This presentation premiered at WaterSmart Innovations

watersmartinnovations.com

watersmart
INNOVATIONS

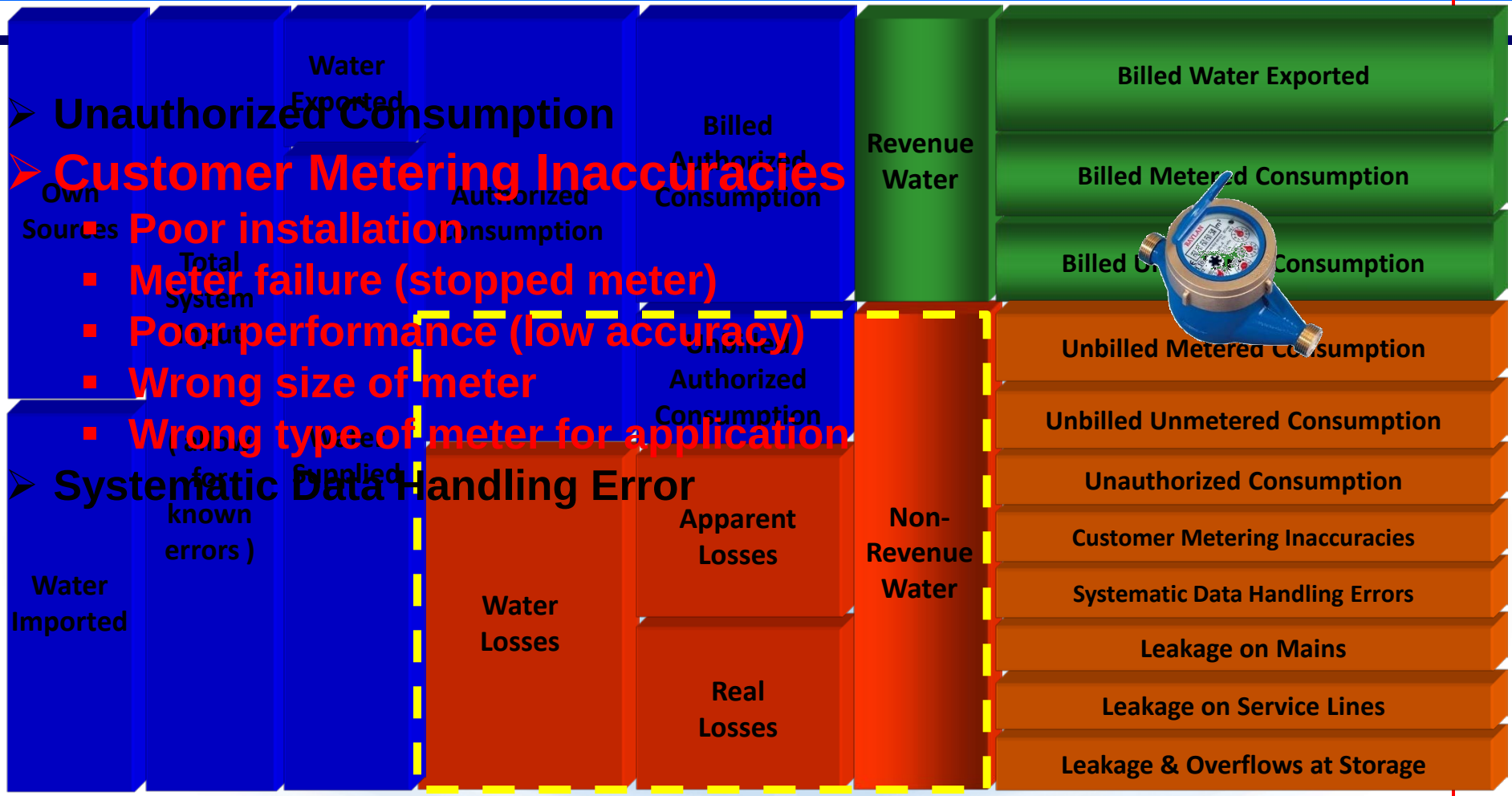
American Water Works Association

Suspect Measurement of Customer Consumption: Customer Metering Challenges in the Drinking Water Industry

WaterSmart Innovations
Las Vegas, NV
October 9, 2014

George Kunkel P.E.
Philadelphia Water Department
george.kunkel@phila.gov

IWA / AWWA Water Balance



- Unauthorized Consumption
- Customer Metering Inaccuracies
  - Poor installation
  - Meter failure (stopped meter)
  - Poor performance (low accuracy)
  - Wrong size of meter
  - Wrong type of meter for application
- Systematic Data Handling Error

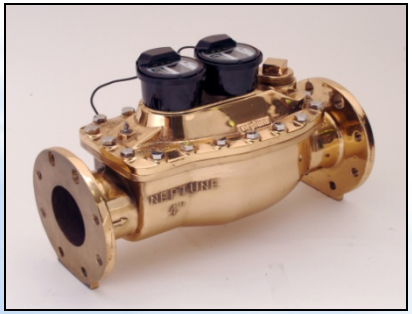
Importance of Customer Meter Data

- Sends price signal to customers
- Basis of customer billing/revenue
- Water conservation
- Water loss control
- Hydraulic modeling (demands)
- Quantify community water needs:
  - Locally: infrastructure modeling/sizing
  - Regionally: water resources management

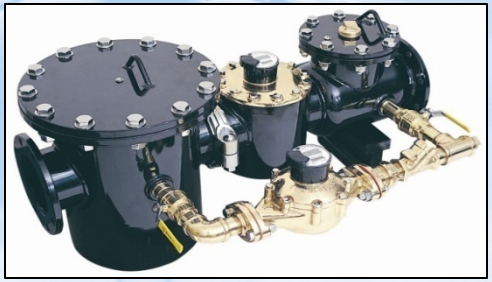
Customer Metering Applications

- Residential (small)

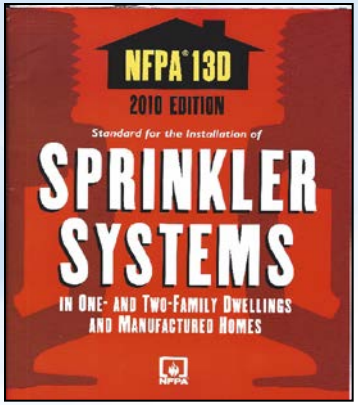
- Commercial/industrial (large)



- Fire Service



- Residential Fire Service



Apparent Loss from Meter Inaccuracy occurs due to:

- Poor Selection of Meter for the given application
- Poor installation
- Poor surveillance and management of the meter population
- Key focus areas
  - Small (residential) meters – less complexity (except for residential fire sprinkler systems)
  - Large (commercial, industrial) customers – greater complexity in management due to many different sizes and types of meters

Poor Installation

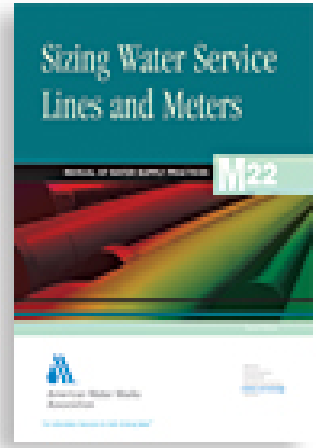
- Who conducts the meter installation?
- How are permits issued for new installations?
- Is there an inspection process?

Meter installed upside down

Bank of meters not installed horizontally

Service Line Sizing and Metering of Large Customers

- AWWA M22 Publication provides guidance
- Historic guidance derived from Hunter Curves (1941)
- Guidance now results in many lines/meters being over-sized relative to low consumption and peak flows
- New data collection and research is needed
- New guidance should be coordinated with governing plumbing codes and International Association of Plumbing and Mechanical Officials (IAPMO) – Pipe Sizing Task Group
- AWWA Customer Metering Practices Committee is striving to launch a data collection process to establish basis for an updated rational method for large meter and service line sizing



Traditional Large Meter Types

- Positive Displacement meters – commonly used in the residential setting but also appears in larger sizes up to 2-inch
- Turbine meters – designed to measure steady, moderate to high flows; often used for large sizes of 3-inch and up
- Compound meters – designed to measure varying flows from low to high; used typically in sizes of 3-inch to 8-inch

1-1/2 inch PD meter at apartment building

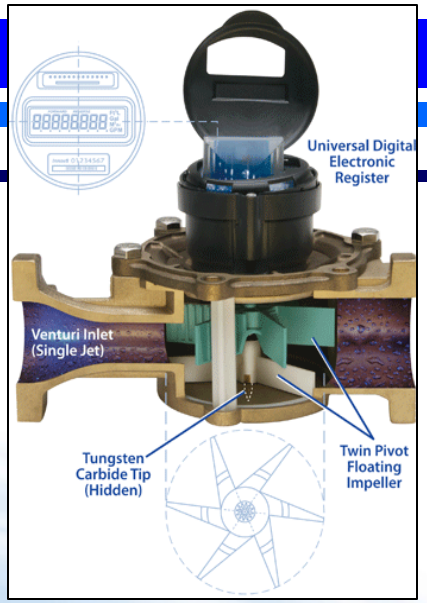
10-inch Badger Turbine Meter at medical facility

4-inch compound meter in a high school

Emerging Metering Technology

- Single Jet Meters
- Solid State Meters
  - Non-mechanical meters free of moving parts
  - Electro-magnetic meters
  - Ultrasonic meters
- Advantage: strong accuracy at both high ad low rates of flow, even in large sizes

Single Jet Meter



Sensus iPerl Magnetic Meter

Badger Ultrasonic Meter

Solid State Metering Technology

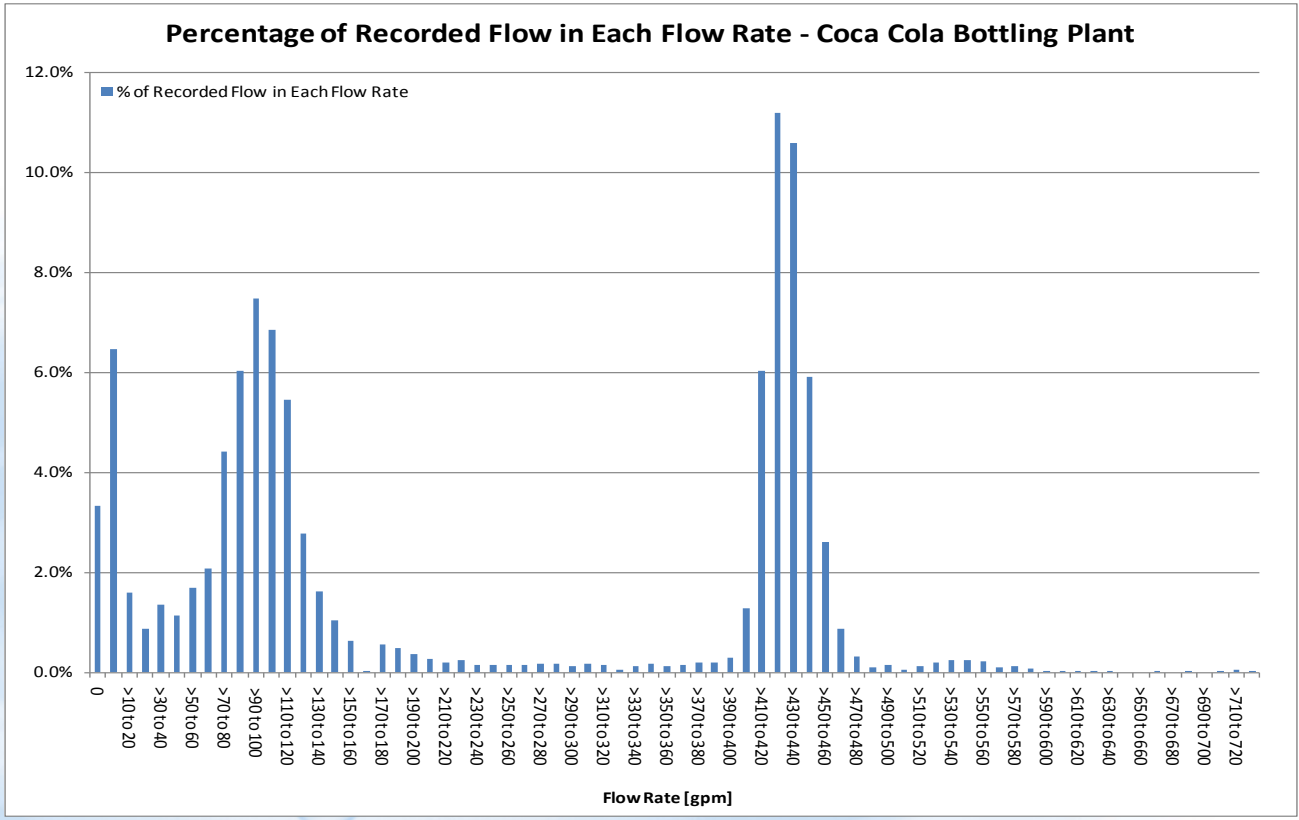
- Electric Power Required
  - Long Battery life is making these meters feasible for the retail customer setting
  - Ultimate battery life “to be determined”
  - Loss of power = loss of meter readings
- Wave of the future – some manufacturers are moving away from mechanical meters

Badger Magnetic Meter

Badger Ultrasonic Meter

PWD: Large Customer Meter Study

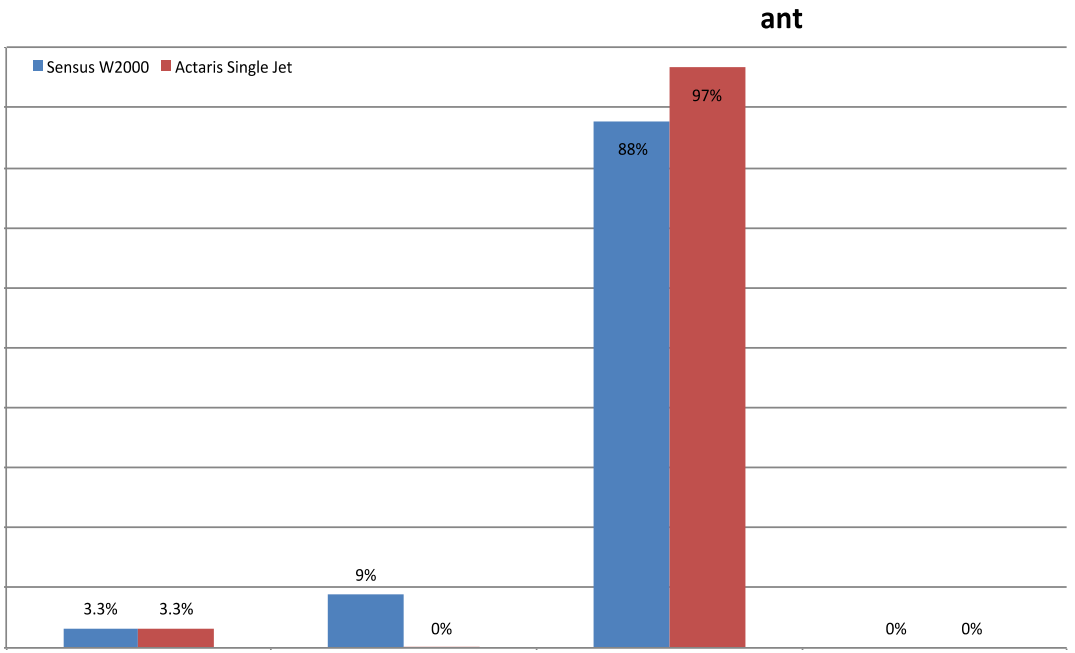
- Coca Cola Bottling Plant
  - 6-inch Sensus compound meter
  - Data-logging data collection: Sept 2010

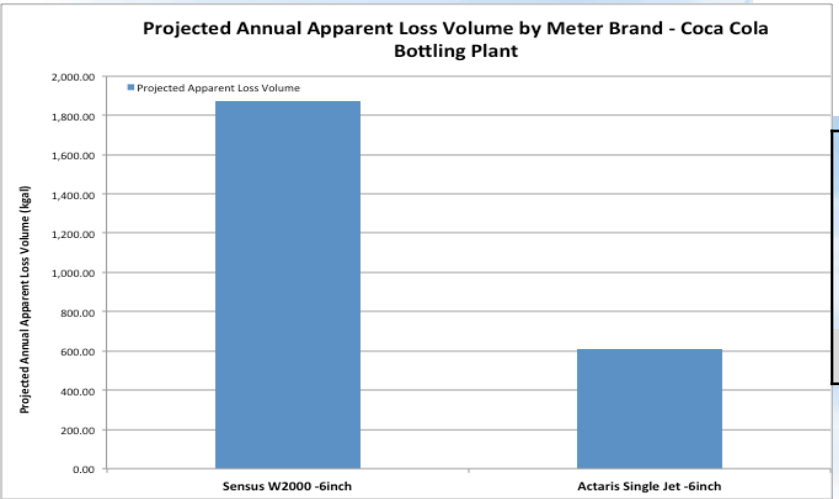


Wide variations in flowrate occur. This meter is adequately sized, but a different meter (single jet) might register more flow

PWD: Large Customer Meter Study

- Coca Cola Bottling Plant
- Time profile and economic analysis
  - Potential payback in 0.6 year with single jet meter, which costs $4,050

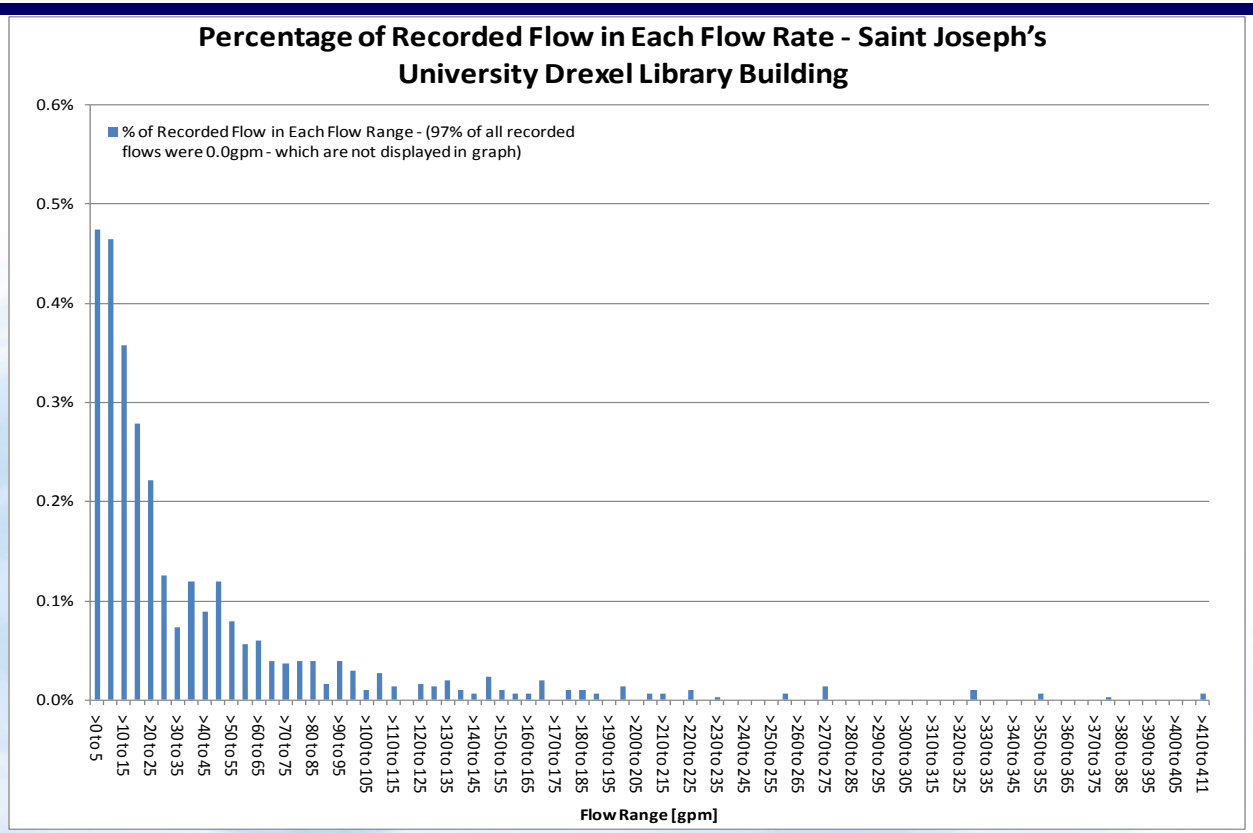




Projected Annual Savings	Monetary ($/year)	Volume (kgal/year)
Sensus Total Apparent Losses	$10,900.45	1,870.28
Actaris Total Apparent Losses	$3,562.33	611.22
Savings from switching from Sensus to Actaris	$7,338.12	1,259.06

PWD: Large Customer Meter Study

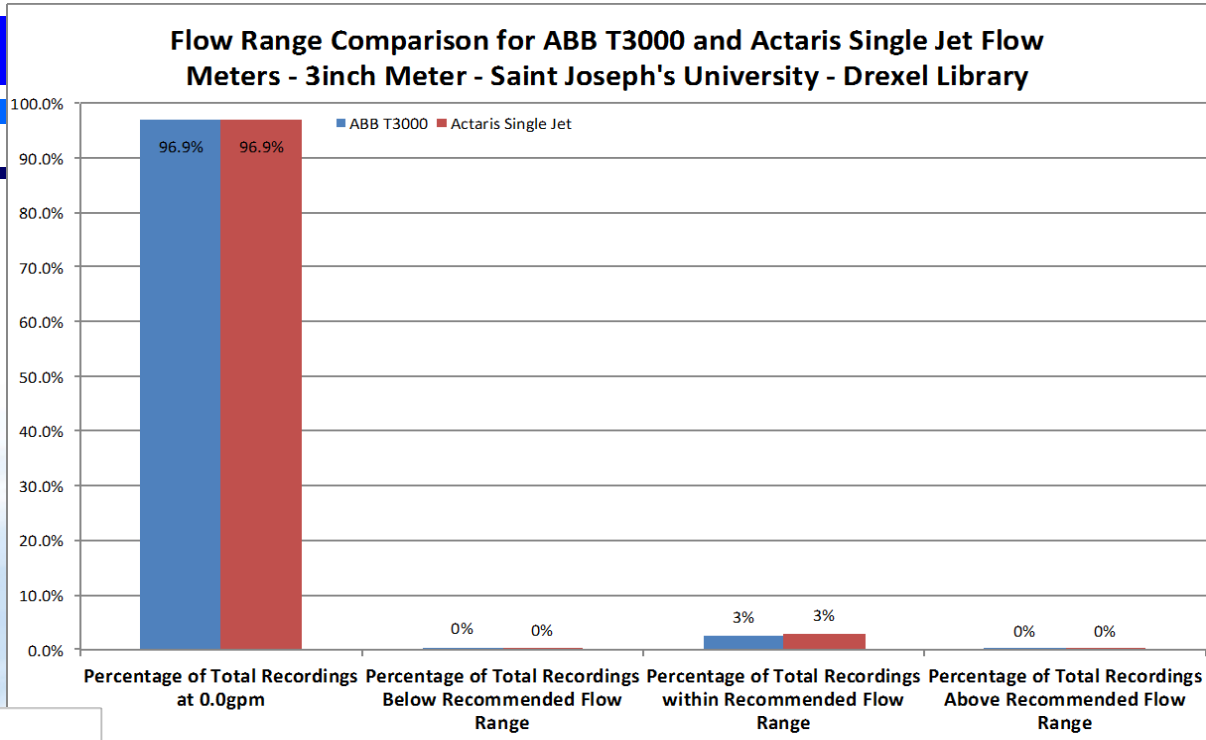
- St. Joseph's University – Drexel Library
  - 3-inch ABB turbine meter

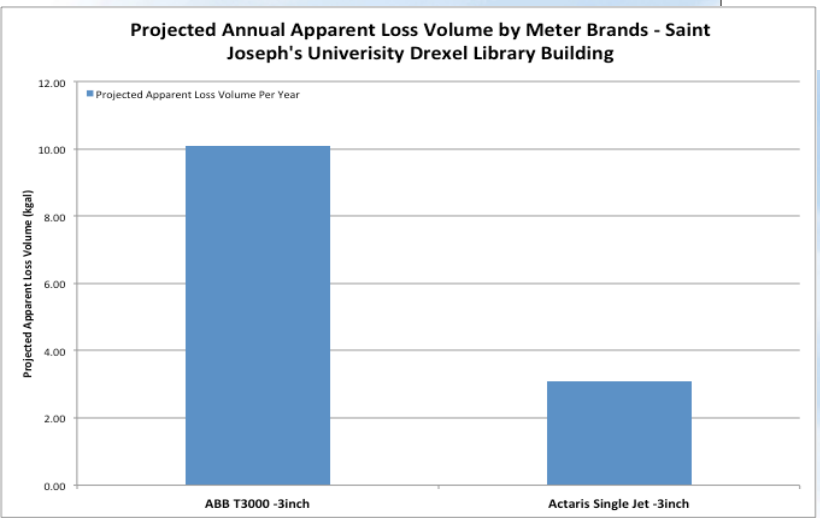


Note: flow through this meter is zero for 97% of the data-logged values. The above graph shows the profile for the remaining 3% of data values. This meter is dramatically oversized, but typical of many such buildings.

PWD: Large Customer Meter Study

- St. Joseph's University – Drexel Library
- Time profile and economic analysis
  - Potential payback in 46 years with single jet meter, which costs $2,014





Projected Annual Savings	Monetary ($/year)	Volume (kgal/year)
ABB T3000 Total Apparent Losses	$63.40	10.09
Actaris Total Apparent Losses	$19.37	3.08
Savings from switching from ABB T3000 to Actaris	$44.04	7.01

Water Rate Structure – Service Charges

- Service Charges – can be a disincentive to the water utility to right-size an over-sized meter

Philadelphia Water Department - Monthly Service Charges 2014			
Meter Size, in	Monthly Water Charge	Monthly Sewer Charge	Combined Monthly Charge
5/8	$6.46	$6.55	$13.01
3/4	$7.49	$8.04	$15.53
1	$9.98	$11.39	$21.37
1-1/2	$15.56	$19.24	$34.80
2	$23.05	$29.31	$52.36
3	$39.64	$52.07	$91.71
4	$69.00	$89.15	$158.15
6	$133.60	$174.77	$308.37
8	$208.47	$275.38	$483.85
10	$302.43	$398.07	$700.50
12	$530.00	$715.77	$1,245.77

Water Rate Structure – Service Charges

- If service charges are high then improved meter accuracy without a size change is an advantage

Philadelphia Water Department - Monthly Service Charges 2006			
Meter Size, in	Monthly Water Charge	Monthly Sewer Charge	Combined Monthly Charge
5/8	$4.61	$16.03	$20.64
3/4	$5.15	$82.09	$87.24
1	$6.60	$133.22	$139.82
1-1/2	$9.69	$260.07	$269.76
2	$14.04	$413.44	$427.48
3	$23.46	$77.03	$793.49
4	$41.42	$1,287.62	$1,329.04
6	$79.37	$2,568.89	$2,648.26
8	$122.76	$4,102.58	$4,225.34
10	$178.65	$5,901.45	$6,080.10
12	$305.82	$10,981.96	$11,287.78

Customer Metering: Food for Thought

- Metering of customer consumption is beneficial for many reasons
- Accurate customer metering can be compromised by:
  - Poor knowledge of meter population demographics by utility managers
  - “Blind” adherence to traditional metering practices or manufacturer guidance
  - Poor oversight of meter permitting, installation and data collection processes
- Water utility managers can promote accurate metering by:
  - Proactive management of the meter population
  - Transition from traditional guidance to emerging guidance for meter sizing and type
  - Pilot new meter types, particularly if service charges are high