

सीएचटी/एसएसी-90/ 2605

CHT/SAC-90/

सेवा में/ To,

09 दिसंबर 2020

09th December 2020

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 90वीं बैठक का कार्यवृत्त

Sub: Minutes of 90th Meeting of the Scientific Advisory Committee (SAC) on Hydrocarbons of Ministry of Petroleum & Natural Gas

प्रिय महोदय/महोदया / Dear Sir/Madam,

दिनांक 01 दिसंबर, 2020 को विडियो कॉन्फ्रेंसिंग द्वारा सम्पन्न, पेट्रोलियम और प्राकृतिक गैस मंत्रालय की हाइड्रोकार्बन पर वैज्ञानिक सलाहकार समिति की 90वीं बैठक के कार्यवृत्त की प्रतिलिपि आपकी सूचना एवं आवश्यक कार्यवाही हेतु संलग्न की जा रही है।

Enclosed please find a copy of the Minutes of 90th Meeting of the SAC on Hydrocarbons of Ministry of Petroleum & Natural Gas held on 01st December, 2020 through video conferencing, for your kind information and necessary action.

सादर,

With kind regards,

भवदीय,

Yours sincerely,



(के.के.जैन)

कार्यकारी निदेशक

(K.K. Jain)

Executive Director

Copy for information to:

- Secretary, P&NG
- Chairman IOCL
- CMD BPCL / HPCL / EIL
- MD MRPL / CPCL / NRL

List of Members for 90th meeting of SAC

S. No.	Name, S/Shri	Designation	Organisation
CHAIRMAN			
1.	Dr. Anil Kakodkar	Former Chairman, Atomic Energy Commission	BARC
MEMBERS			
2.	Prof. R. Kumar	Professor Emeritus	IISc, Bangaluru
3.	Prof. J. B. Joshi	Professor Emeritus	HBNI
4.	Dr. M. O. Garg	Head – Refining and Petchem R&D	RIL
5.	Prof. A. B. Pandit	Vice Chancellor	ICT, Mumbai
6.	Dr. Shashi Kant	Technical Advisor	Universal Group, Vadodara
7.	Prof. Shankar Narasimhan	Professor	IIT, Chennai
8.	Dr. R. K. Malhotra	Director General	FIPI
EX-OFFICIO MEMBERS			
9.	Shri S. M. Vaidya	Chairman & Director (Refineries)	IOCL
10.	Shri Arun Kumar Singh	Director (R) & Director (M)	BPCL
11.	Shri V. S. Shenoy	Director (Refineries)	HPCL
12.	Dr. S.S.V. Ramakumar	Director (R&D)	IOCL
13.	Ms. Vartika Shukla	Director (Technical)	EIL
14.	Dr. Sanjeev S. Katti	Director General	ONGC Energy Centre
15.	Shri Manoj Jain	CMD & Director (BD)	GAIL
16.	Shri Niranjana Kumar Singh	Secretary	OIDB
17.	Shri Niranjana Kumar Singh	Executive Director	PCRA
18.	Shri Neelkanth V. Marathe	Officiating Director	ARAI
19.	Dr. Anjan Ray	Director	CSIR-IIP
20.	Shri S.C.L. Das	Director General	DGH
MEMBER SECRETARY			
21.	Shri K.K. Jain	Executive Director	CHT
PERMANENT INVITEE			
22.	Shri Sunil Kumar	Joint Secretary (Refineries)	MoP&NG
23.	Shri V. Ravikumar	CGM (R&D)	BPCL
24.	Shri S. Bharathan	Head (R&D)	HPCL
25.	Shri H. Shankar	Director (Technical)	CPCL
26.	Shri S.C. Gupta	Head (R&D)	EIL

27.	Shri D.V. Shastry	Executive Director (Training, R&D and Start-Up)	GAIL
SPECIAL INVITEE for PM-JIVAN Yojana			
28.	Shri K. Salil Kumar	Dy. Secretary	MNRE
29.	Shri Rajendra Kumar Soni	Director	D/o CP
30.	Dr. Rohit Misra	Assistant Industrial Advisor	D/o CP
31.	Shri V.K. Chaurasia	Joint Advisor	MoH&UA
32.	Dr. Suresh Kumar Malhotra	Agriculture Commissioner	DAC&FW
33.	Shri Dharmvir Jha	Director (MGNREGA)	D/o RD
34.	Dr. Sangita Kasture	Scientist 'F'	DBT
ADDITIONAL MEMBERS OF SELECT COMMITTEE OF SAC			
35.	Shri Sushil T. Williams	Dy. Secretary (BR/OR)	MoP&NG
36.	Dr. D.K. Tuli	DBT Bio-energy Chair	DBT
37.	Shri Arvind Acharya	CGM (Finance)	IOCL

Minutes of 90th Meeting of Scientific Advisory Committee (SAC) on Hydrocarbons of MoP&NG

1. The 90th Meeting of SAC was held on 1st Dec'20 through Video Conferencing. The meeting was chaired by Dr. Anil Kakodkar, Chairman, SAC.
The list of participants is enclosed as **Annexure-I**.
2. Shri K.K. Jain, ED (CHT) welcomed the Chair, Members, Permanent Invitees, Special Invitees of SAC & other participants.
3. At the outset Chairman, SAC, while welcoming members and Invitees of SAC as well as Select Committee, in his opening remarks emphasized on the following;
 - a. RFS under PM JI-VAN Yojana has been issued two times so far. First time 6 commercial and 1 demonstration project proposals were received. SAC recommended 4 commercial and 1 Demonstration project proposal for VGF / Financial assistance, which were approved by Steering Committee. RFS was issued 2nd time in June'20 and 3-month timeline was given for proposal submission. However, no proposal was received and RFS was extended by one more month. Only one proposal has been received from SAIL, which is an area of concern and there is a need to deliberate / analyze the probable reasons. He opined that next RFS should be issued only after addressing the challenges / issues so far.
 - b. The proposal from SAIL is based on Gas fermentation technology of M/s LanzaTech. He referred SAC's initiative for inviting M/s LanzaTech to present their technology in one of the SAC meetings (79th meeting held on 17th March 2017). SAC, in one of the meetings (81st meeting held on 14th March 2018) also reviewed the proposal of IOC R&D for demonstration of M/s LanzaTech technology for production of Ethanol from refinery off gases at Panipat Refinery. SAC had recommended the proposal for funding by OI DB. Chairman SAC requested Director, IOC (R&D) to update on the same.
 - c. The primary intent of PM JI-VAN Yojana is to create an import substitute of hydrocarbons by producing ethanol through leveraging biomass and using biotechnologies. He appreciated that Select Committee, through legal interpretation of different definitions given under PM JI-VAN Yojana, has recommended that industrial waste, if valorized through biological route, can also fall under the purview of Yojana. He lauded the efforts of the Select Committee for broadening the base of Yojana through their deep analysis.

SAC had given recommendations in earlier meetings that other energy forms using bio-mass should also be promoted on the basis of a level playing field and should be

made eligible for support similar to one for bio-ethanol. He mentioned that biomass has a potential to replace at least 25% of domestic fuel demand.

4. ED (CHT) made a presentation covering the details of proposal from SAIL and evaluation & recommendations of Select Committee. The salient points are as under:
- a. One proposal from M/s SAIL received on 15th Oct'20 against RFS for setting up a commercial plant to produce Ethanol through fermentation of off-gases from their Chandrapur Ferro-alloy Plant (CFP).
 - b. There are 3 Submerged Arc Furnaces viz. SAF -I, II & III. Each furnace has independent gas cleaning facility. Volume of off gases generated from these furnaces are 5000, 5000 & 7000 NM3/hr respectively. Presently, approx. 700 NM3/hr of off gases are being used for internal applications like calcination of lime, sintering & roasting of Mn ores. Remaining gases are being flared as a waste as there is no utilization of these gases in the plant.
 - c. The proposal is for setting up a commercial plant to produce Ethanol through fermentation of SAF off gases. Off gas flow rate is 12000 Nm3/hr having composition of 50% -CO, H₂-4%, CO₂-30%, N₂ -16%, & CH₄-0%. Ethanol production potential is 16 Million L/A (12400 MTPA). Technology licensor is M/s LanzaTech. Estimated CAPEX is Rs 375 crores with \pm 30% based on pre-feasibility report as DFR is not yet prepared.
 - d. The proposal was evaluated by following Select Committee of SAC on 2nd Nov'20, which was reconstituted by Chairman SAC as Shri L.K. Vijh (Chairman of earlier Committee) superannuated from EIL and Shri Sushil T. Williams has taken charge in place of Shri Rohit Mathur in MoP&NG:
 - i. Ms Vartika Shukla, Director (T), EIL --- **Chairperson**
 - ii. Shri Sushil T. Williams, Dy. Secretary (BR/OR), MoP&NG
 - iii. Dr. Anjan Ray, Director, CSIR-IIP, Dehradun
 - iv. Prof. A.B. Pandit, Vice Chancellor, ICT Mumbai
 - v. Dr. D.K. Tuli, DBT Bio-energy Chair
 - vi. Finance representative from IOCL /EIL /OIDB
 - vii. Shri K.K. Jain, ED (CHT) ----**Convener**
 - e. Committee observed that proposed feedstock is different from conventional agro-residue and therefore to ascertain whether the industrial waste gases qualifies as eligible feedstock under PM JIVAN Yojana, Committee deliberated on the definitions of 2G Ethanol, Biomass resources and waste, given in Section 2 of RFS and also given in PM JI-VAN Yojana.
 - f. Committee observed that ethanol produced from biomass and cellulosic materials is defined as 2G Ethanol. Besides biomass resources which are biodegradable, industrial waste can also be considered as feed source for production of 2G

Bioethanol through a biological route. Committee was of the view that off-gases are eligible as feedstock under the scheme, as these are industrial waste which is proposed to be converted to ethanol following a biological route.

- g. Committee, however, observed that it is important to ascertain the quantity, composition of the off gas and reasons for its flaring to establish that the quantity as well as its composition have not been modified intentionally to declare as a waste for the purpose of availing VGF. Accordingly, M/s SAIL along with M/s LanzaTech clarified queries of Select Committee through presentation on 17th Nov'20 and followed by a letter dated 19th Nov'20.
- h. Select Committee after deliberations recommended the following for consideration of SAC:
 - i. Off-gases are eligible as feedstock under PM JI-VAN Yojana as these are industrial wastes which is proposed to be converted to ethanol through a biological route.
 - ii. The proposed technology of LanzaTech has already been established at commercial scale in China using steel mill off gases. Therefore, promotion of different technology platforms would help in meeting the objective of broadening technology base, which is one of the objectives of the Yojana.
 - iii. M/s SAIL is meeting pre-qualification criteria as per the scheme. However, the proposal is submitted without DFR. SAIL indicated that if consent is given for VGF, DFR shall be prepared within 4-5 months.
 - iv. Committee did not endorse the request of SAIL for giving consent for VGF in advance to prepare DFR as approval of VGF is done by the Steering Committee of CHT for PM JI-VAN Yojana on the recommendation of SAC.

The minutes of Meeting of Select Committee held on 2nd Nov'20 & 17th Nov'20 enclosed as **Annexure-2A & 2B** respectively.

- 5. Ms Vartika Shukla, Chairperson of the Select Committee, mentioned that Evaluation was done in two steps. The first was a preliminary assessment of what was submitted by SAIL. The committee found that the merit of conversion of these gases through biological route warrants a look in more detail. And as these gases are qualified as waste and has currently no value, it is leading to more CO₂ emissions by way of burning the CO and flaring it. Since it is biological route, it can be classified as 2G ethanol and hence qualifies under PM JI-VAN Yojana.

Technically feed is not a biomass in strict sense, but since there is a qualifying statement within RFS drawn from PM JI-VAN Yojana which includes Industrial Waste as well, this stage gate is acceptable in the context of the scope of qualification of the proposal. Therefore, SAIL and M/s LanzaTech were invited for detailed presentation wherein merits of utilization of these waste gases for any other purpose were looked into.

Considering the cost of power and subsidy being given, this stream continues to be treated as waste in times to come and SAIL has no plans of using this waste for any other purpose. Hence this end route of biological conversion, from both conversion and economic perspective, is a proposal which can be considered. However, the presentation was preliminary in nature and Committee advised SAIL to price the feed in terms of calorific value since it is compared with power. Hence, Committee opined that DFR is necessary for consideration of the proposal for qualification as it will give right cost estimate as well as right return (which is shown above 12%). This will not only address technological issues but also tie ups for supply of microbe, integration with existing setup, detailed assessment of cost and machinery and revenues leading to more accurate IRR.

As DFR is not submitted which is the minimum requirement of RFS, Committee was of view that conditional acceptance cannot be given and would like see the proposal in totality though prima facie it was looking promising.

She also indicated that since submission date of RFS is closed, it is difficult to accept from contractual perspective and hence fresh round of submissions need to be started.

6. Dr SSV Ramakumar, Director, IOC (R&D) clarified that he has visited China Plant personally and since 2018, plant has produced 1 crore 23 lakh litres of ethanol. All the three trains of plant are being operated. The only requirement of Microbe is minimum 4% of CO for ethanol production. Microbe is capable of generating H₂ during the reaction. Microbe has the capability to consume even CO₂ also once the reaction sets in.

In China plant, Steel mill off gases are being considered as feed as in case of SAIL, however at IOC plant, refinery off gases are being taken as feedstock wherein CO% is lesser. Therefore, IOCL ascertained the performance of technology in LanzaTech demo plant and results were very much encouraging. Ethanol production cost is much cheaper in LanzaTech technology than 2G ethanol technology.

Adoption of LanzaTech technology is solely IOC initiative and for the first time in the world refinery off gases will be converted into Ethanol. He however stated that upon SAC recommendations, OIDB has granted Rs 158.75 Crores as grant. IOC is confident about plant including Microbe where permissions are in place. He further affirmed that M/s LanzaTech technology is getting extended to several other value added products by just changing the microbe using the same feed (either Refinery off gas or Steel mill gas).

7. Shri Sunil Kumar, Joint Secretary (Refineries) indicated that based on response received against RFS and the level of investment required, there are few takers for the scheme. Even Rs 150 crores of VGF does not make projects viable. Therefore, proposal has been put to amend the clause of PM JI-VAN Yojana to include Bolt ON plants also under the scheme. Further, with regards to inclusion of advanced biofuels, the same has been proposed for Demonstration projects.

8. Chairman SAC advised that amendment should be done for both Commercial as well as Demonstration projects. Policy should be generic in nature accommodating all variations in advanced biofuels as a whole and at the same time waste as whole, be it bio-resourced or the industrial waste which can be converted into biofuel through biotechnological route. If that policy is available by early Feb'21, a common RFS can be issued for all remaining projects (6 +2 Commercial and 4+5 Demonstration). This will create a larger momentum in the industry with an objective to minimize imports. JS (R) agreed for the same and responded that minimum 60 days are considered for any policy change.
9. SAC did not recommend the proposal of SAIL for consideration of Steering Committee as DFR is not submitted though it looks a promising project. SAC advised that the proposal along with DFR may be submitted against next RFS which will be based on amended PM JI-VAN Yojana. SAC expected that next RFS shall be issued within 2 to 3 months.

The meeting ended with thanks to chair and other participants.

**90th Meeting of Scientific Advisory Committee (SAC) on Hydrocarbons of MoP&NG held on
1st December, 2020 through Video Conference**

List of Participants

	Name	Designation	Organization
1	Dr. Anil Kakodkar	Chairman - SAC	BARC
2	Sh. Sunil Kumar	Joint Secretary (Refineries)	MoP&NG
3	Prof. R. Kumar	Professor Emeritus	IISc
4	Prof. J.B. Joshi	Professor Emeritus	HBNI
5	Prof. A.B. Pandit	Vice-Chancellor	ICT
6	Dr. M.O. Garg	President (R&D)	RIL
7	Dr. R. K. Malhotra	DG	FIPI
8	Dr. Shashi Kant	Technical Adviser	Universal Group
9	Sh. Niranjan Kumar Singh	Secretary	OIDB
10	Sh. V. S. Shenoy	Director (R)	HPCL
11	Dr. S.S.V. Ramakumar	Director (R&D)	IOCL
12	Ms. Vartika Shukla	Director (T)	EIL
13	Dr. Anjan Ray	Director	IIP
14	Sh. K.K. Jain	ED	CHT
15	Sh. Sushil T. Williams	Dy. Secretary	MoP&NG
16	Dr. D. K. Tuli	DBT Bio-energy Chair	DBT
17	Dr. Sangita Kasture	Scientist 'F'	DBT
18	Sh. P. V. Ravitej	ED I/C (R)	BPCL
19	Sh. M. S. Patke	ED (Biofuels)	BPCL

	Name	Designation	Organization
20	Sh. S. Bharathan	Head (R&D)	HPCL
21	Sh. H. Shankar	Director (T)	CPCL
22	Sh. S. C. Gupta	Head (R&D)	EIL
23	Sh. D. V. Shastry	ED (Trg., R&D and Startup)	GAIL
24	Dr. Ravikumar V.	CGM (R&D)	BPCL
25	Sh. S. B. Lahkar	CGM (T)	IOCL
26	Dr. Bharat L. Newalkar	GM (R&D)	BPCL
27	Sh. P. Raman	Director	CHT

November 02, 2020

Minutes of 3rd meeting of Select Committee of SAC held on 2nd Nov'20 through video conferencing for evaluation of proposal received from SAIL for grant of VGF under PM JI-VAN Yojana

1. During 85th meeting of SAC held on 5th July'19, it was decided that the proposals received for VGF / Grant under PM JI-VAN Yojana shall be evaluated by a Select Committee before putting up to SAC. As Shri L.K. Vijh has superannuated from EIL and Shri Sushil T. Williams has taken charge in place of Shri Rohit Mathur in MoP&NG, Chairman SAC has reconstituted the Committee as under:
 - i. Ms Vartika Shukla, Director (T), EIL --- **Chairperson**
 - ii. Shri Sushil T. Williams, Dy. Secretary (BR/OR), MoP&NG
 - iii. Dr. Anjan Ray, Director, CSIR-IIP, Dehradun
 - iv. Prof. A.B. Pandit, Vice Chancellor, ICT Mumbai
 - v. Dr. D.K. Tuli, DBT Bio-energy Chair
 - vi. Finance representative from IOCL /EIL /OIDB
 - vii. Shri K.K. Jain, ED (CHT) ----**Convener**

Note: Finance representative did not attend the meeting

2. ED (CHT) welcomed the Chair & other members of the Committee. He informed that RFS was issued on 17th June'20 with cut-off date of 16th Sept'20 for remaining 2 Commercial and 4 Demonstration projects under phase-1. RFS was further extended till 15th Oct'20 as no proposal was received till cut-off date. ED (CHT) informed that a proposal has been received from M/s SAIL on 15th Oct'20 against RFS for commercial plant for the production of Ethanol through fermentation of off-gases from their Chandrapur Ferro-alloy Plant (CFP).
3. CFP has 3 electric Submerged Arc Furnaces (33 MVA, 2 nos & 45 MVA, 1 no) from which a considerable amount of off gases having CO, CO₂ & H₂ and small amount of other gases like Nitrogen, Methane etc. are generated in the gas cleaning plant. M/S SAIL, in its proposal, has mentioned that these gases are being flared as a waste as there is no utilization of these gases in the plant.
4. Ms Vartika Shukla, Chairperson, observed that proposed feedstock is different from conventional agro-residue and therefore we need to first ascertain whether the industrial waste gases qualifies as eligible feedstock under PM JIVAN Yojana. Thereafter, views of the members were sought.

Committee deliberated on the definitions of 2G Ethanol, Biomass resources and waste, given in Section 2 of RFS as under:

- a. **2G Bioethanol:** Ethanol produced from biomass and cellulosic materials such as bagasse, wood waste, agricultural & forestry residues, grasses etc. The produced ethanol should meet BIS standards IS 15464 (2004).
- b. **Biomass resources** are the biodegradable and non-edible fraction of products, wastes and residues from agriculture, forestry and related industries as well as the biodegradable fraction of industrial and municipal wastes.
- c. **Waste** is any substance or object which the holder discards or intends or is required to discard. Raw materials that have been intentionally modified to count as waste (by adding waste material to a material that was not waste) shall not be considered as qualifying under this Scheme.

Committee observed that ethanol produced from biomass and cellulosic materials is defined as 2G Ethanol. Besides biomass resources which are biodegradable, industrial waste can also be considered as feed source for production of 2G Bioethanol through a biological route. M/s SAIL has declared that off gases are being flared as a waste as there is no utilization of these gases in the plant and that the ethanol shall be produced through fermentation of these gases.

Prof. Pandit mentioned that recovery of calorific value of off- gases with 50-60% CO & H₂ is worthwhile. One of the routes available is industrial route of combustion. He supported the proposed biological route of conversion of off-gases into Ethanol as heat recovery from off-gases with 50% or lower CO may not be economically viable.

Dr. Anjan Ray opined that the proposal brings conversion to Ethanol through fermentation of off gases comprising of CO/CO₂/H₂ against present route of disposal of Carbon atom through flaring. This will enable import reduction, which is one of the objectives of PM JI-VAN Yojana.

Dr. Tuli opined that the proposed feedstock conversion through fermentation is a biological process. He referred the case of off gas heat recovery in M/s Jindal Steel plants, wherein, the CO percentage is 70 and more. In view of this, he supported that the proposed feedstock qualifies under the scheme.

5. After extensive deliberation, the Committee was of unanimous view that off-gases are eligible as feedstock under the scheme, as these are industrial waste which is proposed to be converted to ethanol following a biological route.
6. Committee also observed that the technology is already established, as commercial plant has already been set up in China using steel mill off gases. Therefore, promotion of different technology platforms would help in meeting the objective of broadening technology base, which is one of the objectives of the Yojana.

7. The Committee, however, observed that it is important to ascertain the quantity, composition of the off gas and reasons for its flaring to establish that the quantity as well as its composition have not been modified intentionally to declare as a waste for the purpose of availing VGF.
8. Committee observed that although PD has indicated that the proposed facility is a “Bolt on” facility, it does not appear to be a case of “Bolt on” as the technology is independent of current operations and having altogether a new approach. Clarification to be sought from PD in this regard.
9. Committee further reviewed the proposal based on technical and commercial prequalification criteria and their observations are given in Annexure-1.
10. Committee also reviewed the documents submitted by M/s SAIL as per the requirement of RFS and their observations are given in Annexure-2.
11. The Committee advised CHT to request PD to make a detailed presentation to the Committee, including the following;
 - i. Material balance of off gases generated in Ferro Alloy Steel plant which is being proposed as feedstock
 - ii. Reasons for flaring of off gas: Whether PD has explored all technological options for internal utilization of off gases
 - iii. Quantity declared for flaring in the Consent to Operate from pollution Control Board.
 - iv. Historical data on the quantity and composition of off gas flared for the last 2-3 years.
 - v. PD has to provide certificate from technology licensor that the proposed composition of gases would be used as such.
 - vi. Commitment from Licensor that they would provide support and provide microbial consortium for at least 3 years post commissioning of the plant.
 - vii. Steps proposed by SAIL in overcoming perpetual dependence on the licensor for supply of microbe.
 - viii. Time frame for submission of DFR, which is pre-requisite for consideration.
 - ix. Whether the proposed facility is a “bolt on” facility.
12. The Committee advised CHT to request PD to make a presentation to the Committee, clarifying the above points, at 2.00 Pm on 17th November, 2020

Prequalification Criteria / Attributes

Attributes	RFS Criteria	Submission by SAIL	Committee Observation / Remark
Feedstock	Info	Off-gases from Ferro Alloy steel plant	
Technology Licensor	Info	LanzaTech	
Location	Info	Chandrapur, Maharashtra	
Ethanol Production	Info	16 ML/A (12400 MTPA)	
Feedstock Processing	Info	12,000 dry Nm ³ /h.	
% of Ethanol Production	Info		
Operating Hours		8000 per year	
Experience of PD	Required	Manufacturing of Steel	OK
Whether PD has commenced mechanical erection of their projects before starting of this scheme?	No / Oil PSU exempted	No	OK
Whether proposal is for Bolt on /Brownfield projects?	No	Yes	Land is available and the proposed facility is sharing common facilities from existing Ferro alloy unit. As per scheme, bolt on plants are not eligible. Clarification may be sought from PD.

Attributes	RFS Criteria	Submission by SAIL	Committee Observation / Remark
Whether Technology is demonstrated at 1/50th or higher Capacity, in India or elsewhere?	Required	The ethanol production data from Shougang-LanzaTech (SGLT) commercial plant is attached. Further, 1 klpd plant data for SGLT demo unit is also shared. (Annexure III-A, Annexure III-B). In addition, a brief about LanzaTech process performance summary is attached as Annexure IV.	Commercial plant, based on steel mill off gases, Commissioned in May 2018. Name plate capacity: 46 KMTPA More than 48 KMT ethanol (16 million gallons) has been produced till date. However its feedstock composition is different from proposed plant feedstock.
Submission of operational data of 3 Months (Cumulative or Continuous) duration of atleast 50% capacity of demonstration/ commercial plant or 1 Month (Cumulative or Continuous) data at 100% capacity	Required		Not OK Demo plant: 56 days data averaging 57kg /hr (Provided in the form of graphs), page 2/3 of 3 (SGLT Demonstration scale Data). Plant operating conditions and daily operation data is not given. Feedstock for proposed plant (As a part of FR on page 3 of 19): CO-50%, H2 -4% max, CO2-30%, N2 -16%, methane -Traces, Commercial Plant SGLT off gas composition: CO-45~61%, H2 -0.4-1.0%, CO2-12-25.6%, N2-23.2-38%

Attributes	RFS Criteria	Submission by SAIL	Committee Observation / Remark
The annual turnover during any of the preceding three financial years from the date of RFS publication should be at least Rs 250 Crore (excluding GST/ Excise Duty).	Required		OK
FY 2019-20 (Crore)		61024	
FY 2018-19 (Crore)		66267	
FY 2017-18 (Crore)		58297	
Net Worth of an Entity should be positive on the date of previous year ending for which balance sheet has been prepared.	Required		OK
FY 2019-20, Rs crore		39777	
Whether PD, a declared willful defaulters, as per RBI norms?	NO	NO	OK
Whether PD, a declared Non-cooperative borrowers, as per RBI norms?	NO	NO	OK
Whether PD has availed one time settlement (OTSs)?	NO	NO	OK

Other requirements of RFS

Documents submission	RFS Criteria	Submission by SAIL	Committee Observation / Remark
Detailed Feasibility Report (DFR) covering standard heads	Required	FR submitted	DFR not submitted
Biomass Assessment /waste assessment report duly vetted by third party	Required	Not applicable as waste gases are proposed to be used for making Bio-Ethanol.	OK
Supply chain & logistics report duly vetted by third party	Required	Not applicable as Industrial waste gases shall be used for Bio-ethanol Production..	OK
Technology License Agreement	Required	NDA signed with M/s LanzaTech. Licensing agreement shall be signed before start of the project.	Technology License Agreement to be submitted.
Validated Life Cycle Analysis of proposed technology	Required	Included in the Feasibility Report (Refer p.18, Section 6)	OK
Freedom to operate (FTO) with Licensor	Required		Not required.
Balance Sheet for earlier 3 preceding financial years	Required	Annual Report of 18-19 Submitted	Annual Report of only 18-19 Submitted
P&L for earlier 3 preceding financial years	Required	Annual Report of 18-19 Submitted	Annual Report of only 18-19 Submitted
Cash Flow for earlier 3 preceding financial years	Required	Annual Report of 18-19 Submitted	Annual Report of only 18-19 Submitted
Documentary proof for connectivity with OMC depot (Not required if PD is an OMC)	Required	To be signed	To be submitted.

November 18, 2020

Minutes of 4th meeting of Select Committee of SAC held on 17th Nov'20 through video conferencing for evaluation of proposal received from SAIL for grant of VGF under PM JI-VAN Yojana

1. 4th meeting of Select Committee of SAC was held on 17th Nov'20 through video conferencing. The meeting was called as a follow up of last meeting held on 2nd Nov'20, wherein Committee reviewed the proposal of SAIL received under PM JI-VAN Yojana. Committee also raised queries and advised CHT to sought clarification / reply on the same from SAIL. Committee desired a presentation from SAIL regarding the proposal on 17th Nov'20.

The meeting was attended by all Committee members except finance representative of IOCL. The list of participants is given in Annexure-I.

2. ED (CHT) welcomed the Chairperson, members of the Committee and officials from SAIL, SRTMI and LanzaTech. ED (CHT) informed that as advised by the Committee, CHT sent the queries to SAIL vide letter dated 3rd Nov'20 and received their response vide letter dated 9th Nov'20. The same was shared with committee on 13th Nov'20.
3. At the outset, Chairperson, Select Committee of SAC, while welcoming the members of the Committee and officials from SAIL, SRTMI and LanzaTech, mentioned that the objective of calling 2nd meeting in quick succession is to bring clarity on some of the queries raised by the Committee in its last meeting held on 2nd Nov'20. This will enable Committee to get additional input for consideration of the proposal from SAIL with a view to expand the base for bioethanol generation to supplement gasoline. This is important from national perspective as well as any waste which can be valorized.
4. Thereafter, SAIL made a detailed presentation to the committee regarding the proposed plant as well as clarified / responded on the queries of Committee members.
5. SAIL during the presentation mentioned that there are 3 Submerged Arc Furnaces viz. SAF - I, II & III. Each furnace has independent gas cleaning facility. Volume of off gases generated from these furnaces are 5000, 5000 & 7000 NM³/hr respectively. Presently, approx. 700 NM³/hr of off gases are being used for internal applications like calcination of lime, sintering & roasting of Mn ores. Balance gases have no use in the plant and thus are being flared.
6. It was also mentioned that a power plant of 4.2 MW based on waste heat recovery boiler with off gases from first 2 furnaces as fuel was under operation till 2017. However, the same was stopped to avail subsidy in power tariff offered by Govt. of Maharashtra. As per the provision, a plant having captive power generation could avail maximum subsidy of Rs 50 lakh / month. SAIL mentioned that 4.2 MW power plant was able to meet only 8-10% of total

power requirement of 65 MW and therefore, it was decided to stop the power plant operation to avail full subsidy offered by Govt. of Maharashtra. SAIL has a net gain of Rs 3 crore / month through this decision as power cost contributes almost 50% in cost of production of Silicon Magnus. Grid power cost is Rs 7.50 per unit and internal cost of generation is around Rs 5 per unit. SAIL also mentioned that there was a proposal to set up 4 MW power plant using off gases as fuel from 3rd furnace with off gas volume of 7000 NM³/hr. The proposal was dropped due to aforesaid reason. 3rd furnace was commissioned in 2018 without any associated power plant.

7. ii. SAIL, while giving justification for the proposed route to produce ethanol, mentioned that there is significant amount of heat loss during power generation from off gases and only 30-35% efficiency is achieved vis a vis 70 – 75% efficiency in ethanol production route. Preliminary Life cycle analysis shows 50-55 % lower carbon foot print, which is in line with optimal point of steel sector initiatives to reduce carbon emissions per ton of steel production. Simultaneously it shall meet PAT obligations.
8. On the query of path forward for utilization of assets created in power plant, SAIL mentioned that they are in discussion with Govt of Maharashtra and they have proposed to allow them to generate power from waste gases as well as continue to provide subsidy for taking power from State Electricity Board. They are awaiting the decision from Govt due to pandemic and till that time the power generation shall be kept suspended as it does not make a techno-economic sense.
9. Regarding the query on Ethanol production guarantee given by licensor and adaptability of Biocatalyst on varying composition of off gases, M/s LanzaTech clarified that Bio catalyst can adapt to variations in the composition of incoming gases. The same is proven on commercial scale in the plant in China, where the concentration is varying from 45% to 65%. These kinds of variations have been well handled by the microbes. However, there has been some impact on the economic productivity. For SAIL, average composition is considered in its design. On the query of sufficient amount of H₂ percentage, it was clarified that there is sufficient hydrogen in incoming gas, however microbe has ability to generate hydrogen from water even if hydrogen concentration in incoming gas goes to zero for some time.
10. On the query of a long-term strategy of SAIL whether to depend on LanzaTech forever or is there any timeline wrt indigenization of the process, LanzaTech clarified that currently Microbes supply will be from USA and long-term supply agreement with SAIL is being done. However, in case SAIL needs alternate source of Supplier after initial supply by LanzaTech for certain period, such options can be worked out. However, LanzaTech may further explore valorization of these off gases into fuel or value-added chemicals by just changing the microbes.

11. On the query of path forward in case no subsidy is given by Govt, SAIL explained that it will never go back to power generation as even with subsidy total revenue generation is 38 crore per year for power (considering 4.2 MW existing and 4.0 MW additional new one and power cost of Rs 7.5/unit) whereas for ethanol, the revenue will be Rs 93 crore (with Zero feed cost and Ethanol price of Rs 59.48/litre). Revenue difference is mainly because of 30-35% efficiency in power generation and 70-75% for Ethanol production.
12. Committee asked for more historical data for feed off gasses. SAIL confirmed to provide the same.
13. Regarding query on level of integration with existing facilities, it was clarified that all the facilities will be installed as new plant except one tie up for process water from existing header.
14. Committee after deliberations recommended the following for consideration of SAC:
 - a. Off-gases are eligible as feedstock under PM JI-VAN Yojana as these are industrial wastes which is proposed to be converted to ethanol through a biological route.
 - b. The proposed technology of LanzaTech has already been established at commercial scale in China using steel mill off gases. Therefore, promotion of different technology platforms would help in meeting the objective of broadening technology base, which is one of the objectives of the Yojana.
 - c. M/s SAIL is meeting pre-qualification criteria as per the scheme. However, the proposal is submitted without DFR. SAIL indicated that if consent is given for VGF, DFR shall be prepared within 4-5 months.
 - d. Committee did not endorse the request of SAIL for giving consent for VGF in advance to prepare DFR as approval of VGF is done by the Steering Committee of CHT for PM JI-VAN Yojana on the recommendation of SAC.

The meeting ended with thanks to Chair, members of the Committee and other participants.

List of Participants

Select Committee of SAC

1. Ms Vartika Shukla, Director (T), EIL --- **Chairperson**
2. Shri Sushil T. Williams, Dy. Secretary (BR/OR), MoP&NG
3. Dr. Anjan Ray, Director, CSIR-IIP, Dehradun
4. Prof. A.B. Pandit, Vice Chancellor, ICT Mumbai
5. Dr. D.K. Tuli, DBT Bio-energy Chair
6. Shri K.K. Jain, ED (CHT) ----**Convener**

SAIL

7. Shri M.V. Zode, Exe. Dir. CFP
8. Shri A. Devadas, Exe. Dir. Operations
9. Shri D.D. Bhattalwar, G.M. (Project), CFP

SRTMI

10. Dr. Mukesh Kumar, Director, SRTMI

M/s LanzaTech

11. Shri Sangeet Jain, Director
12. Shri Sanjay Katrekar, Director (Tech. & BD)
13. Dr. Preeti Jain, Director (BD & Govt. Rel.)

CHT

14. Shri P. Raman, Director
15. Shri Brijesh Kumar, Advisor
16. Shri S.K. Varshney, Joint Director
17. Shri Manoj Thomas V, Joint Director