

Spanish Water Industry 2050

Where it stands and where it is headed



Contents

About Arup

Introduction

Synthesis of Current Market

State of Play	06
Key Timeline	07
Near-term Developments	08
Opportunities	10
Challenges	12

Horizon Scan: Where is the sector going?

Trends Radar	15
Uncertainty Matrix	16

Future Scenarios

Smart Stability	18
Transparent, but Thirsty	19
Digital Springs	20
Thirst as Usual	21
Indicators	22
Key takeaways	23

Expert Contributions

References

About Arup

Arup is a [global, independent consulting firm](#), with a presence in [more than 30 countries](#), working on the design, development and advisory of complex projects across [engineering, urban planning, sustainability, energy and infrastructure](#).

Our employee-ownership structure allows us to set our own direction, to work with clients on ambitious projects that will set new standards.

A holistic approach of Total Design

Scientific and industrial sector expertise

Local knowledge, global expertise

Within Arup, the [Business and Investor Advisory \(BIA\)](#) team supports public and private clients in strategic investment decision-making, market entry and business model development. We provide integrated advice across financial, economic, policy, technical, ESG and procurement matters, enabling well-informed and robust decisions.

Acting as a bridge between strategy, regulation, technical reality and economic viability, we help clients manage risk, unlock value and deliver sustainable outcomes, particularly in capital-intensive and highly regulated sectors such as waste, energy and infrastructure.

Arup's [Foresight](#) team helps clients navigate an increasingly complex and uncertain future. Bringing together futurists, designers and technical experts, we provide long-term perspectives on emerging trends, early signals of change and potential future operating contexts.

Through rigorous foresight and strategic engagement, we support better decision-making, risk management and informed investment, helping organisations identify opportunities for innovation and long-term resilience.

For this specific project, the [two teams collaborated from the outset](#), combining BIA's grounded, sector-specific perspective with Foresight's future-oriented approach. This integration has enabled the development of a report that is both strategically robust and forward-looking, linking real-world market, regulatory and investment considerations with long-term trends and emerging opportunities.

Introduction

This report starts from a simple but critical observation: Spain's water sector cannot be understood as a unified or competitive "market" in the conventional economic sense. Insights from expert interviews and sector analysis consistently point to a far more fragmented reality. Prices do not reflect scarcity in a consistent way, incentives are fragmented across territories, and investment signals are often distorted by subsidies, regulatory asymmetries and political constraints. As a result, the performance and evolution of the water system cannot be understood by looking at utilities or tariffs alone, but must be read as the outcome of interacting sectoral choices, institutional arrangements and societal priorities.

Against this backdrop, the purpose of this study is not to forecast demand or revisit long-standing debates on ownership models or pricing levels. Instead, it seeks to understand how the current configuration of the system conditions what is possible in the years ahead. By combining sector analysis with qualitative insights from water experts, the report builds a systemic picture of how pressures accumulate, where constraints harden, and where room for adaptation and investment still exists.

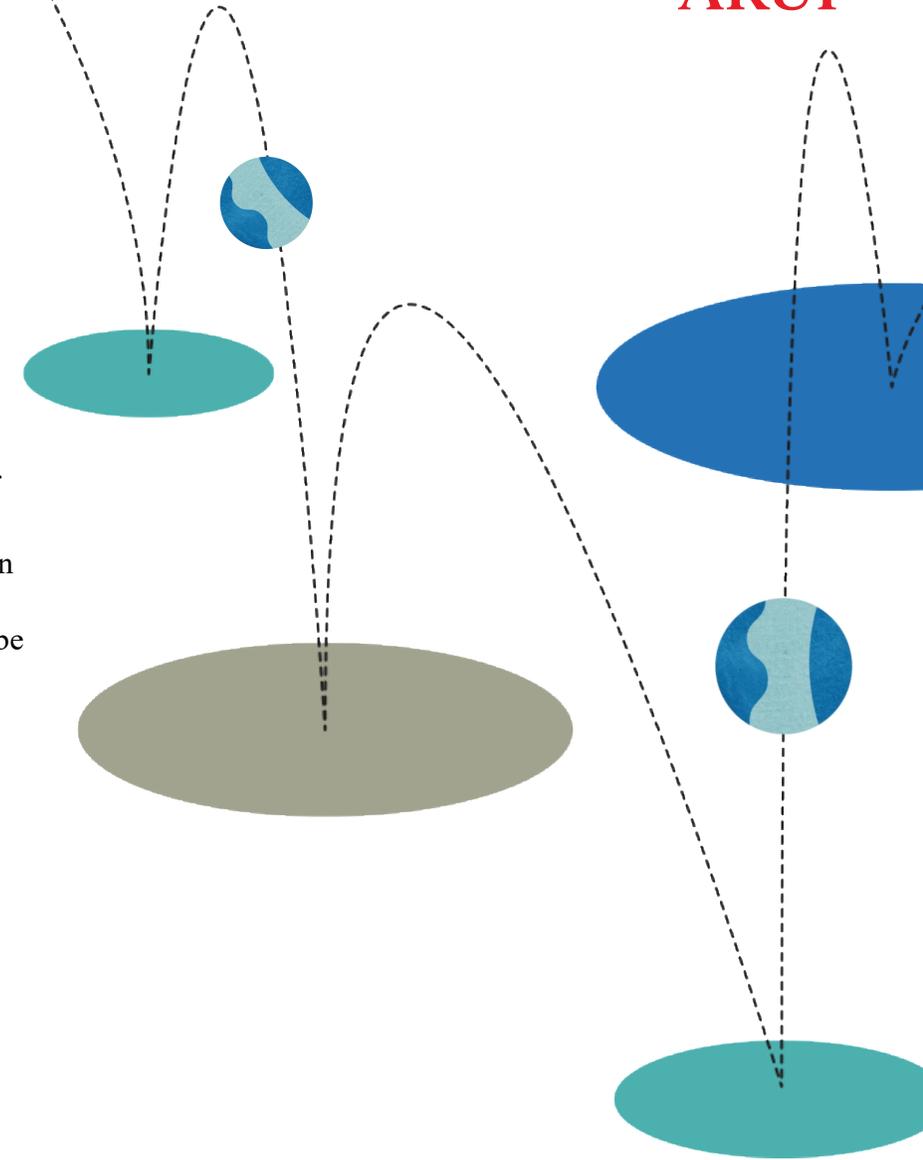
Looking ahead to 2050, the central question is therefore not whether Spain's water sector will "become a better market", but whether its governance, institutional coordination and incentive structures will evolve enough to sustain the investments, behaviours and cross-sector alignment required to secure water availability in a context of climate stress and growing competition for resources. This report approaches that question through a foresight lens, exploring how today's institutional and sectoral configurations shape the range of plausible futures for Spain's water system.

Synthesis of Current Market

Understanding Spain's water sector today required combining quantitative analysis with insights from expert interviews to capture the forces shaping the system. Rather than examining challenges, opportunities or policy developments in isolation, this section weaves them into a coherent narrative that reveals the structural logic of the sector: how historical and governance arrangements, economic incentives and environmental pressures have collectively shaped the landscape that actors navigate today.

This synthesis is structured to provide a progressive understanding of the present. It begins with a [State of Play](#), followed by a [Key Timeline](#) that situates current dynamics within their regulatory and institutional evolution. It then highlights [Near-Term Developments](#) already reshaping the sector, before concluding with [Opportunities and Challenges](#) that capture the tensions and openings defining Spain's water market today.

The purpose of this section is to bring into focus the dynamics defining the present, where pressure points concentrate, where adaptation is already emerging, and which institutional and market forces exert the greatest influence on decision-making. By articulating these relationships, the synthesis captures not only the state of play but the momentum of the system: the tendencies, tensions and constraints that condition what is possible in the short and medium term. In doing so, it offers an informed baseline from which future developments can be interpreted, ensuring that any forward-looking analysis rests on a grounded understanding of how the sector functions now.



State of Play

Water under pressure

The Economist

International | Too much, too little. Too late?

The poisonous global politics of water

Polarisation makes it harder to adapt to climate change

The New York Times.

Flash Floods in Spain Leave at Least 95 Dead

About 1,000 soldiers from emergency response units deployed to the affected areas, and the death toll was expected to rise after one of the worst natural disasters to hit the country in recent years.

LE MONDE *diplomatique*

DOSSIER EAU

Politiques de la sécheresse

Le Monde

Drought in Spain: 'If water management doesn't change, the country will become a desert'

With 80% of intake absorbed by agriculture, researcher Salvador Sanchez-Carillo warns against the overexploitation of water resources.

FINANCIAL TIMES

Water pricing debate bubbles up in Portugal amid intensifying droughts

As an artificial lake on the Iberian peninsula attracts more businesses, it has become a victim of its own success

Bloomberg

Green | Climate Politics

Spain's Catalonia Is Spending \$2.6 Billion to Survive Without Rain

Barcelona and surrounding areas are planning to end their dependency on rain water by 2030 as global warming forces the region to adapt to a dramatically different climate.

ECONOMIST IMPACT

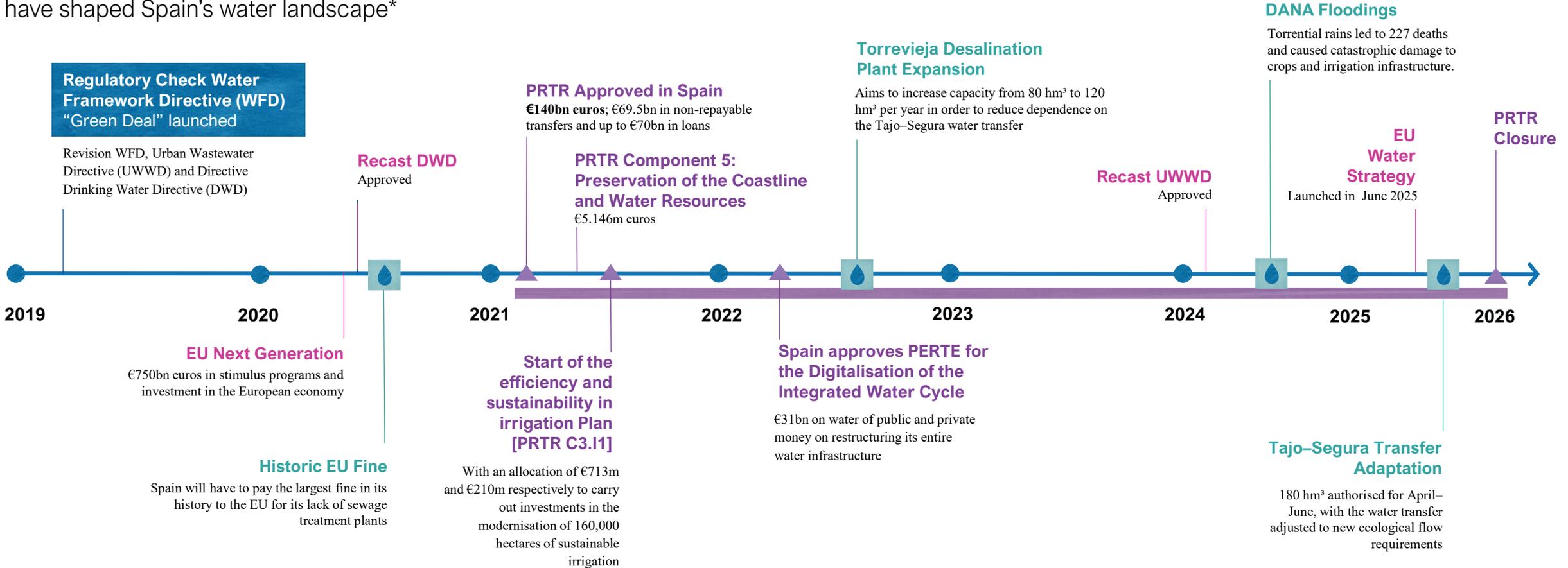
Only 2.4% of wastewater is further treated for reuse in the EU, and on an average, 25% of the water supply in the continent is lost to leaks annually, exacerbating the water challenge in the EU.

Reuters

Europe's water resources under pressure, most surface bodies polluted, EU says

Key Timeline

How policy, funding and weather events have shaped Spain's water landscape*



- Water-related events in Spain
- EU regulatory framework
- Spain's Recovery, Transformation and Resilience Plan (PRTR) related to water

Non-exhaustive diagram*

Near Term Developments

Where the present sets the pace

Ageing Infrastructure and Investment Backlog

Spain’s water sector has been in a [high capital expenditure \(CapEx\) cycle since 2022](#), driven by ageing infrastructure, climate pressures, and declining reservoir inflows. Spain’s water network is increasingly aged, with a significant share of pipes and dams over 30 to 65 years old, contributing to annual water losses of around 25% ([INE, 2022](#))¹⁸. Operators note that optimal renewal cycles average 58-66 years, highlighting [the urgent need for strategic investment to maintain reliability and efficiency](#) ([PwC, 2024](#))³⁷.

Current investment priorities include regulatory-driven upgrades, loss reduction, efficiency improvements, and renewable integration to mitigate energy-related risks ([Fitch Ratings, 2024](#))¹⁴, a need intensified by the energy crisis following Russia’s invasion of Ukraine. This wave, catalysed by the PRTR programme (*Plan de Recuperación, Transformación y Resiliencia*), which channels funds from the Next Generation EU initiative, is [expected to mobilise €3bn in total public-private investment, including €842m in committed public funds](#), and

is focused on digitalising the urban water cycle, with the investment phase set to conclude by Q2 2026, potentially marking the end of this intensive cycle.

However, according to sector experts, [the estimated investment needs for Spain’s urban water cycle far exceed current PRTR allocations](#). The Spanish Association of Urban Water (DAQUAS) estimates [an annual structural deficit of over €5,000m](#) ([PwC, 2024](#))³⁷, highlighting that without a comprehensive national reform and a restructured tariff framework, the sector’s underlying challenges will persist. The problem is deeply structural, requiring long-term planning beyond the current PRTR cycle to ensure sustainability and resilience.



Regulatory and Governance Bottlenecks

Spain’s urban water sector faces structural, efficiency, and governance constraints. With over [2,500 local or regional networks and transport costs accounting for ~50% of total expenses](#) rendering the development of a national water network economically unviable. Physical and topographical limitations further confine operations to the local or regional scale. The absence of a national upstream monopoly—unlike in other network industries such as electricity—constrains local-level margins, limits the potential for scale efficiencies, and structurally restricts competition across the sector ([CNMC, 2020](#))⁷. These physical and economic constraints are compounded by [transparency gaps and information asymmetries](#), which weaken regulatory oversight and hinder effective market discipline.

Against this backdrop, the central challenge lies first and foremost in [pricing](#). Water prices remain [systematically low](#), failing to reflect underlying costs, investment needs, and resource scarcity. While privately operated services are associated with an average increase in household bills of

approximately 26% ([ACA, 2024](#))¹, this effect should not be interpreted as evidence that the management model itself is the primary issue. Rather, it reflects deeper structural weaknesses in [tariff design](#). In particular, tariff structures are opaque and [highly fragmented across local and regional jurisdictions](#), which prevents transparent comparison, limits public scrutiny, and obscures the true economic value of water.

These governance and pricing failures also generate significant [hidden costs through non-compliance](#). Spain has already faced the largest EU sanction imposed on the country for deficiencies in water purification standards ([Ruiz de Apodaca Espinosa, 2020](#))³⁹. [Regulatory pressures are expected to intensify](#), given the Water Framework Directive’s limited coverage of scarcity and quantitative management, intersecting with broader EU strategic priorities on competitiveness, agriculture, and the Single Market (see Draghi report, Niinistö report the Strategic Dialogue on the future of EU agriculture and the Letta report; [European Commission, 2024](#))¹³.



Near Term Developments

Where the present sets the pace

Agriculture-driven Water Stress

Water availability in Spain is limited and unevenly distributed: as of early 2024, northern reservoirs were at ~70% capacity, while southern Spain and Catalonia were below 40%, compounded by aquifer overexploitation, soil salinisation, and ecosystem degradation (Fundación Rafael del Pino, nd)¹⁵. This acute water stress—Spain uses 43% of its available freshwater, with agriculture accounting for 82% of demand (UNECE, 2022)⁴⁴—places strong pressure on irrigation, which underpins Spain’s agrifood system: in 2021, irrigated land represented 22.9 % of cultivated areas but contributed over 50% of plant production, sustaining the country’s leading role in EU fruit and vegetable exports. Modernisation has enabled more efficient irrigation techniques and higher yields per cubic metre of water, in line with recent policy objectives for sustainable and efficient agriculture. However, these improvements have not translated into aggregate water savings, as efficiency gains are often accompanied by crop intensification, leading to reduced return flows even as irrigated areas expand. (CaixaBank Research, 2023)³¹



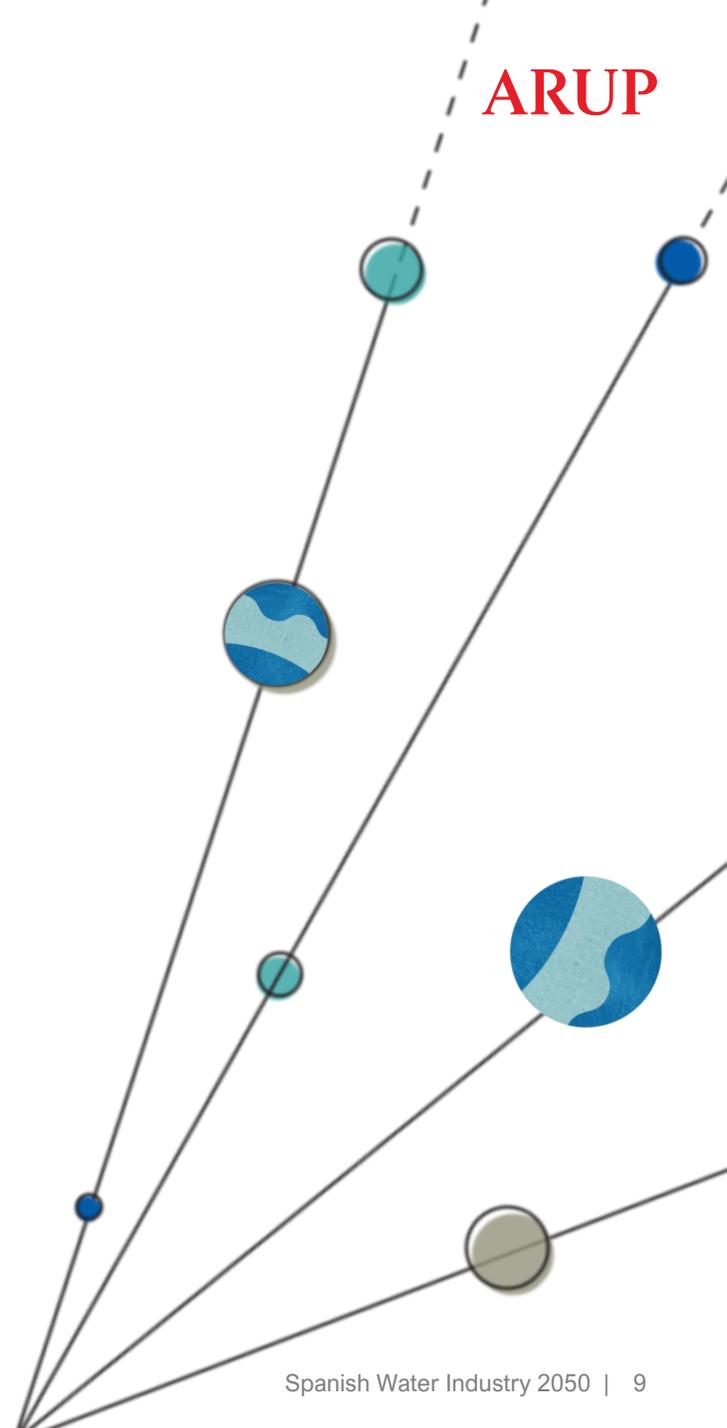
Extreme Weather Events & Social Awareness

These governance challenges are further compounded by extreme weather events, notably the 2024 DANA, which have exposed the fragility of Spain’s water resources and the shortcomings in governance. The events underscore the urgent need for stronger institutional coordination, improved transparency, and robust planning, not only to manage the resource efficiently but to protect human lives during future crises. Yet, these tragic events have brought water management sharply into the public eye, potentially catalysing a renewed societal impetus for reform and resilience in the years ahead.



Tourism-driven Water Stress

Urban water management in Spanish cities faces acute stress, with gaps in connectivity, risk mitigation, and efficiency (Economist Impact, Water City Index, nd)¹¹. Mass tourism along drought-prone coasts magnifies pressures, as tourists consume several times more water than residents (Lázaro Florido-Benítez, 2024)²²; with tourist establishments up 309.6% since 2000 (INE, 2023)¹⁹, scarcity risks are escalating.



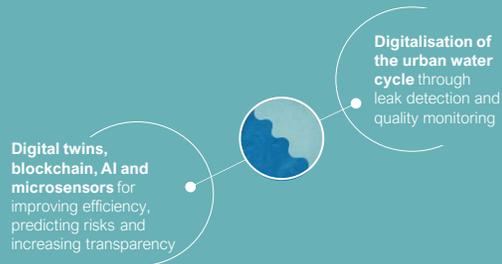
Opportunities

Pathways unlocked by today's conditions (1/2)

Digitalisation

The water sector, traditionally seen as a “latecomer” to digitalisation, is now undergoing a major shift. Utilities are evolving from being solely operators of critical infrastructure to also becoming data managers. This transition opens the door for technology providers, including big tech companies, start-ups and consultancies, to play a key role.

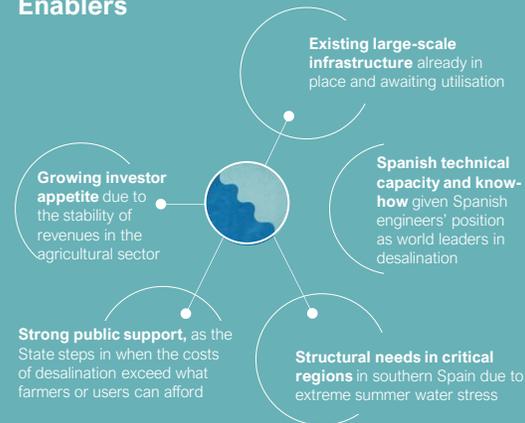
Enablers



Desalination

Spain is the 5th largest desalination power globally, with more than 770 plants (AEDyR, 2024)⁵. Despite substantial national and EU investment, these plants have historically been underutilised, on average, operating only 16% of installed capacity over the past 20 years (Serraller, 2023)⁴⁰. This presents an opportunity to make better use of existing infrastructure, redesign financing schemes, and position desalination as a reliable water security tool.

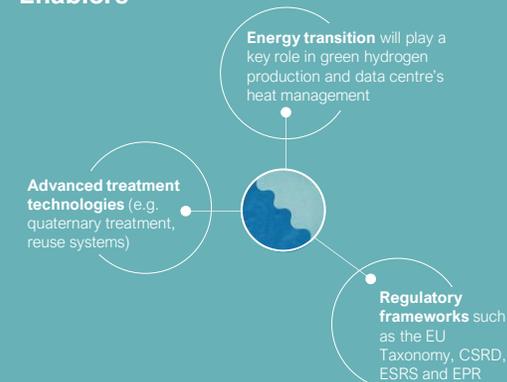
Enablers



Industry

Water is emerging as a critical resource across multiple industrial sectors, from energy and finance to pharmaceuticals, cosmetics, textiles and tourism. Stricter EU regulation and the accelerating energy transition are reshaping how industries manage water, creating both compliance pressures and opportunities for innovation, efficiency and new services.

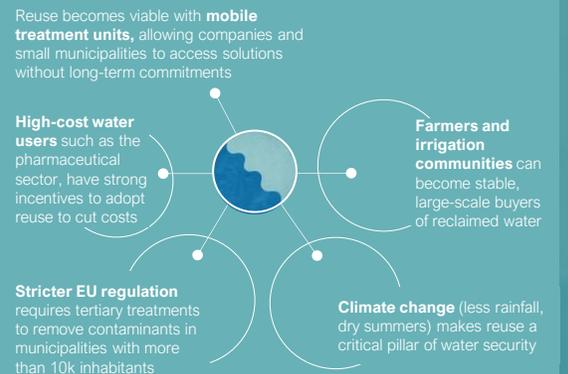
Enablers



Water Reutilisation

Spain is the EU leader in water reuse, with around 400 hm³ reused annually, more than any other Member State. However, water reuse remains underexploited due to the small scale of current projects. The opportunity lies in scaling up reuse through institutional reform and the creation of parallel markets for water, nutrients, energy, and agricultural products. By fostering industrial symbiosis and supporting cost-sensitive industries, Spain can transform its position from having isolated circular economy success stories to achieving systemic, large-scale impact in water reuse.

Enablers



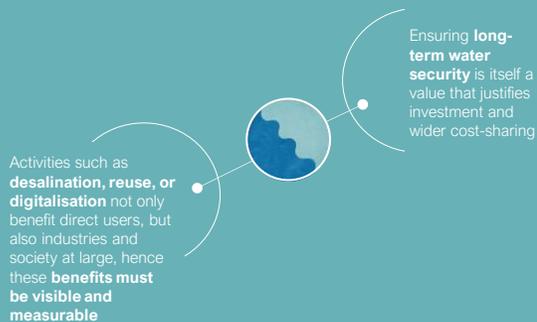
Opportunities

Pathways unlocked by today's conditions (2/2)

Monetisation of Positive Externalities

Current water governance mainly applies the principle of “the polluter pays”, internalising only negative externalities. Yet many water-related investments generate positive externalities, wider benefits that extend beyond direct users. By creating mechanisms to value and monetise these benefits, the sector can unlock new financing sources, reduce dependence on subsidies, and ensure more equitable cost-sharing.

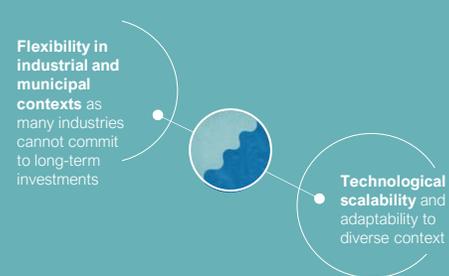
Enablers



Modular & Mobile Treatment Units

Modular and mobile treatment units represent a shift from infrastructure ownership to infrastructure as a service. By aligning technological innovation with financial flexibility, they enable smaller users and industries to access advanced treatment solutions while maintaining adaptability to economic and environmental uncertainty.

Enablers



Living Labs

Unlike healthcare or education, centralised models are not efficient in water: each territory requires tailored solutions. Water-Oriented Living Labs represent a powerful mechanism for bottom-up water innovation. By decentralising experimentation, connecting diverse stakeholders and tailoring infrastructure solutions to local contexts, they address regulatory challenges while unlocking efficiencies.

Enablers



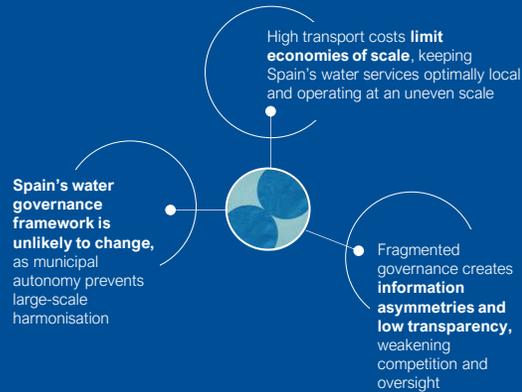
Challenges

Forces constraining today's conditions (1/2)

Structural Atomisation

Spain is the third EU Member State with the most municipalities (8,132) organised into around 2,500 tariff systems (CNMC, 2020)⁷ (Albet i Ma, 2019)³. This leads to extreme fragmentation, loss of economies of scale, and weak institutional capacity. The contrast is evident in larger metropolitan areas, where aggregated management models have proven far more efficient while still respecting municipal competences.

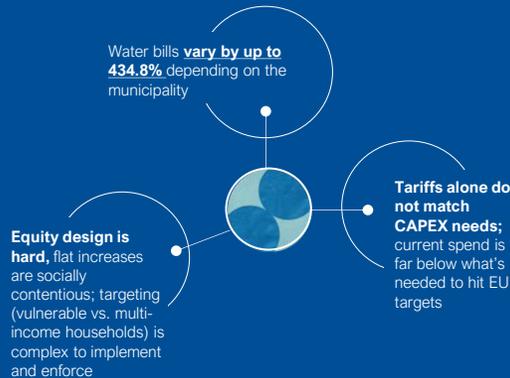
Blockers



Water Tariffs

Tariff-driven stagnation has slowed sector growth from 6% in the 2000s to 2% in 2010–2020 (PwC, 2024)³⁷. Beyond low overall levels, Spain's water tariffs also suffer from wide municipal disparities, reflecting uneven infrastructure and management, which further hinder coherent sector growth.

Blockers



Stringent EU Targets

The 2024 Urban and Industrial Wastewater Treatment Directive is the main regulatory challenge, requiring major plant upgrades and extended producer responsibility (EPR). Its ambitious standards demand significant investment and coordination, while Spain has yet to achieve full compliance with the 1991 directive, highlighting a persistent gap between regulatory ambition and market capacity.

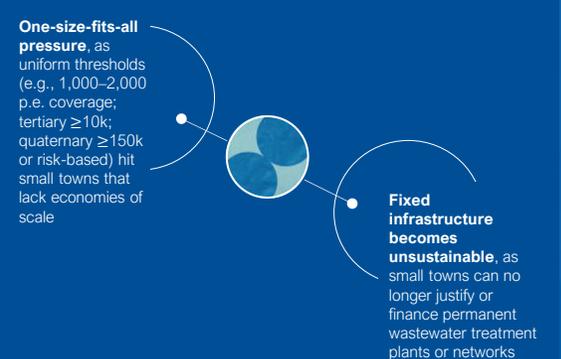
Blockers



Rural Depopulation

Rural municipalities are losing around five inhabitants every hour, which means that, at present, over 85% of the Spanish population is concentrated in just under 20% of the territory (López, 2024)²⁵. Depopulation is closely tied to water scarcity, driven by recurring droughts and aquifer overexploitation, a combination that deepens the shortage of basic services and employment opportunities in rural areas.

Blockers



Challenges

Forces constraining today's conditions (2/2)

Poorly Designed Incentives

In Spain, investors flock to desalination for irrigation despite low returns, drawn by state-backed subsidies that guarantee farmers' water supply.

Urban water distribution, by contrast, barely covers operating costs, offering little profit and deterring private capital.

Floating Population

Spain is one of the world's top tourist destinations; the number of tourist establishments jumped 309.6% between 2000 and 2022. In many Spanish municipalities, the population triples during the summer, while this influx can be positive, it also creates challenges for critical infrastructure (Cubria de Gorostegui, 2024)⁹.

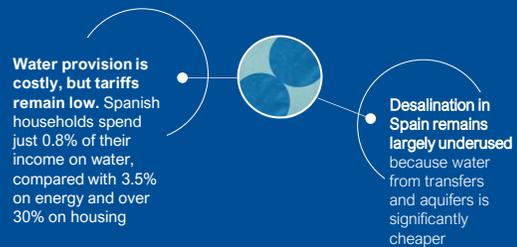
Intensive Agriculture

A key regulatory challenge for Spain lies in managing nitrate pollution linked to intensive livestock production. The excessive generation of these residues often exceeds the soil's absorption capacity, leading to their improper use as fertiliser and resulting in diffuse pollution through runoff. This issue underscores the need for stricter waste management controls within the agri-food sector.

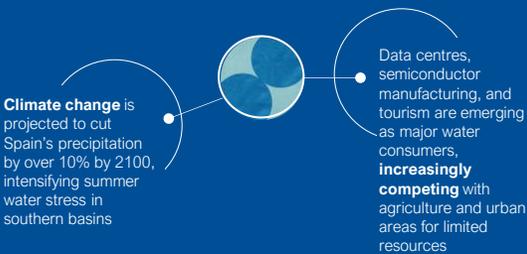
Industrial pushback and regulatory slowdown

Despite a comprehensive regulatory framework, industrial pressure and instruments like the Omnibus Regulation risk slowing or diluting future environmental directives, as seen with flexibilities granted on EV targets under rising global competition.

Blockers



Blockers



Blockers



Blockers



Horizon Scan

Where is the sector going?

Once the current configuration of Spain's water market was mapped, the next step was to understand its trajectory.

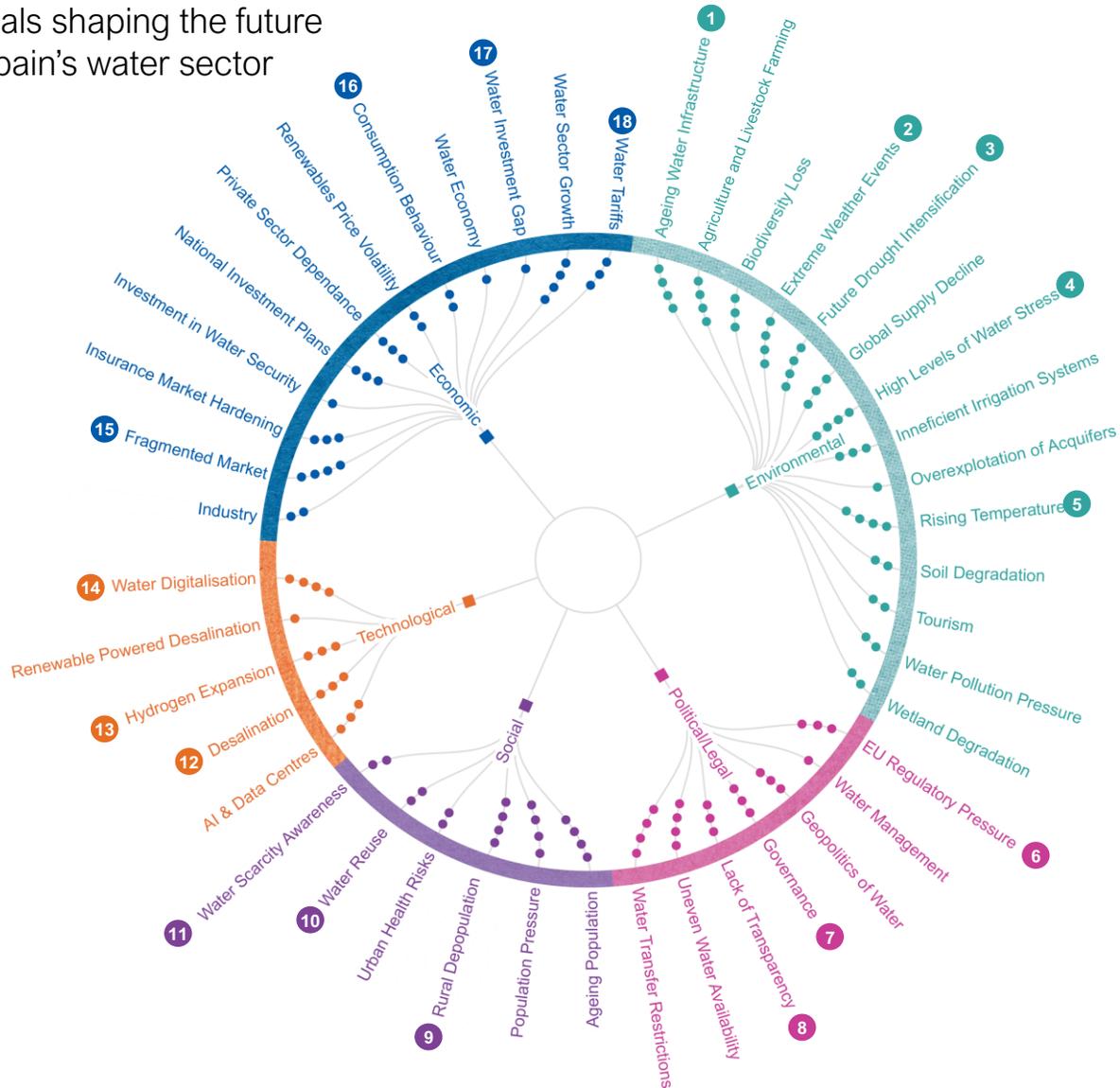
To do so, the analysis moved beyond static indicators and focused on the signals already reshaping the sector. Policy shifts; technological breakthroughs, climate pressures, economic dynamics and social factors were examined not as isolated trends but as interconnected forces influencing long-term market conditions.

The Horizon Scan consolidates these signals and drivers into a structured **trend radar** that reveals which forces are gaining momentum, how they interact, and where they may direct the sector in the coming decades.

It serves as the bridge between today's landscape and the forward-looking scenarios that follow, tracing the trajectories that could reshape strategic priorities and future investment opportunities across Spain's water system.

Trend Radar

Signals shaping the future of Spain's water sector



Categories

- Environmental ■
- Political/Legal ■
- Social ■
- Technological ■
- Economic ■

Signal Classification

- Weak Signals ●
- Growing Insights ●●
- Emerging Issue ●●●
- Mainstream ●●●●

- Legend**
- Spain's water networks lose 25% of supplied water to ageing infrastructure. At the current pace, full pipe renewal would take 400 years (Rodríguez, 2025).
 - By 2029, EU losses from summer's extreme weather events will total €126bn, with Spain bearing the largest share at €34.8bn (Planelles, 2025).
 - Under a high-emissions scenario, Spain could face megadroughts lasting more than 15 years across much of the Iberian Peninsula toward the end of the century (Castro-Diez et al., 2024).
 - By 2050, 17% of Europeans could face severe water stress levels. Spain and Greece will be among the hardest hit, with Seville, Granada, Córdoba, and Murcia at the highest risk in Europe (WWF, 2020).

- Spain is warming about 1.6x faster than the global average (Clivar, 2024). In fact, Spain could surpass +1.5 °C by 2030 and may reach +3 °C by 2050 if warming is not curbed (Olave, 2025).
- The EU has been actively pushing for a standalone EU Blue Deal to complement the Green Deal. By 2030, the transition to a Water-Smart Society through this strategy should be in full swing (Water Europe, 2023).
- Information asymmetries among operators, government agencies, and consumers weaken market competition, resulting in flawed tenders and inadequate concession oversight (CNMC, 2020).
- No government agency that oversees the urban water cycle in Spain, collects, analyses or publishes information on the sector periodically (CNMC, 2020).
- Between now and 2050, smaller municipalities in Spain could lose up to four million inhabitants (Oficina Nacional de Prospectiva y Estrategia, 2025)
- A California project can turn sewage into drinking water in less than an hour and could be a blueprint for other water-scarce regions (Gammon, 2025).
- 2 in 10 Spaniards acknowledge there isn't enough water, but only 2 in 10 support reducing consumption. Public perception is also skewed: just 31% identify agriculture as the main consumer, yet in reality the sector uses 80% of all water (El País, 2023)
- Spain ranks 4th worldwide and 1st in Europe in desalination capacity positioning it strongly as the global market doubles to €97bn by 2030 (RETEMA, 2022; Trindade, 2025).
- Spain aims to install 12 GW of electrolyser capacity by 2030, the most ambitious target in Europe. The country already hosts ~20% of global hydrogen projects. However, electrolysers require vast amounts of high-quality water, a challenge overlooked by Spain's national hydrogen strategy (Kramer, 2025).
- The Spanish government's PERTE for the digitalisation of the Water Cycle will mobilise over €3bn in public and private funding. In Madrid, more than 50% of meters are already equipped with remote reading, with the goal of reaching 100% by 2027 (MITECO, 2022; Escobar, 2025).
- Spain's water sector is highly fragmented, with 2,500 supply and sanitation systems operating at scales often above or below the ideal where economies of scale give way to diseconomies due to high fixed and transport costs (CNMC, 2020).
- Drinking water use in Spain has fallen by more than 20% in the past 20 years (ADICAE, 2021).
- Spain needs €6.2bn/year for urban water cycle; current investment is €1.2bn, creating a €5bn annual deficit (López, 2024).
- Water tariffs in Spain vary sharply: households in privately managed systems pay on average 26% more, with annual bills differing by up to €500 depending on the municipality (Agència l'aigua a Catalunya, 2024).

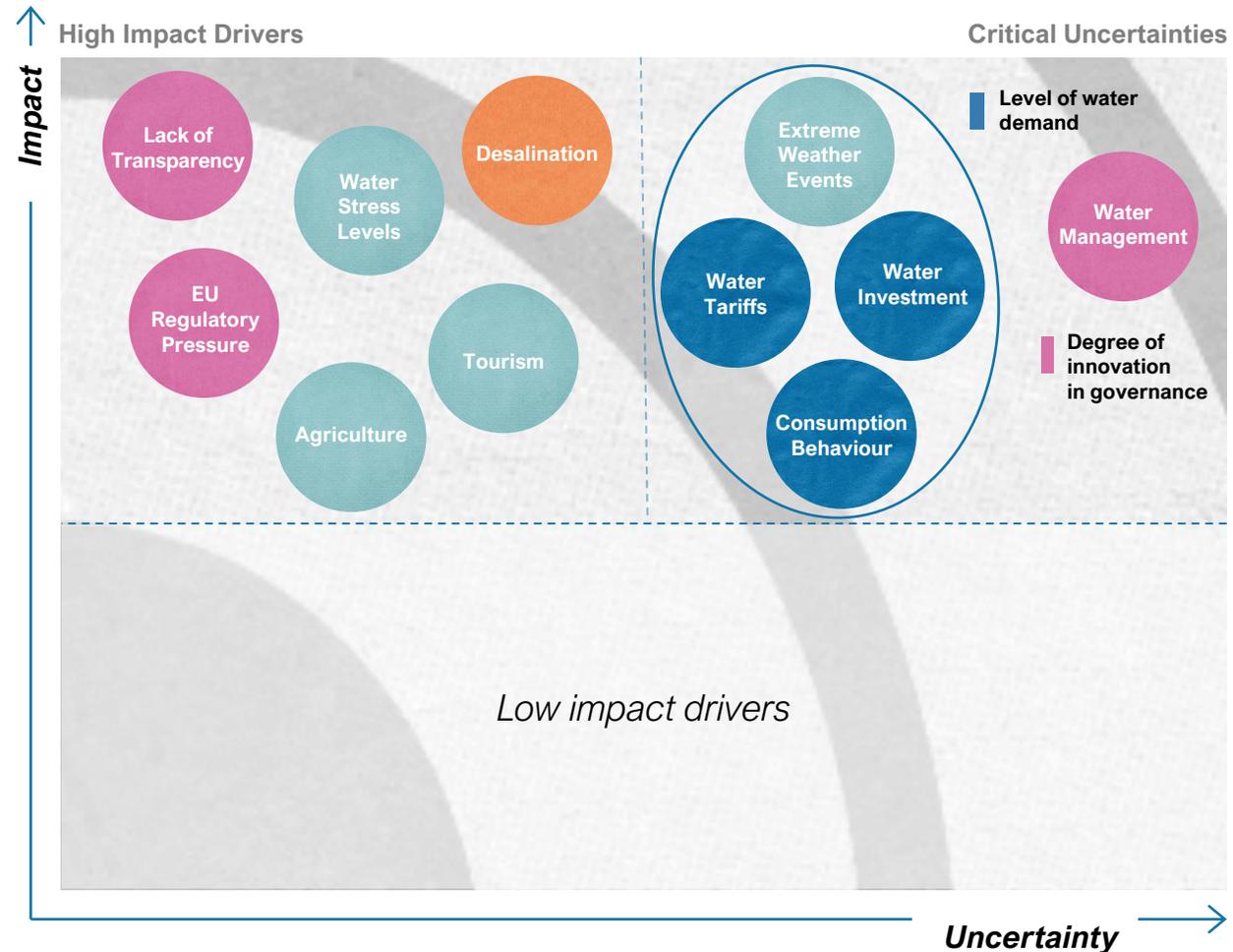
Uncertainty Matrix

To translate the horizon scan into actionable scenarios and visualise change, we used an Impact/ Uncertainty Matrix. Each driver was evaluated along two dimensions: **Impact** (estimated through speed and depth of change) and **Uncertainty** (estimated through precedents, polarisation and existing barriers to change). The analysis distinguished between **high-impact drivers** or trends that will shape Spain’s water future in all cases, such as agriculture, ongoing ecosystem degradation and shifting demographics; and a set of forces whose trajectories remain genuinely open. We discarded the two low-impact quadrants.

Based on expert discussions, we identified two critical drivers in the high-impact, high-uncertainty quadrant that emerged as the study’s **critical uncertainties**:

- **Degree of innovation in governance:** Captures the degree to which Spain’s water governance system evolves and modernises over time.
- **Level of water demand:** Captures the trajectory of water consumption, widely shaped by tariff evolution, consumption behaviour, extreme weather events and investment levels.

Together, these uncertainties form the axes of the scenario framework, defining the strategic space within which Spain’s water market could evolve over the coming decades.



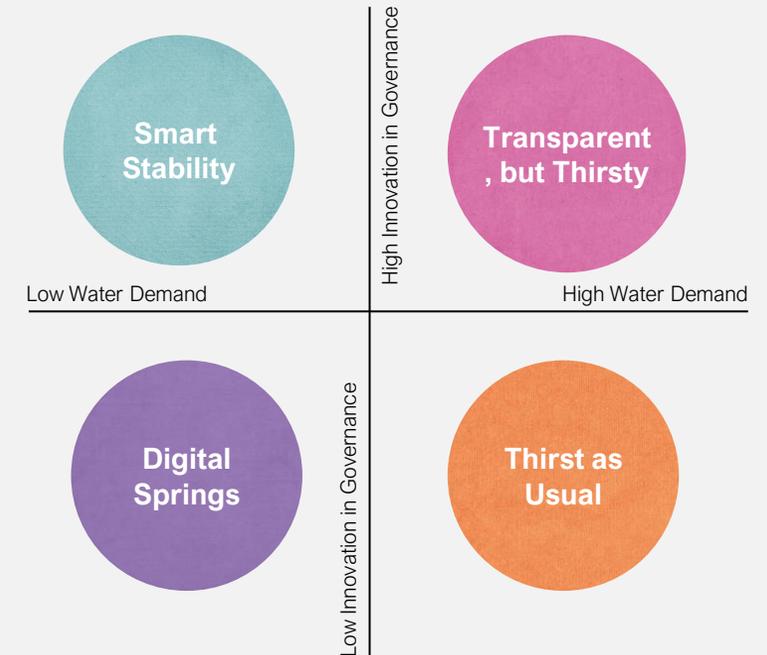
Future Scenarios

In the context of this research, scenarios are to be understood as exploration of different plausible futures rather than as forecasts, they help us understand different ways in which the Spanish water market could evolve by 2050. They are built around the critical uncertainties identified in the horizon scan: **level of water demand** (shaped by consumption behaviour, tariffs, investment decisions and the severity of extreme events) and the **degree of innovation in governance** (reflected in the future quality and coherence of water management).

The purpose of the scenarios is not to guess what will happen, but to **rehearse what could happen**. They work as **strategic simulations that allow organisations to test assumptions, identify vulnerabilities, and explore how risks and investment opportunities shift under different conditions**. Rather than endpoints, they serve as a decision-support tool, as they highlight where proactive action today could influence tomorrow's outcomes.

In this context, four plausible and distinct scenarios emerge. If governance innovation accelerates and societal behaviours shift toward efficiency, then Spain enters the **“Smart Stability”** scenario, where demand declines, integrated markets emerge, and sustainability becomes a competitive advantage. Conversely, if governance reforms advance but technological and economic inertia keep demand high, then Spain enters **“Transparent but Thirsty”** scenario, where structural pressures persist and affordability dominates the policy agenda.

If external conditions break in Spain's favour, pressure on the system eases without requiring deep reform, giving rise to a **“Digital Springs”** scenario where efficiency gains, softer tourism peaks and modest demographic shifts stabilise demand. If nothing changes and current patterns persist, Spain falls into a **“Thirst as Usual”** future of high demand and low innovation, where consumption remains largely unchanged, governance stays reactive and tariffs rise only as a side-effect of mounting production costs.



Smart Stability

High Innovation in Governance | Low Water Demand



By 2050, Spain's water sector operates under conditions of persistently low demand and highly innovative governance. This outcome is not driven by radical technological disruption, but by a gradual institutional transformation combining smarter policy design, behavioural change and the scaled deployment of long-available technologies.

During the 2020s, it was widely assumed that securing the sector would require blunt and politically costly measures, such as abrupt consumption cuts or steep tariff increases. Spain ultimately follows a different path. Public authorities lead a structural shift in governance, creating frameworks that attract investment and experimentation through regulatory sandboxes, stakeholders' platforms (e.g., [Living Labs](#)), cross-sector partnerships and transparent, predictable rule-making. Regulation becomes more flexible and innovation-friendly, enabling new business models and highly optimised operations. As demand declines, many utilities achieve a net positive financial balance for the first time.

At the core of this transition lies a fundamental change in regulatory logic. Spain moves from a system focused primarily on penalising negative externalities to one that actively rewards positive ones. Beyond pricing scarcity or pollution, the framework begins to value efficiency, circularity, ecosystem restoration and long-term resilience, internalising the benefits of good practice rather than only the costs of poor behaviour.

As these positive externalities are embedded into incentives and pricing, previously fragmented water markets begin to converge. A more integrated landscape emerges in which actors across energy, agriculture, hydrogen and tourism move beyond siloed operations to compete and collaborate within a value-driven water economy. This convergence accelerates innovation in pricing, resource efficiency and water-related business models. The private sector's role expands through targeted public incentives, while the state remains the strategic orchestrator.

Crucially, low water demand in this scenario is not the result of water policy alone. Given the transversal nature of water, demand evolves as a systemic outcome of political, social and cultural shifts across adjacent sectors.

Agriculture, once responsible for nearly 80% of total demand, undergoes the most significant transformation. Precision-irrigation technologies play an enabling role, but the decisive factor is a behavioural shift driven by outcome-based incentives that align farmers' economic decisions with water-saving objectives. For the first time, technology adoption translates into a genuine and sustained reduction in consumption, setting the pace for the national decline in water use.

Tourism, long a source of seasonal pressure, also evolves as cultural preferences shift towards authenticity and experience-based travel (Lipovetsky, 2024), favouring lower-impact models. In parallel, effective demographic policies reverse rural depopulation, turning many seasonal destinations into year-round communities. Together, these changes reduce sharp population inflows and allow local water systems to operate more predictably and under significantly lower stress.

Digital monitoring, behavioural nudges, and strong sustainability norms reinforce these patterns, pushing overall demand well below 2020s levels and decoupling consumption from economic growth.



Transparent, but Thirsty

High Innovation in Governance | High Water Demand



By 2050, Spain has travelled a long way in how it governs water, even as water demand itself has remained strikingly inertial. Consumption continues broadly along the trajectory set in the early twenty-first century: neither collapsing under scarcity nor being fundamentally reshaped by technological disruption. Proven solutions, widely deployed elsewhere are available, yet only partially adopted.

Throughout the 2030s and 2040s, public authorities pursue ambitious governance reform. Regulatory frameworks are modernised, coordination improves across administrations, and new instruments are introduced to enhance transparency, planning and long-term resilience (e.g., Living Labs). However, governance innovation alone proves insufficient to bend the demand curve. Deeply embedded social and cultural preferences, combined with sustained population growth and a structurally strong tourism sector, continue to exert upward pressure on water use.

In this context, governance reforms have significantly increased transparency across the sector. Desalination emerges as a dynamic and competitive subsector, yet rising demand continues to outpace efficiency gains. Gradual tariff adjustments become unavoidable. For the first time, households and businesses can clearly see what they are paying for, with prices per litre comparable across regions and cost differences explicitly linked to water origin. Rather than fostering a broader social debate, this transparency channels Spanish water policy—reflecting patterns seen since the 1978 Constitution—into managing regional inequalities.

Water policy increasingly centres on managing interregional compensations rather than fostering sector-wide collaboration, as public concern shifts from resource sustainability to regional inequalities and household affordability.

While the focus on regional disparities is a distinctly Spanish feature, this occurs against a broader European backdrop in which sustainability and long-term environmental considerations have gradually receded. A pivotal turning point came in 2025, when European policy shifted from a primarily sustainability-driven agenda to one increasingly focused on geopolitical and economic security. Since then, EU green ambitions have gradually waned, and previously bold environmental targets have lost traction. Together, these pressures reinforce societal inertia and limit the capacity of governance innovation to drive behavioural change.

Ultimately, even with high levels of governance innovation, the lack of alignment with social and cultural factors severely limits its effectiveness. Persistently high-water demand overwhelms these measures, preventing any single intervention from attracting sufficient investment to enable a comprehensive sector-wide reform. Sub-sectors such as desalination do become more competitive and dynamic, but overall, the structural challenges of a high-demand water economy remain largely unresolved.



Digital Springs

Low Innovation in Governance | Low Water Demand



By 2050, Spain experiences an unexpected easing of water pressures. Governance remains largely unchanged, as there is no restructuring of incentives, nor strong regulatory intervention. Yet demand drops substantially. The driver is not policy, but technology: private-sector innovation accelerates far faster than governance does, reshaping consumption patterns across agriculture, households and municipalities. This is a “good luck” scenario: the system improves because external conditions shift favourably, not because governance has evolved.

Agriculture, traditionally the largest consumer of water, experiences a remarkable drop in demand. This is not the result of the conventional “irrigation modernisation” schemes that experts warn can lead farmers to expand irrigated land and ultimately maintain or even increase water use. Instead, the reduction comes from a new generation of digital precision tools that optimise irrigation with surgical accuracy. Companies specialising in data analytics, remote sensing, crop modelling and automation enter the sector aggressively, encouraged indirectly by the PERTE for water digitalisation. Although the PERTE does not represent a profound governance innovation, it acts as a minimal institutional signal that unlocks private investment.

At the same time, Spain sees a stabilisation of water demand linked to broader societal shifts. Tourism becomes less intensely seasonal, reducing the sharp summer peaks that have historically strained coastal systems.

Rural areas attract new residents, which evens out consumption profiles across the year and allows small municipalities to enjoy more stable and predictable demand.

Because demand falls and seasonal volatility diminishes, the financial stress on utilities decreases, and in many cases benefit from the operational savings generated by technology. Tariffs do not rise, and in many cases stabilise. Technologies are pushed forward almost entirely by private firms that see a clear commercial opportunity, not by regulatory innovation. The private sector becomes the de facto leader of the transition. Technology companies scale solutions rapidly, utilities adopt smart systems because the business case is suddenly favourable and agricultural producers internalise digital tools because they reduce risks and costs.

The paradox of this scenario is that the system improves precisely while governance remains stagnant. Water use becomes more efficient, financial pressures ease and demand shrinks in the largest consuming sector, all without new incentives or major public intervention. It is a technologically intensive future in which private innovation compensates for the absence of strategic direction. Spain benefits from fortunate demographic shifts and rapid digital adoption rather than from policy foresight. The underlying governance weaknesses remain unresolved, but for a period, the country enjoys a more stable, less stressed water system thanks to forces that operate independently of institutional reform.



Thirst as Usual

Low Innovation in Governance | High Water Demand



By 2050, Spain finds itself navigating a new decade shaped not by disruption or reform, but by inertia. No substantial changes are introduced in water governance, pricing, transparency or demand management. Technological innovation remains modest and fragmented; social behaviours evolve only marginally. In short: Spain continues operating under the same system and incentives that defined its water sector a generation earlier.

But the context no longer cooperates. Water demand keeps rising, climate pressures have intensified and traditional sources, such as exhausted aquifers, stressed rivers, can no longer shield the country as they once did. Without coordinated action, Spain drifts into a future where the system stays structurally unchanged, but the consequences of that inaction become increasingly inescapable.

With no comprehensive tariff reform, the current pricing structure remains intact, but underlying costs climb. Energy prices fluctuate sharply, desalination expands, infrastructure ages and treatment becomes more complex. As a result, households face steady and often unpredictable increases in their water bills.

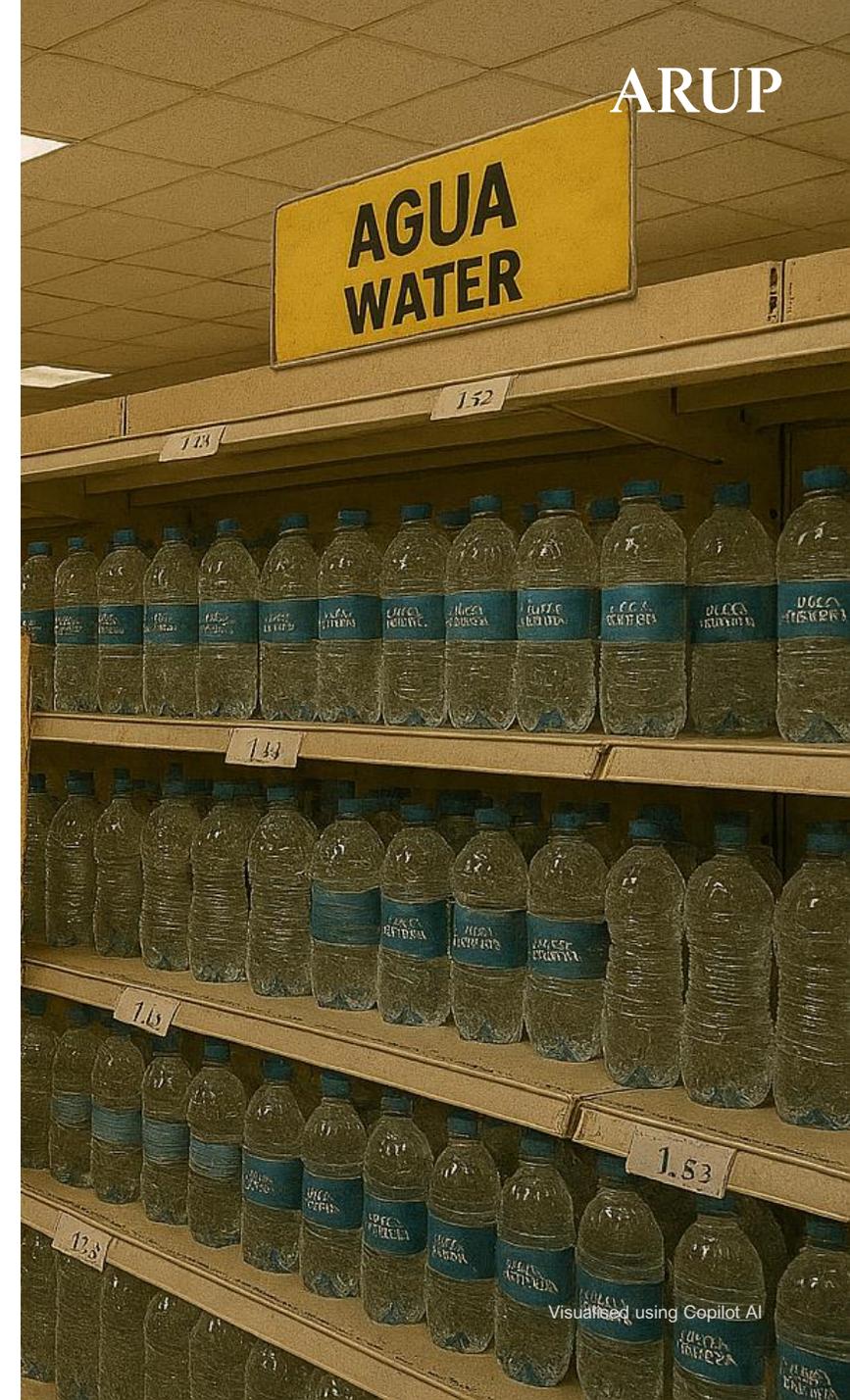
These rises are not linked to better services or a clear investment plan; they simply reflect a system absorbing higher costs. Public trust erodes, and many consumers feel they are paying more for the same. The social contract that once framed water as an affordable essential begins to unravel.

As pressures mount on the southern basins, Spain is gradually forced to embrace alternative water sources. Desalination becomes unavoidable in large parts of the Mediterranean. Under mounting pressure, Spain adopts large-scale potable reuse. Technically, it works. The water meets all safety standards. Plants operate reliably. Supply is stabilised. Yet socially, it fails.

With limited public engagement, weak communication and fragmented leadership, the introduction of potable reuse sparks discomfort and rejection. Misinformation spreads quickly. Media narratives polarise the debate. A large share of the population refuses the idea of “drinking treated sewage water,” regardless of the science behind it. Demand for bottled water rises sharply, pushing its price upwards. Ironically, the consumers least able to absorb higher costs are those who end up paying the most.

Desalination expands rapidly in the Mediterranean basins, ensuring water availability but exposing consumers to energy-driven price shocks. Every spike in electricity prices directly inflates the cost of producing water. Without integrating renewables or long-term energy contracts, Spain becomes dependent on a supply pathway that is secure, but financially unstable.

Despite deploying new technologies, neither public nor private actors introduce the structural reforms needed to manage demand, improve transparency or support households through rising costs. There are no major efficiency programmes, no digitalisation push, and no efforts to redesign tariff structures.



Indicators

Indicator	Description	Smart Stability	Transparent, but thirsty	Digital Springs	Thirst as usual	KPI(s)
Investment level	Level of capital flow into water infrastructure and innovation	High – Governance attracts investment via incentives and integrated markets	Medium – Governance reforms exist, but high demand limits ROI	Medium-High – Private sector drives tech adoption, governance passive	Low – Fragmented, reactive spending, rising costs without strategic plan	<ul style="list-style-type: none"> • CapEx Flows by Ownership Model (3): Year-on-year percentage change in water sector investment, segmented by ownership type CapEx Public CapEx Private CapEx PPP (Public-private partnerships) • Alternative Governance Instrument Uptake: Number and scale of experimental governance models (e.g., Living Labs, multi-stakeholder platforms) implemented within the water sector • Directive alignment rate: % of agglomerations / assets compliant with key technical requirements
Technology adoption	Deployment of advanced water-saving and monitoring technologies	High – Incentives + behavioural shifts enable systemic adoption	Medium – Available tech partially adopted, cultural inertia persists	High – Private innovation accelerates adoption in agriculture/utilities	Low – Limited, fragmented adoption; desalination dominates	<ul style="list-style-type: none"> • Non-Conventional Water Source Penetration: % of total water supply derived from a specific source (e.g., desalination) • Technological Maturity Index (Water Tech): Composite measure of adoption rates, innovation level, and efficiency gains from new water technologies (e.g., smart metering, leak detection)
Industry competitiveness	Ability of industries to compete and innovate, including both water-related sectors and other industries competing for water	High – Integrated water economy, cross-sector partnerships	Medium – Desalination competitive, but overall sector constrained	High – Tech firms dominate, utilities adapt quickly	Low/Medium – Reactive, cost-driven, no structural reform	<ul style="list-style-type: none"> • Herfindahl-Hirschman Index (Water Tech): Measures market concentration in water technology; higher values indicate less competition • Water Intensity per Industry: Volume of water used per unit of economic output • Compliance Cost per m³ // Cost of Water per m³ • # Patents in water innovation
Social tension	Degree of public acceptance or resistance to water policies and technologies	Low – Strong engagement, incentives align with social norms	Medium – Affordability concerns dominate, regional inequalities visible	Low – Tech-driven improvements reduce stress, no major conflicts	Very High – Society-wide unrest due to rising costs and rejection of ‘new normal’ (e.g., water reuse)	<ul style="list-style-type: none"> • Water Tariff Transparency Index: Measures the clarity, accessibility, and standardisation of tariff information provided to consumers and stakeholders • Water Tariff Dynamics: Tracks year-on-year percentage changes in water tariffs, across regions or customer segments • Floating Population Ratio: Ratio of peak seasonal population (summer/holiday periods) to annual average resident population, based on census data (long-stay residents)

Key takeaways

The forces and choices that will define Spain's water future

This study set out to understand how Spain's water system operates today and what that implies for its future. The conclusions below distil the most critical insights emerging from the analysis, highlighting the structural features, constraints and levers that will shape how the system evolves in the decades ahead.

First, Spain does not have a single water market, but a fragmented water system. Water outcomes are shaped by territorially bound monopolies, local governance structures and sectoral policies that sit largely outside water management itself. Pricing, investment signals and incentives vary widely across regions, often reflecting political and historical arrangements rather than scarcity or efficiency. This fragmentation is not a temporary distortion but a structural feature that conditions all future pathways.

Second, the system is already in transition, but change is uneven and poorly coordinated. Near-term developments show significant movement, driven by EU regulation, climate shocks, digitalisation programmes and targeted public funding, yet these shifts remain partial. Progress in one area is frequently offset by inertia or misalignment elsewhere, limiting systemic impact. The result is a system under growing pressure that adapts incrementally rather than transforming decisively.

Third, governance and demand emerge as the pivotal levers shaping future outcomes. Across all analyses, the degree of innovation in governance and the trajectory of water demand consistently determine whether pressures translate into resilience or crisis. Technological solutions are available and, in some cases, already deployed, but their effectiveness depends on institutional coordination, incentive design and social acceptance. Without alignment across these dimensions, even high levels of investment fail to deliver lasting change.

Fourth, opportunities exist, but they are conditional rather than automatic. Digitalisation, reuse, desalination, modular treatment and cross-sector integration offer credible pathways to improve water security and efficiency. However, these opportunities only materialise where regulatory frameworks, financing mechanisms and behavioural incentives reinforce one another.

In their absence, innovation remains fragmented and returns, either economic, social or environmental, remain limited.

Finally, the future of Spain's water system is not predetermined. The scenarios explored in this report show that radically different outcomes can emerge from the same starting point. Small shifts in governance quality, demand management and cross-sector coordination can compound over time, steering the system toward stability, stress or transformation. The central insight is not which future will occur, but that today's decisions (particularly those taken outside the water sector itself) will quietly but decisively shape the range of futures that remain possible.

Expert Contributions



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