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Changing Currents: Bringing Sustainability To the Great Lakes

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Changing

Bringing sustainability to the Great Lakes

by Amy Oprean

With aging infrastructures, many of the nation's cities now are faced with the challenge of restructuring their water systems to address the need for energy efficiency and water conservation. Detroit is no exception, as the need for smart, innovative uses of the Great Lakes continues to grow.

Taking on the challenge of optimizing Detroit's water transmission distribution is Carol Miller, Ph.D., P.E., chair and professor of the Department of Civil and Environmental Engineering in the College of Engineering. Her team is collaborating with a hydraulics specialty firm, TYJT Inc., and researchers at the University of Dayton and University of Illinois.

"Living in the center of the largest fresh water source in the world, it's incredibly important that we're good stewards of it," Miller said. "As it turns out, improving the health of the Great Lakes is strongly correlated with becoming more energy efficient."

Funded by a $1.5 million grant from the Great Lakes Protection Fund, Miller is developing a software package that will minimize the consumption of the Detroit Water and Sewerage Department (DWSD) water system while improving the health of the Great Lakes. The software has the potential to reduce the energy required to run the DWSD water system 15 to 20 percent and improve the health of both Lake Huron and the Detroit River. The pilot program will be tested on

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the DWSD water system, which provides water to more than four million people in Detroit and 124 surrounding communities. If successful, the new software package could be applied to water systems across the country.

The software is intended to utilize sensors already in place in the DWSD water system that provide real-time data on operational, weather and energy distribution conditions and use the information to provide "on-the-fly" optimization. This can be done in many ways, such as reducing overload on the water works' infrastructure; detecting leaky infrastructure where water is being wasted; and reducing the total amount of water needed to be treated and processed.

Miller's software will aim to reduce the peak load on energy and water systems by moving some transmission and distribution to non-peak hours. Due to the overload it puts on both power grids and water infrastructure, most waste occurs when energy and water demand spike during the day. Water transmitted and distributed during non-peak hours is less expensive, uses less energy and puts less pressure on the network. The approach would require efficient methods of storing energy and water, both of which also are being developed.

The groundbreaking software also will adjust for the inclusion of alternative energy sources, such as wind and solar, into the system. It will have the ability to adjust for predictable factors such as hot, arid days when water and energy use tend to spike. Preparing the system by storing energy and water ahead of time will put less pressure on the network when such heat waves occur.

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> — Dr. Carol Miller

"We're designing this software with other breakthroughs in mind," Miller said. "Every way that energy can be more efficient in the future, we want this software to be compatible with it."

Sensor tracking will pinpoint areas of infrastructure where water is being wasted. It is estimated that in a typical "aged" water system, 15 to 30 percent of water is lost by the time it reaches the user because of old infrastructure, leaky pipes and water idling in pipes connected to empty parts of the city. "This software will feed us the information that will allow better accounting of water and energy losses, and the causes and potential solutions."

Ultimately, Miller's cutting-edge work on energy and water conservation has a very specific goal in mind – improving the health of the Great Lakes.

About Dr. Carol Miller:

Dr. Miller received her B.S.E., M.S.E. and Ph.D. in civil engineering from the University of Michigan. She joined Wayne State University in 1984.

Using less energy per unit of water distributed will reduce the negative environmental impacts associated with energy generation. By transmitting and distributing a more efficient amount of water from Lake Huron and the Detroit River, the DWSD will reduce the amount of airborne contaminants released from power plants. It also will reduce the amount of warm water being released into the lake and river after it's used for the treating process – bi-products that negatively impact the ecology of the Great Lakes.

After considering the complex challenges of revamping an entire water system, Miller is confident Wayne State's expertise and collaborative spirit will contribute to their success. "We have specialists in every area needed to make this project team cohesive and successful. From hydraulics experts to electrical engineers and economists, we have the expertise to develop a comprehensive, real-life solution that can be applied to entire water systems."

To learn more, visit: http://www.eng.wayne.edu/page.php?id=524

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