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Summary

All around the world there are many different ways to produce power and electricity, but which is the best way to do so? When trying to determine the best option one has to think about many different factors. One has to think about people; how many people will this new resource benefit? Will this resource affect the surrounding towns we are producing near? Also one has to look at it in more of an environmental stand point and ask, “Is this the best resource for the town, county, state, or even the Nation or World?” one will also ask is this harming many species or is this beneficial. What one is doing when researching different resources for electricity is weighing the Pros and Cons. This is exactly what I am doing in this paper for Hydroelectric Power. More specifically I am weighing the pros and cons of two Dams in Lewis County to see how these dams have been harmful or beneficial.

Hydro Electric Power

Introduction

Hydro Electric Power is one of the leading suppliers of energy in Washington State, producing 75% of its power (Energy development technical assistance,2016). Due to hydroelectric power being a major source of energy for Washington State, the local communities in Lewis County have been directly affected by the Mossyrock Dam.

Is hydroelectric power the best option of energy production? Do the positives outweigh the negatives? This paper will look at how hydroelectric power has affected Washington State; in particular how the Mossyrock and Mayfield Dams in Lewis County have affected the community, along with its fish and wildlife.

Mossyrock Dam

What is hydroelectric power?

There are many ways to produce energy in Washington State, but a major producer of energy is hydroelectric power. But what exactly is hydroelectric power? Hydroelectric power is the clean production of energy using water. Hydroelectric power is a clean, renewable resource that generates electricity without burning fossil fuels or polluting the air (Hydro Power, 2016). Producing power is very similar in many different ways. The main difference is the resource that is used to start the process. Some examples are coal, wind, and hydropower; they all are used to power a generator that creates electric power. The steam from coal, wind, and water from hydro power move a propeller like piece called a turbine, which then turns a metal shaft in an electric generator, which is the motor that produces electricity (Perlman, 2015). The only difference is what is moving the turbine.

Hydroelectric power is using the gravitational force of falling or flowing water to move the turbine. The main idea is to build hydroelectric power producing dams on large rivers. A large drop in elevation would be another factor in deciding where to build a hydro power producing dam. The dams built on these rivers then create a large body of water to build up behind the dam. These dams are so large they create lakes behind the dams. This area is known as the reservoir. The dam then sucks water from the reservoir through the bottom known as the intake. The water is sucked from the gravitational force of the reservoir being up higher than the river it drains to below. As gravity pull water through the intake it pushes through the penstock (the flow path of the water) inside the dam that leads to the turbine (propeller), which moves from the water passing, through it. The shaft from the turbine goes up into the

generator to produce power. Then the water flows through to the other side of the dam to outflow into the river below the dam. The power produced is then sent through power lines into your home. There are multiple dams all around Washington State that contribute to the energy supply.

Power is not a product that is in high demand twenty four hours a day. Yes, power is used twenty-four hours a day, but there are peak hours when the most power is used. These peak hours are the hours when the most electricity is used; therefore this is the time of the most production for hydroelectric dams. A hydroelectric dams' power is unique because it can be used in a way that is more effective at peak hours of energy use compared to other sources of producing power. For example, more energy is used for more power during the day than at night (Perlman, 2015). Therefore, hydroelectric plants are more efficient at providing in times of high demand rather than coal, nuclear plants, or wind. This is because dams can open up the intake letting water through to produce energy, or they can close it, to not produce any energy. Dams are in control the entire time, and have the ability to stop or start production right away.

Some dams use a method of pumped storage. "Pumped storage is a method of keeping water in reserve for peak period power demands by pumping water that has already flowed through the turbines back up a storage pool above the power plant at a time when customer demand for energy is low, such as during the middle of the night. The water is then allowed to flow back through the turbine-generators at times when demand is high and a heavy load is placed on the system." (Perlman, 2015) Pump storage is a great aspect to have with the dams so the same water can be used and reused multiple times; unlike coal or nuclear power. The

ability to save up water is very useful because you can then use it when anyone needs it, whether it is to produce energy for an hour or up to as long as they need their demands met.

Mayfield Dam

It is very important to learn about histories of dams because a lot goes into the production of such a huge change to an area. Mayfield Dam was one of the biggest changes in Lewis county history, and more specifically to the Cowlitz River. Mayfield Dam is one of two hydroelectric dams built on the Cowlitz River that caused very drastic changes to its environment for many decades.

Tacoma City Light began planning to construct the dams in 1945, but delays would result in a much later completion date. Construction on Mayfield Dam began on July 7, 1955. The dam was going to be 850 feet long, 185 feet high, and would generate 460,000 kilowatts. In 1957 the production of the dam had stopped because of court action, but began again in 1959. The Dam cost $44.5 million (Mayfield Dam, 2016). However, Mayfield Dam did not begin producing power until March 30, 1963. The huge time span was because anglers and The State Game Department objected to the dam. They felt it would impact the salmon and steelhead population. To compromise Tacoma built two fish hatcheries, one Salmon hatchery and one trout (Steelhead) hatchery. Because of the court action the dam included a $4.5 million system to carry adult fish from the river over the dam into the new lake. In addition to this system the fish hatcheries cost $20 million to maintain the fish population. (Wilma, 2002) The $20 million was the price for the initial production of the hatcheries.

Today Mayfield Dam is 250 feet high (above bedrock), 850 feet long, concrete arch and gravity dam that form Mayfield Lake (Mayfield Dam, 2016). The width of the dam varies from top to the bottom. The top of the dam is 5 feet wide and the bottom is 23 feet wide (Mayfield Dam, 2016). There is 110,000 cubic yards of concrete in the dam (Mayfield Dam, 2016). As stated before the Cowlitz River is the main contributor to Mayfield Lake, but the Tilton River also contributes. According to Tacoma Power Utilities website "An 854-foot-long power tunnel passes through the right abutment of the dam and terminates at a concrete forebay structure. Four penstocks continue from the forebay structure to the four 40,500 kilowatt vertical Francis turbines for an installed capacity of 162 megawatts." The Mayfield Dam produces enough power to serve around 58,000 homes per year. The Dams average flow of cubic feet per second is 6,120. (Mayfield Dam, 2016)

The Mayfield dam created a reservoir known as Mayfield Lake. Mayfield Lake is 13 miles long, and has a shoreline length of 33.5 miles (Mayfield Dam, 2016). On the other side of the Mayfield Dam the drainage is 14,000 square miles. But the drainage side did not suffer such severe changes as the upstream of the Mayfield Dam did.

When the production of Mayfield Dam was beginning its process to start one of the issues was that towns were in the way. In regard to where they wanted to put the dam there were nice towns with people's homes, and businesses. The first step was getting people to sell their homes, businesses, and land. Most of this was done very quickly because some were not aware of what was happening, and others thought they could fight it (Sparkman, 1994). But what would happen is most people sold their land and moved to surrounding towns in Lewis County. Some businesses could relocate, but the others would just have to sell. Many people

did not get a ton of money for their land because it was either sell it or you can own land that would soon be under many feet of water. Some structures were dismantled, but many were left as is to decompose under the water.

Mayfield Lake is on top of a town called Mayfield. If Mayfield Lake were to ever drop low enough one would see remnants of the ghost town once known as Mayfield. When swimming in Mayfield Lake there are a few spots that if you had goggles on one could see what is left of the old highway road. One structure that might still have some evidence of its once service to people is the Mayfield Post Office. In April 1962, The Mayfield Post Office notified its customers that it would be closing on the 13th, after 71 years of service and serving 200 people. (The Chronicle, 2012) The week before the post office moved itself to a small house trailer a mile south of Mayfield, since the new reservoir from the Mayfield Dam would soon be filling up with water. The newspaper at the time had said, “The town may disappear under the new lake but Mayfield will keep its post office” (The Chronicle, 2012).

The history of the dam tells a lot of how it has impacted the area in so many different ways. With the size of the dam and the lake being so large the surrounding land has to be affected somehow, and many towns were destroyed because of it.

(Picture is from Chronicle)

The Picture above is a 1,062 foot bridge built for highway 12 to cross over the future Mayfield Lake. The picture allows the reader to see how deep Mayfield Lake really is when compared to a picture of what the bridge looks like today with water under it.

Mossyrock Dam

Mossyrock Dam also has a lot of history. Being just13 miles upstream form Mayfield Dam one cannot forget to involve this other half of the puzzle.

Mossyrock Dam is the tallest dam in Washington State measuring at 606 feet tall from the bedrock (Mossyrock Dam, 2016). The dam was complete in 1968 and is also on the Cowlitz River. It is also a Concrete arch gravity dam, but is also an embankment dam. The dam is 1,648 feet in length, and the width at the top is 27 feet, the bottom or base is 117 feet. The volume of concrete in the dam is 1.27 million cubic yards (Mossyrock Dam, 2016). The original investment of the dam was $117.8 million. The dam has three penstocks between 248 and 285 feet in length that extend down to the power house. The 40 year old turbine generators were replaced in the power house in 2010 and 2011(Mossyrock Dam, 2016). The two turbines in the dam are 150,000 kilowatt generators. The new turbines produce more energy but still use the same amount of water. The dam's average annual generation is 1,100,000,000 kilowatt-hours, serving about 78,500 homes. The average flow is 5,140 cubic feet per second (Mossyrock Dam, 2016). The drainage area below the dam is 1,042 square miles, which is counting Mayfield Lake because that is where it is flowing to. (Mossyrock Dam, 2016)

The Mossyrock Dam also created a reservoir that changed its surroundings. The reservoir is now known as Riffe Lake. The lake got its name from one of the towns the lake now covers. The lake's length is 23.5 miles, and the shoreline is 52 miles long (Mossyrock Dam, 2016). The lake elevation at its fullest is 778.5 feet; at the lowest allowed is 600 feet (Mossyrock Dam, 2016). Mossyrock Dam is much larger than Mayfield dam and the land allowed it to create a much larger reservoir. Today Riffe Lake stretches across three different small towns. At the end of the Dam you are in the town of Mossyrock and at the other end you are in the town of Glenoma.

Riffe Lake is very large and it has so much more space to cover, which is why it now sits on top of 3 small towns, Kosmos, Nesika, and Riffe (Mittge, 2015). Both towns were forced to move with its owner selling their property, houses, and businesses just like the people of Mayfield. As it happened in Mayfield some structures were left to be covered by water, and some were demolished. When the lake recedes down during certain times of the year structures are very visible. You can see old roads, what is left of building structures, and even old fallen bridges. Some remnants of houses you can clearly see their perfect black and white tiles flooring. These left over structures just show how many people were actually living there at one point. Many people had to relocate to new towns in the surrounding area. Some people would go to Randle, Mossyrock, or even go as far as Chehalis or farther.

Effects of the Dam to the Local Community

When these two new lakes were established from two new hydro dams it affected the community. The majority of people in the towns that were no longer there lost their jobs and business, but the new lakes give the opportunity to start new businesses. The people were very displaced (Mittge, 2015). Some people would open up gas stations on the highway, canoe and boat rentals, and even campgrounds. The changes affected a lot of people in multiple communities.

Recreation is one of the major businesses that would eventually thrive as the lakes became more and more popular. People would come to have fun, camp, boat and fish (Fish, Wildlife, and Environment, 2016). Some of the campgrounds on Mayfield Lake are Ike Kinswa

State Park, Mayfield Lake Park, Harmony RV Park, and Lake Mayfield Marina and Resort. Each campground is different and each one has their own rules, regulations, prices, and benefits.

For example Ike Kinswa State Park, you need to have a Discovery Pass to park on their property and use their boat ramps. You also have to follow all the state park rules for bookings and reservations. Mayfield Lake Park is under supervision by Tacoma Power, the company that built and runs the hydro dams. Therefore they can make their own prices and rules along with following wildlife laws and regulations. The other campgrounds like Harmony RV Park, Lake Mayfield Marina and Resort are privately owned and have their own preferences for their parks.

Some benefits of campgrounds are trees, grass, open spaces, water access (sites on the water), day use areas, boat launches, rentals, and showers, bathrooms with running water, mini stores on site, and water/sewer hookups for campers. Depending on what you may want and where you camp, each campground will have different benefits. All the campgrounds have the ability to make reservations for your family. Some campgrounds are only open during the summer though.

The Effect of the Dam on the Fish and Wildlife

With the production of the Mayfield and Mossyrock dams, there were regulations that Tacoma power had to meet in order to build these dams. One of the first guidelines that needed to be met was land for wildlife; Therefore, Tacoma Power designated lots of land

around Mayfield Lake and Riffe Lake for the local animals. A second thing Tacoma did was put in two hatcheries. One Salmon hatchery and one trout hatchery were placed in the area as part of the Cowlitz river project. The entire project of the Dams and hatcheries is known as the Cowlitz River project. The hatcheries were put into production to keep the salmon and trout population higher than it would be without the hatchery.

The Cowlitz River Project is Tacoma Powers' largest electricity generating facility. The project produces enough energy to power 135,000 homes in the northwest. (Cowlitz River Project, 2016) There is 14,000 acres designated by Tacoma Power for animals. Some animals that thrive in that environment are deer, elk, eagle, osprey, and raccoons just to name a few. Tacoma owns the 14,000 acres but the Washington Department of Fish and Wildlife manages it with funding from Tacoma. (Cowlitz River Project, 2016)

The hatcheries that Tacoma Power implemented rear Coho salmon, Chinook salmon, steelhead and cutthroat trout. You may also catch Brown bullhead, Chinook salmon, Coastal cutthroat, Coho salmon, Largemouth bass, Northern pikeminnow, Rainbow trout, Sculpin, Sucker, General, Tiger Muskie, Yellow perch (Fish, 2016). In 2002 a license for operating the Cowlitz River Project was issued for the restoration and recovery of naturally spawning salmon. At the hatcheries, naturally spawning adult fish are collected at the Salmon hatchery and hauled upstream above the dam in tank trucks. Downstream baby fish are also collected and hauled down stream to complete their journey to the Pacific Ocean. (Fish, 2016)

Conclusion

Hydroelectric Power is a very clean source of energy that can be reused; it doesn't create carbon emissions that go into our atmosphere. But to get this clean source of energy dams have to be built. There are already a ton of dams in Washington State because hydroelectric power is a major source of energy. Is the outcome of a dam worth the energy and power that comes later? Are species lives and habitats worth destroying, flooding towns, and causing people to lose their jobs? Are the positives outweighing the negatives? Is all of this worth it to get new jobs, new businesses, new recreational camping, and fishing, boating, and hunting, clean energy and less carbon emissions? Each person's opinion will vary and that is for the reader to decide.

Due to hydroelectric power being a major source of energy for Washington State; local communities in Lewis County have been directly affected from Mossyrock Dam and Mayfield Dam. Are the new positives worth the negative that the people at the time had to deal with? In my opinion, out of the many resources of energy in Washington State there are plenty of consequences that take place, but there are some positives as well. Until a better source of producing energy is found, hydroelectric power is a dependable option.

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