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Centre for High Technology
Ministry of Petroleum & Natural Gas





At a Glance

| | | |
|-----|---|----|
| 1. | Editorial | 02 |
| 2. | Presentation of Awards for Swachhta Campaign..... | 05 |
| 3. | Meeting of Union Minister of Petroleum and Natural Gas & Steel with CHT officials..... | 05 |
| 4. | Governing Council Meeting of CHT..... | 06 |
| 5. | Steering Committee of CHT for PM-JIVAN Yojana..... | 06 |
| 6. | Executive Committee Meeting of CHT..... | 06 |
| 7. | Scientific Advisory Committee Meetings..... | 07 |
| 8. | Review Meeting by MoP&NG of On-going 2G Ethanol Plants and CBG Plants..... | 08 |
| 9. | MoA Signing under PM JI-Van Yojana..... | 08 |
| 10. | Expert Group Meeting of R&D projects..... | 09 |
| 11. | US-India-Energy Webinar on Transition to Clean Energy Technologies in Refining & Petrochemicals..... | 09 |
| 12. | Refinery Benchmarking Study..... | 11 |
| 13. | Pipeline Benchmarking Study -2020 cycle..... | 11 |
| 14. | Catalyst Manufacturing in India..... | 11 |
| 15. | MBN Reduction Target for PAT cycle VI..... | 12 |
| 16. | Mandatory Energy Audit..... | 12 |
| 17. | Study on Business Opportunity for India in Petrochemicals..... | 13 |
| 18. | Feasibility Study for the production of Ethanol from Refinery Off Gases | 13 |
| 19. | Refinery Performance Improvement Programme (RPIP) Phase II..... | 14 |
| 20. | Review Meeting by MoP&NG by Refining Capacity Expansion..... | 14 |
| 21. | Meeting on Crude Oil Storage Facilities..... | 14 |
| 22. | Development of Process Scheme for Reference Fuel..... | 15 |
| 23. | Technical Committee Meeting of National Energy Conservation Award (NECA) 2020..... | 15 |
| 24. | Activity Committee Meetings..... | 16 |
| | • Strategies for Turnaround Management | |
| | • Digitalization in Refining Business Process | |
| 25. | Refinery Performance Awards and Saksham Award for 2019-20..... | 17 |
| 26. | Innovation Awards..... | 18 |
| 27. | CHT Presentation in Biofuture Summit of Brazilian Bioenergy Science & Technology Conference (BBEST) 2020..... | 18 |
| 28. | CHT Presentation in Webinar on Role of PSUs in Making Chemical Industry Aatma Nirbhar..... | 19 |
| 29. | Automation of Refinery Secretary Data Submission by CHT..... | 19 |
| 30. | CHT website certified by MQAS for Web Security Audit Certificate..... | 19 |
| 31. | Baseline Report of the Working Group on R&D and Innovation Constituted under Integrated Monitoring and Advisory Council (IMAC)..... | 20 |
| 32. | e-office Implementation at CHT/OIDB/OISD/PCRA..... | 20 |
| 33. | Technologies for Energy Independency..... | 21 |
| 34. | Hindi Section | |
| | • आईएसओ 9001:2015 ऑडिट | 25 |
| | • आवश्यक प्रमाण पत्र..... | 25 |
| | • स्वच्छता पखवाड़ा 2020..... | 25 |
| | • स्वतन्त्रता दिवस 2020..... | 26 |
| | • न्यू नॉर्मल पर तकनीकी कार्यशाला..... | 26 |
| | • हिंदी पखवाड़ा 2020..... | 27 |
| | • CHT पर जनांदोलन COVID अभियान | 28 |
| | • एकता दिवस..... | 28 |
| | • उच्च प्रौद्योगिकी केंद्र में पेट्रोलियम एवं प्राकृतिक गैस मंत्रालय द्वारा राजभाषा का निरीक्षण..... | 28 |
| | • सीएचटी कार्यालय में अंतर्राष्ट्रीय महिला दिवस समारोह..... | 29 |

From the desk of the Executive Director



Dear Esteemed Readers,

Greetings!!

Amidst the second wave of pandemic COVID-19 with which the humanity is confronted all over the world, New Normal is here to stay and all must exercise utmost precautions in maintaining all the COVID-19 guidelines of social distancing, wearing of mask and washing of hands frequently. Millions all over the world have been inflicted since the advent of this pandemic. At this hour, my sincere prayers go out to all those precious lives which could not be saved due to this pandemic. I also take great pride and salute all the frontline COVID warriors especially Doctors/ Nurses, Policemen, and those rendering Essential Services, who have selflessly & tirelessly continued to serve our Nation and save lives.

I truly believe that each one of us must acclimatize to the "New Normal" of doing business and navigate through the evolving working ecosystem. The whole world has witnessed that Digitalization has really helped all sectors to remain connected in these difficult times and continue to do business. It is time to accept that technology & Innovation are the lifelines of modern-day business to meet the growing needs of the present and the future. The Indian economy is opening up varied opportunities in the energy sector including steadfast progress towards a low-carbon economy. It must therefore be our endeavor to align all our efforts to revisit our core business objectives, re-establish corrected plans & projections and continue to move forward. Hope is what we all must possess at these difficult times.

In this Annual report, I am pleased to recapitulate the many activities undertaken in the year. At Centre for High Technology, the main highlights during the year 2020-21 include Presentation of Swachhta Awards: Swachhta Pakhwada Awards 2020 & Swachhta Hi Seva 2019 Awards to Oil & Gas PSUs by Shri Dharmendra Pradhan, Hon'ble Minister of Petroleum & Natural Gas and Steel, Govt. of India, Various Review Meeting by MoP&NG on Refining Capacity Expansion, on On-going 2G Ethanol Plants and CBG Plants, and Crude Oil storage facilities; Select Committee Meetings for reviewing the proposals of projects under PM JI-VAN Yojana; Signing of Memorandum of Agreements by CHT with IOCL and HPCL under PM JI-VAN Yojana; Review of Business opportunity in Petrochemicals; Technical evaluation of the proposals received against EOI for setting up Catalyst Manufacturing Plants in India under Atma-Nirbhar Bharat; Signing of long term contract with M/s Solomon Associates upto 2028 for Refinery Benchmarking Study; Signing of contract agreement for Pipeline Benchmarking Study 2020 cycle, etc.

Shri Dharmendra Pradhan, Hon'ble Minister of Petroleum & Natural Gas and Steel, Govt. of India also held a meeting during September 2020 with officials of the Centre for High Technology (CHT) to discuss the adoption of best practices and promotion of Research Development and innovation in oil and gas operations.

Besides these, various important Review Meetings by Governing Council of CHT, Steering Committee of CHT under PM-JIVAN Yojana, Executive Committee of CHT, Scientific Advisory Committee on Hydrocarbons

of MoP&NG were held during the year.

Other CHT activities held during the year include Phase-II Review on Development of scheme for production of reference fuels, Meeting of Technical Committee for finalising National Energy Conservation Award 2020 in the Petroleum Refinery Category, coordination of Mandatory Energy Audit (MEA) of refineries under PAT VI Cycle, Automation of process for compilation of Refinery data for submission to MoP&NG for review by Secretary, PNG, etc.

Awards for Refinery Performance Improvement & Saksham for the year 2019-20 & Innovation Awards – 2020 were also finalised during the year. These Awards shall be presented during the upcoming 25th Refining & Petrochemicals Technology Meet (RPTM) during the 3rd quarter of 2021. These awards are presented to encourage competition amongst the refineries, recognize overall performance improvement and excellence in innovation.

In pursuit of our major objective of Information & Knowledge Dissemination, 2 nos. Activity Committee Meetings – “Strategies for Turnaround Management” and “Digitalization in Refining Business Process” were successfully held online for the first time during the year.

During April 2021, CHT along with American Chamber of Commerce in India (AMCHAM) and MoP&NG coordinated a webinar wherein US companies presented technologies focusing on Clean Energy in Refining & Petrochemicals for possible cooperation with Indian Companies from downstream sector. For the first time, CHT participated in the Webinars - Biofuture Summit of Brazilian Bioenergy Science & Technology Conference (BBEST) 2020 and ‘Role of PSUs in Making Chemical Industry Aatma Nirbhar’.

I am very happy to share that the long-awaited Digitization project eOffice lite 7.0 is implemented on centralized basis in CHT, OISD, OIBD and PCRA wef 1st April 2021. CHT successfully completed the first Periodic Audit under ISO 9001-2015 Management system certificate in July 2020. CHT also witnessed an important activity for Inspection of Rajbhasha / Official Language by MoP&NG.

I would like to thank the patronage and guidance received from MoP&NG and the constant support and co-operation received from Indian refining sector. I urge all my friends for adopting optimism which will help renew our energies in rededicating ourselves to our work goals.

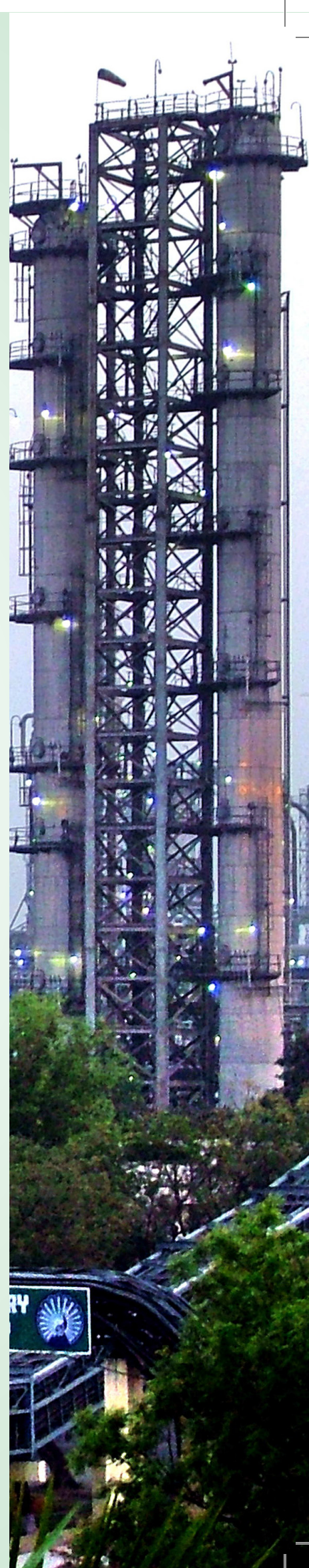
In the end, I am signing off with a short prayer

ॐ सर्वे भवन्तु सुखिनः
सर्वे सन्तु निरामयाः ।
सर्वे भद्राणि पश्यन्तु मा कश्चिद्दुःखभाग्भवेत् ।
ॐ शान्तिः शान्तिः शान्तिः ॥

May all become happy,
May no one suffer from illness,
May all see auspiciousness everywhere,
May none ever feel sorrow.
Om peace, peace, peace.

(Handwritten signature)

(K.K. Jain)
Executive Director





Shri Dharmendra Pradhan, Union Minister for Petroleum & Natural Gas and Steel, commends Oil PSUs for Swachhta Campaign

Shri Dharmendra Pradhan, Minister of Petroleum & Natural Gas and Steel, presented Awards during “Swachhta Awards Distribution Ceremony” to the best performing Oil & Gas Sector CPSEs on 14th December 2020 at Shastri Bhawan, New Delhi in the presence of Secretary, PNG and senior officials of the Oil & Gas CPSEs. The Swachhta Pakhwada 2020 award was presented to the Oil & Gas PSUs for having undertaken exemplary work during July 1-15, 2020.



Shri Dharmendra Pradhan, Union Minister for Petroleum & Natural Gas and Steel, presented Awards to the winners of the Swachhta Pakhwada Awards 2020 & Swachhta Hi Sewa 2019 Awards (seen in the centre). Also seen in the pic are Shri Tarun Kapoor, Secretary, PNG, along with Award winners from IOCL, BPCL, HPCL, ONGC & Shri K.K. Jain, Executive Director, CHT

The Swachhta Hi Sewa 2019 Award was distributed based on the efforts made towards the Campaign “Say No To Single Use Plastic” during 11th September 2019 to 27th October 2019 to pay homage to Mahatma Gandhi on his 150th Birth Anniversary.

Speaking on the occasion, Shri Dharmendra Pradhan said that Prime Minister Narendra Modi has made ‘Swachhta’, a Jan-Andolan which is drawing wide participation from society, urban and rural areas alike. He appealed to intensify this cause. “As India completes 75 years of its independence in 2022, we must realise the dream of a Swachh Bharat”, he further added. He suggested to PSUs to build state-of-the-art toilet facilities at all pilgrim centres and major places of tourist attractions in the country.

Following Awards were presented -

Swachhta Pakhwada Awards 2020: First Prize – IOCL, Second Prize – BPCL, Third Prize – ONGC, Outstanding Contribution – HPCL;

Swachhta Hi Sewa 2019 Awards: 1st Prize – HPCL, 2nd Prize – BPCL, 3rd Prize -IOCL.

Shri Dharmendra Pradhan, Union Minister of Petroleum and Natural Gas & Steel discusses with CHT officials about research, innovation in oil and gas operations

Union Minister of Petroleum and Natural Gas & Steel, Shri Dharmendra Pradhan held a video-conferencing meeting with CHT officials on 3rd September 2020 to discuss the adoption of best practices and promotion

of Research Development and innovation in oil and gas operations to achieve continuous improvement in performance, processes and energy efficiency.



Shri Dharmendra Pradhan, Union Minister of Petroleum and Natural Gas & Steel discusses with CHT officials about research, innovation in oil and gas operations





Governing Council Meeting of CHT

The 39th Meeting of the Governing Council of CHT was held under the Chairmanship of Shri Tarun Kapoor, Secretary, P&NG through video conference on 24th July 2020. The meeting was attended by GC members from MoP&NG, viz., AS&FA, JS (IC), JS (GP & M), JS (R), and Secretary, OADB; C&MD, HPCL; CMD, BPCL; Chairman, IOCL; CMD, GAIL; CMD, OIL; CMD, EIL; Director, CSIR-IIP; MD, CPCL; MD, NRL; MD, MRPL; Dir (R&D), IOCL; DG, OEC; ED (R&D), GAIL and ED, CHT. GC approved the IOC R&D proposal "Development & Demonstration of Commercially Viable Fuel Cell Buses based on Hydrogen produced from multiple Pathways" for funding under Hydrogen Corpus Fund. The 40th Meeting of the Governing Council of CHT was held under the Chairmanship of Secretary, P&NG through video conference on 16th February 2021. The meeting was attended by all the GC members.

Shri K.K. Jain, ED-CHT, made a detailed presentation on the progress and status of following activities taken-up by CHT.

- Refinery Performance Improvement Programme (RPIP) of PSU Refineries
- Reduction of Water Footprint at PSU Refineries
- Performance Benchmarking Study of PSU Refineries & Pipelines by Solomon
- MBN Roadmap and Actual Performance



Shri Tarun Kapoor, Secretary, P&NG chairing the 40th Governing Council Meeting of CHT on 16th February 2021 through Video Conference in presence of GC members from MoP&NG and various PSUs.

- Petrochemicals Study
- Catalyst Manufacturing Unit in India
- Study on Additional Strategic/ Operational Crude Oil Storage
- Feasibility Study by M/s LanzaTech for Ethanol Production from refinery Off-gases
- Feasibility Study for manufacture of Reference Fuel
- Finalization of Refinery Performance and Innovation Awards
- Status on PM JI-VAN Yojana
- Status update on HCF and major CHT funded R&D projects
- Adoption of Annual Audited Accounts for Financial Year 2019-20, and CHT budget, etc.

Steering Committee of CHT for PM-JIVAN Yojana

1st meeting of Steering Committee of CHT for PM -JIVAN Yojana was held on 1st Jun'20 under the Chairmanship of Secretary, PNG. The Total financial assistance of Rs. 615 Crore was approved for four Commercial plants

of IOCL -Panipat, BPCL-Bargarh, HPCL- Bathinda and ABRPL - Golaghat and one Demonstration plant of IOCL - Panipat.

Executive Committee Meeting of CHT

The 29th Meeting of the Executive Committee of CHT was held under the Chairmanship of Shri Sunil Kumar, Joint Secretary (R), MoP&NG through video conference on 24th June 2020. The meeting was attended by Secretary, OADB; Dir (R), BPCL; Dir (R), HPCL; MD,

CPCL; MD, NRL; Dir (T), EIL; Dir (R), MRPL; ED(O), IOCL; ED(MR), BPCL; ED(R&D), BPCL; ED (Trg., R&D and Start-Up), GAIL; ED (T)-I/C, EIL; Sr. Scientists from IIP. The 30th Meeting of the Executive Committee of CHT was held under the Chairmanship of Shri Sunil Kumar, Joint



Secretary(R), MoP&NG through Video Conference on 10th December 2020.

In the above EC Meetings, Shri K.K. Jain, ED-CHT, made a detailed presentation on the progress and status of various activities / initiatives taken-up by CHT. Besides the agenda points discussed in the Governing Council meetings, the additional activities presented in the EC Meeting include

- Steam consumption reduction workshop through M/s Solomon Associates
- Mandatory Energy Audit (MEA) by PCRA
- e-Office Implementation in CHT / OIIB / OIIS / PCRA
- Reconstitution of GC
- Reconstitution of SAC
- Energy reduction under PAT
- Status of SAC Activities
- Compliance audit by CAG

- Compliance of Transparency Audit
- Initiative Under Atma-Nirbhar Bharat in the areas of chemicals, petrochemicals, pharmaceuticals intermediates / feed stock
- Standardization of inputs for Nelson Complexity Index (NCI) etc.



Shri Sunil Kumar, Joint Secretary(R), MoP&NG chaired the 30th Executive Committee Meeting of CHT held online on 10th December 2020.

Scientific Advisory Committee Meetings

88th Meeting of the Scientific Advisory Committee (SAC) on Hydrocarbons of MoP&NG was held through Video Conferencing on 8th September 2020 under the Chairmanship of Dr. Anil Kakodkar. Shri K.K. Jain, ED (CHT) welcomed the Chairman, JS (R), other esteemed members of the SAC and special invitees. During the meeting, following points related to PM JI-VAN Yojana were deliberated / discussed: Payment terms for demonstration projects; MoA finalization; Specification of fuel grade Ethanol; Outlook for fund disbursement

for 2020-21; ACM on biofuels; path forward for successful implementation of scheme. SAC also had detail deliberations on one new proposal of IIT-B (R&D grant) and two new proposals of IOCL and HPCL under HCF.

89th Meeting of the Scientific Advisory Committee (SAC) on Hydrocarbons of MoP&NG was held through Video Conferencing on 17th Sept.'20 under the Chairmanship of Dr. Anil Kakodkar. Shri K.K. Jain, ED (CHT) welcomed

“India accords topmost importance to the Oil and Gas sector. We are implementing pioneering reforms in the sector aimed at fulfilling our needs and at the same time working towards creating a sustainable planet.”

- Narendra Modi
Hon'ble Prime Minister of India



the Chairman, JS (R), other esteemed members of the SAC and special invitees. During the meeting SAC deliberated on the new proposal received from SAIL for VGF under PM JI-VAN Yojana. SAC also discussed the status of RFS for remaining projects under Phase-1 of PM JI-VAN Yojana. SAC also had detailed review of the on-going R&D and HCF projects.

90th Meeting of the Scientific Advisory Committee (SAC) on Hydrocarbons of MoP&NG was held under the Chairmanship of Dr. Anil Kakodkar through Video

Conference on 1st December 2020. Shri K.K. Jain, ED (CHT) welcomed Dr. Kakodkar, Chairman, AC, Shri Sunil Kumar, JS (R), MoP&NG, other esteemed members of the SAC and special invitees. During the meeting, SAC deliberated on the new proposal received from SAIL for VGF under PM JI-VAN Yojana. SAC also discussed the reasons / issues for poor response to RFS under Phase-1 of PM JI-VAN Yojana and recommended the further issuance of RFS based on amended PM JI-VAN Yojana for both Commercial as well as Demonstration projects.

Review Meeting by MoP&NG of On-going 2G Ethanol plants and CBG plants

Shri Sunil Kumar, Joint Secretary (Refinery), MoP&NG reviewed progress of the On-going 2G Ethanol and CBG plants on 29th January 2021 through virtual meeting. Officials from IOCL & IOC-R&D/ BPCL/ HPCL and ABRPL participated in the meeting.



Shri K.K. Jain, ED-CHT gave brief presentation on the progress. During the meeting, Shri Sunil Kumar, JS(R), MoP&NG advised to utilise the Budgeted amount for the year 2020-21 by expediting the work.

MoA signing under PM JI-VAN Yojana

Two separate Memorandum of Agreements (MoA) were signed between IOCL and CHT on 1st December 2020 at CHT Office, for providing VGF of Rs. 150 Crore to a Commercial plant and Rs. 15 Crore to a Demonstration plant of 2nd Generation Bioethanol being installed by IOCL at Panipat, Haryana under PM JI-VAN Yojana. The Commercial project MoA was signed by

Shri K.K. Jain, ED-CHT and Shri Santanu Gupta, CGM I/C (AE & SD), IOCL. The Demonstration project MoA was signed by Shri K.K. Jain, ED-CHT and Shri Shailendra Kumar Sharma, ED(TPF), IOCL. Earlier, MoA for Commercial Project was signed with HPCL in November 2020 with Shri J. S. Prasad, ED (Biofuel).



The Commercial project MoA was signed on 01st December 2020 by Shri K.K. Jain, ED-CHT and Shri Santanu Gupta, CGM I/C (AE & SD), IOCL.



The Demonstration project MoA was signed on 01st December 2020 by Shri K.K. Jain, ED-CHT and Shri Shailendra Kumar Sharma, ED (TPF), IOCL.



Expert Group Meeting of R&D projects

The Expert Group meeting of R&D projects was held through Video Conference on 13th July 2020, under the Chairmanship of Prof. R. Kumar (Professor Emeritus, IISc). Following projects were reviewed:

- a. Biomass Hydro-pyrolysis for production of fuel grade Hydrocarbons: IIP/ HPCL
- b. Scale-up studies and process development for H₂ production by catalytic decomposition of natural

gas: HPCL / IIT-D/ CeNS

Shri K.K Jain (ED-CHT) welcomed the Chairman & participants. He gave the brief background of projects and expressed concern for delay in the completion of both projects. The Chairman made some suggestions for improvement in both projects and advised to implement those suggestions in next 6 months. IIP & IIT-D agreed to implement the suggestions.

US-India-Energy Webinar on Transition to Clean Energy Technologies in Refining & Petrochemicals

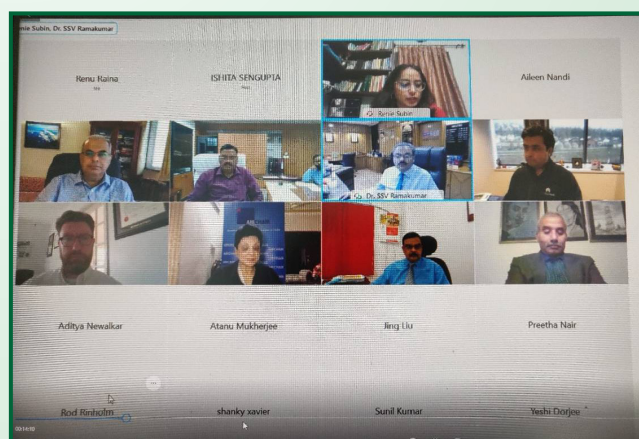
In Feb, 2018, USTDA hosted Indian delegation to US as part of RTM (Reverse Trade Missions) on Refineries Performance Optimisation. As follow up of this visit, after due approval by MoP&NG, an MoU was signed on 8th May, 2018 between American Chamber of Commerce in India (AMCHAM) and CHT on U.S.- India Collaboration in Refining and Petrochemical Industry. A meeting with US companies and Indian Oil PSUs senior officials was held on 4th February 2020 at Scope Complex New Delhi. In continuation of the above, the US-India- Energy webinar on 'Transition to Clean Energy Technologies in Refining & Petrochemicals India' has been jointly hosted by AMCHAM and CHT on 6th April' 2021.

The Webinar was attended by 120 participants including Senior officials from 35 US companies and Indian PSU Oil PSUs refineries, GAIL, IOC (R&D) and EIL.

The Webinar started with the introduction of panelists and opening remarks by Ms Preetha Nair, Chairman, Energy Committee of American Chamber of Commerce pitching on furthering U.S. India Collaboration through the U.S. India Strategic Energy Partnership.

Senior Commercial Specialist, US Embassy, New Delhi, Mr Renie Subin addressed the participants citing importance of the MoU and assured cooperation on clean technologies adoption.

Sh. K. K. Jain, ED(CHT) delivered welcome address and briefed about the Future of Refining and Petrochemical Sector in India. He hoped that today's webinar would further strengthen the ties between US and Indian companies in Petroleum sector and facilitate enhancing cooperation and specific studies for promoting technical exchange and absorption of clean technologies for sustenance.





Ms. Aileen Nandi, Minister Counselor for Commercial Affairs, U.S. Commercial Service, India spoke about the Market Entry Challenges faced by U.S. companies at the time of Introducing Innovative and Disruptive Technology Solutions in the Market.

Dr. S.S.V. Ramakumar, Director (R&D), IOCL made a presentation on India's NDC targets and highlighted commendable progress made by India in mitigation of carbon di oxide emissions. He also presented Priority areas for India for deployment of innovative and disruptive technology solutions towards transition to clean energy. He emphasized that US technology providers has ample scope to collaborate with India especially in the field of Novel refinery process catalyst, enhancing petrochemical intensity, Plastic recyclability, Novel bio-degradable monomers beyond Poly lactic Acid, Biofuels, Green Hydrogen production & storage, carbon capture to bring cost of CO₂ capture below \$25/Ton.

Dr. Kenneth R. Vincent, Director, Office of Asian, U.S. Department of Energy spoke on need for India-US collaboration in field of R&D on green energy technologies focusing on green hydrogen production, storage and transportation.

Mr. Sushil Williams, Deputy Secretary (Refineries), MoP&NG emphasized on commitment of Govt. of India towards CO₂ mitigation. He mentioned that India is looking at options and systemic changes to increase efficiency in energy usage, increased role of gas and decarbonisation of energy mix by increasing role of renewable energy. He further highlighted the various Initiatives by Government of India towards Transition to Clean Energy. He hoped that today's webinar would further strengthen the ties between US and Indian companies in Petroleum sector and facilitate exchange of clean technologies.

Following 7 companies made brief presentation. The co. wise major technological offerings are as under;

1. Aquatech International: Water recycling & Zero Liquid Discharge (ZLD). Solutions to meet specific industry requirement, enhance system performance and reliability and significantly reduce installation time and costs in the area of water management.

2. Black & Veatch: Analysis and detailed design of CO₂ capture, compression and handling systems; renewable power generation and distribution; electric vehicle charging; blue & green hydrogen and ammonia; renewable methane, waste plastic conversion, hydrogen fuel cells projects.
3. Bloom Energy: Leading solid oxide fuel cell manufacturing company; role of hydrogen/fuel cell in Energy Transformation in stationary and transport applications (road and marine); cost effective CO₂ capture; will commercially introduce high efficiency Solid Oxide Electrolyser next calendar year.
4. Dastur Energy: IP based Clean Energy Company. Optimizes the design of integrated clean energy systems for long-term techno-economic performance that include emerging energy systems like blue and white hydrogen production, multi-feed gasifier complexes, methanol ecosystems, waste gas conditioning and use. Co. is working with Gujarat refinery on Industrial scale carbon capture from Hydrogen unit
5. Gas Technology Institute (GTI): Clean energy solutions provider through Carbon Capture and Utilization, Green/Blue Hydrogen, developing advance processes for carbon capture and utilization of captured CO₂ and CO₂ rich gases.
6. NxtBrane: Specializes in Membrane Technology, Molecular sieve, etc. Potential uses include the separation of ethanol/butanol and water in biofuel production for lowering the cost and energy intensity. Zeolite thin film membrane development reaching to industrial application in 2020 as certified in Exxon Mobil lab.
7. Trident Desalination Inc.: Temperature Swing Solvent Extraction (TSSE) - a membrane-less, non-evaporative desalination method capable of treating water with over 7X the salinity of sea water, high water recovery rate and Zero Liquid discharge with low energy and low cost technology.

The presentations by US cos. was followed by brief Q&A session.

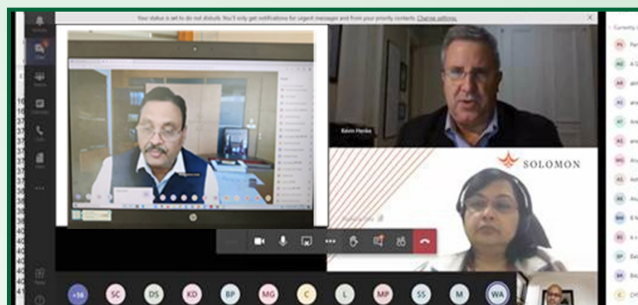
The Webinar ended with closing remarks vote of thanks by Ms. Ranjana Khanna, Director General C.E.O., American Chamber of Commerce in India.



Refinery Performance Benchmarking

Data Coordination Seminar for Refinery Performance Benchmarking for the year 2020 cycle was held via video conferencing on 3rd and 4th December 2020 for 16 Indian PSU Fuel Refineries and 4 Indian PSU Lube Refineries. The programme was inaugurated by Shri K.K. Jain, ED-CHT in presence of delegates participating from Refinery, Solomon and CHT, which was followed by technical sessions for two consecutive days.

In line with the recommendations of Governing Council of CHT, a Long Term Agreement has been finalized with Solomon to carry out Benchmarking Study Bi-Annually upto 2028. After multiple rounds of meetings, Solomon has agreed to keep the techno- commercial conditions similar to past studies along with additional



Shri K.K. Jain, Executive Director, CHT (see top left) inaugurated the two-day Online Data Coordination Seminar for Refinery Benchmarking – 2020 cycle on 03rd December 2020. Also seen in the pic are Mr. Kevin Henke & Ms. Radhika Ojha from M/s Solomon Associates.

complimentary workshops on steam reduction as well as reliability improvement.

Performance Benchmarking Study for Pipelines – 2020 cycle

CHT and M/s Solomon Associates, USA signed a contract agreement on 10th November 2020 to carry out the Pipeline Benchmarking Study 2020 cycle on behalf of IOCL, BPCL, HPCL, OIL & GAIL. The Study shall cover a total of 41 pipelines including 6 Crude, 24 product

pipelines, 5 LPG pipelines & 6 gas pipelines along with 5 SPMs. The duration of the study is 9 months from the work order. Data Coordination Seminar was held on 12-13 January 2021.

Catalyst Manufacturing in India

With a view to setup world class catalyst manufacturing units in India under Make in India initiative by GOI, a committee was formed under chairmanship of Smt. Vartika Shukla, Director (T), EIL to discuss with the interested parties to take it forward. The first phase of interaction was held on 29/30th September 2020 with parties namely M/s Sud-Chemie, M/s Halder Topse, M/s Axens and M/s ART/Grace. The second phase of interaction was held on 14th and 22nd October 2020, parties like M/s REZEL, M/s HCpect, M/s CPTDC and M/s Porocel participated. A meeting of the committee on setting up Catalyst manufacturing plants in India, was held on 23rd November 2020. During the meeting, responses received from various bidders of Catalyst Manufacturing against the EOI were reviewed and further deliberations via VC was held with the parties. Each of OIL PSU were asked to put up firm areas in which they would like to invest namely type of catalyst and other areas interest for putting up the facilities.

Refining industry in India has made rapid strides in terms of refining capacity as well as development & adaption of state-of-the-art refining technology. In terms of refining capacity, it is 4th largest in the world with present capacity of 248.9 MMTPA, which shall increase to 443.6 MMTPA by 2030. The refining industry employs many catalytic processes where catalyst play major role. The newer developments in process technologies are also centering around new and efficient catalytic systems. Indian R&D organizations/ institutes have also developed process technology that competes with the best in the world. However, there is no major catalyst manufacturing facility in India and the country is mostly dependent on catalyst import.

Current estimated catalyst market in India is around 8 TMTA for Fixed Bed Hydroprocessing, 40 TMTA for FCC Catalyst and Additives which is valued at about Rs. 2800 Crore per year. By the year 2025 requirement is set to increase to 18-21 TMTA for Fixed Bed, and



70 TMT for FCC catalyst per annum. The industry is considering setting up a number of Ebullated Bed Resid Hydrocracking units, which will result in new demand of 10-15 TMTPA for EB catalyst.

For a long time, a need has been felt to set up a catalyst manufacturing plant in India to make India Self Reliant aligned with Govt's initiative of Make in India and ATMA NIRBHAR BHARAT.

Considering the above, MoP&NG constituted a committee on 30th October 2017 to finalise the approach for setting up a catalyst manufacturing unit in Joint Venture with suitable established catalyst manufacturer. Subsequently, the Working Group on Refineries, in its meeting on 12th June 2018, approved the approach for setting up the plant as the strategic initiative and advised the Committee to propose the business model. Accordingly, Expression of Intent dated 27th December 2019 was published by CHT to gather market intelligence and discussions with reputed vendors. The response to EOI was good and 8 parties showed interest in different areas of catalysts.

The subject was further discussed in EC of CHT on 24th June, 2020. While showing willingness to partner in JV with the prospective partner, BPCL & HPCL both expressed that a firm proposal including business proposition may be put up for taking a final decision. EIL also expressed willingness to explore joining such a venture. It was advised that deliberations be held with individual bidders through a committee of ED level

representatives to formulate the business proposition and roadmap including partnership aspect by PSUs. Accordingly, a committee was reconstituted by MoP&NG on 6th August 2020 with following Terms of Reference for setting up a Catalyst Manufacturing Unit in India:

1. To formulate business proposition and roadmap including partnership aspects by PSUs after deliberation with individual bidders including type and capacity of plant (s), requirement of raw materials, utility and land, expected cost of plant.
2. Evaluation of information and recommending signing of NDA with prospective partners, if required.
3. Suggest path forward
4. Presentation to EC on broad proposal.

On the basis of above interaction and inputs received, five parties namely M/s Halder Topsoe, Sud-Chemie, ART, AXENS and POROCEL were identified. The second round of discussion were completed in January' 2021 with five short listed prospective partners. The discussions ranged from Type of catalyst, investment, area and utilities required, marketing/sales aspects, scale up of catalyst recipes developed by Indian PSUs and toll manufacturing, Policy issues, Structure of JV, etc. These deliberations will further help PSUs to develop Joint venture and M/s HPCL will now lead further discussions with the prospective partners.

MBN reduction target for PAT Cycle-VI

VC meetings among refineries / BEE / CHT were held on 10th June 2020 & 14th July 2020. During the meetings the discussion was held on the representations made by MRPL, RIL & 4 IOCL Refineries i.e. JR, BGR, MR and GR as they felt that stringent MBN reduction targets

have been notified by BEE for them for year 2022-23 under PAT Cycle VI. The outcome of the meeting was successful as ultimately all refineries accepted BEE Gazette notification target.

Mandatory Energy Audit

BEE has notified PAT Cycle VI in March 2020 and participating refineries are required to complete Mandatory Energy Audit within 18 months. PCRA had offered to carry out the study on nomination basis. The proposal was discussed during 29th Executive Committee meeting of CHT held on 24th June 2020 under the Chairmanship of Shri Sunil Kumar, Joint

Secretary (Refineries), MoP&NG. EC advised CHT to form a committee comprising members from refinery groups for evaluation of the offer from PCRA. Accordingly, VC meetings of the constituted committee were held on 3rd August 2020, 20th August 2020 & 3rd September 2020 to discuss and finalise the offer.



Study on Business opportunity for India in Petrochemicals

A presentation on the existing petrochemical units, approved petrochemical units and petrochemical units under conceptualization / feasibility study was done by Shri K.K. Jain, ED CHT to Committee consisting of Secretary, PNG, Secretary, Chemicals & Petrochemicals and other members through VC on 04th August 2020. Further, a committee has been constituted by MoP&NG for the following

- Firm up scope of work for the study by the consultant
- Review and finalisation of EOI for identifying prospective consultants
- Finalise QCBS based evaluation criteria for selection of consultant
- Finalise budget estimate for the consultant fee
- Review and Finalization of tender document

A virtual meeting has been held on 14th August 2020 with the members of the committee to decide on the way forward to line up the consultant. On 2nd September 2020 & 29th September 2020 an online meeting was held by the committee for lining up consultant based on QCBS/PQC for the study on enhancing production of petrochemicals.

A meeting was held on 16th October 2020 for discussions on the perspective plan on Petrochemicals. The meeting was chaired by Shri Sunil Kumar, Joint Secretary – Refineries, MoP&NG, Govt. of India and was attended by the Directors of Oil Companies, EIL &

Business Development (BD) group from IOCL. EIL along with IOCL presented a brief overview of the Perspective plan on Petrochemicals already submitted to Ministry of Chemicals and Petrochemicals for providing prevailing outlook, Supply - Demand scenario of major petrochemicals and various feed options. Follow up meeting of the committee for Review was held on 18th November 2020.

Shri Sunil Kumar, JS(R), MoP&NG constituted a committee to undertake a detailed study on Business opportunity for India in Petrochemicals. As Department of Chemicals and Petrochemicals (DCPC) has already undertaken comprehensive study on supply - demand of petrochemicals in India, it was decided that the scope of the proposed study shall be confined to plans of the refineries for petrochemicals. The refinery expansion plans were obtained from refineries and demand for petroleum fuels were based on projection from the "Report of the Working Group on Enhancement of Refining Capacity by 2040" of January 2017. The committee deliberated and identified major Petrochemicals based on consumption in terms of volume, value, import, growth and Capacity in India including projected capacity addition for the identified petrochemicals. Also, the committee highlighted Petrochemical Indian Outlook, feedstock availability & management, global perspective and technological advancements with respect to petrochemicals. The detailed Report was submitted by the committee to MoP&NG on 21st January 2021.

Feasibility Study for the production of Ethanol from Refinery Off gases & other projects in India by M/s LanzaTech

A virtual meeting was held with M/s LanzaTech (LT) through video conferencing on 05th August 2020 wherein LT gave a detailed status on the Phase-1 Feasibility Study for the production of Ethanol from Refinery Off gases and also the projects from the other

sectors. They indicated that with change in Microbe only, manufacture of other petrochemicals like Acetone, Iso-Propyl Alcohol (IPA) etc., is possible without major hardware changes in the unit.



Refinery Performance Improvement Programme (Phase II)

In the 28th meeting of Executive Committee, CHT informed that the RPIP for balance refineries including IOC-GR and DR shall be taken up in Phase II.

On 24th February 2020, a committee formed by CHT, comprising of senior members from the participating PSU's (IOC-JR,BR,HR,BGR,GR,DR,CPCL and NRL) met at CHT to review the Expression of Interest /Tendering process to be followed along with methodology to be adopted for selection and award of work.

EOI was floated on 30th July 2020, to identify new consultants capable of carrying out the study over

and above the ones which were shortlisted for the Phase I study. No new consultants could qualify while the existing consultants M/s KBC, McKinsey and BCG expressed their willingness to participate in the Phase II.

Final tender has been prepared by CHT in consultation with the committee members and same shall be floated refinery wise once confirmation is received from the participating refineries on their availability of optimal operational data for minimum 3 months owing to suboptimal operation during the COVID period.

Review meeting by MoP&NG on Refining Capacity Expansion

Review meeting on Refining Capacity Expansion was held on 01st October 2020 and was chaired by Shri Tarun Kapoor, Secretary, PNG. The CMDs of various oil companies & EIL attended the meeting along with officials from CHT & PPAC. In this meeting, Shri K.K. Jain, ED, CHT presented brief overview of fuel demand

materialization for 2019-20 and Crude capacity plan till 2030. Secretary, PNG stressed on addressing the mismatch in actual demand of MS & HSD over the projections. PPAC to provide revised demand projections and CHT to compile the product availability from refineries for further deliberation.

Committee on Crude Storage Facilities

A meeting was held by Shri Sunil Kumar, JS (R) on Crude oil Storage facilities at Indian Refineries on 26th August 2020. ED-CHT gave detailed presentation covering present days cover and expected days cover with planned Capacity expansion of Indian Refineries till 2030, JS (R) observed that Indian refineries Crude storage capacity is not in line with their capacity increase. To address the issues related to enhancing Crude oil Storage in India, MoP&NG constituted a committee with following objectives.

1. Detailed study on all aspects including Capex, Opex, financing etc. in respect of enhancement of common storage facilities for Crude Oil in the country.
2. Submit a report to MoP&NG on the measures to augment the existing crude oil storage facilities at the refineries.

The committee met on 28th September, 2020 and submitted the report pertaining to Objective 2 of the committee.

As regards objective 1 i.e. to carry out detailed study on all aspects in respect of Common Crude oil Storage Facilities in the country, a meeting was held on 21st October 2020. The meeting was attended by officials from IOCL, BPCL, HPCL, EIL, ISPRL and CHT and chaired by Smt. Vartika Shukla, Director (T), EIL. Overview on Strategic Crude storage was provided by Shri Ahuja of ISPRL.

On 26th November 2020, a meeting was held with Adani Group on the Common Crude Oil Storage Facilities with committee members.



Development of Process scheme for Reference Fuel

Stage-1 Closure meeting was held on 13th July 2020 through VC wherein representatives from EIL, IOC-R&D, MRPL, IOC-PR and CHT were present.



Outcome of Stage-1 was presented by EIL and way forward for Stage-2 was discussed by the participating members Review Meeting on Phase-II-Development of Scheme for Production of Reference Fuels (Diesel & Gasoline) was held on 8th Oct'2020, 16th Oct'2020 & 2nd Nov'2020. The meeting was attended by EIL, IOC-R&D and IOC-Panipat Refinery (PR). Stream Samples for HSD & MS blend were sent from IOCL-Panipat to IOCL-R&D and the characterization of the same is in progress.

On 23rd December 2020, a KOM was held virtually on 23rd December 2020 to take up the Stage-2 of the project for Development of Scheme for Production of Reference Fuels (Diesel & Gasoline). Shri P. Raman, Director, CHT, Shri Ravi Kant Gupta, SGM (R&D), EIL and Shri Sarvesh Kumar, GM (IOCL-R&D) attended the KOM.

Technical Committee meeting of National Energy Conservation Award (NECA) 2020

A meeting of Technical Committee for finalization of awardees for National Energy Conservation Award (NECA) 2020 was convened on 9th November 2020 through video conference under the Chairmanship of Shri Prakash Mhaske, Chairperson, CEA.

The agenda of the meeting was:

- (1) Briefing about the participations under various sectors of NECA 2020
- (2) Allocation of sectors to Evaluating Agencies for Role of PSUs in making Chemical Industry

Aatma Nirbhar finalization of awardees

- (3) Finalization of timeline for evaluation of questionnaires

Shri K.K. Jain, ED (CHT) being one of the members of the technical committee attended the same and CHT evaluated the submissions made by the 12 participating refineries on Specific Energy Consumption to finalize the winners in the Petroleum Refinery category.

*“Hard work never brings fatigue.
It brings satisfaction”*

- Narendra Modi
Hon'ble Prime Minister of India



Activity Committee Meeting

1. Strategies for Turnaround Management

1st CHT Activity Committee Meet on “Strategies for Turnaround Management” was organized by CHT virtually in collaboration with HPCL-Visakh Refinery on 24th November 2020. Over 230 delegates from IOCL, HPCL, BPCL, MRPL, CPCL, HMEL, BORL, Numaligarh Refineries and Nayara Energy Limited participated. The presentations by the participant refineries were based on their experiences in Turnaround Management. M/s L&T and Shri S.L. Maurya, Ex-ED-M&I, IOCL and a Consultant in Petchem Commissioning & Maintenance also made a presentation and shared their experiences.

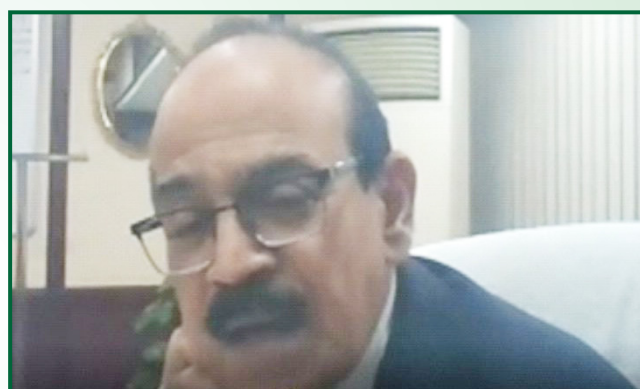
Shri V.S. Shenoy, Dir(R)-HPCL & Chief Guest for the Meet inaugurated the ACM and delivered the Inaugural address. Shri V.S. Shenoy, Dir(R)-HPCL stressed upon the fact that the intended benefit of the shutdown was of prime importance apart from finishing it in time. Shri Ratan Raj, ED-HPCL, Visakh delivered Welcome Address, followed by Opening Address by Shri K.K Jain, ED-CHT. Keynote Address was delivered by Shri V.K. Raizada, ED(M&I)-IOCL(RHQ). Shri P. Venkata Narayana, CGM-Maint, HPCL- VR was the convenor of the ACM. Participants expressed that there are number of take aways for emulation at their individual refineries.



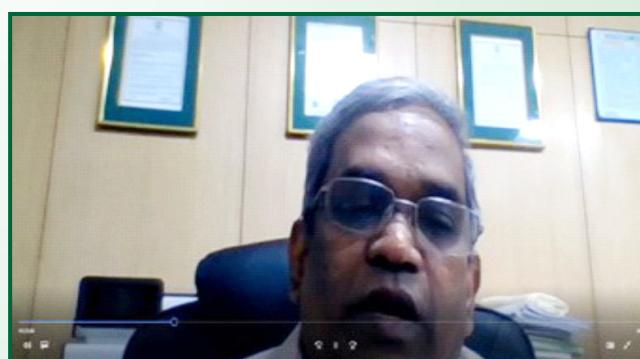
Shri V.S. Shenoy, Dir (R), HPCL and Chief Guest of the Meet delivering the Inaugural address online during the ACM on Strategies for Turnaround Management on 24th November 2020.



Shri K.K. Jain, ED-CHT delivering the Opening Address



Shri V.K. Raizada, ED-M&I, IOCL, RHQ delivering the Keynote address online during the ACM



Shri. Ratan Raj, ED-HPCL VR delivering the Welcome address

The Key Takeaways of the ACM were

- Planning for Turnaround (TA) to be done 5 years in advance
- New inspection Techniques can be incorporated & training to be imparted
- Turnaround Execution: Digitalization of Online Labour gate pass request, Formation of dedicated team from Maint. / Operation & Inspection to check



wrong gasket Installation during deblending which will save considerable time & execution of major TA of multiple units amid COVID pandemic.

- Digital Turnaround include Real time and integrated Turnaround management, Installation of Drone camera for HSE management, Collaboration with other refineries for ideas / unplanned material exchange.

2. Digitalization in Refining Business Process

CHT organized a virtual Activity Committee Meeting on “Digitalization in Refining Business Process” on 25th February, 2021. The meeting was attended by representatives from all the private and public sector oil companies along with Global Consultants who are spearheading the “Digitalization” initiatives across the world in the area of “Refining Business Process”.



During the Inaugural session, Shri K.K. Jain, ED(CHT), welcomed the special invitees of the meet comprising of Shri S.M. Vaidya, Chairman, IOCL, Shri V.S. Shenoy, Director, HPCL and Shri P.V. Ravitej, ED, BPCL along with all the delegates and participants.

The theme, keynote and inaugural addresses were given by special invitees where they emphasized on the need to embed digital capabilities in all aspects

of refinery business operations in order to improve yields, efficiency, explore market opportunities, improve plant safety, reliability and availability thereby reducing cost and protecting revenues and margins. The closing remarks were given by MD (NRL), ED (BPCL) and ED (IS, IOCL). The ACM was co-hosted by BPCL, Kochi and was attended by more than 200 participants.

The Key Takeaways covering major areas of applications are as under:

- Remote Supervision of Catalyst Offloading/ Loading
- Bringing data from Control Systems to a tailor made in-house analytical dashboard
- Drone Assisted Thermography
- Robotic Process Automation (RPA) in E&C for Engg. Drawing Meta data extraction
- Videos for SOP Training
- AI based Predictive Analysis
- Online Crude column performance monitoring
- Predicting Heat Exchanger Fouling & decision for cleaning
- Smart fleet management using GPS technology
- Future Initiatives in progress for Valve Maintenance Portal, Asset Historian, Alarm Management
- QR based asset tracking and verification solution
- SAP PM Planning Portal and Mobility
- Digitally enabled Project Management
- Corrosion Monitoring Platform
- Project Commissioning using digital tools

Refinery Performance Awards and OGCF/ Saksham Award for 2019-20

With a view to encourage competition amongst the refineries and recognize overall performance improvement, Ministry of Petroleum & Natural Gas (MoP&NG), Government of India has instituted Awards under the following two categories:

1. Refinery Performance Improvement Award
2. OGCF/Saksham Award

The parameters and evaluation criteria are approved by MoP&NG, Govt. of India.

To finalize the awards, a meeting of the selection



committee constituted by MoP&NG, was held through Video Conference on 26th November 2020. These awards are to be presented to the winners from the Indian Refineries, during upcoming 25th RPTM.



Innovation Awards

Sectoral Innovation Council for Petroleum and Natural Gas was constituted as a part of the National Innovation Council initiative to drive innovations in the Petroleum and Natural initiative to drive innovations in the Petroleum and Natural Gas Sector and to provide executable and implementable policy inputs and initiatives. The Sectoral Innovation Council recommended awarding innovations in Refining Sector, with objective to promote innovative scientific endeavour in country by encouraging and rewarding excellence in invention/Innovation.

MoP&NG has instituted Innovation Awards which aims at recognizing the hidden creative talent in individuals or group in industry/ R&D system that could be harnessed for the benefit of the Nation. The Innovation Awards are conferred in the following

three categories:

- Best Indigenously developed Technology
- Best Innovation in Refinery
- Best Innovation in R&D Institute

Applications for the above awards were invited from both public and private sector units. A total of 37 nos. nominations in all the three categories were received from refineries. including innovations in catalyst, energy optimization, troubleshooting, environment issues, digitalization, development of new technologies. On 4th & 6th January 2021, presentation of the applicants was done before the constituted Award Committee via video conferencing for evaluation. The Innovation Awards will be presented in the upcoming 25th RPTM.

Presentation by CHT in Biofuture Summit of Brazilian Bioenergy Science & Technology Conference (BBEST) 2020

Shri K.K. Jain, Executive Director, CHT participated as a Speaker in the Brazilian Bioenergy Science & Technology Conference (BBEST) 2020 on 15th October 2020 through video conferencing. This conference brings together the vision, policies, innovation and science to enable a sustainable low carbon bio-economy among the 20 Biofuture Platform Member Countries. Shri K.K. Jain, ED, CHT shared the details regarding India's ambitious growth plan ahead and the thrust to promote major initiatives on Biofuel economy. Shri Jain presented details on Government of India Initiatives on 'Atmanirbhar Bharat' supporting Biodiesel, PM JI-VAN Yojana, Ethanol Blending with

thrust on 1G Ethanol & 2G Ethanol, Compressed Bio-Gas (CBG), Sustainable Alternative Towards Affordable Transportation (SATAT) model, Bio-ATF, Waste to Energy through Municipal Sewage Waste (MSW).

Through this conference and amidst COVID-19 crisis, efforts are being made to bring to light the need for strong economic recovery programmes across many sectors and several countries to consider the opportunity to build back better environmental considerations as an integral part of the recovery packages.





CHT's presentation in Webinar on Role of PSUs in Making Chemical Industry Aatma Nirbhar

A webinar was organized on 27th November 2020 wherein Role of PSUs in making Chemical Industry Aatma Nirbhar was deliberated by the panelists from BPCL, EIL, HMEL, GSFC, IIM Lucknow, HIL, FACT etc. Shri K.K. Jain, ED, CHT participated in the Webinar as a Panelist.

Shri K.K. Jain, ED, CHT participated in the Webinar as a Panelist. The Public Sector Undertakings (PSUs) have proved as main pillars of India's economic growth. The key discussion points were

- Role of PSUs in developing Indian chemical sector
- PSUs emerging as a savior during the crisis
- Privatisation and Chemical PSUs
- Performance of PSUs and its impact, Modernisation
- Future of PSUs
- Need of PSUs to make India Aatma Nirbhar in chemical sector



Automation of Refinery Secretary Data submission by CHT

In-order to simplify the process of compilation and submission of refinery performance data for review by Secretary, P&NG, CHT developed an online software to enable refineries to upload their performance data directly at the CHT website every month by the cut-off date. This shall enable refinery groups as well as CHT to save significant amount of time and effort in compilation of final data for

submission to Ministry for review. To develop a clear understanding of the process flow for updation, two rounds of video conference meetings were held on 8th & 22nd of September 2020 with refinery coordinators of IOCL, BPCL, HPCL, CPCL, MRPL and NRL. The initiatives by CHT was appreciated by all the participating members.

CHT website certified by MQAS for Web Security Audit Certificate

CHT has been successfully issued the Web Security Audit Certificate for its website on 10th October 2020. The Web Application is certified to be free from OWASP 2017 Top 10 vulnerabilities and is found safe for hosting. This certificate is valid for one year from the date of issue or till no additional changes are

made in the contents whichever is earlier. Centre for High Technology (CHT) web application of Kreate Technologies LLP, New Delhi has been tested/ audited by Maverick Quality Advisory Services Private Limited (MQAS).



Baseline Report of the Working Group on R&D and Innovation constituted under Integrated Monitoring and Advisory Council (IMAC)

During 2nd meeting of Integrated Monitoring and Advisory Council (IMAC) chaired by Hon'ble Minister, P&NG, it emerged that holistic and coordinated strategy in close coordination with all IMAC Member Ministries is imperative towards the exercise of Reassessment of the Roadmap to implement the Hon'ble Prime Minister's vision of reducing oil import dependency. Accordingly, 6 Working Groups have been constituted for monitoring the progress on various initiatives, schemes, projects and strategies taken under respective Member Ministries domain with a view to augment Supply of energy, Savings in energy as a means to achieving oil import reduction with following Terms of Reference;

"To Study / analyse and document various initiatives taken by concerned ministry/ Departments from FY 2016 to FY 2020 towards the achievement of roadmap of reducing import dependency of Oil/Gas/ coal and in overall energy Sector;

- i. Quantify the impact of initiatives on reduction in import dependency vis-a-vis that "without initiative Scenario".
- ii. Arrive at Quantum of Savings realised in Nation's import bill through interventions under each pillar."

PPAC will prepare comprehensive report based

on inputs highlighting the progress on efforts by different Stakeholders along with actions that need to be taken towards reducing dependence of imported crude by 10% by 2021-22.

CHT has been entrusted to coordinate the activities of the Working Group-5 on R&D and Innovation under the chairmanship of Prof. Sandeep Verma, Secretary, Science & Engg. Research Board (SERB-DST) (Chairman) and convenorship of Shri Dinesh Dayanand Jagdale, Joint Secy., MNRE. The other members of the working Group are drawn from the important Sectors, namely Renewable Energy, Railways, Heavy Industries, Automotive, Chemicals & Petrochemicals and Oil & Gas: Petroleum Refinery & upstream and Defence. The task of this working group is very significant as R&D and Innovation can provide thrust and could be an important input for the policy makers. The recommendations from this group would greatly help in reducing dependence on energy import.

The Baseline Report of the Working Group has been submitted to MoP&NG and PPAC. The final report on the above is to be submitted by June 2021. Subsequently, Working groups shall submit quarterly report after June 2021 covering the progress on actionable as detailed in previous reports to PPAC/ MoP&NG.

e-office Implementation at CHT/OIDB/OISD/PCRA

The Executive Committee Meeting during its 29th meeting held on 24th June 2020, approved the implementation of e-office at CHT for 5 years. NIC recommended to implement e-Office Lite version due to constraint of customizing e-leave and e-tour rule of multiple organizations in single office as the present manpower is drawn on deputation from different organizations. CHT has taken initiative for E-office implementation over Internet which can be accessed from everywhere and anywhere in the world using GOV.IN email id and password. The URL

to access eOffice is <https://eofficemop.gov.in>.

CHT was the nodal agency to coordinate all activities for e-office implementation at CHT, OIDB, PCRA, OISD. A three days online Master Training Programme and PIMS & Product Administrator Training programme on e-Office Product Suit was imparted to the identified master trainers and local administrator officials (PIMS Manager) from all offices on 23-25 March 2021. e-office Implementation at CHT has gone live from 1st April, 2021



Technologies for Energy Independency



- Dr. N.S. Raman, Director, CHT

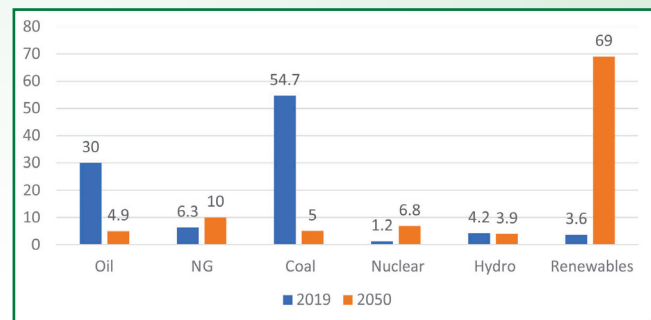
1.0 Introduction

India is celebrating 75th Independence anniversary called Azadi ka Amrit Mahotsav. Since Independence, India has made great strides in many areas but in Energy, we are still import dependent as we import more than 80% of our energy needs in the form of crude oil including LPG, LNG, natural gas, coal etc. Any change in energy price abroad, particularly crude oil price affects the country directly. As a consequence, we grapple to control our fiscal deficit, inflation rate, foreign exchange rate etc.

Recently, our PM launched Atmanirbhar Bharat Abhiyaan or Self-reliant India campaign. The aim is to make the country and its citizens independent and self-reliant with a view to increase production in India. This article emphasises on technologies that should be engaged in Research, Development and Deployment (RD&D) to transform energy sector. This article focuses on technologies to transform energy sector to energy independency and hence energy security. This also implies to develop technologies that utilises indigenous energy resources for the transformation across applications including domestic, transportation, industrial etc.

2.0 Energy consumption trend

The primary energy consumption in India in 2019 was 34.06 Exajoules (813.5 Mtoe) excluding traditional biomass use. This comprises share of coal @ 54.7%, crude oil @ 30%, natural gas @ 6.3%, nuclear energy @ 1.2%, hydro-electricity @ 4.2% and renewable power @ 3.6%.



(Source: BP Outlook for India:2020)

As per BP Energy outlook 2020 for India, total primary energy consumption in 2050 under Net Zero scenario is expected to increase upto 77 Exajoules (1839 Mtoe). The share of coal will drastically reduce to 5% from 54.7% and share of crude oil will reduce to 4.9% from 30%. On the contrary, share of renewable power will increase to 69% from 3.6%.

In 2018, India's net imports were nearly 205.3 Mtoe of crude oil and its products, 26.3 Mtoe of LNG and 141.7 Mtoe of coal totalling to 373.3 Mtoe of primary energy which is equal to 46.13% of total primary energy consumption. India is largely dependent on fossil fuel imports to meet its energy demands. By 2030, India's dependence on energy imports is expected to exceed 53% of the country's total energy consumption.

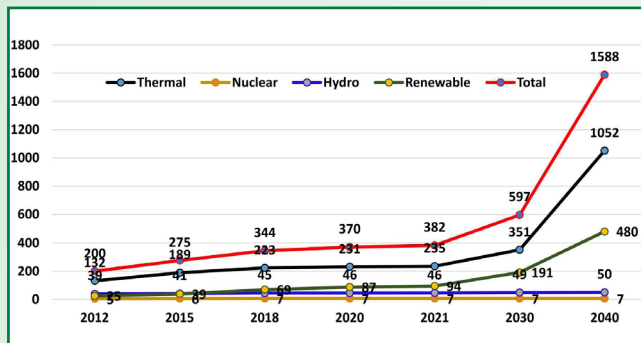
3.0 Major energy consumption

3.1 Power

As per BP Energy outlook 2020 for India, total power consumption share will increase to 80% in



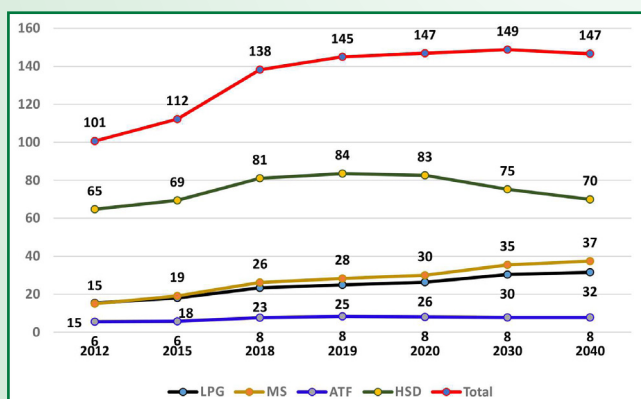
2050 from 50% in 2018. As on March 2021, power generation capacity in India is ~ 382 GW. The major contributors are thermal @ 235 GW, renewable @ 94 GW and hydro @46 GW. As per the straight line projection, total power generation capacity in 2040 is expected to be ~ 1588 GW, wherein share of renewables expected to be significantly higher.



(Source: Central Electricity Authority, India)

3.2 Petroleum products

Consumption of major petroleum products viz. LPG, ATF, MS and HSD in 2020 has been 147 MMT and the same is expected to remain at the similar level of 147 MMT in the year 2040 using straight line projection or business as usual scenario. However, HSD consumption is expected to reduce to 70 MMT in 2040 from 83 MMT in 2020. MS consumption will increase to 37 MMT in 2040 from 30 MMT in 2020. But the scenario is expected to change if suitable alternatives are emerged like batteries or even fuel cell backed by renewable power and this is the scenario India should relish.



(Source: Petroleum Planning & Analysis Cell, MOPNG India)

4.0 Energy Resources & Technologies

In this article, we try to identify the technologies

that utilises primarily indigenous resources to transform energy sector. To begin with we need to identify indigenous resources that can take care of domestic needs.

4.1 Resources

4.1.1 Crude oil & Natural gas

The indigenous resources of crude oil available to the extent of 30-35MMTPA along with natural gas availability by the year 2024 of the order of 80-100MMPTA, should be primarily used for petrochemical and polymer production and not for energy as it emits carbon emissions.

4.1.2 Solar

The country has a potential of 750GW of solar power as per MNRE and current solar installed capacity is about 90GW and projected to be 175 GW by 2022 and subsequently scaled up to 450GW by 2030 as per the government projections. However, the entire 750GW may be tapped as solar power generation getting cheaper by the day.

4.1.3 Wind

Wind is a site specific, seasonal and intermittent resource however, India has a large costal line provides opportunity to explore wind power. Current wind power capacity is around 39GW and has potential of more than 300GW to augment as per MNRE.

4.1.4 Biomass

Currently it is estimated that the surplus biomass available for value addition mainly for energy sector is about 178MMTPA. However, it is estimated that about 40% of the agricultural crops are cultivated for one season per year. These lands should be explored for more energy crops such as oil seeds to produce aviation fuel.

4.1.5 Hydrogen

For hydrogen production water electrolysis using renewable energy sources such as solar, wind etc. should be explored. As the energy cost of solar is getting cheaper, solar



based hydrogen generation should be given priority as it will be clean and cheaper. Since hydrogen transportation and storage is cost and technology intensive, hydrogen may be used for captive purposes across industries including steel, cement, petrochemical etc.

5.0 Energy Technologies

5.1 Petroleum

In the short term to medium term petroleum products continue to be primary source for the transport sector and therefore, efforts must be on for consolidating the existing technologies. However, technologies such as crude to chemicals will add value in the longer term as well. One more innovative technology namely, membrane deasphalting must be pursued as it increases not only the refinery thru'put by more than 20% but it provides opportunity to remove energy intensive vacuum distillation unit thus significantly reducing energy cost as well as emission in the refinery. For longer term, technologies managing CO₂ and make value addition should be pursued and not mere CO₂ capture.

5.2 Solar

Solar going to be mainstay in our energy basket and therefore solar technology adoption, research and development should be on our top priority. Further, solar PV going to be leading technology, though focus is already there in the solar, in order to make it robust, following areas need to be focused. 1) High purity silicon production 2) Silicon wafer technology 3) New materials to improve solar efficiency and to reduce cost 4) Solar electrolysis to produce hydrogen 5) Offshore solar technology. Though it appears to be difficult but efforts should be made as these technologies are already in place across the globe. Further, solar thermal technologies should be developed as it has higher efficiency and cheaper and hence probably techno-economically feasible to adopt for stationary solar energy storage.

5.3 Energy storage & batteries

Energy storage going to be backbone of solar & wind energy generation. Decentralised energy storage could be the concept in the form of residential, community storage as large energy storage may not be feasible. Batteries would be mainstay for the transport sector and therefore adoption of batteries technologies should be focused. However, for the longer run, indigenisation of battery technology with the raw material available is important. Following areas should be given priority. In the near and medium term, adoption Li-based battery technologies may be the option as it is a capital item, has a life of more than 10years and the power for charging is the consumable should be sourced from renewables. However, in the longer run sodium-based batteries are the way forward. These include 1) Sodium ion capacitor 2) Sodium sulphur battery 3) Sodium air battery 4) Materials for cathodes, anodes and separator 5) Battery management software. These sodium-based batteries are real solution to our needs and are possible to achieve. However, for bulk storage flow batteries to be researched and can be adopted if it is techno-economically feasible.

Aluminium air technology as range extender may be adopted once auto OEMs give green signal as we have plenty of aluminium in the country, aluminium is recycled and the industry is well established for recycling. However, source of power should be shifted to green source such as solar and wind to make the aluminium air technology green and clean. This option technically much better than fuel cell, but both can coexist and might work for different segments.

5.4 Hydrogen

Role of hydrogen is going to be two-fold 1) To supplement batteries for transport sector 2) for captive use in industries as a chemical hydrogen. Therefore, adoption of hydrogen related technologies should be important. 1) Solar



Electrolyser technology 2) Fuel cell technology 3) New materials for anodes, cathodes and membrane separator 4) Hydrogen storage and high pressure materials and equipment. However, we must be aware about the hydrogen emission as it is a secondary green house gas as many studies have indicated. Therefore, parallelly, studies should also be conducted to ascertain the negative side of the hydrogen before going ahead on hydrogen technology implementation.

5.5 Biomass

India is a large country depends on agriculture for food and therefore, large quantity of agriculture waste and or biomass is available to convert them to use as energy materials. Following technologies should be focused 1) Biomass gasification 2) Syngas to various chemicals, polymers etc. 3) Fermentation technologies to ethanol production. For aviation sector, biomass-based aviation fuel is the way forward.

5.5.1 CBG/ HCNG: Compressed biogas or CBG production under SATAT program propose to build 5000 plants targeting 15MMTPA has dual benefit of cleaning up environment and production of energy and bio manure. However, in the longer run CBG may be converted to HCNG by reforming to supplement energy basket which would cater to heavy vehicle. This would increase energy efficiency as well as reduce emissions. Areas needs to be focused 1) Technologies for on spec CBG production including membrane separation of CO₂ 2) value addition to CO₂ as it reduces the cost of CBG.

5.6 Wind Power

Wind energy continues to supplement solar power and requires attention as we have large coastal line. Following areas must be focussed 1) Wind turbine technology 2) Material for wind blades 3) Research on wind pattern & location identification etc.

5.7 Nuclear

Nuclear power continues to be supplementing the power production but because of safety it may not be given the priority. However, if safety is established then nuclear power may be one of the cheapest and clean power especially if raw material is sourced indigenously.

6.0 Summary

Energy is primarily consumed in transport, industry, building and domestic sectors. For transport, batteries would be the mainstay followed by fuel cell. For building and domestic, it would be power from rooftop or community solar that would essentially replace LPG and city gas as well. For industry, it is going to be the power and hydrogen. Therefore, mission mode projects need to be identified and backed by the government policies keeping implementation target of the year 2030 or earlier.

The current energy consumption of around 900 mtoe will be increased to 1900 mtoe as per BP outlook for India or this is equivalent to increase from ~1.0TW to ~2.5TW. Depending upon the indigenously available renewables, future energy scenario would be placed with or without import. However, with energy technologies with higher energy efficiency, the import could be curbed and make India energy secured and independent.

“As India moves towards a cleaner & more fuel-efficient economy, its benefits must expand horizontally to all sections of society”

- Narendra Modi
Hon'ble Prime Minister of India

आईएसओ 9001:2015 ऑडिट

पहला आवधिक आईएसओ 9001:2015 ऑडिट मेसर्स आईसीएस द्वारा 29 जुलाई 2020 को सीएचटी में सफलतापूर्वक आयोजित किया गया था। पहली बार ऑडिटर ने CHT के विभिन्न

तकनीकी प्रक्रियाओं और परियोजनाओं सहित, मानव संसाधन, वित्त कार्यों की समीक्षा करके, इस ऑडिट को ऑनलाइन किया।

आवश्यक प्रमाण पत्र

पिछले 5 वर्षों में CHT द्वारा दी गयी सिफारिशों के आधार पर MoP&NG ने आवश्यक प्रमाण पत्र जारी किए जोकि मुख्य तौर पर निम्न लिखित डाटा के ऊपर आधारित है।

क) नई रिफाइनरी परियोजना

ख) 25% से कम नहीं के साथ पर्याप्त क्षमता विस्तार

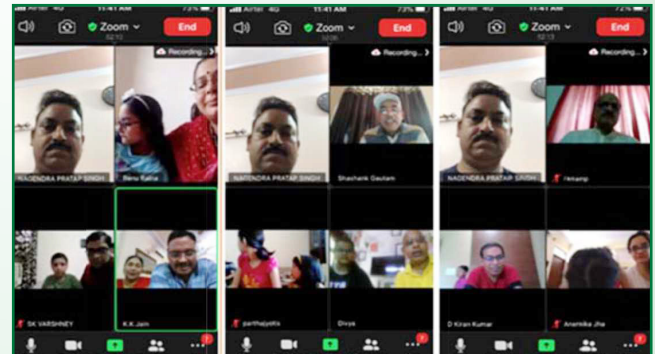
ग) एलएनजी गैसीकरण परियोजनाएं

घ) क्रूड एंड प्रोडक्ट्स से जुड़ी पाइपलाइन

MoP&NG द्वारा आवश्यक प्रमाण पत्र जारी करने के लिए जून 2020 में संशोधित प्रक्रिया जारी की गयी।

स्वच्छता पखवाड़ा 2020

पेट्रोलियम एवं प्राकृतिक गैस मंत्रालय, भारत सरकार के दिशा निर्देशों के अनुपालन में उच्च प्रौद्योगिकी केन्द्र ने 1-15 जुलाई 2020 के दौरान स्वच्छता पखवाड़ा मनाया। स्वच्छता पखवाड़ा को सफल बनाने के लिए सीएचटी ने स्वच्छता से संबंधित कुछ कार्यक्रमों का आयोजन किया। आम जनता में स्वच्छता के प्रति जागरूकता बढ़ाने के लिए विभिन्न प्रकार के कार्यक्रम आयोजित किए गए। इस दौरान उच्च प्रौद्योगिकी केन्द्र ने गाजियाबाद के वसुंधरा में स्थित लाल बहादुर शास्त्री सुदर्शनम बाल आश्रम (अनाथालय) के बच्चों को स्कूल बैग के साथ स्वच्छता किट जिसमें मास्क, हैंड टावल, सैनिटाइजर, डिटोल साबुन व खाने का सामान दिया। इसके अलावा स्टेनलेस स्टील के डस्टबिन, वाइपर्स, डिस्पेंसर व लिक्विड बोटल भी दिये। अनाथालय के संचालक श्री हरिन्दर सिंह व श्रीमति गीता व उनके अन्य कर्मचारी बहुत खुश हुए और उच्च प्रौद्योगिकी केन्द्र का आभार व्यक्त किया। उच्च प्रौद्योगिकी केन्द्र के अधिकारियों और कर्मचारियों



स्वच्छता पखवाड़ा 2020 के अवसर पर सीएचटी के अधिकारियों के बच्चों के लिए चित्र कला प्रतियोगिता का आयोजन किया गया।

के लिए स्वच्छता पर अनेक प्रतियोगिताएं आयोजित की गयी। अधिकारियों व कर्मचारियों के बच्चों के लिए चित्र कला प्रतियोगिता व उनकी स्पाउज के लिए स्वच्छता पर भाषण प्रतियोगिता का भी आयोजन किया गया और स्वच्छता पखवाड़ा के समापन समारोह पर विजयी प्रतिभागियों को कार्यकारी निदेशक श्री के.के. जैन द्वारा पुरुस्कृत किया गया।



स्वतन्त्रता दिवस 2020

15 अगस्त 2020 को सीएचटी कार्यालय में स्वतन्त्रता दिवस समारोह का आयोजन किया गया। सीएचटी अधिकारियों एवं कार्यालय के सभी कर्मचारियों के साथ मिलकर श्री के.के. जैन, कार्यकारी निदेशक महोदय ने सुबह 9 बजे ध्वजारोहण किया। इस अवसर पर श्री के.के. जैन, कार्यकारी निदेशक महोदय ने देश के सभी सफाईकर्मी, पुलिसकर्मी, डॉक्टर्स, सिकोर्टी गार्ड, मिलटरी आदि को दिल से धन्यवाद दिया। उन्होने कहा कि कोरोना काल के इस मुश्किल समय में हमारे देश के सफाईकर्मी, पुलिसकर्मी, डॉक्टर्स सिकोर्टी गार्ड, मिलटरी आदि को मैं दिल से धन्यवाद देता हूँ कि उनकी वजह से आज हम सब सुरक्षित हैं और हमें भी उनका पूरा सहयोग करना चाहिए ताकि इस कोरोना जैसी महामारी से जल्द से जल्द निजात मिल पाये। अंत में श्री के.के. जैन, कार्यकारी निदेशक महोदय ने समारोह



श्री के.के. जैन, कार्यकारी निदेशक, सीएचटी, ने 74वें स्वतन्त्रता दिवस के अवसर पर सीएचटी कार्यालय के परिसर में ध्वजारोहण किया एवं सभी अधिकारियों एवं कर्मचारियों को शुभकामनाएँ दी।

में उपस्थित सभी लोगों को 74वें स्वतन्त्रता दिवस की शुभकामनाएँ दी और जय हिन्द, जय भारत के नारे के साथ अपने शब्दों को विराम दिया।

‘न्यू नॉर्मल’ पर तकनीकी कार्यशाला

ज्ञान और जानकारी साझा करने के लिए सीएचटी के उद्देश्यों के अनुपालन में, 24 अगस्त 2020 को ‘न्यू नॉर्मल’ पर सीएचटी में एक तकनीकी कार्यशाला आयोजित की गई थी। कार्यशाला के दौरान, इन हाउस संकाय ने ‘न्यू नॉर्मल’ में कार्यस्थल पर अपनाये जाने वाली नई प्रथाओं के बारे में अधिकारियों को बताया। कार्य स्थल पर पूरी सावधानी बरते हुवे, इस अवधि का उपयोग हमारे व्यावसायिक लक्ष्यों और उद्देश्यों की समीक्षा करने एवं सुधारात्मक कार्यवाई लेने के लिए किया जाना चाहिए। ‘न्यू नॉर्मल’ के दौरान व्यापार प्रक्रियाओं में एवं बाजार में हिस्सेदारी बनाए रखने की चुनौतियां जटिल हैं तथा उन पर चर्चा हुई। वर्तमान पेट्रोलियम उत्पाद की मांग को ध्यान में रखते हुए, भविष्य में ऊर्जा क्षेत्र यानी

नवीकरणीय, जैव ईंधन और पेट्रोकेमिकल्स में प्रमुख अवसर मौजूद हैं। व्यावसायिक प्रक्रियाओं में ऑटोमेशन और डिजिटलाइजेशन को अपनाना, आर्टिफिशियल इंटेलिजेंस, ऑयल एंड गैस सेक्टर में नई और क्लीनर टेक्नोलॉजीज, नया जनादेश है। ऑयल सेक्टर में व्यापार की निरंतरता बनाए रखने के लिए मुख्य अनिवार्यता है इकोनॉमिक स्टिमुलस पैकेज, सुनिश्चित कर्मचारी सुरक्षा, उपभोक्ता व्यवहार, आपूर्ति श्रृंखला प्रबंधन और लोअर क्रूड प्राइस के साथ कार्यशील पूंजी का संरक्षण करते हुए आपूर्तिकर्ता के पारिस्थितिकी तंत्र से जुड़ना। सरकार की सहायता के साथ उद्योग द्वारा किए गए सही प्रयासों के हस्तक्षेप से, हमारे देश की अर्थव्यवस्था निश्चित रूप से वापस उछाल देगी।

**जीवन में जब तक जीना है तब तक सीखना है।
अनुभव ही जीवन का सर्वोत्तम शिक्षक है।**

— स्वामी विवेकानंदा

हिन्दी पखवाड़ा 2020

उच्च प्रौद्योगिकी केन्द्र में 14 सितम्बर से 28 सितम्बर 2020 तक हिन्दी पखवाड़े का आयोजन किया गया जिसका शुभारंभ 14 सितम्बर 2020 को श्री के.के. जैन, कार्यकारी निदेशक महोदय ने किया। हिन्दी पखवाड़ा अवधि के दौरान अनेक प्रतियोगिताएं आयोजित की गयी जिसमें उच्च प्रौद्योगिकी केन्द्र के सभी अधिकारियों एवं कर्मचारियों ने उत्साहपूर्वक भाग लिया। समापन समारोह में मुख्य अतिथि के तौर पर उपनिदेशक (हिन्दी), पेट्रोलियम एवं प्राकृतिक गैस मंत्रालय, श्रीमति

शोभना श्रीवास्तव जी उपस्थित रही और हिन्दी में काम करने की प्रेरणा दी। इस अवसर पर मुख्य अतिथि श्रीमति शोभना श्रीवास्तव जी एवं श्री के.के. जैन, कार्यकारी निदेशक महोदय ने हिन्दी पत्रिका 'राजभाषिका सुरभि 2020' का विमोचन अपने कर कमलों से किया। मुख्य अतिथि तथा कार्यकारी निदेशक महोदय ने समारोह के समापन पर विजयी प्रतिभागियों को पुरुस्करत किया गया और सभी प्रतिभागियों का होसला बढ़ाया।

हिन्दी पखवाड़े की कुछ झलकियाँ



हिन्दी पखवाड़े के उद्घाटन के अवसर पर माननीय पेट्रोलियम और प्राकृतिक गैस एवं इस्पात मंत्री श्री धर्मेन्द्र प्रधान जी द्वारा जारी अपील का पठन श्री के.के. जैन, कार्यकारी निदेशक महोदय द्वारा किया गया



हिन्दी पखवाड़े के समापन समारोह में मुख्य अतिथि श्रीमति शोभना श्रीवास्तव, उपनिदेशक (हिन्दी), पेट्रोलियम एवं प्राकृतिक गैस मंत्रालय एवं श्री के.के. जैन, कार्यकारी निदेशक महोदय ने हिन्दी पत्रिका 'राजभाषिका सुरभि 2020' का विमोचन अपने कर कमलों से किया

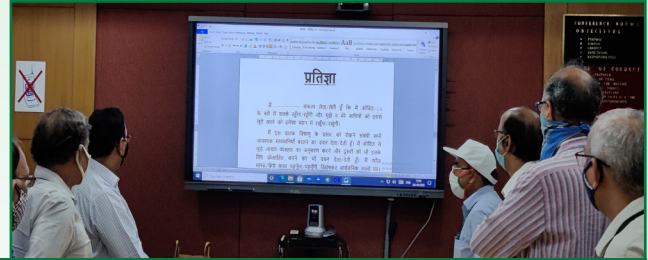




CHT में जनांदोलन COVID अभियान

हाल ही में, CHT ने जनांदोलन COVID अभियान में भाग लिया और COVID-19 को रोकने के लिए संदेश फैलाने के लिए CHT परिसर और OADB भवन में विभिन्न

बैनर लगाए। इस अवसर पर, श्री के.के. जैन, कार्यकारी निदेशक, सीएचटी ने 08 अक्टूबर 2020 को सभी सीएचटी अधिकारियों को शपथ दिलाई।



श्री के.के. जैन, कार्यकारी निदेशक, सीएचटी, 08 अक्टूबर 2020 को जनांदोलन के अवसर पर सीएचटी अधिकारियों को कोविड-19 को रोकने के लिए संदेश फैलाने की शपथ दिलाते हुए

एकता दिवस

भारत के लौह पुरुष सरदार वल्लभ भाई पटेल की जयंती समारोह के अवसर पर 31 अक्टूबर 2020 को उच्च प्रौद्योगिकी केंद्र में राष्ट्रीय एकता दिवस मनाया गया। COVID-19 दिशानिर्देशों को बनाए रखते हुए,

श्री के.के. जैन, कार्यकारी निदेशक, सीएचटी ने सभी अधिकारियों को ऑनलाइन शपथ दिलाई। इस अवसर पर सभी सीएचटी अधिकारियों शामिल हुए।

उच्च प्रौद्योगिकी केंद्र में पेट्रोलियम एवं प्राकृतिक गैस मंत्रालय द्वारा राजभाषा का निरीक्षण

भारत सरकार के पेट्रोलियम एवं प्राकृतिक गैस मंत्रालय की उपनिदेशक (राजभाषा), श्रीमती शोभना श्रीवास्तव जी ने राजभाषा के कार्यान्वयन में हुई प्रगति का आंकलन करने के लिए, 25 नवंबर 2020 को उच्च प्रौद्योगिकी केंद्र (सीएचटी) में राजभाषा निरीक्षण किया। इस अवसर पर सीएचटी की हिंदी कार्यान्वयन समिति के अध्यक्ष एवं कार्यकारी निदेशक, श्री के.के. जैन महोदय ने सीएचटी में श्रीमती शोभना श्रीवास्तव का स्वागत किया। उन्होंने हमारे दिन-प्रतिदिन के कामकाज में राजभाषा की कार्यान्वयन पर सीएचटी की प्रतिबद्धता को फिर से दोहराया। इस अवसर पर श्रीमती रेनु रैना, संयुक्त निदेशक और सदस्य,

हिंदी कार्यान्वयन समिति, सीएचटी, श्री सत्यवीर सिंह, अतिरिक्त निदेशक (मानव संसाधन) और हिंदी कार्यान्वयन समिति, सीएचटी के सदस्य, कार्यकारी सचिव, श्री विजय सिंह भी मौजूद थे। पेट्रोलियम और प्राकृतिक गैस मंत्रालय द्वारा उपलब्ध कराई गई प्रश्नावली के आधार पर उच्च प्रौद्योगिकी केंद्र में राजभाषा कार्यान्वयन की समीक्षा की गई। श्रीमती शोभना श्रीवास्तव ने भारत सरकार की राजभाषा नीति, नियमों और कार्य पर प्रकाश डाला और हिंदी कार्यान्वयन की दिशा में सीएचटी द्वारा किए जा रहे कार्यों की सराहना की। निरीक्षण बैठक का समापन धन्यवाद ज्ञापन के साथ किया गया।



सीएचटी कार्यालय में अंतर्राष्ट्रीय महिला दिवस समारोह

उच्च प्रौद्योगिकी केंद्र ने 8 मार्च 2021 को अंतर्राष्ट्रीय महिला दिवस-2021 मनाया। अंतर्राष्ट्रीय महिला दिवस महिलाओं की सामाजिक, आर्थिक, सांस्कृतिक और राजनीतिक उपलब्धियों का जश्न मनाने वाला एक वैश्विक दिवस है। यह दिन महिलाओं की समानता में तेजी लाने के लिए कार्रवाई का आह्वान भी करता है। इस अवसर पर उच्च प्रौद्योगिकी केंद्र ने 'आधुनिक भारत के निर्माण में महिला का महत्व' विषय पर कार्यशाला का आयोजन किया।

सीएचटी के सभी अधिकारियों ने कार्यशाला में भाग लिया

और अपने विचार रखे। इस अवसर पर महिला शिक्षा और कौशल विकास, विविधता लाने के लिए पारिस्थितिकी तंत्र को मजबूत करने की आवश्यकता, सीखने की संस्कृति का निर्माण, मनोवैज्ञानिक कल्याण सहित कई क्षेत्रों पर चर्चा हुई और अधिक महिलाएं आर्थिक रूप से स्वतंत्र बने इस बात पर जोर दिया गया।

हमारे समाज में एक मजबूत नींव के निर्माण में एक महिला के बढ़ते महत्व को इस अवसर पर दोहराया गया।



"The growth story of India depends on its success in science and technology sector. My motto for the young scientists in this country is - Innovate, Patent, Produce and Prosper. These four steps will lead our country towards faster development."

- Narendra Modi
Hon'ble Prime Minister of India



उच्च प्रौद्योगिकी केन्द्र
CENTRE FOR HIGH TECHNOLOGY
पेट्रोलियम एवं प्राकृतिक गैस मंत्रालय
Ministry of Petroleum and Natural Gas
भारत सरकार
Government of India

गुणवत्ता नीति / QUALITY POLICY

उच्च प्रौद्योगिकी केंद्र (सीएचटी), पेट्रोलियम एवं प्राकृतिक गैस मंत्रालय के लिए समर्पित प्रौद्योगिकी सेल के रूप में हाइड्रोकार्बन सेक्टर के निम्नलिखित क्षेत्रों में कार्य करने के लिए प्रतिबद्ध है।

- ❖ शोधन, ईंधन की गुणवत्ता और पर्यावरण संरक्षण में उत्कृष्टता के लिए तकनीकी सहायता और मार्गदर्शन
- ❖ रिफाइनरी और पाइपलाइन संचालन का बेंचमार्क
- ❖ सतत शोधन कार्यों के लिए निष्पादन, प्रक्रिया एवं ऊर्जा दक्षता और मूल्य संवर्धन में निरंतर सुधार को बढ़ावा देना
- ❖ जैव ईंधन सहित डाउनस्ट्रीम हाइड्रोकार्बन क्षेत्र में अनुसंधान एवं विकास और नवपरिवर्तन को बढ़ावा देना
- ❖ उद्योग के लाभ के लिए नीतिगत ढांचे, विधियों, प्रणालियों और प्रौद्योगिकी के उन्नयन और दक्षता विकास के लिए प्रक्रिया को बढ़ावा देना
- ❖ सभी इच्छुक पक्षों को उनके अनुरोध पर आवश्यकता के अनुपालन के लिए नीति प्रदान करना

Centre for High Technology (CHT) will act as the dedicated technology cell of the Ministry of Petroleum & Natural Gas for the Hydrocarbon Sector committed to:

- ❖ Provide technical support and guidance for excellence in refining, fuel Quality and environment protection
- ❖ Benchmark Refinery and Pipelines operations
- ❖ Promote continual improvement in performance, process & energy efficiency and value addition for sustainable refining operations
- ❖ Promote R&D and innovation in downstream hydrocarbon sector including bio-fuels
- ❖ Promote policy framework, methods, systems and process for updation of technology and competency development for the benefit of the industry
- ❖ To provide this policy to all interested parties on their request and compliance of applicable requirement

आरईवी सं./REV NO. 02
दिनांक/Date: 15.04.2019


(के.के.जैन)/(K.K. JAIN)
कार्यकारी निदेशक, उच्च प्रौद्योगिकी केन्द्र
EXECUTIVE DIRECTOR, CHT

PETROLEUM REFINING & PIPELINE NETWORK



(As on 1st October 2019)

| MAJOR PIPELINES (>500 KM) | | | | |
|---|---|----------------|------------------|-------------|
| Owner | Name of Pipeline | Dia in Inch | Capacity (MMTPA) | Length (KM) |
| CRUDE OIL (Total length = 10419 KM) | | | | |
| IOCL | Salaya Mathura Pipeline | 42/28/24 | 25.0 | 2660 |
| | Mundra Panipat Pipeline | 28/22 | 8.4 | 1194 |
| | Paradip Haldia Barauni Pipeline | 48/36/30/18 | 15.2 | 1447 |
| OIL | Dulajani-Digboi- Bongaigaon | 16/14 | 8.4 | 1193 |
| | Barauni- Pipeline | | | |
| JV | HMEL (JV with HPCL) Mundra – Bhatinda Pipeline | 28/30 | 11.3 | 1017 |
| | BPCL (JV with BPCL) Vadinar – Bina Pipeline | 24 | 7.8 | 937 |
| CAIRN | Mangat Bhogat Pipeline | 24 | 8.71 | 688 |
| PRODUCT (Total length = 14063 KM) | | | | |
| IOCL | Koyali Sanganer Pipeline | 22/18/16/12/10 | 4.6 | 1644 |
| | Barauni Kanpur Pipeline | 20/12 | 3.5 | 857 |
| | Haldia Barauni Pipeline | 12 | 1.25 | 526 |
| | Chennai Trichy Madurai Pipeline | 14/12/10 | 2.3 | 683 |
| | Paradip Raipur Ranchi Pipeline | 18/16/14/12/10 | 5.0 | 1073 |
| BPCL | Mumbai Mammad Bijwasan Pipeline | 18/14/16/8 | 6.0 | 1389 |
| HPCL | Mumbai - Pune - Solapur Pipeline | 14/12 | 4.3 | 508 |
| | Visakh - Vijayawada - Secunderabad Pipeline | 18/16/12 | 5.38 | 572 |
| OIL | Mundra - Delhi Pipeline | 18/16 | 5.0 | 1054 |
| | Numaligarh - Siliguri Product Pipeline | 16 | 1.72 | 654 |
| LPG (Total length = 3381 KM) | | | | |
| IOCL | Paradip Haldia Durgapur Pipeline | 12/10 | 1.15 | 673 |
| GAIL | Jammagar - Loni Pipeline | 16/14/12/8 | 2.5 | 1414 |
| | Vizag-Secunderabad Pipeline | 12/10 | 1.33 | 618 |
| GAS (Total length = 16324 KM) (MMSCMD) | | | | |
| GAIL | HVI (Hazira Vijalpur Jagdishpur)- GREP (Vijaipur-Dadri)-DVPL(Dahej) Vijalpur + spur lines | 36 | 53.0 | 4554 |
| | DVPL(Dahej Vijalpur) - GREP(Vijaipur-Dadri) upgradation (DVPL-II & VDPL) | 48 | 54.0 | 1385 |
| | Dadri Bawana Nangal | 36/30/24/18 | 31.0 | 852 |
| | Dahej - Panvel - Dabhol | 30/18 | 19.9 | 928 |
| | Dabhol - Bengaluru | 36/4 | 16.0 | 1116 |
| | Gujarat - Bharuch, Vadodara Ex Hazira | 24/16 | 15.42 | 685 |
| North Gujarat (Ahmedabad) | | 14 | NA | |
| | | 12 | 2.91 | |
| KG basin | | 18 | 16.0 | 884 |

Legend

- Crude Oil Pipeline
- Ongoing Crude Oil Pipeline
- Product Pipeline
- Ongoing Product Pipeline
- LPG Pipeline
- Ongoing LPG Pipeline
- Gas Pipeline
- Ongoing Gas Pipeline
- ★ Refinery (Capacity in MMTPA)
- ★ New Refineries (Upcoming)

उच्च प्रौद्योगिकी केंद्र
(इंजीनियरिंग एवं रणनीति के माध्यम से)
Centre for High Technology
(Ministry of Petroleum & Natural Gas, Govt. of India)



Centre for High Technology
Ministry of Petroleum & Natural Gas

OIDB Bhawan, Tower 'A', 9th Floor, Plot No. 2, Sector – 73
Noida – 201 307, Uttar Pradesh (India)
Website: www.cht.gov.in