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Isle Utilities

WORLD ECONOMIC FORUM

A Freshwater Future: Without Blue, There Is No Green Economy

BRIEFING PAPER

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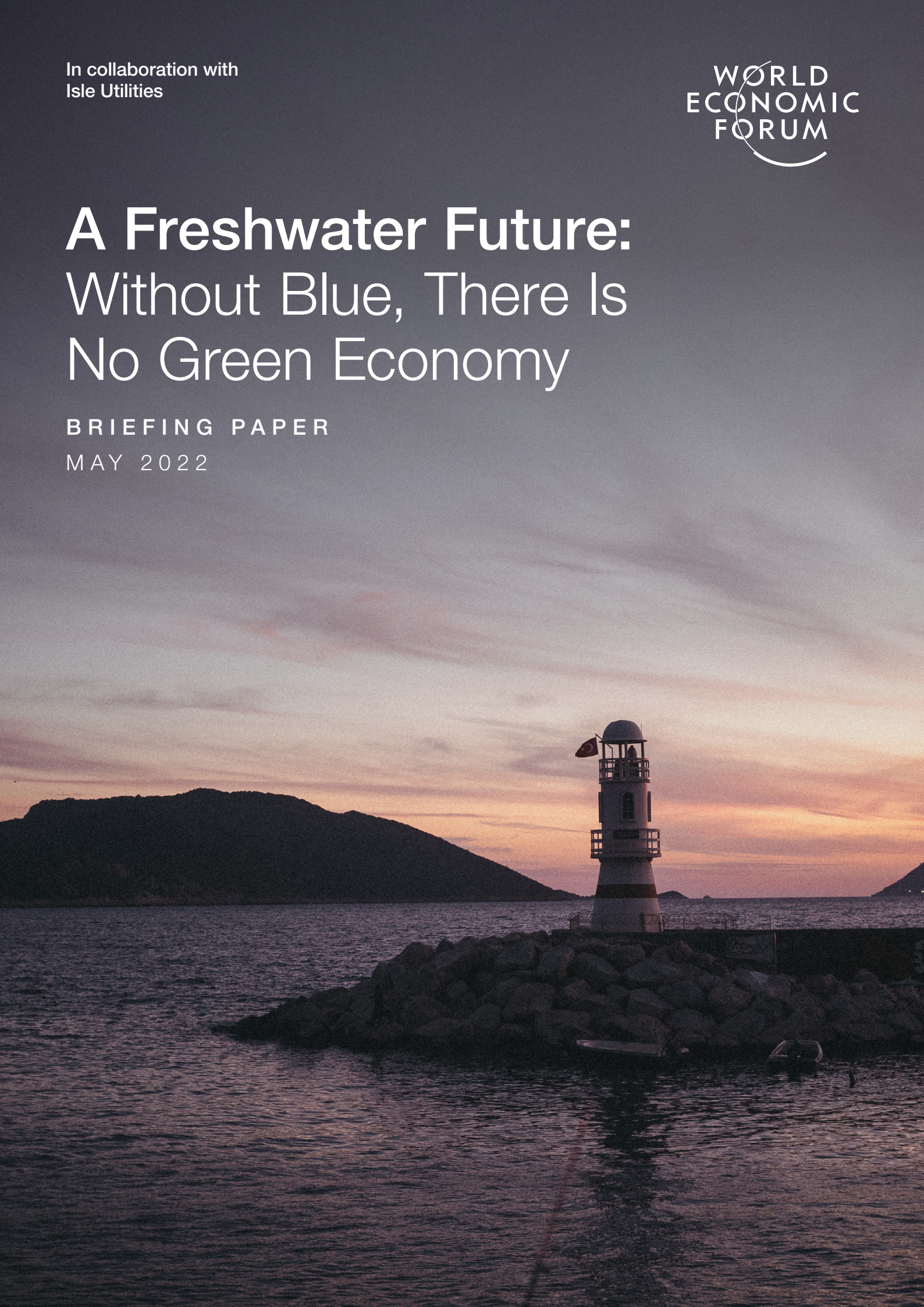

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Foreword

In today's challenging global context, water's role as an enabler and impact multiplier to transition to a green economy is ever more critical.

From flood and drought to fire and famine, the impacts of climate change are being felt across the globe. In 2021, economic losses from climate and weather-related disasters totalled an estimated $329 billion, the third costliest in history.[1] Governments and industries around the world are responding with an array of goals, commitments and strategies in the race to net-zero carbon and a green transition. But, they are failing to include water as a central part of decarbonization strategies and roadmaps to success.

While awareness of greater water-related business risks driven by climate change has grown, and the need for water security has gained attention, the topic is often seen in competition for attention and resources with other sustainable development priorities. However, water can be used as a universal lens to focus on, serving as an enabler and impact multiplier. Water has the ability to enable economic activity to grow and human health to thrive both directly (through a healthy environment) and indirectly (where green infrastructure leads to better mental health outcomes), as well as contributing to resilience and sustainable development agendas in less obvious ways.

This white paper shines a spotlight on opportunities and highlights examples of companies taking action. It provides insight on how water can unlock multiple gains to stimulate discussion and mainstream best practice to become common practice. The hope is to inspire a broader set of leaders to take action and create a groundswell movement of even bolder ideas in the lead up to the UN Water Conference – the first in over 40 years – taking place in March 2023.

Executive summary

Water remains largely missing from decarbonization strategies, potentially compromising efforts, while overlooking important opportunities in the race to net-zero carbon economies.

The international commitment to transition to a green economy has largely remained strong, even in the face of challenging current economic, social and geopolitical headwinds. Countries and companies alike continue to commit themselves to net-zero carbon goals and sector decarbonization strategies. But if water is not central to these strategies, realizing these goals is put at risk.

Water's intrinsic link to energy and carbon can be a useful lever in net-zero strategies. A recent study by global water technology company Xylem estimates water utilities worldwide account for ~2% of greenhouse gas (GHG) emissions – the equivalent of the world's shipping industry. Furthermore, 50% of electricity-related emissions from the wastewater sector can be abated with existing technologies, and ~95% of this impact is achievable at zero or negative cost.[2]

Although water is a local issue that requires context-specific approaches and solutions, the disruption that water insecurity creates in today's interconnected and vulnerable supply chains is very real and should not be underestimated or ignored. For example, the mobility sector's drive towards electric vehicles is vulnerable to the water risk in the supply chain, including mining the metals needed to manufacture batteries. Mining is constrained by lack of access to water, and metal exports are buffeted by geopolitics and COVID-19 travel restrictions capping labour availability in mining regions. In Chile, drought or disease could disrupt the production of batteries destined for a car manufacturer in the Philippines.

With 80-90% of new operations globally being built in water-scarce areas,[3] the value at stake and the impact across supply chains for companies can be significant, and ultimately decarbonization efforts may be compromised. The links seem obvious.

Including water in net-zero carbon strategies requires innovative technologies, know-how, governance and financial instruments. Being innovative is challenging, and rising to this challenge demands a paradigm shift. This paper describes how this shift can be made and how it already has been done by multinationals, utilities, municipalities and small companies in both the Global North and the Global South.

Each example in the paper shows that the barriers to innovation have been surmounted by multistakeholder partnerships throughout the world, and that those partnerships continue to meet with success. However, to reach the scale and pace of change that is needed, a further step-change is required. Leveraging pre-competitive collaborative platforms to continue the sharing, learning, replication, transfer and adaptation of these actions across sectors and borders is a must. A broader set of champions is also needed to push the boundaries and mainstream innovation in water.

Exploring bold frontier ideas as a collective – such as through trade pacts, tax incentives and transparent, responsible sourcing – can be powerful levers for change. While innovation can enable the change, the right leadership can turn it into a reality.

1

Breaking innovation barriers

Many companies are not on track to achieve net-zero carbon, or positively impact on water security in the catchments where they operate.

The past two years have revealed the fragility and vulnerabilities of global supply chains. The COVID-19 pandemic and current conflicts have hindered the production, movement and availability of goods and services with significant economic and human impacts. The disruption that water insecurity creates in supply chains is equally real, but can fly under the radar in certain industries. Left unaddressed, it risks derailing global climate ambitions and efforts.

The need to deliver on key Sustainable Development Goals (SDGs) and climate commitments remains just as pressing, if not more urgent than ever before. The race to net zero is on, with all sectors of industry and society looking to reduce their reliance on fossil fuels and decrease greenhouse gas (GHG) or carbon emissions.

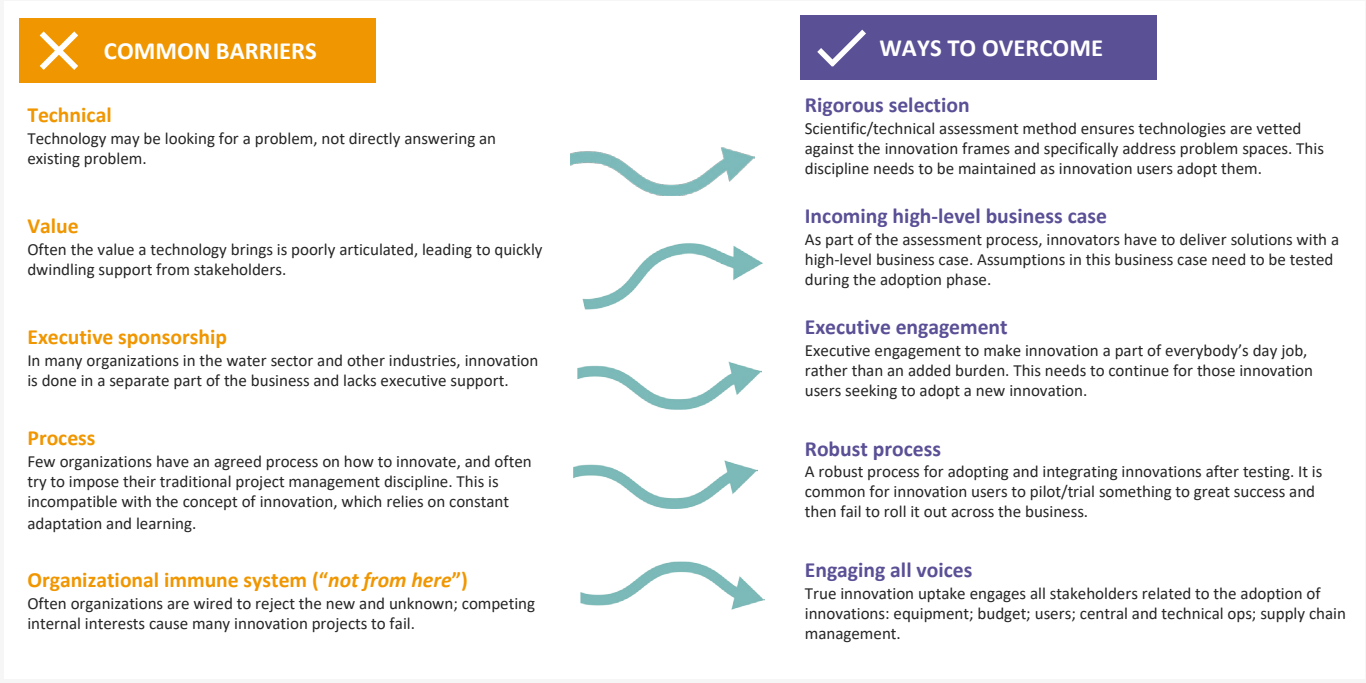
It is important to keep an eye on water security; decarbonization cannot come at the cost of adequate access to water. Treating water to standards suitable for consumption contributes an estimated 10% of global carbon emissions[4] and yet wastewater itself is a source of energy and water. Industry plays a crucial role in reducing freshwater withdrawals and minimizing energy expenditure on water transport and treatment, even when the connection between industrial activity and the local catchment or basin is not obvious. Replacing traditional surface and groundwater resources with a diversified mix requires innovation, which can be extremely challenging. While there is no shortage of good ideas, supporting these with sufficient capital and longevity to break through the most common innovation barriers (see Figures 1 and 2) is key.

All the listed innovation barriers can be distilled to a single barrier: culture. People and businesses that want to innovate from within and/or adopt innovations from the outside can help create the conditions and incentives throughout the entire organization for success. This includes investing time and other resources in ideation and scouting, enabling continuous staff learning, internally funding innovation or securing external funding and finance, and creating top-level stretching goals, supported by innovation processes.

The examples that follow illustrate that if a culture of innovation exists, these barriers can be removed or surmounted.

Innovations may be new technologies, ways of working, know-how, or organizational models. The barriers to innovation appear to be many and varied.

FIGURE 1 **Overcoming barriers to innovation**



In addition to those listed above, insufficient capital is the most common barrier technology developers cite to market entry and widespread uptake of their innovations. In fact, 38% of technology startups that failed during 2018 and 2022 across all sectors included insufficient funds among their reasons for failure as seen below.

FIGURE 2 **Reasons why tech startups have failed**

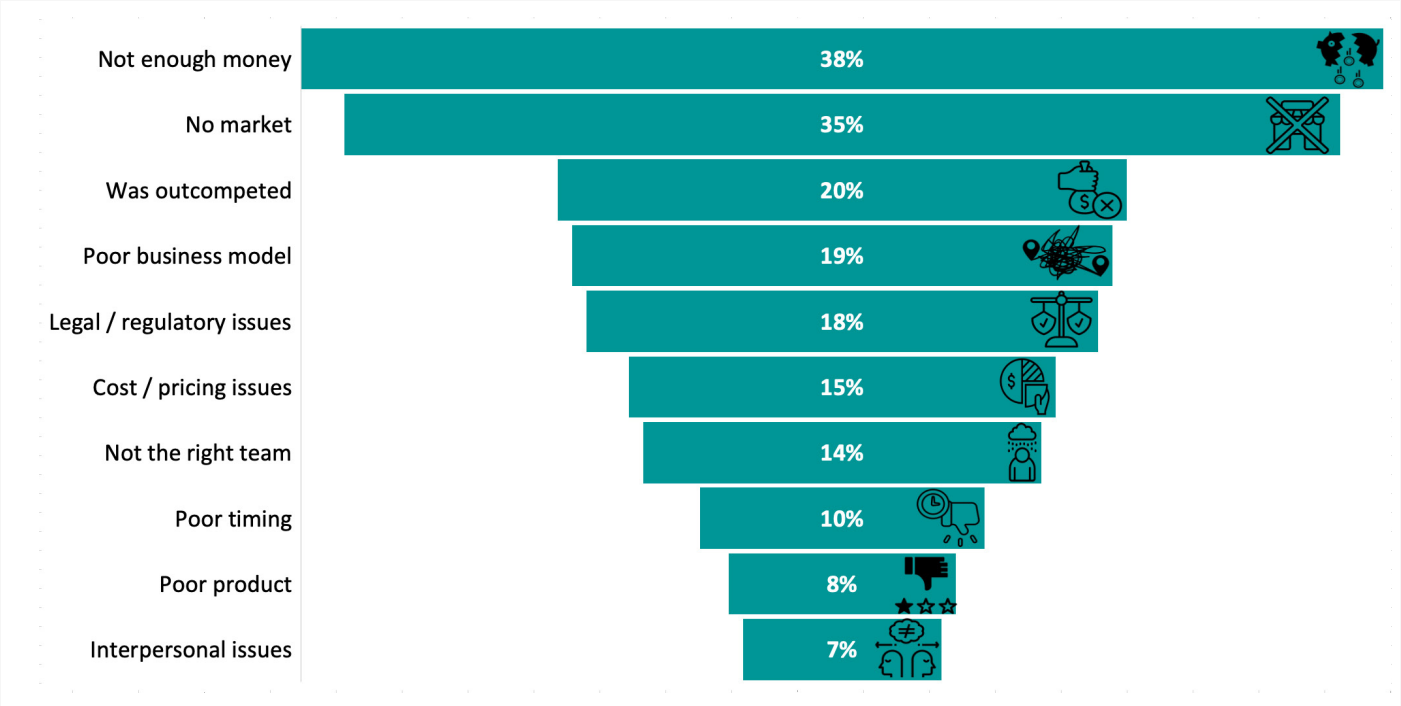


Figure drawn using data from CB Insights, 397 Startup Failure Post-Mortems, 2022

2

Decoupling water treatment and use from carbon emissions

Companies operate within river basins and in doing so depend on and affect public utilities and other companies.

Treating and distributing water – whether for human of industrial use – requires energy, producing GHG emissions. Large, centralized facilities offer efficiencies of scale, but pumping water over large distances is energy intensive. Once used, water is then either discharged to the environment or pumped back for treatment, creating a vicious cycle of carbon emissions from water treatment and use. Shrinking the water footprint is an essential part of lowering carbon impact, and innovations in technology and institutional arrangements can enable this decoupling.

One example is to enable off-grid or energy-positive potable water schemes. In 2016, American water treatment company Pentair and Coca-Cola joined forces to bring a water kiosk to Ruhanda, a rural community in Rwanda, providing two water filters to treat groundwater. The EKOCENTER water kiosk is entirely solar powered and provides safe drinking water for sale, a convenience store, mobile phone charging station and a WiFi hotspot, while also empowering local entrepreneurs – women in particular – through training to operate and manage the centres. Each litre of safe drinking water provided within walking distance of a rural household saves approximately 3.03 kg CO_2-e carbon emissions.[5] Any company operating its own supply chain across low- and middle-income countries could replicate this successful business model, irrespective of core product.

In 2021, Danish multinational brewer Carlsberg opened a water treatment plant that recycles 90% of the process water used at their brewery in Fredericia, Denmark,[6] a crucial step towards achieving the company's target of virtually eliminating water wastage globally by 2030. The new plant is a collaboration of the Danish partnership for Resource and water efficient Industrial food Production (DRIP), engaging food sector companies, technology providers, universities, and research and technology organizations to produce more food with less water without compromising quality and food safety. The plant is expected to halve water consumption from the current 2.9 litres of water per litre of beer produced to 1.4 litres of water per litre of beer, with projected annual savings of more than 500 million litres. Greenhouse gas emissions from the delivery of 1m^3 of potable quality water abstracted from surface water resources are approximately 0.42 kg CO_2-e,[7] thus the annual water savings represent 210,000 tonnes CO_2-e emissions averted. Simultaneously, the brewery's energy consumption will be reduced by 10% through biogas production and hot water recirculation.

Water utilities can also play an important role. For decades they have focused solely on the quality of treated wastewater, removing carbon, phosphorus, and nitrogen from sewage to the lowest possible levels. An unintended consequence, nitrous oxide (N_2O) is now one of the main sources of GHG emissions from wastewater treatment works, with a warming potential almost 300 times stronger than CO_2. Careful consideration of how effluent standards can be set using water resource quality objectives rather than the lowest feasible targets would deliver better overall environment outcomes.

3

The circular economy demands collaboration

Water conservation and demand management pays back through other resource savings, but investments must be made outside the factory fence.

Any industrial company, whether using water in products or only for operations, has an opportunity for water reuse on its own premises. However, greater opportunities exist in transferring water and by-products between organizations.

The E4Water project has demonstrated the possibility of uncoupling industrial growth from water and energy by recycling the effluent of a neighbouring industry partner into Solvay's manufacturing loop at their Solvic Lillo site in Belgium. With its innovative, mobile testing facility that is moved from site to site, Solvay, a multinational chemical company, tests the effects of recycled water on performance before it is integrated into the production process. This rapid assessment of impacts and benefits accelerates the uptake of water recycling. The Lillo E4Water site involves 19 industrial partners from the Antwerp chemical cluster as well as the Antwerp Port authority. It corrects a systemic local issue with such success that it has been replicated at five more sites.[8] Solvic saves 500,000m^3 of drinking water annually. The neighbouring facility is now a zero-liquid discharge site, thanks to the diversion of salt and water from waste disposal to Solvic.

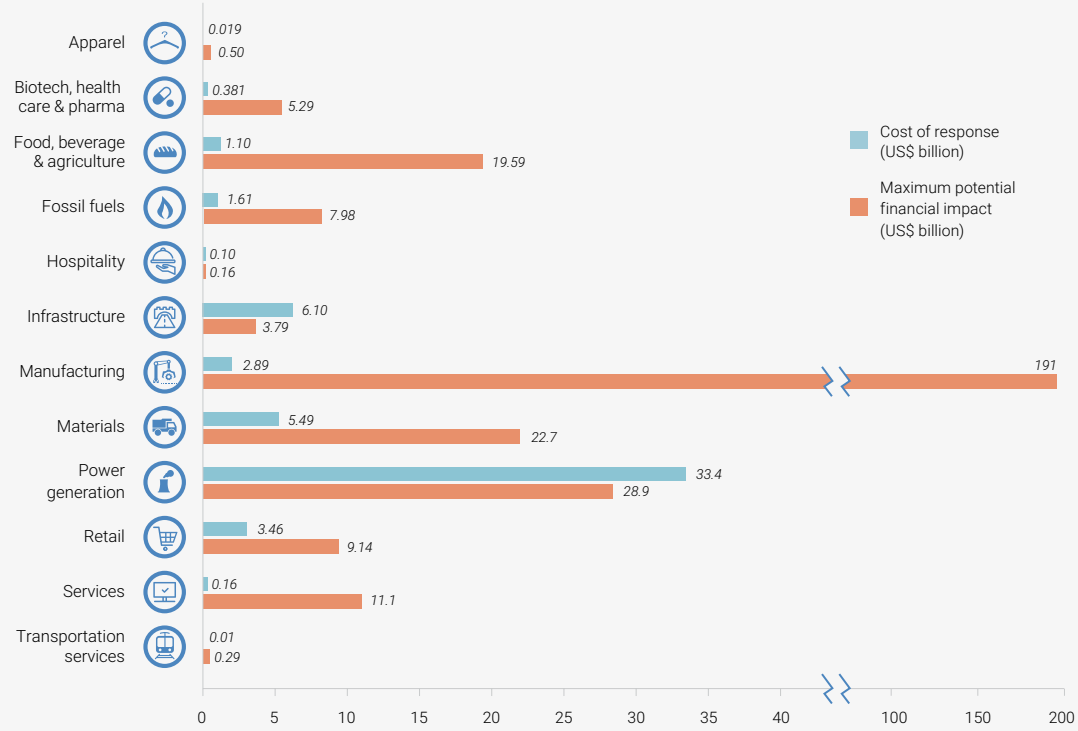
Shell's Groundbirch natural gas production facility is located in British Columbia, Canada, near the City of Dawson Creek. Gas is extracted with hydraulic fracturing, for which a large volume of process water is required, and product water is generated. The area suffers from surface water shortages, making their supply vulnerable. To minimize local freshwater use, Shell partnered with the city to establish the Dawson Creek Reclaimed Water Project. The city treats municipal wastewater to an industrial standard, and Shell pumps the treated wastewater from the water plant through a pipeline to its gas facility for use in operations. Removing the need for water hauling trucks equates to avoiding over 3 million kilometres travelled per year, reducing road safety risks, dust and noise for the local community, and averting 3,154 t CO_2-e emissions per annum. With access to 3,400m^3 per day of reclaimed water, plus onsite water recycling, Shell has virtually eliminated the need to use local surface water. Both Shell and the city are now replicating the concept with other partners.

This need to innovate for water security is not an isolated case. With 80-90% of new operations globally now being built in water-scarce areas,[9] companies are increasingly competing against each other, domestic consumers and agricultural users for freshwater alike. Environmental operating permits are becoming increasingly difficult to obtain in areas where the water resources have been fully allocated, unless it can be demonstrated that water withdrawal levels will be near zero, or that the catchment or basin will not be adversely impacted. In Europe alone, the value of new industrial and commercial

real estate investment in 2021 was €38.3 billion,[10] meaning that €30.64-€34.47 billion of investment is at risk of becoming stranded assets due to water scarcity locally and in the upstream supply chain.

As operations face greater water-related business risks, especially those caused by climate change, the need for better water management and supply chain practices is gaining attention. The business case is clear. CDP, an international non-profit organization that helps companies and cities disclose their environmental impact, reported that globally, almost all sectors the cost of responding to water risks is far outstripped by the cost of not responding. In Figure 3 below, CDP shows the potential monetary impact of water risks to businesses is over five times higher than the cost of addressing them, and that potential budgetary impact of water risks outweighed the cost of acting on those risks for more than three-quarters of companies[11] across all industries, including retail, transportation, hospitality and services.

FIGURE 3 **Potential monetary impact of water risk and cost of response per sector**



Heavy and extractive industries such as oil and gas, power generation and mining are still working out the best way to reduce their environmental impacts, with water yet to feature in many long- or short-term goals, despite the direct relationship. The global move towards renewable energy use and away from fossil fuels has a hidden impact.

The increased demand for energy storage for electric vehicles (EVs), solar and wind energy, and electronic devices for e-commerce and the "greening" of service industries by replacing paper with electronic documents has become an important driver for many mined metals, including copper, nickel, cobalt and lithium. While copper and nickel are used in various other industries, cobalt and lithium are primarily used in lithium ion (Li-ion) battery production.

All sectors that rely on energy storage are at risk. Producing lithium requires vast amounts of energy and water, with considerable environmental impacts.[12] The intensive water consumption of lithium extraction can affect local water security and agriculture, and could lead to water imports in producer countries.[13] The motor industry, in its push for wider uptake of EVs, needs to think about where the water for battery metal extraction comes from and whether extractive industries can continue operating the way they are currently. The six leading lithium producers are Australia, Chile, China, Argentina, Zimbabwe and Portugal. Water insecurity in the locations where lithium ore deposits are found prevents mining from taking place, hampering the production of batteries and disrupting the supply chain – from mine to motor – potentially derailing sectors' and countries' decarbonization transitions to EVs.

4

Reaching the scale and pace of change needed

Collaborative platforms and co-creation of innovation pathways are the keys to success.

Water can be an important lever to realize gains across water resource management, while helping take industry and society towards net-zero carbon, zero-liquid discharge and a circular economy. The key is to find ways that move beyond one-off projects and enable a clear pathway for replication and scaling to affect the change we need. The key is leveraging existing collaborative platforms that support such co-creation pathways with the right partners, funding support, collaborative framework and conditions for scale.

For example, the Trial Reservoir is a source of loans for technology companies trialling innovations that mitigate climate change in any sector (providing there is a link to water). It is an evergreen reservoir of money that will only release a loan when the trial has been designed in a way that leads directly to full-scale commercial implementation immediately after the trial has successfully concluded. The trial design must include key performance indicators (KPIs) and critical success factors (CSFs), which trigger uptake at scale, and the agreement under which the trial is run must include a clear description of the path to post-trial procurement and implementation, provided the KPIs and CSFs were met. This prerequisite forces a collaboratively created process by which successfully piloted innovations will be replicated and scaled from the outset. The revenue that flows from the end user to the innovator from implementation whenever a trial is successful enables the innovators to repay the loan so the money can be recycled to support another trial.

Another is the 2030 Water Resources Group (2030 WRG), a partnership hosted at the World Bank, which engages over 1,000 government, private sector and civil society partners in 13 countries across three regions. One project in the state of Uttar Pradesh, India, is aimed at benefiting 1 million rice and sugarcane farmers. Targeting the mobilization of $100 million in private investments by 2025, the project is working with agribusiness companies, technology players and financial institutions, among others, to improve farm yields, reduce water and carbon footprints, and increase farmer incomes. The project aims to drive a tenfold increase in the area under water-efficient technologies such as Direct Seeded Rice (DSR) and drip irrigation, and a 60% reduction in greenhouse gas emissions resulting from flooding of farmers' fields.

Conclusion: A great water-efficient future lies ahead if…

The notable examples provided in this paper demonstrate the potential impact that water innovations can deliver on energy and climate goals. These examples are predominantly single companies or small clusters of partners undertaking company-wide actions. For transformative change, organizations need to come together in a more meaningful way, particularly through multistakeholder programmatic approaches, to achieve national and regional impacts.

While water stewardship efforts at the local level need to continue and set the foundation, bold global initiatives can also play a role in building energy and momentum. This includes multinational trade pacts and tax incentives, which are appropriate instruments for moving whole industries towards adopting best practices. Imagine if there could be a global trade pact, where benefits included better access to markets, tax exemptions or credits, or freer movement of imports/exports – for companies that can demonstrate good water stewardship as part of their decarbonization strategy, or if their products were able to be traced back to "gold standard" sustainably managed water basins.

Perhaps a special G20 meeting together with the World Trade Organization can explore this concept. With the continued advancement of technology and digital systems, it may finally be possible to create a fully integrated "water map" that combines real-time data from public and private sources, overlain with economic and population growth projections and climate modelling to help leaders make the best decisions possible.

Technology innovation makes this idea possible; the commitment of leaders could turn such bold ideas into a reality. This is the opportunity to seize, and with the 2023 UN Water Conference on the horizon, the moment is now.

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This report is written in collaboration with Isle Utilities, an innovation consultancy whose core business is collaborative review of disruptive technologies and acceleration of their uptake. Isle Utilities has reviewed 8,000+ innovations, matched 1,000+ to end users, commercialized 200+ technologies to serve 150+ public and private sector end users, and leveraged $1 billion+ external investment in clean technology.

Endnotes

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