

# Membrane bioreactor performs better than the conventional activated sludge process in techno-economy

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Techno-economic performance comparison before and after the retrofitting of wastewater treatment plants from the conventional activated sludge process to the membrane bioreactor process. Credit: Higher Education Press Limited Company

To better achieve environmental goals, a growing number of wastewater treatment plants (WWTPs) are being retrofitted from the conventional activated sludge (CAS) process to the membrane bioreactor (MBR) process due to MBR's small footprint and high effluent quality. However, retrofitting from CAS to MBR has been controversial due to the high energy consumption and membrane fouling in MBR applications. It is essential to clarify this issue by comparing the techno-economy of CAS with that of MBR.

On the one hand, energy consumption accounts for the largest proportion of operating costs and is a key factor restricting the sustainable development of wastewater treatment processes. MBR normally has higher energy consumption than that of CAS. On the other hand, [high costs](#) are often associated with high returns. MBR obtains higher environmental benefit from higher effluent quality than CAS. Therefore, a justified techno-economic assessment of MBR vs. CAS requires comprehensively considering both [economic costs](#) and environmental benefits. However, the previously reported techno-economic evaluation of WWTPs mostly lacked a systematic comparison between the CAS and MBR processes, especially a strict paired comparison between them in the same WWTP.

Now, a research group from the University of Chinese Academy of Sciences studied the techno-economic characteristics of 20 full-scale WWTPs that had been retrofitted from CAS to MBR via the [cost-benefit analysis](#) and data envelopment analysis. The results were published in *Frontiers of Environmental Science & Engineering*.

They found that after the retrofitting from CAS to MBR, the effluent quality improved significantly, accompanied by an increase in energy consumption from 0.40 to 0.57 kWh/m<sup>3</sup>, while the change in operating cost was not such significant. The average marginal environmental benefit increased remarkably after the retrofitting, leading to an increase in the average net profit, which indicates the techno-economic feasibility of the retrofitting. After the retrofitting, the relative cost efficiency increased from 0.70 to 0.73 (the theoretical maximum is 1), while the relative energy efficiency did not change significantly. Meanwhile, the techno-economy is closely related to the effluent standard adopted. MBR is more profitable than CAS given stricter effluent standards.

Therefore, just as the researchers considered, MBR performs better than CAS in cases of strict effluent standards and pollutant-sensitive

destinations, and there is still much room for further reducing the [energy consumption](#) of MBR.

**More information:** Tingwei Gao et al, Techno-economic characteristics of wastewater treatment plants retrofitted from the conventional activated sludge process to the membrane bioreactor process, *Frontiers of Environmental Science & Engineering* (2021). [DOI: 10.1007/s11783-021-1483-6](#)

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