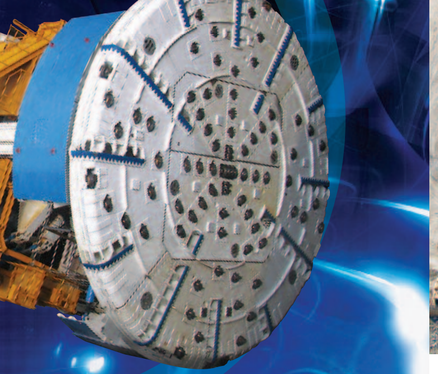
THE NIAGARA TUNNEL



A MAJOR OPG CLEAN-ENERGY INITIATIVE

ONTARIO POWER GENERATION

BUILDING THE TUNNEL

Ontario Power Generation contracted Strabag, the Austrian design build contractor, through an international competition. Strabag is recognized worldwide for its expertise in large-tunnel construction. The majority of its 230-member Niagara Tunnel workforce, though, comprises a roster of Canadian talent.

This aerial photograph shows the intake end of the tunnel, at the International Niagara Control Works upstream from Niagara Falls. Strabag has subcontracted to several Canadian firms for work at the tunnel intake and outlet. The intake structure and other civil engineering activities are progressing as planned.

BIG BECKY

To build a tunnel this size, you need a very, very big drilling machine. So in 2006, the Strabag experts shipped in machinery parts from all over the world to the job site at Niagara Falls. They brought parts in by road, by sea, and by rail. And then they built the largest hard-rock Tunnel Boring Machine (TBM) in the world: Big Becky. At an incredible 150 metres in length and 14.4 metres in height, Big Becky deserves the name. Becky weighs more than 4,000 tonnes.

KEEPING SAFETY A TOP PRIORITY

Construction on the tunnel has been slowed by challenging rock conditions and it is now expected to be in service at the end of 2013. The project is still good value for Ontario's electricity consumers. While challenges remain, OPG is committed to complete the tunnel with safety as the number one priority. When complete, the Niagara tunnel is designed to operate for about one hundred years before requiring maintenance.

Workers use Big Becky's computer guidance system to keep her progress on course to within a few centimetres. After each advance of 1 to 2 metres, Big Becky pauses as workers support the surrounding rock with steel ribs, wire mesh, rock bolts and shotcrete, which is sprayed on concrete. As the tunnel boring machine progresses, a huge conveyor belt system carries the excavated rock out of the tunnel. It's expected to carry out enough rock to fill 100,000 dump trucks and some of it will be used on the project, while the excavated Queenston shale will become feedstock for Ontario's clay brick manufacturers. Big Becky works twenty hours a day, seven days a week. Every day, the TBM takes a four-hour break so that workers can complete safety checks and regular service to keep Big Becky in good working order.

As Big Becky progresses through the rock, workers reinforce the walls and ceiling of the tunnel to ensure long-term stability. In this photograph (top right), workers apply wire mesh.

Safety is always the top priority in the tunnelling process, even if it slows down progress (bottom right). Here a worker reinforces the rock immediately above the area Big Becky is about to dig into. The workers drill long holes into which they insert long poles called spiles to support unstable rock.

At the worksite, 140 metres underground, no one can tell if it's day or night. Be it noon or midnight, the work goes on seven days a week, all year long. With the exception, that is, of one day. On December 4, the machinery is turned off and the workers walk into daylight to honour the feast day of Saint Barbara, the patron saint of tunnellers and miners.

For further information about OPG's Niagara Tunnel, Visit www.opg.com or contact:
Richard Schwass
Senior Communications Advisor, OPG
richard.schwass@opg.com
1-877-592-2555 extension 2679

Recycled
Design, Print, Distribution: OPG Office Services

Speak the name of Niagara Falls, and Ontarians cast their minds to the spectacular Horseshoe Falls and the city's reputation as the Honeymoon Capital of the world. Now Ontarians have another reason to be proud of Niagara Falls – the Niagara Tunnel, a major clean-energy project by Ontario Power Generation (OPG).

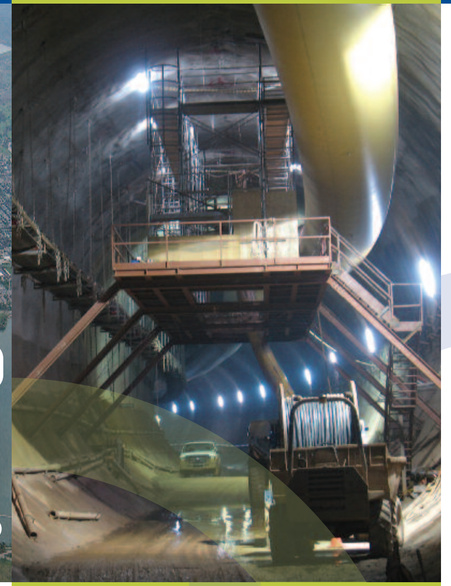
As you read this booklet, the largest hard rock Tunnel Boring Machine in the world is hard at work, drilling a massive tunnel deep beneath the City of Niagara Falls. It will be an incredible 14.4 metres wide and 10.2 kilometres long. OPG planned this unprecedented feat of engineering to divert water from the Niagara River and carry it downstream to the Sir Adam Beck Generating Stations. Gravity alone will propel the water at a very fast 500 cubic metres per second. Think of it this way: that flow of water would fill an Olympic-sized swimming pool in a matter of just five seconds.

OPG's Niagara Tunnel will be a source of pride not only as an engineering feat, but also as a practical solution for meeting Ontario's energy needs through clean sources. The Niagara Tunnel will allow OPG to provide enough clean water power to generate a further 1.6 billion kilowatt-hours of electricity annually – enough to meet the electricity needs of about 160,000 homes. Ontarians now and in the future will all benefit from the hard work taking place now – with minimal maintenance costs, all this energy will be generated year-in, year-out for a hundred years or more.

TUNNEL ROUTE

The Niagara Tunnel will run below Stanley Avenue, next to two existing OPG water diversion tunnels. Water that flows into the tunnel entrance, just above the Horseshoe Falls, will quickly drop about 100 metres. Unheard and unseen, the water will rush around the falls, underneath the city, and onward to its destination: the Sir Adam Beck Generating Stations.

HOW BIG IS IT?



The Niagara Tunnel is 14.4 metres high – as high as a four-storey building. It's so big you could drive a double-stacked container freight train through it with plenty of room to spare.

ONE MORE STEP TO A GREENER ONTARIO

One of the largest producers of electricity in North America, Ontario Power Generation operates sixty-five hydroelectric stations, three nuclear stations, five fossil-fuelled stations, and two co-owned gas-fired stations. Altogether, OPG supplies about 70 per cent of the electricity Ontario uses every year.

ANTICIPATING THE FUTURE

Ontario needs electricity to light homes and schools, run businesses and hospitals, and drive the economy. Through conservation, individuals and businesses are working to reduce Ontarians' per capita energy needs. But conservation alone cannot provide for the energy needs of a growing population.

HYDROELECTRICITY – MAKING SENSE

Hydroelectricity has a long and storied past in Ontario. This clean, renewable source of energy fuelled the province's dramatic economic growth in the first half of the twentieth century and continues to supply about 25 per cent of Ontario's electricity.

WHY DOES HYDROELECTRICITY MAKE SO MUCH SENSE TODAY? HERE ARE FOUR KEY REASONS:

- Hydroelectricity is clean – it produces no pollution and minimal greenhouse gases.
- Hydroelecticity is a renewable resource. Like solar and wind power, water power will never run out. OPG has a wealth of experience and expertise in harvesting the energy potential of falling water.
- Hydroelectricity preserves the natural environment. All water used is returned, with no added pollutants or temperature change.
- Hydroelectric facilities are long-lasting. They can run with minimal maintenance for a hundred years or more.

HOW DOES A TURBINE WORK?

There are several stages involved in transforming the water power of Niagara Falls into the electricity that lights up your home.

1. Water is diverted from the Niagara River at a high elevation (above the falls).
2. It makes a detour around the falls through deep, underground tunnels that bring it to the hydroelectric power generating stations, where the drop to the lower Niagara River is about 89 metres.
3. In the power station, the water rushes through a pipe called a penstock, where it strikes the rotating blades of a turbine.
4. The water makes the turbine spin very fast.
5. The spinning turbine blades are attached to a shaft, which in turn is attached to the generator's electromagnets. These also spin very quickly.
6. When the spinning electromagnets pass through stationary coils of wire, electricity is created in the coils.
7. The electricity travels along electrical wires to transformers where the voltage is increased for long-distance transmission over power lines.

(at left) Sir Adam Beck No. 1 Generator