UNIVERSITÀ DEGLI STUDI DELL'INSUBRIA

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Non-recyclable cellulosic waste briquettes consumption in Andean areas:

assessment of social acceptance and potential applications

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1

Introduction:
Research in waste-based briquettes production and consumption

2

Background:
Pilot project and case study

3

Methods:
questionnaire survey, laboratory analysis, qualitative and on-field tests

4

Results:
Social involvement, fuels quality and potential applications

5

Concluding remarks:
Are waste based briquettes sustainable?

Introduction

Main issues to solve in Bolivia (Andean area)

- **Solid waste management: find potential alternatives to final disposal**
- **Resource circularity: find alternative options to recover waste**
- **Lack of energy sources: non-renewable energy (methane) and no-biomass available in the Andes**

Research conducted from 2019

- Waste briquetting can be employed <u>when no other treatment and recycling options are available</u> (among others)
- Waste-based briquettes are a better fuel compared to firewood (use of **cardboard waste**)
- Potential **environmental benefits** compared to fossil fuels.
- Waste-based briquettes are cheaper than wood but **more expensive than Bolivian LPG and methane**

Literature Review

Review

Are waste-based briquettes alternative fuels in developing countries? A critical review

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Laboratory analysis – Cellulosic waste-based briquettes

Biomass and cardboard waste-based briquettes for heating and cooking: Thermal efficiency and emissions analysis

Navarro Ferronato [a,*], Iris Jabneel Calle Mendoza [c], Jazmín Gidari Ruiz Mayta [b], Marcelo Antonio Gorritty Portillo [b], Fabio Conti [a], Vincenzo Torretta [a]

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Energy for Sustainable Development

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E-LCA

Environmental Life Cycle Assessment of biomass and cardboard waste-based briquettes production and consumption in Andean areas

Navarro Ferronato [a,*], Alberto Pietro Damiano Baltrocchi [a], Francesco Romagnoli [d], Iris Jabneel Calle Mendoza [b,c], Marcelo Antonio Gorritty Portillo [b], Vincenzo Torretta [a]

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S-LCA and LCC

Socio-economic analysis of waste-based briquettes production and consumption in Bolivia

Alberto Pietro Damiano Baltrocchi [a], Navarro Ferronato [a,*], Iris Jabneel Calle Mendoza [b], Marcelo Antonio Gorritty Portillo [b], Francesco Romagnoli [c], Vincenzo Torretta [a]

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Background

Development cooperative project financed by the Italian Agency for Development Cooperation

Non-recyclable Cellulosic waste-based briquettes production in Bolivia

AGENZIA ITALIANA PER LA COOPERAZIONE ALLO SVILUPPO

COOPI COOPERAZIONE INTERNAZIONALE

sustainability

MDPI

Article

Circular Economy, International Cooperation, and Solid Waste Management: A Development Project in La Paz (Bolivia)

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Methods

Social survey: Interviews (n=150) with structured questionnaires

Laboratory analysis of conventional and alternative fuels: Thermal efficiency and emissions

On field analysis of briquettes combustion for heating and cooking

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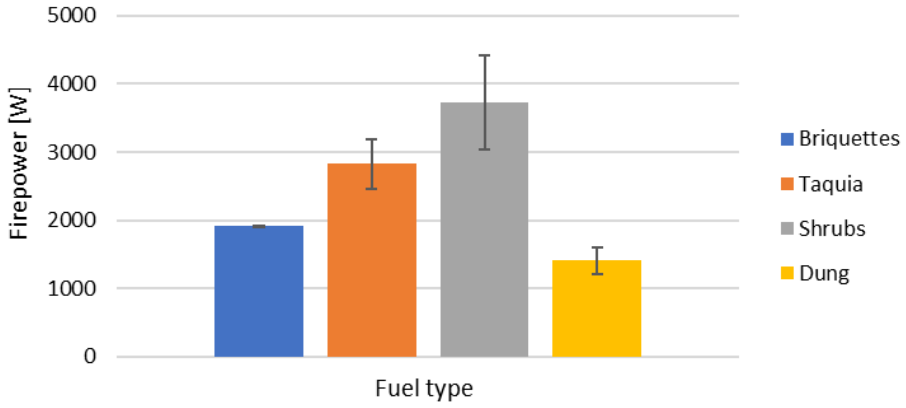
Results – Public acceptance

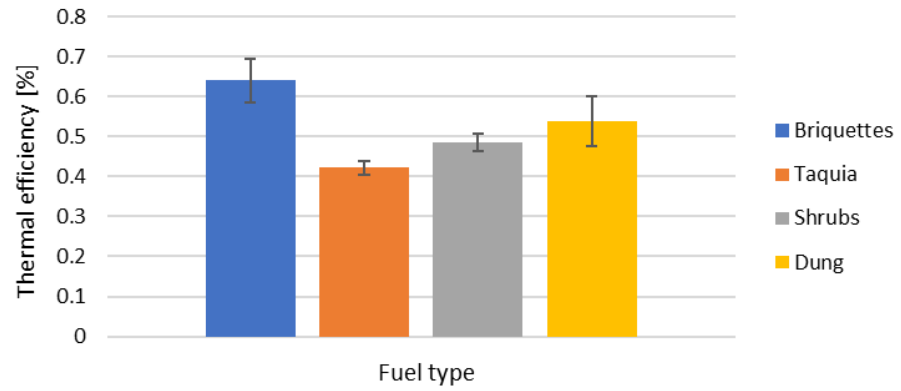
- Among fuels, they use methane, **dung, and firewood**.
- Around 39% use exclusively gas stoves, while **about 12% use exclusively wood or dung.**
- Globally, 61% of the citizens state that **they use both wood stoves and gas stoves**

- Up to 70% of the respondents stated that the fuel employed is due to the **easy access**, while only 4% state that it is for economic reasons.
- **About 81% of women buy fuel**, in other cases they collect it along the way, as is the case of **dung and shrubs**. The costs of purchasing fuel are between 0.3 USD to **5 USD per month**, which is equivalent to a methane jar.

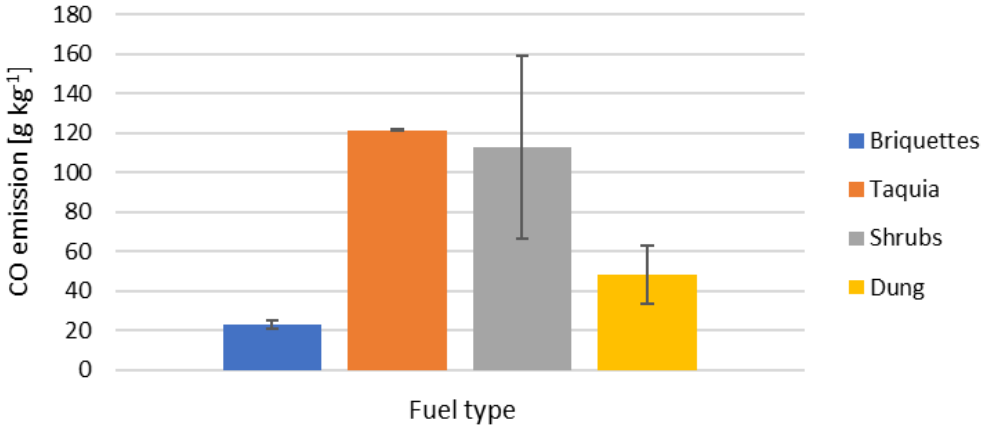
Results – Laboratory analysis

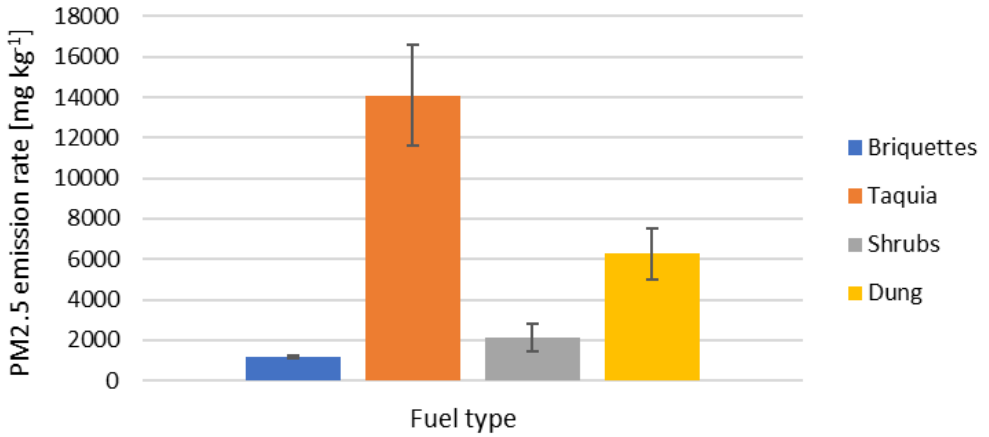
Thermal efficiency





Emissions analysis





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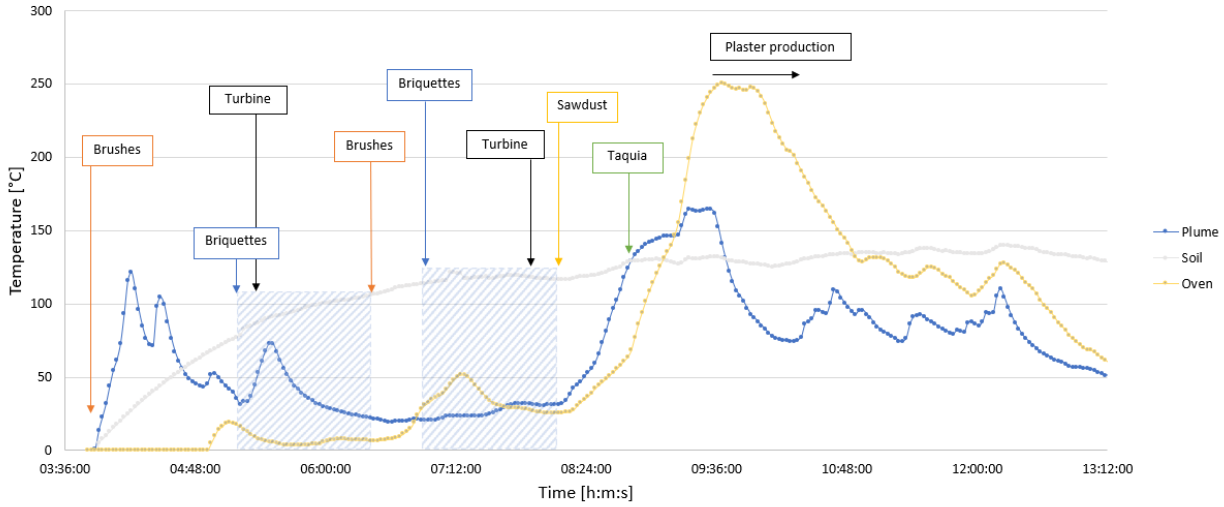
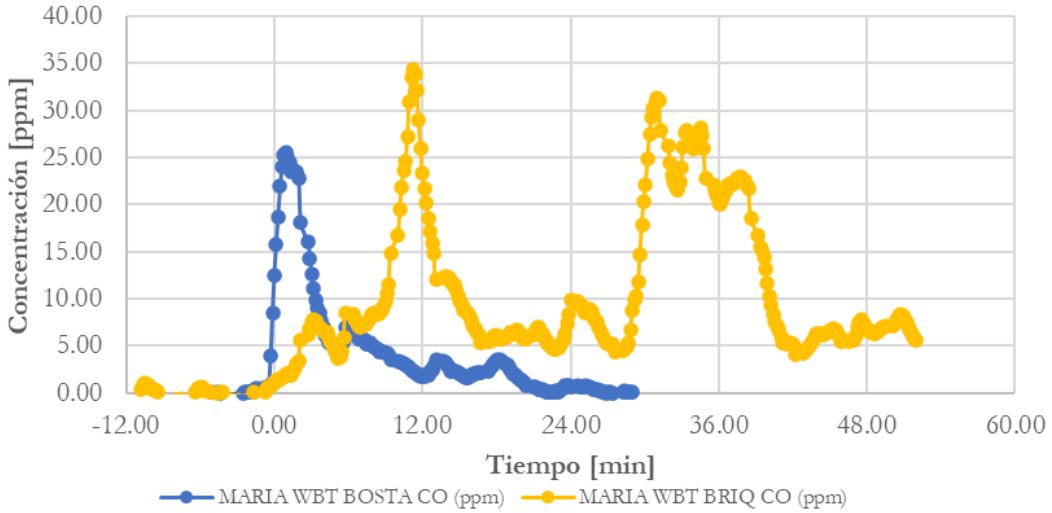
Results – On-field tests





Pilot analysis show that briquettes can be employed for **reducing about 30% of the conventional fuels** (animal dung and brushes), with a **potential increase of costs of about 3 to 5 times**: on balance, the potentiality exist, but waste-based briquettes seems to be too expensive compared to conventional fuels.

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Concluding remarks

At household level, briquettes cannot be effectively employed for three main reasons:

- **Cookstoves are not appropriate for burning briquettes**. In the current situation, the higher thermal efficiency of briquettes are lost due to the lower performance of stoves.
- **Low-income families are not conveyed to buy an alternative fuel** to minimize pollution and maximize cooking efficiencies.
- **Middle-income households are more likely to buy methane** since they already have an improved cookstove for cooking.

For plaster production, briquettes allows to:

- **Mitigate the weight of brushes and wood to be collected and burned** during the combustion phase;
- **Reduce the working time that the operators should spend during the night** to feed the combustion chamber with brushed and Taquia;

The study suggested that the great potentiality arise to the **local manufacturing**, proposing that waste-based briquettes can be employed for **pre-heating combustion chambers**.
However:

- **briquettes cannot be used to substitute 100% of conventional fuels** (natural or fossil) and
- the **costs seem to be too high if briquettes are not subsidised or briquettes' production costs are covered by waste producers.**

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Thank you

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