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ADAPTING EXISTING LIFE CYCLE INVENTORY OF BUILDING PRODUCTS FOR THE BRAZILIAN CONTEXT

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We need to select the lest impacting technology.
Choosing by use LCA indicators

Introduction

✓ In Brazil

- exist few LCI (*Life Cycle Inventory*) data
- when available they are calculated using different rules
- until now no central database has been developed
- difficult the environmental assessment of buildings based on LCA – *Life Cycle Assessment*

Hypothesis: adapting existing background LCI databases to Brazilian context can be consistent and more adapted way than having no data or non-adapted data

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Introduction

✓ Main benefits

– take advantages of the completeness of the background databases

– possibility of changing the foreground data considering the national practices (e.g. *energy distance and truck load*)

Introduction

- ✓ Sectorial databases present cumulative LCI and is not recommended to directly reuse for other contexts (e.g. South America)

- ✓ In opposite, the Ecoinvent data are breakdown into processes with raw data and LCI data that can be adapted for a new context using LCA software (e.g. GaBi, SimaPro)

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Objective

Presenting an approach to adapt existing LCI data of building products for the Brazilian context which can be used to conduct an environmental assessment of buildings.

Research method and analysis

- ✓ The approach is based on
  - analyses of Brazilian and generic LCI data
  - adaptation of LCI data for the Brazilian context
- ✓ The Brazilian data used were taken from previous studies (*Lima, 2010; Souza, 2012; Saade 2010; Campos, 2011 and Punhagui,2012*)
- ✓ Selected Ecoinvent v. 2.2 and the software SIMAPRO v. 7.3 to LCI adaptation
- ✓ The feasibility of the approach is supported by comparing environmental indicators of concrete, considering the Brazilian, original and adapted LCI data

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Preliminary approach to adapt LCI data for the Brazilian context

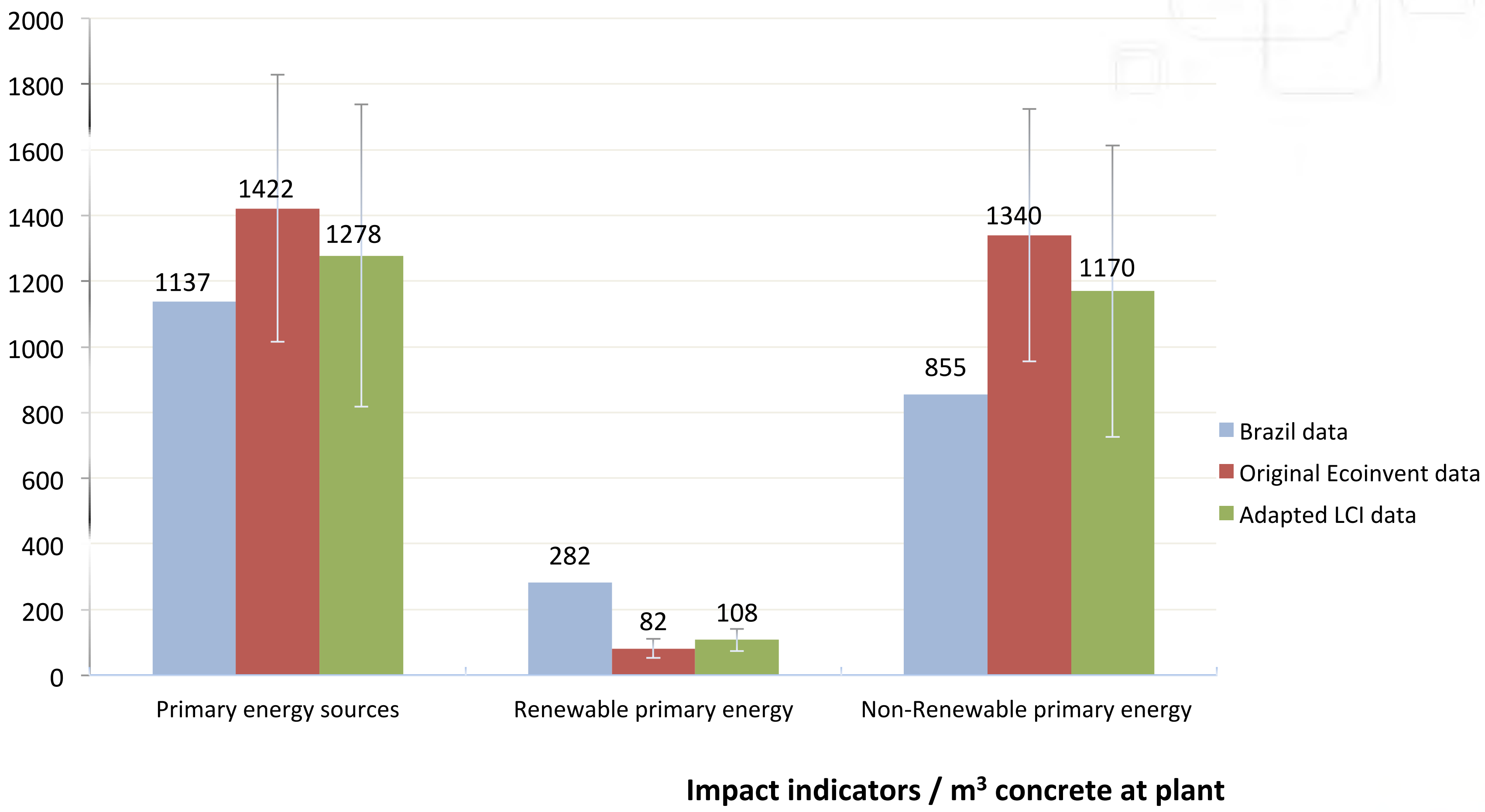
Table 1- Adapting existing LCI data for the Brazilian context (adaptation of *Colodel, 2008; HODKOVA and LASVAUX, 2012*)

1- Goal and scope definition
2- Selection of a Generic LCI data (adoption of Ecoinvent database)
3- Identify the Brazilian context and indicators – Overview the differences related to energy mix, technologies/process, market size, etc – *Top down*
4- Adapt the generic data base inputs related to the process - Overview the inputs of the inventories concerning the process - amount of raw materials, transport distance, etc – *Bottom up*
5-Verify the data quality of the inputs data – identity the uncertain values adopted on Ecoinvent
6- Set the impacts indicators to be considered and analyzed: consumption of primary energy; consumption of the non-renewable energy; climate change; water consumption and waste generation
7- Selecting on SIMAPRO the method to calculate the impacts, also considering the standard deviation by Monte Carlo simulation
select the French method that integrates IPCC, CML and CED
8- Results presentation- Set a worksheet model to be fulfilled for each LCI adapted, warranting reliability and transparence
9- Data Analyses - Macro Comparisons among environmental indicators calculated by Brazilian LCI, original and adapted LCI
10- Others observations

Table 2 – Adaptations of Life cycle inventory (LCI) data from Ecoinvent to Brazilian context – normal concrete, at plant

Original Ecoinvent Inputs				Changed Inputs	Ecoinvent adapted inputs			deviation comparisons	
No.	Parameters	initial amount	functional unit	Parameters Changed	new input	assumptions	demonstrative calculus	Ecoinvent	Brazilian context
1	concrete mixing plant CH U	4,57E-07	unit						
2	diesel, burned in building machine GLO U	22,7	MJ						
3	disposal, concrete, 5% water, to inert material landfill	16,9	kg						
4	disposal, municipal solid waste, 22.9% water, to municipal incineration	0,0951	kg						
5	electricity, medium voltage, at grid CH U	4,36	kwh	Brazilian energy matrix	2,0500	Brazil specific data (Souza, 2012)		1,21	1,21
6	gravel, round, at mine CH U	1890,00	kg						
7	heavy fuel oil, burned in industrial furnace 1MW, non-modulating CH U	3,09	MJ						
8	light fuel oil, burned in industrial furnace 1MW, non-modulating CH U	13,3	MJ						
9	lubricating oil, at plant RER U	0,0119	kg						
10	natural gas, burned in industrial furnace low-NOx >100kW RER U	1,16	MJ	remove	0,0000	not used to concrete production in Brazil (generic data)			
11	Portland cement, strength class Z 42.5, at plant CH U	300	kg	module cement BR	300kg			1,3	1,3
12	steel, low-alloyed, at plant RER U	0,0238	kg						
13	synthetic rubber, at plant RER U	0,00713	kg						
14	tap water, at user CH U	186,00	kg	Changed amount	170,00	Brazil specific data (Souza, 2012)			
15	transport, barge RER U	4,92E+01	tkm	remove	0,0000	changed by lorry			
16	transport, freight, rail CH U	6,82	tkm	remove	0,0000	changed by lorry			
17	transport, lorry 3.5-20t, fleet average CH U	0,998	tkm	remove	0,0000				
18	transport, lorry 20-28t, fleet average CH U	9,44	tkm	remove	0,0000	transport of cement, sand, gravel to construction site by truck	*	2	2
19	transport, lorry >32t	0	tkm	included	193,0900		*	2	
19	treatment, concrete production effluent, to wastewater treatment, class 3 CH U	0,0143	m3						
20	concrete, normal, at plant CH U	1	m3						

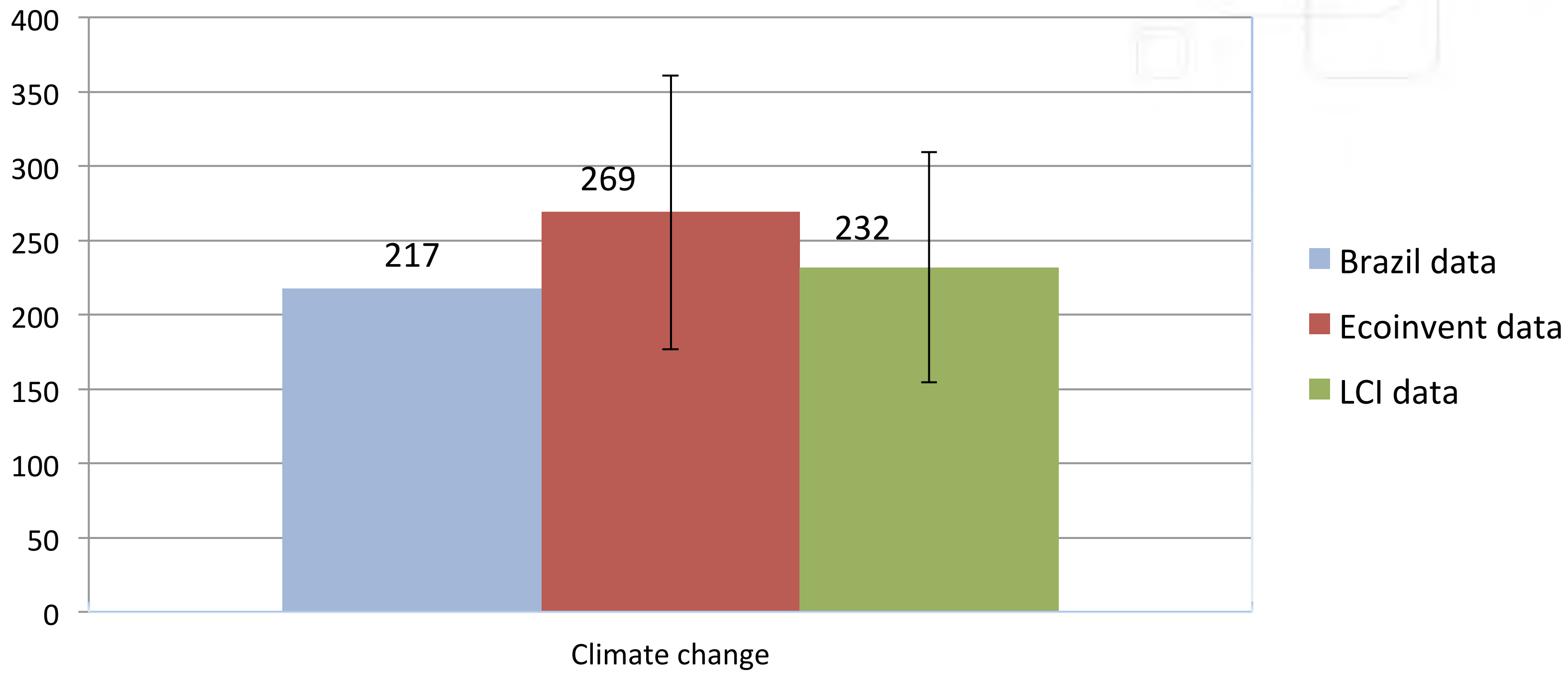
Example of application -
Environmental indicator of concrete at plant



Graphic 1 – Comparison among primary energy, renewable energy and non-renewable energy indicators calculated from Brazilian, Ecoinvent and adapted LCI data

Example of application-

Environmental indicator of concrete at plant



Impact indicators/ m3 concrete at plant

Graphic 2 – Comparison among climate change (kgCo_2 equiv/ m^3 concrete) indicators calculated from Brazilian, Ecoinvent and adapted LCI data

Conclusions

- ✓ The LCA results represent one generic database
- ✓ The adaptation from Ecoinvent data is suggested to facilitate the environmental assessment of buildings using consistent yet not fully representative datasets
- ✓ The results of the concrete at plant show the adapted LCI data have less impact than the original LCI (differences between 5% and 10% - energy and global warming potential)
- ✓ The efficiency of the Brazilian energy mix despite the large consumption of the non-renewable energy due to the type and distance of transportation

Conclusions

and **now**

- ✓ The adapted LCI must now be improved by working closely with Brazilian producers to get
  - more accurate generic data for Brazil or
  - specific data representing different manufacturers
- ✓ at IPT two researches have just began aiming collected these data closely to producers

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THANK YOU!

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