

---

## **The Project Feasibility Analysis of a Waste-Electric Power Plant of Kamalasai Sub-district Municipality, Kamalasai district, Kalasin province**

---

**Prayoon Wongchantra<sup>1\*</sup>, Kuantean Wongchantra<sup>2</sup>, Surasak Kaeongam<sup>1</sup>, Likhit Junkaew<sup>1</sup>, Kannika Sookngam<sup>1</sup>, Suparat Ongon<sup>1</sup>, Chonlatit Phansiri<sup>1</sup> and Akkharadech Oncharoen<sup>1</sup>**

<sup>1</sup>Center of Environmental Education Research and Training, Faculty of Environment and Resource Studies, Mahasarakham University, Mahasarakham, Thailand 44150 ;  
<sup>2</sup>Srimaharakham Nursing College, Mahasarakham, Thailand 44000.

Wongchantra, P., Wongchantra, K., Kaeongam, S., Junkaew, L., Sookngam, K., Ongon, S., Phansiri, Ch., and Oncharoen, A. (2017). The project feasibility analysis of a waste-electric power plant of Kamalasai Sub-district Municipality, Kamalasai district, Kalasin province. *International Journal of Agricultural Technology* 13(7.2): 1773-1789.

Kalasin province has a lot of solid waste and the problems encountered in solid waste management in the community as a whole were : trash stink, trash was not categorized, trash was not enough, location bins inappropriate, the ferret waste of people and animals and also drop around, wastewater from the garbage collection vehicle, the garbage truck comes not in time, including the lack of motivation to participate and the lack of the campaign and promote continuously. Therefore, joint problems should be solved in the management of solid waste in Kalasin province by bringing refuse derived fuel (RDF) from solid waste to produce electricity. The purpose was to the project feasibility study and analysis of a waste-electric power plant of Kamalasai Sub-district Municipality, Kamalasai district, Kalasin province. The study found that 1) The model of the project : using gasification technology. The process of manufacturing uses refuse derived fuel (RDF); category 5: Densified RDF. 2) finance and economics : the IRR is 3% and the NPV is 187,678,311.38 baht, which has a payback period of 13 years and 1 month, which shows that the 8 MW. It is possible to invest in construction being economically feasible and feasible to invest because of the return on investment of the project in the appropriate range of investment. 3) impact of the waste electrical power plant project : the expected impact on direct and indirect power plants is the instability of the power generation system, electricity purchase prices during periods of different power requirements, impact on society and environment. 4) risk and risk management : the risks that may result from implementing the project are technical issues, financial problems and management issues along with the risk management of the project and the solution to problems and obstacles. 5) the availability of the junk power plant project : there are the preparation of the project in various areas such as the readiness of the local government organization, readiness of area, readiness of technology, readiness of personnel and readiness of budget. Therefore, this project is feasibility and appropriate in all aspects; the model of the project, finance and economics, impact of the waste electrical power plant project, risk and risk management and the availability of the junk power plant project.

---

\*Coressponding Author: Prayoon Wongchantra; E-mail address: prayoon\_nam@yahoo.co.th

**Keywords:** The Project Feasibility Analysis, Waste-Electric Power Plant, Kamalasai Sub-district Municipality Kamalasai district Kalasin province

## **Introduction**

Thailand is a developing country and from the economic, social and industrial growth as well as increasing the number of population popular consumption. In everyday life human beings have more needs every day. The rest of the consumption and consumption will become waste. The amount of waste on a daily basis increased. It became a key issue that must be resolved urgently. The accumulation of solid waste causes many problems whether the contamination of water sources, contamination of air, contamination of toxins. There is also an impact on physical and mental health of the people directly. It also affects the tourism caused economic loss and most importantly, the overall environmental problem of the community. (Wijanun, B. 2007: 1)

The problem of solid waste is increasing cause a lot of problems to the environment. Because solid waste is a food source and a breeding ground for insect pests such as cockroach, mosquito, mice, etc., and the hidden of mice and other animals causing a stench and causing a nuisance. Some solid waste causes air pollution. Solid waste left in the community or abandoned in waste disposal sites while waste collection vehicles or by not concealed entirely. That waste to smell disturbance fragments of garbage can be blown into the air, resulting in atmospheric pollution which affects human health and dirt to the adjacent area. In addition, solid waste left in the pile, there will be a fermentation of fermented germs, such as bio-flammable or explosive and the eggs (Hydrogen sulfide) which has a foul odor. (Sujittanon, S.: 15) Solid waste affects the environment causing contamination of the ground, water and air make the country ratings tidy affect the health of people in general. Solving problems of solid waste should be done to prevent and correct the consequences for good protection and correction consider the cause of the solid waste.

The problem of solid waste management is the environmental problems that all parties involved to be aware of the importance and need to collaborate. The problem will be even more intense. A sequel to the prosperity of both the economy and society continues the production of the new technology used in daily life and a higher standard of living makes waste. While the methods and locations for disposal of solid waste are also being sanitation and the efficiency of the agency responsible for keeping the garbage is low. There are also problems with the provision of rare and expensive disposal and disposal facilities. The behavior of the general public also leaves the waste by the lack of consciousness and leave the burden of responsible agencies the amount of waste is many. At present, the government has promoted the role of local

people in the conservation and rehabilitation of natural resources and environment (Chukeit, Ch. 1998: 1-4).

Thailand needs to supply electricity from neighboring countries. It will support the production and use of alternative energy at the village level under appropriate incentives. Thus, the supply of renewable energy sources is as an alternative to urgent action and in line with current government policies. Therefore waste processed into renewable energy in the form of electricity or heat as an alternative to reduce the environmental management. The solution to such problems accelerate local sanitation municipalities make a short and long term solid waste management plan for solid waste management, from collection, transportation, treatment and final disposal to accelerate the construction of waste disposal plants to meet the standards and efficiency. This will reduce the problem of waste management in each community by controlling the production of solid waste, budget support, personnel and local academic to provide solid waste management from the archive, segregation, transportation, reuse and sanitary disposal (Pollution Control Department Ministry of Natural Resources and Environment. 2004: 9-10).

Kalasin province has a lot of waste the problems found in community solid waste management are as follows; collection, trash stink, trash is not enough, the trash is not appropriate including scavenging of people and animals wastewater from garbage trucks lack of public relations and knowledge from relevant agencies. Therefore, it is necessary to study the methods of disposal of solid waste efficiently and without any impact on the environment. The privatization of solid waste is as a fuel to produce electricity. It can respond to high levels of waste disposal because there is no smoke. It is also environmentally friendly and can generate income for the villagers in the area as well. It will also help reduce the government's burden of investing in new power plant and reduces reliance on electricity produced from natural gas by then. It is an alternative to proper waste management and maximizes the benefits.

Objectives: To analyze the project feasibility of a waste-electric power plant of Kamalasai sub-district Municipality, Kamalasai district, Kalasin province.

## **Materials and methods**

### ***Project area***

Kamalasai Sub-district, Kamalasai district, Kalasin province.

## ***Data Collection***

2.1 Study general information of the project feasibility of a waste-electric power plant of Kamalasai sub-district Municipality, Kamalasai district, Kalasin province.

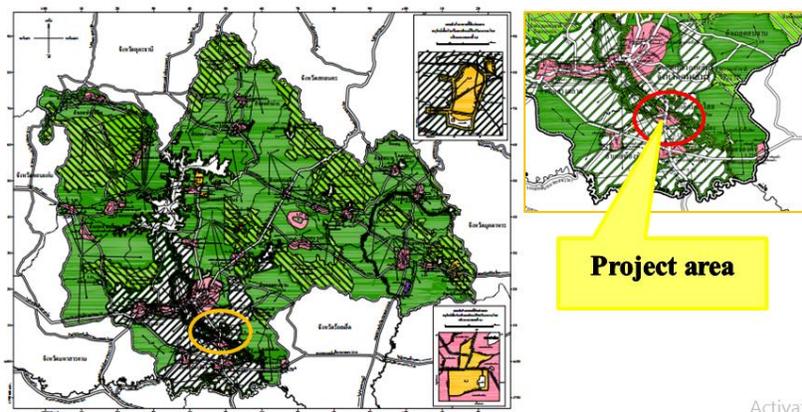
2.2 Analyze the project feasibility of a waste-electric power plant consists of 5 aspects.

- 1) Analyze the project feasibility. Using gasification technology.
- 2) Analyze the financial and economic aspects of the project of a waste-electric power plant.
- 3) Analyze the impact of the waste electrical power plant project of a waste-electric power plant.
- 4) Analyzed the risk and risk management project of a waste-electric power plant.
- 5) Analyzed the availability of the project of a waste-electric power plant.

## **Results**

### ***General information of the project feasibility analysis of a waste-electric power plant.***

The study on the area of establishment of waste electrical power plant (RDF) of Kamalasai sub-district municipality, Kamalasai district, Kalasin province: There is sample space to allocate space for utilities facilities and environmental management and protection. The land acquisition is a voluntary agreement of the original owner. And when considering the location of the project compared with the ministerial regulations. The use of the Kalasin province plan in 2017 found that the area is located in the pink area. It is a community type land the use of land for residential, commercial, agricultural, educational institutions, religious institutions, the public utilities and infrastructure for land use for other activities operate or operate in high buildings or large buildings. The project, which is in the land of forbidden land use activities as required, law on the factory according to the category, type and the end of the regulations, law on fuel regulation, law on conservation and protection of wildlife for trade. The area of Kamalasai sub-district can establish a waste power plant (RDF). (As shown in Figure 1.)

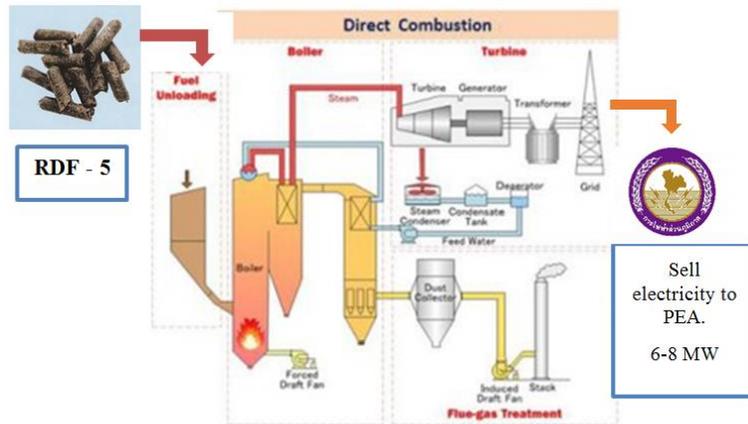


**Figure 1.** Land use classification plan as classified by the Ministerial Regulations for the implementation of the Kalasin province plan 2017.

### *Analysis of the possibility of a waste-electric power plant*

Analysis the feasibility of the project using gasification technology: The production method is used as fuel in the fuel RDF-5 production which is approximately 100 - 150 tons/day, able to generate electricity at 8 MW, will be sent to substation to convert electricity into transmission system of the Electricity Generating Authority of Thailand by accepting the fuel rods from the fuel production plant RDF-5. It is one of the projects to build a waste management system for the production of RDF-5 fuel rods of Kamalasai sub-district municipality, Kalasin province using municipal solid waste, there are electricity generation processes using gasification technology a steam production system. In this system, the flue gas is generated from the combustion process by entering the steam generator using waste heat to produce steam. The steam produced will produce electricity and some will be recycled into the gasification process. The hot gas from the combustion process, the temperature is 1,250 °C and fed into the steam generator, a steam temperature of 520 °C, in order to drive a steam turbine to generate electricity. However, the establishment of a project must have a suitable and environmentally friendly production system. The pollutant emissions resulting from burning down to a minimum. According to the technical requirements of the power plant of the gasification system must have installed capacity of not less than 5 MW use a stoke fluidize bed. The amount of heavy ash and fly ash should not exceed 15 tons/day. Installation of waste air treatment system, dust generated by the process is effective and complies with the environmental standards of the Pollution Control Department. It is designed to be installed in a closed building only and the power generation system must be capable of

operating at least 80%. Therefore, the model of the gasification technology project. This is an alternative to the production method of Kamalasai sub-district Municipality, Kamalasai district, Kalasin province. It is appropriate to establish the project.



**Figure 2.** Electricity generation from waste fuels (RDF)

Analysis of financial feasibility and economics of power plant projects, the financial analysis of power plant waste (RDF) from the investment 1,210,800,000 Baht, the Internal Rate of Return (IRR) was 3%, the Net Present Value (NPV) from investing activities was 187,678,311.38 Baht, the payback period is 13 years 1 month. It showed that the project of a waste-electric power plant of Kamalasai sub-district Municipality, Kamalasai district, Kalasin province. It is economically feasible and feasible to invest. The return on investment of the project is in the right range for investment.

### **Analyze the project of a waste-electric power plant.**

#### **1. Impact on the project**

##### *- Direct impact*

1) Instability of the electric power system because of the inability to control the power system to be stable under the requirements of the Provincial Electricity Authority the operator loses electricity revenue, and the need to invest more to improve supply or power systems provide a more stable and able to pay for electricity grid. The synthesis gas produced from the waste fuel (RDF) as fuel to produce heat energy in the manufacturing process of some kind to control the rate of heating to maintain the temperature to produce a constant and uniform.

2) The purchase price of electricity in the period of different power demand the time of day is different. The Provincial Electricity Authority has set the price for electricity purchased from small producers in the period of high demand for electricity to 5.2674 Baht/unit and low of 2.1827 Baht/unit. The cost of electricity during the peak demand is more or less the same due to the overtime pay of employees at work. Most operators choose not to generate electricity during periods of low electricity demand because they are not cost effective. Revenue from electricity sales of entrepreneurs is reduced to the entrepreneur financial problems.

3) Social impact trash behavior of Thai people who are not disciplined make no effective enough to separate waste before disposal, there is no sufficient management cost, the dependence of the public's lack of continuity.

*- Indirect impact*

1) The generation of electricity from community waste is another useful process such as recycling new processing or organic fertilizer production. Although these processes are useful they are difficult and costly.

2) Reducing greenhouse gas emissions by generating electricity from community waste, carbon dioxide is about 1,100 kg./ton of community waste. The proportion of carbon dioxide generated from fossil derived material is 47% of plastic, equivalent to 517 kg. The production of electricity from municipal solid waste, there were 1,088 gm/kWh. The higher carbon dioxide content the more energy produced from coal and natural gas. Therefore, the dehumidification to increase the heat of community waste is higher than 1,633 Kcal/kg. It is important to keep carbon dioxide emissions when community waste is heated to 2,000 Kcal/kg., the carbon dioxide emission rate is reduced to 889 gm/kWh.

*- Environmental impact*

Electricity generation with gasification technology reduction of methane emissions into the atmosphere directly is as gas for electricity generation. The carbon dioxide from the generator however, when considering the net quantity it also reduces the amount of carbon dioxide. Therefore, the generation of electricity from community waste contributes to mitigating global warming caused by greenhouse gases the waste management hierarchy.

2. Preventive measures and preliminary environmental impact.

1) Air quality action plan: the control surface is wet to prevent dust dispersion and minimize the impact on the communities nearby. The system maintenance and pollution treatment equipment are used continuously.

2) Sound action plan: sound level control is provided in accordance with engineering standards from the sound source source not to exceed 85

dB(A) and the project is regularly monitored throughout the project area and around the project area.

3) Surface water quality plan: temporary drainage and sedimentation ponds are to be constructed to reduce drainage problems inspect and supervise the drainage system in the project area to be available at all times and control the quality of water discharged from the wastewater treatment system according to the wastewater standard.

4) Groundwater quality action plan: provide toilets that are sanitary. Design of septic tank – seepage is not permissible to drain the wastewater from the project area into the external water source. The wastewater from the project was reused the water is circulated within the project such as watering a tree and cleaning streets.

5) Water ecology action plan: provide measures to prevent soil erosion by creating a cliff around the area. Keep trees and plants along the banks of the canal in order to prevent soil erosion line. Wastewater treatment plants from waste electrical power plants meet the waste water standards before reuse and monitor the quality of wastewater in the ponds before reuse.

6) Transport action plan: traffic signals are installed to monitor traffic safety. Provide adequate parking space for the project the transportation is in good condition.

7) Waste management plan: preparation or storage area to store construction material and debris by sort by suitable areas. The garbage bin is to be separated and classified according to the location.

8) Health action plan: provide knowledge and advice to workers and staff in the disease prevention, ask for cooperation from community health facilities and health check-up staff the annual health check.

9) Socio-economic action plan : there are community development funds in the area around the power plant including the creation of good conscience to realize the importance of environmental and energy conservation to the public.

3. Corporate social responsibility: power plants exhibit more responsibilities than legal responsibilities, such as social activities and environmental such as support and promote the education of school in the area around the power plant and support for cultural and community traditions.

### **Feasibility analysis of risks and risk management of a waste-electric power plant.**

#### *- Project risk*

1) Technical risks gasification technology, especially fixed bed, in the development of technology based on the price of gas city qualifier fixed bed

imported from abroad and produced locally in the country where the establishment. However, the power plant waste (RDF), there may be limitations on the performance of the technology used in the production of potential risk restrictions on the use of the term, size and moisture content of raw materials, waste from many production processes and the uncertainty of the electricity generation system.

2) Financial risk the lack of search depth study before making investment decisions and to consider in choosing the project's operator and the procedure for applying for permission to engage in energy business. Establishment using gasification technology for commercial electricity production, it takes more than a year to apply for a power plant.

3) Risks in the management of commercial electric power plants are activities that involve a large amount of raw materials or fuels, provide RDF fuel to meet the demand, the supply of engineers, employees/ employees/ workers. The number of personnel who are capable and sufficient to perform the duties including disposal of waste from the power generation process. The charcoal/ash removed from the reactor is between 10-15 tonnes/day.

*- Project risk management*

1) Technical risk management guideline for gasification technology must have a consultant/engineer with knowledge, experience and application and limitations of technology in the production process not a problem. It also solves technical problems caused by the use of gasification technology for continuous use the system is more stable.

2) Financial risk management approach, which is based on internal factors to help the project by searching for reliable unbiased sources of information on investment projects can be sustainable. If the government wants to boost the number of operators in order to keep the country's electricity system stable. Government agencies need to take other measures helps reduce risk and obstacles, to increase the number of entrepreneurs who are ready to invest in power plant projects. The use of gasification technology to generate electricity should not be the first investment to be considered alone, but should be carried out throughout the life of the project that affect the value of investment operations. And loans must be approved to establish a power plant before the operator must bear the burden of higher than expected interest and risk.

3) Management risk management approach to provide sufficient RDF fuel to meet the demand for fuel for power generation. The project there may be no impact on the shortage of fuel waste (RDF). This is derived from the RDF fuel plant, which is one of the projects to create a waste management system for fuel of Kamalasai sub-district Municipality, Kamalasai district,

Kalasin province throughout the project life. And the waste disposal management can be processed into a product and then recycled.

**Feasibility analysis of the availability of the power plant waste.**

1) Availability of local government organizations of Kamalasai sub-district Municipality, Kamalasai district, Kalasin province are ready for sorting waste from source to waste that will be used to generate electricity at a thermal process with appropriate heat and the organizational model for the management of the agency to carry out joint projects power plant waste (RDF). It encourages the private sector to take part in implementing the organizational model to manage the project in a practical and cooperative way.

2) The project area is located at the Kamalasai sub-district, Kamalasai district, Kalasin province about the 13 Rai 66 square meters considering the project compared to the Interior Ministry. The project area is considered suitable for the establishment of power plant waste.

3) Technology availability the waste electrical plant (RDF) project selects RDF (gasification technology) to produce electricity which is suitable for physical characteristics, the quantity of fuel and the state space of Kalasin province.

4) Ability to work with personnel in project implementation, ability to work with highly skilled personnel in legislation inspection and issuing licenses construction, maintenance, equipment and design education waste management system. Readiness for disaster relief the project has provided enough personnel to work effectively. The management structure of the waste management plant (RDF) project, there are plans to operate the system, environmental experts, occupational health and safety officer, environmental officer, technician or production control engineer, accountant/purchasing officer (RDF), administrative officer, mechanical engineer, production staff, fuel management officer (RDF), security guard and cleaning staff to be effective in the operation.

5) The availability of budgetary the total budget of the waste management system (RDF) is approximately 1,210,800,000 Baht. The project will cost very high.

The Kamalasai sub-district Municipality is necessary to get cooperation from the private sector to jointly invest in the construction and operation of an efficient operation project that will allow the private sector to provide funding for the operation of the project to of Kamalasai sub-district municipality, Kamalasai district, Kalasin province.

## Discussion

The project of waste electrical power plant in Kamalasai sub-district , Kamalasai district, Kalasin province: Considering the location of the project compared with the ministerial regulations. The application of the Kalasin Provincial Plan in 2017 published in the Government Gazette, Vol. 134, No. 47, April 28, 2017. Located in a pink area, can be operated or operated in a high-rise building or large building, it can be seen that the establishment of a waste-power plant is due to the fact that the project area is not in the nationally important wetland on 1 August 2000. Thailand's National and International Wetland Register of Wetland Regions Wetland Conservation Measures and Cabinet Resolutions on 3 November 2009. Review of Cabinet Resolutions on International Priority Wetland Registers And the national level of Thailand and wetland conservation measures the project area is not located in the watersheds of Levels 1 and 2 and is not in the protected area or forest conservation Natural disaster area Community areas where residents are densely populated and the area has the capacity to support the project, such as the appropriate terrain there are factors contributing to the operation of the project, such as wind and air distribution tides in the water supply. According to the rules Pollution Control Department. (2013: 1). The location requirements are: 1) not located in the first and second floor of the watershed, in accordance with the cabinet resolution regarding the delimitation of the watershed class on 28 May 1985. 2) The location is located at distance from the temple, archaeological site, school, educational institute, hospital no less than 1 kilometer or the distance of the location according to the government or relevant law. 3) It should be located away from natural or man-made water wells, wetlands, irrigation canals and water supply plants not less than 300 meters, or as required by government agencies or other relevant laws. 4) Located in a suitable location and environment, sufficient space for establishment and expansion including a space for construction install or carry out environmental treatment or treatment and disposal which is in line with the research of Tasuwor, T., Prongjai, W. (2014: 63). A study of application of geographic information system to find suitable areas for landfill waste disposal in Muang district, Phrae Province. In the first step, a suitable site for landfill disposal was prepared. The second step was to determine the potential of the landfill the south east of Ban Sri Sri, an area of 2.75 square kilometers, or about 1,718.8 acres west of the tea house area of 0.63 square kilometers or about 393.8 rai and the eastern area of the tea house of 2.56 square kilometers or about 1,600.0 rai, and in order to rank the potential of the three places by the way weight-rating. It was found that the area south east of Ban Sri Phum most appropriate.

Analysis the project feasibility of the waste electrical power plant of Kamalasai sub-district Municipality, Kamalasai district, Kalasin Province.

1. Analyze the project feasibility using gasification technology. This is an alternative to the production method RDF-5, will use 100% of the RDF-5 fuel to produce 100 to 150 tons per day, it will produce 8 megawatts of electricity the transmission line of the Electricity Generating Authority of Thailand Municipal, solid waste is produced by using gasification technology. Therefore, the establishment of a project must have a suitable and environmentally friendly production system and the emissions from the combustion to the least safety environmental pollution in the factory and around the project to comply with the requirements of the department of factory and the Pollution Control Department. The project will use gasification technology as an alternative to the production method of Kamalasai district, Kalasin province. It is possible to set up a project which is based on the concept. Dacharin, P. (2012:162) The project analysis is a guideline for successful decision making and consistent with various approaches. There is a need to consider the project with various factors to cover thoroughly and carefully in the analysis. Appropriate tools should be provided to assist in thinking and analyzing the project and act as a way to allocate resources in various areas achieve objectives with a method that can be applied systematically to analyze investment activities which is in line with the research of Saranrom. K., Yongcharoen, Y. (2015: 40) A case study of waste processing plant fuel establishment in Nonthaburi Municipality, Nonthaburi. The results showed that there are the wastes that can be component of fuel around 174 tons per day in Nonthaburi city area. Plastic, paper and wood waste are selected as raw materials to produce and use lime to be as a emulsifier for briquette to hold tight with a ratio of 38:4:1:1 respectively. Once it processed into waste fuel, it will be able to produce fuel with a capacity of 71.56 tons per day which is equivalent to the heating value 23.79 MJ / KG. There are 7 steps to transform waste into fuel and by economic value analysis founded that the discount rate is 10 percent and net present value equals 118,772,598 baht internal rate of return of 30.91 percent and a payback period of 4.11 years, 15- year project life.

2. Analysis of financial feasibility and economics of power plant projects to study and analysis the cost of the RDF-5 RDF-5 project, which is about 100-150 tons / day. From the investment of 1,210,800,000 Baht, the financial return (IRR) of 3% has the net cash flow (NPV) of 187,678,311.38 Baht with the payback period a project of 13 years and 1 month showed that the 8 MW RDF project for construction investment build waste power plant from RDF of Kamalasai sub-district Municipality, Kamalasai district, Kalasin Province, it is economically feasible and feasible to invest the return on

investment of the project is in the right range for investment which is based on the concept of Cleesuntorn, At. (2013: Website) In order to solve certain problems or bring desired improvement, a public or private organization should first lay down clear policies. Then, they should do their planning based on capable goals. The plan should clearly explain and prioritized the objectives and projects. Thus, policy, plan and projects are closely related. All the components of the projects should be clearly defined. It is extremely important that report clearly describes the project's scope, its objective, procedures, evaluation criteria and the expected results. Clearly defined project can bring the ideas into practices which is based on the concept of Sararom,D. (2017:215) study to assess the cost of generating electricity from waste investment in Nonthaburi Municipality to be used for the benefit of waste and saving cost landfill which a waste landfill of 137,600 tons per year and the budget for the landfill, about 500 baht per ton. Researchers have studied the technology used in the garbage disposal to get a worthwhile return on investment. Then choose a size 7.35 MWe power plant, which has a capacity of 31 tons per hour. The total cost of construction 565,670,612.50 Baht and the implementation and maintenance of all life projects 52,166,453 Baht, which can reduce the cost of landfill throughout the project life 56,550,000 Baht per year and Nonthaburi Municipality, is revenue after tax from power plant throughout the project life 2,962,297,150.84 Baht. We have estimated the cost of investing in the economics of generating power from waste. The net present value of the project (NPV) amount 680,536,577 Baht with internal rate of return (IRR) amount 25.33 percent and the discounted payback period (DPB) amount 5 years and 2 months, indicating that the power from waste this project is feasible.

3. Analyze the impact of the waste electrical power plant project; Expected impact on the power plant project, Direct and indirect impacts are important factors to help guide the development of appropriate waste jumbo power plants in direct effect, the instability of the power generation system electricity purchase prices in different periods of time. The indirect impact will be on the environmental management of the junk power plant project, the design and construction of the system must meet the standard for electricity environmental impacts on electricity generation with gasification technology reduction of methane emissions into the atmosphere directly as a gas for electricity generation. Therefore, the generation of electricity from community waste contributes to mitigating global warming caused by greenhouse gases. waste management hierarchy is a priority for the project in project has implemented measures to prevent and correct the initial environmental impacts from the project and to set measures to mitigate or mitigate impacts minimal environment the action plan, air quality, surface water quality, groundwater

quality aquatic ecology transport waste and health waste management and socio-economic aspects. The power plant project must have social and environmental responsibility the importance of being involved in environmental protection by organizing social and environmental activities support and education culture and traditions in the community which is based on the concept of Onmang, Ph. (1998:27). The definition of the feasibility study to study the information necessary for the project before starting the project will it be implemented and find the right way to plan the action it has the least barriers under limited resources which is based on the concept of Veeranonth, P. (2010:82) The Ministry of Transport's assessment of the implementation of the Environmental Impact Assessment, there are approximately 20% of the total projects submitted in compliance with environmental measures sort by; 1) support from the management 2) structure of the organization 3) task assignment and assignment, personnel readiness, 4) Monitoring the performance 5) Availability of budget 6) Determining the penalties and awards 7) Political, economic, social, cultural and technological environments.

4. Analysis of risk and risk management of power plants, waste, potential risks from project implementation 1) Technical risks caused by the use of gasification technology for electricity generation the potential for long-term limitation of use depends on the size and relative humidity of raw materials, resulting in large amounts of waste from the production process and the instability of the electricity generation system. 2) Financial risks, the main cause of financial problems is divided into problems caused by internal factors, which are the problems arising from the vision, the business concept decision or decision making management of the operator. 3) Risks in the management of commercial electric power plants are a continuing concern for raw materials and fuels throughout the year RDF provides sufficient fuel for the demand, including the provision of skilled personnel. In the implementation of risk management, there must be a solution for technical management of gasification technology need a consultant with knowledgeable engineers financial intermediaries must be able to operate sustainably, and should seek out reliable, unbiased and unbiased sources of information and management risk management. Project is expected RDF will not be affected by the shortage of fuel, as it is derived from RDF, one of the projects to create a waste management system for fuel of Kamalasai sub-district Municipality, Kamalasai district, Kalasin Province throughout the project life which is based on the concept of Apisitpinyo, Ch. (2003:218) Explain that investment analysis is the decision-making process to choose to invest in a long-term project this will require a lot of investment and the answer to the future is uncertain Investment analysis is very important to businesses it is therefore necessary to rely on

financial techniques and tools to help them make the most out of their venture capital decisions least which is based on the concept of Leungsajakul, An. (2008: 67 ) Project risk analysis the weaknesses and obstacles of the mean scores from the interviews were compared to the mean and standard deviation Sorted from highest to lowest. Find out the risks of the project, there are risky events that will result in the presentation of a lack of revenue projection strategies, there are eight events that have a high average level show that a lot of opportunities moreover, the standard deviation was low, indicating that most of the interviews with the firms were consistent according to the worst case scenario, the worst case scenario is the worst case scenario, it is important to monitor and control the factors affecting the project's revenue and the internal rate of return.

5. Analysis of the feasibility of the junk power plant project; Human resource management and clear division of duties as a result, the implementation of the project has been improved. 1) Availability of local administrative organizations, Kamalasai sub-district Municipality, Kamalasai district, Kalasin Province, it is ready to separate the waste from the community source to the waste to produce electricity it encourages the private sector to participate in the investment. 2) The availability of the power plant area located at Moo 5 sub-district Kamalasai, district Kamalasai, Kalasin Province. The area is 13 rai 66 square wah, so the project area is suitable for the establishment the project of Kamalasai sub-district Municipality, Kamalasai district, Kalasin Province 3) Technology availability project of waste electrical power plant by using the technology of waste gas gasification for RDF-5 is 100 to 150 tons per day installed capacity is 8 Megawatts it will be delivered to the power system of the Provincial Electricity Authority 4) Personnel readiness to perform and maintain the expertise and efficiency of the successful management of the junk power plant project, and to provide a cost-effective return on investment 5) budget availability in waste management system overall, approximately 1,210,800,000 Baht, is a project that requires a lot of investment the Kamalasai Municipality, Kamala District, Kalasin province, it is necessary to get cooperation from the private sector to jointly invest in the construction and operation of an efficient operation project that will allow the private sector to provide funding for the operation of the project to Kamalasai sub-district, Kamala District, Kalasin province which is based on the concept of Jantaro, J., Thongprasert S. (1997 : 2) It gives the meaning of feasibility studies a study of the need to know the consequences of implementing the project to assist the decision making of investors who are investing in the project in this study, it is necessary to detail and analyze what is needed in relation to production as well as other alternatives of production. In addition, the appropriate capacity and

location of the project must be specified what technology to use? What are the costs of investing and processing? To get the most return on investment. This is consistent with the research of Research Institute Foundation of Environmental Education. (2015: 6-5) Study and analyze the waste management and disposal project of the metropolitan municipality and local administrative organizations nearby Phra Nakhon Si Ayutthaya province, the study indicated that the implementation of the waste management plan of Ayutthaya province by selecting the RDF is at the ready and appropriate in effective waste disposal management to promote to practice the guidelines for the development of solid waste disposal system from collection, reuse, reuse Removal technology and style of management in addition, the private sector is involved in the implementation. The project can accommodate the amount of waste that occurs in the future as well the municipality is ready to dispose of waste and recycle it for reuse, in a cost effective and environmentally friendly manner.

### **Acknowledgement**

This research has been successfully completed with cooperation from Kamalasai Sub-district Municipality, Kamalasai district, Kalasin province. Thanks to all the Center of Environmental Education Research and Training, Faculty of Environment and Resource Studies, Mahasarakham University, Mahasarakham, Thailand.

### **References**

- Apisitpinyo, Ch. (2003). Management Accounting. Ideas about Investment Analysis. Bangkok : SE-EDUCATION.
- Chukeit, Ch. (1998). The strategic administration of solid wastes : case study of tambol dankhumtod municipalit, Nakornratchasima Province. Thesis Master of Arts (Development Administration) M.A. (Development Administration) Khon Kaen University.
- Cleesuntorn, At. (2013). Project Writing: From idea into Practice. Available. (Online). from: [http://www.moe.go.th/moe/th/news/detail.php?NewsID=32184&Key=news\\_research](http://www.moe.go.th/moe/th/news/detail.php?NewsID=32184&Key=news_research). [accessed July 14,2016].
- Dacharin, P. (2012). Look at the new angle : Business Success Management. Bangkok, Business Bangkok.
- Jantaro, J., Thongprasert S. (1997). Feasibility Study of Business and Industrial Projects. 6<sup>th</sup> edition. Bangkok, Chulalongkorn University Printing House.
- Leungsajakul, An. (2008). Risk analysis of construction project of Bannka telephone terminal. Thesis Master of Engineering Silpakorn University.
- Onmang, Ph. (1998). Feasibility study on the opening of the curriculum Master of Science Health Education Srinakharinwirot University.
- Pollution Control Department Ministry of Natural Resources and Environment. (2004). Solid waste management in the community. A Guide for Local Government Administrators 4. Bangkok: Kurusapa Printing Ladphrao.

- Pollution Control Department. (2013). Community solid waste management. Bangkok, Kurusapa Printing Ladphrao.
- Research Institute Foundation of Environmental Education. (2015). Study Report on solid Waste Management and Disposal Project of Metropolitan Municipality And local administrative organizations nearby Phra Nakhon Si Ayutthaya Province. Research Institute Foundation of Environmental Education Mahasarakham..
- Saranrom. K., Yongcharoen, Y. (2015). A Case Study Of A Waste Processing Plant Fuel Establishment In Nonthaburi Municipality, Nonthaburi. Province. Journal of Energy Research. (12)2, July – December, 40.
- Sararom, D. (2017). Evaluating The Value Of Investment In Solid Waste Power Plant Project A Case Study In Nonthaburi Municipality. Graduate Journal Rajamangala University of Technology Thanyaburi Under the Royal Patronage, 2 (11), May - August. 215.
- Sujittanon, S. (1998). "Waste Disposal Techniques", Congress Press. 2(10): 4.
- Tasuwor, T., Prongjai, W. (2014). Application of Geographic Information System to find suitable areas for landfill disposal in Muang District, Phrae Province. Bachelor of Science Program in Geography.
- Veeranonth, P. (2010). Assessing the Implementation of Environmental Impact Assessment Measures: A Case Study of Ministry of Transport. Journal of Environmental Management, (6) 2, July - December, 82-98.
- Wijanjan, B. (2007). Public Participation in Waste Management in Khon Kaen Municipality Market. Independent Study Report on Public Administration Khon Kaen University.

(Received 22 October 2017 ; accepted 25 November 2017)