

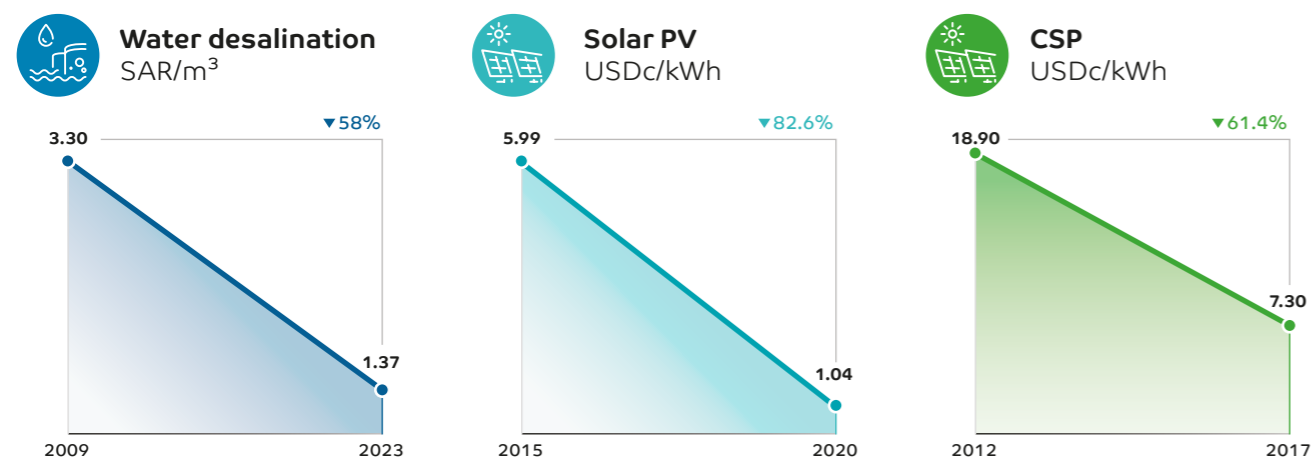
INNOVATION REVIEW

Innovation is at the core of ACWA Power and has been since the Company's inception 20 years ago. It gives us competitive advantage, creates value, and is a vital ingredient in the energy transition because it enables

us to move faster and make our plants more energy efficient and sustainable. It also delivers world-beating, low tariffs for offtakers and for the communities in which we serve.

ACWA Power has been leveraging innovation to deliver tangible benefits to offtakers

Tariff reductions achieved across core technologies



Source: Company information

Innovation, a key enabler for ACWA Power's ambitious growth strategy

ACWA Power stands at the forefront of technological innovation in energy and water desalination and is a well-established leader in the industry. This was achieved through our commitment to excellence in continuously enhancing the performance of existing technologies while also spearheading the introduction of new cutting-edge innovations into the market on a large scale. The expertise we have acquired over time in perfecting this approach gives us the confidence to maintain our leadership status as we embark on our 2030 growth strategy.

Our domains of technology excellence span water desalination, renewables, hydrogen, Battery Energy Storage Systems (BESS), system integration, and digitalisation. With the overarching goal of enhancing energy efficiency in these technologies, we are decarbonising both our existing and future projects. And by harnessing the power of these technologies, we are not only meeting the demands of the present but also shaping the future, towards a greener and more sustainable world.

Partner of choice...

Given our expertise and technological prowess as mentioned above, ACWA Power is the ideal partner for governments and offtakers seeking to implement energy and water projects at scale, by leveraging the latest advances in technology and digitalisation to deliver optimal outcomes. Whether it's enhancing energy security or improving water access while mitigating environmental impacts, partnering with

ACWA Power ensures the realisation of the most efficient and effective projects and programmes. Moreover, ACWA Power serves as an invaluable collaborator for technology developers and R&D partners. Through strategic partnerships and co-development initiatives, we provide a unique platform for the development and commercialisation of innovative technologies.

ACWA Power, the bridge between the lab and field

ACWA Power has a structured and disciplined approach to innovation and a roadmap which encompasses energy transition, renewables, storage and green fuels, and water desalination technologies.

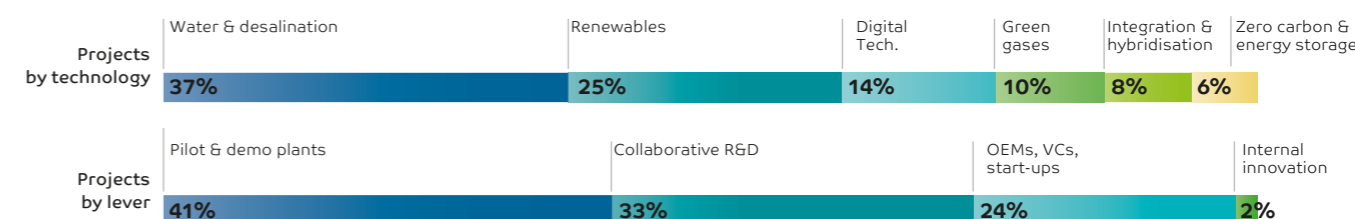
R&D and innovation serve as pivotal drivers for value creation within our organisation and provide us with several levers to enhance our competitiveness, including leveraging first-mover advantage and adopting the best new technologies available, while also achieving operational excellence through the optimal utilisation of existing technologies. This requires a dynamic approach to the market at the appropriate time by proactively anticipating game changing developments through active monitoring. To bolster competitiveness with emerging technologies,

we engage in co-development initiatives and pilot programmes at our own plants. Simultaneously, we prioritise internal development and collaborative efforts to enhance operational excellence by leveraging existing technologies. This multifaceted strategy ensures that we remain agile and responsive to market shifts while continuously advancing our capabilities.

There are 36 ongoing projects across three business verticals, with a continuing bias to water desalination, where there are significant opportunities for further development, and a spread of initiatives across renewables and digitalisation. The project levers include pilot and demo plants, collaborative R&D, start-ups and internal innovation.

ACWA Power's innovation roadmap covers all aspects of growth strategy

Ongoing projects by technology and initiatives



Thought leader through collaborative R&D...

ACWA Power's strategy for technology innovation and R&D emphasises collaboration and involves partnerships with R&D partners, original equipment manufacturers (OEMs) and start-ups, rather than relying solely on an in-house R&D unit. We partner with leading universities in the Kingdom, technology companies, and strategic partners through an open innovation system.

Aligning with our commitment to driving local economic development and industrialisation, ACWA Power is dedicated to fostering the localisation of technology development within Kingdom. We are contributing to the strategic research agenda in the Kingdom through the Ministry of Energy Innovation Programme and Research Development and Investment Authority (RDIA), which oversees research and development funding in the country. Our successful collaboration with King Abdullah University for Science and Technology (KAUST) in desalination, solar PV and hydrogen will expand to new areas, culminating in the establishment of a joint Clean Energy and Water Desalination Technologies Development Centre.

Through these efforts, ACWA Power not only contributes to the diversification of the Saudi economy but also reinforces our commitment to driving positive socio-economic impact within the communities we serve. Following the model in the Kingdom, we are also building an R&D collaboration network with institutes and partners in the countries where we operate, with the goal of enhancing expertise to facilitate localisation and industrialisation within our key markets.

ACWA Power's increased focus on innovation has led to notable achievements



¹ ACWA Power was ranked the fourth most innovative company in the Kingdom's energy sector, and the ninth most innovative overall by Forbes Middle East.



Our innovation journey

Throughout 2023, we forged 24 MoUs with leading technology firms and organisations worldwide, focusing on desalination, solar PV, hydrogen, and BESS. An additional nine MoUs were secured in the first quarter of 2024.

By the end of 2023, we had filed a total of 15 patents, primarily in desalination but also in green hydrogen and solar PV. Furthermore, we registered three trademarks and completed three IP sprints in the Kingdom.

At ACWA Power, fostering innovation is ingrained in our culture, and we value individuals who challenge conventions, seek new approaches, and take

calculated risks. In 2023, we conducted three internal innovation challenges and IP sprints, receiving and evaluating around 150 potential ideas. Additionally, we are committed to promoting innovation globally and organised four external engagements, which yielded over 100 potential ideas.

From its inception as an embedded function with limited resources in 2020, the Innovation and R&D department has evolved into a well-structured business support unit, now reporting to the Chief Technology Officer and overseeing a broader spectrum of streamlined activities. With these accomplishments, the department is primed to contribute to our growth strategy into 2024 and beyond.



ACWA Power, the world leader in water desalination

In a world where access to clean, potable water remains a pressing challenge, with the strain on freshwater resources posed by an increasing population, ACWA Power stands out as the world's largest private company for desalination, dedicated to not just meeting the world's water needs, but to reshaping the very nature of water provision. Over the years, ACWA Power has led efforts to develop innovative solutions, while setting new benchmarks in providing safe drinking water to communities around the globe.

Since 2007, ACWA Power has reduced the levelised cost of water by nearly 45% and has developed highly efficient Reverse Osmosis (RO) technology, used at most of ACWA Power's water assets. Furthermore, numerous projects within the company's portfolio harness renewable energy sources, driving down energy requirements for water purification. Over the past decade alone, ACWA Power has managed to reduce Specific Power Consumption (SPC) at our plants by an outstanding 87%.

ACWA Power's water portfolio currently comprises 19 assets, spread across four GCC countries, with a contracted capacity of 7.6 million m³/day, constituting 20.6% of its total portfolio in terms of project cost. We serve the demand of 20% to 30% of the local population in each of the 4 countries where we operate. All our plants are designed, built, and operated to adhere to Product Water (PW) standards, satisfying the stringent requirements of the world's largest off-takers.

Proven track record



the largest SWRO plants in the world (Guinness World Record holder)



the lowest water desalination tariff in the world



the first hybrid solar PV SWRO plant in the world



the largest hybrid solar PV SWRO in the world



the first and only 100% green SWRO plant in the world

¹ As of 31 December 2023.

² Seawater Reverse Osmosis.

³ Multiple Stage Flash distillation (thermal desalination).

⁴ Multiple Effect Distillation (thermal desalination).

ACWA Power water desalination portfolio¹

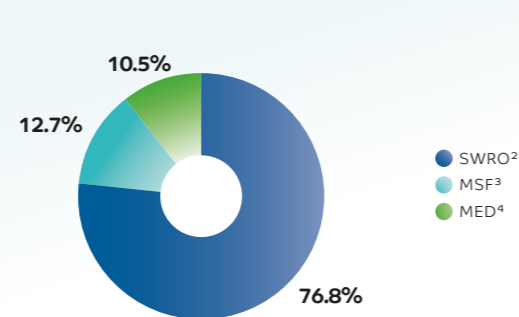


Capacity by region



ACWA Power produces **30%** of the total desalinated water in the Kingdom

Capacity by technology



Our SWRO desalination journey

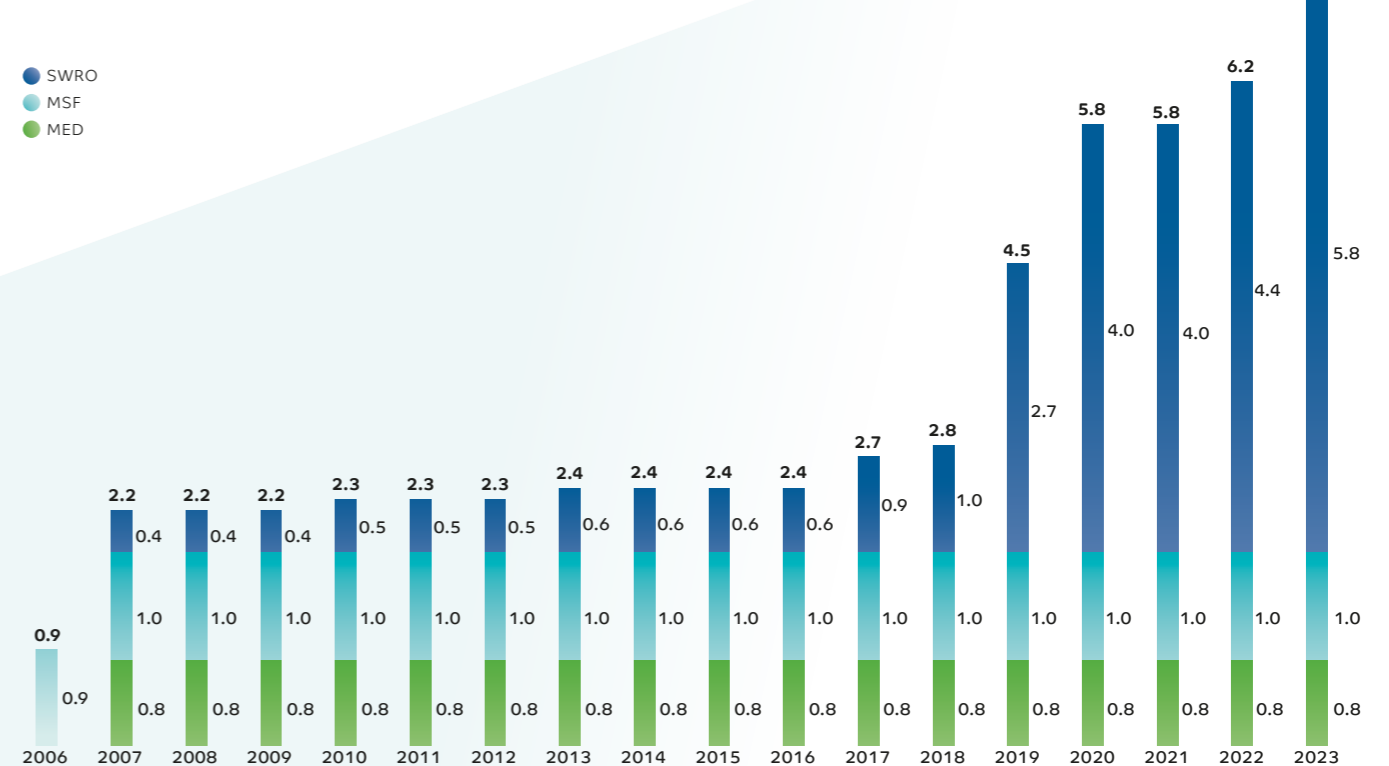
ACWA Power entered the business in 2009, seizing on SWRO as a potential replacement for traditional, oil-fired thermal co-generation methods of desalination, and launching our 150,000 m³/day SEPSCO IWP in the Kingdom. This was followed by the development of two large commercial SWRO plants on the west coast of the Kingdom over the next three years. These projects successfully demonstrated efficiency with significantly lower SPC and marked a permanent shift from thermal co-generation to SWRO.

Over the next five years until 2017, we invested heavily in developing, applying and refining the technology and effectively reshaped the entire market. With conventional energy prices increasing significantly, ACWA Power developed integrated plants that combine the environmental and commercial benefits of reverse osmosis with renewable energy sources (PV). This advanced integration led us to develop some of the world's largest RO plants, while continuously breaking records for the world's lowest levelised water tariff by significantly reducing SPC in our plants through big data analytics, advanced simulation tools, integration of solar PV and focus on Levelised Cost of Water (LCOW).

Two of our operational water desalination plants, Taweelah IWP in the UAE, the world's largest efficient RO facility, and Jazlah IWP (Jubail 3A) in the Kingdom, have successfully integrated on-site captive PV plants. This integration has reduced grid power dependency by approximately 25%, achieving the lowest specific power consumptions of 2.81 KWh/m³ and 2.79 KWh/m³, respectively, and cutting over 2.5 million tonnes of CO₂e emissions annually.

We maintain our competitive edge by treating each project as unique and by developing the best solution for that particular plant. NOMAC's experience of running the plants, and improving them on a continuous basis, provides us with a wealth of experience that advances our knowledge, capabilities, and technology. This experience is the basis for our continuous innovation to optimise our plant design, apply the latest proven technology and leads to successive reductions in SPC. This has eventually made us the world's largest private company for water desalination.

Water portfolio evolution million m³/day



A leading innovator in desalination

Globally, partners value ACWA Power's innovative approach, giving us a world-leading track record in winning bids, and an enviable international asset portfolio

First solar-desalination pilot plant based on forward osmosis and CSP in advanced planning stage in the Kingdom

Lowest spec. energy consumption for large scale RO in GCC and world-wide based on normalised seawater conditions

First company to switch to 100% RO in a power-desalination IWPP project

First company in GCC to investigate nanofiltration as pretreatment for seawater RO and for Magnesium salt and Sodium chloride salt production

First deployment of AI in a large-scale SWRO plant in GCC with real bottom line savings

First company to introduce spiral wound membranes in a large-scale SWRO

First large-scale solar-assisted SWRO plant with on-site electricity generation using PV

Application of in-house developed first-of-a-kind simulation and optimisation tool to achieve lowest LCOW

40 R&D projects
20 pilot plants in the Kingdom and abroad
11+ patent applications

Local talent – EWA

Digitalisation and AI

Design optimisation tools



PMRO
Performance Model for RO



SWSTAT
Seawater Statistics

Operation optimisation tools



RO-TRACK
Analytics of the membrane performance



PTCALC
Post-treatment chemical consumption minimisation



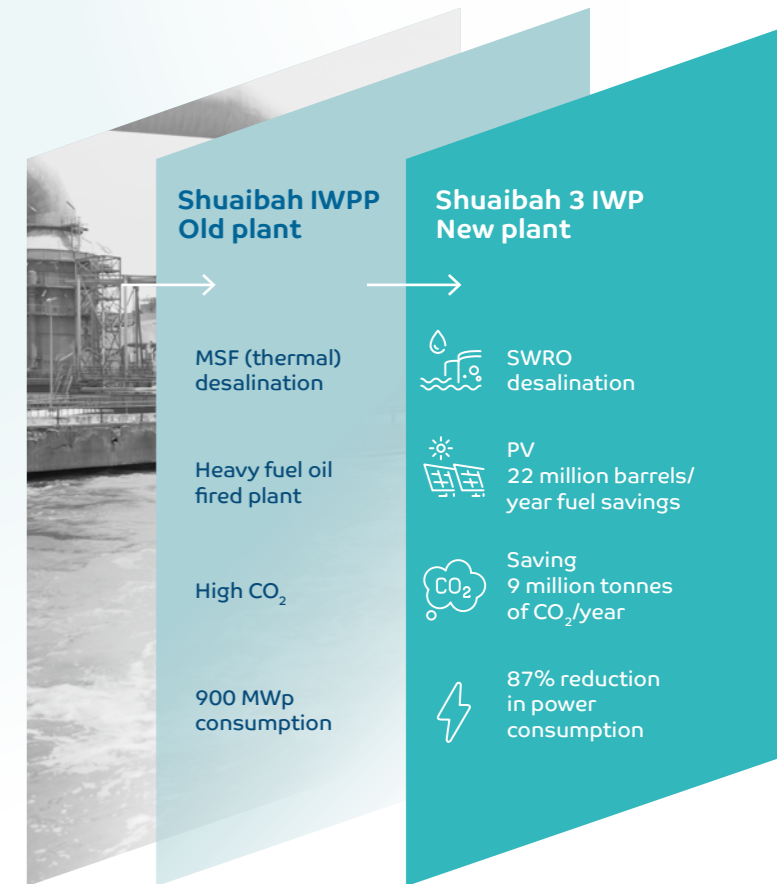
SDI Prediction
ML-based SDI Prediction

Shuaibah 3 IWP

Conversion of an oil-fired thermal IWPP to efficient SWRO

ACWA Power is converting this oil-fired thermal IWPP into a energy efficient 600,000 m³/day SWRO project by integrating 65 MWp PV replacing boilers and MSF technology. This will lead to an 87% reduction in power consumption and a saving of nine million tonnes of CO₂/year by avoiding fuel consumption of 22 million barrels/year. The plant will be operational in 2025.

Conversion live date	Q2 2025
Location	120 kms south of Jeddah, KSA
Capacity	880 m³/day
Conversion cost	SAR 3.1 billion



Growth:

Global demand for water is increasing and it is estimated that by 2050, around 2.5 billion people will face water scarcity. Given that 40% of the world's population lives within 100 kilometres of a coastline, efficient and sustainable seawater desalination can provide a solution. In fact, large scale seawater desalination capacity is expected to grow 60-70% to over 80 million m³/day by 2027 (source: GWI and company estimates).

As the global leader in water desalination, ACWA Power remains committed to capturing our fair share of the growth opportunities. Through continuous innovation to bring LCOW and SPC to sustainable levels, we hope to maintain our competitive advantage to stay ahead of the curve.

2023 Awards:



Desalination Project of the Year – Taweelah RO IWP (UAE National Winner)
MEED 2023



Desalination Project of the Year – Taweelah RO IWP (UAE National Winner)
MEED 2023



Desalination Project of the Year – Jazlah (J3a) RO IWP (KSA National Winner)
MEED 2023



Operational Excellence Award – Shuaiba Two Water Development Project Company (STPC)
Saudi Water Partnership Company (SWPC) 2023



Partnership Award – Jazlah Water Desalination Company
Saudi Water Partnership Company (SWPC) 2023

→ For more on our water desalination technology go to: Sustainability review / Environment / Water management.