Capacity development and strengthening for energy policy formulation and implementation of sustainable projects in Indonesia

CASINDO

DELIVERABLE NO. 15 part I:

Research agendas of the Indonesian partner universities

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Preface

This report on the research agendas of the five CASINDO partner universities is part I of deliverable No. 15 of the project 'Capacity development and strengthening for energy policy formulation and implementation of Sustainable energy projects in INDOnesia (CASINDO)'. The CASINDO project aims to establish a self-sustaining and self-developing structure at both the national and regional level to build and strengthen human capacity to enable the provinces of North Sumatra, Yogyakarta, Central Java, West Nusa Tenggara and Papua to formulate sound energy policies and to develop and implement sustainable energy projects. The CASINDO project is funded by NL Agency and implemented by a consortium co-ordinated jointly by the Indonesian Ministry of Energy and Mineral Resources and the Energy research Centre of the Netherlands (ECN), comprising the following organisations:

- Indonesian Ministry of Energy and Mineral Recourses, Jakarta.
- Muhammadiyah University of Yogyakarta, Yogyakarta.
- Diponegoro University, Semarang.
- University of Sumatra Utara, Medan.
- University of Mataram, Mataram.
- University of Cenderawasih, Jayapura.
- Institute of Technology of Bandung (ITB), Bandung.
- Technical Education Development Centre (TEDC), Bandung.
- Technical University Eindhoven, Eindhoven.
- ETC-Nederland, Leusden.
- MVV-Decon, Bonn
- Energy research Centre of the Netherlands ECN, Petten.

The preparation of this report was done based on contributions provided by the university of Cenderawasih, Jayapura, Diponegoro university, Semarang, university of Mataram, Mataram, Muhammadiyah university, Yogyakarta and university of Sumatra Utara, Medan. The contributions provided by these organizations are greatly appreciated.

Abstract

~~This report explains the process of developing a research agenda for the five CASINDO partner universities.~~ This report provides an overview of the status of development of research agendas at the five partner universities. The research agendas consist~~s~~ of ~~a~~ research proposals, purchasing and installation of research equipment, cooperation with industries and conducting the research proposals. Start of the development of the agendas is determining the fields of interest and formulating research projects. Research development is an ongoing process and therefore by the end of 2011 part II of this report will be prepared which will present the new developments in the research agendas over the coming year.

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1. Introduction to the research program

During the inception phase the partner universities in Indonesia have expressed the need for the development of a research program that on one side will support the teaching activities and on the other side supports research for local industries (knowledge valorisation).
An additional aim of the research is to make staff, students, industry and the communities aware of the possibilities and potential for sustainable energy.
The need for equipment necessary for research and the need for demonstration equipment for knowledge valorisation and awareness raising will be cleverly combined. Based on the needs of industry at least three pilot research projects with a duration of less than one year will be developed and implemented using the chosen demonstration and research equipment. The research will be supported by means of visits by TU/e staff members (combined with visits for support of the education program) and on distance support through e-mail and telephone.

Aim is to set up a structural way of industries and universities working together to introduce sustainable energy units in society. The exchange between universities and industry will be organized through workshops

Research development within the Casindo framework is an ongoing process, starting with good preparation. Development of the research agenda can therefore be characterized by development in research proposals, purchasing and installing of equipment and co-operation with industries. Specific deliverables will be dedicated to knowledge valorisation (D19) and the demonstration units (D20); therefore not too many details will be presented here. Focus will be on the proposals and research fields in which the universities are interested.

In this report the status of the development of a research agenda is presented for each of the partner universities. In one year a similar report(D15, Part II)will again present the status of this agenda at that moment in time.

2. UMY

2.1 Research Fields

The research fields of interest in general of UMY are: energy management, wind energy, solar energy and energy efficiency in the built environment. During the inception phase UMY expressed interest in the development of the following research projects:

Economic evaluation of renewable energy potential, Yogyakarta as a case
Mapping renewable energy potential in Yogyakarta
Solar water heating & heat storage (industry related)
Vertical and slow rotating wind mill for instance for a mosque (industry related)
Energy conservation for Build Environment (industry related)
Energy potential scanning (DINAS)

Social-economic study on Energy, including evaluation of micro-hydro systems
Energy Information System (DINAS)
Energy utility Management

For only some of these projects research and demonstration equipment needs to be purchased and only for three research projects financial means will be provided through the Casindo project. For these projects reports will be presented to the Casindo management. The research projects on wind energy, solar heating and storage and energy conservation in the built environment are intended to be executed in co-operation with industrial partners or companies. These projects have to be reported on since they are partly financed through the Casindo framework.

After the Inception Phase UMY submitted a proposal to construct a sustainable demonstration house. All demonstration and research equipment will be an integrated part of this house. This proposal has been commented on by a TU/e expert of Building Engineering and has been approved of. Current status is that UMY has submitted quotations for all equipment and after some minor aspects have been sorted out, UMY will be ready to purchase and install the equipment.

This (general) definite list of equipment of UMY consists of approximately the following:

1. Solar home system
2. Demonstration house
3. Small scale wind generator
4. Solar water heater
5. Weather station
6. LED lights (set of different intensities)
7. Renewable Energy Science kits for laboratory

2.2 Wind energy

At UMY there was not much knowledge available in this field. Novi Caroko has therefore worked on wind energy during the combined education and research meeting on wind energy in March in Yogyakarta as well as during his training in Eindhoven in April 2010. Mr. Caroko works on the development of an undergraduate course in wind energy and will most likely also be the project leader of the research initiated in this field at UMY.

As a research and demonstration project UMY would like to place a small scale wind turbine on top of a mosque, but UMY will first execute tests and research by placing a small scale turbine on top of a building.

UMY aims to purchase an 8 channel multi-purpose data logger to ensure that different kind of data can be saved and analysed simultaneously. Furthermore UMY wants to use off-the shelve DC permanent magnet generators to be connected to the wind mills. It will not be easy to match these to the wind turbine, but this offers an interesting field of research. Furthermore, the department of mechanical engineering and electrical engineering are advised to co-operate together in this field of research.

2.3 Solar Energy

UMY does already have experience in this field. Some parts of their engineering courses are dedicated to solar energy (solar pumping, thermal radiation) and they've already done research projects in this field (for example: solar pumping for pools, installation design of SHS system for education of students)

Mr. Najib is in charge of the solar research of UMY. He gave a presentation during the combined education and research mission in Medan in March 2010. He explained why UMY wants to use paraffin wax as a solar heating absorption fluid instead of water. Paraffin is a lighter material which will reduce the weight of the installation. Furthermore, Mr. Najib had a two weeks training in Eindhoven on the same topic.

2.4 Longer term (3-5 years) research agenda

Centre for Regional Energy Management UMY, has determined three research cluster (group) for the agenda in 2010 – 2015 i.e;

- Energy conservation and efficiency
- Conservation and development of renewable energy sources
- Energy planning and management

In the period of 2010-2015 the research groups are expected to conduct at least one research funded by DGHE, Ministry or any other external funding. Research category proposed by the research group can be of fundamental research, applied research, industrial research, or commercial research stage. For the first agenda of 2010-2015, the groups are urged to concentrate o fundamental research, or early stage of applied research, in accordance with their research experience and resources.

2.5 Conclusions and remarks

Development of the research agenda progresses fast. UMY was the first university to submit proposals for equipment. Staff of UMY is motivated and active which ensures continuous development.

3. USU

3.1 Research Fields

At USU several lecturers with different background are interested in research development in the field of sustainable energy. The below mentioned research topics were proposed by lecturers of the department of agriculture and husbandry and chemical engineering.

Solar-Desiccant Assisted Drying

Problems solving at cacao plantation by Methanization process
Biodiesel production in oscillatory baffled reactor by two-step transesterification

The fields of interest have changed a little after the inception phase, also due to changes of people in and management of the project team. Currently research proposals on the following topics have been submitted.

1. Biogas Prototype unit combined with problem solving on cacao plantations by bio-methanization technology. This proposal has been submitted by the faculty of Agriculture and husbandry.
2. Electricity generation from liquid waste fermentation. This proposal was submitted by the faculty of Chemical Engineering.
3. Development of a prototype of solar-powered adsorption refrigerator in combination with the data acquisition system for teaching and research equipment. This proposal was submitted by mechanical and electrical engineering.

These proposals have just had a first round of comments and are currently being improved by the lecturers of USU. All of these research proposals will be executed in co-operation with local industry or companies.

3.2 Digestion

Mrs. Nurzainah who has already been involved for years in practical research on digestion has a large network of small, scale industries, farmers etc where this technology can easily be applied. She also offers advisory services to local government and assists them whenever they want to reach people in more rural areas. The first knowledge valorisation workshop was organised at USU in august 2010 by Mrs. Nurzainah. Topic of this workshop was the use of slaughterhouse waste for digestion. This technology is already in use in some slaughterhouses. The operators of these slaughterhouses could provide the audience with much, practical knowledge which motivated some of the participants to also discuss application of this technology with USU staff. Currently at least two slaughterhouses are interested in a MoU with USU on this specific topic.

3.3 Liquid waste to electricity

Staff members (Mr. Irvan and his colleagues) of USU are already co-operating with several palm oil industries which can provide them with liquid waste of these plants. This waste is the raw material used in the research mentioned secondly on electricity production. If a small scale, mobile demonstration unit can be built at not too high costs this will offer business opportunities may be to USU staff to build the units and for others to operate them.

3.4 Longer term (3-5 years) research agenda

This still needs to be developed as the institutionalization of this project at USU is still under development.

3.5 Conclusions and remarks

USU was unfortunate to have experienced changes in management just after the inception phase which resulted in a slow start. Nevertheless staff of USU is motivated and catches up fast. Three research proposals have been submitted, 5 staff members have been trained at TU/e, and

several staff members participated in the research and education mission of March on solar energy at the campus of USU. Equipment will most likely still be purchased and installed this year.

4 UNRAM

4.1 Research Fields

During the Inception phase UNRAM expressed interest in the following research topics.

Efficient biomass for drying of tobacco
Use of solar power and heat storage for drying of tobacco
Biogas for frying of jackfruit (replacing LPG)
Redesign oven for tobacco drying (energy efficiency)
Energy self-sufficiency of communities (economic analysis; integrated with other research projects)
Power control system device for integrating generation units

After the inception phase, UNRAM has changed its fields of interest also due to some changes in active staff members and growing knowledge in other fields. Key field of interest remains biomass, which at an earlier knowledge valorisation workshop was supported by local industry (amongst other; the tobacco industry which is abundantly present at Lombok and household industries for food/drinks etc. which have a lot of organic waste). Furthermore, interest has moved to the field of solar energy and wind power.

Therefore UNRAM decided to purchase and install the following equipment.

1. Biomass Demonstration unit in which production of biogas is demonstrated and measured and connected to a dual fuel engine (diesel or gasoline)
2. Biomass demonstration unit in which biomass is burned to produce bio oil (pyrolysis oil), syngas and char
3. Solar energy demonstration unit (PV systems)
4. Wind Energy demonstration unit (small scale wind turbine)

Each of the sets of equipment is linked to research which has been elaborated on convincingly during the visit of TU/e staff members in June 2010. Furthermore, a detailed description and purpose for use of the equipment was provided. Three research projects will be executed in co-operation with local industry.

Currently UNRAM is waiting to receive quotations of companies for this equipment. It is expected that the equipment will be purchased and installed before the end of this year.

4.2 Solar Energy

Research on a hybrid solar dryer combined with traditional fuels like rice husk will be set up. Mr. Mulyanto visited the combined education and research meeting in this field and was also

trained in Eindhoven on the topic of solar energy. At UNRAM there was not yet much experience in this field of expertise.

4.3 Biomass

Mr. Yesung visited the combined education and research mission on biomass in Mataram in July 2010 and presented research on pyrolysis of coconut fruit.

Mr. Citarsa presented research on biogas digestion during the same meeting.

4.4 Wind energy

At UNRAM research has been done on the potential of wind energy, but there is a lack of funding and a lack of interested students as this is not part of their regular curriculum. There are plans for further curriculum and research development though. Windmills could be applied for water supply as well as electricity supply for small business or households.

4.5 Longer term (3-5 years) research agenda

This still needs to be developed.

4.6 Conclusions and remarks

UNRAM is progressing well in the development of their research. As soon as the equipment is installed they will start several research topics. After the first research has been finalised, which is initiated under the framework of the Casindo project, there is a long line of researchers waiting to use the equipment. Therefore, staff of UNRAM is very motivated to finalise the process of purchasing and installing fast.

Furthermore, organisation of the knowledge valorisation workshops has been postponed until after the installation of equipment. In this way, UNRAM will have the local industry something to offer and demonstrate. Co-operation can be sought specifically in the fields in which research is being done.

5 UNDIP

5.1 Research Fields

The topics of interest of UNDIP can be found in energy efficiency, solar energy and biomass.

Biogas processing and implementation for households
Solar cell equipment for implementation in communities
Energy Efficiency measurement for transport (industrial)

Next to this UNDIP is very interested in energy management and energy planning. The master programme which is being developed at UNDIP is devoted to energy planning. For research in energy planning though, no additional funding was necessary under the Casindo framework.

The topics of interest of UNDIP remained the same after the inception phase.

General list of equipment

1. Digester and several tanks for upgrading of biogas
2. Smoke meter, digital gas analyzer, data logger and auto scanner for improving the efficiency of engines
3. Solar cells sitting ground; in which students can use the electricity of panels for use of laptops etc. The small grid installed for the sitting ground will be the basis for practical work and research.

UNDIP has handed in all three proposals for demonstration equipment and three quotations of companies per proposal. UNDIP also handed in three proposals for research equipment. All proposals have been approved of and the money for all equipment has been transferred. Currently therefore UNDIP is purchasing and installing the equipment.

UNDIP is very actively working with local industry. A general knowledge valorisation workshop has been organised in January 2010, as part of the fast-track of UNDIP. After this workshop UNDIP continued to discuss the possibilities of co-operation with industry. Industry showed interest in execution of energy audits as this has become important due to changes in government policy. In August 2010; a workshop on energy audits was organised in which around 55 people participated. TU/e staff supported this workshop.

5.2 Solar cells

Mr. Joko is in charge of the research in this field. A sitting ground will be designed with a roof containing PV- systems which are used for recharging of laptops. The system will be connected to the electricity grid which will be used for backstopping. Mr. Joko participated in the combined education and research mission in Medan in March. Focus of his training in Eindhoven was on the broad field of renewable energy technologies.

5.3 Biomass

UNDIP wants to do research in use of algae for bio-ethanol production and biogas purification. Use of micro-algae for purification of biogas is a more advanced technology then current used traditional manners of purification. Mr M. Djaeni is one of the leaders in all research executed in the field of biomass. He would like to built a research unit in which the purification of biogas (desulfurization, removal of water and CO_2) to obtain a higher quality of biogas, higher production capacity and more feasible process are put central. He gave a presentation on the first topic during the combined research and education mission on biomass at UNRAM. Furthermore, he visited TU/e for his training in the field of biomass earlier this year.

5.4 Wind energy

The research on wind energy is not supported by equipment of Casindo but is seen as part of the research that will be supporting teaching and research for industry.

Mr. Nazaruddin, who participated on behalf of UNDIP in the combined education and research mission on wind energy in Yogyakarta in March, has already experience in this field. UNDIP is interested in windmills with horizontal as well as vertical axes which can be used at low wind

speed. Furthermore, UNDIP would, in the future, like to produce windmills. Currently they are interested in software for blade design which can add to their future research. UNDIP is currently looking at small scale turbines, which is stimulated because it's good to get experience in small scale turbines before designing larger scale mills. UNDIP is already co-operating with industry in this field. An interesting field of research could be optimising of rotor and motor.

5.5 Longer term (3-5 years) research agenda

This still needs to be developed.

5.6 Conclusions and remarks

Staff of UNDIP has demonstrated to be very motivated. Staff of UNDIP participated in all combined meetings on research and education and has started up the installation of all equipment. The official opening of this equipment is planned for 14th of October.

6 UNCEN

6.1 Research Fields

During the Inception Phase UNCEN did not have the opportunity of discussing research topics or ideas with staff members of TU/e. In December 2009 the first meeting took place in Jayapura and among a lot of information related to the Casindo project, staff of UNCEN already could present us the key areas of interest of West Papua because of the high potential in this area: biomass, solar energy and micro hydro technology.

Very rapidly afterwards UNCEN has submitted research proposals.

These proposals are about the following topics:

- Making charcoal briquettes out of rice husk by using the hydraulic jack tool, which is applied by household industries in Papua.
- Increasing the biodiesel production out of the Nipah fruit (Papua) by using raw, solid limestone as catalyst
- Technical and socio-economic assessment of the use of solar home systems in Papua.

Staff of UNCEN has taken the local business opportunities in consideration by formulating research in these areas.

6.2 Biomass and Solar Energy

During the combined education and research meeting on biomass in July, Ms. Libertina presented also intended research on the production of bio-ethanol out of starch from Sago, a local plant.

Mrs. Endang and Mr. Numberi both took training in the field of Biomass in Eindhoven in spring of 2010. Mr. Numberi will focus on bio ethanol production out of starch of Sago, a local, widely spread plant. Mrs. Endang will focus on biodiesel production out of the locally grown Nipah fruit. This is also a non-cultivated variety widely spread throughout Papua.
In January 2011 UNCEN is planning to organise the first knowledge valorisation workshop in Jayapura in the field of biomass as West-Papua offers many opportunities in this field.

In July 2010 UNCEN together with TU/e organised a two day workshop in the field of biomass and solar energy. This workshop was part of the fast-track specifically aiming to improve the relation between TU/e and UNCEN (and TU/e and UNDIP) and offer a possibility to the staff members of UNCEN to become more knowledgeable in topics of interest. The other universities, because of the longer existing relationship, already have had this opportunity.

In March 2010 Mrs. Endang and Mr. Yosef Lefaan participated in the combined education and research missions on wind energy in Yogyakarta and solar energy in Medan. Mr. Lefaan presented UNCEN's experience in solar energy. In West Papua, solar energy offers possibilities to remote areas. Mr. Lefaan explained UNCEN's motivation to map the solar energy potential (also considering the no. of inhabitants and possibilities for maintenance etc). Furthermore, he explained about the student's projects in which student's calculate the needed capacity, inverters, storage etc. A possible research topic could be to determine the optimal inclination of the panel in West Papua.

6.3 Longer Term Research Agenda (3-5 years)

This still needs to be developed as the institutionalization of this project at UNCEN is still under development.

6.4 Remarks and conclusions

Staff of UNCEN is very active and works hard to catch up with the universities that were involved earlier in this project. Based on the needs assessment executed by UNCEN among local industry as well as the workshops they have already organised and the participation of staff members in training at TU/e, UNCEN staff members are working hard to obtain sufficient knowledge in their field of interest to continue working on the research agenda.

Annex; Examples of Research proposals

Demonstration Equipment OF electricity generation from liquid waste fermentation

Irvan

Chemical Engineering Department, University of Sumatera Utara

Background

Every day, liquid wastes are produced in huge quantities whether from domestic, agriculture, or industry sector. These liquid wastes are considered as burden because they have to be treated before being discharged to environment. Generally, industrial liquid wastes are available in huge amount at one location. For example, palm oil mill with capacity 30 tonnes fresh fruit bunches (FFB) per hour produces 18 tonnes palm oil mill effluent (POME) per hour.

Based on the research results conducted by Irvan et al. (2009), liquid wastes are very potential to be converted into renewable energy via methane fermentation process. However, no industry wants to apply this technology because no prototype is available to prove that the process is feasible.

This project is intended to make a prototype of electricity generator system where biogas produced from liquid waste fermentation is fed as fuel. The prototype is used as demonstration equipment in order to facilitate the feasibility study of this system technically and economically.

Project Purpose

- To make of a prototype of demonstration equipment to produce electricity from liquid waste fermentation
- The prototype is able to produce electricity about 500 watt hour
- The prototype is expected to be compact and moveable
- It can be fed by various liquid wastes

Proposed Project

The prototype is expected to be able to produce electricity about 500 watt hour. It is considered to be compact and moveable and also can be used to power electrical equipment such as light bulb, rice cooker, refrigerator, TV, PC, or iron. The flow sheet of the process is shown at Figure 1 and the prototype is visualized like Figure 2.

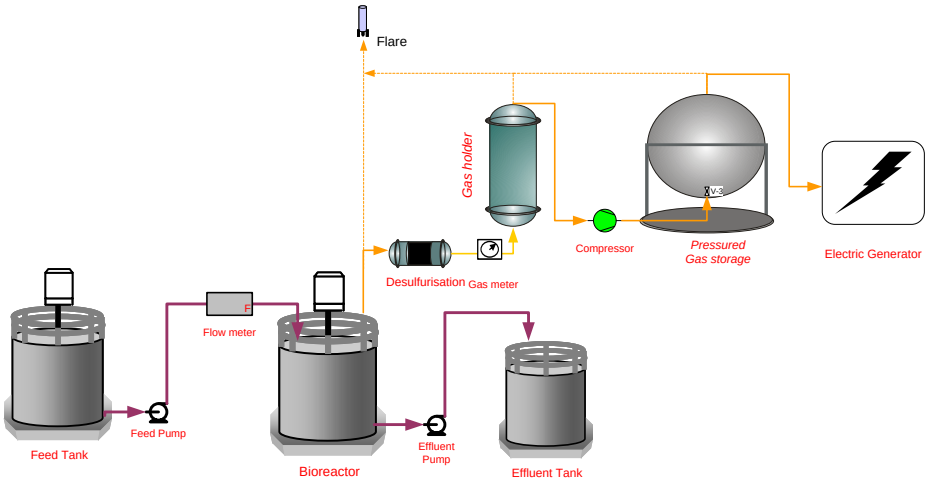

Figure 1. Flow sheet of Proposed Project

Figure 2. Illustration of the Prototype of Electrical Generator System

The equipment of the process consists of feed tank, bioreactor, adsorber, gas meter, gas holdup, pressured gas storage system, and generator set. The feed tank is required for pre-treatment of the liquid wastes. The bioreactor which equipped with stirrer, heater, thermocouple, and pH sensor is the main equipment where the fermentation occurred. The adsorber is a small column contained with sponge iron as adsorbent to removed H_2S gas. The gas meter is used to measure the flow of produced gas. The gas holdup is a tank to keep biogas temporarily before being sent to the pressured gas storage system. The pressured gas storage system consists of compressor, cooler, and pressured gas storage. The system is required to store pressured biogas before being used as fuel. The generator set is used to produce electricity. The set consists of a gasoline engine and an electrical motor. Gasoline engine have been modified before, therefore it can use biogas as fuel.

Considered Result of the Research

Yeoh B.G. (2004) reported that biogas yield from methane fermentation with temperature 55^{o}C is 1.41 m^3kg^{-1}-BOD_{added} and to generate 1 kWh electricity consume 0.55 to 0.41 m^3-biogas. Irvan et al (2008) also reported that POME from Rambutan, Pagar Merbau, and Sisirau Palm Oil Mill have different BOD values in the range of 25,000 – 59,000 mg BOD/L-POME. The experiment results showed that the system could reduce BOD value to 6,700 – 9,100 mg BOD/L-POME. It means, for 1 litre POME added to bioreactor can generate electricity about 25.80 – 70.36 Wh. Therefore in order to produce 500 Wh electricity as we wish, it requires 7 to 20 litre of POME.

Specification

1. **Feed and Effluent Tank**.
    - Capacity: 50 litre (D = 33 cm & H = 66 cm)
    - Material: stainless steel, thickness: 0.5 mm
    - Quantity: 1 (one).
    - Additional item: baffle and stirrer.
2. **Feed and Effluent Pump**.
    - Type: slurry pump
    - Capacity: $\pm$ 20 litre/sec
    - Head: 2-4 meter
    - Electrical power: 100 watt
    - Quantity: 2 (two).
3. **Bioreactor**.
    - Capacity: 175 litre (D = 45 cm & H = 108 cm)
    - Material: stainless steel, thickness: 0.5 mm
    - Quantity: 1 (one)
    - Additional Item: stirrer, heater, thermocouple, and pH sensor.
4. **Adsorber**.
    - Capacity: 1 litre
    - Material: stainless steel
    - Quantity: 2 (two).

5. **Gas meter**.
    - Capacity: 0.5 m^3/s
    - Quantity: 1 (one).
6. **Gas holdup**.
    - Capacity: 40 litre (D = 28 cm & H = 67 cm)
    - Material: carbon steel, thickness: 0.5 mm,
    - Additional item: attached with biogas bag, capacity 35 litre
    - Quantity: 1 (one).
7. **Pressured gas storage system**. The system consists of compressor, cooler and pressured gas storage. Capacity of compressor is able to increase the pressure at least 10 times from initial pressure. The cooler should be able to reduce temperature of pressured gas, back to the normal temperature.
    - Capacity of biogas storage: 50 litre (spherical shape, D = 51 cm)
    - Material: stainless steel, thickness: 0.8 mm
    - Quantity: 1 (one).
8. **Generator set**.
    - Capacity: 500 Wh
    - Phase: single
    - Quantity: 1 (one).
9. **Controller set.** The set consists of temperature controller, pH controller, timer, automatic on/off switch, and flaring system.

Budget

1. Equipments Cost

No	Equipments	Quantity	Price (Rp)	Total (Rp)
1	Feed Tank	1	7,500,000.00	7,500,000.00
2	Effluent Tank	1	7,500,000.00	7,500,000.00
3	Bioreactor	1	20,000,000.00	20,000,000.00
4	Feed and effluent pump	2	10,000,000.00	20,000,000.00
5	Adsorber	1	5,000,000.00	5,000,000.00
6	Gas holdup	1	5,000,000.00	5,000,000.00
7	Gas meter	1	5,000,000.00	5,000,000.00
8	Generator set	1	10,000,000.00	10,000,000.00
9	Controller set	1	25,000,000.00	25,000,000.00
10	Panel and Frame	1	10,000,000.00	10,000,000.00
11	Insulation	1	5,000,000,00	5,000,000,00
	Sum			**120,000,000.00**

2. Commissioning and Test Run Cost

No	Items	Cost
1	Labour Cost	5,000,000.00
2	Chemicals and reagents	10,000,000.00
3	Transportation for collecting sample	5,000,000.00
4	Chemical analysis for biogas quality	10,000,000.00
	Total	**30,000,000.00**

Total = Equipments Cost + Commissioning and Test Run Cost

= Rp. 120,000,000,00 + Rp. 30,000,000,00

= Rp. 150,000,000.00 **= € 12,927.69**

1 Euro = Rp. 11,603 currency at July 27, 2010

(http://www.klikbca.com/individual/silver/Ind/rates.html)

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RESEARCH PROPOSAL

Biogas purification by membrane contactor coupled with algae photo-bioreactor

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1. Title:

Biogas purification by membrane contactor coupled with algae photo-bioreactor

2. Motivation

As consequence of the energy crisis, biogas has become an important alternative energy to be used in developing countries. In addition, replacing fossil fuel with biogas has the following important benefits: (i) it will reduce the harmful greenhouse gas emissions that cause climate change as well as particles, dust and nitrogen oxide emissions, (ii) it will cut down on air pollution from diesel emissions, (iii) it will reduce the dependency on fossil fuels. Nevertheless, the use of biogas is limited by its impurity. The presence of impurity will generally either reduce the heating value of biogas or cause other problems such as corrosion. Biogas or raw landfill gas or digester gas is a mixture of methane (CH_4) 40-60%, carbon dioxide (CO_2) 20-35% and ammonia (NH_3) <5%, which is saturated with water vapour, resulted from an anaerobic digester. It is usually contaminated with highly corrosive levels of H_2S (100-300 ppm). Trace amounts of hydrogen (H_2), nitrogen (N_2), carbon monoxide (CO), saturated or halogenated carbohydrates and oxygen (O_2) are also occasionally present in the biogas. One of the significant impurities in biogas is carbon dioxide. The proportion of methane to carbon dioxide in biogas depends on the substrate used [1,2]. Factors such as temperature, pH and pressure can alter the gas composition slightly. For example, typical gas compositions for carbohydrate feeds are 55% methane and 45% carbon dioxide, while for fats the gas contains as much as 75% methane. Therefore, removal of CO2 from biogas is very important and will broaden the application of biogas.

Several methods have been proposed for CO2 removal such as absorption based processes, adsorption based processes, membrane based processes and bioreactor based processes using microalgae. In this project, the removal of biogas will be performed by using membrane absorber coupled with algae bioreactor. The use of membrane absorber is aimed to control the CO2 inlet to the algae bioreactor (it should be noted that the CO2 fixation by microalgae in influenced by CO2 inlet), whereas the use of microalgae bioreactor is to consume the CO2 and finally could be used as raw material for biodiesel production.

2. Biogas characteristics and upgrading its quality

The characteristics of biogas are somewhere in-between town gas (deriving from cracking of cokes) and natural gas (Table 1). The energy content is defined by the concentration of methane. Ten percent (10 %) of CH4 in the dry gas correspond to approx. one kWh per m3. For many applications the quality of biogas has to be improved. The main parameters that may require removal in an upgrading system are H2S, water, CO2 and halogenated compounds.

An illustration, pure methane has a calorific value of 9,100 kcal/m^3 at 15.5°C and 1 atmosphere; the calorific value of biogas varies from 4,800 - 6,900 kcal/m^3 [1]. In terms of energy equivalents, 1.33 - 1.87, and 1.5 - 2.1 m^3 of biogas are equivalent to one litre of gasoline and diesel fuel, respectively. In order to improve its utilization, further treatments are needed. For example, if it will be used to power vehicles or others, the presence of CO_2 is unsatisfactory, for a number of reasons. It lowers

the power output from the engine, takes up space in the storage cylinders (thereby reducing the range of the vehicle), and it can cause problems of freezing at valves and metering points, where the compressed gas expands, during running, refuelling, as well as in the compression and storage procedure. All, or most, of the CO_2 must therefore be removed from the raw biogas, to prepare it for use as fuel for vehicles, in addition to the compression of the gas into high-pressure cylinders, carried by the vehicle.

Table 1. Characteristic of biogas compared with other fuel gases [3]

Parameter	Unit	Natural Gas	Town Gas	Biogas (60% CH_4, 38% CO2, 2% Other)
Calorific value (lower)	MJ/m³	36.14	16.1	21.48
Density	kg/m³	0.82	0.51	1.21
Wobbe index (lower)	MJ/m³	39.9	22.5	19.5
Max. ignition velocity	m/s	0.39	0.70	0.25
Theor. air requirement	m³air/ m³gas	9.53	3.83	5.71
Max. CO_2-conc. in stack gas	vol%	11.9	13.1	17.8
Dew point	°C	59	60	60-160

In order to be used as fuel, biogas has to be purified. The following steps are the examples processes for improving biogas quality [3]:

- Desulphurisation to prevent corrosion and avoid toxic H2S concentrations (the maximal workplace concentration is 5 ppm). When biogas is burned SO2/SO3 is emitted which is even more poisonous than H2S. At the same time SO2 lowers the dew point in the stack gas. The sulphurous acid formed (H2SO3) is highly corrosive.
- Removal of water because of potential accumulation of condensate in the gas line, the formation of a corrosive acidic solution when hydrogen sulphide is dissolved or to achieve low dew points when biogas is stored under elevated pressures in order to avoid condensation and freezing.
- Removal of CO2 will be required if the biogas needs to be upgraded to natural gas standards or vehicle fuel use. It dilutes the energy content of the biogas but has no significant environmental impact.
- Landfill gas often contains significant amounts of halogenated compounds which need to be removed prior to use. Occasionally the oxygen content is high when too much air is sucked in during collection of the landfill gas.

3. Project objectives

The objective of this proposed project is to upgrade bio gas quality. More specific, the objectives are CO2 removal from biogas by using membrane contactor coupled with micro algae photo-bioreactor.

4. Methods

The proposed project will be done by the team, which possesses significant experience in the membrane technology, microalgae culturing and, energy conversion. The synergistic contributions of the team members will allow the development of a new and effective method for increasing the biogas production rate and the resulting biogas quality. The project activities are explained as follow:

1. Design and fabrication of membrane absorber unit coupled with algae bioreactor. Figure 1 shows the schematic laboratory unit that will be prepared.
2. Study the effects of process variable on CO2 removal and CO2 fixation by microalgae in photo bioreactor.

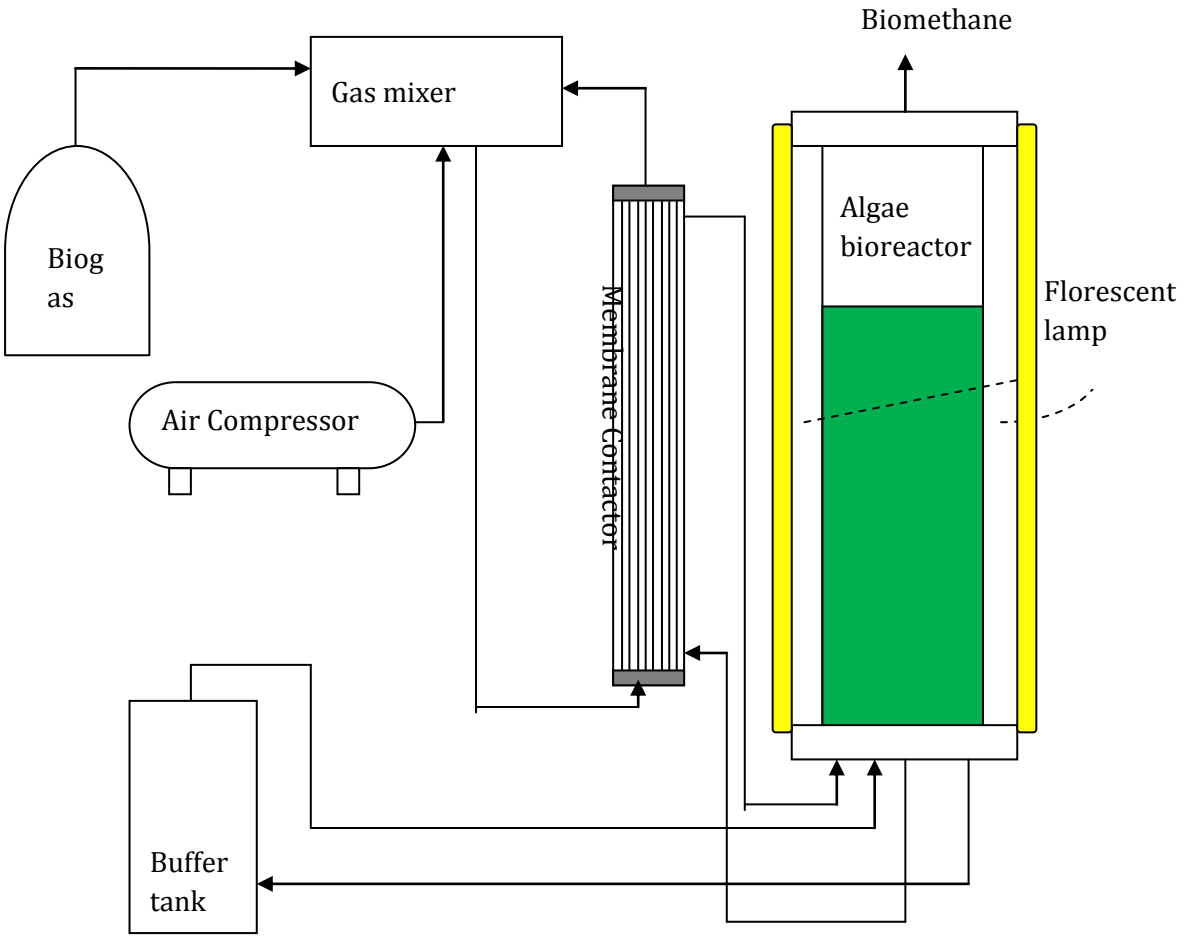


Figure 1. Schematic representation of membrane contactor coupled with algae photo-bioreactor

5. Persons

This project will be coordinated by:

Dr. Heru Susanto with his expertise in membrane technology

Dr. Hadiyanto with his expertise in bioprocess

Dr. Mohammad Djaeni with his expertise in energy conversion

6. Project budget

The total budget of this project will be €3000

1.	Membrane module		500
2.	Regulator (2)		400
3.	Biogas		500
4.	Pump		150
5.	Peristaltic pump		200
6.	Blower		300
7.	Algae bioreactor		500
8.	Florescent lamp	150	
9.	Gas analysis		300

References

[1] U. Marchaim, Biogas processes for sustainable development, FAO, Rome, 1992

[2] D. Deublein, A. Steinhauser, Biogas from waste and renewable resources, Wiley-VCH, Weinheim 2008

[3] A. Wellinger, A. Lindberg, Biogas upgrading and utilizations, IEA Bioenergy Task 24 in: http://www.iea-biogas.net/

RATIFICATION SHEET

RESEARCH PROPOSAL TO CASINDO PROJECT

1. Title : Benefit of Rice Husk as Material of Charcoal Briquette uses Hydraulic Jack Tool Press for Home Industry Scales

2. Researcher Chairman:

a. Complete Name : I Gusti Ngurah Suarsana, ST., M.Eng.

b. Sex : Male
c. Nip (official mother number) : 132 258 347
d. Structural function : Chairman of Study Program Diploma III
e. Functional function : Skilled Assistant
f. Faculty/direction : Technical/Mechanical Engineering
g. Centre of research : Laboratory of Mechanical Engineering Cenderawasih University and Koya - Jayapura
h. Phone/facsimile : 0967-574124
i. Home address : Raya Abepura-Entrop, Skyline no.38 Jayapura - Papua
j. E-mail/HP : gustisuarah@yahoo.com / 081328005964

agustinus1966@yahoo.com

3. Research Duration : 8 Month

4. Cost of Research : Rp. 60.000.000 (Sixty Million Rupiah)

Jayapura, May 7th 2010

Detect and approve

Dean Assistant I of Technical Faculty of Cenderawasih University

Researcher Chairman

Deasy Widyastomo, ST., MT.

Nip : 197312212000121002

I Gusti N. Suarsana, ST., M.Eng.

Nip : 132 258 347

I. RESEARCH IDENTITY

1. Title of Proposal :

Benefit of Rice Husk as Material of Charcoal Briquette that made uses Hydraulic Jack Tool Press for Home Industry Scales

2. Researcher Chairman

a. Complete Name : I Gusti Ngurah Suarsana, ST.,M. Eng.

b. Science specialization : Mechanical (Material Engineering)

3. Researcher Member

No	Name and degree	Science specialization	Institution	Time precipitation
1	I Gusti Ngurah Suarsana, ST.,M. Eng	Mechanical (Material Engineering)	Cenderawasih University	15 hours per week
2	Agustinus, ST., MT.	Mechanical (Energy Conversion)	Cenderawasih University	10 hours per week

4. Theme of Research : Rice Husk Benefit for Alternative Energy

5. Object of Research

No	Object of research	Materials of research	Research aspect
1	Engineer to overcome rice husk waste that produced from rice mill factory or from society processing	Rice husk (rice skin)	Rice husk waste condition that can be made which standard briquette charcoal appropriate rules

2	Engineer of press hydraulic and moulding tool for briquette charcoal maker	Hydraulic press and moulding tool	Practicability level and reliability of tool that made
3	Rice husk briquette charcoal density test from mould and press	Rice husk charcoal briquette	Rice husk briquette charcoal density appropriate condition
4	Rice husk briquette charcoal calorie content test	Rice husk charcoal briquette	Rice husk briquette charcoal with calorie content appropriate

6. Research Location : At environment areal rice agriculture Koya Jayapura and at Technical Engineering Repair Shop/Laboratory UNCEN

7. Research Target

No	Object of research	Finding target
1	Engineer to overcome rice husk waste that produced from rice mill factory or from society processing	Got of condition rice husk briquette charcoal appropriate for briquette charcoal
2	Engineer of press hydraulic and moulding tool for briquette charcoal maker	Got of practicable and reliable tool
3	Rice husk briquette charcoal density test from mould and press	Got of rice husk briquette charcoal with density appropriate
4	Rice husk briquette charcoal calorie content test	Got of ice husk briquette charcoal with calorie appropriate

8. The other Institution in Concerned

No	Agency (resort)	Involvement

1	PEMDA Jayapura (Government of City Local Jayapura)	Licensing and assistance in data taking
2	BLKI Jayapura (Indonesian Grounding Couch Jayapura)	Construction and assembling of briquette tool press
3	Laboratory of Mechanical Engineering of Polytechnic Hasanudin University	Density and calorie test of rice husk briquette charcoal

II. Research Substance

ABSTRACT

The objectives of this research to effort society especially for rice farmer at Koya district Jayapura Papua with make use rice husk that can be processed to be husk charcoal briquette. Make of rice husk charcoal briquette very useful to develop because rice at Papua is principal staple food after sago.

Based of result study that done from environment aspect, rice skin waste (rice-husk) can dirty environment, so that to overcome it so rice husk castaway from processing result rice farmers can be made as rice husk charcoal briquette by using hydraulic jack tool press. The final purpose for this research is achievement effective technology that can be made as home industry. This tool can suppose produce rice-husk charcoal briquette appropriate of density that is between 0.60 ÷ 1.50 gr/cm^3, so that can be made alternative burn material. Method of this research divided in a few stage appropriate draft (flow chart) that begun from planning stage, making stage, assembling stage, charcoal stage, come up with moulding stage and calorie testing stage.

The results of this research can help farmer society to overcome waste castaway that can evoke environment pollution. The results can also suppose produce rice husk charcoal briquette with high value calorie so that can be used briquette burn material or made alternative fuel to change oil and get high enough attention.

Keyword: Active charcoal, Tool press, Density, Calorie value, Production capacity, Rice- husk.

CHAPTER I. INTRODUCTION

A. Background

Rice husk or rice skin waste disposal from rice mill factory (huller) where many operate at rural district or village. Because in Indonesia rice is staple food, the waste rice husk will not ever finish. During the time rice husk only limited for fertilizer mixture organic, horticulture plants media, poultry broiler, and brick fuel, and ash scrubs, but its (rice husk) can be used to super carbon production or charcoal briquette.

Basic commodity for rice husk waste that be used to production super carbon best will still new and dry condition, the purpose so that efficiency carbon that got to achieve 50 % from roughage. So look at the prospect of rice husk waste that the produced by rice mill factory can be make use and precise potential basic commodity available, so can open opportunity to be developed made fuel alternative because has hydrocarbon and high potential energy

B. Problem

1. How to make use rice husk waste that produced by rice mill factory
2. How to design tool mould and tool press rice husk charcoal briquette for household scale
3. How many calorie (heat) value of rice husk charcoal briquette that be made burn material alternative.

CHAPTER II. BOOK OBSERVATION

1. Biomass Development in Indonesia

Since year 2006 Indonesian begins to enter resurrection era energy II, in this era development of energy is priority for expansion as alternative energy as source of energy and decrease use petroleum base energy. Passes of Indonesian president regulation no.5 year 2006 about of wisdom national energy. Indonesian government has decided hotpotch of national energy year 2025 with petroleum as character energy will reduced from 52% in this time up to less than 20% in year 2025. In year 2025 alternative energy supposed begin to take character

more important with 17% supply to hotpotch national energy, belonging to bio fuel or vegetable fuel. The benefit of alternative energy very related to society comprehension towards to self alternative energy.

2. Rice Husk Benefit

Momentum of energy crisis that undergone in this time very correct to can promoting rice husk as one of source alternative energy. Rice husk benefit gives choice to society concerns source fulfilment economical energy and beneficial, because ash of husk briquette burning result can be made use for ash scrub, ingredient amelioration sour soil, mixture ingredient in hydraulic cement maker, stones mixture ingredient press, and mixture ingredient in rubber processing.

3. Biomass Fuel

Biomass fuel comes from leavings agriculture plants. This ingredient can be used to continue with use total equal with total of planting (rice ground). If this is done, there is no dioxide carbon emission because plant that planted consuming dioxide carbon as much as that released when ingredient is burnt. If energy that produced used in the place of fossil ingredient so there also dioxide carbon emission reduction.

Biomass fuel used on and ongoing basis industry rural district in nations has bloomed. Sugar, and rice mill factory, palm oil and agro industry another according to periodically rely on their waste self to produces that need

4. Husk Charcoal

Rice husk produced by rice mill process as waste, rice husk frequently to appear troubleshoot. While rice husk very potential as basic commodity of source alternative energy and cheap for society.

Rice husk chemical composition

Husk extern part from rice grains that result side moment rice mill process. Rice husk chemical pregnancy composition is explained in table I.

Table I. Rice husk chemical composition

No	Component	Content
1	Soeharno (1979)	
	- water degree	9.02
	- protein coarse	3.03
	- fat	1.18
	- coarse fibre	35.68
2	- ash	17.71
	- carbohydrate coarse	33.71
	follow DTC IPB	1.33
	- carbon (charcoal substance)	1.54
	- hydrogen	33.64
	- oxygen	16.98
	- silica (SiO_2)	

Source: Balai Penelitian Pasca Panen 2006
(Research coutch pasca harvest 2006)

About 20-30% from rice heavy husk and approximately 15% from husk composition ash that produced every husk burning. Rice husk consists of coarse fibre good for covers with percentage achieve 35,68%. Fibre lotion (fibre layer) this consist of two parts that called lemma and palea mutual interdependent.

Rice husk production in country very adult, because most of Indonesian society makes rice as main eats. Vast Indonesian rice production harvest total per period July month 2006 estimated to achieve 12 million hectare with production achieves 55 million ton in widespread throughout archipelago (see Table II)

Table II. Vast Indonesian rice production harvest per year from 2003 - 2006

No	Province	Rice production year			
		2003	**2004**	**2005**	**2006**
1	NAD (Aceh DI)	1.548	1.552	1.412	1.463
2	West Sumatera	1.824	1.875	1.907	1.947
3	North Sumatera	3.403	3.419	3.447	3.100
4	Riau	414	454	424	429
5	Jambi	576	579	580	580
6	South Sumatera	1.97	2.261	2.320	2.361
7	Bengkulu	414	415	441	409
8	Lampung	1.966	2.092	2.124	2.134
9	Banten	1.692	1.813	1.862	1.888
10	West Java	8.777	9.602	9.787	9.671
11	Central Java	8.124	8.513	8.424	8.530
12	Jogjakarta DI	652	693	671	722
13	East Java	8.915	9.002	9.007	9.186
14	Bali	793	788	787	785
15	West Nusa Tenggara	1.423	1.467	1.368	1.
16	West Kalimantan	1.027	1.064	1.021	1.068
17	Central Kalimantan	4490	590	492	448
18	South Kalimantan	1.410	1.519	1.599	1.628
19	East Kalimantan	430	486	500	58.581
20	North Sulawesi	370	407	433	453
21	Gorontalo	156	163	167.167	172
22	Central Sulawesi	739	726	717	719
23	South Sulawesi	4.003	3.553	3.390	628
	Total	**51.802**	**53.769**	**53.808**	**54.398**

Source: Produksi Padi, BPS dalam Booklet BPS edisi Juli 2006

(Rice Production, BPS in Booklet BPS July edition 2006)

If every one kilogram heavy rice is produced 20 grams of husk, for total rice production as large as 55 million ton will be produced of husk approximately 11 million ton.

That large potential of, husk should be benefitted of by making standard bio briquette and with basic commodity.

5. Bio briquette

Increase of petroleum price of year 2005 give significant effect for down circle society. Increase kerosene price jump from price Rp. 1.500 per litre is twice folds to Rp. 3.500 that very load for down circle society and at add again by increase of petroleum price always following to the height of another staple price. Bio briquette is potential fuel and certifiable for household. Bio briquette can supply energy for a long term

Definition of bio briquette is solid extant burn and come from leavings ingredient organic that experience compression process with certain power pressed. Benefit of briquette as alternative energy be a step in the right direction. Bio briquette can replace firewood use that begins to increase the consumption and potential botch forest ecology. Besides price of bio briquette relative cheap and achievable by society especially that isolated living and effort of bio briquette can absorb of employee for briquette effort, distributor, furnace industry, and briquette engine.

6. Hydraulic Pressing

Hydraulic pressing method is extraction process with use pressure. Extraction quantity depends on pressure magnitude, time pressure, and oil content in origin ingredient. Magnitude of pressure is in general around 140.6 kg/cm^2 (136 tam). Tool pres that worn to depress batter hydraulic jack, and rice husk charcoal powder that insert into printing until full content can be printed with depress lever press hydraulic jack downwards until hard rice husk charcoal batter. Sularso (1983) follows, that when does emphasis process can use tool press hydraulic system knowable with similarity :

$$P \quad —$$

with : P = pressure style (kg/cm^2)

F = force of load (ton)

A = cross suction area of cylinder (cm^2)

Ratio (comparison) of mass and volume of printing product called specific mass (density), and the density value countable by using similarity:

$$\rho \quad —$$

with : ρ = specific mass (gr/cm^3)

M = briquette mass (gr)

V = briquette volume (cm^3)

Sample volume is counted with:

$$v = 1/4\pi (d)^2 (t)$$

with : d = sample diameter (cm)

t = high (tall) sample (cm)

Charcoal briquette is solid fuel that made from powder or saw waste remainder, rice and others from agricultural produce by dry, sieve, forged and heat. Benefit of powder waste that measure little upon which burn in the form of briquette effective and efficient because form and the size can be accustomed with need, the density can be increased and value calorie tall permanent ranges from 4.700 ÷ 4.800 kcal/kg, slower the burning speed so that its use expandable for example upon which burn fish fumigation (smoke fish).

CHAPTER III. PURPOSE AND BENEFIT OF RESEARCH

1. Special Purpose

Come from background on that explained the purposes of this research can be formulated several principal :

a. Overcome and handling rice husk waste that produced from rice mill factory or from society processing

b. Make moulding tool and pressing tool for briquette

c. Testing of charcoal briquette density after moulding process

d. Testing of charcoal briquette calorie to detect of magnitude calorie content.

2. Principal Purpose

Availability of basic commodity that overflow and society dependence towards petroleum, so one of efforts to use another source of alternative energy is reviewed from economy technical aspect and environment that rice husk waste benefit is charcoal briquette. Charcoal briquette maker from rice husk waste very potential to effective technology development like home industry that can increase society economy as local resource income. Beside of that the technical moulding very easy because only uses hydraulic tool press.

3. Research Benefit

The results of this research will give benefit for farmer:

a. Technical Benefit

- To give information to society especially for farmer at Koya about waste purpose of husk rice that changeable is charcoal briquette.
- Upon which burn alternative kerosene successor and can be made home industry based on local or national.

b. Economy Benefit

- Result of rice husk waste charcoal briquette can increase income and welfare for farmer.

- Result of rice husk waste charcoal briquette can decrease society dependence from petroleum (oil fuel) excelsior the price, so that increase society cognizance to create employment passes local resource development.

- Hydraulic tool press briquette can be made home industry based on local or national.

c. Research Product

1. Product Year I

- Overcome waste from environment pollution

- Got rice husk waste charcoal briquette that can be made alternative fuel for household.

- Got closeness value and value calorie by determine comparison mass and volume from product result.

- Produce tool press and simple waste charcoal briquette mould.

2. Long-range Product

- To environment preservation guarantee from waste pollution

- The result that got from rice husk waste charcoal briquette can create employee intensive pattern form employment with also effort based on local or national.

  Thereby society can involved in waste processing be briquette to fulfil their need beside that marketable because has high economy value.

CHAPTER IV. RESEARCH METHOD

1. Research Place

This research is carried out at Mechanical Technical Laboratory of Faculty of Cenderawasih University and at BLKI (Indonesian grounding couch) Jayapura. Research plan will be begun in April month up to December month 2010. Sample material (ingredient) that used to made charcoal briquette rice husk waste got from rice mill factory at Koya Jayapura regency.

2. Research View

Rice husk charcoal briquette can be made by using simple technology from modification of hydraulic jack. This tool can be applicable and developed for farmers, especially those living at Koya Jayapura. Reason selected location because Koya biggest rice producer at Jayapura so that rice husk produced from rice mill factory can be used.

Activities view that be carried out in this research will make moulding tool from round iron pipe and design tool press from hydraulic with stage as follows:

1. Make briquette mould

   Material (field) that used for charcoal briquette moulding tool is pipe iron of the size 1.5 inches.

2. Hydraulic tool press

   Tool press which is used for charcoal briquette maker. This tool is modified with add gauge or manometer that legible direct pressure style magnitude that got this tool. Use very easy only pumps (lever move) so that piston depresses briquette in mould as according to volume t hat determined so to take outside result from press. Schematic of press machine show Fig. 1

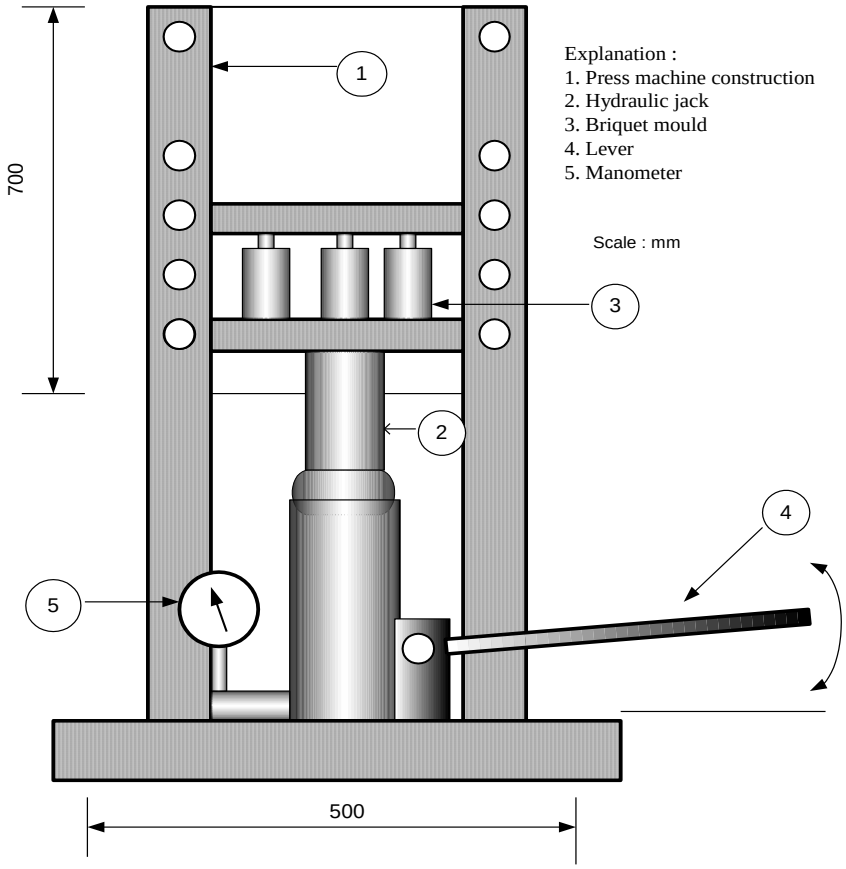
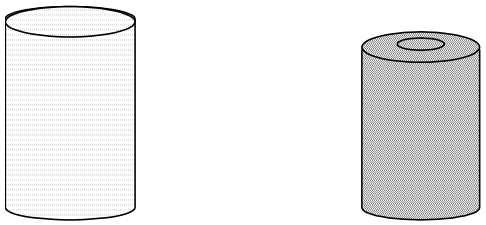


Fig. 1. Schematic of hydraulic briquette press machine

3. Rice husk briquette product can see at Fig. 2



a. b.

Fig. 2. Rice husk briquette

a. before press

b. after press

4. Research chart as follows

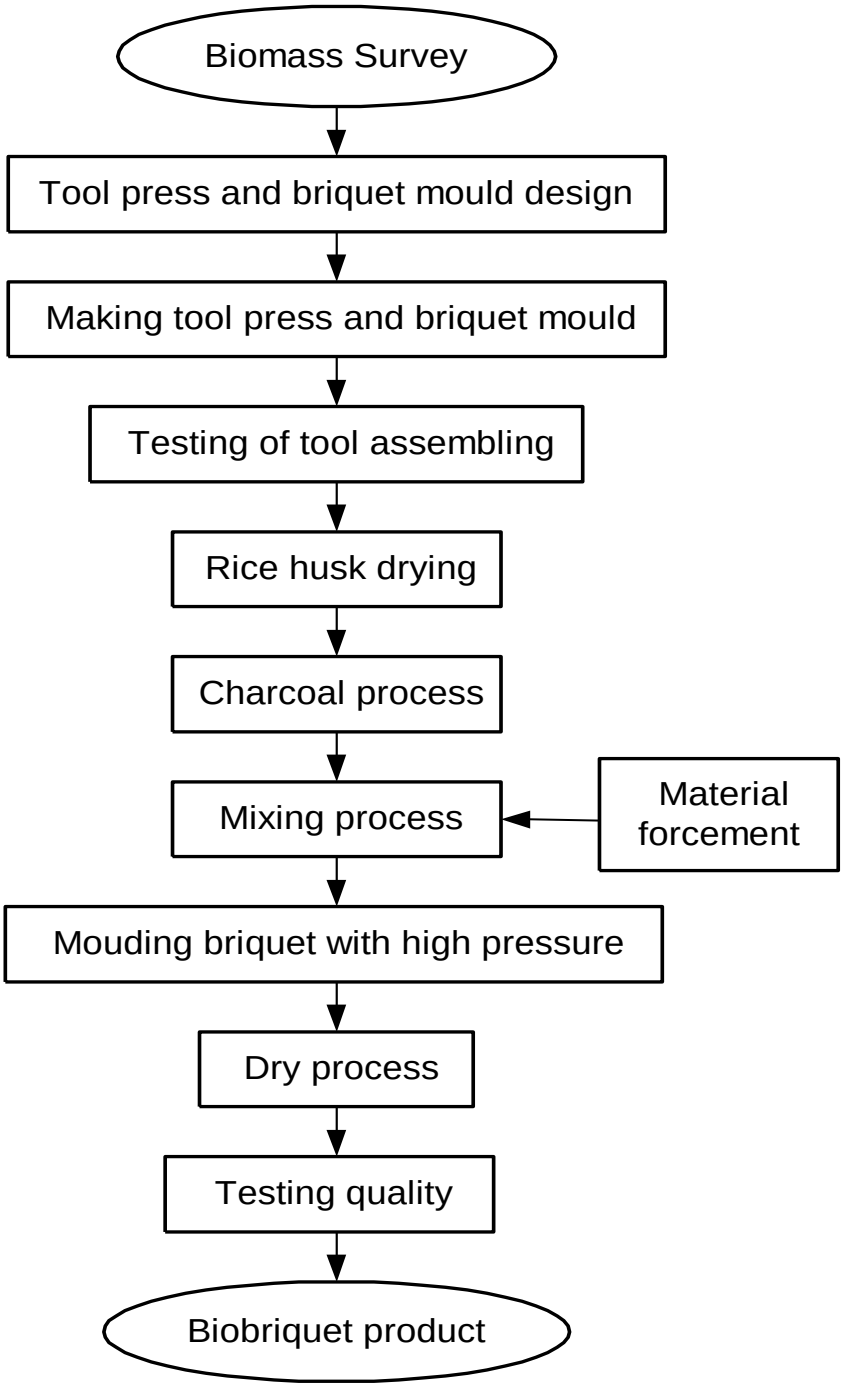


Fig. 3. Research flow chart

5. Execute time-table

1. Testing variables

a. **Table 3**. Density stages testing of rice husk briquette

No	**Force** **F (N)**	**High** **T (cm)**	**Volume** **V(cm³)**	**Density** ρ **(gr/cm³)**
1				
2				
3				
4				
5				

b. **Table 4**. Calorie value of rice husk briquette

No	**Density** ρ **gr/cm³**	**Sample weight** **m (gr)**	**Temperature** **T (°C)**	**Calorie value** **(q) kcal/kg**
1				
2				

3 4 5				

2. **Table 5**. Research Schedule

Activities	Time Month								Place
	4	5	6	7	8	9	10	12	
1. Preparation • Site visiting • Device preparation and field (materials) research									Koya Uncen (lab.)
2. Activities execution • Waste dehydration • Making tool press • Making briquette and result testing value (calorie)									Uncen (lab.)
3. Activity report arrangement									B LKI Jayapura Uncen (lab.)
4. Evaluation									Uncen (lab.) Uncen (lab.)

CHAPTER V. COST OF RESEARCH

Estimate of Research Cost

No	Name of test	Total		Unit cost	Cost
1	Mass density test for 3 samples, replicated 3 time	9	pieces	Rp 300,000	Rp 2,700,000
2	Calorie content test for 3 samples, replicated 3 time	9	pieces	Rp 300,000	Rp 2,700,000
3	Hardness test for 3 samples replicated 3 time	9	pieces	Rp 300,000	Rp 2,700,000
4	Samples pack and travel cost to test of samples at Hasanudin University (two way tickets plane)	2	tickets	Rp 2,600,000	Rp 5,200,000
	Total Cost				**Rp 13,300,000**

a. Cost of sample test

b. Material (ingredient) finished

No	Material Name		Unit	Unit cost		Cost	
1	Rice-husk	100	kg	Rp	6,000	Rp	600,000
2	Tinner	10	litere	Rp	50,000	Rp	500,000
3	Cerosene	10	litere	Rp	6,000	Rp	60,000
4	Iron paint	1	litere	Rp	125,000	Rp	125,000
5	Oil	2	litere	Rp	75,000	Rp	150,000
6	Coarse abrasive paper	50	pieces	Rp	4,000	Rp	200,000
7	Soft abrasive paper	50	pieces	Rp	4,000	Rp	200,000
8	Welding electrode	3	box	Rp	150,000	Rp	450,000
9	Iron pipe dia. 2”	3	stick	Rp	350,000	Rp	1,050,000
10	Iron pipe dia. 1/2”	2	stick	Rp	300,000	Rp	600,000
11	Ring and bolt	36	pieces	Rp	15,000	Rp	540,000
12	Small ring and bolt	20	pieces	Rp	75,000	Rp	1,500,000
13	U - Iron profile	3	stick	Rp	1,600,000	Rp	4,800,000
14	L - Iron profile	3	stick	Rp	700,000	Rp	2,100,000
15	Iron plate	1	sheet	Rp	400,000	Rp	400,000
16	Cast iron	4	stick	Rp	125,000	Rp	500,000
17	Tapioca flour	65	kg	Rp	20,000	Rp	1,300,000
18	Sinchromate	1	litere	Rp	150,000	Rp	150,000
19	Resin of certain trees	3	gr	Rp	500,000	Rp	1,500,000
20	Rinso/detergent	2	kg	Rp	49,000	Rp	98,000
	Total Cost					**Rp**	**16,823,000**

c. Tools

No	Tool Name		Unit	Unit cost	Cost
1	Hacksaw	2	pieces	Rp 150,000	Rp 300,000
2	Saw eye	10	pieces	Rp 50,000	Rp 500,000
3	Drill eye	5	pieces	Rp 75,000	Rp 375,000
4	Hand grinstone	1	pieces	Rp 2,000,000	Rp 2,000,000
5	Mildstone	6	pieces	Rp 250,000	Rp 1,500,000
6	Charcoal drum	2	pieces	Rp 1,000,000	Rp 2,000,000
7	Hydraulic jack 5 tons	1	pieces	Rp 950,000	Rp 950,000
8	Hydraulic jack 4 tons	1	pieces	Rp 900,000	Rp 900,000
9	Hydraulic jack 3 tons	1	pieces	Rp 800,000	Rp 800,000
10	Hydraulic jack 2 tons	1	pieces	Rp 750,000	Rp 750,000
11	Big catter	2	pieces	Rp 45,000	Rp 90,000
12	Coarse stingty	1	pieces	Rp 75,000	Rp 75,000
13	Soft stingty	1	pieces	Rp 75,000	Rp 75,000
14	Small brush	6	pieces	Rp 7,000	Rp 42,000
15	Steel elbow ruler	2	pieces	Rp 125,000	Rp 250,000
16	Pair of scales	2	pieces	Rp 450,000	Rp 900,000
17	Meter scales	2	pieces	Rp 75,000	Rp 150,000
18	Hammer	2	pieces	Rp 110,000	Rp 220,000
19	Meter calorie	1	unit	Rp 3,000,000	Rp 3,000,000
20	Manometer	2	pieces	Rp 500,000	Rp 1,000,000
	Total Cost				**Rp 15,877,000**

d. Travel expenses and others

No	Activities	Cost
1	Loading and sample transportation from location	Rp 2,500,000
2	Transportation	Rp 3,500,000
3	Consumption	Rp 2,500,000
4	Activities report	Rp 3,000,000
5	Documentation	Rp 2,500,000
Total Cost		**Rp 14,000,000**

Total Cost Recapitulation

No	Expanation	Cost	
a	Cost of samples test	Rp	13,300,000
b	Material (ingredient) finished	Rp	16,823,000
c	Tools	Rp	15,877,000
d	Travel expenses and others	Rp	14,000,000
Total all of Cost		**Rp**	**60,000,000**
Said : # ***Sixty million rupiah*** #			

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Education

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Reaserch experience

No	Title of Research	Cost (fund) Source	Function/Year
1	Depth of Cuts Influence, Movement and Cuts Speed towards Surface Roughnes	DIPA Uncen	Chairman//2003
2	Treatment and Lubricating System Repair in Principal Components of Petrol Motor	Self-support	Member / 2003
3	Literature Based of Tension Calculation to Single Hook 5 tons of Load	Self-support	Chairman//2004
4	The Influence of Receiver Drier Type to AC System in Vehicle	DIPA Uncen	Member / 2004

Publication

No	Scientific Work	Seminar Place	Year
1	The Influence of Voltage, Temperature and Plating Time of Hard Chrome to Wear and Plating Hardness on AISI Steel 1045 with and Without Hardening (ISBN: 978-879-95620-5-0.MB/BT-12.SN. Development.	KPTU Building UGM Yogyakarta	9 June 2009

	Research and Technology in Industry – 15. UGM)		
2	The Influence of Temperature, Time and Voltage of Hard Chrome to Plating Hardness, Specific-wear and Plating Thickness on AISI Steel 1045 (ISBN: 978 -979 -704 -772 - 6. M3-005. SNTTM-VIII. UNDIP)	Graha Santika Premiere Hotel Semarang	11 August 2009

Jayapura, May 7th 2010

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Reaserch experience

No	Title of Research	Cost (fund) Source	Function/Year
1	Depth of Cuts Influence, Movement and Cuts Speed towards Surface Roughnes	DIPA Uncen	Member / 2003
2	Treatment and Lubricating System Repair in Principal Components of Petrol Motor	Self-support	Member / 2003
3	Overcome Way to Disturbance Ignition System Toyota 4 K	Self-support	Chairman/2004
4	Tensile Test Treatment towards Cast Iron Strength in Fusion FCD 40 with Alloy Element	DIPAUncen	Chairman/2004
5	The Influence Analysis of Spark-plug towards Fire-works Jump in Petrol Motor Toyota 4 K	Self-support	Chairman/2004
6	Development of Technology Tool Press Sago Waste Briquet With Hydraulic Jack System for Home Industry Scales	DIKTI	2009

Publication

No	Scientific Work	Year
1	Stress Analysis, Dimension and Materials of Single Hook to Lifter Tool 5 tons of Load, Volume : 08.15,37-49 (ISSN : 1410-7015)	December 2004
2	The Optimasi Diameter Variation of Co-axial Annulus Pipe in Pumping. Engine Synergy Journal & Energy, 4(2),170-181 (ISSN : 1693-1548)	October 2004

Jayapura, May 5th 2010

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