Partners FOR the Saskatchewan River Basin

SASKATCHEWAN RIVER BASIN

Hydroelectric Operations

Flick on a light, crank up the air conditioner, plug in the snow blower, and somewhere water turns a turbine to product the hydroelectric power that you need. Generating electricity is an important use of water in the Saskatchewan River Basin.

More than three million people live, work and play in the Saskatchewan River Basin and many depend on hydroelectricity. In Manitoba, almost all of the province's electricity comes from hydroelectric dams. Approximately six percent of North America's water flows through Manitoba and the rivers in Manitoba that supply power have more than twice the hydroelectric potential of Niagara Falls. To date, only 50% of this potential has been harnessed for electricity. Manitoba has 15 hydroelectric generating stations or dams. Most of Manitoba's hydroelectric power is generation by five dams on the Nelson River, which receives 30 percent of its flow from the Saskatchewan River Basin.

Hydroelectric power produces about 20 percent of Saskatchewan's electricity and Saskatchewan has seven hydroelectric generating stations or dams. The majority of Alberta's power is generated by fossil fuels, although there are 22 hydroelectric generating stations or dams in Alberta. The majority of the stations are small power producers.

Hydroelectricity comes from flowing water, which turns turbines to generate electricity. There are two types of hydroelectric power plants:

Reservoir power plants store water upstream by building a dam. Water flow through the dam can be adjusted like a tap to generate only the amount of power needed.

Run-of-river power plants don't use dams. Instead, water takes a detour from the river through a tube. The flow of the water in the tube produces electricity and is then sent back into the river. The amount of electricity generated depends on the flow of the river.

Not all dams within the Saskatchewan River Basin produce electricity. Dams of all sizes have been constructed for irrigation, flood control, recreation and other uses. Managing all of the uses of dams is a complex task!

POWER FACTS...

- Electricity is measured in kilowatt hours (kwh). It takes one kwh to light ten 100-watt light bulbs for one hour.
- In a thermal station, production of one kwh of electricity requiries 140 litres of water, most of which returns to the river.
- In a hydroelectric generating station, 8-12,000 litres of water passing thriough the turbines generates one kwh of electricity.
- Originally built by the federal government to supply power to Banff Park, TransAlta's Cascade Plant is one of the few hydro plants located in a National Park.

HOW DOES WATER MAKE ELECTRICITY?

Water rushes down a rapids or over a waterfall with an energy of its own. A hydroelectric power station harnesses that energy to create electricity. Water flows into a power station at an intake gate, and is channeled through a penstock to turn huge turbines. Each moving turbine rotates a generator which produces electricity. The water leaves the power station at the tailrace and flows downstream. Alternating current electricity from the generators passs through a transformer and is then carried by transmission lines to our homes and businesses.

Water can be stored in the reservoir which is formed upstream of the dam. Excess water, perhaps after heavy rains or spring runoff, flows down the spillway without turning the turbines. Controlling the amount of water entering the turbines allows TransAlta, SaskPower and Manitoba Hydro to supply the level of electricity needed by their customers.

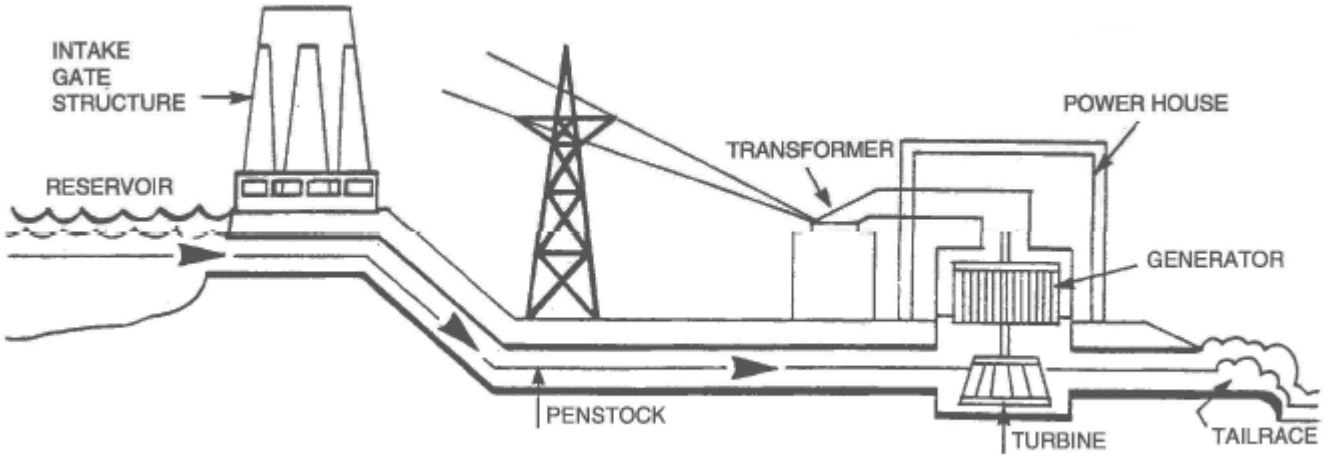
What Happens When a Hydroelectric Dam is Built?

Building a hydroelectric dam causes changes in a river. Some of these changes or impacts are positive while others are negative. The impacts of each dam in the Saskatchewan River Basin vary, depending on the size and lcoation of the dam.

When a dam is constructed, land along the river may be flooded and a reservoir formed. The amount of flooding depends on the size of the dam and how flat or hilly the region is. Flooding may mean that people have to move their homes, heritage sites may be lost and wildlife habitat changed. Fish are particularly affected. Changes to fish habitat and erosion, which increases sediment in the water, alter the fish species which thrive in the reservoir. The dam itself can block fish mvoement. Operation of the dam raises and lowers the level of the reservoir, affecting its use by humans and animals.

We make environmental trade-offs for the benefits provided by hydroelectric dams. In adition to generating electricity, the hydroelectric dams help water management within the Saskatchewan River Basin. For example, the Coteau Creek Hydroelectric Power Station was built as part of the Gardiner Dam on the South Saskatchewan River. The Gardiner Dam and Lake Diefenbaker provide water needed for towns and cities, industries and the irrigation of crops. During flood years, dams can help to reduce damage to homes, businesses and agricultural lands. Boaters, swimmers and sports fishing enthusiasts also enjoy the lake created by the dam.

Water passing through the turbines of a hydroelectric station is available to users downstream. Unlike thermal generating stations which depend on non-renewable sources to produce electricity, water passing through a hydroelectric generating station is a renewable and continuous source of power.



The flow of water in a hydroelectric station

Grand Rapids Dam
Photo courtesy: Manitoba Hydro

Thermal Generation

Not all of our electricity comes from hydroelectric dams and the importance of hydroelectricity varies across the prairie provinces. The other major source of electricity in the Saskatchewan Rivr Basin is thermal generating stations. Thermal stations are especially important in Alberta and Saskatchewan. These burn coal to produce electricity. Water is important for these stations because it is needed for cooling.

The cooling water from thermal generation stations may impact the aquatic ecosystem. Water is withdrawn at one temperature and may be returned at a higher temperature after it has cooled the steam driving the turbines. Even a few degrees warmer can affect fish and other aquatic organizism. For example, fish may be fooled into spawning too early in the spring. The impact is greatest in winter, however, especially if the station does not operate continuously, causing sudden drops in the river temperature when operation stops. Fish may experience thermal shock when the warm water outflow from the plant is disrupted.

Solutions to these impacts, such as installing fish fencing around the warm water outlets, have been developed. Although some solutions may be expensive to build and maintain, such as cooling towers and ponds, utilities that operate thermal generating stations and discharge warm water directly into streams and rivers must find ways to reduce their impacts.

Case Study: Grand Rapids

Construction and operation of hydroelectric generating stations affect those people who live near the dam and the reservoir. First Nations peoples are often directly impacted, particularly from projects undertaken in northern regions. The electricity benefits people far away, while First Nations people must adjust to the local environmental changes.

Begun in 1960 and completed in 1968, the Grand Rapids Generating Station straddles the Saskatchewan River just before it drains into Lake Winnipeg. A large reservoir was created out of Cedar Lake and other lakes upstream of the dam, flooding 1,280 square kilometres of land. Several First Nation communities experienced adverse effects from the project, impacting fishing, trapping, recreation and other traditional pursuits.

In the last 45 years, mitigation and compensation have resolved many issues between the affected First Nations, their communities and Manitoba Hydro. The new community of Easterville was constructed for residents of the Chemawawin Reserve displaced by the flooding. To support the commercial fishery of Cedar Lake, a fish hatchery was constructed at Grand Rapids, incubating walleye, whitefish and trout eggs.

In 1990 and 1991, Manitoba Hydro reached settlement agreements resolving outstanding concerns with all the communities affected. The financial settlement will be used to create new opportunities for members of the First Nation.

Photo credit: Ducks Unlimited Canada

Lake Sturgeon Rehabilitation

Lake sturgeon are a slow-growing and long-lived fish and are among the the largest fish in the basin. They require up to 20 years to reach sexual maturity and may only spawn once every seven years. They migrate over long distances and because of their long life, they can tell us much about what is happening to the environment in which they live. Populations of lake sturgeon once thrived throughout the basin from Winnipeg to Edmonton.

Lake sturgeon generally spawn in shallow water at the base of falls. This characteristic has made them especially vulnerable to hydroelectric dams as many of their spawning grounds were destroyed when the dams were constructed 20, 30 and 50 years ago; their migration routes were also blocked. The low reproduction rate of the species reduces their ability to recover rapidly. A once thriving commercial fishery has been virtually eliminated, and at one point, fisheries managers belived lake sturgeon to have disappeared from many of their traditional waters.

Hydroelectric utilities are working to bring back the lake sturgeon. Both Manitoba Hydro and SaskPower participate in lake sturgeon management commitees who first priority has been to better understand this elusive species. A substantial amount of research, detailed scientific study and public education initiatives are all under way. Radio-tagging and monitoring programs in Manitoba and Saskatchewan indicate that the species may be more numberous than expected. To help restore the lake sturgeon population a provincial hatchery has been established at Grand Rapids, supported in part by Manitoba Hydro. The fingerlings will be used to reintroduce the species into areas where they have been lost. In 2012, the hatchery successfully raised and released 33,000 sturgeon.

Photo courtesy:Robert H. Pos/U.S. Fish and Wildlife Service

What YOU Can Do: Be Power Smart!

Governments and agencies in the Saskatchewan River Basin are taking positive steps to protect the environment and manage the water resource, while ensuring a reliable supply of electricity.

Reducing the amount of electricity used in homes, industries and businesses is an important way to reduce the impacts on rivers in the Saskatchewan River Basin. Less demand for power, even as our economy grows, means that the need to build new hydroelectric or thermal power stations can be delayed. For existing thermal stations, less coal needs to be burnt and less water is needed for cooling.

The Power Smart program is one way that energy efficiency is promoted. TransAlta, SaskPower and Manitoba Hydro are members of Power Smart and have many customer-oriented programs for energy conservation. Individual actions contribute to reductions in electricty usage. Contact your utility or Partners FOR the Saskatchewan River Basin for further information.

You can make a difference!

For More Information

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