20

STANDING COMMITTEE ON
PETROLEUM & NATURAL GAS
(2016-17)

SIXTEENTH LOK SABHA

MINISTRY OF PETROLEUM & NATURAL GAS

'CENTRE FOR HIGH TECHNOLOGY (CHT)'

TWENTIETH REPORT

LOK SABHA SECRETARIAT
NEW DELHI

August, 2017 / Shravana, 1939 (Saka)

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Presented to Lok Sabha on 01.08.2017

Laid in Rajya Sabha on 01.08.2017

LOK SABHA SECRETARIAT
NEW DELHI

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COMPOSITION OF THE STANDING COMMITTEE ON PETROLEUM & NATURAL GAS (2016-17)

Sl. No.	Name of Members	
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3	Shri P. K. Biju	
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	SECRETARIAT	
1	Shri A.K.Singh	Additional Secretary
2	Dr. Ram Raj Rai	Director
3	Shri H. Ram Prakash	Additional Director

INTRODUCTION

I, the Chairperson, Standing Committee on Petroleum & Natural Gas having been authorised by the Committee to submit the Report on their behalf present this Twentieth Report on 'Centre for High Technology (CHT)'.

2. The Committee took evidence of the representatives of the Ministry of Petroleum & Natural Gas at their sitting held on 23.12.2016.

3. The Committee considered and adopted the Report at their sitting held on 27.07.2017.

4. The Committee wish to express their thanks to the representatives of the Ministry of Petroleum and Natural Gas and Public Sector Undertakings/Organisations for placing their views before them and furnishing the information desired in connection with examination of the subject.

5. The Committee also place on record their appreciation for the assistance rendered to them by the officials of the Lok Sabha Secretariat attached to the Committee.

New Delhi;
***31 July*, 2017**
9 Shravana,1939 (Saka)

PRALHAD JOSHI,
Chairperson,
Standing Committee on
Petroleum & Natural Gas.

REPORT

PART - I

INTRODUCTORY

Centre for High Technology (CHT) was established as a dedicated technology cell of Ministry of Petroleum & Natural Gas (MOP&NG) in 1987. CHT acts as a focal point of oil industry for centralised technical assistance, knowledge dissemination, performance data base, exchange of information and experience sharing. CHT also coordinates funding of research work in downstream hydrocarbon sector and pursue the programmes of "Scientific Advisory Committee on Hydrocarbons" of MOP&NG.

2. CHT was registered as a Society in 1992. CHT functions under the overall guidance and supervision of the Governing Council (GC) headed by the Secretary, P&NG as the Chairman. The members include Addl. Secretary, AS&FA, JS(R), JS(M), JS(E), Secretary OIDB, Chief Executives of IOCL, HPCL, BPCL, CPCL, MRPL, NRL, EIL, GAIL, IIP with ED, CHT as the Member Secretary.

3. There is also an executive committee to carry out the directions of the Governing Council and for implementing plans and programmes of CHT. The Executive Committee is headed by Joint Secretary (Refining), MoP&NG and consists of Director (Refineries) or IOCL, BPCL, HPCL; Director Planning GAIL; Director IIP; Director (T) , EIL; Director, MoP&NG; Secretary IODB and ED, CHT as Members.

4. Current manpower at CHT is 14 Technical Officers and 7 HR/Fin officers/staff, drawn from oil industry, GAIL on deputation / retired officers from PSU oil companies engaged as advisors.

Role and Objectives of CHT

5. Major functions of CHT include assessment of technology requirement, operational performance evaluation and improvement of the refineries. Over the period, the activities of CHT have undergone change as the oil companies have been empowered for Technology Selection, Import of Technology etc.

Currently, the focus areas of CHT are as under:

i) Benchmarking and Performance Improvement of PSU refineries through special studies\

(ii) Performance Evaluation & Monitoring

(iii) Energy Efficiency Improvement

(iv) Product Quality Improvement and liaison with BIS

(v) Co-ordination of activities of Scientific Advisory Committee (SAC) on Hydrocarbons of MoP&NG for Promoting Research & Development in Downstream Sector

(vi) Long Term Strategic Studies

(vii) Sharing of Best Practices through Activity Committee Meetings on Major Areas of Refinery Operations

(viii) Information and Knowledge Dissemination through Refinery Technology Meet

(ix) Technical Support/Assistance to MoP&NG.

6. The expenditure of CHT is funded through grants from OIDB. Budget of the CHT for last three years along with RE and actuals is as under:

(Figs in Rs. crore)

Particulars	2014-15	2015-16		2016-17			
	Actual	RBE	Actual	BE	Actual upto Dec-16	Estimated Jan17 to Mar 17	Total (RBE)
REVENUE EXPENDITURE							
Salary	7.43	8.15	8.28	9.00	5.26	2.41	7.67
Other than Salary	2.11*	1.65	1.49	2.10	1.47*	0.47	1.94*
Sub-total	**9.54**	**9.80**	**9.77**	**11.10**	**6.73**	**2.88**	**9.61**
CAPITAL EXPENDITURE	**0.05**	**0.03**	**0.02**	**0.03**	**0.02**	**0.01**	**0.03**
PROJECTS							
Funding of R&D Projects	5.99	5.96	5.94	11.82	2.11@	7.22	9.33
Special Studies	0.84	3.90	3.58	5.00	0.00	2.40	2.40
Sub-total	**6.83**	**9.86**	**9.52**	**16.82**	**2.11**	**9.62**	**11.73**
TOTAL EXPENDITURE	**16.42**	**19.69**	**19.31**	**27.95**	**8.86**	**12.51**	**21.37**

* includes contribution of Rs 0.25 crore from OIDB for RTM and expenses on Awards
@ Demand for Rs 1.45 crore sent to OIDB

7. In response to specific query whether there are other sources of funds for CHT In addition to funding by the OIDB, the Ministry stated in a written reply that all expenditure of CHT is funded by OIDB.

8. When asked about the utilisation of the money received as grants from OIDB, the Secretary MoPNG during the oral evidence stated the following:

> "It is only Rs. 20 crore which is spent mostly in salaries and research projects".

Activities of CHT

9. When asked about the innovations developed by CHT in operations and improvement in performance of oil refineries as a result of adoption of such innovations, the Ministry in its written reply stated the following:

> "CHT assists refineries in performance/operational improvement through: -
>
> - Sharing of best practices and dissemination of information
> - Organising Activity Committee Meetings in critical areas of operations
> - Organising Refinery Technology Meet to keep abreast with the latest developments world-wide
> - Carrying out Performance/Energy Improvement Studies through global consultants
> - Benchmarking Studies for PSU refineries through global consultant
> - Assisting in Performance Monitoring
> - Conducting Surveys in refineries (including JV/Private refineries) alternately on Furnace Efficiency and Steam Leaks during OGCF/Saksham in January every year
> - Assisting oil companies/R&D institutes through grant-in aid in building knowledge base and R&D activities in key areas recommended by SAC".

10. The details of major activities undertaken by CHT in various areas during last few years are summarised below:

- Integrated Refinery Business Improvement Programme (IRBIP) through Shell at BPCL-Kochi, IOCL-Mathura, CPCL-Manali and HPCL-Visakh refineries - Cumulative net benefit of over US $ 50 million per year realised

- IRBIP Phase-II through Shell at BPCL-Mumbai, HPCL-Mumbai and MRPL. Cumulative potential saving of around US $ 30 million per year

- Performance Benchmarking of refineries for study cycle 2010, 2012 and 2014 through Solomon Associates, USA. Study for cycle 2016 in progress

- Centralised Technical Services Agreement (TSA) with Shell Global Solutions, Netherlands to provide refineries/GAIL/EIL access to the international standards and best practices.

- Comprehensive Energy Efficiency Improvement
    - Regular monitoring of Specific Energy Consumption (SEC): New Methodology (MBN-Thousand BTU per barrel per energy factor) developed and implemented from 2015-16 for Performance Evaluation and Awards
    - PSU average SEC (MBN) has come down by 19.6 % during 2005-06 to 2015-16.
    - Study for PSU refineries through EIL initiated to bring down Specific Energy Consumption in both short/medium term
    - Refinery Sector included in PAT (Perform Achieve & Trade) Scheme Cycle-II (April 2016 to March 2019)
    - CHT assisted in setting refinery-wise targets including JV/ Pvt. Refineries
    - Overall Energy Reduction Target of 5.97 % mandated by Ministry of Power through BEE. Refinery sector contribution under PAT Cycle-II is 12.4%.

- Regular monitoring of distillate yield. PSU average distillate yield increased from 73.3 to 79.8 % during 2005-06 to 2015-16.

- Annual Performance Evaluation of MBN, validation and recommendation of awards for best performance

- Annual Survey on Furnace/Boiler Efficiency & Insulation Effectiveness and Steam Leak in refineries during Oil Conservation Fortnight followed by evaluation for awards

- Institution of Innovation Awards

- Monitoring Quality Improvement Projects of refineries for BS-VI

- Activity Committee Meetings on 10 major refinery processes, Maintenance, P&U and pipelines for dissemination of experience/expertise, technological improvements and best practices

- Promotion of R&D in downstream sector: Position paper on futuristic areas of research, Inviting proposals through EOI introduced in July, 2016

- Compendium on Experience Sharing

- Publication of Compendium on Refineries

11. When the Committee wanted to know about the methodology adopted to arrive at Cumulative net benefit of over US $ 50 million per year realised by CHT research projects, the Secretary of MoPNG stated the following during the oral evidence:

> "Our technical experts from Engineers India Limited have the details. But my understanding is that it would be the rough estimates of the benefits accruing out of those research projects and even the projects which have been indigenously developed".

12. When asked about the infrastructure available with CHT for carrying out its R&D projects, the Ministry in its written reply stated as under:

> "CHT assists refineries in performance improvement and promoting R&D through funding of R&D projects. As such, CHT does not have its own laboratory.
>
> In case of funded projects, R&D work is carried out by the R&D institutes of grantee organisations / institutes like, IOCL-R&D, EIL-R&D, HPCL-R&D, BPCL-R&D, IIP, IITs etc. CHT also, through grant-in aid, provides financial assistance in putting-up necessary infra-structure at these institutes required for the CHT funded R&D projects".

13. Further elaborating the specific role of CHT in enhancement of performance of refinery, the Secretary MoP&NG submitted the following details during the oral evidence:

> "One of their activities is benchmarking the performance of refineries through Soloman Associates which is one of the best consultants in that field. So, we engaged Soloman Associates through this organization to carry out the studies and benchmark the performance of refineries. So, they have a role in improving the performance of refineries".

14. When Committee asked whether CHT has any mechanism to coordinate with other research organization such as the PCRA etc. and to work together as per the need of industry in petroleum sector, the Ministry in its written reply submitted the following:

> "The role of CHT is mainly in the area of refining sector for assisting refineries in performance improvement and promoting R&D through funding of R&D projects as recommended by SAC.
>
> PCRA, on the other hand, is engaged in formulating policies and strategies for petroleum conservation and promoting energy efficiency in various sectors of economy. It sponsors R&D activities for the development of fuel-efficient

equipment / devices and organizes multi-media campaigns for creating mass awareness for the conservation of petroleum products.

Considering the expertise of PCRA of carrying out Energy Audits in areas other than Refining Process Technology, CHT on behalf of PSU refineries have engaged PCRA for conducting Mandatory Energy Audit as required under PAT of Government of India".

Elaborating the role of EIL in research activities of CHT, the CMD, EIL made the following submission:

"Sir, I think I will elaborate on two or three points which are related to technology upgradation and indigenization and what we are doing in that. Sir, actually for all these projects, which we have in the hydro-carbon sector, first it is hi-tech and second, it is highly capital intensive. So, along with that we also need very critical technology as Mr. Sanjeev Singh has explained and also very proficient and detailed engineering activities. So, the whole technology gamut is actually divided into three major factors. One is basic engineering, another is licensed engineering and third is detailed engineering. I think the Hon. Members would be very happy to note that in this country on the third segment, which is detailed engineering, we have achieved 100 per cent indigenization in spite of the growing complexity which we have in our refineries and petrol. Everything is engineered in India.

On the frontal part, which is the licensed component, we are all driven by fundamental research. So, most of the European and the US researches on that and are all catalytic oriented processes. Those are technologies which up till now were only privy to these major countries. India has made a very strong beginning in that through a collaborative effort. So, all the oil majors in India have joined together and we have many plants now which are commercialized through collaborative arrangement. The first diesel hydro treated plant together between EIL and IOCL is already operating in Bongaigaon and there are two more which are coming up as part of the Euro-6 and there are many other technologies which we have commercialized together. So, that particular jinx that this is only going to remain in Europe with our vast experience in refineries is also gradually seeping in. So, we are also getting into the fundamental part of the research.

I think IOCL very recently has set some kind of a technology which possibly could be a model because, I thought some Hon. Members have asked that if you are doing so much of technology, is there avenue for us to also licence the technology and make some money out of it. I think the time has already come. IOCL has already installed one of the very big INDMAX units at Paradip refinery which is possibly giving extremely positive results. I think the time has come not only in Indian refineries, but perhaps abroad also, where we will able to licence and also earn some revenues for India.

On the basic engineering front, I think there is almost all the projects in India are being engineered indigenously and we are also taking that engineering abroad. So, there are a lot of service components which we are doing in all the other countries. A very recent example is what we are doing in Nigeria.

> Everything has been engineered in India. So, we are exporting services abroad including basic engineering. So, that is also happening as a part of it".

15. In response to specific query whether CHT executes projects for refineries in the private sector also and the number of such projects executed by CHT so far and revenues generated in the process, the Ministry state in its written reply that CHT is not involved in execution of projects for refineries in the private sector.

16. Similarly when asked by the Committee whether CHT have any collaborative arrangements with other national and international institutions for technology exchange, the Ministry submitted that CHT does not have any collaborative arrangements with other institutions for technology exchange.

CHT and Auto Fuel Vision and Policy 2025

17. Asked by the Committee about the contribution of CHT in the Auto Fuel Vision and Policy 2025, the Ministry submitted the following in its written reply:

> "CHT provided secretarial and technical support to the Expert Committee constituted by MOP&NG under the Chairmanship of Shri Saumitra Chaudhuri, the then Member, Planning Commission, Government of India for formulating Auto Fuel Vision and Policy 2025.
>
> CHT provided technical inputs in respect of historical and current auto fuel quality specifications and emerging trends in various countries, existing technical capability of refineries, modifications/additional facilities required by refineries for upgradation, estimated investment on industry basis etc. CHT was also actively involved in preparation of the Draft Report".

18. When the Committee wanted to know about the role of CHT in the implementation of auto fuel policy by the refineries, the Joint Secretary (Refineries) Shri Sandeep Poundrik during the oral evidence submitted the following:

> "In public sector refineries, there were two stages of upgradation. .....We are upgrading our fuel quality. We started with BS-I around 2000. Now we are going to BS-IV. By 1st April 2017, we will be having BS-IV fuel quality throughout the country which is equivalent to Euro-IV in Europe. For doing that, the PSU refineries have invested about Rs. 30,000 crore because when you upgrade to a higher quality fuel, you have to install many new units. What we are broadly saying is that the sulphur content has to be reduced in both petrol and diesel. For that, we have to install large number of additional units for which we have invested Rs. 30,000 crore. All those parameters have already been fixed. There is a scientific process that goes into it. We are broadly going by the Euro norms but catering to Indian conditions. So, we are going for BS-IV. After that, the Government has decided to skip BS-V stage

which is perhaps the first example of doing so in the entire world. We will directly go to BS-VI which is a much more stringent norm. That will be from the 1st April, 2020".

Supplementing further on the topic, the representatives from CHT submitted the following during the oral evidence:

"... we are saying that earlier when the Auto Vision Document was referred to, in that it was recommended that we would first come to BS-V and then by 2023-24, we would go to BS-VI. But the Government has said that it would be done by 2020. For that again, the refineries will induce about Rs. 30,000 crore plus. That is the funding for public sector refineries for investing to meet the auto fuel quality; and the sulphur in both petrol and diesel will come from 50 down to 10. That is the best in the world as of now. BS-VI or Euro VI is the best norm".

19. When asked about the sulphur content that will be in BS-VI, the officials from CHT made the following submission during the oral evidence:

"It will be reduced from 50 ppm to 10 ppm, that is 20 per cent of what it is now. Earlier, in BS-III, it was even higher. As I said, there are many parameters which have to be controlled and for which we will need to invest a lot of money".

20. When the Committee asked whether CHT has any institutional arrangement with individual oil refineries for undertaking studies on their behalf to improve their productivity and the Ministry gave the following written reply:

"CHT undertakes studies on behalf of PSU refineries for e.g., Performance Benchmarking, Performance Improvement Programmes and Energy Efficiency Improvement Studies".

21. When the Committee asked as to whether the R&D work of individual oil companies and the research project of CHT will not amount to duplication, the officials from CHT made the following submission during the oral evidence:

"When it comes to PSU refineries, for example, IOC has about ten, HPCL has three including one in joint venture; and BPCL another three. They are trying to improve their own refineries. The CHT is co-ordinating on common issues which are of importance to the country and to the refineries as a whole. So, for example, Solomon benchmarking is the main benchmarking in the world. It studies about 200 plus refineries in the world and tells us where our refineries stand at the world level. They have various parameters. For example, you have seen in the presentation that there is a lot of focus on energy efficiency. We are not performing well since most of our refineries are old and capacity has been expanded in stages. So, efficiency-wise they are not good. The older refineries do not perform well in that. The Solomon benchmarking tell us

for each refinery how is the refinery vis-à-vis world standard, Asian standard, and all that. Those are things which are important for the country as a whole.

The next is the cross-learning. What HPCL is doing, IOC should know; what IOC is doing, BPCL should know. So, cross-learning of best practices is co-ordinated by CHT. They do not have any research of their own as the Secretary said. There is a Scientific Advisory Committee with renowned scientists for that. Shri Kakodkar is there is the Scientific Committee. There were others earlier. The individual scientists propose projects that they want to research on for a particular project".

22. Elaborating about the usefulness of CHT, the Director (Refinery) IOCL during the oral evidence submitted the following:

"Sir, I would like to clarify one thing. Till late nineties, the diesel specification sulphur was one per cent. Today we are targeting 10 ppm (parts per million). When we were switching to BS, there was a need to go for diesel decentralisation units. In the country, we had none till that time. We were not aware of technologies. There were a lot of technologies which were available globally and everyone was trying to sell his concept to India. So at that time CHT, on industry basis, evaluated what best technology was available in the world. They evaluated and recommended what should be followed by the industry. So, it was a tremendous exercise done for the industry. Probably individually IOCL, HPCL and BPCL would not have got the best solution. Sir, you very well noted this 55 million benefit or 28 million benefits. So, now the CHT, as such, are not recommending anything for these benefits. Now, these are by engaging external consultants for the industry. Now, if I do it for Indian Oil, probably, I will have to repeat it for each refinery. But, when we do it on industry basis, if HPCL has done a similar study, we need not repeat that study. We exchange our notes and we exchange the benefits to see what can be done. It is not only exchange of providing platform, they are the technical wing of the Ministry. They help the Ministry in monitoring those and see that whatever has been recommended whether we all are following that or not. So, I think that platform is a very good platform which is provided by CHT".

23. Asked by the Committee as to whether all equipment/technologies used in the refineries have been indigenously developed and the contribution of CHT in that, the Ministry in its written reply submitted the following:

"The technologies employed in petroleum refining is complex and sophisticated and are licensed by global process licensors. India has made significant progress in developing some of the sophisticated technologies like Indmax, DHDT, SRU etc. which competes with the best in the world. India has also developed capability for detailed engineering.

CHT, through SAC, has played important role by sponsoring R&D projects leading to development of knowledge base (fundamental), specific studies

related to improvement in the existing processes, hardware and catalyst development".

24. When the Committee enquired as to how are the technology developed by CHT is adopted by the oil companies, the Ministry in its written reply stated the following:

"Refining Technology has high gestation period from conceptualisation to commercialisation involving several steps like basic research, simulation & modeling, scale-up, setting up of semi-commercial followed by full scale commercial units. Such technology developments require concerted efforts and dedicated R&D Institutes with analytical and pilot plant facilities which are available with major R&D Centre like IOCL-R&D, IIP, EIL-R&D etc. CHT, through SAC, has played important role by sponsoring R&D projects leading to development of knowledge base (fundamental), specific studies related to improvement in the existing processes, hardware and catalyst development.

The list of technologies developed through CHT funding and implemented is given below :

- Aromatic extraction for Benzene/Toluene developed by IIP/EIL: Implemented at BPCL-Mumbai & Kochi and NOCIL
- Food Grade Hexane Technology developed by IIP/EIL: Implemented at BPCL, CPCL, HPCL, ONGC-Hazira
- Bimetallic Reforming Catalyst developed by IIP/IPCL: Implemented at CPCL & IPCL
- NMP extraction for LOBS developed by IIP/EIL/CPCL : Implemented at IOCL- Haldia Refinery
- Delayed Coker developed by IIP/EIL: Implemented at BRPL, NRL.
- Debottlenecking of Dewaxing/Deoiling of Lubes by IIP: Implemented at CPCL, IOCL - Haldia Refinery
- Improved Soaker Visbreaking technology developed by IIP/EIL : Implemented at 7 refineries
- Distributor design based on Hydrodynamics of Trickle Bed Reactor by EIL & IOC (R&D) – implemented for DHDS at IOCL-BGR and FGH unit of HMEL (GGSRL), Bathinda".

25. When asked by the Committee whether CHT is also exporting its know-how in its area of expertise to other countries, the Ministry stated that CHT is not exporting its know-how.

26. When asked by the Committee to furnish a note on the status of developing the technology for converting coal to liquid, the Ministry in its written reply submitted the following:

"A Brief Note on Coal to Liquid (CTL) Fuels Technology Development by EIL, BPCL & Thermax funded through CHT is given below:

Energy mix in India is dominated by fossil fuels and the share of Coal is more than 50% in the mix, which is projected to remain at the same level in foreseeable future. India is bestowed with large reserves of coal, 4th largest in the world, but ash content in Indian coal is more than 40%. Thus there is need to develop clean coal technology to harness our coal reserves in an environment friendly manner. Gasification of coal is considered to be environmental friendly technology. During the gasification process any carbonaceous material is converted to Syn Gas ($CO+H_2$), which can be cleaned and put to use for the production of variety of chemicals, petrochemicals, power, Hydrogen etc. This route has been mainly pursued in South Africa and China. However, technology is not available to gasify high ash Indian coal in efficient manner. The technology is highly technical as well as capital intensive.

In order to develop indigenous technology suiting Indian coal, CHT, based on the recommendations of SAC, has funded a Project on "Coal to Liquid (CTL) Fuels Technology Development by EIL, BPCL & Thermax" at a cost of Rs 33 crore (including Rs 14.84 crore funding by CHT).

The project has been envisaged in three major steps:

Step1: Gasification of coal to syn gas

Step2: Cleaning of syn gas (Removal of H_2S, NH_3, HCN, CO_2, COS, etc.)

Step3: Conversion of syn gas to liquid fuels through Fischer-Tropsch (FT) synthesis

The catalyst and process for FT synthesis have been developed for production of liquid fuel from synthetic syn gas. For gasification part, simulation and modelling has been completed and a pilot plant has been set up in EIL along with Thermax and presently validation of model is in progress. So far, plant run has been established in combustion mode. Gasification of coal has been done upto 4 bar pressure and Syn gas cleaning is being done simultaneously. The pressure will be raised gradually upto 20 bar pressure, needing certain modification in the gasification system.

This project is 94% completed so far. SAC has reviewed the project regularly and granted time extension up to June 2017 considering the complexity and steps required".

27. Elaborating the efforts of EIL in the Coal to Liquid Fuels (CTL), the Chairman EIL made the following submission during the oral evidence:

"I think there is an important initiative which has been taken between BPCL and EIL to handle and look into the specific coal which we have in India. Indian coal is high ash coal. It is a very different kind of a coal which we have in other countries. This coal requires a specific and appropriate technology to

address this issue. So, together we are engaged in this process. The plant has already been set up in EIL (R&D) premises. The initial start ups were done. There is certain troubleshooting which is going on that. In this plant, there are certain components which are given some problems. We are into the process of troubleshooting that. One section of the plant might get operational very fast and along with that we believe that the next section will also be put in position shortly. The plant has already been installed. So, I think there is a very good research which is going on this and since we have abundance of coal probably there is a good solution also available in terms of technology which could be domestically developed and probably utilized in a larger way. So, I think there is a lot considerable amount of work which has been done during that time when the project was initiated as a pilot".

28. When the Committee enquired about the coordination of CHT with consultancy service companies such as EIL, the Ministry gave the following written reply:

"CHT is associated with EIL for undertaking Energy Efficiency Improvement Studies for PSU refineries on a centralised basis. CHT carried out a workshop of oil refineries and R&D institutes/EIL for sharing information on technologies available indigenously. CHT, based on the recommendations of SAC, also provide grant-in aid for R&D projects to EIL".

29. When asked about the work being undertaken by CHT in developing technologies for manufacturing of different by-products after refining of crude oil, the following submission was made by the Ministry:

"By-products like petcoke, sulphur are produced as co-products during refining of crude oil. So far, CHT has not worked in the areas of manufacturing of by-products".

30. When asked about whether CHT has any research project on upstream activities in the petroleum sector, the officials of the CHT stated the following during the oral evidence:

".... The CHT is not doing upstream. They are primarily on refineries and to some extent on alternative fuel and other things.

...The Scientific Advisory Committee has already approved research projects for alternative fuel. This basically means ethanol, bio-diesel or hydrogen which is a futuristic fuel; these are non-hydrocarbons, other than petrol and diesel".

31. When asked about the role of CHT in development of alternative energy sources such as gas hydrates, shale gas, hydro energy etc. and whether technology

for exploitation of these sources have been developed or under development, the Ministry submitted the following written reply:

> "Development of alternative energy sources such as gas hydrates, shale gas etc. is done by R&D Institutes in Upstream Sector like ONGC etc. The role of CHT is mainly in the area of Refining Sector".

32. Asked by the Committee as to whether CHT is also involved in enhancing the availability of ethanol for blending with auto fuel by developing alternative sources in order to achieve the mandated level of blending i.e. 10 per cent. The Ministry stated that this work is being done by Public Sector OMCs.

33. When the Committee asked as to furnish note on the activities of CHT being undertaken in the fields of environmental pollution and in its management, the Ministry stated as under:

> "CHT conducts Activity Committee Meetings on Environmental Management with active participation of all the refineries for dissemination of information and sharing of best practices/latest development. CHT was also actively involved in quality upgradation of MS and HSD".

34. When the Committee asked the Ministry to give a brief note on the major projects being undertaken by CHT at present giving out details such as the company for which project is being undertaken, objectives of the project and fee charged by CHT in each case, the Ministry in its written reply submitted the following:

> "Major projects being undertaken by CHT at present in the refineries are as under:-
>
> - Performance Benchmarking of 15 PSU fuel refineries and 4 lube refineries through Solomon Associates, USA for cycle 2016 has been initiated at a cost of US $ 890,000 (~ Rs 6.0 Crore excluding taxes). CHT will bear 50% of the base cost excluding service tax.
> - Comprehensive Energy Efficiency Improvement for 15 PSU refineries through EIL has been initiated to bring down specific Energy Consumption in both short/medium term at a cost of Rs. 12.9 Crore excluding taxes. CHT will bear 50% of the base cost excluding service tax.
> - Integrated Refinery Business Improvement Programme (IRBIP) Phase-II through Shell at BPCL- Mumbai, HPCL-Mumbai and MRPL is in progress. The fee is payable to the consultant depending upon actual demonstrated benefit.
> - Refinery Performance Improvement Programme (RPIP) for all PSU refineries is being planned in a phased manner by 2021-22 through global consultant".

35. When asked about number of patent applications made by CHT so far date-wise and how many patents have been allotted/granted and the patents pending status of CHT at different stages, the Ministry in its written reply submitted the following:

> "CHT is involved sponsoring R&D projects, recommended by SAC, for development of knowledge base (fundamental), specific studies related to improvement in the existing processes, hardware and catalyst development by way of grant-in aid. All IPR (Intellectual Property Rights) vests with developing institutes who only file the patents. However, CHT has got the first right of using the developed know-how in any of the PSU refineries".

36. When the committee wanted to know whether CHT has been undertaking any research project in exploiting gas hydrates which has been found to be in large quantity in Mahanadi Basin in the Country, the Secretary MoPNG during the oral evidence made the following submission:

> "Regarding gas hydrates that you have mentioned, gas hydrate as a research project is already undergoing. Phase two has been completed. Actually, research under this project is being undertaken basically in three countries, Japan, US and India. We are already in talks and negotiations with those countries to go for the third project. As the member has mentioned, this is in a very-very preliminary stage. It has not been demonstrated even at the pilot stage. Commercial extraction of gas hydrate project may take some more time. It would depend on various other factors like the crude price in the international market and how it develops but definitely there is a huge potential particularly in the East coast. We are cognizant of this fact. We are undertaking these negotiations.
>
> The second phase of the project is completed and for the third phase we are already in negotiation. The basic issue there is whether commercial scale exploitable technology can be developed. That is the stage at which we are in. This technology was being tested in pilot stage in Japan but not very encouraging results have come so far. More and more research is needed in this field which we are already under negotiation".

37. The Committee was desirous to know whether CHT is undertaking any project to use hydrogen as an alternative fuel along with natural gas, the Ministry in its written reply have made the following submission:

> "Two projects were undertaken by IOC (R&D) for use of hydrogen as an alternative fuel along with natural gas as under :
>
> 1. Setting up of HCNG dispensing station at IOCL COCO, Dwarka, New Delhi by IOC (R&D) - Completed in 2011

The estimated cost of the project was Rs. 499 lakh with Ministry of New & Renewable Energy (MNRE) contributing Rs. 250 lakh and the balance capital cost of Rs. 249 lakh under HCF. The project was approved by MNRE in July 2006 and completed in 2011. The objective of the project was to set up hydrogen and HCNG dispensing station at Dwarka for supplying fuel to vehicles, gain experience for implementation of HCNG & Hydrogen under commercial environment and its acceptance as a safe fuel.

Hydrogen is produced by electrolysis of water and the electrolyzer has been designed for producing Hydrogen @ 5 Nm^3/ hr with 99.99% purity and delivery pressure of 10 bar. Hydrogen produced is subsequently compressed and stored in high pressure storage tank. CNG is blended with Hydrogen in the blender using supersonic nozzles technology to achieve blend of CNG & Hydrogen in the ratio of 82:18 by volume.

The salient features of the facility are:

- HCNG Fill Pressure = 200 bar
- Temperature compensated fill
- Dispensing rate = 0.52 kg/ min to 25 kg/ min for HCNG blend
- Hydrogen hose not connected as per PESO but H_2 filling can be done @350 bar

2. Demonstration project on “Use of Hydrogen-CNG blends in Automotive Vehicles” by IOC (R&D) - Completed in September 2015

   The project was undertaken with estimated cost of Rs. 1105 lakh in March 2007. The project involved following activities:

   - European Steady-state Cycle (ESC) and European Transient Cycle (ETC) tests and optimisation of the complete system involving M/s ApiCom, Italy (TED supplier)
   - Endurance of Engine after Optimisation first for 100 hrs. with performance testing at 0 & 100 hrs. using 18% HCNG blend
   - Testing/ endurance studies with Ashok Leyland and Tata Motors engines and field trials for 20,000 km.

   The project was completed in September 2015".

Manpower in CHT

38. The current manpower at CHT is 14 Technical Officers and 7 HR/Finance officers/staff. The manpower required for functioning of CHT is drawn from Oil PSUs on deputation. In addition, retired officers from PSU Oil Companies are engaged as advisors on contract.

39. The Committee wanted to know whether CHT has own employees. The Ministry in their reply stated that "CHT does not have regular employees".

40. When the Committee sought to know why the CHT does not have its own employees and the staff are taken only on deputation from other PSUs, the representatives of the Ministry during the oral evidence stated as follows:

> "As far as their staffing is concerned, presently they are staffed through deputation of officers and senior executives largely from public sector enterprises. When this organisation was established, the role of private sector was very limited. Private sector has entered this industry of late and not at the initial stage. One reason why the officers have come on deputation is that we need the experienced people from the industry; we need people who have the experience of working in the refineries and have first hand experience of the functioning of these refineries. That perhaps would have been one consideration why people have been brought on deputation from public sector enterprises. But we are always open to taking some people from open market. It is not that we will have people only from PSUs or through deputation".

41. When pointed out that many organizations under Ministry of Petroleum are being manned by staff from PSUs, the Secretary, Ministry of Petroleum supplemented the following during the oral evidence:

> "We are looking into those aspects as well whether we can have some experts even from open market or private sector. In fact, it has been other way round also. People who have been working in public sector have gone to private sector. Originally the manpower was available in public sector only. As private sector entered into this industry, they have taken people from this side".

42. Supplementing on the issue of deputing officers from PSUs to CHT, the Director (Refinery) of IOCL made the following submission during the oral evidence:

> "Firstly, Sir, in a refinery, we have different processes. It is not a single industry. It is a combination of small industries and we have different licensed technologies which we use within the refinery. So, in CHT, these 15 or 16 officers, each individual officer is drawn for a particular purpose or a particular technology. They come with a very specific background. That is why, this organisation is small but experience wise they are very wide. They are providing a platform across the industry.
>
> ... Sir, because they need people of specific background, so that is why probably there is a need that they are taken from industry on deputation basis.
>
> ... Now, taking the retired people in CHT, in fact, the fault lies with us because although there had been a lot of demand from CHT because of lot of projects

which are undergoing for BS-4 and BS-6. We are, within Indian Oil, talking about more than 20 projects which are undergoing. We could not probably release. My observation is it is only very recently it has happened. It was not a practice for this organisation to have and even our own people who go to CHT on deputation basis, they get tremendous value. I think it is a wonderful platform for the industry which has been provided".

Part - II

Observations / Recommendations

Recommendation No. 1

Mandate and Function of CHT

The Committee note that Centre for High Technology (CHT) was established in 1987 as a dedicated technology cell of the Ministry of Petroleum and Natural Gas. The major functions of CHT include assessment of technology requirement, operational performance evaluation and improvement of the refineries. CHT acts as a focal point of oil industry for centralised technical assistance, knowledge dissemination, performance data base, exchange of information and experience sharing. The Committee further note that CHT functions under the overall guidance and supervision of the Governing Council (GC) headed by the Secretary, MoP&NG as the Chairman.

The Committee also find that the refining capacity in the country at present is about 240 MMTPA and the refining sector has seen a significant participation from private sector like Reliance, Essar etc. and also there are joint venture companies like HMEL and BORL in that business. The Committee further note that the country is importing 80 per cent of its crude oil requirements and at the same time there is significant exploration activities yet to be done in the country. There is a need for technological requirements in deep water exploration, high pressure-high temperature exploration, shale gas, etc. in the country. Also, the country has recently identified gas hydrates resources which have immense potential to meet its energy requirements. However, there is no technology available within the country or at global level also as except US and Japan no other country seems to be interested in this energy source. The Committee find that CHT basically looks at performance assessment and experience sharing with select R&D projects relating to public sector refineries on recommendation of Scientifc Advisory Committee on hydrocarbons and the technology developed through CHT funding is implemented at various refineries as per their requirement . The Budget available with CHT for funding such R&D Projects and special studies is very

small i.e. around Rs. 10 crore every year. The Committee, are therefore, not satisfied with the narrow mandate of CHT limited to assist the refineries in performance improvement and promoting a few R&D projects carried out by dedicated R&D institutes with analytical and pilot plant facilities available with R&D centres of OMCs and not developing it as a dedicated technology cell of the Ministry covering the technological requirements of whole oil industry including both the upstream and downstream sectors. Therefore, the Committee recommend that MoP&NG should conduct a thorough review either by itself or through any external agency with an objective to redefine the role of CHT and widen its mandate so as to justify its name and include research areas of upstream sector also of the petroleum industry in addition to its role of improvement in the performance by technological innovation in refining sector.

Recommendation No. 2

R&D infrastructure with CHT

The Committee note that CHT assists refineries in performance improvement and promoting R&D through funding of R&D Projects as recommended by Scientifc Advisory Committee on hydrocarbons . While performing the role in improving the performance of refineries, CHT actually engages consultant to carry out the studies and benchmark the performance of refineries. Moreover, CHT neither has any laboratory nor there is any mechanism to coordinate with any national or international research organisation in R&D Projects. As a matter of fact, in case of funded projects, R&D work is carried out by the R&D Institutes of grantee organisations/institutes like IOCL-R&D, EIL-R&D, HPCL-R&D, BPCL-R&D, IIP, IIT etc. Therefore, CHT is actually not working as a dedicated technology cell of Ministry which prepares R&D Projects based on assessment of technology requirements of the industry, rather R&D activities of PSU refineries are only coordinated and supported by CHT. Projects are undertaken on the advice of Scientific Advisory Committee which receives the proposals from various research related institutes and also from the refineries. Moreover, CHT has no control over the intellectual property generated through the R&D Projects but

CHT works as the cross learning platform through which the notes and benefits are exchanged with each other.

While going through this working of CHT, the Committee observe that with this present design, CHT is not actually able to justify with its mandate. In Committee's view, the Refining technology development require focussed efforts and dedicated R&D Centre with analytical and pilot plant facilities which is not there with CHT. The Committee, therefore, desire that CHT should be developed as platform working for whole oil industry with high profile team of experts and an independent fully developed R&D laboratory capable to cater the needs of technological advancement of oil industry. The Committee further desire that CHT should also tie up with petroleum institutes within the country as well as abroad for their R&D activities. The Committee, therefore, hope that MoP&NG will strengthen CHT accordingly so that it can be able to work as a technical cell the Ministry.

Recommendation No. 3

Budgetary Allocation of CHT

The Committee note that the expenditure of CHT is fully funded by OIDB and it has no other source of revenue generation and CHT is totally dependent on OIDB for its funds. The major capital expenditure of CHT is for funding of R&D projects and for special studies. The revenue expenditure is mainly on account of salaries to its staff. The budgetary allocation was Rs. 16.42 crore in 2014-15 and Rs. 19.31 crore in 2015-16 and expected expenditure is around Rs. 21.35 crore during 2016-17. The Committee find that the fund allocated by OIDB is not adequate to handle the important responsibility assigned to CHT to fund capital intensive projects relating to refining sector. Simultaneously, the Committee are worried to observe the trend of expenditure being made by CHT during the last three years. It is surprising to note that CHT is even not able to spend the small allocation of Rs. 10 to 12 crore by OIDB for funding of R&D Projects and the studies in a balanced manner. The Committee, therefore, desire that CHT should scientifically project its estimates to commensurate with the industry requirements and assigned responsibilities and should improve its spending of the allocation during each financial year.

The Committee further observe that CHT does not get any royalty for the technologies developed through CHT funding when it is implemented by the refineries. CHT does not carry out any R&D project incorporating private sector refineries also. The Committee do not find it a happy situation. Being a research sponsoring organization it does not augur well for CHT to depend on one agency for its entire funding and should try to raise resources on its own so as to reduce its dependency on OIDB. Therefore, the Committee recommend that CHT should also incorporate the private sector refineries along with Public Sector ones to carry out advanced studies and their requirements so as to benefit the industry as a whole and on implementation of technologies beneficial to them should try to earn revenues both from public as well as private sector so as to make it more sustainable. CHT can also explore the possibility of selling the technology to private players of the industry and generate revenues.

Recommendation No. 4

Manpower for CHT

The Committee note that CHT functions as a technology cell of the MoP&NG with a small manpower of 14 technical officers and 7 HR/Finance officers drawn from Oil PSU on deputation. Retired officers from PSU oil companies are also engaged as advisors. The Committee further note that there is no permanent staff or officers on the rolls of CHT. This is a very undesirable situation of functioning of such an important organisation responsible for advising the Ministry on futuristic requirements, assess, develop and adopt technologies in refinery processes and petroleum products. The Committee have not been given any convincing reason for not recruiting engineers, scientists, staff on a permanent basis in CHT. The Committee have been assured that the Ministry is open for appointing people from open market to CHT. The Committee, therefore, desire that CHT should attract people from other research organizations like CSIR, IIT etc. to work on specific projects in a time-bound manner. The Committee also desire that the Ministry should approach the manpower requirements in CHT with an open mind to have a mix from PSUs and open market and devise a suitable policy in CHT to attract the

people from scientific and technical background with research experience from open market along with officials on deputation from Oil PSUs.

Recommendation No. 5

Coal to Liquid Project (CTL)

The Committee note that CHT has funded a R&D project on Coal to Liquid (CTL) Fuels Technology Development by EIL, BPCL & Thermax at a cost of Rs. 33 crore (including Rs. 14.84 crore funding by CHT). The Committee further note that this project was first considered during 2007 and then a modified proposal was considered in April 2008. MoU between CHT, BPCL (R&D) and EIL (R&D) has been signed in March 2009. The Committee have noted that the project has been completed to the extent of 94 per cent so far and the SAC has reviewed and granted time extension upto June 2017 for completion of the project.

The Committee consider that by development of indigenous clean coal technology for conversion of Coal to Liquid will certainly help the country in harnessing the coal reserves in an environment friendly manner and the break through in this technology would contribute in strengthening the energy security of the country. Therefore, the Committee recommend that the Ministry and the SAC should closely monitor the project at regular intervals and ensure that any difficulty being faced by the concerned agencies is remedied and the project reaches its successful completion by the extended time positively.

Recommendation No. 6

Performance Benchmarking of Refineries

The Committee note that CHT undertakes studies on behalf of PSU refineries for performance benchmarking, performance improvement programmes and energy efficiency improvement. The performance benchmarking of the PSU refineries is done by engaging M/S Solomon Associates on various parameters. The Committee further note that Solomon benchmarking is the main benchmarking in the world and it studies about 200 plus refineries and tells about where particular refinery stands at the world level. The Committee observe that in benchmarking, the main focus is on

energy efficiency where Indian refineries are not performing well. Moreover, most of the Indian PSU refineries are old ones and have several complexities and an **improvement in their performance at par with global standards will be a tough and challenging task. The Committee also note that the fuel quality in the country has been upgraded to BS-IV norms since April, 2017 and the Government has decided to skip BS-V and go to BS-VI fuel quality directly by the year 2020. For meeting the BS-VI quality norms, the refineries have to modernise the units quickly by introducing new technology. The Committee would, therefore, recommend that CHT by regularly carrying out performance improvement programmes should ensure that the old PSU refineries are modernised quickly and reach the desired standards in their performance and become ready to produce BS-VI fuel by 2020.**

Recommendation No. 7

Research on Alternative Energy Sources

The Committee note that CHT is also the nodal agency for taking up hydrogen projects and related activities from the Hydrogen Corpus Fund (HCF). The objectives of HCF are to develop hydrogen as an alternative energy source, facilitate R&D activities, synergise hydrogen development activities between Oil companies and institutions and facilitate training and capability building. Initial Hydrogen Corpus Fund of Rs. 100 crore has been created with contribution of Rs. 40 crore by OIDB and Rs. 16 crore each by IOC, ONGC and GAIL and Rs. 6 crore each by HPCL and BPCL and the fund will be managed by OIDB. All proposals under the HCF will be received by CHT and put up to Scientific Advisory Committee for approval. But the Committee find that CHT has not undertaken any serious activity relating to H_2 projects except the single project relating to coal gasification. Further, the Committee also observe that CHT has no research programme on bio fuels which is an important area for Indian scenario.

The Committee feel that the projects relating to hydrogen as an alternative energy source are very important not only for the Government and CHT but also for the country as a whole as this is an advanced area of research and any breakthrough in this direction will strengthen the energy

security of the country. The Committee, therefore, recommend that the Ministry should accord top priority to H_2 projects and bio-fuel projects and expect CHT to play a pro-active role in taking up these projects and related activities by proper guidance, regular monitoring and necessary funding in every area so that all the projects are completed in a time-bound manner.

New Delhi;
***31 July*, 2017**
9 Shravana,1939 (Saka)

PRALHAD JOSHI,
Chairperson,
Standing Committee on
Petroleum & Natural Gas.

MINUTES **Confidential**

STANDING COMMITTEE ON PETROLEUM AND NATURAL GAS
(2016-17)

Seventh Sitting
(23.12.2016)

The Committee sat on Friday, the 23 December, 2016 from 1100 hrs. to 1245 hrs. in Room No. 'G-074', Parliament Library, New Delhi.

PRESENT

Sh. Pralhad Joshi - Chairperson

MEMBERS

LOK SABHA

2 Dr. Ravindra Babu Pandula
3 Shri P. K. Biju
4 Shri Elumalai V.
5 Dr. Thokchom Meinya
6 Smt. Pratima Mondal
7 Shri Ashok Mahadeorao Nete
8 Shri Arvind Ganpat Sawant
9 Shri Ravneet Singh
10 Shri Om Prakash Yadav
11 Shri Laxmi Narayan Yadav

RAJYA SABHA

12 Shri Om Prakash Mathur
13 Shri Bhubaneshwar Kalita
14 Shri Dilipbhai Pandya
15 Shri V. Lakshmikantha Rao
16 Shri V. Vijayasai Reddy
17 Mahant Shambhuprasadji B. Tundiya
18 Shri A. Vijayakumar

SECRETARIAT

1. Dr. Ram Raj Rai - Director
2. Shri H. Ram Prakash - Additional Director
3. Shri Sujay Kumar - Under Secretary

Representatives of the Ministry of Petroleum & Natural Gas

1 Shri K.D. Tripathi - Secretary
2 Shri Ajay Prakash Sawhney - Addl. Secretary
3 Shri Ajit Kumar - Deputy Secretary (Ref.)

Representatives of Public Sector Undertakings and other Organisations

1	Shri Sanjay Gupta	-	CMD, EIL
2	Shri Brijesh Kumar	-	Executive Director, CHT
3	Shri A.S. Pathak	-	Director, CHT
4	Shri R. Krishnamurthy	-	Advisor, CHT
5	Shri Vijay Prakash	-	Executive Director (Ops.), IOCL
6	Shri R. Ramachandran	-	Director (R), BPCL
7	Shri V.S. Sehnoy	-	Director (R), HPCL
8	Shri V. Anand	-	Executive Director (Planning & Infr.), BPCL

2. At the outset, the Hon'ble Chairperson of the Committee welcomed Members of the Committee and representatives of the Ministry of P&NG to the sitting of the Committee. Thereafter, the representative of the CHT made a power point presentation on the subject "Functioning of Centre for High Technology".

3. Subsequently, Members of the Committee deliberated on issues related to the subject such as role and functioning of CHT, its funding pattern and budgetary allocations, infrastructure for its activities, staffing of the organisation, collaboration with academic institutions at the national and international level, augmentation of investments in refineries for improving auto fuel quality in the country, cost benefit analysis of exports of indigenous refining products vis a vis substitution to crude oil imports of the country, foreign exchange earnings accruing out of export of refinery products and detailed information on ongoing research projects at CHTetc.

4. Further, issues like Coal to Liquid (CTL) project being undertaken jointly by EIL and BPCL, taking help of experts/scientists working in the field of petroleum sector/open market, sulphur content in BS-V and BS-VI auto fuels, evaluation of petroleum related research projects by the scientific advisory committee, level of indigenisation of technology in engineering processes, percentage of ethanol blending in petrol and exploration of shale gas in the country also came up for deliberation during the sitting of the Committee**.**

5. A copy of the verbatim proceedings of the sitting has been kept for record.

The Committee then adjourned.

MINUTES

STANDING COMMITTEE ON PETROLEUM AND NATURAL GAS (2016-17)

TWENTY FIRST SITTING (27.07.2017)

The Committee sat on Thursday 27 July, 2017 from 1600 hrs. to 1640 hrs. in Committee Room 'B', Parliament House Annexe, New Delhi.

PRESENT

Sh. Pralhad Joshi - Chairperson

MEMBERS

LOK SABHA

2 Dr. Ravindra Babu
3 Smt. Rama Devi
4 Shri Elumalai V.
5 Shri P.K. Biju
6 Smt. Jayshreeben Patel
7 Shri Kalikesh N. Singh Deo
8 Shri Naranbhai Kachhadiya
9 Shri Rajendra Agrawal
10 Shri Kamakhya Prasad Tasa
11 Shri Om Prakash Yadav
12 Shri Laxmi Narayan Yadav
13 Shri Rajesh Verma
14 Dr. Thokchom Meinya

RAJYA SABHA

15 Shri Bhubaneshwar Kalita
16 Shri Dilipbhai Pandya
17 Shri V. Lakshmikantha Rao
18 Shri V. Vijaysai Reddy
19 Mahant Shambhuprasadji B. Tundiya
20 Shri A. Vijaykumar

SECRETARIAT

1.	Dr. Ram Raj Rai	-	Director
2.	Shri H.Ram Prakash	-	Additional Director

2. At the outset, Hon'ble Chairperson welcomed the Members to the sitting of the Committee. The Committee then took up for consideration the draft Report on the subject "Centre for High Technology (CHT)" and adopted the same with minor modifications.

3. The Committee authorised the Chairperson to finalize the report and present/lay in both the Houses of Parliament.

The Committee then adjourned.