THERMAL ENERGY RESEARCH LABORATORY

Thermal Energy Research Laboratory (TERL) is designed to provide current and future applied research required in thermal energy sector. TERL was established in 2017 with funding from USAID. The research in the laboratory will be concerned with questions related to industrial applications based on thermodynamics, fluid mechanics, and heat and mass transport principles. Using a combined approach of theoretical analysis, numerical calculations, and experimental investigations; TERL aims to carry out fundamental studies, development of cutting-edge technology and applications based on industrial requirement in various thermal energy field. The research lab is equipped with modeling software, analytical equipment, test facilities, and data acquisition to address the problems of thermal energy sector of Pakistan. Research at TERL was funded by USAID, HEC, PSF, and other industrial partner. The state-of-the-art facilities available at TERL provides the testing services to academia, public, and private sector.

LAB MISSION

To solve issues and challenges faced by the thermal energy sector.

RESEARCH PORTFOLIO

Thermal Fluid Sciences, Power Plants, Gas Turbines, Fuel and Combustion, Thermal Hydraulics, Environmental Protection, Thermal Energy Storage, Multiphase Flow, Computational Fluid Dynamics

RESEARCH EQUIPMENT

Equipment	Description	Specification
Bomb Calorimeter	To determine the calorific value of liquid and solid fuels.	Calorimeter with Isoperibol oxygen bomb. Required Sample wt. or vol.: 5-10 mg or ml
Gas Chromatography Mass Spectrophotometer	To identify different substances present within a sample.	Column: SH-Rxi™-5Sil MS. For qualitative analysis of liquids: semi-volatiles, chlorinated hydrocarbons, phthalates, phenols, amines, organochlorine and organophosphorus pesticides, and hydrocarbons.
Thermal Conductivity Meter	To determine thermal conductivity.	Method: Guarded Heat Flow Meter Specimen Diameter: 50 mm Specimen Thickness: 12-22 mm Thermal Conductivity Range: 0.1 - 40 W/m.K
Differential Scanning Calorimetry	To determine the glass transition temperature.	Method: Standard Heat Flow Specimen wt.: 7-10 mg Temperature Range: -20 - 300 oC
Viscometer	To measure the viscosity of a fluid as a function of temperature.	Specimen vol.: 16-20 ml Spindle Speed: 1-200 RPM Temperature Range: 0 - 100 oC
High Speed Camera	For the flow visualization and capturing moving the images at frame rates in excess of 0.8 million frames per second	Max. Speed: 12,000 fps at full resolution 1280 x 800; 820,000 fps at reduced resolution of 128 x 16. Sensitivity: Monochrome 32,000D
Infrared Camera	A non-contact temperature measurement device for thermal imaging and analysis.	Temperature Range: -10-1200 oC Image Capture Frequency: 9 Hz IR Spectrum band: 7.5-14 µm
Particle Image Velocimetry	A non-intrusive laser optical measurement technique used for research and diagnostics into flow.	The 2D-PIV system measures the in-plane two-dimensional velocity component irradiated on the laser light sheet. Typical time resolution: 10 Hz
Flue Gas Analyzer	To determine constituents of flue gas stream along with other measurements.	Probe Length: 300 mm Stack Gas Sensors: O2 (0-25 %), CO2 (0-99.9 %), and NOX (0-5000 ppm). Temperature Range: -20-800 oC, Differential Pressure Measurements: -10-200 mbar
Engine gas Analyzer	For analyzing the emissions produced by automobiles.	Emission Analysis of petrol and diesel IC engines
Data Acquisition Systems	For measuring an electrical or physical phenomenon such as voltage, current, temperature, and pressure, with a computer.	Inputs: Standard 4-20 mA signal; Temperature, Pressure, Flow, Voltage, Frequency etc. Channels: 36, Response Time: 1 sec
Engine gas Analyzer	For analyzing the emissions produced by automobiles.	Emission Analysis of petrol and diesel IC engines