EFFECTIVE UTILIZATION OF ENERGY BY SMART AUTOMATED LOAD DISTRIBUTION SYSTEM

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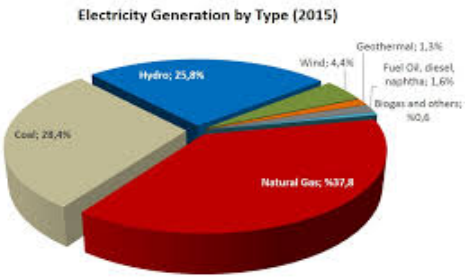
Abstract*—Previous research and development where been carried out in the field of electric meter such as Remote wireless Energy measurement from Meter, Electricity meter based on RFID based Electric Metering System. But none of them found to be an effective tool to eliminate the problems associated with power demand. The current project work is carried out to solve the problems associated with power demand by designing a system that effectively handle the power consumed by the consumer with the power available on that time. The flexibility is given to the consumer to determine which loads to be operated in a particular time. We can reduce the misuse of the power and the power saved can be given to other places or industries for the better of the country's growth. Prototype hardware is developed to demonstrate the efficient of the system.*

Keywords*—Demand Response (DR), Energy Management System, Nonintrusive Load Monitoring (NILM), Load Distributing, Smart Grid.

1. INTRODUCTION

The old system consisted of direct flow of power from the generation plant to user end, but in these past ten years grid system has been introduced which pools down power generated from the various power plants and distributes equally to the 230KV substations. This reduces
the risk involved in the major substations and enhance the stability of load distribution in the distribution transformers. Thus, our project concentrates on the user end where the control and distribution is lacking. In the EB system power cuts due to lacking in power generation for a limited period of time (1-2 hours), thus our project enables a limited power supply distributed over range of sectors instead of power cuts within sectors.



This process efficiently manages the usage level control intimated by LDC (load distribution centre) for a given period of observation (per day). The LDC provides the usage and statistical reports on power generation with which they schedule power cuts. Here we use these obtained data at the sub-station to statistically distribute the power limitation instead of power cuts.

2. OBSERVATION OF POWER DISTRIBUTION

To meet the ever-increasing energy demand in the coming years, TANGEDCO has proposed new schemes for the next 5 years. TANGEDCO has fully exploited the hydroelectric potential available in the state. However, to balance the excess power available during off peak hours and to tide over the peak hour shortage, a Pumped storage scheme in Kundah for 500 MW has been proposed.

Based on the statistics of TANGEDCO to satisfy the energy needs of the State Tamil Nadu Generation and Distribution Corporation

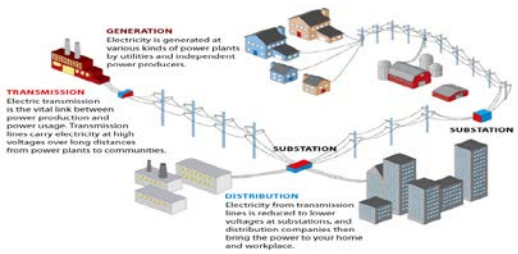


Fig 1: Distribution of electricity from generating station to consumer end

Limited has installed capacity of 13231.44 MW power plants which includes State projects, Central share and Private Power Project. Other than this, the State has installations in renewable energy sources like wind mill, solar, biomass and cogeneration up to 8470.16 MW. The power generation side examines the extraction of fossil fuels, alternative energy generation, oil spills, carbon emissions, and nuclear power. The utilities side focuses on the customer-oriented delivery side of the business, from

electricity bill surcharges to outages in our electricity supply. In the transmission and distribution space (T&D), an important cluster of industries that include the production of machinery, electric lines and transformers as well as line management systems (such as "smart-grid" technology) that improve efficiency. These are responsible for the actual "delivery" of the electric power—no matter the generation source, be it solar, gas, oil, wind or otherwise—to commercial, private and industrial users in a usable format. The T&D market supplies equipment, services and production systems for energy markets. The initial stage in the process is converting power from a generation source (coal, nuclear, wind, etc.) into a high voltage electrical format that can be transported using the power grid, either overhead or underground. This "transformation" occurs very close to the source of the power generation. The second stage occurs when this high-voltage

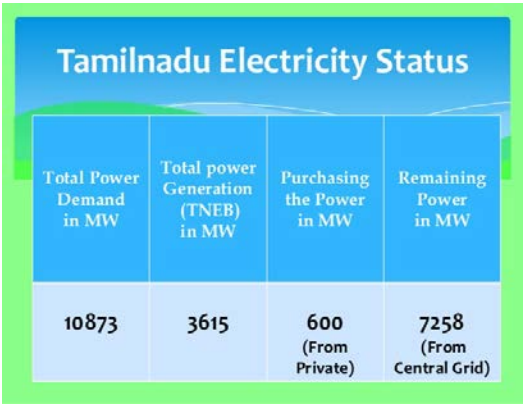


Fig 2: Tamil Nadu Electricity status

power is "stepped-down" by the use of switching gears and then controlled by using circuit breakers and arresters to protect against surges. This medium voltage electrical power can then be safely distributed to urban or populated areas. The final stage involves stepping the power down to useable voltage for the commercial or residential customer.

3. CURRENT POWER SCENARIO IN TAMIL NADU

Tamil Nadu is the 7th largest state in India by area and 7th most populous state and therefore each and every year there is a drastic increase in the power demand. The amount of power that is being generated from different sector is given below

POWER GENERATION FROM DIFFERENT SECTORS				
THERMAL(MW)	SUB TOAL THERMAL (MW)	NUCLEAR(MW)	RENEWABLE	TOTAL
COAL 10,075.10	11,513.06	986.5	HYDEL 2,182.20	23,104.91
GAS 1,026.30			OTHER RENEWABLE 8,423.15	
DIESEL 411.66			SUBTOTAL 10,605.35	

Fig 3: Statistical data from TANGEDCO

- The all-time peak power consumption recorded is 345.617 MU (Million Units) on 29-4-2016.
- Tamilnadu contains around 20million house.
- On an average day each individual house consumes of about 7.5units of power.
- And about 5.5 units are consumed by high loads while only 2 units are consumed by the low load devices.
- And therefore during the power shortage times if we can able to shut down the high load devices and operate only the necessary low load devices then we can tackle the problem easily.

4. PROPOSED SYSTEM

Our proposed system will be based on controlling the loads in the consumer end by shutting only the high loads during the power shortage time and operating only the low power loads. And this can be achieved by two modes of operations. Here we are considering the first mode (NORMAL MODE) where all the appliances both high power load and low power loads are operated normally. And then comes the second mode (CRITICAL MODE) where the high power loads are shut down by tripping it off through a microcontroller and giving power supply only to the low power loads. The change in mode can be done automatically from the LDC (Load Distribution Center). And the change in modes can be done from the LDC (Load Distribution Center) since it has the statistical on the amount of power that will generated for that particular day or for a month. Every time a mode changes it can be intimated by a colored LED. The choice of which devices should be given power is given to the consumers in order make it more comfortable for them.

5. LOAD DISTRIBUTION IN A TYPICAL HOME

APPLIANCES	NO.	POWER (WATT)	HOURS	UNITS/ DAY
TUBE LIGHT	3	40	6	0.72
CEILING FAN	2	75	18	2.7
BULB	2	20	4	0.16
TABLE FAN	1	25	6	0.15
TELEVISION	1	60	3	0.18
DESKPTOP COMPUTER	1	85	3	0.255
MIXI	1	750	10MINS	0.125
FRIDGE	1	175	12	2.1
GRINDER	1	150	3	0.45
OTHERS	-	50	1	0.05
TOTAL	-	-	-	6.89

- The above table is energy consumption of various appliances in a middle class house.
- If appliances below 75W are considered as the low load devices then around 1.26 units are consumed by them.
- The power consumed by the high load devices are 5.630 units.
- And therefore if we can shut off the power supply to the high load devices then we can supply at least 1.26 units to the houses during the power crisis times.

TOTAL UNITS PER DAY = 6.890

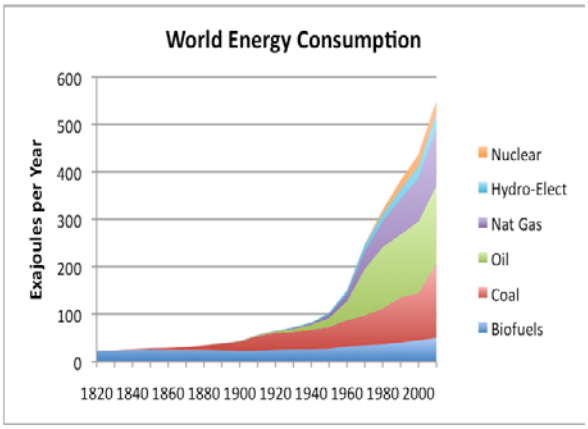
TOTAL UNITES PER MONTH = 206.7

POWER CONSUMED BY HIGH LOAD DEVICES ONLY = 5.630

POWER CONSUMED BY LOW LOAD DEVICES ONLY = 1.26

6. CONCLUSION

In this paper we have studied the power distribution from the generating station then to the power grid and then to the various level substations where the power have stepped down to various different level and finally to the consumer ends. The reason for the power cut is the lack of power generated or increased usage of load.



Since we cannot increase the generation of power which is both time consuming and costly. So our proposed is an easy method of controlling the loads through GSM thus efficiently utilizing the electricity that been generated. According to the statistics around 3 billion units of current have been wasted in a year in India. And therefore this system will efficiently handle the power wastage and we can give an efficient system to our future generation.

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