ENVIRONMENTAL ASPECTS OF WAVE POWER

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Contents

Summary

Wind wave power is renewable, easy to predict, in general environmentally benign. Use of wave energy does not produce wastes, does not need land estrangement and decreases expenses for coastline protection.

Wind wave energy has also a number of disadvantages that withhold its wide usage. First, is the intermittent character of wave power and therefore impossibility to match the energy demand of customers? Second, are problems of placing and fixing wave power devices offshore, problems of energy transmission to the customer, problems of stability in storm conditions, corrosion and sea-crust prevention, that are possible in aggressive sea environment.

Influence of WPD upon the environment is localized as a contrary to thermal or nuclear power plants.

1. General Aspects

In general, the influence of WPD upon the environment is created by the following factors:

- Change of natural condition of ecosystems in the vicinity of WPD
- Change of coastal alluvium movement conditions
- Change of previous shipping routes
- Water contamination mainly during WPD erection.

The main environmental advantage of a WPP as compared with conventional power plants is the absence of harmful wastes and emissions such as noxious and green house

gases, ashes, nuclear and heat wastes. Since at a WPP there are no combustion processes it does not consume oxygen.

Just like other renewable energy sources, the impact of WPD on the environment directly correlates with the sizes of the WPD. This impact being negligible for small devices but grows with the device scale and sometime becomes determinative. Hence the environmental friendliness of WPD claimed by some scientists a priori, is rather conditional, because its construction, operation and maintenance affects nature as well as any human activity.

2. Wave Power Devices Environmental Features.

To assess the ecological situation in coastal regions of relatively homogeneous sea and ocean water areas it is necessary to collect a vast volume of data to define existing statistical regularities. The cost of this work just like the cost of processing the obtained data is extremely high.

To define the site for a WPP erection detailed knowledge and description of marine and coastal ecosystems will be necessary. In particular it will be important to define species on the brink of extinction and if some are found to minimize the possible risk of harmful WPD impacts.

Hydro-biological monitoring of ecosystems in the region has to be organized in advance of constructional works and during the whole WPD operation period. This includes regular metering of main water characteristics on fixed stations with a period of 2-3 years; quantitative exploration of bottom fauna composition and distribution revealing multiyear dynamic changes and tendencies.

Methods of express analysis of ecological condition of sea coastal systems are developed to estimate short term, sudden changes of the existing ecosystem. These methods include usage of mini-probes and diving methods for arborvitae monitoring.

In order to decrease the time and cost of research it is attractive to elaborate numerical correlation using data collected during research on small isolated water areas, where the variations of biotic parameters are limited. Conduct of such research on small-scale model water areas with expressed gradients of environmental characteristics helps to get the response of hydro-cores on a wide range of different environmental parameters. The research starts with mapping of littoral (ocean coastal bottom area of shallow water) with segregation of representative areas, occupied by certain biological communities. After the obtained data has been processed, it is possible to classify the explored areas by spatial and temporal variations of characteristics. Functions of the arborvitae response are obtained and the degree of biotic and abiotic environmental factors influencing the quantitative characteristics of species distribution is determined.

Alteration of hydrodynamic situation due to the WPD erection may provide for redirection of bottom sediments in the coastal region, populated by fauna and flora. The fractional and chemical structure of alluviums and water temperature are the determinative factors for bottom organism’s distribution on biotopes. Even the slight

change of superficial sediments structure can cause great changes in vital functions of digging organisms that are the basic of many bottom ecosystems.

Substantial amounts of suspended matter and sediments in some parts of water area and their accumulation can eventually limit the navigation and even worsen the WPD uninterrupted operation.

The surface temperature distribution, sea water salinity, the pH value of water, the mean oxygen content as well as the vertical distribution of biogenically active elements are totally dependent on the WPP operation mode. So, a long interruption of the WPP operation can destabilize all ecosystems.

The change of commotion regimes and hence alteration of water exchange must also affect water turbidity and may finally affect the surroundings of organisms living in the sea water as well as bottom ecosystems production. The response of hydro-bionts on some decrease or increase of water turbidity may not only change its productivity but falso result in a change of species structure. For example harmful ones can replace harmless species.

Erection of a WPP in firth and estuary areas complicates living conditions for marine mammals and passing fishes. It is possible to harm big fishes occurring in the WPP vicinity. The range of habitation of sea bears and sea dogs can be decreased and their population can shrink. At the same time the decrease of surf intensity caused by WPP erection can increase bio diversity in particular increase variety of fishes living in the area protected by the WPP.

A WPP along with marine ecosystems can in some cases affect land communities in case when such plant is erected in a less developed area where virgin nature is preserved. Development of the WPP infrastructure would lead to adverse changes in the environment. Inflow of manpower, erection of settlements, moorage lines and roads, erection of the power plant itself, transmission line construction etc. will deteriorate the virgin landscape. It is obvious, however, that any human activity has the same consequences.

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Biographical Sketch

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Born 19.04.1926, Stavropol, USSR

1948 Graduated from Moscow Civil Engineering Institute

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1955 Full professor, Moscow Power Engineering Institute

1979 Director general, Scientific-Research institute for power constructions

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