RESEARCH SUMMARY

Non-domestic Water Use; Learnings from International Data & Conservation Initiatives

RESEARCH SUMMARY PREPARED FOR THE WATER FORUM

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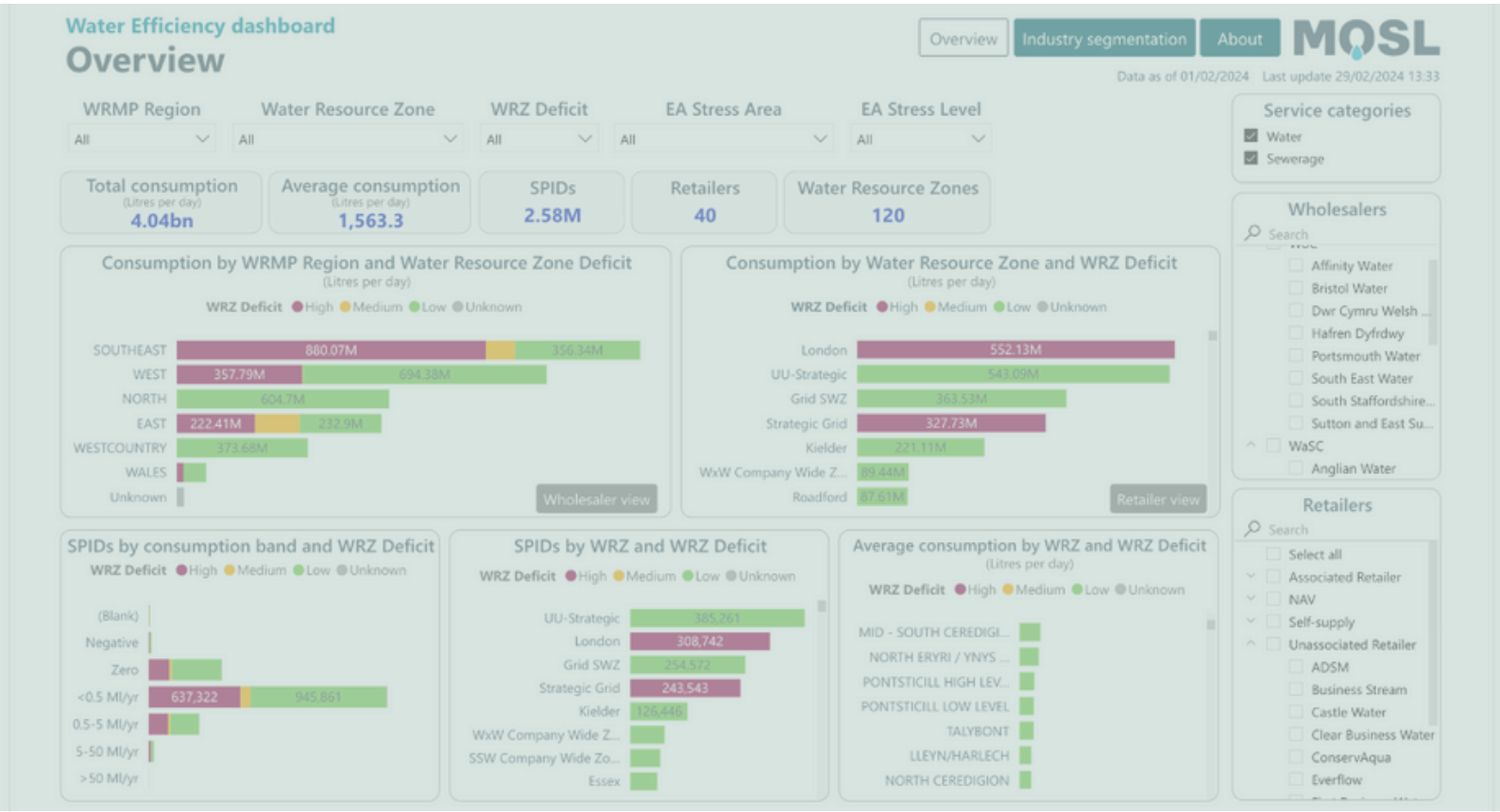

BASED ON A RESEARCH REPORT BY

Dr. Sarah Cotterill, Dr Triona McGrath and Dr Rosanna Kleemann

Executive Summary

There is a growing disparity between the demand for water and the available supply across Europe. Although Ireland is not considered a water-stressed country, it is still crucial to plan for sustainable management of water resources to meet current and future needs. This brief was prepared in 2022 in response to An Fóram Uisce's Open Research Call on learnings from international data and conservation initiatives on non-domestic water use.

This research was done in 2022 prior to the Water Environment (Abstractions and Associated Impoundments) Act 2022 and its associated regulations coming into effect (in August 2024), and prior to the Planning and Development Bill passing through the Dáil (in October 2024) which led to the reorganisation of An Bord Pleanála to An Coimisiún Pleanála. A review of the new Planning and Development Regulations was not included.

The terms ‘water use’ and ‘water consumption’ are often used interchangeably, but they do not exert the same pressure on ecosystems or water resources. The proportion of water returned after abstraction varies significantly across sectors and even when a large portion is returned, there may be variations in where or when it’s returned, or the water quality may be changed, which can impact water bodies.

The Environmental Protection Agency (EPA) is responsible for regulating water abstractions in Ireland. Water abstracted for hydropower represents 91% of the net sectoral volume of abstractions in Ireland (from data supplied in Oct 2022). However, hydropower largely does not consume water.
The next largest abstractor is industry (72% of abstractions when hydropower’s removed), followed by drinking water supplies (22%) (Figure 1).

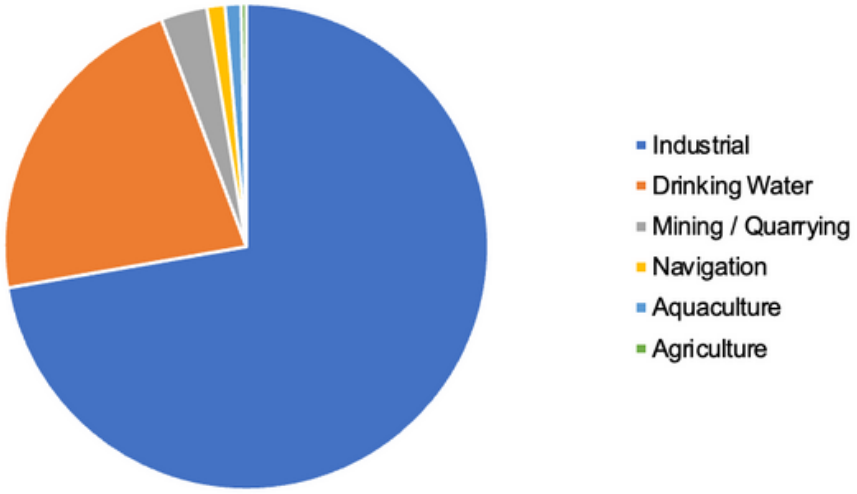

Figure 1. Primary use of registered abstraction by total volume, after removing hydropower (Source: EPA registered abstractions Oct 2022).

Ireland's industrial sector is diverse and includes manufacturing, data centres, pharmaceuticals, energy companies and more. Drinking water abstractions in Ireland supply public water supplies through Uisce Éireann (83.5%), group water schemes (6.1%) and private wells (10.4%).

n 2022, the Government signed into law the Water Environment (Abstractions and Associated Impoundments) Act. As a result, Uisce Éireann’s available water supply across its four regions could decrease substantially due to a reduction in the volumes of water that can be legally abstracted.

Executive Summary

Whilst leakage reduction programmes will help to address supply-demand balance issues, water conservation and efficiency measures are an underused tool that will be critical for meeting future demand.

International best practice in sector-specific solutions includes upgrades to conveyance infrastructure, changing irrigation practices and irrigating with harvested or reclaimed water in agriculture; optimising cooling technologies in the power sector; re-using process water for washing/cooling applications in the pharmaceutical and food and beverage industries; or implementing similar best-practice solutions seen for domestic water conservation - such as low flow taps and showers - in the tourism and retail sectors.

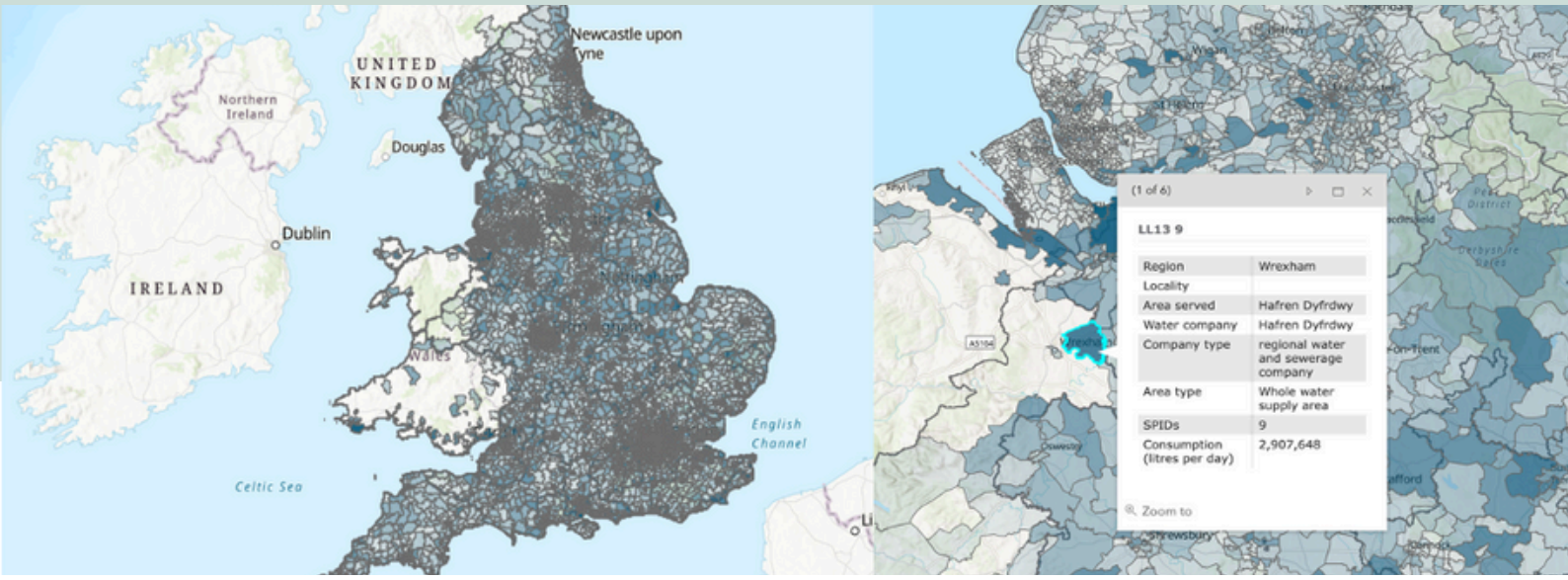

Figure 2. MOSL dashboard showing non-household consumption in England and Wales by postal sector (MOSL, 2022a).

National and international initiatives on non-domestic water conservation were drawn from Ireland, Denmark, the United Kingdom, Singapore, Australia and the USA. This included stewardship programmes; governance; publicly-available databases; legislative limits on abstraction, time-bound abstraction licenses, systems for measuring and reporting water consumption data; mandatory water efficiency practices, and financial supports for companies to adopt water-efficient measures.

The current understanding of water abstraction for non-domestic demand in Ireland is limited, making it difficult to assess its impacts accurately. Key issues include the unknown locations and volumes of many abstraction points, uncertainties in categorising water use, implementing efficiency measures, and ensuring sufficient governance for sustainable water management. To address these challenges, seven policy recommendations were proposed across four areas to: (i) address data gaps, (ii) scale-up best practice, (iii) strengthen governance, and (iv) build capacity and resources.

Recommendations

1. **Increase transparency in water use at a national and local level.** This is key for regulatory control of planning, to support decisions around if and where there is sufficient water in a catchment for a new (potentially high) water user.

2. **Refine demand projections in non-domestic demand forecasts, for private abstraction and public water users, with a specific focus on key sectors in Ireland.** Key growth sectors - such as agriculture and data centres - should not be omitted from forecasts due to uncertainty in demand. Greater transparency on the amount of water abstracted, from which water sources, along with the location of any wastewater discharges should be required in future planning applications.

3. **Facilitate bottom-up sharing of best practice in sector-specific technology, amongst non-domestic users from both private abstraction and public water customers.** This should build on good practice (e.g. water stewardship programmes and UÉ's advice for business customers) to include more sectors (e.g. energy production and data centres) and reach a larger proportion of the non-domestic market for greater impact. Strategies to overcome barriers should also be discussed.

4. **Strengthen governance in relation to planning and prioritising of regional water use.** The planning process should involve an independent assessment of water available for use within a catchment, the cumulative impacts of water users in a catchment and the current and future pressures on water availability. In some cases, it may be necessary to implement conditional planning approval for industries with high water/energy needs. Uisce Éireann are in a difficult decision-making position with statutory obligations for both economic growth and housing, with potentially competing demands for water in an area. An independent body could be established to address this, undertaking reviews for planning and management of water resources, enhancing coordination between stakeholders, and scaling-up water use efficiencies through knowledge exchange.

5. **Develop specific regional and national metrics for water efficiency savings relative to growth projections.** Targets for efficiency improvements should be quantified through offsetting e.g. *a 20% efficiency saving in X, would enable growth or delivery in Y.* This approach may also include adjusting minimum efficiency standards for infrastructure associated with a water permit, or implementing conditional planning approval for industries with high water/energy needs. This should be applied to private abstractions and public water customers.

More information on each recommendation is provided on p10 - 11

Introduction

Although Ireland is not considered a water-stressed country, it is still crucial to plan for sustainable management of water resources to meet current and future needs. In 2018, Ireland's total freshwater withdrawal, excluding environmental flow requirements, was 16% of its renewable freshwater resources. This figure rose to 21.6% in 2019 and 2020, exceeding the target set by the 'Roadmap to a Resource Efficient Europe,' which aims to keep water abstractions below 20% of available freshwater resources. Ireland has one of the highest average annual precipitation rates in the EU, but the timing and distribution of rainfall vary regionally and seasonally. These variations, coupled with seasonal changes in non-domestic water demand, can result in temporary regional or seasonal water stress.

The terms 'water use' and 'water consumption' are often used interchangeably, but they do not exert the same pressure on ecosystems or water resources.

In 2017, approx. 40% of abstracted water across Europe was consumed, with the remaining 60% returned to the environment. The proportion of water returned varies significantly across sectors with less returned from agriculture than industrial cooling, which returns less than hydropower. However, even when a large portion of abstracted water is returned to the environment, there may be variation in where or when it is returned, or a change in the quality of what is returned which may still impact water bodies. Seasonal and geographic variations can influence water abstraction volumes in agriculture, public water supply, and energy.

WATER ABSTRACTION IN IRELAND

The Environmental Protection Agency (EPA) is responsible for managing water abstractions in Ireland, including the management of abstraction data, monitoring water discharges, and assessing the risk of over-abstraction. To remain compliant with the European Union (Water Policy) (Abstractions Registration) Regulations 2018 in Ireland (S.I. No. 261 of 2018) any abstraction in excess of 25,000 litres of water per day, must be registered with the EPA. A review of abstraction data, supplied by the EPA on Oct 10th 2022, prior to it being published more transparently online (in December 2023), showed that 1,717 people/businesses/schemes had registered their abstraction(s), with a total of 2,650 individual abstraction points. These data did not include Department of Defence abstractions (5), Uisce Éireann (UÉ) wastewater treatment plant abstractions (55) or private drinking water abstractions (74). Furthermore, abstraction figures are likely to be underestimated as only those abstracting more than 25 cubic metres per day are required to register, and the register can become outdated if registrations are not updated regularly.

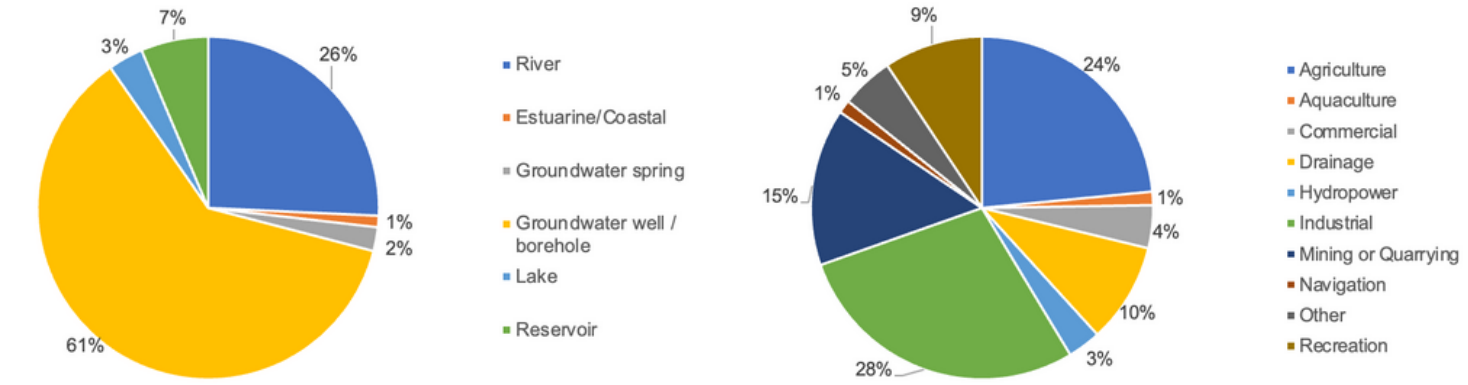

Figure 3. Registered water abstractions by abstraction type (left) and by abstraction purpose (right) (Source: EPA Abstraction Points 10/10/2022). N.B. this depicts no. of registrations, not total volumes

Drinking water abstractions make up 22% of the EPA's registered abstractions by volume when hydropower is removed (Figure 1). Drinking water abstractions in Ireland supply public water supplies through UÉ (83.5%), group water schemes (6.1%) and private wells (10.4%). UÉ is Ireland's national water utility. In 2021, UÉ developed a National Water Resources Plan outlining how they intend to balance the supply and demand for water in a 25-year strategy. This report, which contained a breakdown of water demand from public supplies in 2019 showed that 23% of their consumptive use was for non-domestic properties (Figure 4).

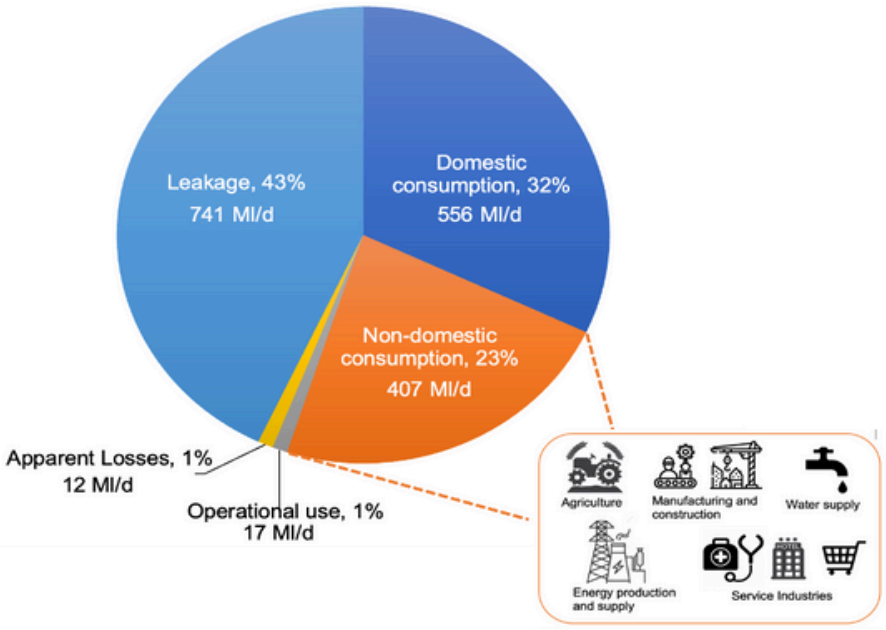

Figure 4. Breakdown of water demand from public water supplies for 2019, based on data from (UÉ, 2021)

Table 1. Number of customers, volume supplied, and sources of water for each regional water resource areas in the NWRP. Data sources are noted.

	Total no. of water supply customers (in 2019)	Amount supplied (Ml/d)	No. of non-domestic properties served (in 2019)	Non-domestic consumption (Ml/d)	Projected population growth (%) 2019 – 2044	No. of groundwater sources	No. of surface water sources	No. of WRZs	No. (and %) of WRZs with a SDB deficit *	Reference
North West (NW)	732,700	369	74,137	89 (24%)	25 (Galway City = 38 - 53%)	12	88	106	60 (56.6%)	(UÉ, 2023b)
South West (SW)	549,000	316	45,000	70.0 (22%)	33 (Cork City = 54%)	172	75	174	91 (52%)	(UÉ, 2023a)
South East (SE)	369,240	161	29,714	30. 4 (19%)	28 (Waterford City = 52%)	120	53	111	63 (56.7%)	(UÉ, 2023c)
Eastern and Midlands (EM)	2,480,000	887	76,000	219.10 (25%)	25 (Limerick City = 61%)	163	46	134	90 (67.2%)	(UÉ, 2022)

UÉ manages 539 water supply areas known as Water Resources Zones (WRZs). Phase 2 of the NWRP summarised the needs of the individual water sources within four Regional Water Resource Plans (Table 1). The Eastern and Midlands region has the largest number of water supply customers (2.48 million) and the highest amount of water supplied daily (887 Ml/d). It also has the highest non-domestic water consumption at 25%. Population growth from 2019 to 2044 is projected to be highest in urban areas such as Cork City (54%) and Limerick City (61%). The proportion of WRZs with a supply-demand balance deficit is significant across all regions (52 – 67.2% of all WRZs), with the Eastern and Midlands region having the highest percentage. There is a supply-demand deficit in 20 of the 26 counties assessed (78%).

By 2044, this deficit is expected to worsen in almost all counties due to a reduction in the water available for use – due to changes in abstraction legislation – and an increase in demand from both population growth and growth in non-domestic demand. The Irish Government signed into law the Water Environment (Abstractions and Associated Impoundments) Act in 2022. Under this Act, UÉ's available water supply across the four regions could decrease substantially due to a reduction in the volumes of water that can be legally abstracted.

Regional Water Resources

There is regional variation in water resource availability, water demand, projected growth (domestic and non-domestic), leakage, and categories or sectors abstracting water. Uisce Éireann acknowledge in their NWRPs that they "may have to make some modifications to our surface water and groundwater abstractions once the Abstractions Act commences".

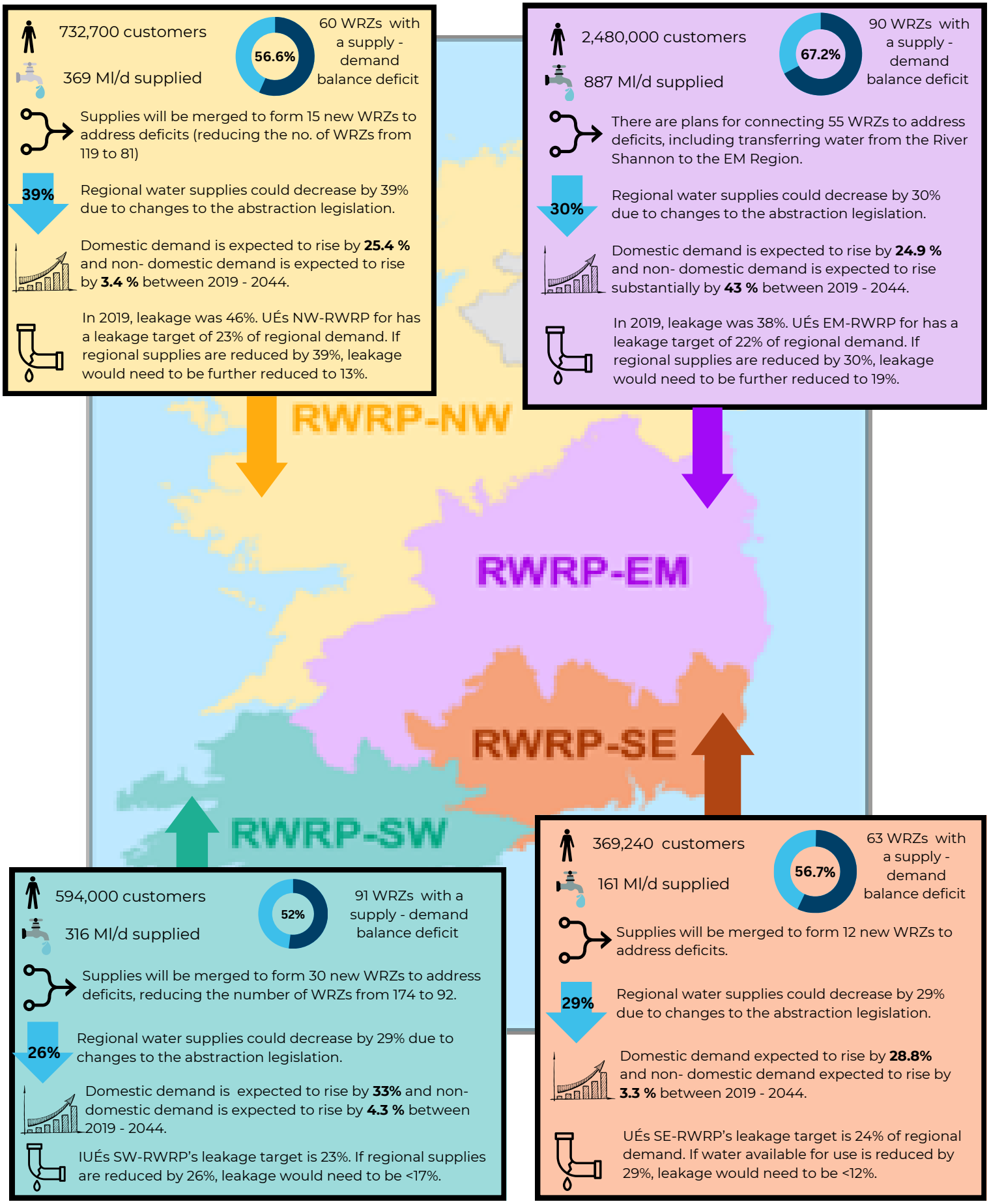

Figure 5. Regional variation in water demand and resource availability across UÉ's four regions, taking into account new abstraction legislation (UÉ, 2022) (UÉ, 2023a-c)

Sector - specific solutions

The term, 'Water use efficiency' was originally introduced as a concept over 100 years ago to describe the relationship between plant productivity and water use. Since then, it has been applied to agriculture, electricity production, industry, mining, public water supply and tourism. In the EU all of these sectors have seen an increase in efficiency (up to 17% lower in 2017 than a 1995 baseline), despite up to 20% growth (EEA, 2021). Whilst there is the potential for improved water use efficiency to deliver a further reduction in water abstraction this will neither offset the climate change impacts on rainfall-dependent nature, nor will it offset strong local increases in water demand (EEA, 2021). Compounding this, (i) urbanisation and growth in coastal tourism has the potential to further concentrate water demand geographically within Europe, and (ii) rising temperatures due to climate change could increase irrigation requirements by up to 20% (EEA, 2021). There is significantly more to be done to reduce water consumption here.

Table 2. Potential water savings from applying indicative technical measures in the agricultural sector (EEA, 2021)

Measure	Potential water saving (%)
Upgrading conveyance infrastructure (e.g. closed pipes replacing open trenches)	10-25
Changing to use irrigation methods with higher application efficiency (e.g. drip micro-irrigation replacing furrow irrigation)	15-60
Changing irrigation practices (e.g. rescheduling irrigation, mulching)	30
Crop restructuring (e.g. drought-resistant crops replacing water-demanding and drought-sensitive crops)	50
Irrigating with reclaimed water	10

Source: Dworak et al. (2007).

Agriculture-specific solutions included water use efficiencies through upgrades to conveyance infrastructure; changing irrigation practices and methods; irrigating with harvested or reclaimed water; and selecting drought-resistant crops.

In the power sector, water use efficiency will depend firstly upon which technologies are prioritised in the energy transition - as some technologies have a higher water footprint than others – and secondly what specific cooling technology is used in these industrial processes.

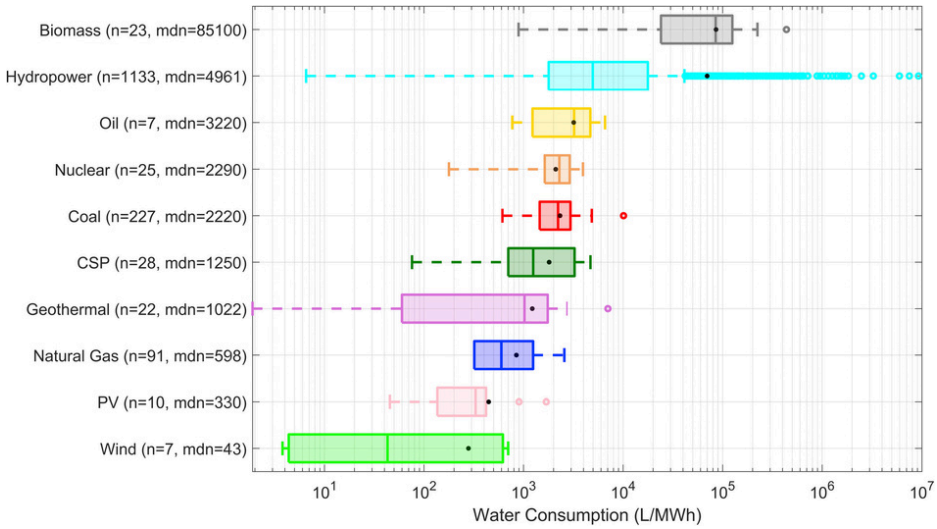

Figure 6. Blue water consumption (i.e. water withdrawals) over the life cycle of each energy generation type (Jin, et al., 2019) N.B. Water consumption is shown on a log scale.

Some sectors – such as the food and beverage, or pharmaceutical industries – have additional challenges where a particularly high quality of water is required for product generation, but considerable water savings can still be made in the re-use of process water for washing and cooling applications. Finally, it was noted that many of the technologies that could be used in the tourism and retail sectors were comparable with those cited in a previously published domestic water conservation report (Cotterill & Melville-Shreeve, 2021), but many barriers remain that limit their uptake.

Figure 7. Waste and Resources Action Programme (WRAP) Roadmap 2021

International best practice

National and international initiatives were drawn from Ireland, Denmark, the UK, Singapore, Australia and the USA. This included Uisce Éireann's Water Stewardship programme; the role of the U.S. Environmental Protection Agency in governing the WaterSense scheme; the U.S. Geological Survey and England and Wales' MOSL database, which captures and shares non-domestic water use and consumption data to improve planning and regulatory decisions; Denmark's legislative limits on water abstraction, time-bound abstraction licenses, and transparent system for measuring and reporting water consumption data; Singapore and Australia's mandatory water efficiency practices, as well as the financial supports Singapore provides for companies to adopt water-efficient measures through the Water Efficiency Fund.

Denmark is the only country in the EU that uses untreated groundwater for more than 99% of water use (OECD, 2017), and one of only three European countries (with France and the UK) with an abstraction charge for groundwater use (introduced in 1994) (OECD, 2017). There is also a tax on water utilities to reduce water losses via the distribution network. Water loss in the Danish distribution network is as low as 6.3 % (Skræm, 2022).

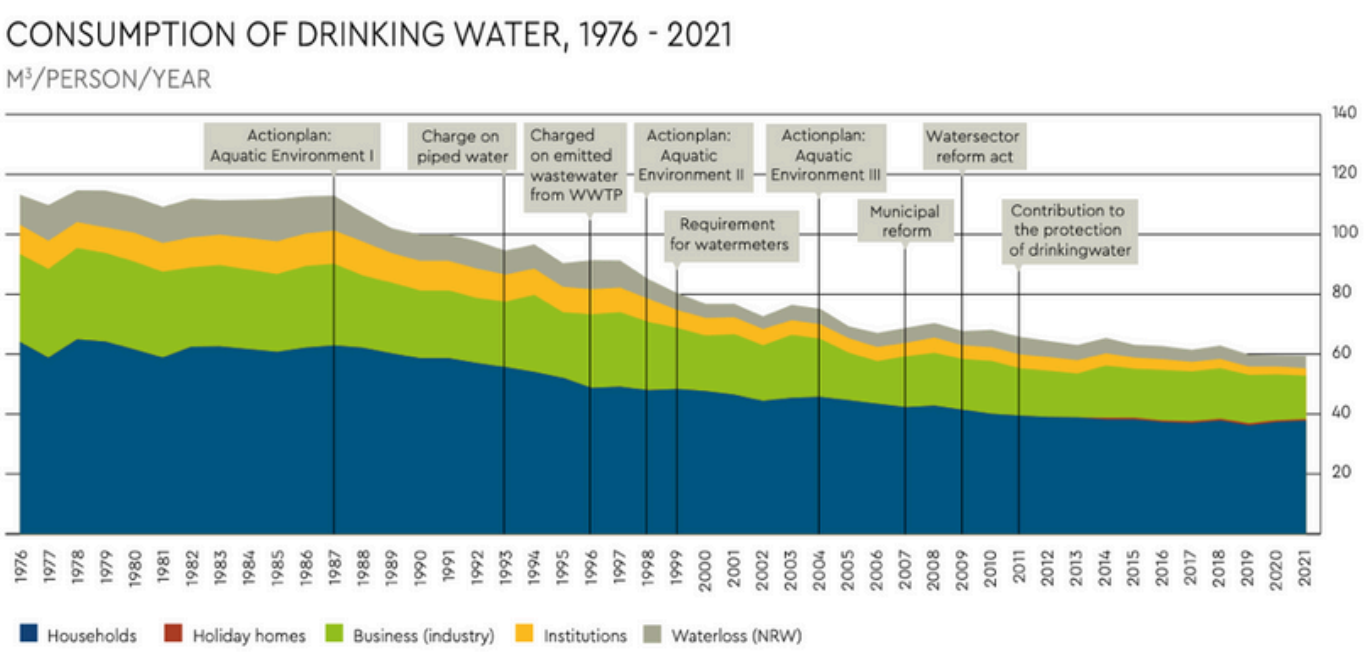

Figure 8. Consumption of Drinking water in Denmark 1976 - 2021 (DANVA, 2022)

Denmark has developed a comprehensive set of policies to protect groundwater including:

- **Legislative limits on abstraction** – Denmark's Environmental Act requires that the total volumes of groundwater abstracted should not undermine water-dependent ecosystems' compliance with defined environmental targets.
- **Time-bound entitlements for abstraction licences** – The duration granted by municipalities depends on the purpose of use and on the source of water.
- **Annual measurement and reporting** of total volumes of groundwater abstracted.
- **Groundwater abstraction charges,** including for irrigation (OECD, 2017).

International best practice

Given the variation in the non-household market in England and Wales – including differences in regional water resource availability – it can be difficult to understand, and support non-domestic sectors to reduce their impact on the environment.

MOSL, the market operator for the non-household water retail market in England, opened in April 2017 enabling more than 1.2 million business customers to choose their water and wastewater supplier (MOSL, 2022a). In 2022 they developed a water efficiency dashboard (Figure 9) which enables users to filter by non-household supply, supplier and industry segment, as well as by factors relating to water stress to evaluate consumption.

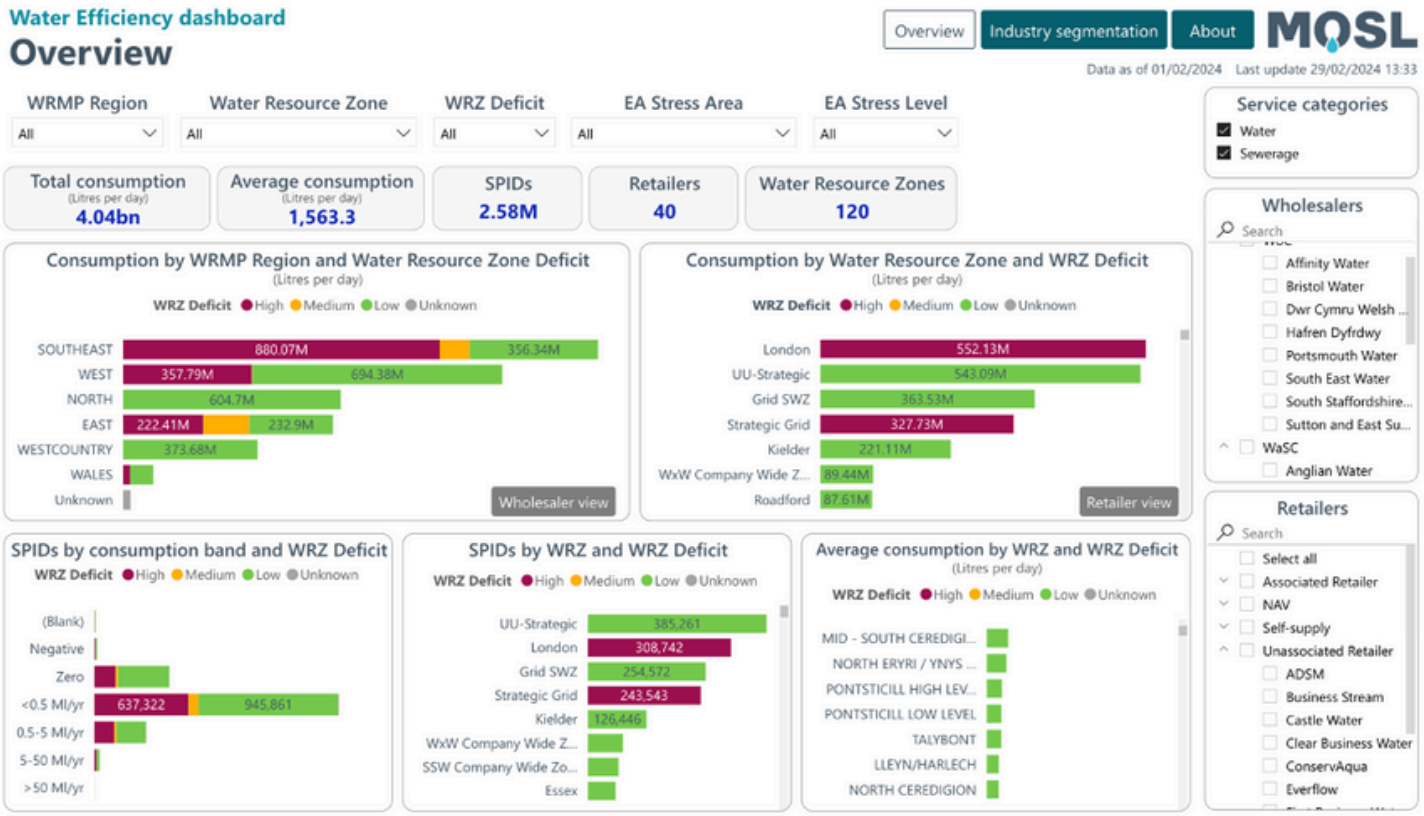

Figure 9. MOSL Water Efficiency Dashboard for England and Wales as of Tuesday 5 March 2024 (MOSL, 2022b)

The database uses the Central Market Operating System (CMOS) data (i.e. core IT system for the non-household market) as well as data from water utilities' water resource management plans from 2019, the Environment Agency's 2021 water stress designations, industry categorisation and annual water company operational carbon emissions (MOSL, 2022b). The database is updated monthly.

There are also three supporting map views which show geographic boundaries for water resource planning regions, water stress areas and water resource zones (MOSL, 2022b). Additionally, MOSL created a searchable map (Figure 2) which shows non-household water consumption in each of the 9,000+ postal sectors in England and Wales, where darker map segments indicate a higher total consumption than lighter map segments (MOSL, 2022c) . The information provided for each postal sector is the location name, number of NHH supply points and average water consumption in litres/day. Water consumption is based on aggregated supply point and consumption data at each postcode address and is averaged from the previous 18 months (MOSL, 2022c).

Recommendations

1. Address gaps in data and transparency.

The first recommendation relates to increasing transparency in water use and consumption data at a national and local level to facilitate better regulatory control of planning processes. This could support decisions around if and where there is sufficient water in a catchment for a new, potentially high water user. International examples of better practice in the capturing and public dissemination of such data include the USGS data and the MOSL database (Figure 9) for water efficiency in England and Wales and their associated searchable tool for non-household consumption by postal sector (Figure 2).

2. Refine demand projections

The second recommendation aims to refine demand projections in non-domestic demand forecasts with specific focus on key sectors in Ireland, such as agriculture, pharmaceuticals and data centres. Sectors should not be omitted due to uncertainty in demand. Farming production is expected to increase significantly over the coming years, but due to uncertainty in the impact of volume of treated water, it is not included in UÉ's forecasts. Whilst it is complex to evaluate how agricultural demand for water may change considering growth in farming, and climate change impacts on rainfall, temperature and soil moisture, it is also important to consider these in combination with other competing demands at a local and regional scale. Similarly, the anticipated growth in data centres could have a considerable impact on regional water demand and SDBs. Greater transparency on the environmental impact of data centres from a water perspective – i.e. the amount of water withdrawn, from which water sources, and the location of any wastewater discharges – rather than purely an energy perspective, is required.

3. Innovate and scale-up best practice

The third recommendation includes the sharing of best practice in the use of sector-specific technological tools to reduce both the amount of water withdrawn and the amount consumed, as well as determining how to overcome barriers to implementing water efficiency in the non-domestic sector. It is not within the scope of this report to provide a comprehensive list of all of the sector-specific innovations for non-domestic sectors. Whilst good practice approaches are shared through the likes of water stewardship programmes and UÉ's advice for business customers, there is potential to scale this up and out to include more sectors (for example energy production and data centres were not covered in their website-based advice at the time of the research) and reach a larger proportion of the non-domestic market for greater impact. There is also a significant gap in informing non-domestic users with private water abstraction on the need to conserve water and on sector specific water efficient technologies.

This approach takes a bottom-up approach, making use of 'champions' or 'ambassadors' who can share example case studies, rather than top-down approaches of how to effect change. This has been observed to great effect in Singapore through their industry forums and conferences. A scaling-up of the education and awareness raising to do with how to save water will only be effective if it is combined with sufficient resources to support such measures (to address businesses' willingness to pay and improved governance).

4. Strengthen governance

The fourth recommendation suggests a strengthening of governance in relation to planning and prioritising of regional water use. This should involve an independent assessment of water available for use within a catchment, the cumulative impacts of water users in a catchment and the current and future pressures on water availability.

Future expansion of certain industries (for example those that use industrial cooling) may have a high energy and water footprint and as such, it would be worthwhile considering mechanisms such as conditional planning approval (and follow up enforcement) on the basis of sufficient evidence to demonstrate there will not be an adverse effect on water supply-demand balances and that appropriate technological innovations have been included to address high water/energy needs. This would be particularly important for the public water supply as it could support decision making with UÉ around potentially competing demands for water in an area. UÉ are in a difficult position with statutory obligations to support both economic growth and housing requirements, therefore have competing demands in any one region. An independent oversight over this process would support decision-making on water use between users and more transparent management of local water resources.

Examples may be drawn from Denmark, where policies implemented to protect water supplies include legislative limits on abstraction, time-bound entitlements for abstraction licences, and a transparent mechanism for the annual measurement and reporting of total volumes abstracted. An independent body could be established to support more independent and transparent reviews for planning and management of water resources with respect to growth scenarios. It could also enhance coordination between stakeholders, and scale up water-use efficiencies through knowledge exchange.

5. Improve accountability through specific targets

The fifth recommendation relates to setting specific metrics or target for water efficiency improvements which offset growth. This is relevant to private abstractions and public water customers. The projections made in UÉ's demand forecasts are heavily reliant on water efficiency measures offsetting growth in non-domestic water use. Evidence from the UK and Singapore indicates that there is often an unwillingness to pay for water efficiency measures by non-domestic customers as the return on investment is seen as too low. As such, it is recommended that if UÉ's projections are to be met, then there will need to be stronger governance of water efficiency implementation, a radical increase in the delivery of water conservation initiatives, and provision of funding to support such interventions.

Targets for efficiency improvements should be quantified in terms of the offsetting e.g. *a 20% efficiency saving in X, would enable growth or delivery in Y*. This should be quantified at a national, regional and potentially catchment scale. Examples include Defra's target to reduce business water use by 9% by 2037 (Ofwat, 2022); WRAP UK Roadmap (for food and drink supply) (WRAP, 2021); and the French Government's Water Plan, to achieve a 10% reduction in water abstraction by 2030 (French Government, 2023). Another target-based option would be to consider adjusting the minimum efficiency standards for infrastructure associated with a water permit. This is particularly relevant for the energy sector where it will be necessary to ensure that energy policies seeking to achieve climate neutrality and 80% of electricity to be generated from renewable sources do not do so at the expense of water resources (Lohrmann, et al., 2021).

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