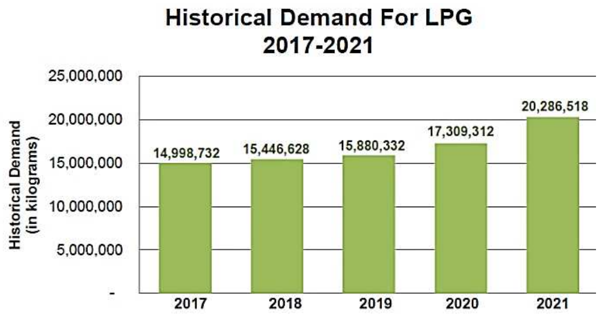

Figure 1 Historical annual demand for LPG

4. Historical annual data for LPG supply.

The supply of LPG was based on the Department of Energy Comprehensive Report of 2019 and 2020 [8,9]. Using the data for the overall population of the Philippines, the refinery production and importation of LPG, the proponents was able to narrow it down to arrive at the historical supply of LPG in Calamba City Laguna.

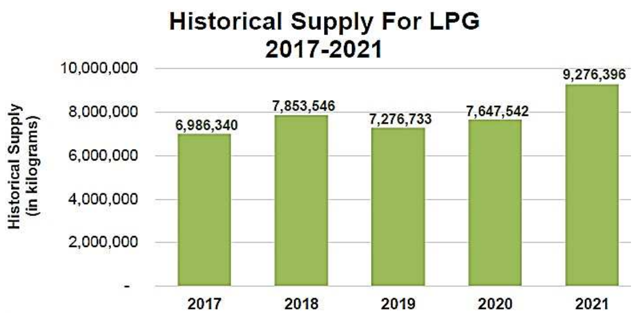

Figure 2 Historical annual supply for LPG

Figure 2 shows the historical supply of LPG in Calamba City. It was calculated by solving the product of total supply in the Philippines, household percentage of Calamba City from the total households of the Philippines, and supply in thousand barrels. It was converted into liters and kilograms. The proponents used the kilogram derived values as historical supply. Observably, it shows there is inconsistent in supply of LPG.

B. Data Gathering Procedure

The researchers made a letter of request to the City Population Management Office of Calamba City Hall to be able to know the distribution of households in all barangays

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of Calamba City Laguna. The researchers carefully selected their respondents through statistical formula of Slovin's formula and random sampling to get the total number of target respondents in collecting the necessary data. Standardized questionnaire was used in conducting the study which was used as a survey guide for the researchers and research instrument to gather first hand data.

The researchers personally approached the selected respondents and explained the nature and scope of the study. The signed letters to respondents are also presented to show formality and then the researchers' proceeds.

C. Statistical Treatment of Data

The data obtained from the respondents were tallied, tabulated, and interpreted using the various statistical tools such as:

1. Slovin's Formula, in computation of sample size to be surveyed.

$$n = \frac{N}{1 + Ne^2} \quad (1)$$

Where:

n= sample size
N= total number of households
1= constant
e = margin of error

2. Average Growth Rate Formula for calculating in between unknown data.

Average Annual growth rate:

$$= \frac{\frac{\text{Final Value} - \text{Initial Value}}{\text{Initial Value}} \text{x } 100}{\text{No. of years}} \quad (2)$$

Where:

Final value = last year
Initial value = first year

3. Projection methods.

In this study, researchers used four projection methods, which are Arithmetic Straight-Line Method, Arithmetic Geometric Curve Method, Statistical Straight-Line Method, and Statistical Parabolic Curve. In this case, the proponents used the Statistical Straight-Line method as it yields the next smallest derived value of standard deviation, and it will evidently satisfy the inconsistent increase in demand.

Formula: Statistical Straight-Line Method

$$Y_c = a + bx \quad (3)$$

Where:

$$a = \frac{\sum Y}{n} - b\frac{\sum X}{n}$$

$$b = \frac{n\sum XY - \sum X \sum Y}{n\sum X^2 - (\sum X)^2}$$

Figure 3 Graph of projected annual demand for LPG

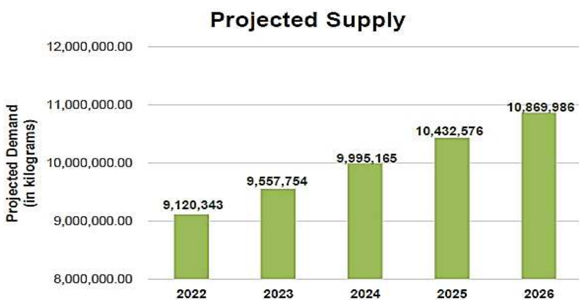

Figure 4 Graph of projected annual supply for LPG

Figure 3 and 4 shows the projected demand and supply for LPG in the next five years (2022-2026) respectively. For the demand, it has an average increase of 5.58%, whereas in supply it has an average increase of 4.49%.

4. Net Present Value.

To get the present value of cash flow from 2021-2026.

$$NPV = \sum_{t=0}^{n} \frac{Rt}{(1+i)^t} \quad (4)$$

Where:
R_t = Net cash inflow-outflows during a single period, t
i = Discount rate or return that could be earned in alternative investments
t = Number of timer periods

5. Internal Rate of Return.

To obtain the annual growth rate in which the company's investment is expected to generate.

$$0 = NPV = \sum_{t=1}^{T} \frac{C_t}{(1+IRR)^t} - C_0 \quad (5)$$

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Where:
C_t = Net cash inflow during the period t
C_0 = Total investment costs
IRR = The internal rate of return
t = The number of time periods
6. Payback Period.

To assess how fast does the initial investment will be recovered to the company's funding.

$$Payback\ Period = \frac{Initial\ Investment}{Cash\ flow\ per\ year} \quad (6)$$

D. Experimental Procedure

Experiments are carried out using a known quantity of LDPE plastic waste and the catalyst at a moderate reactor temperature. The reactor vapors are condensed in the coiled condenser, and the condensate, or liquid fuel, is stored in the improvised glass bottle. Figure 5 shows the experimental set up for production of fuel from LDPE and coal fly ash.

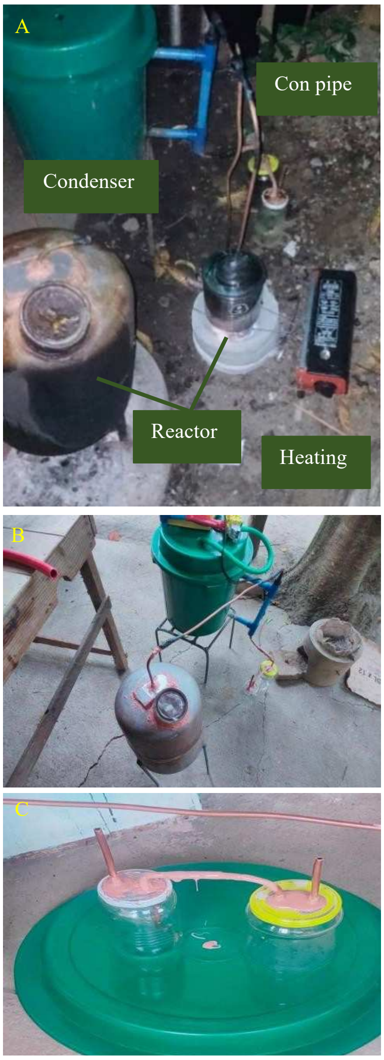

Figure 5 Experimental setup for production of fuel from LDPE: (A) Parts of the experimental setup, (B) Condenser and reactor, and (C) One-way valve and gas chamber

As previously described, the experimental setup employed for this study is depicted in Figure 5. This setup is composed of Condenser, Reactor, Con Pipe, Heating, One-way Valve, and Gas Chamber. In this sample, the collected LDPE, such as bubble wrap, cling wrap, and plastic pouches, were classified as garbage after being used for their original purpose. After collecting, LDPEs are cleaned by washing them thoroughly with clean water to eliminate contaminants. After washing, it is sun-dried to remove excess water. The LDPE plastics are then shred into little pieces to enhance the surface area available for the reaction. For this experiment, the researchers utilized at least 14 kg of LDPE plastic.

The experiment begins by placing LDPE plastics weighing at least 14 kilograms in the reactor and adding at most 2 kilos of coal fly ash as a catalyst. Heating is initiated in order to melt and shatter the plastic trash in the reactor. When the temperature rises over 115˚C, the waste LDPE begins to melt. The vapor generation process began after the temperature reached 160˚C. Temperature rise began gradually by providing more heat from 160˚C to 290˚C during a 30-minute period. When the reactor temperature hits 170˚C; the first drop of condensate is noticed. Nearly 30% of the fuel has been gathered in the temperature range of 170 C to 250 C. When the temperature rises to 290˚C the fuel collection rate increases and obtained an additional 40% of liquid fuel. When the temperature hits 310˚C, the remaining fuel is collected. The researchers produced a total of 21.56 liters or 11 kg of liquid fuel (gas conversion) from at least 14 kg of LDPE plastic and no more than 2 kilogram of coal fly ash.

III. RESULT AND DISCUSSION

A. Marketing Aspect

The potential marketability of the company is centered on the product's supply and demand, as well as how it will address unsatisfied demand. With 385 responses and a percentage of 96.49%, the Figure 6 demonstrates that the majority of respondents are willing and inclined to buy VERDE Fuel in 11 kg. This means that there is a market for the product and an existing demand in all of Calamba City Laguna's barangays.

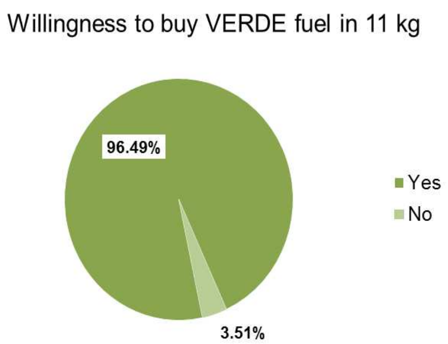

Figure 6 Graph of willingness to buy VERDE fuel in 11 kg

The proponents analyzed the company's feasibility in entering the market using demand and supply analysis, which acts as a business decision guide. The yearly rate of increase in unsatisfied demand was calculated using this

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technique. The Figure 7 below depicts the predicted unsatisfied for LPG demand over the next five years. It is clear that VERDE Fuel has a higher opportunity of entering into the market. This indicates that the demand for LPG is continuously increasing and this is an opportunity for VERDE Fuel. The proponents can potentially market their product to their target market, which is in Calamba City, Laguna. The unsatisfied demand has an average annual increase of 6.43%.

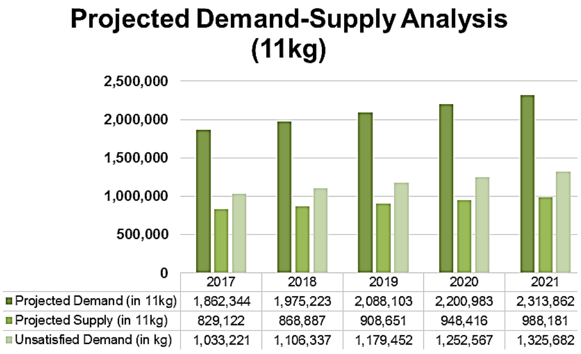

Figure 7 Graph projected demand-supply analysis (11 kg)

With this, the Table II below shows the proposed production volume of OCTAVERDE Solutions, Inc. in obtaining the number of potential customers, the product of the projected unsatisfied demand and percentage of who are willing to avail VERDE Fuel, which is based on the responses on the survey conducted, is solved. Meanwhile, the proposed production volume was derived by multiplying the potential number of customers and the desired production rate. The company sets a 47% production rate in the first year of operation since it is in the beginning phase and there is a possibility for adjustments. Production rate has a 2% increase annually.

TABLE II
PROPOSED PRODUCTION VOLUME

YEAR	PRODUCTION RATE	PROPOSED PRODUCTION VOLUME (IN KG)
2022	47%	475,853
2023	49%	531,209
2024	51%	589,430
2025	53%	650,517
2026	55%	714,470

Through this, the Figure 8 below shows the projected market share of the company for the next five years. It has an average annual increase of 4.85%.

Figure 8 Graph of market share

Given the computed market share, the projected annual sales is possible. Table III shows the projected annual sales for VERDE Fuel. The price is for retail and is assumed to be in a refill basis. It was obtained by multiplying the proposed production volume at 95% and selling price. It was divided by 1.12 for the value added tax. On the other hand, the remaining 5% will be on the company's inventory. Moreover, the company will offer the fuel with LPG tank for wholesale and retail as well.

TABLE III
PROJECTED ANNUAL SALES

YEAR	ANNUAL SALES (IN PHP)
2022	306,351,612.19
2023	357,307,089.05
2024	397,337,230.79
2025	438,666,221.23
2026	481,905,269.54

B. Technical Aspect

OCTAVERDE Solutions, Inc. will have a total land area of 5,049 square meters and a manufacturing plant area of 2,880 square meters, with a production area of 293.579 square meters, or 10.19 percent of the overall plant size *(Figure 11)*. The VERDE Fuel will go through twelve phases in the manufacturing process as illustrated in Figure 10, which is divided across the plant's three primary production areas. It consists of raw material preparation, plastic segregation, plastic shredding, plastic densifying, pyrolysis processing, condensation, and fuel refining forthe first area. The obtained and pre-purchased empty LPG tanks were tested and refurbished in the second area. The gas filling procedure comes last, followed by weight checking scale, air leakage testing, safety cap, and thermos-sleeve setting. The Densifier machine, ELIXIR 12-point Electronic Filling Carousel, Electric Crucible Induction Melting Furnace, Fuel Treatment Refinery Machine, LPG Gas Cylinder Air Leakage Testing Machine, and Shredding Recycling Machine, on the other hand, are required for the company to be able to generate fuel.

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It includes validated product testing results, production volume, plant layout designs, manpower needs, production schedule, and product cost estimate in this aspect. The plant capacity of the company is as follows:

Working Capacity of the Plant	:	2,096.09 tanks/shift
Expected Plant Capacity Utilization	:	82.55%
Production Days per year	:	295 days
Number of Production shift	:	One Shift (8 hours)

1. Product Description

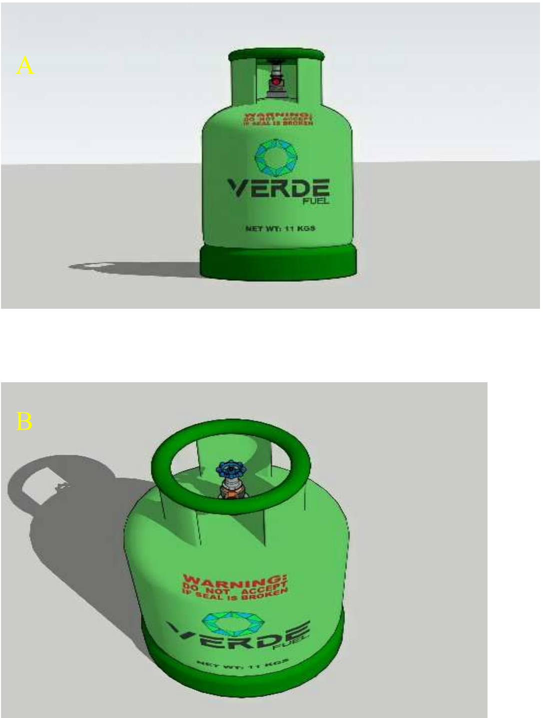
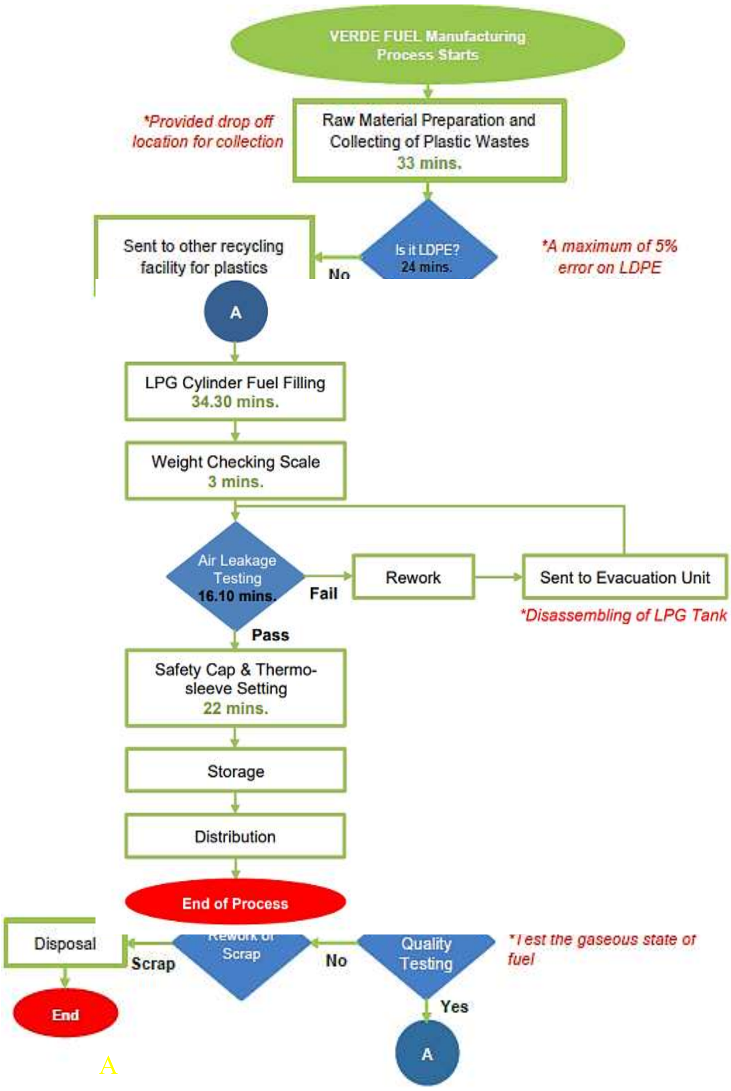


Figure 9 Different perspectives of product design: (A) front view (B) perspective

The product VERDE Fuel as shown in Figure 9, is a sustainable fuel made from Low-Density Polyethylene (LDPE) with coal fly ash as a catalyst. It is intended to be used as a fuel for cooking, an alternative to traditional liquefied petroleum gas (LPG). The purpose of OCTAVERDE Solutions, Inc. is to develop an affordable and innovative product that can be used by households in Calamba City, Laguna. VERDE Fuel is recommended for ovens, furnaces, gas stoves, cooktops, etc. It is stored, as a liquid, in a cylindrical tank and available in 11 kg. This clean-burning fuel is also easy to store, provides good flame control, and is environmental-friendly with minimum emissions.

This product is an attempt towards plastic waste management, as it uses a type of plastic that is usually disposed after single use as well as coal fly ash, which is an industrial byproduct of electricity generation. The raw ingredients are gradually heated to depolymerize, separating the crude oil and gas.

2. Manufacturing Process



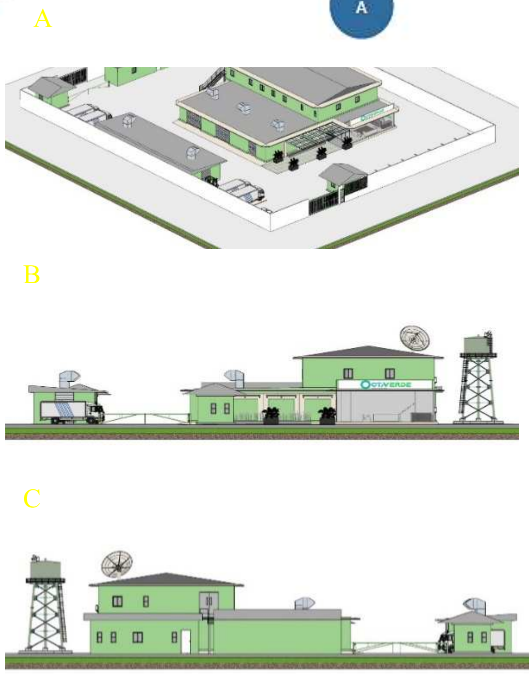


Figure 11 Different perspectives of plant layout: (A) isometric view (B) front elevation view (C) back elevation view

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4. Results of the Laboratory tests and Interpretations

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF SCIENCE AND TECHNOLOGY
INDUSTRIAL TECHNOLOGY DEVELOPMENT INSTITUTE
STANDARDS AND TESTING DIVISION

TEST REPORT
ITDI-022022-OCS-0071

Customer's Name : Polytechnic University of the Philippines-Sto. Tomas Branch/ Christine Joy B. Catindig
Address : 0622 San Pedro, Sto. Tomas City, Batangas
Contact Details : CP# 0917.366.5316
Date Received : February 07, 2022

Sample Code : OCS-2022-0075
Sample : ***Fuel gas-Liquid fuel (LDPE & fly ash as catalyst)***
Description & Identification : About 400 mL brown liquid in a plastic bottle with screw cap, unmarked
Date(s) Tested : February 8-17, 2022

Test Parameter, Unit	Result	Test Method
Specific Gravity @ 25.0 °C	0.784	ASTM D1298[a]
Kinematic Viscosity at 40 °C, mm^2/s	1.71	ASTM D445[a]
Kinematic Viscosity at 100 °C, mm^2/s*	0.673	ASTM D445[a]
Heating Value, BTU/lb	17700	ASTM D240[b]

*The sample boiled during kinematic viscosity analysis at 100°C.

References: [a] ASTM Book of Standards: Petroleum Products, Lubricants and Fossil Fuels, Volume 5.03, 1993
[b] ASTM Book of Standards: Petroleum Products and Lubricants (I), Volume 5.01, 1993

VALIDITY OF THE TEST REPORT: The test results are those obtained at the time of the test and pertain only to the sample(s) received by the Laboratory of this Institute. *Codes and words in Italics are quoted solely for the customer's reference; significance of these codes and words is not verified by the Laboratory.* This report is not to be used for advertising purposes or sales promotion. This report shall not be reproduced except in full without the approval of the Standards and Testing Division.

GP 5.10-01-F06
Rev 1 / 28 June 2018

ALMA B. CRUZ, MAS, RCh
PRC Reg. No. 0008521
Head, Organic Chemistry Section

Issued under the Authority of:

MA. RACHEL V. PARCON, MSc, RCh
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Officer-In-Charge

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February 21, 2022
Page **1** of **1**

Quality Life and Products Through Testing.

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Figure 12 Laboratory test report of fuel

This test method, as shown in Figure 12, covers the determination of the relative density, or API gravity of crude petroleum. The process of testing Petroleum products or mixtures of petroleum and nonpetroleum products that are normally handled as liquids and have a Reid vapor pressure of 101.325 kPa (14.696 psi) or less in the laboratory using a glass hydrometer and a series of calculations. Similarly to the study of [10], aspects of the reactor core have been studied regarding the surface temperature of the fuel and fluid. This computation is calculated at current temperatures and corrected to 25 °C where VERDE Fuel is less than one that is considered on international standard table values. Base on the result of the laboratory, VERDE Fuel will float on water since it is less dense than water therefore it is easy to detect for any sign of leakage.

The amount of heat released by combusting a specified quantity (at first at 25°C) and returning the temperature of the combustion products to 150°C, assuming the latent heat of vaporization of water in the reaction products is not recovered. This combustion releases a heating value of 17700 BTU/lb., whereas liquefied petroleum gas has a heating value of 17673 BTU/lb. to 19017 BTU/lb., therefore it can be concluded that VERDE Fuel has entered the LPG calorific value range.

Kinematic viscosity is a test needed for fuel to know whether it is suitable for LPG hose and regulator. Too much resistance on the flow can cause disruption and blockage of hose that can cause pressure on both tank and refilling machine. This is also a test to know if VERDE Fuel can match the current stove design of a regular household. For the existing fuel which is LPG, its kinematic viscosity range are 4.979603 mm2/s at 40°c and 7.079212 mm2/s at 100°c while VERDE Fuel reach only 1.71 mm2/s at 40°c and 0.673 mm2/s at 100°c. In layman's terms, viscosity defines a fluid's resistance to flow. The higher the viscosity of a liquid, the thicker it is and the greater the resistance to flow, therefore, VERDE Fuel is thinner than regular LPG and it can be processed easily with less pressure needed.

C. Management Aspect

The vision, mission, core values, and commitments are all part of this aspect. It also establishes a clear separation between the duties and responsibilities of all personnel in the company. This part also includes information on the type of corporate ownership, the hierarchical flow of authority, manpower that satisfies the requirements, hiring and training of staff, and job descriptions and qualifications. Furthermore, management is responsible for planning the overall operations of the organization to ensure its stability. OCTAVERDE Solutions, Inc. features a five-tiered organizational chart that is made up of functional and line structure.

OCTAVERDE Solutions will present two (2) types of organizational chart – the functional and the line organizational chart. The company opted to choose the said type of organizational charts to properly depict the structure of the business and to convey the details of the roles, responsibilities, and relationship between employees within the company.

1. Functional organizational chart

In this type of organizational chart as shown in Figure 13, the name and the responsibilities of the company's employees from the c-suite or executive positions down to its subordinates are presented. Here, employees that have similar set of skills and specialization are grouped together. Since OCTAVERDE Solutions is an incorporated company, it is suited to have a traditional business structure so that the employees can focus on their role and specialization.

2. Line organizational chart

Similar to functional organizational chart, here, it will also show the responsibilities of every position. However, this is much simpler than the other types of organizational chart. OCTAVERDE Solutions, Inc. opted to create a separate organizational chart for Human Resource and Administration, Finance, Marketing, as well as Planning & Development Department to show the self-contained or completed department structure and highlight its key personnel. As for the partition of shared capital stock subscribed by the stockholders see Table IV in Financial Aspect.

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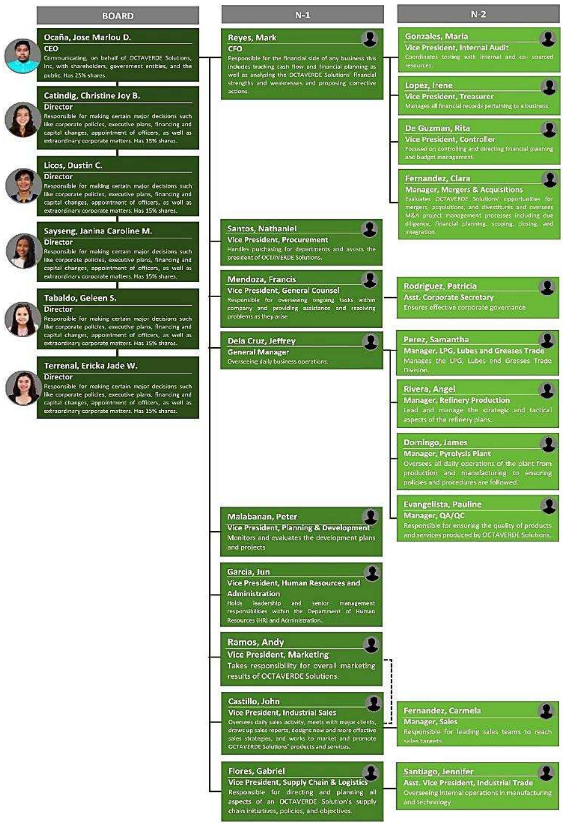

Figure 13 Functional organizational chart

D. Socio-Economic Aspect

Socio-Economic Aspect is a study of how OCTAVERDE Solutions, Inc. could prosper in its market setting. The corporation supports the UN Sustainable Development Goals, aiming for Affordable Clean Energy, Decent Work and Economic Growth, Industry, Innovation, and Infrastructure, Sustainable Cities and Communities, Responsible Consumption and Production, and Climate Action. The company also intends to establish and participate in environmental and social projects. The corporation set aside 1.5% of its gross profit for such programs as a means of giving back.

E. Financial Aspect

The six incorporators will provide 80% of the total capital, with the remaining 20% will be covered by a loan as illustrated by Table IV. The payback period is 3.25 years, with an internal rate of return of 38.70% while the profitability index is 2.38. It means that the initial investment is expected to at least double within the five years of operation. OCTAVERDE Solutions, Incorporation have a gross profit and net margin of 28.63% and 26.86% respectively for the first year of operation. The current ratio is expected to be in a healthy level of 5.11 with a debt ratio of 25.97%.

TABLE IV
AMOUNT OF INITIAL CAPITAL INVESTMENTS

Name	No. of shares	Amount of capital stock subscribed (PHP)
Christine Joy B.Catindig	15%	48,000,000.00
Dustin C. Licos	15%	48,000,000.00
Jose Marlou D. Ocaña	25%	80,000,000.00
Janina Caroline M.Sayseng	15%	48,000,000.00
Geleen S. Tabaldo	15%	48,000,000.00
Ericka Jade W. Terrenal	15%	48,000,000.00

1. Project Cost

OCTAVERDE Solutions, Inc.
Project Cost
For the Years 2022-2026

Fixed Assets	
Machineries	₱2,763,830.40
Equipment	1,831,516.01
Furniture and Fixtures	206,259.82
Total Fixed Assets	4,801,606.23
Working Capital	
Direct Materials	94,030,171.55
Direct Labor	423,509.17
Overhead	2,391,390.44
Utilities Expense	1,152,882.31
Other Expense:	
SSS Contribution	420,870.04
Philhealth Contribution	22,800.00
Pag-IBIG Contribution	99,935.22
Taxes and Licenses	3,828,160.95
Salaries	68,527,008.00
Total Working Capital Requirements	175,698,333.92
Pre-Operating Expenses	
Advertising Expense	5,000,000.00
Land and Building	83,234,324.18
Total Pre-Operating Requirements	88,234,324.18
Cash Requirements	263,932,658.10
Cash Contingencies	136,067,341.90
Total Project Costs	**₱400,000,000.00**

Figure 14 Project cost

As reflected in the project cost in Figure 14, a total of four hundred million pesos will be needed in venturing this business. Cash requirements are the total of expected working capital requirements and the total pre-operating requirements. A cash contingency is allocated more than the half of cash requirements as it will cover the emergency funds.

2. Project Appraisal

Figure 15 Graph of payback period

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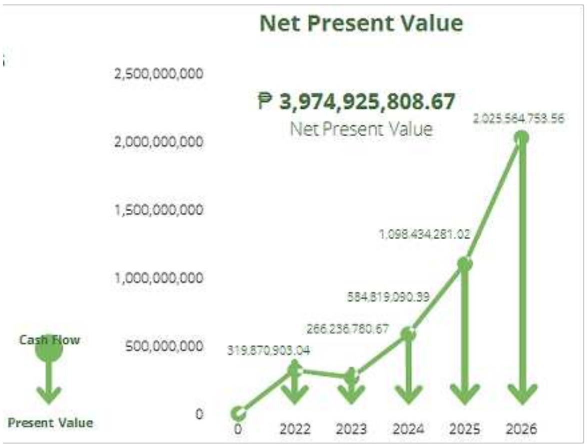

Figure 16 Graph of net present value

Given all of this information, the Figure 15 in which the shareholder will be able to receive back their investment on the third and one fourth year of the operation. This time frame is comparable to in investment instruments such as bonds and treasury bills. By converting the future net cash flow into present value as shown in Figure 16, ascertainment is possible on how much the initial investment would cost at present time. Now, the net present value of investment is estimated to be ₱ 3,974,925,808.67, which is significantly higher than the initial investment of P320, 000,000.00.

IV. CONCLUSION

The conversion of waste plastic into liquid fuel has the potential to alleviate the problem of plastic waste recycling as well as the scarcity of liquid fuel in developing nations such as the Philippines. Thermal degradation of plastic is a simple and cost-effective process. The yield of the product may be done and enhanced by adjusting process parameters such as temperature, pressure, and catalyst quantity. As mentioned, catalyst used is the coal fly ash which a byproduct in coal-fired power plants. It has a significant contribution in the process by solidifying the sustainability of the liquid fuel produced as it provides great factor in the chemical reaction of the product output.

As verified by research and laboratory institution available in the country, the qualities of the liquid fuel created in this feasibility study were determined to be equivalent to liquefied petroleum gas (LPG) and even better for used in households. As a result, it may beargued that "VERDE Fuel" may be a future alternative fuel not only for household but to other applications. Its great potential for usage may immensely contribute to the country's gap for LPG demand and allows whole nation to enjoy a safe and environmental- friendly fuel.

In terms of the residue generated throughout the conversion process, it can be employed in the road-building processes. Since no trash is produced throughout the process, it is referred to as a zero-discharge process or a green process that avoids emissions allowing the process to conform to its sustainability promise. Turning global wastes like Low-density polyethylene and coal fly ash into liquid fuel is revolutionary and innovative step in resolving pressing issues in environmental standpoint. This research is a foreground for further studies which will opens greater opportunity and potentiality.

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ATTACHMENT

Informative Advertising:
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