IMPACT OF DIGITAL GENIUS METERS IN BUILDING CONFIDENCE WITH CONSUMERS
EXPERIENCE OF SOUTH DELTA ELECTRICITY DISTRIBUTION CO . , EGYPT

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ABSTRACT

The mission of electric utility is to provide safe, reliable, and economical public electric service with a focus on customer needs . SDED (South Delta Electricity Distribution Co.) is one of the biggest energy companies in Egypt , and provide energy service in several densely populated cities . This paper aims to introduce practical experience of SDED in use of Digital Genius Meters and exploit technical advantages in building confidence with Consumers in terms of transparency , their ability to build a reliable measure system for both Company and their Consumers . SDED has installed 300 Digital Genius Meters with large scale consumers . A questionnaire after Digital Genius Meters installation shows an increase of confidence between SDED and Consumers who have this type of meters. This Meters helps improve confidence in measurement and supports consumers' confidence.

INTRODUCTION

Electric utilities have always been concerned with the need to provide power with a high level of quality and continuity of supply to their consumers . Also help their consumers to overcome both technical and commercial problems, which leads to confidence-building with consumers, it all leads to increase the resources utilities and reduce disputes between utilities and their consumers Consumers Satisfaction is the key to long-term success for any utility, high levels of consumer satisfaction bring several positive aspects to a utility. One of the most important factors in consumer satisfaction is good consumers service and accuracy of bills. A consumer's utility bill is driven by two factors : the utility rates and the consumer's metered usage. It is important to understand electric utility billing terms and its structure .

UTILITY BILLING

I. Electricity Bill Terms

Electricity bill consists of 3 terms as following :
(i) Active energy term (kWh) :consumption of active energy (kWh) , applying different tariffs and rates.
(ii) Maximum demand term (MD) : maximum demand register (kW) . This is the maximum power value, usually the average of 15 minutes, reached during the billing period (this average time vary depending on the country). Once the value is higher than the contracted power , the consumer will pay a penalty on the bill.
(iii) Reactive energy term (kVArh): consumption of reactive energy (kVArh) , applying different tariffs and rates. Depending on the cosϕ value, the user will pay a penalty (this penalty is not applied in all countries).

II. Consumer Categories Bill

Consumer electricity bills consists of following components as per the tariff schedule existing :
1) Residential /Commercial Consumers
(less than 10KW) build on single part tariff consists of :
• Energy Charges (k w h)
2) Residential/Industrial/Commercial Consumers
(less than 500KW) build on single part tariff consists of :
• Energy Charges (k w h)
• Power factor penalty
3) Residential/Industrial/Commercial Consumers
(more than 500KW) build on single part tariff consists of
• Energy Charges (k w h)
• Power factor penalty
• Maximum demand charges (k w)

TABLE 1- Egypt Consumer Categories

Categories	Contracted Power KW	Bill Terms		
		E KWH	P.F	MD KW
Small Scale	≤ 10 KW	√		
Medium Scale	10 to 500 KW	√	√	
Large Scale	≥ 500 KW	√	√	√

E Electric energy (kwh) , M.D Maximum demand (kw)
P.F Power factor (Ratio between the kW and the kVA)

ENERGY METERING ... BRIEF& HISTORY

Energy meter is an instrument which measures amount of electrical energy used by the consumers. Utilities install these instruments at every place like homes, industries, organizations to charge the electricity consumption by loads such as lights, fans and other appliances. For more than a century the measurement of electricity consumption has been accurately recorded using electro-

mechanical Ferraris disc meters that are read manually by a meter reader visiting the consumer's premises. These meters can record consumption as a single number (a single register meter)، or have multiple registers that separately record consumption at different times of the day (time-of-use (TOU) consumption recording) Switching between the registers can be done using time clocks or ripple control signals. In the latter part of the twentieth century electronic meters with no moving parts began to be installed , replacing the Ferraris disc meters .

USE OF NEW METERS

In 2005, SDED supplying electricity to 12.5 million residents and businesses (approximately16% of the Egypt energy market), began to replace electromechanical meters with electronic ones. The new electronic meters can record events such as problems with the electrical system and voltage fluctuations. The new meters provide two-way communication between utilities and consumers

GENIUS METER PURPOSE & FEATURES

The digital genius meter (DGM) is a multifunction device for measurement of electric energy. CT operated meters comply with requirements of IEC 62053-22 standard, class 0.5 or 0.2s. DGM is 3 phase solid state unit with ability to connect to either 3 phase, 4 wire or 3 phase, 3 wire delta circuits. DGM display the energy used on an LCD display, and can also transmit readings to remote places. In addition to measuring energy used , DGM can also record other parameters of the load and supply such as maximum demand, power factor and reactive power used. They can also support time-of-day billing, for example, recording the amount of energy used during on-peak and off-peak hours. The DGM also offers PQ tools

ADVANCED METER PILOT PROJECT

SDED launched a small-scale pilot project in September 2012 to test the technology of advanced meters. The year-long pilot involved about 300 SDED consumers .

Participants

To ensure broad participation, consumers were selected from five different geographic areas in SDED. All of the pilot participants were Large Scale Consumers. SDED installed a DGMs on the MV or LV Distribution Power Centers unit of the pilot project participants.

Pilot goals

SDED 's goals for the pilot included :
(i) Better understand consumers preferences toward specific technology and information. (ii) Develop useful materials to inform SDED's consumer base about the new meters. (iii)Test how participants utilize the energy and cost information available from the meters.

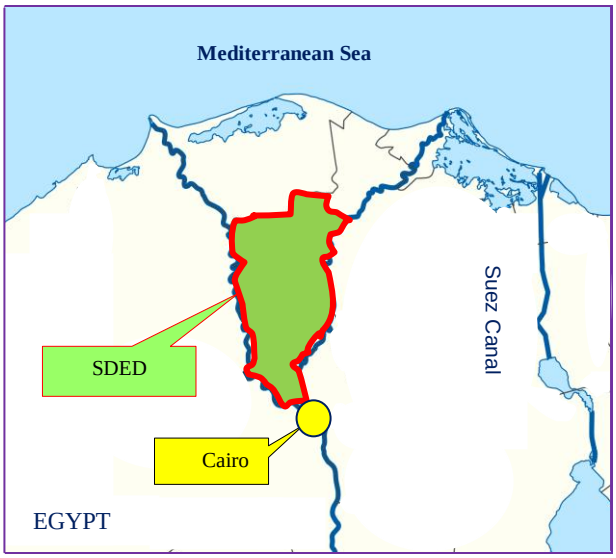

Fig. 1 Map of SDED area

BENFITS OF DIGITAL GENIUS METER

After SDED installed DGM, many of the technical problems have been solved with consumers, for example:
(i) Measurement accuracy has became a higher (±0.5%)
(ii) Calculate MD, P F became easier and accurate
(iii) Possibility of achieving contact between SDED and meter. in the area of improved consumer service. DGMs deliver the following advantages :

1- Improved Accuracy

Meters are classified in terms of the accuracy of their measurements. It is typical, for example, for a mechanical energy meter to have an accuracy of better than 2%. by comparison, an average DGM may have an accuracy better than 0.8%, while some will offer accuracy specifications of 0.5% and even 0.2%, meeting for example, the more stringent American National Standard (ANSI) C12.20-2002 specifications . The accuracy of MCU or DSC-based designs may be specified by software parameters that can be easily modified as requested by the application (upon installation) while maintaining a single common hardware platform .

2 - Concurrent Maximum Demand

Electricity Metering Over Multiple Feeders is a common problem faced by the electricity Supply Industries. For electricity invoicing on large-scale consumers, it is the energy and demand that forms the input . Tariff metering becomes complex in case of multi-feeders due to the challenges poised by the measurement of summated energy and concurrent maximum demand over multiple feeders. Concurrent demand is the demand measured on a single equivalent feeder of the multiple feeders in the same time domain.

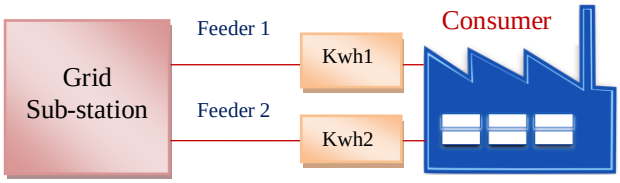

Fig. 2 Large scale consumer with multiple feeders

In the above figure, the consumer is receiving electricity over two feeders emerging from the same Sub-station
To solve the problem of concurrent maximum demand, following methods are used : (i) The Summation CT's. (ii) The Pulsing Meters. Both previous method has the following limitations : 1. Errors due to circulating current 2. Errors due to voltage feeders difference .

Digital Genius Meter Summation :

This system has overcome all the disadvantage of the pulse and C.T based summation system by using a single, true four quadrant, DGM on each of the feeders with the facility for electronic communication with the digital Summator.DGM registers values of maximum demand of active (+P,-P), and apparent (+S,-S) power of each demand on daily and monthly basis. Monthly maximum demand values are stored in monthly profiles and daily maximum demand - in daily profiles.

Case Study

Delta Textile Co. has been selected for the installation of DGM, this consumer is fed from Tanta S/S1 by 4 feeders DGM supports high resolution summated load survey.

Load profile for Delta Textile Co. Tanta . Jun 2013

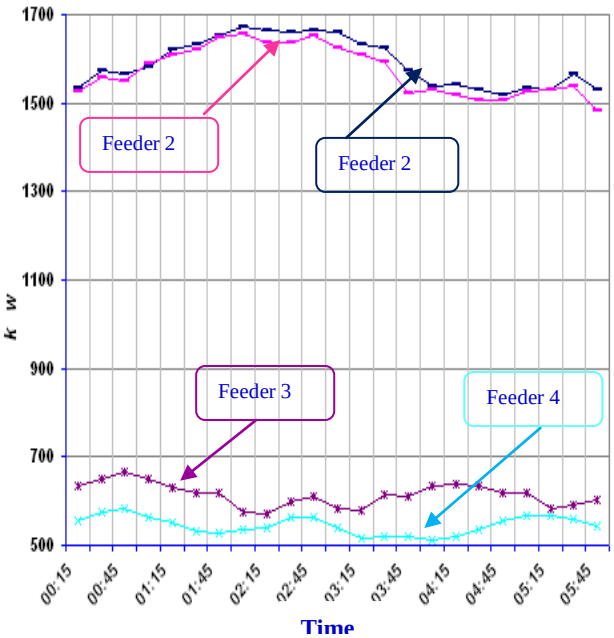

Fig.3 4 Feeders load profile for Delta Textile Co. Tanta. Egypt

3 - Energy Registration

DGM has two memory units : RAM memory and energetically independent FLASH memory for data storage. In the case of power outage the data stored in RAM are lost while the data stored in FLASH remain . DGM measures active electrical energy in both directions +A and –A. All measured values of those parameters are stored in RAM memory unit. At the end of integration period or in case of power failure, those values are written into appropriate FLASH memory registers. Old meter does not record the electrical energy consumed when a malfunction in the wiring , in this case, the electricity distribution company based accounting on the approximate reading of electrical energy consumed. DGM was able to solve this problem by using energy consumption (kwh) stored in his memory and restore it.

Case Study

Delta Plastic Factory Co. has been selected for the installation of DGM, As a result of a malfunction in the wiring (lost phase voltage) - An error occurred in the recording consumption. By using the data stored in DGM memory, Consumption accurately calculate.

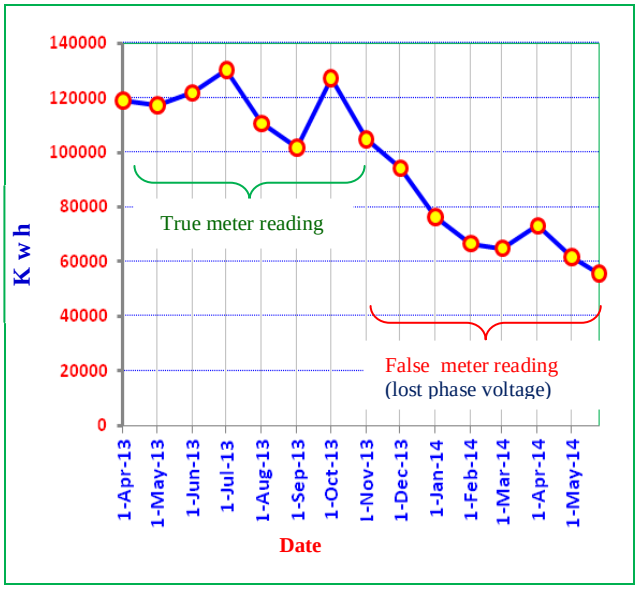

Fig. 4 Load profile for Delta Plastic Factory Co.

4 - Power Quality Registration

Traditionally, most revenue meters have been electro mechanical types that simply measure and display one parameter such as cumulative watt-hours. The DGM offers advanced power quality tools to measure compliance to power quality agreements or gather data to help set power quality requirements. These tools include:
(i)Voltage and Current THD (Total Harmonic Distortion) ,TDD (Total Demand Distortion) (all recordable).
(ii) Programmable sag and swell monitor that logs voltage sag and swell duration down to one cycle

5 - Communication Interfaces

Traditionally, the electricity meters are installed on consumer's premises and the consumption information is collected by meter-readers on their fortnightly or monthly visits to the premises. This method of gauging electricity consumption has many disadvantages. In order to overcome these disadvantages of the Old meter reading system, Efforts are underway around the world to AMR and to provide comprehensive information to the consumer for efficient use of the utilities. For data exchange with external units (i.e. computer or manual data reading terminal), the DGM has standard optical and electrical communication interfaces as following :(i) Optical Interface: this interface is used for the meter Parameterisation and for transferring of data stored in the meter to a data reading terminal or portable PC with a software installed in it. The optical interface transfer protocol is IEC 62056-21 compatible.

(ii) Electrical communication interface: this interface is used for the meter parameterization and for data transfer via local network.

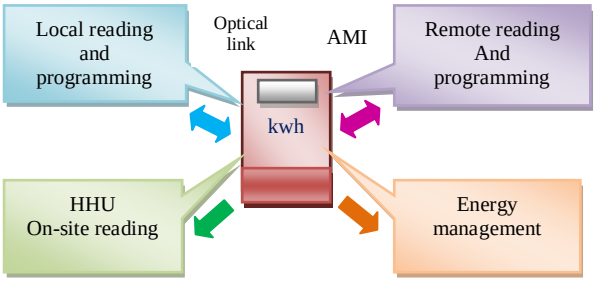

Fig. 5 The digital genius meter communication interfaces

QUESTIONNAIRE

DGM pilot study is a first step in the proposed implementation of "smart metering" technology as a more efficient means of tracking electrical consumption by SDED and its consumers. A pilot study involves a group of 300 SDED consumers to understand differences in confidence level of the pilot program participants. The survey was administered during August of 2013. And it was divided into two sections : (i) Confidence factors (ii) Metering Confidence level .

Questionnaire results

The results of the survey for SDED's "DGM" study showed that the most important factors affecting the metering confidence are:(i) Meter accuracy (ii) bill value.

TABLE 2- Factors cited by people with confidence in metering

Factors	Proportion (%)
Meter accuracy	39
Regularity and logical bill value	34
Ease of dealing with meters	19
Others	8

A questionnaire after DGMs installation shows an increase of confidence for consumers who have this type of meters. DGM helps improve metering confidence and supports consumers' confidence in SDED. (See Table 3)

TABLE 3 – Metering Consumer Confidence level

Confidence Level	Proportion (%)	
	Before	After
Complete confidence	25	29
Relative confidence	50	53
Little confidence	19	14
No confidence	6	4

INCREASE CONFIDENCE BENEFITS

Increase consumers confidence lead to achievement :
1-An increase in the electric utilities resources.
2-Decrease consumers complaints, commerce problems.
3-Building public supportive opinion of the firm service such as energy saving and loads shedding.
4-Reduce harmful practices, such as theft, illegal joint.

NEXT STEPS

Egyptian Electricity Holding Company (EEHC) is planning to start a project to replace Old-style electricity meters by Smart meters. In order to increase consumer confidence , (EEHC) should to do the following :
(i) Development a consumer belief that Smart meters system is for his service. (ii) Enable consumers to deal with the new Smart metering system technology.

CONCLUSION

Undoubtedly, no business can exist without consumers. In the philosophical words of Peppers and Rogers *"The only value your company will ever create is the value that comes from consumers—the ones you have now and the ones you will have in the future.* This is absolutely true. Consumer value is an asset to the organization. Electric utilities must give the subject of gaining the consumer's confidence special attention, thus achieving utilities more reliability and credibility, also increase consumer's loyalty. Loyal consumers provide honest,quality feedback

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