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Hydro Power, Technology, Consumption and Generation Progress

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Abstract

In this work we want to have a presentation on the subject of hydropower energy which is needed in all life fields in all over the world. That contains definition of that energy, comparative costs with other types of energies ,the world production of this and other energies, indicating the necessity of electric energy, mainly, hydropower for its low cost and its positive effects on world environment . Also explains simply the mechanism of production hydropower from running water. Conclusions of results and discussion and some recommendations for increasing the quantities of produced hydropower and decreasing fuel energy which pollutes the environment parallel with increasing the productions of other renewable energies such as solar, wind and others which are clean sources of energy. The importance and benefits of such clean energy is referred to in this work. The present work has been carried out for more investigation in the relation between hydro energy and environment mainly the CO2 aggressive gas.

Aim of Work

To have more information, conclusions, discussion and recommendation in the field of hydropower for more progress in that important energy.

Keyword: Hydropower, generation consumption, renewable energy, progress, low cost, clean environment, water falling energy

Introduction

Hydropower is a clean or renewable energy generating the electricity from the water falling from the high to lower elevation. It is one of the oldest and largest sources of renewable energy which is uses the natural flow of moving water to generate electricity.

It is very interesting source of energy which is able to supply us in clean and sustainable way [1], It is a proven mature, predictable and price-competitive-technology. Hydro power has the best conversion effect and the most preferred way of energy production among all renewable energy sources due to constant and reliable energy production. Hydropower is a low cost competitive technology, it has the best conversion efficiency of all known energy [2]. There is a large potential for further development, as the total technical potential has been estimated to be roughly 16.000 TWh. Hydropower offers significant potential for carbon emissions reduction. It is also support other RE. Such as solar and wind [3]. Hydropower can provide both energy and irrigation. It supplies one sixth of the world electricity. Power sector is facing problem of increasing demand, as well as regulation of greenhouse gas emission. Due to the requirement of energy, RE-resources, such as hydro, solar wind and nuclear energy are needed to meet the growing energy demand. Literature survey. Reveals the earlier study connected to optimize specific components of small hydro power. It is the largest sources of renewable energy which uses the natural flow of moving water. It provides benefits beyond electricity generation by providing flood control, irrigation support and driving water or falling from the higher to lower elevation [4] -Hydropower power is a renewable energy source which is the most preferred way of energy production among all renewable energy sources due to constant and reliable energy production, with a share of (16 -17)% of the total world electric generation [5, 6]. It is low cost completive technology, also it has the best conversion efficiency of all known energies, about- 90 % [7]. Hydropower can provide both energy and water management support other variable, RE, wind, and solar which offers significant positional for carbon emissions reductions, typically - less than 1%. The amount of water flow through the generator cannot be controlled, so it is not possible to control the amount of electrical energy produced in those stations, and the flow of the river depends on the rainfall in the region [7]. It is very interesting source of energy which is able to supply power as in clean and sustainable way [8].

Many of the current hydro power stations have exceeded their operational life, and many of them have been damaged as a result of floods or dry seasons damage, as well as the initial costs of building new hydro power stations or to replace the old ones are very high, so most of the investments currently go to other forms of renewable energy. The economic risks in investing in hydropower projects can be great, because they require very high capital costs. In addition to the uncertainty regarding energy prices in the future, the costs of building and producing hydroelectric power vary greatly from one station to another, and one of the most important reasons is the size of the station.

A small generator requires a number of workers to operate and maintain, almost equal to what a large hydropower plant needs, which makes the cost of producing one kilowatt in large hydro power stations less than the cost of production in smaller plants. Compared to other sources of electricity generation, production costs in hydro power stations are about one third of generation costs in plants that use fossil fuels to generate energy, gas, coal, oil, or nuclear power [9]. Hydropower stations in most cases are less than the production costs of fossil and nuclear fuel stations .The calculation of the amount of electricity in watts can be done by mathematical formula.

P= c (d*v) g* h ….. Where:

P: is the actual power in watt

c: coefficient between zero to one range

d: the density of water[1000kg./m3]

v: volumetric flow rate in m3/ sec

g: the acceleration due to gravity as 9.81 m/sec2

h: the change in water height in [m] . . [10]

Before the use of hydro power on a large scale to provide electric power, water power was used for irrigation purposes only to operate machinery, such as water mills, textile machines and sawmills. Currently electric power genera-

tion technologies are highly advanced and developed, it is not expected that there will be a major breakthrough in the future to increase its efficiency and expand its use. Power generation from waterfalls by the force of falling water to move turbine generators. There are two types of hydro power stations; the first includes stations that use high water falls. Those are done by building dams along the main rivers and usually giant tanks are created to store water and also to control the flow of water through the dam according to the demand for electricity. As for other type of hydropower stations they are those that use water drops from rivers, and these stations benefit from the flow of the river to move turbines, The power produced from those stations is much less than the amount of energy generated by the high waterfall stations currently hydropower is the main source of renewable electric energy .It provides more than 97% of the total renewable energy which is about 700.000 megawatts of power and this represents about 19 % of the produced electricity in all over the world. As for other sources, including solar, geothermal, wind and biomass energies, they constitute less than 3% of renewable electricity generation. But it is not expected that this production will increase much, especially in advanced countries, because most of available capabilities have been exploited in these countries. There are many benefits from energy production by hydroelectric stations, i.e. No emissions of hazardous gases or solid waste, and there are no cost for fuel, as well as hydropower stations that are reliable in their technical performance and have low maintenance costs in addition to that the dams help to control floods. Hydro power production is also cheaper than electricity generated using fossil fuels or nuclear power. The abundance of hydropower sources helps to attract industry, but at the same time there are negative effects of hydropower that may pose a great challenge to it. Environmental warnings from the effects of dams and giant reservoirs may limit the development and increase of economic hydroelectric energy sources on wildlife of fish passage. One of the great advantages of this type of hydropower station is its ability to handle high seasonal and even daily peak loads, For example, when the demand for electricity decreases, the dam stores more water, which subsequently provides more flow when needed. While the stations that use waterfalls from rivers, their effects are much less, but here the flow of the amount of water through the generator cannot be controlled, so it is not possible to control the amount of electrical energy generation in these station, and the flow of the river depends on the rainfall, and many of them have been damaged as a result of floods in recent years with irreparable damage, so most of the investments currently go to other forms of renewable energies. The economic risks investing in hydropower projects can be great, because they require very high capital costs. Costs of building and producing hydro power vary greatly from one station to another hydropower plant needs, which makes the cost of producing one kilowatt in large hydroelectric power stations less than the cost of production in smaller plants. Production costs in hydro power stations are about one third of generation` costs in plants that use fossil fuels to generate energy, gas, coal or oil, or in nuclear power plants. The main factor of the difference in the cost of production is due to the fuel costs needed in other types of energy production sources. Required to build power plants that do not run on fossil fuels [11, 12.13]. The hydropower over the years between 1970 and 2022 could be seen in the following table-1 [14, 15].

Table 1: The Change in Hydro Energy through Years 1970 – 2022

Year	Hydro Energy In Twh	Total Energy Twh	Percent %
1970	1.174.66	1.200.35	97.8
1975	1.448.88	1.483.70	97.7
1980	1.683.17	1.731.65	97.2
1985	1.979.24	2.058.02	96.2
1990	2.158.09	2.280.09	94.7
1995	2.158.09	2.280.09	94.7

2000	2.646.73	2.864.09	92.4
2010	3.430.13	4.189.29	81
2020	4.359.01	7.510.23	58
2022	4.334.19	8.538.50	51

Table 2: The Change in World Population during the Same Period [16]

Years	Total World Population In Milyard
1970	3.7
1975	4.084
1980	4.43
1985	4.8
1990	5.3
1995	6.1
2000	6.16
2010	6.21
2020	7.8
2022	8

Results and Discussions

From above information we could state that the increasing in electricity consumption during years 1970-2022 reach 7.338 TWh, While the increasing in hydropower during the same period was 3.160 TWh ,which means that consumption of total world energy was 2.332 times relative to increasing in hydropower because the hydro power plants were becoming old, so they need high cost for maintenance and spare parts which need additional cost. World population increased in the same period from 3.700 to 8.000 Milliards which was 2.162 times. As hydropower has very economical cost, without west, clean and save, so it enables planning, highly influence by climatic effects, it could be increasing by increasing the difference in water level- h and c coefficient which is relating to accuracy mounting and installation, The high advance technology of hydropower station can ergs to increase the investments in that type of very low cost relative to other energy types even that its construction its high because it saves the environment from pollution of aggressive

Wastes which is now very important .From tables 1 and 2 it could be seen that the increasing in world population was 2.162 times.

During the same period of times, and the increasing in total energy consumption was 6.965 times but the increasing in hydroelectricity production was only 3.698 times, that needs more- HE -increments. The generation of hydro. And total energy at 1970 per person were 317. 475 KWh, and 324.410 KWh, and at 2022 hydro. And total energy per person Were 541.773 KWh and 1171.659 KWh respectively .Hydro and total energies increased by 1.700 and 3.293 times respectively. The increasing in both types of energies clarified that more increasing in hydropower generation to satisfy the demand to energy is needed.

Conclusions and Recommendations

From above results we could conclude that there is large lack of hydropower relative to consumption of the world consumed energy. At the time when the generated -Hp- represents more than 97 % of consumed energy at 1970

decreased to 51% at 2022,which is not compared with its reasonable or highlight affiliates, so we could recommend to increase the investments in that important field of such clean ,sustainable, low cost energy instead of increasing investments in other destructive fields.

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