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Findings

The energy need in India rises to almost more than a double during this period. Since 2016, the global energy demand pushes from 5% to 11% in 2040. Consecutively, this pushes the energy production from 56% in 2016 to around 60% in 2040 with hike in import of about 141%. This steep growth in energy demand is broadly spread among all sectors. As per consumption scenario, the consumption of energy in industrial sector is about half of globe energy, residential sector accounts for 29% and transport accounts for 20%. To fulfill the consumer demand with good quality of life in reasonable incomes, efficient management of energy services need to be achieved. This outcomes the improvement in sustainability with competitive economy. Government of India deals with two different approaches to manage the energy demand with minimum CO_2 emissions, so that it may not cause irreversible damage to earth environment. They have used different techniques to implement the use of renewable sources of energy and besides this implemented innovative measure under the Energy Conservation Act 2001, to effectively manage the energy in customer end side.
This thesis presents the control algorithms involved for energy management while prioritizing the user's consumption at residential sector.

The proposed study deals with demand side management (DSM) techniques to effectively administer the consumer's energy resources and the load consumption graph profiles. In our work, we have introduced the concept of battery array in houses when power is unavailable from grid. At this time, exchange of power takes place between battery array and grid to reduce the fetching charge of power from grid. An analysis has been carried out for 50 homes by considering their energy consumption scenario. The work significance lies in the fact of utilizing the user's comfort on priority basis and simultaneously reduces the computational time with implementation of artificial neural network (ANN) technique. Firstly, the neural network is trained with particle swarm optimization technique (PSO) and then to enhance its convergence rate, the functional link artificial neural network (FLANN) model comes into significance. This hybrid FLANN-PSO model improves the convergence rate and learning rate towards optimal point.
Energy market is full of new uncertainties due to severe effects of environment along with the periodic repair and maintenance of different power plants units. Every time creating new generation, transmission and distribution units depending on need of consumers is one such possibility, but on the other side it is not feasible from economy point of view. So, in order to overcome this rising need of consumers while considering their load preferences and energy cost without being affecting the global environment, the new concept of approximately zero energy buildings with demand response applications has been introduced. Demand response has paramount potential for controlling the scenario of residential load consumption patterns with reduced peak period. In order to achieve these energy cost benefits, the power consumption curves of shift-able appliances are varying based on real time pricing criteria. This proposed application will try to achieve the user comfort along with the cost benefits. In order to achieve these energy cost benefits, the power consumption curves of shift-able appliances are varying based on real time pricing criteria.

Accurate load forecasting (LF) is important for applications in different operations of power grid and in decision making. More accurate load forecasting mitigates the energy cost, enhance power system security, develop the optimal power plan and therefore provide socio-economic benefits for powergrid management. This study develops the hybrid forecasting model and completely utilizes the benefits of individual models with enhanced performance. In this study, a fuzzy based prediction framework integrated with deep learning network

has been presented for Short term load forecasting (STLF). The main idea behind this study is to generate ensemble prediction from multiple local regressors and this regression variable activates the forecast process using data clustering method to assign the input to different clusters. This proposed model is designed to predict the one week a-head load demand and its performance is tested on two power networks i.e. Hellenic interconnected and Cretan power networks. This method is verified while comparing with four benchmark models like 24hr-Multiple Regression (24hr-MLR), 24hr-Support Vector Machine (24hr-SVM), ML-SVM and Fuzzy-Radial Basis Function Neural Network (Fuzzy-RBFNN) in terms of forecasting accuracy.On the basis of obtained results and complete analysis the following conclusions are being drawn. Firstly, in comparison to Long Short-Term Memory (LSTM) method (generally for RBFNN second layer) activations performed by Convolution Neural Network (CNN) on Radial Basis Function (RBF) gives around 9% improvement in forecasting accuracy. It indicates that higher forecast accuracy is attained by RBF-CNN regressors. Secondly, the application of CNN on RBFNN hidden layer gives high robustness. Third, the proposed model (Fuzzy-RBF-CNN) performs better than ML-SVM and results in 14% improvement on an average. Forth, in comparison of MAPEs of 24h-SVM and fuzzy-RBFNN, the fuzzy clustering approach is more successful, as it provides 39% and 34% better performance with reference to 24h-SVM. Thus, it shows the effectiveness of fuzzy clustering method and improvement in RBFNN response by CNN.

In recent studies, it is demonstrated that the main factor that affects the load consumption graph of end users are the heating loads which is followed by lighting and plug loads. Consequently, the overall combination of heating, ventilation and air conditioning (HVAC), lighting and plug loads consumes around 89% of overall energy usage in a building, so there is a need to design a smart monitoring and controlling energy management system. For real time implementation and for remote surveillance of various home appliances of energy sectors, IoT (internet of Things) plays a significant role. By simply assigning the IP addresses to the system, we are able to collect and transmit the information through internet while including the feature of cloud server technique. With the proliferation of this intelligent technique, the smart lighting energy management system is developed with two controlling functions i.e. occupancy control and scheduling control. The proposed study shows the integrated design of energy management where movement of occupants within the room is controlled by lighting load controller. There are two operation modes, first is manual and other on the basis of cloud based Message Queuing Telemetry Transport (MQTT)approach. The controlling is done based on publishing the messages by occupancy sensor on to cloud server with which LED lights are subscribed. The design is done with relay module (4-channel) with 32 bit Microcontroller unit with lighting sensors and occupancy sensor. Similarly, for effective control of HVAC loads that accounts for 30% of energy consumption according to EIA report, the air conditioning controller has been designed with Arduino Mega 2560, temperature sensor and Infrared blaster. This design model compares the internal room temperature with set point temperature value and minimizes the energy usage based on thermal comfort.