

Effects of COVID-19 Pandemic on Household Energy Consumption at College of Science and Technology

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Abstract:

The COVID-19 pandemic caused by the coronavirus (SARS-CoV-2) has infected people across the world. The global economy came to stand still as many countries announced complete lockdown to break the chain of transmission. After the detection of first COVID-19 case in Bhutan, the government placed restrictions in some places. All forms of in country movements drastically reduced. Government and corporates resorted to alternatives and work from home. Online teaching became popular through different online platforms. Hotels and restaurants closed temporarily and dining out drastically reduced. Home activities increased, changing energy consumption pattern. The scenario at residential units of College of Science and Technology, Phuentsholing was no different. This paper investigates the effect of COVID-19 on household energy consumption pattern in staff quarters at College of Science and Technology, Phuentsholing, Bhutan by comparing energy consumption with same time in the past two years. Increase in household energy consumption was noticed since the restriction due to detection of COVID-19 in Bhutan and started declining after the relaxation. Increase in household energy consumption during the COVID-19 pandemic has positive effects on power industries. However, the impact was not much in case of working small families.

Keywords — COVID-19, energy consumption, lockdown, family,

I. INTRODUCTION

COVID-19 is an infectious disease caused by a newly discovered coronavirus. The COVID-19 pandemic is widespread across the globe and has infected millions across the world. The outbreak was first identified in December 2019 in Wuhan, China. They found that people with fewer pre-existing medical conditions recover in about two weeks, while people with severe or critical disease recover in three to six weeks.

The disease is now well established in the human population, efforts should be put on reducing transmission and treating patients. The countries around the world were forced to impose restrictions on movement to prevent the spread of the virus

[1]. More than 25.327 million are affected with 0.848 million death as of 2nd September 2020 [2]. Everything came to stand still except frontline workers. Many countries announced complete lockdown. All forms of transportation came to halt. People were asked to stay indoors to break the chain of transmission. Whenever possible people started working from home, teaching shifted from face to face to online classes.

Environment got recuperation time. Air pollution decreased drastically improving the air quality. People started viewing Mount Everest from far flung plains of the Ganges in India. River water became clean as industries were shut down. People enjoyed watching the starry night due to clear sky condition and children felt like long vacation,

staying with parents and feasting on varieties of home cooked food. They spent indoor time in activities like organizing wardrobe, repairing cloths, painting houses, kitchen gardening, writing journals, connecting old friends through social media, and arranging flowers and photos. Hypothetically, the domestic energy consumption should be higher during COVID-19 pandemic lockdown compared to other normal time. All forms of transportation, shopping centers, and industries including power industry were affected. Sudden reduction in energy demand occurred in power industries due to decrease in demand from industries during the lockdown [3]. However, the domestic energy consumption tends to increase during lockdown period [4]. Restaurants closed and eating out decreased to a great extent. Home cooked food had to become more preferred alternative for all families. As the domestic energy demand is far less compared to industrial demand, the overall energy demand curve remains same.

Bhutan started declaring closing of schools and institutions and reduction of business hours during the 2nd week of March 2020. The complete nationwide lockdown was implemented since 11th August 2020. In between, movements were allowed, office started, schools and college reopened for selected levels and continued with online class for the others. This paper describes the effect of COVID-19 Pandemic on energy consumption pattern at staff residential units of College of Science and Technology. The study period includes the months of March to August for the year 2018-2020. Like other countries, Bhutan need to investigate how the COVID-19 pandemic has influenced the national energy consumption pattern.

The pandemic situation has made remarkable environmental impacts due to lockdown worldwide. The immediate positive effect on global CO₂ emission dropped by 17% in April 2020 compared to the average emission level of 2019 [5]. In India, the household income level is the most important factor in household energy consumption [6]. In Bhutan, the energy sources most widely used for

cooking are electricity (84% of households)[7]. The research has shown that 100% of the households uses electricity in some form for cooking[8]. Many uses induction cooktops in the country which is expected to lead to reduction in the dependency on imported LPG [9]. For the purpose of this study, monthly energy consumption for last 3 years were obtained from college records. The period covered in this study is from March to August. The reason of considering March as initial period is that the first COVID-19 cases was detected in the country from a tourist which steered the country to declare closing of some schools and institutions in the 2nd week of March 2020.

II. ENERGY CONSUMPTION FOR SMALL FAMILY

A small family type is a group of people of any age group in a household that comprises not more than 2 members. In most cases both were working in offices. The study on total energy consumption over a period of 6 month shows that some consumed less energy while many consumed more during pandemic period as shown is fig.1. The small variation in energy consumption for this group was due to decrease in frequency of use of washing machine while some expressed due to slight drop in number of meals. Many shared they were mainly in office during relaxation period like any other working days keeping same pattern of energy consumption.

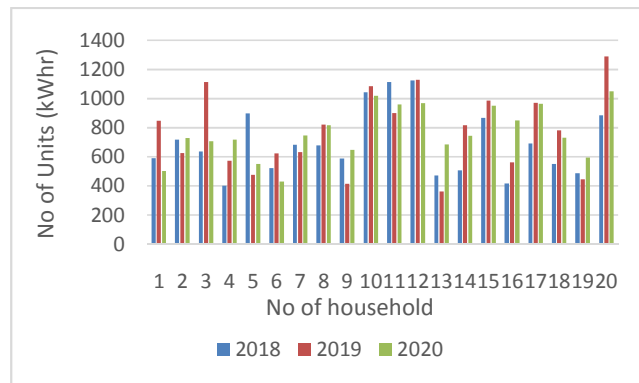


Fig 1. Energy consumption in small family

III. ENERGY CONSUMPTION FOR MEDIUM FAMILY

A medium family type is a group of people of any age group in a household that comprises 3 to 4 members only. This group comprises of children and other elderly parents in the family. At any time, there is at least a person at home. The study shows variation in total energy consumption over a period of 6 months during pandemic as shown in fig.2. The use of electrical appliances like lights, fan, water boiler, microwave oven, toaster, induction cooktop, air condition, washing machines, charger for mobile phones, iPad, laptop, PC increased. The preparation of varieties of foods and the frequency of meals have risen. Children using TV and other electronic gadgets for online class, leisure and entertainment increased which contributed to higher energy consumption.

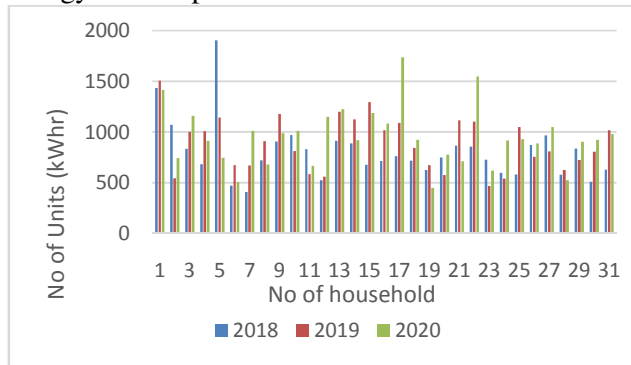


Fig 2. Energy consumption in medium family

IV. ENERGY CONSUMPTION FOR LARGE FAMILY

A large family type is a group of people of any age group in a household that comprises 5 or more members. The study shows increase in energy consumption over a period of 6 months during pandemic as shown in fig.3. In many households there is a sharp rise in the use of electricity as high as 40% compared to 2019. The increased use of washing machine, fans, AC are the reasons for rise in power consumption. Some family members always remain indoors. The preparation of varieties of foods and frequency of meals increased. Children using TV and other electronic gadgets for online class, leisure and entertainment also

increased which contributed to more energy consumption.

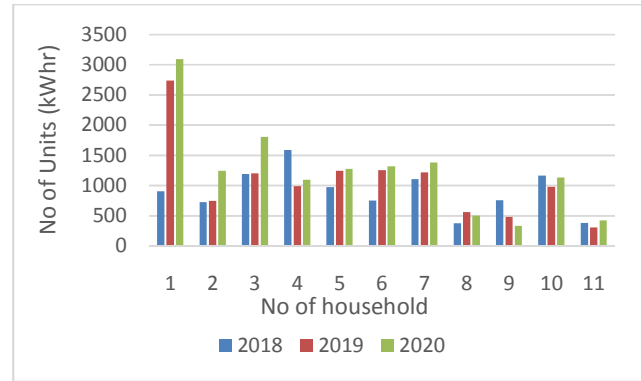


Fig 3. Energy consumption in large family

V. ENERGY ANALYSIS

The analysis shows average household energy use increased by 6.7% in 2020 compared to 2019 during the pandemic. Fig 4 shows energy consumption by different family groups.

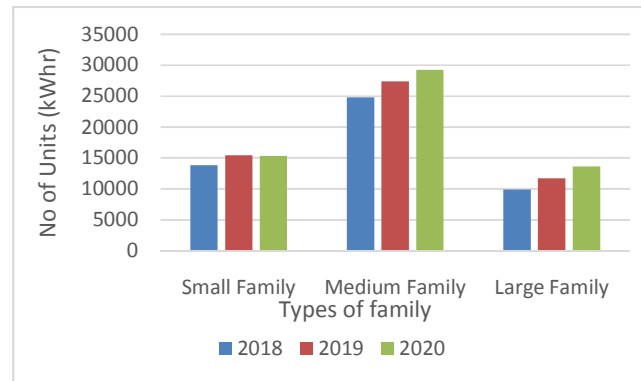


Fig.4 Energy consumption among different family

Most of the staff are working from home as colleges and schools are closed and home computers/laptop and televisions are busier than ever. Some faculties and staff worked in the college for few hours and are now working from home for the remaining portion of time. Most of the school-going children were at home as face-to-face teaching started only for Class X and XII during the relaxation period.

The figure 5, shows energy consumption by various household between March to August in 2020 and a same period for 2019 is shown in figure 6.

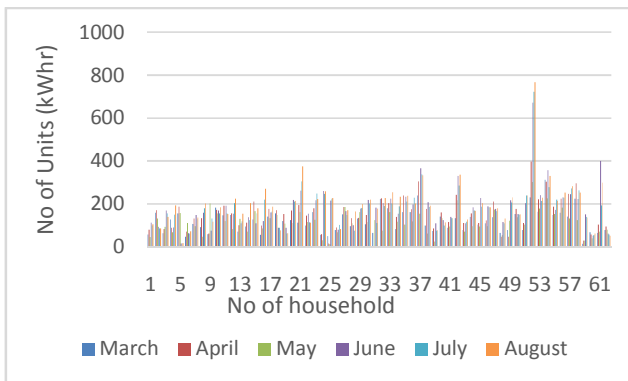


Fig. 5 Energy consumption in 2020

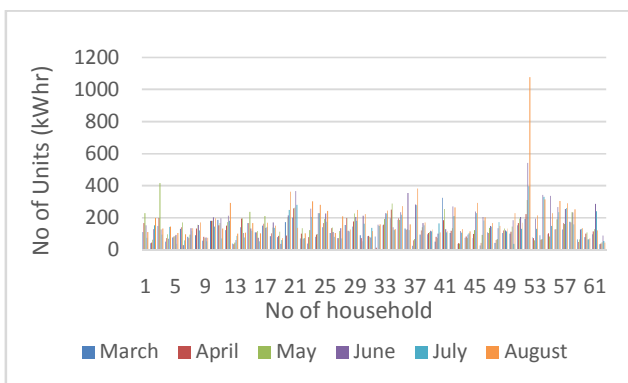


Fig. 6 Energy consumption in 2019

Many expressed that there has been change in daily routine for household chores and sleep timing. Morning routines are less structured and therefore the peak has shifted in load curve. The energy being saved in the morning is thus consumed later towards night. The peak demand for household has changed as the pattern of individual working hours varied. Cooking time and its frequency increased which intensified power consumption while working from home.

Details study will show a big change in the way people consume energy during the lockdown period. Overall, domestic demand has increased only by 6.7%, rather than dramatic surging. Similar pattern may be observed in other parts of the country, if such kind of study is carried out.

VI. RESULT AND DISCUSSION

The COVID-19 pandemic has an impact on monthly energy consumption. The closure/operating business and industries with less manpower has resulted in decrease in power demand. It is apparent from Fig 4, that the monthly household energy consumption has increased during pandemic, which is a positive impact on energy consumption for the nation by small fraction. In case of small family, the consumption increased by 10.8% compared to 2018 and -0.5% compared to 2019. The energy consumption increased by 18% and 6.8% more compared to 2018 and 2019, respectively for medium family. For large families, the energy consumption is 37% and 16.1% more compared to 2018 and 2019, respectively. The overall increase is 19.8% compared to 2018 and 6.7% compared to 2019 for resident considered in the study. The result implies the effect of COVID-19 pandemic on household energy consumption. This indicates there is short term as well as long term relationship between COVID-19 pandemic and energy consumption in the resident, which needs further study. Given the nature of pandemic and the lockdown measures implemented continues, and sustained decrease in industrial power lingers, the power demand will continue to decrease. However, domestic energy consumption is increasing and will further continue to increase with winter season approaching. It is a positive sign for power industry.

VII. CONCLUSION

The household energy consumption has increased, during this pandemic. The result implies that the domestic energy consumption was higher compared to previous year. As the situation is changing all the time during COVID-19 pandemic, the effects on residential energy consumption is likely to change. A study on energy consumption based on household income may show better correlation and is recommended.

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