

COMPUTING ELECTRICITY CONSUMPTION PROFILES FOR THE APPLIANCES IN A HOUSE

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Abstract - Energy consumption may vary between house to house based on various factors like number of occupancy, time (at which they occupied), number of appliances, health issues of the housemates, work shift, weather patterns etc. Energy consumption profile provides the clear image of energy consumed by different appliances in a house. This analysis has minute wise energy consumption data for nine different appliances with total records of 10,080 in a week. This analysis helps to understand the need for energy at a particular time/day in a house. In this paper an attempt is made to analyze energy consumption of each nine appliances in a house. From the analysis, Wednesday is consuming high amount of energy and Sunday is consuming low amount of energy, air conditioner is consuming high amount of energy when compared to other appliances, most of the appliances are working simultaneously at the time of 7.00pm in a day. This analysis shows the highest and lowest energy consuming day, the appliance which consumes high amount of energy, at which particular time.

Key Words: Energy consumption, Appliances, Energy data analytics, Residential data, Energy consumption profile.

1. INTRODUCTION

Electricity plays a vital role in today's modern world. Human cannot live in this world without electricity. It is an essential commodity to power many industrial and home appliances. Now-a-days electricity is used for running electric train, planes, motors, cars, bicycles etc. Electricity used in houses that comes from burning fossil fuels like coal or oil. Increase the efficiency of energy consumption using modern data mining and various machine learning algorithms. In order to maintain the proper and optimized energy consumption format, it is need to monitor the entire energy consumption method.

The household energy can include the energy consumption of various appliances such as air conditioner, refrigerator, washer dryer, oven, microwave, furnace, living room appliances, bathroom appliances, kitchen appliances, dryer etc. In these appliances, heating and cooling appliances like heater, air conditioner are the real energy hogs that consumes enormous amount of energy.

Analysis done for the energy consumption using different methods like web application – velix[7], profile analytics[8], spotlight – consumption profiler[2], energy consumption profile from household smart meter data[3], smart sensors for power management[1] etc. In this paper, high and low consuming appliances, time at which most of the appliances are consuming energy, day at which is consuming high and low amount of energy are concentrated.

In this paper, section 2 explains about the related works based on this paper, section 3 shows the information about dataset used for analysis process, section 4 explains about the results of analysis. Section 5 draws conclusion for the analysis.

2. LITERATURE REVIEW

This section reviews some articles regarding analysis and controlling mechanism of various appliances by different methods like web application, profile analytics, using wsn sensors etc.

Hourly energy data as Residential energy dataset (REDD)[6] is taken as reference for the process of computing energy profiles. Shiraz Latif et al [8] proposed the article based on the analysis of Appliances and weekly data. Younghun Kim et al [4] proposed the application 'viridiscopes' which monitors and estimates the power consumption of every appliance virtually in a home. It is done by inexpensive sensors which are placed near the appliances and they also developed the system 'spotlight'[2] which is a personalized natural resource consumption profiler using wireless sensor network technology that provides power measurement, activity monitoring and energy resource management subsystems. Website named 'velix' that stimulates the conservation of energy in a house by intimating users about their usage by sending emails and sms which is developed by Graml Tobias et al [7]. Andreas Reinhardt et al [5] showed the appliance identification process by various techniques based on

characteristics features of traces collected for 24 hours of a day. Omid Ardakanian et al [3] had proposed the simple and interpretable technique for computing energy consumption profiles for many houses and the readings are recorded by smart meter which includes temperature effects. Nagender Kumar Suryadevara et al [1] developed the website which monitors every appliance in a house that determines the daily peak hours of electricity usage and minimizing the usage and enhance better utilization of limited resources in peak hours.

3. EXPERIMENTAL SETUP AND DATASET

Data is collected for first week of September from the year 2012. Energy data is gathered for seven days (3rd September – 9th September 2012) in a single house which includes energy consumption of different appliances. 10,080 data are collected for per week (7days * 24hr * 60mins) and 1440 data are collected for per day (24hr * 60mins). The energy consumed by various appliances is measured by the unit kilowatts per minute. The locality of the house is not made public to ensure the privacy.

It has both weekdays and weekend data for every appliance. Energy data include energy consumption of various appliances such as Air conditioner, Dining room, dishwasher, dryer by gas, furnaces, kitchen outlet, living room, master bathroom, microwave, oven, refrigerator, washer etc. The definition of variable outlet and master bathroom includes one or more small appliances instead of individual appliance. For example, all small appliances of kitchen are grouped in kitchen outlet; likewise all small appliances of bathroom are grouped in master bathroom. This Analysis is done by the tool Matlab.

4. ANALYSIS AND RESULTS

Analyzing data helps to increase the knowledge about data. Basically analysis has many profits which include deeper understanding of energy consumption by different devices that help to schedules the appliances, enabling the implementation of preventive measures if problem occurs, better insight into energy performance and reduce costs that increase profits etc.

Appliances are used in a house based on its need and time. Most of the appliances consume more amount of energy in evening time. Some appliances are constant for consuming energy like refrigerator. Kitchen appliances are used at morning, afternoon and night time for cooking purpose. Most of the appliances are used at the time of 6pm to 8pm. Refrigerator consumes energy throughout the day. Air conditioner is the one of the cooling appliances which consumes high amount of energy when compared to other appliances.

CASE -1

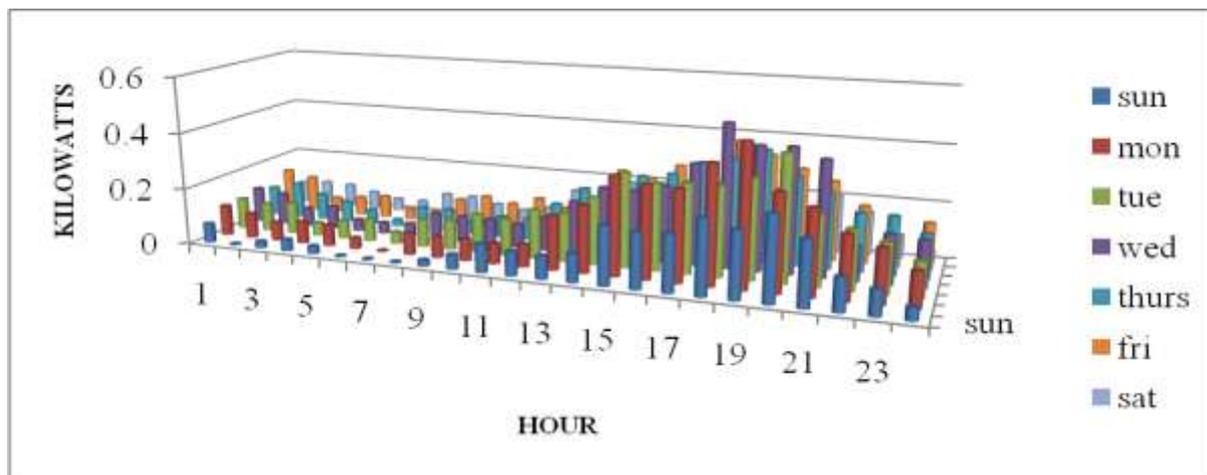


Chart -1: Energy consumption for each day in a week

Considering the nine appliances in a house and aggregating the energy consumption of nine different appliances for each hour in a day for seven days is depicted in Chart -1.

From the above graph, it is analyzed that, at which day energy is consumed at high and low for particular time.

The energy consumption of all appliances particularly for weekends (Saturday and Sunday) is comparatively less than weekdays (Monday to Friday). Particularly Sunday is consuming less amount of energy at the highest of around 1.5 kilowatts per hour in a week whereas weekdays Wednesday is consuming high amount of energy around 3.5 kilowatts per hour.

As per the above 3d graph, Wednesday is consuming high amount of energy (0.49kwh as the highest) when compared to other days in a week whereas Sunday is consuming low amount of energy (0.29kwh as the highest). By comparing all days, everyday is consuming very high amount of energy at 7.00pm particularly in a week.

CASE -2

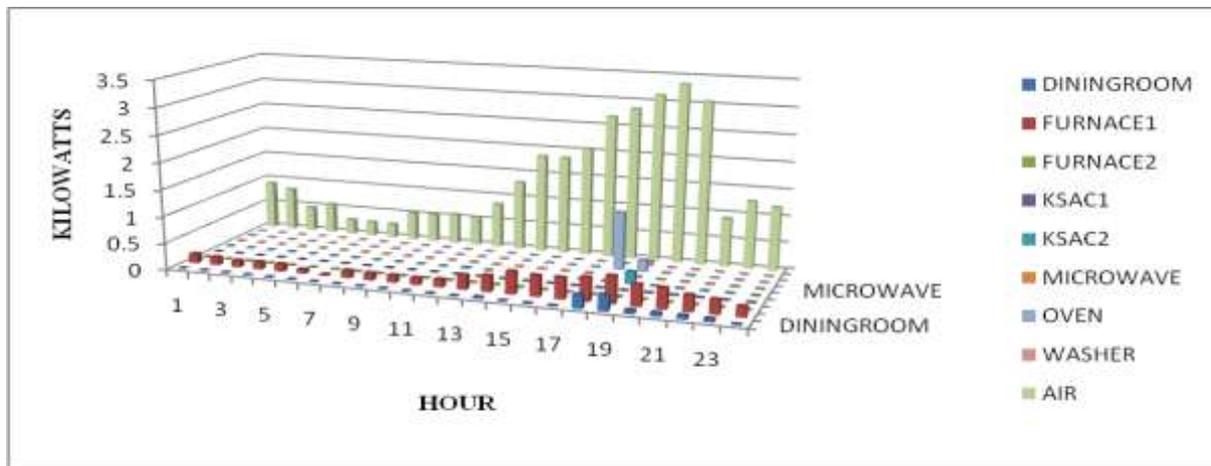


Chart -2: Energy consumption of nine different appliances

Chart -2 shows the average energy consumption of various appliances such as dining room appliances, furnaces, kitchen appliances, microwave, oven, washer and air conditioner as kilowatts per hour. In that air conditioner is consuming high amount of energy.

It shows that, these appliances are mostly used at the time of evening. The time around 7.00pm is the peak time of consuming energy by these appliances.

CASE -3

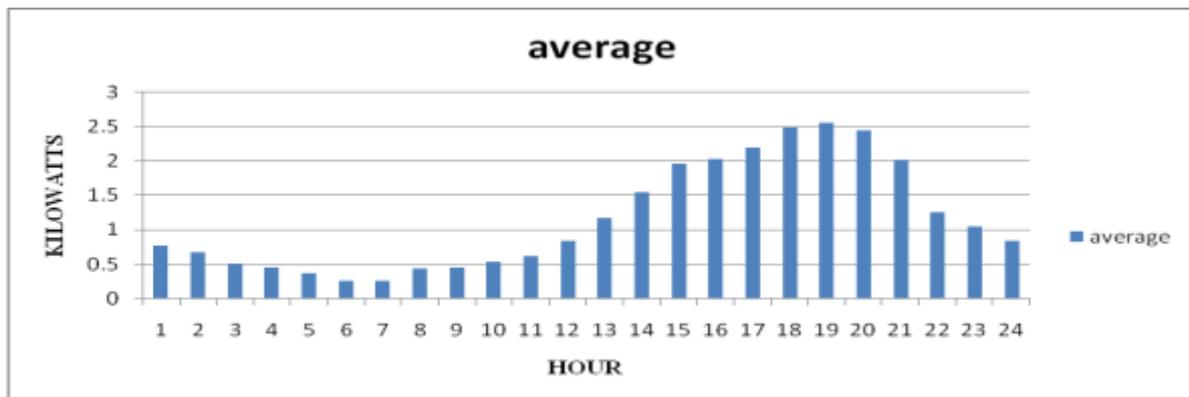


Chart -3: Average energy consumption of air conditioner in a day

Chart -3 explains about the average energy consumption of air conditioner. This analysis shows that, air conditioner is consuming high amount of energy at the time of 7.00pm.

5. CONCLUSIONS

In this work, energy consumption of different appliances is analyzed to understand the energy required for each day by each appliance. Analysis of the energy consumption of nine different appliances in a single house shows that, all appliances are used between 6pm to 8pm thereby increasing high energy consumption. This peak time can be reduced by scheduling the appliances by shifting some shiftable appliances like microwave, washer and oven to low energy consuming time.

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BIOGRAPHIES



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