Bulwarks with Brains

When a levee breaks, it endangers not only human life but also the infrastructure of entire regions. As part of the international UrbanFlood project, Siemens in Russia is researching a detection system that monitors levee condition and issues a warning before danger develops.

Emerging Markets on the Move

After years of stagnation, Latin American countries have been posting stable growth over the past few years. One of them, Brazil, is among the world’s most promising up-and-coming economies. Rio de Janeiro is currently investing heavily to expand its infrastructure in time for the World Cup in 2014 and the Summer Olympics in 2016. Meanwhile, energy-efficient technologies are gradually being introduced in Mexico. And in Bogotá, Colombia, a highly efficient new factory from Siemens is making products for emerging Latin American markets.

A sensor system (right) can register levee damage and warn of an impending break—for example, by comparing data with measurements from actual tests (center). Left: A dam near St. Petersburg, Russia.

Once the software has been updated, it will be tested at Livdijk, near the Dutch port of Eemshaven. The two-year trial will teach the intelligent software from Siemens in Russia how to correctly interpret dike-sensor data under real-life wind and weather conditions. This will also involve incorporating into the analysis seasonal and daily influences, such as precipitation levels and winds from various directions. The goal of the research is to ensure that the system can automatically provide information in a timely fashion on whether and when a levee or dike section is becoming porous and beginning to shift, thereby indicating that it may be at risk of breaking.

Cell Phone Alarm. Researchers are also working on alarm notification options. Sensor positioning technology, for instance, would make it possible to inform authorities of the precise location of a damaged levee section, which would allow them to repair it as quickly as possible.

If a levee breach could no longer be prevented, residents of the surrounding area could be informed via cell phone and then evacuated. Such a system would notify all cell phones operating in the affected area. It would even be possible to instruct vehicle navigation systems to guide vehicles away and avoid from area deemed to be at risk.

Synergies with Industrial Solutions. Meijer found what he was looking for in 2009—at Siemens Corporate Technology (CT) in Russia and the State Polytechnical University in St. Petersburg. The CT team, which is headed by Bernhard Lang, has a name for itself among other things with a self-controlling software system that uses measurement sensors to monitor the operation of production facilities. This adaptive system is fed with all available production data. Using this input, the system then independently monitors manufacturing activities by comparing the information with data obtained from sensors mounted on machines. It is thus able to recognize errors in the making, and issue an alarm before they occur (see Pictures of the Future, Spring 2010, p. 96).

“Monitoring a levee is similar to monitoring a production process,” says Lang. “It’s only the definition of the problem to be solved that’s different. The challenge with the UrbanFlood project was to generate the data we needed to program our sensor system. In this case, we needed empirical data. These parameters provide us with information on when specific factors will result in levee damage.”

Lang and his team constructed several test levees and dikes along the Dutch-German border in Emsland, fitted these inside and out with sensors, and then intentionally destroyed them using different methods. “We eroded the back of one dike by deluging it with water, for example, which is exactly what happened during the great North Sea flood of 1953,” Meijer explains. “In another test, we simulated piping—one of the main causes of levee damage and failure. Piping occurs when water persistently penetrates a levee, creating a small tunnel. Huge forces are released during this process, and eventually, within just a few minutes, the barrier falls apart like a house of cards.” Piping was in fact one of the reasons for the breach at St. Petersburg in 2009, says Meijer, explaining. “In another test, we simulated piping—one of the main causes of levee damage and failure. Piping occurs when water persistently penetrates a levee, creating a small tunnel. Huge forces are released during this process, and eventually, within just a few minutes, the barrier falls apart like a house of cards.”

Piping was in fact one of the reasons for the breach at St. Petersburg in 2009, explains. “In another test, we simulated piping—one of the main causes of levee damage and failure. Piping occurs when water persistently penetrates a levee, creating a small tunnel. Huge forces are released during this process, and eventually, within just a few minutes, the barrier falls apart like a house of cards.”

A higher aggregate GDP can be an indication that an emerging market has become an industrialized nation. High value-added production steps are increasingly being transferred to emerging markets. Focusing on innovation instead of just production means more domestic R&D and boosts demand in the home market. Emerging markets often strive for solutions that are more cost-effective than those used in industrialized nations. Siemens is responding to this trend with “S.M.A.R.T. Products” that are specially developed for these markets. (pp. 44, 58)

China and South Africa have shown that greater prosperity leads to better healthcare. In China, sophisticated imaging systems are being introduced in rural hospitals. Siemens is actively supporting this process. In South Africa, more and more doctors are using telemedicine solutions—and in the country’s high-end medical facilities the focus is on equipment from Siemens. (pp. 60, 62)

More prosperity leads to increased energy consumption. In the area of energy, emerging markets should avoid repeating the development mistakes made by the industrialized nations, says Jamshed J. Irani, who, as a member of the Board of Directors of Tata Sons, helps direct India’s largest conglomerate. Renewable sources of energy are part of the solution and their exploitation is being expanded in areas such as North Africa and the Middle East. As a result of this development, different technologies, including combined cycle gas turbines and thermal power plants, can bring their respective strengths to bear. (pp. 52, 64, 65, 66)