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Model for Development of a Business Strategy for Renewable Energy Technology Services

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ABSTRACT

The purpose of this study is to formulate a model of the current business position of technology services in the field of renewable energy. The method used in this study is a research method with a qualitative approach, through descriptive analysis. To find information on internal resources for technology business services in the field of renewable energy and obtain organizational response to external environmental conditions, focus group discussions were held with key people in the field of renewable energy at The Agency for the Assessment and Application of Technology (BPPT). Based on the results of the analysis, it was found that the development of the business strategy already being carried out was by (1) responding to the economic conditions of Indonesia. (2) Development of technology, (3) Incorporation of natural resources, (4) community/user involvement, (5) available products and services and (6) avaiability of financial resources owned or initiated by the BPPT in the renewable energy field. Our research found that other factors that need to be considered and even to be prioritized include (1) policy, (2) socio-cultural conditions, (3) suppliers, (4) company business partners, (5) product development and marketing program preparation, (6) production and operation capabilities.

Keywords: Internal Resources, External Environment, Market Needs, Renewable Energy
JEL Classifications: M21, Q42, Q48, Q55, Q56

1. INTRODUCTION

In general, the application of technology in Indonesia is currently running better than in previous years. However, this level of application is still below expectations. BPPT, provided the researchers with a record of the application of technology that has been carried out in Indonesia since 2009, as a basis for evaluation, especially for technologies developed by the nation itself. All of this is intended to enable further improvement of the application of technology in Indonesia in the future (International Renewable Energy Agency [IRENA], 2017).

The Agency for the Assessment and Application of Technology (BPPT) has established nine technological fields in Indonesia as priority technology fields. These nine technological fields include: (1) Technology in the energy sector, (2) technology in the field of renewable energy, (3) technology in the field of transportation, (4) Food technology, (5) technology in the fields of environment and geology, (6) defence technology and security, (7) manufacturing technology, (8) health technology, (9) material technology field (Hasan et al., 2012).

The notes given by BPPT in the field of renewable energy in particular are still based on the supply of petroleum-based fuels (50%) nationwide. This condition has caused Indonesia to be vulnerable to the turmoils that have occurred involving petroleum, such as turmoil due to scarcity and turmoil caused by price fluctuations. Meanwhile, increasing fuel demands for petroleum have been obtained from imports, as a result of the inability of domestic petroleum production to meet consumption needs (Verbruggen, 2008).

To answer these problems, BPPT currently has and continues to develop technology that can provide solutions to problems effectively and efficiently utilizing existing local wealth. Among others is the development of a small-scale power generation systems with renewable energy resources that are local in nature, such as a geothermal power plants with a scale of 2-5 MW, PLTS, PLTB, PV-Wind-Diesel PLTM and hybrid PLT. In addition, BPPT has also developed a new renewable energy PLT providing hydrogen fuel to both stationary and transportation systems such as the fuel cell PLT system and nuclear PLT (Connolly et al., 2016).

They are also planning to develop more environmentally friendly coal power generation technologies, such as the development of coal gasification technology, developing the use of circulating fluidized bed boilers, and has plans for the construction of a PV thin solar film and R&D facilities at PT LEN industry and PLTS system testing facilities in PUSPIPTEK Serpong, are recommendations given by BPPT for addressing the challenges to Indonesia's renewable energy problems of the future (Strbac, 2008).

Whether people realize it or not, technology plays an important role in the sustainability of human life. Technology also plays an important role both directly and indirectly in creating a nation's prosperity. Based on our instinct and reason we humans are always trying to create or develop something to assist and simplify the completion of work that is being done. In reality, it takes time to implement, carry out trials, and be creative in developing of tehnologies, as is being done in the technological services of BPPT's renewable energy fields, as described above (REN21-Renewable Energy Policy Network for 21st century, 2016).

In the 21st century, the level of technological advances has become very fast in line with the increasing need for guaranteeing human survival. Behind the benefits of using renewable energy technology services in improving the quality of life, there are also problems that will arise if we cannot use the benefits wisely. As stated above, technology plays an important role in various fields. In the field of industry, many small, medium and even large industries are using more and more technology in order to increase production capacity or production quality.

In order to increase production capacity or production quality, various obstacles have been found, including the high cost of research and development (Department of Energy, 2015). Very few industries in Indonesia have their own research and development institutions, they generally submit research and development activities to other parties in order to reduce costs incurred by the company (International Energy Agency, 2013).

In accordance with its main tasks and functions, The Agency for the Assessment and Application of Technology (BPPT), has been appointed as the government agency to carry out the assessment and application of technology in accordance with the applicable legal provisions. The Agency for the Assessment and Application of Technology (BPPT) also conducts research and development before the technology is implemented. The results of research and technology development will, in time, be applied in the community, including in industry, especially technology services in the field of renewable energy (Graubner, 2006).

Based on the above explanation of the importance of increasing technological services in the field of renewable energy, the development of a business strategy for technology services in the field of renewable energy also becomes a very important aspect to study.

2. LITERATURE REVIEW

The study uses a focus on the group discussion approach from internal renewable energy fields at BPPT and obtains information about the organization's response to changes/ external environmental conditions. The study was carried out by experts from several higher education institutions who have experience in research into private companies and state-owned enterprises, and as resource persons in developing technology-based business strategies at BPPT. The theoretical approach used is the theory of strategic business management whose implementation has been tested for several private companies and state-owned enterprises, specifically in answering three key questions (1) what is the position of the advantages of BPPT's research with regard to current renewable energy technology services? (2) Where do you want to bring technology services in the renewable energy sector in the future? (3) How to achieve the objectives that have been formulated? (Agency for Assessment, 2016).

In reviewing the potential superiority of technology services in the renewable energy sector BPPT has used a strategic business management approach for various stages including (1) analysis of the external and internal environment to determine the potential position of excellence in BPPT's renewable energy technology services, (2) formulating business vision, business mission, and the aim at BPPT's renewable energy technology services, (3) to formulate the development of BPPT's renewable energy technology business services strategy (International Renewable Energy Agency, 2017).

2.1. Position of Renewable Energy

The level of external opportunities and internal resources is not based solely on total potential, but the most essential are the partial potentials for each product/service technology in the field of renewable energy. In turn, the partial potential will be a benchmark for BPPT's renewable energy sector technology service which also enables it to become a superior technology product/service in the renewable energy sector technology service itself. Based on the potential position of the superiority over the renewable energy technology service, the strategic intent will be realized in the business vision, business mission, and the development of a business strategy for renewable energy technology services (Strbac, 2008).

2.2. Renewable Energy Vision and Mission

This involves the formulation of a business vision, business mission, business goals and objectives and requires the establishment of a business vision, business mission, and business goals that are in line with the level of balance between opportunities that originate from the external environment and the potential for internal resources (Amer and Daim, 2010).

2.3. Alternative Strategies for Managing Renewable Energy

In developing the renewable energy service technology business strategy in the field of renewable energy there are five business strategy formulations that must be designed (BPPT, 2016):

a. A portfolio business strategy: Reviewing technology products/services in the renewable energy sector with markets appeals, and relevance to the business mission of BPPT's renewable energy sector technology services
b. A product/market/opportunity business strategy: Identifying opportunities for each existing product/service technology in the field of renewable energy within the scope of markets demands
c. A competitive business strategy: Including ways to service BPPT's renewable energy technology in enhancing excellence in order to achieve competitive positions
d. Business strategy market targets: Namely how to select target markets that will be served by technology services in BPPT's renewable energy fields
e. A business positioning strategy: A way to position technology services in the field of renewable energy in competition to gain competitive advantage in serving the target market.

3. METHODOLOGY

The method used in this study is a research method with a qualitative approach, through descriptive analysis aimed at finding information about internal resources for technology business services in the field of renewable energy and organizational response to external environmental conditions.

Data types such as strengths/weaknesses for internal resources and opportunities/threats of the external environment, were obtained from primary data. Primary data for this was taken from key actors in the field of renewable energy at BPPT.

Support data for empirical problems, such as a list of products and technology services in the field of renewable energy in BPPT, a list of products and services needed by the market, and an organizational profile, as well as their annual report were provided by BPPT.

In collecting data, we need techniques for collecting data directly with focus group discussion (FGD). Observations were made to obtain initial information on the problems and to obtain fields findings that were not included in the FGD to enrich the discussion.

4. RESULTS AND DISCUSSION

4.1. Development of Maximum Small-scale Hydropower with Domestic Component Level the Domestic Component Level (TKDN)

The Agency for the Assessment and Application of Technology (BPPT) and pertamina geothermal energy (PGE) are collaborating on the development of small-scale geothermal power plants (PLTP). Both parties work together throughout the stages of engineering design of the generating systems and all their components. The processing procedure of engineering, procurement, construction through to manufacturing component plants is carried out in the domestic industry itself.

TKDN of the energy industry, especially geothermal energy, is still very low. Therefore, through cooperation with PGE as the owner of WK geothermal, the application of technology carried out by BPPT can be easily implemented.

Until now, the low level of local component content (TKDN) in the country for upstream to downstream activities of PLTP is only 2-3%. Therefore, PGE fully supports all research and development activities aimed at encouraging increased local content in all power plant projects.

The application of technology carried out by BPPT in small scale power plants is expected to be able to develop the manufacturing industry in the electricity sector in the country. Namely manufacturing turbines, generators, pressure vessels (separators, silencers, etc.), heat exchangers (evaporators, preheaters, condensers, cooling towers).

BPPT has designed and tested a prototype of a binary cycle PLTP with a capacity of 2 kw, using hydrocarbon fluid as its working fluid. The entire system and its main components such as turbines, evaporators, condensers and control systems were designed and made by the BPPT geothermal team.

The activity plan for 2010-2014 concerning the development of small-scale geothermal power plants in BPPT includes 2 main activities, namely, the development of a binary cycle PLTP with a capacity of 1 MW (2014 target) through stages of prototype 2 kw (2008) and 100 kw pilot project (2012), and development of a PLT turbine condensing technology with a capacity of 2-5 MW (Behrangrad, 2015; Demirbas, 2009).

4.2. Design and Operational Test for the Prototype of 2 kw Ocean Current Power Plants (PLTAL) in the Flores Strait, East Nusa Tenggara

The diminishing availability of energy sourced from fossil fuels means that steps need to be taken to find alternative energy sources that are environmentally friendly and renewable. As a maritime country, Indonesia has an energy source that could come from its very abundant ocean current systems. Starting from this, the technical implementation unit of the Hydrodynamic Research and Research Institute (UPT-BPPH) of BPPT has developed a marine current power plant (PLTAL).

Starting from the results of the research of the head of the UPT-BPPH, Erwandi regarding the wave resistance of ships. From his research a numerical calculation was made to calculate the circulation of ocean currents. "From the calculation of ocean currents, it is now known how to take advantage of these ocean currents so that they can be converted into electrical energy."

Since 2006, the engineering team from UPT BPPH BPPT has been mapping energy of ocean currents in Indonesia using numerical simulation techniques. "From the mapping results, it is shown that the electric power potential for ocean currents in central to eastern Indonesia is quite large." One of them is the potential for electric power from ocean currents in the Larantuka Strait, East Nusa Tenggara which reaches 6000 MW. This is a very good potential if it can be utilized.

In 2007 the PLTAL design process began. In the process of studying the types of PLTAL turbines that are suitable for Indonesian water, darrieus types vertical shaft ocean turbines with three turbine blades were selected. This type of turbine is simple, easy to manufacture, easy to maintain, and inexpensive. The straight and longitudinal turbine blade test model, similar to an aircraft wing, and made of aluminium, can be made easily at a motorcycle casting factory in Surabaya.

The PLTAL prototype was made in 2008. Almost all components in the manufacture of the prototype were domestic components, only generators and inverters were purchased from abroad. The PLTAL developed by UPT BPPH is designed for low ocean currents but produces high electric current.

The first PLTAL trial carried out in the Larantuka Strait at the end of March and June 2010 produced an electrical power output of 1900 watts. Following this a further PLTAL trial was conducted with a larger capacity of 10 kw in this strait and the electricity produced was planned to be channelled to illuminate the pier and to provide power for some residents of the Tanah Merah Adonara hamlet which had not yet received electricity before.

It is hoped that this PLTAL will later become one of the renewable energy source solutions to the national energy problems. This is especially so because the PLTAL is environmentally friendly, it has a large kinetic energy intensity compared to other renewable energy, and doesn't require the design of structures of excessive strength (Behrangrad, 2015; Budde et al., 2012; Nguyen et al., 2015).

4.3. Development of Biodiesel as an Alternative Fuel

Consumption of fossil fuels, commonly called petroleum based fuel (BBM) has increased from year to year. Overall, fuel consumption in 2004 reached 61.7 million kl, consisting of 16.2 million kl of premium, 11.7 million kl of kerosene, 26.9 million kl of diesel oil, 1.2 million kl diesel oil, and 5.7 million kl of fuel oil. Extreme estimates suggest that at the current rate of oil consumption Indonesia will run out in 10-15 years. This fact not only opens up opportunities for the use of renewable energy but also underlines the need to reduce the use of fossil fuels now. These renewable energy resources are energy sources whose output will be constant over millions of years.

One type of renewable energy is biomass energy. The materials included in the category to biomass are plant products, both terrestrial and aquatic and materials produced from the processing of these plants by humans or animals. One form of conversion of biomass that can substitute petroleum fuels is biodiesel produced through the trans-esterification process. Biodiesel has a comparative advantage compared to other forms of energy which include being easier to transport, having higher energy density per volume, relatively clean combustion characteristics, low production costs and being environmentally friendly.

Based on the results of research by Ruhyat and Firdaus (2009), it was found that the characteristics of the first selection criteria were the characteristics of the biodiesel raw material itself. Indonesia is very rich in natural resources which can be used as raw material for biodiesel. Many types of biodiesel are based on the source of their raw materials. Crude palm oil (CPO) biodiesel is a type that has been developed commercially. In addition to CPO, there are still more than 40 types of potential vegetable oils as biodiesel resources in Indonesia, such as jatropha oil, coconut oil, kepyar oil and used cooking oil. Although other vegetable oils do not produce oil as much as palm oil, the development of biodiesel can adjust to the local natural potential. In general, the parameters that define biodiesel quality standards are density, flash point, setana number, kinematic viscosity, sulphate ash, energy produced, iodine number, and carbon residue.

4.3.1. Environmental impact

The process of making fuel to plants requires a large amount of energy so that it does not actually contribute to reducing CO_2 emissions of the atmosphere. For example in the case of oil palm, the oxidation process of one hectare of peat land for oil palm cultivation per year is estimated to produce 100 tons of CO_2 emissions.

4.3.2. Commercialization

Commercialization is a very complex thing, and includes many interrelated factors. The study by the digital external research program states that there are three things that determine the efficiency and effectiveness of the technology transfer process, namely the quality of planning, programs, and communication between the giver unit and the technology receiver. The approach used refers to research from the U.S. Department of Energy regarding energy market behavior. This approach is used to predict the market potential for newly marketed technologies and commodities. One important outcome of commercialization is the level of market penetration.

4.3.3. Energy usage

Recent research reports by scientists from cornell university and the university of California at Berkeley, USA, published by natural science research show that the process of producing biofuels requires more energy than the process of producing fuel from fossil fuels. The criteria for energy use is a comparison between the energy used for the process of converting fuel and the energy produced.

4.3.4. Availability level

The growth in demand for biofuels in the world is very large and is credited with causing the unexpected soaring prices of CPO in the world. The impact on biodiesel made from CPO in Indonesia has been that the biodiesel industry has had difficulty getting raw materials because producers prefer the higher benefit of CPO exports. This is also caused by the price of biofuels that are not competitive compared to the prices of fossil fuels.

4.3.5. Competitiveness

To determine the selling price, according to presidential regulation No. 5 of 2006 concerning national energy policy, it has been stated that energy prices are adjusted in stages until a certain time limit towards their economic prices. Economic prices are production costs per unit of energy including environmental costs plus margin costs. Public purchasing power that is below the economic price will be the basis of the government's policy of providing subsidies. Therefore, biodiesel raw material that is too expensive can reduce its competitiveness compared to other raw materials.

4.3.6. Ease of processing

The commonly used vegetable oils conversion technology is trans esterification from vegetable oil to methanol using a base catalyst such as NaOH or KOH. In a trans esterification or alcoholics reaction one mole of triglycerides reacts with three moles of alcohol to form one mole of glycerol and three moles of the next fatty acid alkyl ester. The main obstacles and burdens with developing biodiesel fuel oil are due to difficulties in the process of converting vegetable oil into biodiesel.

In the development stages of alternative fuels, research institutions, governments and industrial sectors are involved in conducting, developing, integrating, regulating and using technological resources to encourage economic growth by making changes to achieve added value. For this reason, it is necessary to select the right raw materials so that biodiesel can immediately compete with diesel fuel which depends on the supply of world oil imports.

Because supply is still low, used cooking oil cannot be the only raw material for biodiesel. Under normal conditions, food fat (palm and coconut) will not be able to compete, because the price of raw fat is more determined by demand of the food sector. But the biodiesel industry can support the resilience of the competitiveness of the national food oil industry by accommodating a surplus of food fat when supply rises above demand. The science and technology industry based biodiesel is minimally able to mix various oils and fats to produce the right biodiesel and to meet the requirements for quality/quality standards. For this reason it will also be able to accommodate oil-fat that is milked/extracted from the seeds of food-beverage industrial waste as well as ornamental or shade tree seeds. The production of oil-fat can be a business area for small and medium enterprises (Ahmad et al., 2011; Huang et al., 2010; Tiffany et al., 2006).

1. Palm oil can be a support so that the biodiesel supply does not stagnate as it does now
2. The opening of an alternative biodiesel fuel market makes the development of biodiesel engineering processes and plants commercially attractive. The national biodiesel roadmap shows: 720,000 KL of biodiesel in 2009 required 8-25 units of capacity of 30,000-100,000 tons/year. The main challenge is how to design and produce commercial scale factories in locations around DKI Jakarta at competitive prices so that the cost of biodiesel production can be reduced as low as possible
3. There are three things that determine the efficiency and effectiveness of the biodiesel development process, namely the quality of planning, programs, and communication between producers and consumers. Suggestions that can be given to the regional government of DKI Jakarta are as follows:
   - The science and technology-based biodiesel industry must at least be able to mix various oils and fats (raw materials) made from WVO, castor oil and palm oil to produce biodiesel that meets the requirements of quality/quality standards as biofuel. Therefore, the biodiesel industry can be a supporter of the resilience of the oil-food industry by accommodating a surplus of food-grease when supply soars on demand
   - Issue productions and distribution regulations (biodiesel trading system) so that biodiesel suppliers, producers and distributors can obtain legal certainty
   - Although the supply of biodiesel is still lacking, the distribution of fertile land is only used to cultivate food crops (produce food), while dry land is critical to cultivating energy crops. Additional supply of biodiesel raw materials can be obtained from used cooking oil.

4.4. Utilization of Dimethyl Ether (DME) as Liquid Petroleum Gas (LPG) Substitute Material for Use in Household Stoves

The Technology Assessment and Application Agency (BPPT) is currently developing alternative gas fuels at the level of LPG, named DME. The fuel is likely to be cheaper than similar gas fuels on the market. To support this effort, BPPT collaborated with the Japanese gas company NKK and was expected to begin marketing in 2010. "DME has actually been widely used in many developed countries for the cosmetics industry, agricultural chemicals and aerosol propellants." As an aerosol material, DME exists in Indonesia where it is used in the form of methanol or as a dehydration agent. Both of these materials are found in an area in East Java and Lampung.

DME technology has been developed, because there are still many small-scale natural gas reserves that have not yet been utilized. So far, the development of small-scale natural gas using LPG mini refinery technology is new. "In the future, small-scale natural gas can be utilized by converting to DME. BPPT has conducted DME testing as a transportation fuel for vehicles using diesel engines with little modification to the fuel injection system." Many advantages for using DME can be seen from the results of these trials, among others, the combustion fumes are very clean, the engine ignition is quite good, and NOX emissions are reduced by 20-30% compared to diesel fuel. Besides also having a faster combustion time resulting in better heat efficiency and the engine power produced not being much different than using materials as for household fuels, DME is very similar to propane and butane (the main components of LPG), therefore DME can be used on LPG gas stoves or city gas mains without modification. "For this reason, it was targeted that from 2010 DME could already be marketed as an alternative fuel to replace diesel fuel, LPG and coal."

DME prices in the world market today look a little cheaper than LPG. "In Japan, the DME price is 2.3 yen per cubic meter, while the price of LPG is 3.35 yen per cubic meter." The program is expected to be cheaper in Indonesia. Indonesia's gas reserves are estimated at 212, 4 trillion standard cubic feet (TSCF), of which proven reserves of around 114 TSCF and 98.2 TSCF exist in the form of untold reserves. Of all the natural gas reserves, around 67% are located offshore, while the rest are spread over onshore locations ranging from Aceh, to Sulawesi and to Irian Jaya and are in large quantities. There are also many natural gas reserves which, although relatively small in number, are generally located around oil fields in the form of associated gas from oil fields. Most of these are only burnt off and only become economical if produced for export in the form of LPG "This is because gas liquefaction technology or conventional liquefied natural gas processing technology is still quite expensive to process." However, on the other hand these small-scale natural gases fields are numerous and widespread, so it is time to adopt the application of small-scale natural gases utilization technology as has been done by other countries, for domestic purposes (Kumar et al., 2009; Olah, 2013; Sezer, 2011).

5. CONCLUSION

The development of the business strategy undertaken to date is by (1) responding to the economic conditions in Indonesia, so that research and development is carried out to produce a product/service that is in accordance with the current economic conditions in Indonesia. (2) The development of technology, renewable energy products are very dependent on the technology to be used, because it will need to increase efficiency in production so that ultimately it can make selling prices attractive in order to encourage investors to invest. (3) Natural resources must be maintained for their startegic importance. (4) The community/user level needs to be increased because from the efficiency of the use of the aforementioned technology the selling price applied can be adjusted to the people's purchasing power. (5) Products and services that have been owned or initiated by the BPPT renewable energy sector, can be utilized, especially for the welfare of the Indonesian people, and therefore the role of the government becomes very important for the utilization of the research results. (6) Financial resources need to be made available for funding research and development activities, so that renewable energy can be produced and can be utilized by industry and the community at a relatively low cost, so investors will be interested in investing in that field.

While priority 2 must be the first factor to be considered it should be that there is (1) Government policy to support the use of alternative energy becomes very important by being strengthened by rules that are in favour of people's welfare. (2) Consideration of Socio-economic and cultural conditions - Indonesia which has a large population and not allelectricity consumption demands have not been able to be served by all by PT. PLN (state electricity services), especially those in remote areas, so that it requires an alternative energy that has the same capability, and relatively the same costs to be used for the underserved communities. (3) Cooperation with suppliers, including partnerships with suppliers, need to be carried out. (4) Business partners companies, cooperation with business partner companies also need to be carried out, supported by government policies. (5) Product development and marketing program preparation, after testing, cooperating with business partners, then preparing market programs. (6) Capability of production and operation, and partnership with private companies/SOEs facilitated by the government.

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