

Supplementary Material

Life Cycle Assessment in Higher Education: Design and Implementation of a Teaching Sequence Activity

Alberto Navajas^{1,2}, Itsaso Echarri¹, Luis M. Gandía^{1,2}, Jorge Pozuelo³, Esther Cascarosa^{3*}

¹Department of Science, Public University of Navarre (UPNA), Arrosadía Campus s/n, Pamplona, 31006, Spain

²Institute for Advanced Materials and Mathematics (InaMat2), Universidad Pública de Navarra (UPNA), Edificio Jerónimo de Ayaz, Campus de Arrosadía, Pamplona-Iruña, 31006, Spain

³Department of Specific Didactics, Faculty of Education, University of Zaragoza, c/Pedro Cerbuna 12, 50009, Zaragoza, Spain. BEAGLE research group and IUCA institute.

* Email corresponding author: ecascano@unizar.es; alberto.navajas@unavarra.es (A.N.); itsaso.echarri@unavarra.es (I.E.); lgandia@unavarra.es (L.M.G.); jpozuelo@unizar.es (J.P.M.).

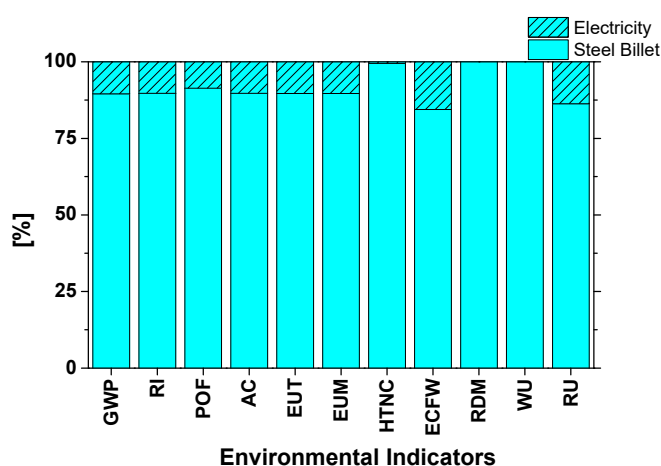


Figure S1- Contribution of steel billet and electricity to the total value of steel pieces LCA 11 EIIs.

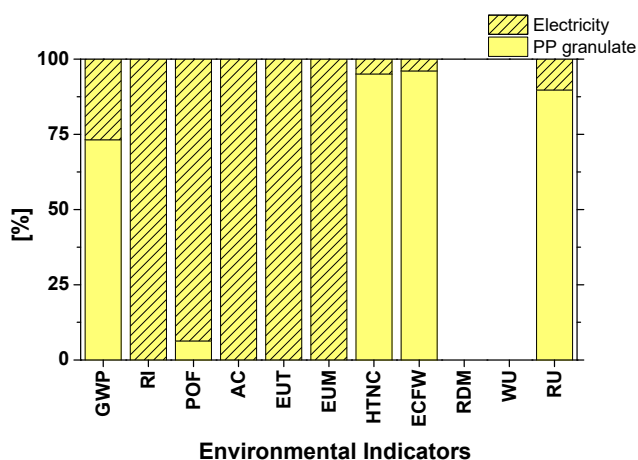


Figure S2- Contribution of PP granulate and electricity to the total value of PP pieces LCA 11 EIIs.

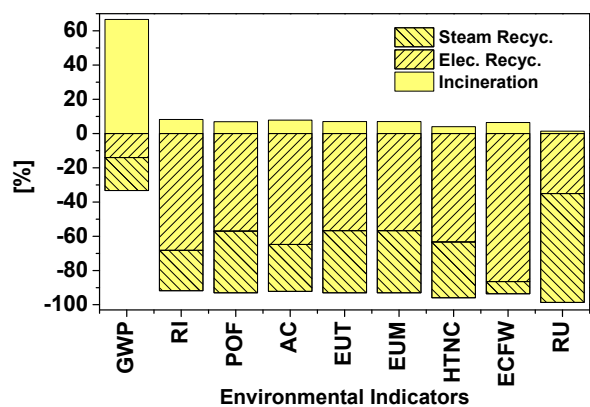


Figure S3 - Contribution of incineration, and electricity and steam recycling to the total value of 1 kg waste PP incineration end of life LCA 11 EILs.

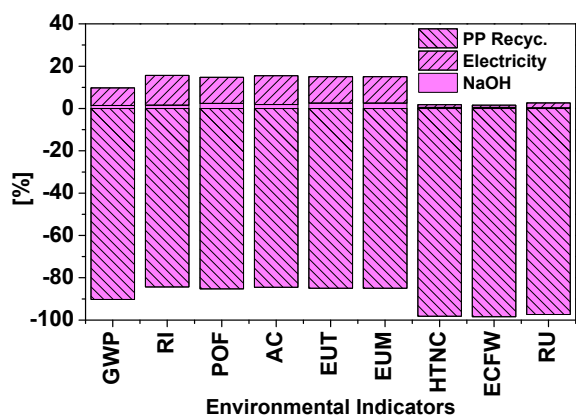


Figure S4 - Contribution of electricity, sodium hydroxide and PP recycling to the total value of 1 kg waste PP mechanical recycling end of life LCA 9 EILs.

Ecodesign midterm exam

Name....

1- (4 points) Determine the environmental impacts on the GWP, DRM and HTP indicators according to the life cycle stages of the following system:

	Raw Material extraction	Fabrication	Transport	Use	End of Life
Oil	15 MJ		23 MJ		
Natural Gas	13 MJ		15 MJ		
Coal	9.7 MJ				3.2 MJ
Benzene		0.5 kg	1 kg	2 kg	1.2 kg
CO ₂		1.2 kg	12 kg	10 kg	
CH ₄		0.6 kg		1.2 kg	1.5 kg

2- (3 points) You want to replace an aluminum window with a PVC one and you want to know which of the two has the greater carbon footprint [kg CO₂ Eq.]. It is known that the aluminum one lasts 5.5 years while the PVC one does 3.8 years. The functional unit of the study is the use of the window for 20 years. The following data are available:

[kg]	Al ingot[1kg]	PVC granulate [1 kg]	Electricity [1 kWh]
CO ₂	1.2	2.3	4.5
CH ₄	0.7	1.2	2.3

Manufacture of 1 Al window	
Electricity [kWh]	Al ingot [kg]
12.3	5.6

Manufacture of 1 PVC window

Electricity [kWh]	PVC granulate [kg]
9.8	3.4

3- (3 points) It is known that a domestic oven has a power of 80 kW. Determine the kg of CO₂ emitted when the oven is used for 45 minutes at its maximum power, knowing that the electrical mix in the area is made up of 40% renewable energy and 60% natural gas.