THE USE OF AMR[1] SYSTEM FOR THE PURPOSE OF MEASURE AND SEPARATE THE PARTS OF DISTRIBUTION NETWORKS LOSSES

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***Abstract**: Development of distribution networks and much losses (on this networks) to cause that the reduction of energy losses be one of the most important worry for managers of Iran's electrical industry spatially in part of distribution.*
The percent of distribution networks losses always measured and calculated totality, but to be informed from the parts of losses and also separate and appointment quantity's share of main factors, it does have well-deserved role at management and programming to reduce losses of distribution networks.
The present article is just section of investigational project that it does conclusion in Lorestan Province Electric Power Distribution Company (LEPDC) to know and separate the important parts of losses and to appointment share of each compilation effective on losses for the one sample low- voltage (400V) fider.
In this project, we tried with use of a logical method and use AMR (Automatic Meter Reading) system too, measuring total quantity of energy losses in the sample fider. and then with improvement the factors that effective on losses in several stages, reduce the among of fider's losses to standard limit in each stage and finally we do calculate and determine share the whole of important factors effective on losses.

INTRODUCTION

Generally, "losses" is the section of energy that it does not convert to useful work function. Certainly to clear up the means of losses we must define the means of useful work function.
In electric energy distributions companies, the losses indeed apply to the section of energy that is obtain of difference import and export energy of distribution networks, therefore [1]:
(Losses = delivery energy – sold energy)

Or

(Losses = bought energy – sold energy)

SHARING THE PARTS OF LOSSES IN LOW- VOLTAGE NETWORKS

In electric distribution networks, electrical energy does loose in different forms; so that the parts of losses and share of them on total losses are, differ in different networks.
Therefore, it is necessary to consider energy losses in a network; recognize the different parts of losses; then facts of reduce it. In a general sharing, could introduce the parts of losses in distribution networks and spatially in low-voltage section, as follows [2]:

- Joule losses at distribution lines.
- Losses of meters (counters).
- Incorrect operation of measuring instruments.
- Incorrect designing networks.
- Non-allowed use from electric networks.
- Unregulated voltage at network.
- Effect oldness of parts and incorrect connections
- Imbalanced load at network.
- Increase service cable's length of customers.
- Connection of network with branches of trees.

SPECIAL MANNER OF MEASURING LOSSES IN LOW-VOLTAGE NETWORKS

Measuring losses at low-voltage networks is often difficult for the reason of dispersion customers and their used load and up to this reason, separate the parts of losses at this part of distribution networks is infinitely harder than another part of this network.
For the reason of decrease measurement error, it is necessary to calculate energy losses of a sample low-voltage network in during a period of several days (if energy interchange is few), measure delivery energy from output of distribution substation.
At the beginning of this Project by introduction sample network and recognition case situation that, calculate total losses of sample network, with the help of AMR system. Then by doing feasibility studies and determine losses factors, we will take necessary practical and amendatory actions for each one of important factors at creation losses. Such that after improvement any factor, be able within the

1 Automatic Meter Reading
2 Lorestan [Province] Electric Power Distribution Company

range of possibility, decrease losses of that factor at least to own amount standard. In addition, specify the share of energy losses with a low error in any factor [2].

INTRODUCTION THE SYSTEM OF READING METERS BY FAR

AMR system (independent of electricity, gas or water meters) is able to synchronized reading of meters by far. At the present, be able by using the considered AMR system to find goals as follows [3]:

- Record amount of load and energy, prepare related profiles (separating hour, day and night, week and month), and prepare model of use for mono-phase and three-phase customers.
- Bilateral and continues relation with meters.
- It does not need to reading meter in their quarters.
- Relatively accurate calculation of load losses and undistributed energy too.
- To be informed of non-allowed interference at meters by individuals.
- Record accurate information and analyze it by software.
- Omission the human error (by mistake or intentional) at reading meter completely.

SELECTION THE SAMPLE NETWORK

By done investigation on low-voltage distribution networks of Khorram Abad city, the sample fider selected as fallows:

- Possibility installs AMR system easily.
- Capability achievement reforms for decrease losses.
- It does not have maneuverability from two-supply.

By this viewpoint, the sample fider selected by technical and general data as follows:
-Kind of substation: grounding
-Medium length of fider: 200 meter
-Length of highest point of fider: 275 meter
-Used conductor's area in length of fider: often are16mm^2, 25mm2 and some part is 35mm^2
-Arrangement of air network is in form of 3-wires and 5wires by radial supply
-Number of mono-phase customers: 72 customers
-Number of three-phase customers: 2 customers
-Kind of fider's load:90%is domestic and10%is commercial

INSTALLATION AND START UP THE AMR SYSTEM

It is show on figure (1) and as follows:
1-Installation electronic module (RU[3]) on new meters that delivery by factory on maximum standard error value at 1.5%.
2-Planning the electronic module.
3-Testing meters equipped by electronic module.
4-Replace old installed meters of customer with new meters equipped by RU.
5-Installation and starting up the adding system (concentrator), in local of low-voltage substation.
6-Installation a digital meter at the beginning of sample fider, for reading total delivery energy to customers in the period of study.

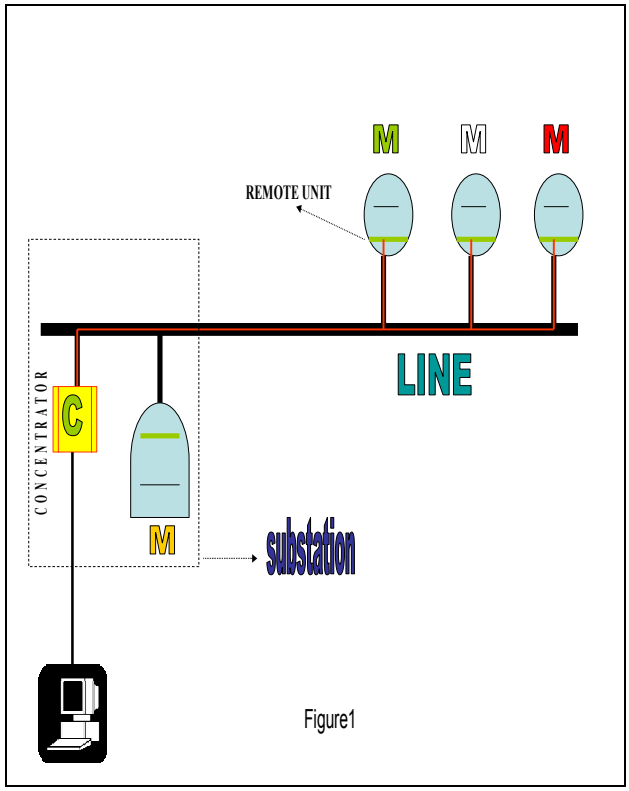


Figure1

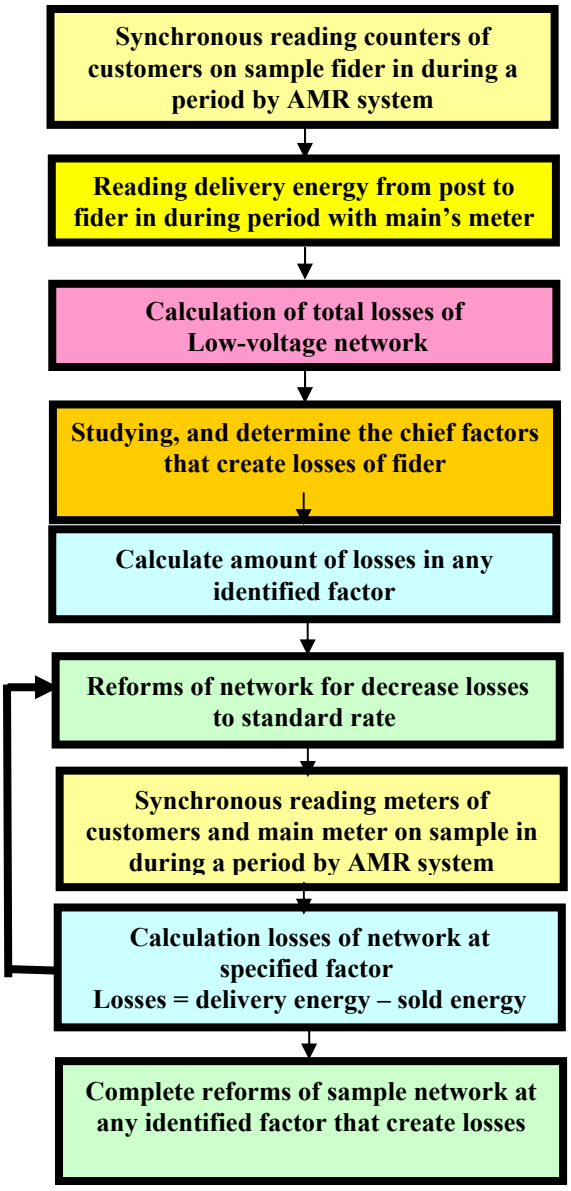
DETERMINE THE CHIEF POINTS OF LOSSES

By doing studies on sample low-voltage fider and based on basic studies that exist in the matter of losses, determine the factors that create losses by take notice of recognition and nature of sample fider. Then specified that determined factors be able to improve in three steps because some factors are dependent on each other at the time of network improvement; and practically does not exist capability separate the above factors at over three steps, as fallows [2]:
a) Aging of network, non-standard area of conductors, incorrect connections of jumpers.
b) To be long service cables of customers, and to be non-standard their connections with network.
c) Existence of noticeable load imbalanced on network, and to be 3-wiers of some secondary service lines.

3 Remote Unit

METHOD OF READING AND MEASURING LOSSES

At this project, calculation of energy losses is base on measuring difference of delivery energy and used energy of customers. Every time this measuring performed before and after achievement improvement of network for any identified factor that create losses.
By considering load nature of domestic customers and the fact that use rate of any family is not similar during two periods of reading (before and after doing network reforms); moreover, to do decrease error of measurement and obtain to reality rate of measured losses, all of the periodical readings does regulate based on similar used energy. It does mean that without consider a particular time for reading before doing network reforms, only used energy does use; and reading after doing network reforms, measuring losses does calculate based on that same approximation rate of used energy.
For the reason of existence capacitor on sample network, in during any period, measured passive load relative to active load is insignificant and almost, it is be same during periods of reading; so, we do not consider its effect on network losses[2].
(It does according to opposite flowchart).



CONCLUDING

By doing the research-operational project that briefly explains at this article, determine and measure the most important factors that create losses. Generally, we were able to identify, measure and separate the three chief factors in relative to another factors, in any case, another factors may on some of the low-voltage networks, even, have a more important role in creating losses.
The result of measuring losses after reforms of factors (a), (b) and (c) show on tables (1), (2), (3) and figure (2).

REFERENCES

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Table1: The results of measuring energy losses for improve factor (a)

description	First reading (before network reform)	Second reading (after network reform)
Time of period	5days	4days and 4hours
Delivery energy	2909KWH	2842KWH
Total used energy (based on similar used energy)	2581 KWH	2578KWH
Amount of losses	328KWH	264KWH
Percentage of losses	11.275%	9.289%
Percentage of losses in (a) factor's	**1.986%**	

Table2: The results of measuring energy losses for improve factor (b)

description	First reading (before network reform)	Second reading (after network reform)
Time of period	4days and 4hours	6days and 3hours
Delivery energy	2842KWH	2812KWH
Total used energy (based on similar used energy)	2578KWH	2570KWH
Amount of losses	264KWH	242KWH
Percentage of losses	9.289%	8.606%
Percentage of losses in (b) factor's	**0.683%**	

Table3: The results of measuring energy losses for improve factor(c)

description	First reading (before network reform)	Second reading (after network reform)
Time of period	6days and 3hours	7days and 17hours
Delivery energy	2812KWH	2780KWH
Total used energy (based on similar used energy)	2570KWH	2577KWH
Amount of losses	242KWH	203KWH
Percentage of losses	8.606%	7.302%
Percentage of losses in (c) factor's	**1.304%**	

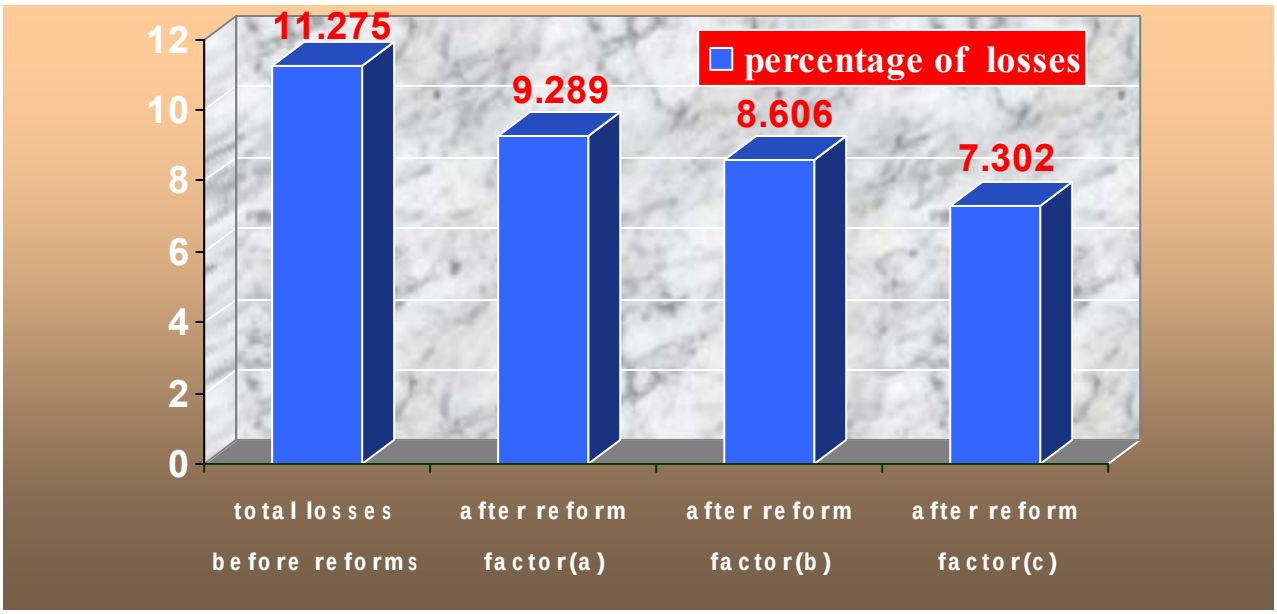

Figure2: Calculation of energy losses before and after reform factors (a), (b) and(c)