Emergy Accounting of a Course of Management at the Federal Institute of Southern Minas Gerais: A Case Study

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Creation of the Federal Institutes of Education, Science and Technology through federal law # 11.892 of 2008, as a part of the expansion plan of the Federal Schools Chain implies construction and/or adequation of *campi* infrastructure and remote units.

The offer of technical teaching includes Distance Teaching as a means of inclusion for students living in locations unnatended by physical units of the institute and /or are unable to attend standard school hours.

IFSULDEMINAS in 2009:

3 campi

6,611 enrolled students

Expansion of IFSULDEMINAS

IFSULDEMINAS today: 26,000+ students

This case study puts forward a discussion about the implicit environmental budget behind the expansion of IFSULDEMINAS *in-campus and out-of campus* infrastructure by analyzing the environmental investment necessary to offer a course of Technical Management given in an average classroom environment, which will later be compared to that of an online version of a similar course, as well as their impact on the environment from carbon dioxide emissions.

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General Objective of this study:

The aim of this work is to use Emergy accounting to assess the investment in natural resources necessary to build the infrastructure and operate a technical course of Management while evidencing the implications of the institutional action both inside and outside the campus, providing the board of directors with a broader view of the question of investment in campus expansion. This analisys covers the full two-year long cycle of the course duration.

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Methodology

Emergy Environmental accounting:

A methodology which allows for the accounting of energy inflows of different types by converting those into a common base: the solar energy Joule.

Energy source:

Renewable (R), Non-renewable (N) and/or Economy Feedback (F) resources.

"Emergy is the available solar energy used directly or indirectly to obtain a product or servisse, including the contributions from nature and economy."

(ODUM, 1996)

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Methodology

J(joule)
g (gram)
m^3 (cubic metre)

X

transformity
or **UEV**

= **EMERGY**
(seJ/time)

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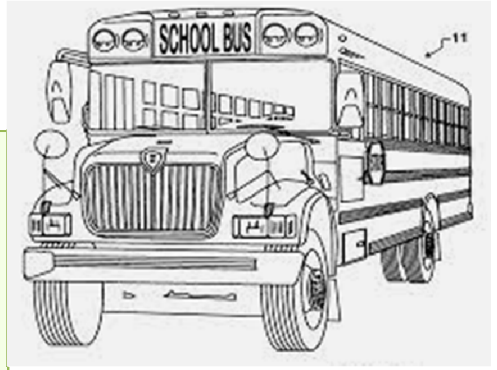
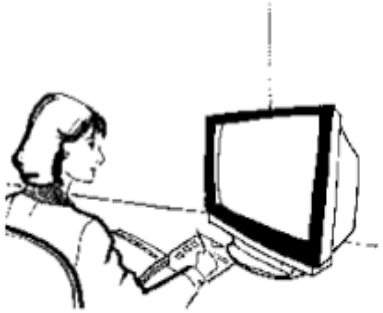
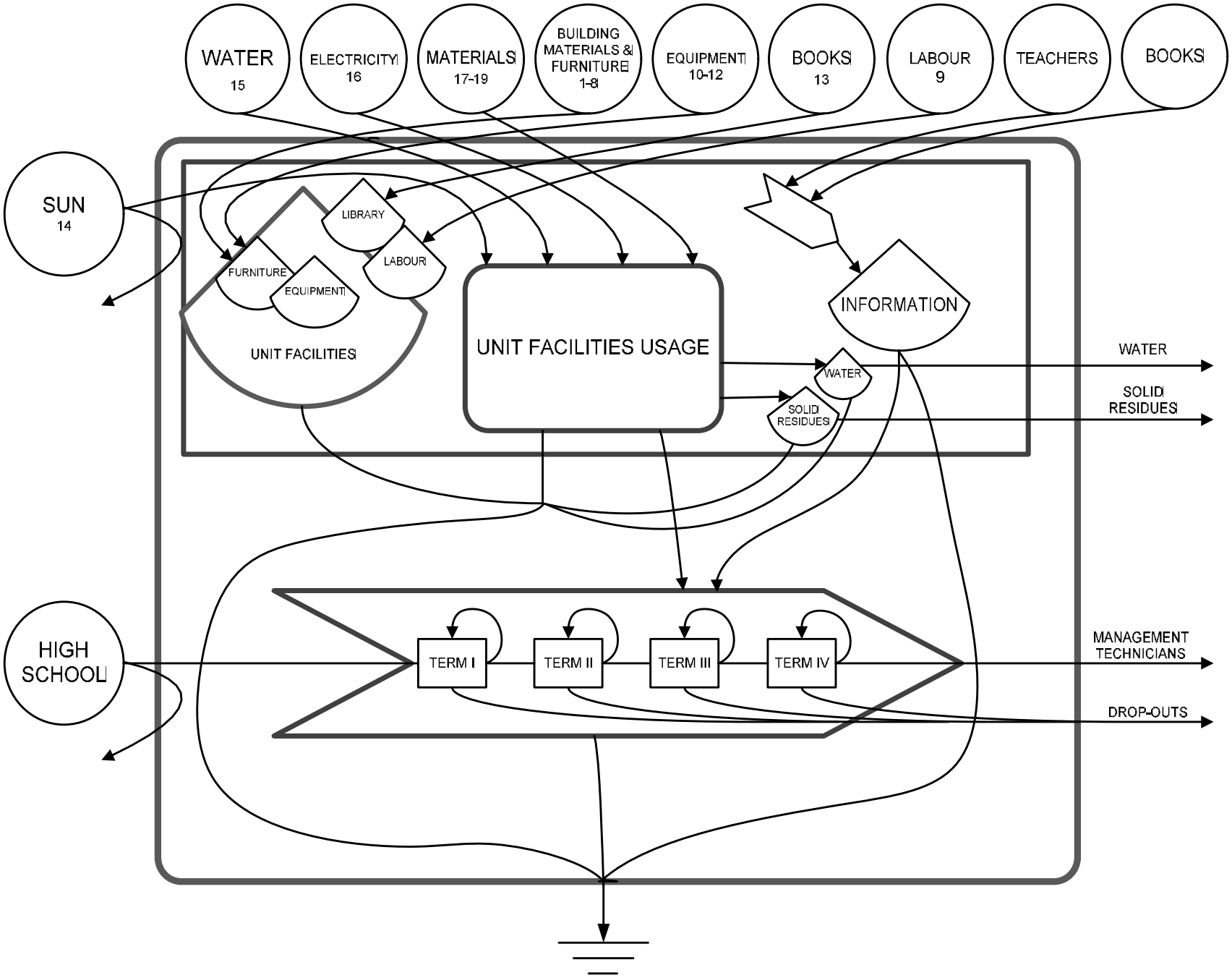
This study's object:



A class group of the Technical Course of Management (post high-school level);
The unit occupies 86,5m² within the *Escola Municipal Vilma Pieroni* premises in Jacutinga-MG;
40 seats offered;
34 currently attending students.



Results


WATER
15
ELECTRICITY
16
MATERIALS
17-19
BUILDING MATERIALS & FURNITURE
1-8
EQUIPMENT
10-12
BOOKS
13
LABOUR
9
TEACHERS
BOOKS
SUN
14
LIBRARY
FURNITURE
EQUIPMENT
LABOUR
UNIT FACILITIES
UNIT FACILITIES USAGE
INFORMATION
WATER
SOLID RESIDUES
WATER
SOLID RESIDUES
HIGH SCHOOL
TERM I
TERM II
TERM III
TERM IV
MANAGEMENT TECHNICIANS
DROP-OUTS

Item	Description	Unit/ 2 years	Quantity (unit)	Emergy/unit (seJ/unit)	Emergy (seJ)
	Building implementation				
1	Concrete	g	1.30E+07	1.54E+09	2.00E+16
2	Steel	g	4.03E+05	4.15E+09	1.67E+15
3	Wood	g	1.94E+04	8.79E+08	1.71E+13
4	Plastic	g	4.42E+02	5.75E+09	2.54E+12
5	Iron	g	3.42E+04	4.15E+09	1.42E+14
6	Ceramics	g	2.69E+05	3.06E+09	8.23E+14
7	Glass (windows, doors)	g	1.34E+04	2.16E+09	2.89E+13
8	Glass (lamps)	g	3.52E+02	2.16E+09	7.60E+11
9	Labour	J	2.17E+09	4.30E+06	9.33E+15
10	Computers	g	1.50E+04	8.90E+10	1.34E+15
11	Data projector	g	1.44E+03	1.13E+11	1.63E+14
12	Fan	g	2.88E+03	4.10E+09	1.18E+13
13	Books (library stock)	J	1.23E+05	3.45E+09	4.24E+14
	Total phase emergy				**3.40E+16**

Item	Description	Unit/ 2 years	Quantity (unit)	Emergy/unit (seJ/unit)	Emergy (seJ)
	Building usage				
14	Sun	J	5.25E+09	1	5.25E+09
15	Water (from well)	m3	9.52E+01	7.75E+11	7.38E+13
16	Electricity	J	1.17E+10	2.77E+05	3.25E+15
17	Paper	g	1.29E+05	2.38E+09	3.07E+14
18	Paper (towels and toilet)	g	4.23E+04	2.38E+09	1.01E+14
19	Plastic (cups)	g	1.94E+04	5.76E+09	1.12E+14
20	Workbooks (total in 2 years)	J	2.34E+06	3.45E+09	8.07E+15
	Total phase emergy				**1.19E+16**

Item	Description	Unit/ 2 years	Quantity (unit)	Emergy/unit (seJ/unit)	Emergy (seJ)
	Access to information				
21	Bus	g	1.67E+06	4.15E+09	6.92E+15
22	Diesel oil	J	1.89E+11	1.13E+05	2.13E+16
23	Labour (bus driver)	J	4.12E+08	4.30E+06	1.77E+15
	Total phase emergy				**3.00E+16**

+65%

Item	Description	Unit/ 2 years	Quantity (unit)	Emergy/unit (seJ/unit)	Emergy (seJ)
	Information (Odum)				
24	Information transmitted by teachers	J	1.48E+07	2.08E+11	3.08E+18
25	Information transmitted by books (1%)	J	2.46E+04	3.45E+09	8.49E+13
26	Students' previous information - (10%)	J	1.37E+09	1.80E+09	2.46E+18
	Total phase emergy				**5.54E+18**

Accounting summary

Phase	seJ
Building implementation	3.40E+16
Building usage	1.19E+16
Access to information	3.00E+16
Information	5.54E+18
Total	**5.63E+18**

Partial conclusions:

- The investment in natural resources backing the infrastructure increases 65% with the inclusion of the environmental costs related to the students' transportation, an input not considered in other authors' works on educational systems.
- Due to its high transformity value, most of the system emergy derives from the information flows, as predictable.

Thank you!

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