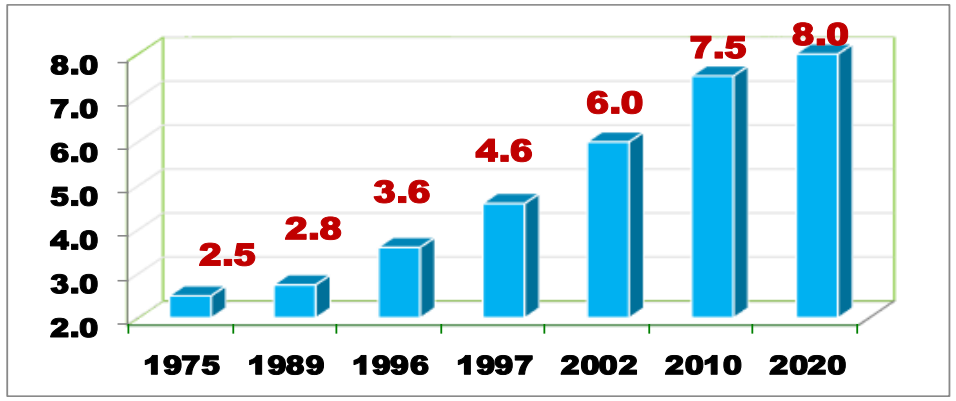
CII National Award for Excellence in Energy Management 2021

Company Name : Indian Oil Corporation Ltd.
Haldia Refinery

Presenting Members:

1. Mr E Panthya, CTSM
2. Ms Lalitha Rani, PSM
3. Mr. Amit Kalyan Chandra, PSM

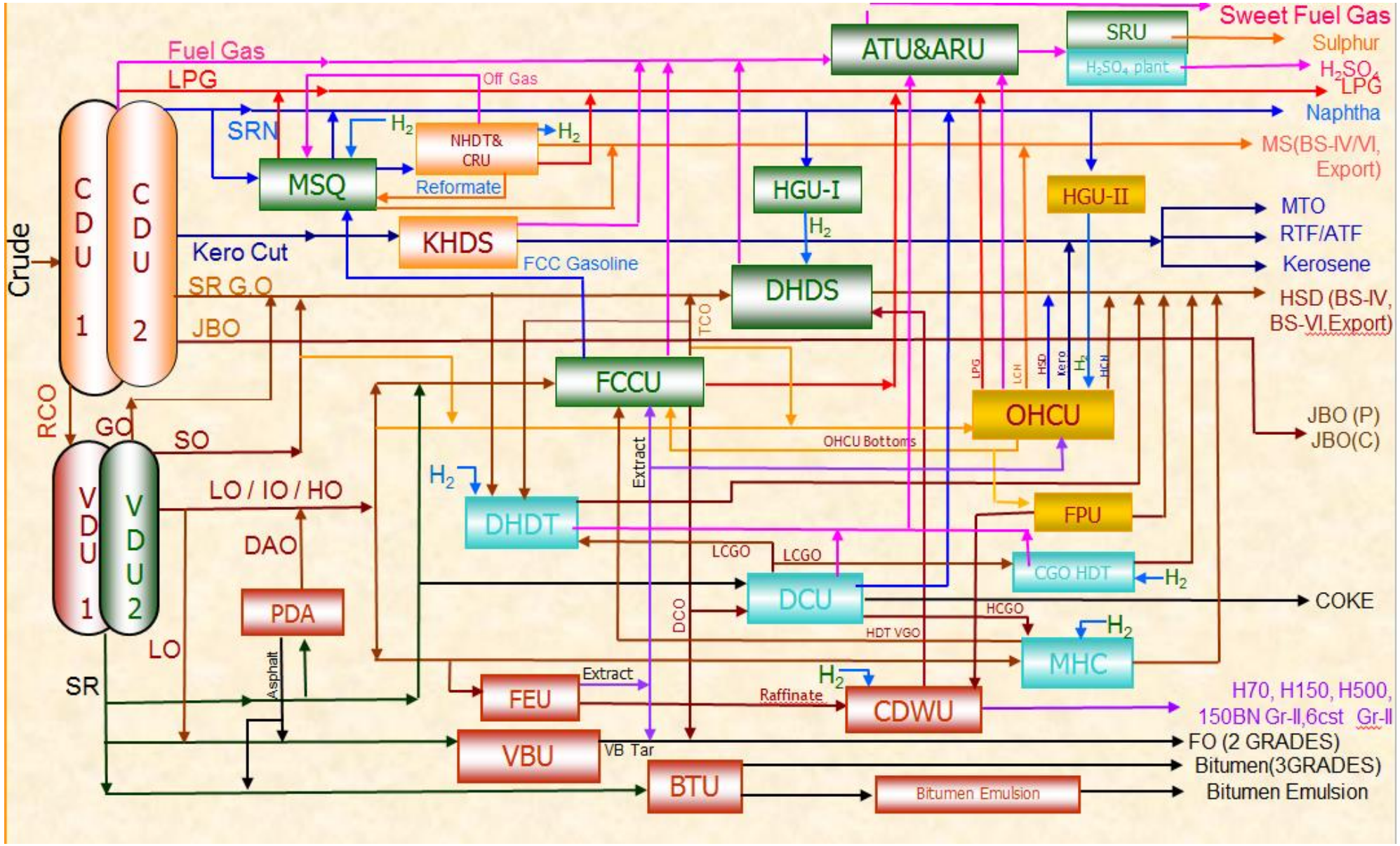
HALDIA REFINERY OVERVIEW

SN	Attribute	Remarks
1	Located at	Haldia, Medinipur (E) District of West Bengal, 130 km from Kolkata.
2	Employees	1529
3	Area	583 Acres
4	Foundation Stone laid	by Late Prof. Triguna Sen, Hon'ble Petroleum Minister on 6th Dec 1969.
5	Commissioned with 2.5 MMTPA capacity	in January 1975
6	Present Crude capacity after revamping 6 times	8.0 MMTPA (1,50,000 bpd) (Capacity revamp for 8 MMTPA done in Jan'20) 
7	**Crude imported from**	Saudi Arabia, Iran, Iraq, UAE, Nigeria, Angola, Malaysia, Kuwait, America and Indigenous crudes

HALDIA REFINERY OVERVIEW

SN	Attribute	Remarks
8	Crude Basket	Arab mix, iran mix, basrah, Kuwait, das, mars, Ural, Maya, Girasol, Clov, Bonny Lt, Labuan AkPO, Bonga, Kissanje, Miri, Agbami, Seria Lt, Murban-LS,WTI midland, Egina, Escravos, Mondo.
9	No of process plants	34 Nos (CDU1/2,VDU1/2,DCU,OHCU,FPU,RFCCU,DHDS, MHC, CGOT, HGU-1/2, CRU,KHDS, MSQ-ISOM,PRIME-G, LHFU, CIDWU,FEU,PDA,VBU, SRU2/3/4/5, SWSs, ARUs ETPs1/2 etc..)
10	CPP capacity	4 STGs:48 MWh 3 GTs:60 MWh **Total Power :108 MWh** 4 Boilers : 525 TPH 3 HRSGs : 360 TPH **Total Steam : 885 TPH**
11	Total storage tanks	198Nos (911,340 KL storage capacity)
12	Despatch facilities	**PPL, Rail, Road, Coastal (Barge, tanker), Bitumen bulk loading and drum filling**
13	Products	MS, HSD, Kero, ATF, MTO, JBO, Naphtha, Bitumen, Bitumen emulsion, 5 grades of **LOBS**, Sulphur(Liquid and Sulphur),petcoke
14	Sulphur, petcoke end users	Sulphur: Production of sulfuric acid for sulfate and phosphate fertilizers, matches, insecticides, and fungicides Petcoke: Gasification/Electrode Preparation/ cement industries

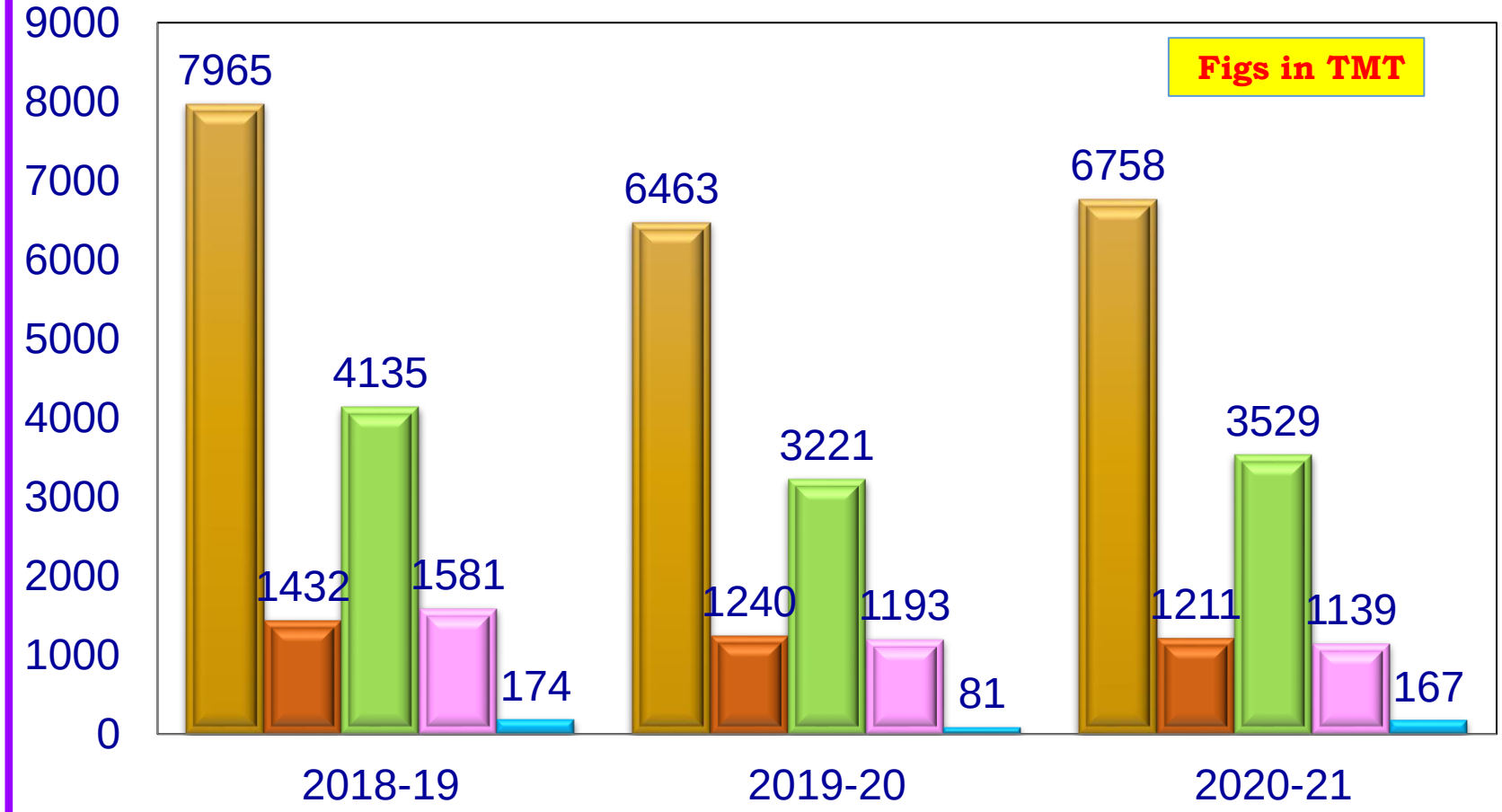
HALDIA REFINERY-Block Flow Diagram



->Stream sharing among the process plants for manufacturing final products like LPG, MS, HSD, Kero, ATF, Bitumen etc..

-> H2SO4 plant erection started

PRODUCTION DATA OF LAST THREE YEARS FY 2018-2021



Light Distillate includes:
Production of LPG, Naphtha, MS.

Middle Distillate includes:
Production of ATF, MTO, SKO, HSD, JBO.

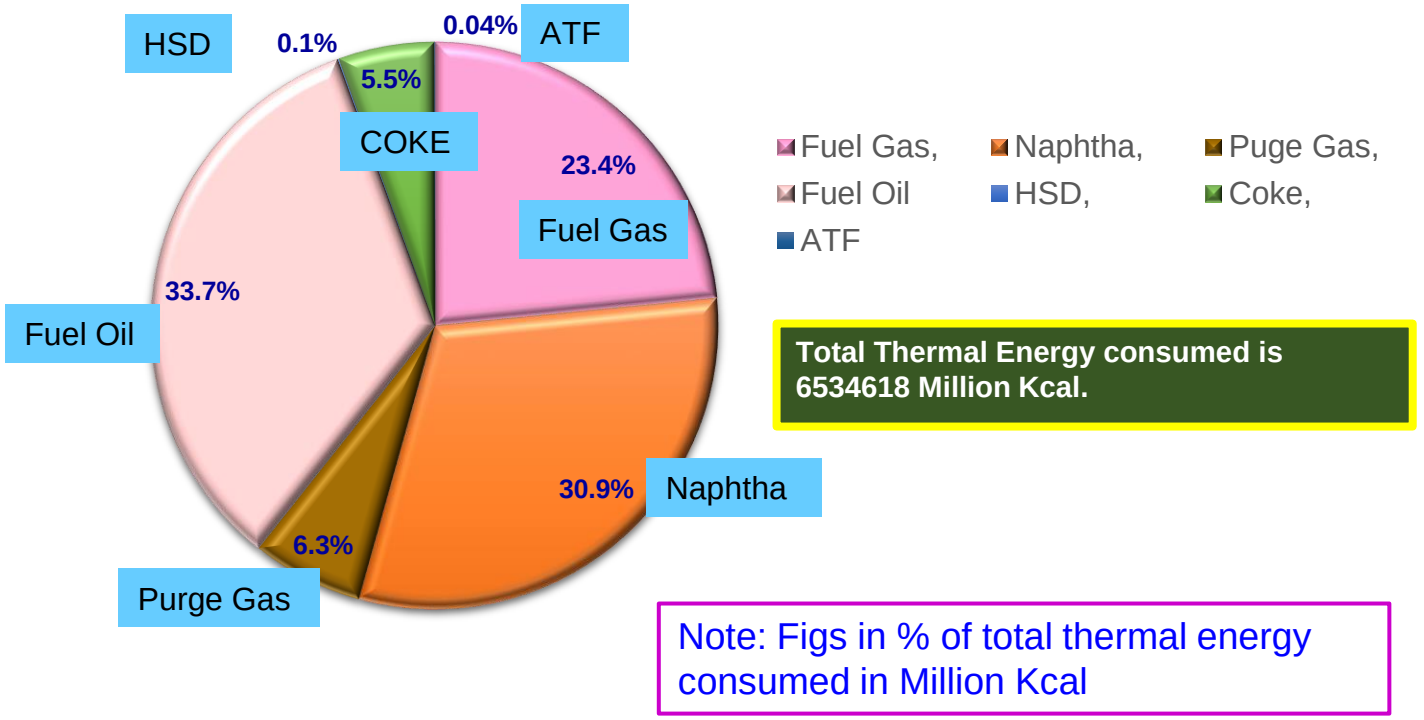
Heavy end Distillate includes:
Production of FO, Bitumen, Coke & Sulphur.

LOBS:
H70,H150 Gr-2/3,H500,150BN

- Crude processed in FY2019-20 was less due to revamp shutdown of crude processing unit for capacity enhancement to 8 MMTPA
- Heavy end distillates will reduce further as DCU is commissioned

THERMAL AND ELECTRICAL ENERGY CONSUMED IN FY 2020-21

Thermal Energy Consumption FY 2020-21



Total Thermal Energy consumed is 6534618 Million Kcal.

Note: Figs in % of total thermal energy consumed in Million Kcal

- Major sources of fuel are Fuel oil, naphtha , fuel gas and RFCCU coke
- Catalyst coke burnt in regenerator of RFCCU is used for catalyst/feed heating to reaction temperature 505°C

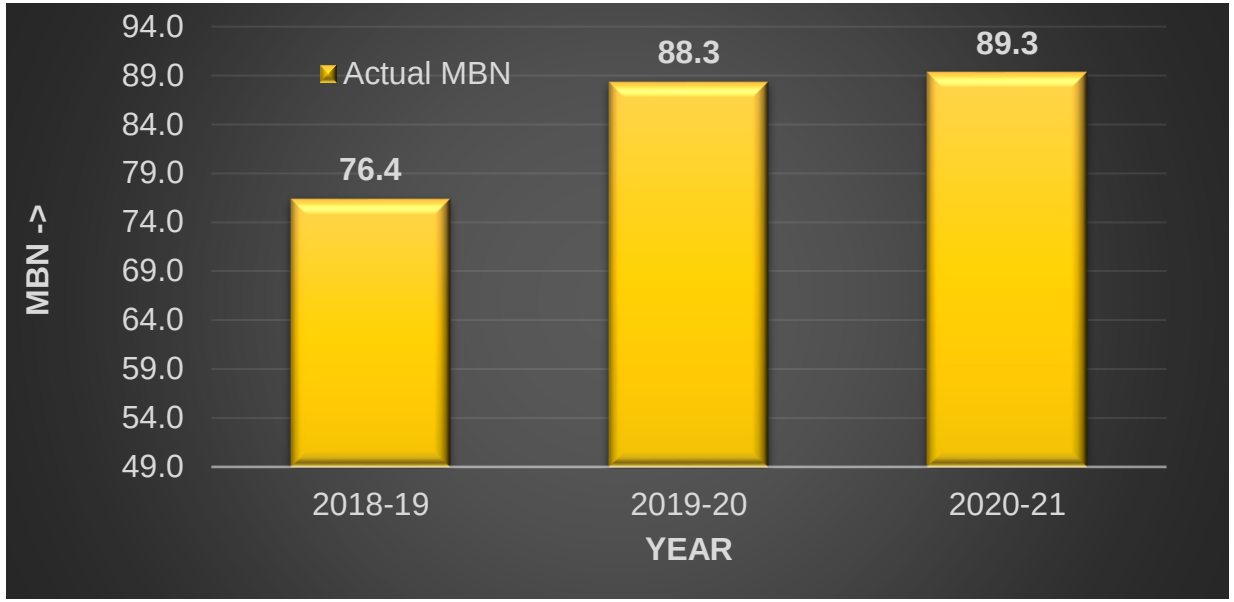
❖ Electrical Energy consumption: **460 Million kWh**

❖ Overall Energy Consumption (Thermal + Electrical): **6,53,462 TOE.**

IMPACT OF COVID-19

1	Impact on annual production performance	Crude and products impact @10%-20% reduction
2	Impact on Specific energy consumption (SEC)	SEC Impact@10%-20% higher
3	Measures taken by the plant/unit to address the challenges	❑ Production planning rescheduled to improve the productivity ❑ Energy efficiency improvement measures undertaken ❑ Initiatives undertaken to improve energy performance of Utility areas

OVERALL ENERGY CONSUMPTION OF LAST THREE YEARS FY 2018-2021



- **MBN**(SEC)=Million BTU/1000 Barrels/NRGF
- **NRGF**= Equivalent Crude intake for all refinery units in KL/Crude processed in KL
- More crude processed, lower will be MBN

Year	Sp energy consumption	Annual (F&L) TOE	% improvement	Reason for variation
2018-19	76.4	601684	-5.33	Higher crude unit & secondary utilization with higher energy savings schemes about 18370 SRFT implementation.
2019-20	88.3	603391	16.10	Higher due to delay commissioning of DYIP units , capacity revamp of CDU-1/VDU-2/MSQ/HGU-2 and OHCU/CIDW M&I. Lower crude capacity utilization(86%)
2020-21	89.3	688514	1.13	Due to lower crude unit & secondary utilization during COVID-19 pandemic.

SPECIFIC ENERGY CONSUMPTION (SEC/MBN) Target

SEC/MBN Target till Mar'23

SN	PAT cycle	Base line MBN	Target MBN	Actual achieved
1	PAT-2	78.95 (FY2014-15)	73.61 (FY2018-19)	76.087 (FY2018-19)
2	PAT-6	76.087 (FY2018-19)	70.87 (FY2022-23)	**Tgt reduction :6.8%**

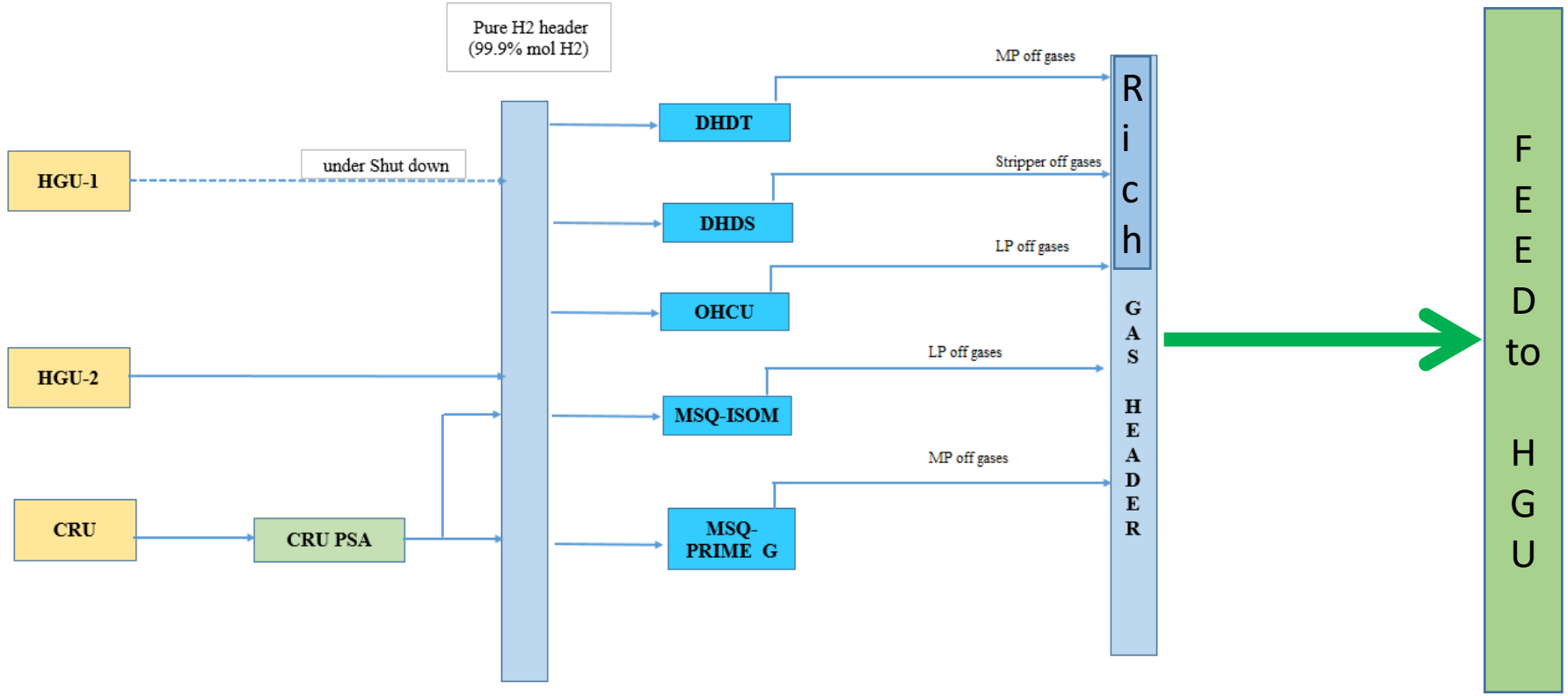
- Total annual TOE reduction planned to achieve PAT-6 SEC/MBN target is: **60442 TOE**

SUMMARY OF ENERGY SAVING PROJECTS IMPLEMENTED IN LAST THREE YEARS FY 2018-21

Year	No. of Proposals	Investments in Rs Million	Savings, Rs Million	Savings, TOE	Impact on SEC
2018-19	07	51.15	187.39	5653	0.57
2019-20	07	14.56	112.55	3607	0.36
2020-21	05	62.13	457.24	25891	2.59
Total	**19**	**127.84**	**757.18**	**35151**	**3.52**

❖ **Name of the Project: H2 recovery from DHDS (stripper off gases), ISOM (LP off gases), Prime-G (MP off gases), OHCU (LP off gases) and DHDT (MP off gases) which contain about 50-60 vol% H2**

❖ **Brief Description:** Hydrogen rich off gases are either flared or consumed as fuel gas in the refinery.



Benefits Achieved:

- ✓ H2 recovery @ 250 kg/hr is being recovered.
- ✓ FG generation reduction by 2 TPH as excess FG off gases are consumed as feed in HGU which resulted in reduced flaring

Annual Savings: 771.6 Rs Lacs
Investment : 293.4 Rs Lacs

Reduction in Carbon Foot print – Encouraging Renewable Energy sources

- Haldia Refinery is installing solar panels over all roofs inside refinery and community buildings in township.
- This has helped refinery in saving power bills.
- Haldia Refinery solar power generation:

Year	MWH
FY 2018-19	143
FY 2019-20	446
FY 2020-21	160*

* Lower generation due to damaged panels during cyclone Amphan in May'20

WASTE MANAGEMENT

S.N	Type of waste Generated	Disposal method	Quantity of waste generated (MT/year)		
			FY 2018-19	FY 2019-20	FY 2020-21
01	Spent RFCCU catalyst	To secured landfill through PCB authorized TSDF agency	1219	839	699
02	Spent adsorbent	Incineration through TSDF agency	52	355	153
03	Oil soaked waste mineral wool	Incineration through TSDF agency	221	788	296
04	Residual oily sludge	Incineration through TSDF agency	406	356	3491
05	Residual oily sludge	For co-processing in CPCB authorized cement plant (Ambuja Cement)	4995	5923	2646
06	Spent resin	To secured landfill through TSDF agency	22	8.7	5.5
07	Spent RO membrane	To secured landfill through TSDF agency	21	0	0
08	Spent hydro processing catalysts	Through MSTC to authorized recyclers	0	312	168
		Total	**6936**	**8582**	**7459**

Other Initiatives taken for waste utilization & management:

Food Waste

- Bio-methanation plant installed in township guest house with capacity @**250 kg/day**
- Use of food waste based **bio-gas generator with 500Kg capacity** for use in industrial canteen.
- ❖ Bio-gas generator (**100 kg** capacity) installed for use by Vivekananda **school**.
- ❖ Manure generated is used for horticulture purpose.

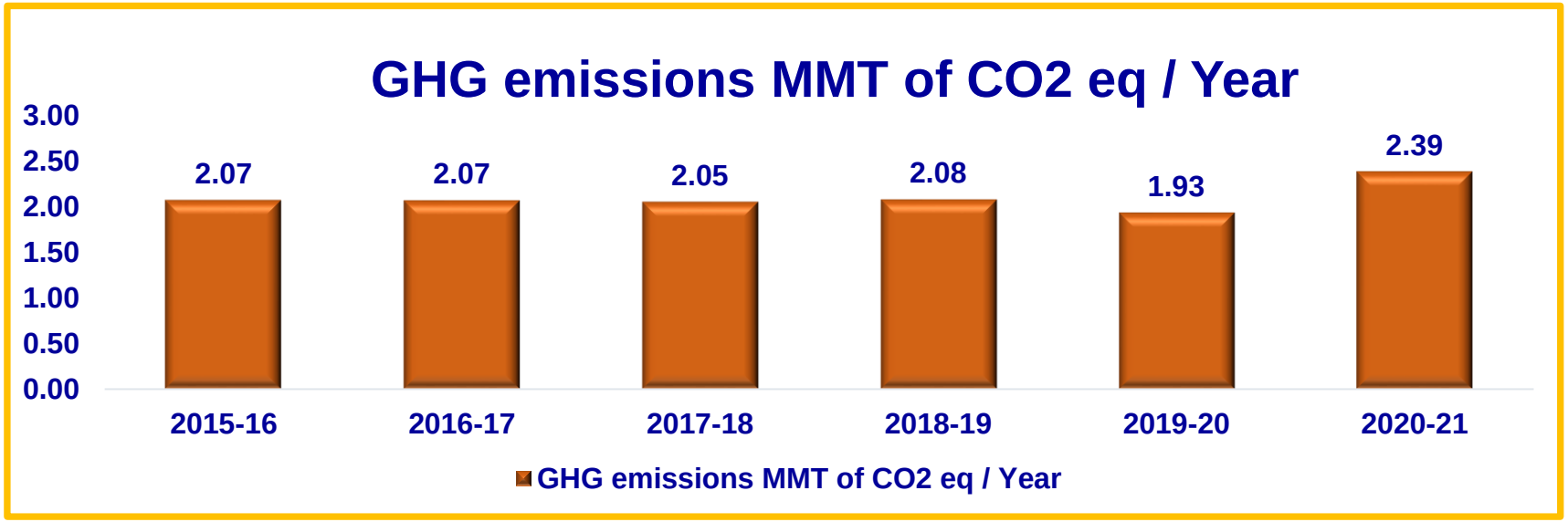
Waste paper

- Annually about **1500kg** waste paper donation to Vivekananda mission for manufacturing **recyclable paper products like files, envelopes** etc

Spent RO Membranes

- Utilization of spent RO membranes for barricading local water bodies and improving aesthetics.

GHG (Absolute Emission trend)



- Higher plant loads resulted in high productions and higher emissions
- However CO2 emissions per ton of product remains lesser for high T'put years

Year	Total product, TMT	Total (kgCO2 / Ton of Final Product)	Remarks
2017-18	6820	301.25	
2018-19	7321	283.94	CO2 emissions lesser than 2017-18 on account of higher capacity utilization and higher production
2019-20	5734	337.39	CO2 emissions higher than 2018-19 on account of lower capacity utilization and less production
2020-21	6047	394.44	Increase in CO2 per ton of product due to lower capacity utilization

1. **100% BS-VI MS & HSD supply since 1st Apr'2020.**

- Haldia Refinery has revamped two units DHDS & Prime-G to produce < 10 ppm sulphur diesel and MS.
- Haldia Refinery successfully started producing another new grade of product, i.e Marpol FO (0.5 wt% S).

2. **LPG Pipeline Transfer facility ex Haldia Refinery to Paradip - Haldia- Durgapur with capacity of 0.67 MMTPA**

   - Benefits: Reduction in CO2 emissions by 12.5 TMTPA

3. **Haldia-Barauni petroleum products pipeline with capacity of 3.4 MMTPA is expected to be commissioned in FY 22-23.**

   - Benefits: Reduction in CO2 emissions by 99 TMTPA.

4. **Target (short term/long term) for CO2 emission reduction and action plan:**

Attribute	No of schemes planned	CO2 emission reduction, MT/Yr
Short term schemes	07	38526
Long term schemes	08	57991
Total	**15**	**96517**

4. Target (short term/long term) for CO2 emission reduction and action plan:

S.N	**Short Term - Scheme planned in FY 2021-22**	CO2 emission reduction, MT/Yr
01	Maximizing Feed Preheat Temperature in NHT (CRU) unit	1733
02	Crude Preheat Temperature improvement by 9°C in CDU-2	18900
03	Heat recovery from 3 no's HRSG blow down	1481
04	Hot UCO from OHCU to RFCCU	2363
05	Recovery of RFCCU naphtha splitter Off gases	2520
06	MP to LP PRDS system in U-29 SWS to avoid H2S slippage in stripped water going to ETP and route sour gas to SRU	9450
07	Excess air optimization of Heater 16-F-01 & 16-F-101 , 31-F-01 & 31-F-02 by replacement of faulty burner components, air resisters cleaning, APH cleaning, damper closing, replacement of O2 analyzer with TDLS analyzer type	2079
	Total reduction	**38526**

4. Target (short term/long term) for CO2 emission reduction and action plan:

S.N	**Long Term - Scheme planned**	CO2 emission reduction, MT/Yr
01	Replacement of fuel oil with LNG. (Expected consumption: 2.3 MMSCMD)	18900
02	Hot VR (during HS run about 87 TPH) from VDU-1 to DCU	4901
03	Hot RCO line from CDU-I to VDU-2	3969
04	Hot RCO line from CDU-II to VDU-1 feed temp will increase by ~ 10 from 110-to 120 °C	3150
05	Replacement of Full condensing Turbine of WGC to motor in RFCCU unit	20699
06	Heating of DM water (used in GT for steam generation) by GO-CR in VDU-2.	2930
07	Pre heat improvement of NSU column by 6 °C by heating of NSU feed by Heart cut naphtha generated from NSU column (U-85)	1575
08	DHDT vent steam recovery from RGC upstream MP steam header	1867
	Total reduction	**57991**

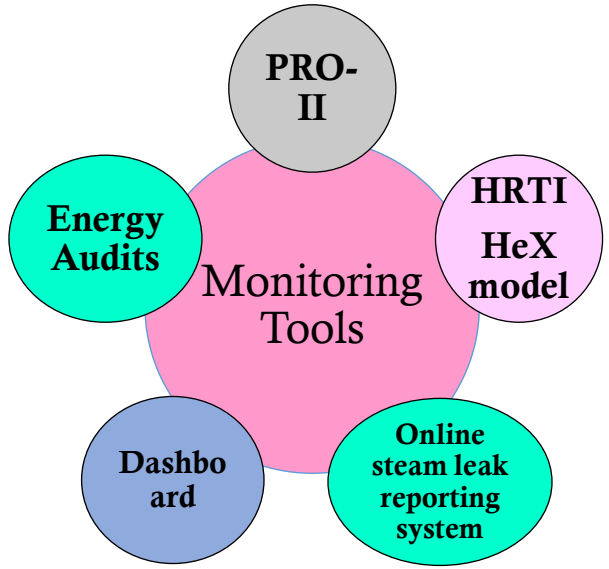
GHG INVENTORISATION

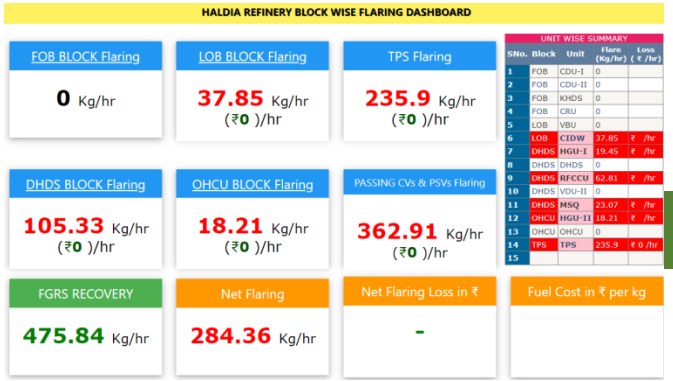
Location wise tree plantation		No. of trees planted
Water Treatment plant at Geonkhali	:	3750
Water Treatment plant at Chaitanyapur	:	2000
Miyawaki forest at Mahisadal	:	19200
Miyawaki forest at Haldia Refinery & KV school	:	12000
At various schools and colleges	:	25925
Along green belt channel in front of Haldia Refinery	:	110
	Total:	**77985** (1950 MT CO2 reduction annually)

Tree plantation at Haldia Refinery is on going activity

ENCON Monitoring System at Haldia Refinery

1. Monitoring Tools available





Flare monitoring dash board

2. Daily/Monthly – Monitoring

S.N	Monitoring Activity
	Daily/Monthly Activity
01	Unit Specific Energy Consumption
02	Energy Intensive Equipment's – Heater, compressor performance
03	Steam let down, flare, Pressure recovery Turbine
04	Fuel & Loss
06	Specific Energy Consumption (MBN)
07	Energy Intensity Index (EII)

ANNUAL PROGRAMS ON CREATING AWARENESS ON ENERGY CONSERVATION

- Annual budget for Energy conservation awareness: ~ **7 to 10 Rs Lacs**
- **Celebrated every year: 16th Jan to 15th Feb**

- **Street Plays** in Local Community for spreading the message of Energy Conservation at various places viz Schools / Township Parks/MARKETS/colonies etc

- **Quiz** Competition for School Students/ Employees /House wives

- **Walk Rally** by school children, IOCL employees and CISF dependents

- Energy Audit by CHT nominated persons

- **Training** program by external faculty

- **Drawing competition** for school students.

PROJECTS IMPLEMENTED THROUGH KAIZENS – SUPERVISOR LEVEL

KAIZEN
IDEA SHEET

Pillar	FI	AM	PM	QM	EM	E&T	SHE	OTPM	ENC
			■						

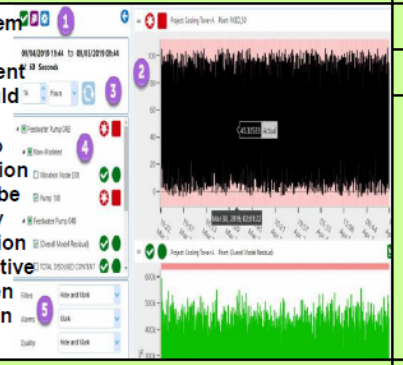
Result Area	P	Q	C	D	S	M
	■			■		■

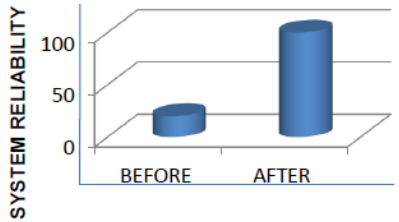
Improvement Type	E	C	R	S	a	A
		■				■

Kaizen No.

Unit/Plant	OHCU	Machine	91-K-02	Component	Reliability Improvement through implementation of AI and ML technology in Predictive Analytics

Kaizen Theme	Idea	Bench Mark
Machine learning system for OHCU RGC Compressor (91-K-02)	RELIABILITY IMPROVEMENT OF SUPER-CRITICAL EQUIPMENTS TO AVOID UNPLANNED SHUT-DOWNS	Multiple instances of unit interruption due to tripping of 91-K-02

Problem/Present Status	Countermeasures/After Status	Target	ZERO INTERRUPTION	
Recycle Gas compressor tag no. 91-K-02 is a super critical equipment of Haldia Refinery. There have been multiple instances of unit interruption due to tripping of this machine due to low lube oil pressure, sudden spikes in vibration of rear journal bearing etc. Its tripping leads to unplanned interruption of OHCU	The proposed system shall provide early warning of equipment conditions that could cause equipment damage and lead to unplanned production losses. Status can be monitored remotely from any work-station and suitable corrective actions can be taken against alerts well in advance. 	KAIZEN Start	07.08.2020	
		KAIZEN Finish	12.11.2020	
		Team Members	Name	Emp. No.
			Jaydip Chattaraj Anmol Agarwal	72720 511145

Analysis (WHY – WHY)	Results	Benefits
LOW LUBE OIL PRESSURE/SUDDEN SPIKES IN VIBRATION OF REAR JOURNAL BEARING ↓ TRIPPING OF COMPRESSOR ↓ FREQUENT UNIT INTERRUPTIONS		Increased equipment availability, efficiency, and profitability, and shall enable better decision making and planning. Aversion of unplanned tripping of OHCU. Recurring Benefit= Rs. 4.00 crore per interruption averted (approx.)

Scope & Plan for Horizontal Deployment:

Equipme			

KAIZEN
IDEA SHEET

Pillar	FI	AM	PM	QM	EM	E&T	SHE	OTPM	ENC
	■								

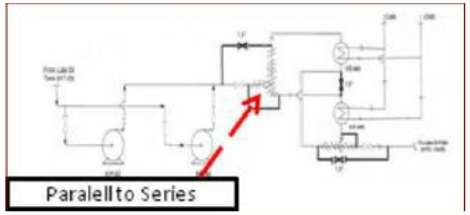
Result Area	P	Q	C	D	S	M
	■					

Improvement Type	E	C	R	S	a	A
						■

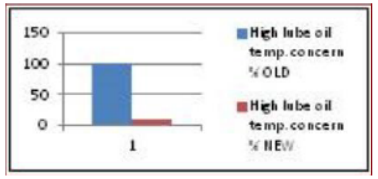
IndianOil — Kaizen No.

Unit/Plant	OHCU	Machine	91-P-01A	Component	91-E-43A/B

Kaizen Theme	Idea	Bench Mark	High reliability of main feed pump
To mitigate the effect of high LO temperature and increase the reliability of feed pump.	To provide console overhead shed		

Problem/Present Status	Countermeasures/After Status	Target	Maintaining LO temp & properties within in limits.
The Lube oil coolers of main feed pump are in parallel configuration. During summers, the problem of high lube oil temp is very common. Lubricating oil is unable to remove enough heat from bearings due to its own high temperature. Thus it was leading to lesser reliability of bearing which in turn was reducing the overall reliability of feed pump.	The parallel coolers were connected to series configuration which provided large surface area for heat transfer and reduced lube oil temperature even with high cooling water supply temperature. 	KAIZEN Start	15.07.2020
		KAIZEN Finish	28.07.2020

Team Members	Name	Emp. No.
	Sandip Kar J Meena	72172 507265

Analysis (WHY – WHY)	Results	Benefits
Why1: High lube oil temperature? Why2: Poor cooling of lube oil in LO cooler? Why3: lesser heat transfer during high cooling water temp in summers? Why4: More surface area is required when supply temperature is high during summer ?	1. Lube oil temperature within desirable range 2. Better cooling of bearings and more reliability of equipment. 	1. Lube oil temp is within in desirable range 2. Better reliability of pump and motor bearings 3. Min temp rise during backwash of coolers 4. No local draining of cooling water is required to maintain LO temp.

Scope & Plan for Horizontal Deployment:

Equipment	Target	Responsibility	Status

IMPLEMENTATION OF ISO 50001

Certificate

MANAGEMENT SYSTEM CERTIFICATION

This is to certify that

Energy Management System

Of

INDIAN OIL CORPORATION LIMITED

HALDIA REFINERY

P.O Haldia Oil Refinery, Haldia,
Dist. Purba Medinipore-721606, West Bengal, India

Complies with the requirements of

ISO 50001: 2018

This certificate is valid for the following activities related to:
CRUDE OIL REFINING & SUPPLY OF VARIOUS GRADES OF PETROLEUM PRODUCTS, BY PRODUCTS AND LUBE OIL BASE STOCKS

28.12.2020	27.12.2023	10050
Date of Issue	Valid Until*	Certificate No.

Associates

Technical Director

DEMING CERTIFICATION SERVICES PVT. LTD.

For Further Clarification Of The Scope Of The Certificate, Validity And The Applicability Of The Management System, Can Be Obtained From info@demingworld.Com Website: www.demingworld.com
Astoria Park, 09-09, Tower E, 32, Lorong Mydin, Singapore - 416826

Energy Policy

Haldia Refinery is committed to continuously enhance energy efficiency in all its activities, products and services through use of state-of-the-art, energy efficient, eco-friendly & Renewable technologies and leverage energy efficiency in its operations by:

- Meeting all relevant statutory and other requirements.
- Ensuring availability of updated information.
- Providing Energy Efficient resources.

We believe to achieve our Energy Objectives with the participation of our employees.

(Partha Ghosh)
Executive Director &
Refinery Head

IndianOil

Indian Oil Corporation Ltd.
Haldia Refinery

ROHS

ISO 9001 / ISO 14001 / OHSAS 18001

Encon Project budget allocation %

Total turnover of the refinery in FY 2020-21 (Rs. Million)	174936
Amount invested in EnCon Projects FY 2020-21 (Rs. Million)	571
Investment %	0.33%

AWARDS & ACCOLADES

SN	Name of award received	Remarks
1	**OHWI (Occupational Health and Wellness Index) among all the Refinery Units in 2020-2021**	
2	**Energy efficient Unit award by CII in 2020**	
3	Won the ***Director (HR) Trophy for "Best CSR Unit"*** among 31 establishments across IndianOil at IndianOil CSR Conclave held at Digboi. **FY 2019-20**	
4	Won "***Best Swatch Establishment Award***" for Refinery Division for outstanding contribution to Swatch Bharat Mission during Swatchhata Pakhwada. **FY 2019-20**	
5	"**TOLIC award"** for 2018-19 in the field of best implementation of official language under aegis of Ministry of Home Affairs, Govt. of Indian. **FY 2019-20**	
6	Haldia Refinery has won the prestigious "**Suraksha Puraskar**" (Bronze trophy & certificate) in Group –A under the manufacturing Sector from National Safety Council of India for the year 2016 on Thursday, the 20th April, 2017	

AWARDS & ACCOLADES

SN	Name of award received	Remarks
7	**Haldia Refinery has been conferred Best Performance Award in "Carbon Di-Oxide Emission" under Refineries without Natural Gas category. FY 2017-18**	
8	Haldia Refinery has been awarded OISD Award (2016-17) under "Refineries and other processing plant" category.	
9	**Received Golden Peacock Occupational Health & Safety Award-2016** by Institute of Directors	
10	Received the prestigious National Safety Award – 2014 by DGFASLI, Government of India.	
11	Received International Safety Award - 2016 achieved from British Safety Council with 'Merit'.	
12	Received CII Excellence Award in Safety with four Star rating, by CII Eastern Region.	
13	**Received 17th National Award for Excellence in Energy Management 2016 from CII on 24th Aug 2016 at Hyderabad**	
14	**Haldia Refinery was recognized for best performance in Carbon dioxide Emission Awards (2014-15) under category of Refineries without natural gas on 7th Sep 2016 during 20th RTM at Gandhinagar.**	
15	Accreditation Certificate was issued by National Accreditation Board for Testing and Calibration Laboratories (NABL) on 18.10.2016 in the wake of the onsite assessment of Quality Control Laboratory,	