How meter accuracy impacts revenue

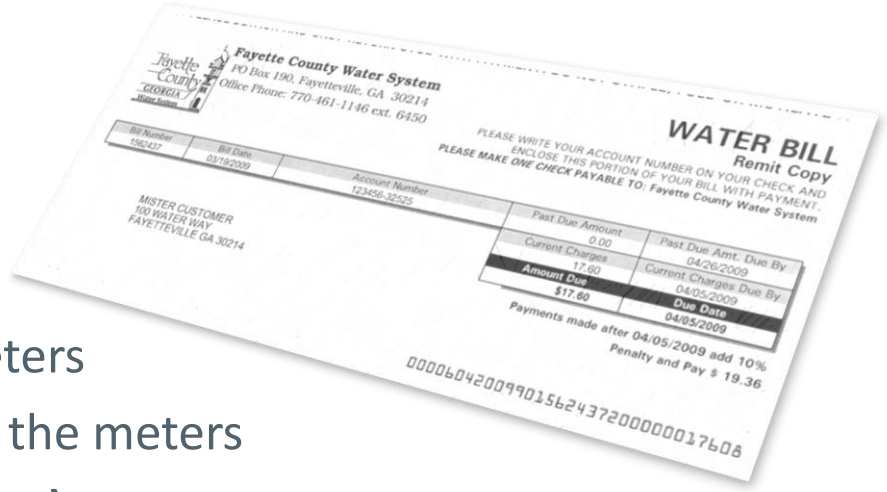
Explaining the benefits of sustained meter accuracy and the effects of warranty terms on revenue

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


Fayette County Water System
PO Box 190, Fayetteville, GA 30214
Office Phone: 770-461-1146 ext. 6450

WATER BILL
Remit Copy

PLEASE WRITE YOUR ACCOUNT NUMBER ON YOUR CHECK AND ENCLOSE THIS PORTION OF YOUR BILL WITH PAYMENT.
PLEASE MAKE ONE CHECK PAYABLE TO: Fayette County Water System

Bill Number	Bill Date	Account Number
156417	03/19/2009	123456-32525

MISTER CUSTOMER
100 WATER WAY
FAYETTEVILLE GA 30214

Past Due Amount	Past Due Amt. Due By
0.00	04/26/2009
Current Charges	Current Charges Due By
17.60	04/05/2009
Amount Due	Due Date
$17.60	04/05/2009

Payments made after 04/05/2009 add 10% Penalty and Pay $ 19.36

00006042009901562437200000017608

- 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

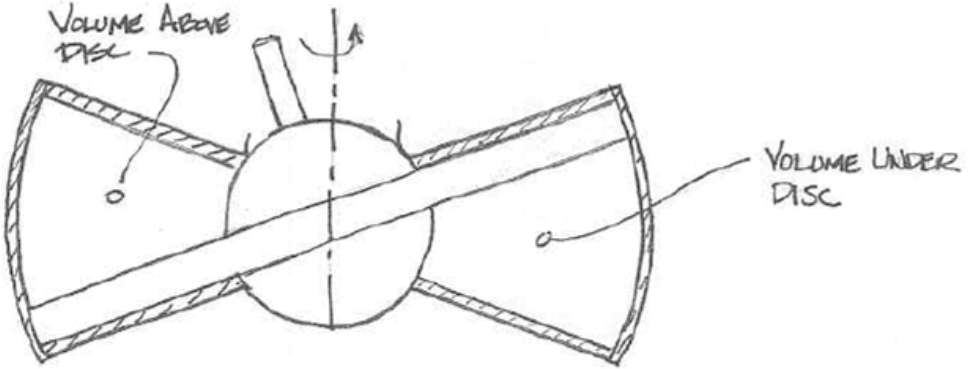
Advantages

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

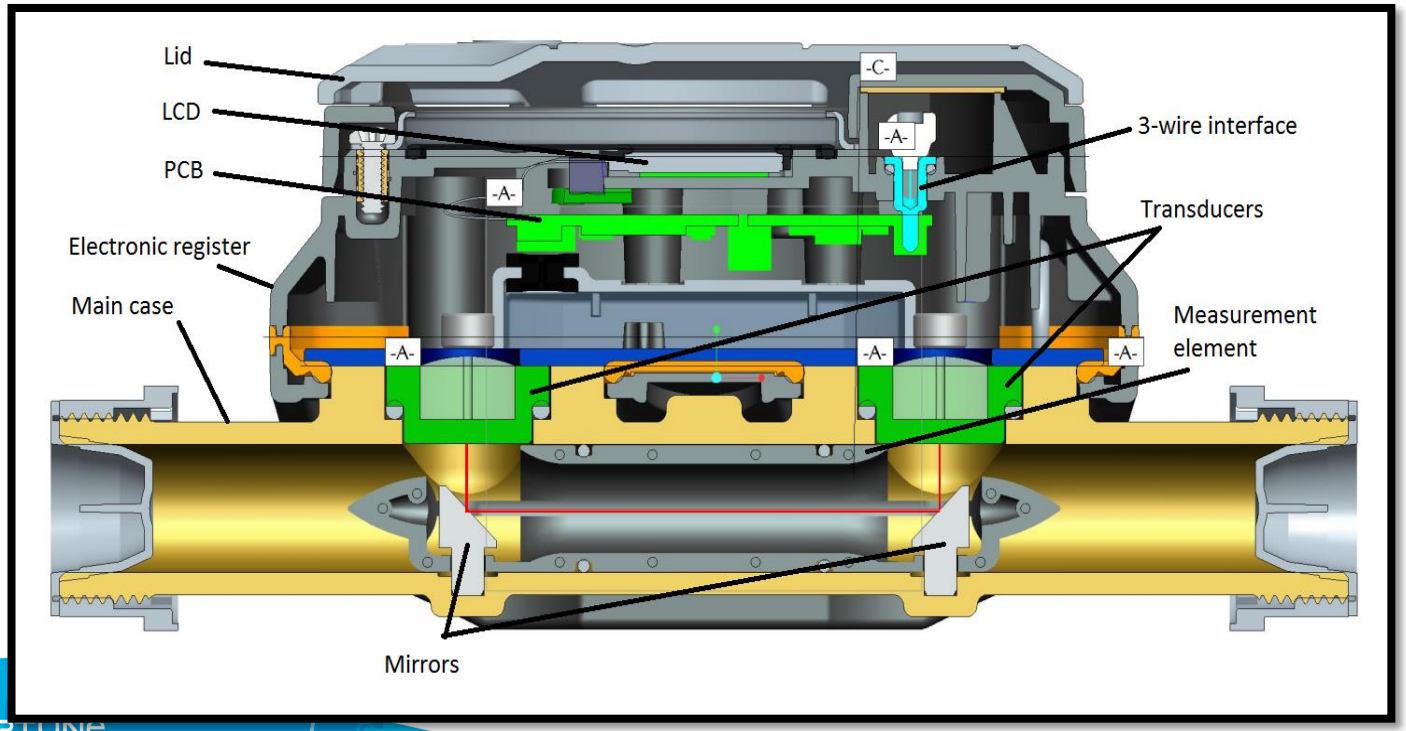
Disadvantages

Limited in high flow rates by pressure losses

Limited in size by forces

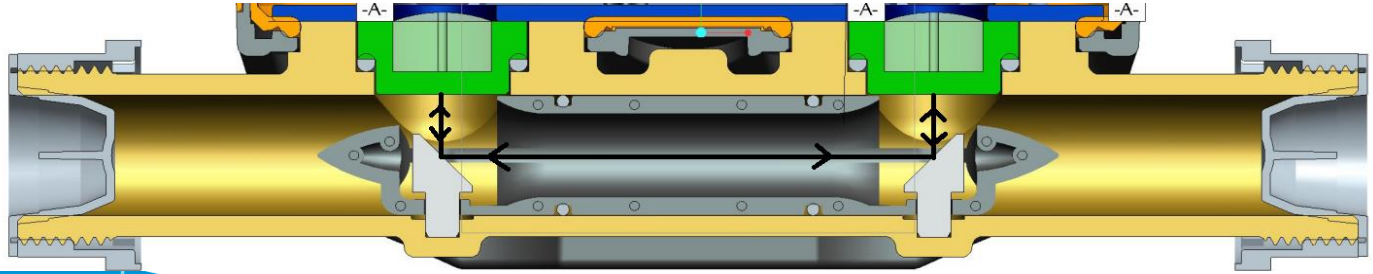


MACH 10™ Ultrasonic Meter

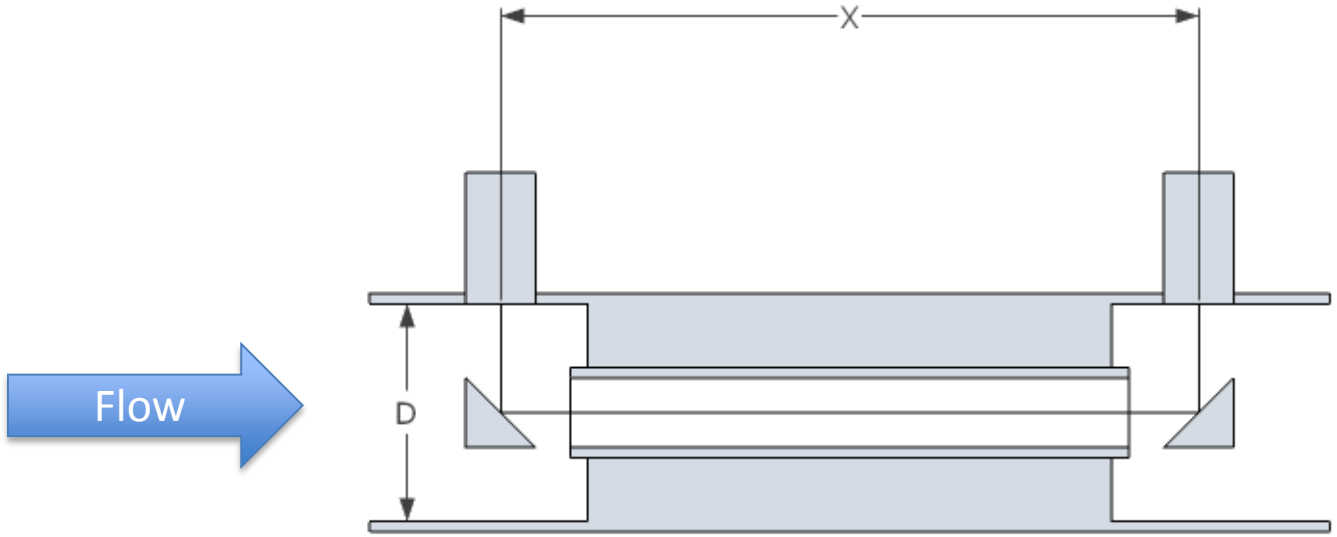


MACH 10 Ultrasonic Meter

- 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

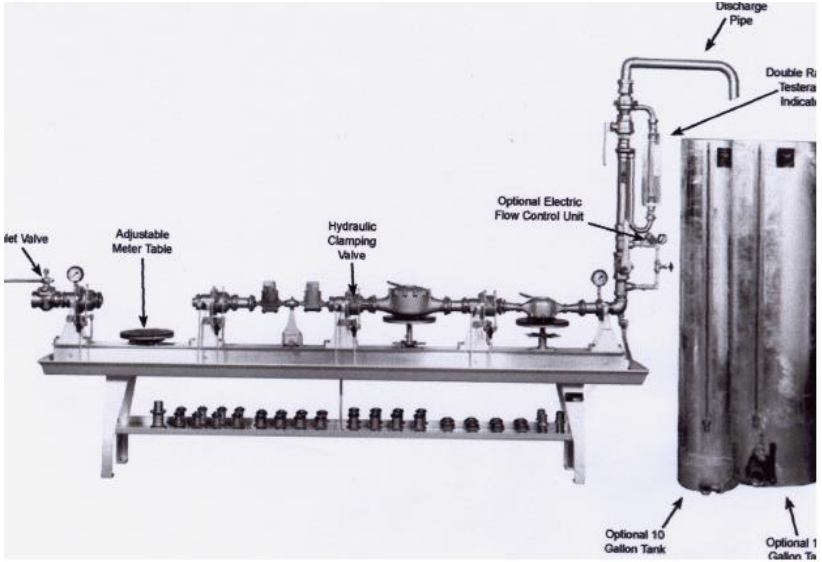


How accurate are your meters?

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

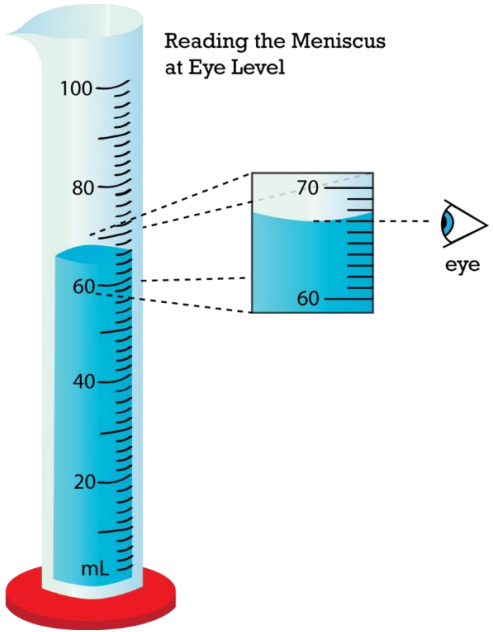
Meter Test Bench

- 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)													
	Maximum Rate (All Meters)				Intermediate Rate (All Meters)				Minimum Rate (New and Rebuilt)				Minimum (Repaired)
Size	Flow Rate†	Test Quantity††		Accuracy Limits	Flow Rate**	Test Quantity††		Accuracy Limits	Flow Rate	Test Quantity††		Accuracy Limits	Accuracy Limits
in.	*gpm*	*gal*	*ft³*	*percent*	*gpm*	*gal*	*ft³*	*percent*	*gpm*	*gal*	*ft³*	*percent*	*percent (min)*
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?

- Currently no AWWA Standard but meter requirements will be released…
  - **AWWA C715 – Cold Water Meters – Electromagnetic and Ultrasonic Type for Revenue Applications**
    - To be released by Q4 2018

What about testing static meters?

- Currently, not addressed by AWWA but…
- **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
in.	*gpm*	*gal*	*ft³*	*percent*	*gpm*	*gal*	*ft³*	*percent*	*gpm*	*gal*	*ft³*	*percent*	*percent (min)*
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

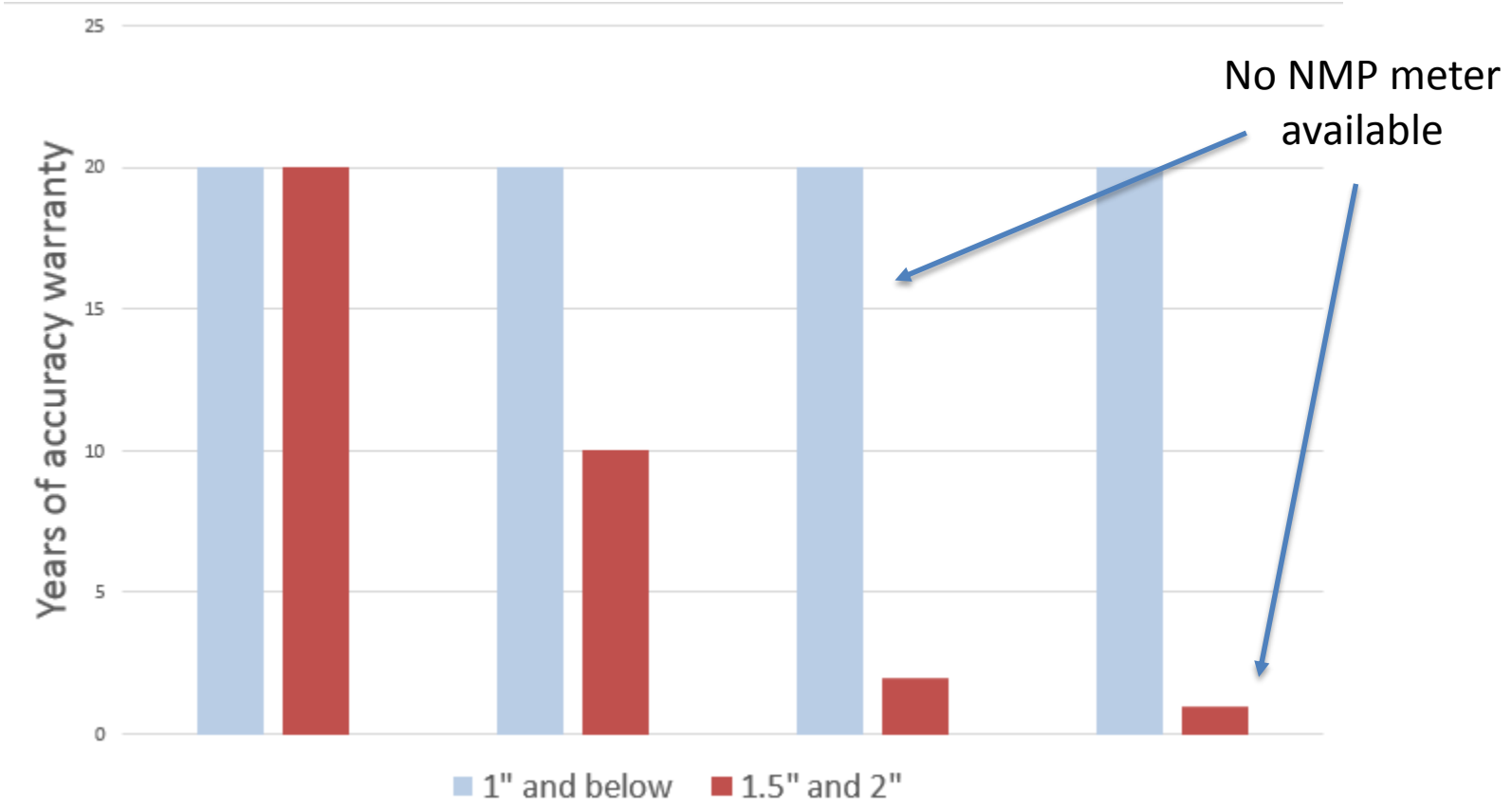
For Positive Displacement Meters…

- 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


25
20
15
10
5
0
Years of accuracy warranty
No NMP meter available
1" and below
1.5" and 2"

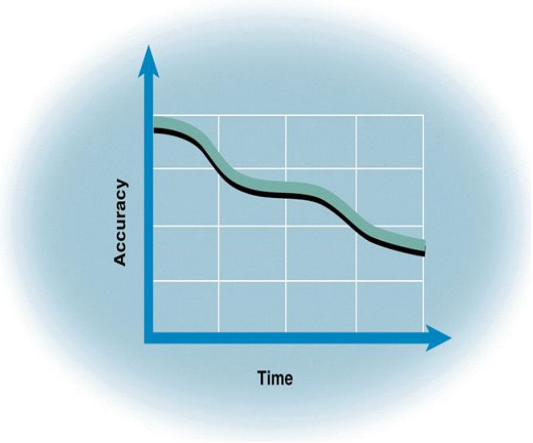
Take Aways

- 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 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

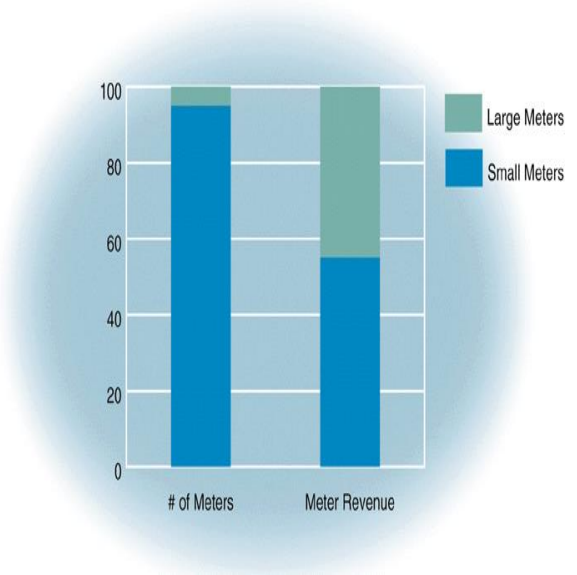
higher rates to recover losses

But, which meters are losing money?

“Biggest Bang for the Buck”

Focus on the Commercial and Industrial Meters
Often, <u>less than 5%</u> of a utility’s meters <u>generate more than 40% of the revenue</u>

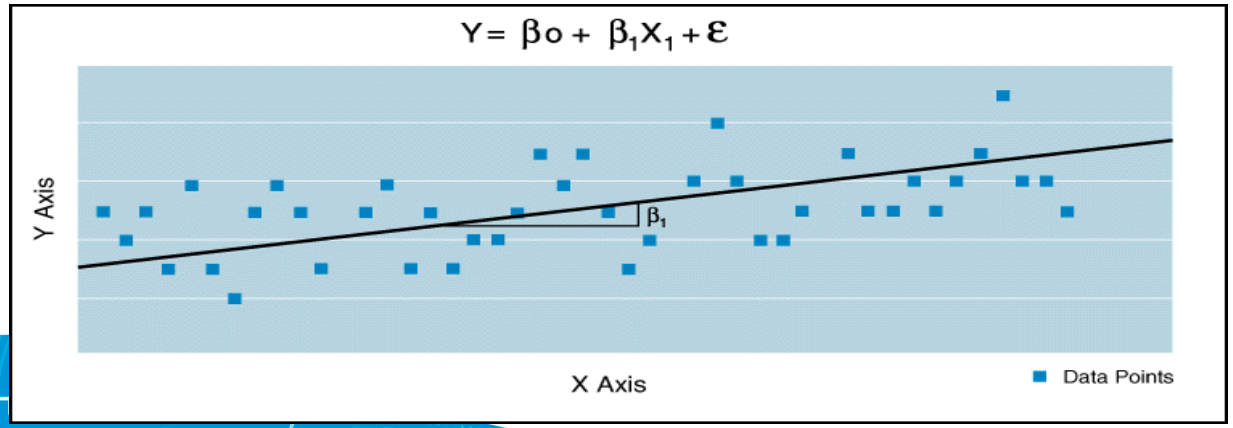
	C&I Accounts	C&I % Sales
Hartford, CT	6%	54%
Springfield, MA	8%	57%



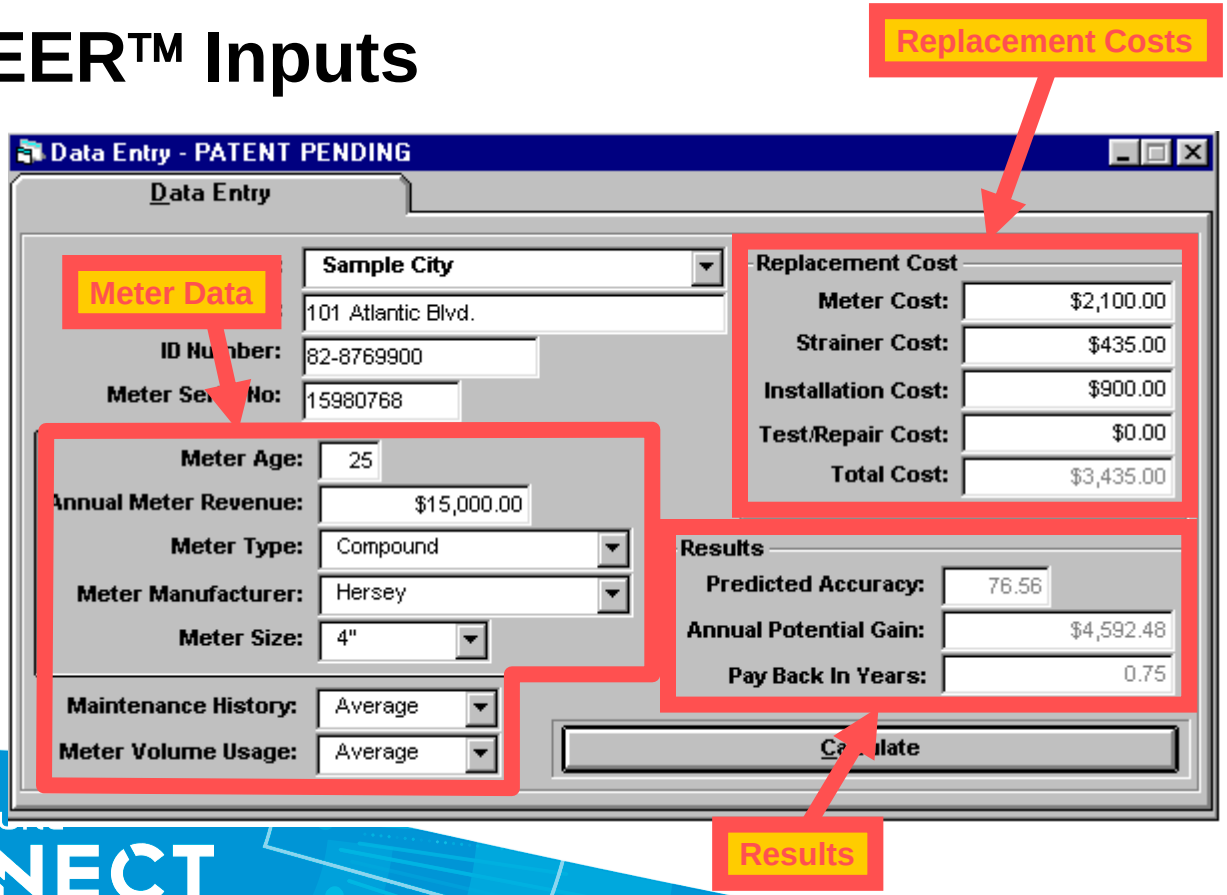
Innovative Way to Maximize Cash-flow

SEER™ Software

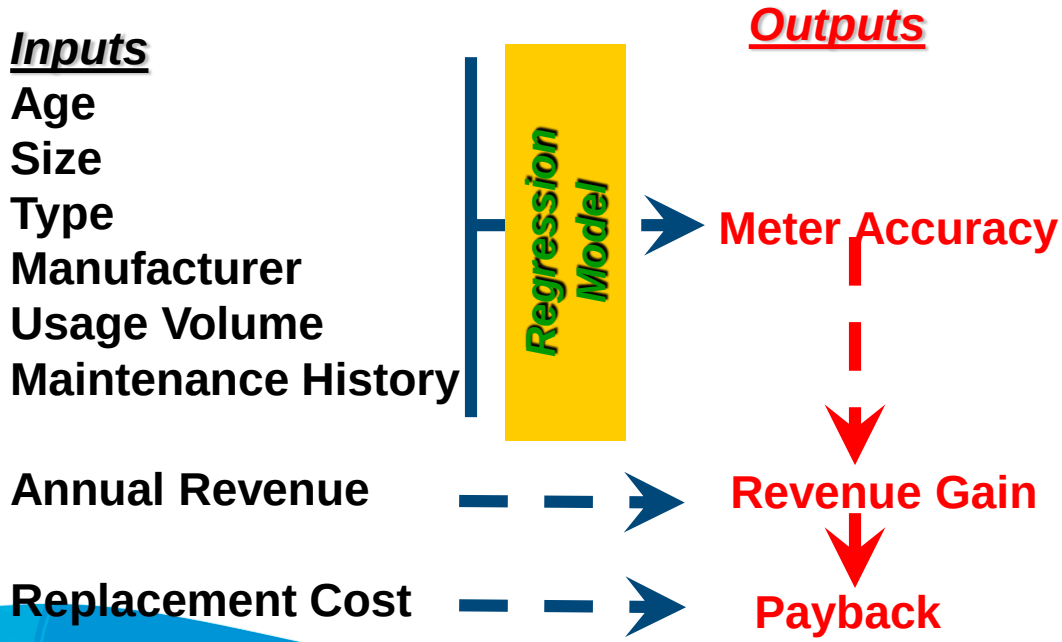
- **Based on over 10,000 large meter tests**
- **Multiple linear regression**
- **Developed and patented by Neptune**



SEER™ Inputs


Replacement Costs
Data Entry - PATENT PENDING
Data Entry
Meter Data
Sample City
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 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
Results

SEER™ Logic


Inputs
Age
Size
Type
Manufacturer
Usage Volume
Maintenance History
Annual Revenue
Replacement Cost
Regression Model
Outputs
Meter Accuracy
Revenue Gain
Payback

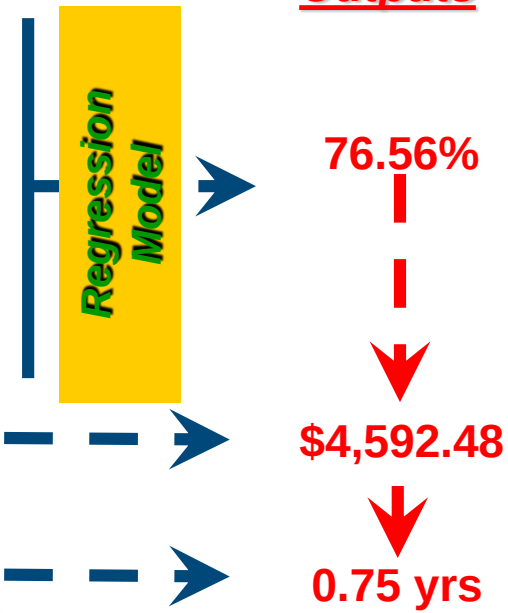
SEER™ Logic

Inputs

25 yrs
4”
Compound
Hersey
Average
Average

$15,000.00 / yr

$3,435.00



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

Ray Schwarz – Sales Manager

NECO

330 283-3828

rschwarz@necowater.com


Thank you
#winyourday