ENVIRONMENT

Environmental management

ACWA Power has developed an Environment and Social (E&S) Implementation Manual that sets out the minimum requirements for Environmental and Social Management Systems (ESMS) at all of its projects. The E&S Manual is aligned with the ISO 14001 standard, and it is designed to help each ACWA Power project company to develop and implement an ESMS that is appropriate to its specific project and context.

Every project at ACWA Power is a separate company, in which ACWA Power has a direct or indirect interest, typically 100%.

NOMAC, ACWA Power's wholly-owned subsidiary, is responsible for the operations and maintenance of the majority of ACWA Power's projects. NOMAC, with 2,163 employees, has developed plant-specific procedures to maximise safe, secure and efficient operations and maintenance. NOMAC has five globally respected ISO standards:

1. ISO 9001:2015 – Quality Management System
2. ISO 14001:2015 – Environmental Management System
3. ISO 27001:2013 – Information Security Management System
4. ISO 45001:2018 – Occupational Health and Safety Management System
5. ISO 22301:2019 – Business Continuity Management System

All our project companies are required to develop their own Environmental and Social Management System (ESMS) in accordance with the requirements of the E&S Manual, that aligns with international best practice and conforms with the International Finance Corporation's standards as a minimum.

In collaboration with other stakeholders in our projects, we set indicators and KPIs to promote and assure high environmental performance. We also implement feedback systems to monitor, audit and report such performance.

All our operations currently have ISO 14001 certification, to ensure the highest standards across energy usage, waste management and minimise environmental impact.

Our operations are being audited annually by independent third parties, to ensure compliance with the ISO standards.

Internally, we conduct HSSE audits on all our operations on an annual basis, where environmental aspects are audited.

The ESMS includes a number of key elements, including:

- A policy statement that commits the project company to managing its environmental and social impacts in a responsible manner.
- A risk assessment process to identify and assess potential environmental and social impacts.
- Mitigation measures to reduce or eliminate potential environmental and social impacts.
- Monitoring and reporting procedures to track the performance of the ESMS.
- Commitment to implementing measures to reduce the consumption of natural resources, while implementing measures to prevent pollution.

ACWA Power provides support to project companies in developing and implementing their ESMSs. This support includes training on the E&S Manual, as well as technical assistance on specific topics such as biodiversity management and community engagement.

By requiring all project companies to develop and implement ESMSs, ACWA Power ensures that our projects are managed in a sustainable and responsible manner. This is important for both the environment and the communities where we operate.

Waste management and circular economy

ACWA Power has targets for responsible resource use and waste reduction. Each project site is required to have waste reduction objectives as part of its Environmental and Social Management System (ESMS). These objectives are set in accordance with each project's environmental targets.

ACWA Power has an integrated waste management procedure to manage hazardous and non-hazardous waste. This ensures minimal impact on the environment and that local and international regulatory requirements are satisfied. The ideal way to reduce the stress on disposal systems is to reduce the amount of waste that is produced, so our emphasis is on reduction, re-use and recovery before disposal.

The circular economy is an innovative method aimed at minimising waste and maximising resource efficiency throughout the entire product lifecycle. Instead of the traditional linear model of 'take-make-dispose', the circular economy promotes a closed-loop system whereby materials are continuously reduced, re-used and recycled. In developing our integrated waste management system, we have pinpointed the optimal levels for recovering individual and collective materials, aiming to maximise material production savings, reduce resource costs and conserve energy.

ACWA Power's waste management involves identifying, segregating, packing, labelling, storage, transporting, treating and disposing of waste. It focuses on the reduction of waste generation at the source itself. Colour-coded waste skips and containers are clearly marked and placed at the point of source of the waste generation. Any hazardous waste generated by the industrial process is collected and segregated based on its nature, and a full set of safety procedures is applied to handling and disposal of such waste.

ACWA Power uses various means of waste disposal including incineration, landfill, decomposition and treatment based on the local availability of recycling and composting facilities, the cost of different disposal methods, and environmental regulations.

The specific methodology of re-use and recycling varies according to the type of waste (e.g., wood waste, used oil waste, cardboard, used paper, construction and demolition, and organic waste). Usually, used oil is sent to a third-party for recycling. Similarly, organic waste is sent to a composting facility.

ACWA Power is committed to the prevention of water loss and spillages at all of its operations. In addition to the commitments defined in our Corporate HSSE Policy, we have developed a spill contingency procedure that outlines the steps to be taken in the event of a water spill. This procedure includes measures to contain the spill, clean it up, and minimise the environmental impact.

	2021	2022	2023
Waste generated (tonnes)	23,483	25,959	32,632
Hazardous waste recycled and re-used (tonnes)	246	28	22.2
Non-hazardous waste recycled and re-used (tonnes)	110	101	64
Fly ash recycled and re-used (tonnes)	5,529	10,738	9,405
Hazardous waste disposed (tonnes)	2,435	3,836	2,793
Non-hazardous waste disposed (tonnes)	6,133	5,250	11,267
Fly ash disposed (tonnes)	9,030	6,006	9,081
Share of waste recycled and re-used of total waste generated	22%	40%	29%
Number of spills	9	8	22
Total volume of spillage (m^3)	**6**	**481**	**12**

Hazardous waste

Hazardous waste disposal decreased 27.2% compared to 2022. In 2022, due to major spills and maintenance activities, hazardous waste generation had increased.

Fly ash

There was a slight increase at R1IPP, SQIWPP and SIWPP, compared to last year. This was due to increased power generation capacity and the disposal of collected quantities due to maintenance activities.

Spills

There have been more spills in 2023 than the previous year but the total volume of spillage reduced from 481m³ to 12m³. In 2022, we had two notable spillages. Shuqaiq IWPP (not an ACWA Power project, but managed by NOMAC) had a spill of 330 m³ due to an accident of external origin. ACWA Power's CEGCO decommissioning project in Jordan had a 145 m³ of spill. Shuqaiq has now been fully divested and the CEGCO asset has been fully decommissioned.

Recycled waste

While ACWA Power kept recycling levels stable, with no significant change in quantity, there was a notable increase in non-hazardous material compared to last year that led to lowering the overall recycle percentage, attributed to new plants entering operation.

Air quality

In our ongoing commitment to sustainability, we recognise the critical importance of reducing NO_x, SO_x and non-methane volatile organic compounds (VOCs) emissions in our operations. We understand our responsibility to minimise our environmental footprint, while providing reliable energy solutions.

All our project companies have ESMS in place. This includes management and mitigation measures for NO_x, SO_x and VOCs. At ACWA Power, we provide our project companies with tangible objectives, according to the nature of each project and its environmental target.

During our Environmental Impact Assessment studies for each of our projects, we conducted a Potential Impact, Mitigations, Management and Residual Impact study. This includes identifying all potential sources of air emissions, with detailed emissions modelling, to ensure compliance with national regulations and IFC standards. Each potential impact is assessed in terms of its likelihood and severity, with mitigation measures put in place to minimise the risk.

In our operations, Continuous Emissions Monitoring Systems (CEMS) are in place to ensure compliance is maintained throughout our asset's lifetime. As part of mitigation measures, our plants are equipped with modern low NO_x burners to minimise the impact of such emissions.

In 2023, our air pollutant emissions intensity on an equity basis for NO_x, SO_x and VOC were 1.09 kg/MWh, 4.86 kg/MWh and 0.042 kg/MWh, respectively. This measurement of the intensity is based on the air pollution produced per gross electricity generation. All intensity figures have shown a continuous downtrend over the past few years. Compared to the baseline year of 2020, we have achieved reductions of 6% in NO_x, 15% in SO_x and 4% in VOC emissions intensity. We will continue to engage with the offtakers of our oil-fired assets to look for potential conversion solutions, in our continuous efforts to reduce our air emissions.

Total portfolio basis

Year	2020	2021	2022	2023
t NO_x	130,227.5	138,165.0	121,741.3	126,089.6
t SO_x	520,598.0	570,001.2	469,641.2	434,132.2
t VOCs	5,139.0	5,214.9	4,830.6	5,081.7
Intensity of NO_x emissions (kg/MWh)	1.04	1.07	1.01	0.98
Intensity of SO_x emissions (kg/MWh)	4.15	4.40	3.88	3.36
Intensity of VOC emissions (kg/MWh)	0.041	0.040	0.040	0.039

Total equity basis

Year	2020	2021	2022	2023
t NO_x	52,732.2	56,246.7	51,476.1	54,075.3
t SO_x	260,459.9	282,316.6	255,974.1	241,842.0
t VOCs	2,006.5	2,076.7	1,956.4	2,095.8
Intensity of NO_x emissions (kg/MWh)	1.16	1.16	1.14	1.09
Intensity of SO_x emissions (kg/MWh)	5.72	5.83	5.66	4.86
Intensity of VOC emissions (kg/MWh)	0.044	0.043	0.043	0.042

Biodiversity

All our projects are subject to an environmental and social impact assessment (ESIA) to identify and mitigate any potential negative impacts to biodiversity and adhere to international good practice standards, such as those set by the International Finance Corporation (IFC), World Bank Group (WBG) and European Bank for Reconstruction and Development (EBRD).

We establish specific methodologies and metrics within an ESIA study report for biodiversity-applicable projects. This involves identifying indicators within each project's ESIA report and integrating biodiversity studies as necessary.

In accordance with our corporate responsibility principles and relevant regulations, ACWA Power is committed to protecting terrestrial and marine biodiversity. We achieve this through a combination of project-specific mitigation measures and broader initiatives, such as the relocation of coral reefs in the Red Sea region and the development of a nursery for endangered species in the MEA region, and restoration of land in the Africa region.

ACWA Power:

- does not currently have a standalone forest plantation project, but we do support forestation initiatives through our corporate responsibility programmes. For example, we have planted Ziziphus Spina, mangroves, and Tamarix Aphylla trees in various locations. We are always exploring new opportunities to support forestation, and we are open to considering new forest plantation projects if they align with our strategic goals and values.
- has some projects located in areas designated as protected by the governments of host countries, such as the Red Sea and Hassyan projects. We are exploring ways to incorporate habitat restoration into our existing projects and to develop new habitat restoration projects in the future.
- engages with governments, regulators, NGOs, and local or international organisations to prevent biodiversity loss at the places of operation in a number of ways, including:
  - complies with all applicable environmental regulations in the countries where we operate. This includes obtaining the necessary permits and approvals for our projects and implementing mitigation measures to minimise our impact on biodiversity.
  - consults with governments, regulators, NGOs, and local or international organisations throughout the project development process. This helps us to identify and address potential biodiversity impacts, and to develop a Biodiversity Action Plan (BAP) and implement effective mitigation measures.
  - supports research on biodiversity and conservation in the areas where we operate. We also work with local and international organisations to build capacity for biodiversity management and conservation.

The fully sustainable off-grid, circular economy Red Sea project

This is the world's largest completely off-grid fully sustainable eco-resort project is supported by a multi-utility system developed by ACWA Power, powered by five solar plants with a total capacity of 406MW and one of the world's largest battery energy storage systems (BESS) of 1.2 GWh, along with three 100% renewable-powered RO desalination plants. This circular economy will also include a unique sustainable wastewater treatment solution that will eventually treat 16,000m³/day of wastewater that will be used to grow wetlands and plant nursery creating a natural carbon sink.

ACWA Power has partnered with Red Sea Global (RSG) to develop more than 8.3 hectares of new wetlands through its sustainable approach to utilities.

The wetland approach to sewage treatment starts at the screening stage to remove solid matter. After this, effluent is sent to the wetland site made up of phragmites plants, a type of common reed, which naturally absorbs the nutrients and metals, treating the water without the need for chemicals.

Once treated and in compliance with the national regulation for water quality, the Treated Sewage Effluent (TSE) is transferred to RSG's Landscape Nursery, which, with an area of more than 100 ha, is the largest in the Middle East, to irrigate the trees and shrubs. To date, more than five million plants have been grown to landscape RSG's destinations, and 30 million will be grown by 2030.

When the phragmites reeds grow too long or stop effective water treatment, they are pruned, and the ends are recycled and with other waste materials are made into bricks for the project construction.

By mid-2024, the sewage treatment facility will reach its design capacity of treating 16,000m³/day of wastewater and result in 17 hectares of new nature-based carbon solutions being constructed.

Water management

Sustainable and technologically advanced

We operate in water-scarce regions, such as the Gulf, where global issues such as climate change, population growth, industrialisation and water waste are likely to increase water stress in the future. These regions' heavy dependence on desalination poses sustainability risks itself, with cost and environmental impacts remaining key concerns. It is therefore imperative for ACWA Power to consider water management a key part of our ESG and corporate strategy. Oversight of water management policies lies with our Board of Directors, with strategy monitoring conducted at the Executive Management level.

As part of our ESMS, we aim to minimise the impact of our operations on water resources. In our operations we encourage the use of non-freshwater resources such as desalinated and recycled water.

For example, our Zarqa power plant uses dry-cooling techniques that significantly reduce the amount of water required for power generation operations.

Another example where we have optimised our water consumption is at our Sirdarya plant in Uzbekistan. The project has been designed to maximise the re-use of water where possible. The plant has cooling tower blowdown, boiler blowdown and condenser blowdown flow streams via a demineralisation system to achieve zero liquid discharge at the site.

Water-related risks are identified during our Environmental Impact Assessment studies which we conduct for all our projects, with mitigation measures in place to minimise any potential impact. To address these challenges, we rigorously monitor and manage key water quality metrics related to discharge, such as Temperature and Total Dissolved Solids (TDS) within the designated mixing zone, to ensure compliance with local regulations. In addition, continuous monitoring of biodiversity and aquatic life is conducted to identify and avoid any potential negative impacts.

More than two-thirds of our desalination plants use world-class energy-efficient technology, namely seawater reverse osmosis (SWRO). As we grow our capacity, SWRO will become the sole technology used in our desalination plants. This will play a critical part in reducing water production costs and energy consumption significantly and contributing to our sustainability and ESG goals.

Water is a critical resource for our operations in both power generation and sea water desalination. Water used in our power plants is primarily for cooling and condensing, and 99.99% of the desalinated water discharge is returned to the sea.

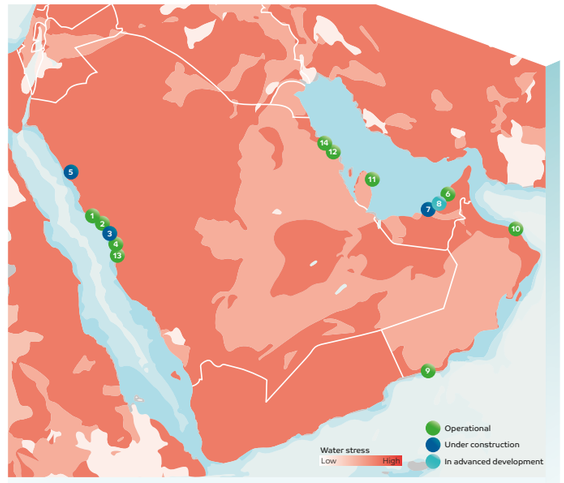
Our overall water withdrawal for 2023 was 99.94% from seawater, with 0.06% coming from freshwater. Based on the Aqueduct Water Risk Atlas, water withdrawal from the sea is considered to not affect water stress. ACWA Power is committed to using desalinated water for our activities and minimise the withdrawal of freshwater where possible.

We continue to improve the measurement and reporting of our water performance by integrating internal reporting systems for water metrics.

Jazlah IWP, the first large-scale, operating, integrated desalination/ solar PV project in the Kingdom.

ACWA POWER'S DESALINATION ASSETS

		m³/day	COD
1	Rabigh 3 IWP	600,000	Q1 2022
2	Petro-Rabigh IWSPP	133,920	Q2 2008
	Petro-Rabigh (Phase 2) IWSPP	54,480	Q1 2018
3	Rabigh 4 IWP	600,000	Q1 2026
4	Shuaibah IWPP	880,000	Q1 2010
	Shuaibah Expansion IWP	150,000	Q4 2009
	Shuaibah 2 IWP	250,000	Q2 2019
5	The Red Sea Project	33,000	Q3 2024
6	UAQ IWP	682,000	2022
7	Taweelah IWP	909,000	Q1 2024
8	Hassyan IWP	818,000	PPA signed
9	Salalah IWP	114,000	Q1 2020
10	Barka 1 IWPP	91,000	Q3 2023
	Barka 1 Expansion IWP	45,460	Q2 2014
	Barka 1 Phase II Expansion IWP	56,826	Q1 2016
11	Al Dur Phase II IWPP	227,000	Q2 2022
12	Jazlah IWP	600,000	Q1 2023
13	Shuaibah 3 IWP	600,000	Q2 2025
14	Marafiq IWPP	800,000	Q4 2010



Water desalination plants are located in the extremely high water risk region, where we are contributing a positive impact by distributing portable water to water-scarce regions. ACWA Power's desalination assets are in the Middle East, an area of extremely high water risk.

Boundary definition

The boundary is the operational assets in which ACWA Power has equity shares and which have reached full plant Commercial Operation Date (COD).

m³	Water withdrawal[1]	Water discharge[1]	Water consumption[1, 2]	Internal water consumption	Water export
IWPP	6,479,397,765	5,740,627,867	738,769,898	33,132,869	705,637,029
Power	6,247,847,658	6,235,658,958	12,188,701	12,188,701	–
Water	1,987,035,775	1,231,245,680	755,790,095	13,149,846	742,640,250
Total	**14,714,281,199**	**13,207,532,505**	**1,506,748,694**	**58,471,415**	**1,448,277,279**

m³	Seawater	Surface water	Third-party water	Ground water
Source of water withdrawal	14,705,516,563	7,474,270	1,104,548	185,818
Source of water discharge	13,205,559,814	1,972,691	–	–

%	sea	Others (Surface water, third-party water and Ground water)
Source of water withdrawal	99.94%	0.06%
Destination of water discharge	99.99%	0.01%

Categorisation

Seawater	Surface Water	Third-part Water	Ground Water
Sea	River	Government	Water well
	Dam	DEWA	
	Evaporation pound	Tanker	
		Supplier	

[1] Values are independently verified by an external party. Refer to the assurance report on page 244.
[2] Water consumption = Internal water consumption + water export.

ACWA Power's Seawater Reverse Osmosis (SWRO) energy and GHG efficiency

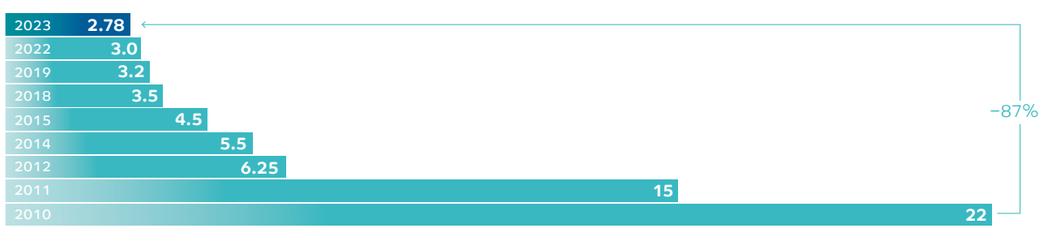
ACWA Power's technical advancements in SWRO plants underscore significant improvements in both efficiency and sustainability. By implementing a pressure centre design, fewer high-pressure pumps are needed, improving both operational efficiency and flexibility in managing RO trains. The N-1 redundancy configuration keeps all trains operational, lowering energy consumption and improving water quality through enhanced permeate splits.

Additionally, the integration of solar PV plants within SWRO facilities helps reduce carbon emissions and lowers electricity costs by minimising grid dependence. This initiative has been successfully implemented across several projects, including Jubail 3A, Taweelah, Shuaiba 3 Conversion, and Rabigh 4 SWRO. Innovations such as high efficiency pumps, pressure exchangers, and membranes have further optimised energy use and salt rejection rates, while energy recovery devices have significantly cut pump costs and energy consumption without compromising water quality. Online analysers are also used to consistently monitor and maintain the high quality of potable water.

We are developing a range of SWRO plants, from as small as the 1,000 m^3/day Red Sea Project to the world's largest SWRO plant at Taweelah IWP, producing 909,000 m^3/day. We optimise the specific power consumption and availability to deliver the lowest water tariffs, for human consumption and agricultural use.

For instance, at Hassyan IWP (SWRO capacity of 818,000 m^3/day), we have achieved the lowest water tariff in the history of desalination, $0.365/$m^3$ (which is almost 10% lower than the previous record), by optimising the Specific Power Consumption (SPC) and using efficient process design.

Specific Power Consumption of our desalination plants, kWh/m^3



We have achieved an energy consumption reduction of 87% since 2010. We have gone through three phases to accomplish this: the first phase, from 2010 to 2012, entailed moving away from thermal coupling to SWRO and this enabled us to reduce the SPC from 22 kWh/m^3 to 6.5 kWh/m^3; the second phase, up until 2017, was a period when we improved our design and operations such that we reduced our SPC to below 4 kWh/m^3; during our current phase, with our paradigm shift in design, membrane analysis and big data analytics, we have kept the SPC at a level of only 3 kWh/m^3. In fact, we have recently launched Taweelah 3 IWP, the very first SWRO plant partly using renewable energy sources and we designed the Rabigh 3 IWP, the first plant in Saudi Arabia to be built on a pressure centre design.

We have also implemented artificial intelligence within plant operation and control which has improved power consumption and further availability and reliability. There was no increase in the redundancy level of the plant. In 2024, we are expecting further improvement via AI implementation within plant operation to reduce power consumption and chemical use, predict failures and enhance preventive maintenance.

ACWA Power is now exploring and piloting a new desalination method, Hydraulic Injection Desalination (HID), which is expected to be more energy-efficient than any other current technology. In addition, we are increasing water availability and reliability of supply by implementing AI within plant operation and control, to reduce power requirements and chemical consumption, predict failure and enhance preventative maintenance.

The thermal water desalination processes

- **Multi-stage flash distillation (MSF)**
  From the 1970s to 1990s, the most common desalination method involved heated seawater flashing into steam as it passed through vacuum-induced chambers. This process typically involving 20 to 30 stages, continuously lowers pressure without additional heat, condensing steam into fresh water using cool incoming seawater.
- **Multi-effect distillation (MED)**
  Like MSF, MED uses evaporation and condensation across multiple stages at progressively lower pressures without extra heat. The key difference lies in the evaporation method; MED operates at lower temperatures (~70°C) and involves seawater film contacting heating tubes. Despite their 50-year history, reverse osmosis (RO) now leads due to higher efficiency.

The difference in energy intensity between types of desalination plants

- Multi-stage flash Distillation (MSF): 16–22 kWh/m^3
- Multi-effect Distillation: (MED) 12–18 kWh/m^3
- Reverse Osmosis (RO): 2.7–3.5 kWh/m^3

The amounts above are equivalent electrical energy across all assets. The intensity depends on a specific plant's configuration and the local seawater conditions.

Seawater desalination – environmental concerns and mitigation

ACWA Power identifies and manages the environmental impacts at its desalination plants, as indicated in the table below.

Concern	Mitigation
Concentrate discharge	Disperse concentrate through multiport diffuser
Marine pollution	Treatment of all backwashing and cleaning wastes
Seawater intakes	Use subsurface or submerged intakes with low intake velocities
Chemical use	Implement low or no chemical use technologies
Material use	Improve recyclability and reuse of materials
Land use	Minimise land use and landscape impacts through site selection
Energy use and GHGs	Use renewable power sources and digital technologies

Our desalination projects adhere to the rigorous environmental protection regulation mandated by the Equator Principles of Finance institutions (IFC) and the World Bank, ensuring minimal ecological impact. An independent audit conducted for ACWA Power's Rabigh 3 IWP, has confirmed no significant ecological impact in the aquatic ecosystem, reinforcing our commitment to sustainable operations.

Brine management

Minimising the environmental impact of brine discharges (defined in multiple engineering references, e.g., American Water Works Association – AWWA) requires an integrated project development approach.

- Early site selection to avoid sensitive habitats.
- High-efficiency multiport diffusers to ensure optimal initial dilution of brine.
- Advanced hydrodynamic modelling to maximise brine dilution and minimise environmental impact.
- Real-time monitoring and extensive marine surveys during both construction and operation phases.

We have made significant strides in increasing the efficiency of the reverse osmosis (RO) process, enhancing water recovery rates from 37% to 45%, moving closer to the thermodynamic limit of 60% at 70 bar. This high recovery rate reduces the volume of brine discharge and minimises the intake of juvenile fish and larvae. Our plants also optimise chemical usage, further reducing environmental impacts.

A key achievement in our operational strategy is the transition from thermal desalination to more sustainable SWRO technologies. For instance, the Taweelah IWP in UAE, the world's largest SWRO plant, derives a third of its energy from on-site PV, while our Red Sea Global RO units are powered entirely by renewable energy. This shift significantly reduces both the thermal impact on marine environment and our carbon footprint.

Looking forward, we are exploring innovative solutions such as brine mining and the potential for Zero Liquid Discharge systems to further reduce environmental impacts. Our long-term collaboration with renowned marine consultants ensures continuous improvement in our operational processes and environmental strategies.