AUTOMATIC METER READING SYSTEM USING POWERLINE CARRIER COMMUNICATION IN ZESCO- A CASE STUDY FOR KITWE REGION

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AGENDA

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- Aims and Objectives
- Cost Estimates
- Automatic Meter Reading (AMR) System Network Architecture
- PLCC technology and its application to AMR
- System Installation and Testing
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INTRODUCTION

- The Automatic Meter Reading (AMR) System is a host driven, multi-level network

- AMR refers to the collection of data from electronic meters or other devices and then automatically transmit the collected data via communication links without any human intervention

AIMS AND OBJECTIVES

OBJECTIVE

- Design and implement an Automatic Meter Reading (AMR) System using Power Line Carrier Communication (PLCC)

AIMS

- Detect tamper events and outage occurrences
- Remotely connect/disconnect power supply through meter
- Remotely read meters from the Network Operation Centre (NOC)
- Reconfigure the tariff of meters (multi-tariff) according to system demand

COST ESTIMATES

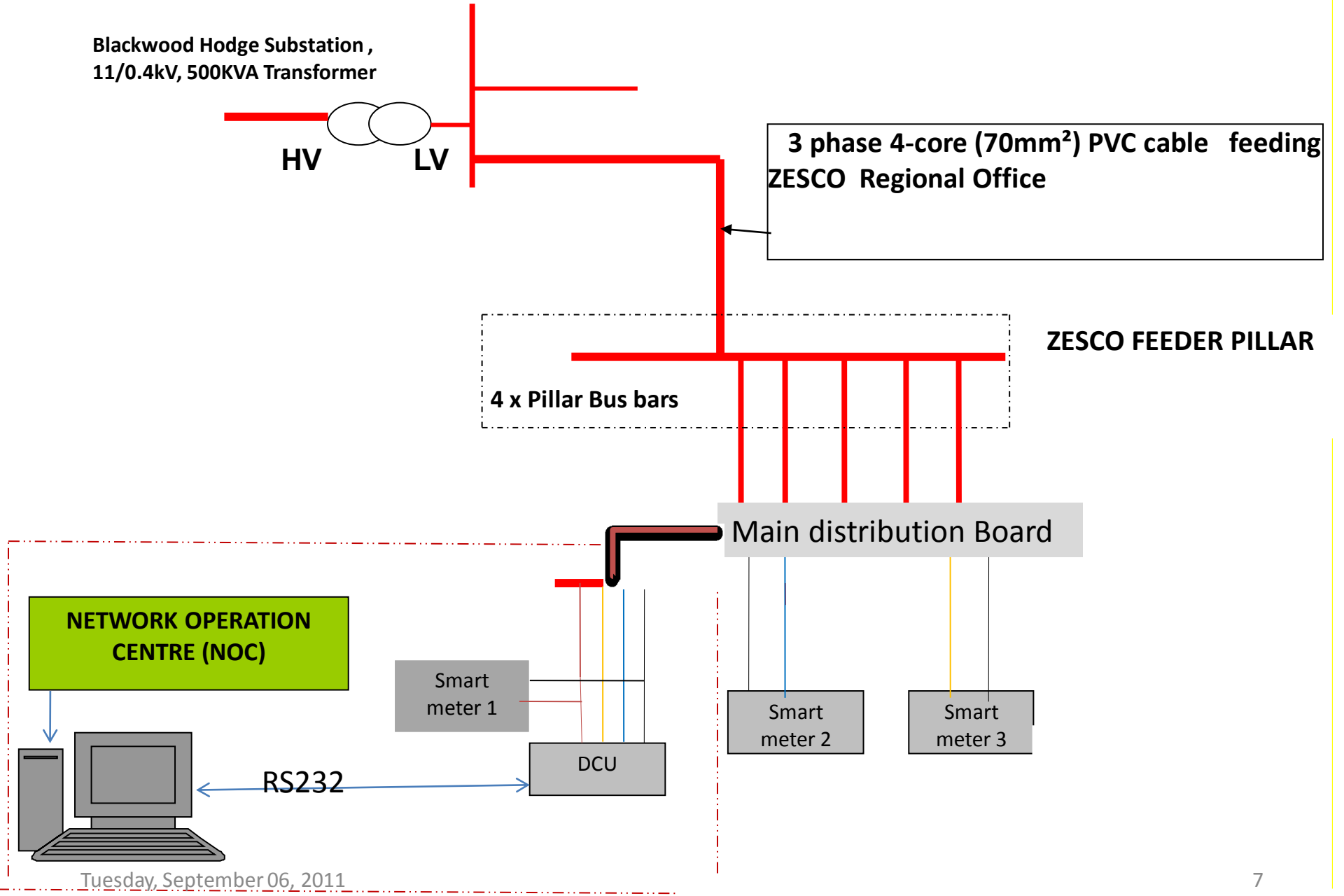
Table 1. Expenditure

ITEM	UNIT PRICE (US DOLLAR)	TOTAL
1X DCU	$ 500	$ 500
3X SMART METER	$ 30	$ 90
BANK COMMISSION	$ 30	$ 30
FREIGHT CHARGES	$ 240	$ 240
ZRA(Customs duty and VAT)	$ 333.33	$ 333.33
MISCELLENEOUS	$ 277.78	$ 277.78
GRAND TOTAL	**$ 1411.11**	**$1471.11**

AUTOMATIC METER READING (AMR) SYSTEM NETWORK ARCHITECTURE

The main components of the AMR system are;

1. Data Concentrator Unit (DCU)
2. Central office equipment
3. Smart Meter


Blackwood Hodge Substation ,
11/0.4kV, 500KVA Transformer
HV
LV
3 phase 4-core (70mm²) PVC cable feeding ZESCO Regional Office
ZESCO FEEDER PILLAR
4 x Pillar Bus bars
Main distribution Board
NETWORK OPERATION CENTRE (NOC)
Smart meter 1
Smart meter 2
Smart meter 3
DCU
RS232

PLCC TECHNOLOGY AND ITS APPLICATION TO AMR

- PLCC is the most economically viable technology for transferring meter data to DCU
- It uses the technique of communicating the data over existing electrical power lines with a frequency of 50Hz
- Employs an ASIC, which accepts digital data and converts it into FSK modulation and transmits it over the power line by sensing a zero crossing of the 220V sine wave
- The typical frequency used for frequency modulation is 132kHz

SYSTEM INSTALLATION AND TESTING

- Installation of the AMR system was done at ZESCO Regional Office-Kitwe
- Supply for smart meter 1 was tapped directly from the DCU and load connected to it was a 100W bulb
- Smart meter 2 was installed in the kitchen and load connected was a 2 plate cooker
- Smart meter 3 was used as a mobile meter to test for communication at various points and load connected to it was 100W bulb

RESULTS

Table 2. Test Results

Smart Meter Serial Number	Location	Connected Load	Communication with Meter	Remarks
709497	Network Operation Centre	100W bulb	Yes	Communication perfect with a delay of less than 10 seconds
367789	Kitchen	2 plate cooker	Yes	Communication perfect with a delay of less than 10 seconds
367788	Customer service centre	100W bulb	Yes	Communication perfect with a delay of less than 10 seconds
367788	Faults centre	100W bulb	Yes	Communication perfect with a delay of less than 10 seconds
367788	Cashiers office	100W bulb	Yes	Communication perfect with a delay of less than 10 seconds
367788	Area Managers office	100W bulb	No	No communication
367788	Control Room	100W bulb	Yes	Communication perfect with a delay of less than 10 seconds
367788	Construction office	100W bulb	No	No communication

BENEFITS OF AMR SYSTEM

AMR System offers a lot of benefits both to the utility and the customer

To the customer

- Total transparency in meter reading/billing is ensured
- The reading date for each month can be fixed

To the utility

- Time to access site and time to read meter manually will be curtailed

BENEFITS OF AMR SYSTEM Contd.

- Reduction in operational costs
- Easy to detect tamper and outage occurrence
- Remotely connect/disconnect power through the meter
- Calculate transformer loading and sizing from interval data
- Interval data gives accurate load information for supply scheduling, switching operations and planning

CONCLUSION

The AMR system designed in this project worked as per expectation though some expected results were not realized due to:

- Difficulties in software installation and system configuration
- Poor earthing and electrical wiring system of the building

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- ZESCO Limited Copperbelt Division (CBD), Kitwe region, metering and customer services departments

Thank you