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Climate Change Adaptation and Integrated Waste Management in the time of Pandemic in Ondokuz Mayıs University

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Abstract. In this study, consumption data for 2020 were obtained from the Administration Activity Reports published annually by Ondokuz Mayıs University (OMU). Waste data were also taken for the 2020 period as the amounts recorded within the scope of the Zero Waste Project carried out by the university. With the collected data, in the second part, the changes in waste types and amounts will be mentioned in addition to the approximate carbon footprint calculation with the effect of the pandemic process experienced with the year 2020, within the scope and limits determined by the university. The amount of waste per person as students and faculty members of the wastes originating from the units of the university was also calculated. By using the amounts of glass, paper, metal and plastic waste types collected separately by the Ministry of Environment and Urbanization, the amount of gains to be obtained against parameters such as energy, raw material use and emission reduction was calculated with the help of zero waste counter. In order to evaluate the zero waste studies carried out by the University. Within the scope of Zero Waste studies of Ondokuz Mayıs University, the types and amounts of waste coming from the units during the 2020 pandemic period were evaluated. Considering the data obtained from the different units of the university, a decrease was observed in the amount of waste, as in the consumption data. In addition to the harmonization of integrated waste management and transfer mechanisms in our university, carbon capture gardens have been designed to be implemented in our university.

Keyword:

integrated waste management, carbon release, carbon footprint, carbon capture garden

1. Introduction

Since the discovery and emergence of new coronavirus, officially called COVID-19, declared as a public health emergency of international concern by the World Health Organization, various measures and preventions have been conducted by many countries [1,2]. Globally, the number of confirmed cases has reached over 98 million in 219 countries and territories with an accumulated death of over 2 million as of January 21, 2021, and it is still continuously increasing [3,4]. More plastic or paper packages and food wastes have been found in waste caused by the lockdown period. COVID-19 wastes should be managed and treated whenever possible using existing protocols for infectious and healthcare waste management [5,6, 7], as suggested in national or international guidelines. This study provides knowledge for nowadays and further research in sustainable waste management and climate change plans during the pandemic in Ondokuz Mayıs University. Our university has made significant progress in waste management by obtaining a zero-waste certificate [8] from the Ministry of Environment and Urbanization.

2. Climate Change Adaptation and Integrated Waste Management in the time of Pandemic in Ondokuz Mayıs University

2.1. Waste Management

The aim of Zero Waste Regulation prepared on the basis of Environmental Law No. 2872 (2019) regulates is to establish and develop "zero waste management system" which aims to protect the environment and human health and all resources in waste management processes in line with the principles of sustainable development with effective management of raw materials and natural resources. It regulates the principles and procedures concerning the establishment of "zero waste management system" and "zero waste certificate" to be issued for the places where the establishment of zero waste management system is mandatory. The basic level zero waste certificate was obtained at the beginning of the pandemic for our campus, which has 70 000 students, administrative and academic staff and is spread over a wide area. Moreover, the Turkish government in the pandemic time set up an Environmental Agency, which will operate under the Environment and Urbanization Ministry. The agency aims at improving the environment and carrying out a zero waste project, launched by the ministry to collect and dispose of wastes effectively. The agency will carry out activities to improve the environment and contribute to the establishment of a zero waste management system. In this context, a zero-waste action program has been carried out at our university, and the studies are continuing. We give great support to the participation of wastes in the recycling and recovery cycle. In addition, while supporting these studies with research and development studies, we carry out awareness-raising activities both at the university and in our city.

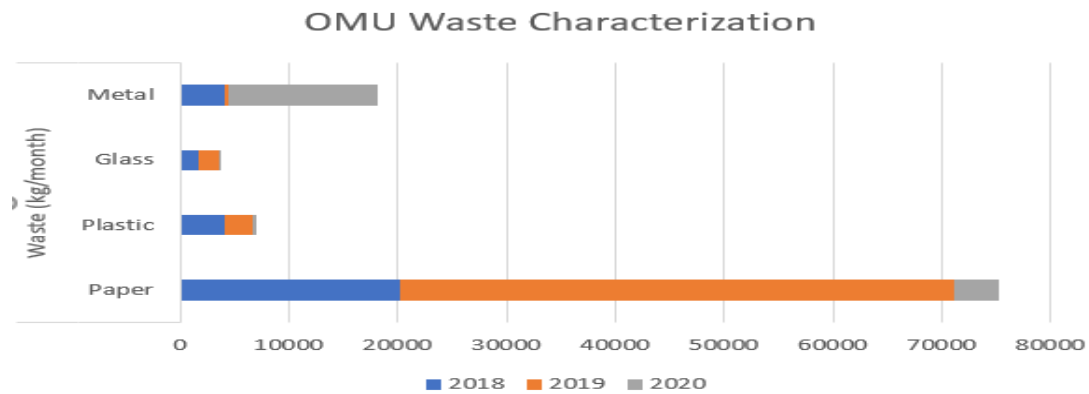


Figure 1. OMU Waste Characterization in the Pandemic time

In this study, consumption data (Fig-1) for 2020 were obtained from the Administration Activity Reports published annually by Ondokuz Mayıs University. Waste data were also taken for the 2020 period as the amounts recorded within the scope of the Zero Waste Project carried out by the university. With the collected data, the changes in waste characterization and amounts will be mentioned in addition to the approximate carbon footprint calculation with the effect of the pandemic process experienced with the year 2020, within the scope and limits determined by the university.

The amount of waste per person as students and faculty members of the wastes originating from the units of the university was also calculated. By using the amounts of glass, paper, metal and plastic waste types collected separately by the Ministry of Environment and Urbanization, the amount of gains to be obtained against parameters such as energy, raw material use and emission reduction was calculated with the help of zero waste counter. In order to evaluate the zero waste studies carried out by the University;

Considering the data obtained from the different units of the university, a decrease was observed in the amount of waste, as in the consumption data. At the beginning of the most important factors of this, the decrease in the human population on the campus due to the pandemic can be shown as the biggest factor. In parallel with the decrease in resource use and consumption, a certain amount of waste has decreased. In addition, the awareness of both students and staff and the decision of the senior management to support waste minimization were also effective.

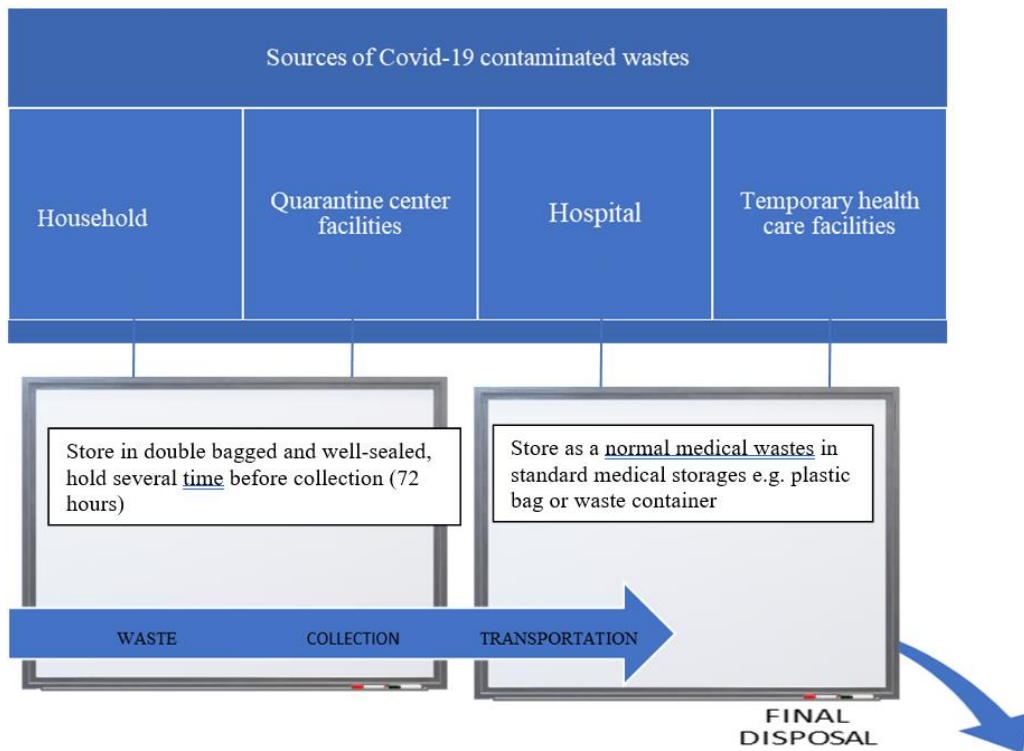


Figure 2. In the pandemic time the management of the hygiene materials as mask and gloves

The Ministry of Environment and Urbanization recently adopted the new Regulation on Control of Medical Waste. Based on the Environment Law No. 2872, the purpose of the Medical Waste Regulation is to reestablish the legal, administrative and technical procedures and principles, as well as policies and programs regarding the collection, temporary storage, transportation and disposal of medical waste. Provisions on the requirement of the authorization certificate will enter into force on January 25, 2018. The remaining provisions entered into force on January 25, 2017, repealing the previous regulation dated July 22, 2005. The principles of integrated waste management are based on waste prevention, waste reduction, reuse, recycling, energy recovery and disposal. Furthermore, an integrated waste management system should have the following attributes: the system must be holistic, it should create economic value, and it must be flexible and suitable for regional planning. During the pandemic, the hospital in our university (Fig-2) became a pandemic hospital. Medical waste management, which is very well managed in our already existing University, has also been carried out more meticulously with success. Medical wastes such as masks, gloves and other personal hygiene materials of university employees were also collected in separate closed containers in each unit and disposed of as medical waste.

2.2. Climate Change

Scientists are observing changes in the Earth's climate in every region and across the whole climate system, according to the latest Intergovernmental Panel on Climate Change (IPCC) Report, released on Aug 9, 2021. The report provides new estimates of the chances of crossing the global warming level of 1.5°C in the next decades, and finds that unless there are immediate, rapid and large-scale reductions in greenhouse gas emissions, limiting warming to close to 1.5°C or even 2°C will be beyond reach. In this report it was highlighted stabilizing the climate will require strong, rapid, and sustained reductions in greenhouse gas

emissions, and reaching net zero CO₂ emissions. Limiting other greenhouse gases and air pollutants, especially methane, could have benefits both for health and the climate. For this purpose, we calculated the carbon emissions in OMU (Table-1).

Table 1. Percentage of change in the university's consumption data for 2020 (%)

Year	2019	2020	Change in 2020 compared to 2019
Water Consumption Amounts (m ³)	41.658,06	29.762,00	-28,56%
Electricity Consumption Amounts (Kwh)	31.554.447,25	27.248.398,80	-13,65%
Natural Gas Consumption Quantities (m ³)	1,888,991.91	1,370,727.82	-27.44%
Fuel-oil Consumption Amounts (tons)	132.65	76.28	-42.50%

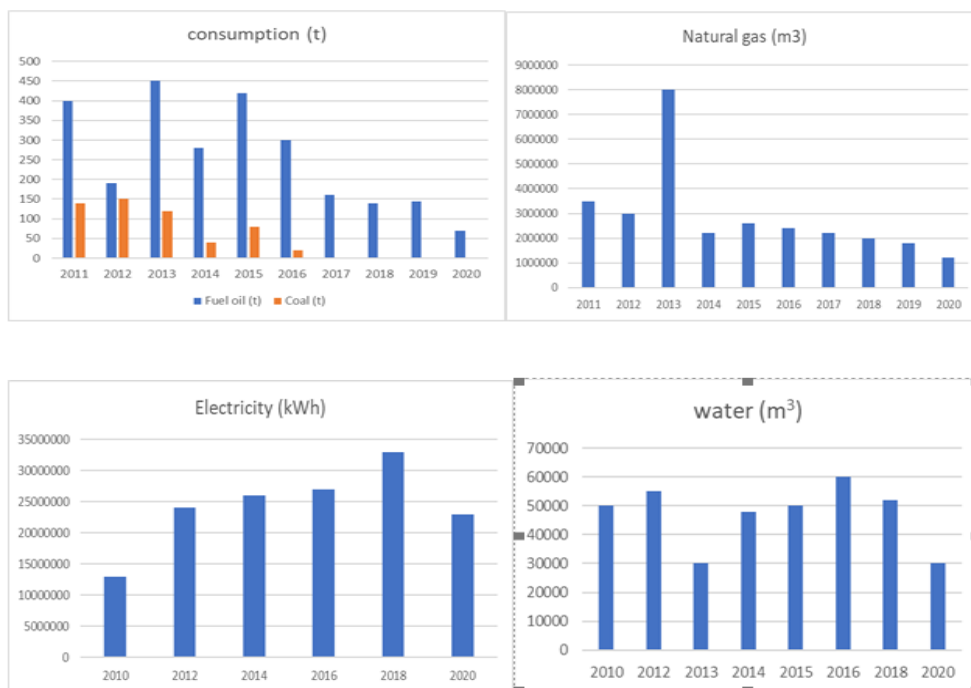


Figure 3. Consumption fuel oil, coal, natural gas, electricity and water in OMU campus

Table 2. OMU Carbon Footprint (tCO₂-eq) in the pandemic time (2020)

Scope	Resources	2020 (t CO ₂ -eq)
Scope-1	Natural gas consumption	2881,722
	Fuel-oil consumption	0.194403
	Total	2881,9164
Scope-2	Electricity consumption	13412,424
Scope-3	Electricity transmission-distribution	1448,541
	Water consumption	10238,128
	Domestic waste	4.6075
	Total	11691,27
	Total	27985,61

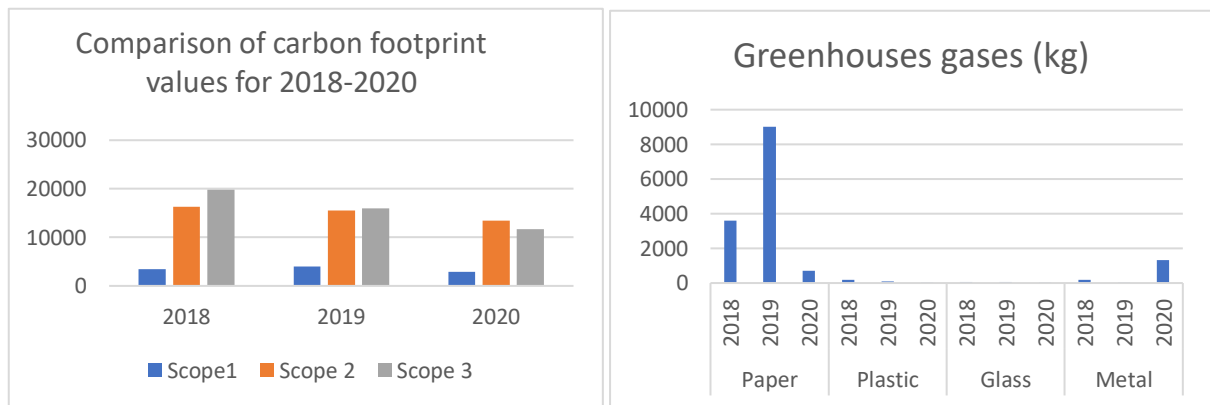


Figure 4. Comparison of carbon footprint values for 2018-2020 and environmental gain values calculated according to waste types for greenhouses in OMU

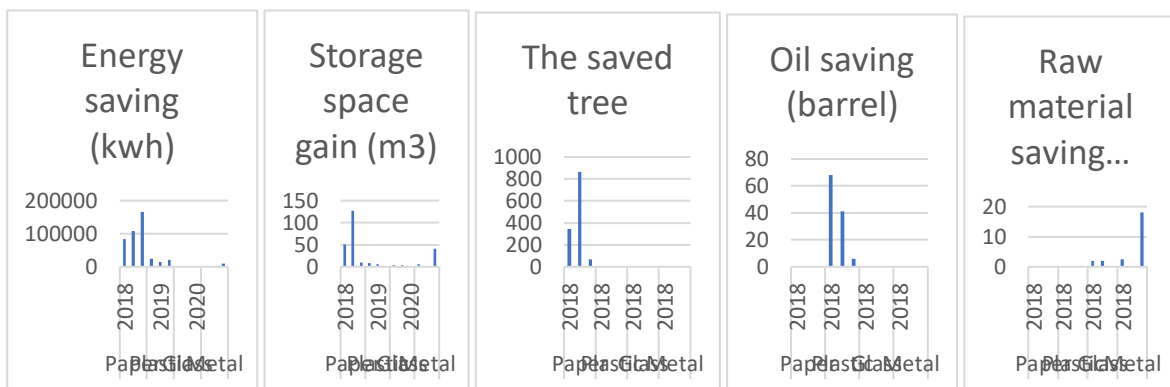


Figure 5. Environmental gain values calculated according to waste types in OMU

Looking at the annual consumption data of our university announced in the recent past and today (natural gas, fuel-oil, electricity, water, etc.); It is observed that the consumption for heating purposes (natural gas, fuel-oil) decreases every year between 2018 and 2020. In addition, the reduction in electricity, water consumption and waste generation draw attention.

Compared to two thousand eighteen and 2020 in our university, water consumption has been reduced by approximately thirty percent, electricity consumption by fourteen percent, natural gas consumption by twenty seven percent, and fuel oil consumption by fifty percent.

It has been determined that the fuel-oil consumption has decreased compared to the previous years. Ensuring the continuity of the decrease in the consumption data for heating, which is one of the important sources of carbon emissions, will bring many environmental and economic gains.

In our university, the buildings are thermal insulated. The water requirement of Kurupelit Campus is under the ownership of our university. It is supplied from the Karakavuk Pond Drinking and Potable Water Facility. In 2020, an average of two thousand and five hundred cubic meter of water per day and an average of nine hundred thousand cubic meter of water per year were consumed.) It is inevitable that the reduction in consumption will have positive contributions to our university in many respects.

The carbon footprint of our university, which we calculated based on these consumption data (Scope 1, Scope 2 and Scope 3), has also decreased in the last three years. Consumption in terms of heating in Scope 1, electricity consumption in Scope 2, transmission-distribution losses in Scope 3, water and waste data were evaluated.

3. Conclusion

Most of the university administrative and academic staff generally from home and normal activities in the field are on hold in the pandemic time. Pandemic also delayed the educational system, for example universities have been closed. Distance education information was given to academic staff at Ondokuz Mayıs University. Continuing distance education due to the new type of coronavirus measures, Ondokuz Mayıs University provided 10 GB of free internet support to its students.

Many studies are carried out and planned for the development of adaptation and climate-resilient planning in the areas of our university. In addition to the harmonization of integrated waste management and transfer mechanisms in our university, carbon capture gardens (CCG) have been designed to be implemented in our university. Despite the measures we have taken to release carbon in our university, the fact that it is an active hospital serves a large part of the Black Sea in terms of health, and many cars enter our university in terms of environment. We aim to turn the current situation into a positive one by establishing carbon capture gardens at our university. The aim of this CCG is to effect "permanent" chemical or biological subsurface sequestration of CO₂, to convert CO₂ to useful products, and to ensure environmental security.

Integration of different approaches for solid waste management optimizes the existing systems and implements new waste management systems. In addition to climate concerns, recycling and energy recovery enriches resource efficiency and reduces the environmental impacts from greenhouse gas emission. We reduce our carbon emissions by doing waste management at the university. Packaging wastes are delivered to a company

authorized by the municipality for recycling. Biodegradable wastes are delivered to the biogas facility authorized by the Municipality, a very small amount of waste is sent to landfills.

Waste management is one of the key services every city government provides, and climate change can impact waste facilities both directly and indirectly. At the same time, improper waste management as waste blocking drainage exacerbating flooding during rainfall events can reduce the ability of a city to cope with extreme climate events. All new and existing waste management systems therefore will be designed to be resilient to climate change in our university and region.

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