



DNV

WHEN TRUST MATTERS

Water Management in the Chlor-Alkali Industry: Risks, Regulations & Strategic Solutions

Ensuring sustainable practices through compliance and innovation

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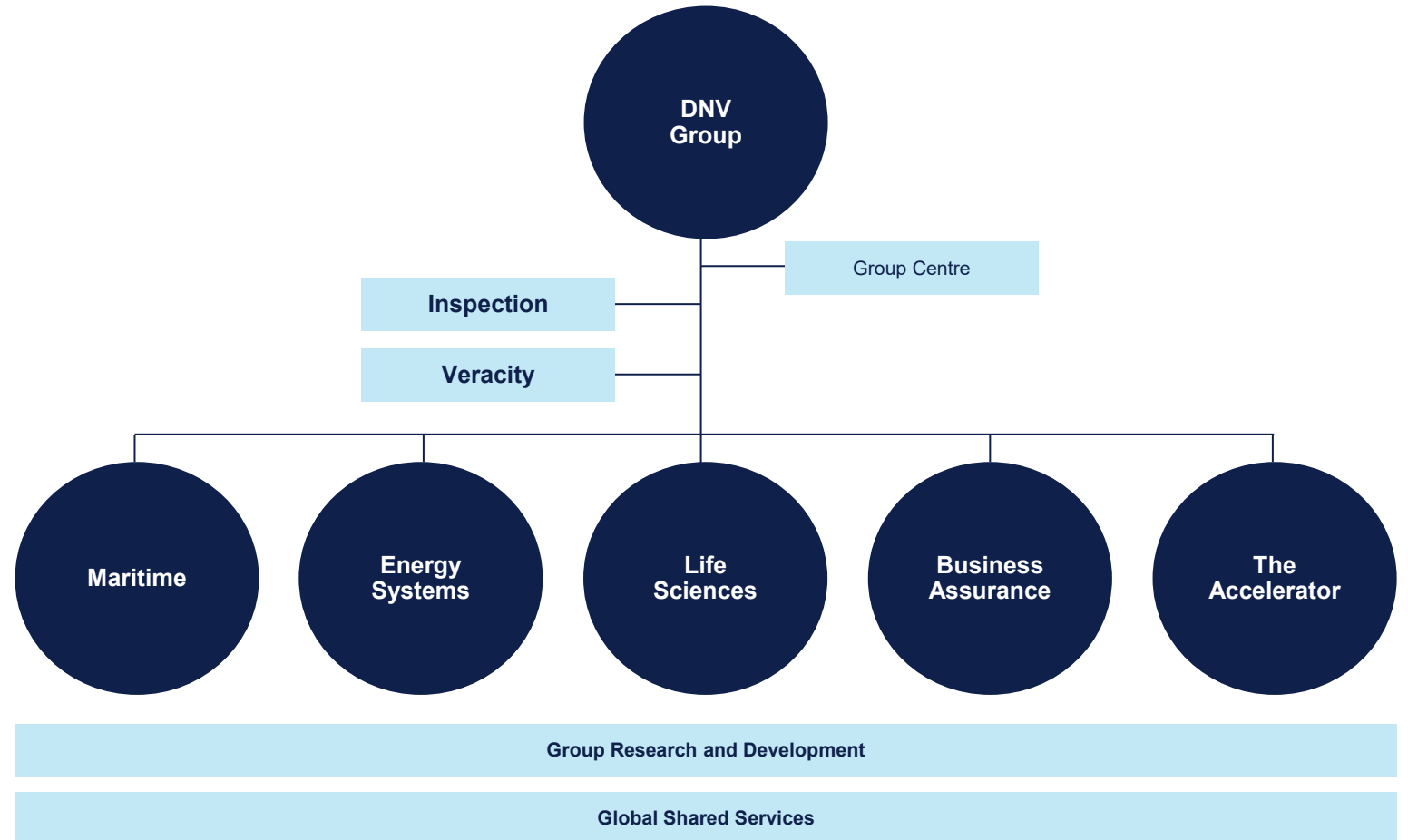
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About DNV

Organization

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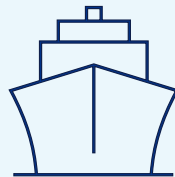
100+

countries

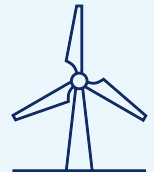
6%+

of revenue to R&D

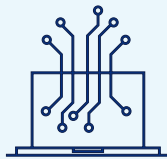
Ship and offshore
classification and advisory



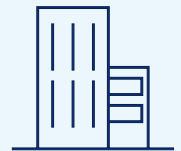
Energy advisory, certification,
verification, inspection and
monitoring



Software, cyber security, data
platforms and
digital assurance



Certification and assurance across
industry sectors, including
healthcare and ocean health



Our purpose

To safeguard life,
property, and the
environment

Our vision

A trusted voice
to tackle global
transformations

A trusted voice in global transformations

Decarbonization

Digitalization

Sustainability

Industry Context and Water Dependency

Why Water Matters for Chlor-Alkali Operations

- Critical Role of Water in Production
 - Water is essential for brine preparation, electrolysis, and cooling in chlor-alkali manufacturing processes.
- Water Scarcity Risks
 - Disruptions in water supply can halt production, causing financial losses and supply chain impacts.
- Water Stewardship Strategies
 - Chlor-alkali producers must adopt closed-loop systems and alternative water sources to reduce freshwater dependence.
- Regulatory and ESG Importance
 - Water management ensures compliance with regulations and supports environmental, social, and governance goals.





Industry Snapshot and Wastewater Complexity

- Chlor-Alkali Industry Processes
 - The industry uses membrane cell technology replacing mercury cells for safer, large-scale chemical production.
- Wastewater Complexity
 - Effluent contains extremely high TDS, chlorinated organics, and brine sludge, requiring advanced treatment methods.
- Advanced Treatment Solutions
 - Multi-stage RO, nanofiltration, thermal evaporation, and oxidation methods address difficult effluent treatment needs.
- Regulatory Compliance and Sustainability
 - Zero Liquid Discharge regulations drive investments in ZLD systems promoting water reuse and environmental safety.

Challenges and Strategic Risks

Key Water Management Challenges

- Freshwater Scarcity and Cost
 - Freshwater scarcity and rising tariffs increase operational costs for chlor-alkali producers competing with agriculture and domestic use.
- Complex Wastewater Treatment
 - High-TDS and chlorinated organics in effluent require advanced, costly treatment systems to meet environmental standards.
- Regulatory and ESG Compliance
 - Strict regulations like Zero Liquid Discharge and ESG demands compel companies to improve water governance and avoid penalties.
- Community and Social License Risks
 - Industrial water use can cause conflicts with local communities, risking social license and brand reputation.





Strategic Risks for Chlor-Alkali Producers

- Operational Water Risks
 - Water shortages can halt production and affect brine quality, impacting product output and maintenance costs.
- Financial and Regulatory Risks
 - High costs for water treatment and non-compliance penalties threaten financial stability and licensing.
- ESG and Reputation Risks
 - Poor water management harms reputation, reduces investor confidence, and limits green financing opportunities.
- Social License to Operate
 - Conflicts over water use with communities can cause protests and regulatory actions, threatening operations.

Solutions and Best Practices

Water Efficiency and Process Optimization

- Closed-Loop Cooling Systems
 - Recirculating cooling water reduces consumption compared to once-through systems, improving water efficiency.
- Brine Recovery and Purification
 - Reusing concentrated brine minimizes blowdown volumes and eases effluent treatment loads effectively.
- Digital Water Monitoring
 - IoT sensors and analytics provide real-time data on water quality and losses for proactive management.
- Leak Detection and Automated Controls
 - Leak detection programs and conductivity-based controls prevent waste and optimize water usage.



Advanced Treatment and ZLD Implementation

- Multi-Stage Filtration
 - Advanced treatment uses multi-stage reverse osmosis and nanofiltration to effectively remove dissolved salts and organics.
- Thermal Concentration Processes
 - Mechanical vapor recompression evaporators and crystallizers concentrate brine and recover solids in ZLD systems.
- Energy Optimization
 - Heat recovery and hybrid membrane-thermal designs reduce energy costs in evaporation stages of ZLD systems.
- Sustainability Benefits
 - ZLD provides regulatory compliance, freshwater savings, improved ESG ratings, and secondary revenue from salt recovery.





Alternative Water Sources and Circular Strategies

- Rainwater Harvesting Benefits
 - Rainwater harvesting supplements plant water needs during monsoon, reducing dependence on external freshwater sources.
- Treated Wastewater Use
 - Treated municipal wastewater can be safely reused in sensitive processes after strict risk assessments and quality controls.
- Industrial Symbiosis
 - Wastewater reuse between industries in clusters promotes efficient circular water management and cost savings.
- Water Stewardship Leadership
 - Adopting circular water strategies aligns with ESG goals and builds resilience against climate water stress.

ESG Integration and Case Studies

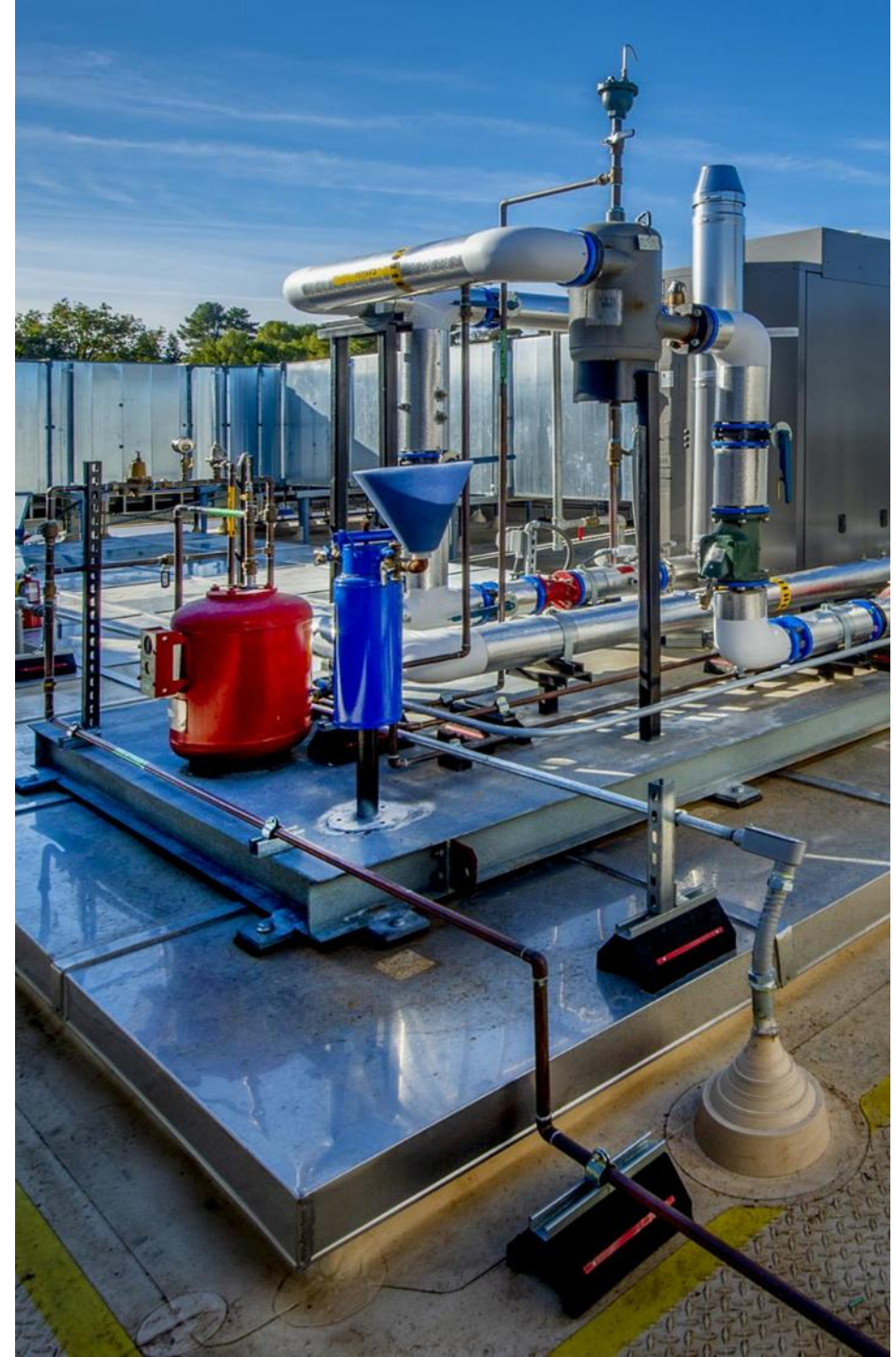


ESG Alignment and Water Stewardship

- ESG Frameworks for Water
 - Key frameworks like GRI 303, CDP Water Security, and UN SDGs guide water stewardship in the chemical industry.
- Proactive Water Risk Management
 - Chlor-alkali producers implement reduction targets, zero liquid discharge, and stakeholder engagement to manage water risks.
- Transparent Reporting and Investor Confidence
 - Reporting on water use, recycling, and effluent quality builds investor trust and supports sustainability-linked financing.
- Strategic Value of Water Stewardship
 - Integrating water stewardship into ESG boosts brand reputation, social license, and links to executive incentives.

Case Example: Indian Chlor Alkali Industry

- Zero Liquid Discharge Implementation
 - Industry deployed advanced ZLD systems using membrane filtration and thermal evaporation for near-total water reuse.
- Sustainability and Compliance
 - The initiative reduced freshwater use, improved compliance with CPCB norms, and boosted ESG performance.
- Community and Social Engagement
 - Industry also supports rainwater harvesting and community water projects, enhancing its social license to operate.
- Financial and Risk Benefits
 - Integrating water management improved investor confidence and secured sustainability-linked financing.



Case study 2 – Indian Industry

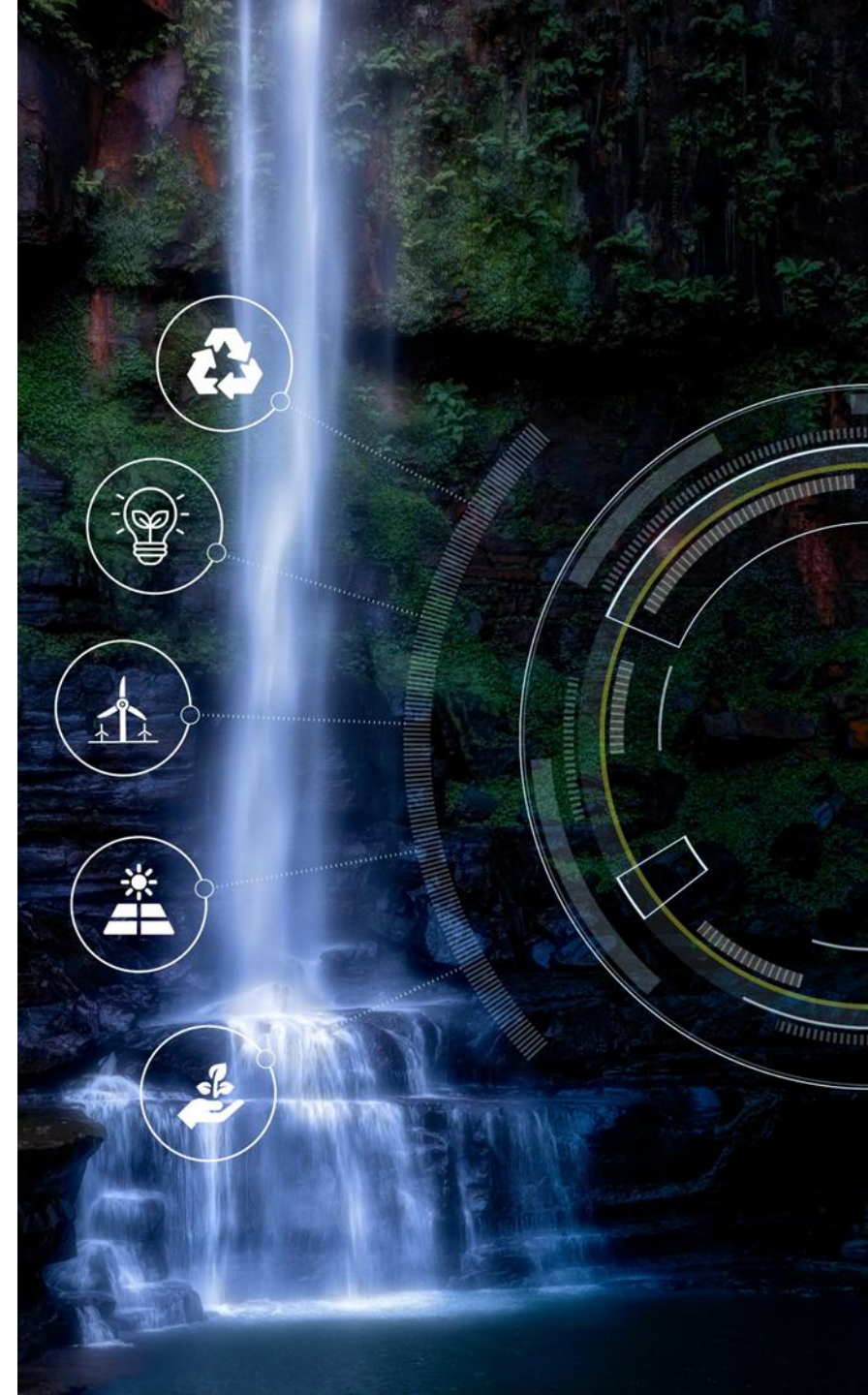
- Water Management Strategies
 - Industry has implemented multi-stage RO, nanofiltration, evaporation, and crystallization to achieve zero liquid discharge.
- Water Recycling and Efficiency
 - Treated water is recycled for process and cooling, reducing freshwater use and ensuring compliance.
- Sustainability Initiatives
 - Industry has also integrated renewable energy and ESG reporting to lead sustainable chemical manufacturing.



DNV's Role and Strategic Value

DNV's Services for Water Risk Management

- Water Risk and Footprint Assessments
 - Detailed evaluations of site-specific water dependencies and catchment vulnerabilities inform strategic water management.
- ESG Integration and Advisory
 - Guidance on embedding water strategies into ESG frameworks aligning with global standards like GRI and CDP.
- ZLD Implementation Support
 - Advisory services on zero liquid discharge technology, energy optimization, and resilient system design.
- Capacity Building and Assurance
 - Technical training and independent assurance enhance water stewardship and data credibility.



Thank you!

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