Advancement in Distribution System through HVDS Concept

Vinay Chawla
M.Tech Student ,Baba Banda Singh Bahadur Engineering Collage Fatehgarh Sahib

Gursewak Singh Brar, PhD
EED, Baba Banda Singh Bahadur Engineering Collage Fatehgarh Sahib

ABSTRACT
In India, the average transmission and distribution losses have been officially indicated as 23% of the electricity generated. There as on for high losses is the use of low voltage for distribution as in the low voltage system; the current is high and thus more losses. This paper proposes a method, which is used to find minimum losses in distribution system. In which shifting of existing low voltage distribution network to high voltage distribution (HVDS) and Network Reconductoring then, comparing boththe systems in terms of losses. In over all economic point of view, annual savings and payback period is also determined. Thus by using high voltage for distribution we can reduce the losses as current in HVDS(high voltage distribution system) is low**.**

Keywords
Distribution transformer (DTR), high voltage distribution system (HVDS),low voltage distribution system(LVDS), power losses, annual Saving ,payback period.

1. INTRODUCTION
1.1 High Voltage Distribution System
In the existing system, large capacity transformers are provided at one point and the connections to each load is extended through long LT lines. This long length of LT lines is causing low voltage condition to the majority of the consumers and high technical losses. In the HVDS project, long length LT mains are converted into 11 kV mains and thereby installing the appropriate capacity distribution transformer as near as to the end and the supply is provided to the consumer at suitable voltage level. The three phase load is feed by the three phase small capacity transformer. This results into improvements in tail-end voltage thereby, reducing losses, overloading, and distribution transformer failure and improving the efficiency of the system.

1.2 Conversion of LVDS to HVDS
In the existing system, large capacity transformers are provided at one point and the connections to each load is extended through long LT lines. This long length of LT lines is causing low voltage condition to the majority of the consumers and high technical losses. In the HVDS project, long length LT mains are converted into 11 kV mains and thereby installing the appropriate capacity distribution transformer as near as to the end and the supply is provided to the consumer at suitable voltage level. The three phase load is feed by the three phase small capacity transformer. This results into improvements in tail-end voltage thereby, reducing losses, overloading and distribution transformer failure and improving the efficiency ofthesystem

FIG.1.2 Conversion Of LVDS Into HVDS

2 LITERATURE REVIEW
Amaresh K. et al (2006) presented the minimization of losses in radial distribution system by using HVDS . the load in rural area are predominantly pump sets used for lift irregeration .the loads have low power factor and low load factor. Further,load density is low due to dispersal of loads. The existing distribution system consist of three phase 11 kv /433 volts distribution transformerswith lengthy LT lines ,in this system the losses are high ,voltage profile and reliability are unsatisfactory ,In this paper ,HVDS have been introduced with small capacity distribution transformers.Davidson I.E and IJumba(2002) discussed the optimization in a deregulated power distribution network .Power sector deregulation and its impact on power system performance is investigated. The introduction of distributed generation in network by independent power producers(IPP) is bound to have a significant effect on network losses ,voltage profile and loading limits. Earlier syudies showed that the contribution to network losses by additional model to achieve loss minimization through constrained power flow and optimal sitting of distributed generatorsin a mult-bus distribution network.

Mutale J .et al (2000) presented the allocation of losses in distribution system with embedded generation .Dificiencies in present –day loss allocation practice are demonstrated using as an example the substitution method applied in England and Wales to evaluate the impact of embedded generation on losses .Two new loss allocation scheme are proposed ; one based on the allocation of marginal losses and other on the allocation of totol losses.Sampath et al.(2011) discussed the minimization of power losses in distribution system through HVDS concept .in India there is aneed to improve the quality and economy of electricity distribution process which has increased varying from year yo year. In overhead network ,the limiting factor to load carrying capacity is generally the voltage reduction. To imorove the quality of supply one of the recommendations is the implementations HVDS.under this system HT distribution system with small capacity single phase trabsformer. i.e 25 kva and to extend supply to consumer through a short length of LT lines,preferale insulated overhead cable system . Losses in the existimg system are as high as 30% (approx)Paruchuri V and Dubey S. (2012) discussed an approach to determine non technical energy losses in India .this paper present a new methodology based on smart metering and advanced communication protocols to identify NTL due to theft as tampered or malfunctioning meter.

3 PRESENT WORK

Uttar Haryana Bijli Vitran Nigam Limited (UHBVNL), a Govt. of Haryana undertaking undertakes the Power Distribution and Retail Supply Business in the Northern Parts of Haryana and covers 11 districts of Haryana through 10 no. defined Operation Circles. HVDS was initiated during FY 2008-09. UHBVN took up HVDS projects in the four circles of UHBVN that is Kaithal, Karnal, Kurukshetra & Rohtak under “Apna Transformer Scheme” with an objective to provide better quality power supply, reduction of losses and better consumer service. HVDS project is to reconfigure the existing Low Voltage Network as High Voltage Distribution System, wherein 11 kV line is taken as near to the load as possible and the Low Voltage Supply is fed by providing an appropriate capacity transformers and minimum length of LV line. The prevailing Low Voltage in the line also affects the efficiency of the pump sets and the failure rates of motors. Also there is a possibility of unauthorized IP set connections to hook the LV lines, which results in overloading of the transformers and failure in highly overloaded ones. Scheme envisaged for covering about 1.33 lacs existing AP connections under 4 circles of UHBVN. The work orders for converting about 1.22 lacs existing LT AP connections to HT on turnkey basis were issued to various firms.HVDS is implemented in order to minimize losses and to improve quality of supply. Here HVDS is implemented nearer to the load and small size transformer of capacity 6.3, 10, 15,20,25,40 kVA are erected and supply is released with LT lines

4 CASE STUDY

Case study of 33 kV Mathana Substation was undertaken. In this thesis one receiving station namely Mathana receiving station is considered which has five 11 kV feeders. Loss calculation is done for 11 kV Charpura feeder of 33 kV Mathana substation.

4.1 11 Kv Charpura Feeder

- No of connection = 144
- Agreement load on feeder = 1975 kW
- Number of DTRs = 38
- Capacity of DTRs =2970 kVA [(100x20) + (63 x13)+(25x5)
- Energy pumped =1.87 lac units

4.2 Calculation of Power Losses, Voltage Regulation

Line loss in KW = [{ cum load in KVA /(1.732 * voltage in KV * DF)}^2 *line length in Km
* Resistance constant] /1000
Line loss in units = [{ cum load in KVA /(1.732 * voltage in KV * DF)}^2 *line length in Km

* Resistance constant * LLF * 8760] /1000
Voltage = 11 kV
Diversity factor =1.5
Load factor (LF) = Annual energy consumption / (peak load * 24 * 0.9 *365 *1000) =0.36
Line loss factor (LLF) = (0.2 * L;F)+ (0.8 * (LF^2)) = 0.8
Formula For Calculate Voltage Regulation :-
Percentage Voltage regulation ,V.R = [Moment (KVA-KM) * R.C] /D.F
Where D.F =Diversity factorR.C = Line Regulation constant

5 RESULTS AND DISCUSSION

5.1 Calculation of Payback Period of Network Reconductoring

The total cost of network reconductoring i.e thickening the conductor is estimated in equation. The total capital outlay include the cost of material ,Cost of labour charges ,cost of transportation charges and also the cost of storage and handling .

Total capital outlay = Rs.1290850

Annual loss reduction in units = 0 .73921

Units price = Rs.6 /unit

Annual saving = Annual loss reduction in units X Units price

= 0 .73921x 6 = 4.43 lacs

Payback period = Total capital outlay / Annual savings

= 1290850 / 4.43 = 2.91 years

5.2 Calculation of Payback Period of HVDS Work

The total cost errection of DTs and of reconductoring i.e thickening the conductor is estimated in equation .the total capital outlay include the cost of material ,Cost of labour charges ,cost of transportation charges and the cost of storage and handling .
Total capital outlay = Rs.7357980
Annual loss reduction in units == 0.97721
Units price = Rs. 6 /unit
Annual saving = annual loss reduction in units x units price = 0.977721x 6 = 5.8 lacs
Payback period = Total capital outlay / Annual savings = 73.47980 / 5.8 = 12.6 years

6 CONCLUSION

By comparing the two methods for reduction of losses we found that HVDS method has more payback period than Network Reconductoring but losses are reduced much greater than network reconductoring. HVDS scheme has led to the formulation of new strategy of energy conservation and minimisation of transmission and distribution losses by reducing the power theft. The adoption of HVDS has been indicated as the necessary factor in efficient energy distribution and developing the proper utilization of electricity and efficient distribution of energy in agricultural sector thereby, tackles the problems faced by the farmers. It reduce thefailure of transformers, burning of agricultural pump sets and curtailment of demand through retrofitting of energy-efficient pumps. This in turn, reduced the wastage of energy and optimization of power intake, thereby promoting the environmental concerns and because of reduced consumption, the farmer gets benefited by the reduction in his monthly expenditure on electricity. It is concluded that the use of distribution transformer of small rating for two or three consumers has reduced the outages, transformer and power losses due to low current and pilferage to a great extent. Also, the accountability of the farmer has increased resulting in moral ownership of the transformer dedicated to single pump.

7 REFERENCE

[1] Mutale J ,Strbac G ,CURIC S ,and Jenkins N (2000) "Allocation of Losses In Distribution System With Embedded Generation" IEEE Proceeding of generation ,Transmission and Distribution, vol. 147 ,issue1,pp. 7-14.

[2] Amresh K . Sivanagaraju S and Sankar V (2006) , "Minimization of Losses In Radial Distribution System By Using HVDS,"IEEE Power Electronics Drives and energy Systems PEDES ,International Conference ,Dec. 2006, pp. 1-5.

[3] Davidson I.E and IJumba (2002) "Optimization In A Deregulated Power Distribution Network" 6th IEEE Africon Conference in Asia(AFRICON) , Africa, vol. 2,pp.887-894.

[4] Kumar Sampath S. A . Vasudaven V, antony j. Raju Madhu sudhan and Ramesh L.(2011) "Minimization Of Power Losses In Distribution System Through HVDS Concept" International Conference on sustainable Energy and Inyelligent System , Chennai,India,pp 86-90

[5] Paruchuri V and Dubey S. (2012) " An Approach To Determine Non-Technical Energy Losses" 14th International Conference on Advanced communication technology,pp 456-461.

8. AUTHOR PROFILE

Vinay Chawla
Received B.Tech Degree in Electrical Engineering from Sri Sukhmani Engineering College,Derabassi,Mohali in 2010

Dr .Gursewak Singh Brar
Associate professor and Head of Electrical Department in Baba Banda Singh Bahadur Engineering College , Fatehgarh Saheb has received B.Tech, M.Tech and P.hd degree's in 1996,2001 and 2010 respectively