Issue 3, August 2021

# ENSIDER

## In This Issue:



Department of Energy Science and Engineering

# From the HoD

It has been a year since ENsider was launched, and I am pleased to see that the newsletter from the students has been well appreciated. This newsletter has its first issue come out in the middle of the covid pandemic, and the efforts of the students are commendable to successfully start the newsletter in these difficult times.

The “new normal” of online classes are still going on, and a batch of new students is starting their classes without being on campus. It places the students in a very difficult situation, and as a department, we need to put our best efforts to make the interactions with students as useful as possible. Although we have to go through a tough time, it has also given us a lot of opportunities to appreciate the utility of online tools for the dissemination of information and knowledge. All of us are waiting for a post-lockdown world; however, some of the learnings from the covid period are likely to result in better interaction opportunities between students and teachers in the post-covid world as well.

The “work from home” and “social distancing” have changed the world's patterns of energy usage. As the pandemic goes away, some of the things will go back to their usual pattern. However, there will definitely be lots of changes from earlier. As energy engineers and scientists, it gives us an opportunity to prepare the society for this paradigm shift. Stay safe and healthy. Hope to see all of you on campus soon.

Prof. Suneet Singh

# ENERGY DAY 2020-21

## Annual Department Research event of DESE

Energy Day is the department's annual flagship event that brings academia and industry on a common platform. The event focuses on sharing insights into the research work going on in the department through elaborative presentations primarily by graduating students of the department. The event also aims at the interaction between the industry representatives, students, and the faculty.

Energy Day 2021, the 18th annual event of its kind, was very different from its predecessors as it was the first time that the event took place online. Adding to that was the fact that Energy Day 2020 had to be pulled off back due to the then uncertain situations in the early phase of the ongoing pandemic.

The planning for the event began early this year, somewhere in January, when the two Professors-in-charge from the department, Prof. Sagar Mitra and Prof. Zakir Hussain Rather, along with the Department General Secretary began gauging the situation and tried to come up with rough plans for the same. "Despite the fact that the event hadn't been conducted in an online mode ever we were sure we will attract a larger audience given the convenience of online events ", says Chaitanya Kolhe, the erstwhile Department General Secretary. But slowly, in late February, the organizing team started to take shape, and the detailed planning of the event began.

> *"Despite the fact that the event hadn't been conducted in an online mode ever, we were sure we will attract a larger audience given the convenience of online events "*
> *– Chaitanya Kolhe*

A team of over 30+ students spanning different years of all the programs in the department, comprising of the overall coordinators, managers, and volunteers, under the guidance of the two Professors-in-charge, worked tirelessly for a period of about two months to shape up the event. The different background tasks of media and marketing, web development, corporate relations, and logistics were well coordinated by the students given the fact that most of the students weren't present on the campus. "The logistics of an online event had challenges of its own. As against an offline event, where guests from industry had multiple opportunities to directly interact with students and faculty either in the presentation rooms, during tea breaks, or their stay close to IITB during the two days of the event; we had to deal with the challenge of fruitful discussions between the stakeholders in the online mode", adds Geetanksha Gupta, one of the three overall coordinators for the event.


Mr Anil Sardana from Adani Power Ltd. as Chief Guest

The event took place on May 15, 2021 - starting from 2.30 pm - a one-day virtual event. The event received a unique opportunity to host Mr Anil Sardana, MD, and CEO - Adani Transmission Ltd., MD - Adani Power Ltd., and Prof. Subhasis Chaudhuri, Director - IIT Bombay. With encouraging words from these two chief guests and Prof. Rangan Banerjee, Head of the Department, the event kick-started in the presence of over 50 guests from different industries that were in some way related to the energy sector. There were four different channels that run parallelly focusing on different areas from the energy domain namely electrochemical conversion and storage, solar PV and solar thermal, electrical systems, wind, and hybrid energy systems, and energy systems modeling. Each channel held about 13 presentations with optimum time for post-presentation discussions. Even though it was not very usual for the department to host such an online event, it catered well to allow guests to smoothly move across the channels to touch upon the areas of their interest - an enthusiastic audience for sure!


Mimicking the proceedings of the earlier offline events, each channel had a jury consisting of two members - one Industry chairperson and one Faculty chairperson. The evaluation of the presentations by the jury was used to decide three winners from each channel and the overall best presentation prize which was awarded to Prabhat Sharma, a second-year MSc. student from the department, by the special guest Dr. Anuradha Ganesh, Director - Research and Innovation, Cummins Technologies India Ltd. (also the organization that was the event's Prize sponsors). Other prizes from the event were also announced, 3 pertaining to each channel. The winners included Prashant Gupta, Indrajeet Mohite, Premanshu Kumar Singh, Manu Mohan, Suren Patwardhan, Prabhat Ranjan, Lomesh Tikariha, Manoj Vishwakarma, Aditi Mahajan, Amit Upadhyay, Ansari Mohd. and Suraj Kanojia. The event concluded with alumni talks bridging the life of students at IIT and the atmosphere in industry, from Mr. Ayush Mahajan, Co-founder - PV Diagnostics, and Ms. Neelima Praganiha from General Electric followed by a vote of thanks from Arnav Kamble, Overall Coordinator of the event.

**50+ companies**
**200+ participants**
**30+ coordinators**
**15+ professors**

# SIMULATION OF PHASE CHANGE MATERIAL FOR INDIAN CLIMATIC CONDITION

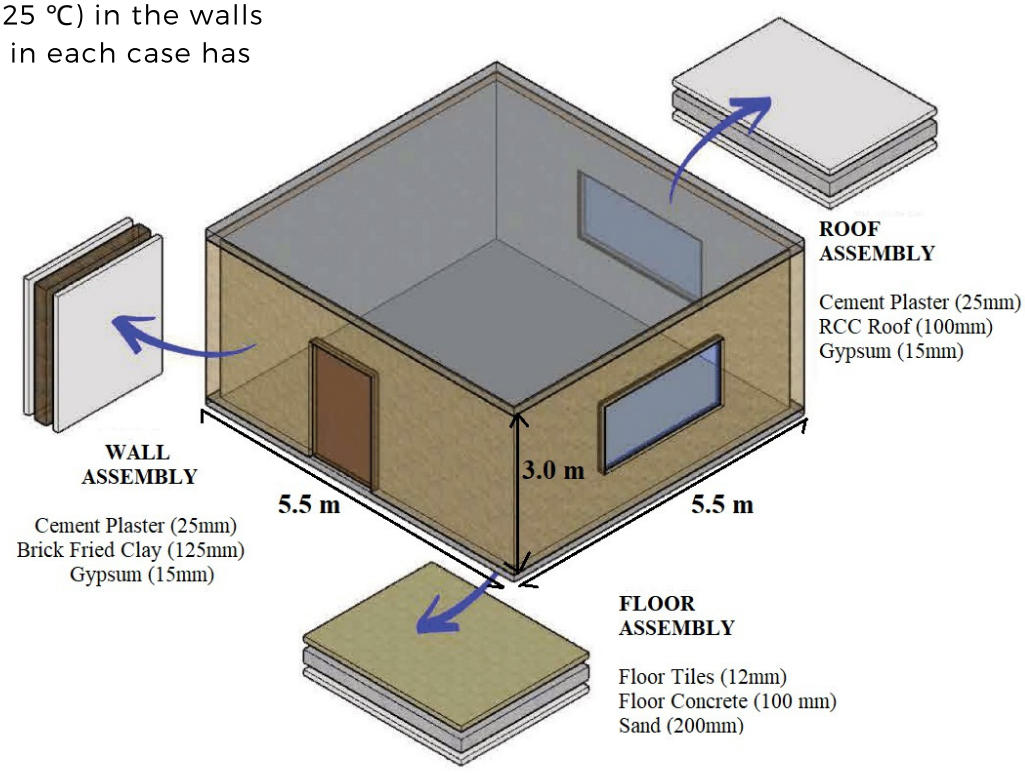
Prabhat Sharma

Phase change materials (PCMs) that utilize the principles of latent heat thermal energy (LHTES) storage are increasingly being used in the built environment. LHTES properties of PCM facilitate the shifting of the peak energy demand of the built environment from peak to off-peak hours. Though the use of PCMs is increasing, the choice of whether to include PCMs in the roof and walls and the relative merits/demerits have not been clearly addressed in the literature, especially for Indian climatic conditions.

A naturally ventilated single-story building of dimensions (5.5m × 5.5m × 3m) (which comprises a door on the south wall and two windows placed on the north and east wall) has been modelled using DesignBuilder for simulating its performance over the year for different Indian locations. The building has been modified to include PCM (paraffin wax, melting temperature 25 ℃) in the walls and roof. The performance in each case has been compared with the baseline with no PCM. In the base case, the walls are made of cement plaster, clay brick, and gypsum and the roof is made up of cement plaster, reinforced cement concrete (RCC) and gypsum.

In the case of PCM, an extra layer of PCM has been added between cement plaster and RCC in the roof, and for the wall, an additional layer is added between cement plaster and brick clay with a specified thickness. The floor materials used are sand, concrete and floor tiles for both cases. The materials for the door and windows are also the same for both cases.

To study the effect of PCM, the variable heat capacity method combined with the finite difference method has been used to study the effect of PCM, which is the implicit scheme of Energy Plus software (a whole building energy simulation tool). Variable specific heat capacity method has been selected due to the assumption that heat transfer occurs from the PCM surface in the built environment due to natural convection. Before going for the simulation, it is important to get an optimum thickness of PCM. The PCM should be chosen in such a way that it should operate in the latent heating zone for the maximum number of hours. It will increase the effectiveness of



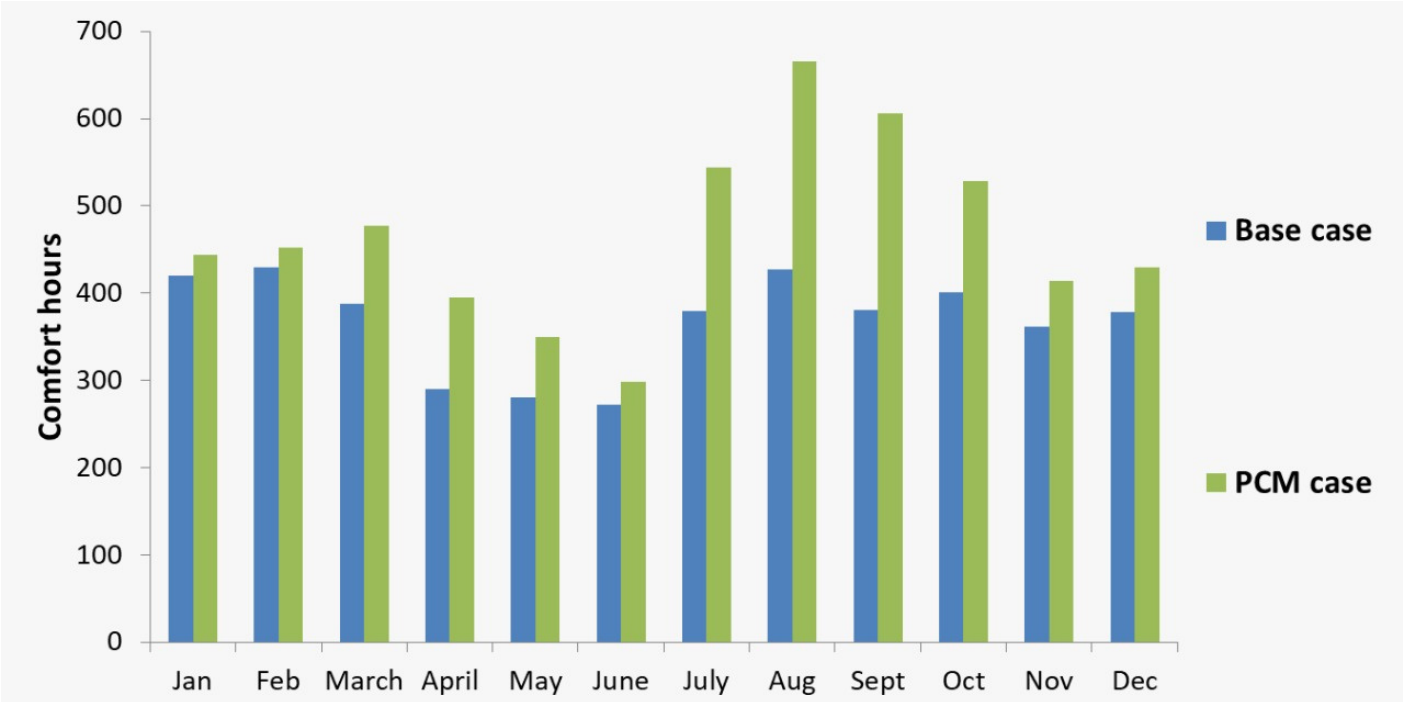
PCM in reducing the temperature fluctuation inside the building. A parametric study has been performed to get the optimum thickness of PCM for each surface in terms of latent heating hours. The optimum thickness for different surfaces differs as the amount of solar radiation falling on them varies. The thickness of PCM has been varied from 5 mm to 50 mm with a difference of 5 mm, and latent heating hours have been calculated. The thickness at which a maximum number of latent heating hours is observed for roof, west, east, north and south walls is 30 mm, 20 mm, 15 mm, 35 mm, and 25 mm respectively. Therefore in this study, PCM integrated with the roof and west wall has been considered as optimal design. To analyze the thermal performance of the optimal design, simulations have been performed for the typical summer day of Delhi.

The peak outdoor temperature on a typical summer day for Delhi is 44.2 ˚C on 10th June. For the base case, indoor temperature ranges from 31.4 ˚C to 43.1 ˚C whereas, in the case of optimal design, it ranges from 30.4 ˚C to 39.0 ˚C. Thus a reduction of 4.1 ˚C is facilitated by the PCM integrated design. The reduction in temperature is obtained due to the LHTES property of the PCM, which is higher than other construction materials used in the base case.

Now to analyze the monthly thermal performance of the PCM integrated built environment for Delhi, the number of thermal comfort hours is calculated using the IMAC model. For Delhi, with 90% acceptability, 4509 hours out of 8760 hours are within the IMAC comfort band for the base case. While in the case of PCM, the thermal comfort hours increase to 5605 hours.

After integrating PCM in the roof and west wall, there is a 24% increase in comfort hours for Delhi. It is clear from the figure that the number of thermal comfort hours increases for each month. So, PCM incorporated in roof and west wall works efficiently in all the months. At the same time, the maximum increase of 55.97% occurs in August.

The study provides a methodology for simulation of a specified thickness of paraffin wax as a phase change material for buildings in different climatic zones of India. This methodology can be used to determine the increase in the comfort conditions over the year (annual number of discomfort hours) with PCM inclusion. This analysis can also facilitate a cost-benefit analysis in terms of energy savings in mixed-mode buildings with air conditioning.



# Alumni Profile

## Nilay Shah

**As we all know college life is completely different from our JEE & school life. So what new things did you adopt when you got admission to IIT Bombay? Please share some of your college experiences with us.**

In the starting few days itself, it was clear to me that university life was to discover my passion – what do I really like to do? In this pursuit and out of sheer curiosity, I tried various clubs and activities in the starting months – debating, drama, swimming, literary arts, Mood Indigo, Techfest etc. Most of these things were new to me. I, then, continued with debating throughout my first year; however, towards the end I realised I'm not really enjoying it, it is only the associated glamour that was attracting me. I did not go for a single session for the rest of my IIT years. The journey of trying many things, continuing on a few that I seemed to like and then evaluating if it was true was a worthwhile pursuit.

Towards the end of the second year, a senior had posted about Shodh Yatra on the Events mailing list. It was a 7-day foot journey in rural Vidarbha in the scorching summer heat. I went; and had to get intravenous saline on the second day of the journey. Yet, the experience was awesome. Having lived in Mumbai all through my pre-IIT years, this foot journey sensitized me to the needs of people on the rural ground for the first time. And I felt I should do something. But how? I found my quest answered very quickly. In the same summer, I did an on-field project assessing the success and failures of rural water supply schemes in 3 villages. I realised that I could help solve real, on-ground application challenges by developing and utilizing multi-disciplinary thinking – technical, economic, social and political aspects. I believe this is what we energy engineers are bred for. The closeness to people on the ground and visibility of impact on their lives made the entire experience rewarding for me. I had found my passion. In the pursuing years, I went on to become the first student to graduate with a Minor in CTARA, became club manager of Samwad – a platform to discuss social issues, organized voter registration and blood donation camps, co-founded Abhyuday, the first social festival of IITB which later became the umbrella body bringing together people inclined towards the development sector.

The result? During resume-making time, when people look back at their college life, I remember feeling extremely content with myself. I would urge everyone to walk a similar path – to tap into the umpteen opportunities at the campus, or create new ones (Abhyuday is an example that this is possible) and discover what you truly like to do.

**What are the career opportunities in the energy sector after completing graduation?**

There are ample opportunities now for energy engineering graduates. All companies in solar, wind, oil and gas, process efficiency, energy utilities are possible fits. A lot of start-ups in electric vehicles, battery research, fuel cells, demand-side management, industrial IoT, etc. have come up. Choosing a thesis project in a similar field as the target job profile is a great pathway to have an edge during recruitment

> *Discover your passion as soon as you can by following your gut and experimenting. Curiosity and perseverance will naturally follow. This would make a great career and life for you ahead.*
>
> NILAY SHAH

# Alumni Profile

**You are a co-founder and CEO of Optify. Can you tell us about Optify and also your journey?**
Optify is about optimizing industrial dryers. Dryers are commonplace and are big energy guzzlers consuming 15-25% of all industrial energy. Taming a dryer is difficult because a lot of parameters are to be controlled together. The industry is currently relying on age-old PLCs and PID loops technology which work on instantaneous values and single-input-single-output. This leads to variations in the output which need to be corrected by manually changing some setpoints. Human operators tend to keep safer setpoints to avoid crossing the maximum allowed thresholds. This practice brings reliability, however loses on productivity and efficiency to the tune of tens and hundreds of crores of rupees in a single plant. So can we reduce the process variations reliably, which will allow plant managers to get higher productivity and efficiency?

We can bring smarter controls that work by identifying trends of multiple parameters over time and taking actions holistically by understanding the entire process chain, like a process expert would do – artificial intelligence. By training the control system to do this, we reduce variations 24x7, reliably which is not possible manually. Our work involves a lot of process understanding, control systems, electronics, AI algorithms, and mechanical integrations. For each $^2$ plant we optimise, we save carbon dioxide equivalent to taking thousands of cars off the road. The impact is positive on the triple bottom line – people, planet and profits.

This journey personally started for me when I was completing 2 years at CleanMax and felt that henceforth the learning curve would start flattening for me. I called up my DESE batchmate and friend, Piyush Patil, to discuss if he has any ideas and interests in doing something together. It was a ripe time for him too. He had worked on industrial dryers for the previous 2 years at Forbes Marshall R&D and had these ideas and skillset about how smarter control algorithms can transform the industry.

With Piyush as a co-founder, the journey has been very exciting throughout. We live and work out of the same house – it is very hostel-like. We've secured two grants, from DST and Cisco each. There have been a lot of unconventional learnings too – we figured hard timelines are actually counter-productive in the R&D type work that we are doing. We found our core focus recently. We are now in the first on-site trials phase of our products and expect good results in the next 2-3 months.

**You had worked in CleanMax Solar as a business developer for 2 years. What was your motivation to join the company? What all things did you get to learn from this job?**
There were multiple things that happened:
1. Around 2015-16, solar PV was established as a technology and people were saying that we need business model innovation to increase its adoption. CleanMax Solar had cracked the right business model and was on a stellar growth journey ahead.
2. Personally, I have a criterion that whatever I do professionally, needs to positively meet the triple bottom line – people, planet, profits. While CleanMax was great on planet and profits fronts, I was unclear about the people front (does it promote social equality or aggravates inequality?). Over the years, I have come to believe that a responsible capitalist attitude is better to than a socialist attitude because it is more likely to create a larger impact in terms of employment and GDP which have multiplier effects.
3. I had spoken to a batchmate who was working with CleanMax in the same role before interviewing. She said the role would be a mix of financial analyses, commercial and legal negotiations, sales, communications and technical evaluation. This is what I liked – multi-disciplinary skills at use together. I was never someone who could work in a lab or do one task at length. So, the role fit my attitude and liking. I had never thought that I would land up doing sales during IIT, but I have found to like it!
4. CleanMax had a startup culture and I personally knew 2 DESE seniors who were working there. This gave more confidence in the atmosphere.

Being in the business development role helped immensely because we got to know the entire value chain internally as well as from the customer viewpoint. What do customers evaluate while deciding? How can I negotiate a better deal? What does it take to take a business from Rs. 200 cr turnover to Rs. 1200 cr turnover. How do teams get organised and communicate with each other? What type of people are required for which role? So a lot of business learning happened very quickly in those 2 years.

# Solution to Climate Change

# "Innovation"

Nowadays, most of the world believes that climate change is happening and it is affecting the natural environment as well as human life. In 1970-1980 people started to talk about it but the change of mindset of the world and leaders of the countries could not happen in a moment. carbon dioxide emissions are going up and up so we must have to move to renewables. In the 19th century, all renewable technologies were available but till now the world is not using renewables to satisfy all types of needs. The answer to this question is 'economics' related to renewables. According to data of world total primary energy fuel consumption-2018, we are using 15% energy from renewables(in that 4% is from solar, wind and geothermal).

So how to decrease the use of fossil fuels? Taxes on non-renewables and subsidies on renewables can not really solve the problem. The energy taxes on non-renewables especially hurt the poor people. We are owing for subsidies and that amount increases year by year. Both things are not good for the energy economy. So is there any smarter way? Yes, there is.
The solution is 'Innovation'. You are wondering, Is this a smarter solution? Yes. When we go deep into the history of the world we find many more examples. In those situations, problems are solved by innovation. The examples are as follows:

1. When India was starving in the 1970s, the solution was not to subsidize food. The solution was the Green Revolution.
2. When London roads were filled with the manure of horses in horse carts, the solution was not to subsidize walking. The solution was 'car'
3. When Whale oil was used for lighting the lamps and whales were going to extinct. The solution was not to imply a tax on whale oil but the solution was the innovation of kerosene.

So the conclusion of the above examples is 'Work on the cause, not on the symptom'. According to the first example, the cause of starvation is insufficient food production in India. So the green revolution is to improve the practices of farming such as the use of fertilizers, farm mechanisation etc. So India had worked on the cause and it was successful.
The same thing is valid for climate change. We need good innovation on renewables. So that we can tackle the economic problems that we are currently facing for renewables. We are investing our money in subsidies for wind turbines which are not effective and financially affordable compared to fossil fuels. So we have to invest money in research so that affordable windmills can possible. This is the same for all other renewable sources. This is useful for countries like China, India, and the US which are more dependent on fossil fuels.

## TED TALK

### by Bjorn Lomborg

> Taxes on non-renewables and subsidies on renewables can not really solve the problem. The energy taxes on non-renewables especially hurt the poor people.
>
> BJØRN LOMBORG

Source:https://www.youtube.com/watch?v=SEjNVWV5jbs

# Know your Lab:

# "Urja Lab"

Laboratories are the most important part of learning as students get a real-life demonstration of the theory and concepts they study in lectures. Our department also has various labs like Urja lab, Forbes-Marshall lab and non-conventional energy sources lab. Let's get to know about Urja Lab first.

**History:**

Urja Lab is one of the oldest labs of the Department of Energy Science and Engineering. The history of Urja lab begins with the history of the department itself. The lab was established 25 years ago. Initially, it was a nuclear lab of the mechanical department which was transformed into an energy systems laboratory. It had a teaching lab experimental setup and a computational lab. The department office was also functional in the lab for the first few years, along with the experiments setups for various department faculties. Currently, Urja lab has experiments setups of three faculties- Prof. Ashish Sarangi, Prof. Prakash Ghosh and Prof. Pratibha Sharma.

**Brief Overview:**

This lab has an amalgamation of various kinds of instruments that are equipped to perform a range of experiments. Outside the lab, different types of solar panels are placed including amorphous silicon, monocrystalline silicon, multi-crystalline silicon and cadmium telluride. The performance comparison, grid synchronization, spectral response and quantum efficiency calculations can be done on these solar cell modules. Apart from studying the characteristics of solar cells, various applications of solar energy like solar water pumping systems and solar inverters are also studied in the lab. All these solar cells and other systems are fabricated by the department students themselves. Alongside the solar modules, there are other experimental setups also present inside the lab. A setup of a centrifugal pump and a three-phase induction motor is there, the efficiency testing can be done for both the instruments. There is also a setup for determining the power efficiencies of different light sources like incandescent lamps and LEDs. An Internal combustion engine is also present in the lab which works on diesel. An experiment of producing biodiesel from natural oils is performed in the lab and a performance comparison of the IC engine is done in the case of normal diesel and biodiesel.

So, in the Urja lab, a student can get practical experience on solar energy derived devices and other light devices. They also get experience working on IC engines, centrifugal pumps and motors. Wait for the next issue to know about other labs!

# Research life at DESE...

## Bhrigu Rishi Mishra

**Can you tell us about Yourself?**
I am Bhrigu Rishi Mishra and I am from Prayagraj, Uttar Pradesh. I joined IIT Bombay in 2016. My program was an MSc-PhD program. During my MSc, I did my project under Prof. Shireesh Kedare and Prof. Anish Modi. Then I got PMRF in 2019, and right now I am a Ph.D. student under Prof. Kartik Sasihithlu.

**How did you get to know about the Department of Energy Science and Engineering?**
Actually, from 2016 onwards, the MSc-PhD program was removed from the counseling portal of the IIT-JAM exam. Hence they opened applications outside the official portal and included interviews also. When I filled the form for counseling, it was mentioned to apply explicitly for the MSc-PhD program. Also, one of my friends in the Physics department told me that apart from main core subjects, you can also join in interdisciplinary departments like Energy Science.

**How is your experience here so far?**
It is good. Fabulous. Whatever I expected from IITB, I got it, but a few things can be improved from the institute side. Coursework is standard as the academic curriculum is almost the same everywhere, apart from the pressure that adds up due to highly qualified faculties compared to other colleges. I remember in the first year; I gave 52 exams which is more than the total exams I gave in my graduation. According to me, the most important thing is how you manage your time. IIT teaches you that, and if you learn time management, you can succeed in life. One thing to add is the way courses are taught here can be made more engaging so that students can learn more. For example, we had an energy modeling course where we did a project concerning some real-life problems. So in that way, we can implement the theory in real life, which makes learning enjoyable. Apart from that everything was fine.

**You mentioned that time management is really important. Can you give some tips on how you did manage your time during MSc?**
During my MSc, it was not very easy. I tried to continue my tennis practice, but I could not do it regularly since we had class between 7 to 8 in the evening. It's challenging to create your own timetable as you can hardly follow it for more than two weeks because you cannot bound yourself to a specific time interval here due to a hectic academic schedule and coursework. So, whenever you get time, extract it to learn new skills. I used my time to do tennis practice or in other cultural activities. It is your personal choice how you utilize your time.

**So what all opportunities one can expect after completing PhD from this department?**
Since it is an interdisciplinary department, many types of research happen here. Again after finishing your PhD depending upon your work and interest, there are three things you can go ahead with - postdoctoral practice, get a job in the industry, or just after completing PhD you can apply in state universities, private universities, and NIT for an academic job. However, if you want to acquire a job in IITs and other prestigious universities, you need experience, so it requires two to three post-doctorates from decent universities and some good research papers. So a lot of my seniors chose to do postdocs. Many of my seniors also got into industries as their PhD work was more applicable in an industrial background. So you have a lot of options available depending upon the work you are doing.

**What is the advantage of the interdisciplinary nature of the department?**
In an interdisciplinary department, you have many choices. I just graduated in physics when I came here, so I had no idea of the energy field. I gradually learned that I have many options, and I cannot just bind myself to hardcore physics things or only my subject-related things.

I can explore any research field related to energy. I know my friend who had a mathematics background and now doing research related to material science. So it depends on you and your interest which way you like to go. For me, I did my master's project on solar thermal. It was solar thermal on a surface level, but it was based on atmospheric science-related things on the core level. Now in PhD, I am doing work related to material science for a specific application. So the thing is you have many options, you come here and explore, and then decide which field you like. If someone likes to work in the battery, fuel cell, photovoltaics, and solar cells, you have plenty of opportunities here. So the thing is, in an interdisciplinary department, you can get different things under a single roof, and depending upon your interest, you can find your way.

**What exactly is your work and how is it related to the world of energy?**

As I said earlier, my master's project was in solar thermal related to atmospheric science, and it was for a specific problem of solar thermal power plants. In PhD, I am trying to develop a coating for a specific type of application which is passive radiative cooling. So we are trying to develop a coating that has optical properties such that when coated on the walls or roofs, it can cool down the interior space without the use of electricity. So basically, it is electricity-free cooling thus it has many advantages. If it ever came to market, it would be a big blow.

**It seems great! So what can industries expect from a research scholar of the energy field?**

One of the critical things that we learn during PhD is how to find a problem and what steps to take further to solve that problem. Problem is itself a big thing to find out, but as PhD students, we always try to find a lazy way to solve a problem because everyone wants a shortcut rather than going inside a big circle. We are learning in the PhD how we can reduce the complexity of the problem and then try to achieve our goal. We work on a specific application, but if you have developed a skill, you can also apply it in other fields. I know one of my seniors who did a PhD in solar thermal, but now he is working in the fuel cell industry with a decent package. Industries want skills, whatever the area may be, you can learn a new topic it is not a big problem. The thing is, if you have the skill to solve a problem that matters, and you are doing your PhD honestly, the industry is a good place for you.

**What kind of projects or industrial projects is our department equipped to take upon?**

People work in different fields in our department, like solar energy extraction from solar cells and solar thermal, batteries, fuel cells, application-based material development, biogas, and geothermal. So whatever the area is, if it is somehow related to energy, at least one professor in the department is working on it or is related to it. Even some professors are working on energy policies related issues and collaborate with the policymaking department of IIT Bombay. We have some professors here with greatly facilitated labs who have significant projects funded by the government.

**Finally, what is your suggestion after the experience of these 4-5 years? What are the areas with the scope of improvement?**

As I said earlier, one thing is coursework. It should be more engaging. It should not be just attending lectures, mugging things up one night before an exam, and forgetting. Coursework should be modified such that it becomes related to real-life rather than just conceptual topics. From my perspective, everything is good, but I have heard from friends and colleagues that they don't have many choices in the department as they come from specific backgrounds. So for those people, I want to say that there are many things that you can do. PhD is always a fresh start, even if you say that you are comfortable in a specific topic, but then also you have to start from scratch, and then you dig deeper. You should not complain about not getting hardcore topics. For example, if someone is interested in physics, they say that they don't have options as they want to work on theoretical physics only. But the thing is, we have professors who work on theoretical physics or at least have knowledge of that field, they can guide on that, and you can collaborate with professors of other departments. IITB gives a lot of flexibility to the students.

# The First: Indian Rocket Launch

You know it's meant to be when God blesses himself. The story of the first Indian rocket launch is also an example of the same. It starts from a Catholic church present in a small fishing village called Thumba in Trivandrum. The location of the church was ideal for a rocket launch. St. Mary Magdalene Church, located on the magnetic equator of the earth, grabbed the attention of Dr Sarabhai.

In the early 1960s, Dr Sarabhai and his coworkers went to speak to the then-bishop of Trivandrum, Rev Dr Peter Bernard Pereira, about acquiring the church as a rocket launch station. However, the conversation did not result in any conclusion. Instead, the bishop asked all of them to Sunday mass for that week. One of India's most admired and celebrated scientists, Dr APJ Abdul Kalam, was also present that week. He shared his experience of that Sunday mass in his book Ignited Minds: Unleashing The Power Within India. He writes the words of the bishop as:

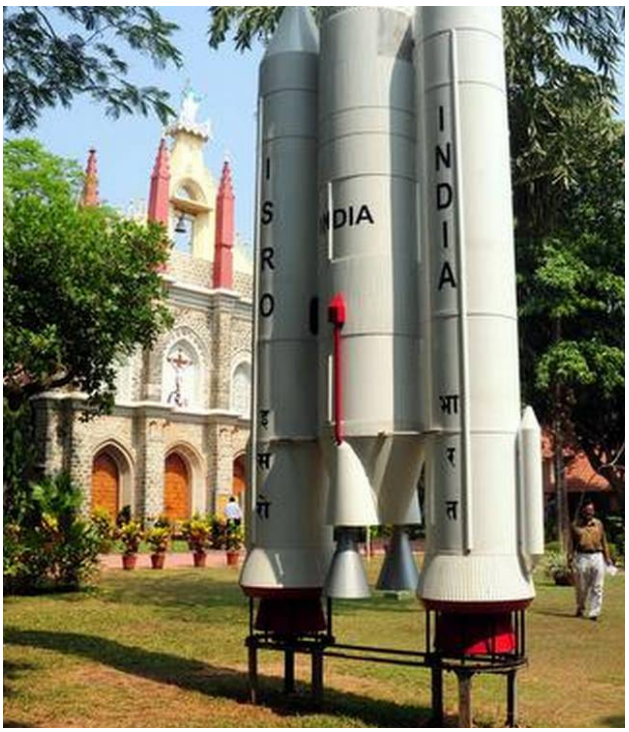
*"My children, I have a famous scientist with me who wants our church and the place I live for space science and research. Science seeks the truth that enriches human life. The higher level of religion is spirituality. The spiritual preachers seek the help of the Almighty to bring peace to human minds. In short, what Vikram is doing and what I am doing are the same – both science and spirituality seek the Almighty's blessings for human prosperity in mind and body. Children, can we give them God's abode for a scientific mission?"*

These words made the whole church vibrant as all together said amen. Soon after that Sunday mass, necessary actions and paperwork began. All the people of Thumba moved to another village which also had its own church. Then the journey of rocket launch begins. The rocket was built in the garden near the church.

In the 1960s, St. Mary Magdalene Church transformed to Thumba Equatorial Rocket Launching Station (TERLS). The cattle's shed changed to laboratories, and the main church building was converted to a space museum. The building, which bears the church-like beauty of towers and bells, now houses a space museum, where you cannot walk in with your shoes on. Later on, TERLS became Vikram Sarabhai Space Centre (VSSC).

The NASA-made rocket was carried to the church on cycle and bullock cart in small parts. Finally, on November 21, 1963, India's first-ever rocket Nike-Apache was launched into space from the garden facing St Mary Magdalene Church or now the VSSC.

So in this way, a place where people come to pray became the centre of the country's scientific development—a true example of the amalgamation of science and spirituality.




SOURCE:https://www.indiatoday.in/fyi/story/india-first-rocket-launched-from-a-church-isro-vssc-nike-apache-15606-2016-06-22?utm_source=inshorts&utm_medium=referral&utm_campaign=fullarticle

# AROUND THE WORLD

## Tata Power Solar secures order from NTPC to build 210 MW of solar projects worth ₹ 686 crores.

June 02, 2021

Tata Power Solar, a wholly-owned subsidiary of Tata Power, announced on Wednesday that it had obtained a Letter of Award from NTPC for the construction of 210 MW of solar projects in Gujarat worth ₹ 686 crores. The projects will be commissioned by November 2022.

With this addition, Tata Power Solar's order pipeline has grown to 2.8 gigawatts (GW) with a value of ₹ 13,000 crores, according to a company's press release. The solar projects' scope of work comprises land, transmission, engineering, procurement, installation, and commissioning. The NTPC project site is located in Gujarat.

SOURCE: https://energy.economictimes.indiatimes.com/news/renewable/tata-power-solar-secures-rs-686-cr-orders-from-ntpc-to-set-up-210-mw-projects/83174833 , Last accessed: July 21, 2021

## Britain to ban all-new diesel and petrol heavy goods vehicles from 2040

July 14, 2021

Britain will ban the sale of new petrol and diesel heavy good vehicles from 2040 as part of a broader package of green initiatives to achieve net-zero emissions from all modes of transport. Prime Minister Boris Johnson's government seeks to elevate Britain's environmental credentials as he prepares to hold the United Nations Climate Change Conference, known as COP26, in Scotland later this year.

Smaller diesel trucks will be banned from sale in 2035, while larger diesel trucks weighing more than 26 tonnes will be banned in 2040, or sooner if possible. It also outlined ambitions to build a net-zero emission rail network by 2050 and achieve net-zero domestic aviation emissions by 2040.

SOURCE: https://energy.economictimes.indiatimes.com/news/oil-and-gas/britain-to-ban-all-new-diesel-and-petrol-heavy-goods-vehicles-from-2040/84400239,Last accessed: July 21, 2021

## India's EV revolution is here: Ola S1 electric scooter launched on 15 August

August 15, 2021

'India's EV revolution is here and how! Reservations pouring in from 1,000+ cities and towns. Right from day 1 of deliveries, we'll deliver & service all across India.' said Ola co-founder Bhavish Aggarwal. On August 15, Ola unveiled its first e-scooter in India, the Ola S1 series. The Ola S1 and the Ola S1 Pro are the two versions of the electric scooter released. The Ola S1 has a 2.9 kWh battery and can provide 8.5 kW peak power. A 750 W portable charger can charge the battery in around 6 hours, and the Ola supercharger can charge it up to 50% in just 18 minutes. The Ola S1 Pro, on the other hand, has an 8.5 kW motor but a larger 3.9 kW battery.

Both the electric scooters come with several modern features, including a Reverse Mode, in-built speakers, proximity sensors, app compatibility, and also a Hill Hold feature that prevents the vehicle from rolling back on slopes during riding.

SOURCE: https://indianexpress.com/article/technology/tech-news-technology/ola-s1-escooter-launch-live-updates-7454499/, Last accessed: July 21, 2021

# Freshie Interview

**Hello Samanvaya! Could you please tell us about yourself, the course you are enrolled in and include any positions you hold?**

Answer: Hi! I am Samanvaya, currently a sophomore student pursuing my dual degree in DESE, IIT Bombay. I am from Tonk, Rajasthan. My hobbies include playing the harmonica, playing badminton and stock trading. I was the Department's Alumni Secretary in the last year and the Corporate Relations Coordinator at E-cell and currently the Events and Operations core team member at SARC.

**Getting to the course, Could you tell us how you got to know about the department and what motivated you to take admission here?**

Answer: I am happy that this question came up. I first got to know about this department from my Coaching Institute's head, post the entrance exam's results. The biggest motivation to join this department was the scope of Energy Science in the near future and the potential opportunities it holds. The interdisciplinary nature opens up a plethora of opportunities, allowing us to pursue our interest for a wide range.

**As first-year students, everyone learns some common subjects and is welcomed in the department only in the second year of the course. How has this transition been for you? What are some of the unique things that you find about the department?**

Answer: The first year at the department gave a glimpse of many different things that we would be learning in our tenure. In the second year we learnt introductory subjects like basic electrical and electronics course and thermodynamics, mechanics etc. These subjects could be seen as basic building blocks and also helped us gauge where our interests lie. The transition was also very smooth owing to the guidance students received from the DAMP mentors.

**The past year has been a difficult one, with the transition from offline mode to online teaching mode. What has been your experience so far with the online mode of learning?**

Answer: The transition of great on some fronts, while there were some hurdles faced by students and professors. But the professors have been very supportive through this transition phase. The attendance policy was laid aside temporarily. Since all the interactions were on a virtual platform it was easy to record them and make them available to the students. Even if you had attended the lecture the first time, it was always a handy tool to revisit during revision. Explanations during the class were written on virtual boards and were saved for later reference. The delay that used to happen in offline mode to set up projectors and other tools was also eliminated.


**Left: Samanvaya and his batchmates on their visit to Team Shunya**

**If given the opportunity, what's the one thing you wish could be changed/done in a better way in the department.**

Answer: The online semesters highlighted some amazing but unknown ways. Some of them were virtual industry visits and connecting to Industry representatives from different parts of the world with the elimination of travel-related logistics. But the fact that now students have experienced such online visits realized that it could also be equally value-adding and we also have some experience in arranging them. I think it would be a great idea to continue such things even when we resume learning in offline mode in near future.

# the Glory of TEAM SHUNYA

**Project Daksh**

Their brainchild, Project Daksh delivers a sustainable design to redefine an Artist Village, a site in Belapur, Navi Mumbai. The project addresses the pain points of the residents of the area, including issues of emergency vehicle access, waterlogging, lack of parking spaces, and reduced natural lighting and ventilation. They have come up with a cluster-level design consisting of four 1BHK, four 2BHK, and two 3 BHK houses in each cluster.

**Unique Selling Points**

The cluster can be scaled up and cost-effectively set up in areas of similar geographical features. The design provides a very economical and viable option to the beneficiary. In addition, the design also proves to be more profitable than its conventional counterparts for the construction companies as well. The construction cost of $ 49 per sqft. is much less than the Mumbai and USA average of 79 and 103 dollars per sqft, respectively. The design is highly customizable with interior and exterior elements such as bamboo *jalis* and railing patterns. The project incorporates an efficient automation system and a user-friendly application with which the HVAC, lights, and fans can be controlled effectively, incorporating recycled building material, rainwater harvesting, and greywater recycling. The system, along with Glass Fibre Reinforced Plastic (GFRP) panels for walls and roofs for efficient use of energy, altogether makes a net positive energy cluster that is environment friendly. The design is sustainable enough in terms of resource intensity and disaster resilience during the occupant's stay of over 50 years. The design preserves the individuality and community living setup of the place, as it had been in the eyes of the celebrated architect Charles Correa. The project's overall design along with energy simulations took the enthusiastic team around three months along with competition submissions, with members contributing from different parts of the country due to the prevalent restrictions in campus activities.

**Team composition and sponsorship**

The team that represented IIT Bombay consisted of 46 members across all disciplines, working under various subsystems. The project was supported by DesignBuilder Software Ltd., funds coming in from the Student Technical Program Committee of IIT Bombay and mentored by seven faculties from various departments, and headed by Prof Rangan Banerjee of Department of Energy Science and Engineering, IIT Bombay.

**Bonus awards and acknowledgments**

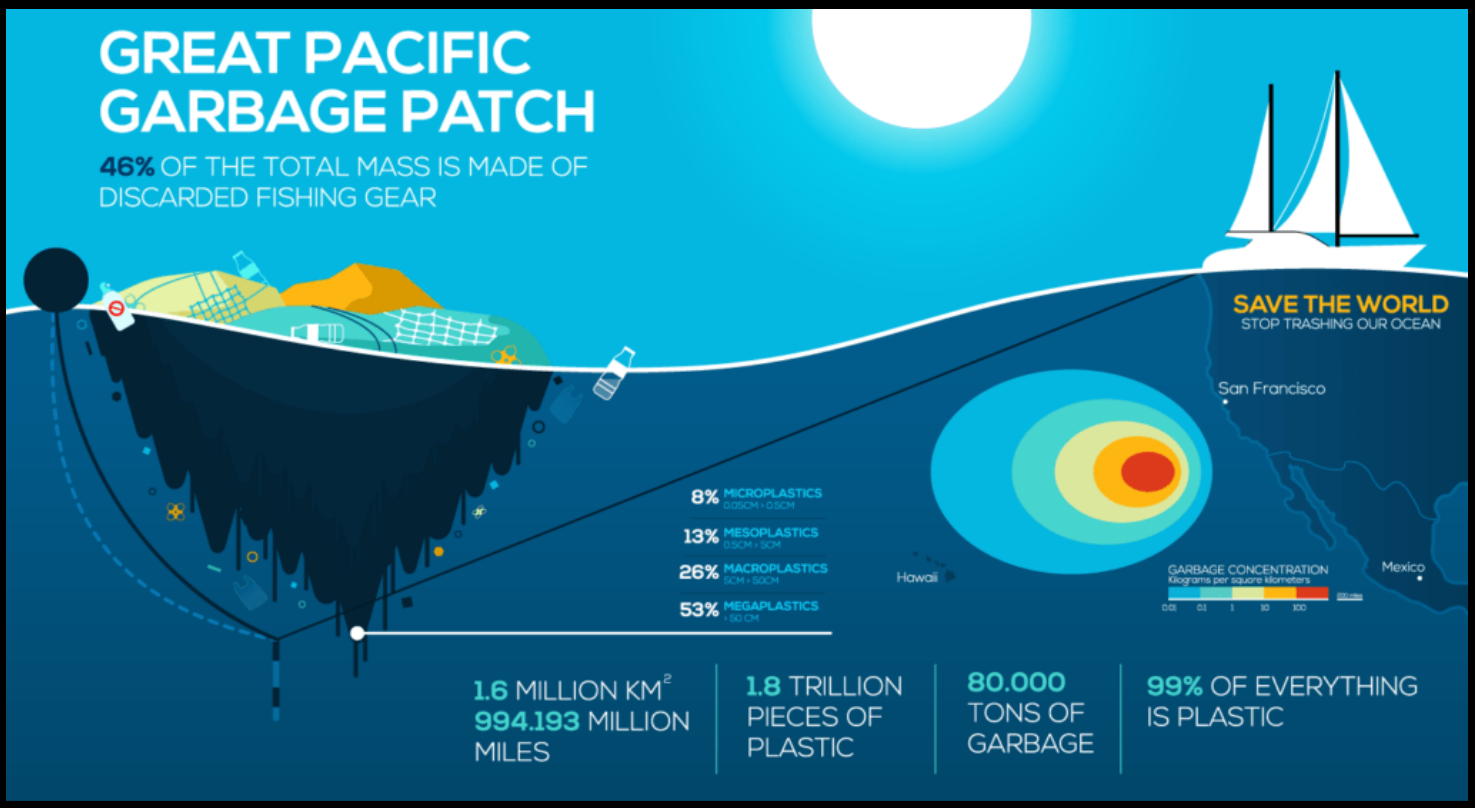
The team has also demonstrated their creativity and excellence in their presentation, receiving appreciation from the jury for their creative and smooth display and winning the Best Graphic Designer Award to develop the Best Virtual Background for the project display.

**Future plans**

The team deliberates on making this proposal with the respective authorities to implement their cost-effective design in the target sites and improve the living conditions of the residents of the sites.

IIT Bombay has once again proved their mettle in the Solar Decathlon Challenge organized by the US Department of Energy, with Team Shunya, the technical team at IIT Bombay, came second in the 2021 edition of the Design Challenge in the division of Attached Housing.

# GREAT PACIFIC PATCH




- The Great Pacific Garbage Patch is a collection of marine debris in the North Pacific Ocean (the Pacific trash vortex). It spans waters from the West Coast of North America to Japan.
- The North Pacific Subtropical Gyre is formed by four currents rotating clockwise around an area of 20 million square kilometres (7.7 million square miles).
- The area in the centre of a gyre tends to be very calm and stable. The circular motion of the gyre draws debris into this stable centre, where it gets trapped.
- The amount of debris in the Great Pacific Garbage Patch accumulates because much of it is not biodegradable. Many plastics do not wear down; they simply break into tinier pieces.
- "Garbage patch" in reality, are patches almost entirely made up of tiny bits of plastic, called microplastics that can't always be seen by the naked eye.
- A 2018 study found that synthetic fishing nets made up nearly half the mass of the Great Pacific Garbage Patch, largely due to ocean current dynamics and increased fishing activity in the Pacific Ocean.
- In the ocean, the sun breaks down these plastics into tinier and tinier pieces, a process known as photodegradation.
- Marine debris can be very harmful to marine life in the gyre. For instance, Loggerhead Sea Turtles often mistake plastic bags for jellies, their favourite food. Albatrosses mistake plastic resin pellets for fish eggs and feed them to chicks, which die of starvation or ruptured organs.
- Seals and other marine mammals are especially at risk. They can get entangled in abandoned plastic fishing nets, which are being discarded largely due to inclement weather and illegal fishing. Seals and other mammals often drown in these forgotten nets—a phenomenon known as "ghost fishing."
- Because the Great Pacific Garbage Patch is so far from any country's coastline, no nation will take responsibility or provide funds to clean it up. Charles Moore, the man who discovered the vortex, says cleaning up the garbage patch would "bankrupt any country" that tried it.

https://www.nationalgeographic.org/encyclopedia/great-pacific-garbage-patch/
Last accessed: August 14, 2021

# JuSt FoR FuN

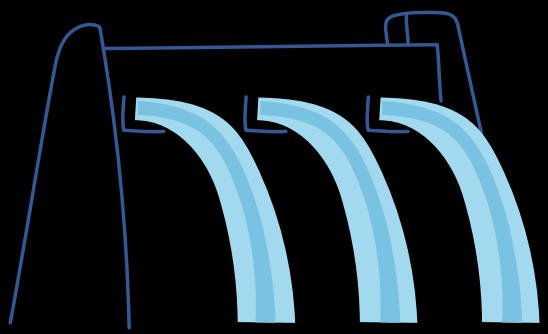
Around 80% of the sunlight that hits ice is reflected into space, whereas the ocean absorbs 90%

The energy it takes to conduct 100 searches on google is equivalent to a 60-watt light bulb burning for 28 minutes.

One hour of sunlight is equivalent to one year's worth of energy for the planet

In 2017, Costa Rica lasted 300 consecutive days on renewable energy alone.

Hydropower supplies about 20% of the world's electricity



*Chaitanya Kolhe*


*Rikin Shah*

*Moitreyee Sarkar*

*Arya Motegaonkar*

*Shreya Sharma*

*Saurabh Jagtap*

*Srushti Bhamare*

On behalf of the ENsider Team, I am delighted to present the very third edition of the newsletter. Continuing the legacy of the last two editions, we have brought many rich articles, interviews, research stories from our Department in this latest edition. We want to thank Prabhat Sharma, Nilay Shah, Bhrigu Rishi Mishra and Samanvaya Jain for their valuable input. We would also like to thank Rikin Shah, DESE General Secretary, and Chaitanya Kolhe, former DESE General Secretary, for their constant support throughout.

We hope you had a marvellous time going through the newsletter. We welcome your feedback on this issue and ideas for the next.

~Moitreyee Sarkar
Chief Editor , ENsider

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