

Saltwater Lifeline: Inside Barcelona's Answer to an Unprecedented Drought

A case study of the Llobregat
desalination plant and its critical
role in a water-stressed world.



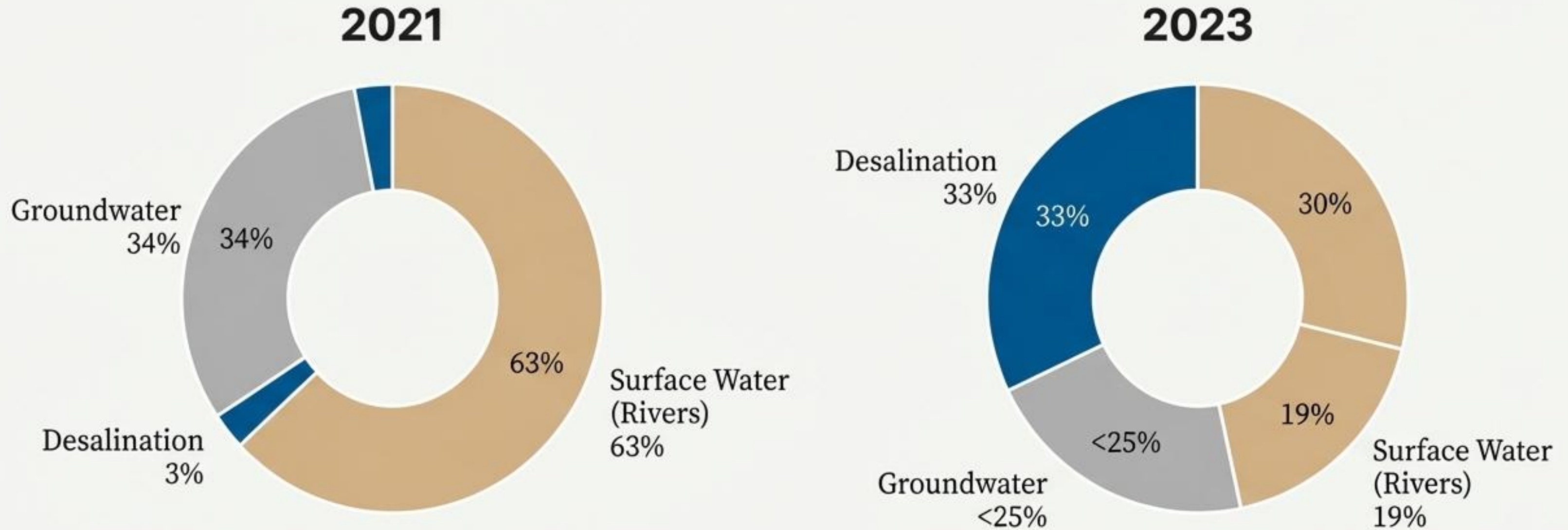
A Region on the Brink of Water Scarcity

The city of Barcelona and the surrounding Catalonia region are confronting their **worst drought on record**, a direct consequence of a **rapidly changing climate**.

This has created a **severe water crisis**, forcing a radical re-engineering of the metropolitan area's water supply.

In response, a critical piece of infrastructure is now central to the region's survival: the **Llobregat desalination plant**.

A Sudden and Dramatic Shift in Water Sources



In just two years, reliance on traditional water sources has **plummeted** while dependence on **desalination** has **skyrocketed**. This is not a gradual change; it is a rapid, **crisis-driven transformation**.

The Llobregat Plant: A Pillar of Water Security

The plant has become an indispensable lifeline for the region, operating at maximum capacity to meet demand.



4.5 Million

Residents served in the Barcelona metropolitan area.



24%

Maximum contribution to the area's total water consumption.



200 Million Liters

Maximum daily production capacity.



60 Billion Liters

Potential fresh water production per year (equivalent to 60 hm³).

The Journey from Sea to Tap

The Llobregat plant uses a sophisticated, multi-stage process called **Reverse Osmosis** to turn seawater into potable drinking water. This journey is broken down into five key stages.



Stage 1 & 2: Intake and Pre-Treatment

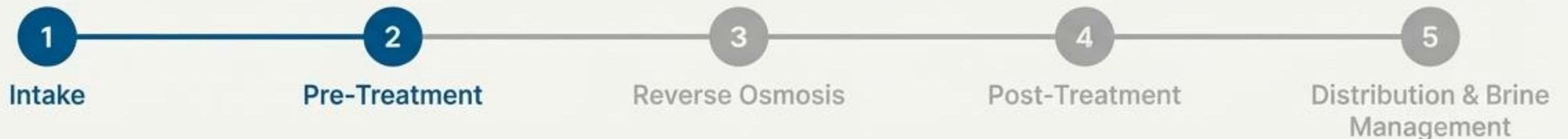
1. Seawater Intake

Water is collected via two submerged towers **2.2 km offshore** at a **depth of 30m**. This strategic location ensures higher quality water, avoiding coastal runoff. The water travels through a 3km pipeline crossing under the Llobregat River.

2. Pre-Treatment

A crucial three-step cleaning process protects the delicate reverse osmosis membranes.

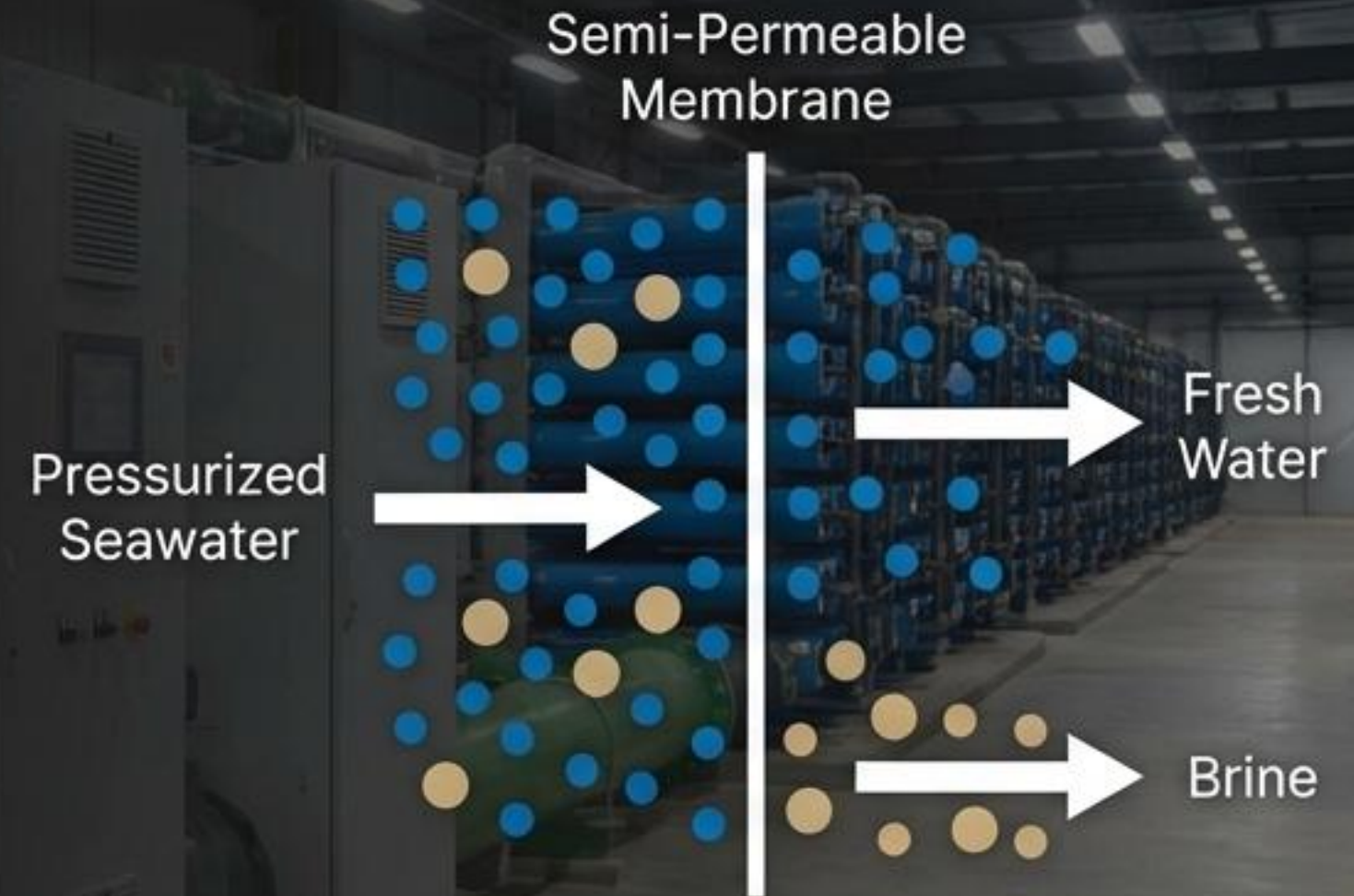
- **Flotation:** Removes algae and suspended solids.
- **Filtration:** Multi-layer open gravity and pressurized filters screen out smaller particles.
- **Polishing:** Final cartridge filters ensure optimal water quality.



Stage 3: Reverse Osmosis, The Heart of the Plant

This is where the separation of salt from water occurs.

- Pre-treated seawater is pressurized to **70 atmospheres**.
- This immense pressure forces water molecules through semi-permeable membranes.
- The membranes are engineered to block larger salt molecules and other dissolved elements.
- **The Result:** Two streams are created—pure, fresh water (permeate) and a highly concentrated brine.



Stage 4: Post-Treatment, Creating Potable Water

The pure water from reverse osmosis is not yet suitable for drinking. It must be stabilized and enhanced.



Remineralization

Water is passed through calcite beds to reintroduce essential minerals, improving its taste and quality.



Disinfection

A final disinfection step ensures the water is completely safe and meets all potable water standards.

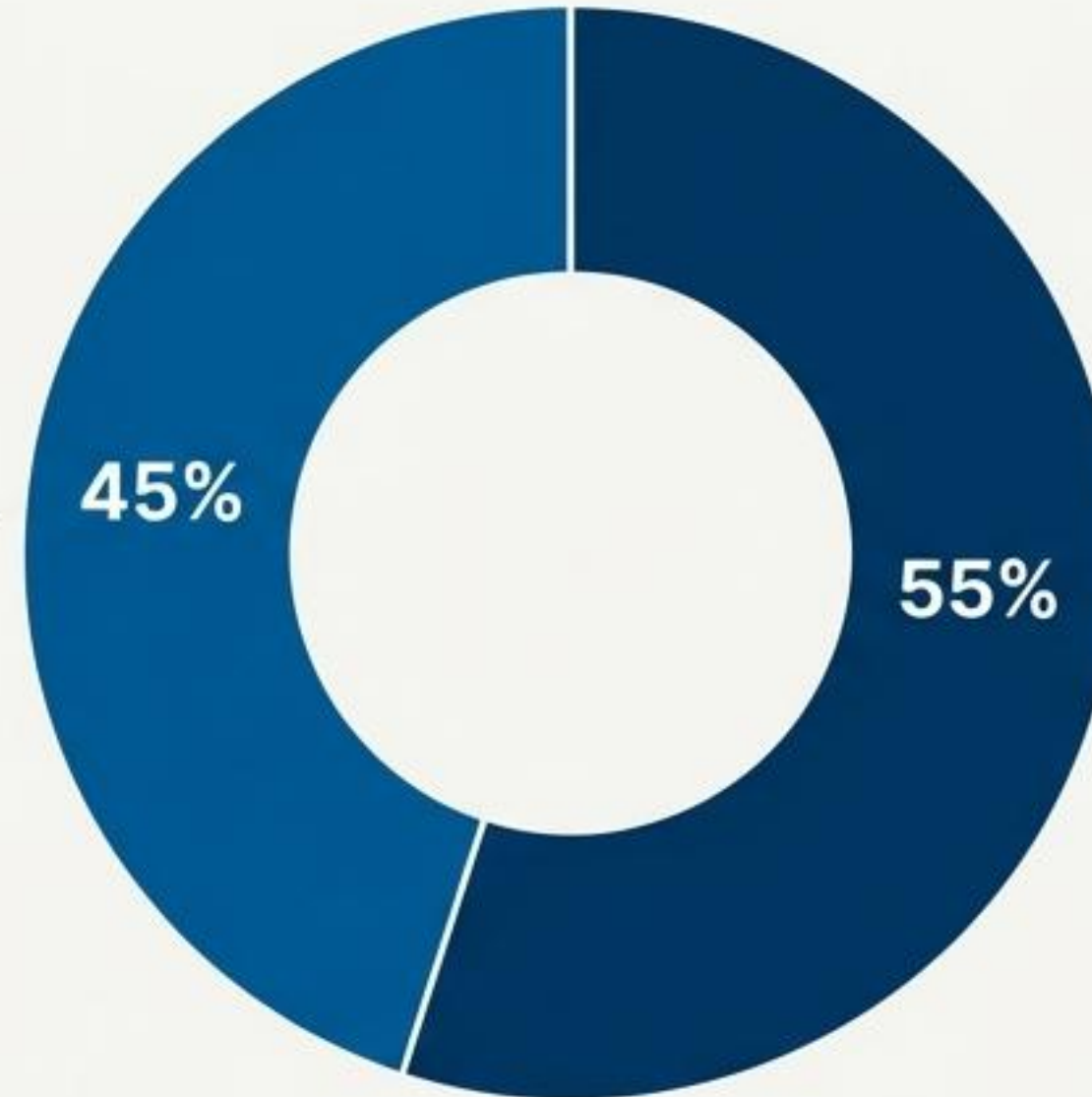


Stage 5: Distribution and Brine Management

For every 100 liters of seawater processed, the plant produces:

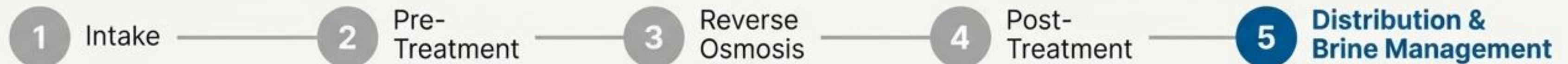
45% Drinking Water

Transferred via a **12 km pipeline** to the FontSanta reservoirs for city distribution.



Salty Brine

The brine is mixed with treated wastewater and discharged **3 km offshore** at a **depth of 60m** to minimize environmental impact.

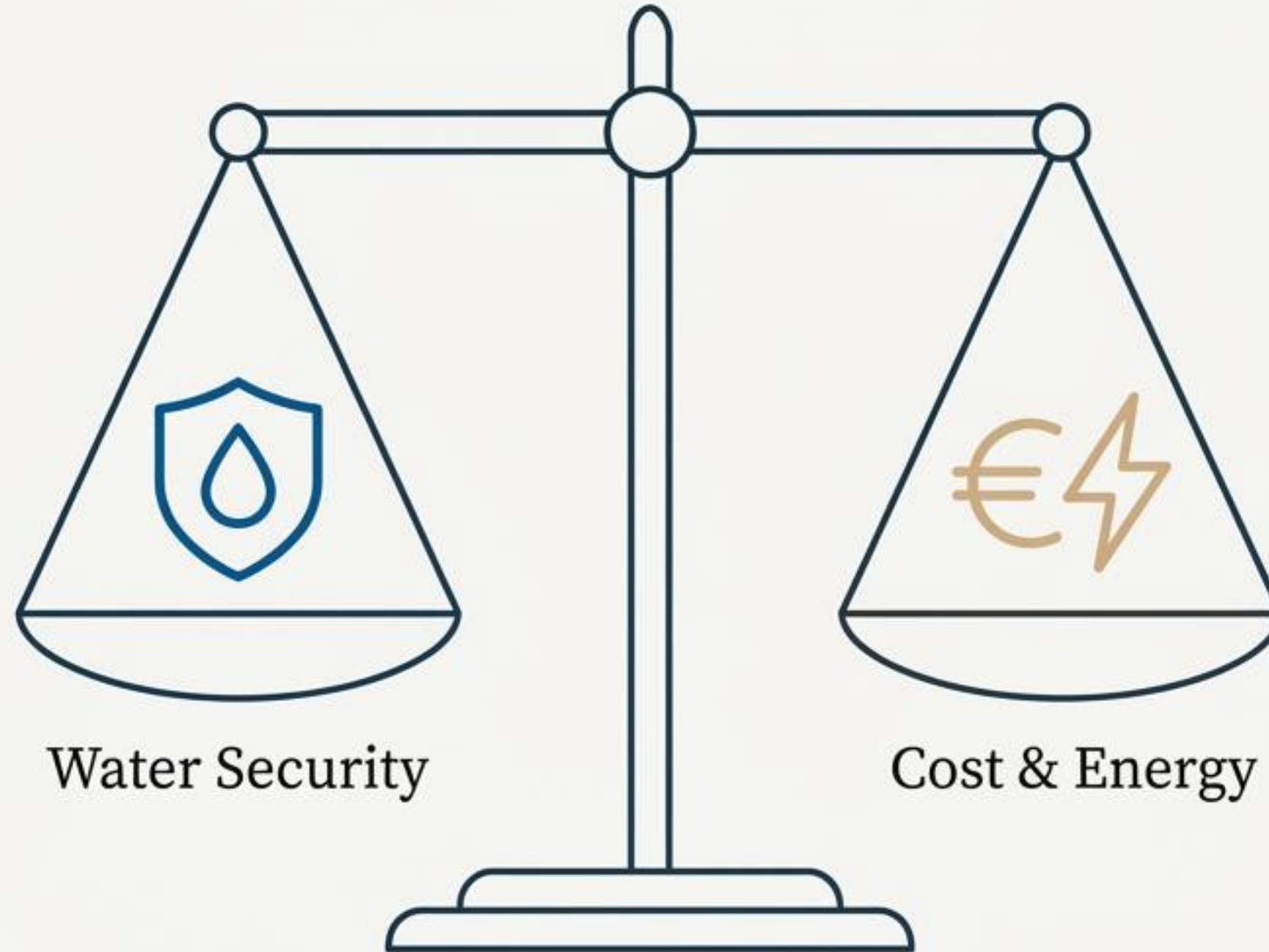


From the Mediterranean to the Metropolitan Grid



A Guaranteed Supply Comes at a Price

Desalination is a powerful tool for water security, but its advantages must be weighed against its considerable financial and energy costs.



The Trade-Offs: Security vs. Cost

Benefit: Water Security

- Provides a reliable, climate-independent source of fresh water.
- Acts as a crucial buffer during severe and prolonged droughts.

Drawback: High Cost

Financial Cost: Cost to produce 1,000 liters



Energy Cost



The process requires **4 kWh of electricity** to produce 1,000 liters of water.

An Expert's Perspective: A Lifeline, Not a Silver Bullet

“ Desalination plants like Llobregat have provided a **‘lifeline’** to residents during the crisis.

“ Authorities should not rely on this single solution...
Desalination is a **‘really expensive solution.’**

”

— Xavier Sánchez-Vila, Professor and groundwater expert, Universitat Politècnica de Catalunya.



A Vital Tool for an Uncertain Future

The Llobregat plant is a feat of modern engineering and a critical part of Barcelona's climate adaptation strategy.

It transforms seawater into millions of liters of drinking water, ensuring taps don't run dry in a crisis.

While the high costs are a significant trade-off, its role as a guaranteed water supply has proven indispensable.

In an era of increasing climate uncertainty, it stands as a vital lifeline for millions.

Sources & Credits

Sources

- From Saltwater to Lifeline: How Barcelona's Desalination Plant Makes Drinking Water
- ATL, "The Desalination Process"

Image Credits

Interior Machinery: Agbar

Filtration Tanks: ATL

Aerial View: Aigües de Barcelona