POTENTIAL OF WIND ENERGY IN SUSTAINABLE DEVELOPMENT OF RESORT ISLAND IN MALAYSIA: A CASE STUDY OF PULAU PERHENTIAN (PERHENTIAN ISLAND)

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Abstract: The world oil crisis in 1970s powerfully illustrated that the concerns over the energy resources which exposed the vulnerability of the energy supply and the over dependence on oil as a fuel for energy. This conditions lead to the necessity for the diversification of energy resources. The government strategies of achieving national energy objectives which among others are diversification of fuel type sources, technology, maximise use of indigenous energy resources and minimizing negative environment impact. The energy efficiency and renewable energy under the Eight Malaysia Plan (2001 – 2005) and Ninth Malaysian Plan (2006 – 2010) focused on targeting for renewable energy to be significant contributor and for better utilization of energy resources. An emphasis to further reduce the dependency on petroleum provides for more effort to integrate alternative source of energy. Aware at the potential of the harvesting the wind energy, Malaysian Government under Joint venture partnership with the State Government of Terengganu and National Electric Board in 2007 embark on the project of integrating power supply at Pulau Perhentian (Perhentian Island). The project consists of installing two wind turbine, solar farm (Solar Panel), Generator and battery. This paper will encompass the potential of wind energy in Malaysia. It will also cover and present a case study of wind energy at system and application at Pulau perhentian.

Key-*W*ords. Energy, Policy, Wind Energy, wind Turbine, Sustainable, Renewable Energy.

1 Introduction

Malaysia faces many challenges in the era of globalisation on it quest to achieved developed nation status in 2010. Sustainable development of the energy sector is a potential factor to maintain economic competitiveness and progress. The world oil crisis in 1970s powerfully illustrated that the concerns over the energy resources which exposed the vulnerability of the energy supply and the over dependence on oil as a fuel for energy. This conditions lead to the necessity for the diversification of energy resources. This triggered the development of The National Energy Policy which has the three main objectives that guide the future energy sector development based on supply, utilization and the environment. Energy and environment are link at every level thus the requirement for mandatory assessment to address negative impact. Energy policies and regulations play an important role in achieving the goal of sustainable development in Malaysia. National Energy Policies (NEP) ensure that adequate and available supplies are reasonably priced to

support National Economic Development objectives. The government strategies of achieving national energy objectives which among others are diversification of fuel type sources, technology, maximise use of indigenous energy resources and minimizing negative environment impact. The energy efficiency and renewable energy under the Eight Malaysia Plan (2001 – 2005) and Ninth Malaysian Plan (2006 – 2010) focused on targeting for renewable energy to be significant contributor and for better utilization of energy resources. An emphasis to further reduce the dependency on petroleum provides for more effort to integrate alternative source of energy.

2 Potential of wind energy in Malaysia.

Wind energy growth in Asia is on the rise. Both India and China are leading the switch to wind energy with more installed capacity and manufacturing facilities. India rank fourth with 4400 MW production and China in eighth with 1260 MW. The Asian region is set to be the most dynamic geographical zone with a growth rate of 48 %.

In Malaysia, wind energy conversion (WES) is a serious consideration. The potential for wind energy generation in Malaysia depends on the availability of the wind resources that varies with location. Wind energy is considered a green power technology because it has only minor impact on the environment. Wind energy plans produce no air pollutant or greenhouse gasses. Wind energy conversion system have great potential on resort islands in Malaysia especially on the East Coast in South China Sea. University Kebangsaan Malaysia studies in 2005, reported that the use of a 150KW wind turbine in the Terumbu Layang Layang demonstrate with some success. This is the first project installed in the island off the East Malaysia. The wind speed in Malaysia is light and varies from season to season in the range of 2 m/s to 13 m/s. The north east monsoon which is from the month of September to March play and important role in this region where the strongest wind comes from the South China Sea to the East Coast. Aware at the potential of the harvesting the wind energy, Malaysian Government under Joint venture partnership with the State Government of Terengganu and National Electric Board in 2007 embark on the project of integrating power supply at Pulau Perhentian (Perhentian Island). The project consists of installing two wind turbine, solar farm (Solar Panel), Generator and battery.

3 Pulau Perhentian (Perhentian Island)

Pulau perhentian is one of the popular resort island in Malaysia consisting of cluster of island off the East Coast of Malaysia. They are about 21 KM from the coast of Terengganu. They consist of two main island known as Pulau Perhentian Besar 9The Big Island) and Pulau Perhentian Kecil (The small Island). Both island are popular spot for tourist from all over the world. They are attracted to the white long sandy beach and the coral garden. Majority of the building in the island are resort with only one fisherman village where the local people live. Before NEB come to the island the villager relied on their own generator. In 2002 NEB installed a diesel generator that power the island for 24 hours.

Figure 1.The map of Malaysia showing the location of Pulau Perhentian

4 Project Background and Objectives

The main purpose of this project is to provide a reliable sources for around the clock supply of electricity to the customer which is the people of Pulau Perhentian. For the beginning it will focusing on the fishermen village at the Pulau Perhentian Kecil (The small Island). They were

relying on the three numbers of 200KW generator set that fuel by diesel. The generator set were operated on parallel scheme which synchronise between them on semi auto mode. The problem arise when the price of diesel rises and the difficulty to obtain and transport the fuel to the island. Inline with the NEP the potential optimizing the usage of renewable energy need to be explored. By introducing the integrated source of energy it is also mean upgrading the existing system and it will lead to cost saving by reducing the usage of diesel and maintenance.

5 Location of the Wind Farm..

A thorough research and analysis of the wind speed was done by the NEB ES and the university kebangsaan Malaysia. An average monthly wind speed was recorded from 2003 to 2005. The wind data is shown in figure 2.

	2005			2004			2003		
Month	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
Jan	5.6	14	7.9	5.6	14	8.1	5.1	13	8.4
Feb	6.1	8.2	6.85	5.6	8.7	6.93	5.6	13.3	7.82
Mar	6.1	13.3	7.56	6.1	13.3	7.59	5.6	14.3	7.74
Apr	5.5	10.7	6.78	6.6	14.3	7.73	4.1	9.7	6.54
May	4.9	11.5	6.91	5.1	11.7	7.3	4.6	13.8	7.01
Jun	N.A	N.A	N.A	3.6	13.3	7.35	4.6	11.2	7.39
Jul	4.8	11.5	6.63	5.1	13.8	8.22	5.6	12.8	7.24
Aug	5	15.6	7.16	4.6	13.3	7.68	4.6	13.8	7.69
Sep	4.4	12.7	6.88	5.1	13.3	7.93	5.1	14.3	7.5
Oct	3.9	14.3	7.12	5.6	12.8	8.12	4.6	14.3	7.47
Nov	4.7	15.4	7.57	5.1	13.8	7.88	5.1	13.8	7.62
Dec	4.6	15.3	7.88	5.1	12.8	8.41	6.1	13.3	9.31

Figure 2. Show the average monthly wind speed m/s recorded from year 2003 -2005.

From the data collection, it was determined that the suitable location of the Re farm for the wind turbine and PV array is on the top of the hill on the eastern part of the island as shown in the diagram 3.

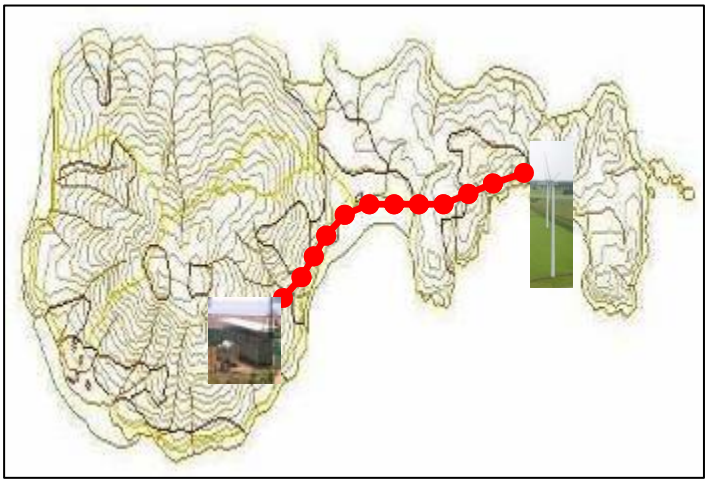

Diagram 3. Location of the RE farm.

6 System Components

The project started with detail proposal of system arrangement and specification of the main equipment as shown in the diagram 4. From the analysis of the anticipated load demand as shown in figure 5 the requirement of the system will consist of as follows:

i. 1 unit of 100kW Disel Generator set to replace 1 Unit of 200 kW existing diesel genetaror set.
ii. Multiple Generetor set control system for all generator sets which include the new and existing.
iii. 2 units of 100kW (mechanical output) wind turbine
iv. 100 kW PV array.
v. 240 Volt DC 480 kWh baterry bank
vi. Hybrid control system.

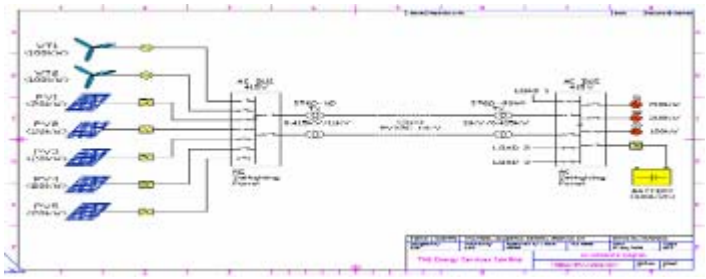

Diagram 4. show the schematic diagram of the system arrangement.

Season	Occupancy Rate	Estimated Daily Energy Consumption (kWh/day)	Max. Demand (kW)
Peak Season (March-July)	100%	1721	192
Low Peak Season (Aug-Feb)	60%	1031	115

Figure 5. Show the load profile at Pulau Perhentian Kecil.

It is also to include suitable plant control and monitoring system which incorporates remote operation and monitoring. This will provide the capability to operates the wind turbines and the PV array system from the diesel generator station as well remote operation and monitoring from the NEB Besut office and the NEB-Es Office in the mainland.

Diesel Generator

RE Interface Module (REIM)

Bi-Directional Inverter

480KWh Battery Banks

Step-down tx (11/0.45)KV

Solar Farm

Wind Turbine

Step-up tx (0.45/11)KV

Block Diagram of The Hybrid System (Wind/Solar/Diesel)

The main design consideration of power generation is based on priority as planned where the main consideration is the solar and wind. The diesel generator set were only be used when the amount energy store in the battery from the access power produce by the wind and solar depleted beyond capability of the combine produce by the wind and solar , the renewable energy producer. The battery shall function in this case as buffer for instantaneous peak load and back up.

7 System Performance.

For the purpose of this paper an analysis of the performance made on the 23 rd of march 2008. On that day the wind turbine and the solar energy were in the performance as the wind turbine will only function with the wind speed between 5 m/s and 15 m/s. If the wind speed is less than 5 m/s the blade will not mowing and the blade will be automatically stop if the wind speed is more than 15 m/s. The wind speed/time data as shown in the figure 6.

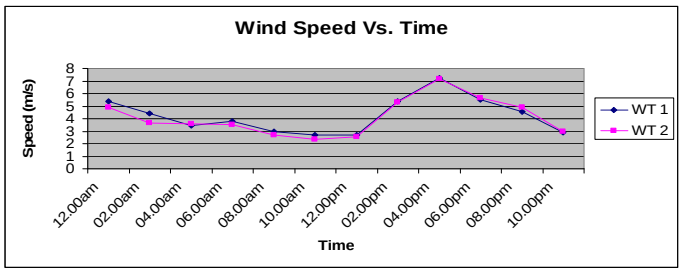

Figure 6 . The 2 hours interval of wind speed.

The data was recorded from 00 hours to 2200 hour on the 28th march 2008 on two hourly basis. The wind speed start at 5 m/s at 0100 hours and drop to 3 m/s at 1300 hour before it increase and reach at the peak of 7 m/s at 1700 hours.

The data recorded shown on the remote monitoring system at generator set station as shown in diagram 5. It is noted both wind turbine (WT 1 and WT 2) produce 18 KW each. Meanwhile the solar PV produce 39 KW. Total energy produce by RE farm is 75 KW. It was also noted that the site load requirement on that day is 71 KW. Therefore there is and access of 4 KW which will be stored in the battery. Therefore the energy produce by the two wind turbine will fulfil about 50 % of load required with the average wind speed of 7.26 m/s.

8 Conclusion

The potential of wind energy and possible integration of other renewable energy is possible to be achieved successfully. At this stage the hybrid system of wind and solar is not to replace the diesel generator but to minimise the usage of diesel as a source of electricity. The combination of solar panels, wind turbines and diesel generator will ensure a continuous low electricity no matter what the weather conditions are. As the turbine are designed to harness the wind on Pulau perhentian as efficient as possible. As March is the end of the North East monsoon season were most of the wind flow there it is clear that the potential of the wind energy can be further explore in this region where there are plenty more island resort that can be benefit to this technology. A further innovation research and development is recommended where this technology can be transformed to more efficient individually and to be more cost effective.

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