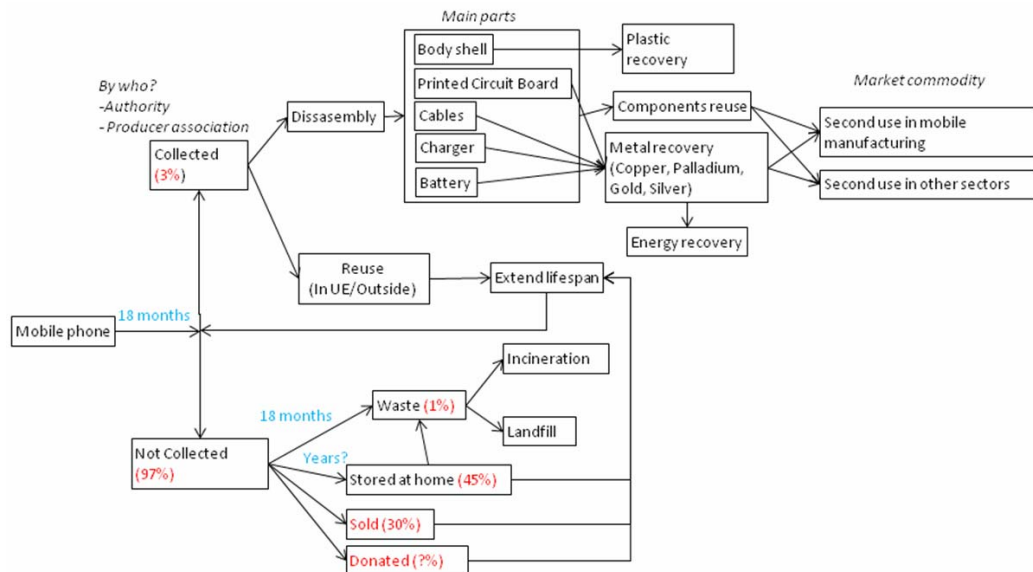


Research topic: Waste management scenarios of end-of-life multifunctional mobile phones

- Research line: Industrial ecology (material and energy flow analysis)
- Research group: SosteniPrA
- Project: PROSUITE www.prosuite.org



Directors:
Dra Gara Villalba Méndez
Dra Laura Talens Peiró



Main aim: Establish present and future waste management scenarios for end-of-life mobile phones in Europe.

Summary: Mobile phones along with other cutting edge technologies have increased the need for certain groups of metals, which are critical as they are relatively scarce, found in low concentrations or located in specific countries which have a high supply risk. For resource importing economies as Europe, end-of-life electronic devices as mobile phones are an important potential source of them. In this project, we will focus on studying the flows of materials and energy during the waste management of mobile phones. We will analyze the amount of mobile phones that are reused directly on secondary markets and the amounts that go to disassembly. From the last, the amount of plastics, metals and other components recycled today. See more information at the end of this document.

Bibliography:

Villalba, G, et al. 2011. "Technology forecasting of rare earth and scarce metal use ". ISIE 2011 conference, Berkeley.

Work plan

- Literature survey about waste management technologies and current recycling of mobile phones in Europe. By using:
 - CCUC and *ISI WebOfKnowledge*.
 - Contacts as the StEP initiative of the EC, recycling companies (Umicore and Greentronics) and mobile phone companies (Nokia, Sony Ericsson, LG, Apple, Hewlett-Packard, Sony Computers) which have already participated in the project.

- Comparison of different waste management technologies and definition of scenarios

- Assessment of the recycling of mobile phone

- Proposal for future waste management practices

- Estimate of the potential recycling rates

Research topic: Urban metabolism studies of southern Europe

Research group: Sostenipra (Industrial Ecology). With Aveiro University.

Project: Ecotech Sudoe- www.ecotechsudoe.eu



Directors:

Gara Villalba

Xavier Gabarell

Ana Claudia

Objective: The aim of the project is to study the metabolism flows of Barcelona, Aveiro and Marseille based on data already compiled and previous studies. Special emphasis will be placed on waste flows.

Summary: Urban metabolism studies are used to quantify resource consumption of cities (energy and material) in order to assess energy intensity, GHG emissions, resource efficiency and other measures that help us benchmark a city's progress toward sustainability. Based on material flow analysis, these studies can vary depending on how the system is defined, which flows are included, and if a life cycle analysis approach is used. This project will tackle these questions by comparing the metabolism of these three cities, for which a lot of data is already available.

References: Kennedy, C., Steinberger, J., Gasson, B., Hansen, Y., Hillman, T., Havrnek, M., Pataki, D., Phdungsilp, A., Ramaswami, A., and Villalba Mendez, G. (2009) Greenhouse Gas Emissions from Global Cities. *Environ. Sci. Technol.*, 43 (19), 7297–7302.

Kennedy, C., Steinberger, J., Gasson, B., Hansen, Y., Hillman, T., Havrnek, M., Pataki, D., Phdungsilp, A., Ramaswami, A., and Villalba Mendez, G (2009b) Methodology for inventorying greenhouse gas emissions from global cities. *Energy Policy* doi:10.1016/j.enpol.2009.08.050

4. Constraints for choice of diagnosis methodology

Study scale-s for the territories



	inhab	km ²	density
Região Centro	2 348 400	28 405	83
Distrito Aveiro	713 000	2 808	254
Baixo Vouga	385 700	1 800	214
Município de Aveiro	73 335	200	370
14 Freguesias			

	inhab	km ²	density
Catalunya	7 504 880	31 895	235
Província Barcelona	5 512 000	7 733	715
Ambit Metropol. de Barcelona	4 992 190	3 236	1 542
Àrea Metropolitana de Barcelona	3 218 000	636	5 060
Comarca Barcelonès	2 251 600	145	15 560
Barcelona	1 619 340	100	16 130

	inhab	km ²	density
PACA	4 951 400	31 400	158
Bouches du Rhône	2 008 600	5 087	395
Aire urbaine Aix-Marseille	1 418 500	1 290	1 100
Communauté urbaine MPM	1 047 300	672	1 560
Arrondissement de Marseille	1 039 700	605	1 720
Marseille	851 400	240	3 540
16 Arrondissements			

Research topic: Life Cycle Assessment of Cork sector in the Iberian Peninsula (IBERCORK)

Research group: Sostenipra (Industrial Ecology). With Aveiro University.
Project: Ecotech Sudoe. Biomass activity. (After Demeter project)



Directors:
Xavier Gabarell

Junior researcher:

Main aim: The main aim of this project is to study the cork sector in the Iberian Peninsula, both to forest level and to industrial level. It is necessary to obtain and to check Life Cycle Assessment (LCA) inventory data.

Summary: Today the Catalan Cork Sector is a worldwide leader on production and marketing of technical corks for sparkling wines and also ranks high in natural cork stoppers for still wines. Nowadays the world production of cork is approximately of 270.000 tons per year, which are obtained of a whole of 2.860.000 Has of cork oak forests distributed in the western area of the Mediterranean basin. Climatic conditions do that 80% of the world production of cork be concentrated in the Iberian Peninsula. The cork sector could be considered in two parts: on the one hand the forest management and for other one the cork industry, that includes the manufacture of natural cork stoppers for still wines, the manufacture of binded cork stoppers with discs of natural cork for sparkling wines, the auxiliary industry of cork stoppers and the manufacture of diverse products.

Research topic: Uncertainty in the assessment of non-seasonal food products

- Research line: Sostenibilitat i Agricultura
- Research group: SosteniPrA (Industrial Ecology)
- Project: LC-IMPACT



Directors:
Dr. Assumpció Antón

Main aim: To assess uncertainty in studies for non seasonal food products according qualitative methods

Summary: Environmental assessment of life cycle foods have shown the preference by local and seasonal products. The assessment of non seasonal foods means the assumption of data and models (e.i. frozen, chilling, refrigerated transport, storage) with a variable degree of uncertainty .

As a first approach we will follow the "ILCD data quality indicators" to classify the achieved data quality of LCI data and later we will calculate uncertainty for the main process involved in non seasonal foods.

REFERENCES

ILCD, (2010). *International Reference Life Cycle Data System Handbook*. European Commission. Joint Research Centre. Institute for Environment and Sustainability

Research topic: Carbon Sequestration and CO₂ footprint of greenhouse crops.

- Research line: **Sustainability and Agriculture**
- Research group: SosteniPrA (Industrial Ecology)
- Project: SOST-CO₂



Directors:

Pere Muñoz (IRTA)

Julia Martínez (ICTA)

Junior researcher:

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Main aim: Calculation of carbon sequestration and carbon footprint of several protected crops using organic or mineral fertilizers in a Mediterranean greenhouse

Summary:

Evaluate the environmental behavior of the products has become an essential issue, not only to fight against earth threats but also because consumers are demanding this information. Nowadays CF (PAS 2050; ISO 14067) is becoming a popular tool because it is easy to use and understand and the study is shorter and cheaper than other environmental methodologies. Carbon sequestration, produced when compost is applied to the experimental crops, has been recognized by the IPCC as one of the possible measures through which greenhouse gas emissions can be mitigated.

References:

- BSI, British Standard Institution (2011): PAS 2050:2011 - Specification for the assessment of the life cycle greenhouse gas emissions of goods and services.
- Martínez-Blanco, J., Antón, A., Rieradevall, J., Castellari, M., Muñoz, P., 2010. Comparing nutritional value and yield as functional units in the environmental assessment of horticultural production with organic or mineral fertilization. The case of Mediterranean cauliflower production. IJLCA DOI: 10.1007/s11367-010-0238-6.
- Pascual, P., M. Gasol, C., Martínez-Blanco, J., Oliver-Solà, J., Muñoz, P., Rieradevall, J. and Gabarrell, X. Calculation of CO₂ equivalent emissions in agri-food sector applying different methodologies. 7th International Conference on Life Cycle Assessment in the Agri-food Sector. Bari (Italy), September 22-24, 2010.

Research topic: ENVIRONMENTAL INDICATORS ASSOCIATED WITH URBAN VEGETATION PRODUCED IN NURSERY

- Research line: Sustainable Urban Systems
- Research group: Sostenipra (Industrial Ecology)

CONTACT: jordi@ineditinnova.com



Directors:

Dr. Jordi Oliver-Solà
Dr. Carles M. Gasol
Dr. Joan Rieradevall

Student:
Wanted

Main aim: Calculation of the capacity to fix carbon dioxide by different urban species.

Methodology:

1. Select a sample of individuals of different ages from different species.
2. Determination of fresh weight of the specimen.
3. Determination of the dry weight of the specimens. Plants are placed in an oven at 60°C for 3 days and weighed again, thus obtaining the dry weight.
4. Determination of carbon content in biomass.
5. Calculation of carbon stock in the specimens analyzed.

Objective:

To create new knowledge on the potential carbon fixation by urban vegetation, in the line of local policies for reducing GHG emissions and increasing fixation.

Research topic: SOCIAL LIFE CYCLE ASSESSMENT (S-LCA) APPLIED TO THE CATALAN CORK SECTOR

- Research line: LCSA Methodology
- Research group: Sostenipra (Industrial Ecology) *CONTACT: jordi@ineditinnova.com*



Directors:
Dr. Jordi Oliver-Solà
Dr. Carles M. Gasol
Tutor
Dr. Jesús Rives

Student:
Wanted

Main aim: To design and apply the S-LCA methodology to the Catalan Cork Sector. This project will start from previous experience of LCA results obtained in the CENIT DEMETER project. At the same time, this tool could be the first step for developing CSR reports in this sector.

Summary: Today the Catalan Cork Sector is a worldwide leader on production and marketing of technical corks for sparkling wines and also ranks high in natural cork stoppers for still wines. However, due to globalization, the sector is undergoing a period of changes in the functioning of business. And the environmental and social issues are among the ones that will determine its future success.

Concerning the methodology, Social Life Cycle Assessment (S-LCA) is part of the Life Cycle Sustainability Assessment (LCSA), currently under development by UNEP/SETAC LIFE CYCLE INITIATIVE.

Title: Waste management scenarios of end-of-life multifunctional mobile phones

Supervisors: Gara Villalba Méndez and Laura Talens Peiró

Contact e-mails: gara.villalba@uab.cat; laura.talenspeiro@insead.edu.

This project is embedded in PROSUITE, an EU collaborative project that aims to develop a coherent, scientifically sound methodology for the sustainability assessment of current and future technologies, taking into account their entire life cycle. PROSUITE will provide a free, open source software to assess the economic, environmental and social dimensions of well-developed technologies, and to ones that are just emerging in a standardized, comprehensive way. To demonstrate the methodology and tools, the twenty six European universities, research centers and companies that make up PROSUITE will deliver actual sustainability estimates for 4 technology cases: biorefinery technology, nanotechnology, carbon capture and storage and multifunctional mobile phones. The UAB is working on the mobile phone case study. More information: www.prosuite.org.

Mobile phones along with many other cutting edge technologies have increased the need for certain groups of metals, notably conductors (gold, silver and copper) and semi-conductors (especially gallium, tantalum and rare earths like neodymium), photo-detectors and photo-emitters. Some of these metals are critical as they are relatively scarce, found in low concentrations or located in specific countries (ie. China supplies more than 97% of rare earth metals), having as consequence a high supply risk. For resource importing economies as Europe, end-of-life mobile phones are an important potential source of these scarce metals.

The main objective of this project is to establish present and future waste management scenarios for end-of-life mobile phones in Europe.

The specific objectives are:

1. To determine present re-use and waste management scheme for mobile phones in Europe.
2. To develop and assess scenarios for future waste management technologies and future recovery and recycling rates of mobile devices in Europe.

Description of the working plan

In this project, we will focus on studying the flows of materials and energy during the waste management of mobile phones illustrated in figure 1. The potential life span of a mobile phone (excluding batteries) is over 10 years, however they are frequently replaced after 18 months (Nokia 2010). Of all phase out mobile phones, only about 3% are collected. From all collected mobile phones, there is an amount that goes to secondary markets and the rest goes to disassembly. During disassembly, mobile phones are separated in 5 main components: body shell, printed circuit board (PCB), cable, charger and battery. Some of these components are directly used in other



phones or other electronic devices, whereas the rest is recycled to recover metals that will be used in other mobile phones or electronic devices.

We will analyze the amount of mobile phones that are reused directly on secondary markets and the amounts that go to disassembly. From the last, the amount of plastics, metals and other components recycled today.

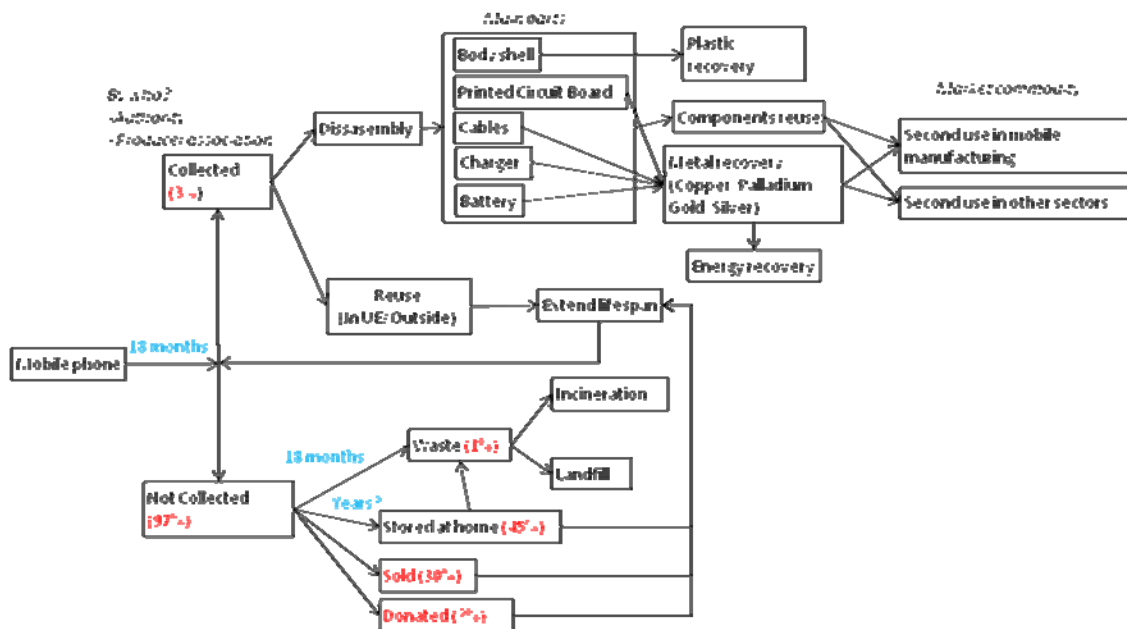


Figura 1. Waste management of mobile phones in Europe.

The potential improvement of the recycling of metals and plastics of mobile phones will be developed based on the amount of plastics and metals recycled today, and an inventory of materials used (this will be provided by the project PROSUITE).

During the project, we will contact different public bodies and companies working on the collection of electronic devices and mobile phones. For example, the *Agència de residus de Catalunya*, the StEP initiative of the European Commission, as well as Ecotic, Viuda Lauro Clariana, Synthesia, Tragamovil, Zoozoom, etc. At European level, we will contact the recycling companies Umicore¹ (Belgium) and Greentronics² (Romania), as well as the mobile phone companies Nokia, Sony Ericsson, LG, Apple, Hewlett-Packard, Sony Computers which have already participated in the project.

The results are expected to be published in an international index journal (such as *Environmental Science and Technology*, *Journal of Industrial Ecology or Resources*, *Conservation and Recycling*) and presented in the conference Green Electronics 2012. The candidate needs to have a good enough level of English to write, discuss, and have meetings. The candidate should also expect some travel, at the project's expense.

¹ Umicore web site: <http://www.unicore.com/en/>

² Greentronics web site: <http://www.greentronics.ro/Home-en/>