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Topic: Recycling

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"Fri3Oil system, the new concept in refrigeration and air conditioning"
Fernando Gutiérrez Antolín (CSF, Spain)

Appropriate Technologies for Plastic Recycling in Saharawi refugees camp, South Algeria

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1. The Saharawi refugees camp

During the 1975 people living in Western Sahara, after the Marocco's occupation, began to leave their cities, and settling in the hinterland of Tindouf in Algeria. Since 1979 more of 250.000 people live in a refugees camp, under very bad conditions, struggling to survive in this inhospitable part of the Sahara Desert, and organizing camps structure like a real city. So, from 30 years people settled on the camp are living only thank to humanitarian aids, arriving from world communities.

1.1 The waste in the refugees camp

The consumption of food only from humanitarian aids cause the generation of a lot of solid waste (especially food packing) that create environmental impact and health risks. It was estimated the production of 1,5 kg/dia per capita of solid waste, constituted of the about 90% of packing: plastic, paper, cardboard, rubber, wood, textile and ferrous and not ferrous material.

Figure 1 Saharawi refugees camp

2. Appropriate Technologies for plastic recycling

Among all packaging the plastic have a really environmental impact and represents a very big consumption of non-renewable natural resources. Plastic represent about the 20% of total waste in Saharawi's camp. The creation of simple process for plastic recycling can help to reduce the environmental impacts.

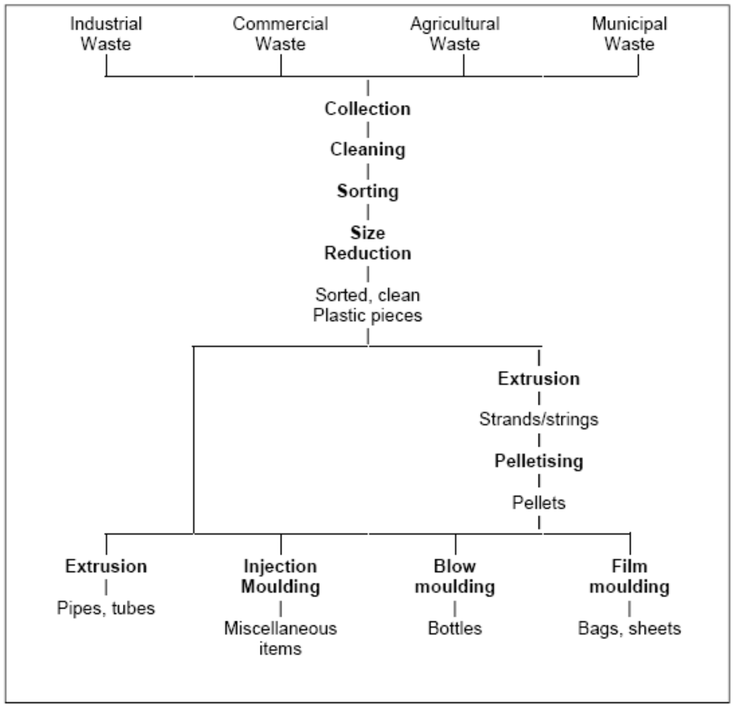

Figure 2 Typical sate plastic reprocessing stream in a low-income country that can be reproduced in a poor contest like Saharawi camp

Considering the contest, the process used for the recycling and manufacturing must implement appropriate technologies, that are the most appropriate and adapted to the environmental, cultural, economic and social contest where they are applied.

Simple machines like a little shredder to size reduction, injection moulding machine or film moulding machine to plastic manufacturing, can be used for the recycling. The products derived from recycling and manufacturing can be used to the creation of artisan products (like, bags, hats, toys and others). It can be allow the realization of “recycling laboratory” in the camp.

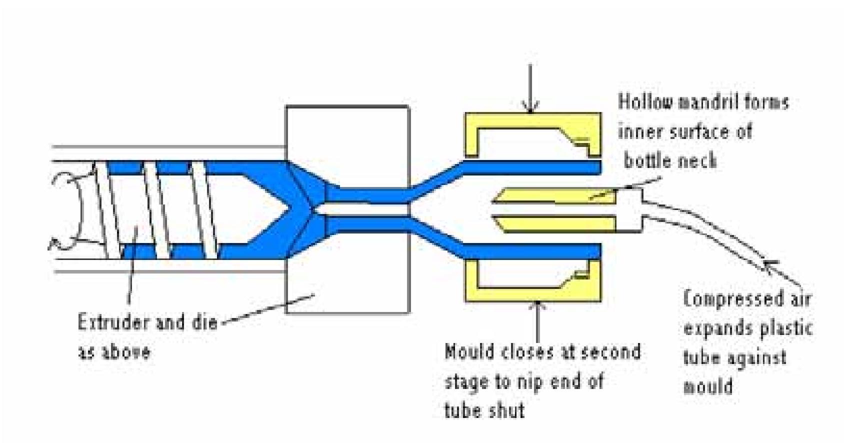

Figure 3 An Example of plastic manufacturing techniques: blow moulding scheme

3. Energy balance of plastic recycling

Focus on the environmental impact, it was conduced a comparison, developed with the Life Cycle Assessment (Simapro6), between the recycling of 1 kg of PET and its collection and discharge in landfill. It was considered a simple recycling process characterized on the use of a little shredder and a plastic injection moulding machine.

The figure below shows total impacts connected with the discharge and the recycling of 1 kg of PET.

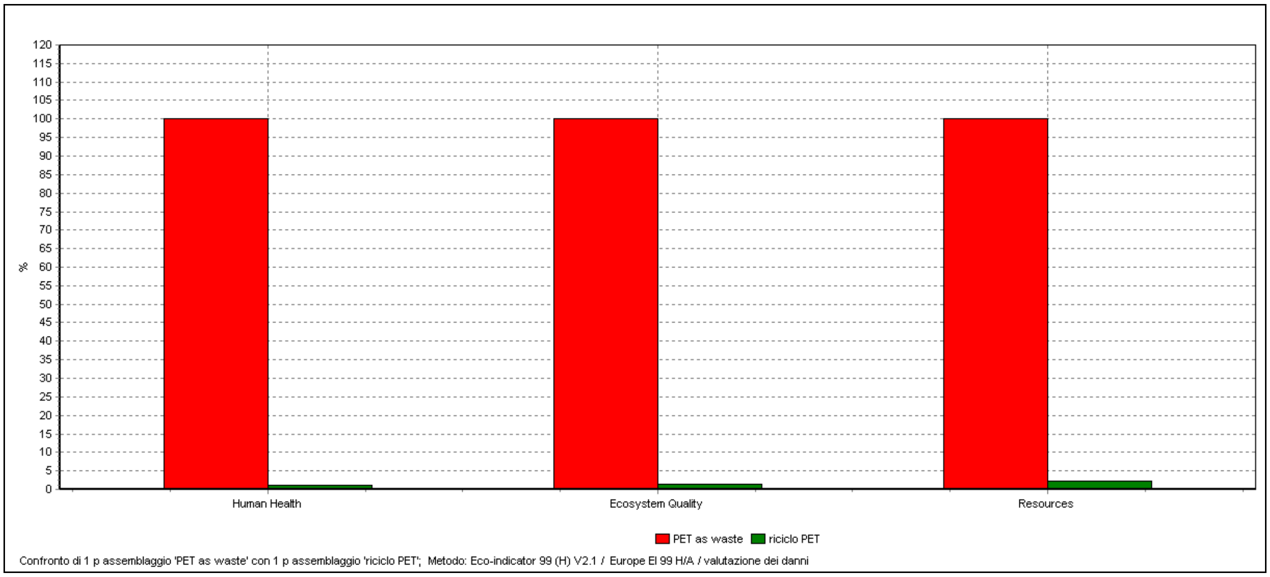

Figure 4 Contribute to Human Health, Ecosystem Quality and Resources

The following figures show the energy consumption, necessary to discharge of 1 kg of PET and to recycle the same quantity.

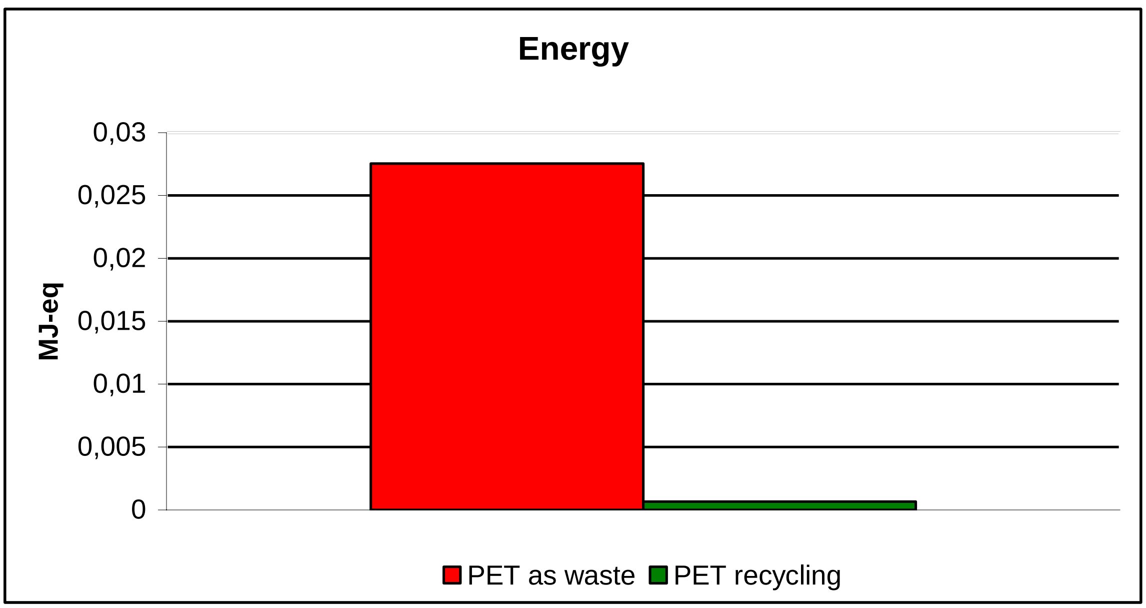

Figure 5 Energy consumption

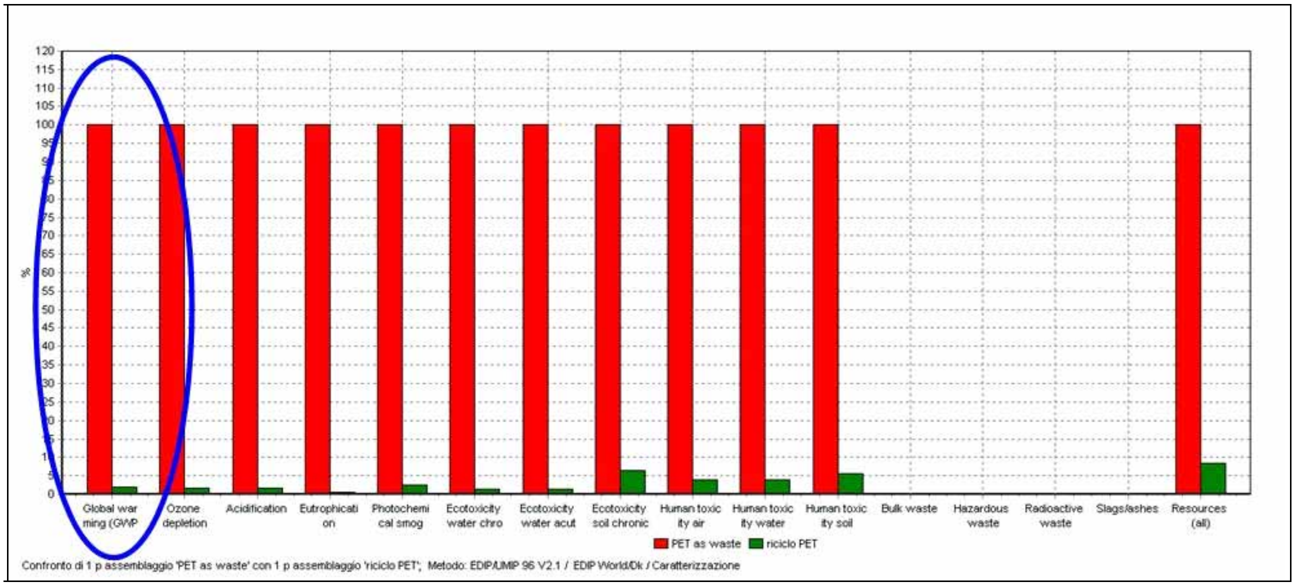

Figure 6 Contribute to Global Warming

4. Conclusion

The results of the Life Cycle Assessment show that plastic recycling reduces the environmental, social and economical impacts and the consumption of energy derived from non-renewable resources. Focus on the contest, it is important to say also that the creation of a recycling laboratory in a Saharawi refugees camp can give a social added value, because it can involve the population in social communitarian projects, and activities of environmental sensibilization.

Assessment of C&D waste recycling scenarios – Economics, Logistics and Environmental Impact

Johan Van Dessel, Jeroen Vrijders - BBRI *

BBRI – Belgian Building Research Institute is a scientific institute that started research in the field of demolition and building waste in the late 1970s. Since then BBRI has been involved in several project concerning construction and demolition waste and recycling. BBRI has extended experience via research projects and studies with selective demolition techniques and the technical and environmental quality of construction and demolition waste. BBRI is leading national normative activities regarding recycled aggregates and is present in the CEN TC 154 on aggregates.

The author Johan Van Dessel (info@bbri.be) is head of the division Sustainable Development and has a large experience on applied research and applications related to recycling and construction and demolition waste management.

For the construction of the new NATO Headquarters in Brussels, an army site containing over 60 buildings had to be demolished, resulting in 200 000 tonnes of inert waste. This huge amount of rubble has to be managed in an economical and environmental friendly way within an urban environment. BBRI found this case a perfect example to implement the knowledge developed within the EU FP5 IRMA project, in order to maximise the **economical benefit** of the project by optimising the amount of **recycled materials** in applications such as road foundations, concrete, … **on the site** itself in that way avoiding a lot of **transport** and **primary resource** use and thus minimising hindrance and **environmental impact** of the works. The study was elaborated in cooperation with the governmental body Brussels Environment.

In first instance, promising scenarios for recycling were developed. On the one hand, the choice has to be made to recycle on-site or off-site (or not to recycle at all). On the other hand, detailed on-site recycling scenarios had to be developed in order to assure that all inert material that originates on the site can be reused in the future applications.

NATO's PMT have chosen for full on-site recycling, based on a full **scenario assessment.** This assessment tool makes a comparison between the different scenarios in terms of **economy** (costs are the most important decision parameter for an owner/developer), **logistics** (timeframe, space available on site, hindrance for neighbours) and **environmental impact** (CO2-emission, PM-10, natural resource consumption …). Most important parameters in the evaluation are transport (distances and amounts of materials to be transported), costs and recycling percentage on site.

Results showed that in this case, on-site recycling is the best solution. It can save up to 350_000 km of traffic and as such also more than 300 tonnes of CO2 emissions. Also in terms of economics, the gain in on site recycling is 2 million € compared to off-site recycling. The assessment of the boundary conditions showed that there were no restrictions due to the timeframe or storage space on site.

Additional to the scenario assessment, a tender specification on waste management and recycling was elaborated. This tender document is based on the principle that the requirements are laid on the secondary aggregates, but that the demolition contractor is free to organise the demolishing works to his own insights. Important topics in the specifications are quality control, waste management and site logistics.

Co-Processing Waste Material in Energy-Intensive Industries (EII)

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Abstract

The University of Applied Sciences Northwestern Switzerland in cooperation with Geo Partner AG conducted a research study for determining the needs and for demonstrating the opportunities that waste material can offer if not looked at as unwanted nuisance but as a relevant element in the overall industrial production and consumption chain. The overall energy and material needs of the energy intensive industry (EII) has been analysed and compared with the material and energy content of generated waste qunatities.

The EII such as the steel, glass, cement, chemical, paper or lime industries, as well as power plant operators, are the world's main industrial energy and resource consumers and emitters of CO_2. The sector is coming more and more under political and public pressure to demonstrate its responsibility for reducing greenhouse gas emissions in the context of global warming. Additionally, volatile natural resource prices, such as fossil fuels and minerals during the last years reflect the need for enhanced resource management, too. The present political environment offers an excellent opportunity for the EIIs to promote and apply innovative concepts fostering a more sustainable production mode through the application of co-processing as a methodology for applied industrial ecology. Co-processing is meant as a direct recovery of energy and material from specific waste streams.

The study demonstrates the opportunities waste material can offer if used as an alternative fuel and raw material (AFR) and not looked at as unwanted left-over. In this context the potential of material and energy content of generated waste material is estimated and than combined with the overall energy and material needs of the EIIs. The investigation is focused on Europe but compares also the results with worldwide data.

Results and conclusions of the study are:

- Despite of efforts for increasing re-use and recycling quotas there are still huge amount of wastes which are disposed at sanitary landfill sites. The future EU ban of landfilling organic material requires complementary solutions to incineration.
- Anthropogenic stocks are growing reservoirs of many valuable resources and represent a huge potential for future recycling and co-processing. Urban mining (anthropogenic stocks) will become more and more important and thus resulting in a new culture of resource and end-of-life management.
- Co-processing of AFR as a substitute for virgin raw material and fossil fuels proofed to be a valuable element in sustainable development and to foster industrial ecology. However, the concept and its advantages are not yet sufficiently known to industrial and political decision makers.
- There is a need to determine criteria and basic principles for co-processing of waste material in collaborating industries in order to assure an optimized flow of the AFR and to secure best environmental practice. The application of best available technology (BAT) is obligatory.
- On a global level up to 28% of the energy need of EII (including power plants) could have been covered by waste material in 2004 with an increase of the substitution rate to 31% in the year 2030.
- Roughly 60% of the waste to be used for co-processing in EIIs and power plants is estimated to be CO_2 neutral. This appears to be a huge potential for contributing to ease the climate change problem.

The formation of alliances and the set-up of a network among EII is considered as a key step for allowing an optimized use of waste material.

Enhanced Recycling
Rob Sinclair (Natural Resources Canada)

I would like to respond to your call for papers. Natural Resources Canada (Government of Canada) had a program called Enhanced Recycling in which a direct link was established between recycling, energy efficiency and reduced greenhouse gas emissions. The program embraced a diversity of recycling initiatives but with respect to your conference theme I would propose focusing on the "Greenhouse Gas Implications of Waste Management" report that broke a lot of new ground in Canada on this very issue.

The study of interest was co-funded by Environment Canada and the Government of Canada's Action Plan 2000 on Climate Change (Natural Resources Canada). This study is actually an update of an earlier version from 2001. The newer work expanded the life cycle analysis, added new materials and improved the energy factors. Through a Request for Proposals, the update contract was awarded to ICF Consulting. ICF did the original work for Environment Canada and also developed extensive GHG materials for the U.S. EPA.

The objectives of the study were twofold: (1) To build capacity surrounding solid waste management options in relation to greenhouse gas (GHG) emissions; and (2) to attempt to quantify emission factors associated with Canadian residential as well as industrial, commercial and institutional waste management practices, from a life cycle perspective. The primary target audience is the municipal waste management planner but other policy makers find it of interest as well.

This report evaluated the effect of solid waste management activities (recycling, composting, landfill, combustion, and anaerobic digestion) on GHG emissions. This was accomplished through life-cycle assessments of materials such as aluminum cans, copper wire, steel cans, glass bottles, various types of paper, plastics, and organic waste. Material composition estimates for a number of other household items enabled the consultants to estimate the impact of end-of-life options for white goods (large appliances), personal computers, televisions, microwaves, VCRs and tires. The life cycle stages included raw materials acquisition, manufacturing and fabrication, and transportation. The energy profiles for primary and recyclable feedstock materials were calculated through these life cycle stages and comparisons made. The energy numbers were converted into carbon dioxide equivalents as the representative GHG emission. Depending on how the various materials or products are managed at their end-of-life, emission reductions or increases were then attributed to the waste management options compared. AS an example, if an aluminum can is disposed or recycled, a GHG emissions impact can be assessed.

The full report is available on the Recycling in Canada web site in English (http://www.recycle.nrcan.gc.ca/summaries_e.htm#33) and French (http://www.recycle.nrcan.gc.ca/summaries_f.htm#33). To maximize transparency, the report appendices contain all of the energy values used throughout the life cycle for each material examined. These data and the report itself were thoroughly peer reviewed. As our collective knowledge of life cycle analyses and greenhouse gas emissions improves, it is likely that this report will be updated again. This conference represents an excellent opportunity to exchange information on our respective progress towards a better understanding of waste management and some of its previously unknown implications.

The following is some information about myself:
Since March 2003, I have worked at Natural Resources Canada as a Recyclable Materials Policy Advisor. During the preceding eight years I was at the City of Ottawa, Solid Waste Services, implementing organic waste diversion pilots, co-collection trials and waste characterization audits (among many other activities). Prior to the City, I spent seven years as a waste management consultant for RIS in Brussels and Toronto on a variety of projects for both public and private sector clients in Canada, the US and Europe chiefly in the area of waste reduction and recycling. While in Brussels (1991-1994) I provided consulting assistance to ERRA as well as OVAM (Flanders).

“FRI$_3$OIL SYSTEM, THE NEW CONCEPT IN REFRIGERATION AND AIR CONDITIONING”

Fernando Gutiérrez Antolín.

Biography of the autor:

Fernando Gutiérrez Antolín is a Technical Industrial Engineer since 1.971 who has dedicated more than 35 years to the refrigeration, air conditioning and refrigerant gases sector.

Until 1989, he runned his own company as a contractor for refrigeration and Air Conditioning, with self-developed specific applications for adiabatic cooling & saturated air in vegetables and flowers.

Since 1.989 until 2.000 carried out the technical & commercial development of refrigerant gases in Spain for DU PONT DE NEUMOR INTERNATIONAL. With the company KIMIKAL, S.L. During these years, he gave more than 400 courses of: refrigerant gases, circuits cleaning, recycling, etc.

As a businessman, he has run more companies on other sectors. But, in 2004, he decided to create a system which could be able to reclaim and recycle refrigerant gases, and clean refrigeration circuits, called Fri3Oil System and which is now being used in more than 15 countries.

Summary:

The **EU** has promulgated Regulations which set the rules that must be fulfilled,
regardind the Environment, such as: 2037/200, or 842/2006, and other European Directives for the improvement of the *Climate Change*.

In refrigeration, the solution was to use new HFC refrigerants, which use entails the use of Polyol ester Oils (POE). These oils can be easily decomponed, creating acids inside refrigeration cirucuits, and contaminating refrigerants, and equipments.

Contaminated refrigerants must be sent to **Incineration Plants** for their destruction. With this method, they are producing more **CO_2** that will go to the atmosphere. So, it is recomendable to recycle “in situ”(on site) as it is indicated in the **European Regulation 2037/2000**.

But, still it is necessary to eliminate all those Ozone-layer-depleting-Chlorine Refrigerants. Professionals are able to do it now “on site” with this new tool.

Based on three main physical principles,

1. Miscibity & Solubility of the refrigerant with oils & acids.
2. Densities Decantation.
3. Liquids separation by refrigerant evaporation.

Fri$_3$Oil System is able to:

- Reclaim & recycle ON SITE all halocarbon refrigerants from any installation or equipment.
- Recycle equipments from dangerous oils, to extract raw materials from them
- Avoid incineration of contaminated refrigerants. This avoids emission of **CO_2**.
- Avoid emission of Chlorine Refrigerants which affect the ozone layer by the direct effect of their molecules.

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