Brock University Niagara Community Observatory

Working Paper
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A History of Hydroelectric Power Generation in Niagara, Pre–1969

> *Niagara! To thee my spectacles I turn! O what a deaf'ning noise thy tortur'd waters make! The thunders of thy voice kept me all night awake: I could but hear the lumbering sound, when all were sunk in sleep profound…O what a waste of water-power is here! 'Twould move ten thousand water-wheels and run them thro' the year! Well might the Yankee say—be still—oh what a place to build a mill.*[1]
>
> —Rolph Thomas, 1836.

Introduction

Rivers and natural waterways are symbolic of not only Canada's physical landscape, but cultural one as well. They tell the grand narrative of nation-building and collective identity that helped shape our country's political, economic, and social development.[2] Before colonization, the Niagara River was an important crossroads while the Niagara Falls were a predominant spiritual and physical resource for Indigenous peoples and their lifeways.[3] Fish and other meat were collected from animals that went over the Falls, and the Haudenosaunee built agricultural villages nearby. Prior to the advent of major hydroelectric generation in Canada, natural waterways and tributaries were used to power Niagara's first industries. As time passed and technological advances in waterpower developed, Niagara became one of Canada's leaders in the generation of hydroelectric power. Hydroelectricity comes from the energy produced by falling or moving water which turns blades or turbines connected to generators that convert this energy into electricity,[4] and this process would soon become synonymous with Niagara's economic, political and social development.

Hydroelectric power generation in Niagara was a catalyst for the region's significant industrial developments at the turn of the 20th century. Without the hydroelectric power sector, many of Niagara's other key sectors like manufacturing and tourism would not have developed or even been a fraction as successful as they are today.

Niagara Falls, painted in 1792 by Elizabeth Simcoe. Courtesy Archives of Ontario.

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This paper will explore the beginning of this sector in the late 18th century, when mill owners in Niagara began producing the region's first energy in the form of water wheels attached to mills.[5] It will then follow crucial technological advancements within the sector through to the end of the 1890s, recounting hydro policy and its development through time. These policies would lead to the creation of the Hydro-Electric Power Commission of the Province of Ontario (HEPCO), the fight for publicly owned power, and the creation of some of the largest and most advanced hydro plants in the world, in Niagara Falls, Ontario. These projects would create thousands of jobs for the community, attract new industries to the region, while improving and strengthening existing sectors.

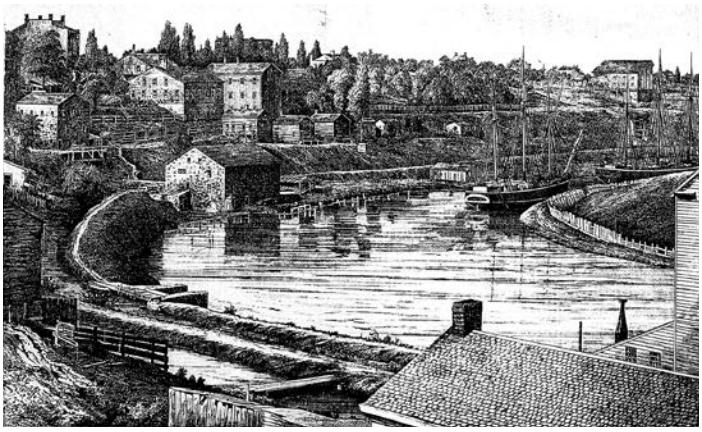
Natural Waterpower

Before the construction of hydraulic raceways and, eventually, the Welland canals, Niagara communities relied on the Niagara River and its tributaries to power industries. Beginning around 1779, families set up saw and grist mills along the Four-Mile Creek in Niagara-on-the-Lake in response to Fort Niagara's struggle to supply provisions for its soldiers.[6] This was followed by multiple mills being constructed along the Twelve-Mile Creek in St. Catharines, such as Hamilton Merritt's grist and sawmill. However, the creeks powering the water wheels had an irregular water flow and the Twelve-Mile Creek suffered from an irregular water supply, often sitting idle during dry periods in the summer. As a result, Merritt began to envision a hydraulic ditch that would divert water from the Chippawa Creek (Welland River) to St. Catharines. This "ditch" housed a surplus of water that would help power industries suffering from the irregular water supply of the river.[7] However, by 1823, while the Erie Canal was under construction, Merritt expanded his plans to build a canal which would link Lake Ontario and Lake Erie via Chippawa Creek and the Niagara River. Subsequently, a feeder canal was constructed in 1829 to divert additional water from the Grand River, supplying an adequate amount of water (and power) for both the canal and industries.[8]

Hydraulic Raceways

Eventually, hydraulic raceways began to look more appealing to Niagara business owners. Hydraulic raceways were man-made enclosed pathways that directed steady flows of water to power mills and industry. Before the colossal undertakings of the hydroelectric plants in the early-20th century, hydraulic raceways had a major impact on Niagara's development and quality of life, which paved the way for modern-day hydroelectric production.

With the opening of the First Welland Canal in 1829, more shops, mills, and factories began to crop up along its course as ship traffic increased. These industries took advantage of the abundance of hydraulic power provided by the canal which, in addition, provided a cheap transportation route for the immediate shipment of goods to both Canadian and international markets during the 19th century.[9] During the early 1830s, a series of hydraulic raceways were built, allowing more mills and factories in canal-side communities to be established in St. Catharines, Merritton, Thorold, Welland and Port Colborne. Other businesses, such as shipyards and drydocks, were also quickly set up along the canal.[10] As canal communities continued to expand and grow through the late 1800s, the raceways could not supply sufficient power to the towns and most raceways were filled in during the late 1920s.



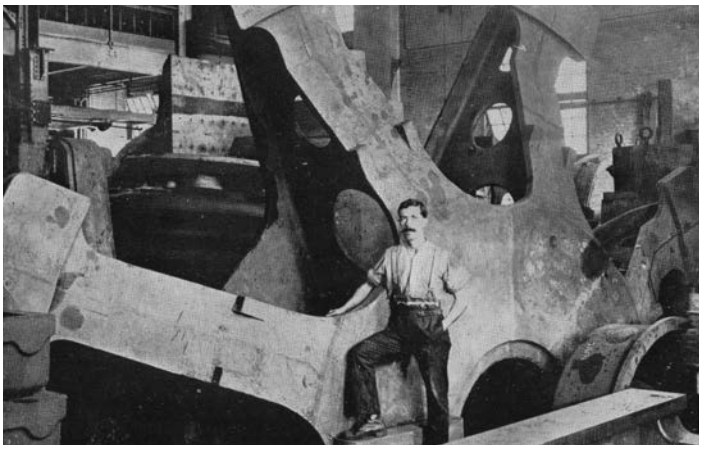
View of a hydraulic raceway in St. Catharines, drawn in 1871. Courtesy of The Canadian Illustrated News.

Waterpower Developments

Although not Canadian in origin, it is important to note the achievements of the Niagara Falls Power Company in further developing waterpower technology. The electric light and power industry would not have made its extraordinary achievements if it wasn't for the adoption of the alternating current which the Niagara Falls Power Company publicly supported and later implemented.[11] First formed in 1892, this New York-based company sought the help of some of the most prominent engineering minds in Europe at the time, prompting the formation of the International Niagara Commission, with its headquarters in London.[12]

Marking one of the first notable international conferences of scientists for industrial purposes, the Commission included as Chairman the renowned British physicist and mathematician William Kelvin, who had recently become the first scientist to be elevated to the House of Lords, and the British civil and mechanical engineer, William

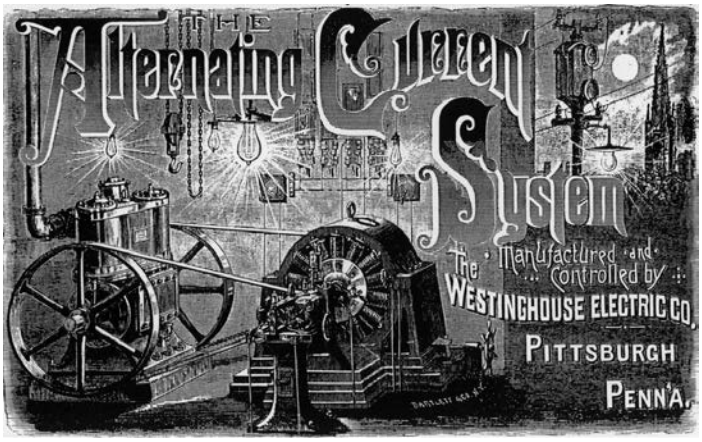
Cawthorne Unwin, who recorded the meetings. After many meetings and investigation, the Commission announced on Dec. 14, 1891 its decision to abandon the old method of waterpower development, which used a mill over a wheel pit, and to adopt a central station for the development of waterpower and its distribution by compressed air, electricity or water under pressure.



Part of an upper bracket for one of the Generating Units during construction of the Queenston Generating Station, c. 1920. Courtesy Brock University Library Archives and Special Collections.

On May 6, 1893, the official decision was made to adopt an alternating current and the first contract for electrical generators was put into effect in October of that year for three alternators of 5,000 horsepower (hp) each.[13]

The late 1890s were known as the "war of the currents," with American inventor Thomas Edison vehemently defending direct current—an electrical current that runs continually in a single direction. This was the standard current for the days of early electricity in the U.S and Canada. However, the Serbian engineer Nikola Tesla, who had moved to the United States in 1884, encouraged the



An 1888 advertisement for the alternating current system. Courtesy of Iwona Rudinska, "The Tesla Collection."

switch to alternating current—a current that could be converted to different voltages by using a transformer.[14]

The transmission of electricity always involves energy loss but transmitting electricity at higher voltages minimizes these losses. The higher the voltage the more "push" sent toward the charged particles, creating an electric current. Direct current was incapable of easily changing voltages which made alternating current appealing to many industries.[15] On Nov. 16, 1896, the city of Buffalo, New York, was lit up by alternating current from Niagara Falls, and after this event many industries began to make the switch from direct to alternating current.[16]

Niagara's Early Hydro Politics

By the late-19th century rapid hydroelectric development was taking place across North America and, by 1886, there were 45 water-powered electric plants in Canada and the United States.[17] On the Canadian side of Niagara Falls, hydroelectric policy first developed within the framework of parks and recreation policy, and thus the hydro and tourism industries became intertwined on a larger scale. The goal was to keep the aesthetic appeal and touristic value of Niagara Falls, while also harnessing the economic potential of hydroelectric power generation. In this way, provincial leaders orchestrated the development of the tourism sector around the Falls—protecting significant sections along the parkway that remain green and inviting to visitors today.

During the late 1800s, many locals and tourists alike complained about the gaudy commercialism that began surrounding the Falls. In response, in 1880 Ontario Premier Oliver Mowat introduced a bill which cleared jurisdictional ground for the federal government to obtain land for a national park located at the Falls.[18] The need for a park was later confirmed by a Royal Commission and in 1887 the Queen Victoria Niagara Falls Park was incorporated, which led to the Commissioners buying up the lands in the vicinity of the Falls. Mowat's Act also stated that there was to be no fee for entry to the park and that it would be self-sustaining and not aided by legislative grants. Their attempt to create a park with no financial assistance made the Commissioners look to the hydroelectric industry for help.

Around the same time as the Queen Victoria Niagara Falls Park was developing, American lawyer William Birch Rankine, who had helped found the Niagara Falls Power Company in 1889 on the American side of the Falls, recognized the potential for hydroelectric power on the Canadian side.[20] As a result, Rankine founded the Canadian Niagara Power Company which would become the first to build a hydroelectric generating station on the Canadian side of the river.

Subsequently, an agreement was reached between the Commissioners of the Queen Victoria Niagara Falls Park and the Canadian Niagara Power Company on April 7, 1892, for a license with the exclusive right to produce electricity within the park.[21] This partnership would be mutually beneficial with the park attaining the financial assistance it so desperately needed while the Canadian side of the river finally began to harness the Niagara Falls for hydroelectric purposes. However, during this time there was no market in Canada for major hydroelectric power production and as a result, companies like the Canadian Niagara Power Company sought to transmit electricity physically to the U.S.[22]

Queen Victoria Park in Niagara Falls. Courtesy Niagara Parks.

Earliest Hydroelectric Power Production in Niagara

Although Niagara didn't see major hydroelectric production until the early 1900s, there were still significant achievements being made on a smaller scale throughout the region. These allowed businesses and families throughout Niagara, including in rural areas, to take part in revolutionary technology and improve methods of communication and transportation, increase productivity, and drive growth.

One of the earliest developments of hydroelectricity in the region was in 1886 when the St. Catharines Electric Light and Power Company formed and began producing electricity using a small generating station at Lock 5 of the Second Welland Canal. This produced electricity for 15 streetlights along St. Paul Street, and later powered the streetcar system.[23] Additional generators were set up at the Canada Hair Cloth Factory using water from the canal to produce power for the factory as well as some surrounding homes. Moreover, a power plant was established below Lock 3 on the second canal and by 1897, Cooke & Sons had set up a steam-powered generator.[24]

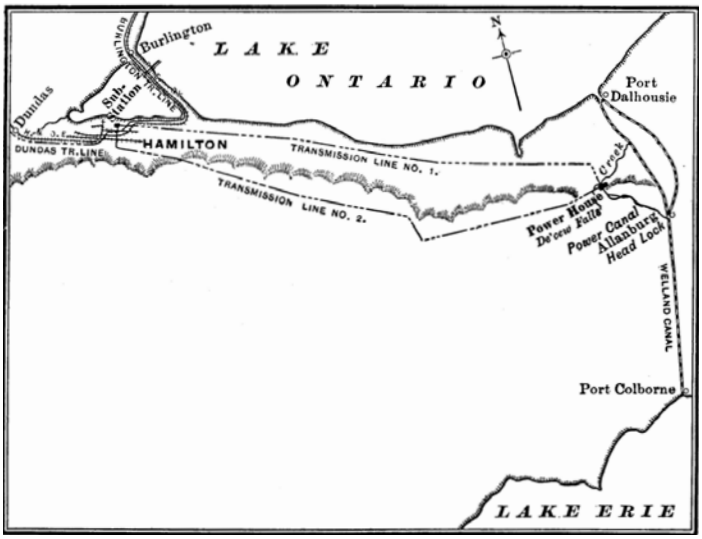
In Niagara-on-the-Lake, the Municipal Waterworks Plant, built in 1891, was a steam plant that provided electricity for its residents before the hydro revolution.[25] The first lights were installed in 1893: the 700-volt Heisler system was one of the first incandescent light systems in the world. The pump house, also built in 1891 and located on Ricardo Street at the mouth of the Niagara River, served the community until 1983, supplying water for the town from the Niagara River.[26] Not only did the station supply water, but the steam-powered pumps also supplied electricity to some of the neighbourhoods.

Around the same time as these pioneering hydroelectric projects were being established, the first plant at Decew Falls in St. Catharines was built and began operation in 1898 with two 1,500-hp units. The electricity generated then travelled through high voltage wires on wooden poles spaced 90 feet apart, heading towards Hamilton. The line followed the Grand Trunk Railway westward to the company's substation on Victoria Avenue in Hamilton. The men who started this largely experimental endeavour were from Hamilton, forming the Cataract Power Company. They chose the southwest corner of St. Catharines at Decew, with its steep cliffs, Twelve Mile Creek natural trail race for the powerhouse, and potential for a consistent water supply from the Welland Canal at Allanburg via a feeder canal to create storage reservoirs around Beaver Dams.[27] Once again it was Niagara's unique geography, coupled with its growing commercial network, that provided the production capacity necessary for large-scale industrial operations. It powered businesses, electric railway transportation, factories, and eventually rural farms and homes in Hamilton and Niagara soon after.

Within a 14 year period, the power plant's capacity was expanded four different times and was officially finished in 1912 by the Cataract Power Company.[28] Decew was recognized as a pioneering project in the generation and transmission of electrical energy as it produced higher voltages at greater distances and on Aug. 25, 1898, Decew Falls No. 1 plant transmitted power (22,500 volts, 66 2/3 Hertz, two-phase) a distance of 56 kilometres to Hamilton, Ont.[29] The plant was acquired by the Hydro-Electric Power Commission of the Province of Ontario (HEPCO) in 1930 and continues to generate power for Ontario today with a second station, Decew Falls No. 2 plant, added in 1943.[30]

As the 19th century ended, Ontario was faced with a difficult problem. Up until then, Ontario relied mainly on foreign sources of energy like coal to produce its electricity despite the early successes of the Welland Canal and Decew Falls plants. The great coal famine of 1902 increased the frustration and need for an alternative source of energy, and, most importantly, one created in Ontario and run by Canadian companies.[31] Additionally, during the late 1800s,

private American companies like the Canadian Niagara Power Company and the Ontario Power Company began building generating stations on the Canadian side of the river with the sole purpose of transmitting the electricity back to the U.S. It wasn't until the early 1900s when Canadians began to protest this export of hydroelectricity that Premier George William Ross set up a Commission to investigate the possibilities of supplying electricity to places within 150 miles (241 km) of Niagara.[32]



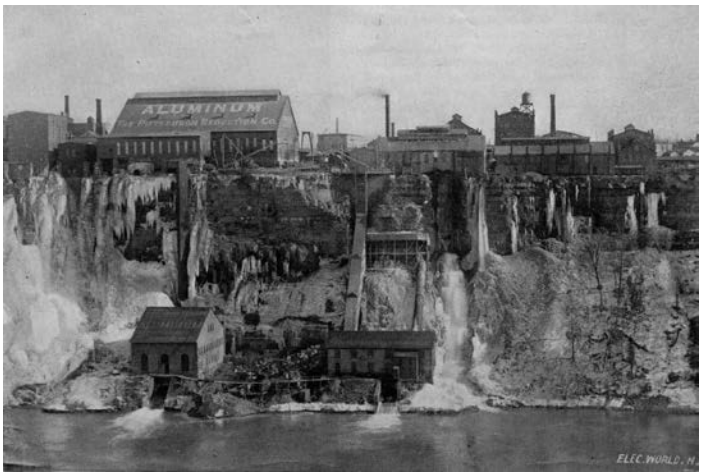
This 1906 drawing shows the location of the powerhouse, feeder canal, and transmission lines connecting the facility at Decew Falls to Hamilton. Courtesy of Electrical World and Engineer.

The Argument for and Against Hydro

As waterpower technology continued to develop, most Niagara communities looked favorably on the hydroelectric industry. However, there were a few members of the community who fought back against the utilization of Niagara Falls despite the efforts of the Queen Victoria Niagara Falls Park Commissioners, stating that these developments "would grievously impair, if not entirely destroy" the scenic beauty of the Falls.[33] H.G Wells, the famous American science-fiction writer, shared this sentiment, reflecting on what costs such massive industrialization along the Falls would bring. In a 1906 magazine article, titled "The End of Niagara," Wells stated that the Falls had already been destroyed by hotels, factories, powerhouses, bridges, and tramways, illustrating how "ugly and defiling"[34] such industrialization is to the natural landscape. He predicted that the social and industrial processes would win the conflict and "capture Niagara altogether.[35]

Although overdramatic at times, these outlooks were not entirely unwarranted. Hydroelectric technology of this calibre had never been seen before, especially in this capacity, and some people were worried that a beautiful landmark would turn into a landscape of ugly factories. In response to these criticisms, Harold Buck, chief electrical engineer of the Niagara Falls Power Company, stated that people couldn't ignore the potential economic benefits that this hydroelectric project could bring to Niagara.

Buck argued that hydroelectric development at Niagara was not the result of vandalism or capital greed but a "physical expression of the law of supply and demand.[36] He emphasized that the demand for this power was a direct result of the actions and desires of both Americans and Canadians. He argued that both manufacturers and consumers would benefit, as products would be less expensive with the implementation of this electricity. Buck, like many community members, engineers, and businessmen, argued that the economic benefits of this project could not come secondary to that of the scenic interests.



View of Niagara Falls Hydraulic Power & Manufacturing Company's station from the Canadian side. Courtesy Brock University Archives and Special Collections.

Thomas Keefer, a successful engineer and businessman from Thorold, had shared a similar sentiment several years earlier. Keefer recognized the substantial success and prosperity hydroelectricity could bring to the region and the rest of Canada. In 1899, he stated that, because of the rapid development of hydroelectricity in Canada, there would be a second industrial revolution, which he predicted would take place at the dawn of the century. Not only would hydro provide a cheap and abundant energy source for industry, but he anticipated that, "the by-products and applications of electrical technology would bring to Canada entirely new manufacturing processes."[37]

This is exactly what happened. The Niagara region became home to industries like aluminum, paper, carbide, chemical, abrasives, and electro-metallurgical factories, which had

not been in existence a decade earlier. Most significantly, however, Keefer recognized that even above the employment benefits, hydroelectricity would transform the use of raw materials—plenty of which Canada possessed but had not been able to manufacture into actual products until the advent of hydroelectric power.

An example of this can be seen in the paper industry where waterpower could turn pulp into paper, yielding Canada 10-times the value for which spruce and pulp wood was currently exported. Furthermore, Keefer touched on another significant reason why hydroelectricity was so important for Canada: it would "deliver the Dominion from its hewer of wood servitude to American Industry and its bondage to American coal."[38] Canada relied almost entirely on exports, mostly from the United States, for its coal. Discovering and implementing a self-sustaining energy source for Canada was monumental for its economic and industrial development.

Niagara's Early Hydro Politics and the Creation of Ontario Hydro

After the creation of Queen Victoria Niagara Falls Park in 1887, the park Commissioners looked to the hydroelectric industry for financial assistance. Consequently, that same year Ontario sold exclusive waterpower rights to the Canadian Falls. Colonel A.D Shaw of Watertown, New York purchased those rights and then sold them to the U.S-owned Niagara Falls Power Company.[39]

During this time, Ontario governed the hydroelectric industry by "retaining title to waterpower in the hands of the Crown and by leasing waterpower privileges instead of selling them outright."[40] The Park needed this revenue to buy additional property next to the Falls and convert this into a riverfront greenspace that would also be used to accommodate additional powerhouses. However, during this time, the Niagara Falls Power Co. found it was more profitable to transmit its electricity back to the U.S instead of transmitting it to small manufacturers in southwestern Ontario. As government officials and the Canadian public soon realized, these private hydro utilities were negatively impacting local industry and efforts were made to intervene and reverse the privatization of hydroelectric development.

A few years earlier, 25 businessmen and politicians had met at the Walper House on June 9, 1902, in Berlin, Ont. (now Kitchener-Waterloo). It was here that a crusade was launched "to capture the magic force of electricity from its private owners and make it serve the common man."[41] Organizers E.W.B Snider and D.B Detweiler, along with the keynote speaker of the meeting, Alderman Frank Spence of Toronto, presented a solution to recapture private hydro ownership. They introduced the idea of a government Commission to control the transmission of power to municipalities in Ontario. It was at this moment the hydro revolution began.

In 1905, newly elected Premier of Ontario James Whitney declared, "the waterpower of Niagara should be as free as air…it should not in future be treated as the sport and prey of capitalists."[42] Soon after, Adam Beck, former mayor of London and a manufacturer, became Ontario's Minister of Power and introduced a bill that was passed on June 7, 1906, creating the Hydro-Electric Power Commission of the Province of Ontario (HEPCO),[43] and took his seat as chairman.

During the same year that HEPCO was created, the preservation of the scenic beauty of the Falls came into question once again. As more hydroelectric projects were being constructed, people worried about the Falls and surrounding land and how it could be potentially ruined by these projects. Abraham Lincoln once commented on the aesthetic value of the Falls, stating that the value of the great cataract was not so much in its grandeur of power as in its "power to excite reflection and emotion," in the people who viewed it.[44] With this sentiment in the minds of businessmen, tourists, and locals alike, a bill was passed on June 29, 1906, known as the Burton Act. This Act would control and regulate the waters of the Niagara River for the purpose of the preservation of Niagara Falls, restricting the amount generated and transmitted to both the U.S. and Canada.[45] This Act was one of the first successful attempts to recognize and implement regulations regarding the preservation of the Falls for scenic purposes.

Although this hydroelectric development and the positive legislation that went along with it were turning a profit and creating obvious improvements, there was still concern over the private ownership of these plants. In a 1909 magazine article on the topic, Henry M. Hyde warned the people of Ontario, "WAKE UP! The public lands—the richest patrimony that ever fell to the lot of careless and purblind people—have already passed into the clutching hands of organized greed and cunning."[46] He continued that water was a gift from God but that it was already being heavily exploited by private companies.

However, with the rise of HEPCO in the early 1900s came the promise of a "people's power," one that relied on a rhetoric of fairness and transferring of cheap electricity—"power at a cost"—to middle class and small manufacturers rather than favoring the rich Torontonians and U.S citizens across the border.[47] The motivation for this public utility focused on providing cheap and accessible electricity which, as a result, would accelerate a growth economy. In the beginning, this meant industrial growth, lighting and streetcars.

However, in the 1920s and 30s it would focus more on domestic individual comforts and conveniences. In a 1935 advertisement for hydro lamps, published in its company bulletin, HEPCO asks the reader if they ever had eyestrain from trying to read in low, spotty lighting. The advertisement then recommends hydro lamps as they are made for "easy, comfortable seeing" and their low prices allow for light in every room in the house.[48] Hydro-powered household appliances, most notably electric ranges but also electric toasters, coffee makers, irons, washing machines, and refrigerators became increasingly accessible to Niagara residents, and hydro companies such as Canadian Niagara promoted this new technology. The popularization of electricity for home use had a significant impact on the lives of Niagara's women, both rural and urban, by making domestic labour less physically-demanding and time-consuming.[49]

As electricity became more available across North America, it promised an improvement in living standards. Enterprising businesses benefited from Niagara Falls' commercial potential through the sale of electric home appliances. The economic value of this natural wonder had gone far beyond its original tourist draw, as many had predicted.

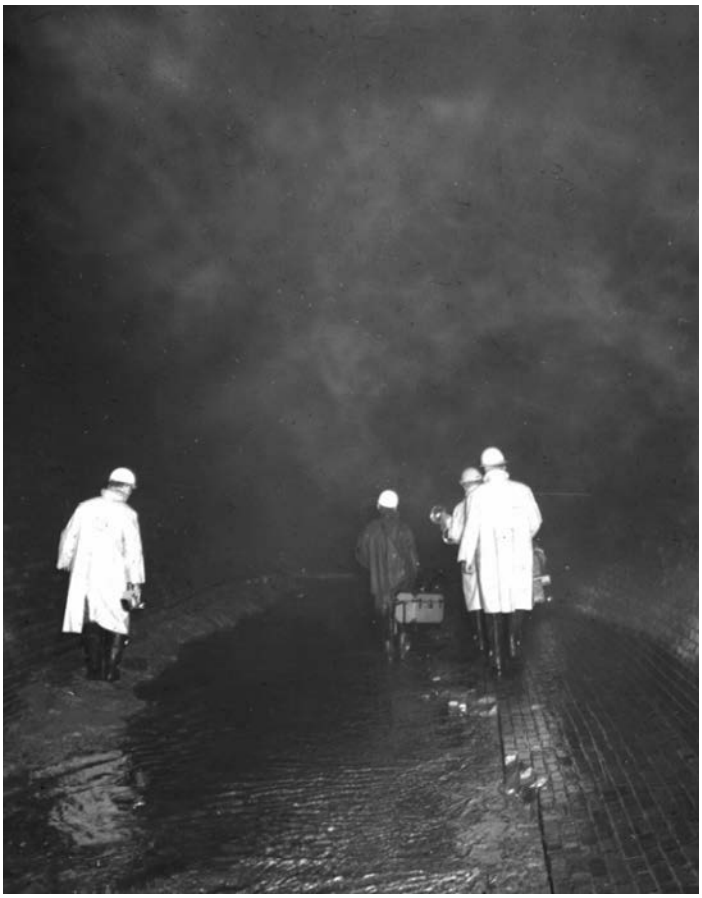
Hydro's First Power Plants

During the first decade of the 20th century, three hydroelectric stations were completed on the Canadian side of the Falls. These were built by the Ontario Power Company, Electrical Development Company, and the Canadian Niagara Power Company. The first in Niagara Falls, Ont. was the American-owned Canadian Niagara Power Generating Station. This generating station contained a canal, forebay, powerhouse, wheel pit, generators, turbines and an underground tunnel. Water was diverted from the Niagara River to the forebay where it travelled through the penstocks to the turbines located in the wheel pit.[50]

Ontario government officials were disappointed in the additional power stations being constructed on the Canadian side of the Falls as they were mostly owned by Americans who were uninterested in the improvement of the Ontario economy and the wishes of its residents. The power stations were much more preoccupied with the lucrative industrial markets of Toronto and Buffalo, and by 1910, 64 per cent of the power generated in Canada was exported.[51]

Regardless, the new power being produced by these companies and the jobs they created saw Niagara Falls and the surrounding area begin to rapidly expand. Between 1890 and 1910 the population on the Ontario side almost tripled.[52] Before these pioneering hydro projects took place, the population comprised mostly of British-descent: English, Scots or Americans of similar background.[53] By 1911, a major demographic change was seen as 13 per cent of the population was now recorded as being of "foreign" descent with most identifying as Italian, Austro-Hungarian or Eastern European.[54] This was as a result of the rapid influx of foreign immigrants to the Niagara region in hopes of work, including on the numerous new hydro projects.

The economic development of the hydroelectric sector in Niagara was powered by a steady working class of men who excavated, constructed, and maintained these operations—many of them immigrants working in precarious conditions for low pay. Some 90 men lost their lives during the 13-year construction of the Queenston-Chippawa Plant, completed in 1930.[55] Death notices include descriptions of electrocution, being crushed by equipment, and falling from heights. In addition to local Niagarans there were Russians, Bulgarians, Italians, Poles, Englishmen and Canadians listed from other provinces. Thousands of these forgotten workers built the foundations that underpinned the sector's future commercial success and its ability to improve the lives of people throughout the region and beyond.



The Canadian Niagara Power Company generating station's tailrace tunnel. Courtesy Brock University Archives and Special Collections.

Queenston-Chippawa Plant

As the demand for power increased, Adam Beck, still chairman of the Hydroelectric Power Commission, realized he needed to find another source of hydroelectricity as it was predicted the present available power supply in Niagara would be exhausted before 1920.[56] The Commission first requested the construction of a new plant in 1913, however it was not approved until 1917 as the demand for the manufacture of war munitions was using up almost the entire power supply in the region at the time. Throughout the First World War the Steel Company of Canada doubled its steel output in Hamilton. New shipyards produced military and merchant ships out of Welland.[57] Beck promptly sent surveyors and engineers into the Niagara Gorge where they found a small rock face at Queenston.[58] The plan for the new development was to take water from the upper Niagara River at Chippawa and feed it into a canal that went around the Falls, delivering it to a clifftop 12 miles downstream.

The Commission had the ability to create its own waterfall which was almost twice the height of the natural Falls. The water would plummet 294 feet into turbines below with two to three times the force of water at the actual Falls.[59] Construction began in May 1917 where this arrangement would allow the use of a full head of water between Lake Erie and Lake Ontario, twice the available head of the other plants at Niagara Falls and, as a result, delivering twice the amount of power using the same diversion of water.[60]

To put in perspective how monumental this construction was, it was stated that 2,000 men at an average wage of $35 a week moved five times as much material just to dig the canal as was used to build the Great Pyramids.[61] The first unit began producing electricity in 1921, however, the whole plant officially finished in 1930. In 1950, on the 25th anniversary of Adam Beck's death, the Queenston-Chippawa Plant was renamed Sir Adam Beck Niagara Generating Station No. 1.

Electric locomotive c. 1918 during the construction of Sir Adam Beck G.S. #1. Courtesy Niagara Railway Museum.

Prior to the completion of the Queenston-Chippawa Plant there were three Acts passed in 1916 providing further power to the Hydroelectric Power Commission that would develop and ensure the success of the Queenston plant.[62] The first of these was the *Power Commission Act*, which allowed the Commission to create regulations regarding design and construction for the generation, transmission and distribution of electricity and could also order corrections, removals or alterations at any time to any works.[63]

Next came the *Waterpowers Regulation Act* which gave further powers to the Commission, including the ability to appoint inspectors to take measurements as well as test the quality of water used, the electrical efficiency, and amount of power developed and available. It also gave the Commission power to fix the quantity of water to be taken.[64] Lastly, The *Ontario Niagara Development Act* allowed the Commission to enter and survey all lands, water rights and privileges, while also entering into preliminary contracts for the purchase of land for right of way, location of buildings, and plant construction. This would allow for the diverting of the Niagara and Welland rivers as well as tributary waters, to develop electricity.[65] The *Niagara Development Act* gave the Commission specific powers to develop waterpower and generate electricity on the Niagara River, and to run the newly constructed Queenston-Chippawa Plant more efficiently.

Soon after the renaming of the Queenston-Chippawa Plant to Sir Adam Beck Generating Station No. 1 in 1950, work began to enlarge the plant's original capacity of 441,000 kilowatts (kW) in the form of another generating station. This station, named Sir Adam Beck Generating Station No. 2, would be located six miles downriver from the Falls, on the side of the 300-foot cliff of the lower Niagara River Gorge and just upstream from the No. 1 plant.[66] The first unit began generating power in April of 1954, while the completion of the whole 16-unit plant occurred in 1956.[67]

In addition to the developments happening at the Adam Beck Generating Station, the Niagara Diversion Treaty of 1950 came into effect. This treaty, between the U.S and Canada, ensured the preservation of the Falls for scenic purposes, stipulating that the diversions of water for power purposes should not reduce the flow over the Niagara Falls to less than 100,000 cubic feet per second in the daytime during the tourist season, and 50,000 cubic feet per second at any other time.[68] This policy is still in effect today.

Welland Hydro

While Niagara Falls was known around the world for its pioneering hydro projects, Welland was known locally as a crucial industrial centre. However, Welland would never have attained this reputation without adequate hydroelectricity. The industrial expansion of this municipality exemplifies the vital role of hydroelectric power generation for the historical development of Niagara's manufacturing sector. Beginning in 1887, the Welland Electric Company obtained a franchise from the Town of Welland to supply street lighting at its intersections. These lights were powered by a waterwheel in a raceway at the west end of West Main Street, near the pumping station.[69]

As the 20th century dawned, the demand for house lighting gradually increased and, as a result, the second generator installed to meet this demand quickly became inadequate. The company looked to the Dominion Power and Transmission Company, who at the time were pioneers in the transmission of power from far distances. The company had lines built to Welland, supplying power from Decew Falls to Plymouth Cordage Company (which made twine and rope), and the Beatty Plant (a foundry and machine shop).[70] Dominion began supplying the Welland Electric Company with power and the replacement of carbon lights to tungsten in 1906. Nonetheless, on Aug. 6, 1912, the citizens of Welland voted to purchase the privately owned distribution system for $45,000 and, consequently, a contract for a supply of power from HEPCO was signed September 30, 1912.[71]

Subsequently, in January 1913, the first members of Welland Hydroelectric Commission took office while 500 lighting and 18 power customers were recorded that same year.[72] Additionally in 1913, a 60,000-volt line from Niagara Falls was constructed by HEPCO that gave Welland, "unrivalled power services."[73]

By the time Welland Hydro had formed, many industries were already established in the city, thanks in large part to the abundance of power available for businesses. The Montreal-based Empire Cotton Mills was set up in Welland a few years after the 60,000-volt line was installed, and dozens of other manufacturers followed suit between 1920 and 1930, including Volta Manufacturing, Welland Iron and Brass, Stokes Rubber, Welland Electric Steel, and Atlas Steel Company.[74]

In addition to this, the Welland Electric Company provided power to Port Robinson until 1925 when HEPCO took over the assets. More rural parts of Welland and Port Robinson were also sold to HEPCO's Welland Rural Power District.[75] Following this, there was a steady growth of electrical usage as more industries came to the city and the quality of life and household conveniences improved for everyone. This can be seen most notably in July 1961 when Welland Hydro's customers doubled from 5,534 to 10,549 overnight, following the annexations of parts of Thorold, Pelham, Crowland and Humberstone townships.[76]

Hydro & Rural Areas

Most districts in the Niagara region received their electrical power the same way, beginning with small waterwheels to meet the needs of the community and local businesses and then through HEPCO. The company promised Ontarians that rural districts would not miss out on the new hydroelectric power. This power operated the chopping mills, cream separators and threshing machines while lessening the burden of cooking, washing, ironing and sewing which "transform[ed] the domestic tasks of the farm wife."[77]

An Ontario farm supplied with hydrolectricity by the Hydro-Electric Power Commission, c. 1920. Courtesy Brock University Archives and Special Collections.

HEPCO promised that this power would finally bridge the gap between the comfort of life on the farm and the comfort of living in towns and cities. Not only did hydroelectricity improve the standard of living on the farm but, in some cases, was the deciding factor in its success or failure. In a 1935 study, the output of two poultry pens were compared, with each pen kept under the same conditions aside from one being equipped with electric lighting. It was discovered that the production of the lighted pen exceeded that of the unlighted by 166 dozen, which could be the deciding factor in whether a farm succeeded or failed.[78]

Contrary to HEPCO's statements that hydroelectricity was available even in the farthest rural parts of Ontario, some rural communities still struggled to obtain this new power. While much of Niagara Falls and Welland were enjoying the benefits of hydroelectricity during the early 1900s, some districts on the outskirts of the region were still in the dark. In a scathing article written in the *Grimsby Independent* in 1924, the author reflected on Grimsby's frustration and disappointment in not being supplied with hydroelectric power even two years after residents voiced concerns. At this point, the village had approximately 2,000 residents compared to the 14,700 in Niagara Falls and 8,600 in Welland.[79] The author described how this delay made the community and himself feel unimportant and ignored. There are many examples of this, as the early decades of hydro favored city centres because that is where most industries were located.[80]

Considering the struggles rural households and businesses faced at the beginning of the 20th century, notable progress was made by HEPCO in 1951 for rural customers. In Ontario, an estimated 3,415 miles of line was constructed (about the width of the United States) and an estimated 31,486 rural customers were added. That meant the total number of customers was now doubled from six years earlier (to 318,606) and the total length of rural line installed was estimated at 38,134 miles.[81] From January 1 to November 30, 1950, the consumption of electricity by rural hydro customers in Ontario was 858,294,000 kilowatt-hours. Consumption in the following year totalled one billion kilowatt-hours, an overall increase of 16.7 per cent and an increase of 15.7 per cent in Southern Ontario.[82]

World War II and Hydro

Adam Beck developed and advanced hydroelectric power generation in Ontario from the ground-up, while creating hydro's biggest power operation of its kind in the world. However, 14 years after his death in 1925, as Ontario began to report on its ample supply of power for generations to come, Hitler invaded Poland. It is estimated that during the Second World War, 25 per cent of hydro's production went into the war effort with Niagara turbines turning around the clock.[83]

This was succinctly put in a 1943 advertisement depicting the efforts of both the hydro and chemical industries: "hydroelectric energy, the handmaiden of progress in peacetime, [was] indispensable in time[s] of war."[84] During this time the chemical and hydroelectric industries worked together to develop formulas for powerful explosives, depth bombs, land and sea mines, and chemicals for flame throwers. As a result of the increased demand for chemical industries and the subsequent increased need for hydroelectricity to power them, more hydro plants were built. Between 1914 and 1942, hydro utilities in Ontario operating in municipalities increased from 49 to 323, while the number of domestic consumers grew from approximately 65,000 to 560,000.[85]

Laying power conduit along the parkway, c. 1905. Courtesy Niagara Railway Museum.

Environmental Impacts of Hydro

Despite the late 19th-century warnings to temper the exploitation of Niagara Falls as an economic resource, there were ultimately some negative environmental impacts in the decades that followed. By the turn of the century, industries were scrambling to relocate to the Falls to take advantage of the abundant hydroelectricity. However, the most evident of these were the chemical industries on the U.S side that began to form a clustered line of steel buildings, smokestacks and furnaces. One of the oldest accounts of a chemical spill from these industries was reported in a newspaper on May 27, 1899.[86] According to the report, a large plume of poison and dead fish was tracked back to Union Carbide, a chemical plant on the U.S. shore. This company was dumping chemical waste into the Niagara River from railroad cars.

With the influx of industries to the same location along the U.S. and Canadian shores, the Niagara River became severely polluted. In the decades leading up to the 1970s, the worst dumping took place in the Niagara River because of the minimal rules and regulations in effect to protect public health. During the 60s and 70s, Maid of the Mist captains and tourists alike began complaining of the horrible smell and scum that coated the waters.[87]

As a result, wildlife in the area was dying and the last of the commercial fishing industry died with it. In addition, scientists began to discover that the toxins being dumped at Niagara Falls had reached wildlife hundreds of kilometers away in the St. Lawrence River, with chemical counts being so high that some whale carcasses qualified as hazardous waste.[88]

Although hydroelectric power is viewed as a "cleaner" source of energy today, it continues to have substantial negative impacts on the environment. Hydroelectric generation produces a significant amount of methane, which is caused by the decomposition of plant matter in flooded areas. Additionally, fish populations can be severely impacted by these projects. The diversion of water out of major water bodies can injure fish populations: dams remove water needed for healthy ecosystems, fish become disorientated by slow reservoir pools which impact migration, and bacteria form from the decaying vegetation which can cause changes in mercury levels.[89] This mercury, which is present in rock formations underlying a reservoir, can become water soluble where fish can then become poisoned with toxic amounts of it as well as people who rely on fishing for food.

Conclusion

The hydroelectric revolution in Niagara and all of Canada began with men like Daniel Detweiler and E.W.B Snider in a waffle house in Kitchener. Along with Adam Beck, previously the mayor of London, men of spectacular vision led the campaign for a publicly owned electric system in Ontario. As a result of this historic meeting, HEPCO was created, promising "people's power," cheap and abundant hydroelectricity for the people of Ontario.

With the expansion of the Commission and subsequent takeover of privately owned power companies, towns like Welland, St. Catharines and Niagara Falls began to see a rapid growth of industries and population density while witnessing some of the biggest hydroelectric projects in the world. By 1921, the Queenston-Chippawa Plant had begun producing electricity while Decew Falls No. 2 plant was added in 1943.[90] During the 20th century, rural areas located on the outskirts of the Niagara region finally began to reap the benefits of hydro power, which was proven to improve not only livestock quality, but the standard of living as well.

The exploitation and control of Niagara Falls for hydroelectricity was a key development in Niagara's history not just for hydroelectricity, but tourism as well. Unlike other hydroelectric power plants and control works in North America that dominated the landscape, the ones at Niagara Falls were largely hidden. As a result, Niagara Falls contained an uninterrupted curtain of water that, "was pleasing to the eye and reduced spray onto visitors",[91] creating a better tourist experience. As a result, this extraordinary landscape continues to draw large numbers of tourists to the area and is what makes Niagara Falls stand apart from the rest of the hydroelectric world.

Image Credits

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