MESSAGE FROM THE HEAD

It is privilege and pleasure to write these introductory lines for the M. Tech. programme in Energy Studies offered by us at the Centre for Energy Studies (CES) of the Indian Institute of Technology Delhi. Founded in the year 1981, this M. Tech. programme has the distinction of being the first such initiative in the country with primary focus on low carbon options for the energy sector. The alumni of the M. Tech. programmes offered by the CES have been making excellent contributions in the field while working with industry, government and non-governmental organizations as well as with academia.

While studying for their M. Tech. degree in Energy Studies, the students are provided knowledge and skills on various relevant facets of energy sector that include energy efficiency, renewable energy technologies, energy-environment interaction, energy economics and planning etc. In addition, they get an opportunity to undertake a detailed research project to acquire in-depth knowledge and practically useful skills in a certain focus area. All students are provided opportunities to grasp the inherent interdisciplinary nature of energy sector interventions and undertake appropriate case studies to reinforce the same. Moreover, it is our constant endeavor to keep the programme structure and course curricula updated and fine-tuned at regular periodic intervals so as to keep pace with the latest developments as well challenges and opportunities in the energy sector.

These students having unique advantage of getting exposed to all relevant interdisciplinary aspects of energy sector, I am confident that they will contribute effectively to the vision and the objectives of your organization, in particular and the country, in general. I strongly recommend them for your consideration and look forward to your recruiting them into the positions matching their caliber.

Prof. T.C. Kandpal
Head of Department
Centre for Energy Studies
Indian Institute of Technology, Delhi
Centre for Energy Studies (CES), IIT Delhi is an interdisciplinary centre with faculty members from different arenas of Science and Engineering. The competent group of faculty members who are involved in nurturing the future energy graduates are highly proficient in their fields of specializations, with strong commitments towards achieving the core objective of training their students. Currently, the Centre offers Masters and PhDs in distinct areas of energy. The course structures are designed to cater the requirements of the present day industries, ensuring placement for all the graduating students. In addition to this, the Centre also promotes to achieve career objectives in the core research areas of energy studies promoting higher studies, R&D and teaching through adequate personality and skill development. The students during their curriculum at CES, get transformed to capable technocrats ready to take up highly challenging interdisciplinary tasks having high societal impacts.

With state of art laboratory facilities and track record of international repute, we are confident that our students get the opportunity to learn the best technological innovations in the field of energy.

Also, we would like to mention the persistent zeal of our Centre students who leave no stones unturned to give their best when it comes to portray the high quality technical deliverable they have to tackle with in the fast growing area of energy sector. Our students are doing exceedingly good in their post degree endeavours achieving global recognitions exemplifying with exceptions to be from one of the Institute of Eminence, attracting both national and international companies for future recruitments.

Under the capable instinct and leadership of our Head with perennial efforts from the faculty members of our Centre, our students are definitely channelizing their interest in the right direction to achieve the best possible opportunity. We wish the students of Centre for Energy Studies the very best for their future endeavours.

Prof. Dibakar Rakshit  
Professor-in-Charge  
T&P, CES

Prof. K. Ravi Kumar  
Professor-in-Charge  
T&P, CES
The Centre for Energy Studies (CES) (Estd. 1976) at IIT Delhi is an interdisciplinary centre offering Master’s and Doctorate programmes. The centre derives its strength from the disciplines of Mechanical, Electrical, Instrumentation, Chemical Engineering along with Physics. The centre aims to promote clean energy solutions with better environment and standard of living for future.

Currently CES offers M.Tech in Energy Studies (JES). Apart from this, two new programmes—M.Tech in Energy & Environment Technologies and Management (ESN) and M.Tech in Renewable Energy Technologies and Management (ESR) are being introduced from this academic year. The ESR programme is specially introduced for students from member countries of International Solar Alliance (ISA).
ABOUT THE PROGRAMME

M.Tech in Energy Studies (JES) is a two year interdisciplinary Master’s programme offered by CES, IIT Delhi. Students after being screened on the basis of GATE (Graduate Aptitude Test in Engineering) score are selected based on their performance in test and interview conducted by CES. The programme offers a set of compulsory core courses and student can choose electives floated by CES (Programme electives) as well as other related departments (Open Electives). Students also need to undergo one lab course, that gives the glimpse of all the domains under CES. The programme aims at excelling student in emerging technologies in Energy sector as well the conventional technologies being used today. State-of-the-art Lab facilities are available in the department, which encourages the students to take full benefit of. The programme also tends to create awareness about environment for future and judiciously use the energy sources through techno economics, data analytics and other computational facilities.

**CORE**

- Fuel Technology
- Non-Conventional Sources of Energy
- Energy Conservation
- Heat Transfer
- Energy, Ecology and Environment
- Economics and Planning of Energy Systems
- Direct Energy Conversion

**PROGRAMME ELECTIVES**

- Energy Storage
- Economics and Financing of Energy Systems
- Wind Energy and Hydro Power Systems
- Hydrogen Energy
- Power Plant Engineering
- Solar Photovoltaics Devices and Systems
- Energy Audit
- Power Generation, Transmission and Distribution
- Operation and Control of Electrical Energy Systems
- Electrical Power Systems Analysis
- Fusion Energy
- Plasma Based Materials Processing

And many more.
OUR DOMAINS

IC Engine
- CFD analysis of IC engine processes
- Backfire study on Hydrogen fuelled SI engine
- DME direct and port injection
- Methanol fuelled SI engine
- Endurance test on lubricating oil
- Frictional study on IC engine

Fuel Technology
- Coal liquefaction and gasification
- Refining of Petroleum and Natural gas
- Biofuels: Solvent extraction process, double transesterification process
- Bio-char and waste water treatment plant
- Bio-oil extraction through pyrolysis process
- Oil / gas extraction from waste biomass

Solar Thermal
- Concentrated Solar Power System
- Solar thermal energy storage
- Solar Cooker
- Storage material characterisation

Electrical Power and Renewable Energy Systems
- Distribution System Analysis and Optimisation
- Power system stability
- Evaluation of multi generation frequency control
- System expansion planning
- Smart grid, micro grid and rural electrification
- Power electronic converters

Solar Photovoltaic
- Silicon solar cells
- Perovskite based solar cells
- Organic PV solar cells

Plasma Physics
- Negative Hydrogen ion production
- DC, RF and ECR sources
- Atmospheric pressure plasmas
- ECR thrusters
- Plasma theory and simulation
**LAB FACILITIES**

**IC Engine and Unconventional fuel lab**
- AVL Research Engine
- Smoke Meter
- VISEOFEM
- FTIR and NDIR Analysers
- Combustion and exhaust Analysers
- SI, CI and HCCI Engine setup for DME, CNG, Hydrogen, Biodiesel fuel.

**Setup for hydrogen fuelled Multi-cylinder spark ignition engine**

**Electrical Power and Renewable Energy Systems**
- Wind and Small Hydro Lab
- Wind and Solar System Emulator
- Transmission Line Models
- Smart DC home, smart meters
- Unbalanced Distribution models
- Power Flow and Stability Analysis
- State Estimation and Optimal power flow studies
- Power electronic converters, renewable energy integration

**Small Hydro Turbine Arrangement**
Solar thermal and Refrigeration Lab

- Light Pipe System
- Thermal Imaging Infrared Camera
- Differential Scanning Calorimeter
- Solar Pyranometer and Pyrheliometer
- Ultrasonic Homogenizer
- Thermocouple Calibrator
- Heat Pipe
- Thermoelectric Generator/Refrigerator Setup
- Solar PV based thermoelectric cooling system

Pyrheliometer

Solar Photovoltaic Research Lab

- Silicon cell characterisation and fabrication
- Plasma Cleaner
- Solar Simulator
- Thermal Evaporator
- UV visible Spectrography
- Impedance Analyser
- Photo Luminescence Quantum Efficiency
- Plasma Enhanced Vapour Decomposition
- Capacitance Voltage Measurement
- PV powered PEFC Fuel cell system

PLQE Setup
Plasma Physics Laboratory

- Software on beam propagation methods and self-organization/chaos
- High resolution spectrometer for plasma emission spectroscopy
- Large volume plasma system (volume ~ 2 cu. m)
- Compact ECR plasma sources
- Microwave Generator at 2.45 GHz up to 5 kW Power
- Atmospheric Pressure Plasma Jet

Tools and technologies

Tools and technologies
Spray Propagation Simulation using converge CFD
## Students' Profile

<table>
<thead>
<tr>
<th>Name</th>
<th>Background: Mechanical Engineering</th>
<th>Project</th>
<th>Areas of interest</th>
<th>Software Skills</th>
<th>Experience</th>
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<tbody>
<tr>
<td>Abhinav Prajapati</td>
<td>(Background: Mechanical Engineering)</td>
<td>Battery Thermal Management System of Cylindrical Battery Pack in Electric Vehicles</td>
<td>Electric Vehicles, Heat Analysis in PCM, Thermal Power Plant</td>
<td>ANSYS, MATLAB, Python</td>
<td>Industrial Training (6 Month) at NTPC</td>
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<tr>
<td>Aditya Singh</td>
<td>(Background: Mechanical Engineering)</td>
<td>Development of DME Fuelled Compression Ignition Engine under HCCI mode</td>
<td>Alternate fuels in IC Engine, Artificial Intelligence, Electric Vehicle</td>
<td>SolidWorks, ANSYS, CONVERGE CFD, MATLAB, Python</td>
<td></td>
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<tr>
<td>Anish Tuteja</td>
<td>(Background: Mechanical Engineering)</td>
<td>Modelling Methanol blended fuel Spray Characteristics</td>
<td>Power plant, Modelling and Simulation, techno-economics</td>
<td>MATLAB, Python, CFD Converge, Techplot</td>
<td>Bhilai Steel Plant (15 days), NTPC Sipat Bilaspur (1 month)</td>
</tr>
<tr>
<td>Anshika</td>
<td>(Background: Mechanical Engineering)</td>
<td>Analysis based design of heat exchanger using supercritical CO2 as a heat transfer fluid</td>
<td>Power plant, Modelling and Simulation, techno-economics</td>
<td>C, C++, MATLAB, Python, ANSYS</td>
<td>4-week summer training in ‘Rolling Stock Department’ in DMRC</td>
</tr>
</tbody>
</table>
Anshuman Singh (Background: Electrical Engineering)
Project: An optimization Framework for Load data clustering including Electric Vehicles
Areas of interest: Power system, optimization, renewables integration and microgrids, demand response, energy economics
Software Skills: SIMULINK, ETAP, PSPICE, MATLAB, PYTHON
Experience: 4 Week Vocational training in BHARAT COKING COAL LIMITED (BCCL)

Deepak Prasad (Background: Mechanical Engineering)
Areas of interest: Electric Vehicle, Alternate Fuels
Project: ETAP, Python, CFD

DIVYA DAS (Background: Mechanical Engineering)
Project: Impact of phase change material on the HVAC effectiveness of an automobile cabin
Areas of interest: HVAC, Energy Storage, Machine Learning
Software Skills: MATLAB, Ansys FLUENT, Python, C, C++, AutoCAD
Experience: Vocational Training at Ordinance factory Khamariya (15 Days) and Vehicle factory Jabalpur (15 Days)

Kirtan B. Patel (Background: Electrical Engineering)
Project: Development of algorithm for peer to peer energy sharing in building clusters in deregulated environment
Areas of interest: Power System Analysis, Demand side management, Distributed Generation Optimization and Control, Energy Blockchain
Software Skills: MATLAB, Python, ETAP, SIMULINK
Experience: Industrial Training (15 Days) at Wanakbori Thermal Power Plant, Gujarat; Siemens certified Basics of PLC course

Priyam Guria (Background: Mechanical Engineering)
Project: Numerical Analysis and Design of Rotating Heat Pipes for Turbine Blade Cooling
Areas of interest: Thermo-Fluids & Turbo machinery, CFD, Energy Auditing
Software Skills: CFD (ANSYS FLUENT & CONVERGE), MATLAB, AutoCAD
Experience: 21 days Vocational Training on O&M and Utility Services at Bakreswar Thermal Power Project, WBPDCL

R Sripathi Anirudh (Background: Mechanical Engineering)
Project: Hydrogen Storage using metal Hydride and integration with SI engine
Area of interest: CFD, CAD Modelling, Machine Learning, Heat/fluid flow Simulation/Analysis, Electric Vehicle, Energy Storage
Software Skills: Python, Creo Parametric (PTC), Ansys Fluent+ICEM (CFD mesh tool), COMSOL Multiphysics
Sushant Kumar (Background: Mechanical Engineering)
Project: Nonlinear Waves and Turbulence in Fluids
Areas of interest: Thermal and Fluid engineering, Electric vehicle
Software Skills: Autocad, Catia, CFD
Experience: GET (1 Year) in Reliance Industries Limited; Summer training (1 Month) at NTPC

Sourabh Patil (Background: Mechanical Engineering)
Project: Development of a thrust balance mechanism for measurement of the thrust of ECR based thrusters
Areas of interest: Metrology, Propulsion, Automobiles, Electric Vehicles, Supply Chain Management, Energy Auditing, Industrial Safety Techno Economics
Software Skills: MATLAB, CATIA, Python, C
Experience: 1 Year experience in Purchasing, Auditing, Safety and Supply Chain Management in Alfa Laval (I) Ltd; 15 Days summer internship on pump assembly line

Sushant Kumar (Background: Mechanical Engineering)
Project: Nonlinear Waves and Turbulence in Fluids
Areas of interest: Thermal and Fluid engineering, Electric vehicle
Software Skills: Autocad, Catia, CFD
Experience: GET (1 Year) in Reliance Industries Limited; Summer training (1 Month) at NTPC

Vaishali (Background: Electrical Engineering)
Project Title: Development of control algorithms for load frequency control in a deregulated environment
Software Skills: C, C++, MATLAB, Python
Area of Interest: Power system analysis, machine and drives

Vishal Srivastava (Background: Mechanical Engineering)
Project: Droplet Vaporization modelling of pure and blended alternative fuels in DISI engine
Area of interest: IC Engine and alternative fuels, Power plant Engineering, Solar refrigeration and air conditioning
Software Skill: CATIA, MATLAB, CONVERGE, PYTHON
Experience: 6 Weeks summer training at IRDE, DRDO, Dehradun

Yogesh Vishwakarma (Background: Mechanical Engineering)
Project: Modelling of atmospheric pressure plasma jet
Area of interest: Thermal and Heat transfer Simulation/Analysis, Power Plant Engineering
Software Skills: Comsol Multiphysics, Matlab, ANSYS
Experience: One month vocational training in Boiler Maintenance Department and Pump Section at NTPC Singrauli; Two week training in Heavy machine shop and Rotor shop at DLW Varanasi

Rishikesh Badagaiyan (Background: Mechanical Engineering)
Project: Plastic waste management by using plasma and IC engine.
Areas of interest: Waste management techniques, Power plant, Solar refrigeration & Air conditioning, Operation research.
Software skills- MATLAB, CONVERGE, Python, ANSYS
Experience: 1 Month industrial training on "hydraulic and pneumatic systems" at CRISP BHOPAL
Some ongoing funded projects

- Development and Demonstration of enhanced performance of the commercial automotive vehicle with Alternate Transportation (DST)
- Development of a Methanol-gasoline Fueled Spark Ignition Engine (SERB)
- Model Development and Analysis of Flash Boiling Spray for Internal Combustion Engines (DST and SERB)
- Demonstration of Grid Supportive EV Charger and Charging Infrastructure at LT Level (DST)
- Development and Characterization of ECR based plasma (DST)
- Strategic University Network to Revolutionise Indian Solar Energy (EPSRC, UK)
- Energy harvesting system for integrated low cost water sensor for real time river water monitoring and decision making (Indo-US Science and technology forum and DST)
- Characterization Studies of Nano-enhanced Phase Change Material in Thermal Storage Device for Sustainable Building Designs in India (DST)

There are always active research and development projects going on in CES. Numerous prestigious funding agencies often collaborate with CES for active R&D.

Annual average funding received in the last four years (2015-19):

~₹ 7 crores (~₹ 70 million)

Value of ongoing funded projects:

~₹ 10 crore (~₹ 100 million)
Past Recruitors

Placement Statistics 2018-19

- Placed: 70%
- Higher Education: 15%
- Other Interests: 15%
Interested companies contact professor-in-charge or placement officer, Training and Placement Cell for a Job Notification Form (JNF) at placement@admin.iitd.ac.in

JNF requires the companies to fill in mandatory details of the job profile – role offered, pay package, place of posting, eligible departments.

Once the filled-in-JNF with all the required details is received, companies are assigned username/password to access their online account on T&P website.

Companies are also assigned space on the server on which they may upload any presentation, videos, data or other information they want the students to see.

The JNF has to be frozen on the T&P website by the company till a deadline, after which the students shall be able to view all the details, and the eligible students may apply.

After the application deadline for the students, the resumes are visible to the company. The company submits shortlist on its online account before a deadline.

Shortlisted students get notified. The placement office allot dates for the campus interviews.

After the completion of the selection procedure on campus, company is required to announce the final list of the students on the same day itself.

If a student is selected, the job is registered against him/her and he/she would not be allowed to appear for more interviews as per placement policy.
PROFESSOR IN CHARGE

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T&P, CES
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Prof. K Ravi Kumar
T&P CES
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