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ArcelorMittal Nippon Steel India

13th Edition of CII National Award for Environmental Best Practices 2026

A joint venture between ArcelorMittal and Nippon Steel Corporation

ArcelorMittal NIPPON STEEL

Case Study Presentation By:

ArcelorMittal Nippon Steel India Pvt. Ltd. Hazira Works

Title of the Project : Sustainable Industrial Water Management In Integrated Steel Plant by Optimization of Cycle Of Concentration(COC) In Cooling Towers



SMARTER STEELS
BRIGHTER FUTURES

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Company Profile

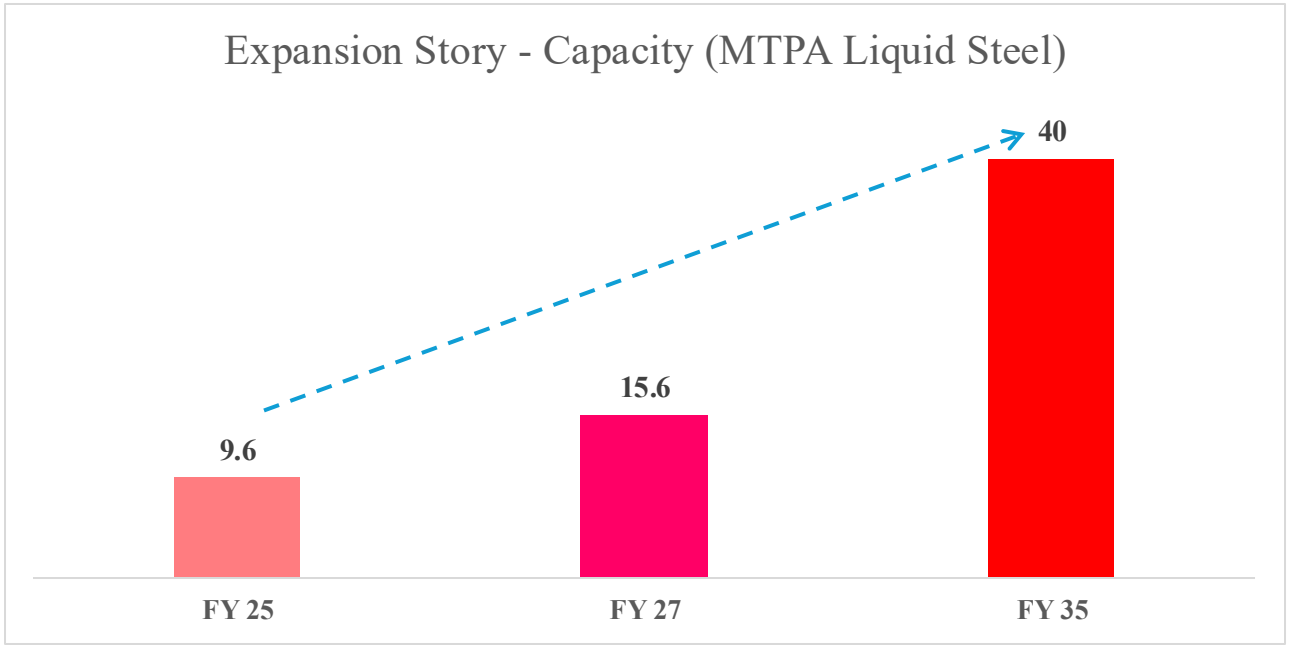
One of India's largest Integrated flat Steel Producers

ArcelorMittal + Nippon Steel

Joint venture since 2019 - an alliance of two global steel leaders.

INDIA

Set to become the world's largest integrated flat steel plant at a single location,
with total capacity planned to reach 40 MTPA of Liquid Steel by 2035.



Smarter Steels, Brighter Futures Strong ESG focus with decarbonization, sustainable resource conservation at the core.

FLAT-ROLLED STEEL PRODUCTS FOR

Automotive | **Construction** | **Transportation** | **Agriculture** | **Defense** | **Energy** | **White Goods**

SMARTER STEELS
BRIGHTER FUTURES

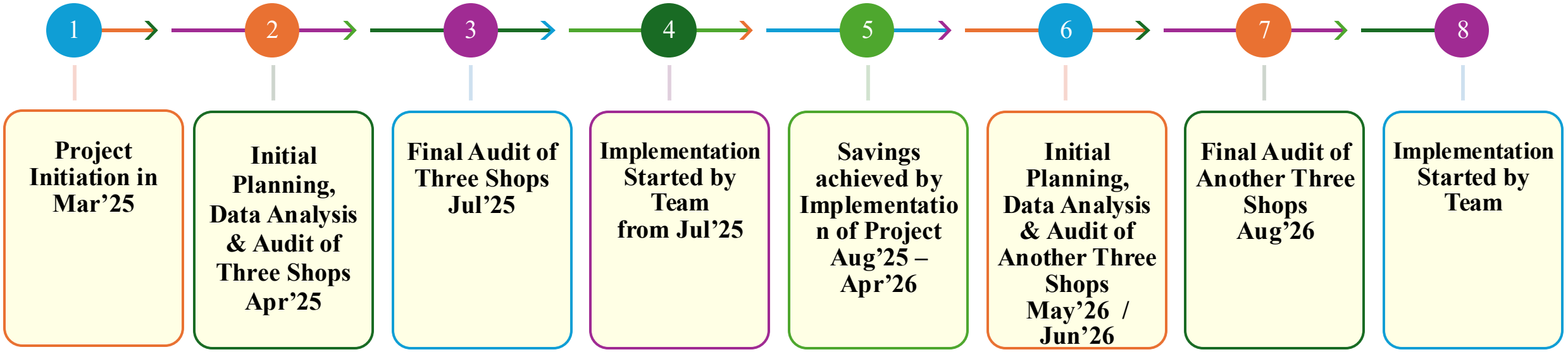
Need of the Project

Driving Sustainable Steel Growth through Resource (Water) Conservation with circularity concept

- Steel Plant Outlook – India Scenario
  - Current Production in India (**FY 2025-26**): **168.4 MT against present installed capacity 218.4 MT**
  - **National Steel Policy 2017 India Target**: Increase India's crude steel production to **300 MTPA by FY 2030-31**
- Growing **Steel production will significantly increase water demand**
- Fresh water **availability is declining** in India due to **Population growth**, **Uneven Seasonal Rainfall**, **Increased requirement from Agriculture**, **Industries** & **Cities** in line with economic growth.
- Being an Integrated Steel & Power producer (Water intensive Industry) located in Water Stress region of India (North -western), freshwater availability is critical for us for sustainable business.
- Integrated steel plant, Cooling Towers consume **65-75%** of total freshwater requirement
- **Cycle of Concentration optimization** is the primary lever for **makeup and blowdown** water reduction in cooling tower.

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Major milestones of the Project

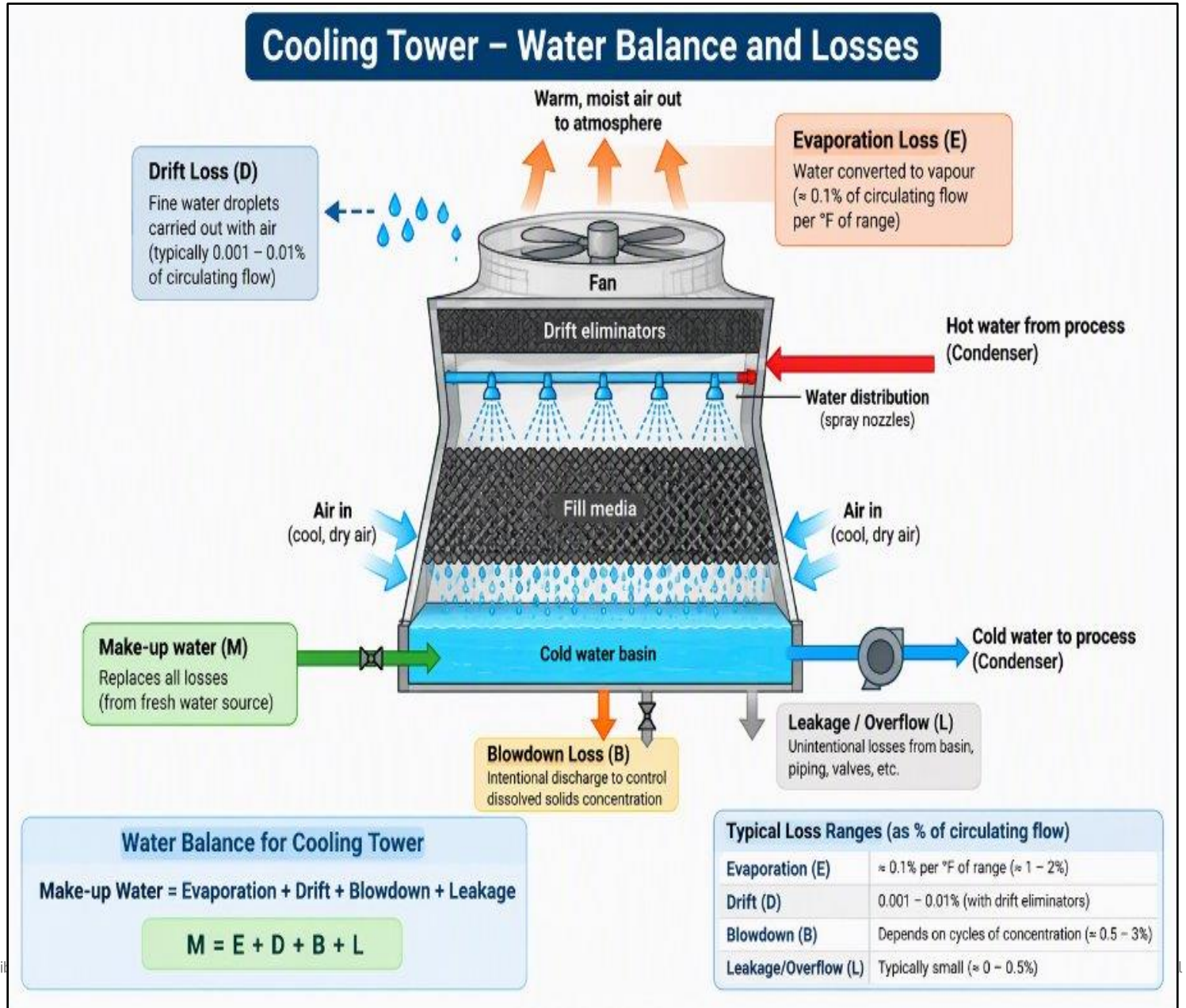


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Project Overview – Cycle of Concentration (CoC)

Cycle of Concentration (CoC) is the ratio of the concentration of dissolved solids (or a specific dissolved constituent such as chlorides, TDS, conductivity, silica, etc.) in **circulating cooling water** to that in the **make-up water**.

$$\text{CoC} = \frac{\text{Salt Concentration in circulating water}}{\textit{Salt}\ \text{Concentration in makeup water}}$$



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Project Drivers – CoC Project

- Circulating water Quality analysis against OEM Recommendation & Optimization of Blowdown
- Change the blowdown practice based upon the data driven circulating water quality
- Implementation of Optimum backwash frequency of side stream filters (Pressure sand filters, Dual media filter , Multi-Media Filter, Mixed Gravity Filter, Auto valveless gravity filter etc.)
- Regular monitoring & Tracking of COC & Water Audit.
- Design the chemical treatment program of Cooling Tower based upon OEM recommended water chemistry
- By optimize the blowdown as a part of chemical treatment program
- Reduce nearby ambient dust load and improve housekeeping
- By controlling Leakage

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Cooling Circuit COC Assessment & Water Saving

Plant Name : Steel Making Plant (SMP – 1) - Open Loop Water System Existing								As per OEM	Result Achieved			Difference in Blowdown in m3/Hr	Water Saved in m3/day
Name of Circuit	Flowrate (m3/Hr)	ΔT (Degree Measured)	TDS (PPM) in Circulation Water	TDS (PPM) in Makeup Water	COC	Evaporation loss (m3/Hr)	Blowdown (m3/Hr)	TDS (ppm)	TDS (PPM) in Circulation Water	COC	Blowdown (m3/Hr)		
EAF 1 & 2	1850	5	746	290	**2.57**	14.15	9.00	**1250**	1050	**3.62**	5.40	3.60	86.40
EAF 3	1850	3	608	290	**2.10**	8.49	7.74	**1250**	1135	**3.91**	2.91	4.83	115.91
CCM 1 & 2 Spray	700	12	667	290	**2.30**	12.85	9.89	**1250**	990	**3.41**	5.32	4.56	109.48
EAF 4	2380	2	696	290	**2.40**	7.28	5.20	**1250**	1025	**3.53**	2.87	2.33	55.88
CCM 3 Spray	1250	7	655	290	**2.26**	13.39	10.64	**1250**	988	**3.41**	5.56	5.07	121.79
												Total Water Saving in m3/day	**489.47**

Plant Name : Blast Furnace - Open Loop Water System Existing								As per OEM	Result Achieved			Difference in Blowdown in m3/Hr	Water Saved in m3/day
Name of Circuit	Flowrate (m3/Hr)	ΔT (Degree Measured)	TDS (PPM) in Circulation Water	TDS (PPM) in Makeup Water	COC	Evaporation loss (m3/Hr)	Blowdown (m3/Hr)	TDS (ppm)	TDS (PPM) in Circulation Water	COC	Blowdown (m3/Hr)		
Secondary Cooling	5250	5	520	290	**1.79**	40.16	50.64	**1000**	890	**3.07**	19.41	31.23	749.47
Machine Cooling Circuit	1550	4	585	290	**2.02**	9.49	9.33	**1000**	910	**3.14**	4.44	4.89	117.32
Steam Turbine Cooling	9000	8	598	290	**2.06**	110.16	103.72	**1000**	930	**3.21**	49.92	53.81	1291.34
Air Compressor	250	3	715	290	**2.47**	1.15	0.78	**1000**	850	**2.93**	0.59	0.19	4.53
												Total Water Saving in m3/day	**2162.65**

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Cooling Circuit COC Assessment & Water Saving

Plant Name :CSP Mill - Water System Existing								As per OEM	Operate as per OEM			Difference in Blowdown in m3/Hr	Water Saved in m3/day
Name of Circuit	Flowrate (m3/Hr)	ΔT (Degree Measured)	TDS (PPM) in Circulation Water	TDS (PPM) in Makeup Water	COC	Evaporation loss (m3/Hr)	Blowdown (m3/Hr)	TDS (ppm)	TDS (PPM) in Circulation Water	COC	Blowdown (m3/Hr)		
Laminar	4200	8	665.02	270	**2.46**	51.41	35.14	**1500**	1130	**4.19**	16.14	23.65	567.70
Work Roll	8100	5	506.17	270	**1.87**	61.97	70.84	**900**	820	**3.04**	30.42	0.42	10.09
Indirect	3910	5	861.56	270	**3.19**	29.91	13.65	**1500**	1095	**4.06**	9.79	58.25	1397.97
Total Water Saving Potential in m3/day													**1805.38**

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Total Water Saving

Circuit Group	Per Day Freshwater Saving (m3)	Yearly Freshwater Saving (m^3)
SMP-1	489.47	1,78,656
Blast Furnace	2,162.65	7,89,369
CSP Mill	1,975.77	7,21,155
Total (Audited Circuits)	**4,627.89**	**16,89,180**

Total Cost Saving

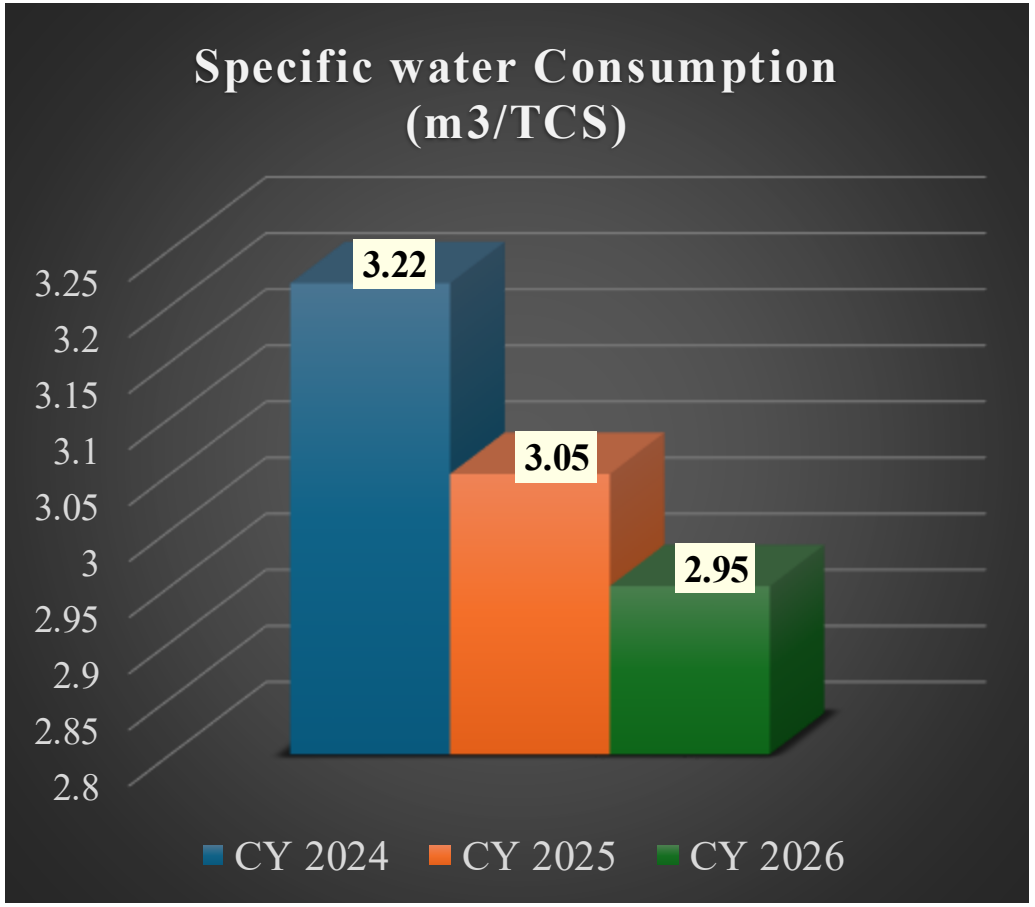
Circuit Group	Per Day Freshwater Saving (m3)	Amount Saved Daily (Rs)	Amount Saved Yearly (Rs)
SMP-1	489.47	21536	7860873
Blast Furnace	2,162.65	95156	34732232
CSP Mill	1,975.77	86933	31730805
Total (Audited Circuits)	**4,627.89**	**2,03,627**	**7,43,23,911**
Industrial water charges taken near about Rs. 44.00 per m3			

🎯 **Total amount saved per Year approximate 7.43 Cr.**

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Tangible benefits from this project

- 💧 **Reduced Makeup Water Volume:** Higher CoC means the cooling system uses less makeup water.
- 📉 **Lower Blowdown Water Volume:** Blowdown water is reduced & related cost reduction
- 💰 **Decreased Water Costs:** Reduced water consumption help save on water charges.
- 🧪 **Lower Chemical Treatment Costs:** Treatment chemicals remain in the system longer, reducing the need for frequent chemical addition.
- ⚡ **Energy Efficiency Savings:** Proper CoC helps prevent scale and biological fouling, improving heat transfer and reducing energy consumption.



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Intangible from the COC project

Enhanced Sustainability

- Supports water conservation and helps achieve ESG goals

Regulatory Compliance

- Less wastewater discharge makes compliance easier.

Extended Equipment Lifespan

- Reduced scaling and corrosion increase equipment lifespan

Improved Risk Mitigation

- Lower dependence on fresh water reduces local water shortages, rationing, or sudden utility price hikes.

Better Reputation

- Demonstrating active water conservation enhances brand reputation among consumers, investors, and local communities.

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Replication Potential Across Industries

- Other Steel Industries
- Power Plants
- Petroleum Refineries
- Chemical & Petrochemical Industries
- Fertilizer Industry
- Cement Industry
- Pharmaceutical Industry
- Food & Beverage Industry
- Paper & Pulp Industry
- Textile Industry
- Commercial Buildings

This concept can be applied for the Industries of the facilities where cooling tower exists

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Challenges faced countering During COC Optimization

Technical	Maintenance	Administrative
Scaling at higher COC	Cleaning of cooling tower fills & basins	Cross-functional coordination and maintain optimum COC of cooling tower
Fouling due to high TSS & dust ingress	Heat exchanger cleaning & maintenance	Optimized the performance of Side stream filters
Fluctuating makeup water quality	Leakage identification & rectification	Close Monitoring of the circulating water quality
Corrosion control at elevated COC	Close monitoring of corrosion rate through installation of Corro-loop assembly	Dosing of Chemical based upon the designed chemical treatment program and monitoring the residuals
Optimization of chemical dosage	Design the proper chemical treatment program based upon the OEM recommended water chemistry	Dosing of Chemical based upon the designed chemical treatment program and monitoring the residuals
Microbiological growth control	Biocide type and dose selection and apply, optimum blowdown	Close Monitoring of the circulating water quality
Maintaining target conductivity & silica limits	Maintain the Optimum COC	Close Monitoring of the circulating water quality
High blowdown requirements	Avoid unnecessary blowdown	Give the optimum blowdown based upon water quality recommended by OEM

Achieving National Benchmark / Standards

❑ National Benchmark / Standards

The **Ministry of Steel, Government of India** has reported that the specific water consumption of integrated steel plants in India is in the range of **1.8 to 3.5 m³ per tonne of crude steel (TCS)**.

❑ CREP Target (CPCB & MoEFCC)

Under the **Charter on Corporate Responsibility for Environmental Protection (CREP)** for integrated steel plants, the industry has been encouraged to progressively reduce freshwater consumption through water recycling, reuse, and higher Cycle of Concentration (CoC) in cooling systems.

❑ Benchmark Levels

Performance Level	Specific Water Consumption
World-class integrated steel plant	< 2.0 m³/TCS
Good Indian integrated steel plant	2.0 - 3.0 m³/TCS
Average Indian integrated steel plant	3.0 - 4.0 m³/TCS
Improvement required	> 4.0 m³/TCS

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Priority Plans / Way Forward & Resource Requirement

Way Forward :

Project Implementation in following Shops (05 Nos.) :

- ❑ Corex
- ❑ SMP2
- ❑ Plate Mill
- ❑ Pipe Mill
- ❑ Hot Briquetted Iron (HBI) Plant

Resource Requirement : Nil

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Major Learnings

- Consistent sustainable production by reduction of Maintenance
- Significant Resource (water) Conservation Achieved
- Reduction in Effluent Generation and lower environmental Pollution load and statutory compliance to achieve and sustain Zero Liquid Discharge (ZLD)
- Significant Water Cost Saving
- Impact on Energy efficiency and de-carbonization
- Improved Sustainability Performance & Commitment
- Baseline Assessment (Water quality, Blowdown quantity, existing CoC)
- Water Quality Monitoring Drives Success
  (conductivity, pH, hardness, alkalinity, silica, and chloride levels)
- Optimization of Chemical Dosing
- Improve Moral of the team involved

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Thank You



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