CHAPTER II
THEORETICAL FRAMEWORK

2.1 Time Value of Money (TVM)

Analysis of financial feasibility is very important to do in evaluating a project. Berk (2017) states that what needs to be done in conducting financial analysis is calculating future cash flows. The calculation of this can help the company in making decisions.

In conducting financial analysis, an inseparable and fundamental thing is Time Value of Money (TVM). Ross (2017) states that the time value of money can simply be interpreted as being more valuable $ 1 today than $ 1 in the future. The logic behind this is that the current $ 1 can be invested and generate returns that make the money we have in the future to exceed $ 1.

The use of the concept of the time value of money is of course very necessary in order to carry out financial analysis. This is because the cash flows generated by the project are not only present in the present, but also involve future cash flows. The absence of the concept of the time value of money in conducting financial analysis for long-term projects has the potential to result in misleading decisions.

2.2 Capital Budgeting

Every business unit in the world has limited resources. This limited resource is then endeavored to get the maximum possible economic benefits. This is done by maximizing the management of the resources owned by the business unit.

One of the forms of management referred to is Capital Budgeting. Baker (2014) defines capital budgeting as the process of planning, analyzing, selecting, and managing capital investments. The basic idea is that managers will invest long-term funds into a project from which the economic benefits of this project are expected to flow to the company for the next several years.

The capital budgeting process is a process that is closely related to the strategic plan of the company. This process must also be carried out carefully because the amount of funds involved in this process is very large. Mistakes in the implementation of capital budgeting can have an impact on sustainable massive losses for the company.

2.3 Net Present Value (NPV)

Net Present Value (NPV) can be defined as the difference generated by cash inflows and cash outflows from a project. Titman (2017) and Berk (2017) state that a project is considered worthy of investment if the NPV generated by the project is positive, otherwise the project is not suitable for investment. For projects that are mutually exclusive, the projects taken are the projects with the largest NPV value.

Although NPV is not the only tool in making decision whether to take investment or not, NPV is one of the gold standards used in evaluating the financial feasibility of a project (Titman, 2017). The results of the NPV calculation show the amount of gain or loss with the current valuation. The formula for calculating the NPV is as follows

$$NPV = CF_0 + \frac{CF_1}{(1+K)^1} + \frac{CF_2}{(1+K)^2} + \cdots + \frac{CF_n}{(1+K)^n}$$

Where:

NPV = Net present value

CF_n = Cash flow for the year n

n = Period

K = Discount rate

2.4 Internal Rate of Return (IRR)

Internal Rate of Return (IRR) can be defined as the interest rate used to generate zero NPV for a project (Titman, 2017). Ross (2017) state that IRR is used to find a single rate of return that summarizes the financial aspect of the project. IRR is widely used when it comes to project finance and also easier for related parties to interpret the result.

The basic idea for IRR is this rate is expected to be an "internal" rate because it only depends on the cash flow of a particular investment, not on the rate provided elsewhere. Base on the basic idea, the rule for interpreting this rate is we should accept the project if the IRR is more noteworthy than the required rate of return that is used to ascertain the NPV of the project, and reject it in any case. The formula for calculating the IRR is as follows

$$NPV = CF_0 + \frac{CF_1}{(1+IRR)^1} + \frac{CF_2}{(1+IRR)^2} + \cdots + \frac{CF_n}{(1+IRR)^n} = 0$$

Where:

NPV = Net present value

CF_n = Cash flow for the year n

n = Period

IRR = Internal rate of return

2.5 Payback Period (PP) and Discounted Payback Period (DPP)

Payback Period (PP) and Discounted Payback Period (DPP) are other criterias those can be used in evaluating company's project. The basic idea of these two alternatives is the same, namely finding the time needed by the project to reach a condition where the cash that has been spent for the initial investment has been paid off. The only difference is in the use of the TVM concept where the PP calculation ignores this concept while the DPP calculation still includes it.

The way to apply the PP and DPP concepts in evaluating project finance is to compare the time obtained from PP and DPP calculations with the maximum time required by the company to pay back the initial investment (Titman, 2017). If the time for calculating PP and DPP is shorter, then the project can be approved. However, if it is longer than the required time, the project is rejected.

2.6 Debt Service Coverage Ratio (DSCR)

The DSCR evaluates the Project Company's ability to service its debt using cash flow from its annual operations (Yescombe, 2014). It's computed by dividing the

project's annual net operating cash flow by the project's annual debt service. The detail formula for calculating the DSCR is as follows

$$DSCR = \frac{Cash\ Available\ For\ Debt\ Service}{Debt\ Service} = \frac{Operating\ Cash\ Flow - Tax}{Principal + Interest}$$

Obviously, the minimum DSCR requirement varies by project, with higher-risk projects requiring a higher DSCR and vice versa. For a project with unusual risks or one that is located in a credit-risky country, higher levels of coverage would be required. For standard projects, very approximate levels could be (Yescombe, 2014):

- 1.20:1 for an Accommodation-based Contract;
- 1.25:1 for a process-plant project with an offtake Contract;
- 1.50:1 for a natural-resources project with no offtake Contract;
- 1.75:1 for a transportation concession;
- 2.00:1 for a ‘merchant' power plant project with no offtake Contract or price hedging.

2.7 Weighted Average Cost of Capital (WACC)

The sources of funding used by the company in financing its projects are generally divided into two, namely debt and equity. The combination of costs arising from debt (cost of debt) and equity (cost of equity) funding adjusted to the proportions of the two types of funding will be the company's cost of capital for the project. This cost of capital is called the Weighted Average Cost of Capital (WACC) which will later

be used as the discount rate. The formula for calculating the WACC is as follows (Ross, 2017):

$$WACC = k_d \times \frac{D}{D+E} \times (1-t) + k_e \times \frac{E}{D+E}$$

Where:

WACC = Weighted average cost of capital

k_d = Cost of debt

k_e = Cost of Equity

D = Total Debt

E = Total Equity

t = Corporate tax rate

2.8 Cost of Debt (kd)

One of the components in calculating WACC is the cost of debt. The cost of debt is the rate of return that a company's creditors demand on new debt. Because of cost of debt is simply the interest rate the corporation must pay on new borrowing, the firm's cost of debt can generally be viewed either directly or indirectly in the financial markets. The amount of a company's cost of debt is equivalent to the interest rate on loans from banks, non-bank financial institutions, or the government, which is based

on the company's health, rating, or the presence of a government guarantee letter (Ross, 2017).

2.9 Cost of Equity (ke)

The cost of equity is another factor to consider when calculating WACC. The cost of equity is the rate of return investors expect to receive from investing in the company's stock which also reflects the risk of investing in the equity of the company. This return is received in the form of cash distributions such as dividends and revenues from stock sales.

In general, there are at least 2 ways to calculate the cost of equity, namely the dividend growth model and the capital asset pricing model. However, in conducting financial analysis of a project, the use of CAPM in measuring the cost of equity is a best practice procedure. The formula for calculating the cost of equity is as follows (Titman, 2017):

$$k_e = R_f + \beta \times \text{EMRP} = R_f + \beta \times (R_m - R_f)$$

Where:

k_e = Cost of equity

β = Beta coefficient of equity

EMRP = Equity market risk premium

R_f = Risk free rate

R_m = Expected return on the market portfolio

2.10 Waste Processing Technology

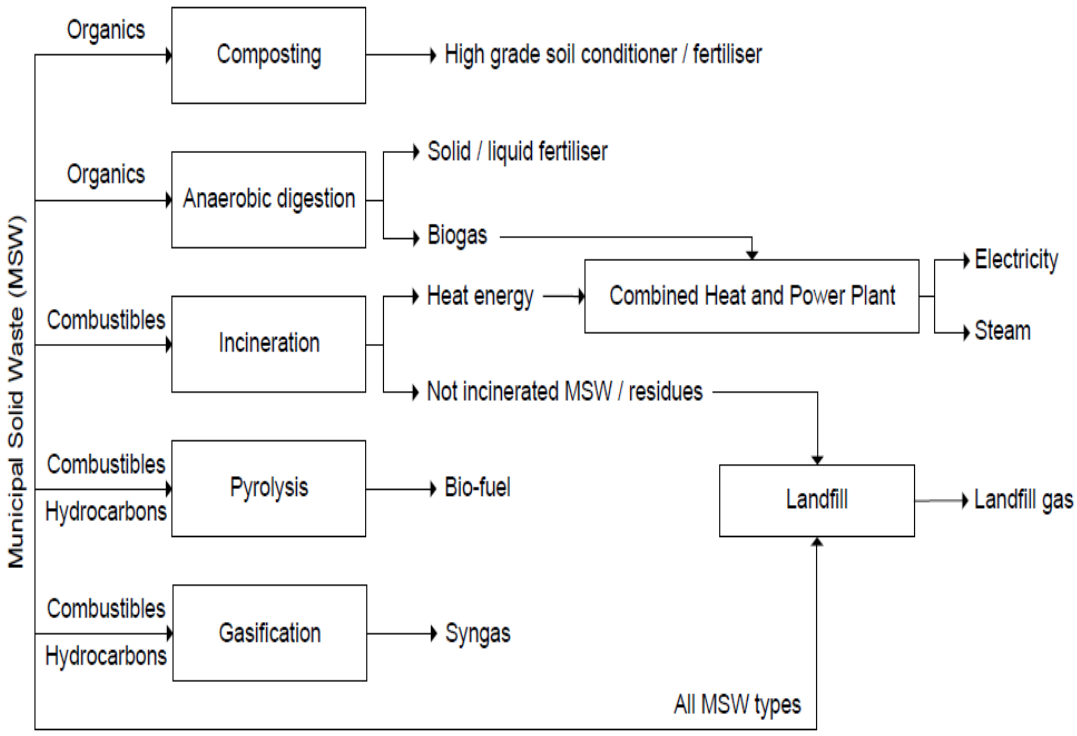
Waste produced by humans does not automatically become an energy product. This waste needs to be processed first. Proper, efficient, and effective processing will help people to get value-added products and achieve the main goal, namely a better ecosystem for the earth.

Waste processing also depends on the characteristics or types of waste. In general, there are 3 types of waste processing, including thermal conversion, biochemical conversion, and landfilling (Chua et al., 2011). Each method will be used for the appropriate type of waste.

Thermal MSW conversion employs heat energy to reduce the amount of MSW and produce biofuels such as syngas, char, and bio-oil, among other things. Incineration, pyrolysis, and gasification are examples of common thermal conversion methods. Enzymes and microorganisms are used in MSW biochemical conversion to break down organics for biogas production and the collection of value-added goods.

Anaerobic digestion, fermentation, and composting are examples of biochemical conversion processes. All thermal and biochemical conversion procedures result in MSW leftovers that must be landfilled or released into the atmosphere. The general waste processing process that is adjusted to the type of waste and the products produced is shown in the illustration below (Wendy et al, 2013)

Figure II. 1 General MSW processing technologies and their typical products



Source: Wendy et al (2013)

2.11 Public Private Partnership

In providing public services, it is impossible for the state to fully finance it through the budget. The reason behind is the budget is faced with limitations. This limitation is known as a budget constraint, which then makes the government only able to finance things with the highest priority.

The limitation in government budget in financing public services certainly needs to be overcome, because providing public services is the responsibility of the government. In this case, a form of cooperation exists that can be a solution. This

cooperation involves the interaction between the private sector and the government which is commonly known as the Public-Private Partnership (In Indonesia, known as Kerja sama Pemerintah dengan Badan Usaha (KPBU)).

If implemented properly, PPP can help the state to overcome the inadequate infrastructure that restricts economic growth, especially in developing countries. PPP can also help improve project selection, execution on time and budget, and ensuring proper maintenance by mobilizing private sector resources (IEG, 2014). Salvatore (2017) states that the government must do the following for all types of PPP that can accommodate public services

- Being effective in negotiating PPP agreements
- Being strict in supervising the implementation of PPP
- Carefully assess the risks of the government's mid- and long-term fiscal status, social impact, and the risks of collusion and corruption
- Formulate the final financial obligations under a multi-year financial perspective.

Independent Evaluation Group (2014) states that there is a rising trend in the implementation of PPP mechanisms for social infrastructure projects. The social infrastructure projects in question include the construction of schools, health facilities, and so on. This shows that there is still hope to implement a PPP mechanism in this waste-to-energy project because the social objectives raised in this project are significant enough despite the obstacles in the commercial aspect of the project.

2.12 Climate Change Funding Agency in Indonesia

In general, the sources and instruments of climate change funding in Indonesia are divided into two, public and non-public funding. Several sources and instruments of public funding in Indonesia today include (Badan Kebijakan Fiskal, 2019):

1. Indonesia Climate Change Trust Fund (ICCTF)

The Indonesian Climate Change Trust Fund is managed by the Indonesian Government. The ICCTF has gone through two phases of institutional development, the first of which was a preparatory phase (PREP-ICCTF) from 2010 to 2014 with UNDP acting as interim trustee, and the second of which began in 2015 with the ICCTF becoming a national trust fund (Nationally Managed Trust Fund) with an institutional form in the form of a work unit under Bappenas. The ICCTF receives funding from UNDP in the first phase, and the APBN mechanism is used in the second phase of the ICCTF financial system (ICCTF, 2018).

2. Badan Pengelola Dana Lingkungan Hidup (BPDLH)

The government has established an Environmental Fund Management Agency (BPDLH) with the goal of optimally mobilizing environmental funds from within and outside the country, managing them transparently and accountably, and distributing them effectively and efficiently. BPDLH is designed with four main policy directions in order to achieve this goal:

a) Policy Direction for Organizational Development

b) Collecting Environmental Funds Policy Directions

c) Recommendations for Increasing Environmental Funding

d) Distribution of Environmental Funds Policy Direction

3. Indonesian Government Green Bonds and Green Sukuk

The Indonesian government has also developed a Green Bond and Green Sukuk Framework to support its commitment to low-carbon and climate-resilient policies, which has been reviewed by the Center for International Climate and Environmental Research (CICERO) and given a Medium Green rating. This framework outlines best practices for green bond and green sukuk financing of viable green projects, such as those that aid in the transition to low-carbon, climate-resilient economic growth. According to the framework's criteria and processes, this includes climate mitigation, adaptation, and biodiversity.

4. Adaptation Fund (AF)

The Adaptation Fund (AF) is a multilateral funding source that focuses on climate change adaptation. The Clean Development Mechanism uses 2% of the proceeds from carbon transactions to fund the AF (CDM). The CDM is one of the Kyoto Protocol's mechanisms for reducing GHG emissions by developed countries. CDM allows developing country emission reduction projects to earn Certified Emission Reduction (CER), which can then be traded and used by industrialized countries to meet a portion of their Kyoto Protocol emission reduction targets.

5. Global Environment Facility (GEF)

The Global Environment Facility (GEF) is a multilateral incremental funding mechanism (additional financing). It is expected to be a catalyst for existing programs to be accelerated in order to provide benefits for global environmental management (global environmental benefits). GEF, in general, provides funding for activities such as investment and technical assistance that promote the creation of conditions that promote global environmental benefits.

6. Green Climate Fund (GCF)

The GCF is tasked with distributing funds for projects, programs, policies, and various activities related to mitigation and other climate adaptation efforts in developing countries. It is one of the climate funding agencies with the highest commitment value. The GCF funds mitigation and adaptation activities equally, with the scope of the activities divided into two categories:

a) A shift to low-emissions, sustainable development
b) Encourage climate-resilient, sustainable development.

For non-public side, the followings are several sources and instruments in Indonesia

1. Green Bonds of PT. Sarana Multi Infrastruktur (SMI)

PT SMI is an Indonesian government-owned infrastructure finance company. It participates in non-public climate change funding through the Ministry of Finance. This is accomplished by issuing green bonds in accordance with the Green Bond Framework (GBF) and the Environmental and Social Safeguard (ESS), as well as the Environmental and Social Management Framework (ESMF) and the Environmental and Social Management System (ESMS) (ESMS).

2. Green Bonds of Bank OCBC NISP

Non-public funding for climate change was also provided by private banks, such as Bank OCBC NISP. PT. Bank OCBC NISP collaborates with the International Finance Corporation (IFC), a member of the World Bank group, as the sole investor in the initial issuance of green bonds (IFC, 2018). IFC has pledged US$ 150 million in green bonds as part of this collaboration. The funds raised will be used to finance environmentally sound projects, with an initial focus on debtors in the water management industry.

2.13 Previous Studies

There have been quite a lot of research on the analysis of the financial feasibility of a project. However, these studies mainly discuss about the commercial sector. Research on the financial feasibility analysis of a waste-to-energy project is still relatively new due to the lack of reviews on this sector.

The following are previous studies that discuss the financial feasibility analysis of a waste processing project

Table II. 1 Previous Related Studies

No.	Author(s)	Year	Research Title	Parameters Used
1	Siti Ade Fatimah	2009	Analisis Kelayakan Usaha Pengolahan Sampah Menjadi Pembangkit Listrik Tenaga Sampah (PLTSa) Di Kota Bogor	• Net Present Value, • Internal Rate of Return, • Net Benefit Cost Ratio, • Payback Period, • Sensitivity Analysis
2	Nalim Kurniawan	2009	Analisi Kelayakan Usaha Pengolahan Sampah Kota Menjadi Produk Yang Berguna Di TPA Bantargeban	• Break Even Point • Benefit Cost Ratio, • Payback Period,
3	Sanchez et al	2014	Financial Analysis of Paper Waste in University of Brawijaya	• Net Present Value, • Internal Rate of Return, • Net and Gross Benefit Cost Ratio, • Break Even Point

Source: Processed

Reviews of research in the waste-to-energy project sector are still limited to seeing the project's financial feasibility. Further research on the aspects of financing that can be used and how the funding aspect can be implemented is still very minimal. The following picture are summarization of similar financing scheme with Indonesia those are applied in worldwide.

Figure II. 2 Summarization of similar financing scheme in worldwide

Scheme	Technical Assistance	Premium Tariff		Project Development Funding		Credit Enhancement Funding	
		Bidding process	First come, first served	Call for Proposals	First come, first served	Guarantee	Credit line
GET FiT	X	X				X	
PFAN	X			(X)	(X)		
REPP	(X)		X		X		
Finland		X					
ARECA	X					X	
SEFF	X						X

Source: Asian Development Bank (2019)

Where:

GET FiT = Global Energy Transfer Feed-in Tariff (Uganda); PFAN = Private Finance Advisory Network (Global); REPP = Renewable Energy Performance Platform (Sub-Saharan Africa); Finland = Competitive Bidding of Long-Term Premium Tariff (Finland); ARECA = Accelerating Renewable Energy in Central America (Central America); SEFF = Sustainable Energy Financing Facility (Global)