NRW AND METERING

Francisco Arregui
farregui@ita.upv.es
IWA - Water balance

System Input Volume

Authorized Consumption

Billed Authorized Consumption

Unbilled Authorized Consumption

Water Losses

Apparent Losses

Real Losses

Billed exported consumption

Billed Metered Consumption

Billed Unmetered Consumption

Unbilled Metered Consumption

Unbilled Unmetered Consumption

Unauthorized Consumption

Customer Meter Inaccuracies

Billing & Accounting Errors

Leakage on Transmission and/or Distribution Mains

Leakage and Overflows at Utility’s Storage Tanks

Leakage on Service Connections

Revenue Water

Non Revenue Water
Why do you want to reduce water losses?

- Political reasons
- Economic reasons
- Environmental reasons
- Socio-economical reasons

Then we are ready to set targets
Thinking about the drivers

How to get there in the most efficient way?

Think on the long term!
Any policy must be sustainable
First we need to know where we are
IWA - Water balance

Where is your problem?
Whatever your problem is any decision requires a proper assessment of the system
Obviously, this assessment of the network and the current situation is far more difficult without meters.
If we do not have meters we will have to make ESTIMATIONS.

We will see what we want to see (or what others want to be seen)
Why are meters important?

- They help us in knowing where we are
- They are also the cash registers of our company
- The amount of water used is related to the presence of a water meter
- Remember that the optimal /expected metering quality is related to the value of the good we are selling
  - Expensive meters make no sense if water price is low!
Selecting a meter

High-tech meters are not always the best choice, even if they have a very nice error curve.
Selecting a meter

- Remember that the optimal /expected metering quality is related to the value of the good we are selling
  - Expensive meters make no sense if water price is low!
- A water meter type cannot be selected without considering:
  - Water quality
  - Continuity of service
  - Tampering problems
  - High/low temperatures
  - Pressure
  - Others...
How large can meter inaccuracy be?
- Meters have measuring limitations
  - The error depends on the water flow rate through the meter

![Class B Velocity meter](image)

**Meters performance**

![Graph showing error vs. flow rate](image)

Flow rate (l/h)

Error (%)
Each meter type has a different error curve (signature)
We need to know how customers use water!
How accurate is a brand new domestic meter?
What is the initial error of a domestic meter?

- Apartments (few leaks)
- Users with roof tanks

Meter brand

Weighted error (%)

Pattern 1 → Pattern 2 → Pattern 3 → Pattern 4
What is the initial error of a domestic meter?

Depending on the domestic meter brand the INITIAL error can be as high as \(-11\%\) or even more!

Maybe now you do not give an answer so easily!
What about old/used domestic meters?

Would you make a guess about the error?
And about commercial meters?

Would you make a guess about their measuring error?
Do not believe the figures in the catalogue!
Performance is also affected by installation conditions

How much money you lose if you do not install meters horizontally?
Performance is also affected by installation conditions

Valves/strainers/bends upstream the meter
Check for appropriate installation sites
Selecting a meter

High-tech meters are not always the best choice, even if they have a very nice error curve
Would you drive this car on this road?
Would your rather drive this one?
We should not only be interested in the initial error
The rate of degradation of the error curve is much more important
It will depend:
  - On the design of the meter
  - Quality of materials
  - Installation conditions
  - Working conditions
  - Water quality
The initial performance is not forever

Some meters will break
The initial performance is not forever

Some meters will be affected by water quality
The initial performance is not forever

Some meters will be affected by water quality

Velocity meters can show over-registration!
This particular meter had an error of +25%
The initial performance is not forever

Some meters will be manipulated by customers
The initial performance is not forever

We need to protect our measuring instruments from being dismounted

Is this the way?
The initial performance is not forever

Quite often installing seals is more than enough
The initial performance is not forever

Meters with electronic components will also suffer from software bugs!
The initial performance is not forever

Consumption patterns can significantly contribute to the degradation of the meters

- Sudden changes
- High flows
Example of a commercial meter degradation

Accumulated volume = 27000 m$^3$
Consumption = 400 m$^3$/month
Age = 5.7 years
Water selling price = 0.5 €/m$^3$

Weighted error = -6.1% (installed meter)
Weighted error = -1% (new meter – same type)
Apparent losses components

APPARENT LOSSES

Economic level of apparent losses

Meter Inaccuracy

Illegal Consumption

Data Handling
● Meter are an essential tool to conduct a proper assessment of the system
● Metering quality should be in accordance to water price
● As any other instrument, meters have a metrological limitations
  ❏ They cannot measure everything
  ❏ Their performance degrade with over time
  ❏ Can be manipulated
● Measuring errors can be extremely high even from the start
● Measuring errors do not only depend on the meter