ABSTRACT

In recent years, many countries have paid more attentions in the issue of alternative energy sources due to energy shortage problem. The tidal energy has the advantages of environment protection and easy access, making the industry develop high performance tidal energy generator and tidal energy related products. In this paper, we do not only discuss the principles of tidal energy generation, but also investigate the application examples of relative research scheme in recent years. These results provide useful information for the mechanical structure design of the tidal energy.

Key Words: alternative energy sources, tidal energy, tidal power generation, application examples.

1. INTRODUCTION

Tidal power, also called tidal energy, is a form of hydropower that converts the energy of tides into electricity or other useful forms of power [1-3].

Although not yet widely used, tidal power has potential for future electricity generation. Tides are more predictable than wind energy and solar power. Among sources of renewable energy, tidal power has traditionally suffered from relatively high cost and limited availability of sites with sufficiently high tidal ranges or flow velocities, thus constricting its total availability. However, many recent technological developments and improvements, both in design (e.g. dynamic tidal power, tidal lagoons) and turbine technology (e.g. new axial turbines, crossflow turbines), indicate that the total availability of tidal power may be much higher than previously assumed, and that economic and environmental costs may be brought down to competitive levels [1-3].

The earth has appreciable size relative to the distances between earth and the sun and the moon. Thus, there are small but yet significant variations in the attractive forces exerted by both sun and moon on different parts of the earth. Figure 1 shows the gravitational attraction of the moon at the center of the earth, where it is average in value, and at a point A on the earth's surface off earth-moon line. The difference between the actual attractive force of the moon and the average attractive force can be regarded as the disturbing force. The tangential component of the disturbing force tends to force sea water towards the earth-moon line and create a hump of water on the earth's near side. At a point, e.g. B, on the other side of the earth the tangential component of the disturbing force acts away from the moon and tends to create a hump of water on the earth-moon line. The two humps correspond to high tides which occur twice every 24 hr. 50 min. - the time required for one apparent rotation of the moon around the earth; i.e., a tide due to moon's attraction occurs every 12 hr. 25 min [2].

These are called the semidiurnal tides. Semidiurnal tides are caused by the difference in the moon's attraction of an average earth particle, acting at the center of the earth, and a particle on its surface, off the earth-moon line. Triangle of forces shows average particle force, the actual force, and the resultant force, which is the difference between them. This force it also divided into components tangential and vertical to the earth's surface the tangential component is responsible for tide generation. On the other side of the earth, away from the moon, this component sets away from the moon, tending to create a "hump" of water on the earth's far side. The two humps correspond to the high tides which occur twice every 24 hr 50 min-the time of the moon's apparent rotation around the earth. Similar tides are produced by the sun [2].

The rise and fall of water level as a result of tides is periodic in nature as shown in the Figure 2. The point A indicates the high tide point and point B indicates the low tide point. The tidal range h varies from time to time. Generally a long time mean value of h is designated as mean tidal range at any particular place [1-3].