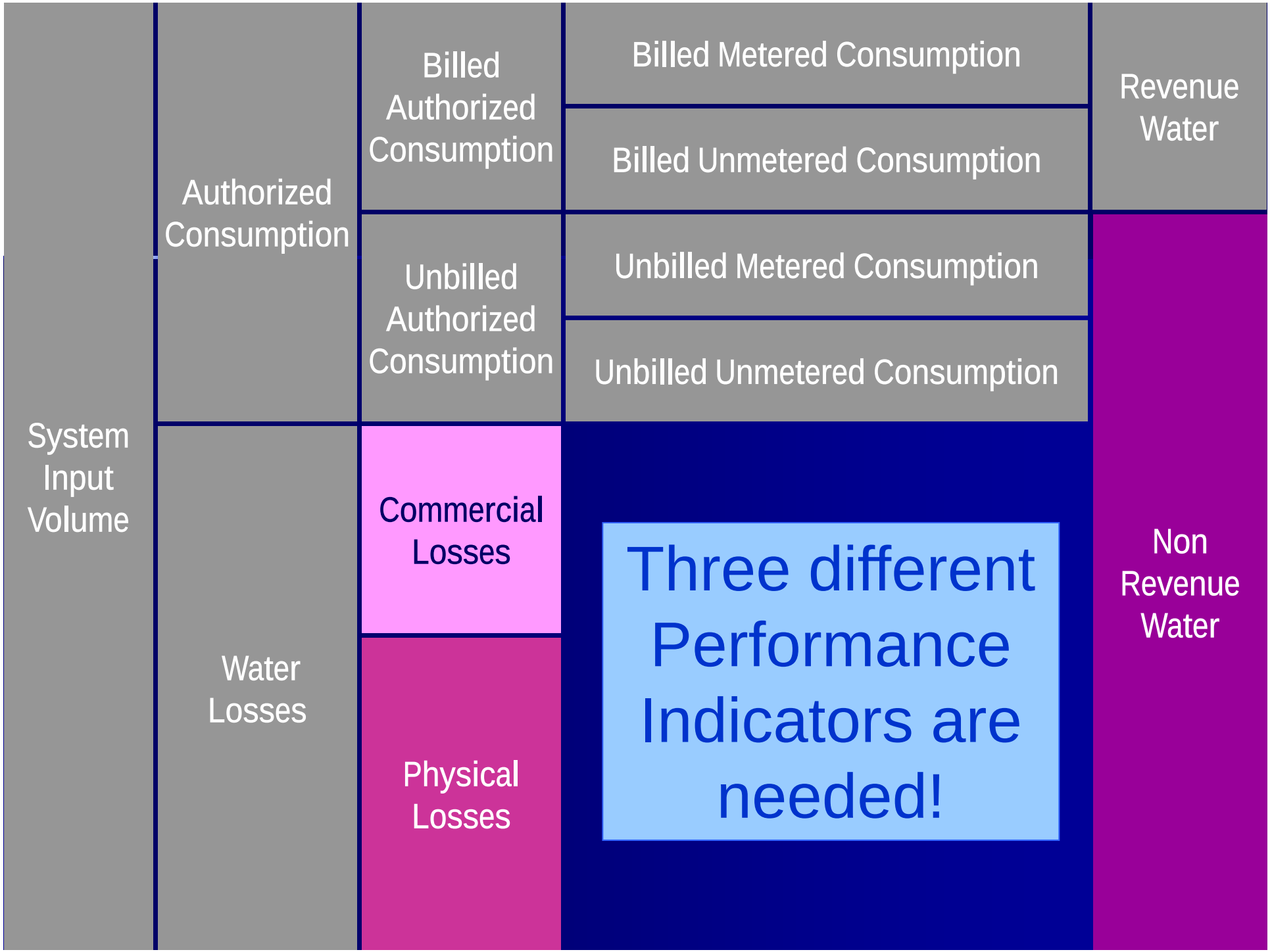
Water Loss Performance Indicators

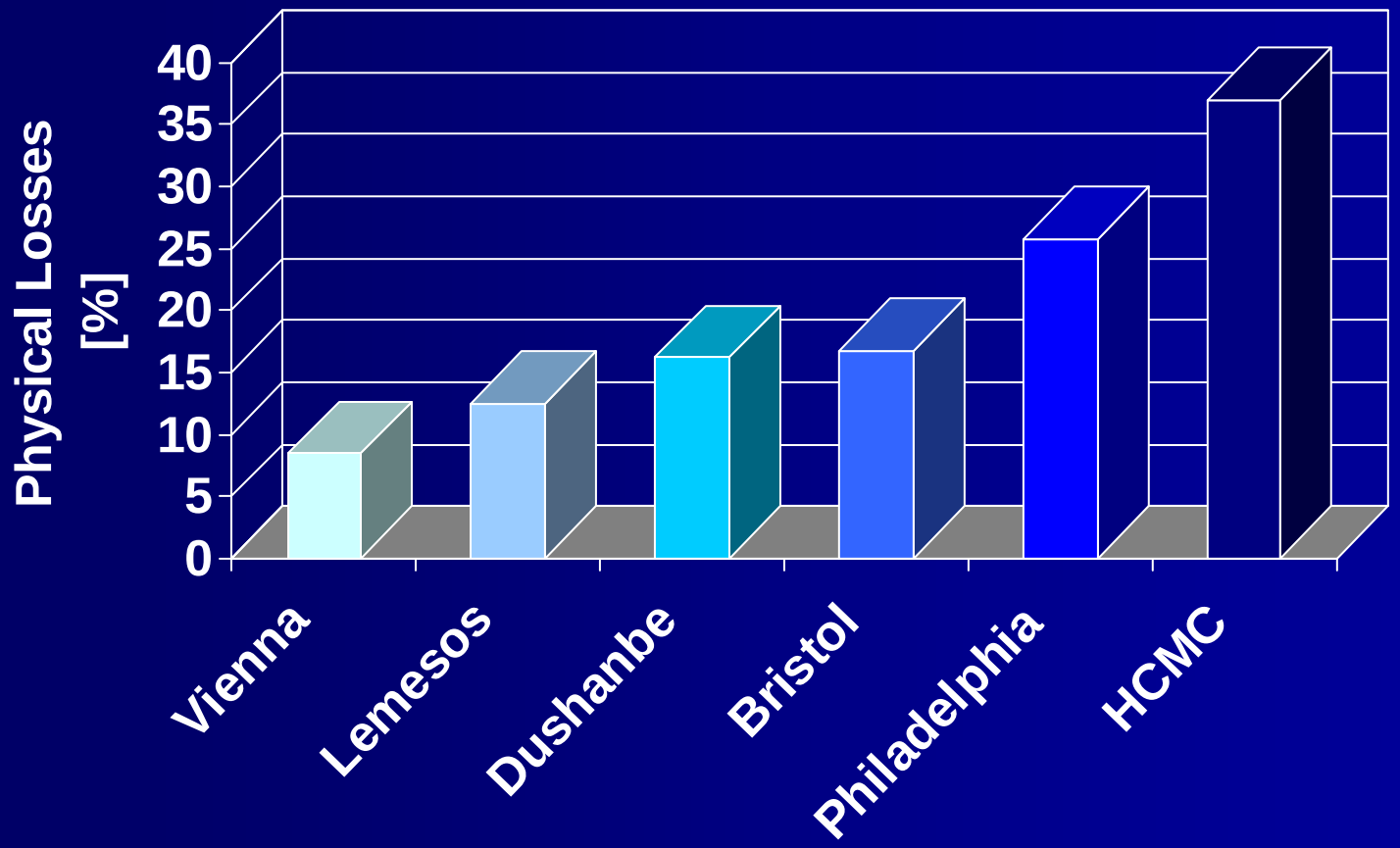
Water Balance and Performance Indicator Training
Bangkal, 11/18/10


System Input Volume
Authorized Consumption
Billed Authorized Consumption
Billed Metered Consumption
Billed Unmetered Consumption
Unbilled Authorized Consumption
Unbilled Metered Consumption
Unbilled Unmetered Consumption
Revenue Water
Water Losses
Commercial Losses
Physical Losses
Non Revenue Water
Three different Performance Indicators are needed!

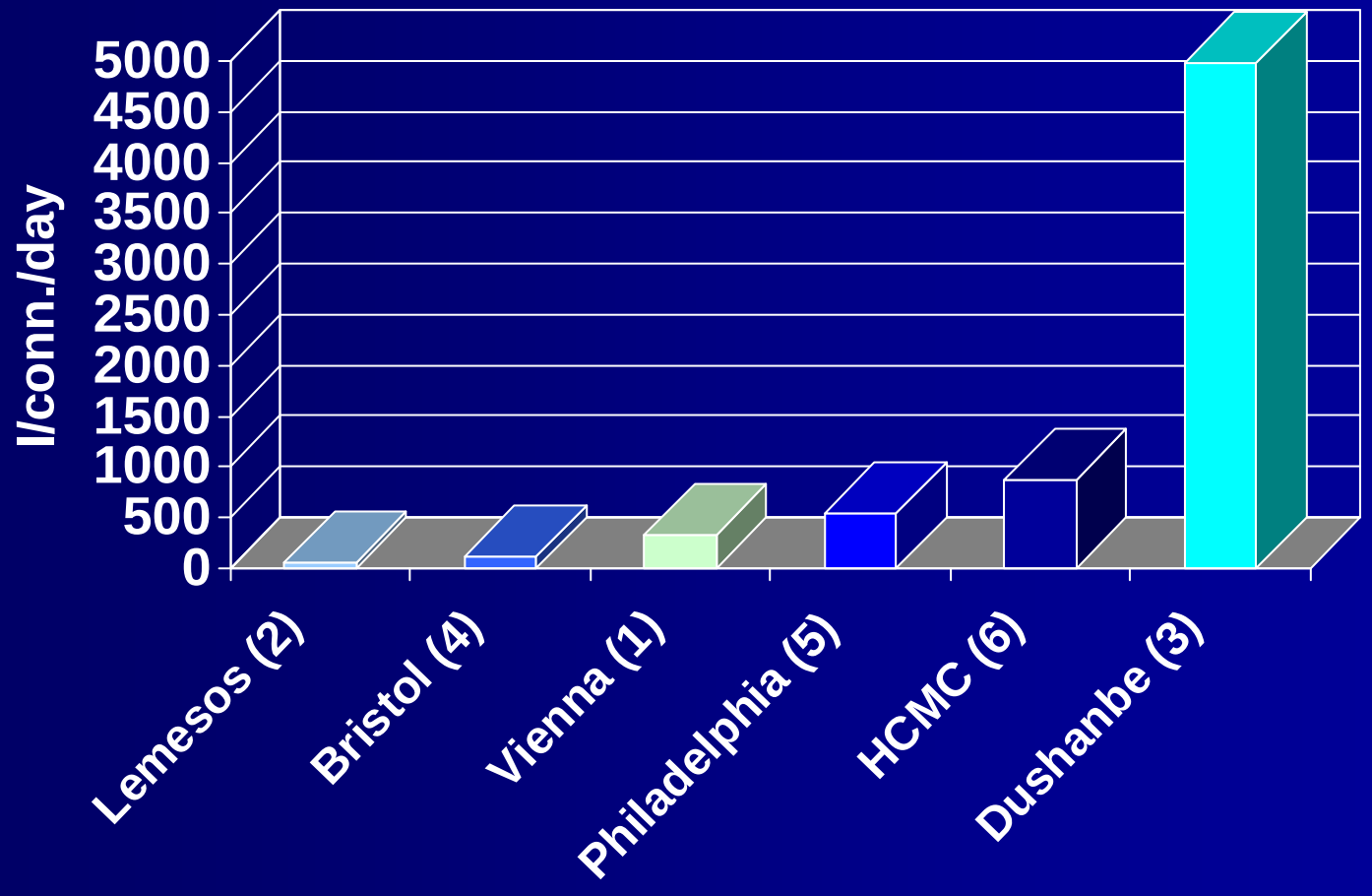
NRW as % of System Input is a very misleading Indicator

- % NRW is a poor technical indicator: why?
  - misleading: “favours” utilities with high consumption, intermittent supply, low pressure
  - lumps together two independent loss components: physical and commercial losses
- Many international and national associations advise against using percentages
- But: unfortunately still the most common indicator!

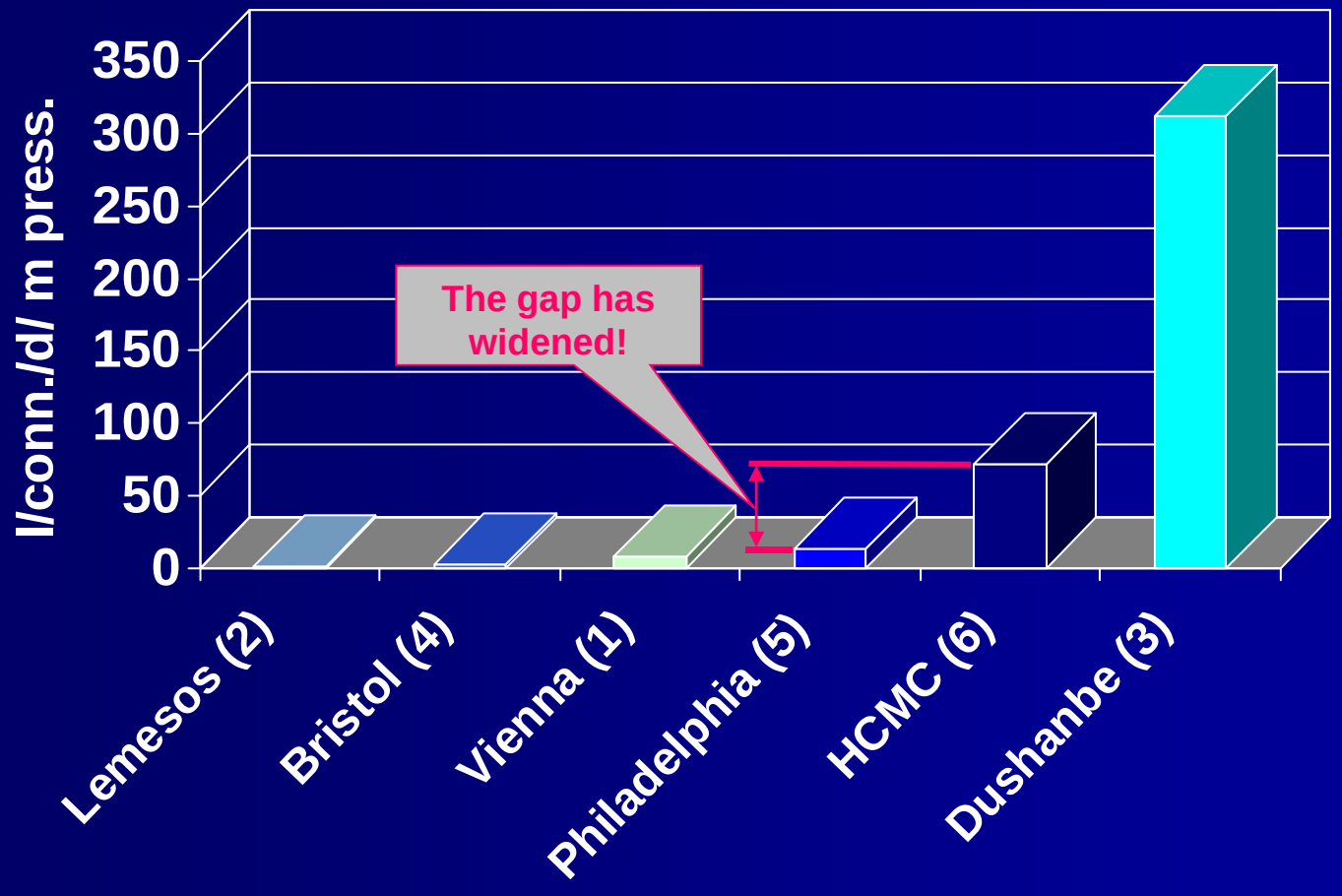
Six Systems Ranked According to Physical Losses as % of System Input



Ranked According to: Liters/Connection/Day



Ranked According to: Liters/Connection/Day/m Pressure



First Conclusions

- % Input Volume gives a false indication
- The picture becomes clearer using liters per connection per day
- But only when taking average pressure into account the true leakage situation is revealed
- Therefore: quote average pressure when talking about leakage

How to Account for Intermittent Supply?

- Always calculate Liters per Connection for a full 24 hour period for valid comparison
- For example: If leakage is 200 liters per connection per day at 12 hour supply time, the performance indicator would be:
- 400 liters/connection/day (w.s.p. = WHEN the system is pressurized)

Adjusting Performance Indicators for Intermittent Supply Situations

Average Supply Time	Representative for an area of about ..... service connections	multiply
24 h/d	10,000	240,000
12 h/d	20,000	240,000
6 h/d	5,000	30,000
~ 14.6 h/d	35,000	510,000

Correct Indicator for measured 200 liters per day:

200 /14.6 x 24 = 329 l/conn./d (w.s.p.)

Infrastructure Leakage Index (ILI)

one number capturing leakage management efficiency

Infrastructure Leakage Index (ILI)

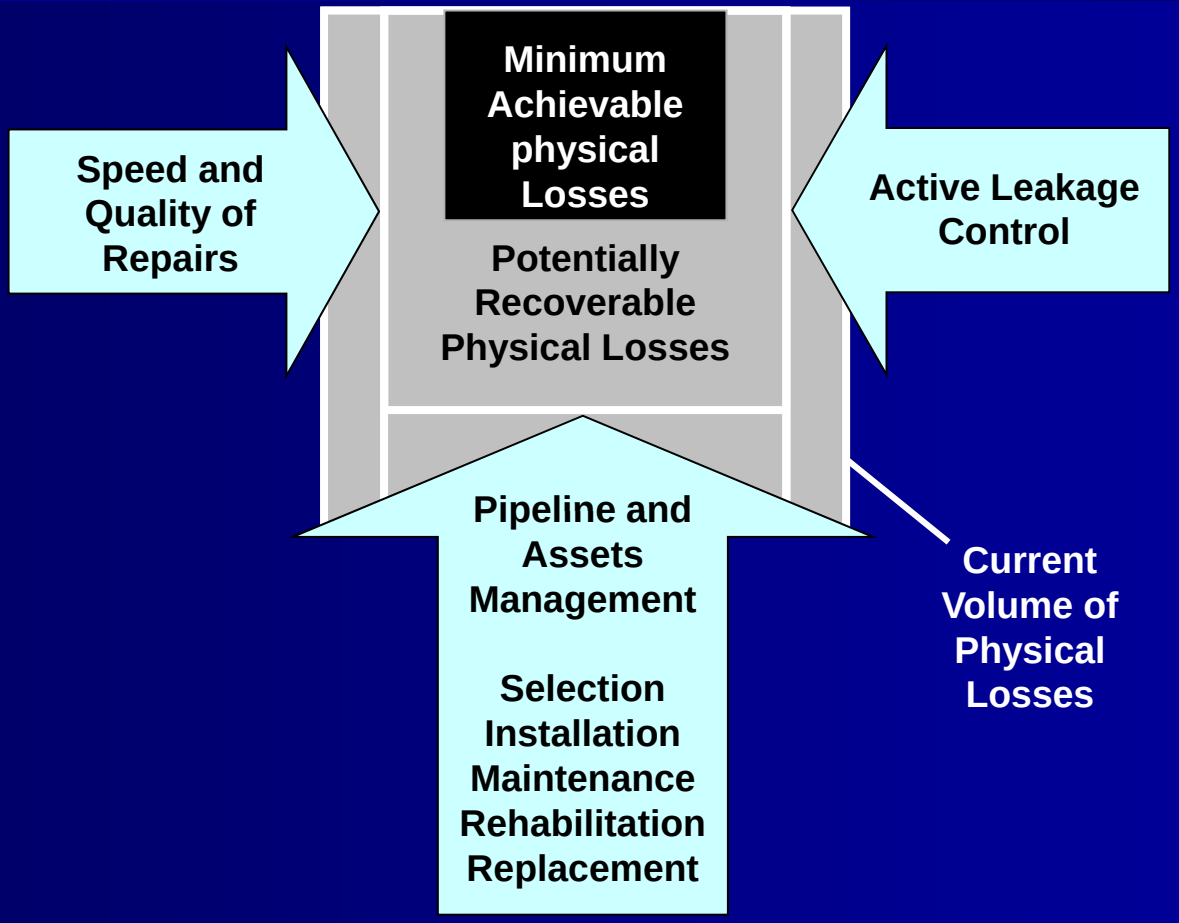
The ILI is a simple ratio:

ILI = CAPL / MAAPL

CAPL = Current Annual Physical Losses

MAAPL = Minimum Achievable Annual Physical Losses, level of losses that one would expected from an utility with a network that is in good condition AND which practices intensive active leakage control

Illustrating the ILI Concept



Calculating the ILI

- **Step 1: Calculate MAAPL (reference value):**

MAAPL (l/day) = (18 x LM + 0.8 x NC + 25 x LP) x P

LM = Length of Mains (km)

NC = Number of service Connections

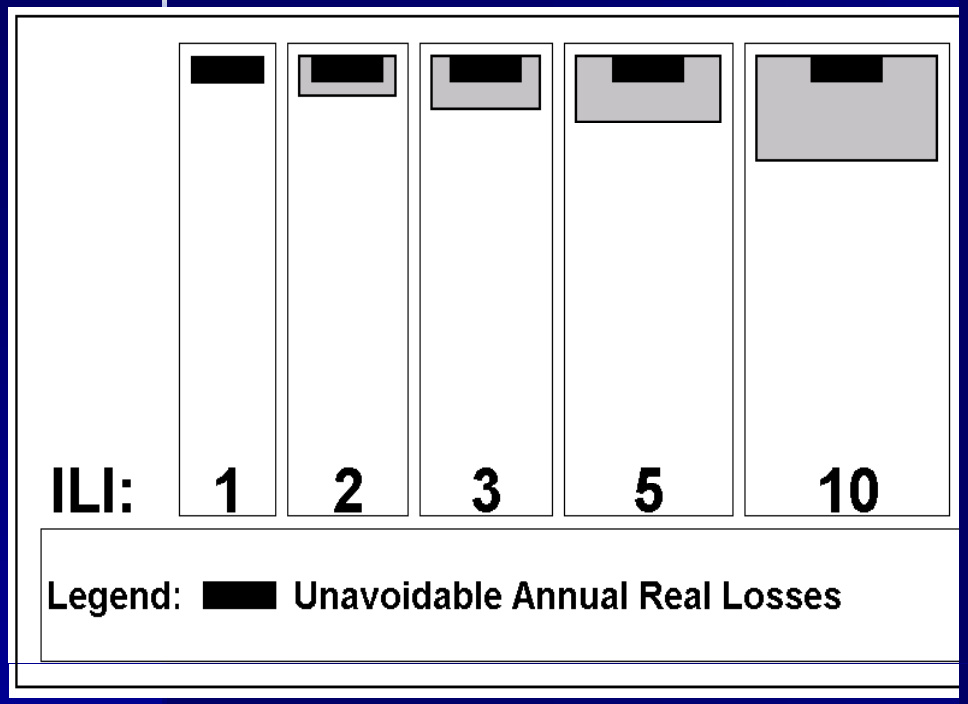
LP = Length of Service Connections from property boundary to customer meter (Length of pipe on Private land) (km) *not to be confused with total length of Connections*

P = average Pressure (meters)

Calculating ILI (continued)

- Step 2: Calculate current physical losses per day (e.g. from Water Balance)
- Step 3: Calculate ILI = CAPL / MAAPL
- Step 4: adjust for intermittent supply by dividing MAAPL by the number of average number of supply hours per day
- Step 4: Compare ILI with Physical Loss Target Matrix

ILI from 1 to . . . . . .?



Physical Loss Target Matrix

(use with either ILI or l/conn./day & average pressure)

Technical Performance Category		ILI	Physical Losses [Litres/connection/day] (when the system is pressurised) at an average pressure of:				
			10 m	20 m	30 m	40 m	50 m
Developed Countries	A	1 - 2		< 50	< 75	< 100	< 125
	B	2 - 4		50-100	75-150	100-200	125-250
	C	4 - 8		100-200	150-300	200-400	250-500
	D	> 8		> 200	> 300	> 400	> 500
Developing Countries	A	1 - 4	< 50	< 100	< 150	< 200	< 250
	B	4 - 8	50-100	100-200	150-300	200-400	250-500
	C	8 - 16	100-200	200-400	300-600	400-800	500-1000
	D	> 16	> 200	> 400	> 600	> 800	> 1000

Physical Loss Performance Categories; Guide to Further Action

- **Category A:**
  - **Good; further loss reduction may be uneconomic; careful analysis needed to identify cost effective improvements**
- **Category B:**
  - **Potential for marked improvements: consider pressure management, better active leakage control practices, and better maintenance**
- **Category C:**
  - **Poor: tolerable only if water is plentiful and cheap; even then intensify NRW reduction efforts**
- **Category D:**
  - **Terrible: inefficient use of resources; NRW reduction programs imperative and priority**

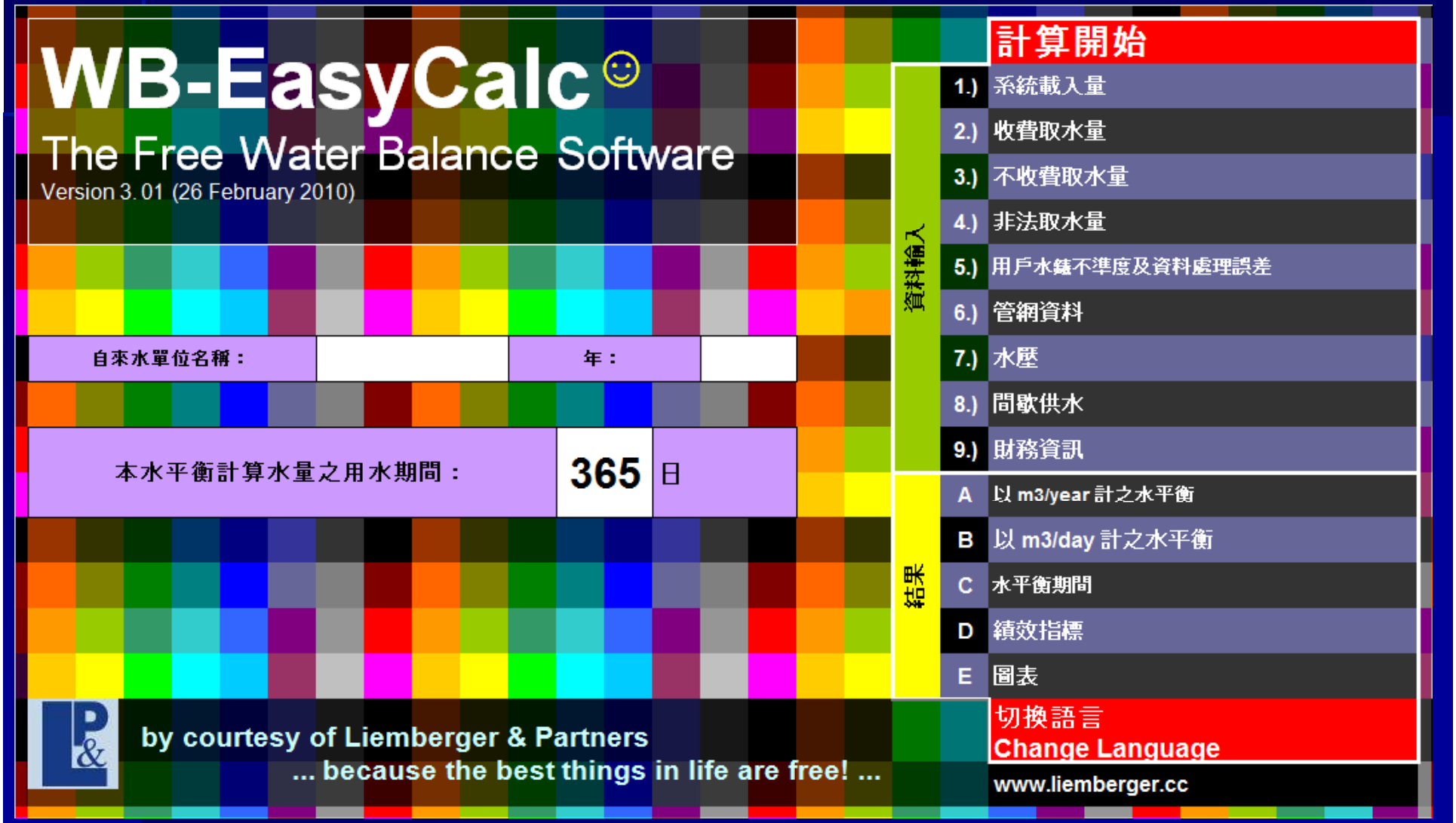
Water Loss Performance Indicators

- Physical Losses
  - Liters/connection/day
  - Infrastructure Leakage Index (ILI)
- Commercial Losses
  - % of Authorized Consumption
  - Liters/connection/day
- NRW
  - NOT % of system input volume;
  - Liters/connection/day

Work in progress: NRW Target Matrix

NRW Management Performance category		Non-Revenue Water in Liters/connection/day when the system is pressurized at an average pressure of:				
		10 m (15 psi)	20 m (30 psi)	30 m (45 psi)	40 m (60psi)	50 m (75 psi)
High Income Countries	A1		< 50	< 65	< 75	< 85
	A2		50-100	65-125	75-150	85-175
	B		100-200	125-250	150-300	175-350
	C		200-350	250-450	300-550	350-650
	D		> 350	> 450	> 550	> 650
Low and Middle Income Countries	A1	<55	<80	<105	<130	< 155
	A2	55-110	80-160	105-210	130-260	155-310
	B	110-220	160-320	210-420	260-520	310-620
	C	220-400	320-600	420-800	520-1000	620-1200
	D	> 400	> 600	> 800	> 1000	> 1200

R Liemberger, from a paper to be given at Water Loss 2010, June 2010



Key Messages

- NRW as % of system input is very misleading and it COMPLETELY unsuitable for benchmarking and international comparisons
- Always use liters/connection/day (w.s.p.)
- Separate indicators needed for physical and commercial losses
- ILI, the best indicator for leakage benchmarking