

The history about tidal energy environmental sciences essay



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Abstract: Nowadays, the green technologies energy sources are in high demand because it have no side effect towards the environment. This renewable technology consists of solar, wind, wave, tides and etc. In Malaysia, fossil fuel or coal was heavily used to fulfill the electricity demand thus causes in increasing of emissions greenhouse gases. Due to the increasing of oil prices, Malaysia has taken an initiative to explore other alternative energy that can replace current technologies. The ocean is one example of renewable energy sources that has already been tried but in a small scale. There are two types of ocean energy sources which is; wave energy and tidal energy. This report will focus and tell in detail on tidal energy as alternative energy sources in Malaysia. The current development of various devices to extract the tidal energy will be reviewed. Although technologies are currently being developed in the areas of tidal power, wave power, thermal energy gradient, current energy, winds and salinity gradient, not all of these are suitable for Malaysian sea areas. This paper surveys the available Malaysian oceanographic data and identifies the potential sources of energy.

1. 0 Introduction

1. 1 Overview of Tidal Energy

Tidal energy is produced by the surge of ocean waters during the flow and ebb of tides. The turbines are placed in areas with high potential of tidal movements, and the turbines are designed to capture and convert the

kinetic motion of the ebb to electricity. Tidal energy is a renewable source of energy. During the 20th century, engineers has developed several of ways to use the tidal energy sources to generate electricity at the high potential tidal movement. Special generators for instance like turbines to convert tidal energy into electricity. The amount of power produced from the tidal plant has so far is small. Nowadays, there are two commercial-sized tidal power plants operating in the world. One is located in La Rance, France while the other is at Annapolis Royal, Nova Scotia, Canada. There are potential country that can use the tidal energy which is France, England, Canada, and Russia. Tides energy is very predictable than wind and more energy produced from the tidal energy because water is more dense than air. Even though, there are several impact in the environment, the engineer has work hard to improve the technology and decrease the pollution of environment. Besides that, they need to find a new way to improve the energy production to follow the demand of consumer.

HISTORY OF TIDAL ENERGY:

History of tidal energy around the world.

The history of tidal stretches into antiquity. The earliest evidence of the use of the oceans tides for power conversion dates back to about 900 AD but it is likely that there were predecessors lost in the anonymity of prehistory. Early tidal power plant utilized naturally-occurring tidal basins by building a dam across the opening of the basin and allowing the basin to fill on the rising tide, impounding the water as the tide fell, and then releasing the impounded water through a waterwheel, paddlewheel or similar energy-conversion device. The power was typically used for grinding grains into

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flour. Power was available for about two to three hours, usually twice a day. In Hayley, England, tidal power was used to dredge a shipping channel by flushing it regularly with a pulse of stored tidally-impounded water.

1)In Europe

Has a long history of tidal forces to generate power. The concept is they build the dam with a sluice tidal was turned into a reservoir and high tide sea water flowed into the reservoir via a one way gate. The gate closed automatically when the tide begin to fall, the stored water was released to turn a water wheel. Woodbridge Tide Mill establish from 1170 in Suffolk, England is a famous example of tidal energy. Modern tidal energy dates to the 1920s in France but the first attempt was ultimately abandoned due to insufficient funds. Later, in 1966, the France Tidal Power Station on the France River in France became the world's first tidal power station. The first tidal generating station in North America was built in 1984 and is the Annapolis Royal Generating Station in Nova Scotia, Canada.

History of tidal energy in Malaysia

In Malaysia the technology of tidal energy is not exist but several university for instance University Tenaga Nasional(UNITEN) and University Tengku Abdul Rahman(UTAR) have done a small scale plant which is in still in researcher and development.

GLOBAL PERSPECTIVE:

-Tidal energy is a fairly new form of renewable energy that could prove to be more productive than both wind and solar energy.-For one, the high cost of producing and installing this technology needs to be reduced in order for the

resource to be considered economically efficient.-There is also the fact that, for this particular project, the U. K. is the only region that will benefit from it. Overall, the only areas that could benefit from a tidal turbine are regions that are within close proximity to a coastline.-With some basic knowledge of tidal turbines, I now understand how it relates to wind and solar energy and why it may prove to be a more predictable resource.

PRINCIPAL OPERATION OF TIDAL ENERGY:

Tidal energy is the form of hydropower that convert the energy of tides into the form of electricity. The technology required to convert tidal range energy into electricity is very similar to the technology used in traditional hydroelectric power plants. The first requirement is a dam or "barrage" across a tidal bay. At certain points along the dam, gates and turbines are installed. When there is an adequate difference in the elevation of the water on the different sides of the barrage, the gates are opened. The "hydrostatic head" that is created, causes water to flow through the turbines, turning an electric generator to produce electricity. Below is the figure that tell in brief how the tidal energy worked. a tidal barrage

IMPORTANT OF ELECTRICAL MACHINE IN THE SYSTEM:

There are many types of electrical machine in this system. It was DC and AC. There are the important of electric machine in this system: High efficiency over wide torque and speed ranges so as to increase the utilization of extractable energy. High reliability so that it can reduce the operational failure or damage. Maintain the good voltage regulation so it can balance the system voltage. Most electric motor work by electromagnetism, but motor

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based on other electromechanical phenomena is also exist. The fundamental principle upon which electromagnetic motors are based that there is a mechanical force on any current carrying wire contained within a magnetic field. The force is described by the Lorentz force law and is perpendicular to both wire and magnetic field. Most magnetic motor are rotary, but the linear motor are also exist.

DIFFERENCE TYPES OF DESIGN:

Tidal energy has been used in some capacity for many years. Tidal stream energy are differs from tidal barrage technology because the electrical generators are installed directly to the tidal stream. This design means that there is no requirement for a wall to obstruct the flow and for this reason they have already said, a much smaller impact on the environment. There are many types of designs in tidal stream energy devices. Horizontal-axis turbine: Similar to wind turbine but with difference aerodynamic shape of a blades. seagen-generator. jpgVertical axis turbine: Blades are design to be in a vertically position. The advantage of this device is the motion is not dependent on the direction of the tidal stream flow. tidal3. pngHydrofoil concept device: Used the principal of hydrofoil which similar in shape to plane wing.

Challenges in Implementation of Tidal Energy

Like many other renewable and non- renewable energy sources, tidal power has its own challenges at the local, national, and global levels. However, tidal power generation requires more sacrifices of local communities, especially when the project scale is big. In spite of the project benefits that could

reducing carbon dioxide emission and green technology it also have more <https://assignbuster.com/the-history-about-tidal-energy-environmental-sciences-essay/>

environmental impact that can prevent the implementation of tidal energy.

Below is the list of the challenges and problem:

The risk to marine life and environment

Tidal energy uses the dam technology or barrage that creates many environmental concerns. Tidal dams can prevent the fish migration and cause the silt build up which affects tidal basin ecosystems in negative ways. This dam technology or system have turbines with blades can cause fish kills, because the speed of turbines is slow and have very large opening between the turbines sharp blade. Thus the fish or marine life can move through it and can kill them. Besides that, the form of silt which is a sediment that made from mineral and soil which will be pollute the water. Thus, the source of clean water for human to drink is undrinkable. After the silt is formed at the very large quantity for a long time it will clogged the canal and sewages. But it is still controllable.

The Cost of Implementations

Tidal energy involving tidal dams are more expensive per KW of installed power than similar size systems that use river dams. Tidal energy generator are very expensive to build and maintained (a 1085MW generator facility could cost about 1. 2 billion US dollars to construct and run). Tidal flow is jiffy. It only occur twice a day and will be through the flood stage, slow down, stop and reverse to ebb tide and the process is repeated from flow ebb tides. This intermittency problems similar to the process of wind and wave energy. Even though a tidal dam might be identical with a river dam in every way including cost; the tidal dam will produce approximately less than half of the amount of electricity. The typical average plant load factor for tidal energy <https://assignbuster.com/the-history-about-tidal-energy-environmental-sciences-essay/>

generators is about 28%. The function of the load factor is to define the amount of actual power output expected from a given capacity. Installed generating capacity of 100 MW with a load factor of 28% will produce only 28 MW per hour when averaged over a given time, usually a year. This is the cause tidal energy very expensive and not very competitive with fossil fuels.

Availability

Because of intermittency and variable flow problems occurred of tides, the resources and places is very limited. The DOE Tidal Energy link, states that there are only about 40 really good sites on Earth with high enough flows to be considered economically practical. Tidal energy requires fast flowing rivers and tides, which will be providing the kinetic energy for turning the turbines of the dam. Such rivers and water are mostly available in most countries, except the desert countries like Saudi Arabia.

Low Efficiency

Most turbines require a constant and steady flow of water in order to spin the turbines and creates kinetic energy and convert to electricity. However, both tidal and wave energy is multi-directional and not constant. This can lead to low efficiency rates.

Storm

All equipment used on the ocean must be very durable enough so that it can survive storms and to handle corrosion from salt water.

Current Opportunities of R&D and Commercialization

Malaysia is one of the country that is very dependent to fossil fuels to satisfy the demand of people in it. Each year the demand for energy is gradually increasing through years. This can cause greenhouse gas emissions to grow drastically from 43 million tones in 2005 to 110 million tones in 2010 that can cause climate changes. Moreover, the oil and gas that was reserved will be depleted in this incoming year. Therefore, the government have do some R&D for the renewable energy source especially tidal energy. The Universiti Tunku Abdul Rahman have done some preliminary research about the tidal energy. As the tidal energy is highly predictable, therefore it has the potential to be a very reliable energy sources. To harness the tidal energy, there to method that have been researched internationally:(a)Barrage Approach(b) Tidal Stream Approach. An analytical assessment has been carried out to find and estimates the amount of electricity to be generated by MCTs (Marine current turbines). This analytical assessment is to evaluate the economic viability and environmental benefits of installing MCTs in Malaysia. After the assessment 4 locations have been identified with high potential of tidal energy which is; Pulau Jambongan, Kota Belud, and Sibul. All four location is estimated to generate total electricity power which is 14. 5 GWh/year. This proof that the tidal energy has more electricity produced than pv system (photovoltaic system). The government and industries can save about RM 1. 12 billion of natural gas and reduces the total greenhouse emission about 4, 552, 512 tons per year. The power supply generated by MCTs can be predicted using the types of tides available on the 4 locations mention above which is; Pulau Jambongan, Kota Belud and Sibul. Hence, maximum power supply from MCTs on those locations occurs at the extreme

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declination of the moon and lowest current at the zero declination.

<http://www.utar.edu.my/ipsr/img/chart%203.JPG>

The Importance of Tidal Energy.

Due to all the challenges, the tidal energy also have some important on the people or country itself. Below is some of the importance of the tidal energy:

1. It is renewable resource, it needs no fuel to maintain, and free of charge
2. Have no pollution, but if there is pollution for example the water pollution it is still controllable and not very severe. Unlike the fossil fuels, it produces no greenhouse effect gases for example carbon dioxide or other waste.
3. It is very predictable energy source (compared to wind and solar energy), it is independent to weather and climate change and it is only dependent to the lunar (sun and moon).
4. It is more efficient than wind because of the density of water is denser than wind
5. The barrage or dam will protect the coast line against high storm tides
6. More jobs opportunity for the local people. Thus increasing the country's economy and will boost up the deficit.
7. The use of environment friendly resources of energy will control the casual respiratory disease as well as fatal diseases like cancer.

Role of Government and Subsidiaries for Sustainability of the Tidal Energy

The role of the Malaysian's Government and subsidiaries is very important for the sustainability of the tidal energy. Below is the ministry and the company who has the role to help the government for sustainability of the tidal energy: Economic Planning Unit (EPU) The EPU has an important function particularly related to the development of the electricity sector.

With the entry of independent power producers (IPPs) in the electricity

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industry, the EPU has acquired a bigger direct planning and implementation role. It reviews and considers each IPP proposal in consultation with other relevant parties and issues letters of intent of the government. It thus plays a key role in determining how IPPs operate in the electricity market and their subsequent impact on the rest of the economy. The Ministry of Science, Technology and Environment (MoSTE) The role of the MoSTE within the energy industry is to provide research and development (R&D) support through the Intensification of Research in Priority Areas (IRPA) programed. Tenaga National Berhad (TNB), Sabah Electricity Supply Board (SESB) and Sarawak Electricity Supply Cooperation (SESCO) The power market is still mostly monopolized, although restructuring of the sector is in progress. While a number of IPPs have entered the power market, the TNB still holds a monopoly on power transmission and distribution in Peninsular Malaysia, while SESB and SESCO hold monopolies in Sabah and Sarawak, respectively. All these three agencies conduct demand forecast and supply planning. Universities and research institutions Malaysia has followed the success stories of countries such as Taiwan and South Korea and has tried to develop a strong link between the public and private sectors for successful R&D in the country. The universities and research institutes play an exceedingly important role in conducting fundamental and applied research on energy. Univesiti Tunku Abdul Rahman (UTAR), for example have make an intensive research and development about the tidal energy. Department of Environment (DoE) The DoE has the responsibility of controlling, monitoring, conserving and maintaining the environment through legislative power vested in it. The Environmental Quality Act, 1974, was the first legislation put in place to develop an environmental conservation programme. This was <https://assignbuster.com/the-history-about-tidal-energy-environmental-sciences-essay/>

followed by a number of other legislations, regulations and guidelines. In addition, the DoE issued the Environmental Impact Assessment (EIA) Order in 1987, which listed a set of guidelines for environmental impact assessment. This has facilitated better understanding of the government's requirements in relation to the environment for all affected projects, including power projects.

Government Policy

National Energy Policy is the first Malaysia's energy policy emphasizing on oil and gas resources to serve the need of energy in Malaysia. The main purpose of the policy is to ensure the availability of the energy supply and that the supplies are reasonable in price to support the nation's economy developments. Under this policy, the Ministry of Energy, Green Technology and Water (KeTTHA) has identified three principal energy objectives that would be instrumental in guiding the development of its energy sector. The three principals of National Energy Policy: (1) Supply: To ensure the provision of adequate, secure and cost-effective energy supplies through developing indigenous energy resources both non-renewable and RE resources using the latest cost options and diversification of supply sources both from within and outside the country. (2) Utilization: To promote the efficient utilization of energy and discourage wasteful and non-productive patterns of energy consumption. (3) Environmental: To minimize the negative impacts of energy production, transportation, conversion, utilization and consumption on the environment. In order to promote the utilization of RE, GoM further introduce several other policies such as the Fifth Fuel Policy 2000, National

BiofuelPolicy2006, National Green Technology Policy 2009 and the latest, yet to be launched National Renewable Energy Policy 2011.

Pros and Cons of IPP for Tidal Energy Development in Malaysia

As we all knew that all types of renewable or non-renewable energy sources have its own pros and cons. In this section will tell in details about the pros and cons of Tidal energy (tidal power). Tidal Energy is the renewable green energy source produced by capturing the power of the tides caused by the gravitational forces of the moon and the sun. Our group has identified a few major pros and cons about the implementation of tidal energy. For the pros: Renewable and Green Energy Source. Tidal Energy is one of the renewable energy source that it is independent on fossil fuel. It does not pollute the environment with greenhouse gas emissions and it is will renewed at all time. Tides only occur twice daily which is flow and ebb tides once their power is captured it can be converted to electricity.

A Predictable Energy Source

Tides are very predictable. The flow and ebb tides is very dependable on the lunar activity. These characteristics make it possible to build tidal power plants at specific area with high current.

An Effective Methods at Low Speeds.

Because of the water is much denser than air, about 1000 times more, this should enables tidal generator or turbines to produce electricity at lower tide speeds than wind plants.

Efficiencies

Tidal energy sources are more efficient than many fossil fuel energy. For example a tidal plant can convert the tides into useful energy of electricity, about 80% of the kinetic energy while a coal plant achieves only 30% efficiency.

Protects the coastline against the damage

The dam will protect the coastlines from high storm tides that could kill human. The cons:

1. Location has to be Very Specific

Building a tidal power plant has its own certain specifications, even though the tides are predictable. The sites suitable for the implementation are very limited. On these days only 40 places around the world are identified that are suitable for the tidal power plant.

2. Long Distance of Grid Connection
Grid connectivity is important so that the electricity produced can be consumed by the consumer. Usually, tidal plants are built at remote places and makes the connectivity to the grid difficult and highly expensive.

3. Have Low Running Time
Tidal power plants can produce electricity only 10 hours per day. This means that despite of the fact that the tides are predictable the useful period is only about 40% of the year.

4. High Initial Cost of the Construction of Barrage
Tidal Plants are very expensive to be built and this is an important factor which has to be taken into when we want to implement the technology

Environmental Impact

Building a tidal plant will affect the marine life of the places. It has an impact on marine life and sea birds. An environmental study should always accompany a feasibility and business case associated with a tidal power plant.

Case Study in China

Tidal energy is the potential energy of water caused by flood and ebb tide. Its principle of operation is similar to hydroelectric generation. Tidal energy can be extracted by building a dam (barrage) across an estuary or coastal inlet. The dam containing turbines to generate electricity. The energy produced is approximately proportional to the square of the tidal range and area of the water trapped in the barrage. It is estimated that the theoretical generating capacity of tidal power in China reaches 1.1×10^8 kW and there are 242 potential tidal energy dam sites with installed capacity from 200 to 1000 kW with total capacity of 12.3×10^4 kW and annual energy output of 3.05×10^8 kWh. In China, these resources are unevenly distributed. The tidal range of the tides along China's coast is moderate in the world. The maximum tidal range are half of that in area with the supreme tidal range of the world, as well as average tidal range. East China Sea has the largest tidal range whereas South China Sea has the least, Yellow Sea and Bohai Sea fall in between. In coast of China, estuary mouth of Qiantang River has the most abundant tidal energy, followed by mouth of Yangtze River and then comes the estuaries of Zhujiang, Jinjiang, Minjiang, and Oujiang. <http://ars.els-cdn.com/content/image/1-s2.0-S1364032110003278-gr4.jpg> Distribution of Tidal Energy resources of China's coast

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Jiangxia Tidal Power Station

The Jiangxia tidal power generation plant is one of the largest tidal generation plants in China and third largest tidal power in the world. The plant located in Jiangxia port at 16 km southwest from Zhejiang's Wenling County. The power plant started built its construction in 1972 approved by the State Planning Commission as a Tidal Power Generation Research Project on tidal features, tidal generation units, and ocean construction technical problems, and integrated resource utilization. The current plant installs two models of double direction bulb-type hydraulic generating units. Unit 1 and 2 of the same model installed accelerators between water turbine and generators to increase the propeller's low rotate speed of 118 rotations per minute to the generator synchronized 500 rotations/minute. The specified power of the unit 1 is 500 KW, and the unit 2 600KW. Unit 3, 4, and 5 are of the same model. Their water turbines and generators are connected directly with rotation speed of 125 R/M and specified power 700 KW. With the totalling installed capacity of 3200 KW and annual production of 6. 5 GWh. This facility also hosts a 40 KW solar PV power installation with an estimated 45, 000 KWh annual production capacity. This system is composed of 216 pieces of 185w monocrystalline solar modules manufactured by Perlight Solar. The power station feeds the energy demand of small villages at a 20 km (12 miles) distance, through a 35-kV transmission line. The maximum tidal range in the estuary is 8. 39 m (27. 5 ft). http://t3.gstatic.com/images?q=tbn:ANd9GcTd_yK7-A7v-GQ8r5a8o5j8isFyoUfK4EJaQ-lfw-vRN610sTBK http://2.bp.blogspot.com/-6YnP4FCiDw4/TXi6fgzJLQI/AAAAAAAAABNY/co9KRv3_-zM/s1600/1.jpg

[jpg](http://2.bp.blogspot.com/-6YnP4FCiDw4/TXi6fgzJLQI/AAAAAAAAABNY/co9KRv3_-zM/s1600/1.jpg)Jiangxia Tidal Power Station

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Case Study in Malaysia

Tidal energy device such as tidal barrage requires a dam to collect the water in the basin. As for this purpose, it needs to have a large tidal difference between low and high tides. The well-developed technology of these devices is in tidal range above five meters in height. As for this situation case in Malaysia, the tidal range in Malaysia Ocean is too small and not suitable for the development of these devices. However, this type of renewable energy can still be explored. For instance in Tanjung Berhala, Kemaman Terengganu is claimed as an identified area to perform tidal energy in Malaysia. The river widths of the site are assumed approximately 200 meters. This study was held by UKM research group. In this study, the calculation was made using the tidal barrage technology and has been applied to generate tidal water to research area. The used of tidal barrage is approximately 200m x 200m and were assumed according to Department of Irrigation and Drainage Malaysia. According to the data in tidal table made between the year 2006 and 2007, the height of either inward or outward movement of tide is stated by time. The power was calculated from the difference between the height of inward and outward movement of tidal. The graphs show the result from the spatial calculation. Histogram graph of water energy differential versus its location have been plotted from the values shown, to identify the area where the water tidal energy is maximum and consistent throughout the year. The data have been analyzed by month where maximum daily power is taken as monthly value involved. According to the figure, the energy generated from Tanjung Berhala area is between 90kWatt to 203kWatt. Energy value is not consistent due to the increment and decrement of tidal wave drastically in the middle of year 2006. The <https://assignbuster.com/the-history-about-tidal-energy-environmental-sciences-essay/>

condition this situation is probably due to the monsoon season which had increases the water level in the early of 2006. In 2007, the highest energy generated from Tanjung Berhala is 207kWatt and the lowest is 107kWatt. As for this case, Tanjung Berhala is maybe the potential area to generate electricity by using the tidal energy because of the highest value that generated energy throughout year 2006 and 2007 which is 203kWatt.

Conclusion

As for the conclusion, tidal energy in the future has a very bright potential to be used due to its environmentally friendly and its ability as a renewable energy. The cost increment and resource decrement of natural gas and petroleum in the world and Malaysia itself give a way to development of this renewable energy. Tanjung Berhala area is identified as a very potential area and a bright future to develop this tidal energy. As for the suggestion, government should send researchers to the country that has this energy to make more research about it. Besides that, encourage the government to provide additional research funding for design, development, erection and installation of marine current turbine prototypes. On the other hand, environmental issues should also need to be investigated and resolved due to the threat on marine life and conflict with pollution. Therefore, it is necessary to have an additional research to resolve this problem before tidal energy become a new realistic renewable energy source in Malaysia.

Sources: <http://www.wseas.us/e-library/conferences/2009/lalaguna/EPREWA/EPREWA01.pdf>

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