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## Mitigation of GHG emission from the wastewater treatment plant: Life cycle assessment approach

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The rapid expansion of wastewater treatment plants, aimed at mitigating global water stress, has significantly increased the energy demand. In India, the anticipated rise in sewage generation to treatment ratio from 46% to 80% by 2050 [1]. It is expected to further intensify the energy demand of treatment facilities to meet national standards. This required energy, predominantly in the form of electricity, primarily fulfill from coal-based thermal plants, consequently contributing to air pollution and emissions. Moreover, enhancing the oxygen supply in the biological process to improve treatment efficiency is projected to escalate direct greenhouse gas (GHG) emissions. India's central electricity authority reports that the Indian grid produces around 0.91 kg CO<sub>2</sub>eq/kWh. A typical wastewater treatment plant (WWTP) demands an average of 185 kWh per million litres per day (MLD), resulting in approximately 168.35 kilograms of CO<sub>2</sub> equivalent emissions per MLD [2]. Exploring alternative mitigation measures becomes imperative to address the energy demand from the grid. One approach involves employing mitigation technologies like gasification, anaerobic digestion, or pyrolysis to generate electricity from the sludge process. The study aims to estimate direct and indirect emissions from WWTPs by conducting a comprehensive life cycle assessment of various mitigation technologies. Notably, gasification, anaerobic digestion, and pyrolysis demonstrate potential emission reductions of around 81.8%, 57.2%, and 36.4%, respectively.