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Maritime sector has always been influencing the global economy. Shipping facilitates the bulk transportation of raw material, oil and gas products, food and manufactured goods across international borders. Shipping is truly global in nature and it can easily be said that without shipping, the intercontinental trade of commodities would come to a standstill.

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HYDEL POWER GENERATION AND REGENERATION OF
ENERGYS
(GREEN PORT DEVELOPMENT)

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P. Seth (Cadet)

Abstract

This projects aims at utilising the flow and the wave energy specifically from the flowing rivers. The project is primarily designed for the inland waterway project which is at its growth in India. Here, we have proposed two different designs that is one is fixed unit and the other is a floating unit. The flow energy of river is utilised and converted to electrical energy via a rotary impellor and the wave energy is converted to the electrical energy through a rack and pinion mechanism or by one more mean that is through the phenomenon of electromagnetic induction. These designs can be installed as per there suitability towards the river behaviour and can serve to the need of the rising demand of green energy with minimum investment and maintenance. A proper experimental and stimulation data have been complied to prove the feasibility and application of the design along with getting to know the areas to work on more. In our paper we have specifically displayed worked upon by taking into consideration the parameters of river Ganga for carrying out the experiment and stimulation's, similarly the parameters of other rivers can be taken into consideration for designing the components of the device in order to be installed in that particular river. The proposed device could bring renewable power generation as close as the nearest flowing water, making micro-hydro a reality for many who live near streams and rivers. It is both efficient and cost-effective, as well as less intrusive to the environment than other hydroelectric solutions.

Keywords: Hydel Power Generation

1. INTRODUCTION:

India has around 14,500 km of inland navigable waterways. There are twelve rivers which are classified as major rivers, with the total catchment area exceeding 2,528,000 km² (976,000 sq. mi). All major rivers of India originate from one of the three main watersheds:

- The Himalaya and the Karakoram ranges
- Vindhya and Satpura range in central India
- Sahyadri or Western Ghats in western India

Also it has an extensive network of inland waterways in the form of rivers, canals, backwaters and creeks. The total navigable length is 14,500 km (9,000 mi), out of
which about 5,200 km (3,200 mi) of the river and 4,000 km (2,500 mi) of canals can be used by mechanized crafts.

So, it is highly sensible and important to utilise the hydel energy stored in water in some of the other way. This energy can be further utilised as per our requirements. Our design aims at utilising the flow for producing electricity at the most cost effective way.

The project consists of two design:
1. FLOATING UNIT (FLOATING HYDRO WHEEL)
2. FIXED UNIT (HYDRO WAVE IMPELLOR)

Both the designs aim at generating electricity from water. The floating hydro wheel is a floating unit which converts the river flow into electricity. The hydro wave impellor is a fixed instalment unit which converts the river flow into electricity and also generates electricity through waves and variable river depth.

2. PROPOSED SYSTEM DESIGN and OPERATION:

A. System design and configuration
1. FLOATING UNIT (FLOATING HYDRO WHEEL)

![Diagram](image)

Figure.1: Block diagram describing the utilisation of river flow

The river flow rotates the impellor mounted on the floating structure. The shaft on which the impellor is mounted is geared with the stepper motor. The electricity produced can be further utilised as per the requirements.
3. **SCOPE OF IMPROVEMENT:**

- **Catamaran Hull:** For streamline flow of water
On a higher scale the floating structure can be made of a catamaran hull, in order to reduce the river drag so that more of the river flow can be utilised to rotate the impellor rather than just forcing the entire unit backwards. Here, we have put up a CFD analysis of a Catamaran hull in comparison with the normal cylindrical hull used in our experiment. And the difference in the velocity over the body can be seen, from which the formation of eddies and thus drag can be seen.

- **Aluminium Fins:**
  
  To reduce the moment of interia of the rotor the Fins can be made of aluminium.

![Figure.5: Deformation analysis of aluminium fins](image)

We have performed a deformation analysis of a aluminium blade in order to find out the degree to which it can take up the river flow pressure. In the analysis we have applied the 5bar pressure which resulted in the maximum deformation at the center of blade but the amount is still small. So, it can be concluded that the blade is safe.

- **Hydrofoil Blade:**
  
  Due to the limitation we had in manufacturing facility and in the availability of material we chose to have a flat shape blade but the most optimise shape will be a hydrofoil shape.
with application the hydrofoil blade the impellor will be assisted with more torque leading towards more rotation. Since, the thrust of water will more be utilised in the lift force rather than in the drag force.

4. FIXED UNIT (HYDRO WAVE IMPELLOR):

This design is a fixed instalment which generates which utilises flow as well as the waves of the river to generate electricity

Figure. 6: Positive and negative pressure distributions along hydrofoil surfaces

Figure. 7: Block diagram describing the utilisation of river flow

Figure. 8: Block diagram describing the utilisation of river waves
The river flow rotates the impellor mounted on the floating structure. The impellor is geared with the stepper motor. In case of waves the impellor will move vertically up and down which will lead the rack connected on its backside to undergo a reciprocating motion leading to the pinion connected to the another stepper motor to rotate. This vertical motion can also be utilised by connecting current transformer instead to the rack and pinion leading to generation of electricity via EMI phenomenon. The electricity produced can be further utilised as per the requirements.

The ball joints are employed so that in case of any thrust by the river flow in any transverse direction the rotor can adjust itself and do not get damaged.
5. PROJECT ELECTRICAL CIRCUIT DIAGRAM:

Switches that can be turned to different positions to make a connection with the contacts in that particular position. A rechargeable battery, storage battery, or accumulator is a type of electrical battery. It comprises one or more electrochemical cells, and is a type of energy accumulator. It is known as a secondary cell because its electrochemical reactions are electrically reversible. Rechargeable batteries come in many different shapes and sizes, ranging from button cells to megawatt systems connected to stabilize an electrical distribution network. Several different combinations of chemicals are commonly used, including: lead–acid, nickel cadmium (NiCad), nickel metal hydride (NiMH), lithium ion (Li-ion), and lithium ion polymer (Li-ion polymer). When electricity is produced in DC generator, current passes through the rectifier and rechargeable battery is charged. When power is needed during the night time, selector switch is on and rechargeable battery supplies required power.
6. ANALYSIS AND RESULT:

This was the result found after the performance of our device.

Experiment conducted at the institute lake.

**RPM:** 1000  
**Voltage Produced:** 12V  
**Current:** Greater Than 0.125Amp

7. SCOPE OF OUR PROJECT:

The device can be installed at-

- Rivers near the embankment—where the generated electricity can be transmitted to the sub-stations. This means this device can be used on certain intervals of distance in particular region of suitable rivers (where the flow rate is more favourable). So, the units as a whole can supply the electricity to the sub-station which can further be used for the nearby locality and inland waterway terminals.

- The unit at night can also be used for the harbour lighting.

- For the rivers where the flow rate is less than the required a separate water tunnel can be constructed, which would channelise the river water onto the unit by increasing the velocity of the flow. At the same time that channel can act as a way through at the time of river flooding.
• Since the unit is floating apart from generation of electricity it can also be used for installing signal transmitting antenna and also as a guiding lights at ports.

• If this device is installed in units than it can also be equipped with the PPM meter or Viscosity sensor which can detect the oil spill and pollution and send signal immediately to the nearby inland waterway terminal. So, that suitable action can be taken as soon as possible.

Figure.13: Calculations for moment of inertia (Aluminium and Mildsteel)

8. CONCLUSION:

In coming days, it will prove a great boon to the world, since it will save a lot of electricity of power plants that gets wasted in illuminating the street lights. As the conventional source are depleting very fast, then it’s time to think of alternatives. We got to save the power gained from the conventional sources for efficient use. So this idea not only provides alternative but also adds to the economy of the country. Now
vehicular traffic in big cities is more, causing a problem to human being. But this vehicular traffic can be utilized for proper use by taking this specialised speed breaker into use. It has advantages that it does not utilize any external source. Now the time has come to put forte this type of innovative ideas, and also researches should be done to upgrade its implication. In future, if the flywheel speed control device and voltage protection devices are added with large generation process, it would be a model all over the world. After some modification of the designed project, the efficiency of the whole system can be increased by increasing the capacity of the generator and applying more weight. Also during our experiment, we have used mild steel due to availability but if we replace this by aluminium the effectiveness increases which is shown in the calculations above

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