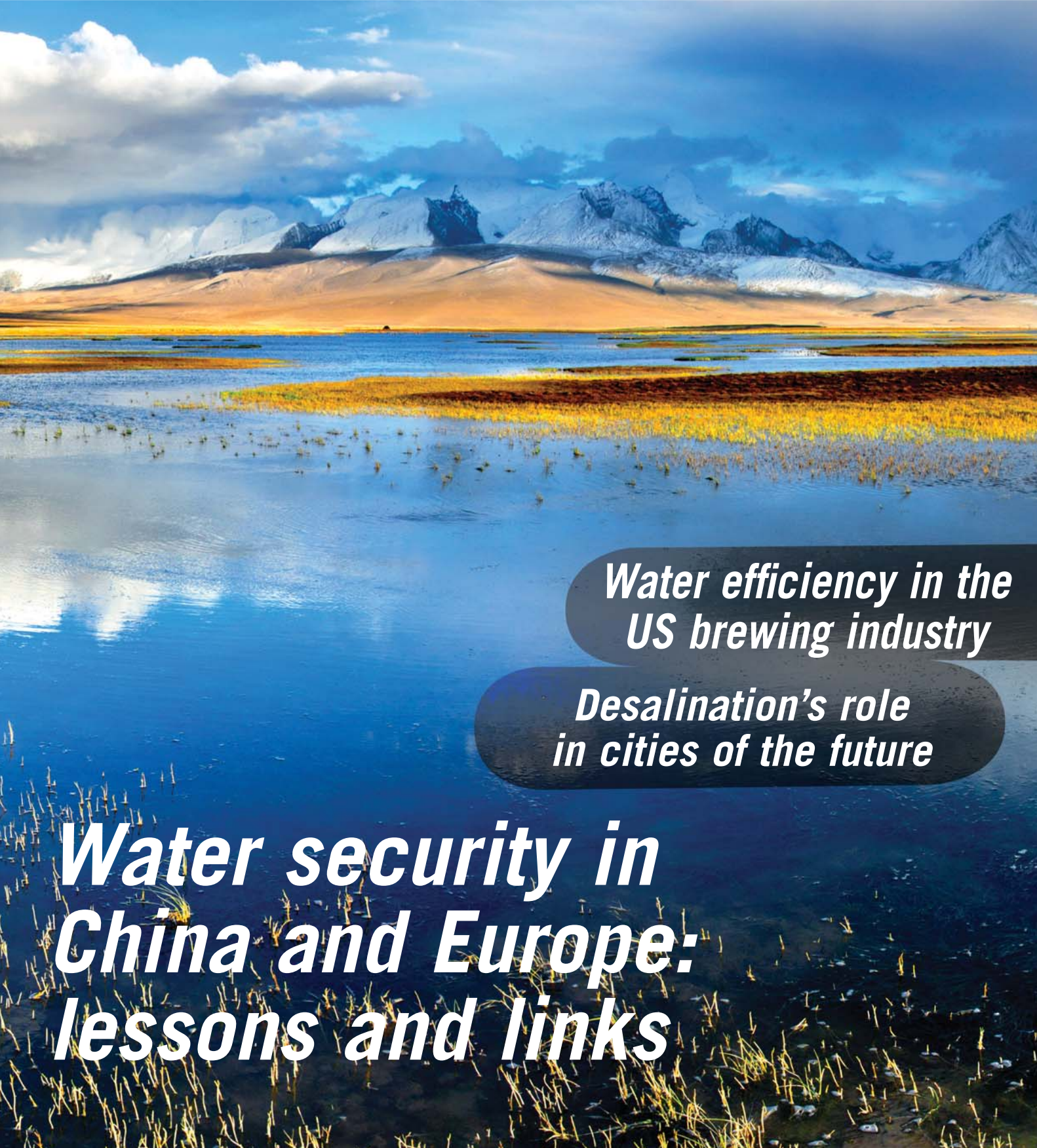


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*Water efficiency in the
US brewing industry*

*Desalination's role
in cities of the future*

*Water security in
China and Europe:
lessons and links*

Benchmarking of non-revenue water: experiences from South Africa

● The South African Water Research Commission assists South African utilities in managing leakage, and has used leakage data to put together a comprehensive assessment of non-revenue water in the country. In the latest article from the IWA Water Loss Specialist Group, **JAY BHAGWAN, WILLEM WEGELIN** and **ZAMA SIQALABA** discuss the outcomes of South Africa's largest leakage assessment to date.



In 2012 the largest leakage assessment to date was undertaken in South Africa. Credit: Dr Ronnie McKenzie.

The South African Water Research Commission (WRC) has been providing support to municipalities throughout South Africa to address leakage and wastage from their potable reticulation systems since the early 1990s. South Africa was one of the first countries outside the UK to fully recognise the benefits of adopting the Burst and Background Estimate (BABE) methodology that was initially developed by the UK water industry when the major water suppliers in England and Wales were privatised in the early 1990s.

Non-revenue water (NRW) measurement and benchmarking is one of the important interventions that WRC has been pursuing and developing over the years. Complementing this, WRC has supported the development of various models to help water suppliers to understand and ultimately reduce their leakage. These included the night-flow analysis model Sanflow (WRC, 1999), the pressure management model Presmac (WRC, 2001),

the economics of active leakage control model Econoleak (WRC, 2002), and finally a model to assess the levels of NRW based on the IWA Water Balance.

All these initiatives have resulted in one of the largest and most comprehensive NRW assessments to date, which provides information on progress with NRW and benchmarking over the past five years.

Developments in NRW assessments

The initial NRW assessment in 1999 ultimately used only 20 datasets that were considered to be of an acceptable quality from a potential set of around 600 water suppliers. The assessment suggested that the average NRW for the 20 water suppliers was in the order of 25% with an average ILI value of 6.0. Most of the acceptable datasets were provided by the larger municipalities, which were the only water suppliers at the time that collected the appropriate base data and meter readings. As a result of this initial assessment, WRC commissioned a follow-up assessment in 2005.

In the 2005 assessment (WRC, 2005) information was obtained from 60 water suppliers. Thirty acceptable datasets were identified from these, representing nearly 50% of the municipal water supplied throughout South Africa. In this assessment the percentage of NRW was not calculated in line with the IWA recommendation, to avoid the use of percentages when dealing with NRW.

The ILI, which provides an indication of physical leakage, was however calculated for the 30 municipalities and an average value of 6.3 was derived. Once again, the value of the assessment was clear to WRC as well as the government, which commissioned a third assessment to be undertaken.

The third assessment was undertaken in 2007 (WRC, 2007). This involved 100 datasets, from which 62 were included in the final assessment, representing almost 60% of the total municipal water use in South Africa. In this assessment many of the smaller municipalities were included, and the average NRW was estimated to be 36%, with an average ILI of 7.6. The percentage of NRW was again included in the assessment despite the fact that it was accepted that percentages can be very misleading. Some of the high level committees were uncomfortable with the use of the ILI and other recommended performance indicators, with the result that percentages were used, albeit with a 'health warning' to highlight that they can be misleading in certain cases.

The 2012 NRW assessment

Following the success of the 2007 assessment in raising the issue of NRW to the national platform where it was discussed at length by government, a

System Input 100 %	Authorised consumption 68.2%	Billed Consumption 63.2%	Revenue water 63.2%
	Water loss 31.8%	Unbilled Consumption : 5.0%	Non-revenue water 36.8%
		Commercial losses 6.4%	
Physical losses 25.4%			

Figure 1: National water balance for South Africa from WRC report (WRC, 2012).

Table 1: NRW figures per municipal category

Category	Population	Input (m ³ /a)	NRW (m ³ /a)	Revenue water (m ³ /a)	l/c/d
A	17,420,512	1,849,091,117	634,192,022	1,214,899,095	291
B1	7,756,187	683,667,320	282,585,164	401,082,156	241
B2	3,882,070	325,623,095	99,407,207	226,215,889	230
Urban total	29,058,769	2,858,381,532	1,016,184,393	1,842,197,140	269
B3	3,845,279	230,642,568	85,229,869	145,412,699	164
B4	4,245,736	101,138,956	73,334,514	27,804,442	65
Rural total	8,091,015	331,781,524	158,564,383	173,217,141	112
National total	37,149,784	3,190,163,056	1,174,784,776	2,015,414,281	235
Extrapolated	49,988,373	4,292,650,981	1,580,730,012	2,711,920,969	235

fourth assessment was undertaken between 2010 and 2012, the results of which were officially released in March 2013 (WRC, 2012). This is the most comprehensive and detailed assessment of NRW undertaken in South Africa, and involved water balance information from more than 130 municipalities. The project was supported not only by WRC but also the Department of Water Affairs (DWA).

The data gathered from 132 of the possible 237 municipalities supplying water to more than 40 million residents throughout South Africa represents over 75% of the total volume of municipal water supplied. The results indicate that the current level of NRW estimated for the country as a whole is almost 37%, with an average ILI of 6.8.

The NRW figure for South Africa is similar to the estimated world average of 36.6%, but is considered high in comparison to developed countries and low when compared to developing countries. Once again, it must be stressed that percentages can be misleading and the values provided in Figure 1 should therefore be used with caution. The ILI of 6.8 is considered to provide a realistic indicator of physical leakage for the South African systems and it is interesting to note that the various estimates of ILI over the past 12 years have all been between 6 and 8. Again, this would be considered high for most developed countries but low for most developing countries and highlights the fact that levels of physical leakage are generally high in South Africa.

It should be noted that in South Africa, every water supplier is categorised according to the size of the population supplied and whether the area is urban or rural. The results from the breakdown into the different categories are provided in Table 1.

For the purposes of this study, an estimated total urban and rural consumption of approximately

4300M.m³/year was considered more realistic and this figure was used in the calculations as shown by the extrapolated values in the last row of Table 1.

Conclusions

The latest NRW study undertaken for WRC and DWA represents a major advance in the understanding and assessment of water losses from municipal water supply systems in South Africa. It is the most comprehensive assessment yet undertaken, and despite the many problems experienced with data collection from many of the smaller municipalities it was possible to gather information for more than 75% of the water supplied throughout South Africa. The overall NRW for South Africa is estimated to be 1580M.m³/year which is approximately 33% of the total water supplied. This conservatively represents a loss of over R7 billion (almost \$1 billion) based on an average bulk water tariff of approximately R5/m³.

The average ILI value for all of the South African municipalities was estimated to be 6.8, which again is in line with the world average and would be above average (that is, bad) when compared to most developed countries and well below average (that is, good) when compared to most developing countries. Effectively, the ILI value of 6.8 tends to support the perception created by the percentage NRW figures for South Africa (36.8%) that there is clearly a high level of wastage or water losses in the country and considerable scope for improvement.

The above figures are based on the standard IWA Water Balance in which the 'revenue water' figures provided by the financial departments are assumed to be correct. In South Africa, however, there can be a significant component of revenue water that is never paid for by the consumers. Preliminary estimates of this compo-

nent suggest that if it is taken into account the level of NRW may increase by up to 10%. Investigations are continuing to try and quantify this element with greater reliability, so that the next assessment can provide a more complete and accurate water balance. ●

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