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Real Time Tracking and Controlling Co-Generation of Plant the Use of SCADA in TNPL

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ABSTRACT: This paper deals with PIC controller based optimal power distribution in residential areas with available limited power which is most sought for the power deficiency state like Tamil Nadu. Presently Round Robin method of power supply to manage power shortage with time based power shutdown has been followed. During peak times ,the above method makes the routine human life more difficult and increase the usage of Uninterrupted power supply(UPS) system which in turn again increase the power consumption .This technique of power supply management affects regular life in fields like agriculture ,industrial ,educational institutions ,etc .to a greater extent .To overcome the above drawbacks ,a new systems has been proposed based on PIC controller for managing the deficient power .The objective of proposed system is to avoid frequent power shutdown and proper utilization available power. This will be achieved by sharing the available power equally to all the consumers without shutdown.

I. INTRODUCTION

1.1 TAMILNADU NEWSPRINT AND PAPERLIMITED:

TNPL is an acknowledged leader in manufacture of printing and writing paper from bagasse. The company has a to high speed paper machines supplied by M/s Beloit Wellesley Ltd, U.K and M/S VOITH paper, Germany. The paper machines have the unique flexibility of producing both news and printing and writing paper. Together they produces 750 tonnes of paper per day, fully backed by online process and quality control system under the recently executed, a new 300tpd state-of –the-art Hardwood Pulp Line with ECF bleaching and a 500 tpd ECF bleach plant for chemical bagasse, pulp have been installed with supporting system. The supporting system includes installation of a new recovery boiler of 1300tpd capacity, an evaporator of 352tph capacity, a 20mw turbo generator and a fully integrated a 15tpd chlorine -di-oxide plant, the largest of its kind in the paper industry. With the change over to ECF bleaching, the plant will become more environmentally complaint, operationally more efficient and cost effective. Besides, the capacitive of paper production has been increased to 245,000tonnes per annum. TNPL uses bagasse, a sugar cane residue, has primary raw materials for producing newsprint and writing paper .The usage of 1 million tons of bagasse for manufacture of newsprint and printing and writing paper prevents denudation of tress in about 40,000 acres of land every year.

1.1.1 Energy Management

TNPL has five turbo generators with a power generation capacity of 81.12 Mw including one new TG of 20Mw added under the mill development plan during the year the 2007-08. Power required for process requirement is met form the captive power generation .Surplus power is exported to the state grid.C.Nagarajan et al [2,6]studies However, with the steep increase in imported coal price, the power export to the state grid has become uneconomical .Hence, since September 2007 TNPL stopped export of TG power export a small quantity.

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1.2 COGENERATION

Cogeneration (Combined Heat and Power or CHP) is the simultaneous production of heat and electricity, both of which are used .The central and most fundamental principle of cogeneration is that, in order to maximize the many benefits that arise from it, systems should be based on the heat demand of the application.This can be individual building,an industrial factory or a town /city served by district heat/cooling.Through the utilization of the heat, the efficiency of a cogeneration plant can reach 90% or more. Cogeneration therefore offers savings ranging between 15-40% when compared against the supply of electricity and heat from conventional power stations and boilers.

2.2.1 Principle of cogeneration

Cogeneration or combined Heat and power (CHP) is defined as the sequential generation of two different forms of useful energy from a single primary energy source, typically mechanical energy and thermal energy. Mechanical energy may be used to drive an alternator for producing electricity, or rotating equipment such as motor, compressor, pump or fan for delivering various services.Thermal energy can be used either for direct process applications or for indirectly producing steam, hot water, hot air for dyer or chilled water for process cooling. Cogeneration provides a wide range of technologies for application in various domains of economic activities. The overall efficiency of energy use in cogeneration mode can be up to 85 percent and above in some cases. For example an industry requires 24 units of electrical energy and 34 units of heat energy. Through separate heat and power route the primary energy input in power plant will be 60 units (24/0.40). If a separate boiler is used for steam generation then the fuel input to boiler will be 40 units (34/0.85). If the plant had cogeneration then the fuel input will be only 68 units (24+34)/0.85 to meet both electrical and thermal energy requirements. It can be observed that the losses, which were 42 units in the case of, separate heat and power has reduced to 10 units in cogeneration mode. Along with the saving of fossil fuels , cogeneration also allows to reduce the emission of greenhouse gases (particularly CO2 emission).The production of electricity being on-site the burden on the utility network is reduced and the transmission line losses eliminated .Cogeneration makes sense both macro and micro perspectives .At the macro level, it allows a part of the financial burden of the national power utility to be shared by the private sector; in addition , indigenous energy sources are conserved .At the micro levels , the overall energy bill of the users can be reduced , particularly when there is a simultaneous need for both power and heat at the site, and a rational energy tariff is practiced in the country.

2.3 INTRODUCTION TO TRANSFORMER

The electrical energy is generated at place it is easier to get water, oil or coal for hydroelectric diesel or thermal power station respectively. Then energy is to be transmitted at considerable distance for using in voltage. Towns and cities located at distance place. As shown of transmission of electric energy at high voltage is economical, therefore some meanings are required for stepping up the voltage at generating station and step down the same at the place where it is to be used. Electric machine used for this purpose is “transformer “.In India the electrical energy is usually generated at 6.Kv or 11kv , step up upto 132Kv ,220Kv and 400Kv and 765Kv with the help step up transformer .For transmission and step down to 66Kv and 33Kv at grid substation of feeding various substation ,which further step-down the voltage to 11KV for feeding distributing transformer step-down the voltage further to 400/230volt for consumers use.

2.3.1 DISTRIBUTION TRANSFORMER

A power transformer is usually installed in generating station or a large substation and there is always supported to operate at full load .They design up must those increase that it transformer efficiency is available at full load .This requires that iron losses is may equal to full load copper loss. In distribution on other hand kv terms to requirements of is consumer

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whose connected their load according to requirement the average load therefore on distribution is about 70% of full load value .

2.3.2 Current transformer:

As the current transformer is used in conduction with current measuring device, its primary winding is designed to be connected in series with the line .It is therefore necessary that impedance of the primary winding be made as small as possible. Since C.T. is used ordinary, those not necessarily. To reduce the current, the secondary consists of more turns then the primary, the ratio of secondary current being inversely proportional to the ratio primary and secondary conditions. Current transformer in operation slightly different from that power transformer. Here, the load impedance for burden on the secondary is very small. So the current transformer operates short circuit conditions. The secondary usually to carry a current 5 ampere.

2.3.3 Potential Transformer

The potential transformers are used for measurement of high voltage by means of flow range voltmeters or for energizing the potential coil of wattmeter and energy meter.These are also used for energizing relay and other protected device. The potential transformer operates on the same principle as a power transformer. Both primary and secondary winding are wound on a high grade steel.Low voltage winding is kept next to the earth core and high voltage winding on theoutside.The potential transformer is always step down transformer.Since they are meant for reducing the voltage to reasonable operating value. The input voltage may be as higher as 138,000volt or higher even and in this case of the pressure exist between the primary terminals as they are connected across the supply system and not in series with it as in the case of C.T.

2.3.4 Circuit Breaker:

The device which is used for making the circuit and breaking the circuit is called circuit breaker.The contacts of circuit breaker gets separated under fault conditions while moving the contacts is get separates from fixed contacts.The contact resistance is decreased and current density in the fixed contacts is increased.Thereby the moving contact is separates from the fixed contacts by last tip of touch this heavy fault current break in the area. Thereby large electromagnetic energy gets converts in to electrostatic energy thereby voltage rise.This voltage rise setup in potential gradient to break the insulation space between two contacts.Thereby the gap is ionized and is will struck.This arc carry fault current thereby load will damage even those the contacts physically isolated there by electrically not isolated to causes this area should by extinguishing as quick as possible.

2.4 RELAY:

These are the device that detects abnormal condition in electrical circuit by measuring the electrical quantity which are different under normal and fault condition.Due to abnormal condition voltage, current, phase angle and frequency may be changed.After detecting the fault the relay operates to complete the trip circuit which results in opening of the circuit breaker and isolating the fault current. The purpose of protective relay and protective relaying system is to operate the correct circuit breaker so as to disconnect only the faulty equipment from the system as quick as possible, thus the minimizing the trouble and damage causes by faults when they do occur. The modern power system is very complex and even though protective equipment from 4-5%of the total cost involved in the system.They play a very important role in the system design for good quantity of reliable supply.

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2.5 GROUNDING:

Grounding is an important accept of power system design because the performance of the system is terms of short circuit, stability, protection etc.is greatly affected by the state of the neutral .In most of the modern high voltage system the neutral of the system is solidly grounded.The neutral connected directly to the ground without any intentional impedance between neutral and grounding.

2.6 BUS BAR:

Buses are essential in both power system and industrial switchgear.Bus Bar protection needs careful attention because, 1.Fault level at bus bar is very high.2.The stability of the system is affected by fault in bus zone.3.The fault on bus bar causes discontinuation of power to a large portion of system.4.A fault on bus bar should be interrupted in shortest possible time (60ms) , in order to avoid damage to the installation due to heating of conductors.Internal faults are less frequent than line faults.

III. SENSORS AND HARDWARE-SOFTWARE COMPONENTS

Advances in sensor technology are making new sensors available for deployment in distribution system. These sensors can provide information that was not available in the past. If the cost of sensors is low, large quantities can be placed at critical locations in the system. The information's available from these sensors can be used to implement new applications.

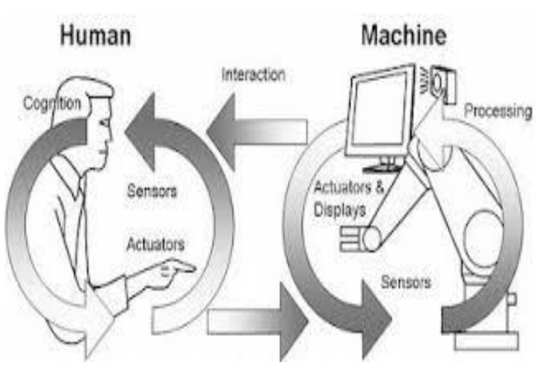

Figure 1 Human Machine Interface

An important part of most SCADA implementations is alarm handling. The system monitors whether certain alarm conditions are satisfied, to determine when an alarm event has occurred. Once an alarm event has been detected, one or more actions are taken (such as the activation of one or more alarm indicators, and perhaps the generation of email or text messages so that management or remote SCADA operations are informed).In many cases, a SCADA operator may have to acknowledge the alarm event; this may deactivate some alarm indicators, whereas other indicators remain active until alarm conditions are cleared. In designing SCADA systems, care is needed in coping with a cascade of alarm events occurring in a short time, otherwise the underlying cause (which might not be the earliest event detected) may get lost in the noise. Unfortunately, when used as a noun, the word alarm is used rather loosely in the industry; thus, depending on context it might mean an alarm point, an alarm indictor, or an alarm event.

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Central monitoring station

The central monitoring station (CMS) is the master unit of the SCADA system. Its function is collecting information gathered by the remote stations and generating necessary action for any event that is detected. The CMS can have a single computer configuration or it can be networked to workstations to facilitate sharing of information from the SCADA system.

Figure 2 Central Monitoring System

It uses a Man Machine Interface (MMI) to monitor various types of data needed for the operation. A MMI program runs on the CMS computer. A mimic diagram of the whole plant or process can be displayed onscreen for easier identification with the real system. Each I/O point of the remote units can be displayed with corresponding graphical representation and the present I/O reading. Set-up parameters such as trip values, limits, etc. are entered on this program and downloaded to the corresponding remote units for updating of their operating parameters. There are two typical network configurations for the SCADA system. They are the point-to-point and the point-to-multipoint configurations. The point-to-point configuration is the simplest set-up for a telemetry system. Here data is exchange between two stations. One station can be set up as the master and the other as the slave. The point-to-multipoint configuration is where one device is designated as the master unit to several slave units. The master is usually the main host and is located in the control room, while the slaves are the remote units. Each slave is assigned a unique address or identification number.

IV. RESULT

The following screens shows the results obtained from SCADA systems implemented in TNPL cogeneration plant.

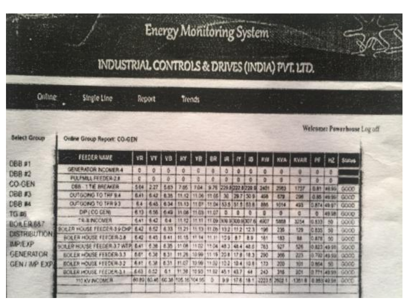

Figure 3 Co generation

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V. CONCLUSION

Thus the performance of SCADA system implemented in TNPL for monitoring and controlling the various cogeneration plant parameters has been studied. Using SCADA system, manual data collection and difficulty in forecasting the future possible troubles has been nullified .Continuous monitoring of Speed and Frequency , Geographical monitoring, Supervising the status , Generation operation planning, Active and reactive power control and Turbine protection can be made easier by deploying SCADA system in cogeneration plant.

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