2024

قمة الصلب العربي الـ 17
و المعرض الدولي للحديد و الصلب

17th Arab Steel Summit
and International Iron and Steel Exhibition

قطر ستيل
QATAR STEEL
Regional Host Sponsor

NALCO Water's Innovative Offerings for GREEN STEEL

NALCO Water
An Ecolab Company

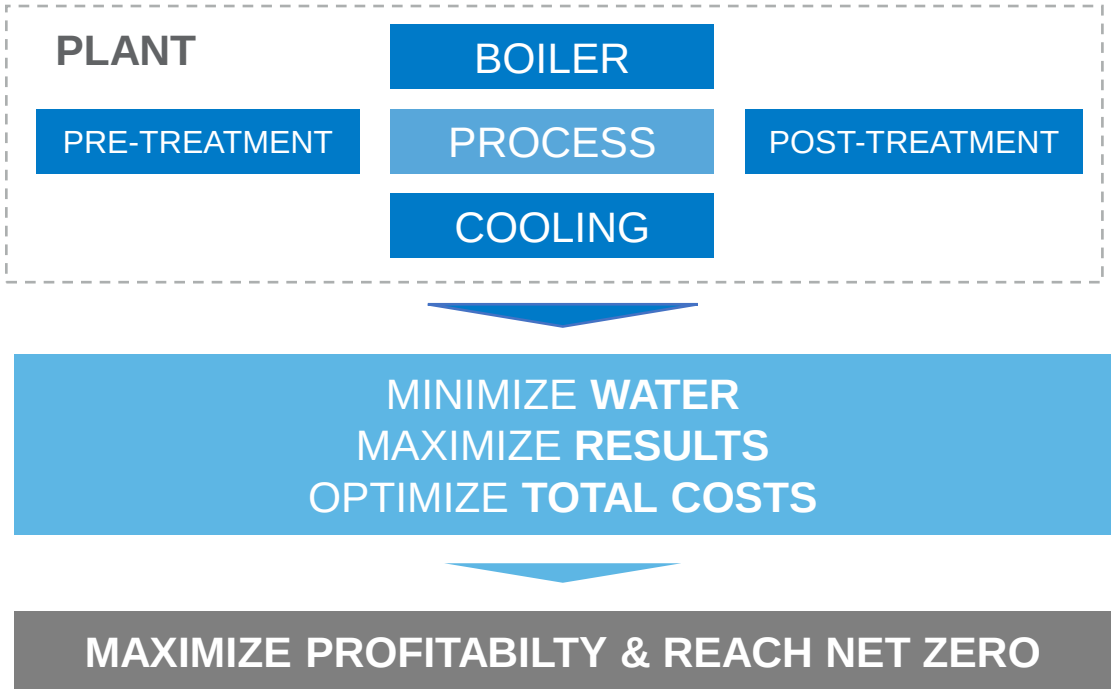
Agenda

- About Nalco Water
- Future of Green Steel & Associated Challenges.
- NALCO Water innovative offerings for Green H2/ Green Steel Industry.

WHAT IS NALCO WATER

Nalco Water, an Ecolab company, is a **global leader in water, energy and process management** for the industrial markets.

We offer connected chemistry, digital innovation, and extensive expertise to bring **significant savings in water, energy, and greenhouse gas emissions**, contributing to improved system performance and reliability at **optimized total cost**.



ALLIANCE FOR WATER STEWARDSHIP

Member of
Dow Jones Sustainability Indices
Powered by the S&P Global CSA

UN GLOBAL COMPACT

WATER RESILIENCE COALITION

GLOBAL OUTLOOK

Nearly **3 million** customer locations and **50,000** connected customer systems monitored

16 global technology centers

90+ manufacturing facilities

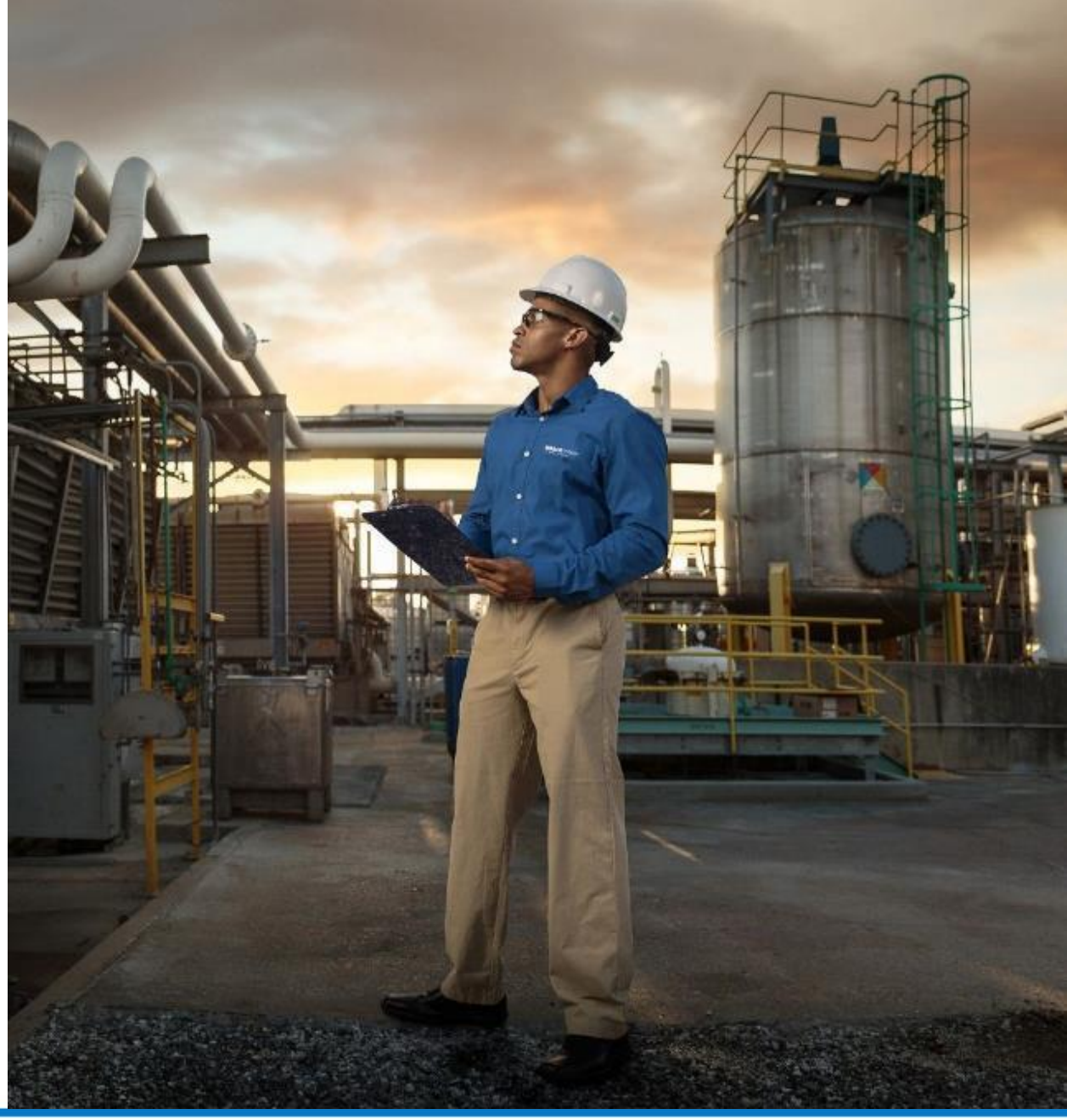
10,000+ patents

56,000 associates globally

2023 Ecolab annual revenue **$15.3B**

24,000+
sales and service associates

1,200+
RD&E scientists and technical specialists



STEEL MARKET OVERVIEW

- Our Market share is almost 2X of our Nearest Competitor.

WHO WE SERVE

TRUST AND CREDIBILITY

❖ *Top 15 world largest Steel producers around the world are NALCO's Key Customers.*

Sustainable Steel: Current Trends and Future Potential

Trends

- Increasing Adoption of the Greener Technologies by the Manufacturers
- Rising Developments on Green Hydrogen-based Direct Reduced Iron Electric Arc Furnace Technology
- Countries' Growing Focus Towards the Reduction of Greenhouse Gas Emissions

Growth Factors

- Energy and Cost Efficiency Owing to the Use of Recycled Steel
- Significant Increase in Steel Demand with Scarcity of Raw Materials and Energy
- Rising Demand in Automotive, Aerospace, Building and Construction Industries

Business Challenges

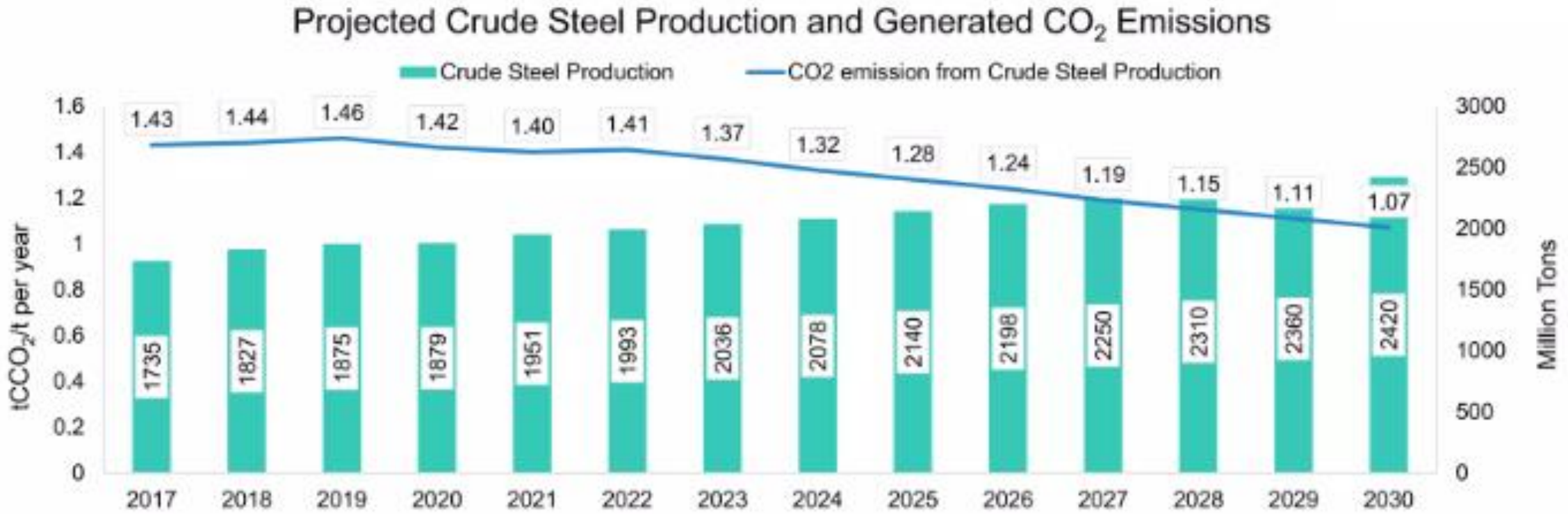
- High Production Costs of Green Hydrogen
- High Production Costs of Green Steel
- Complex Product Design and Inadequate Recycling Technologies

Opportunities

- Newer Technologies for the Decarbonization of Steel Production
- Rising Focus Towards Ensuring Supply of Sustainable Energy for Green Steel Production

FUTURE OF STEEL

Crude Steel Production and CO_2 Emissions Scenario



Source: IEA, World Steel Association, and BIS Analysis

- Conventional process routes is expected to dominate global crude steel production till 2030 but as per net zero scenario, significant changes represent the beginning of an important transformation. The share of the emissions-intensive Blast Furnace-Basic Oxygen Furnace (BF-BOF) route is projected to decline, while the share of scrap based Electric Arc Furnace (EAF) route is estimated to grow due to increased scrap availability.

Renewable Hydrogen **needs water and energy**

Water and energy are key imperatives

Water as central feedstock

Ultrapure water is required for electrolysis, but upgrading water quality is energy intensive

Water as cooling medium

Cooling is critical for electrolyser operation and hydrogen gas compression. Some cooling methods require less water but more energy.

20 m3/h

Ultrapure Water

100 MW

Electrolyser

Energy consumption

45–55 kWh / kgH_2

Water consumption

100MW

40 m3/h

Cooling Water

100 MW

Electrolyser

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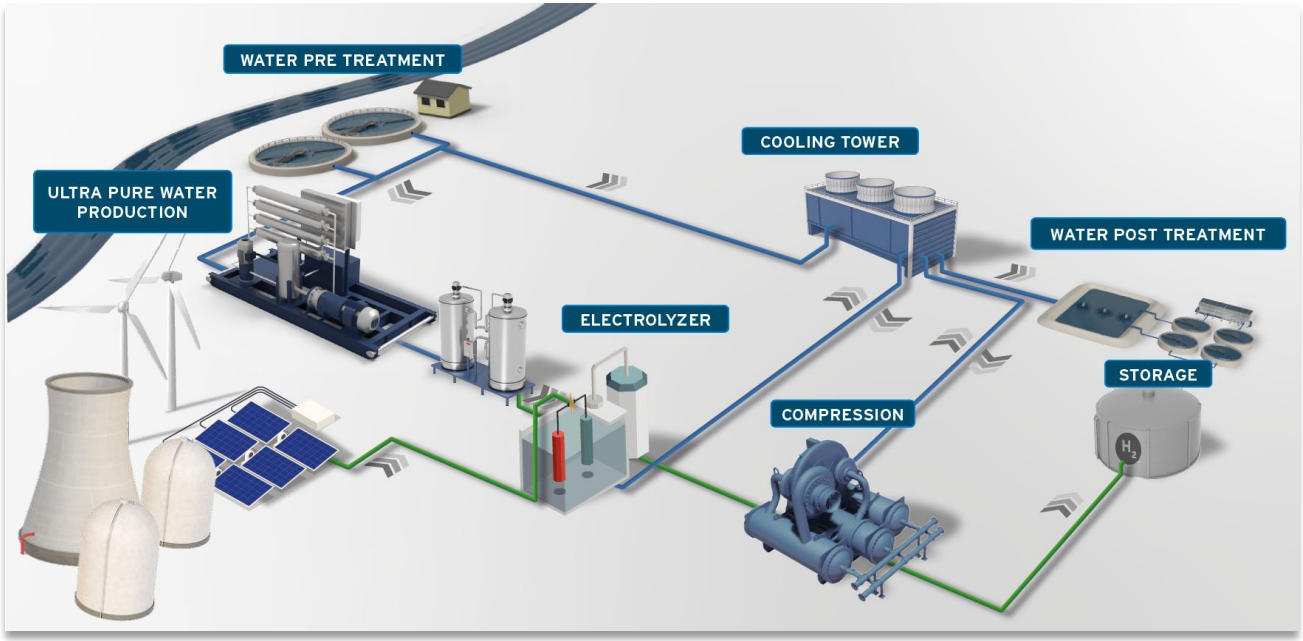
Water Footprint and Water Stress

Water and energy challenges in operating large-scale electrolytic hydrogen plants not visible in pilot units

- Process water quality variability from dynamic operations
- Variability in water source quality
- Seasonal or weather-related stresses
- Dynamics of co-located industries or off-takers
- Competing community needs
- Performance degradation over time



Most full-scale projects are first-of-a-kind

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Ecolab Green Hydrogen Strategy

We partner with our customers to deliver highest efficiency and minimized water footprint

CAPABILITIES

3 Global Green H2 Tech Centers

+

3 Pilot Electrolyzers

+

500+ Field People

+

200+ Engineering Team Members

+

24 Dedicated H2 Team Members

+

50,000+ systems remotely monitored 24/7

APPROACH

Innovative Chemistries
More efficient and sustainable

On-site Service
Expertise/Automation/ Digital to ensure KPIs under control

Digitalization
Developing insights, visibility and action

Water Reduction Solutions
Process water reuse, effluent recycle

VALUE

FROM COMMISSIONING

WE SECURE RELIABILITY

and

ELECTROLYZER EFFICIENCY OVER TIME

@

MINIMIZED WATER & ENERGY CONSUMPTION

METRIC

OPERATIONAL COSTS

WATER FOOTPRINT

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ULTRA PURE WATER PRODUCTION

Design **B**uild **O**wn **O**perate and **M**aintain UPW systems

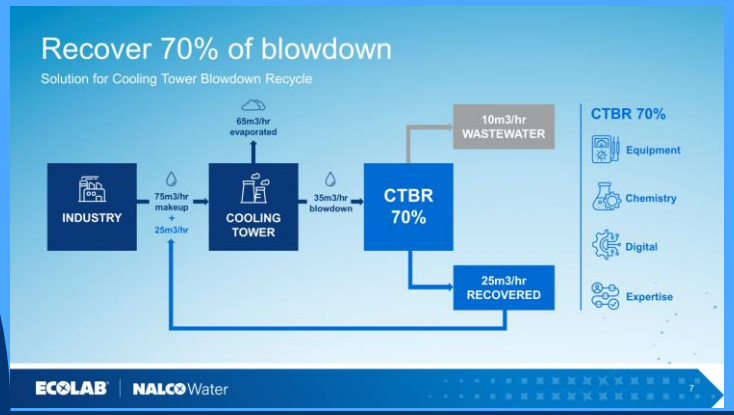
Long terms contract with **Management Outcome** obligations

EFFICIENCY

Reliability

OPTIMIZED WATER COOLING SYSTEMS

Innovative solution to **recover 70%** of the Cooling Tower **blow down** - This will significantly reduce the **water impact** of your operations



INNOVATION

3 Pilots electrolisers
3 Tech Centers

- H2 **bubble release efficiency** from electrode
- **Contaminant removal** in PEM

Purolite® An Ecolab Company

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DIGITAL SERVICE

26,000 employees in the field
50,000 systems digitally monitored

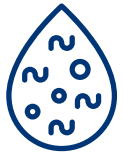
3DTRASAR™

3DTRASAR™ Automation

Available for :
UPW
Cooling
Close loops
WWT
Hydrogen*

Contaminants in PEM electrolyzers

Contaminant control strategy



Continuous **release of contaminants** from membranes

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Contaminant control require **continuous removal strategy**

Nalco Water focusing **on ion exchange-based design** with in-house resin supply (Purolite)

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Ion exchange known technology but further optimization for electrolyzer use required

I. Optimization of polishing unit design, sizing and location within internal streams
II. Improving PEM electrolyzer temperature profile with improved polished design
III. Resin lifespan optimization in PEM-recirculation loop

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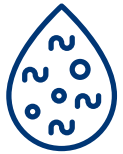
Contaminants & electrochemistry

Alkaline electrolyzers

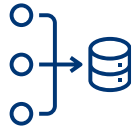


Contaminant are known to affect electrochemistry

quantitative relationship is not fully understood

Quantifying the contaminant effects is first step

to proper control strategy



Contaminant sources

I. Make-up water

II. Electrolyte Chemical.

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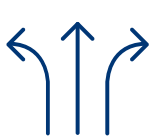
Performance improvement

Hydrogen bubble release from electrode

Unreleased hydrogen bubbles on electrode surface reduce the efficiency of electrolyzer



Modification of surface tension can help to coalescence bubbles

This will have direct effect on efficiency of electrolyser

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