



Powering the Wastewater Renaissance

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Xylem's latest research yielded a powerful insight...

Globally, nearly 50% of the electricity-related emissions associated with wastewater management could be abated at negative cost by investing in readily available technologies.

1

We ran this analysis for the United States, Europe, and China, and then extrapolated the results to produce a global estimate.

2

We projected wastewater volumes and calculated the energy savings and correlated CO₂e emissions from the wastewater equipment upgrades the treatment steps.

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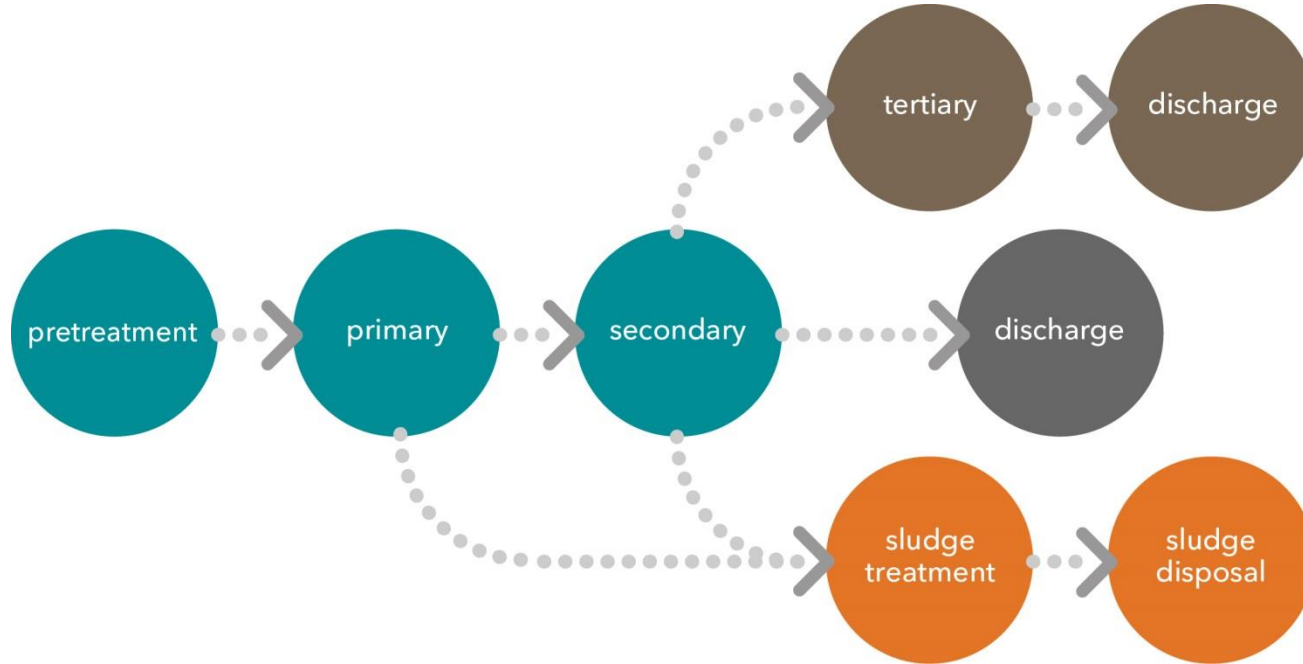
3

We ran an analysis using the concepts of marginal abatement cost (MACC) and internal rate of return (IRR) that compared the cost of each abatement opportunity with the energy and maintenance savings over the 20 year life of the equipment.

4

We identified 18 different 'abatement opportunities' where wastewater treatment technology upgrades could deliver varying levels of energy savings at various cost points.

We analyzed every stage of wastewater management...



... and identified 18 different emissions abatement opportunities across these wastewater management stages

Each abatement opportunity leverages wastewater treatment technology upgrades that deliver varying levels of energy savings at various cost points

Code	Abatement option	Stage
1	High efficiency pumping	Transport
2	Optimal speed pumping	Transport
3	High efficiency pumping	Secondary
4	Efficient variable speed blowers	Secondary
5	Optimized aeration control and aeration systems	Secondary
6	Efficient mixing	Secondary
7	High efficiency pumping – aerobic sludge	Sludge
8	Efficient variable speed blowers	Sludge
9	Optimized mixing solutions	Sludge

Code	Abatement option	Stage
10	High efficiency pumping – anaerobic sludge	Sludge
11	Improved biogas production	Sludge
12	High efficiency pumping	Tertiary
13	Air scour efficiency	Tertiary
14	Filter control	Tertiary
15	More efficient optimized new plant – secondary	Secondary
16	More efficient optimized new plant – tertiary	Tertiary
17	More efficient optimized new plant – aerobic digestion	Sludge
18	More efficient optimized new plant – anaerobic digestion	Sludge

We analyzed the opportunities using MACCs and IRRs...

But what is a MACC?

- Technique used by many sectors to compare varying **emissions reduction opportunities**.
- Estimated by dividing the net present value of the updated equipment by the discounted volume of emissions abatement. If the result is negative, then **capital is actually saved** over the life of the equipment.
- When the abatement cost of each opportunity is sorted in increasing order and presented on a chart this is **known as a ‘marginal abatement cost curve’**, or MACC.

$$\text{Marginal Abatement Cost (\$/t CO}_2\text{e)} = \frac{\text{Net Present Value of Savings}}{\text{Net Present Value of GHG Abatement}}$$

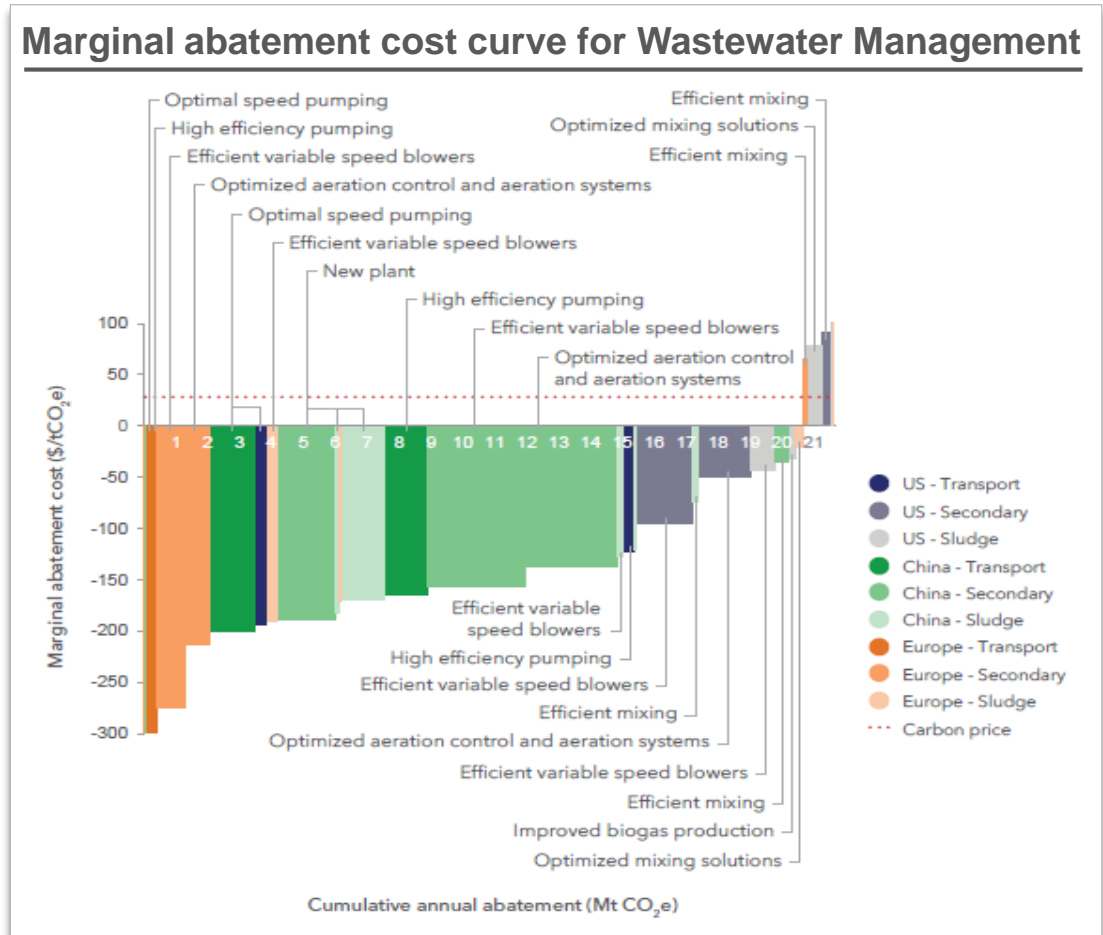
Where,

$$\text{Net Present Value of Savings (\$)} = \frac{\sum(\text{Equipment Cost} - \text{Operating Cost Savings} - \text{Energy Cost Savings})}{(1 + \text{Discount Rate})^{\text{Equipment Life}}}$$

$$\text{Net Present Value of GHG Abatement (t CO}_2\text{e)} = \frac{\sum(\text{GHG Emissions Abated by New Equipment})}{(1 + \text{Discount Rate})^{\text{Equipment Life}}}$$

...and the MACC results are compelling for the three core regions

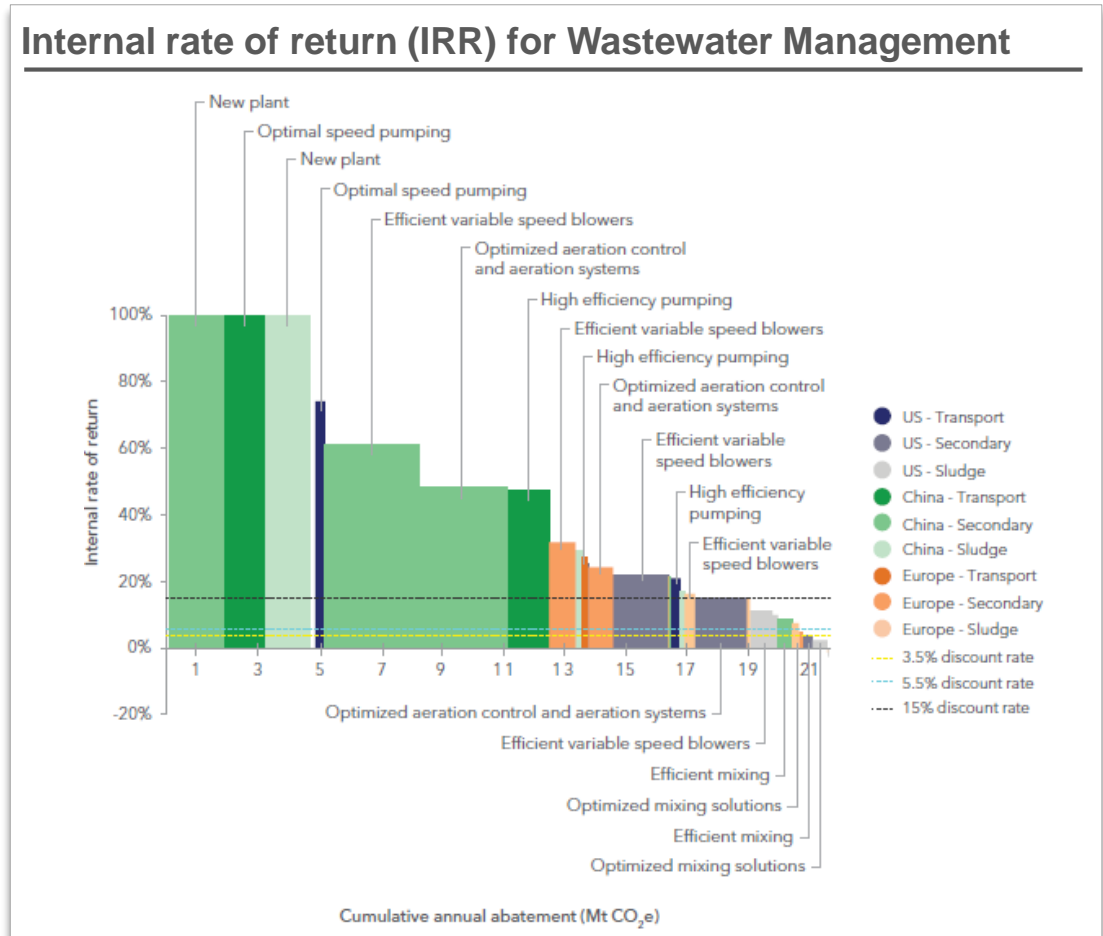
- **20 Mt CO₂e per year at zero or negative cost.**
- China has the largest total opportunity with **13 Mt CO₂e per year.**
- Europe has the most **financial attractive** opportunities.
- The most attractive abatement opportunities are **Optimal Speed & High Efficiency Pumping, and Efficient Variable Speed Blowers.**



Note: Numbers presented based on the mid-range discount rate of 5.5% and carbon price shown is mid-range price of \$30/ton CO₂e.

...and the IRRs are strong for the three core regions

- Abatement potential is possible **even at a relatively high investment hurdle rate.**
- Rates of return are **strongest in China** where **green field development** makes for attractive investments.
- The sector savings are **\$40B over the 20 years** which could be reinvested in our outdated water infrastructure.



Note: Numbers presented based on the mid-range carbon price assumption of \$30/ton CO₂e.

These results have little sensitivity to the assumed discount rates and carbon prices

Sensitivity analysis for assumed discount rate and carbon price

Total abatement volume (Mt CO ₂ e)	Discount rate assumption			Sensitivity (holding carbon price constant)	
	3.5%	5.5%	15%	Absolute sensitivity	Relative sensitivity
Carbon price					
\$0/tCO ₂ e	21	21	17	4	19%
\$30/tCO ₂ e	21	21	19	2	10%
\$125/tCO ₂ e	22	22	20	2	9%
Absolute sensitivity	1	1	3		
Relative sensitivity	5%	5%	15%		

No matter the assumptions, the abatement potential is ~17 – 21 Mt CO₂e per year.

- Thus, this realizing this abatement...
 - **DOES NOT** need new technologies or R&D.
 - **DOES NOT** need a carbon price to be set.
 - **DOES NOT** need wastewater operates to assume low returns on investment.



It is purely a matter of accelerating adoption!

Adopting these technologies will reduce emissions and could power the “wastewater renaissance”

If these high efficiency technologies were to be globally adopted...

...and to accelerate realizing these benefits, we have two recommendations.

We would free up **\$40 billion in economic savings** to reinvest in the badly needed upgrades to our water infrastructure.

We would **cut 44 Mt CO₂e annually**, which is equivalent to taking 9.2M cars off the road.

We need **Finance Solutions** to help wastewater treatment operators overcome the higher upfront cost of more advanced and efficient equipment.

We need **Regulations and Standards** – such as those for high-efficiency pumps – to be expanded to other equipment and geographies.

Read the report and reach out to be a part of the wastewater renaissance!

Visit the [Powering the Wastewater Renaissance Microsite](#) for copies of the report and infographic...

... reach out to Randolf.Webb@xylem.com if you have any questions at all

...or email Powering.Wastewater@xylem.com to connect with the authors, to explore partnerships and additional research opportunities, and to engage in the Wastewater Renaissance!

