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# Security of Revenue: Multi-Type & Multi-Vendor compatibility

23 Aug, 2019



This paper leads into the topic of "Security of Revenue: Multi-Type & Multi-Vendor compatibility" in a typical Utility Smart Meter AMI Program.

**Security of Revenue** is a definition describing two major issues affecting Water/Electricity/Gas Utilities today:

- Revenue Protection
- Revenue Security

**Revenue Protection** is effectively the policing of consumption theft (physical tampering, meter bypassing etc) and management thereof.

**Revenue Security** is the management and securing of revenue.

#### Contents



#### **Introduction: Current Challenges Utilities face**

Definition of "Security of Revenue"

Metering Data Management as an answer

Features and Benefits of Metering Data Management

References

What else can Siemens offer?

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#### The Utility business is changing

- The end-to-end energy business value chain is affected by change
- Technology and ICT are playing a huge role in modernisation within the industry
- In the last 10 to 15 years we have seen emerging international trends focused on:
  - Better service delivery
  - Improved system operation
  - A greater customer centric focus => the 'Energy Prosumer'
  - ✤Big Data the Internet of Things (IoT)

## Smart Grids 🗇 Smart Metering

- South African municipalities owe Eskom providers in excess of R20 billion
  - "As of May 2019, the overall debt is at R21.1bn, a growth of R7.5bn since end of March 2018 (R13.6bn). " - Eskom spokesperson Dikatso Mothae
- 'Uncollectable' debt at municipalities totals more than R144bn 28 February 2019 - Linda Ensor
- Traditional ways of collecting money for utility services such as water, electricity and rates are not working



... but in South Africa we live in challenging times

- This level of debt is crippling utilities and illegal connections compound the problem
- It is time for more effective methods of revenue collection

We need to Transform Municipal Services and maximise Revenue Collection

# Typical sources for Aggregate Technical Commercial & Collection (ATC&C) losses



Source: Siemens Convergence Creators GmbH

30-07-2019

Total consumed energy

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### **Examples of Electricity Theft**



#### Features and Analysis

#### Analysis: Electricity theft in South Africa



System Input Volume	Authorized Consumption	Billed Authorized Consumption	ed Billed Metered Consumption rized Billed Un-metered Consumption		
		Unbilled	Unbilled Metered Consumption	-	
		Authorized Consumption	Unbilled Un-metered Consumption		
	Water Losses	Apparent Losses (Commercial Losses)	Unauthorized Consumption Customer Meter Inaccuracies and Data Handling Errors	Non Revenu Water (NRW	
		Real Losses (Physical	Leakage in Transmission and Distribution Mains Storage Leaks and Overflows from Water Storage Tanks		
		iosses)	Service Connections Leaks up to the Meter	T	

Home > Blog Posts > water meters > Who is Stealing Your Water?

 
 Arad Ltd.
 Who is Stealing Your Water?

 Arad Measuring Technologies
 April 2, 2015

 Master Meter
 Image: Compare the the second Compare the

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 Construct Consumption
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Water utilities are tasked with providing homes and businesses in a defined

entire production capacity. Some of that volume is simply lost — either real physical losses from leakage or storage overflows, or commercial losses, from unauthorized consumption, meter inaccuracies and billing errors. Non Revenue Water (NRW) also includes unbilled authorized consumption, such as fire fighting, flushing of mains and sewers, street cleaning, etc.



NEW is a more cruccal issue in developing countries where effective metering and billing infrastructures are less universal. In 1996 the American Water Works Association (AWWA) Leak Detection and Accountability recommended 10% as the NRW benchmark to which American water utilities should aspire.

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#### er theft and water smuggling

The purpose of water regulation is to ensure long-term water sustainability and compatibility of water use across society, by all actors, and among competing uses, such as drinking, agriculture, industry, and energy, as well as to ensure the preservation or biodiversity of natural ecosystems. Strict legal compliance of course does not guarantee the sustainable and efficient use of water. If the regulatory system is inadequate, all kinds of deficiencies

The World Bank has sestimated the total cost of NRW to utilities worldwide at S\$14 billion per year. NRW is typically expressed as the % of water for which no revenues were realized over the utility's entire production capacity. The table to cause—natural catastrophes, pollution, poor water managemen or theft—can have grave consequences. In this paper, Vanda Felbab-Brown examines the highly controversial and epot topics of water theft and smuggling, and the policy for the that give rise to problematic illegal water markets are the world.

#### THE CONTROVERSY ABOUT / 2R (THEFT)

The topic is highly controversial because there is no common definition as to what constitutes water theft and smuggling, or, for that matter, whether such phenomena exist at all. Increasingly, newspaper articles around the world, particularly in countries experiencing intense drought and water shortages, are highlighting water theft as a growing problem. Yet water experts, water-focused nongovernmental organizations (NGOs),

WaterTech

#### Tampering can vary from very simple to very sophisticated

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The challenge to detect energy fraud attacks efficiently depends on people, process and products





#### Tampering can vary from very simple to very sophisticated

POSTED ON THURSDAY, APRIL 26, 2018 BY KRISTAN ROKKJÆR

# Don't try this at home! – 6 creative examples of water meter tamper...

I was visiting a customer when I came across a rare collection of water meters. The collection displayed various attempts to avoid the water bill... - Seeing it made me think of an old Paul Simon hit ("there must be 50 ways to kill your water meter"). I have shared the 6 most creative examples below for your entertainment. If you have any similar pictures please share them, perhaps we can actually get to 50.



#### Contents



Introduction: Current Challenges Utilities face

#### **Definition of "Security of Revenue"**

Metering Data Management as an answer

Features and Benefits of Metering Data Management

References

What else can Siemens offer?

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- Security of Revenue" is really a term that ensures that maximum revenue for a utility is secured so that the Aggregate Technical, Commercial and Collection losses (ATC&C) is minimised and profitability and financial viability of the Utility secured!
- Security of Revenue is a definition describing two major issues affecting Water/Electricity/Gas Utilities today:
- Revenue Protection
- Revenue Security



- In today's world a lot of Utilities in Africa are struggling to make ends meet, blaming electricity/water/gas theft and "Non-Technical Losses" (NTL) as a main contributor to their negative financial issues.
- One key point is that Utilities are moving from an OT (Operational Technology) centric strategy to an IT (Information Technology) strategy – this means a huge shift in resource focus and management.



#### What our utilities customers most value



**Revenue Protection Addressing four main valued fields** 





#### Contents



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Introduction: Current Challenges Utilities face

Definition of "Security of Revenue"

#### **Revenue Protection**

Security of Revenue

References

What else can Siemens offer?

#### **Revenue Protection**



Identify and locate non-technical power losses caused by meter tampering and potential theft.





- Smart Metering systems (essentially Meter Data Management Systems -MDMS) allows for vital meter data visibility in "near" real time, depending on the consumer usage policy.
- Analysis of the MDMS data is the first step to realising "Revenue Protection".
- > Theft of electricity and water is a global issue, and more so in Africa.
- Typically, ATC&C losses range between 15% (for well managed Utilities and their respective systems) to 70+% (a utility in Nigeria has an effective 72% ATC&C loss average!)

#### **Monetising Meter Data**



#### Improve customer support and billing process

- Predict high-bill
- Correct meter failure before bill is sent out
- Better VEE
- Find leaks for water customers
- Improve knowledge of the customer support group

#### **Customer segmentation becomes possible**

- Improve existing and design new rate cases
- Design demand response programs
- Find the best customer group for marketing e.g. EE campaigns

#### **Implement Revenue Protection**

- Find revenue losses because of malfunctioning meters
- Find theft of commodity on the meter level

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### **Energy Analytics Offering Overview**



#### **Revenue Protection – Theft – How to identify and analyze**



How to identify theft reliably?

How to find a solution that can scale as thieves get more sophisticated? How to reduce the burden on your analysts?

Advanced machine learning uses multiple theft signatures to score each customer for likelihood of theft Easy customizable to add new theft signatures and uses big data processing to maintain high performance. Automated and comprehensive ticket management system will streamline your analyst workflows.

#### **Revenue Protection**

- Advanced algorithms to detect and **flag energy theft** or other occurrences of non-technical loss.
- Automated investigation ticket created for any suspected non-technical loss.
- Numerical score assigned to each service point indicating likelihood of nontechnical loss.
- An investigation management system **to track each investigation** from initial detection to final disposition.
- Intuitive and powerful tools for data analysts, supervisors and site investigators.









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#### **Revenue Protection Steps**

The Revenue Protection application consists of 7 steps, the first 6 are automatically done as part of the Revenue Protection Job run and the last one is the manual review and assignment of the tickets provided by the Revenue Protection Job.



#### 7. Case Management

After ticket creation is complete, use the Case Management user interface to handle the overall case management. You can perform actions such as create new ticket, evidence analysis, ticket assignment, and feedback management.



#### **Revenue Protection Jobs**



#### 1. Pre-load Data Store

The data which is used for the algorithm to be executed can be pre-loaded into memory so that the execution of the Revenue Protection run is better performing.

#### 2. Model Creation

Model creation is executed for scoring purpose based on the features that you configure. It is an optional step and executed only with MLScorer

#### 3. Analytics Execution

All the analytics that you configure as active in the Data Svc Version are executed. You can also configure a new/custom algorithm. \*

#### 4. Scoring

The algorithm result are prioritized using a scorer. The feature result and the final score are stored either in the HBase, HDFS, or both. You can also configure a new/custom scorer. \*

#### 5. Investigation Filter

Investigation Filters filter out all the SDPs that do not meet certain criteria. You can use Investigation Filters to filter out the SDPs for which you do not want to create tickets. Apart from the in-built filters, you can add your own filter.

#### 6. Ticket Creation

After the filtered list of SDPs is available, tickets are created for each SDP. If a ticket already exists in database table for the service point and same data ref end date then the existing ticket is updated with status as "Void" and the ticket gets closed. SR

\* https://docs.emeter.com/display/RP24/Configure+Revenue+Protection" \l "ConfigureRevenueProtection-ConfigureReferenceDataForFeaturesandScorer

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#### **Revenue Protection - Algorithms**

Currently there are twenty-one algorithm available in Revenue Protection that look for incidents of Revenue Losses.

The following algorithm to the right are available for electric and gas as well as single and three phase meters

	#	Algorithm Name and	Electric	Gas	Single	Three
		Abbreviations	Data	Data	Phase	Phase
					Meters	Meters
	1	Usage with no Active Account (UWNAA)	1	1	1	1
	2	Intervals with no Active Account (IWNAA)	1	1	1	1
	3	No Usage for x Days (NUFXD)	1	1	1	1
	4	Estimated Usage (EU)	1	1	1	1
	5	Estimated Intervals (EI)	1	1	1	1
	6	Opposite Usage Pattern Compared to Neighbors (OUPCTN)	1	1	1	1
	7	Opposite Usage Pattern Compared to CIS (OUPCTNSIC)	1	1	1	1
	8	Night Time Bypass (NTB)	1	1	1	1
	9	Interval Validation Fail Code (IVFC)	1	1	1	1
	10	Register Validation Fail Code (RVFC)	1	1	1	1
	11	Tamper With Usage Drop to Zero (TWUDTZ)	1	1	1	1
4	12	Theft Count (THEFT_COUNT)	1	1	1	1



#### **Revenue Protection - Algorithms**

The following algorithm to the right are available for electric meters only but work for single and three phase meters.

The following algorithm to the right are available for electric meter only and only work for 3-phase meter.

ht are available for single and	#	Algorithm Name and Abbreviations	Electric Data	Gas Data	Single Phase Meters	Three Phase Meters
	13	Remote Disconnect Load Side Voltage Zero Usage (RDLSVZU)	1	X	1	1
	14	Reverse Rotation (RR)	1	X	1	1
	15	SDP Low Voltage (SDPLV)	1	X	1	1
	e1					
ht are available vork for 3-phase	#	Algorithm Name and Abbreviations	Electric Data	Gas Data	Single Phase Meters	Three Phase Meters
	16	QoC Three Phase Low Voltage (RTPLV)	1	X	X	1
	17	QoC Register Three Phase Current Phase Angle CT Value (RTPCPACTV)	1	X	X	1
	18	QoC Three Phase Current CT Value (RTPCCTV)	1	X	X	1
	19	QoC Three Phase Angle (RTPA)	1	X	X	1
	20	QoC Three Phase Current (RTPC)	1	X	X	1
	21	QoCThree Phase Current Phase Angle (RTPCPA)	1	X	X	1
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#### Contents



Introduction: Current Challenges Utilities face

Definition of "Security of Revenue"

**Revenue Protection** 

#### **Security of Revenue**

References

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#### **Revenue Security – Smart Prepay**



### **Revenue Security – Smart Prepay vs. Voucher Prepaid Metering**

Traditional Prepaid Metering

- Balance controlling is done locally at the pre-payment (budget) meter
- Cost, complexity and reliability of pre-payment meters
- Physical tokens (smart cards/keys/keypad) are required to transfer payment
- Specific physical pre-payment meter needed

Prepayment with Smart Meters	<ul> <li>Balance controlling is done in the back-office</li> <li>Support of different payment methods, tariffs &amp; incentives</li> <li>Lifestyle "channels" for consumer engagement: <ul> <li>via WebPortal, mobile Apps, SMS and e-mail</li> <li>Supplier Portal assisted access for Self Care</li> </ul> </li> </ul>
	<ul> <li>Same smart meter for postpaid and prepayment, no field activities for change</li> </ul>



### Revenue Security – STS "Prepaid" Metering vs Smart "Prepaid" Metering



#### **PREPAID ENERGY BENEFITS**



Upfront Collection Cash Optimization	Revenue Protection	Debt Management for Recovering Debt
Mobile enablement via mobile Apps		Lifestyle "option" for consumer
Usage of normal (smart) meters	Provisioning of very Flexible Tariff Model	Support of "Dual/Multi Fuel" (electricity, gas, water…)

### Siemens EnergyIP Prepay – Overall architecture





# **REVENUE CONTRIBUTION: ELECTRICITY & WATER USERS**





#### Contents



Introduction: Current Challenges Utilities face

Definition of "Security of Revenue"

**Revenue Protection** 

Security of Revenue

#### Combining both Electricity and Water into a "Smart Prepaid"

system

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#### Central "Smart PrePay Wallet" for Elect | Water | Gas | Heat smart meters



Continuous service improvement The future of smart metering



# Smart Grids



# **Connected power generation**

# Flexible tariffs

# **Smart Home**

# Follow you metering

### Contact



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