Systematic methodology to estimate apparent losses due to water meters inaccuracies

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This presentation was made by Francisco Arregui at the World Water Congress and Exhibition in Busan in September 2012.

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BUSAN KOREA
16–21 September 2012 BEXCO, 43 APEC-ro, Haeundae-gu, Busan

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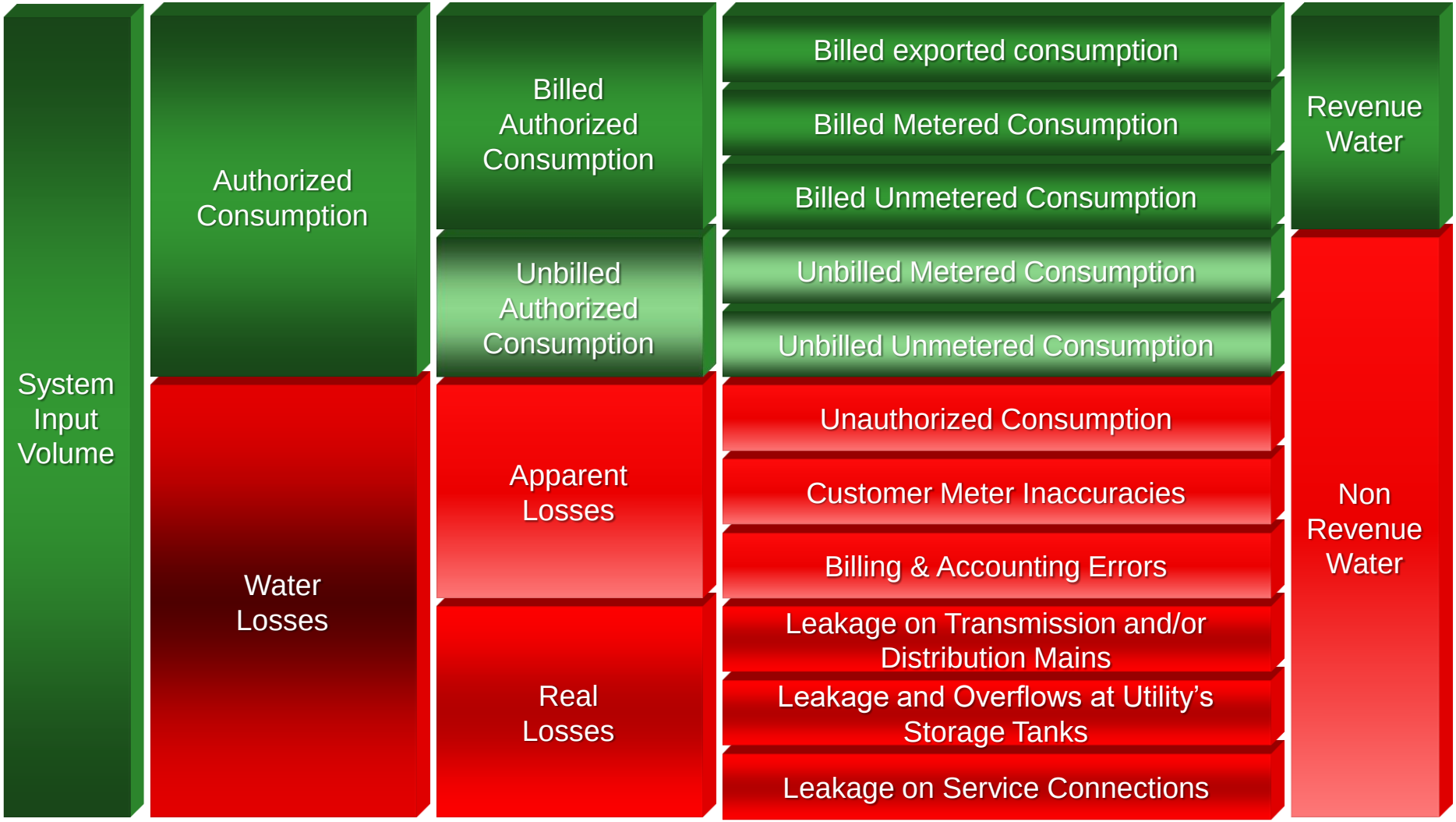
IWA - Water balance



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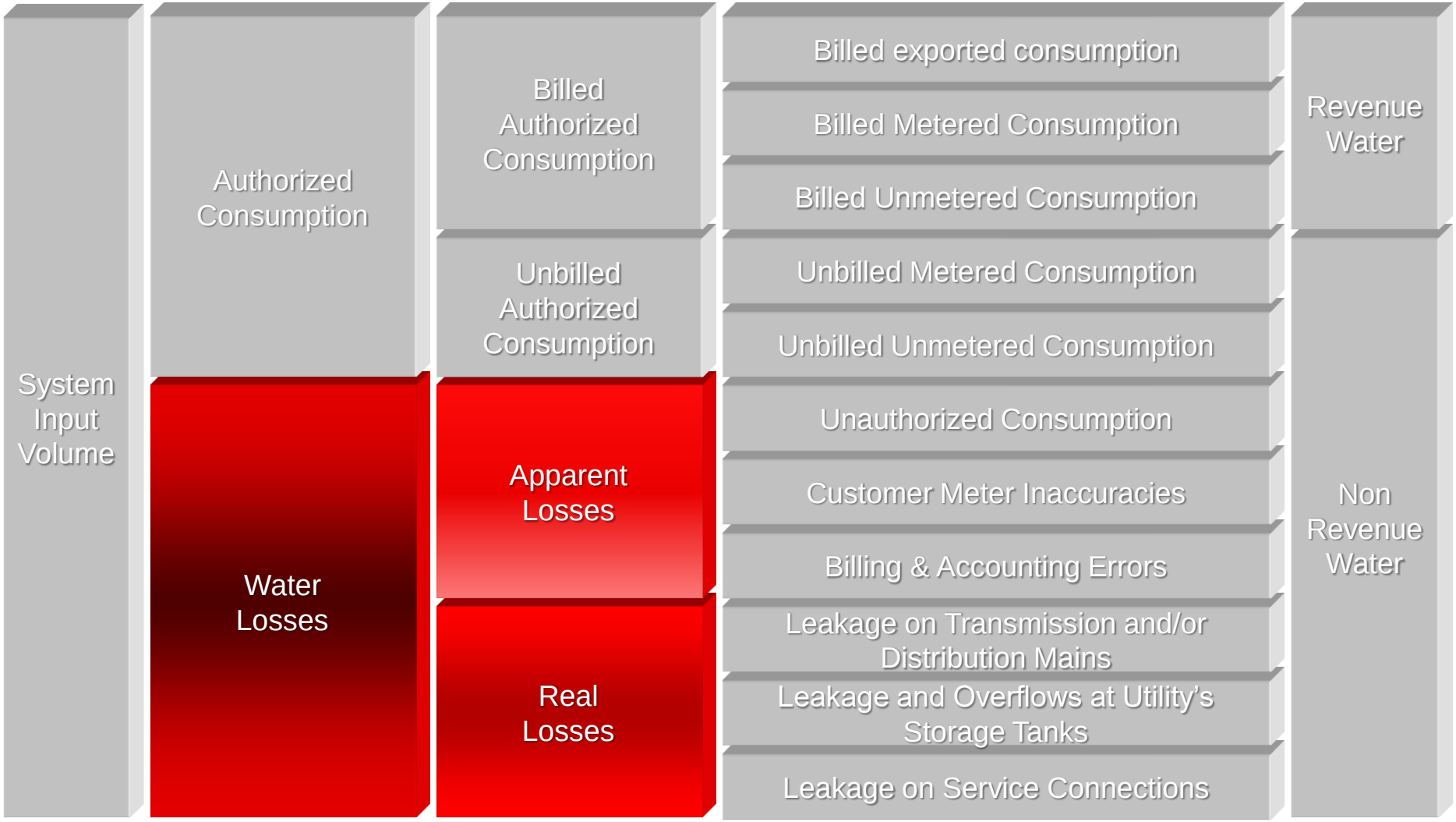

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IWA - Water balance

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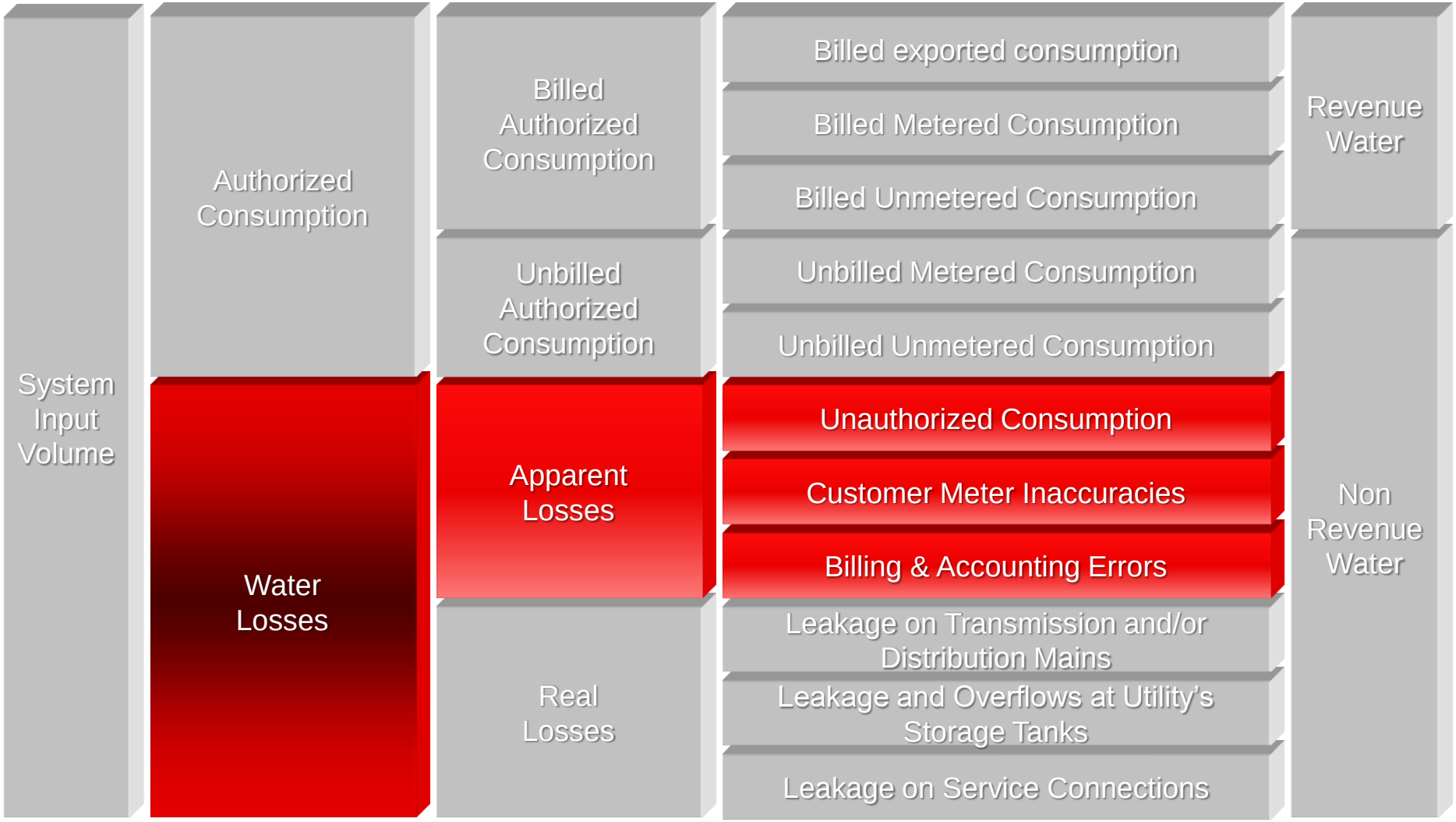

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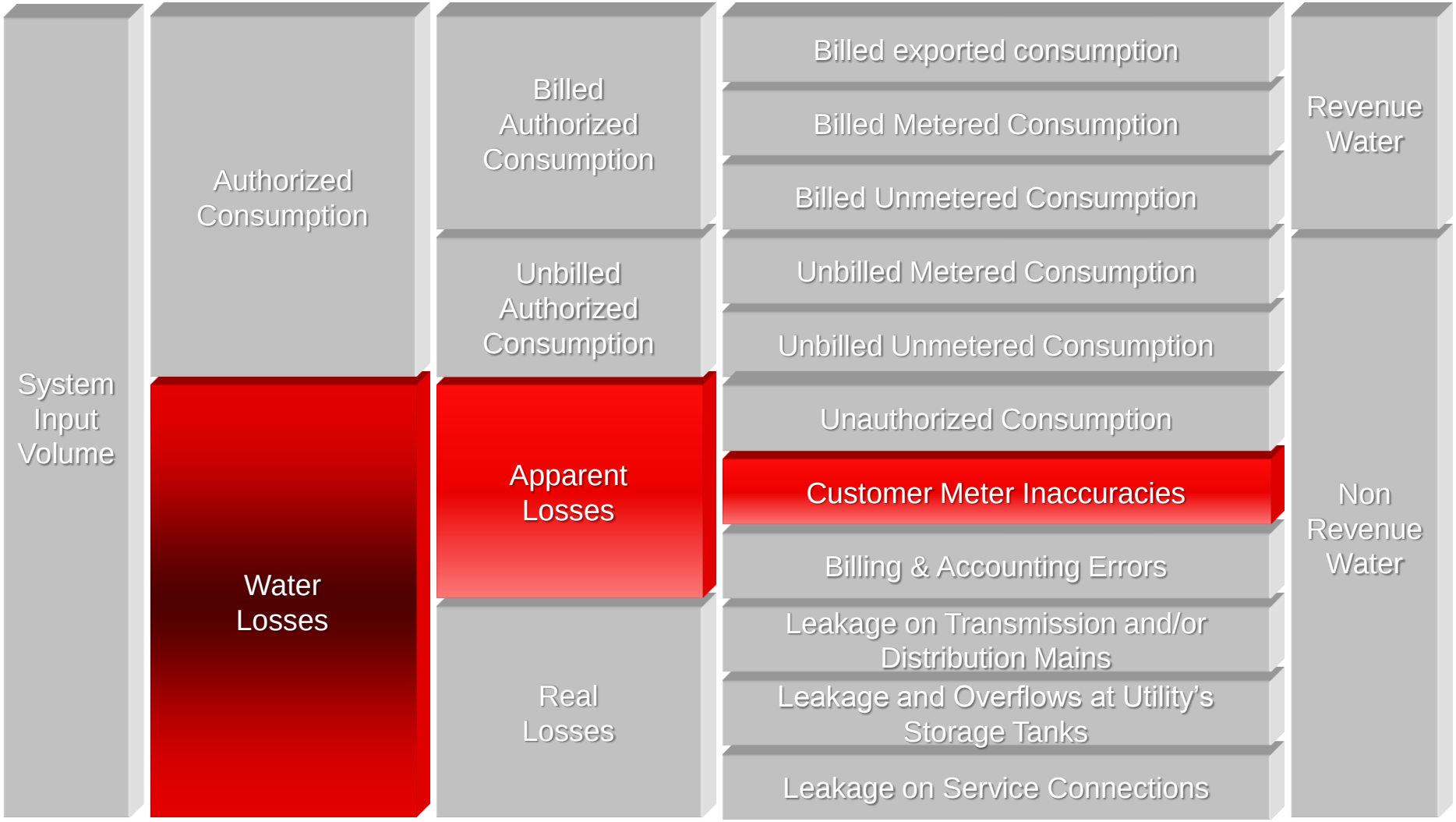


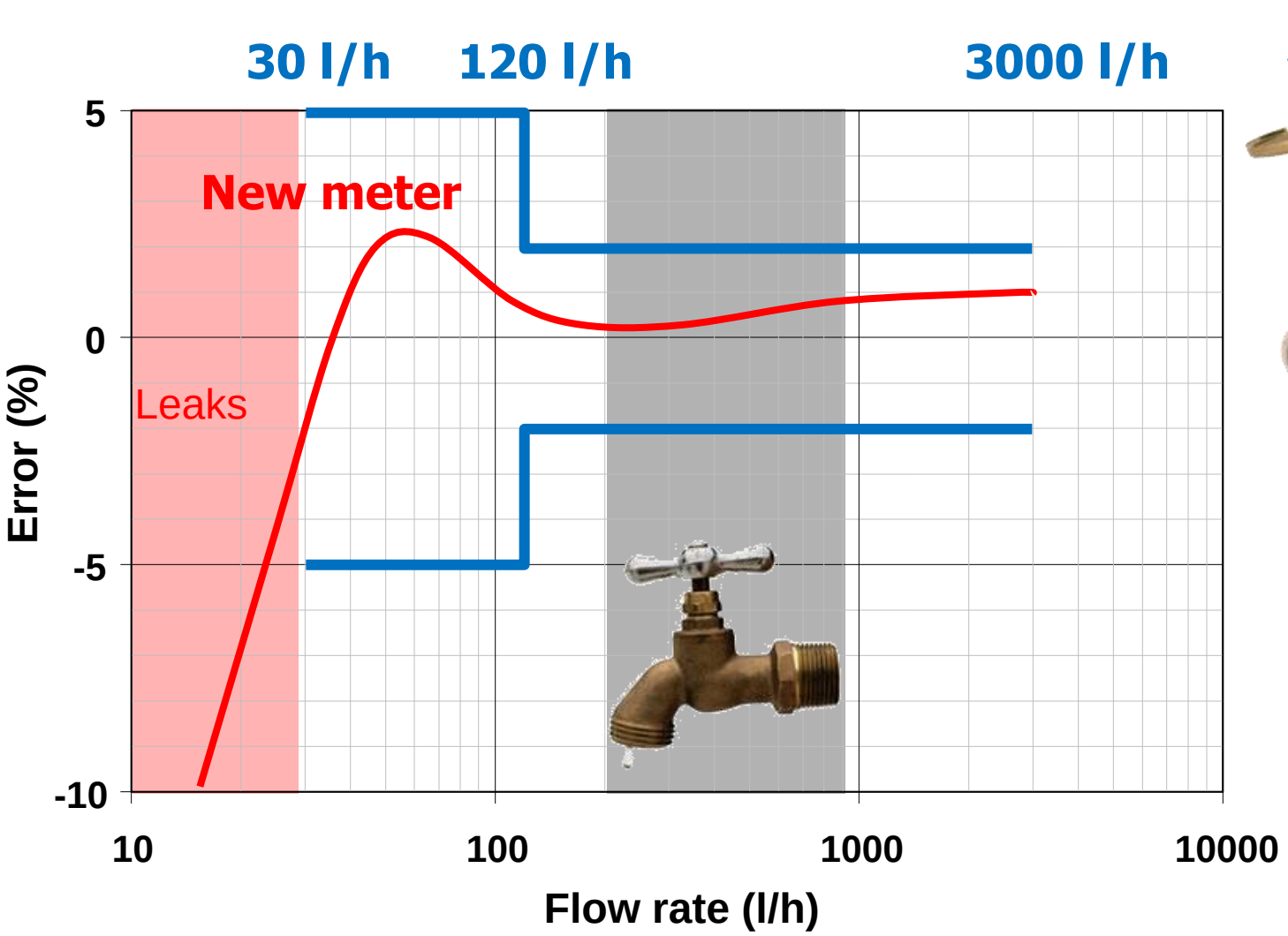
How accurate is a brand new domestic meter?

How accurate is a brand new commercial meter?

How accurate is an old domestic meter?

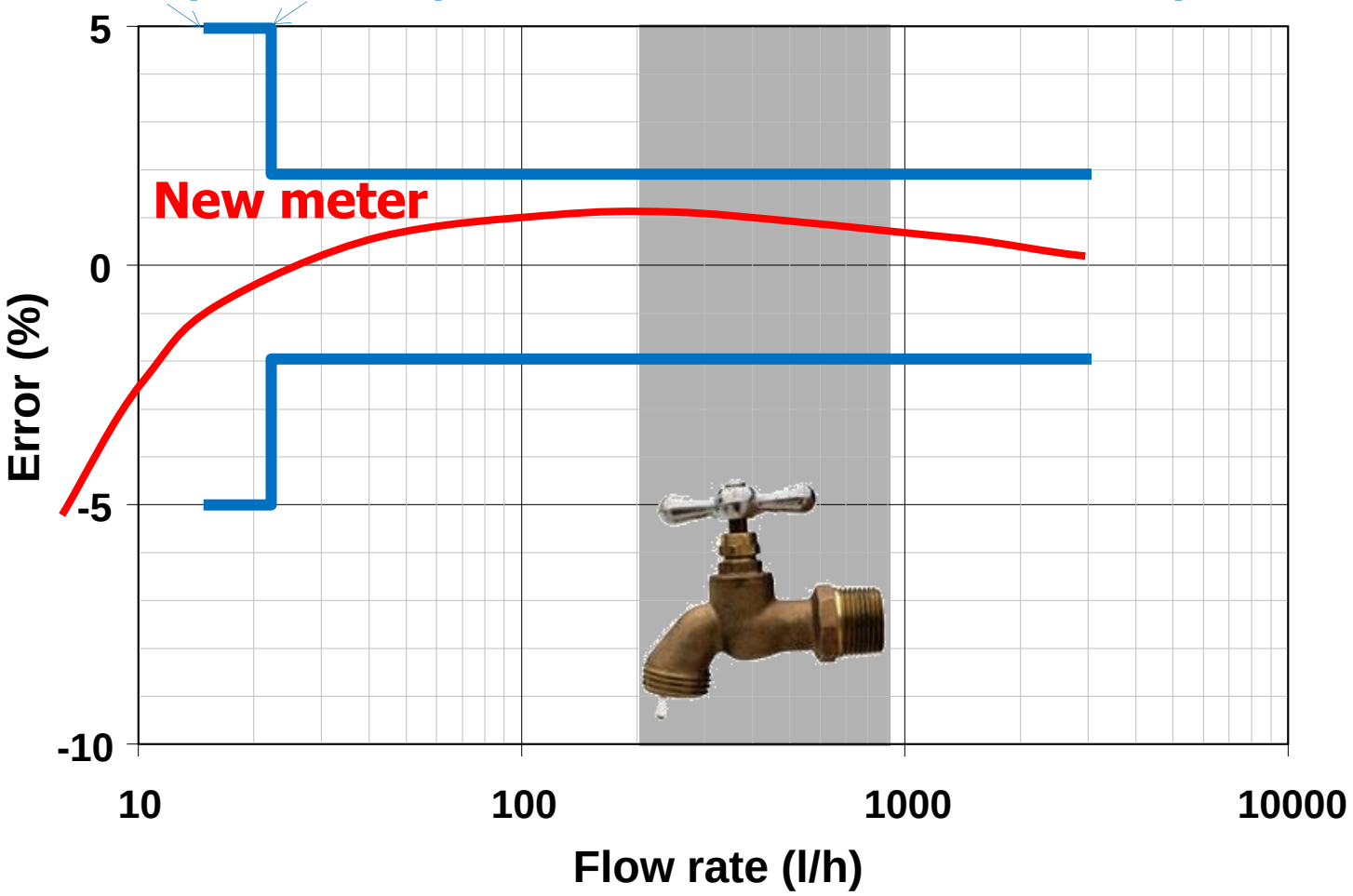
How accurate is an old commercial meter?

Metering errors vary with flow rate



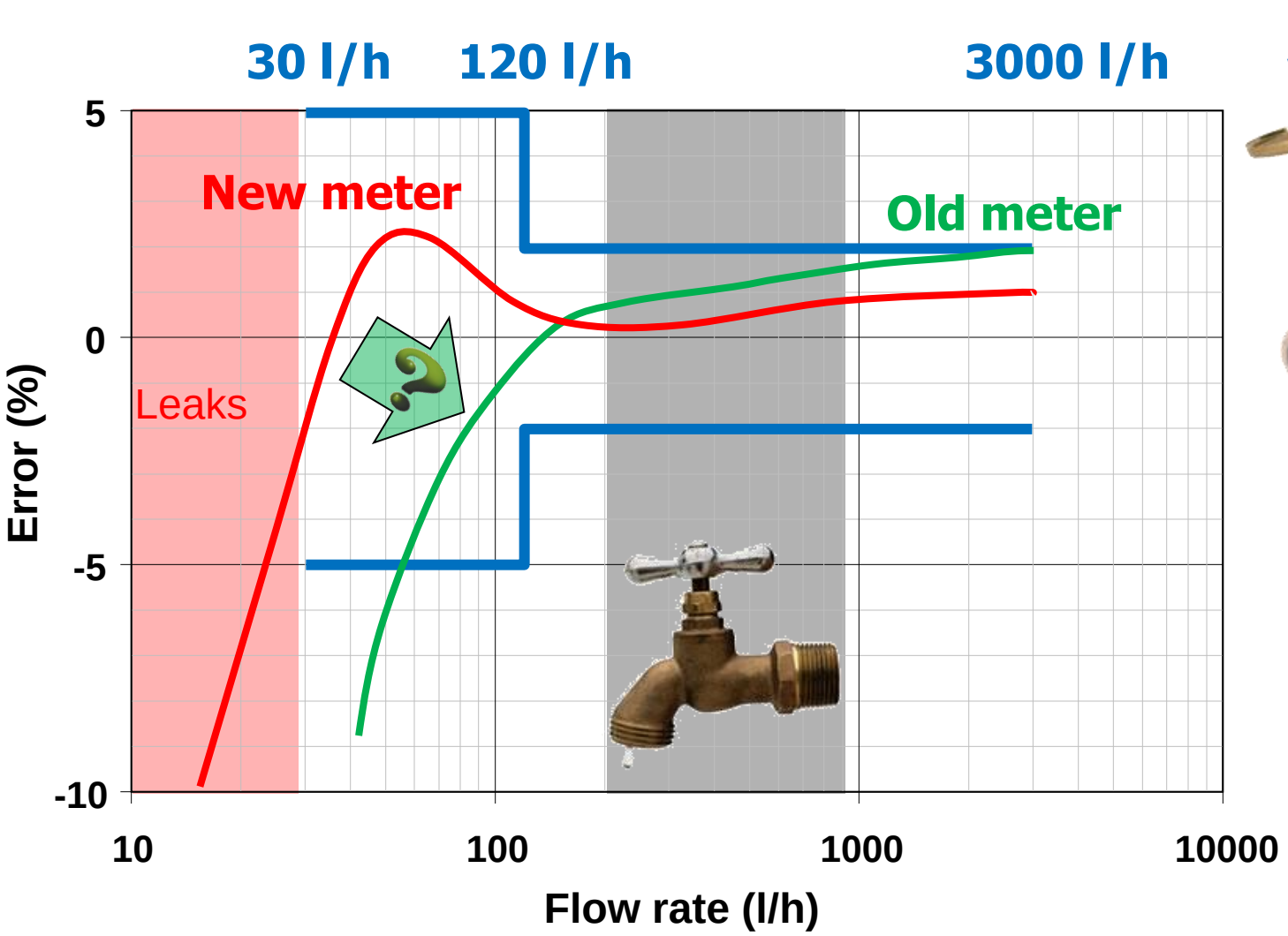
Class B
Velocity meter

Metering errors vary with flow rate



Class C - PD

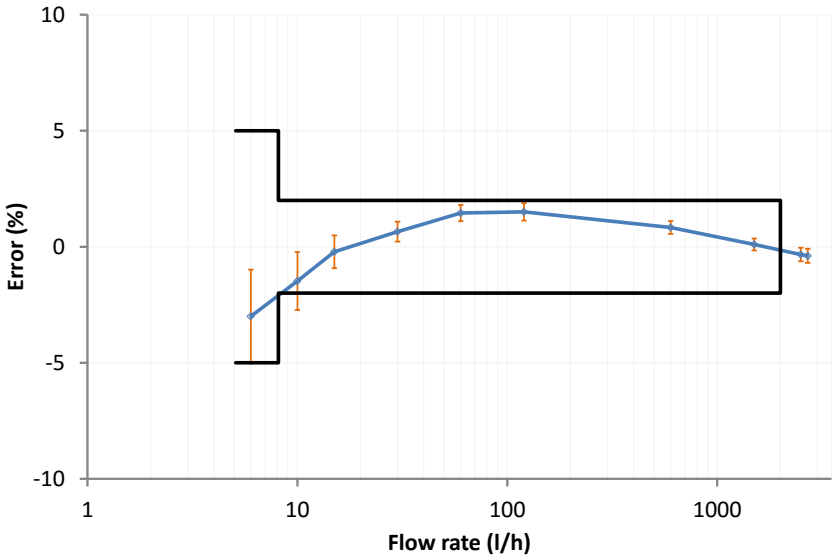
Metering errors also vary with time!!!



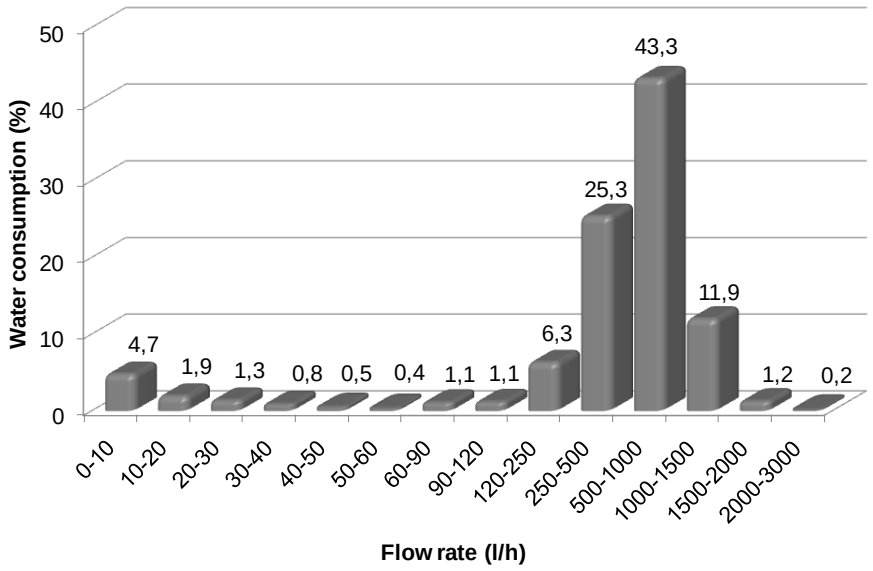
Class B
Velocity meter

Finding real field performance of a meter

Error curve

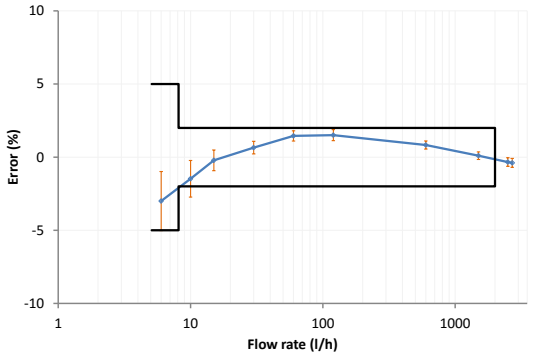


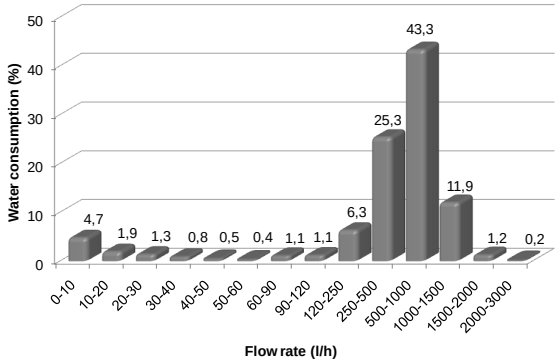
Water consumption pattern



Weighted error

Understanding weighted error of a meter



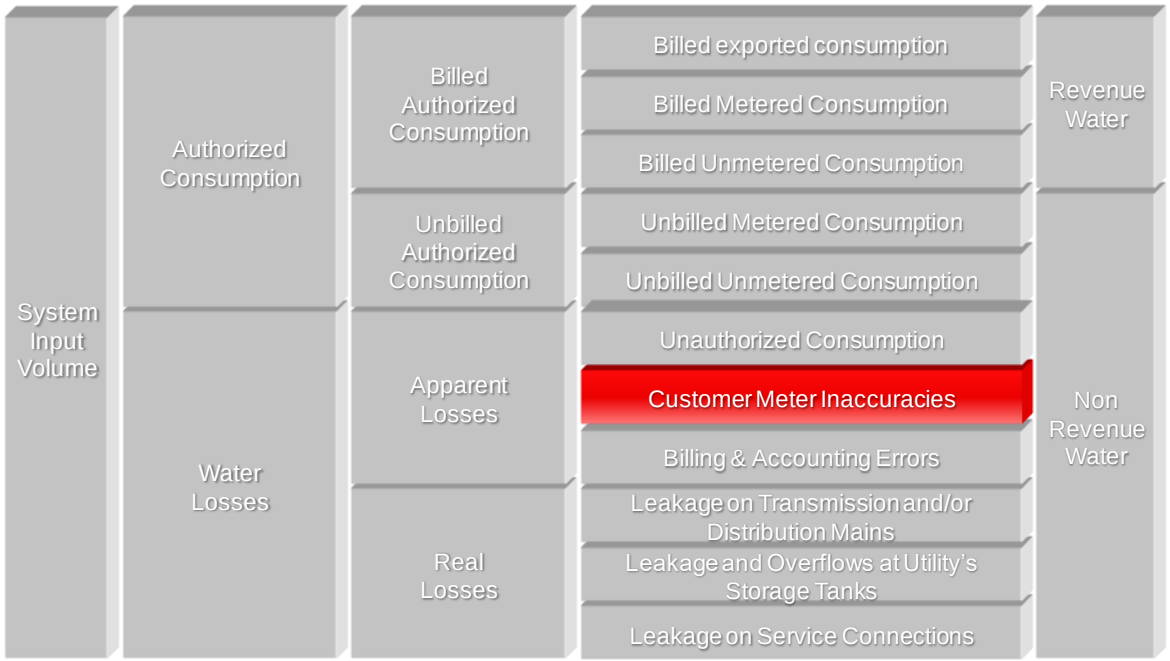


Weighted error of -X%

- -X% weighted error means that every 100 litres consumed X litres are not measured
- It is strictly associated to:
  - **One meter (or type of meter)**
  - **One customer (or type of customer)**

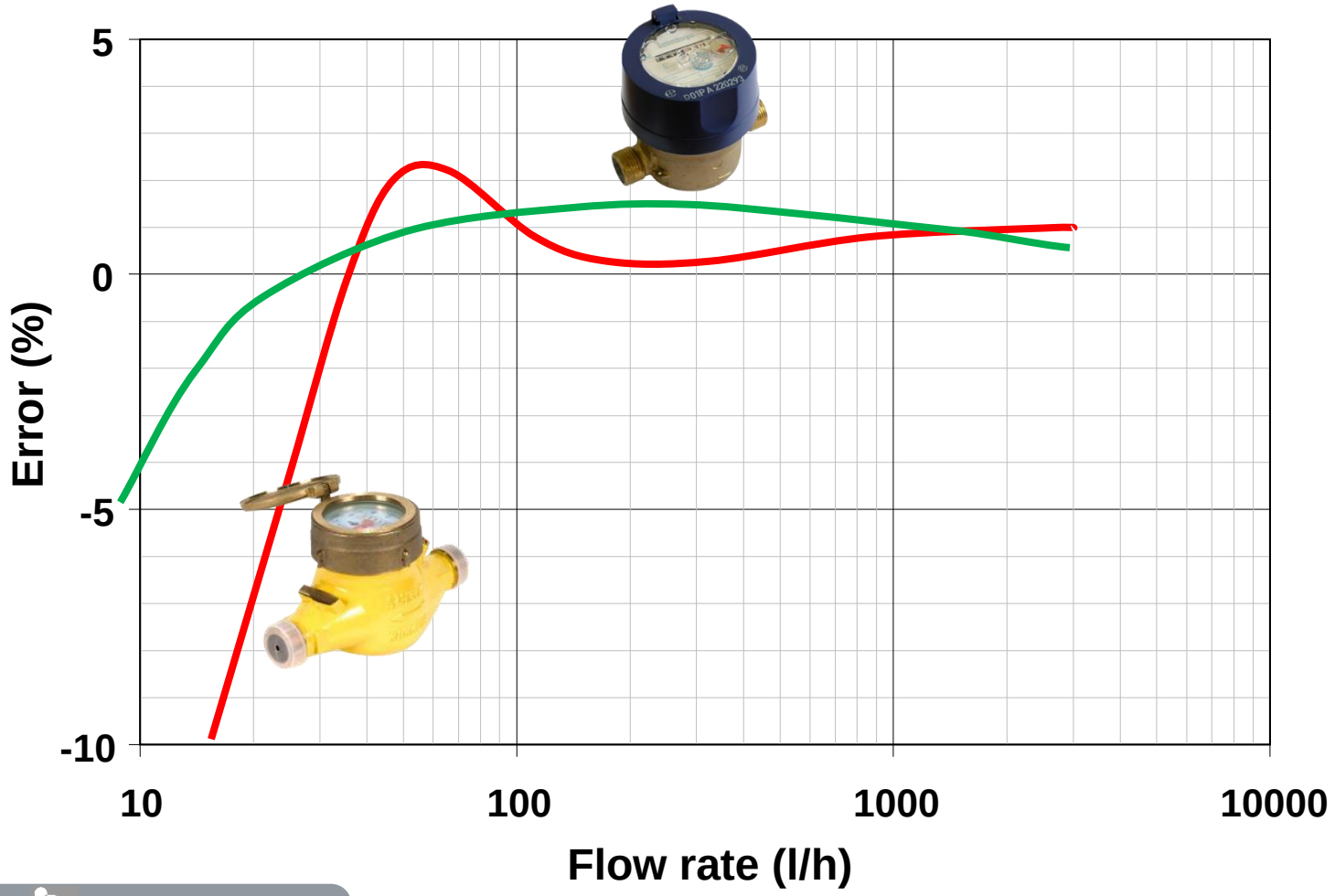
Understanding weighted error of a meter

- If the weighted error of all installed meters is known then the Customer Meters Inaccuracies term is also known



Finding the error curve of water meters

- There are large differences between meter types



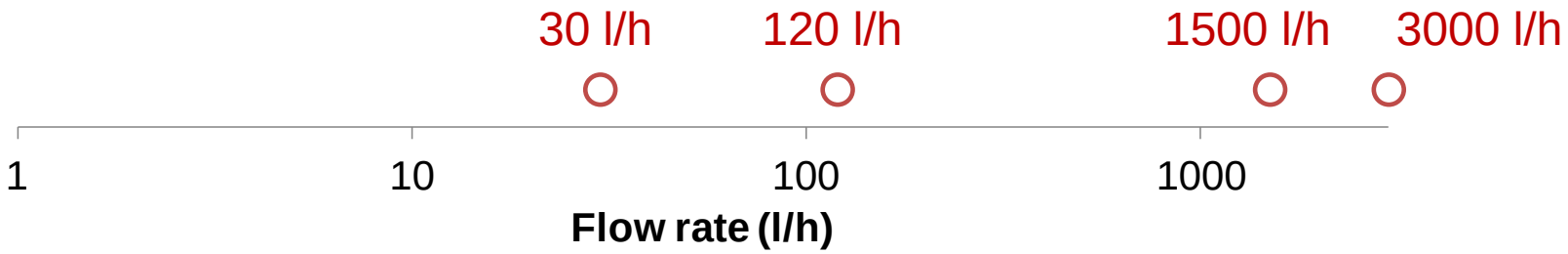
Finding the error curve of water meters

- There are large differences between meter types
- Metering errors depend on the flow rate

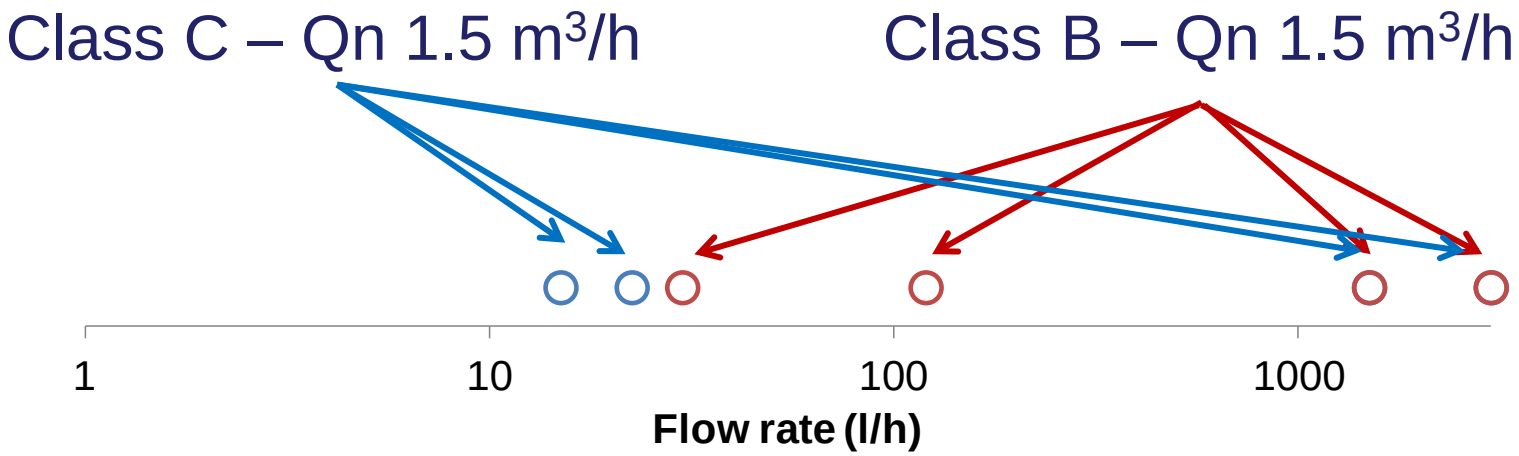
  Which flow rates do I test?
  - **Use standards (ISO 4064, AWWA)?**
    - Minimum, Transition, Permanent, Maximum
  - **Other criteria**

Selecting flow rates based on the standards

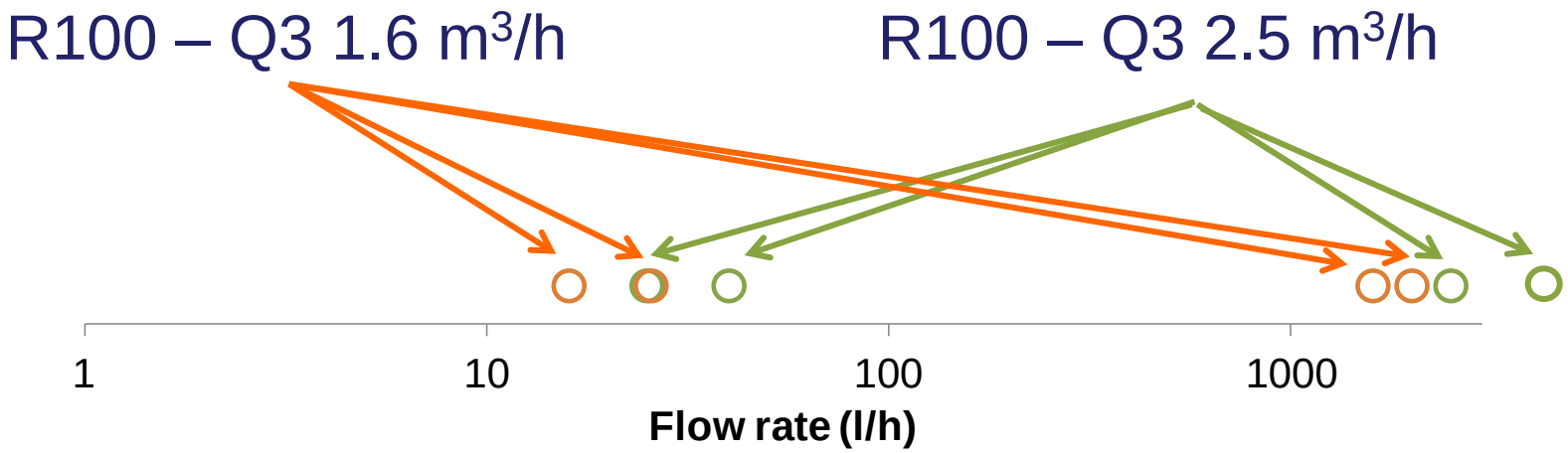
Class B – Qn 1.5 m^3/h



Selecting flow rates based on the standards

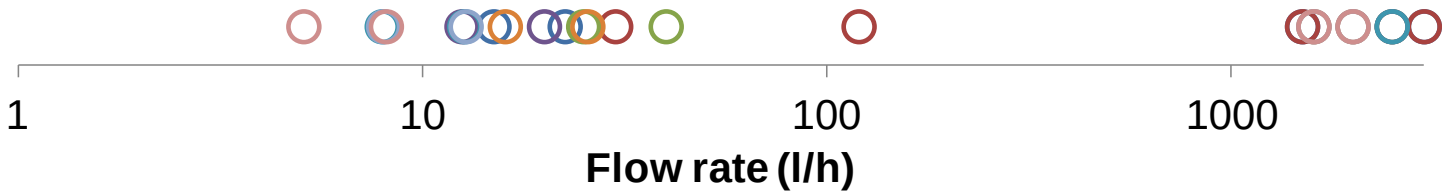


Selecting flow rates based on the standards



Selecting flow rates based on the standards

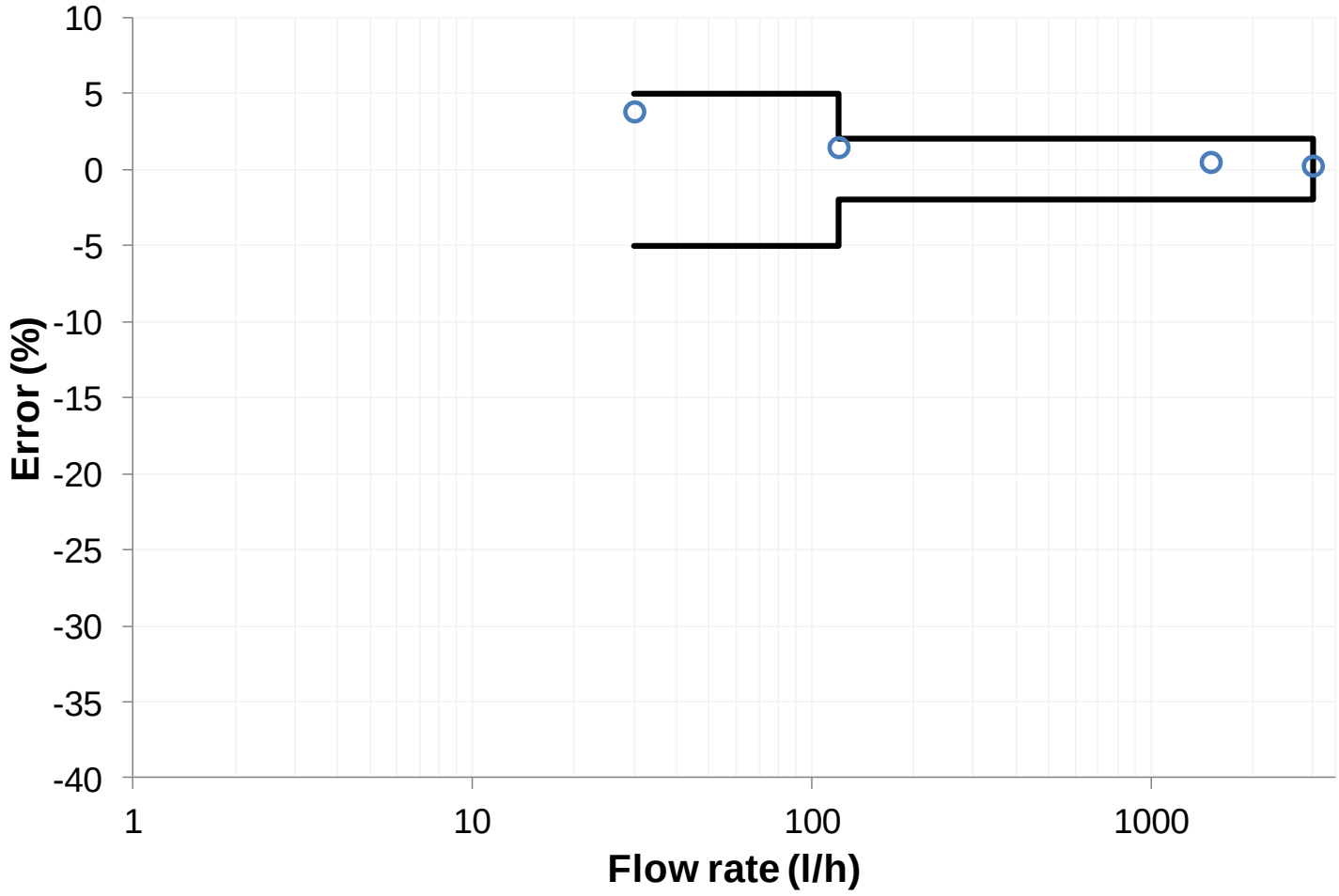
With the new ISO 4064:2006 there are too many options for domestic meters



Using standards to select testing flow rates is impractical!!!

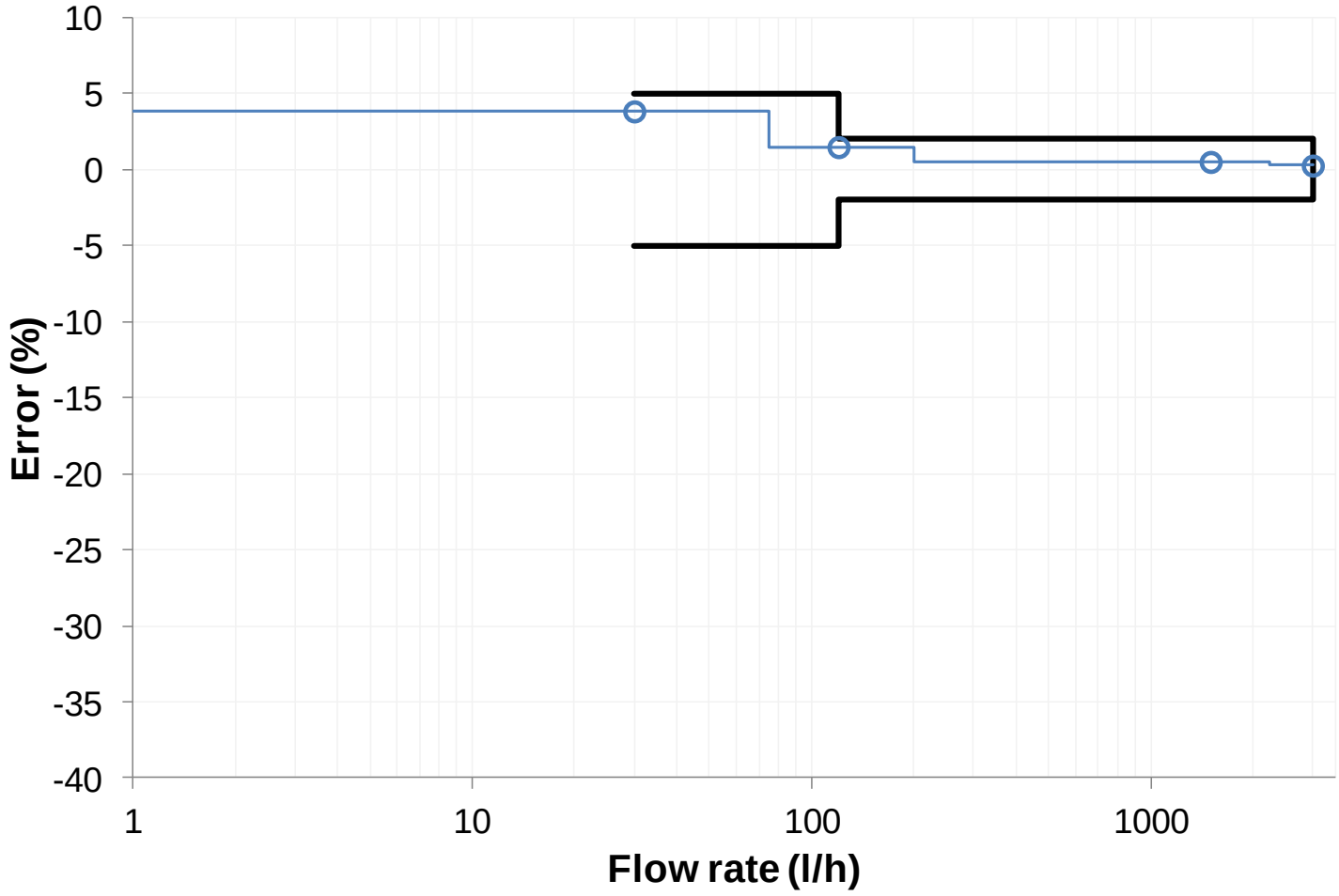
Selecting flow rates based on the standards

Class B – Qn 1.5 m^3/h



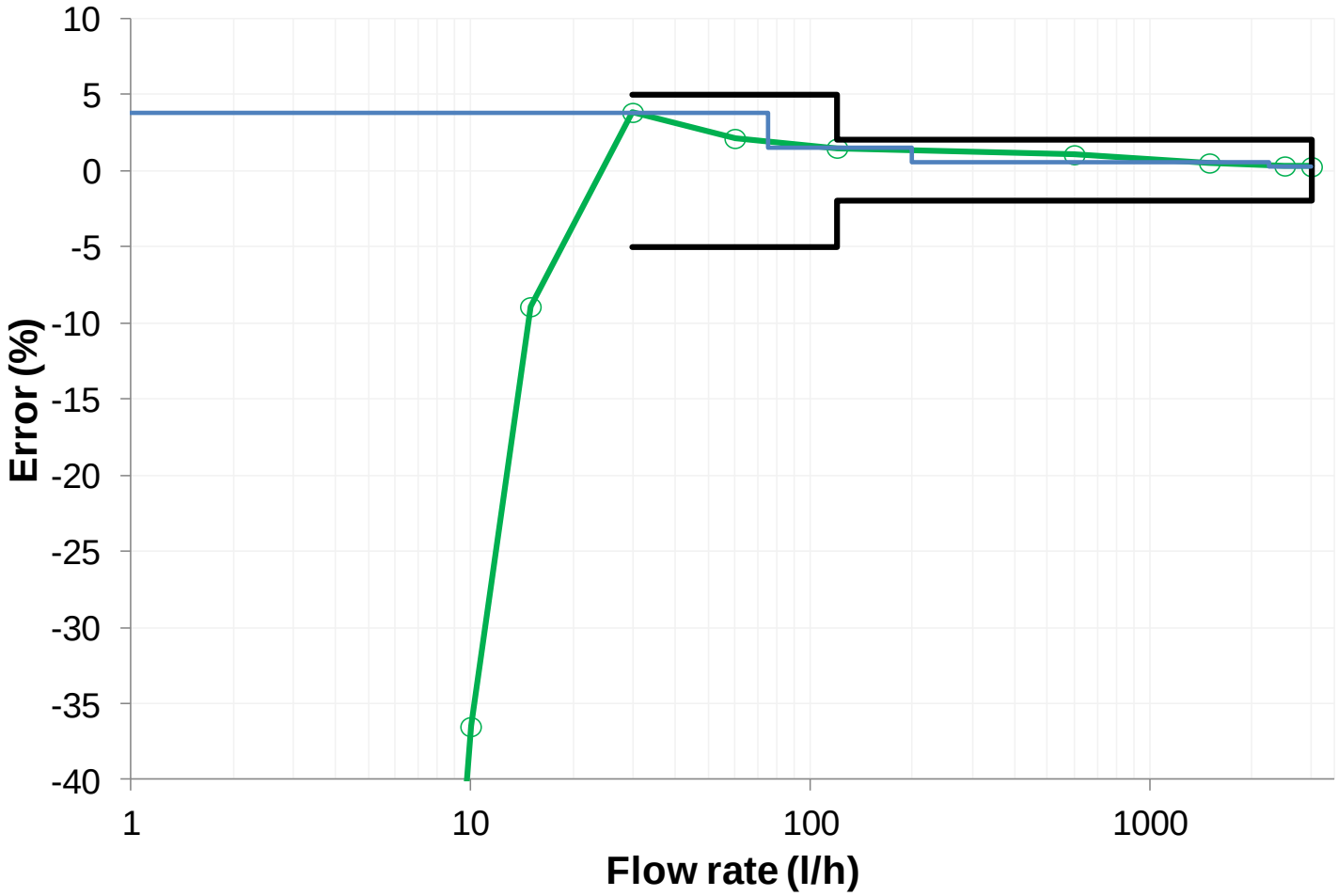
Re-constructing the error curve

Class B – Qn 1.5 m³/h



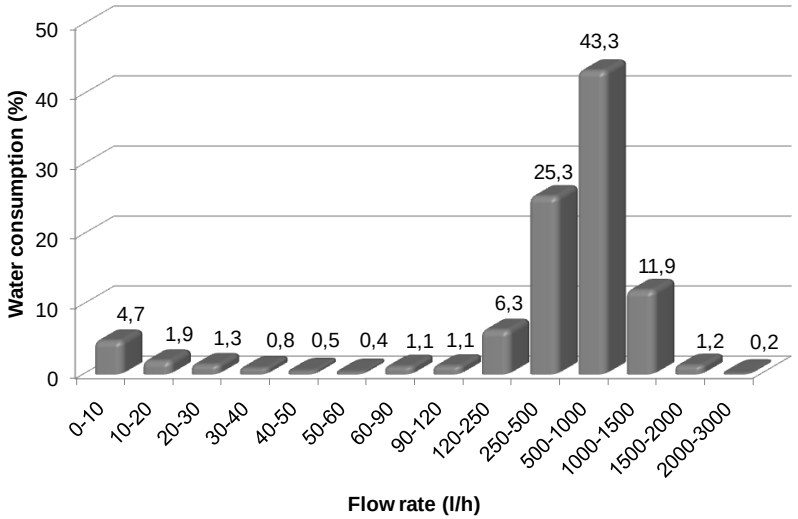
Do you think these curves are the same?

Class B – Qn 1.5 m³/h

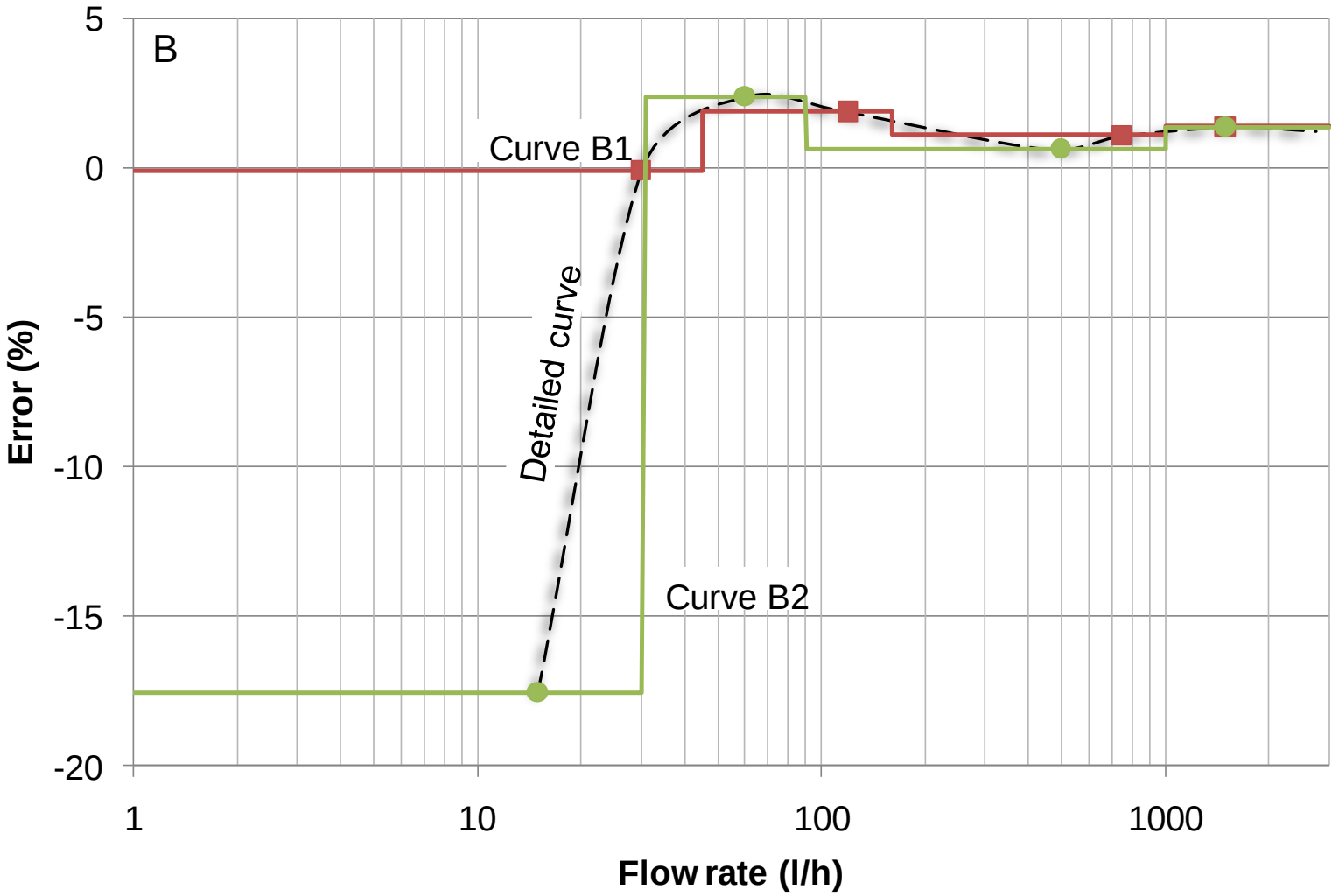


Example 1

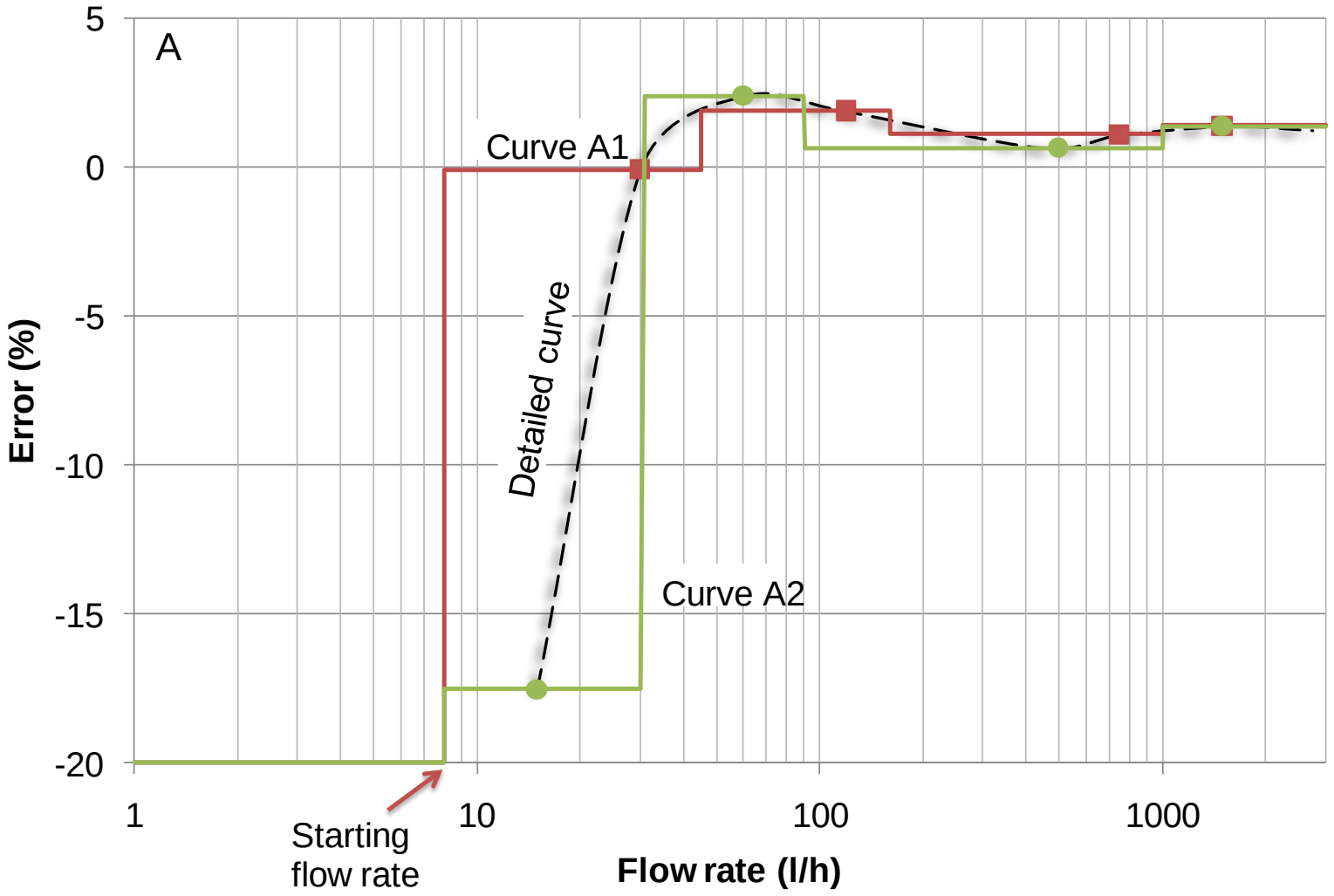
- One meter was tested at two set of flow rates:
  - **30 l/h, 120 l/h, 750 l/h and 1500 l/h**
  - **15 l/h, 60 l/h, 500 l/h and 1500 l/h**
- The error curve was reconstructed from the information of the tests using two different methods
- The weighted error was calculated using the same consumption pattern



1st reconstruction method



2nd reconstruction method



Calculating the weighted error

- From the same error curve and the same consumption pattern very different results are obtained!!

	Curve	Weighted Error
	Detailed curve	-4.33%
30 l/h, 120 l/h, 750 l/h, 1500 l/h	1st reconstruction	-2.72%
	2nd reconstruction	0.80%
15 l/h, 60 l/h, 500 l/h, 1500 l/h	1st reconstruction	-3.75%
	2nd reconstruction	-0.66%

>5% difference

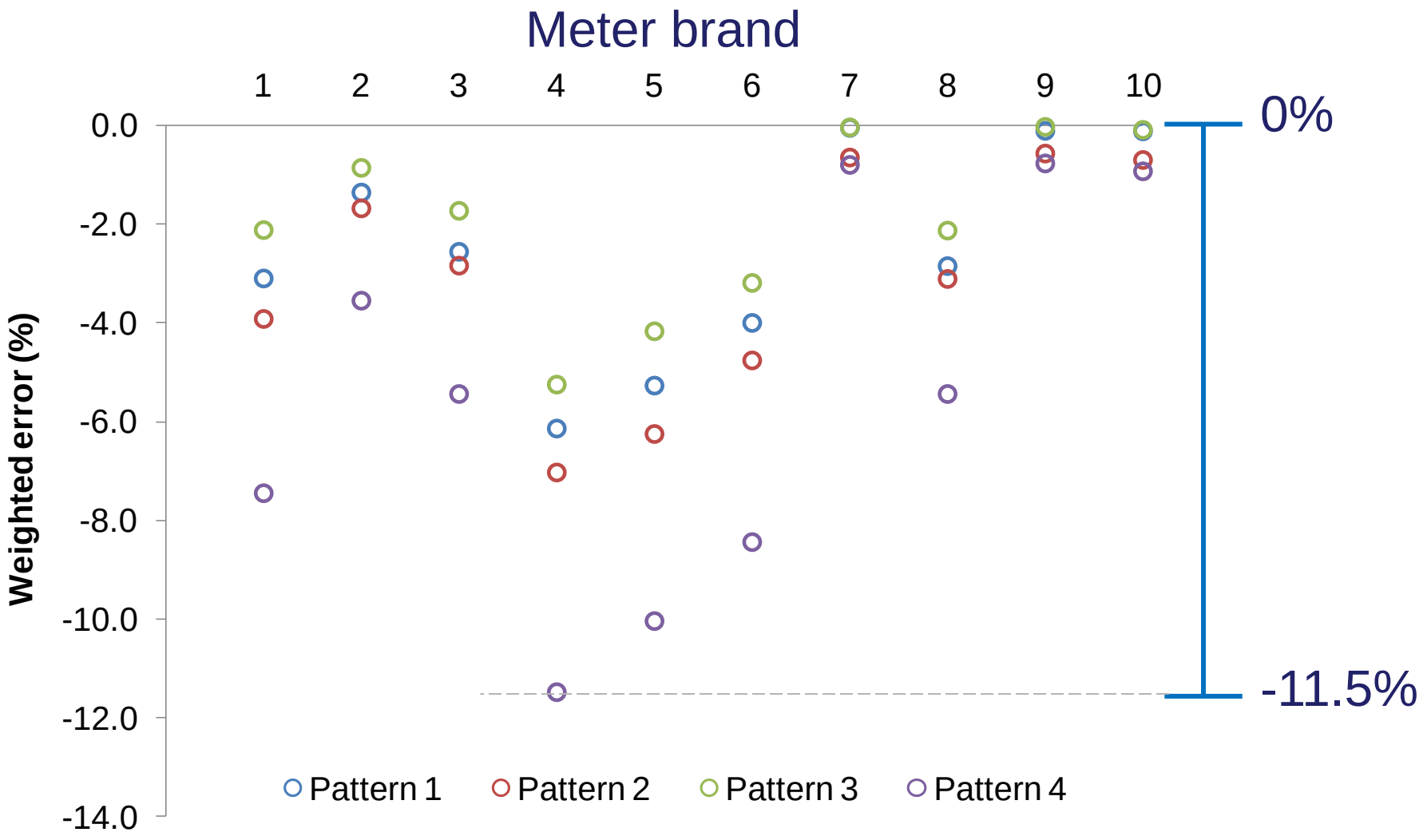
Such differences are not acceptable!

Example 2
Weighted errors of new domestic meters

- Results for 10 different brands of domestic meters
  (meters were tested at 10 flow rates)

	Consumption pattern			
Brand	**Pattern 1**	**Pattern 2**	**Pattern 3**	**Pattern 4**
1	-3.09	-3.91	-2.11	-7.44
2	-1.35	-1.67	-0.85	-3.54
3	-2.55	-2.83	-1.72	-5.43
4	-6.13	-7.02	-5.24	-11.47
5	-5.26	-6.24	-4.16	-10.03
6	-3.99	-4.75	-3.18	-8.43
7	-0.04	-0.64	-0.03	-0.79
8	-2.84	-3.1	-2.12	-5.43
9	-0.1	-0.56	-0.02	-0.76
10	-0.11	-0.69	-0.08	-0.92

Weighted errors of new domestic meters



How accurate is a brand new domestic meter?

Maybe now you do not give an answer so easily

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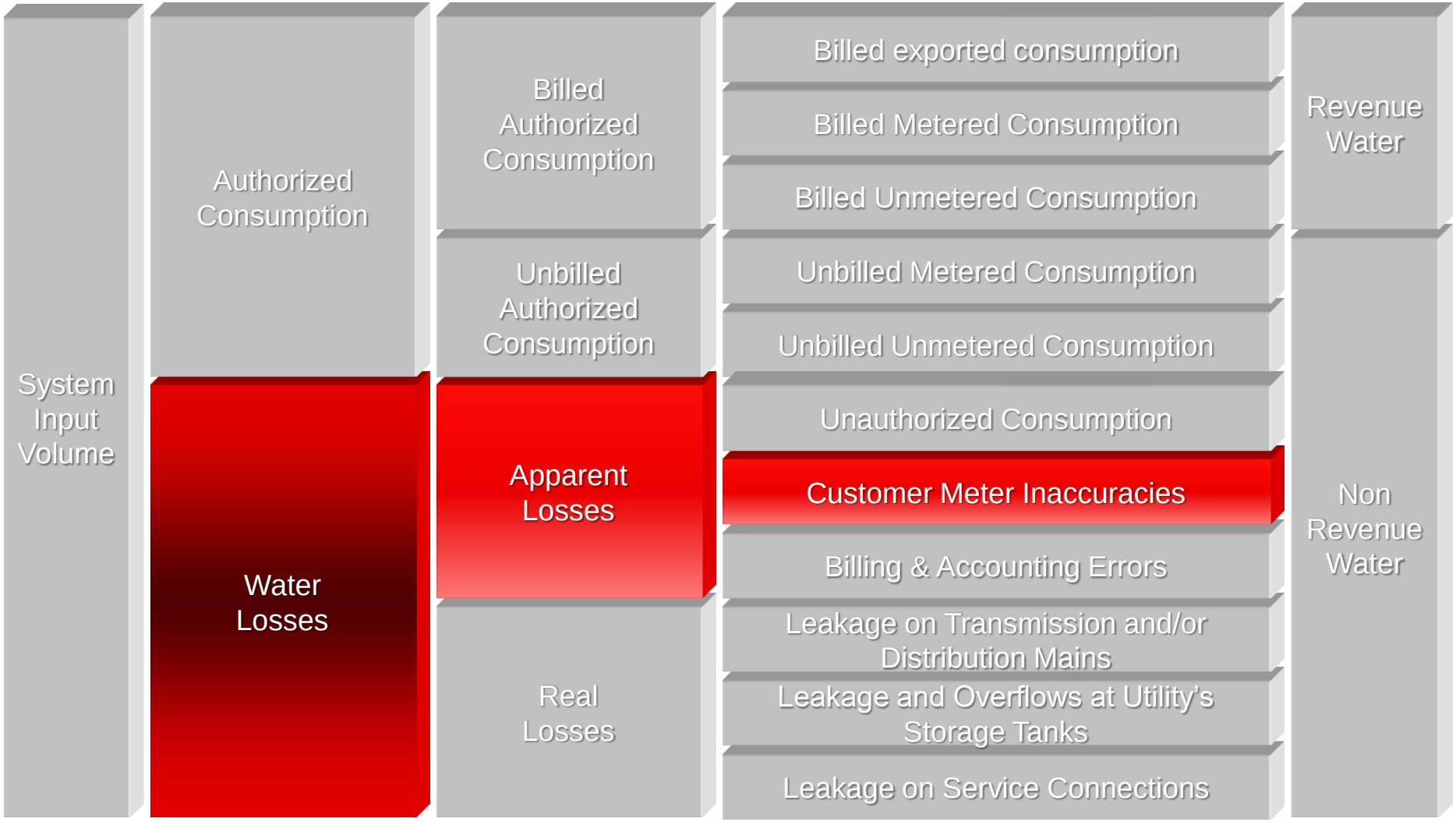

Conclusions

- Calculated meter performance can dramatically change depending on the methodology used for the calculation
- A standard methodology for calculating meters inaccuracies is needed. This include:
  - **Selection of testing flow rates**
  - **Consumption patterns to be used**
  - **How errors should be weighted with consumption patterns**
- Maybe standardization will not produce the most accurate results but figures will be comparable

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