



GYPSUM TO GYPSUM

A CIRCULAR ECONOMY FOR THE CONSTRUCTION SECTOR:

LAYMAN'S REPORT

START DATE OF THE PROJECT: 2013/01/01

DURATION: 36 MONTHS

LIFE PROGRAMME: LIFE11 ENV/BE/001039

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GYPSUM – AN EXCEPTIONAL CONSTRUCTION MATERIAL

The GtoG project focuses on lightweight gypsum components, also known as plasterboards, which mainly consist of gypsum cores covered with paper in their surfaces and longitudinal edges. These products are used for partitions, lining walls and ceilings. Other generic terms used for these products are gypsum boards, drywalls and wallboards.

THEIR MAIN PROPERTIES ARE:

- **Easy to handle and install**
- **Recyclable**
- **Very good fire performance**
- **High levels of robustness against impact**
- **Easily combined with insulation materials providing good thermal and acoustic properties to the system**

Gypsum is a rock-like mineral used in construction through different applications: plasterboards, building plaster and gypsum blocks.



THE CONTEXT

The construction sector represents an important constituent of the European economy. However, this sector generates one of the heaviest and most voluminous waste streams in the European Union, the so-called Construction and Demolition (C&D) waste. This waste arises from activities such as the construction of buildings and civil infrastructure, or their total or partial demolition including renovation activities and maintenance. It accounts for approximately 30% of all waste generated in the EU and consists of numerous materials, including concrete, bricks, wood, glass, metals, plastic, solvents, asbestos and excavated soil and of course gypsum, many of which can be recycled.

Despite the fact that gypsum is 100% recyclable, there is currently a large proportion of gypsum waste being landfilled and backfilled, while recycling systems in Europe are mostly operating in Benelux,

Denmark, Finland, France, Norway, Sweden and the United Kingdom.

As a C&D waste fraction, gypsum based wastes can be differentiated into three categories depending on their origin:

- Production waste, meaning the waste resulting from the manufacturing process
- Construction waste, the waste resulting from new buildings construction sites
- Demolition waste, the waste arising when refurbishing or removing existing buildings, thus including both demolition and renovation waste

The GtoG project focused on eight EU target countries (Belgium, France, Germany, Greece, Poland, Spain, the Netherlands and the UK); estimating that around 1,150,000 tons of plasterboard waste was generated in 2012. In most of these European countries, a low recycling rate of gypsum waste was observed.

The aim of the GtoG project was to produce plasterboard with up to 30% content of recycled gypsum coming from both production and C&D waste.

¹ BioIS: Management of construction and demolition waste in the EU - requirements resulting from the Waste Framework Directive and assessment of the situation in the medium term (draft final report, 2010). Note: for some Member States, only data for 2004 were available



MAIN TYPES OF GYPSUM

Gypsum is an abundant mineral rock from which plaster is made and is commonly found in quarries. The European gypsum industry comprises 160 quarries and about 200 factories (plaster powder plants, plaster block plants and plasterboard plants), which directly employs 28,000 people and creates products for more than 850,000 users.

Until mid 1980s most of the gypsum used in the European Union was natural gypsum extracted from quarries. Since then, flue gas desulfurization (FGD) gypsum, a by-product from coal-fired power plants, has become an alternate and important supply for the gypsum industry. This raw material is also known as synthetic gypsum and largely used in Belgium, Germany, the Netherlands and Nordic Countries.



RESOURCE	ORIGIN
Natural gypsum	Formed geologically
FGD gypsum	By-product from the desulphurization of gases in coal-fired power stations
Recycled gypsum	From the processing of gypsum waste in accordance with particular specifications

Table I. Origin of the main types of gypsum

REASONS FOR RECYCLING PLASTERBOARD PRODUCTS

1. Gypsum is fully and eternally recyclable. Gypsum products can be recycled because their chemical composition remains unchanged. Gypsum's chemical composition is calcium sulphate dehydrate which exists in nature in a rock-like shape. When heated (calcined), calcium sulphate hemihydrate is created, a substance that can be formed into shape and hardened by adding water (new gypsum products are made), whereby the material is turned into the original and naturally occurring gypsum state again. Therefore, gypsum products can be counted amongst the very few construction materials where "closed-loop" recycling is possible, i.e. where the waste is used to make the same product again.

2. Article 4 of the Directive 2008/98/EC on Waste (also known as the Waste Framework Directive, hereinafter WFD) drafts the waste hierarchy that

should be applied as a priority in all EU Member States. Waste prevention leads this hierarchy, followed by preparing for re-use and material recycling that should always be preferred to recovery and landfill disposal.

3. Article 11 of the WFD establishes that, by 2020, the preparing for re-use, recycling and other material recovery of most of the categories defined in the European List of Waste (ELW) shall be increased to a minimum of 70% in terms of weight. This target applies to non-hazardous C&D waste (where gypsum waste is included) and excluding soil and stones other than those containing dangerous substances.

4. If gypsum waste products are accepted at normal cells in non-hazardous landfills with biodegradable waste, its sulphate would break down, amongst other substances into Hydrogen Sulphide (H_2S), a hazardous flammable gas with environmental and health effects when inhaled, that even in very small concentrations creates odour problems and is dangerous. Council Decision 2003/33/EC, therefore, established that "Non-hazardous gypsum-based material should be disposed of only in landfills for non-hazardous waste in cells where no biodegradable waste is accepted. The limit values for TOC and DOC shall apply to wastes landfilled together with gypsum based materials". When the gypsum waste is separated from organic matter, the risk of formation of Hydrogen Sulphide is limited.

5. Recycling plasterboard waste avoids primary mineral resource depletion.

GTOG, CLOSING THE LOOP EFFECTIVELY

Closed loop recycling involves a close collaboration among all the stakeholders throughout the entire value chain: from the dismantling and collection of plasterboard waste in buildings, via the recycling of this waste and culminating with the reincorporation of the recycled gypsum by the plasterboard manufacturing plants, in order to create a highly efficient reverse logistics.

The GtoG project will serve to boost the closed-loop recycling route whenever possible.

Deconstruction: dismantling of plasterboard on the demolition site

Deconstruction enables the quantity and quality optimization of valuable materials, thereby increasing the potential for their future recycling. It results in different waste fractions with minimal damage, due to the time and care taken for separating the waste, in order to achieve the minimal negative effect of its generation.

The reprocessing of the recyclable plasterboard waste

Once plasterboard waste from construction and demolition waste is separated on site, it can be collected by a third party and transported to a gypsum recycler for processing.

The reincorporation of the recycled gypsum in the manufacturing process

Once the plasterboard waste has been processed, the gypsum recycler provides the manufacturer with the recycled gypsum that will be reincorporated in the production process.



THE GTOG PROJECT STRUCTURE

The GtoG project has put in place an integrated approach to C&D waste by holistic management, starting from the major refurbishment/demolition sites to the reincorporation of the recycled gypsum in the manufacturing process via the processing of gypsum waste as a secondary raw material.

The project structure has been conceived to be simple and comprehensive at the same time. Indeed, the project has developed all its technical activities through three actions:

ACTION A analyzed and evaluated the current practices in deconstruction/demolition, C&D waste characterization, processing the gypsum waste for the production of recycled gypsum and its reincorporation into the manufacturing process. This action represented a sort of introduction to GtoG, where a technical, economic, environmental and legislative analysis was carried out for the different stages of the value chain. This analysis has been performed by UPM (Universidad Politécnica de Madrid, Spain) with the collaboration of all the partners, who provided astute information about deconstruction, recycling and re-incorporation of recycled gypsum into the production process. The result has been an Inventory of best practices.





ACTION B the project implementation actions, where five pilot projects implementing the deconstruction techniques, the decontamination and the waste qualification, reprocessing and reincorporation in gypsum manufacturing plants have been carried out in Belgium, France (2), Germany and UK. This action has been developed through the following sub-actions:

— **The 5 deconstruction projects.**

Recovering, a French consulting company, led this action. This activity has been implemented by the five demolishers in the project (Recass for Belgium, KSE for Germany, Occamat and Pinault & Gapaix for France and Cantillon for the United Kingdom), who selected commercial buildings, where gypsum products and systems have been audited and deconstructed, using various techniques and practices.

— **The 5 recycling projects.**

Gypsum Recycling International A/S (GRI) led this action, and counted on the participation of the other recycler for the project, NewWest Gypsum Recycling (NWGR). In this sub-action, the plasterboard wastes supplied by the deconstruction project have been processed and then transferred as recycled gypsum powder to the five manufacturer's plants to be re-incorporated in the production process.

— **The 5 reincorporation projects.**

The National Technical University of Athens (NTUA) led this action, and coordinated the five gypsum

manufactures of the project (Saint Gobain Gyproc for Belgium, Placoplâtre and Siniat SA for France, Knauf Gips KG for Germany, and Siniat Ltd for the United Kingdom). Within the sub-action, the recycled powder supplied by the recyclers has been re-incorporated into the production process. The recycled gypsum powder used during the re-incorporation phase has also been tested by the laboratory LOEMCO (Fundación Gomez Pardo, Spain).

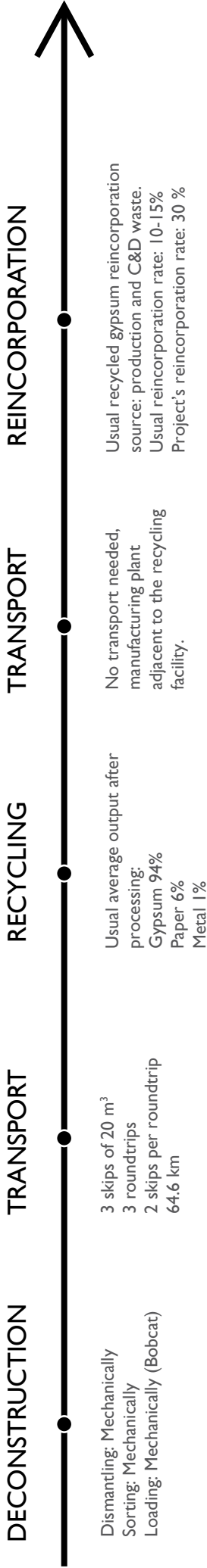
ACTION C which monitored the impact of the project actions. The end result has been a report on best practice indicators, the responsibility of the Polytechnic University of Madrid. In addition, other outcomes of this action have been the carbon footprint of gypsum: landfilling versus landfilling route, developed by UPM, and the roadmap for implementing a gypsum sustainable value chain, a document created by Eurogypsum, where an outline plan has been determined in order to achieve a more widespread implementation of gypsum C&D waste recycling.

GTOG PILOT PROJECT 1: BELGIUM



GENERAL DATA

Duration: 08/ 2014 – 12/2014
Demolition location: Brussels – BE
Demolisher: RECASS
Description of the building: 2 floor building, offices, from 1990
Square meters of gypsum system (m²): 2,800
Type of gypsum system: Double-sided plasterboard partition with a metallic frame, infilled with mineral wool insulation
Amount of recyclable gypsum waste (t): 42.94
Amount of non-recyclable gypsum waste (t): 0.00
Recycling location: Kallo – BE
Manufacturing location: Kallo – BE
Recycler: NWGR
Manufacturer: GYPROC



DECONSTRUCTION

The total amount of gypsum waste generated was tracked as well as accepted by the recycler. Deviation between the recyclable gypsum waste generated and foreseen is 28%, and therefore above the agreed criteria¹. Environmental and economic benefits are shown for the recycling route compared with the landfilling route as both emissions were less and the total amount of recyclable gypsum was sent to the recycling facility.

RECYCLING

No impurities neither any significant amount of wet gypsum was found in the load, which was been totally accepted and appropriately stored in the recycling facility. There is a lack of data regarding processing and transport for ENVI.

REINCORPORATION

Although all recycled gypsum was accepted, not all technical and toxicological parameters fulfill the GroG guidelines (TECH2)². The recycled content incorporated is in line with the project target (up to 30%), experiencing a significant increase with respect to the usual rate (TECH5).

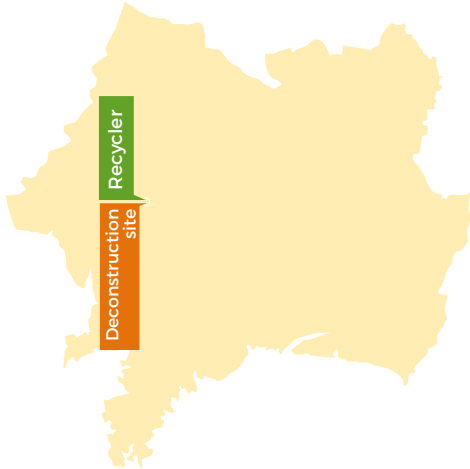
In addition, the percentage of production waste generated is below the European average (TECH6).

There is a lack of data regarding energy consumption in the pre-processing stage (ENVI and ECO4).

¹ Deviation <20%. Acceptable

² Deliverable DB4: Report of Production Process Parameters

GTOG PILOT PROJECT 2: FRANCE



GENERAL DATA

Duration: 08/ 2014 – 01/2015
Demolisher: PIN
Deconstruction location: Paris – FR
Description of the building: 3 floor building, commercial, from 1998.
Square meters of gypsum system (m²): 340
Type of gypsum system: Gypsum block partition, Double-sided plasterboard partition with a metallic frame, infilled with expanded polystyrene, plasterboard ceiling with a metallic frame.
Amount of recyclable gypsum waste (t): 9.38
Amount of non-recyclable gypsum waste (t): 7.80
Recycling location: Vaujours - FR
Recycler: NWGR
Manufacturing location: Vaujours - FR
Manufacturer: PLACOPLATRE

DECONSTRUCTION

Dismantling: Manually (automatic screwdriver and pickaxe)
Sorting: Manually (wheelbarrow and shovel)

TRANSPORT

2 skip of 20 m³
1 roundtrip
2 skips per roundtrip
39.5 km

RECYCLING

Usual average output after processing:
Gypsum 94%
Paper 6%
Metal 1%

TRANSPORT

No transport needed, manufacturing plant adjacent to the recycling facility.

REINCORPORATION

Usual recycled gypsum reincorporation source: production and C&D waste.
Usual reincorporation rate: 15 %
Project's reincorporation rate: 27.5%

DECONSTRUCTION

The total amount of gypsum waste generated was tracked as well as accepted by the recycler. This is the only case where the deviation of the audit for gypsum-based systems complies (TECH1).

Environmental and economic benefits are shown for the recycling route compared with the landfilling route as both emissions were less and the total amount of recyclable gypsum was sent to the recycling facility.

Regarding the non-recyclable gypsum waste, plaster blocks and plasterboards appeared glued to ceramics and sound / thermal insulation respectively.

RECYCLING

No impurities neither any significant amount of wet gypsum was found in the load, which was been totally accepted and appropriately stored in the recycling facility. There is a lack of data regarding processing and transport for ENVI.

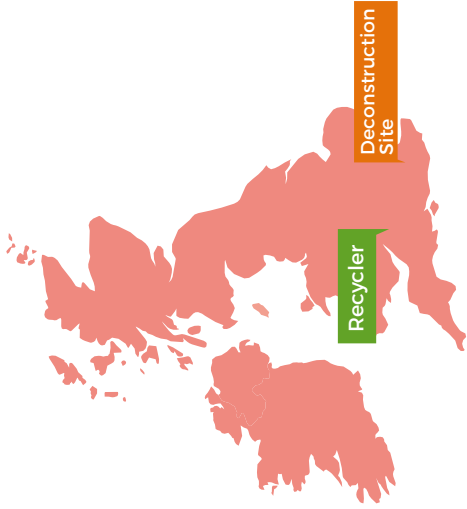
REINCORPORATION

All recycled gypsum was accepted, complying with the quality criteria according to the GtoG guidelines (TECH2)¹. The recycled content incorporated is in line with the project target (up to 30%), experiencing an increase with respect to the usual rate (TECH5).

The percentage of production waste generated is lightly higher than the European average (TECH6).

¹ Deliverable DB4: Report of Production Process Parameters

GTOG PILOT PROJECT 3: UNITED KINGDOM



GENERAL DATA

Duration: 07/2014 – 02/2015
Demolisher: CANTILLON
Deconstruction location: London – UK
Description of the building: 12 floor building, offices, from 1980's
Square meters of gypsum system (m²): 8,640
Type of gypsum system: Plasterboard partition, metal frame, glass/rock wool insulation.
Amount of recyclable gypsum waste (t): 50.00
Amount of non-recyclable gypsum waste (t): 0.00
Recycling location: Avonmouth – UK
Recycler: NWGR
Manufacturing location: Bristol – UK
Manufacturer: SINIAT

DECONSTRUCTION

Dismantling: Manually (crowbar, pickaxe or sledgehammer)
Sorting: Manually (hopper)
Loading: Mechanically (bobcat)

TRANSPORT

199,00 km

RECYCLING

Usual average output after processing:
Gypsum 94%
Paper 6%
Metal <1%

TRANSPORT

6.60 km

REINCORPORATION

Usual recycled gypsum reincorporation source: production and C&D waste.
Usual reincorporation rate: around 15%
Project's reincorporation rate: 22%

DECONSTRUCTION

A pre-deconstruction audit is not mandatory in this country (TECH1). All the gypsum waste generated was recyclable plasterboard waste, which was 100% tracked and accepted by the recycler. Environmental benefits are shown.
However, a higher recycling fee than landfill is observed (ECO4).

REINCORPORATION

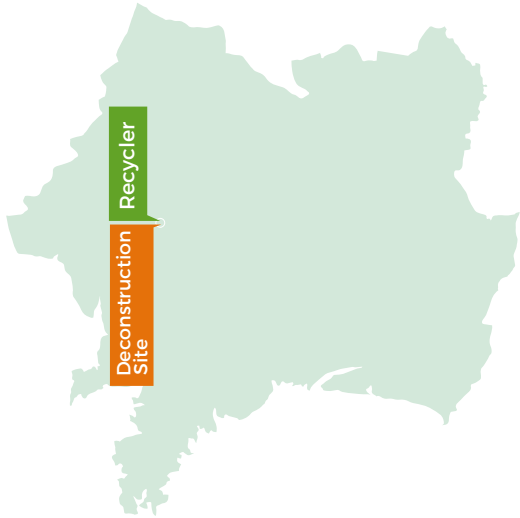
All recycled gypsum was accepted (TECH1). However, not all technical and toxicological parameters fulfill the GroG guidelines (TECH2). The recycled content increase is 7.5%, which is considered medium achievement'.

There is a lack of data regarding energy consumption in the pre-processing stage (ENV1 and ECO4) and the specific amount of quality checks carried out were not available (ECO1).

RECYCLING

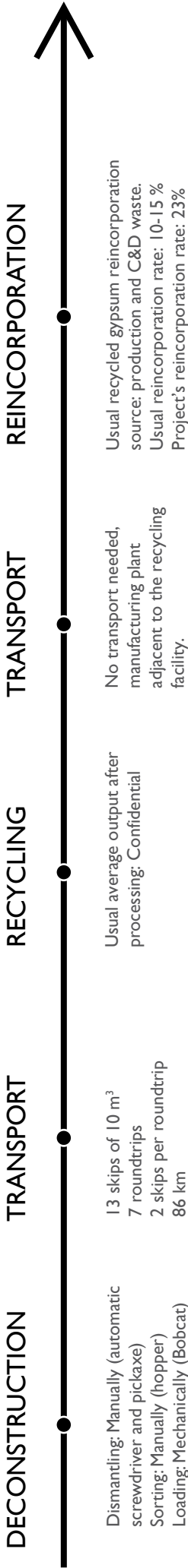
No impurities neither any significant amount of wet gypsum was found in the load, which was appropriate stored in the recycling facility.
There is a lack of data regarding processing and transport (ENV1).

GTOG PILOT PROJECT 4: FRANCE



GENERAL DATA

Duration: 01/2014- unknown
Deconstruction location: Levallois Perret – FR Demolisher: OCC
Description of the building: 9 floor building, offices, from 1968.
Square meters of gypsum system (m²): 6,740
Type of gypsum system: Gypsum block partition, Double-sided plasterboard partition with a metallic frame, infilled with expanded polystyrene, plasterboard ceiling with a metallic frame.
Amount of recyclable gypsum waste (t): 67.52
Amount of non-recyclable gypsum waste (t): 0.00
Recycling location: Auneuil– FR Recycler: Siniat
Manufacturing location: Auneuil– FR Manufacturer: Siniat



DECONSTRUCTION

The total amount of gypsum waste generated was tracked as well as accepted by the recycler. However, the deviation of the pre-deconstruction audit in relation to the real amount of gypsum waste generated is above the established criteria. Environmental and economic benefits are shown.

RECYCLING

No impurities neither any significant amount of wet gypsum was found in the load, which was appropriate stored in the recycling facility.
There is a lack of data regarding processing and transport.

REINCORPORATION

All recycled gypsum was accepted, complying with the quality criteria according to the GtoG guidelines¹ (TECH 1 and TECH2). The recycled gypsum content is below the pilot's project average – 22.3% (TECH4). Similarly, the recycled content increase (TECH5) does not meet the threshold established (>10%).

There is a lack of data regarding energy consumption in the pre-processing stage (ENV1 and ECO4).

GTOG PILOT PROJECT 5: GERMANY



GENERAL DATA

Duration: 02/2014 – 01/2015
Demolition location: Graben – DE Demolisher: KSE
Description of the building: 5 single-floor buildings, offices, from 1965
Square meters of gypsum system (m²): 3,450
Type of gypsum system: plasterboard ceiling, wooden frame, mineral wool insulation;
Plasterboard laminate, metallic frame; Plasterboard partition, wooden frame, wood wool insu.
Amount of recyclable gypsum waste (t): 23.64
Amount of non-recyclable gypsum waste (t): 13.00
Recycling location: Werkendam – NL Recycler: GRI
Manufacturing location: Iphofen – DE Manufacturer: KNAUFKG

DECONSTRUCTION

Dismantling: Manually (crowbar, pickaxe or sledgehammer)
Sorting: Manually (wheelbarrow and shovel)
Loading: Manually and mechanically

TRANSPORT

4 skips of 36 m³
2 roundtrips
2 skips per roundtrip
80 km

RECYCLING

Usual average output after processing:
Gypsum 90%
Paper 10%
Metal <1%

TRANSPORT

Assumption: 5 km*
*There is no gypsum recycler in Germany

REINCORPORATION

Usual recycled gypsum reincorporation source: production waste.
Usual reincorporation rate: up to 5%
Project's reincorporation rate: 17%

DECONSTRUCTION

Around 55% of the plasterboard waste generated was laminates, which are currently considered as non-recyclable gypsum waste (GW). This is why the deviation of the pre-deconstruction audit in relation to the real amount of recyclable GW generated is above the established criteria¹. The rest of GW generated was tracked as well as accepted by the recycler. Environmental and economic benefits are shown. ECO4 couldn't be calculated due to confidential issues.

RECYCLING

No impurities neither any significant amount of wet gypsum was found in the load, which was appropriate stored in the recycling facility.

There is a lack of data regarding processing and transport (ENV1).

REINCORPORATION

The manufacturer reports 20% of not usable material (TECH1) and technical and toxicological parameters do not fulfill the GtoG guidelines (TECH2)². Therefore, the manufactured plasterboard did not reach the manufacturer's requirements, so it was considered production waste (TECH6).

While the recycled gypsum content is below the pilot project's average - 22.3% (TECH4), the recycled content increase is above 10%, which is considered high achievement (TECH5).

¹ Deviation <20%: Acceptable

² Deliverable DB4: Report of Production Process Parameters

PROJECT ACHIEVEMENTS/ RESULTS

- **Preliminary study** (UPM, January – September 2013)
The inventory of current practices for deconstruction, recycling and re-incorporation in the manufacturing process of the recycled gypsum
- **Dismantling VS demolition** (Recovering, September 2013 – March 2014)
The European handbook of best practices for controlled deconstruction of gypsum system and the European manual of best practices for the audit of building prior to deconstruction
- **Recycling** (GRI and NWGR, February 2014 – September 2015)
European guidelines on gypsum waste acceptance criteria
Guidance document for the quality criteria of the recycled gypsum - Technical and Toxicological Parameters
- **Re-incorporation** (NTUA, February 2014 – September 2015)
Techno-economic assessment of recycled gypsum incorporation into the plasterboard manufacturing process
- **Final Study** (UPM and Eurogypsum, October 2013 – December 2015)
Report on best practices for deconstruction, recycling and re-incorporation in the manufacturing process of recycled gypsum
Assessment of the carbon footprint of gypsum waste recycling
Roadmap for future implementation of a sustainable value chain



TRANSFERABILITY, IMPACT, RELEVANCE TO EU AND NATIONAL LEGISLATION AND CONTEXT

RECOMMENDATIONS FOR THE NATIONAL AUTHORITIES

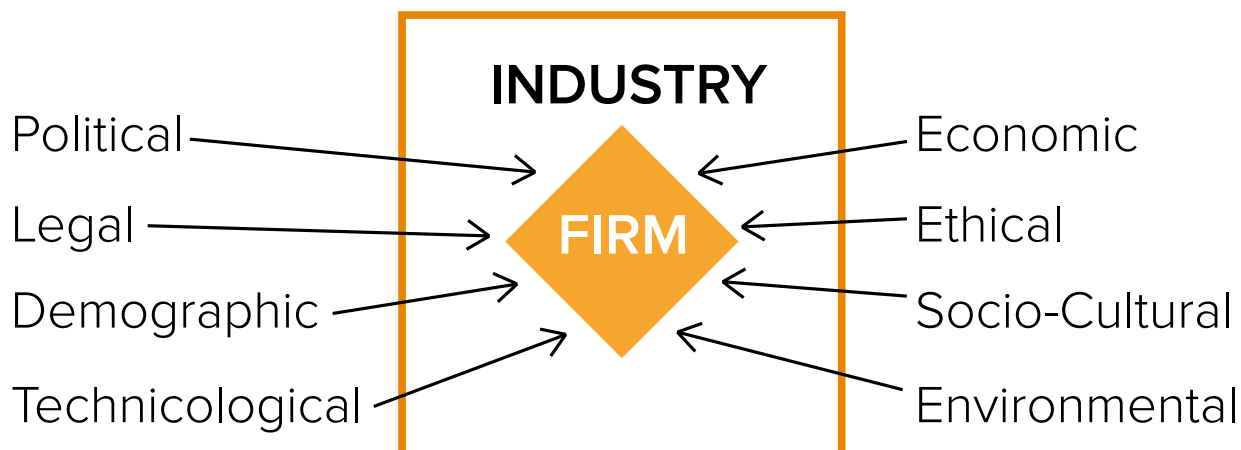
— Across Europe, the plasterboard market maturity differs, as the plaster consumption and recyclability rates change very much. Moreover, the market is only one factor that influences the plasterboards recycling rate. In fact, the recycling of plasterboards production, construction and demolition waste depends greatly on a macro-environment formed by different elements that vary considerably country by country.

Therefore, a fit-for-all solution might not be most adequate. We, thus, suggest that the proper set-up, establishment, development and support of the plasterboard value chains should be done at country level, with a constant and significant exchange of best practices all around Europe. As a minimum the

national authorities of each member state should start by assuring that the national legislation is in full compliance with EU waste laws, such that all EU waste laws with consequences for plasterboard recycling have been properly implemented and enforced.



MACRO ENVIRONMENT





RECOMMENDATIONS FOR THE EC

— The project has revealed a lack of implementation of EU waste laws in member states with negative consequences for the successful establishment of plasterboard recycling systems that can help to divert waste from landfill and use all the resources found in gypsum based waste. Consequently, it is recommended that the EC assures full and proper implementation of EU waste laws in all member states.

— There is a need for detailed and reliable statistics on materials available from construction and demolition activity. The volume of plasterboard waste stemming from renovation activities is unknown, but could offer potential. Current day statistics on plasterboard waste generation are non-existent or too approximate due to the lack of data. Moreover, the statistics at European level are not harmonized which slows down the incentives to recycle effectively. With the lack of good information and incentives, a recommendation is required to include the breakdown of the different streams in the Eurostat database, differentiating at least among: plastics, metals, concrete and rubble, roofing and plasterboard. This could be easily achieved for countries in this project, where deconstruction is a common practice, such as Belgium, France, the Netherlands and the UK.

— Deconstruction (dismantling and sorting on site) is essential for recycling and should become the focus of European regulatory and non-regulatory measures in the future. Similarly sorting on new construction sites is essential for preparing waste for recycling. In that sense, an audit of all materials in the buildings prior to construction and deconstruction is a step towards a dismantling culture, at least for building above 1000 square meters. A detailed

report, in some countries referred to as a Building Waste Management Plan, about the quantity, quality and recyclability of the waste materials should be a result of the audit. Such Building Waste Management Plan could be considered to be made mandatory for receiving a permit for a given construction/ demolition activity.

— The design for deconstruction and recycled content is one of the issues where the EC could focus its attention. This will increase the materials recyclability and will promote a mentality of waste prevention.

RECOMMENDATIONS FOR THE GYPSUM INDUSTRY

One of the main lessons learnt from this project is that “closing the loop” cannot be limited to a single operator responsibility. Construction and demolition companies, waste collectors, recyclers and manufacturers have to collaborate intensively in order to achieve this goal. In any case, achieving a sustainable value chain does not happen overnight, and we suggest the participants get involved in a long-term and clear plan with the following objectives.

To apply real selective demolition of plasterboard systems.

— Enhancement of the reference catalogue on gypsum-based systems built 20-30 years ago. Within the project framework, this catalogue covers Belgium, France, Germany and the UK. It should be enriched in 2016 with other countries, such as Nordic countries, Austria and the Netherlands.



- Dissemination of the best practices to dismantle plasterboard systems via the national gypsum associations and the national demolition associations.

- Enhancement of the cooperation with the European Demolition Association to increase the uptake of plasterboard dismantling, bearing in mind that high volumes coming from this source are not currently available.

To set up a collaborative platform between the recyclers and the manufacturers spread all around Europe to exchange best practices and to take the following actions.

- To monitor the waste legislation at EU and national level, including their correct implementation, with the creation of dissemination tools such as a bi-annual newsletter.

- To reach a point in which the optimization of the recycling and reincorporation processes materialized during the GtoG project would become “business as usual”.

- To implement a full collaboration for assuring that an economic viable recycling system is set up.

- To investigate in each member state whether the definition of the product status for the recycled gypsum at national and/or plant level would be useful or not.

- To prepare applications to current EU funding instruments for implementing new collaborative pilot projects able to boost R&D&I activities and show the benefits of an uptake of C&D waste recycling.

17 PARTNERS FOR COVERING AN INTEGRATED SUPPLY CHAIN

The GtoG is a LIFE project co-financed by the European Commission.
It covered the duration of three years, from January 2013 to December 2015.

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COORDINATOR

- Eurogypsum, the European association of plasterboard manufacturers, Belgium

UNIVERSITIES

- The National Technical University of Athens (NTUA), Greece
- Universidad Politécnica de Madrid (UPM), Spain

LABORATORY

- Fundación Gomez Pardo (LOEMCO), Spain

CONSULTING AGENCY

- Recovering SARL, France

DEMOLITION COMPANIES

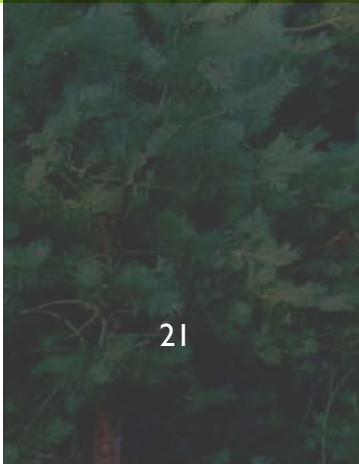
- Occamat, France
- Cantillon Ltd, United Kingdom
- Recycling assistance BVBA, Belgium
- Pinault & Gapaix, France
- KS Engineering, Germany

RECYCLING COMPANIES

- New West Gypsum Recycling Benelux BVBA, Belgium
- Gips Recycling International A/S (GRI), Denmark

GYPSUM MANUFACTURING COMPANIES

- Placoplâtre SA (Saint Gobain Group), France
- Siniat SA, France
- Siniat Ltd, United Kingdom
- Knauf Gips KG, Germany
- NV Saint Gobain Construction Products Belgium SA (Gyproc), Belgium







GYPSUM TO GYPSUM