

BIOWASTE : NO MORE GHG EMISSIONS

Background

More than 1 billion metric tons of rice straw are produced annually worldwide [1]. While some of the straw is used domestically, majority of it is disposed (e.g. landfill). During disposal, biological degradation of organic compounds generates greenhouse gases (GHG) which contribute to climate change. Alternatively, if the paddy straw is properly utilized and treated, the biowaste can be turned into bio-products & bio-energy [1]. Common utilization technologies for biomass & biowaste in the European Union are composting, anaerobic digestion (AD) and biomass incineration. These technologies are often used in combination (e.g. AD and composting) for enhanced recovery. With more than 25 years of experience, u&i plays a leading role as a solution provider for climate mitigation through efficient waste management. Amongst others, u&i designed a **biomass incineration facility in Elsfleth** (25 MW thermal output) where the generated steam is supplied to a paper mill and electric power is fed into public grid, a perfect example of industrial symbiosis. We also designed **fermentation facility at two sites in Emsland**. The incurred approx. 48,000 t/a organic waste are used in the boxes fermentation plants at the sites in Dörpen and Venneberg. The produced biogas is used for power generation on-site, while the generated heat is used internally. Currently, a state of art Integrated facility including dry fermentation & composting is also being **designed in Göttingen** which can utilize 22,500 t/a of bio & green waste.

Case Study

The GHG calculation is performed considering Punjab state (India) as a case study where 2,000 t/a of rice/paddy straw is assumed to be available for utilization. The untreated paddy straw contains 10 % moisture and 90 % total solids on wet basis, with 84 % volatile matter and ash content respectively, on dry basis. The elemental composition includes by weight 40 % Carbon, Nitrogen, 5.50 % Hydrogen, 0.75 % Nitrogen content on dry basis [2]. To understand the emission reduction potential, a GHG emission estimation tool based on latest IPCC estimates was applied [3] on four technological scenarios- landfilling, anaerobic digestion, composting & incineration. CO₂ emissions having biogenic origin and those related to operations (during process) have not been taken into account for GHG calculation in the tool. **This tool will be available on the u&i website shortly.** Only those emissions have been considered which are contributed by release of CH₄ & N₂O and can be more than compensated by replacing chemical fertilizer, landfilling, fossil-fuel-based conventional electricity and thermal energy production.

Result

- High amount of GHG emissions are produced in case of uncontrolled landfilling due to formation of methane over a long duration.
- All regarded technologies (anaerobic digestion, composting & incineration) lead to a massive reduction of uncontrolled GHG emissions. Estimated GHG reduction of more than 1500 kg of CO₂-eq/ton of paddy straw waste is possible.
- The reduction of uncontrolled biowaste landfills and unused biomass is important for climate protection. Therefore, u&i will support you to find the best solution. Please feel free to discuss with us.

References

- [1] Gupta, P.K., Sahai, S., 2004. Residue burning in rice – wheat cropping system: Causes and implications 87, 1713–1717. <https://repository.cimmyt.org/bitstream/handle/10883/1457/81123.pdf?sequence=1&isAllowed=y>
- [2] Trivedi, A., Ranjan, A., Kaur, S., Jha, B., Vijay, V., Chandra, R., Kumar, V., Subbarao, P.M., Tiwari, R., Hariprasad, P., Prasad, R., 2017. Sustainable bio-energy production models for eradicating open field burning of paddy straw in Punjab, India. Energy 127, 310–317. <https://doi.org/10.1016/j.energy.2017.03.138>
- [3] IPCC 2006 Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K.(eds). Published: IGES Japan. <https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol5.html>

u&i Selected Project References

Biomass Incineration:



- Biomass Power Plant Elsfleth
- Biomass Power Plant Dollbergen

Anaerobic Digestion:

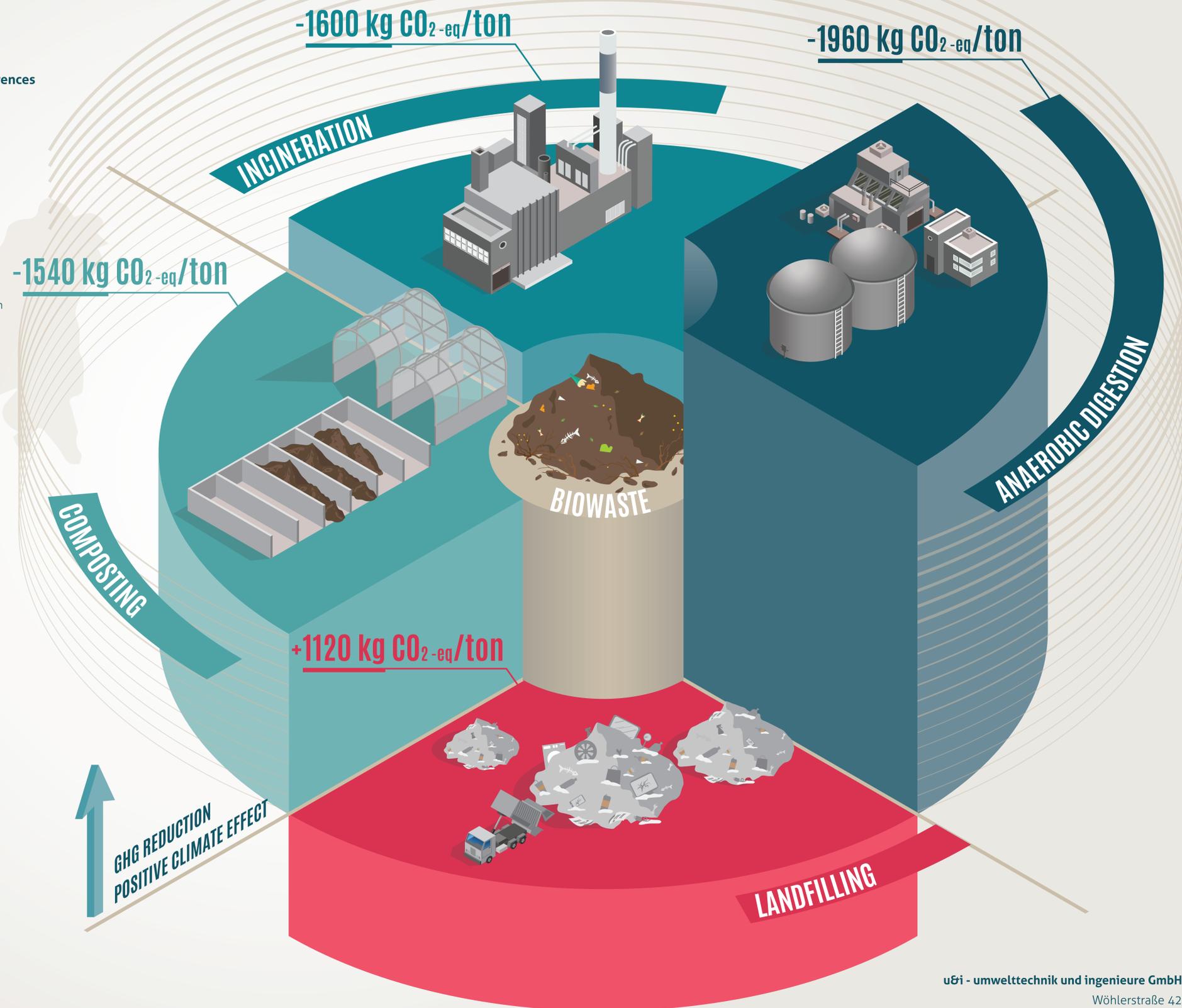


- Fermentation Plant Bützberg
- Fermentation Plant Emsland

Composting:



- Integrated Composting Plant Göttingen



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