



Engineers India Limited

HEAT AND MASS TRANSFER SERVICES





PROFILE

Engineers India Ltd. (EIL) is a leading global engineering consultancy and EPC company. The Company has a diverse portfolio comprising Hydrocarbon, Chemicals & Fertilizers, Mining & Metallurgy, Infrastructure, Water and Waste Management, Solar & Nuclear Power sectors.

EIL has emerged as a 'Total Solutions' engineering consultancy company providing design, engineering, procurement, construction and integrated project management services from 'Concept to Commissioning' with highest quality and safety standards. It also provides specialist services such as heat and mass transfer equipment design, environmental engineering, specialist materials and maintenance and plant operations and safety services.

Over the past five decades, EIL has executed more than 5000 projects including over 400 major projects. These projects, successfully completed and operating smoothly (in most

cases at more than rated capacity), have created an array of satisfied clients. EIL has secured many repeat businesses from clients; a sign of client satisfaction, confidence and trust reposed in EIL.

Over the past five decades, EIL has executed more than 5000 projects including over 400 major projects worth USD 200 Billion in total cost.

EIL has earned the reputation of being a veritable treasure of technical knowledge, skills and professional competence. We have worked with almost all process licensors and a large number of engineering/ contracting companies worldwide and are well versed with international engineering codes and practices. With an workforce of over 3400 experienced employees determined to deliver projects, EIL offers an advantage to clients like none other.

5.6 million available Technical Manhours annually

9,600 available Construction Management and Supervision Man-months annually

Geographical Regions

Middle East

Asia Pacific

Europe

Africa

Key Countries served

UAE / Bahrain / Kuwait / Iran / Oman / Saudi Arabia / Qatar / Iraq

Australia / Malaysia / Indonesia / Turkey / Bangladesh / Vietnam

Norway

Algeria / Ghana / Kenya / Nigeria / Angola / Sudan / Cameroon

Key Strengths

Track Record

- 59 Refinery projects, including 10 green field refineries,
- 9 Petrochemical complexes,
- 39 Oil and Gas Processing projects,
- 209 Offshore platforms including 40 process platforms,
- 42 Pipeline projects,
- 13 Ports, Storage & Terminals,
- 8 Fertilizer projects,
- 29 Mining and Metallurgy projects,
- 29 Infrastructure projects (airports, highways, bridges, water management, & energy-efficient intelligent buildings),
- 17 Turnkey/EPC projects.

Technology

- Technology Neutral Company - having experience with almost all Licensors.
- Dedicated R&D centre which has developed over 30 process technologies.
- In-house Specialist services in: Geotechnical, Material selection, Corrosion and Maintenance, Refractory engineering, Environmental engineering, Energy efficiency studies, Risk analysis, EIA, HAZOP and Safety services.
- Exposure to recent technological developments via practical implementation on projects.
- Continuous Process improvement through feedback from operating plants.

Leadership Position In Design, Engineering And Project Management

- All capabilities under one umbrella offering services from Concept to Commissioning/Closure.
- Established Process Design Capabilities.
- Global presence and experience in project execution in challenging terrain, delivering Cost effective, Time bound, Quality solutions.
- Dedicated Planning, Estimation & Costing Departments.
- Extensive Revamp and Modernization experience.
- Five decades of Integrated engineering & project management experience in heavy industries.

Value Engineering Through Innovative Solutions

- Sourcing from its strong Basic Design Capabilities.
- Exposure to alternative technologies.
- Experienced and qualified technical personnel.
- Extensive in-house databank for complete projects in Process Design, Engineering, Costing and Procurement.
- Extensive Vendor capabilities Database with over 2000 vendors globally. Annual worldwide Equipment Procurement of over USD 2 to 3 Billion.
- In-house Construction Management Team for Quality Assurance and Construction Supervision.
- In-house bulk material control systems for management of bulk materials from Engineering to Construction stages.
- Continuous updation of Design Procedures based on feedback from clients and post-commissioning services.

Quality & HSE

- An ISO 9001-2008 certified company.
- Follows its in-house Quality and HSE procedures, manuals and lessons learnt during all stages of project execution from Conceptualization to Commissioning.
- Adheres to International and Local Environmental regulations and norms during implementation of all its projects.
- Received several Safety awards and Certifications from various clients and safety accreditation councils.



Services from Concept to Commissioning

Pre-project Services

- Feasibility Studies (Pre, Detailed and Bankable)
- Financial Evaluation including sensitivity analysis
- Environment Impact Assessment for Mines and Process Plants
- Due diligence Studies
- Site Selection
- Technology & Process Licensor Selection
- Process Scheme Optimization
- Cost Estimation (Capital and Operating)
- Planning and Scheduling
- Mining Plans and Mine Closure Plans (for submission to Statutory Authorities)

Project Implementation Services

- Integrated Project Management
- Process Design and Front End Engineering
- Basic and Detailed Engineering
- Integrated 3D design & modeling
- Procurement
- Inspection and Third Party Certification
- Construction Management
- Commissioning and Plant Start-up Assistance
- Assistance during Factory Acceptance Tests
- Troubleshooting



Specialist Services

- Heat and Mass Transfer Equipment Design
- Environment Engineering
- Specialist Materials and Maintenance Consultancy
- Plant Operations & Safety including HAZOP, HAZID, SIL and Risk Analysis
- Corrosion Protection, Plant Integrity and Residual Life Assessment
- Yield & Energy Optimization Studies

Modes of Project Implementation

- Scoping, Pre-Feasibility & Feasibility
- Preparation of Process, Design and Basic Design Engineering Package
- FEED Preparation
- Project Management Consultancy (PMC)
- Engineering, Procurement and Construction Management (EPCM)
- Flexible service bundle offering to suit client requirements & process complexity.

Heat and Mass Transfer Services

The Heat and Mass Transfer Department of EIL was established in 1970 with an objective of developing and acquiring know-how of Heat and Mass Transfer equipment, the heart of process plants. EIL has evolved as a Technology based solution provider with a mission of creating value for its esteemed customers in Fired Heaters & Air Preheat Systems, Heat Exchangers, Column Trays, Packings & its Associated Internals, Oil/Gas/Water Separators, Gas Dehydration Systems, Waste Heat Boilers/Recovery Systems, Incinerator Systems, Sulphur Condensers, Desalters and Heater Treaters, Water Bath Heaters, Deaerator & Vacuum Ejectors.

EIL has worked on a very wide range of plants with a large number of Process Licensors and Engineering & Contracting Companies active in the Oil and Gas industry. It has a highly skilled, dedicated and experienced work force to meet the challenges offered by the Industry with continued in-house development of Systems and Technology.

Services Offered

EIL is one of the unique companies in the world offering following expertise in Heat and Mass Transfer Technology captively under one roof:

- Thermal / Hydraulic Design & Sizing of Fired Heaters & Air Preheating Systems, Heat Exchangers, Air Coolers, Column Tray/Tower Internals, Waste Heat Boilers/Recovery Systems, Sulphur Condensers, Separators, Vacuum Ejector systems, OBSG etc.
- Synthesis and Optimization of Heat Exchanger Networks, such as Crude Preheat Trains etc.
- Process Design and Engineering of onshore/offshore Gas Dehydration Systems.
- Mechanical Design and Engineering of the Heat and Mass Transfer equipment including Reaction Furnaces, Thermal Incinerator, etc.
- Procurement services for engineered as well as un-engineered equipment and systems as per customer's requirements.
- Site check and certifying EIL's designed / specified systems as ready to commissioning.
- Performance Guarantee Test Runs.
- Troubleshooting (including collection/analysis of performance data), recommendations w.r.t. operation/corrective engineering (as applicable) and other technical services/assistance.
- Revamp studies and implementation of system capacity enhancement and energy optimization.
- Efficiency improvement studies including retrofitting of Heat Recovery Equipment such as Air Pre-heaters, Steam generation systems etc.
- Execution for grass root, brown-field / revamp projects including adequacy checks of Process/Reaction furnace system, Trays / Tower Internals etc.
- System definition and formulation of technical specifications for procurement of vendor designed items : Utility Boilers, HRSG, Desalters, Heater Treaters & Water Bath Heaters etc.
- NOx / SOx abatement studies including technology evaluation and implementation services.
- Development of new products/upgradation of existing products through in-house R&D testing facilities.
- Development of new vendors for fabrication and supply of new products for competitive bidding.



Fired Heaters

EIL has to its credit over 400 installations of Fired Heaters including few with absorbed duty of more than 110 MMkcal/hr and over 100 cases of performance & efficiency optimization, capacity enhancement and revamps in different modes of execution (EPCM, PMC, EPC & OBE) spanning across all industrial sectors in domestic and international markets.

Expertise Offered

- ▶ NOx emission Audits and mitigation process
- ▶ Thermal Mechanical Design & Engineering of Process firedHeaters
- ▶ Mechanical Design and Engineering of Reaction furnaces
- ▶ Design/Engineering of Heat recovery systems like APH/Steam generation
- ▶ Procurement, Execution & PGTR
- ▶ Capacity and Efficiency Improvement
- ▶ Accidental Assessment
- ▶ Performance Assessment & Improvement
- ▶ Troubleshooting
- ▶ On-site performance evaluation and optimization
- ▶ Two-phase Flexibility & Vibration analysis and Computational Fluid Dynamics
- ▶ Failure Analysis and replacement of typical fired heater components
- ▶ Achieving target NOx emission through burner retrofits
- ▶ Specialized services for mechanical maintenance



Enviable Track Record

Design and execution of Fired Heaters of various configurations using industrially proven softwares based on vast experience.

- Vertical Cylindrical
- Box (Single / Multiple)
- Vertical tube Multi-cellular
- Twin VC
- Helical coil
- Arbor

Broad Spectrum of Applications

- Crude Heaters
- Vacuum Heaters including deep-cut service
- Hydrotreating Heaters
- Hydrocracking Heaters
- Delayed Cokers
- Reformers & Crackers
- Paraxylene heaters
- Hot Oil Heaters
- EDC Crackers, LAB heaters & PG reductio furnaces

Specialized Fired Heater Services

Performance Improvement Studies & Implementation

Fired Heaters need to be designed and operated at the maximum level of thermal efficiency. Typically, for each percentage increase in thermal efficiency, a potential saving of approximately 10 tons per annum of fuel is achieved for every MM kcal/hr of absorbed fired duty. This, with ever increasing energy cost makes it imperative to introduce energy conservation techniques in process plants. EIL enables:

- Extensive survey of existing furnace system to assess existing performance and identify areas of heat recovery potential.
- Provision or augmentation of heat recovery devices: Air-preheaters, steam heating/ generation system to boost up furnace efficiency.
- Refractory evaluation & recommendation.
- Computational Fluid Dynamic Analysis for improved performance.



The EIL Advantage

- 92+ % Thermal Efficiency
- Control scheme with advance features and latest instrumentation
- Optimized Heat Recovery System with minimum payback period
- Reliability and flexibility in operation
- Customized designs to best suit customer's application
- Heater designs to meet statutory emission targets
- Longer run-length
- Comprehensive services with single point responsibility.



Low NOx Burner Retrofit

With stringent NOx emission norms, Low NOx burners for Fired Heaters are a necessity. EIL has installed Low NOx burners in almost all heater configurations with varying burner spacing & orientation within the firebox and renders exclusive services in :

- Evaluation of Low NOx burners within existing constraints of firebox.
- Retrofit using vast inhouse databank and experience.

Natural Gas Firing Conversion

EIL provides total solution for displacement of fuel oil with natural gas in process fired heaters along with enhanced system efficiencies

- On-site survey and assessment of existing performance of the furnace system.
- Performance assessment with natural gas firing.
- Techno-economic evaluation of suggested modifications.
- Implementation assistance.

Revamps & Capacity Enhancement

- Establishment of de-rating of Fired Heater to ramp up its performance accurately for post revamp scenario.
- Capacity enhancement of Fired Heaters entailing minimal outages and modifications and downtime.
- Methodical and planned approach to simplify revamps.
- With EIL Fired Heaters are assured to surpass design expectations.

Mechanical Troubleshooting Assistance

- Flexibility & Vibration analysis of two phase flow in heater coils and providing solutions for mitigating vibrations and its associated hazards.
- Providing solutions to tube support failures in convection and radiant sections.
- Analyzing the tube failure situation.
- Re-building of heater systems.
- Implementation of revamp schemes considering maximum modularization and minimal down time.

Our Developments

- In-house development of Cast, Glass Airpreheaters and zero leakage site-doors.
- Development of plate type air-preheater for clean fuel services.
- Continual upgradation of own design modules based on actual operation and in-house data.

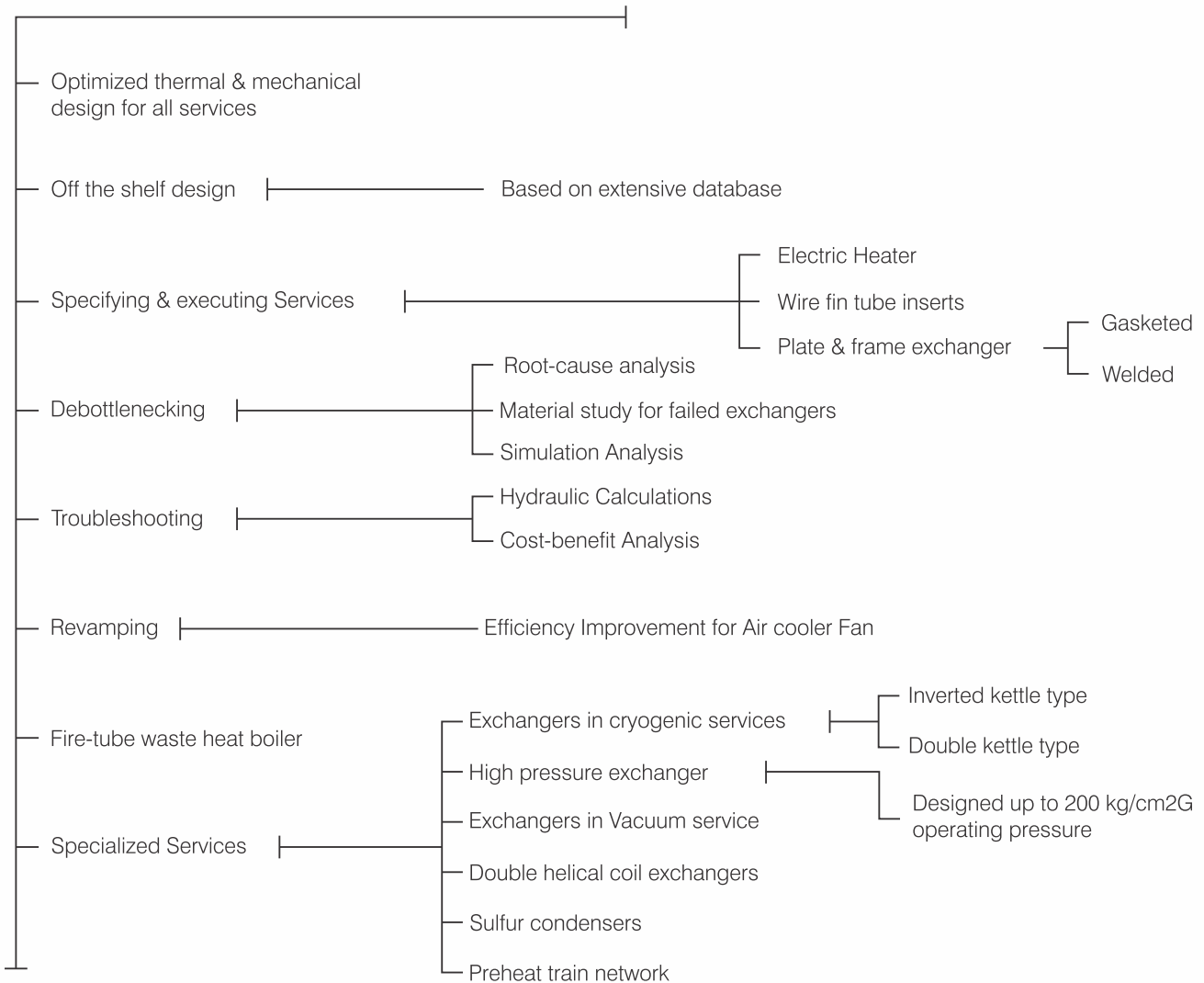
Heat Exchangers



Heat Exchangers play a vital role in energy optimization of process industry, ranging from refineries to petrochemicals, fertilizers, metallurgy and offshore. EIL has access to latest internationally recognized softwares for thermal design of Heat Exchangers by virtue of continued association with HTRI (Heat Transfer Research Inc., USA). In its more than 5 decades of experience EIL has designed more than :

- 10,000 shell & tube exchangers designed- single phase, condensers, vaporizers and reboilers.
- 700 air coolers.
- 75 multitube & double pipe exchangers
- 60 preheat train networks designed for various units like CDU/VDU, DCU, DHDT, FCCU etc.
- 50 preheat networks revamped.

Our Services & Expertise



Preheat Train

EIL expertise lies in synthesis and optimization of Heat Exchanger Network through in-house software based on cutting edge Pinch Technology. Because of crude price fluctuations energy management has become very dynamic and crucial, so there is a need to reduce energy cost by efficient network design.

The services offered by EIL are:

- Design of preheat networks for various units like CDU/VDU, DCU, DHDT, FCCU etc.
- Optimization and revamp of existing networks for best possible energy utilization.



Vacuum Ejector System

EIL has more than three decades of experience in design of single-stage and multi-stage ejector system. In-house software developed after extensive research along with globally renowned soft wares used for optimized design of pre/inter/after condensers.

- Vacuum in order of 5mm Hg.
- More than 60 ejectors designed running successfully in various industries.

Mass Transfer Technology Solutions

Beginning in 1980s, through collaboration with leading technology providers - M/s Hydronyl, UK and Norton, USA, EIL engineers not only assimilated the knowledge but also consistently improved the technology using the vast operating experience gained over the years coupled with regular performance feedbacks from various customers on a regular basis. All these improvements are validated in EIL's plant scale in-house testing facilities backed up by a strong R&D team. EIL has also been a regular member of Fractionation Research Inc. (FRI), USA. Information gathered on various developments taking place worldwide and the feedbacks received from FRI are well utilized in EIL design and practices. EIL has established relationships with major clients as well as Process Licensors & International Engineering companies.

Our Services

Ejector Hybrid System

Ejector System with overall cost effective Lifecycle Cost

Optimize Motive Steam consumption by Performance Feedback

Design Upgradation

Recycle Ejectors to supplement Overhead Ejectors to Reduce Steam



Process & Performance Guarantees under one roof



Cost Effective Designs — Extensive data bank — Experienced manpower



Inlet Feed Devices

Inlet feed device plays a vital role in separation of high flash mixed feeds. Performance of these devices is critical for meeting the quality of distillates particularly in Crude & Vacuum Columns and Product Fractionators. These devices have been successfully used in other separation services such as Gas-Liquid Separators and Gas Dehydration Units. EIL offers a wide range of Inlet Feed Devices such as Vane Type, High Performance Vapor Horn Type, Tangential Feed Type & Flash Gallery for these services.

- Well proven design based on CFD Studies further validated through testing at EIL R&D Facilities and actual plant applications.
- Uniform vapour velocity profile with minimum entrainment.

Trays

EIL services have been uniquely backed up by a well experienced process design & engineering group. EIL establishes an optimum column configuration keeping in view the overall process requirements and offers most suitable, well proven & cost effective design of trays for various grass root & revamp process applications including petroleum refineries, petrochemical plants, fertilizer industries, gas processing plants and other chemical industries. These applications include the following types of trays:

- Conventional trays with High Performance Valves, Sieve Trays, Bubble Cap Trays, Heat Transfer Trays, Collector trays and other internals for any grass root or revamp application.
- High Capacity trays mostly used to salvage the existing column. EIL evaluates the high capacity trays requirement and their selective application in a column.





Separators

Majority of two phase & three phase Test and Production Separators at offshore and onshore installations in India have been designed and engineered by EIL. These separators have been consistently under successful and trouble free operation meeting the desired separation. EIL has also successfully executed many projects involving grass root and revamp design of separator for the Middle East Clients. The services offered by EIL in this area include:

- Design of "Stand Alone Equipment" as well as "Skid Mounted Modular Construction"
- Upgradation/Debottlenecking for onshore/ offshore applications
- Guarantees at par with International standards:
- Oil in exit gas (~ 13.4 l/MMSCM)
- Oil in produced water (Max 200 ppmv)
- Water in Oil (Max 2% by volume)

Total Solutions

- Wide spectrum of services offered from Concept to Commissioning
- Total System approach for trouble free operation
- Continuous technology improvement ensuring the engineering excellence
- Work closely with clients to provide total solution unique to their needs
- On-site performance evaluation and troubleshooting with minimum modifications by immensely experienced team of engineers with unparalleled know how
- Process performance & mechanical design guarantee
- Cost effective Design
- Life-cycle support
- Extensive in-house data bank



Random, Structured Packing & Tower Internals

Special features of EIL Structured Packing:

- Patented Rhombus openings at module junction
- Patented Surface Texturization for better performance
- Smooth transition of fluid through modules
- Enhanced capacity
- Lower pressure drop
- Better structural rigidity





Gas Dehydration Systems

EIL has capability and expertise to carry out process design & engineering of Glycol based Gas Dehydration Systems for onshore and offshore installations. For the offshore modular installations, EIL has unique capability to carry out both process and mechanical design & engineering. EIL has executed GDUs for various domestic and international Clients. EIL has been closely associated with these clients and successfully completed several studies and troubleshooting assignments involving GDUs. The key features of the design offered are :

- Design of "Stand Alone Equipment" as well as "Skid Mounted Modular Construction"
- Upgradation/Debottlenecking for onshore/ offshore applications
- Performance guarantees at par with International standards:
- Low moisture content in the treated gas (3-6 lb/MMSCF)
- Low overall Glycol Losses (~13.4 l/MMSCM)
- Lower Glycol Circulation Rate by use of state of the art equipment.

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Delivering Excellence through People