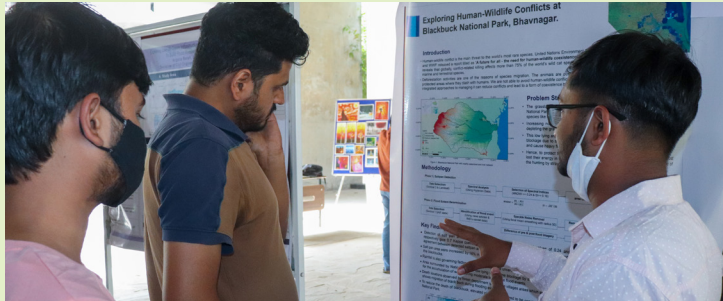


KPCSD EVENTS



IITGN-IITK JOINT SYMPOSIUM ON ENERGY TECHNOLOGIES

The symposium brought together faculty of IIT Gandhinagar and IIT Kanpur to discuss areas of mutual interest in the domain of energy technologies. It provided a platform to present the current research areas and interests of faculty at both the institutes, leading to the identification of potential joint research proposals

and projects. The event held on April 15 and 16, 2022 was attended by six faculty members from IIT Kanpur and ten faculty members from IIT Gandhinagar. Some of the topics that were discussed during the symposium were energy systems, smart grids, solar energy technologies, electrochemical energy storage, and clean hydrogen generation. Prof Atul Bhargav coordinated the event.

KPCSD POSTER COMPETITION ON SUSTAINABILITY

Dr Kiran C Patel Centre for Sustainable Development (KPCSD) organised a 'Poster Competition on Sustainability' on April 19, 2022 to explore and showcase sustainability ideas and research. Nearly 50 students across all programmes and disciplines of the Institute presented their research project or publication, course project, dissertation or any other work that relates to sustainability or United Nations' Sustainable Development Goals (SDGs).

SUSTAINABILITY SEMINAR SERIES

The Centre conducted three e-seminars between January through June 2022 as part of the Sustainability Seminar Series. The webinars covered a range of topics including food systems and security, global agriculture, communities and climate change, natural resource management, and governance models by speakers from renowned organisations. Nearly 300 people attended the webinar series from India and several locations across the globe, such as Canada, Japan, Libya, the United Arab Emirates, and the United States. Details of the e-seminars organised are as follows:

Ms Disha Shetty (Science Journalist); Staff Reporter, The Fuller Project; Role of researchers and journalists in communicating impacts of climate change on communities around India

Dr Yogesh Gokhale; Senior Fellow and Area Convenor, Centre for Forest Management and Governance, Land Resources Division, The Energy and Resources Institute (TERI); Governance of Biodiversity and other Natural Resources in India

Prof Navin Ramankutty; Professor and Canada Research Chair in Global Environmental Change and Food Security, University of British Columbia; Exploring solutions to our food system challenges

KPCSD PROJECTS

PILOT PROJECT ON WASTEWATER MANAGEMENT

KPCSD supported a pilot project, led by Prof Sudhir Arora, Professor of Practice, Civil Engineering, for management of sewage and greywater in rural and peri-urban areas. It proposes a new concept of spiral sewer to overcome high water requirements and steep slopes in gravity sewers. The project follows a holistic approach including innovations such as use of modified traditional and locally available water-wheel for aeration to create aerobic conditions and use of plastic waste as fillers in HDPE balls to mitigate nuisance of plastic bottles and polythene bags.

SUSTAINABILITY PROJECTS IN COURSEWORK

Several KPCSD faculty provided mentoring support to students who worked on various sustainability related projects including those on wastewater management, electric vehicle charging stations, food waste management and waste segregation in the course Sustainability and Environment, a compulsory course for undergraduate students in Civil Engineering.

SPOTLIGHT

STARTUP ON ENERGY SYSTEMS

Prof Atul Bhargav, Professor, Mechanical Engineering, co-founded Cellegant Energy Systems, a IIEC-incubated startup company. Cellegant aims to provide fuel cell based distributed energy systems technology for various applications to reduce CO₂ emissions, decrease the total cost of ownership and to augment the capabilities of the armed forces. The startup has signed a licensing agreement with IIT Gandhinagar to use the design of a patent-pending design on fuel reformers for strategic applications. The company has been recognized as a startup by the Department for Promotion of Industry and Internal Trade (DPIIT-recognised startup) and received the Nidhi Prayas grant from the Government of India.

ANNOUNCEMENTS

MoU WITH CLIMATE CHANGE DEPARTMENT

IITGN signed an MoU for a strategic partnership for the Development of Climate Change Policy and Roadmap for Net Zero by 2070 for Gujarat with the Climate Change Department (Government of Gujarat) on February 21, 2022.

TIMES HIGHER EDUCATION IMPACT RANKINGS 2022

IITGN ranked in the top 401-600 band in the Times Higher Education Impact Rankings 2022. It ranked among Top 200 globally for SDG 1 (no poverty) and SDG 6 (clean water and sanitation) and Top 300 for SDG 7 (affordable and clean energy) out of nearly 1500 institutes. THE Impact Rankings assess universities worldwide against United Nations Sustainable Development Goals (SDGs).

NATIONAL WATER AWARD 2020

IITGN received 2nd prize in the category for best institution for campus usage at the 3rd National Water Awards ceremony held at Vigyan Bhawan, New Delhi on March 29, 2022. The award was given by the Ministry of Jal Shakti in recognition of the strides made by the institute to promote water conservation and proper water management.

Q & A

Water-energy nexus and sustainability

How are the water and energy systems connected with each other, specifically from the sustainability perspective?

Water and energy are critical interdependent resources: large quantities of water withdrawal and consumption are involved in power production, and energy is necessary at various points in the water usage cycle: for treatment before and after use, and transportation of water to the site of use. Therefore, challenges related to the availability of water and energy should be addressed in an integrated, holistic manner.

How can industries manage their wastewater in an energy efficient manner?

Wastewater treatment towards zero liquid discharge in industrial settings is inherently energy intensive. Industrial units must try to recover as much water as possible using a more efficient reverse osmosis process, reducing the load on evaporators.

Some of the recent work in our group has leveraged the unique ability of industries to change the chemistry of the wastewater they produce based on the choice of chemicals in various processing steps. The eventual energy demand for desalination of the wastewater is a strong function of effluent chemistry. In the particular case of reactive dyeing of cotton fabric, we have suggested eliminating chloride anions in the solution and thereafter using nanofiltration for lower-energy desalination in a recent study.

How are renewable energy technologies suited for desalination applications?

Coupling desalination with renewable energy can help reduce its environmental impact. However, direct coupling with renewable energy sources comes with its own challenges such as intermittent availability of energy, resulting in only partial utilisation of the invested capital. A photo-voltaic powered RO system for example may also have to be powered by a battery or from the grid at night if we want continuous water production.



Prof Jaichander Swaminathan
Kanchan and Harilal Doshi
Chair Assistant Professor,
Mechanical Engineering

The most common technology for solar desalination is solar thermal distillation using a solar still, for example. While this technology is simple, it has a low energy efficiency due to lack of energy recovery from the condensing vapour, resulting in a low productivity. A few devices have recently been demonstrated in the scientific literature with improved productivity.

India has a long coastline with a huge potential for using seawater as a drinking water source. What is the role of desalination and water treatment in such a context?

Desalination becomes a viable alternative source of water under the following conditions:

1. there is insufficient average renewable water supply from precipitation and rivers reaching the location;
2. if transporting water from the point of availability to the point-of-use is energetically expensive (due to long distance/elevation);
3. as an insurance policy against prolonged droughts to avoid future scarcity.

Seawater RO technology has matured today and when implemented in large sized plants (of the order of around 10 crore litres per day), it can produce water at less than around Rs. 50 per 1000 L. This cost relative to other sources of water would govern its viability. In addition to seawater, it is likely that wastewater desalination and treatment up to a drinkable quality which is possible at much lower energy cost would play an important role going forward in the future.

Prof Swaminathan leads the Water-Energetics Lab at IIT Gandhinagar, which undertakes fundamental and applied research to improve water and energy systems. A key focus area is the energy efficient design and operation of desalination technologies for water treatment.

RESEARCH

Nine sponsored research and consultancy projects relating to sustainable development were initiated at the institute during January to June 2022.

- Climate change impacts on hydropower in India; United Nations Development Programme (UNDP); PI: Vimal Mishra
- Cyber-attack analysis toolkit for cyber-physical distribution system security [CyberDISS]; Central Power Research Institute (CPRI); PI: Naran Pindoriya
- Enhanced air-water interaction through surface coatings of honeycomb cooling pads; and Surfaces for water collection from humid air; Symphony Limited; PI: Soumyadip Sett
- Institutionalisation of capacities on climate change studies and actions; Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ); PI: Vimal Mishra
- Investigating air quality and its dynamics in built environments in urban India; SERB - Start-up Research Grant (SRG); PI: Sameer Patel
- Special study to determine the impact of different

drivers for groundwater depletion in OE/critical talukas of Banaskantha district; Gujarat Water Resources Development Corporation (GWRDC); PI: Vikrant Jain

- Technology development of RF power LDMOS devices; ISRO and A Deep Neural Network (DNN) based framework for inverse design of high-power RF LDMOS transistors; Science and Engineering Research Board; PI: Nihar Ranjan Mohapatra

IITGN faculty published nearly 60 journal papers, books/ book chapters, conference papers, or newspaper/ magazine articles in various sustainability areas during January to June 2022:

Water

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- Patel, Chirag G.; Barad, Digvijaysinh and Swaminathan, Jaichander, "Desalination using pressure or electric field? a fundamental comparison of RO and electro dialysis", *Desalination*, DOI: 10.1016/j.desal.2022.115620, vol. 530, May 2022.
- Arora, Sudhir, "Har Ghar Jal" A lifetime opportunity

for water industry, *Water Age*, pp 30-34, May 2022.

- Raju, Martin; Sarma, Rakesh Narayana; Suryan, Abhilash; Nair, Prasanth P. and Nizetic, Sandro, "Investigation of optimal water utilization for water spray cooled photovoltaic panel: a three-dimensional computational study", *Sustainable Energy Technologies and Assessments*, DOI: 10.1016/j.seta.2022.101975, vol. 51, Jun. 2022.

Pollution and Waste Management

- Mondal, Susmita and Kulkarni, Sameer G., "A blockchain based transparent framework for plastic waste management", in the *14th International Conference on COMmunication Systems & NETworkS (COMSNETS 2022)*, Bangalore, IN, Jan. 4-8, 2022.
- Chakrabarty, Satadru and Jasuja, Kabeer, "Applications of nanomaterials in the textile industry", in *Nanoscale engineering of biomaterials: properties and applications*, DOI: 10.1007/978-981-16-3667-7_20, Singapore: Springer, pp. 567-587, Feb. 2022, ISBN: 9789811636660.
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- Tiwari, Amar Deep and Mishra, Vimal, "Sub-seasonal prediction of drought and streamflow anomalies for water management in India", *JGR Atmospheres*, DOI: 10.1029/2021JD035737, Jan. 2022.
- Singh, Jitendra; Ashfaq, Moetasim; Skinner, Christopher B.; Anderson, Weston B.; Mishra, Vimal and Singh, Deepti, "Enhanced risk of concurrent regional droughts with increased ENSO variability and warming", *Nature Climate Change*, DOI: 10.1038/s41558-021-01276-3, vol. 12, no. 2, pp. 163-170, Feb. 2022.
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EDUCATION

Minor in Sustainable Development introduced: KPCSD announced an interdisciplinary ‘Minor in Sustainable Development’ for IITGN students from the academic year 2022-23. Students interested in the Minor will be required to take six courses from the list of selected courses. The courses encompass the domains of water, energy, environment/ biodiversity/ earth systems, climate change and pollution and waste management, given the interdisciplinary character of sustainability.

Short courses on themes related to sustainability offered at the institute included the following:

- ‘Regulatory economics and rate making’ by Prof Anand Kumar, Professor of Practice, Electrical Engineering, IIT Gandhinagar from January 28 to February 28, 2022
- ‘Management of domestic wastewater - Conveyance, treatment and reuse’ by Prof Sudhir Arora, Professor of Practice, Civil Engineering, IIT Gandhinagar from January 31 to February 11, 2022
- ‘Renewable energy future beyond 2030’ by Prof Anand Kumar, Professor of Practice, Electrical Engineering, IIT Gandhinagar from March 22 to April 22, 2022

Invited talks, lectures and short courses by the affiliated faculty include:

- Short course on ‘Management of Domestic Wastewater: A paradigm shift in approach’ by Prof Sudhir Arora for the officers of Kerala Water Authority, during March 2-7, 2022
- Invited talk on ‘Energy-Focused Modelling and Control of an Industrial Process’ by Prof Hari Ganesh at Centre of Innovative and Applied Bioprocessing (CIAB) Mohali, Department of Biotechnology (Government of India) on April 7, 2022
- Prof Sudhir Arora invited as a panellist in Regional Conference of States/ UTs on Jal Jeevan Mission (JJM) and Swachh Bharat Mission at Jaipur on April 8, 2022
- Prof Sameer Patel invited as a panellist in the webinar on ‘Institutional engagement: How can the NKN structure be strengthened for effective implementation from local authorities’ hosted by Climate Trends on May 4, 2022
- Prof Vikrant Jain delivered a keynote speech on ‘Managing disconnected rivers in the Anthropocene: Challenges in the Himalayan and Peninsular river basins, India’ in the 2nd International Conference on River Corridor, Research & Management held during May 30 - June 1, 2022 at IIT Guwahati
- Short course on ‘Modelling of mass transport processes in near-subsurface’ by Prof Rishi Narain Singh at CSIR-National Geophysical Research Institute, Hyderabad during June 6-15, 2022