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Small Scale Power for Tall Buildings through Waste Water Management

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Abstract: *This article demonstrates how small scale power is produced in tall buildings throughhydraulic energy by using micro hydro turbine. All the waste water of the building that are to be disposed in public sewage through excrete pipes is first stored in a giant storage tank situated at a suitable head in the building. The water that is stored in whole day is discharged through pipe with steady rate by using gear. Water of steady rate of discharge falling from a great head when strike the blades of turbine produce energy. This paper studies the application of renewable energy sources in wastewater treatment plants to achieve self-sustain- ability of power*

Keywords: *Combined Heat Power; Economic Evaluation; Hybrid Renewable; Waste Water Treatment Plant*

I. Introduction

Water, food and energy securities are emerging as increasingly important and vital issues for India and the world. Most of the river basins in India and elsewhere are closing or closed and experiencing moderate to severe water shortages, brought on by the simultaneous effects of agricultural growth, industrialization and urbanization. Current and future fresh water demand could be met by enhancing water use efficiency and demand management. Thus, wastewater/low quality water is emerging as potential source for demand management after essential treatment.

In urban areas the consumption of water is more but the supply is limited. As the population is increasing day by day, hence the per capita consumption is also increasing. So as to counter this upcoming future problem, we have to think beyond the box. Management of waste used water for the sack of production of electricity can be a good alternative.

Combining renewable energy to form standalone hybrid systems is considered as one of the most promising ways to handle the electrical requirements of tall buildings. Beside the residential applications, the idea of studying the self-sustainability of power in industrial & service facilities looks very appealing due to their relatively high energy demand, such as wastewater treatment plants (WWTPs). This is because water pollution by nature is an energy intensive process. Also, the operating costs of waste-water treatment facilities in the recent years have increased substantially due to the in- creases in the unit cost of energy.

II. Management of waste water

In long storeyed buildings in urban areas where the gallons of waste water are discharged through pipes can provide an efficient source of water to produce electricity. All the waste water of the building that are to be disposed in public sewage through excrete pipes is first stored in a giant storage tank situated at a suitable head in the building. The water that is stored in whole day is discharged through pipe with steady rate by using gear. Water of steady rate of discharge falling from a great head when strike the blades of turbine will produce energy. But as the space is restricted here, so the usage of normal giant turbine cannot be done. So the introduction of Micro hydro turbine can be a great idea.

Micro hydro is a type of hydroelectric power that typically produces up to 100 kW of electricity using the natural flow of water. These installations can provide power to an isolated home or small community, or are sometimes connected to electric power networks. There are many of these installations around the world, particularly in developing nations as they can provide an economical source of energy without the purchase of fuel.Micro hydro systems complement photovoltaic solar energy systems because in many areas, water flow, and thus available hydro power, is highest in the winter when solar energy is at a minimum. Micro hydro is frequently accomplished with a pelton wheel for high head, low flow water supply. The installation is often just a small dammed pool, at the top of a waterfall, with several hundred feet of pipe leading to a small generator housing.The turbine turns a generator, which is then connected to electrical loads; this might be directly connected to the power system of a single building in very small installations, or may be connected to a community distribution system for several homes or buildings.

III. Micro hydro turbine

Banki turbine, pelton wheel turbine and kaplon turbine are the three choices that can be attached with Micro hydropower system. But amongst them banki turbine is often preferred for low-head micro hydro power systems and hence less efficient while on the other hand traditional kaplan turbine is of large diameter and slow turning. So pelton wheel turbine is the best choice left for this purpose.

Micro-hydro power is generated through a process that utilizes the natural flow of water.This power is most commonly converted into electricity. With no direct emissions resulting from this conversion process, there are little to no harmful effects on the environment, if planned well, thus supplying power from a renewable source and in a sustainable manner. Micro-hydro is considered a "run-of-river" system meaning that water diverted from the stream or river is redirected back into the same watercourse.Adding to the potential economic benefits of micro-hydro is efficiency, reliability, and cost effectiveness.

IV. Methods

Taking a small sky scraper (say 25 storeyed) on an account, water getting wasted through an Indian household can produce more than 18kwh a day by running a turbine with a speed of 100 gal/min without any cost(except some initial investment in micro hydro turbine set up).

We consider a 25 storeyed building with 50 flats in an urban house complex. 50 families are there. Say, each family have 3 members on an avg.

In India where population is above 1 lakh living in this kind of buildings, per head water consumption is 150-200 litres. We take an avg. of 175 litres.

Water consumption (by drinking) = 5 litre
Water consumption (by toilet flashing) = 30 litres.
Therefore, net waste water through excrete pipe that can be stored = (175-5-30) = 140 litres.
3.79 litres = 1 US gallon
140 litre = 37 gallon (approx)
In this 25 storeyed building, a storage tank is to be set up 10th floor which will collect all the waste water from the upper 30 flats.
1. Let the height of each storey is 12 feet.
2. For 10 storeys we will get a head of about (12x10) or 120 feet.
3. 30 flats have (30x3) or 90 members whose net water production is (37x90) or 3330 gallon.

Power output = $(\frac{\text{nethead (ft)} \times \text{gpm}}{13})$
(If, gpm = 100),
Power output= $\frac{120 \times 100}{13}$
= **923.1 watt** (approx)
Where, gpm = gallon per min.
Total storage = 3300 gallon
We control the rate of water discharge by using gear. Through steady rate of discharge (100gpm) we can empty the tank in (3330/100) or 33.30 min.
In 33.30 min we can produce energy =(923.1 x 33.30 x 33.30/60) = **17.06 kwh**
Per day energy production = 17.06 kwh
Per month energy production = 17.06 x 30 = **512 kwh**(approx).

***beside this amount of calculated energy, we can also generate more energy if the rain water accumulating in the terrace is used**
***though it is not a sound source of energy in our country, but it is surely golden step towards a sustainable development.**

In cities like Hong-Kong, New York where very tall sky scrapers are seen, there this project can come handy. Avg. height of sky scrapers in Hong-Kong is 580ft and per capita water consumption is 219 litres. Through the above set up we can produce about 2mwh energy per day.

V. Future Scope of the system:

We have tried to use an alternative energy source for saving electricity and thus using green energy.

The following are the obstacles or **Disadvantages** of this project and on further development or modification it can attain its heights:

1. Setting up of storage tank on 10th floor can be challenging.

2. Micro hydro turbine can demand high maintenance cost.

Advantages:
1. Being a non-conventional source of energy its pollution free and helps sustainable development.
2. Can be used as a great back up source of energy during immense scarcity of electricity.
3. Overall it serves as a great way of recovering energy from Waste water with nominal cost.

VI. Conclusion:

From the above investigation and examination it can be concluded that this management of waste water to produce energy from 'nothing to everything' can turn out to be a fruit full asset in coming years. In upcoming days it is seen that nations are getting more dependable on non-renewable sources of energy; hence these versions of resources are getting limited and limited. So through modification to upgrade this plant so as to increase its efficiency can turn out to be one of the best alternative renewable source of least investment. For example, storing of rain water falling on building terrace followed by its management can improve plant's efficiency to greater extent.

References:

[1]. https://www.google.co.in/search?q=google&rlz=1C1MIMX_enIN546IN546&oq=g&aqs=chrome.0.69i59l3j69i61.3655j0&sourceid=chrome&espvd=210&es_sm=122&ie=UTF-8#es_sm=122&q=per+capita+water+consumption+in+hong+kong
[2]. www.thehindu.com
[3]. Micro hydro turbine by s. grey