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EU Experience in Waste Recycling and Conversion for Renewable Energies

Fadila BOUTORA[1], Samia GHARBI[2], Sufian Eltayeb Mohamed[3]

[1]University of Larbi Tebessi, Tebessa
[2]University of Abdelhamid MEHRI Constantine 2, Constantine
[3]Sultan Qaboos University

Corresponding Authors:** ***Sufian Eltayeb Mohamed, *Sultan Qaboos University*

Abstract: *This study aims to know the importance of recycling waste and converting it to renewable energies, and to know the statistical reality of the EuropeanUnion experience (EU) in the field of waste recycling, treatment and conversion to renewable energies. The study has found the process of recycling waste contributes mainly to reducing the percentage of pollution of all kinds, by reducing the accumulation of waste that contributes significantly to pollution of the environment, due to the release of polluting gases and toxic elements to air, water and soil, in addition to its role in reducing the pressure on waste collection and landfills. The study recommended that there is need to develop an integrated strategy clear objectives with regard to the recycling of waste, especially in developing countries, due to the role in protecting the environment as well as the production of renewable energies, which is a strategic alternative that works to preserve traditional non-renewable energies. As well there is a need to research modern techniques that work to exploit and benefit as much as possible from the process of recycling waste and converting it to renewable energies.*

Keywords: *Waste recycling, renewable energies, Traditional energies, European Union, pollution.*

1. INTRODUCTION

Energy is the main means and key to the development and advancement of human civilization over the decades. It is the means by which all the activities of the state, whether economic, social, service-related. It also contributes to the improvement of the level of well-being of society as a whole. However, traditional energy sources are known to be powerful and to have a negative impact on the environment. Human beings have been alerted to the possibility of benefiting from other clean and inexhaustible energy, namely renewable energy, which is derived from natural resources that are renewed or cannot be implemented.

As waste presents a challenge at the global level, it warns of serious health, financial and environmental consequences if it is not properly handled. This is a problem related to how societies produce and consume them. This is due to the growing population, urbanization, and industrial growth. Currently, the weight of waste produced per capita in many developing countries exceeds one kilogram per day. The quantity of industrial waste is also very high. Economic growth aims to increase consumption and the production of goods, regardless of environmental and social dimensions and the erosion and destruction of natural resources. We need to develop new economic models aimed at achieving sustainability by using fewer resources and changing the prevailing practices of disposal of waste products and by converting them into renewable energies.

2. RESEARCH QUESTIONS

The paper rasies the following questions :

1. What is the importance of waste recycling and renewable energy conversion, and what is happening through the EU experiment?
2. What is a waste recycling and what are its benefits?
3. What is the concept of renewable energies? What are its advantages?

4. What is the statistical reality of the EU experience with waste recycling and conversion to renewable energies?

2.1. Relevance of the Study

The importance of the study stems from the importance of waste recycling and renewable energies, given their prominent role in protecting the environment and preserving the various natural resources as well as biodiversity.

3. Study Objectives

The core objectives of this study can be summarized as follows:

- Identification of theoretical concepts on waste recycling and renewable energies.

- To highlight the statistical reality of the EU experiment on waste recycling and conversion to renewable energies

3.1. Background of Study

The study was based on a descriptive and analytical approach to explain the various theoretical concepts of the two variables of the study, as well as a study approach when examining the statistical reality of the EU experiment with the recycling and conversion of wastes into renewable energies.

3.2. Topics of Study

The problem can be addressed in this study through the following axes:

- Theoretical concepts on waste recycling and renewable energies.

- The statistical reality of the EU experiment on waste recycling and conversion to renewable energies.

3.3. Theoretical Concepts on Waste Recycling and Renewable Energies

First: Concept of Waste

Waste is defined as "those substances that are not considered as valid products (i.e. not considered as products produced in the market) and therefore cannot be used by manufacturers in any other uses within industrial and production, conversion, recycling, consumption or those that need to be disposed of" (Hubri, 2019, p: 02), also defined as "somethings whose owner has become unwilling somewhere and at some time and which have become irrelevant or worthless" (Al-Qaisi, 2016, p: 435), also defined as "all residues from the processes of production, conversion or use, and in general all materials and movable objects that the holder of is or intends to dispose of or that need to be disposed of or have been removed with the aim of not harming human health and the environment" (Chelahie and Mezlef, 2018, p: 120).

Second: Waste Classification

Waste can be classified according to several criteria: (Saud and Abbas, 2019, p: 70-71).

4. Depending on their Degree of Severity

The severity of the waste is divided into two categories:

Hazardous Wastes: Wastes, the components of which contain mineral or radioactive compounds leading to serious environmental problems, generated from industrial and chemical substances and wastes, and agricultural wastes (chemicals used as boosters in agriculture), having the following characteristics: toxic, eaten, radioactive, metallic, and explosive.

Good Waste (non-Hazardous or Ordinary): The aggregate of substances the presence of which is not a serious environmental problem and which are easy to dispose of in an environmentally safe manner.

By Source and Nature: Classified to domestic, industrial, commercial, agricultural, medical, building or removal waste, mine waste, wastewater treatment wastes, radioactive waste, electrical and electronic waste.

Depending on the Situation: They are:

Liquid Wastes: Liquid substances formed through the use of water in various industrial and agricultural processes, such as oils and sewage.

Gaseous Waste: gases or fumes from manufacturing rings, which rise in air through factory chimneys such as carbon monoxide, sulfur dioxide, nitrogen oxide, etc.

Solid Waste: Waste consisting of metal or glass materials, produced by domestic, industrial, and agricultural waste, takes hundreds of years to decompose.

Third: The Concept of Waste Recycling

Recycling is defined as "the process of recovering materials from the waste with a view to acquiring raw materials that can be added to the raw materials needed to manufacture the product that made up the waste or reuse the waste as it is again (Tariq Ghoneimi, 2017, p.: 250), also means that "some types of waste, such as paper, glass, metals, and plastic, are recovered and prepared through industrial processes, to be reused as raw materials for the manufacture of new products, although industrial processes of waste recycling such as separation, purification, smelting, etc. may cause some damage to the environment in addition to the expected economic cost, However, there are many benefits, including the conservation of natural resources and energy from oil, gas, and minerals. and to reduce the amount of municipal waste buried and its environmental consequences: Such as air pollution by gases, groundwater pollution, and others (recycling as a green economy trend, 2018, p. 24-25).

Fourth: The Economic, Social, and Environmental Importance of Waste Recycling

The importance of waste recycling lies in many aspects such as the environmental, economic, social, and health aspects, and the following is the impact of recycling on each of these aspects: (Bozorin and Girard, 2019, p.: 25).

4.1. Environmental Aspect

Recycling of wastes mainly contributes to reducing pollution of all kinds by reducing the accumulation of wastes that contribute significantly to environmental pollution due to the production of contaminated gases and toxic elements to the air, water, and soil, apart from their role in reducing pressure on waste collection and burial sites (landfills), in general, waste recycling contributes to mitigating the impact of human activity on the planet.

4.2. Economic Aspect

Waste recycling plays an important role in reducing economic expenditures and assist States in meeting the challenges of rising prices of raw materials such as oil and coal, Reliance on importing primary resources for many industries can be reduced and thus reduce the cost of production as a result of lower tax and customs bills, insurance premiums and transportation, Sometimes landfills may be dispensed with and exploited for investments and other projects benefiting the individual and society. and contributes to the provision of substantial financial resources, as the establishment of sanitary cemeteries requires substantial financial resources, as well as reducing the costs of collecting, transporting, and disposing of waste.

On the other hand, waste recycling helps reduce the consumption of natural raw materials used in various industries, thus reducing energy consumption for manufacturing and production processes, as well as reducing the costs of treating diseases caused by waste accumulation, the spread of harmful insects, and toxic pollutants, and waste recycling also contributes to higher tourism sector returns by attracting tourists to clean areas and a healthy environment.

4.3. Social Aspect

Waste recycling contributes to reducing unemployment among young people who want to work by creating new employment opportunities in the collection, sorting, and transfer of solid waste to private factories in recycling processes and helps to change the behavior of community members and raise

awareness of the risks posed by waste, so that the individual can be directed to apply the idea of sorting waste into the source to be recycled;

4.4. Health Aspect

Waste recycling reduces diseases, depression, and mental disorders resulting from waste accumulation, lack of proper disposal, and provides a safe, clean, and unpleasant environment, toxic gases, harmful insects, and rodents.

Fifth: Benefits of Waste Recycling

Some may think that the primary objective of waste recycling is not to pollute or damage or preserve the environment and to meet the needs of society and the consumer without depleting natural, especially depleted or non-renewable, environmental resources and the preservation of the environment and its natural resources for future generations, which may indeed be some of the benefits, but there are very important economic and environmental advantages: (Habri, Recycling Waste under Circular Economy and Achieving Sustainable Development, 2019, p.: 06)

Sixth : The Concept of Renewable Energies

Renewable energies are defined as "Every energy that has a solar, geophysical or biological source that is determined in nature at an equivalent pace or greater than its usage ratios, Successive currents are generated in nature, such as biomass, solar and underground energy. There are many mechanisms that allow these sources to be converted into primary energies such as heat, electric power, and kinetic energy using multiple technologies that allow energy from fuel and electricity, Their use does not give rise to any residues such as carbon dioxide or harmful gases (Qadari, Tayyip, and Amri, 2018, p.: 177), as it is also defined as "energy whose source is not a fixed and limited stock in nature, which periodically exists faster than the pace of its consumption and appears in the following forms: (Talim, 2017, p. 283).

Based on the foregoing, renewable energies express those energies derived from nature that are constantly regenerated and characterized as immature, not polluting the environment, available in nature, whether limited or unlimited, have many sources such as solar, hydro, and wind.

Seventh: Sources of Renewable Energies

The most important sources of renewable energies can be summarized as follows (TWI, 2021).

Solar Energy

The Sun's potential to provide the planet's energy needs is enormous, given the fact that enough energy to meet the planet's energy needs for a full year reaches Earth from the Sun in just one hour; however, the challenge has always been how to harness and use this enormous potential.Solar power is currently used to heat buildings, warm water, and appliances energy is collected using solar, photovoltaic, silicon cells, or other materials, These cells turn sunlight into electricity, and anything from the tiniest garden light to entire neighborhoods can be turned on, rooftop panels can provide energy to the home, while community projects and solar farms that use mirrors to concentrate sunlight can create a much larger supply. solar plantations can also be established in water bodies, called "floatovoltaics," which provide another option for locating solar panels.

In addition to being renewable, solar-powered energy systems are also clean energy sources, because they don't produce air pollutants or greenhouse gases, if the panels are positioned and manufactured responsibly, they can also count as green energy because they don't have a negative environmental impact.

Wind Power

Wind power works like ancient mills, using wind power to transform a blade, where the movement of these blades would once cause millstones to grind together to make flour and today's turbines that produce electricity.

When wind turbines are placed on the ground, they need to be placed in high wind areas. , such as hilltops or open fields and plains, offshore wind power has been developed for decades with wind

farms providing a good solution for power generation while avoiding many complaints around it. and, of course, overseas use has its own disadvantages due to aggressive environments in which turbines need to operate.

Hydropower

Hydropower works in a similar way to wind power in that it is used to rotate turbine blades for generators to create electricity hydropower uses fast-moving water in rivers or waterfalls to rotate turbine blades and is widely used in some countries, It is currently the largest renewable energy exporter in the United States, although wind power is quickly closing the gap.

Hydropower dams are a source of renewable energy, but these are not necessarily green energy sources, and many large "mega-dams" transform natural water sources, making a negative impact on animal and human populations due to restrictions on access to water sources, however, smaller hydroelectric plants if carefully managed. (Less than 40 megawatts) have no catastrophic effects on the local environment such as converting only a small portion of the water flow.

Biomass Energy

Biomass energy uses organic materials from plants and animals, including crops, trees, and wood waste, this biomass is burned to create heat that forces steam turbines and generates electricity, and while biomass can be renewable if its sources are sustainable, there are many cases where this energy is not green or clean.

Studies have shown that biomass from forests can produce higher carbon emissions than fossil fuels, while also having a negative impact on biodiversity. However, some forms of biomass offer a low-carbon option due to the right conditions, and sawdust can be used, for example, in biomass energy where it usually decomposes and releases higher levels of carbon into the atmosphere.

Geothermal Energy

Geothermal energy uses heat trapped in the Earth's core that arises from the slow decomposition of radioactive particles in rocks at the center of the planet by drilling wells, we are able to bring very hot water to the surface that can be used as a hydrothermal resource to transform turbines and create electricity and this renewable resource could be made greener by pumping steam and hot water back into the ground, thereby reducing emissions.

The availability of geothermal energy is closely linked to geographical location, where places like Iceland have supplies easy to get and ready for geothermal resources.

Tidal Energy

Tidal energy provides an option for renewable energy supply, since the tide is governed by the Moon's continuous gravitational pull, the energy that can be generated by the tide may not be static, but reliable, making this relatively new resource an attractive option for many.

However, care must be taken regarding the environmental impact of tidal power, as the tidal barrage and other dam-like structures can damage wildlife.

Eighth: Benefits of Renewable Energy Use

Renewables are characterized by their diversity and versatility, being used in many areas, such as electricity generation, small household uses (cooking and heating), industrial fields, so the use of renewables brings many of the following advantages: (Al-Saadi and Sami Fouad, 2018, p. 133)

1. **Diversification of Energy Sources:** savings in conventional sources of energy, provision of energy needs for different sectors, as well as the potential for future surpluses of electricity produced from renewable sources for export abroad.
2. **Improvement of the Environment:** Renewable energy sources are clean sources that do not affect the environment, so the use of these sources helps to reduce the emission of gases from the production of electrical energy using traditional sources of environmental pollution.
3. **Provision of Electricity:** Many electric power production projects can be established in remote and rural areas, where many renewable energy sources are available in these areas,

such as wind, solar heat, and biomass, in order to promote the development and development of these areas through the creation of new jobs, the establishment of new factories and residential cities and the improvement of the standard of living of the inhabitants of these areas.

4. **Raising the Standard of Living:** the production of electricity from renewable sources in many remote and rural areas helps to improve the standard of living of individuals and provide them with the electricity needs at the appropriate cost s population, and providing employment opportunities for local workers in these areas in the manufacturing, installation, and maintenance of renewable energy equipment, power plants, and desalination areas.

Ninth : the Role of Renewable Energy in Securing Energy

Although many appeals have been repeated towards maximizing dependence on alternative sources of energy, alternatives that can be added to a country's energy package remain subject to three conditions: Technological availability, or an acceptable local participation rate, and second: availability of human competencies And finally, the economic feasibility that has happened with wind power, technology is available to all, and it's a good idea. There are no caveats on them either by manufacturing or buying with the potential to develop and increase local participation The cost of producing an energy unit can compete with its thermal counterpart. If compared with world fuel prices (Mohammed, 2016, p. 06).

Statistical reality of the European Union (EU) experience with waste recycling and conversion to renewable energies

EU waste management policies aim to reduce environmental and health impacts of waste and improve resource efficiency in the EU and the long-term objective of these policies is to reduce the amount of waste generated and when the generation of waste cannot be avoided to enhance it as a resource and achieve higher levels of recycling and safe disposal of waste, These figures show this as follows: (The Statistical Office of the European Union, 2020).

First: Total Waste Generation: In 2018, total waste generated in the 27 EU countries from all economic activities and households amounted to 2,317 million tons.

Table1. *Waste Generation through Economic Activities and Households*

	Mining and quarrying	Manufacturing	Energy	Construction and demolition	Other economic activities	Households
EU-27	26.3	10.6	3.5	36.0	15.4	8.2
Belgium	0.1	24.9	1.2	33.5	33.1	7.2
Bulgaria	82.4	2.0	10.0	0.1	3.1	2.4
Czechia	0.3	18.2	1.8	41.6	24.8	13.3
Denmark	0.0	4.7	5.1	56.0	17.8	16.3
Germany	2.2	13.9	2.3	55.6	16.8	9.2
Estonia	29.5	18.8	32.3	9.5	7.6	2.4
Ireland	14.2	24.7	1.1	13.6	35.1	11.4
Greece	56.4	11.8	7.6	5.0	9.2	10.1
Spain	8.6	10.8	4.6	29.8	28.5	17.7
France	0.4	6.6	0.4	70.2	13.7	8.7
Croatia	12.0	8.9	1.3	22.7	31.7	23.3
Italy	0.8	16.5	1.3	35.3	28.7	17.5
Cyprus	6.6	16.3	0.1	45.8	14.5	16.8
Latvia	0.1	21.7	2.5	17.5	25.7	32.6
Lithuania	1.6	37.2	2.1	8.8	30.3	20.0
Luxembourg	0.0	6.9	0.1	81.2	9.7	2.1
Hungary	1.0	14.6	11.2	33.2	25.1	14.9
Malta	1.6	1.1	0.0	79.3	10.9	7.2
Netherlands	0.0	9.6	1.1	70.0	13.3	6.0
Austria	0.1	8.7	0.8	74.4	9.3	6.7
Poland	36.7	17.0	10.7	9.7	20.6	5.3
Portugal	0.2	19.0	1.1	8.8	38.1	32.8
Romania	87.9	4.0	3.4	0.3	2.4	2.1
Slovenia	0.2	20.2	11.8	8.1	51.9	7.8
Slovakia	2.2	27.5	7.9	4.4	39.8	18.2
Finland	74.9	6.7	1.0	12.3	3.5	1.6
Sweden	74.7	3.7	1.4	8.9	8.0	3.2
United Kingdom	5.2	4.0	0.2	48.8	32.4	9.4
Iceland	0.0	24.4	0.0	3.9	31.5	40.2
Liechtenstein (')	3.0	2.3	0.0	87.9	1.5	5.4
Norway	1.2	12.8	1.5	40.0	27.4	17.1
Montenegro	27.4	3.7	27.6	11.3	8.6	21.4
North Macedonia	14.2	46.6	0.5	3.1	35.6	0.0
Serbia	75.6	3.0	14.7	1.1	2.1	3.6
Turkey	22.3	:	32.6	0.0	8.9	36.1
Bosnia and Herzegovina	8.2	28.1	48.1	1.8	0.2	13.6
Kosovo*	93.5	2.0	3.4	0.1	0.0	1.0

Source: *(The Statistical Office Of The Europen Union, 2020)*

Table 01 shows the share of various economic activities and households in total waste generation in 2018. In the 27 EU countries, the construction sector contributed 36.0 percent of the total in 2018, followed by mining and quarrying (26.2 percent), manufacturing (10.6 percent), waste and water services (9.9 percent), and households (8.2 percent); The remaining 9.1 percent was waste generated by other economic activities, particularly services (4.2 percent) and energy (3.5 percent).

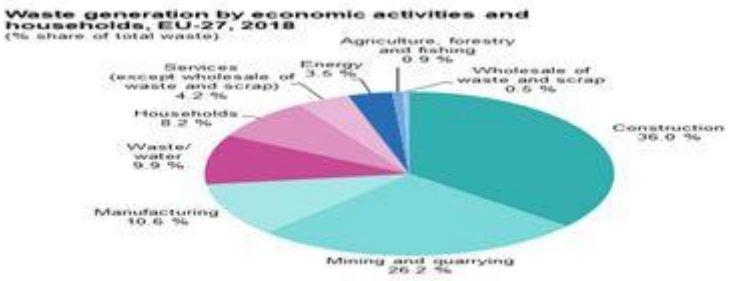

Figure1. *Waste generation through economic activities and households*

Source: *(The Statistical Office Of The Europen Union, 2020)*

Figure 02 shows an analysis of the amount of waste generated in a uniform form. and high levels of total waste generated in some smaller EU member states can be clearly seen, with a particularly high value recorded for Finland where 23.3 tonnes of waste was generated per inhabitant on average in 2018, about four and a half times the average of 5.2 tonnes per resident in the EU27 and a number of Member States with unique levels of waste generated per capita have reported very high shares of waste from mining and quarrying, construction and demolition elsewhere have often contributed to higher quotas.

Much of the waste from mining, quarrying, construction, and demolition is classified as major mineral waste: Analysis in figure 03 distinguishes major mineral waste from all other wastes and was approximately two thirds (65% or 3.4 tonnes per inhabitant) of total waste generated in the EU - 27. In 2018, major mineral wastes, the relative share of major mineral wastes in total generated varied considerably among the EU27, Which may reflect, to some extent at least, different economic structures and, in general, the 27 member states of the European Union that had higher shares of major mineral waste were those described as engaging in relatively large mining and quarrying activities. such as Romania, Finland, Sweden, Bulgaria, and/or construction and demolition activities, such as Luxembourg; In these Member States, major mineral wastes accounted for 83 percent - 89 percent of all waste generated; in Liechtenstein (91%) and that share was even higher.

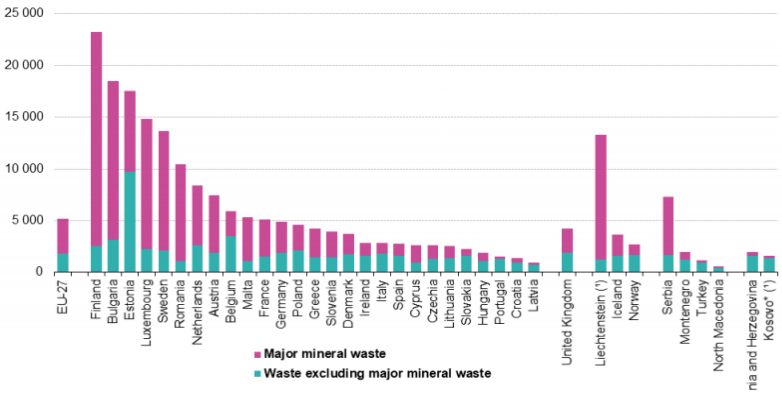

Figure2. *Waste generation*

Source: *(The Statistical Office Of The Europen Union, 2020)*

Second: Waste Generation Excluding Major Mineral Waste

In the EU27, 812 million tonnes of waste was generated excluding major mineral waste in 2018, equivalent to 35% of the total waste generated, and when expressed for population size, the EU - 27

generated on average 1.8 tonnes per inhabitant of waste except for major mineral waste in 2018 (figure 04).

In all 27 EU member States, waste generation, excluding major mineral waste in 2018, ranged from an average of 9.7 tonnes per inhabitant in Estonia to less than one tone per inhabitant in Latvia, Croatia, and Cyprus, and the large amount of waste generated in Estonia is associated with shale-based energy production**.**

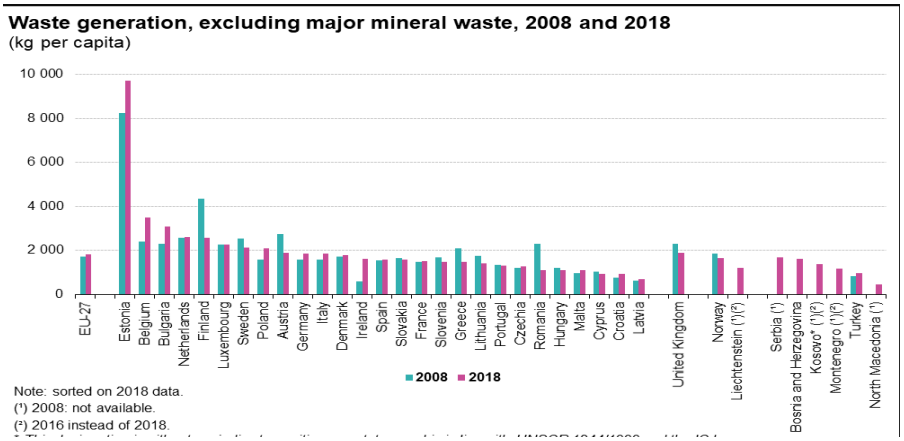

Figure3. *Waste generation, excluding major mineral wastes, EU-27, 2004-2018*

Source: *(The Statistical Office Of The Europen Union, 2020)*

Table 02 shows the evolution of waste generation in the 27 EU countries with the exception of major mineral wastes analyzed by economic activity. In 2018, the highest levels of waste generation were recorded in waste and water services, for households and for industrial activities (207 million tons, 184 million tons, and 180 million tons), which followed different patterns over time: Between 2004 and 2018 waste generation (excluding major mineral waste) through waste and water services, households increased by 175.7 percent and 9 percent respectively, and manufacturing activities shrank significantly, down by 24.9 percent.

Table2. *Waste generation, excluding major mineral wastes, EU-27, 2004-2018*

Waste generation, excluding major mineral waste, EU-27, 2004-2018

(million tonnes)

	2004	2006	2008	2010	2012	2014	2016	2018	Change 2018/2004 (%)
Total	779.5	789.9	760.5	758.7	758.3	769.0	785.9	811.7	4.1
Agriculture, forestry and fishing	62.3	56.7	45.5	20.2	20.4	17.7	19.9	19.3	-69.0
Mining and quarrying	10.4	7.1	10.0	7.9	7.5	7.7	7.0	8.1	-22.5
Manufacturing	239.9	225.8	216.8	190.5	176.5	176.0	179.9	180.2	-24.9
Energy	85.4	93.3	84.1	78.6	88.8	87.4	75.0	78.4	-8.3
Waste/water	75.2	83.3	98.9	129.9	155.4	180.7	195.7	207.5	175.7
Construction	34.4	33.4	34.8	42.1	39.8	38.6	37.7	41.2	19.7
Other sectors	97.7	111.2	88.8	102.3	88.9	85.1	89.4	92.7	-5.1
Households	174.1	179.2	181.6	187.2	181.0	175.9	181.4	184.4	5.9

Source: *(The Statistical Office Of The Europen Union, 2020)*

Third: The Generation of Hazardous Wastes

Hazardous wastes may pose a high risk to human health and the environment if they are not safely managed and disposed of. Of the waste generated in the 27 EU countries in 2018, 101.4 million tonnes (4.3% of the total) were classified as hazardous waste.

Compared to 2010, 11.6% of hazardous waste was generated in 2018 in EU27, representing an increase in quantity from 90.8 to 101.4 million tonnes, in 2018, the share of hazardous waste in a total waste generation was less than 10.0% in all EU27 member states except Estonia and Bulgaria, where, respectively, it accounted for 46.9% and a 10.4% share of the total (see figure 05). The high share of Estonia is mainly attributable to shale energy production. Among the non-member countries in figure 4, Serbia recorded the highest proportion of hazardous waste in total waste generation. (30.0 percent) due to intensive mining and quarrying activity, followed by Montenegro (27.8%), Norway (11.6%), and Turkey. (15.3%).

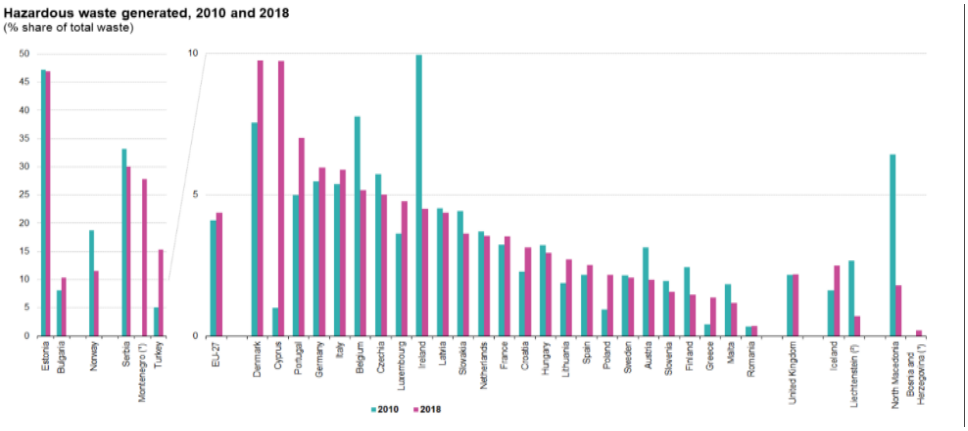

Figure5. *Hazardous wastes generated, 2010-2018*

Source: *(The Statistical Office Of The Europen Union, 2020)*

Fourth: Waste Treatment

In 2018, around 2,149 million tonnes of waste was treated in the EU27, this does not include waste exported but includes treatment of waste imported into the EU27, and therefore the amounts reported cannot be directly compared to quantities related to waste generation.

Figure 06 shows the evolution of waste treatment in the 27 EU States in total and the two main treatment categories - recovery and disposal - during the 2004-2018 period, the amount of waste recovered, in other words, recycled, used to fill waste (Use of waste in excavated areas for slope reclamation, safety or engineering purposes in landscape planning) or burned with 33.9 percent power recovery from 870 million tonnes in 2004 to 165 million tonnes in 2018; As a result, the share of this recovery in total waste treatment rose from 45.9% in 2004 to 54.2% in 2018, and waste disposal decreased from 027 1 million tons in 2004 to 984 million tons in 2018, a decrease of 4.2%. The share of waste disposal in total waste treatment decreased from 54.1 percent in 2004 to 45.8 percent in 2018.

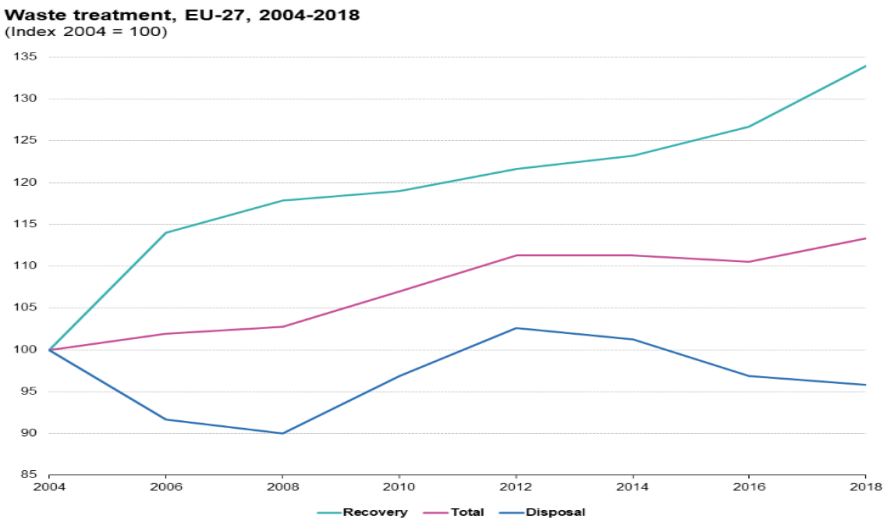

Figure5. *Waste treatment, EU-27, 2004-2018*

Source: *(The Statistical Office Of The Europen Union, 2020)*

As mentioned above, in the EU - 27 - in 2018, more than half (54.2%) of the waste was treated in recoveries: Recycling (38.1% of total waste treated), backfill (10.1%), or power recovery (6.0%), the remaining 45.8% either buried it (38.7 percent), where it was burned without power restoration (0.7 percent) or discarded otherwise (6.3%), significant differences can be observed among the 27 EU member states on the use of these different therapeutic methods, for example, there have been very high rates of recycling in some member states. (Italy and Belgium), while other States preferred landfills (Greece, Bulgaria, Romania, Finland, and Sweden), see figure 07.

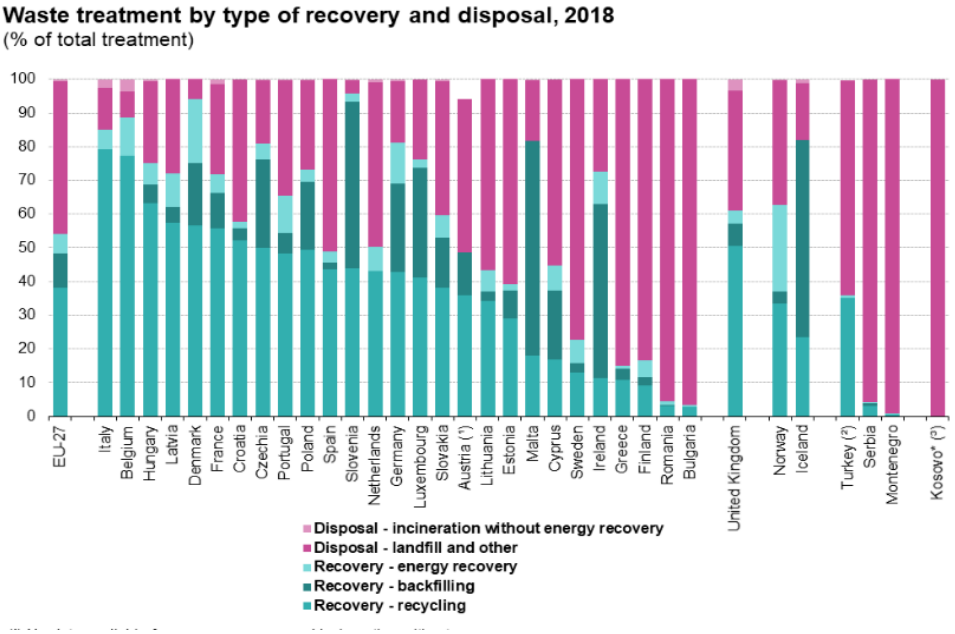

Figure6. *Waste treatment by recovery and disposal type, 2018*

Source: *(The Statistical Office Of The Europen Union, 2020)*

Fifth: Hazardous Waste Treatment

In total, 82.2 million tons of hazardous waste were treated in the 27 EU countries in 2018, and more than two-thirds of this waste was treated in only 27 EU member states Germany (27.3 percent), Bulgaria (16.5 percent), Estonia (13.1 percent) and France (11.6 percent), see Figure 08.

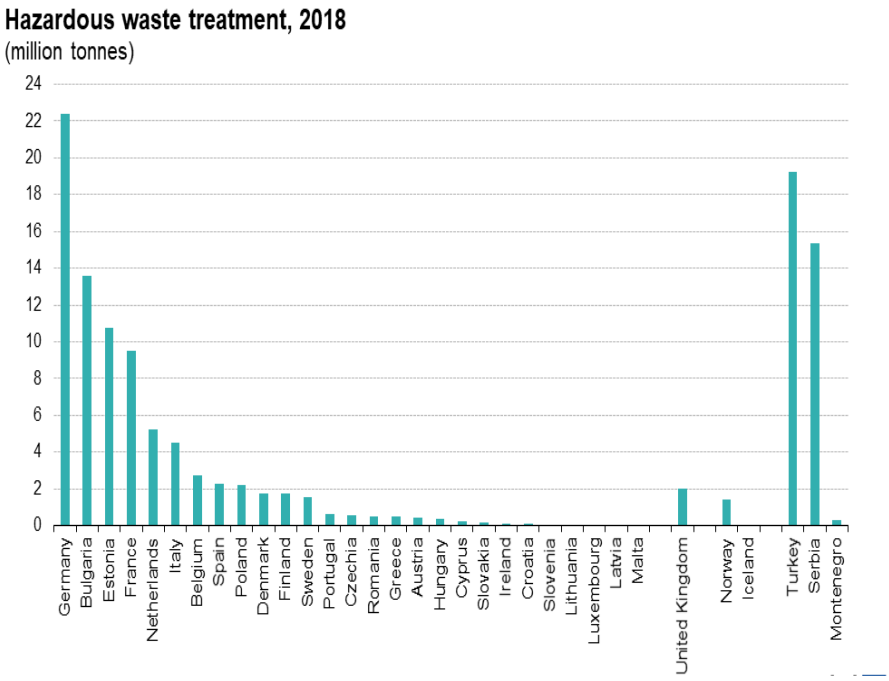

Figure7. *Hazardous waste treatment, 2018 (1,000 tons)*

Source: *(The Statistical Office Of The Europen Union, 2020)*

In 2018, almost half (45.0%) of the hazardous waste treated in the EU - 27 - was recovered: 37.4% by recycling or filling (equivalent to 69 kg per inhabitant) 7.6% by power recovery (14 kg per inhabitant), the remaining 55.0 percent was burned without restoring power, "see figure 09. (5.7 per cent or 10 kilograms per inhabitant), or buried, in other words, deposited in the ground, on land, or through land processing and release into water bodies (33.0 percent or 61 kilograms per inhabitant) or otherwise disposed of (16.2 percent or 30 kilograms per inhabitant).

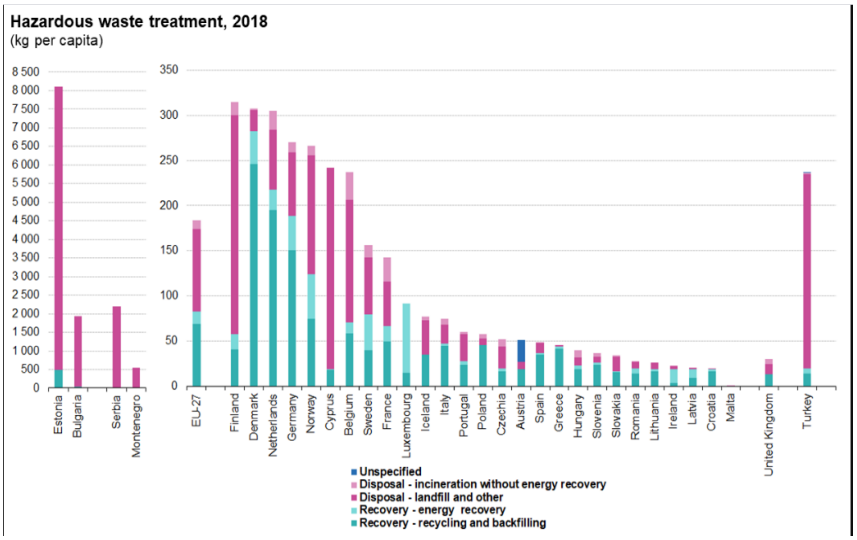

Figure8. *Hazardous Waste Treatment, 2018 (kg-individual)*

Source: *(The Statistical Office Of The Europen Union, 2020)*

5. RESULTS

Through this study, a set of results were reached, the most important of which are summarized as follows:

- Waste recycling reflects the recovery of waste materials with a view to obtaining raw materials that can be added to raw materials for the manufacture of the product that made up the waste or the reuse of the waste as it is again.

- Waste recycling mainly contributes to reducing the proportion of pollution of all kinds by reducing the accumulation of wastes that contribute significantly to environmental pollution due to the production of contaminated gases and toxic elements to the air, water, and soil, apart from their role in reducing pressure on waste collection and landfills (landfills).

- Renewable energies are a strategic alternative to traditional non-renewable energies, reflecting those that are derived from nature and are constantly regenerated and are non-polluting to the environment, available in nature, whether limited or unlimited, with many sources such as solar, hydro, and wind.

- Renewable energies are used in many areas such as electricity generation, as well as small household uses (such as cooking and heating), and industrial fields, since the use of renewable energy sources offers many advantages such as improving the environment, raising the standard of living, among others.

- In the 27 EU countries, 812 million tonnes of waste was generated excluding major mineral waste in 2018, equivalent to 35% of the total waste generated, and when expressed for population size, the EU-27 generated on average 1.8 tonnes per inhabitant of waste excluding major mineral waste in 2018.

- In EU countries - 27 - in 2018, more than half (54.2%) of the waste was treated in recoveries: Recycling (38.1% of total waste treated), backfill (10.1%), or power recovery (6.0%), the remaining 45.8% either buried it (38.7 percent), where it was burned without power restoration (0.7 percent) Or get rid of otherwise (6.3%), and significant differences can be seen among the 27 EU member states on the use of these different therapeutic methods, for example, there have been very high rates of

recycling in some member states. (Italy and Belgium), while other countries preferred landfills (Greece, Bulgaria, Romania, Finland, and Sweden) were low.

6. CONCLUSION

Waste recycling is a helpful step in supporting the green economy trend, given its particular importance with regard to the environmental aspect, where waste recycling mainly contributes to reducing pollution of all kinds. By reducing the accumulation of wastes that contribute significantly to environmental pollution, Due to the release of contaminated gases and toxic elements to the air, water, and soil Other than its role in reducing pressure on waste collection and burial sites (landfills), and in general, waste recycling contributes to mitigating the impact of human activity on the planet, This shows that waste recycling is a successful step in supporting the trend towards renewable energy production. as well as preserving the environment and various natural resources for future generations, Investment in waste recycling has therefore become necessary and mandatory in light of the prevailing depletion of non-renewable energies.

7. RECOMMENDATIONS

Through this study, a set of suggestions have been reached, the most important of which are summarized as follows:

- There is a need to develop an integrated and clearly targeted strategy for waste recycling, especially in developing countries, as there is no role in the protection of the environment as well as the production of renewable energies, which is a strategic alternative to conserving traditional non-renewable energies;

- The need to explore modern techniques to exploit and utilize as much as possible the process of recycling and converting wastes to renewable energies, given their effective role in preserving the environment, on the one hand, as well as the non-depletion of non-renewable (traditional) energies on the other, while continuing to develop such techniques;

- The need to conclude cooperative agreements with successful States on the issue of waste recycling and conversion of renewable energies and to benefit from their knowledge and expertise;

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AUTHORS' BIOGRAPHY

Fadila Boutoura, is a lecturer at Larbi Tebessi University - Tebessa / Algeria, Faculty of Economics, Commercial and Management Sciences, Department of Management Sciences, specializing in economics. She teaches management, entrepreneurship, and finance courses, and her research focuses on studying finance, economics, administrative management and project management.

She has published many articles locally and internationally in refereed scientific journals in the field of economics and management, and has participated in many conferences in the field of economics and business administration inside and outside Algeria.

Samia Ggharbiis, a lecturer at the University of Constantine / Algeria, Faculty of Economics, Commercial and Management Sciences, Department of Commercial Sciences, majoring in economics. She teaches management, marketing and finance courses, and her research focuses on the study of finance and economics.

Sufian Abdel-Gadir, work as an Associate Professor in Economics at Sultan Qaboos University. His current research focuses on sustainable development, energy economics, development economic, international economics, Private Capital flows, Institutions and Growth, Financial development, Political and Economic freedoms in MENA and Sub-Saharan African Countries. For scholarly work, he intensively participated in reviewing papers at international reputed journals. In addition,he is a member in many research and professional organizations and he is currently actively work as research Associate at ERF https://erf.org.eg/erf_affiliation_tax/research-associates/. In addition, he published many papers in various peer-reviewed and Scopus indexed journals and presented many papers in international conferences.

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