DIGITALISING
DESALINATION

BOOSTING EFFICIENCY
AT SCALE

HEXAGON / R-evolution

In collaboration

Desolenator

R-evolution is partnering with Desolanator to provide
an **end-to-end digital twin of solar powered desalination**
plants, boosting efficiency by putting data to action.

3D Digital representation of desalination plants

Increased efficiency from construction to operations

Pre-integrated solution for new plants

Actionable insights at your fingertip

Smart Digital Reality
for Desalination

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Introduction

Freshwater scarcity is one of the biggest challenges for humanity. Despite approximately 71% of the Earth's surface being covered by water, 97% of all water on Earth has such a high mineral concentration that it cannot be used for either agriculture or drinking purposes.

Desalination is the process of removing mineral components from water with high mineral concentration – e.g. saline or brackish water, presents a significant opportunity to address freshwater scarcity.

The challenge with desalination at scale

While the desalination market is mature, it is still facing significant challenges to secure scale and reach to all communities. One major challenge is the levelized cost of water, making purified water more affordable on a global scale. The conventional desalination methods, such as Reverse Osmosis, Electrodialysis and Distillation have a high operating cost, as they require substantial power inputs, are run under complex operational structures and have resource inefficiencies, due to required maintenance of moving parts. Another posing challenge with energy intensive methods is environmental impact, where fossil use and contaminated wastewater lead to disruption of ecosystems and continued climate change.

Introducing a new partnership

R-evolution has teamed up with **Desolenator**, a Dutch start-up with a novel approach to challenges across the board. Desolenator is pioneering the world's first circular solar thermal desalination system, producing high-quality water while ensuring zero harm to the planet at low Levelized Cost – down to 1USD per 1000 litres.

Desolenator – The physical layer

Desolenator is pioneering the world's first circular solar thermal desalination system, having an innovative approach that produces high-quality pure water, ensuring zero harm to the planet and for a low Leveralized Cost of Water (LCW) – Net-zero water for down to 1 USD per cubic meter (1000 litres)
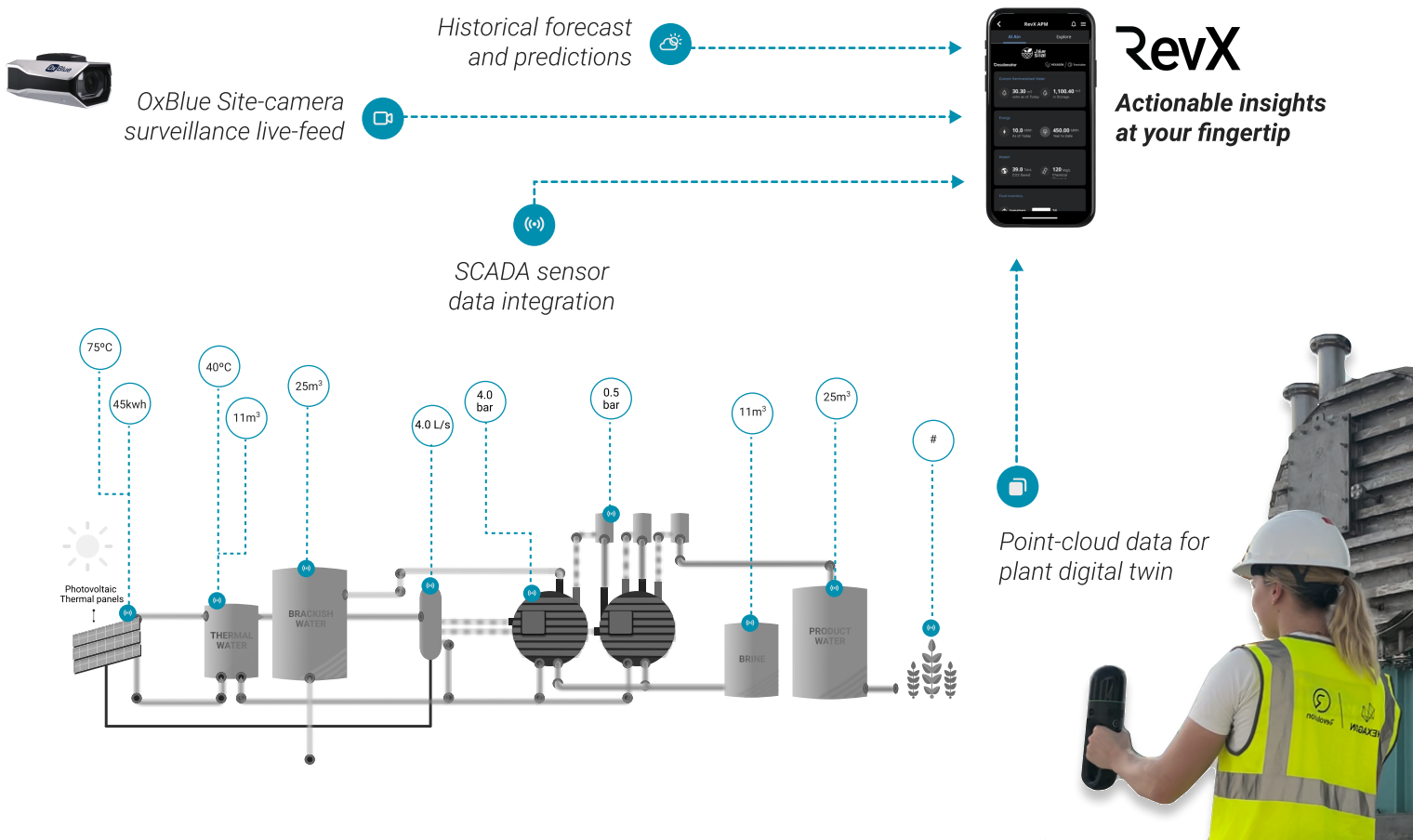
Desolenator process step-by-step
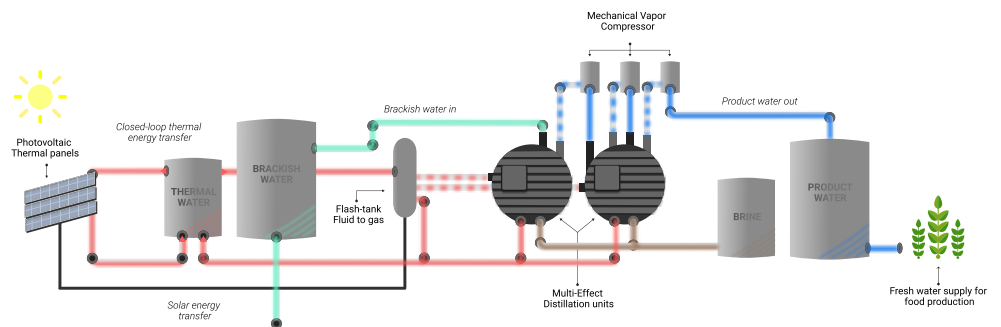
1 *The process starts by extracting brackish water from the ground, a highly mineralised water that is not suitable for farming or drinking purposes.*

2 *This brackish water is pushed into the Multi-effect Distillation (MED) unit, where it showers a set of pipes that are running a hot water steam. This water steam has been previously heated by the Desolanator proprietary photovoltaic (PV) and Thermal (T) panel system, that runs a circular close water loop to increase the water temperature to a boiling level. A Flash-tank Fluid helps with a vacuum effect that accelerates the steam generation and increases its quality, improving the process efficiency.*

3 *Once the brackish water reaches the boiling level, the separation happens, on one end a steam of semi-pure water moves up, going through a compressor that liquifies it and takes it to the next iteration, and, on the other, the brine gets stored in the brine tank.*

4 *The semi-pure water then falls into the second MED and repeats the same process twice, the resulting water is now ultra-pure and is stored in the product water tank.*

5 *Once the brine tank is full, the brine is reintroduced into the system and runs 3 iterations, increasing the plant production efficiency by increasing the total product water output and limiting the brine levels.*

6 *The last step is to send the remaining brine into the "Zero Liquid Discharge" step, finally transforming the brine into solid state, securing a zero environmental impact.*

Adding a digital layer

R-evolution and Desolenator join forces to enhance the efficiency of the process and maintainance of the plant through Smart Digital Reality™ – Visualizing plant performance and enabling faster speed of reaction, based on live data. The R-evolution technological blueprint includes OxBlue for on-site surveillance, Leica BLK2Go for generating a 3D digital twin of the plant and RevX for the Asset Performance Management, a recipe aimed to improve the end-to-end efficiency, replicability and scalability of desalination plants and operations world-wide.
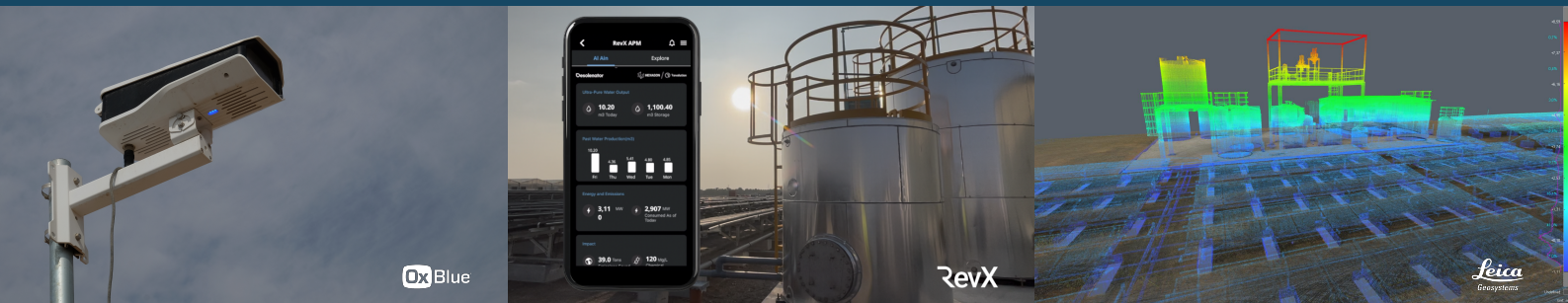
The plant utilizes a large amount of off-the-shelf sensors, responsible for capturing, among others, the electricity generated by the panels, temperature of the water at its different stages, tanks capacity, water pressure, pumps and grid meters. In addition to those sensors, hexagon introduces advanced solutions to bring to life the digital twin of the plant in all stages.

Historical forecast and predictions

RevX

OxBlue Site-camera surveillance live-feed

Actionable insights at your fingertip

SCADA sensor data integration

Point-cloud data for plant digital twin

75ºC

40ºC

25m³

45kwh

11m³

4.0 L/s

4.0 bar

0.5 bar

11m³

25m³

#

Photovoltaic Thermal panels

THERMAL WATER

BRACKISH WATER

BRINE

PRODUCT WATER

Digital deep-dive

Build – Time laps & AI monitoring

Hexagon's OxBlue on-site surveillance camera increases visibility on the performance of the plant, monitoring its efficiency and enabling quicker time-to-resolution and early performance insights.

Visualise the status of the plant real time and track specific maintenance activities on need basis.

Visualising the progress of the construction, augmented with AI functions that can track safety guidelines, usage of helmets, etc.

Operate – Asset Performance Management

Hexagon's Mobile Asset Performance Management solution RevX provides key data points from the site, helping to increase speed of reaction, streamline the work order management and be up to date to the plant overall performance. RevX is at the core of the digital twin, covering a set of use cases that will help the operations and management team react quickly.

Streamlining key data points is the baseline for O&M efficiency, secured by Hexagon Xalt Integration, connecting sensors within the plant, using SCADA. Relevant data is exposed to, a easy to use mobile interface.

Work order management, integrated with Hexagon's EAM, RevX provides a solution to manage different issues in the site, assigning a problem directly to an operator, and easily following up on their actions.

Historical data, having a built-in big lake, RevX can provide historical data visualization to be used for regular maintenance activities, or more advanced AI use cases such as anomaly detection or yield forecast use cases.

3D Plant visualization, RevX also provides an interface that allows the user to navigate using the 3D representation of the site, useful for identifying issues or to help an operator identify or fix a problem remotely.

Optimize –3D Digital Twin

Hexagon's Leica BLK2GO Reality Capture sensor captures point cloud data to generate a digital twin of the plant. This visualisation help to optimize workflows and improve site management to achieve increased efficiency in the desalination process. The quality and precision provided by BLK2GO allows to perform a set of actions:

Site measurements, to be used for comparing design vs as-built, replacement of different components or expansion of the plant.

3D visualisation for quickly track specific problems, connecting the point cloud with the SCADA system and the plant documentation. Activities perform using Cyclone software from Hexagon, enabled by the data collected by the BLK2GO.
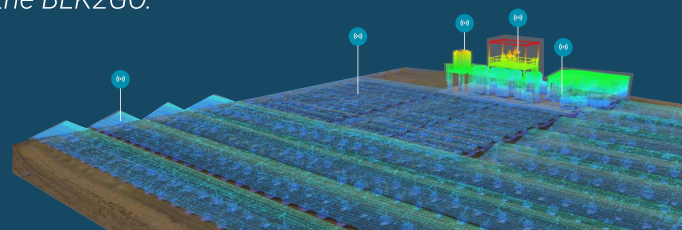
Foreseeable future

Desolanator system is planned to expand its reach to introduce two more steps in the process, so the end-to-end desalination process becomes even more sustainable and efficient:

> *Reintroduce brain into the system to maximize the product water efficiency.*

> *Zero-liquid discharge for re-use the minerals, that solidify the brain to be able to store the by-product, lowering the environmental impact even further.*

Hexagon has a wide amount of capabilities that enable even advanced functions that can be applied at desalination plants to further improve the overall efficiency, those range from project management and cost control, wider APM solutions that include document handling and device geotagging or using regular point cloud scans to monitor the status of different components, comparing how the system evolves physically over time.
These capabilities are being explored as part of the partnership with Desolanator and will be made available in the short-medium term.

Impact for humanity

By 2040, all communities in the planet should have affordable, sustainable and reacheable access to fresh water. With a pioneering approach, Desolenator and R-evolution are approaching the fresh-water scarcity challenge by bringing a more sustainable and accessible access to water for all communities at need today and in the future.

> *Desolenator seeks to revolutionise the future of agriculture through desalination through renewable energy and sustainable plants designs.*

> *R-evolution look to improve the end-to-end efficiency, replicability and scalability of desalination plants operations.*