

Energy efficiency key to global climate change mitigation

Energy-efficient investments in wastewater management could dramatically reduce energy consumption and greenhouse gas emissions, according to the results of the study "Powering the Wastewater Renaissance." Xylem, Inc. Vice President for Strategy and Business Development Al Cho discusses the key points of this landmark study.

Investment in currently available high-efficiency technologies could reduce electricity-related greenhouse gas emissions from the global wastewater sector by up to 50 percent, according to "Powering the Wastewater Renaissance," a new study commissioned by the US company Xylem Inc. Adopting these technologies would have a significant effect on the greenhouse gas emissions responsible for fueling climate change – potentially equivalent to removing 11.4 million cars from the road, as reported by American Forests, a non-profit organization based in the United States. The analysis also suggests that much of this reduction in electricity-related emissions can be achieved at a negative or neutral cost.

As a global water technology provider, Xylem confronts the intersections among water, climate, and sustainable development every day. The company launched the "Powering the Wastewater Renaissance" report to help decision-makers around the world understand the role the water sector can play in global climate change mitigation and adaptation.

One key insight from the report is that energy-efficient investments can offer low-cost abatement potential in the wastewater sector, offering a potential solution to the high-energy costs of global wastewater operations. Similar energy efficiency opportunities are commonly seen in sectors such as transportation, commercial buildings, and manufacturing. These opportunities create a potential "win-win" situation: communities can reduce energy consumption and greenhouse gas emissions while renewing water infrastructure and saving money.

The report mostly quantifies what most water professionals intuitively know: most wastewater systems could be more energy-efficient. In many cases, efficiency improvements can be achieved through investments that lower the utility's total cost of operations. Simply put, under-investing in efficient infrastructure costs more in the long run. The missing piece is an enabling framework to incentivize investment and accelerate adoption of high-efficiency technologies.

While many of the benefits of renewed wastewater infrastructure will accrue locally, there are important global implications. The landmark Paris agreement on climate change, signed in December 2015, set ambitious targets for global greenhouse gas emissions reductions without providing clear plans for achieving them. Going forward, policymakers around the world

cannot afford to ignore any meaningful opportunity to increase energy efficiency; this report suggests that they can start by accelerating the wastewater renaissance at home.

Global opportunities for emissions abatement

The wastewater sector emits greenhouse gases in two primary ways: through fugitive emissions from the breakdown of organic materials in wastewater and through electricity-related emissions associated with energy consumed in the treatment and transport of wastewater. Identifying low-cost ways to reduce these emissions is of interest to both the wastewater industry and to stakeholders in global climate policy. This report focused on the second area: greenhouse gas abatement options associated with energy efficiency.

Xylem identified and assessed abatement opportunities across the wastewater management cycle, from pumps used to transport wastewater, to the blowers used to aerate it, to the various processes used to treat it. These abatement opportunities were evaluated in three core markets: the United States, Europe, and China, then extrapolated to provide a global estimate of the electricity-related emissions reduction opportunity in wastewater management.

According to the assessment, nearly 50 percent of electricity-related emissions from wastewater management in the three regions studied can be abated with technologies that exist today. Furthermore, nearly 95 percent of this abatement can be achieved at zero or negative economic cost.

In the United States and Europe, the study focuses on abatement from the replacement of existing equipment, given the relatively low rate of new wastewater plant construction. It found that the USA could abate nearly 40 percent of its 2015 electricity-related emissions, 86 percent of which would be at negative cost. Europe could abate 33 percent of its 2015 electricity-related emissions, 94 percent at negative cost.

China presents an even more potentially attractive opportunity. Nearly 60 percent of electricity-related emissions associated with current and planned wastewater infrastructure can be abated, nearly all at zero or negative cost. Given growing public concerns about air and water pollution, coupled with strong government commitment to environmental remediation in the 13th five-year plan, adopting high-efficiency

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wastewater technologies in existing and planned infrastructure could significantly advance vital national objectives. Many other rapidly industrializing countries planning new wastewater treatment infrastructure in the upcoming years face similar opportunities for emissions reduction relative to baseline forecasts.

Across these regions, the largest abatement options exist in secondary treatment, which drives more than 60 percent of the total abatement potential across the stages of wastewater management. Within this step of the water management process, variable speed blowers and optimized aeration systems provide the greatest potential savings, offering abatement of more than 11 Mt CO₂e (11 million tons of carbon dioxide emissions) over the life of the equipment if adopted in the three core regions studied.

Beyond emissions abatement, these technologies provide highly attractive financial returns resulting from savings in electricity and maintenance costs over the life of the equipment. Globally, the net present value of the most attractive investments exceeds US\$40 billion. For a sector that is often capital constrained, operational cost savings would be a new source of capital to support the renewal of water and wastewater infrastructure that could ultimately power the next wastewater renaissance.



Innovative financing and regulation

Two primary obstacles stand in the way of more widespread adoption. First, utilities are naturally conservative when considering new technologies and approaches, given the importance of complying with regulations and protecting public health as well as the environment. Second, utilities have a finite – and in many cases, insufficient – pool of capital and often choose products with a lower initial cost, even if this choice leads to higher lifecycle costs.

Given the inherent economics of investments in more efficient technologies, innovative financing mechanisms and public assistance programs can help to unlock abatement in the wastewater sector by giving utilities credit for saving energy. Structures that have worked in other sectors, such as commercial real estate or industrial facilities, include energy savings performance contracts, carbon finance, and asset leasing programs. Grant programs supported by governments, electric power utilities, or other funding sources could also catalyze more rapid adoption.

In the near future, it is also possible that a regulatory solution could emerge for energy efficiency in wastewater management. Standards for energy efficiency in specific components, such as circulator pumps, are already due to commence in Europe and the United States. Similar regulations may extend over time to other components or other jurisdictions and



could also accelerate adoption of technologies that are more highly efficient.

Next steps

This analysis was intended to provide a fact-based assessment of the opportunities for emissions abatement within the wastewater sector and to initiate a similar dialogue in the broader water sector. It is clear that modernizing global wastewater infrastructure would advance multiple policy objectives, including water pollution control, energy efficiency, emissions reduction, and job creation.

Moving forward, wastewater industry stakeholders should collaborate on finding ways to translate the opportunity into real savings through further research, policy development, and pilots of new financial structures. The global wastewater sector has a historic opportunity before it to show leadership and drive change. There is no better time than the present to invest in highly efficient wastewater infrastructure, which has immense environmental, societal, and economic benefits to be realized now and well into the future.



Author's Note

Al Cho is the vice president for strategy and business development at Xylem, Inc. and is also an editorial advisory board member of World Water.

Top left: A municipal wastewater treatment plant on the shores of Lake Como in Italy reduced energy consumption 65 percent and operating costs by US\$55,000 annually by installing Xylem's Flygt 4530 mixers. Energy savings paid for the mixers in 13 months. Photo by Xylem

Top right: In early 2013, Heathrow installed two Flygt Exporior pumps systems in the wastewater pumping station located at the airport's cargo center. According to a comparison study conducted by Heathrow Airport's Water Services Department, the Xylem solution reduced the station's energy consumption by 50 percent. In addition, the non-clogging capabilities of the Flygt Exporior system eliminated the need for maintenance call outs during the first year of operations. Photo by Xylem

Bottom left-right: The Macchiarreddu wastewater plant on the Italian island of Sardinia, an island off the coast of Italy, reduced energy consumption and operating costs 35 percent by replacing old pumps with Xylem's Flygt Exporior system. The solution met the needs of island residents and the pink flamingos that nest in a lagoon adjacent to the plant. Photo by Xylem

References

1. <http://www.americanforests.org/assumptions-and-sources/#vehicle> and Abatement Opportunities paper, p.5.
2. Lu, S. (2014). Water infrastructure in China: the importance of full life-cycle cost analysis in addressing water challenges. *International Journal of Water Resources Development*, 30(1), 47–59.