CII **25th** **National Award for Excellence in Energy Management 2024** **SEIL**
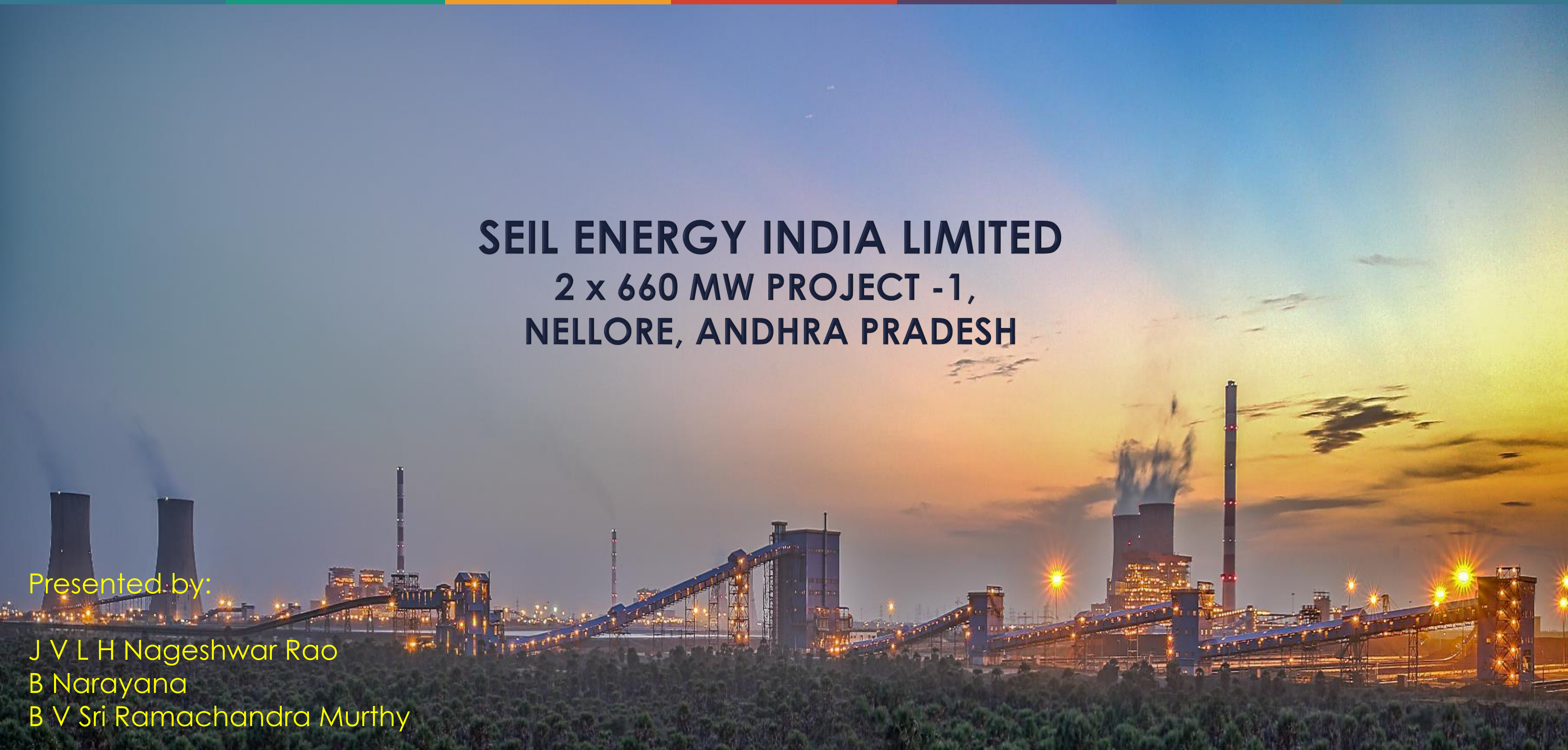
SEIL ENERGY INDIA LIMITED
2 x 660 MW PROJECT -1,
NELLORE, ANDHRA PRADESH

Presented by:

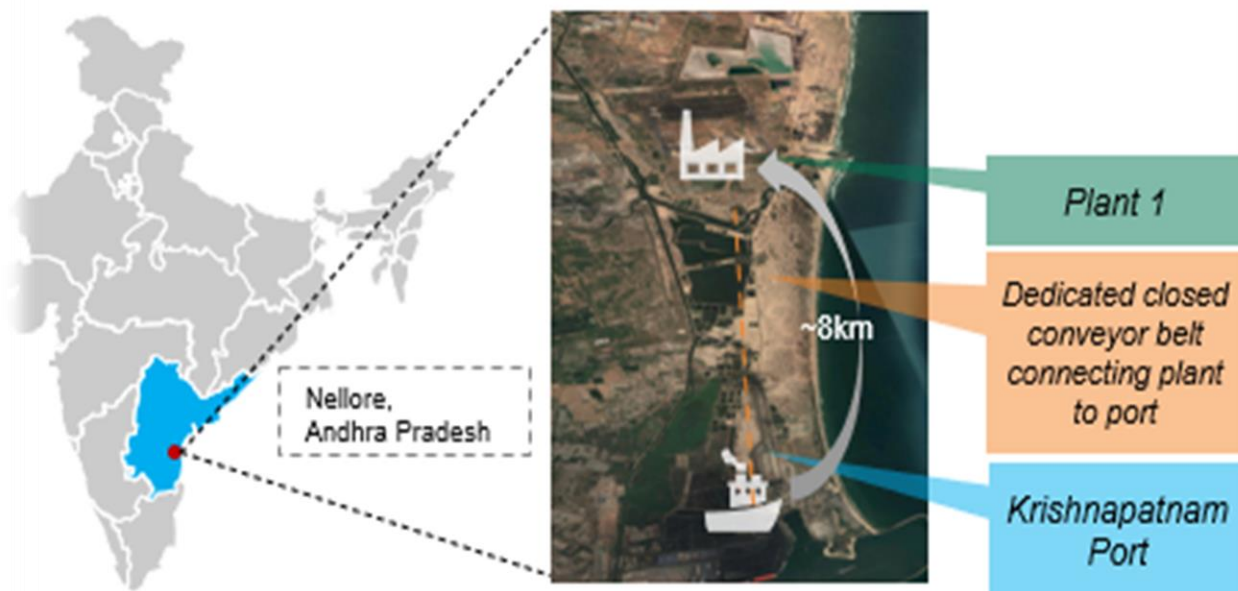J V L H Nageshwar Rao
B Narayana
B V Sri Ramachandra Murthy

25th National Award for Excellence in Energy Management 2024

SEIL

INDEX

OVERVIEW-SEIL at a Glance

Nellore, Andhra Pradesh

Plant 1

Dedicated closed conveyor belt connecting plant to port

~8km

Krishnapatnam Port

CERTIFICATONS
✔ ISO-9001,ISO-14001,ISO-18001 ✔ IMS 45001 ✔ NABL ✔ 5S

👁 VISION

- ▪ **SEIL's purpose and passion are to play a pivotal role in building a sustainable tomorrow.**
- ▪ **Our vision is to be a leading provider of reliable and sustainable energy solutions, supporting India and the sub-continent in their development, and creating value for our stakeholders and communities.**

✈ VALUES

- ▪ **Our Core values: Institution first, Collaboration, and Accountability.**
- ▪ **Our values are translated into day-to-day action and practical behavior through our policies and frameworks, creating a common culture founded on these values within SEIL**

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Plant Introduction & highlights

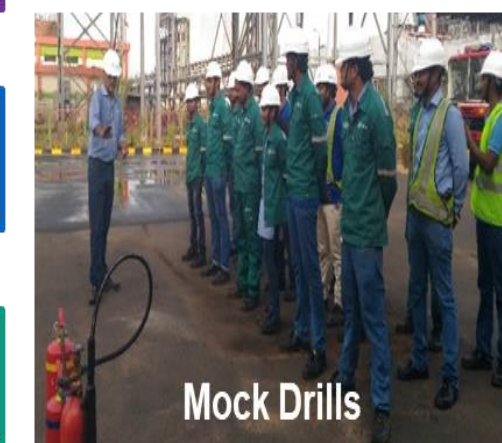|	
Location	▪ Painapuram and Nelaturu villages in Nellore, Andhra Pradesh
COD	▪ Unit 1: March 2015 & Unit 2: September 2015
Land	▪ Located on 1,408 acres of land
Equipment details	▪ BTG OEM: Dongfang Electric Corporation ("DEC") ▪ Boiler: Flow: 2105 TPH, MS Pr: 25.5 MPa, MS Temp: 570 Deg C, HRH Temp: 603 Deg.C. Opposed wall firing; Design Efficiency: 86.5% ▪ Turbine: Supercritical, Single-intermediate RH, dual back pr., condensing steam and with eight-stage regeneration; Design Gross Heat Rate: 2138 kCal/kWh ▪ Generator: Rated output: 660 MW (776.5 MVA) ▪ BOP supplier: BGR Energy Systems; Pipe Conveyor, GIS, Piped Seawater intake
Power evacuation	▪ Dedicated 400kV double circuit transmission line owned by PGCIL ▪ Long and short-term open access to Inter-State Transmission System ("ISTS")
Offtake	▪ 500MW PPA with Andhra Pradesh and Telangana ▪ 570MW PPA with Telangana (till March 2024)
Fuel supply	▪ 20-year FSA with Mahanadi Coalfields Ltd ("MCL") ▪ Imported coal from Indonesia, South Africa and Australia
Other	▪ Received the 'Mega Power Project' status from the MoP, GoI

Low emission transportation of fuel

Pipe conveyor from port to plant

Gas Insulated Sub-station

Sea water based RO

Energy consumption overview FY 2023-24

Description	Units	Value
Annual Generation	MU	9522.79
PLF	%	82.13
Availability	%	88.88
Gross Station Heat Rate	kCal/kWh	2224
APC	%	5.14
Boiler Efficiency	%	85.68
Turbine Heat Rate	kCal/kWh	1904
DM Make Up	%	0.57
Raw Water (Sea water)	m3/MWh	6.67
Sp. Oil Consumption	ml/kWh	0.12

Framework for Sustainable performance

Identifying training needs and fulfilling

SOPs & SMPs

Performing Mock Drills

Competency

Simulator Training

Inter Plant Technical Audits

Plant Emergency Response Plans

Job Rotation & Knowledge Transfer platforms

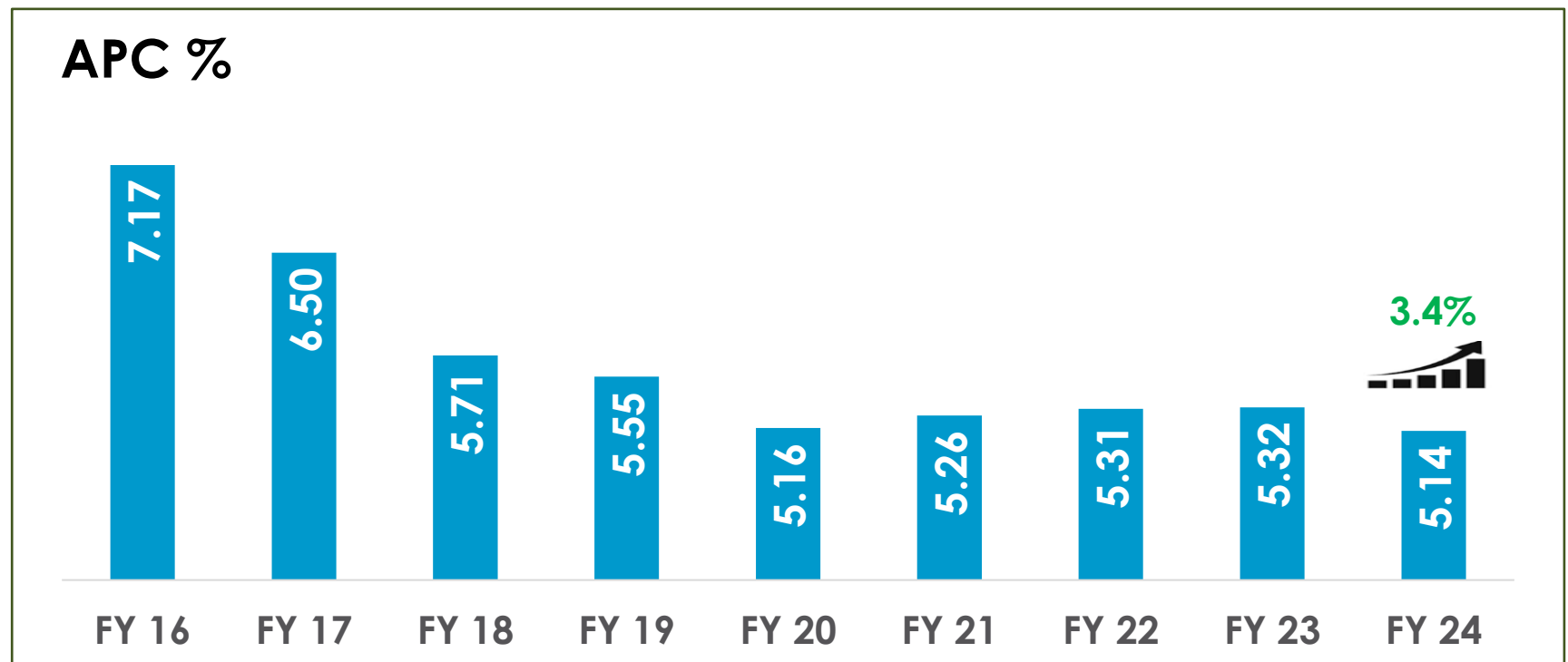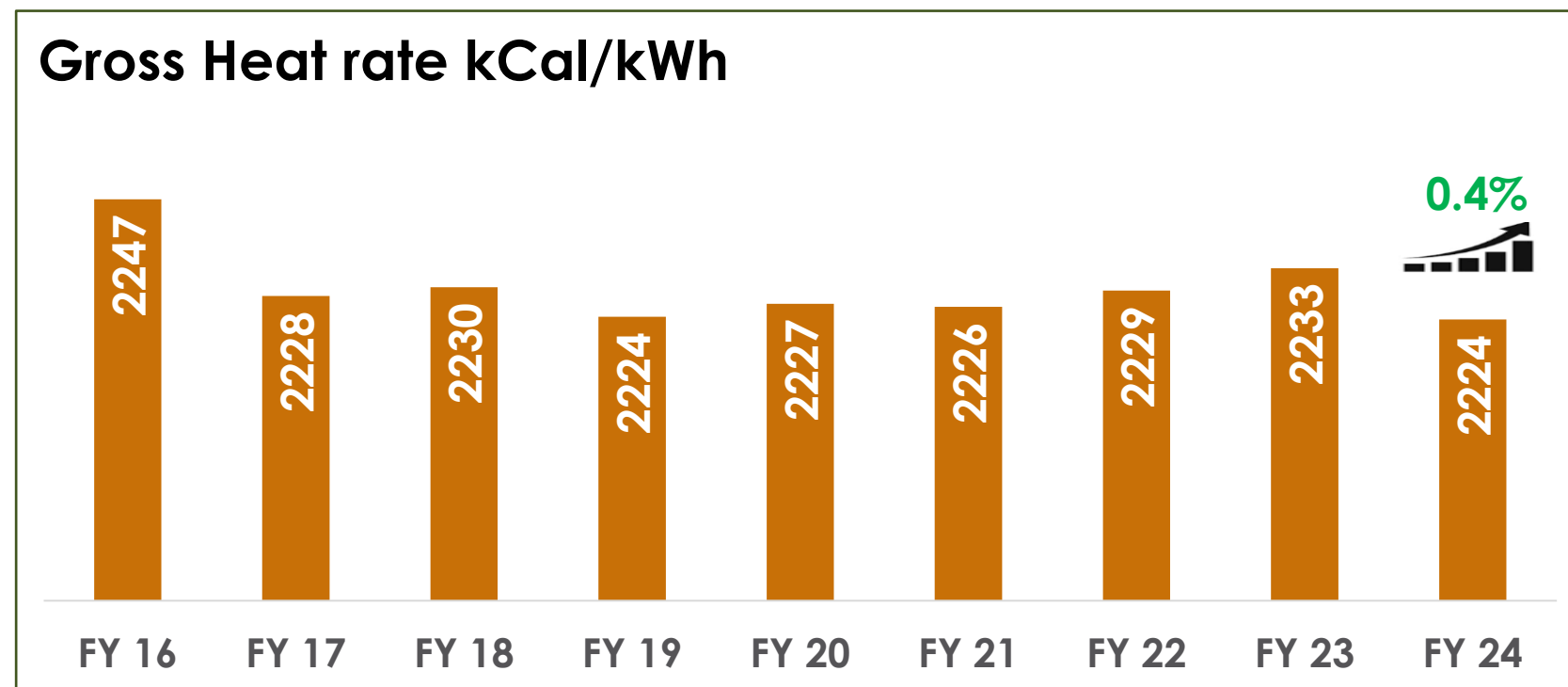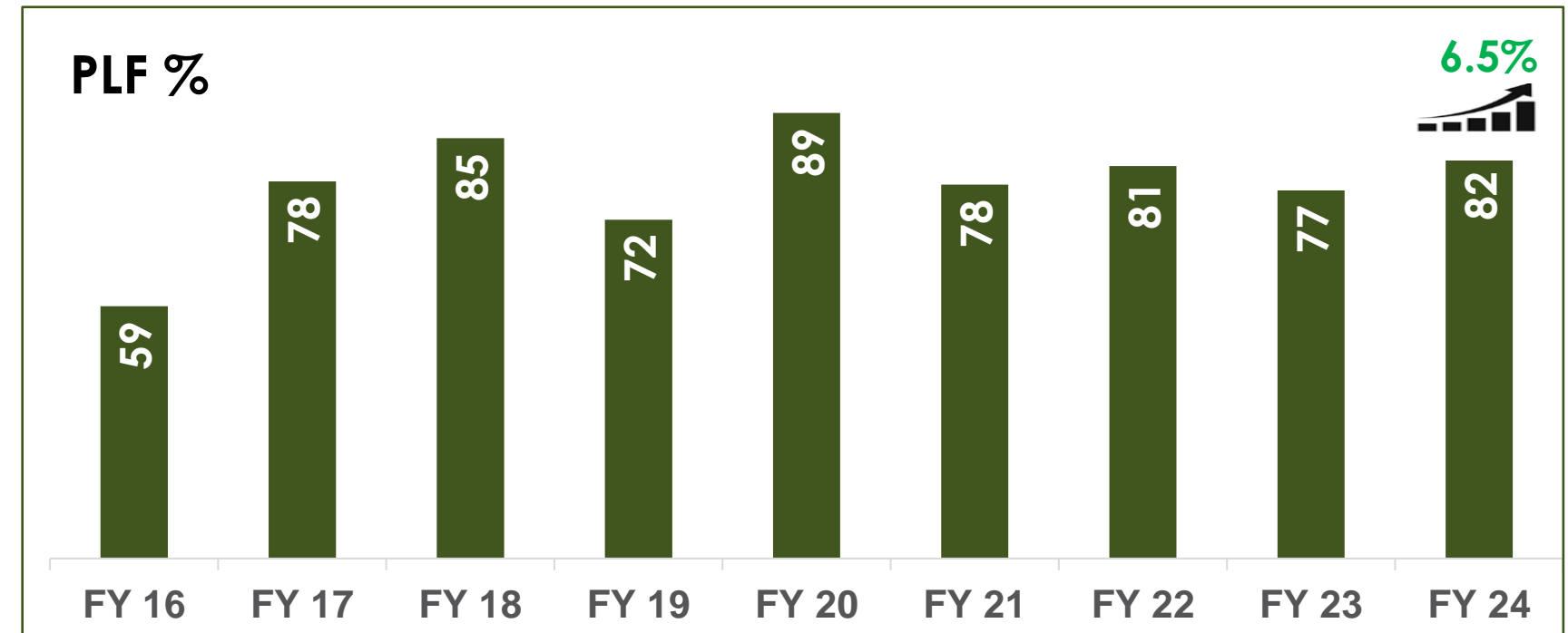SEIL Training Center

Simulator Training Sessions

Mock Drills

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Specific Energy consumption overview

PAF %

FY 16	FY 17	FY 18	FY 19	FY 20	FY 21	FY 22	FY 23	FY 24
81	85	94	78	97	84	91	91	89

COH

PLF %

6.5%

FY 16	FY 17	FY 18	FY 19	FY 20	FY 21	FY 22	FY 23	FY 24
59	78	85	72	89	78	81	77	82

Gross Heat rate kCal/kWh

0.4%

FY 16	FY 17	FY 18	FY 19	FY 20	FY 21	FY 22	FY 23	FY 24
2247	2228	2230	2224	2227	2226	2229	2233	2224

APC %

3.4%

FY 16	FY 17	FY 18	FY 19	FY 20	FY 21	FY 22	FY 23	FY 24
7.17	6.50	5.71	5.55	5.16	5.26	5.31	5.32	5.14

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Internal Benchmarking

PAF %

	FY 21-22	FY 22-23	FY 23-24
Target	93.8	93.8	90.4
PAF %	91.2	91.1	88.9

PLF %

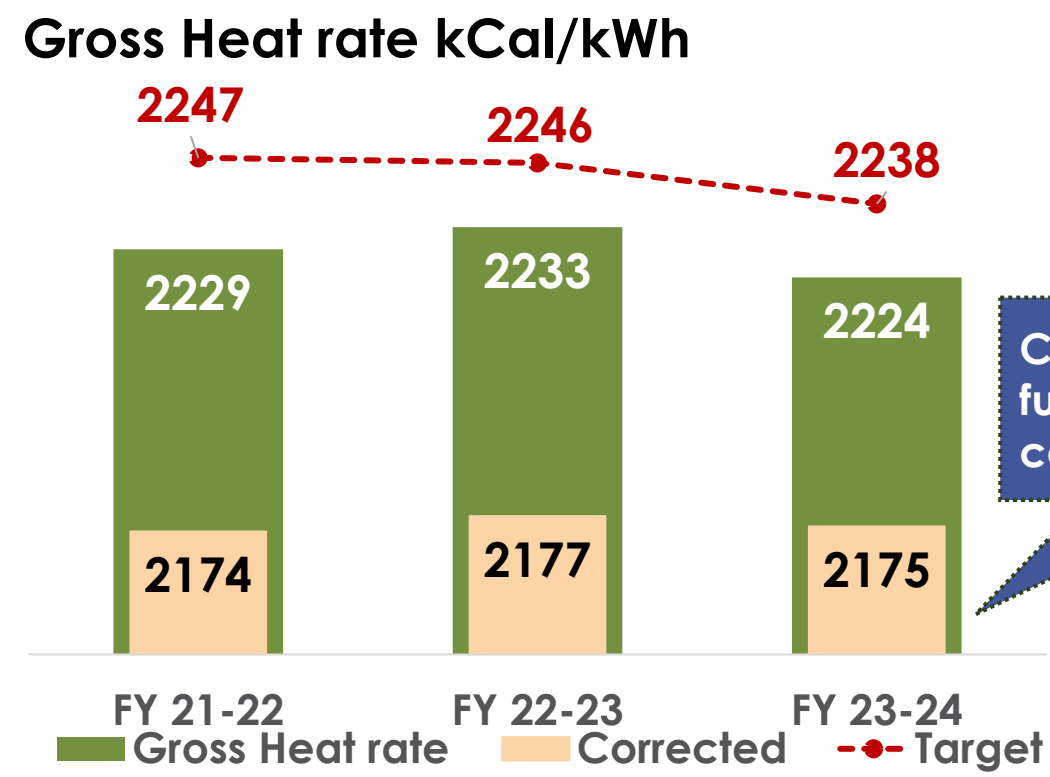|	FY 21-22	FY 22-23	FY 23-24
Target	84	83	79
PLF %	80.7	76.9	82.1

SOC ml/kWh

	FY 21-22	FY 22-23	FY 23-24
Target	0.18	0.18	0.15
SOC ml/kWh	0.09	0.08	0.12

Gross Heat rate kCal/kWh

	FY 21-22	FY 22-23	FY 23-24
Target	2247	2246	2238
Gross Heat rate	2229	2233	2224
Corrected	2174	2177	2175

> Corrected to Design fuel & PLF as per OEM correction curves

APC %

	FY 21-22	FY 22-23	FY 23-24
Target	5.39	5.33	5.31
APC %	5.31	5.32	5.14

Energy conservation Planned for FY 2024-25

Unit-2 Air Pre Heaters baskets & Seals replacement	
Savings (Mn kWh)	6.31
Investment (Mn INR)	58
Unit-2 Turbine steam path audit & Seal gap correction ,Grit blasting	
Savings (Mn kCal)	24062
Investment (Mn INR)	15
Unit-2 NDCT Fills & Nozzles replacement	
Savings (Mn kCal)	18048
Investment (Mn INR)	50
Thermal pads installation for high energy drains online monitoring	
Savings (Mn kCal)	4762
Investment (Mn INR)	3

External Benchmarking

SHR- kCal/kWh

SEIL	Sasan	PPGCL	JNSTPP	OPGC
2224	2250	2222	2183	2168

PLF %

SEIL	Sasan	PPGCL	JNSTPP	OPGC
82.1	85.8	72.0	69.5	77.0

PAT CYCLE-III NHR-kCal/kWh

Base	Target	Achieved
2406	2396	2360
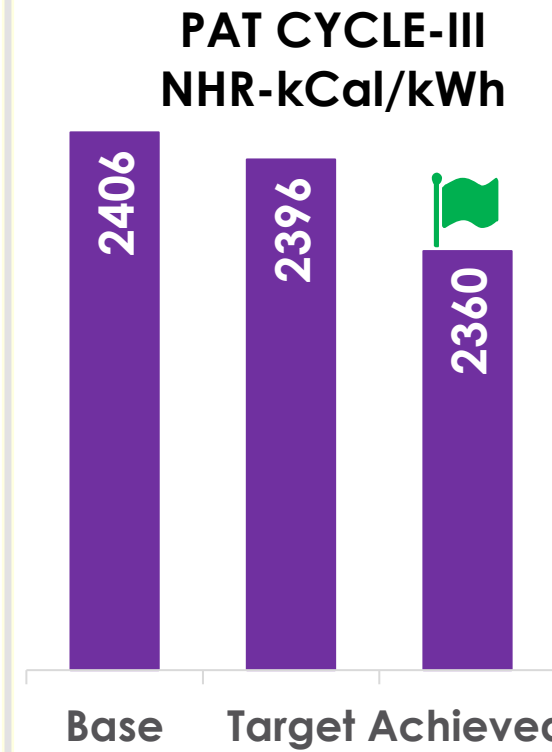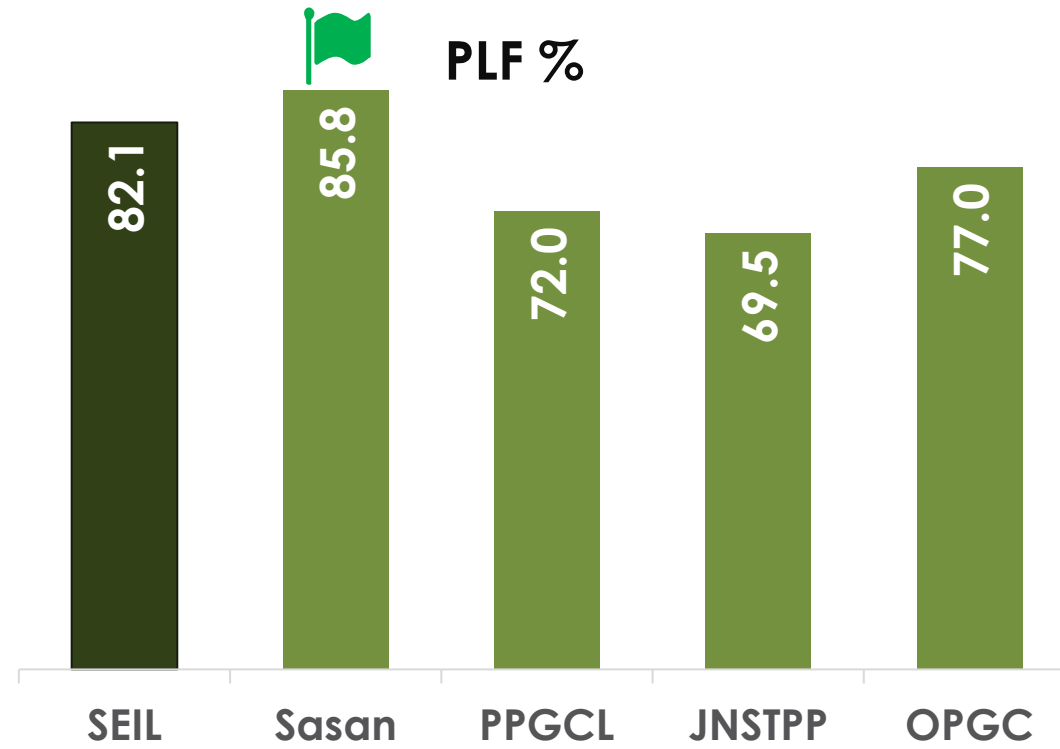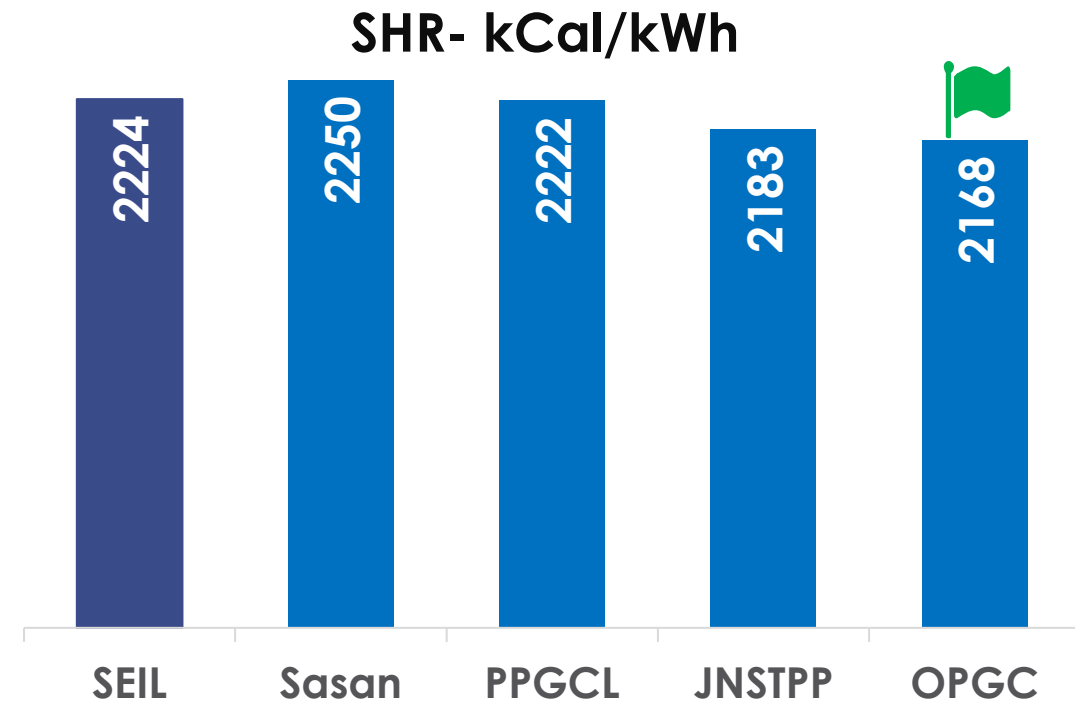
Highlights

- Successfully completed PAT Cycle-III and running under PAT Cycle-VII
- Station net heat rate achieved 2360 against targeted 2396 kCal/kWh (i.e., 36 kCal/kWh less)
- 22289 ESCerts received.

APC %

SEIL	Sasan	PPGCL	JNSTPP	OPGC
5.14	6.0	5.75	5.41	5.63

SOC ml/kWh

SEIL	Sasan	PPGCL	JNSTPP	OPGC
0.12	0.10	0.15	0.31	0.15

Roadmap for becoming World class

- Dedicated Asset performance Excellence cell's efforts for sustainable and continual improvement towards enhanced Performance
- Embracing technology and exploring better alternatives for improved APC and Heat Rate
- Adopting best practices and learnings of industry
- Working in collaboration with Educational institutes and subject matter Experts

*Benchmark source data from CII -2023 award's Presentations

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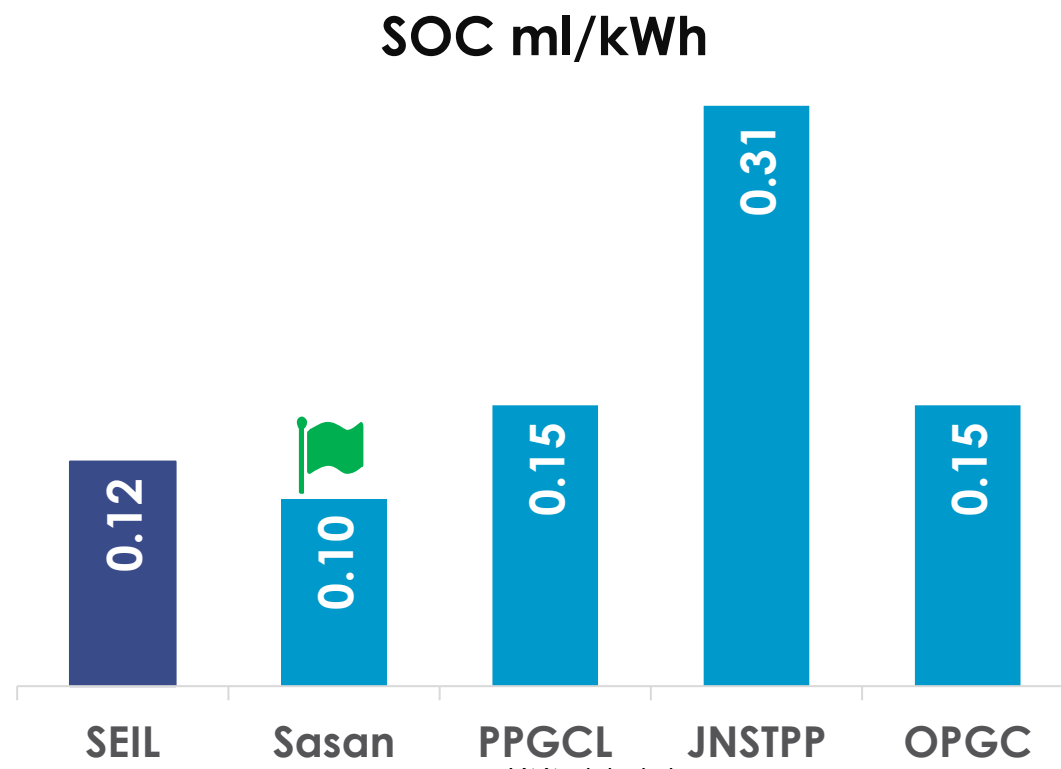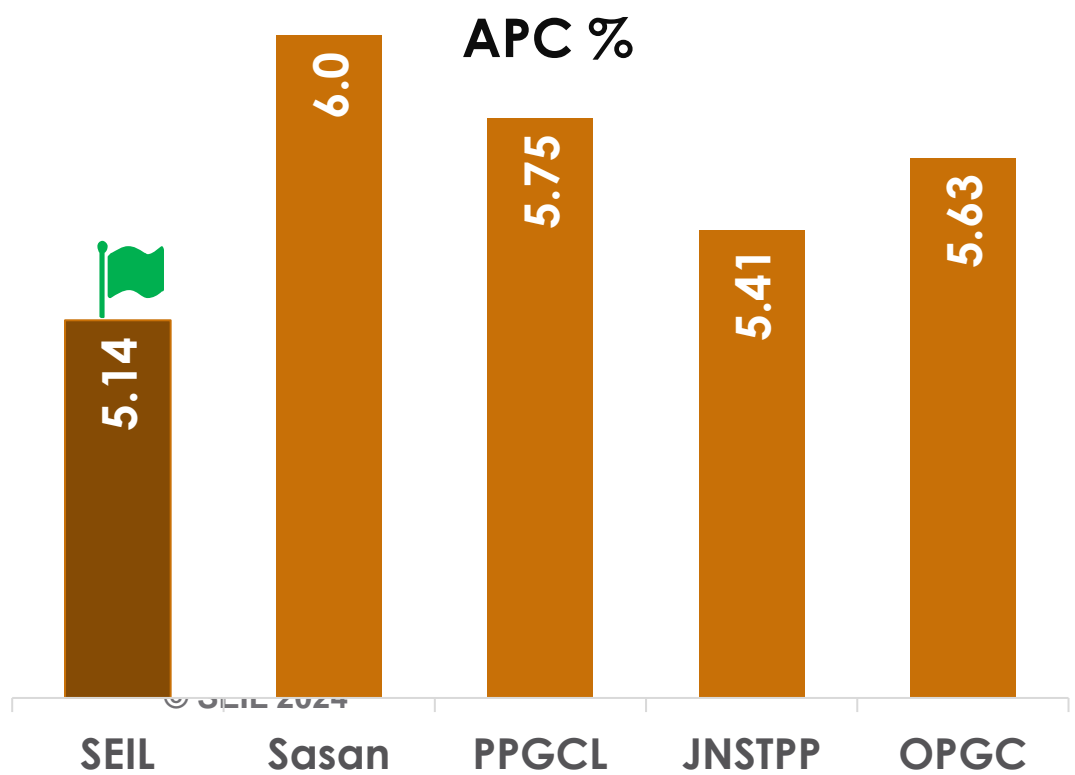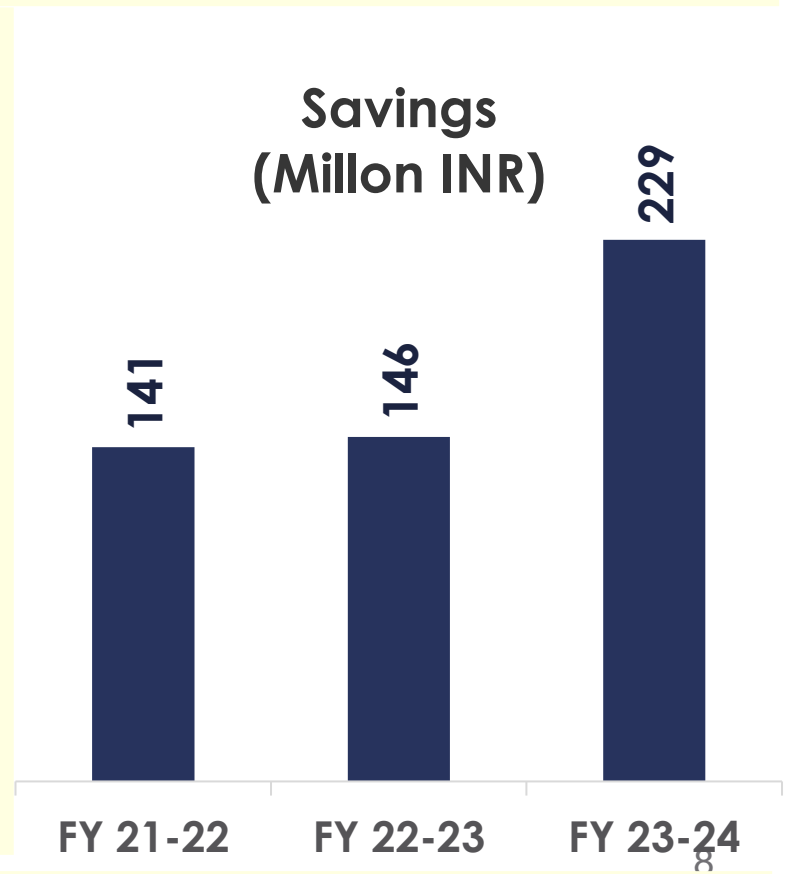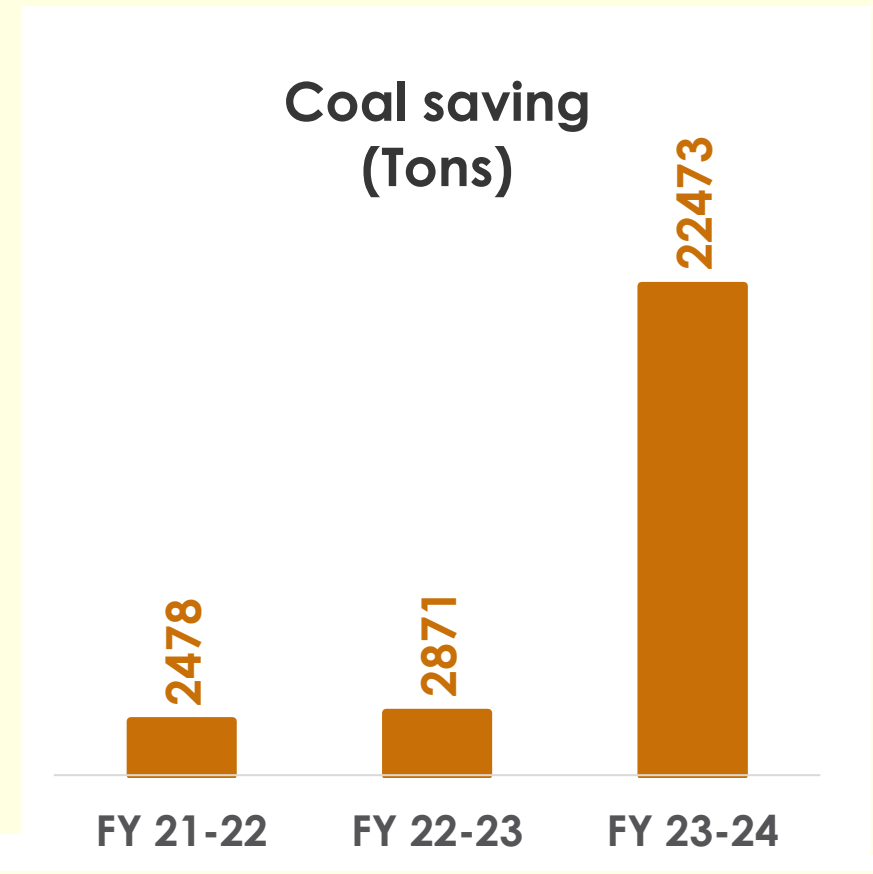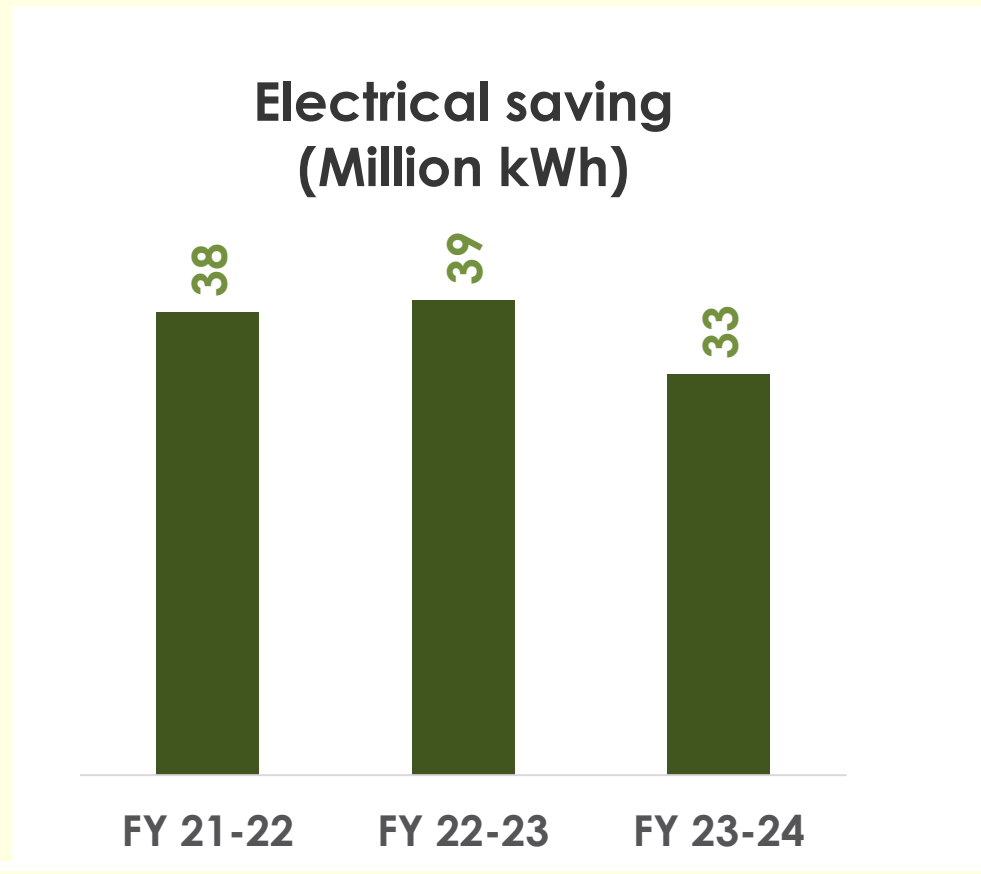
Summary of Energy Savings Projects

Year	No of Energy saving projects	Investment (INR Million)	Electrical savings (Million kWh)	Thermal savings (Million Kcal)	Total Savings (INR Million)
FY 2021-22	5	16.20	38.26	9141.32	141.26
FY 2022-23	5	28.98	39.24	10190.55	145.57
FY 2023-24	7	195.73	33.13	80589.34	228.95

Investment made (INR Million)

FY 21-22	FY 22-23	FY 23-24
16	29	196

Electrical saving (Million kWh)

FY 21-22	FY 22-23	FY 23-24
38	39	33

Coal saving (Tons)

FY 21-22	FY 22-23	FY 23-24
2478	2871	22473

Savings (Millon INR)

FY 21-22	FY 22-23	FY 23-24
141	146	229

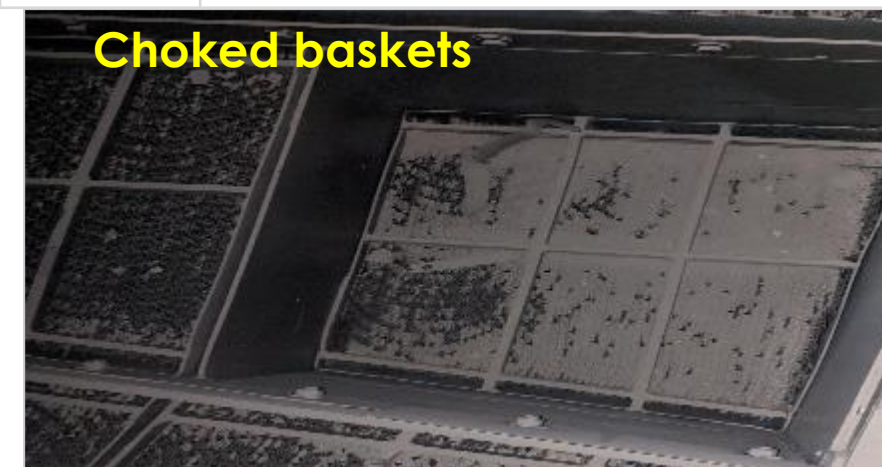# 25th National Award for Excellence in Energy Management 2024
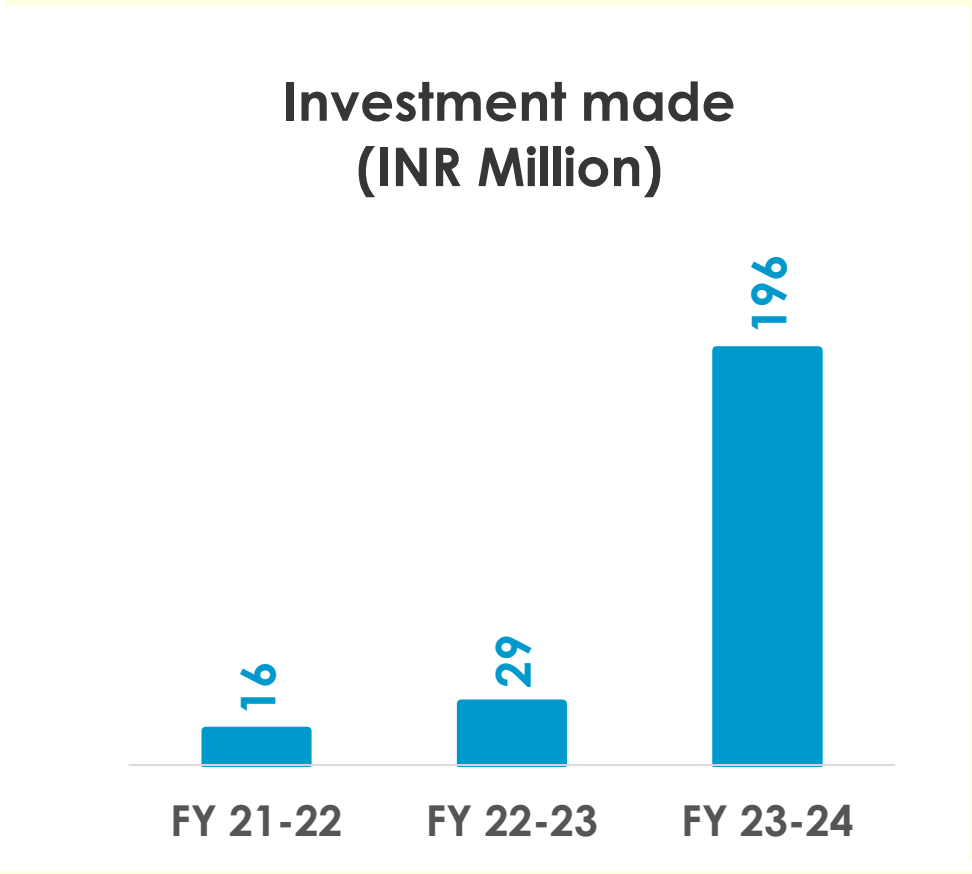
Major Energy conservation Projects FY 2021-2022

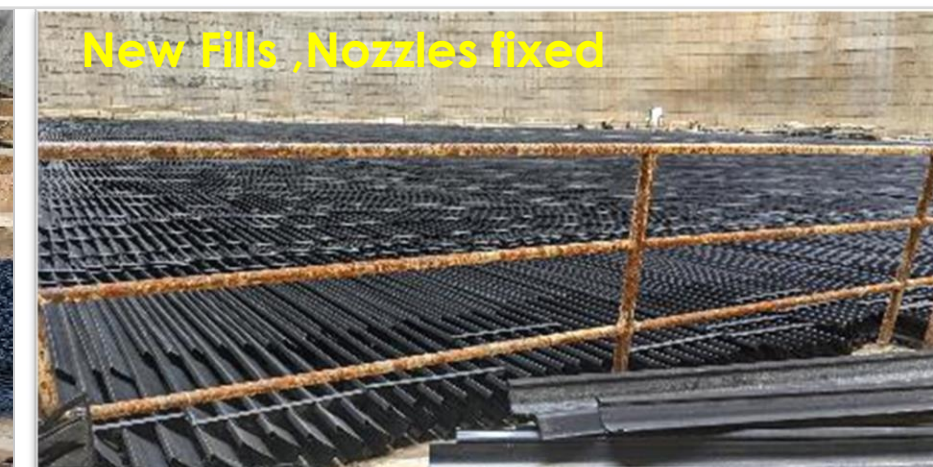| Sl.No	Name of Energy saving projects	Investments (INR Mn)	Electrical savings (Mn kWh)	Thermal savings (Mn kCal)	Total Savings (INR Mn)	Remarks
1	Air Pre Heater (APH) baskets – Replacement during AOH for DP & Fan power reduction	4.25	13.57	-	45.73	APH DP and Fan(s) Power consumption reduced by 0.8 kPa and 1720 KW respectively in Unit 1
2	Replacing conventional lighting fixtures with LED fixtures	6.19	0.29		0.98	18% of conventional fixture replaced with LED fixture.
3	Optimization of CW pumps operation under favorable ambient / process conditions	-	23.48	-	79.13	Fourth CW pump stopped for 6210 Hrs and an annual average power saving is 2680 KW
4	Augmenting NDCT fills area for enhancing spray quality and performance	5.75	-	9141.32	12.32	Condenser vacuum improved by 0.3 kpa & Heat Rate by 2 kcal/kwh
5	CW blowdown through CW discharge without affecting condenser vacuum for seasonal benefits.	-	0.92	-	3.1	Power saving of 210 KW

Choked baskets

New baskets

Fills Replacement

New Fills ,Nozzles fixed

Major Energy conservation Projects FY 2022-2023

Sl.No	Name of Energy saving projects	Investments (INR Mn)	Electrical savings (Mn kWh)	Thermal savings (Mn kCal)	Total Savings (INR Mn)	Remarks
1	Air Pre Heater (APH) baskets – Replaced during AOH for DP & Fan power reduction.	17.36	10.51	-	35.41	DP reduced by 0.6 kPa and Fans power reduced by 1358 KW in Unit 2
2	Replacement of conventional lighting fixtures with LED fixtures	7.17	0.62	-	2.08	24.6% of conventional fixture replaced with LED fixture.
3	Optimization of CW pumps operation under favorable ambient / process conditions	-	27.20	-	91.65	Fourth CW pump stopped for 7451 Hrs and annual average power saving is 3100 KW
4	U2 NDCT replacement of fills & drift eliminators	4.45	-	10190.55	13.33	Condenser vacuum improved by 0.3 kpa and Heat Rate by 2.4 kcal/kwh
5	CW blowdown through CW discharge without affecting condenser vacuum for seasonal benefits.	-	0.92	-	3.1	Net saving is 210 KW

Choked baskets

New baskets

Fills Replacement

New Fills ,Nozzles fixed

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Major Energy conservation Projects FY 2023-2024

Sl.No	Name of Energy saving projects	Investments (INR Mn)	Electrical savings (Mn kWh)	Thermal savings (Mn kCal)	Total Savings (INR Mn)	Remarks
1	Unit-1 Air Pre Heater-1A/1B clogged heating elements & damaged seals replaced with new during COH	82.5	8.99	34255.42	78.54	Fan(s) power consumption reduced by 1208 KW. Boiler efficiency improved by 0.3%
2	Unit-1 Turbine steam path auditing, seals rectifications during COH	14.5		20842.97	27.6	Accounted THR improvement of 4 kcal/kwh.
3	Unit-1 Coal burners diffusers upgradation for better combustion.	48.53		3605.83	4.77	CO formation loss reduced by 0.03% (0.8 kcal/kwh of GHR improvement).
4	Unit-1 NDCT replacement of fills & drift eliminators	50.2		21885.12	28.98	THR improvement by 4.2 kcal/kwh on condenser vacuum improvement.
5	Optimizing operation of AHP conveying air compressor's dryers by monitoring the ash conveying efficiency		1.12		4.12	Power saving of 85 KW per unit for ~6 hrs per shift operation
6	Optimization of CW pumps operation under favorable ambient / process conditions		22.10		81.55	Annual average power saving is 2523 KW
7	CW blowdown through CW discharge without affecting condenser vacuum		0.92		3.39	Net saving is 210 KW

HIP Rotor after grit blast

HPT Interstage Seal measurements

Experts Inspection

Burner Replacement

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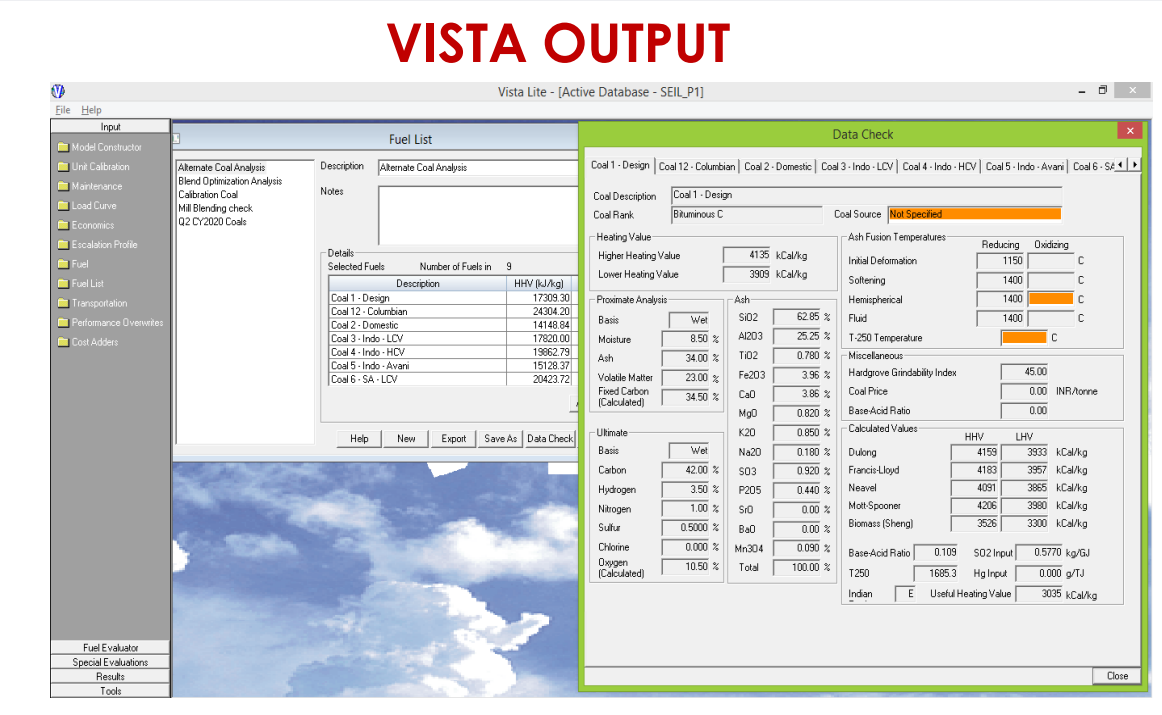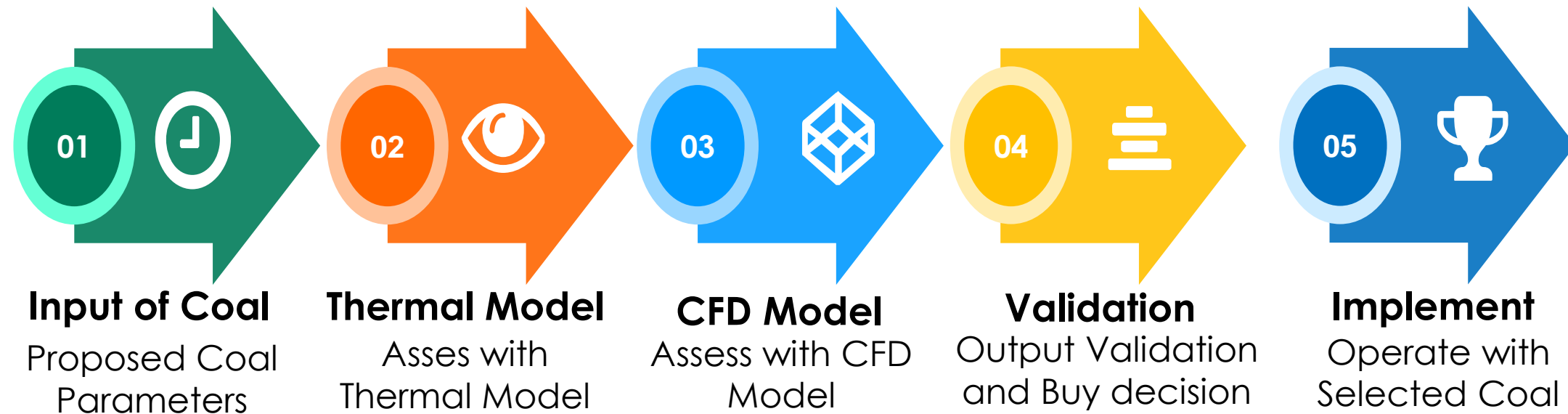
CII | **SEIL**

Innovative Project – Thermal Model for Fuel Sourcing (EPRI VISTA + Boiler CFD Model) *"Replicability-Yes"*
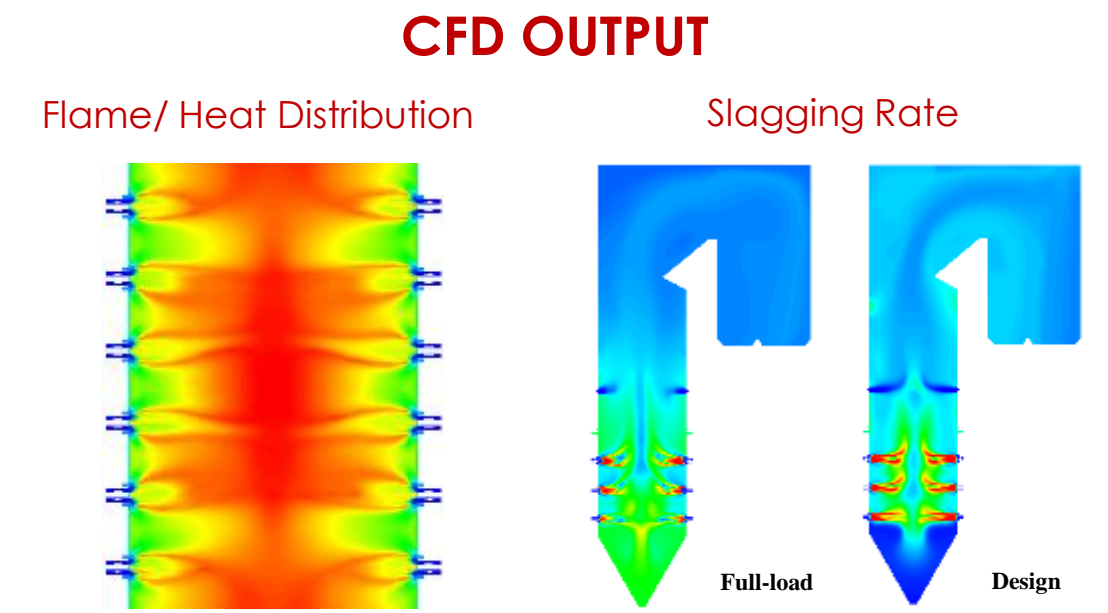
Project Trigger: To increase the Coal Sourcing Horizon

EPRI VISTA is developed by Black and Veatch (B&V) + CFD model (developed inhouse with the collaboration of Research Scholars from National University of Singapore).

EVALUATION METHODOLOGY

01 — Input of Coal
Proposed Coal Parameters

02 — Thermal Model
Asses with Thermal Model

03 — CFD Model
Assess with CFD Model

04 — Validation
Output Validation and Buy decision

05 — Implement
Operate with Selected Coal

✓**Thermal Model (VISTA):** Assess Full load Capability, Water, Steam and Gas parameters, Slagging, fouling & Erosion potential, Boiler & Auxiliaries availability and Fuel Economics

✓**CFD Model:** Provides insights on Flame/ Heat distribution various zones of boiler, Identify potential hotspots, Locate zones prone to Slagging and Erosion, Slagging rate, Erosion Rate. Process parameters input from Thermal model.

✓ **Outcome:** Suggestion on right blend and firing elevations, Estimating required Airflow and distribution, Overall economics, Sensitivity Analysis to confirm the impact

Model results are validated against the operating parameters and tuning of the model, if needed

VISTA OUTPUT

CFD OUTPUT

Flame/ Heat Distribution

Slagging Rate

Full-load | Design

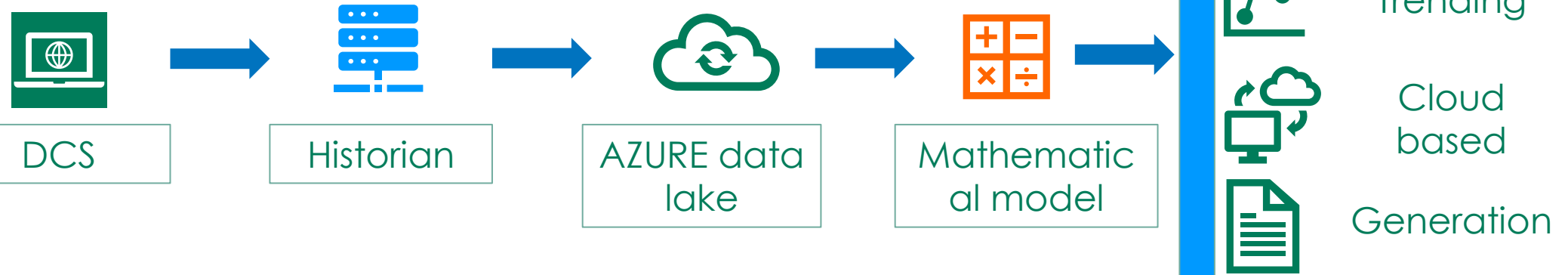# 25th National Award for Excellence in Energy Management 2024

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Innovative Project – Smart Performance Assessment of Realtime KPI (SPARK) – Developed inhouse "Replicability-Yes"

"What cannot be Observed cannot be Measured ; What cannot be Measured cannot be Monitored; What cannot be Monitored cannot be Controlled; What cannot be Controlled cannot be Achieved"

Project Trigger: Performance monitoring tool for maintaining the plant efficiency during full load and part load operations.

Inhouse developed cloud-based tool, **SPARK** to monitor key parameters and support desk operators to keep them under design operating limits, time to time, thereby ensuring system efficient operations. It reduces GHG emissions and improve profitability.
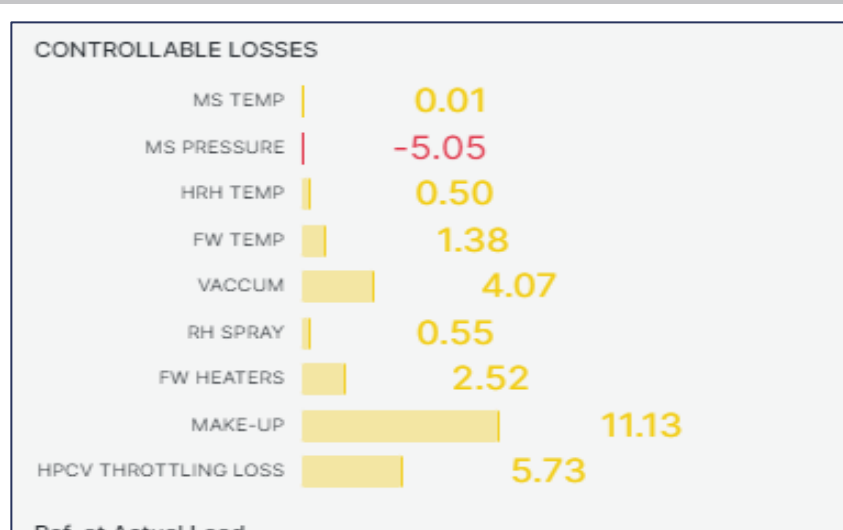
SPARK ARCHITECTURE

DCS → Historian → AZURE data lake → Mathematical model

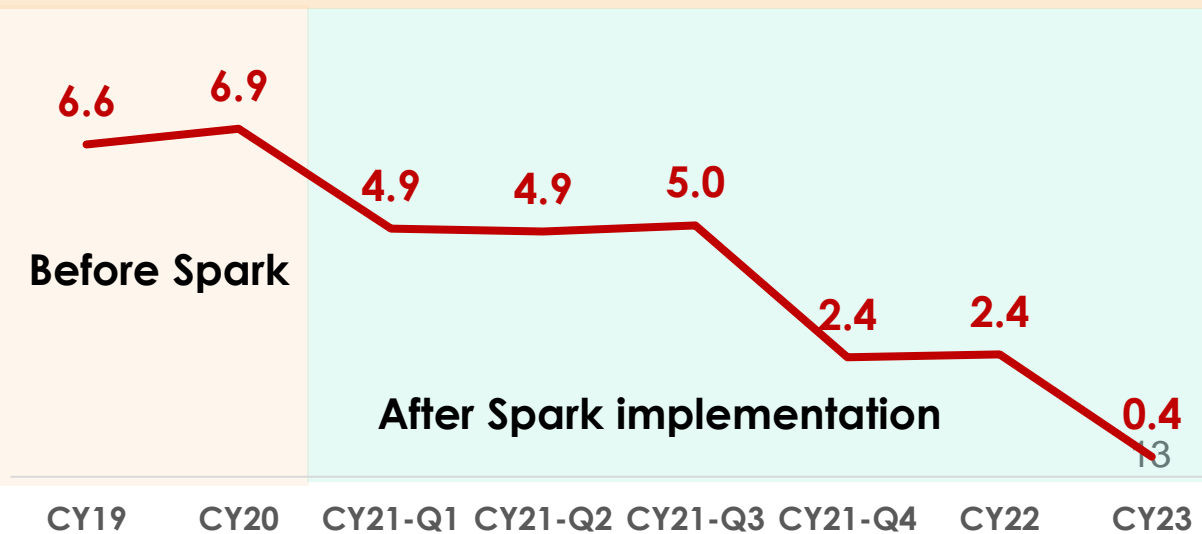- Data Visualization
- Trending
- Cloud based
- Generation

FEATURES

- ✓ Robust mathematical model for real time KPI calculations
- ✓ Trending capabilities for KPIs and parameters
- ✓ Dashboards for KPI and parameters
- ✓ Automatic report generation for user defined periodicity
- ✓ Cross correlation between KPI and Critical parameters
- ✓ Dynamic Gap Analysis

TYPICAL DASHBOARD KPI's : Gross & Turbine heat rate   Boiler Efficiency   APH Performance

UNIT 2

GENERATION	594.60	COAL FLOW	368.09	WEIGHTED GCV (kcal/kg)	3476.19
GROSS HEAT RATE	2275.30	BOILER EFFICIENCY	84.22	THR (Actual)	1916.13

Turbine Heat Rate & Power

CONTROLLABLE LOSSES

MS TEMP	0.01
MS PRESSURE	–5.05
HRH TEMP	0.50
FW TEMP	1.38
VACCUM	4.07
RH SPRAY	0.55
FW HEATERS	2.52
MAKE-UP	11.13
HPCV THROTTLING LOSS	5.73

Reduction in controllable loss (kCal/kWh)

Before Spark

6.6 — 6.9 (CY19, CY20)
4.9 (CY21-Q1)
4.9 (CY21-Q2)
5.0 (CY21-Q3)
2.4 (CY21-Q4)
2.4 (CY22)
0.4 (CY23)

After Spark implementation

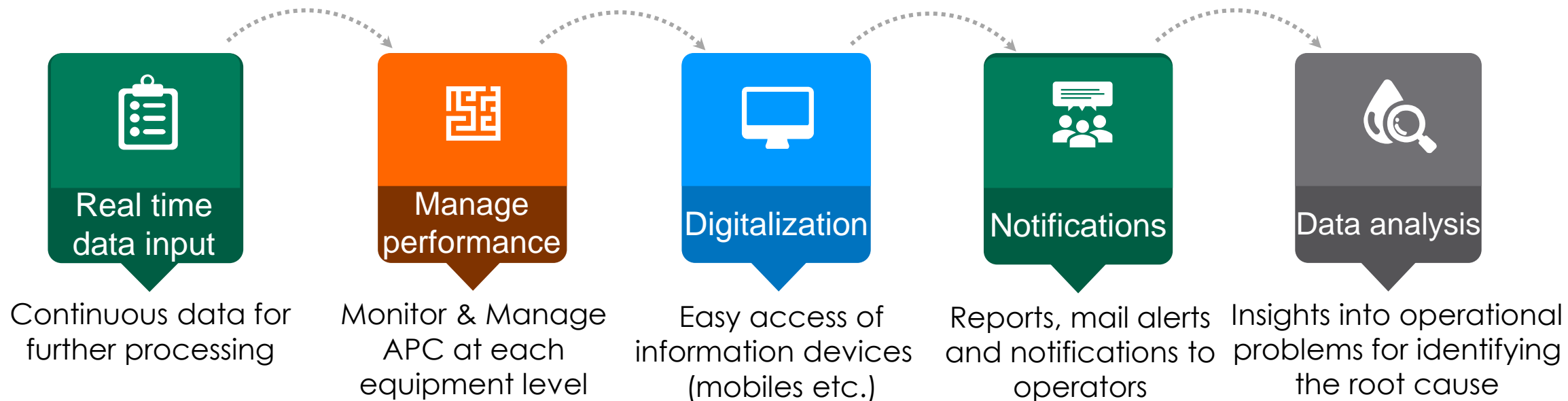| CY19 | CY20 | CY21-Q1 | CY21-Q2 | CY21-Q3 | CY21-Q4 | CY22 | CY23 |

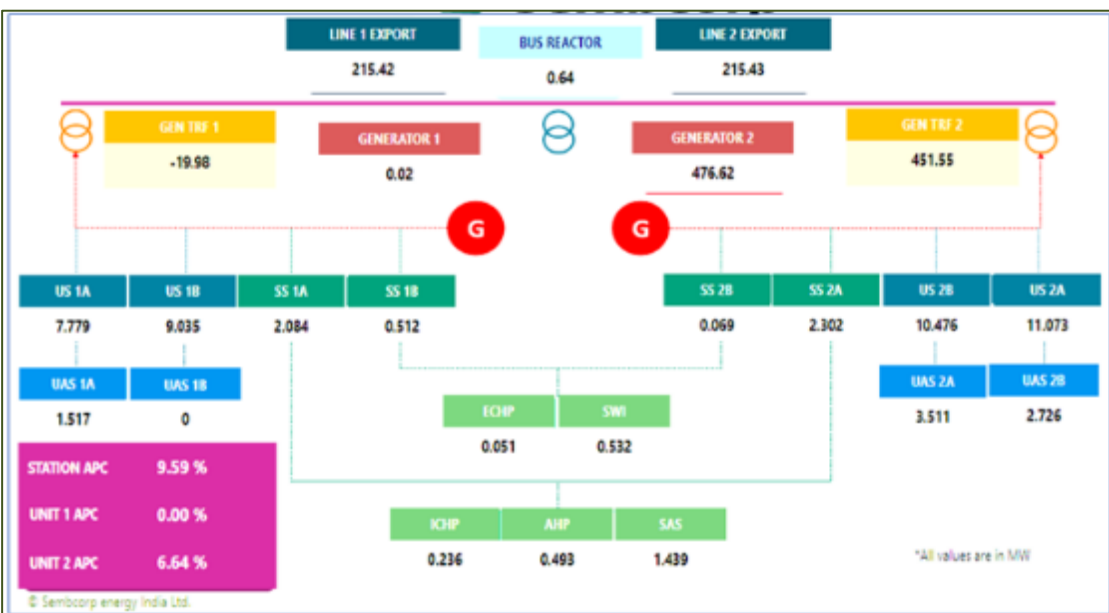## Innovative Project – Energy Management System "Replicability-Yes"

Project Trigger: To achieve the optimum auxiliary power consumption (APC), monitor at each board level on real time basis.

Energy management system is equipped with features like dynamic target Dashboards, drill-down & detail views, Station, Unit level dashboards, Deviation Settlement Mechanism (DSM), Equipment / system level specific power consumption screens.

Dynamic targets are introduced to help operator in optimizing auxiliaries power consumption at all unit load conditions.

Real time data input	Manage performance	Digitalization	Notifications	Data analysis
Continuous data for further processing	Monitor & Manage APC at each equipment level	Easy access of information devices (mobiles etc.)	Reports, mail alerts and notifications to operators	Insights into operational problems for identifying the root cause

Board level Dashboard

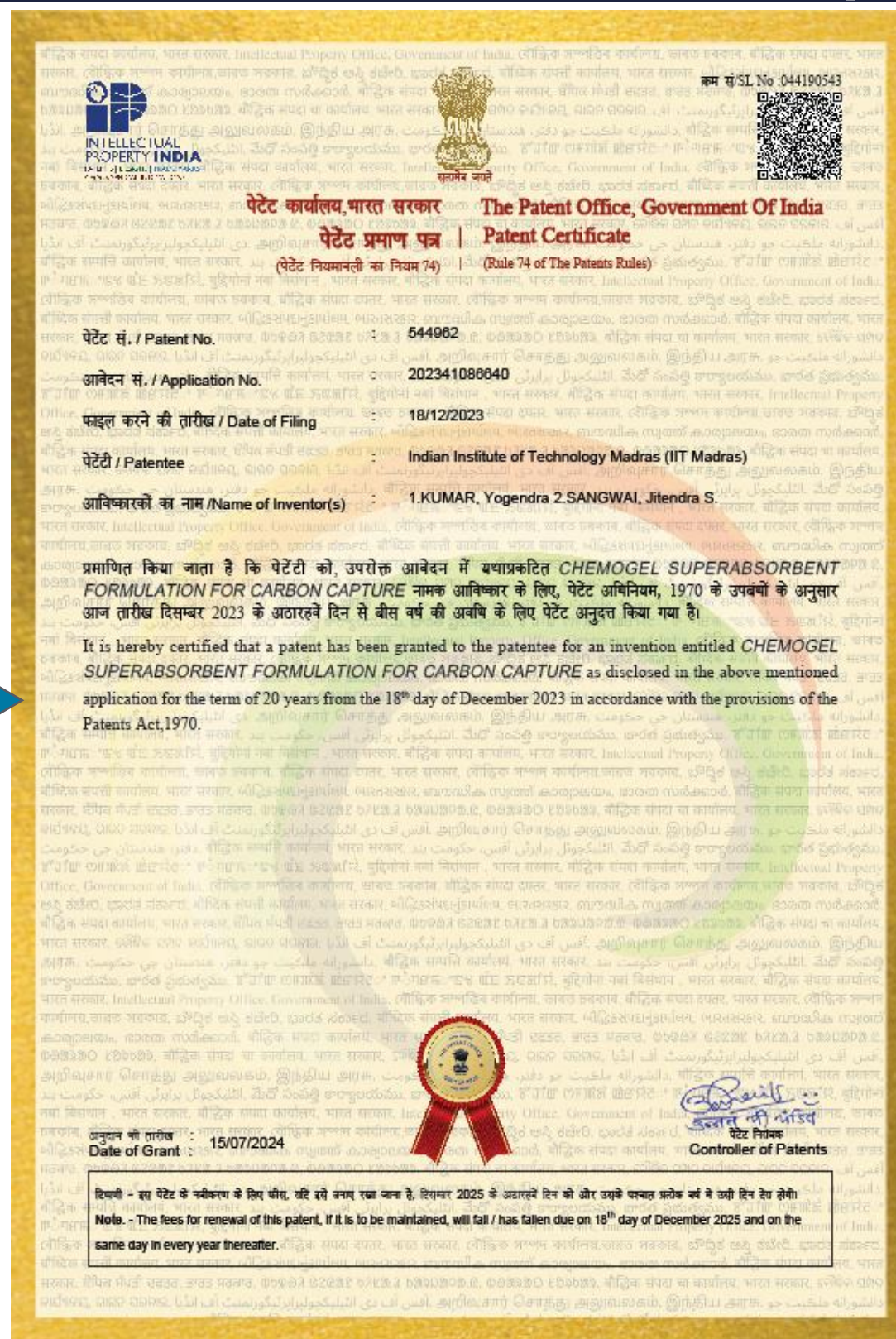**DSM Dashboard**

Equipment Dashboard

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Innovative Project – Development of Novel Solvent for CO2 Capture (Collaboration with IITM under CSR)

Project Trigger: Promoting Excellence in CO2 Capture Research

- SEIL CSR initiative at IIT Madras, supporting the groundbreaking research in developing a novel Solvent for efficient capture of CO2 in conventional absorption process, leading to a patented innovation.

- The Project has developed Chemogel, a nano particle-based solvent, which is anticipated to outperform traditional amine-based solvents. In lab tests, Chemogel demonstrated:

  01 Enhanced Carbon Capture efficiency
  02 Improved Regeneration efficiency
  03 Higher operating temperatures
  04 Increased SO2 tolerance

- Next phase involves scaling up the lab trials to a pilot at SEIL project site aiming to validate Chemogel' s performance

- This breakthrough has a potential to significantly impact industrial carbon capture processes.

Patent Certificate – The Patent Office, Government Of India (Rule 74 of The Patents Rules)

पेटेंट सं. / Patent No.	544962
आवेदन सं. / Application No.	202341086640
फाइल करने की तारीख / Date of Filing	18/12/2023
पेटेंटी / Patentee	Indian Institute of Technology Madras (IIT Madras)
आविष्कारकों का नाम / Name of Inventor(s)	1.KUMAR, Yogendra 2.SANGWAI, Jitendra S.

It is hereby certified that a patent has been granted to the patentee for an invention entitled CHEMOGEL SUPERABSORBENT FORMULATION FOR CARBON CAPTURE as disclosed in the above mentioned application for the term of 20 years from the 18th day of December 2023 in accordance with the provisions of the Patents Act,1970.

Date of Grant : 15/07/2024

Controller of Patents

Note. - The fees for renewal of this patent, if it is to be maintained, will fall / has fallen due on 18th day of December 2025 and on the same day in every year thereafter.

Department of Chemical Engineering
Indian Institute of Technology Madras, Chennai 600 036

Dr. Jitendra S. Sangwai
Professor

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jitendrasangwai@iitm.ac.in; jitendrasangwai@gmail.com

Date: 01/08/2024

To,
The Head,
Corporate Social Responsibility (CSR)
SEIL Energy India Limited.

Subject: Grant of patent out of CSR project funded by SEIL Energy India Limited.

Dear Sir,

Greetings!

I am very happy to inform you that following patent has been granted. The patent is out of CSR project given by SEIL Energy India Limited on the project "**Large-scale CO₂ capture from high sulfur flue gas exhaust from coal-fired plants**" (Ref. CR23241360CHSEIL008450).

Patent No:	544962
Application No:	202341086640
Filed and granted on:	Filed: 18 December 2023, Granted on 15 July 2024.
Title:	CHEMOGEL SUPERABSORBENT FORMULATION FOR CARBON CAPTURE
Inventors:	KUMAR, Yogendra; SANGWAI, Jitendra S.
Applicant:	INDIAN INSTITUTE OF TECHNOLOGY MADRAS (IIT Madras)
Our Ref No:	IITM-022700IN
IDF no.	2697

I am sincerely thankful for your CSR support for the above project.

Thank you.

(Dr. Jitendra S. Sangwai)

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Renewable Energy Installations – Onsite and Offsite

Onsite

Year	Source (Solar, wind, etc.,)	Installed capacity (in MW)	Capacity addition (MW) after FY 2021	Total Generation (million kWh)	Share % w.r.t to overall energy consumption
FY 2021-22	Solar -Roof	0.05	-	0.0676	0.01
FY 2022-23	Solar -Roof	0.05	-	0.0540	0.01
FY 2023-24	Solar -Roof	0.05	-	0.0333	0.01

PROPOSED :- 2 MWp Rooftop Solar at SEIL Plant Buildings for compensating the Auxiliary Power Consumption

On site

CSR

Year	Source (Sola, Wind etc.)	Type	Installed capacity (in KW)	Location
FY 2022-23	Solar	On grid	250	VSU and IRCS Hospital
FY 2023-24	Solar	On grid	250	Jaya Bharti , St Joseph and PPC Hospital
FY 2022-23	Solar	Off grid	14	Anganwadi
FY 2023-24	Solar	Off grid	18	Anganwadi
FY 2023-24	Solar	Off grid	10	Revenue Department
FY 2023-24	Solar Pumping	Off grid	5hp-4 nos	VSU University

CSR

Year	Source (Solar, wind, etc.,)	Application	Location	Capacity	Total Nos
FY 2022-23	Solar	Streetlights	Nelaturu Panchayat	30W	70
FY 2023-24	Solar	Streetlights	Varkaipudi, MB Palem, Pynapuram	30W	490
FY 2023-24	Solar	Solar water heater	VSU, IRCS Hospital	500LPD	15

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Environment Management -Ash Utilization

Ash Utilization %

- FY:22 — 100
- FY:23 — 97.5
- FY:24 — 100

Areas of Utilization

Legend: FY:22, FY:23, FY:24

Area	FY:22	FY:23	FY:24
Cement/Export	90	87	88
Fly Ash bricks	10	13	12
Roads	0.30	0.04	0.00
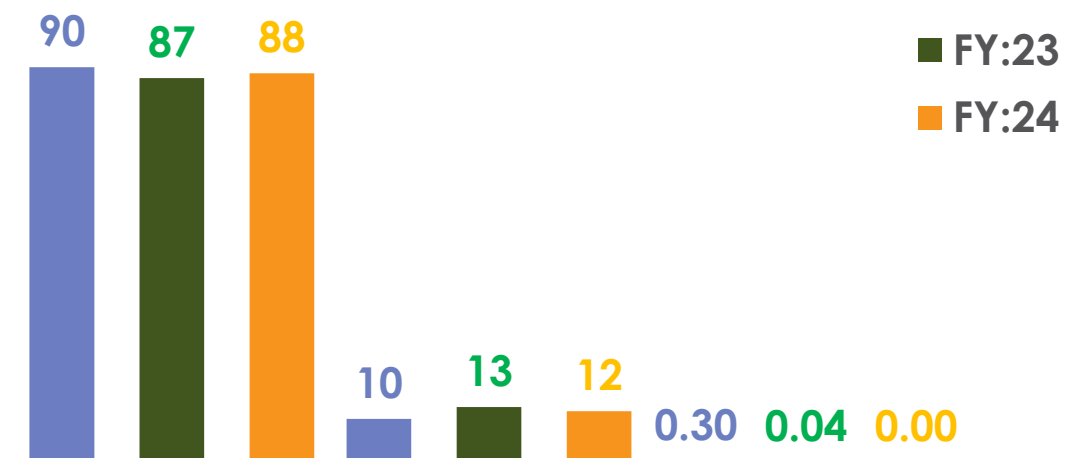
Ash Handling Method

- Wet — 13
- Dry — 87
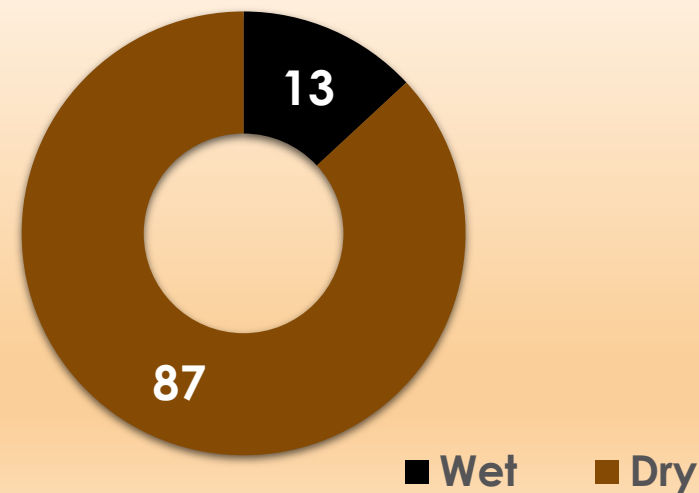
Pond ash (Lakh Tons)
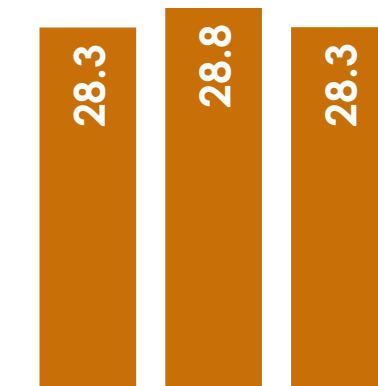
FY:22	FY:23	FY:24
28.3	28.8	28.3

Ash Generated (Lakh Tons)

FY:22	FY:23	FY:24
17.0	17.4	17.6

Best Practices

- Developed infrastructure for enhancing fly utilization like bagging facility, storage sheds for filled bags, container loading arrangement, parking facilities and amenities for transporters and drivers etc.
- Segregation of fine ash and coarse ash through process control for value addition and export
- Provided training on brick manufacturing to local communities for development
- Used all modes of transport for ash movement
- Ash Export Through Ship by using jumbo bags & Bulkers to US,Austraila ,Saudi, Srilanka & total 16 countries
- Worked in close co-ordination with NHAI for making use of ash in roads development
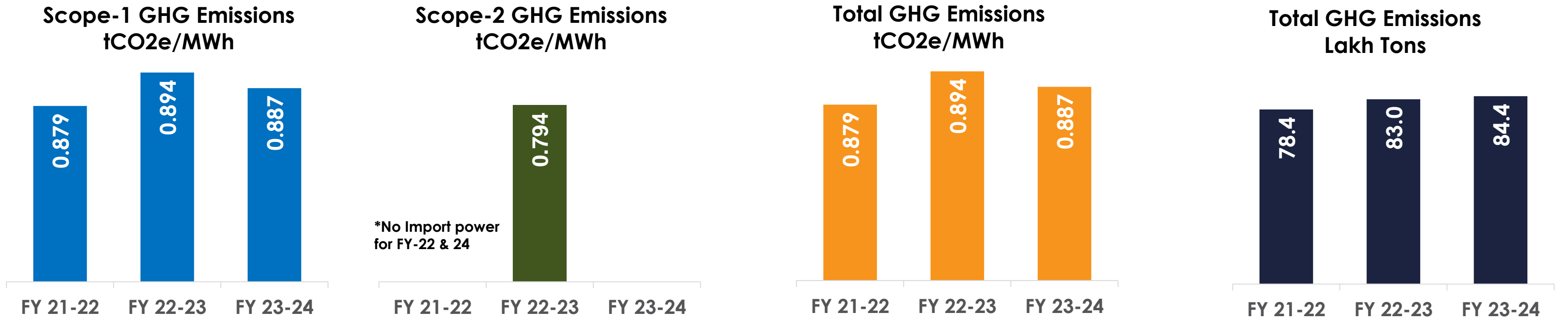
Modes of transportation being used
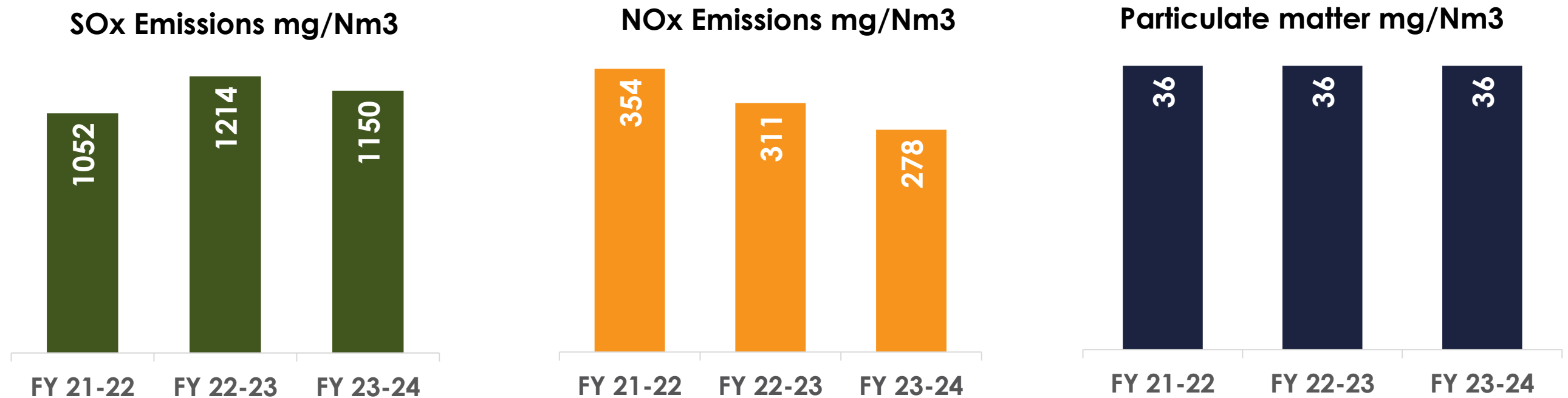
SEIL ash in road development

Environment Management -Emissions

Calculated Emissions

Scope-1 GHG Emissions tCO2e/MWh

FY 21-22	FY 22-23	FY 23-24
0.879	0.894	0.887

Scope-2 GHG Emissions tCO2e/MWh

*No Import power for FY-22 & 24

FY 21-22	FY 22-23	FY 23-24
	0.794	

Total GHG Emissions tCO2e/MWh

FY 21-22	FY 22-23	FY 23-24
0.879	0.894	0.887

Total GHG Emissions Lakh Tons

FY 21-22	FY 22-23	FY 23-24
78.4	83.0	84.4

Stack Emissions

SOx Emissions mg/Nm3

FY 21-22	FY 22-23	FY 23-24
1052	1214	1150

NOx Emissions mg/Nm3

FY 21-22	FY 22-23	FY 23-24
354	311	278

Particulate matter mg/Nm3

FY 21-22	FY 22-23	FY 23-24
36	36	36

Emissions monitoring and control

- ❖ SEIL P1 is equipped with the following for controlling the emissions within the prescribed limits
    - a. High efficiency ESPs
    - b. Low NOx burners
- ❖ O2 grid measurement ,
- ❖ Periodic Combustion tuning and Air flow adjustment practices while firing different grades of coal
- ❖ Coal mills tuning with **CAVT,DAVT** and Fineness adjustment
- ❖ Pipe conveyers for coal transportation from port to plant, eliminating spillage and emission
- ❖ Dry fog dust suppression system in coal handling plant.

- ❖ **SOX Emission Management update**
- ❖ Blending imported coals having Low Sulphur content
- ❖ Limestone based Flue Gas Desulphurization (FGD) technology is finalized. Bid Evaluation in Progress.

GHG Emission monitoring and control

- ❖ Adopted SDG 7 (Affordable and clean Energy), and SDG 13 (Climate Action) as our priority SDGs.
- ❖ ESG data capturing practices are put in place
- ❖ Developed in-house **Realtime GHG Emissions data monitoring system**
- ❖ We have increased Horticulture and plantation (5.8 lakh saplings till now).
- ❖ SEIL is exploring 2 MW solar roof top installations in coming years.
- ❖ Engaged with premium **Education institutions like IIT, Madras** and working in areas of CO2 absorption, etc.

Environment Management – Water

Raw water consumption m3/MW

- FY 21-22: 6.64
- FY 22-23: 7.02
- FY 23-24: 6.67

DM water consumption %

- FY 21-22: 0.55
- FY 22-23: 0.61
- FY 23-24: 0.57
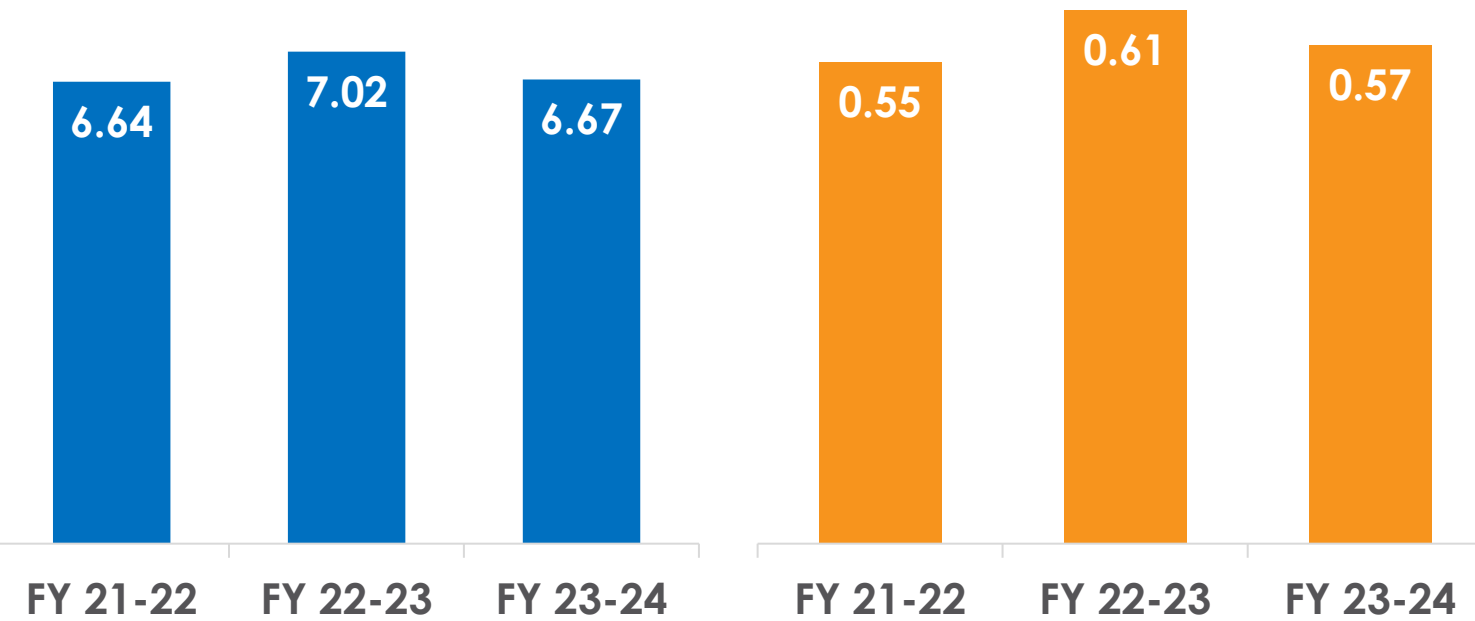
SEIL ENERGY INDIA LIMITED - P1
2X 660MW Super Critical Thermal Power Plant
Service Water Consumption Report — 20-Aug-24

Sample Daily Report

S.No	Description	Major Utilised areas	UOM	Bench Mark	Day	Month (Avg.M3/Day)	Remarks
1	AHP seal water /Fly Ash Silo	ASPH&silo	M3	1000	1383	1273	U#2 wet conveying
2	Booster water Pump &APH\ESP wash water consumption.	Bottom ash hopper	M3	1000	3451	1238	U#1&2 BAH Make-up , U#2 bottom ash conveying,APH wash water pipe line leak (attended), water used for U#2 Boiler drain water cooling
3	Fire Hydrant consumption	Coal Yard	M3		176	681	
4	Green Belt	CHP CCR, FOPH & Serv.Building	M3	300	334	149	
5	Service water consumption	Canteen	M3	425	455	419	
6	Coal Stockpile consumption		M3	100	7	17	
7	Potable Water Consumption		M3	20	20	16	
8	Plant HVAC system- TG		M3	5	0	3	
9	Fire Spray system consumption		M3	0	38	44	
10	Unbalance water quantity (leakages, others usages etc)	Flow meter error	M3	0	319	376	
	Total consumption		M3	3100	6163	4199	
11	Plant usage		M3		5510	3672	
12	Green Belt usage		M3		334	149	
13	Unaccounted		M3		319	376	

Salient Features in Water Management

❖ Sea water from Bay of Bengal is used for plant requirements. Flowmeters are installed at identified locations for monitoring water consumption at different locations.

❖ System wise benchmarks are developed, and actual consumptions are tracked against benchmarks for optimization.

❖ STP and ETP treated water being reused for green belt.

❖ Rainwater harvesting pits in all buildings to increase the ground water level.

❖ High Efficiency sprinkler/drip system used for horticulture development. Most of the processes are designed for optimal wastewater recovery like ash water recovery, brine water recovery, etc.

❖ Formed a water-monitoring group to execute a system-wise water audit regularly to conserve water.

❖ High water consumption areas discussions in daily O&M meetings.

❖ Online integrated water management system implementation under progress.

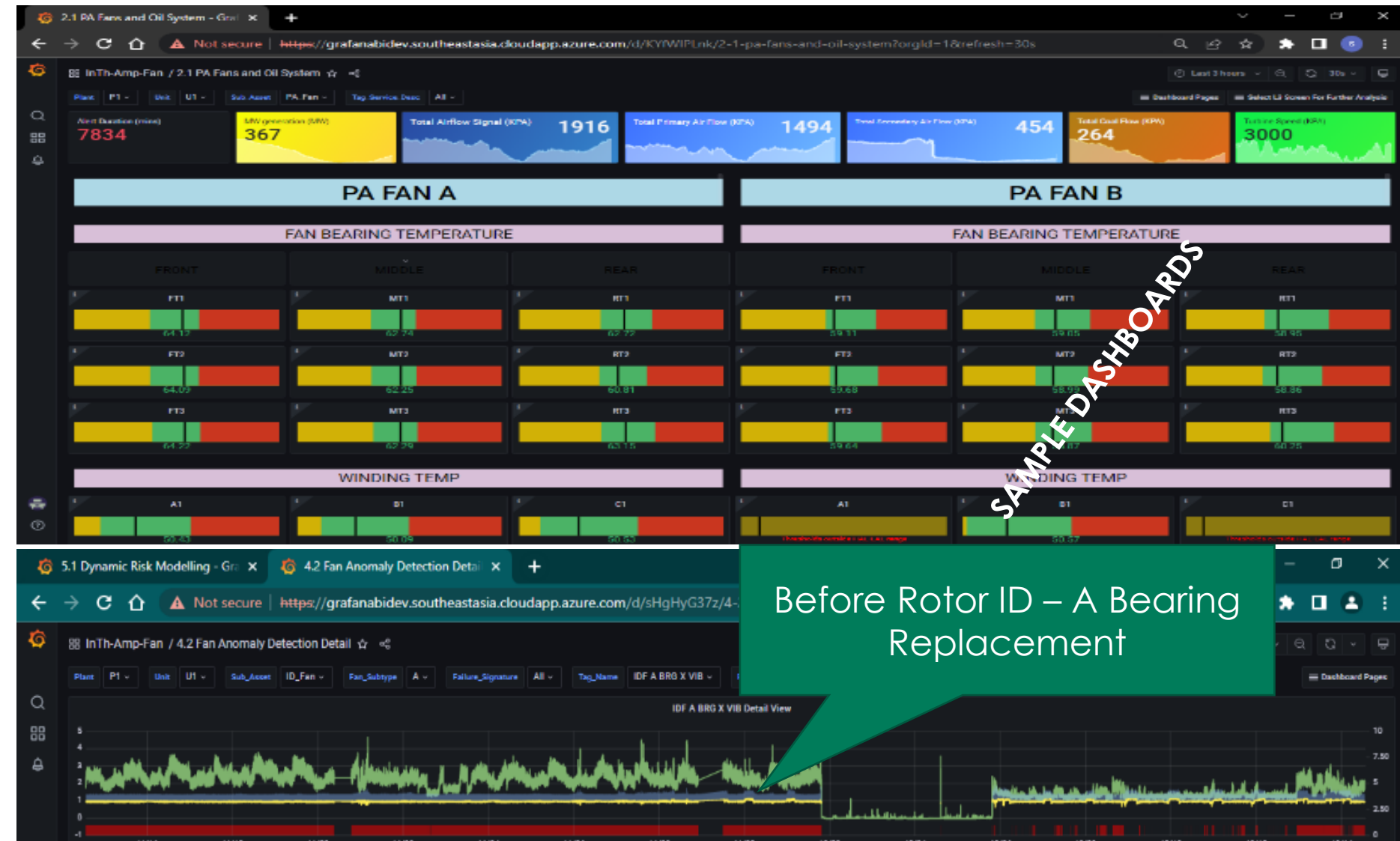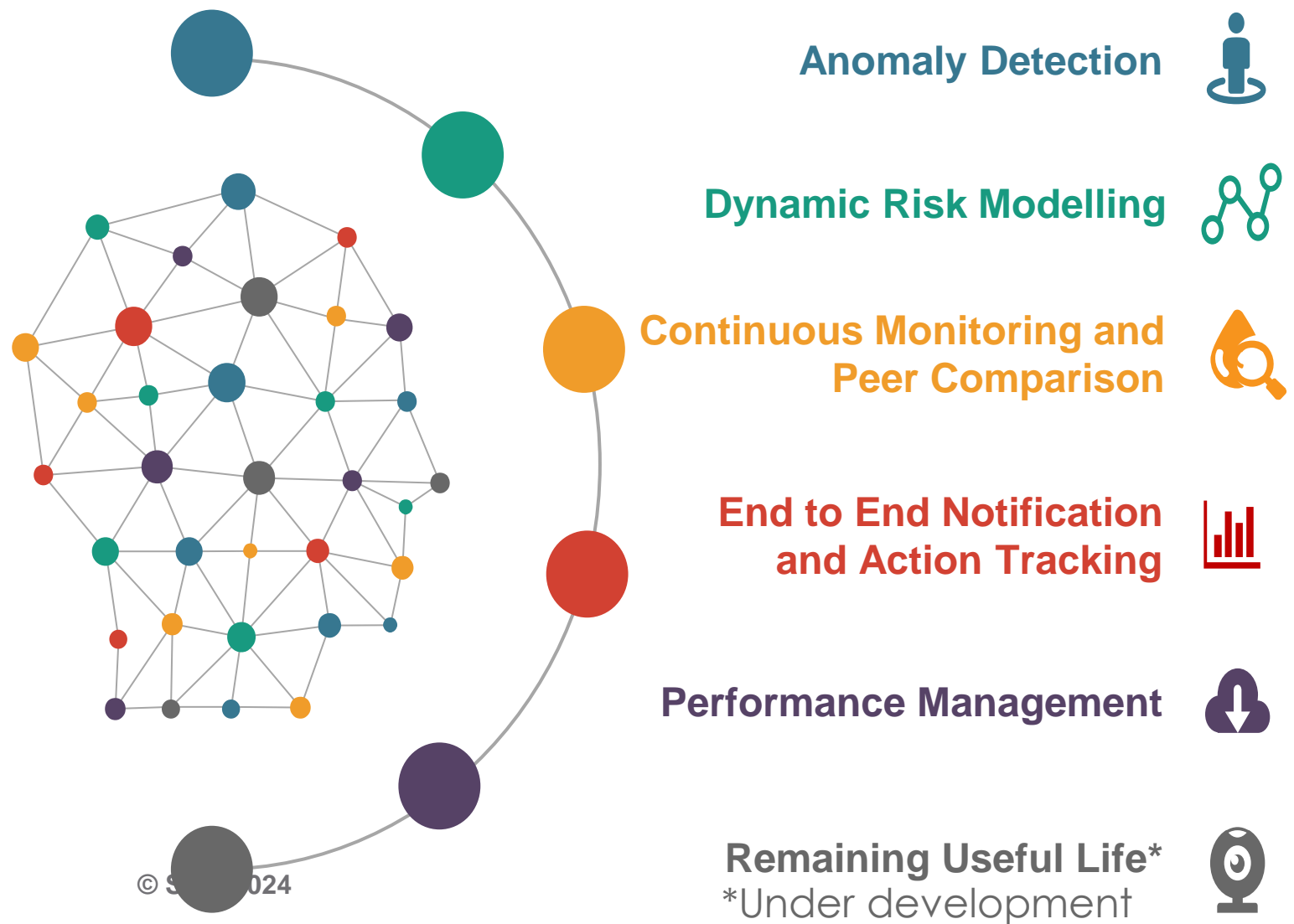# 25th National Award for Excellence in Energy Management 2024

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Best Practices "Technology Adoption"- Inhouse developed PAM (Predictive Asset Maintenance Tool)

Project Trigger: Machine Learning based PAM is to identify potential issues early in the fault progression time-line and to reduce unplanned downtime.

The Tool is developed inhouse with the help of digital team and implemented for Generator, Critical fans and Pumps with the following objectives:

- ✔ Provide real-time dynamic insight about asset condition thru continuous monitoring of all relevant operational data sets.
- ✔ Detect early stage / incipient anomalous behavior of an asset.
- ✔ Point-in-time view of the asset health status
- ✔ Estimation of the operating time preceding preventive maintenance.

Anomaly Detection

Dynamic Risk Modelling

Continuous Monitoring and Peer Comparison

End to End Notification and Action Tracking

Performance Management

Remaining Useful Life*
*Under development

© SEIL 2024

SAMPLE DASHBOARDS

Before Rotor ID – A Bearing Replacement

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Best Practices "Technology Adoption"- ....."Few more"

Realtime GHG Emission Monitoring

Real time monitoring of GHG developed inhouse as per IPCC-2006.

Video Analytics for PPE compliance

Ensuring PPE compliance by making use of existing CCTV infrastructure.

Field log digitization

Effective usage of huge field data for analysis through field data logging.

Mobile coal reclaiming

MOC process is also digitalized.

Use of Total station for coal physical verification for more accuracy

Leica Total Station

Drone

Drone Usage for Coal PV &

Coal heap Drone Images

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Best Practices - Maintenance

PREDICTIVE MAINTENANCE

- Usage of Condition Monitoring tools for assessment of equipment condition
- PAM tool for critical equipment monitoring

CORRECTIVE MAINTENANCE

- Notifications are raised against deviations
- Corrective actions are then taken based on priority
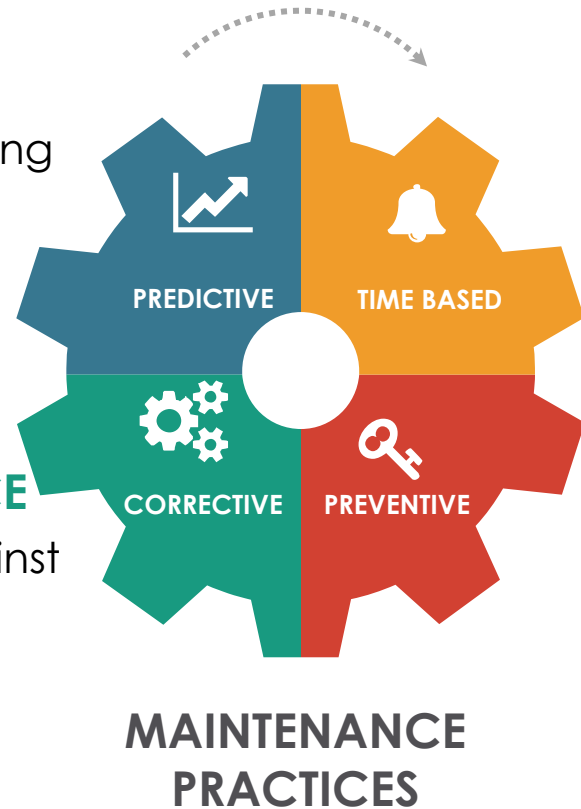
TIME BASED MAINTENANCE

- Annual / Bi-Annual Maintenance for boiler & turbine
- Trained in house team organizing maintenance activities

PREVENTIVE MAINTENANCE

- Preventive maintenance schedule is preloaded into SAP
- Work orders are auto generated from PM plan and are updated annually

MAINTENANCE PRACTICES

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Best Practices: Asset Management & Reliability

- Expert engagement for trouble shooting and knowledge enhancements
- Mapping of equipment changeover in SAP
- Performance optimization under all operating conditions
- Inclusion of compliances into processes
- Structured review by senior management
- Adopting best ware housing practices including preservation.
- Alignment of individual's goals with organization goals/objectives
- Collaboration with premier educational institutions like IITM for working in decarbonization initiatives (like CO2 capture).
- Digitization of plants processes for effective control, field data logging, management of change process, gate pass process etc.
- Embracing technology for process enhancement

SEIL Reliability Enhancement Practices

- Dedicated Reliability Department
- Root Cause Analysis
- Incident Investigation & Trip Reports
- Failure Mode Effective Analysis
- Single Point Failure Analysis
- Management of Change
- Periodic Protection System Checks
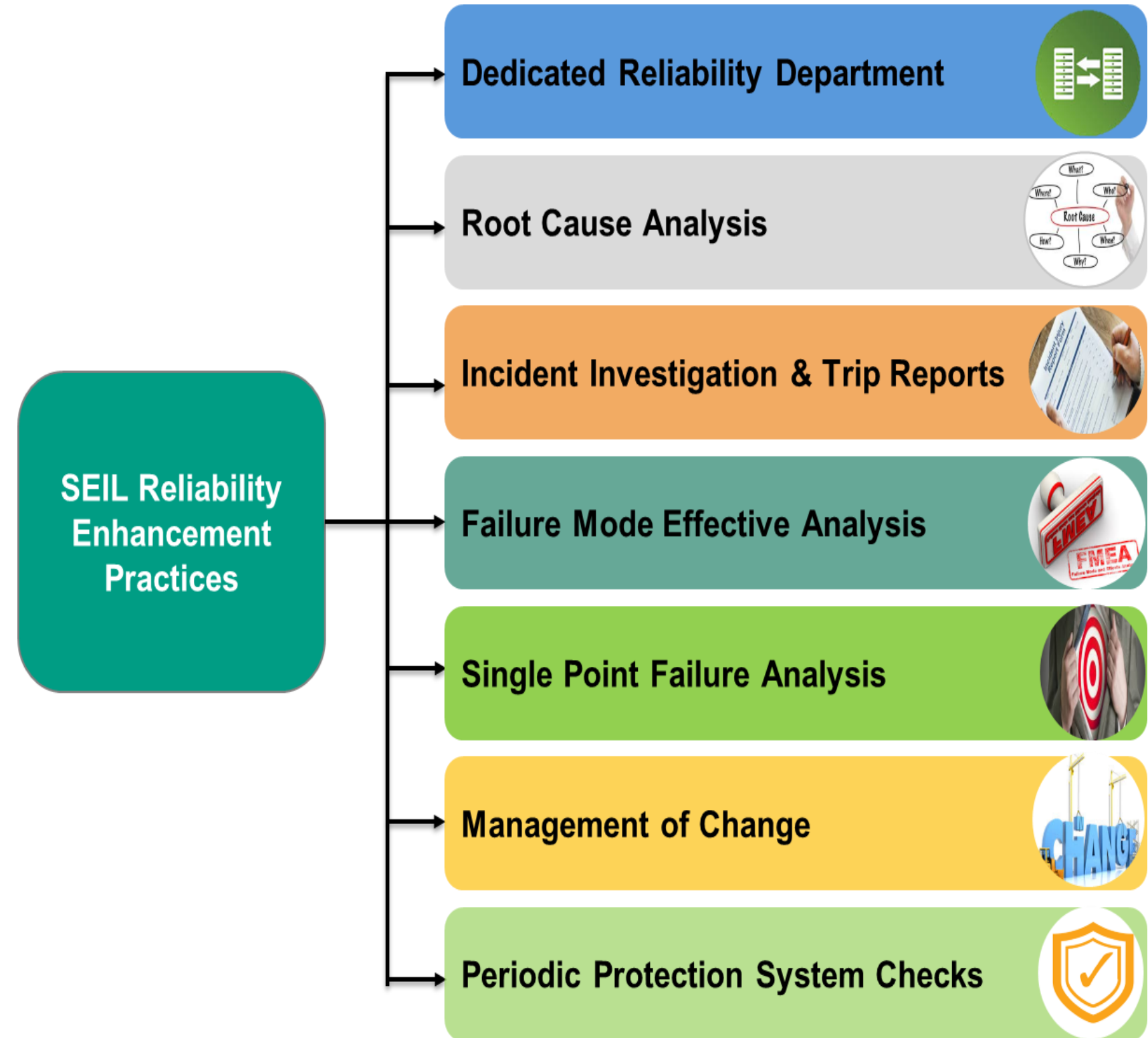
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Best Practices: Asset Management -Warehousing Practices

Quick accessibility and retrievability are achieved through customized stacking methods.

Structured racking system

Clear Driveways

Heavy Duty Rack

Tool Rack

Storage for small items

Preservation

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Best Practices – Maintenance (Advanced Predictive Maintenance Tools)

Vibration Monitoring
- Monitoring of all critical equipments
- Dedicated software for analysis of data
- Portable Monitors (CSI 2140 for monitoring vibrations for all critical equipments
- Ultrasound for APH supporting bearing

Thermography
- Provided for scanning of piping network, AIS equipment, transformer bushings, LA's and switchgears
- Passing valve identification
- UV photography (AIS, GIS, Transformers etc.)
- Boiler insulation leak survey

Lube oil Analysis
- Lube oil analysis done for all major equipment
- Oil Samples sent to third party lab for detailed analysis
- Wear and Debris Analysis & Oil condition Monitoring
- Corrective actions are taken

Other Tools (Online/Offline)
- SF6 Gas leakage measurement
- IR Measurement
- Winding Resistance Measurement
- Tan Delta Measurement
- Inductance Measurement for Motor healthiness
- UT, RT, DPT

Electrical Systems

Partial discharge measurement

Corona checking for outdoor bushings, CT, PT & conductors

Dissolved Gas Analyzer for Transformer

LA Monitoring: 3rd harmonic leakage current measurement

Generator Rotor Inter turn Fault Measurement

Mechanical Systems

NDT of critical equipment during maintenance viz. BFP turbine & Fan blades for defect prediction.

Preventive RT on high pressure Joint : to identify weak/vulnerable joints & rectify

Micro Photograph

Replica test for High temperature headers to check metallurgical deterioration

Ultrasonic thickness monitoring of Boiler tubes & Pressure vessels

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Turbine Vibration analyser

Portable Vibration analyser CSI 2140

Lube Oil Analysis

Condition Monitoring of Rotating equipment

Thermography of vulnerable equipment/Systems

Thermography of Bushings

Thermography of Piping

Eddy current testing for Heat Exchangers tube thickness measurement

Best Practices: Biodiversity & Afforestation

Green lush in SEIL

Biodiversity in & around SEIL

Medicinal Garden

Admin Building

Pancha tatwa garden

Y-o-Y Plantation Progress

Year	Acres	Nos	Total Saplings	Total Acres
2020	23	26729	458045	353
2021	34	16859	501633	387
2022	30	15000	516633	417
2023	50	25000	541633	467

Sapling Details

| TYPE OF SAPLINGS	NOS
Avenue Plantation	398000
Ornamental plantation	97500
Fruit plantation	30000
Medicinal Plantation	5000
Aromatic plantation	10000
Aquatic plantation	1000
TOTAL	**541500**

Best Practices : Corporate Social Responsibility (CSR)

Telemedicine Center

HEALTH
- Committed to wellbeing of the community
- Create Social Health Awareness
- Bring behavior-based change
- Provide Preventive, Curative and Promotive Health services
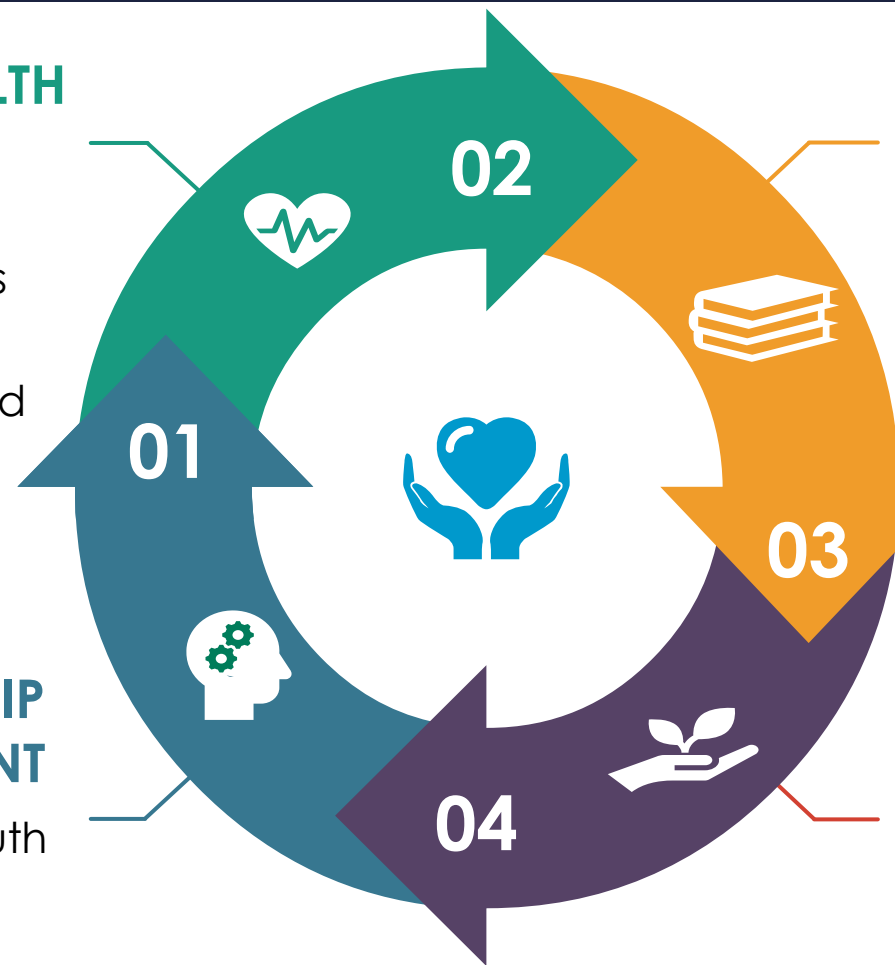
EDUCATION
- Important aspect for long term community development
- Reduce dropout rates in schools
- Quality education through Learning improvement programme (LIP) at Govt Schools
- Transform pre-school education in Anganwadi centers

Pre-school education

02 **01** **03** **04**

SKILL AND ENTREPRENEURSHIP DEVELOPMENT
- Meaningful engagement of youth and women
- Aim to bridge the social and economic gap

ENVIRONMENT SUSTAINABILITY
- Reduce Carbon emission in the environment
- Promote renewable energy sources
- Promote Green cover through plantation
- Promote innovation through Research & Development

Skill Development Training

Plantation at schools

- ✓ **Skill Development:** Computer Trainings for Youths & Women in Data Entry Operator, Web Designing, Advanced Tailoring
- ✓ **Health:** Mobile Medical Unit, Community Emergency Ambulance, Health and Wellness, Support to Government & Charitable Health Institutions, Community Eye Screening, RO Water plants, Audiometry Camps
- ✓ **Education:** Quality Education for Classes VI to IX, Pre-School Education teaching and training in Anganwadi centers, Career Counselling for Govt. School Students,
- ✓ **Environment:** Afforestation in 80 acres, Solar Provision at Hospitals, Colleges & Anganwadi Centers.500 kWp On-grid solar project(s), Solar Street lights, Solar water heaters Support to IIT-Madras for R&D in Carbon capture

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Best Practices : Corporate Social Responsibility (CSR)

HEALTH & WELLNESS CENTRE

BEDS for CHARITABLE HOSPITAL

SKILL DEVELOPMENT

150 KWP ROOFTOP SOLAR AT IRCS

ULTRASOUND MACHINE AT IRCS

EYE CAMPS

NUTRITION SUPPORT

100 KWP ROOFTOP SOLAR AT VSU

ULTRASOUND MACHINE AT IRCS

MOBILE MEDICAL UNIT

CAREER COUNSELING

PLANTATION AT VSU

- 17500 Audiometry screenings & 19431 Eye screenings
- 53 dental camps
- 1500 families benefitted by RO plants
- Medical Consultation to 21,000 people
- Quality education to 3800 Students in 20 Govt. Schools & 1000 students guided for soft skills
- 560 Solar Street Lights across 5 villages
- 8 Anganwadi provided pre school education & 32 Anganwadi centers provided with off grid solar
- Medical Equipment & Solar installations for Charitable Hospitals

Best Practices : EV Usage and Solar

EV Usage for employee conveyance

Battery vehicles

Battery vehicles from town ship to Plant

Harnessing Solar energy

Solar system in VSU

Solar system in Red cross Hospital

Solar Water Heater in girls hostel at VSU

Solar Street light in Nelaturpalem Village

Solar Pumps

Best Practices : HSE

Monthly mass toolbox talks

Regular Trainings

QR Code for quick reporting

Behavior based safety

Migration from Reactive to Inter dependent safety culture

Skip level meetings (CEO with work force)

Regular Mock drills

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Trainings

Technical

Trainings for employees & Contractors Focus on Improving Technical skills

Safety

Trainings for employees & Contractors Focus on best place to work

Managerial

Trainings for employees for improving Interpersonal & Managerial skills

Trainings(Man hours)

Legend: ■ FY:21-22 ■ FY:22-23 ■ FY:23-24

|	FY:21-22	FY:22-23	FY:23-24
Technical	4433	3036	6314
Managerial / Functional	7674	4115	4016
Safety	4724	11042	3160
Total Man Hours	16830	18193	13490

Learnings

- Coal blending alternatives to minimize the over heating of water wall tubes, slagging and fouling potential

- Transition to Oxygenated Treatment (OT) from All Volatile Treatment (AVT).

- Exfoliation in Supercritical Boilers and strategies to address the issue.

- Corrosion issue in Coastal power plants, means to address the corrosion and identification of alternate materials

- Various means to reduce Auxiliary Power Consumption, Heat Rate improvement and implemented the modifications through stringent Online Management of Change Process

- Combustion Tuning for various type of coals to minimize NOx emissions and improve overall boiler efficiency in consultation with OEM and industry experts

- Management of fuel logistics, Vessel Management and coal transportation through pipe conveyor

- Inhouse digitalization approach to the extent possible to minimize dependency on external agencies

- Development of alternate vendors to minimize the dependency on OEMs

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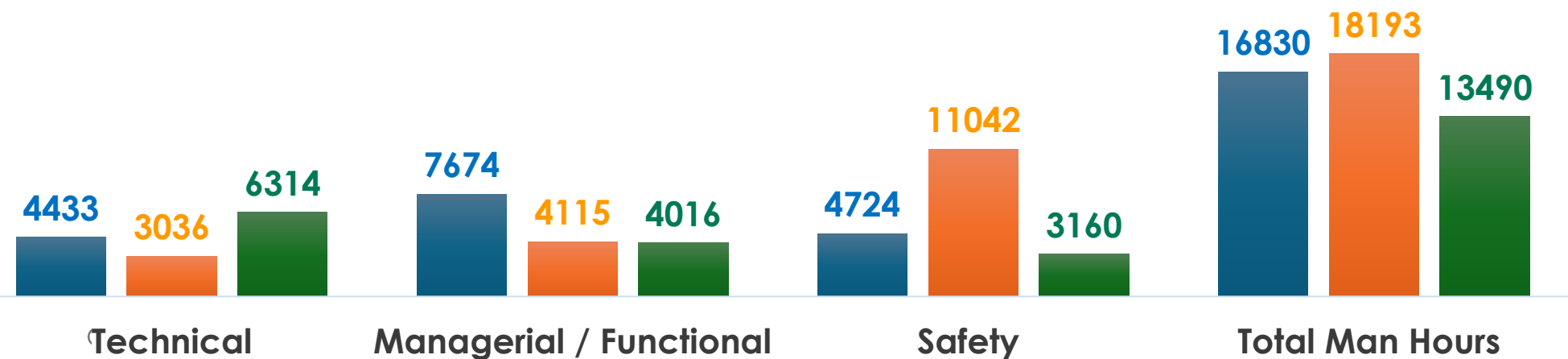
AWARDS & CERTIFICATES

|				
2023-24	Industrial Safety leadership Award-CII	Green Building best Practices Award	BBS 'Platinum Award from -FBS	5S 'Excellence Award from-QCFI
2022-23	5S 'Excellence Award from-QCFI	Gold Award from Quality circle forum	Corporate 'Platinum Award from -FBS	Best CSR Award from -UBS
2021-22	Sustainability-4.O Award -TERI	Quality Award from-NCQC	5S 'Excellence Award	Best Exporter (Coastal)-
2018-21	Golden Peacock Environment-Mgmt	Corporate 'Platinum Award from -FBS	IMS Certification	
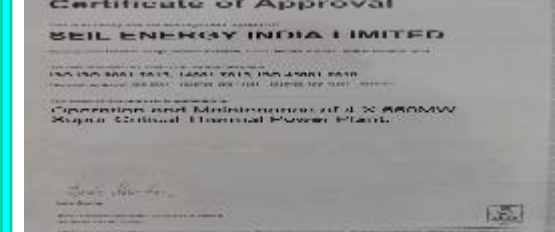
"Often when you think you're at the end of something, you're at the beginning of something else."

– Fred Rogers, Television Personality

THANK YOU

Contact details

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