

Hydroelectric Pseudo DAM Power Generation

1. Field of Invention

The invention is a Pseudo DAM System, which incorporates the conventional DAM parameters - Heads, Flow, Density of water - to generate sizeable amount of power. The pseudo dam is built alongside the bank of lower riverbed, as opposed to a conventional dam which is built on the riverbed.

2. Background

2.1 Introduction

Hydro-power is generated by using water to make electricity. Water constantly moves through a vast global cycle, evaporating from lakes and oceans, forming clouds, precipitating as rain or snow, and then flowing back down to the ocean. The energy of this water cycle, which is driven by the sun, can be tapped to produce electricity. Hydropower uses a fuel - water - that is not reduced or used up in the process. Because the water cycle is an endless, constantly recharging system, hydropower is a renewable energy.

2.2 Hydropower Contribution to Electricity

Currently, the world's total installed capacity of hydro-electric power is about 850 GW, and hydro sources produce about 3000 TWh of electricity annually (2008 data). Hydroelectric power supplies over 15% of total world's electricity, and about 5% of its total commercial energy.

In recent years, focus and discussions on renewable energy sources have been more towards wind, tidal, solar and geothermal. Hydro technology has been neglected over the past few decades. This also implies that there are more opportunities for innovation to be deployed here.

The International Energy Agency (IEA) projects that hydro capacity growth to increase by 63% for the period 2002-2030. While the agency predicts that new hydro plants will continue to be built, it predicts that they will not be built at a rate high enough to maintain hydro's current share of electricity generation; as a result, hydro's share in electricity generation is projected to fall to 13% by 2030, from about 16% in 2009.

It is estimated that two-thirds of the world's economically feasible potential is still to be exploited and is mainly concentrated in developing countries in Africa, Asia and South America. China has used only about one-quarter of its huge hydro potential of 450 GW. It is the main contributor to hydro development today and government figures suggest that it will add more than 12 GW of new capacity each year until 2020 to reach 300 GW.

2.3 Hydro-electric Dam

Large-scale hydro-electricity generation works as follows. A dam is built on a large river that has a large drop in elevation. The dam stores large quantities of water behind it in the reservoir. Near the bottom of the dam wall there is the water intake. Gravity causes water to fall through a gate which controls water flow. At the end of the gate there is a turbine propeller, which is turned by the moving water. A shaft connected to the turbine goes up into the generator which produces the power. Power lines are connected to the generator that carries electricity to consumers

2.5 Advantages of Pseudo Dam System

Large scale dams are costly to built and take long time for survey and construction. Furthermore, dams disrupt the natural eco-systems, usually flooding large river valleys, covering a lot of native habitat with water, displacing animals and sometimes people. In China more than one million people were moved when they built their big "Three Gorges" dam. Many archaeological sites are now unreachable under water and there is environmental damage along the banks of the many tributaries of the Yangtze River.

The Pseudo Dam invention is a river diversion technique which eliminates the shortcomings of a conventional Dam and yet able to produce sizeable Hydroelectric power using the same parameters for power generation in a Dam.

Furthermore, with the advance in civil and mechanical technology, Pseudo Dam takes shorter time and lower cost to build than a conventional dam.

3. Summary

3.1 3.1 This excerpt provides an overview of the inventive methods of the pseudo dam. It is a high level overview and is by no means a detailed listing of how the dam should be built. Details will be provided in a follow-up to this.

3.2 The invention seeks to provide a system for exploiting the kinetic energy of falling water at a height to catalyze the generation of power in the dam. As a result, it is an invention for a hydroelectric system.

3.3 The system comprises:

- A penstock for falling water, vertically erected in the pseudo dam;
- One or more turbines mounted on a vertical shaft to capture the kinetic energy of falling water;
- The lower portion of the vertical shaft is mounted one or more propellers, with said propellers propelling sizeable amount of water flow towards the mouth of the hydroengine
- The hydropower engine at the bottom of the dam will generate electricity based on flow, heads, and density of water.

3.4 The followings are the various formations of the pseudo dam:

- The use of turbines can be varied, i.e., Kaplan, Francis, Turgo and Pelton Turbines
- The number of turbines can be varied, from 1 to 5 turbines
- The inclination of penstock can be diagonal or vertical

3.5 High level formation of Pseudo dam.

- Firstly, on the waterfall top, there is a catchment area (aka a headpond) constructed to reserve water. In order to reserve sufficient water for the coming of dry season, there is a need to deepen the river bed on top.
- Secondly, a long penstock will be connected from the catchment down to the pseudo dam underneath the bank of the waterfall.
- A pseudo dam is built beside the riverbed below the waterfall. The pseudo dam is built high up to contain sufficient water heads, similar to a conventional dam.
- Inside the Pseudo dam, the penstock, turbines, shaft, propellers are setup as per clause 3.3 and 3.4
- Below the pseudo dam, the hydroelectric power generator is erected.

4. Description of Drawings

4.1 This invention will be described by way of non limiting formations of the present inventions, with reference to the attached drawings as shown in figures below.

4.2 Fig 1.1 illustrates the overall architecture of the pseudo dam.

4.3 Fig 1.2 illustrates the positioning of Hydro engine and the circular flow of water in the dam. This is for Vertical penstock design.

4.4 Fig 1.3 is similar to Fig 1.2, except Diagonal penstock design is shown.

4.5 Fig 2.1 to 2.5 illustrates the cross section of the pseudo dam for use with turbines and penstock. Various types of turbines and inclinations of penstock are detailed.

4.6 Fig 2.1 shows a Kaplan or Francis or similar Turbine, with vertically direct impact of water flow on the turbines.

4.7 Fig 2.2 is similar to Fig 2.1, except the water flow impact on the turbines is from the side. Furthermore, more than 1 turbine is installed.

4.8 Fig 2.3 is similar to Fig 2.1, except the turbine's shaft is diagonally inclined.

4.9 Fig 2.4 shows diagonal shaft with more than 1 turbine installed.

4.10 Fig 2.5 shows a Pelton or similar Turbines, driving the flow.

4.11 Fig 3.1 to 3.2 illustrates another method by using fan belt to boost the power of water flow.

4.12 Fig 3.1 shows more than 1 penstock/turbine connecting via circular belt to combine the rotational energy. This is using vertical shaft.

4.13 Fig 3.2 is similar to Fig 3.1, except the turbine's shaft is diagonal.

4.14 Fig 4.1 shows the Angular propellers as they generate the water flow towards the mouth of the intake gate. Furthermore, the shape of the penstock creates a Venturi effect to concentrate the water flow into the intake gate of the hydro generator.

5. Description

5.1 Specific and various formations of the invention will be described with reference to the attached drawings, from Fig 1.x to Fig 4.x. It shall be obvious to one skilled in hydro and mechanical domains. This invention may be deployed without specific details. Some of the details are obscured to reflect only the concept of the invention. For ease of reference, common reference numbers will be used throughout the figures when referring to the similar components of the figures.

5.2 Fig. 1.1 shows the overall architecture of the invention – Hydroelectric Pseudo Dam Power Generation. First, water is redirected to catchment area (1), via drainage (2). An obstacle (3) is erected in the river to channel water to catchment (1). The remaining water of upper river (4) is passed through to the lower river (15). A long penstock (5) brings the water from catchment (1) down to the pseudo dam (6). Dam's penstock (7) drops the water down to the dam, filling the dam up to heads (10). Turbine (8) in Dam's penstock (7) is driven by falling water. This in turns transmit energy via a transmission shaft (9), which rotates the propeller (10). Propeller (10) generates water flow and drives the hydro generator (12) to produce electricity. Power lines (13) are linked to a power switchyard (14) which transmits electricity to the Power Grids for distribution to consumers.

5.3 Legends of Fig 1.x to Fig 4.x:

- 1 is Catchment
- 2 is drainage
- 3 is obstacle
- 4 is upper river
- 5 is Penstock
- 6 is Pseudo dam
- 7 is dam's penstock
- 8 is turbine
- 9 is transmission shaft
- 10 is propeller
- 11 is Dam's head
- 12 is hydro generator
- 13 is power line
- 14 is power switchyard
- 15 is lower river

- 20 is circular flow
- 21 is lower shaft
- 22 is diagonal shaft
- 25 is Vertical water impact
- 26 is Water impact by side
- 30 is Circular Belt
- 31 is Watertight closure
- 45 is Venturi effect

5.4 Fig 1.2 shows the Alternate Positioning of Hydro electric generator and using vertical shaft method. As mentioned, water is channeled from upper river (4) to catchment (1), then flows down penstock (5) to fill pseudo dam (6). Falling water drives turbine (8) and propeller (10) to generate flows towards its hydro generator. Circular flows (20) are created due to residual flow bouncing off walls. Circular flows (20) are sucked into opposite adjacent propeller which in turn produces water flow, thus creating a continuous circulation of water in the dam (6).

5.5 Fig 1.3 shows the Alternate Positioning of Hydro electric generator (12) similar to Fig 1.2, except using diagonal shaft (22) method.

5.6 Fig 2.1 shows a cross-section of Pseudo dam (6) operations with Kaplan or Francis or alike Turbine and using vertical flow impact (25). Water flows down dam's penstock (7), rotating turbine (8), which in turns rotates propeller (10) via transmission shaft (9). The equation of head (11) and water flow generated by propeller (10) generates electricity at hydro engine (12).

5.7 Fig 2.2 shows a cross section of Pseudo dam (6) similar to Fig 2.1 except water impact is from the side (26). Furthermore, this diagram illustrates using more than 1 turbine (8) to boost the rotational energy, thus generating more water flows.

5.8 Fig 2.3 shows a variant of Fig 2.1, whereby diagonally inclined shaft (22) is used instead of vertical shaft (9). In Fig 2.1, as vertical flows are redirected diagonally into the Hydro engine, flows are reduced. While in Fig 2.3, diagonal propeller (10) created flows which are directly pumped into hydro generator (12).

5.9 Fig 2.4 is similar to Fig 2.3, whereby diagonally inclined shaft (22) is used for transmission of energy, except this method is using more than 1 turbine (8) to boost the water flows.

5.10 Fig 2.5 is similar to Fig 2.4, except the turbine (8) is using Pelton or similar type. More than 1 turbine is used here to boost the water flows.

5.11 Fig 3.1 shows a method of combining rotational forces from more than 1 shaft (9), by using circular belt (30) encases in watertight closure (31). Falling water from Penstocks (7) drives turbines (8) to rotate. Vertical shaft (9) transmits rotational energy to circular belt (30), which boost the spin on the shafts of the propeller (10)

5.12 Fig 3.2 is similar to Fig 3.1, a method of combining rotational forces from more than 1 shafts (9), using circular belt (30), except the shafts are diagonally inclined (22).

5.13 Fig 4.1 shows the angular propellers (10) and the venturi effect (45) shape of penstock (7). Lower shaft (21) is turned by turbines on shaft (9). The propellers (10) are angled inwards to concentrate the flow of water towards the venturi (45) of the penstock (7). This method will generate concentrated and increased flows of water towards venturi (45) and hydro generator (12).

Hydroelectric Pseudo DAM Power Generation Claims

1. to 16.

1. A Hydroelectric Pseudo Dam system comprises:
 - A catchment area on top of waterfall or upper river
 - A tall Dam constructed on the bank of the lower river, with water reservoir of certain height.
 - A long penstock leading from the upper catchment area to lower Dam. Inside the dam, a vertically erected penstock has falling water supplied by the long penstock.
 - A spindle or shaft inside the penstock.
 - One or a few modified hydro turbines mounted on upper shaft of penstock
 - One or a few propellers on lower shaft of penstock.
 - One or a few hydroelectric generator inside the dam.
2. A hydroelectric dam system according to Claim 1, whereby the water flow from penstock (leading from catchment to the vertical penstock in the dam), with kinetic energy of falling water driving the hydro turbines on the upper shaft.
3. A hydroelectric dam system according to Claim 2, whereby the rotating hydro turbines transmit the rotational energy to the lower shaft propellers. The propellers cut through the water friction and propel strong flow of water towards the intake gate of the hydroelectric generator penstock.
4. A hydroelectric dam system according to Claim 3, whereby the water flow and pressure from heads of water, rotate the hydro turbine. The shaft from the turbine goes up into the generator, which produces the power.
5. A hydroelectric dam system according to Claim 4, whereby the electricity is generated and transmitted to a switchyard and power grids, which in turn carries electricity to consumers
6. A hydroelectric dam system according to Claim 1, whereby the pseudo dam is built on the bank of the lower river. Hydroelectric generators are placed diagonally opposite each other.
7. A hydroelectric dam system according to Claim 6, whereby the dam is oval in shape and the placement of the generators facilitates the circular motion of the water flow, thus aiding the energy flow. The dam is filled with water to certain heights to provide the pressure heads.
8. A hydroelectric dam system according to Claim 7, whereby the dam has flood gates on the side to regulate the height of the water.
9. A hydroelectric dam system according to Claim 1, whereby the turbines are modified light weight and durable turbines of type, Francis, Kaplan, Turgo or Pelton.
10. A hydroelectric dam system according to Claim 1, whereby the lower shaft propellers, are angled inwards to provide more directed flow towards intake gate of the hydro generator.

11. A hydroelectric dam system according to Claim 1, whereby the catchment area on the top is built with filters and net to prevent debris from flowing down to the dam.
12. A hydroelectric dam system according to Claim 11, whereby the top river flow is redirected by building a large drain and driving an obstacle onto the river bank next to the catchment area. The river water is contained in the catchment area.
13. A hydroelectric dam system according to Claim 1, whereby the top river, the river bed is deepened to reserve water for dry season. The river can be extensively (horizontally) deepened for a few hundred meters or more.
14. A hydroelectric dam system according to Claim 2 and 3, whereby the energy of the turbines can be increased by adding 2 or more penstocks in parallel to the main shaft penstock. Fan belt is used to tie the additional penstocks to the main shaft. The additional penstock, each has a hydro turbine catching the kinetic energy of the falling water. The rotational energy is transmitted via circular belt to add rotational force on the main shaft. The belt will be enclosed in water tight casing.
15. A hydroelectric dam system according to Claim 1, whereby the propeller is angled inwards. Propellers are angled inwards to concentrate the flow of water towards the venturi of the penstock. This method will generate concentrated and increased flows of water towards venturi and hydro generator.
16. While specific variants of the pseudo dam design have been illustrated, it is understood that many changes could be made to the current invention, which is still within claims 1 to 16, as follows:
 - a. no. of turbines, types of turbines
 - b. no. of circular belts,
 - c. no. of shafts,
 - d. no. of penstocks
 - e. no. of Hydro generator,
 - f. inclination of shafts
17. A hydroelectric dam system according to Claim 1 to 16, whereby sand can be added to increase the force of the falling water, thus driving the hydro turbine rotating faster. The sand can be drained out via built-in pipes in the bottom of the dam. The sand will be pumped up to the top catchment area during electricity off peak hour.
18. Claims to concept of power generation in pseudo dam as follows:
 - a. Standalone dam built below a waterfall or upper river
 - b. Kinetic energy from falling water rotates turbines
 - c. Turbines rotation transmitted via shafts to propellers
 - d. Propellers absorb the transmitted energy and rotate, sending water flow down to Hydro generator
 - e. Hydro electricity generated when equation of Heads (of dam), multiplied by water flows (produced by propellers).
19. A hydroelectric dam system comprising a network of the systems according to any one of the claims from 1 to 18.