



MODELLING OF 11kV OF SPINNING MIL

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ABSTRACT:

In this paper a detailed modelling of 11kV of Spinning Mill is presented with the Digital Simulation and Electrical Network Calculation Program DIgSILENT Power Factory software. This work focuses on the detailed monitoring by using the most modern DIgSILENT Power Factory software, from High Voltage Substation (HVS) to the loads. The capability and effectiveness of modelling the system are demonstrated with

DIgSILENT Power Factory by applying it to the actual distributed power system of Spinning Mill. It provides all the necessary functionality to conduct complex studies for the integration of renewable generation into distribution, transmission and industrial networks, which is nowadays one of the key issues in network planning and analysis.

Key Word: DIgSILENT, High Voltage Substation, Distributed Power Systems

I. INTRODUCTION

One of the most common computational procedures used in power system analysis is the Modelling of system. They are used in planning studies to determine if and when specific elements will become overloaded. These load flow solutions are performed using computer programs designed specifically for this purpose. In operating studies, Modelling of system is used to ensure that each generator runs at the optimum operating point; demand will be met without overloading facilities and maintenance plans can proceed without undermining the security of the system. Some examples of the uses of Modelling of system are to determine the Component or circuit loadings, Steady-state bus voltage, Reactive Power flows, Transformer tap setting, System losses, Generator exciter/regulator voltage at set points and Performance under emergency conditions.

As the load distribution, and possibly the network, will vary considerably during different time periods, may necessary to obtain load flow solution representing different system condition such as peak load, average load, or light load. These solutions will be used to determine either the optimum operating modes for normal conditions, such as proper setting of voltage control devices, or how the system will respond to abnormal conditions such as outage of lines or transformers. Because the load flow problem pertains to balanced, steady state operation of power systems, a single-phase, positive sequence model of the power system is used. Three-phase load flow analysis software analysis software is available, but it is not normally needed for routine industrial power system studies. Modelling of system that can practically be experienced on the actual system. The study of load flow involves the following three steps: i) Modelling of power system components and network. ii) Development of load flow equations. iii) Solving the load flow equations using numerical techniques.

Power Factory is a leading power system analysis software application for use in analyzing generation, transmission, distribution and industrial systems. It covers the full range of functionality from standard features to highly sophisticated and advanced applications including wind power, distributed generation, real-time simulation and performance monitoring for system testing and supervision. Power Factory is easy to use, fully Windows compatible and combines reliable and flexible system modelling capabilities with state-of-the-art algorithms and a unique database concept. Also, with its flexibility for scripting and interfacing,

Power Factory is perfectly suited to highly automated and integrated solutions in your business applications. The transmission grid is currently undergoing a major change to reliably accommodate increasing amounts of non-dispatchable resources. Power factory offers a complete suite of functions for studying large interconnected power system and addressing new challenges and emerging needs.

Different phasing technologies, such as single-wire earth return, two-phase bi-phase or classical three-phase systems, have created need for multi-distribution power system modelling. Power Factory provides comprehensive modelling features for studying all kinds of electrical networks. To ensure continuity of production and safety of personnel, the proper operation of industrial networks is of utmost importance. Power Factory offers a vast array of functionality perfectly suited to industrial user's and needs.

Fei Zheng described a large number of PV power station integrated to the grid, some problems such as the grid-connected stability, relay protection, etc. brought out by it. In this paper, dynamic modelling and control strategy of grid connected PV power stations were researched based on DIGSILENT. Ahmed S. Al-akayshee presented the modelling and performance evaluation using DigSILENT Power Factory software of the 400kV National Grid in Iraq. In particular, this work is applied on Iraqi national power system and focused on the Iraqi 400kV. The Iraqi 400kV super grid has been deeply introduced by its modelling steady state simulation. DigSILENT Power Factory simulation package was used to simulate the grid model based on the real data. The performance analysis of the grid is based on the voltage profile, power losses and transmission lines loading according to the power flow results.

Kristóf Hackel described the spread of distributed generation (DG) sources which are using renewable energy, and also with the expected propagation of electric vehicles that have to be recharged, more and more inverter-based sources and loads are likely to appear on the electricity grid. One of the main issues of the penetration of these grid-tied inverters is the possible harmonic resonance formed between the inverter output impedance and the grid impedance due to the PWM switching frequencies of these inverters. Thus, to precisely model the effects that this equipment might have on the grid (in respect of grid stability and power quality), appropriate models of the inverters are required. A detailed inverter model is presented in this paper and is validated through simulations in DIGSILENT Power Factory.

In this paper the system is modelled by collecting the distribution data from Spinning Mill and the modelling for the Mill is performed with the available data, through which the effect of the changes in equipment configuration can be studied.

II. TEST SYSTEM

The planning, design, and operation of any power system necessitates thorough modeling and analysis to ensure steady-state performance under various operating conditions and to evaluate the impact of changes in equipment configuration. This modeling process is typically conducted using specialized computer programs tailored for this purpose. The objectives include seeking optimal solutions, assessing component or circuit loadings, determining steady-state bus voltages, analyzing real and reactive power flows, managing transformer tap settings and load tap changer actions, evaluating system losses and voltage drops, assessing real and reactive power demand, as well as voltage drop at utility source connections. Furthermore, the analysis considers conditions such as under-voltage and over-voltage scenarios for both buses and equipment terminals, and the system's performance during emergency situations.

In this paper, Vigneshkumar Spinning Mill private limited, which is located at Pollachi main road Kamanaickenpalayam, Coimbatore is selected for modelling and analysis. It plays a crucial role in the textile industry, as they are responsible for producing the yarn that serves as the foundation for various textile products. It receives 11kV from TNEB for their requirements. After, they are stepping down 11kV to 415V by using 2 winding transformers. Total demand of the Spinning Mill is 739.11kW. They have 4 generators for standby purpose during shutdown of power from TNEB. It consists of 32 motors with different rating according to their work nature.

III. SYSTEM REPRESENTATION AND MODELLING

A simplified visual means of representing the complete system is essential to understanding the operation of the system under its various possible operating modes. The system Single-Line Diagram (SLD) serves this purpose. It consists of a drawing identifying buses and interconnecting lines. Loads, generators, transformers, Motors etc., are all shown in their respective places in the system. It is necessary to show equipment parameters as well as their relationship to each other. The Single Line Diagram (SLD) for this project. It shows the operating condition to be studied in terms of which breakers are open or closed. Bus names are displayed along with the nominal voltages. Interconnecting lines are shown with their impedance values and lengths are entered. Motor loads are indicated separately DB-1 and combined loads into one equivalent motor based on their size and quantity. MV-1 with a rated voltage level of 0.7 kV. The MV-1 have 2 separate buses named BUS 1 and BUS 2 connected with different loads and 4 Transformers used which 4 transformers are connected between the MV-1 & BUS 1. The 4 Emergency generators are available in this project for Emergency supply to the respective loads connected to them. The Single line Diagram (SLD) for this project is shown in Annexure 1.

A bus connected between the feeder cable and a transformer is typically displayed as a node, while a bus connected to the secondary load side of the transformer is represented as a bus MV 1. By keeping the output voltage of the PV array at its MPP reference, the proposed bidirectional converter assures MPPT stability. The load side demand and the amount of solar PV electricity available

determine how switches S1 and S2 operate. when the PV array and the inverter reference power are not in synchrony Switch S1 is activated to charge the battery (in buck mode) with the excess power required to maintain the MPP, and switch S2 is activated to drain the battery (in boost mode) to satisfy the load requirement during the period of lower irradiance when the PV array's terminal voltage exceeds the MPP reference.

In modelling of system, the following assumptions are, X/R ratio of the grid is considered as 8, Two winding transformers is considered to be ON for all the cases considered for modelling of system and Transformer Tap setting is to be +/- 10% and Step is 1.25. In this operating of machine, power supply is fed from the 11 kV Grid Supply, the contract demand of the plant is 739.11 KW. This project consists of MV-1 with a rated voltage level is 0.415kV, MV-1 Bus 1 and Bus 2 have Different Loads. It has only one Transformers (T1) are used, T1 is connected between External Grid from TNEB to MV-1, In emergency conditions, 4 Generators are kept as stand by and also to meet ups load requirement of spinning mill.

Table 1: Case scenario of Working Spinning Mill

S.No	Equipment	Case 1	Case 2	Case 3
1	Grid	ON	ON	OFF
2	Transformer 1	ON	OFF	OFF
3	Generator (1 to 4)	OFF	ON	ON

Table 2: Rating of Cables

S.NO	Types of Conductor	Sq.mm	Core Type
1	Aluminum Armoured	180	3C/2C
2	Aluminum Armoured	400	2C
3	Aluminum Armoured	95	2C

To perform power flows, the first system needs to consider all the modes of operation required to keep the continuous operation in critical loads. The system model performance can be evaluated by the means of different case scenarios out of three modes of operations and also rating of cables are specified as shown in the Table I and Table II.

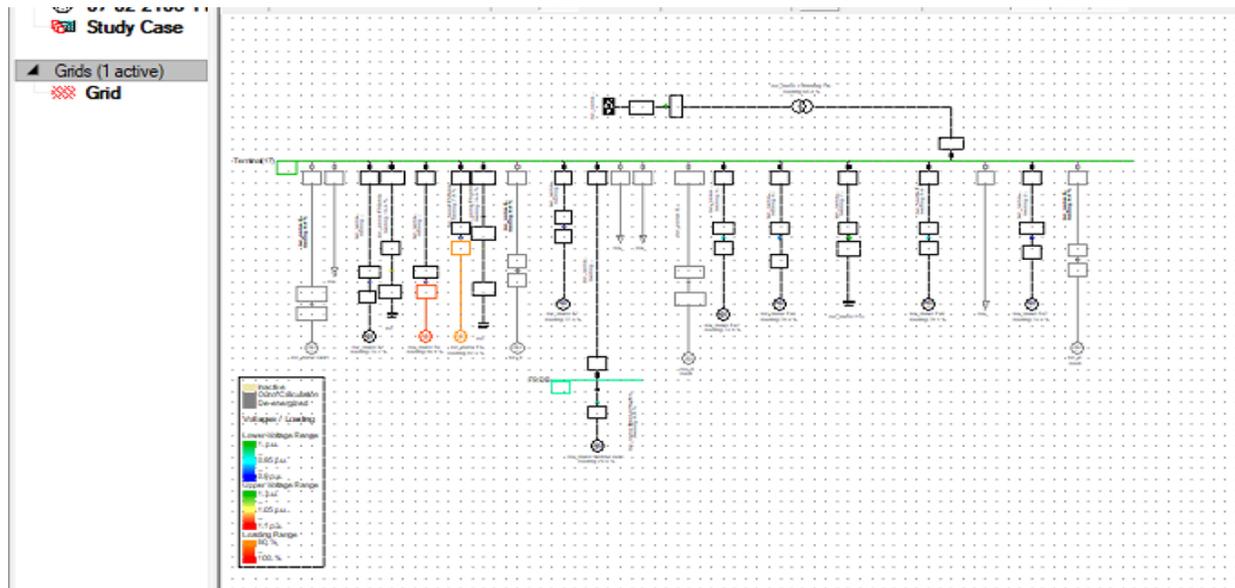


Fig. 1. DIgSILENT simulation of spinning mill with loading effect

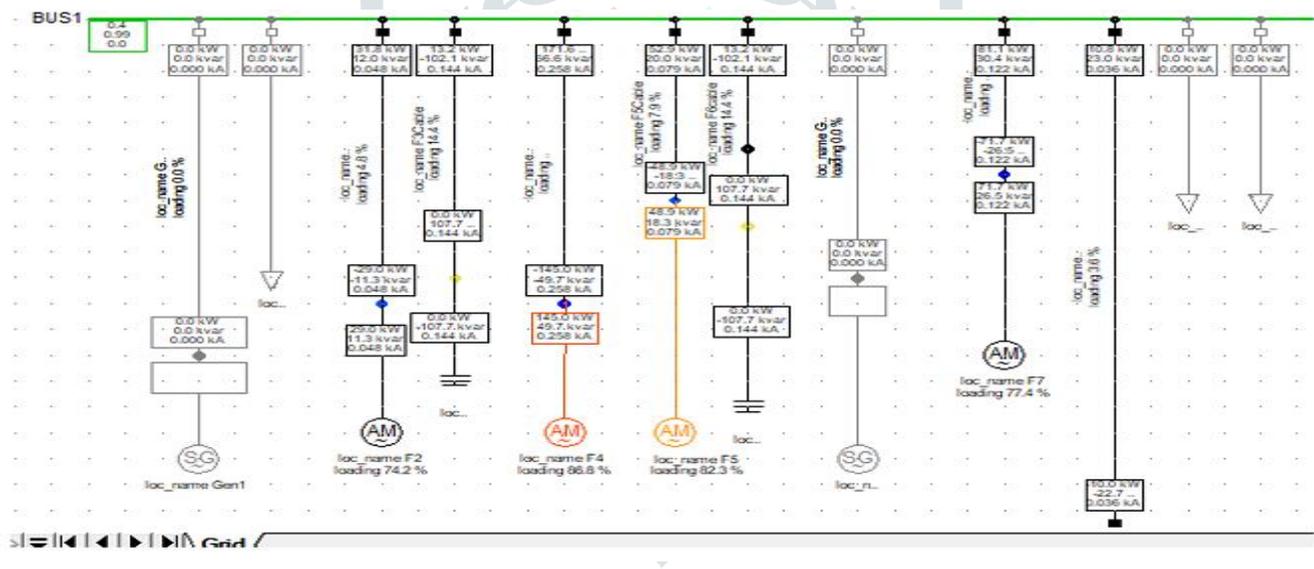


Fig. 2. DIgSILENT simulation of asynchronous machine(motor)

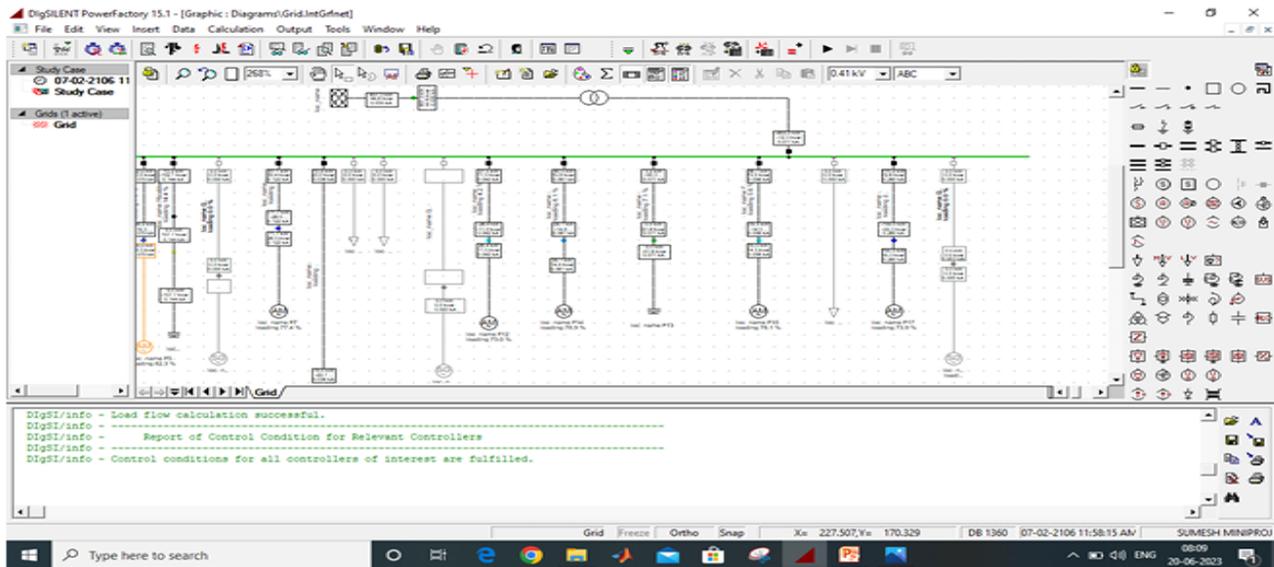


Fig. 3. DigSILENT simulation of distribution system with grid connected

The modelling is performed by DigSILENT PowerFactory using the AC Load Flow balanced positive sequence Newton Raphson method. The modelling model of Spinning Mills distribution system using DigSILENT PowerFactory is shown in fig.1. The modelling model of Spinning Mills distribution system explains effect of loading in motors DigSILENT PowerFactory is shown in fig.2. The load details before and after the modelling can be summarized. The DigSILENT PowerFactory will describes a grid connected distribution system and the modelling shown in the fig.3. The new project created in the power factory various components are modelled. How to place this component in the DigSILENT Powerfactory overview sheet can be studied. At last, the modelling of bus bar can be explained detail in DigSILENT Powerfactory software. Transmission line modelling is an important task in the power system, we will provide different parameters like resistance, reactance, length of the line, etc. The modelling of transmission line cables is shown in Fig.4

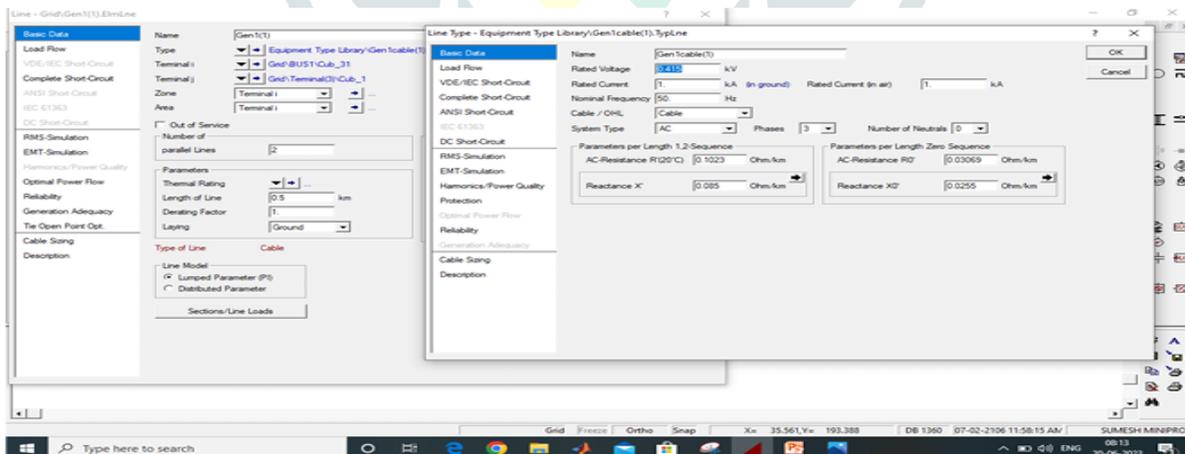


Fig.4. Modelling of cables using DigSILENT

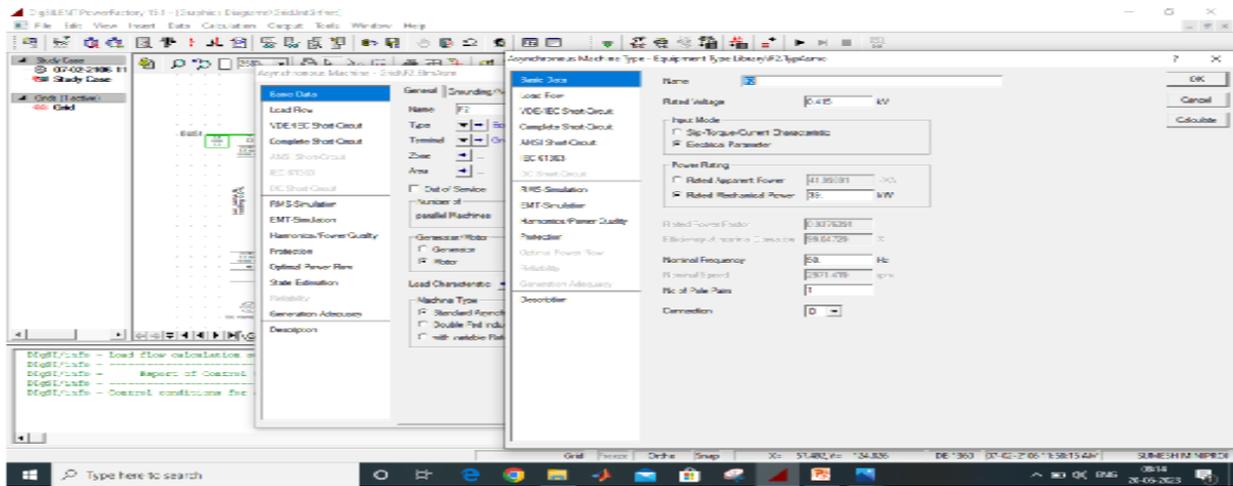


Fig. 5. Modelling of Asynchronous machine (motor) using DIgSILENT

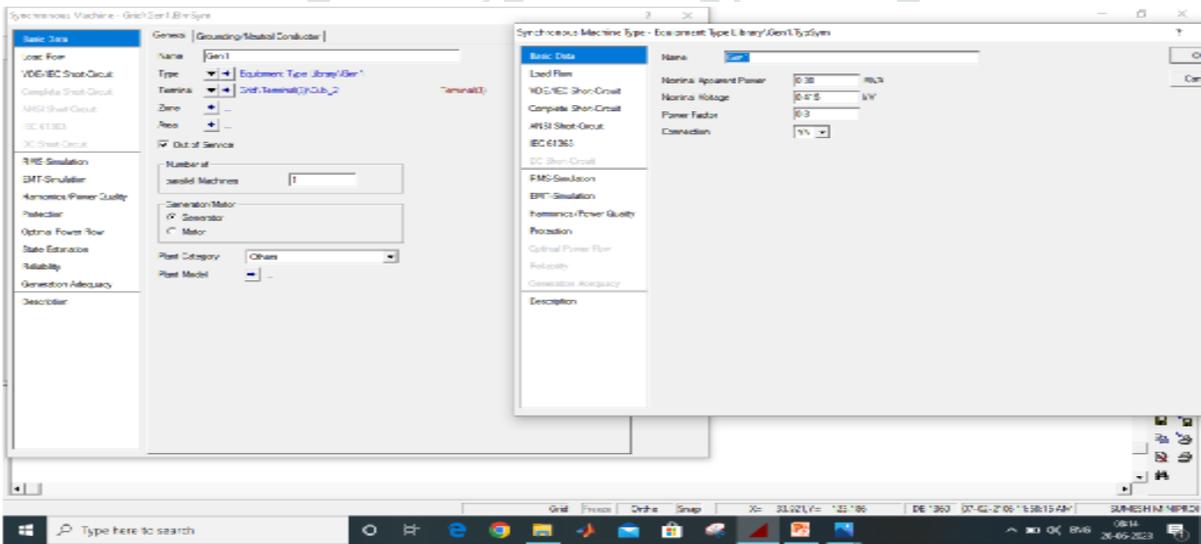


Fig. 6. Modelling of generators using DIgSILENT

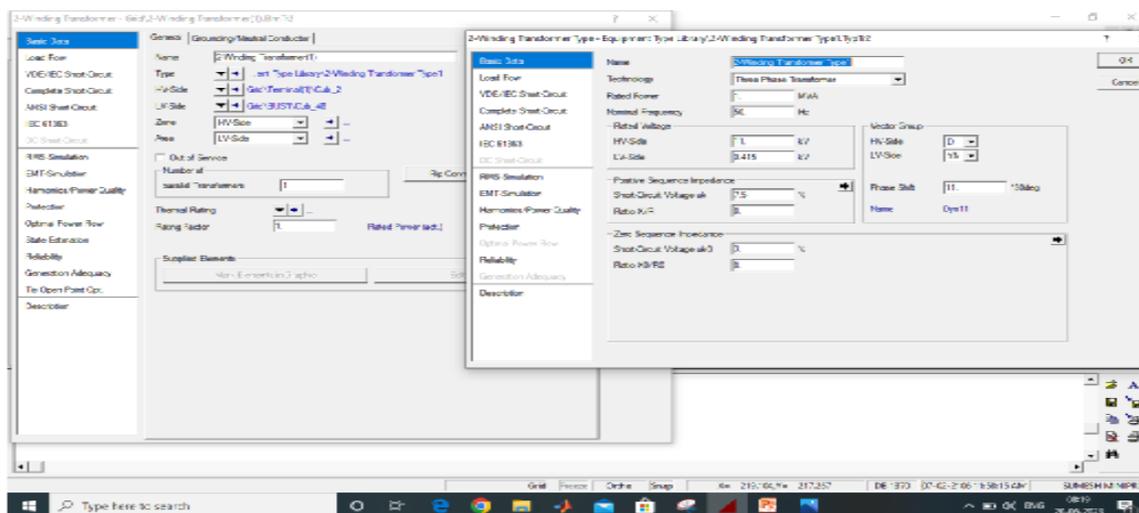


Fig. 7. Modelling of transformer using DIgSILENT

In modelling, Asynchronous consist of parameters like frequency, rated mechanical power, number of pole pairs and connections as shown in the Fig.5. The generator plays a major role in electrical power generation. Different parameters like voltage, power factor, apparent power and connection can be provided from the modelling as shown in the Fig.6. In transformer modelling as shown in Fig.7 depends on requirements the parameters like HV side voltage, LV side voltage, frequency, rated power of transformer, impedance and X/R ratio selected.

IV. CONCLUSION

In this paper by Modelling of system using data which are available in the Single Line Diagram (SLD). The main advantage of this method is the reduction of the complexity of the network and this model is useful for conducting various type of studies and also to analyze distribution system of spinning mill. The Load demand got for Spinning Mills from TNEB is 1000 kW. In that up to 739.11kW is consumed as of now. For each load, the power consumed data is collected and the modelling of system explained using DIgSILENT software.

V. FUTURE WORK

Modeling the spinning mill thorough, it is possible to analysis and study whole power system studies of the spinning mill like load flow, short circuit and relay co-ordination etc. These studies will help to check whether the spinning mill running in conditions, based on the standards and future extinction of spinning mill

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