ESTABLISHING 110/11KV, 1X10MVA SUBSTATION AT ULLUR

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Abstract—: In this paper, the importance of Establishing substation and process of establishing substation are presented in detail. Many urban and rural utilities are evaluating and upgrading the transmission and distribution system to provide adequate and reliable power to meet their growing business and residential area needs. Limited areas for new substation in congested areas, the requirement to obtain city permits and community approval, as well as the need to provide uninterrupted service to customers during construction, requires innovative, flexible and cost-efficient substation designs. The results & vital information generated through these activities are documented. The Energy Auditing for a day is the index of the consumption which normalizes the situation of Energy crisis by providing the conservation schemes.

Index Terms: Substation, Load Center, Existing system, Estimated cost, Annual Energy Loss

I. INTRODUCTION

As Electric Substation is a subsidiary of an electricity generation, transmission, and distribution system where voltage is transformed from high to low or the reverse using transformers. Electric power flows through several substations between generating plant and consumers changing the voltage level in several stages.

A Substation that has a step-up transformer increases the voltage with increase in the current for domestic and commercial distribution. The word substation comes from days before the distribution system became a grid. At first substation were connected to only one power station where the generation was housed and were subsidiary of that power station.

In all these systems, the power flow of electrical energy takes place through electrical substation. An electrical substation is an assemblage of electric components including busbars, switchgear, power transformers, auxiliary, etc. Basically, an electrical substation consists of a number of incoming or outgoing circuits are connected. Each circuit has certain electrical components such as circuit breakers, isolators, earthing switches, current transformers, voltage transformers, etc. These components are connected on a definite sequence such that a circuit can be switched off/on during normal operation by manual/remote command and automatically during abnormal conditions such as short circuits.

A substation receives electrical power from generating station via incoming transmission lines and delivers electrical power via the outgoing transmission lines and delivers electrical power via the outgoing transmission lines. Substations are integral parts of a power system and form important links between the generating stations, transmission and distribution systems and the load points.

A Substation will consist of several components, including power transformer, switchgear, control and protection equipment metering and communication equipment, and auxiliary power supply equipment. The power transformer will be used to step down the incoming 110KV to 11KV for distribution to customers. The switchgear will be used to control the flow of power through the substation and to isolate faulty equipment will monitor the substation and ensure safe and efficient operation.

The metering and communication equipment will be used to monitor the power flow through the substation and to communicate with the utility control center. The auxiliary power supply equipment will provide backup power to the substation in case of a power outage.

Overall, the establishment of a 110/11KV, 1x10MVA substation is a complex that requires careful planning and execution to ensure reliable and efficient operation of the electrical infrastructure.

II. RELATED WORKS

The objective of the proposed system is to transmit some important signals from the 33/11 kv distribution stations via optical cable (McDonald 2003c), provide secure communication transmission (Thomas 2010), prevent interference and interference (Boyer 2009), speed of information (Shaw 2021), improve the work system in monitoring secondary stations and help in setting strategic plans for the development of the energy distribution sector (Thomas et al. 2004). The SCADA system contains four components (Grigsby 2018), the first of which is the remote terminal unit (RTU) which is the field control system link, to obtain data from the secondary stations and to pass control system link, to obtain data from the secondary stations and to pass control commands (McDonald 2003b).[1]

With a growing trend in transmutation of traditional electromechanical distribution system into a fully intelligent networks, many utilities around the globe have made or in the verge of adopting smart grid technologies in their system monitoring, control, and operation tasks. Such initiatives are fulfilled by a large area within the three hierarchal levels of generation, transmission, and distribution sectors.[2]

This paper discusses the 21st century substation design requirements, which should meet the following criteria: improved reliability, cost, interoperability, reconfigurability, security, controllability, and flexibility. Such criteria require designs that use new mythologies quite different from the existing philosophy. The design strategies are focused on reducing cost while maintaining the performance, or maintaining cost while improving performance. Based on the considerations mentioned above, we proposed three design approaches: a) retrofitting the existing substations by replacing legacy equipment with new technologies without disrupting continuity of service, b) implementing brand new substation design using of-the-shelf technologies, and c)

envisioning green-field substation design considering energy market, profitoptimization and system-operation/price.[3]

In this paper, research on the classification of substation background information thus helping the overall monitoring of the whole electrical system. At first, the exiting defaults in present substations are analyzed including the low efficiency, inconsistent standards, and low automation level. As a result, there are many hidden dangers in the substations, which threat the whole electrical system. As a remedy, we proposed several ways to handle these defaults directionally. First, all the background information is classified into several categories with different priorities. Therefore, the workers could deal with the important issues at first to avoid the failure of the whole system.[4]

A smart Grid is the recognized and established aim of future grid of future grid throughout all countries in the world. In smart grid, SMART stations play the key technologies that are about to make it smart. In the recent years, especially the intelligence of equipment has attracted an increasing amount of attention are costly and are also difficult to maintain since they are dispersed in one unit. The functionality optimization and device integration are the important point to be considered in the development of smart substation. This paper compares few of the methods mainly based on IEC61850 Standard and communication technologies. The methods to be evaluated here are like “three layers & two net-works” and “based on RTE”, “SCADA based substation “with ICS. These methods deal with applications, communication protocols, architecture, information standards largely focusing on substation automation in transmission and distribution field. At the end of this paper, most reliable and accurate methods for the establishment of the smart substation are evaluated and identified.[5]

In order to establish a base for the Vattenfall group R&D-activities within the substation area a study with the aim to create a vision of the future regional substation has been conducted. A great number of group specialists from different countries have been involved in the innovative work to ensure that the design fulfil future requirement from customers, authorities and owner. Substation using power electronics has in long-term been found most suitable to meet relevant demands.[6]

III. EXISTING SYSTEMS

An electric is a substation is a subsidiary of an electricity generation, transmission and distribution system where voltage is transformed from high to low or the reverse sensing transformers. Electric power flows through several substation between generating plant and consumer the voltage level in several stages

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In all these systems, the power flow of electrical energy takes place through Electrical Substation. An Electrical Substation is an assemblage of electrical components including busbars, switchgear, power transformers, auxiliaries, etc. Basically, an electrical substation consists of several incoming circuit and outgoing circuit connected to common busbar system. Busbars are conducting bars to which several incoming or outgoing circuits are connected. Each circuit has certain electrical components such as circuit breakers, isolates, earthing switches, current transformers, voltage transformer, etc. These components are connected in a definite sequence such that a circuit can be switched off/on during normal operation by manual/remote command and also automatically during abnormal conditions such as short-circuits.

A substation receives electrical power from generation station via incoming transmission lines and delivers electrical power via the outgoing transmission lines. Substations are integral parts of a power system and form important links between the generation stations, transmission and distribution systems and the load points.

IV. PROPOSED SYSTEMS

Establishing a 110/11KV, 1*10MVA substation requires careful planning and execution to ensure that the power distribution system is efficient and reliable. Here is a proposed system for establishing such a substation:

Site Selection: The first step is to select a suitable site for the substation. The site should be easily accessible and located near the load center. It should also have enough space to accommodate the substation equipment and provide for future expansion.

Equipment Selection: The next step is to select the equipment required for the substation. The major equipment includes transformers., circuit breakers, isolators, lightning arrestors, and control and protection equipment. The equipment should be of high quality, reliable, and meet all the required standards.

Design and Engineering: The substation design and engineering process should be carried out by experienced engineers. The design should take into consideration the power demand, voltage level, and system configuration. The layout should also be optimization for easy access and maintenance.

Construction: Once the design is finalized, the construction process can begin. This includes excavation, foundation work, equipment installation, and commissioning. All work should be carried out according to the design and engineering specifications.

Testing and Commissioning: After the construction is complete, the substation should be thoroughly tested and commissioned. This includes functional testes, insulation tests, and protection tests. The commissioning process should be carried out by qualified personnel.

Operation and Maintenance: Once the substation is commissioned, it should be operated and maintained regularly. This includes periodic inspections, cleaning, and testing. Any faults or defects should be repaired immediately to ensure reliable operation of the substation.

Overall, establishing a 110/11kV, 1*10MVA substation requires careful planning, execution, and maintenance. By following these steps, you can ensure that the substation is efficient, reliable, and meets all the required standards.

V. EXISTING DISTRIBUTION NETWORK

Ullur village is situated at 25kms from Sagara Taluk Head Quarters. At present the area in and around ullur village is fed through 11KV feeders namely F-9 ullur feeder from 110/11KV Substation at Anandpura, F-6 Thyagarthi from Sagara Substation.

At present existing 110/11KV SS1 line is feeding from 110/11KV Sagara substation substation with recorded Peal load of 288 Amps. 110/11KV Sagara has got installed capacity of 2x100MVA,110/11KV power transformer and 2x20MVA, 110/11KV power transformer. Existing 110KV SS1 line is also feeds to110/11KV substation.

VI. PARAMETERS OF THESE 11KV FEEDERS

Name of the Substation	Name of the feeders	Length of the feeders in kms	Total load in KVA	Peak load in Amps
Sagara	Ullur	21.98	6937	228
Anandpura	Thyagarthi	18.48	6191	177

VII. PROPOSAL MADE

Ullur and Thyagarthi Sections Limits mainly consists of domestic loads, small Industry Plants etc. Water Supply installation and rapidly developing Irrigation Pump sets load etc. There is huge scope for developments in and around Ullur and Thyagarthi Sections Limits. Numbers of Irrigation Pump sets are developing day by day with load demand and 2 substations overloaded.

The power supply to portion of Ullur and Thyagarthi Sections are being catered from 110/11KV Sagara, 110/11KV Anandpura substation.

Power supply to the Ullur and Thyagarthi section at present is catered from 1X10MVA, 110/11KV Sagara,1X10MVA,110/11KV Anandpura substation. The existing feeders namely F9 ullur, F6 Thyagarthi overloaded. The peak load recorded is 228A, & 140A respectively. The tail end voltage regulation is also poor. These 11KV feeders from 110/11KV Sagara substation is having poor voltage regulation of 12.12%, 9.33% which is also beyond the permissible limits. Apart from the above, there are domestic loads, small Industry Plants etc. Water Supply installation and rapidly developing Irrigation Pump sets load etc. for which there is a demand for additional electricity to an extent of 9000 KVA. Further the residential layouts are coming up.

The existing 11KV feeders are overloaded and facing Low Voltage problems due to the feeders being very lengthy and due to over load. The consumers at the tail end point are unable to run their Industries and IP sets during peak hours. Due to frequent interruption continuous power supply is not provided to Industrial & IP set continuous. No corridor is available to draw new feeder or link line and it is too difficult to obtain approval from Forest department & difficulty is experienced in drawing Double Circuit line to maintenances necessity clearance. Hence the proposals for establishing 1X10MVA, 110/11 KV Sub Station at Ullur with 3 numbers of 11 KV feeders. In view of the above, to cater quality and reliable power supply and to meet the future load growth establishment of the substation at Ullur is essential. At existing 110/11 kV Sagara and Anandpura Substation mainly there is no space to provide to additional breaker and take out 11 KV line as it needs to run in populated area and dense forest. So, running express feeders is not possible in this case.

Following alternatives have been studied

a) ALTERNATIVE 1 - Bifurcation of existing feeders and re-conductoring

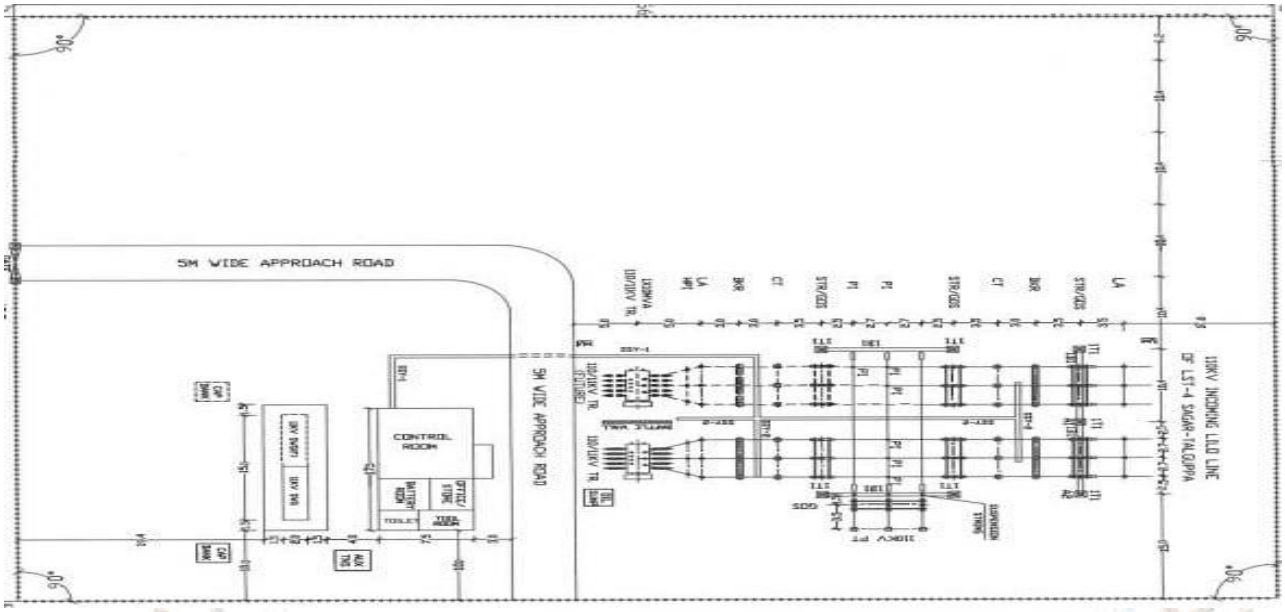
It has been examined by bifurcating the existing feeders by drawing express line and reconductoring the existing conductor by rabbit ACSR. Even then the VR could not be brought with in the permissible limit.

Name of the Substation	**Name of the feeders**	**AEL in MU**	**VR%**
Sagara	Ullur	0.63780	10.98
Anandpura	Thyagarthi	0.95200	8.85

b) ALTERNATIVE2 - Constructing link line for existing 11KV

Name of the substation	**Name of the feeder**	**AEL in MU**	**VR%**
Sagara	Ullur	0.49280	6.38
Anandpura	Thyagarthi	0.88900	5.03

VIII. LAYOUT



c) ALTERNATIVE 3 - Proposal for establishing 110/11 KV substation:

Establishing 1X10 MVA 110/11 KV substation at Amrutha Village results in the following advantages.

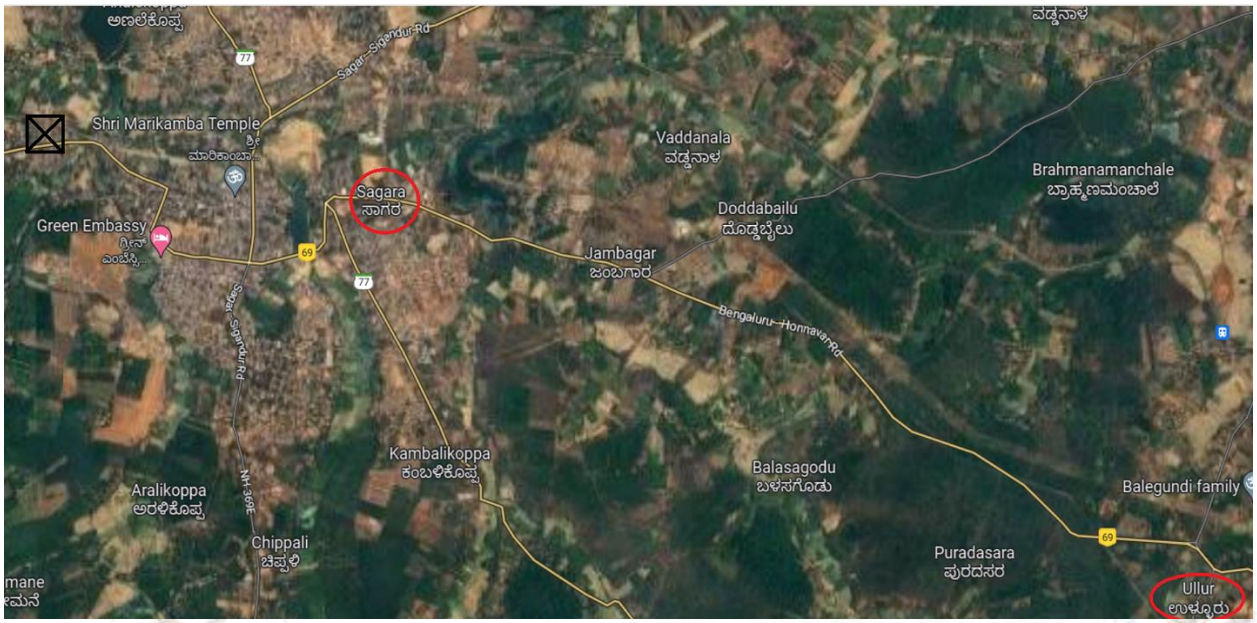
I. The Voltage regulation would be order of 3.77 %, 4.32%, For the Proposed feeder and 12.12%,9.33% Residual feeder.

II. Annual Energy saving is 1373934 Units(13.73MU) , BCR works out to 1.42

IX. ESTIMATED COST

PARTICULARS	AMOUNT IN RS
Material cost	3,43,44,000
Spares at 3% on material cost	34,52,100
Erection charges	14,38,200
Applicable GST on erection charges	2,46,38,000
Testing and commissioning charges	2,54,49,466
Applicable GST on Testing and commissioning charges	91,456
Total cost	89413222

X. EXISTING SUBSTATION



XI. PROPOSED STATION

XII. SUMMARY OF ALTERNATIVE 3

- Total load on new sub-station will be 8025 kVA.
- Annual energy savings will be 1.814837 MU/Annum.
- Approximate cost of the project is Rs 890 Lakhs.

CONCLUSION

The importance of Establishing substation and process of establishing substation are presented in detail. Many urban and rural utilities are evaluating and upgrading the transmission and distribution system to provide adequate and reliable power to meet their growing business and residential area needs. Limited areas for new substation in congested areas, the requirement to obtain city permits and community approval, as well as the need to provide uninterrupted service to customers during construction, requires innovative, flexible, and cost-efficient substation designs.

The metering and communication equipment will be used to monitor the power flow through the substation and to communicate with the utility control center. The auxiliary power supply equipment will provide backup power to the substation in case of a power outage.

Overall, the establishment of a 110/11KV, 1x10MVA substation is a complex that requires careful planning and execution to ensure reliable and efficient operation of the electrical infrastructure.

The voltage regulation of existing two feeders is in the order of 12.12%, 9.33% but it should be the order of 4.32%,3.65%. If the substation is installed in ullur section voltage regulation order will be reduced to 6.56%, 4.33%.

Improvement after installing new substation is:

1. Tail end Voltage improved
2. Interruption is reduced.
3. System losses are reduced.
4. Reliable and quality power supply to the consumers.
5. Future load growth can be met.

ACKNOWLEDGEMENTS

1) Ahmed T. Jaiad The Ministry of Electricity / General Electricity Distribution Company of the Middle and DR. Syed Vahab AL-Din Makki Razi University, Iran.

"Implementation of SCADA System for DATA Transmission 33/11KV Substation", 2019

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3)Yufan Guan Electrical and computer Engineering Texas A and M University College Station, TX, USA. "The 21st century substitution design vision of the future, 2020".

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