आज़ादी का अमृत महोत्सव

सीएचटी
ISO 9001:2015

उच्च प्रौद्योगिकी केन्द्र
पैट्रोलियम एवं प्राकृतिक गैस मंत्रालय, भारत सरकार
Centre for High Technology
Ministry of Petroleum & Natural Gas, Govt. of India

सीएचटी/एसएसी-98/ 3877
CHT/SAC-98/

26 मार्च 2024
26th March 2024

सेवा में/ To,

पेट्रोलियम और प्राकृतिक गैस मंत्रालय की हाइड्रोकार्बन पर वैज्ञानिक सलाहकार समिति के अध्यक्ष, सदस्यगण, स्थायी व विशेष आमंत्रित अतिथिगण।
(संलग्न सूची के अनुसार)
Chairman, Members, Permanent & Special Invitees of Scientific Advisory Committee (SAC) on Hydrocarbons of MoP&NG
(as per list attached)

विषय: पेट्रोलियम और प्राकृतिक गैस मंत्रालय की हाइड्रोकार्बन पर वैज्ञानिक सलाहकार समिति (SAC) की 98वीं बैठक का कार्यवृत्त

Sub: Minutes of 98th Meeting of the Scientific Advisory Committee (SAC) on Hydrocarbons of Ministry of Petroleum & Natural Gas

प्रिय महोदय/महोदया / Dear Sir/Madam,

दिनांक 19 मार्च, 2024 को मुंबई में सम्पन्न, पेट्रोलियम और प्राकृतिक गैस मंत्रालय की हाइड्रोकार्बन पर वैज्ञानिक सलाहकार समिति की 98वीं बैठक के कार्यवृत्त की प्रतिलिपि आपकी सूचना एवं आवश्यक कार्यवाही हेतु संलग्न की जा रही है।

Enclosed please find a copy of the Minutes of 98th Meeting of the SAC on Hydrocarbons of Ministry of Petroleum & Natural Gas held on 19th March, 2024 in Mumbai, for your kind information and necessary action.

सादर,
With kind regards,

भवदीय,
Yours sincerely,

(राजेश सी अग्रवाल)
कार्यकारी निदेशक
(Rajesh C Agarwal)
Executive Director

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26th March, 2024

Minutes of Meeting of 98th Scientific Advisory Committee (SAC) meeting on Hydrocarbons of MoP&NG

98th SAC meeting was held on 19th Mar'24 at Mumbai.

The list of participants is attached as Annexure-I.

The pre-lunch session was chaired by Dr Anil Kakodkar, Chairman SAC, and the post-lunch session was chaired by Prof. AB Pandit, ICT Mumbai.

ED CHT welcomed Chairman, Ms. Sujata Sharma, JS (M&OR), Ms. Varsha Sinha, Secretary (OIDB), other SAC members and Participants to the meeting and thereafter briefed SAC on the agenda of the meeting.

The meeting started with opening remarks from the Chairman and JS (M&OR) followed by detailed deliberation on the role of SAC and CHT in the past in developing eco-system for R&D and innovation in the Oil and gas sector, and the status of commercialization of indigenous technologies in particular in the downstream sector and the way forward.

A. Roadmap for CHT R&D Projects

CHT made a detailed presentation on the role played by SAC/ CHT in development of eco system for R&D and innovation in the Oil and gas industry, particularly in the downstream sector. CHT presented the details of the funding mechanism and the current 17 focus areas of R&D including a summary of the CHT Sponsored Completed R&D Projects, as classified under various heads;

S.No.	Nature of Project	No. of Projects
1	Laboratory level projects (Proof of concept stage)	23
2	Commercialised	18
3	Potential for commercialization	19
4	Studies	26
5	Projects dropped	8
	Total no. of R&D Projects	94

The detailed presentation on the subject is attached as Annexure-II

Chairman raised concern that the challenges due to climate change are growing faster than their mitigation through the Clean Energy Transition which does not seem to be moving at the desired pace. While the marginal improvements are welcome and should continue to happen, there is a need for adoption of more disruptive technologies that can lead to faster transition. This may call for taking bold decisions.

JS(M&OR), MoPNG expressed that climate change has posed an existential challenge before the industry as the energy scenario is uncertain going forward. She observed that the results so far are mixed in terms of commercialization. This forum can guide the industry in the energy

R.D. Agarwal
ED (I/C): CHT

transition in common areas of interest while leveraging on the strength of the R&D of various PSUs. CHT can play a role in defining problem statements to achieve net zero and in the demonstration of projects requiring big-ticket investment. She expressed that requests are received for small items, which are continued to be imported due to a lack of attention and proper technology. Indigenous technology would make the country Atmanirbhar in many of such items.

Sh R Ramachandran, ex Director (R), BPCL expressed that the issue of transition requires intense and collective engagement both by industry and academia.

Dr Ashish Lele, Director, NCL emphasised that academia is handicapped in carrying out techno-economic analysis. As a result, development beyond TRL-4 becomes difficult. He mentioned that new models for demonstration are emerging and cited the example of Hydrogen Valley for end-to-end demonstration.

Prof AB Pandit emphasised that refineries need to transition from fuel to petrochemicals. Oil PSUs need to come together in feedstock management as scale to bring down the cost.

Dr RK Malhotra mentioned that the commercialisation of indigenous technologies would necessitate taking higher risks. Many of the indigenous technologies have been used for captive use but their adoption by the industry is very poor and the industry continues to rely on imported technologies, even though competitive indigenous technology is available.

Director (R), IOCL highlighted Green hydrogen, the use of sewage waste for meeting refinery water requirement and CO_2 utilisation as primary areas of focus. She also highlighted approval and regulatory issues in the adoption of green hydrogen.

Chairman expressed that PSUs are in market competition with each other. While they do make significant investments in R&D, there are limits to failure risks, which are inherent in R&D, that they can manage. There is thus a need for taking a national approach to funding demonstration projects in key disruptive areas.

One of the major impediments in the promotion of innovation and cutting-edge indigenous technology is arising from PQC of PSU refineries, disqualifying technologies if demonstrated for captive use. Also, many technologies have reached a significant level of development but need collaboration in further scale-up and commercialization to reduce risk and sharing of capex. He recalled that a few years back, the issue was extensively deliberated, and it was suggested that PSU refineries in their PQC, after due diligence, should allow qualification of indigenously developed technologies of other PSUs, even if the same has been demonstrated in a refinery for captive use only, and consider them for techno-economic evaluation along with other competing technologies. Chairman also mentioned that setting up of a catalyst plant was suggested to leverage research and competitive advantage and to achieve scale of economy at global scale. HPCL mentioned that they are continuing to explore setting up of such a plant.

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SAC suggested that to improve the commercialization of indigenous technologies/ products, more emphasis and handholding among various Institutes is required avoiding conflict of interest. If required, due diligence on the technology may be done by an expert committee with external members. SAC advised CHT to compile the information on key technologies/ products developed by various downstream R&D centres and share it with all PSUs.

SAC also suggested CHT to come out with a paper reviewing key technological disruptions to facilitate a faster clean energy transition and identify around three cutting edge technologies that are at a level ready for setting up demo plants. After a review in SAC, these can then be recommended to be taken up as a national programme.

Action by: CHT/IOCL/HPCL/BPCL/GAIL/EIL/IIP

B. PCRA R&D Projects

PCRA was funding R&D projects pertinent to energy conservation & Development of efficient Technologies.

- PCRA R&D promotion scheme do not require Oil PSUs as Industrial partner.
- PCRA contribution was limited up to Rs. 42 Lakhs.

PCRA R&D projects transferred to CHT:

S.No	Project Name	Research Institute	Project Duration (in Months)	Project Start Date	Project End date
1	Design and development of a micro turbine combustor working on biogas	IIT Jodhpur	24 + 4+2 Completed	23.08.2021	23.02.2024
2	Design and Development of Inline Bio-methane Enrichment and CO2 Separation System	CSIR- CMERI Ludhiana	18+3+3 Completed	16.07.2021	15.10.2023
3	Interventions to Improve Performance of Combustion System in MSMEs	IIT Delhi	24+6 Completed	16.07.2021	15.01.2024
4	Performance Evaluation of a Bio gas Integrated Semi-Transparent Photovoltaic Thermal (SPVT) collectors (Bi-SPVT)	RGIPT Amethi	24+6 Completed	16.07.2021	15.01.2024
5	Development of Encaapsulated Asphalt Rubber PaVEment (EARPAVE) product for Road Applications.	IIT Tirupati	24+6 Completed	16.07.2021	15.01.2024
6	Identification of the most critical locations having the highest impact on traffic in case of vehicular breakdown	CRRI Delhi	18+6 Under Progress	29.07.2022	28.07.2024
7	Design and Development of a fuel flexible burner for domestic and community cooking applications	IIT Hyderabad	24 Under Progress	16.06.2022	15.06.2024
8	Design and Development of Integrated Spouted Bed Roaster	CFTRI Mysore	24 Under Progress	29.07.2022	28.06.2024
9	Development of New Energy Efficient Porous burner (Stove) for Domestic cooking with PNG	IIT Kharagpur	24 Under Progress	22.12.2022	21.12.2024

It was informed that out of 9 Projects 5 projects have been completed & the remaining projects shall be completed by Dec'24.

CHT proposed that PCRA R&D Projects (without PSU Partner) may follow the same approval, review and closure process in line with current practice followed for other CHT funded projects.

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New projects under PCRA domain areas will be put up to EC after recommendation of SAC in line with current practice of CHT R&D projects.

SAC approved the same.

Action by: CHT

C. PM JI-VAN Yojana:

At the outset Chairman reiterated earlier discussion on the need to look at 2G biofuel deployment on a technology agnostic basis and necessary policy correction in this scheme. Further the impact on rural economy and the need to address socio-economic aspects of biomass supply chain in a manner that does not become exploitative of marginal farmers and at the same time assures reliability of supplies at competitive prices, was also reemphasized.

1. <u>Status of RFS-I projects</u>

CHT has so far floated RFS (Request for Selection) documents 4 times under PM JI-VAN Yojana.

Four Commercial plants from IOCL, BPCL, HPCL & ABRPL & 1 Demo plant from IOCL R&D has been approved under RFS-I.

Status of RFS-I projects:

PSU	Location	Capacity (KLPD)	Feed- stock	Project Cost (₹ crore)*	Expected Commissioning
IOC	Panipat	100	Rice Straw	909.00	Commissioned Mar 2023
ABRPL	Numaligarh	185	Bamboo	3250.00	Mech. Comp. Feb 2024
BPC	Bargarh	100	Rice Straw	1397.00	Mar 2024
HPC	Bathinda	100	Rice Straw/Cotton Stalk	1421.46	Aug 2024

Milestone for Commercial Plants:

	IOCL	ABRPL	BPCL	HPCL
Mechanical Completion date	Completed (Mar 23)	Completed (Feb 24)	Mar 24	Aug 24
25% annual Production Capacity	Feb 2025	Jan 25	Sep 25	Aug 25
75% annual production capacity	Feb 2026	Jan 26	Feb 27	Aug 26

Milestone for Demonstration Plant:

	IOCL (Demo)
Mechanical erection of the project Completion date	Apr 24
Upon achieving ethanol capacity of 50% of rated capacity for 3 months and completion of experiments	Dec 24
After 15 months of (Continuous or cumulative operation at minimum 50% capacity or 3 years of plant whichever is later	Mar 27

CHT mentioned that a stakeholder meeting with Project Developers of RFS-I Projects was held on 29th Dec'23, including technology Licensor M/s Praj. IOCL shared the troubleshooting

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experience of handling the high moisture biomass and the installation of shredders for size reduction. The overload tripping issue and its mitigation measures were also deliberated. IOCL further shared that that the impregnator motor power rating has been increased from 22.5 to 30 KW & recently upgraded to 45 KW in Mar'24. IOCL expressed gratitude to HPCL management for sending their impregnator to IOCL Panipat plant. IOCL, Dir (R) stated that plant is currently running at 25-30% capacity and is expected to run at 60% capacity in 2 weeks' time.

SAC complimented IOCL for sharing their troubleshooting/ learning experience which is helping in plant execution works of other Project Developers. SAC inquired whether the assessment of remaining part of the technology has been conducted, IOCL explained that the plant is expected to reach 60% capacity utilisation and post stabilisation at 60% capacity utilisation, the overall plant performance can be evaluated. IOCL further expressed concerns over plant capacity increment above 60% capacity and informed SAC that their team is working with OEM & Licensor M/s Praj on the way forward.

SAC expressed that controlling moisture in the biomass within a narrow limit might be unrealistic. Alternate ways of dealing with this issue may be necessary.

Action by: CHT/IOCL/HPCL/BPCL/ABRPL

2. Update on approved projects under RFS-III

CHT shared the status of approved projects under RFS-III. Progress of the projects is tabulated as under:

PSU	Location	Capacity (KLPD)	Feed stock	Project Cost/ Financial Assistance Approved, ₹ crore	Current Status
MRPL (Comm)	Karnataka	60	Corn Cob	950/100	As the Project cost is based on 2021 prices, MRPL is revalidating the project cost and planning to obtain fresh Board Approvals from MRPL and ONGC Boards (meeting in March'24) for investment support.
SIMPL (Comm)	Karnataka	150	Bagasse	960/150	**PD withdrawn from the Scheme**
HPCL (Demo)	Bihar	3	Rice Straw/ Bagasse	150/15	• Basic Engineering Design package (BEDP) completed. • Front End Engineering and Design (FEED) in progress. • Draft MoA shared with HPCL, MoA signing to be finalized.
CIPL (Demo)	Punjab	1.2	Wheat / Rice Straw	195/15	**PD withdrawn from the Scheme**

HPCL expressed that MoA can be signed shortly for the demo plant.

SAC noted the same.

Action by: CHT/MRPL/HPCL

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3. <u>Update on Proposals approved under RFS-IV:</u>

CHT shared the status/ progress of approved projects under RFS-IV as under:

Project Developer	Plant Location	Feedstock / Capacity (KLPD)	Technology	Capex / FA ₹ crore	Remarks
Rice Cellulose Pvt. Ltd. (Comm)	Andhra Pradesh	Bagasse/ 100	Praj	1000 / 150	**Extension of 3 months sought From Dec-Mar 2024** PD exploring export of 2G ethanol with EU companies and sought further extension of 1.5 months from Mar – Apr 2024 for financial closure.
JSPL (Comm)	Angul, Odisha	Off gases / 185	Lanzatech	1568 / 150	**PD withdrawn from the Scheme**
Lignopura Agrotech Pvt. Ltd. (Demo)	Maharashtra	Bagasse/ 1.27	In-house	26.5 / 13.25	**MoA signed.**
Godavari biorefineries ltd. (Demo)	Karnataka	Bagasse/3	In-house	36 / 15	**MoA signed.**

SAC noted the same.

Action by: CHT

D. New R&D Projects Proposals

At the outset, SAC suggested to form a sub-committee for detailed deliberation and review of the new proposals before putting up to SAC as was the practice before.

Action by : CHT

1. Biomethane production from petcoke and value-added products of biofertilizer and carbon nanomaterials (Phase – I): Veltech/NIT AP/CPCL

Objective:

- To demonstrate, optimize the process conditions in the Pilot plant for the pretreatment and production of Biomethane in continuous mode of operation.
- To demonstrate, optimize the process conditions in the Pilot plant in purification unit to achieve high purity of biomethane
- To enhance the biomethane production using iron oxide nanoparticle
- To demonstrate byproducts of luminescent nanomaterial production and bio fertilizer from anaerobically digested sludge from the pilot plant.

Project Deliverables:

Product: Biomethane with 95% purity, Petcoke fluorescent material, Iron oxide nanomaterial and Bio fertilizer

Capacity: Petcoke Feed of 100 Kg/day to 100 Tonns/day.

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Project Schedule for each Milestone:

S. No.	Activity	Timeframe (Months)
1	Collection of petcoke from CPCL and its characterization. Procurement of chemicals and equipments Pilot plant operation run for the pre-treatment and production of Biomethane in continuous mode of operation.	8
2	To demonstrate, optimize the process conditions in the Pilot plant in purification unit to achieve high purity of biomethane	4
3	Synthesis of iron oxide nanoparticle To enhance the biomethane production using iron oxide nanoparticle	6
4	To demonstrate by-products of luminescent nanomaterial production and bio fertilizer from anaerobically digested sludge from the pilot plant.	6

Project Funding:

Total Project Cost (₹ lakh)	57.34
Funding by CHT/ OIDB (₹ lakh)	28.67 (22.94 to Veltech, 5.73 to NIT AP)
Funding by PSU partner (₹ lakh)	5.73
Funding by NIT AP (₹ lakh)	11.47
Internal Funding by Veltech (₹ lakh)	11.47
Project Duration (Months)	24
PSU Partner	CPCL

2. Utilizing CO_2 released from biomethane pilot plant for the growth of Algal biomass and extraction of value-added products (Phase – II): Veltech/NIT AP/CPCL

Broad Objective:

- To demonstrate, optimize the process conditions in the Pilot plant photo bioreactors for the utilization of CO2 for the growth of algal biomass.
- To extract and purify the phycocynine as value added by products from the algal biomass
- To synthesis phycocyanin conjugated magnetic iron oxide nanoparticle which act as bioprobe.

Project Deliverables:

Product: Algal biomass – Spirulana, Phycocynine –byproduct and Phycocyanin conjugated magnetic iron oxide nanoparticle- Bioprobe

Technology:

- Technology development for CO_2 sequestration.
- Technology for extraction, purification and characterization of phycocyanin.
- Technology development for the bioprobe

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Project Schedule for each Milestone:

S. No	Activity	Timeframe (Months)
1	Optimization of process conditions for the utilization of CO2 by the algae using existing photobioreactor Harvesting of algal biomass using existing tank and tray dryer	6
2	Extraction and purify the phycocynine using Ultrasound assisted extractor	2
3	Synthesis of phycocyanin conjugated magnetic iron oxide nanoparticle. Application as a bioprobe.	4

Project Funding:

Total Project Cost (₹ lakh)	14.57
Funding by CHT/ OIDB (₹ lakh)	7.285 (to veltech)
Funding by PSU partner (₹ lakh)	1.46
Funding by NIT AP (₹ lakh)	2.91
Internal Funding by Veltech (₹ lakh)	2.91
Project Duration (Months)	12
PSU Partner	CPCL

PI presented proposal 1 & 2 both to SAC.

SAC recalled that a project on algae to oil was undertaken along with CPCL earlier. On prima facie evaluation, SAC was apprehensive about the viability of petoke methanation via bio route.

SAC suggested CHT to share both the proposals to Dr Ashish Lele, Director-NCL to get them reviewed in detail and present it in next SAC meeting. Experience with earlier project on utilising CO2 for algal biomass growth should also be considered while reviewing the phase II (second) project.

Action by: CHT/NCL/Veltech/NIT AP/CPCL

3. Assessment of fitness for repurposing of natural gas pipeline for transportation of hydrogen (HyTrans): IITR/IOCL/BPCL

Broad Objective

Generating knowledge and data for assisting regulatory authority and the industry to develop standard operating procedure including the extent of blending, total pressure, duration, acting stress (Hoop stress) for transporting hydrogen in blended condition through natural gas pipeline for Indian conditions.

Project Deliverables:

- Effect of hydrogen on the mechanical properties of the steel (in welded and un-welded condition) in the existing natural gas pipeline for transportation.

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- Evaluating the safe limit of blending of hydrogen with natural gas for transporting through pipeline
- Developing **nomographs** on the amount of hydrogen absorbed/diffused into the steel as function of H_2 gas pressure, extent of blending and time of exposure
- Developing **nomographs** on the extent of material property degradation as function of H2 gas pressure, extent of blending and time of exposure

Project Schedule for each Milestone:

S. No	Activity	Time period (months)
1	Construction of new building to house the facilities	0-6
2	Identification and sourcing of materials to be tested in order of priority (Responsibility: IOCL)	0-6
3	Design optimisation of the in-house developed high-pressure chamber (Responsibility: IOCL, BPCL)	0-6
4	Design modification and upgradation of in-situ testing chamber	0-6
5	Ex-situ testing at high pressure of H_2 + NG gas blended mixture for 01 virginmaterial (Responsibility: BPCL)	0-18
6	Installation of new facilities (high pressure in-situ tensile test, H_2 determinator etc)	0-12
7	Modelling of amount of H_2 charged as function of pressure and exposureduration	0-24
8	In-situ testing in pure H_2 environment at lower pressure	06-30
9	In-situ testing at high pressure of H_2 + NG gas blended mixture for 01 virginmaterial	12-36
10	Quantification of H_2 charged into the material	12-30
11	Comparison and analysis of results between ex-situ and in-situ study	18-36
12	Comparison and analysis of results between pure H_2 and blend of H_2 + NG	18-36
13	Comparison between modelling and experimentally obtained amount of diffused H_2	18-36
14	Final report submission with recommendation for making policy decisions	24-36

Project Funding:

Total Project Cost (₹ lakh)	1478.68
Funding by CHT/ OIDB (₹ lakh)	689.34 (to IITR)
Funding by IOCL & BPCL (₹ lakh)	689.34
Internal Funding by IITR (₹ lakh)	100
Project Duration (Months)	36
PSU Partner	**IOCL** & BPCL

The PSU partner certificate has been shared by PI, however financial contribution amount has not been submitted by IOCL & BPCL.

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As per the recent approval granted by EC for projects involving multiple PSU partners, CHT proposes equal contribution of CHT, IOCL & BPCL of Rs 459.56 Lakhs each.

PI presented the proposal to SAC.

SAC deliberated on the proposal and enquired about the status of Hydrogen Loop project discussed in 94th SAC meeting held on 3rd Aug'22. SAC expressed that the current proposal is overlapping with the hydrogen loop project discussed earlier.

SAC opined that a comprehensive programme on integrity of pipeline carrying hydrogen blended in Natural gas is important. Aspects related to material degradation as well as pipeline components integrity should be covered. The proposal should take into account the planned scope of the hydrogen loop project and cover complimentary aspects. The project may be finalised taking above into account after discussion with all stakeholders.

Action by: CHT/OMCs/GAIL/Others

E. Review of Ongoing HCF Projects

1. Development & Demonstration of commercially viable Fuel Cell buses based on Hydrogen produced from Multiple Pathways: IOCL/IISc/OEM

Broad Objectives:

a. A comprehensive pilot study to develop and demonstrate clean transportation solution through hydrogen fuel cell technology based on various indigenously designed hydrogen production pathways / indigenously available resources.
b. To indigenously develop and commercialize fuel cell stack / system for heavy-duty buses.
c. Understanding the performance and durability of fuel cell buses under Indian operating conditions
d. To develop and scale up / explore commercially viable hydrogen production pathways from 4 different routes (namely: Biomass gasification, bio-methanation to H_2, solar electrolysis based on three different electrolyzer technologies, and natural gas reforming)
e. Evaluate the technology by executing the field trials on 15 fuel cell buses in Delhi NCR region for a running distance of 20,000 kms and undertaking the techno-commercial evaluation for providing end to end solution for heavy duty buses including cost effective and environmentally friendly production pathways.
f. Developing an understanding of the complexities of hydrogen refuelling station especially in terms of addressing the requirements of heavy-duty fleet.

Physical Progress:

MOU Date	Start Date	End Date	Physical Progress
Dec 2020	Dec 2020	Dec 2023 (IOCL vide mail dated 09/01/2024, requested CHT to extend the project term by 18 months)	60%

Overall Status:

Development & demonstration of oxy-steam biomass gasification-based hydrogen production technology

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- Draft BDEP for 16 kg/hr demo plant received from IISc in Mar'23. The same has been vetted by IOCL design group. The modifications suggested by IOCL have been incorporated and final BDEP received from IISc in Dec'23
- Work is in progress to undertake full scale demonstration of 5 kg/hr hydrogen generation using four columns VPSA
- Testing of agro-residue briquettes with varying ash content in 5 kg/hr system under oxy-steam mode is in progress.

Way forward

- Finalization of technical specification & tendering for setting up of demo plant - Apr'24
- Setting up 10 kg/hr demo plant - Jun'25

Creation of Solar based H_2 production and dispensing station

A. Solar PV Infrastructure

- P.O. placed to M/s Sun Photonics Pvt Ltd for supply and installation of 1 MWp Solar PV system- July'22
- Installation and commissioning of the Solar PV System has been completed.

B. Hydrogen Infrastructure

- Purchase order placed to M/s Eastern Electrolyser Ltd (EEL), Noida- Sep '21
- Design package submitted by vendor -May'22
- P.O.s placed by vendor for the supply of stacks (Alkaline, PEM SOEC), storage tubes, compressors, dispensers to the respective OEMs- Oct'21-Mar'22
- Civil construction work at site is almost complete for making the site ready for installation.
- Application for consent to establish the H_2 station has been submitted offline to PESO, Nagpur- Oct'22
- Meeting held with PESO Nagpur regarding CTE- Nov'22, Mar'23 and Oct'23
- Consent to Establish (CTE)-PESO approval obtained for setting up of the facility- Nov'23
- ***Manufacturing status of equipments-***
    - Alkaline and PEM systems – Manufactured and FAT completed.
    - SOEC- under manufacturing
    - Compressors- Received at EEL works, PESO compliance pending.
    - Storage systems: Type 1- Received at EEL, PESO approval pending, Type 3- Received at EEL, Type 4- Manufactured and available at vendor's Works, Hexagon Purus Gmbh, Germany, PESO approval pending.
    - Dispensers- Manufactured at vendor's Works, PEC, Italy, PESO approval pending.
- ***Major Concerns:***
    - Delay in PESO Approvals for equipment (Type 1 and Type 4 Cylinders, Dispenser, compressor)
    - Delay in supply of ready equipment by M/s EEL at IOC site
- ***Way forward***
    - PESO approvals of the pending equipments

- Supply of all the equipments of H2 Infrastructure by M/s EEL
- Installation and commissioning of H2 Infrastructure

Supply of 15 Nos. Fuel Cell Buses

- An order for supply of 15 number of Hydrogen PEM fuel cell electric buses was placed to Tata Motors Limited. Additionally, a MoU executed between Tata Motors and IOCL for joint research on fuel cell development.
- Two prototypes (2/15 non-homologated buses) developed by TML have been supplied to IOC for trials. – **Jul'23**
- Approvals pertaining to testing & trials of non-homologated buses on specific routes (in Delhi NCR) were obtained from MoRTH**- Jul'23**
- Trials on two non-homologated started from 27.09.2023 **–Sep'23**
- Completed milestone "**Obtaining necessary approval and completion of Trials on First Two Buses**"- **Oct'23**
- Homologation certification qualifying AIS 157 & CMVR rules granted to TML. Certification document pertaining to homologation are awaited from TML**–Dec'23**
- Additional six buses (8/15) homologated fuel cell buses have been supplied to IOCL **(Dec'23, Jan & Feb'24).**
- Commissioning by a team of Tata Motors on six fuel cell buses is underway at IOC R&D.
- A total of ~13000 kms have been accrued till date on two non-homologated buses on approved routes in Delhi NCR region. **– Feb'24**
- Data acquisition protocols have been finalized with TML. Mutually agreed performance parameters of fuel cell bus pertaining to Fuel cell system, Powertrain, CHSS to be shared by TML for undertaking in depth analysis of performance of FC buses.

IOCL shared that 8 buses have been delivered and sought extension of 18 months for the completion of the following:

- Supply of additional 7 fuel cell buses, commissioning, STA/RTO approvals & commencement of trials on homologated fuel cell.
- Devising field test plan of FC buses for different operating conditions & drive scenarios
- Data analysis to establish the operational reliability, efficiency, and efficacy of fuel cell buses/technology for passenger transport.
- IOCL shared supply disruptions due to COVID and delay in regulatory approvals have led to delay in project execution.

SAC approved the extension of the project by 18 months till Jul'25.

Action by: CHT/ IOCL/IISc/OEM

R.K. Agarwal
ED (I/C): CHT

2. Cost Effective Hydrogen production through Membraneless Electrolyzer & Storage: HEB/OEC

Project Objective:

a. Design, Development, and Demonstration of indigenous Membraneless Electrolyzer for hydrogen production.

The objective is to design and develop indigenous electrolyzers for hydrogen production at an affordable cost. The design seeks to remove the use of expensive membranes in the electrolyzers and reduce the use of expensive materials like titanium and noble metals considerably. Water electrolysis will be conducted through these innovative electrolyzers to produce Hydrogen and oxygen with minimal to nil environmental impact.

b. Compressed hydrogen storage and evaluation of Hydrogen produced using PEM fuel cell stack.

Regarding storage, Hydrogen can be stored in the compressed, liquified, and solid state. Since the density of Hydrogen is very low 0.089 kg/m3, as such storing in gaseous form requires compression to high pressures. In this project, the commercially available Type III and Type IV tanks which can store Hydrogen at 350 bars or 700 bar, is considered. The storage pressure on these cylinders shall typically be around 50 –100 bars. The hydrogen storage circuit incorporates the necessary BoP, processing, compression, and safety systems. The generated Hydrogen through the above concept will be evaluated with PEM Fuel Cell stack at stages for data generation. The generated data will be useful for the next phase of scale up and commercialization.

Physical Progress:

MOU Date	Zero Date	End Date	Physical Progress
10 FEB-2023	10 Mar 2023	10 Mar 2025	35%

Financial progress (Figures in Rs. crore):

- Sanctioned fund: Rs. 6.08
- CHT approved fund: Rs 3.04
- Fund released so far: Rs 1.88

Overall Status:

- Reactor & electrode design –Completed
- CFD analysis for 30 mm, 150 mm,300 mm reactor -Completed
- Inlet flow distributors & outlet flow collectors design – Completed
- CFD for Inlet flow distributors & outlet flow collectors-Completed
- Electrocatalyst was tested under different current density of 0.200 mA/cm^2 & 0.500 mA/cm^2 at different substrate - Completed
- Exploration of bimetallic catalyst for hydrogen evolution reaction (HER) & oxygen evolution reaction (OER)- Completed
- Design of cell stack -Completed
- Evolution of 30mm reactor in cell voltage of 2.25 V at an electrolyte flow rate of 1.7 LPM

R.C. Agarwal
ED (I/C): CHT

(27°C in 6M KOH)- Completed

- BoP Schematic design for 30mm reactor -Completed
- Design /process development with BoP for 3 kW electrolyzer (hydrogen generation) P&ID - Completed
- Design/Process development with BoP for hydrogen compression/storage Under progress
- Procurement of Hydrogen storage cylinders & hydrogen safety sensors – Completed
- Establishment of required infra/facilities – Under progress

Further milestones in the project are as follows:

- Membraneless 30 mm reactor demonstration at the HEB facility, April/May 2024
- Membraneless 3 kW electrolyzer hydrogen generation system demonstration with BoP at HEB facility, June/July 2024
- Membraneless 3 kW electrolyzer hydrogen generation / compression / storage demonstration with BoP at the HEB facility, Dec 2024 /Jan 2025

In response to queries raised by SAC, HEB indicated that

- The purity of hydrogen generated from 3 kW membraneless electrolyzer will be checked during the demonstration as per the hydrogen purity indicated in the MOA.
- Hydrogen generation will be 1kg/day for 3kw electrolyser system as given in the MOA.

SAC noted the above and observed that the project is progressing as per the milestone.

Action by: CHT/ HEB/OEC

3. Design, Development & Demonstration of PEM Fuel Cell Technology: HEB/IOCL/GAIL

Objective:

a. Design, Development and Demonstration of 1 kW Polymer Electrolyte Membrane Fuel Cell (PEMFC) and further scaling up for 2.4 kW with Target Specification of 42V / 2400W with Hydrogen & Air from gas cylinders.
b. Membrane developed by Amrita will be evaluated in this phase and if found satisfactory, scale up for use in subsequent phase of commercialization. In this phase, demonstration is planned with Nafion and test/evaluation with indigenous membrane.
c. **Technology development:** Hydrogen generation through Sodium borohydride hydrolysis by Amrita. Proposed to work and establish process for generation so that the same can be coupled with Fuel Cell as a complete system in the next phase of work while use of compressed gas cylinder can be avoided, such needs are there for customer specific applications and or locations.

Physical Progress:

MOU Date	Start Date	End Date	Physical Progress
24-April-2023	May 2023	Apr 2025	30%

Financial progress (All figures in Rs. crore**):**

- Sanctioned fund: Rs. 10.65
- CHT approved fund: Rs 5.32

R.C. Agarwal
ED (I/C): CHT

- Fund released so far: Rs 1.65

Overall Status:

Following activities are progressing as per the milestones:

- Commercial MEA baseline data generation
- Commercial Catalyst Characterization
- Commercial GDL evaluation
- Commercial Graphite evaluation
- 25cm^2 Single cell design
- 1 kW stack design
- Determining the proton conductivity of the membrane
- Catalyst synthesis with chloride precursor
- Hydrolysis of synthesized catalyst
- Reactor system installation and operation

HEB shared the completion date of the following activities:

- Demonstration of 1 kW fuel cell stack, April/May 2024
- Scale up of 1 kW stack to 2.4 kW stack, May / Feb 2025
- Demonstration of 2.4 kW stack using 2 W/ 3 W application with IOCL, Mar / April 2025

In response to queries raised by SAC, HEB indicated that

- Presently HEB is working on a closed cathode as per the project scope, and after completion of the project scope, it will check the feasibility of an open cathode at the unit/multi-cell level.
- HEB indicated that they will check the Gas permeability in graphite plates.

SAC noted the above and observed that the project is progressing as per the milestone.

Action by: CHT/HEB/IOCL/GAIL

4. Development and Scale-up of Indigenous Next Generation Solid Oxide Fuel Cell Technology and Demonstration of Process Line (10 kW) for Prototype Production: HPCL/ARCI/CGCRI

Progress at ARCI (Specific Objectives from May 2023- March 2024):

1. Establishment of civil infrastructure as per floor plan for process-line
2. Procurement of equipments as per the technology
3. Initiation on indigenous development of interconnect formulations
4. Training on technology developed at CGCRI

Physical Progress:

1. Floor plan for the pilot scale facility establishment – jointly made along with CGCRI, minor civil works completed as per the plan to place the equipments, Clean Room of 1 lakh class is ready, electrical fixings are in progress

R.C. Agarwal
ED (I/C): CHT

2. Procurement of raw materials and chemicals – anode, electrolyte powders delivered, cathode powder in-house synthesis will be started after the receipt of the spray pyrolyser, tape-casting additives procurement in process
3. Procurement of processing facility for the fabrication of Half Cells – tape caster PO released, spray pyrolyser PO released, hot air oven purchased, binder burnout furnace purchased, high precision balance purchased, mortar grinder PO released, screen printer procurement initiated, pot jar mill procurement initiated, high temperature furnace procurement initiated, creep flattening furnace procurement initiated, planetary ball mill procurement initiated
4. Procurement of characterization facilities for the testing of SOFC half cells and single cells – contour measuring system procurement initiated
5. Interconnect formulation development – powders received, batch formulations completed, compaction under different loads completed, binder burnout step completed, H2 sintering is in process

Financial progress (All figures in Rs. lakh):

Received an amount of Rs. 351.00

Expenditure: Rs. 335.00

Progress at CSIR-CGCRI (Specific Objectives from May 2023- March 2024):

1. Establishment of SOFC single cell manufacturing process line in a clean and humidity-controlled room for cell SOP establishment
2. SOP establishment for the SOFC stack for thermal cycling and load cycling
3. Stack fabrication and testing protocol establishment using ARCI developed indigenous interconnects
4. Development of compressive – composite sealants

- 10 cell stack tested in SOFC mode with an endurance of 400 hr. (running condition completed on 27th November – Thermal cycling is being carried out – The stack has been given for the Remote access and the successfully operated with remote access both for the load and thermal cyclabilities – 5 Thermal cyclabilities are complete
- 14 cell stacks tested in the month of March in SOFC mode– The stack is being tested with the Remote access for 5th to 6th thermal cyclability
- Weekly meeting with the consortium partners regarding progress of the project.
- Indent for assorted furnace for translatory research for making SOFC/SOEC cells (04 low temperature upto 1200°C + 02 high temperature upto 1600 °C) for procurement. The file is in process internally and obtained the approval from T & PC committee internally from CGCRI and placing the file for GTE without PAC approval through CSIR HQ – TSC held for the approval.
- GTE has been decided based on the Nabertherm Report stating that Reseller's quote is not accepted and neither their price nor the catalogue is verified by Nabertherm GmbH, and unable provide any patent and thus the decision is made suggested for GTE with multi-currency (without PAC) – Market survey for the GTE has been made and form is being placed to Purchase for finalization.

R.D. Agarwal
ED (I/C): CHT

- Procured of other equipments (through LPC & GeM) i.e., Bottom Loading furnace, Double syringe pump, Temperature controller and other miscellaneous equipments (Vernier caliper, Drilling machine, Air compressor).
- The process of tendering is finalized with the selection of the party for the clean room facility for production of SOFC single cell having the definitive SOPs – Fund Rs. 89.67 lakhs are released from CHT
- Optimization of particle sizes for preparation of flexible compressive sealants – Initial gasket for 50 X cell bipolar / cell holder is fabricated successfully
- The work/construction of clean room facility is going on.

To render training process line demonstration for SOFC single cell making to Team ARCI Hyderabad: As a part of consortium partner under the scope of major responsibilities mentioned in the MoA point number "c" and "d" ARCI (Dr. Suresh Buchi, Dr. Prasenjit Barik, Dr. Amit das) visited CSIR-CGCRI on 31.07.23 to 04.08.23.

The highlights of the visit:

1. Detailed and hands-on experience on batch preparation (Anode layer, anode functional layer, electrolyte, substrate)
2. Detailed and hands-on experience on casting preparation (Anode layer, anode functional layer, electrolyte, substrate).
3. Process of lamination, pressing Firing process (Binder burnout, sintering, creep flattening)
4. Screen printing on half cell (Cathode layer, Cathode functional layer)
5. Demonstration of powder preparation for cathode layer, cathode functional layer
6. Electrochemical testing demonstration on anode based 5x5 cm cell
7. Discussion regarding clean room establishment at ARCI premises
8. Arranged meetings with vendors (Nabertherm, A G enterprises)
9. Demonstration of spray pyrolyser

The following samples have been handed over to team ARCI as a part of research activity:

- SOFC Half Cell (50mm X 50mm) – 01 no.
- SOFC Half Cell (100mm X 100mm) – 01 no.
- SOFC Single Cell (100mm X 100mm) – 01 no.
- SOFC Stack Cell Holder with Cell and Seal for 50mm X50mm Cell – 01 no.
- SOFC Stack End Plate with applied glass seal for 50mm X50mm Cell – 01 no.
- SOFC Stack Bipolar Plate for 100mm X 100mm Cell – 01 no.

Financial progress (All figures in Rs. lakh):

Received an amount of Rs. 198.94

Expenditure: Rs. 147.48

CGCRI & HPCL presented the status of the project.

As the project has the potential to pave the path for electrolyser production in the country, CHT proposed to form Project Steering Committee (PSC) in line with the MoA.

SAC suggested CHT to discuss with Dr Ashish Lele, Director-NCL for finalizing the structure and role of PSC for this project.

Action by: CHT/ HPCL/ARCI/CGCRI/NCL

R.C. Agarwal
ED (I/C): CHT

5. Development of Cost-Effective 2.5 kW PEM Fuel Cell Stack based on Less-Pt Bimetallic Electrocatalysts and Mesoporous Carbon support materials: PSGIAS / PSGiTech / IITP / BPCL

Objective:

To develop a low-cost 2.5 kW PEM fuel cell stack module and pilot plant using durable, mesoporous N- doped carbon support materials with corrosion-resistant metal nitride overlayer coating, integrated with Less-Pt electrocatalysts.

Physical Progress

MOU Date	Start Date	End Date	Physical Progress
Oct 2023	Dec 2023	Oct 2025	10%

Financial Progress (All figures in Rs. lakh):

Total fund required from CHT: Rs 192

Total fund released by CHT: Rs 73

Work done so far:

- Manpower training and purchase of equipments
- Electrocatalysts development and Support materials
- Literature survey, Finalization of specifications of equipments,Purchase of equipments,
- Optimization of synthesis processes of less-Pt bimetallic electrocatalyst materials, CFD Modelling studies, Optimization of MEA fabrication

CHT shared the progress of the project. CHT mentioned that the MoA is signed in October'2023 and the 1st PMC meeting is scheduled on 21st March'24. The order for procurement of capital items has been placed by PSGIAS.

SAC noted the same.

Action by: CHT/PSGIAS/PSGITECH/IITP/BPCL

F. Review of Ongoing R&D Projects

1. Synthetic Aviation Lubricants (SAL) - Phase 2: CSIR-IICT, HPCL & CEMILAC

Objective:

- To prepare 500 kg each of the base oils for SVS-11 and SVS-21 lubricants at CSIR-IICT and carryout preliminary testing.
- Formulation of SVS-11 & SVS-21 lubricants and their physico-chemical testing at HPCL - R&D.
- Testing of both the lubricants for compatibility with elastomers at 3BRD/ HPCL/ IICT and for ground test in Aero engines on test bed in comparison with reference oils and In-flight by IAF with CEMILAC participation.

Physical Progress:

MOU Date	Start Date	End Date	Extension	Physical Progress
Mar 2016	Apr 2016	Sept 2017	Dec 2023	90%

R.D. Agarwal
ED (I/C): CHT

CSIR-IICT had requested CHT to extend the SAL Phase-II project from January to December 2023 to complete the following activities:

a. In-flight test schedule finalization with Air HQ to facilitate flight trials after getting clearance from CEMILAC for SVS-11 oil TV3 aero engine ground test report

b. In-flight testing with SVS-11 oil at 3BRD, IAF

c. Compilation of the data from participating organizations & submission of final report by CSIR-IICT

Observation of 96th SAC (May'23): CHT informed that IICT is still waiting for IAF response for arranging a meeting to discuss about the way forward for inflight testing with SVS-11 Lubricant oil. HPCL has agreed to support and interact with IAF to facilitate flight trials.

PI indicated that as per meeting held at RCMA, Chandigarh on 5th December 2023, it was decided for retesting of the SVS-ll oil (100 lts) to check its stability and shelf life beyond 5 years, before taking up the flight trials. Accordingly, HPCL has taken up the retesting studies during 14th -18th December 2023 in presence of all the stake holders. Since the shelf life testing of SVS-11 oil is still in progress and also the flight test schedule, allotment of TV3-117MT, Al-9V APU and aircraft by Air HQ is pending.

PI further requested CHT for the extension of the SAL Ph-II project tenure from December 2023 to March 2025 without any additional funding.

During the extension period the following activities will be completed.

- Retesting of SVS-II oil (by April 2024)
- Flight Test schedule finalization by Air HQ (after April 2024)

Allotment of engine and aircraft for Flight trails by IF HQ (after May 2024)

- Flight trials by IAF/3BRD (after June 2024)

Compilation of the data from participating organizations & submission of final completion report by CSIR-IICT (January - March 2025)

CHT shared the progress of the project and expressed concern on the poor progress of the project.

SAC observed that the delay in the project is mainly attributed to regulatory approvals etc. and hence SAC advised HPCL to take up the lead and resolve logistic and implementation related issues in the project.

SAC approved the extension of the project by 15 months from Jan'23 to Mar'25.

Action by: CHT/ IICT/HPCL/CEMILAC

R.K. Agarwal
ED (I/C): CHT

2. Development of Clay-based Polymer Composite for Flame Retardant & Heat Resistive Materials: ICTM/BPCL

Objective: To discover the potential efficacy of clay based composite material for flame retardant as well as thermal resistant application as per CHT interest.

Physical Progress:

MOU Date	Project Start Date	End Date	Physical Progress %
Oct 2023	Dec 2023	Apr 2025	15

Financial progress : 78%
Total fund required from CHT: Rs 27.14 Lakh
Total fund released by CHT: Rs 21.2 Lakh

Overall Status of the Activities:

- Initiated the purchase of instruments required to study the fire resistance of the materials to be prepared.
- Literature survey completed.

Plan for next quarter:

- Finalizing the route for designing and making composite material, followed by characterization.
- Installation of instruments, study and analysis of the prepared materials.

SAC noted the progress.

Action by: CHT/ ICTM/BPCL/VFC

3. Integration of parabolic trough solar collectors with multi effect evaporator for reducing the dependency of energy intensive industries over fossil fuels: IIT Roorkee/IOCL

Physical Progress:

MOU Date	Project Start Date	End Date	Physical Progress %
Sep 2023	Oct 2023	Mar 2025	10

Financial progress : 3%
Total fund required from CHT: Rs 21.12 Lakh
Total fund released by CHT: Rs 0.63 Lakh

CHT shared the progress of the project. SAC observed that although the MoA was signed in Sep'23, low progress has been achieved due to general administrative process of the institutes.
CHT informed SAC that PI is in advance stage of capital item procurement with the help of IOCL.

SAC noted the same.

Action by: CHT/IITR/IOCL

R.D. Agarwal
ED (I/C): CHT

4. Catalytic pyrolysis of Multilayer Plastic Waste (MLP) to Value Added Products – A Circular Economy Approach: IITM/VIT Vellore/CPCL/ SWC/ITC

Objective:

- To optimize the process parameters (temperature, catalysts) for different combination of MLP on oil yield.
- To study the impact of feed composition on pyrolysis oil properties.
- To analyse the composition & characterization of oil, gas & char from pyrolysis of non-recyclables and MLP.
- To study the effect of hydrogenation on pyrolysis oil to improve the product quality.
- Techno-economic and environmental feasibility of the above processes will be studied to potentially use the pyrolysis oil in packaging industry as alternate fuel.

Physical Progress:

MOU Date	Project Start Date	End Date	Physical Progress %
Oct 23	Nov 23	Oct 25	10

Financial progress : 7%

Total fund required from CHT: Rs 32.68 Lakh

Total fund released by CHT: Rs 2.31

Overall Status of the activities:

- 10% of the project funds received from CHT and ITC to IIT Madras.
- Literature on catalysts, hydro processing has been reviewed.
- Discussion with fabricators for fabricating the bench scale setup is in progress.
- Received eight different types of multi-layer plastic waste samples from ITC Chennai were received in the second week of Jan 2024.
- Batch pyrolysis trials with five different types of plastics have been completed. Pyrolysis oil, gas and char samples will be analyzed.
- Quotes for bench scale pyrolyzer, lab scale hydrogenator set-up have been received and vendor for pyrolysis set up fabrication is finalized.

Plan for next quarter:

- Fabrication of bench scale pyrolysis setup will be completed.
- Batch pyrolysis trials with optimized parameters will be conducted in bench scale pyrolysis setup.
- Optimization of process parameters for combination of MLPs will be finalized.
- Orders will be placed for lab scale hydrogenation set up, catalyst and other consumables.

SAC suggested CHT to discuss the plastic waste utilisation plans of ITC. CHT indicated that the deliberation would be covered in 1st PMC meeting (schedule in Apr'24).

SAC noted the same.

Action by: CHT/IITM/VIT Vellore/CPCL/ SWC/ITC

R.D. Agarwal
ED (I/C): CHT

5. Nature based solution for the valorization of technical lignin to sequester biogenic carbon in a sustainable circular bio-economy model: TERI/IOCL

CHT shared the progress of the project indicating that the MoA was signed in Jan'24 and the advance amount has been released to TERI. SAC deliberated the importance of this project in context of various 2G ethanol plants which are being put up in the country.

SAC opined that many institutes are working in the field of lignin valorization and someone with background in synthetic organic chemistry can join in the proposal. CHT informed that ICAR scientist is involved in the project.

Physical Progress

MOU Date	Start Date	End Date	Physical Progress
Jan 2024	Mar 2024	June 2026	5%

Financial Progress

Total fund required from CHT: Rs 63.39 Lakh

Total fund released by CHT: Rs 6.04 Lakh

SAC noted the same.

Action by: CHT/TERI/IOCL/ICAR

6. Carbon capture by adsorption process from refinery flue gases at low temperature using novel porous organic polymeric (POP) adsorbents: IICT/BPCL

CHT informed that the MoA was signed in Oct'23 and capital equipment procurement is planned in Next F.Y.

Physical Progress

MOU Date	Start Date	End Date	Physical Progress
Oct 2023	Jan 2024	Oct 2026	10%

Financial Progress

Total fund required from CHT: Rs 243.17 Lakh

Total fund released by CHT: Rs 7 Lakh

SAC noted the same.

Action by: CHT/IICT/BPCL

G. Action Taken Report (ATR) on the SAC deliberated projects on which activities have not commenced

1. Light weight novel Multicomponent High entropy alloy for hydrogen storage application: CSIR-IIP/Midhani, Hyderabad/3Wi Technologies/IOCL

R.C. Agarwal
ED (I/C): CHT

Objectives:

- Novel HEAs with a hydrogen storage capacity of ≥ 3 wt.% at ambient temperature and pressure < 10 bar
- HEA with cyclic stability of more than 10000 cycles
- 85 to 90% recyclable material
- 25 kg of HEA H2 canister generates 0.5 kg of hydrogen
- Lightweight HEA H2 canister with the life span of more than 5 years

Project Schedule: Total Duration: 36 months

Project cost estimate: Rs 167.29 Lakh with contribution of CHT/OIDB Rs 83.65 Lakh under HCF.

SAC recommended the project in its of 93rd meeting subject to IOCL participation. Further the proposal was approved by EC in its 33rd meeting subject to meeting SAC recommendation.

CHT shared the MoA in Aug'22, however IOCL has indicated that similar work is already being done and not pursuing the project further.

GAIL showed the interest in the proposal. CHT to initiate the discussion with PI & GAIL.

Action by: CHT/ IIP/GAIL

2. Enrichment of Biogas to Biomethane using Metal Organic Framework (MOF) based Mixed Matrix Membranes (MMM): IITB/IOCL

Objective:

Development of a defect-free mixed matrix hollow fibre membrane with a suitable MOF as filler, and a technology based on the same for the enrichment of biogas to bio-methane.

Project Schedule: Total Duration: 36 months

Total project Cost: Rs 411.18 Lakh (CHT contribution of Rs 204.14 Lakh & IOCL contribution of Rs 207.04 Lakh)

SAC recommended the project in its of 95th meeting (with deliberation on inclusion of GST). Further the proposal was approved by EC in its 35th meeting.

As PI has withdrawn from the proposal, CHT proposed to drop the project.

SAC approved the closure of the project.

Action by: CHT/ IITB/IOCL

3. Intelligent Leak detection System for oil Pipelines: Bharat Flow Analytics

Objective:

To develop an Intelligent Leak Detection System for Oil Pipelines using Artificial Intelligence (AI) and Internet of Things (IoT) based sensor systems.

Project Cost: Rs 45.97 Lakhs (**Fund required from CHT**: Rs 22.98 Lakhs)
Project Duration: 12 Months

R.K. Agarwal
ED (I/C): CHT

95th SAC deliberated but did not approve the proposal as TRL-3 has not been achieved. SAC further advised PI to either approach DST or seek startup funding from Oil PSU's like HPCL, BPCL, IOCL & ONGC.

PI further informed that it has achieved TRL-3 status in Oct'23, however, IOCL has not agreed to support the project. Hence, CHT proposed to drop the project.

SAC approved the same.

Action by: CHT

4. Process technology for the catalytic dehydration of methanol to dimethyl ether (DME)- Demonstration of 2.5 TPD pilot plant: NCL/IOCL

Project Cost: Rs 3590.74 Lakhs **(cost revised to Rs 70 Cr, without breakup)**

Fund required from CHT: Rs 3590.74 Lakhs

Project Duration: 36 Months

PSU Partner: IOCL, financial contribution to be decided after internal approval.

95th SAC deliberated on the proposal and indicated that the project cost is to be firmed up as fragmented information is presented. IOCL has shown interest in the proposal and shall review the project cost & proposal with NCL. NCL will put up the revised proposal adhering to OIDB funding guidelines of 50 % max of total project cost.

IOCL has indicated that due diligence of the facility/project is scheduled in Mar'24.

SAC noted the same.

Action by: CHT/ NCL/IOCL

5. Inline Inspection Tool for Oil & Gas Pipelines: VDT Pipelines

Objective: To develop Inline Inspection Technology to the extent of Ultrasonic and Crack Detection Tool to improve e safety monitoring and health inspection of Oil and Gas Pipelines to ensure safe and efficient operations of Oil and Natural gas pipelines.

Project Cost: Rs 5.08 Cr

Fund required from CHT: Rs 2.54 Cr

Project Duration: 12 Months

PSU partner: GAIL

96th SAC had deliberated and observed that the proposal lacks the technical information to enable taking decision. The PI was suggested to put up revised proposal with technical details such as functionality of sensors, sensitivity of detection, defined targets of detection etc. The role of Industrial partner, GAIL to be defined. SAC further suggested that GAIL shall be the equal custodian of the technology developed by PI.

As has PI failed to fulfil the recommendation of SAC, CHT proposed to drop the project.

SAC approved the same.

Action by: CHT/GAIL

H. Status by Sub Committee formed for testing of Enzymes

As Dr Tuli, the Team lead could not attend the meeting due to other official engagement, SAC decided to take the discussion in next meeting.

R.K. Agarwal
ED (I/C): CHT

Annexure-I

List of members for 98th meeting of SAC

	Name	Designation	Organization
CHAIRMAN			
1	Dr. Anil Kakodkar	Former Chairman, AEC	BARC
MEMBERS			
2	Prof. A. B. Pandit	Vice Chancellor	ICT, Mumbai
3	Dr. Ashish Lele	Director	NCL, Pune
4	Prof. Lakshmi Kantam Mannepalli	Professor	ICT, Mumbai
5	Prof. Sanjay M. Mahajani	Professor	IIT, Mumbai
6	Dr. R. K. Malhotra	Former Director General	FIPI
7	Sh. R. Ramachandran	Former Director (Refineries)	BPCL
MEMBER SECRETARY			
8	Sh. Rajesh Agarwal	ED (Act. I/C)	CHT & Convener
EX-OFFICIO MEMBERS			
9	Ms. Sukla Mistry	Director (R)	IOCL
10	Mr. Sanjay Khanna	Director (R)	BPCL
11	Mr. S Bharathan	Director (R)	HPCL
12	Ms. Varsha Sinha	Secretary	OIDB
13	Mr. Sanjay Verma	Director (R) (Attended by Mr. V. Nandakumar, GGM-CS)	MRPL
14	Dr H S Bisht	Director (Attended by Dr Sunil Pathak)	CSIR-IIP
PERMANENT INVITEE			
15	Ms. Sujata Sharma	JS (M&OR)	MoP&NG
16	Mr. N Chandrasekharan	Head (R&D)	BPCL
17	Mr. V K Maheshwari	Head (R&D)	HPCL
18	Mr. H Shankar	Head (R&D)	CPCL
19	Mr. R N Maiti	Head (R&D)	EIL
20	Mr. Sanjeev Kumar	Head (R&D)	GAIL
OTHER ATTENDEES			
21	Dr. C. Kannan	ED (CT & TPF)	IOCL
22	Mr. Joydeep Choudhary	ED (PJ)	IOCL
23	Mr. Rajesh Badhe	CGM (R&D)	IOCL
24	Mr. Ravikumar V	CGM (R&D)	BPCL
25	Dr. Bharat Newalkar	CGM (R&D)	BPCL
26	Dr. Jaya Rawat	DGM (R&D)	BPCL
27	Mr. Nandakumar T.	GM (R&D)	GAIL

R.K. Agarwal
ED (I/C): CHT

a) Focus area of Research for CHT

1. Value addition to refinery streams including petrochemicals
2. Water Conservation / waste water treatment
3. Carbon Capture, Utilization and Sequestration (CCUS)
4. Industry 4.0: Digitalization to improve efficiency
5. Bio-fuels: Cost effective Biomass and bio-oil valorisation
6. Waste: Domestic, Municipal, Sewage, Plastic, agricultural, Industrial valorisation
7. Syngas valorisation
8. Hydrogen production and Storage
9. HCNG: mixing and pipeline transportation
10. Batteries & Energy storage systems
11. Gasification of Coal, Pet-coke, Biomass, waste, etc
12. Fuel cell technology
13. Solar energy technologies
14. Electrification of cooking
15. Biotechnology
16. Nanotechnological Interventions
17. Domestic fossil energy: shale gas, gas hydrate, coal bed methane, etc.

b) Summary of CHT Sponsored Completed R&D Projects (Category wise):

S.No.	Project Category	Fundamental Projects	Commercialised Projects	Potential for commercialization	Studies	Projects dropped	Total no. of Projects
1	Bio-Process (B)	1	1	1	0	3	**7**
2	Catalyst (C)	2	1	9	0	0	**12**
3	Environment (E)	6	0	0	4	0	**10**
4	Hardware (H)	2	11	1	3	3	**20**
5	Lubricant (L)	2	0	0	4	0	**6**
6	Simulation / Modelling (M)	5	1	0	2	0	**8**
7	Product (P)	1	0	0	1	0	**2**
8	Study (S)	1	0	0	6	1	**8**
9	Technology Development (T)	1	4	8	4	1	**17**
10	Wax (W)	2	0	0	2	0	**4**
	Total no. of R&D Projects	**23**	**18**	**19**	**26**	**8**	**94**

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c) Financials of R&D Projects (last 6 years)

Figs in ₹ Crore

FY =>	18-19	19-20	20-21	21-22	22-23	23-24	24-25
R&D Projects							
Approved Cost	10.5	0.76	3.48	0	0.42	13.28	35.98*
CHT contribution	3.83	0.76	1.73	0	0.21	6.63	17.08 *
Actual Expenditure	10.43	3.07	1.9	0.51	0.31	1.2	11.53 (6.32*)
HCF Projects							
Approved Cost	65.16	0.00	296.66	0.00	87.91	3.86	21.33**
CHT contribution	25.00	0.00	97.52	0.00	43.92	1.92	10.66**
Actual Expenditure	0.86	7.70	11.23	0.09	11.00	18.50	68.56

***Under EC approval, ** Under EC/GC Approval**

d) Details of R&D Projects (last 5 years)

Sr. No.	Project Title	Organization	Nodal Agency	Approval	Start Date	Close Date	Funding by CHT (in Lakh Rs.)
Closed Projects							
1	Development of 3D CFD Model of Fluidised Bed Coal Gasifier	EIL/BPCL	EIL	26th EC	Nov-19	Mar-23	181.3
2	Design and Development of Fibre Optic gas Sensors and System for Petroleum Industry –Phase 1	CSIR-CSIO/ BPCL	BPCL	27th EC	Jan-20	Dec-22	72.96
3	Development of Superior Absorbents for CO2 Separation from Biogas	ICT-Mumbai/ IOCL	IOCL	26th EC	Mar-19	Jun-22	82.84
4	Development of catalysts for direct production of lower olefins from Syngas (SynOlefins)	CSIR-IICT/ BPCL	BPCL	26th EC	Mar-19	Dec-22	72.75

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Sr. No.	Project Title	Organization	Nodal Agency	Approval	Start Date	Close Date	Funding by CHT (in Lakh Rs.)
5	Enhancing (Speedy) the Leak detection times in Pipelines by deployment of REAL-TIME Ethernet protocols	HPCL- VVSPL	HPCL	25th EC	Jan-20	Dec-22	55.2
On-going Projects							
6	Integration of parabolic trough solar collectors with multi effect evaporator for reducing the dependency of energy-intensive industries over fossil fuels	IITR/IOCL	IOCL	33rd EC	Jul-23	Apr-25	20.24
7	Development of Clay-based Polymer Composite for Flame Retardant & Heat Resistive Materials	ICTM/BPCL/VIMAL FIRE	BPCL	35th EC	Nov-23	May-25	27.14
8	Nature based solution for the valorization of technical lignin to sequester biogenic carbon in a sustainable circular bio-economy model	TERI/IOCL	IOCL	35th EC	Feb-24	Aug-26	63.39
9	Zero Emission Catalytic Pyrolysis of multilayer plastic waste (MLP) to value added products - A Circular Economy Approach	IITM/VIT/CPCL/ITC/SWC	CPCL	35th EC	Nov-23	Oct-25	32.68
10	Carbon capture by adsorption process from refinery flue gases at low temperature using novel porous organic polymeric (POP) adsorbents	CSIR-IICT/BPCL	BPCL	35th EC	Nov-23	Oct-26	24.31
11	Prototype Development of Ultra-Efficient Green Gasoline Fueled Compression Ignition (GCI) Engine for Decarbonization of Transport Sector:	IITK/CSIR-IIP/IOCL	IOCL	35th EC	MOA to be signed		541.38

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e) Details of HCF Projects (last 5 years)

	Project Title	Approval	Organization	Nodal Agency	Start Date	Close Date	Funding by CHT (Rs.Lakh)
1	Setting-up of single step compact reformer unit of 4 TPD capacity to produce Hydrogen blended CNG (H-CNG) and associated facilities in Delhi bus depot for demonstration in commercial CNG vehicles	27th EC	IOCL	IOCL	Mar-20	Mar-21	920 (Closed)
2	Development & Demonstration of Commercially Viable Fuel Cell Buses based on Hydrogen produced from multiple Pathways	39th GC	TML/IISC/IOCL	IOCL	Jan-21	Dec-23	9752
3	Development and Scale-up of Indigenous Next Generation Solid Oxide Fuel Cell (SOFC) Technology and Demonstration of Process Line (10 kW) for Prototype Production	33rd EC	HPCL/ARCI/CGCRI	HPCL	Jun-23	Jun-28	3473
4	Cost – effective Hydrogen production through Membraneless Electrolyzer & Storage	33rd EC	HEB/OEC	OEC	Mar-23	Mar-25	304
5	Design, Development & Demonstration of 1kW PEM Fuel Cell Technology	33rd EC	HEB/IOCL/GAIL	GAIL	Jun-23	Jun-25	532.9
6	Lightweight Novel Multicomponent High Entropy Alloy for Hydrogen Storage Application	33rd EC	CSIR-IIP/IOCL	IOCL	MoA not signed		
7	Development of Cost-Effective 2.5 KW Proton exchange membrane (PEM) Fuel Cell Stack based on less-Pt Bimetallic Electrocatalysts and Mesoporous Carbon Support Materials	35th EC	PSGIAS/PSGITECH/IITP/ BPCL	BPCL	Nov-23	Oct-25	192.46
8	Development & Demonstration of BSVI compliant hydrogen fuelled Internal combustion engine in commercial Vehicle	35th EC recommended / GC Approval Pending	VECV/IOCL	IOCL			

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