Department of Energy Science and Engineering IIT Bombay

thinking outside the barrel

www.ese.iitb.ac.in

VISION

"To develop sustainable energy systems and solutions for the future"

24 core faculty

30 associate faculty

150 project staff

400 students

The Department of Energy Science and Engineering (DESE) is a leading inter-disciplinary energy education and research hub. DESE has developed several novel education programmes focussing on the application of science and engineering to problems in energy. Recent highlights in research and development include a grid connected MW scale solar thermal power plant and test facility, self cleaning solar PV modules, high efficiency PV cells based on new materials, novel Li ion batteries, improved flow fields for fuel cells, and biofuel based rural electrification. DESE has cutting edge fabrication, characterisation, testing and demonstration facilities with strong industrial linkages and international collaborations. We welcome you to partner with us to help design and build sustainable energy systems for the future.

December 2017

ACADEMIC PROGRAMMES

PhD

A programme that aims to develop researchers who can provide fundamental inputs required to meet the challenges of a sustainable energy future

Duration: 3-5 yrs

Admissions: May & Dec; written test/interview

Student intake: 20

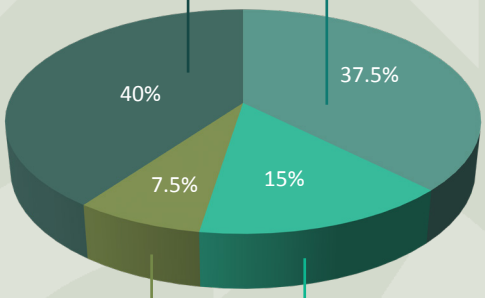
BTech-MTech

Interdisciplinary programme designed to train specialist engineers who can tackle the challenges of the energy sector with cross cutting analytical skills

Duration: 5 yrs

Admissions: Summer; JEE

Student intake: 30



MSc-PhD

Students with a BSc take science and engineering courses relevant to energy preparing them to tackle fundamental research problems in sustainable energy

Duration: 5+ yrs

Admissions: Summer; JAM score & written test/ interview

Student intake: 15

MTech

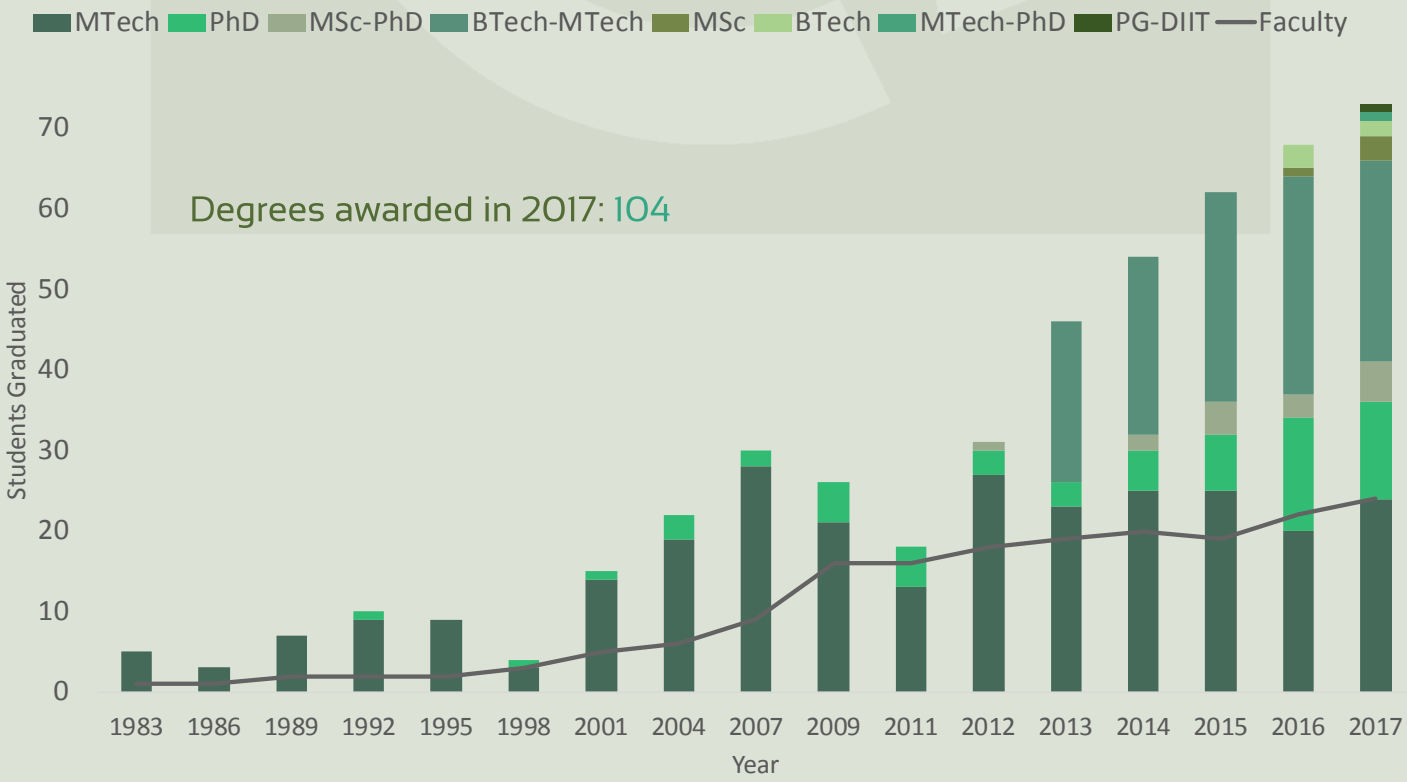
A programme designed to enhance the fundamental engineering education for a career in energy systems engineering

Duration: 2 yrs

Admissions: Summer; GATE score

Student intake: 25

***MINOR** : Students majoring in other disciplines can take courses towards a minor in Energy Engineering

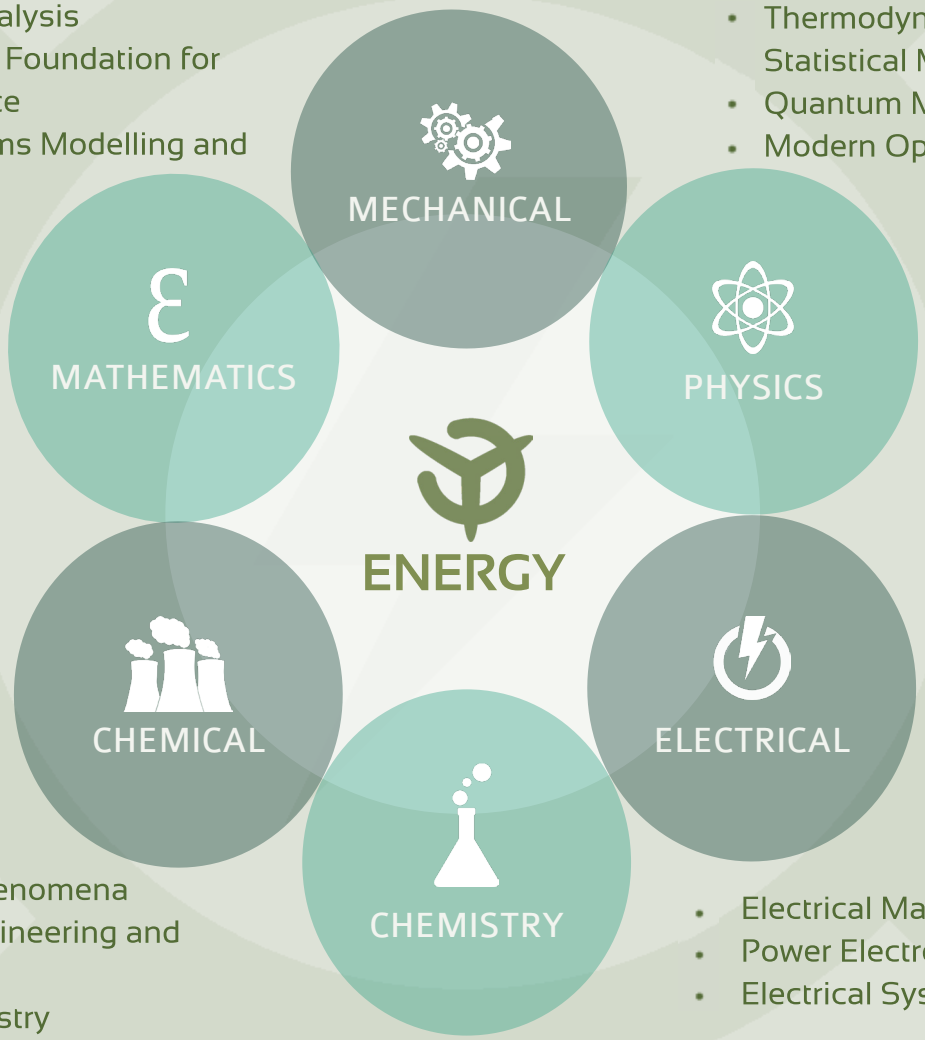


COURSES

- Thermodynamics and Energy Conversion
- Thermo-Fluid Devices
- Mechanics of Materials

- Numerical Analysis
- Mathematical Foundation for Energy Science
  Energy Systems Modelling and
- Analysis

- Thermodynamics and Statistical Mechanics
- Quantum Mechanics
- Modern Optics



- Transport Phenomena
- Reaction Engineering and Combustion
- Electrochemistry

- Electrical Machines
- Power Electronics
- Electrical Systems Analysis

- Chemistry for Energy Science
- Methods in Analytical Techniques
- Molecular Spectroscopy

ENERGY

- Energy Management
- Renewable Enrgy Technologies
- Energy Resources, Economics and Environment
- Hydrogen Energy
- Waste to Energy
- Nuclear Reactor Theory
- Wind Energy Conversion Systems
- Materials and Devices for Energy Conversion
- Solar Photovoltaics: Fundamentals, Technology and Applications
- Power Generations and System Planning
- Energy and Climate

FACULTY

Anish Modi
Solar thermal energy utilisation, concentrating solar power plants, energy sustainability

Balasubramaniam Kavaipatti
Cheap and abundant materials for photovoltaic applications, transparent conductors

Chetan S. Solanki
C-Si cells, solar PV technologies and systems, off-grid solar and energy access

Dayadeep Monder
Multiscale modelling of fuel cells, first principles (electro)catalysis

Jayant K. Nayak
Solar thermal energy, passive solar architecture

Lalit Kumar
Wax deposition, bulk and interfacial rheology, oil water separation, oil rock interaction

Manaswita Bose
Flow of granular materials, multiphase fluid dynamics, coal gasification & combustion

Manoj Neergat
Fuel cells, precious & non-precious metal catalysts, microbial fuel cells

Prakash Chandra Ghosh
Hydrogen production from renewables, low temperature fuel cells

Pratibha Sharma
Solid state hydrogen storage materials, fluorescent core shelled nano structures for PV

Rajesh Gupta
Reliability and degradation of PV cells and modules - characterization and modelling

Rangan Banerjee (Head)
Energy management & efficiency, energy systems modelling, planning & policy

Sagar Mitra
Nanostructured materials, Li-ion, Na-ion batteries, battery electrode design/fabrication

Sandeep Kumar
Biomass gasification, alternate fuels in IC engines, solid waste management

Sankara Sarma V. Tatiparti
Hydrogen storage, nano-interface engineering, polycrystalline nano dendritic growth

Santanu Bandyopadhyay
Process Integration, pinch analysis, industrial energy conversion, energy systems modelling

Shaibal K. Sarkar
Sensitized solar cells, photoelectrochemistry, nanocrystalline materials for PV

Shireesh B. Kedare
Concentrating solar collector, industrial thermal systems, wind machines

Srinivas Seethamraju
Gasification, fischer-tropsch synthesis, reactive distillation, waste to energy

Suneet Singh
Numerical methods for neutron diffusion and fluid flow, stability of nuclear reactors

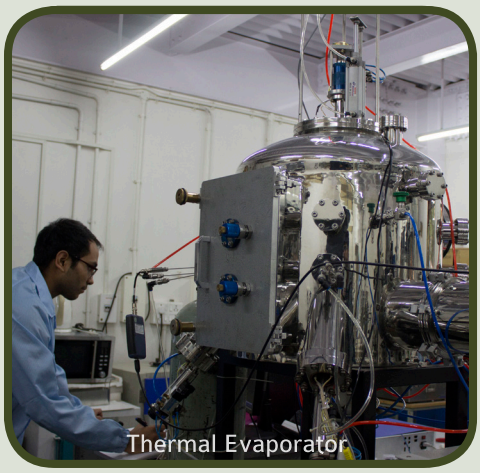
Suryanarayana Doolla
Smartgrids, microgrids, power systems operation & control, grid integration of renewables

V. S. S. Pavan Kumar Hari
Power electronics, AC motor drives, wind energy conversion, PV inverters

Venkatasailanathan Ramadesigan
Modelling & numerical simulation of electrochemical energy storage systems

Zakir Hussain Rather
Grid integration of renewables, power system dynamics & control, smartgrids & microgrids

LABS AND FACILITIES


Thermal Evaporator

PECVD


Metal Sputtering

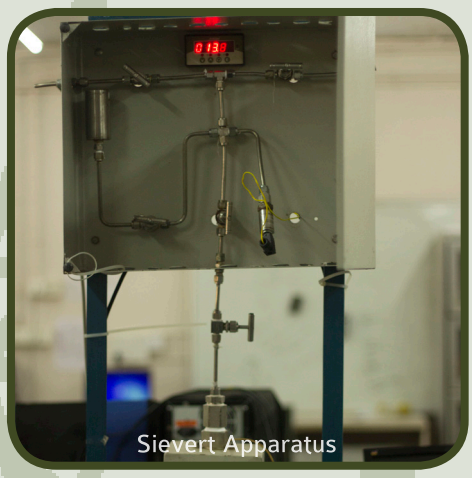
XRD

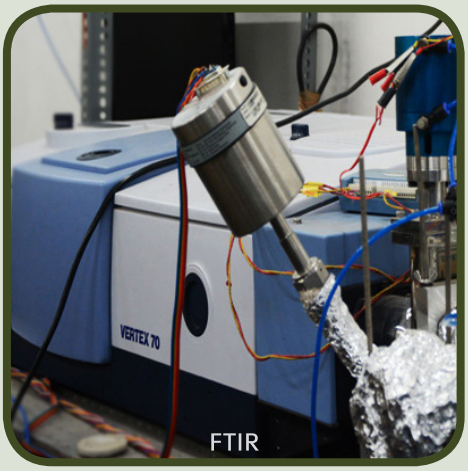
FE-SEM


VMP3


ALD Reactor

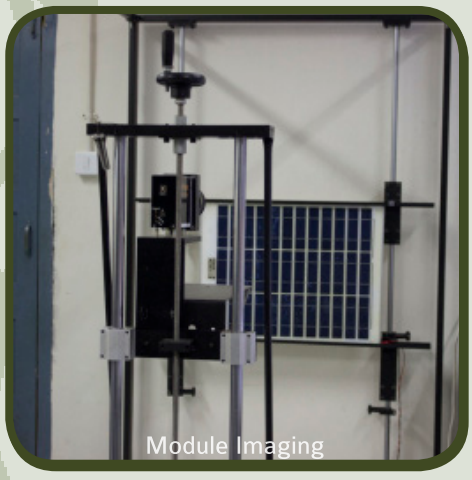

Reel to Reel Coater


Sievert Apparatus



FTIR

I-V Measurement


Module Imaging

Battery Cycling System

Solar Simulator

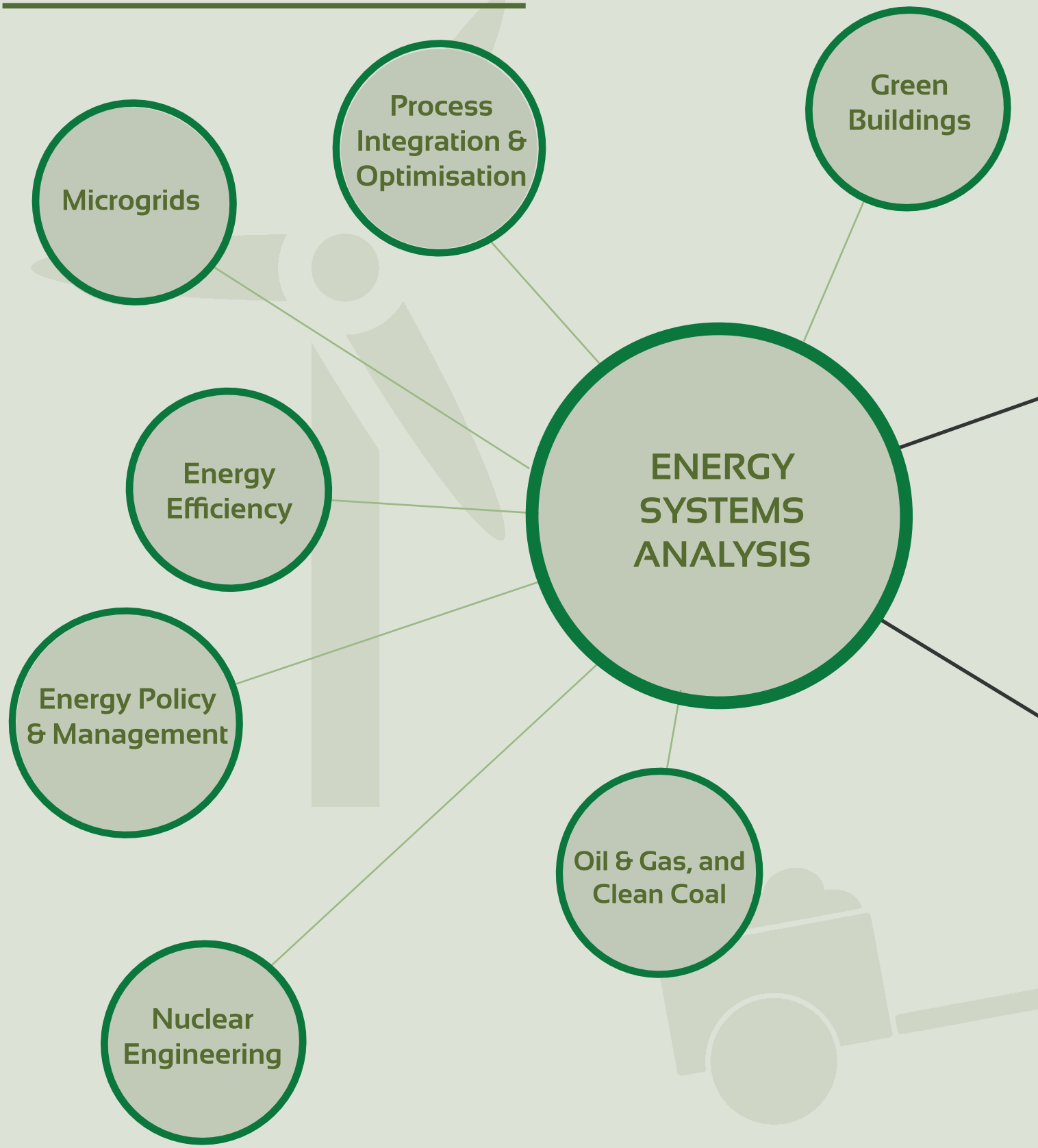
Environmental Chamber

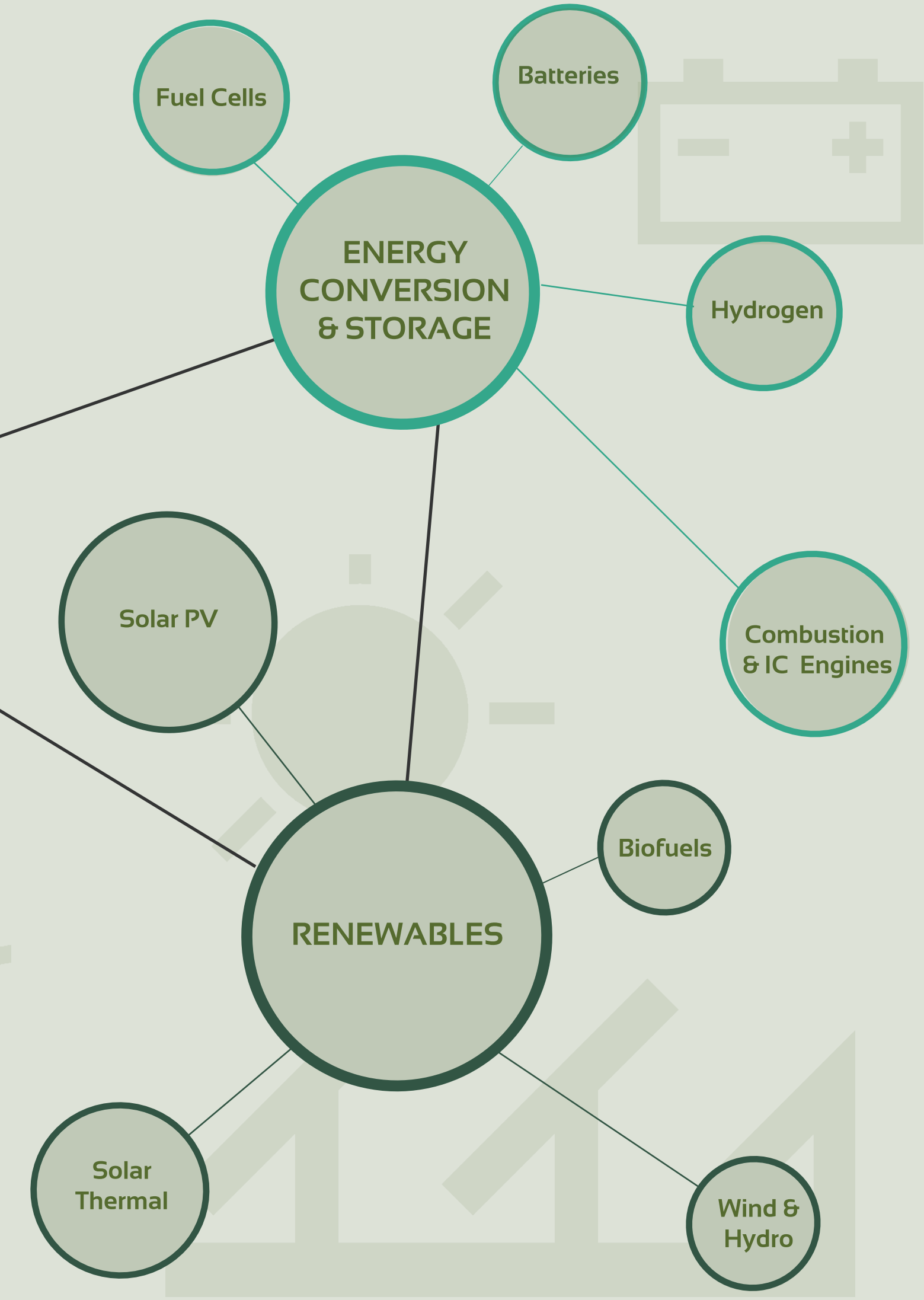
Vaccuum Pyrolysis Plant


Thermocline thermal storage


Biodiesel generation plant

RESEARCH AREAS



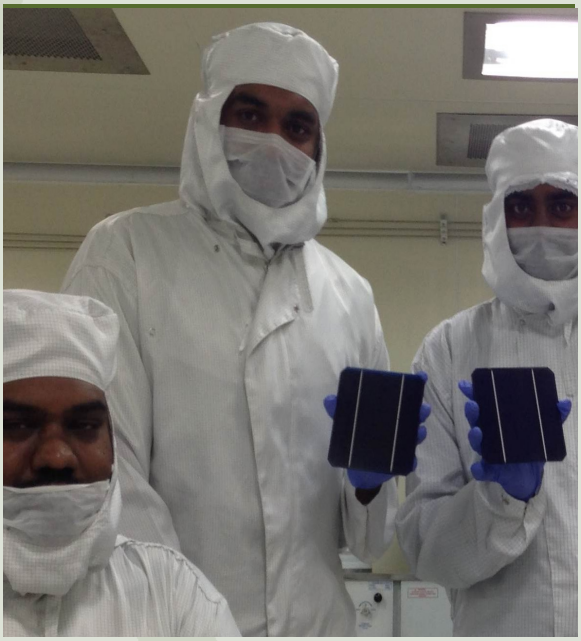

Fuel Cells
Batteries
ENERGY CONVERSION & STORAGE
Hydrogen
Solar PV
Combustion & IC Engines
RENEWABLES
Biofuels
Solar Thermal
Wind & Hydro

MAJOR RESEARCH INITIATIVES

National Solar Thermal Power Plant

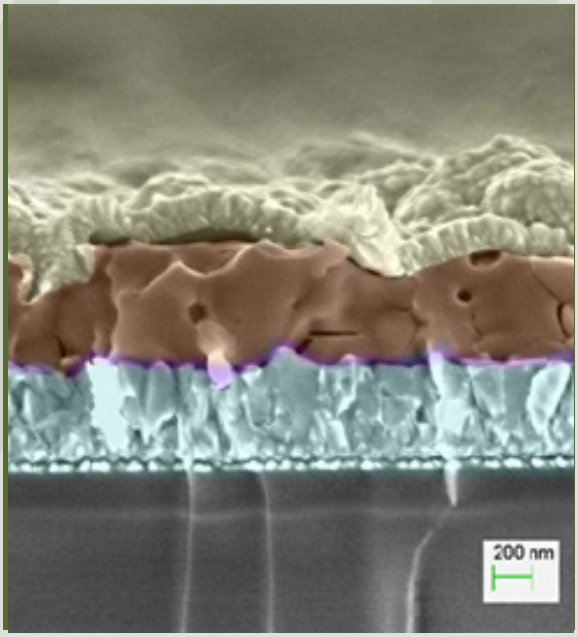
1 MW grid connected solar thermal power plant designed, developed and implemented by IITB led consortium at Gurgaon
Unique feature: Integration of two different solar fields (Parabolic Trough & Linear Fresnel)

National Centre for Photovoltaic Research and Education



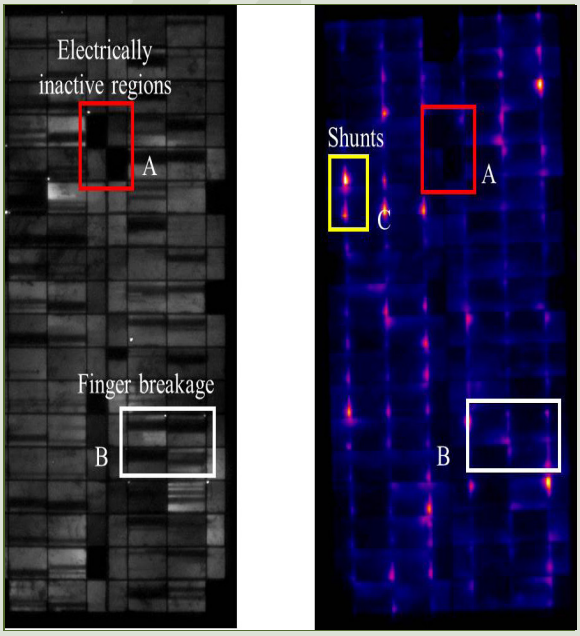
A interdisciplinary research centre focusing on solar PV cells, modules, and associated power electronics
State of the art facilities for fabrication and characterization - sponsored by MNRE

Solar Energy Research Institute for India and the United States (SERIIUS)



- Indo-US research initiative to develop and ready emerging and revolutionary solar technologies
- SERIIUS will accelerate the development of solar electric technologies by lowering the cost per Watt of photovoltaics and concentrated solar power

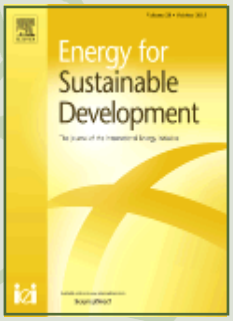
Stability and Performance of Photovoltaics (STAPP)

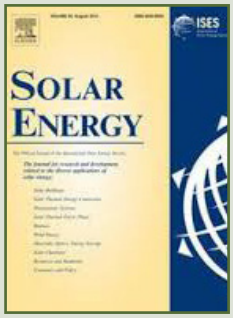


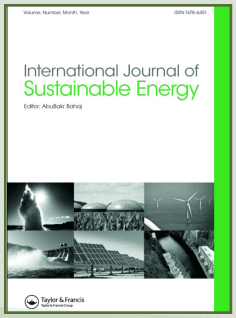
- A joint Indo-UK research initiative to address the stability and long-term performance of PV modules and systems
- Understanding and predicting the generation and growth of defects, effective lifetimes of modules, PV rating in different climates

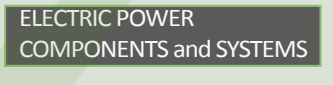
PUBLICATIONS & PATENTS

Journals with our faculty members on the editorial board









Journals where we publish

- ACS Applied Materials & Interfaces
- Applied Energy
- Chemical Engineering Science
- Current Science
- Electrochimica Acta
- Energy and Fuels
- Energy Policy
- IEEE Transactions on Industrial Electronics/ Power Delivery/Smart Grids
- Industrial & Engineering Chemistry Research
- International Journal of Heat and Mass Transfer
- Journal of Physical Chemistry B/C
- Journal of Power Sources
- Journal of the Electrochemical Society
- Nanoscale
- Philosophical Magazine
- Physical Chemistry Chemical Physics
- Renewable and Sustainable Energy Reviews
- Renewable Energy
- RSC Advances
- Solar Energy
- The Journal of Physical Chemical Letters

Books by our faculty members

- Handbook on Energy Conscious Buildings
- Renewable Energy Technology for the new Millenia
- Renewable Energy Technologies
- Solar Energy - Principles of thermal collection and storage
- Solar Photovoltaics : Fundamentals, Technologies and Application,
- Solar Photovoltaic Technologies and Systems
- Antireflection and light trapping in c-Si solar cells
- Engineering Education in India

Annual Data (2016)

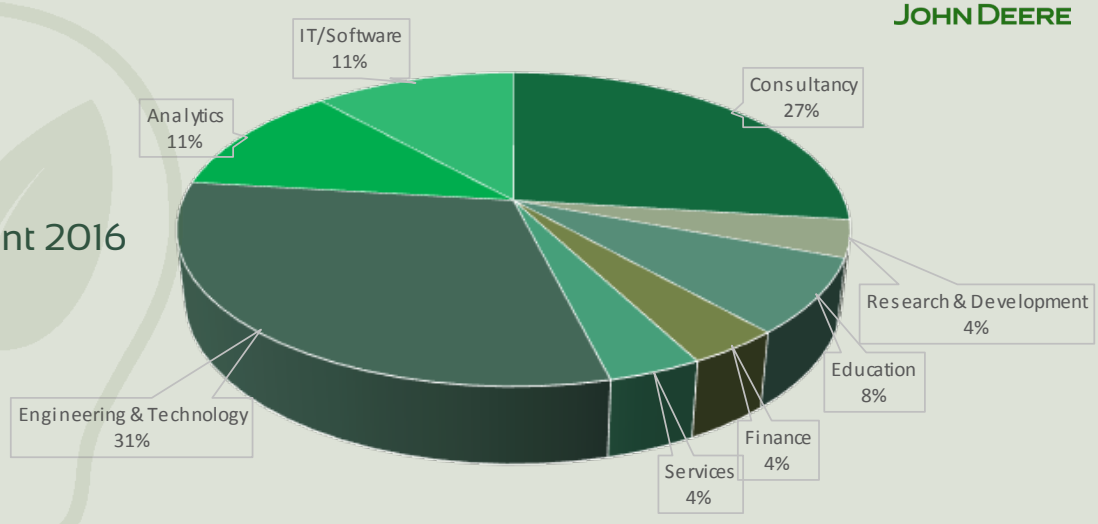
110+ Journal Publications

₹60+ Funding (in crores)

16 Patents (last 3 years)

PLACEMENTS

Sector wise placement 2016



Priyanka Desouza
UN Environment Programme, Nairobi

"Winning the Oxford Rhodes Scholarship was a dream and I can only ascribe my winning it to the freedom [the department] gave me in developing my interests"

Sameer Maithel
Director, GreenTech Solutions

"A wide variety of courses covering renewable energy generation, energy management and energy systems modelling, provided me with a robust foundation to develop a career in research and consulting"

Ravi Gehlot
Sony Energy Devices Corporation Japan

"One of the prominent factors that got me into Sony Energy Devices was the diverse curriculum of the department. The curriculum equips students with analytical and problem solving skills, which are essential for different jobs across the sectors"

COLLABORATIONS

Loughborough University

Imperial College London

University of Strathclyde

northumbria UNIVERSITY NEWCASTLE

UNSW AUSTRALIA

Carnegie Mellon University

RICE

NUS National University of Singapore

Washington University in St.Louis

WEIZMANN INSTITUTE OF SCIENCE

UNIVERSITY OF TEXAS ARLINGTON

MONASH University

The University of Nottingham

NORTHWESTERN UNIVERSITY

PURDUE UNIVERSITY

UNIVERSITY OF WASHINGTON 1861

UNIVERSITY OF CALGARY

DE LA SALLE UNIVERSITY MANILA

ARUN SOLAR (with CLIQUE developments limited)

CUMMINS village electrification programme

Strong linkages with 50+ partner companies - Industry Partnership Scheme

CUMMINS engine laboratory

FORBES MARSHALL energy efficiency laboratory

OUTREACH

1 MW SOLAR PV Plant, setup at campus building rooftops has an annual electricity production of 1.4 million kWh

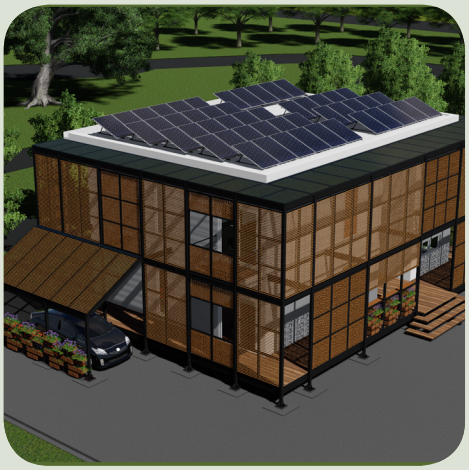
CEPs (continuing education programmes) offered in fields of energy management & solar thermal systems assist industry professionals in improving their skills

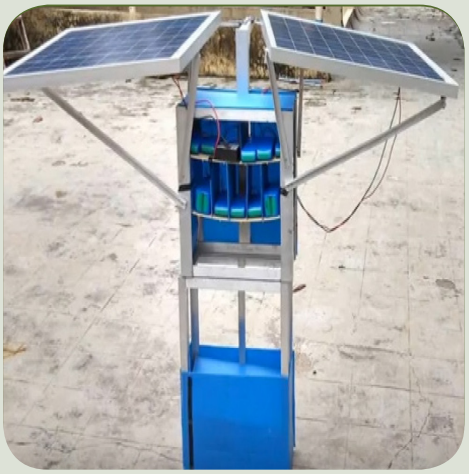
ICAER, an international conference for taking stock of current status of research in energy while also setting guidelines for future directions in research

MILLION SOUL (Solar Urja Lamp) project, aims to distribute 7.5 million solar lamps to students across India (sposored by MNRE)

STUDENT ACTIVITIES

Project on portable power generation by students won first prize in Global Tech Energy Challenge, organized by Global alliance of Technological Universities in July 2013





TEAM SHUNYA: The first Indian student team to design and build a 'Net-Positive Energy' house and the only selected team to represent India in Solar Decathlon Europe'14 and Solar Decathlon China'18

ENERGY DAY, a platform for the young researchers of the department to showcase their work to industry

ENERGY CLUB, a group of energy conscious students aiming to spread energy awareness on campus

Energy Science and Engineering
IIT Bombay

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Designed by: Anisha Bajaj, Ankit Jotwani, Suraj Naik (students, DESE)