Carbon Footprint of the Coffee Roasting Process Based on Two Technologies with Different Sources of Energy in Peru

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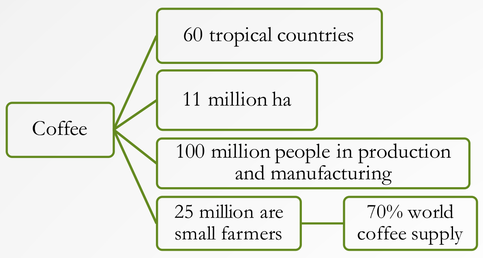
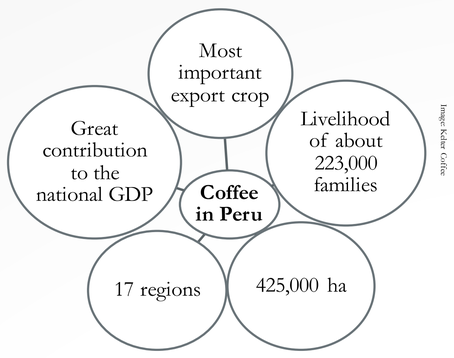
Intro

- Coffee is one of the most valuable and the most widely- traded commodities in the world .





Access to electricity in Peru accounts 92% (2014)

In Junin, <50% of the population do not have access to electricity

Diario Correo, 2015

In Satipo,
- coffee contributes to GDP up to 90%
- half of the population livelihood depend on this crop
- 50% of the arable land is for coffee
- coffee production accounts 27% of the national producion

- Climate change is changing weather patterns. Rain are no longer predictable and coffee production is not consistent.

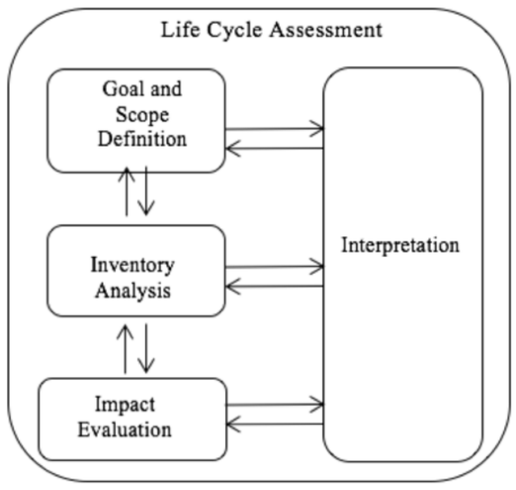
Strategies for the development of the sector?

Climate change, mitigation strategy: use of renewable energy and the implementation of clean energy technologies in the sector

Aim of the Research

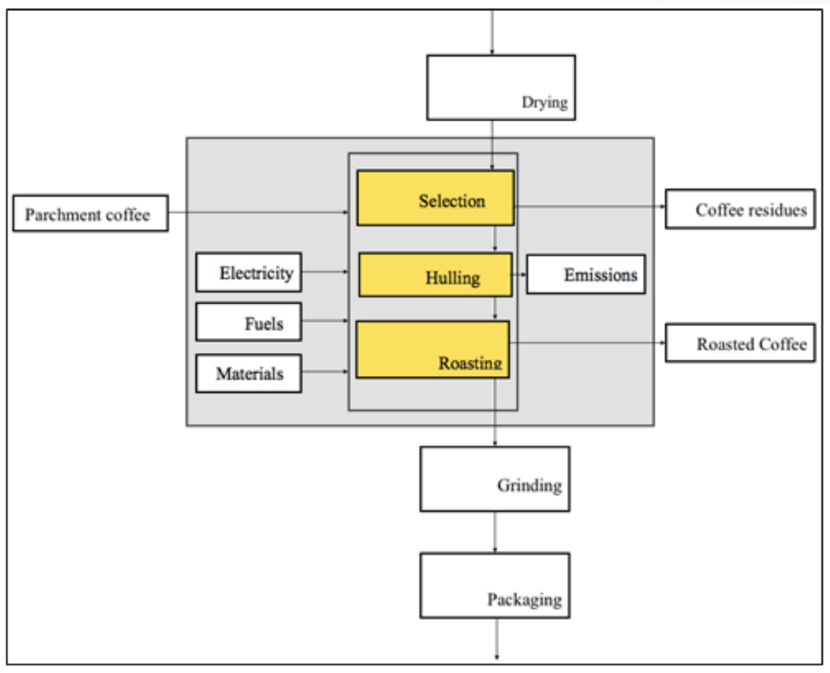
To determine and to compare the Carbon Footprint of the coffee roasting process carried out by using two technologies with different sources of energy. To this aim, two coffee roasting companies were selected in the rainforest of Peru.
These companies apply concentrated solar and photovoltaic energy, and electricity from the local grid as source of energy during the coffee roasting process.

Methodology



ISO 14040/SimaPro
Functional unit: 1kg de café tostado
Impact Category: Global Warming Potential (kg CO2-eq) ≈ Carbon Footprint

Limits of the System

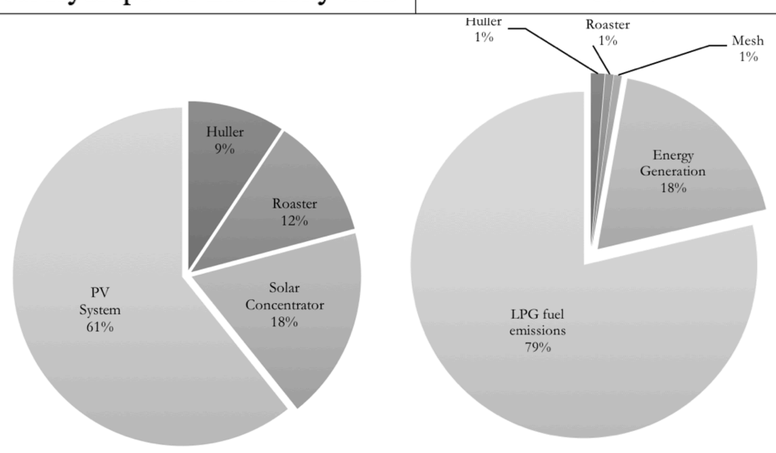


Company	Solar Energy based	Local Electricity Grid based
Location	Rural area, rain forest	Urban area
Energy source	Photovoltaic, Concentrating Solar	Electricity, LPG
Annual production of roasted coffee (kg)	705.4	1772.1
Roasted coffee medium degree production (%)	100	70
Material based stages	Hulling, Roasting	Selection, Hulling, Roasting

Results

1. Carbon Footprint of the Coffee Roasting Process

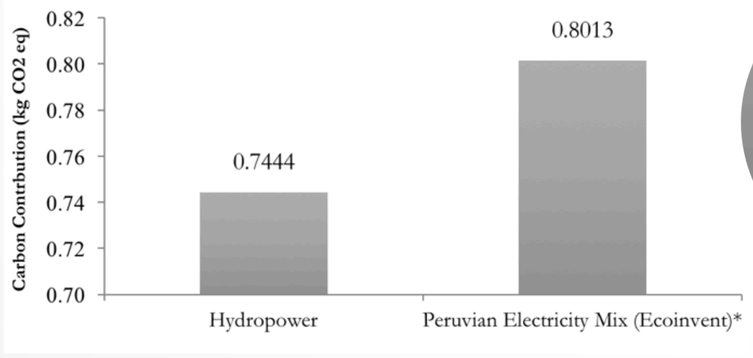
Type of Production	Carbon Contribution (kg CO_2-eq)
Solar Energy based	0.3178
Local Hydropower Electricity Grid	0.7444

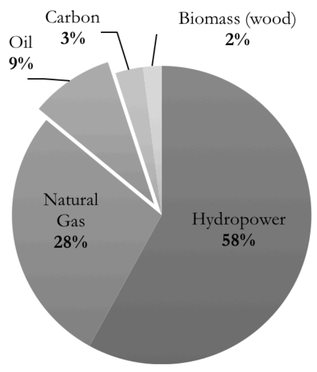


Carbon Contribution shares of Local Hydropower Electricity Grid based Production

Carbon Contribution shares of Local Hydropower Electricity Grid based Production

2. What is the impact of the Energy Matrix?





Peruvian Energy Matrix in 2008

3. What is the impact of the facilities?

Type of Production	Carbon Contribution (kg CO_2-eq)	Carbon Contribution + Facility (kg CO_2-eq)
Solar Energy based	0.3178	0.4529
Local Hydropower Electricity Grid	0.7444	0.7857

Conclusions

1. The Carbon Footprint of the solar energy roasting process is 0.318 and of the local electricity grid production is 0.744 kg CO2-eq per kg of roasted coffee.
2. Difference in greenhouse gases (GHG) emissions of 134%, mainly due to the use of LPG as fuel. This contributes 79% of the carbon contribution in the roasting stage.
3. The material based facility can increase the carbon contribution from 5 to 30%. Even though facilities have a considerable impact, these are not linked to roasting technology. Thus, facilities should not be included when comparing roasting technologies.
4. The selection of Peruvian Energy Matrix for Electricity Generation does not have a major effect on the results.

Discussions

1. Carbon Footprint helps us to make decisions on how to improve our environmental performance.
2. Roasting stage accounts from a negligible value up to 6% of the total carbon contribution in the coffee life cycle (BALAS, 2012; Pilotprojekt Deutschland, 2008; ITC, 2012 and Salomone, R.; 2003).
3. Across the coffee roasting process, the highest volumes of greenhouse gases are produced during the roasting stage due to the combustion of fuel for heating purposes. As a result, the main focus of the companies involved should be to improve their environmental performance in this stage.

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