Implementation of Microgrid for Optimal Power and Tariff Management in Institutions

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***Abstract*—Recently intensive efforts have been made on the transformation of the world's largest physical system, the power grid, into a "smart grid" by incorporating extensive information and communication infrastructure. Key features in such a "smart grid" include high penetration of renewable and distributed energy sources, large-scale energy storage, and market-based online electricity pricing and widespread demand response programs. An energy calculation through wireless smart meter using Zigbee is proposed for automatic meter data collection, give intimation through messages displayed on LCD and energy auditing to GSM consumer. This is the project to meet demand and to satisfy consumers. Power consumed by the consumer is monitored by Electricity Board through wireless. It aims to reduce the man power for billing and achieving good communication link among consumer and EB. In this project we implement smart metering with solar panel, when the energy is exceeded from the solar panel it supplies the energy back to grid our meter will automatically reduce the supply cost. In this project, we discuss hardware techniques for tripping, indicating, intimating the consumers and power monitoring, the Microcontroller based system continuously records the readings and the live meter reading can be sent to the LCD display and GSM message Signal. The microcontroller automatically takes the responsibility of calculating the bill with the data received from the energy meter, and the tariff provided by the operator and displays the same and also discusses the suitability of Zigbee for required communication link.**

***Keywords*- Optimal Power Management, Smart Grid, Lyapunov Optimization, Renewable Energy Generation, Real-Time Pricing, Energy controlling Measurement Unit.**

I.INTRODUCTION

The electricity sector in India had an installed capacity of 249.488 GW as of end June 2014. Captive power plants have an additional 39.375 GW capacity. India's network technical losses are 23.65% in 2013, compared to world average of less than 15%. The Government has pegged the national T&D losses at around 24% for the year 2011 & has set a target of reducing them to 17.1% by 2017 & to 14.1% by 2022. A high proportion of non-technical losses are caused by illegal tapping of lines, and faulty electric meters that underestimate actual consumption also contribute to reduce payment collection. The micro grid operation model is shows in Figure.1

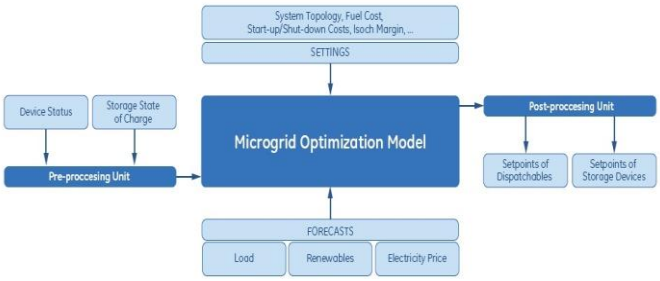

Figure.1 Micro Grid Operation Model

The term "micro grid" reflects a new way of thinking about designing and building smart grids. The micro grid approach focuses on creating a design and plan for local energy delivery that meets the exact needs of the constituents being served, whether a city, University, business park, or major mixed use development. At the local level, smart micro grid is the economic and environmental benefits to consumers of the smart grid transformation are maximized.

Normally the total electric load capacity in institution is 232 KW. Tamil Nadu solar purchase obligation install the solar power plant in the range of 20KW (off-grid system).Now it is generating 85 Units/day, monthly average is around2500 Units. In this system no battery storage unit it gets loss. To avoid this problem real time load monitoring system is to be used. The proposed system architecture is shows in Figure.2. It will monitor the present load demand of the individual block and distribute the solar power if load is within the generating capacity.

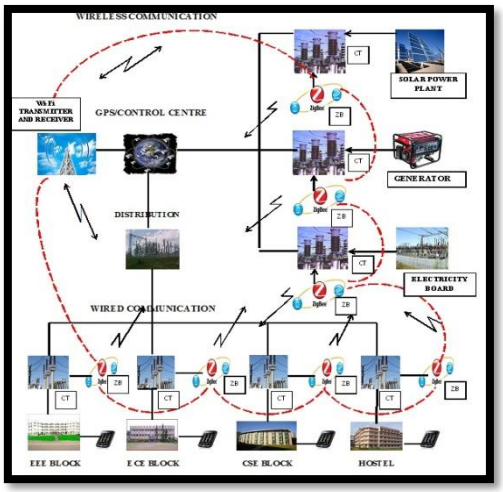

Figure.2 proposed system architecture.

Efficient utilization of the energy in the institution, the smart sensor network is implemented in the campus. It is used to monitor the type of energy consumption by the device and also tariff, and its switch-off the heavy loads like (AC/ Pumps and etc..,) based on the tariff rate. It is also used to reduce the power consumption and energy wastages.

II. METHADOLOGY

In proposed model, having wireless communication with GSM technology for controlling the electric power supply has effectively.

A. Wireless communication

Zig-Bee is a wireless communications technology that is relatively low in power usage, data rate, complexity and cost of deployment. It is an ideal technology for smart lightning, energy monitoring, home automation, and automatic meter reading, etc. Zig-Bee and Zig-Bee Smart Energy Profile (SEP) have been realized as the most suitable communication standards for smart grid residential network domain by the U.S National Institute for Standards and Technology (NIST). The communication between smart meters, as well as among intelligent home appliances and in home displays, is very important.

Figure.3 Mpr2400 Micaz Zigbee Wireless Sensor Node

Zig-Bee has 16 channels in the 2.4 GHz band, each with 5 MHz of bandwidth. 0 dBm (1 mW) is the maximum output power of the radios with a transmission range between 1 and 100 m with a 250 Kb/s data rate and OQPSK modulation. From the Figure-3, Zig-Bee is considered as a good option for metering and energy management and ideal for smart grid implementations along with its simplicity, mobility, robustness, low bandwidth requirements, low cost of deployment, its operation within an unlicensed spectrum, easy network implementation, being a standardized protocol based on the IEEE 802.15.4 standard. Zig-Bee SEP also has some advantages for gas, water and electricity utilities, such as load control and reduction, demand response, real-time pricing programs, real-time system monitoring and advanced metering support. Smart Meter system, every smart device is equipped with a radio module and each of them routes the metering data through nearby meters. Each meter acts as a signal repeater until the collected data reaches the electric network access point. Then, collected data is transferred to the utility via a communication network.

B. Global System Monitoring Technology

Global System for Mobile communication is the most popular standard for mobile phones in the world. Its promoter, the GSM Association, estimates that 82% of the global mobile market uses the standard GSM is used by over 2 billion people across more than 212 countries and territories, the architecture is in Figure.4. Its ubiquity makes international roaming very common between mobile phone operators, enabling subscribers to use their phones in many parts of the world. GSM differs from its predecessors in that both signaling and speech channels are digital call quality, and thus is considered a

second generation (2G) mobile phone system. This has also meant that data communication was built into the system using the 3rd Generation Partnership Project (3GPP).

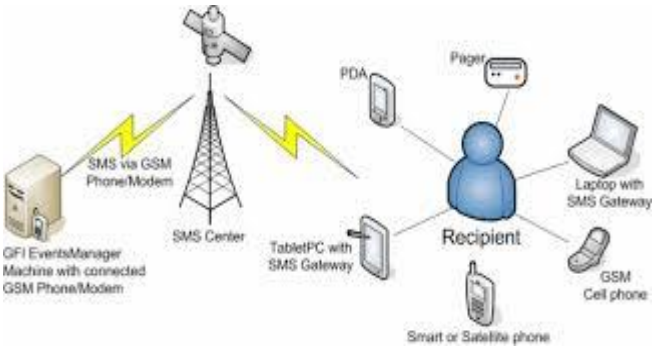

Figure.4 Global System Monitoring Technology

III. AUTOMATIC SUPPLY CHANGE OVER

The ATMEGA-8 logic controller is High-performance, Low-power AVR 8-bit Microcontroller. The AVR core combines a rich instruction set with 32 general purpose working registers. All the32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.

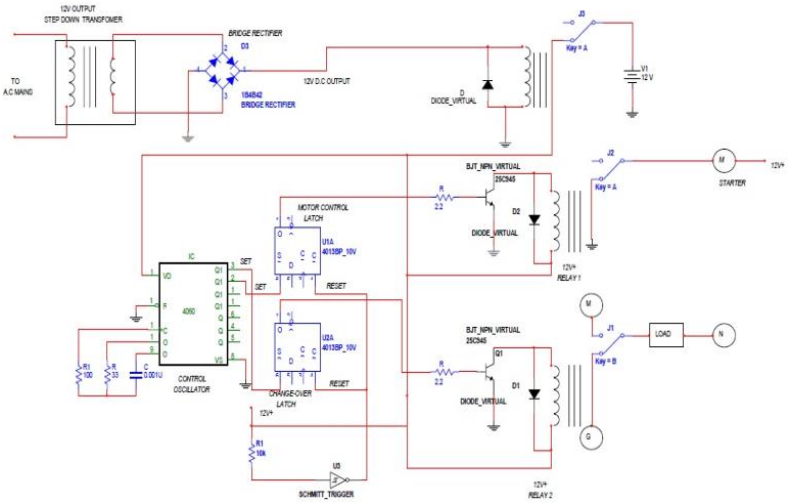

FIGURE.5 AUTOMATIC SUPPLY CHANGE OVER CIRCUIT DIAGRAM

The Figure.5ATmega8 provides the following features: 8K bytes of In-System Programmable Flash with Read-While-Write capabilities, 512 bytes of EEPROM, 1K byte of SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible Timer/Counters with compare modes, internal and external interrupts, a serial programmable USART, a byte oriented Two-wire Serial Interface, a 6-channel ADC (eight channels in TQFP and QFN/MLF packages) with10-bit accuracy. A programmable Watchdog Timer with Internal Oscillator, an SPI serial port, and five software selectable power saving modes. The Idle mode stops the CPU while allowing the SRAM, Timer/Counters, SPI port, and interrupt system to continue functioning.

VI.CONCLUSION

The output results are comparing with the exciting result. Fine tuning is made to get the exact result. To avoid the energy outage and reduce the tariff of the consumer, this project is developed with low cost and user friendly. This project is implemented any were without disturbing the present system, so the implementation is user friendly. GPS devices are used to give the present load and the tariff. This helps the user to choose the energy based on the tariff so the energy uses is reduced.

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