

WASTE MANAGEMENT AND TREATMENT IN PORTO METROPOLITAN REGION

Susana Abreu
LIPOR Coordination

Pedro A. Vieira
Porto Business School Coordination

Ruthia Portelinha

Raquel Araújo
Translation

RFX
Sound and image collection

QOOB Design Studio
Editorial Design

—

Copyright © 2021 LIPOR
Serviço Intermunicipalizado
de Gestão de Resíduos do Grande Porto

Rua da Morena, 805
4435-746 Baguim do Monte
Portugal

+ 351 229 770 100
info@lipor.pt



www.lipor.pt

Foreword

João Pedro Matos Fernandes

Minister for the Environment and Climate Action

The last dump in our country was closed in 2002, after a five-year investment of around 900 million euros to eradicate waste disposal in open sites. Many have noticed it was the end of an “environmental cancer” that was martyring the country for decades.

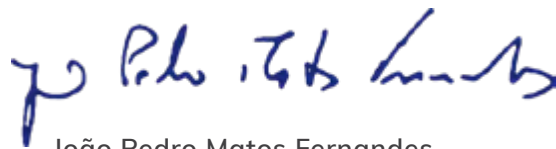
It was a revolutionary jump we took at the turn of the millennium, as far as waste management is concerned. It is true that at that time words such as “recycling”, “valorisation”, “reuse” joined our lexicon and since then instruments were created to look at waste as a resource – rather than as “rubbish” – but it is also certain that our country still faces some major challenges.

In order to overcome those challenges, Portugal needs a tough system from both a technical and a financial point of view and LIPOR’s experience emerges as a virtuous example for those who have not yet followed that path of excellence. Mainly because LIPOR created a virtuous ecosystem encompassing waste collection and treatment systems served by a capable infrastructure of landfills, screening and sorting plants, recycling units and specific ranks to waste collection and valorisation.

In Portugal, one of the major challenges consists in discouraging the use of landfills as the waste final destination, as this solution is the furthest from respecting the principles of circular economy, guided by the mantra of recover, valorise and recycle prior to eliminate. Our challenge is precisely to improve material productivity and increase the circularity rate, hence avoiding material loss and reducing the quantity of produced waste –because, as I keep repeating, there is no planet Earth 2.0.

The European goals are ambitious and clear. Among them, the quantity of urban waste deposited in landfills must be reduced in 10%, until 2035; the national recycling rate must reach 55%, from 2025 onwards; starting on 2024, the country must create a network to segregate biowaste. These goals set us significant challenges that demand for all intervenient entities – citizens, municipalities, private operators, management systems, companies, managing bodies, supervising authorities and state – the assumption of responsibilities and contributions to change.

At the beginning of a new decade, with these goals ahead and with the ambition underlying our commitment towards carbon neutrality in 2050, the contribution from entities such as LIPOR is determinant, whose internationalisation I hereby congratulate. As the player of an economic model we aspire to Portugal – sustainable and resources' regenerator -, LIPOR contributed with efficiency and innovation for the implementation of innovative and circular practices. I wish you can now fulfil your vision, reaching out for new markets where you create the trends that support a more sustainable future.

A handwritten signature in blue ink, reading "João Pedro Matos Fernandes". The signature is fluid and cursive, with a large initial 'J'.

João Pedro Matos Fernandes
Minister for the Environment and Climate Action

Abstract

Urban waste consists in one of the major environmental challenges that societies must face today. This is particularly true for the urban regions. The entities responsible for the waste management and treatment deal with the exponential growth of produced quantities, motivated by unsustainable consuming levels together with a wider variety of waste typologies and a less degradation capacity in nature.

Oporto metropolitan region joined efforts to deal with these issues and in the mid-80s of the 20th century LIPOR was created, an association which is now responsible for the management, valorisation and treatment of the waste produced in eight associate municipalities: Espinho, Gondomar, Maia, Matosinhos, Porto, Póvoa de Varzim, Valongo and Vila do Conde.

This case study analyses the path and the evolution in urban waste management within that specific geographic context, where around 10% of the Portuguese population lives in. In addition to its characterisation, this document identifies success factors and the main challenges this territory faces over time.

The future of this public entity is also taken into perspective, highlighting, in particular, its focus on innovation, circular economy and knowledge export, in an internationalisation process that emerges naturally from its excellence standards.

Resumen

Los residuos urbanos constituyen uno de los mayores retos ambientales que las sociedades enfrentan en la actualidad, sentido de manera más aguda en las áreas urbanas. Las entidades responsables de la gestión y tratamiento de residuos lidian con el crecimiento exponencial de cantidades producidas, motivado por niveles de consumo insostenibles, acompañado de una mayor diversidad de tipos de residuos y una menor capacidad de degradación en la naturaleza.

En el área metropolitana de Oporto se concentraron esfuerzos para lidiar con estos problemas a mediados de los años 80 del siglo XX, con la creación de LI-POR, una asociación que hoy en día es la responsable de la gestión, valorización y tratamiento de los residuos producidos en ocho municipios asociados: Espinho, Gondomar, Maia, Matosinhos, Oporto, Póvoa de Varzim, Valongo y Vila do Conde.

El presente estudio de caso analiza la trayectoria y evolución de la gestión de los residuos urbanos en aquel contexto geográfico específico, que concentra aproximadamente el 10% de la población portuguesa, caracterizándolo, identificando los factores de éxito y principales retos que enfrentó y sigue enfrentando.

Se perfila también el futuro de esta entidad pública, haciendo hincapié en su apuesta por la innovación, economía circular y exportación de conocimiento en un proceso de internacionalización que resulta, naturalmente, del nivel alcanzado de excelencia.

Resumo

Os resíduos urbanos constituem um dos maiores desafios ambientais que as sociedades enfrentam atualmente, sentido com particular acuidade nas regiões urbanas. As entidades responsáveis pela gestão e tratamento de resíduos lidam com o crescimento exponencial de quantidades produzidas, motivado por níveis de consumo insustentáveis, a par com uma maior diversidade de tipologias de resíduos e uma menor capacidade de se degradarem na natureza.

Na região metropolitana do Porto congregaram-se esforços para lidar com estes problemas em meados dos anos 80 do século XX, com a criação da LIPOR, uma associação que hoje é responsável pela gestão, valorização e tratamento dos resíduos produzidos em oito municípios associados: Espinho, Gondomar, Maia, Matosinhos, Porto, Póvoa de Varzim, Valongo e Vila do Conde.

O presente estudo de caso analisa o percurso e evolução da gestão dos resíduos urbanos naquele contexto geográfico específico, que concentra cerca de 10% da população portuguesa, caracterizando-o, identificando os fatores de sucesso e principais desafios que enfrentou e enfrenta.

Perspetiva-se também o futuro desta entidade pública, com destaque para a sua aposta na inovação, economia circular e exportação de conhecimento, num processo de internacionalização que resulta, naturalmente, do alcançado patamar de excelência.

Contents

01	Historical background of waste management in Greater Porto	09
02	Legal context of waste management in Portugal	13
03	About LIPOR	18
04	Corporate governance	24
05	LIPOR Financing model	31
06	Recycling and circular economy programmes	35
07	Communication, education, and environmental awareness	39
08	The future of LIPOR	43
09	Conclusions and recommendations	47
10	Sources	55
11	List of acronyms and abbreviations	58



01

Historical background of waste management in Greater Porto

At the beginning of the 20th century Portugal was characterised by its weak industrialisation and precarious economic conditions, resulting in a low level of consume and waste. This scenario changed after the 1974 revolution and, in particular, after joining the European Economic Community (EEC), in the mid-80s. Joining the European Economic Community, today the European Union, opened a whole new range of opportunities and financial support, but it also brought a set of responsibilities, either at a macro context, of environmental preservation, or at a specific context, regarding basic sanitation and waste services. The gradual adjustment to the Community guidelines – namely to the Landfill Directive (1999) and to the Packaging Directive (1994) – resulted in a very significant evolution in waste management in Portugal, over the last decades.

Joining the European Economic Community, today the European Union, opened a whole new range of opportunities and financial support, but it also brought a set of responsibilities, either at a macro context, of environmental preservation, or at a specific context, regarding basic sanitation and waste services.

Although a national policy about waste was already addressed in a Resolution of the Council of Ministers from 1980, the first estimates to characterise waste date from the early 90s. At the time municipal collection served around 80% of the population, with values close to 100% within urban areas, but the destination of the urban waste was mainly the dumps. Estimates indicate that circa 20% was sent to controlled landfills and two composting units. The selective collection of packaging waste revealed a rate under 1% and was focused on glass packaging¹.

Given the obvious delay in relation to most EU Member States, in the mid-90s solving the issues related to urban waste was considered a priority. The first precursor instrument in the sector's organisation was released, the I Strategic Planning for Solid Urban Waste Management (PERSU I, 1997-2007), which set goals, in time and quantity, to start an integrated waste management at national level. This instrument triggered the eradication of over 340 municipal dumps inventoried, a process that came to an end around the year 2000.

¹ APA, 2019c, p. 20.

Historically, the sector of urban waste management in Portugal is associated with municipalism, due to its proximity and association with preserving public health². However, the growing Community demands and the need for large investments in infrastructures led to the development of an organisational model that surpassed municipal boundaries.

In the early 90s emerged the first multi-municipal systems which operated upper urban waste, in other words, they were directly in charge of selective multi-material collection, sorting packaging waste, treatment, valorisation and final destination of urban waste, aiming at achieving the advantages of economies of scale in terms of investment in infrastructures, operation costs and results regarding material recovery and recycling. To sum up, the municipalities and the regions felt the urge to get organised, with the purpose of gaining dimension, reducing costs, and optimising resources in waste management³.

Throughout the country emerged a few regional waste treatment projects and the great Porto metropolitan area was no exception. This is the most relevant sub-region in Northern Portugal and the second metropolitan area in the country, representing 2,21% of the national territory and 16,6% of the total population (1,7 million inhabitants). The sub-region has crucial infrastructures such as an airport, a seaport, road and train network, the country's largest university and a productive sector historically important that represented, in 2017-2018, 16% of the national GDP⁴.

From the 17 municipalities the encompass Porto Metropolitan Area, five (including Porto) got together in an intermunicipal model of common waste management, in the early 80s. LIPOR - Intermunicipal Waste Management of Greater Porto⁵ was born, legal person governed by public law that was later enlarged to accommodate eight municipalities. Together they represent 0,7% of national territory (646 km²) and almost 10% of the country's population.

Nowadays, the sector of urban waste in mainland Portugal relies on 23 "upper" management systems, and, according to the Annual Report of Water and Waste Services in Portugal 2019, with 255 entities responsible for undifferentiated collection.

² The first Waste Framework Law (Decree-Law no. 488/85 of 25 November) established City Halls were obliged to plan, organise, and implement the collection, transport, elimination or use of urban waste produced within their jurisdiction areas, as well as register it.

³ PERSU I draw today's functioning model of the waste collection and treatment system, through multi- and intermunicipal models, combined with entities in charge for specific flows.

⁴ INE – Statistics Portugal, 2019a, p. 260

⁵ The name LIPOR resulted from the junction of the names "lixo" (rubbish) and "Porto", reflecting a perception that was not yet resources focused.

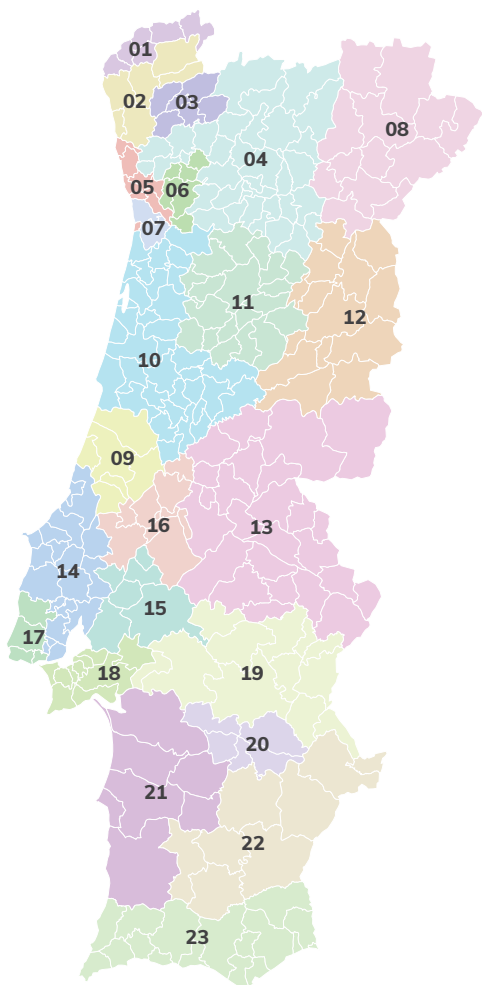


Figure #01
Distribution Map of Urban Waste Management Systems in mainland Portugal

Source: APA – Portuguese Environment Agency, 2020, p. 8

- | | |
|-------------------------|-----------------|
| 01 VALORMINHO | 13 VALNOR |
| 02 RESULIMA | 14 VALORSUL |
| 03 Braval | 15 Ecolezíria |
| 04 RESINORTE | 16 Resitejo |
| 05 LIPOR | 17 Tratalixo |
| 06 Ambisousa | 18 AMARSUL |
| 07 SULDOURO | 19 Gesamb |
| 08 Resíduos do Nordeste | 20 Amcal |
| 09 VALORLIS | 21 Ambilital |
| 10 ERSUC | 22 Resialentejo |
| 11 AMR Planalto Beirão | 23 ALGAR |
| 12 RESISTRELA | |

From the 23 existing Urban Waste Management Systems (SGRU), 11 are inter-municipal and 12 are multi-municipal. The latter are responsible for managing around 66% of the urban waste produced in national territory.

The intermunicipal systems may be directly operated by the municipalities or indirectly, through a public entity. This is the case for LIPOR, but also for Ambisousa, Resíduos do Nordeste, Ecobeirão, Resitejo, Ecolezíria, Tratalixo, Ambilital, Gesamb, Resialentejo and Amcal. The multi-municipal SGRU result from the allocation by the State to concessionaires whose capital is mostly public, for example Valorminho, Resulima, Braval, Resinorte, Suldouro, Valorlis, Ersuc, Resiestrela, Valnor, Valorsul, Amarsul and Algar⁶.

According to the 2019 annual report of urban waste, compiled by the Portuguese Environment Agency (APA), there is a major heterogeneity between systems considering the number of municipalities, geographic dispersion, demography, and socioeconomic conditions. The differences in each SGRU intervention areas are reflected in the options they take in terms of collection and treatment, as well as in the network of equipment and infrastructures and in the waste specific flows. Such options do condition the associated costs.

⁶ Braval is expected to become an intermunicipal company in 2021. This measure results from legal changes and from the end of the concession of the current system (October 2021). By that time, it will abandon the concession of multi-municipal system.

The existing set of waste treatment infrastructures, at a national level, is displayed in the table below.

Table #01
Main Existing Infrastructures (units)

Source: APA, 2020, p. 9

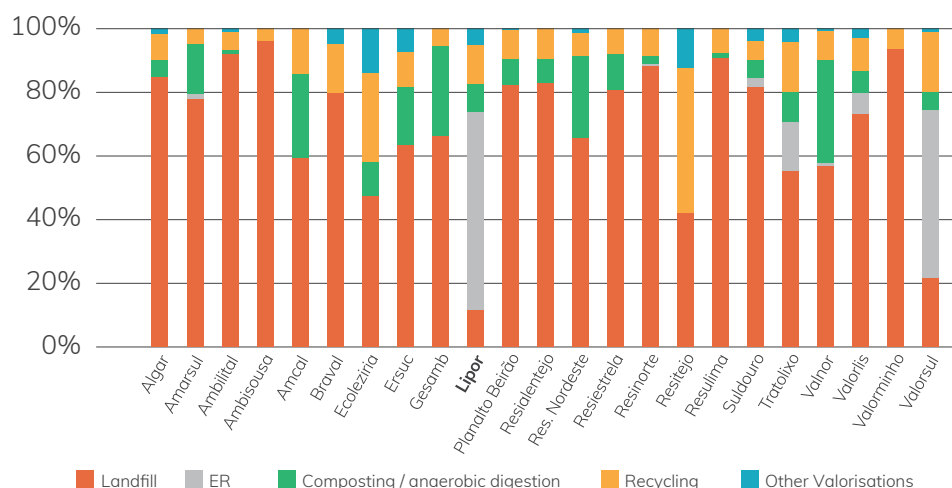
Landfills	32	Energy Recovery	2
Mechanical Treatment	5	Sorting Centre	30
Mechanical and Biological Treatment	18	Transfer Station	90
Composting Plant (Rsel)	5	Drop-off Sites	197

In 2019, the national production of urban waste reached 5,28 million tonnes, which represents an increase of around 1% compared to 2018. As far as the direct forwarding of urban waste is concerned, the distribution in mainland Portugal is as follows: 33% for landfills, 24% for mechanical and biological treatment, 19% for energy recovery, 11% for the sorting centre, 9% for mechanical treatment and 2% for composting plant.

Nevertheless, the APA report alerts that although the “waste direct destiny” is a rather relevant indicator, it is not a direct consequence about what is the final and effective destiny of the waste. In fact, data shows that the total fraction of waste deposited in landfills, both directly and indirectly, being the latter the trash and rejections from the treatment processes, constitutes approximately 58% of the total waste managed in mainland Portugal, which highlights that a significant percentage of treatment trash/rejections is not valorised.

Figure #02
Final Destinations of urban waste, per SGRU

Source: APA, 2020, p. 18





02

Legal context of waste management in Portugal

Portugal is among the first countries to enshrine constitutional environmental protection as one of the State's main functions, in article 9, paragraph e) of the Constitution of the Portuguese Republic. It is also established as a citizens' fundamental right in article 66, no. 1. However, most of the national law regarding the environment and waste management is based on the transposition of European Directives. Over the last decades, the country gradually adjusted its fragile legislation in this domain to the EU demands. The European legal framework was faster in following the evolution of the technical-scientific references corresponding to the man and environment interaction.

Portugal is among the first countries to enshrine constitutional environmental protection as one of the State's main functions. However, most of the national law regarding the environment and waste management is based on the transposition of European Directives.

Though most of the waste legal framework is currently under revision, the Portuguese law for the waste sector focuses on two basic legal diplomas: the Basic Environment Law (Law no. 19/2014 of 14 April) and the Waste Framework Law (Decree-Law no. 178/2006 of 5 September, with the wording given by the Decree-Law no. 73/2011 of 17 June), that passed into the internal legal framework the Directive no. 2008/98/EC of the European Parliament and of the Council.

There is no Law to unify all the environmental issues; still, the Basic Environment Law may be considered a compilation of fundamental legal norms. It provides an overall picture of environmental protection with the corresponding major guidelines and principles.

The Waste Framework Law came to consecrate a National Planning for Waste Management (PNGR), including all the waste typologies and the diverse origins, assuming a crucial relevance, not only because it embraces all the environmental policies for the sector, but also because of its transversal nature in the preservation of the natural resources and in other environmental strategies.

The PNGR is a planning broad instrument when it comes to waste, aiming at integrated prevention and management strategies, combining efforts towards a circular economy, to ensure more efficacy in the use of natural resources and guarantee the reduction and the elimination of the environmental risks caused by waste.

The approach to waste management considers the products and materials entire life cycle and not merely the end-of-life stage.

The Strategic Planning for Solid Urban Waste Management (PERSU, under revision while this study is being produced) and the Strategic Planning for Industrial Waste Management (PESGRI, approved by the Decree-Law no. 89/2002 of 9 April)⁷.

The Waste Framework Law regulates some important issues and updates a series of legal documents on the matter. In addition, it establishes the preparation of specific waste management plans as well as multi-municipal, intermunicipal and municipal action plans. Given this context, prevention programmes were approved, and several goals were set in terms of reuse, recycling, and other ways of waste material valorisation, to be met until 2020. Furthermore, the DL no. 73/2011 introduced a mechanism for the extended producer responsibility. This approach to waste management considers the products/materials entire life cycle and not merely the end-of-life stage, with the inherent advantages from the point of view of the efficient use of the resources and of the environmental impact.

The Framework Law also defined a principle for the waste hierarchy, with the following order of priorities: 1) Prevention and reduction; 2) Preparation for reuse; 3) Recycling; 4) Other types of valorisation and 5) Elimination. There is related legislation that, combined with the two basic norms described earlier, rule the waste management in national territory, without prejudice to more sectorial or specific diplomas.

That is the case for the Decree-Law no. 152-D/2017 of 11 December, consolidated legislation that gathers in one single diploma the regime of the specific flows subject to the principle of extended producer's responsibility, which transformed into Portuguese Law the Directives no. 2015/720/EU, 2016/774/EU, and 2017/2096/EU.

Let's add the Law no. 10/2014 of 6 March that establishes the norms and the management principles of ERSAR – Regulatory Authority for the Water and Waste Services, in charge for the regulation and management of the water, waste water and urban waste; the Decree-Law no. 294/94 of 16 November, with the changes introduced by the Decree-Law no. 195/2009 of 20 August, which settles the legal status for the exploration and management concession of the multi-municipal systems for the treatment of urban waste and establishes the tariff rules for waste collection; the Decree-Law no. 210/2009 of 3 September, which establishes the regime for the constitution, management and functioning of the regulated waste market; the Ordinance no. 209/2004 of 3 March, partly revoked by the Decision 2014/955/EC of the Commission of 18 December, which includes the European List of Waste, and the Decree-Law no. 127/2013 of 30 August⁸, which establishes the regime for the industrial emissions that applies to the integrated prevention and control of pollution, whose Chapter IV interferes with the waste management and treatment, as it is related to the activity of incineration and co-incineration and the corresponding licensing.

⁷ Between 2011 and 2016 the Strategic Planning for Hospital Waste (PERH) was also in force, approved by the Ordinance no. 43/2011 of 20 January.

⁸ Transformed into the national legal system the Directive no. 2010/75/EU, of the European Parliament and the Council of 24 November.

It is also worth mentioning the Decree-Law no. 183/2009⁹ of 10 August (and the corresponding Amendment no. 74/2009), that establishes the legal system for the deposit of waste in landfills, and the general requirements to be taken into consideration in their design, construction, exploration, closure, and post-closure, inclusive the specific technical characteristics for each landfill classification.

At last, the recycling and valorisation objectives must also be referred, as a result from the Directives no. 94/62/EC of 20 December, and 2004/12/EC of 11 February, related to the management of packaging and packaging waste transformed into the internal legal system by the Decrees-Law no. 366-A/97 of 20 December, 162/2000 of 27 July and 92/2006 of 25 May.

This legal framework is developed, or put into practice, through a set of sectorial plans that seek to guarantee the European goals are fulfilled. Among these structural documents we underline, given the scope of this work, the successive management planning for urban waste: PERSU I (1997-2007), PERSU II (2007-2016) and PERSU 2020 (2014-2020).

PERSU I launched the foundations for a waste policy, eradicated the open dumps, allowing the creation of landfills and of a national waste management network that would encompass the entire national territory. The value associated to waste started to be looked at as an asset for the creation of new markets, new productive activities, and employment. A strong investment in technical, economic, and political means was then made to close and requalify all dumps and to create landfills that would respect the technical and legal requirements capable of guaranteeing a more environmentally sustainable deposit. At the same time, the first steps were taken to support selective collection and recycling, which also demanded the construction of new supporting infrastructures.

PERSU was revisited in 2007 (Ordinance no. 187/2007 of 12 February), setting the goals for the upcoming decade and providing an answer to new legal demands formulated in the meantime, both at national and European levels, namely a new general waste management regime introduced by the Decree-Law no. 178/2006. Climbing the waste hierarchy, sort at the source, reduce the deposit in landfills and increase multi-material recycling were the main strategic lines presented by PERSU II which, meanwhile, expressed environmental concerns associated with the carbon emission (Kyoto Protocol) and sustainability (Lisbon Strategy).

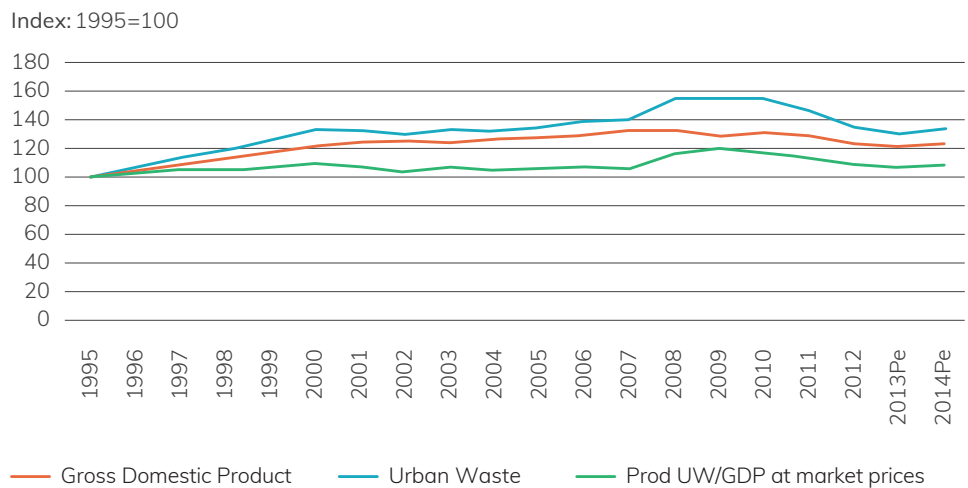
An important change was related to the necessary involvement of the citizens and a more intense focus on prevention – which gave rise to the Prevention Planning for Urban Waste (PPRU), published by the Order no. 3227 of 22 February 2010 – aiming at disintegrating the economic growth of waste production, minimising the negative environmental impacts of its management, and contributing to the sustainable development through a better management of natural resources.

⁹ Transformed into the national legal system the Council Directive no. 1999/31/EC of 26 April that refers to the deposit in landfills, changed by the Regulation (EC) no. 1882/2003 of the European Parliament and the Council of 29 September and which brings into force the Council Decision no. 2003/33/EC of 19 December 2002.

According to the Waste Statistics 2014, in the prior two decades a connection has been identified between GDP variation and UR production. We have to underline, however, that several instruments listed in these chapter are currently being revised.

Figure #03
Ratio between collected urban waste and GDP

Source: INE, 2016, p. 26



The intermediate assessment of PERSU II revealed a significant gap regarding the goals defined for the deposition of Biodegradable Urban Waste (RUB) in landfill, as well as for the capitations of selective collection, so PERSU II was revised in 2014. The third generation of this planning, the PERSU 2020, is currently into force, materialised through the Ordinance no. 187-A/2014 of 17 September.

With separate goals for each SGRU, PERSU 2020 established the eradication of direct deposition of urban waste in landfills up until 2030 and a significant decrease of RUB sent to landfill up until July 2020. Regarding the goals for preparation for reuse and recycling, it is expected, until 31 December 2020, a minimum global increase of 50% in weight of urban waste, including paper, cardboard, plastic, glass, metal, wood, and biodegradable urban waste. In addition, nationwide, until 31 December 2030 the level of packaging waste for recycling shall reach a minimum of 70%, in weight.

The circular economy goals have already been identified, as far as 2035.

Recently the PERSU 2020+ was approved (Ordinance no. 241-B/2019 of 31 July), in order to adjust the measures included in PERSU 2020, following a report from the European Commission warning that Portugal was in risk of non-compliance with the goals of preparation for reuse and recycling, but also as a result of the change of paradigm the new circular economy challenges pose to the sector until 2035, namely:

- Obligation to sort and recycle at origin or selective collection for biowaste until 31 December 2023;
- Preparation goals for reuse and recycling, measured in comparison to the total urban waste, of 55% in 2025, 60% in 2030 and 65% in 2035;
- Recycling goals for an increase in packaging waste recycling, measured at the recycler: of 65%, in weight, by 31 December 2025 and by 70% in 2030, as well as forbiddance to deposit recyclable waste in landfill after 2030;
- Landfill reduction goal for a maximum of 10% of the total urban waste produced until 2035.

PERSU 2020+ identified some priority investment for the municipalities and the SGRU located in the Northern Region, taking the local specificities into account: reinforcement of the multi-material selection collection [door-to-door, PAYT¹⁰/others], in the selective collection of biowaste, in the capacity to make multi-material sorting, in the capacity for biological treatment, programmes and projects for home and community composting and increase in the capacity to reduce and/or valorise the material components of the “rest” fraction, to be developed in a regional context, according to the terms of PERSU 2020¹¹.

¹⁰ Pay-as-you-Throw.

¹¹ APA, 2019c, pp. 109 e 125.



03

About LIPOR

Prior to the creation of LIPOR, each municipality had one or more dumps, where the urban waste was deposited with no previous treatment. Waste management was still at a very early stage, characterised by the lack of investment, at a national level. The main concern was to solve a public health problem.

LIPOR was created in 1982, pushed by the financial difficulties of the company that managed the major landfill in Porto metropolitan area, but also due to the political will of a set of mayors from the region. At that time, this company was considered absolutely strategic¹², because there was no other place where the municipality of Porto or the neighbour municipalities could deposit their waste.

The first major task was, for that reason, the execution of a very thorough study of the region starting from a verification list of over 100 items. It enabled an accurate characterisation of the situation, at a metropolitan and regional spectrum, rather than merely at the level of each municipality. As a consequence, they decided, in coordination with the Central Government which followed the process closely at the beginning, it should from the start have an intermunicipal nature.

The second major task was planning, and it started with an analysis to all the options and alternatives to solve the problem, considering variables such as the typology of waste, geography, orography, and accessibilities and involving universities and experts. They came up with an integrated solution meant to last, at least, 25 years. With the statute revision carried out in 2001 it has now an indeterminate deadline. Prior to its creation, each municipality had one or more dumps, where the urban waste was deposited with no previous treatment. More often than not, these disposal sites were on fire for consecutive days, with the smells, the plagues and the pollution resulting therefrom, and the presence of an informal group of collectors that made a living out of it. Waste management was still at a very early stage, characterised by the lack of investment, at a national level. The main concern was to take the rubbish out of the streets, hence solving a wholesomeness problem.

¹² In 1966, A PRIVATE COMPANY CREATED the first waste transformation plant in the country.

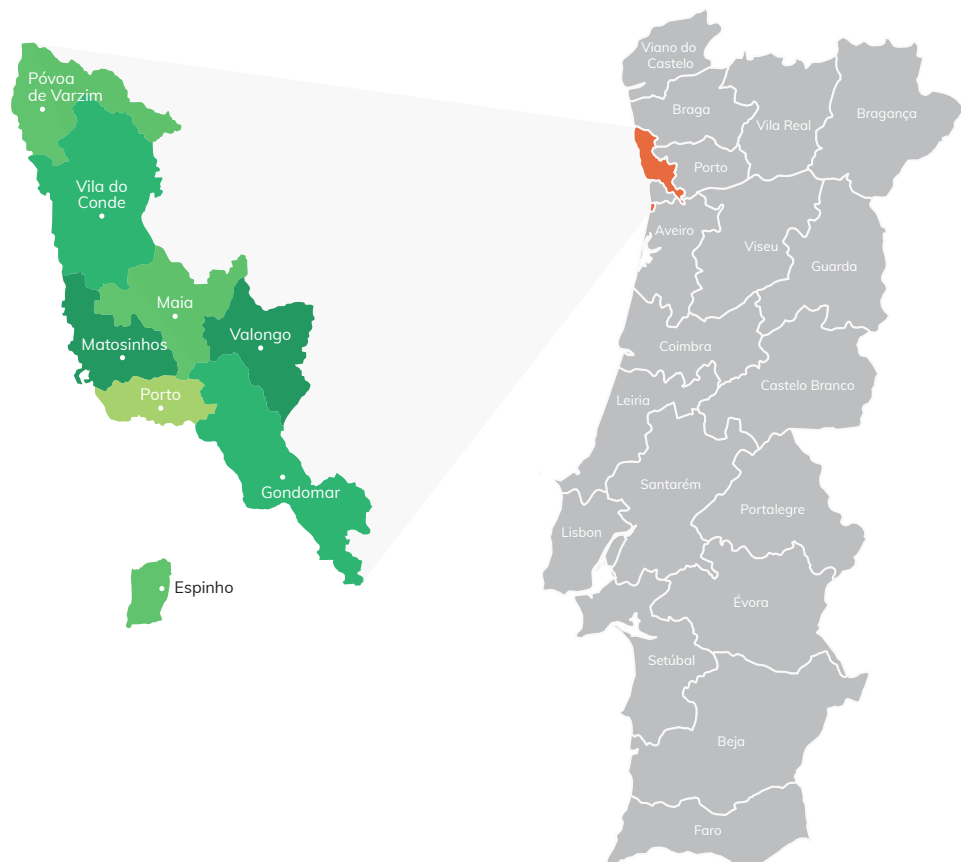
The plant located in Ermesinde registered growing functional difficulties in the 70s, until the State intervened and signed a protocol with the five LIPOR founding municipalities, to run the facility.

Legally speaking¹³, it was decided to create an association of five municipalities. A few years later it was extended to accept three more municipalities. Today, LIPOR is the public entity responsible for the management, valorisation and treatment of waste produced in eight associated municipalities: Espinho, Gondomar, Maia, Matosinhos, Porto, Póvoa de Varzim, Valongo and Vila do Conde.

When LIPOR was created, the associate members (Municipalities) continued to be in charge of waste collection, still undifferentiated at the time, while the association took the lead of its management, transforming it into fertiliser – Fertor – once 50% of the produced waste at the time was organic. Taking advantage of a context when financial help was arriving as part of the pre-accession deal to the European Economic Community, LIPOR planned an integrated system of waste management with several components, supported by a broad regional diagnosis, preparing all the projects and the corresponding specifications to apply for the structural fund ahead. Indeed, Community funds represented 45% of the initial investment, 15% came from the budget of by the associated municipalities and the remaining 40% from a long-term loan.

Figure #04
LIPOR's geographic location

Source: LIPOR, 2007, p. 28.



¹³ From a legal point of view, an association of municipalities corresponds to a legal person governed by public law, created by two or more municipalities to accomplish common specific interests, according to the Law no. 75/2013 of 12 September.

The construction of the main facilities of the LIPOR complex started in the late 90s, when an Energy Recovery Central (CVE) was built in Maia, though the first unit to actually get into operation was the Sorting Centre in Gondomar (1999), the preparatory stage to recycle the material from the selective collection circuits. The existence of a CVE made it possible, on the one hand, to treat large quantities of waste (installed capacity to treat 380 thousand tonnes per year) strongly reducing the dependence upon the landfill. This was strategically meaningful, considering the unavailability of an area suitable to create such a unit, but above all considering it would be the worst option in terms of waste treatment hierarchy¹⁴. On the other hand, it added value to the waste: being a deficit area in energy, the CVE promoted a very significant injection in the National Electric Network¹⁵, in addition to supporting the unit itself in terms of energy.

Throughout the years, LIPOR developed an integrated strategy of waste valorisation, treatment, and encapsulation, based on three axes: Multi-material Valorisation, Organic Valorisation and Energy Valorisation, complemented by a landfill to receive waste that do not have any valorisation potential.

CVE demanded, on its own, extra care regarding the collection process, given the prohibition to burn green waste or inflammable materials, to name just a few examples. At an early stage, the system focused on more robust technologies, but it did not neglect the preparation for selective collection, which requires more involvement from the communities.

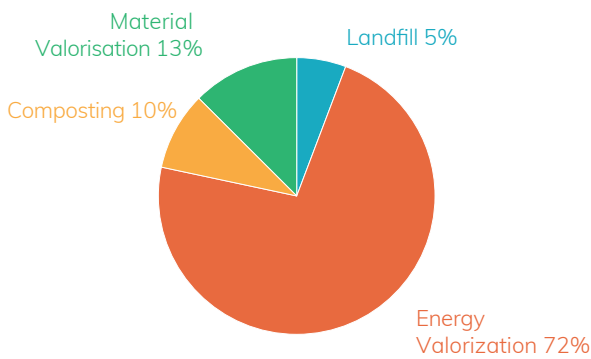
It was this straight connection between selective collection growth, with an initial focus on recycling packages, paper/cardboard, and glass, but without leaving unattended the collection of the “monsters” that had no access to CVE, that made it possible for LIPOR to develop the current high-capacity system. The selective collection practices were intensified in the early 2000s, when a Composting Plant was built to deal with the flow of bio-waste that includes food waste as well as green waste. The plant’s operation started in 2005, entering in full operation mode after a period of tests.

Throughout the years, LIPOR developed an integrated strategy of waste valorisation, treatment, and encapsulation, based on three axes: Multi-material Valorisation, Organic Valorisation and Energy Valorisation, complemented by a landfill to receive waste that does not have any valorisation potential. To sum up, today’s SGRU LIPOR is composed by a Composting Plant, an Energy Recovery Centre, a Sorting Centre, 19 Ecocentres and a Landfill, almost at the end of its lifecycle.

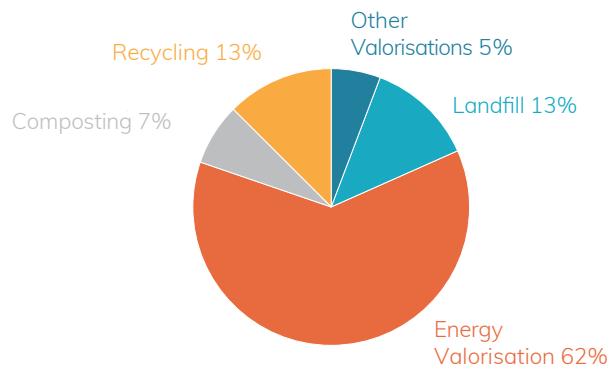
¹⁴ A landfill to serve the geographical region at stake, for a 15-year period, would require an area of 200 hectares.

¹⁵ The unit produces around 25 Megawatts/hour of electric energy, enough to supply a city as large as Matosinhos, with nearly 175 thousand inhabitants.

Direction of the UW collections (Destinations)



Final Destinations



Collection Ecobins



Selective Collection and other Collections (Origins)

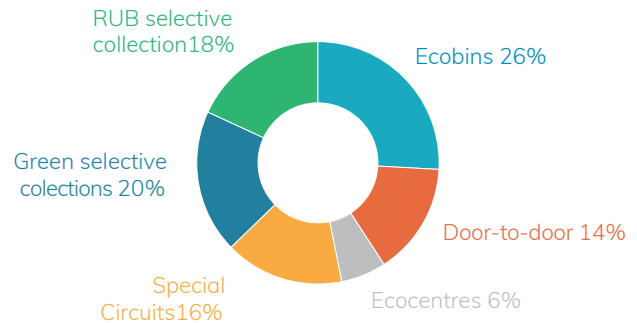


Figure #05

Source: APA, Worksheets SGRU, 2020.

The purpose of the Sorting Centre is to prepare the materials that arrive from selective collection circuits, supported by a structured network of Ecobins¹⁶, EcoCentres and door-to-door collections, to address domestic and non-domestic producers, together with more specific circuits, for instance the Eco-phone Service¹⁷.

The Composting Plant can add value, through the composting process, to circa 60 thousand tonnes of biowaste per year, which results in the production of a high-quality organic corrective, certified for biological agriculture (Nutrimais), brought to market by LIPOR directly. It is in operation for about 15 years, so the unit is reaching its maximum capacity, so a new major and complementary project emerges in the horizon: an anaerobic digestion unit with the production of biomethane, fuel to inject in the network, and the possibility to obtain a liquid fertiliser as well.

¹⁶ At the moment, within the LIPOR universe, there is a ratio of 1 drop-off site per 263 inhabitants, if we count solely the drop-off sites near the streets.

¹⁷ The service is being provided since June 2000 and consists in the free door-to-door collection of recyclable materials such as paper and cardboard, glass, plastic and metal packaging. Available through a toll-free number for the city of Porto – 800 200 345 –, it is specially intended for the tertiary sector (services and commercial), schools with no ecobins, public administration services and Horeca channel (hotels, restaurants, cafés, and similar establishments).

The purpose of the Energy Recovery Centre is the valorisation, in the form of electric energy, of the fraction of the waste that cannot be used through the composting and recycling processes. In fact, it is noticeable that a significant percentage is still directed into energy valorisation (over 70%). One of the SGRU main characteristics is the residual deposition in the landfill; the entity has indeed overcome the goals set by PERSU 2020, when it comes to seize in percentage how much is prepared for reuse and recycling from the biowaste deposited in landfill and in the selective collection of packaging.

Challenge: invert the predominance of energy valorisation

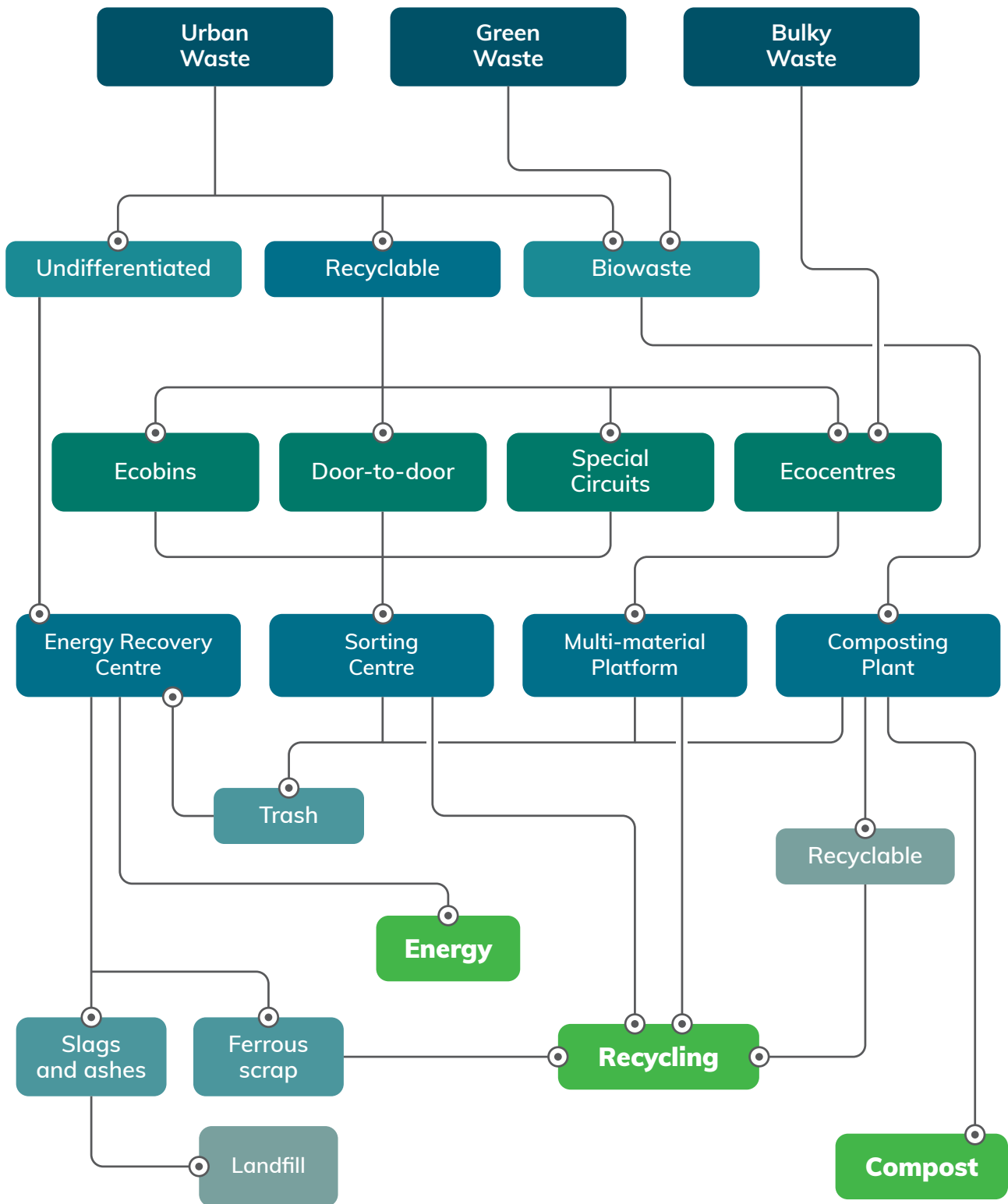
The SGRU LIPOR is still based upon incineration with energy valorisation, something that is urgent to invert, considering the goals for 2025 demand a focus on the preparation for reuse and recycling, which shall become as high as 55% of the urban waste produced.

The challenge to invert this predominance inspired a great focus on the diversification of the selective collection models, namely door-to-door. In the meantime, the Energy Recovery Centre may serve, apart from LIPOR, other municipalities from the Northern region, following a logic of facilities sharing.

LIPOR also promotes a correct direction of other flows, namely used food oils and waste from electric and electronic devices. Therefore, four Waste Electric and Electronic Equipment Recovery Plants (CREW) were created, an initiative that is meant to cover all the municipalities. LIPOR is also developing a way for the sustainable textile waste management, based on a selective collection of that flow. Its waste management strategy is based on annual campaigns to characterise the waste within the undifferentiated and selective fractions (multi-material and biowaste), divided into two sampling periods, according to the technical specifications required by law.

Figure #06
Waste direction flows

Source: LIPOR, 2007, p. 33.





04

Corporate governance

LIPOR manages over 500 thousand tonnes of waste per year, has 202 employees and 40 million euros in turnover. It is the largest public entity working on the waste sector in Portugal.

Adopting a national perspective, the eight LIPOR associated municipalities concentrate around 10% of the population, though they represent only 0,7% of the mainland territory. This geographical area is characterised by a high population density¹⁸ – on average, 1505 inhabitants per KM² -, concentration of industry and other economic activities, where Tourism stands out increasingly. Furthermore, important pendular movements are also noticeable due to the presence of the country's second major city, Porto.

If the waste production in the entire northern region corresponded to around 32% of the national urban waste in 2017, the eight municipalities that form LIPOR produced 524,3 thousand tonnes of urban waste in 2019, which represents a capitation of 1,5 kg/inhabitant per day. Managing over 500 thousand tonnes of waste per year, the association has 202 employees and a turnover close to 40 million euros.

Table #02

Waste production in LIPOR Municipalities

Source: LIPOR Observatory

	2018	2019
Total production (t)	505 974,39	524 283,26
Kg/inhab.day	1,44	1,50
Undifferentiated collection	79,87%	76,69%
Selective collection	20,13%	23,31%

When EGF was privatised, LIPOR became the largest public entity operating in the waste sector in Portugal. The administration considers it essential that the public sector can guarantee the national waste management, given its implication in public health.

¹⁸ The population density varies from 499 inhabitants per KM² (Vila do Conde) to 6341 inhabitants per KM² (Porto).

The fact that LIPOR is an association of municipalities results in idiosyncrasies regarding management and governance models. The decision-making body is the Intermunicipal Assembly, and the executive body is the Board of Directors where each municipality member has a seat, usually the Environment councilors, though it is praxis that the President is a Mayor¹⁹.

The President role does not follow a rotation logic, it results from the associate members consensus and it has been quite stable: throughout its 38 years of existence, LIPOR and its Board of Directors have only counted five Presidents. This stability is also found in the technical staff and is considered a success factor in an organisation that tries not to be permeable to election cycles and to procedure variations, bearing in mind the investments require a medium-long term perspective. It is worth mentioning the political party of the current President is in minority when we look at the eight associate municipalities, but, still, the mayors highlight the need to keep LIPOR above any political or party interests. In fact, the municipalities' representatives insist on playing the role of businessmen in running this organisation, using management tools and models they may not be using at City Hall.

At LIPOR, each municipality has a vote in the Board of Directors, regardless of population density, waste production²⁰ or territorial extension. In this simple and linear process, there are 5 effective members and 3 substitute members, following an annual rotation logic, but they all take part in the Board meetings, have access to the agenda and propose discussion topics. Despite only the effective members have the power to vote, what happens is that all decisions are unanimous. The Directors are not paid.

Looking through the management lens, LIPOR's performance is controlled by strictly defined indicators that make it possible to assess how far is the strategic vision being implemented: sustainability, in all its dimensions. The organisation has developed and implemented its own "Balanced Scorecard" model, together with a set of other tools to analyse global performance on a daily basis and to follow-up the results in any given area.

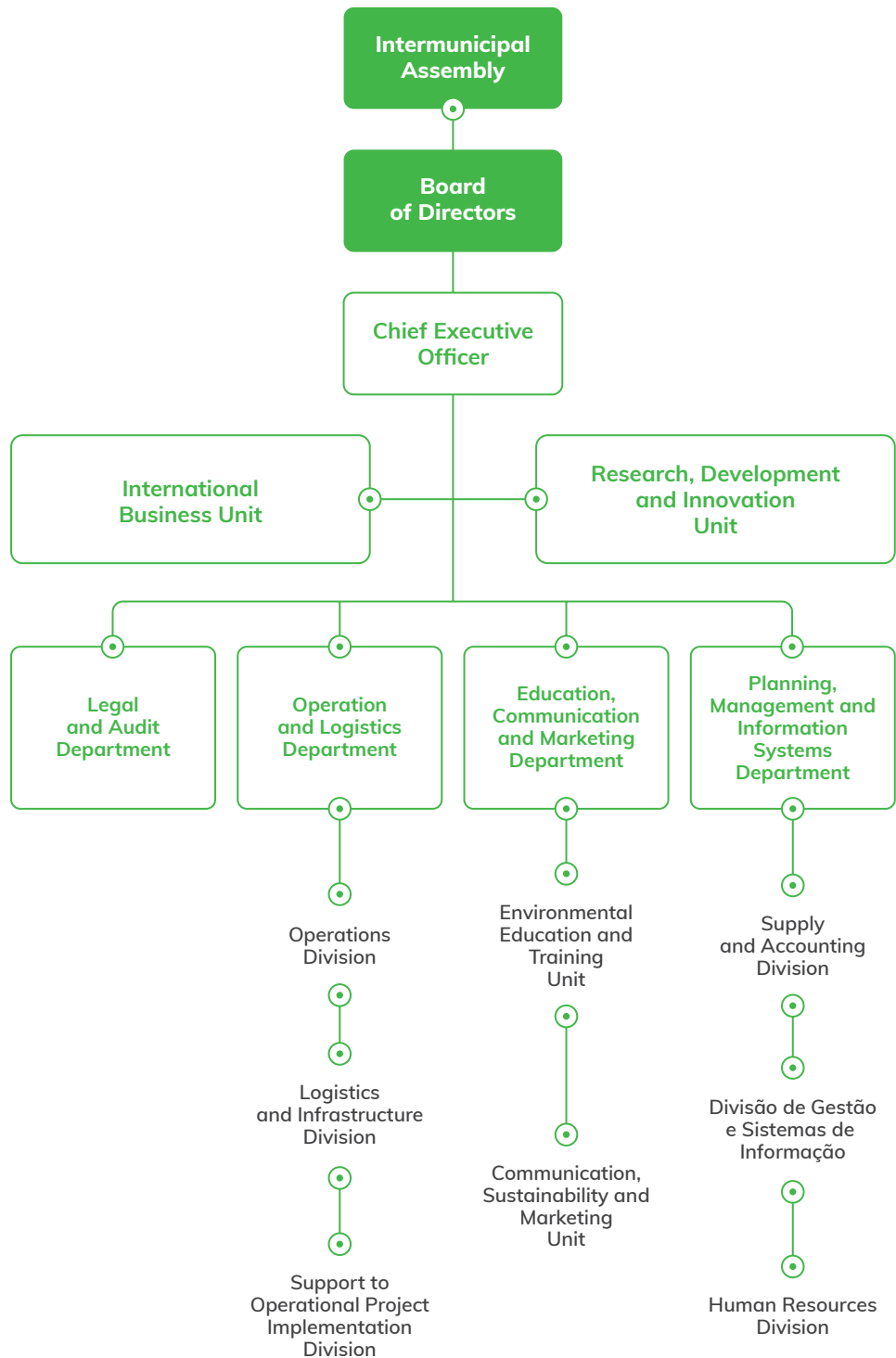
The strategic vision, the goals and the path defined by the Board of Directors are put into practice by a team of technical experts that proposes, every step of the way, the necessary measures to reach those goals, considering the best and updated practices in waste management. The Chief Executive Officer, appointed by the Board of Directors and to whom he reports directly, is the link between the political bodies and LIPOR's technical structure. The same person plays this role since the association was founded.

¹⁹ At the moment, the Mayor from Póvoa de Varzim is the Head of the Board of Directors. He is in his second term, after succeeding to the former President from the same municipality. From 1982 to 2005, the Board of Directors was led by the representatives of the Valongo municipality.

²⁰ The Porto municipality assumes particular relevance in this territory, not only because it is the second largest city in the country, but also because it is responsible for more than half of the waste produced in the territory covered by LIPOR.

Figure #07
LIPOR Internal Structure

Source: LIPOR



The credibility of the work LIPOR develops because it provides essential services to the community is not, per se, an asset, but results from the outcomes it keeps achieving, the path it follows and the permanent focus on continuous improvement and excellence. However, its legal model imposes a set of rules that restricts its agility, especially regarding human resources management – limited to the civil servant wage table – and the complexity of legal procedures. To a large extent, this explains the option for the externalisation of the waste treatment units. Each one of them is operated by a different entity²¹, usually major corporations that assure LIPOR's strategic objectives, but they are on the market and have their own objectives. Hiring this type of services provision undergoes a transparent, public, and thorough process that meets the legal requirements in force.

On the one hand, the construction and operation of the Energy Valorisation Centre was licensed because it required technical know-how and specialised labour force that did not exist in Portugal by the time the project was launched; on the other hand, the Sorting Centre began by being internally operated, but then moved into subcontracting motivated by the lack of flexibility to hire civil servants, harming a non-stop operation with periods of high activity.

Given this context, a new legal model was studied to maintain the intermunicipal trait and to keep LIPOR a fully public company, but simultaneously more agile, bringing innovation, dynamism, and modernity to the statutes of an organisation whose action goes beyond waste.

The new trends in the waste sector are associated with industry-related challenges, global environmental challenges, and social and behaviour changes, hence reinforcing the importance of a sustainable management of urban waste. As a consequence, and in order to reinforce the position as a state-of-the-art entity within this sector, LIPOR emphasises transparency, continuous improvement and innovation, broadly demonstrated approaches that materialise, for example, in the promotion of circular purchases, in a low carbon strategy and in the promotion of several projects to preserve biodiversity.

LIPOR's guiding principle is sustainability, and the environmental and social axes are a priority over economic profitability. This positioning reflects in the choices it takes for waste treatment, focused on environmental quality. Hence, only a small part of the waste treated by the association is deposited in landfill, which is the cheapest, but environmentally more harmful solution, in a coun-

²¹ The Composting Centre has always worked under a subcontracting regime, and is currently being explored by HIDURBE, whose contract ends in 2023. The same applies to the Energy Recovery Centre, which was object of a long, 20-year contract signed with Port'Ambiente, one of the companies from the Veolia Portugal group. This contract expires in 2025, after a supplementary 10-year period. The Sorting Centre is being operated by Ferrovial Serviços, since 2016. This subcontracting model relies on a critical success factor which is the interdependence between the several stages of a project (design, construction, supply, and operation).

try where more than half of the urban waste has that final destination²². The sustainability principle also rules the construction of solid facilities, where the quality, environment, safety, and hygiene systems are duly implemented.

Throughout the last nine years, after signing an Energy Consumption Rationalisation Agreement with the Directorate-General for Energy and Geology (DGEG), LIPOR carried out several actions aiming at improving the efficiency of its production processes and energy performance. Under this scope, the energy self-sufficiency of both CVE and CVO are remarkable. In fact, CVO not only is self-sufficient, but it is also exclusively powered with renewable energy, due to the recent installation of photovoltaic panels. After the regeneration of the former landfills in Ermesinde and Matosinhos and their conversion into playgrounds, it was made full use of the biogas energy potential. In addition, LIPOR has the commitment and the responsibility of closing, sealing, and assuring the landscape recovery of the Vila do Conde and Póvoa de Varzim landfills.

Strength: LIPOR Waste Observatory

LIPOR Waste Observatory is a portal installed in the institutional website to provide reliable and transparent information to the community. It releases quantitative, global, and municipal data about the main waste flows.

The municipal information includes data on population, waste production, available equipment, and local performance, regarding the flow of selective collection and the flow directed to energy recovery, as well as the impact on CO₂ emissions and the tonnes of CO₂ avoided.

With this instrument it is possible to follow-up both the municipalities individual situation and LIPOR overall performance concerning the national and the European goals. Additionally, it encourages the co-responsibility of the associate members towards its fulfilment.

This sustainability journey inspired LIPOR's commitment towards the United Nations Sustainable Development Goals on Agenda 2030. For instance, with the production of its natural agriculture corrective, Nutrimais, LIPOR contributes to maintaining or increasing the soils' natural fertility and, consequently, to the "zero hunger" Sustainable Development Goal. The river Tinto Restoration Project is meant to check the evolution in the water quality, enabling imperative interventions to recover the river, bring to life the riverside ecosystem and set its sustainable uses, addressing the Sustainable Development Goal "clean water and sanitation". The Adventure Park is an open space for leisure, physical activity promotion and awareness as a result from the process of closing,

²² 2019 data released by APA draw the attention to the fact that three out of five kilos of urban waste (57,6%) produced in Portugal end up being deposited in a landfill.

recovering and conferring environmental and landscape valorisation to a landfill, under the pursuit of “sustainable cities and communities” Sustainable Development Goal.

Among all the projects that meet the spirit of the Sustainable Development Goals, the LIPOR 4M Strategy - less Waste, less Carbon, more Climate, more Biodiversity stands out. It encompasses several objectives including the fight against climate change. Given this context, the association defined as a goal the reduction of greenhouse gas emissions in 30% until 2030, one step further after overcoming the goal set for 2020 prior to the deadline, as it registered a decrease of 21% in the emissions (-84.543 t CO₂e) when compared to 2006, the reference year.

In parallel with the pursuit for environmental sustainability in its activity, LIPOR anticipated a scenario where the waste sector would join the carbon market, which would require the payment for its CO₂ emissions. This scenario would have a huge impact on profitability, so, in 2007, LIPOR gathered efforts and launched a study to calculate its carbon footprint for the first time, following its waste management activity. This initiative took place in 2006, and from that year onwards mitigation goals have been defined. A carbon strategy was then launched to minimise the emissions, an innovative path supported by compensation measures.

Strength: zero carbon fleet

Under the scope of the 4M strategy, LIPOR promotes the compensation for the inevitable emissions that come from the use of its fleet, guaranteeing the sequestration of those emissions in equivalent carbon quantity, through national forest projects followed closely by Ponto Verde Serviços. In 2019, LIPOR made accounts and compensated a total emission of 276,7 tCO₂e²³.

Since then, the reforestation campaigns were reinforced both in the country and abroad, namely at the Hill of Santa Justa, located in the surroundings of the organisation’s intervention territory, hit by forest fires in recent years. LIPOR developed its Square Meter Programme, launched in 2015 for the adoption of native forest areas. The Square Meter Program obtained an approved application under the terms of the Biodiversity and Nature Conservation Programme (Environmental Fund for short), which allowed another 10ha to be added onto the initial 12ha in the Nature 2000 network in the Porto Hills, thus contributing to the protection and conservation of species identified in the Habitats and Birds Directive or considered rare species.

Internationalisation is another of LIPOR’s strategic axis to improve the business, boost the organisation and its brand. As such, the Association’s Inter-

²³ Tonnes of equivalent carbon dioxide - 1 tonne of carbon dioxide matches 1 Carbon credit.

national Business Unit, whose mission is to encourage LIPOR's internationalisation strategy, based on the sale or provision of technical and specialised services worldwide, offering tailor made solutions adjusted to the dimension and the culture of the client countries. In 2019, LIPOR kept business and prospective relations with 26 countries.

About 20 years ago, LIPOR started its certification journey, which was very rare, mainly in the public administration context. This initiative was not to exhibit the flag, but to work as a management tool. To this day the organisation sums six certifications: quality management, environment management, occupational health and safety management, social responsibility, energy management and research and innovation management. Moreover, all the suppliers must hold a certification by one of the quality management systems.



05

LIPOR Financing Model

The last LIPOR consolidated report addressed the financial year of 2019 and indicates a turnover of around 40 million euros and a positive net result above two million euros. This represents a 1,1% growth compared to the same period of the previous year, explained by the positive evolution in product sale and services provision around 0,4% and 2,1%, respectively²⁴. Product sale represents already 60% of the organisation's turnover, a weight LIPOR expects to enhance in the upcoming financial years.

In line with previous years, LIPOR sought to increase the quantities of recoverable materials to recycling and organic valorisation, hence achieving a good performance in revenue from the sale of recyclables and compounds, with increases of around 13% and 4%, respectively. The increase in the turnover made it possible to minimise the impact on EBITDA, given the evolution in the operational costs that are a normal consequence of the activity increment.

Table #03

Direct economic value generated (€)

Source: LIPOR, 2020, p. 47

Revenue	2017	2018	2019
Sales and services provision	38 723 275	39 582 550	40 027 327
Supplementary income	218 351	365 603	336 256
Grants and transfers	6 599 533	7 028 772	7 193 027
Interests and deposits	47 724	28 418	5 918
Cash discount	0	0	0
TOTAL	45 588 885	47 005 343	47 562 527

²⁴ Products sale represented around 23 million euros and services provision almost 17 million euros.

Unlike many public entities, LIPOR was never in deficit, closing all the financial years with a positive result. Both the turnover and the EBITDA keep growing steadily throughout the years, and the Board of Directors established as a goal to reach 50 million euros in turnover until 2030. By taking the stand to look at waste management through the resource lens, its approach relies on the projection of a circular business model. In line with the state-of-the-art waste management concepts, the organisation defends adding value along the production cycle through the reintroduction of “waste” as “resource” in the value chain.

LIPOR closed all the years with positive results. Part of those results are invested in environmental and social projects, for the benefit of the community.

By the end of each financial year, the Board invests the results, either in equipment for selective collection, or in environmental and social projects, for the benefit of the community.

Over the years, LIPOR attempted to get national and Community support to fund its investments. Indeed, to reach the objectives it established, it is crucial to obey the guidelines of the Structural Programmes, in order to make the most out of the existing funding possibilities. Until the end of 2019, 88 applications have been submitted to different structural funding programmes, 23 of which received assent, an approval rate of around 26%. Hence, the investment during the financial year of 2019 was approximately 7,5 million euros, 19% of the revenue from national funds and 4% from European funds.

Among the different existing funding programmes, we hereby highlight those particularly important for presenting the best and most suitable opportunities within the waste sector: Portugal 2020, in particular, THE Operational Programme for Sustainability and Efficient Use of Resources (POSEUR)²⁵, as well as the Community programmes Horizon 2020²⁶, LIFE²⁷ and INTERREG²⁸.

Credit was the resource used for larger investments, namely the large loan LIPOR got from the European Investment Bank to build the CVE, now on its final payment stage. It was an unprecedented investment In Portugal, it took a long time to get the approval of the associates and the bank. In 2012, the debt was renegotiated, adjusting the amortisation plan, and extending the deadline for an additional two years, which

²⁵ Collection equipment is being bought under the scope of this programme and then sent to the municipalities, according to the local needs.

²⁶ European Framework Programme for Research and Innovation for the period 2014-2020.

²⁷ The LIFE programme 2014-2020 is a funding instrument for the environment and climate action established by the Regulation (EU) No. 1293/2013 of the European Parliament and of the Council of 11 December 2013, with the objective to contribute to sustainable development and to the achievement of the objectives and targets of the Europe 2020 Strategy and of relevant EU environment and climate strategies and plans.

²⁸ European Territorial Cooperation Programme focused on encouraging economic, social, and territorial development in harmony for the entire Union, in a context of sharing actions and policy exchanges between national, regional, and local players from different member-states. Interreg is organised around three cooperation categories: cross-border (Interreg A), transnational (Interreg B) and inter-regional (Interreg C).

required studies and negotiations, as well as the endorsement of the Ministry of Finance. New investments are expected to take place soon, given the fact that all treatment units are in operation for 15 to 20 years. The SGRU economic and financial sustainability, a requirement to pursue environmental goals, demands that tariffs are charged to translate the effective waste management costs, from collection to the costs of installation, operation and maintenance of facilities and equipment. According to LIPOR statutes, the organisation management shall be based on profitability criteria, both in the activity design and operation, as a way to keep economic and financial balance. Thereto, charges must apply to cover the costs.

The financial contributions of the associate municipalities, both for investments and for current expenses, are established by the Intermunicipal Assembly, after proposal from the Board of Directors. In addition, the municipalities pay a tariff per tonne of waste sent for treatment at LIPOR's CVE.

In Portugal, the fee for waste is frequently charged by municipal services to the citizen, in the water bill, to support part of the cost charges with waste management and treatment.

Table #04
Tariff system

Source: Information made available by the municipalities, 2020

Municipality	Domestic users		Nondomestic users	
	Flat rate	Variable rate	Flat rate	Variable rate
Espinho	3,969€	0,6138€ ou 0,9884€/m ³ (bands 1 and 2)	3,969€	1,9456€/m ³
Gondomar	2,2265€	0,6281€/m ³	10,0284€	0,7144€/m ³
Maia	3,61€	0,62€ ou 1,00€/m ³ (bands 1 and 2)	3,61€ (15 mm)	1,95€ ou 2,20€/m ³ (bands 1 and 2)
Matosinhos	3,9454€	0,6375€ ou 1,0366€/m ³ (bands 1 and 2)	3,9454€ (15 mm)	1,9857€ ou 2,2099€/m ³ (bands 1 and 2)
Porto	3,4684€ (≤ 25 mm)	0,52€ ou 0,9856€/m ³ (bands 1 and 2)	3,8152€ (≤ 20 mm)	1,8036€/m ³
Póvoa de Varzim	4,12€	0,77€ ou 1,03€/m ³ (bands 1 and 2)	4,38€	1,29€ ou 1,55€/m ³ (bands 1 and 2)
Valongo	4,6749€ (≤ 25 mm)	0,8206€ ou 1,1984€/m ³ (bands 1 and 2)	7,0124€ (15 mm)	0,8206€ ou 1,1984€/m ³ (bands 1 and 2)
Vila do Conde	9,9674€ (13 mm)	1,0871€ ou 1,8979€/m ³ (bands 1 and 2)	9,9674€ (13 mm)	2,6129€ ou 1,8979€/m ³ (bands 1 and 2)

mm - millimeters concerning the nominal diameter of the meter

The municipalities within LIPOR service area use a two-party tariff system, adding a variable rate, indexed to water consumption, to a flat rate²⁹. The variable rate is influenced by M3 of consumed water.

The location and the water consumption are crucial factors to interpret the tariff system, as they interfere directly in the rate applied to waste and making it difficult to make an exact allocation of costs to the final user. In other words, the rate the citizens pay does not correspond to the amount of produced waste, it does not match the compliance to pro-environmental behaviour and, for those reasons, harms social equity. Therefore, LIPOR carried out studies to develop a tariff model coherent with the Pay-As-You-Throw (PAYT) approach, as well as a pilot project in the Lidador area, in the municipality of Maia, guided by the pay as you pollute principle³⁰.

Besides promoting the SGRU economic viability, this type of tariff system is fairer from a social point of view³¹. Several international experiences indicate environmental advantages, because it encourages an overall reduction in the quantity of produced waste (prevention) and an increase in sorting recyclables and biowaste, which do not penalise the rate at stake.

²⁹ The flat rates are charged per type of user and per water meter, and they are likely to be indexed to municipal characteristics, such as frequency and collection system.

³⁰ <http://www.payt.pt/oprojeto>

³¹ Though a PAYT system may give rise to illegal depositions and additional concerns for large or low-income families, it would have to be compensated with costs reductions, exactly what happens with water, electricity, and other essential services.



06

Recycling and circular economy programmes

LIPOR's ambition is to stop being just a services provider to have a range of products in a competitive market.

LIPOR is committed to boosting the topic of Circular Economy in Portugal. Thereto, it shares new strategies and searches new business models, which have already earned LIPOR the recognition as "Highly Commended" (2015) under the scope of the Circular Economy strategy. Its entire activity has an impact on this level; the waste is fully utilised so to be reintroduced in the productive chain, for the manufacturing industry, by sending paper/cardboard, glass, plastic, wood, steel, and aluminium to recycling plants. As far as undifferentiated waste is concerned, LIPOR takes advantage of its heat potential, so it is transformed into electric power that joins the national electric network, hence avoiding the deposition in landfill and the subsequent methane emissions, a powerful greenhouse gas. The next step will be to transform in energy just what cannot be valorised through recycling (either multi-material or organic), thus avoiding the consumption of primary raw materials and natural resources.

To sum up, the purpose is to add value to the waste, transforming it and putting it on the market, under principles of circularity and sustainability. All future plants will be designed from a circularity point of view and planned according to the output that results from the waste treatment. As a consequence, the new Composting Plant is expected to produce biogas through a process called anaerobia digestion and LIPOR has already studied which subproducts will result from that process. One of those subproducts, biomethane, will be used as fuel to inject in the network.

Under this context, the organisation has created a Research, Development and Innovation Unit, in 2016, to encourage a culture of innovation through creativity, to gain and retain knowledge, to foster partnerships and funding and Research and Development in the waste area and, mainly, to carry out projects to create new sustainable products. This contribution increases the value added to the organisation at three levels: economic, environmental, and social. Underneath there is a disruptive logic: LIPOR's ambition is to stop being just a services provider to become a prominent transformation and production entity in a competitive market. More than just a R&D challenge, this challenges LIPOR's organisational culture, the workers mindset, and the brand, which is still extremely associated to waste treatment.

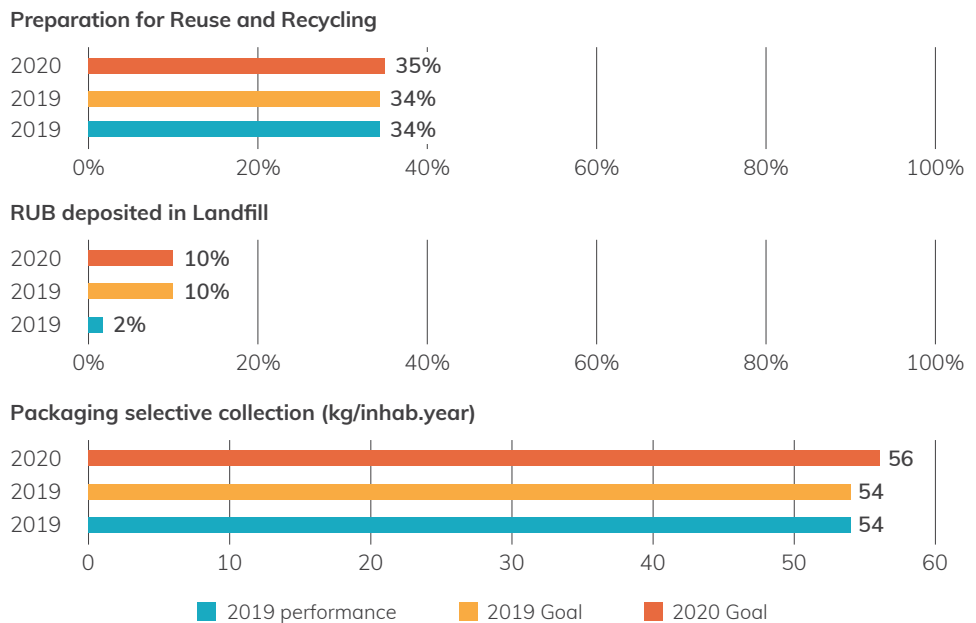
LIPOR was the first waste sector entity to have a certification in Portugal; it is certified in Research, Development and Innovation (RDI) by the standard NP 4457:2007 under the scope: “Research, Development and Innovation of Sustainable Solutions in Waste Management”. The purpose is to use the raw material it receives and add value to it through the creation of a diversified range of sustainable and innovative products that are then placed in the market.

The identified priority areas are threefold: the valorisation of incineration slag to serve as construction materials, agriculture products, and purity level materials, for instance preparing high quality polymers and metals to be reintroduced in industry productive processes. The valorisation of around 70 thousand slag tonnes may contribute to the production of construction materials and even decoration objects. Concerning agriculture products, the purpose is to diversify the range of Nutrimais products, which will improve the soil and the plants it grows. In this context, studies are being carried out to produce substrates (22 prototypes have already been made) and liquid fertilisers, 100% natural, that upon certification will be qualified to biological agriculture. At last, in partnership with researchers from Minho University, LIPOR is also studying how to take advantage from plastic.

Together with the municipalities, huge efforts are being made to diversify the selective collection models. They are walking a path to invert the predominance of energy valorisation and work so the association can continue to fulfil its goals. It is true that the objectives set for SGRU LIPOR are being reached (check graphic below), but it requires extra effort to reach the 2025 goals, when the preparation for reuse and recycling shall represent 55% of the produced urban waste.

Figure #08
PERSU 2020 Goals

Source: APA, SGRU Worksheets, 2020



The new goals for the quantity of waste to be sent to reuse and recycling triggered the reinforcement of door-to-door selective multi-material collection, both in residential and non-residential sectors. The current operation relies inevitably on raising the population's awareness³² and on technological solutions. The bins – to sort paper/cardboard, glass, packaging, and metal – are equipped with electronic RFID UHF readers, which show the citizens' behaviour regarding quantities produced and type of flow and support the municipalities management and decision-making process to later feed data reporting to LIPOR Board of Directors and the project's funding bodies³³. Some municipalities have also delivered bags for the selective collection of green waste, also with an identification system.

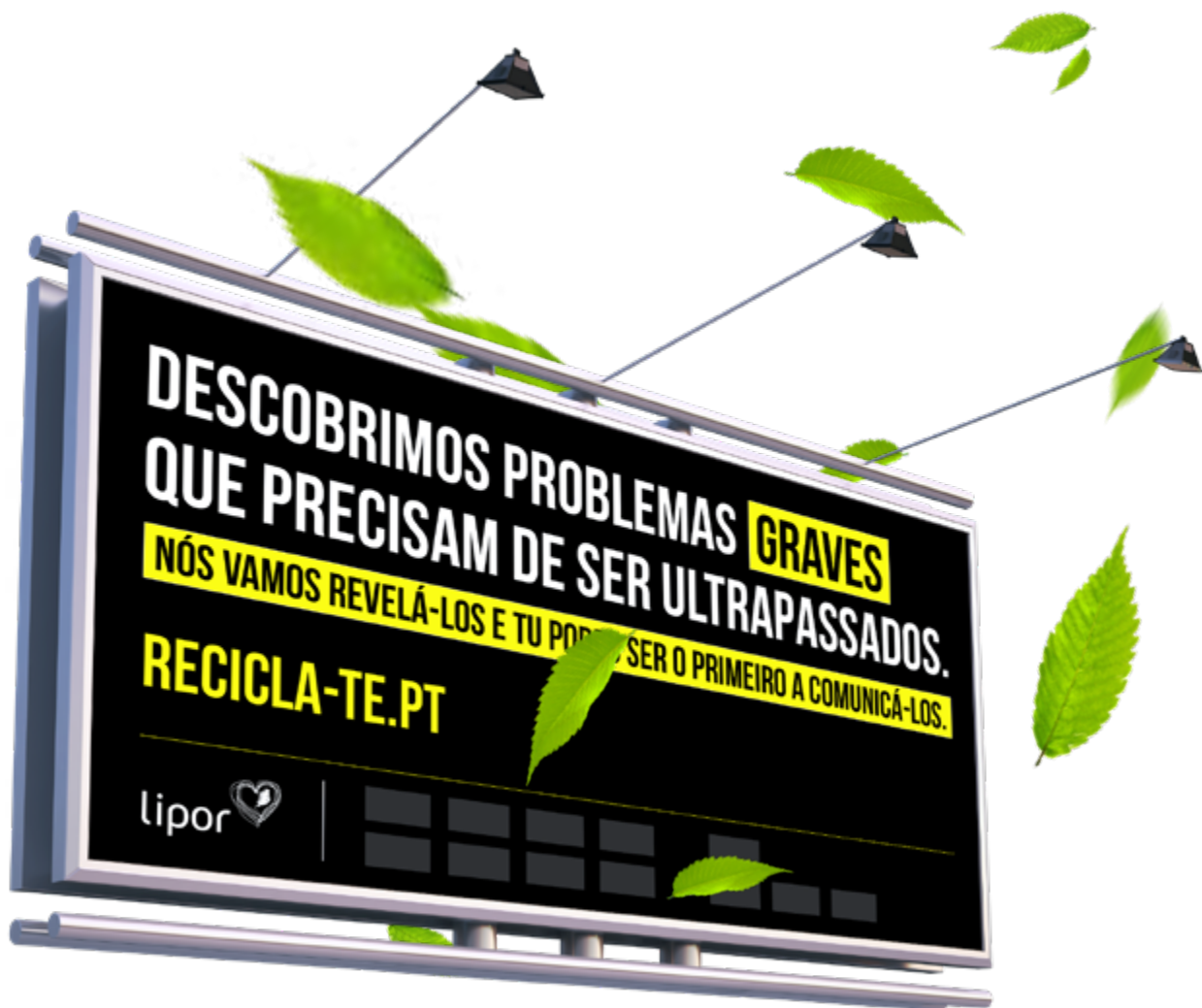
LIPOR moved from the collection of containers placed near public roads six days a week into a collection that covers all door-to-door flows in different days. Today's operation includes around 22 thousand dwellings from seven municipalities. In addition, there is the entire population from Maia, where this strategy began to be implemented about a decade ago and has its entire territory covered. The new wave of door-to-door projects was submitted in a 2015-2016 application and its implementation began in early 2018, and ever since increases the number of homes and population included.

LIPOR foresees major investments, within the expansion of selective door-to-door collection projects, in the construction of new valorisation facilities and in the requalification of the existing one, with the necessary adjustments to new technologies. Considering the expected increase in the quantities of waste produced and the objectives and goals declared in PERSU 2020+, this investment is considered essential to face the lack of capacity of the existing infrastructures, regarding sorting processes and composting.

The new goals inspired a change in the recycling communication strategy in 2019, supported by the scientific approach of Semiotics. Recycle yourself! Change your attitude, change your life, transform yourself – the linguistic change resulted from an internal reflection about what was missing so that people would understand the need to recycle. The change of paradigm in the way LIPOR communicates recycling aims at leading the citizen to an important reflection: unsorted/unrecycled waste is rubbish, sorted/recycled waste is resource.

³² The communication and awareness campaign was based on a positive door-to-door approach, introducing the individual advantages the citizens had by joining this collection service that relies on proximity, convenience, sustainability and solidarity.

³³ Most projects are POSEUR funded.



* We have found some serious issues that need to be solved.
We will reveal them, and you may be the first the communicate them.
Recycle yourself – [recicla-te.pt](https://www.recicla-te.pt)



07

Communication, education, and environmental awareness

It is important to invest in communication and awareness, as the system does not work without the citizens.

Its positioning sets LIPOR as a reference organisation in waste valorisation, social responsibility and ecoefficiency. Thereto, it develops several social- and ecological-related projects, particularly regarding education, environmental awareness, recovery of environmental liabilities, and concerning sustainability. The Education, Communication and Marketing Department plays a transversal and multifunctional role that works with every unit within LIPOR to support its global strategy and the organisation major projects.

The emphasis on the brand started roughly 20 years ago, when the organisation underwent a significant change in its integrated system, while at the same time it invested strongly in awareness and corporate communication campaigns. The assumption was that it is not enough to build plants – with state-of-the-art technology and treatment systems, with minimum environmental and visual impact on the surrounding communities –, it is equally important to invest in communication and awareness, as the system does not work without the citizens.

At an early stage, the organisation defined its vision and the repositioning of the LIPOR brand, focused on creating a clear and reliable brand, guided by an open-door policy that welcomes visitors to see how it works, to demystify. Ever since, the association listens to the relevant stakeholders twice a year about the topics materially relevant for LIPOR, under the context of its sector and of the community it serves. The communication has very objective specificities and goals for each stakeholder: shareholders, regulatory authorities, suppliers, citizens, among many others. To underline this aspect let us refer the organisation of the European Waste Prevention Week when LIPOR led initiatives with over 100 partners.

Looking at the performance pyramid of waste management, the first axis is prevention. LIPOR developed, throughout the years, several interventions, and initiatives to embody that strategy, in particular, under the field of food waste. A few examples are the Embrulha (wrap it) project for restaurants, to tackle food waste; the 54 organic vegetable gardens distributed by all the municipalities in the geographical area of LIPOR, which exist to prevent biowaste and to produce sustainable ingredients; or the project Terra a Terra (earth to earth) about composting at home. In parallel, LIPOR created Horta da Formiga (Ant Garden), a home composting centre to show all possibilities of biowaste valorisation.

All the campaigns are supported by work methodologies that guarantee a diagnosis, the definition of a plan, continuous follow-up, and assessment. LIPOR realised that to reach continuous, consistent outcomes it was necessary to work together with several audiences. The investment on environmental education is always a medium or long-term investment, considering the assumption that mentalities cannot be changed overnight: the awareness addresses topics related to the citizen's behaviour, but causing a change in behaviour is hard work.

A knowledge-sharing strategy resulted in the creation of Academia LIPOR, a training centre with an annual plan that includes training courses from prevention to circular economy, from valorisation and waste treatment to a more conceptual, legal-related area. The Academy also develops tailor-made solutions to answer a market failure in terms of waste training for companies, especially for those that hold certifications by international environmental standards.

Strength: Project GENERATION+

The Generation+ project, whose target is the school community, is one of the most successful models of raising environmental awareness promoted by LIPOR. It all starts with a diagnosis, and then characterises the group of schools, or other institution, and identifies the members of the community that will be in charge for the project. The diagnosis describes what is going on in terms of waste management, but also regarding other environment issues, such as energy, water, or food waste. As a result, from that initial audit, a plan of action is developed, where both partners define deadlines and priority intervention areas. Then the plan is implemented, with several awareness activities and a final audit that may or may not lead the institution to receive a green heart certificate.

The methodology rapidly went beyond school context and is nowadays implemented in all types of entities, from courts to welfare institutions or companies. So far, LIPOR received 269 applications and awarded 146 certificates.

An additional advantage is the possibility to visit LIPOR's treatment units to demonstrate certain waste management practices. Offering in-class, e-learning and b-learning training formats, the academy implemented online training in areas such as composting, during the pandemic.

The principle of knowledge sharing and cocreation also led LIPOR to establish partnerships with several entities, under the scope of its communication and awareness strategy (the Girl move Academy, the project África 2Eco, the Oceanário or Serralves Foundation, to name but a few examples) and made it join several national and international entities, such as ACR+ - Association of Cities and Regions for Sustainable Resource Management, ISWA – International Solid Waste Association and ECN – European Compost Network.

Community involvement

LIPOR takes its social responsibility very seriously, as it is a public organisation providing a service to the community in a sector related to public health and environment issues.

Given this sensitivity, the organisation designs several projects to be implemented in the communities where it intervenes, bearing in mind the population needs and the environmental impacts LIPOR was partly responsible for in the territory. The river Tinto restoration project, developed with other local entities, represents this principle beautifully, considering that part of the old Ermesinde / Baguim do Monte landfill, around 19 hectares long, received from the 70s onwards most of the rubbish produced by the associate municipalities, having a huge impact on the riverside ecosystem. The purpose is to give back to the community what, for a few years, was not so well taken care of. The reforestation programme Square Metre also exemplifies this organisational mission of making a positive, environmental, and social impact.

LIPOR looks at these projects from a value sharing perspective: the citizen is motivated to be part of the selective collection, but receives in return an adventure park, the restoration of a river, facilities the community can benefit from, as leisure and sports spots.

PONTO FORTE: PARQUE AVENTURA

The Adventure Park & Ecological Trail, created once the Ermesinde landfill was closed, received 70.633 visitors in 2019. Open all year, but with high season from May to October, the park has a leisure component the families can enjoy, they can walk, make picnics or even birthday parties. In addition to the trail, the complex also has a radical park, tree top walks, playground, minigolf field, football field, parking, and toilets.

LIPOR defined an annual educational activity plan for the complex, under the scope of its biodiversity protection plan. Once the natural capital of the space is treasured, due to the restoration of a section of Tinto river, it is possible to develop ateliers and carry out environmental visits, to get to know the fauna and flora species under preservation.

The 2019 consolidated report informs that during that economic year LIPOR invested circa 591 thousand euros in the community, in environmental awareness and prevention campaigns, in composting and biological agriculture projects, but also in environmental and landscape restoration projects. The community involvement and the projects with a positive social and environmental impact help explaining why there are no NIMBY³⁴ protests in LIPOR's intervention territory about its waste treatment and valorisation units.

³⁴ Not in my backyard.

Table #05

Operational costs (€)

Source: LIPOR (2020). Integrated report 2019, p.47

Operational costs	2017	2018	2019
Suppliers and external services	42 410 854	44 135 781	46 810 946
Salaries	3 946 593	4 073 171	4 368 906
Payments to capital suppliers	2 403 582	1 947 750	1 530 704
Taxes	18 917	7 142	3 573
Investments in the community:	225 785	183 908	591 806
– Environmental awareness	101 805	71 715	483 088
– Prevention projects	17 362	343	1 945
– Home composting and biological agriculture projects	106 617	73 320	59 120
– ERMESINDE LANDFILL / Adventure Park	6 621	0	25 135
– Promotion of food waste reduction from catering and citizens	0	24 981	22 518
TOTAL	49 005 731	50 347 751	53 305 935

In the land where the Sorting Centre and the CVO were created there was once a composting centre and a landfill that released intense odours. LIPOR “inherited” the landfill in conditions far from ideal, and the surrounding community suffered from several years the negative consequences of living close to it. When it was decided to build the Sorting Plant and, later, the Composting Plant, that experience was crucial to make sure LIPOR had operational units whose related environmental impacts were controlled and smoothed (for example, smell and noise) and with a pleasant surrounding landscape.

As far as the Energy Recovery Plant is concerned, due to its higher potential to generate NIMBY effects, LIPOR designed an involvement plan that included, among many initiatives, taking local authorities and policy makers to visit similar facilities in Europe, in urban areas, the organisation of information sessions about the project and the constitution of a monitoring committee that exists to this day. The work with the stakeholders and the plant project were simultaneous. Believing transparency to be fundamental, LIPOR releases on a regular basis the plant’s performance and emissions reports.



08

The future of LIPOR

In Portugal, the waste sector is working within a protected and little competitive system, supervised by the Ministry for the Environment and Climate Action. However, at this point, the sector is undergoing change, which poses new challenges to entities such as LIPOR.

The organisation provides a service to the associate municipalities, which pay a tariff per tonne of treated waste. Furthermore, it sells a few products (not integrated into the regulated market in force) in competitive market. Regarding the recyclables there is the Integrated System for Packaging Waste Management (SIGRE), which, until recently, offered interesting counterpart values, now being revised down. Looking at the CVE production, LIPOR receives a bonus on the sale of electricity as green energy (but the bonus system is currently under revision).

A change of paradigm, towards an open market, represents a major change and a challenge for both LIPOR and the sector.

A change of paradigm, towards an open market, represents a major change and a challenge for both LIPOR and the sector. Aware of the fact that playing in a competitive market may have its advantages, the organisation thought thoroughly about its future, putting its energy also on a change of matrix, from service provider to producer.

This change will, in the near future, transform LIPOR into an entity that transforms waste into products and places them in the competitive market, as a result from the investment in innovation and development and from the experiences it developed so far in a smaller scale. This is the case of the natural compost Nutrimais, an excellent product the market consumes for its high-quality and compliance for use in biological farming.

The presence in the competitive market goes beyond the development and sell of new products. The strategy includes stretching LIPOR's geographic scope, as a service provider to other entities, companies, and municipalities in the Northern region. Considering its performance, the association is approaching the Government, the neighbouring municipalities and other entities with problems clearly identified and acknowledged, namely regarding issues reported by the press on the percentage of landfill deposition and waste import. However, this poses an additional challenge considering the treatment plants which, like most infrastructures in Portugal, are in operation since the mid-90s to the early 2000s.

CHALLENGE

The evolution to the status of intermunicipal company could improve LIPOR's performance by expanding its scope and allow the diversification of the business model. However, this aspect alone is a major challenge to the organisation to reach consensus within the Board of Directors and to its organisational culture.

One of the challenges ahead of LIPOR in this change of path is the regulatory entity, which sets limits to the SGRU performance and compares performance, in terms of results and costs. Considering its focus on sustainability, LIPOR operational costs cannot be compared to those from other entities focused on economics results alone and, for that reason, still send a significant percentage of waste to landfill.

It will take a strong funding to make the technological renewal and even the construction of new plants, at national and local level, which requires the National Government to acknowledge and make such investments. LIPOR's major investments in the last couple of years are collection-related, so to meet the goals, but the treatment plants have to correspond to the increase in the quantities. That is why building a new composting centre emerges as an objective (implementing an anaerobic digestion process) to treat 60 thousand tonnes a year, duplicating the current capacity to deal with biowaste, and then making it possible to provide a positive answer to the need to expand the selective collection of this important flow.

The future of LIPOR is also about a strong commitment towards internationalisation, making available for international clients the know-how the organisation developed over almost four decades. Thereto, it relies on a vast team of consultants with expertise in technical and strategic consultancy, environmental awareness, and training (LIPOR services portfolio includes these three major service areas). The International Business Unit identified as target-markets the Portuguese-speaking African countries, Maghreb, some Balkan countries and countries from Latin America and Caribbean.

Through specialised technical consultancy, LIPOR designs and implements sustainable waste management solutions, adjusted to the needs of the international clients, and to the dimension and the culture of the target countries. So far it has developed projects in countries such as Tunisia, Turkey, São Tomé and Príncipe, Kenya, or Brazil.

The range of services about environmental awareness reveals a huge action potential in other countries, as it combines as possible services the development of communication plans, environmental awareness projects, environmental education programmes, plans to involve stakeholders and still the definition of communication strategies. Regardless of the project's dimension, it is fundamental to understand the target and the objectives, to define a strategy based on a thorough diagnosis, to guide the communication to a value sharing message, saving time for a listening stage that is instrumental to plan and propose custom-made solutions.

Having a sound plan and a clear idea of the extension of the actions and projects is fundamental for the task to last in time, with quality and reliability, according to the client's expectations. To illustrate this point it is worth mentioning the services provision in Tunisia with the implementation of the Education Project for Sustainable Development, addressing the school community, which included training for the teachers and activities to raise environmental awareness.

Last but not least, the training component has a huge internationalisation potential, through the development of training courses and programmes, broad or customised, specific, for example, for managers and decision-makers from the waste sector, politicians, experts and local influencers. At this level and to show an example, there are workshops, conferences and training courses in Portugal, Tunisia, Greece, Brazil, Israel, Colombia, Angola, Romania, Hungary and Macedonia; also worth mentioning are several empowerment programmes for senior managers from the waste sector in several countries.

The recent protocol signed between the Portuguese Ministry for the Environment and its Argentine counterpart stands out. Projects are expected to be implemented in that Latin American country. Following this agreement, LIPOR was asked to participate in the implementation of projects in Argentina, in 2021.

STRENGTH: International projects in Tunisia

LIPOR is currently developing environmental education projects in Tunisia, in cooperation with the Ministries for Education and for the Environment. The main purpose is to embed the principles of Sustainable Development in daily school practices and in all aspects of education and learning.

The first project, which ended in November 2020, included training for Tunisian teachers, empowering them to disseminate that knowledge within the school community and to prepare teaching materials to be used in the classroom.

In the second project, still running, LIPOR is supporting the implementation of a selective collection system for 5 materials and the corresponding flows, adjusted to local needs and to the Tunisian context, in 400 local schools. These schools will then be part of the network of Sustainable Schools in Tunisia.

These projects are based on the contract signed between the Environmental Fund of the Ministry for the Environment of the Portuguese Republic and the Ministry for Local Affairs and Environment of the Republic of Tunisia (2019), regarding the financial support to the Project "Enhancing Education for the Sustainable Development at School level".

At the same time, a third project is being prepared so to implement a management system of waste from electric and electronic devices, in the same Maghrebi country.

But the process is dynamic and will not stop. While this case study was still being developed, another project was announced, still at an embryonic stage, the creation of an International Knowledge Centre for the Waste Field in Porto, open to establish partnerships with research centres, universities, companies, and start-ups, among other entities. The project will be devoted to public policies, regulation, and waste management, aiming at developing knowledge and innovation, based on a multidisciplinary and integrated approach, at national and international level. Another major objective is to transfer this knowledge and innovation into society, which unfolds in four areas:

- Encourage reflection and strategic follow-up to support policy makers and decision makers to define the best approach to solve waste problems and challenges;
- Promote education, training and empowerment for youngsters, professionals and waste-related organisations (with face-to-face, online or collaborative training actions), hence contributing to enhance the sector's capital;
- Provide incubation and acceleration of start-ups and support industry to foster innovation and development in the waste sector;
- Promote communication and social participation, raising awareness on waste matters and contributing to improve consumer protection, social commitment, ethics, integrity, and information to society.



09

Conclusions and recommendations

The reality of African, Asian, or Latin American and Caribbean countries is very different from the Portuguese one, in particular in Porto metropolitan area where LIPOR operates. Therefore, the institutional and technological solutions successfully implemented in this organisation must be contextualised in space, time and in the state each country finds itself in, as far as the sector evolution is concerned.

A waste management system must emerge from a thorough diagnosis, have a holistic perspective, and be complemented by a prospective analysis of the region where it belongs.

There are, however, common premisses that any given waste management system should follow, regardless of the geographic location and local idiosyncrasies. The first premise is that a waste management system is supposed to be holistic and shall emerge from a thorough diagnosis. Initially, the characterisation cam-

paigns were carried out in each municipality, and for each one there was the definition of urban circuits, predominantly rural or from mixed zones.

LIPOR carried out multiple characterisations to grasp the waste typology produced in rural, urban, and peri-urban areas, then proceeding to the fine tuning of its treatment choices. As time went by, LIPOR moved into a more regional, metropolitan perspective, rather than an individual perspective per municipality. It noticed alarming levels of food waste and a composition of around 50% organic matter. Today, the association uses digital tools that facilitate obtaining that information, while providing concomitantly thorough portraits. Waste produced in Portugal is not the same as waste produced in other countries, the raw materials are not the same one can find in Denmark or South America, because they are influenced by different habits and consumption. The diagnosis is then supposed to be complemented with a prospective analysis on the region and how it is

It is important to involve entities from the scientific and technological system, be familiar with examples from other countries, and fit technology into the solution and not the other way round.

expected to develop in terms of waste, but also in terms of industry and consumption. This diagnosis and prospection will allow to make reasonable treatment choices, respecting waste hierarchy at all times.

The definition of the management system follows the analysis of the waste typology and

the characterisation of the local. It can be more or less integrated depending on having all the treatment possibilities or not. In this process,

LIPOR took into consideration suggestions from several university experts, adopted a benchmarking vision, by taking part in international fora, getting to know the best available technology, the solutions implemented in other countries and the successful cases, but it then adjusted the solutions to its specific reality, to the geographic, orographic limitations and local accessibilities.

The best available technologies do not fit any given context, they shall fit the solution and not the other way round. It is not a catalogue sale, the solutions that answer the diagnosis better will need a combination of technology that most certainly already exists on the market.

The solutions depend upon the reality in each country, the waste typology, and a cost-benefit assessment. But above all they must address the resolution of public health problems.

Decide on the type of SGRU depends upon each country's reality and upon the waste typology. Though a cost-benefit assessment applies, the priority is solving public health issues.

In some specific points on the planet, there are still entire communities that live near dumps which contaminate water courses and release toxic gases, let alone the fact they are a source of greenhouse effect gases – it is urgent to solve these wholesomeness issues, whose negative impact extends to the fight against climate changes. That requires the creation of solid facilities, capable of handling a large quantity of waste.

The world is spinning towards an urban future and waste is a subproduct that results from an urban lifestyle. The waste quantity increases faster than the urbanisation rate. In order to solve the quantity issue, countries like Portugal, China or Sweden chose incineration centres, which from an environmental perspective is better than deposition in landfill. LIPOR concluded this technology would allow a quicker return on investment, due to the electricity sale tariff, in a country that imported that type of energy.

Over time, the management systems may evolve into more specific projects that create value in society.

This does not mean an energy recovery plant is essential in any context. Some islands or small archipelagos, like São Tomé and Príncipe, for example, may not need an incineration centre if they reach high recycling and composting rates. The ideal system for Dominican Republic will not apply to Mexico. Furthermore, the options to produce energy have developed a lot

since LIPOR was created, it is now possible to invest in less conventional solutions, for instance regarding the use of steam (to be applied in heating and cooling), the production of biomethane and even hydrogen or yet in processes like anaerobic digestion, suitable for organic matter, and a source of energy production as well.

Once the main public health challenges that stem from an exponential waste production are solved, the management systems may develop (a path that can be almost simultaneous) into more specific projects that create value in the society.

Recycling is one of those projects. It continues to rely on informal workers in Latin America and Caribbean, but it guarantees aluminium recycle rates close to 100% in Brazil, for example. To be resilient and inclusive, integrated waste management projects are expected to onboard and organise the citizens that “operate” in landfills, making sure their income is guaranteed, and obtained in decent living and working conditions. At the same time the profitability is maximised, and the system becomes more professional, with Sorting Centres and plans to distribute the products in a circular economy perspective. The creation of jobs is one of the many planning constraints to be taken into consideration by policy makers.

To achieve long-term success, it is necessary to adopt an entrepreneurial vision, avoid instability related to political cycles and support the political decisions in technical-scientific knowledge.

To sum up, the definition of an integrated waste management and treatment system shall fit the local reality, according to the territory specificities and based on a thorough diagnosis.

The legal framework should provide for an integrated approach and define priorities.

In the case of LIPOR, such a system results in the allocation of resources, goals and waste management options differentiated for each associated municipality. The technical staff presented the available solutions to waste management and treatment in Greater Porto, but the final decision was up to the Board, whose members play political roles in their corresponding municipalities, but from whom this organisation expects a businessman attitude.

The LIPOR model – an intermunicipal association – demands a huge commitment from its associate members, which may be difficult to reach. This is an extremely democratic organisation, one where each municipality has a vote in the Board of Directors, and which tries to remain safe from election

cycles and procedure changes, considering the investments require a long-term perspective. One of the striking success factors has to do with the leadership stability, whose decisions are consensual. The stability is obvious because the Chief Executive Officer is the same since the beginning. The strategic vision, the goals and the path defined by the Board of Directors are put into practice by a specialised technical staff, also very stable, that suggest every step of the way the necessary measures to achieve those goals, considering the best and most updated waste management practices.

Despite its public nature, this model assumes a business approach. In fact, a new legal model has been studied to keep the intermunicipal trait and the public capital, but which would confer LIPOR more agility and innovation, adjusting the statutes to its broad performance spectrum. A possible evolution to the legal concept of “intermunicipal company” would allow a more professional management, though under a supervision policy, and would also have advantages regarding funding.

A business management and approach decrease the dependence from grants and increase the projects' financial sustainability.

It is obvious that the praxis of waste management does not exist in a vacuum, nor is it detached from a national reality; it is necessary a legal framework that defines priorities, clear environmental and economic criteria, as well as long-term objectives. The Portuguese legal system about environmental preservation that rules the waste sector, to a large extent compelled by EU guidelines on this subject, provides stability and guidance regarding the path to be followed. An example is the extended producer responsibility defined by law, which originated the SIGRE, now supporting the packaging recycling projects. By guaranteeing the products' distribution, the system was decisive for the SGRU to have sorting centres in full operation.

The strict daily control of indicators is fundamental.

If the integrated approach fails, there is no collection nor market for the products: the system dies because it is not economically sustainable. From an environmental point of view, the legislation exists, it just lacks a more strict compliance. For example, Brazil has waste management plans for over a decade, Cape Verde had already five or six versions, whose compliance is limited by political changes. Waste management requires a medium-long term approach, because it implies huge investments that cannot depend upon short and instable political cycles. In the face of very significant investment costs, it is compulsory to assure any treatment plants, once built, are maintained, and operated for a long period. If there is no local capacity for that commitment, the solution may involve joint efforts from several municipalities or regions that share common goals and establish a business-like structure.

Overall, the choice for such a structure decreases the chances of unfinished projects due to lack of political cooperation from the decision-makers. This leads us to the issue of economic viability and funding models, as the projects must be carefully designed under long-term economic and financial models. The SGRU costs must be paid by the service final beneficiaries (citizens and companies) or by the State, through subsidies. This last option may, however, induce dependence, so it is preferable if the market creates the necessary conditions for the SGRU financial health.

The business approach implies great economic and financial accuracy in the management models. A close look at LIPOR reveals the performance is controlled through well-defined indicators that assess the strategic vision: sustainability, in all its components. Besides, the Board of Directors

Vertical systems are more efficient, though it is not always possible in contexts where the local power is very strong.

has at its disposal a Balanced Scorecard and a set of other tools to analyse global performance, monitor the results from the different areas closely, as well as control the business daily management. Consequently, it is possible to foresee the results of the economic year right in the first quarter, and also do a daily management of the plants, namely plan the CVE stops, predict cash flow reinforcement needs and develop future endeavours.

The context that gave rise to LIPOR determined a separation between waste collection and treatment. The first remains a responsibility of the eight associates, whereas the organisation is responsible for the treatment, although all try to work in cooperation.

For the parties to work in harmony was important the creation of a 12-people expert team, whose job is to technically support the municipal projects. A vertical system, with collection and treatment organised jointly is, however, more efficient, because it does not depend upon the municipalities technical development and enables economies of scale. As far as LIPOR is concerned, it would be possible to open a public request for tenders to assign the collection service, with common criteria. Furthermore, it would allow a more coherent organisation, regardless of the geographic boundaries that separate the municipalities benefitting from the service.

Training, a good communication and the involvement of the communities are crucial.

The vertical systems are very common abroad, as collection does have an impact on treatment, which is extremely affected by unconformities: the better the first stage, the better the treatment in the plants, reducing the number of rejections. However, a vertical activity is not always possible where the local authorities are very strong.

Sustainability is at the centre supported by three pillars that must be balanced: environmental, social, and economic.

One of the lessons LIPOR learned during its almost four decades is that strategic planning is fruitless without the involvement of the community and the other stakeholders. Today's context of megacities with unsustainable levels of consumption demand solid technological solutions and, above all, the population awareness, because the citizen's behaviour influences, blatantly, the waste sector activity.

The system collapses if the citizen does not do his/her share, it is as simple as that, invalidating the efficacy of the best technology, of the best facilities, quality and safety policies, the best supervision, measurement, and follow-up models. The same thing happens if the products do not return to the value chain, to the industry. For that reason, the farmers were the first

visitors of LIPOR Composting Plant, as potential users of the organic corrective Nutrimais.

This consciousness was the cause for the definition of decisive mobilisation strategies to involve the communities. It has been a long way since the first national awareness campaign starred by a chimpanzee that sorted waste:

LIPOR Education, Communication and Marketing Department has today 33 employees, who try to communicate effectively with each target, from pre-school age to the elderly, though the age bracket 16-23 years old brings the greater challenges. It was necessary to study how to communicate, entering the semiotics field, to reach a level of communication that actually hits the intended goal.

The community involvement goes far beyond sporadic campaigns in schools. It takes regional needs into consideration and includes the territory valorisation, by integrating the waste treatment facilities in the landscape, recovering environmental liabilities, and implementing social projects, for example the urban vegetable gardens that generate value in wastelands and help the community, not to mention the environmental projects, for instance reforestation and biodiversity preservation.

The international agenda for sustainable development includes, necessarily, an adequate waste management. Therefore, the region's global trends and characteristics are not to be missed, nor are the reasons why such management is a political priority, or the risks of inaction on this subject.

LIPOR identifies sustainability-based management as one of its successful ingredients. Under a win-win strategic principle, all planning considers three pillars: environmental, social, and economic. Sustainability is the "magical formula" that balances the three axes, though the environmental and the

The formula for balancing the environmental, social, and economic pillars may vary according to the local context.

social pillars are a priority over profitability. The SGRU is supposed to benefit the community and have the minimum possible impact on the Environment, in a long-term profitability perspective, avoiding more profitable short-term solutions, but that entail higher socioenvironmental costs.

This paradigm is reflected in the treatment choices, focused on environmental quality, explaining why only 2% of the waste treated by the association is sent to landfill, the cheapest, but environmentally more harmful solution, in a country where more than half the urban waste has that destination. The sustainability principle is also reflected in the construction of solid facilities, with quality, environment, occupational safety, and hygiene systems. However, unlike many other public entities, LIPOR was never in deficit, closing every year with positive economic and financial results.

The investment in innovation and circular economy contributes to develop new business models, follow trends, and answer the market.

While seeking environmental sustainability in its activity, LIPOR anticipated a scenario where the waste sector would be integrated in the carbon market, which would require the payment for its CO₂ emissions. This scenario would have a deep impact in LIPOR's profitability, so the organisation invests in the annual calculation of its carbon footprint, since 2006, and from that year forward it defined a strategy to reduce emissions, based on compensation measures.

LIPOR's dynamic changed over the years. At the beginning the association was worried with waste management, then evolved into the emission of greenhouse effect gases, reducing the carbonic impact of its activity, seeking energy efficiency, and investing also in circular economy and innovation. One of its main focus is the natural capital and the preservation of biodiversity, because any industrial plant comes with liabilities for the surroundings. Consequently, part of its revenue is shared to reinforce natural capital, which included the reforestation of burned areas or the restoration of a riverside ecosystem.

The pillars previously mentioned – environmental, social, economic – apply to any country. However, the essential focus may be different, according to local characteristics and needs. In certain African, Latin American, or Caribbean countries, the social pillar may be preponderant, considering the unemployment levels. The environmental side cannot, however, be neglected in countries with a remarkable wealth in terms of biodiversity and virgin raw materials. Though fundamental, the environmental and social components have a cost, that reflects in the financial pillar. This raises the question of funds allocation in national contexts with many and urgent priorities, in the social and the health fields.

LIPOR's natural evolution, during its long existence, brought it to the definition of a Circular Economy strategy, common to the entire organisation. The association aims at boosting the Circular Economy discussion in Portugal, by sharing new strategies and looking for new business models. Its entire activity has an impact on this level, and for that reason the next step is to transform in energy only what cannot be otherwise introduce in the Economy, so to avoid the consumption of primary raw materials and natural resources.

In 2012, the organisation created an innovation team – currently composed by doctors – and implemented an innovation management system certified by the standard NP 4457:2007, to study possible improvement in the performance and outputs of its activity. For example, the new composting plant intends to produce biogas through anaerobic digestion. The purpose is to use the raw material it receives and add value to it, originating different products.

Three main areas were identified for the development of new products, namely, the valorisation of incineration slag to produce construction materials or decoration objects, the agriculture products, and the pure materials. Notwithstanding, LIPOR is open to establish new partnerships, with public or private entities, catalysts for new ideas and processes. The organisation is paying special attention to the textile market, micronutrients

in organic matter (currently, the macronutrients are mainly used) and rare metals, resulting from electric and electronic components.

LIPOR came a long way since it was created, in the mid-80s of the 20th century, and it had to overcome important challenges and develop a strategic reasoning to reach today's excellence stage. As a result, the organisation counts on an accumulated know-how that may be useful to other entities and regions from a context like the one Porto metropolitan area faced when LIPOR was created, making room for an internationalisation journey.

Reco

- » Planning based in a deep characterisation
- » Long-term approach
- » Definition of indicators (BSC), follow-up and focus on continuous improvement
- » Technological choices adjusted to the local reality, in a circular economy paradigm
- » Verticalisation of the collection system and waste treatment
- » Priority of public health issues
- » Involvement of the community and the stakeholders
- » Need for an adequate legal framework
- » Effective institutional and funding models
- » Sustainability-oriented management
- » Social and environmental projects, with a regional impact



10

Sources

References

AGÊNCIA PORTUGUESA DO AMBIENTE (2019a). PERSU 2020: plano estratégico para os resíduos urbanos. Amadora: APA.

AGÊNCIA PORTUGUESA DO AMBIENTE (2019b). Dados sobre resíduos urbanos. 2019. Available at: <https://apambiente.pt/index.php?ref=16&sub-ref=84&sub2ref=933&sub3ref=936>. Viewed 28 July 2020.

AGÊNCIA PORTUGUESA DO AMBIENTE (2019c). PERSU 2020+: Reflexão Estratégica e Ajustamentos às Medidas do PERSU 2020. Amadora: APA.

AGÊNCIA PORTUGUESA DO AMBIENTE (July 2020). Resíduos Urbanos 2019. Relatório Anual. Amadora: APA.

BATLLEVELL, Marta & HANF, Kenneth (2008). "The fairness of PAYT systems: Some guidelines for decision-makers" in *Waste Management* 28(12), 2793-2800. Available at: <http://dx.doi.org/10.1016/j.wasman.2008.02.031>

COENTRÃO, Abel (4 August 2020). "Ups! Em 2019 fizemos mais lixo, mas a reciclagem pouco subiu" in *Jornal Público*.

GONÇALVES, Marcelino de Andrade, VALE, Margarida Maria de Araújo Abreu Vilar de Queirós do & GONÇALVES, Alexandre Honig (2016). "Um estudo comparado entre a realidade brasileira e portuguesa sobre a gestão dos Resíduos Sólidos Urbanos". *Sociedade & Natureza* 28(1), 9-20.

HETTIACHCHI, Hiroshan, RYU, Sohyeon, CAUCI, Serena & SILVA, Rodolfo (2018). "Municipal Solid Waste Management in Latin America and the Caribbean: Issues and Potential Solutions from the Governance Perspective". *Recycling* 2018 3(19).

HOORNWEG, Daniel & GIANNELLI, Natalie (2007). "Managing municipal solid waste in Latin America and the Caribbean". *Gridlines - Note nº 28*. PPIAF – Public-Private Infrastructure Advisory Facility to the World Bank.

INSTITUTO NACIONAL DE ESTATÍSTICA DE PORTUGAL – INE (2016). Estatísticas dos Resíduos 2014. Lisboa: INE.

INSTITUTO NACIONAL DE ESTATÍSTICA DE PORTUGAL – INE (2019a). Anuário Estatístico da Região Norte - 2018. Lisboa: INE.

INSTITUTO NACIONAL DE ESTATÍSTICA DE PORTUGAL – INE (2019b). Estatísticas do Ambiente 2018. Lisboa: INE.

LIPOR (2007), Plano Estratégico da LIPOR 2007-2016. Porto.

LIPOR (2015), Plano Estratégico da LIPOR 2015-2020. Porto.

LIPOR (March 2019). Relatório e Contas 2018. Porto.

LIPOR (2020). Relatório Integrado 2019. Porto.

MARKETLINE Industry Profile (june 2020a). Global Waste Management. Available at <https://store.marketline.com>. Viewed on 14 de August 2020.

MARKETLINE Industry Profile (june 2020b). Waste Management in Brazil. Available at <https://store.marketline.com>. Viewed on 14 de August 2020.

MARKETLINE Industry Profile (june 2020c). Waste Management in Mexico. Available at <https://store.marketline.com>. Viewed on 14 de August 2020.

PORTELA, Ana Julieta de Sá (2011). Tecnologia RFID na Gestão de Resíduos Sólidos Urbanos: integração num modelo PAYT para uma zona piloto no Município da Maia. Masters dissertation presented to the Faculty of Economics of the University of Porto.

QUEIRÓS, M. (2002) O Desafio ambiental. As Políticas e a Participação dos Actores. PhD thesis in Human Geography presented to the University of Lisbon.

RIQUELME, Rodrigo, MÉNDEZ, Paola & SMITH, Ianthe (April 2016). Solid Waste Management in the Caribbean: proceedings from the Caribbean Solid Waste Conference. Inter-American Development Bank.

THE SECRETARIAT OF THE BASEL CONVENTION (2012). Vital Waste Graphics 3. Belley, France.

THE WORLD BANK (2012). What a Waste: A Global Review of Solid Waste Management. Urban Development Series Knowledge Papers, Paris. Available at: <https://siteresources.worldbank.org>. Viewed on 10 August 2020.

THE WORLD BANK (2013). Crecimiento Verde Inclusivo en América Latina y el Caribe. Department of the Latin America and Caribbean Region (LCSSD).

THE WORLD BANK (2015). Implementation, completion and results report (IBRD-73620) on a loan in the amount of US\$40 million equivalent to the republic of Argentina for a National Urban Solid Waste Management Project. Report nº ICR00003627. Latin America and the Caribbean.

UN ENVIRONMENT (2018). Waste Management Outlook for Latin America and the Caribbean. United Nations Environment Programme. Latin America and the Caribbean Office. Panama City, Panamá.

Interviews

(in alphabetical order)

- 01 Aires Pereira, President of LIPOR Board of Directors
- 02 Fernando Leite, Chief Executive Officer
- 03 Isabel Nogueira, Operations and Logistics Department
- 04 José Luís Marques, Legal and Audit Department
- 05 Mónica Monteiro, Planning, Management and Information Systems Department
- 06 Paula Mendes, Education, Communication and Marketing Department
- 07 Susana Abreu, International Business Unit
- 08 Susana Lopes, International Business Unit

LIPOR Projects

Additional information about the projects referred throughout the document can be found at:

www.lipor.pt/en



11

List of acronyms and abbreviations

- ACR+** – Association of Cities and Regions for Sustainable Resource MANAGEMENT
- APA** – Agência Portuguesa do Ambiente (Portuguese Environment Agency)
- CREW** – Waste Electric and Electronic Equipment Recovery Plants
- CVE** – Central de Valorização Energética (Energy Recovery Plant)
- CVO** – Central de Valorização Orgânica (Composting Plant)
- DGEG** – Directorate General for Energy and Geology
- EBITDA** –Earnings before interest, taxes, depreciation and AMORTization
- ECN** – European COMPOSt Network
- EEC** – European Economic Community
- EIB** – European Investment Bank
- ERSAR** - Regulatory Authority for the Water and Waste Services
- EU** – European Union
- GEE** –Greenhouse gases
- GDP** – Gross Domestic Product
- ISWA** – International Solid Waste Association
- LER** – European Waste List
- NIMBY** – Not in MY backyard
- ODS** – Sustainable Development Goals
- PAYT** – Pay-As-You-Throw
- PERAGRI** – Strategic Planning for Agricultural Waste
- PERH** – Strategic Planning for Hospital Waste
- PERSU** – Strategic Planning for Solid Urban Waste Management
- PESGRI** – Planning for Industrial Waste Management
- PNAC** – National Planning for Climate Change
- PNAPRI** – National Prevention Planning for Industrial Waste

PPRU – Prevention Planning for Urban Waste

POSEUR – Operational Programme for Sustainability
and Efficient Use of Resources

QREN – National Strategic Reference Framework

RASARP – Annual Report on Water and Waste Services in Portugal

REN – National Electric Network

SGIDI – Research, Development and Innovation Management System

SGRU – Urban Waste Management Systems

SIGRE – Integrated System for Packaging Waste Management

SIRAPA – Integrated Registration System of the Portuguese
Agency for the Environment



www.lipor.pt

lipor

