Executive Summary of DTU Energy Audit Report (Phase-1 & 2)

1) Context, Goal & Method

This energy audit of Delhi Technological University (DTU) was carried out to assess the entire campus electricity consumption, identify inefficiencies in major systems, and recommend targeted Energy Conservation Measures (ECMs). The study involved two phases, covering not only the quantitative assessment of energy bills, equipment loading, and system efficiencies but also on-site inspections and performance monitoring. The purpose is to provide a roadmap that ensures energy savings, cost reduction, improved system reliability, and lower carbon emissions. The methodology combined detailed measurement of chillers, pumps, AHUs, transformers, elevators, lighting systems, and power quality with a critical review of electricity bills and operational practices.

2) Campus Energy Profile (Baseline Snapshot)

The DTU campus annually consumes ~8.27 million kWh of grid electricity, with diesel generators contributing a negligible fraction of less than 0.02%. The total energy bill amounts to approximately ₹12.39 crore at an average tariff of ₹14.97 per unit. The power factor across the campus is generally strong, averaging 0.98, which means reactive power penalties are unlikely. This baseline reveals that electricity is the overwhelming cost driver, and therefore any meaningful savings must come from efficiency improvements in electrical systems rather than fuel substitution. This highlights the potential of low-cost, high-impact interventions like optimizing transformer loadings, HVAC improvements, and solar PV adoption.

3) Electrical Distribution & Power Quality

Electricity is supplied through six 11 kV transformers distributed across the campus. However, the audit revealed extremely low loading on certain transformers, such as the AB3–AB4 1600 kVA units running at only 6–12% capacity. Since transformers operate most efficiently at 40–50% loading, this under-utilization results in significant no-load losses. By consolidating loads and switching off redundant transformers, DTU could save up to 12,614 kWh annually per substation, equating to ~₹1.9 lakh in avoided costs. Similarly, hostel transformers are also running under-loaded.

In addition, power quality studies showed dangerously high current harmonics (THD over 670% in some cases) at elevator panels, though voltage harmonics remained acceptable. These distortions not only waste energy but can also shorten equipment life. The installation of harmonic filters and better load management is urgently required. This shows how invisible inefficiencies can silently increase energy costs and risks.

4) Central Plants, HVAC & Allied Systems

The chiller plants form the backbone of DTU's cooling requirements. The study found that Chiller-2 at the Central Library was operating with a Specific Actual Energy Consumption (SAEC) of 0.88 kW/TR, which is significantly higher than the efficient benchmark. Contributing factors include inefficient condenser pumps and poorly performing cooling towers. Cooling Tower #3 was found with an effectiveness of just 33.5% and an approach temperature close to 6°C, far from desired efficiency levels. Refurbishment of towers and installation of automatic tube cleaning systems for condensers are immediate solutions. Air Handling Units (AHUs) were also found wanting, with 15 of 24 units delivering substandard performance due to clogged coils, filters, and worn-out parts. Refurbishing these AHUs while retaining casings is a cost-effective option compared to replacement. Booster pumps were recorded at efficiencies as low as 54%, pointing to both poor selection and maintenance practices. Variable Frequency Drives (VFDs) can provide better control and savings. Elevators, especially older ones, showed lagging power factor and higher energy draw, requiring retrofits with modern drives. Street lighting, with a connected load of nearly 138 kW, still depends on older fixtures. LEDs with occupancy and dusk-to-dawn controls can slash this load. Heating systems, reliant on oversized electric water heaters, were alarmingly inefficient, converting less than 3% of electrical energy into useful heating due to fouled coils and insulation losses. Refurbishment is strongly recommended.

5) Proposed ECMs (Savings & Paybacks)

The ECM portfolio includes a mix of quick wins and medium- to long-term investments. Quick wins such as cooling tower refurbishment, occupancy sensors, and automatic tube-cleaning systems provide paybacks of less than a year. For example, occupancy sensors alone can save 135,000 kWh annually with a payback of 0.22 years. Medium-term measures include VFDs for pumps and elevators, AHU refurbishments, BLDC fan replacements, and building insulation upgrades. These require higher investment but deliver significant recurring savings.

The most capital-intensive recommendation is the installation of a rooftop solar PV system. Depending on final sizing (612 kW based on available area, or 952 kW as proposed in ECMs), DTU can generate nearly 1 GWh of renewable electricity annually. This offsets ~₹77 lakh in annual costs with a payback period of less than 5 years, besides positioning the university as a sustainability leader. Supporting measures like APFC panels and water management systems avoid hidden losses and ensure compliance with regulatory standards.

6) Emissions Impact

Implementing the recommended measures would reduce carbon emissions by ~1,500–1,640 tonnes of CO_2 annually. This aligns with India's broader climate targets and demonstrates DTU's contribution to reducing the carbon footprint of educational campuses. Such reductions also open doors for future recognition, possible carbon credit monetization, and enhanced public image.

7) Implementation Roadmap

The recommended path forward is to phase out investments strategically. Phase-0 actions involve immediate operational measures with little to no capex, such as transformer load optimization, tube-cleaning systems, cooling tower refurbishment, occupancy sensors, and heater maintenance. These yield fast returns. Phase-1 involves moderate investment items like VFD installations, AHU refurbishments, BLDC fan rollouts, roof insulation, and harmonic mitigation. These have medium paybacks but also improve comfort and system reliability. Phase-2 focuses on larger strategic investments such as solar PV, which has a longer payback but provides sustainability branding and long-term cost reduction.

8) Expected Outcomes

If implemented, DTU can expect energy savings of 2.2–3.6 GWh annually, translating to ₹2.36–2.64 crore in financial savings each year. The overall portfolio yields a simple payback of 2–2.4 years, which is very attractive for institutional projects. Beyond cost savings, DTU gains in reliability (better performing HVAC, lighting, lifts), improved comfort for staff and students, and significant reductions in environmental impact. This positions DTU not only as an efficient campus but also as a role model for other institutions.

8) Key Comments

- Installed systems generally reliable and in serviceable condition.
- Preventive maintenance practices are followed.
- Safety measures (earthing, relays, breakers) in place.
- Skilled staff available for routine O&M.
- Weak Points of Electrical Equipment:
- Certain equipment reaching end of service life.
- Risk of failure increases due to ageing infrastructure.
- Limited redundancy in older systems.
- Efficiency is lower compared to modern technology.
- UG Cable Replacement (Due to Ageing):
- Underground (UG) cables showing signs of deterioration.
- Periodic testing recommended (insulation resistance, VLF, Hi-pot).
- Replace ageing cables to avoid unplanned outages.
- Priority to be given to high-load and critical feeders.
- Solar Power (1 MW – Future Expansion)

- Existing 1 MW solar plant operational.
- Scope to install higher capacity to meet growing demand

In short, DTU can achieve immediate, medium, and long-term gains by prioritizing ECMs sensibly. Low-capex quick wins provide momentum, while strategic investments like solar PV ensure long-term resilience and sustainability. The dual benefit of economic savings and emission reductions ensures the report's recommendations are not only financially sound but also environmentally responsible.

For **Namdhari Eco Energies Pvt. Ltd.**

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