

# Manitoba Hydro

# Kelsey Generating Station

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The Kelsey Generating Station was built on the upper arm of the Nelson River in northern Manitoba between 1957 and 1961 to supply the International Nickel Company's (INCO) mining and smelting operations in the Moak Lake and Mystery Lake areas. Kelsey was also built to supply electricity to the City of Thompson. Six years after completion, the generating station was linked to the province's electrical system. Kelsey is located 680 kilometres (km) by air from Winnipeg, and was the first Manitoba Hydro generating station to be built on the Nelson River. It is about 137 km upstream from the Kettle Generating Station.

Kelsey's original five turbine generators (called units) operated with a 17.1-metre (m) head, which is a waterfall created by the generating station's structure. Each unit pro-

duced 30 megawatts (MW) for a combined output of 160 MW. In 1969, a sixth unit was installed to provide an additional 30 MW. It was added to meet the power requirements of INCO's expansion program in Thompson as well as to supply electricity to the construction site of the Kettle Generating Station, which was completed in 1973.

When the decision was made to put in the sixth generating unit, it was also decided to prepare the concrete portion for a seventh generating unit and its intake. This was eventually added to the generating station in 1972 to supply extra electricity to the provincial electrical system.

Currently with a capacity of 211 MW, three more units can be added at the generating station in the future to bring the capacity to 464 MW.

The Kelsey Generating Station is operated as a base load station, which means all seven units operate at maximum output all of the time (units at other generating stations are turned on and off in response to demands for electricity). Kelsey supplies power to the provincial power system through 138-kV transmission lines to Thompson, and to the high voltage direct current (HVDC) system at the Radisson Converter Station, which is located three kilometres south of Kettle. Kelsey solely supplies northern communities through transmission lines running directly from the generating station — to Split Lake, Gillam, Ilford, and Churchill, and nine communities on the east side of Lake Winnipeg. The communities of Oxford House, God's Lake, God's Lake Narrows, Garden Hill, Wasagamack, God's River, Red



*The interior of the Kelsey Generating Station's powerhouse*

Sucker Lake, St. Theresa Point, and Island Lake, previously received limited supplies of electricity produced by a diesel-fueled generating station within each community.

### **The powerhouse and spillway**

The concrete and metal-clad powerhouse was built across a channel of the Nelson River. Before it was begun 135 382 m<sup>3</sup> of earth and 249 348 m<sup>3</sup> of rock had to be removed. All the generating equipment is housed inside the building, while the transformers are located on the outside deck downstream of the generating station, and the switching equipment is on the roof.

The Nelson River's water level in Kelsey's forebay (the lake-like body of water upstream of the generating station) is controlled by a spillway located a short distance away from the powerhouse (see the photo on the opposite page). The spillway has nine vertical lift sluice gates with a total water discharge

capacity of 7 082 m<sup>3</sup> per second.

At the time that coarse aggregate (broken rock) was being excavated for the concrete needed in the station's construction (as well as rock fill for building the cofferdam, for maintaining the railway spur, and for constructing an air strip), it was decided to also excavate the rock needed for a portion of the forebay, and for the future water intakes for units eight, nine and 10.

### **The station's construction**

The building of the cofferdam at the site of Kelsey's powerhouse was completed on April 30, 1958, then pumped dry a month later. A cofferdam is a temporary, watertight, island-like enclosure that is built across the river where construction takes place. The first concrete for the powerhouse was poured on September 1, and by the end of 1960 four of the first five generating units installed in the structure were in service. At a record-setting pace, the switching

station, spillway and tailrace were completed, which permitted the cofferdam to be removed.

For the construction of the Kelsey Generating Station, geography had to be altered to fit the engineering design. A large neck of land extended from the far shore across the course of the river and made a sharp turn down the one side of the peninsula. It then completed a turn of 180° and returned up the far side.

To change this, a channel was built to direct the spreading river into the spillway. Over 458 000 m<sup>3</sup> of earth had to be excavated during this part of the project. A second channel was then built to accommodate the powerhouse, and a number of auxiliary dykes were constructed to create Kelsey's forebay.

During the original construction phase between 1957 and 1961, a total of 22 937 m<sup>3</sup> of material was placed in the dykes and main dam.



*This aerial view of the Kelsey Generating Station shows the powerhouse (upper left) and the spillway (far upper right) a short distance away. The geography of the area did not lend itself well to having the spillway built "run-of-river" — that is, built adjacent to the powerhouse.*

### **Henry Kelsey, the trader**

The Kelsey Generating Station is named after the Hudson's Bay Company (HBC) employee Henry Kelsey, who was the first white man to explore the northern interior of Manitoba.

In the early 1690s, Henry Kelsey entered the words "mighty with falls" in his diary to describe the rivers of northern Manitoba. To Kelsey, the numerous falls, rapids, and cataracts were unavoidable obstacles which deterred his progress into the unexplored areas of Manitoba. To electrical engineers nearly three centuries later, these same falls, rapids and cataracts represented power to be harnessed.

The European traders and explorers who opened up the north-west all displayed fortitude and

hardiness, but few adjusted to the land and its inhabitants as well as Henry Kelsey. Originally from London, as a young boy he was apprenticed to the HBC in 1684 and sent to Fort York on the Hudson Bay. While there, he quickly learned the language and life-style of the natives.

Beginning in the summer of 1689, Kelsey, then a lad of 20, was sent from Fort York on various excursions to establish trade relations. On one of his trips along the Saskatchewan River, he came to an Indian village which he named Deering's Point, after an HBC official. Historians speculate that this may have been the site of the town now known as The Pas.

It was from Deering's Point that Kelsey conducted his two most significant exploratory probes into

the west. On one of these two trips, Kelsey and his guides travelled through the park belt and into the prairies.

Also on this trip, Kelsey became the first white man to see the treeless plains and the mighty buffalo that roamed them.

*Kelsey House, the staffhouse which provides a home away from home for Kelsey's transient operating and maintenance staff, is located about half a kilometre from the generating station. Most of the staff live in various northern communities and are flown in and out of Kelsey to work shifts of eight days on and six days off. Kelsey House has 32 bedrooms and six suites. Also a weight room and a dining room (the caterer's menu reads "best care anywhere").*

### **Kelsey Generating Station facts**

Construction started	1957
Construction completed	1961
Cost	\$50 million
Capacity	211 MW (potential 464 MW)
Average annual generation	1 800 million kW.h
Waterfall drop	17.1 m
Powerhouse	Length: 202.5 m Width: 53.7 m
Number of turbine generators (units)	7 (each turns at 102.9 rpm)
First unit in service	1960
Production of units	approximately 30 MW each
Units' total discharge capacity	1 713 m <sup>3</sup> /s of water
Forebay area	708 km <sup>2</sup>
Forebay's normal water level	184.4 m
Spillway sluice gates	9, each measuring 12.2 m by 13.6 m
Spillway's discharge capacity	8 495 m <sup>3</sup> /s of water
Transmission lines	Three 138-kV to Thompson One 138-kV feeding Split Lake Two 138-kV to Gillam feeding Gillam, Ilford, and Churchill One 138-kV to Island Lake area feeding seven First Nation and two off reserve communities

### **Major contractors**

General civil contract	McNamara Construction Co. Ltd. (Toronto) and Brown and Root Ltd. (Edmonton)
Turbines	Dominion Engineering Co. Ltd.
Generators	Canadian General Electric
Cement	Portland Cement
Intake gates	Dominion Structural Steel Ltd. (Montreal)
Spillway gates	Canadian Vickers (Montreal)



For more information contact:  
Public Affairs  
Manitoba Hydro  
P.O. Box 815  
Winnipeg MB  
R3C 2P4  
(204) 474-3233

