ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

DUWIS
Department of
Environmental Sciences

UNS
Umweltnatur- und Umweltsozialwissenschaften
Natural and Social Science Interface

Using the Swiss ecological input-output analysis 2005 in municipal solid waste management – the case of glass packages

Helen Ami, Grégoire Meylan, Natural and Social Sciences Interface (NSSI), ETH Zürich

LCA Discussion Forum 45: Environmentally-Extended Input-Output Analysis and LCA

15 September 2011

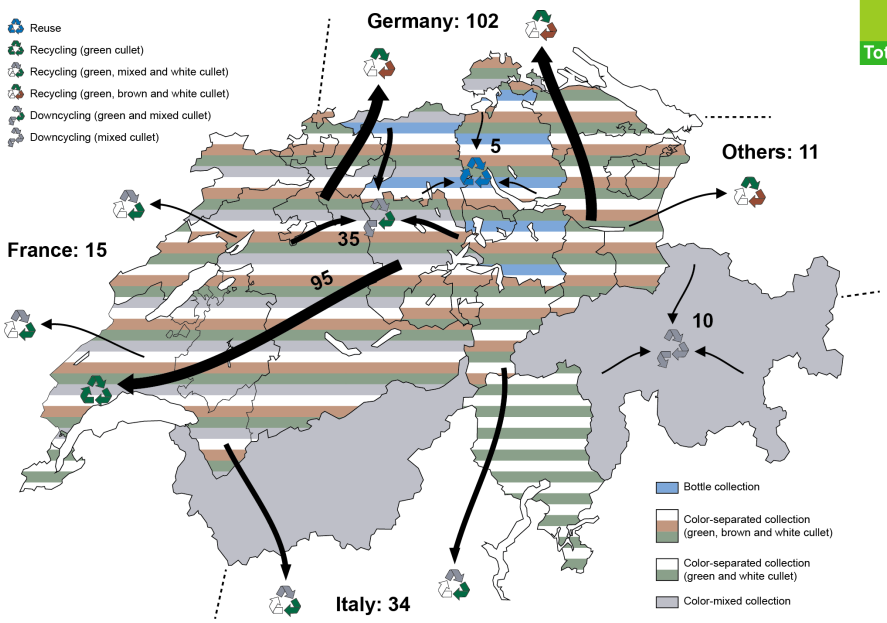
Background and goal of study

Guiding questions:

1) What are meaningful future options for the management of discarded glass packages and dismantled flat glass for construction?

2) What is the eco-efficiency of today's system and of future options?

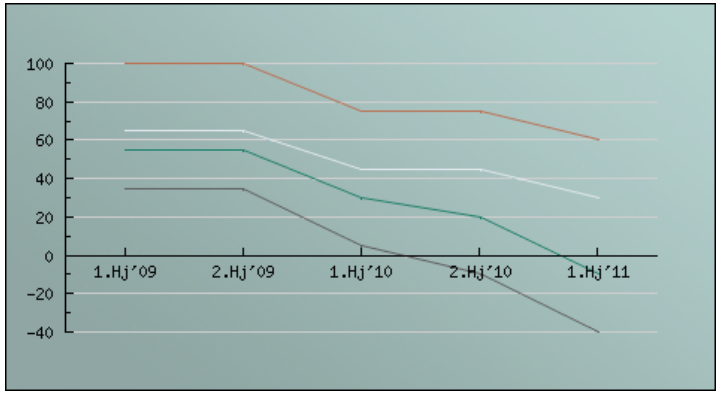
System highly embedded in EU context



An Anticipated Disposal Fee on glass packages

Type of collection and recovery		Waste glas quantity Tons	Percentage %	Compensation rate CHF/t	Total compensation CHF
Bottles for reuse as beverage packaging	2009	4,861.323	1.54%	100.00	486,132.300
Color-separated cullet for the production of new glass 100% or ecologically high-grade products	2009	220,492.327	69.78%	100.00	22,049,232.700
Color-mixed cullet for the production of new glass	2009	45,089.717	14.27%	60.00	2,705,383.020
waste glass for processing to ecologically high-grade products	2009	44,989.080	14.24%	60.00	2,699,344.800
remaining waste glass (e.g. for recovery as sand substitute)	2009	541.247	0.17%	20.00	10,824.940
Total compensation for waste glass		315,973.694	100.00%		27,950,917.760

Falling cullet prices



Waste input-output model (See work from Nakamura and colleagues)

	Goods and services sectors					Treatment sectors				
	Agriculture & Food	Construc-tion	Goods	Machines	Electricity	Glass packages	Glass-based insulation	EPS-based insulation	Inland final demand	Export
Agriculture & Food Construction Goods Machines Electricity	$A_{I,I}$ (CHF/CHF output)					$A_{I,II}$ (CHF/ton of waste)			$X_{I,F}$	$X_{I,F}$
Glass packages Glass-based insulation EPS-based insulation	$SG_{.,I}$ (tons of waste/CHF output)					$SG_{.,II}$ (tons of waste/ton of waste)			$SW_{.,F}$	
Import of goods	R (e.g. CO_2/CHF ouput)					R (e.g. UBP/ton of waste)				
Import of services	R					R				
Direct environmental impacts	R					R			$E_{.,F}$	

$$e = R\left(I - \begin{pmatrix} A_{I,I} & A_{I,II} \\ SG_{.,I} & SG_{.,II} \end{pmatrix}\right)^{-1} \begin{pmatrix} X_{I,F} \\ SW_{.,I} \end{pmatrix} + E_{.,F}$$

Some issues to be solved…

- Too few enterprises in one branch in Switzerland
  - Difficulties to get economic data when disaggregating a subsector
  - Could we develop a common strategy to acquire such data in view of upcoming hybrid LCAs?
- High level of sector aggregation of Swiss EE-IOA
  - E.g. utilities sector (energy, gas and water)
  - Is such disaggregation planned?
- Choice of eco-efficiency indicators for an economic subsystem
  - What economic indicator (inputs, added value, with or without exports/ imports, total output) do we use? What environmental indicator (direct impacts, imported/exported impacts)?

Some issues to be solved…

- Modeling waste exports
  - If money flow (different $X_{I,F}$ for each type of cullet), then the more expensive the cullet, the higher the environmental impacts in Switzerland
  - Possible solution: final demand of "public services", allocation of material flow and environmental impacts
- Capital goods
  - How can we take into consideration investments in e.g. new furnaces?
- Consequential considerations
  - First step: changes in glass disposal system are compensated by imports/ exports
  - Second step: changes in glass recycling system are compensated by changes in other systems (EPS-based insulation). In this case, how should we model EPS production (through disaggregation or final demand)?