



Intelligent
Distribution
for Efficient
and Affordable
Supplies

An IWA Conference



Bologna, Italy
20 - 21 October 2016

Regulation in water loss management and benchmarking to achieve efficiency: an International perspective.

Marco Fantozzi & Allan Lambert, IWA

IWA Fellow - IWA WaterLoss Specialist Group

Regional Representative for Europe

marco.fantozzi@email.it

IWA Water Loss Specialist Group

- **IWA Water Loss Task Force** (now **Water Loss Specialist Group**) was created 16 years ago and has grown from its humble beginnings to a group of almost **1000 members** from around the globe
- **IWA WLSG** and its members have developed many practical concepts and tools over the last 20 years
- A **'Free to all' rapid dissemination policy** of 2nd WLTF, from 2002 to 2011 was very effective via:
 - **Water 21 articles** every 2 months to around 2010
 - **Water Loss World Conferences** in Lemesos 2002, Halifax 2005, Cape Town 2009, Sao Paulo 2010, Manila 2012, Vienna 2014, Bangalore 2016 plus many regional events held under the auspices of the Group
 - **Guidelines on DMAs, Leak Detection**, etc..
- **More than 10 thousand employees of around 1000 water utilities have been trained on the new methods of non-revenue water (NRW) management in many countries worldwide.**

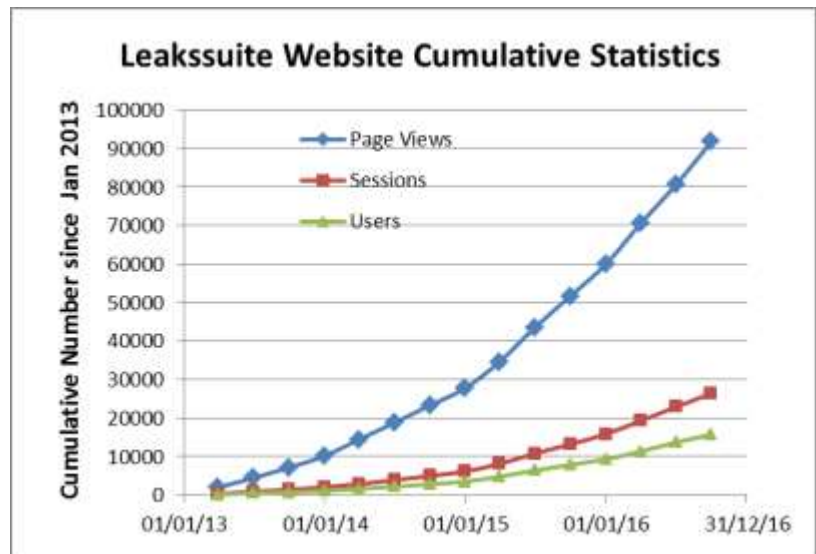
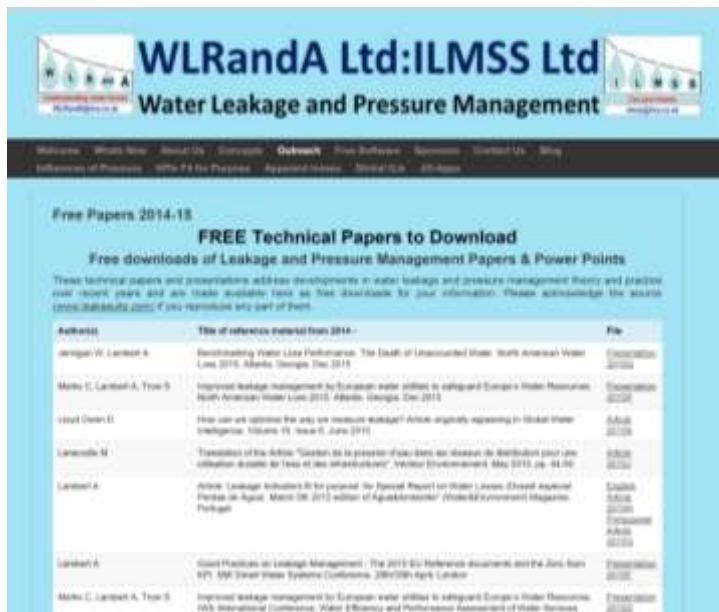
IWA Water Loss Specialist Group

International Tools for Practical Leakage Management 1992 to 2016

Key to colours		Development and testing								Implementation															
Concepts	UK Leakage Control Initiative			IWA 1st Water Loss Task Force					IWA 2nd Water Loss Task Force									IWA Water Loss Specialist Group							
	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Component analysis of Real Losses (Bursts and Background Estimates, BABE)																									
Economic Leakage Levels using minimum total cost approach without pressure management)																									
Pressure: leak flow rate relationships: Fixed and Variable Area Discharges, FAVAD	Developed by John May																								
Night flow component analysis using BABE & FAVAD concepts. Average Zone Point AZP and Night-Day Factor NDF																									
IWA Best Practice International Water Balance and Terminology																									
IWA recommended Key Performance Indicators (KPIs) for Non Revenue Water and Real Losses																									
How low could you go? System-specific equations for Unavoidable Annual Real Losses UARL, and Infrastructure Leakage Index ILI																									
Economic Intervention Policy for Active Leakage Control based on rate of Rise of Unreported Leakage																									
Uncertainty in Water Balance and Night Flow calculations																									
Leakage Performance Categories (WBI Banding System) for assessment of Real Loss Technical Management Performance and appropriate actions for improvement																									
Economic Leakage Levels with and without pressure management																									
Pressure: burst frequency relationships	Quick predictions for systems with high initial burst frequency																								
	A more generally applicable 2-part equation with a non-pressure-dependent component																								
Influence of reduced burst frequency on annual repair costs, extension of residual infrastructure life and economics of pressure management																									
EU Reference document Good Practices on Leakage Management WFD CIS WG PoM Main Report and Case Studies																									
Guidance Notes on Apparent Losses and Water Loss Reduction Planning, with 9 Separate Appendices																									

IWA Water Loss Specialist Group

- In 2013, to facilitate dissemination of authoritative up-to-date information on 'state of the art', Allan Lambert (past Chair of the WLSG) decided to expand/restructure the **LEAKSSUITE web site** www.leakssuite.com into a non-commercial web site, supported by sponsorship, offering free source of information on concepts, free software, papers, presentations, Guidelines, data and blogs.
- Rapid growth since early 2013 as the web site is fulfilling a need for those with limited financial resources, or without easy access to Conferences proceedings and copyrighted published material



EU Reference document Good Practices on Leakage Management (WFD CIS WG PoM) 2015

Scope and purpose of the project

- Leakage in drinking water distribution systems
- Raise attention and increase knowledge
- Recognise there is no 'one size fits all' solution
- Allow Member States to identify whether action is needed, and if so, provide guidance in effectively doing so

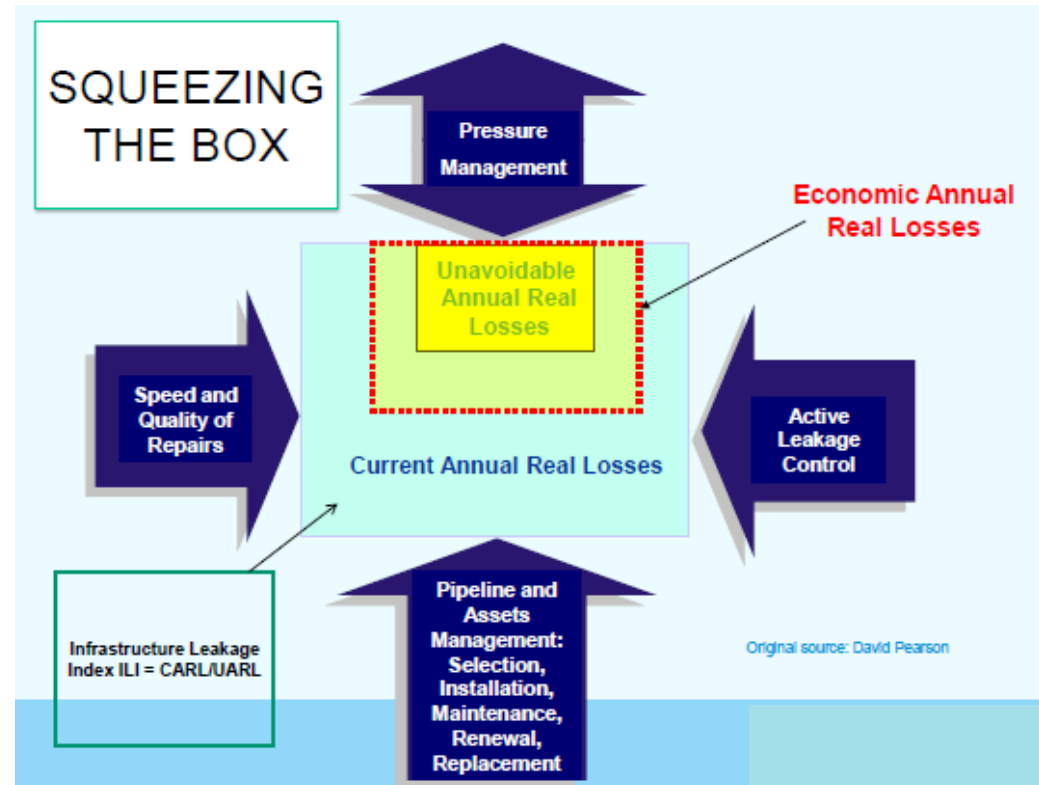


EU Reference document Good Practices on Leakage Management (WFD CIS WG PoM) 2015

Recommendations – All stakeholders

• Performance indicators

- Use m^3/km mains/day, $\text{l}/\text{connection}/\text{day}$ or $\text{l}/\text{billed property}/\text{day}$ for tracking progress in individual systems and sub-systems
- Use ILI (always with some measure of pressure) for making technical comparisons between systems and sub-systems
- % of System Input volume is a misleading indicator, use a volumetric parameter for tracking performance and comparing performance



EU Reference document Good Practices on Leakage Management (WFD CIS WG PoM) 2015

Which Leakage KPI should I use?

Evidence-based conclusions from 16 Case Studies
 'Good Practices on Leakage Management', EC 2014

OBJECTIVE	GOOD PRACTICE PERFORMANCE INDICATOR FOR LEAKAGE						
	Volume per year	litres/ service connection	m ³ /km mains	litres/ billed property	% of System Input Volume	% of Water Supplied	Infrastructure Leakage Index ILI, with Pressure
SET TARGETS AND TRACK PERFORMANCE, FOR AN INDIVIDUAL SYSTEM	YES, large systems	YES	YES	YES (UK)	NO	NO	Only if all pressure management has been completed
TECHNICAL PERFORMANCE COMPARISONS OF DIFFERENT SYSTEMS	NO	NO	NO	NO	NO	NO	YES
DRAW GENERAL CONCLUSIONS FROM SINGLE OR MULTIPLE SYSTEMS	NO	NO	NO	NO	NO	NO	YES, with other context factors

Source: Allan Lambert, October 22, 2014

EU Reference document Good Practices on Leakage Management (WFD CIS WG PoM) 2015

Recommendations – Water Utilities

Pressure management

- Pressures to be measured and monitored
- Excess pressures and pressure transients to be managed and reduced wherever feasible
- Standards for pressure should be flexible
- Sequence of activities is fundamental
- Incorporate value (€/m³) of leakage and energy used
- **Benefits include:** reduced volume of losses, reduced energy consumption, reduced costs of bursts, **extention of asset life** and **deferred investments**

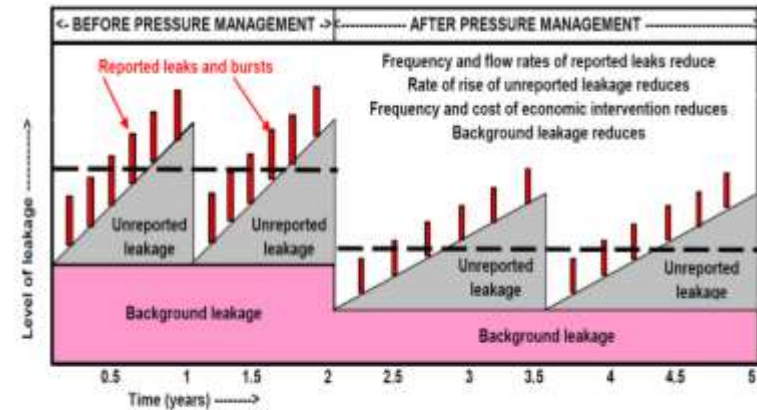
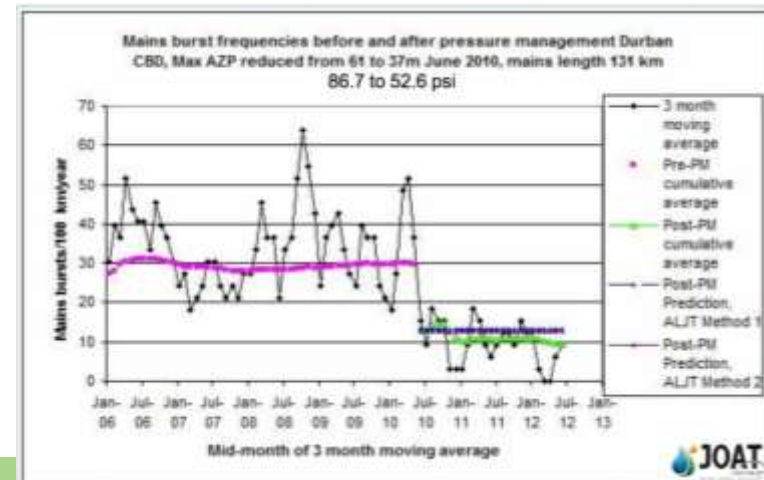


Figure 3 – Benefits of Pressure Management (source: A. Lambert and M. Fantozzi).



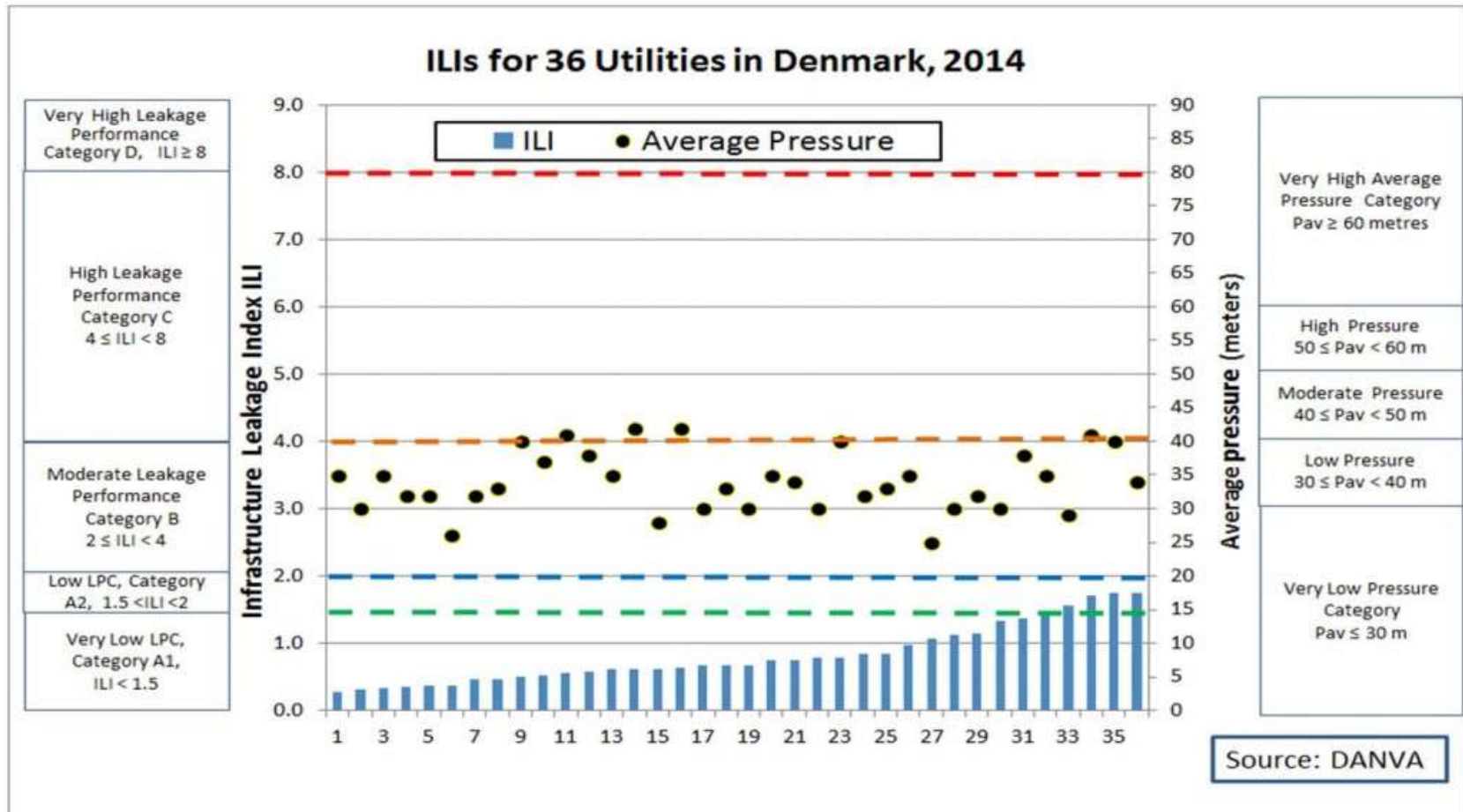
EU Reference document Good Practices on Leakage Management (WFD CIS WG PoM) 2015

Recent achievements

- A) **It is already influencing better choices in leakage performance indicators fit for purpose in some European countries** (reducing use of misleading %s, increasing use of ILIs, better choice of 'per km' or 'per service connection') e.g. Bulgaria, Flanders, Denmark, Portugal, West Balkans, Germany...
- B) **Recognition of the importance of pressure management** on burst reduction and asset management as the foundation of good leakage management, and the dangers of intermittent supply
- C) **The importance of taking leakage management actions in an appropriate sequence** after collecting relevant data for predicting outcomes and prioritising zones for action.

DENMARK

Denmark: the lowest published ILI data set in Europe (DANVA, 2015). Small systems designed for low pressures with DMAs. **Median ILI 0.7**, median pressure 33 metres. See <http://www.leakssuite.com/global-ilis/danish-ilis/>



FLANDERS (BELGIUM)

With the 6th state reform (mid 2014), the competence for drinking water tariff regulation was transferred from the federal level (Belgium) to the regional level (Flanders). End 2014 the competence was delegated to The Flanders Environment Agency (VMM) whom was already housing the drinking water regulation unit called 'WaterRegulator' at that time. The WaterRegulator started working on the development of a tariff regulation methodology. This resulted in a (detailed) Tariff Plan to be approved or disapproved by the WaterRegulator. The tariff plan has to be elaborated using a fixed **tariff plan TEMPLATE**.

In the chapter 'Quality of the network', the ILI-indicator is part of the template (incl. the formula and its components UARL & CARL). The adapted legislation covering the tariff regulation (including the detailed tariff plan template) was published in the official Belgian Bulletin (Belgisch Staatsblad) on June 10th 2016. See http://www.ejustice.just.fgov.be/mopdf/2016/06/10_1_2.pdf#page=64.

For the chapter on 'Quality of the network' including the ILI-indicator see p.35400.

Operationeel - Infrastructuur
TZZZ kwaliteit van het netwerk

	Eenheid	N.1	N.2	N.3	N.4	N.5
Leidingsbreuken veroorzaakt door derden	Aantal	TZZZ005				
Leidingsbreuken onder eigen verantwoordelijkheid	Aantal	TZZZ006				
Niet geregistreerd verbruik per afkapping per dag	liter	TZZZ007	-	-	-	-
Niet geregistreerd verbruik per km per dag	liter	TZZZ008	-	-	-	-
Infrastructuur Leakage Index	Factor	TZZZ009	-	-	-	-
Unavoidable annual real losses (UARL)	m ³	TZZZ010	-	-	-	-
Lm = lengte van de leidingen (maats) (eenheid: km)	km	TZZZ011				
N = aantal afkappingen	Aantal	TZZZ012	-	-	-	-
Lm = lengte van de verbinding tussen de leiding (maats) en de watermeter (eenheid: km)	km	TZZZ013				
P = gemiddelde druk bij de huusaansluitingen (eenheid: m)	m	TZZZ014				
Current annual real losses (CARL)	m ³	TZZZ015	-	-	-	-
het water gekend aan het netwerk (d.i. eigen waterproductie + import van water - export van water)	m ³	TZZZ016	-	-	-	-
naar het gefactureerde water	m ³	TZZZ017	-	-	-	-
naar het niet gefactureerde geautoriseerd verbruik (schakeling)	m ³	TZZZ018	-	-	-	-
naar het niet geautoriseerde verbruik (schakeling)	m ³	TZZZ019	-	-	-	-
naar de fout door on nauwkeurigheid van de watermeters bij de klant (schakeling)	m ³	TZZZ020	-	-	-	-

Toelichting bij de evolutie van de kwaliteit van het netwerk.

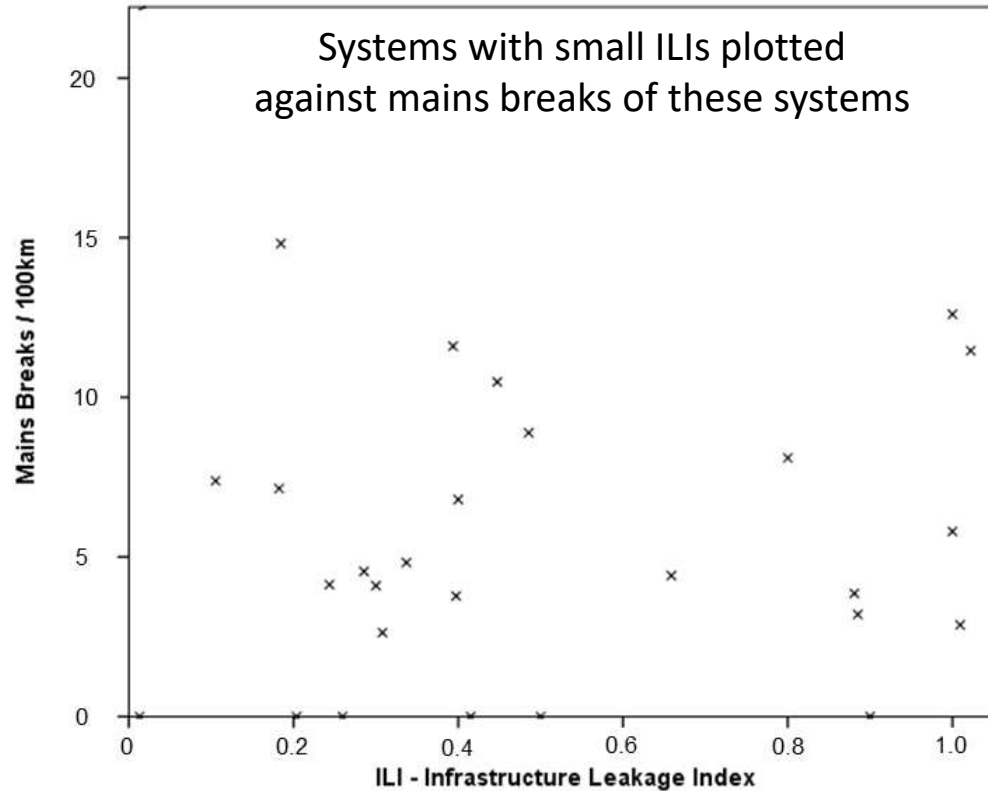
AUSTRIA

Following detailed OVGW Benchmarking studies in 2004 and 2007, **In 2009 OVGW switched from %s and m³/km/day to ILI and litres/connection/day using the ILI as a principal technical performance indicator (OVGW W63, 2009).**

Calculations of ILI (with confidence limits) are available for 54 Austrian distribution systems with 10,000 service connections or less.

The median ILI was 1.0, and twenty four of these systems recorded a calculated ILI less than 1.0.

Austria: A country with many small Utilities and generally very low leakage.



Source: Interpreting ILIs in Small Systems, A.O.Lambert, J. Koelbl, D. Fuchs-Hanusch, WaterIDEAS 2014

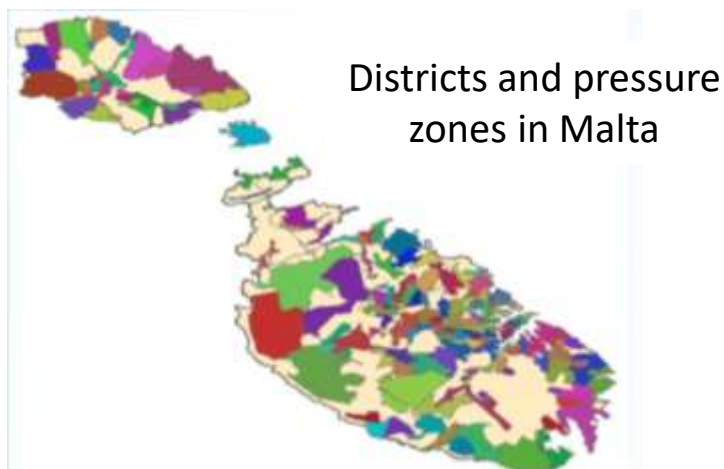
MALTA

Malta adopted the IWA approach in 2003 and implemented pressure management and network rationalisation – divided into around 300 DMAs, each permanently metered and logged

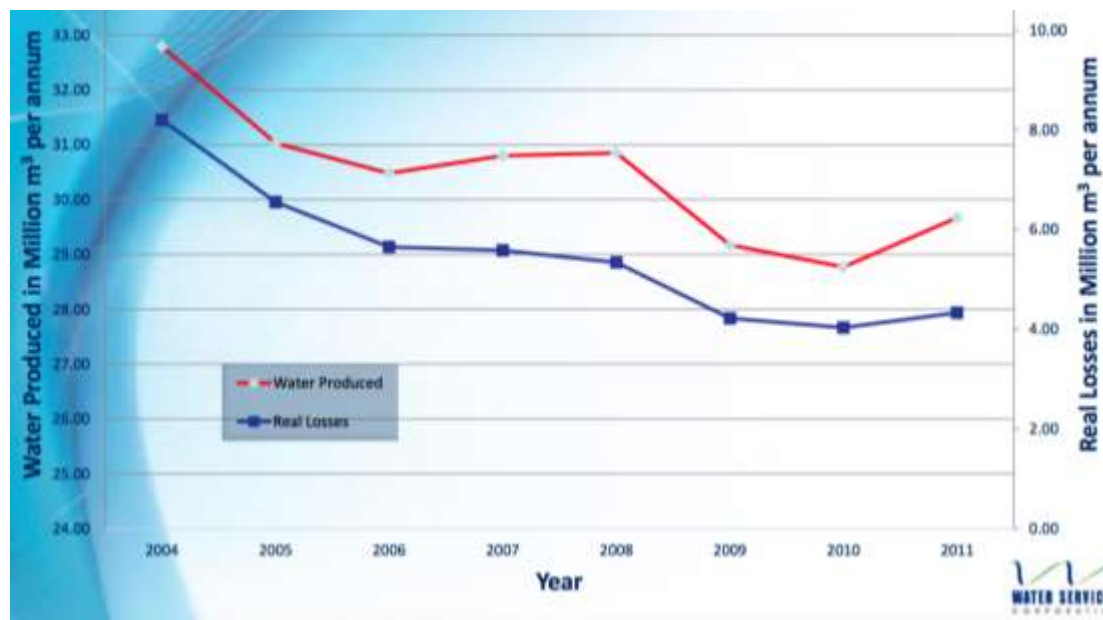
- Intermittent supply in late 1990's, System Input 51 Mm³/year, ILI > 20
- 5 desalination plants constructed to achieve continuous supply, 2 have now been decommissioned (not needed)

Malta Regulator stopped using % of SIV and m³/km mains/day, set targets in terms of ILI

- System input reduced from 51 Mm/year to 30 Mm/year,
- ILI reduced from 20 to 2.1 in 2013



Decrease in Water Production & Real Losses Over Time

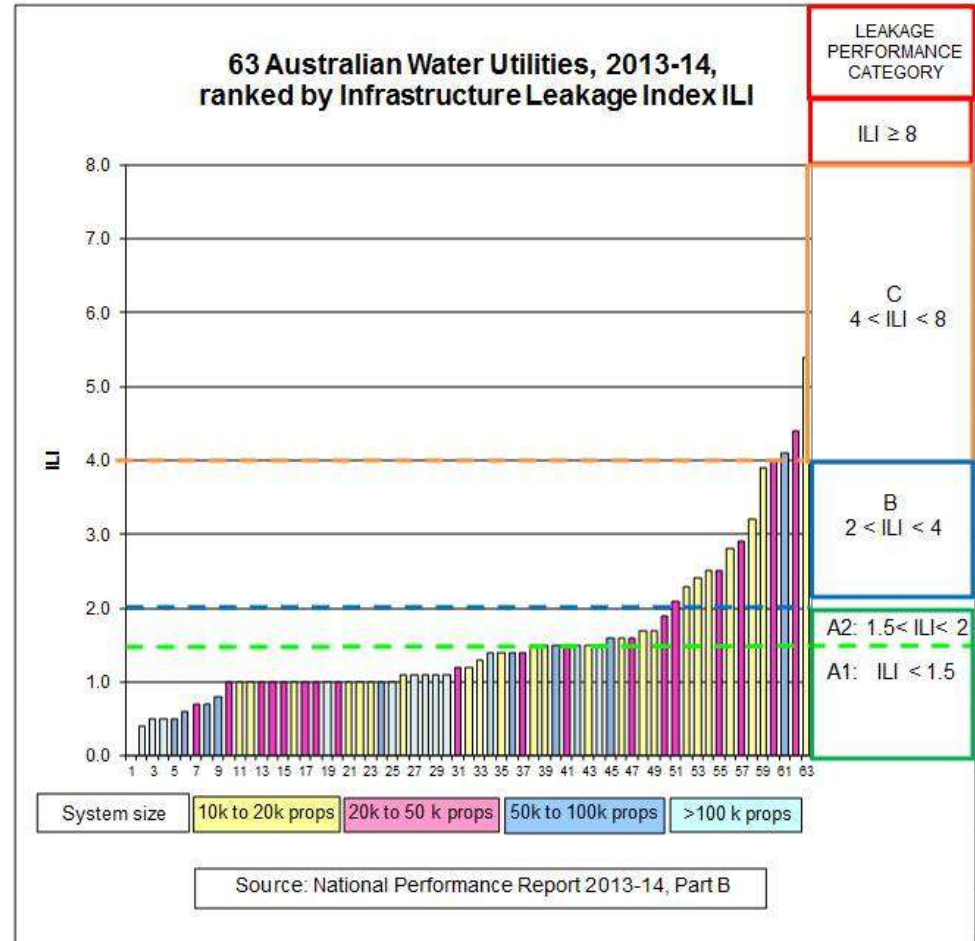


AUSTRALIA

Australian WSAA adopted the IWA approach in 2004, just as the millennium drought 2002-09 started to bite.

Ceased to use %s of SIV, moved to using ILI and litres/connection/day, pressure management DMAs etc, now have excellent water loss control with low apparent losses and almost half of WSAA Utilities having ILIs close to 1.0.

See <http://www.leakssuite.com/global-ilis/australian-ilis/>



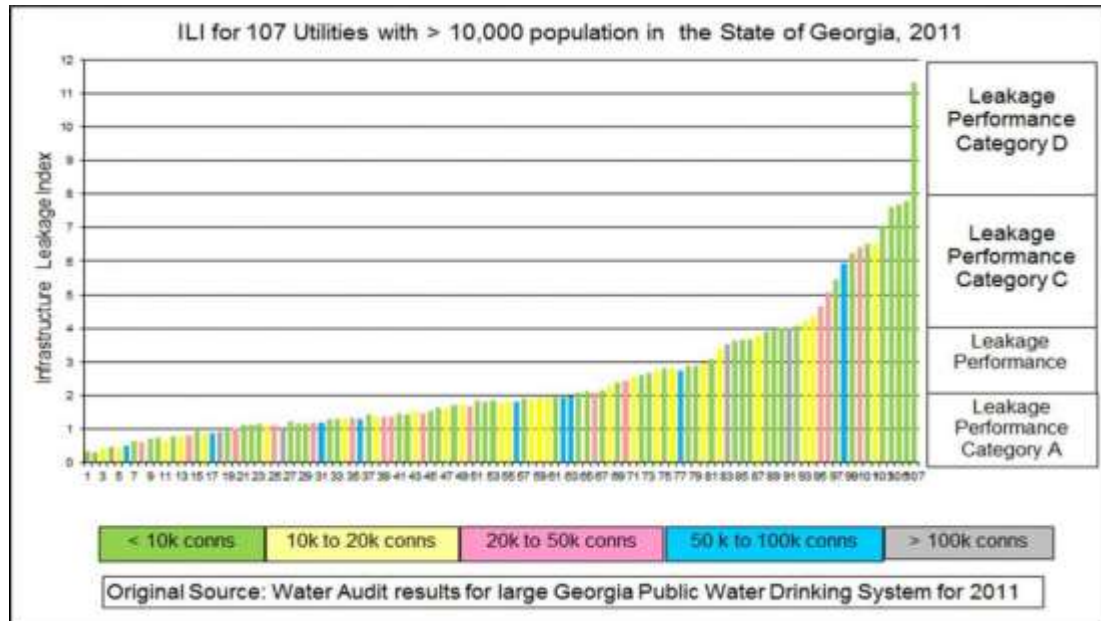
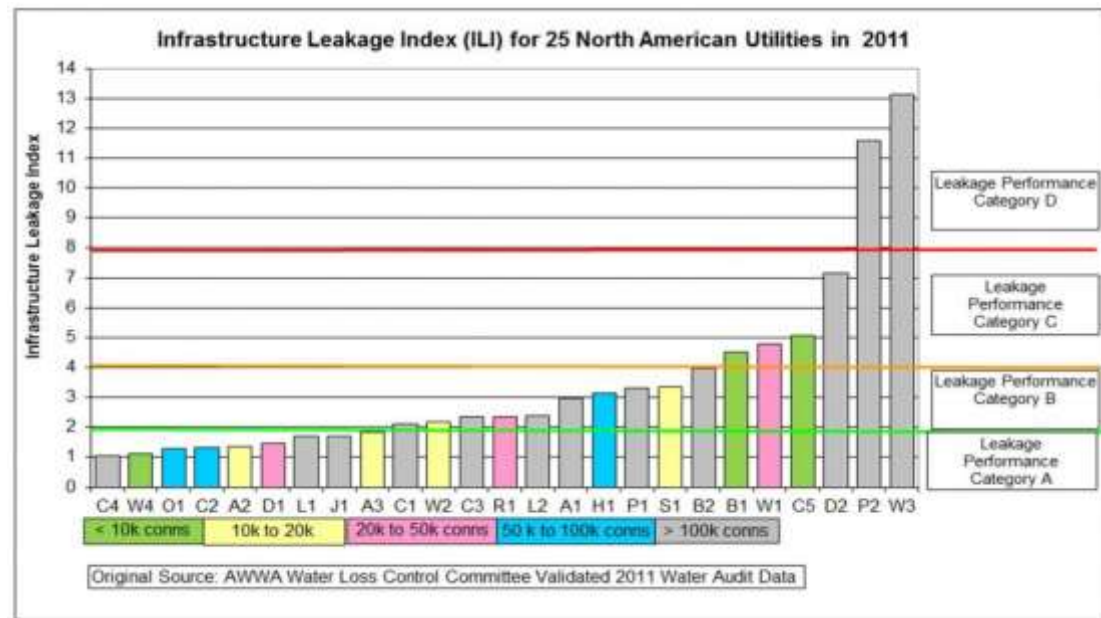
USA

American Water Works Association adopted the IWA approach in 2003 and has used a free National Water Audit software to collect the same data and KPIs that the Italian regulator is now asking utilities to collect.

AWWA M36 Manual

Georgia is the most advanced State in terms of publishing and validating the data, with a **median ILI of 2.0**, followed by California and New Mexico, Tennessee and Texas.

See <http://www.leakssuite.com/global-ilis/north-america-ilis/>

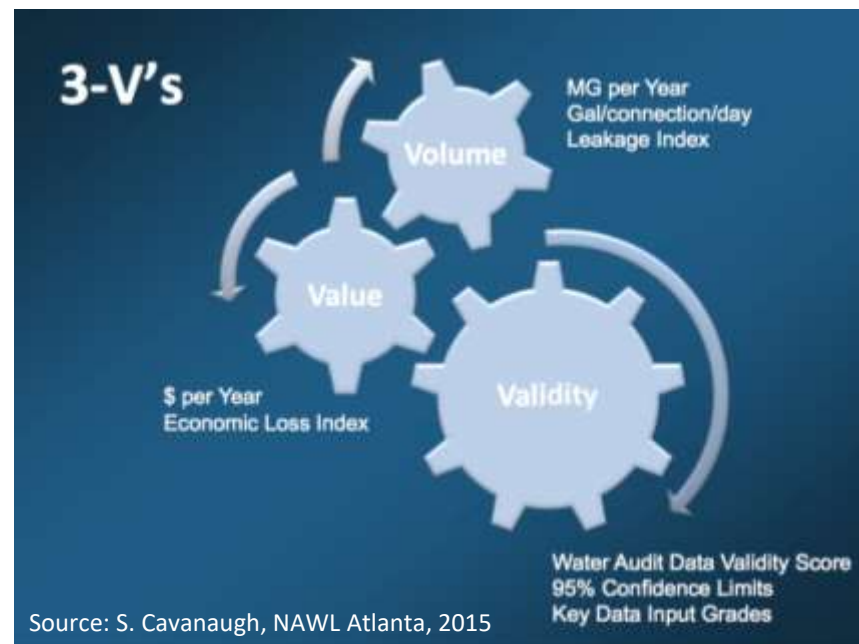


Georgia (USA)

Regulations are extremely helpful to drive the behavior and to help the utility prioritize NRW management as something that is critical to move forward on.

- **Phase one** is to establish that **annual water auditing** requires outreach, technical assistance, training, providing the requisite training to get that utility up to speed.
- **Phase two** is achieving a minimum standard of audit reliability. This includes **posting of information**, and **validation**. *Water Research Foundation paper 4372B* really pointed out the implausibility of self-reported data. Georgia has now moved forward on a **Qualified Water Loss Auditor training program** that the Georgia Section of AWWA is administrating right now.

Effective NRW management is now recognised as an important Risk Assessment Factor with an impact on Bond Ratings



STANDARD & POOR'S RATINGS SERVICES
McGraw Hill Financial

Impact on Bond Ratings

#48 Enterprise Risk Profile Assessment Factors (Table 10)

Strong – Utility has performed a water audit consistent with the AWWA M-36 methodology on an annual basis for the prior five years. The utility has a well-structured and documented Non-Revenue Water Management Program that includes ongoing leak detection work and annual accuracy testing of finished water meters and a representative sample of customer meters.

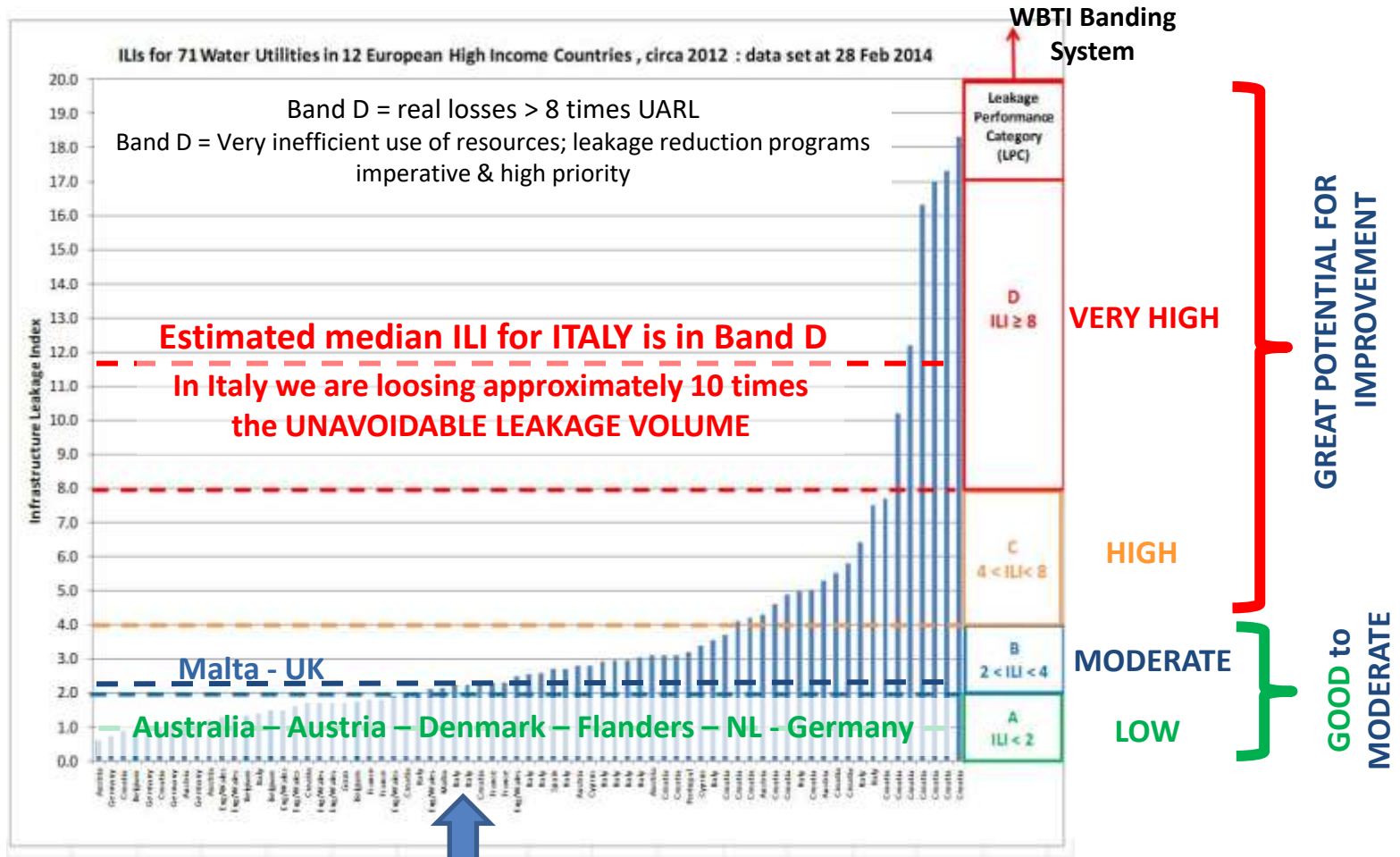
Good – Utility has performed a water audit consistent with the AWWA M-36 methodology on an annual basis for the prior three years. The utility has engaged in specific components of a Non-Revenue Water Management Program such as periodic finished water meter testing, accuracy testing of samples of customer meters and active leak detection.

Standard – Utility has performed a water audit consistent with the AWWA M-36 methodology but does not do so on an annual basis. The utility tracks some basic water loss information on a monthly basis but does not have an active Non-Revenue Water Management Program.

Vulnerable – Utility has not performed a water audit consistent with the AWWA M-36 methodology and does limited tracking of some basic water loss information on a monthly basis. **This information is generally reported on a percentage of volume-supplied basis.**

* Final review, expected publication – December 2015

ITALY Technical Performance Indicators (water distribution)

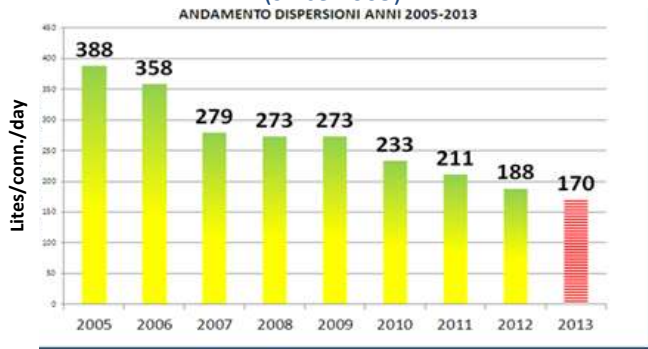


IREN Reggio Emilia

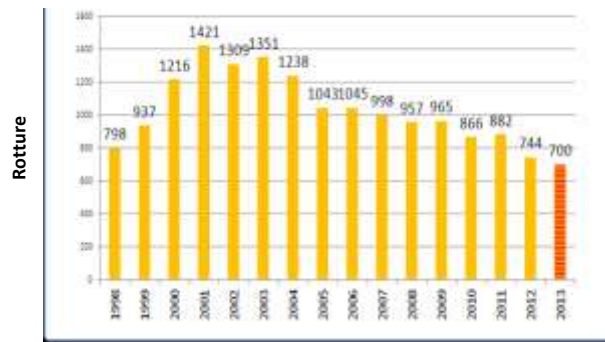
ITALY

Results achieved by IRETI Reggio Emilia applying IWA methodology (Water Balance, KPIs, Pressure Management, DMAs, Night Flow Analysis, Active Leakage Control, Asset Management, Meters Replacement, Selective Rehab.)

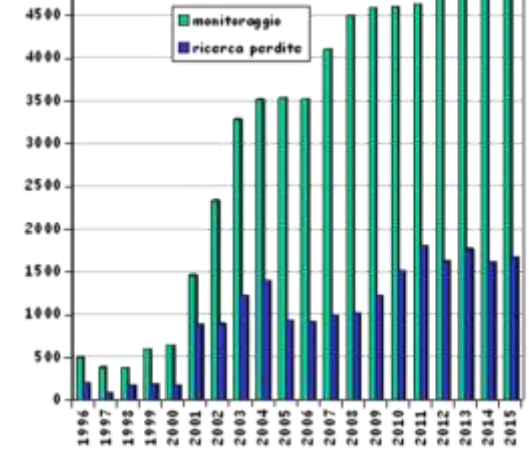
Leakage volume reduced by 56% (since 2005)



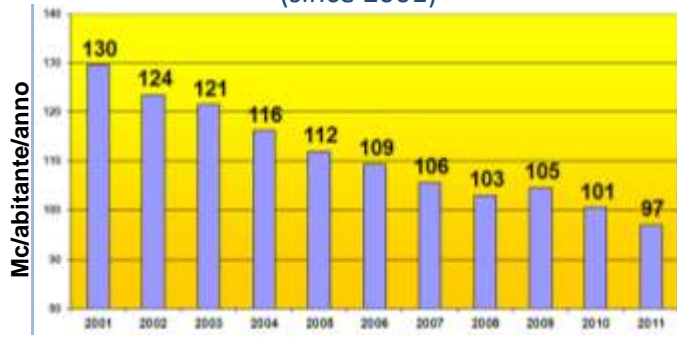
Bursts reduced by 39% (since 2001) (city of Reggio Emilia)



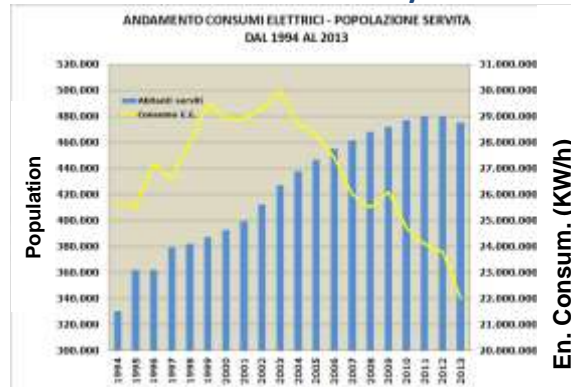
Network divided in sectors and Economic ALC



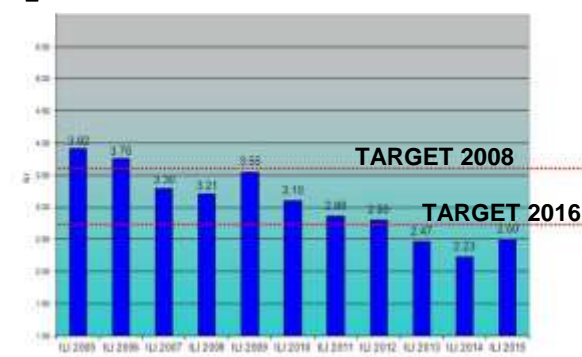
Per capita Input Volume reduced by 25.4% (since 2001)



En. Consum. reduced by 20%

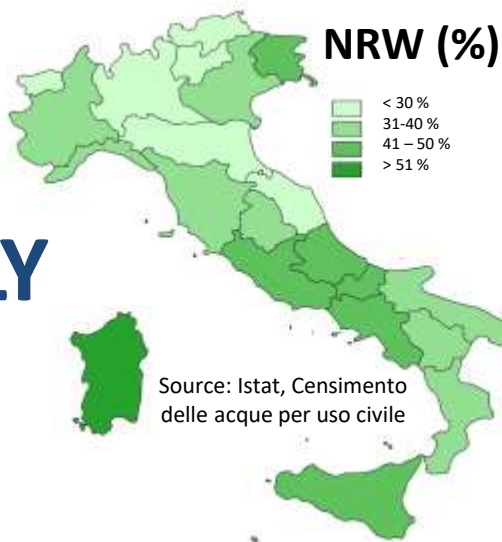


ILI Trend - IREN Reggio Emilia

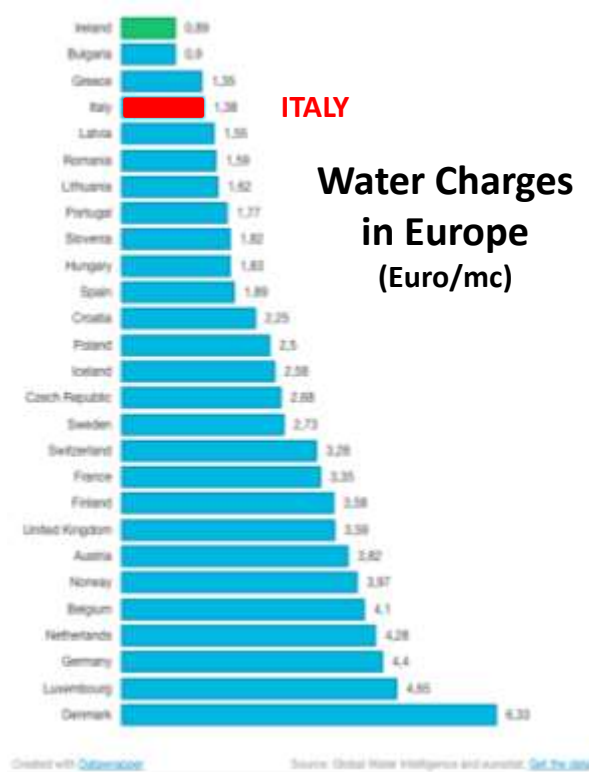
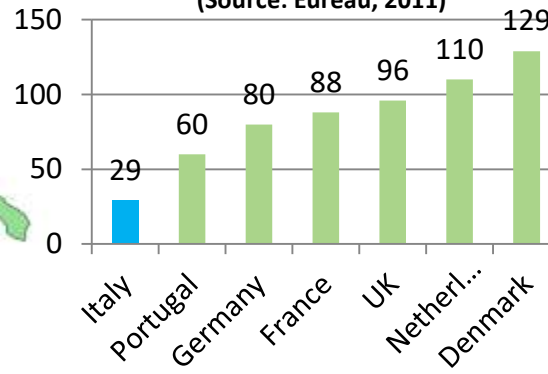


Source: F. Calza, IREN Reggio Emilia (now IRETI)

ITALY



Investments in Euro/person/year (Source: Eureau, 2011)



- In Italy there are **more than 2500 water utilities**, a figure which is in most cases incompatible with the minimum size, organisation and Know-How needed by a utility to guarantee efficient management,
- **water tariffs are too low** (around one third of the tariffs in Germany or UK limiting investments) and therefore **investments are too low**. So far **tariffs are not designed to reward efficiency**,
- **NRW in Italy exceeds 37%** of system input volume. **The use of % provided so far an underestimated picture of performance in NRW management**, especially in large cities.
- **we lack efficiency** and even more **we lack innovation**, as in many cases investment in new technologies is seen as risky and is not supported by adequate financial measures,
- not enough importance is given to **capacity building** even if **employees represent** the most valuable asset for utilities. **We under-estimate the importance of know-how and NRW skills certification.**

What Future for Water Investments in ITALY

Water Data

Population 60 M (2012)

Organization

1994 reorganization: mixed PPP; Concession; In-House – Still not applied

Regulation

Central National Regulator (AEEGSI - 2012) – Local Regulator (1996 on)

- ❑ **The water sector suffers from lack of investments**

A BIG PUSH IS EXPECTED IN THE NEW REGULATION REGIME IN ITALY

- **More stability**, homogeneity and transparency of a Regulator with «better regulation» tools
- **More investments** without a great increase of the tariffs, or at least explain what benefits will be achieved
- **Regulator to set compulsory standards** for quality of service by incentives, penalties, refunds
- **More utilities progressively adopting IWA approach and smart water technologies !**

IMPROVEMENTS SO FAR THANKS TO AEEGSI

- Thanks to the Authority regulation, **investments have already increased by 55% over the last four years**
- AEEGSI in DCO 42/2016 (6.3) and 5/2015 included a **Water Balance** inspired by the EU Reference Document Good Practices on Leakage Reduction

ITALY Technical Performance Indicators (water distribution)

It is fundamental to apply international standard to calculate the Water Balance and KPIs (already adopted by many countries worldwide).

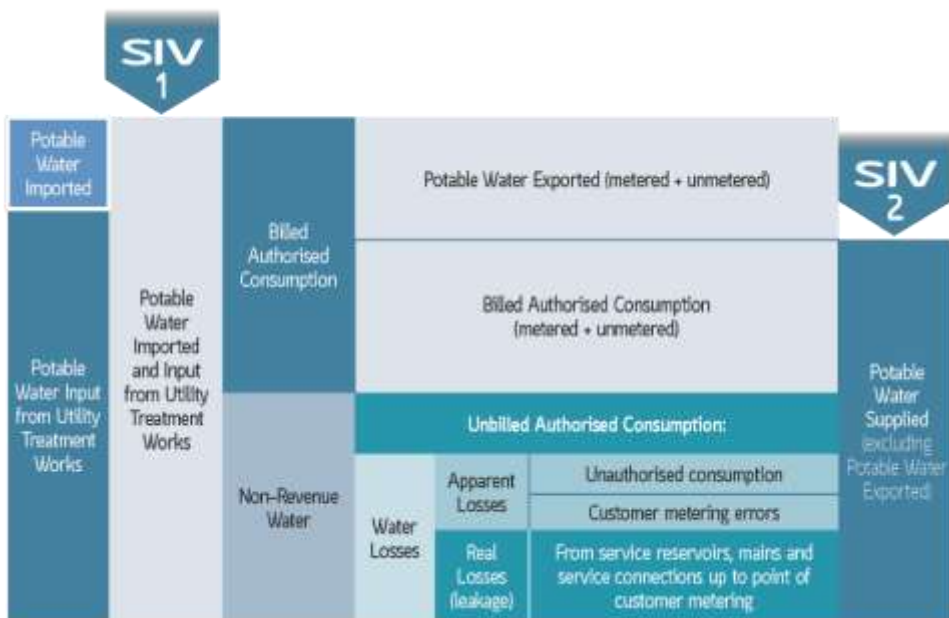


Figura 4 – Bilancio idrico annuale per il sistema di distribuzione

Acqua potabile importata in distribuzione (AID _{distr})		Acqua potabile esportata dalle distribuzioni (AED _{distr})		
Acque prelevate dall'ambiente per la distribuzione (exA2 _{distr})	Volume di input nel sistema di distribuzione (S _A _{distr})	Acqua potabile immessa nel sistema di distribuzione	Consumo autorizzato, misurato e fatturato (esclusa acqua esportata)	Consumo autorizzato, misurato e non fatturato
			Consumo autorizzato, non misurato e fatturato (esclusa acqua esportata)	
			Consumo autorizzato non fatturato (UAC)	Consumi non autorizzati (exA3)
			Consumo non fatturato (NRW)	Perdite idriche apparenti (AL)
				Perdite idriche totali (WL)
			Perdite idriche reali (CARL)	Consumi non autorizzati (errori di misura (exA3)) Da serbatoi, condotte principali e di allaccio fino al misuratore d'utenza

In 2015 the **EU REFERENCE DOCUMENT GOOD PRACTICES ON LEAKAGE REDUCTION** has been published.

Download at: <http://bit.ly/16dzx9f> and at: <http://bit.ly/1K6K8BK>



AEEGI in DCO 42/2016 (6.3) and 5/2015

- includes Water Balance inspired by EU REFERENCE DOCUMENT GOOD PRACTICES ON LEAKAGE REDUCTION
- correctly requires all data needed to calculate UARL, average pressure and IWA best practice KPIs

Summary: international advances in WLM

After 16 years experience worldwide, we know what needs doing to manage and sustainably reduce water losses.

- **We can even predict ‘how low could you go’ for any system.**
- **Remedial actions must be carried out in appropriate sequences, based on well-targeted data which improves with time.**
- **Pressure management is fundamental.**
- **There are no short cuts, and no simple solutions.**
- **Throwing money at the problem, without identifying and understanding the priorities for each individual system, does not work.**
- **Nor does denial, pretending that there is no problem, or that it can be hidden by manipulating data and using KPIs that hide the problem.**
- **Many countries are officially adopting IWA best practice methodology and are benchmarking performance using IWA KPIs.**

Summary: some ideas to improve WLM

Based on International experience, the development of a comprehensive **national plan** including the following phases can be suggested:

1. Officially **adopt the IWA approach** for water loss management
2. Use a **customised National free water audit software**
3. **Implement a National Training and certification program**
4. Develop a **Qualified Water Loss Auditor training program**
5. Require each single water utility to **measure NRW performance** by means of **external annual audits** using IWA methodology, a customised free water audit software and **third party validation**
6. **Benchmark water utilities performance in water loss management**
7. **Stimulate activities with short ROI** (social sustainability of water tariffs) like Pressure Management, ALC, DMAs, meters replacement with support measures like:
 - a) **Reduced amortization period** (equal to ROI) and/or
 - b) **Rotational funds at very low interest rate.**
8. **Introduce incentives / penalties related to performance**

This approach may be adopted at **pilot scale (Regional or local regulator (ATO) scale)** for validation and monitoring results achieved before application at larger scale / national scale.



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