



(Photo courtesy Nova Scotia Tourism and Culture)

*Nova Scotia Power's Annapolis Tidal Power Generating Station, by the Bay of Fundy, attracts over 40,000 tourists annually.*

# Nova Scotia Power... A Tidal Power Pioneer Adds Wind To Its Renewable Resources

**N**ova Scotia Power Inc., (NSPI) the first North American utility to include tidal energy in its power grid, will soon be adding wind power to its electrical system arsenal.

Based on available-wind studies, Nova Scotia Power has selected Western Valley, the Amherst area, and the western coast of Cape Breton as potential sites for installation of the first of two wind 600 kilowatt turbines purchased by the utility.

In early February, in three of the communities expressing a strong interest in wind energy, NSPI, along with community representatives, co-hosted open houses to give local residents the opportunity to gain a better understanding of the site selection process and of wind power in general.

“Providing emission-free electricity harnessed from the wind is an important part of our goal to improve air quality in Nova Scotia,” said Terry Toner, envi-

ronment manager for power production, Nova Scotia Power. “We are looking for a community to be a partner with us in launching this program and showcasing this technology in the province.”

In addition to the purchase of two commercial wind turbines, Nova Scotia Power has also requested independent power producers to supply up to 50 megawatts of wind power to the provincial grid. The company wants to enter into discussions leading to long-term

contracts with wind power producers, local or world wide, willing to build wind turbines in Nova Scotia to supply the provincial grid.

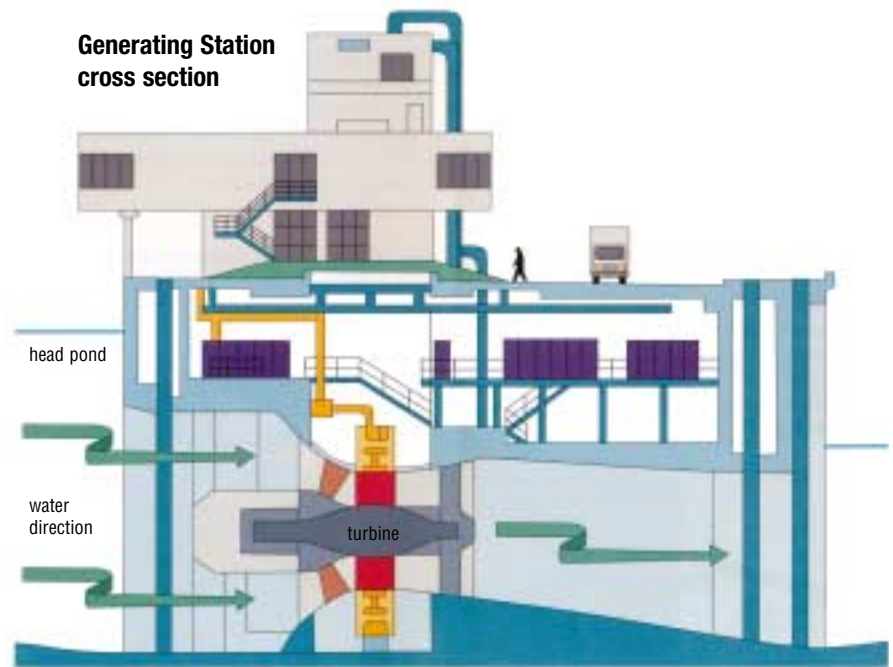
“A number of circumstances are combining to make this the right time for wind power,” said Joan McDougall, manager of green power development. “The technology has matured. Nova Scotia has an abundance of this renewable energy source. And consumers across the country and here in Nova Scotia are saying they are ready for green power.”

Criteria for the first Nova Scotia community to be selected for commercial wind power will be based on factors such as a stable wind regime, strong community support, proximity to the power grid, and potential for expansion. Site selection will be made this spring and installation of the wind turbines is scheduled for completion this year.

The selection of a launch community for the first two wind turbines, which will be able to produce enough energy for about 400 homes, opens the door for other communities in the province to participate in future wind power development.

### **Annapolis... One Of Three Tidal Generating Plants In The World**

Nova Scotia Power distinguished itself as being home to the first and only modern tidal generating plant in North America. In 1984, the company assumed operation of the Annapolis



Tidal Generating Station, a federal and provincial government pilot project initially designed to explore harnessing energy from the sea that now contributes its 20 MW capacity to the provincial grid. Construction of the Annapolis project began in 1980, was completed four years later, and carried with it high expectations for its technology to find application not only for tidal power but also for low-head rivers throughout Canada.

Annapolis station is one of three tidal power plants in the world. Of its two counterparts, the largest one is located

in France on the estuary of La Rance, near St. Malo, with a generating capacity of 240 MW on the incoming and outgoing tide, while the smallest is located in Russia on the White Sea, with a capacity of 0.5 MW.

The Annapolis plant is located on a small island at the mouth of the Annapolis River near Annapolis Royal, by the Bay of Fundy - a bay noted for producing the highest tides in the world. Tides at the Bay of Fundy's eastern extremity, in the Minas Basin, average 12 metres but can reach up to 16 metres in height. Besides the Bay's

exceptional tides, another factor that favoured locating the station at Annapolis was an existing causeway already equipped with sluice gates for control of a head pond that would be required as a key component of the power plant's operation.

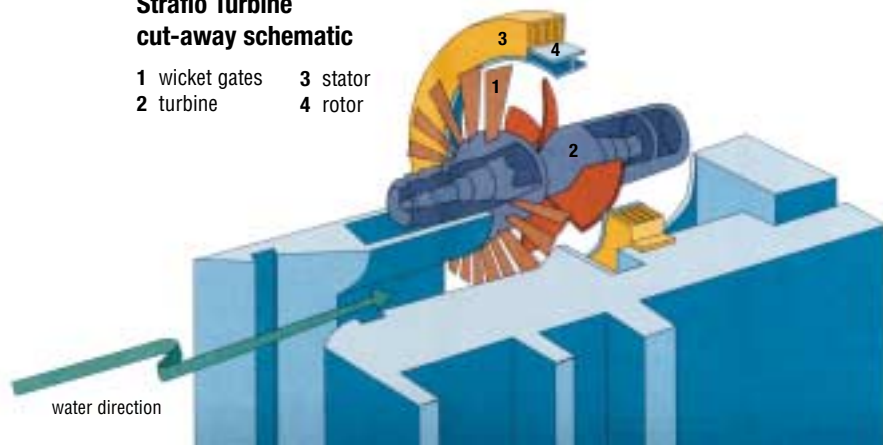
Tracing the plant's generating cycle, starting with the incoming tide, when the sea level reaches the level of the head pond, the causeway's sluice gates are opened to fill the head pond. When the pond reaches its maximum level (less than high tide in the case of Annapolis), the sluice gates close to trap the seawater upstream from the turbine. As the tide recedes, a head develops between the head pond and the seaside. When a head of 1.6 metres or more is produced, the 18 wicket gates of the distributor assembly open. These wicket gates, which resemble venetian blinds arranged in a circle, control the flow of water through the turbine. When they open, water rushes through at the rate of 400 cubic metres per second and turn the turbine's massive four-blade runner. This power-generating phase of the cycle continues until the level of the head pond has dropped to within 1.6 metres of the incoming tide, which it does in just over five hours. Then, the wicket gates close, awaiting a repeat of this twice-daily tidal cycle. The Annapolis system uses a single-effect turbine that generates electricity only in one direction - when the flow of water is towards the sea. With clockwork regularity, in harmony with the high-tide rhythm of the sea, the Annapolis station feeds the grid every 12 hours and 25 minutes.

"During that twenty-four hour period, the Annapolis station comes on for five hours, then it's off for seven hours, generating about 30 gigawatt hours annually," said Don Berringer, Nova Scotia Power's manager of hydro production. "That's enough energy to power over 4,000 homes," he added.

Mr. Berringer also noted that the electricity output is not in a straight line, but varies depending upon tides and weather. It almost doubles when tides are highest but also reacts noticeably to the barometric pressure as storms move in and out of the area.

### Straflo Turbine cut-away schematic

- |                |          |
|----------------|----------|
| 1 wicket gates | 3 stator |
| 2 turbine      | 4 rotor  |



"Depending on the cycle when a storm passes through, it can lower production 3 to 5 per cent," Mr. Berringer said.

But in order to maximize production, why doesn't the Annapolis station use a double-effect turbine that could generate power in both directions?

"There are a couple of reasons", Mr. Berringer, said. "While double-effect turbines generate more than single-effect turbines, their output is considerably less than twice as much. More importantly, as far as the Annapolis is concerned, they also require higher head."

By way of example, he added, "Double-effect turbines as large as the one we're using at the Annapolis plant would be better suited for use farther up the Bay where the average tides are higher. The tides at Annapolis average 7 metres, which is about 4.5 metres short of what's needed for a double-effect turbine".

The potential for tidal power in the Bay of Fundy is enormous and many ambitious projects have been considered for sites in both the Cumberland Basin and Minas Basin. The one proposed for the Minas Basin would span eight kilometers, be outfitted with 97 sluice gates, a three-kilometre long powerhouse with 128 double-effect turbines, and have an installed capacity of more than 5,000 megawatts. A smaller development proposed for the Cumberland Basin would use 42 turbines and have an installed capacity in excess of 1,400 megawatts.

However, before any such large scale projects could be installed, more environmental studies as to their impact on fish populations, head pond siltration and, in the case of the of the Minas Basin project, the impact a sta-

tion of such enormous proportions would have upon tides along the coast.

As far as the Annapolis area is concerned, Nova Scotia Power's tidal generating station has been more than just a good source of clean, renewable energy. It has also been a source of tourist interest, attracting more than 40,000 visitors annually, as well as engineers and investors from around the world who are interested in its technology and its potential both as a resource, and an investment opportunity.

Nova Scotia Power is the primary operating subsidiary of Emera Inc., a diversified energy company, based in Halifax, Nova Scotia, with a customer base of 550,000 customers.  $\Omega$

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## ANNAPOLIS TIDAL GENERATING STATION

### SPECIFICATIONS

#### **Location:**

Annapolis River between Granville's Ferry And Annapolis Royal

#### **Sluices:** 2

#### **Units:** 1

**Depth:** 30.5 m (100 ft.)

**Length:** 46.5 m (153 ft.)

**Capacity:** 20 MW

#### **Energy Production:**

50 GWh (annual operation)

#### **Water Flow:**

408m<sup>3</sup>/sec. (14,418 cu ft/sec)