

Detailed Analysis  
From Gypsum to Gypsum:  
**closing the Loop efficiently  
for a Green Economy**



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## EXECUTIVE SUMMARY

- ▶ **Similarly to Construction and Demolition (C&D) waste recycling**, C&D **gypsum** waste recycling in general is not a **single operator responsibility**. It is **collaboration** between different operators throughout the value chain (demolishers-waste collectors-recyclers-manufacturers). The efficiency of the gypsum and C&D recycling lies in the efficiency of the C&D value chain. The role of the **waste collector and sorting centres** in the value chain should be clearly defined as separate collection is crucial for recycling gypsum waste at a high quality level.
- ▶ Challenges for making efficient recycling happen in practice:
  - ▶ The main barrier for effective recycling today is that **buildings are currently crushed** rather than dismantled. The **economics of deconstruction versus demolition** should be clearly demonstrated. The monetary value of an effective (de)construction site place handling can push or not for dismantling and recycling-gypsum waste is a commodity with little monetary value which is a barrier for its dismantling and recyclability;
  - ▶ **Turning waste into a resource**: recycled gypsum shall become a resource once having legally obtained the **end-of waste status** at EU or national level in accordance to article 6 of the Waste Framework Directive. In that case recycled gypsum is a resource giving more confidence to the owner;
  - ▶ **Terms** like recyclable C&D waste, recyclable gypsum waste, backfilling, recovery, recycled C&D waste, recycled gypsum waste should be **clearly and legally** defined before any regulatory decision is taken banning any type of landfilling;
  - ▶ The Waste Framework Directive is an important tool for driving recycling of C&D waste. **The Current C&D waste target is a recovery target** covering recycling, recovery operation and backfilling. The concept of the target should be reviewed to go for a recycling target excluding recovery operations and backfilling. Furthermore, a **C&D recycling target** without considering the efficiency of the whole value chain (deconstructing-sorting and collecting-recycling and manufacturing) has **little incentive to drive recycling- moreover so that** reliable and harmonized waste statistics are missing across Europe ;
  - ▶ **Correct Implementation of current EU waste legislation** in a harmonized way across Europe is crucial to drive **recycling and dismantling** forward.



## A. BACKGROUND

With an annual turnover of over 7.7 billion EURO, the European Gypsum Industry operates around 154 quarries and some 160 factories (plaster powder plants, plaster block plants and plasterboard plants) and generates employment directly to 28,000 people and indirectly to 300,000 people. 1,100,000 people are installing Gypsum Industry products and 25,000 people are trained yearly by industry across Europe.

Gypsum is virtually indispensable for the interiors of homes and offices, and indeed all types of buildings where people congregate such as schools, shops, airports, etc.

More than 1,600 million m<sup>2</sup> of European interior surfaces are covered with plasterboards every year. More than 5 million tons of plaster/year is used in Europe for interior lining. More than 20 million m<sup>2</sup>/year of European interior walls are built using plaster blocks<sup>1</sup>.

The European Gypsum Industry is one of the few fully integrated industries within the construction products field.

Indeed, the companies which extract the mineral “Gypsum” also process it and manufacture the value-added products and systems used in construction. Gypsum products are indefinitely and fully recyclable as they always keep their natural properties during use. Therefore, the gypsum companies strive to effectively recycle the products at the end of their life-cycle (renovation, demolition and also construction off-cuts) and to use it as raw material for manufacturing new gypsum products.

## B. THE SITUATION OF GYPSUM-BASED WASTE RECYCLING IN 2013

### 1. Introduction: gypsum waste categories



► Gypsum Waste



#### We have three categories of Gypsum waste based on origin:

- **Production waste:** gypsum products which do not meet specifications and waste resulting from the manufacturing process.
- **Construction waste:** waste resulting from construction sites.
- **Demolition waste:** the last category includes both demolition and refurbishment waste and is the most complex to address because the waste stream includes other construction materials (such as plasters, paints & screeds etc.). This renders the treatment more complex at higher costs and limits the ability to use the resulting material.

<sup>1</sup> Eurogypsum sustainability brochure 2008: <http://www.eurogypsum.org>

### We recycle with ease:

- ▶ Production waste is generally recycled by the factories and used as raw material. Therefore this measure is waste prevention.
- ▶ Construction waste collection and recycling has started and is increasing in Scandinavia, France, the UK and Benelux. However the re-incorporation rate of the recycled gypsum in the manufacturing process differs from country to country and from plant to plant.

### We recycle far less demolition waste for the following reasons:

- ▶ The buildings are currently crushed and not dismantled, thereby impeding the sorting of plasterboard before the building is demolished;
- ▶ Plasterboard is a relatively new product used in construction after the second world war and we are now only beginning to dismantle buildings with plasterboard linings;
- ▶ Gypsum demolition waste tends to be contaminated (screws, vinyl wall paper etc.) This renders the treatment more complex at higher costs and limits the ability to use the resulting material.

### What we can use:

Processed gypsum waste – **recycled gypsum** – used as secondary raw material meeting quality requirements to be re-incorporated in the manufacturing process.

There is **ongoing debate** regarding the appropriate name for gypsum obtained from the processing of waste gypsum products.

Commonly speaking, ‘recycled gypsum’ is used to mean gypsum resulting from the controlled processing of waste plasterboard to separate the gypsum, paper liner, and any contaminants, such that it can be used in lieu of natural or synthetic gypsum. N.b in some countries other gypsum materials are also recycled, such as plasters and blocks

Recycled gypsum is usually in the form of a fine or granular powder or a small aggregate-type material.

### Statistical data

There are very limited statistical data available on plasterboard waste generation beyond anecdotal evidence and ad hoc projects. Figures from different sectors of the industry (recyclers as well as manufacturers) are being quoted with limited evidence base.



▶ Recycled Gypsum

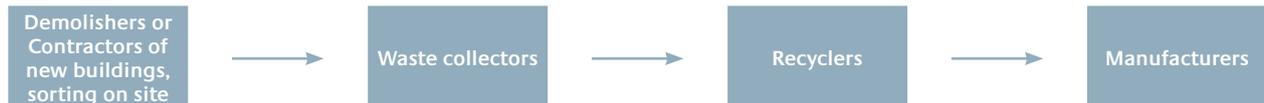


▶ Recycled Paper

## 2. Business model to recycle gypsum and C&D waste

The business model differs from country to country according to the culture and environmental legislative framework of that country. However there are main characteristics which are valid for any kind of C&D waste recycling.

The C&D recycling systems always involve more than one operator. Each operator has its own responsibility in the economic, technical and environmental efficiency of the recycling of the C&D waste stream:



Waste collectors can also be recyclers and recyclers can also organize the waste collection. Manufacturers can also be recyclers (having internal recycling facilities) and they can also collect waste. Some Gypsum manufacturers have put in place take back schemes for collecting **construction waste**.



► Dismantling



► Collection



► Recycling



► Re-incorporation in the manufacturing process

## a. The efficiency of the recycling lies in the efficiency of the value chain.

The efficiency of the value chain also depends on the monetary value of the recycled C&D Gypsum waste: metal has infinite value and is thus recycled. Plasterboard is a commodity and has little monetary value for the waste collectors, the demolishers or the contractor.

The sorting at demolition and construction sites will happen for plasterboard if

- ▶ National authorities push for dismantling, recycling or recovery of the plasterboard waste;
- ▶ Other types of waste of high monetary value are recovered at the same time;
- ▶ Logistics are optimized.

Otherwise, the landfill route will still be seen as the easiest and often most economically viable route. Handling space changes on the (de)construction site saves time and money.

## b. Towards Closed-loop Recycling

The aim of the European Gypsum Industry is to manage our products and systems in a way which is consistent with the ever increasing environmental, social and economic standards and cultures we operate in.

Gypsum products can be counted amongst the very few “green” construction materials where “**closed-loop**” recycling is possible, i.e. where the processed waste (recycled gypsum) is used as secondary raw material to make the same product again. Gypsum as such is 100% and eternally recyclable. You can always reuse Gypsum because the chemical composition of the raw material in plasterboards and blocks always remains the same.

The European Gypsum Industry wishes to go forward in reducing the environmental impact of construction materials at the end-of life, i.e. at the demolition phase of a building or during major renovation of a building.

This is a challenging task that we wish to push forward being conscious that successes depends on our real willingness to make our commitment happen and on the willingness of the operators in the value chain.

## c. The UK example of recycling Gypsum based Waste

The Ashdown Agreement on Plasterboard Recycling between the Gypsum Products Development Association (GPDA) and Waste & Resources Action Programme (WRAP) took effect from 1 April 2007. It sets out shared objectives for the diversion of waste plasterboard from landfill. The progress achieved regarding the agreed targets are reviewed and updated annually.

The current targets are:

- ▶ **Target 1 UK** Economy zero plasterboard waste sent to landfill by 2025
- ▶ **Target 2 UK** plasterboard manufacturing operators zero plasterboard waste to landfill by 2015
- ▶ **Target 3 UK** Economy increase recycling of new construction plasterboard waste to 50% by 2015

### RESULTS 2012

#### ▶ **Target 2 | Zero production waste to landfill**

- ▶ The 2012 generic (cross industry) data was zero tonnes, so that the GPDA continue to achieve the 2015 target

#### ▶ **Target 3 | Target 50% of construction waste** recycled by 2015 to environmentally acceptable uses (plasterboard, cement or for agricultural use) based on annual production of 210,000t

- ▶ The quantity recycled by manufacturers-close loop recycling reached 68,988 t or 32.9% in 2012 (62,750 t or 29.9% in 2011) so a 3% improvement on 2011. The next challenge to address is how to measure the contribution of cement and agricultural use, which is being developed through the Plasterboard Sustainability Partnership (PSP)<sup>2</sup>.

<sup>2</sup> <http://www.plasterboardpartnership.org/> The PSP is made up of the broad range of stakeholders involved in the production, installation and disposal of plasterboard as well as the relevant government departments and regulatory agencies. The intent of the PSP is to enable greater awareness and understanding amongst all stakeholders of existing knowledge about the role plasterboard plays in construction and of the sustainability issues throughout the supply chain, and to use this knowledge to develop practical and coordinated strategies for sustainability. This includes economic and social as well as environmental impacts.

## C. DEVELOPING THE RECYCLING ROUTE

### 1. The need for an appropriate legislation correctly implemented

#### a. The Construction Products Regulation <sup>3</sup>

The Construction products regulation includes within its annex (basic requirements for construction works) a basic requirement on the Sustainable use of natural resources. It reads as follows:

The construction works must be designed, built and demolished in such a way that the use of natural resources is sustainable and in particular ensure the following:

**(a) Reuse or recyclability of the construction works, their materials and parts after demolition;**

(b) Durability of the construction works;

(c) Use of **environmentally compatible** raw and **secondary materials in the construction works**.

The requirements fall on the works, not on the singular products. For the basic requirements to become applicable to singular construction products, the Commission usually drafts an interpretative document for translating the basic work requirement into products characteristics. On the basis of this document, the Commission drafts CEN mandates for each construction product family of products. The technical committee of the construction product then include the mandated product into the construction product standard. The construction product standards are mandatory.

This job will require time and efforts but may bring over time an added value to the recyclability of the construction products.

#### b. The Waste Framework Directive <sup>4</sup>:

- **The C&D recovery target of 70%**

The Waste Framework Directive (WFD) could be an important tool for driving the recycling of C&D waste. However, the EU authorities set a target for recovery operations including recycling operations. Therefore the current 70% recovery target (by 2020, including backfilling operations) for non-hazardous waste become an ambiguous tool and deserves a strong reorientation by the European authorities. Furthermore, without proper statistics and a harmonised calculation method for the Member States, it is difficult to evaluate any target even if it is clearly set.

- **The waste hierarchy**

Another important driver is the waste hierarchy according to article 4 WFD. Recycling activities for plasterboard waste in the Member States began to increase with the entry into force of the WFD in 2008 and after with the transposition in national law. Before plasterboard waste generally was landfilled or used in other material recovery. The higher priority for recycling compared to other recovery should be implemented with clearer definitions in national law of the Member States.

- **Design for recycling and waste prevention**

The environmental preference is ultimately to **reduce waste at source**, i.e. at the design stage. The Gypsum Industry has thus in place policies to prevent waste and follow the waste hierarchy of the Waste Framework Directive, article 4 (see annex I).

<sup>3</sup> Regulation (EU) No 305/2011 of the European Parliament and of the council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC

<sup>4</sup> Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain directives

- **The way forward**

- ▶ As the Commission is reviewing the C&D Recovery target, we recommend going beyond the targets and thinking about the funding of collaborative value chain to recycle specific waste streams via the financial tools of the European Commission.
- ▶ Exchange of best practices between member states would also be very useful.
- ▶ Clearly Define terms like
  - ▶ Recyclable waste
  - ▶ Recycled waste
  - ▶ Recyclability
  - ▶ Recovery, etc.

Terminology used and its definition should be improved and harmonized across Europe. Otherwise, national interpretation will prevail **sometimes favouring** the landfilling route rather the recycling route or vice-versa.

We recommend to the commission to incentivise at national level the real implementation of the waste hierarchy as defined in the Waste Framework Directive.

### c. The Landfill Directive

#### **Council decision of 19 December 2002 establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 and Annex II to Directive 1999/31/EC (landfill Directive)**

On 19 December 2002 the Council of the European Union took a decision to establish criteria and procedures for the acceptance of waste at landfills. Section 2.2.3 of the annex mentions: “Non-hazardous gypsum-based materials should be disposed of only in landfills for non-hazardous waste in cells where no biodegradable waste is accepted”.

The Consequences of this decision are:

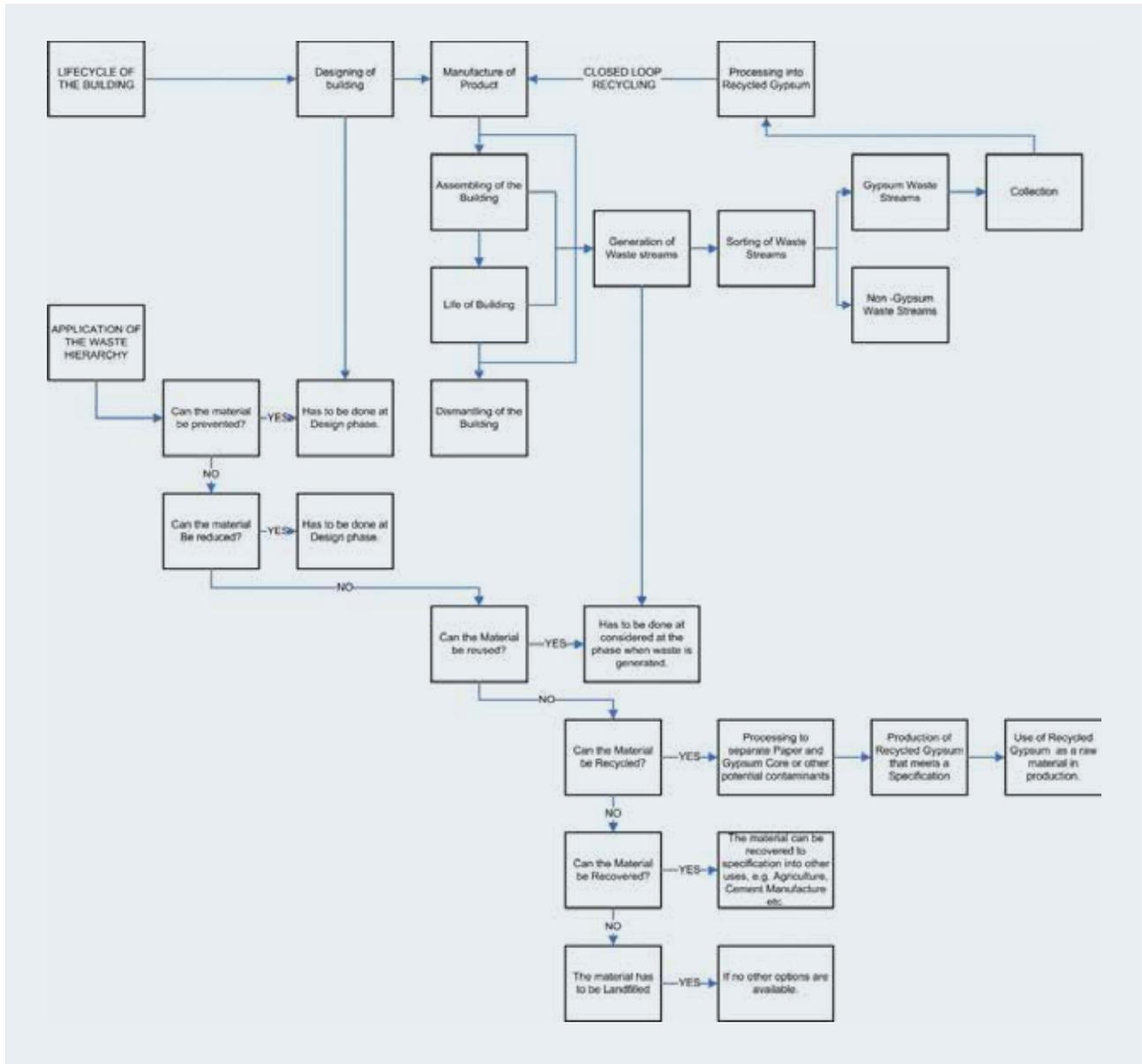
- ▶ Plasterboards, plasters and blocks need to be removed from demolition waste destined for compulsory disposal in non-inert, non-hazardous landfills;
- ▶ Dedicated cells have to be established for gypsum waste in non-inert, non-hazardous landfills;
- ▶ Landfill charges are higher in non-inert, non-hazardous landfills than in inert landfills, and are higher for dedicated gypsum cells than for the normal cells.

The Decision took effect on 16 July 2004 and Member States had to implement it by 16 July 2005.

**2. Create the market conditions to facilitate the use of the recycled gypsum**

**a. Turning gypsum based wastes into a resource to boost its market use**

The recyclability of the plasterboard waste and other Gypsum wastes supports requirement for lifecycle thinking and design for deconstruction – as applying the waste hierarchy in principal goes hand in hand with lifecycle planning of a building.



The manufacturer only accepts from the recyclers a quality of the recycled gypsum which enables him to re-incorporate the recycled gypsum in the manufacturing process. The quality requirements are very strict to ensure an optimal re-incorporation into the manufacturing process. One part is technical requirements to ensure a high plasterboard quality and to avoid any technical problems in the manufacturing process. Another part are requirements on trace components like heavy metals to prevent overall adverse environmental or human health impacts. Country specific quality requirements exist, however European wide harmonized specifications still need to be developed. Often, the recycled gypsum qualities are low and can only be used for open-loop recycling, which is not our preferred option.

Therefore, the European Gypsum Industry wishes to turn the Gypsum waste into a resource for closed-loop recycling in accordance to the criteria set in article 6 of the Waste Framework Directive. **If the demolition practice is turned into a deconstruction practice** the recyclable gypsum becomes a resource and must no longer be landfilled.

## b. Green Public Procurement Criteria

In 2010, the Gypsum Industry developed the Green public procurement criteria for wall panels (i.e. plasterboard) with the Commission. The percentage of recycled gypsum in the board is currently set at 5% in the comprehensive criteria <sup>5</sup>.

### 3. Dismantling and sorting on site: the practice to promote



Selective deconstruction enables an increase in;

- ▶ The materials quality
- ▶ Potential for future use
- ▶ Economic value.

However, the current average demolition techniques employed throughout Europe are reducing raw materials quality, potential for future use, and economic value into, i.e., aggregates for road filling material and in some cases, preventing close-loop recycling (gypsum products) as the building is just crushed.

Deconstruction should also be applied in major renovation and light renovation of buildings. Internal partitions within an office can be dismantled where an office is being refurbished. This is not the current practice. Education of the workforce is essential to create a dismantling mentality when it is easily implemented.

<sup>5</sup> [http://ec.europa.eu/environment/gpp/second\\_set\\_en.htm](http://ec.europa.eu/environment/gpp/second_set_en.htm)

**Applying dismantling techniques instead of using traditional demolition techniques will lead to sorting and recycling of non-load bearing elements for re-use in the production process.** However, as the waste characterization differs, the production processes of the manufacturers must be adapted to increase the recycled content in the product.

Notwithstanding the above, some good practices do exist.

As an example – in the UK, with the inception of the Site Waste Management Plan Regulations (SWMP) in 2008, the demolition industry tends to have a good idea of the amount of Plasterboard to be removed from a building. The demolition industry is also able to stream all other materials fairly accurately as well.

On the other side, in France, a study on 15 selective demolition sites showed that at least 50% of Gypsum based waste did not comply with the quality required due to a bad dismantling process.

The dismantling process includes separate sorting of the waste on site (same requirement as for construction waste) and an efficient collection system.

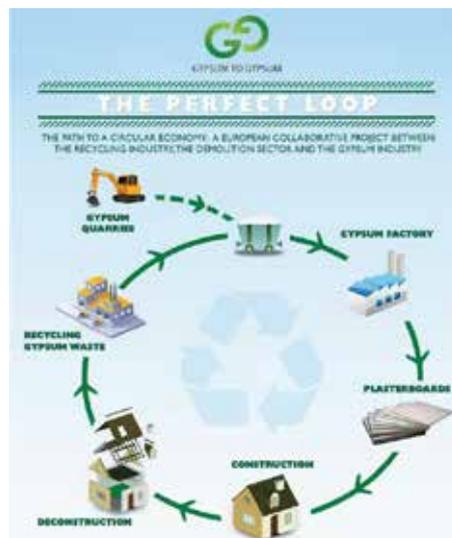
Dismantling a building should therefore become standard if we are serious about implementing a cradle to cradle approach in recycling.

## D. THE FUTURE



A consortium composed of 16 partners, led by Eurogypsum, was selected by the European Commission (EC) in 2012 to conduct a Life + project **LIFE11 ENV/BE/001039** entitled “ GTOG (from Gypsum to Gypsum) From production to recycling: a circular economy for the European gypsum Industry with the demolition and recycling Industry”.

The aim of the project is to close the loop effectively and transform the plasterboard demolition waste market to achieve higher recycling rates of plasterboard waste.



## E. CONCLUSIONS

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With the “closed-loop recycling concept” Eurogypsum contributes to fulfilling the environmental objectives of the Waste Framework Directive.

**This recycled gypsum** must fulfil the quality requirements of the European gypsum industry. In this case the recycled gypsum can be used as raw material next to natural gypsum and synthetic gypsum for production of new gypsum based construction materials.

To achieve the closed-loop recycling concept the following considerations will need to be met;

- ▶ Deconstruction (Dismantling and sorting/separating on site) is crucial for recycling and should become the focus of European regulatory and non-regulatory measures in the future;
- ▶ We should create an increased demand for the use of recycled gypsum with non-regulatory incentives stemming from the national government (example of the UK).
- ▶ On the basis of the Waste Framework Directive and the upcoming results of the GtoG project terms like recyclable waste, recyclability, recycled waste, recovery, backfilling, recovery and recycling targets etc. can be clearly defined between all stakeholders involved in the management of plasterboard waste streams in a common understanding.
- ▶ Once the term “recyclable” is clearly defined we could agree that landfilling for these materials should be avoided.

Whilst closed loop recycling is the preferred option for gypsum materials, there may be some cases where this is not appropriate such as

- a) It is not the most environmentally sound option or
- b) The material cannot meet the requirements of the gypsum manufacturing process.

In these cases other open loop recycling is preferable – again following the best options according to the waste hierarchy.

**With this approach, recycling primary raw material resources can be saved, recycling rates and resource efficiency can be increased and recyclable waste streams to be landfilled can be reduced.**



## ANNEX I-GYPSUM WASTE HIERARCHY MODEL

