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Waste to Energy: Čalorific Improvement of Municipal Solid Waste through Biodrying

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Abstract

Municipal solid waste (MSW) is an energy resource with sufficient energy / calorific value, making it a suitable substitute for fuel. This study investigated the effect of air flow rate on the MSW calorific value, the hemicellulose content, and the MSW degradation rate in a biodrying process. Four biodrying reactors equipped with flowrate and temperature recorders were used in the study. The air flow rate was varied as follows: 0 L/min/kg, 2 L/min/kg, 4 L/min/kg, and 6 L/min/kg, corresponding to reactors R1, R2, R3, and R4, respectively. The calorific value, water content, hemicellulose content, organic Č content, and total N were measured on day 1, day 15, and day 30. The results showed that the biodrying process could increase the calorific value by 55.3 %, whereas the control reactor could increase the calorific value by only 4.7 %. The highest calorific value was 17.63 MJ/kg, at an air flow rate of 4 L/min/kg. The air flow rate had a significant effect on increasing the calorific value (sig.<0.05).

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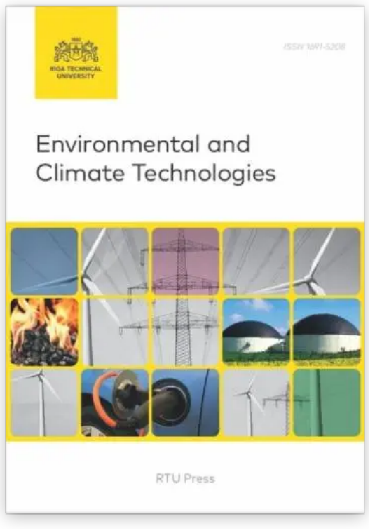

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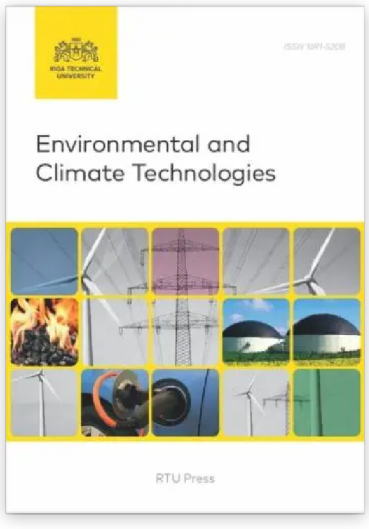

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Energy Saving and CO_2 Mitigation as a Result of Reshaping Transportation in Jordan to Focus on the Use of Electric Passenger Cars

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Waste to Energy: Calorific Improvement of Municipal Solid Waste through Biodrying

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***Abstract* – Municipal solid waste (MSW) is an energy resource with sufficient energy/calorific value, making it a suitable substitute for fuel. This study investigated the effect of air flow rate on the MSW calorific value, the hemicellulose content, and the MSW degradation rate in a biodrying process. Four biodrying reactors equipped with flowrate and temperature recorders were used in the study. The air flow rate was varied as follows: 0 L/min/kg, 2 L/min/kg, 4 L/min/kg, and 6 L/min/kg, corresponding to reactors R1, R2, R3, and R4, respectively. The calorific value, water content, hemicellulose content, organic C content, and total N were measured on day 1, day 15, and day 30. The results showed that the biodrying process could increase the calorific value by 55.3 %, whereas the control reactor could increase the calorific value by only 4.7 %. The highest calorific value was 17.63 MJ/kg, at an air flow rate of 4 L/min/kg. The air flow rate had a significant effect on increasing the calorific value (sig.<0.05). The highest temperature in the biodrying process was 41 °C. The final MSW moisture content was 27.28 %, resulting from R4. According to the statistical test results, the air flow rate had a significant influence on the water content parameters. Hemicellulose degradation due to air flow rate reached 80–85 %. The air flow rate did not significantly influence the hemicellulose degradation (sig.>0.05). The biodrying process is the suitable method to increase the calorific value of MSW while reducing its water content; thus, the process promotes the realization of waste to energy as refuse-derived fuel.**

***Keywords* – Biodrying; Calorific; Energy; Municipal solid waste; Refuse-derived fuel**

Nomenclature		
HHV	Higher heating value	MJ/kg
MSW	Municipal solid waste	–
RDF	Refuse-derived fuel	–

1. INTRODUCTION

Solid waste production is one of the greatest challenges of recently [1]. Municipal solid waste (MSW) is an energy resource with sufficient energy/calorific value, making it a suitable substitute for fuel [2]. Municipal solid waste comprises all the wastes arising from human and animal activities such as food waste, construction debris, polyethylene, cloth, garden

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Examining the Impact of Different Technical and Environmental Parameters on the Performance of Photovoltaic Modules

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***Abstract* – This article presents an evaluation of the performance of PV modules with the variation of some technical and environmental parameters: The PV module tilt angle, and the impact of soiling on the power output of PV module, and the transmittance of the PV glass surfaces. The experiments were achieved in Helwan City (Egypt) at the premises of the Faculty of Engineering of Helwan University. For the soiling part, it comprises two experiments: Transmittance of PV glass surfaces, and the power output of PV modules. For the transmittance experiment, it has been achieved using a simplified method, where three PV glass surfaces were placed at three different tilt angles (0°, 15°, and 30°) and left exposed to the outdoor environment without cleaning for a period of 25 days during the summer season. For the experiment concerning the impact of soiling on the power output, a set of PV modules connected in series have been exposed for a period of 75 days to the outdoor environment without cleaning. Finally, for the PV module tilt angle experiment, another set of PV modules have been used for that purpose, where four different tilt angles were experimented: 0°, 15°, 30°, and 45°. The present research recommends that more studies are needed in the same context, taking into consideration correlating the technical and environmental parameters in one single experiment and during different times of the year. This would be helpful in having overarching perspective regarding the electrical performance of PV modules under different circumstances of tilt angles and soiling patterns within the area of Helwan (Egypt).**

***Keywords* – Dust; Photovoltaic (PV); soiling; solar; tilt angle; transmittance**

Nomenclature	
PV	Photovoltaic
GW	Giga Watt
V_{oc}	Open Circuit Voltage
V_m	Maximum Power Point Voltage
I_{sc}	Short Circuit Current
I_m	Maximum Power Point Current

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The Importance of Science, Technology and Innovation in the Green Growth and Sustainable Development Goals of Colombia

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***Abstract* – Green growth and sustainable development goals (SDGs) are two strategies to improve the productivity and competitiveness of countries with respect to environmental protection. In these strategies, science, technology and innovation (STI) plays an important role in generating new knowledge. Colombia is a highly diversified country that is currently seeking to promote green growth initiatives and the SDGs through five axes: policy, new economic opportunities from the sustainable use of natural resources, the efficient use of natural capital and energy in production, business and human competences and capacities in STI. In this context, this study seeks to analyse the main contributions and adequate measures that determine the relationships between green growth, SDGs and STI in Colombia over recent years using different econometric models. The results of this study suggest the importance of STI in promoting green growth and achieving SDGs. In other words, higher investments in STI promote lower pollution and higher productivity, competitiveness and development, and new knowledge and technologies are found to be important to increasing the sustainable use of natural resources in productive processes. These results suggest policy implications with regard to energy use and conservation, resource efficiency, and the reduction of pollution. It is important to formulate and frequently measure the indicators of STI related to green growth and SDGs from a baseline, as this will allow us to analyse improvements in competitiveness and productivity from a sustainable development perspective.**

***Keywords* – Colombia; empirical analysis; green growth; science, technology and innovation; sustainable development goals**

1. INTRODUCTION

Worldwide, there is a general consensus that growth has been achieved at the expense of natural resources and the environment. The subsequent environmental degradation affects human activities, especially the population living in poverty, through extreme and violent weather, floods and climate change. Different interest groups, such as policymakers, development experts, decision-makers and international organizations (the World Bank, the Interamerican Development Bank, etc.), have developed effective strategies for ending poverty, generating economic growth, making demand inclusive and sustainable and achieving fundamental universal access to energy, responsible and conscientious resource use

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Industrial Energy Efficiency Towards Green Deal Transition. Case of Latvia.

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***Abstract* – Energy efficiency policy has been one of the European Union top priorities for decades and will continue to play a vital role in the next 10 years with the introduction of The Clean energy for all Europeans. Likewise, in Latvia energy efficiency has been given high priority; however, the energy efficiency targets for industry has lacked ambitions. This research focuses on evaluating the Latvian industrial energy efficiency policy using top-down approach and benchmarking energy intensity of Latvian industry to the average of the European Union's. Results confirm that on average Latvian industry consumes 2.6 times more energy to produce the same amount of value added compared to the average in the European Union; however, every saved energy unit in Latvia would save twice less CO_2 emissions considering already largely decarbonized energy mix. In the spotlights of the Green Deal proposed by the European Commission, much higher contribution in terms of CO_2 reduction and energy efficiency will be expected from the industry. Nevertheless, energy efficiency targets for Latvian industry should be sector-specific, separately addressing CO_2 intensive sectors, and non-intensive CO_2 sectors with low added value.**

***Keywords* – Industrial CO_2 intensity; industrial energy efficiency; industrial energy intensity; top-down analyses; the Green Deal**

1. INTRODUCTION

Energy efficiency policy has been one of the top priorities in European Union (EU) for more than 25 years. Energy efficiency is considered to be one of the cost-effective ways to ensure energy security, reduce carbon emissions and ensure economic competitiveness. EU Directives impose increasing mandatory energy efficiency targets to the Member States, however the particular way to reach the energy efficiency targets is up to the Member States themselves [1]–[4]. Another key aspect of energy efficiency policy implementation is the increased focus on the industrial sector as it is one of the largest greenhouse gas (GHG) emitters in the EU, causing approximately 20 % of all GHG emissions in the EU [5]. Article 8 of Energy Efficiency Directive (EED) imposes mandatory energy audits for large enterprises or implementation of an energy or environmental management system certified by an independent body according to the relevant European or International Standards [3].

The Clean energy for all Europeans [6] envisages even more ambitious energy efficiency targets and recognizes essential importance of energy efficiency improvements to the environment, public health, reduction of GHG emissions and energy security by reducing dependence on energy imports from outside the EU. Even more so, it will cut energy costs for households and companies, help to reduce energy poverty, and lead to an increased

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