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WASTE TO ENERGY FOR WESTERN BALKANS CEMENT INDUSTRY

MARKET RESEARCH ON QUALITY AND QUANTITY OF WASTE AND POTENTIALS OF ESTABLISHMENT OF RDF PRODUCTION IN THE REPUBLIC OF ALBANIA

waste 2 energy

CO-PLAN INSTITUTE FOR HABITAT DEVELOPMENT

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WASTE TO ENERGY FOR WESTERN BALKANS CEMENT INDUSTRY

MARKET RESEARCH

ON QUALITY AND QUANTITY OF WASTE AND POTENTIALS OF ESTABLISHMENT OF RDF PRODUCTION IN THE REPUBLIC OF ALBANIA

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INSTITUTE FOR HABITAT DEVELOPMENT

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"Waste to Energy in the Western Balkans Cement Industry"
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Abbreviations and Acronyms

ATR:	Administrative-Territorial Reform
Ad.Unit:	Administrative Unit
AF:	Alternative Fuel
AU:	Administrative Unit
BT:	Biological Treatment
C & I:	Commercial and Industrial
DCM:	Decision of the Council of Ministers
EC:	European Commission
EU:	European Union
EWC:	European Waste Codes
EURITS:	European Union for Responsible Incineration and Treatment of Special Waste
GHG:	Greenhouse Gas emissions
ISWMP:	Integrated Solid Waste Management Plan
LSGU:	Local-self Government Units
LIMSWMP:	Local Integrated Municipal Solid Waste Management Plan.
MBT:	Mechanical Biological Treatment
MFE:	Ministry of Finance and Economy
MSW:	Municipal Solid Waste
MU:	Municipal Unit
NGO:	Non-Governmental Organization
NEA:	National Environment Agency
NSRF:	National Strategic Reference Framework
OP:	Operational Programme
PPP:	Public Private Partnership
RDF:	Refuse Derived Fuel
RES:	Renewable Energy Sources
RGJC:	Civil Registry
RU:	Regional Unit
SKMM:	National Strategy of Waste Management
SME:	Small and medium-sized enterprises
SRD:	Sustainable Rural Development
SRF:	Solid Recovered Fuel
SWM:	Solid Waste Management
PCE:	Public Communal Enterprises
TT:	Thermal Treatment
WMP:	Waste Management Plan
WtE:	Waste to Energy
WTS:	Waste Transfer Station
WTT:	Waste Treatment Technology

EXECUTIVE SUMMARY

This Market Research on quality and quantity of waste and potentials of establishment of RDF production in the Republic of Albania provides a thorough screening with regard to the refused urban and industrial waste have for further coprocessing vis a vi the actual treatment which consists on landfilling.

On a brief statement on the problem covered, it is important to underline that similar research was conducted in North Macedonia and Serbia whereas the current status converges on the fact that waste management is one of the main pollution sources in urban, rural and coastal areas.

In Albania aside of littering there is a notable lack of local administrative capacities to efficiently provide a service that meets hygienic-sanitary standards nevertheless the absence of final treatment infrastructure and lack of segregation practices combined with incineration practices presented during the last years to reduce the volume of waste have deteriorated further more the concept of making this a profitable process.

Through this market research and further the feasibility study, we shall provide an environmental and economical feasible option for that waste typologies containing thermal capacity and that are not subject to reuse-recycle shall be further recovered and treated, offering thus a final product in the form of Alternative Fuel. A product that can be co-processed by Cement Industry to extract their thermal input and further reuse the ashes as part of the clinker for the cement.

Waste to Energy is a rather new concept but during the last decades it gained a lot of terrain both among scholars and cement industry whom have past through the piloting phase and now aiming to subsidy more than 25% of fossil fuel yearly consumption with alternative fuel. First given the feasible economical perspective alongside with the EU Green Deal obligation to reduce their carbon emission until becoming carbon neutral by 2050

For a background information through this market research we have provided specific waste management options/scenarios that optimize the service provided by local government units in Albania. Screening of the existing legal framework to further provide specific suggestion how Waste to Energy could be regulated and controlled as a new practice in our country. Also, for most of the LGU part of this study, project team assisted the public services directorates to update their Local Waste Management Plans in order to acknowledge first and further orient the local waste management philosophy towards including recovery as a practice that can and should be executed locally. Given the sensitivity that the subject has on many layers (social, political and financial) we were persistent on maintaining the elaboration of the concept transparent and inclusive with all interested actors whereas aiming to design an intervention that will ensure waste are not deposited after recycling but rather we deploy needed infrastructure that would process them into Alternative Fuel, a product highly required by local industry. Co-processing is by far less harmful with regard to air, soil and water contamination.

The study included desk analyses, questionnaires and surveys, on-site data verification through inspections and interviews, in order to confirm the qualitative and quantitative data from the entities which didn't provide reports on a regular basis to the relevant institutions.

The regular annual statistical survey on municipal waste and C&I (Commercial and Industrial) waste is being carried out in accordance with the national legislations and European standards. Therefore, we assume that the referenced information in this Market Research is of high credibility. Currently, RDF (Refused Derived Fuel)/SRF (Solid Recovered Fuel) is one of the most efficient practices to

recuperate the refused municipal solid waste through mechanical treatment or MBT (Mechanical-Biological Treatment). Further, we have foreseen that the alternative fuel may also include a mix fraction of non-recycled waste, with low chlorine composure and with a non-urban origin. One of the preliminary findings indicate that RDF/SRF can be an important contributor for a sustainable management of waste and reduction of raw materials from Cement Industry. Reducing the overall amount of refused waste from landfilling while co-processing it as an alternative fuel provides similar income with recycling practices if compared. Therefore, for LGU and service providers is clearly more economic feasible to revise their service strategy taking into account that investments on RDF/SRF infrastructure appear to be secure within a market where fuel products especially low carbon are highly requested. Market Research study among other provides a detailed diagnosis on the quantity and quality of municipal waste and the respective waste streams with potential for production of RDF/SRF for cement industry in the Wester Balkan Countries.

The study envisages exact information on:

1. Total waste generated in the municipalities of Lezhë, Kurbin, Mat, Krujë, Kukes and Durrës in Albania, from households, commercial sector and industry,
2. Specific calculation of streams, quantities and qualities with potential for RDF/SRF production,
3. Analysis of existing capacities and infrastructure of service and treatemnt,
4. Energy, Environment and Economic analysis of indientified quantities
5. Concept scenarios how each LGU or combined could produce practically Alternative Fuel

Also, part of this market study is the identification of the legal framework in Albania, which is mostly related to the waste management process and their incineration. The document further presents data on European standards for integrated waste management citing the main European directives related to this process which are:

- Directive 2008/98 / EU, Waste Framework Directive,
- Directive 2010/75/EC on industrial emissions IED,
- Directive 2015/2193 on the limitation of emissions of certain pollutants into the air from medium combustion plants)
- Best Available Techniques (BAT) means the most effective and advanced techniques, developed on a scale allowing implementation in the relevant industrial sector, under economically and technically viable conditions.
- Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe, OJ L 152, 11.6.2008, p. 1- 44.

Conclusions of Market Research are baseline for the feasibility study which will further explore both impacts and implication of Alternative Fuel production and usage in Albania.

Initially, the interested actor on purchasing Alternative Fuel in Albania as already invested in this project is TITAN Antea Cement. An overall amount of **40'000 tons/year** of alternative fuels RDF and SRF is required by the company to reduce their fossil fuel consumption by 20% until 2025 and further increase the demand by double until 2030.

There are two main scenarios developed with regard to available waste quantities, whereas the first indicates information from municipalities and the fact that there is a recycling rate between 5-8%, whilst the second refers to the calculation as indicated by the National Strategy including here also future recycling rates.

Types of waste considered for this research are: Letter, Cardboard, Plastic, Used tires, Waste from leather, Waste from Textile Industry, Residues from the carpentry process, Waste from biomass and urban greenery, wood, leaf's, dry sludge after wastewater treatment as well as high calorific waste streams (Used oils, Industrial Sludge.

Total amount of MSW that can be used for the production of alternative fuel in the form of RDF/SRF in the actual conditions (data from previous years 2017-2019) is 33,177 tons.

Including Durres input to the overall calculation, the amount of MSW that can be used for the production of alternative fuel in the form of RDF/SRF could be **53,270 tons/year.**

The same amount if processed as Alternative Fuel shall contribute to extend the lifespan of Bushati and Sharra landfill with at least 4-5 years.

Further if Alternative Fuel is co-processed in Cement Kilns in a temperature above 1450oC it could reduce a considerable amount of green-house gasses being emitted in air. More specifically introduction of AF in the cement kiln could lead to an overall **reduction by 9'726 ton CO_2/year.**

In case that the above-mentioned amount is offered within the required standards to the interested consumers in the market, an overall estimation indicates that at least 880'000.00 Euro could be generated from selling them whilst the consumer will be supplied with an estimated calorific input of 1092GJ.

For the feasibility study it is proposed that along with the extension project of Bushati Landfill, there should also be included the RDF/SRF production facility. Cost and technical specification of which will be presented in the feasibility study.

Mati, Kurbin, Kruja, Durres and Lezha Municipalities as per the projections of the Sectorial Plan and Strategy on Waste Management shall be equipped with transfer-stations, whereas our proposal is to include a small-scale technology that will process refused waste into Alternative Fuel.

One of the most prevailing preconditions from communities with regard to usage of alternative fuel by cement factory is related to the emissions. Given the lack of independent and state monitoring practices there is a growing concern among public upon whom will control emissions.

ACKNOWLEDGEMENTS:

Co-PLAN team and AMU would like to thank the following experts and authorities for helping with this research project. Representatives from Municipalities of Krujë, Mat, Kurbin, Shkodër, Lezhë, Durrës, Kukës as well as representatives from Bushati Landfill, AKUM, AKM, Ministry of Infrastructure and Energy for their willingness to impart their knowledge. All the National Working Group members from CSOs, Academia, Journalists and community representatives from Thumana who took the time to consult and contributed so thoroughly both in person during our round-tables as well as through their further comments and emails.

PART I, OVERVIEW, CONTEXT AND METHODOLOGY

1. GENERAL INFORMATION

1.1. Waste management situation in Albania

In Albania, waste constitutes one of the highest risks concerning environmental pollution. With regard to waste management and recycling, Albania is facing serious challenges to reach EU targets on recycling and reducing the amount of waste deposited in deposit sites, landfills or worse, uncontrolled in the environment. The national average waste collection rate for households is estimated at 87.9 % (INSTAT, 2019) of the total waste generated, and the current overall recovery and recycling rate is estimated at around 18.7 % (INSTAT, 2019). In July 2018, the Government of Albania established a new agency, the National Agency of Sewerage Water Supply and Waste Infrastructure that will be responsible for the implementation nationwide of infrastructure projects related to waste management.

Despite the progress regarding the development of the regulatory framework and legislation in line with the policies of the European Union (EU) in the waste management sector, there is more to be done by Albanian Government as an aspiring country to join the EU in order to approximate the legislative framework of countries with the acquis Communautaire, especially with regard to chapter 27-Environment and Chapter 15-Energy.

In most of the municipalities in Albania, there is no reliable data on waste collection rates (the amount of municipal waste generated versus the amount of municipal waste collected). Although municipalities report the amount of waste collected annually to the MEI (Ministry of Energy and Infrastructure) and to MTM (Ministry of Tourism and Environment), due to the lack of bridge scales at municipal deposit sites the reported data can be considered as approximate calculations made by the municipal staff. The data obtained from the existing bridge overpasses in the sanitary landfills of Bajkaj, Bushat, Sharra and Maliq regarding the quantity of waste deposited are not integrated into a digital waste information system, which would allow the competent authority to have a better understanding on quantities and typologies of waste deposited in those facilities. As a result, the engaged staff of the project visited all the municipalities of the pilot area for a control and assessment of the respective MSW (Municipal Solid Waste) system situation and the ongoing projects.

In addition to the data analysis, meetings with Municipal representatives were essential for characterizing the WM sector in the project regions and collection of data at the local level.

The most highlighted problems related to waste management sector in the region are:

- Poor conditions and insufficient number of vehicles for waste collection (WC);
- Poor conditions of waste containers and waste collection points (WCP);
- Poor distribution of containers and WCP in the territory;
- Poor road conditions other than downtown areas;
- Low level of revenue collection and consequently low capacity in expanding the service area;
- Infrequent collection, leading to overfilling of containers;
- Lack of support from the population (lack of awareness among the citizens regarding waste management).

1.2. Purpose of the study

The purpose of this Study is to identify the potential of using various types of waste in cement kilns, knowing the fact that using the waste as alternative fuel for co-combustion is a well-known measure to ensure sustainable solution for reduction of different waste streams and in meantime reduction of fossil fuels used for energy generation in the cement industry.

Among the reasons why the waste-to-energy (WtE) technology is to be considered as an option in the region of Western Balkans, is the fact that despite the number of policy documents that have been drafted and approved, the proper implementation of solid waste management system and final disposal (landfilling) of waste, including achievement of the agreed targets for waste reduction, recycling and recovery is still lagging behind. Therefore, analysing the establishment and utilization of the collection network for different waste streams with the aim to improve the conditions for co-processing of waste as alternative fuel, is considered as a great option for succeeding the environmental benefits (coming from reduced use of natural raw materials, the reuse and recycling of waste saving landfill space, reducing greenhouse gas emissions).

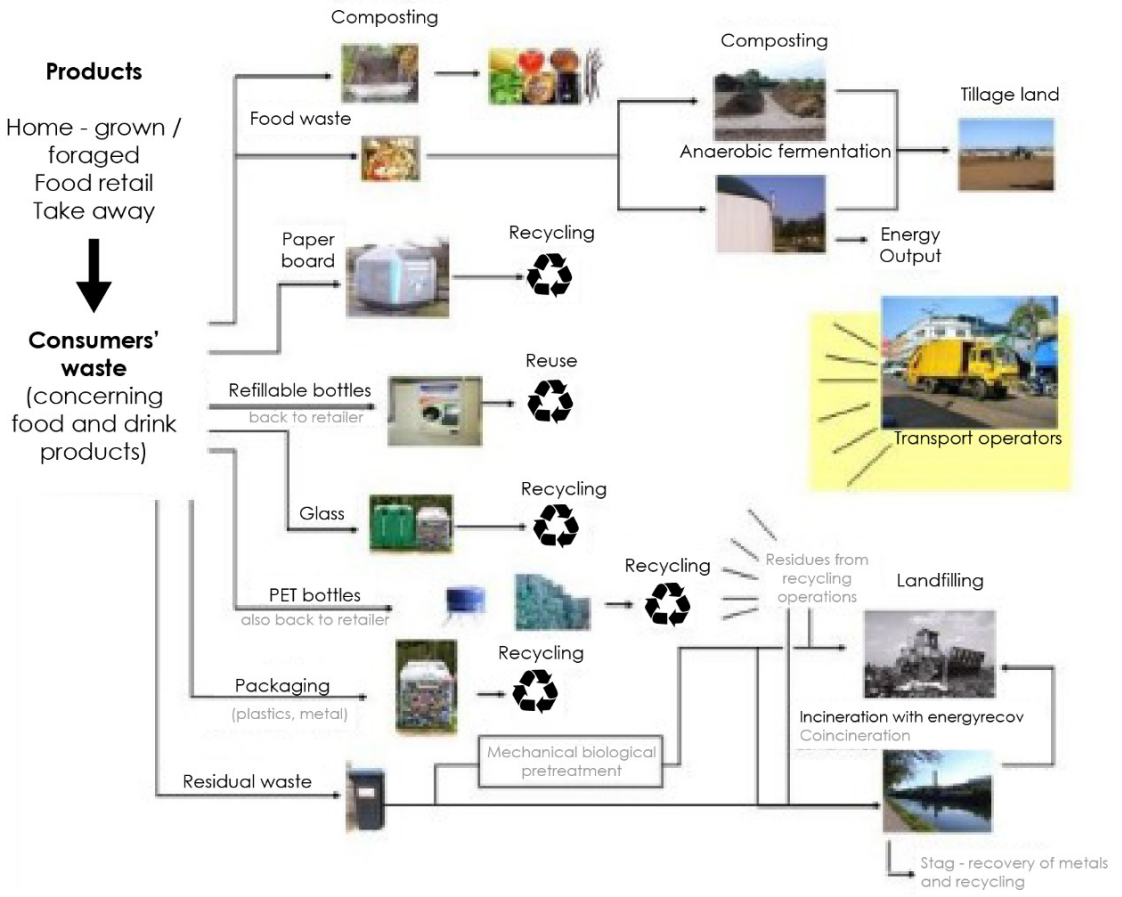
Besides the environmental benefits, the WtE process also provides economic benefits given that the overall production costs would be lower which could increase the competitiveness of the companies in the international market. Use of Alternative Fuels would reduce cost of production, improve energy efficiency in industrial processes and develop co-effective products.

The alternative solution for waste recovery, that is expected to further derive based on the analyses of this Study, should incorporate the principles of the waste hierarchy and must be financially sustainable, technically feasible, socially, legally acceptable and environmentally friendly.

The objectives of this study include:

- to provide data on the waste management situation within the study area of the municipalities,
- address environmental problems caused by municipal waste,
- to offer waste processing options to turn them into useful products (compost, alternative fuels), and creating new jobs for communities.

Figure 1. Graphical representation of the general system of waste management



2. RESEARCH METHODOLOGY

The qualitative and quantitative data for municipal waste as well as commercial and industrial [1] [1](C&I) waste, generated at regional and national level respectively, were provided by consulting the key background documents (National/Local Waste Management Plans, Waste Management Strategies, Annual Reports, INSTAT). In addition, to collect as much data as possible and cross-check different sources of information, data was collected from relevant institutions, entities, companies, responsible to provide data on waste generation, collection, transportation, storage, recovery, treatment and final disposal. Currently, in the major part of the territory the municipal waste collected is not weighed before its disposal in the respective landfills and or deposit sites Based on this fact, the reference to extract the amount of waste generated remains the generation rate per capita provided in official sector documents.

Referring at the data obtained from the above-mentioned entities, it is noticed that the information on the population number, from which the total amount of generated waste is calculated for each municipality (based on the annual waste generation of each resident), is obtained from three various sources (Civil Registry, Census 2011, Formula by MFE).

Based on this fact, in order to generate data as close to reality as possible, in addition to the reference based on the number of inhabitants, some other methods have been applied to be as close as possible to reality.

The main sources of information from where the data for this study were obtained are presented below:

- **Desk research**

Initially, public documents related to waste management in Albania were consulted and analysed, including those generated by central government institutions such as the Ministry of Environment (Ministry of Environment), NEA (National Environmental Agency), etc

In addition, to gather information on the local context the WMP of Lezhë, Shkodër and Kurbin were consulted as well as documents and data from the Krujë and Mat municipalities which at the current stage do not have a WMP.

Table 1. Implementation periods of the WMP for each municipality

No.	Municipality	WM Plan (yes/year)	No WM Plan	Alternative study
1	Lezhë	2017-2021		
2	Kurbin	2021-2025		
3	Krujë		x	Waste management analyses, 2019
4	Mat		x	
5	Shkodër	2017-2022		

Source: Co-PLAN

Data regarding the waste quantities were obtained through information on total amount of collected municipal waste and by using estimations based on waste generation rate per capita per year. While data on municipal waste generated, recovered, transported and treated form the business sector, both industrial and commercial, have been extracted from the Annual Environmental Report (2019) published by the National Environmental Agency (NEA).

- **Meetings with local and national institutions**
- **Data regarding municipal waste, generated and collected, were obtained and validated**

from meetings held with the representatives of Service Directorates in the target municipalities of the study area. In these meetings, the municipal representatives emphasized the accuracy of data on municipal waste in their territory due to the lack of infrastructure for their weighing.
Meetings with businesses/industries and recyclers

In order to raise awareness among stakeholders and obtain a different opinion on the situation of waste management in the country, meetings with businesses', industries, and recycling companies were conducted. During the meetings, there were discussions and confrontations over the information obtained through various state sources.

These meetings were attended by about 20 representatives from various industries such as textile, leather, wood, tire services, and construction and also representatives of 7 other entities which deal with the delivery of cleaning services in the study area or recycling of waste from plastic, metal, cardboard/paper, etc.

- **Questionnaires**

In addition to the data obtained from the above-mentioned sources, the rest of the data mainly on industrial and commercial waste were obtained through questionnaires conducted in different businesses/industries, located in areas within the municipalities that are part of the project.

The questionnaires were initially consulted with all representatives of partner organizations and then distributed to citizens (69 Household Questionnaires fulfilled) and to businesses or industries in Lezhë, Krujë, Kurbin, and Mat (56 completed Questionnaires for Industrial and Commercial sectors).

PART II, USE OF WASTE FUELS AND STUDY AREA

3. USE OF WASTE FUELS IN THE CEMENT INDUSTRY

3.1 Refused Derived Fuel (RDF) - requirements for utilization in cement production

3.1.1 Introduction

Waste management is one of the main problems related to environmental issues in Albania, which remained yet unsolved, being a threat to the environment and public health and a big step forward challenge related to the economic development of the country. Till now waste-management practices are still dominated by a linear collect-and-dispose approach instead of integrated sustainable waste management.

The management of landfills and closure of uncontrolled dumpsites remains one of the main issues to be solved, while waste management at a local level is beyond being insufficient. Although Albania has made major steps toward the improvement of the legislation about the waste management sector and most of it is approximated to EU legislation, nevertheless the waste management sector remains a big challenge to work on. The recently approved National Waste Management Strategy (2020 – 2035) has developed a roadmap toward integrating the principles of the circular economy and extended producer responsibility.[22]

Cement companies, 20-30 years ago, started to treat waste as a source of raw material and energy. Nowadays, the cement industry provides a significant contribution to the waste management practices of many countries. The responsible use of waste as an alternative fuel to heat cement kilns is lowering the industry's consumption of fossil fuels, which is helping to reduce the environmental footprint of global cement production.

Municipal waste management is a hot topic that Albania has to deal with. One of the ways of managing the MSW is depositing them in landfills or open dumpsites. In the study area, except for Sharra landfill, in Tirana, and Bushat, in Vau i Dejes which are sanitary landfills according to engineering requirements, other types of sanitary landfills are in the process. These landfills or open dumpsites are often close to urban areas. Environmental pollution, due to the landfill sites or open dumps is mostly associated with atmospheric pollution, land pollution, and water pollution due to the uncontrolled burning of waste and releases into the atmosphere of polluted gasses such as carbon dioxide CO2, methane CH4, and hydrogen sulfide H2S, etc.

Improved management of MSW is only achieved through a system that consists of several coordinated actions by the local governments to recover the generated material of the waste and minimize environmental impacts in the context of wide sustainable development. But there is no treatment method at the end in the wide range of MSW. Improving the MSW management through an integrated system is summarized in the know-how of 4R, intended to be achieved through the integrated solid waste management strategy for the period of 2013-2020.

The disposal rate of waste that goes into landfills is approximately 45%, and recycling of urban waste is approximately 55%.

3.1.2 Possible use of msw as rdf in cement plant

Waste management is one of the main problems related to environmental issues in Albania, which remained yet unsolved, being a threat to the environment and public health and a big step forward challenge related to the economic development of the country. Till now waste-management practices are still dominated by a linear collect-and-dispose approach instead of integrated sustainable waste management.

Due to these reasons, there are applied many new alternative technologies for waste[33] processing, such as RDF/SRF. Production of RDF (from paper and cardboard, plus plastics that are not suitable for

use in the highest degree recycling, textiles, and wood), has been very successful in some cement plants in EU countries. RDF can be burned along with other typologies of fuel in cement factories. The data on the composition of municipal solid waste in Albania show that there are significant fractions of waste that can be processed and produced as alternative fuels in the form of RDF/SRF.

When RDF is used as a fuel or as a supplement, it is fired in a moving grate furnace or a boiler equipped with some form of the grate. The cement rotary kiln raises a temperature exceeding 1,450 0 C, in a controlled burning process, which practically eliminates the formation of dioxins and carbon monoxide. A cement plant today has abatement equipment for air emissions, such as bag filters and electrostatic precipitators to minimize the particulate matter and SNCR (Selective non-catalytic reduction technology) to minimize the NOx emissions.

Worldwide the RDF is used as fuel in cement kilns, helping by reducing the amount of waste that goes in the landfill and CO2 emissions from the use of fossil fuels. There have been numerous scientific studies regarding the use of RDF in cement kilns showing no significant adverse impacts regarding emissions to air, for example, the US EPA published "Air Emissions from Scrap Tire Combustion Project Summary".

Once licensed, cement plants should have a Continuous Emissions Monitoring system, which monitors all significant emissions continuously. At this point, since the RDF is going to be used in the cement kiln, the process becomes a strict inspection regime and continuous monitoring.

3.2 The current situation

Even though Albania has improved its legislation and most of it is similar to EU legislation, the waste management sector remains a challenge. The problems are mainly related to the partial extent of service coverage, insufficient waste collection and disposal, the limited amount that is deposited and treated in landfills, the existence of a large number of disposal sites (permitted and unauthorized), which mostly do not meet the sanitary and engineering standards, limited number and poor quality of equipment for waste collection and transport, lack of waste separation at source and low % of recycling, lack of infrastructure for integrated waste management.

The competent authorities have recently adopted two main policy documents, the "Integrated Waste Management Strategic Policy Document and National Plan 2020- 2035" (Strategic Policy Document) and the "National Sectorial Plan for Solid Waste Management" Approved with a Decision of the Council of Ministers Nr. 418, dated 27.05.2020 and also Approved by the National Territorial Council with Decision Nr. 1 dated 13.01.2020

In this study, we have collected a group level of data to give a wide view of the waste situation in Albania, regarding the focused municipalities that are taken into consideration to draw a relationship between the usages of RDF/SRF and cement plant requirements and of course focusing in the environmental performance of the whole system (MSW and Cement Industry). Some analysis taken by the cement manufacturers reveals that CO2 emission and other air emissions such as NOX, SO2, and dust can be reduced by increasing the usage of AFs. Thermal energy consumption of the plant can also be reduced by using certain wastes such as AFs.

Municipal Solid Waste (MSW) comes from external (customer/community) and internal (factory) activities, then can be processed in the form of RDF, biomass, and compost. RDF can be used by the cement industry as fuel in the process of cement making. Cement industry in Albania through the use of MSW (RDF) is expected to reduce the quantity of MSW that is directly disposed into final disposal and use it as the substitution for fossil fuels (such as coal/pet coke in rotary kilns).

The MSW conversion to RDF may contribute to the reduction of untreated MSW in the municipalities of the study area. According to data from INSTAT for 2019, the service is provided for 87.9% of the population for a total number of 2,508,834 out of the total resident population of 2,854,191 inhabitants, while in 2018 coverage was provided only at the levels of 65.7%.

Based on these statistics, increasing waste collection coverage by 22.2 % in 2019 as compared to 2018 is a major achievement in service improvement, though remains to be done, as there is a significant amount of waste, which ends up, uncontrolled in the environment, mainly along roads, water lines, and rivers.

Data from INSTAT indicate that about 18, 7% of the total waste generated in 2019 is recycled, while ARA reports that the recycling level in Albania is at about 10% though none of the sources specify that the sources of waste recycled are separated from the waste generated in the country, and it is unclear if this amount includes imported recyclable waste, especially metal scrap. The waste hierarchy is not applied and municipalities do not have in place a system for the collection of waste in 4 streams; paper/cardboard; metals; plastic and glass; as is foreseen by the law. The new Strategic Policy Document and National Plan 2020-2035 have set the following targets for recycling of main four waste streams.

Table 2 . Targets for reduction of MSW

Type of waste (from the total weight of the type of waste)	Year/Waste Reduction in Targets		
	2023	2028	2033
Paper/cardboard	10%	30%	60%
Metals	10%	30%	50%
Plastic	6%	12%	23%
Glass	10%	30%	60%
Wood	5%	10%	15%

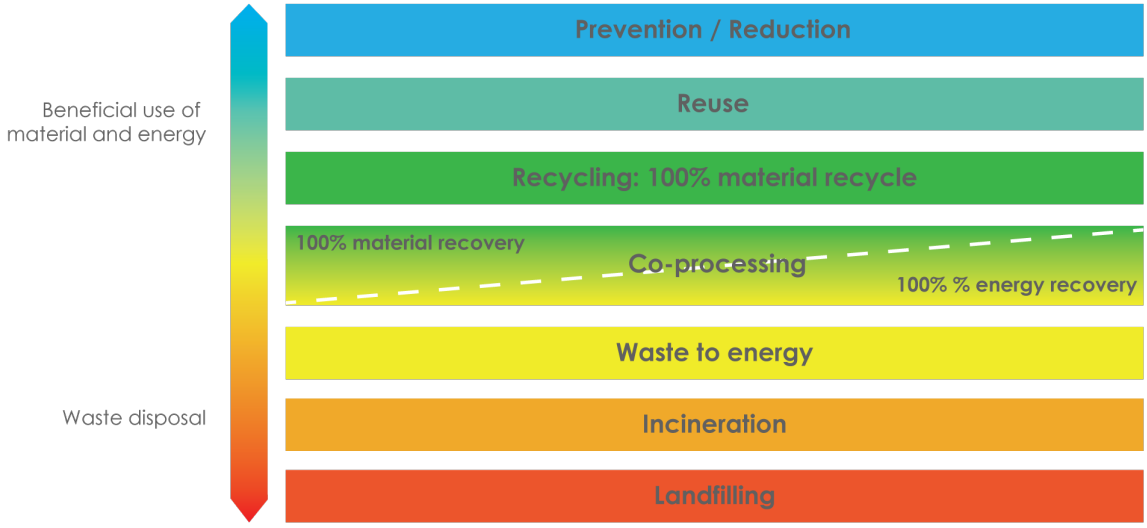
Source: Strategic Policy and the National Plan for WM 2020-2035

Based on the hierarchy of waste management, the open dumping system such as landfills should be placed as the last option of the waste management system.

One form of the material recovery system is waste conversion which can be used as fuel, better known as Waste to Energy (WtE) includes waste incineration and Refuse Derived Fuel (RDF): DIRECTIVE 2008/98/EC.

The main waste management principle in Albania is in line with the principles according to the EU Framework Directive on Waste, which is the "waste hierarchy".

Figure 2. Presentation of the Waste Hierarchy and the role of Waste-to-Energy



Source: (adapted from EU- COM (2017) 34)

3.3 What are alternative fuels

Alternative fuels, known as non-conventional and advanced fuels, are any materials or substances that can be used as fuels, other than conventional fuels like; fossil fuels, with less impact and emissions in the air.

Accordingly, the following wastes are considered to be alternative fuels for the cement industry:

- Used car tires;
- Plastics;
- Packaging waste;
- Wood waste, impregnated sawdust;
- Paper and cardboard;
- Sewage sludge, paper sludge;
- Agricultural and organic waste;
- Oil shale;
- Distillation residue;
- Coke of chemical origin;
- Waste oils, oily water;
- Used solvents.

3.1.2 Possible use of msw as rdf in cement plant

The implementation of WtE usually utilizes waste with high potential heating value, such as inorganic waste (plastic, paper, wood, rubber, and textiles) with several processing. The cement industry is an industry that has the potential to benefit from waste management. It may utilize waste as a substitute for fossil fuels as the main energy source in the kiln.

Based on the European Commission in 2010, the cement industry is recorded as the industry with a large amount of fuel needs. CEMBUREAU (European Cement Association) stated that 40% of the total operational costs of the cement plant were spent on energy procurement. The increase in global CO2 emissions indicates that the use of fossil fuels is increasing. Whereas, the main environmental problem associated with cement production is emissions.

Since there is a large consumption of electricity and fuels in various forms, alternative fuels have begun to be used in the cement industry. The usage of alternative fuel (AF) such as RDF/SRF has become a trend for the cement manufacturer due to increasing fossil fuel prices, limited fossil fuel resources, and environmental concerns. The rotary kiln used in cement manufacturing can burn a wide range of materials due to the long-time exposure at high temperatures, the ability of clinker to absorb and lock contaminants within and the alkalinity of the kiln environment. Materials like waste oils, plastics, waste tires and sewage sludge are often proposed as alternative fuels for the cement industry.[4]

3.3.2 Refuse Derived Fuel - RDF

Refuse derived fuel (RDF) is a fuel generated from certain types of waste, such as municipal solid waste and other combustible refuse. Based on Gendebien et al., (2003), RDF refers to the separation of fractions with high calorific values from the MSW. Refuse Derived Fuel - RDF covers a wide range of waste materials (residues from municipal solid waste (MSW) recycling, industrial/trade waste, sewage sludge, biomass waste, and so on) that have been processed to fulfill guideline, regulatory or industry specifications mainly to achieve a high calorific value - CV.

In this case, study the type of RDF that can be produced and may be used by Antea Cement in the form of pellets or fluff RDF. RDF pellet or Fluff RDF is an alternative fuel from waste processing by separating metals, glass, and other inorganic materials.

3.3.3 Solid Recovered Fuel (SRF)

The term "Solid Recovered Fuel" (SRF) is used to define any secondary fuel that fulfills the standard CEN/TC 343, having a more homogenous structure, with standardized and predictable characteristics (Glorious, 2014). =SRFs)= are a subset of the large family of RDFs, consisting of processed fuels that meet quality requirements for economic, technological and environmental needs defined in a standard (e.g., EN 15539 in Europe or JIS Z7311 in Japan).

SRF is a high-quality alternative to fossil fuel produced from commercial waste including paper, card, wood, textiles and plastic with a calorific value between 17 – 22 MJ/kg.

With a moisture content of less than 15 % SRF has a high calorific value and is used in facilities such as cement kilns. 1 ton of coal is the equivalent of approximately 1.5 tons of SRF. The main requirement is that a producer specifies and classifies its SRF by detailing its net calorific value, Chlorine and mercury content of the fuel. Specification includes (as mandatory) several other properties, such as the content of all heavy metals mentioned in the Industrial Emissions Directive.

The production of refuse-derived fuel (RDF)[5] and solid recovered fuel (SRF)[6] should be from non-recyclable wastes, in line with the Waste Framework Directive[7], which lays down requirements to respect the EU waste hierarchy (Article 4) and ensure that recyclable waste is separately collected and recycled and not incinerated (Article 10). Recovering energy from non-recyclable waste avoids landfilling and is in line with the waste hierarchy and the objectives of the circular economy. Waste-derived fuels subject to incineration or co-incineration fall under the strict requirements set out in the Industrial Emissions Directive (IED)[8].

Note: The World Bank has estimated that it requires 80–100 kW h to process 1 t of MSW and a further 110–130 kW h to dry the waste.

3.3.4 The Difference between RDF and SRF

The terms RDF and SRF are often used interchangeably but refer to very different alternative fuels with very different properties:

- RDF is a crude "fuel" typically derived from Municipal Solid Waste (MSW) or commercial and industrial waste with similar properties to MSW with a Net CV (Calorific Value) of 8-14 MJ/kg (Megajoules per kilogram). It is typically pre-sorted and shredded residual waste removed where practical, or the reject fraction of a MRF (Materials Recycling Facility) operation;

- SRF is produced to a fuel standard specified by the receiving plant and can be produced to the European standard specifications set out in CEN153591 It is typically derived from pre-sorted commercial & industrial (C&I) waste or rejects from MRF activities, and typically has a Net CV of >15 MJ/kg.

3.3.5 Specifications regarding the AF

As a basic rule, wastes accepted as fuels and/or raw materials must give the following added value to the cement kiln:

- calorific value from waste material
- material value from waste material.

Requirements to consider in the selection and use of waste as raw material:

- the waste consists primarily of the clinker components
- low volatile heavy metal concentration, i.e., mercury, thallium and other types of metals
- regular monitoring of inputs, e.g., used waste materials by sampling and analysis.

3.3.6 The advantages of RDF

Converting waste to energy has several positive commercial and environmental impacts. The most visible of which will be the direct impact it has both on the finances and the environment. Sending waste to landfill has become increasingly ineffective, and increases the focus on watching environmental impact. Taking advantage of the opportunity to send the waste to waste-to-energy for the cement plant helps decrease waste management costs.

Alternative fuels such as RDF reduce the reliance on fossil fuels, such as oil and coal, whose negative environmental impact is well-known. This has a direct impact on reducing global carbon emissions and moving towards focusing on renewable energy.

Environmental advantages of using alternatives such as RDF in rotary kilns in cement plants are:

- Kiln uses high temperatures (1800-2000°C) giving so the guarantee on complete waste combustion and breakdown of all components potentially harmful for the environment, such as DTT, furans, etc.;
- The RDF material has a long treatment in the kiln at temperatures above 1100°C, due to the length and slow rotation of the kiln;
- there is no combustion process residue; i.e., all unburned fuel components are embedded into clinker;
- the alkaline reactions environment inside the rotary kiln limits the emissions;
- use of the RDF gives possibilities for a rational investment;
- as per the air emissions, there are no significant changes compared with the use of fossil fuels.

RDF has a wide array of advantages including energy efficiency, ease of transportation, better fuel characteristics, multiple uses, etc;

a) Energy Efficiency
b) Homogeneity
c) Uniformity
d) Transportation
e) Emissions

Important fuel properties of RDF

Table 3 . Typical of RDF recovered from municipal solid wastes generated in industrialized nations

Type of Fuel	Heating Value as Received (J/g)	Moisture Content (%)	Ash Content (%)
RDF	12,000 to 16,000	15 to 25	10 to 22
Coal	21,000 to 32,000	3 to 10	5 to 10
MSW	11,000 to 12,000	30 to 40	25 to 35

Source: CalRecovery, Inc.

3.3.7 Quality of RDF/SRF according to international standards

There are two criteria defining the viability of using waste as input for RDF:

- its homogeneity regarding physicochemical characteristics and
- long-term waste availability.

As mentioned before, the calorific value, particle shape and size, chlorine, moisture, heavy metals, and ashes contents are influenced by the waste characteristics and the treatments to RDF.

Developed by CEN/TC343, the EN15359 - 2011 (Solid Recovered Fuels – specifications and classes) is the most crucial. EN15359 provides a system for the specification and classification of SRF. It also provides for a set of compliance rules that points out how SRF can be characterized reliably. The EC 15359 identifies three properties for describing and/or classifying SRF (RDF that fulfills the standards):

- Net calorific value (increasing market value of the fuel)
- Chlorine is unwanted as it contributes to corrosion. High chlorine content will lower the market value.
- Mercury (Hg), of all relevant heavy metals, Hg is selected as an indicator of the environmental quality of an SRF. Because of its high volatility, Hg is the heavy metal most likely to be emitted.

Although the classification system focuses on mercury element (Hg), all heavy metals according to the Waste Incineration Directive (WID) are obligatory parameters for specification according to EN 15359.

3.3.8 Energy requirement

The production of cement consumes large quantities of raw materials and energy (thermal and electricity). This process requires approximately 3.2 to 6.3 GJ of energy and 1.7 tons of raw materials (mainly limestone) per ton of clinker produced. Being an energy intensive industry, thermal energy used in the cement industry accounts for about 20–25% of the production cost. The typical electrical energy consumption of a modern cement plant is about 110–120 kWh per ton of cement.

Based on the European Commission in 2010, the cement industry is recorded as the industry with a huge amount of fuel needs. CEMBUREAU (1999) stated that 40% of the total operational costs of the cement plant were spent on energy procurement. The increase in global CO2 emissions indicates that the use of fossil fuels is increasing. Whereas, the main environmental problem associated with cement production is emissions.

- **Cement manufacturing process**

The main process routes for the manufacturing of cement vary for equipment design, method of operation and fuel consumption. The cement manufacturing process includes quarry, raw meal preparation, preheating of raw meal, kiln, clinker cooling, grinding, storage, and dispatch. Usage of alternative fuel (AF) such as RDF/SRF has become popular to cement manufacturers due to increasing fossil fuel prices, limited fossil fuel resources and environmental concerns.

The amount of energy required to produce one kilogram of clinker is 730 kcal/kg. Therefore, the amount of energy to be extracted from RDF with 15% or 85% substitution is given in:

ERDF= 730×15 / 100 = 109.5 kcal
EPC=730×85 / 100 = 620.5 kcal

- where ERDF is the energy required from RDF with a 15% substitution rate to produce one kilogram of clinker; (15% of the needed energy secured by pet coke)
- EPC is the energy required from pet coke with a substitution rate of 85% to produce one kilogram of clinker.

This research has been conducted, aimed at determining the available capacities of industrial and commercial waste on the territory of Krujë, Lezhë, Kurbin and Mat, which could be mobilized and included in the process of production of alternative fuels for use in TITAN Antea Cement Industry in Albania.

The main industries and businesses aimed at obtaining the waste necessary for the production of alternative fuels are given below:

1. **Textile Industry:** Manufacture of Textiles/Leather and Textile/Leather Products including

spinning of fibers (cotton, wool, worsted, etc.), textile weaving, manufacture of carpets, soft furnishings, clothes and footwear.

2. **Chemical Industry**: Manufacture of Rubber and Plastic Products such as tyres, plastic products, including floor coverings, synthetic rubber, man-made fibers etc.

3. **Wood and wood products:** Manufacture of Wood and Wood Products including sawmills, and manufacture of plywood, panels and boards, carpentry and wood art; manufacturing articles of cork, straw and plaiting materials/ Manufacture of Furniture.

4. **Paper and paper products:** Manufacture of Pulp, Paper and Paper Products, paperboard and articles of paper, including stationery, wallpaper, cartons, and boxes. Publishing, Printing and Reproduction of newspapers and books.

5. **Food Industry:** Food, drink and tobacco manufacturing, Manufacture of beverages including alcohol, production, processing and preserving of:
   - meat and fish products; fruit, vegetables; animal oils and fats; dairy products; grain mill products, starch products and animal feeds.

6. **Machinery and Equipment and Electronic Industry related to waste production.**

7. **Wholesale and retail trade repair of motor vehicles:** Wholesale and Retail Trade; Repair of Motor Vehicles, Motorcycles and Personal and Household Goods/ Retail shops and stores

Table 4. Different types of wastes used as fuels in EU-27 cement kilns

Group Nr.(*)	Types of waste fuels (hazardous and non-hazardous)
1	Wood, paper, cardboard
2	Textiles
3	Plastics
4	Processed fractions (e.g., RDF)
5	Rubber/used tires
6	Industrial sludge
7	Municipal sewage sludge
8	Coal/carbon waste
9	Agricultural waste
10	Solid waste (impregnated sawdust)
11	Solvents and related waste
12	Oil and oily waste
13	Others
(*)	Each grouping spans several EWC listings, see Table 6.1 in Section 6.2.1 Source: [74, CEMBUREAU, 2006], [168, TWG CLM, 2007]

Source: CEMBUREAU, 2006

Following the requirements of the technology installed by TITAN Antea Cement as quality standards and quality of clinker production, only part of the waste is possible to be used in the co-incineration process in the combustion furnaces of the cement plant.

According to Antea Cement sh.a., owned by the Titan Group, they possess a permit for waste co-combustion at its facility, but it has not yet begun the process. The capacity planned is the thermal energy in the entry equal to or higher than 50 MW with 200,000 tons of AFs per year. The total AF capacity includes 40,000 tons of RDF/SRF per year.

Based on the requirements of the European Union and the global requirements for the reduction of CO2 emissions in the atmosphere, TITAN Group has become part of the initiatives to be included in projects that will lead to the concretization of the reduction of consumption of alternative fuels and CO2 emissions.

TITAN Antea Cement sh.a. has installed almost all the necessary technology for the use and combustion of alternative fuels. With some additional investment, the company can start purchasing RDF raw materials from third parties that perform the preliminary mechanical preparatory processes, for a product that will be fully controlled and within the standards and strict requirements of its composition. Below are some of the types of waste that can be used for the production of alternative fuel RDF, with the respective calorific value.

Table 5. Types of waste with the respective calorific value

No.	Type of waste	Calorific value (MJ / kg)
1	Letter	12.5-22
2	Cardboard	14-16
3	Plastic	29-40
4	Used tires	28.5-35
5	Waste from leather	16.5-18.5
6	Textile	13.5
7	Residues from the carpentry process	18.5-21
8	Waste from biomass and urban greenery, wood, leaf's, dry sludge after wastewater treatment	15-17
9	High calorific waste streams (Used oils, Industrial Sludge)	42-46

Source: Co-PLAN Archive

SRF is similar to RDF but with a much more closely defined and controlled specification. The specification is defined by a set of European Standards (CEN/TC 343). The specification of a typical commercial SRF is shown in Table 5.

Table 6. Typical Solid Recovered Fuel (SRF) Specification

Particle Size	Typically, Less Than 35 mm
Calorific value	17 to 22 MJ/kg
Moisture content	Less than 15% by weight
Chlorine content	Less than 0.9% by weight
Sulfur content	Less than 0.5% by weight

Source: Sita

3.3.9 Fractions of the RDF

The fraction of RDF or SRF is determined using analytical standards ASTM D6866 and EN ISO 21644. RDFs and SRFs have proven to be effective substitutes for fossil fuels because they have low production costs but have significant thermal value. European countries that produce and use SRF include Austria, Italy, Germany, Greece, the Netherlands, the UK, and the Scandinavian countries. In Japan, Refuse Plastic & Paper Fuel (RPF) is more widely used. RPF is made of non-reclaimable used paper and plastic waste excluding PVC (Polyvinyl chloride) and PVDC (Polyvinylidene chloride).

3.3.10 Air emissions

More than 50% of the total CO2 from cement production results from the chemical reaction that

converts limestone into clinker, the active ingredient in cement. This chemical reaction accounts for approximately 540 kg CO2 per ton of clinker.[9]

Table 7. GHG performance of typical alternative fuels

Fuel type	Net CO_2 emission factor (Kg CO2/GJ)
Petcock	101
Coal	96
Natural Gas	54.2
Tires	85
Waste oil	74
Plastic	75
RDF-SRF / MSW	8.7
Animal meal	0
Waste wood	0

Source: Co-PLAN Archive

The main emissions from the production of cement are emissions to air from the kiln system. The following pollutants have been listed in the Best Available Techniques Reference (BREF) document on the issue (European Commission, 2010):

- oxides of nitrogen (NOx);
- Sulfur dioxide (SO2) and other Sulphur compounds;
- dust;
- volatile organic compounds (VOC);
- polychlorinated dibenzodioxins and dibenzofurans (PCDDs and PCDFs);
- metals and their compounds;
- hydrogen fluoride (HF);
- hydrogen chloride (HCl);
- carbon monoxide (CO);
- ammonia (NH3).

which mainly originate from pre and after-treatment. Emissions from the kiln are a combination of combustion and process emissions but the emissions of the main pollutants — NOx, Sulphur oxides (SOx), CO, non-methane volatile organic compounds (NMVOC), and NH3 — as well as heavy metals and persistent organic pollutants (POPs), are assumed to originate mainly from the combustion of the fuel.

3.4 UTILIZATION PROCESS

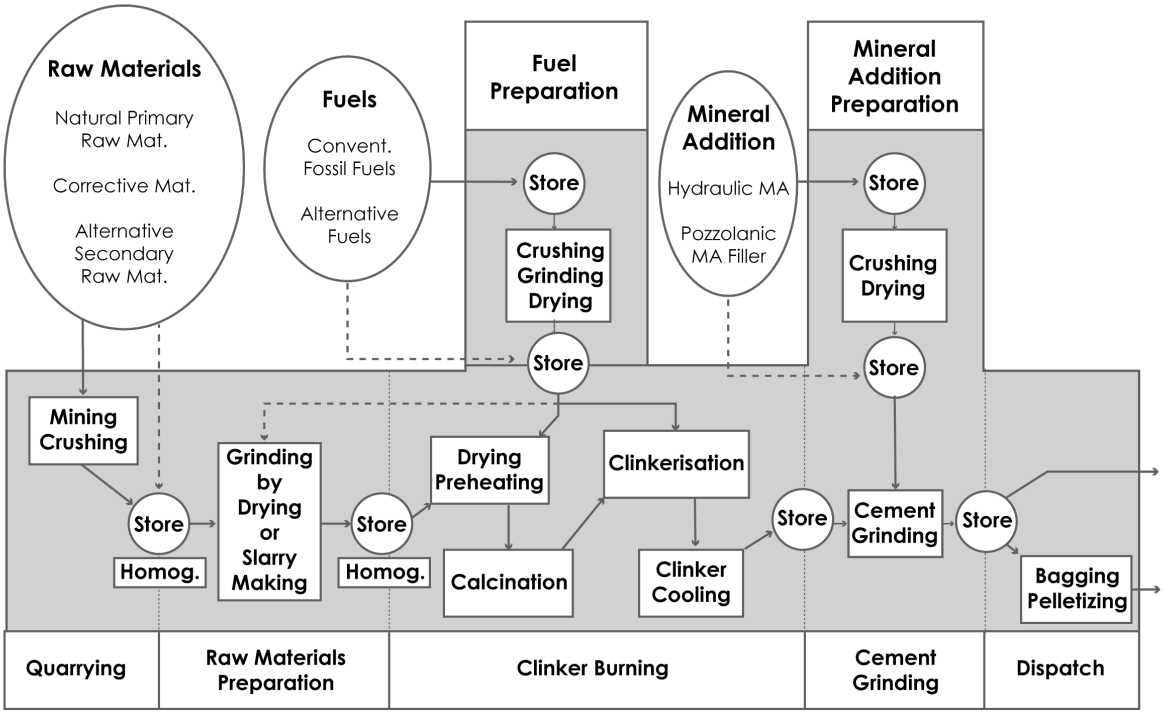
3.4.1 Operation in the cement manufacturing process

A fully integrated cement manufacturing process is as shown in the figure below, divided into three major parts activities:

i) mining activities (extraction and preparation of raw materials),
ii) chemical processes (clinker production)
iii) grinding stage (getting cement powder as a final product)

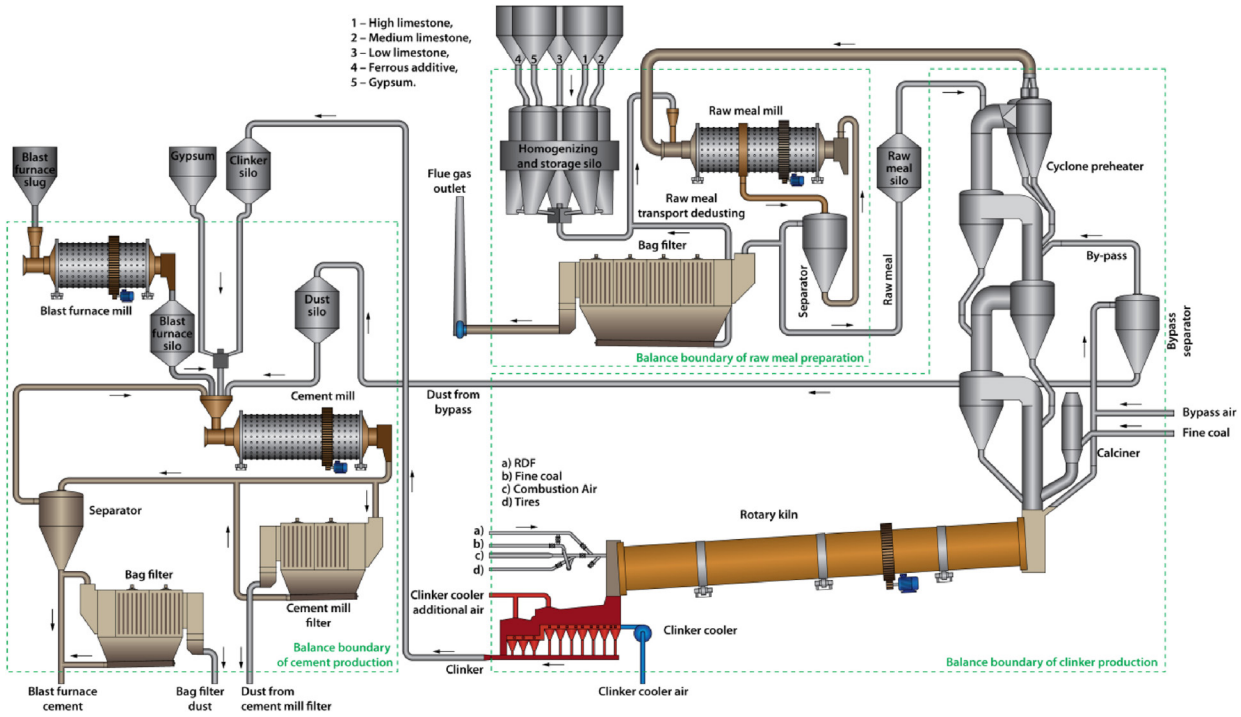
The rotary kiln is the heart of the cement manufacturing process where the clinker is formed at very high temperatures. Kiln operations conditions allow the use of alternative fuel derived from wastes in a sound way for the environment and to guarantee the organic components are burned and destroyed.

Figure 3. Simplified cement manufacturing process



Source: Source: BAT/, Cembureau

Figure 4 . Cement Manufacturing Preheater Process Flow Diagram (CEMBUREAU, 1999)



Source: K. Kogut, J. Górecki, P. Burmistrz, 2019: https://prtr.eea.europa.eu

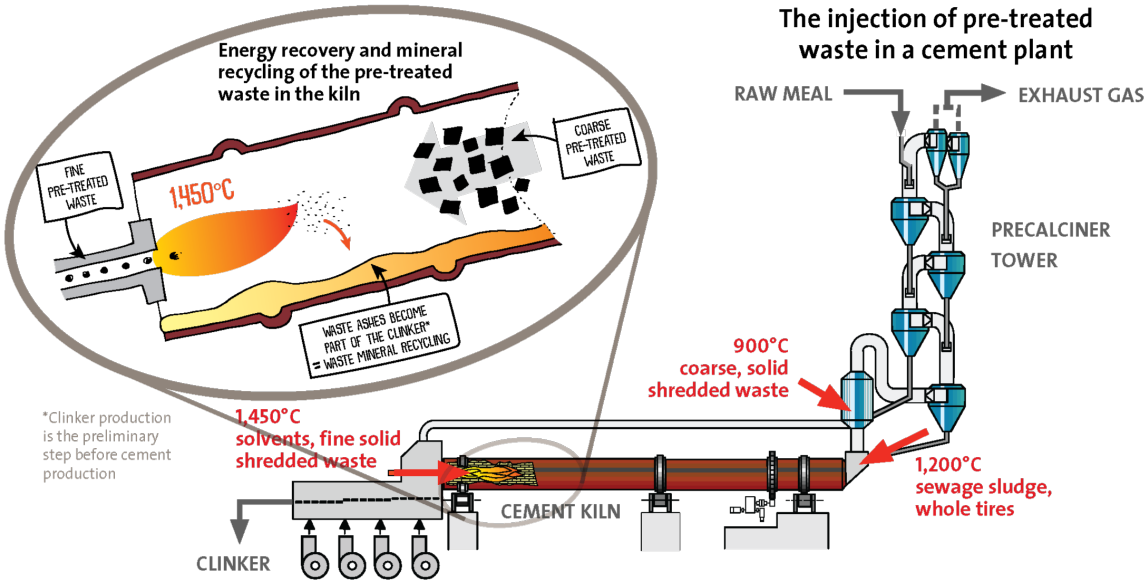
3.4.2 How can it feed the cement plant to use the RDF/SRF waste to energy?

Potential of co-processing in Waste-to-Energy initiatives. Recent studies done by Ecofys have highlighted that in Europe "there is no technical limitation at the cement plants to increase the share of alternative fuels from 36% now to 95% EU-wide."

There is a wide range of non-recyclable waste including industrial and municipal plastics. These wastes are previously separated from the recyclable part that returns to plastic manufacturing. Indeed, plastic waste co-processed is contaminated by pollutants, mixed with other plastics or streams that impede their recycling into new plastic products.

Co-processing of this plastic waste offers an optimal treatment as 100% of energy is recovered and the full mineral fraction is recycled into cement. This mineral content varies from 15% (plastic mixed with other waste) to 60% (i.e., carpet waste) according to the type of waste.

Figure 5. Co-Processing: A unique waste treatment solution



Source: geocycle.com

Co-processing is one of the best practices for municipal waste treatment. Benefits of co-processing compared to the most commonly used treatment solutions in Europe for the non-recyclable fraction of municipal waste.

Findings

RDF is produced from combustible fractions contained in waste from packaging, cardboard, car tires, textile, biomass etc. The calorific value varies significantly depending on the type of waste from which RDF is produced (8-20 MJ / kg).

SRF is an alternative fuel which is produced mainly from waste with a purer composition such as paper, cardboard, wood, plastic. These materials go through several additional processes to improve the quality and calorific value it can generate (15-25 MJ / kg).

Recommendations coming from the study, to enable tangible investment opportunities in the alternative fuels supply chain in the Albanian market based on each municipality's actual situation.

Figure 6 - Co-processing compared to the most commonly used treatment solutions in Europe

A "2 in 1" process:
- treats the waste & produces cement,
- recycles the mineral content of the waste
- recovers 100% of waste energy,
- final treatment, no residue
- thermal destruction up to 1,450°C

An elimination process:
- recovers part of the energy,
- no recycling,
- thermal destruction: 800°C, 2 sec. residue 20% ashes,
- heavy investment for municipalities

A disposal solution:
- No waste recovery.
- No recycling.

In case of illegal dump:
strong impact on the environment ground, water, soil) and local community (health, odour), risk of open fire, strong GHG emissions.

Source: geocycle.com

There are some common recommendations useful regarding the situation, particularly related to:

- improved cost recovery of waste management services;
- ensure that revenues collected for waste are forwarded to subnational entities who cover the cost of waste service delivery (particularly in the case where they are implementing waste management concessions to the private sector);
- enabling long-term supply agreements of wastes, to potential investors in the supply chain such as pre-processing;
- regulatory improvements to increase waste collection and treatment efficiency;
- Ensuring strong partnerships between waste suppliers, waste management operators, government authorities (including at the governorate and municipality level), and the cement industry;
- The need of implementing the regulations on waste management with an integrated approach based on best criteria such as waste and pollution prevention, circular and green economy;
- To create awareness utilizing education, activities and promote social participation in strategies, plans and projects of waste management in their territories;
- To promote and adopt reasonable initiatives in the field of waste management, the participation of the private sector can provide technological innovation and economic

3.4.3 Examples of types of alternative fuels used / the influence on emissions behavior and concentration ranges for substances in waste materials

a) Germany Case

Germany serves as a model for waste co-processing in cement plants and waste management. Co-processing is a mature practice after many years of development and operation.

A Founding member of the European Community and a responsible country as far as implementation of environmental regulation is concerned, Germany has almost eliminated waste landfilling and co-processing has been encouraged both by the cement industry and authorities.

Based on VDZ[10] environmental data, the use of alternative fuels in Germany has grown notably since 2003, reaching a thermal substitution rate of 65% in 2016.

AF streams' contributions for the years 2015 and 2016 are shown in the Table below.

Table 8. AF items energy contribution 2005 (left) and 2016 (right).

2005 contribution		AF type	2016 contribution	
%	kt		%	kt
20,06	567	1. Other industrial and commercial wastes	41,14	1.163
11,45	309	2. Plastics	24,79	640
12,61	188	3. Waste tires	9,48	201
5,00	198	4. Mixed fraction of MW	7,15	283
1,60	237	5 .Pulp, paper and cardboard	0,55	81
0,18	3	6. Packing	0	0
0,85	42	7. Scrap wood	0,02	1
0	0	8. Wastes from textile industry	0,35	7
4,18	92	9. Waste oil	3,22	66
0,20	11	10. Fuller earth	0	0
0,79	157	11. Sewage sludge	2,34	463
4,08	101	12. Solvents	5,09	126
10,76	355	13. Animal meals and fats	4,04	145
0,75	28	14. Other hazardous industrial wastes	1,47	58
100,00%	2.388	Total Alternative fuels	100,000%	3.243

Source: VDZ And Self Production

Main conclusions:

- Four AF families (non-hazardous industrial and commercial wastes, plastics, waste tires, and RDF from municipal wastes) account for more than 82% of the total AF contribution.
- Non-hazardous waste either coming from industry or commerce and MSW represent the biggest opportunity for increasing waste co-processing.
- Waste tires are an interesting steady alternative fuel flow for the cement industry.
- Some traditional AF families (e.g., waste oils, solvents or animal meals) are progressively decreasing due to new alternative management solutions, market concurrency or generation reduction.

4. STUDY AREA

The study area which has been part of this Market Study is located in the northern part of Albania. Initially part of the study were 4 (four) municipalities respectively Lezhë, Kurbin, Mat and Krujë, which from a geographical position are located closer to the Antea Cement factory.

During the project implementation, the Study Area was expanded with two other municipalities namely Shkodër and Kukës These municipalities were added to meet the needs of the study and to create more opportunities to ensure the continuity and quality of waste that can be used for the production of alternative fuels.

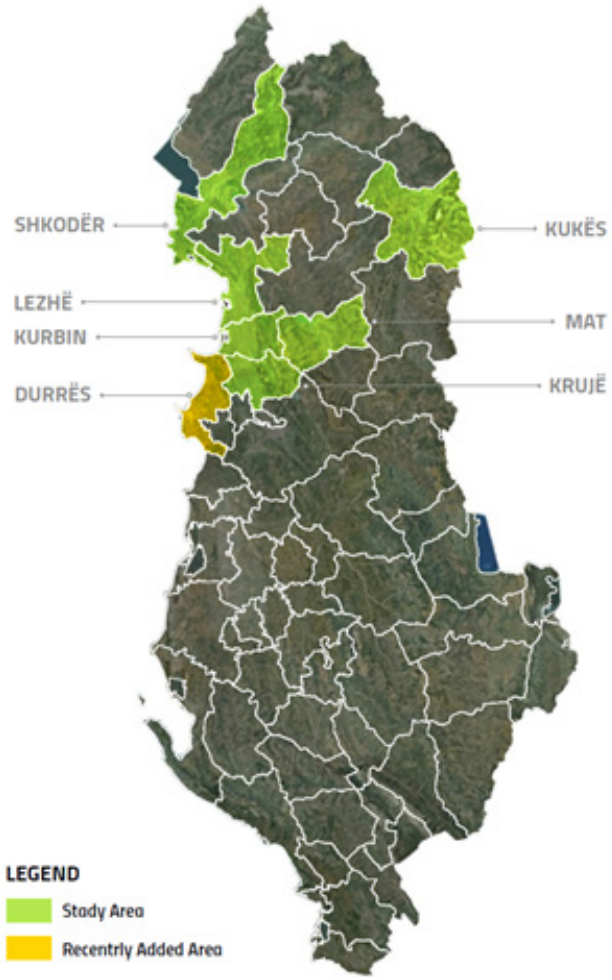
An important component for the selection of these municipalities was the fact that this area is not part of the state or contractual obligations to deposit municipal solid waste in any incineration plant.

The municipalities taken in the study are located in the north of the central area of Albania (Krujë, Mat, Kurbin), in the northwestern area (Shkodër, Lezhë) and northeast (Kukës).

The study area is watered in its western part by the Adriatic Sea and part of it is Lake Shkodër and some of the main rivers of Albania such as the Drin River, Mat River and Ishëm River.

The study area has a climate variation in adaptation to the change of terrain. Lezhë, Krujë and part of Shkodër municipality have a Mediterranean climate while Kukes, Mat and the northern part of Shkodër have a continental climate with cold and rainy days in the winter and hot and dry days in the summer.

Figure 7. Graphic presentation of the municipalities within the study area



Source: Co-PLAN

The municipalities part of the study area have in their composition coastal areas (Shengjin and Tale in Lezhë, Patok in Kurbin, Velipoja in Shkodër) as well as very popular historical tourist areas (Krujë old city) which brings significant changes in the number of populations in different seasons throughout the year and mainly in the summer period.

On the other hand, the town of Fushe Krujë, which is part of the municipality of Krujë, has a well-known industrial character and is mainly related to tailoring and furniture production.
Demographic data of the Study Area covered by the research are:

Table 9. Population data about the pilot area municipalities.

Admin. Unit	Population Census 2011	Population RGJC 2017	Population	Population	Area (Km2)
			Formula MFE	Families	
Lezhë	65,633	110,119	8,979	29,295	509.1
Krujë	59,814	81,772	66,401	15,750	339.02
Kurbin	46,291	74,167	54,654	16,521	269.03
Mat	27,600	37,338	30,521	11,230	493.5
Shkodër	135,612	205,983	156,723	42,259	873
Kukës	47,985	58,126	51,027	-	933.86
Total	**382,935**	**567,505**	**438,306**	**115,055**	**3,418**

Source: Local WM Plans, INSTAT, Civil Registry

In the final phase of the implementation of the project, interest has been shown to include the municipality of Durrës in the study. This municipality has a population of 175,110 inhabitants according to INSTAT (Census 2011) and 299,989 inhabitants according to the civil registry.

The municipality of Durrës lies on the western side of Albania, along the coast of the Adriatic Sea, which emphasizes its tourist character. The touristic profile of the area and the inclusion of some important areas for international tourism cause significant fluctuations in the population and therefore in the waste generated during the summer season.

Findings

All the municipalities part of the study area are located within a feasible proximity with the cement factory of Antea Cement sh.a which is foreseen to consume the Alternative Fuel produced by refused waste generated in the study area.

These municipalities are not part of the state or contractual obligations to deposit municipal solid waste in any incineration plant aside from Durres which at the moment is constricted to deposit nearby Sharra Landfill in Tirana Municipality.

This Study Area (without Durres) has a population of about 438,000 inhabitants and an range zone of about 3,418 km^2.

PART III, INSTITUTIONS AND RESPONSIBILITIES

5.INSTITUTIONS AND STAKEHOLDERS INVOLVED IN THE WASTE MANAGEMENT SECTOR

5.1 Responsible institutions at the Central, Regional and Local levels

Below are listed the responsible institutions in different levels of governance related to the waste management sector.

5.1.1 Central Level

The institutional framework at the central level for waste management includes two main ministries:

The Ministry **of Tourism and Environment (**MTE) is the leading institution in the sector of waste management responsible for developing and monitoring policies, legislations, regulations, drafting and monitoring the implementation of the "Integrated Waste Management Strategic Policy Document and National Plan 2020-2035". In collaboration with its subordinate agency the National Environmental Agency (NEA), it has full responsibility for the implementation and monitoring of the waste management system at the regional (Qark) and local levels. NEA has the responsibility to collect, elaborate and publish data annually regarding quantities and typologies of waste generated, collected and treated in the country.

The Ministry of Infrastructure and Energy (MIE) is responsible for the construction and maintenance of waste management infrastructures such as landfills, transfer stations, incinerators, etc., and set standards for building new waste treatment facilities. The agency subordinate to MIE, the National Agency for Water and Waste is responsible for the capital investment planning and management for the realization of the regional-national network of integrated waste management.

Other ministers involved in the management of specific types of waste:

1. **The Ministry of Health and Social Protection** regulates the collection and treatment of hospital waste through the State Health Inspectorate.
2. **The Ministry of Agriculture, Rural Development and Water Administration** regulates the use of waste from wastewater and animal waste.
3. **The Ministry of Defense** drafts and implements regulations on military waste management.
4. **Ministry of Finance and Economy** proposes the base for taxes charged for activities that harm the environment

5.1.2 Regional level

The Regional Council is the second level of local government in Albania and its function is to design and implement regional waste management plans and harmonize them with national waste management plans. The RC has to report to MTE annually on the implementation of the regional waste management plans.

5.1.3 Local level

Law No. 139/2015 on Local Self-Government defines the responsibilities and authority of LGUs regarding waste management in Albania. In particular, the collection, transportation, and disposal, as well as the treatment of municipal waste is defined as a function of municipalities. According to this definition, municipalities have the right and responsibility to manage service delivery in a way that best suits their specific conditions to cooperate with other municipalities and to set service and tariffs and a mechanism for revenue collection. Municipalities are entitled to draft Local waste management plans under Regional Plans and the Strategic Policy Document and the Sectoral Plan.

51.2. Target Groups

The identified target group and beneficiaries are composed of different active recipients (at different levels) in target municipalities and institutions.

1. **Public Institutions at the local level:** Staff of Municipalities of Lezhë, Kurbin, Krujë, Mat, Shkodër, Kukës, and Durrës in charge of waste management.
2. **Central Government Institutions at the national level**:
   - Ministry of Tourism and Environment - Waste Management Directory.
   - Ministry of Infrastructure and Energy - General Director of Water Supply and Sanitation and Waste.
   - Directory of Coordination for Foreign Investments National Agency of Water-Sewage and Waste Infrastructure (AKUM).
   - National Environmental Agency.
3. **NGOs**: Staff of NGOs working on waste management, environmental protection, and renewable energies, mainly from Tirana, Lezhë, Kurbin, and Krujë, including Co-PLAN, Milieukontakt Albania, Urban Research Institute; EDEN Center; REC Albania; Eko-Movement;
4. **Waste management companies (public and private)**, including companies implementing producer responsibility schemes.
5. **Academia and researchers**: Polytechnical University of Tirana (Environmental Engineering Department), Agricultural University of Tirana-Environment Sciences Department; POLIS University-Faculty of Environment and Urban Planning
6. **General Public/Experts/Other stakeholders**: Environmental Experts working on the field; PROEXPORT – Association of Textile and Leather Processors; APCA – Albanian Plastics Converters Association; EU Delegation in Albania- Officer for Environment and Energy;
7. **Media**: Journalists from media.

5.1.3. TITAN Antea Cement

ANTEA Cement Factory is an investment with the highest standards applied in terms of construction and operation in Albania and a total value exceeding 200 million euros.

Titan Antea Cement is part of TITAN Group which is an international cement and construction materials producer and is present in more than 15 countries.

ANTEA Cement has more than 200 employees and is the first and only company in Albania that has successfully implemented and is certified with the Social Responsibility Standard 8000 (SA8000).
The Plant was constructed by CBMI Construction Co, a Chinese construction company. Under the supervision of TITAN Engineering which implemented the highest possible safety standards the project was completed on time, within the forecasted budget and with zero accidents.

ANTEA Cement has a production capacity of 1.4-million-ton cement yearly and 3.300 ton of clinker per day. The plant is located at Boka e Kuqe, Borizane which is 50 km away from Tirana, the capital city of Albania. The plant serves not only local market demands in Albania but exports clinker and cement to Egypt, Montenegro, Libya, and Italy.

Corporate social responsibility is a basic element of TITAN Group and consequently ANTEA's governing objectives and one of its corporate values. ANTEA has been constructed from the very beginning to ensure energy efficiency and environmental effectiveness while addressing societal concerns.

The products of the Antea Cement Plant are as below:

- **CEM I / 42.5 R**
- **CEM II / A-LL 42.5 R**
- **CEM II / B-LL 32.5 R**

All cement types produced by ANTEA are certified with CE marking according to EN 197-1 issued by EUROCERT.[11]

Based on the requirements of the European Union and the global requirements for the reduction of CO2 emissions in the atmosphere, TITAN Group has become part of the initiatives to be included in projects that will lead to the concretization of the reduction of consumption of alternative fuels and CO2 emissions.

According to Antea Cement sh.a., owned by the TITAN Group, they possess a permit for waste co-combustion at its facility, but it has not yet begun the process. The capacity planned is the thermal energy in the entry equal to or higher than 50 MW with 200,000 tons of AFs per year. The total AF capacity includes 40,000 tons RDF/SRF per year.

Table 10. Waste types for which Antea Cement possesses an environmental permit for co-combustion

No.	Waste type	EWC[12]
1.	Flammable wastes (RDF)	19 12 10
2.	Waste from plastic packing	15 01 02
3.	Wood packing waste	15 01 03
4.	Textile packing wastes	15 01 09
5.	Tires out of use	16 01 03
6.	Plastic	16 01 19
7.	Pyrolysis wastes other than those mentioned in 19 01 17*	19 01 18
8.	Textiles	20 01 11
9.	Saw powder, shavings from wooden pieces, panels with particle material and plates that contain hazardous substance	03 01 04*

Antea Cement sh.a. has installed almost all the necessary technology for the use and co-combustion of alternative fuels. With some additional investment, the company can start purchasing RDF raw materials from third parties that perform the preliminary mechanical preparatory processes, for a product that will be fully controlled and within the standards and strict requirements of its composition.

Based on the requests of Antea Cement sh.a. the alternative fuels (RDF) that are a priority to be used in their factory are:

- Plastics (packaging waste including composites)
- Wood
- Commercial (household-like) waste
- Clean commodities (selected at source)
- Mixed communal waste.

The raw materials that will be used for the production of RDF will be waste that cannot be recycled and will meet the defined criteria of their composition according to the legal requirements and relevant standards.

Findings

Based on the Albanian legislation in force, it is determined that the municipalities are the responsible to offer integrated waste management process including the municipal council which has the task of approving the waste management plan and its respective changes.

TITAN Antea has the necessary permits from the state institutions as well as almost all the appropriate technological conditions for burning certain categories of waste.

PART IV, STRATEGIC, REGULATORY AND LEGAL FRAMEWORK

6.WASTE MANAGEMENT POLICY AND LEGISLATION

6.1 Legislative and Regulatory Framework

The following table describes the status of transposition and implementation of the EU legal acts, as identified through the SPA performed within SANE27 - Phase I, the detailed list of legal acts and their current status, regarding the approximation to the EU acquis, is included in is included in the Position Paper document.

EU acquis	Competent body	% Transposition	Implementation status
Chapter 27		48%	Initial stage
Horizontal	MTE	78.6	Partly implemented
Air quality	MTE	66.8	Initial Stage
Waste management	MTE	53.5	Initial Stage
Water quality	AMBU	35	Initial Stage
Nature protection	MTE	33	Initial Stage
Industrial Pollution	MTE	44.5	Initial Stage

Source: ToRs SANE27 Phase 2, November 2020

According to the last EU Country Progress Report 2020[13] Albania shows some level of preparation regarding Ch.27, however still limited progress was made in further aligning the policies and legislation with the acquis, in areas such as waste and water management, environmental crime and civil protection. Furthermore, significant efforts are still needed in implementation and enforcement, especially on waste management, water and air quality and climate change.

According to the 2020 Albania progress report, Albania should in particular:

- align further with key water directives and accelerate the capacity development of the national agencies for Water Resource Management and for Water Supply, Sewerage and Waste Infrastructure;

- implement the Paris Agreement by implementing the Climate Change Strategy and Action Plan on Mitigation and Adaptation 2019-2030, adopted with DCM No. 466, date 03.06.2019, to adopt the relevant legislation and develop its integrated National Energy and Climate Plans in line with Energy Community obligation.

Table 11. List of legal acts and status of approximation to the EU acquis:

#	EU acquis	Competent body	%	Implementation status
Horizontal Legislation		**MTE**	**78.6**	**Partly implemented**
Waste management		**MTE**	**53.5**	**Initial Stage**
1.	Directive 2008/98/EC - Waste Framework Directive	MTE	34	Initial stage
2.	Directive 86/278/EEC Sewage Sludge	MTE	100	Initial stage
3.	Directive 2006/66/EC Batteries	MTE	82	Initial stage
4.	Directive 94/62/EC Packaging	MTE	81	Initial stage
5.	Directive 96/59/EC- PCB/PCT	MTE	87	Initial stage

6.	Directive 850/2004/EC - POPs	MTE	58	Initial stage
7.	Directive 2000/53/EC - ELVs	MTE	74	Initial stage
8.	Directive 2011/65/EU – RoHS (recast)	MTE	3	Not implemented
9.	Directive 2012/19/EU – WEE	MTE	38	Not implemented
10.	Directive 1999/31/EC Landfill	MTE	81	Initial stage
11.	Directive 1013/2006/EC – Shipment of waste	MTE	12	Initial stage
12.	Directive 2006/21/EC Mining Waste	MTE	45	Partly implemented
13.	Directive 1257/2013/EU – Ship recycles	MTE (full set of competences not defined)	1	Not implemented

Source: Progress Report Albania, 2020

6.1.1 The legislative and regulatory framework in Albania

- **Law 10431, dated 09.06.2011 "On environment protection"** provides the basic framework for the regulation of the environment sector, including integrated waste management.

The law aims to protect, preserve and improve the environment and prevent and reduce risks to human life and health. The law promotes the conservation, protection and improvement of nature and biodiversity and establishes rules for the prevention, control and reduction of pollution in air, water and soil. The law promotes initiatives and activities for environmental protection through the prevention and reduction of environment pollution, and projects that use less energy or fewer fossil fuels.

The law includes the 'polluter pays' principle which states that every natural or legal person who performs an activity that causes environmental pollution bears the financial responsibility for the damage caused. In this line are foreseen implications for natural or legal persons that deal with the collection, transportation, recycling, reuse and import of waste of any kind. To achieve a higher level of environmental protection the line Ministry encourages voluntary agreements with individuals, organizations/groups of organizations and or agreements between them. In addition, the law promotes entities that during their activities use less energy and promote renewable energy resources, or decrease the amount of waste deposited in a landfill by promoting and applying 3R (reduce, reuse, recycle) concepts, or any other method that causes environmental pollution.

- **The Law nr.10440, date 07.07.2011 "On environment impact assessment"**

Law "On environment impact assessment" aims at securing a high standard of environment protection through the prevention, minimization and compensation of damages in the environment from proposed projects before their development.

The Law on Environmental Impact aims to ensure a high standard of environmental protection by preventing, minimizing and compensating for environmental damages from proposed projects before their implementation or development. The law regulates the procedures for the evaluation and the possible effects that different projects may have on the environment as well as the obligation of the applicants who apply for projects in the field of agriculture, extractive industry, energy industry, mining, food industry, installations for disposal of waste, wastewater treatment.

- **Law 'On integrated waste management'[14] as amended with Law no.156, date 10.10.2013**

The law aims to protect the environment and human health and to ensure proper environmental management of waste through the prevention and minimization of waste, improving the efficiency of their use and reducing the overall negative impact on the efficient use of resources in the sector. This law establishes a legal framework and highlights the importance of proper waste management

in the territory of the country. It introduces the principles of waste management as the 'polluter pays principle', the 'extended producer responsibility' that is applied to different streams of waste, the waste hierarchy, recovery and recycling techniques to reduce the impact of waste in water, air, soil, flora and fauna. The law foresees the safe management, collection, transportation, storage (temporary and non-temporary) and treatment of municipal waste, hazardous waste, batteries and accumulators, construction and demolition waste and waste oils. The law defines the role and competencies of stakeholders in the sector, whether public or private, about the drafting of policies, plans, regulations and data reporting related to the collection, transportation, treatment and final disposal of waste. The law was followed by several DCM that address the different collection and management of specific waste streams.

- **DCM no. 177 of 6.3.2012 "On packaging and packaging waste" as amended**

This DCM aims to prevent the generation of packaging waste, promote differentiated waste collection and reuse, and recycle and recover packing material and packaging waste of all types in order to lower as much as possible the amount of packaging waste finally disposed of.

The producers of packaging materials and packaging prepare their programs for prevention based on regional and national waste prevention programs. These programs are approved and monitored by NEA.

Under the producer's responsibility, the producer of packaging and waste from packaged goods takes measures to finance all costs arising from the establishment of waste return and recovery systems, individually or in cooperation between them.

- **DCM no.418 of 25.06.2014 "On differentiated collection of waste"**

The DCM charges the LGUs with the implementation of a separate collection of four waste streams: paper/cardboard, metal, plastic and glass. The DCM also set targets for the collection, reuse and recycling of these four streams.

- **DCM no. 178 of 06.03.2012 "On waste incineration"**

The purpose of this decision is to set out detailed requirements for the incineration and co-incineration of waste to prevent as much as possible the negative effects on the environment and pollution caused by the emissions of this process into the air. The DCM foresees the typologies of waste that can be used for incineration along with rules and restrictions regarding this process. All incineration plans should be equipped with environmental permits in which all the values of their emissions in the air, soil and water are determined .

- **Law no. 10448 date 14.07.2011 "On environment permits"**

This law aims to prevent, reduce and keep under control pollution caused by certain categories of activities, to achieve a level of high protection of the environment as a whole, human health and quality of life. The law defines rules and sets measures for the prevention or the reduction of the pollution that certain activities can cause in the environment.

- **Law no. 7/2017 "For the promotion of the use of energy from sources of renewable energy"**

The law aims to stimulate energy production from renewable sources to ensure sustainable development by increasing the diversification of the use of energy resources and reducing greenhouse gas emissions. The law foresees as one of the possible sources of energy biodegradable waste, which can be generated from agricultural activity, and industrial urban and rural waste.

- **DCM no. 179, dated 28.3.2018 "For the approval of the national plan of action for resources and renewable energy, 2018- 2020"**

The national plan foresees the production of electric energy from the degradable part of the urban solid waste, industrial and rural waste. Of major concern is the treatment of urban waste from the old waste deposit sites and one of the proposed measures foreseen in the National Strategy of Waste Management and Action Plan, approved in 2011 is the establishment of an incinerator in the vicinity of the cement factories[15] for the incineration of waste to use the produced energy for industrial purposes.

6.1.2 Overview of the existing strategic planning documents

The Government of Albania has approved recently the "Integrated Waste Management Strategic Policy Document and National Plan 2020-2035[16]" (Strategic Policy Document) and "National Sectorial Plan for Solid Waste Management[17]" (Sectorial Plan), which are the two major strategic documents in the waste sector that define the objective, targets and main infrastructure needed for the integrated waste management. These documents to be implemented should be followed by regional and local waste management plans and facilities for the temporary storage (transfer stations) and final disposal of waste.

The **Strategic Policy Document** is the main planning document, which regulates the management of municipal, non-municipal and hazardous municipal waste. The Strategic Policy Document takes into consideration planning and infrastructure developments at the Central and Local Government levels and the involvement of private businesses. The revised Strategic Policy Document is developed on the vision or perception of the "zero waste" concept, so that waste is collected and treated as raw material and management is done under the concept and principles of the circular economy system and introduces the waste recovery concept through waste to energy plants, which can be done through incineration and other technologies.

The **Sectoral Plan** represents the second-level planning document on waste management, which defines the planning framework related to national and regional infrastructure investments, the selection of sites for the development of the infrastructure and the allocation of investments for related infrastructure.

6.1.3 Identification of the current legislative framework regulating the process of production and usage of RDF/SRF

At this stage, there are no legal acts, laws, by-laws or regulations that regulate the use of Refuse Derived Fuels and Solid Recovered Fuels in waste to energy plants. Waste management in Albania can still be considered in its first steps, shifting from the previous function of cleaning as an initial step to a more integrated approach that was introduced with the approval of the law "On integrated waste management" in 2011. Although, some indications, that need to be further elaborated by the line ministries, regarding the use of waste in waste to energy plants are given in the old (2010 – 2025) and the new (2020 – 2035) strategy on integrated waste management and in the law "For the promotion of the use of energy from sources of renewable energy"

6.1.4 Status of transposition with EU WM directives and possible gaps

The Albanian legislation in the waste management sector is mostly transposed and in line with EU directives. The Government of Albania has mostly transposed EU legislation in the waste management sector where the transposition level of legal acts is considered to be around 53.5% . However, despite the fact that the Government of Albania has taken good steps forward on the approximation to EU legislation the waste management sector remains a challenge in terms of financing, human resources and implementation of legislation.

The Council of Ministers[19] has approved in 2020 two major policy documents the "Integrated Waste Management Strategic Policy Document and National Plan 2020-2035[20]" (Strategic Policy Document) and "National Sectoral Plan for Solid Waste Management[21]" (Sectoral Plan), which are the two major strategic documents that set strategic objectives, targets and define the main infrastructure needed for the integrated management of waste. These documents are an important step for the

sector, but in order to achieve higher environmental standards and to reach the objective set in these documents regional and local waste management plans should be drafted along with the investment to build temporary storage facilities, sanitary landfills and waste to energy plants.

Strategies for hazardous, construction and demolition waste should follow in order to address the management of such waste.

Legislation transposing Directives on ELVs, WEEE, Batteries, PCB/PCT, Mining Waste and Use of Sludge in Agriculture are partially transposed but they are in their early stages of implementation and more is needed in order to fully transpose and implement these directives. For these specific waste streams, which most of them are under the extended producer responsibility, more collaboration is needed between public institutions, at central and local level, and businesses, importers and retailers to set up EPR schemes in order to comply with EU and Albanian legislation.

Findings

Albania is improving its approach regarding the waste management sector and the approval of the two strategic documents proves the availability of the Government of Albania to achieve better environment standards.

On the other hand, the EU waste policy aims to contribute to a circular economy by extracting high-quality resources from waste as much as possible. In this line the use of processed waste as an alternative fuel in waste to energy plants and cement industry will fulfil both requirements set by the Government of Albania and EU.

The use of waste in waste energy plants will accomplish one of the stages of the waste hierarchy and will help the reduction of waste been disposed in landfills and deposit sites on the other hand the processed waste in the form of RDF/SRF will be used as alternative fuel in cement industry plants.

Furthermore, Alternative Fuel is an equivalent product with conventional fuel therefore it should be controlled and standardized before marketed.

PART V, DATA COLLECTION

7.DATA COLLECTION FROM MARKET RESEARCH

7.1 Waste management in Albania

From the data published by INSTAT, in 2018 a total of about 1.52 million tons of urban waste were generated and 1.32 million tons of urban waste were managed, while during 2019 there was a decrease of 18% of the amount generated and consequently that managed. The annual amount of urban waste managed per capita, nationwide, in 2019 was 381 kg/capita, from 462 kg/capita in 2018.

The national data on the overall municipal waste quantities generated per country/ region/ municipality are usually estimated based on the defined annual waste generation rates per capita. According to the Statistical Yearbook from 2015, the generation rates for the last 5 consecutive years showed the following figures.

Table 12. Municipal waste (kg per capita) in Albania

Years	Total generated (tonnes)	Managed (tonnes)	Total managed kg/ cap/year	Non-urban wastes k/cap/ year	Urban waste kg/cap/year
2015	2.492.414	1,413,233	490	94	396
2016	2.211.936	1,300,373	452	79	373
2017	1.817.266	1,253,913	436	50	386
2018	1,523,256	1,325,071	462	79	383
2019	1.201.598	1,086,692	381	50	331

Source: Instat.gov.al

The data illustrated above suggest a decrease in waste generation per capita and an increase in managed waste compared to those generated through the years.

7.1.1 Waste managed per inhabitant

In 2019 the amount of non-urban waste managed together with urban waste was 13.0 % of the total, from 17.2 % in 2018, marking a decrease by 4.2 %.

The amount in the percentage of industrial wastes mixed with urban wastes[22] has not been stable with a slightly decreasing trend in recent years. The coverage level of the population with municipal waste management services in 2019 was 87.9 %, marking an increase by 22.2 % compared to the previous year.

Table 13. Population and level of offered service

Years	Population (residents) in years	Number of served residents for wastes	Coverage level with services		Typical family wastes and similar		Industrial wastes managed together with urban wastes	
	Inhabitants	Inhabitants	%	Tonnes	%	Tonnes	%	
2015	2,886,026	1,735,945	60.0	1,142,964	81.0	270,269	19.0	
2016	2,875,592	1,975,531	68.7	1,072,236	83.0	228,137	17.0	

2017	2,873,457	1,980,524	68.9	1,109,399	88.5	144,514	11.5
2018	2,866,375	1,882,919	65.7	1,097,705	82.8	227,366	17.2
2019	2,854,191	2,508,834	87.9	945,024	87.0	141,668	13.0

Source: Instat.gov.al

7.1.2 Type of managed waste

In the composition of urban waste, organic is the main fraction of waste generated at the municipal level. Compared to the total amount of managed waste the amount of organic waste has faced some slight fluctuations.

Table 14. Percentage of each waste category

Years	Organic wastes	Wood	Paper, paper-board	Glass	Plastic	Textile	Metal	Non hosp. hazard. waste	Elec. PC etc	Solid	Other	Hospital wastes
2017	45.9	3.9	9.5	4.8	16.8	3.2	2.7	0.2	1.2	7.4	3.4	0.01
2018	61.2	5.1	7.7	3.8	9.7	2.2	1.5	0.2	1.0	5.5	0.1	2.0
2019	58.4	2.4	7.6	3.2	9.0	5.6	1.8	0.1	1.4	7.7	1.7	1.1

Source: Instat.gov.al

In 2019, 78 % of the total amount of waste was deposited in landfills, while in 2018 the analog figure was 76.4 %, marking an increase of 1.6 % of the total amount of waste deposited in the landfill and approved dump sites as temporary deposits by the respective municipalities.

In 2019, according to INSTAT 18.7 % of the total amount of waste collected was recycled, while in the previous year this indicator was 18.5 %. In 2019, about 0.9 % of total waste was treated with incineration for energy purposes, marking a decrease of this indicator by 1.9 %, compared to the same indicator in 2018.

Table 15. Information on the quantities and percentage of waste subject to various processes

Years	Energy Burning		Burning for elimination		Recycling		Landfill deposits		Free disposal		Total managed wastes		Not managed wastes		Total generat-ed wastes
	Ton	%	Ton	%	Ton	%	Ton	%	Ton	%	Ton	%	Ton	%	Ton
2017	22,864	1.8	19,816	1.6	218,181	17.4	971,572	77,5	21,480	1.7	1,253,913	69	563,352	31	1,817,265
2018	36,558	2.8	25,978	2	245,040	18.5	1,012,517	76,4	4,979	0.4	1,325,071	77	198,185	23	1,523,256
2019	9,732	0.9	1,744	0.2	203,440	18.7	847,208	77.9	24,538	2.3	1,086,692	90	114,898	10	1,201,598

Source: Instat.gov.al

Findings

According to the discussions in the consultation meetings with industry and waste recycling company representative, they are concerned about the amount of waste generated, declared in the publications of national and local level. Representatives of the recycling companies had disagreements regarding the official data declared on the amount of waste generated. According to them, the real figures of waste generation are significantly lower than what is declared and also the level of recycling in Albania is much lower than the official value of 18.7% in 2019.

7.2 Waste management in the Study Area

Municipalities of the study area do not have a common methodology or plan for the calculation of the service costs. In 2018 the DCM No. 319, dated 31.5.2018 'For the approval of measures for costs of integrated waste management' were approved by the Albanian Government but not all the municipalities applied this methodology.

Lack of relevant infrastructure for the successful implementation of the waste weighing process by each municipality leads to the use of other empirical methods, some of which are defined by DCM no. 538, dated 22.9.2021"For the adoption of rules for keeping, updating and publishing waste statistics". But, due to the differences and the debatable accuracy of some factors, no real accurate conclusions can be drawn from these calculations,

Currently, the results for the amount of waste generated by each municipality (except for small periods when pilot projects have been done for weighing in a certain area), refer to the daily rate of waste generation for each resident in the area where the service is provided according to the respective number of the population (formula below).

Amount of waste (ton) = No. of inh. x generation rate (kg/inh/day) x 365 days / 1000.

From the above, the following quantitative data refer to the quantities declared by the respective aggregate derived from the empirical calculation or in some cases from real residual weights.

In this region, there is no separation at the source of any waste typology. Waste recycling is in its infancy, mostly performed by the Roma community and some small collectors which then deliver this amount to recycling companies operating in the area. The main types that are collected are aluminum cans, paper, cardboard, plastics and iron. Most recyclable waste comes from urban waste and industry. In these municipalities, there is no composting plant for biodegradable waste and incineration of urban waste (non-recyclable) as well as industrial waste for heating/energy production purposes.

In these municipalities, it is noticed that there is a low level of awareness by residents regarding waste management and environmental protection. In some cases, there have been implemented pilot projects to initiate the separation of waste at source or their recycling (Lezhë municipality) but for various reasons have not been successful.

Also, state institutions or civil society organizations need to do more to improve the process of raising awareness and informing the public about the municipality projects or the current state of service of the municipality in this regard.

7.2.1 Lezhë Municipality

Lezhë municipality is composed of 10 Administrative Units (Lezhë, Shengjin, Shenkoll, Zejmen, Kallmet, Dajc, Blinisht, Balldre, Kolsh, Ungrej) and has a population of 65,633 inhabitants (INSTAT, Census 2011) and an area of 509.1 km2.

The Municipality of Lezhë also has a diverse landscape and it is characteristic that the sea, the fields, and the mountains are very close to each other.
The data regarding the waste management sector in the municipality of Lezhë are extracted from the Lezhë Integrated Waste Management Plan 2017 – 2021.

Below are illustrated some main data about waste management in this municipality.

Table 16. Data on coverage with the waste management service[23]

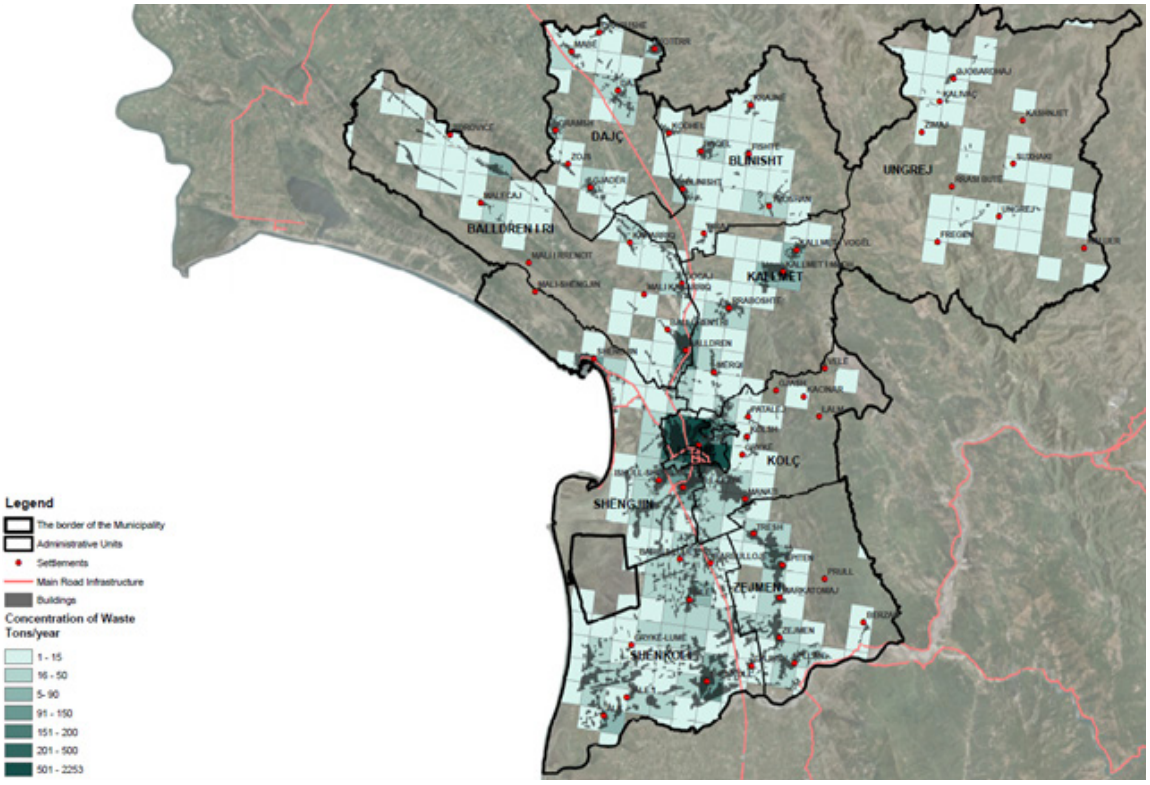
Data\Ad Units	City of Lezhë	Shëngjin	Other Ad Units	Total
The population receiving the WM service	29,000	9,650	30,632	**69,282**
The families that receive service	8,259	2,727	8,563	**19,550**
% of the population receiving service	97%	82%	61.8%	**66%**
Waste collected (ton/year)	8,760	5,938	7,952	**22,650**
Generation of (kg/inhabitant/day)	0.69	1.29	0.44	0.56

Source: Local WM Plan

According to IWMP, in the AU Lezhë almost the entire population receives the service of waste management (97%) while at the municipal level approximately 66% of the population receives regular waste management services. According to the projections of the Plan, in 2021 the level of service coverage in this municipality will reach 95% covering most of the territory. The lowest level of coverage is recorded in Balldren AU which is 39% of the population, while the AU of Ungrej is the only one that does not receive regular service.

Based on the data collected from official documents and meetings held with local authorities and businesses, below is shown a map of the distribution of population density in Lezhe municipality. From the map, it can be seen that the concentration of population is higher in AU Lezhe and less in other administrative units, this indicator helps us to understand which AU has the highest generation of waste.

Figure 8: Population density/waste concentration map in Lezhë municipality

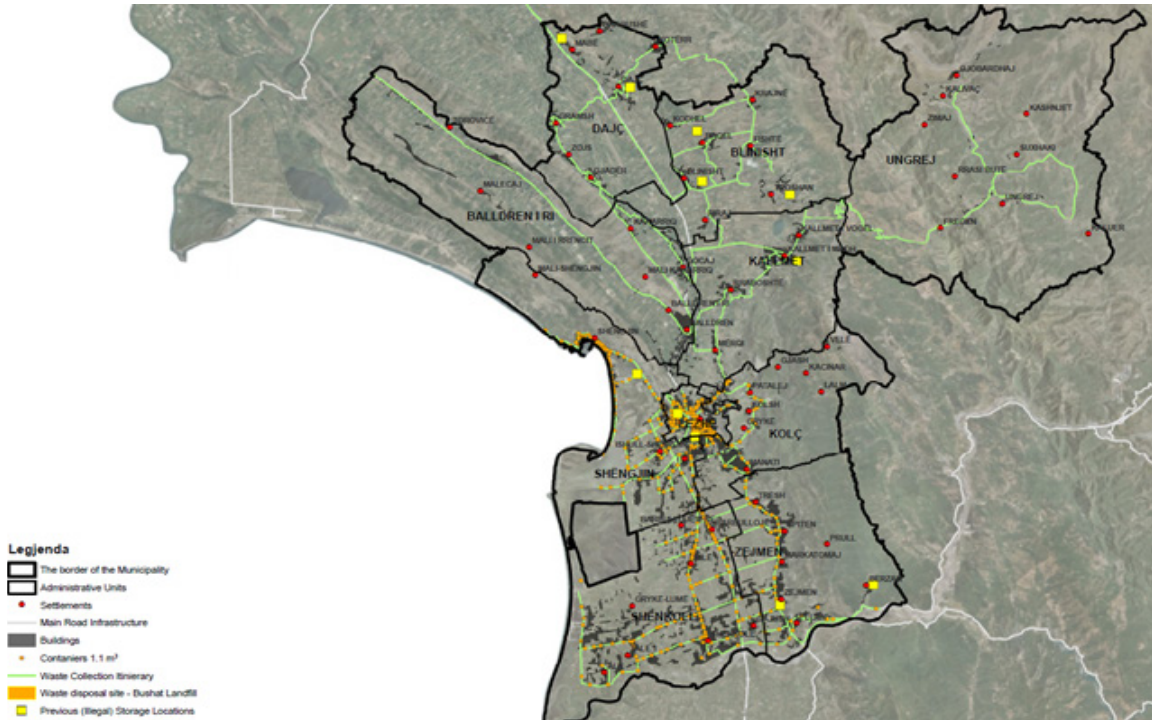


Source: Co-PLAN

Based on the data in the Municipality of Lezhë:

- There are about 20-30 open waste collection points (without containers) in Kolsh administrative unit, while there is no accurate data for Ungrej AU;
- There are a total of 3 deposit sites, 2 located in Blinisht, and 1 in Bërzanë, Zejmen; on the other hand, the data suggests that these deposit sites are no longer used by the waste service units, however, no measures have been taken to close them properly;
- From the statements of the representatives of the Municipality of Lezhë, currently, all the waste managed in the municipality is deposited in the landfill of Bushat;
- There are at least two designated sites for the disposal of inert waste, in the swamp area of Lezhë and Dajç.

Figure 9: Map of the itinerary, containers distribution, and landfill for Lezhë municipality



Source: Co-PLAN

Data from the IWMP shows that about 31% of waste generated in Lezhë is composed of recyclable fractions including paper/cardboard, plastics, glass, and metals[24].

Although the objective of the municipality of Lezhë is to separate the waste at the source to reduce as much as possible the amount of waste that is deposited in the Bushati landfill, it can be mentioned that even with the help of projects financed by foreign donors, this objective has not yet been achieved. Even if about 69% of the waste of the Municipality of Lezhë is said to be biodegradable waste (organic, wood and waste from the kitchen, yard, animals, etc.), mixed with non-recyclable waste, so far, in the municipality of Lezhë, there has been no initiative by institutions or bodies responsible for waste management to conduct a study or implement a project for the promotion of composting practices. Composting is carried out by inhabitants of rural areas as part of the tradition of rural areas in Albania to use the use of food waste or waste from gardening works as fertilizer or to feed animals on their farm.

7.2.2 Krujë Municipality

The municipality of Krujë is located in the central part of Albania and is known for its historical values and as a very frequented tourist destination since in its territory is located the Kruje Castle, a symbol

of the resistance of the Albanian people in the fight against the Ottoman Empire occupation. The municipality is composed of 6 AUs Krujë Fushë Krujë, Bubq, Nikël, Thumanë, Cudhi and has a total population of 59,814 inhabitants (INSTAT, Census 2011) and an area of 339.02 km^2.

Fushë Krujë is the largest city of Krujë municipality, and has a population of around 30,000 people with an area of 59.7 km^2.

The municipality of Krujë has a mainly mountainous and hilly landscape and is part of the Mediterranean mountain climate with cold winters and cool summer.
The municipality of Krujë does not have a Local Waste Management Plan. Currently, the only official document that analyses the waste management system in this municipality is the Solid Waste Management Analysis, drafted in January 2019. The data that will be presented below in this chapter is extracted from this document.

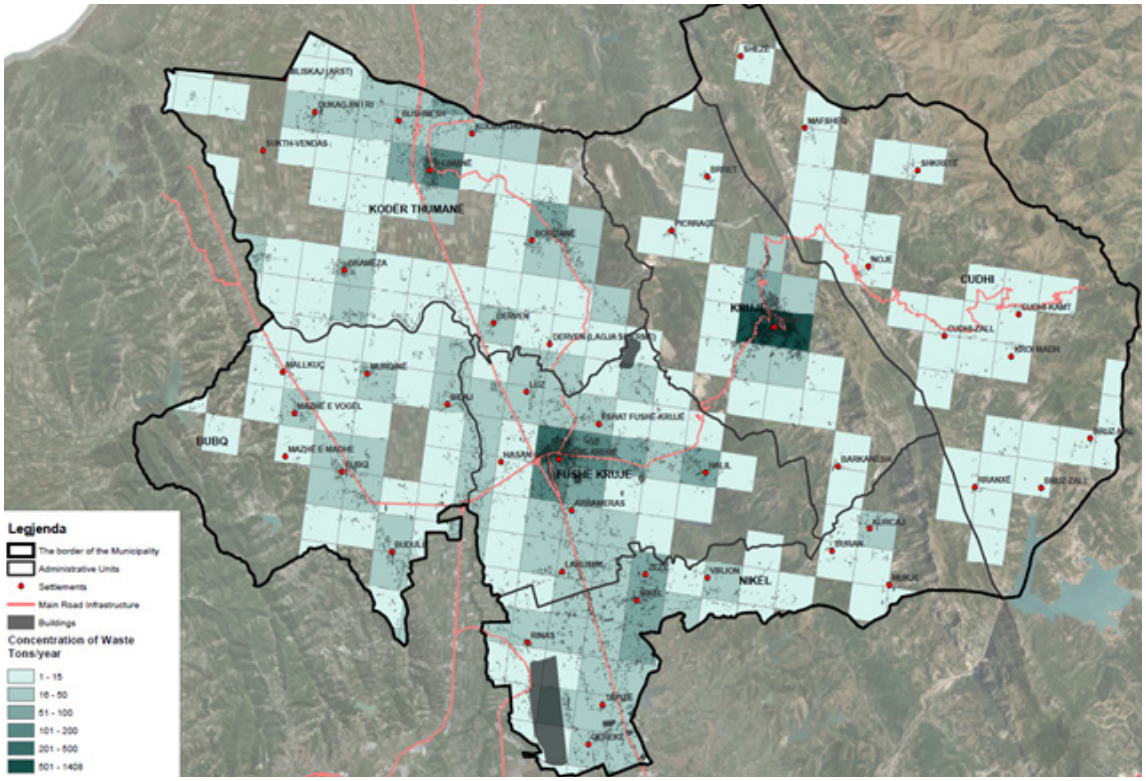
According to these analyses, the inhabitants of the municipality generate about 17,136 tons of waste per year out of which 13,708 t / year go to the designated deposit site (80%).

The service of collection of municipal solid waste in the municipality of Kruje is performed for 96 % of the inhabitants.

Also, the Regional Waste Management Plan, Durrës Region (Krujë is part of Durrës Qark) is an outdated plan of 2011 and has remained on paper without being approved by the regional council. Official data from the Municipality of Krujë regarding waste generation are still debatable and are based only on general estimates based on the population of the municipality and the generation rate since vehicles transporting the waste are not counted and also not weighed.

The Ad. Unit of Krujë and Fushë Krujë has the highest density of waste generation, which are the two largest inhabited centers with the largest number of services.

Figure 10. Population density/waste concentration map in Krujë municipality



Source: Co-PLAN

According to the data, the major part of the waste generated in the municipality of Krujë is composed of organic waste and paper / cardboard and plastic.

Waste management service in this municipality is provided by private companies contracted by the municipality of Krujë but the evaluation level of performance by residents is low.[25]

In addition to problems related to the infrastructure of service delivery to residents, this municipality has major problems with landfills/dumping sites which are inappropriate and are not equipped with the relevant environmental permit, no being able to control the significant negative impacts on the environment.

Figure 11. Deposit sites in Krujë Municipality

Administrative Unit	Place	Status	Environmental Permit
Krujë	Stanet e Ndojes (Krastë)	Municipal Council decision	No
Fushë Krujë, Nikël dhe Bubq	Dollak hill	Municipal Council decision	No
Thumanë	Dukagjin	Municipal Council decision	No

Source: Waste Management Analysis Kruje Municipality, 2019

7.2.3 Kurbin Municipality

Kurbin is a municipality in Lezhë Qark, northwestern Albania. It was created in 2015 by the merger of the former communes/Ad Units of Fushë Kuqe, Laç, Mamurras and Milot. The center of the municipality is the town Laç. The total population is 46,291 (INSTAT, Census 2011) in a total area of 269.03 km^2.

In the municipality of Kurbin there is a variety of landscape with plains in the west, mountains in the east and in the north with the valley of the Mat River.

The data of this chapter are taken from the Local Integrated Waste Management Plan, drafted for the period 2021-2025.

According to this data the municipality of Kurbin generates about 12,158 tons of waste per year and the waste management service is offered for the most part of the territory (approximately 80%). However, there are areas in which various wastes are deposited that need to be removed and stored in a sanitary landfill to avoid environmental problems.

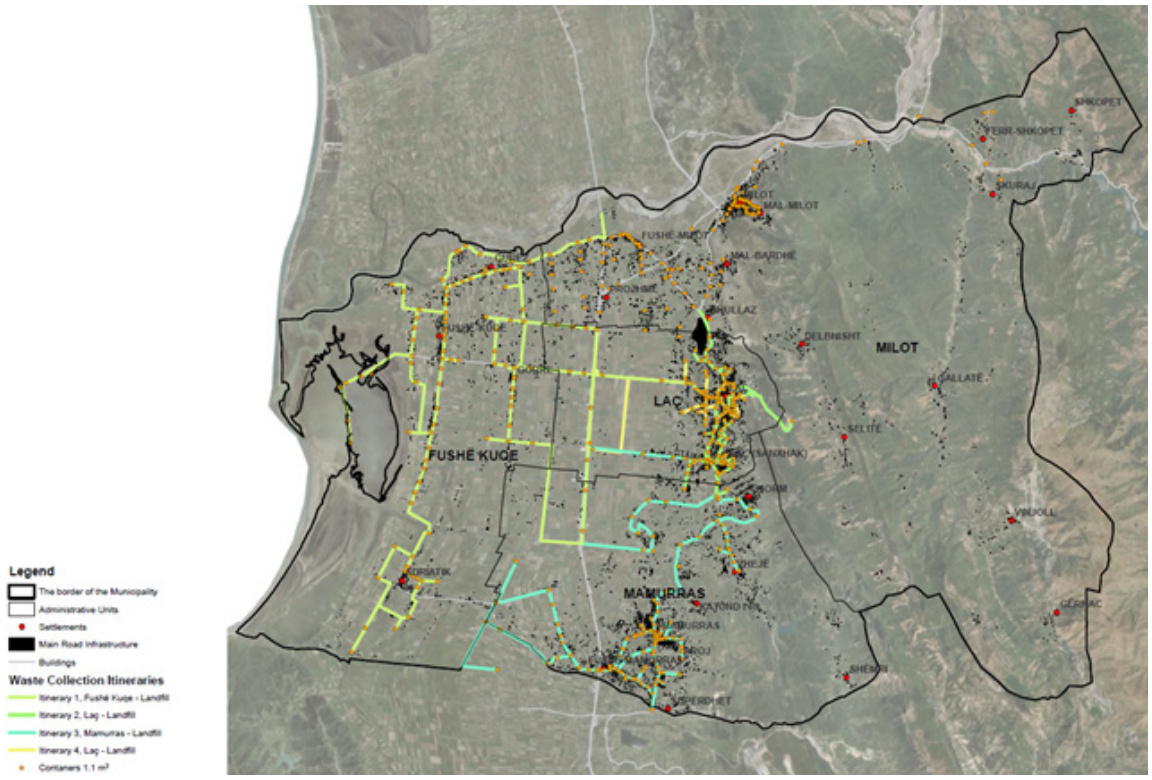
The waste collection and transport service in the Municipality of Kurbin is currently organized through 2 service areas.

During the summer season due to the increase of the population the municipality offers a more intensive service as there is an increase in population in certain tourist areas.

The data shows that the main source of waste is generated from households, businesses, and institutions which account for 65% of the total, inert waste and mixed household waste accounts for 14% while the weight of the tourism effect accounts for about 0.6% of the total waste generated in the municipality.

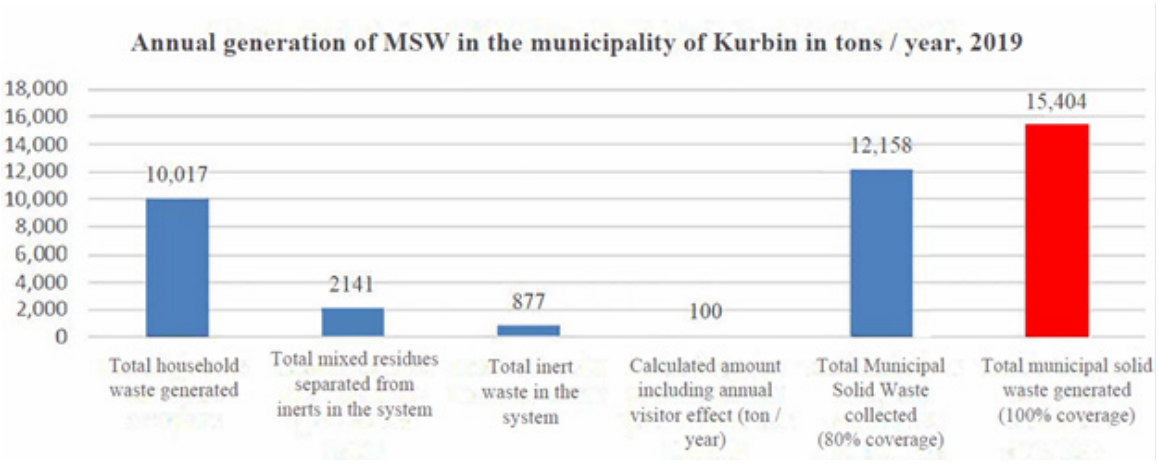
The remaining 20% of waste generated in the territory of the municipality is unmonitored due to the lack of service coverage.

Figure 12. Map of the itinerary, and containers distribution for Kurbin municipality



Source: LWM Plan 2021-2025, Kurbin Municipality (refined by Co-PLAN)

Figure 13. Annual generation of MSW in the municipality of Kurbin in tons / year, 2019



Source: LWM Plan 2021-2025, Kurbin Municipality

In 2019, during the drafting of the local waste management plan, the amount of municipal waste was measured in the first service area (Laç, Milot, Fushe Kuqe), as well as in the second service area (Mamurras).

From these measurements the amount collected and weighed results on average in about 33.31 tons/day or about 10,017 tons/year, which indicates an average generation of about 0.63 kg/ inhabitant/day for a service coverage of 80% of the resident population.

Figure 14. Total quantity of inert and mixed waste generated and weighted

Municipal solid waste		No. Waste Collection Points	No. contain.	No. damaged container	Quantity tons/day	Quantity tons/year	Quantity kg/inh/ day
Zone 1	Lac-Milot-Fushe Kuqe	223	282	98	21	7,563	0.63 kg/ inh/day
Zone 2	Mamurras	80	119	40	7	2,454	
Total		**303**	**401**	**138**	**27**	**10,017**	

Source: LWM Plan 2021-2025, Kurbin Municipality

As can be seen above, there is a difference of 0.13 kg / inh / day, between the amount of waste coming out of the calculation through the average generation rate per inhabitant coming from the number of the population of the municipality (0.76 kg/inh/day) and the amount coming out of the field measurement for a specified area (0.63 kg/inh/day)[26].

According to the statements of the representatives of Kurbin municipality, the landfill located in the city of Laç has not been used for a long time, but all the waste is deposited in the Bushat landfill.

This deposit site used until 2020, in the municipality of Kurbin is out of any kind of technical and environmental conditions to function as such and its closure and immediate rehabilitation is required. So far, there has been no study or analysis of possible damage discharged from the presence of this landfill and no concrete measures are foreseen for its complete closure and rehabilitation.

7.2.4 Mat Municipality

Mat is the smallest municipality of the study area in terms of population with 27,600 inhabitants (INSTAT, Census 2011) and a surface of 493.5 km^2.

This municipality is composed of 8 administrative units, which are: Burrel, Baz, Derjan, Rukaj, Macukull, Komsi, Lis, and Ulëz.

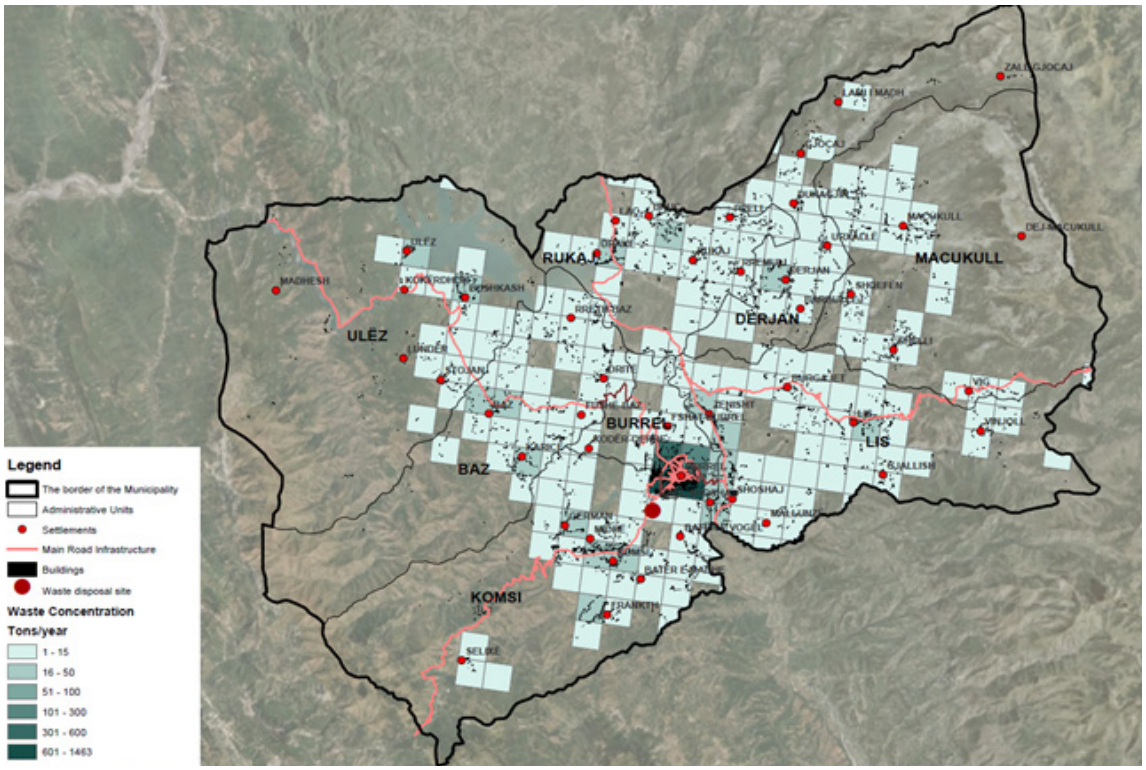
Data for this municipality were obtained in part from interviews with representatives of the services directorate in this municipality and also from official online data.

However, the data are limited and not based on real measurements or field verifications.

The municipality of Mat generates about 4,484 tons of waste per year and the waste management service is offered for the most of the population (appr 85%) but for a smaller area of territory taking into account the large extent of this municipality and the difficult terrain in some mountainous areas. For many years, the Mat Municipality has conflicted with the inhabitants of some villages within the municipality territory regarding waste management issues. The deposit site because its vicinity to inhabited areas, has led to land grabs, smoke and heavy winds, not only for passers-by on the Mat-Komësi road, but also for the residents of the surrounding villages. The current dump site in this municipality is outside all technical and environmental standards and does not have the relevant environmental permits or a study/analysis on its negative impacts in the area.

The city of Burel which is also the most populated administrative unit of the municipality generates the major quantity of waste. As it is illustrated in the map below, in the municipality there is a considerable area of the territory where a very small number of houses are located, which are very far from the center of the municipality, creating many difficulties in providing service to those inhabitants.

Figure 15. Population density/waste concentration map in Mat municipality



Source: Co-PLAN

So far, the municipality of Mat has not yet drafted a plan for integrated waste management, according to legal requirements or development requirements of the municipality itself.

Based on the technical findings reflected above, there was a need to expand the study area, thus taking into account two other municipalities (Shkodër, Kukës), which meet the needs and requirements of TITAN Antea cement for alternative fuels, generated by urban solid waste.

7.2.5 Shkodër Municipality

Shkodër municipality is located in the northwest of Albania in a territory of 873 km². This municipality has 135,612 inhabitants (INSTAT, Census 2011) and consists of 11 Administrative units (Shkodër, Ana e Malit, Bërdicë, Dajç, Guri i Zi, Postriba, Pult, Rrethina, Shale, Shosh and Velipoja), where the center of the municipality is the city of Shkodër.

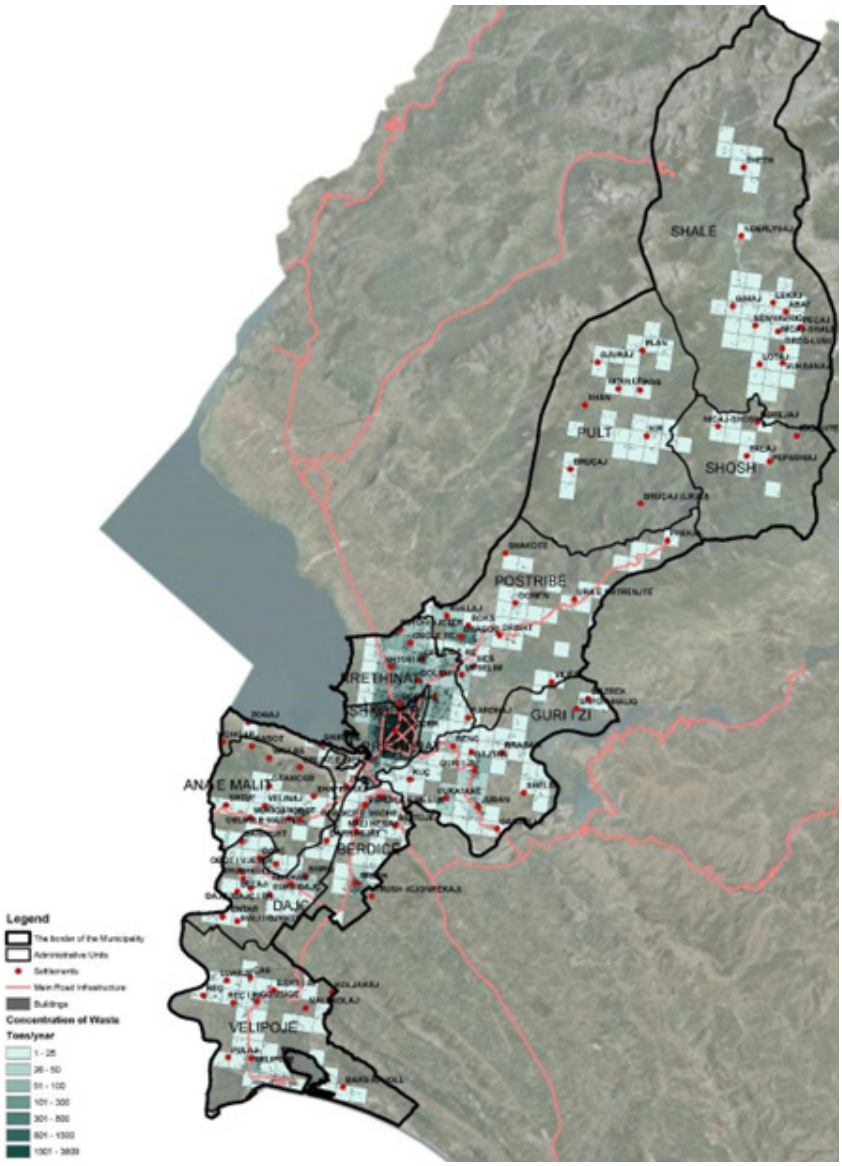
The Municipality of Shkodër, is located in the middle of a plain, hilly, pre-mountainous and mountainous landscape, as well as near the Adriatic Sea and Lake Shkodër.

The city of Shkodër is divided into 5 Regions and in two suburban neighborhoods, Shiroka and Zogaj. The service in this city was provided by a private company.

In the main area of the Shkodër city, where the population is also denser, more services are offered and in frequent intervals.

All waste generated by this municipality is deposited in the Bushat Landfill which is located at a distance of about 15 km from the city of Shkodër.

Figure 16. Population density map in Shkodër municipality



Source: Co-PLAN

Despite the fact that in Bushat landfill there is a structure for the separation of recyclable waste, in the plant there is only the process of waste disposal and compaction. Also, in the landfill there is no treatment of waste water coming out of the drainage system or surface water, despite the existence of a plant for this purpose.

However, some of the generated waste is deposited in illegal landfills, including river streams, and therefore there is a difference between the amount of waste generated and the amount collected. Reported amount of collected waste deposited in the Bushat landfill by the Shkodër Municipality is 28,224 tons/year of urban waste, for 90% of the territory covered by service.

The Ad. Unit of Velipoja during the summer months has a fourfold increase in population, thus generating a considerable amount of waste for the tourist season (658 tons).

Despite the increase of the level of service during the summer period, in this municipality there are still problems of infrastructure and illegal landfills of urban and inert waste located in different peripheral areas.

Table 17. Comparison of waste generation and production rates for 2016 in the Municipality of Shkodër

Ad. Units	Population	Number of families	Number of families that take service	Quantity of collected waste	Waste generation rate	Waste collection rate
	no.	no.	no.	tons/year	kg/inh/day	kg/inh/day
Shkodër	87,853	25,434	19,800	28,224	1.131	0.88
Rrethinat	21,840	5,433	3,680	650	0.12	0.082
Velipoja	6,372	1,652	1,150	1148	0.709	0.494
Velipoja (summer)	~25,000			658		0.263
Other Ad Units	37,908	9,740	5,620	1,338	0.1704	0.109

Source: Shkodër Municipality

During the drafting of the National Waste Strategy and Plan in 2010, the Municipality of Shkodër (only the city of Shkodër), was one of the cities, which were taken as champion cities for determining the mercological composition of waste. The table below shows the mercological composition of waste in the Administrative Unit of Shkodër for the 16 waste streams selected during the sampling phase:

Table 18. Composition of waste streams

Nr.	Category of waste stream	Ad Unit of Shkodër
1.	Organic	45.4%
2.	Wood	1.5%
3.	Paper	5.1%
4.	Cardboard	8.3%
5.	LD- plastic	10.7%
6.	HD-plastic	5
7.	Glass	5.4%
8.	Textile	5.1%
9.	Ferrous metals	0.5%
10.	Non-ferrous metals	0.5%
11.	Hospital waste	4.5%
12.	Rubber products	0.3%
13.	Inert	7.7%
14.	MPEE	0.5%
15.	Batteries	0.03%
16.	Animal waste products	1.14%

Source: LSWM Plan Shkodër Municipality

7.2.6 Kukës Municipality

Kukës municipality is located in the northeast of Albania in a territory of 933.86 km2. This municipality has 47,985 inhabitants (INSTAT, Census 2011) and consists of 15 Administrative Units (Kukës, Arrën, Bicaj, Bushtricë, Kolsh, Malzi, Zapod, Shishtavec, Shtiqen, Surroj, Tërthore, Topojan, Ujëmisht, Krykë Çajë, Kalis).

The municipality of Kukës is bordered on the north by the Municipality of Krumë, on the west by the municipalities of Mirditë and Fushë-Arrëz, on the south by the Municipality of Dibër and on the east by the Republic of Kosovo and North Macedonia.

In general, the municipality is distinguished by a significant difference in a landscape where almost the entire eastern and southeastern part is crossed by mountain ranges. Mountains occupy most of the territory but are intertwined with low areas or river terraces.

Regarding waste management, the following data of this chapter are based on the document of the Integrated Waste Management Plan of the municipality of Kukës, realized in February 2016 and valid for the period 2016-2020.

According to the data, the municipality of Kukës offers waste management service and other related services through the relevant structure within it. The amount of waste in the managed area in this municipality is about 9602 tons/year.

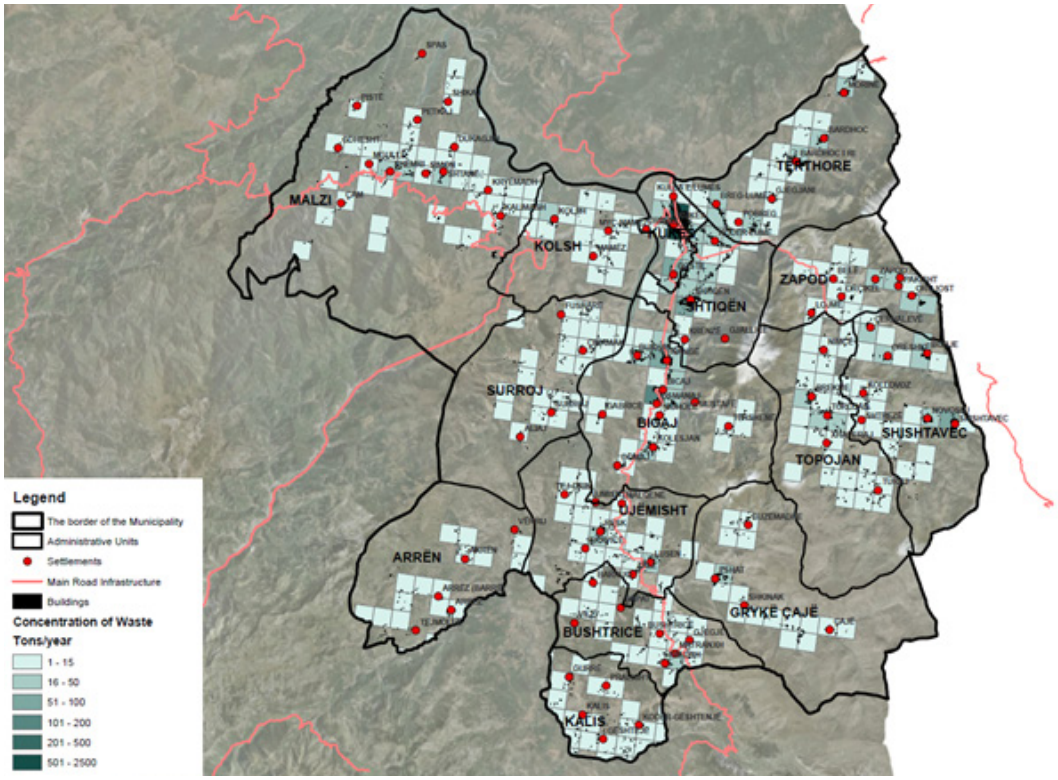
Table 19. Population and area covered with service in Kukës municipality

Administrative Units	Population, RGJ 2011	Area of the service
Kukës	16'719	85 %
Bicaj	5'631	75 %
Kolsh	1'250	75 %
Kukës Municipality	47'985	20 %

Source: Kukës Municipality

The waste management service in the city of Kukës is performed by the Directorate of Public Services in this municipality, while in the other two administrative units the service is performed by these units themselves.

Figure 17. Map of the waste quantity grid in Kukës municipality



Source: Kukës Municipality

Waste service infrastructure does not meet the technical and environmental needs and requirements at all. This is because the majority of the containers are damaged, a part of the collection points (collection points in Bicaj and Kolsh) do not have containers but are only open points and the vehicles that perform the service are not suitable and not in good condition.

Currently, urban waste generated by the municipality of Kukës is sent to a dump site called Suka-Mamëz, in the Kolsh Administrative Unit, while inert waste is sent to a place called Bregu on Bozhe Both of these landfills do not have any enclosure or isolation of waste, no specialized treatment and do not meet all the technical and environmental conditions without having the relevant environmental permits which lead to the generation of pollution and emissions at uncontrolled rates.

To date, there has been no plan or project in this municipality for the recycling or composting of municipal solid waste, according to the legal requirements in force and the provisions of the National Sectoral Solid Waste Management Plan.

The main information obtained through Local Waste Management Plans, Waste Management Analyzes, local studies, or interviews with representatives of municipalities that are part of the study area, are presented below in the tabular form.

The reflected data are taken in some cases from different sources of information and refer to different periods (based on the relevant data of each municipality).

Table 20. Data from local sources

Administrative Units	Population, RGJ 2011	Area of the service
Kukës	16'719	85 %
Bicaj	5'631	75 %
Kolsh	1'250	75 %
Kukës Municipality	47'985	20 %

Source: *Data from Ministry of Interior Affairs (Letter with no. 3556/1 prot., dated 30.11.2017)
**Generation rate according to the statements of local plans and documents
***Data according to DCM no. 538 dt. 22.9.2021 for the year 2020

As can be seen from the table, almost in all municipalities the declared level of the population to which the service of waste management is provided is over 80% (except the municipality of Kukës which covers about 54% of the population), while the municipality of Krujë declares that this service is provided to about 96% of the population, not including only the Cudhi unit which occupies about 4% of the general population of this municipality.

It can be seen that the level of waste generation for each resident varies from one municipality to another where the highest level is in Shkodër municipality with 0.67 kg/inhabitant/day (Shkodër Administrative Unit declared the generation rate of 1.13 kg/inhabitant/day, the collection rate 0.88 kg/inhabitant/day, while other units declare much lower generation rates, about 0. 2 kg/inhabitant/day. Meanwhile, Krujë municipality has the lowest level of the generation rate with 0.55 kg/inhabitant/day.

The amount of waste generation in the municipality of Kurbin (0.63 kg / inh / day), has emerged as a result of a weighing carried out during the drafting phase of the Waste Management Plan[27] of this municipality in November-December 2019.

Findings

The municipality of Shkodër generates a significant amount of solid urban waste, being the municipality with the largest amount in the north of Albania. This municipality deposits all the

...

...
waste in the Bushati landfill, thus creating a complete dependence on the fees set by this landfill, which have increased over the years and have complicated the economic situation of the municipality.

The village of Velipojë, as a coastal touristic area, has a considerable impact on the production of waste during the summer season (June - August), significantly influencing the increase in the amount of waste generated.

7.2.7 Durrës Municipality

The Municipality of Durrës is located in the west of Albania and consists of 11 Administrative Units (6 Regions in the city of Durrës and Sukth, Ishëm, Katund i Ri, Rrashbull and Manëz) with a total area of 338.3 km^2.

Durrës has 219,644[28] inhabitants according to the Civil Registry, of which 69% are in the rural area and 31% in the urban area. The center of the Municipality is the city of Durrës. This municipality has about 103,282 families.

The waste management service, which includes the process of waste evacuation, storage, cleaning and maintenance, is carried out by two public utilities:

- Durrës Municipal Services Utility: which offers its service in region 1,2,3,4,5, in Durrës, Sukth Administrative Unit, Manëz Administrative Unit, Katundi i Ri Administrative Unit, Ishëm Administrative Unit.
- Plazh Municipal Services Utilitie: neighborhoods no. 13, 14 in Shkozet and Rrashbull Administrative Unit.

The frequency of waste evacuation is 7 times a week, and the prescribed distance to the end point of waste treatment is 40 km.

Pursuant to the Decision of the National Council of the Territory no. 01, dated 13.01.2020 "On the approval of the National Sectoral Plan for Solid Waste Management", Decision No. 438, dated 15.07.2021 "On financial support for waste management in Durrës District Municipalities", DCM no. 496, dated 30.07.2021 "For the Approval of the request of the Municipality of Durrës for financial support from the Central Government for waste management", the Municipality of Durrës has concluded a contract with No. 9853/8 prot. Date 08.10.2021 with the operator Integrated Energy BV SPV shpk, administrator of the landfill of Sharra, Tirana, for "Urban waste disposal of Durrës Municipality", with a unit price of 3,518.86 all/ton without VAT, for approximately 80,000 tons, determining with this contract the end point of urban waste and the realization of the closure of the existing waste collection sites in the territory of Durrës Municipality.

During the year 2021, in the municipality of Durrës, the Regulation approved by the Decision of the Municipal Council no. 41, dated 09.05.2022 "On the approval of the waste management regulation in Durrës Municipality". This regulation has determined some changes that have to do with the infrastructure of the service offered as well as the increase in the fees for the waste management service for families and businesses.

Table 21. Number of families and fees for each of the service areas

No.	Adm. Unit	Families	Tariffs (ALL)	
			Previous	Actual
1.	Durrës / zone A	52474	2300	3500
2.	Other Adm. Units / zone B			

2.1	Sukth	2786	500	1500
2.2	Ishëm	1657	500	1500
2.3	Katundi i Ri	4592	500	1500
2.4	Rrashbull	7327	500	1500
2.5	Manëz	2520	500	1500

Source: Durrës Municipality

According to the municipality of Durrës, this regulation has brought some other changes to the waste management system in this municipality, as follows:

Table 22. Changes in WM system in Durrës Municipality

Service / Items	Until year 2021	After year 2021
Urban waste disposal service	Once per day	Twice per day (three times per day during summer season)
Means / Machinery	15 machines (mostly automated)	Fleet change by purchasing 7 technologic trucks
Containers	1000 pieces, most of them not in good technical conditions	Add another 1000, including a stock for the tourist season
Budget	417,847,000 ALL	1, 038,723,000 ALL
Existing dumpsites	4	None is used as the final disposal of urban waste is carried out according to the Decision of the National Council of the Territory no. 01, dated 13.01.2020
Service coverage area	80%	100% by performing with the private company Admin Unit of Sukthi and Ishmi and the rest from the municipal services companies of Durrës and Plazh

Source: Durrës Municipality

Since the municipality of Durrës is one of the largest municipalities in the country and has a large population, this means that the amount of waste generated is quite large.

Below are the data on the amount of waste managed by the municipality of Durrës during 2021, divided by month. The amount of waste is unspecified based on its deposit in the Sharra Landfill, Tirana, according to the provisions of the Decision of the National Council of the Territory and the contract with the private operator.

Table 23. Monthly generation of waste in Durrës municipality

No.	Month	Waste quantity (tons)	No.	Month	Waste quantity (tons)
1.	January	4336.19	**7**	July	6336.8
2.	February	3823.96	**8**	August	6599.32
3.	March	4410.55	**9**	September	4350.78
4.	April	4115.15	**10**	October	3667.41
5.	May	4682.33	**11**	November	4459.52
6.	June	3813.76	**12**	December	4710.42
TOTAL / 2021					**55306.2**

Source: Durrës Municipality

PART VI. ANALYTICAL OVERVIEW, ALTERNATIVES, CONCLUSIONS/RECOMMENDATIONS

8.ANALYTICAL APPROACH

To explore the potential use of waste in cement industries for energy production, this study takes into consideration the study area, es described above, composed of 6 municipalities: Krujë, Lezhë, Kurbin, Mat Shkodër, and Kukës. The study is based on data from desk research and interviews conducted with various stakeholders within the project implementation phase. To give broader information regarding the quantity and typology of waste generated in these municipalities, below are illustrated data in terms of possible scenarios taking into account data from local sources and data from references to plans and documents at the national level.

The following scenarios take into consideration generated quantities for all the municipalities of the study area and extract from these quantities only the waste fractions that can be used in the production of alternative fuels in the form of RDF/SRF.

SCENARIO 0

The following data reflect the mereological composition in the percentage of waste by fractions, determined by local study documents (Plans, Analysis) as well as the definitions in the Strategic Policy Document for waste.

For some of the municipalities, the data are complete, reflecting the distribution of the total amount of waste by fractions, while for some of the municipalities the data are partial.

In those municipalities where no data from local information were found, the fractions defined in the Strategic Policy Document for waste were distributed on the basis of the total amount of waste declared by the Local Government Units.

Table 24. Percentage of waste fractions in each municipality

	Municipality	Lezhë	Kurbin	Mat	Krujë	Shkodër	Kukës
Fractions	**National WM Strategy**	**Waste Composition (%)**					
Organic	61.20%	69.00%	58.40%	51.00%	52.30%	45.50%	61.20%
Paper & cardboard	7.70%	8.05%	7.80%	11.00%	10.10%	13.40%	7.70%
Plastic	9.70%	4.03%	9.00%	11.00%	10.00%	14.20%	9.70%
Glass	3.80%	17.03%	3.20%	5.00%	4.20%	5.40%	3.80%
Metal	0.20%	1.86%	1.80%	1.00%	1.60%	1.00%	0.20%
Wood	5.10%	0.00%	2.20%	2.00%	5.84%	1.50%	5.10%
Textile	2.20%	0.00%	5.60%	2.00%	4.60%	5.10%	2.20%
HHZ	5.50%	0.00%	0.00%	0.40%	0.23%	0.03%	5.50%
WEEE	1.00%	0.00%	0.00%	0.60%	0.84%	0.50%	1.00%
Inert	0.10%	0.00%	8.85%	4.00%	7.20%	7.70%	0.10%
Medical	1.50%	0.00%	1.10%	2.00%	2.50%	4.50%	1.50%
Other	2.45%	0.04%	2.05%	10.00%	0.59%	1.17%	2.45%

Source: Co-PLAN Institute for Habitat Development

From the data reflected in the table, it can be seen that there are significant differences between the percentages reflected, from one municipality to another or compared to the percentage of fractions reflected in the Strategic Policy Document.

In the municipality of Lezhë, it is noticed that organic waste occupies about 70% of the total waste, having a difference of about 20% more compared to the% stated in the National Strategy.
It is worth mentioning that in the same municipality the glass fraction occupies 17.03% of the total waste, with a difference of about 12% with the municipality of Shkodër or more than 13% with the data of the National Strategy.

In the municipality of Shkodër medical waste occupies 4.5% of the total, resulting in 3 times higher than the definitions for this fraction from the Strategic Policy Document.

Based on the figures on waste composition for each municipality below are presented quantities of waste fractions that can potentially be used for the production of AF in the form of RDF/SRF. In this scenario, the amount of waste is taken in full according to the fractions of waste for which it is possible to process and produce alternative fuel. The only fraction that is partially considered for this purpose is organic waste, out of which only 15% is considered as a potential for alternative fuel production (however, this type of waste is not in the interest of the partner company to be used as AF at this stage).

Table 25. Quantity of total waste and waste fractions per each municipality

Total quantity of waste t/ year	**17,790**	**10,017**	**4,484**	**17,136**	**32,018**	**9,602**	**91,047**	**RDF**	**SRF**
Waste Composition\ Municipality	**Lezhë**	**Kurbin**	**Mat**	**Krujë**	**Shkodër**	**Kukës**	**Total**	**ton/year**	
Organic	12,275	5,850	2,287	8,962	14,568	5,876	49,819	7,473	
Paper & cardboard	1,432	781	493	1,731	4,290	739	9,467	9,467	
Plastic	716	902	493	1,714	4,547	931	9,302	9,302	
Glass	3,030	321	224	720	1,729	365	6,388	-	
Metal	331	180	45	274	320	19	1,169	-	
Wood	-	220	90	1,001	480	490	2,281	2,281	
Textile	-	561	90	788	1,633	211	3,283		3,283
HHZ	-	-	18	39	10	528	595		
WEEE	-	-	27	144	160	96	427		
Inert	-	887	179	1,234	2,465	10	4,775		
Medical	-	110	90	428	1,441	144	2,213		
Other	7	205	448	101	375	235	1,371	1,371	
Total (t/year)								**29,894**	**29,894**

Source: Author, Co-PLAN, Institute for Habitat Development

The total amount of MSW that can be used for the production of alternative fuel in the form of RDF/SRF in the actual conditions (data from previous years 2017-2019) is **33,177 tons.**

Taking into account the data on the amount of waste managed in the municipality of Durrës, the inclusion of this municipality in the production process of AF would bring an increase in the amount of AF by about 60% of the total amount generated by the other municipalities taken in the study.

If we add the municipality of Durrës (the year 2021 data) to the calculations made, the amount of MSW that can be used for the production of alternative fuel in the form of RDF/SRF could be **53,270 tons.**

Three other scenarios are presented below to reflect the possible amount of AF production according

to population projections until 2025, considering the waste streams based on the Strategic Policy Document.

This analysis will help the relevant stakeholders engaged in the waste management sector get a better overview of the amount of waste that can be used in cement industries to lower the number of fossil fuels used in the process of cement production.

To present the scenarios for the use of MSW in the cement industry were taken in consideration the population growth of the study area and the generation of waste till 2025. It was possible to make projections of population and waste generation using data obtained from desk research, as shown below.

To make these projections possible the following data were used.

The reference year to calculate the number of inhabitants of the area is 2017, which is calculated by applying the formula used by the MFE (INSTAT pop. + (CR – INSTAT pop.) *30%), and then used for the population projections.

Table 26. Number of inhabitants per municipality, 2017

Number of inhabitants per municipality 2017	
Mat	338
Lezhë	110,119
Krujë	81,772
Kurbin	74,167
Kukës	58,126
Shkodër	205,983
Total population of the study area	**567,505**

Source: Co-PLAN Institute for Habitat Development

To calculate the generation of waste per municipality were taken in consideration the following generation norms. The data for waste generation kg/person/day were taken from a calculation made during the draft of the "Integrated Waste Management Strategic Policy Document and National Plan 2020-2035[29] " (Strategic Policy Document). Data illustrated below are an average of waste generation per inhabitant in each Administrative Unit.

Table 27. Generation rate and waste generation per each municipality

Municipality	**Generation kg/person/day**	**Waste generated**
Mat	0.46	19,141
Lezhë	0.62	60,420
Krujë	0.83	59,670
Kurbin	0.78	47,367
Kukës	0.47	35,114
Shkodër	0.46	140,769
Total		**362,481**

Source: Co-PLAN Institute for Habitat Development

To make possible the projections data from INSTAT were used to calculate population growth (the average growth of the population was taken into consideration) and data from the Strategic Policy Document were used to project the generation rate per inhabitant.

% Of population growth - 0.54% [30]
% Increase in generation per capita – 0.3% [31]

Population projections

The population projection is based on current values and growth indicators according to the average scenario for INSTAT population growth with a value of about - 0.54%.

Table 28. Population projections for the target municipalities

Population projections for the target municipalities									
Year	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Mat	37,338	37,136	36,936	36,736	36,538	36,341	36,144	35,949	35,755
Lezhë	110,119	109,524	108,933	108,345	107,760	107,178	106,599	106,023	105,451
Krujë	81,772	81,330	80,891	80,454	80,020	79,588	79,158	78,731	78,305
Kurbin	74,167	73,766	73,368	72,972	72,578	72,186	71,796	71,408	71,023
Kukës	58,126	57,812	57,500	57,189	56,881	56,573	56,268	55,964	55,662
Shkodër	205,983	204,871	203,764	202,664	201,570	200,481	199,399	198,322	197,251
Total	**567,505**	**564,440**	**561,392**	**558,361**	**555,346**	**552,347**	**549,364**	**546,398**	**543,447**

Source: Co-PLAN Institute for Habitat Development

Waste generation projections

Projections of the quantity of waste generated in the study are illustrated below based on the generation norms used in the Strategic Policy Document in which were taken in consideration the population growth (the scenario with the average population growth, INSTAT) and the % of raise of generation rates for inhabitants till 2025.

Table 29. Waste generation projections, ton/day

Waste generation ton/day									
Year	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Mat	17.27	17.23	17.19	17.14	17.10	17.06	17.02	16.98	16.94
Lezhë	68.27	68.11	67.94	67.78	67.62	67.45	67.29	67.13	66.97
Krujë	68.14	67.98	67.81	67.65	67.49	67.32	67.16	67.00	66.84
Kurbin	57.48	57.34	57.20	57.06	56.93	56.79	56.65	56.51	56.38
Kukës	27.51	27.45	27.38	27.31	27.25	27.18	27.12	27.05	26.99
Shkodër	95.50	95.27	95.04	94.81	94.58	94.35	94.13	93.90	93.67
Total	**334.18**	**333.37**	**332.57**	**331.76**	**330.96**	**330.16**	**329.36**	**328.57**	**327.77**

Source: Co-PLAN Institute for Habitat Development

Table 30. Waste generation projection ton/year

Waste generation ton/year									
Year	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Mat	6,303	6,288	6,273	6,258	6,242	6,227	6,212	6,197	6,182
Lezhë	24,920	24,860	24,800	24,740	24,680	24,620	24,561	24,501	24,442
Krujë	24,872	24,812	24,752	24,692	24,633	24,573	24,514	24,455	24,396

Kurbin	20,980	20,929	20,879	20,828	20,778	20,728	20,678	20,628	20,578
Kukës	10,042	10,018	9,994	9,970	9,946	9,921	9,898	9,874	9,850
Shkodër	34,858	34,774	34,690	34,606	34,522	34,439	34,356	34,273	34,190
Total	**121,976**	**121,681**	**121,387**	**121,094**	**120,801**	**20,509**	**120,218**	**119,927**	**119,638**

Source: Co-PLAN Institute for Habitat Development

This data gives a general overview of the study area in terms of population and waste generated till 2025. The amount of waste generated in this area will be potential material to produce alternative fuels in the form of RFP/SRF or as raw material in the cement industry.

Waste generation per type

To have general information on the typology of waste generated in the study area, as reference were used % of waste composition as in the Strategic Policy Document. This data will serve for the construction of scenarios and as a reference to understand the amount of waste that can hypothetically be used to produce alternative fuel in the form of RDF / SRF or used after a preliminary processing (selection, grinding, etc.) in the cement industry.

Below are illustrated the % given in the Strategic Policy Document for waste fractions as well as recycling targets for each of the typologies, designated as mandatory to be applied until 2025.

Table 31. Percentage of each waste topology

Type of waste	Percentage
Organic	61.20%
Paper & cardboard	7.70%
Plastic	9.70%
Glass	3.80%
Metal	0.20%
Wood	5.10%
Textile	2.20%
HHZ	5.50%
WEEE	1.00%
Inert	0.10%
Medical	1.50%
Other	2.45%

Source: Strategic Policy Document, 2018

Table 32. Targets for recycling and reduction of waste streams till 2025

Type of waste	Percentage
Organic	75%
Paper & cardboard	10.00%
Plastic	6.00%
Glass	10.00%
Metal	10.00%
Wood	5%

Source: Strategic Policy Document, 2018

SCENARIO 1

These percentages were applied to each of the municipalities of the study area, giving potential amounts of waste available to be used as alternative fuel. From the fraction of organic waste, is calculated as potential to use for the production of alternative fuels only 15% of the total of organic waste generated.

Table 33. Waste generation per type in Mat municipality, projections

Waste generation per type	Mat								
Year	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Organic	579	577	576	574	573	572	570	569	568
Paper & cardboard	485	484	483	482	481	480	478	477	476
Plastic	611	610	608	607	606	604	603	601	600
Glass	240	239	238	238	237	237	236	235	235
Metal	13	13	13	13	12	12	12	12	12
Wood	321	321	320	319	318	318	317	316	315
Textile	139	138	138	138	137	137	137	136	136
Total	**2,388**	**2,382**	**2,376**	**2,370**	**2,365**	**2,359**	**2,353**	**2,348**	**2,342**

Source: Co-PLAN Institute for Habitat Development

Table 34. Waste generation per type in Lezhë municipality, projections

Waste generation per type	Lezhë								
Year	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Organic	2,288	2,282	2,277	2,271	2,266	2,260	2,255	2,249	2,244
Paper & cardboard	1,919	1,914	1,910	1,905	1,900	1,896	1,891	1,887	1,882
Plastic	2,417	2,411	2,406	2,400	2,394	2,388	2,382	2,377	2,371
Glass	947	945	942	940	938	936	933	931	929
Metal	50	50	50	49	49	49	49	49	49
Wood	1,271	1,268	1,265	1,262	1,259	1,256	1,253	1,250	1,247
Textile	548	547	546	544	543	542	540	539	538
Total	**9,440**	**9,417**	**9,394**	**9,371**	**9,349**	**9,326**	**9,304**	**9,281**	**9,259**

Source: Co-PLAN Institute for Habitat Development

Table 35. Waste generation per type in Krujë municipality, projections

Waste generation per type	Krujë								
Year	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Organic	2,283	2,278	2,272	2,267	2,261	2,256	2,250	2,245	2,240
Paper & cardboard	1,915	1,911	1,906	1,901	1,897	1,892	1,888	1,883	1,878
Plastic	2,413	2,407	2,401	2,395	2,389	2,384	2,378	2,372	2,366
Glass	945	943	941	938	936	934	932	929	927
Metal	50	50	50	49	49	49	49	49	49

Wood	1,268	1,265	1,262	1,259	1,256	1,253	1,250	1,247	1,244
Textile	547	546	545	543	542	541	539	538	537
Total	**9,422**	**9,399**	**9,376**	**9,354**	**9,331**	**9,308**	**9,286**	**9,263**	**9,241**

Source: Co-PLAN Institute for Habitat Development

Table 36. Waste generation per type in Kurbin municipality, projections

Waste generation per type	**Kurbin**								
Year	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Organic	1,926	1,921	1,917	1,912	1,907	1,903	1,898	1,894	1,889
Paper & cardboard	1,615	1,612	1,608	1,604	1,600	1,596	1,592	1,588	1,584
Plastic	2,035	2,030	2,025	2,020	2,015	2,011	2,006	2,001	1,996
Glass	797	795	793	791	790	788	786	784	782
Metal	42	42	42	42	42	41	41	41	41
Wood	1,070	1,067	1,065	1,062	1,060	1,057	1,055	1,052	1,049
Textile	462	460	459	458	457	456	455	454	453
Total	**7,947**	**7,928**	**7,909**	**7,890**	**7,871**	**7,852**	**7,833**	**7,814**	**7,795**

Source: Co-PLAN Institute for Habitat Development

Table 37. Waste generation per type in Kukës municipality, projections

Waste generation per type	**Kukës**								
Year	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Organic	922	920	917	915	913	911	909	906	904
Paper & cardboard	773	771	770	768	766	764	762	760	758
Plastic	974	972	969	967	965	962	960	958	955
Glass	382	381	380	379	378	377	376	375	374
Metal	20	20	20	20	20	20	20	20	20
Wood	512	511	510	508	507	506	505	504	502
Textile	221	220	220	219	219	218	218	217	217
Total	**3,804**	**3,795**	**3,786**	**3,776**	**3,767**	**3,758**	**3,749**	**3,740**	**3,731**

Source: Co-PLAN Institute for Habitat Development

Table 38. Waste generation per type in Shkodër municipality, projections

Waste generation per type	**Shkodër**								
Year	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Organic	3200	3192	3185	3177	3169	3161	3154	3146	3139
Paper & cardboard	2684	2678	2671	2665	2658	2652	2645	2639	2633
Plastic	3381	3373	3365	3357	3349	3341	3332	3324	3316
Glass	1325	1321	1318	1315	1312	1309	1306	1302	1299
Metal	70	70	69	69	69	69	69	69	68
Wood	1778	1773	1769	1765	1761	1756	1752	1748	1744

Textile	767	765	763	761	759	758	756	754	752
Total	**13,204**	**13,172**	**13,140**	**13,109**	**13,077**	**13,045**	**13,014**	**12,982**	**12,951**

Source: Co-PLAN Institute for Habitat Development

To give an indicative amount of waste fractions that can potentially be used as an alternative fuel in the cement industry below is presented the quantity of waste generated in 2022.

This scenario does not take into consideration recycling processes that may be newly applied or those from the informal recyclers in the municipalities of the study area.

Table 39. Waste generation per type per year in each municipality

Waste generation per type per year	**2022**						
Municipality	**Mat**	**Lezhë**	**Krujë**	**Kurbin**	**Kukës**	**Shkodër**	**Total**
Organic	572	2,260	2,256	1,903	911	3161	**11063**
Paper & cardboard	480	1,896	1,892	1,596	764	2652	**9279**
Plastic	604	2,388	2,384	2,011	962	3341	**11689**
Glass	237	936	934	788	377	1309	**4579**
Textile	137	542	541	456	218	758	**2651**
Total	**2,111**	**8,342**	**8,326**	**7,023**	**3,361**	**11,668**	**40,828**

The total amount of MSW that can be used for the production of alternative fuel in the form of RDF/SRF in 2022 is **40,828 tons.**

SCENARIO 1.1

With the approval of the Strategic Policy Document, objectives have been set for the recycling of specific waste streams that must be achieved by the municipalities by 2025. These objectives are presented below together with the amount of waste that could potentially be used as an alternative fuel after the application of recycling processes.

Table 40. Targets for recycling and reduction of waste streams till 2025

Waste typology	**Percentage**
Organic	75%
Paper & cardboard	10.00%
Plastic	6.00%
Glass	10.00%
Metal	10.00%
Wood	5%

Source: National Waste Strategy

Table 41. Waste generation per typology per each municipality

Year	**2025**						
Waste generation per typology ton/y	**Mat**	**Lezhë**	**Krujë**	**Kurbin**	**Kukës**	**Shkodër**	**Total**
Organic	21	84	84	71	34	118	**412**

Paper & cardboard	428	1694	1691	1426	683	2369	**8291**
Plastic	564	2229	2224	1876	898	3117	**10909**
Wood	300	1184	1182	997	477	1656	**5796**
Total	**1,313**	**5,191**	**5,181**	**4,370**	**2,092**	**7,260**	**25,408**

Total amount of MSW that can be used for the production of alternative fuel in the form of RDF/SRF in 2025 is 29,715 tons.

SCENARIO 2

Under this scenario, it is considered part of the waste that can be used as an alternative fuel in the form of raw material (pre-treated) in the facility owned by Altea Cement Sh.A. part of Titan Group. Altea Cement possesses an environmental permit for co-combustion for the following waste types which will allow them to co-incinerate waste fractions in combination with fossil fuels.

Table 42. Waste types for which Antea Cement possesses and environmental permit for co-combustion

No.	Waste type	EWC
1.	Flammable wastes (RDF)	19 12 10
2.	Waste from plastic packing	15 01 02
3.	Wood packing waste	15 01 03
4.	Textile packing wastes	15 01 09
5.	Tires out of use	16 01 03
6.	Plastic	16 01 19
7.	Pyrolysis wastes other than those mentioned in 19 01 17*	19 01 18
8.	Textiles	20 01 11
9.	Saw powder, shavings from wooden pieces, panels with particle material and plates that contain hazardous substance	03 01 04*

Source: Titan Antea Cement

To extract from the total amount of MSW generated in the study area only the types that Antea Cement possesses a permit, the percentage used in the Strategic Policy Document was applied.

Quantities of packaging waste from waste types	
Paper & cardboard	50%
Plastic	50%
Glass	50%
Metal	50%
Wood	40%

The quantities that are presented below are a potential source of waste that can be used from Antea Cement in their facility as an alternative fuel. Those waste fractions are extracted only from the MSW generated in the municipalities of the study area in 2022. Other sources of waste e.g., textile waste generated from the textile Industry, used tires etc. are not included.

Waste types	EWC	2022					
		Mat	Lezhë	Krujë	Kurbin	Kukës	Shkodër
Waste from plastic packing + Plastic	15 01 02 + 16 01 19	604	2,388	2,384	2,011	962	3341

Wood packing waste	15 01 03	191	753	752	634	304	1,054
Textile packing wastes + Textile	15 01 09 + 20 01 11	137	542	541	456	218	758
Total		**932**	**3,683**	**3,676**	**3,101**	**1,484**	**5,152**

The total amount of waste that can be used by Antea Cement as an alternative fuel, generated in 2022 is **18,028 tons.**

Below a table of the amount of waste from used tires and used oil extracted from the NEA Report 2019. This type of waste could also potentially be a primary product for the production of RDF/SRF.

Table 43. Amount of waste from used tires and used oil

Information data	Albanian Waste Catalog Code	Tiranë	Shkodër	Vlorë	Elbasan	Korçë	Fier	Gjirokastër	Lezhë	Dibër	Berat
Amount of tire waste (Tons)	16 01 03	231	2	164	278	1	541	0	12	0	405
Amount of waste of used oils (Kg)	12 01 06*	-	0.001	56	28	151	714	0.021	8	0.004	101

Source: NEA Report 2019

9. ALTERNATIVES
Discussions and comments

During the meetings held with representatives of the municipalities of Lezhë, Kurbin, Krujë, Mat, Kukës, Shkodër, and Durrës, some issues related to the needs of these municipalities for the successful implementation of the project were discussed, and also some alternatives and options for possible legal and technical changes at the local and central level were proposed.

Below are listed key topics and issues raised by the municipal representatives:

- Very high interest from the municipalities for the reduction of the amount of waste due to the high tariffs for landfilling;
- Initial consideration of some opportunities for cooperation with potential stakeholders who can support the municipalities with the appropriate capacities;
- Lack of technical capacity, staff, and financial means to assist the process by the municipalities;
- Discussions on how to provide the new service and the costs planned by the project or stakeholders (to be further developed by Feasibility Study);
- Type of waste that can be part of the process as well as the calorific values of the waste that can be used;
- Review of Public Private Partnership issues or other existing cooperation opportunities;
- It was suggested to set up transfer stations in some small towns or areas where there is a larger collection of waste to facilitate the process as well as an analysis of the situation of existing landfills or landfills;
- Skepticism about the progress of the project from the fact that some previous pilot projects did not work, mainly related to source sharing and recycling;
- The municipality of Kurbin declared the possibility for cooperation after it became clear initially the alternatives and opportunities that exist;

- The leaders of Lezhë municipality see the project as very avant-garde for the current time and situation where the municipality is located but are ready for cooperation by implementing the relevant legal requirements and obligations.
- The leaders of the municipality of Mat and Shkodër expressed great interest to be part of the project and the need to implement it successfully as assistance to the current waste management system.
- The leaders of the municipality of Krujë suggested that there should be a subsidy from central government authorities to cover increased costs for a certain buffer period.

Proposed steps and alternatives:

- Step 1: Review of the legal framework to allow the processing of waste and the production of AF.
- Step 2: Create the accompanying legal framework which regulates the new market and sets product standards.
- Step 3: Update of the Integrated Waste Management Local Plans and regulations on urban waste processing.
- Step 4: The municipality invests in the processing of waste, the production of AF Alternative and then trades.
  - Landfill operators create this new processing line;
  - Public Private Partnership / Union of Private Operators;
  - Private operators licensed for collection and transport invest in the processing line.

In principle, waste carries calorific energy which can be used in industrial processes. As such, they are minimally not a cost to the generator and maximally a source of revenue.

10. CONCLUSIONS / RECOMMENDATIONS

Based on the collected information, and meetings/discussions with all stakeholders, below are some of the main conclusions and recommendations:

Conclusions:

- The waste hierarchy is not applied and municipalities do not have in place a system for the collection of waste in 4 streams; paper/cardboard; metals; plastic and glass; as is foreseen by the law;
- Measures should be taken by the municipality of Mat and Krujë to draft an Integrated Waste Management Plan;
- The municipalities of Krujë, Kukës, and Mat do not weigh the waste before their final deposit in the landfills, which also do not have the status of a sanitary landfill and do not meet the techno-legal conditions in force.
- The line ministry has prepared as yet no Waste Prevention Program
  - None of the municipalities has established differentiated waste collection;
  - The Extended Producer Responsibility is defined and regulated by the line ministry and monitored by the Agencies. Currently, the line ministry has not provided the producers with: waste prevention programs, the best available techniques, and waste treatment facilities;
  - No producer has implemented a packaging collection system within its extended responsibility;
- A collection of data by municipalities can be done for specific categories of waste which can produce RDF.
- An assessment can be made of the capacities (technical, financial) and interests of the municipalities to create a system for the collection of this waste.
- Municipalities can analyze the existing data and suggest to the central institutions or the municipal council the necessary legal, and regulatory changes for the collection of this waste and their use/trade.

- Municipalities and producers do not regularly report data to National Agencies;

Recommendations:

- Implementation of the extended producer responsibility especially for business and industries operating in the area should be done;
- A common database should be established and updated with real waste management data from each municipality;
- All municipalities should:
    - provide in their budgets events and campaigns to raise public awareness about waste management and environment protection.
    - take measures for the rehabilitation of closed landfills as well as the closure of illegal dumpsites.
    - develop action plans for the collection and processing of organic waste as they constitute the largest part of the generated waste.
    - create a database collected by private entities regarding the types, categories and quantities of waste generated by industries and businesses.
    - contracts should be established and agreements drafted for the collection and processing of recyclable waste by licensed entities.
- Draft an Integrated Waste Management Plan for Mat, Krujë, and Kukës and revise the existing ones in the other municipalities of the study area;
- Extend the service delivery in all the territory of the municipalities of the study area (where the road infrastructure allows it;
- Renew the fleet (partly or in full) of vehicles operating in these municipalities;
- Replacement of amortized containers;
- Construction of the Transfer Stations as foreseen in the Sectoral Plan;
- Separation of inert and green waste from household waste and deposit them on authorized containers or facilities;
- Promotion of waste reduction practices through composting and recycling;
- Promotion of composting at home in rural areas and especially in remote areas;
- Separation of waste management service from cleaning and other public services such as greening, decoration, etc.

PART VII, ANNEXES

11. QUESTIONNAIRES AND PUBLIC AWARENESS

11.1 Summarized answers to the questionnaire from the industrial sector.

Name	Special waste streams and subtypes by waste streams	Classification according to the waste catalog	Annual tonnage (t) / volume (m^3)	Source of data on quantities/ volume	Description of waste management - method and subcategory
Mali sh.p.k.	Carpet, Clothing, Feet wearing	191208	0.6 t	Data from internal representatives	Extermination with an authorized and registered company for transport and disposal of hazardous waste
	Other textile waste/leather waste	401	100 t		
	Plastic packaging	150102	1 t		
	Other rubber waste	191204	3 t		
	Other mixed paper & card waste	150101	2 t		Permanent disposal at a communal landfill
Panorama Restaurant & Hotel	Cooking / Vegetable oil	200125	21 t	Data from internal representatives	Disposal: permanent disposal at a communal landfill
	Other food/cooking wastes	202	54 t		
Elite Line	Other textile waste/leather waste	401	26 t	Data from internal representatives	Disposal: permanent disposal at a communal landfill and also with an authorized and registered company for transport and disposal of hazardous waste
Altek shpk	Other textile waste/leather waste	401	70 t	Data from internal representatives	Disposal: permanent disposal at a communal landfill and also with an authorized and registered company for transport and disposal of hazardous waste
SPAR	Plastic packaging	150102	1 t	Data from internal representatives	Processing - recycling from non-formal subjects
	Card packaging	150101	30 t		Permanent disposal at a communal landfill
Mobileri Koleci	Sawdust and shavings	30105	5 t	Data from internal representatives	Processing - recycling: Informal selling
	Wood	200138	8 t		Reuse: External reuse

Big Market	Plastic packaging	150102	5 t	Data from internal representatives	Disposal: permanent disposal at a communal landfill
	Cardboard waste: Mixed packaging of paper and cardboard	150101	100 t		
AZA	Plastic packaging	150102	0.7 t	Data from internal representatives	Disposal: permanent disposal at a communal landfill
	Card packaging	150101	1.8 t		
Big Market Kruje	Cardboard waste: Mixed packaging of paper and cardboard	150101	11 t	Data from internal representatives	Disposal: permanent disposal at a communal landfill
Gomisteri Kasmi	Used tires	160103	113	Data from internal representatives	Disposal: permanent disposal at a communal landfill and also external reuse
Junik shpk	Sawdust and shavings	30105	5 t	Data from internal representative	Internal reuse, external reuse and permanent disposal
	Wood	200138	7 t		
	Plastic packaging	150102	1 t		
Ulaj shpk	Cardboard waste: Mixed packaging of paper and cardboard	191201	8 t	Data from internal representatives	Disposal: permanent disposal at a communal landfill
Gomisteri Sokoli	Used tires	160103	26 t	Data from internal representatives	Disposal: permanent disposal at a communal landfill and also external reuse
Gomisteri Alba	Used tires	160103	15 t	Data from internal representatives	External reuse and permanent disposal
Shkelzen Gjinaj	Used tires	160104	12 t	Data from internal representatives	External reuse and permanent disposal
Big Mat	Plastic packaging	150102	2 t	Data from internal representatives	Disposal: permanent disposal at a communal landfill
	Cardboard waste: Mixed packaging of paper and cardboard	150101	8 t		
Gjoka Market	Plastic packaging	150102	2 t	Data from internal representatives	Disposal: permanent disposal at a communal landfill
	Cardboard waste: Mixed packaging of paper and cardboard	150101	8 t		
Fortuna shpk	Other textile waste/leather waste	401	20 t	Data from internal representatives	Disposal: permanent disposal at a communal landfill
	Cardboard waste: Mixed packaging of paper and cardboard	150101	1.5 t		

Uraka 93 shpk	Other textile waste/leather waste	200111	15 t	Data from internal representatives	Disposal: permanent disposal at a communal landfill
	Sawdust and shavings	30105	10 t		Processing - recycling: Informal selling
	Wood	170201	15 t		Reuse: External reuse
"PROTEC SHOES" Fushe-Krujë	Carpet, Clothing, Feet wearing	191208	45 t	Data from internal representatives	Disposal: permanent disposal at a communal landfill and also external reuse
BARDHYL KALE-SA" Fushe-Krujë	Carpet, Clothing, Feet wearing	191208	32 t	Data from internal representatives	Disposal: permanent disposal at a communal landfill and also external reuse
"FLANTE" Fushe-Krujë	Carpet, Clothing, Feet wearing	191208	28 t	Data from internal representatives	Disposal: permanent disposal at a communal landfill and also external reuse
"FALK PRO" Krujë	Carpet, Clothing, Feet wearing	191208	25 t	Data from internal representatives	Disposal: permanent disposal at a communal landfill and also external reuse
"PLANET/K" Fushe-Krujë	Carpet, Clothing, Feet wearing	191208	5.6 t	Data from internal representatives	Disposal: permanent disposal at a communal landfill
"ALMODA" Krujë	Carpet, Clothing, Feet wearing	191208	15 t	Data from internal representatives	Disposal: permanent disposal at a communal landfill and also external reuse
"KADRAG" Krujë	Cardboard waste: Mixed packaging of paper and cardboard	150101	12 t	Data from internal representatives	Disposal: permanent disposal at a communal landfill and also external reuse
"NBP" Krujë	Carpet, Clothing, Feet wearing	191208	21 t	Data from internal representatives	Disposal: permanent disposal at a communal landfill and also external reuse
"TANJA HERRI" Krujë	Carpet, Clothing, Feet wearing	191208	52 t	Data from internal representatives	Disposal: permanent disposal at a communal landfill and also external reuse
	Other textile waste/leather waste	401			

The questionnaire was created in a way to establish individual flows of solid (non-hazardous) waste that are generated in business entities from different business sectors. Its completion provides insight into all phases of waste management, including its generation, movement and disposal, ie. further transfer to other links in the waste management chain.

- In section A, included the industrial sector in which the business entity operates.
- In section B, , included data on special waste streams and their subtypes are entered, with additional data that determine them in more detail: waste classification code, annual quantity / volume and source of verification.
- In section C, included the waste management method for each of the separate streams indicated in section B.
- In section D, , included data about the person who fills in the survey are entered, but also leaves room for personal review and opinion on these activities.

The questionnaire has collected information on all waste streams within the business entity, regardless of whether it is produced on site (at the location of the business entity), whether it is brought to the location (so-called incoming waste), whether it is temporarily disposed of or further transported. (so-called outgoing waste).

From the results of the questionnaires made in business, it turns out that 56 questionnaires were completed by commercial entities that are mostly from the area of Lezhë, Krujë and less from Kurbin and Mat.

These entities carry out various activities, including shoe and textile factories, tyre shops, furniture, markets, restaurants, etc.

Most of these enterprises (about 55%) have less than 10 employees, about 25% are medium (50-250) and 12.5% are large businesses (more than 250 employees).

The dominant industry which includes the subjects that have answered the questionnaires belongs to the field of textiles and leather, then there are wholesale and retail trade, then there are other activities that include tyre shops and less completed questionnaires are from hotels and restaurants, wood industries, food products etc.

From the answers received it results that the main waste generated by these entities are cardboard waste (35.8%), textile waste (28.3%) and then wood waste and other waste including used tires.

From the answers given for the quantities of waste generated by businesses, it results that there are 7 entities that generate 20-50 tons of waste from textile products and 4 entities that generate over 50 tons or 100 to 250 tons of waste from these industries.

Regarding plastic waste and waste from used tires, it turns out that there are 11 entities that generate 0-2 tons of plastic waste and 4 businesses that generate 15-20 or 100-250 tons of waste per year.

From the businesses that carry out wood processing activities, it results that most of the respondents generate 5-10 tons of waste per year consisting mainly of sawdust, shavings and wood waste. A smaller part of these businesses generates 10-15 tons / year of waste of this nature.

Cardboard waste is generated mainly by markets and other similar businesses and it turns out that most of them generate 0-2 tons/year of waste coming from cardboard packaging. A smaller number of these businesses generate 10-15 tons/year of cardboard waste or similar waste.

In terms of food waste, they are generated mainly by restaurants and have a distribution of quantities of waste produced in quantities ranging from 1 ton/year to 20 tons/year.

Large wastes are those generated from packaging waste ranging from 1 to 10 tons /year.

There are also some entities that generate other waste, especially from those given in the questionnaire where we can mention the waste generated by poultry which creates 2-5 tons / year. From the results of the questionnaires most of them (25%) deposit the waste in a municipal landfill, then 19.6% of them deposit it in an industrial landfill and equally declare that their waste is reused outside their activity by subjects or individuals for different needs.

According to the data from the questionnaires conducted in field in the premises of some key industries and businesses in the study area, data which are not reflected in LIMSWMP result in some preliminary waste generation data from the questionnaires:

- Leather waste 80-100 tons/year
- Textile waste 350-400 ton/year
- Furniture waste 60-80 tons/year
- Cardboard waste 100-150 tons/year

Main industries that produce RDF / SRF
Textile handlers
Tire shops/services
Furniture producers
Leather handlers
Supermarkets
Restaurants

11.2 Summarized answers to the household's questionnaire

By the stage of data extraction, the questionnaire has been completed by 69 people.

From the data extracted from the answers of the participants in the questionnaire it results:

- Most of the participants are female.
- The areas from where the questionnaire was completed are mainly part of the city of Lezhë and the city of Krujë.
- The age with the largest number of participants turns out to be 30-49 years' old.
- Most residents live in the reporting area for as many years as they have lived.
- The vast majority of participants are university educated and work mainly in state institutions.

Regarding Market Research and the information generated it turns out that:

- Most of the participants have information about the waste management process and waste service is provided in their area.
- The quality of service according to most of the participating persons is average with average hygiene.
- Most of them state that they have no knowledge about the drafting of a plan or its approval by the municipality nor have they received any training or dedicated information regarding waste treatment.
- Only very few people have information on the current tariff set by the municipality for waste management or cleaning.
- The largest amount of waste generated is dominated by household waste and after that comes plastic waste, metal waste such as cans, etc. and then cardboard and glass waste.
- Only ¼ of the interviewees state that they separate the waste in their apartments.
- The vast majority state that they deposit the waste in a public container placed by the municipality because more than 90% of them have a public container in the vicinity of their house.

- The condition of the containers is good but, in some cases, there are damaged containers or they are not in the right size.
- Most of the participants, about 60% think that the process of waste disposal and collection is a problem.
- More than 75% of respondent's state that they are ready to do the waste separation if a recycling program is defined in their municipality.

Regarding the public awareness examination and the possibility of using waste for energy production, it results as follows:

- The participants in the questionnaire think that they are partially satisfied with the status of the state of the environment in their municipality.
- The main issues related to the concerns of the residents are air quality, public hygiene and waste management, specifically forest fires, construction without criteria, pollution, etc.
- More than 75% of participants do not have information about RDF and most have little information about the use of waste as fuel in EU countries.
- Almost half of the participants have information on co-processing and its benefits and most of them agree on the use of these technologies for the production of alternative energy from waste.
- Most require information to be shared through the media and social networks and the rest through community meetings or large public meetings.
- More than 52% of the persons participating in the questionnaire support the production and use of RDF if the municipality would be transparent and the environmental parameters would be respected.
- Residents' concerns regarding the production of energy from RDF are mainly related to concerns about air pollution, transparency, environmental impacts, etc.

12. EXAMPLES OF CONCENTRATION RANGES FOR SUBSTANCES IN WASTE MATERIALS/WASTE INPUT CRITERIA

Below examples of typical metal concentration ranges and typical input criteria for different substances of suitable wastes used as fuels and/or raw materials in different cement plants in several countries.

Table 44. Limit values in different permits and regulations in Austria, Switzerland and Germany for used wastes

Parameter	Austria (1, 10)			Switzerland [2]		Germany [3]	
	Combustible waste [4, 9] in general	Plastic, paper, textile waste, wood, etc. high calorific fractions from common waste	Solvents, spent oil, waste lacquers	Combustible waste [5, 9] in general)	Other wastes for disposal	Plastic, paper, textile waste, wood, etc. high calorific fractions from common waste [6]	Solvents, spent oil
	Maximum values (mg/kg)						
As	15	15	20	15	-	13	15
Sb	5	20 (200)[7]	100	5	800[4]	120	20
Be	5	-	-	5	-	2	2
Pb	200	500	800	200	500	400	150
Cd	2	27	20	2	5	9	4
Cr	100	300	300	100	500	250	50

Cu	100	500	500	100	600	700	180
Co	20	100	25	20	60	12	25
Ni	100	200	-	100	80	160	30
Hg	0.5	2	2	0.5	5(8)	1.2	1
Tl	3	10	5	3	-	2	2
V	100	-	-	100	-	25	10
Zn	400	-	-	400	-	-	-
Sn	10	70	100	10	-	7	30
Cl (total)	1%	2%	-	-	-	1.5%	-
PCBs	50	-	100	-	-	-	-

(1) Voluntary self-commitment from the cement industry with authorities and relevant ministry
(2) BUWAL, co-processing guidelines from Switzerland
(3) Voluntary self-commitment from the waste industry and regulations from the Government North Rhine Westphalia (NRW) Germany
(4) Net calorific value of 25 MJ/kg
(5) Net calorific average value of 18 MJ/kg
(6) Polyethylene terephthalate (PET)
(7) Polyethylene terephthalate (PET), polyester
(8) Special case, flue-gas cleaning for Hg
(9) Other combustible waste in general (not applicable to selected authorised waste streams)
(10) More up-to-date values can be found in the 'Guideline for Waste Fuels' of the Federal Ministry of Austria, notified by the European Commission

Source: [104, HOLCIM/GTZ, 2006], [168, TWG CLM, 2007]

Table 45. Examples of permit criteria (median and 80 percentile values) for substances in waste used in Austrian cement plants

Parameter	**Paper and sewage sludge**	**Waste oil**	**Solvents**	**Plastics**	**Waste wood**	**Paper**	**Rubber**	**Animal meal**
	Median and 80 percentile values (mg/kg dry substance)							
	Median	Median	Median	80 perc.	80 perc.	Median	Median	80 perc.
As	3.78	12	6	10	10	0.46	16.4	0.2
Sb	4.97	67	6	20	20	0.37	5.72	0.6
Pb	25.5	59	180	150	150	31.85	28	1.5
Cd	1.02	0.5	0.6	15	5	0.63	3.9	0.0.5
Cr	28	8	30	150	50	12.2	26	3
Co	6.6	1	1.8	15	10	3.6	80	0.4
Cu	160.5	52	300	300	50	10.75	300	12
Mn	350	0.1	42	200	150	287	28.6	25
Ni	22	1	24	100	100	11.1	77	1
Hg	1.2	0.47	0.6	0.6	0.5	0.26	0.02	0.1
Tl	6.69	0.05	0.6	1.5	1	1.11	0.4	0.3
V	16.05	1	6	30	60	6.11	12	0.5
Zn	40.6	390	30	30	20	1.76	10	1
Sn	877	1 000	180	-	-	34.9	8 597	120
Cl	-	0.4 wt-%	-	-	-	-	-	-

S	-	2wt-%	-	-	-	-	-	-
PCB/PCT	-	50	-	-	-	-	-	-
Median value: 50 percentile values Maximum value: 100 percentile value 80 perc.: 80 percentile value Source: [161, Austria, 2006], [168, TWG CLM, 2007], [170, Austria, 2007]								

13. WASTE CATALOGUE

Source:
- CEMBUREAU's waste fuel groupings versus those of the European Waste Catalogue EWC
- Albanian catalogue for waste classification DCM Nr. 99, date 18.2.2005 "On the Approval of The Albanian Waste Classification Catalog"

CEMBUREAU's waste fuel groupings versus those of the European Waste Catalogue EWC.

Group 1: Wood, paper, cardboard		
Waste category	**Waste description**	**Hazardous**
Category 02	Wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing, food preparation and processing	
02 01 07	Waste from forestry	
Category 03	Wastes from wood processing and the production of panels and furniture, pulp, paper and cardboard	
03 01 04	Sawdust, shavings, cuttings, wood, particle board and veneer containing dangerous substances	*
03 01 05	Sawdust, shavings, cuttings, wood, particle board and veneer other than those mentioned in 03 01 04	
03 03 07	Mechanically separated rejects from pulping of waste paper and cardboard	
Category 15	Waste packaging; absorbents, wiping cloths, filter materials and protective clothing not otherwise specified	
15 01 01	Paper and cardboard packaging	
15 01 03	Wooden packaging	
Category 17	Construction and demolition wastes (including excavated soil from contaminated sites)	
17 02 01	Wood	
Category 20	Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions	
20 01 01	Paper and cardboard	
20 01 37	Wood containing dangerous substances	*
Group 2: Textiles		
Waste category	**Waste description**	**Hazardous**
Category 04	Wastes from the leather, fur and textile industries	
04 02	Waste from the textile industry	
Category 15	Waste packaging; absorbents, wiping cloths, filter materials and protective clothing not otherwise specified	
15 01 09	Textile packaging	
Category 19	Wastes from waste management facilities, off-site wastewater treatment plants and the preparation of water intended for human consumption and water for industrial use	

19 12 08	Textiles	
Category 20	Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions	
20 01 10	Clothes	
Group 3: Plastics		
Waste category	**Waste description**	**Hazardous**
Category 02	Wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing, food preparation and processing	
02 01 04	Waste plastics (except packaging)	
Category 12	Wastes from shaping and physical and mechanical surface treatment of metals and plastics	
12 01 05	Plastics shavings and turnings	
Category 15	Waste packaging; absorbents, wiping cloths, filter materials and protective clothing not otherwise specified	
15 01 02	Plastic packing	
Category 20	Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions	
Group 4: RDF		
Waste category	**Waste description**	**Hazardous**
Category 15	Waste packaging; absorbents, wiping cloths, filter materials and protective clothing not otherwise specified	
15 01 06	Mixed packing	
Category 19	Wastes from waste management facilities, off-site wastewater treatment plants and the preparation of water intended for human consumption and water for industrial use	
19 02 10	Combustible wastes other than those mentioned in 19 02 08 and 19 02 09	
19 12 10	Combustible waste (refuse derived fuel)	
19.12.04	Plastic and rubber	
Category 20	Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions	
20 03 01	Mixed up waste	
Group 5: Rubber/Tyres		
Waste category	**Waste description**	**Hazardous**
Category 16	Wastes not otherwise specified in the list	
16 01 03	End-of-life-tyres	
16 02 16	Components removed from discarded equipment other than those mentioned in 16 02 15	
Group 6: Industrial sludges (filter cakes, centrifuged, dried, etc.)		
Waste category	**Waste description**	**Hazardous**
Category 03	Wastes from wood processing and the production of panels and furniture, pulp, paper and cardboard	
03 03 02	Green liquor sludges (from recovery of cooking liquor)	
Category 04	Wastes from the leather, fur and textile industries	
04 02 19	Sludges from on-site effluent treatment containing dangerous substances	*

04 02 20	Sludges from on-site effluent treatment other than those mentioned in 04 02 19	
Category 05	Wastes from petroleum refining, natural gas purification and pyrolytic treatment of coal	
05 01 09	Sludges from on-site effluent treatment containing dangerous substances	*
05 01 10	Sludges from on-site effluent treatment other than those mentioned in 05 01 09	
Category 06	Wastes from inorganic chemical processes	
06 05	Sludges from on-site effluent treatment	
Category 07	Wastes from organic chemical processes	
07 01 11	Sludges from on-site effluent treatment containing dangerous substances	
07 01 12	Sludges from on-site effluent treatment other than those mentioned in 07 01 11	
Category 08	Wastes from the manufacture, formulation, supply and use (MFSU) of coatings (paints, varnishes and vitreous enamels), adhesives, sealants and printing inks	
Category 10	Wastes from thermal processes	
Category 11	Wastes from chemical surface treatment and coating of metals and other materials; non-ferrous hydrometallurgy	
Category 12	Wastes from shaping and physical and mechanical surface treatment of metals and plastics	
Category 13	Oil wastes and wastes of liquid fuels (except edible oils, and those in chapters 05, 12 and 19)	
Category 14	Waste organic solvents, refrigerants and propellants (except 07 and 08)	
Group 7: Municipal sewage sludges		
Waste category	**Waste description**	**Hazardous**
Category 19	Wastes from waste management facilities, off-site wastewater treatment plants and the preparation of water intended for human consumption and water for industrial use	
19 03 07	Solidified wastes other than those mentioned in 19 03 06	
19 02 05	Sludges from physico-chemical treatment containing dangerous substances	*
19 02 06	Sludges from physico-chemical treatment other than those mentioned in 19 02 05	
19 08 05	Sludges from treatment of urban waste water	
Group 8: Animal meal, fats		
Waste category	**Waste description**	**Hazardous**
Category 02	Wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing, food preparation and processing	
02 01 02	Animal-tissue waste	
02 01 02	Animal-tissue waste	
Group 9: Coal/carbon waste		
Waste category	**Waste description**	**Hazardous**
Category 05	Wastes from petroleum refining, natural gas purification and pyrolytic treatment of coal	
05 01 09	Sludges from on-site effluent treatment containing dangerous substances	*

05 01 10	Sludges from on-site effluent treatment other than those mentioned in 05 01 09	
05 01 17	Bitumen	
05 06 01	Acid tars	*
05 06 03	Other tars	*
Category 19	Wastes from waste management facilities, off-site wastewater treatment plants and the preparation of water intended for human consumption and water for industrial use	
19 01 10	Spent activated carbon from flue-gas treatment	
19 01 17	Pyrolysis wastes containing dangerous substances	*
19 09 04	Spent activated carbon	
Group 10: Agricultural waste		
Waste category	**Waste description**	**Hazardous**
Category 02	Wastes from wood processing and the production of panels Wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing, food preparation and processing	
02 01 03	Plant tissue waste	
02 01 08	Agrochemical waste containing dangerous substances	*
02 01 09	Agrochemical waste other than those mentioned in 02 01 08	
02 01 07	Waste from forestry	
Category 03	Wastes from wood processing and the production of panels and furniture, pulp, paper and cardboard	
03 01 01	Waste bark and cork	
03 03 01	Waste bark and wood	
Group 11: Solid waste fuels (impregnated sawdust)		
Waste category	**Waste description**	**Hazardous**
Category 03	Wastes from wood processing and the production of panels and furniture, pulp, paper and cardboard	
03 01 04	Sawdust, shavings, cuttings, wood, particle board and veneer containing dangerous substances	*
Category 19	Wastes from waste management facilities, off-site wastewater treatment plants and the preparation of water intended for human consumption and water for industrial use	
19 12 11	Other waste (including mixtures of materials) from mechanical treatment of waste containing dangerous substances	*
Group 12: Solvents and related waste		
Waste category	**Waste description**	**Hazardous**
Category 02	Wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing, food preparation and processing	
02 03 03	Waste from solvent extraction	
Category 07	Wastes from organic chemical processes	
07 01 04	Other organic solvents, washing liquids and mother liquors	*
07 01 08	Other still bottoms and reaction residues	*
07 03 04	Other organic solvents, washing liquids and mother liquors	*

07 03 07	Halogenated still bottoms and reaction residues	*
07 03 08	Other still bottoms and reaction residues	*
07 04 03	Organic halogenated solvents, washing liquids and mother liquors	*
07 04 04	Other organic solvents, washing liquids and mother liquors	*
07 04 07	Halogenated still bottoms and reaction residues	*
07 04 08	Other still bottoms and reaction residues	*
07 05 03	Organic halogenated solvents, washing liquids and mother liquors	*
07 05 04	Other organic solvents, washing liquids and mother liquors	*
07 05 07	Halogenated still bottoms and reaction residues	*
07 05 08	Other still bottoms and reaction residues	*
07 06 03	Organic halogenated solvents, washing liquids and mother liquors	*
07 06 04	Other organic solvents, washing liquids and mother liquors	*
07 06 07	Halogenated still bottoms and reaction residues	*
07 06 08	Other still bottoms and reaction residues	*
07 07 03	Organic halogenated solvents, washing liquids and mother liquors	*
07 07 04	Other organic solvents, washing liquids and mother liquors	*
07 07 07	Halogenated still bottoms and reaction residues	*
07 07 08	Other still bottoms and reaction residues	*
Category 08	Wastes from the manufacture, formulation, supply and use (MFSU) of coatings (paints, varnishes and vitreous enamels), adhesives, sealants and printing inks	
08 01 11	Waste paint and varnish containing organic solvents or other dangerous substances	*
08 01 12	Waste paint and varnish other than those mentioned in 08 01 11	*
08 01 21	Waste paint or varnish remover	*
08 03 12	Waste ink containing dangerous substances	*
08 03 13	Waste ink other than those mentioned in 08 03 12	*
08 04 09	Waste adhesives and sealants containing organic solvents or other dangerous substances	*
08 05 01	Waste isocyanides	*
Category 09	Wastes from the photographic industry	
09 01 03	Solvent-based developer solutions	*
Category 14	Waste organic solvents, refrigerants and propellants (except 07 and 08)	
14 06 02	Other halogenated solvents and solvent mixtures	*
14 06 03	Other solvents and solvent mixtures	*
Category 19	Wastes from waste management facilities, off-site wastewater treatment plants and the preparation of water intended for human consumption and water for industrial use	
19 02 08	Liquid combustible waste containing dangerous substances	*

Category 20	Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions	
20 01 13	Solvents	*
20 01 27	Paint, inks, adhesives and resins containing dangerous substances	*
20 01 28	Paint, inks, adhesives and resins other than those mentioned in 20 01 27	*
Group 13: Oil and oily waste		
Waste category	**Waste description**	**Hazardous**
Category 01	Wastes resulting from exploration, mining, quarrying and physical and chemical treatment of minerals	
Category 04	Wastes from the leather, fur and textile industries	
Category 05	Wastes from petroleum refining, natural gas purification and pyrolytic treatment of coal	
Category 12	Wastes from shaping and physical and mechanical surface treatment of metals and plastics	
Category 13	Oil wastes (and wastes of liquid fuels except edible oils and those in chapters, 05, 12 and 19)	
13 01 01	Hydraulic oils, containing PCBs	*
13 01 04	Chlorinated emulsions	*
13 01 05	Non-chlorinated emulsions	*
13 02 04	Mineral-based chlorinated engine, gear and lubricating oils	*
13 02 05	Mineral-based non-chlorinated engine, gear and lubricating oils	*
13 02 08	Other engine, gear and lubricating oils	*
13 03 01	Insulating or heat transmission oils containing PCBs	*
13 03 06	Mineral-based chlorinated insulating and heat transmission oils other than those mentioned in 13 03 01	*
13 03 07	Mineral-based non-chlorinated insulating and heat transmission oils	*
13 03 08	Synthetic insulating and heat transmission oils	*
13 04 01	Bilge oils from inland navigation	*
13 04 02	Bilge oils from jetty sewers	*
13 04 03	Bilge oils from other navigation	*
13 05 01	Solids from grit chambers and oil/water separators	*
13 08	Oil waste not otherwise specified	
Category 16	Wastes not otherwise specified in the list	
16 01 13	Brake fluids	*
Group 14: Others		

Source: [192, CEMBUREAU, 2012].

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- Integrated Local Waste Management Plan ok Kurbin, 2021-2025

- Local Integrated Solid Waste Management Plan, Shkodër, 2017-2022

- Report on the State of the Environment, National Environment Agency, 2020

ENDNOTES

1 C&I are not part of the analysis presented in this report.
2 MEFWA: State of the Environment Report for 2010-2020.
3 www.defra.gov.uk: Review of Environmental and Health Effects of Waste Management: Municipal Solid Waste and Similar Wastes
4 Nielsen, A.R., Aniol, R.W., Larsen, M.B., Glarborg, P., Dam-Johansen, K., 2011, Mixing Large and Small Particles in a Pilot Scale Rotary Kiln, Powder Technology 210 (3), p.273
5 RDF is a fuel produced from the treatment (e.g., shredding and dehydrating) of solid waste
6 SRF is a fuel produced from non-hazardous waste in accordance with EU standards EN15359.
7 Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives, OJ L 312, 22.11.2008, p. 3–30.
8 Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control), OJ L 334, 17.12.2010, p. 17–119.
9 Ali Hasanbeigi, Hongyou Lu, Christopher Williams and Lynn Price, International Best Practices for Preprocessing and Co-Processing Municipal Solid Waste and Sewage Sludge in the Cement Industry (Lawrence Berkeley National Laboratory, 2012). http://eetd.lbl.gov/sites/all/filespublications/co-processing.pdf
10 VDZ (Verein Deutscher Zementwerke) is the economic, technical and scientific association for the German cement industry
11 https://www.anteacement.com
12 Decision of CM no.402 date 30.6.2021 "Approval of the waste catalogue"
13 COMMISSION STAFF WORKING DOCUMENT Albania 2020 Report Accompanying the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 2020 Communication on EU Enlargement Policy https://ec.europa.eu/neighbourhood-enlargement/sites/near/files/albania_report_2020.pdf
14 No. 10463, date 22.9.2011
15 DCM no. 179, dated 28.3.2018 "For the approval of the national plan of action for resources e renewable energy, 2018- 2020.
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22 www.instat.gov.al
23 Solid Waste Management Plan of Lezhë, 2017-2021
24 Integrated Waste Management Plan, Lezhë Municipality, 2017-2021
25 Waste Management Analysis Krujë Municipality, 2019
26 Integrated Local Waste Management Plan ok Kurbin, 2021-2025
27 Local Integrated Waste Management Plan 2021-2025, URI and Kurbin Municipality
28 Data from Durrës Municipality, 2022
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30 ALBANIA Population Projections, 2011-2031 May, 2014, INSTAT http://www.instat.gov.al/media/3075/projeksionet_e_popullsis__2011-2031.pdf
31 Integrated Waste Management Strategic Policy Document and National Plan 2020-2035
32 Analysis of experiences in the production and use of refuse derived fuel (RDF) in Southeast Europe and EU countries, April 2021.