**MARMARA UNIVERSITY**

**FACULTY OF ENGINEERING**

**ENVIRONMENTAL ENGINEERING DEPARTMENT**

**ENVE 4197/4198 ENGINEERING PROJECT**

**PROPOSAL FORM**

**FALL 2025-2026**

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| **Instructor: BARIŞ ÇALLI****Project Title:** COMPARATIVE ESTIMATION OF GREENHOUSE GAS EMISSIONS IN FOOD WASTE MANAGEMENT SYSTEMS**Proposal No.:** #1**Number of Students:** (Max 2 students)**Requirements (from students):** Successful completion (pass) of ENVE3030 Solid Waste Engineering |
| **Scope of the Project:**The project will evaluate and compare greenhouse gas (GHG) emissions associated with various food waste management systems, including landfilling, aerobic composting, anaerobic digestion with energy recovery, and onsite dehydration. The study will estimate direct and indirect GHG emissions and potential carbon sequestration benefits. Using life cycle assessment (LCA) principles and available emission factors, a comparative framework will be developed to identify environmentally preferable options. Operational variations, such as landfill gas capture efficiency and energy recovery potential, will be considered to reflect realistic scenarios. |
| **Hardware/Software/Lab/Equipment Requirements:****Methods*** Review and aggregate GHG emission data for each pathway.
* Estimate net emissions (kg CO₂-e per wet ton) using a Microsoft Excel model.
* Include high/low emission scenarios for uncertain parameters.
* Exclude non-comparable emissions (e.g., product transport).
* Focus on GHG emissions as the main environmental indicator; qualitative notes on water use, odour, and biosecurity where relevant.
* Consider the system from waste generation to final use or disposal.

**Hardware/Software Requirements*** Microsoft Excel (for modelling).
* Access to published datasets and reports on food waste and GHG factors.
* No laboratory or specialized equipment required.
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| **Development Plan:****Work Package 1: Scenario Definition*** Define food waste management pathways to be assessed (landfill, aerobic composting, anaerobic digestion, onsite dehydration).
* Identify required data: waste input, GHG emissions, energy recovery, treatment outputs.
* Source data from literature and municipal or commercial records.

**Work Package 2: GHG Emissions Estimation*** Quantify net GHG emissions (kg CO₂-e per wet ton) for each pathway.
* Include high/low performance scenarios for uncertain parameters.
* Assess impacts of energy recovery and treatment outputs.

**Work Package 3: Comparative Analysis*** Compare GHG emissions across pathways to identify environmentally preferable options.
* Conduct sensitivity analysis for key variables (e.g., landfill gas capture, waste composition).

**Work Package 4: Reporting*** Prepare a final report with results, comparisons, visual summaries, and recommendations for sustainable food waste management.
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