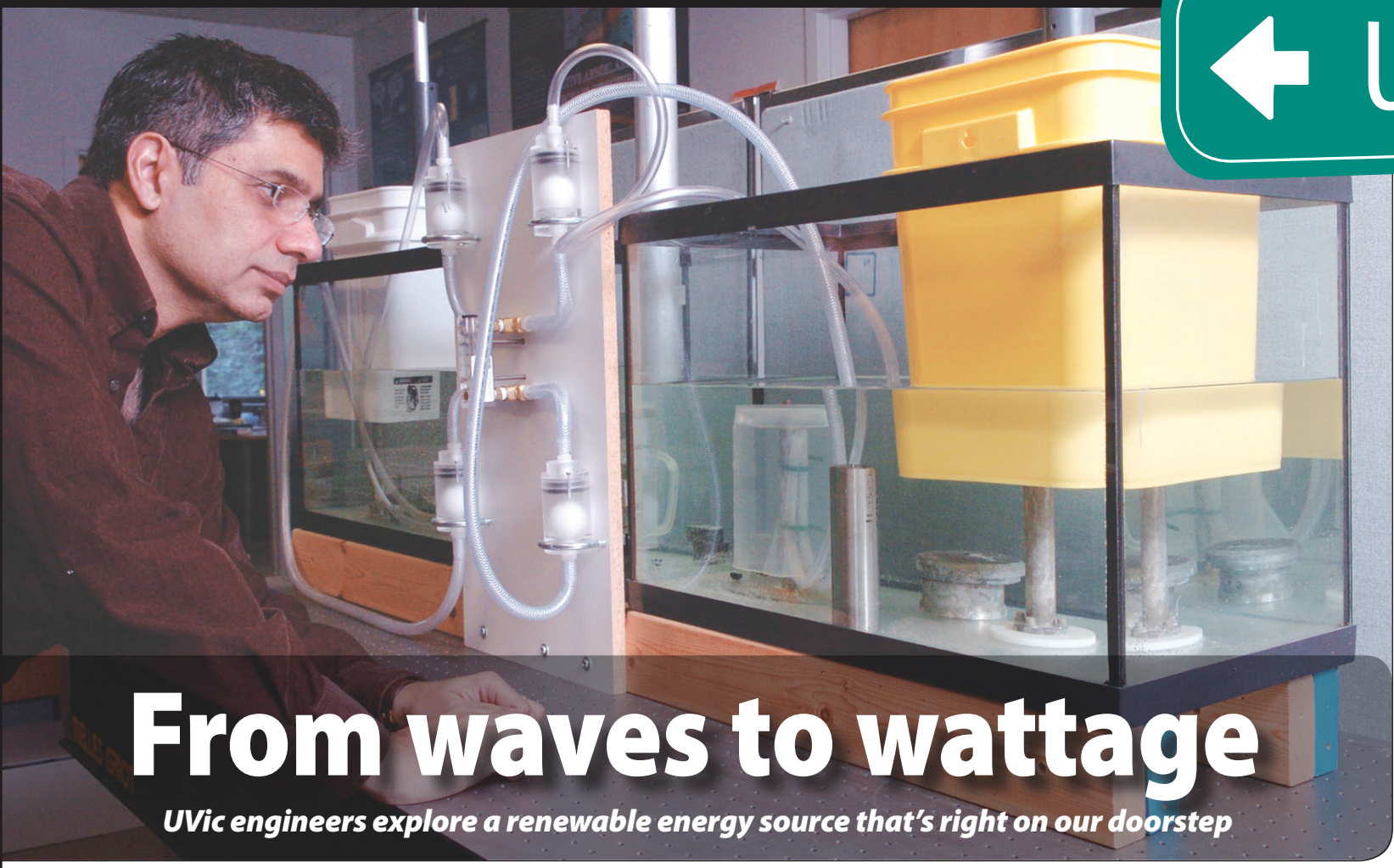

DIANA NETHERCOTT

From waves to wattage

UVic engineers explore a renewable energy source that's right on our doorstep

Suleman and the prototype wave energy converter.

How many times have you gazed out at the ocean and marvelled at the raw power of its restless waves?

For Afzal Suleman, the sight of those waves is much more than a natural wonder. The University of Victoria mechanical engineer sees an endless source of energy just waiting to be harnessed.

"Turning waves into wattage may seem like a far-fetched idea," he says, "but ocean power is gradually joining the ranks of wind and solar as a feasible source of renewable energy."

Suleman, whose expertise is aerospace engineering, became interested in the possibilities of wave energy when one of his graduate students, Julio Rodriguez, chose the topic for his master's thesis. "Julio was very eager to pursue this project and had some very good ideas," says Suleman.

Wave power captures the energy from wave motion or pressure and converts it into electricity. It is estimated that wave power could supply 10 per cent of the world's electricity if harnessed efficiently. Why, then, is the technology still in its infancy?

There are still some big challenges to overcome, says Suleman. Wave energy converters must be durable enough to withstand the harsh ocean environment. They must be unobtrusive, with minimal visual or physical impact on the ocean environment. And, above all, they must be cost-effective.

"The commercial viability of wave energy depends largely on reducing costs per kilowatt hour to make it competitive with other sources of renewable energy," says Suleman. Current wave energy technology involves enormous equipment—some of the devices being tested are longer than a six-car train. "These systems are very expensive to construct, transport, install and maintain," he says.

Suleman and Rodriguez have developed a prototype wave energy converter that addresses many of these challenges. The device sits on the ocean floor and uses a series of interconnected pumps, driven by wave pressure, to force air toward a central turbine. The air flow drives the turbine, which generates electrical power.

The air pumps are sensitive to waves coming in at any angle or wavelength. This air pump system is unique, says Suleman, who notes that a provisional patent has been filed. "There are no devices like ours that are currently deployed, that I know of," he says.

The two researchers visualize an array of these devices, arranged horizontally along the seafloor into a shape resembling a Christmas tree. The beauty of the design, says Rodriguez, is that components are small and easy to manufacture, transport and maintain, and the device is submerged.

"An underwater device is more aesthetically pleasing and safer from storms and boat traffic," he says. "And, because there are no external moving parts, the possibility of harm to marine animals is minimal."

The size of the array would depend on the energy needs at that location, but could be as large as 200 metres. "Our next step is to establish the relationship between size and energy output," says Suleman. "It could potentially power a small coastal town and this is our goal."

Suleman continues to work on the device with Rodriguez, who has since graduated and moved back to his native Mexico. To help field-test the device off the west coast of Vancouver Island, Suleman is seeking a partnership with a local diving company.

"The foundation of a robust energy supply lies in a diversity of sources," he says. "Wave energy could help BC meet its long-term power needs."

EDGEwise

Wave energy is really a stored and concentrated form of solar energy. The sun's heat creates wind which then blows over the ocean, converting wind energy to wave energy. Waves gather, store, and transmit this energy thousands of miles with little energy loss.

It's believed that there is enough energy in ocean waves to provide up to two terawatts of electricity. A terawatt is equal to a trillion watts and is enough to power a small developing country for a year.

To be reliable, wave energy projects need to be located where there is consistently strong wave action. Good sites are along the western coasts of North America and northern Europe, which face open oceans.

England and Japan were the first to develop methods to capture the power of waves. Today, companies have built or are building wave energy test installations in Scotland, Portugal, Norway, the US, Australia, India and China.

UVic researchers were awarded more than $71 million in external research grants in 2006/07, doubling the average annual research support of the previous five-year period.