TIME AND TIDE...

THE CAPE SHARP TIDAL PROJECT

TESTING THE WATERS

It is as reliable and predictable as clockwork. Twice a day, the tide washes in and twice a day, it washes back out; a constant ebb and flow driven by the gravitational pull of the sun and the moon. And nowhere in the world is this better demonstrated than in the Bay of Fundy, home to the highest tides in the world.

PHOTO COURTESY OF MIRIAM BEACH

THE OCEAN FLOOR IS A HOSTILE AND CORROSIVE ENVIRONMENT. GENERATORS NEED TO BE NEAR POPULATED AREAS AND THE TIDAL CURRENTS NEED TO BE STRONG ENOUGH TO GENERATE ELECTRICITY EFFICIENTLY, WHICH IS WHY THE BAY OF FUNDY, WITH ITS HIGH TIDES AND CLOSE PROXIMITY TO LAND, IS CONSIDERED TO BE ONE OF THE MOST PROMISING SITES FOR TIDAL POWER IN THE WORLD.

While a visit to Nova Scotia is not complete without witnessing the incredible tides of the Bay of Fundy, which can reach as much as 16 metres (about the height of a five-storey building), the rise and fall of the ocean is attracting the attention of more than just tourists. Each tide brings in about 160 billion tonnes of sea water into the bay, which is more than four times the estimated combined flow of all the world's freshwater rivers. This means that each tide carries an enormous amount of potential energy. If the tides in the Minas Basin, an inlet at the northern end of the Bay of Fundy, could be tapped, scientists calculate that they could generate as much as 2,500 megawatts of electricity, equivalent to about two nuclear power plants.

Tidal energy has a lot to commend it. It is, like wind and solar power, a renewable form of energy with no greenhouse emissions and it has an additional, distinct advantage. Tidal energy can be predictable but tapping into that energy has proved to be more difficult than expected. The ocean floor is a hostile and corrosive environment. Generators need to be near populated areas and the tidal currents need to be strong enough to generate electricity efficiently, which is why the Bay of Fundy, with its high tides and close proximity to land, is considered to be one of the most promising sites for tidal power in the world.

In 2009, the Fundy Ocean Research Center for Energy (known as FORCE) was set up with federal and provincial funding and within a year, it had identified a test site about one kilometre offshore on the Minas Passage with four berths, where companies could deploy their turbines.

One of the companies that's testing its technology in the Minas Basin is Cape Sharp Tidal, a joint venture between Emera and OpenHydro, a DCNS company specializing in the design, manufacture and installation of tidal turbines. Cape Sharp Tidal is planning to install two turbines in the bay in the coming months, each one capable of generating two megawatts

PHOTO COURTESY OF MIRIAM BEACH

PROJECT FILE

The Cape Sharp Tidal Project

CLIENT: OpenHydro Technology Canada

AECON DIVISION: Aecon Atlantic Industrial (part of Aecon Energy)

LOCATIONS: Dartmouth and Pictou, Nova Scotia

SCOPE: Fabrication and assembly of two turbines and a deployment and recovery barge

EQUIPMENT STATISTICS:
Turbines: diameter – 16 metres
weight – 1,000 tonnes
generating capacity – 2 megawatts

Barge: length – 64 metres
width – 37 metres
weight – 680 tonnes

CONTRACT VALUE: $22 million

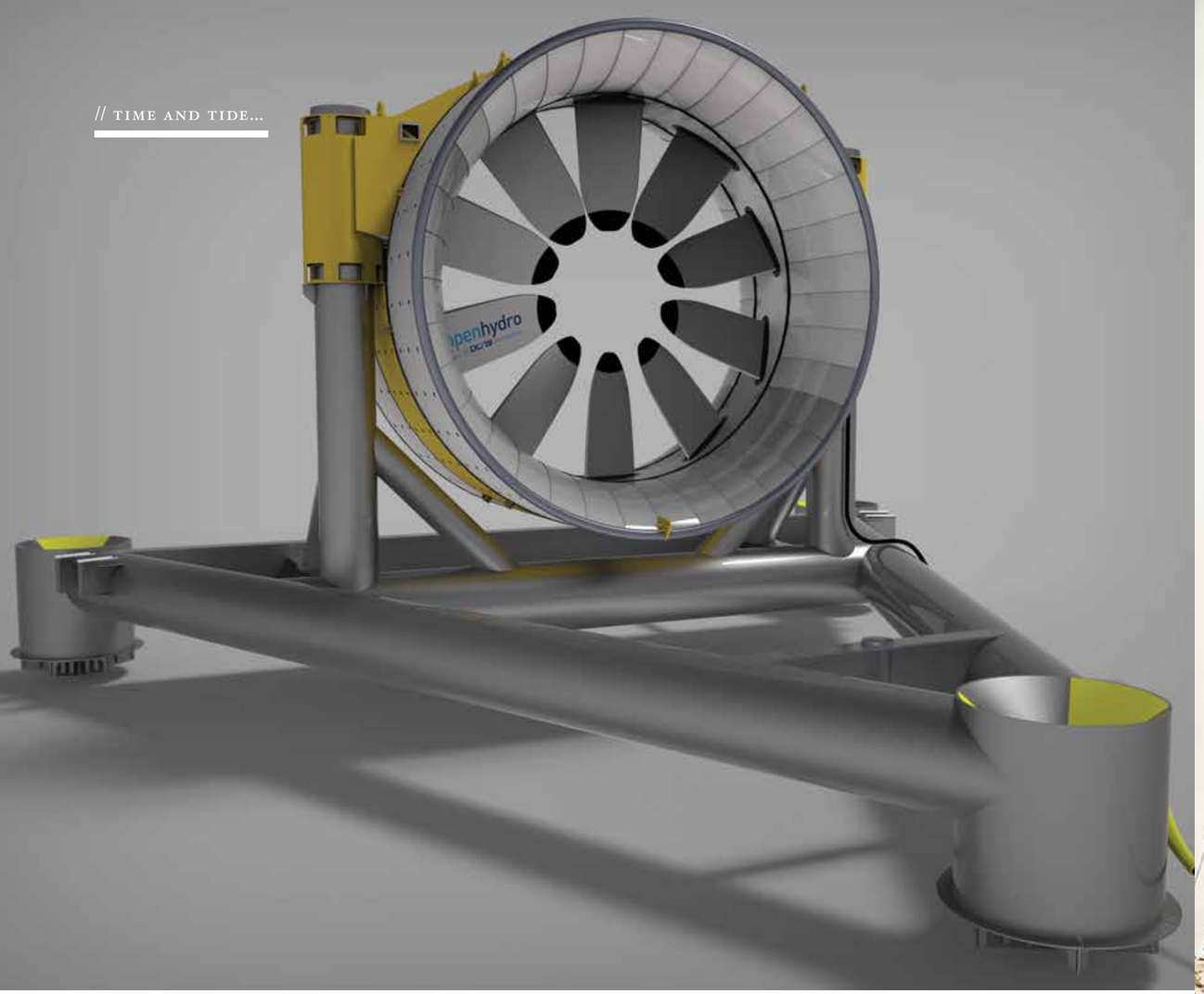
TIMING: Started December 2014

EMPLOYEES ON SITE AT PEAK:
280 trade employees

KEY EMPLOYEES:
Mike Jones – Project Manager
Peter Struthers – Project Manager

DARTMOUTH:
Jerry Berkvens – Shop Manager
John Dove – Supervisor
Rick Anthony – Supervisor
Wade Swinamer – Supervisor

PICTOU SHIPYARD:
Bo Kell – Shop Manager
Brendon Fitzpatrick – Supervisor
Blair Martell – Supervisor
Bruce Morton – Supervisor
Steve Baker – Supervisor
Tim Braniff – Supervisor
Shawn Forsyth – Supervisor
Paul MacNeil – Supervisor



of electricity, enough to power about 1,000 homes.

In late 2014, OpenHydro Technology Canada awarded Aecon two contracts, one for the fabrication and assembly of the two turbines and another for the construction of the barge that will be used to take the turbines out to sea.

BARGING AHEAD

At Aecon's fabrication shops in Dartmouth and Pictou, Nova Scotia, workers raced to complete the fabrication of the barge and turbines.

"Pictou hadn't seen this type of activity in a long, long time," says Brendan McCormick, Aecon Atlantic Industrial's senior manager of project controls. "At the height of the project, we had almost 300 trade workers in the shops working on the fabrication; the largest employment job in our history."

Aecon has had two distinct contracts to fulfill – the fabrication and assembly of the two underwater turbines and the barge that will be used to carry them to their berth.

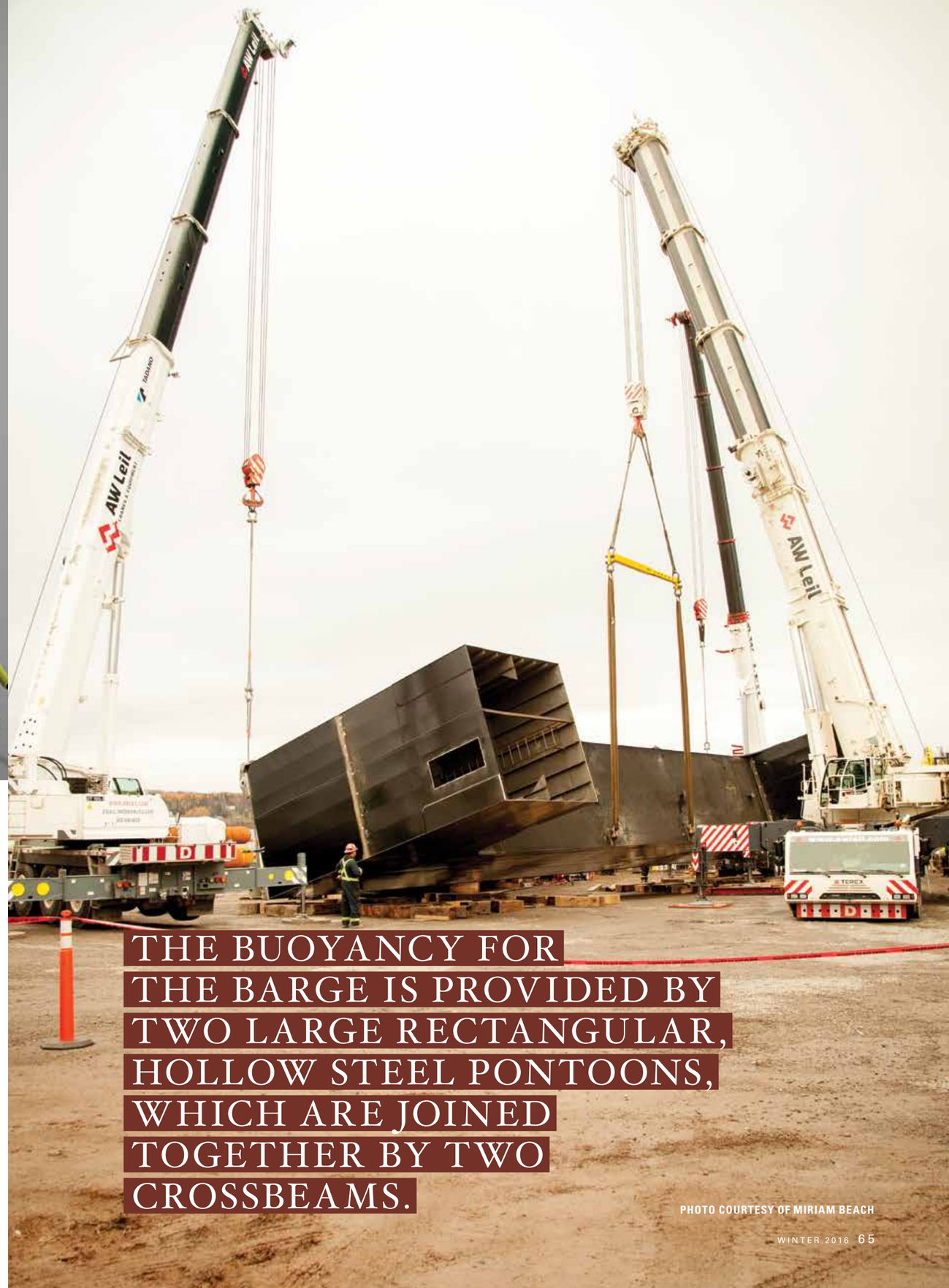
The two turbines, which bear a striking similarity to giant fans, are 16 metres in diameter and weigh 1,000 tonnes with ten reinforced plastic blades. The blades, imported from Europe, are set at a fixed pitch so that the turbine will rotate when the tide comes in and when it goes out. Each turbine will be mounted on a subsea base, a triangular frame that will sit directly on the seabed.

"A few years ago, OpenHydro installed a small test turbine in the bay. The engineers hadn't realized just how strong the Bay of Fundy's tidal currents are," notes Brendan. "They learned a lot from that early test. The design of these two turbines is also based on the lessons learned from a similar 10-metre turbine that has been in operation in France."

But even though the turbines are massive pieces of equipment, each one about the size of a seven-storey building, they are still precision instruments and the tolerances, Brendan says, are exacting.

"The clearance for the rotor is just a few millimetres and we have dimensional control survey technicians working around the clock to ensure that the allowances are met."

It's highly specialized work and Aecon has operated closely with OpenHydro to



THE BUOYANCY FOR THE BARGE IS PROVIDED BY TWO LARGE RECTANGULAR, HOLLOW STEEL PONTOONS, WHICH ARE JOINED TOGETHER BY TWO CROSSBEAMS.

PHOTO COURTESY OF MIRIAM BEACH

ensure that the turbine assembly went according to plan.

"OpenHydro is acknowledged as a world leader in the manufacture of tidal turbines," says Brendan. "It provided all the instructions on how the assembly sequencing had to proceed and its field engineers were here on site, managing the final assembly work."

The barge used to deploy the turbines is equally impressive, although calling it a barge is a bit misleading, Brendan says. "It's more like a floating platform than a barge, specifically designed to deploy the turbines in high flow conditions."

The buoyancy for the barge is provided by two large rectangular, hollow steel pontoons, which are joined together by two crossbeams. Three hydraulic winches on the barge will lower the turbine into place and subsequently raise it for maintenance. The assembled barge is 64 metres long and 37 metres wide – slightly bigger than a standard NHL ice rink.

"The Pictou yard gave Aecon a competitive edge for this project," says Ken McCormick, Aecon Atlantic's vice president and general manager. "It is not only a fabrication shop. It's also a shipyard, so we have direct access to water and the use of our marine railway. (The railway is a set of tracks 230 metres long, half of which is underwater, with a 100-metre-long moving platform with a capacity of 3,000 tonnes). There's no overland transportation involved. We launched

PHOTO COURTESY OF DARREN PITTMAN/IMAGES EAST PHOTOGRAPHY

PHOTO COURTESY OF MIRIAM BEACH

THE PICTOU YARD GAVE AECON A COMPETITIVE EDGE FOR THIS PROJECT. IT IS NOT ONLY A FABRICATION SHOP. IT'S ALSO A SHIPYARD, SO WE HAVE DIRECT ACCESS TO WATER AND THE USE OF OUR MARINE RAILWAY. THERE'S NO OVERLAND TRANSPORTATION INVOLVED. WE LAUNCHED THE BARGE AT THE YARD AND IT WAS TOWED DIRECTLY TO THE BAY OF FUNDY.

–KEN MCCORMICK, VICE PRESIDENT AND GENERAL MANAGER, AECON ATLANTIC

the barge at the yard and it will be towed directly to the Bay of Fundy."

Nevertheless, Ken adds, the last phase of the project has been a nerve-wracking time. "A year on fabrication and assembly and it all came down to the last few days when we launched the barge. And doing this during the coldest months of the year didn't make the task any easier."

The barge was assembled in the yard and then moved on air bags to the sea, where it has been launched for the very first time. The next phase of the project is to have a crane lift the 16-metre turbine onto the barge, where it will be locked in place, ready to start its final commissioning prior to being towed to the Fundy Ocean Research Centre for Energy (FORCE) test site. It will not be a short trip. Even though Pictou is only about 60 kilometres from the Minas Passage, it's about as far as you get from its ultimate destination by water. To reach the FORCE test site, the barge will have to be towed almost completely around the Nova Scotia coastline,

THE TWO TURBINES, WHICH BEAR A STRIKING SIMILARITY TO GIANT FANS, ARE 16 METRES IN DIAMETER AND WEIGH 1,000 TONNES...

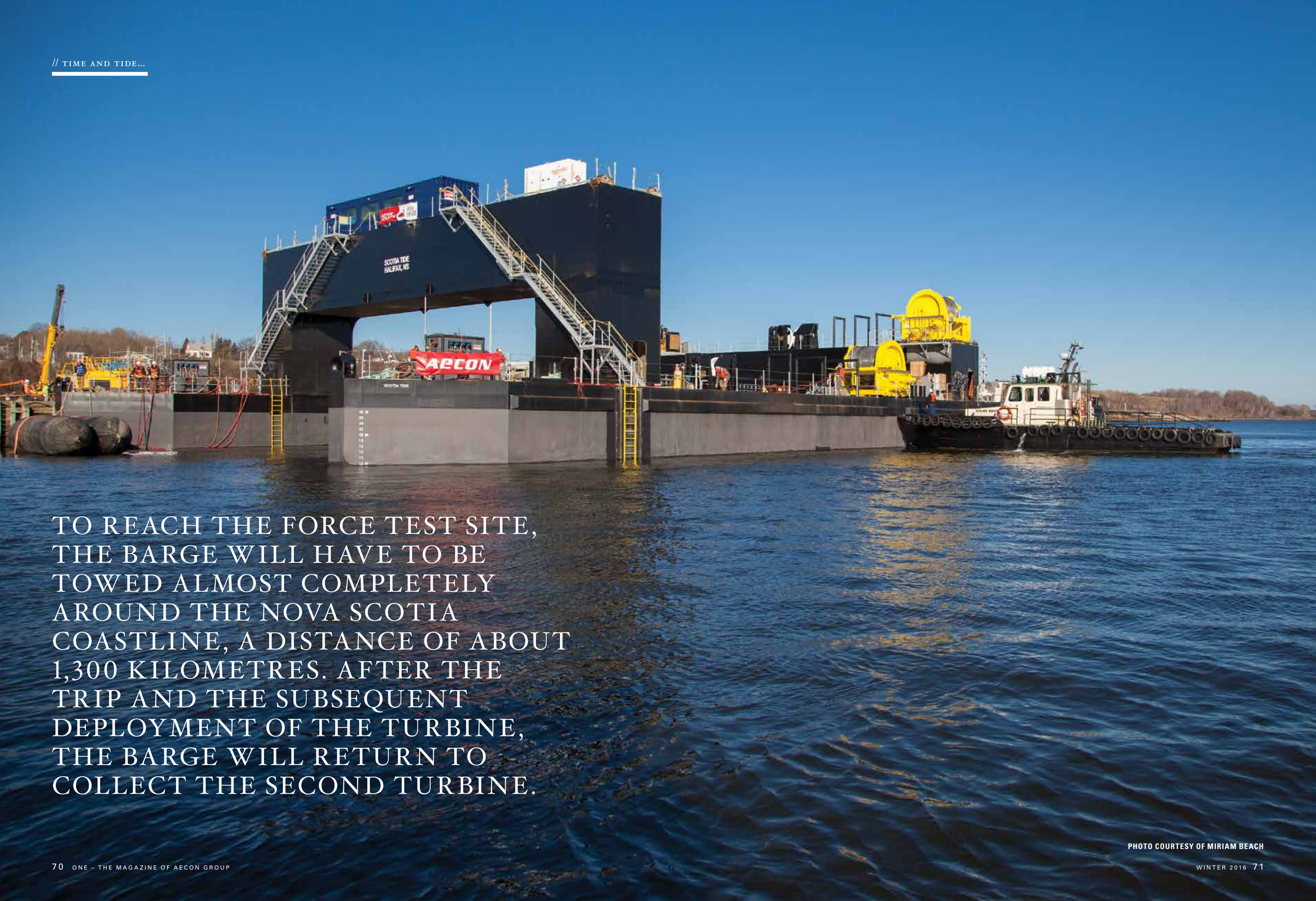
a distance of about 1,300 kilometres. After the trip and the subsequent deployment of the turbine, the barge will return to collect the second turbine.

In the coming months, the two turbines will be sitting on the seabed, hooked into the subsea cable that joins the berth at the bottom of the bay to Nova Scotia's power grid, and ready to start generating a new supply of clean energy for the province.

It is said that a rising tide lifts all boats and that's certainly the hope for this project – a rising tide of clean energy from the Bay of Fundy that will vault Nova Scotia to the forefront of tidal energy development.

Cape Sharp Tidal's long-term goal is to install about 300 megawatts of tidal turbine capacity in various locations around the Bay of Fundy by the 2020s.

"This has been a pioneering project not just for Nova Scotia but for Aecon Atlantic Industrial as well – an opportunity to showcase our facilities and the craftsmanship of our employees," concludes Ken. "The potential for tidal energy in this region is huge and so too, is the potential for Pictou."



TO REACH THE FORCE TEST SITE, THE BARGE WILL HAVE TO BE TOWED ALMOST COMPLETELY AROUND THE NOVA SCOTIA COASTLINE, A DISTANCE OF ABOUT 1,300 KILOMETRES. AFTER THE TRIP AND THE SUBSEQUENT DEPLOYMENT OF THE TURBINE, THE BARGE WILL RETURN TO COLLECT THE SECOND TURBINE.

PHOTO COURTESY OF MIRIAM BEACH