



The International Maritime Transport and Logistics Conference

“MARLOG 12”

**Sustainable & Innovative
Technologies**

Towards a Resilient Future

12 - 14 March, 2023 Alexandria - EGYPT





Bassma Sameer

Graduate Teaching Assistant

**Obtaining green warehouses
from converting the potential
energy of trucks into
Piezoelectricity:**

A Conceptual Introduction

Sameer.B⁽¹⁾, Hanafi.I⁽²⁾ and Elbarky.S⁽³⁾



Presentation Agenda

1. INTRODUCTION: -GREEN WAREHOUSE
-KINETIC ENERGY AND ITS ADVANTAGES
-PIEZOELECTRICITY
2. METHODOLOGY
3. RESEARCH FINDING
4. CONCLUSION
5. RECOMMENDATION

1-INTRODUCTION

The general trend in all countries of the world is the use of clean, renewable, and inexhaustible energy sources, no matter what happens, to preserve the environment by reducing emissions from fuels and at the same time preserving the existing stock of fuel for future generations.

In this research, we highlight the technical potential and the economic feasibility of activating the conversion of kinetic energy, specifically the kinetic energy resulting from the movement of trucks and cranes.

First we should discuss the followings:

GREEN WAREHOUSE

KINETIC ENERGY AND ITS ADVANTAGES

PIEZOELECTRICITY

2. METHODOLOGY

- The research methodology is depending on reviewing the previous studies to get a theoretical framework linking between piezoelectric tiles and green warehouse so as to answer the following research questions:
- **A) what are the previous studies that link piezoelectricity with obtaining green warehouses?**
- **B) can we get a theoretical framework for the relationship among the dependent variable “ Obtaining Green Warehouses” and the independent variable “piezoelectricity” ?**

2-METHODOLOGY

In order to achieve the research methodology's first aim to obtain the theoretical framework, the previous studies were divided into three sections to explain how to reach the required frame :

1- CONVERTING KINETIC ENERGY INTO ELECTRICAL ENERGY

As published by (Arfken et al., 1984) It explains kinetic energy that Galileo discovered in 1638, and the beginning of the law of motion, which explains how to deduce the law of motion, how to convert energy from kinetic to static, and all the laws of motion that have been discovered over the ages and show that the law of kinetic energy which is: $K = \frac{1}{2} m * v^2$

K= KINETIC ENERGY, M= MASS OF BODY, V= VELOCITY

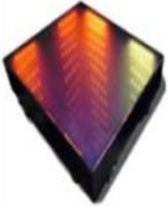


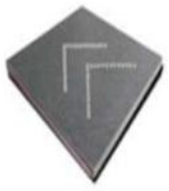

THIS EQUATION CAN BE ACHIEVED THROUGH (PIEZOELECTRIC TILES)

AND THERE ARE MANY TYPES OF TILES AS SHOWN IN TABLE (1) AND (2)

TABLE (1) TYPES OF PIEZOELECTRIC TILES

Company	Tiles Size	Energy Produced	Price in US \$	Life span by years
Waynergy Floor	40 x 40 cm	10 W per step	451.5	20
Sustainable Energy floor (SEF)	75 x 75cm <u>OR</u> 50 x 50 cm tile	Up to 30 watt of continuous output. Typical power output for continuous stepping by a person lies between 1 and 10W (average 7W)	1,693	20
Pavegen tiles	50 x 50 cm	5 W continuous power from footsteps	395	20
(EAPs) Electro-Active Polymers	Sheets	1W	-----	20
Sound Power	50 x 50 cm	0.1W per 2 steps	270.9	20
PZT ceramic (Lead Zirconate Titanate)	Manufacturing in a small size	0.0084 W	36.1	20
Parquet PVDF layers	Layers	0.0021 W per pulse with loads of about 70 kg	-----	20
Drum Harvesters - Piezo buzzer Piezoelectric Ceramics	Vary	Around 0.002463 W	56.4	20

TABLE (2) SEF piezoelectrics tiles

Product	SDF	SEF basic	SEF led	SEF car	SEF solar
					
Power output per step (peak / average)	30 / 10 W	15 / 6 W	15 / 6 W	50 / 20 W	90 / 45 W

2-METHODOLOGY

2- VARIOUS LOGISTICAL ALLOCATIONS THAT USED PIEZOELECTRICITY

Article written by (Jettanasen et al., 2020) aims to obtain the use of piezo-electric tiles in several countries such as Switzerland, Ghana and London to reduce the use of fuel energy and reduce carbon emissions to create smart cities that operate with sustainable energy and also shows the difference between carbon emissions before and after the use of the piezo energy resulting from human steps and electronic devices vibrations.

3- THE ECONOMIC FEASIBILITY OF USING PIEZOELECTRIC TILES

to show the ratio in decreasing the cost, (Adnan Elhalwagy et al., 2017) explain if piezoelectric tiles applied on floor in building's interior spaces in different areas public area as shown in table (2) ,and private spaces as shown in table (3) and how much costs saved from applying these tiles and also explained the different companies that produced piezoelectric tiles

TABLE(3)Output results of public area

option	Number of tiles	Company	Initial cost- EGP	saving percentage	total saved amount
1	1334	sound power	2668000	92.69%	33,833,333
2	14	pavagen	490000	98.72%	36,033,333
3	10	SEF	150000	99.48%	27,232,143
4	7	Waynergy	28000	99.93%	36,473,333

TABLE (4) Output results of private area

option	Number of tiles	Company	Initial cost- EGP	saving percentage	Total saved number
1	1600	sound power	3200000	-8667.12%	3,163,500 -
2	16	pavagen	560000	-1434.25%	523,500-
3	12	SEF	180000	-526.22%	144,054-
4	8	Waynergy	32000	12.33%	4,500

2-METHODOLOGY

- Data analysis is done as per objectives. To achieve the 2nd aim objective the following questions are used for collecting data and then these data are analyzed.
- **Question 1:** Will you choose to generate electricity through trucks?
- **Question 2.** Are you interested in producing energy yourself?
- **Question 3:** Have you heard of piezo electricity?
- **Question 4:** How did you learn about this technology?
- **Question 5.** Would you like to install new electronic floor tiles in your warehouse?
- **Question 6.** How many times do the trucks go inside the warehouse per day?
- **Question 7.** What is the truck load per day?
- **Question 8:** How much do you prefer to invest in equipment that can generate electricity for the warehouse?

3-RESEARCH FINDING

- The findings are the outcome of reviewing the previous studies, and the result of reviewing the literature is the suggested research theoretical framework "The Research Model".

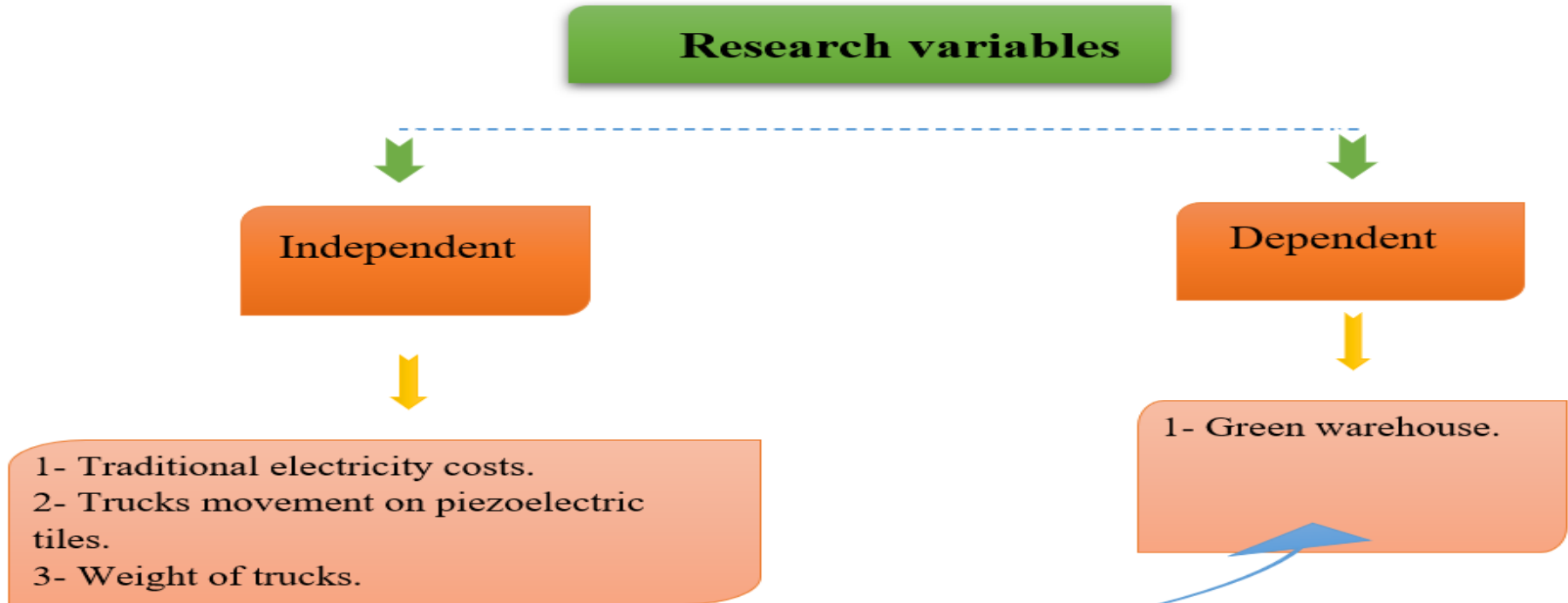


Figure 1: The Research Model

4-CONCLUSION

- From the foregoing, it is clear that through previous studies, piezoelectric tiles have done practical and theoretical studies on many scales, whether in the practical field or even daily, and previous studies show the extent of savings, whether providing non-renewable energy or saving related costs, and therefore the presented model can be taken From this research paper, and as for the data that will be collected from the people interested in applying this model and analyzing it, we can obtain the actual percentages of the extent to which piezoelectric tiles can be applied, and obtain the actual results of the extent to which non-renewable energy is provided, as well as the related costs.

5-RECOMMENDATION

- THE RESEARCH RECOMMENDS PREPARING A CASE STUDY ON ONE OF THE MAJOR WAREHOUSES TO COMPARE THE SITUATION BEFORE AND AFTER APPLYING THE PIEZOELECTRICITY TECHNOLOGY ACCORDING TO COST LEVELS AND OBTAINING A GREEN WAREHOUSE, SO WE CAN TEST THE RESEARCH THEORETICAL FRAMEWORK "THE RESEARCH MODEL".

Thank You