

उ.प्रौ.के./ईसी/32/
CHT/EC/32/ 3081

दिनांक: 21 दिसम्बर, 2021
Date: 21 December, 2021

To,

उच्च प्रौद्योगिकी केन्द्र की कार्यकारी समिति के माननीय अध्यक्ष महोदय एवं सभी सदस्यगण (संलग्न सूची के अनुसार)
Chairman and Members, Executive Committee of Centre for High Technology (As per list enclosed)

महोदय,

Dear Sir,

विषय: उच्च प्रौद्योगिकी केन्द्र की कार्यकारी समिति की 32वीं बैठक का कार्यवृत्त

Sub: Minutes of 32nd Meeting of the Executive Committee (EC) of Centre for High Technology

दिनांक 10 दिसम्बर 2021 को संयुक्त सचिव (रिफाइनरीज), पेट्रोलियम और प्राकृतिक गैस मंत्रालय की अध्यक्षता में विडियो कॉन्फ्रेंस द्वारा सम्पन्न हुई उच्च प्रौद्योगिकी केन्द्र की कार्यकारी समिति की 32वीं बैठक का अनुमोदित कार्यवृत्त आपकी सूचना और आवश्यक कार्रवाई हेतु संलग्न किया जा रहा है।

Please find enclosed the duly approved Minutes of the 32nd Meeting of Executive Committee (EC) of CHT held through Video conference on 10th December 2021, under the Chairmanship of Joint Secretary (Refineries), MoP&NG, for kind information and necessary action.

भवदीय,

Yours sincerely,

आलोक शर्मा
21/12/21

(आलोक शर्मा)

कार्यकारी निदेशक

उच्च प्रौद्योगिकी केन्द्र

(Alok Sharma)

Executive Director

Centre for High Technology

संलग्न: यथा उपर्युक्त

Encl.: As above

Members of the Executive Committee of CHT

1. **Shri Sunil Kumar**
Joint Secretary (Refineries)
Ministry of Petroleum & Natural Gas
Shastri Bhavan
New Delhi - 110 001

2. **Dr. Navneet Mohan Kothari**
JS (M & GP) and Secretary, OIDB
Oil Industry Development Board
OIDB Bhawan
Plot No. 2, Sector-73
NOIDA - 201 301

3. **Shri Kapil Verma**
Dy. Secretary (BR/OR)
Ministry of Petroleum & Natural Gas
Shastri Bhavan
New Delhi - 110 001

4. **Shri S. M. Vaidya**
Chairman & Director (R)
Indian Oil Corporation Ltd.
3079/3, Sadiq Nagar
J.B. Tito Marg
New Delhi - 110 049

5. **Shri Arun Kumar Singh**
CMD & Director (R) & Director (M)
Bharat Petroleum Corporation Ltd.
Bharat Bhawan
4 & 5 Currimbhoy Road
Ballard Estate
Mumbai - 400 001

6. **Ms. Vartika Shukla**
CMD & Director (T)
Engineers India Ltd.
EI Bhawan
1, Bhikaiji Cama Place
R. K. Puram
New Delhi - 110 066

7. **Shri V. S. Shenoy**
Director (Refineries)
Hindustan Petroleum Corporation Ltd.
Petroleum House
17, Jamshedji Tata Road
Mumbai - 400 020

8. **Shri M. V. Iyer**
Director (BD)
GAIL (India) Ltd.
16, Bhikaji Cama Place
R. K. Puram
New Delhi – 110 066
9. **Dr. Anjan Ray**
Director
Indian Institute of Petroleum
P.O. Mohkampur
Dehradun - 248 005
10. **Shri Alok Sharma**
ED (CHT) /Member – Secretary, Executive Committee
Centre for High Technology
9th Floor, Tower-A, OIBD Bhawan
Plot No. 2, Sector-73
NOIDA – 201 301

Special Invitees

11. **Shri Arvind Kumar**
Managing Director
Chennai Petroleum Corporation Ltd.
536, Anna Salai
Teynampet
Chennai - 600 018
12. **Shri M. Venkatesh**
Managing Director
Mangalore Refinery & Petrochemicals Ltd.
Regd. Office: Kuthethoor
P.O. Via Katipalla
Mangalore - 575 030
13. **Shri S.K. Barua**
Managing Director
Numaligarh Refinery Limited
122 A, R.G. Barua Road
Guwahati – 781 005

December 21, 2021

Minutes of 32nd Meeting of the Executive Committee (EC) of Centre for High Technology (CHT) held through Video conference on 10th December 2021

Shri Sunil Kumar, Joint Secretary (Refineries), MoP&NG and Chairman of the Executive Committee of CHT chaired the Meeting.

The list of participants is enclosed as **Annexure**.

Shri Alok Sharma, ED-CHT welcomed the Chairman and other members of the Executive Committee.

Thereafter, CHT made a detailed presentation on the Agenda Items. The following are the salient point of discussions:

1. Items for Information of EC & Action Points of 31st Meeting of EC (23rd Sept'21)

1.1 Refinery Performance Improvement Programme (RPIP) for PSU Refineries

RPIP Phase I

CHT presented the progress of the ongoing phase-1 study for 7 refineries.

CHT informed that BCG has escalated the issue related to delayed implementation and fees to CMD, BPCL

BPCL informed that the issue related to Assessment phase completion has been resolved in BPCL-Kochi. BPCL-Mumbai has already resolved the issue and payment has been made. Chairman advised BPCL to ensure that the payments are released in a timely manner for completed milestones and projects as most of the companies during COVID have struggled with cash flows.

BPCL assured that all the issues including payments shall be resolved with the consultant amicably within a month.

Action by: BPCL

Phase II:

CHT mentioned that the phase-2 study for balance 8 PSU refineries (Barauni, Gujarat, Haldia, Bongaigaon, Guwahati, Digboi, CPCL & Numaligarh) is being taken up. CHT has Applied for Approval for floating Global Tender Enquiry (GTE). Complete set of data has been received only for IOCL -Barauni and the tender for the same shall be floated once GTE approval is received.

Tenders for other refineries shall be floated as and when refinery provides the data.

EC noted the above

Action by: Refineries /CHT

1.2 Study on crude selection and procurement

CHT informed that a Committee comprising senior members from the oil companies have been formed and the Terms of Reference have been prepared. The Committee is expected to meet for deliberation in the coming week.

Chairman advised committee deliberate in detail and get support of others if required.

Action by: Refineries

1.3 Performance Benchmarking Study of PSU Refineries

CHT informed that all major milestones for Cycle Year (CY) 2020 is almost completed and presented the key findings as below:

There is an opportunity to capture additional value of 2.25 USD/bbl for Indian PSUs.

For CY 2020, the Energy Intensity Index (EII) performance and process unit Capacity Utilization have been inferior when compared to previous cycles as well as with the best in group.

All the milestones will be completed by Dec'21 and M/s Solomon will provide refinery-specific gap closure insights based on the 2020 Study for necessary action.

EC deliberated on various measures being undertaken to further improve the refinery performance quartile ranking with respect to various Key Performance Indicators (KPI's)

EC took a note of the above.

Action by: Refineries/CHT

1.4 Status of Catalyst Manufacturing Unit

A Committee was constituted by MoP&NG on 6th August 2020 for setting up a Catalyst Manufacturing Unit in India.

Its objective was to progressively develop marketing capability, indigenous raw material production, metal recovery & disposal of used catalysts and scale up facilities for indigenously developed catalyst in the JV.

The committee discussed with five shortlisted prospective partners in January' 2021. The discussions ranged from Type of catalyst, investment, area and utilities required, marketing /sales aspects, scale up of catalyst recipes developed by Indian PSUs and toll manufacturing, Policy issues, Structure of JV, etc.

The detailed study report has been submitted to MoP&NG on 9.2.2021.

HPCL informed that they have signed Non-Disclosure Agreement (NDA) with M/s Porocel and they have started giving more technical & commercial inputs for evaluation and Pre-Feasibility Report (PFR) finalization. HPCL is also in the process of finalizing PFR with M/s ART-Grace by January 2022. Basis PFR, business decision will be taken.

IOCL informed that they are going ahead with putting up catalyst plant at Panipat and it is expected to be completed by July 2022.

BPCL indicated that they have signed NDA with ART-Grace for FCCU Catalyst.

Chairman advised HPCL to finalize the proposal in next 3 months' time.

Action by: HPCL

1.5 Feasibility Study for manufacture of Reference Fuel under make in India by EIL & IOC R&D

CHT presented the progress on Feasibility study being undertaken through IOC-R&D and EIL for the development process scheme for production of reference fuel indigenously.

The phase-2 of the study, including feasibility in lab with actual streams, has been completed and report submitted to CHT on 9th September 2021.

Complete specifications of Reference Gasoline/HSD could be met by blending various streams from IOCL Panipat refinery. HSD reference fuel specification was also studied from MRPL streams, but target specification not met.

IOCL expressed the willingness to go ahead with the project execution based on the 3rd stage of study which involves preparation of feasibility report and business model by EIL. Chairman expressed concern in time taken for completion of the project and indicated that a lot of import of reference fuels is happening in India and urged for quick completion of the study.

EIL expressed that Stage -3 study shall be completed by Dec'21. IOCL indicated that depending upon the report, plant would be setup in Panipat refinery premises and would be ready in next 15 months after the completion of the Stage-3 study.

Chairman expressed concern over delay in study and advised EIL to expedite the stage-3 of the study in association with IOC-Panipat by Dec'21.

Action by: IOC/EIL/CHT

1.6 Status on PM JI-VAN Yojana

Steering Committee of CHT for PM JI-VAN Yojana, in its 1st meeting held on 1st June 2020 approved VGF / Financial assistance for 4 commercial projects and 1 demonstration project. Schedule for Milestones Completion for Commercial Projects:

Milestone	IOCL	BPCL	HPCL	ABRPL
Erection and Installation of Proprietary Equipment	Oct-21	Mar-22	Dec-21	Feb-22
Mechanical Completion	Mar-22	Mar-23	Nov-22	Aug-22
25% of Annual Production Capacity	Dec-22	Dec-23	Mar-23	Dec-22
75% of Annual Production Capacity	Mar-23	Jun-24	Dec-23	Mar-23

Schedule for Milestones Completion for Demonstration Project:

Milestone	IOC R&D
Mechanical Completion	June-22
Upon achieving ethanol equivalent to 50% of rated capacity for 3 months and completion of experiments over a period for 3 months as per Pre-designated Matrix	Feb-23
After 15 months (continuous or cumulative) operation at min 50% capacity or 3 years of plant operation whichever is later	May-24

Based on the above schedule, Year wise Expenditure Plan (Rs, Crore) is as under:

	2021-22	2022-23	2023-24	2024-25
IOCL	37.50 + 37.50	37.50 + 37.50		
HPCL	37.50	37.50 + 37.50	37.50	
BPCL	37.50	37.50	37.50	37.50
ABPRL	37.50	37.50 + 37.50 + 37.50		
IOC R&D		7.50 + 3.75		3.75
CHT Fee	1.88	3.11	0.75	0.41
Total	189.38	314.36	75.75	41.66

1st milestone of IOCL Panipat project completed. All PDs confirmed adherence to above schedule.

RFS was issued 3rd time on 24th Nov'21 for 8 Commercial and 9 Demonstration Projects with proposal submission date of 23rd Feb'22. Same was communicated to Oil PSUs, IITs, CSIR labs, private companies, State Biofuel Boards, foreign technology licensors, All India Distillery Association (AIDA), Indian Sugar Manufacturers Association (ISMA), etc.

Presentation followed by Q&A has been planned by CHT on 21st Dec'21, wherein all prospective PDs will be invited.

EC noted the above.

As tenure of current SAC is ending on 29th Dec'21, CHT requested for extension of SAC tenure.

Chairman advised CHT to get suggestion from Oil PSUs and R&D institutes for new SAC members which can be included in the new SAC.

Action by: Refineries / CHT

2. Items for approval of EC

2.1 R&D project for funding by OIDB

Title: Enrichment of Biogas to Bio-methane using Metal Organic Framework (MOF) based Mixed Matrix Membranes (MMM): IOCL/IIT-B

Broad Objective:

1. Removal of CO₂ and H₂S from Biogas using mixed matrix membranes (MMM)
2. Proposed material for MMM comprises of Polysulfone (PSf) as polymeric phase and Metal Oxide Framework (Mg-CUK-1) as fillers
3. Technology can be used for landfill gas, coal bed methane, and NG upgradation also.

Project Duration: 36 months.

Project Cost Estimate and year wise allocation (Amount in Rs, Lakh)

	Agency	Amount in Rs, Lakh				
		Year 1	Year 2	Year 3	Inst. Overheads	Total cost
1	IIT, Bombay	73.48	32.82	37.87	28.83	173.00
2	IOCL (in kind contribution)	91.49	43.82	39.97	-	175.28
Total estimated budget		164.97	76.64	77.84	28.83	348.28

Overheads for IIT Bombay (@20% of non-recurring and recurring) as per Institute norms.

During 91st meeting of SAC (5th May'21), IOC-R&D mentioned that LOI has been for 600 CBG plants by IOCL under SATAT scheme. The technology can be deployed at large scale, if it is economically viable meeting requirement of <3% CO₂ in the gas with simultaneous removal of H₂S. The loss of methane in the permeate (CO₂) will also be an important economic consideration. SAC deliberated and recommended the project.

Rs 173.00 lakh has been sought from CHT/OIDB for expenditure by IIT Bombay. IOCL shall contribute Rs 175.28 lakh as in-kind for scope of work related to them.

EC, in its 31st Meeting, deferred the proposal for discussion in the next meeting with representative of IOC R&D.

Chairman enquired whether other R&D institutes are doing similar kind of work.

ED-CHT mentioned that, this is a totally new concept and nobody in India is working in this area. This proposal was thoroughly deliberated in SAC and due diligence has been done.

Head (R&D), HPCL mentioned that they have a matured technology for purification of biogas, though it is based on PSA. They are working on exclusively membrane technology, but in some other area. This proposal is about MOF based membrane technology and only issue with MOF is that, its stability has not been established by anybody, so that is where the R&D work is required.

Chairman mentioned that we can go ahead with this proposal with the view of developing an alternative technology for CBG purification.

EC considered and approved the above proposal at a cost of Rs 348.28 Lakh with contribution of Rs 173.00 Lakh by CHT/OIDB.

Action by: CHT/OIDB

2.2 R&D project for funding from HCF

Title: Development of Solid Oxide Based Fuel Cell (SOFC) Range Extender Technology for a Fleet of Passenger and Goods Transport Electric Vehicles: IOCL / ARAI / h2e

Broad Objective: Development, integration and demonstration of Range Extended Electric Vehicle (REEV) using on-board Solid Oxide based Fuel Cells (SOFC).

Project duration: 36 Months

Specific objectives:

1. Development & Demonstration of Range Extended Electric Vehicle (REEV) using on-board Solid Oxide based Fuel Cells (SOFC) of 3 categories of vehicle viz. 3-wheeler electric rickshaw; Short commercial electric vehicle; & Light duty passenger car-EV.
2. Extension of present range of all three categories of vehicle by 40-60 %, operating on natural gas/ LPG / Bio CNG /Ethanol as a fuel with developed FCV architecture (Increase in Gross Vehicle Weight)

SAC (8thSept'20) recommended the proposal (project cost: Rs 777.70 Lakh plus taxes as applicable) for funding under Hydrogen Corpus Fund (HCF). SAC advised IOC R&D to carry out due diligence on cost element and include tax component before putting up for approval.

IOC R&D submitted the revised proposal on 5th April'21, which was reviewed by SAC (5th May'21). The revised project cost is Rs 824.47 lakh and funds sought from CHT is Rs 412.17 lakh.

During last EC meeting (23rd Sept'21) CHT mentioned that in view of technological advancements in batteries, recent launches of EVs with enhanced ranges, Consortium need to identify vehicle manufacturer as commercial partner.

As advised by EC (31st meeting), CHT sent the proposal to IOC R&D for reconsideration.

Chairman advised IOCL (R&D) to review the project and fund from its own resources based on its merit.

Action by: IOCL R&D

2.3 Approval of 50% base fee refund to BORL in 2020 Cycle and 50% reimbursement to BPCL-KR/MR

EC in its 30th meeting held on 10th Dec 2020, advised CHT to seek a separate undertaking from BPCL that in case of privatization during study period BPCL shall bear the full cost of study.

BORL requested to include it in CY 2020 study, EC advised to put up a proposal for inclusion in CY 2020 and future cycles along with 50% reimbursement once BORL gives a declaration that it is a PSU entity.

Since BPCL remains as a PSU during the Study Cycle & BORL confirmed being a PSU from 31st Mar 2021.

CHT sought approval for the following:

- Inclusion of BORL in the Long-term agreement with Solomon including CY 2020 and reimbursement of 50% of the base fee for CY 2020. (Base fee: 49000 USD excluding taxes)
- Reimbursement of 50% of the base fee paid by BPCL

EC approved the same.

Action by: Refineries/CHT

2.4 Cancellation of Refinery Performance Improvement and Innovation Awards for the year 2020-21

CHT informed that the refineries operated in a sub optimal way due to demand contraction and other irregularities due to Covid 19 restriction/lockdowns during FY 20-21 & Shutdown slates were modified frequently due to pandemic

In all the key parameters including Crude T'put, MBN, Specific steam consumption and Specific water consumption, refineries performed sub optimally compared to previous years.

Hence CHT proposed to cancel Refinery Performance Improvement & Innovation Awards for FY 2020-21.

CHT informed that the process for Steam leak audit by external teams for all 21 refineries in Jan 22 has been initiated as it was not Carried out in Jan'21 due to travel restrictions.

EC approved the cancellation of Refinery Performance Improvement & Innovation Awards for FY 2020-21.

Action by: Refineries/CHT

3. Items for Recommendation of EC for approval by Governing Council

3.1 RBE for F.Y. 2021-22 and BE for FY 2022-23

CHT presented the RBE for FY 2021-22 and BE for FY 2022-23 as under:

(Figs in Rs crore)						
	Particulars	2020-21	2021-22			2022-23
		Actual				
			BE	RBE	Actual Upto 03.12.2021	BE
A	Revenue Expenditure					
	Manpower	9.68	12.00	11.50	6.82	12.00
	Other than Manpower	1.31	2.00	1.71	0.70	2.90
	Sub-total (A)	10.99	14.00	13.21	7.52	14.90
B	Capital Expenditure	0.19	0.21	0.19	0.00	0.40
C	Special Studies	2.65	6.34	6.02	2.41	3.35
D	R&D Projects					
	R&D Projects	1.90	5.40	1.50	0.00	6.10
E	TOTAL EXPENDITURE (A+B+C+D)	15.73	25.95	20.92	9.93	24.75
F	HCF	11.23	54.65	10.89	0.09	71.58

Expressing concerns over progress of R&D Projects Chairman desired to review these projects separately.

EC deliberated and recommended the above budget for approval of Governing Council.

Action by: CHT

3.2 Treatment of Assets created under R&D projects subsequent to its closure

As per the Existing Policy, CHT has to recover Residual Value of Assets created through OADB grants from grantee Institutions/Organizations (minimum 5% Salvage value or disposal value whichever is higher) after closure of the project. There are issues in recovering the same from Academic as well as Oil companies. CHT is allowing to maintain and use these assets for Research purpose in most of the cases and is kept in CHT balance sheet since no assets has been disposed-off till date. Since it cannot be kept perpetually in CHT accounts, the subject was taken up with SAC

Subject discussed in 91st SAC meeting (5th May'21), CHT proposed following changes in the assets treatment policy:

1. Post completion of the project, participating agencies should be allowed to use assets created through CHT funding for research purposes till it is in working condition.
2. Post financial closure of the project, assets along with revenue expenditure are to be written off from the books of CHT.
3. Whenever, participating agency is disposing off the assets, the proceeds should be remitted to CHT/OIDB and it should be treated as refund of Grant to CHT in that particular financial year.

SAC recommended the CHT's proposal and advised to obtain views from CHT's internal auditor regarding rule position on such matters before putting up to GC.

Comments from OIDB on CHT's proposal is as under:

"OIDB is of the view that CHT should continue with their existing provisions which are in line with GFR 2017 and also as per the terms & conditions of Memorandum of Agreement (MOA)".

CHT proposes following changes in the assets treatment policy for consideration by EC:

1. Post completion of the project, R&D institutes and academic institutes may be allowed to retain the assets for research purpose and will be written off from the books of CHT.
2. PSUs have to remit salvage value at 5% of asset purchase cost post completion of the project, as per the existing asset treatment policy for all the closed projects (PSUs agree with this proposal). For On-going and Future projects with PSUs, the final payment shall be made keeping 5% asset purchase value.

EC recommended to recover the salvage value at 5% of asset purchase cost from PSUs for all the closed projects as per the existing asset treatment policy. For On-going and Future projects with PSUs, the final payment shall be made keeping 5% asset purchase value.

Before putting up to Governing Council approval, EC advised CHT to take opinion of internal auditor on writing off the Assets from the books of CHT where Salvage Value is not possible to recover from R&D and Academic institutes.

Action by: CHT

4. Other Items for information of EC

4.1 Petrochemical Benchmarking

In line with refinery benchmarking studies, CHT proposed to carry out benchmarking of major petrochemical units of PSU's.

The proposed units are as underneath:

Unit	PSU
Naphtha Cracker	IOC Panipat, GAIL Pata, Brahmputra Cracker -Lepatkata
Poly Propylene (PP)	IOC-Panipat & Paradip, MRPL, Brahmputra Cracker -Lepatkata
Poly Ethylene (PE)	IOC-Panipat, GAIL PATA, Brahmputra Cracker-Lepatkata

CHT informed that post confirmation from PSU for participation, a committee comprising PSU representatives shall be formed to finalize various units and the Terms of Reference (TOR) of EOI will be finalized. Potential consultants will be identified and a global tender shall be floated. Evaluation and shortlisting shall be done by the committee.

EC approved the same.

Action by: Refineries/CHT

4.2 Petrochemical Performance Improvement Programme (PPIP)

In line with refinery RPIP studies, CHT proposed to carry out similar programme for major petrochemical units of PSU's.

The proposed units are as underneath:

Unit	PSU
Naphtha Cracker	IOC Panipat, GAIL Pata, Brahmputra Cracker-Lepatkata
Poly Propylene (PP)	IOC- Panipat & Paradip, MRPL, Brahmputra Cracker-Lepatkata
Poly Ethylene (PE)	IOC-Panipat, GAIL PATA, Brahmputra Cracker-Lepatkata

CHT informed that post confirmation from PSU for participation along with units to be considered, a committee comprising PSU representatives shall be formed to finalize the Terms of Reference (TOR) of EOI to identify potential consultants. Post identification of consultants a global tender prepared by committee shall be floated. Evaluation and shortlisting shall be done by the committee.

In line with RPIP, the final award after negotiations will be done by the respective PSU's

EC advised to consider the PPIP after petrochemical benchmarking is completed so that the areas where the PPIP needs to focus is known.

4.3 Transitioning of Oil & Gas (O&G) sector Towards Net Zero

To reach the net zero goal set by our Hon'ble PM, the Oil & Gas sector needs to focus on the strategy that is the most technically feasible, cost-effective and socially acceptable.

For O&G sector, net zero is a commitment to both reducing emissions from internal operations and limiting impact from transportation and use.

The industry can answer these questions by either looking at short-term profits as oil and Gas company or embracing a steep and tough road to diversification as an “energy” company for long-term growth and business sustainability.

Therefore, the synergies / plans / outlooks of all PSU oil companies shall be combined for formulating an effective roadmap for the industry ahead.

CHT initiated discussions with international consultants namely Mckinsey, BCG, PWC, and Deloitte etc., the outcome will be shared by Dec’22

The meeting ended with thanks to the Chair & Participants.

32nd Meeting of Executive Committee (EC) of Centre for High Technology (CHT) held through Video Conference on 10th December 2021

Participants

MoP&NG

1. Shri Sunil Kumar, JS(R) – Chair

OIDB

2. Dr Navneet Mohan Kothari, JS (M) with additional charge of Secretary OIDB

HPCL

3. Shri V.S. Shenoy, Director (R)
4. Shri S. Bharathan, ED (R&D)

BPCL

5. Shri Sanjay Khanna, ED I/C (R)

IOCL

6. Shri V.K. Raizada, ED (M&I)
7. Shri Kaushik Singha, CGM(T)
8. Shri Mohana Rao, Manager (R&D)

GAIL

9. Shri Sanjeev Kumar, Head (R&D)

MRPL

10. Shri M. Venkatesh, MD

CPCL

11. Shri Arvind Kumar, MD

NRL

12. Shri S. K. Barua, MD

EIL

13. Shri Rajeev Aggarwal, ED (I/c)
14. Shri S.C. Gupta, Head (R&D)

CHT

15. Shri Alok Sharma, ED-CHT
16. Shri P. Raman, Director
17. Dr N.S. Raman, Director