Terms of Reference (ToR)

Title of the Assignment: Study on the Fuel Switching Potential and Readiness Assessment of Thermic Fluid Heating Systems in Nepal's Plastic Manufacturing Industry

1. Background

Nepal's plastic manufacturing sub-sector — comprising PVC and HDPE pipe extrusion, woven sack and PP/BOPP bag production, flexible packaging film manufacturing, blow-moulded container production, and injection-moulded plastic goods — relies on process heat at several stages of manufacturing: resin drying and pre-conditioning, extrusion barrel and die-head temperature control, calendaring, lamination and coating of films, mould pre-heating, and product annealing/finishing. A substantial share of these units use thermic fluid heaters (hot-oil systems) fired on diesel or furnace oil to generate and circulate the heat required for these processes, particularly where indirect, closely-controlled, and uniform heating is needed for product quality (e.g., film lamination, pipe socket-forming, and calendar-roll heating).

Diesel- and furnace-oil-fired thermic fluid heating exposes plastic processors to volatile fuel prices, import dependence, and periodic fuel-supply disruption, while also contributing to Scope 1 GHG emissions and localised air-quality impacts around industrial clusters. At the same time, Nepal's power system has undergone a structural shift over the past three to four years: large hydropower commissioning has moved the country from chronic import dependence toward periods of domestic surplus, and the national utility now actively promotes electricity use in industrial process-heat applications through preferential industrial and 'high-value' tariff structures.

This creates a plausible — but as yet unquantified — opportunity for plastic manufacturing units to substitute diesel- and furnace-oil-fired thermic fluid heating with electricity-based alternatives, including electric thermic fluid heaters, electric resistance/induction heating systems, and heat-pump-assisted process heating, potentially supplemented by hybrid configurations where full electrification is not yet economic or technically suitable for a given process step.

Whether this opportunity is realistically exploitable, however, depends on facility-specific factors that have not been systematically studied for Nepal's plastic processing sector: the temperature and heat-transfer-fluid flow requirements of each process line, the capacity and reliability of local grid connections, the capital cost and payback period of electric retrofit options relative to continued fossil firing, sensitivity of product quality (e.g., film clarity, pipe wall integrity) to heating-system changes, and the willingness and financial capacity of plant owners to invest in transition technologies.

2. Rationale and Need for the Study

This study is needed for the following reasons:

- No existing baseline quantifies the current fuel mix, thermic fluid system configuration, or process-heat consumption intensity across Nepal's plastic manufacturing units, which constrains evidence-based policy and investment planning.

- Nepal's Renewable Energy and Energy Efficiency (REEE) Bill and the Nationally Determined Contribution (NDC) both signal a policy direction toward industrial fuel switching and process electrification, but sector-specific readiness assessments — including for plastic processing — remain limited.
- Diesel and furnace oil price volatility directly affects the production-cost competitiveness of Nepali plastic products (pipes, packaging, sacks) relative to imports, making fuel switching a potential cost-resilience measure as much as an environmental one.
- Thermic fluid heating is closely tied to product quality in plastic processing (e.g., uniform lamination temperature, consistent pipe wall-forming heat), so switching feasibility must be assessed against process-control and quality-risk considerations, not fuel cost alone.
- Technology vendors, financiers (including AEPC subsidy windows and commercial green-financing lines), and utilities require a credible, facility-level probability assessment — not aspirational statements — before committing resources to pilot or scale interventions.

The study is therefore designed to move beyond a generic advocacy statement for electrification, and instead produce a defensible, facility-differentiated estimate of which segments of the plastic manufacturing industry can realistically switch their thermic fluid heating systems, under what conditions, and with what technology, timeline, and support.

3. Objectives

3.1 Overall Objective

To assess the technical and economic probability of fuel switching from diesel- and furnace-oil-based thermic fluid heating systems to electric and other greener process-heating technologies in Nepal's plastic manufacturing industry, and to produce actionable recommendations for industry, financiers, and policymakers.

4. Scope of the Task

- Conduct a comprehensive literature review of national and international best practices on industrial process heating, thermic fluid heating systems, industrial electrification, biomass-based heating technologies, and fuel switching in the plastic manufacturing sector.
- Identify and prepare an inventory of plastic manufacturing industries in Nepal utilizing thermic fluid heating systems, including their geographical distribution, production capacity, and major manufacturing processes.
- Conduct walkthrough energy surveys of identified plastic manufacturing industries using thermic fluid heating systems to collect information on:

  - Industrial profile and production capacity.
  - Existing thermic fluid heating systems and process applications.
  - Fuel type, annual fuel consumption, and fuel costs.
  - Operating parameters and annual operating hours.
  - Thermal energy demand and process heat requirements.

- Existing electrical infrastructure and grid readiness.
- Production processes utilizing thermic fluid heating.
- Existing operational and maintenance practices.
- Future expansion plans and investment priorities.

- Identify and evaluate technically feasible fuel-switching pathways for thermic fluid heating systems.
- Assess the technical feasibility of each fuel-switching option by evaluating process compatibility, heating temperature requirements, equipment modifications, electrical infrastructure requirements, fuel availability, operational reliability, safety, maintenance requirements, and technology maturity.
- Carry out techno-economic analyses for each identified fuel-switching scenario, including estimation of capital investment, operating costs, annual energy savings, fuel cost savings, greenhouse gas emission reductions, payback period, Net Present Value (NPV), Internal Rate of Return (IRR), and sensitivity analysis.
- Assess the availability, supply chain, quality, pricing, and long-term sustainability of alternative fuels such as biomass pellets, briquettes, and other renewable fuels.
- Evaluate the readiness of the electrical distribution infrastructure, including transformer capacity, sanctioned demand, load profile, tariff implications, and grid upgrade requirements for electrification of thermic fluid heating systems.
- Conduct KII with relevant government agencies, industry associations, plastic manufacturers, technology providers, fuel suppliers, financial institutions, and other key stakeholders to validate findings and identify barriers to adoption.
- Review existing policies, regulations, standards, financing mechanisms, and incentive programs related to industrial energy efficiency, process heating, and fuel switching, and recommend policy interventions to facilitate sector-wide adoption of cleaner heating technologies.

5. Expected Outputs / Deliverables

- Inception Report, including finalised methodology, sampling frame, and data collection tools.
- Industry Mapping Database (Excel), covering the identified population of plastic manufacturing units with thermic fluid heating application.
- Techno-Economic Model (Excel), covering LCOH, payback, IRR, and GHG abatement by technology pathway.
- Final Study Report including the fuel-switching probability index and sub-sector extrapolation.

6. Study Team and Expertise Required

Position	No.	Minimum Qualification	Minimum Experience
Team Leader (Certified Energy Auditor)	1	Master's in energy system and related field; certified Energy Auditor	8+ years in industrial energy auditing, with demonstrated experience leading multi-sector or facility-level fuel-switching/feasibility studies
Techno-Economic Analyst	1	Master's in Economics/Energy Economics, Business Administration with engineering background	7+ years in techno-economic modelling (LCOH, payback, IRR), GHG accounting)
Electrical Engineer	1	Bachelor's degree in Electrical Engineering	5+ years in industrial electrical system, load/power quality assessment and electric process heating system.
Thermal Engineer	1	Bachelor's in Mechanical/ chemical Engineering	5+ years in industrial thermal systems, thermic fluid heating, process-heat assessment
Researcher (Desk Study, Survey & Data Collection)	1	Bachelor's degree in Engineering, Statistics, or related field	Fresh graduate eligible

7. Timeline

The study is expected to be completed within approximately 2 months from the date of signing of contract.

8. Required Documents from Consultant

- Cover letter for submission of Expression of Interest (EoI), need to indicate clearly about the applied assignment
- Firm/Company Registration Certificate (with updated renewed)
- VAT/PAN Certificate (For Domestic Consultants only)
- Tax Clearance Certificate of FY 2081/82 (For Domestic Consultants only)
- Power of Attorney for authorized signatory
- Self-declaration of eligibility
- Profile of Key Human Resources (During EoI Stage) and Signed CVs of proposed experts (During RFP Stage only)
- Documents to demonstrate:
    - General work experience within the last 10 years
    - Specific work experience within the last 10 years
    - Technical and Managerial capacity of the Consulting Firm including Audit Reports of last three years

9. Consultant Selection Method:

A Consultant for each cluster will be selected in accordance with the **Consultants Qualifications-based Selection (CQS)** method set out in the prevailing Procurement Regulations of the World Bank.