CII National Award for Excellence in Energy Management 2022

Company Name: Indian Oil Corporation Ltd.
Mathura Refinery

Presenting Members :	**Mr. Rahul Srivastava, DGM (TS)**
	Mr. Imran Ali Khan, CTSM
	Mr. Bandish Soni, STSM
	Ms. Vandana Gautam, PSM
	Ms. Srishti Singh, AMPS
	Ms. Garima Shahi, AMPS

AGENDA

- IOCL Overview
- Mathura Refinery Overview
- Refinery Business Model
- COVID Impact
- Performance over the Years
- Specific Energy Consumption
- Solomon Benchmarking
- PAT Cycle Performance
- Schemes Implemented in Last 3 years
- Planned EnCon schemes for future
- Innovations & Future Projects
- Renewable Energy
- EnMS ISO 50001
- Waste Utilisation & Management
- GHG Inventorisation
- Green Initiatives
- Teamwork, Employee Involvement & Monitoring
- Awards & Recognitions

IOCL OVERVIEW– THE ENERGY OF INDIA

Refining/PetChem | **Marketing** | **E&P**

The Energy of India

Corporate Vision of 21st Century

VISION

Ethics
Setting high standards for ethics and values

Customers
Fostering relationships for a lifetime

People
Leading with passion to excel

IndianOil

The Energy of India

A Globally Admired Company

Technology
Harnessing frontier technology

Innovation
Pioneering the spirit of creativity and research

Environment
Caring for the environment and community

VALUES

Care • Innovation • Passion • Trust

IOCL OVERVIEW

Indian Refineries Ltd. 1958

Merger

Indian Oil Company Ltd. 1959

Indian Oil Corporation Ltd. 1964

Companies Merged

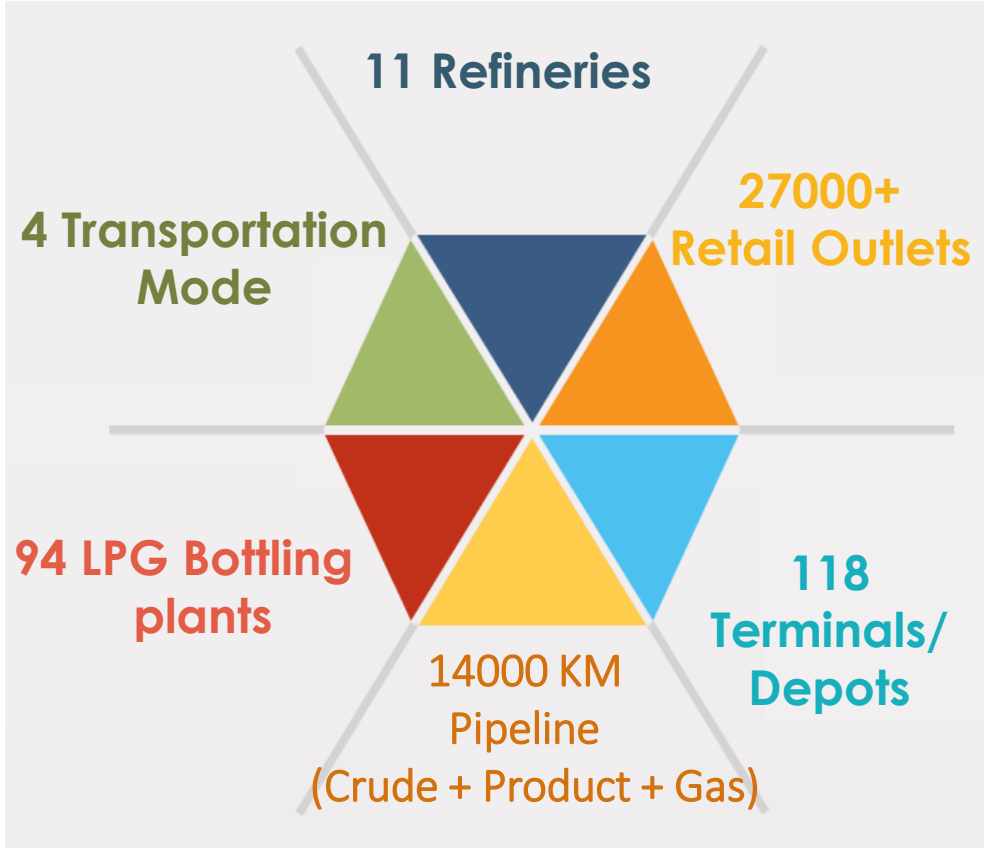
Assam Oil Company 1981

IOCL 2006

IBP Co. Ltd 2007

BRPL 2009

1 Integrated Refining and Marketing company in PSU domain



Group Refining
- 11 out of 23 refineries in the country

Marketing
- 50,000 Touch Points (52%)
- 131.1 million LPG customers

Pipelines
- Over 14,670 Km length
- 94.56 MMTPA capacity

R&D
- BS VI technologies
- In-house technologies
- carbon capture

Petrochemical
- Linear Alkyl Benzene (LAB) plant
- Paraxylene Terephthalic Acid (PX/PTA)
- Export to 76 countries

Exploration & Production
- Domestic: 12 Blocks
- Over Seas: 12 blocks

Gas
- Co-promoter in M/s PLL
- LNG at Doorstep
- CGD
- IOAGL
- (Storage /

Renewable
- Biofuel : Captive plantation
- Wind : 167.6 MW
- Nuclear : Equity partnership
- Solar: 6.23 MW

Mathura Refinery Overview

1962
GUWAHATI REFINERY 1 MMTPA

1964
BARAUNI REFINERY 6 MMTPA

1965
GUJARAT REFINERY 13.7 MMTPA

1975
HALDIA REFINERY 7.5 MMTPA

1981
DIGBOI REFINERY 0.65 MMTPA

1998
PANIPAT REFINERY 15 MMTPA

2009
BONGAIGAON REFINERY 2.35 MMTPA

2016
MATHURA REFINERY 8 MMTPA

0.8 MMTPA
1962

80.7 MMTPA (Including subsidiaries CPCL: 11.5 MMTPA)

Late Prime Minister Smt. Indira Gandhi, laid the foundation stone of Mathura Refinery on 2nd October, 1973.

- **Mathura Refinery is a Public Sector Refinery, built in collaboration with erstwhile USSR**

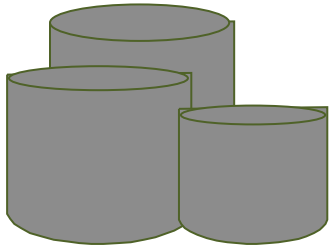
Mathura Refinery is an ISO 50001 certified company

REFINERY BUSINESS MODEL

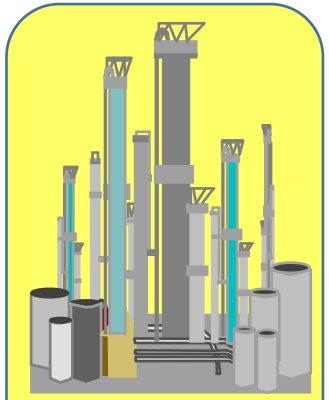
Crude Intake & Production

Crude Purchase (Imports 87%)

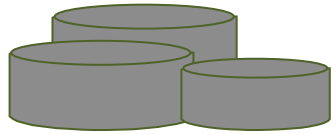
Crude Transportation (Tanker/Pipeline)



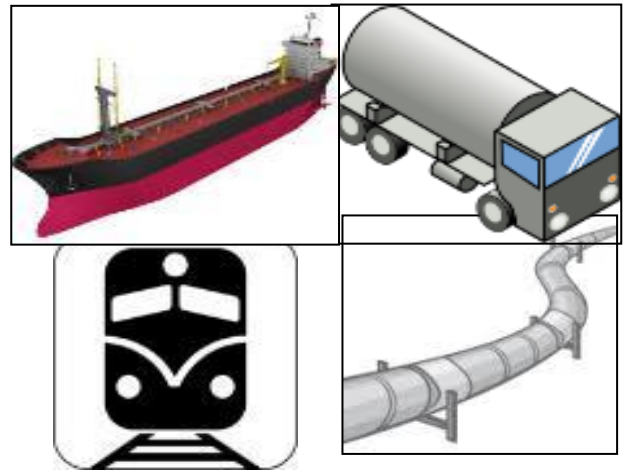
Crude Storage



Refining & Petrochemical

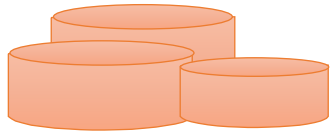


Refinery & Petrochemical Products



Product Transportation/Distribution (Tanker/Pipeline/Rail/Road)

Product Distribution

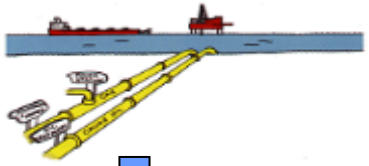


Marketing Product Storage (Terminal/ Depot/ Port/Warehouse/Consumer)

Retailing / Consumer (Demand Centre)

MATHURA REFINERY - PRODUCT PATTERN

SUPPLY OF CRUDE



CRUDE FROM
SALAYA PORT

MATHURA
REFINERY

TRANSPORTATION

Liquefied
Petroleum Gas

Propylene

Naphtha

Motor Spirit

EBMS

Aviation
Turbine Fuel

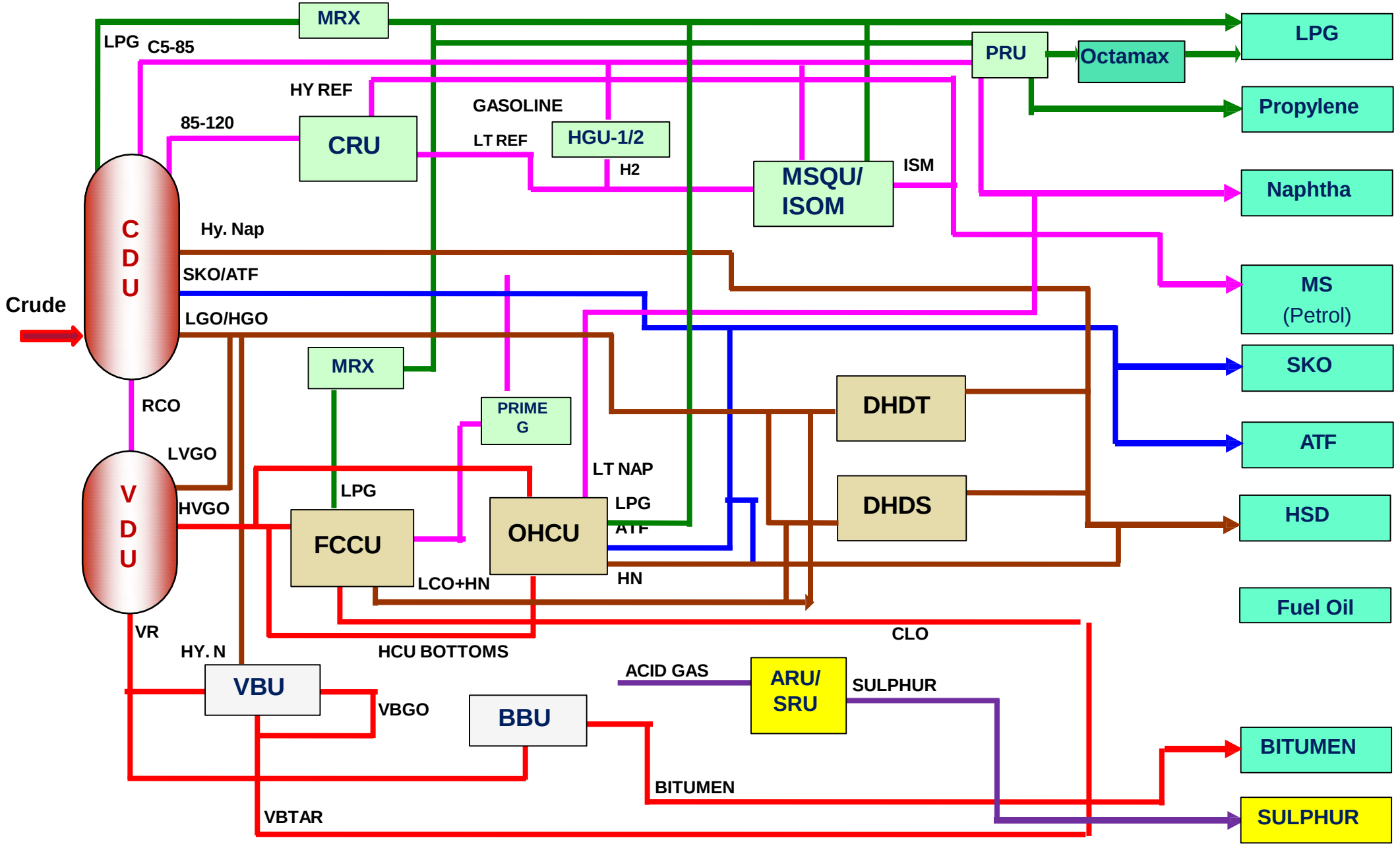
Kerosene

Diesel Fuel
(HSD)

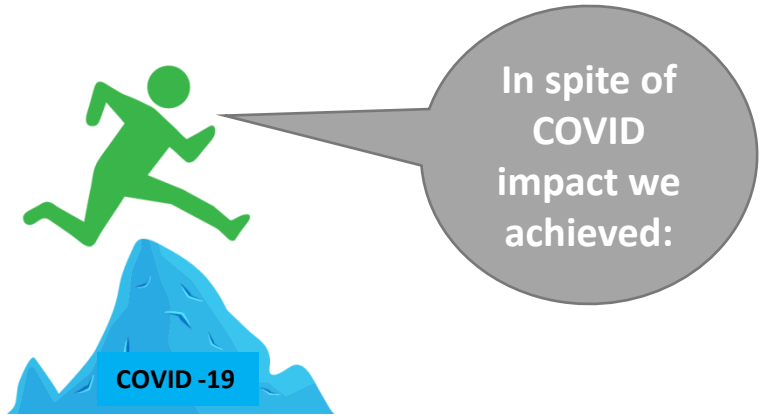
Furnace Oil,
Bitumen

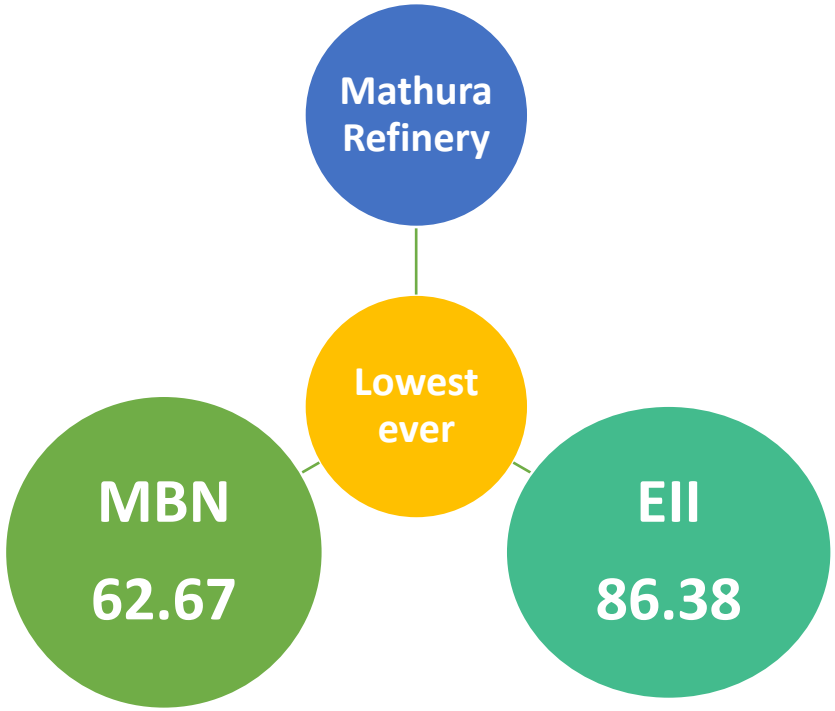
Sulfur

Mathura Refinery Block Flow Diagram



Highlights for the year





Zero Flaring

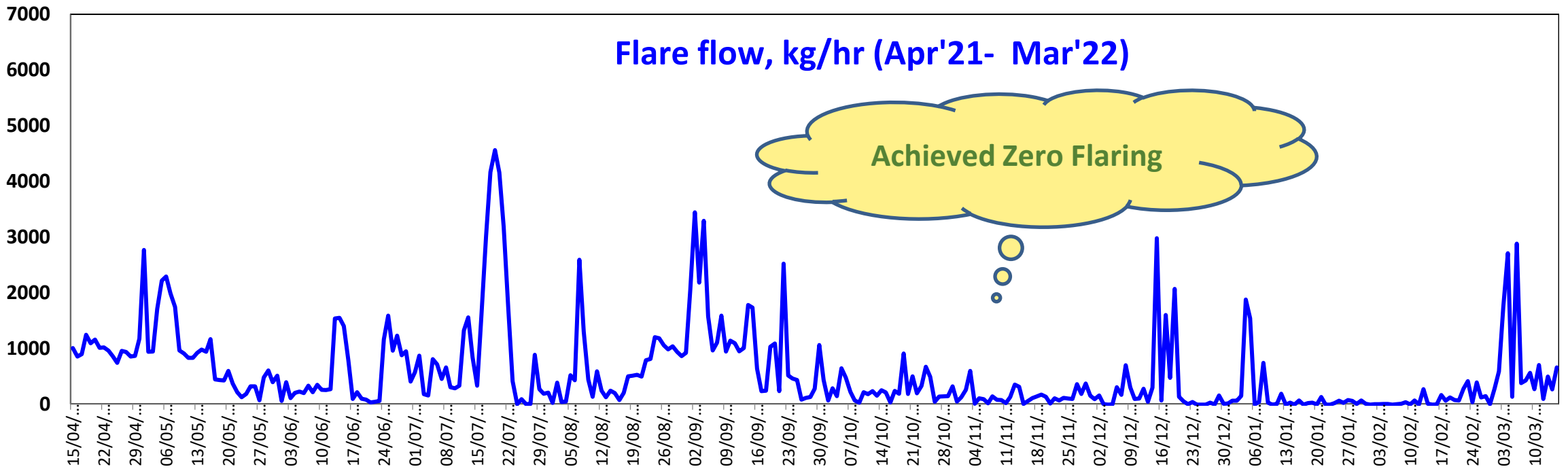
Zero Steam Leak

Online dashboard - Monitoring of AVU preheat

Energy management system (EMS) Dashboard

Zero Flaring

Mathura Refinery Achieved Zero Flaring for several days in the year 2021-22.

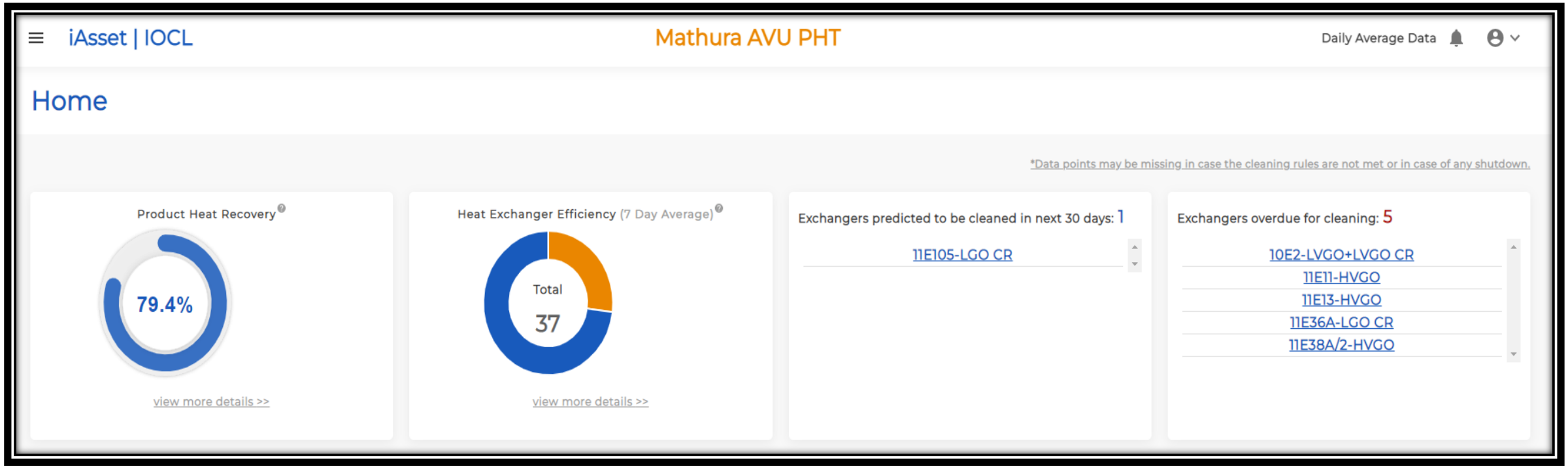


Zero Steam Leaks

Mathura Refinery is now a zero steam leak refinery

Steam Leak audit by CHT nominated auditors conducted from 14th -16th Mar’22 as part of SAKSHAM 2022. Total identified steam leaks 20.42 kg/hr (including shutdown jobs).

Online dashboard has been developed for **Monitoring of AVU preheat and fouling prediction of AVU preheat exchanges**.
This dashboard will also provide heat efficiency of each preheat circuit of AVU and keep track of preheat exchanger cleaning record.



Energy Management System

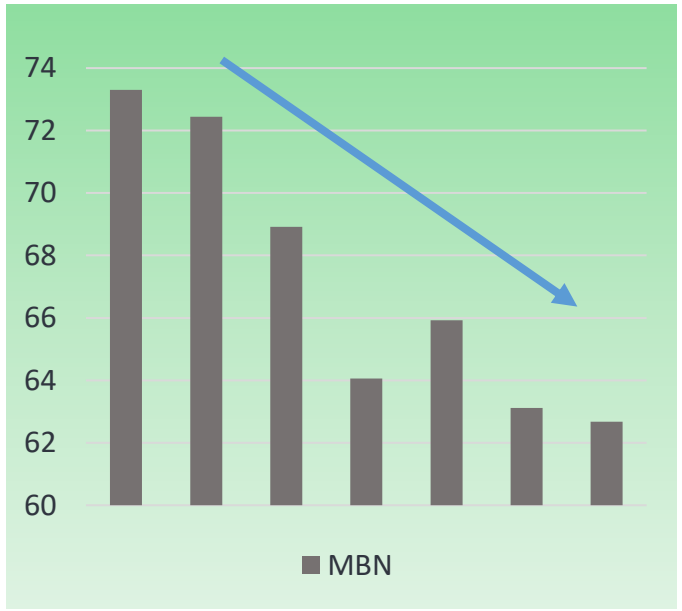
Energy management system (EMS) Dashboard has been developed at Mathura Refinery to monitor hourly basis performance of ENCON parameters. It includes:

- over all performance like MBN, F&L NRGF etc.
- TPS performance
- Unit wise fuel consumption.
- Trends and deviations
- Cost impact
- It also suggests more efficient ways of operation.

Mathura Refinery has been recognized as "**Excellent Energy Efficient Unit**" for its Energy performance during the year FY'21-22 by the Confederation of Indian Industry (CII).

MATHURA REFINERY – A UNIQUE REFINERY

MBN

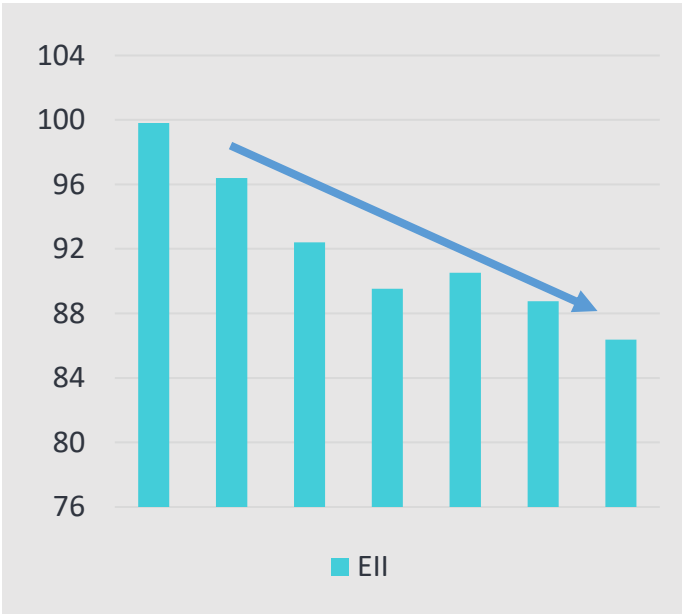


73.3 (2015-16)

14 % ↓

2021 – 22→ 62.67

Energy Intensity Index

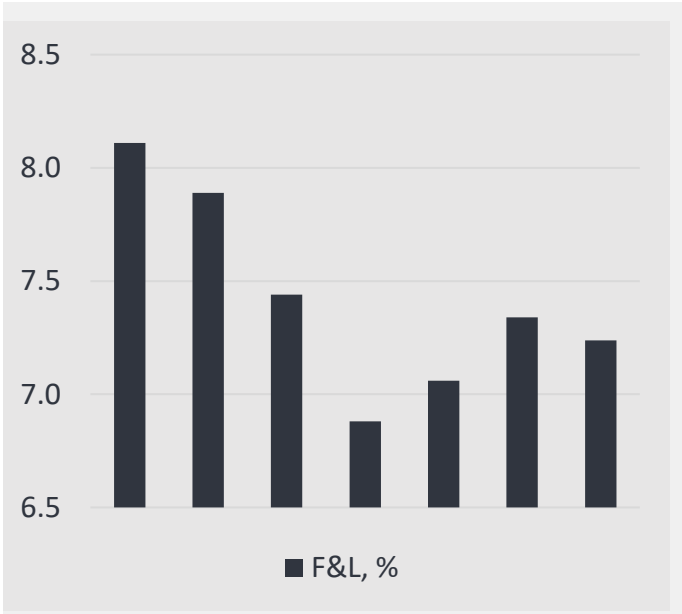


99.8 (2015-16)

15 % ↓

2020 – 21→ 86.38

Fuel & Loss %



8.11 % (2015-16)

11 % ↓

2021– 22→ 7.24%

IOCL will build the nation's first 'Green Hydrogen' plant at its Mathura refinery, as it aims to prepare for a future catering to the growing demand for both oil and cleaner forms of energy.

Mathura Refinery: Path to Greenest Refineries in APAC

Be the pioneer in green energy transition among the Asian Refineries

1. **Migration** from grey captive/grid power to Round The Clock (RTC) green power **at no additional cost impact**
2. **Phase wise migration** from grey Hydrogen to green Hydrogen **at minimal impact on GRM**.

MATHURA REFINERY – A UNIQUE REFINERY

India's first 100 RON MS, "XP -100" was manufactured in Mathura Refinery .

MATHURA REFINERY – A UNIQUE REFINERY

1st industry in the country for which **Scientific Environmental Impact Assessment (EIA)** study carried out before commissioning.

1st refinery in the world to be accredited with **ISO-18001 (Occupational Health & Safety Management System)** certification in Nov'98.

1st refinery in Asia and 3rd in the world to be accredited with coveted **ISO-14001 (Environment Management System)** certification in July'96.

Set up a Hospital **(Swarn Jayanti Samudaik Hospital)** outside township for community welfare in April'99.

MATHURA REFINERY – Last Year Achievements

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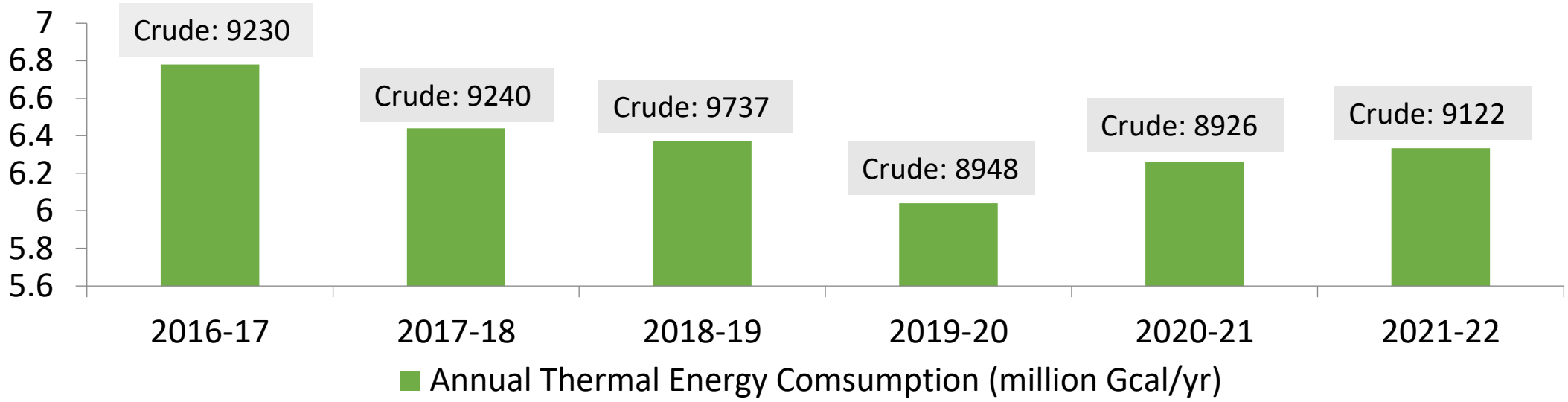
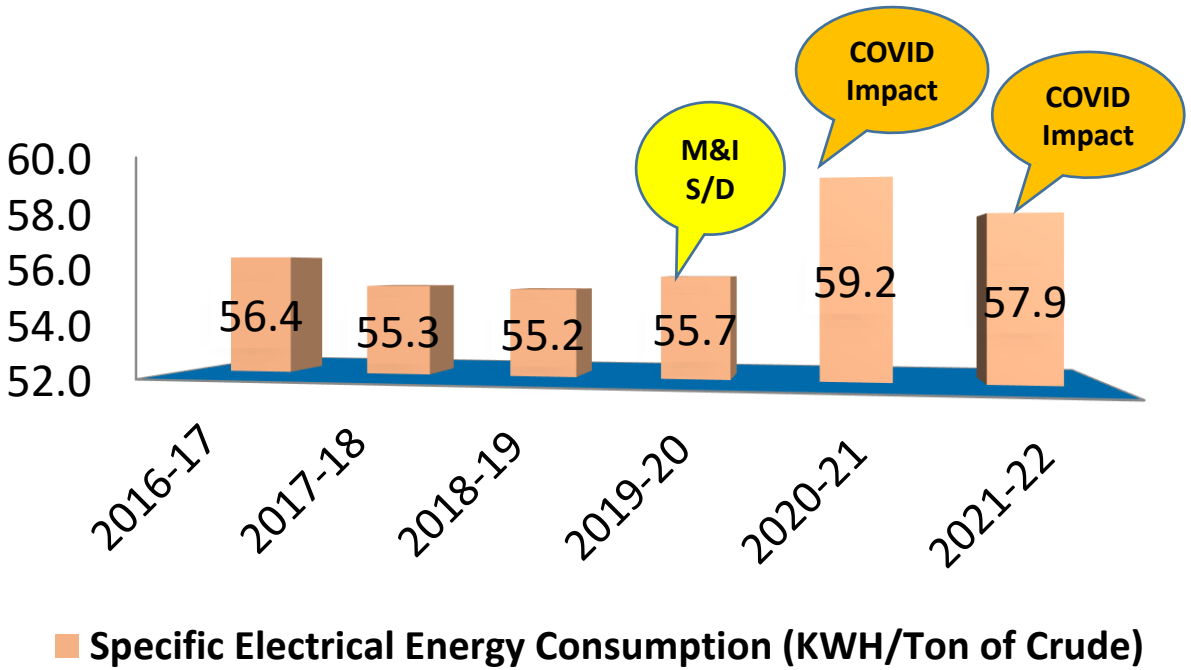
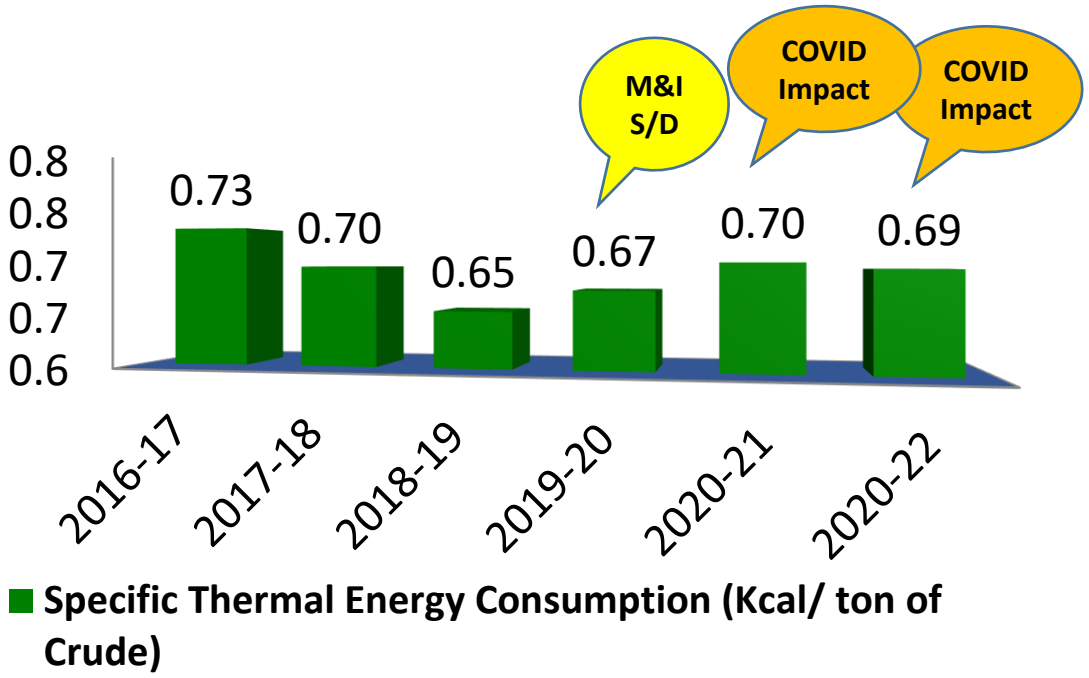
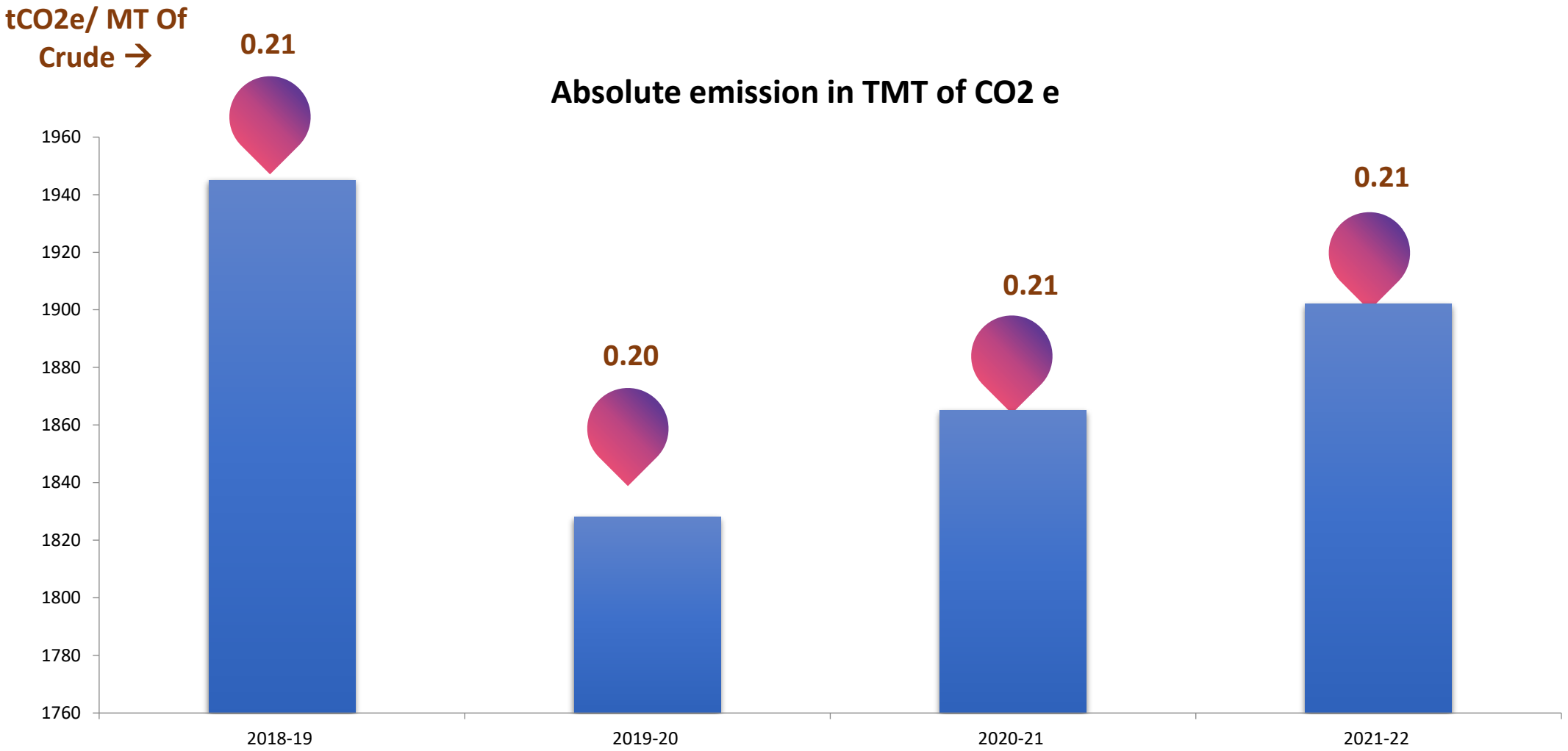
Energy Consumption Overview



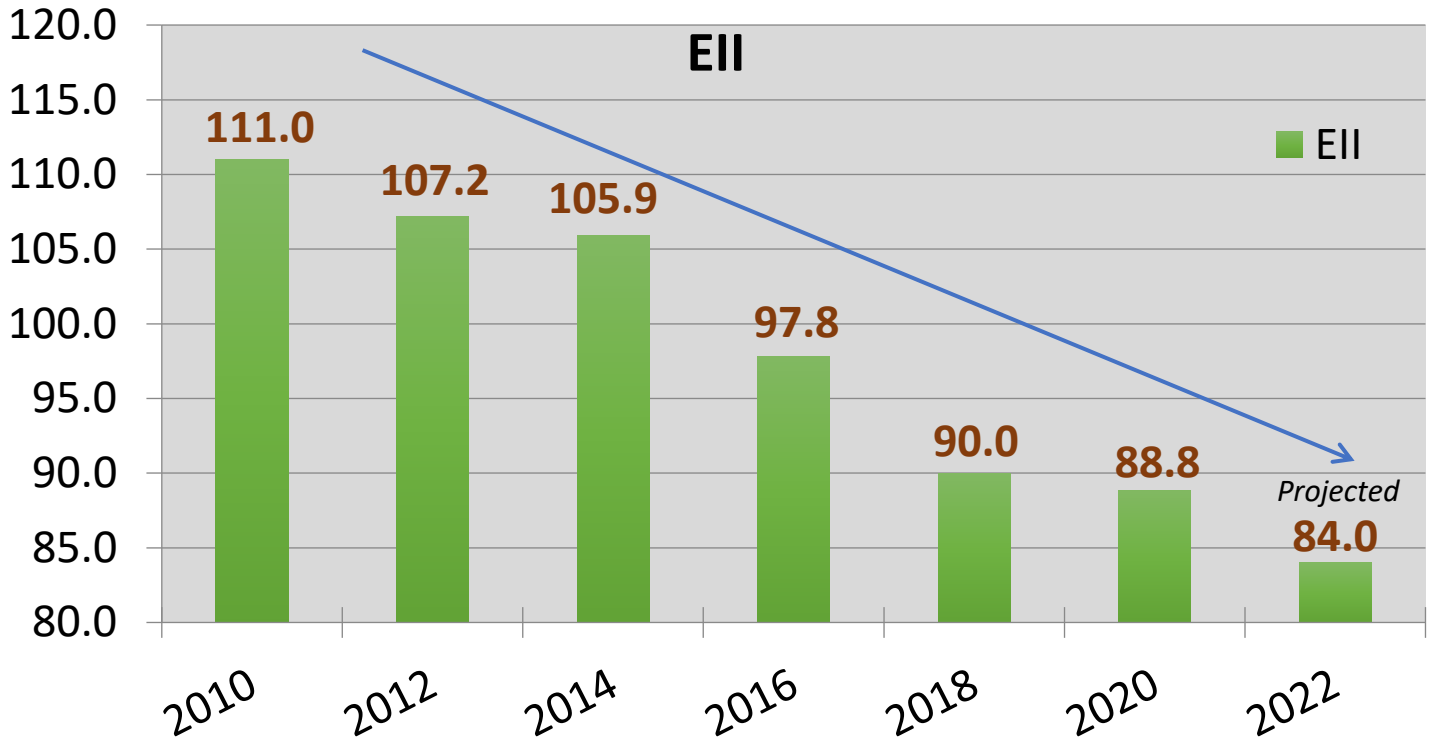




Performance Over the years



Solomon Benchmarking : Energy Performance



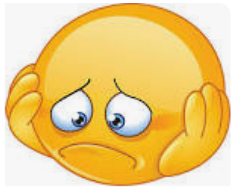
2010	111.0	Q4
2012	107.2	
2014	105.9	
2016	97.8	
2018	90.0	Q3
2020	88.8	Q2
2022	84.0	Q2

Projected

- **Worldwide Average Refinery EII reduction : 1 EII/ year**
- **27.0 EII Reduction in 12 years (2.3 EII/Year reduction)**
- **One quartile reduction in EII from Q3 to Q2 in Solomon study of 2020.**
- **Till Jul'2022 EII : 82.05 → Q2**

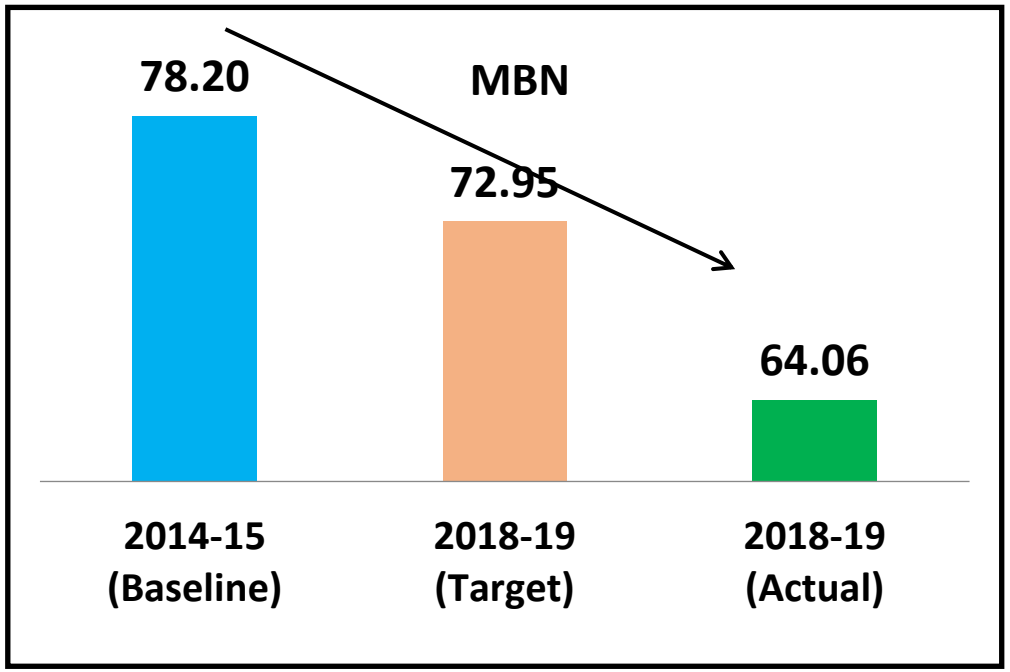
Q-1 — Best 25% of peer group refineries

Q-4 — Worst 25% of peer group refineries



PAT CYCLE: IOCL-MR Performance

PAT Cycle-II : FY 2016-2019



14 MBN Reduction against

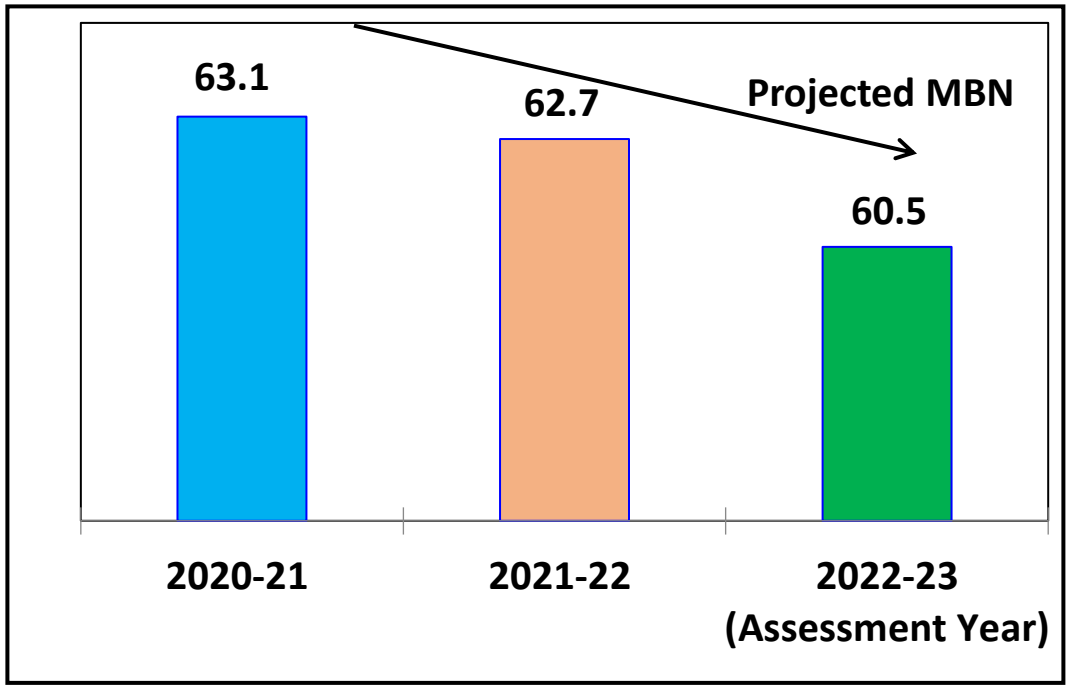
5.2 MBN Target

No of Escerts issued:

71718 Escerts

With focused approach, IOCL- MR has not only achieved but surpassed the target.

PAT Cycle-VI : FY 2020 -23



Target for Year 2022-23 : 60.7 MBN

Action Plan to Achieve PAT Cycle-VI target (Future Schemes)

S.N	Operational Improvements	Savings SRFT/yr	Year
1	Replacing MAB Condensing Turbine Drive with Motor Drive (Present steam cons: 36 TPH HP steam; Power req : 7.5 MWH)	5000	22-23
2	Converting turbine to motor in Heat pump compressor (Present steam cons: 28 TPH MP steam; Power req : 4.0 MWH)	5500	22-23
3	Replacing WGC condensing turbine drive with motor (Present steam cons: 18 TPH HP steam; Power req : 4.0 MWH)	4900	22-23
4	•HGU-II leaky APH replacement •HGU-II APH bypass open due to control valve stuck-up	1600	22-23
5	Provision of HP rich amine flash vessel in OHCU to recover fuel gas	800	22-23
6	Installation of Electrical Heat tracing in offsite piping	1500	22-23
7	PSA-140 Revamp: Recovery of additional H2 rich LP off gases @ 9630 Nm3/hr (472 kg/hr)	2500	22-23
8	Welded Plate type heat exchanger in AVU HVGO preheat circuit	2500	22-23
9	Ensure single STG operation during summer months (post 220 kV Power Import Project)	1700	22-23
10	Shifting of the Prime G shutdown of 18 days for catalyst replacement to FY-23-24 instead of Feb'23	1400	22-23
11	CDU COT reduction in LS run by 5°C.	944	22-23
Total SRFT Saving (~2.99 MBN reduction)		**28344**	

Schemes Implemented in last 3 Years (2019-22)

SI. No.	Year	SRFT Savings/A	MBN Impact
1.	2019-20	12520	1.31
2.	2020-21	3550	0.37
3.	2021-22	11947	1.26
Total		28017	2.94

S.N	ENCON Scheme	Savings SRFT/yr	Year
1	MP steam stoppage in TPS Deaerators	3500	21-22
2	Repair/Replacement of faulty Steam Traps & Valves	2646	21-22
3	Overhauling of STG-1 & Vacuum improvement in STG-1 by arresting Air ingress in condenser leakage and Condenser tube cleaning	1470	21-22
4	Scheme for “Routing the propylene analyzer purge in NPRU to HPC suction KOD to reduce flaring” implemented in Jun’21 which led to significant reduction in flare flow from	1570	21-22
5	One running Boiler Feed Water Pump stopped at TPS by increasing reliability of auto-start logic in Jan’22.	400	21-22
6	Water Washing in GT-1	475	21-22
7	Overhauling, Refurbishment of Blades Turbine & Compressor of GT-1	836	21-22
8	Optimizing UCO hot feed to FCC	472	21-22
9	Replacement of Thermal Insulation in TPS	578	21-22

Schemes Implemented in last 3 Years (2019-22)

S.N	ENCON Scheme	Savings SRFT/yr	Year
10	Redundant tracing steam isolation in 6 Km of line	1150	20-21
11	commissioning of the condensate recovery in area 153 with condensate recovery of 10.5 T/hr and steam recovery of 0.6 T/hr.	1000	20-21
12	Stoppage of the off gas compressor K-4 in PSA 140 by routing the higher amount of impure hydrogen through PSA 140 bypass	600	20-21
13	Running of the both K5 compressor and preventing CRU rich gas from going to FG header	400	20-21
14	Steam header isolation from First aid to OHCU(~1.8 Km)	400	20-21
15	Installation of MLP steam generator in MCB circuit (LP Steam generation ~ 6.5 TPH)	3200	19-20
16	Installation of Divided Wall Column in CCRU NSU to improve separation & saving of energy	2850	19-20
17	Installation of DHDS feed preheating exchanger for preheat up to 97oC C by product rundown, thus reducing the furnace duty	2200	19-20
18	Installation of steam generator in DHDS stripper bottom stream	1920	19-20
19	Use of Low Temperature Co-Mo catalyst in TGTU and bypass of Tail gas heater with new Gas-Gas Exchangers	1800	19-20
20	Excess air optimization by installation of TDLS analyser in VBU & VDU heaters	550	19-20

Operational Improvements in last 3 Years (2017-20)

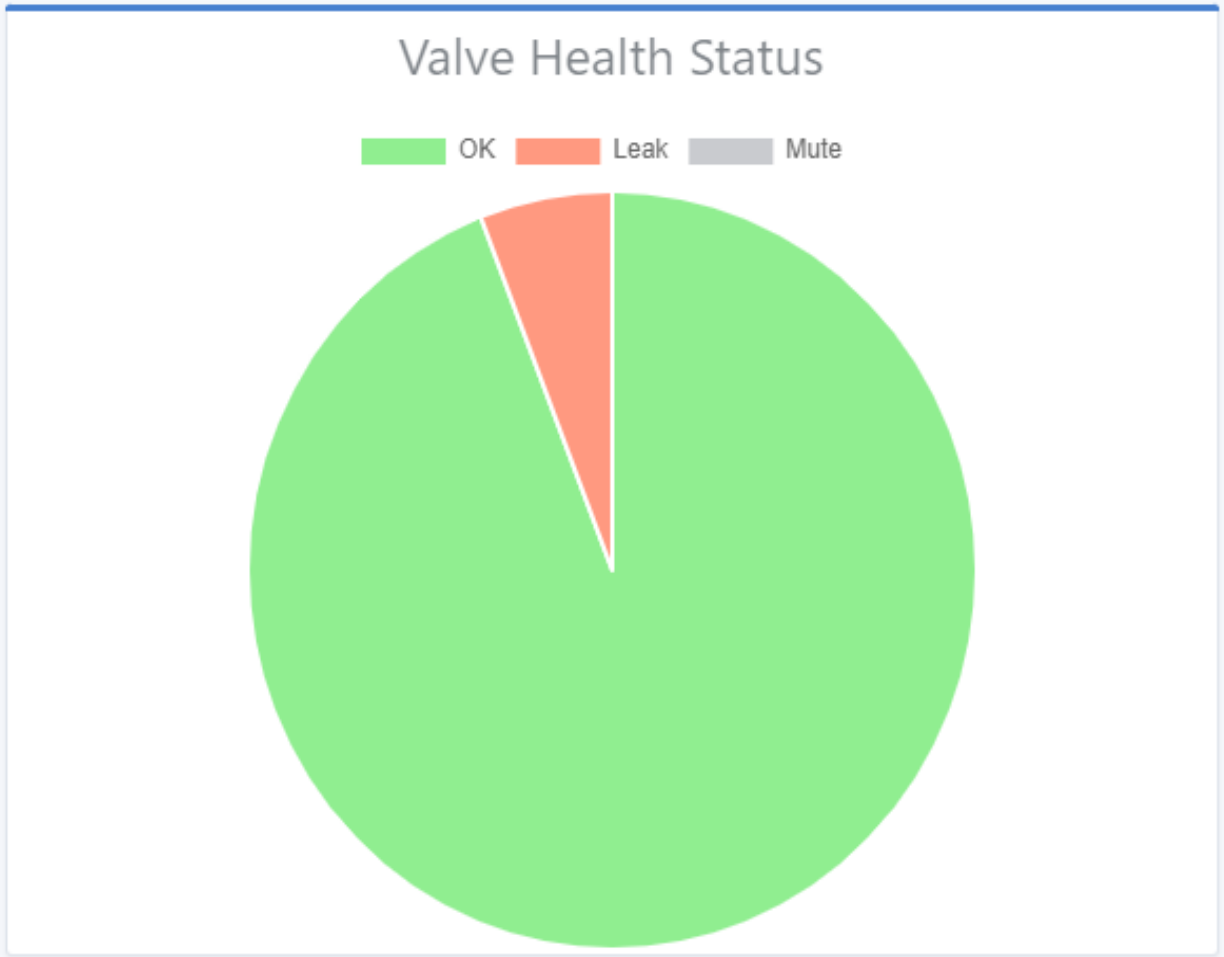
Sl. No.	Year	SRFT Savings/A	MBN Impact
1.	2019-20	10257	1.08
2.	2020-21	9000	0.95
3.	2021-22	2350	0.25
Total		21607	2.28

S.N	Operational Improvements	Savings SRFT/yr	Year
1	Stepless controller in OHCU attended in Jul'21. Post this, spillback opening of compressor reduced to 0% & compressor loading has also come down from 95% to 68%.	1200	21-22
2	Total H2 rich gases ex DHDS and DHDT routed to PSA-140 in Dec'21. Additional H2 recovered: 450 kg/hr.	1150	21-22
3	Stoppage of BBU and direct production of bitumen from VDU bottom from 28th Mar'20 to 30 Sep'20	5000	20-21
4	Commissioning of the scheme "Injection of the BFW in AVU preheat train 3 for Preheat Improvement"(1st of its kind in IOCL)	4000	20-21
5	Replacement of ARU column trays with high efficiency trays and cleaning of plate type heat exchanger (LP steam saving ~ 8 TPH)	4000	19-20
6	Replacement of CO boiler economizer module (MP Steam gen. increase ~ 4 TPH)	3200	19-20
7	Overhauling/re-blading of GT-2 to improve heat rate:	875	19-20
8	Energy savings by replacement of Pump	138	19-20
9	Overhauling and water washing of GT-3 compressor to restore their design efficiency	2044	19-20

IIoT based PSV Monitoring System

- Joint survey was done by IOCL ENCON team, Permaweld Pvt. Ltd. and Forbes Marshall Pvt. Ltd. for checking the reliability of IIoT based Acoustic Wireless Trap/PSV Monitoring System (AWTMS) devices installed in Mathura Refinery.

- 51 IIoT PSV Monitoring System (AWTMS) devices installed in Hydrogen service for leakage monitoring of PSV/CV, all are working fine. Out of 51 AWTMS, 3 are found passing.



Total Valves Monitored 51

OK	48
Leak	3
Mute	0

Valve Uptime: 94% AWTMS Uptime: 100%

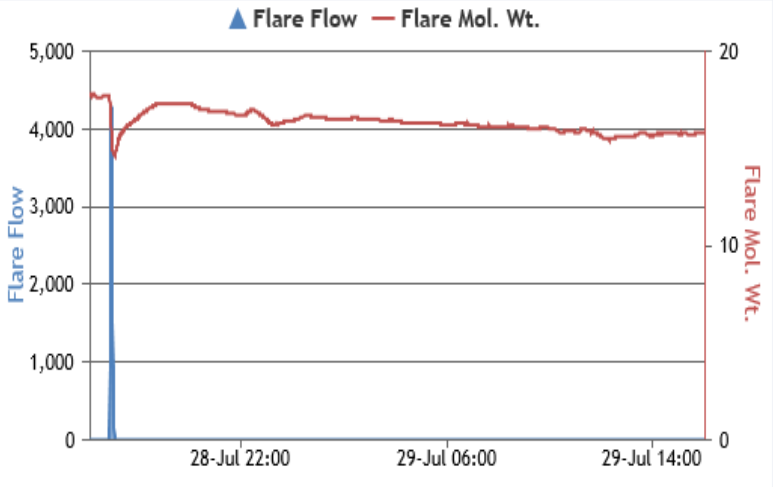
VALVES	LOCATION	STATUS (All)
05210101	7UV5102 RGC DISCHARGE TO FLARE OHCU	Leak
05210097	302-PV-3102 HYD. PRODUCT TO FLARE HGU-2	Leak
05210065	301-PSV-0601A 301-V-07 OFF GAS DHDT	Leak

Flare Dashboard

Flare Dashboard 1.0

Flare Flow	Avg. Flare Flow (Last 24 hrs.)	Flare Mol. Wt.	No. Of FGRS Running	Flare Recovery thru FGRS
0 Kg/hr	15 Kg/hr	15.8	2	596 Kg/hr

Trend (Last 24 Hrs.)



Flare Control valves Currently open in Flare

Unit	Description	Tag No.	% Opening
No data to display			

Unit	Description	Tag No.	Kg/Hr or Nm3/Hr
NPRU	Flare FT	MRA.18NFI1701.PV	571.5
prime G and octamax	Flare FT	MRA.307_FI_2602.PV	66.2

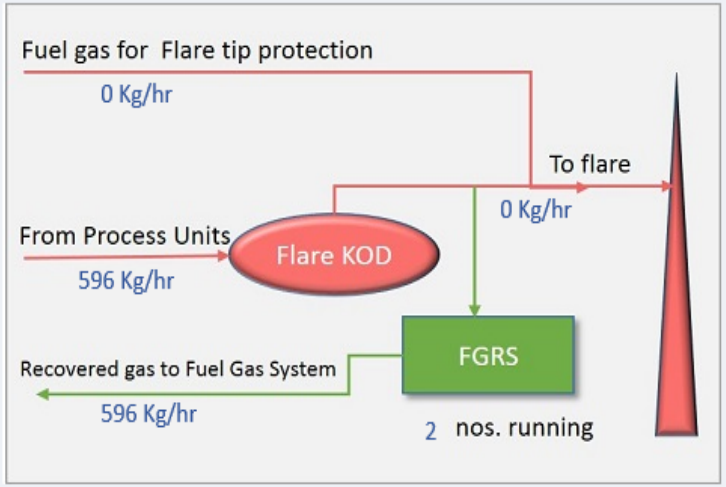
Flare Control valves opening in last 24 hrs

Unit	Description	Tag No.	% Opening	No. Of Hrs.	Max Opening
Octamax	Stabilizer Reflux drum 401-V-3	MRA.401PIC0607B.OP	0.7	2.8	1.90
Unit 99	FG to flare header	MRA.99PRC01A.OP	2.8	1.8	12.20
FCCU	Main Frac (19V5) reflux Drum	MRA.19PIC0202.OP	68.1	0.7	100
	VB tar				

Passing PSVs (4 No.s, Loss: 211.76 Kg/Hr) , Updated On: 07-06-21

Unit	Tag No.	Location	Passing Since (in Days)	Est. Qty.
OHCU	07-PSV-4801	07-V-009 C.L.P.S	52	100
DHDT	PSV-0601A	301-V-07 OFF GAS	178	51.76
NHGU	PV-3102	302-S-12	52	32
OHCU	07-UV-5102	C/V TO FLARE	52	28

Flare Schematic



Unit	Description	Tag No.	Flow	No. Of Hrs.	Max Flow
NPRU	Flare FT	MRA.18NFI1701.PV	343.3	24.0	644.40
prime G and octamax	Flare FT	MRA.307_FI_2602.PV	71.7	23.9	362.40
MSQ	Flare FT	MRA.308FI3402.PV	55.4	23.9	85.30

Flare Camera

IIOT Based PSV Monitoring

TPS Dashboard

TPS Dashboard

Hits: 7054

	Flow (TPH)	Pr. (kg/cm²)	Temp.°C
HP Steam Export	147	64	454

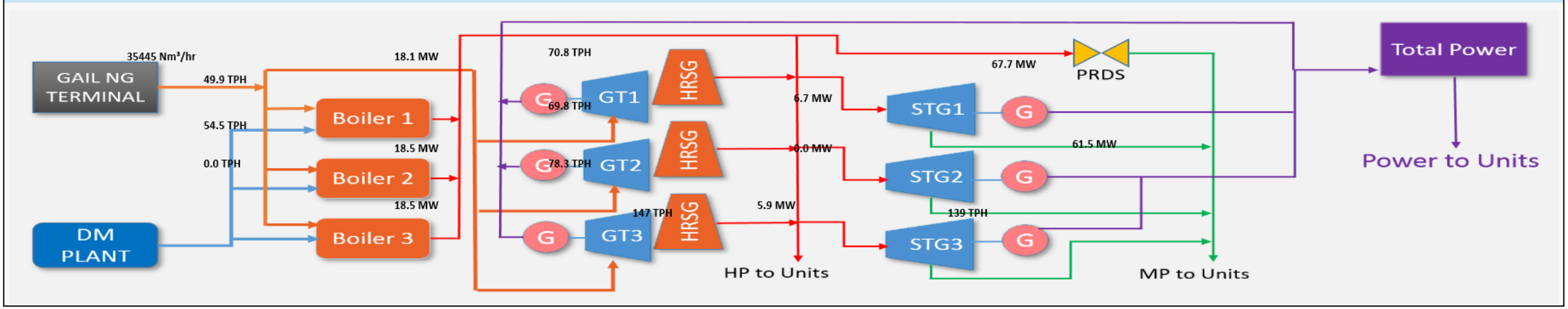
	Flow (TPH)	Pr. (kg/cm²)	Temp.°C
MP Steam Export	139	0	302

	Nm³/hr		Nm³/hr		MW
LP-NG to MR	45085	LP-NG to TPS	35445	Power Export	61.5 MW

Power Generation	Rated Capacity (MW)	Actual Gen (MW)	Rated Heat Rate (Kcal/Kwh)	Actual Heat Rate (Kcal/Kwh)	Eff.
GT-1	20	18.1	3282	3545	24.3
GT-2	20	18.5	3207	3491	24.6
GT-3	20	18.5	3323	3462	24.8
STG-1	12.5	6.7	2025	1188	96.8
STG-2	12.5	0.0	2025	0	0.0
STG-3	12.5	5.9	2025	2395	87.4
Total Generation	97.5	67.7			

HP Steam Generation	Rated Capacity (TPH)	Actual Gen (TPH)	S/f Ratio	Eff.
HRSG-1	103	70.8	17.4	77.0
HRSG-2	103	69.8	17.4	77.8
HRSG-3	103	78.3	19.5	85.5
Boiler-1	150	49.9	12.8	82.7
Boiler-2	150	54.5	12.1	77.8
Boiler-3	150	0.0	0.0	0.0
Total Generation	759	323.3		

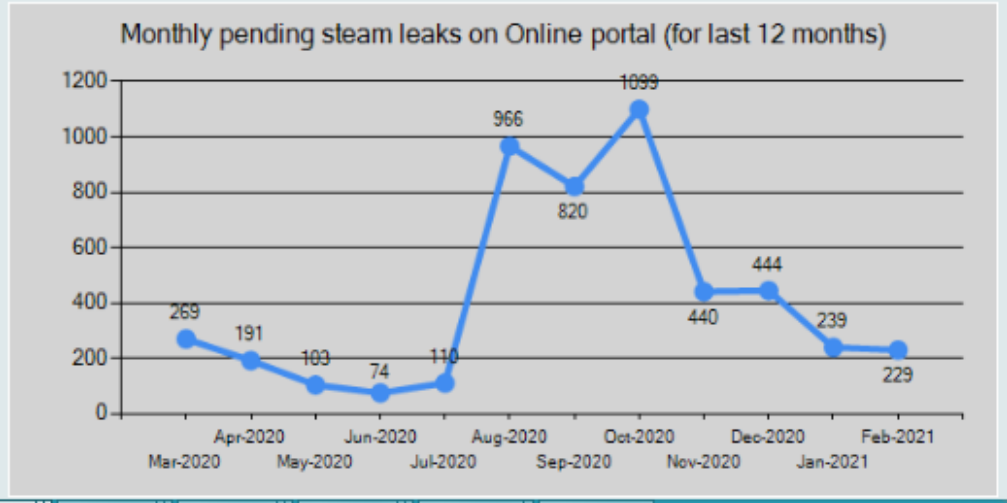
MOU Parameters of TPS			
% Overall Thermal Plant Efficiency		% Fuel Cons wrt Crude T'put	
Target	83.55	Target	3.04
Actual	82.1	Actual	3.0
Fuel SRFT (TPS)		33.0	
Crude T'put (T'MT) Processed		1.1	
Internal Steam Cons(TPH)	40.0	Aux Power(MW)	6.16

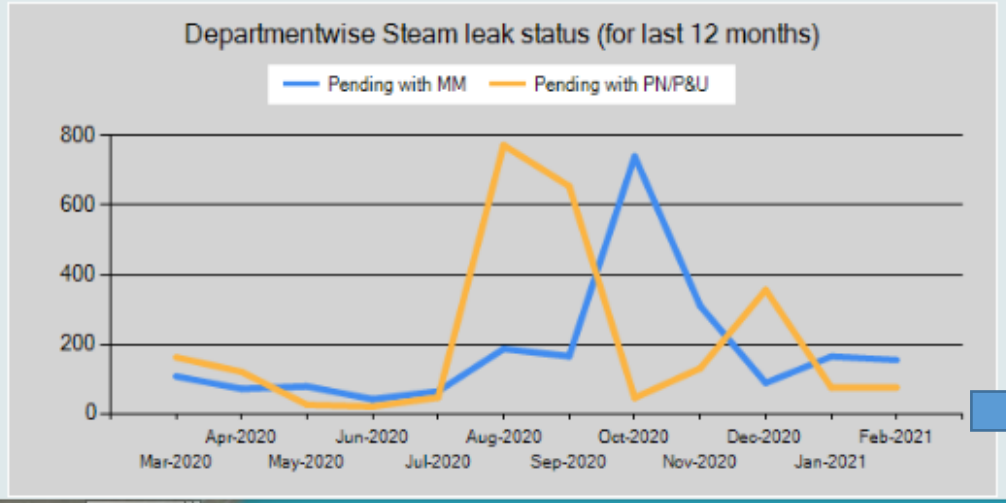


Steam Leak Reporting System

Dashboard

Area	Unit	Leaks attended till Today	Last Week Activity: New leaks reported	Last Week Activity: Released by Operation	Last Week Activity: Leaks attended by MM	Steam leaks as on Today: Pending Leaks	Pending With Operation	Pending With MM	Shutdown Job	Steam Loss (Kg/Hr)	Monetary Lo (Lacs/Yr)
TPS	TPS/CPU/DM Plant	160	0	0	0	**67**	61	0	6	294.0	77.3
WB	Water Block / SR-8 Common Area / Road 14 / Road 13/18 / Road 09/10/12 / Road 03	530	0	29	191	**57**	0	57	0	294.5	77.4
Old units 2	VBU/Merox / FCCU/PRU	312	0	0	77	**28**	0	28	0	181.2	47.6
New Units 1	OHCU / HGU-II / HGU-I / DHDT / DHDS	549	3	11	76	**27**	0	15	12	122.9	32.3
OMS-2	LPG / ETP / BSDS	336	0	0	0	**14**	14	0	0	31.4	8.2
SRU Block	TGTU / SWS / SRU-D / SRU-C / SRU-B / SRU-A / SRU Common Area / SPU / BBU / ARU	1551	41	0	37	**11**	0	10	1	4.3	1.1
OMS-1	Road 13/19/22 / Road 05/06/08/09 / Road 01/02/04 / NR-8 Common Area / IFO PH and T/F / Crude T/F / 82 PH and T/F / 81 PH and T/F	983	0	0	5	**8**	2	5	1	23.8	6.2
Old units 1	CCRU / AVU	456	0	0	122	**3**	0	3	0	9	2.4
New Units 2	Prime-G / Octamax / MSQ	51	0	0	0	**0**	0	0	0	0	0
	Total	**4928**	**44**	**40**	**508**	**215**	**77**	**118**	**20**	**961.1**	**252.6**





INNOVATION: Green Hydrogen Project

Attribute	Grey Hydrogen	Green Hydrogen
Feedstock:	Natural Gas	Water
Carbon Emission:	High	No CO_2 emissions
Technology:	Steam Methane Reforming	Electrolytic dissociation
Energy:	Using fossil Fuel	Renewable sources like solar or wind
Cost $/kg:	~2.5	~4

Hydrogen Unit	Design Capacity	Feedstock	Refinery H_2 Demand
HGU-I	102 TPD	Natural Gas	~240 TPD
HGU-II	180 TPD	Natural Gas	

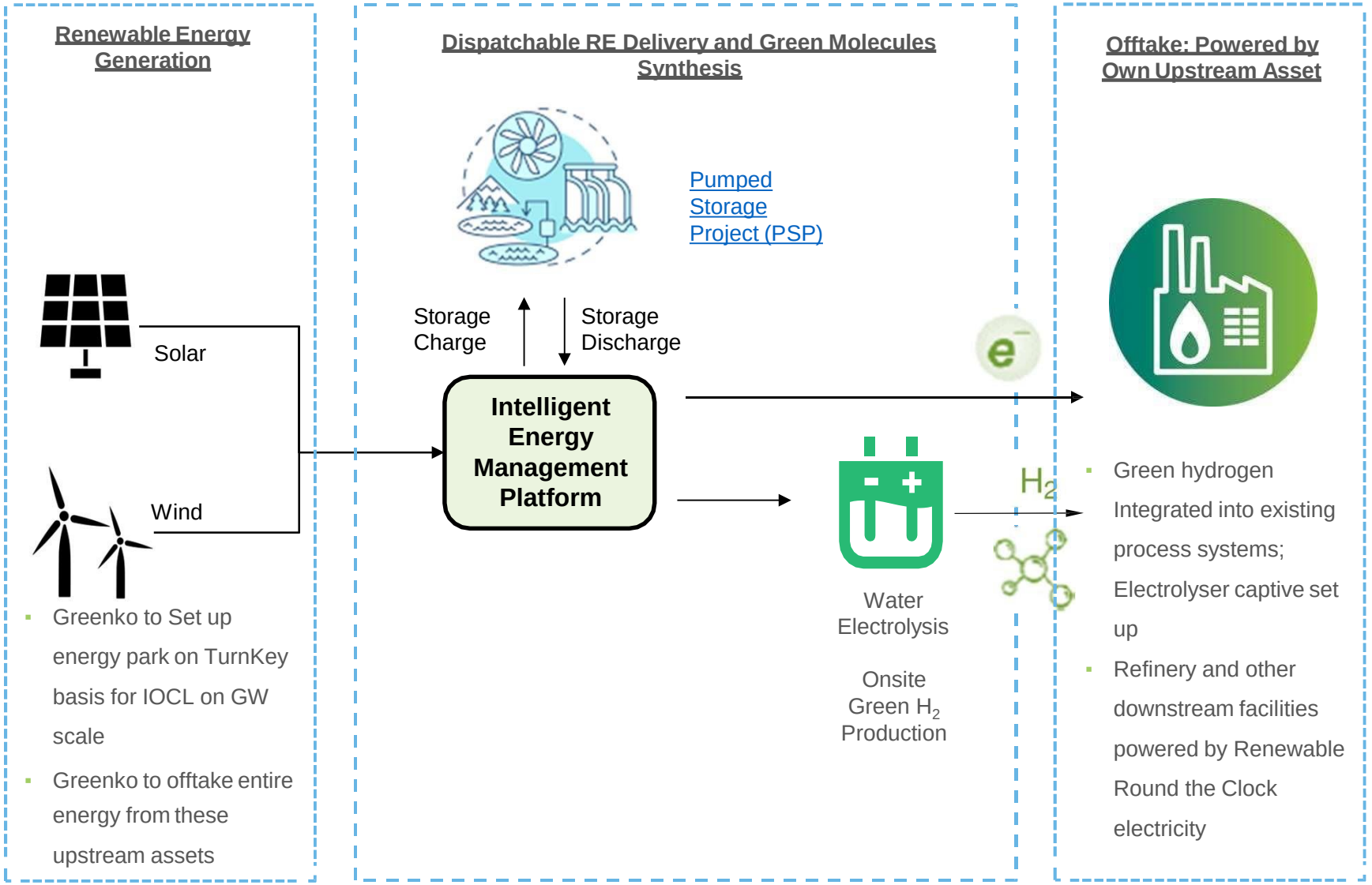
- Like all other refineries, Mathura Refinery Currently produce "Grey Hydrogen" with Natural Gas.
- Being in TTZ area, Mathura Refinery has decided to put-up *India's first* "Green Hydrogen Plant".
- Refinery CO_2 emission is around 3000 MT/day. By shifting from Grey to Green H_2, **~20 % reduction in Carbon footprint** is expected.
- By shifting from Grey to Green Power, **~ 40% reduction in Carbon footprint** is expected.

INNOVATION: Green Hydrogen Project

- Architecture for greening of Mathura Refinery (MR).
  - H_2 storage – Intermittent Renewable Energy (RE)
  - Electricity storage – Round the Clock (RTC) RE
- Electrolysis System
- Electrolyser OEM landscape

INNOVATION: Green Hydrogen Project

Architecture for Greening of Mathura Refinery

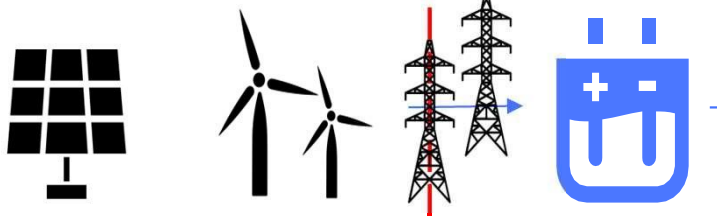


MATHURA REFINERY: PATH TO GREENEST REFINERY IN APAC

Two Energy Architecture Designs for Green H_2

HYDROGEN STORAGE – INTERMITTENT RE

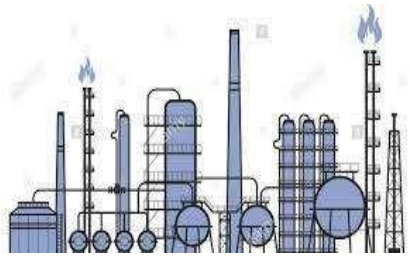
Oversized Grids due to limited Utilization: Implied loaded cost



Intermittent Solar & Wind Generation Assets

Oversized PEM Electrolyzer: Intermittent RE Energy

H_2 Storage

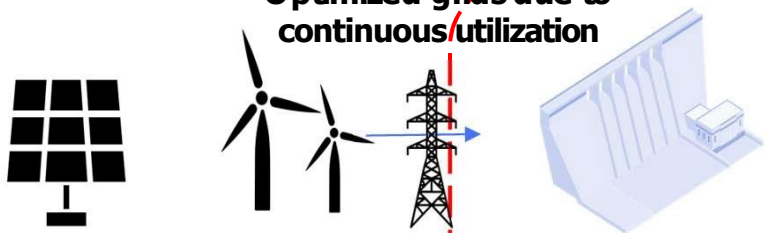


$6-7 / kg

ELECTRICITY STORAGE- RE RTC

Intelligent Energy Management Platform

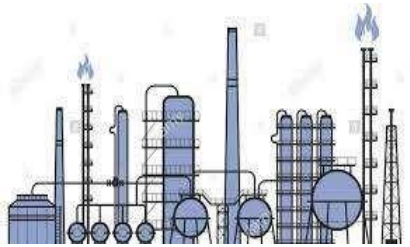
Optimized grids due to continuous utilization



Intermittent Solar & Wind Generation Assets

Pumped Hydro Storage

Optimized Alkaline Electrolyzer: Continuous RE Base Load



Continuous Supply of H2 – Key Process Industry Requirement

$3.5-4 / kg

INNOVATION: Extra Premium Motor Sprit XP 100

- **1st ever MS XP 100 is launched by Mathura Refinery in India.**
- FIAT has technically approved XP100, as the fuel for *first-fill application* for all models of petrol cars and will be the *substitute the imported grade of petrol*, as it meets the standards and requirement of FCA (Fiat Chrysler Automobiles, USA).

Success of XP100 had made our country proud to join elite countries in the world (USA, Germany, Greece, Indonesia, Malaysia, Israel & India).

100 Octane Gasoline gives faster acceleration, significantly boost engine performance, give better drivability, and enhanced fuel economy engine life.

It exceeds IS 2796 specifications. Therefore, addition of XP 100 in product basket of Indian Oil Corporation is a big value addition.

INNOVATION: Extra Premium Motor Sprit XP 100

From Conceptualization to implementation in just 7 days!!!

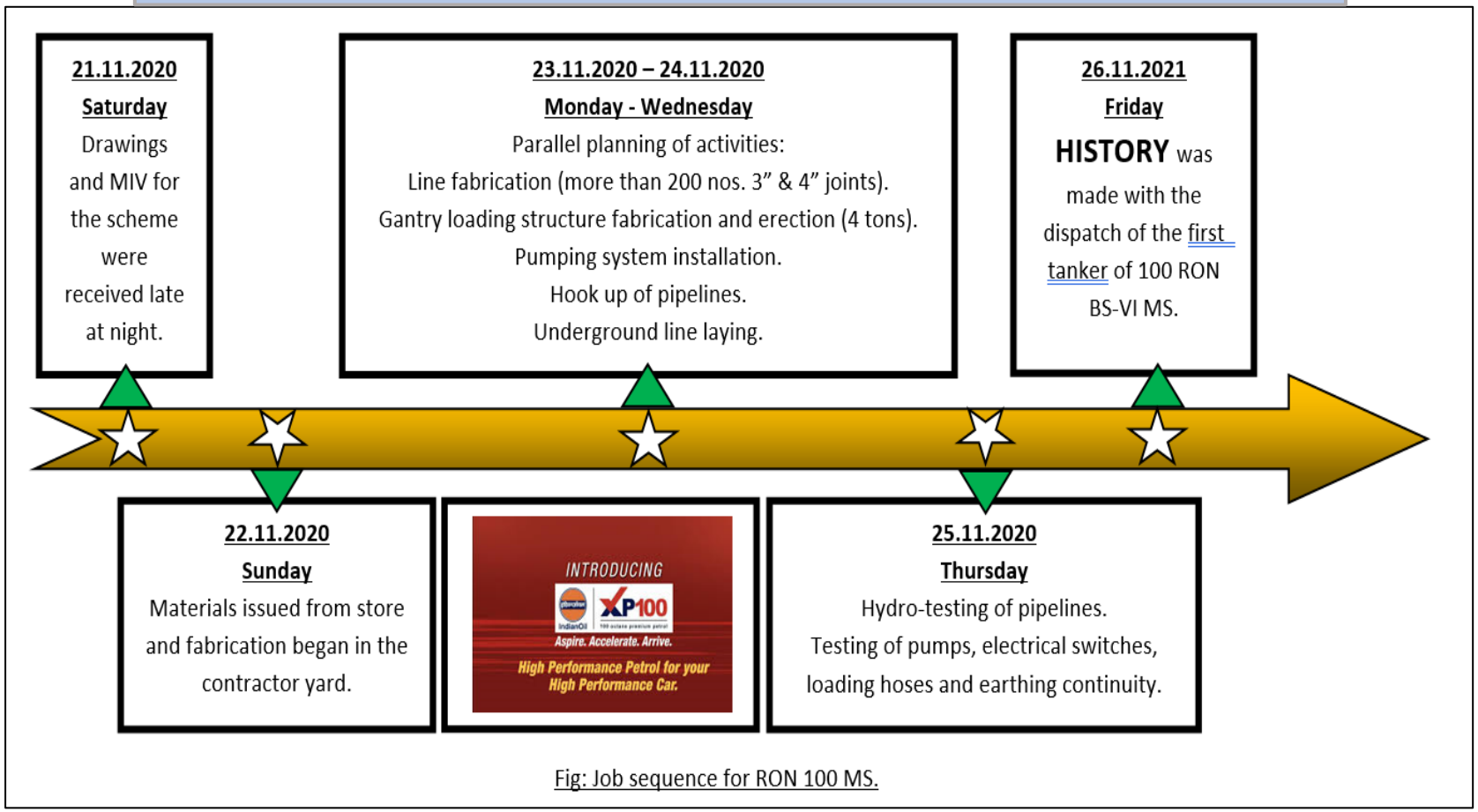


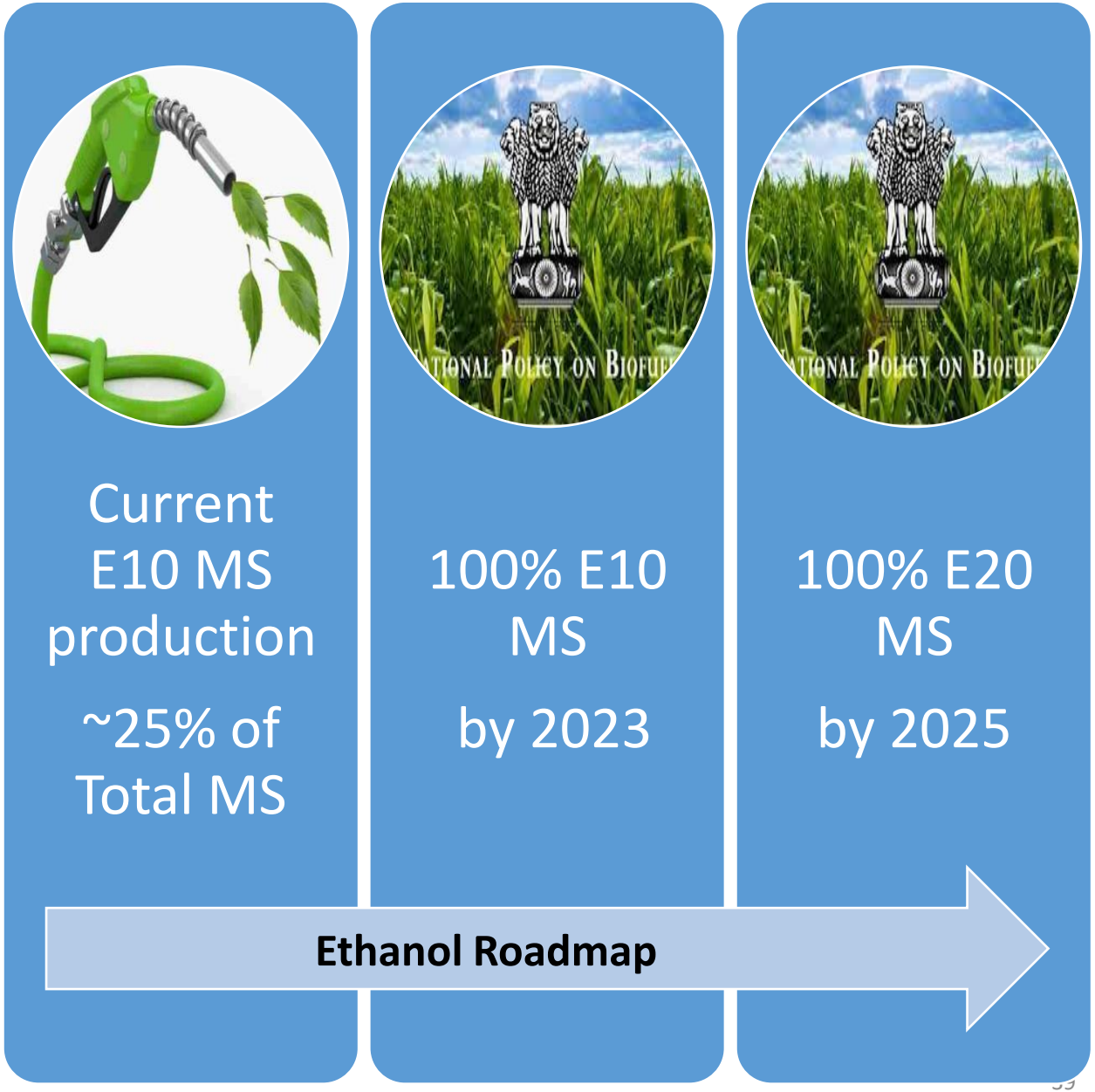
Fig: Job sequence for RON 100 MS.

High-end premium vehicles equipped with the latest technology were facing scarcity of suitable fuel. 100 Octane Motor Gasoline was available only in few countries of world. Innovatively developed XP100 at MR created a niche market for luxury vehicles that demand high performance. Availability of XP100 in India is a big relief and solution to luxury car & bike segment.

INNOVATION: MR Getting Future Ready with EBMS

Use of Ethanol in Motor Spirit:

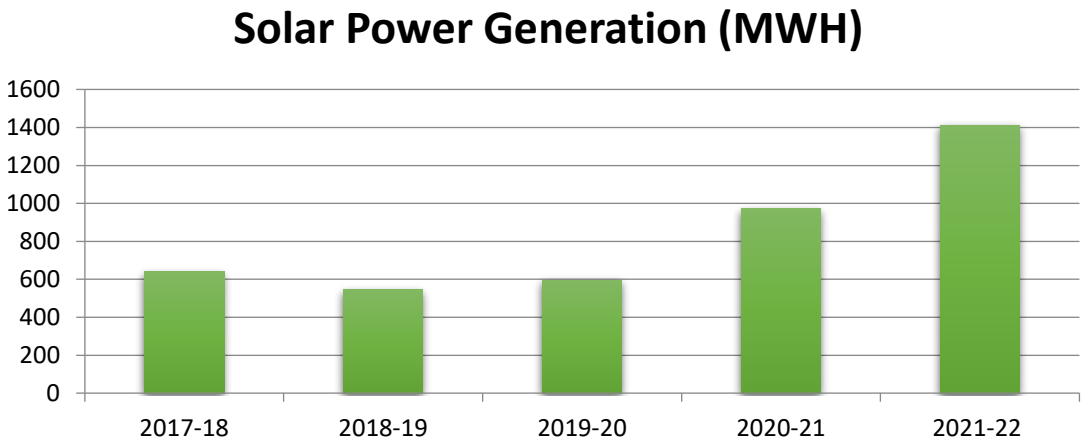
- Mathura Refinery carved a niche by becoming first among Indian Oil refineries to supply Ethanol (10%) Blended Motor Spirit (EBMS)from the refinery itself.
- Since start of supply from Mar'19, it is continuing till date.
- Apart from having environmental benefits, blending of ethanol in MS also has economical benefits due to reduction in import of crude. Cost on crude can be reduced by **$3 billion per year with 10% blending of ethanol.**
- **It also reduce our energy dependency on fossil fuels.**
- **Ethanol production support farmers and create domestic jobs.**
- **It lowers NOx emissions.**



Utilisation of Renewable Energy sources

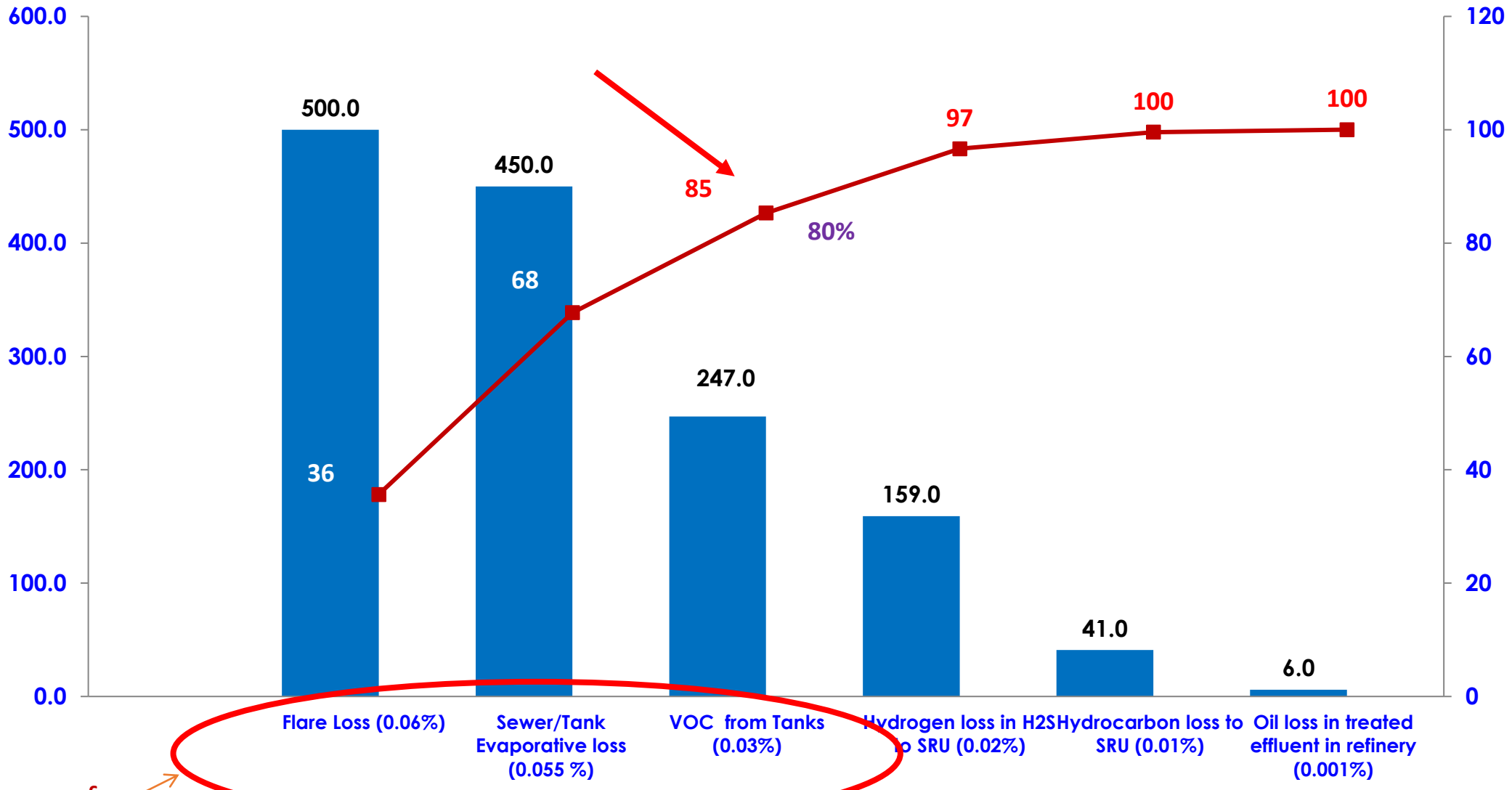
Reduction in Carbon Footprint: Encouraging Renewable Energy Sources

- Mathura Refinery is installing solar PV panels over all roofs inside refinery and community buildings in township.
- This has helped refinery in savings power bills
- Mathura Refinery Solar Power Generation:



Year	MWH (annual)
2017-18	640
2018-19	545
2019-20	595
2020-21	973
2021-22	1412

Hydrocarbon Loss: Pareto Chart



Focus area of improvement

Waste/ Flare gas Loss reduction

Process Units

- **Low Pressure Gases** → MPU rectification
- **Passing PSV, Flare CV & bypass valve** → PSV/CV passing Survey on daily basis by External agency
- **Depressurization of LPG Horton sphere** → Scheme for recovery of LPG
- **Hydrocarbon not recovered in Process** → Flare gas recovery system

Waste Utilisation and Management

Mathura Refinery Care for Nature : Reduction in Water Footprint by Using Treated Sewage Water

Namami Gange Project

(Utilization of sewage water in Refinery)

- Mathura Refinery will be the first refinery to use effluent discharge and sewage water for 100% industrial use
- Refinery will use 20 MLD of treated from sewage treatment plant located at Yamuna river bank in Mathura
- Rehabilitation of STP and laying of the pipeline is in progress. The company will procure water at Rs. 8.70/M^3

A tripartite agreement between UPJN, National Mission for Clean Ganga (NMCG) & IOCL has been signed for reuse of 20 MLD treated water from STP of Laxmi Nagar.

- Mathura Refinery has planted 3,10,689 trees in surrounding areas including township .
- 1,15,000 trees in Agra region around Taj Mahal.

Tree plantation at Mathura Refinery is an on-going activity

GHG Inventorisation

FY	Absolute emission in TMT of CO2 e	Intensity tCO2e/ MT of crude processed
2018-19	1945	0.21
2019-20	1828	0.20
2020-21	1865	0.21
2021-22	1902	0.21

Mathura Refinery has been certified for GHG Emission inventory 2020-21 (**ISO 14064)** by M/s BUREAU VERITAS (INDIA) PRIVATE LIMITED, which specifies **principles and requirements** at the organization level for quantification and reporting of greenhouse gas (GHG) emissions and removals. It includes requirements for the design, development, management, reporting and verification of an organization's GHG inventory.

Scope Included:

1. Direct GHG Emission(Emission from Process unit, TPS, Flaring, Fugitive emission, CH4, LPG, Fire extinguisher, Bioremediation process, Refrigerants, Vehicular Emissions)
2. Indirect GHG Emission(Emission through imported power)

Mathura Refinery Care for Nature by Lowering of Sox Emissions:

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

- Mathura Refinery has revamped two units DHDS & Prime G to produce < 10 ppm sulpher Diesel and MS.

2. Implementation of Oxy-enrichment Technology increase recovery of solid sulfur from Gases

- Sox from refinery gaseous emissions causes acid rain.
- In order to reduce SOx emission from Mathura Refinery even without compromising on refinery crude processing capacity, Mathura Refinery implemented innovative technology of Oxy-enrichment to reduce SOx emissions and increase recovery of solid sulfur from Gases.
- Oxy-enrichment Technology was implemented in Sulfur recovery unit by Mathura Refinery in Feb'19, with assitsance from M/s. Air Liquide

Waste Utilization and Management

FY	Type of waste generated	Quantity of Waste Generated in MT	Disposal Method
2018-19	Oily Sludge	750	Bio-remediation
	Spent Catalyst	Nil	Nil
2019-20	Oily Sludge	59	Bio-remediation
	Spent Catalyst	768.82	Disposed through MSTC/ TSDF agency (CPCB/ SPCB approved)
2020-21	Oily Sludge	679	Bio-remediation
	Spent Catalyst	608.48	Disposed through MSTC/ TSDF agency (CPCB/ SPCB approved)
2021-22	Oily Sludge	845	Bio-remediation
	Spent Catalyst	675.6	Disposed through MSTC/ TSDF agency (CPCB/ SPCB approved)

Awards & Recognitions

MR bagged prestigious awards of

"Best Performing Refinery as per MOU parameters "

&

"Refinery with the least interruptions - **Category I "**

During Annual MoU Awards 2020-21 Ceremony on 11.06.21

Other Innovative technologies implemented

Use of Innovative Drone Technology for Inspection:

- In-service inspection using drone technology has been carried out for the first time in any IndianOil Refinery.
- The specialised drone uses automated flight and GPS system .
- Adopting **“Industry 4.0” technologies** to make inspection functions more intelligent and efficient, **miniature drone** has been used at Mathura Refinery for internal inspection of tall structures.

Awards & Recognitions

Awards	Year
Mathura Refinery has been recognized as "**Excellent Energy Efficient Unit**" for its Energy performance during the year FY'20-21 by the Confederation of Indian Industry (CII).	2021-22
MR won prestigious "**Excellent Energy Efficient Unit Award**" from Confederation of Indian Industries (CII) during 21st National Award for Excellence in Energy Management 2020.	2020-21
"Safety Innovation Award 2019" by The Institution of Engineers, Delhi State Centre for outstanding efforts and performance in the field of Safety on 17th Sept. 2019	2019-20
Mathura Refinery has bagged the prestigious **CII EXIM BANK – BUSINESS EXCELLENCE AWARD in the Gold plus** category as recognition of business excellence.	2019-20
"**Safety Innovation Award 2018**" by The Institution of Engineers, Delhi State Centre (DSC) for outstanding efforts and performance in the field of Safety	2018-19
"Excellence in People Management under Emerging Leader Award Category" from Confederation of Indian Industry (CII)	2018-19
"**Best CSR Initiative by a PSU Award**" at India Concord Summit & Awards 2018	2018-19
For the 2nd consecutive year MR bagged Director (Refineries) Trophy for Best Performance in Refinery Operations for FY 2018-19	2018-19
'Shri AV Ogale' safety award (Gold category) for highest standards in Fire prevention & Safety for FY 2018-19	2018-19

Awards & Recognitions

Awards	Year
Mathura Refinery nominated two group Kaizens which were successfully implemented in the Refinery for 39th CII National Kai-Zen Competition 18-19 February 2021: Virtual CISCO Webex Platform organized by CII TPM club of India. Both the KAIZEN entries from Mathura Refinery got awarded as following :	2020-21

S.N.	Kaizen Theme	Category	CII Award
1	Leveraging Industry 4.0 IiOT (Internet of Things) for monitoring and mitigation of Crude column overhead corrosion.	Innovative Kaizen	Platinum Award
2	De-bottlenecking in MSQU-NHTU capacity utilization from 65 m3/hr to design T'Put 80 m3/hr under LSRN case.	Breakthrough Level Kaizen	Gold Award

Confederation of Indian Industry

TPM

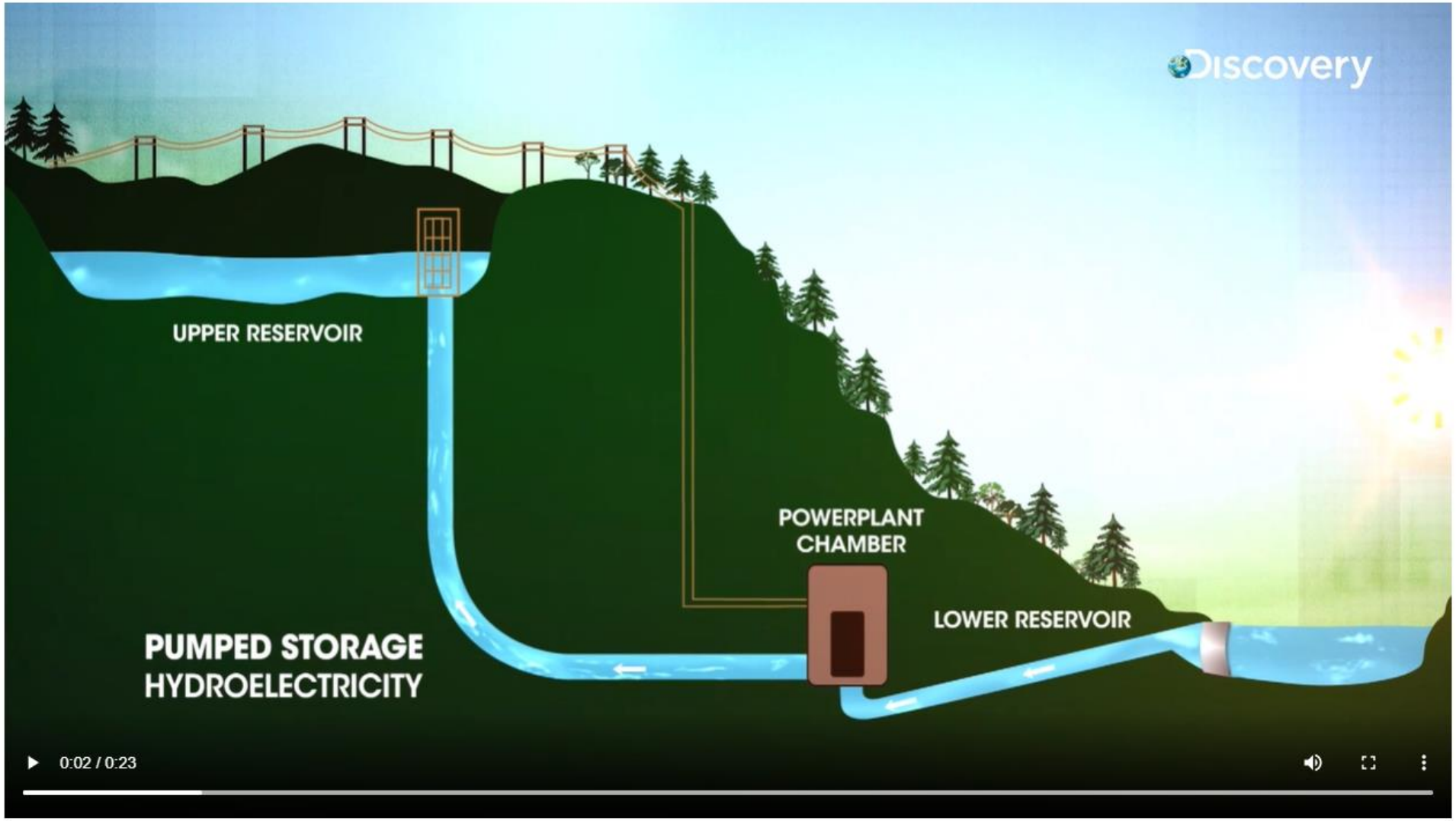
INSTITUTE of QUALITY

Winners: 39th CII National Kaizen Competition, 18-19 February 2021

Gold Award	Restorative Category	Renovative Category	Innovative Category	Breakthrough Category
Gold Winner	Marico Ltd, Pondicherry	Rane TRW steering systems private limited, Siruganur	Piramal Pharma Limited_ Breakdown Elimination	Mathura Refinery, Indian Oil Corporation
Gold Winner	Mankind Pharma Limited ,Unit	MRF Ltd, Arkonam	Tata Hitachi Dharwad	The Tata Power Company Limited,


THANK
YOU

PUMPED STORAGE PLANT (PSP)



https://www.greenkogroup.com/iresp.php