11. GREECE

11.1 Legal Framework – Waste Management Plans and Strategies

11.1.1 National Legislation concerning CDW

Up to date legislation in Greece includes the following: **European Directive 98-EE-2008, Law 2939/2001, Law 3854/2010** (modification of previous law), **JMD36259/1757/E103/2010** (CDW, Solid Marble Wastes, concrete), **JMD 50910/03**, **Law 4030/2011** (paragraph 4), **Law 4042/2012-part B**, **Law4067/2012** (New Construction Code). However, the program for the management of CDW was put in place with the Joint Ministerial Decision 36259/1757/E103 (Gov. Gazzete, second issue, 1312/24.8.2010) in 2010.

Law 4042/2012 on waste management, which transposed the Waste Framework Directive 2008/98/EC into national law, provided for the obligation of the Ministry of Environment, Energy and Climate Change to compile a (new) National Waste Management Plan (NWMP) in compliance with Law 4042/2012 which would set out the policy, strategy, principles and targets for the management of waste in Greece and which would suggest the appropriate measures and actions to be taken for the achievement of these targets and principles.

11.1.2 Waste management plans (WMP) and Strategies

On the basis of the provisions of the (new) NWMP, (new) regional waste management plans should be prepared for the management of all waste produced at regional level.

The new National Waste Management Plan ("New NWMP"), described the new plan as "the reversal of government policy which has been pursued for the last ten years. The aim of the new plan is to direct us to a zero-waste economy and society, which converts waste into resources."

The key priority targets of the New NWMP centre around the re-allocation of waste management to a municipal level, placing the responsibility for separation at source and recycling on the municipalities through small-scale units, the encouragement of community participation, the targeting of advanced waste management techniques and, as an overarching principle, maintaining the public nature of waste management. The consequences are, according to the plan, reduced costs, local communities reaping the profits from waste management through appropriate financial incentives and up to 16,000 new jobs, presumably most of those in the public sector. Alternative waste management, currently almost entirely privately-run, will also be brought under public control.

11.1.3 Legal framework for sustainable management of CDW

No data found.

11.1.4 Targets

The program for the management of CDW was put in place with the Joint Ministerial Decision 36259/1757/E103 (Gov. Gazzete, second issue, 1312/24.8.2010) in 2010. Present Gazzatte has specific quantitative targets, concerning the recycling and reuse of CDW. Those targets are summarized below:

1) By 2012, the preparing for reuse, recycling and other material recovery, including backfilling operations using waste to substitute other materials, of non-hazardous construction and demolition waste excluding naturally occurring material defined in category 17 05 04 in the list of waste shall be increased to a minimum of 30 % by weight.

2) By 2015, the preparing for reuse, recycling and other material recovery, including backfilling operations using waste to substitute other materials, of non-hazardous construction and demolition waste excluding naturally occurring material defined in category 17 05 04 in the list of waste shall be increased to a minimum of 50 % by weight.

3) By 2020, the preparing for reuse, recycling and other material recovery, including backfilling operations using waste to substitute other materials, of non-hazardous construction and demolition waste excluding naturally occurring material defined in category 17 05 04 in the list of waste shall be increased to a minimum of 70 % by weight.

In particular, energy recovery is excluded from this scope, while category 17 05 04 (excavated material) is not included in the calculation of the target.

11.1.5 End of Waste (EoW) status

There are no End of Waste criteria established in Greece.

11.2 Non legislative instruments (best practices, guidelines, recommendations…)

CDW management cannot be only a subject of technical and scientific process but also political, social and educational ones. In order to implement recycling targets, Greece created the term Alternative Waste Management and founded the National Organization for the Alternative Management of Packaging and Other Products, which later was renamed at "Greek Recycling Organization".

The alternative management of Construction and Demolition Wastes in Greece began in 2011 with the establishment and licensing of the first Collective Alternative Management System which is located in Thessaloniki. From 2012 until 2014, collection systems adopted came up to 9, covering 18 geographical regions. According to statistics maintained by the Greek Recycling Organization, the amount of CDW managed by the existing in 2012 was more than 12.000 tons[9], for 2013 around 50.000 tons, while for 2014 more than 20.000 tons [10]. The amount collected from the Alternative Management Systems is a very low

[9] data only from treatment plant "Anakyklwsis Adranwn Makedonias SA"
[10] data only from treatment plant "Anakyklwsis Adranwn Makedonias SA"

percentage compared to the quantity of CDW believed to have been produced and which comes up to around 2.000.000 tons.

Other non-legislative instruments that contribute to create conditions for a sustainable management of CDW are BREEAM and LEED.

11.3 CDW management performance – CDW data

11.3.1 CDW generation data

EUROSTAT database reports data shown in Table 39 for CDW generated between years 2010 and 2014.

Table 39. EUROSTAT database for CDW generated between years 2010 and 2014.

	2010	2012	2014
Mineral waste for construction	1.545.533	601.476	355.171
Metal wastes, ferrous	173.361	67.540	39.898
Metal wastes, non-ferrous	0	0	0
Glass wastes	36.640	14.275	8.698
Plastic wastes	128.495	50.061	29.575
Wood wastes	202.051	78.718	46.504
Total	**2.086.080**	**812.519**	**479.999**

11.3.2 CDW treatment data

Data published by EUROSTAT deals with different waste categories but becoming from all the economic activities. Therefore, only for the category "Mineral waste from construction", data can be considered reliable, as in Table 40.

Table 40. EUROSTAT database for "Mineral waste from construction"

Mineral waste from construction [tons]	**2010**	**2012**	**2014**
Landfill / disposal (D1-D7, D12)	1.544.505	601.668	139.486
Deposit onto or into land	1.544.505	601.668	139.486
Land treatment and release into water bodies	0	0	0
Incineration / disposal (D10)	0	0	0
Incineration / energy recovery (R1)	0	0	0
Recovery other than energy recovery	249	2.701	626
Recovery other than energy recovery - backfilling	249	133	31
Recovery other than energy recovery - except backfilling	0	2.568	595
Total waste treatment	**1.544.754**	**604.369**	**140.112**

11.3.3 CDW exports/imports data

There is no data available concerning the exports and imports of CDW in Greece.

11.3.4 CDW treatment facilities data

Landfills for inert CDW do not exist in Greece. There are mostly general purpose landfills, receiving all kinds of waste except hazardous waste.

According to national waste planning, it is suggested that at least one landfill for inert waste should be constructed in each of the Greek administrative regions, with specific preference in the island regions to integrate separate modules for inert waste in existing landfill sites instead of designating a new site.

The existing CDW treatment facilities in Greece treat mainly the mineral fraction of CDW, while materials such as metals, plastics and glass are sent to recycling facilities that handle each specific material fraction. Wood wastes sometimes are treated in the CDW treatment facilities or alternatively disposed. There are 54 CDW treatment facilities in Greece, all affiliated with the certified CDW management systems pursuant to JMD 36259/1757/E103/2010.

11.3.5 Future projections of CDW generation and treatment

The new WMP includes the projection of future CDW generation until 2020. The projection of CDW generation was based on the production of the building construction sector since no concrete data exist on CDW from road works, infrastructure projects and excavations. As a result, naturally occurring materials from big infrastructure projects and other excavation activities are not taken into account in the projections. Moreover, naturally occurring materials are also excluded from the calculation of the CDW recovery target in the WFD.

Within the **DEWAM** project (Information System for Demolition Waste Management), a Decision Support System (DSS) has been developed, namely **DeconRCM**, and in it, estimation of the generated CDW quantities are realized with the use of an algorithmically model in Excel file format, based on building practices in Greece. The output of CDW quantities estimation model is stored in databases, also developed with MySQL. Optimization of the integrated CDW management is solved with the use of a mixed-integer linear programming (MIPL) model. Cost parameters that are included are; (i) the fixed deconstruction process cost, (ii) the fixed cost of demolishing the entire building, (iii) the fixed demolition process cost, (iv) the variable cost of deconstructing the building (€/t), (v) the variable cost of separating CDW, plus loading cost in container for each material, (vi) the fixed cost of using/renting a container and (vii) the variable cost of a container to a disposal site (€/container). Revenues from secondary materials' sales are also considered.

11.3.6 Methodology for CDW statistics

The methodology for CDW statistics of data reported in this document follows Eurostat guidelines.

11.4 C&D waste management in practice

11.4.1 CDW management initiatives

In order to assist construction companies, public bodies, engineers and individuals towards environmental sound management of CDW, a web-based Decision Support System (DSS) has been developed, namely DeconRCM, within the framework of of the DEWAM project (Information System for Demolition Waste Management). A beta version of DeconRCM can be visited at: http://pandora.meng.auth.gr/deconrcm. Currently, the application is built for the case of the Region of Central Macedonia, Greece, but can be easily expanded to other areas with the necessary adjustments. In this paper, functional specifications of DeconRCM are provided, together with a brief description of its technical aspects. The DSS tool's capabilities are illustrated through a case study of a major construction project at the campus of Aristotle University Thessaloniki, Greece.

11.4.2 Drivers / barriers to increase CDW recycling

As reported in DELOITTE study, main drivers/barriers to increase CDW recycling are listed below.

Main obstacles to sustainable CDW management:

1. Lack of political will

• There is low, if non-existent, political will to tackle the issue of illegal CDW disposal and the enforcement of the law concerning CDW management. Major delays in the application of the laws and complementary regulations for CDW.

• Low financial and human resources support to environmental inspections renders the inspection and enforcement of the CDW management regulations totally ineffective.

• Recent amendments in CDW management regulations resulted in ambiguity which stalls the effort for increased CDW recovery.

• Delays in administration of fines or non-conviction of CDW management rules violators

2. Mentality in the construction sector

• General mentality in the construction sector (and of the general public in Greece) is that CDW is not considered to be a waste stream that requires immediate attention and treatment. It can be disposed somewhere and left there, since its inert nature makes it harmless for human health and the environment.

• Contractors prefer to avoid the cost of CDW management.

• No market/no demand for recycled CDW, natural materials are always preferred over recycled materials in the construction works.

3. Lack of treatment facilities and low territorial network

• The current network of CDW treatment facilities is not sufficient to cover the total amount of generated CDW or even the national territory of Greece

• There is no register of appropriate sites (e.g. abandoned quarries, etc.) for the establishment of new CDW treatment facilities.

4. Lack of incentives for recycling

• The landfill tax is not considered enough for diverting CDW from landfilling to recovery, accentuated by the ineffective control of illegal activities concerning dumping of CDW.

• Cost of recovery activities is higher than the prices of the recycled end-product. No pull effect from market conditions.

Main drivers to sustainable CDW management

1. Existence of a well-articulated legal framework for CDW management including provisions for the sustainable management of CDW.

2. Existence of a separate authority (EOAN – Greek Recycling Organization) for the supervision of the alternative management of CDW (recovery, recycling).

3. Organization of CDW Management Systems by the actors in the construction sector (obliged by legislation) for the sustainable management of CDW

4. Strong community awareness for the creation of preconditions for sustainable CDW.

11.5 CDW sector characterization

11.5.1 CDW materials (CONCRETE, BRICKS, TILES AND CERAMIC, ASPHALT, WOOD, GYPSUM)

Product description and applications

CDW refer to a wide range of materials, which, according to their origin can be divided into the following categories:

- Demolition materials such as concrete, aggregates, wood, bricks and other building materials.
- Road materials such as bituminous mixtures as well as aggregates of various particle sizes.

- Excavation materials, such as excavated soil, sand, gravel, rocks etc, which arise almost in every construction activity, especially during the underground constructions and geotechnical engineering works.
- Construction and Demolition Wastes are usually grouped together under "CDW"; however these waste streams are produced by different processes, while they have quite different characteristics, both in terms of quantities, composition and potential for recovery.
- Composition of CDW includes materials, such as concrete, generally inert materials, asphalt, paper, glass, plastic, wood, bricks etc, depending on the source. Building and construction waste can be absorbed in various applications/technical projects after appropriate treatment. Such engineering projects are:
    - ✓ buildings' construction
    - ✓ road construction
    - ✓ geotechnical works
    - ✓ flood defenses
    - ✓ concrete production
    - ✓ rail projects
    - ✓ temporary works.

Quantitative analysis

Volume of CDW produced depends on factors, main of which are population growth, city or regional planning, state of construction industry as well as landfill fees.

Construction waste (originating from new constructions) is usually less mixed, less contaminated, and its recovery potential is higher than demolition waste because of these characteristics. Its share in the total quantities of CDW is generally low. On the other hand, demolition waste, which represents the highest amounts of CDW, tends to be more contaminated and mixed, and therefore is more difficult to recover.

Data about generation of different kind of CDW are reported in paragraph 11.3.1.

Recovery techniques

No data found.

Environmental and economic impacts of CDW waste management

Recycling of CDW and the use of their, after treatment, products apart from the environmental benefits due to the restriction of the use of primary materials as well as the illegal and uncontrolled deposition in open spaces, has also economic benefits. Initially new jobs created both in the part of management and research on these materials. Secondly, it is crucial the fact that a supplier of CDW can take back pure secondary material at the same time he goes to the treatment plant, without being forced to go to the quarry. So, the benefits have to do with both time and money savings.

The management costs range from 2,00 € -25,00 €/tn depending on the purity of the materials carried to the treatment plant including separation of various categories of wastes and their treatment till final product, which can be purchased at half the cost of a primary quarry material (an average of 3€/tn).

Drivers / barriers to increase recycling

Provided in section 11.4.2

11.5.2 Recycled materials from CDW

CDW can be reused or recycled in many sectors, one of which is in civil engineering works. Those wastes, after the appropriate treatment, can be used as secondary materials for the production of new concrete mixtures, as base or sub base in road construction, as aggregates for the production of bituminous mixtures or as secondary filling material in geotechnical works. In Greece, and especially in the Universities of Thessaloniki and Thrace, recycled aggregates have been used for the production of new concrete mixtures. CDW's composition is not steady, while there is no CE for those materials, so since they generate from building of different age, different concrete category etc utilization of those materials in civil engineering works and especially in concrete and road works demands every time laboratory tests in order to certify their use as alternative aggregates.

11.5.3 Market conditions / costs and benefits

There are no significant financial incentives for CDW recycling while at the same time the uncontrolled dumping of CDW and the breaching of legislation by many actors in the CDW management chain, especially the waste holders and the collection services not affiliated to any CDW management system as laid down in legislation, hampers any efforts towards the direction of increasing CDW recycling.
The recycling of CDW is perceived as a cost to pay, since alternatives are not well developed in Greece and the market for recycled CDW is not developed.
Although it is considered uneconomical at the moment to recycle CDW in Greece, especially due to lack of other financial incentives supporting recycling and/or punishing landfilling and dumping, there is a possibility that resource scarcity issues might become more prominent in the future and ultimately the recycling of CDW would become more favorable.