# Mapping of Tidal Energy Potential based on High and Low Tides for Sabah and Sarawak

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**Abstract.** Tidal energy is one of the best predictable and reliable source of renewable energy. Therefore, this paper aims to map extractable tidal energy, and to determine potential locations to generate electricity from tidal power along the coastline of Sabah and Sarawak states of Malaysia. The data was obtained from Sarawak Marine Department, and analyzed by using ArcGIS version 10.3. There are two potential locations, namely Tawau in Sabah, and Pending in Sarawak, where 67.0kW and 115.4kW of optimum power generated were obtained respectively.

## 1 Introduction

The oceans around the world are a bountiful and reliable source of renewable energy [1]. Electricity generation from the ocean power offers a numerous advantages over other sources of renewable energies [2]. The sea energy has a vast potential in its operation and developments [3]. Sea energy can be categorized broadly into two main types, namely tidal and wave power. The specific forms of sea current are surface waves, tides, salinity, thermal gradients and circulation [1]. In general, the waves were produced by the interface of wind with the sea surface, and potential to deliver a boundless source of renewable power [4]. As soon as the wind blows across huge starches of sea, then the ocean waves were created [5]. The wave power can be extracted and transformed into electricity through wave power technologies and devices [4] [6].

The tidal power is more predictable than wave energy and wind power. The tidal power activities ebb and flow of the coastal tidal waters affected by interface of gravitational fields of the moon, sun and the earth [4, 7]. The tidal water levels follows a periodic highs and lows which were related with variations of water levels, and hence the tidal currents. Stronger tides were form, due to either in water level height or tidal current velocities [8]. The tidal generator uses this phenomenon to produce power. Tidal power is a method of non-pollution energy production, which has a vast potential [9]. Besides, growing awareness in the enhancement of tidal power, potentially support to shift use of fossil fuel in the generation of electricity. However, tidal power is not a new idea and several barrage type plants were working, the biggest existence 240 MW in Larance, Farance [10]. The tidal power comprises both potential energy and kinetic energy components [6, 7]. Hence, either utilizing the kinetic energy for tidal stream energy or constructed a barrage to generate the electricity using the potential energy by storage of water [11].

Till the year 1990, for utilization of tidal power required a basin with an appropriate water level variation as comparative to the outside body of water, as an existing turbine required a significant hydraulic head to work [12]. The tidal energy involved ocean waters at high tide and low tide, although its waves show the movement of its flow horizontally [7]. The diurnal tides, semidiurnal tides and the mixed tides are main types of tide. These tides have varying tidal periods, for example the diurnal tides have about 24 hours and 48 minutes whereas a period of 12 hours and 24 minutes reported for semidiurnal tides. The combination of the diurnal and the semi diurnal tides were known as a mixed tide, exists in the most different locations. Some of mixed tides were dominant on the diurnal and the semidiurnal tides. When the diurnal tides were dominant, the maximum tidal current arises at the greater declination of the moon and last current at the zero declination. While the semidiurnal tides were dominant, then the maximum tidal current arises at spring tide and the last tidal current at neap tides [13, 14, and 15].

The principle of tidal energy usage as a renewable energy source has a key role in the improvement of the human society by serving it to control and adapt to the environment [16]. Its utilization depends on the state of the technology and local characteristics of potential regions. For example, some of the challenges were often found with the operating principles, status, and efficiency and cost of generating energy related with each technology [17].

The barrages were constructed through the river estuary. The water level would flow in and flow out through the channel by which turbine rotates as soon as the forces applied onto the turbine (example shown in figure 1) [7].

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