

How meter accuracy impacts revenue

Explaining the benefits of sustained meter accuracy and the effects of warranty terms on revenue



NECO

Smart Solutions, Water Powered

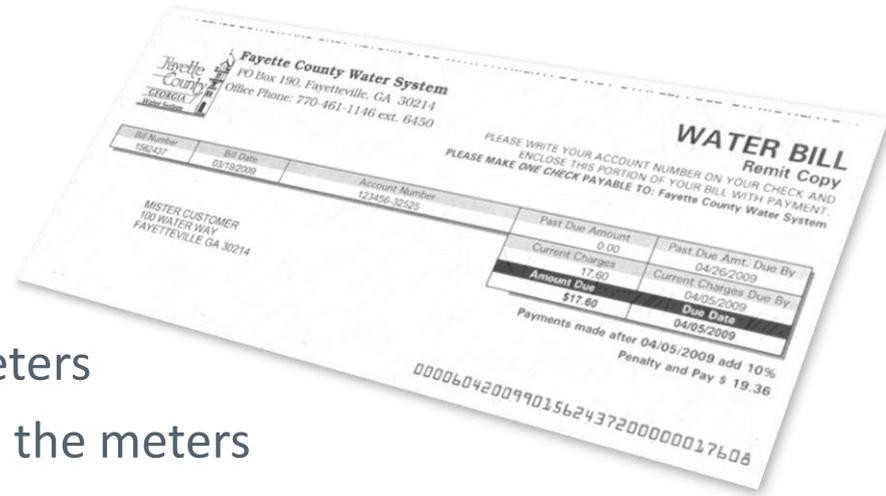
Ray Schwarz
Sales Manager
NECO

Agenda

- Introduction
- How to test a meter
- AWWA accuracy standards
 - Mechanical vs Static
- Accuracy degradation
- Meter warranties
 - How do various warranties stack up?
- Impact of accuracy on revenue

Accuracy = Revenue

- Improved meter accuracy means
 - More water measured through meters
 - Increased billing on water through the meters
 - **Reduced Non-Revenue Water (NRW)**



*You want your meters to be as accurate as possible
for as long as possible.*

Residential Meters

- Types of Residential Meter
 - Positive Displacement
 - Nutating Disc
 - Osculating Piston
 - Velocity Meters
 - Single Jet, Multi Jet
 - Magnetic, Ultrasonic,

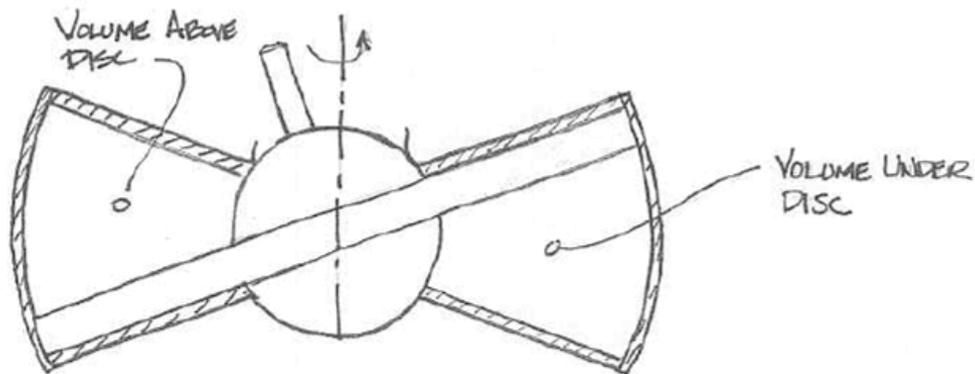
Positive Displacement – Disc or Piston Meter

Advantages

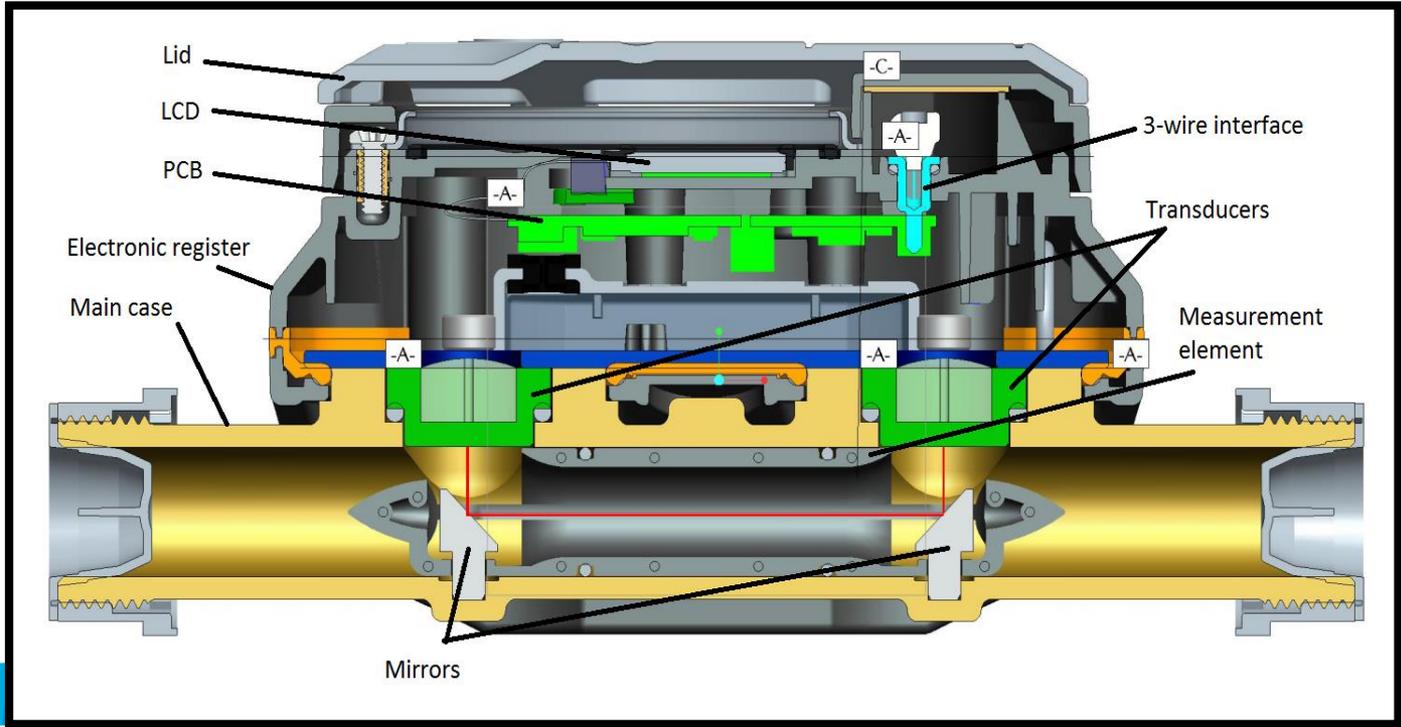
- Excellent low flow accuracy
- Not affected by upstream flow disturbances
- Not affected by piping variations

Disadvantages

- Limited in high flow rates by pressure losses
- Limited in size by forces

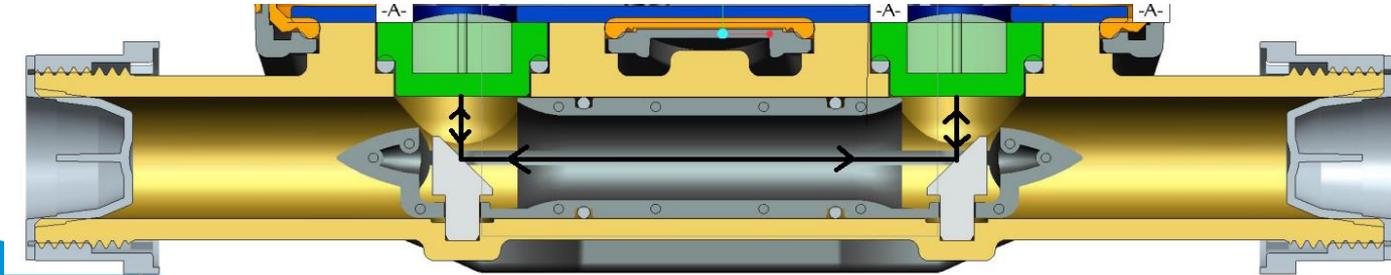


MACH 10™ Ultrasonic Meter

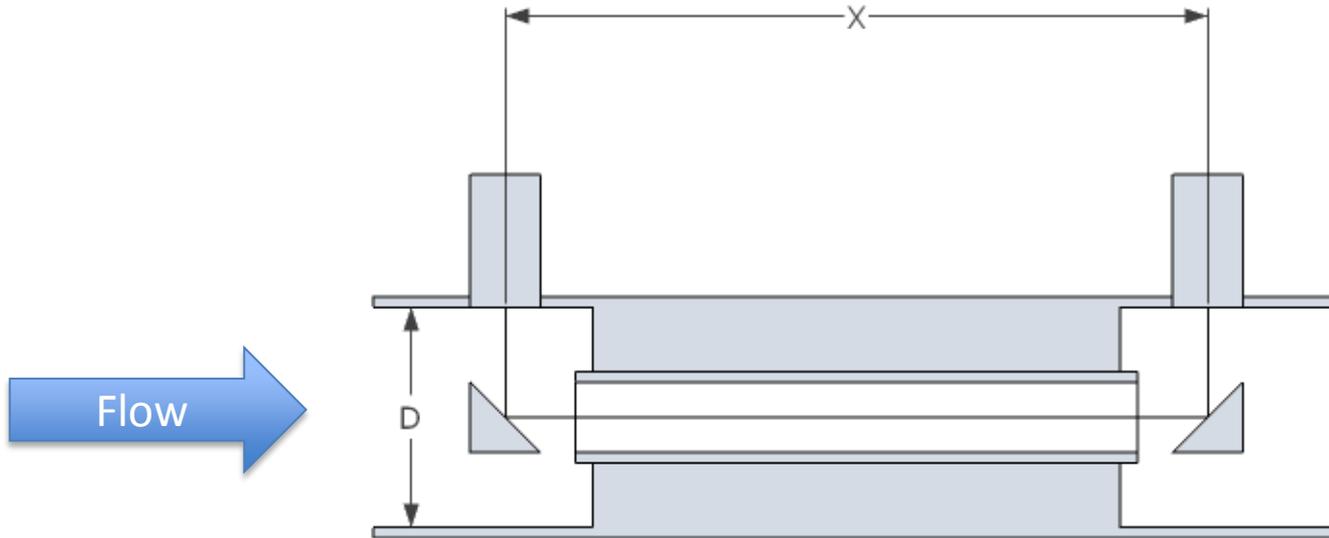


MACH 10 Ultrasonic Meter

- No moving parts
 - No wear, no maintenance, no accuracy loss
- No temperature probe required
 - Elimination of a potential failure point in the meter.
- Lead free bronze maincase NSF 61
 - Regulatory compliance
 - No stranded assets due to stripped threads or broken spuds
 - Bronze scrap value at end of life (~\$4.00)
- No ground straps required (~\$8.00 savings per meter installation)



Ultrasonic Signal With Flow



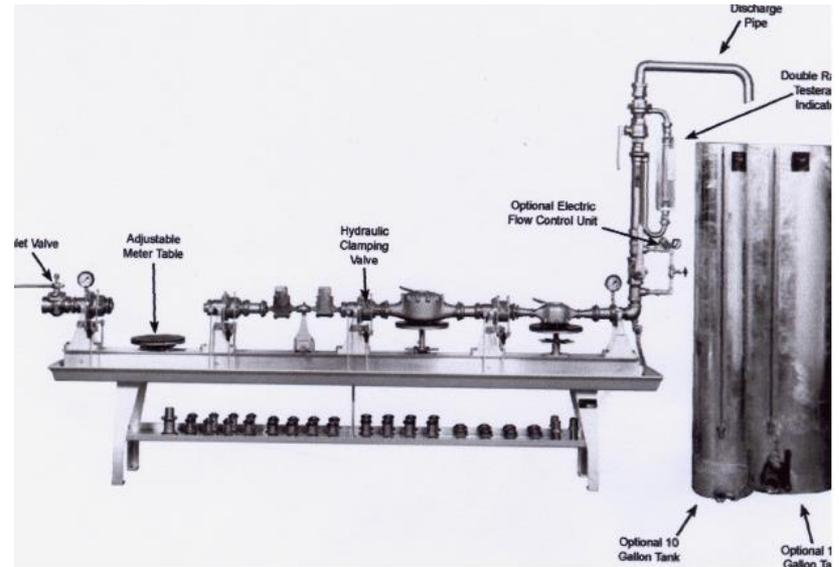
How accurate are your meters?

- How to test meters
 - Volumetric vs gravimetric testing
 - Importance of purge
 - Importance of volume vs uncertainty



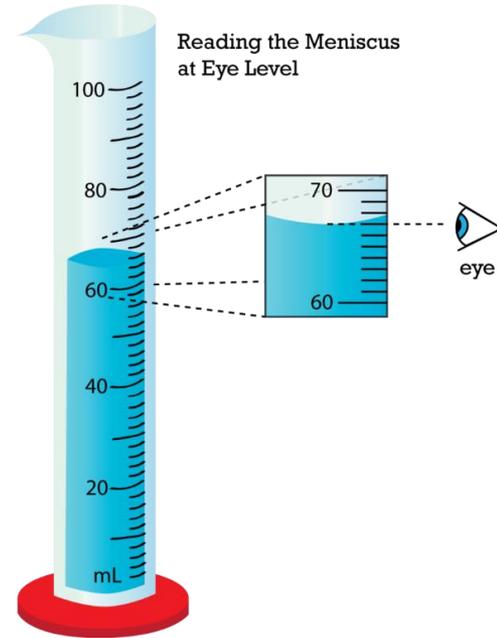
Meter Test Bench

- Volumetric testing device
- Actual volume of water measured through the meter
- Testing based on actual volume rather than another meter.



Volumetric Reference

- $Accuracy = \frac{Volume_{meter}}{Volume_{reference}} \times 100$
- Uses a calibrated tank for the reference volume
- The tank MUST be “wetted” (filled then emptied) prior to start of test
- Readings MUST be taken at the bottom of the meniscus



Gravimetric Reference

- Uses a tank that is set on a calibrated scale
 - Tank does not have to be “wetted” before testing

- *Volume_{reference} is determined by:*

- $Volume_{reference} = \frac{Weight_{tank}}{Density_{water}}$

- $Density_{water} = 62.2975 \frac{lb_f}{ft^3} \sim 8.328 \frac{lb_f}{gal}$ at 70°F per NIST

Reading Error and Uncertainty

- As the volume of the test increases, the total test uncertainty decreases



AWWA Accuracy Standards

- From AWWA M6

Table 5-3 Test requirements for new, rebuilt, and repaired cold-water meters*

| Displacement Meters (AWWA C700 and C710) | | | | | | | | | | | | | |
|--|------------------------------|--------------------------------|-----------------------|----------------------------|-----------------------------------|--------------------|-----------------------|--------------------------------|-----------------------------------|--------------|--------------------------------|--------------------|--------------------------|
| Size | Maximum Rate (All Meters) | | | | Intermediate Rate (All Meters) | | | | Minimum Rate (New and Rebuilt) | | | | Minimum (Repaired) |
| | Flow Rate [†] | Test Quantity ^{††} | Accuracy Limits | Flow Rate ^{**} | Test Quantity ^{††} | Accuracy Limits | Flow Rate | Test Quantity ^{††} | Accuracy Limits | Flow Rate | Test Quantity ^{††} | Accuracy Limits | Accuracy Limits |
| <i>in.</i> | <i>gpm</i> | <i>gal</i> | <i>ft³</i> | <i>percent</i> | <i>gpm</i> | <i>gal</i> | <i>ft³</i> | <i>percent</i> | <i>gpm</i> | <i>gal</i> | <i>ft³</i> | <i>percent</i> | <i>percent (min)</i> |
| ½ | 8 | 100 | 10 | 98.5–101.5 | 2 | 10 | 1 | 98.5–101.5 | ¼ | 10 | 1 | 95–101 | 90 |
| ½ × ¾ | 8 | 100 | 10 | 98.5–101.5 | 2 | 10 | 1 | 98.5–101.5 | ¼ | 10 | 1 | 95–101 | 90 |
| ⅝ | 15 | 100 | 10 | 98.5–101.5 | 2 | 10 | 1 | 98.5–101.5 | ¼ | 10 | 1 | 95–101 | 90 |
| ⅝ × ¾ | 15 | 100 | 10 | 98.5–101.5 | 2 | 10 | 1 | 98.5–101.5 | ¼ | 10 | 1 | 95–101 | 90 |
| ¾ | 25 | 100 | 10 | 98.5–101.5 | 3 | 10 | 1 | 98.5–101.5 | ½ | 10 | 1 | 95–101 | 90 |
| 1 | 40 | 100 | 10 | 98.5–101.5 | 4 | 10 | 1 | 98.5–101.5 | ¾ | 10 | 1 | 95–101 | 90 |
| 1½ | 50 | 100 | 10 | 98.5–101.5 | 8 | 100 | 10 | 98.5–101.5 | 1½ | 100 | 10 | 95–101 | 90 |
| 2 | 100 | 100 | 10 | 98.5–101.5 | 15 | 100 | 10 | 98.5–101.5 | 2 | 100 | 10 | 95–101 | 90 |

What about static meters?

- AWWA Standard but meter requirements still vary with various meters
 - **AWWA C715 – Cold Water Meters – Electromagnetic and Ultrasonic Type for Revenue Applications**
 - Released 2019

What about testing static meters?

- **AWWA M6** will be releasing an addendum to cover the electromagnetic and ultrasonic meter testing

**2018 Addendum to
AWWA Manual M6, *Water Meters—Selection, Installation, Testing, and Maintenance*,
Fifth Edition (2012)**

Purpose of this Addendum

The purpose of this 2018 Addendum to AWWA Manual M6 on *Water Meters—Selection, Installation, Testing, and Maintenance*, fifth edition, is to provide guidance to users on testing procedures and related topics for meters conforming to ANSI/AWWA standard C715-18 on Cold Water Meters—Electromagnetic and Ultrasonic type, for Revenue Applications. This new standard was approved by the AWWA Standards Committee on Water Meters on February 19, 2018. It was approved by the AWWA Board of Directors on June 9, 2018, and made effective on November 1, 2018.

And static meter accuracies?

- AWWA M6 updated to Table 5-3

Electromagnetic and Ultrasonic Meters for Revenue Applications, Type I (AWWA C715)

| Size | Maximum Rate (All Meters) | | | | Intermediate Rate (All Meters) | | | | Minimum Rate (New and Rebuilt) | | | | Minimum (Repaired) |
|------------|------------------------------|--------------------|------------|--------------------|-----------------------------------|--------------------|------------|--------------------|-----------------------------------|--------------------|------------|------------------------|--------------------------|
| | Flow Rate† | Test Quantity†† | | Accuracy Limits | Flow Rate** | Test Quantity†† | | Accuracy Limits | Flow Rate§§ | Test Quantity†† | | Accuracy Limits§§ | Accuracy Limits |
| <i>in.</i> | <i>gpm</i> | <i>gal</i> | <i>ft³</i> | <i>percent</i> | <i>gpm</i> | <i>gal</i> | <i>ft³</i> | <i>percent</i> | <i>gpm</i> | <i>gal</i> | <i>ft³</i> | <i>percent</i> | <i>percent (min)</i> |
| 1/2 | 8 | 100 | 10 | 98.5–101.5 | 0.35 | 10 | 1 | 98.5–101.5 | 0.11 (0.18) | 10 | 1 | 95–105 (98.5–101.5) | — |
| 5/8 | 15 | 100 | 10 | 98.5–101.5 | 0.4 | 10 | 1 | 98.5–101.5 | 0.13 (0.20) | 10 | 1 | 95–105 (98.5–101.5) | — |
| 3/4 | 25 | 100 | 10 | 98.5–101.5 | 1 | 10 | 1 | 98.5–101.5 | 0.15 (0.5) | 10 | 1 | 95–105 (98.5–101.5) | — |
| 1 | 40 | 100 | 10 | 98.5–101.5 | 1.5 | 10 | 1 | 98.5–101.5 | 0.3 (0.75) | 10 | 1 | 95–105 (98.5–101.5) | — |
| 1½ | 60 | 100 | 10 | 98.5–101.5 | 4 | 100 | 10 | 98.5–101.5 | 0.6 (2) | 100 | 10 | 95–105 (98.5–101.5) | — |
| 2 | 100 | 100 | 10 | 98.5–101.5 | 5 | 100 | 10 | 98.5–101.5 | 1 (2.5) | 100 | 10 | 95–105 (98.5–101.5) | — |
| 3 | 200 | 500 | 50 | 98.5–101.5 | 15 | 100 | 10 | 98.5–101.5 | 2.5 (7.5) | 100 | 10 | 95–105 (98.5–101.5) | — |
| 4 | 400 | 1,000 | 100 | 98.5–101.5 | 20 | 500 | 50 | 98.5–101.5 | 3.5 (10) | 300 | 40 | 95–105 (98.5–101.5) | — |
| 6 | 800 | 2,000 | 200 | 98.5–101.5 | 40 | 1,000 | 100 | 98.5–101.5 | 9 (20) | 300 | 40 | 95–105 (98.5–101.5) | — |
| 8 | 1,000 | 5,000 | 500 | 98.5–101.5 | 80 | 3,000 | 400 | 98.5–101.5 | 18 (40) | 2,000 | 300 | 95–105 (98.5–101.5) | — |

Positive Displacement vs Static AWWA Testing Comparison

Residential Meter Size – AWWA Testing Recommendation

PD

| High | Medium | Low |
|--------|--------|---------|
| 15 gpm | 2 gpm | .25 gpm |

Static Meter

| High | Medium | Low |
|--------|--------|---------|
| 15 gpm | .4 gpm | .25 gpm |

Neptune MACH 10

- Neptune developed transit-time ultrasonic meter
- NSF/ANSI Standard 61-G Certified
 - Lead free bronze maincase
- Sustained meter accuracy with extended flow ranges

| Meter Size | Normal Operating (±1.5%) | Extended Low Flow (±3%) |
|------------|-----------------------------|----------------------------|
| 5/8" | 0.10 to 25 gpm | 0.05 gpm |
| 3/4" | 0.10 to 35 gpm | 0.05 gpm |
| 1" | 0.40 to 55 gpm | 0.25 gpm |
| 1-1/2" | 0.80 to 125 gpm | 0.30 gpm |
| 2" | 1.50 to 160 gpm | 0.50 gpm |



Mechanical meter degradation

| 5/8" PD Meter Reading | High Flow Accuracy (%) | Int Flow Accuracy (%) | Low Flow Accuracy (%) | Weighted Accuracy (%) | Install/Mfg Date |
|-----------------------|------------------------|-----------------------|-----------------------|-----------------------|------------------|
| 2,637,170 | 98% | 97% | 0% | 83% | 1971 |
| 2,253,330 | 98% | 99% | 48% | 91% | 1971 |
| 1,483,910 | 99% | 99% | 94% | 98% | 1996 |
| 1,354,150 | 99% | 100% | 92% | 99% | 1996 |
| 536,620 | 100% | 99% | 92% | 98% | 2000 |
| 497,570 | 99% | 99% | 96% | 99% | 2000 |
| 139,550 | 98% | 99% | 96% | 98% | 2011 |
| 111,880 | 98% | 100% | 95% | 99% | 2010 |
| 950 | 98% | 99% | 96% | 98% | 2015 |

All these are 5/8" nutating disk meters.

Low flow accuracy drops first.

Mostly due to volume of water flow.

Also water quality.

Warranties are created equal

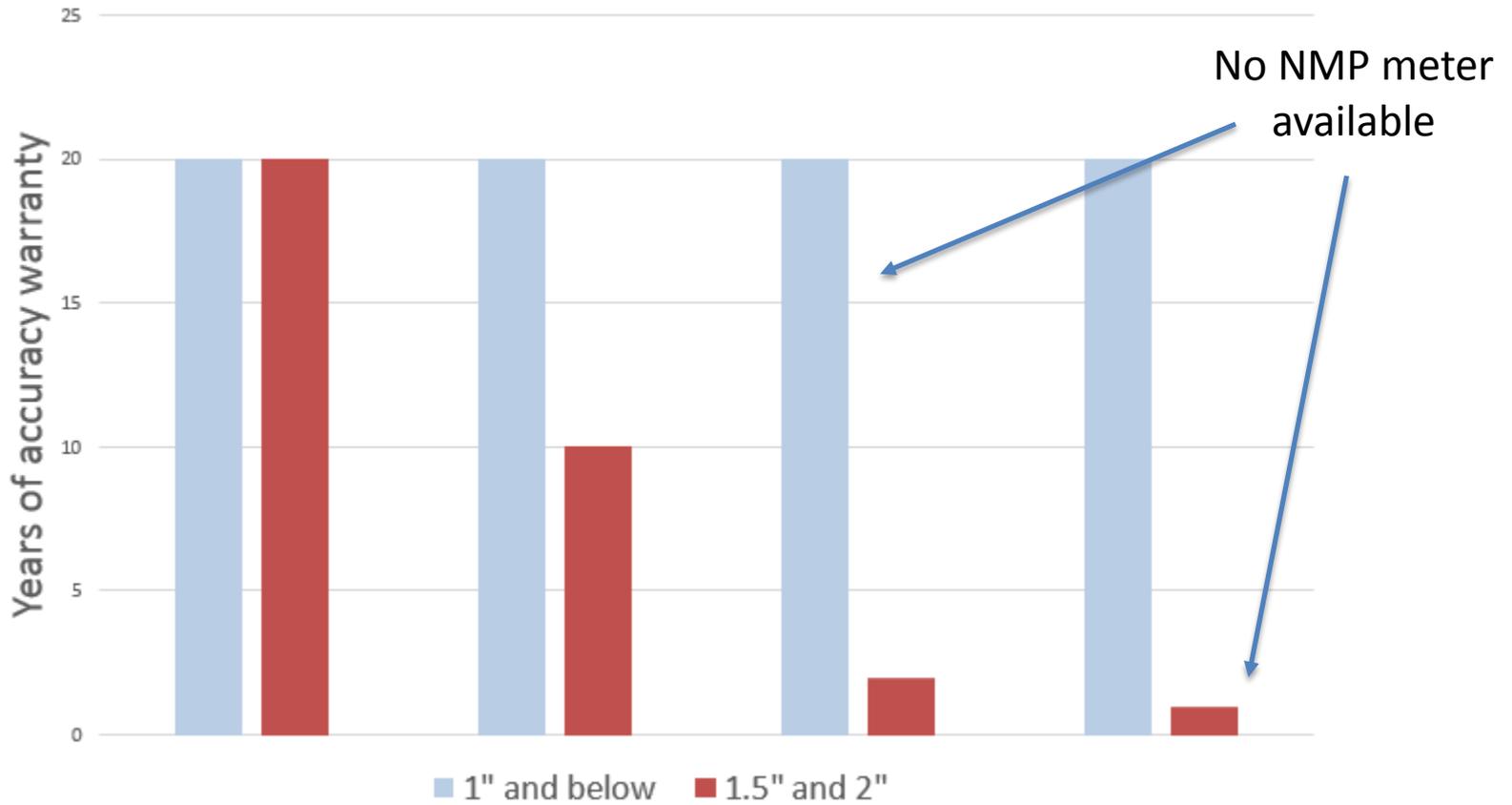
For Positive Displacement Meters...

- 5/8" to 2"
 - Long-term proven history on Positive Displacement Meters
 - Similar accuracy warranties across vendors
 - Most vendors offer nutating disc or piston meters in this size

Not all warranties are created equal

For static meters...

- 5/8" to 1"
 - Similar accuracy warranties across vendors
 - Not all major vendors offer static meters in this size
- 1.5" and 2"
 - Dramatic differences in product offering and warranty
 - Not all major vendors offer static meters in this size



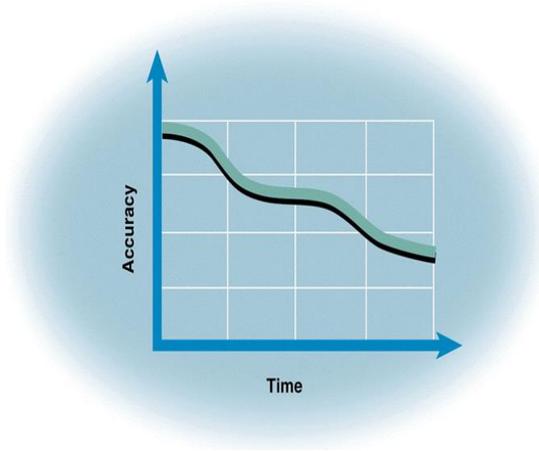
Take Aways

- Meter accuracy = revenue dollars
(in addition to reduced non-revenue water)
- Little water losses add up to big dollars over time
- All warranties are not the same
- Best long-term accuracy over the life of the meter PD vs. Static
static meters (98.5% vs. 97.975%)
- Be sure to compare the best warranty for all sizes

Large Meter Testing

On-site Testing Process

Water Meters Lose Accuracy Over Time



Results:

lost revenue for the utility

OR

higher rates to recover losses

But, which meters are losing money?

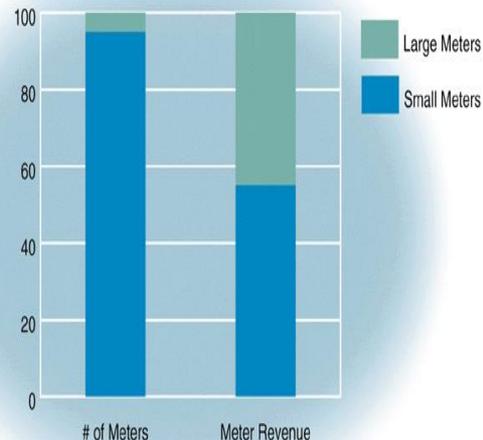




“Biggest Bang for the Buck”

Focus on the Commercial and Industrial Meters
Often, less than 5% of a utility's meters generate more than 40% of the revenue

| | C&I Accounts | C&I % Sales |
|-----------------|--------------|-------------|
| Hartford, CT | 6% | 54% |
| Springfield, MA | 8% | 57% |



Big Bang
for the
Buck

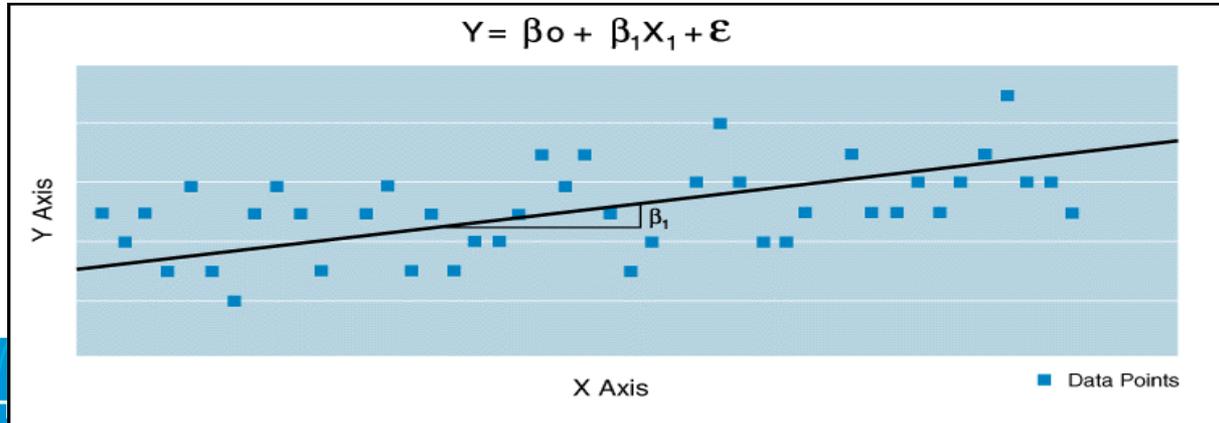
Or
Just the Big
Buck



Innovative Way to Maximize Cash-flow

SEER™ Software

- Based on over 10,000 large meter tests
- Multiple linear regression
- Developed and patented by Neptune



SEER™ Inputs

Data Entry - PATENT PENDING

Data Entry

Meter Data

Sample City: [Dropdown]
101 Atlantic Blvd.

ID Number: 82-8769900
Meter Serial No: 15980768

Meter Age: 25
Annual Meter Revenue: \$15,000.00
Meter Type: Compound
Meter Manufacturer: Hersey
Meter Size: 4"
Maintenance History: Average
Meter Volume Usage: Average

Replacement Costs

Replacement Cost

| | |
|--------------------|-------------------|
| Meter Cost: | \$2,100.00 |
| Strainer Cost: | \$435.00 |
| Installation Cost: | \$900.00 |
| Test/Repair Cost: | \$0.00 |
| Total Cost: | \$3,435.00 |

Results

Predicted Accuracy: 76.56
Annual Potential Gain: \$4,592.48
Pay Back In Years: 0.75

Calculate

SEER™ Logic

Inputs

Age
Size
Type
Manufacturer
Usage Volume
Maintenance History

Regression
Model

Outputs

Meter Accuracy

Revenue Gain

Payback

Annual Revenue

Replacement Cost

SEER™ Logic

Inputs

25 yrs

4"

Compound

Hersey

Average

Average

\$15,000.00 / yr

\$3,435.00



Outputs

76.56%

\$4,592.48

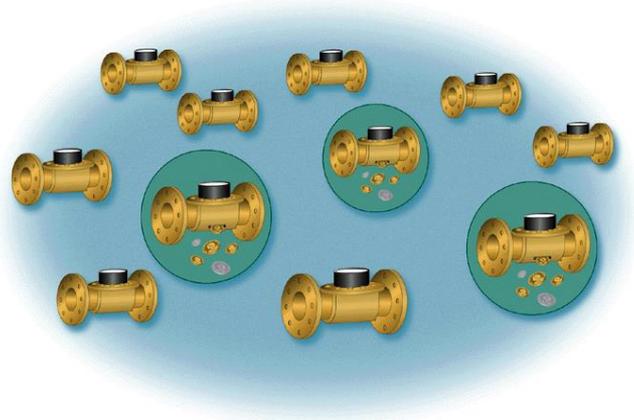
0.75 yrs

SEER™ Pinpoints Revenue Loss

SEER™ Software
Identifies which
meters need attention

Establishes priorities
based on revenue gain
and payback

Allows utilities to
implement targeted
revenue enhancement
programs



Testing Methods

- **Meter Testers**
 - Master Meter (volume to volume)
 - Typical meter tester sizes 3” and 4”
- **Things to Remember**
 - Meter testers cannot test the full range of a meter
 - Provides a snap shot only
 - Start at low flows, then medium, and high flow rates
 - If a test fails, repeat it to verify result.
 - Ensure and verify meter can be isolated
 - Cavitation (maintain 20-30 psi at tester)
 - Meter Tester is not 100% accurate at all flow rates.
 - Calibration certificate

Portable Field Testing Equipment

- Conduct Field testing with Test meter in location where it is being used
- Accuracy Testing - Site meter with a known test meter
- Water runs through the site meter and then through the test meter



Questions

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Thank you

#winyourday