

Construction and Demolition Waste Handling in the EU

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Abstract

Construction and demolition waste (C&D waste) should be considered as a secondary resource if the aim is to recover and recycle such materials and reduce the load on landfills. The present paper discusses the definition of such waste as is used in European Union, analyzes the broad statistical data basically drawn from EUROSTAT publications and the documents of the DG Environment of the European Commission. The analysis and discussion focused on waste generation during the baseline year 2008 and the recycling rate and priority fractions of C&D waste. Analysis and discussion were followed by a brief conclusion which has highlighted some of the basic problems in waste handling in the EU and those might have a negative influence on the 2020 target of recycling and/or re-use percentage of the Waste Framework Directive of the EC.

Keywords: Waste Framework Directive, European Waste Catalogue, Recycling, Waste management plan, C&D waste

Introduction

Construction and demolition (C&D) waste stream has been considered by the European Commission (EC) as a priority one as this is the largest waste stream and has a high potential for reuse, recycling and other material recovery. Keeping in mind this great potential of C&D waste, the Waste Framework Directive (Directive 2008/98/EC) has called on the member states to take necessary measures to reach a minimum target of 70 percent by weight of those wastes for preparation for reuse, recycling and other material recovery by 2020, including the back-fill operation by non-hazardous C&D wastes. Some of the member states, particularly with high population density, have already attained that target but many of them have to go a long way to fulfill this requirement.

While analyzing the C&D waste management process in the EU or for that matter any national or local ones, the question of sustainability should not be forgotten. Does C&D waste management in member states fulfill the essential requirements of integrated sustainable C&D waste management? It is very difficult to find out the answer. It seems that sustainability indicators on

this issue have not yet been prepared or developed, not even on a European scale. C&D waste management has remained a technical issue and the Waste Framework Directive (WFD) looks at it simply from the angle of resource economics and related resource efficiency as has been mentioned in the Sustainable Development Strategy and subsequent Environmental Action Programs of the EU which identify waste prevention and management as one of the four top priorities, and underline the relationship between the efficiency of resources and waste generation and management. The objective is to decouple the use of resources and generation of waste from economic growth, while sustainable consumption should not exceed environmental capacity. This objective has been based on three principles: waste prevention, recycling and reuse, and improving final disposal and monitoring. The principles are equally applicable for construction and a demolition waste stream.

Definition of C&D Waste and Management Hierarchy

C&D waste can be defined as any substance or object, arising out of construction and demolition work, which the owner of the substance discards, intends or is required to discard. This particular definition has mistakenly lead to disposal instead of efforts for the reuse of C&D as secondary raw materials for construction work. The European List of Waste (ELW) or European Catalogue of Waste (ECW) has defined such waste in the chapter 17. Whereas, the waste statistics are usually gathered only from the data gathered under economic sector NACE F (Construction sector). The ELW or ECW refers to the types of materials (cement, bricks, wood etc.) and the characteristics (hazardous and non-hazardous). The statistics gathered from the construction sector reflect to all types of wastes (not only the C&D wastes) generated in the construction sector (classified in a different pattern in different member states) but fail to reflect or report the construction and demolition waste in other economic sectors. This obvious discrepancy, however, influences the statistically meaningful analysis very little.

EU Waste Framework Directive states five steps– the “waste hierarchy”, for dealing with waste, ranked according to environmental impact. Prevention, which is at the top of the list, is followed by preparing for re-use, recycling, other recovery and disposal, in descending order of environmental preference. The hierarchy is applicable for C&D waste too. It is presented in table 1.

Table 1: Hierarchy for C&D waste management

Stages	Explanation
Prevention/reduction	Use less materials, use materials which may be reused/recycled/otherwise revered, use minimum hazardous materials, deconstruction
Preparing for re-use	Source separation, cleaning, if needed repairing, salvage
Recycling	Processing of demolition products
Other recovery	Use combustible non-hazardous material for energy recovery (wood etc.)
Disposal	Back-filling, landfills. If possible, incineration

The basic problem in adoption of this hierarchy in C&D waste management is the amount of demolition waste which is usually much more than construction waste in a given locality. Being a densely populated area, many of the construction sites in European countries are rising up after the completion of demolition of past objects (brown fields, dilapidated buildings etc. Prevention of demolition waste to a great extent will not be possible. Initially, existing buildings should be assessed against project needs, with a view to avoiding unnecessary demolition activities and minimizing new construction requirements, thereby preventing waste generation. Salvaging of materials from demolition wastes and subsequent re-use or deconstruction will contribute meagerly to reduction of total waste. Recycling and disposal will remain the main options for management of C&D wastes. Considering the available space for disposal in many member states, it will be prudent to have selective land filling of wastes, so that in the distant future, when technological and economic conditions will be favorable, it will be possible to mine some of those landfills and recycle those fractions which are not presently feasible for recycling. Source separation, re-use, source processing and on the site use of recycled products should be aimed at.

The situation regarding construction wastes is much easier. Here, prevention is the key word and new constructions must be planned keeping in view the easier application of waste hierarchy not only during construction of new object but during the future demolition. If that can be done, then the End of Waste philosophy may approach reality in the distant future. Prevention of construction wastes arising is financially advantageous if proper material management is available on site. Examples of good planning of material management at the site will include:

- It reduces the volumes of construction material needed.
- It reduces the volumes of waste that require disposal/recovery.
- Ensuring materials are purchased as needed to prevent over supply.
- Keeping delivered materials packaged until ready to be used.
- Assigning responsibility for particular materials to the (sub)contractor.
- Involved, thereby ensuring that the material is appropriately managed.
- Ensuring appropriate sequencing of operations on-site

Material management is one aspect of prevention but there are other aspects which should be considered during the planning and design phase. New construction projects should take into consideration the possibilities of “Deconstruction”, which is re-use of construction segments in other objects. The other aspect of great importance is the choice of materials for construction. As far as possible, the materials to be used are to be recyclable with ease or can be re-used.

Proper design of building having least impact on environment is another way to prevent and minimize C&D waste. The design stage offers scope to reduce the production of waste materials by prioritizing waste prevention as

a criterion. In essence, it is important to apply the design and construction decisions which will allow the recovery of valuable resources that will be generated from building removals in the decades ahead and beyond. For example, suitable choice of finished ground and floor levels can greatly reduce the amount of excavated spoil generated. Modular construction, open floor plans, the use of recyclable materials such as concrete, stone, steel and glass contributes positively to sustainable building. Building design should consider the whole life-cycle of the building. Designers can therefore reduce resources used in construction, aid site waste minimization through appropriate design and influence the use of reclaimed materials.

Constructors can plan the construction process to eliminate/reduce waste. They can minimize the volume arising on-site, use reclaimed materials in the works and influence wastage caused by poor materials handling. Full advantage should be taken of all opportunities for the reuse of construction materials. Inclusion of period architectural features salvaged from old buildings can greatly enhance the aesthetics and appeal of new construction. Excavated soil can also be used creatively in the landscaping of developments and for the construction of embankments and screening/noise abatement berms in civil engineering projects.

Reduction, reuse and recycling of C&D waste, commonly known as 3Rs are important for material saving. Success depends a lot on efficiency of source separation which requires materials separated to be placed on separate containers. Before going for source separation, it is imperative to consider a host of factors, including: space for additional containers, labor cost for separation, potential revenue from diverted materials, avoidance of landfill costs and costs for training of workers.

In the field of reusing, there can be number of strategies, including:

- Reusing existing building structures.
- Using standardized or pre-engineered building components.
- Reducing disposable packaging for materials delivered to site.
- Educating builders and site workers on efficient use of materials on site.

Reused materials typically serve one of two functions:

- Item serves same or similar function (e.g., using a salvaged door as a door in new construction).
- Items serves new function (e.g., using salvaged door as a table top).

C&D recycling can be divided broadly into three systems: source separation, on-site recycling, mixed recycling. Common examples are wood, drywall, cardboard, and stone/masonry. The materials after on-site recycling are used on-site for erosion control, filling materials, materials for drainage system, soil amendment etc. It must be noted, that efficacy of recycling will depend on market for recycled products, that is the demand and also on the environmental impact of recycling process.

The role of the Government of member states is basically seen in framing the C&D waste management policy through policies and legislation. Mere transposition of European directives and regulations may not deliver the goods. Every member state must take supplementary measures or create adequate instruments and environments for attaining the goals of the European Directive and the European Strategy. Good practice examples in some member states may be studied and adopted for particular national conditions. For example, one of the very important steps for the government may be to prepare adequate legislation asking for mandatory preparation of a C&D waste management plan for construction projects (new construction, demolition and renovation projects). The other steps may be the banning of particular fraction of C&D waste for land fill or back filling, charging of a high levy for land disposal of some fraction of C&D waste. Approval of such plan should be one of the requirements of approval of any construction project provided it comes under the threshold values (to be established on the basis of total investment in the project) for which such plans should be mandatory.

A waste management plan prior to construction and/or demolition may have the following minimum items:

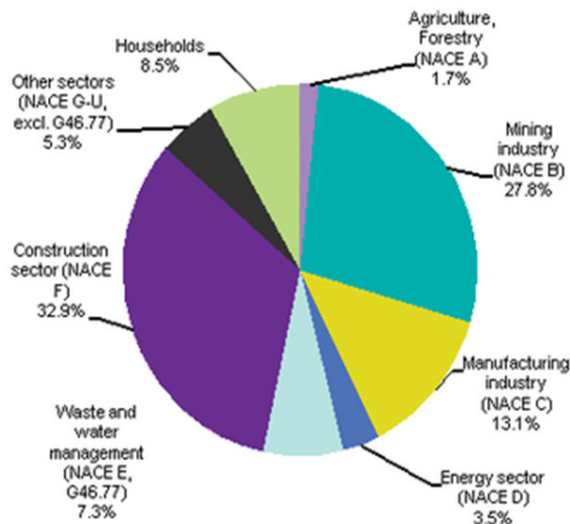
- Description of project along with construction drawings and materials list.
- Amount of wastes to be generated over the life cycle of the project and their characters as per ELW.
- Methods of handling the wastes to be generated and their linkage, to be expressed as per type and quantity.
- Roles and responsibilities for C&D waste handling.
- Record keeping procedures.
- Waste auditing procedure during construction and post construction period.
- Cost of waste handling and management.

Zero waste strategy may be seen only as a future goal in case of C&D waste and may be achievable only after a technological revolution. Presently, diversion from landfills should be the immediate goal. As can be seen from the present statistics, the scenario is not very encouraging. The total waste stream and the consequent C&D stream is growing along with the waste factor (waste generated per capita) and the achievement of recycling rate in the EU is considerably lower than the target set. The good news is, some of the member states have already achieved the rate. So, there is hope in the future.

C&D Waste Generation and Handling in the EU

Figure 1 represents the contribution of different economic activities to the total waste stream of the EU.

Figure 1: Contribution of economic activities as per NACE code in waste generation in the EU



Source: EUROSTAT 2011

The figure indicates that the construction sector is the dominant producer of EU waste. In spite of the resources contained in such wastes, until lately the C&D waste stream has not received great attention and much more attention was given to wastes coming from other sectors of the economy, namely the household activities and/or communal wastes. This had been so, because most of the C&D wastes are inert materials and the percentage of hazardous substances in such wastes is particularly low. On the other hand, the question of community health and political questions have led to the effective legislation in the area of communal and hazardous wastes.

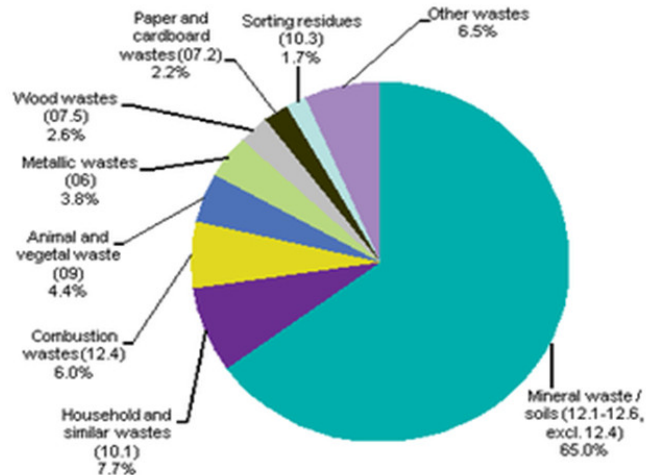
Whatever the case may be, a casual look at figure 2 will show that mineral waste and soils, which have a considerable opportunity to be reused or recycled has a very large share in the EU waste stream. The large share is due to the other dominant waste generation sector, that is mining and excavation. Together, these two sectors are responsible for more than 60 percent of the EU waste.

It must not be forgotten, that a substantial amount of construction materials are manufactured using natural resources. Therefore, a boom in construction creates additional demands on the mining sector.

The data on waste generation always show a broad variation that makes it difficult to draw general conclusions. Data on waste from the construction sector are sensitive to issues of waste definitions, survey coverage and methodological approaches. The method of reporting may seriously influence the final

waste generation data (for example, inclusion or non-inclusion of communal wastes or inclusion of reused demolition debris at the site etc.).

Figure 2: Presence of important fractions in a waste stream



Source: EUROSTAT 2011

Total waste generation of wastes in the EU, as presented in the latest report of EUROSTAT, has been presented in table 2.

Total waste in the EU-27 amounted to approximately 2.62 billion tonnes. 98 million tonnes or 3.7% of this amount were classified as hazardous waste. This means that per capita in 2008 each EU citizen produced on average about 5.2 tonnes of waste of which 196 kg were hazardous.

C&D wastes (NACE section F) have accounted for 859 million tonnes or 32.9% of the total and mining (NACE section B) sector has contributed to 27.8% of the total. According to EUROSTAT, 97% of the waste produced in these two sectors, or 1.53 million tonnes respectively, was mineral waste or soils (excavated earth, road construction waste, demolition waste, dredging spoil, waste rocks, tailings, etc.). This explains the high share of mineral waste and soils, 65% in relation to total waste produced.

The table itself is an example of non-reliability of data on C&D wastes as we may observe that countries like France and Germany have reported a very high amount of such wastes with very low reporting of wastes from the mining sector. Whereas, countries like Romania and Portugal have reported very low amount of C&D wastes. This has naturally resulted in wide range of waste factor (C&D waste per capita) among countries. Different economic structures may be one of the reasons for such variations but methodological differences in reporting have played the usual roles. It seems that, there will be a need to formalize and unify the methodical approach in reporting waste data from different member states to the EUROSTAT. In case of Czech Republic, the C&D waste factor is around 1000 kg/capita.

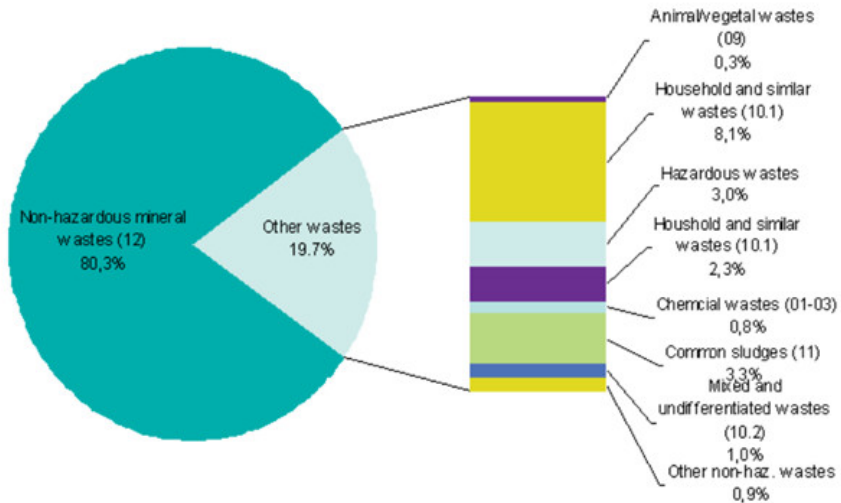
Table 2: Production of wastes in the EU in 2008

	Total waste from economic activities and households	Total	of which Hazardous waste	Agriculture forestry and Fishing (NACE A)	Mining and quarrying activities (NACE B)	Manufacturing industry (NACE C)	Energy activities (NACE D)	Construction and demolition activities (NACE F)	Other economic activities (NACE E, G-U)
EU-27	2 615 220	97 680	45 050	726 740	342 710	90 880	859 490	328 930	
Belgium	48 622	5 919	288	503	10 090	1 067	15 442	16 753	
Bulgaria	266 093	13 043	754	267 559	3 447	7 655	1 829	1 943	
Czech Republic	25 420	1 510	255	167	5 293	1 920	10 651	3 959	
Denmark	15 155	420	41	2	1 454	1 358	5 674	4 111	
Germany	372 796	22 323	1 351	28 288	52 322	11 708	197 207	46 515	
Estonia	19 584	7 538	240	7 198	3 772	5 424	1 099	1 412	
Ireland	23 637	743	19	2 061	4 026	292	.	15 095	
Greece	68 644	253	.	38 152	5 703	11 181	6 828	2 826	
Spain	149 254	3 649	11 356	25 716	19 369	4 872	44 926	18 584	
France	345 002	10 893	1 313	1 195	21 640	1 004	252 980	37 559	
Italy	179 034	6 655	349	1 263	43 066	3 090	69 732	29 043	
Cyprus	1 843	24	127	505	138	2	431	207	
Latvia	1 495	67	75	3	501	20	12	278	
Lithuania	6 835	116	1 288	3	2 758	51	412	961	
Luxembourg	9 592	199	2	10	673	1	8 282	347	
Hungary	20 060	671	468	272	4 789	3 050	5 240	2 795	
Malta	1 499	55	3	0	17	0	1 099	212	
Netherlands	99 591	4 724	3 464	270	15 824	1 318	59 477	9 757	
Austria	56 309	1 330	459	678	13 077	569	31 390	6 317	
Poland	140 340	1 469	1 350	33 666	56 746	19 541	6 930	15 228	
Portugal	36 480	3 368	160	1 891	9 001	255	8 085	11 932	
Romania	189 311	524	17 035	140 677	11 064	7 058	318	4 695	
Slovenia	5 038	153	132	55	1 735	354	1 376	673	
Slovakia	11 472	527	789	151	4 469	1 151	1 302	1 838	
Finland	81 793	2 163	2 739	31 796	16 948	1 531	24 455	2 648	
Sweden	86 169	2 063	314	58 702	11 927	1 508	3 310	6 014	
United Kingdom	334 127	7 285	681	85 963	22 837	4 885	100 999	87 223	

Source: EUROSTAT, September 2011

EUROSTAT does not offer any separate statistical data on land-filling of C&D wastes. However, the figure 3, based on EUROSTAT, gives a picture of land-filling of non-hazardous mineral wastes.

Figure 3: Land-filling of EU wastes in 2008



Source: EUROSTAT

Extrapolation of data gives us the information, that about 40 to 60 percent of C&D wastes go to the landfills or used for back-filling operation.

In view of the EU efforts on increasing resource efficiency and the return from the landfills, the WFD of EC has set up an ambitious target. The quantitative target set by the Waste Framework Directive is the following: “by 2020, the preparing for reuse, recycling and other material recovery, including back-filling 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.” The target totally excludes the excavated materials and does not take into account the energy recovery from waste.

The investigation commissioned by the DG Environment of the European Commission shows that recycling rates (to be understood here as reuse, recycling and materials recovery) at member states are different. Table 3 presents a glimpse of recycling rate at different countries established by the consulting organization for DG Environment of the Commission. Denmark, Netherlands, Ireland, Germany and Estonia have already attained the 70% target.

In the final report submitted by Bio Intelligence Service has provided some recycling (to be understood here as reuse, recycling and materials recovery) rates of C&D waste from two sources (UBA2009) and (ETC/RWM 2009). Recycling rate for the Czech Republic has been established at 30% as per UBA

(estimated C&D waste 8.4 million tonnes) and 23% as per ETC/RWM (estimated C&D waste 11.8 million tonnes). The base year was 2006. As may be seen, both the sources have used different data for calculation. It is, however, important to note that there are serious discrepancies in the data provided by those two sources due to different reporting procedures by national agencies and had to be taken with reservations although it might indicate the trends in recycling. As per the mentioned report, the plausible recycling rate could be established at 46%, which is well within the expert guess of range between 30 to 60% (Bio Intelligent Service, Management of C&D waste 2011).

Table 3: Recycling rate in selected countries

Recycling rate	Countries
60–70%	Austria, Belgium and Lithuania
40–60%	France, Latvia, Luxembourg and Slovenia
Less than 40%	Cyprus, Czech Republic, Finland, Greece, Hungary, Poland, Portugal and Spain
No data	Bulgaria, Italy, Malta, Romania, Slovakia and Sweden

Source: Final Report on Task 2– Management of C&D wastes submitted by Bio Intelligence Service commissioned by the DG Environment, European Commission

The same report also provides estimated data for the range of composition of C&D waste. The compositions are reported in table 4.

Table 4: Ranges of composition of C&D wastes in EU-27

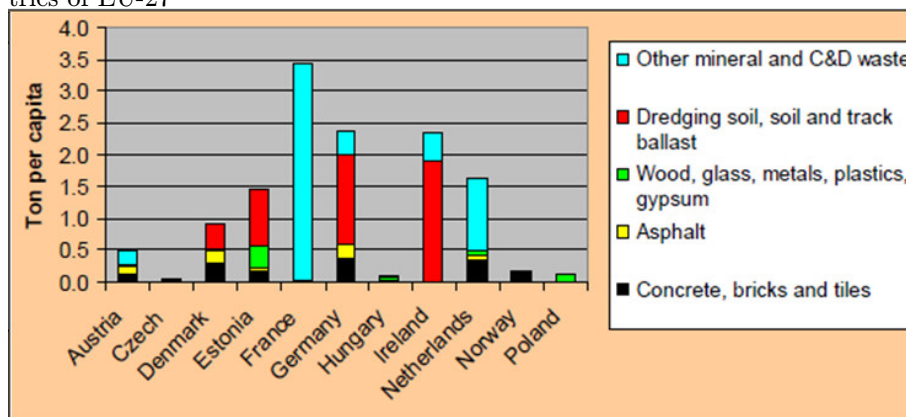
Ranges	% – min	% – max	Million tonnes (min)	Million tonnes (max)
Concrete & masonry	40	84.0	184	387
Concrete	22.0	40.0	55	184
Masonry	8.0	54.0	37	249
Asphalt	4.0	26.0	18	120
Other mineral waste	2.0	9.0	9	41
Wood	2.0	4.0	9	18
Metal	0.2	4.0	1	18
Gypsum	0.2	0.4	1	2
Plastics	0.1	2.0	0	9
Miscellaneous	2.0	36	9	166

Source: Final Report, Task 2 – Management of C&D waste, submitted by Bio Intelligence Service commissioned by the DG Environment, European Commission

It should be evident that, it will be necessary to concentrate on the major type of fractions presented in the table. The mineral fractions of C&D waste could, if recycled or reused, help to achieve the target subject to recovery of the wastes (selective demolition and reconstruction) and source sorting. Smaller fractions will also need special attention. Some of those like metals are usually separated and are sold but materials like glass, wood, plastics can be salvaged from the waste stream and sent for recycling. Figure 4 presents percentage

composition of recycled C&D wastes per capita in the EU. It is clear from the data that the recycling percentage in the countries depends on their perception of the word “recycling” and the types of recycled wastes and the manner of reporting. In the case of the Czech Republic, the diagram refers only to concrete, bricks and tiles, although several other fractions are reused or recycled. Large amount of dredging soil, soil and track ballast have been reported by Denmark, Germany and Ireland. If those fractions are omitted, then recycling scene in those countries will be different. It is interesting to note that many countries have not at all reported this category among recycled wastes. Unfortunately, due to the absence of uniform reporting by all the countries, it is not possible to come to some definite conclusion regarding the basic trends towards the recycling target of 2020 of the EU.

Figure 4: Percentage composition of recycled C&D waste in selected countries of EU-27



Source: European Environment Agency, July 2010

Conclusion

Notwithstanding the widely varying C&D waste management facilities, industry structure, legislative framework, policies and market situation, the member states of the EU must find their way towards meeting the common 2020 target. National strategies must of necessity combine different instruments in a tailored package that takes account of these factors. It is too early to judge the effects of recently introduced measures with certainty, but some of these potential success factors are already emerging from the work: some measures led to a decrease in land-filling of waste after the very first year of their introduction. In countries with high levels of material recovery it appears that selective ban on the land-filling has been an effective measure in increasing the reuse and recycling of such wastes going to landfill. The introduction of a comprehensive and mandatory waste management plan associated with waste auditing could be an effective instrument to encourage reduction of C&D waste. One of the important things that should be introduced is legislative measures and financial instruments to re-use waste and recycled waste. This may be achieved

by introduction and implementation of secondary raw material regulation and standards, as have been experienced by some of the member states of the EU.

Legislation and policies alone could not help. Other important issue is the producer responsibility towards C&D waste management. The producers of waste should start to look at the by-products of construction and demolition process as secondary raw materials for construction. Their efforts should be directed to diminishing of such by-products right from the design stage (choice of materials depending on their possible re-use and recyclability, use of recycled material, source separation, selective demolition, designing for future deconstruction, source re-use of by-products etc.) and thus leading to a voluntary commitment, which has given good results to some of the member states, towards C&D waste reduction.

The basic problems in C&D waste management can be found in the inability to reduce the total waste generation, lack of source separation, economic and traditional aspects of recycled waste, low cost of land-filling in comparison to the entire chain of process with material recovery from waste, regional imbalance in recycling facilities, inadequacy of national legislative framework and in some cases absence of a C&D waste management policy in some member states. The most important driver to date is the target set up by the Waste Framework Directive of the EC which requires that the member states by 2020 should re-use and/or recycle C&D waste to the degree of 70%. Implementation of a national voluntary commitment of the construction industry which aims to reduce 50% the amount of C&D waste land-filled, is a measure tried by Germany since 1996, which has given good results.

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Nakládání s konstrukčními a demoličními odpady v EU

Konstrukční a demoliční odpad (K a D odpad) by měl být považován za sekundární zdroj surovin, protože cílem je znovuvyužití a recyklace odpadových materiálů a tím snížení zátěže skládek těmito odpady. Tato práce pojednává o odpadu, v souladu s definicí odpadu používanou v Evropské unii, analyzuje široké množství statistických údajů získaných z publikace Eurostatu (Statistický úřad Evropské komise) a dokumentů z DG (Directorate General) pro životní prostředí při Evropské komisi. Analýza a diskuse jsou zaměřené na produkci odpadů v základním roce 2008 a míru recyklace prioritních frakcí S a D odpadu. Analýza a diskuse jsou ukončeny krátkým závěrem, který uvádí některé základní problémy nakládání s S a D odpady v Evropské unii, které by mohly negativně ovlivnit naplnění stanovené míry recyklace nebo opětovného použití těchto odpadů, jak je uvedeno v rámcové směrnici o odpadech.

Klíčová slova: rámcové směrnice o odpadech, evropský katalog odpadů, recyklace, plán odpadového hospodářství, stavební a demoliční odpad

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