



उच्च प्रौद्योगिकी केन्द्र

(पेट्रोलियम एवं प्राकृतिक गैस मंत्रालय, भारत सरकार)

Centre for High Technology

(Ministry of Petroleum & Natural Gas, Govt. of India)

सीएचटी/एसएसी-79/1085

CHT/SAC-79/

23 मार्च 2017

23rd March 2017

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 79वीं बैठक का कार्यवृत्त

Sub: Minutes of 79th Meeting of the Scientific Advisory Committee (SAC) on Hydrocarbons of Ministry of Petroleum & Natural Gas

प्रिय महोदय/महोदया / Dear Sir/Madam,

आपकी सूचना एवं आवश्यक कार्रवाई हेतु दिनांक 17 मार्च 2017 को भाभा चैंबर, स्कोप कॉम्प्लेक्स, लोधी रोड, नई दिल्ली में पेट्रोलियम और प्राकृतिक गैस मंत्रालय की हाइड्रोकार्बन पर आयोजित 79वीं बैठक के कार्यवृत्त की प्रतिलिपि संलग्न की जा रही है।

Enclosed please find a copy of the Minutes of 79th Meeting of the SAC on Hydrocarbons of Ministry of Petroleum & Natural Gas held on 17th March, 2017 at Bhabha Chamber, SCOPE Complex, Lodhi Road, New Delhi for your kind information and necessary action.

सादर,

With kind regards,

भवदीय,

Yours sincerely,

(बृजेश कुमार)

कार्यकारी निदेशक

(Brijesh Kumar)

Executive Director

संलग्न यथोक्त

Encl: As Above

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**Chairman, Members, Permanent Invitees and Special Invitees
to the Scientific Advisory Committee**

1.	Dr. Anil Kakodkar, Bhabha Atomic Research Centre, 7 th Floor, Central Complex, / Trombay, <u>Mumbai – 400 085</u>	Chairman
2.	Dr. R. Kumar, Professor Emeritus, Department of Chemical Engineering, Indian Institute of Science, Bangalore, <u>Bengaluru – 560 012</u>	Member
3.	Dr.M.O.Garg, Professor, Department of Chemical Engineering, Indian Institute of Technology Bombay, Powai, <u>Mumbai – 400 076</u>	Member
4.	Dr. Anjan Ray, Director, CSIR – Indian Institute of Petroleum, P.O.IIP, Mohkampur, <u>Dehradun – 248 005</u>	Member
5.	Dr. B.D. Kulkarni, Distinguished Scientist, CSIR – National Chemical Laboratory, Dr. Homi Bhabha Road, <u>Pune – 411 008</u>	Member
6.	Dr. D.V. Khakhar, Director, Indian Institute of Technology-Mumbai, Powai, <u>Mumbai – 400 076</u>	Member
7.	Dr. (Ms) M. Lakshmi Kantam, Distinguished Professor & Ex-Director, CSIR-IICT, Department of Chemical Engineering, Institute of Chemical Technology, Matunga. <u>Mumbai – 400 019</u>	Member
8.	Prof. Shantanu Roy, Department of Chemical Engineering, Indian Institute of Technology-Delhi, Hauz Khas, <u>New Delhi – 110 016</u>	Member
9.	Dr. Ajit Sapre, President - Refining Technology Group, Reliance Industries Ltd. Reliance Corporate Park, Bldg. No. 7A, Thane-Belapur Road, Ghansoli <u>Navi Mumbai – 400 701</u>	Member

10.	Dr.R.K.Malhotra, Director General, Federation of Indian Petroleum Industry (FIPI), 2 nd Floor, PHD House, 4/2, Siri Institutional Area, August Kranti Marg, <u>New Delhi – 110 016</u>	Member
11.	Shri Sanjiv Singh, Director (Refineries), Indian Oil Corporation Ltd., SCOPE Complex, 5th Floor, Core-2, Lodhi Road, <u>New Delhi – 110 003</u>	Member
12.	Shri R. Ramachandran, Director (Refineries), Bharat Petroleum Corporation Ltd., Bharat Bhawan, 4&6 Currimbhoy Road, Ballard Estate, <u>Mumbai – 400 001</u>	Member
13.	Shri V.S. Shenoy, Director (Refineries), Hindustan Petroleum Corporation Ltd., 17, Jamshedji Tata Road, <u>Mumbai – 400 020</u>	Member
14.	Dr. S.S.V.Ramakumar, Director (R&D), Indian Oil Corporation Ltd., R&D Centre, Sector-13, <u>Faridabad – 121 007</u>	Member
15.	Shri Ajay N. Deshpande, Director (Technical), El Bhawan, Engineers India Limited, 1, Bhikaiji Cama Place, <u>New Delhi – 110 066</u>	Member
16.	Dr. B. Bhargava, Director General, ONGC Energy Centre, 15 th Floor, South Tower, Core-4, SCOPE Minar Complex, Luxmi Nagar, <u>New Delhi – 110 092</u>	Member
17.	Shri Atanu Chakraborty, Director General, Director General of Hydrocarbons, OIDB Bhawan, Tower A, Sector 73, <u>NOIDA – 201 307</u>	Member

18.	Director (BD), GAIL India Limited, 16, Bhikaji Cama Place, R.K. Puram, <u>New Delhi-110 066</u>	Member
19.	Secretary, Oil Industry Development Board, OIDB Bhawan, Plot No. 2, Sector – 73, <u>NOIDA – 201 301</u>	Member
20.	Shri Brijesh Kumar, Executive Director, Centre for High Technology, OIDB Bhawan, Plot No. 2, Sector-73, <u>NOIDA – 201 301</u>	Member-Secretary
21.	Shri Sandeep Poundrik, Joint Secretary (Refineries), Ministry Of Petroleum & Natural Gas, Shastri Bhawan, <u>New Delhi – 110 001</u>	Permanent Invitee
22.	Shri Sanjay Bhargava, General Manager (CRDC), Bharat Petroleum Corporation Ltd., Corporate R&D Centre, Plot no. 2 A, Udyog Kendra, Surajpur Industrial Area, <u>Greater Noida – 201 306</u>	Permanent Invitee
23.	Shri G. Sriganesh, Executive Director (R&D), HP Green R&D Centre, Hindustan Petroleum Corporation Ltd., KIADB Industrial Area, Tarabahalli, Devanagundi, Hoskote, <u>Bengaluru – 560 067</u>	Permanent Invitee
24.	Ms.Vartika Shukla, Executive Director (T), R&D Centre, Engineers India Limited, Sector-16, <u>Gurgaon – 122 001</u>	Permanent Invitee
25.	Shri G. Suresh Kumar, General Manager (Projects & R&D), Chennai Petroleum Corporation Limited, Manali, <u>Chennai – 600 068</u>	Permanent Invitee
26.	Shri Jaivinder Singh, Dy. General Manager (R&D), GAIL India Limited, 8 th Floor, Jubilee Tower, B- 35-36, Sector – 1, <u>NOIDA – 201 301</u>	Permanent Invitee

27.	Shri Gautam Roy, Managing Director, Chennai Petroleum Corporation Ltd., 536, Anna Salai, Teynampet, <u>Chennai – 600 018</u>	Special Invitee
28.	Shri P.Padmanabhan, Managing Director, Numaligarh Refinery Limited, 6 th Floor, Tolstoy House, 15-17, Tolstoy Marg, <u>New Delhi – 110 001</u>	Special Invitee
29.	Shri H.Kumar, Managing Director, Mangalore Refinery & Petrochemicals Ltd., Kuthethoor, P.O.Via Katipalla, <u>Mangalore – 575 030</u>	Special Invitee

23rd March 2017

Minutes of 79th Meeting of the Scientific Advisory Committee (SAC) on Hydrocarbons of MoP&NG held in New Delhi on 17.03.2017

- 1.0** 79th Meeting of the Scientific Advisory Committee (SAC) on Hydrocarbons of MoP&NG was held at 10:00 Hrs on 17.03.2017 at Bhabha Chamber, Core-8, Scope Complex, New Delhi under the Chairmanship of Dr. Anil Kakodkar.

The list of participants is enclosed (Annexure-1)

- 2.0** Shri Brijesh Kumar, ED, CHT extended warm welcome to Chairman, SAC Members, other invitees & participants. He gave brief overview of the Agenda including ATR on actionable points of the last meeting, various recommendations made by the committee set up to study impediments and recommend measures to improve commercialization of indigenously developed technologies and the various initiatives taken by CHT.
- 3.0** As there were no comments / observations on the MoM of 78th SAC, the same were approved.
- 4.0** At the outset Dr. Anil Kakodkar, Chairman appreciated that the Committee, on the commercialization has brought out many significant recommendations, which will lead to improvement in the commercialization of domestic technology. He emphasized that the indigenous technology needs to be continually improved to remain competitive.

He also appreciated CHT's initiative for inviting R&D proposals through EOI which will attract broader participation & the process will be more transparent. He suggested that the proposals received in CHT should be monitored for their coverage of the areas identified in the position paper, and areas not getting covered should be given prominence while seeking further proposals to ensure balanced development in demand driven R&D mode.

5.0 Commercialisation of Indigenously developed technologies

ED, CHT presented various recommendations made by the Committee on the commercialization. Director (R), IOCL, the chairman of the Committee shared that out of 79 CHT funded completed projects, 9 projects having potential for commercialization have been identified for preparing the way forward. Most of them are related to catalyst, which have been developed at lab scale but not scaled up and commercialized. He further highlighted that there was a lack of awareness in industry on the various technologies available indigenously.

The following are the recommendations made by the Committee:

Grantee institutions to focus on tie-ups for scale-up and commercialisation

- CHT to consider capability for sustaining development and tie-up for commercialisation while recommending to SAC for consideration
- Henceforth, Steering Committee nominated by CH, SAC to recommend and advise modifications, if required before consideration by SAC
- Way forward to be presented by Commercial / Lead Partner to SAC on completion of the project
- Captive commercialisation of indigenous technologies may be considered by oil companies on case to case basis
- EIL's technology basket will be declared at the time of offering for PMC and in such cases, the technology selection will be done by the client or EIL may offer selected technologies as part of the package
- Fiscal incentives
 - Presently, excise duty benefit for 3 years available to product produced from indigenous patented technology: May be extended to products produced using indigenous patented process
 - Accelerated depreciation on units using indigenous technology: Currently benefits allowed for patented technology: may be extended to filed patent as grant of Indian patent takes 5-7 years

The following points emerged out of extensive deliberations on the above:

- a. Regarding Conflict of interest issue in selection of technologies by EIL where EIL is the PMC, it was suggested that an independent assessment may be carried out for technologies where EIL is a joint developer.
- b. In order to promote indigenous technology, once the patent is granted in one of the country out of US, EU and Japan, the full publishing of patent in India may be considered sufficient for the financial benefits. This will overcome the issue of delay in grant of Indian patents.
- c. A Technology monitoring and promotion cell to be formed within CHT to disseminate information on technologies developed, monitor technology gaps & promote development to overcome vulnerabilities, to enhance competitiveness through assessment of comparative performance & to ensure that the best technology does not suffer because of implementation & other policy related issues.

- d. SAC advised all the concerned agencies to send Way forward to CHT on all projects having potential for commercialization, completed under CHT funding/HCF. List of the projects along with nodal agency responsible for advising way forward is attached.

SAC endorsed the recommendations of the Committee subject to above observations.

6.0 ED, CHT informed that following actions have been taken by CHT;

- a. Two-Day work shop on the Commercialisation of Indigenous Technologies was conducted by CHT on 20-21 June 2016 with the objective to highlight the indigenously developed technologies available with respective Oil industry & R&D institutes and sharing of commercial and technical information of these technologies. The senior officials from Refineries and R&D institutions of IOCL, BPCL, HPCL, EIL, CSIR-IIP, CPCL, NRL, MRPL, BORL and GAIL participated in the workshop.

b. Compendium on Indigenous Technology

A Compendium of Indigenous technologies with gap analysis has been prepared by CHT and a copy provided to all stakeholders.

c. Approach paper on setting up of catalyst manufacturing plant

Total catalyst market is around 8000 MT for the fixed bed & 40000 MT for FCC/RFCC valued at around Rs 2800 Crore per year. The catalyst demand will grow with addition of new refining capacity & is expected to get doubled by the year 2030 in line with refining capacity. There is no major catalyst manufacturing facility in India as yet and the country is mostly dependent on catalyst import. Thus, there is a need to establish Catalyst Manufacturing in India as newer developments in refining technology are centred around development of new & efficient catalyst systems.

CHT has prepared an approach paper on Catalyst Manufacturing Unit in India highlighting Indian Growth, global perspective, catalyst demand in India, different business models, current status in India and various constraints. The approach paper has been sent to MoP&NG with request to constitute a committee to prepare way forward including the present as well as future requirement of catalyst, Capacity of catalyst plant with type, Facility needed for Scale up, Funding Mechanism for manufacturing unit, Steps required for demonstration & promotion of commercialization of Indigenous catalyst & Strengthening infrastructure for catalyst development initiative and continual improvement.

- d. ED (CHT) informed that the First EOI was published in June 2016 and total 15 proposals were received (7- Alternative energy, 4- carbon capture, 2- Demo plants & 2- Process development). A Steering Committee was nominated by Chairman, SAC

to recommend and advise modifications in the proposals, if required before consideration by SAC. The Committee scrutinized all the proposals in its meeting held on 4th November, 2016 and shortlisted three proposals for consideration by the SAC after modifying as recommended by the Committee. Shortlisted proposals were kept as a separate agenda item under new proposals.

Second EOI was published on 3rd February 2017. No project proposal has been received till date. Last date for receiving proposals is 31st March 2017. The screening committee will be set up by Chairman SAC after receiving all the proposals.

SAC suggested that while issuing EOI for inviting R&D proposals, topic of current relevance should be given prominence which will provide impetus to demand driven R&D.

7.0 ED CHT briefed on the current status of various ongoing R&D projects. The project brief and status is summarized as under:

7.1 Coal to Liquid (CTL) Fuels Technology Project: EIL-R&D, Thermax and BPCL-R&D

Project cost: Rs 3300 lakh (CHT: 1484, EIL: 924, BPCL: 560 & Thermax: 332). Rs 1220.95 lakh has been released by CHT so far.

Zero date: July 2009

Completion scheduled: 45 months (April 2013), extended up to March 2017 by SAC

Current status:

The gasifier pilot plant was started in combustion mode at 6.0 bar pressure followed by air gasification operation. However, the operation couldn't be sustained for more than 2-3 hrs due to:

- High dust load in the syn gas exited from gasifier causing choking of downstream system
- Choking of screw type ash extractor due to agglomeration of smaller size particles causing prohibition in fluidization process

In view of the above EIL suggested for additional cyclone system & modification in Ash removal system & requested SAC to extend the project till June 2019.

SAC extensively deliberated and suggested to check the physical properties at lab scale before carrying out trials at pilot scale.

SAC accorded approval for project extension up to June 2019, however, with no extra financial assistance from CHT.

7.2 Experimental and Simulation studies on coke mitigation in petroleum refinery systems: BPCL and BITS-Goa

Project cost: Rs 132.07 lakh (CHT/OIDB: 132.97). Rs 119.67 lakh has been released by CHT so far.

Zero date: April 2015

Completion schedule: 36 months (March 2018)

Current status: The Project is on schedule as per milestones.

SAC took note of the above.

7.3 Development of Process know-how for indigenous production of Biphenyl for thermic fluid and other applications: BPCL

Project cost: Rs.260 lakh (CHT/OIDB: 260). So far, Rs 35.94 Lakh has been released by CHT.

Zero date: November 2014

Completion schedule: 36 months (October 2017)

- For the first step (Benzene to cyclohexylbenzene), several catalyst formulations prepared & evaluated to study the effect of shape & type of Zeolite & metal loading on the activity and selectivity for hydroalkylation reaction.
- For the second step of dehydrogenation of cyclohexylbenzene to biphenyl, catalyst based on Cr-Mg/Al₂O₃ exhibited good activity and selectivity.
- Biphenyl produced from the above evaluation was purified from 60% to 95% using crystallization followed by vacuum filtration technique.
- Firmed up the specifications in a fixed bed isothermal reactor to generate data for process conceptualization.

BPCL R&D requested for foreclosure of this project as advancement in PV technology have outsmarted the CSP technology leading to fall in the power tariff.

SAC extensively deliberated the matter. It was felt that CSP technology may become necessary. Also the developed oil may have applications for industrial heating requirement. SAC suggested that the project should be taken to its logical end.

7.4 Production of Naphthenic Base oil and Paraffin wax from waxy distillate streams in refinery: IIP and IOC Digboi

Project cost: Rs 99.28 lakh (CHT/OIDB: 87.28, IOC Digboi:12.00). Rs 64.39 Lakh has been released by CHT so far.

Zero date: March 2015

Completion schedule: 18 months (September 2016), extended up to March 2017

Current status:

Hydro finishing of foots oil over different catalysts was carried out; however, Naphthenic content was achieved only upto a level of 37% against 45% required. Further improvement in Naphthenic content in product is not possible.

In view of above, the objective of the project could not be met. IIP requested for closure of project.

SAC accorded approval to close the project.

7.5 Parametric Study and Technology Development for Desalter Design: EIL-R&D and BPCL-R&D

Project cost: Rs1451.10 lakh (CHT/OIDB: 853.00, BPCL:348.10 and EIL: 250). So far, Rs 142.76 Lakh has been released by CHT.

Zero date: March 2015

Completion schedule: 36 months (March 2018)

Current status:

Purchase orders have been placed by EIL for the prototype Desalter with delivery period of 13 months. EIL is trying to squeeze the delivery period to 10 months and with that project can be completed by March 2018 as per the schedule.

SAC took note of the above.

7.6 Feasibility study of improved 3-phase reactor configuration for Hydroprocessing applications: BPCL, EIL and IIT Delhi

Project cost: Rs 115 lakh (CHT: 115). Rs 69.61 Lakh has been released by CHT so far.

Zero date: May 2015

Completion schedule: 18 months (November 2016), extended up to July 2017

Current status:

BPCL

- Multi scale cold flow facilities are in place at BPCL CRDC. Internals for CFR have been conceptualized and implemented. Operating window determined for cross

flow concept ($VG = 0.5-6 \text{ cm/s}$, $VL = 0.05- 0.35 \text{ cm/s}$) for weeping free operation, beyond these liquid superficial velocities weeping free operation is not possible.

- BPCL CRDC has ordered 3-5 mm diameter size porous alumina beads for EIL to carry out cold flow studies with particles of shape other than trilobe (current packing).
- BPCL CRDC has STAR CCM software; work initiated for adopting simulation model developed by IITD (Software-Ansys Fluent).
- Experiments as suggested by IITD to validate their CFD model are in progress.

EIL

- EIL R&D has modified 30 cm column (existing Trickle bed reactor) for carrying out experiments for cross flow concept under moderate pressure $\sim 6 \text{ bar}$. Carried out hydrodynamic studies, tracer study completed in collaboration with BARC. Weeping in the setup from EIL is not evaluated being an opaque system. Data analysis is in progress. EIL is pursuing modifications in reactor to facilitate measurement of weeping (reactor is opaque).
- CFD simulation models developed by IITD (for CFR and TBR) have been received.

IIT Delhi

- Performed simulations by taking a small sector of CFR, essentially to establish a correlation between radial gas velocity, downward liquid velocity and back pressure. However, owing to oversimplified geometry of such a sector that was used, the predicted results may not be serving the purpose.
- The model verification for two-phase down-flow TBR is now established (by comparing measured and predicted pressure drop and overall liquid hold-up).
- CFD simulation of CFR (based on experimental data of BPCL facility post modification in gas out let section) was validated.

It was informed that the Project is on schedule as per the revised milestones of July, 2017.

SAC took note of the above.

7.7 Development of catalyst and process for Slurry phase Residue Hydrocracking: CSIR-IIP, HPCL, BPCL and EIL

Project Cost: Rs 2235 lakh (CHT/OIDB: 1366 lakh, HPCL: 776 lakh and CSIR-IIP: 93). Rs 786.36 lakh has been released by CHT so far.

Zero date: July 2015

Completion schedule: 36 months (June 2018)

The current status:

IIP

- Vacuum residues received from BPCL, Bina refinery and HPCL, Vizag were characterized
- Detailed patent search was done with the help of CSIR-URDIP
- Slurry phase catalysts are prepared and their hydrocracking activities are under progress
- One catalyst has been tested at different operating conditions to generate kinetics data as per EIL guideline
- Micro carbon residue analyzer was installed. Purchase orders for Procurement for Parr reactor and GC have been placed. Procurement of slurry phase continuous flow reactor is under progress.

HPCL

- Feed selection, characterization & catalyst synthesis facilities setup are completed.
- Preparation of catalyst formulation & testing of catalyst are in progress.
- Procurement of batch reactors and Analytical equipment is completed.
- PO has been placed for continuous pilot plant.
- Optimization of catalyst parameter and process conditions is in progress.

BPCL

- Literature survey and strategy of catalysts preparation have been completed.
- Feed selection and characterization completed.
- Preparation of catalyst formulation & testing is in progress.
- Procurement of 1L HPHT batch reactor is in progress.

EIL

- Hydrodynamic study for phase reactor in cold flow is under progress
- Initiate formulation of slurry reactor model based on literature kinetics and hydrodynamics-model formulation, code written, debugging of the code are under progress

Project is expected to be completed as per the schedule.

SAC took note of the above

7.8 Synthetic Aviation Lube - Phase 2: CSIR-IICT, HPCL and CEMILAC

Project cost: Rs 250 lakh (CSIR-IICT: 30, HPCL: 118, CEMILAC: 5 and CHT/OIDB: 97). Rs 41.14 Lakh has been released by CHT so far.

Zero date: April 2016

Completion schedule: 18 months (December 2017)

The current status:

- CSIR-IICT supplied of SVS-21 lubricant, prepared in phase-1,
 - 240L to 3BRD for conducting ground as well as in flight test in TV2 engine
 - 40L to HPCL for conducting elastomer compatibility test
- CSIR-IICT has also supplied freshly prepared 5 Kg of SVS-21 base oil to HPCL for formulation study.
- HPCL has conducted various tests on SVS-21 as well as on commercial lubricant 90X-38. Results of both were found almost similar.
- CSIR-IICT will supply fresh batch of 200 Kg of SVS-21 base oil to HPCL by April 2017 for formulation study. After that preparation of lubricant SVS-11 will be started.

Director (R&D), IOCL observed that TV2 aero-engine is being phased out. SAC advised HPCL/IICT to interact with IOCL & other agencies for latest update.

SAC after deliberations advised HPCL/IICT to continue development as lubricant may find applications in advanced versions as well as in other applications.

7.9 Biomass Hydro-pyrolysis for production of fuel grade Hydrocarbons: HPCL and CSIR-IIP

Project Cost: Rs 2407 lakh (CHT/OIDB: 1440 and HPCL: 967). So far, Rs 144 lakh has been released by CHT.

Zero date: November 2016

Completion Schedule: 36 months (November 2019)

The current status:

- Feedstock (Rice straw and Bagasse) procured.
- Composition analysis of feedstock initiated.
- EOI has initiated for BET/SA/PSD.

- ZSM-5 catalyst has synthesized with different precursors

The Project is initiated recently and is as per the schedule.

SAC took note of the above.

7.10 Renewable crude and liquid Hydrocarbon fuels from Algae, Phase-1: CPCL/ Aban/ICGEB

Project Cost: Rs 434.52 lakh (Contribution of CHT/OIDB: Rs 434.52). So far, Rs 37.63 lakh has been released by CHT.

Zero date: April 2017

Completion Schedule: 24 months (April 2019)

Current status:

EC approved the above in its 19th meeting held on 24th May 2016 and MoU signed in December 2016. The activities in the project are being initiated.

SAC took note of the above.

7.11 Hydrogen production by catalytic decomposition of Natural gas, Phase-1: HPCL, IITD and CeNS

Project Cost: Rs 2945.70 lakh (CHT/OIDB: 1692.10 and HPCL: 1253.60). MOU signed in February 2017. So far, Rs 160.91 lakh has been released by CHT.

Zero date: April 2017

Completion Schedule: 48 months (April 2021)

Current status:

GC approved Phase-1 of the proposal in its 35th meeting held on 9th February 2017 based on SAC recommendation. The KOM is planned on 17th March, 2017.

SAC took note of the above.

8.0 New Project Proposals

8.1 Demonstration of Indigenous CO₂ removal process from flue gases: EIL & CSIR-IIP

Estimated cost: Rs 1492 lakh, (CHT/OIDB: Rs 1216 lakh)

Completion schedule: 30 months

In the last SAC meeting, it was concluded that the project has merit and may be pursued. However, EIL was advised to seek participation from Ramagundam Fertilisers and Chemicals Limited (RFCL) in addition to their own contribution, besides sharing of benefits (revenue/royalty) of commercial exploitation with CHT/OIDB, as token of commitment to commercialisation, if found successful.

EIL mentioned that RFCL project is a JV of EIL/ NFL /FCIL with balance funding being tied up from banks/FIs etc. The implementation of the project is in progress with the usual issues of finance and project management. The JV company, does not have any operating revenues and resources of finances as such. Thus it would not be feasible for the JV to commit any fund to the project.

SAC extensively deliberated and decided not to recommend the project in view of the above. However, should a possibility for participation of an industry for setting up demonstration set up arise, the matter can be reviewed again.

8.2 Development of Indigenous Graphite Fibre Reinforced Storage Tank for Hydrogen Fuel: MITS, Madanapalle (AP)

Project Cost: Rs 96.5 Lakh

Duration: 12 Months

The proposal was received against 1st EOI and was reviewed by the Steering Committee. The observations of the Committee, as under, were communicated to the proposer;

- The project deliverables need to be assessed by Mechanical engineers also
- Proposed timeline is too short to deliver objective
- IOCL expressed desire to participate in the proposal. IOCL was advised to interact with MITS and submit revised proposal to CHT for consideration of SAC

Revised proposal is not received till date.

SAC took note of the above.

8.3 Electro-Chemical Treatment of Refinery Waste water: EIL/IIT Roorkee/ISM Dhanbad

Project Cost: Not Provided

Duration: 36 Months

The proposal was received against 1st EOI and was reviewed by the Steering Committee. The observations of the Committee, as under, were communicated to the proposer;

- Key area more relevant to Industry
- Financial details not submitted by EIL
- Proposal to include handling of at least 2-3 kinds of streams available from Refinery
- Monitoring of the project should be by industry personnel
- IOCL expressed interest for collaboration
- In view of its wider scope for implementation in various refineries, project deliverables need to be re-defined in consultation with IOCL-R&D

Revised proposal is not received till date.

SAC took note of the above.

8.4 CO₂ Hydrogenation to form Methanol via a Reverse Water-Gas Shift Reaction: ICT, Mumbai

Project Cost: Rs 141.62 Lakh

Duration: 36 Months

The proposal was received against 1st EOI and was reviewed by the Steering Committee. The observations of the Committee, as under, were communicated to the proposer;

- Proposal deals with deliverables having large opportunity for commercialisation
- Proposal is OK, but PSU tie-up essential. ICT to explore PSU partner
- Proposal should be more focused. PI's experience in multiphase reactions should be combined with a catalysis scientist for successful outcomes
- Reduction in timeline to 2 years
- Overheads to be limited to 10% RE
- Consultation fee & fund requirement to be reviewed

Revised proposal received on 9th March 2017. ICT further informed that the project will be pursued along with EIL.

The proposal was deliberated in detail including economics and energy efficiency of proposed conversion of CO₂ to olefin via syngas and methanol route.

SAC advised ICT/ EIL to carry out cost benefit analysis including energy balance of the proposed pathway.

8.5 Development and durability testing of Ethanol-Diesel blend engine: ARAI, Pune

Estimated cost: Rs 110 lakh(CHT/OIDB)

Completion schedule: 6 months

Objective:

- To evaluate the Emission and Power performance of ethanol blended diesel by comparing base diesel engine performance.
- To evaluate vehicle performance of ethanol blended diesel by comparing base diesel vehicle performance.

Salient features:

The activities will be carried out in two phases:

Phase I: Engine Durability and performance testing at 0 hrs, 20 hrs, every 100 hrs and final engine test after 500 hrs(3.5 months)

Phase II: Evaluation of Vehicle performance before & after predefined vehicle durability at 50,000 KM & submission of report (2.5 months)

SAC extensively deliberated and observed that the proposal outcome may give a way to reduce emissions from the old vehicles by using ethanol blended diesel.

SAC recommended the proposal.

8.6 Hydrogen Recovery from Refinery off Gases: EIL

Estimated cost: Rs 200 Crore

CHT/OIDB: Rs 20 Crore

EIL has developed and patented a cryogenic based hydrogen recovery process ("EngCryo™") that has capability to recover hydrogen from low pressure low purity hydrogen streams with very high level of recovery. This process has potential to recover

hydrogen with purity of 94 mol % and recovery of >98%. This cryogenic process doesn't require any cryogenic utility like liquid nitrogen. Required low temperature is achieved in the process itself. For a refinery, with 700-900 kg/hr of hydrogen recovery potential, overall project IRR (Internal Rate of Return) can be expected above 12%.

SAC deliberated in detail and observed that the proposal cannot be recommended as it is for demonstration and does not have R&D component.

- 9.0** Presentation was made by LanzaTech for conversion of CO/CO₂/MSW to chemicals through fermentation route. The technology has been demonstrated.

The meeting ended with thanks to the Chair and the participants.

Annexure-1

79th Meeting of Scientific Advisory Committee (SAC) on Hydrocarbons of MoP&NG held on 17th March 2017 at SCOPE Complex, New Delhi.

List of Participants:

S.No.	Name	Designation	Organisation
1	Dr. Anil Kakodkar	Chairman - SAC	BARC
2	Sh. Sanjiv Singh	Director (R)	IOCL
3	Dr. R. K. Malhotra	DG	FIPI
4	Dr.(Ms) M. Lakshmi Kantam	Distinguished Professor	ICT, Mumbai
5	Sh. Brijesh Kumar	ED	CHT
6	Dr. B. Bhargava	DG	OEC
7	Dr. M. O. Garg	Professor	IITB
8	Sh. Ajay N Deshpandey	Director (T)	EIL
9	Sh. U. Venkata Ramana	Director (T)	CPCL
10	Dr. S.S.V. Rama Kumar	Director (R&D)	IOC (R&D)
11	Prof. Shantanu Roy	Professor	IITD
12	Dr. Anjan Ray	Director	CSIR-IIP
13	Ms. Vartika Shukla	ED (R&D)	EIL
14	Sh. G. Sriganesh	ED (R&D)	HPCL
15	Sh. Sanjay Bhargava	Head, CRDC	BPCL
16	Sh. C.J. Iyer	GM I/C	BPCL MR
17	Sh. M. Venkatesh	Director (T)	MRPL
18	Dr. P.V.C. Rao	GM (R&D)	HPCL
19	Dr. Ravikumar V.	DGM	BPCL (R&D)
20	Sh. Sheo Raj Singh	DGM	EIL (R&D)
21	Sh. Ravi Kant Gupta	DGM	EIL (R&D)
22	Dr. R. N. Maiti	DGM	EIL (R&D)
23	Dr. S. K. Maity	Scientist	CSIR-IIP
24	Dr. Manoj Srivastava	Scientist	CSIR-IIP
25	Sh. Salim Akhtar Farooqui	Scientist	CSIR-IIP
26	Dr. Manoj Kumar Thapliyal	Scientist	CSIR-IIP
27	Dr. Reji Mathai	DGM (R&D)	IOCL (R&D)
28	Sh. Jaivinder Singh	DGM (R&D)	GAIL
29	Sh. Pramod Kumar	Scientist	HPCL
30	Dr. Prakash D. Vaidya	Scientist	ICT
31	Dr S S Thipse	Dy. Director	ARAI
32	Sh. Rairikar Sandeep	DGM	ARAI
33	Sh. S. Ghatodgajudu	Addl. Director	CHT
34	Sh. Santosh Kumar Varshney	Joint Director	CHT

Annexure-II

List of completed CHT funded project having potential for commercialisation

S.N.	Project	Organisation	Cost Rs Lakh	Area
1	Catalyst and Technology Development for Hydro-treatment of Diesel and Vacuum Gas Oil	IIP (Jul 2000)	178.32	Catalyst
2	Catalyst for Ultra Deep Desulphurisation of Gas Oil	IIP (Nov 2007)	47.02	Catalyst
3	Development of Catalyst, Technology & Process know how for conversion of C5-C6 Naphtha cuts to Aromatics and C4	IIP & BPCL (Sep 2001)	22.59	Catalyst
4	Development of Catalyst for Reducing Sulfur in FCC Gasoline with Minimum Octane Loss	IIP & CPCL (Mar 2006)	43.57	Catalyst
5	Development of Low Metal / Skewed Reforming Catalyst by IIP / March 98	IIP (Mar 1998)	78.00	Catalyst
6	Development of Solid Acid catalyst for Alkylation Isobutane with Alkenes to form Alkylates as Gasoline blend	IIP (Apr 2011)	51.61	Catalyst
7	Catalyst Development for Isomerisation of C7+ Hydrocarbon with Industrial Feed Stocks	IIP (Apr 2011)	60.72	Catalyst
8	Etherification of C5 Olefins and Light FCC Gasoline (IBP-110°C)	IIP (Jun 1999)	57.49	Technology
9	Pressure Swing Adsorption Technology for Hydrogen Purification and Recovery	EIL & IPCL (2003)	92.52	Technology

List of completed projects under HCF having potential for commercialisation

S.N.	Project Title	Project Cost (Rs, lakh)	Company	Status	Amount utilized (Rs, lakh)
1	Demonstration project on use of H-CNG blends in Automotive vehicles	1105.00	IOCL	Completed in 09/2015	642.60
	Demonstration project planned by MNRE on DTC bus fleet & 3 wheeler in Chennai				
2	H ₂ production from Natural Gas by Catalytic decomposition	51.00	HPCL & IIT-Delhi	Completed in 09/2013	43.99
	Project proposal under phase- II approved by GC in February 2017 Project cost: Rs 29.457 Crore (HPCL: 12.53, CHT: 16.92)				
3	H ₂ generation from water by Thermo-Chemical process	1240.00	OEC	Completed in 09/2015	1215.95
	OEC in talks with EIL/CSIR-IIP for phase-II (I-S cycle)				

4	Design & Construction of Metal Organic Framework Material for H ₂ storage	77.95	HPCL & Gitam Univ	Completed in 09/2013	75.72
5	An Integrated approach for bio H ₂ production through combined dark & photo fermentative process	141.63	HPCL & TERI	Completed in 03/2014	141.63
6	Hybrid-Sorption Enhanced Steam Reforming for the production of Hydrogen from Natural Gas	415.00	BPCL	Completed in 04/2014	303.82
Demo plant proposed earlier to be revived by BPCL					