

# Rajat Saxena

**Phone:** +91 9015607615; +91 8587865099;

**Email:** rajat.saxena@ces.iitd.ac.in; rajat.ideal@gmail.com

**Current Address:** A3/A6, Type A, South Avenue, IIT Delhi, Hauz Khas, New Delhi, India - 110016;

**Institute Address:** Indian Institute of Technology Delhi, Hauz Khas, New Delhi, India - 110016;

**Permanent Address:** House No. 850, Khata Baba, Isai Tola, Jhansi, Uttar Pradesh, India - 284003;

**D.O.B.:** 02/07/1986; **Citizenship:** Indian; **Languages:** Hindi, English; **Marital Status:** Married



## HIGHLIGHTS

Mechanical Engineer with excellent analytical skills having professional experience in the areas of **research and development** pertaining to **experimental investigations, laboratory management**, project management and quality assurance. A Ph.D. from Centre for Energy Studies, Indian Institute of Technology, Delhi (India) with proven ability in the field of building energy conservation. Currently, working on incorporation of thermal energy storage systems within building elements and provide a sustainable solution for reducing cooling/ heating loads. **Writing research proposals**, preparing and maintaining project schedules, developing project cost estimates etc. are other worth mentioning attributes. Outstanding skills in performing engineering evaluations and implementing solutions to various application issues. An eloquent speaker and proficient in leading technical discussions with existing and potential clients while working together with business developers and developing proposals for work programmes. Hands-on experience in mentoring students at tertiary level in building heat transfer, thermal characterization studies using differential scanning calorimeter (DSC) and manufacturing processes during research tenure at IIT Delhi. Have teaching experience of six and a half years in reputed Engineering colleges. Have taught Manufacturing Processes, Thermodynamics, Thermal & Hydraulic Machines and Material Science etc. during the teaching career and provided guidance to students for their final year projects.

## RESEARCH

My principal research interest lies in the field of Thermal Energy Storage (TES) for various applications. Application of TES by using a conventional method of increasing thermal mass of buildings using Phase Change Materials (PCM), has been explored meticulously. My future research plans are to build on the foundations being laid down during my PhD to further develop systems that can utilize solar energy to conserve fossil fuel and move towards greener tomorrow. I have published **three international journal paper** one in Elsevier Solar Energy and two in ASME Journal of Solar Energy. Two other publications are in pipeline. I have published and presented my work in four International conferences of which one was awarded with **Best Paper Award** in **4<sup>th</sup> World Congress in Madrid, Spain**. One conference poster won the **Runner-up prize** at **DTU, Delhi** and was highly appreciated by the scientific community. I have also mentored various group tasks of the team that included proposal preparation/ submission to sponsoring agencies and various outreach programs related to academic industry interactions at Institute level.

## EDUCATION

### 2016-ongoing Ph.D. (Thesis submitted)

**Title:** "Integration of phase change materials for thermal regulation & cooling load abatement of buildings in typical Indian conditions"

**University/Institute:** Indian Institute of Technology, New Delhi (India); **Score:** 9.0/10 (Ph.D. course work)

**Supervisors:** Dr. Dibakar Rakshit (Associate Professor) & Prof. S.C. Kaushik (Emeritus Professor)

**Courses studied:** Solar thermal power generation, Solar Refrigeration & Air Conditioning and Solar Energy Utilization;

**Research Outcomes:** 3 journal publication; 1 book chapter under review; 1 journal paper under review and 4 international conferences of which one was awarded with **Best Paper Award** and another with **runner-up award** for poster presentation.

**Projects:** Worked on a project "Characterization Studies of Nano-enhanced Phase Change Material (NEPCM) in Thermal Storage Devices for Sustainable Building Designs in India" under CERI, Department of Science & Tech., Govt. of India.

### 2010-13 Master of Technology (Energy and Environment Management)

**University/Institute:** Indian Institute of Technology, New Delhi (India); **Score:** 7.85/10

### 2005-09 Bachelor of Technology (Mechanical Engineering)

**University/Institute:** Uttar Pradesh Technical University, Uttar Pradesh (India); **Score:** 65.32%

### 2004 Higher Senior Secondary (Class 12<sup>th</sup>) (Indian School Certificate Examination)

**Institute:** Cathedral College, Jhansi, Uttar Pradesh (India); **Score** 80.3%

### 2002 Senior Secondary (Class 10<sup>th</sup>) (Indian Certificate of Secondary Education Examination)

**Institute:** Cathedral College, Jhansi, Uttar Pradesh (India); **Score:** 77.83%

## PROFESSIONAL EXPERIENCE (10 years)

### Research Experience (3.5 years)

- **Senior Research Fellow (SRF)**, Indian Institute of Technology Delhi (**IIT Delhi**), New Delhi (India), [1.5 years; Jan, 2018 – Till date]
  - Teaching Assistantship responsibility which includes preparation of course content, taking tutorials, evaluating assignments etc. for different subjects as instructed by respected supervisor (Heat Transfer, Solar Energy Utilization, Special Topics in Mechanical Engineering, etc.)
  - Conducting Laboratory Experiments for M. Tech and B. Tech students.
  - Other Departmental responsibilities i.e. during Admissions, Open House etc.
- **Junior Research Fellow (JRF)**, Indian Institute of Technology Delhi (**IIT Delhi**), New Delhi (India), [2 years; Jan, 2016 – Dec, 2017]
  - Teaching Assistantship responsibility which includes preparation of course content, taking tutorials, evaluating assignments etc. for different subjects as instructed by respected supervisor (Heat Transfer, Energy Conservation, Solar Energy Utilization, Non-Conventional Sources of Energy etc.)
  - Conducting Laboratory Experiments for M. Tech and B. Tech students.
  - Other Departmental responsibilities i.e. during Admissions, Open House etc.

### Teaching Experience (6.5 years)

- **Asst. Professor**, Department of Mechanical Engineering, G.L. Bajaj Institute of Technology, Greater Noida, Uttar Pradesh (India), [4 years; Jan, 2012 - Dec, 2015]
  - Courses taught: Manufacturing Processes, Manufacturing Science, Material Science and Manufacturing Practices.
  - Appointed as Proctor (section wise) consecutively for eight semesters; Worked as Counsellor in Admission Cell
- **Lecturer**, Department of Mechanical Engineering, Ideal Institute of Technology, Ghaziabad, Uttar Pradesh (India), [2.5 years; July, 2009 – Dec, 2011]
  - Courses taught: Thermodynamics, Thermal & Hydraulic Machines, and Material Science etc.
  - Responsible for co-ordination of activities under Industry Institute Partnership Cell & Value Education Cell and organized of technical and cultural fests/workshops
  - Worked for N.B.A. Accreditation; Appointed as Secretary of I-Robotics Club

## KEY ACHIEVEMENTS:

- **Publication & Conferences** (during Ph.D.): 3 International Journal Publications, 2 under review and 4 International Conference publications (*refer appendix for details*)
- **Technical Projects**: Worked on two technical projects (*refer appendix*)
- **Co-curricular Activities & Positions of Responsibility**: have been actively involved in the community services, extra-curricular activities and held responsible positions and designations throughout the Career progression.
- **Training and Seminars**: have undergone Training workshops and attended seminars to sharpen the attributes of practical learning, knowledge and presentation.

## KEY SKILLS

- **Research and Development** – Have experience of conducting experimental research. Ability to undertake experiments and data acquisition within stringent health and safety protocols. Have carried out thermal characterization experiments on DSC and on PCM incorporated building elements to assess its appropriateness. During M. Tech have worked on case hardening of steels using Plasma Nitriding.
- **Project Analysis, Evaluation and Execution** – Steering projects involving new concepts and approaches towards design of products. Executing analysis/evaluation of assigned projects, procedures and product/programme requirements.
- **Domain Skills** – Extensive experience in application of thermodynamics, heat and mass transfer and trained to perform thermal characterization studies using Differential Scanning Calorimeter (DSC).
- **Process Improvements** – Ensuring engineering test reports, engineering bulletins and assembly procedures are prepared in timely and professional manner. Recommending materials and components for inclusion in design specifications based on experience and reference data.

## STRENGTHS

- **Proposal Writing**: Hands-on experience of writing research proposals trained by my supervisors during research tenure.
- **Good Teaching skills**: Students of my section scored **highest marks** in **entire university** for **two years** in a row in my Course at **G.L.B.I.T.M., Gr. Noida, India**. At research level gave presentations to M.Tech./B.Tech students and assisted them in their research through knowledge transfer and guided/helped them in their projects.
- **Eloquent Speaker**: I was appointed as **student counselor** in **admission cell** at **G.L.B.I.T.M., Gr. Noida, India**.
- **Experimental Expertise**: Trained to work on **Differential Scanning Calorimeter** (DSC Q2000); Performed testing on **Thermal conductivity analyzer** (TPS 2500 S)
- **Software Skills**: EnergyPlus, Design Builder; Basic knowledge of LabView, C/C++.

## APPENDIX

### RAJAT SAXENA

**Current Address:** A3/A6, Type A, South Avenue, IIT Delhi, Hauz Khas, New Delhi-110016;  
**Phone:** + 91 9015 607 618; + 91 8587 865 099; **Email:** rajat.saxena@ces.iitd.ac.in; rajat.ideal@gmail.com;  
**Permanent Address:** House No. 850, Khatai Baba, Isai Tola, Jhansi, Uttar Pradesh, India - 284003;  
**University/Institute Address:** Indian Institute of Technology Delhi Hauz Khas, New Delhi-110 016;  
**D.O.B.:** 02/07/1986; **Languages:** Hindi, English; **Marital Status:** Married; **Citizenship:** Indian;

### Ph.D. RESEARCH DETAILS

#### RESEARCH TOPIC:

“Integration of phase change materials for thermal regulation & cooling load abatement of buildings in Indian conditions”

**University/Institute:** Indian Institute of Technology, New Delhi (India); **Score:** 9.0/10 (Ph.D. course work)

**Supervisors:** Dr. Dibakar Rakshit (Associate Professor) & Prof. S.C. Kaushik (Emeritus Professor)

**Courses studied:** Solar thermal power generation, Solar Refrigeration & Air Conditioning and Solar Energy Utilization

**Comprehensive Exam passed on** 12<sup>th</sup> May, 2017

**Pre-Ph. D exam passed on** 9<sup>th</sup> April, 2019

**Thesis Submitted on** 29<sup>th</sup> July, 2019

#### SYNOPSIS:

With an ambitious aim to formulate and develop systems which can utilize solar energy and conserve fossil fuel energy to advance towards greener tomorrow. My on-going research work expedited on incorporation of thermal energy storage systems within building elements and providing a sustainable solution for reduction in cooling loads during summer by building cool houses. This is achieved by using a conventional method of increasing thermal mass of buildings but with Phase change material (PCM) incorporation. My future research plans are to build on the foundations being laid down during my PhD to further develop systems that can utilize solar energy and conserve fossil fuel and move towards greener tomorrow.

#### KEY PROJECTS (During Ph.D.):

**Mar, 2017 - Present** **Characterization Studies of Nano-enhanced Phase Change Material (NEPCM) in Thermal Storage Devices for Sustainable Building Designs in India under CERI, Department of Science & Tech., Govt. of India**

PCM mapping and its suitability assessment for composite climate based on phase change temperature, for a particular configuration has been carried out, followed by DSC characterization. Procurement of instruments/consumables and budget record is maintained.

**Mar, 2017- July, 2017** **Energy Efficient Buildings: Technology with Intelligence, Department of Science & Tech., Govt. of India**

Literature Survey related to salts and salt hydrates (inorganic PCMs) potentially suitable for building application in India was carried out at initial stage. The purchase and procurement of instruments under the project was also coordinated and taken care of.

#### RESEARCH PUBLICATIONS & CONFERENCES:

- 2019** **R. Saxena**, N. Agarwal, D. Rakshit, S. C. Kaushik, “Suitability assessment and experimental characterization of PCMs using DSC for thermal management of buildings in composite climate”, ASME Journal of Solar Energy Engineering. **(Journal Publication)**
- 2019** **R. Saxena**, D. Rakshit, S. C. Kaushik, “Review on PCM application for cooling load reduction in Indian buildings”, Springer Publication **(Book Chapter under second review)**
- 2019** **R. Saxena**, D. Rakshit, S. C. Kaushik, “Phase Change Material (PCM) incorporated bricks for energy conservation in composite climate: A sustainable building solution”, Elsevier Solar Energy 183 (2019) 276–284, <https://doi.org/10.1016/j.solener.2019.03.035> **(Journal Publication)**
- 2019** **R. Saxena**, D. Rakshit, S. C. Kaushik, “Experimental assessment of Phase Change Material (PCM) embedded bricks for passive conditioning of buildings”, Elsevier Renewable Energy **(Paper Under Review)**
- 2019** **R. Saxena**, C. Dwivedi, V. Dutta, S. C. Kaushik, D. Rakshit, “Nano-Enhanced PCMs for low temperature thermal energy storage systems and passive conditioning applications”, 12th International Conference on Thermal Engineering: Theory and Applications, Gandhinagar, India, February 23-26, 2019 **(Conference Publication)**

- 2018 R. Saxena**, D. Rakshit, S.C. Kaushik, “Experimental assessment of characterised PCMs for thermal management of buildings in tropical composite climate”, 5th International Conference on Heat Transfer and Fluid Flow, Madrid, Spain, August 16-18, 2018 (**Won Best Paper Award**)
- 2018 R. Saxena**, D. Rakshit and S. C. Kaushik, “Utilization of phase change material (PCM) as thermal shield for building energy conservation” in International Conference on New Frontiers in Engineering, Science and Technology (NFEST-2018), DTU, Delhi, January 8-10, 2018. (**Won Runner-up Prize**)
- 2017 R. Saxena**, K. Biplab and D. Rakshit, “Quantitative assessment of phase change material utilization for building cooling load abatement in composite climatic condition,” ASME Journal of Solar Energy Engineering, vol. 140, no. 1, pp. 1-15, 2017, doi:10.1115/1.4038047. (**Journal Publication**)
- 2016 R. Saxena**, D. Rakshit and S. C. Kaushik, “Study of thermal energy storage materials for building energy conservation: present status” in International Conference on Informatics, Management & Technology on Solar Energy: Issues & Opportunities (ICIMTSE- 2016), New Delhi. (**Conference Publication**)

## ALLIED PUBLICATIONS/CONFERENCES

- 2019 A. Khan**; P. Saikia; **R. Saxena**; D. Rakshit; S. Saha, “Microencapsulation of Phase Change Material in Water Dispersible Polymeric Particles - A holistic approach,” Springer Journal of Materials Science. (Paper Under Review)
- 2013 R. Saxena**, T. Chouhan and S. S. Saxena, “A Review on Vapor Absorption System in Indian Conditions” in International Conference on Manufacturing Excellence (MANFEX-2013), Noida, May 30-31, 2013. (Published)
- 2012 R. Saxena**, T. Chouhan, S. S. Saxena and D. Chouhan, “A Review on Permanent Magnet Based PMM & Its Implementation” in International Conference on Manufacturing Excellence (MANFEX-2012), Noida, Mar 29-30, 2012. (Published)
- 2011 H. Chouhan**, **R. Saxena** and T. Chouhan, “TRIZ Based Innovations” National Conference on Emerging Frontiers in Mechanical Engineering for New Generation Industry, Ghaziabad, sponsored by MNRE, Govt. of India, March 12-13, 2011. (Published)
- 2011 K. Gupta**, **R. Saxena** and M. K. Tiwari “Computer Aided Dynamic Analysis of a Horizontal Slider Crank Mechanism,” National Conference on Emerging Frontiers in Mechanical Engineering for New Generation Industry, Ghaziabad, sponsored by MNRE, Govt. of India, March 12-13, 2011. (Published)
- 2011 H. Chouhan**, **R. Saxena** and T. Chouhan, “A Review on Innovation In Engineering Using TRIZ” in National Conference on Manufacturing Excellence (MANFEX-2011), Noida, Mar 3-4, 2011. (Published)
- 2011 R. Saxena**, T. Chouhan and H. Chouhan, “TRIZ Based Smart Garments for Fire Fighters” in National Conference on Recent Trends in Engineering and Mathematical Sciences (2011), Palwal, February 24-25, 2011. (Published)
- 2008 R. Saxena**, “Anthropower: Generation of Power from Human Body” in National Conference on Engineering, Technology for Sustainable Development: Opportunities and Challenges (2008), Ghaziabad, March 24-25, 2008. (Published)
- 2007 R. Saxena**, “Harnessing Power from Body Movements Using Piezoelectric Materials: A Review,” in National Level Paper Presentation Summit, ISTE Student’s Chapter, Ideal Institute of Technology, Ghaziabad, March 31, 2007. (Presented)

## KEY TECHNICAL PROJECTS

- Jan, 2013 - M. Tech Major Project: Environment Friendly Case Hardening using Plasma Nitriding**
- June, 2013** Experiments were conducted on mild steel (SAE 8219) and stainless steel (304, 202) to assess the variation in hardness values with respect to duration of plasma nitriding process. The case depth achieved due to the same was also assessed.
- July, 2012 M. Tech Minor Project: Environment Friendly Case Hardening using Plasma Nitriding**
- Dec, 2012** Different case hardening methods were studied in detail with emphasis on nitriding process. Plasma nitriding being the latest in the field of nitriding, its different aspects were studied in depth and product surface quality was studied. Experimental Set-up was repaired and modified for the experiments to be conducted during M. Tech Major Project.



- July, 2008- June 2009** **B. Tech Project: Anthro-formic Power Generation, its storage and utilization**  
It dealt in different methods of generating as well as recovering power from the human body due to various processes and activities such as breathing, walking, running, etc. with the help of various mechanisms using piezoelectric materials, etc. The project dealt in harnessing the energy spent by our human body during everyday activities to generate power.

## TRAININGS & WORKSHOPS ATTENDED

- Dec, 2011** **Short Term QIP Course on Photovoltaic Thermal (PVT) Applications**  
Completed a short-term course on “**Photovoltaic Thermal (PVT) Applications**” conducted by Prof. G. N. Tiwari, at CES, IIT Delhi under sponsorship of Quality Improvement Programme, AICTE, Govt. of India. In this, learned different solar photovoltaic and solar thermal applications, creating an interest to work in the area of solar energy utilization
- Nov, 2011** **National Level Workshop on Advances in Materials**  
Attended this National level workshop on “**Advances in Materials**” held at Krishna Inst. of Engg. & Tech., Ghaziabad, which helped in knowing new materials and processes, helping me as a faculty of Material Science/ Manufacturing Science
- Feb, 2010** **Faculty development program (FDP) on Human Values & Professional Ethics**  
Attended eight-day faculty development program on “**Human Values & Professional Ethics**” conducted by Value Education Cell, UPTU at M.P.E.C., Kanpur. This course helped me to understand what is required for being a good teacher and how can we move towards a sustainable development, being in harmony with nature.
- Nov, 2009** **Seminar on Advances in Arc Welding**  
Attended Seminar on “**Advances in Arc Welding**” organized by The Indian Institute of Welding, Delhi Branch at Ideal Inst. Of Tech., Ghaziabad, which helped me as a faculty of Manufacturing Science, to get a hands-on experience and learning of latest welding technologies.
- Feb, 2009** **Entrepreneurship Awareness Camp**  
Attended three days “**Entrepreneurship Awareness Camp**” organized by TBI-KIET, sponsored by Department of Science and Technology, Govt. of India, at Ideal Inst. of Tech., Ghaziabad. This programme helped in developing skills on how to be a successful entrepreneur.
- June-July, 2008** **Industrial Training at Bharat Heavy Electricals Limited, Jhansi**  
Worked as an Industrial Trainee for a period of four weeks at Bharat Heavy Electricals Limited, Jhansi on CNC cutting and welding machine, and was rated excellent in my work.
- June, 2007** **Vocational Training at Diesel Locomotive Works, Varanasi**  
Three weeks training programme was conducted in different sections at Diesel Locomotive Works, Indian Railways, Varanasi, and learnt about the manufacturing of a complete diesel locomotive.
- May-June, 2003** **National Level Leadership Development Program**  
Attended “**National Level Leadership Development Program**”, conducted at Rani Laxmi Bai Jaycess, Jhansi. This program honed my leadership and management skills with people, helping me to be a good team member as well as a good leader

## POSITIONS OF RESPONSIBILITY

- Member **organizing team** of **Short Term QIP Course** on “Energy Conservation and Management in Buildings and HVAC Systems” at Centre for Energy Studies, IIT Delhi (June, 2016)
- **Departmental Volunteer** for Centre for Energy Studies in Open House, 2016, IIT Delhi, New Delhi, India (Apr, 2016)
- **Proctor** for different batches of B.Tech. students for four consecutive years at G.L.B.I.T.M, Gr. Noida (2012 – 2015)
- **Secretary**, I-Robotics Club, Ideal Institute of Technology, Ghaziabad, India (Oct, 2009 – Dec, 2011)
- **Coordinator**, Value Education Cell, Ideal Institute of Technology, Ghaziabad, India (Dec, 2009 – Dec, 2012)
- **Coordinator**, Industry Institute Partnership Cell (IIPC), Ideal Institute of Technology, Ghaziabad (Jul, 2009 – Dec, 2009)
- **President**, IMECH Society for Mechanical Engineers at Ideal Inst. of Technology, Ghaziabad (Aug, 2008 – Jun, 2009)
- **Vice-President**, IMECH Society at Ideal Institute of Technology, Ghaziabad, India (Aug, 2007 – Jan, 2008)

## INDUSTRIAL VISITS

- July, 2016**     **Visit to National Institute of Solar Energy, Gurgaon**  
Observed operational features of different types of Solar PV Systems, Solar Thermal Plant, and Parabolic Trough Collectors.
- May, 2009**     **Visit to Carriage and Wagon Workshop, Jhansi**  
Visited Carriage and Wagon Workshop, Jhansi, which is the largest wagon workshop of Indian Railways, spread across 3.4 lakh sq. m. A short-term training was undertaken in retrofitting of bogie mounted brake system, BOXHAM conversion and modification of BCNHL wagons.
- June, 2008**     **Visit to Spring Workshop, Sithouli,**  
Learnt the process of manufacturing of hot coil springs of various types for different types of rolling stock of Indian railways. A unique experience to learn about the manufacturing intricacies of handling high temperature steels and forming them into different springs.
- July, 2007**     **Visit to Diesel Loco Shed, Jhansi**  
Diesel Loco Shed, Jhansi, homes 126 main line BG locos. It was a workshop where I learnt different loco engines being tested and repaired during my course of short-term visit to the loco shed.
- Nov, 2003**     **Visit to Paricha Thermal Power Station, Paricha**  
Selected as one of the top five students in class XII for this visit and gave presentation to all students in class on system components, power generation/distribution and operational features of the plant.

## CO-CURRICULAR ACTIVITIES

- Prepared and presented Poster for Open House, 2019, IIT Delhi, New Delhi, India (Apr, 2019)
- Prepared and Presented Poster in Poster Competition on Industry Day, held at IIT Delhi, New Delhi, India (Sept, 2018)
- Prepared and presented Poster for Open House, 2018, IIT Delhi, New Delhi, India (Apr, 2018)
- Prepared and Presented Poster in Poster Competition on Industry Day, held at IIT Delhi, New Delhi, India (Sept, 2017)
- Prepared and presented Poster for Open House, 2016, IIT Delhi, New Delhi, India (Apr, 2016)
- Prepared and presented Poster for Open House, 2013, IIT Delhi, New Delhi, India (Apr, 2013)
- Was part of the team, which developed driver-less car at Ideal Institute of Technology, Ghaziabad (Dec, 2010)

## PRO BONO ACTIVITIES & COMMUNITY SERVICE

- Delivered lecture on title “Humanity Brushed Aside” to students of R.K.G.I.T, Ghaziabad, India (Sept, 2010)
- Conducted Seminars/ Workshops on Human Values for students of Ideal Institute of Technology, Ghaziabad, India (Dec, 2009 – July, 2011)
- Seminar on Human Values for students of class X<sup>th</sup>, XI<sup>th</sup> and XII<sup>th</sup> at Siddhartha International School, Panipat, India (Dec, 2009)
- Seminar on Human Values for students of class X<sup>th</sup> at Cathedral College, Jhansi, India (Nov, 2009)

**Referee 1:**     **Dr. Dibakar Rakshit – Ph.D. Supervisor and Subject Teacher**  
Associate Professor,  
Center for Energy Studies (CES),  
Indian Institute of Technology Delhi,  
Hauz Khas, New Delhi – 110016  
Email: dibakar@iitd.ac.in; Tel: +91-11-26597313; Fax: +91-11-26582037

**Referee 2:**     **Prof. S.C. Kaushik – Ph. D. Co-supervisor and Subject Teacher**  
Emeritus Professor,  
Center for Energy Studies (CES),  
Indian Institute of Technology Delhi,  
Hauz Khas, New Delhi – 110016  
Email: kaushik@ces.iitd.ac.in; Tel: +91-11-26591253; Fax: +91-11-26582037

**Referee 3:**     **Prof. T.C. Kandpal – Subject Teacher**  
Professor, Head (CES, IIT Delhi)  
Center for Energy Studies (CES),  
Indian Institute of Technology Delhi,  
Hauz Khas, New Delhi – 110016  
Email: tarak@ces.iitd.ac.in; Tel: +91-11-26591262; Fax: +91-11-26581121