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Learning from Covid–19 in Energy and Environment Management through Case Studies in Education and Commercial Sectors

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Abstract

This paper presents case study results of learning from COVID-19 in energy and environment management in the areas of education and commercial sector. This focuses on analysing the adaptation of online platforms in terms of energy and environment aspects through the learnings during the COVID-19 pandemic period. In addition, the paper estimates the relationship between online adaptive approaches and traditional classroom or workplace approaches in terms of primary electricity consumption, fuel usage, emission of air pollutant gases.

The outcome of this paper will be useful to all who could make some strategic decisions on working from home as well as the policymakers and respective officials of the education sector who could design their courses or programs with a novel approach. Eventually, researchers willing to further investigate will get new areas or openings.

The research has identified six main areas of the primary energy use at home which have to be addressed separately to measure the impact on energy and the environment. They are transport, equipment use, cooling and heating, lighting, cooking, and entertainment. Then the total primary energy use was compared with energy consumption at the office, classroom, or meeting room. The study found that work from home scenario has a significant impact on energy and environment, and following that online education and online meeting, scenarios display lesser impacts on energy and environment during the COVID–19 pandemic period. It highlights that transportation has played a vital role in all three contexts.

Introduction

The world was surprised in early 2020 when a novel coronavirus quickly spread from China to other countries [1]. As more cities were locked-down, non-essential businesses were ordered to close, and customers avoided public places. Brands had to adapt and be flexible to meet changing needs. The pandemic led to widespread disruption of the education, industries, and many other sectors. Many countries adopted new health and working conditions to continue their industries.

The COVID-19 pandemic has created the largest disruption of the education systems in history, affecting nearly 1.6 billion learners in more than 190 countries in all continents. Closures of schools and other learning spaces have impacted 94 percent of the world's student population, up to 99 percent in low and lower-middle income countries [2]. Before the crisis, working and learning from home was an option and often considered a luxury. This changed with the crisis, requiring fast migration of most educational and commercial activities to online or virtual.

The temporary closure of educational institutions during the COVID-19 pandemic has suddenly transformed the global education landscape in favour of distance learning. This radical move saw an upwelling in the use of digital platforms and applications, including digital learning management systems, collaboration platforms for live video communication, open online courses, and tools for creating learning content. Some platforms have offered free access to basic services, especially during the pandemic, which higher education institutions used extensively, especially among academic staff and students with digital experience [3].

Research Questions

1. What is the effect on the energy aspect due to work from home practices during the COVID – 19 in the commercial sector?

2. What is the effect on the energy aspect due to online education platforms during the COVID – 19 in the education sector?
3. What is the effect on the energy aspect due to online meeting practices during the COVID – 19 in the commercial sector?
4. What are the environmental impact due to online education, work from home practices and online meeting practices during COVID – 19?

Research Design

The objective of the study project was to analyse the adaptation of online platforms in energy and environment aspects through the learnings during the Covid-19 pandemic period for education & commercial sectors and to estimate the relationship between online adoptive approaches & traditional classroom or workplace approaches in terms of electricity consumption, fuel usage, emission of air pollutants gases and environmental impact. A quantitative research approach, with quantitative data analysis, was chosen according to the objectives of the research. Since this study analyses data gathered from a selected sample representing a specific population at a point of time, it was also conducted as a cross-sectional study. A literature review was conducted to study the work that has been carried out. Current studies were explored to identify the fundamental determinants related to energy consumption & environmental impacts for selected scenarios.

The parameters of the study could be divided mainly into three categories as,

1. Primary energy use in six economic and social activities of (1) transportation (2) cooking, (3) entertainment, (4) heating and cooling, (5) lighting, and (6) learning or working devices
2. Energy consumption at workplace or university lecture room or meeting room
3. Environmental impact in terms of emission of CO_2

Three surveys were designed separately. The questionnaire consisted of three sub-sections. Knowledge gathered from the literature review was used as a basis for preparing the structure of the questionnaire.

Part A: Collected data related to demographic factors
Part B: Collected the data related to primary energy use
Part C: Collect respondents general views and opinions related to the given scenario

The questionnaire was designed with close-ended, open-ended, and multiple-choice questions, targeting to capture the individual consumption levels and perspectives on energy and environment aspects of the relevant scenario. One questionnaire was distributed among students of Master of Energy Management, The Open University of Sri Lanka to assess the online education scenario. Target sample size was 49 respondents from such students, and to avoid the non-response error, 52 questionnaires were distributed in an online version. The next questionnaire was distributed among the employees of a key telecommunication company in Sri Lanka. The second questionnaire's target sample was 76 and to avoid the non–response error, 78 questionnaires were distributed in the online version. The final questionnaire was distributed among the directors of the Sri Lanka Energy Managers Association. In addition, the energy consumption of the lecture room of the selected university, the office building of the selected organization, and the board room of SLEMA, prior to the COVID – 19 have been calculated to compare the survey findings.

Table 1: Summary of the Energy Consumptions, Energy Savings & CO_2 Emission Reductions

Online Education Scenario			**Work from Home Scenario**			**Online meeting Scenario**		
Primary Energy Usage Parameter	Saving or Spending	per student (kWh/month)	Primary Energy Usage Parameter	Saving or Spending	per person (kWh/month)	Primary Energy Usage Parameter	Saving or Spending	per participant (kWh/month)
Transport	Saving	102	Transport	Saving	820	Transport	Saving	47.8
Cooling & Heating	Spending	11	Cooling & Heating	Spending	71	Cooling & Heating	Spending	1
Lighting	Spending	0.3	Lighting	Spending	6			
Equipment Use	Spending	1.7	Equipment Use	Spending	16			
Lecture Room Power Consumption	Saving	10.4	Office Area Power Consumption	Saving	52	Meeting Room Power Consumption	Saving	0.05
Energy Saving		**99.4**	**Energy Saving**		**779**	**Energy Saving**		**46.85**
		per student (kg of CO_2/month)			per person (kg of CO_2/month)			per participant (kg of CO_2/month)
CO_2 Emission Reduction		**24.2**	**CO_2 Emission Reduction**		**196.3**	**CO_2 Emission Reduction**		**11.42**

Table 2: Summary of General Views

Online Education Scenario		
Question	Response	Percentage of Respondents
Do you believe any method other than transport, heating or cooling, lighting or computers has caused to increase your energy consumption in the online education scenario?	Yes	13%
	No	71%
	May be	15%
Your general idea on whether energy consumption during online education during COVID – 19 has increased, decreased or remained the same	Increase	23%
	Remain same	37%
	Decrease	40%
Your general idea on whether the overall energy consumption has increased or decreased or remained te same with online education during COVID – 19 (comparing university energy consumption and your energy consumption)	Increase	13%
	Remain same	8%
	Decrease	79%
Do you believe that online education is good for the environment?	Yes	81%
	No	8%
	May be	12%
Work from Home Scenario		
Do you believe any other method other than transport, heating or cooling, lighting, office equipment or entertainment has caused your energy consumption to increase during work from home scenario.	Yes	6%
	No	94%
	May be	-
Your general idea on whether your energy consumption during work from home under COVID – 19 has increased or decreased or remained the same.	Increase	69%
	Remain same	12%
	Decrease	19%
Online Meeting Scenario		
Do you believe any other than transport, heating or cooling, lighting, office equipment or entertainment has caused your energy consumption during work fro m home scenario to increase.	Yes	25%
	No	75%
	May be	-
Your general idea on whether work from home during COVID – 19 has cause your energy consumption to increase, decrease or remained the same	Increase	69%
	Remain same	-
	Decrease	31%

Results and Conclusion

This research has identified that transportation has a higher impact than cooling & heating, lighting, and appliance usage in the context of online education, work from home, and online meeting. According to the respondents, other areas such as entertainment and cooking have a negligible effect.

Scenario	Energy use before COVID - 19 (kWh/ person)	Energy saving (kWh/ person)	Percentage of saving
Online Education	112	99	88.4%
Work from Home	872	779	89.3%
Online Meeting	48	47	98.0%

Moreover, there was an indication of a higher percentage of energy-saving, but it must be understood that it was because of restrictions in transportation but not for electricity consumption. Overall electricity consumption has no significant impact in the case of both scenarios, such as before and online practices during the pandemic period. In addition, it has been identified that conducting education or office services based on one location in terms of electricity consumption and output is more effective than conducting it in several locations.

Quantitative results have shown that this could lead to significant energy savings or reduction of CO_2 emissions. The ability and willingness of householders to shift their consumption over time might have economic and environmental implications for the electricity system. Working from home and online education represent an opportunity to use energy more flexibly. Over time, a more significant shift to home working or online education could also result in a reduction in demand for office or lecture room space and energy for commercial buildings or educational institutions, and therefore, a greater overall reduction in energy consumption and CO_2 emissions. However, the longer-term impacts on energy and emissions of a trend towards greater working from home or online education are uncertain due to other social concerns.

This study contains a few implications which can be examined in further studies. This study does not reflect the dynamic new realities of working practices such as 'zero hours' contracts and flexi-time arrangements. Normally, experts do not consider online education or work from home or online meeting, the most obvious measure to increase energy savings or reduce carbon emissions from travel, because they expect to meet resistance in respective organizations, and they suspect it might deteriorate the output of employee or quality of education. Moreover, the associated energy and carbon savings will depend on additional factors such as the carbon intensity of the energy used for transport (e.g. conventional versus electric vehicles), as well as that used for heating and cooling buildings since both of these are undergoing rapid change.

Research may be conducted in similar context to assess the other impacts such as social, economic and adaptability even using qualitative research approach, considering the impacts such as non-work travel or leisure activities, More long-term and comprehensive studies need to be conducted for various contexts (countries, climates, cultures, industries) and identification of means to attract people toward public transport in the domain of energy and environment while developing a sustainable transport model are some of the areas for future research opportunities.

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Further Reading

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