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A New Techniques to Calculate the Efficiency of Electric High Voltage Network in Basra

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Abstract: The complexity of electrical power system that need to provide electricity to many customers under different requirement with high efficiency. For this reason, its imperative to find a modern technology that can be implemented to obtain reliable electrical power network. In this paper is a new technique have been proposed based on the load flow direction from generation station to substations. Keep track of route method was implemented to determines the path of the load flow and give minimum disconnected. Matlab environment software was implemented later to discover the weaknesses point and calculate the efficiency of the electric power network.

1. Introduction

Electrical power network has many structures based on their complexity. It may take simple that have a parallel and series type of built. Other networks don't have this easy type of structure or have intricate operational logic. Additional modeling and evaluation techniques are needed in order to determine the efficiency of this systems [1]. Keep efficiency of electrical power system in high level is the effective process to make electrical network under control. This process based on comparison of production with actual working time hours. The accuracy rating of high voltage network has generally comprised transmission and generation system. The transmission line formed to assure a favorable power move from the generation station to customers, furthermore, is analytical accession are the two methods of techniques handled properly with power system [2]

The relationship between power station and load must be solid to avoid over load through usual operation this means additional generation energy required and additional transmission line [3]. There many researchers deal with efficiency of electrical power networks [4] proposed method to calculate the efficiency of part of Iraqi super grid electric network 400 KV to find a weak point. To avoids use of iterative techniques, Fussell [5] discusses a new approach which gives approximate calculations to predict the reliability indexes for repairable and non-repairable systems. To calculate the availability of electrical network grid [6] discuss the effect of failure rate on by take into account part of Iraqi (Baghdad North) network then adding other connections between Mosul and Kirkuk. so that [7] presents a new study to estimate performance of Iraqi super grid 400 KV after being divided into three areas; Iraq north areas, Iraq south and middle of Iraq using the Markov technique which is contributed to reduce the tie sets method then compared the results with the fault tree technique. In this paper the efficiency of Iraqi electrical power network.

2. Methodology

The proposed techniques include the following steps:



For safety analysis and design, cut series method is introduced in current work. Its provide an important information that needed to calculate the reliability of electrical network. It takes into account general event conditions leading to system shut down. Figures below helps to show a group of components, which fail in order to lead damage all paths between the input of the high voltage network and the output network. System defect will happen when any of given group of components is cut and this is known as a minimal disconnect later the whole power system will go to failure. This method is a strong method to describe the efficiency of a power system [8].

2.1. Keep Track of Route Method

As the Electrical grid becomes more complex, as in the study of high voltage network it becomes more difficult to determined minimum disconnect. Follow the tracks between load center and the generation station under consideration will help to solve this problem [9].

The steps of this method as follows:

1. Determine the minimum disconnect by the track of the load flow direction.
2. Put all the components of each Track in matrix.
3. So, first event will consider when any column in matrix is composed from elements of non-zero, while the second event happen when, combining two columns with non-zero elements in In same manner combining three columns with non-zero elements in this result three event. Rabbet the above steps until high event of a minimum disconnect has been reached.

2.2. Vesely Algorithm

To estimate the efficiency of a system one or more numerical techniques are needed. In this work vesely algorithm was suggested for this purpose. Algorithm procedure introduced by [6] that can be implemented to estimate efficiency of the parameters. Matlab code has been used to calculate the required parameter as illustrated in the following numerical steps:

$$\xi_a = f_a * M_a \quad 1$$

$$\xi_s = \prod_{a=1}^n \xi_a \quad 2$$

n: number of the first stage in minimum disconnect.

a: first stage in the minimum disconnect.

f_a : Fault rate of the first stage.

M_a : average dead time of the first stage.

ξ_a, ξ_s : Unavailability of the first stage and minimum disconnect.

F_s : PDF of the first stage of minimum disconnect.

Q_s : non-Probability of the first stage of minimum cut set.

$$F_s = \xi_s \prod_{i=1}^n \frac{f_a}{\xi_a} = \xi_a \quad 3$$

$$Q_s = \int_0^t F_s(t) dt \quad 4$$

$$A_s = \frac{F_s}{1-Q_s} \quad 5$$

$$Q_t = \sum_{s=1}^N Q_s \quad 6$$

A_s : Fault rate of minimum disconnect.

N: number of minimum disconnect.

Q_t : non-Probability of major stage.

Q: non-Probability for the limit time.

P: Probability work of full system.

t: the limit time.

η : efficiency of overall system

D: Average working days of power system.

$$Q = Q_t * t \quad 7$$

$$P = (1 - Q) \quad 8$$

$$D = \frac{P * t}{24} \quad 9$$

$$\eta = P * 100 \quad 10$$

3. Result and Discussion

Power system can be dividing into three sections: generation, transmission and substation distribution system. In general, the most systems of power station are connected with transmission system its 400KV & 132KV high voltage network [2]. Figure 1 shows 400KV high voltage power network in Basra it consists of:

1. Generation power stations (P.S) (Nassiriya P.S., Khor-Alzubair P.S. and Hartha P.S.)
 2. Sub Stations (S.S) (Khor-Alzubair S.S. and Hartha S.S.)
 3. Transmission Line (T.L) (Nassiriya - Khor-Alzubair T.L. and Khor-Alzubair - Hartha T.L.)
- [7].

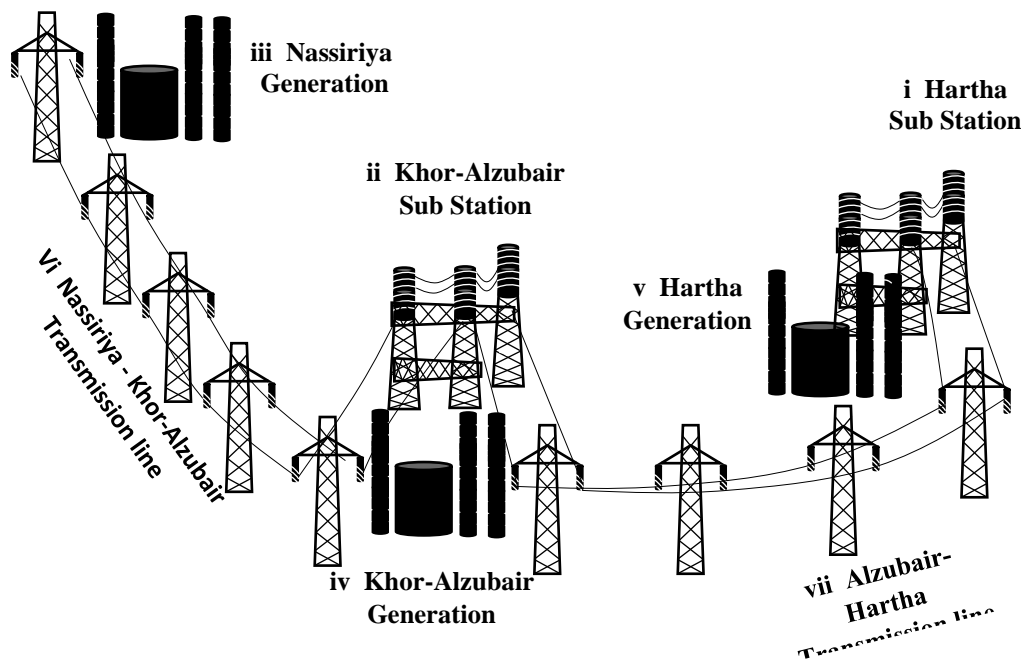


Figure 1. Diagram of High Voltage network in Basra

Power of the above stations can be described in the following table:

Table 1. Iraqi Power station Characteristics

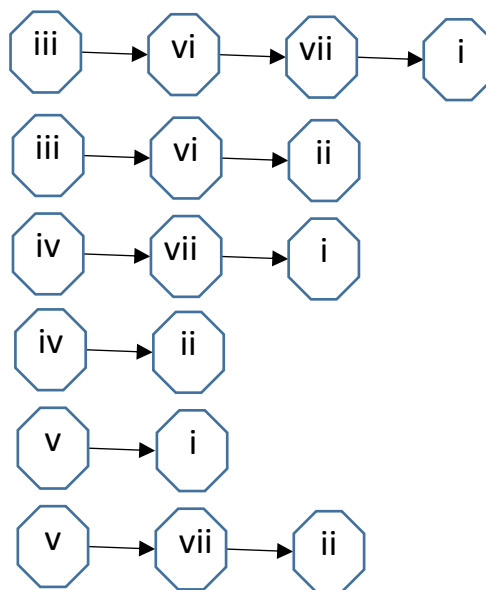
Components	General Information
Nassiriya Generation	Standard thermal power station 4*200 MW
Khor-Alzubair Generation	Standard thermal power station 2*125 MW
Hartha Generation	Standard thermal power station 4*200 MW
Khor-Alzubair Sub Station	Auto Transformer 400KV/132KV;33KV;11KV
Harth Sub Station	Auto Transformer 400KV/132KV;33KV;11KV
Nassiriya – Khor AlZubair TL	202.7KM long/ All Aluminum Alloy Conductor
Khor Alzubair – Hartha TL	54.6KM long/ All Aluminum Alloy Conductor

The adjacent matrix of high voltage network in Basra that described in figure 1 represented input data to first computer program. The input statistical data which are described in table .2.

Table 2. Input statistical Data

Symbol	i	ii	iii	iv	v	vi	vii
Fault Rate	1.522e-6	1.201e-6	1.52e-4	1.343 e-4	1.573 e-4	32.39 e-6	5.817e-6
Average Dead Time	200	200	2182.1	1317.6	2406.7	1457.2	1315.3

The output results which illustrated in figure 2 from this figure it is noted that there are cut series, the efficiency characteristics are generally dominated by the low event cut series because have high probability. The results can be used as inputs to the second program to calculate the efficiency characteristics. From the output results of second program, and from table (1), it has been noted that the dead time of components (Gen.:iii, iv, v) is very high. From analysis for load flow direction in figure.1. Keep track of route can be illustrated in figure 2.

**Figure2.** Keep track of route for high voltage network

From figure .2. the following matrix can be deduced:

$$matrix = \begin{bmatrix} 1 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 \end{bmatrix}$$

Can get minimum disconnect by Arrangement all paths matrixes, which are: (i-ii), (ii-v-vii), (iii-iv-v), (iv-v-vi), (i-iii-iv-vii), (i-iv-vi-vii). The efficiency indexes of the high voltage network can summarize by the table (2). Figure 3 shows that efficiency of electrical power network in Basra was decreased as time progresses.

Table 3. Efficiency of high voltage in Basra

Days	1	31	59	90	120	151	181	212	243	273	304	334
Efficiency %	99.8	96.8	94	90.8	87.8	84.7	81.6	78.5	75.4	72.3	69.2	66.1

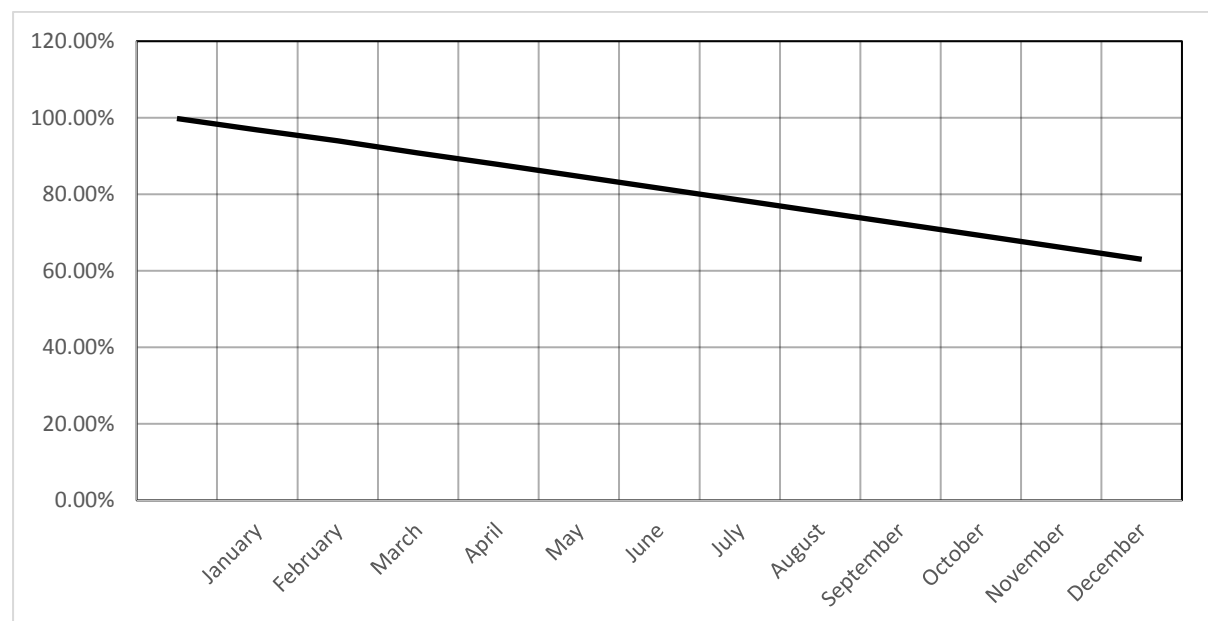


Figure. 3 Efficiency of high voltage in Basr

4. Conclusion

In current approach the results show the efficiency of electrical network go down as progress and the performance of system below the required level. There is a big difference between the required electric power energy with the actual productive. In order to improve efficiency of electrical power network, it should be increasing the electric power production that reach to the transmission lines by adding new substations.

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