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INDUSTRIAL POWER AND LOAD MANAGEMENT: REVIEW

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Abstract

Energy management in industry is one of the important objective in industries because it is desirable to reduce operating costs, increases efficiency and output, maintains reliability and for enhanced communications. This paper details a review on various systems of industrial power and load management. Activities involved in maintaining an energy management (EM) system are presented. In order to maintain adequate amounts of quality power and to protect industrial plants from power outages, the systems proposes some application modules as part of complete industrial Power Management System (PMS) for small to large plants. The energy management system (EMS) switches the mode of power supply, and controls the load share according to the condition by controlling it. An energy management system (EMS) permits for centralized monitoring and controlling of energy used in that particular industry. There are different aspects in planning energy or power management and demand, also load management which can also prevents from blackouts and disturbances to operation. So, we have summarise various power and load management systems. The paper also focuses on the power and load management by using PLC and SCADA.

Index Terms: PMS, EMS, EM etc.

1. INTRODUCTION

The electric power industry includes the generation, transmission, distribution and sale of electric power to various consumers. In the last decades, microprocessor and microcontroller controlled protection, communication and automation have become available which reliably manage and controls the automation operation. In addition to advanced features, PLC and SCADA are also some modern devices have made load and power management system reliable and economical. This paper will help to design and specify the most reliable, advanced-featured and economical load and power management system. Following diagram shows an example of PLC and SCADA used system -

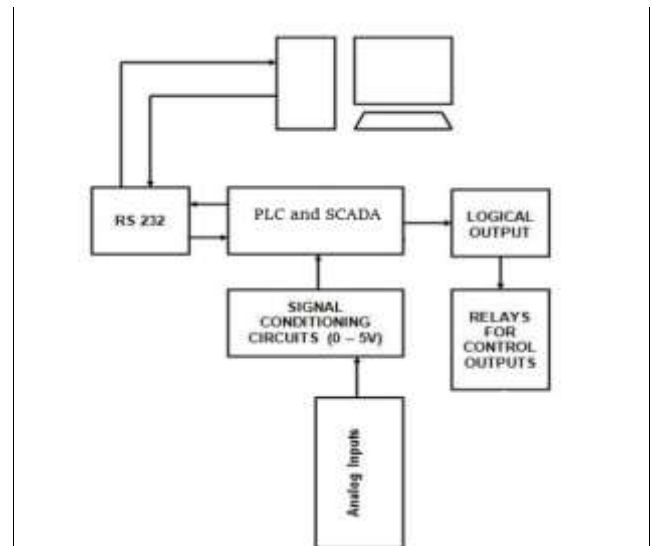


Fig-1: Block diagram of PLC and SCADA system

As the industrial sector is growing rapidly, demand for electrical power is also increasing. Today's century is now

in an era of rising prices of electricity. Many developed countries have increased 90% of consumption and growth in power and load. Consumption of electrical energy is the energy demand on existing electricity supply. Thus, supply of constant and sufficient energy is most important factor. Modern and advanced energy efficient appliances are majorly required to replace the conventional ones. Due to drastically growing consumption of energy, increase in the rates of electrical energy, transmission losses, power failure it is necessary to monitor and control industrial load and power management.

In this paper, study of various power and load management systems are summarised to find out the best energy management system according to the conditions and requirement. Now a days, in many industries various advanced devices such as PLC and SCADA are used for monitoring and controlling of load and power management with modern technologies.

1.1 PLC

PLC is an advanced device designed to perform logical functions. Whenever fault occurs in the system, it becomes more time consuming to find the fault in these systems. Thus, this problem is overcome by PLC. PLC is an abbreviation for programmable logic controller. Any machine can be controlled automatically by using PLC. The PLC can handle several inputs and outputs signal. One PLC can run many machines simultaneously if their working procedure is same.

1.2 SCADA

SCADA is an abbreviation for supervisory control and data Acquisition. The main function of this system is the collection of data and control at the supervisory level. Some SCADA systems are used for the data acquisition only. Supervisory control system provides the process to control automation. It consists of input output signal hardware, controllers, Human machine interface (HMI), networks, databases, communications and software.

2. LITERATURE REVIEW

The energy management system (EMS) is the centre of the control system for power and energy management system. Following are some papers on industrial power and load management along with main technologies-

Table-1: Name of the table

Sr. No	Name of Authors	Title	Description
1.	<ul style="list-style-type: none"> Afua Mohamed Mohamed Tariq Khan 	Review of electrical energy management techniques supply and consumer side (industry)[1]	The load management techniques used at supply side for direct load control, interruptible load control, time of

			use(TOU), power factor correction
2.	<ul style="list-style-type: none"> Kamaldeep Kaur Prof. Ravinder Kaur 	Energy management system using PLC and SCADA.[2]	PLC controls the load or machines in industry by M340PLC and overall automation of industry is controlled by SCADA software named Unity pro XL
3.	<ul style="list-style-type: none"> Maria G. Ioannides 	Design and implementation of PLC based monitoring control system for induction motor[3]	PLC is used in automated system with and induction motor
4.	<ul style="list-style-type: none"> Atul Aher Aniket Bhadekar Shubham Ghodeswar Vikram Gite Prof. Jyoti Rokade 	Auto changeover from MSEB to DG SET and vice versa by using PLC[4]	This system will replace the conventional system which further will increase the speed of operation without interruption
5.	<ul style="list-style-type: none"> Y Jaganmohan Reddy Y V pavan Kumar K Padma Raju Anilkumar Ramsesh 	PLC based energy management and control design for an alternative energy power system with improved power quality[5]	This proposed system improves the power quality of the system, which ensures continuous and reliable supply to loads
6.	<ul style="list-style-type: none"> Pavan R. Gosavi Prof. R. S. Khule 	Industrial energy monitoring system using PLC and SCADA[6]	This system is used to monitor the energy uses in different sections of the industry
7.	<ul style="list-style-type: none"> Pushpavalli M Dhanasu M Nivetha K Gopinath B Rajalakshmi A 	An efficient energy management system using PLC for real time applications[7]	Energy management system is operating on ladder logic programming
8.	<ul style="list-style-type: none"> Ashok S 	PLC-based load management in steel rolling mills[8]	PLC with proposed model saves electricity cost with optimal load scheduling under TOU tariff
9.	<ul style="list-style-type: none"> P. 	Energy	Number of energy

	Thamarai • R. Amudhevali	monitoring system using PLC and SCADAS[9]	meters with a single PLC and SCADA is used to adopt monitoring technology
10.	• S. R. Katkar • S. V. Umredkar	Intelligent SCADA for load control[10]	This system presents the intelligent system with SCADA software
11.	• Roshan Bhaishwar • Ambarish A. Salodkar • Pravin kshirsagar	Power management using PLC and SCADA[10]	PLC with logic control system was created additionally, SCADA software with program to control and monitor the system

Table-1: Literature review on power and load management system

3. PLC AND SCADA : TECHNOLOGY

The paper propose that the existing Power Factor Correction (PFC) techniques must be re-evaluated at the time of non-linear loads. Also, for acquiring an optimal energy consumption, usage of automatic demand control method is also recommended which will further improve reliability of supply side reducing environmental degradation

Another paper introduces a system with the load control during peak hours by using PLC and monitors all parameters of motors on personal computer by using SCADA in industry. In next paper, DC motors are used instead of converters for the optimal utilization of primary energy sources and improves the power quality and an energy management and control unit using Programmable Logic Controller (PLC). In one paper this system of given paper, S7-1200 PLC and WinCC SCADA software is used to control, monitor and logging of data by using PLC and SCADA system, a live comparison of yesterday's energy consumption and today's ongoing condition is displayed on the screen which will helps in energy improvement in the system. ASEA Brown Boveri (ABB) company provides a common automation structure for integrated system solutions that include safety, instrumentation, electrical and analytic systems. PLC and SCADA system consumes less power and is time saving. It is used in small scale industries, large scale industries and in real time applications.

PLC based monitoring and control system for 3 phase induction motor is used for automation process as PLC can be programmed to sense, activate and control industrial equipment which allow electrical signals to be interfaced. Whenever there is a power failure in most of the industries, factories and academic institutions-generators are used for backup power supply. The automatic changeover switch can be operated manually as well as automatically by using PLC. It detects when power has been restored to main supply and returns the load to this source and it turns off the power from the generator set.

4. POWER MANAGEMENT

Power management allows users to control the amount of electrical power consumed by industrial consumers and power from grid system. Industries are supplied by different power sources such as power grid, co-generation power, renewable power plant. So, there may be a possibility of failure of anyone source which may cause an interruption to power supply. For the continuity of supply there must be a proper power management system which will supply the power to different kind of loads. The following graph shows the use of EMS on PLC based –

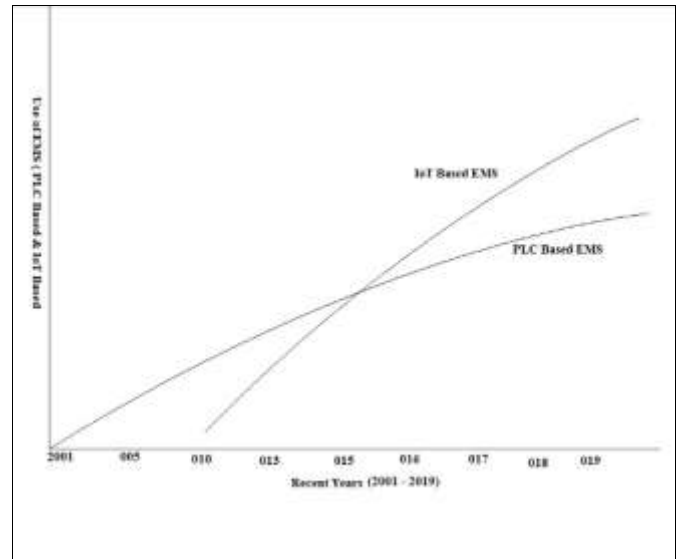


Fig.-2: Increment of use of EMS(PLC based & IoT based)

Power management system provides following advantages:

- Provides energy cost allocation and billing features
- Can monitor primary and backup power system
- Track the performance of electrical systems and equipment's.
- Provides continuous power supply without interruption.

5. LOAD MANAGEMENT

Load management is the process of balancing the supply of electricity on the network with the electrical load by adjusting and controlling the load. It is also known as demand side management. Many developed countries have increased 90% of consumption and growth in load. It can be shown by following graph –

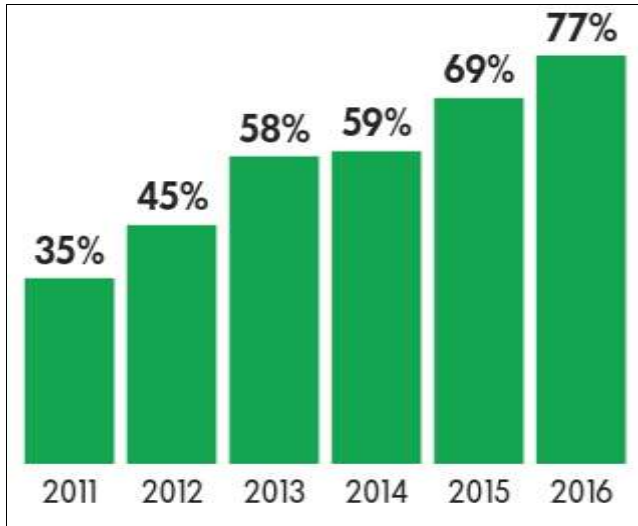


Fig.-3: Consumption of load in %

There are various types of loads used in industries such as motors, transformers DG set, furnaces, linear loads and non linear loads etc. So, there must be a proper load scheduling process which will provide proper tripping of load according to preference that which loads are kept to be ON and which are kept to be OFF in case of power supply failure.

6. CONCLUSION

In this review of paper, conclusion has been carried out that the industrial power and load management by using PLC and SCADA system can be designed for the automatic load control and online monitoring of various meters. It can also be used for various industrial applications such as automatic control of induction motors, rolling mills, automatic changeover switch and for real time applications.

The reason behind using of PLC and SCADA is the grid system operates by it. Therefore, a system of PLC and SCADA can also be used to manage the power and load in industries.

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