Feasibility Study for a Small-Scale MRF + Organic Waste Processing Facility for the Campus (Revised)

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1. Estimated Waste Generation on Campus

1.1 Residential Households

- **50 households × 3.6 members ≈ 180 residents**
- **Per-household weekly waste:**
    - **Biowaste: 3.6 kg/week**
    - **Dry waste: 0.5 kg/week**
- **Total weekly waste = 50 × (3.6 + 0.5) = 205 kg/week**
- **Daily generation ≈ 29 kg/day**

1.2 Hostels (Updated)

- **Kitchen biowaste: 47.5 kg/week**
- **Dry waste: 11 kg/week**
- **Total weekly waste = 58.5 kg/week**
- **Daily generation = 58.5 ÷ 7 ≈ 8.4 kg/day**

1.3 Academic Areas + Students + Grounds

Using a conservative estimate:

- **Students enrolled: ~3,959**
- **Daily presence ≈ 2,000**
- **Per-student mixed waste = 0.1 kg/day**
  → 200 kg/day

Additional staff waste + garden waste:
→ 20–50 kg/day

1.4 Total Estimated Waste Generation

Source	Daily Waste (kg/day)
Residential	~29
Hostels (updated)	~8.4
Students + Campus	200–250
Total	≈ 237–287 kg/day (≈ 0.24–0.29 TPD)

So the revised generation is approximately 0.24–0.29 tonnes per day, still well within the range for a small modular waste facility.

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2. Suitable Waste-Processing Facility Types

Because the campus generates <1 TPD, a compact, low-cost modular system is ideal.

2.1 Material Recovery Facility (MRF)

A manual or semi-mechanized MRF is adequate.

Key components:

- **Sorting tables or small conveyor**
- **Magnetic separator**
- **Storage for recyclables**
- **Optional baler (only if recyclable volumes justify)**

2.2 Organic Waste Processing

Biowaste (residential + hostels + campus organics): approx. 150–240 kg/day

Suitable technologies:

1. **Compost pits / windrow composting**
    - **Low cost, simple**
    - **Requires moderate land**
2. **Vermicomposting**
    - **High-quality compost**

- **Sensitive to weather**

3. **In-vessel composting (IVC)**
    - **Compact, odour-controlled**
    - **Higher CAPEX**
4. **Anaerobic Digester (Biogas)**
    - **Only advisable with steady feedstock and trained operator**
    - **Higher investment + maintenance**

2.3 Support Infrastructure

- **Incoming waste receiving area**
- **Leachate drainage and collection**
- **Dry waste storage zone**
- **PPE and safety equipment**
- **Weighing scale (optional but recommended)**
- **Data monitoring system**

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3. Is the Waste Volume Sufficient for an MRF?

Yes—although campus waste (~0.24–0.29 TPD) is small:

- **A small manually operated MRF is fully feasible**
- **Operating costs per kg are higher, but acceptable for campus sustainability objectives**
- **Industrial-scale mechanization is NOT required at this stage**

To reach a 1 TPD facility, waste volume would need to quadruple, which is only possible by including nearby communities.

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4. Recommended Minimum-Viable Facility

Component	Recommended Specification
Receiving Area	250–300 kg/day capacity; roofed

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MRF Line	2–3 sorting stations + sorting tables
Organic Processing	Compost pits initially OR in-vessel composter
Recyclable Storage	Segregated bins; baler if volume grows
Staffing	1–2 workers + student volunteers
Leachate Management	Leachate tank + drainage
Monitoring	Track daily waste and recovery efficiency

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5. Scaling Criteria

Scale up when:

- **Waste exceeds 0.5–0.7 TPD**
- **Segregation levels stabilize**
- **Compost quality is consistent**
- **Recyclable volume justifies mechanization (baler, conveyor)**
- **Campus population or catchment increases**

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6. Key Risks & Challenges

1. **Poor source segregation → contamination**
2. **Operational cost maintenance**
3. **Compliance with MSW Rules (2016 & amendments)**
4. **Space limitations, especially for composting**
5. **Community participation and behaviour change**

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7. Implementation Strategy

Phase 1 – Pilot (6–12 months)

- **Manual MRF + compost pits**
- **Collect accurate baseline data**

- **Quality testing of compost**
- **Awareness activities for students/residents**

Phase 2 – Expansion

- **Add baler + conveyor belt**
- **Upgrade to in-vessel composting or vermicomposting**
- **Evaluate feasibility for biogas plant**
- **Explore partnerships with municipality, NGOs, recyclers**

Conclusion
This quantity is fully adequate for a small-scale MRF + organic processing system.

A modular, low-cost setup is recommended initially, with room to expand as waste generation and campus participation increase.
