IIChE NEWSLETTER 2023

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SPOTLIGHT

PRESIDENT'S CORNER

Dear IIChE members,

We are already into the seventh month of the year in no time at all. For the IIChE fraternity, the present year continues to be special as the Platinum Jubilee celebration of IIChE that began last year still continues. The commemoration will come to an end with CHEMCON 2023, which is going to be organised by the Headquarters in Kolkata during 27 – 30 December 2023 in association with Rajiv Gandhi Institute of Petroleum Technology, Jais; Jadavpur University, Kolkata; Heritage Institute of Technology, Kolkata and University of Calcutta, Kolkata. 'Energy Transition: Challenges and Opportunity' will be the central theme for CHEMCON 2023. Globally renowned academics, scholars and industry bigwigs will be sharing their knowledge about the latest developments in the domain of energy sector as well as analyzing the

global shift in energy production from fossil fuels to renewable energy sources. Each passing day people across the globe are feeling the inevitability and the imminence of the catastrophic Climate Change. The whole question of Energy and the issue of transition to alternative modes of energy are inherently associated with the larger issue of climate change. Therefore, in order to ensure our collective sustainability, it is undeniable that world as a whole addresses the issue of energy transition with utmost urgency.

Over the years, through various initiatives and programmes IIChE has been a consistent advocate for sustainable development and growth. The upcoming CHEMCON 2023 will be a part of that continuing campaign for a sustainable world. I invite our valued members to join us at CHEMCON 2023 in Kolkata and actively take part in the four-day long interactions which will be both invigorating and enlightening.

Keeping up with IIChE's consistent endeavour to contribute towards development of a sustainable ecosystem, the theme for SCHEMCON 2023, the 19th Students' Chemical Engineering Congress of IIChE, is also going to be 'Sustainable Future'. SCHEMCON 2023 will be organised on 22 and 23 September 2023 by the IIChE Student Chapter of Kongu Engineering College, Perundurai (Tamil Nadu) under the guidance of the Coimbatore Regional Centre. Over the years, SCHEMCON has developed into a much appreciated platform for the young students, research scholars, etc. to showcase and try out their innovative ideas. At the same time, with a number of senior faculty members and industry professionals from across the country attending the event and speaking on various topics, SCHEMCON serves as a very effective portal for the young minds to the emerging ideas and innovations in the domain of scientific and technological knowledge. I will request the IIChE Student Chapters in various engineering colleges and in universities, particularly those in the southern region, to arrange for their Student Members to attend SCHEMCON 2023 in large numbers.

Talking about IIChE's year-round activities for skill and knowledge enhancement, the Online Internship Program (OIP-2023) for the under-graduate students of Chemical Engineering and allied subjects is underway. Designed in consonance with the AICTE curriculum to equip students to become familiar with the cutting edge fields in the vast expanse of Chemical Engineering, the present session of OIP is offering subjects, such as, Chemical Process Technology, 6-Sigma (Yellow Belt), Biochemical Engineering, Petroleum Refinery Engineering and Matlab and AI-ML. All the details are available on the IIChE website. We expect this session of OIP to be as successful as that of the previous years.

We update the IIChE website on a regular basis to share with our members all the important news about the Institute's activities and events. I request our members to follow the website frequently. Also please send us your suggestions and opinions which would help us all to ensure a more meaningful role for IIChE.

Thank you.

Anil K. Saroha

OBITUARY

With profound grief, we announce the sad demise of our following respected Members:

Mr. Aok Kumar Bhaduri (LM 03682). The late Mr. Bhaduri joined IIChE on 10 October 1978

Prof. G.K. Roy (LF 02011). The late Pof. Roy joined IIChE on 13 August 1973

Mr. H.N. Mawani (LM 19497). The late Mr. Mawani joined IIChE on 19 December 1999

Mr. B.V. Anjaria (LM 13577). The late Mr. Anjaria joined IIChE on 13 March 1996

Prof. T.R. Das (LM 03352). The late Prof. Das joined IIChE on 26 March 1973

We offer our heartfelt condolence to the bereaved families of the departed Members.

IIChE-CHEMCON 2023 and the 76th Annual Session of IIChE will be organized by the Institute Headquarters in Kolkata from **27 to 30 December, 2023** in association with Rajiv Gandhi Institute of Petroleum Technology, Jais; Jadavpur University, Kolkata; Heritage Institute of Technology, Kolkata and University of Calcutta, Kolkata.

The theme of IIChE-CHEMCON-2023 is **Energy Transition: Challenges & Opportunities**

Venue: **Heritage Institute of Technology, Kolkata**

Contact: Dr. Avijit Ghosh (Organizing Secretary)
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IIChE Updates

Council Election 2023: The online (e-voting) process to hold the Council Election 2023 is underway. Accordingly, biodata of the valid candidates from the four zones have been uploaded on the IIChE website (wwww.iiche.org.in). Polling will start on 1 August 2023 at 10 AM and end on 31 August 5 PM. Members who have not updated their mobile phone numbers so far are requested to do so through the Membership Update portal.

Council Members and senior members of EC, Bangalore RC at M S Ramaiah Institute of Technology, Bengaluru where 4th Council Meeting was held on 24 June 2023.

Achievement: It is our pleasure to share the news of **Prof. Anil Verma**, Editor-in-Chief, *Indian Chemical Engineer* being conferred on the honour of **National Innovation Challenge Winner 2023** by the Dept. of Science & Technology (DST), Govt. of India. Prof. Verma was presented with a **Citation Plaque and a Prize of Rs. 2 lakhs** by **Dr. Jitendra Singh**, Union Minister of Science & Technology, Govt. of India on **21 July 2023**. This honour came to Prof. Verma for the project, **Vanadium Redox Flow Battery for Rural Electrification** (**VRFB-SURE**), which he and his team developed with a grant of Rs. 10 lakhs from the DST for 'National Innovation Challenge for Designing and Developing Energy Storage Devices for Rural Household/Enterprise Application'. **We congratulate Prof. Verma and wish him many more accolades.**

Website launched: Website (**iichearc.org.in**) of the IIChE Amaravati Regional Centre was inaugurated by **Prof. Anil Kumar Saroha**, President, IIChE on **20 March 2023** in the presence of **Prof. K.S. Rajanandam**, IIChE Vice President; **Dr Avijit Ghosh**, IIChE Honorary Secretary; **Prof. S.V. Satyanarayana**, IIChE President (2019) and **Prof. Anil Verma**, Hony. Editor-in-Chief, *Indian Chemical Engineer*.

Professor Hira Lal Roy - The Teacher Extraordinaire and Founding Father of ChemicalEngineering Education and Research in India

Prof. Asit Kumar Mitra[1]

PREFACE

The **Chemical Engineering Department of Jadavpur University** finally could recently celebrate its centenary year – it unfortunately got delayed by two years because of the COVID 19 pandemic. It was a proud occasion indeed as here in the erstwhile BTI the first Chemical Engineering course was started in 1921 in India and the whole of Asia. It would be interesting to trace back the times and understand in that perspective the mind of the visionary Professor Hira Lal Roy, who made it possible. He is since regarded as the Father of Chemical Engineering education and research in India.

EARLY LIFE

Born on November 2, 1889 in Panchpaika, a remote village in the Dacca district of eastern part of the then undivided Bengal, Hiralal Roy lost both his parents by the age of five years. He grew up with the support fromthe immediate members of his family. The sensitive mind of the intelligent young Hiralal could easily perceive that he "did not particularly belong to anyone and was not of much importance to anybody". From age 5 years, Hiralal studied in local schools and moved from Matlabgange in Tipperah district to Nator, Agartala, Comilla and finally, in March, 1908, he went to Dacca for entrance exam (school final).

The national awakening that had been ushering upon Bengal since the days of Raja Rammohon Roy suddenly burst forth under the impact of Lord Curzon's ill advised and arrogant scheme for the partition of Bengal which was given effect to on October 16 1905 in the teeth of vehement public opposition. A wave of nationalsentiment spread over the whole country. The students of Bengal were very deeply moved by the partition. They threw themselves heart and soul into the anti –Partition agitation. On 11thMarch 1906 The National Council of Education, Bengal was founded, the first Principal of the college was Sri Aurobindo Ghosh (Rishi Aurobindo).

Hiralal decided to quit government institutions of education and join Bengal National College in Calcutta. Those were the days of freedom struggle. Sri Aurobindo had by then resigned when he came to know that he was suspected by the police for his revolutionary activities. A student of the National College was a potential political suspect. Uncertainty and fear of political oppression reduced the student intake and it was becomingdifficult to get teachers. This is when Professor Benoy K. Sarkar came up with the idea that some good students should be sent abroad for higher training so that on return they could serve the institution as teachers. He collected Rs.30,000 from a donor whose name could not be disclosed for fear of the government. Seven brilliant students were selected and Hiralal was one of them going to Harvard University in Massachusetts, USA.

Harvard with its museums, laboratories, botanical garden, astronomy special class, sports and games instilledin the ever curious mind of Hiralal the infinite quest of knowledge and silently sowed in his mind the plant of future teacher solid in its stem with the strength of knowledge, wisdom, humanity and philanthropy.

Hiralal Roy has mentioned in his autobiography, "It is not merely the book knowledge that one receives inthe University, the more important are the University life and culture which one gradually and without any conscious effort imbibes." This he remembered and implemented in BTI, when its new Jadavpur campus was taking its shape during 1923-24.

He graduated from Harvard University in 1913 with high honours (Maqgna cum Laude) in Chemistry. Hiralal was the recipient of Burr Scholarship (awarded to deserving under graduates who combine as nearly as possible Burr's remarkable qualities of character, leadership and athletic ability), Greenleaf Scholarship and Detur. He was elected to the very prestigious Harvard chapter of Phi Beta Kappa Society and became a member of Boylston Chemical Club.

ICH DIENE- I Serve

Hiralal Roy was very passionate about chemistry and could well have stayed back in USA and pursue his Doctoral research which his adviser Prof. Forbes probably would have liked. The nationalist and passionate educationist that he was, Hiralal on the contrary, decided to leave Harvard after the convocation to teach Chemistry to his countrymen, and expressed his intention to his professor. The teacher understood the mission of his student and consented. So he left Harvard in 1913 to join Bengal Technical Institute as a teacher.

In Hiralal's own words –'When I left America, I was barely twenty-three. India, of course attracted me, not so much for the sake of family and friends as for the **Service** I would be able to render to the institution (and thecountry) which had been so kind to me and which I loved.' These were his guiding spirit- the institution (and hence the country) and the **services** he can render with the advanced knowledge he received in Harvard University. Bengal National College and Bengal Technical Institute have by then merged into one Central National Institute and later Bengal Technical Institute still housed in Panchabati Villa at the outskirt of Calcutta under National Council of Education-NCE. NCE had strong emphasis on a liberal and rational education based on nationalistic interests. The Council was the first educational body in India to make compulsory for engineering studies the additional study of literature, history and economics, because without literature and history the knowledge about one's own heritage is not complete and without understanding of economics the science becomes unproductive and unsustainable.

Dr.Hiralal Roy - an enigmatic Teacher

For rigorous teachers seized my
youth and purged its Faith and
trimm'd its FireShow'd me the high
white star of Truth There bade me
gaze and there aspire.

- Mathew Arnold

Hira Lal Roy was a born teacher and the above piece by Mathew Arnold- son of Thomas Arnold, the famous Head Master in Victorian Times sort of sums up the personae of Hira Lal Roy. He loved teaching – just not when he was taking Classes but in every small thing he believed, followed and did during his lifetime.

Rabindranath Tagore was very much impressed by the achievements of Hiralal and he gave him a certificate in his handwriting on 21 April, 1919,"*I have great pleasure in certifying that I came to know Mr Hiralal Roy in America while he was studying for his AB degree in Harvard University. He was very highly spoken by his professors and he passed his examinations with distinction. I have no hesitation in saying that he has exceptional qualifications for teaching work because of his character attainments and experience. Since my first acquaintance with him (in 1913) I have had opportunity to know him intimately (in Shantiniketan) and I can confidently recommend him to any post where honest work of high quality is needed in his own subject which is Chemistry"*

Teaching was in his blood and he expressed in his own words:

"*Teaching is a profession in which there is not much money to be earned but it has advantages. The compulsory work imposed from above is much less than in other professions. And there are a good many holidays and plenty of leisure and time to do the work one likes. The greatest pleasure, in my opinion, is the constant contact with young minds, many of whom have still some idealism and are not worldly wise*". These words exemplify him. He truly had many noble interests - Literature, Gardening, Games, Music, Astronomy were just a few of them but the most that probably occupied his mind was knowing new things and spreading the knowledge he had gained to others.

He was indeed an outstanding teacher. His intellectual approach to his students, his customary grace and towering personality had left a lasting memory in the minds of his students. Dr. Roy's style of teaching was vastly different from that of others and he was successful in many ways in bridging the gap between a teacher and his students. In fact, in his teaching method he combined the fundamentals of the principles of chemical engineering and physical chemistry in such a way that in the years that followed, the instruction proved to be the real foundation for the subsequent development of different carriers the students chose to follow. And in his teachings always there was constant connection with real life industrial problems. While healways insisted on solid reading, deep theoretical knowledge, he unfailingly cited as examples the riddles of Industries, which with the knowledge were becoming solvable.

Start-Up of the Chemical Engineering Course

Hiralal Roy came back from Harvard to India in the autumn of 1913 after securing a B.A in Chemistryto join his alma mater BTI. He was a dreamer and achiever who made it possible through his great conviction, nationalistic fervour and untiring efforts. Immediately on the hill of his return the first world war broke out in 1914 bringing in its wake unmitigated disaster in Europe, Asia and also in India.

In the years following the WWI, Hiralal Roy was teaching courses in Physical Chemistry, Industrial Chemistry and Mathematics to the engineering students in BTI belonging to NCE.

During those pre-independence days in India, the higher educational infrastructure was very rudimentary. Hesays, "Our Institute's laboratory had no facilities for research, not even for any routine advanced work, and there was no one from whom I could receive guidance." So he was getting frustrated and there was little

he could do other than take up teaching to engineering students as there were courses in mechanical and electrical engineering. But the NCE was too poor at that time to build up facilities for the BTI's chemistry department to match those of Calcutta University. So the more gifted of the students were all opting for the Mechanical or Electrical engineering and not Industrial Chemistry.

This sowed the seed of thinking in him as to "why not a course in chemical engineering". Which at that time was offered nowhere in the world, not even in the UK, except in the USA – that too, not a full-fledged chemical engineering course.

Dr Hiralal Roy - during his young days in Harvard (L) and in later years as Emeritus Professor (R)

Hiralal decided to start a chemical engineering course in Bengal Technical Institute. He obtained syllabi from some American Institutes and found that with some modification, the one from Massachusetts Institute of Technology could be followed. So he went to discuss with his predecessors in the line and having some preliminary discussions, he prepared a syllabus and got it approved by the famed Sir Prafulla Chandra Ray (SirPC Ray), an eminent chemist, educationist, philanthropist and industrialist. Thus the first chemical engineering course was started in 1921 in the whole of Asia. Such a course began in England only two years later.

Since this was an absolutely new course, Hiralal had to innovate and develop the study and teaching materials. For this branch of engineering, there were no textbooks available at the time. The first edition of a textbook on chemical engineering came in 1923, written by Walker, Lewis, McAdams and Gilliard. So, he requested the Institute authorities to send him to USA for being trained in chemical engineering. However, Hiralal's plans to go overseas for being trained in engineering got delayed due to lack of funds.

Around that time a new campus for the Institute was being planned. Land was acquired in Jadavpur, which was then outside the municipal limits. The foundation stone for the main building was laid by Sir Asuthosh Chaudhari in 1922 and the Bengal Technical Institute was transferred to Jadavpur in 1924. Hiralal was also involved in addition to teaching, on the plans for the laboratories, classrooms etc. and also fund raising for the buildings. Another college, the Bengal National College merged with the Bengal Technical Institute and became the College of Engineering and Technology, which later became Jadavpur University in 1955.

Aurobindo Bhavan where the chemical engineering course was held in the beginning, in the 1920's and 30's

As funds started coming in, another founder of the Institute, Hirendra Nath Dutta, told Hiralal that he could now plan to go overseas. Though Hiralal's preference was to go to US, the Institute decided to send him to Germany for advanced studies in chemical engineering – though even in Germany at that time this discipline was not fully evolved. Based on feedback of some faculties with prior experience, Hiralal was sent to the Berlin-Charlottenburgh Techniches Hochschule, along with two other teachers, junior to him, in 1923.

In 1925, Dr Hiralal Roy returned from Germany with a doctorate in Engineering and became the Head of the newly christened Department of Chemical Engineering, the first in India. ***It was his idea to include the study of language as part of the engineering course.***

Importance of Chemical Engineering

It took many years, after the opening of the chemical engineering courses at Jadavpur and other institutions in India for the industrialists to appreciate the usefulness of this new engineering discipline-particularly at a time when industrialisation in India was at a very nascent stage and World War II was also raging around the time destroying old concepts, associations, uses and requiring and reshaping new demands, new raw materials and new technologies.

The industry employers thought that the chemical engineering courses dealt mostly with unit operations like crushing and grinding, filtration, evaporation, absorption, distillation, etc. where no chemical reactions took place. These operations, they thought, could as well as be handled by mechanical engineers. In industries like cement, paper, rubber, ceramics, etc., where chemical reactions took place, the employers had been hiring chemists.

This was one of the challenges that Dr Hiralal Roy faced on how he could get the graduates from the Chemical Engineering Department employed in industries.

Pioneers like Hiralal Roy along with his fellow travellers of Chemical Engineering education, G.P. Kane, R.R. Hattiangadi and Govinda Rao had to explain to the leaders of chemical and allied industries that mechanical engineering textbooks did not deal with those operations common in the chemical industry. While mechanical engineers, they argued, were capable of running and maintaining these unit operations, they were not trained to enter into their intricacies. A chemical engineer with a strong base in physical chemistry and training in engineering fundamentals was better suited to bring about better yields or improved efficiency in process plants.

Such pleas of the senior members of the profession during the early years of chemical engineering education have been amply justified by the outstanding contributions made by the Indian chemical engineers in later years. They have proved themselves not only in the traditional areas such as hydrocarbon processing, agricultural chemicals and high polymers, but also in the newer fields of atomic energy, space and biotechnology.

Innovator, Inspirer

Post 1925 and especially after the WWII when there was acute industrial depression, Dr. Roy as the head of the newly formed discipline - Chemical Engineering, realised that his duty towards his students did not end with their graduation. So, Dr Roy took it upon himself to help the recent graduates in finding new opportunities for themselves.

A few example will illustrate how he did this:

In October 1928, Dr. Roy received a letter from Amritsar Distillery about a recurring problem in the Rectifying Column. Dr. Roy deputed a fresh Chemical Engineering graduate of 1927 batch, Tomohar Gupta to the distillery and with regular correspondence and guidance from Dr. Roy, Gupta was able to solve the problem within two months.

In a successful instance of Industry-Academia partnership, the soap demonstration plant of the BTI laboratory was rented to a group of former students who successfully produced Shaving Soap and high quality Toilet Soap. Dr. Roy's guidance and innovation in both the process and quality control did pave the way for the Toilet soap and the then only Indian manufacturer of Shaving Stick to make it a successful Small scale enterprise.

In another case, an owner of a China clay mine was able to economically remove the sand and brown colour present in China Clay. The initial tests were done in the laboratory and the pilot plant was set up accordingly. The process of washing and acid treatment evolved in the department enabled the mine owner to produce China Clay conforming to the quality of Paper industry.

In addition to convincing the industry leaders about the usefulness of chemical engineers in Chemical process industries, Dr Roy encouraged chemical engineers from Jadavpur University to start small enterprises and manufacture what was not yet produced in the country.

Prominent among them were the

- Successful import substitution of Glass shells for Electric Bulb in the Bengal Lamp Works Ltd in 1938-a pioneering company headed by Prof. S.K. Roy –an alumnus of CET, Bengal.
- Battery Manufacturing unit- Bharat Battery set up by Prof. Roy's student Mr. S.P. Saha in Mid 30s of the twentieth century. The Lead Acid Battery manufacturing process which was till then imported was initially developed in an adjoining room of Prof Roy. It was a successful industrial venture startedby Mr. S.P. Saha, which received constant encouragement and guidance from Prof. Roy.

By encouraging the students who wanted to establish manufacturing business on their own, Dr Roy was instrumental in building up expertise in the country in many new areas like Liquid Ink, High purity Chemical Reagents, high performance Vacuum Pumps, Filters and many process equipment for the Chemical Industry.

Thus during the period 1930-47, a fertile breeding ground of technical manpower and industry was slowly taking shape which played a significant role in Independent India. 1946 to 1955 was a period of financial and academic development with grants of various kind and recognition by UPSC, various governments and academic Institutions. In 1955 BTI then known as the College of Engineering and Technology, Bengal was rechristened as Jadavpur University.

Quite a good number of members of the alumni of the chemical engineering department of Jadavpur University became well-known in Industry, Administration and Academic fields all over India and abroad.They have made both their peers and the followers proud and have left an indelible mark on the paths they had traversed.

The Tireless Educationist

This was the spirit in which Dr. Hiralal Roy lived and worked till his official retirement in 1952, a retirement that in no way diminished his continuing influence on the chemical engineering profession in India. Throughout his life-time, he continued to be loved, revered by the Industry and Academia alike. He previously helped to find the Alumni Association in 1921, when he was just a young professor- 34 years of age. He was also at the foremost along with his associates and students in founding the professional body of Chemical Engineers of the country. Dr. Roy founded the Indian Institute of Chemical Engineers in 1947 at Jadavpur campus and he was the Founder President.

Prof. Hem Chandra Guha, former Vice-Chancellor of Jadavpur University and a former student of Prof. H.L. Roy said in his reminiscences, "Dr. Hira Lal Roy coveted neither money, nor power nor academic glamour. It is, therefore, a matter of great satisfaction to us, his admirers, that the Indian Institute of Chemical Engineershas given him the recognition, which is due to him-recognition not only as the founder president of the Institute and the founding father of Chemical Engineering Education in India, but also as a person of the mostextraordinarily diverse human qualities."

Dr. G. P. Kane, former Professor of UDCT, Bombay, former Adviser to the Government of India for Development of Chemical Industries and a Past President of IIChE said : "I have cherished greatly the association with Hiralal, and always valued his advice. When the time came for me to changeover from a Professorship to the position of Adviser to Government for the Development of Chemical industries, he

warned me that because of my nature I might either flop with a bang or soar to a height of achievement. Fortunately, neither of us found it necessary to regret the change of occupation. However, my new responsibilities made it impossible for me to continue with our leisurely discussions on subjects of mutual interest. But their memory always remained as a priceless possession."

Prof Roy was the first Indian Vice President of the Institution of Chemical Engineers, UK. He was also the first Chairman of the All India Board of Technical Studies in Chemical Engineering and Technology. In addition to the Academia and institutional bodies, he was in the board of numerous industries and was advisor to many others. Retire he did officially in 1952, but he continued to regularly come to the University and the Department he so lovingly nurtured- A Dhuti Panjabi clad gentleman with a Gandhi Cap on his head and an umbrella in his hand- the teacher extraordinaire and the sage of the modern era. His students and disciples were spread within and without his own university or state and he continued to work till the end of his life and was actively involved in the progress of education and application of chemical engineering in India.

Sir Fredrick Warner, a Fellow of the Royal Society, UK and the Former Chairman of the Scientific Advisory Committee, SCOPE-RADPATH, university of Essex, UK had said during his lecture delivered in 1973 at the Indian Institute of Chemical Engineers, "My first meeting with Dr. Roy was memorable. It was in 1956 and he arranged a dinner for me in the old Great Eastern Hotel. The air conditioning made winter inside the restaurant but he was unperturbed, wearing only a simple dhoti , while my lightweight suit provided insufficient insulation. At that time he was Vice President of the Institution of Chemical Engineers in the UK and I was honorary joint secretary. It was a source of pride to the small British Institution that he should accept a position to which he gave distinction along with chemical engineers from other countries similarly honoured".

Dr Hira Lal Roy was requested by numerous people to write an autobiography- which he started writing as a diary during the later period. He could only complete till the period of 1925 the time when he came back from Germany but even that opens up to his juniors his time, his ideas, his meetings with the two great national stalwarts- Rabindranath Tagore and Mahatma Gandhi and the great ideas which ultimately shaped the person he was. Professor Dr Hira Lal Roy was engrossed in writing a letter when the final momentsvisited him and he passed away on July 26, 1965.

Sri Udayan Chatterjee, former Director of Industries, Government of West Bengal said during the birth centenary celebration of Dr. H.L. Roy in 1989, "May I add, no chemical engineer can afford to miss this beacon light of guidance for his benefit in life. He has only to study his life and reminiscences. Our members and budding chemical engineers, I hope will remember his motto. 'Ich Diene – I serve' as well as his sage counsel:

"None and nothing is absolutely right or absolutely wrong.

Forgive and Forget

Love all, pity some, hate none."

References:

1 Life and Times of Hira Lal Roy, Editor: Dr T.K. Roy, 1989, Pub: IIChE.

2 Reminiscences – Hiralal Roy, Editor: Dr Bimalendu Ghosh, Nov-2, 1989, Pub: IIChE.

3 Autobiography of H L Roy (written in Bengali, unfinished) unpublished.

4 Presidential Addresses of H L Roy, IIChE, publication

5. Personal reminiscence of Ms Sudakshina Ghosh- Grand Daughter of Professor Hira Lal Roy

[1]The author, Prof. Asit Kumar Mitra, is a former Professor and HOD, Department of Chemical Engineering, Jadavpur University and Past President, Indian Institute of Chemical Engineers and JU Alumni Association. Presently he is the Secretary - National Council of Education, Bengal.

SCHEMCON 2023: The 19th Students' Chemical Engineering Congress of IIChE (SCHEMCON 2023) will be organized on **22** and **23 September 2023** by the IIChE Students Chapter, Department of Chemical Engineering, **Kongu Engineering College, Penrundurai** (Tamil Nadu) under the aegis of the IIChE Coimbatore Regional Centre.

The theme for SCHEMCON 2023 is **Engineering for a Sustainable Future**

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CLIMATE CHANGE AND SUSTAINABLE MANUFACTURING –III

Energy and Water Conservation Ideas in Chemical, Petrochemicals and Refinery Sectors

Joy M. Shah[1]

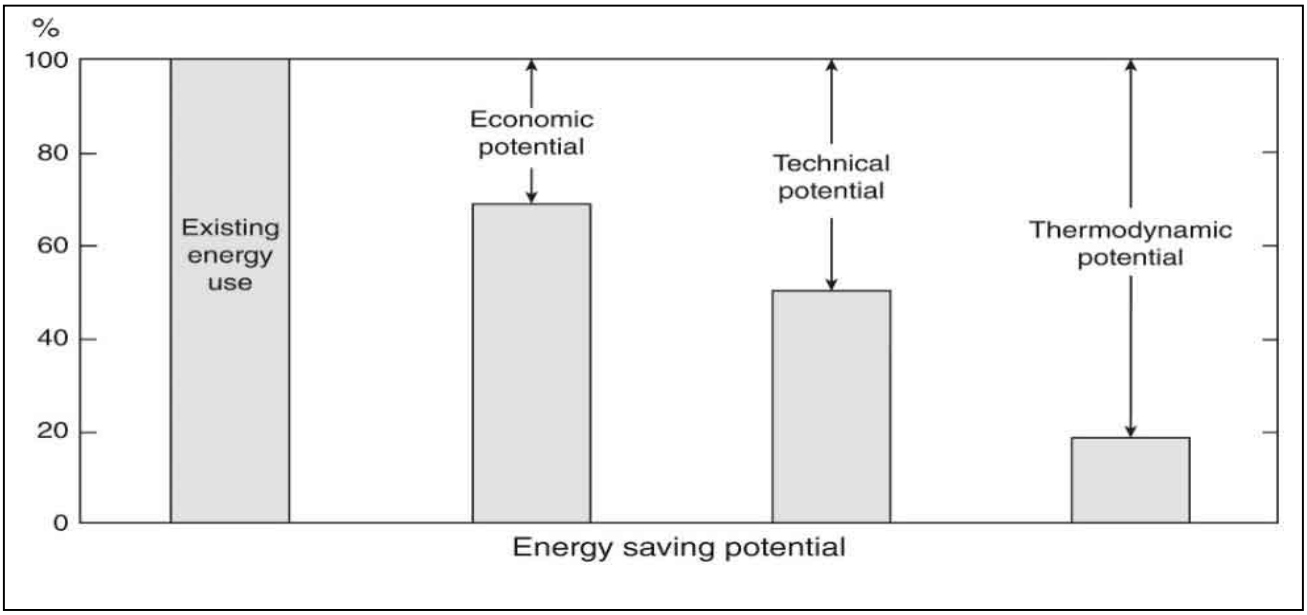
"**Save today, enjoy tomorrow; waste today, cry tomorrow.**" - *Unknown*

Introduction:

Energy is always limited in mother earth. Again higher urbanisation leads to higher per capita energy consumption. Therefore, only way to meet future demand of energy is Energy conservation and improvement of Energy efficiency. Higher energy consumption leads to global warming. To keep us cool, it is now essential to adopt the practice of energy conservation in all aspects of activities, including, industrial activities. After COP 21 commitment as well as present rate of global warming, there is no option except to conserve energy and increase efficiency to meet the requirement.

Similarly, Water is a scarce resource in the world and especially in India. Only 4% of available water in India is serving 16% of the world's population.

In any Chemical or Hydrocarbon complex, Energy saving potential exists and can be defined by following picture.



In this series of articles, I have identified the most common energy and water conservations as well as energy and water efficiency improvement schemes what I have practised for continuous improvement and meeting specific energy and water consumption targets.

EMS-1: All the plants of integrated complex are designed by different licensors. Licensors optimise their process but some inefficiencies remain in-built due to non-availability of heat source or sink with in the process. Carry out pinch analysis or HENA to identify energy saving opportunities within plant as well as by site wide integration.

EMS - 2: Check operating capacity / load vs. design capacity / load of pumps, fans and compressors. In case of large gap, check for use of VFD for reducing speed, and, thereby, power consumption. Alternatively, look for reduction of impeller size of pump and compressors or change of blade angle or use of lighter material for fans.

EMS - 3: Hot condensate is cooled either in water cooler or air cooler for recovery and polishing. Flash this condensate to produce low pressure steam (4 kg/cm2 g or 15 kg/cm2g pressure) and integrate with plant steam header and recover balance heat to produce refrigeration for HVAC.

EMS - 4: It is possible to route part of hot condensate directly to deaerator without cooling and polishing after risk assessment and analysis of contamination possibility of condensate.

EMS - 5: Many furnaces, boilers and HRSGs are operating at very high oxygen in flue gas due to improper control of secondary air and high draft. Optimisation of excess air in flue gas by improved secondary air control and draft can lead to significant energy conservation. Caution: Check and arrest leakage of air in convection zone before optimising excess air.

EMS - 6: Stake temp of furnace or boiler was designed higher in old design due to usage of inferior quality of fuel. It can also be higher due to imbalance of load. It can also be due to fouling of convection bank tubes. This is one of the major reasons for low efficiency.
When fuel is changed to low sulphur and clean fuel or natural gas is used, furnace stake temp can be reduced by addition of convection bank load, adjusting deaerator pressure as well as addition surface area of economiser. Stake temp can also be reduced by addition of air preheater. Now many options are available for online and periodic cleaning of convection bank tubes.

EMS - 7: Furnace and boiler refractory gets damaged over time due to thermal shock or poor workmanship. It is a good practice to measure surface temp of furnace and boilers periodically by portable thermometer, prepare temp contours, identify hot spot and refractory repair for improvement in furnace, heaters and boiler efficiency.

EMS - 8: Boiler drum blowdown is one of the major reasons of energy loss and is required to control TDS as well as silica level. TDS goes up due to addition of pH control chemicals and silica goes up due to feed silica and cycle of concentration. Optimising boiler drum chemical addition and auto control of boiler drum blow down can reduce significant energy loss and chemical loss.

EMS - 9: Steam and electrical tracing is provided to maintain temp of fluid to avoid congealing or solidification. Many fluid freezing points are near ambient temp. In hot weather, this steam or electrical tracing can be stopped, especially when there is continuous flow.

EMS - 10: Insulation of high temp service gets damaged over time due to aging or soaking in water although cladding is intact. Measurement of surface temp of insulation cladding of steam/ hot lines and equipment for repair of the same is one of the best practices. Normally, we measure cladding temp from bottom which might be low as compared to the top of equipment or pipelines, which may be misguiding. Insulation of hot flanges, valves and fittings are not done while commissioning due to the risk of leakage. Once the process is established, identify and insulate them.

EMS - 11: Steam traps are provided on steam line at strategic location to accumulate and remove condensate from steam line. The traps operate frequently and due to frequent operation at high velocity, hot condensate flow through it as well as presence of iron rust, frequency of failure is normally high leading to either passing of steam through trap or non-operation of trap. The first one leads to significant energy loss. Regular monitoring of trap performance and its repair or replacement is one of best practices for energy conservation. Normally, the trap is not a tagged item and are many in numbers. Tag all the traps, monitor periodically for proper performance and repair or replace them. In case of frequent failure at some of the locations, identify root cause, check feasibility of eliminating trap at that location, check for upgradation of the type of trap, change location of trap. Once trap performance monitoring and its maintenance are established, recovery of condensate from steam trap will be possible for conservation of energy and water.

EMS - 12: Motor efficiency gets deteriorated over time due to many reasons. It is good practice to Monitor efficiency of motors, esp. induction motors and decide on replacement requirement. Now new motors of high efficiency are available over standard motors. Replacement of standard motors by high efficiency motors as such or while replacement decision can be economical over long run.

EMS - 13: Compression refrigeration units are high energy consumers. Monitor efficiency of refrigeration machines periodically, regular cleaning of its cooler and condenser tube. Auto cleaning of condensers and coolers is also used to reduce rate of deterioration of efficiency of machine. Many times, replacement of low efficiency old refrigeration unit by high efficiency new machines is also economically justified.

EMS - 14: Many times, as such, replacement by high efficient machine / spares will not be economical decision. However, while increasing capacity of large old machines, e.g., compressors, motors, GTs, steam turbines, etc., replace old spare parts with high efficiency spare parts to reduce energy foot print and improved economics. It is feasible in many applications.

EMS - 15: Compressors and pumps are designed for anti-surge flow requirement or minimum circulation. During the design stage, the designer might be careful to ensure that minimum energy is wasted to meet this requirement. However, in actual practice, the flow and head might change leading to excessive anti surge flow or minimum flow recirculation. It is the best practice to check such circulation flow and carry out operation at minimum circulation flow for compressors and pumps. Look for provision of automation to achieve minimum flow as and when required.

EMS - 16: Reciprocating compressors capacity is adjusted to required capacity by suction loaders in 2 to 4 steps. Many times the operator does not use the suction loader's capacity control due to fear of failure and capacity control is done by discharge to suction circulation. Provision of step-less capacity control for reciprocating compressors is one of the solution for energy saving. Alternatively, if permanent reduction in capacity is required, there are many levers available.

EMS - 17 : For flexibility and reliability of operation, energy saving as well as due to technical limitations, multiple equipment are provided and are operated in parallel e.g. Air/Nitrogen/Natural gas compressors, CW/RW pumps, air finned exchangers. When multiple equipment are operated in parallel, rationalisation of load on machines, sequencing for start up for required flow requirement as well as provision of VFD for at least one machine for variable capacity control requirement can bring significant energy saving.

EMS 18 : Steam tracing is provided in petrochemical and refineries. Due to poor workmanship, use of many fittings as well as aging, many leakages get developed leasing to loss of energy. Frequent repair is required to maintain leak proof system. Multiple traps are provided for steam tracing. Many times trap malfunction leading to ineffective tracing or passing of steam. Now electrical tracings are available for hazardous area also. It may be economical to Convert from steam tracing to electrical heat tracing or use electrical heat tracing from project stage for better temp control and low life cycle cost. Worth checking for local condition of cost of steam and electricity, maintenance cost, cost of losses vs. capital investment.

EMS 19 : Most of control room and building ACs are compression refrigeration. However after commissioning of process plant, it is normally observed that many locations, low level energy is either vented to atmosphere in form of steam /water vapor or cooled by cooling water/ air. This is loss of energy. Present cost of Vapour Absorption Machine (VAM) can justify use of VAM for chilled water generation for an Air conditioning load, esp. heat is from waste heat and do not have high cost tag. This will save electricity and recover waste heat.

EMS 20 : When furnace or boiler is operating at high stack temp and there is no feasibility of recovery of heat in economiser, it is the good practice to install Air preheater or fuel preheater for furnace utilising flue gas to recover waste heat significantly. It will require ID fan and draft control system as well as Interchanger.

EMS - 21 : One more option of stack heat recovery is installation of additional bank of economiser to add surface area for more heat recovery from flue gas and heat water / process stream. Normally, space available in economiser section is not enough and structural integrity do not allow to add one bank. It was be possible to insert one tube bank in available blank slot between tubes and horizontal part of stack, esp in HRSG. Check in your case too.

EMS - 22: Air compressors take air from atmosphere. Temp and RH of air varies leading to variation in load and sometimes become bottleneck. Although suction filters are provided, there can be fine dirt particles passing through filters which can deposit and foul impellers of air compressor, reducing efficiency of compressor; may require frequent water wash as well as increase frequency of periodic maintenance. Installation of combined filter, washer and chiller in suction of air compressor will reduce specific volume of air and dirt load for efficient, consistent and reliable operation ultimately lead to significant energy conservation.

EMS - 23: In many distillation columns and vessels, pressure control is split range type. In case of low pressure, supply the inert gas and when pressure increases, vent gases to flare header or atmosphere (storage tank provision of additional cooler / chiller on such vent stream can condense material for its recovery from which at least fuel value can be recovered.

EMS - 24: Pumping of pressurised liquefied gas, where vapour pressure is more than atmospheric pressure is normal practice in industry. Many types of mechanical seals are tried based on characteristic of fluid, toxicity of fluid and compatibility of fluid. In case of leakage from such seal, the material is either contaminated, vented or flared. However, due to presence of gas at sealing surface in many cases, when seal is once found leaking due to any abnormal operation, it is difficult to get it reset due to the presence of gas and lead to losses and unsafe condition. Use of pressurised double mechanical seals for liquefied gas with compatible sealing fluid is observed to be a good practice to minimise leakage of hydrocarbons in atmosphere and flare and thereby reduce energy loss and improve reliability.

EMS - 25: Many sites have continuous flaring of hydrocarbon. Even after detailed analysis as well as profiling of composition, source could not be identified. It may be due to small passing of many valves and blowdown required for pressure control, resulting in to continuous flare. Due to the presence of large quantity of Nitrogen as purge gas, the recovery is not considered. It is possible to recover such continuous flaring of gas and use as a fuel gas. In case nitrogen, the recovered flare gas posseses combustion issue. Minimise it by use of orifice or replace purge nitrogen by methane, which will be recovered as fuel gas.

EMS - 26: There are certain design margins while designing every equipment and when an equipment is lined up in process, requirement of utility condition will be different than design. Design operating parameters are maintained by control system, which may not be energy-efficient. For example, lower chest pressure of re-boiler, operation of distillation column at lower pressure, low reflux temp, low product temp. It is possible to replace high pressure steam / high temp. energy by low pressure / low temp. at many processes, taking advantage of design margin and design dirt factor, which results in to significant energy conservation.

EMS - 27: While looking for changing from high pressure steam to low pressure steam as energy source, it is observed that the requirement is marginally for higher pressure than available low level steam or operating margin is reduced leading to probability of upset. In such cases, thermo-compressor is one of the solutions to increase steam pressure and reduce high pressure steam usage.

EMS - 28: One of the reasons for continuous flare is passing of minor quantity of hydrocarbon from multiple Class 2 type valves in old design. By changing normally closed control valve and manual valve for pressure control and by letting down to flare header by tight shut off valves will reduce significant hydrocarbon leakage to flare.

EMS - 29: Air compressor impellers get fouled due to fine dust deposits. It is observed that efficiency

reduces efficiency significantly. Dust can deposit in inter and after coolers which further reduces capacity and efficiency. This can be due to passing or malfunction of suction filters or very dusty atmosphere or construction nerby. In order to regain efficiency, online periodic water spray cleaning of impellers is a normally accepted practice and found very effective. Caution: Type and location of spray nozzle is very important to avoid imbalance and malfunction during online water spray cleaning.

EMS - 30: Process compressors handling mixed gases and unsaturated gases are prone for polymerisation and fouling of impellers as well as after/ inter coolers. This reduces efficiency and capacity considerably. Efficiency is regained by online periodic flushing by high aromatic stabilised oil or use of chemical dispersant to clean impellers. In many applications, continuous oil spray is also used to avoid fouling.

EMS - 31: In many reactions, Oxygen is one of the reactants. Reaction is normally at high pressure and temperature. As a source of Oxygen, atmospheric air is used. When process is at high pressure, power consumption in such air compressor is very high. In order to reduce compression power as well as to enhance capacity of Oxygen supply, Oxygen enrichment of air is acceptable practice to reduce specific volume and thereby, power reduction and to enhance capacity.
Caution: Metallurgy of equipment as well as flammability of mix reactant limits extent of oxygen enrichment.

EMS - 32: Convection bank of furnace is getting fouled due to deposits of soot, refractory or dust results in to low energy recovery and increase of stack temperature. Most of convection bank tubes are finned tubes and it is observed that particulate matter deposits in fins cannot be cleaned easily. Chemical cleaning of convection bank from outer surface is done but water and chemical may damage refractory of furnace or boiler. To avoid such damage, dry ice blast cleaning of convection bank was tried and found successful. Blast gun can go inside small space between tubes and can clean solid deposits effectively.

EMS - 33: Off gas from many processes is used as fuel gas which contains Hydrogen. This Hydrogen has very high calorific value per kg but low calorific value per cu.m as compared to the natural gas. When gas is transported from one location to other, it restricts the flow due to high pressure drop, especially, when Hydrogen is higher than design.
Recovery of Hydrogen from off gas/ fuel gas will be energy efficient solution, espically, where required Hydrogen for process is generated by electrolysis process.

EMS - 34: Slop generated as a bottom of any plant contains valuable material also which cannot be recovered by simple distillation operation. There are many other unit operations as well as unit processes by which lighter material from slop can be recovered as liquid/gas fuel of valuable chemicals. Detailed study is worthwhile for value addition and energy recovery.

EMS - 35: Industrial cooling tower is evaporative cooling. Cooling water is pumped to plant and various exchanger to cool process stream. Many times, it is used to cool circulating contaminated water or effluent water stream. For such service, direct contact evaporative cooler for contaminated or effluent water stream is a good energy saving solution. It may reduce capex also as such evaporative cooling can be modular and avoid expensive exchanger and pipeline.

EMS - 36: Mixture of chemicals is separated in a series of column. For each column, there is reflux condenser and re-boiler. Heat is supplied in re-boiler and removed in reflux condenser. Many times, the columns are combined and intermediate product is removed as side stream and then finished in finishing column. In order to reduce significant energy consumption as well as reduce MPI, use of divided wall column is one of the proven technologies and can be used in place of multiple columns, re-boilers and condensers.

EMS - 37: Any catalyst requires activation energy. Therefore, feed is preheated even if the reaction is exothermic. Although energy integration in catalytic reaction is done by utilising waste heat, product heat, etc., energy consumption is large and sometimes require very high level energy. It is observed that due to technological advantage and research, catalysts requiring lower activation energy are available for many applications. During evaluation, it is observed many times that high cost of batch of the catalyst justifies lower energy requirement throughout its cycle of operation.

EMS - 38: Design of plant and design steam balance decides configuration of steam turbine. However, due to variation in capacity, change of operating mode as well as various energy conservation schemes to use low pressure steam, steam imbalance is observed and high pressure steam is let-down through PRDS. In case of such sink available for low pressure steam, change from condensing turbine to back pressure turbine is one of the techno economic efficiency improvement and energy saving options.

EMS - 39: There are many heat exchangers prone for fouling and reduction of heat transfer capacity. This can be due to low velocity in tube side, may be result of operation at low capacity or low design velocity. In many case, it was possible to increase tube velocity and reduce tendency of fouling by use of tube insert.

EMS - 40: At many locations, after capacity expansion or addition of fuel quality upgradation project, hydrogen shortfall is observed, restricting capacity of the unit. Hydrogen is one of the expensive gases used for hydrogenation process or as a clean fuel. In such case, source and sink of hydrogen need to be optimised. Carry out Hydrogen "pinch analysis" to identify source and minimise sink.

I am sure that Professional Chemical Engineers will appreciate their role to actively take up the ideas in execution of sustainable manufacturing and reducing impact on climate change. **We shall discuss another 40+ ideas of Energy conservation in the next issue and Water conservation ideas in the subsequent issue.**

*"Energy Conservation is foundation of energy Independence"* – **Tom Allen**

[1]The author is the Founder and Chief Consultant, Innov8 ProTech Solutions, The Sustainability and Management Consultant. Formerly, he was Sr. Vice President (Head - Technical) at Reliance Industries Ltd. He was also a member of the IIChE Chemical Process Safety, Energy and Environment Committee from 2018 to 2022. For the last five years, he has been consulting for Energy and Water Management, Green company advisor and branding for Sustainable Manufacturing as well as Process Safety and Risk Management.

REGIONAL CENTRE ACTIVITIES

Amaravati Regional Centre

Amaravati Regional Centre organised a **Seminar** on titled, **Hydrogen - Can it be Saviour of the Earth from Global Warming?** on **28** and **29 April, 2023** in hybrid mode. It was held in association with all the Student Chapters, which are under the aegis of Amaravati RC. The seminar was inaugurated by Padmashri **Prof G D Yadav**, Former Vice Chancellor, Institute of Chemical Technology, Mumbai and **Dr S S V Ramakumar**, Director (R&D) and Board Member, Indian Oil Corporation Limited, Faridabad. **Dr. V. Govardhana Rao**, former professor, IIT Bombay and Chairman, Amaravati RC presided over the inaugural function and conducted the proceedings. Padmashri Prof. Yadav delivered a lecture titled, The **Net Zero Goal & Sustainability: Adoption of Green Hydrogen Technologies, CO2 Refineries, Biomass Valorization & Plastic Recycling**. Other speakers during the two-day were **Dr S S V Ramakumar** (Director -R&D and Board Member, Indian Oil Corporation Limited, Faridabad); **Dr C V V Satyanarayana** (Former Chief Scientist. CSIR-National Chemical Laboratory, Pune); **Prof A M Kannan** (Arizona State University, USA); **Dr C S Gopinath** (CSIR-National Chemical Laboratory, Pune); **Dr R R Sonde** (Visiting Professor, IIT Delhi); **Dr G Ranga Rao** (IIT, Madras) and **Shri S R Udayan** (Vice-President, Reliance Industries Ltd., Jamnagar).

The Valedictory programme was presided over by **Dr. Govardhana Rao**. **Prof. G. Ranga Rao** and **Dr. C.V.V. Satyanarayana** were the Guests of Honour.

Baroda Regional Centre

Baroda Regional Centre organised a **Seminar**, titled, '**Connecting Green Hydrogen 2023**' in association with IOCL, Gujarat Refinery on **19 May 2023**. It was held in technical collaboration with Petroleum & Explosives Safety Organisation (PESO).

Northern Regional Centre

Northern Region Centre organized a **Seminar** on '**Recent Developments in Catalysis in Process Industry**' on **21** and **22 March 2023** in association with Fertiliser Association of India, New Delhi. Subjects focussed in the seminar included Petroleum Refining, Production of Fertilizers, Production of Chemicals and Petrochemicals, Engineering Project Consultancy, etc. The welcome address was delivered by **Dr. S. Nand**, Chairman, Northern RC. The seminar was inaugurated by **Mr. Gaurav Mathur**, Managing Director, Chambal Fertilisers and Chemicals Ltd. The special address was delivered by **Mr. Arvind Chaudhary**, Director

General, FAI, New Delhi. **Mr. C.P. Srivastava**, Honorary Secretary, Northern RC presented the vote of thanks. Speakers included **Mr. Manish Goswami**, Chief (Technical), FAI; **Mr. Abhinav Deshwal**, Technical Sales Manager APAC UNICAT Catalyst Technologies, New Delhi; **Mr. Rajesh Garg**, Technical Service Manager, Sud-Chemie India Pvt. Ltd, New Delhi; **Mr. B.P.S. Mehta**, Joint General Manager (Technical), Indian Farmers Fertiliser Corporative Ltd., Kalol; **Dr. Saleem Akhtar Farooqui**, Principal Scientist, CSIR-IIP, Dehradun; **Mr. P. Senthil Nayagam**, General Manager (Works), Southern Petrochemical Industries Corporation, Tuticorin and **Mr. Gautam Pandey**, Senior R&D Manager, Honeywell UOP, Gurugram.

Under the Lecture Series, '**Learning with the Leaders'** the following **lectures** were delivered on **13 May 2023**.

'Blue hydrogen – Production, Costs, Benefits and Drawbacks' by **Mr. Subodh Sarin**, Director, Process Economics Program, S&P Global; '**Solvent-based Recycle of Waste Plastics**' by **Mr. Rajiv Narang**, Executive Director, Process Economics Program, S&P Global; and, '**Plastic Circularity with Focus on Advance Recycling'** by **Mr. Rahul Bhutani**, Director (Industry Processes and Cost Analytics), S&P Global.

Pune Regional Centre

On **21 April 2023,** Pune Regional Centre organised a Seminar, titled, '**Improving Chemical Processes through Application of Chemical Engineering Principles'.** The primary objective of the seminar was to promote Industry institute interaction with a view to enhancing IIChE membership and project initiation.

Vapi Regional Centre

A **Seminar** was organised on **18 April 2023**, titled, '**Out of box Solutions for Chemical Industries**'. It was organised jointly with the **UDCT Alumni Association, Vapi Green Enviro Ltd**. and **Vapi Industries Association**. **Padma Vibhushan Prof. M. M. Sharma** delivered the keynote address during the inauguration of the event.

The Vapi RC organized **Industry Visits** for the students of **Government Polytechnic**, **Daman** to **Krishna Fine Chemicals** at GIDC Vapi on **21 January 2023** and to **Aryan Paper Mills**, Vapi on **29 April 2023**.

STUDENT CHAPTER ACTIVITIES

Government Engineering College, Bharuch

An **Educational Trip** to Tralsa village was organised on **14 February 2023** to explain students about **Smart and Organic Farming In Sustainable Development.** Shri Kalpeshbhai Patel, a senior farmer, addressed the students and explained the importance and benefits of organic farming over the inorganic farming (use of chemical pesticides). Students from the Departments of Chemical Engineering, Electrical Engineering and Civil Engineering comprised the students.

A **Seminar** was organised on **10 February 2023**, titled, **Clean Energy for All under G20 Summit 23.**

Mr. A.I.Shaikh was the resource person who spoke about Clean energy and Green energy by giving various practical examples. He also shared information about renewable energy and its utilization.

A **Quiz Competition** was organised **on 28 February 2023** to celebrate the **National Science Day.**
A total of five teams (three participants per team) participated in the contest.

On **27 April 2023** students participated in recycling of waste plastic materials and produced flower pots from discarded plastic bottles, oil cans, etc.

The objective of the event was to make the students aware of the alarming problem of disposal of waste plastics, which is creating serious environmental concerns.

The number of students participating in the activity was 15.

On **3 June 2023**, an **Industry Visit** to **GNFC Ltd**. was organized for the students on the occasion of the World Environment Day. The GNFC personnel explained the students about unit operations and unit processes in Neem-based products as well as about urea production and processing. The GNFC personnel also demonstrated about the working of various equipment, such as, packed and plate columns, dryers, centrifugal separators, packaging sections, besides working of prilling tower and conveyer belt. The students also learnt about various eco-friendly technologies.

P P Savani University, School of Engineering, Surat

An International **Conference** on **Academic and Industrial Innovations in Engineering (ICAIIE – 2023)** in Surat will be organised on **12** and **13 August 2023**. The event, first of its kind, will focus on the academic and industrial innovations and use of modern technologies in Engineering. The conference will be held in both offline and online modes.

Vishwakarma Government Engineering College, Ahmedabad

On **11 April 2023** three technical events, namely, **Chem-Mystery**, a technical quiz; **Chem-o-Concept**, a technical presentation and **Chem-o-Brainic**, a technical treasure hunt, were organized for all the Student Members of the Student Chapter.

Prizes were given away to all the winners.

IIT Jodhpur, Jodhpur

The Department of Chemical Engineering, **IIT Jodhpur** is to organise a **Symposium**, titled, **Chem-E-Sporption 2023 - 24**, on **13** and **14 January 2024** in association with the **IICHE Student Chapter** at the department. The event will include **Lectures**, **Academic-Industry panel discussion**, **scientific demonstrations** and **Poster presentations.**

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- above Rs. 10 crores	1,000/-	50,000/- + 9,180 GST	60,180/-
- below Rs. 10 crores	1,000/-	25,000/- + 4,680 GST	30,680/-
Academic Institution, Govt. R&D organization (*Irrespective of turnover*)	--	25,000/- + 4,500 GST	29,500/-