



wasteresource

raw material and by-product exchange

Landfill Mining Conference Conclusions

18th/19th October 2017



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On the 18th/19th of October it took place in Barcelona the international conference on Landfill Mining with a great success of public and relevant experiences presented.

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The institutional welcome message was delivered by Pere Casals, chairman of the Chamber of Commerce of Manresa together with Josep Maria Tost, Catalan Waste Agency Director. The first speaker was Floriana la Marca, education officer from EIT Raw Materials. She explained opportunities and services of EIT Raw Materials.

Some key ideas shared in the conference are shown below.

Session 1: Landfill Mining Potential

The objectives of this section were to provide a broad definition of Landfill Mining in terms of current situation and potential future, regulation, policy, instruments and strategies as well as the impacts and resources associated.

Presentations:

- **Yves Tielemans (Eurelco):** *“landfill is stuck in a dump regime. >90% of the landfills are no sanitary sites”. It is hard to create land in densely populated places like Flanders*”. The speaker highlighted the need for the European Union to provide substantial improvements about future remediation costs, resource potential and pilot activities. Furthermore, it has been argued that the integration at local level through common data is a key point toward a circular system.
- **Maria Calaf (ENT):** According to the case study conducted in Spain, the key selection criteria for a viable landfill mining operation have been pointed out: stability, size, age and the distance from inhabited places. However, the most relevant point presented was the importance of the conduction of a specific viability study before proceeding, because of the various factors that may affect each landfill site. She concluded stating that the landfill mining will get more importance in the future as technologies improve and as the raw materials price continues to increase.
- **Eddy Wille (OVAM):** *“55% of landfills are in erosion”*. As published by OVAM, on the 18th September of 2015, it is essential to introduce long-term management of landfill in order to spread and develop the ELFM¹ concept. The speaker focused the attention on technological aspects as well as on policy aspects affirming the importance of the government investment in this sector. He affirmed, in fact, that the EU ought to consider old landfills in the revision of the EU Directive since current regulation addresses mainly new and operating landfills, and that financial support from local authority is needed.
- **Marco de la Feld (Smart Ground Project):** He described the Smart Ground Project as a web platform aimed to manage a better use of secondary raw materials. The process from waste to profit has been explained. It starts from the selection of pilot sites, going through the study of the social, economic and environmental impacts till the implementation of the database itself and the network management. The market place proposed by the project is comprised of the construction engineers,

¹ ELFM stands for enhanced landfill mining



the legislation, the decision makers, the citizens and the academia. Even though a raw material info system is seen as an efficient source to find opportunities, problems in the legislation still exist. Moreover, in response to the statement done by Yves Tielemans about the need of a common data, Marco de la Feld highlighted the crucial role of the quality of the data themselves.

Key points:

- The profitability of a landfill mining project highly depends upon a variety of factors affecting each different site.
- The EU Directive ought to consider the old landfills.
- It is important the integration at local level through an efficient common data system.

Session 2: Landfill Mining Operation

This section set the scene of the material and energy recovery (safety and material stability), the costs, the risk, the technologies, the value and the assessment of the landfill mining resources.

Presentations:

- **Ángel Martínez (Ferroviario Servicios):** He talked about the technical aspects of the excavation and refilling steps characterizing the landfill mining process. According to the case studies analysed from their own trials at their operated landfills, he pointed out the relevance of the analysis of the waste stability related to the mechanical characteristics. In order to get this kind of information he suggested using in-situ tests such as: the CPT (Cone Penetration Test), pressuremeter test, numerical analysis of excavation and refilling, electrical resistivity tomography to evaluate leachate level and field test for internal combustion.
- **Reinhard Göschl (IuT Group Austria):** his presentation was mainly focused on the landfill mining as a sustainable solution for old dumps. From their experience of more than 20mill tonnes mined, he shared that within the different reasons for a landfill mining project (environmental, commercial, volume and resources), the IuT Group projects are principally incentivated by the generation of new space for infrastructure plans. In their experiences the recovery of space is of 50% of volume, but depending on the target on the treatment of mined material (biological activity reduction, material recovery including RDF). Reinhard Göschl findings reported that the factors that influence the composition of the waste are the age of the landfill and whether there is MSW, CDW or industrial waste. On the other hand the location does not have any kind of effect. Another important point of this presentation was about the costs of the landfill mining. The speaker affirmed, in fact, that ~65-75% of costs are local, such as fuel or labor costs as well as local market conditions. For instance, while in Asia the RDF² is sold and the costs are reduced, in Europe this is not possible because RDF is a waste that pays gate fee for energy valorisation. He finally affirmed that one of the most important parameters of the landfill mining is purely technical, focused on what to do with the material recovered. Consequently he highlighted the priority of the objectives up to the legislation in response to the conclusions of the previous session.
- **Roberto Raga (University of Padova):** an Italian landfill mining case study near Verona was analysed. The need behind the operation was to excavate a trench to set up a railway that could not be rerouted. Successful results in terms of biogas emission minimisation were reported. He also shed light on current landfill mining activities in Torretta landfill (Verona). This landfill was originally established on a river bed and the current excavation was principally motivated by municipality fees aimed to the extension of the landfill life. The problem here was the lack of objectives on recovery of materials or landfilling space, they

² RDF: refuse derived fuel



just put the excavated material back to a new landfill section. The presentation concluded in fact with the exposure of the need of incentives to avoid this kind of situation.

Key points:

- The only way to successfully run a landfill mining project is to simultaneously consider material, energy and land recovery.
- The airflow technology allows reducing methane emission.

Session 3: Flagship initiatives

The third session was aimed to report landfill mining international and local initiatives.

Presentations:

- **Francesc Giró (Waste Agency of Catalonia):** a pilot project of landfill mining in Clariana de Cardener was described. After having explained the production of compacting bales and the mechanical and biological treatment, he discussed the project outcomes as follow. The 36% of the volume of the waste was reduced and the 70,2% of the ferrous metal fraction was recovered.
- **Veronika Andrea (Helector):** she presented the landfill mining case study in Polygyros site in Greece. After a detailed analysis of the kind of waste found and the percentages of each material recovered, she shed the light on the high costs related to the process. She specified that the higher costs were associated to the short life of the operational pilot – scale plant.
- **Elisabet González (Ferrovial servicios):** the landfill mining of the waste treatment facility in Piedra Negra (Alicante) was shared. The speaker reminded the importance of the analysis of the technical aspects before proceeding for a landfill mining process. She also argued that the percentage of recyclable waste is higher in older waste layer (previous to 2001). Through the case study undertaken she was able to present some key aspects about the choice of a profitable site such as the presence of RDF production plant on site, as well as the presence of RDF consumer near the installation, although in their trials the RDF analysis retrieved higher concentrations than allowed of S and Cl. She concluded underlining the importance of the involvement of the clients and the local authorities in a landfill mining project.
- **Yves Tielemans (Group Machiels):** he presented the plasma gasification technology as a valuable process for the extraction and valorisation of the methane gas of the enhanced landfill mining project in REMO landfill in Flanders. The “quadruple helix model” was promoted in order to develop sustainable plan with industry, government, research institutes and civil society. The speaker showed that the material revenues were not attractive, as a consequence other technological options were tested as plasma rock for construction materials. However, he stressed the importance of the total recovery of land for urban used and the inclusion of neighbours. The speaker finally suggested to keep bringing industrial upscale in order to develop a market for landfill mining.
- **Kris Broos (VITO):** an ongoing research characterized by X-Ray transmission has been proposed in order to overcome the limitation of the manual analysis of waste composition. The ELFM potential was reported as follow. The flexible machine described is characterized by a volume based technology (accurate mass balance and big data on particle level), it can train algorithms and quickly scan potential material and steer sorting plant.
- **Florian Sheibe (FCC Environment Austria):** the speaker presented two projects of FCC Environment Austria: the project MINE and the project SLAU. With regard to the first one, important outcomes in terms



of material processing were reported such as the need of pre-drying the material and the separation rates with different technologies (air separation), as a consequence, sorting costs were not compensated by material recovery. Going into details, the presence of sludge may impact into a not feasible project. A deeper analysis (as deep as 20 m) was needed in order to reach out the potential interesting materials. For instance, due to a ban in AT (since 2004) to landfill MSW not previously sorted on a MBT plant, only the film fraction was recoverable for recycling (not attractive prices though). In terms of energy recovery, the results got worse due to RDF costs. Even though he presented a detailed analysis of fractions obtained (useful for further research), he finally stated that the project is not economically feasible.

Concerning the project SLAU, only characterized of mechanical treatment, it has been stated that each incinerator has his specific share of metal rich fractions between 1,5% and 3,5% of input. This was considered economically feasible. In the final discussion he gave emphasis on one hand on how important is to generate economic incentives to this kind of process for companies and on the other hand on how difficult it is in practice to obtain the support from the Government.

Key points:

- Crucial role of the Government support.
- It is important to promote the economic viability.
- Relevance of the social aspect in the landfill mining assessment.

Some general conclusions from the conference:

It has been confirmed that an integrated decision considering the trade-off between economic, social and environmental aspects is needed. Three must be the areas of study related to a landfill mining project: costs and benefits, regional potential and social impacts.

It is key to define the objective for the landfill mining operation to assess social, environmental and economic benefits, identifying for instance:

- Identify possible revenues from material recovery.
- Space recovery considered as a main driver (the material recovery is not enough).
- The quality of materials is very variable due to composition of landfill, age, conditions inside the landfill.
- Looking at RDF, it is important the amount of chlorine and sulphur for following energy valorisations, as well as market conditions (cost vs. revenue).

Interesting opportunities were identified in fines fraction such as Al, Ag, Cu, Fe, Zn. Nevertheless, being these fractions nearly impossible to sort by mechanical means, further progress at competitive cost is recommended.

Moreover, the opportunity for X-ray systems or other technologies has been reported as possible challenge for optical sorting to overcome dirtiness challenge.

The institutional framework and green procurement are considered key instruments, in fact:

- Currently, a mass scale LFM EU wide is not expected. It is essential to keep developing knowledge and technologies at industrial scale, in order to develop enough knowledge for a structured and solid EU framework possibly in 10 years.
- The reconsideration of old landfills in the new directive LFM can include restoration and closure operations.



- Economic incentives and markets for EFM are crucial if aligned with the global market. However, it is difficult for politicians to promote LFM projects because of the social acceptance needed (significantly important within the cities). In case of total reclamation of land, in fact, it is highly reasonable to offer new spaces for neighbours. It is strategic to develop the quadruple helix model as explained above.

19th October: Visit to Clariana de Cardener landfill

The landfill mining project of Clariana de Cardener ([read the local press article here](#)) was explored with the participation of:

- Martí Madorell (ARC Waste Agency of Catalonia)
- Toni Jiménez (CC Solsones)
- Miquel Turmo (Gruas Construction)
- Francesc Rosell (Bianna)
- Jordi Fargas (UTE Solsonès)
- Montse Garcia (Ecogest)
- Rosa Coll (UTE Solsonès)
- Raquel Barrena (UAB Autonomous University of Barcelona)

“This pre-treatment plant is characterized by its robustness and simple technologies, due to its flexibility and ability to adapt to changing conditions, and for the containment of management expenses. For its conception and versatility it is considered a pioneering and innovative project in Catalonia called mmasystem”. The plant described was originally implemented in order to comply with the European Directive 1999/31/CE and it is currently considered energetically and environmentally sustainable. It was possible, in fact:

- To reduce the generation of biogas and leachate;
- To extend the life of the landfill (36% of volume recovered);
- To minimise the problem of finding new spaces to build new landfills, first being able to optimize existing ones;
- To value waste products such as ferric, compost and biostabilized;
- To reduce social problems NIMBY

The day trip ended up with the visit of the entire plant. A detailed explanation of the process from the crushing of the material to the biological and mechanical treatment was provided.

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