ECONOMIC INSTRUMENTS TO IMPROVE WASTE MANAGEMENT IN GREECE

INCLUDING A PRE-FEASIBILITY STUDY ON A DEPOSIT REFUND SYSTEM

FINAL REPORT

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Federal Ministry
for the Environment, Nature Conservation
and Nuclear Safety

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& Associates Ltd.

ΥΠΟΥΡΓΕΙΟ
ΠΕΡΙΒΑΛΛΟΝΤΟΣ
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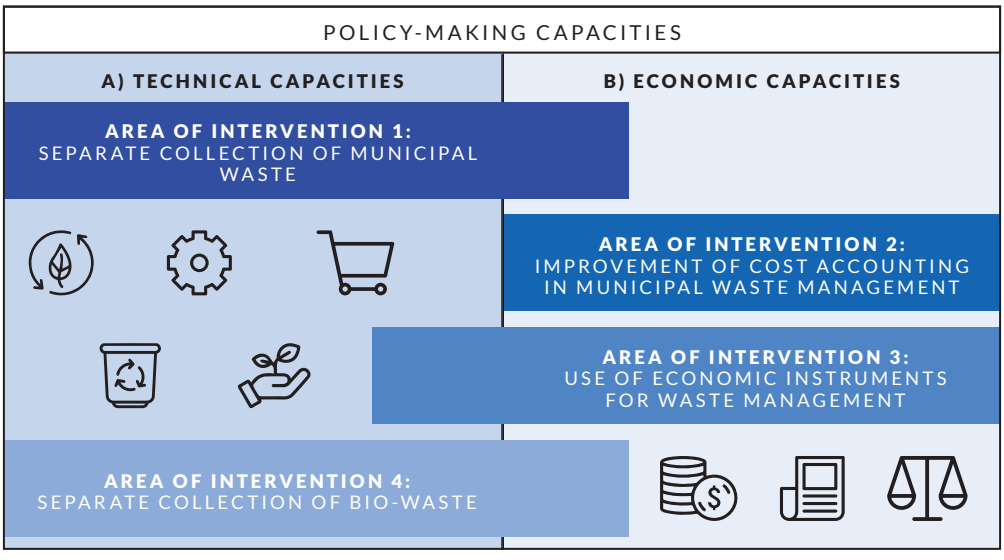
BACKGROUND

The Greek government asked the European Commission (EC) for support in specific areas (including the improvement of municipal waste management, regulatory issues of the waste sector, the management of specific waste categories) in order to raise the quality and quantity of recycling, to improve data quality and to effectively use economic instruments. To achieve the aforementioned goals, the Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ) provides "Technical support for the implementation of the National Waste Management Plan (NWMP) of Greece" from 2018 to 2020. The project is funded by the European Union (EU) via the Structural Reform Support Programme (SRSP) and the German Federal Ministry for Environment, Nature Conservation and Nuclear Safety (BMU), and jointly implemented by GIZ and the Hellenic Ministry of Environment and Energy (YPEN), in collaboration with the European Commission.

GIZ commissioned BlackForest Solutions GmbH (BFS), which formed a consortium including international and national experts from envero GmbH, INFA GmbH, Ressource Abfall GmbH, BlackForest Solutions GmbH and I. Frantzis & Associates Ltd. to provide specific technical expertise to GIZ and YPEN from July 2019 to mid-2020 by supporting four areas of intervention (AI) linked to the optimization of municipal waste management in Greece. The areas of intervention are:

1. **SEPARATE COLLECTION OF MUNICIPAL WASTE**
2. **IMPROVEMENT OF COST ACCOUNTING IN MUNICIPAL WASTE MANAGEMENT**
3. **USE OF ECONOMIC INSTRUMENTS FOR WASTE MANAGEMENT**
4. **SEPARATE COLLECTION OF BIO-WASTE**



Categorization of Area of Intervention

The present study, entitled: "Economic instrument to improve waste management in Greece" focused on the 'Optimizing municipal waste management in Greece - introducing effective separate waste collection and cost-accounting, and making use of economic instruments'. The purpose of this study is to collect data on existing economic instruments in the country, analyse their performance and efficiency, suggest improvements and provide best practices from European countries. In addition to that, a pre-feasibility study on the implementation of a deposit refund system is also contemplated. Recommendations are drawn on decision-making tools, upscaling and replication, citizens engagement and incentives, while proposals on the improvement of legislation and regulations are also provided.

DISCLAIMER

BlackForest Solutions GmbH has taken due care in the preparation of this report to ensure that all facts and analysis presented are as accurate as possible within the scope of the study.

This document was produced with the financial assistance of the European Union. The views expressed herein can in no way be taken to reflect the official opinion of the European Union.

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LIST OF ABREVIATIONS

ARF	Advanced Recycling Fees
AIs	Area of Interventions
BFS	BlackForest Solutions GmbH
BMU	German Federal Ministry for Environment, Nature Conservation and Nuclear Safety
CAMS	Collective Alternative Management System
CDW	Construction and Demolition Waste
CEL	Circular Economy Levy
CSO	Central System Operator
CSRM	Centres of Sorting of Recyclable Materials
DRS	Deposit-Refund Schemes
EC	European Commission
EIA	Environmental Impact Assessment
ELV	End-of-Life Vehicle
EPR	Extended Producer Responsibility
EU	European Union
EUROSTAT	European Statistical Agency
EWC	European Waste Code
EWR	Electronic Waste Registry
FCA	Full Cost Accounting
FoDSA	Solid Waste Management Organizations
GDP	Gross Domestic Product
GHG	Green House Gases
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
HRA	Hellenic Recycling Agency
IELKA	Research Institute of Retail Consumer Goods
JMD	Joint Ministerial Decisions
KEDE	Central Union of Municipalities in Greece
KYSOIP	Government Council for Economic Policy
LOI	Loss on Ignition
LWMP	Local Waste Management Plan
MBT	Mechanical and Biological Treatment
MRF	Material Recovery Facility
MS	Member States

MSW	Municipal Solid Waste
MSWP	Municipal Solid Waste Plan
NIMBY	Not In My Back Yard
NSRF	National Strategic Reference Framework
NWMP	National Waste Management Plan
NWPSP	National Waste Prevention Strategic Plan
OECD	Organization for Economic Co-operation and Development
PAYT	Pay-As-You-Throw
PD	Presidential Decrees
PPP	Purchasing Power Parity
PROs	Producer Responsibility Organizations
RDF	Refused Derived Fuel
RG	Regional Governors
RPR	Rewarding Packaging Recycling S.A.
RRC	Rewarding Recycling Centres
RSWMP	Regional Solid Waste Management Plans
RVM	Reverse Vending Machine
SAS	Selection at Source
SEC	Standard Environmental Commitments
SGSCO	General Secretariat of Coordination of the Greek Government
SRSP	Structural Reform Support Programme
SRSS	Structural Reform Support Service
SUP	Single-Use Plastics
SWMA	Solid Waste Management Association
TOC	Total Organic Carbon
TORs	Terms of References
UNEP	United National Environmental Program
WtE	Waste to Energy
WEEE	Waste of Electrical and Electronic Equipment
YPEN	Ministry of Environment and Energy

KEY DATA

Assignment

OPTIMIZING MUNICIPAL WASTE MANAGEMENT IN GREECE - INTRODUCING EFFECTIVE SEPARATE WASTE COLLECTION AND COST-ACCOUNTING, AND MAKING USE OF ECONOMIC INSTRUMENTS.

Area of Intervention

3 - ECONOMIC INSTRUMENTS TO IMPROVE WASTE MANAGEMENT INCLUDING A PRE-FEASIBILITY STUDY ON A DEPOSIT REFUND SYSTEM

Project Name

TECHNICAL SUPPORT FOR THE IMPLEMENTATION OF THE NATIONAL WASTE MANAGEMENT PLAN (NWMP) OF GREECE (68.3045.9)

PROJECT REGION: **GREECE**
CONTRACT N°: **81241739**

CONTRACT DATE: **08TH JULY 2019**
COMPLETION DATE: **31ST MARCH 2020**

Client / Project Executing Agency

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

DEUTSCHE GESELLSCHAFT FÜR INTERNATIONALE ZUSAMMENARBEIT GMBH (GIZ)

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Financing Institution

EUROPEAN COMMISSION VIA THE STRUCTURAL REFORM SUPPORT PROGRAMME (SRSP) AND THE **GERMAN FEDERAL MINISTRY FOR ENVIRONMENT, NATURE CONSERVATION AND NUCLEAR SAFETY** (BMU).

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1. Executive Summary

This report compiles a range of economic instruments for waste management currently applied in Greece, as well as their general implications on the implementation of additional mechanisms in the country. It also includes a specific chapter with a pre-feasibility study on the introduction of a deposit refund system (DRS) nationwide. The assessment was carried out at a critical time as the country is presently reviewing its waste management practices, struggling to achieve EU recycling targets and explicitly analysing the possibility of the introduction of new economic instruments, including a DRS for one-way (non-refillable) beverage containers.

Six economic instruments were primarily assessed, namely waste charges, landfill and incineration taxes, producer responsibility schemes, pay-as-you-throw (PAYT) systems, and taxation on single-use plastic products and beverages. For each of them, their status quo in Greece was described, a short evaluation of main aspects (environmental, revenue generation, market and social effects, administration costs and political acceptance) was performed, one European best practice was described for comparison and inspirational purposes and optimization actions were recommended. Special attention was given to DRS and its potential application countrywide.

Waste charges are levied as part of a general municipal tax through household electricity bills. User charges are flat rate, calculated based on the property size and location. Across the EU there is an increasing application of variable waste charges rather than flat rate fees, due to the environmental and social benefits of such tax (waste reduction, fairness, and acceptance. Therefore, a gradual adoption of a similar variable waste charging system is suggested for Greece. In the meantime, the collection of waste charges should be recovered via property tax to optimize administration costs and political discussions.

In 2012, the Greek government introduced a **landfill tax**, which has never been implemented according to the initial plan. In 2019, the landfill tax (law 4042/2012, Article 43) was repealed and replaced by an environmental levy, the "Circular Economy Levy" (CEL), with lower fees than the previously foreseen charges. Following EU examples and best practices, such a landfill tax - at least at the same price as previously stated in the legislation , if not higher – should be re-introduced in the country, not only to cover waste management costs but also to finance maintenance and technological enhancements in the system.

Bearing in mind that Greece does not have any operational waste to energy (WtE) plants and is aiming to increase the WtE by refuse-derived fuel (RDF) consumption, currently, there are no requirements for the implementation of an **incineration tax**.

Currently, in Greece, there are 22 operating systems of 'alternative management' covering various types of waste streams, under **"Producer's ResponsibilityFee"** schemes. This study focused on the schemes related to packaging and packaging waste, namely:

- Hellenic Recovery Recycling Corporation (HERRCO), responsible for the operation of the blue bins.
- Rewarding Packaging Recycling S.A. (RPR), which offers rewards for the delivery of plastic, metal, and glass bottles along with the collection of wood packaging and plastic bags.
- Centre for Environmental Alternative

Management S.A – KEPED S.A., which promotes a nationwide collection of the packaging waste of lubricant oils.

- AB VASSILOPOULOS S.A., the only individual EPR scheme focusing on the management of packaging waste of private label products and other products imported by the retail chain AB Vassilopoulos.

Due to the magnitude and impacts in the country's' waste management system, the first two systems (HERRCO and RPR) are analysed in more extent than the others. Main recommendations are given in regards to reduction of impurities (approximately 42%) in the bins, adoption of SMART solutions to improve logistics routing and collection frequencies, intensification and improvement of monitoring and control for the so-called "free-riders", compliance enforcement through the amendment of the legislation, the provision of incentives to the complying entities and the increase in frequency and scope of awareness-raising programs.

Since there is no nation-wide application of **PAYT systems** currently in Greece, a completed, EU funded pilot project implemented in Elefsina Municipality is detailed and analysed. Even though this is considered a very useful economic instrument to reduce waste generation and increase awareness, it requires door-to-door collection schemes. A best practice in Sălacea, Romania is described for comparison purposes. Aiming similar results, it is recommended to implement programs such as "Reward as you Recycle" in pilot scales to obtain experiences and lessons learnt.

Another analysed instrument is the **taxation of specific types of products** to minimise their use and optimise their production. Before 2017, no applicable taxation on single-use products, plastic, or otherwise was imposed. This changed when the Greek government passed the 4496/2017 law under which an environmental levy of €0.03 (€0.04 including VAT) would be imposed from January of 2018, with a prediction to increase the rate in the following year to €0.07 (€0.09 including VAT). It is suggested that environmental taxes should be extended to other products, such as beverages bottles and food containers, supporting the implementation of a DRS in the country.

Evidence from countries where **DRS** is implemented for single-use beverage containers indicates that they can deliver several benefits, including elevated recycling rates, higher purity in the collected material, and littering reduction. Employing and operating such a system implies costs, which must be borne by some or all the actors involved in the production, import and sale of beverages, as well as effects on those that manage the resulting waste. National authorities are usually responsible for the development of the initial studies such as the pre-feasibility and feasibility reports. Through these steps, own capacity building and legislation amendments are triggered.

The pre-feasibility results assemble EU experiences with stakeholder interviews from the beverage industry and reverse vending machine (RVM) producers in Greece. Based on the collected data and local knowledge, some recommendations for the DRS design in the country are delineated. Amongst them, it is vital to highlight the required changes/ amendments in the current packaging legislation (Law 2939/2001, as amended) to define rules and responsibilities specifically for DRS. The establishment of recycling targets and fines for non-compliance should also be defined by law to enable enforcement.

It is highly recommended that the country adopts a single, independent, organisation, owned by the private sector

(beverage industry/association, retailers, logistic companies) operating the DRS on a not-for-profit basis, which has ownership of the collected material. In addition, it is suggested that retailers, with an area bigger than 200-300 m2, should be obliged to participate in the system. Regarding the DRS scope, plastic, glass and aluminium containers are recommended to be addressed in the system.

The deposit fees are proposed to lay between 0.10 – 0.15€ per container and handling fees shall be calculated to reflect the retailer's costs, including storage and staff within shops. Fees shall be higher for an automated system rather than for manual take-back schemes and depend on whether RVMs are under the responsibility of retailers. The informal sector also is benefited from DRS since gathered material has a higher value than the "usual market and collection conditions are normally better through the system.

Considering that Greece has a particular geographic distribution, for the purposes of the current study, the country is divided into categories, based on population and infrastructure. Islands are divided into two main groups: islands with continental behaviour and islands with touristic peaks. For the first ones, bearing in mind that they present similar infrastructure (retailers, recycling facilities, logistic routes) as larger cities, no specific recommendation is necessary. For the islands with high touristic peaks, it is recommended the construction of redemption centres placed in central locations (public squares and/or touristic attractions), considering that tourists may not be aware of the system. Besides, smaller islands may get one reverse vending machine (RVM) in the port area that could be combined with sightseeing/touristic information. The transport of the material would be easier and more accessible. Plus, leasing of RVMs shall be considered for high peak seasons.

Finally, to avoid fraud, facilitate communication and enable monitoring, a standard logo issued by the central system operator shall be applied to all beverages within the DRS scope and harmonisation of the barcodes must be executed countrywide.

As per other European best practices, the above-mentioned economic instruments have proven their success, when well applied and monitored. Greece has already created a solid foundation towards sustainable waste management financing and is on track to develop and implement further instruments to support and enhance recycling in the country.

1. Συνοπτική Παρουσίαση

Σε αυτή τη μελέτη γίνεται αναφορά σε μια σειρά οικονομικών εργαλείων που εφαρμόζονται σήμερα στην Ελλάδα, καθώς και τις γενικές επιπτώσεις που θα έχει η εφαρμογή πρόσθετων μηχανισμών στη χώρα. Περιλαμβάνει επίσης ένα συγκεκριμένο κεφάλαιο με μια προκαταρκτική μελέτη σκοπιμότητας σχετική με την εισαγωγή ενός συστήματος Σύστημα Εγγυοδοσίας (Deposit Refund System, DRS) σε εθνικό επίπεδο. Η αξιολόγηση πραγματοποιήθηκε σε μια κρίσιμη περίοδο καθώς η χώρα επανεξετάζει επί του παρόντος τις πρακτικές διαχείρισης αποβλήτων, ώστε να επιτύχει τους στόχους ανακύκλωσης όπως έχουν τεθεί από την ΕΕ . Πιο συγκεκριμένα η εξέταση της δυνατότητας εισαγωγής νέων οικονομικών εργαλείων, συμπεριλαμβανομένου ενός DRS για συσκευασίες ποτών μίας χρήσης.

Έξι οικονομικά εργαλεία αξιολογήθηκαν κυρίως: η χρέωση αποβλήτων, τα τέλη υγειονομικής ταφής και αποτέφρωσης, τα συστήματα ευθύνης παραγωγού, τα συστήματα καταβολής τελών ανάλογα με τις απορριπτόμενες ποσότητες για τα αστικά απόβλητα "Πληρώνω-Όσο-Πετάω" (ΠΟΠ) " ('pay-as-you-throw', PAYT) και η φορολογία στα πλαστικά προϊόντα και συσκευασίες ποτών μίας χρήσης. Για καθένα από αυτά γίνεται περιγραφή της παρούσας κατάστασης στην Ελλάδα, μια σύντομη εκτίμηση των κύριων πτυχών (περιβαλλοντικών, δημιουργία εσόδων, αγορά και κοινωνικές επιπτώσεις, διοικητικό κόστος και πολιτική αποδοχή), καθώς και περιγραφή μίας ευρωπαϊκής βέλτιστης πρακτικής για σκοπούς σύγκρισης και έμπνευσης. Τέλος προτείνονται δράσεις βελτιστοποίησης. Ιδιαίτερη προσοχή δόθηκε στο DRS και την πιθανή εφαρμογή του σε πανελλήνιο επίπεδο.

Τα **τέλη αποβλήτων**/χρεώσεις για τη διαχείριση αποβλήτων προς το παρόν επιβάλλονται ως μέρος ενός γενικού δημοτικού φόρου μέσω των λογαριασμών ηλεκτρικού ρεύματος των νοικοκυριών. Οι χρεώσεις του χρήστη είναι πάγιες, υπολογιζόμενες με βάση το μέγεθος και την τοποθεσία του ακινήτου . Σε ολόκληρη την ΕΕ παρατηρείται αυξημένη εφαρμογή των κυμαινόμενων τελών αποβλήτων, εξαιτίας των περιβαλλοντικών και κοινωνικών οφελών αυτού του φόρου (μείωση των αποβλήτων, δίκαι χρέωση και αποδοχή). Συνεπώς προτείνεται η σταδιακή καθιέρωση ενός παρόμοιου συστήματος χρέωσης κυμαινόμενων και όχι πάγιων τελών αποβλήτων για την Ελλάδα. Εν τω μεταξύ, η είσπραξη τελών αποβλήτων θα πρέπει να ανακτηθεί μέσω του φόρου ιδιοκτησίας για τη βελτίωση του διοικητικού κόστους και των πολιτικών αποφάσεων.

Το 2012, η ελληνική κυβέρνηση εισήγαγε **τέλος υγειονομικής ταφής**, ο οποίος δεν εφαρμόστηκε ποτέ σύμφωνα με το αρχικό σχέδιο. Το 2019, το τέλος υγειονομικής ταφής αποβλήτων (νόμος 4042/2012, άρθρο 43) καταργήθηκε και αντικαταστάθηκε από την περιβαλλοντική εισφορά, «τέλος κυκλικής οικονομίας» , με χαμηλότερες χρεώσεις από τις αρχικά προβλεπόμενες . Έχοντας κατά νου παραδείγματα και βέλτιστες πρακτικές εντός της ΕΕ, ένα τέτοιο τέλος υγειονομικής ταφής, με το ίδιο ύψος χρέωσης όπως είχε αρχικά οριστεί στη νομοθεσία, αν όχι και ψηλότερο, θα πρέπει να εισαχθεί εκ νέου στη χώρα. Το τέλος αυτό είναι σημαντικό όχι μόνο για την κάλυψη του κόστους διαχείρισης αποβλήτων, αλλά και για τη χρηματοδότηση της συντήρησης και την τεχνολογική βελτίωσητου συστήματος..

Έχοντας υπόψη ότι στην Ελλάδα δεν λειτουργούν εγκαταστάσεις παραγωγής ενέργειας από απόβλητα (Waste to Energy, WtE) και ότι στοχεύει στην αύξηση της παραγωγής ενέργειας από απόβλητα μέσω της χρήσης απορριματογενών καυσίμων (Refuse-Derived Fuel, RDF), δεν υπάρχουν προς το παρόν οι όποιες απαιτήσεις ή αξιώσεις για την εισαγωγή **τέλους αποτέφρωσης**.

Σήμερα στην Ελλάδα, υπάρχουν 22 λειτουργικά συστήματα 'εναλλακτικής διαχείρισης' που καλύπτουν διάφορους τύπους αποβλήτων, στο πλαίσιο των συστημάτων **διευρυμένης ευθύνης του παραγωγού**. Αυτή η μελέτη έχει

επικεντρωθεί στα συστήματα που σχετίζονται με τις συσκευασίες και τα απόβλητα συσκευασίας, και συγκεκριμένα στα παρακάτω:

- Ελληνική Εταιρεία Αξιοποίησης Ανακύκλωσης (ΕΕΑΑ), υπεύθυνη για την ανακύκλωση συσκευασιών με το σύστημα του μπλε κάδου.
- Ανταποδοτική Ανακύκλωση Συσκευασιών ΑΕ , το οποίο προσφέρει αποζημιώσεις για την παράδοση πλαστικών, μεταλλικών και γυάλινων φιαλών παράλληλα με τη συλλογή ξύλινων συσκευασιών και πλαστικών σακουλών.
- Κέντρο Εναλλακτικής Περιβαλλοντικής Διαχείρισης Α.Ε. - ΚΕΠΕΔ Α.Ε., το οποίο είναι ένα πανελλήνιο σύστημα εναλλακτικής διαχείρισης αποβλήτων συσκευασιών λιπαντικών.
- Ο ΑΒ ΒΑΣΙΛΟΠΟΥΛΟΣ Α.Ε., το μοναδικό μεμονωμένο σύστημα EPR που εστιάζει στη διαχείριση απορριμμάτων συσκευασίας προϊόντων ιδιωτικής ετικέτας και άλλων προϊόντων που εισάγονται από την αλυσίδα λιανικής πώλησης Αλφα Βήτα Βασιλόπουλος ΑΕ.

Λόγω του μεγέθους και των αντικτύπων τους στο σύστημα διαχείρισης αποβλήτων της χώρας, τα πρώτα δύο συστήματα (ΕΕΑΑ και Ανταποδοτική Ανακύκλωση Συσκευασιών ΑΕ) αναλύονται σε μεγαλύτερο βαθμό από τα άλλα. Οι κύριες συστάσεις δίνονται όσον αφορά στη μείωση των προσμίξεων (περίπου 42%) στους κάδους, την υιοθέτηση 'έξυπνων' λύσεων για τη βελτίωση των δρομολογίων για τη συλλογή και των συχνοτήτων συλλογής, την εντατικοποίηση και τη βελτίωση της παρακολούθησης και του ελέγχου αυτών που διαφεύγουν των εισφορών ('free riders'), τη συμμόρφωση μέσω της τροποποίησης της νομοθεσίας, της παροχής κινήτρων στις συμμορφούμενες οντότητες και της αύξησης της συχνότητας και του πεδίου εφαρμογής των προγραμμάτων ευαισθητοποίησης.

Λόγω της απουσίας ευρείας εφαρμογής **συστημάτων ΠΟΠ** σε εθνικό επίπεδο, ένα ολοκληρωμένο, ευρωπαϊκό, πιλοτικό έργο που πραγματοποιήθηκε στο Δήμο Ελευσίνας παρουσιάζεται και αναλύεται. Παρόλο που αυτο θεωρείται ένα πολύ χρήσιμο οικονομικό εργαλείο για τη μείωση της παραγωγής αποβλήτων, απαιτεί προγράμματα 'από πόρτα σε πόρτα' συλλογής αποβλήτων . Μία βέλτιστη πρακτική στη Sălacea της Ρουμανίας περιγράφεται για λόγους σύγκρισης. Με στόχο την επίτευξη παρόμοιων αποτελεσμάτων, συνιστάται η εφαρμογή προγραμμάτων όπως το 'Ανακύκλωσε και Ανταμείψου' ("Reward as you Recycle") σε πιλοτικές κλίμακες για την απόκτηση εμπειριών και αντλούμενα διδάγματα.

Ένα άλλο εργαλείο που αναλύθηκε είναι η **φορολόγηση συγκεκριμένων τύπων προϊόντων** με σκοπό την ελαχιστοποίηση της χρήσης τους και τη βελτιστοποίηση της παραγωγής τους. Πριν από το 2017, δεν είχε επιβληθεί φορολογία για προϊόντα μίας χρήσης ή πλαστικων. Αυτό άλλαξε όταν η ελληνική κυβέρνηση ψήφισε τον νόμο 4496/2017 βάση του οποίου θα επιβαλλόταν περιβαλλοντική εισφορά 0,03 € (0,04 € συμπεριλαμβανομένου του ΦΠΑ) από τον Ιανουάριο του 2018, με πρόβλεψη για αύξηση του τέλους τον επόμενο χρόνο σε 0,07 € (€ 0,09 συμπεριλαμβανομένου ΦΠΑ). Προτείνεται η επιβολή περιβαλλοντικών φόρων και σε άλλα προϊόντα, όπως μπουκάλια ποτών και δοχεία τροφίμων και η στήριξη στην εφαρμογή ενός DRS (Σύστημα εγγυοδοσίας) στη χώρα.

Τα στοιχεία από χώρες όπου το **DRS** εφαρμόζεται για δοχεία ποτών μίας χρήσης δείχνουν ότι μπορεί να προσφέρουν πολλαπλά οφέλη, όπως αυξημένα ποσοστά ανακύκλωσης, υψηλότερη καθαρότητα στο συλλεχθέν υλικό και μείωση της ρύπανσης (littering). Η χρήση και η λειτουργία ενός τέτοιου συστήματος συνεπάγεται κόστος, το οποίο πρέπει να βαρύνει ορισμένους ή όλους τους παράγοντες που συμμετέχουν στην παραγωγή, την εισαγωγή και την πώληση ποτών, καθώς και επιπτώσεις σε εκείνους που διαχειρίζονται τα απόβλητα που προκύπτουν. Οι εθνικές αρχές είναι συνήθως υπεύθυνες για την ανάπτυξη των αρχικών μελετών, όπως οι προκαταρκτικές μελέτες σκοπιμότητας και οι μελέτες σκοπιμότητας. Μέσω αυτών των ενεργειών οικοδομείται ίδια ικανότητα και ενεργοποιούνται οι απαραίτητες νομοθετικές τροποποιήσεις.

Τα αποτελέσματα της προκαταρκτικής

μελέτης σκοπιμότητας (pre feasibility study) συγκεντρώνουν τα ευρήματα από διάφορες συνεντεύξεις από εμπλεκόμενες βιομηχανίες ποτών και παραγωγών αυτόματων μηχανημάτων συλλογής συσκευασιών (Reverse Vending Machines, RVM).. Με βάση τα στοιχεία που έχουν συλλεγεί και των γνώσεων που έχουν αποκτηθεί για τις τοπικές συνθήκες , δίνονται ορισμένες συστάσεις για τον σχεδιασμό DRS στη χώρα. Μεταξύ αυτών, είναι ζωτικής σημασίας να επισημανθούν οι απαιτούμενες αλλαγές που πρέπει να γίνουν στην ισχύουσα νομοθεσία περί συσκευασίας (Νόμος 2939/2001, όπως τροποποιήθηκε) για τον καθορισμό κανόνων και ευθυνών ειδικά για το DRS. Ο καθορισμός στόχων ανακύκλωσης και προστίμων για μη συμμόρφωση θα πρέπει επίσης να συμπεριληφθεί και να γίνει η ανάλογη και απαραίτητη νομοθετική ρύθμιση.

Συνιστάται ιδιαίτερα όπως η χώρα προχωρήσει στην δημιουργία ενός ανεξάρτητου Οργανισμού Ιδιωτικού Δικαίου (βιομηχανίες ποτών, λιανικό εμπόριο, εταιρείες εφοδιαστικής αλυσίδας) που να διαχειρίζεται το DRS σε μη κερδοσκοπική βάση και να έχει την κυριότητα του συλλεγόμενου υλικού. Επιπλέον, προτείνεται όπως εταιρείες λιανικού εμπορίου, με έκταση μεγαλύτερη από 200-300 m2, να είναι υποχρεωμένες να συμμετέχουν στο σύστημα. Όσον αφορά το πεδίο εφαρμογής του DRS, προτείνεται η ένταξη στο σύστημα πλαστικών, γυάλινων και συσκευασιών/ δοχείων αλουμινίου.

Τα τέλη καταβολής προτείνεται να κυμαίνονται μεταξύ 0,10 - 0,15 € ανά δοχείο ενώ τα τέλη επεξεργασίας πρέπει να υπολογίζονται με τέτοιο τρόπο ώστε να αντιστοιχούν στο κόστος της εταιρείας λιανικής πώλησης, συμπεριλαμβάνοντας την αποθήκευση και το κόστος προσωπικού εντός καταστημάτων. Τα τέλη θα πρέπει να είναι υψηλότερα για ένα αυτοματοποιημένο σύστημα επιστροφής από τα τέλη ενός μη – αυτοματοποιημένου συστήματος επιστροφής και να εξαρτώνται από το κατά πόσον τα RVM θα βρίσκονται υπό την ευθύνη των εταιρειών λιανικού εμπορίου. Η άτυπη οικονομία επωφελείται επίσης από το DRS, δεδομένου ότι το συγκεντρωμένο υλικό έχει υψηλότερη αξία από την συνηθισμένη αγορά και οι συνθήκες συλλογής είναι συνήθως καλύτερες μέσω του συστήματος.

Λαμβάνοντας υπόψη ότι η Ελλάδα έχει μια ιδιαίτερη γεωγραφική κατανομή, για τους σκοπούς της παρούσας μελέτης, η χώρα χωρίζεται σε κατηγορίες, με βάση τον πληθυσμό και τις υποδομές της. Τα νησιά χωρίζονται σε δύο κύριες ομάδες: νησιά με ηπειρωτική συμπεριφορά και νησιά με αποκλειστικά τουριστικές δραστηριότητες. Για τις πρώτες, έχοντας κατά νου ότι παρουσιάζουν παρόμοια υποδομή (λιανικό εμπόριο, εγκαταστάσεις ανακύκλωσης, εφοδιαστική αλυσίδα) με τις μεγαλύτερες πόλεις, δεν απαιτείται ειδική σύσταση. Για τα νησιά με αποκλειστικά τουριστικές δραστηριότητες, συνιστάται η κατασκευή σημείων / κέντρων επιστροφής που θα βρίσκονται σε κεντρικές τοποθεσίες (δημόσιες πλατείες ή / και τουριστικά αξιοθέατα), δεδομένου ότι οι τουρίστες μπορεί να μην είναι ενήμεροι για την ύπαρξη του συστήματος. Εκτός αυτού, τα μικρότερα νησιά μπορούν να λάβουν ένα μηχάνημα αυτόματης συλλογής (RVM) στην περιοχή του λιμανιού που θα μπορούσε να συνδυαστεί με αξιοθέατα / τουριστικές δραστηριότητες. Η μεταφορά του υλικού θα ήταν ετσι ευκολότερη και πιο προσιτή. Επιπλέον, η μίσθωση RVM θα πρέπει να ληφθεί υπόψη για τις περιόδους αιχμής.

Τέλος, για να αποφευχθεί η απάτη, να διευκολυνθεί η επικοινωνία και να καταστεί δυνατή η παρακολούθηση, ένα συγκεκριμένο λογότυπο που θα εκδίδεται από τον κεντρικό διαχειριστή του συστήματος θα πρέπει να εφαρμόζεται σε όλες τις συσκευασίες ποτώνεντός του πεδίου DRS και η εναρμόνιση των γραμμωτών κωδίκων (barcodes) πρέπει να πραγματοποιείται σε όλη τη χώρα.

Σύμφωνα με άλλες ευρωπαϊκές βέλτιστες πρακτικές, τα προαναφερθέντα οικονομικά εργαλεία έχουν αποδείξει την επιτυχία και την αποτελεσματικότητά τους, όταν εφαρμόζονται και παρακολουθούνται σωστά. Η Ελλάδα έχει ήδη δημιουργήσει μια σταθερή βάση για τη βιώσιμη χρηματοδότηση της διαχείρισης αποβλήτων και βρίσκεται σε καλό δρόμο για την ανάπτυξη και την εφαρμογή περαιτέρω εργαλείων για τη στήριξη και ενίσχυση της ανακύκλωσης στη χώρα.

2. Introduction

Economic instruments encompass a range of policy tools, from waste taxes and marketable permits to DRS and PAYT systems. The main functions of economic instruments, applied to solid waste, are to finance management and operational services, influence the behaviour of public managers, productive sectors and the population, and internalize the impacts generated by the volume of waste produced.

A general overview and a categorisation of the available economic instruments are shown in Figure 1. The taxonomy used is the one adopted by the United Nations Environment Program (UNEP) guidance on the environmentally sound management of household waste (UNEP, 2019).

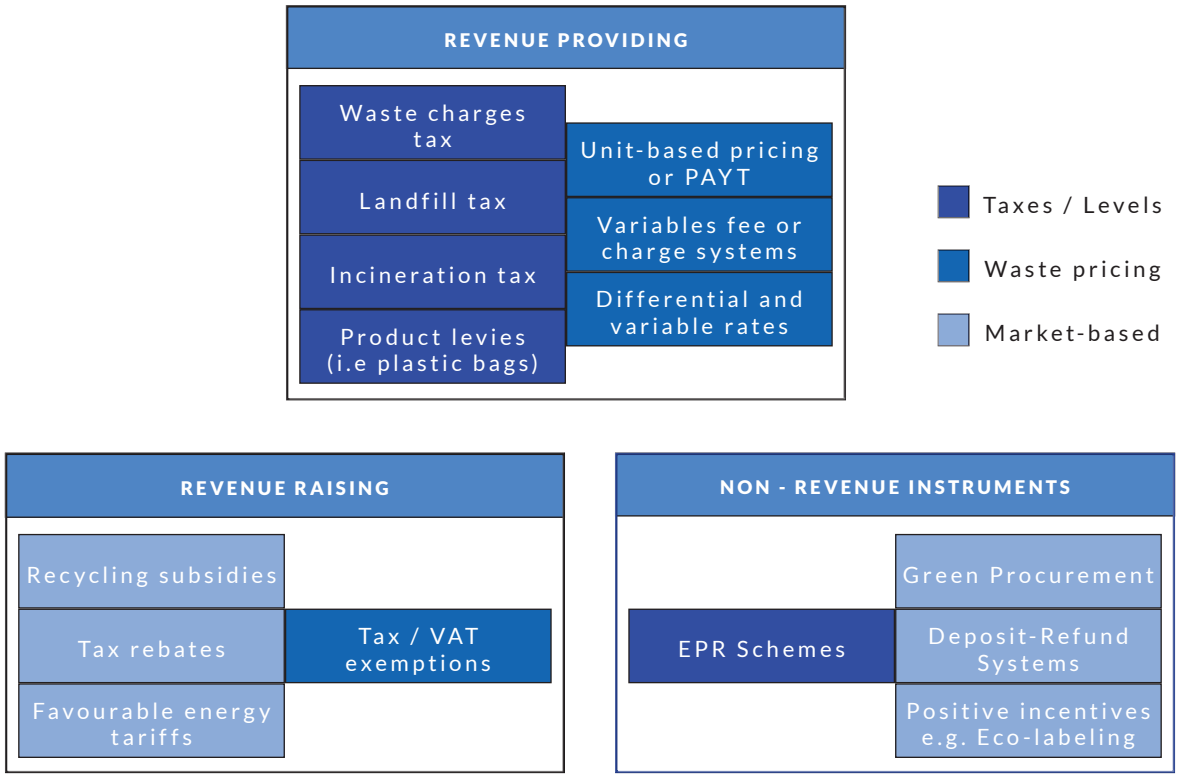


Figure 1 - Categorisation of economic instruments (IFRA, 2019)

According to the World Health Organisation (WHO) (World Health Organization, 2019), the design and application of economic instruments can vary depending on the intended approach, including:

- Revising upwards the prices on products and services, depending on hazardousness to human health and the environment, and expanding the financial returns on adoption and application of more sustainable approaches on production and consumption patterns.
- Reducing the compliance cost to polluters or users of natural resources when using more cost-efficient and environmentally effective measures.

- Encouraging innovative and sustainable technologies investments to create environmental and financial benefits.
- Incentivizing environmentally friendly and responsible actions through the allocation of responsibilities of firms, groups, or individuals.
- Raising revenues to achieve environmental and health objectives.

Greece has adopted its National Waste Management Plan (NWMP), prepared by the Ministry of Environment and Energy (YPEN), in December 2015, which follows the European Union's (EU) Waste Framework Directive (WFD) 2008/98/EC. According to the plan, 50% of the aggregate municipal solid waste (MSW) shall be processed for re-use and recycling through a separate collection scheme of recyclables and bio-waste by 2020 (nationwide). The NWMP is currently under revision and is expected to be updated by mid-2020.

For the past few years, several countries have acknowledged the effectiveness of economic instruments in environmental policies, reflecting an increasing awareness of their potential cost-effectiveness as well as the need to diversify the "policy toolbox" in order to encourage citizens and businesses to improve their recycling performance. The waste framework is no exception to this tendency.

Optimization and enforcement of existing economic instruments, as well as the development of additional tools, can support Greece to achieve its recycling targets.

2.1 OBJECTIVES OF THE STUDY

This study forms part of four areas of intervention to optimize municipal waste management in Greece. By increasing both, technical and economic capacities, this report focuses on the provision of a guideline "Use of economic instruments for waste management" and on a pre-feasibility study on DRS in Greece.

The present study provides a general overview on several economic instruments currently applied in different European countries, their status quo in Greece, a qualitative evaluation of their performances based on pre-defined criteria (see chapter 3) and best practices, with a focus on the Mediterranean region, when feasible, due to cultural similarities to the Greek context.

Since the primary goal of the above-described project is to develop guidelines for best use of economic instruments in Greece, following the introductory chapter, the working methodology is shortly presented.

The guideline itself summarizes the economic instruments which are currently being applied in the country, including operational features, stakeholders, efficiency, and gaps, and explores the opportunities for extended use of these tools for waste policy, focusing on waste from households and the trade, services, and government sector.

Following the discussions with the YPEN, Hellenic Recycling Agency (HRA) and GIZ during the development of this project, a specific emphasis is given to extended producer responsibility and its role in improving recycling rates. For this topic,

a pre-feasibility study is addressed, focusing on DRS.

The guideline and pre-feasibility study shall be used as a baseline study for the implementation/optimization of economic instruments in Greece, aiming the achievement of the recycling target set up by the EU for 2025.

3. Methodology

For the development of the guidelines on the best use of economic instruments and the pre-feasibility study on DRS, two similar methodologies were conducted.

Bearing in mind that EU countries have similar environmental targets and regional similarities, both studies were highly based on previous experiences from member states (MS).

Specifically concerning economic instruments, an extensive literature review was conducted on pre- existing guidelines and case studies were examined focusing on Mediterranean countries since they present the analogous system as in Greece. Besides desk research, the team conducted on-site missions for data acquisition via meetings with waste management related stakeholders.

The main goals were the understanding of the status quo in the country, successful and failure cases, obtaining recommendations on required improvements and optimization measures from decision- makers and defining project boundaries, based on the specific needs of the country. Project boundaries mean, in this context, the economic instruments that would be assessed, and to what extent.

After providing a general overview on the topic, the circumstances for each instrument in Greece was described and qualitatively analysed, including the below-described parameters (see Table 1), following the guidelines on "Economic instruments in the waste management sector" (Green Budget Germany, 2010).

Table 1 - Parameters for evaluating economic instruments (BFS, 2019[1])

PARAMETER	DESCRIPTION
Environmental impact	To what extent are incentives created by the instrument capable of effectively contributing to environmental objectives?
Revenue generation	What is the revenue potential of the instrument? To what extent are revenues reliable and stable?
Market impact	Market impact In which way does the implementation of the respective instrument influence the competitiveness of specific sectors?
Social impact	In which way does the implementation of the instrument influence income distribution?
Administrative costs	What are the administrative costs of the implementation of the instrument (e.g., tax and data collection, monitoring, etc.)?
Political acceptance	In which way does the implementation of the instrument represent any significant political or social opposition?

After this evaluation, one "best-practice" from the EU was delineated, aiming the establishment of a parallel with the Greek context, based on demands described by decision-makers in the meetings conducted during the on-site missions.

The main conclusions of this guideline provide recommendations on different hierarchal levels, legislation amendments, control, and transparency policies and potential technological improvements. The methodology is shown in Figure 2.

1 Table created with data from (Green Budget Germany, 2010).

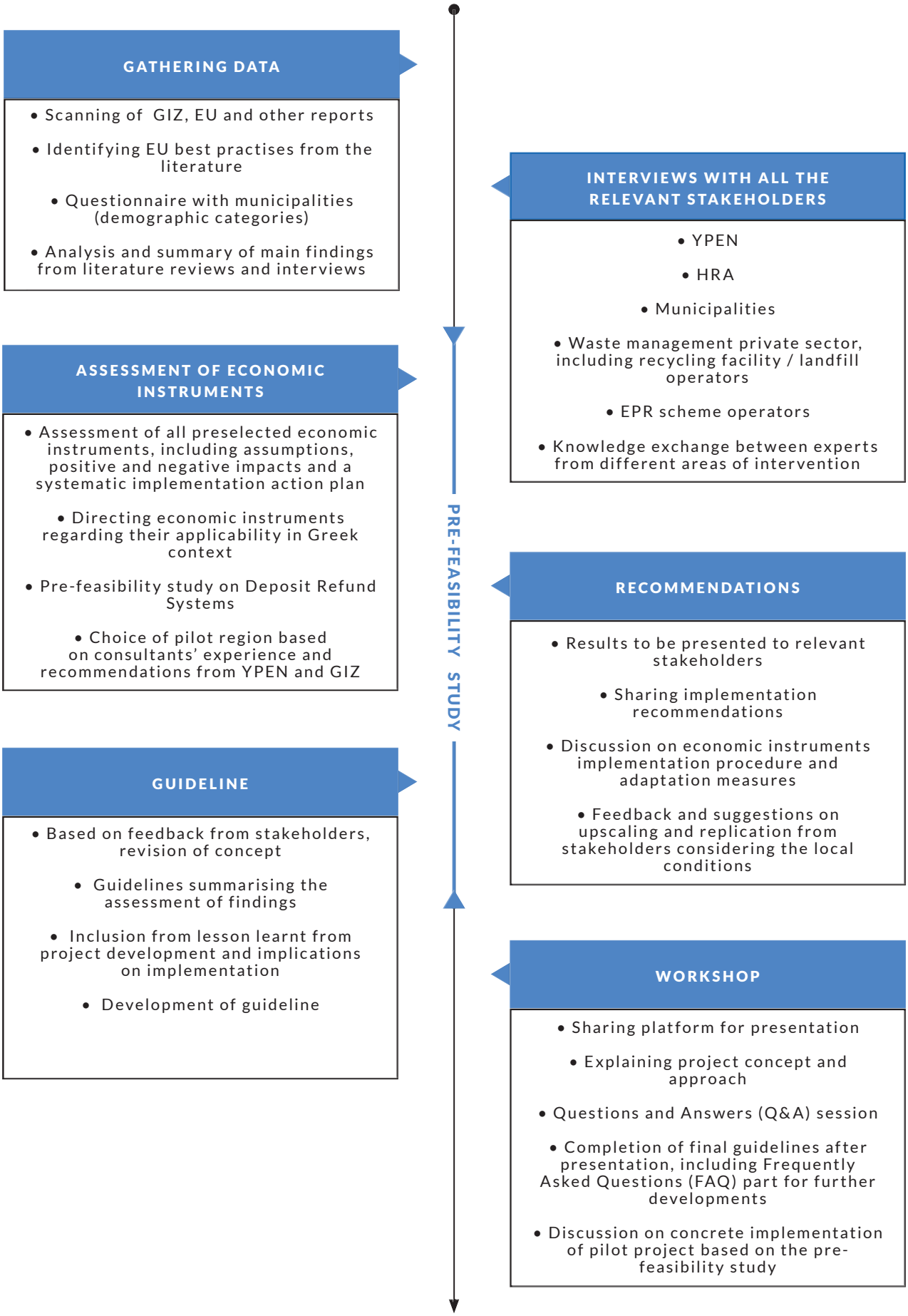


Figure 2 - Methodology for the development of the guidelines (BFS, 2019)

Based on the above-mentioned methodology, the activity was broken down into the following action plans (see Table 2).

Table 2 - Task break-down structure (BFS, 2019)

JULY	TASK 1 GATHERING AVAILABLE DATA AND REPORTS WITH ITS COMPARATIVE ANALYSIS ON THE ECONOMIC INSTRUMENTS	• Screening for various EU/Greek studies/reports for economic instruments in MSW sector • Analysing the following features: waste charges/landfill and incineration tax/levy schemes, price/fee at the point of sale, instruments supporting EPR, amongst others • Analysing the current situation and existing studies e.g. on PAYT schemes • Assessing the existing legal framework conditions in Greece and at the EU level • Analysing of the new provisions under the EU circular economy legislative package
AUGUST / SETEMBER	TASK 2 CONCEPTUALIZING A PROCEDURAL PLAN AND SUGGESTIONS ON USAGE OF ECONOMIC INSTRUMENTS	• Reviewing the usage and efficiency of economic instruments in the region and amongst the EU member states • Setting the criteria for appraising economic instruments • Defining project boundaries (conceptual, legal, institutional etc.)
OCTOBER	TASK 3 PRE- FEASIBILITY STUDY ON ECONOMIC INSTRUMENTS AND DESK RESEARCH ON DRS	• Evaluating the viability of pre-determined schemes, adapted to a Greek context • Determining the scope of the pre-feasibility study, following the recommendations from YPEN, HRA and GIZ • Researching on EU best practices on the implementation of DRS
NOVEMBER	TASK 4 RECOMMENDATIONS ON MEASURES OF AWARENESS, AND UPSCALING	• Checking already implemented awareness-raising measures, training or other information tools in the country and states with cultural similarities, when feasible • Providing recommendations on awareness-raising measures, training or other information tools • Upscaling entry-points and replication for other Greek municipalities
DECEMBER	TASK 5 DETAILED RECOMMENDATIONS TO IMPROVE POLICY INSTRUMENTS IN ECONOMIC INSTRUMENTS	• Providing general recommendations on efficient economic instruments usage • Assessing design parameters for DRS • Establishing a road map for the implementation of DRS in Greece, highlighting variables, possible alternatives, and decision points.
JANUARY	TASK 6 PRESENTATION AND FEEDBACK TO THE FINDINGS IN ECONOMIC INSTRUMENTS	• Presenting the results from the guidelines and the pre-feasibility study to involved stakeholders • Adjusting and refining the final details of both documents after the presentation • Finalizing the deliverables

During the first on-site mission, the expert team discussed with GIZ, YPEN, and HRA major topics on economic instruments and which of them could be further assessed considering the Greek context. After pondering the pros and cons of pilot projects for different economic instruments, it was decided that the project would contemplate a pre-feasibility study on the implementation of a DRS in Greece.

The goal of this study is to provide a holistic understanding of the general required parameters that must be considered while scheming such a system. It aims at showing options for the country when designing its own DRS, based on EU best practices and successful cases.

The pre-feasibility can be used as a tool for decision-makers to engage related stakeholders and promote internal discussion rounds on how DRS could look like, following the Greek context. The study does not aim at defining any preferred scheme and/or partner company for its implementation.

As above-mentioned, the report describes previous experiences from EU member states. The methodology applied contemplated main design parameters for the system, including, but not limited to, legislative framework, institutional setup, input, logistics, financial estimations, monitoring, and awareness programs, among others.

For each parameter, design options, based on previous European successful cases, were described and explained, including context application and potential challenges faced by the system.

To enable a more realistic approach towards a collection scheme, the experts proposed clustering country regions following the Klisthenis law for the mainland. For insular regions, the division did not proceed in terms of the number of inhabitants. Instead, following the recommendations of YPEN, islands were divided concerning the presence of

further infrastructure and activity outside touristic peaks. Clustering assumptions are further detailed in the pre-feasibility study.

Besides EU solid experiences, pilot cases in the country were also addressed, and related stakeholders collaborated with local know-how, especially regarding the operation and legal setup. Meetings with machinery suppliers, existing producer responsibility organizations (PRO), and recycling plants were also conducted to acquire reliable data on waste production, collection, treatment, and marketing. All information gathered during the on-site missions was documented and shared with GIZ and partners.

At the end of the report, the previously cited design parameters were placed within a road map, which encompasses the multiple variables and implementation possibilities of DRS. Besides, a qualitative assessment was provided on positive and negative impacts on the application of this economic instrument, speculating the possible results considering the Greek context.

Further details on the study are shown in chapter 5.

Below, the methodology for the development of the pre-feasibility study is shown (see Figure 3).

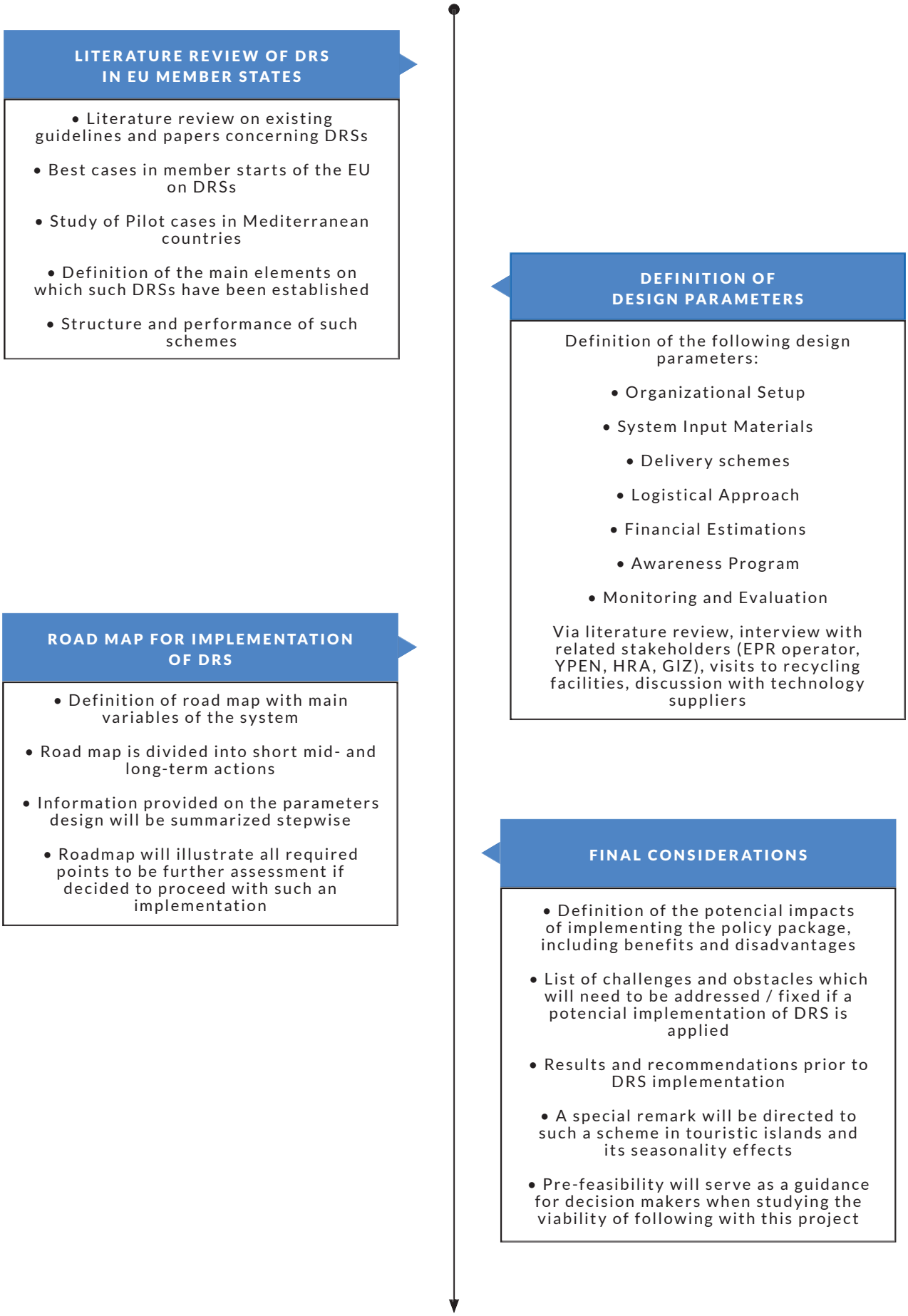


Figure 3 - Methodology for the development of a pre-feasibility study on DRS (BFS, 2019)

4. Guidelines on the usage of economic instruments for waste management in Greece

The financial sustainability of solid waste management systems is one of the most significant challenges in low-, middle- and even in high-income countries. In many cases, fees to cover solid waste management costs are non-existing and/or insufficient. Due to the social challenges of effectively raising these fees, capital and operational costs are rarely covered.

Besides covering costs, fees can incentivize waste reduction and recycling via change of behaviour and, by means of the pricing mechanism, minimize waste generation avoiding adverse impacts (e.g., from landfills), or strengthen resource recovery and recycling.

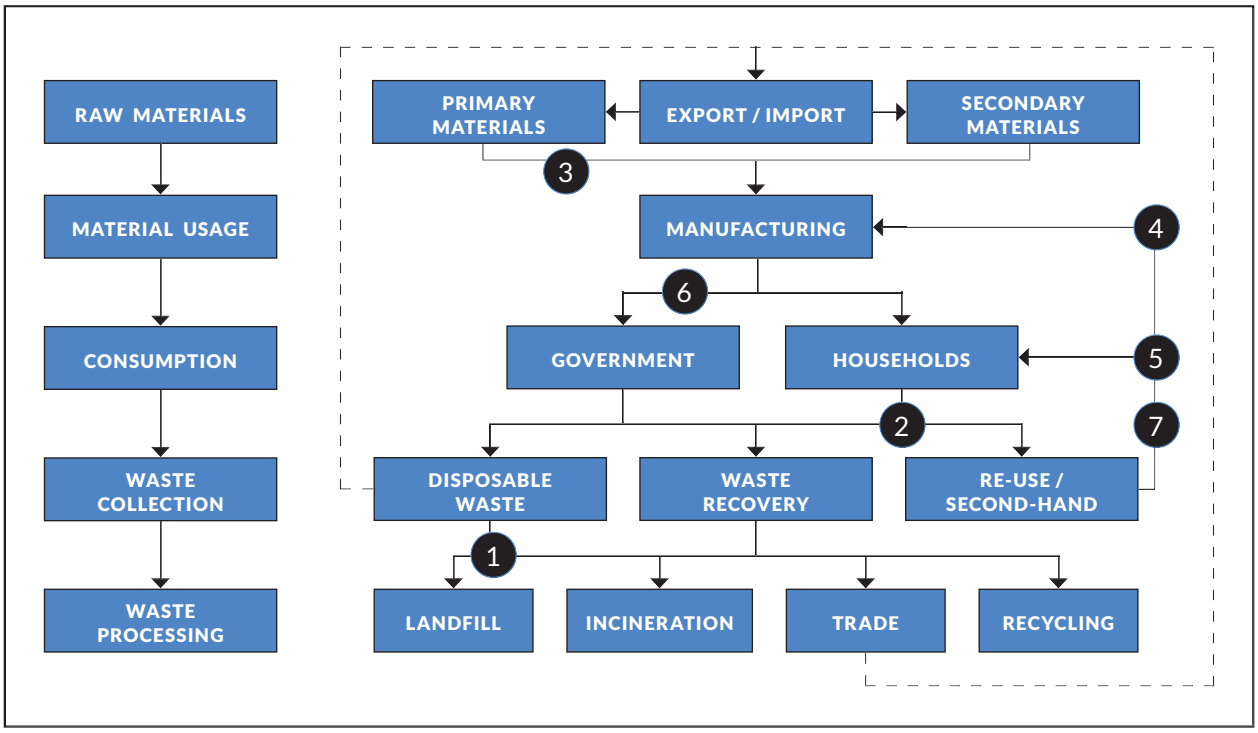
4.1 SYSTEM BOUNDARIES

An analytical framework must be designed, representing the most relevant conceptual dimensions of waste management in order to determine the potential of economic instruments in the Greek waste policy.

There are three scales of intervention which affect the effectiveness of the economic instruments (see Figure 4). In the case of unit-based pricing for waste charges, implementation on a municipal level is most effective since municipal authorities are better able to account for local conditions. When relating to a DRS, national implementation is more practical, given the need for a countrywide collection and refund system. In several countries, international intervention might be required through harmonization of import levies as well as setting up take-back schemes of their used products.

Figure 4 - Scales of intervention for the implementation of economic instruments (BFS, 2019)

Traditionally, waste management policies are mainly focused on the final phase in the material chains, namely the waste stage. These policies can be present along the whole value chain, to offer the most cost-efficient improvements towards sustainable material use in Greece (see Figure 5).



Economic instruments are coded as follows:

1. Landfill and incineration charges
2. Unit-based pricing
3. Taxation of raw materials and products
4. Deposit-refund systems
5. Subsidies
6. Public procurement
7. Value Added Tax rates

Figure 5 - Use of economic instruments along the whole value chain (Oosterhuis, et al., 2009)

4.2 WASTE CHARGES

In most countries, the collection and treatment of municipal solid waste are locally organized by the municipalities, either through public or private waste management services.

On the revenue side, the costs of waste management may be either paid from the general municipal budget or passed on to the citizens, either through a local waste tax or user charges for waste management services.

User charges for waste collection and/or disposal are relatively easy to implement and useful for generating the revenue to cover the costs (Green Budget Germany, 2010).

Depending on how these charges are calculated, they can be further divided into the sub-categories:

Flat rate user charges:

- Specifically, to cover the costs of waste management services.
- All users pay the same amount independent of the quantity or quality of waste.

Service-unrelated variable-rate user charges:

- o Variable rates unrelated (or indirectly related) to waste quality/ quantity.
- o Rate based on property tax, water or energy consumption, income tax, number of dwellers).

Service-related variable-rate user charges (unit-pricing):

- Vary with the amount or quality of waste generated, thus creating an environmental incentive for waste reduction and better separation.
- A representative example of this branch is the PAYT system, further explained in chapter 4.6.

4.2.1 Status quo in Greece

Waste charges in Greece are levied - as part of a general municipal tax - through household electricity bills. The waste levy is regulated by Law 25/1975 (Government Gazette A 74), amended by the laws of 429/74 (Government Gazette A 235), 1080/1980, Article 5 (Government Gazette 246/A/22-10- 1980), and 4555/2018 Article 185 (Government Gazette 133A), which states that "The single fee for cleaning and lighting shall apply to any property within the administrative districts of the municipalities and shall be exclusively intended to cover all costs relating to the provision of waste collection and management services, street lighting, squares, and all other public spaces, as well as any other service provided by the municipalities (...)".

Under Article 185 of the 2018 amendment, the municipalities are entitled to set general and special rates defining the implemented levy of each property for waste management. The levy is determined by multiplying the registered surface area of the residence with the general rates such as type of property (residential, non-profitable/charity, commercial), and any special rates the municipality might deem to apply to specific types of residences, considering economic and environmental factors.

For example, in Attica, housing multiplying factors range from 1.02 €/m2 in Moschato to 2.94 €/m2, in Filothei (Aftodioikisi, 2018). In the municipality of Thessaloniki, it varies from 1.30 to 1.72 €/m2 for the B and A bands, respectively. Zone A includes all real estate outside Zone B, plus all buildings that have at least one facade on its streets, and the squares through which the roads pass these, irrespective of the entry point of the building. Zone B is residential. For retail stores, it ranges from 2.62 to 4.30 €/m2 for the B and A bands, respectively (Thessaloniki, 2019).

A house of 160 m2 in Corinth municipality, about an hour outside Athens, can expect to pay around 61.50€ in municipal charges every two months, for example. Water and sewerage charges are billed separately by the municipality (Irish Times Newspaper, 2019).

The system is sufficient on the basis that these revenues cover the total cost of the municipality's waste management provision (Laws 1080/1980, Article 17, and 1828/1989, Article 25).

4.2.2 Short evaluation summary of waste charges in Greece

In Table 3, a short assessment, including significant aspects of the implementation/ conduction of waste charging in Greece, was performed.

Table 3 - Evaluation of waste charges

PARAMETER	RATE	DESCRIPTION
Environmental Aspects	0	Neither positive nor negative impact, since this type of charge is usually "invisible" to the citizens; hence, no changes of behaviour are affected out of it.
Revenue Generation	++	Usually very positive, since billing is connected to the electricity bill, avoiding default risks and bringing stability to the system
Market Impact	0	Non-applicable, in this case, since levy is charged independently from the waste management sector – does not promote investments/operations optimizations, for instance.
Social Impact	0	Since the fee varies with occupational type, it does not tend to create social impairment. On the other hand, households with bigger areas might pay more than small businesses that are producing more waste. Due to its duality, this aspect is considered neutral.
Administrative Costs	++	Low administrative efforts since household-related data (number of inhabitants, income, and value or size of properties) are monitored and recorded for other purposes and, therefore, the billing for waste charges does not constitute significant additional administrative processes.
Political Acceptance	+	Since the charges have been implemented for a longer time, and are usually raised together with other taxes, like the income or property tax or the water bill, changes in waste charges are, usually, hardly noticed.

4.2.3 Case study – Waste Charges in the EU

Waste charges across the EU vary depending on several parameters such as the type of waste management system they are implementing (PAYT, flat rate, and variable charges etc.), as well as the size of the local authorities, population etc.

Different ways of charging waste management and by different actors are applied across the EU, some of which are presented in Table 4.

Table 4 - Roles and responsibilities on waste charges (Eunomia, 2002)

MEMBER STATE	MUNICIPAL ACTORS	CHARGING
Austria	Municipalities Waste associations	Widespread emptying bin-based variable charging
Belguim	Municipalities Inter-municipal waste associations Net Brussels	Widespread variable charging
Denmark	Municipalities Inter-municipal waste associations	Implementation by 10% of the authorities, usually weight-based but also charges per additional bags while reductions are being applied by some on waste charges fees for home composting
Finland	Municipalities and co-operative municipal waste management companies	Volume-based charging on residual waste
France	Communes and groupings Departments Sometimes responsibility of former with latter treatment	Volume-based and some weight-based
Germany	Municipalities	Widespread variable volume-based, amount of waste and some on collection frequency
Greece	Municipalities Association of municipalities	Widespread flat rate charging, limited piloting of variable charging by weight or sack
Ireland	Municipalities	Weight-based or per lift variable charging (DCCAE, 2019)
Italy	Municipality Ambitio Territoriale ottimale	Variable charging in some regions with tags and/or average weight
Luxemburg	Municipalities Intercommunal Syndicates	Volume-based and weight-based variable charging
Netherlands	Municipalities Independent publicly owned companies	Volume-based and volume/collection frequency waste management charges
Portugal (EC, 2015)	Municipalities and in some private sector	Piloting of variable charging per sack
Spain (I. Ventosa et al., 2017)	Municipalities Autonomous regions Public companies	Frequent flat fees and variable waste charges
Sweden (Avfall Sverige, 2019)	Municipality	Both fixed and variable waste charge (one for collection one for treatment), several municipalities implement a weight-based charge
United Kingdom	Municipalities (divide into waste collection authorities and waste disposal authorities)	Flat rate waste charges

There is an increasing application of variable waste charges rather than flat rate charges across the EU due to the environmental and social benefits of such tax (waste reduction, fairness, and acceptance), even though there are still some administration and financing difficulties in their full- scale application.

4.2.4 Optimization measures

The collection of waste charges could be processed via property tax to optimize administration costs. Extrapolating expectations, the implementation of this principle would have the following impacts:

- It shall put an end to a long-lasting discussion that waste charge billing should not be imposed via the National Electricity Company or any other electricity provider, an issue that is more vivid under the light of the current financial problems of the company.
- The decoupling of waste charges from electricity charges would clarify and remediate the current view on electricity charges e.g.; citizens might have the feeling that the waste charges collected via electricity bills are being claimed by the provider and not forwarded to the municipalities.
- Such a switchover of the charging system would most likely implicate logistical and administrative, with potential costs associated.
- Anyhow, since the property taxes have been in place for the past 5 years, logistical efforts would not be so high. This could overcome the suspicion that if the money is not collected via electricity bills, and is paid directly to the municipalities instead, then local authorities would lose revenues.

On the other hand, the collection of waste charge via water bill (as in many other European countries) could be less efficient:

- Water bills come from another source e.g. Local Water Authorities.
- In this case, a similar issue as per the electricity bill collection route might arise.

Fee collection via property tax would most likely be based on the currently applied principle of charging per sq. meter, as long as the same waste charges system applies, thus taxes would remain the same.

Besides, an alternative waste scheme, accounting for produced waste quantities and qualities, should be established to improve recycling rates and raise awareness among citizens. A realistic PAYT scheme should be established after considering the town planning structure of the vast majority of Greek cities:

- Most of the households in Greece are in blocks of flats.
- PAYT scheme could be established per building (see chapter 4.6 for further details).
- The building administrator should, through specific procedures, allocate the dwelling bill to every dweller.

4.3 LANDFILL TAXES

Landfilling is, in the short term, the most affordable destination for MSW, in comparison to other treatment technologies such as mechanical biological treatment (MBT) and/or incineration. However, the environmental and social costs of landfilling (for example, greenhouse gases (GHG), air emissions, and leachate production causing air, water and soil pollution) are borne by the general public and the communities neighbouring disposal site. These costs are often not considered by local authorities, waste management services, and industrial waste producers when comparing the relative costs of different waste management options (GIZ, 2015).

The landfill tax incorporates and monetizes these factors into the price of waste disposal. Besides covering costs for logistics and landfill operations (maintenance, leachate treatment, etc.),

this tax also serves as an incentive to channel MSW towards treatment and recycling alternatives, provided that the fee is sufficiently high to enable the development of other alternatives economically.

The Dutch landfill tax, for example, has made landfilling more expensive than incineration, resulting in increased recycling rates by companies in the service sector. In some countries, landfill taxes have led to a reduction in landfilling of construction and demolition waste (CDW) (Oosterhuis, et al., 2009).

Commonly, the higher the tax rate, the lower the percentage of waste landfilled. In the EU, there is a usual differentiation between:

- taxes: a levy charged by public authorities, in most cases at a national level, for the disposal of waste in a landfill site, usually with an environmental purpose in mind, and where the revenue is adding to the body responsible for the levy; and
- gate fees: charges set by the operators of the landfills for the provision of the service (e.g., waste disposal) and which are designed to cover their costs and generate profit. This type of fee is subject to variation according to the landfill site used, and to other factors such as available capacity and market variations. Gate fees do not always cover an operators' cost due to the market situation at a given time.

Annex 9.2 provides an overview of landfill taxes, gate fees, restrictions (bans), and compliance with the Landfill Directive (more formally Council Directive 1999/31/EC of 26 April 1999) for some of the European Union Member States (MS) (European Commission, 2012).

4.3.1 Status quo in Greece

In 2012, the Greek government adopted Law 4042/2012, in order to comply with the EU Waste Framework Directive 2008/98/EC, introducing a landfill tax. Starting from 2014, organizations/enterprises disposing untreated municipal waste into landfills would have to pay a landfill tax, which would initiate at 35 €/tonne. The tax was envisaged to raise 5€/tonne annually until 60 €/tonne was reached (Hellenic Republic, 2012).

According to Article 43 of Law 4042/2012, all revenues from the landfill tax should be deposited in the "National Green Fund", set up by the Greek government in 2010, aiming to finance waste recovery and disposal projects with the raised funds. Taking into account that the amount of municipal waste generated per year is around 5,450,000 tonne/yr and that around 80% of this waste is disposed of in landfills (Eurostat, 2017), a landfill tax of 35€ to 60 € per tonne might lead to revenues of approximately EUR 140 to 250 million euros per year (Zachariadis, 2016).

However, landfill tax has never been implemented; instead, since its adoption in 2014, a series of legal suspensions occurred (Laws 4257/2014 – Article 77, Legal Act Government Gazette A'182 - Article 77, 4447/2016 – Article 35, and 4508/2017 – Article 39).

The primary reason for these postponements (commonly shared by the government and other stakeholders) is that the tax would impose an additional economic burden that would have a negative financial and political impact. Local authorities (municipalities and communities) that must pay the landfill tax would have to choose between:

- forwarding this tax through to households and enterprises,

thereby risking aggravating political reactions or even social equity problems; or

- absorbing the costs of this tax without changing the waste charges to individuals, which would nevertheless put financial pressure on local authorities.

Besides, an increase in the cost of official waste disposal might also lead to a rise in illegal dumping, thereby causing failure to achieve both environmental and revenue-raising objectives

The landfill tax (law 4042/2012, Article 43) was permanently repealed and replaced by an environmental levy, the "Circular Economy Levy" (CEL), under Law 4609 in 2019 (Government Gazette 67/A/3-5-2019). According to this, the cost of waste management is calculated annually by the solid waste management organization ("FoDSA", in Greek) and distributed respectively to the affiliated municipalities. In case municipalities or legal persons act as FoDSA, then the cost will be included in their annual budget.

The CEL starts at 10 €/tonne and increases gradually per 5 €/tonne until it reaches a maximum cost of 35€/tonne. The levy shall be recalculated every 6 months, accounting for (Law 4609/2019 – Article 55):

- actual quantities of the untreated waste being landfilled;
- calculated reduction regarding the progression of the RWMP foreseen actions for treatment facilities (if applicable);
- the capacity of the aforementioned facilities.

This levy can be reduced if the FoDSA implements the foreseen by the Reginal Waste Management Plan (RWMP)

actions. The reduction starts at 35% if an environmental impact assessment permit is issued for an MBT or/and bio-waste facilities, and a 70% if there is a contract for the construction of an MBT. If all the foreseen projects from the RWMP are in an operational stage, no levy will be issued to the FoDSA (Law 4609/2019).

Currently, there are FoDSAs such as the ones in West Macedonia and Epirus, which are in accordance with the current EU Directives on waste treatment. However, most of them are either partially implementing the EU requirements (e.g., only landfilling) or in some instances not in line with the EU and national policies by using illegal dumpsites for the disposal of their waste (RES-EIA SA., 2018).

4.3.2 Short evaluation summary of landfill tax in Greece

In Table 5, a short assessment including major aspects of the implementation of the landfill tax in Greece was performed.

Table 5 - Evaluation of landfill tax

PARAMETER	RATE	DESCRIPTION
Environmental Aspects	-	By increasing the price for landfill disposal comparatively to other methods of waste treatment and disposal, municipalities and waste management operators are incentivized to opt for increased recycling and reuse. Considering that the levies are very restricted, the environmental aspects are negative. This evaluation could be positive if legislation (landfill tax) and monitoring were enforced.
Revenue Generation	+	Comparing the CEL with other landfill taxes shown in Table 34 (Annex 9.2), it is clear that Greece fluctuates within the lowest waste fees in western Europe, including Mediterranean countries such as Italy and Spain. For this reason, even if there is a positive revenue out of these taxes, it is still largely underestimated.
Market Impact	0	Generally, no market competition is affected by landfill taxes/CEL.
Social Impact	0	Landfill tax costs are generally assumed to be passed on to the consumer either through the municipal waste charges or through increased prices as businesses forward waste disposal associated costs to consumers. Nevertheless, due to their comparably low rate, this effect is not highly significant.
Administrative Costs	++	Low administrative efforts – especially compared to the potential costs of enforcing a regulation that could pursue the same objective (for instance, PAYT), are made. Only a certain number of landfills must be monitored, and not the innumerable amount of waste producers.
Political Acceptance	++	In most of the countries which have implemented this levy, acceptance is usually quite high, facilitated by the fact that citizens are aware that extensive landfilling is reaching problematic dimensions. Due to the economic crisis, there is a substantial concern that additional taxes would disproportionately burden low-income households. Hence, consumer associations are opposed to it, and policymakers are reluctant to enforce. For these reasons, currently, its political acceptance is high since taxes are low. If this panorama changes – increase in landfill taxes, political recognition will most likely decrease.

4.3.3 Case study – Landfill taxes in Catalonia, Spain

Landfill taxes differ across the EU MS and, in some cases, even between regions of the same country (e.g., Spain, Italy). As no harmonized tax exists at the EU level, each MS has set its own parameters under which the value of the tax was set (CEWEP, 2017).

The deployed tax varies depending on the set parameters of each MS and ranges between 150€/tonne (France) and 0 €/tonne for countries with no landfill tax in place[2]. In many of the MS, landfill tax has been coupled with the application of bans on specific waste streams such as organic and untreated waste among others. (CEWEP, 2017).

According to the data provided in Table 34 (Annex 9.2), only four MS are not implementing a landfill tax (Greece, Cyprus, Malta, Germany), of which the first three are amongst the MS with the highest landfilling rate exceeding 80%. In the case of Germany, however, despite the lack of such a tax, the landfill rates are amongst the lowest in the EU (lower than 1%) (EEA, 2019). That is due to the country's imposition of bans upon landfilling on specific waste streams as well as a combination of incineration and recycling schemes.

It appears that MS with the highest landfill taxes within the EU (Austria, Denmark, France, UK) have achieved higher recycling rates than countries with low or non-existing landfill tax in place, with

2 Reference year 2017.

the exception of Germany who falls under the category of the countries combining recycling and incineration (EEA, 2019).

Table 6 details the evolution of the landfill tax and its main requirements in the Catalonia region, Spain.

Table 6 - Case study: Landfill taxes in Catalonia (IFRA, 2019[3])

BOX 1: CATALONIA - SPAIN
Context: Spain's compliance with the Landfill Directive (due by 2016) and the Waste Framework Directive (due by 2020) relies upon addressing several issues, including the introduction of a national tax on the landfill of municipal waste, which took place in 2017. Catalonia, on the other hand, introduced its landfill tax in 2004.
Aims: - Divert waste from landfills. - Reinforce waste hierarchy according to the EU Directives. - Encourage separate collection and recovery of specific waste streams (bio-waste, packaging waste). - Incentivize municipalities through the creation of revenues for separate collection. - Generate revenues for the Catalan Waste Management Fund, which is used to finance waste management infrastructure and strategy.
Description: In 2004, Catalonia introduced a landfill tax later, followed by a series of amendments. The tax was set to 10€/tonne, later revised to a gradual increase to 20€/tonne in 2010, 30€/tonne in 2017, 35€/tonne in 2018, 41.4€/tonne in 2019 and to 47.1€/tonne, in 2020. The revenue is deposited in the Waste Management Fund, of which at least 50% shall be used to finance projects that would reduce the organic content in residual waste ending up in landfills or incinerators such as biological treatment of bio-waste and MBT. The balance of the fund would be refunded to the municipalities according to performance standards concerning the separate collection of bio-waste. The refund standards were upon the quality of the bio-waste received by the biological treatment plants, the contamination rate (assessed by periodical composition analyses), etc.
Results: - Decrease in the quantities of waste going to incineration. - Revenue from landfill tax on the first year of application amounted to 32.2 million euros. - Increase in the municipalities implementing separate collection of specific waste streams (bio-waste, paper/cardboard). - Increase in quantities of residual waste going to MBT. - Decrease in total MSW generation.

An overview of landfill taxes amongst EU member states is shown in Table 34, Annex 9.2.

4.3.4 Optimization measures

Following EU examples and best practices, a landfill tax - at least at the same price progress as planned, if not higher – should be re-introduced, according to the following issues:

- the tax should be collected by FoDSA via the affiliated municipalities, members of the FoDSA;
- each FoDSA should pay the tax to the Green Fund to be invested, and support separate collection, recycling and recovery activities to the municipalities, precisely like the abandoned landfill tax allowed; and
- the exact level of this tax shall be justified through a corresponding

3 Based on data from (R4R, 2014) and (CEWEP, 2017).

study, considering all legal responsibilities of FoDSA.

To prevent illegal dumping due to the increasing costs for landfills, law enforcement via monitoring, controlling, and penalization of infringers must be ensured.

Moreover, communication and awareness campaigns should be implemented, e.g., explanations on the laws and on the positive impacts they will bring to the cities/country.

4.4 INCINERATION TAXES

Thermal treatment, especially incineration, has been widely applied in the EU, as an effective way of achieving the EU recycling targets (Williams, 2005). For the past decades, waste to energy (WtE) technologies have been extensively applied throughout Europe as an accepted and successful process for treating MSW, especially in the West and Northern Europe (Williams, 2005).

Notably, there is a distinction in the charges concerning incineration, as in landfill charges (Bio Intelligence Service S.A.S, 2012):

- incineration tax: a tax imposed by a public authority for the treatment method of MSW through incineration; and
- gate fee: a charge on the provision of service from the operator of the facility (incinerator).

Several opinions have been expressed on the costs of an incineration tax. Mainly the tax is focusing on the exhaust gas treatment and the externalities of MSW incineration. Nonetheless, several actors agree that an incineration tax should be lower than the landfill tax, so as to avoid reverting back to landfilling (Eunomia, 2011).

The advocates of an incineration tax firmly support that the imposition of such a tax shall have the same effects as the tax on landfilling, and therefore incentivize MS to minimize incineration of their waste. To be more precise, the tax would force countries, profoundly dependable on incineration, to increase their efforts on enhancing other treatment methods which are higher in the waste hierarchy (Dubois, 2014).

So far, there is no flat tax on incineration at EU level. Several MS have adopted incineration taxes based on the environmental externalities of incineration plants, such as the emissions of air pollutants other than GHG (GIZ, 2015).

4.4.1 Status quo in Greece

Greece is one of the EU countries lacking MSW incineration facilities. Thermal treatment methods have been implemented on agricultural waste, bio-waste, non-recoverable hazardous waste, and medicinal hazardous waste (NWMP, 2015).

The country incinerates 58,000 tonnes per year, according to Eurostat's latest data (Eurostat, 2019), counting with one incineration facility for the treatment of hazardous medicinal waste, while the rest of the incinerated waste is majorly exported to EU incineration facilities (NWMP, 2015).

There is an on-going debate on whether incineration facilities should be built in the country to tackle the vast amounts of landfilled waste. However, due to the recently voted "Cohesion Fund post-2020" proposal, from the European Commission (EC), in which the funding of residual treatment facilities would be cut (including incinerators), this option seems unlikely, unless the funding of such a facility would come by the country's own

means.

Nonetheless, domestic co-processing facilities (cement and ceramic industries, paper mills, etc.), should be prioritised, as stated in the NWMP. No foreseeable action has been made so far due to the aforementioned social and political oppositions.

Table 7 - Evaluation of incineration tax

PARAMETER	RATE	DESCRIPTION
Environmental Aspects	**0**	As incineration and co-incineration of MSW are close to non-existent, an incineration tax currently would have no effect. However, as the country attempts to prioritise the WtE potentials of co-incineration, to divert RDF from being landfilled, the imposition of such a tax would be neutral due to the quantities led for incineration, provided that the tax would not exceed the landfill tax.
Revenue Generation	**0 / +**	There is a potential for raising revenues from the imposition of an incineration tax, as the country shall prioritise, according to the NWMP, the use of RDF for co-incineration. However, due to the limited receptors (only one currently), this revenue would prove to be insignificant.
Market Impact	**0**	It could generate a competitive issue between landfill and incineration facilities. Bearing in mind the very limited amount which is currently being incinerated, no significant market effects shall be observed.
Social Impact	**0**	Due to the low quantities that would be conducted to co-incineration, at least in the beginning, social effects would be unnoticeable and insignificant.
Administrative Costs	**-**	The administrative cost for the implementation of an incineration tax would far exceed any revenues incurred from the imposition of such a tax. The reason would be again the limited almost non-existent quantities that would be led for incineration/co-incineration and the lack of facilities.
Political Acceptance	**+**	As the tax in the countries that have imposed is correlated to the protection of the environment and especially to the emissions, such a tax would most likely not be opposed by the public, provided that it communicated adequately. Any opposition would occur regarding the process itself rather than the taxation, as previously stated. Certainly, an additional tax that will burden the middle and low-income households would not be readily accepted and, as such, it would be enforced with reluctance by the policymakers.

4.4.2 Short evaluation summary of incineration tax in Greece

In Table 7, a short assessment, including significant aspects of a potential implementation of an incineration tax in Greece was performed.

4.4.3 Case study – Incineration tax in Catalonia, Spain

In Box 2 (see Table 8), one case study is shown on the implementation of an incineration tax in Catalonia, Spain.

Table 8 - Case study: Incineration tax in Catalonia (IFRA, 2019[4])

BOX 2 - CATALONIA – SPAIN
Context: Spain has no national incineration tax; however, an incineration tax (disposal tax) was being introduced in 2008 in Catalonia.
Aims: - Reduce the waste quantities being incinerated. - Reinforce waste hierarchy according to the EU Directives. - Incentivize separate collection and recovery of specific waste streams (bio-waste, packaging waste). - Incentivize municipalities through the creation of revenues for separate collection. - Generate revenues for the Catalan Waste Management Fund, which is used to finance waste management infrastructure and strategy.
Description: In 2008, Catalonia passed a law (8/2008, as amended in 2011), establishing an incineration tax of 5€/tonne, incremented in 2010 to 15€/tonne for municipalities which have not initiated bio-waste separate collection. The revenue was deposited in the Waste Management Fund, of which at least 50% would be used to finance projects that would reduce the organic content in residual waste ending up in landfills or incinerators such as biological treatment of bio- waste and MBT. The balance of the fund would be refunded to the municipalities according to performance standards in regard to the separate collection of bio-waste. The refund standards were upon the quality of the received bio-waste.
Results: - Decrease in the quantities of waste going to incineration. - Increase of the municipalities implementing the separate collection of specific waste streams (bio-waste, paper/cardboard). - Increase of quantities of residual waste going to MBT. - Decrease of total MSW generation.

An overview of incineration taxes amongst EU member states is shown in Table 35, Annex 9.2.

4.4.4 Optimization measures

Currently, there is no need for the implementation of an incineration tax in Greece. As aforementioned, the incinerated quantities are restricted and do not extend to MSW, except for the co-incineration of RDF in the cement factory, in Volos.

As the country is looking into increasing the RDF consumption in existing and future WtE facilities, an incineration tax would most likely be an additional barrier in the attempt of promoting co-incineration, along with the political and social acceptance of the process.

A way to adhere to the political opposition would be the implementation of continuous communication and dissemination actions regarding WtE at a national and local level, especially in the areas where such facilities are/will be situated. Open and inclusive stakeholder consultations are essential tools to achieve political and social acceptance.

Principally, the government should ensure the enforcement of EU and national regulations concerning the externalities of the process (prevention of air-pollution), standards for the accepted materials, as well as on health and safety issues that might occur.

4 Based on data from (R4R, 2014) and (CEWEP, 2017).

4.5 PRODUCER RESPONSIBILITY SCHEMES

Extended Producer Responsibility (EPR) is a policy approach under which producers are given a significant responsibility – financial and/or physical – for the treatment or disposal of post-consumer products. Assigning such responsibility could, in principle, provide incentives to prevent waste at source, promote product design for the environment and support the achievement of public recycling and materials management goals. (OECD, 2019)

This policy can be applied for several types of waste streams such as packaging, waste electrical and electronic equipment (WEEE), used tires and oil, batteries, end-of-life vehicles (ELV), amongst others. Even though EPR schemes assess a vast number of waste streams, this guideline will focus on packaging waste due to its impact on the MSW management in Greece.

Producer fee schemes for packaging waste have been identified in 24 MS. The majority of MS have implemented a form of producer fee scheme in which the fees support a proportion of the costs of packaging waste collection and recycling; the UK has opted to put in place a system of tradable credits for packaging. Three MS (Denmark, Hungary and the Netherlands) have opted to apply taxation systems and/or DRS. The main types of schemes used for packaging waste in the MS are summarized in Table 9 below (European Commission, 2012).

Table 9 - Overview of the main type of producer responsibility schemes for packaging in the EU-27 (European Commission, 2012)

MEMBER STATE	MAIN TYPE OF SCHEME	MEMBER STATE	MAIN TYPE OF SCHEME
AT	Producer fee scheme (some DRS)	LV	Producer fee scheme
BE	Producer fee scheme (some DRS)	LT	Producer fee scheme
BG	Producer fee scheme	LU	Producer fee scheme
CY	Producer fee scheme	MT	Producer fee scheme
CZ	Producer fee scheme	NL	Tax (some DRS)
DK	Tax and DRS	PL	Producer fee scheme
EE	Producer fee scheme / DRS	PT	Producer fee scheme
FI	Producer fee scheme / DRS	RO	Producer fee scheme
FR	Producer fee scheme	SE	Producer fee scheme / DRS
DE	Producer fee scheme / DRS	SK	Producer fee scheme
GR	Producer fee scheme	SI	Producer fee scheme
HU	Tax	ES	Producer fee scheme
IE	Producer fee scheme	UK	Producer fee scheme (tradable credits)
IT	Producer fee scheme		

Generally, an EPR scheme follows the structure of the packaging cycle shown below (see Figure 6).

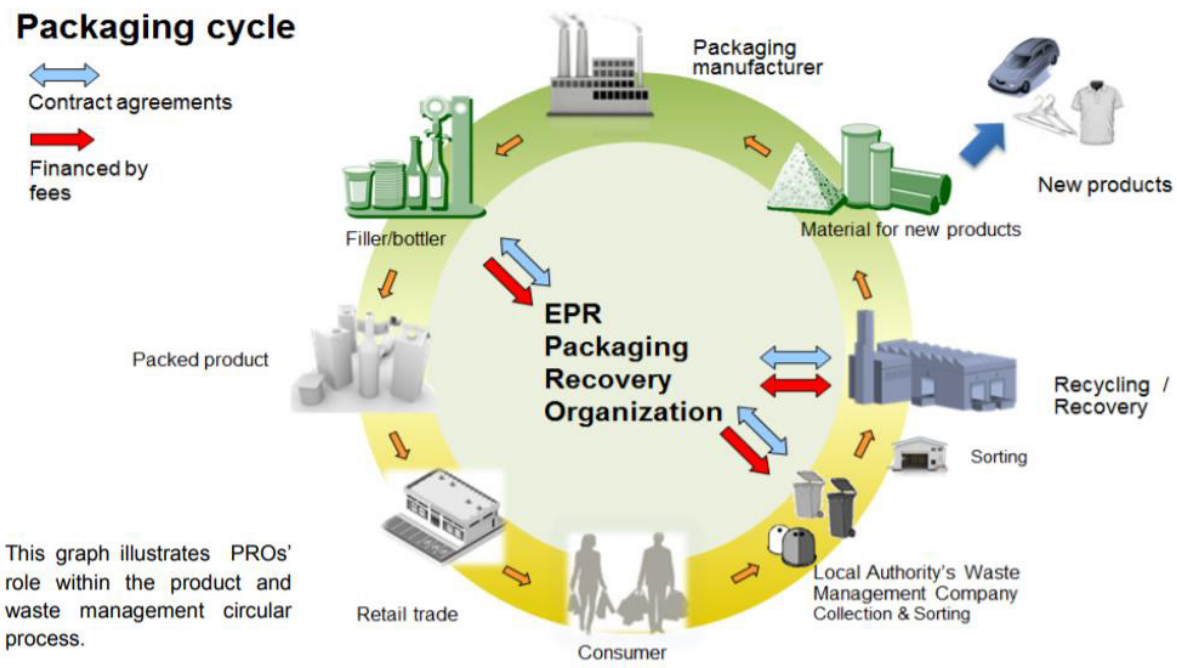


Figure 6 - Flow chart on EPR scheme for packaging waste (EXPRA, 2016)

The role of EPR schemes is to absorb the producer's legal obligation (imposed by the Member States) to meet national packaging recycling and recovery targets. EPR schemes do this by ensuring that packaging waste is collected, sorted, and recycled according to pre-defined targets. This activity is funded by the material-specific fees paid by producers/importers to EPR schemes for the packaging that they place on the national market. These fees are usually charged based on the tonnage (weight) and/or type of packaging the producer puts on the market and, consequently, incentivize material optimization (EUROPEN, 2019).

As shown in Figure 6, industrial stakeholders usually set up Producer Responsibility Organizations (PROs). PROs are collective or individual entities, set up and partially or fully owned by the industry that is liable to participate in such a scheme.

PROs have contracts with the local authorities, to ensure transparency but also services like collection and, in some cases, recycling, with the waste producers, which finance the system, and with waste management companies, which are also connected to the collection and/or treatment schemes. Not all PROs have the same functions. As EPR requirements differ between countries, the role of PROs varies as well.

In some Member States, the fees paid to EPR schemes are used to pay private, or public waste management companies who collect and sort post-consumer packaging waste (e.g., Spain, Czech Republic), and in other countries these fees are paid to local authorities who collect packaging waste separately or appoint contractors to do so on their behalf (e.g., Austria, Belgium, Sweden). Collected and sorted used packaging are then sold to recyclers or, sometimes, to energy recovery operators. Typically, the revenues from sold secondary material are used to

help offset the financial contributions of producers and importers to the EPR schemes (EUROPEN, 2019).

4.5.1 Status quo in Greece

Currently, in Greece, there are 22 operating systems of alternative management covering various types of waste streams, under "Producer Fee" schemes. As of to date, apart from packaging and packaging waste (Law 2939/2001), systems for the alternative waste management of other waste fractions have been approved through Presidential Decrees (PD) or Joint Ministerial Decisions (JMD), including:

- End of Lifecycle Vehicles - ELV (PD 116/2004).
- Waste Electrical and Electronic Equipment - WEEE (JMD 23615/651/E103/2014).
- Waste Lubrication Oils - WLO (PD 82/2004).
- Waste batteries and accumulators - (JMD 41624/2057/E103/2010).
- Used vehicle tires (PD 109/2004).
- Construction Demolition and Excavation Wastes - (JMD 36259/1757/E103/2010).

EPR systems, either collective or individual, are under the authority of HRA, which is responsible for the approval, monitoring, and control of the existing operating systems in Greece (EOAN, 2014). Further details on different EPR schemes in Greece can be found in Annex 9.3.

Due to the vast scope of EPR schemes and relevance to this project, as mentioned above, this report will focus on packaging waste.

Hellenic Recovery Recycling Corporation (HERRCO) - EEAA

HERRCO is the main PRO for packaging waste, implementing a collective system for non-hazardous packaging waste, with a coverage of 94% nationwide, counting more than 2.499 contractors (companies). HERRCO's main activity is the development, funding, and operation of a network of "blue bins" for co-mingled packaging waste, in cooperation with municipalities (EOAN, 2019).

Other activities of this PRO include (HERRCO, 2019):

- Separate collection of glass packaging waste in dedicated containers ('blue bells') in certain urban areas, and in areas where increased quantities of such waste are expected to arise - restaurants, entertainment outlets, hotels, department stores, catering facilities, organized beaches, etc.
- Organic recycling of wood packaging waste, to produce organic fertilizer or soil conditioner, and, valorisation of wood from non-repairable pallets in the production of new pallets (waste treatment operation R12).
- • Collection of industrial and commercial packaging waste (ICPW), as a business activity, consisting mainly of secondary packaging waste and transport, collected separately from the "blue bins" and "blue bells" network.
- Collection of printed paper through the "blue bins" network despite the fact that it does not fall under the original EPR scheme. The system accepts the material due to the PRO's commitment to promoting recycling in the perception of the citizens, as well as the positive sales value HERRCO was receiving (approximately 120€/tonne) a few years ago. Currently, market prices are very low, and revenues vary from 0€ to 30€/tonne, excluding transport costs, implicating in a negative financial effect on the system.

The collected material, from the "blue bins"

network is transferred to sorting facilities (called Centres of Sorting of Recyclable Materials - CSRM). For the separately collected glass packaging waste, the material is either directed to processing/ recycling facilities or exported. At CSRMs, the collected waste is separated into different material fractions (paper, glass, several types of plastic, steel, aluminium), and sold to processing/recycling facilities. HERRCO owns 10 out of the 35 existing CSRMs in Greece. An overview of facilities that are in operation and under planning is shown in Annex 9.1.

According to HERRCO ´s 2018 annual report, approximately 385,000 tonnes of packaging material was made available in the Greek market by the companies affiliated with the system. Still following the official data from HERRCO, 42% of the waste in the "blue bins" are residues, which, after being sorted out from the CSRM treatment lines are being led to landfill (HERRCO, 2019).

Besides HERRCO, three more PROs for packaging waste are operating in Greece: Rewarding Packaging Recycling S.A. (RPR), Centre for Environmental Alternative Management S.A – KEPED S.A. and AB VASSILOPOULOS S.A.

Rewarding Packaging Recycling (RPR) – Antapodotiki Anakiklosi

RPR is another PRO for packaging waste, which implements a nationwide collective system for non- hazardous packaging waste. The PRO is developed up until now within five regions (Attica, Epirus, Thessaly, Central Macedonia, South Aegean) counting to approximately 337 partners, according to the National Producer's Registry[5] (Antapodotikis Recycling, 2019). Additionally, the activities of the PRO expand to verifying industrial and commercial packaging waste (ICPW) collected by private undertakings (HRA, 2019).

The main activity of this PRO is the development and operation of integrated separate collection systems using a network of reverse vending machines (RVM), namely Rewarding Recycling Centres (RRCs) or "Recycling Houses", which are installed in easily accessible public areas. Each RRC occupies a space area of approximately 11 m^2 and is designed to accept packaging waste of mainly 4 waste streams: plastic, metal, glass and paper/cardboard while recently there is an extra provision in some of the RRCs for packaging wood (mainly pallets) (Moustaeras, I., 2019[6]). RRC keeps the disposed materials separated and reduces their size (smashing for glass, pressed for cans and pressed or shredded for plastic) while providing a monetary reward to its users (1€ for every 33 units), which is either offered as a discount voucher in cooperating supermarkets or it can be donated to charities.

The PRO supervises waste management operations such as collection, transfer, treatment, personnel and equipment maintenance, which are offered by contractors. Furthermore, the PRO is responsible to report the data to EOAN. The collaborating municipalities are responsible for the provision of electricity for the operation of the equipment when it is installed in public places.

Currently, the PRO has submitted the new operational plan to be evaluated by the HRA. Certain aspects of their proposed plan related to the operation of the system, include the following, however, it should be noted that the new proposed plan has not been approved officially by HRA yet:

- Annually, the PRO foresees to tender the operation of the RRCs and the implicated waste

5 Data extrapolated by National Producer's Registry accessed at 31/12/2019)

6 MoM– (12/12/2019, Moustaeras Ilias, General Manager of "Rewarding Packaging Recycling S.A.", Meeting on the functioning of the Rewarding Packaging Recycling system in Greece.)

management at each region, prioritising tenderers of Social Cooperative Enterprises due to the non-profit profile of the PRO and its social corporate responsibility. As such, the operational cost and a 50% of the vouchers are foreseen to be provided by the tenderer (Mustaeras I., 2019[6]) RPR, for the past 3 years, even though it is not included in their original operational plan, has included in their actions the establishment of "Environmental Parks" and green multi centres (within the parks), providing space for bulk collection of packaging waste, and citizen's education and awareness (mainly addressed to young people and children).

AB Vassilopoulos S.A.

AB Vassilopoulos is the only approved individual PRO for packaging waste focusing on the management of packaging waste of private label products and products imported by the retail chain AB Vassilopoulos. Its main activity is the development and operation of a network of integrated Rewarding Recycling Centres (RRCs), installed in or at the entrance of the stores of AB Vassilopoulos (HRA, 2019).

Centre for Environmental Alternative Management S.A – KEPED S.A.

KEPED is a nationwide collective PRO for the packaging waste of lubricant oils. The main activity of this PRO is the accumulation of lubricant oil packaging waste in their main production sites (sites where used oil is replaced), followed by the collection and transport of this packaging waste by authorized waste collectors, contracted by the PRO, and transported to recycling facilities in Greece (HRA, 2019).

The main challenge the PRO's are facing is the contribution of the so-called "free riders", which in the case of HERRCO have reached up to 40%[7], due to the inefficiency of monitoring and control of the liable companies to ensure compliance, as well as the inadequate enforcement of the law.

Furthermore, it is worth mentioning that the contributions of the liable companies to the existing PRO's in Greece are much lower and should be increased (Kathimerini, 2020).

According to the largest CSRM in the Attica Region - WATT, the material quality deteriorated after the financial crisis in 2013, due to a decrease in environmental awareness and engagement of the society, directly related to the reduction of campaigns, as well as a general reduction in the percentage of packaging waste (more use of unprocessed/packaged products). Following this trend, investments in communication and awareness to improve the quality of input in the blue bins were not prioritized in the past years.

4.5.2 Short evaluation summary of EPR scheme for packaging waste in Greece

In Table 10, a brief assessment, including major aspects of the current implementation of the EPR schemes for packaging waste in Greece was performed.

7 Data provided by HRA according to HERRCO's reporting (2019).

Table 10 - Evaluation of EPR schemes for packaging waste

PARAMETER	RATE	DESCRIPTION
Environmental Aspects	+	The environmental aspect of the EPR schemes is positive since it achieves their goals like reducing landfilling and increasing material recovery. It could be more efficient into increasing material recovery from certain waste streams, achieving a weight reduction of input products in the market, encourage eco-design, and reduce further landfilling (inclusion of free riders, for example).
Revenue Generation	+	EPR's are raising revenues through the contribution of the affiliated businesses and the revenues from the marketing of the collected recyclable materials, which are used to cover the administrative and operational cost of the systems as well. Since the end of 2017, the global market for recyclables such as plastics and papers has sharply decreased, affecting cash flows from enterprises that highly depend on these sales, mainly due to China's decision to stop importing waste material. Thus, the revenues from the recyclable materials are not stable. However, a revenue despite its value is generated through the contributions of the producers.
Market Impact	+	Negative competitiveness impacts may arise in regard to the market, such in the case of "free-riders", (amounting up to 40% in the country). Thus, the conditions of unfair competition are created against the participants which influences the competitiveness between businesses. EPR's however, have contributed to the development of the recycling industry accounting in billions of dollars (OECD, 2016). The recovery of recyclables generates new business opportunities and creation of recycling services, eventually transcending the negative impact and presenting a positive market aspect.
Social Impact	0	Since costs are borne by waste producers and, even if these fees are reflected in products, they are not significant as to affect the income substantially, there are no adverse social effects on the functioning of EPR systems.
Administrative Costs	0	Any administrative cost is covered by the private sector and the affiliated businesses of each EPR. Even though monitoring/auditing is conducted by a public entity (HRA), administrative costs are not presumably high.
Political Acceptance	++	The implementation of an EPR is widely accepted by the population due to the positive environmental impacts as well as the fact the operational costs do not apply to the consumers, only to the producer.

4.5.3 Case study – Awareness Raising in Catalonia, Spain

A comparison between EPRs across the MS seems to be quite challenging as EPR requirements and responsibilities are different between the countries, with different accountabilities for the PROs. The main differences are towards the type of responsibility (financial, operational), whether there is competition amongst PROs and waste treatment operators, as well as in terms of transparency and surveillance (Expra, 2016).

Furthermore, each system has different fee modulation depending on the type of material (paper, plastic, metals, glass) and even differentiations on the fee per type of material (e.g., PET/HDPE). Information on fees and real costs of the PROs are seldom available to the public due to competition among them.

It is acknowledged that EPR can be successfully implemented by increasing citizen awareness on the functioning of the system and presenting rewards when participating. One of Greek´s most significant issues concerning the "blue bin" is its impurities.

Table 11 shows a very pioneering project that is being conducted in Catalonia, Spain, to raise awareness, especially amongst young people, to increase recycling rates and shift waste management from the country into the new concept of recycling 5.0.

Table 11 - Project "Reciclos" in Catalonia, Spain (BFS, 2020[8])

BOX 3 – PROJECT "RECICLOS" FROM ECOEMBES, CATALONIA, SPAIN

Context: Ecoembes is the non-profit PRO in Spain, responsible for collecting and treating packaging waste in the country. It was founded in 1996 in anticipation of Law 11/97 on Packaging and Packaging Waste. This law sets out specific obligations intended to aid in the recovery of packaging waste and in its subsequent processing and recycling. With an investment of 3.6% of the total PRO budget in sensibilization and communication and 6.9% in R&D and monitoring, Spain is reaching 78% of the material acquired by the EPR scheme (Ecoembes, 2018). To increase citizen participation in the system, the operator decided to create an innovative awareness-raising project associating recycling with reward, connected via mobile application.

Aims:
The pilot project seeks to raise the percentages of recycling with the mobile phone as a tool, in a concept that they define as recycling 5.0 .

Description: The municipalities of Sant Boi de Llobregat, Igualada and Granollers are testing a recycling system that rewards citizens for increasing the collection of plastic containers. This is a pilot project of Ecoembes, in alliance with the Generalitat, which is also being tested in localities of the Pla de l'Estany region, in Girona, and by 2020 it could be extended to more municipalities and other autonomous communities. According to the communication and marketing director at Ecoembes, "the inertia regarding sensitization is very high" and must be used to test new ways to attract citizens towards selective waste collection bins. To do this, they have started with one of the communities that recycle the most, Catalonia, and taking advantage of the benefits of technology, with a mobile application, "to reach the most reluctant and the young".
The pilot program is called Recycling and connects the citizen with the yellow container through an application. The user has to install it on a mobile phone, scan the bar code of the container he/she wants to throw away and do the same with the QR code that the bin has. This is how the application validates recycling and assigns points, called 'Reciclos', to the user. These can be redeemed into raffle tickets to win e.g. an electric scooter, discounts in local stores or donations to entities such as Doctors Without Borders. Figure 7 demonstrates the yellow bin, with the QR code sticker and the mobile app for the delivery of the plastic container.

Figure 7 - Pilot Project "Reciclos" in Catalonia, Spain (El Pais, 2019)

Results:
In Sant Boi, it was experienced in two neighborhoods, Ciutat Cooperativa and Marianao, and the results are so positive that it will spread throughout the city. The experience of the citizens was perceived via interviews and, at first sight, it was very positive. The mobile application is seen as very user-friendly and it has been encouraging citizens who were not recycling before.
Early studies show that the collection of containers has increased in recent months in this town in the metropolitan area of Barcelona. From the City Council, it is clarified that it is still too early to directly attribute this growth to the application (La Vanguardia, 2019).

8 Based on data from (Ecoembes, 2018), (El Pais, 2019) and (La Vanguardia, 2019).

4.5.4 Optimization measures

Recommended optimization measures address the PRO institutional setup as well as the legislative levels; both actions are described in Table 12 and Table 13.

Table 12 - Optimization measures for PROs & regulatory authorities

MEASURES ADDRESSING PRO'S AND REGULATORY AUTHORITIES	
Reduction of impurities	• Intense awareness and marketing campaigns (social media, mass media, awareness campaigns in public spaces and central squares, etc.) with a primary focus on a local level, especially on how to improve household segregation and on the waste management operations in all levels (collection, transfer, storage, treatment). • Adequate access for the majority of, if not all, citizens to the separate collection system alongside the mixed bins. • Incentives and penalties to municipalities to ensure the implementation of the rules and regulations (e.g., HERRCO could define the recovery rates depending on the municipality's purity of the collected material – a municipality with percentage of impurities more than 20% should get less money back, the Ministry of Interior or Environment could set specific standards for the funding of the municipalities etc.).
Logistics	• Improvement and upgrade logistics through technological upgrades (implementation of software for route optimization, collection frequency), in collaboration with the municipalities and the affiliated partners. • Adoption of SMART solutions where feasible in order to improve the services and increase awareness and engagement (e.g. mobile applications). • Re-evaluation of producer's fee by applying a variable-fee based not only in the produced quantities but also on the type of each material, as well as the circular economy principles (innovative eco-design, reusability, recyclability, etc.). • The fee should be increased in both PROs (HERRCO, and RPR), to prevent and discourage the movement of members from one PRO to the other.
Collected material	• Increase and expansion of the collection points for specific separately collected waste streams (glass, wood) to a full-scale coverage. • Integration of waste streams not included in the current system and provision of separate collection options (paper, wood, paper/cardboard). • Commitment to a determinate percentage of the PROs revenues in the upgrade of the equipment in the CSRMs in order to improve the quality of the separately collected material.
Free riders	• Increase the personnel and provision of adequate training to the new and existing personnel of regulatory authorities. The goal is to perform extensive and frequent market audits with the collaboration and coordination between the Ministry of Development and Investments, customs, tax, trading standards officials and the environmental authorities to identify and exert pressure on the "free-riders" in participating in existing EPRs or creating new ones. • Additionally, it should be considered the imposition of market barriers for those who are not under a PRO. • Pressure from PROs and authorities on producers to participate in EPR's through the imposition of sanctions that would gradually (annually) increase in case of non-compliance. • Inclusion of producers from online platforms. • Improvement of coordination across different jurisdictions and regulatory authorities. Maybe through the collaboration with countries under which the most commonly used online platforms are operating. • Insurance of the registration of producers on a national level.

Table 13 - Suggestions at a national level

SUGGESTIONS AT A NATIONAL LEVEL	
Liability	• Implementation of market monitoring activities to identify obligated producers placing unrestricted packaging on the market and guarantee that at least 85% of the packaging placed on the market is reported. • Revision of existing legislation in regards to the liable producers to EPR systems, following the EU Directives including the new Directive on single-use plastics (2019/904/EU), to establish EPRs for specific types of waste such as beverage bottles and food containers, tobacco producers using plastic filters as well as to consider the inclusion of online producers. • Market barriers should be imposed to discourage non-registration to a PRO. For new businesses falling under the law 2939/2001 as amended, the municipality should require, in order to issue the business licence, evidence that the business is participating in a PRO. For already operating businesses they should also require evidence of the businesses participating in a PRO. In case of non-compliance, the business should have increased waste charges high enough to make the registration of the business to a PRO more appealing.
Monitoring	• Intensification of inspections over the registered producers as well as over the declared quantities and packaging units form the PRO's as well as from the HRA. • Enhance collaboration between HRA and PRO's in order to identify free-riders and non-compliant producers, enhancing the collaboration with the PROs in identifying non-compliance. • Inclusion of a chartered accountant in inspections of all scales of businesses in order to verify the registered quantities by going through selected invoices of the company (purchased primary materials, labelling, transportation). • Comparison of the registered producers between PROs to ensure that at least the ones registered in PRO's such as WEEE, batteries, etc. are also registered on the PRO's for packaging. • Establishment of a separate information desk/phone line within the HRA to accurately inform producers about their obligations. • Removal of any factors that hinder the swift prosecution of companies not complying with the EPR law by simplifying the prosecution procedures.
Incentives	• Provision of incentives for innovation, especially towards eco-design to encourage producers to use more sustainable/reusable materials. These products should have a reduced fee which would work as an additional incentive. • Provision of incentives to the private sector involved in recycling processing for new investments and creation of stability (e.g., 20 years) for investors, since prices for recyclable material are volatile and stock market dependent. • Consideration of a subsidy in terms of VAT reduction for producers who are using eco-design on their packaging products, funding of which could result from the circular economy tax. The eco-design should be certified by the Hellenic Organization of Standardization.
Awareness	• Establishment of a minimum amount of the PRO's turnover dedicated to awareness-raising campaigns. • The coordination of different awareness campaigns should be the responsibility of HRA in order to reassure that a concrete message on recycling is communicated. • Repeated actions of awareness could help perhaps more than fancy campaigns that are presented to the public only once (due to high costs).

4.6 PAY-AS-YOU-THROW (PAYT) SYSTEMS

PAYT schemes fall under the "polluter pays" principle as citizens are charged according to an amount of generated residual, organic and bulky waste which is being handled by a third-party waste management entity (Morlok, et al., 2017).

The establishment of a PAYT system is followed by the requirements of a significant input of resources from municipalities, including financial and administrative costs. To implement a PAYT system, it is necessary to identify the waste generators, quantify the waste of each waste stream that is being treated, and enforce a unit-based pricing policy (per kg and/or per capita).

Through a PAYT approach, a part of the overall fee is allocated based on the amount of the collected waste, to provide incentives for citizens to engage in waste prevention and material recovery.

The existing PAYT schemes depending on the waste accounting method are (Bio Intelligence Service, 2013):

- per-user identifier (volume-based or weight-based);
- per-bin identifier, either by an individual or collective assigned bin (volume-based or weight-based); and
- pre-paid systems (pre-paid sacks, tags, stickers, or tokens.

The most common PAYT schemes are:

- volume-based schemes (choice of container size): within this system, a non-corresponding payment may result due to the fact that containers are most of the times only partially filled upon collection;
- sack-based schemes (number of sacks set out for collection);
- weight-based schemes (weight of waste of a given container); and
- frequency-based (frequency of collection of a container).

Weight-based systems are achieving the highest recycling rates and the lowest residual waste quantities accompanied by a well-developed infrastructure and supported by citizens' awareness.

The implementation of PAYT systems has resulted in the incremented rate of separately collected materials and the reduction of residual waste ending up in landfills.

4.6.1 Status quo in Greece

PAYT systems in Greece have only been implemented in pilot programs. The first was in the municipality of Elefsina with the objectives to (Life, 2011):

- develop and implement a demonstration project for the application of such a system in a Greek context;
- create synergies between the national waste management stakeholders to optimise the system; and
- raise public awareness and achieve recycling targets of 20% in packaging waste, 4kg per capita on WEEE, 20% of composting from bio-waste and reduce waste ending up in landfill by a minimum of 20%.

The programme was implemented in an area of 1.500 households, where weighing equipment was purchased and installed on garbage collection trucks. The programme resulted in a diversion of waste of 25.8% from landfill, an increase in recycling up to 56% on packaging waste, a 4.6kg per capita recycling of WEEE, and a composting of organic waste of 17.1%.

Despite the success of the pilot, the programme didn't expand nor continued to be implemented.

More recently, the municipality of Vari-Voula-Vouliagmeni has initiated a PAYT scheme sack-based. The municipality

implements the separate collection of five waste streams:

- bio-waste – brown bin;
- packaging glass waste – "Blue Bells" and door-to-door collection;
- printed paper and packaging paper – door-to-door collection;
- metals and packaging waste of beverages and milk – door-to-door collection;
- residual (mixed) waste – green bin; and
- green waste – green points.

The project was financed by the municipality's own resources and the European Interreg Programme. According to a very detailed cost accounting, the total costs for waste management in 2018 were calculated as approximately 7.5 million euros, 75% of the municipality's total budget.

Operational costs for cleaning and recycling services per inhabitant in the municipality amounts to (Vari-Voula-Vouliagmeni, 2015):

- direct costs of 38.36€ per inhabitant; and
- indirect costs of 78.32€ per inhabitant.

4.6.2 Short evaluation summary of PAYT schemes

In Table 14, a short assessment, including significant aspects of the implementation/ conduction of PAYT schemes in Greece, was performed.

Table 14 - Evaluation of PAYT systems

PARAMETER	RATE	DESCRIPTION
Environmental Aspects	++	Even though there is an imminent risk of increased illegal dumping due to the higher associated costs, as the implementation progresses and the citizens become more engaged, this shall be stabilized at minimum levels.
Revenue Generation	++	Revenues in PAYT systems can be identified as service revenues, the fees addressing the households and commercial businesses, the by-product revenues derived from the sales of marketable products such as recyclables and compost, the tax revenues from the imposed tax indirectly linked to waste management and as well as the expected savings of landfill fees (Dri, et al., 2018). Considering the potential savings from landfill tax as well as the imposed fee to households and commercial businesses alone, a stable and consistent revenue shall be generated by these systems.
Market Impact	-	Commercial businesses and especially restaurants and hotels will certainly be affected by a PAYT system, as they are asked to pay according to the generated quantities which are mounting higher than the households. As such, a negative impact on the market is unavoidable.
Social Impact	+	With the implementation of a PAYT scheme, the main incentive to citizens is the tax reduction in waste charges. With awareness increase, this system shall have a positive social impact.
Administrative Costs	--	The implementation of a PAYT system has higher administrative costs compared to a traditional waste management system. Usually, not only additional personnel are required, but also investments in waste bins, trucks, changes in logistic schemes, and billing form. In some cases, the adoption of a PAYT system resulted in administrative cost savings, only where most of the performing tasks required for the implementation of the system were already been applied (EPA, 2016). In Greece on the other hand, such an implementation would result in higher administrative costs.
Political Acceptance	(-) / ++	Initially, the citizens will certainly perceive a new system with discontentment and mistrust, especially due to its complexity in comparison with the existing one. Opposition on such a scheme may be offered by commercial producers and especially restaurants and hotels, who are generating large quantities and will be called upon paying accordingly in comparison to a traditional flat rated system. However, as the programme progresses, and the citizens see a reduction in their waste charges along with the growing environmental cautiousness as a result of the continuous communication and dissemination campaigns from the local governments, a wide acceptance is expected.

4.6.3 Case study – PAYT in Salacea, Romania

Table 15 shows one case study on the implementation of a PAYT scheme in Salacea, Romania.

Table 15 - Case study: PAYT scheme in Salacea, Romania (IFRA, 2019[9])

BOX 4 – SALACEA – ROMANIA
Context: Salacea is a region of Romania located north-west of the country characterised by its poly- ethnicity (Hungarians, Romanians, Roma). Recycling rates were lower than 1%, and there were no local nor national incentives for recycling.
Aims: By 2020 - Reduce waste generation by 50%. - Implement waste sorting at 100%. - Repair, re-use % recycle of up to 90%. - Achieve a close to 0% landfilling and co-incineration.
Description: In 2018, the authorities of Salacea partnered with Zero Waste Europe and Zero Waste Romania in order to attain a Zero Waste Cities certification. The local authorities fully committed to this goal going through a series of steps to ensure the success of the program, including a complete transformation of Salacea's sorting and separate collection system. The existing communal street bins and containers were replaced by a door-to-door separate collection system of five (5) waste streams including bio-waste. The program was achieved with the engagement of all stakeholders not only, local authorities but the regional operator of a sorting and treatment plan (Eco Bihor) in collaboration with the local waste operator (Ave Bihor), along with experts to provide technical support and advice, such as the University of Oradea. To ensure citizens engagement a four-week education program run before the initiation of the new collection system, along with awareness campaigns throughout the program including multilingual stickers in all bins, local volunteer training to answer citizens inquiries, distribution of information material and guidance. The equipment (bins and bags) was provided by the authorities. Furthermore, financial penalties were given to the citizens who did not participate in the programme. Before, citizens paid 5 lei (1€) per month to the municipality for waste management services. By the new system, the non-participating citizens paid a higher tax of 10 lei (2 €) per month, in contrast with the participating citizens who paid the initial 5 lei (1€) per month, which could be considered as the first step towards a PAYT system.
Results: - Reduction of 55% on waste generation. - Reduction of landfilled waste from 98% to 55% (including residual from MBT and households). - Increment of separately collected waste from 1% to 61% of recyclable packaging and non-packaging waste. - 13.89% of separately collected bio-waste, handled in open-air composting facilities. - Increment of waste sent for recycling from 1% to 40% in three months. - 5% of residual waste was sent to co-incineration facilities. - Increment of citizens engagement from 8.4% to 97%. - 42% of garden and kitchen waste was generated from households. - Most recycled were plastics, specifically PET (68%). - 3% of textile waste was recycled.

9 Based on data from (Zero Waste Europe, 2019).

4.6.4 Optimization measures

As the country is struggling to achieve the EU and national recycling targets, new approaches are required to be adopted, such as the PAYT systems, which, as studies have shown, have high rates of success and are referred to as one of the best environmental practices for waste management (JRC, 2018).

A gradual establishment of PAYT systems at a municipal level should be established, taking into consideration the conditions and specificities of each municipality and according to international experiences (e.g., Salacea, etc.). The implementation should be planned effectively and with cautiousness as to avoid illegalities such as the disposing of waste from one region to neighbouring regions without similar charge systems (Dri, et al., 2018).

Incentives should be given to municipalities for the implementation of such schemes by the government. An approach such as "reward as you recycle" might be considered more efficient on citizen's engagement. Rewards can vary amongst vouchers to certain services/municipal events (concerts, theatre plays, and municipal cinemas) or local businesses offering discounts.

Municipalities that have already initiated a pilot programme should be encouraged to continue implementing and expanding it further until a 100% coverage is reached. At the same time, communication and dissemination actions should be intensified in order to ensure citizens engagement. Some communication strategies are mass media, social media advertisements, face-to- face or door-to-door campaigns for the citizens by engaging "recycling" ambassadors (volunteers) and kiosks in central access points, amongst others.

Finally, for the implementation of a successful PAYT system, it is essential to identify the main revenues and costs of the system and to disaggregate them per service. As such, a full cost accounting (FCA) would be required to estimate the real cost of public services in waste management. Direct and indirect costs should be calculated and defined based on the fees paid by the citizens and the full cost of the managed waste. Transparency should be ensured to gain citizens trust through published accessible online data in the municipality's website.

4.7 TAXATION ON SINGLE-USE PLASTIC PRODUCTS AND BEVERAGES

Taxation of specific types of products with high environmental impact is a method used in order to minimise their use and optimise their production. The main goal is to internalize the environmental costs of such products and to deterrent their demand by the consumers.

In 2015, the EU adopted the 2015/720 Directive, amending the packaging Directive 94/62/EC, emphasizing the EU's introducing measures for the MS to reduce single-use thin plastic bags consumption. In 2019, the EU has progressed further by adopting the Single-use Plastic Directive (2019/904) under the Circular Economy package attempting to tackle plastic pollution and to reduce the impact of certain single-use plastic products. According to the Directive, the following products will be banned within the EU by 2021 (Directive 2019/904/EU):

- single-use plastic cutlery (forks, knives, spoons and chopsticks);
- single-use plastic plates;
- plastic straws;
- cotton bud sticks made of plastic;
- plastic balloon sticks; and
- oxo-degradable plastics and food containers and expanded polystyrene cups.

Within this frame, the imposition of a European tax on plastic waste is certainly gaining momentum. The EC is considering the imposition of the tax to increase revenues to balance the EU budget from

the upcoming Brexit. The idea would be to apply a rate of 0.8€/kg to the weight of packaging waste not being recycled, generating revenues of €6.6 billion annually, according to the commissions' calculations (Euractiv, 2019).

Taxation on single-use plastic products is applied to a national level in several MS. The most common one is the taxation on plastic bags applicable in most MS, including Greece, along with taxation on packaging waste (not only on plastic packaging but on packaging in general), on disposable cutlery (Denmark), razors (Belgium) among others. However, harmonization of such taxation is lacking at the EU level.

4.7.1 Status quo in Greece

Before 2017, no applicable taxation on single-use products, plastic, or otherwise was imposed. This changed when the Greek government passed the 4496/2017 law under which an environmental levy of €0.03 (€0.04 including VAT) would be imposed from January 2018 with a prediction to increase the rate the following year to €0.07 (€0.09 including VAT). The generated amounts from the tax are being deposited in an exclusive account of the HRA, which is used to fund environmental actions through the municipalities, such as the free provision of re-usable bags to citizens.[10]

Additionally, the law banned the oxo-degradable (thin) plastic bags, which are considered responsible for the dispersion of microplastics and therefore contribute to environmental degradation. The law was supposedly, temporarily, excluding kiosks and food markets from the imposition of the tax; however, this exemption hasn't yet been removed.

With the imposition of this environmental levy, according to the Research Institute of Retail Consumer Goods (IELKA), the use of thin plastic bags has been significantly reduced by 80.3% from 2017 to 2018, in supermarkets and by 54% of the total reduction of thin plastic bags per capita (IELKA, 2019).

These encouraging results are showing a change in consumer's behaviour, and an increase in generated revenues as a result of the implementation of the law. However, the legislation offers some loopholes which are being exploited by certain chain supermarkets.

The law imposes the environmental levy on thin plastic bags with a thickness between 15μm and 50μm. Additionally, the law states that plastic bags of 50μm to 70μm are subjected to pricing and not to the environmental levy, meaning that these bags would be charged to the consumer but not as part of the levy, and thus the raised amount would not be attributed to the Green Fund, but it would be included to the supermarkets profits. Moreover, the law states that biodegradable plastic bags would be excluded from the environmental levy.

Within this frame, certain chain supermarkets have chosen to introduce and promote thicker plastic bags as re-usable or bio-degradable plastic bags, not paying the environmental levy and increasing their revenues. These types of phenomena are resulting in the mistrust of the citizens in the imposition of any type of environmental levy.

As of the date of this report's release, no taxation on single-use plastic products and beverage containers are under consideration.

4.7.2 Short evaluation summary of taxation on single-use plastic products and beverages

In Table 16, a short assessment,

10 Law 4496/2017 Article 6.

including significant aspects of a potential implementation of taxation on single-use plastic products and beverages in Greece, was performed.

Table 16 - Evaluation of taxation on single-use plastic products and beverages

PARAMETER	RATE	DESCRIPTION
Environmental Aspects	++	Taxation on single-use products and especially on beverages should lead to the improvement of the product's design. Besides, it should affect waste generation and contribute to a transition towards less consumption by minimising the utilization of single-use packaging products and promote the broader use of reusable/refillable products. In this aspect, the effect would be very positive.
Revenue Generation	++	Even though revenue generation should not be the primary goal, it will undoubtedly be considered as such. If implemented correctly, the instrument should offer a consistent initial revenue, which would gradually reduce until it stabilises.
Market Impact	-	Costs would most likely be passed onto the consumers, affecting the competitiveness and leading to a favourable choice over the non-taxed materials (e.g., glass over plastic). This will bring forth opposition from the producers. Taxation shall be discussed with the involvement and contribution of the industry.
Social Impact	0	An indirect impact on income distribution may rise on producers, fillers, importers, retailers, and the waste management industry. This tax would probably be passed on to the consumers. These, on the other hand, have the option of choosing products without taxation. The impact, in this case, would be neutral.
Administrative Costs	-	An imposition of a new tax would certainly affect administrative costs while setting-up the tax and implementing it. Furthermore, tax and data collection, analysis, and monitoring will be required on a permanent (annual basis) in order to assess, evaluate, and make the necessary improvements, meaning higher administrative costs.
Political Acceptance	(-) / +	As any new tax, the imposition of one on plastic products mainly through VAT would be faced with uncertainty, negativity, and suspicion. It is important to establish transparency and trust between the authorities and the citizens for a tax to be accepted and not disturb the social calamity. As in the case of the environmental tax on plastic bags, the citizens will eventually and with the ensured transparency be more receptive and fully supportive of such a tax, especially with the proper communication and dissemination of the instrument. It is likely that such taxation would not have a good acceptance in the beginning but that its perception would change in a short period of time.

4.7.3 Case study – Packaging tax in Denmark

The following case study presents the experience of Denmark in putting taxes on packaging material (see Table 17).

Table 17 - Case study: Packaging tax in Denmark (IFRA, 2019[11])

BOX 5 – DENMARK
Context: Denmark is generating 781 kg/capita per year with a packaging recycling rate of 74.8%, of which 38.5% is of plastic packaging (EC, 2019) (eurostat, 2019). The country sends more than 50% of the generated plastic waste to WtE facilities, 2% ends up in landfills, while 28% is exported for recycling, and only 13% is being recycled domestically (Recycling International, 2019). In 1987, Denmark introduced a packaging tax, which was amended in 1998 to include small packaging of less than 10cl.
Aims: - Increase reuse and recycle rate of packaging - Prevent packaging waste - Create incentives for collection and refill of used packaging (increment price on new packaging making the collection and refill of used packaging more economically viable - Promote more environmentally friendly packaging through the weight-based part of the tax - Reduce the volume of packaging
Description: The Danish packaging tax is divided into volume-based and weight-based taxes. Volume-based tax is set on specific beverage containers; it varies according to the material used for the packaging and the volume, not including packaging for soft drinks not containing carbon dioxide. The rates vary depending on the volume and the material from less than 10cl to 111-160cl in terms of volume and from 0.03€ to 0.32€ per unit in terms of material. The tax is reduced depending on the times a packaging waste/container is re-used, thus making it profitable for the system to recycle bottles as many times as possible. The volume-based tax was addressing wine, beer, spirits and mineral waste packaging. Concerning weight-based tax, the tax on plastic bags was introduced in 1994. In 1999, packaging tax was replaced by the weight-based tax, which was later amended, in 2001, changing the tax rates based on environmental index per kilogram (based on life-cycle analysis screenings). In 2004 the weight-based tax was abolished from products with only the tax on plastic bags, disposable tableware, and PVC foil remaining. The legislation proposes higher tax rates for aluminum, expanded polystyrene and PVC, and lower rates to paper, cardboard and glass. In its majority, the tax is paid on a monthly basis to the customer service.
Results: - Significant revenue was generated (94.1% in 2014) - Carrier bags were reduced by almost 50% (MFVM, 2018) - The use of paper and plastic materials was reduced by 70%

4.7.4 Optimization measures

Aiming an increase in recycling targets and compliance with EU Directives, an extension of the environmental tax / levy to other types of single-use plastic products should be considered by the government. The tax should be imposed as an addition to the existing EPR systems, as it would enforce the liability of all producers/importers and thus be a partial solution for the "free-riders" issue the country is currently facing. The following considerations are to be noted:

- The tax on single-use plastic packaging should be introduced on most used products such as beverages bottles and food containers. Other EU experiences should be used to define its context and applicability.
- The tax should be accurately calculated through a life-cycle

11 Based on data from (GBE, 2014) and (ECOTEC, 2001).

analysis of the products, considering the percentage of that product in the country's waste constitution.

- Tax level for bottles and containers should be enough to encourage engagement of the sector but not so high that would impose a barrier to the development of the industry. It is essential for the beverage sector (producers, importers and retailers) to be actively involved in the preliminary works of the definition of the tax through consultations to ensure the broader acceptance of the measure by the industry and therefore their commitment.
- It is decisive to minimise any possible unfair competitiveness conditions. It is crucial, for the net revenue from the environmental tax/ packaging tax to be reintroduced to the business sector in general and, particularly, to producers and importers to avoid negative impacts on competitiveness.
- The imposed tax should be calculated proportionately to the average income not to burden household/family incomes.
- Continuous communication and dissemination actions should be run by local, regional, and national authorities/entities, to ensure citizen's awareness and engagement.
- To eliminate the citizen's mistrust, transparency is essential for the use of the generated revenues. For example, the environmental levy on plastic bags is collected and deposited in the HRA, and the revenues are used for the funding of waste prevention actions.

4.8 EVALUATION OF ECONOMIC INSTRUMENTS IN GREECE - OVERVIEW

Table 18 summarizes the analysis conducted in the previous chapters on the use of specific economic instruments, considering the Greek context.

It is possible to observe that the instruments which are intrinsically related to the valorisation of waste (EPR, PAYT, taxes), have not only positive environmental aspects, but also higher revenue generation and, as the systems reach maturity, a more significant political acceptance is also expected.

Other tools like the incineration taxes are still not representative considering the current situation in the country.

In this evaluation, market effects should be addressed and discussed when implementing new policies, but do not represent a major concern contemplating the given provisions. Social effects are always extremely delicate when applying new regulations and should be carefully referred and shielded while writing these policies.

It is also expected that administrative costs are higher during the implementation of new economic instruments. These are likely to be drastically reduced once the system is running, and environmental benefits/ revenue generation are ongoing.

Table 18 - Evaluation of economic instruments in Greece - Overview

ECONOMIC INSTRUMENT	ENVIRONMENTAL ASPECTS	REVENUE GENERATION	MARKET EFFECTS	SOCIAL EFFECTS	ADMINISTRATIVE COSTS	POLITICAL ACCEPTANCE
WASTE CHARGES	0	++	0	0	++	+
LANDFILL TAXES	-	+	0	0	++	++
INCINERATION TAXES	0	0 / +	0	0	-	+
PRODUCER RESPONSIBILITY SCHEMES	+	+	+	0	0	++
PAYT*	++	++	-	+	--	(-) / ++
TAXATION OF SINGLE-USE PLASTICS AND BEVERAGES	++	++	-	0	-	(-) / +
DRS**	++	0	+	+	0	++

* Considering the previous attempts of implementing such a system in Greece, analysis not only includes estimated results based on these experiences but also ponders the effects of this economic instrument in the country after implementation of the determined pre-requirements (see chapter 4.6).

**Results estimated based on the analysis conducted during the pre-feasibility study. Evaluation of the implementation of DRS in Greece is described in chapter 5.7. The following study focusses on the creation of a know-how base for the implementation of a deposit refund system (DRS) in Greece.

5. Pre-feasibility study

The following study focusses on the creation of a know-how base for the implementation of a deposit refund system (DRS) in Greece.

The main objectives of this pre-feasibility study are:

- to provide a general overview of design parameters while establishing a DRS system;
- to present EU existing DRS systems, including concrete and practical aspects of their implementation; and
- to support Greek decision-makers with the required background information to make sound and advised choices, taking into account the specificities of the country.

5.1 DEPOSIT REFUND SYSTEM

DRS is a container management system that associates value for each beverage container to increase recycling rates and reduce litter from the streets. The goal is to change the mind of end consumers, so they perceive beverage containers as a consumer item and not as a waste.

It consists of adding a small extra deposit on top of the price of a beverage – such as those in plastic and glass bottles and aluminium cans – which is refunded to the consumer when they return the empty drink container for recycling.

Also known as bottle deposit schemes, deposit refund/return systems, or bottle bills, they are typically established through legislation passed by state or national governments.

Today, these schemes are in place in more than 40 regions, including 10 US states, with the additional deposit value on drink containers ranging from €0.09 to €0.25.

The beverage producers initiate the process by paying the deposit and a administrative fee to a Central System Operator (CSO). The retailers buy the beverage, including the deposit value. The consumers pay the deposit to retailers, along with the price of the beverage, and claim a full refund when they return their used beverage container to a designated return location. The retailer is reimbursed for the refunded deposit from the CSO, plus a handling fee. The returned used beverage containers usually belong to the CSO, which is usually responsible for transporting this material to a central location to be processed and recycled. Material, cash, and data flow are shown in Figure 8.

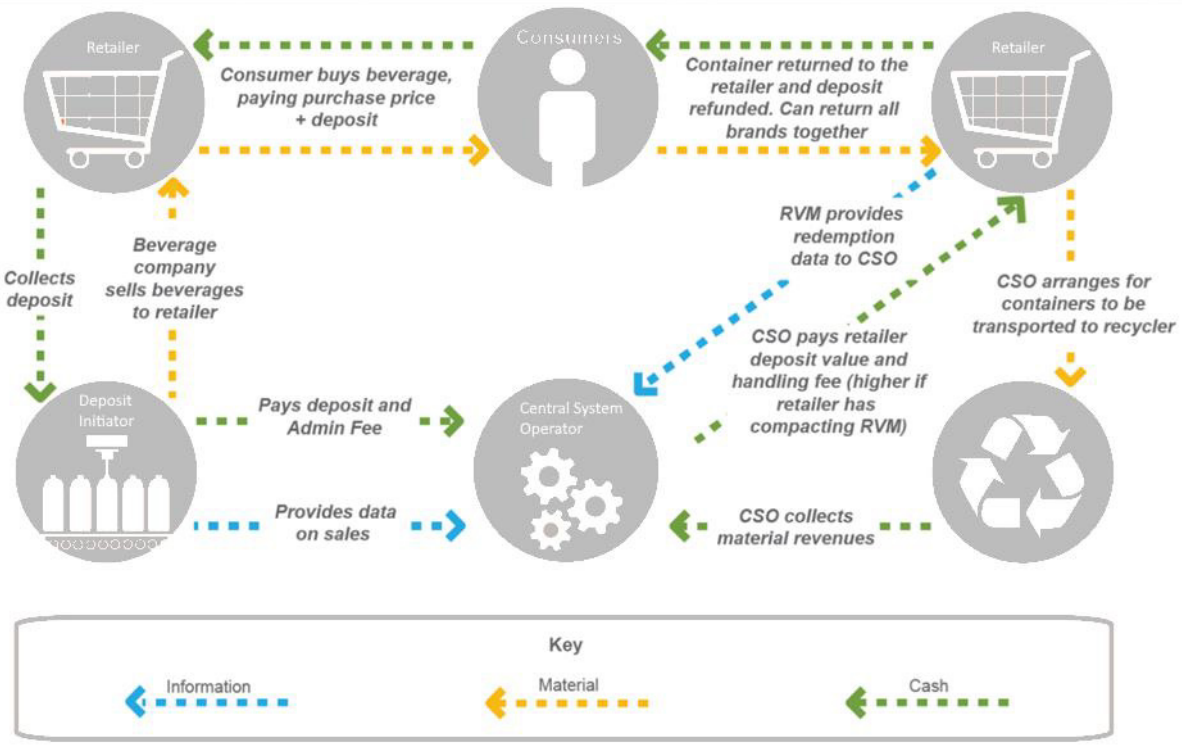


Figure 8 - DRS flow diagramme (Cordle, et al., 2019)

5.1.1 Status Quo in Greece

Currently, in Greece, the only applicable DRS is the voluntary system implemented by the Athenian Brewery under the Heineken N.V Group, the biggest producer and importer of beer in the country. The corporation implemented the system as part of the company's policy of sustainable development by applying a refunded deposit of 0.14€ per 0.5L refillable glass bottles. According to the company's annual report, the firm is reusing 120 million glass bottles, which accounts for 60% of its sales (Athenien Brewery, 2019).

5.1.2 Project Description

Within the scope of this project, a pre-feasibility study has been conducted to assess the potential implementation of a DRS for one-way beverage containers in Greece. The goal is to provide a nationwide study, with a more holistic approach and which could probably be used as a first assessment on Greece´s path towards implementing such a system.

The pre-feasibility study contains a roadmap of necessary steps to be taken in the next years, including legal structure, methodology, financial strategy, implementation features, and rough numbers based on EU past experiences and local data.

5.2 BACKGROUND FOR INTRODUCING THE SYSTEM

Following the consolidation of the bottling industry around the '70s, the increase in transport costs and distances, rise of consumerism, and customer convenience, the consumption of single-use beverage containers rose exponentially. The deposit system started to appear as countermeasures for this development. Iceland was the first country in 1989, setting up a DRS nationwide for a wide range of beverage containers. Sweden,

in 1994, increased its scope from cans to plastic bottles. Resulting from this trend, countries such as Norway, Finland, Germany, Netherlands, Estonia, and Croatia implemented similar systems around the 2000s´. The latest EU country to introduce DRS was Lithuania, to date.

Other countries are also actively addressing this topic, as shown in Figure 9, with data adapted from (Spasova, 2019).

Figure 9 - Status quo of EU MS on the implementation of DRS (BFS, 2020)[12]

1-FRANCE

In the framework of the Action Plan on Circular Economy from 2018, options for the introduction of DRS are currently under study.

2-BELGIUM

Investigation on the introduction of DRS in all 3 regions. In 2018, the Flemish government signed an agreement compromising the packaging sector to introduce DRS if target for waste and litter are not met by 2023.

3-ROMANIA

The country adopted an ordinance on packaging waste, including the introduction of a deposit fee to reusable packaging, starting from March 2019. From March 2022, this shall be extended to non-reusable containers.

4-SPAIN

Several autonomous regions (Catalonia, Navarra, Valencia) have already examined the economic, environmental, and social viabilities of the implementation of DRS. An incentive pilot project is currently ongoing in Tenerife.

5-AUSTRIA

Current discussions triggered by increase littering and the high share of one-way glass and plastic bottles.

6-PORTUGAL

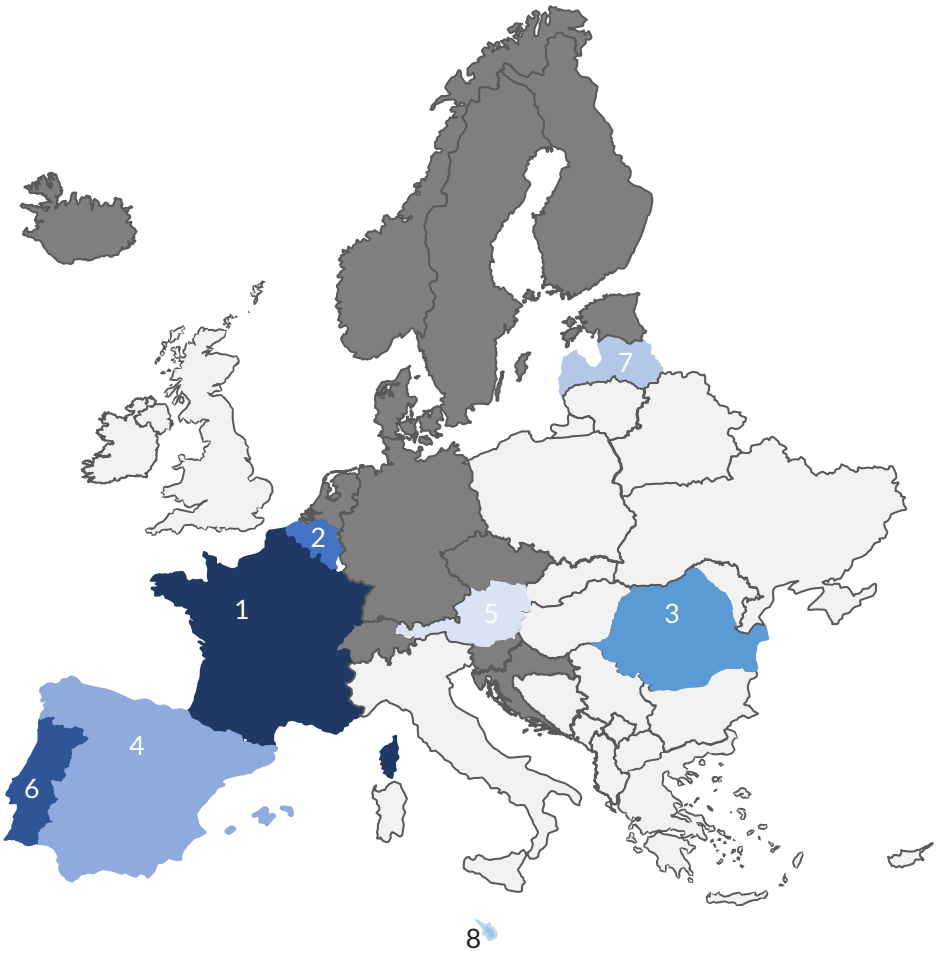
With the risk of failing recycling targets, the Government passed a law, to introduce DRS after 2021, for plastic, glass and metal beverage containers. A pilot project with an incentive scheme for plastic beverage packaging got implemented end-2019, and is expected to be followed by a large-scale roll-out.

7-LATVIA

Current discussions triggered by increase littering and the high share of one-way glass and plastic bottles.

8-MALTA

Confirmed during the EU "Our Oceans Conference", in 2017, scheme is expected to be implemented by the end of 2019.



12 Based on data from (Spasova, 2019).

5.3 DESIGN PARAMETERS

When planning the implementation of a deposit refund system, several parameters must be analysed to shape the system according to the countries demands. The main design parameters for establishing such a system are described in the following subchapters.

5.3.1 Legislative framework

The foundation for DRS is a clear and precise law. This legal framework must consider the current situation as well as the objectives, which should be attained by the system by the bottle market. Based on the different situations and the very different political objectives in the individual countries, every law and every DRS are different. However, the following principles apply in every case:

- Provisions in the law must be unambiguous and implementable.
- Obligated parties and their responsibilities must be clearly stated and individually identifiable.
- Execution must be regulated so that the obligated parties cannot withdraw.
- Clear regulations must be provided for all areas, in particular, for monitoring and execution.

The most important contextual areas of a law in which the foundations for DRS system for bottles are defined are as follows:

- organization and institutional setup;
- system participation obligation;
- financing;
- collection;
- recovery;
- monitoring; and
- involvement of the informal sector.

These topics are further detailed in the following chapters.

Few countries have included specific recycling targets for DRS. Instead, general targets for packaging were incorporated as a transposition of the EU packaging Waste Directive (Spasova, 2019).

Moreover, some countries have included specific legislation essential for the successful implementation of the DRS. Table 19 shows a few of these supporting laws.

Table 19 - DRS laws in EU countries (BFS, 2019)[13]

COUNTRY	LAW
Croatia	The legislation[14] foresees that a deposit is established for one-way beverage containers with a volume greater than 0,2L made of plastic (PET), metal (aluminium or iron) and glass, containing alcoholic and non-alcoholic beverages, waters, fruit juices and soft drinks. Milk and milk-containing beverages are excluded from the system.
Denmark	Establishment of the framework of the DRS[15], defining organisation, roles and financing of the system operator, minimum deposit values for different packaging types, collection targets. The system comprises metal cans, plastic and glass bottles, excluding fruits juices, milk products, spirits and wines (the last two are not considered an environmental problem).

13 Based on data from (Spasova, 2019).

14 Ordinance on packaging and waste packaging (88/2015) and Regulation on management of waste packaging (97/2015).

15 Statutory Order on Deposits implemented in 2012.

COUNTRY	LAW
Estonia	Legislation[16] sets deposit for glass, metal, and plastics containers, with a volume between 0,1 to 3L. Targets for PET and glass bottles are as high as 85%.
Finland	Taxation on alcoholic beverages, soft drinks, and bottled water, based on litres, was applied in 1994. One-way packaging containers which are part of DRS have been subjected to zero tax since 2008. Targets are set for 90% for all types of containers participating in the system. If targets are not reached, the operator must submit an action plan to the environmental agency with measures to be taken.
Lithuania	Legislation[17] sets deposit fee for packages with volumes between 0,1 until 3L, encompassing cans, glass, and plastics bottles. Exceptions are made on products that are exported from the country since producers and importers will not be able to recover the fee. Another exception applies to products sold to operators or users of transportation means which use international routes. First target, in 2016, was 55% of all one-way containers, increasing yearly until 90%, in 2020.
Norway	Non-refillable beverage packaging has a basic fixed tax and a variable environmental tax. The latest tax is not applicable if the return rate is above 95%.
Sweden	Legislation states that all producers or importers of plastic bottles and metal cans must ensure that the product enters an approved deposit refund system. Dairy, juice and vegetable products are excluded from the system. The Ordinance stipulates a minimum recycling rate of 90% for beverage packaging, which falls under DRS. No sanctions are defined by law in case targets are not met.

In any system, it is a best practice to keep the deposit value under continuous evaluation, not least because it will lose value with inflation, and increase it if the return rate is too low. This is partly why deposit values should not be specified in legislation.

5.3.1.1 Recommendations for Greece on DRS Legislation

It is recommended the introduction of a new law or the amendment of the Packaging Law that establishes a centralised mandatory DRS, regulating all parameters of the system (deposit refund fee, liable entities, monitoring etc.). Its implementation should include beverage containers, focusing initially on plastic (PET) bottles, expanding to metal and glass containers. Considering the existing voluntary scheme from the Athenian Brewery, it is highly suggested to start discussions as soon as possible, aiming either the incorporation of this scheme into the national one or determining the conditions of co-existence between both systems.

A pertinent authority, already in place (e.g. HRA) or new established, shall be responsible for auditing and setting targets for the system, ensuring efficiency and participation of producers, importers and retailers, applying penalties for non-compliance with targets and obligations, perform or participate in systems monitoring, controlling and optimization.

In Lithuania, DRS was legally implemented as an amendment of the law on Packaging and Packaging Waste Management. It comprehensively deals with the deposit implementation on single-used beverage containers, including all types of containers. The new deposit system in the country will apply to beer, water, soft drinks (carbonated and non-carbonated), juices and mixed alcoholic drinks sold in cans, glass or plastic containers with a volume of between one-tenth of a litre and three litres. Retailers will be required

16 Packaging Act (2004) and Packaging Excise Duty Act (implemented in 2005)

17 Law on Packaging and Packaging Waste

to provide return possibilities at the point of sale, within 150 meters from the sales area. They will also be obliged to take back all non-refillable containers, regardless of whether they sell the items or not. Retailers can be exempted from this take-back obligation only if they have a sales area of less than 300m2 or if they are gas stations, kiosks or catering establishments. Other countries have applied a minimum area of 200m2. Ideally, every retailer who sells beverage containers must be obliged to take them also back.

Significant changes in the legislation must be executed to proceed with DRS implementation. Some specific points are exemplified in Table 20.

Table 20 - Legislation amendments for DRS implementation (BFS, 2020)

REQUIRED MODIFICATIONS TO THE EXISTING LEGISLATION	LAW
Inclusion of definitions	"Deposit system – the total of organisational, administrative, financial, informational and other measures implemented by a deposit system administrator in order to refund the deposit paid by the packaging users at the time of acquisition of products packaging whereof is subject to a deposit, to reuse the reusable packaging returned to the manufacturers and (or) importers, and to properly manage the waste of single-use packaging in accordance with the packaging waste management priorities set forth in Article X of the Law."
Monitoring and Fraud Control	"Manufacturers and importers placing packaging products on the internal market whereof is subject to a deposit in accordance with paragraph X of Article Y of the Law, shall mark the packaging with a bar-code identifier of packaging manufacturer or importer and with a label of applicable deposit system. The design of the label of applicable deposit system and the labelling procedures shall be endorsed by the Minister of Environment upon submission by the administrator (administrators) of the corresponding deposit system."
Activities of the DRS Operator	"To organise the sorted collection, transportation, preparation for use of all packaging waste originating from the utilisation of packed products placed on the internal market by manufacturers and importers, and (or) to contribute to setting up the management of such waste within household waste management systems organised by municipalities, and to participate in a single-use packaging deposit system, if placing on the internal market single-use packaging products whereof are subject to a deposit in accordance with paragraph X of Article Y of the Law." "To pay the costs of packaging waste collection, transportation, preparation for use and use, referred to in point X hereof, and (or) the costs of participation in the single-use packaging deposit system related with the management of single-use packaging waste collected through the deposit system and administration of single-use packaging deposit system, as well as the costs of organising and implementing public awareness measures referred to in point X hereof."
Obligations of DRS Administrator	"Administrator of single-use packaging deposit system shall provide services under equal conditions for all manufacturers and importers placing products packed in single-use packaging subject to a deposit according to paragraph X of Article Y of the Law on the internal market, as well as for the sellers of packaging trading in such products." "Administrator of single-use packaging deposit system shall not reveal to any third party or any manufacturer and importer or a seller of packaging participating in single-use packaging deposit system any information about the quantities of goods or their corresponding single-use packaging placed on the internal market by manufacturers or importers and sold by sellers, except in cases provided for by the legislation." "The founders and participants of an administrator of single-use packaging deposit system shall not act in the interest or to the benefit of waste managers or producers and distributors of automated (with no human operator) packaging waste reception devices."

REQUIRED MODIFICATIONS TO THE EXISTING LEGISLATION	LAW
Retailers obligations	"Sellers of single-use packaging shall accept waste of single-use packaging subject to a deposit in accordance with paragraph X of Article Y of the Law and refund the deposit, except for the sellers of packaging trading in shops with a commercial area not exceeding x sq. m (excluding rural shops) as well as in marketplaces, kiosks, fuel stations and public catering institutions. Sellers of single-use packaging eligible to the exemption stipulated herein may choose to participate in single-use packaging deposit system voluntarily." "Sellers of single-use packaging referred to in paragraph X hereof shall accept waste of all packaging subject to a deposit in accordance with paragraph X of Article Y of the Law and refund the deposit regardless whether they trade in products with the identical packaging or not." "Deposit for the packaging of traded goods shall be refunded to the users of packaging in cash or, by request of packaging users, they shall be given the right to purchase goods or services for the sum, or to make donations to the beneficiaries listed in the Law on Charity and Subsidies in the amount equal to the value of the deposit." "Sellers of packaging trading in goods packaging whereof is subject to a deposit shall specify the size of the deposit on the price tags at their trading points." "Sellers of packaging whereof is subject to a deposit shall provide written information (on a poster of at least AX format) about the possibilities for the packaging users to return reusable packaging and single-use packaging waste. "
Packaging type	"Manufacturers and importers shall collect a deposit from distributors and sellers of packaging, and shall refund it to sellers of the packaging upon return of packaging waste, if they place on the internal market of the Republic of Lithuania beer and beer cocktails, cider, pear cider, fruit wine and fruit wine cocktails, fruit wine drinks, other fermented drinks, alcohol cocktails and alcohol-free drinks (soft drinks, table water, kvass), natural mineral water, spring water, bottled potable water, juice and nectar packed in the following primary single-use packaging with the volumes exceeding X litre but smaller than Y litres." "The size of deposit for single-use packaging subject to the deposit system in accordance with paragraph X hereof shall be endorsed by the Minister of Environment for a period not less than one year, taking into consideration recommendations of the single-use packaging deposit system administrator (administrators). The size of the deposit shall be established such as to encourage packaging users to return reusable packaging or single-use packaging waste."
Pulling off the system	"For at least one year after cessation of placement of packaging product in the internal market subject to deposit system according to paragraphs X and Y hereof, manufacturer and (or) importer shall accept such empty reusable packaging or single-use packaging waste from the sellers of packaging, as well as the retailers – from the users, and refund the deposit in accordance with paragraphs X and Y hereof. Exemption shall apply to a manufacturer and (or) importer who proves that it has accepted from the sellers the same quantity of no-longer- used packaging as it had placed on the market and has refunded deposit to the sellers."

The above-described amendments should also be implemented in Greece, following the countries legislation pattern and the results from discussions and negotiations with related stakeholders.

5.3.2 Institutional setup

The legal entity structure of DRSs varies between the different systems. All systems of governance will be tasked with inter

alia all, or some, of the following actions (EUNOMIA, 2015):

- setting the deposit level;
- setting labelling prerequisites;
- analysing database;
- managing financial flows;
- controlling logistic system components (RVMs, manual take-back, consolidation centres);
- awareness campaigns; and
- monitoring return rates.

In practice, there are several models, which can be roughly categorized into the following three divergent parameters:

Private organization	X	State-run institution/ authority
Centralized	X	Decentralized
For-profit company	X	Non-profit organization (NPO)

Table 21 shows EU examples of clearing systems, operators and leading stakeholders in several MS.

Table 21 - DRS operators in EU countries - Adapted from (CM Consulting, et al.)

COUNTRY	CLEARING SYSTEM	PUBLIC / PRIVATE	OPERATOR & ADMINISTRATOR	STAKEHOLDERS	
Croatia	Centralized	Public	Environmental Protection and Efficiency Fund	-	
Denmark	Centralized	Private NPO	Dansk Returnsystem A/S	Brewers	100%
Estonia	Centralized	Private NPO	Eesti Pandipakend OÜ	Association of Producers of Soft Drinks	25%
				Association of Brewers	25%
				Association of importers of Soft Drinks and Beer	25%
				Retailers Association	25%
Finland	Centralized	Private NPO	PALPA	Retailer	50%
				Beverage Producer	50%
Germany	Decentralized	++	ADM: Deutsche Pfandsystem GmbH / OP: Retail and Industry	Retail Association	50%
				Food Association	50%
Norway	Centralized	Private NPO	Infinitum AS	Grocery Manufacturers' Service Office	7.5%
				Association of Wholesale Grocers	33.5%
				Coop Norway	15%
				Federation of Petrol Dealers	1.5%
				Federation of Food and Drink Industry	7.5%
				Brewers Service Office	35%
Sweden	Centralized	Private NPO	AB Svenska Returpack	Retail	25%
				Grocers Association	50%
				Brewers	25%

5.3.2.1 Public or Private Governance

The systems can be either run by state authorities or industry organizations.

Most of the systems in the USA are governed by the state, while in Europe, most of them are governed by industries. For example, Dansk Retursystem, from Denmark, is a private NPO owned mainly by Carlsberg. In Sweden, Returpack, the NPO is 50% owned by the Brewers of Sweden, 25% by the Swedish Retail Association and 25% by the Food Retailers Association. If the DRS is governed by industry, it is beneficial to set up a management board to oversee the design and operation of the system and ensure any targets were met.

In some cases, the state plays more of an advisory role like in Germany, where the majority of the system is owned and run by the private sector, and the role of the system administrator is limited to management of marking standards, specifications of the IT interfaces and certification requirements. The administrator has direct involvement in the operational matter and/or funding scheme (EUNOMIA, 2015).

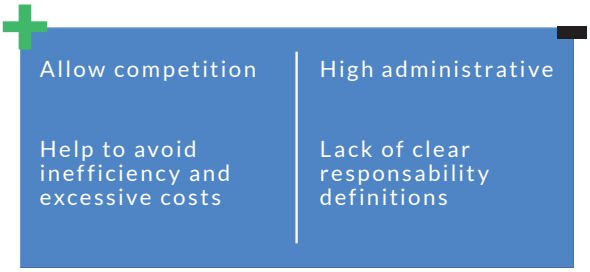
5.3.2.2 Monopoly or Competitive System

DRS, like EPR schemes, may be monopolistic or may contain multiple system operators in competitions. In a centralized system, the beverage industry usually creates a non-profit privately-owned organisation and controls the operations and finance of the system. In a decentralized system, competition between organisations is allowed since there is no single entity responsible for the system's operation or success. The pros and cons of both setups are shown in Figure 10 and Figure 11.

Centralized systems tend to offer greater accountability and transparency since the responsibility lays in one single organisation. This organisation publishes annual reports and accounts, sets fees for producers, monitors participants and frauds and ensures that all deposits are correctly initiated and refunded and that all fees are paid. This means all producers know exactly what they are required to pay and if the annual accounts are published publicly, producers can use their knowledge of the market to assess whether all competitors are paying their fair share. These types of systems might be more efficient, as the single operator arranges for all the containers to be collected and transported (rather than individual producers doing this for their containers) and market the material in bulk so that they get the best price (Eunomia, 2019).

Figure 10 - Centralized system: Pros and cons

Figure 11 - Decentralized system: Pros and cons



5.3.2.3 Potential stakeholders in the system

It is vital for the legal foundation of a DRS to define which parties must participate/ pay packaging fees in the system.

As observed in Table 21, DRS participating stakeholders are likely to include the beverage industry and relevant associations (as scheme funders) and the retailers (as the entities responsible for material return). Depending on the scope

of the DRS (see Chapter 5.3.3), actors such as brewers, distillers, dairies, soft drink manufacturers might also be considered. Since one substantial operational component concerns logistics, their representation might be advantageous.

For example, PALPA, in Finland, is a non-profit organisation, owned and operated 50% by the beverage industry and 50% by the retail industry and funded by fees paid by participating producers and importers whose products are covered by the system. Members pay both a registration fee and an annual fee, which is set according to the type and volume of products placed in the system (Ettlinger, 2016).

Figure 12 provides an overview of the main actors of the bottle supply chain in Greece.

Figure 12 - Examples of the industries at different levels of the supply chain (IFRA,2020)

It is not evident whether the above-mentioned stakeholders will be eager to participate in the implementation of DRS in Greece. Clear communication and exchange between governance and the private sector are crucial for the success of the initiative.

As a first step, it is suggested to conduct interviews with main actors to understand their concerns and openness regarding this topic.

5.3.2.4 Agreement between existing EPR schemes and DRS

In several countries (Finland, Sweden, Netherlands, etc), the DRS system was founded before the establishment of PROs for packaging waste in general. In these cases, there is no arrangement in which the deposit-subject and the no-deposit-subject are managed by the same organisation.

In cases which the DRS comes after the implementation of an EPR scheme for packaging waste, the related infrastructure is, usually, already in place. In such situations, producers are more reluctant to invest further money to set up a DRS as a new system. Besides, beverage containers represent an interesting economic input for these functioning EPR schemes, while handling costs might remain the same.

No comprehensive studies have estimated the effects of one system on the other until the release of this report (Spasova, 2019).

5.3.2.5 Recommendations for Greece on DRS operation

Apart from Germany, all other European systems are centralised, and it is recommended that Greece pursues a similar approach. A centralised approach is usually more efficient and more effective. Due to the clear responsibility definition, a monopoly, in this case, ensures transparency and enables fraud control. Bearing in mind that this is a crucial factor to Greek authorities, this approach would be more recommendable.

Besides, the establishment of DRS in the country would most likely be influenced by the presence of a national framework of extended producer responsibility. Therefore, it could be expected that the system might be governed by industry, within rules set by the Greek government, and with a define return rate target, which could start as low as 60%-70% and increase yearly until it reaches 90%.

Concerning the participants in such a system, it is necessary to create working groups between government entities and industry actors (beverage, retail, logistics, supermarket) to understand demands and restrictions from both sides. These working sessions shall be mediated by a third party, with technical and operational knowledge and no direct political and / or economic interests. It is likely that many beverage producers, fillers and/or importers already participate in existing EPR schemes. As mentioned in chapter 5.3.2.4, the correlation between systems must be further assessed.

5.3.3 Scope

The scope correlates to the range of bottles/cans included within the scheme, both in terms of container type and beverage category. DRSs in Europe are usually comprehensive, covering three main types of one-way packaging materials: plastics, glass and metal. Historically, the main reason why deposit systems were developed for beverage containers is that they are more likely than other types of food-based containers to be consumed away from home and thus end up as litter.

Some standard exceptions within EU DRS are made for wines and spirits. Wines are often imported mainly from smaller, local bottling plants in the country of origin, so the effort to label the containers has sometimes been excessive (EUNOMIA,

2015). Besides, bottle shapes with non-circular cross- sections (as with beverage cartons) meant takeback through RVM required higher investment on machinery (Fletcher, et al., 2012).

Furthermore, hygiene issues, particularly in association with plastic milk bottles, but also for other food-based containers, are raised in most of the DRSs across Europe. These matters associated with milk bottles have been stated as a reason for not including these in existing DRSs.

The disposition of the DRS scope from the UK is shown in Figure 13. This can be considered a typical deposit refund system scope in the EU

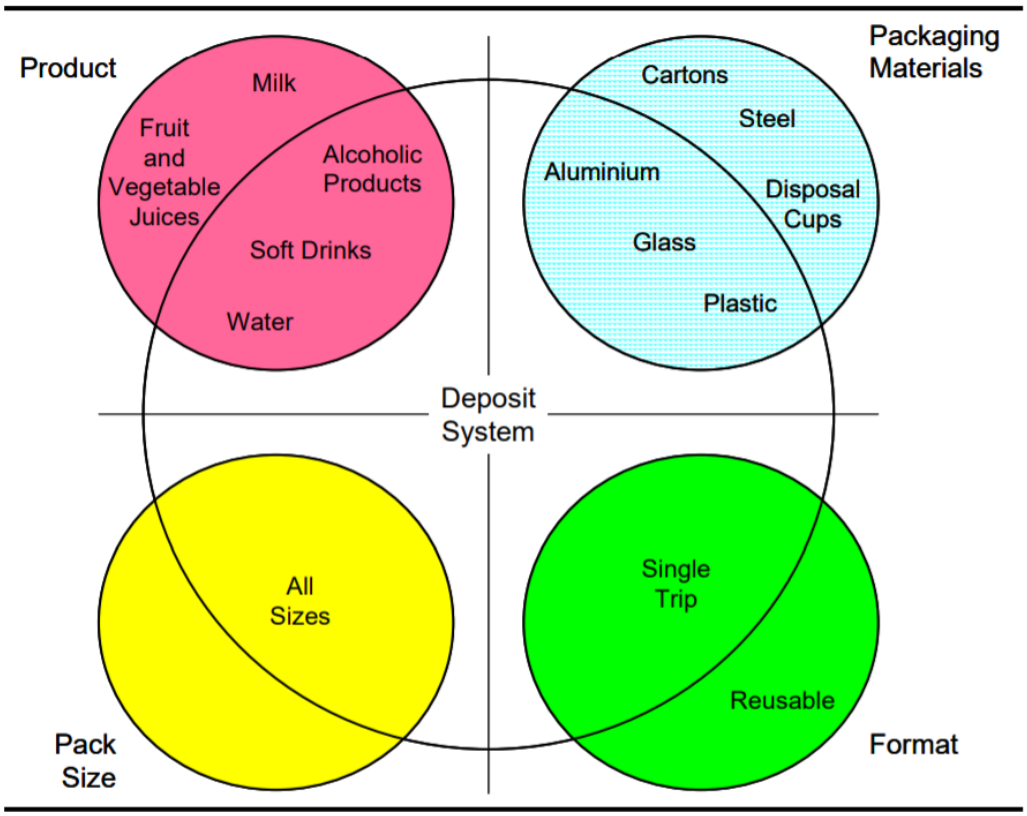


Figure 13 - Venn Diagram of scope of DRS in the UK (Gandy, et al., 2008)

It is also possible to start with a restricted scope to adjust and calibrate the system and later expand it to further beverage types. For example, the finish DRS operator -PALPA- introduced a system for collecting one-way PET bottles in 2008, and in 2011 for one-way glass bottles.

5.3.3.1 Deposit and Fees

Two of the key design features of a DRS are the structure and the level of the deposits. Some systems divide the fees into different categories such as 'container material type' and 'container volume', combining with 'beverage type' or 'alcohol content %', while other countries use a single rate, facilitate the comprehension from the society.

'Container volume' is the main differentiating category. In many countries, 1 litre was the most common volume, used by eight schemes, while five schemes used a 500ml measurement (EUNOMIA, 2015). On one side, settling a fee based on the beverage size provides a sensation that the customer gets a higher award for larger items, including the fact that ensuring recycling of these bigger containers is beneficial. A different

perspective is to show that all containers should be recycled, independent of their size. In this case, including a container volume category would not have the desired results. From a market point of view, larger beverages are usually more expensive than smaller ones. Following this line of thought, it makes sense that the deposit is higher for larger containers so that the relationship between the purchase price and deposit fee is not excessive.

'Container material type' is a category used by most of EU MS. One important factor regarding this category, which shall be considered, is that beverage producers might change their packaging type depending on the fee. If there are much higher fees for cans as for glass bottles, producers might switch to the glass option.

Another aspect is that internalising the environmental damage of the package is not the purpose of the refundable deposit. Considering this, there is no direct relationship between higher environmental benefits and higher deposit fees. Finland and Denmark are examples of it, with the lowest fee being for aluminium cans.

Regarding the deposit rate, previous studies have shown that return rates vary in accordance with the fees. Figure 14 shows the relationship between return rates and deposit values regarding the purchasing power parity (PPP). It is crucial to highlight that deposits must be adjusted to PPP to normalise the relative differences in wealth between the countries concerned, and therefore make the figures more comparable (EUNOMIA, 2015).

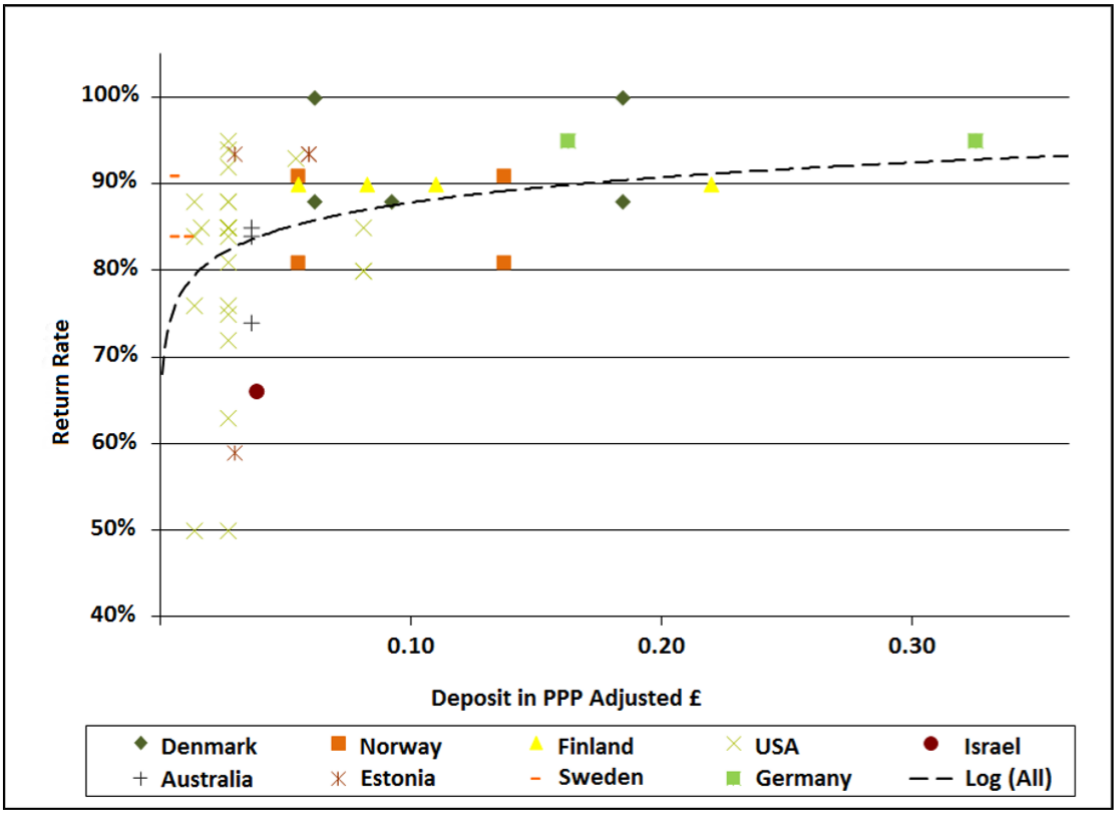


Figure 14 - Return rates as a function of deposits in PPP - Adjusted £ (EUNOMIA, 2015)

As mentioned above, some countries determine their deposit fees differentiating between sizes and material types, while others have one rate for all container types.

Another important financial aspect is the handling fee, as briefly mentioned in chapter 5.1. This fee is paid to retailers in order to compensate them for facilitating the collection infrastructure. These fares

usually vary depending on the collection scheme (RVM or manual) but also differing on container type.

Systems that include redemption centres may also pay handling fees, depending on who operates the centres. If these centres are managed by the central system operator, a handling fee would not be necessary (Eunomia, 2019).

Table 22 provides a general overview of the deposit and handling fees in European countries.

Table 22 - Deposit and handling fees for different one-way containers in EU member states - adapted from (CM Consulting, et al.) and (Spasova, 2019)

COUNTRY	CONTAINER CATEGORY	DEPOSIT FEE (€ / CONTAINER)	HANDLING OPERATION	HANDLING FEE* (€ / CONTAINER)
Croatia	All containers	0.06	Manual	0.01
		0.13	RVM	0.02
Denmark	Metal, glass <1L	0.20	Manual	0.008 - 0.019
	Plastic <1L	0.40	RVM with compactation	0.0019 - 0.0095
	Metal, glass, plastic >1L	0.10		
Estonia	All containers	0.10	Manual	0.0105 - 0.0120
			RVM without compactation	0.0215 - 0.234
			RVM with compactation	0.031
Finland	Plastic <0.5L	0.10	Manual or RVM without compactation	0.027
	Plastic 0.5L-1L	0.20		
	Plastic >1L	0.40		
	Metal	0.15	RVM with compactation	0.03
	Glass	0.10		
Germany	All containers	0.25	**	
Lithuania	All containers	0.10	Manual	0.028
			RVM without compactation	0.015
			RVM with compactation	0.028
Norway	Plastic, metal < 0.5L	0.20	Manual or RVM without compactation	0.005 - 0.01
Sweden	Metal	0.10	Manual	0.00 - 0.023
	Plastic <1L	0.10	RVM without compactation	0.023
	Plastic >1L	0.10	RVM with compactation	0.017 - 0.048

* Handling fee ranges correspond to different container types.

** Germany has a particular system in which there are no handling fees. Instead, the retailer owns the material and sells it to the recycling plants. This practice is an exception considering the European praxis. Therefore it is not considered for this study as a benchmark.

The handling fee is intended to reflect retailers' operational costs such as overhead, space, electricity and usually higher for retailers that install RVMs (with compaction) to promote more efficient options and, consequently, to reduce the overall system costs.

The main fees surrounding the central system operator are highlighted in Figure 15.

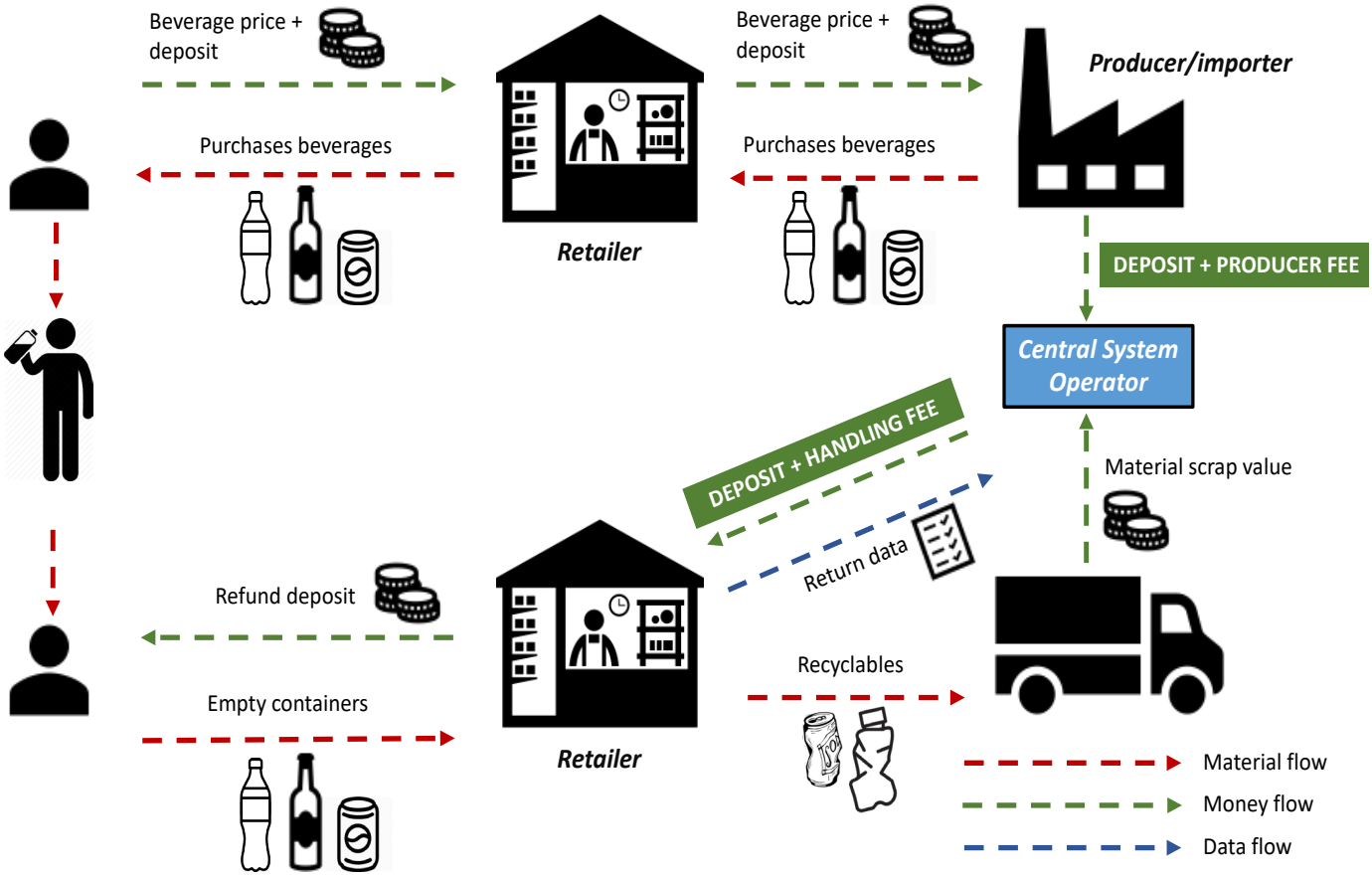


Figure 15 - Deposit and handling fees flow (BFS, 2020)

If the RVMs are the retailers' responsibility, its handling fee is usually higher than the manual service fee, given that they incur more costs but finally generate savings for the system. This is also observed while comparing RVMs with or without compaction at the back end.

If the RVMs are provided by the system operator, is it not clear whether handling fees will be higher for manual or automatic collection. In Denmark, for example, the RVMs are provided by the system operator, and they pay a higher handling fee for a manual service compared to retailers with an RVM. On the other side, in Lithuania, the RVMs are similarly provided by the system operator, but they still pay more for retailers with an RVM than to retailers providing a manual service (Eunomia, 2019).

5.3.3.2 Recommendations for Greece on DRS Scope

Differentiated rates by material type do not seem essential, and more likely to be confusing for the consumers. Determining a larger deposit for a larger container, on the other hand, would seem logical to most consumers (EUNOMIA, 2015).

Considering that Greece is still struggling

with increasing environmental awareness and sensitisation of citizens towards sustainability, it is recommended to keep the deposit system as simple as possible. In this case, it is suggested that the country either adopts a flat rate for all containers, ensuring equal incentive to return all containers and clarity for all stakeholders.

The existing deposit for returnable glass bottles in Greece is €0.14€ per 0.5L refillable glass bottles and achieves a return rate of approximately 45% for bottles and 15% for kegs.

Using successful European systems as a benchmark, container deposits vary between €0.06 up to €0.40 per unit. Correlating EU fees, with return rates shown in Figure 14 and current fees in the country, a deposit fee between €0.10 – 0.15 is indicated. Nonetheless, corresponding research including financial data should be undertaken before setting up the deposit fee.

It is essential to highlight that it is more feasible to increase the deposit level than to reduce it. The primary reason is that producers may try to delay laying containers on the market, and it could adversely affect the operator's cash flow since fees will fall, while consumers are still claiming high deposit refunds. In any system, it is a best practice to keep the deposit value under review, not least because it will lose value with inflation, and increase it if the return rate is too low. This is partly why deposit values should not be specified in legislation (Eunomia, 2019).

Since the system is usually designed for returning beverage containers at retailers, hotels, cafes and restaurants are not paid handling fees. The rates should be calculated annually based on negotiations between the operator and retailer representatives, and an assessment of the implications for logistics costs.

Concerning the ownership of the RVMs, discussions between government, beverage producers, and retailers will be required to define the best setup in the country. From previous EU experiences, more efficient results were met when RVMs belong to the retailers' responsibility. This matter must be defined in the DRS legislation (see chapter 5.3.1.1).

5.3.4 Collection

This section relates to where and how consumers can return their used containers to obtain a deposit refund. Typically, empty bottles and cans are either returned to retail or a specific depot (or a combination of the two). As described in the chapters above, retailers are usually obliged to participate in the system, if they have a larger area than determined by law. In some countries, "redemption centres" are explicitly created to take back used containers and refunding deposits. They can be run directly by the system operator or by private individuals and companies and can be staffed or simply enable consumers to drop-off their used containers.

5.3.4.1 Types of collection

Collection of single-use beverage containers usually involves either:

- reverse vending machines (RVMs); and/or
- retailers manually collecting and storing containers.

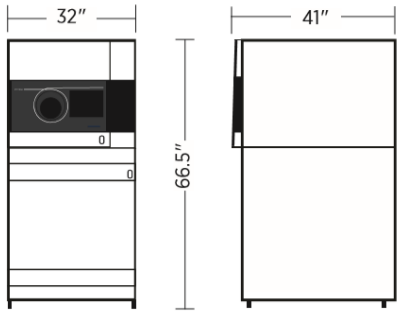
RVMs are automated machines into which customers insert their used beverage containers to obtain their refund. RVMs can identify the container and beverage type, confirm the deposit to be refunded and, in some cases, compact the containers to reduce storage space and prevent multiple redemptions.

They may also be connected online to the system operator, enabling the identification of redemption patterns, determination of the optimal time for collection, and reimburse retailers more

swiftly. Additionally, some RVMs enable retailers to advertise products or offer promotions to potential customers and can allow consumers to donate their deposits to charity.

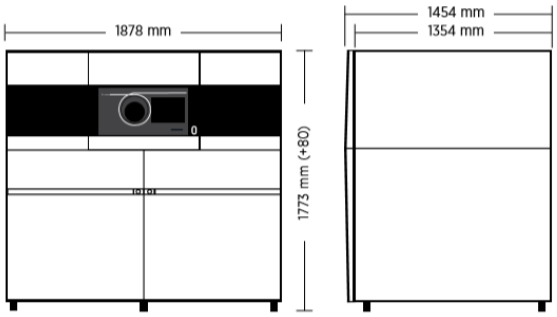
There are several types of machinery which can be either purchased or leased, depending on the requirements and size of retailers.

Two examples with different sizes and capacities are shown in Figure 16 and Figure 17.

Dimensions	Storage capacity (appr. figures with shakedown mixed sizes)
 **Weight:** Max. 624 lbs **Footprint:** 9.1 sq.ft.	PET crusher: Up to 1500 PET (based on mix) Can crusher: Up to 3000 cans (based on mix) Glass: Up to 300 objects (weight limited) Based on bin size: Effective height of bin 34″ (pallet height 6″ appr. figures with shaking down)

Container specifications	Speed capability	Environmental	Electrical	Connectivity
Bottle size Diameter: 1.97″-5.12″ Height: 3.35″-14.96″ **Can size** Diameter: 1.97″-3.94″ Height: 3.15″-7.87″	**Shape & barcode reading** Up to 45 containers per minute	**Humidity** Maximum 90% relative humidity, non-condensing **Temperature** 32°F - 104°F The machine has been designed for indoor use only	**Power consumption** Idle 60W, Max 2000W, Can/PET Crusher nominal in use **Mains** 208 V AC 3-phase w/ground, 60Hz, 20A 400 V, 3-phase w/ground, 50 Hz, 16 A max.	LAN (Ethernet TCP/IP) interface POS compatible

Figure 16 - RVM specifications - Example of T-70 model from TOMRA

Dimensions	Storage capacity (appr. figures with shakedown mixed sizes)
 **Weight:** 525 kg (max weight) **Footprint:** 2.5m²	PET crusher: Up to 1500 PET (based on mix) Can crusher: Up to 6000 cans (based on mix) Glass: 300 objects (weight limited) Based on bin size: B: 800 x D: 1200 x H: 1000 mm Effective height of bin 850 mm (pallet height 150 mm. appr. figures with shaking down).

Container specifications	Speed capability	Environmental	Electrical	Connectivity
Bottle size Diameter 50-130 mm Height 85-380 mm **Can size** Diameter 50-100 mm Height 80-200 mm	**Shape & barcode reading** Up to 45 containers per minute	**Humidity** Maximum 90% relative humidity, non-condensing **Temperature** +10°C to +40°C The machine has been designed for indoor use only	**Power consumption** Idle 60W, Max 2500W, Can/PET Crusher nominal in use **Mains EU** 400 V AC 3-phase w/ground, 50Hz, 16A **Mains US** 208 V AC 3-phase w/ground, 60Hz, 20A	LAN (Ethernet TCP/IP) interface POS compatible

Figure 17 - RVM specifications - Example of T-90 model from TOMRA

Retailers usually choose to install RVMs since handling fees usually are higher, handling costs and logistic efforts are lower, and investment is paid within a short period of time. Beverage sellers may also choose a manual scanner, connected to the system operator, and return deposits directly on the counter.

It is likely that a manual return would primarily be done in smaller retailers and involve customers handing over returned items to a shop attendant to have the deposit returned. This has the benefit for small retailers of not losing selling space with the implementation of an RVM plus avoiding any cost implication of acquiring it. Although, it would have an impact on staff time at the counter, which could trigger matters at busy times, and would involve the storage of used containers behind the counter or in the shop's storage space. The impact on small retailers will vary depending on the scope of the scheme and the size and layout of the store.

Usually, countries initiate the system with a high percentage of manual collection and have a transition to RVMs, as observed in Estonia (see Figure 18).

Year	RVM	MANUAL COLLECTION
2006	20%	80%
2013	94% (80% Pressed)	6%

Figure 18 - Collection structure (RVM Vs. Manual collection) in Estonia (R4R, 2018)

5.3.4.2 Retailers

Retailers typically face extra costs under a DRS, notably those related to receiving and storing returned containers and operating a deposit account (to pay deposit claims from customers and reconcile any difference between sales and returns from the central system).

As mentioned in chapter 5.3.4.1, it is generally the case that handling fees are paid to retailers for their role in accepting returned deposit containers.

Retailers are commonly obliged to participate in the DRS if their area is larger than a determinate space in m2, defined by the legislation. In most EU countries, this defined area ranges between 200m2 and 300m2. If shops are smaller, they might also be obliged to take back the brands they sell.

A list with major retailers, their presence in Greece and the estimated number of stores are shown in Table 37, in annex 9.4.

5.3.4.3 Redemption and counting centres

The return of used beverage containers needs to be as convenient as possible for consumers; therefore, European systems commonly rely on the return to the retail model. This enables customers to return their containers while shopping or if they are consuming their beverage on the way. If consumers must change their routes to return containers, return rates will decrease.

Even though redemption centres might increase logistic costs of collection, they are helpful in locations with less density of retailers (e.g., rural areas) or touristic zones, acting as an awareness- raising tool. Figure 19 exemplifies an automatic redemption centre in Australia.

Figure 19 -Redemption centre for beverage containers in Australia (theleader.au)

Counting centres receive the manually collected material and non-compacted containers from RVMs, count and bale them, ensuring that the retailer receives the correct amount of deposit in return. These centres also prevent fraud since containers that are not compacted might be taken after counting and put back into an RVM to redeem the deposit twice. Counting centres are employed to guarantee that the retailer who pays out the deposits receives the correct amount in return.

5.3.4.4 Impacts on local authorities

The impacts from a DRS implementation on the local authorities will differ from situation to situation. For instance, a local authority that collects co-mingled recycling will not experience the same range of effects as an authority that operates a kerbside sort collection operation. The main reasons for that are the different ways in which staff interact with the collected material and its destination after it is collected. In addition, diversity on whether the local authority operates the collections itself, or whether the services are contracted out to a private sector waste company, as well as different local governance structures (e.g. single or two-tier local government administration), will also lead to different distributions of costs and benefits.

Usually, the main concern on behalf of local authorities is the potential loss of material revenue. Specifically for Greece, this is not entirely applicable since most of the recyclable materials are discarded into the blue bin, belonging to the existing EPR scheme (see chapter 5.3.2.4).

Studies have shown that, despite the reduced amount of collected high-value materials, a DRS still results in net savings. This is mainly due to the reduction in residual waste which requires treatment, along with the possibility of reduced material recovery facility (MRF) costs and potential efficiencies in collection. There is also a potential for reduction in street cleaning costs (Hogg , et al., 2017).

An infographic of the impacts and costs implications assess by (Hogg , et al., 2017) for the UK is shown in Figure 20.

Figure 20 - Financial Impacts of a DRS on Local Authorities in the UK (Hogg , et al., 2017)

5.3.4.5 Impacts on the Informal Sector

In most cities worldwide, the informal sector plays an important role in the collection of beverage containers. In low- and mid-income countries, aluminium cans are usually well valued, while PET and glass bottles vary strongly with the secondary raw material markets.

With the implementation of a DRS, the informal network of "canners," or scavengers can continue their activities and collect deposit containers from streets, public trash and curbside bins to receive the deposit refund. The main positive impacts are that this sector has better "working conditions" since containers are, in many opportunities, left at visible places/allocated places for collection and also has a broader range of container types to pick. A negative impact might be the reduction of available containers in the "free-market".

The informal sector also plays a role in touristic areas, as tourists may not be familiar with the deposit system or know how to redeem their deposit. While this could pose obstacles, Greece´s informal waste sector could compensate for low returns in some areas, as they may pick-up discarded containers to claim the deposit.

Another possibility is to integrate the informal sector into the deposit system, e.g. working in redemption centres, supporting the logistical setup among other functions. It would not only create further jobs but also develop local know-how in the functioning of the system.

5.3.4.6 Logistical Approach

As shown in chapter 5.3.4.1, containers are returned in either a manual or automated manner, varying labour and logistics costs. This is mainly related to the fact the automated machines crush materials to make them denser, which is more efficient in logistics terms.

The number of potential take-back locations is essential, as is the type of collection (manual or automatic) the retailers would be likely to employ.

To determine and optimize logistic

routes, it is vital to understand the retail landscape in the country, to calculate both the number of collection points in the system and whether containers would be likely to be returned to retailers via RVMs or manually over the counter.

Return locations might include:

- hyper- and supermarkets;
- traditional stores;
- food/convenience stores;
- gas stations;
- cafes; and
- bars and pubs, amongst others.

In principle, the design of logistics might be under the central system administration responsibility. Regardless of the liable entity, the costs of operating the scheme are likely to be lower where backhauling is deployed to improve the overall efficiency of logistics, when feasible. Usually, major supermarkets have distribution centres, but it is recognised that some smaller companies might be supplied from distribution centres, so backhauling could be less viable (Hogg , et al., 2015).

5.3.4.7 Recommendations for Greece

Regarding types of collection, international experiences suggest that, while implementing DRS, countries might start with manual return points, but automated systems are likely to be adopted along the first years. It is recommended that Greece follows this trend, but keep the whole system, from its start fully automated, with manual and RVMs collections connected to the central operator system.

Towards retailers' participation in the system, it is advised to include sellers with an area bigger than 200 - 300m2 in the legal obligation of installing a take-back system for beverage containers.

A further option is to oblige smaller retailers to accept the beverage containers which they are selling, expanding the collection scheme. To define the detailed scope of this subject, consultations with retailers in the country must be conducted.

Considering that Greece has a particular geographic distribution, it was suggested, for the purposes of the current study, to divide the country into categories. To suggest collection and drop-off points, the pre-feasibility study followed the pre-defined clusters:

1. **Metropolitan centres in the mainland with more than 10.000 inhabitants**[18]

   Medium to big cities commonly have different supermarkets and shops with constant commercial activities throughout the year, reduced fluctuation in the population (in comparison with highly touristic islands), potentially industrial activities/ beverage production areas, and waste management system(s).

2. **Small cities in the mainland with less than 10.000 inhabitants**

   For small towns and rural areas, it is presumed that population and service densities are much smaller, the distance between towns is bigger, communication strategies are restricted, and retailers might have reduced areas, with fewer supermarkets.

3. **Big islands with "continental behavior": Crete, Rhodes, and Evia**[19]**.**

   Having a continental behaviour for these three specific islands means that services mentioned for the metropolitan centres are also present.

4. **Islands with high population variation**

   Several islands have "summer peaks", where there is a sharp increase in

18 Based on the principles of the Klisthenis Law

19 Based on discussions with GIZ, YPEN and HRA on the 02/10/2019

population from 3 to 6 months of the year. These islands usually have their infrastructure directed to touristic activities and, during wintertime, reduced commercial activities in general.

This division was suggested to understand consumer behaviour, industrial production, recycling facilities, and communication patterns in the country. Estimated logistical setups for the above-mentioned categories are shown in Table 23.

Table 23 - Recommendations on beverage container collection schemes for Greece

CLUSTER	TAKE-BACK SYSTEM
Metropolitan Centres	• Implementation of automated take-back system within retailers (enforced by law); • During initial phase, manual take-back system may be employed and later transposed to RVMs.
Small Towns	• Implementation of automated take-back system within retailers (enforced by law); • During initial phase, manual take-back system may be employed, and later transposed to RVMs; • Construction of redemption centres in isolated regions, with container pressing for logistic optimization and awareness-raising. These redemption centres may also be placed in central squares for higher effects on communication.
Islands with "continental behaviour"	• Implementation of automated take-back system within retailers (enforced by law); • During initial phase, manual take-back system may be employed and later transposed to RVMs.
Islands with touristic peaks	• Considering that tourists may not be aware of the system, the construction of redemption centres placed in central locations (public squares and/or touristic attractions) is vital for higher effects on communication; Smaller islands may get one RVM in the port area that could be combined with sightseeing/touristic information. The transport of the material will be easier and more accessible. • Plus, RVMs shall also be placed in retailers' for the same purposes mentioned above; • Leasing of RVMs shall be considered for high peak seasons.

Opportunities for backhauling should be explored as far as possible, since they provide the most convenient system for consumers, allow for flexibility of take-back, and keep logistics costs down.

It is suggested that in small towns, rural areas, and on touristic islands, the use of backhauling through existing distribution networks is maximised, and where this is not possible, centralised takeback facilities are implemented to reduce logistics costs. Simple, pragmatic takeback arrangements could also be utilised in very remote areas where there are isolated retail outlets, and consequently, more limited potential for fraud. (Hogg , et al., 2015).

5.3.5 Financial estimations

In DRSs operated in other countries, direct financial responsibility for the costs effectively falls mostly on beverage producers, packers, fillers and importers. Retailers typically face additional costs notably those linked to receiving and storing containers and operating a deposit account (to settle deposit claims from customers and reconcile any difference between sales and returns from the central system). Generally, handling fees are paid to retailers for their role in accepting these containers.

The establishment of DRS implies two major costs components:

- setup costs, including investments in RVMs, monitoring and controlling software, vehicles, labelling, recycling plants; and
- operational costs, including handling, logistics, staff, administration, producers fee, awareness-raising, amongst others.

Both setup and operational costs are usually born by producers, importers, and retailers. Based on the main expenses of the DRS, the costs to the retailer on the required space and resources for the DRS (acquirement of RVMs) are by far the most significant component of the total implementation costs. These are usually fully reimbursed by the handling fees that are paid to the retailer by the central system on a per container returned basis. The handling fees compensate for the following (Fletcher, et al., 2012):

- RVM installation and operating costs;
- shop floor space used to house RVMs and to store returned containers; and
- labour costs associated with the emptying of RVMs, the manual take-back of containers by the cashier and facilitating the pick-up of the returned containers by contracted logistics companies or the retailer's own haulage.

It is important to highlight that the Swedish system was primarily supported by a state loan. This might be an alternative, especially if the government pursues to create a single entity with specific responsibilities to deliver a DRS within a given policy framework (Hogg , et al., 2015).

The systems revenues can be basically summarized in:

- producers annual fee;
- unclaimed deposits; and
- revenues from materials sales.

Table 24 summarizes the main financial features from different EU member states while implementing a DRS or conducting a financial feasibility study. These features are briefly explained below:

- RVM costs include the purchasing of equipment (installation and operating) and of the bring points for consumers to return the materials and to collect their deposits. These expenses vary depending on the number and type of machines (with compaction, material separation), the type of purchase agreement (by the tenderer, retailer, leasing, etc.). Further information on the RVMs can be found in chapter 5.3.4.1.
- Vehicle costs refer to the collection of containers from retailers. These expenses rely on the investment of purchasing or leasing new ones.
- Labelling refers to the national harmonisation requirements for products participating in the system. Further information on labelling (see chapter 5.3.6).
- Central system setup refers to the establishment of the centralised DRS system.
- Total setup costs include the equipment (RVMs, vehicles, equipment of the counting centres),

- required labelling, and setup of the central system (IT, communication, etc.).
- Retailers costs refer to the handling fees, including occupied floor space for the RVMs, the storage space for the collected material, and the labour costs (RVMs and manual). Further information on the entailed retailers' costs (see chapter 5.3.4.2).
- Collection and central handling/ counting costs comprise the central counting centres where the manually collected material and non-compacted containers from RVMs are counted and baled. It doesn't account for the initial investment for the equipment. These costs involve potential rental of the building/space, utility costs, handling operational costs, and labour.

- Transportation and logistics costs include the number of routings to transfer collected material from retailers to the counting centres or recycling plants, fuel consumption, and labour.
- Administrative costs are considered on-going and are associated with the staff required to run the central system, including administrative and customer services, marketing, communication and monitoring. In some cases, awareness-raising campaign costs are also included. In the cases of the Czech Republic and Lithuania, the awareness costs are available separately.
- Producers costs include the total annual fee paid in the system by the liable producers. These represent the net cost producers must pay into the system. The producers' fee is part of the system's revenue, including the unclaimed deposits and the revenues from the collected materials sales to recycling facilities.
- Awareness-raising costs include the communication and campaigns to be conducted by the operator to spread and promote the scheme to the consumers. In some countries, the minimum amount of the revenues to be allocated for this feature depends on the operator. In others, such as in Lithuania, it is determined by law (minimum of 1%).
- Total operational costs include the retailer's costs, the collection, and central counting costs, transportation and logistics as well as administrative costs. In some studies, the operational cost account for the losses from fraudulently claimed deposits (e.g., Czech Republic). These are partially covered by the system's revenues.

Table 24 - Financial implications of DRS in EU countries (IFRA, 2020)

Cost Parameters	CZECH REPUBLIC[20]	ESTONIA[21]	LATVIA[4]	LITHUANIA[22]
ARVM (Mi€)	85.20	n/a	16.00 – 20.00	22.00
Vehicles (Mi€)	8.20	n/a	n/a	n/a
Labelling (Mi€)	n/a	n/a	n/a	n/a
Central system setup (Mi€)	0.90	n/a	n/a	5.00
Total setup (Mi€)	96.00	n/a	n/a	96.00
Retailers – handling fee	36.30 – 38.00	3.9	8.15	18.88
Collection & central handling/ counting (Mi€/yr)	0.70 – 1.40	n/a	2.15	25.8
Transportation & logistics (Mi€/yr)	8.20 – 8.50	n/a	1.31	3.189
Administrative cost (Mi€/yr) - including IT infrastructure, staff, etc.	0.50 – 0.90	n/a	0.90	n/a
Producers net fee (€/yr)	9.90 – 14.30	n/a	2.70	13.07
Awareness costs (€/yr)	0.30	n/a	n/a	1%<
Total operational (€/yr)	50.5	n/a	12.51	47.00
Producers fee	9.90 - 14.30	n/a	2.70	13.07
Material revenues	17.70 – 24.6	n/a	4.53	7.85
Unclaimed deposits	18.5 - 23.4	n/a	5.33	5.23
Total Revenues	43.10 – 62.30	n/a	12.56	26.15

20 (Cordle, et al., 2019)

21 (Dace El Blumberga, et al., 2013)

22 (Balcers, et al., 2019)

Cost Parameters	NORWAY[1]	SCOTLAND[23]	SPAIN[24]	UK[25]
ARVM (Mi€)	n/a	28.9 – 29.30	n/a	n/a
Vehicles (Mi€)	n/a	n/a	n/a	n/a
Labelling (Mi€)	N/A	5.60	1.70	1.50
Central system setup (Mi€)	27.00	17.50	32.00	37.60
Total setup (Mi€)	n/a	n/a	n/a	115.00
Retailers – handling fee	n/a	42.33 – 43.62	657.00*	657.87 - 675.46
Collection & central handling/ coun ting (Mi€/yr)	n/a	3.20 – 3.50	134.00	378.00 – 442.00
Transportation & logistics (Mi€/yr)	n/a	23.34 – 24.04	n/a	
Administrative cost (Mi€/yr) - including IT infrastructure, staff, etc.	n/a	2.90 – 2.80	13.00	
Producers net fee (€/yr)	n/a	6.60 – 20.00	120.00	249.00
Awareness costs (€/yr)	n/a	n/a	n/a	n/a
Total operational (€/yr)	41.50	71.8 – 74.00	398.00 – 438.00	1,035.00 – 1,117.00
Producers fee	n/a	6.60 – 20.00	120.00	249.00
Material revenues	n/a	42.10 – 28.03	176.00	220.50 – 246.00
Unclaimed deposits	n/a	42.10 – 28.03	385.00	575.78 – 1,100.00
Total Revenues	n/a	71.88 – 73.76	654.00	1,045.00 – 3,595.00

23 (Hogg , et al., 2015)

24 (Fletcher, et al., 2012).

25 (Hogg , et al., 2010)

From Table 24, key points must be considered:

- The ranges of the costs for the Czech Republic are associated with the different scenarios of either including just PET or both PET and metal containers. The research has shown that the implementation of a DRS just for PET bottles is more expensive than the implementation for PET and metals (€14.4 million and €11.1 net cost respectfully)20. Lithuania's and Scotland's system are an all-inclusive DRS (PET, metals, and glass).
- The ranges for the costs in the cases of Scotland and the UK are associated with the considered low and high scenario assumptions:
  - » For Scotland, the low scenario assumes a deposit of 10pence (€0.12) and a return rate of 85%, while the high scenario assumes a deposit of 20pence (€0.23) and a return rate of 95%. Additionally, the retailer's costs include the fee covering the RVM cost (installation, operation, labour and occupied space) and the manual handling costs (installation, labour, space).
  - » For the UK, the low scenario makes an assumption of an 80% return rate, while for the high scenario the return rate is up to 90%. Furthermore, the high scenario includes an administration fee imposed to the producers on each container placed on the market, amounting to a total of €248 million. The administration fee is used to cover the shortfall of the systems operational cost. The administrative cost included in the €378 million is separately calculated and accounts for €17.50 million per year.
  - » In terms of revenues for the UK, the wide range between the unclaimed deposits for the lower and the higher scenario is notable and can be attributed to the "lost" material to the parallel system.
- Latvia's DRS system was expected to be introduced by 2015 (Dace, et al., 2012), however it has not been implemented yet. The pertinent authority of the country is currently reviewing the amendments of the Packaging Law to introduce a DRS scheme in the country[26].
- The report on a potential DRS scheme in the UK (Hogg , et al., 2010) refers to the total initial setup cost (€115 million) with the RVMs cost being delegated to the retailers, to be reimbursed via handling fee. The report encompasses Wales, Scotland and North Ireland, justifying the significant total operational costs.

The costs for each DRS vary between countries due to the different aspects and factors such as population, types of material included in the system, available infrastructure, consumer patterns, supporting economic instruments amongst others.

In this sense, Table 24 shall not be used for comparison purposes. Instead, its primary purpose is to show rough figures facilitating the understanding of the magnitude and costs implications of DRS.

To illustrate potential investments costs the country might face while executing a DRS, Table 25 compiles the date from a financial proposal that the enterprise TOMRA Collection Solutions shared with the consultants for informative purposes.

Besides TOMRA, there are several other machinery producers in the market. Another example is EURVEN, from Italy (see Table 26). This company does not offer a leasing option.

26 https://www.wearedots.com/en/news-post/depozita-sistema

Table 25 - Examples of RVM types and prices for Greece (BFS, 2019)[27]

Model (Example)	TOMRA H10	TOMRA T70 Single	TOMRA T70 Dual	TOMRA T90
Picture				
Speed capacity (containers/min)	15	45	45	45
Compactor	No	Yes	Yes	Yes
Price (€)	7.900,00	17.500,00	22.000,00	31.500,00
Yearly support fee (€/yr)	1.100,00	2.000,00	2.400,00	3.300,00
3-year leasing (€/yr)	3.480,00	7.500,00	9.150,00	11.000,00
Further Services				
Voucher control (€/yr)	140,00	140,00	140,00	140,00
Donation up to 12 campaigns (€/yr)	100,00	100,00	100,00	100,00
Promotion on screen (€/yr)	180,00	180,00	180,00	180,00
Couponing programs (€/yr)	280,00	280,00	280,00	280,00

Table 26 - Examples of RVM types and prices for Greece (BFS, 2019)[28]

Model (Example)	EC JUNIOR WITH 1 BIN	EC 2 WITH 2 BINS
Picture		
Speed capacity (containers/min)	210 plastic bottles / 800 cans	210 plastic bottles / 800 cans (per bin)
Compactor	Yes	Yes
Price (€)	4.200,00	6.800,00
Further Services		
Voucher control (€/yr)	750,00	750,00

27 Estimated prices based on financial proposal from TOMRA Collection Solutions. Real prices must be inquired on demand.

28 Estimated prices based on financial proposal from EURVEN. Real prices must be inquired on demand.

Other companies shall also be approached to generate a cost-benefit analysis while procuring equipment.

To estimate the implementation costs of DRS in Greece, it is recommended that a complete feasibility study is conducted, including volume estimations, collection rates, prices for secondary raw materials, logistic costs, distances to recycling facilities, deposit and handling fees for the country.

5.3.6 Labelling and Fraud Control

On top of the operational activities, monitoring of target recycling rates is a key aspect of overall governance. This should always be in the control of the public authorities, since operators may lead to reducing costs by designing a system which presents low return rates, and where the revenues for unclaimed deposits are high (EUNOMIA, 2015).

One strategy to avoid this issue would be to apply penalties to the operator in case take-back targets are not met or to require a percentage of the revenues generated by the unredeemed deposits to a governmental fund as a fine.

5.3.6.1 Labelling and Logos

In order to operate a DRS, it is important to distinguish between "visual information logos" (which enable consumers to identify items that can be returned) and "security logos" (whose primary purpose is preventing fraud).

Deposit fraud can occur anywhere along the system, particularly at the back-end, when a refund is claimed on a deposit that was never paid, usually because containers have been imported to the country or when containers excluded from the scope of the DRS are returned. This kind of scam is appropriately more frequent when there is substantial cross-border travel and trade, and neighbouring countries either do not have a DRS or the deposit is lower.

Double redemption of containers and/or receipts is another possibility; in this case, the deposit that was only paid once is refunded multiple times (Eunomia, 2019).

At the front-end of the process, there is the potential for producers or distributors to under-report their sales data, meaning not enough deposits are initiated and fees are avoided.

In addition to the container label being used to provide information to retailers and consumers, the label provides the primary means of detecting and preventing fraud if the barcode is registered with the system operator and scanned by the RVM or at the counting centre.

The RVMs can also include security systems to identify repeat containers and bar codes of the same type, with automatic alerts to the retail outlet.

5.3.6.2 Awareness raising

The participation of the population is key to the success of a deposit return scheme. While the deposit is intended to encourage consumers to take back the containers, it will only be efficient if the customer knows the item holds a positive value. This is particularly important for conditions where some containers have a deposit paid on them, and others do not.

In most EU countries, the beverage containers have an on-pack label that comprises a distinctive logo or mark that identifies the container is carrying a deposit (Figure 21).

Figure 21 - DRS Communication scheme in Scotland (The Scottish Government, 2018)

Figure 22 - Separate values for beverage and deposit in Estonia (R4R, 2018)

In Tallinn, Estonia, in accordance with the national legislation, the producer responsibility organisation must address 1 % of their revenues to awareness-raising campaigns or communication activities in order to make the population take part in the system (R4R, 2018).

About 70% of all activities directed to work with young people (< 18 y):

- Visits/excursions to the packaging collection, sorting and recycling plants.
- Conducting various campaigns with awards over the internet, outdoor advertising, and TV.
- Possibility of donations for various cultural programs to children.
- Spread info sheets and brochures in local sales or in places where packaging is using active, such as public events.

In Scotland, the government created a website[29] where citizens can find animation, infographics, stakeholder toolkit explaining all DRS features before its concrete implementation. As shown in Figure 23, the authorities provide information on the scheme design, background, benefits of the system, press releases, and frequently asked questions.

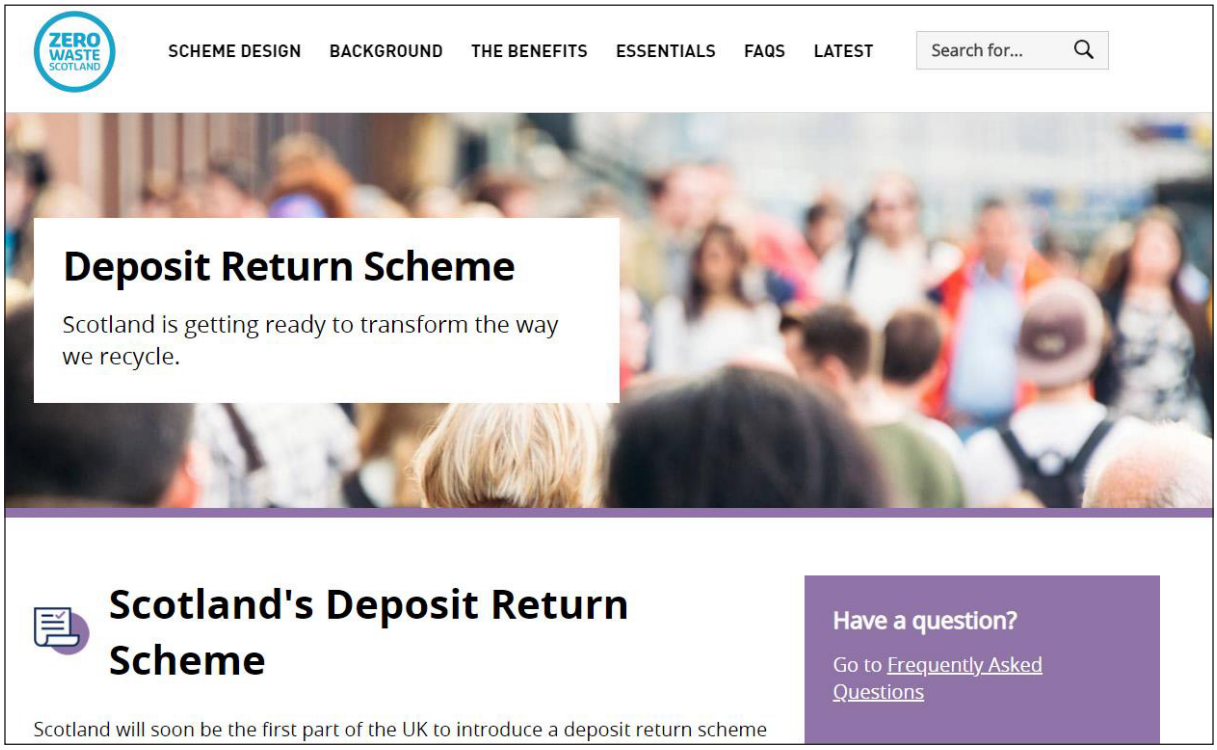


Figure 23 - Scotland's DRS online information (Zero Waste Scotland)

5.3.6.3 Recommendations for Greece

The central operator shall issue a standardised logo, which should also be used to distinguish between one-way and reusable deposit containers, informing the deposit value per beverage container.

In the legislative framework, it is necessary to specify "methods by which returnable packaging is to be identified" and "information on the operation of schemes (including notices on-premises where articles are offered for sale and the content of such notices)." (Hogg , et al., 2015).

Concerning fraud possibilities, there are opportunities for importing non-deposit containers from North Macedonia, Albania, Bulgaria, and Turkey, which do not currently have a DRS. Since the neighbouring countries haven ´t implemented a DRS yet, it is unlikely that people will "export" containers to other countries to receive a higher deposit.

Besides the implementation of logos and bar codes for fraud prevention, it is highly recommended that Greek authorities start disclosing information on DRS and its implications for the country. Before the system launches, it is suggested that an accessible website is created, with a database and updates and inclusion of social media. An "ambassador" might also be chosen to support the communication and have a special appealing towards young people.

29 https://depositreturnscheme.zerowastescotland.org.uk/

5.4 IMPLEMENTATION TIMELINE

The implementation time of DRS is highly variable amongst EU countries.

It fluctuates with the level of legislative development in the country, meaning whether there are legal conditions to execute such a system, stakeholder engagement, and negotiation, potential resistance of beverage producers, importers, and retailers, initial funding, logistic adjustment amongst other factors.

The triggering action in any DRS is to amend and specify the legislation. For example, the first step for Scotland's Deposit Return Scheme was the Climate Change (Scotland) Act 2009. An ambitious piece of legislation, it committed to law a target to cut greenhouse gas emissions by 42% by 2020, the most stringent targets anywhere in the world at the time (Munro, et al., 2019).

Figure 24 and Figure 25 demonstrate the step-by-step legal approach from Scotland towards the implementation of DRS. To highlight some determinate actions, a holistic feasibility study was conducted in 2015; in 2017 the Government announced the introduction of a deposit system and, in 2019, the regulations were laid before the Scottish parliament.

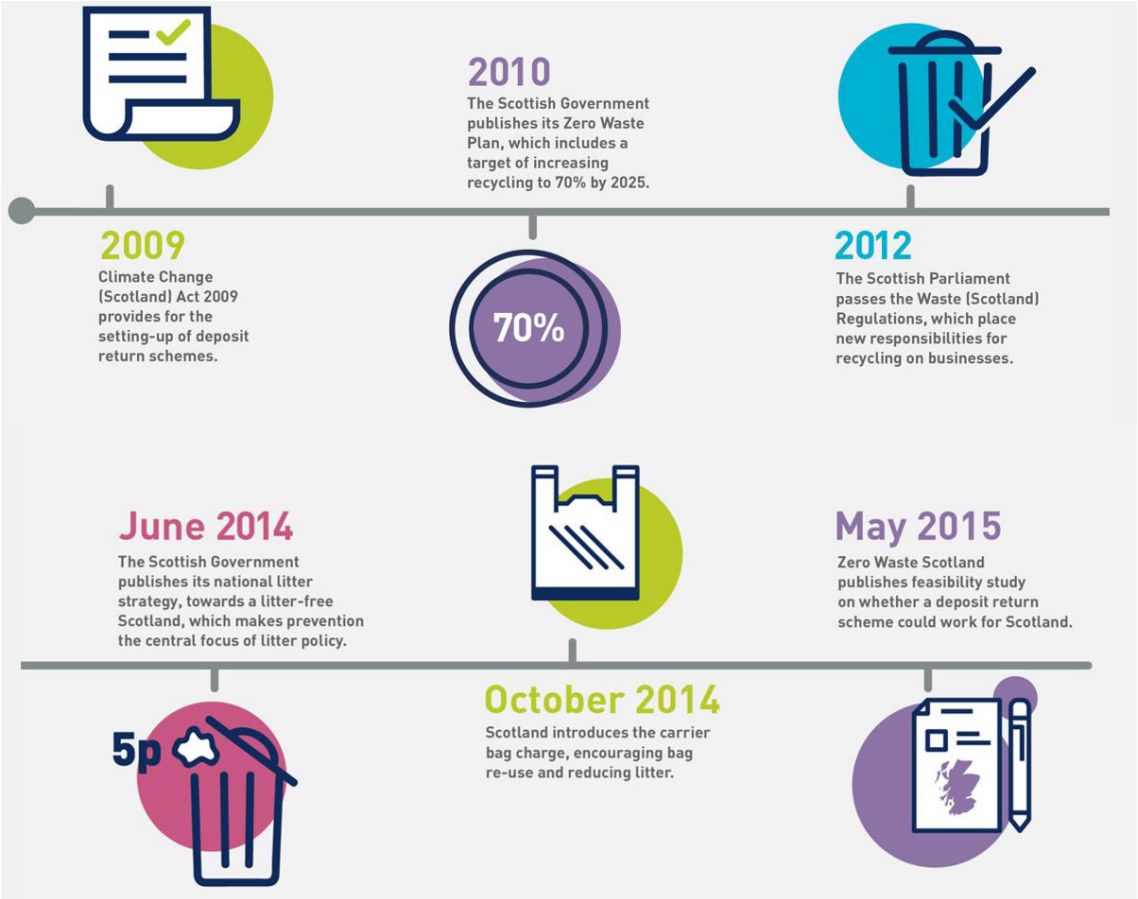


Figure 24 - DRS implementation timeline for Scotland – Part 1 (Munro, et al., 2019)

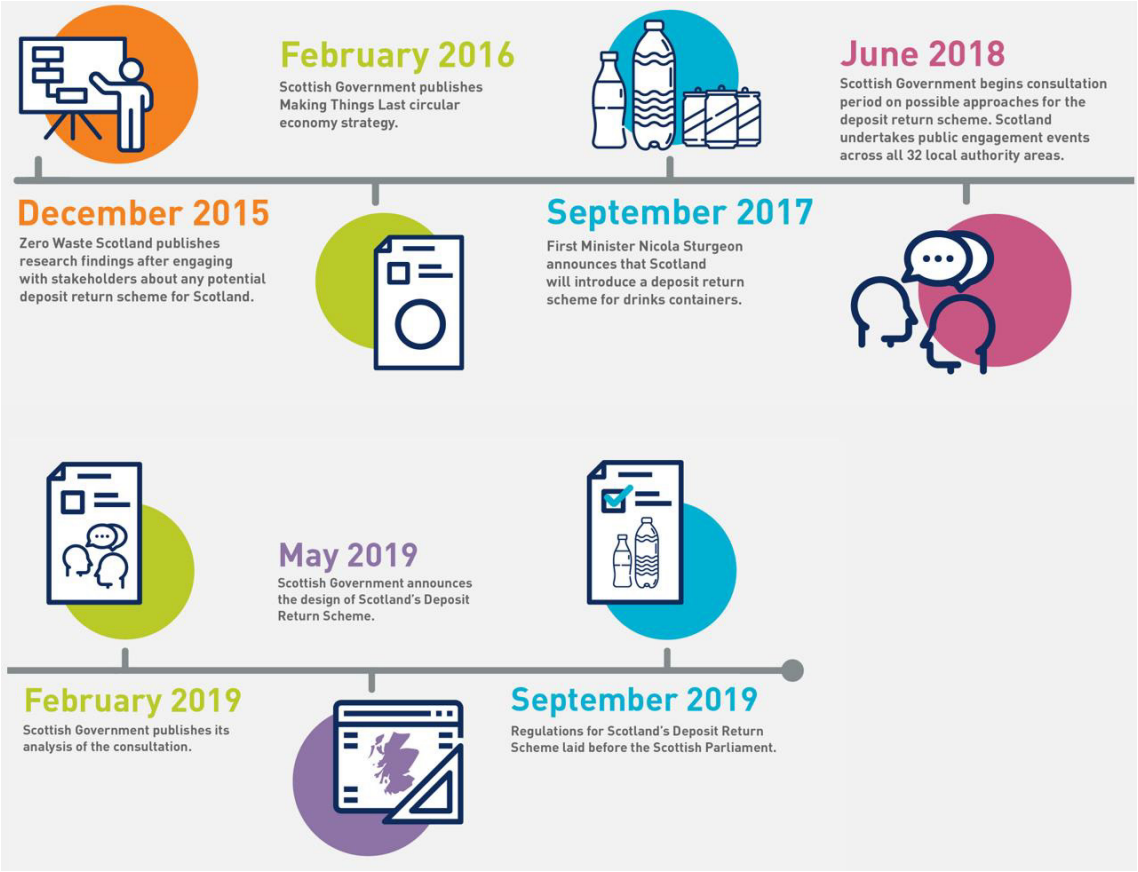


Figure 25 - DRS implementation timeline for Scotland – Part 2 (Munro, et al., 2019)

Ten years have passed, and Scotland is now completing the consultation period for the establishment of a company to run the system. The DRS is planned to be launched in the final quarter of 2020.

Table 27 shows a brief summary of general learnings from other European deposit refund systems.

5.5 SUMMARIZED ROADMAP FOR THE IMPLEMENTATION OF A DRS IN GREECE

As described in the previous chapters, the establishment of DRS is a continuous process amongst EU member states, which initiated early in the 1990 ´s and is currently been referred to in Mediterranean and Balkan countries as a procedure to enhance the recycling quota and attend EU targets, as well as to avoid marine littering, considering that bottles are major pollution streams, especially in island countries.

Table 27 - General learnings from European DRSs - Adapted from (Gandy, et al., 2008)

DESIGN PARAMETER	STANDARD PRACTICES IN THE EU
Implementation	Most of the national systems reviewed are mandatory rather than voluntary.
Institutional Setup	DRS in EU MS typically involve many parties along the packaging supply chain, namely: • producers/importers; • retailers /consumers; • logistics/waste management companies; • centralised body; and • monitoring/enforcement body.
Scope	Most of the systems include a broader range of metal, plastic, and glass bottles/cans. Several MS exclude juice/vegetable and dairy-containing products.
Collection	Divided into RVM and manual collection schemes. As the system establishes, it is likely to expect a roll-out of RVMs, reaching a typical ration of 80:20 (RVM/retailer).
Deposit Value	Varies between 0.06 cents up to 0.40 cents per container.
Return rates	Amongst the EU countries which have implemented DRS, return rates are higher than 80%.
Labelling	In mandatory schemes, a labelling system is used to indicate on which containers a deposit is due. National barcodes reduce the chances of cross- border issues.

These recommendations belong to an initial assessment of the Greek situation towards the implementation of such a system and must be further studied and analysed before been concretely executed.

The next step to confirm these design parameters is to conduct feasibility studies to evaluate the real costs of the system implementation, logistics concept, job creation, environmental impact, and sensitivity analysis.

This information is essential for the negotiation rounds, which will follow at a second stage of the process. Once all these points are analysed and the DRS completion effects are holistically evaluated, it is recommended that an impartial third party conducts the discussions between public and private stakeholders during the decision-making processes. These include, but are not restricted to, legislation amendments, type of operator (private/public), how to divide shares, responsibilities and costs, the inclusion of existing systems, amongst others.

A road map is shown in Table 29, appointing general steps to be conducted towards the enactment of DRS in Greece.

Table 28 - Recommendations for the DRS Design in Greece

DESIGN PARAMETER	RECOMMENDATION FOR GREECE
Legislative Framework	Amendments shall be made into the current packaging legislation (Law 2939/2001, as amended) to define rules and responsibilities specifically for DRS. The establishment of recycling targets and fines for non-compliance should also be defined by law, to enable enforcement.
Institutional Setup	Single organisation, owned by the beverage industry, operating the DRS on a not-for-profit basis.
Scope	One-way beverage containers, including plastic, glass and metal.
Collection	Mandatory take-back system for retailers with an area bigger than 200-300m2. Potentially include smaller shops for the beverages that they sell. Installation of RVMs in supermarkets and shops for bigger city centres, manual return when the automated system is not feasible, redemption centres for remote areas, and touristic islands (with machinery leasing alternatives during high season).
Deposit Fees	Suggestion between 0.10 – 0.15€ per container.
Handling Fees	Calculated to reflect the handling costs, including storage and staff within retailers. Fees shall be higher for an automated system rather than for manual take-back schemes. Fees depend on whether RVMs are under the responsibility of retailers.
Labelling & Fraud Prevention	Standard logo issued by the central system operator applied to all beverages within the DRS scope. Harmonisation of the barcodes countrywide.
Ownership of material	System operator

These recommendations belong to an initial assessment of the Greek situation towards the implementation of such a system and must be further studied and analysed before been concretely executed.

The next step to confirm these design parameters is to conduct feasibility studies to evaluate the real costs of the system implementation, logistics concept, job creation, environmental impact, and sensitivity analysis.

This information is essential for the negotiation rounds, which will follow at a second stage of the process. Once all these points are analysed and the DRS completion effects are holistically evaluated, it is recommended that an impartial third party conducts the discussions between public and private stakeholders during the decision-making processes. These include, but are not restricted to, legislation amendments, type of operator (private/public), how to divide shares, responsibilities and costs, the inclusion of existing systems, amongst others.

A road map is shown in Table 29, appointing general steps to be conducted towards the enactment of DRS in Greece.

Table 29 - General road map for the implementation of DRS in Greece (BFS, 2019)

MAIN RESPONSIBILITY	MAIN RESPONSIBILITY	SHORT TERM	MID TERM	LONG TERM
Development of feasibility studies to calculate implementation costs and estimate political, social and environmental effects	• National authorities • Waste producers • External Consultant	x		
Creation of working groups to enable discussion rounds between multiple stakeholders	• National and local authorities • Waste producers • Existing EPR Schemes	x		
Definition of institutional setup, stakeholders' shares, and management board	• National authorities • Waste producers	x		
Creation of new legislation or amendments to the Packaging Law	• National authorities • Waste producers • Retailers • External Consultant	x		
Development of database on materials from the scope for monitoring targets: Statistics on beverage container production	• National authorities • Waste producers	x		
Constructing of system, including database, clearinghouse, billing structure, labelling and monitoring	• National authorities • Waste producers	x		
Discussions with technology providers (machinery and IT system)	• National authorities • Waste producers	x		
Mapping of recycling facilities in the country	• National and local authorities • Waste recycling companies	x		
Develop logistic schemes for urban centres, rural areas and touristic islands	• Local Authorities • Waste collection companies • Retailers	x		
Awareness campaigns and sensitization actions, including communication brochures, online marketing, municipal events etc	• National and local authorities • Waste producers • Education and research institutes • NGOs	x	x	x
Training of government inspectors, waste producer (data sharing), PRO and retailer staff	• National and local authorities • Waste producers • PRO • Retailers	x	x	x
Auditing of recycling facilities n	• National and local authorities		x	x
Development of recycling capacity in Greece	• National authorities • Private sector		x	x
Board meetings for system optimization	• National and local authorities • Waste producers • PRO • Retailers			x

Initiating the introduction of a deposit system requires careful planning. Some of the main implications of establishing a new system are summarised below (Gandy, et al., 2008).

- Producers and importers must label their products and pay administration fees into the centralised fund for the establishment of the operating entity.
- Safeguards must be put in place to avoid the producers operating outside the system have an unfair market advantage (the purchase price of their goods would be lower than those within the system) and to reduce consumer misperception (e.g., not all drinks would include a deposit).
- Labelling procedures and associated security provisions must be in place.
- Beverage container collection infrastructure would need to be in place to allow consumers to return them following purchase. This would require an upfront investment in collection infrastructure (e.g., RVMs or redemption sites) and prior notification of retailers.
- The deposit refund design system must be clearly established, to ensure all retailers understand the procedures for charging and reimbursing deposits.
- Awareness-raising campaigns are required to ensure citizens understand the system.
- Beverage containers sorting and recycling capacities need to be in place.

5.6 CHALLENGES AND OBSTACLES

While establishing a DRS system in Greece, some challenges are expected, such as:

1. The ability of the Greek authorities to enact the legislation required to set up and operate the DRS. This might be mitigated with the support of external consultancy to provide further experience from other countries and guidance on the topic.
2. The interaction between the DRS with the existing producer responsibility mechanisms in Greece. Financial studies on the impacts of the "removal" of beverage containers belonging to the DRS on the operation costs and incomes from the current PROs will be required.
3. The increase in logistic costs due to overlapping collections systems. These are usually "compensated" due to reduced costs in MRFs and street sweeping/cleaning.
4. Restricted recycling capacity in the country, leading to the export of recyclables. Even though this practice is highly spread worldwide, it could bring less credibility to the system.
5. The potential reluctance of producers, importers, and retailers might affect the initial discussion rounds. This obstacle is usually overcome since most multinationals must maintain international environmental standards, and the country must achieve with EU recycling targets.
6. The implementation of mechanisms to limit fraudulent activity without creating unnecessary costs for consumers and businesses. This issue is usually addressed by the application of harmonized bar codes and centralized system. Monitoring and auditing companies are critical for the success of DRS.

5.7 FINAL CONSIDERATIONS

Around the world, demand is growing for countries to increase their recycling quotas, fight litter and ocean plastic. This is especially important for a country like Greece, with an extensive coastline and thousands of islands. To meet this challenge, many regions are considering container deposit schemes, which have proven of concept in several EU countries. DRSs have reached 70% to almost 100% of return rates, higher than any other waste collection system currently applied.

There are two main reasons container deposit schemes succeed in increasing recycling rates and reducing waste:

- Financial incentive: Deposit return systems provide a financial incentive for consumers to return drink containers, which might otherwise be littered or thrown in the landfill. Providing a financial value to these beverage containers communicates that they have value for society. Containers are viewed and treated as a resource, rather than merely as trash.
- Increased purity: By separating bottles and cans for recycling through reverse vending machines, drink containers are collected without contamination from other types of waste in a household recycling bin. This ensures containers can be recycled into new bottles and cans, rather than used for lower-quality applications.

This reduces both the reliance on raw materials needed to produce new beverages and the recyclables ending up in landfills or in nature as litter.

The evaluation of the potential implementation of DRS in Greece is shown in Table 30.

Table 30 - Evaluation of DRS for beverage containers in Greece

PARAMETER	RATE	DESCRIPTION
Environmental Aspects	++	The environmental aspect of the DRS is very positive since it usually has a high recycling rate, reduces landfilling and littering.
Revenue Generation	0	There is no revenue generation within DRS since it is deposit based. In this case, no fund is created for further investments.
Market Impact	+	Negative aspects may arise when restricted beverage container types belong to the system. This might lead to unfair competition and changes in packaging, but it is easily remediated by expanding the DRS scope. Besides, recovered material is very clean and pure, facilitating recycling. The recovery of recyclables generates new business opportunities and creation of recycling services, eventually transcending the negative impact and presenting a positive market aspect.
Social Impact	+	Since costs are borne by waste producers and deposits are refundable, there are no adverse social effects on the functioning of DRS. It is observed from other EU experiences that low-income citizens might collect containers that lay on the streets to increase revenues. In this case, the social aspect might be considered positive.
Administrative Costs	0	Any administrative cost is covered by the private sector and the affiliated businesses of each DRS. Even though monitoring/auditing is conducted by a public entity (e.g., HRA), administrative costs are not presumably high.
Political Acceptance	++	The implementation of DRS is widely accepted by the population due to the positive environmental impacts as well as the fact the operational costs do not apply to the consumers, only to the producer.

6. Recommendations for the use of economic instruments for waste management

The following recommendations summarize the proposals which have been discussed along with the previous chapters and are divided at the national, regional and municipal levels.

Detailed recommendations and explanations on each economic instruments were delineated in chapters 4 and 5, with the presentation of specific assessments on the functioning and/or implementation of these tools regarding the Greek context. Below, a general overview of recommendations is shown per economic instrument.

6.1 RECOMMENDATION ADDRESSING THE NATIONAL LEVEL

Table 31 offers a summary of the previously discussed recommendations of the economic instruments in Greece on a national level.

Table 31 - Recommendations on implementation/optimization of economic instruments on a national level

WASTE CHARGES
• Revision of the waste charge system by the possible implementation of variable charging systems (PAYT). • Within the existing frame, these charges should be collected through the property tax. This new setup should be based on the same premises (per sq. metre), leading to no extra charges.
LANDFILL TAX
• Reintroduction of the landfill tax, adopting the same fee, if not higher, based on feasibility studies, which would consider the produced quantities, cost of waste management, environmental aspects. • Collection of the tax by the FoDSA, which will forward it to the Green Fund. This shall be invested in activities supporting the separate collection of specific waste streams, recycling, and recovery activities to municipalities. • Continuous monitoring, control, and penalization of infringers must be enforced to prevent illegal dumping. • Application of communication and awareness campaigns to avoid political upheaval.
INCINERATION TAX
• No need for the implementation of an incineration tax as the country is aiming to increase the WtE by RDF consumption, and there are currently no WtE plants in the country. • Initiation of communication and dissemination towards WtE, at a national and local level, focusing on areas where WtE facilities shall be situated. Open an inclusive stakeholder consultation essential to minimize political and social impacts. • Enforcement of EU and national environmental regulations on the externalities of the process to restore the publics' acceptance.

PRODUCER RESPONSIBILITY SCHEMES

- Redefinition of the liable producers according to new EU Directives, including EU Directive of single-use plastic, and establish new EPR schemes for specific types of waste such as beverage bottles and food containers, tobacco producers using plastic filters and on-line producers.
- Optimization of logistics through the adoption of SMART solutions, using mobile applications and route optimization software to increase collection efficiency.
- Improvement of the quality of the collected material by expanding the collection points for specific separately collected waste streams (glass, wood), integrate fractions that are not included in the current system (e.g., printed paper) and upgrade equipment through the produced revenues.
- Requirement of registration to the National Producers Registry in combination with their enrolment in an existing EPR for any procurement for the public sector.
- Identification of all liable entities (businesses, on-line platforms, importers) and minimisation of the "free-riders" through the registration of all producers in the National Producers Registry by checking all suppliers.
- Increase of the personnel and provision of adequate training to the new and existing staff from the competent authorities, to extend and optimize monitoring and auditing of EPR systems and perform extensive and frequent market audits to identify and exert pressure on the "free- riders".
- Imposition of sanctions by the competent authorities, in cases of non-compliance by producers and importers.
- Establishment of an audit/monitoring department, as well as an information desk and call centre within competent authorities, to provide accurate and detailed information to producers on their obligations.
- Provision of incentives (subsidies, VAT exemptions/reductions, participation in public procurement) to companies following CE principles on their production ("more recyclable products" with lower fee), upgrading technologies and promoting innovation.
- Establishment/enforcement of a minimum amount of the PRO's turnover dedicated to awareness-raising campaigns.

PAYT

- The implementation of PAYT system, where feasible, should be promoted by fostering the benefits of such a system through communication and awareness campaigns based on the best- practices within Greece.
- The introduction of such a scheme in Greece might be more practical in the form of "Reward as you Recycle".

TAXATION ON SINGLE-USE PLASTIC PRODUCTS AND BEVERAGES

- Introduction of single-use plastic packaging tax addressing beverage plastic bottles and food containers based on successful EU best practices. The level of the tax should be calculated through life-cycle analysis, and waste management cost of the products, which should be high enough to encourage producers' engagement but so high that would impose as a barrier to the development of the industry as well as the consumer's behaviour (not burden consumers income).
- Preliminary works/consultations should take place with the involvement of the producers to ensure the acceptance of the measure by the industry and, therefore their commitment;
- Continuous communication and dissemination actions should be run to ensure citizens' engagement.
- Transparency towards the generated revenues is essential. The same approach as the environmental levy on plastic bags could be adopted.

DRS

- Amendment of the national law, specifying the main DRS parameters such as nature of the system, deposit refund fee, primary responsibilities of the operator, integrating stakeholders and monitoring entities, among others.
- DRS should have an extended scope of plastic, metal and glass bottles.
- DRS should be governed by industry within rules set by the Greek Government, and with a supporting return rate target, this would appear the most appropriate solution. Targets can start as low as 60%-70% and increase yearly until it reaches 90%.
- The inclusion of already existing voluntary DRS run by the Athenian Brewery should be examined through consultations between the Athenian brewery and the relevant authorities (YPEN, HRA, etc).
- DRS should be mandatory with a given adjustment period for the industry. Detailed studies should be conducted in terms of beverage and food container types that will fall under the DRS.
- A flat rate for all containers should be adopted to ensure equal incentive to return all containers and clarity for all stakeholders and citizens. A recommendation of 0.10 – 0.15€ per container is proposed based on EU practices, but it should be further calculated through an extensive financial feasibility study.
- Handling fees should be calculated annually based on operational costs and negotiations between the operator and retailer representatives.
- Use of a standardised logo should be used to distinguish between one-way and re-usable containers along with the use of a harmonised barcode to avoid handling of containers that do belong to the system.
- Definition of the ownership of the RVMs, discussions between government, beverage producers, and retailers will be required to define the best setup in the country. From previous EU experiences, more efficient results show that investment in RVMs is under the responsibility of retailers. This matter must be defined in the DRS legislation.
- Collection should be performed through a combination of RVMs and manual handling. Retailers with no available space for RVMs placements and/or in remote areas might choose manual return systems, while RVMs are commonly placed within supermarkets/ shops in urban centres and in ample public points in remote and/or insular areas.
- Implementation of redemption centres in public access spaces to increase awareness is highly recommended regarding touristic islands with reduced commercial activities during off-season times. Besides, the leasing of RVMs might be a suitable solution for coping with high volumes of recyclables during summertime.

In general, the enhancement of awareness and marketing campaigns shall be employed in order to ensure the acceptance and involvement of the stakeholders (authorities, producers, citizens) on the implementation and/or optimization of the above mentioned economic instruments through the use of mass the mass media advertisements (TV, radio, newspapers), social media, stakeholders consultation, flyers, etc.

6.2 RECOMMENDATION ADDRESSING THE MUNICIPALITIES

Table 32 summarises the recommendations addressed at regional and local levels on the previously analysed economic instruments.

Table 32 – Recommendations on implementation/optimization of economic instruments on a regional and local levels

WASTE CHARGES
• Calculation of exact waste management cost and revenues that will serve as a basis for accurate determination of waste charges and facilitate the implementation of an alternative system such as PAYT, and ensure the transparency by publicizing the data to the municipality's website to gain the citizens' trust.
LANDFILL TAX
• Facilitation of landfill tax acceptance and its impacts by the public and services through continuous communication and awareness campaigns (what it is, why, impacts to citizens, environment, etc.) to avoid political upheaval.
PRODUCERS RESPONSIBILITY
• Facilitation of PROs, to reduce impurities through the continuous and intensified awareness and marketing campaigns, in collaboration with the PROs, increase efficiency by intensifying collection points, improve routes, etc. • Adoption of SMART solutions (software/apps and cost accounting systems) by upgrading and optimizing the equipment and logistics of the provided services. • Strengthening of monitoring and law enforcement by improving collaboration and co-ordination across different jurisdictions and regulatory authorities.
PAYT
• Facilitation of a gradual establishment of PAYT systems, adjusted to each municipality condition. Factors such as population density, type of dwellings, and produced wastes amongst others, should be taken into consideration. • Establishment of more "appealing" approaches such as "reward as you recycle". The reward system can be re-compensated through vouchers to certain services/municipal events (concerts, theatre plays, and municipal cinemas) or to local businesses offering discounts. • Upscaling of already Implemented PAYT or similar variable charging systems to achieve full- scale coverage. • Intensification of communication and dissemination actions to ensure citizens engagement Some strategies might be mass media and social media advertisement, face-to-face or door-to-door information to the citizens with "recycling" ambassadors and kiosks in central access points, amongst others. • Initially, the development of a pilot program per municipality should be preferable, which will later be upscaled based on the collected data and lessons learned.
TAXATION OF SINGLE-USE PLASTIC PRODUCTS
• Introduction of awareness campaigns towards the impacts of single-use plastic products through mass media, flyers, etc.
DRS
• Initiation of awareness campaigns to ensure citizens', producers, and retailers' engagement.

7. Conclusions and next steps

This study examined the economic instruments in solid waste management and provided optimization measures for the existing mechanisms in Greece, using several EU experiences as a benchmark, as well as recommendations on the implementations of further tools to improve waste management in the country. These guidelines were based on four main pillars:

- Study the status quo of the current economic instruments in Greece (national, regional and local appliances).
- Analyse the legislative system and to recognise the gaps in the optimization/implementation of new economic instruments.
- Provide a pre-feasibility study on the potential implementation of a deposit refund system for single-use beverage containers nationwide.
- Address recommendations at a multi-level basis for all instruments studied.

In summary, the findings revealed that there are significant issues concerning monitoring and enforcement of already existing and/or previously foreseen economic instruments. This is exemplified by the substitution of the landfill tax through the CEL, at lower levies, as well as the high number of free riders in the EPR scheme for packaging waste and percentage of impurities in the blue bins. Besides, waste collection in the country hinders the implementation of new approaches that could increase recycling rates and raise awareness such as PAYT. Incineration taxes were detected as non- applicable, considering the current situation in the country and taxation on single-use plastic products could play an essential role in directing Greece towards circular economy principles. A lack of public awareness and engagement was identified in relation to most of the economic instruments.

The report dedicated a specific chapter on the development of a pre-feasibility study on the implementation of DRS in Greece. Results were built through a compilation of previous EU experiences, feasibility studies, and online available data, in addition to interviews with stakeholders from the beverage industry and RVM producers. Based on this data collection and local knowledge, some recommendations for the DRS design in the country were delineated. Each recommended design parameter must be individually and deeply assessed before establishing a national system.

The usage of economic instruments is considered crucial for the improvement of a waste management system in any country. Starting punctually with initiatives for the implementation of the proposed recommendations is highly suggested to ensure that these measures are continuously followed-up.

Regarding the waste charges and landfill taxes, to implement the prospective changes in the billing and pricing systems, municipalities should start developing awareness campaigns to inform the citizens about these modifications. Public consultations should also be made available, enabling the residents to express their concerns and raise relevant topics. Based on these campaigns and consultation sessions at the municipal level, results must be discussed at a national level, aiming the concrete application of higher landfill taxes and alternative billing schemes for waste charges.

As there are no current WtE plants in Greece and the country wants to increase

co-processing activities, momentarily there are no required actions towards the application of **incineration taxes**.

Producer responsibility schemes will have a higher efficiency if collected material have fewer impurities. To achieve this purpose, a first action would be to redirect the internal budget for awareness-raising programs and develop a national information campaign. To organize and optimize its internal administration settings, PROs should immediately revise company registrations and, together with regulatory authorities, advise free riders on the legislation enforcement. This would bring prompt raise in the incomes and, consequently, more budget for investments.

Since **PAYT** is not prohibited by national policy, it could be implemented in pilot scale in certain municipalities, promoted through the new pricing policy for Municipalities and Circular economy LEVY legislation. As immediate actions, it is crucial to ensure political will, meaning that the Mayor should be committed towards this change. To pilot a project in a chosen location, it is required to collect data on the technical and economic impacts the system would bring, social acceptance, and understand the up-scaling effects. The municipality plays a crucial role not only in supporting the project kick-off, but also committing to the collection, billing, and treatment schemes.

To implement **taxes on single-use plastic products**, it is mandatory to inform the civil society on the reasons/arguments the government defends. For that, informational campaigns about plastics are highly recommended. On the industry side, it is decisive to meet stakeholders from the plastic industry to jointly discuss solutions for their potential "lack of income/production" due to this tax implementation. It is important to form a negotiation committee that will assemble these actors in round-tables and find a suitable diplomatic solution for all parties.

For a **DRS**, a stepwise approach is suggested for the initial stage of the system establishment, including forming a task force within YPEN and other political stakeholders. The main goal is to create expertise within the governmental staff. For that, it is recommended that this committee visits established DRSs in Europe to understand its functioning, main features, and lessons learned. Capacity building from external experts (design parameters) is highly suggested. Once the team is well trained, the following step would be the development of a feasibility study, promoted by an independent consultant contracted by the authorities. With this study, negotiations rounds with external stakeholders, including producers, importers, retailers & existing EPR schemes can take place. These consultations shall result in modifications of the legislation that shall comprise the DRS framework. It is also recommended to amend legislation for the application of new environmental taxes and the promotion of DRS. These regulations must be strict and well defined to avoid fraud and mismanagement.

In general, supplying legal means (e.g., incentives, penalties) for the enforcement, monitoring, and controlling of the existing mechanisms would increase their efficacy. Investments and efforts in public awareness shall come from local and national authorities. Special attention to education and waste management programs also need to be introduced into the current waste management system, as well as training programmes for the waste management department staff.

The efficient use of appropriate economic instruments can support Greece in increasing its recycling rates and achieving EU targets, by providing the means of internalising environmental degradation and resource depletion costs into the production and consumption process.

Despite the challenges, Greece has an undeniable potential thanks to national

authorities such as YPEN who are open for changes in the current system, local authorities that are now provided with more responsibility, decision-making powers and resources, companies that engage in sustainability frameworks and citizens who seek circular economy approaches for their cities. Throughout this project, several workshops have been conducted, local know-hows have been enhanced and generated, creating a suitable environment for the development of Greece´s waste management system. The country has a great potential and should utilize its capabilities to become an example for waste management in the Balkan and Southern Europe region.

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9. Annex

9.1 RECYCLING AND TREATMENT CAPACITIES IN GREECE

Table 33 - Recycling/Treatment Capacities (Existing/Planned) for MSW (IFRA, 2019)[30]

REGION	MBT FACILITIES			BIO-WASTE TREATMENT FACILITIES		CENTRES OF SORTING OF RECYCLABLE MATERIALS (CSRM)	
	Operation / under construction (tonne / yr)	Planning stage*	MBT Capacity (total /region)	Planning stage *	BW Capacity (total /region)	Operation	Future Plan*
East Macedonia and Thrace	MBT Alexandroupoli: 40,000 a 6,000 SaS (under construction)	6	125.000	12	40.000	3	5
Central Macedonia	MBT Serres: 63,000 plus, a 5,000 SaS, (started in 2019)	2	437.000	13	168.000	6	4
West Macedonia	MBT Kozani: 120,000 (started in 2017)	1	61.000	1	18.000	1	-
Thessaly	None	3	158.000	16	90.000	3	-
Epirus	MBT Epirus: 105,000 (started in 2018)	1	105.000	4	22.000	1	-
Western Greece	MBT Ilia: 80,000 (under construction)	4	155.000	6	53.000	2	6
Central Greece	MBT Thiva: 32,000 (under construction)	4	155.000	12	50.000	2	2
Ionian Islands	MBT Kefalonia: 25,000 (started in 2007)	3	70.000	7	25.100	2	-
Attica	MBT Liossia: 350,000 (started in 2007)	5	900.000	7	325.000	4	-
Peloponnese	MBT Tripoli: 105,000 (under construction) MBT Evrota: 65.000 (under construction) MBT Ichalia: 30.000 (under construction)	3	200.000	5	42.000	3	-

30 Compilation of data acquired during the execution of different projects.

North Aegean	None	2	-	5	26.000	1	3
South Aegean	None	4	65.000	23	27.500	5	-
Crete	MBT Heraklion: 75,000 (started in 2008) MBT Chania 75,000 (started in 2006) MBT Amari: 35,600 plus, an AD facility: 7,400 SaS(there is a contractor)	3	205.000	5	64.000	2	2
Greece	14	41	2,564,500	116	950,600	35	22

*According to RWM plans

** Segregation at Source (SaS)

9.2 LANDFILL AND INCINERATION TAXES IN EU MEMBER STATES

Table 34 - Overview of landfill taxes, fees and restrictions - adapted from (European Commission, 2012); CEWEP, 2017[31]

MEMBER STATE (Year Tax was introduced)	CURRENT LANDFILL TAX RATE (per tonne)	CURRENT LANDFILL GATE FEES (range per tonne)*	CURRENT LANDFILL GATE FEE (typical per tonne)* *	TOTAL TYPICAL CHARGE FOR LANDFILL (per tonne)	LANDFILL RESTRICTIONS
Austria [AT] (1999)	€ 87	approx. €58 - €219	€ 70	approx. €96	Waste with a total organic carbon (TOC) content over 5% unless it has been biologically and mechanically treated.
Belgium Flanders	€ 58				Separately collected (1998) and biodegradable waste (2007). Combustible waste (2000) (TOC >6% and LOI >10%)
Belgium Wallonia	€ 113.01 (general waste) € 62.16 (combustible waste)				Combustible waste with TOC > 6%
Bulgaria	€ 30 (2019) € 50 (2020 and following years)				No restrictions
Czech Republic	€ 20 (municipal waste)				No restrictions

31 Reference year 2017.

MEMBER STATE (Year Tax was introduced)	CURRENT LANDFILL TAX RATE (per tonne)	CURRENT LANDFILL GATE FEES (range per tonne)*	CURRENT LANDFILL GATE FEE (typical per tonne)* *	TOTAL TYPICAL CHARGE FOR LANDFILL (per tonne)	LANDFILL RESTRICTIONS
DK (1987)	€ 63.30 (without VAT) - € 79 (VAT included)				Untreated waste with TOC > 3% (2005) Exceptions for waste from MBT with calorific value > 6600 kJ/kg dry substance and waste from MBT with calorific value > 6.600 kJ/kg dry substance and TOC > 8%
Estonia [EST] (1990)	€ 29.84				Untreated and unsorted waste
Finland [FI} (1996)	€ 70	€44.40 - €74.40	€59.40†	approx. €89.40†	Organic waste with TOC > 10% and construction and demolition waste (into force from 2020)
France [FR] (1999)	€ 150(non-authorized landfills) a) €32 (authorized landfills with ISO14001 landfills) b) €23 (authorized landfills with 75% energy recovery through biogas capture c) €32 authorized bioreactor landfills with biogas recovery d) b+c €15 e) € 40 other authorized landfills	€45 – 76 (50% of fees between €57 - €73)	€60.50	€80.50	Untreated waste, separately collected material and municipalities with no source separation schemes
Germany (DE)	€ 70	approx. €60 - €220	€140†	approx. €140†	Untreated waste with TOC > 3% Exceptions on MBT waste with high calorific values and TOC > 8%
Greece [GR] (2012)	Replaced in 2018 with a circular economy tax (see chapter 4.3)				
Hungary [HU] (2013)	€ 19.35				Untreated waste and hazardous waste streams (used tyres, shredded rubber and partially organic wastes_
Ireland [IR] (2013)	€ 75				No restrictions

MEMBER STATE (Year Tax was introduced)	CURRENT LANDFILL TAX RATE (per tonne)	CURRENT LANDFILL GATE FEES (range per tonne)*	CURRENT LANDFILL GATE FEE (typical per tonne)* *	TOTAL TYPICAL CHARGE FOR LANDFILL (per tonne)	LANDFILL RESTRICTIONS
Italy [IT] (1996)	€ 5.2 (pre-treated) - € 26 (varies by region)	approx. €60 - €120	€90†	approx. €120†	No restrictions
Latvia [LV] (1991)	€ 25 (2017) € 35 (2018) € 43 (2019) € 50 (2020)				No restrictions
Lithuania [LT]	€ 3 (2017) € 5 (2018) € 21.72 (2019) € 27.51 (2020)				Untreated waste, biodegradable green waste (gardens, parks, green areas), and used tyres
Luxemburg [LU]	€ 8 (local fee by the municipality who owns the landfill site)				Untreated MSW and organic waste with TOC > 5%
Malta [MT] (Cordina, 2019)	-	-	-	€ 20 + VAT	-
Netherlands [NL] (1995)	€ 13.11	approx. €20 - €30	€25†	approx. €132.49†	64 waste categories (Sande, 2018) (combustible waste)
Poland (PL)	€ 33 (2018) € 40 (2019) € 64 (2020)				Separately collected biodegradable waste and combustible waste with TOC > 5%, LOI > 8% and calorific value > 6MJ/kg
Portugal [PT] (2007)	€ 7.7 (2017) € 8.8 (2018) € 9.9 (2019) € 11 (2020)	€6 - €15 (est. 2005)	€10.50	€ 14	No restrictions
Romania [RO] (2018)	€ 17 (2017) € 26 (2018)				No restrictions
Slovakia [SK] (2014)	€ 4.98 - € 9.96 (varying depending the number of collected waste fractions)				Sorted food waste (kitchen and restaurants), and green waste (gardens, parks, cemeteries)
Spain [ES]	€ 7 – € 41.3 (variable depending the region) € 47.1 for Catalonia (2020)	approx. €13 - €52.50	€32.75	€45.15 (€54.35 if bio-waste not collected at source)	None

MEMBER STATE (Year Tax was introduced)	CURRENT LANDFILL TAX RATE (per tonne)	CURRENT LANDFILL GATE FEES (range per tonne)*	CURRENT LANDFILL GATE FEE (typical per tonne)* *	TOTAL TYPICAL CHARGE FOR LANDFILL (per tonne)	LANDFILL RESTRICTIONS
Switzerland [CH]	€ 4.3 (inert waste) € 13.7 (stabilised waste, bottom ash, construction & demolition waste)	approx. €13 - €52.50	€32.75	€45.15 (€54.35 if bio-waste not collected at source)	None
United Kingdom [UK] (1996) (Date, 2019)	2019 (approx.): € 107.5 – standard rate material (all taxable material in authorized landfill sites) € 3.41 – lower rate material (inert waste) 2020 (approx.): € 110.7 – standard rate material € 3.5 – lower rate material	€ 21 – € 32 (Letsrecycle , 2019)		approx. € 128 - € 140	Scotland: separated at source waste. Biodegradable waste by 2021 Northern Ireland: separately collected food waste Wales: biodegradable waste by 2025

*- ** Gate fee data were not attainable for all countries.

Table 35 - Applicable incineration taxes across EU member states (Source: (Eunomia, 2011); (Eunomia, 2019); (ZeroWaste, 2019)

EU MS	INCINERATION TAX (€/tonne)
Austria	8 (2009)
France	2.4 to 11.2 (2010)
Spain - Catalonia	5.7 to 16.5 (2012)
Belgium - Wallonia	3
Denmark	44 (2010)
Belgium - Flanders	7.9 (2012)
Italy	1 to 5.2 (2009)
Finland	Varied (depending on waste quantity been incinerated locally and waste exported)
***Sweden**	6 (effective from 1st of April 2020)
****Norway**	7.3 - Variable (based on emissions of pollutants) (2009)

*Sweden has voted on the re-introduction of an incineration tax (including RDF) in 2020, which will increase at 8€/tonne for 2021 and 2022, after which an annual rise will be indexed (Doherty, 2019).

**Abolished in 2010

9.3 ALTERNATIVE MANAGEMENT SYSTEMS IN GREECE

Table 36 - List of alternative management systems in Greece (EOAN, 2014)

No.	ALTERNATIVE MANAGEMENT SYSTEMS (EPR Schemes)	ADDRESS	TELEPHONE (+30)	WEBSITE
1. Packaging and Packaging Waste				
1.1	ΑΝΑΚΥΚΛΩΣΗ της Ελληνικής Εταιρείας Αξιοποίησης Ανακύκλωσης (Ε.Ε.Α.Α. Α.Ε.)	Χειμάρας 5, 15125 Μαρούσι	2108010962- 3	www.herrco.gr
1.2	Κέντρο Εναλλακτικής Περιβαλλοντικής Διαχείρισης Α.Ε. (Κ.Ε.ΠΕ.Δ. Α.Ε.)	Λ. Δημοκρατίας 67, Τ.Κ. 193 00 Ασπρόπυργος	2105577673	www.keped.gr
1.3	ΑΒ ΒΑΣΙΛΟΠΟΥΛΟΣ Α.Ε.	Λ. Σπάτων 81,153 44 Γέρακας Αττικής	2106608551	www.ab.gr
1.4	ΑΝΤΑΠΟΔΟΤΙΚΗ ΑΝΑΚΥΚΛΩΣΗ Α.Ε.	Λ. Συγγρού 12, 11742 Αθήνα	2106856110- 11	www.antapodotiki.gr
2. Waste Lubrication Oils				
2.1	Εναλλακτική Διαχείριση Αποβλήτων Λιπαντικών Ελαίων ΑΕ (ΕΝΔΙΑΛΕ ΑΕ) πρώην ΕΛΤΕΠΕ ΑΕ	Λεωφ. Δημοκρατίας 67, 19300 Ασπρόπυργος	2105577673	www.endiale.gr
3. Used Vehicle Tires				
3.1	Σύστημα Εναλλακτικής Διαχείρισης Παλαιών Ελαστικών (ECOELASTIKA Α.Ε.)	ΣΩΡΟΥ 14, Τ.Κ. 15125 ΜΑΡΟΥΣΙ	2106128260 2106128370	www.ecoelastika.gr
4. Waste Batteries and Accumulators				
4.1	Ανακύκλωση Φορητών Ηλεκτρικών Στηλών Α.Ε.(ΑΦΗΣ Α.Ε.)	Λ. Δημοκρατίας 73, 15127 Μελίσσια	2108030355	www.afis.gr
4.2	Σύστημα Εναλλακτικής Διαχείριση Συσσωρευτών Α.Ε. (ΣΥΔΕΣΥΣ Α.Ε.)	Λ. Συγγρού 314, 17673 Καλλιθέα	2103421091	www.sydesys.gr
4.3	Σύστημα Συλλογικής Εναλλακτικής Διαχείρισης Συσσωρευτών Κρήτης (ΣΕΔΙΣ-Κ ΕΠΕ) (υπό εκκαθάριση)	Εφόδου 8, 71303 Ηράκλειο	2810313095	
4.4	Εταιρεία Πανελλαδικής Εναλλακτικής Διαχείρισης Συσσωρευτών Re-Battery Α.Ε (Re-BatteryA.E.)	19ο χλμ Ε.Ο. Αθηνών - Κορίνθου 19300 Ασπρόπυργος	210 55 75 075	www.re-battery.gr
4.5	Ολοκληρωμένη Συλλογική Εναλλακτική Διαχείριση Συσσωρευτών Πανελλαδικής Εμβέλειας Α.Ε. (COMBATT Α.Ε)	Ερμού 2 and Νίκης, Πλ. Συντάγματος 105 63 Αθήνα	2106245591	www.combatt.eu

No.	ALTERNATIVE MANAGEMENT SYSTEMS (EPR Schemes)	ADDRESS	TELEPHONE (+30)	WEBSITE
5. End of Life Vehicles				
5.1	Εναλλακτική Διαχείριση Οχημάτων Ελλάδος(ΕΔΟΕ)	Θερμοπυλών 6, 15233 Χαλάνδρι	2106899039	www.edoe.gr
6. Waste Electrical and Electronic Equipment				
6.1	ΑΝΑΚΥΚΛΩΣΗ της Ελληνικής Ανακύκλωση Συσκευών Α.Ε.	Λ. Συγγρού 196 and Χαροκόπου 2, 17671 Καλλιθέα	2105319762- 5	www.electrocycle.gr
6.2	Φωτοκύκλωση Α.Ε.	Λ. Τατοϊου 349, 13677 Αχαρνές	2104831164	www.fotokiklosi.gr
7. Construction, Demolition and Excavation Waste				
7.1	Ανακύκλωση Αδρανών Βορείου Ελλάδος Α.Ε. (AN.A.B.E. A.E.)	Ν. Πλαστήρα 1Β - Κομνηνών, 57400 Σίνδος, Θεσσαλονίκη	2310 716310	www.anabe.gr
7.2	Σύστημα Ανακύκλωσης Κεντρικής Ελλάδας Ε.Π.Ε. (Σ.ΑΝ.Κ.Ε. Ε.Π.Ε.)	Μπαλαλαίων 19, 34100 Χαλκίδα Πειραιώς 6, 10431 Αθήνα	22210 21689 210 8955610	www.sanke.gr
7.3	Εναλλακτική Διαχείριση Προϊόντων Εκσκαφών, Κατεδαφίσεων Α.Ε. (Σ.Ε.Δ.Π.Ε.ΚΑΤ. Α.Ε.)	Αγνώστων Ηρώων 92-94, 14231 Ν. Ιωνία	2130238752 2106033368	www.sedpekat.gr
7.4	Ι. ΚΟΥΦΙΔΗΣ - Ι. ΚΤΕΝΙΔΗΣ and ΣΙΑ Ο.Ε. (Σύστημα Συλλογικής Εναλλακτικής Διαχείρισης Χαλκιδικής Ο.Ε.)	Θεσσαλονίκης 12, Ν. Μουδανιά 63200	23730 23010, 22042	
7.5	Ανακύκλωση Α.Ε.Κ.Κ. Κεντρικής Μακεδονίας Α.Ε.	Μοναστηρίου 93Α, ΤΚ 54627, Θεσσαλονίκη	2310 595085	www.anakem.gr
7.6	Ψάρρας - Εναλλακτική Διαχείριση Α.Ε.Κ.Κ. Α.Μ.Κ.Ε.	Καλλιπάτειρας 8, 56224 Εύοσμος	2310587760	http://www.psarras-enallaktiki- diaxeirisi.eu/
7.7	Ανακύκλωση Αδρανών Νότιας Ελλάδας Α.Μ.Κ.Ε. (Α.Α.Ν.ΕΛ.)	Χαλεπά 6Α, 15344 Γέρακας Αττικής	2106047497	www.aanel.gr
7.8	Αποστολάκης Εμμ. and ΣΙΑ Ο.Ε.(ΔΙΑΣ Σύστημα Ανακύκλωσης ΑΕΚΚ)	Περιοχή Καστέλι (Κόμβος Λακωνίων) 72100 Άγιος Νικόλαος Κρήτης	28410 22096	
7.9	Ανακύκλωση Α.Ε.Κ.Κ. Αττικής Α.Ε.	Γ.Πρόφη and Α.Πρίφτη 11 19400 Κορωπί Αττικής	210 6623441	

9.4 RETAILERS IN GREECE

Table 37 - List of main retailers in Greece (IFRA, 2019)

RETAILER	PRESENCE	No. STORES	COMMENTS / DESCRIPTION
Βασιλόπουλος ...και του πουλιού το γάλα!	National	460	The majority (277) of the stores exceed 200m² and many of them are over 1000m².[32]
ΣΚΛΑΒΕΝΙΤΗΣ	National	560	Most of the stores exceed 200m², and many of them are over 1000m². [33]
μασούτης	National	333	Main presence in northern Greece, with a recent expansion to Athens. At least 22 of them are more than 200m² (cash & carry stores over 1000m²). [34]
My market εδώ νιώθεις εμπιστοσύνη!	National	225	All stores are bigger than 200m² with a min. 350 – 600m² and max. 1000 – 1200m². [35]
LIDL	National	224	Most stores exceed 200m² most of them approx. 800m². [36]
SUPER MARKET ΚΡΗΤΙΚΟΣ Η ΕΞΥΠΝΗ ΕΠΙΛΟΓΗ!	National	243	Mainly developed in Crete but with a presence to other regions as well. Several their stores exceed 200m². [37]
MARKET IN ...για φθηνές αγορές!	National	198	Most of the stores exceed 200m². [38]
γαλαξίας Το Ελληνικό Σούπερ Μάρκετ	National	161	Most of the stores exceed 200m². [39]
BAZAAR	National	198	At least 11 of their stores are more than 200m². [40]

32 https://www.ab.gr/
33 https://el.wikipedia.org/wiki/Σκλαβενίτης#Καταστήματα
34 https://www.masoutis.gr/Eke/Environment
35 https://www.mymarket.gr/home.aspx
36 https://corporate.lidl-hellas.gr/
37 http://www.kritikos-sm.gr/katastimata/
38 http://market-in.gr/
39 https://www.5ae.gr/
40 https://www.bazaar-online.gr/

RETAILER	PRESENCE	No. STORES	COMMENTS / DESCRIPTION
SYNKA super markets Εκτιμάμε τα προϊόντα του τόπου μας	Crete	52	Many of the stores more than 200m^2.[41]
Χαλκιαδάκης Το όνομα που εμπιστεύεστε Σε Υπεραγορά	Crete	39	Most of the stores exceed 200m^2. They already promote the recycling of packaging, cooking oil, paper; future plans to recycle PET bottles. The chain is partially owned by Sklavenitis. [42]
ΔΙΚΤΥΟ SUPER MARKET proton ποιότητα & οικονομία	National	578	Small supermarkets mainly developed in the Attica region but in other regions as well. No standard size of stores. [43]

41 https://www.synka-sm.gr/

42 https://www.xalkiadakis.gr/el/etairiki-euthini-anakyklosi-xartiou

43 http://www.protonmarkets.gr/omilos/