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Technical landfills sites are an effective tool for waste valorization, recovery and disposal : Case of Jijel province

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Abstract---Projects such as technical landfill centers, waste conversion and sorting units, and inert landfills play a crucial role as significant solutions, especially in the absence of alternative projects or during their establishment, such as waste valorization initiatives, including the innovative project in partnership with the United Nations Development Programme. These initiatives have objectives in line with the principles of sustainable development, promoting the circular economy, generating financial returns, combating climate change and greenhouse gas emissions. They achieve this by involving citizens and associations in management, allocating a dedicated budget for funding, and creating ample space to address the challenge of unplanned landfills. This approach aims to solve the problem of unplanned landfills, create wealth and employment opportunities while preserving the environment. Activating such projects can solve the waste problem that has burdened the specific case of Constantine by addressing the issue of unplanned landfills. This initiative is facilitated by the fact that a significant portion of the waste is organic and recyclable, which bodes well for the region.

Keywords---technical landfills, conversion units, waste, environment, activation, constantine.

General introduction

In the early 2000s, there was still uncertainty about how to deal with the rapidly growing volume of solid household waste. This increase had led to the

proliferation of illegal landfills as a result of inadequate collection and treatment methods and a lack of expertise.

The top priority for public authorities at the time was to deal with these landfills in order to mitigate the impact on human health, the environment and the quality of life of citizens. From a policy perspective, the focus was on establishing a modern regulatory framework and high technical standards for waste treatment facilities. The aim was to ensure the planning, implementation and operation of Technical Landfill Centres (TLCs) for the environmentally sound disposal of solid household waste. My Ministry's policy for the coming years continues to focus on the development of a circular economy.

This includes the establishment of recycling processes for all material streams (cardboard, plastic, glass, tyres, etc.), the training of personnel involved in waste management, and the raising of awareness among citizens with the mobilisation of civil society. Waste management covers a wide range of activities, from its generation to final utilization or landfill. Waste segregation among residents is considered the primary method of waste management and an efficient way to reduce the amount of municipal waste in landfill. However, to make the segregation process economic and environmentally efficient, it must be easy and understandable for the "waste producer" – the consumer (Młoda-Brylewska and Melski, 2022).

The management, treatment and valorisation of waste are environmental, social and economic challenges of great importance to local communities. In this context, numerous projects have been launched throughout the national territory to define the national strategy for waste management up to 2035. Today, more than 50,000 people are employed in this sector and the rate of supervision in the majority of our municipalities is between 0.5% and 2% at best. The main challenge is therefore to improve the qualifications and skills of the management of this collective through young graduates from our universities who need to be trained.

Algeria has made efforts to control and recover waste through a number of laws, which we will mention in our discussion. Jijel is an important industrial and tourist region in the country, known for its stunning natural landscapes and beautiful beaches. The management of technical landfills involves the organization and management of landfills for the disposal of solid, liquid and hazardous waste. The management of these centers aims to ensure safe and environmentally sound waste disposal while minimizing negative impacts on the environment and public health. The management of the technical landfills in the province of Jijel includes various aspects and activities, including:

Planning and design

This includes identifying suitable sites for the establishment of technical landfills and designing the necessary structures and systems for safe waste disposal.

Infrastructure

This includes the construction of roads, pathways, and systems needed to transport waste to the centers and facilitate disposal operations.

Management and operation

This includes establishing administrative structures and teams to coordinate and manage landfill operations, monitoring, and necessary maintenance.

Environmental control

Technical landfills must comply with environmental standards and take necessary measures to minimize negative environmental impacts, such as oil spills and air pollution.

Environmental Awareness

Public awareness is essential to emphasize the importance of proper waste disposal.

The questions to be answered are:

- What are the objectives of the creation of technical landfill centres in the province of Jijel?
- What are the reasons for the incomplete activation of the technical landfill centres at the provincial level?
- Do the technical landfill centres contribute to the elimination of waste? What is their capacity? How do they contribute to recycling and recovery?

Hypothesis

The involvement of citizens and associations in the management and the allocation of a specific budget for their funding, together with the provision of sufficient space, could potentially solve the problem of indiscriminate dumping in Jijel, create employment opportunities, control gas emissions and toxic water leakage, and treat polluted soil resulting from waste, while preserving the environment. The activation of this project aims to achieve these objectives.

Research objectives

- Activate landfill centers throughout the province and find suitable locations for them.
- Eliminate random landfill centers.

The importance of this massive project, which has enormous economic, commercial, social and environmental value, is highlighted, as it will create employment opportunities, contribute to the elimination, conversion, recycling and valorization of household waste, as well as energy production. It also plays an important role in environmental protection. It increases the currently low rate of

recycling and reuse. It reduces the negative impact of environmental degradation on various future environments by controlling and utilising gas emissions and toxic water leaks into the ground caused by waste, while preserving the environment. It also improves the living conditions of citizens.

Research methodology

In this study, we have relied on real data obtained directly, and the methodology followed is descriptive-analytical, appropriate to the nature of the study and as a method of systematic scientific interpretation.

What are the most positive and negative consequences of the activation of technical landfill centers?

Glossary

Cell base/bottom	The sealing level at the base of the landfill cell
Cell	The operational area of the landfill that is physically and technically separated from the rest of the landfill (base sealing) and can be operated independently of other operational areas of the landfill.
Leachate	Any liquid that seeps into the cell and is drained from the cell.

Legislation: The current legislation in the field of waste management and technical landfill centres consists of the following legislation:

Table 1
Current legislation applicable in the field of waste management

Designation	Object	Effective Date
Law	Law No. 03-10 dated 19 Joumada El Oula 1424 corresponding to 19 July 2003 Concerning the protection of the environment within the framework of sustainable development.	19.07.2003
Law	. Law No. 01-19 dated 12 December 2001 concerning the management, control, and disposal of waste.	12.12.2001
Decree	Executive Decree No. 07-145 of 2 Joumada El Oula 1428 of 19 May 2007 regulating the scope, content and approval procedures for studies and impact assessments on the environment of a composite geomembrane or associated materials of a composite geomembrane.	19.05.2007
Decree	Executive Decree No. 2007-144 dated 2 Joumada El Oula 1428 corresponding to 19 May 2007 establishing the classification of installations for environmental protection	19.05.2007
Decree	Executive Decree No. 06-198 dated 4 Joumada El Oula 1427 corresponding to 31 May 2006 defining the regulations applicable to classified establishments for environmental protection..	31.05.2006
Decree	Decree No. 2006-104 of 29 Moharram 1427 corresponding to 28 February 2006 establishing the classification of waste, including hazardous special waste.	28.02.2006
Decree	Decree No. 04-410 of 2 Dhou El Kaada 1425 of 14 December 2004 determining the general rules for the design and operation of waste treatment facilities and the conditions for the admission of waste to these facilities.	14.12.2004

Decree	Executive Decree No. 93-160 dated 10 July 1993 regulating industrial liquid waste discharges.	10.07.1993
Directive	Directive 3011/SG dated 08 October 2005 concerning the management and operation of Technical Landfill Centers.	08.10.2005

The Classes of Technical Landfill Centers (CET)

In Algeria, as in other countries, a distinction is made between three classes of technical landfill centers (CET), depending on the type of waste accepted for disposal, namely

Class 1	Special Waste
Class 2	Household and Similar Waste
Class 3	Green waste

Several aspects, both in design and implementation, are also applicable to other classes of CETs. Class II CETs are defined in Algeria as classified installations subject to authorization by the competent wilaya (governor). Executive Decree No. 2007-144 of 2 Jomada El Oula 1428 of 19 May 2007 establishes the classification of environmental protection installations under category 2719:

"Municipal waste and other residues (storage and treatment), excluding activities covered by other categories of the classification".

Executive Decree No. 2006-104 of 29 Moharram 1427 corresponding to 28 February 2006 establishes the classification of waste, including special hazardous waste, in order to define the type of waste that can be accepted in this type of facility.

The CET is therefore a classified facility designed to store waste while minimizing the risk of pollution or environmental contamination. Each facility is classified according to the danger of the waste stored.

Classified installation

Installations and activities that are likely to generate risks or hazards are subject to specific legislation and regulations (environmental protection, safety, etc.).

Waste characteristics **Household Waste**

Household waste (HW) refers to all waste collected in municipalities, including household waste, bulky waste, green waste, household waste from commercial/trade activities and market waste. The term 'household waste from commercial/trade activities' refers to the part of the waste that can be collected, treated and disposed of under the same conditions as household waste.

Household waste also includes certain dangerous wastes produced by households, such as batteries, paints, solvents and other similar consumer products, as long as they are not subject to separate collection/disposal and their quantities are small.

Definition: Household waste

Waste generated by households. This includes bulky household waste that is too large to be collected with normal household waste, as well as green waste.

Waste assimilated to household waste

This is waste from commercial or craft activities that is similar to household waste in terms of its nature, composition and characteristics.

The majority of domestic and similar waste in Algeria comes directly from households.

Project phases

The project for the construction and operation of a CET is divided into three distinct phases:

- The study phase
- The implementation phase
- The operational phase

Given the complexity of the project, a CET project, if carried out correctly and in accordance with the rules of the trade, requires at least 3½ to 4 years of preparation before the site can be put into operation. This applies not only to the construction of a complete site, but also to the realisation of an extension.

In terms of effort and cost for an engineering office, the following table provides an initial assessment:

Realistically, the construction and commissioning of a CET requires 3 to 4 years between the development of studies, the bidding process and the actual construction. This also means that for an operator, the new cell (or its extension) must be studied at least three to four years before the current cell is saturated and operational.

Some major CET projects have taken up to 10 years or more to become operational (site selection and extensive preliminary studies).

Table 2
Evaluation of Costs and Efforts for Different Phases of the Project in Percentage of
Total Fees

Case No. 1		Case No. 2	
BET Engaged up to construction supervision.		BET In charge of study development.	
Phase	% fees/honorarium	Phase	% fees/honorarium
Data Collection	3%	Data Collection	8%
Preliminary Studies	12%	Preliminary Studies	22%
APS (Preliminary Design)	11%	APS (Preliminary Design)	15%
APD (Detailed Design) + EIA and EDD	25%	APD (Detailed Design) + EIA and EDD	45%
Tender Documentation (Drawing and Specifications)	10%	Tender Documentation (Drawing and Specifications)	10%
Bid Evaluation	5%	-	-
Construction Supervision	34%	-	-
Total	100 %	-	100 %

Below are the different stages of a project according to their duration and the possible constraints that could cause delays.

Sites Presentation

Similar to other states in the country, the province of Jijel has benefited from four technical landfill centers for household waste since 2003. The aim of this initiative is to eliminate the indiscriminate dumping of waste and to implement a monitoring system for this waste. These centers only allow the treatment of household or similar waste, as opposed to the previous chaotic landfills where all types of dangerous and non dangerous waste were dumped. These centers are distributed as follows:



Figure 1. Landfill Technical Center (L.T.C) of Jijel
Site opening date: 28/10/2008

Design Consultant (Project Manager): National Water and Environment (NEE).

Owner: Jijel Province Environmental Directorate.

Construction Companies:

- Cells No. 01 and 02: AMENHYD Company

- Cell No. 03: EGR REKIMA Company

(Supervision of the construction of cell No. 03, 2016. Start of operation: 15/01/2018).

Site area:..... 7 Ha.

- cell area (operating zone):4 Ha.

- Available volume:942,736 m³.

Caisiers	Surface (m ²)	Volume (m ³)	Fill Level (m)	Number of Filling Days
N° 01	14 047,12	170 780	102,00	1 087
N° 02	13 325,13	122 980	100,00	783
N° 03	12 400,77	91797	114,00	584
N° 04	24 241,50	557 179	129,00	3 546
Total	39 773,00	942 736	/	5 999 (approximately 17 years)

Source: NEE Study Office

Number of cells: 03 saturated cells (dome operation).

Quantity buried during the period from: 28.10.2008 to 30.11.2020 for the city of JIJEL only is (391.366.410 Tons).

Quantity buried during the period from: May 2011 to 30 November 2020 for the town of KAOUS only is (46,955,910 Tons).

Quantity buried during the period from: December 2018 to 30 November 2020 for the town of KENNAR NOUCHEFI only is (6,525,800 Tons).

Quantity buried during the period from: February 2019 to 30 November 2020 for the town of Texanna only is (3,840.120 Tons).

Total: 448,688.240 tonnes, equivalent to 500 KG per M3.

An optimal operating ratio

OPERATION:

-a- Staff:	(50)
Centre Manager	(01)
Maintenance Manager.....	(01)
Diesel mechanic	(01)
Car electrician	(.01)
Storekeeper	(01)
Purchasing and sales manager	(01)
Weighbridge Operator	(01)
Billing Section Chief	(01)
Heavy truck drivers	(09)
Equipment operators	(05)
Including one assigned to the inert landfill "Taslamt	
Versatile workers	(03)
Switchmen	(02)
Night guards	(09)
Collection agent	(13)
Sector controller	(01)

-b-Equipment:

1. A sheepfoot roller (VANDEL 38 T).
2. A 28 T bulldozer.
3. A pneumatic loader.
4. A crawler excavator.
5. A weighbridge and weighing terminal.
6. A hydro-cleaning truck.
7. A 10 m3 tanker.
8. A 3 tonne capacity dumper.
9. A 60 KVA generator.

Technical Sheet



Figure 2. C.E.T intercommunal- Demina – TAHER

Technical data sheet

- Site opening date: 12/11/2011.
- Engineering office (project manager): Territoire - Aménagement - Développement (T A D).
- Project Owner: Department of the Environment of the Province of Jijel.
- Construction companies: EGR REKIMA (construction) - T A D (project supervision).
- Site area: 20 Ha.
- Casiers area (operational zone): 4 Ha.
- Available volume: 136,000 m³.

Number of Casiers: 01 Casier - Class 02 Saturated (Dome operation).

Amount of waste to be buried between 12/11/2011 and 30/11/2020 for the 6 towns concerned: Taher, Emir Abdelkader, Chahna (May 2012), Oudjana (January 2012), Sidi Abdelaziz (September 2018), Chekfa (December 2018):

Total: 178,588,410 tonnes, equivalent to 1,313 kg per m³.

An exceptional rate of exploitation.

Exploitation

- a-Staff: (16)
 - Centre Manager: (01)
 - Weighbridge Operator: (01)
- Head of billing section: (01)
 - Heavy truck driver: (01)
 - Equipment operators: (01)

- Multi-skilled workers: (01)
- Gatekeeper: (01)
- Night guards: (09)
- b- Operating equipment:
 1. Sheep's foot roller (BOMAG 28 T) out of service since 23/11/2018 (proposed to be transferred to the Environmental Direction).
 2. Pneumatic loader (proposed for transfer to the Environment Direction).
 3. Weighbridge and weighing terminal.
 4. 3 tonne capacity dumper.
 5. 30 KVA diesel generator.

Technical Specifications



Figure 3. Intercommunal Waste Disposal Center - Zerzour - El-Milia

- Opening date: 23/10/2011.
 - Consulting company (project manager): Territoire - Aménagement - Développement (T A D).
 - Client: Direction de l'environnement wilaya de Jijel.
 - Construction companies: Company EGR REKIMA (construction supervised by T A D).
 - Site area: 15.58 ha.
 - Casier area: 44,722.00 square metres.
 - Available volume: 447,720,000 cubic metres.
- Number of landfills: 1 class 02 landfill with 80% saturation rate.

Amount of waste disposed during the period from 23.10.2011 to 30.11.2020 for the (10) concerned municipalities, including (02) from the Skikda province: El-Milia; Settara (January 2012); Ain Kechra (October 2013); Boulbelout (September 2013); El Ancer (March 2015); Kheiri Oued Adjoul (April 2016); Djemaa Beni H'bib (February 2017); Ouled Yahia Khedrouche (July 2017); Bouraoui Belhade (March 2018); Sidi Maarouf (September 2018), totals:

Total: 167,331.430 tonnes, equivalent to 467 kg per m³ (for 80% of the volume exploited).

An exceptional rate of exploitation.

OPERATION:

-a- Staff: (13)
 Center Manager(01)
 Weighbridge Operator (01)
 Heavy Truck Drivers(01)
 Machine Operators(01)
 Versatile Agent (02)
 Daytime Guard..... (01)
 Night Guard..... (06)

-b- Operating Equipment:

01- Sheep-foot Compactor (VANDEL 28 T).

02- Tracked Excavator.

03- Weighbridge and Weighing Terminal.

04- 3-ton Capacity Dump Truck.

- Inter-municipal landfill centre for household waste in Chekfa:

In 2012, as part of the sectoral development programme, the environment sector in Jijel province benefited from the establishment of the fourth centre under the operation. The construction and preparation of an inter-municipal landfill centre for household waste in Chekfa, serving the towns of Chekfa, Sidi Abdelaziz and Kennar Nouchefi, at an estimated cost of 250,000,000 Algerian dinars.

Notice:

The operation is currently paused due to a problem with the selected land in the Faza area of the area known as Ras Arsa in the municipality of Kennar. The land is owned by the Forestry Sector and has not yet been approved for allocation. This follows a visit by the province's joint ministerial committee at the end of last year. A new site for the project has not yet been identified due to a lack of suitable sites in the affected communities. These municipalities have not been able to propose sites of the size of the project, as all the proposals were for plots of land not larger than half a hectare. In addition, the legal nature of the land is a challenge. Work is underway to redirect the operation or change its location.

Public Institution for the Management of Technical Landfills for Waste in Jijel Province:

In order to manage these centers, a provincial public institution for the management of technical landfills for waste was established in Jijel province, based on the joint ministerial decision dated 08.11.2008.

- A director was appointed to head this institution by the Provincial Decision No. 44 of 01.01.2009.

- The Board of Directors was established by decision No. 103 of 04.02.2009.

Materials Recovered by the Contracted Operator at the Technical Landfill Centers in Jijel Province. Year 2021

ABB Recycling

Month /CET	PET /Kg	PEHD /Kg	FERREUX/ Kg
Total 2020	67 600,00	15 620,00	7 441,00

The National Program for the Integrated Management of Household Waste (PROGDEM) is an ambitious initiative derived from Law 01/19 and the National Program for the Environment and Sustainable Development (PNAEDD). The objectives of PROGDEM include

- improving the quality of life of citizens.
- Improving the means and equipment for the collection and transportation services of the municipalities.
- To reorganize the municipal administration in charge of waste management.
- Opening up public waste management services to private investment.
- Implement a program of training and technical assistance.
- Promote integrated household waste management practices.

Achievements

I. Annual production of household and similar waste: 13 million tons

- Recycling rate: less than 7%.

Treatment facilities

- 95 technical landfills
- 30 CET for inert waste
- 09 Sorting centers
- 09 Waste collection centers
- 03 transfer centers

Month /CET	Plastic PET /Kg	PEHD /Kg	FERROUS/ Kg
Total 2021	289 000,00	36 475,00	31 705,00
Total (2020+2021+2022+2023 April)	356 600,00	52 095,00+268040+78660	51 576

Current situation

- 71 additional waste treatment infrastructure under construction

Source: National Agency for Waste (AND)

New Vision and Perspectives

The Ministry of Environment and Renewable Energy (MEER) finalized the National Strategy for Integrated Waste Management (SNGID 2035) in 2018. Based on the now constitutional right of citizens to a healthy environment (improving the quality of life) and in line with the country's new economic vision (promoting the diversification of the national economy beyond hydrocarbons), in accordance with the National Environmental Strategy (circular economy axis), and through an inclusive and participatory approach,

Objectives of the National Strategy for Integrated Waste Management (SNGID)

- Waste prevention
- Promote selective sorting and valorization
- Minimize risks to health and the environment
- Apply the polluter pays principle
- Increase the involvement of the private sector

To conclude, the aim is to ensure the transition to a circular economy, where waste is transformed into an economic sector that generates wealth and employment opportunities. Existing infrastructures such as the CETs (Centres d'Enfouissement Technique) will not only evolve, but also become essential entities in the implementation of this new approach.

Status of waste buried in the three cets of Jijel. Quantity of waste

Quantity of waste buried in the cet of Jijel (Jijel city) YEAR 2008 - April 2023

	2008 tonne	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023 until April 2023
Jijel city	2543,04	25728,4	29137,5	31666,6	30836,9	33130,3	34316,1	35884,7	38583,7	38197,8	41921,4	42653,4	40814,6	41605,1	42035	7546
Kaous city	/	/	/	2472,72	3697,9	4042,24	4399,52	4743,53	5058,18	5249,45	5832,26	5960,88	5961,56	5961,34	3041	1321
El KennarNou chefi city	/	/	/	/	/	/	/	/	/	/	119,53	3433,31	3252,62	3069,86	3041	713
Texanna city	/	/	/	/	/	/	/	/	/	/	/	1898,87	2097,59	1977,24	2002	411
	2543,04	25728,4	29137,5	34139,4	34534,8	37172,5	38715,7	40628,2	43641,8	43447,3	47873,2	53946,5	52126,4	52613,6	50119	9991
		596358														

Through the table related to the Technical Burial Center for the Jijel City we observe that the largest community disposing of waste there is the military itself, reaching 42,035 tons in 2022. The total over the years is a significant figure in terms of attraction, reaching 596,358 tons.

Year /CET	PET /Kg	PEHD /Kg	FERROUS/ Kg
2020	67 600,00	15 620,00	7 441,00
2021	289000	1 882,00	3635,3
2022	346 700		12430
2023	30152	10810	9560
/	386 752,00	28 312,00	33 066,00
total		448 130,00	

In terms of reception, it reached 188,378 tons, which is also significant and indicates a significant disposal of waste in a safe place for the state and citizens. In the last four years, the amount of waste has reached 679,244 tons in the distributed centers of the province. Of this, approximately 130,448 tons of iron and plastic have been recovered. This figure is very low and insufficient, as the material recovery rate is only 0.86%. Therefore, the relevant authorities should work harder and strive to increase this percentage in the future. Abstract: The management of the technical landfills in the province of Jijel is an important part of waste management and environmental protection in the region. The management of these centers involves a series of steps and measures to ensure proper waste disposal and reduce negative environmental impacts.

Composition of Household Waste

Average annual composition of household waste - Jijel Province - 2018/2019

Over the past two decades, Algeria has experienced uncontrolled population growth and urban development, leading to a significant disparity between the capacity of existing infrastructure and the production of urban waste. Despite the efforts of the authorities, this mismatch is still present. The production of household and similar waste (HSW) was estimated at 13.1 million tons (MT) in 2018.

The average composition of Household and Similar Waste (HSW) in Jijel over four campaigns (seasons) showed the following:

- A preponderance of organic matter, accounting for approximately 58.5%.
- Significant fractions of plastics (all types), accounting for about 14.4%.
- A noteworthy proportion of disposable layers, constituting about 11.6%.

- Paper/cardboard fractions at about 6.22% and textiles at about 2.62%.
- As for other waste streams categorized as " others ", they range between 0.46% and 1.37%.

It is clear to us that a very large part of the waste is organic and can be valorized and recycled, which is a positive aspect for the province.

Objectives of the waste recycling centers, transfer stations, technical landfills in the province of Constantinople

Disadvantages

- The possibility of leachate leakage (waste leaches into the groundwater, causing its pollution).
- The inability to determine the time required for the decomposition of the buried waste, because it is mixed waste, and each component of it has a different period of decomposition.
- It requires a lot of space.
- It requires large funding and much equipment, unlike evaluation projects with countries abroad, which are financed through joint projects in cooperation with the United Nations Development Program.

Advantages

On the other hand, sanitary landfilling has the most important advantages:

- The technical landfill contributes to the activation of waste recycling by sorting recyclable waste (paper, wood, plastic, cardboard, etc.).
- The landfill center generates revenue by selling the sorted materials as raw materials to recycling factories.
- The landfill center contributes to the reduction of waste volume and thus to the reduction of pollution.
- Transforming landfills and landfill basins into green spaces, achieving sustainable development.
- Controlling and benefiting from a significant percentage of gaseous emissions and toxic and polluted water leaking into the soil.

Findings

The technical waste management centers aim to address the growing waste problem caused by the continuous population growth and uncontrolled urban development in Algeria over the last two decades. This has resulted in a significant gap between the capacity of existing infrastructure and the production of municipal waste, despite government efforts. The production of household and similar waste (DMA) was estimated at 13.1 million tons in 2018. The average composition of DMA campaigns in Jijel for the years 2018 and 2019 showed:

- A predominance of organic materials with ~ 58.5%,
- Significant fractions of plastics (all types) at ~ 14.4%,

- A notable proportion of single-use items at ~ 11.6%,
- Paper/cardboard fractions at ~ 6.22% and textiles at ~ 2.62%,
- Other waste categories ranged from 0.46% to 1.37%.

The majority of waste in the province is organic, accounting for 53.5%, indicating its potential for rapid decomposition. A significant portion of the waste is recyclable, contributing to a positive environmental impact. The waste management centers are critical to managing the growing waste problem. The challenge is to transform and utilize this significant amount of waste in an economic, social and environmental manner. This includes recycling and proper disposal of non-recyclable waste. These efforts aim to eliminate uncontrolled landfills, reduce pollution, and create economic opportunities.

By focusing on these projects, the province can capitalize on the large proportion of organic waste that can be valorized and recycled. This will provide a positive impact on the environment, society and economy by promoting sustainability and responsible waste management practices. In addition, there are several reasons for the lack of activation of technical waste disposal centers, including

- Lack of partnership with local associations and residents near the landfills, within a framework of transparency and prudent management. This has led to community rejection, protests, and roadblocks, as seen in the case of the technical landfill in the western part of Ibn Badis city.
- Shift to new projects for assessment and international partnerships, leaving the existing landfills behind. An example is the Algerian-Canadian partnership for the integrated waste management project, which was launched on April 19, 2018, in Constantine and Setif. The aim of this project is to reduce the need for landfills by 75% and to decrease the burden of waste management.
- Establishment of technical landfill centers without adequate funding or in the absence of funding, as was the case with the technical landfill project in Douamis, Ain Abid city, and the technical landfill center in Doudouch Mourad, which replaced the informal dumpsites.
- Technical landfills require space, but the process of land allocation has been completed by the Directorate of Provincial Properties, and studies are underway by the National Agency for Waste Management (AND). The estimated area is 5 ha. in Doudouch Mourad.

The need to establish technical centers for waste management and activate landfills throughout the province will eliminate uncontrolled landfills, which have been a challenge for Constantine. It has become imperative to control and monitor gas emissions, toxic and polluted water seeping into the ground from waste, and to treat it. In addition to economic, commercial, social and environmental benefits, these centers provide employment opportunities. They also contribute to household waste management, recycling, valorization, energy production and environmental protection. Finally, it is important to emphasize that public cleaning is no longer just a matter of complying with public health regulations. It also contributes to a sense of well-being and safety.

General Conclusion

The province of Jijel in Algeria serves as an exemplary model for governments that prioritize environmental protection and proper waste management. The province has modern technical landfill centers that respect the best global practices in environmental management. These centers offer advanced techniques for effective and safe waste disposal. They include systems for sorting, categorizing, collecting and disposing of household, industrial and medical waste. In addition, Jijel's technical landfill centers provide facilities for recycling and material recovery.

The reviewer

Algerian Official Gazette. Laws, decrees, decisions.

Technical Manual CET_PRODEC I.2017 p 01,13,14,19

Management of the CET jijel ,june 2023

Site of the CET on the internet :

https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiV2JWu6br_AhWjoVwKHcbICFYQFnoECA0QAQ&url=http%3A%2F%2Fdenv-jijel.dz%2Findex.php%3Fid%3D58&usg=AOvVaw1XJYbq9RAm9yi8C6ciVMat

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"Technical Service, CET Jijel Direction, June 2023"

Source: Characterization Report of Household and Similar Waste (DMA), Algerian National Waste Agency, p.21, 2019.

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